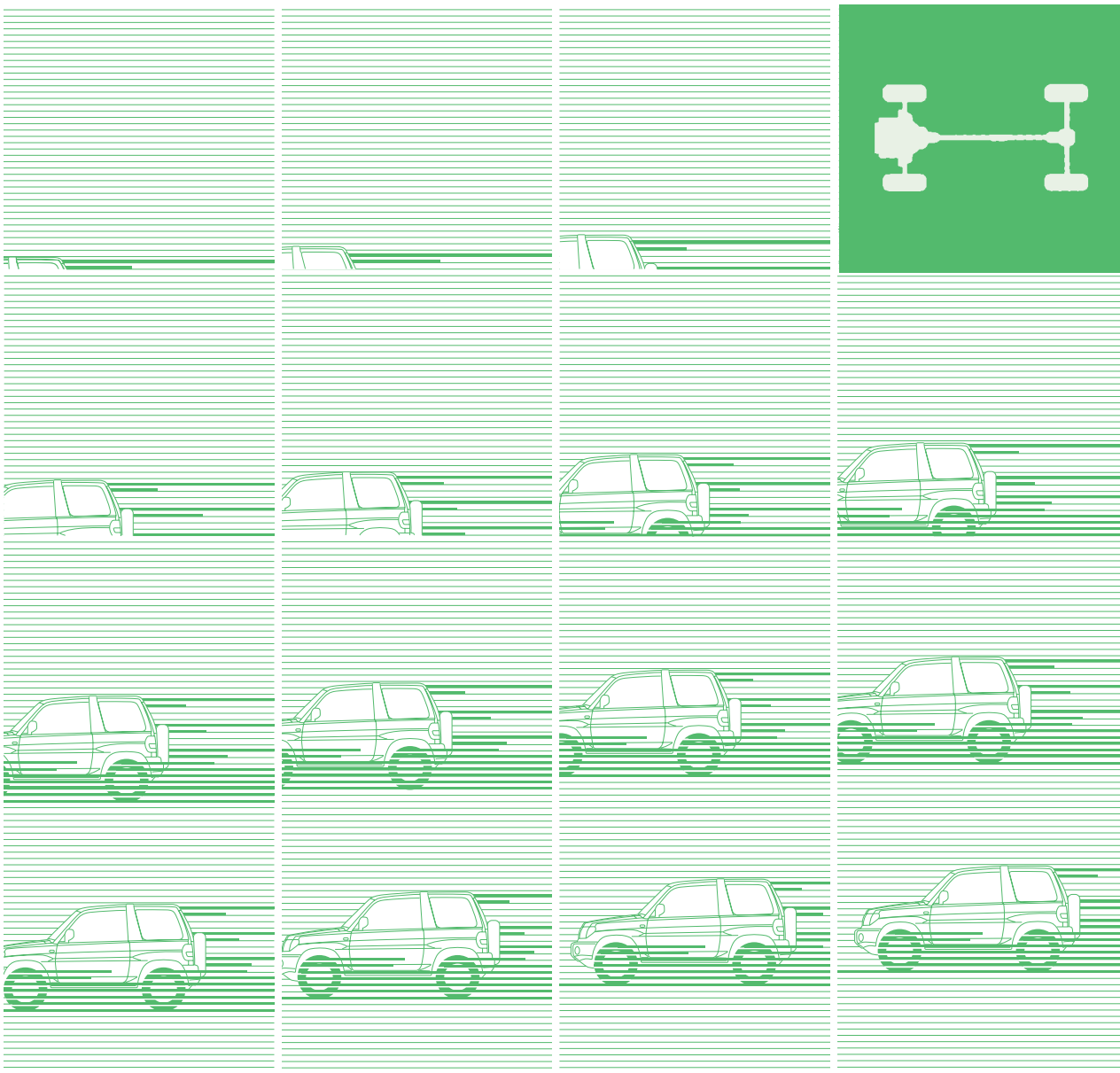
MITSUBISHI MOTORS

Workshop Manual

chassis

Created by lerkom for rutracker.org 28/09/2013

PAJERO PININ '01



PAJERO PININ

WORKSHOP MANUAL

FOREWORD

This Workshop Manual contains procedures for service mechanics, including removal, disassembly, inspection, adjustment, reassembly and installation. Use the following manuals in combination with this manual as required.

TECHNICAL INFORMATION MANUAL	IKRE00E1
WORKSHOP MANUAL	
ELECTRICAL WIRING	EKRE00E1
BODY REPAIR MANUAL	BKRE00E1
ENGINE GROUP	PWEE9502-E
PARTS CATALOGUE	I603F509D□

All information, illustrations and product descriptions contained in this manual are current as at the time of publication. We, however, reserve the right to make changes at any time without prior notice or obligation.

MITSUBISHI MOTOR SALES
Europe B.V.

"GDI" is a trade mark which Mitsubishi Motors Corporation holds.

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WARNING REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLE

WARNING!

(1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver and passenger (from rendering the SRS inoperative).

(2) The SRS components should not be subjected to temperature of 93°C or more. So, remove the SRS-ECU, driver's and front passenger's air bag modules, clock spring, side impact sensors and front seat assemblies (side air bag modules) before drying or baking the vehicle after painting.

(3) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.

(4) MITSUBISHI dealer personnel must thoroughly review this manual, and especially its GROUP 52B – Supplemental Restraint System (SRS), before beginning any service or maintenance of any SRS component or any SRS-related component.

NOTE

Section titles with asterisks (*) in the table of contents in each group indicate operations requiring warnings.

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GENERAL

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HOW TO USE THIS MANUAL

SCOPE OF MAINTENANCE, REPAIR AND SERVICING EXPLANATIONS

This manual provides explanations, etc. concerning procedures for the inspection, maintenance, repair and servicing of the subject model. Note, however, that for engine and transmission-related component parts, this manual covers only on-vehicle inspections, adjustments, and the removal and installation procedures for major components.
For detailed information concerning the inspection, checking, adjustment, disassembly and reassembly of the engine, transmission and major components after they have been removed from the vehicle, please refer to separate manuals covering the engine and the transmission.

ON-VEHICLE SERVICE

"On-vehicle Service" is procedures for performing inspections and adjustments of particularly important locations with regard to the construction and for maintenance and servicing, but other inspection (for looseness, play, cracking, damage, etc.) must also be performed.

INSPECTION

Under this title are presented inspection and checking procedures to be performed by using special tools and measuring instruments and by feeling, but, for actual maintenance and servicing procedures, visual inspections should always be performed as well.

DEFINITION OF TERMS

STANDARD VALUE

Indicates the value used as the standard for judging the quality of a part or assembly on inspection or the value to which the part or assembly is corrected and adjusted. It is given by tolerance.

LIMIT

Shows the standard for judging the quality of a part or assembly on inspection and means the maximum or minimum value within which the part or assembly must be kept functionally or in strength. It is a value established outside the range of standard value.

REFERENCE VALUE

Indicates the adjustment value prior to starting the work (presented in order to facilitate assembly and adjustment procedures, and so they can be completed in a shorter time).

CAUTION

Indicates the presentation of information particularly vital to the worker during the performance of maintenance and servicing procedures in order to avoid the possibility of injury to the worker, or damage to component parts, or a reduction of component or vehicle function or performance, etc.

INDICATION OF TIGHTENING TORQUE

The tightening torque shown in this manual is a basic value with a tolerance of ±10% except the following cases when the upper and lower limits of tightening torque are given.
(1) The tolerance of the basic value is within ±10%.
(2) Special bolts or the like are in use.
(3) Special tightening methods are used.

MODEL INDICATIONS

The following abbreviations are used in this manual for classification of model types.

GDI: Indicates the gasoline direct injection.
DOHC: Indicates an engine with the double overhead camshaft, or a model equipped with such an engine.
M/T: Indicates the manual transmission, or models equipped with the manual transmission.
A/T: Indicates the automatic transmission, or models equipped with the automatic transmission.
A/C: Indicates the air conditioner.

EXPLANATION OF MANUAL CONTENTS

Indicates procedures to be performed before the work in that section is started, and procedures to be performed after the work in that section is finished.

Component Diagram
A diagram of the component parts is provided near the front of each section in order to give a reader a better understanding of the installed condition of component parts.

Indicates (by symbols) where lubrication is necessary.

Maintenance and Servicing Procedures
The numbers provided within the diagram indicate the sequence for maintenance and servicing procedures.

- Removal steps:
  The part designation number corresponds to the number in the illustration to indicate removal steps.
- Disassembly steps:
  The part designation number corresponds to the number in the illustration to indicate disassembly steps.
- Installation steps:
  Specified in case installation is impossible in reverse order of removal steps. Omitted if installation is possible in reverse order of removal steps.
- Reassembly steps:
  Specified in case reassembly is impossible in reverse order of disassembly steps. Omitted if reassembly is possible in reverse order of disassembly steps.

Classifications of Major Maintenance/Service Points

When there are major points relative to maintenance and servicing procedures (such as essential maintenance and service points, maintenance and service standard values, information regarding the use of special tools, etc.), these are arranged together as major maintenance and service points and explained in detail.

◀A▶ : Indicates that there are essential points for removal or disassembly.
▶A◀ : Indicates that there are essential points for installation or reassembly.

Symbols for Lubrication, Sealants and Adhesives

Information concerning the locations for lubrication and for application of sealants and adhesives is provided, by using symbols, in the diagram of component parts or on the page following the component parts page, and explained.

 : Grease
(multipurpose grease unless there is a brand or type specified)

 : Sealant or adhesive

 : Brake fluid or automatic transmission fluid

 : Engine oil, gear oil or air conditioner compressor oil

 : Adhesive tape or butyl rubber tape

Indicates the group title.

Indicates the section title.

Indicates the group number.

Indicates the page number.

STEERING – Power Steering Oil Pump 37A-29

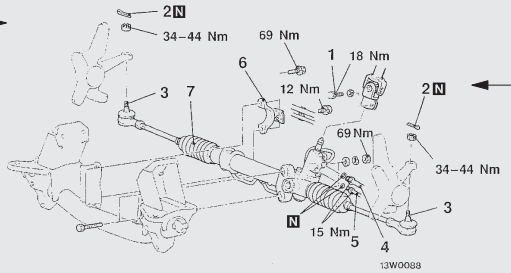
POWER STEERING GEAR BOX

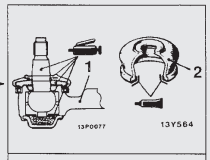
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REMOVAL AND INSTALLATION

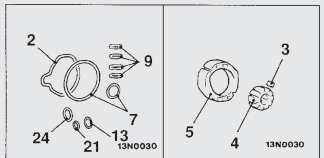
Pre-removal Operation
(1) Power Steering Fluid Draining (Refer to P. 37A-10.)
(2) Air Cleaner Assembly Removal
(3) Under Cover Removal (Refer to GROUP 42 – Under Cover.)

<2WD>





Sealant: 3M ATD Part No. 8661 or equivalent

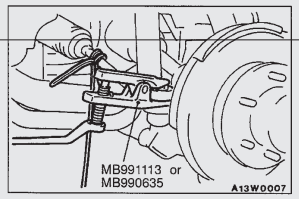


Oil pump seal kit | Oil pump cartridge kit

Removal steps

1. Lower shaft assembly and gear box connecting bolt
2. Split pin
3. Connection for tie-rod end and knuckle
4. Connection for return tube
5. Connection for pressure tube
6. Clamp
7. Gear box assembly

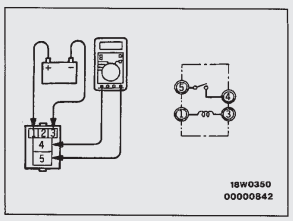
◀A▶ ◀B▶



REMOVAL SERVICE POINTS

◀A▶ TIE-ROD END DISCONNECTION

Caution
1. Using the special tool, loosen the tie rod end mounting nut. Only loosen the nut; do not remove it from the ball joint.
2. Support the special tool with a cord, etc. to prevent it from coming off.

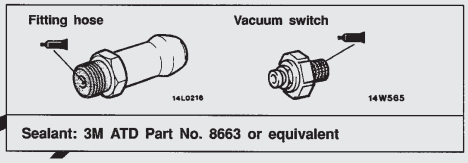


HEADLAMP RELAY CONTINUITY INSPECTION

Battery voltage	Terminal No.			
	1	3	4	5
Power is not supplied	○	○		
Power is supplied	⊕	⊖	○	○

35A-26 BASIC BRAKE SYSTEM – Master Cylinder and Brake Booster

Lubrication and sealing points



Sealant: 3M ATD Part No. 8663 or equivalent

00002471

N Denotes non-reusable part.

Denotes tightening torque.
For bolts and nuts which do not have a tightening torque listed, refer to the “Standard Parts-tightening-torque Table”.

Repair kit or set parts are shown. (Only very frequently used parts are shown.)

Operating procedures, cautions, etc. on removal, installation, disassembly and reassembly are described.

○——○ indicates that there is a continuity between the terminals.
⊕——⊖ indicates terminals to which battery voltage is applied.

The title of the page (following the page on which the diagram of component parts is presented) indicating the locations of lubrication and sealing procedures.

HOW TO USE TROUBLESHOOTING/INSPECTION SERVICE POINTS

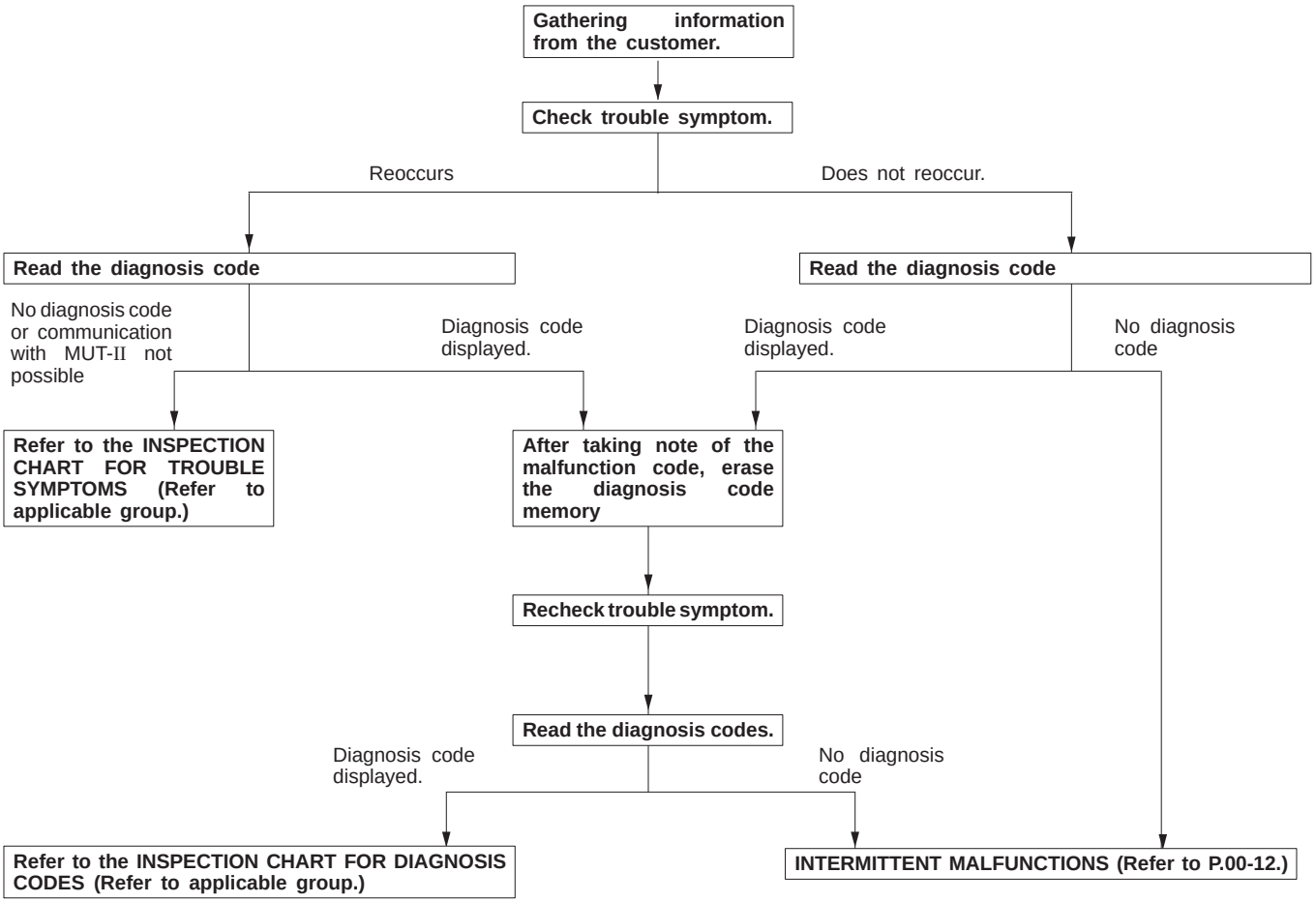
Troubleshooting of electronic control systems for which the MUT-II can be used follows the basic outline described below. Furthermore, even in systems for which the MUT-II cannot be used, part of these systems still follow this outline.

TROUBLESHOOTING CONTENTS

1. STANDARD FLOW OF DIAGNOSIS TROUBLESHOOTING

The troubleshooting sections follow the basic diagnosis flow which is given below. If the diagnosis flow is different from that given below, or if additional explanation is required, the details of such differences or additions will also be listed.

Diagnosis method



2. SYSTEM OPERATION AND SYMPTOM VERIFICATION TESTS

If verification of the trouble symptoms is difficult, procedures for checking operation and verifying trouble symptoms are shown.

3. DIAGNOSIS FUNCTION

Details which are different from those in the “Diagnosis Function” section on the next page are listed.

4. INSPECTION CHART FOR DIAGNOSIS CODES

5. INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Indicates the inspection procedures corresponding to each diagnosis code. (Refer to P.00-9 for how to use the inspection procedures.)

6. INSPECTION CHART FOR TROUBLE SYMPTOMS

If there are trouble symptoms even though the results of inspection using the MUT-II show that all diagnosis codes are normal, inspection procedures for each trouble symptom will be found by means of this chart.

7. INSPECTION PROCEDURE FOR TROUBLE SYMPTOM

Indicates the inspection procedures corresponding to each trouble symptoms classified in the Inspection Chart for Trouble Symptoms. (Refer to P.00-9 for how to use the inspection procedures.)

8. SERVICE DATA REFERENCE TABLE

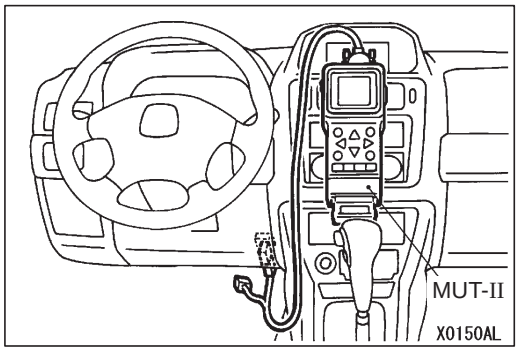
Inspection items and normal judgement values have been provided in this chart as reference information.

9. CHECK AT ECU TERMINALS

Terminal numbers for the ECU connectors, inspection items and standard values have been provided in this chart as reference information.

10. INSPECTION PROCEDURES USING AN OSCILLOSCOPE

When there are inspection procedures using an oscilloscope, these are listed here.



DIAGNOSIS FUNCTION

METHOD OF READING DIAGNOSIS CODES

WHEN USING THE MUT-II

Connect the MUT-II to the diagnosis connector and take a reading of the diagnosis codes.

Caution
Turn the ignition switch to the LOCK (OFF) position before connecting or disconnecting the MUT-II.

METHOD OF ERASING DIAGNOSIS CODES

WHEN USING THE MUT-II

Connect the MUT-II to the diagnosis connector and erase the diagnosis code.

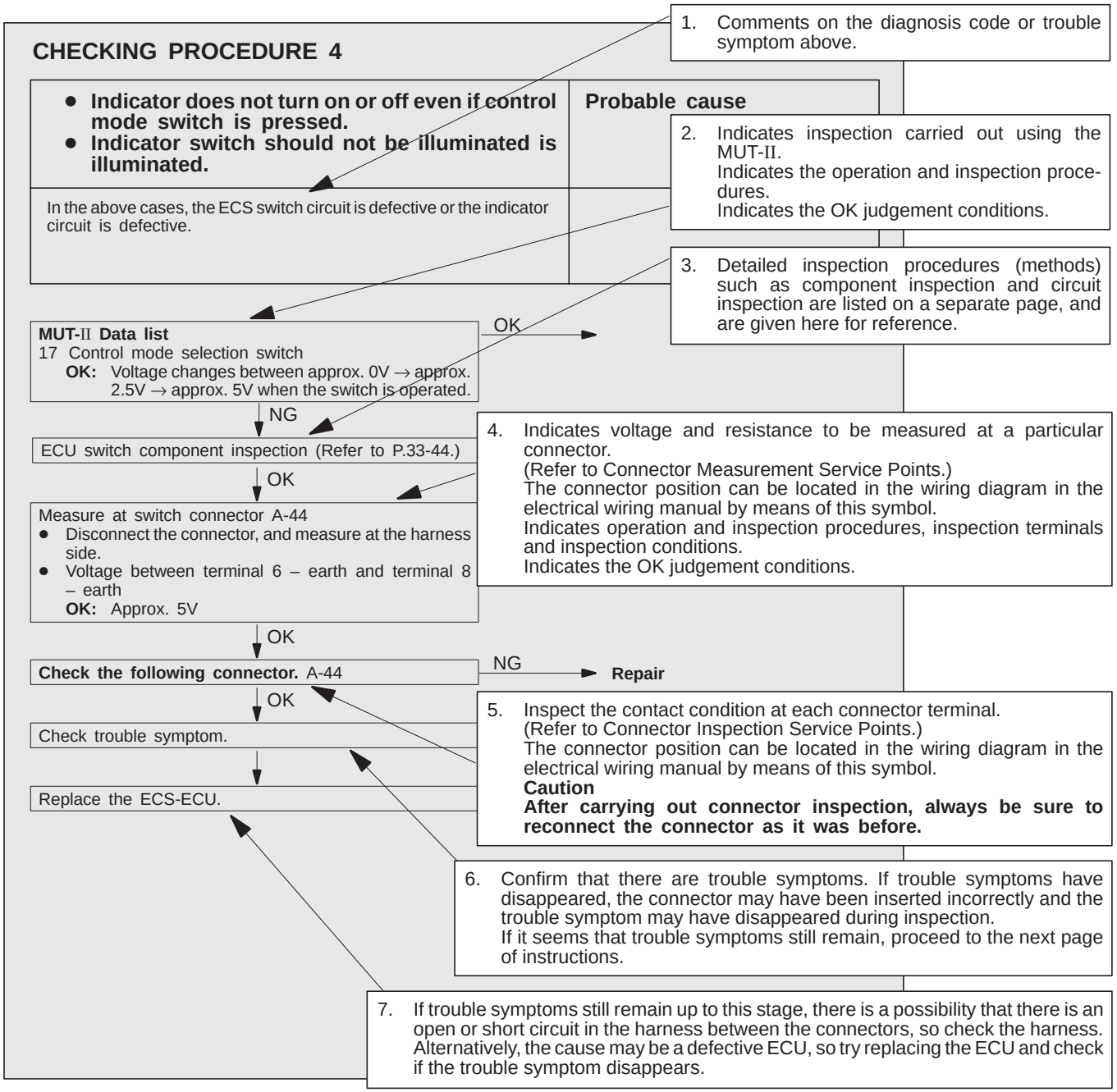
Caution
Turn the ignition switch to the LOCK (OFF) position before connecting or disconnecting the MUT-II.

WHEN NOT USING THE MUT-II

1. Turn the ignition switch to the LOCK (off) position.
2. After disconnecting the battery cable from the negative (–) battery terminal, wait for 10 seconds or more and reconnect the cable.
3. Warm up the engine and run at idle for about 15 minutes.

HOW TO USE THE INSPECTION PROCEDURES

The causes of a high frequency of problems occurring in electronic circuitry are generally the connectors, components, the ECU and the harnesses between connectors, in that order. These inspection procedures follow this order, and they first try to discover a problem with a connector or a defective component.



HARNESS INSPECTION

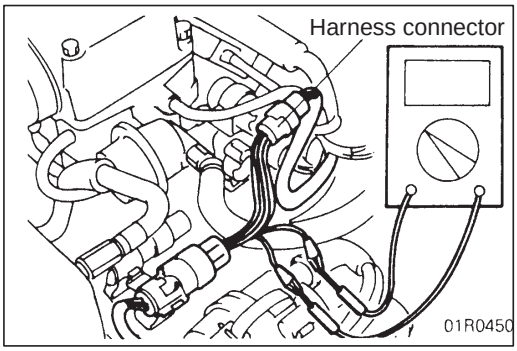
Check for an open or short circuit in the harness between the terminals which were defective according to the connector measurements. Carry out this inspection while referring to the electrical wiring manual. Here, “Check harness between power supply and terminal xx” also includes checking for blown fuses. For inspection service points when there is a blown fuse, refer to “Inspection Service Points for a Blown Fuse.”

MEASURES TO TAKE AFTER REPLACING THE ECU

If the trouble symptoms have not disappeared even after replacing the ECU, repeat the inspection procedure from the beginning.

CONNECTOR MEASUREMENT SERVICE POINTS

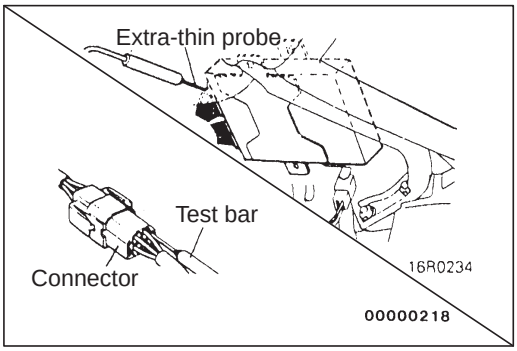
Turn the ignition switch to the LOCK (OFF) position when connecting or disconnecting the connectors and turn the ignition switch ON when measuring, unless otherwise instructed.



WHEN INSPECTING WITH CONNECTOR CONNECTED (WITH CIRCUIT IN CONDITION OF CONTINUITY)

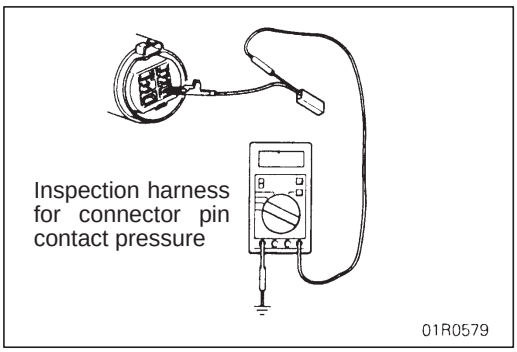
Waterproof Connectors

Be sure to use the special tool (harness connector). Never insert a test bar from the harness side, because to do so will reduce the waterproof performance and result in corrosion.



Ordinary (non-waterproof) Connectors

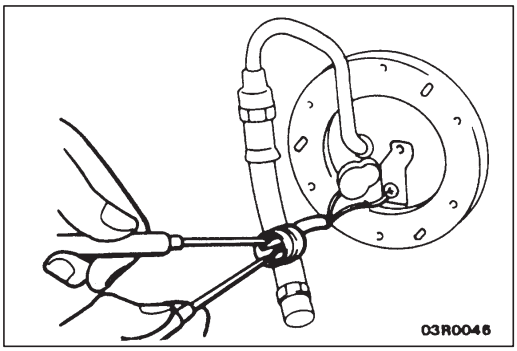
Check by inserting the test bar from the harness side. Note that if the connector (control unit, etc.) is too small to permit insertion of the test bar, it should not be forced; use a special tool (the extra-thin probe in the harness set for checking for this purpose.



WHEN INSPECTING WITH CONNECTOR DISCONNECTED

<When Inspecting a Female Pin>

Use the special tool (inspection harness for connector pin contact pressure in the harness set for inspection).
The inspection harness for connector pin contact pressure should be used. The test bar should never be forcibly inserted, as it may cause a defective contact.

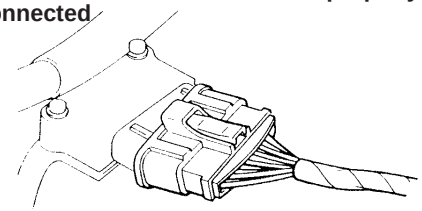


<When Inspecting a Male Pin>

Touch the pin directly with the test bar.

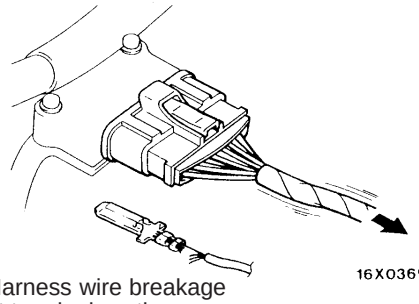
Caution
At this time, be careful not to short the connector pins with the test bars. To do so may damage the circuits inside the ECU.

Connector disconnected or improperly connected



16S0256

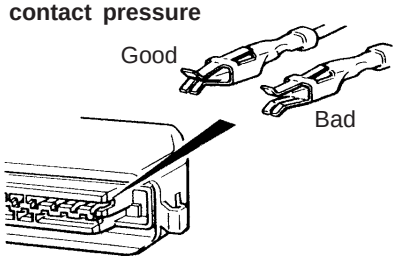
Defective connector contact



16X0369

Harness wire breakage at terminal section

Low contact pressure

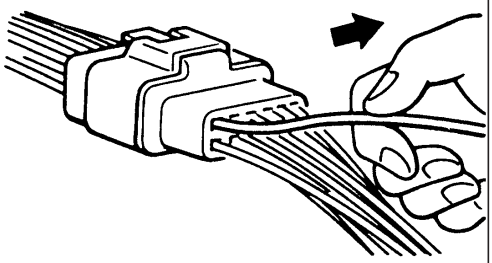


16S0254
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CONNECTOR INSPECTION

VISUAL INSPECTION

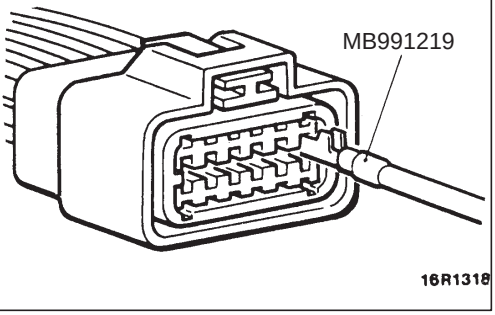
- Connector is disconnected or improperly connected
- Connector pins are pulled out
- Due to harness tension at terminal section
- Low contact pressure between male and female terminals
- Low connection pressure due to rusted terminals or foreign matter lodged in terminals



16R1317

CONNECTOR PIN INSPECTION

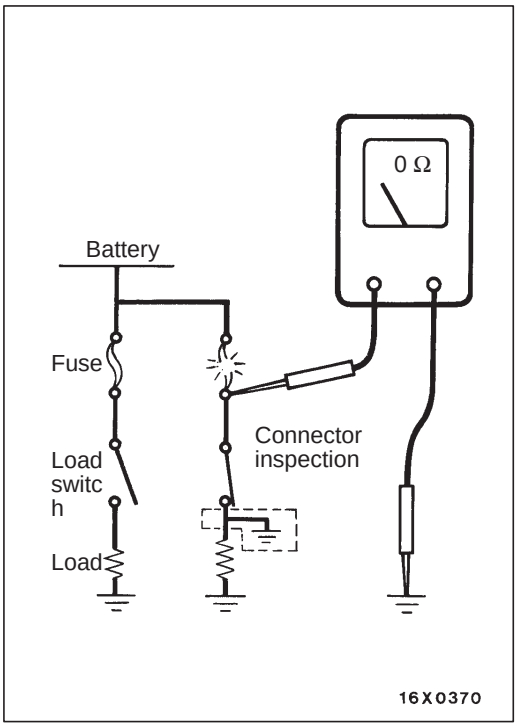
If the connector pin stopper is damaged, the terminal connections (male and female pins) will not be perfect even if the connector body is connected, and the pins may pull out of the reverse side of the connector. Therefore, gently pull the harnesses one by one to make sure that no pins pull out of the connector.



16R1318

CONNECTOR ENGAGEMENT INSPECTION

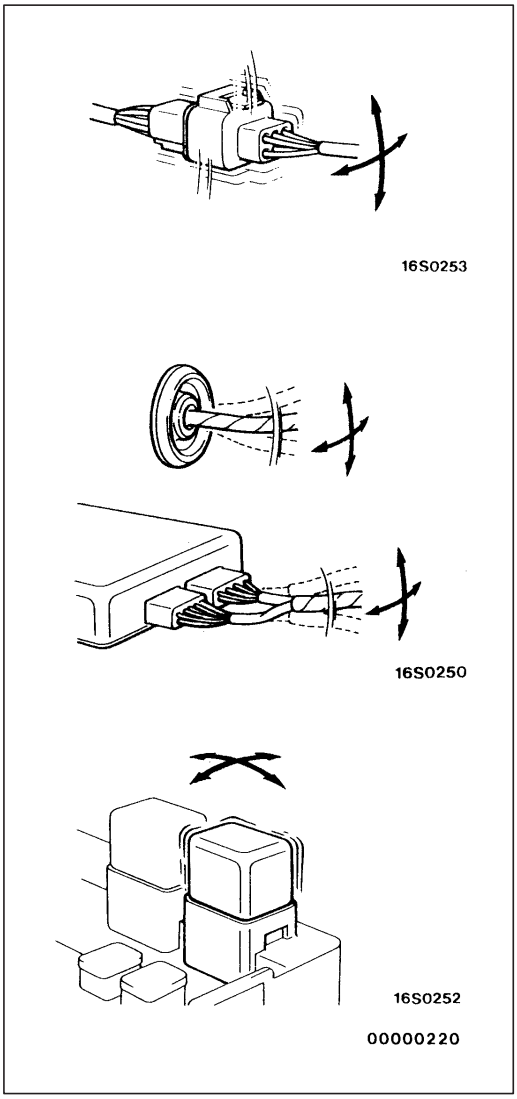
Use the special tool (connector pin connection pressure inspection harness of the inspection harness set) to inspect the engagement of the male pins and females pins. (Pin drawing force : 1 N or more)



INSPECTION SERVICE POINTS FOR A BLOWN FUSE

Remove the fuse and measure the resistance between the load side of the fuse and the earth. Set the switches of all circuits which are connected to this fuse to a condition of continuity. If the resistance is almost 0 Ω at this time, there is a short somewhere between these switches and the load. If the resistance is not 0 Ω, there is no short at the present time, but a momentary short has probably caused the fuse to blow.

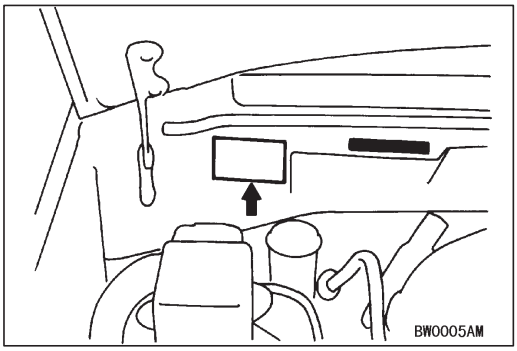
The main causes of a short circuit are the following.
- Harness being clamped by the vehicle body
- Damage to the outer casing of the harness due to wear or heat
- Water getting into the connector or circuitry
- Human error (mistakenly shorting a circuit, etc.)



POINTS TO NOTE FOR INTERMITTENT MALFUNCTIONS

Intermittent malfunctions often occur under certain conditions, and if these conditions can be ascertained, determining the cause becomes simple. In order to ascertain the conditions under which an intermittent malfunction occurs, first ask the customer for details about the driving conditions, weather conditions, frequency of occurrence and trouble symptoms, and then try to recreate the trouble symptoms. Next, ascertain whether the reason why the trouble symptom occurred under these conditions is due to vibration, temperature or some other factor. If vibration is thought to be the cause, carry out the following checks with the connectors and components to confirm whether the trouble symptom occurs.
The objects to be checked are connectors and components which are indicated by inspection procedures or given as probable causes (which generates diagnosis codes or trouble symptoms.)
- Gently shake the connector up, down and to the left and right.
- Gently shake the wiring harness up, down and to the left and right.
- Gently rock each sensor and relay, etc. by hand.
- Gently shake the wiring harness at suspensions and other moving parts.

NOTE
If determining the cause is difficult, the flight recorder function of the MUT-II can also be used.

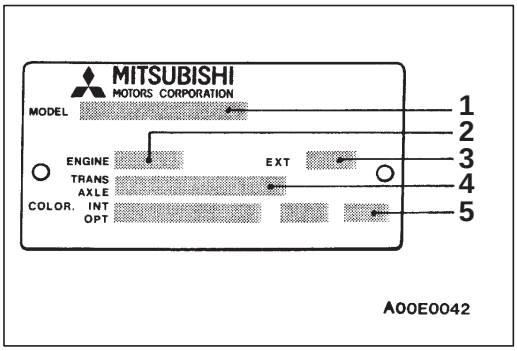


VEHICLE IDENTIFICATION

VEHICLE INFORMATION CODE PLATE

LOCATION

Vehicle information code plate is riveted on the toeboard inside the engine compartment.



CODE PLATE DESCRIPTION

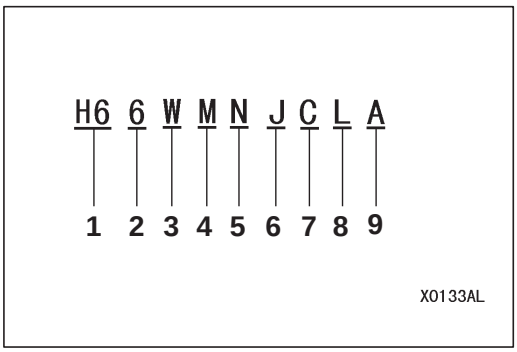
The plate shows model code, engine model, transmission model, and body colour code.

No.	Item	Contents	Contents
1	MODEL	H66W LNUEL	H66W: Vehicle model
			LNUEL: Model series
2	ENGINE	4G93	Engine model
3	EXT	A01A	Exterior code
4	TRANS AXLE	V5M21 4875	W5M21: Transmission code
			4875: Rear differential reduction
5	COLOR INT OPT	A01 11T 03V	A01: Body colour code
			11T: Interior code
			03V: Equipment code

For monotone colour vehicles, the body colour code shall be indicated. For two-tone or three-way two-tone colour vehicles, each colour code only shall be indicated in series.

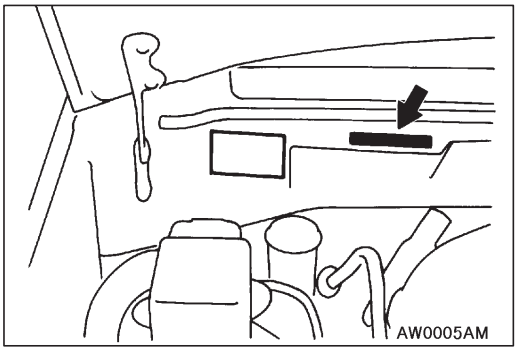
MODELS

Model code		Engine model	Transmission model	Fuel supply system
H66	WMNJCLA	4G93-DOHC (1,834 mℓ)	V5M21 <5M/T>	GDI
	WMNJCRA			
	WMRJCLA		V4AW4 <4A/T>	
	WMRJCRA			



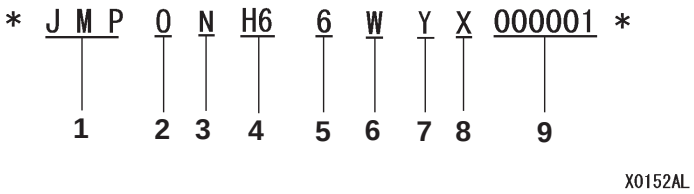
MODEL CODE

No.	Items	Contents
1	Development	H6: MITSUBISHI PAJERO PININ Short wheelbase
2	Engine type	6: 1,800 mℓ petrol engine
3	Sort	W: Wagon
4	Body style	M: 3-door
5	Transmission type	N: 5-speed manual transmission R: 4-speed automatic transmission
6	Trim level	J: GL
7	Specification engine feature	C: GDI-DOHC
8	Steering wheel location	L: Left hand R: Right hand
9	Destination	A: For Europe

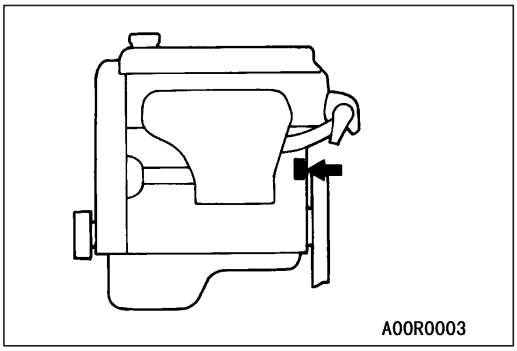


CHASSIS NUMBER

The chassis number is stamped on the toeboard inside the engine compartment.



No.	Items		Contents
1	Steering wheel location	JMP	Left hand drive
		JMR	Right hand drive
2	Body style	0	Standard roof
3	Transmission type	N	5-speed manual transmission
		R	4-speed automatic transmission
4	Development order	H6	PAJERO PININ Short wheelbase
5	Engine	6	4G93: 1,834 mℓ petrol engine
6	Sort	W	Wagon
7	Model year	Y	2000
8	Plant	X	Ooe Plant of Pininfarina Works
9	Serial number	–	–



ENGINE MODEL NUMBER

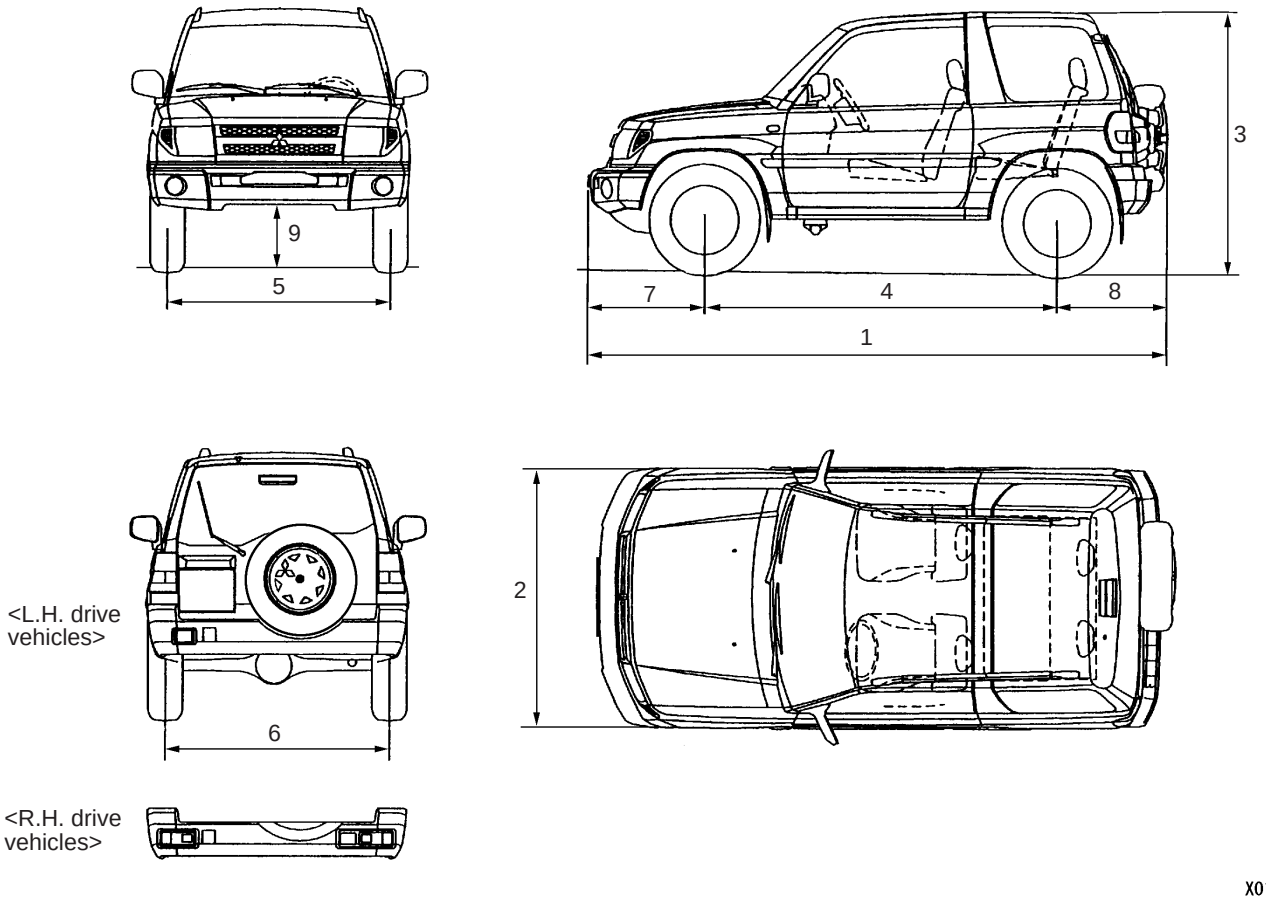
1. The engine model number is stamped on the cylinder block as shown below.

Engine model	Engine displacement mℓ
4G93	1,834

2. The engine serial number is stamped near the engine model number.

Engine serial number	AA0201 to YY9999

MAJOR SPECIFICATIONS



Items			H66WMNJCLA	H66WMNJCRA	H66WMRJCLA	H66WMRJCRA
Vehicle dimensions mm	Overall length	1	3,735/3,765*1			
	Overall width	2	1,695			
	Overall height (unladen)	3	1,695/1,735*2/1,705*3			
	Wheelbase	4	2,280			
	Track-front	5	1,435			
	Track-rear	6	1,445			
	Overhang-front	7	755/785*1			
	Overhang-rear	8	700			
	Ground clearance (unladen)	9	200			
Vehicle weight kg	Kerb weight		1,285		1,305	
	Max. gross vehicle weight		1,690		1,700	
	Max. axle weight rating-front		740		750	
	Max. axle weight rating-rear		545		555	
Seating capacity			4			
Engine	Model No.		4G93			
	Total displacement mℓ		1,834			
Transmis-sion	Model No.		V5M21	V4AW4	V5M21	V4AW4
	Type		5-speed manual	4-speed automatic	5-speed manual	4-speed automatic
Fuel system	Fuel supply system		Gasoline Direct Injection			

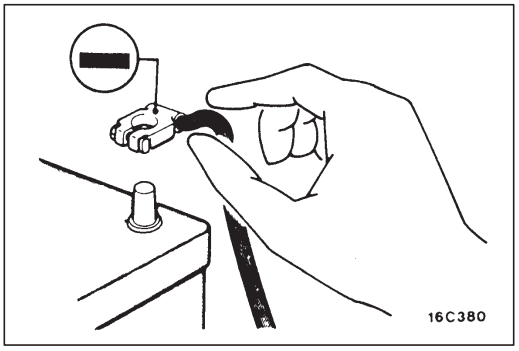
NOTE:
*1: Vehicles with bumper extension
*2: Vehicles with roof rails
*3: Vehicles with roof spoiler

PRECAUTIONS BEFORE SERVICE

SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

1. Items to follow when servicing SRS
   (1) Be sure to read GROUP 52B – Supplemental Restraint System (SRS).
   For safe operations, please follow the directions and heed all warnings.
   (2) Wait at least 60 seconds after disconnecting the battery cable before doing any further work.
   The SRS is designed to retain enough voltage to deploy the air bags even after the battery has been disconnected. Serious injury may result from unintended air bag deployment if work is done on the SRS immediately after the battery cable is disconnected.
   (3) Warning/caution labels must be heeded when servicing or handling SRS components. Warning/caution labels are attached in the following locations.
   - Sun visor
   - Glove box
   - SRS air bag control unit (SRS-ECU)
   - Steering wheel
   - Steering gear box
   - Driver's and passenger's air bag modules
   - Clock spring
   - Side air bag modules
   - Side impact sensors
   - Instrument panel
   - Hood
   - Seat belt with pre-tensioner

   (4) Always use the designated special tools and test equipment.
   (5) Store components removed from the SRS in a clean and dry place.
   The air bag modules should be stored on a flat surface and placed so that the deployment surfaces are facing upward.
   Do not place anything on top of them.
   (6) Never attempt to disassemble or repair the SRS components (SRS air bag control unit, air bag modules, clock spring and side impact sensors). If faulty replace them.
   (7) Whenever you finish servicing the SRS, check the SRS warning lamp operation to make sure that the system functions properly.
   (8) Be sure to deploy the air bag before disposing of the air bag modules or disposing of a vehicle equipped with air bag. (Refer to GROUP 52B – Air Bag Module Disposal Procedures.)
2. Observe the following when carrying out operations on places where SRS components are installed, including operations not directly related to the SRS air bag.
   (1) When removing or installing parts do not allow any impact or shock to the SRS components.
   (2) SRS components should not be subjected to heat over 93°C, so remove the SRS components before drying or baking the vehicle after painting.
   After re-installing them, check the SRS warning lamp operation to make sure that the system functions properly.



SERVICING THE ELECTRICAL SYSTEM

Before replacing a component related to the electrical system and before undertaking any repair procedures involving the electrical system, be sure to first disconnect the negative (–) cable from the battery in order to avoid damage caused by short-circuiting.

Caution
Before connecting or disconnecting the negative (–) cable, be sure to turn off the ignition switch and the lighting switch.
(If this is not done, there is the possibility of semiconductor parts being damaged.)

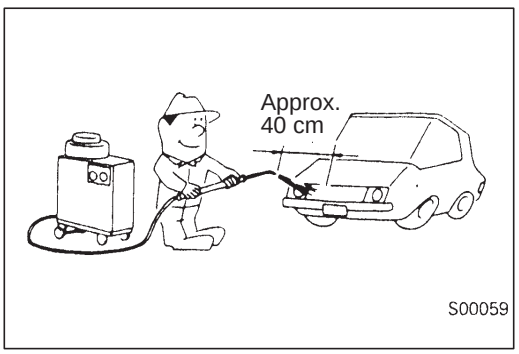
APPLICATION OF ANTI-CORROSION AGENTS AND UNDERCOATS

If oil or grease gets onto the oxygen sensor, it will cause a drop in the performance of the sensor.
Cover the oxygen sensor with a protective cover when applying anti-corrosion agents and undercoats.

PRE-INSPECTION CONDITION

"Pre-inspection condition" refers to the condition that the vehicle must be in before proper engine inspection can be carried out. If you see the words "Set the vehicle to the pre-inspection condition". in this manual, it means to set the vehicle to the following condition.

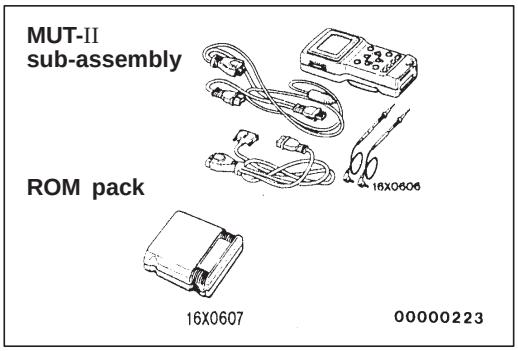
- Engine coolant temperature: 80 to 90°C
- Lamps, electric cooling fan and all accessories: OFF
- M/T: Neutral
- A/T: P range



VEHICLE WASHING

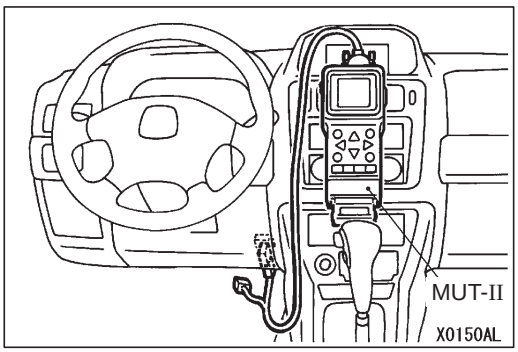
If high-pressure car-washing equipment or steam car-washing equipment is used to wash the vehicle, be sure to note the following information in order to avoid damage to plastic components, etc.

- Spray nozzle distance: Approx. 40 cm or more
- Spray pressure: 3,900 kPa or less
- Spray temperature: 82°C or less
- Time of concentrated spray to one point: within 30 sec.



MUT-II

Refer to the "MUT-II REFERENCE MANUAL" or "MUT-II OPERATING INSTRUCTIONS" for instructions on handling the MUT-II.



Connect the MUT-II to the diagnosis connector as shown in the illustration.

Caution
Turn the ignition switch to the LOCK (OFF) position before connecting or disconnecting the MUT-II.

IN ORDER TO PREVENT VEHICLES FROM FIRE

"Improper installation of electrical or fuel related parts could cause a fire. In order to retain the high quality and safety of the vehicle, it is important that any accessories that may be fitted or modifications/repairs that may be carried out which involve the electrical or fuel systems, MUST be carried out in accordance with MMC's information/Instructions".

ENGINE OILS

Health Warning

Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer. Adequate means of skin protection and washing facilities must be provided.

Recommended Precautions

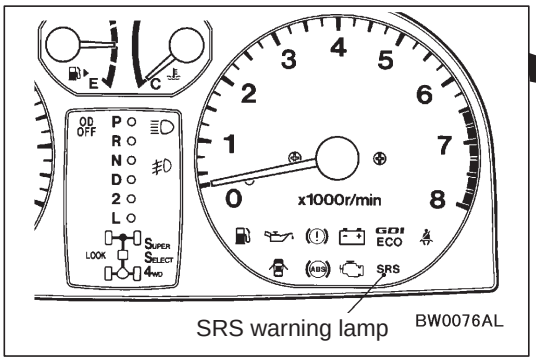
The most effective precaution is to adapt working practices which prevent, as far as practicable, the risk of skin contact with mineral oils, for example by using enclosed systems for handling used engine oil and by degreasing components, where practicable, before handling them.

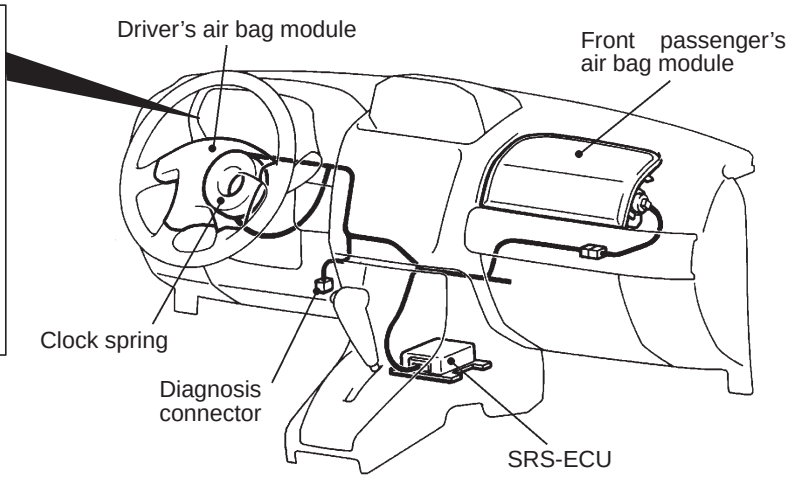
Other precautions:

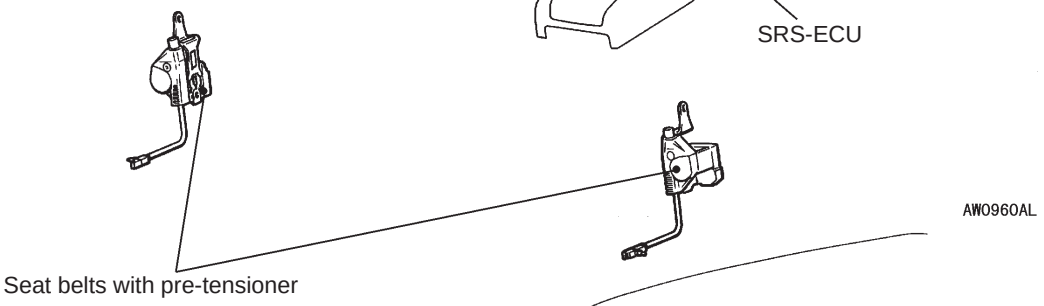
- Avoid prolonged and repeated contact with oils, particularly used engine oils.
- Wear protective clothing, including impervious gloves where practicable.
- Avoid contaminating clothes, particularly underpants, with oil.
- Do not put oily rags in pockets, the use of overalls without pockets will avoid this.
- Do not wear heavily soiled clothing and oil-impregnated foot-wear. Overalls must be cleaned regularly and kept separately from personal clothing.
- Where there is a risk of eye contact, eye protection should be worn, for example, chemical goggles or face shields; in addition an eye wash facility should be provided.
- Obtain First Aid treatment immediately for open cuts and wounds.
- Wash regularly with soap and water to ensure all oil is removed, especially before meals (skin cleansers and nail brushes will help). After cleaning, the application of preparations containing lanolin to replace the natural skin oils is advised.
- Do not use petrol, kerosine, diesel fuel, gas oil, thinners or solvents for cleaning skin.
- Use barrier creams, applying them before each work period, to help the removal of oil from the skin after work.
- If skin disorders develop, obtain medical advice without delay.

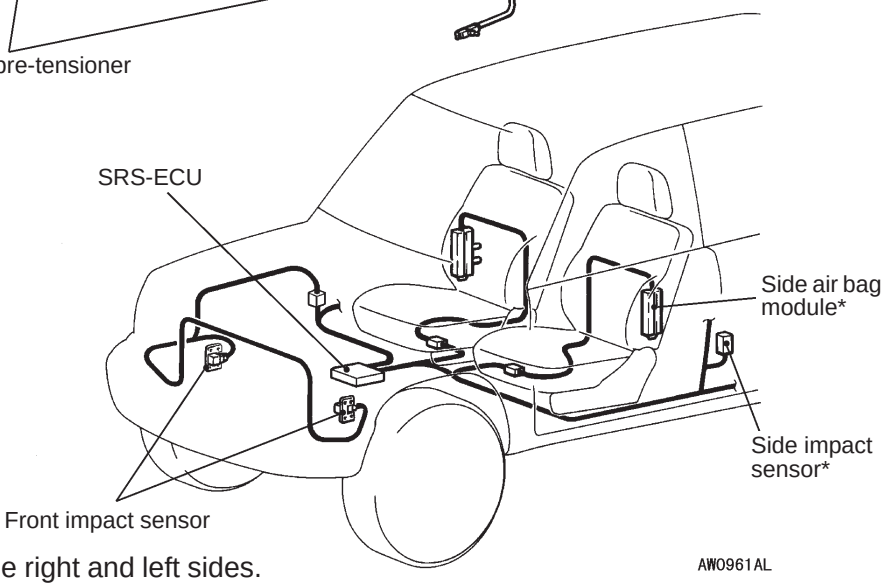
SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

To improve safety, the SRS is available as optional parts. This system enhances collision safety by restraining the front occupants in case of an accident.
The SRS consists of four air bag modules, SRS air bag control unit (SRS-ECU), front impact sensor, side impact sensors, seat belt pre-tensioner, SRS warning lamp and clock spring. The air bags are located in the centre of the steering wheel, above the glove box, and built into the front seat back assemblies. Each air bag has a folded air bag and an inflator unit. The SRS-ECU under the floor console monitors the system and has a safing G-sensor and an analog G-sensor. The front impact sensor are installed on the front side mrmber. The side impact sensors inside the quater panel inner or the quarter panels, inner monitor any shocks coming from the side of the vehicle. The warning lamp on the instrument panel indicates the operational status of the SRS. The clock spring is installed in the steering column.
The SRS side air bags deploy if an impact received at the side of the vehicle is stronger than a certain set value, in order to protect the front seat occupant's torso in the event of a collision. Only authorized service personnel should do work on or around the SRS components. Those service personnel should read this manual carefully before starting any such work. Extreme care must be used when servicing the SRS to avoid injury to the service personnel (by inadvertent deployment of the air bags) or the driver (by rendering the SRS inoperative).

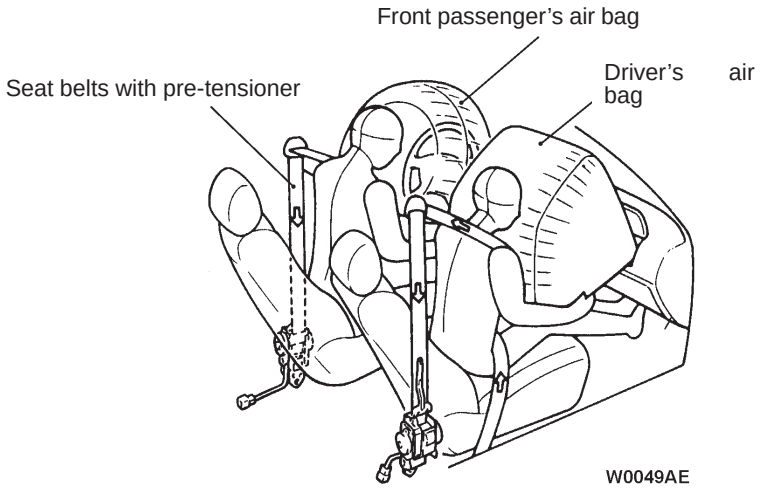


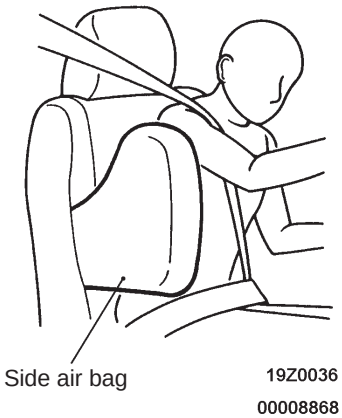






NOTE
*: Indicates the parts equipped on the right and left sides.

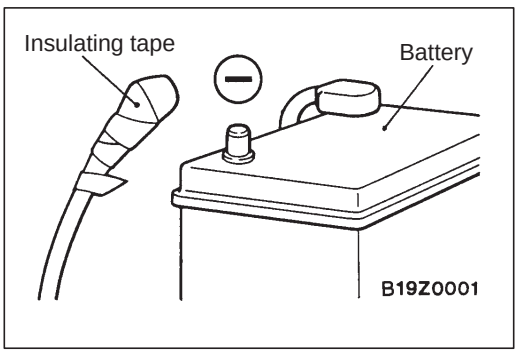




SRS SERVICE PRECAUTIONS

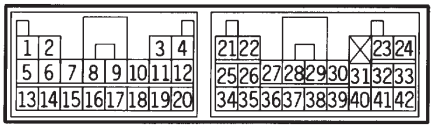
1. In order to avoid injury to yourself or others from accidental deployment of the air bag during servicing, read and carefully follow all the precautions and procedures described in this manual.
2. Do not use any electrical test equipment on or near SRS components, except those specified on GROUP 52B.
3. **Never Attempt to Repair the Following Components:**
   - SRS air bag control unit (SRS-ECU)
   - Clock spring
   - Driver's and front passenger's air bag modules
   - Side air bag modules
   - Side impact sensors

NOTE
If any of these components are diagnosed as faulty, they should only be replaced, in accordance with the INDIVIDUAL COMPONENTS SERVICE procedures in this manual. (Refer to GROUP 52B.)



4. **After disconnecting the negative (–) battery cable, wait 60 seconds at least before any service and insulate the disconnected cable with tape. The SRS retain enough voltage to deploy the air bags for a short time even after the disconnection of the battery. So, serious injury may result by accidental air bag deployment if a work is done on the SRS just after the disconnection of the battery.**

SRS-ECU connector



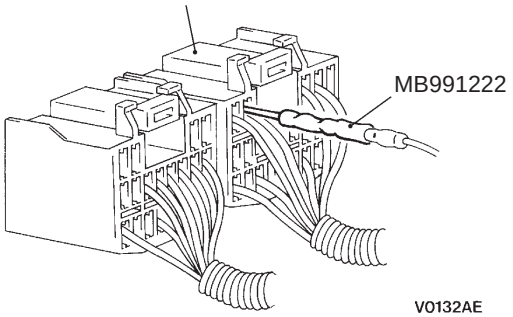
W0582AU

5. Do not attempt to repair the wiring harness connectors of the SRS. If the connector(s) are diagnosed as defective, replace the wiring harness(es). If the harness(es) are diagnosed as faulty, replace or repair the wiring harness(es) according to the table that follows.

SRS-ECU Terminal No.	Destination of harness	Corrective action
1, 2, 3, 4	Instrument panel wiring harness → Front wiring harness → Front impact sensor	Repair or replace each wiring harness
7	Instrument panel wiring harness → Earth	
8	Instrument panel wiring harness → Combination meter (SRS warning lamp)	
9, 10	Instrument panel wiring harness → Front passenger's air bag module	
11, 12	Instrument panel wiring harness → Clock spring → Driver's air bag module)	Repair or replace the dash wiring harness. Replace clock spring.
13	Instrument panel wiring harness → Junction block (fuse No.8)	Repair or replace each wiring harness.
16	Instrument panel wiring harness → Junction block (fuse No.6)	
20	Instrument panel wiring harness → Diagnosis connector	
21, 22	Body wiring harness → Side air bag module (L.H.)	
23, 24	Body wiring harness → Side air bag module (R.H.)	
27, 28	Body wiring harness → Seat belt with pre-tensioner (R.H.)	
29, 30	Body wiring harness → Seat belt with pre-tensioner (L.H.)	
34, 35, 36	Body wiring harness → Side impact sensor (L.H.)	
40, 41, 42	Body wiring harness → Side impact sensor (R.H.)	

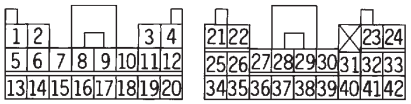
6. Inspection of the SRS-ECU harness connector should be carried out by the following procedure.
   Insert the special tool (probe, MB991222, in the harness set) into the connector from harness side (rear side), and connect the tester to this probe. If any tool than specified is used, damage to the harness and other components will result. Furthermore, measurement should not be carried out by touching the probe directly against the terminals from the front of the connector. The terminals are plated to increase their conductivity, so that if they are touched directly by the probe, the plating may break, which will cause drops in reliability.

SRS-ECU harness connector



V0132AE

SRS-ECU harness connector (rear view)



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7. SRS components should not be subjected to temperature over 93°C, so remove the SRS-ECU, driver's and front passenger's air bag modules, clock spring, front impact sensor, side impact sensors and front seat assemblies (side air bag modules) before drying or baking the vehicle after painting.
8. Whenever you finish servicing the SRS, check warning lamp operation to make sure that the system functions properly. (Refer to GROUP 52B.)
9. Make certain that the ignition switch is LOCK (OFF) position when the MUT-II is connected or disconnected.
10. If you have any questions about the SRS, please contact your local distributor.

NOTE
SERIOUS INJURY CAN RESULT FROM UNINTENDED AIR BAG DEPLOYMENT, SO USE ONLY THE PROCEDURES AND EQUIPMENT SPECIFIED IN THIS MANUAL.

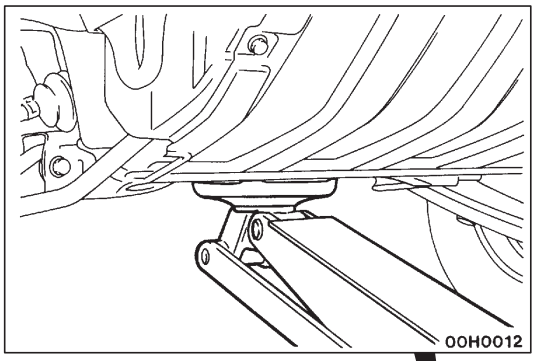
SUPPORT LOCATIONS FOR LIFTING AND JACKING

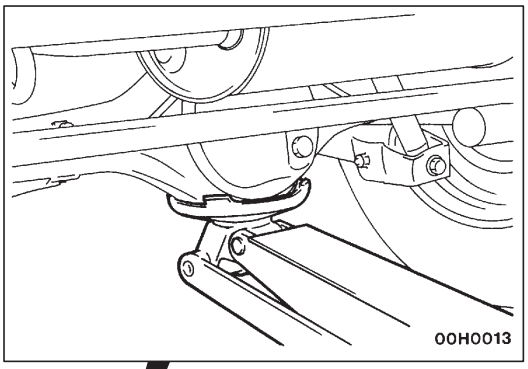
Caution
Do not support the vehicles at locations other than specified supporting points. Doing so will cause damage, etc.

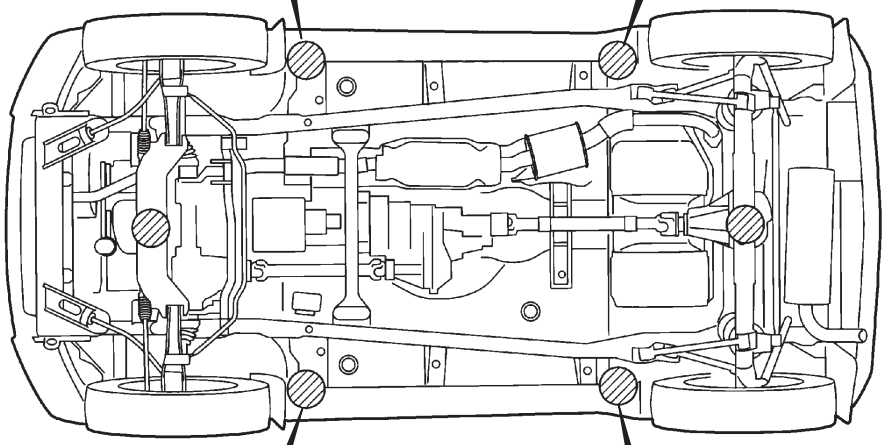
SUPPORT POSITIONS FOR A GARAGE JACK AND AXLE STANDS

GARAGE JACK

Caution
Never support any point other than the specified ones, or deformation will result.

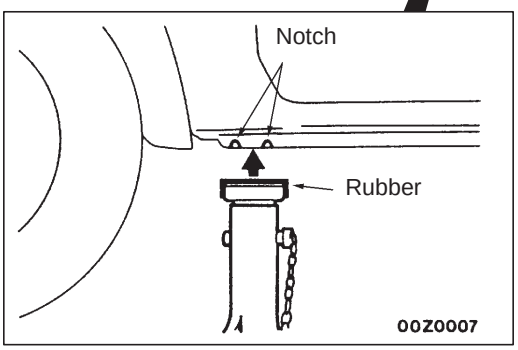


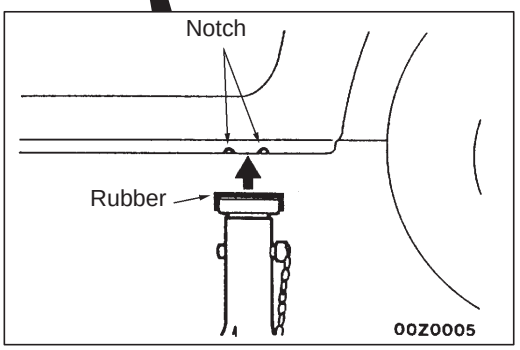




X0010AL

AXLE STANDS



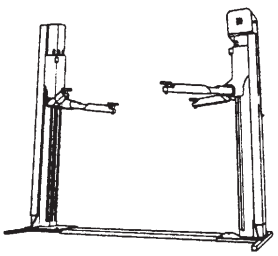


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SUPPORT POSITIONS FOR A SINGLE-POST LIFT OR DOUBLE-POST LIFT

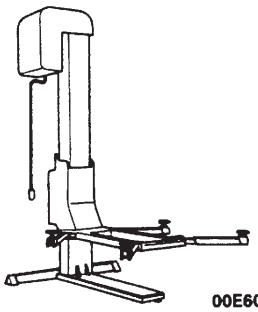
Caution
When service procedures require removing the rear suspension, spare tyre and rear bumper, place additional weight on rear end of vehicle or anchor vehicle to hoist to prevent tipping of centre of gravity changes.

DOUBLE-POST LIFT

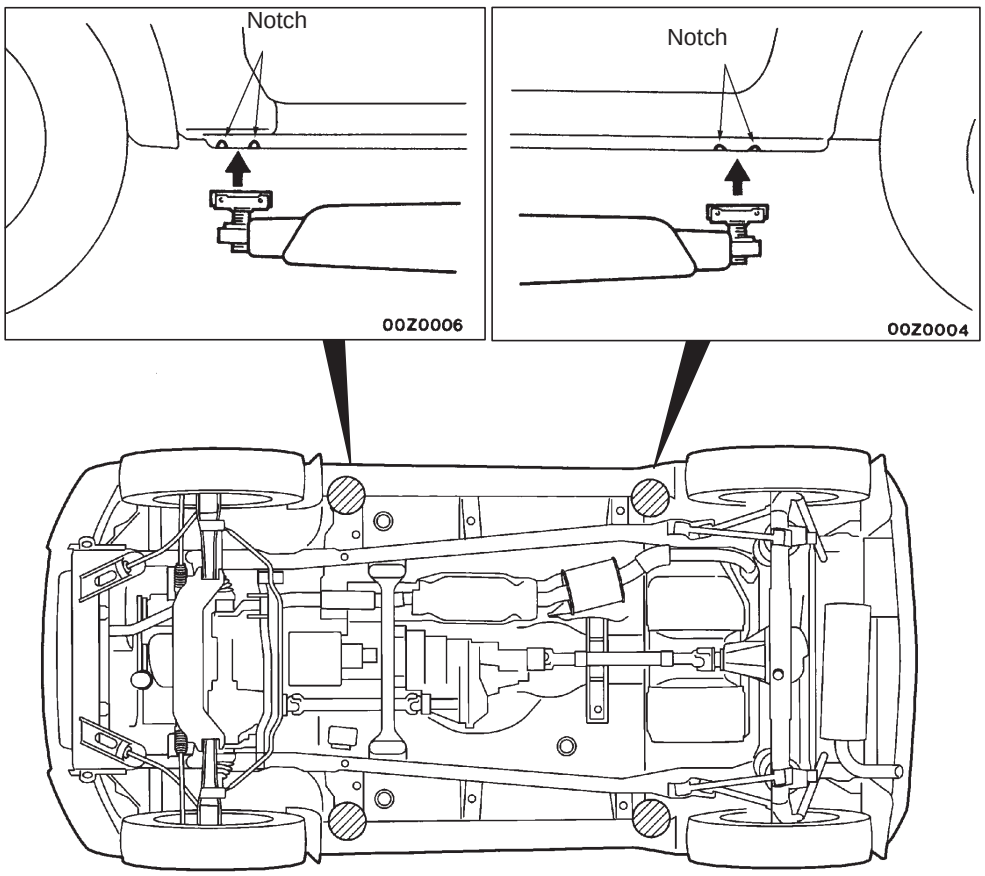


00E610

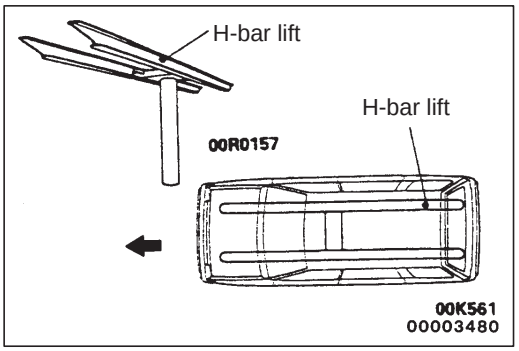
SINGLE-POST LIFT



00E609



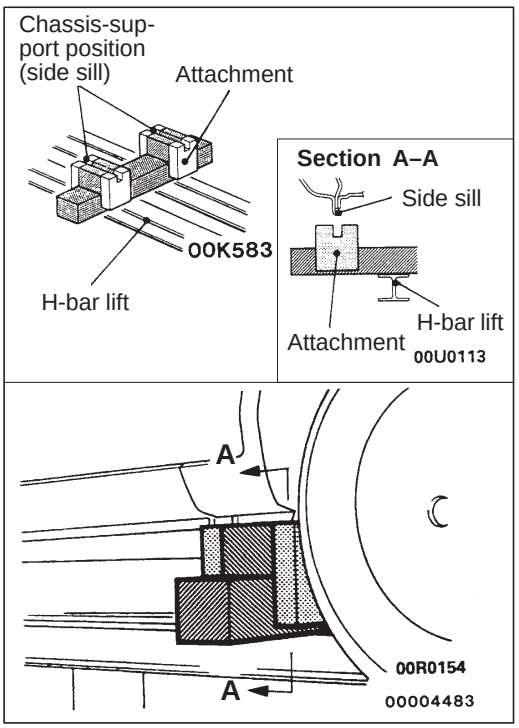
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SUPPORT POSITIONS AND SUPPORT METHOD FOR AN H-BAR LIFT

Caution
When service procedures require removing the rear suspension, fuel tank, spare tyre and rear bumper, place additional weight on rear end of vehicle or anchor vehicle to hoist to prevent tipping of centre of gravity changes.

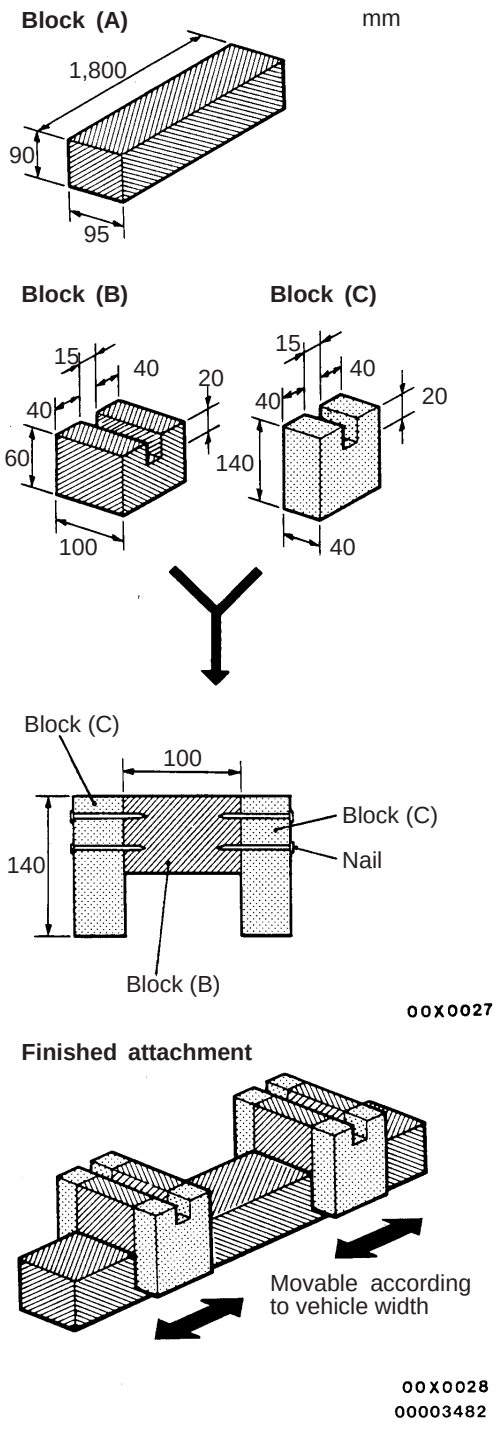
When H-bar lift is used to lift up vehicles, use of metallic attachment attached to the H-bar lift may cause damage to the suspension arm etc. Therefore, lift up the vehicle by the following procedure.



1. Place the vehicle on the H-bar lift (same direction).
2. Place attachments on the H-bar lift at the designated chassis-support positions. When making the attachments, refer to the section concerning making them.

   Caution
   If support is at any location other than the designated positions, the body or suspension might be deformed or otherwise damaged, so care should be taken to support only at the correct (designated) positions.

3. Raise the H-bar lift to the height at which the vehicle is slightly raised and check to be sure that the vehicle is correctly and sufficiently secured; then raise the vehicle.



PREPARATION OF "ATTACHMENTS"

1. Prepare the blocks (wooden) and nails as shown in the figure.

Item	Dimensions mm	Quantity
Block (A)	90 × 95 × 1,800	2
Block (B)	60 × 100 × 95	4
Block (C)	140 × 40 × 95	8
Nail	70 or more	32

Caution
The wood selected for the blocks must be hard.

2. For the (B) blocks and (C) blocks, use a saw and chisel or similar tool to make grooves of the dimensions shown in the figure.
3. Make four "ATTACHMENTS" such as shown in the figure nailing (B) and (C) blocks so that each (B) blocks is sandwiches between (C) blocks.

STANDARD PART/TIGHTENING-TORQUE TABLE

Each torque value in the table is a standard value for tightening under the following conditions.
(1) Bolts, nuts and washers are all made of steel and plated with zinc.
(2) The threads and bearing surface of bolts and nuts are all in dry condition.

The values in the table are not applicable:
(1) If toothed washers are inserted.
(2) If plastic parts are fastened.
(3) If bolts are tightened to plastic or die-cast inserted nuts.
(4) If self-tapping screws or self-locking nuts are used.

Standard bolt and nut tightening torque

Thread size		Torque Nm		
Bolt nominal diameter (mm)	Pitch (mm)	Head mark “4”	Head mark “7”	Head mark “8”
M5	0.8	2.5	4.9	5.9
M6	1.0	4.9	8.8	9.8
M8	1.25	12	22	25
M10	1.25	24	44	52
M12	1.25	41	81	96
M14	1.5	72	137	157
M16	1.5	111	206	235
M18	1.5	167	304	343
M20	1.5	226	412	481
M22	1.5	304	559	647
M24	1.5	392	735	853

Flange bolt and nut tightening torque

Thread size		Torque Nm		
Bolt nominal diameter (mm)	Pitch (mm)	Head mark “4”	Head mark “7”	Head mark “8”
M6	1.0	4.9	9.8	12
M8	1.25	13	24	28
M10	1.25	26	49	57
M10	1.5	24	44	54
M12	1.25	46	93	103
M12	1.75	42	81	96

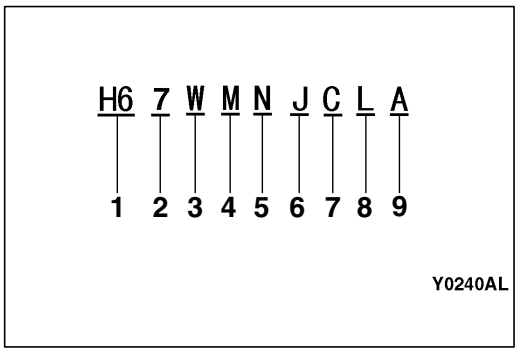
NOTES

GROUP 00
GENERAL

VEHICLE IDENTIFICATION

MODELS

Model code		Engine model	Transmission model	Fuel supply system
H67	WMNJCLA	4G94-DOHC (1,999 mL)	V5M21 <5M/T>	GDI
	WMNJCRA			
	WMRJCLA		V4AW4 <4A/T>	
	WMRJCRA			
H77	WLNJCLA		V5M21 <5M/T>	
	WLNJCRA			
	WRNJCLA		V4AW4 <4A/T>	
	WRNJCRA			

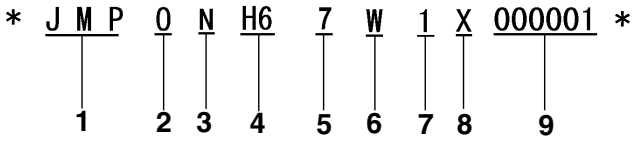


MODEL CODE

No.	Items	Contents
1	Development	H6: MITSUBISHI PAJERO PININ Short wheelbase H7: MITSUBISHI PAJERO PININ Long wheelbase
2	Engine type	7: 2,000 mL petrol engine
3	Sort	W: Wagon
4	Body style	M: 3-door L: 5-door
5	Transmission type	N: 5-speed manual transmission R: 4-speed automatic transmission
6	Trim level	J: GL
7	Specification engine feature	C: GDI-DOHC

No.	Items	Contents
8	Steering wheel location	L: Left hand R: Right hand
9	Destination	A: For Europe

CHASSIS NUMBER

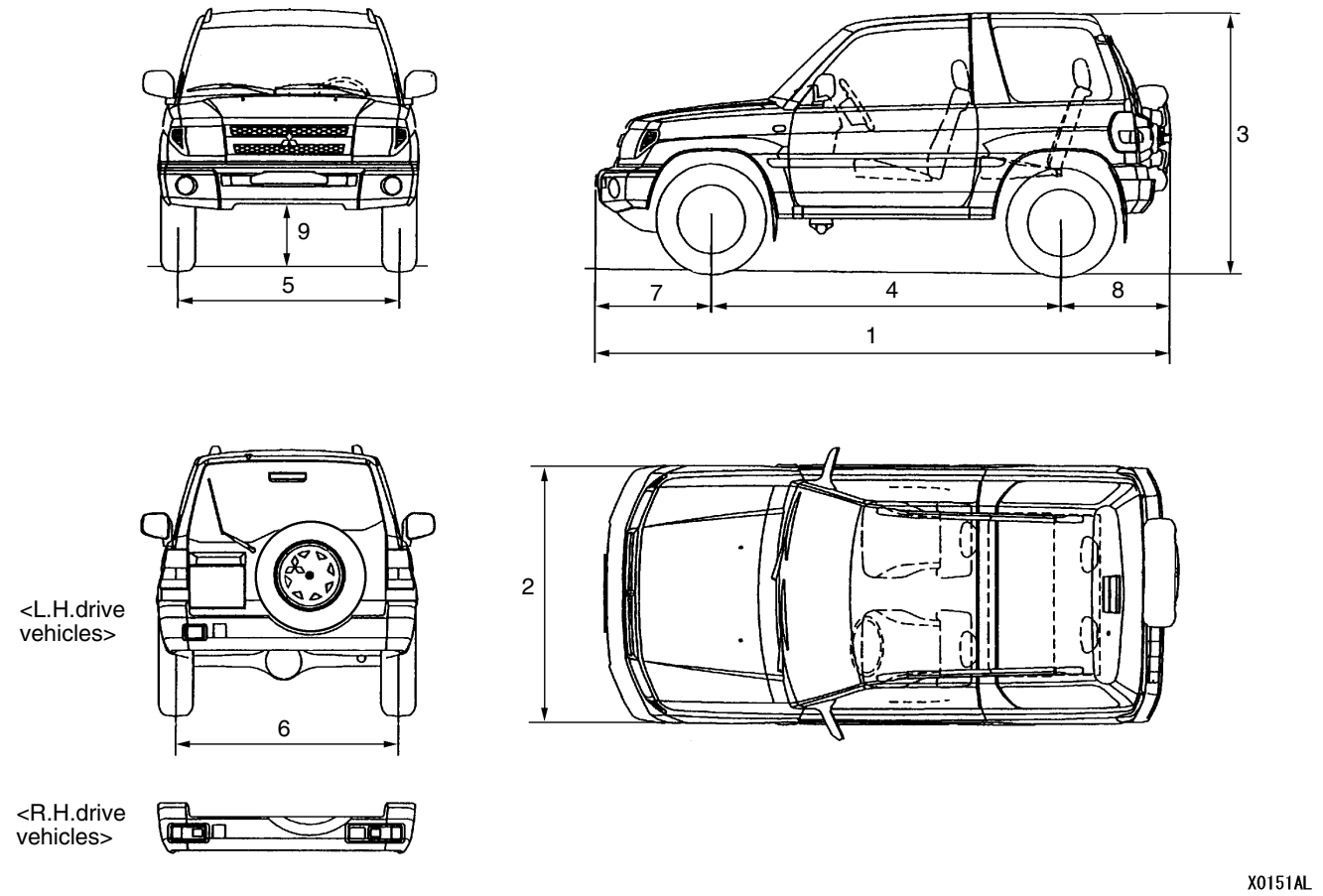


Y0243AL

No.	Items		Contents
1	Steering wheel location	JMP	Left hand drive
		JMR	Right hand drive
2	Body style	0	Standard roof
3	Transmission type	N	5-speed manual transmission
		R	4-speed automatic transmission
4	Development order	H6	PAJERO PININ Short wheelbase
		H7	PAJERO PININ Long wheelbase
5	Engine	7	4G94: 1,999 mL petrol engine
6	Sort	W	Wagon
7	Model year	1	2001
8	Plant	X	IPF
9	Serial number	–	–

MAJOR SPECIFICATIONS

<3-door model>



<L.H.drive vehicles>

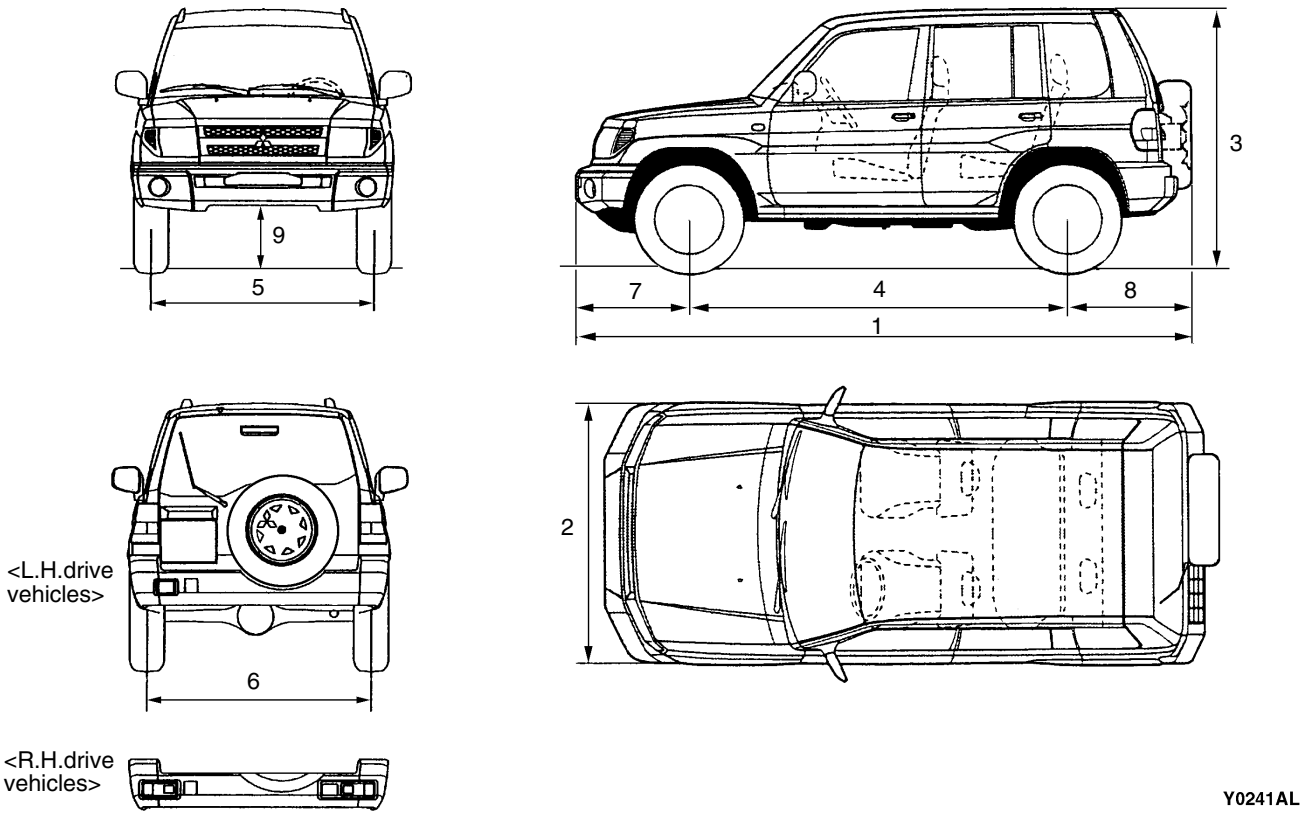
<R.H.drive vehicles>

X0151AL

Items			H67WMNJCLA	H67WMNJCRA	H67WMRJCLA	H67WMRJCRA
Vehicle dimensions mm	Overall length	1	3,735			
	Overall width	2	1,695			
	Overall height (unladen)	3	1,690/1,725*1/1,700*2			
	Wheelbase	4	2,280			
	Track-front	5	1,435			
	Track-rear	6	1,445			
	Overhang-front	7	755			
	Overhang-rear	8	700			
	Ground clearance (unladen)	9	200			
Vehicle weight kg	Kerb weight		1,300		1,320	
	Max. gross vehicle weight		1,725			
	Max. axle weight rating-front		745		755	
	Max. axle weight rating-rear		555		565	
Seating capacity			4			
Engine	Model No.		4G94			
	Total displacement mL		1,999			
Transmis-sion	Model No.		V5M21		V4AW4	
	Type		5-speed manual		4-speed automatic	
Fuel system	Fuel supply system		Gasoline Dirrect Injection			

NOTE:
*1: Vehicles with roof rails
*2: Vehicles with roof spoiler

<5-door model>



Items			H77WLNJCLA	H77WLNJCRA	H77WRNJCLA	H77WRNJCRA
Vehicle dimensions mm	Overall length	1	4,035			
	Overall width	2	1,695			
	Overall height (unladen)	3	1,700/1,735*1/1,720*2			
	Wheelbase	4	2,450			
	Track-front	5	1,435			
	Track-rear	6	1,445			
	Overhang-front	7	755			
	Overhang-rear	8	830			
	Ground clearance (unladen)	9	200			
Vehicle weight kg	Kerb weight		1,390		1,410	
	Max. gross vehicle weight		1,890			
	Max. axle weight rating-front		770		785	
	Max. axle weight rating-rear		620		625	
Seating capacity			5			
Engine	Model No.		4G94			
	Total displacement mL		1,999			
Transmis-sion	Model No.		V5M21		V4AW4	
	Type		5-speed manual		4-speed automatic	
Fuel system	Fuel supply system		Gasoline Dirrect Injection			

NOTE:
*1: Vehicles with roof rails
*2: Vehicles with roof spoiler

GROUP 00
GENERAL

HOW TO USE THIS MANUAL

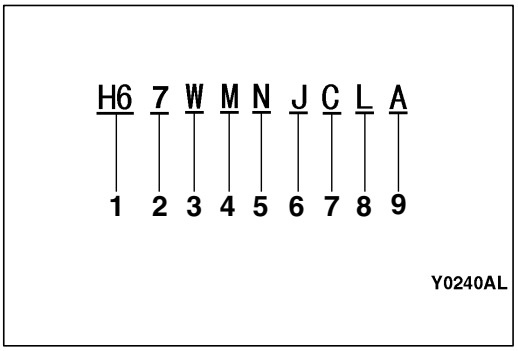
INDICATION OF TIGHTENING TORQUE

Tightening torques (units: N·m) are set to take into account the central value and the allowable tolerance. The central value is the target value, and the allowable tolerance provides the checking range for tightening torques. If bolts and nuts are not provided with tightening torques, refer to P.00-8.

VEHICLE IDENTIFICATION

MODELS

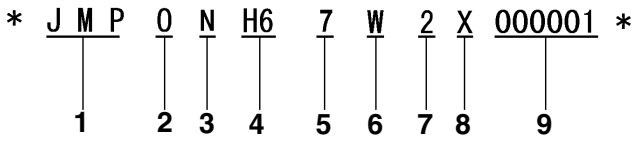
Model code		Engine model	Transmission model	Fuel supply system
H67	WMNJCLA	4G94-DOHC (1,999 mL)	V5M21 <5M/T>	GDI
	WMNJCRA			
	WMRJCLA		V4AW4 <4A/T>	
	WMRJCRA			
H66	WMNDELA	4G93-SOHC (1,834 mL)	V5M21 <5M/T>	MPI
	WMNDERA			
	WMRDELA		V4AW4 <4A/T>	
	WMRDERA			
H77	WLNJCLA	4G94-DOHC (1,999 mL)	V5M21 <5M/T>	GDI
	WLNJCRA			
	WLRJCLA		V4AW4 <4A/T>	
	WLRJCRA			
H76	WLNDELA	4G93-SOHC (1,834 mL)	V5M21 <5M/T>	MPI
	WLNDERA			
	WLRDELA		V4AW4 <4A/T>	
	WLRDERA			



MODEL CODE

No.	Items	Contents
1	Development	H6: MITSUBISHI PAJERO PININ Short wheelbase H7: MITSUBISHI PAJERO PININ Long wheelbase
2	Engine type	6: 1,800 mL petrol engine 7: 2,000 mL petrol engine
3	Sort	W: Wagon
4	Body style	M: 3-door L: 5-door
5	Transmission type	N: 5-speed manual transmission R: 4-speed automatic transmission
6	Trim level	D: L J: GL
7	Specification engine feature	E: MPI-SOHC C: GDI-DOHC
8	Steering wheel location	L: Left hand R: Right hand
9	Destination	A: For Europe

CHASSIS NUMBER



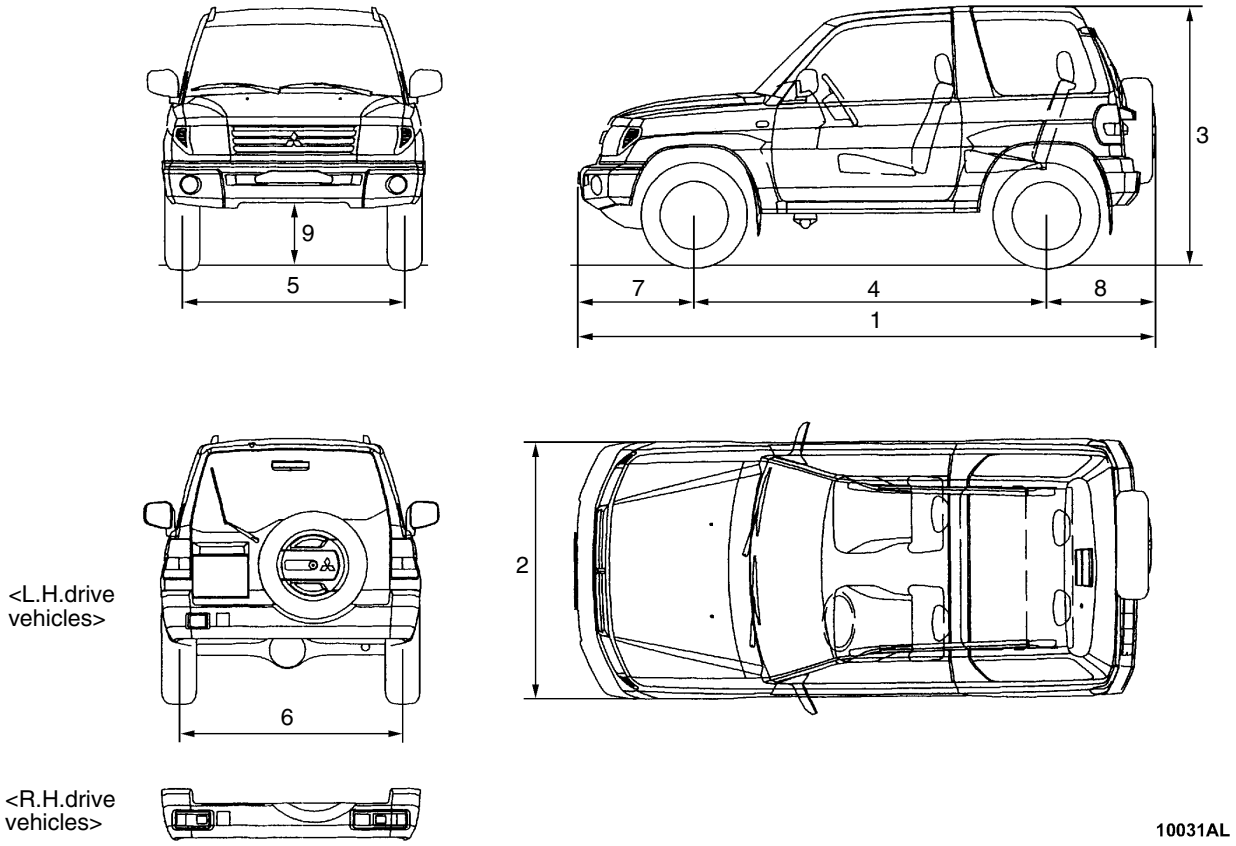
10030AL

No.	Items		Contents
1	Steering wheel location	JMP	Left hand drive
		JMR	Right hand drive
2	Body style	0	Standard roof
3	Transmission type	N	5-speed manual transmission
		R	4-speed automatic transmission
4	Development order	H6	PAJERO PININ Short wheelbase
		H7	PAJERO PININ Long wheelbase
5	Engine	6	4G93: 1,834 mL petrol engine
		7	4G94: 1,999 mL petrol engine
6	Sort	W	Wagon
7	Model year	2*	2002
8	Plant	X	IPF
9	Serial number	–	–

NOTE
*: Indicates new model.

MAJOR SPECIFICATIONS

<3-door model>



<L.H.drive vehicles>

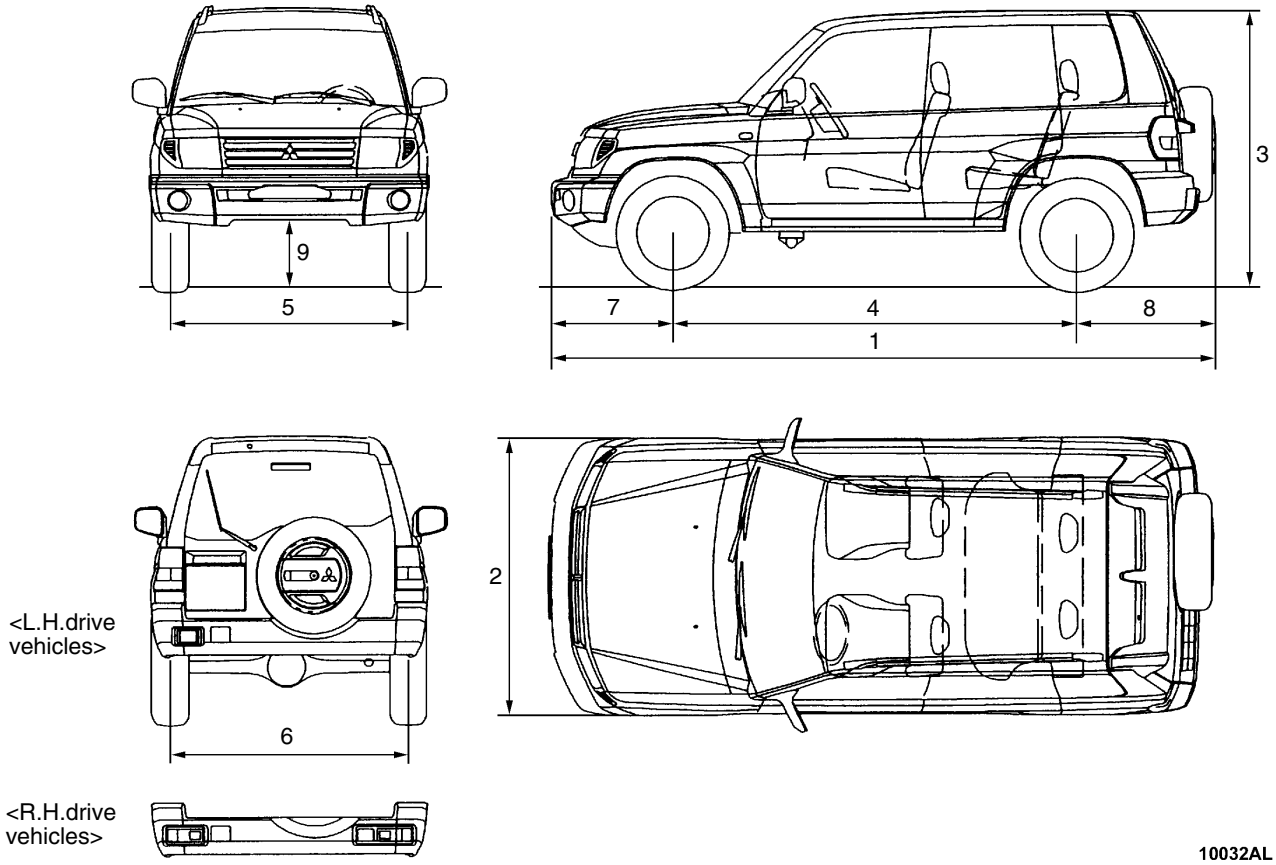
<R.H.drive vehicles>

10031AL

Items			H66WMNDELA	H66WMNDERA	H66WMRDELA	H66WMRDERA
Vehicle dimensions mm	Overall length	1	3,735			
	Overall width	2	1,680			
	Overall height (unladen)	3	1,690/1,725*1/1,700*2			
	Wheelbase	4	2,280/2,272*3			
	Track-front	5	1,435			
	Track-rear	6	1,445			
	Overhang-front	7	755			
	Overhang-rear	8	700			
	Ground clearance (unladen)	9	200			
Vehicle weight kg	Kerb weight		1,255		1,275	
	Max. gross vehicle weight		1,680			
	Max. axle weight rating-front		710		720	
	Max. axle weight rating-rear		545		555	
Seating capacity			4			
Engine	Model No.		4G93			
	Total displacement mL		1,834			
Transmis-sion	Model No.		V5M21		V4AW4	
	Type		5-speed manual		4-speed automatic	
Fuel system	Fuel supply system		Electronically controlled multipoint injection			

NOTE:
*1: Vehicles with roof rails
*2: Vehicles with roof spoiler
*3: Measure in running condition

<5-door model>



Items			H76WLNDELA	H76WLNDERA	H76WRNDELA	H76WRNDERA
Vehicle dimensions mm	Overall length	1	4,035			
	Overall width	2	1,680			
	Overall height (unladen)	3	1,700/1,735*1/1,720*2			
	Wheelbase	4	2,450/2,439*3			
	Track-front	5	1,435			
	Track-rear	6	1,445			
	Overhang-front	7	755			
	Overhang-rear	8	830			
	Ground clearance (unladen)	9	200			
Vehicle weight kg	Kerb weight		1,340		1,360	
	Max. gross vehicle weight		1,840			
	Max. axle weight rating-front		735		750	
	Max. axle weight rating-rear		605		610	
Seating capacity			5			
Engine	Model No.		4G93			
	Total displacement mL		1,843			
Transmis-sion	Model No.		V5M21		V4AW4	
	Type		5-speed manual		4-speed automatic	
Fuel system	Fuel supply system		Electronically controlled multipoint injection			

NOTE:
*1: Vehicles with roof rails
*2: Vehicles with roof spoiler
*3: Measure in running condition

STANDARD PART/TIGHTENING TORQUE TABLE

Each torque value in the table is a standard value for tightening under the following conditions.
(1) Bolts, nuts and washers are all made of steel and plated with zinc.
(2) The threads and bearing surface of bolts and nuts are all in dry condition.

The values in the table are not applicable:
(1) If toothed washers are inserted.
(2) If plastic parts are fastened.
(3) If bolts are tightened to plastic or die-cast inserted nuts.
(4) If self-tapping screws or self-locking nuts are used.

Standard bolt and nut tightening torque

Thread size		Torque N·m		
Bolt nominal diameter (mm)	Pitch (mm)	Head mark “4”	Head mark “7”	Head mark “8”
M5	0.8	2.5 ± 0.5	5.0 ± 1.0	6.0 ± 1.0
M6	1.0	5.0 ± 1.0	9.0 ± 2.0	10 ± 2
M8	1.25	12 ± 2	22 ± 4	25 ± 4
M10	1.25	24 ± 4	44 ± 10	53 ± 7
M12	1.25	41 ± 8	83 ± 12	98 ± 12
M14	1.5	73 ± 12	140 ± 20	155 ± 25
M16	1.5	110 ± 20	210 ± 30	235 ± 35
M18	1.5	165 ± 25	300 ± 40	340 ± 50
M20	1.5	225 ± 35	410 ± 60	480 ± 70
M22	1.5	300 ± 40	555 ± 85	645 ± 95
M24	1.5	395 ± 55	735 ± 105	855 ± 125

Flange bolt and nut tightening torque

Thread size		Torque N·m		
Bolt nominal diameter (mm)	Pitch (mm)	Head mark “4”	Head mark “7”	Head mark “8”
M6	1.0	5.0 ± 1.0	10 ± 2	12 ± 2
M8	1.25	13 ± 2	24 ± 4	27 ± 5
M10	1.25	26 ± 4	49 ± 9	58 ± 7
M10	1.5	24 ± 4	45 ± 8	55 ± 10
M12	1.25	46 ± 8	95 ± 15	105 ± 15
M12	1.75	43 ± 8	83 ± 12	98 ± 12

NOTE
1. Be sure to use only the specified bolts and nuts, and always tighten them to the specified torques.
2. Bolts marked with indications such as 4T or 7T are reinforced bolts. The larger the number, the greater the bolt strength.

SERVICE BULLETIN

MITSUBISHI MOTORS

QUALITY INFORMATION ANALYSIS
OVERSEAS SERVICE DEPT. MITSUBISHI MOTORS CORPORATION

SERVICE BULLETIN	**No.:** MSB-00E00-505	
	Date: 2001-09-25	**<Model>** / **<M/Y>**

Subject: ESTABLISHMENT OF GDI ENGINE IDLE LEARNING FUNCTION

Group: GENERAL — **Draft No.:** 00AL610610

CORRECTION — **INTERNATIONAL CAR ADMINISTRATION OFFICE**

T.MASAKI-MANAGER
TECHNICAL SERVICE PLANNING

<Model>	<M/Y>
(EC)PAJERO/MONTERO(V60,70)	01-10
(EC)GALANT(EA0)	99-10
(EC)SPACE RUNNER/SPACE WAGON(N60,80,90)	99-10
(EC)CARISMA	98-10
(EC)SPACE STAR(H60,70)	99-10
(EC)PAJERO PININ	99-10

1. Description:

On the GDI engine equipped cars, an idle learning function that will be required after replacement of the ECU (for engine control) or after resetting of the battery* has been established.

*: Disconnection of ECU (for engine control) battery backup power supply (disconnection of battery terminals or ECU connectors)

2. Applicable Manuals:

Manual	Pub. No.	Language	Page(s)
2001 PAJERO Workshop Manual VOL.1	PWJE0001 (1/2)	(English)	00-29
2001 MONTERO Workshop Manual VOL.1	PWJS0002 (1/2)	(Spanish)	
2001 PAJERO/MONTERO Workshop Manual CD-ROM	PWJT0008R	(English)	
	PWJT0008R	(Spanish)	
	PWJT0008R	(French)	
	PWJT0008R	(German)	
1999 GALANT Workshop Manual Supplement	PWDE9611-A	(English)	00-12
	PWDS9612-A	(Spanish)	
	PWDF9613-A	(French)	
	PWDG9614-A	(German)	
	PWDD9615-A	(Dutch)	
	PWDW9616-A	(Swedish)	
1999 SPACE RUNNER/SPACE WAGON Workshop Manual	PWDE9803	(English)	00-20
	PWDS9804	(Spanish)	
	PWDF9805	(French)	
	PWDG9806	(German)	
	PWDD9807	(Dutch)	
	PWDW9808	(Swedish)	

Manual	Pub. No.	Language	Page(s)
1998 CARISMA Workshop Manual Supplement	PWDE9502-C	(English)	00-4
	PWDS9503-C	(Spanish)	
	PWDF9504-C	(French)	
	PWDG9505-C	(German)	
	PWDD9506-C	(Dutch)	
	PWDW9507-C	(Swedish)	
1999 SPACE STAR Workshop Manual	CMXE99E1	(English)	00-18
	CMXS99E1	(Spanish)	
	CMXF99E1	(French)	
	CMXG99E1	(German)	
	CMXD99E1	(Dutch)	
	CMXW99E1	(Swedish)	
	CMXI99E1	(Italian)	
1999 PAJERO PININ/MONTERO SPORT Workshop Manual	CKRE99E1	(English)	00-17
	CKRS99E1	(Spanish)	
	CKRF99E1	(French)	
	CKRG99E1	(German)	
	CKRD99E1	(Dutch)	
	CKRW99E1	(Swedish)	
	CKRI99E1	(Italian)	

3. Details:
Contents of Attachment are to be added to GROUP 00 (GENERAL).

PRECAUTIONS BEFORE SERVICE
LEARNING FUNCTION OF GDI ENGINE

1. Purpose

On the GDI engine equipped cars, when replacement of the ECU (for engine control) or resetting of the battery* has been performed, an idle learning function of the ECU (for engine control) will be required.
The idle learning function will be completed by running the engine at idle by the following procedure.

NOTE:
*: Disconnection of ECU (for engine control) battery backup power supply (disconnection of battery terminals or ECU connectors)

2. Idle Learning Procedure

(1) Start the engine, and warm up the engine until its coolant temperature reaches 85℃ or higher. When the engine coolant temperature is 85℃ or higher, you have only to turn the ignition switch to the ON position.
(2) Turn the ignition switch to the LOCK (OFF) position, and stop the engine.
(3) After lapse of ten or more seconds, restart the engine.
(4) Run the engine at idle for ten minutes under the following conditions.
- Transmission: Neutral (P range for automatic transmission)
- Air conditioner and heater: Not operational
- Engine coolant temperature: 83℃ or higher

(5) Stop the engine
(6) Restart the engine, and run it at idle for ten minutes under the following condition.
- Transmission: Neutral (P range for automatic transmission)
- Air conditioner: Operational (Temperature set at “maximum cool”, fan at high speed, and windows fully opened)
- Engine coolant temperature: 83℃ or higher

(7) Repeat steps (5) and (6).

NOTE
1) When the atmospheric temperature is 20℃ or more and the air conditioner has continuously been operated, step (7) may be omitted.
2) During idling operation of the engine in steps (4) and (6), when engine operation switches from lean operation to stoichiometric operation, engine stall can occur. In this case, clean the throttle body (throttle valve) thoroughly, and then repeat step (1) and the subsequent steps.

ENGINE
<4G9-GDI>

ENGINE
<4G9-GDI>

CONTENTS

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SPECIAL TOOLS 4

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- Ignition Timing Check 9
- Idle Speed Check 10
- Idle Mixture Check 10
- Compression Pressure Check 11
- Manifold Vacuum Check 12
- Lash Adjuster Check 13

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TIMING BELT 28

ENGINE ASSEMBLY 33

GENERAL INFORMATION

Items			4G93-GDI
Total displacement mℓ			1,834
Bore × Stroke mm			81 × 89
Compression ratio			12.0
Combustion chamber			Pentroof + ball-in-piston
Camshaft arrangement			DOHC
Number of valve	Intake		8
	Exhaust		8
Valve timing	Intake	Opening	BTDC 15°
		Closing	ABDC 56°
	Exhaust	Opening	BBDC 55°
		Closing	ATDC 15°
Fuel system			Electronically controlled multipoint fuel injection
Rocker arm			Roller type
Auto-lash adjuster			Equipped

SERVICE SPECIFICATIONS

Items		Standard value	Limit
Alternator drive belt tension (When checked)	Vibration frequency Hz	143 – 185	–
	Tension N	294 – 490	–
	Deflection (Reference value) mm	9.7 – 12.9	–
Alternator drive belt tension (When adjusted)	Vibration frequency Hz	155 – 175	–
	Tension N	343 – 441	–
	Deflection (Reference value) mm	10.5 – 12.0	–
Alternator drive belt tension (When replaced)	Vibration frequency Hz	203 – 234	–
	Tension N	588 – 784	–
	Deflection (Reference value) mm	6.7 – 8.5	–

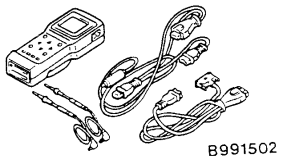
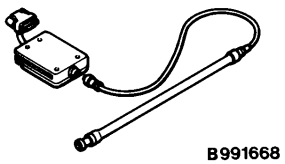
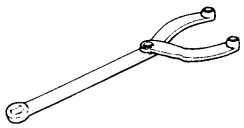
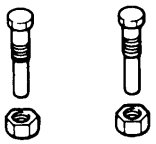
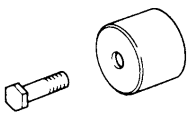
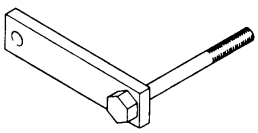
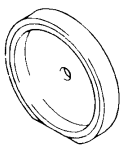
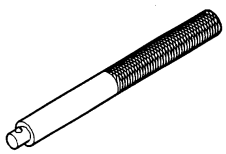
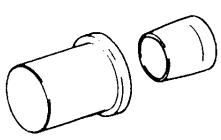
Items		Standard value	Limit
Power steering oil pump and A/C compressor drive belt tension (When checked)	Vibration frequency Hz	114 – 139	–
	Tension N	392 – 588	–
	Deflection (Reference value) mm	10.0 – 12.0	–
Power steering oil pump and A/C compressor drive belt tension (When adjusted)	Vibration frequency Hz	121 – 133	–
	Tension N	441 – 539	–
	Deflection (Reference value) mm	10.0 – 11.0	–
Power steering oil pump and A/C compressor drive belt tension (When replaced)	Vibration frequency Hz	145 – 166	–
	Tension N	637 – 834	–
	Deflection (Reference value) mm	7.0 – 9.0	–
Basic ignition timing		5° BTDC ± 3°	–
Ignition timing		Approx. 16°BTDC*1	–
Idle speed r/min		600 ± 50*1	–
CO contents %		0.6 or less	–
HC contents ppm		200 or less	–
Compression pressure kPa – r/min		1,720 – 300	1,337 – 300
Compression pressure difference of all cylinder kPa		–	Max. 100
Intake manifold vacuum kPa		–	Min. 60*2
Cylinder head bolt shank length mm		–	96.4
Auto-tensioner push rod movement mm		Within 1	–
Timing belt tension torque Nm (Reference value)		2.5 – 4.0	–
Auto-tensioner rod protrusion amount mm		3.8 – 4.5	–

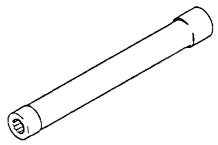
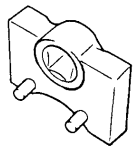
NOTE
*1: Indicates the value measured within 4 minutes since the engine was started.
*2: Indicates the value when more than 4 minutes have passed since the engine was started.

SEALANTS

Items	Specified sealants	Remarks
Beam camshaft cap Cylinder head	3M ATD Part No.8660 or equivalent	–
Cam position sensor support Oil pan	MITSUBISHI GENUINE PART MD970389 or equivalent	Semi-drying sealant
Thrust case Flywheel or drive plate bolt	3M Stud Locking 4170 or equivalent	–

SPECIAL TOOLS

Tool	Number	Name	Use
	MB991502	MUT-II sub assembly	● Measuring the drive belt tension ● Checking the ignition timing ● Checking the idle speed ● Erasing diagnosis code
	MB991668	Belt tension meter set	Measuring the drive belt tension (used together with the MUT-II)
	MB990767	End yoke holder	● Holding the camshaft sprocket ● Holding the crankshaft sprocket
	MD998719 or MD998754	Crankshaft pulley holder pin	● Holding the camshaft sprocket ● Holding the crankshaft sprocket
	MD998713	Camshaft oil seal installer	Press-in of the camshaft oil seal
	MD998781	Flywheel stopper	Securing the flywheel or drive plate
	MD998776	Crankshaft rear oil seal installer	Press-in of the crankshaft rear oil seal
	MB990938	Handle	Press-in of the crankshaft rear oil seal
	MD998717	Crankshaft front oil seal installer	Press–in of crankshaft front oil seal

Tool	Number	Name	Use
	MB991653	Cylinder head bolt wrench	Cylinder head bolt removal and installation
	MD998767	Tension pulley socket wrench	Timing belt tension adjustment

ON-VEHICLE SERVICE

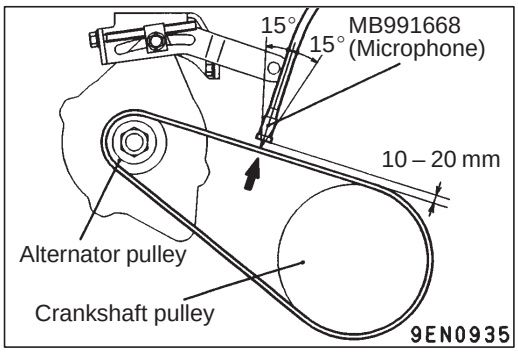
DRIVE BELT TENSION CHECK AND ADJUSTMENT

ALTERNATOR DRIVE BELT TENSION CHECK

Check the drive belt tension in the following procedure.

Standard value:

Vibration frequency Hz	143 – 185
Tension N	294 – 490
Deflection (Reference value) mm	9.7 – 12.9

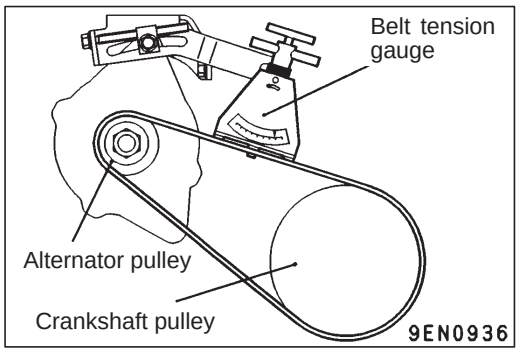


<When using the MUT-II>

1. Connect the special tool (belt tension meter set) to the MUT-II.
2. Connect the MUT-II to the diagnosis connector.
3. Turn the ignition switch to ON and select “Belt Tension Measurement” from the menu screen.
4. Hold the microphone to the middle of the drive belt between the pulleys (at the place indicated by the arrow), about 10 – 20 mm away from the rear surface of the belt and so that it is perpendicular to the belt (within an angle of ± 15°).
5. Gently tap the middle of the belt between the pulleys (the place indicated by the arrow) with your finger as shown in the illustration, and check that the vibration frequency of the belt is within the standard value.

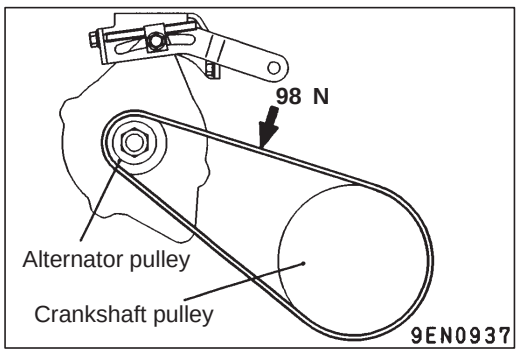
Caution

(1) The temperature of the surface of the belt should be as close as possible to normal temperature.
(2) Do not let any contaminants such as water or oil get onto the microphone.
(3) If strong gusts of wind blow against the microphone or if there are any loud sources of noise nearby, the values measured by the microphone may not correspond to actual values.
(4) If the microphone is touching the belt while the measurement is being made, the values measured by the microphone may not correspond to actual values.
(5) Do not take the measurement while the vehicle’s engine is running.



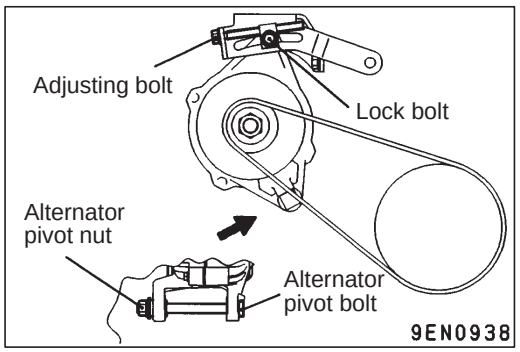
<When using a tension gauge>

Use a belt tension gauge to check that the belt tension is within the standard value.



<Belt deflection check>

Apply 98 N of force to the middle of the drive belt between the pulleys (at the place indicated by the arrow) and check that the amount of deflection is within the standard value.



ALTERNATOR DRIVE BELT TENSION ADJUSTMENT

1. Loosen the nut of the alternator pivot bolt.
2. Loosen the lock bolt.
3. Use the adjusting bolt to adjust the belt tension and belt deflection to the standard values.

   Standard value:

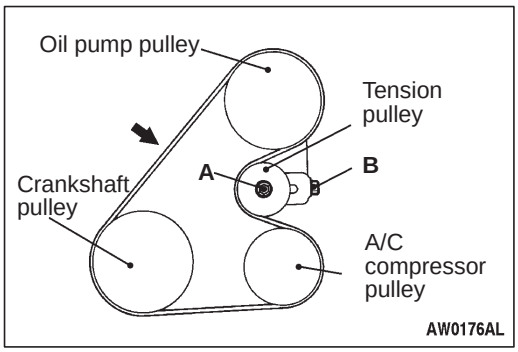
Items	When adjusted	When replaced
Vibration frequency Hz	155 – 175	203 – 234
Tension N	343 – 441	588 – 784
Deflection (Reference value) mm	10.5 – 12.0	6.7 – 8.5

4. Tighten the nut of the alternator pivot bolt.

   Tightening torque: 44 Nm
5. Tighten the lock bolt.

   Tightening torque: 22 Nm
6. Tighten the adjusting bolt.

   Tightening torque: 5 Nm



POWER STEERING OIL PUMP AND AIR CONDITIONER COMPRESSOR DRIVE BELT TENSION CHECK AND ADJUSTMENT

1. Check if the belt tension is within the standard value using one of the methods below.

   Standard value:

Items	When checked	When adjusted	When replaced
Vibration frequency Hz	114 – 139	121 – 133	145 – 166
Tension N	392 – 588	441 – 539	637 – 834
Deflection (Reference value) mm	10.0 – 12.0	10.0 – 11.0	7.0 – 9.0

   <When measuring the vibration frequency>

   With your finger tip lightly tap the centre of the belt between the pulleys in the location shown by the arrow in the illustration and then measure the belt vibration frequency.

   NOTE
   Refer to P.11A-7 for information regarding the vibration frequency measurement method using MUT-II.

   <When measuring the tension>

   Use a belt tension gauge to measure the belt tension.

   <When measuring the deflection>

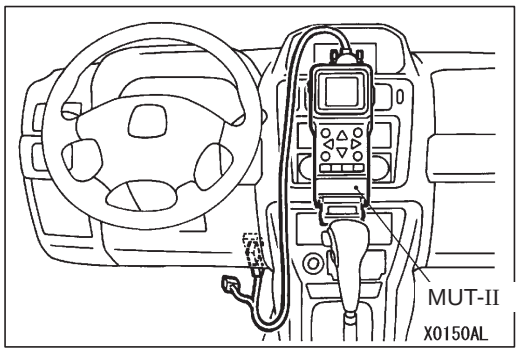
   Apply 98 N of pressure against the location between the pulleys shown by the arrow in the illustration and then measure the deflection.

2. If the tension or deflection is outside the standard value, adjust by the following procedure.
   (1) Loosen tensioner pulley fixing nut A.
   (2) Adjust the amount of belt deflection using adjusting bolt B.
   (3) Tighten fixing nut A.

   Tightening torque: 25 Nm

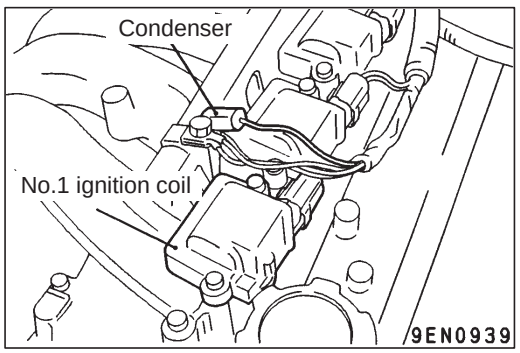
   (4) Check the belt deflection amount and tension, and readjust if necessary.

   Caution
   Check after turning the crankshaft once or more clockwise (right turn).



IGNITION TIMING CHECK

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Connect the MUT-II to the diagnosis connector.



3. Set the timing light to the condenser of the No.1 ignition coil power supply line (terminal No.3).
4. Start the engine and run at idle.
5. Check that engine idle speed is within the standard value.

   Standard value: 600 ± 50 r/min

   NOTE
   After 4 minutes or more have passed in the idle running condition, the idle speed will become 750 r/min.
6. Select No.17 of the MUT-II Actuator test.

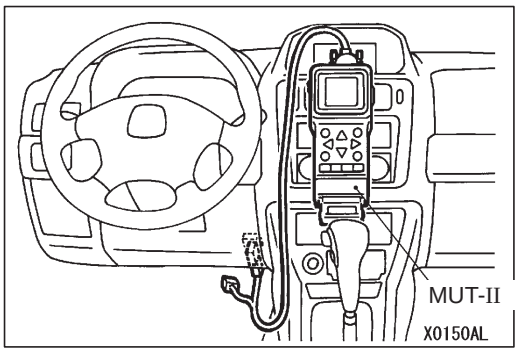
   NOTE
   At this time, the engine speed will become approximately 750 r/min.
7. Check that basic ignition timing is within the standard value.

   Standard value: 5° BTDC ± 3°
8. If the basic ignition timing is outside the standard value, inspect the GDI system while referring to GROUP 13A – Troubleshooting.
9. Press the MUT-II clear key (Select a forced driving cancel mode) to release the Actuator test.

   Caution
   If the test is not cancelled, a forced driving will continue for 27 minutes. Driving under this condition may damage the engine.
10. Check that ignition timing is at the standard value.

    Standard value: approx. 16°BTDC

    NOTE
    (1) The ignition timing will become approximately 5°BTDC after more than 4 minutes have passed since the basic ignition timing set mode was released.
    (2) The ignition timing may fluctuate within ±7°BTDC. This is normal.
    (3) In higher altitude, the ignition timing is more advanced than the standard value by approximately 5 degree.



IDLE SPEED CHECK

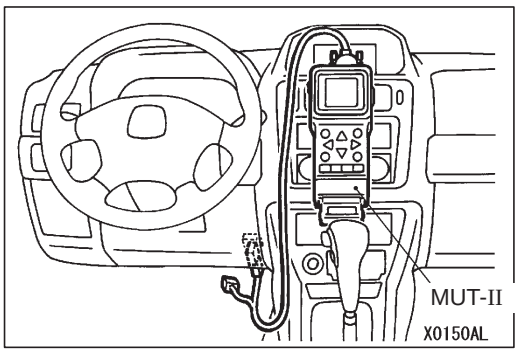
1. Before inspection, set the vehicle to the pre-inspection condition.
2. Turn off the ignition switch and then connect the MUT-II to the diagnosis connector.
3. Check the basic ignition timing.

   NOTE
   Refer to P.11A-9 concerning the check procedure of the basic ignition timing.

   Standard value: 5° BTDC ± 3°
4. Run the engine at idle for 2 minutes.
5. Check the idle speed. Select item No. 22 and take a reading of the idle speed.

   Standard value: 600 ± 50 r/min

   NOTE
   (1) After 4 minutes or more have passed in the idle running condition, the idle speed will become 750 r/min.
   (2) The idle speed is controlled automatically by the idle speed control system.
6. If the idle speed is outside the standard value, inspect the GDI components by referring to GROUP 13A – Troubleshooting.



IDLE MIXTURE CHECK

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Connect the MUT-II to the diagnosis connector.
3. Check that the basic ignition timing is within the standard value.

   NOTE
   Refer to P.11A-10 concerning the check procedure of the basic ignition timing.

   Standard value: 5° BTDC ± 3°
4. Run the engine at 2,500 r/min for 2 minutes.
5. Set the CO, HC tester.

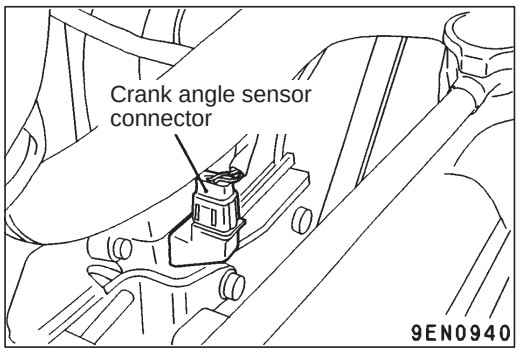
6. Check the CO contents and the HC contents at idle.

   NOTE
   This measurement should be performed in less than approximately 4 minutes since the engine speed become the idle speed.

   Standard value
   CO contents: 0.6% or less
   HC contents: 200 ppm or less

7. If there is a deviation from the standard value, check the following items:
   - Diagnosis output
   - Fuel pressure
   - Injector
   - Ignition coil, spark plug
   - EGR control system
   - Evaporative emission control system
   - Compression pressure

   NOTE
   Replace the three way catalyst when the CO and HC contents are not within the standard value, even though the result of the inspection is normal on all items.



COMPRESSION PRESSURE CHECK

1. Before inspection, check that the engine oil, starter and battery are normal. In addition, set the vehicle to the pre-inspection condition.
2. Remove all of the ignition coils and spark plugs.
3. Disconnect the crank angle sensor connector.

   NOTE
   Doing this will prevent the engine-ECU from carrying out ignition and fuel injection.

4. Cover the spark plug hole with a shop towel etc., and after the engine has been cranked, check that no foreign material is adhering to the shop towel.

   Caution
   (1) Keep away from the spark plug hole when cranking.
   (2) If compression is measured with water, oil, fuel, etc., that has come from cracks inside the cylinder, these materials will become heated and will gush out from the spark plug hole, which is dangerous.

5. Set compression gauge to one of the spark plug holes.
6. Crank the engine with the throttle valve fully open and measure the compression pressure.

   Standard value (at engine speed of 300 r/min):
   1,720 kPa

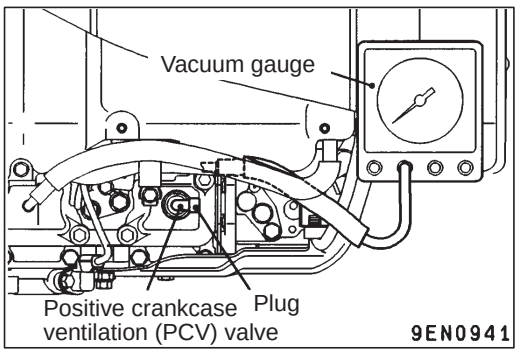
   Limit (at engine speed of 300 r/min):
   Min. 1,337 kPa

7. Measure the compression pressure for all the cylinders, and check that the pressure differences of the cylinders are below the limit.

   Limit: Max. 100 kPa

8. If there is a cylinder with compression or a compression difference that is outside the limit, pour a small amount of engine oil through the spark plug hole, and repeat the operations in steps 6 and 7.
   (1) If the compression increases after oil is added, the cause of the malfunction is a worn or damaged piston ring and/or cylinder inner surface.
   (2) If the compression does not rise after oil is added, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket.
9. Connect the crank angle sensor connector.
10. Install the spark plugs and ignition coils.
11. Use the MUT-II to erase the diagnosis codes.

    NOTE
    This will erase the diagnosis code resulting from the crank angle sensor connector being disconnected.



MANIFOLD VACUUM CHECK

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Turn off the ignition switch.
3. Connect the engine tachometer or connect the MUT-II to the diagnosis connector.
4. Disconnect the ventilation hose from the positive crankcase ventilation (PCV) valve, and then connect a vacuum gauge to the ventilation hose. Plug the positive crankcase ventilation (PCV) valve.
5. Start the engine and run it at idle for 4 minutes or more, and then check the intake manifold vacuum while the engine is idling.

   Limit: Min. 60 kPa

6. Turn off the ignition switch.
7. Remove the vacuum gauge, and then connect the ventilation hose to the positive crankcase ventilation (PCV) valve.
8. Remove the engine tachometer or the MUT-II.

LASH ADJUSTER CHECK

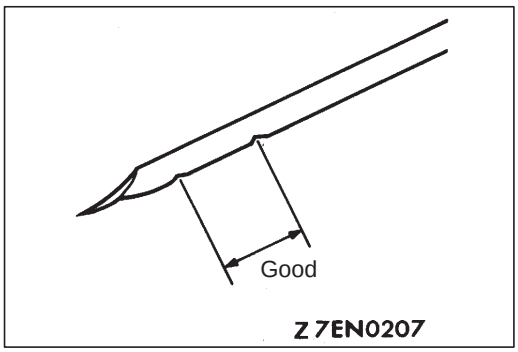
If an abnormal noise (knocking) that seems to be coming from the lash adjuster is heard after starting the engine and does not stop, carry out the following check.

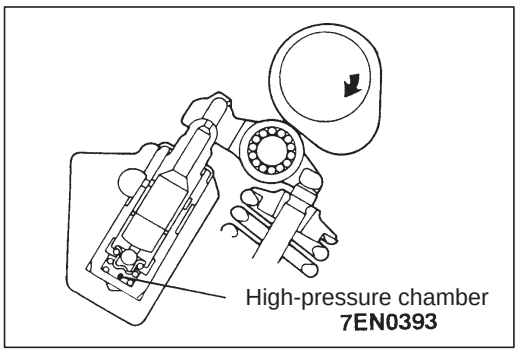
NOTE
(1) The abnormal noise which is caused by a problem with the lash adjusters is generated after the engine is started, and will vary according to the engine speed. However, this noise is not related to the actual engine load.
Because of this, if the noise does not occur immediately after the engine is started, if it does not change in accordance with the engine speed, or if it changes in accordance with the engine load, the source of the noise is not the lash adjusters.
(2) If there is a problem with the lash adjusters, the noise will almost never disappear, even if the engine has been run at idle to let it warm up.
The only case where the noise might disappear is if the oil in the engine has not been looked after properly and oil sludge has caused the lash adjusters to stick.

1. Start the engine.
2. Check that the noise occurs immediately after the engine is started, and that the noise changes in accordance with changes in the engine speed.
If the noise does not occur immediately after the engine is started, or if it does not change in accordance with the engine speed, the problem is not being caused by the lash adjusters, so check for some other cause of the problem. Moreover, if the noise does not change in accordance with the engine speed, the cause of the problem is probably not with the engine. (In these cases, the lash adjusters are normal.)
3. While the engine is idling, check that the noise level does not change when the engine load is varied (for example, by shifting from N → D).
If the noise level changes, the cause of the noise is probably parts striking because of worn crankshaft bearings or connecting rod bearings. (In such cases, the lash adjusters are normal.)
4. After the engine has warmed up, run it at idle and check if any noise can be heard.
If the noise has become smaller or disappeared, oil sludge could make the lash adjusters stick. Clean the lash adjusters. (Refer to the Engine Workshop Manual.) If not improved, go to step 5.
5. Bleed air from the lash adjusters. (Refer to P.11A-14, LASH ADJUSTER AIR BLEEDING.)
6. If the noise has not disappeared even after the air bleeding, clean the lash adjusters. (Refer to the Engine Workshop Manual.)

<LASH ADJUSTER AIR BLEEDING>

NOTE
(1) If the vehicle is parked on a slope for a long period of time, the amount of oil inside the lash adjuster will decrease, and air may get into the high pressure chamber when starting the engine.
(2) After parking the vehicle for long periods, the oil drains out of the oil passage, and it takes time for the oil to be supplied to the lash adjuster, so air can get into the high pressure chamber.
(3) If either of the above situations occur, the abnormal noise can be eliminated by bleeding the air from inside the lash adjusters.

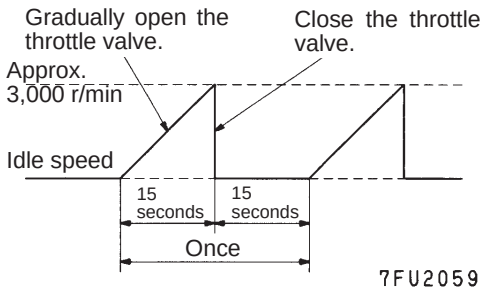




1. Check the engine oil and replenish or replace the oil if necessary.

NOTE
(1) If there is a only small amount of oil, air will be drawn in through the oil screen and will get into the oil passage.
(2) If the amount of oil is greater than normal, then the oil will being mixed by the crankshaft and a large amount of air may get mixed into the oil.
(3) If the oil is degenerated, air and oil will not separate easily in oil, and the amount of air mixed into the oil will increase.
(4) If the air which has been mixed in with the oil due to any of the above reasons gets into the high pressure chamber of the lash adjuster, the air inside the high pressure chamber will be compressed when the valve is open and the lash adjuster will over-compress, resulting in abnormal noise when the valve closes. This is the same effect as if the valve clearance is adjusted to be too large by mistake. If the air inside the lash adjusters is then released, the operation of the lash adjusters will return to normal.

Drive pattern for air bleeding



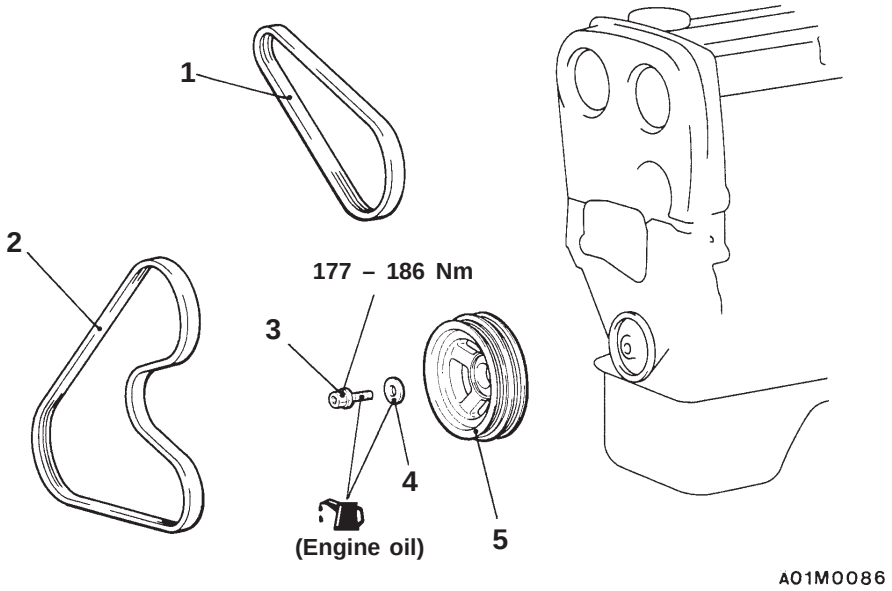
2. Run the engine at idle for 1 – 3 minutes to let it warm up.
3. With no load on the engine, repeat the drive pattern shown in the illustration at left and check if the abnormal noise disappears. (The noise should normally disappear after 10 – 30 repetitions, but if there is no change in the noise level after 30 repetitions or more, the problem is probably not due to air inside the lash adjusters.)
4. After the noise has disappeared, repeat the drive pattern shown in the illustration at left a further 5 times.
5. Run the engine at idle for 1 – 3 minutes and check that the noise has disappeared.

CRANKSHAFT PULLEY

REMOVAL AND INSTALLATION

Pre-removal Operation
Engine Cover and Under Cover Removal

Post-installation Operation
- Drive Belt Tension Adjustment (Refer to P.11A-7.)
- Engine Cover and Under Cover Installation

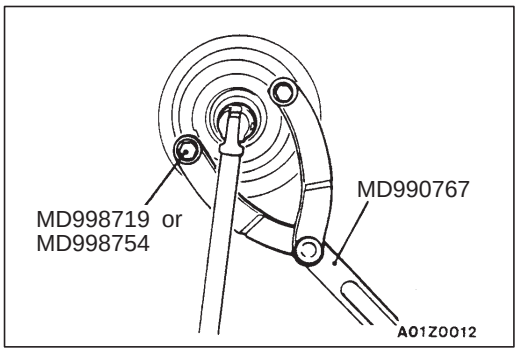


Removal steps

1. Drive belt (Power steering and A/C)
2. Drive belt (Alternator)

◀A▶ ▶A◀ 3. Crankshaft pulley bolt

4. Crankshaft pulley washer
5. Crankshaft pulley



REMOVAL SERVICE POINT

◀A▶ CRANKSHAFT PULLEY BOLT REMOVAL

INSTALLATION SERVICE POINT

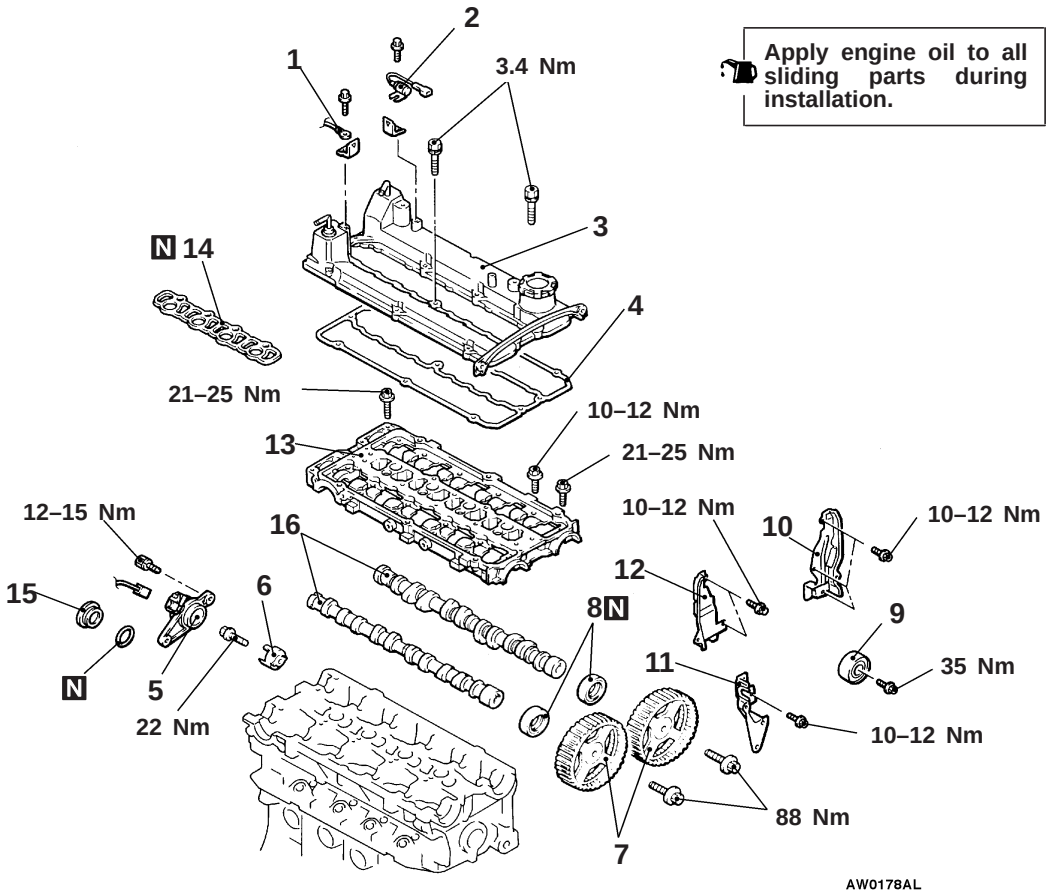
▶A◀ CRANKSHAFT PULLEY BOLT INSTALLATION

When installing the crankshaft bolt, apply the minimum amount of engine oil to the bearing surface and thread of the bolt.

CAMSHAFT AND CAMSHAFT OIL SEAL

REMOVAL AND INSTALLATION

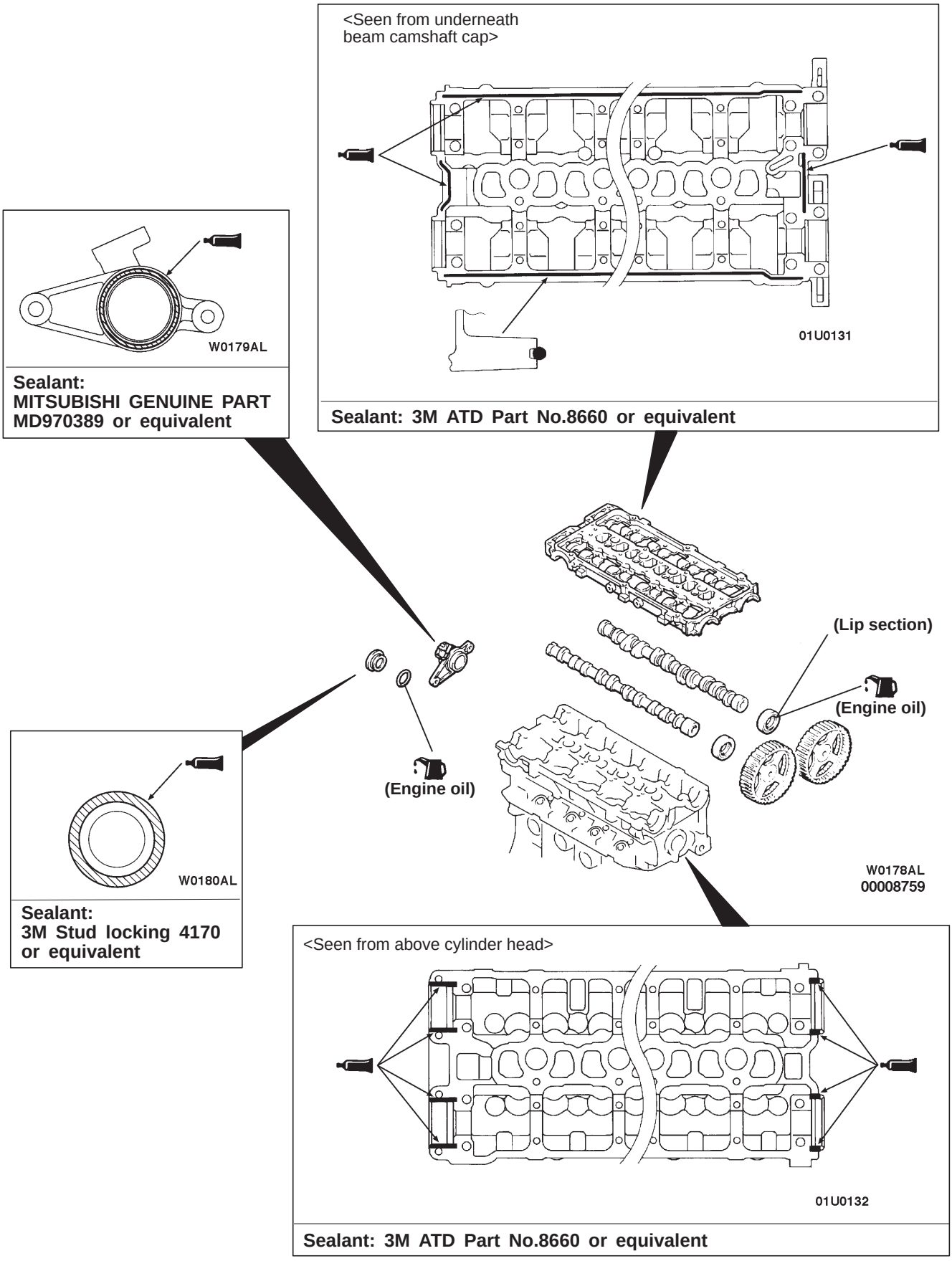
Pre-removal and Post-installation Operation
- Air Intake Hose and Resonance Tank Removal and Installation (Refer to GROUP 15 – Air Cleaner and Resonance Tank.)
- Timing Belt Removal and Installation (Refer to P.11A-29.)
- Engine Coolant Draining and Supplying (Refer to GROUP 14 – On-vehicle Service.)
- Intake Manifold Removal and Installation (Refer to GROUP 15.)
- Fuel Pump (High Pressure) and Fuel Pressure Regulator (High Pressure) Removal and Installation (Refer to GROUP 13A.)

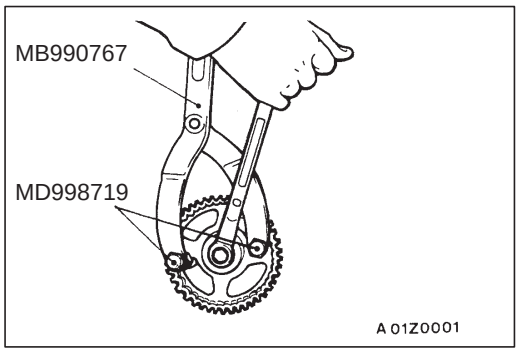


Removal steps

1. Earth cable connection
2. Condenser
3. Rocker cover
4. Rocker cover gasket
5. Camshaft position sensor support
6. Camshaft position sensing cylinder
◀A▶ ▶D◀ ▶C◀ 7. Camshaft sprocket
8. Camshaft oil seal
9. Idler pulley
10. Timing belt rear cover, upper (LH)
11. Timing belt rear cover, lower (RH)
12. Timing belt rear cover, upper (RH)
▶B◀ 13. Beam camshaft cap
14. Beam camshaft cap gasket
15. Thrust case
▶A◀ 16. Camshaft

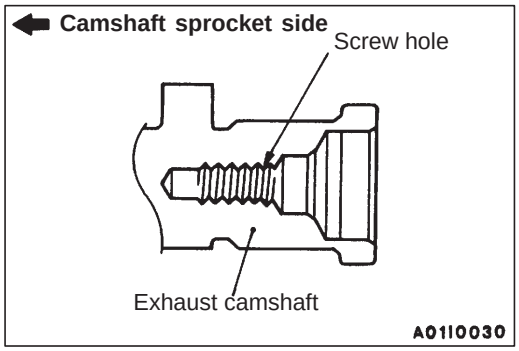
Lubrication points





REMOVAL SERVICE POINT

◀A▶ CAMSHAFT SPROCKET REMOVAL

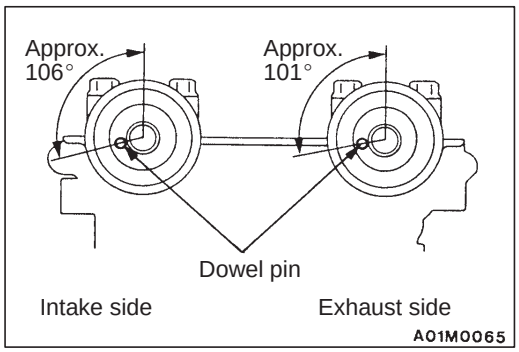


INSTALLATION SERVICE POINTS

▶A◀ CAMSHAFT INSTALLATION

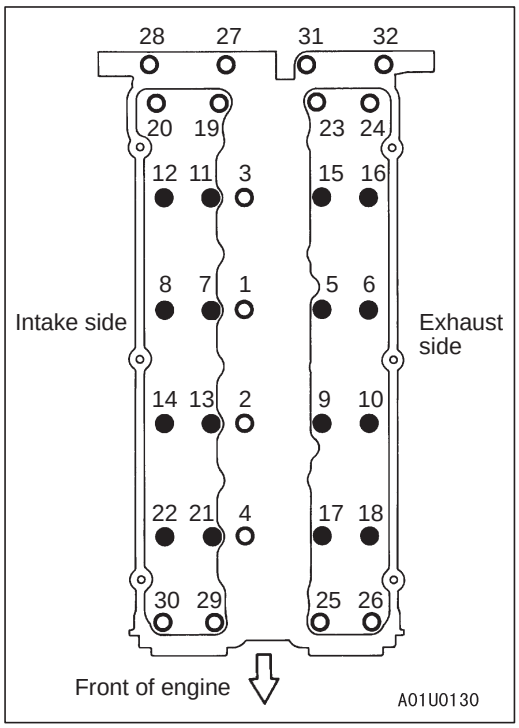
1. Apply engine oil to journals and cams of the camshafts.
2. Install the camshafts on the cylinder head.

Caution
Be careful not to confuse the intake camshaft with the exhaust one. There is a screw hole for the cam position sensing cylinder mounting bolt on the exhaust-side camshaft.



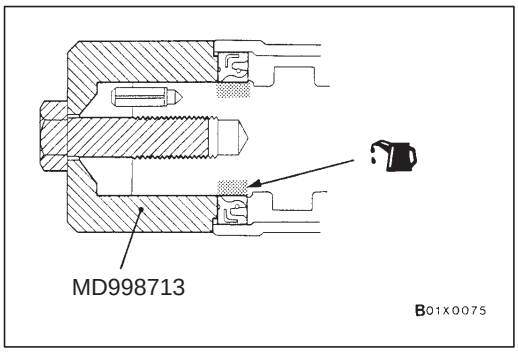
▶B◀ BEAM CAMSHAFT CAP INSTALLATION

1. Place the camshaft dowel pin as shown in the illustration.



2. Tighten the beam camshaft cap mounting bolts to the specified torque in the order shown in the illustration.

Tightening torque:
- **● : 10 – 12 Nm**
- **○ : 21 – 25 Nm**



▶C◀ CAMSHAFT OIL SEAL INSTALLATION

1. Apply engine oil to the entire circumference of the oil seal lip.
2. Press-fit the oil seal as shown in the illustration.

▶D◀ CAMSHAFT SPROCKET INSTALLATION

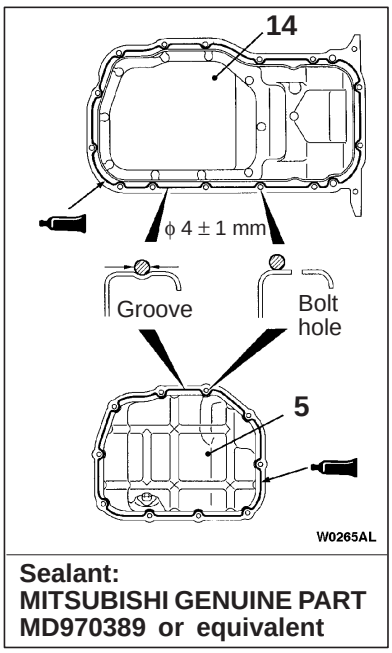
Use the special tool to secure the camshaft sprocket in the same way as during removal, and then tighten the bolt to the specified torque.

Tightening torque: 88 Nm

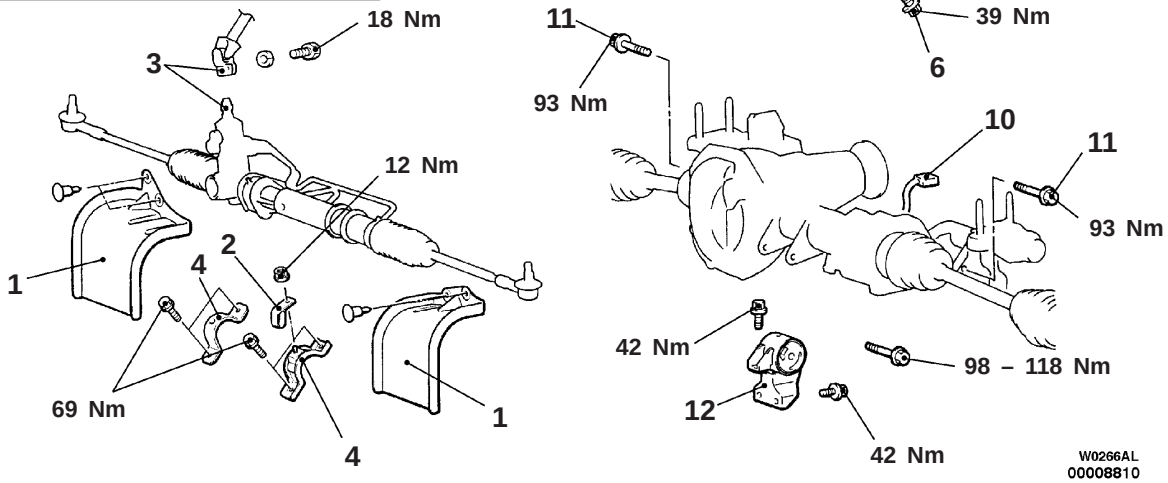
OIL PAN

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Under Cover Removal and Installation
- Oil Level Gauge Removal and Installation
- Engine Oil Draining and Supplying (Refer to GROUP 12 – On-vehicle Service.)



Sealant:
MITSUBISHI GENUINE PART MD970389 or equivalent



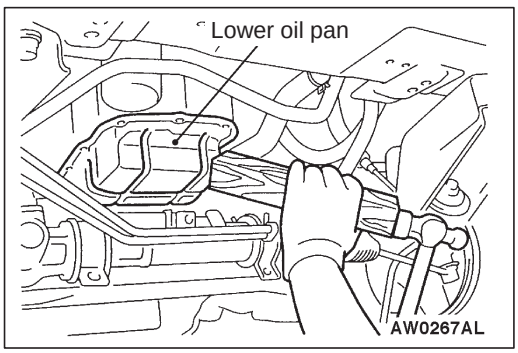
Removal steps

1. Splash shIeld
2. Power steering pressure hose clamp
3. Steering gear box and shaft connection
4. ◀A▶ ◀B▶ Steering gear box installation bolt
5. Lower oil pan
6. Drain plug
7. ▶A◀ Gasket
8. Oil screen
9. Gasket
10. Free-wheeling clutch engage switch connector connection
11. ◀C▶ Front differential mount center bolt
12. ◀C▶ Front differential mount
13. Bell housing cover
14. ◀D▶ Upper oil pan

REMOVAL SERVICE POINTS

◀A▶ STEERING GEAR BOX INSTALLATION BOLT REMOVAL

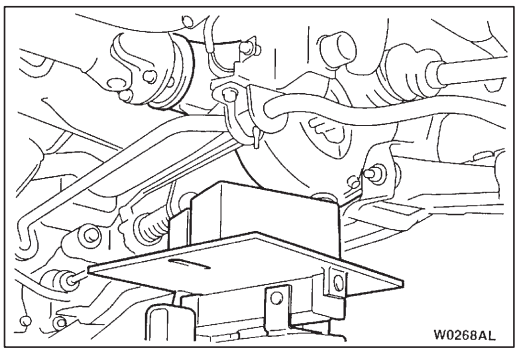
Remove the steering gear box installation bolts and lower the steering gear box.



◀B▶ LOWER OIL PAN REMOVAL

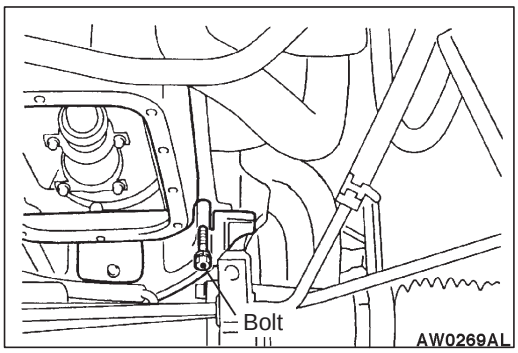
Place a piece of wood against the lower oil pan, and tap the piece of wood with a hammer to remove the lower oil pan.

Caution
Because the upper oil pan used is made from aluminium, the oil pan remover (MB998727) should not be used.



◀C▶ FRONT DIFFERENTIAL MOUNT CENTER BOLT/ FRONT DIFFERENTIAL MOUNT REMOVAL

1. Support the front differential by a jack, and remove the front differential mount center bolts and the front differential mount.
2. Remove the jack and lower the front differential.



◀D▶ UPPER OIL PAN REMOVAL

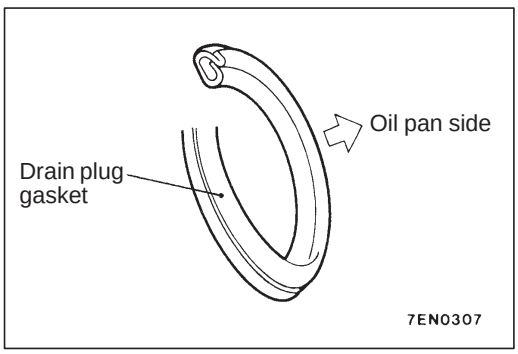
After removing all installation bolts, install 2 bolts (M6 × 85) in the upper oil pan as shown, noting that one located on the left side and one on the right side. Turn the bolts to remove the upper oil pan.

Caution
Because the upper oil pan used is made from aluminium, the oil pan remover (MB998727) should not be used.

INSTALLATION SERVICE POINT

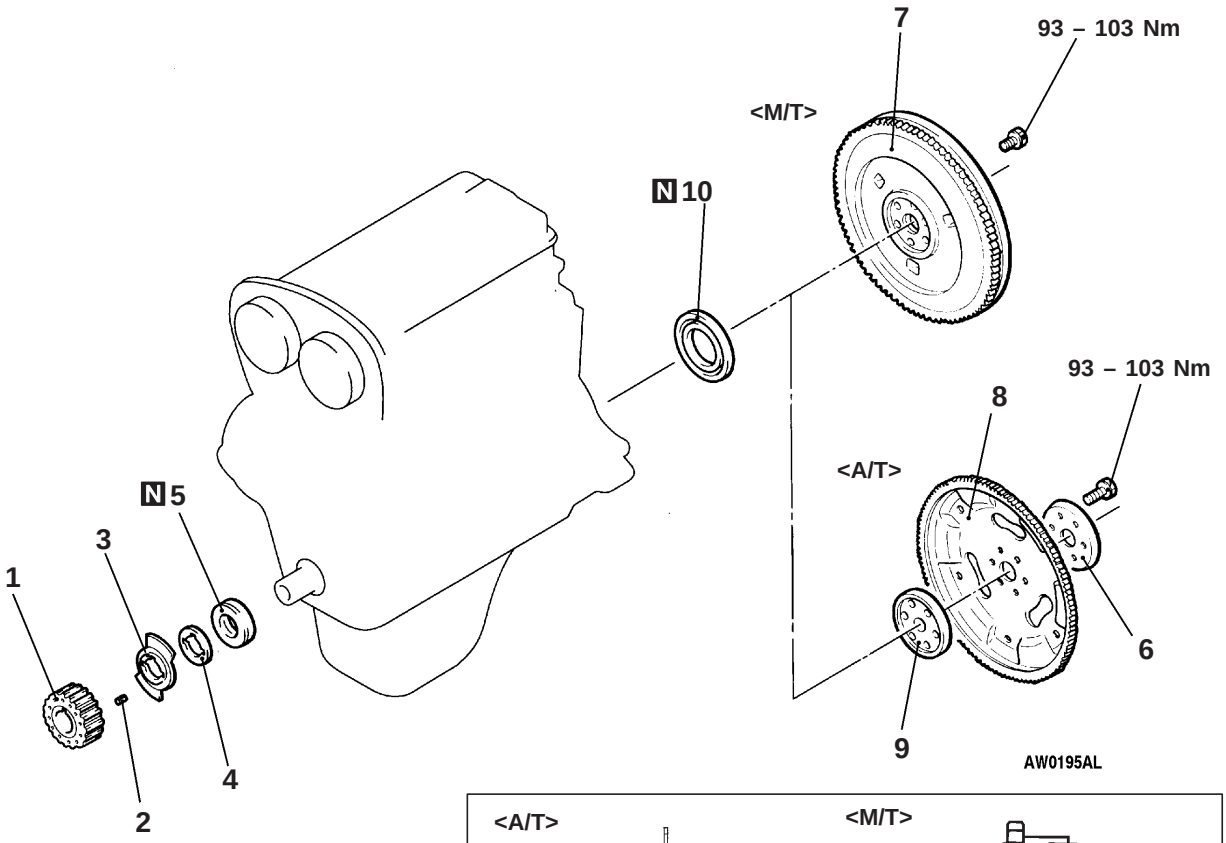
▶A◀ DRAIN PLUG GASKET INSTALLATION

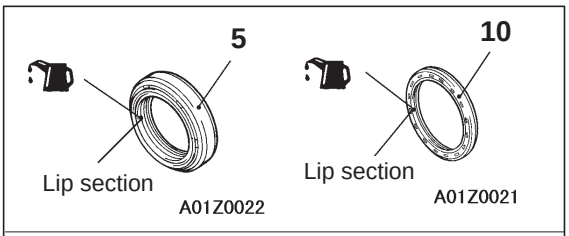
Install the drain plug gasket in the direction so that it faces as shown in the illustration.



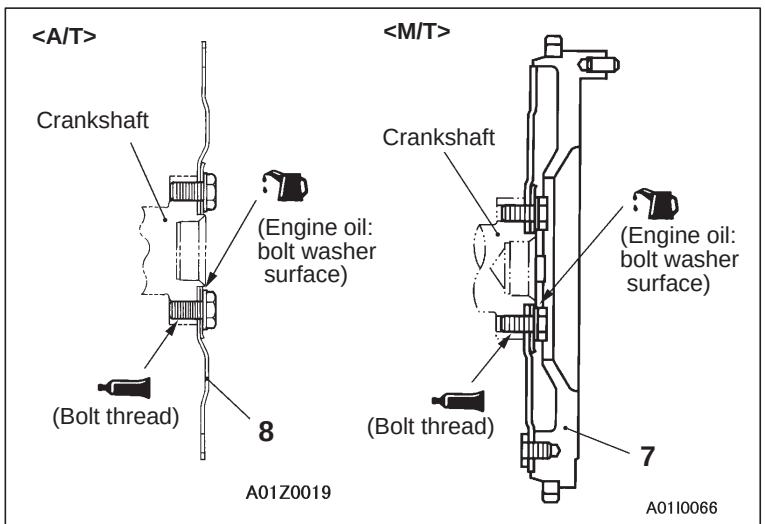
CRANKSHAFT OIL SEAL

REMOVAL AND INSTALLATION





Engine oil



Sealant: 3M Stud locking 4170 or equivalent

Crankshaft front oil seal removal steps

- Timing belt (Refer to P.11A-29.)
- Crank angle sensor (Refer to GROUP 16.)

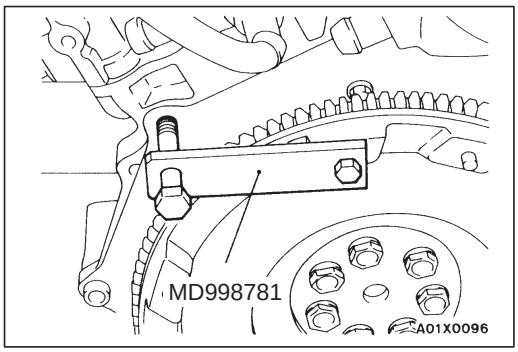
1. Crankshaft sprocket
2. Key
3. Crankshaft sensing blade
4. Crankshaft spacer

▶C◀ 5. Crankshaft front oil seal

Crankshaft rear oil seal removal steps

- Transmission assembly (M/T: Refer to GROUP 22.) (A/T: Refer to GROUP 23.)
- Clutch cover and disc <M/T>

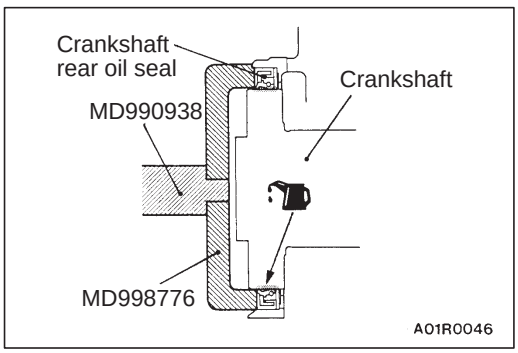
◀A▶ ▶B◀ 6. Adapter plate <A/T>
◀A▶ ▶B◀ 7. Flywheel <M/T>
◀A▶ ▶B◀ 8. Drive plate <A/T>
◀A▶ ▶B◀ 9. Crankshaft adapter <A/T>
▶A◀ 10. Crankshaft rear oil seal



REMOVAL SERVICE POINT

◀A▶ ADAPTER PLATE<A/T>/FLYWHEEL <M/T>/DRIVE PLATE <A/T>/CRANKSHAFT ADAPTER <A/T> REMOVAL

Use the special tool to secure the flywheel or drive plate, and remove the bolts.



INSTALLATION SERVICE POINTS

▶A◀ CRANKSHAFT REAR OIL SEAL INSTALLATION

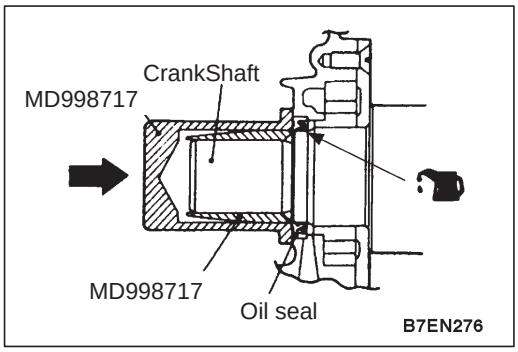
1. Apply a small mount of engine oil to the entire circumference of the oil seal lip.
2. Install the oil seal by tapping it as far as the chamfered position of the oil seal case as shown in the illustration.

▶A◀ CRANKSHAFT ADAPTER <A/T>/DRIVE PLATE <A/T>/FLYWHEEL <M/T>/ADAPTER PLATE<A/T> INSTALLATION

1. Clean off all sealant, oil and other substances which are adhering to the threaded bolts, crankshaft thread holes and the drive plate.
2. Apply oil to the bearing surface of the drive plate bolts.
3. Apply oil to the crankshaft thread holes.
4. Apply sealant to the threaded mounting holes.

   Specified sealant: 3M Stud locking 4170 or equivalent

5. Use the special tool to hold the drive plate in the same manner as removal, and install the bolt.



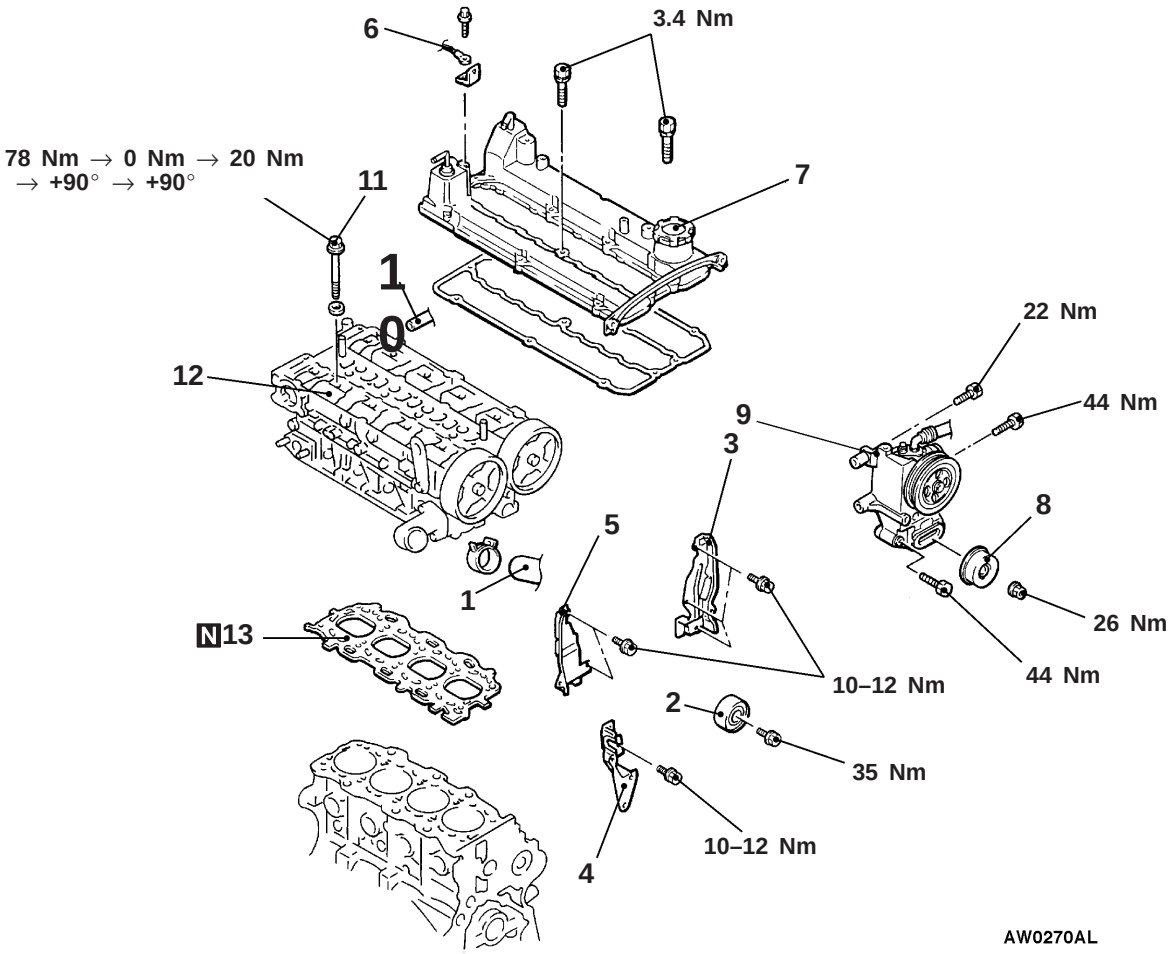
▶C◀ CRANKSHAFT FRONT OIL SEAL INSTALLATION

1. Apply a small amount of engine oil to the entire circumference of the oil seal lip.
2. Tap the oil seal unit it is flush with the oil seal case.

CYLINDER HEAD GASKET

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Fuel Discharge Prevention (Refer to GROUP 13A – On-vehicle Service.) <Pre-removal only>
- Engine Coolant Draining and Supplying (Refer to GROUP 14 – On-vehicle Service.)
- Engine Oil Draining and Supplying (Refer to GROUP 12 – On-vehicle Service.)
- Intake Manifold Removal and Installation (Refer to GROUP 15.)
- Fuel Pressure Regulator (High Pressure) and Fuel Pump (High Pressure) Removal and Installation (Refer to GROUP 13A.)
- Water Bypass Pipe Assembly Removal and Installation (Refer to GROUP 14 – Water Hose and Pipe.)
- Timing Belt Removal and Installation (Refer to P.11A-29.)



Removal steps

1. Radiator upper hose connection
2. Idler pulley
3. Timing belt rear cover, upper (LH)
4. Timing belt rear cover, lower (RH)
5. Timing belt rear cover, upper (RH)
6. Earth cable connection
7. Rocker cover assembly

◀A▶
8. Tension Pulley
9. Power steering oil pump and bracket assembly
10. Heater hose connection

◀B▶ ▶B◀
11. Cylinder head bolt
12. Cylinder head assembly

▶A◀
13. Cylinder head gasket

REMOVAL SERVICE POINTS

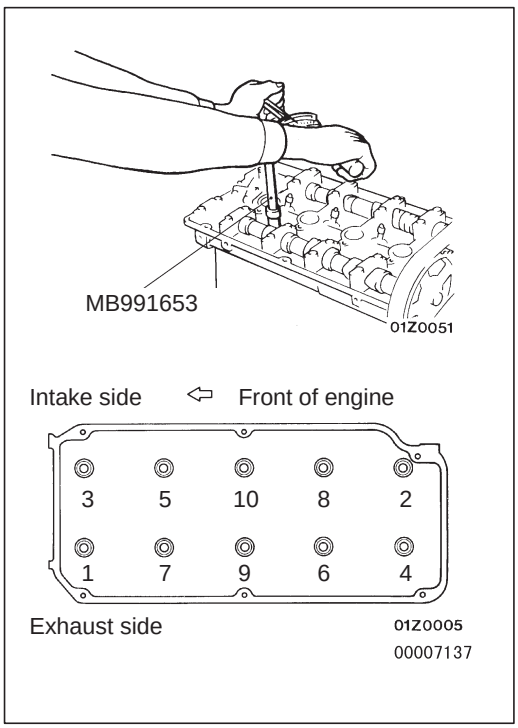
◀A▶ POWER STEERING OIL PUMP AND BRACKET ASSEMBLY REMOVAL

Remove the power steering oil pump and bracket assembly from the engine with the hose attached.

NOTE
Place the removed power steering oil pomp and bracket assembly in a place where it will not be a hindrance when removing and installing the cylinder head assembly, and tie it with a cord.

◀B▶ CYLINDER HEAD BOLT REMOVAL

Use the special tool to loosen the bolts in two or three steps in the order of the numbers shown in the illustration, and then remove the bolts.



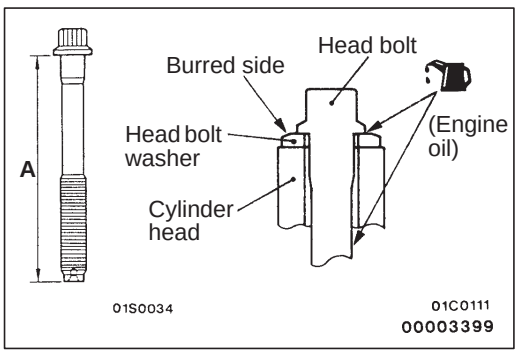
INSTALLATION SERVICE POINTS

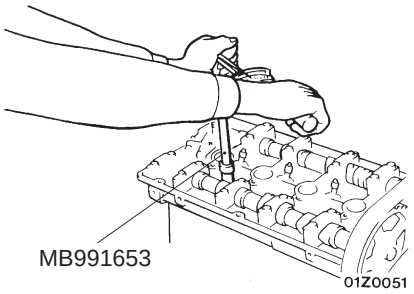
▶A◀ CYLINDER HEAD GASKET INSTALLATION

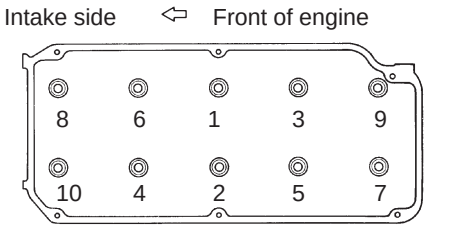
1. Wipe off all oil and grease from the gasket mounting surface.
2. Install so that the shapes of the cylinder head holes match the shapes of the respective cylinder head gasket holes.

▶B◀ CYLINDER HEAD BOLT INSTALLATION

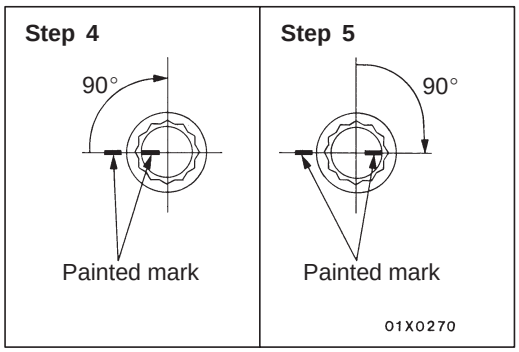
1. When installing the cylinder head bolts, the length below the head of the bolts should be within the limit.
   If it is outside the limit, replace the bolts.
   Limit (A): 96.4 mm
2. The head bolt washer should be installed with the burred side caused by tapping out facing upwards.
3. Apply a small amount of engine oil to the thread section and the washer of the cylinder head bolt.







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4. Tighten the bolts by the following procedure.

Step	Operation	Remarks
1	Tighten to 74 Nm.	Carry out in the order shown in the illustration.
2	Fully loosen.	Carry out in the reverse order of that shown in the illustration.
3	Tighten to 20 Nm.	Carry out in the order shown in the illustration.
4	Tighten 90° of a turn.	In the order shown in the illustration. Mark the head of the cylinder head bolt and cylinder head by paint.
5	Tighten 90° of a turn.	In the order shown in the illustration. Check that the painted mark of the head bolt is lined up with that of the cylinder head.

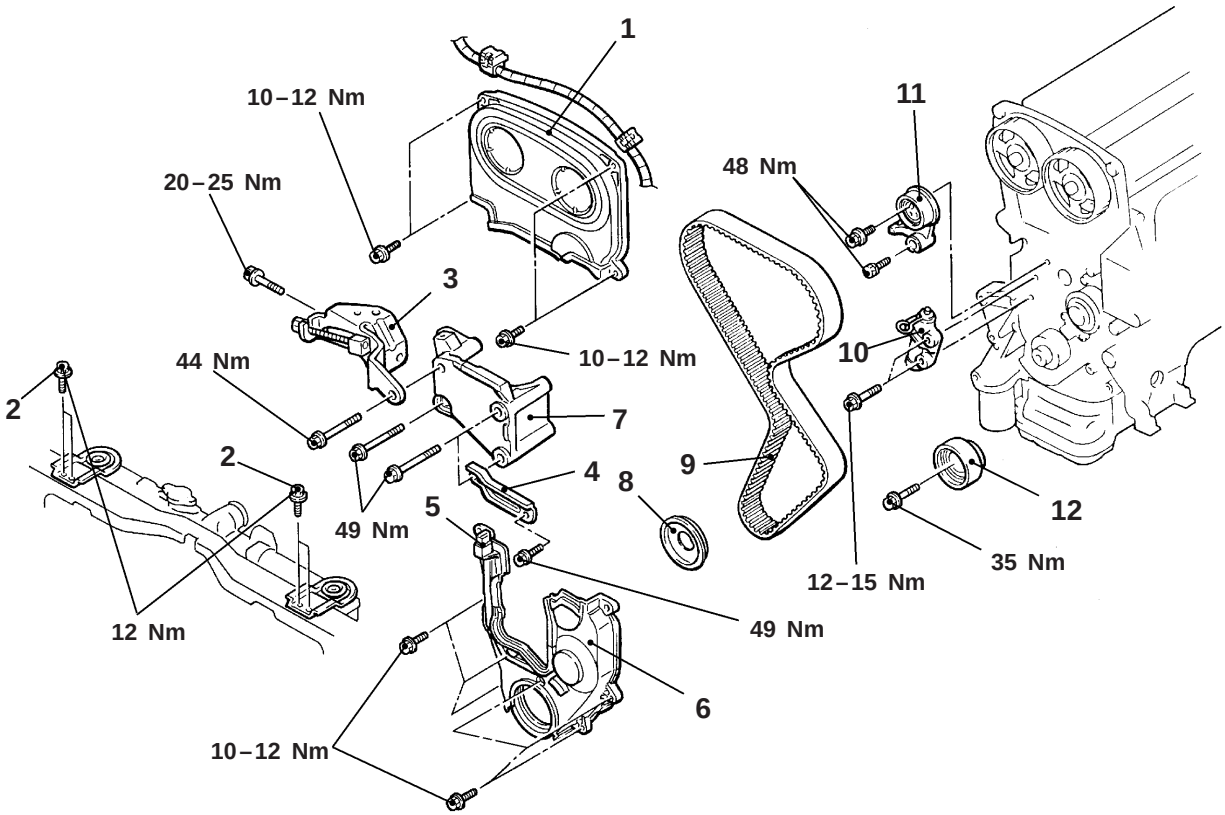
Caution

1. **Always make a tightening angle just 90°. If it is less than 90°, the head bolt will be loosened.**
2. **If it is more than 90°, remove the head bolt and repeat the procedure from step 1.**

TIMING BELT

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Cover Removal and Installation
- Air Intake Duct Removal and Installation (Refer to GROUP 15 – Air Cleaner and Resonance Tank.)
- Crankshaft Pulley Removal and Installation (Refer to P.11A-17.)

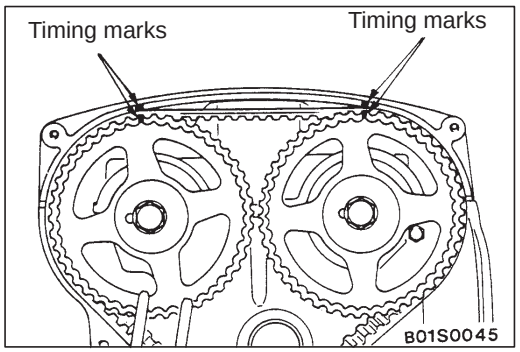


Removal steps

1. Timing belt front upper cover
2. Radiator upper installation bolts
3. Alternator brace
4. Power steering oil pump bracket stay
5. Crank angle sensor connector
6. Timing belt front lower cover
7. Accessory mount
8. Front flange

◀A▶ ▶C◀ ● Timing belt tension adjustment
◀A▶ ▶B◀ 9. Timing belt
▶A◀ 10. Auto tensioner

11. Tensioner pulley and arm assembly
12. Idler pulley



REMOVAL SERVICE POINT

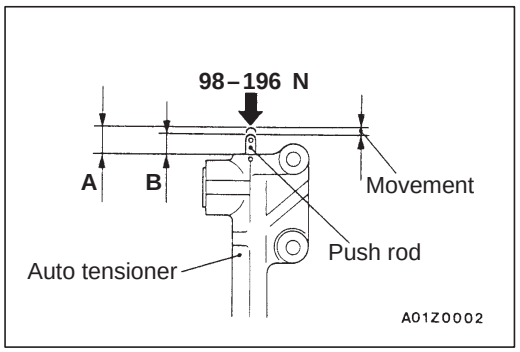
◀A▶ TIMING BELT REMOVAL

1. Turn the crankshaft clockwise to align each timing mark.

   Caution
   The crankshaft must always be turned clockwise.

2. Loosen the tensioner pulley center bolt and remove the timing belt.

   Caution
   If the timing belt is to be re-used, use chalk to mark (on its flat side) an arrow indicating the clockwise direction.



INSTALLATION SERVICE POINTS

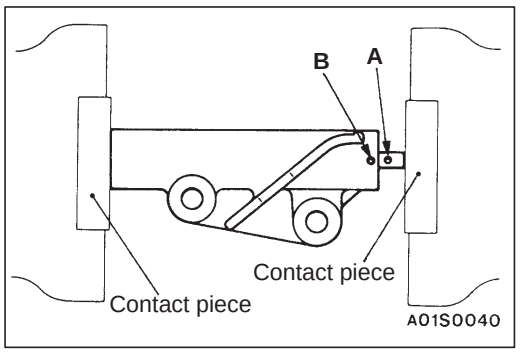
▶A◀ AUTO TENSIONER INSTALLATION

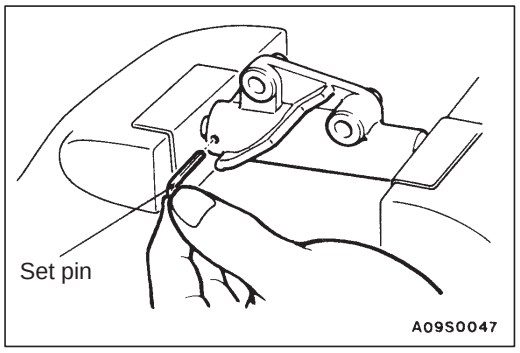
1. Apply 98 – 196 N force to the push rod of the auto tensioner by pressing it against a metal (cylinder block, etc.), and measure the movement of the push rod.

   Standard value:
   Within 1 mm
   A: Length when it is free (not pressed)
   B: Length when it is pressed
   A – B: Movement

2. If it is out of the standard value, change the auto tensioner.
3. Use a press or vice to gently compress the auto tensioner push rod until pin hole A of the push rod and pin hole B of the tensioner cylinder are aligned.

   Caution
   If the compression speed is too fast, the push rod may become damaged, so be sure to carry out this operation slowly.

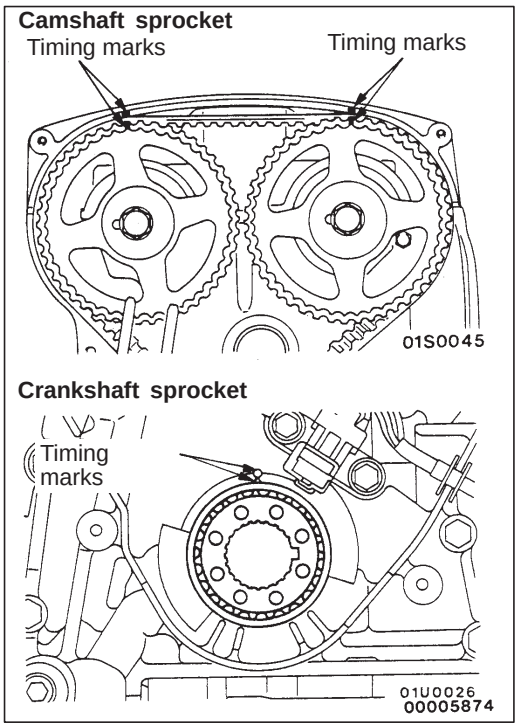




4. Once the holes are aligned, insert the set pin.

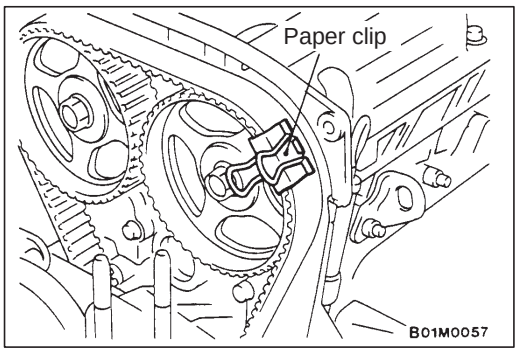
   NOTE
   When replacing the auto tensioner with a new part, the pin will be in the auto tensioner.

5. Install the auto tensioner to the engine.

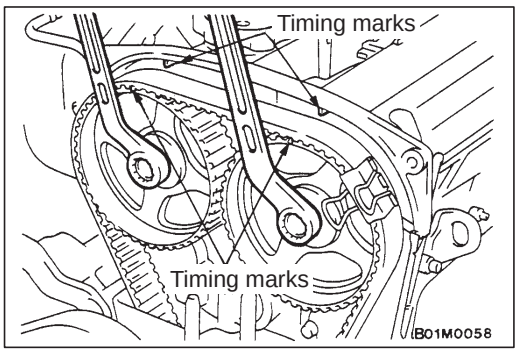


▶B◀ TIMING BELT INSTALLATION

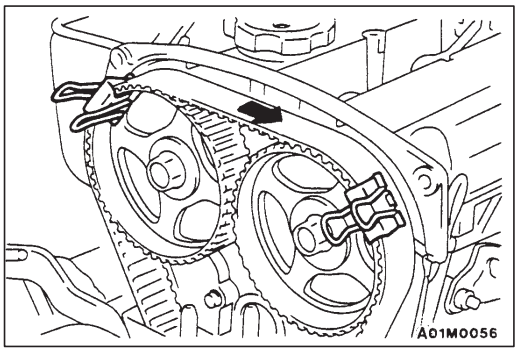
1. Align the timing marks of each camshaft sprocket and the crankshaft sprocket.
2. Loosen the tensioner pulley center bolt.
3. Move the crankshaft sprocket half a tooth width in the anti-clockwise direction.



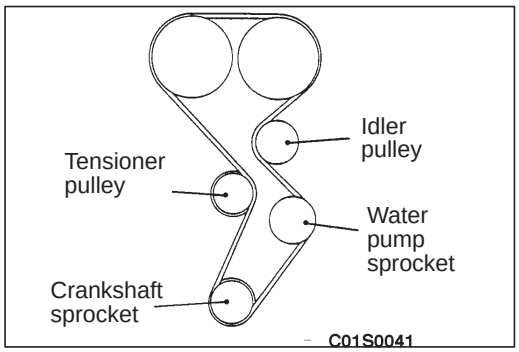
4. Place the timing belt on the exhaust-side camshaft sprocket, and hold it in the position shown in the illustration with a paper clip.



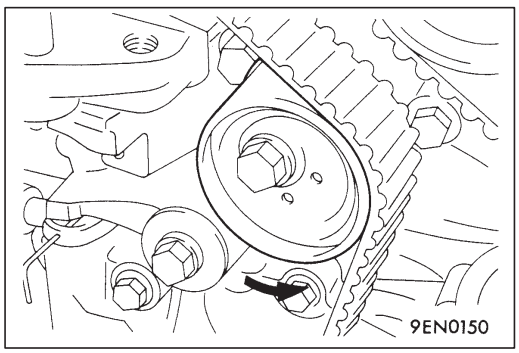
5. Place the timing belt on the intake-side sprocket while using two wrenches to align the timing marks.



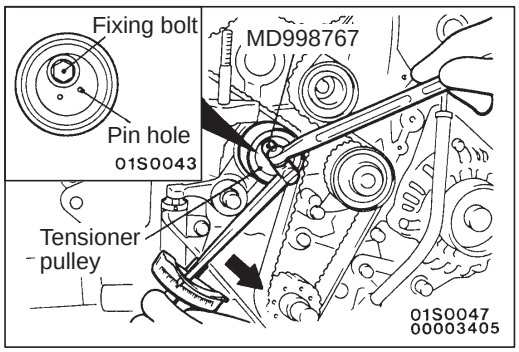
6. Hold the belt in the position shown in the illustration with another paper clip.



7. Place the belt onto the idler pulley, water pump sprocket, crankshaft sprocket and tensioner pulley in that order.
8. Remove the two paper clips.



9. Lift the tensioner pulley in the direction of the arrow and tighten the tensioner pulley bolt.
10. Check to be sure that all timing marks are aligned.
11. Adjust the timing belt tension.

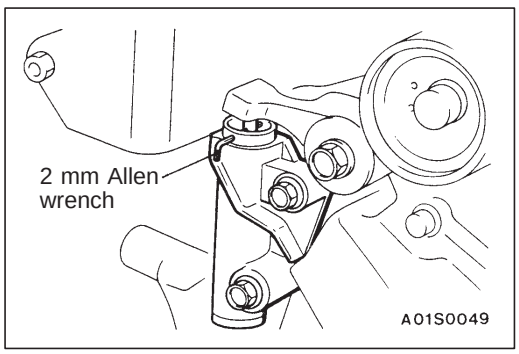


▶C◀ TIMING BELT TENSION ADJUSTMENT

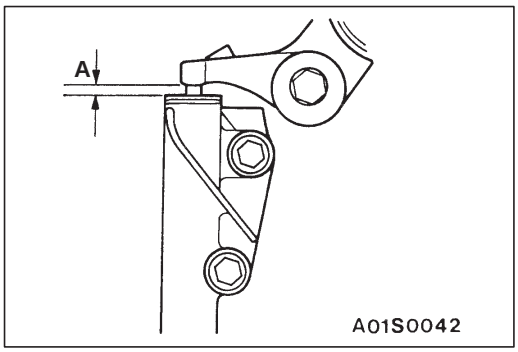
1. After turning the crankshaft a 1/4 turn anti-clockwise, turn it clockwise to the position where the timing marks are aligned.
2. Loosen the fixing bolt of the tensioner pulley and using the special tool and a torque wrench, apply tension to the timing belt; then tighten the fixing bolt at the specified torque.

   Standard Value:
   2.5 – 4.0 Nm [timing belt tension torque (reference value)]

   Caution
   When tightening the fixing bolt, ensure that the tensioner pulley shaft doesn't rotate with the bolt.



3. Take out the 2 mm Allen wrench from the auto tensioner. At this time, check to be sure that 2 mm Allen wrench can be pulled out easily.
   Turn the crankshaft clockwise 2 turns, and after leaving it in this position for 5 minutes or more, check again to be sure that the auto tensioner 2 mm Allen wrench can be pulled out or inserted easily.



NOTE
Even if the 2 mm Allen wrench cannot be easily inserted, then it is satisfactory if the amount of protrusion of the auto tensioner rod is within the standard value.

Standard value (A): 3.8 – 4.5 mm

If it is outside the standard value, repeat the operations in steps 1 to 4.

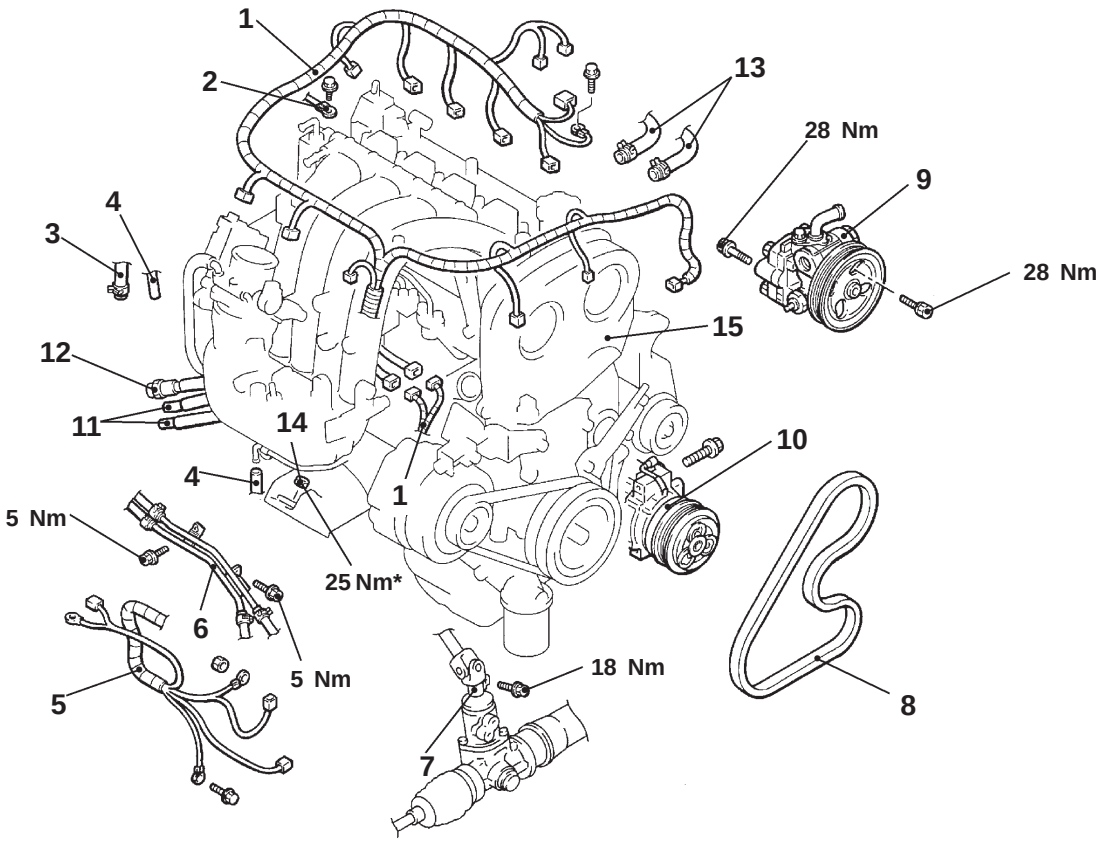
4. Check to be sure that the timing marks on all sprockets are aligned.

ENGINE ASSEMBLY

REMOVAL AND INSTALLATION

Caution
Mounting locations marked by * should be provisionally tightened, and then fully tightened after placing the vehicle horizontally and loading the full weight of the engine on the vehicle body.

Pre-removal and Post-installation Operation
- Fuel Discharge Prevention (Refer to GROUP 13A – On-vehicle Service.) <Pre-removal only>
- Engine Coolant Draining and Supplying (Refer to GROUP 14 – On-vehicle Service.)
- Engine Oil Draining and Supplying (Refer to GROUP 12 – On-vehicle Service.)
- Hood Removal and Installation (Refer to GROUP 42.)
- Radiator Assembly Removal and Installation (Refer to GROUP 14.)
- Air Cleaner and Resonance Tank Removal and Installation (Refer to GROUP 15.)
- Transmission Assembly Removal and Installation (Refer to GROUP 23.)
- Drive Belt Tension Adjustment (Refer to P.11A-7.) <Post-installation only>



Removal steps
1. Engine harness connector
2. Earth cable connection
3. Brake booster vacuum hose connection
4. Vacuum hose connection
5. Battery cable connection
6. A/T fluid pipe clamp
7. Steering gear box and shaft connection

◀A▶
◀B▶

8. Drive belt
9. Power steering oil pump
10. A/C compressor
11. Fuel return hose connection
12. Fuel pressure hose connection
13. Heater hose connection
14. Engine mount installation nut

◀C▶ ▶A◀

15. Engine assembly

REMOVAL SERVICE POINTS

◀A▶ POWER STEERING OIL PUMP REMOVAL

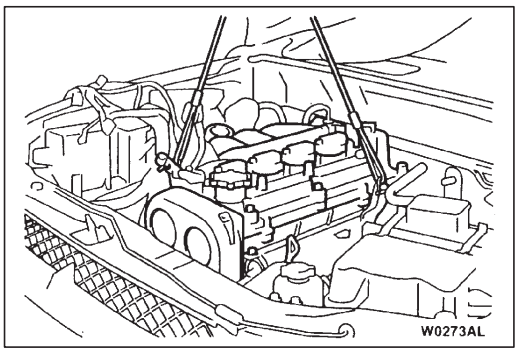
Remove the power steering oil pump from the engine with the hose attached.

NOTE
Place the removed power steering oil pump where it will not be a hindrance when removing and installing the engine assembly, and tie it with a cord.

◀B▶ A/C COMPRESSOR REMOVAL

Disconnect the A/C compressor connector and remove the compressor from the compressor bracket with the hose still attached.

NOTE
Place the removed A/C compressor where it will not be a hindrance when removing and installing the engine assembly, and tie it with a cord.



◀C▶ ENGINE ASSEMBLY REMOVAL

1. Check that all cables, hoses and harness connectors, etc. are disconnected from the engine.
2. Lift the chain block slowly to remove the engine assembly upward from the engine compartment.

INSTALLATION SERVICE POINT

▶A◀ ENGINE ASSEMBLY INSTALLATION

Install the engine assembly, checking that the cables, hoses, and harness connectors are not clamped.

ENGINE <4G9>

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GENERAL

OUTLINE OF CHANGES

Due to the new addition of the 4G94 engine vehicles, the following service procedures have been established regarding the sections which differ from that of the previous models with the 4G93 engine. The same procedures as before are applied except for the items shown below.

- Change in the CO and HC concentration
- Change in compression pressure
- Change of the limits in the intake manifold negative pressure
- Removal and installation of camshaft and camshaft oil seal
- Removal and installation of cylinder head gasket
- Change in the protrusion of the auto tensioner rod

GENERAL INFORMATION

Items	4G94-GDI
Total displacement mL	1,999
Bore × Stroke mm	81.5 × 95.8
Compression ratio	11.0

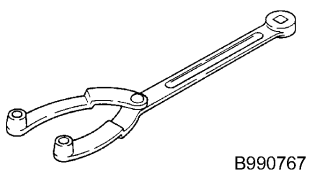
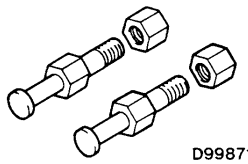
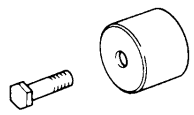
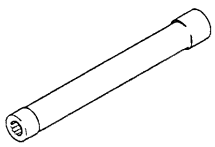
SERVICE SPECIFICATIONS

Item	Standard value	Limit
CO concentration %	0.5 or less	–
HC concentration ppm	100 or less	–
Compression pressure kPa – r/min	1,800 – 200	1,320 – 200
Intake manifold negative pressure kPa	–	56
Shank length of cylinder head bolt mm	–	96.4
Protrusion of auto tensioner rod mm	4.8 – 5.5	–

SEALANT AND ADHESIVE

Application location	Specified sealants	Remarks
Beam camshaft cap	MITSUBISHI GENUINE PART MD970389 or equivalent	Semi-drying sealant
Cylinder head		
Camshaft position sensor support		
Camshaft thrust cover	3M Stud Locking 4170 or equivalent	–

SPECIAL TOOLS

Tools	Number	Name	Use
 B990767	MB990767	Front hub and flange york holder	Camshaft sprocket held
 D998719	MD998719	Crankshaft pulley holder pin	
	MD998713	Camshaft oil seal installer	Press–fitting camshaft oil seal
	MB991653	Cylinder head bolt wrench	Removal and installation of cylinder head bolt

ON-VEHICLE SERVICE

IDLE MIXTURE CHECK

Standard value
CO contents: 0.5% or less
HC contents: 100 ppm or less

COMPRESSION PRESSURE CHECK

Standard value (at engine speed of 200 r/min):
1,800 kPa

Limit (at engine speed of 200 r/min):
Min. 1,320 kPa

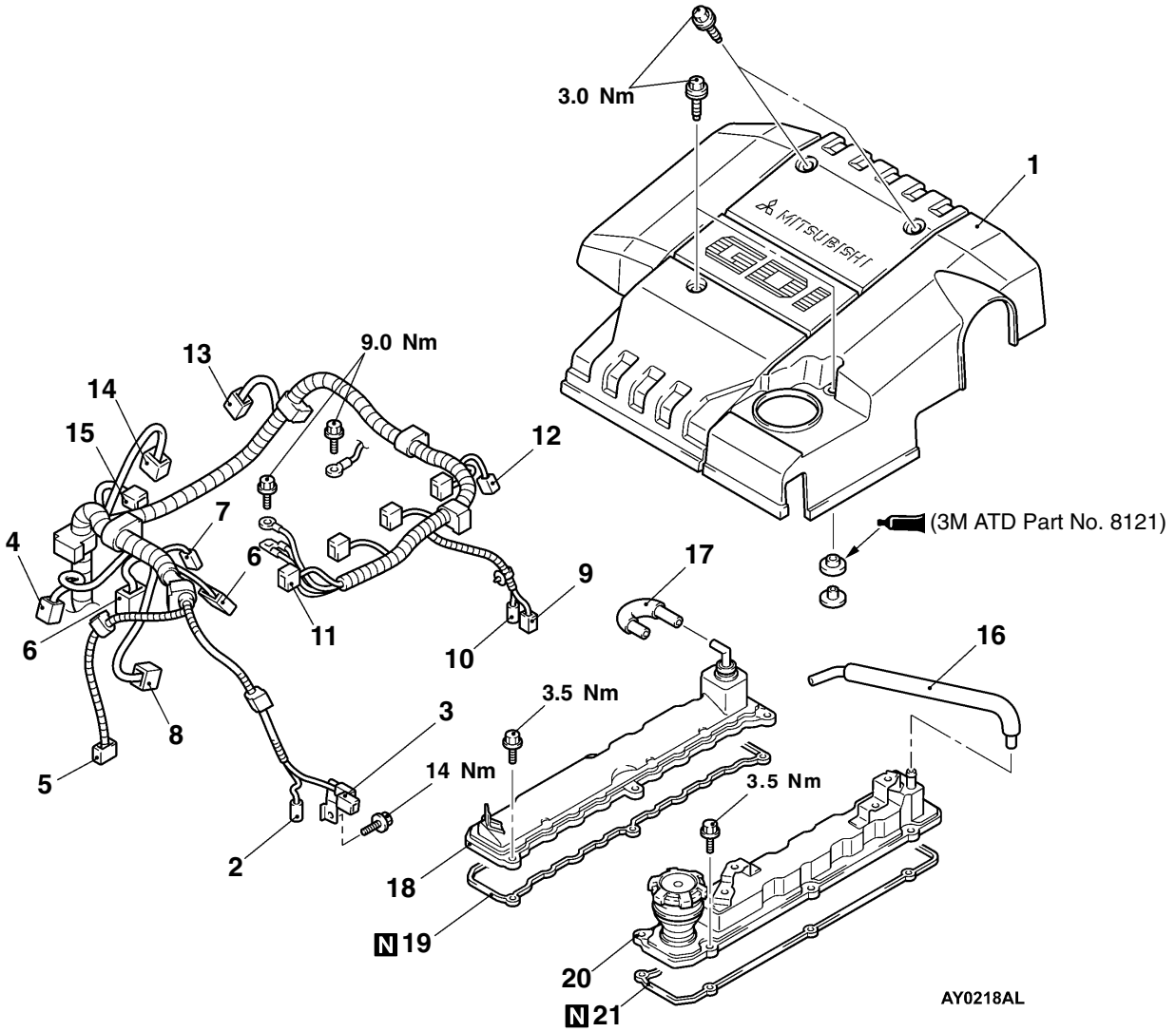
MANIFOLD VACUUM CHECK

Limit: Min. 56 kPa

CAMSHAFT AND CAMSHAFT OIL SEAL

REMOVAL AND INSTALLATION

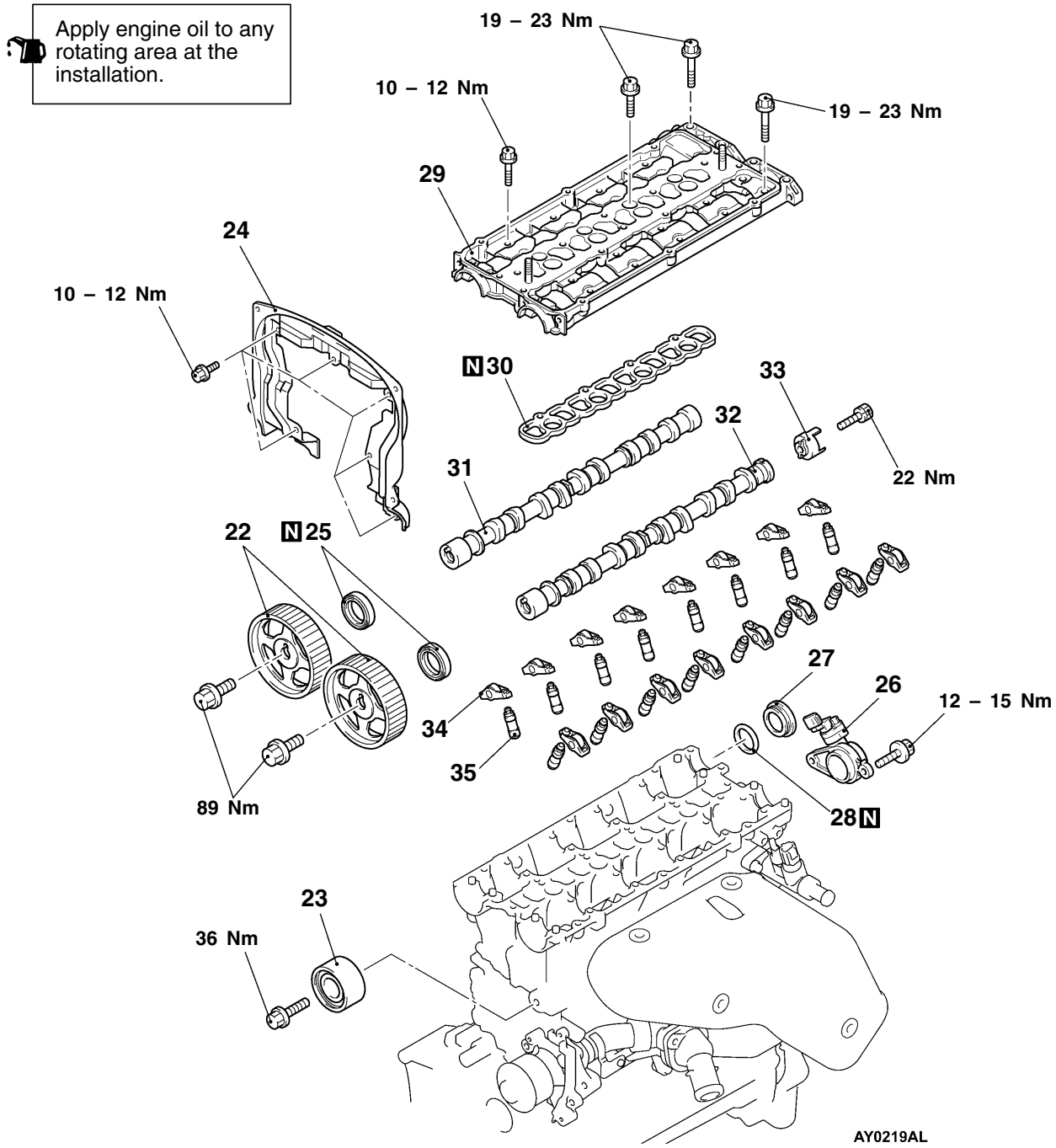
Pre-removal and Post-installation Operations
- Fuel Overflow Prevention Operation <only for pre-removal>
- Fuel Leak Check <only for post-installation>
- Air Bleeding The High-pressure Fuel Line <only for post-installation>
  [Refer to GROUP 13A – Fuel Pump (High-pressure).]
- Removal and Installation of Under Cover
- Check and Adjustment of Drive Belt Tension <only for post-installation>
- Draining and Filling of Engine Coolant
- Removal and Installation of Air Intake Hose and Resonance Tank



Removal steps

▶E◀

1. Engine cover
2. Power steering oil pressure switch connector
3. A/C compressor magnetic clutch connector
4. Ignition failure sensor connector
5. Crank angle sensor connector
6. Front wiring harness and injector/EGR wiring harness combination connector
7. Fuel pressure sensor connector
8. Detonation sensor connector
9. Engine coolant temperature sensor connector
10. Engine coolant temperature gauge unit connector
11. Ignition coil connector
12. Camshaft position sensor connector
13. Throttle control servo connector
14. Throttle position sensor connector
15. Purge control solenoid valve connector
16. Breather hose
17. PCV hose
    - Ignition coil
    - Intake manifold
    - Timing belt
18. Intake rocker cover
19. intake rocker cover gasket
20. Exhaust rocker cover
21. Exhaust rocker cover gasket



◀A▶
- 22. Camshaft sprocket
- 23. Idler pulley
- 24. Timing belt rear upper cover

▶D◀ 25. Camshaft oil seal
- ● Fuel pump (high-pressure) (Refer to GROUP 13A.)

- 26. Camshaft position sensor support
- 27. Camshaft thrust cover
- 28. O-ring

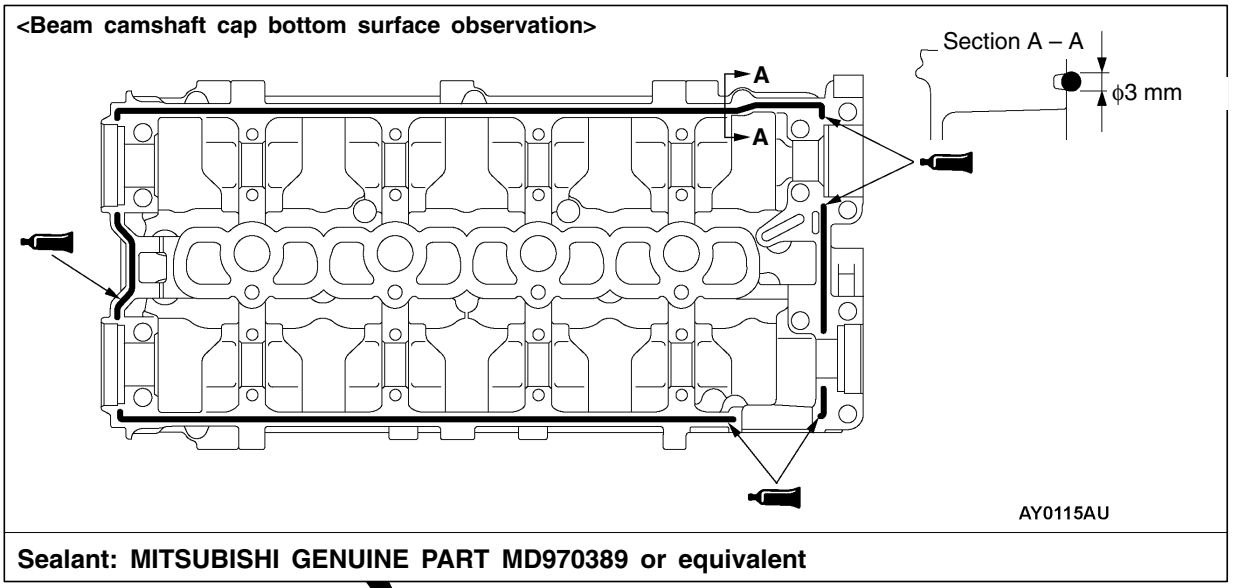
▶C◀ 29. Beam camshaft cap
- 30. Beam camshaft cap gasket

▶B◀ 31. Intake camshaft

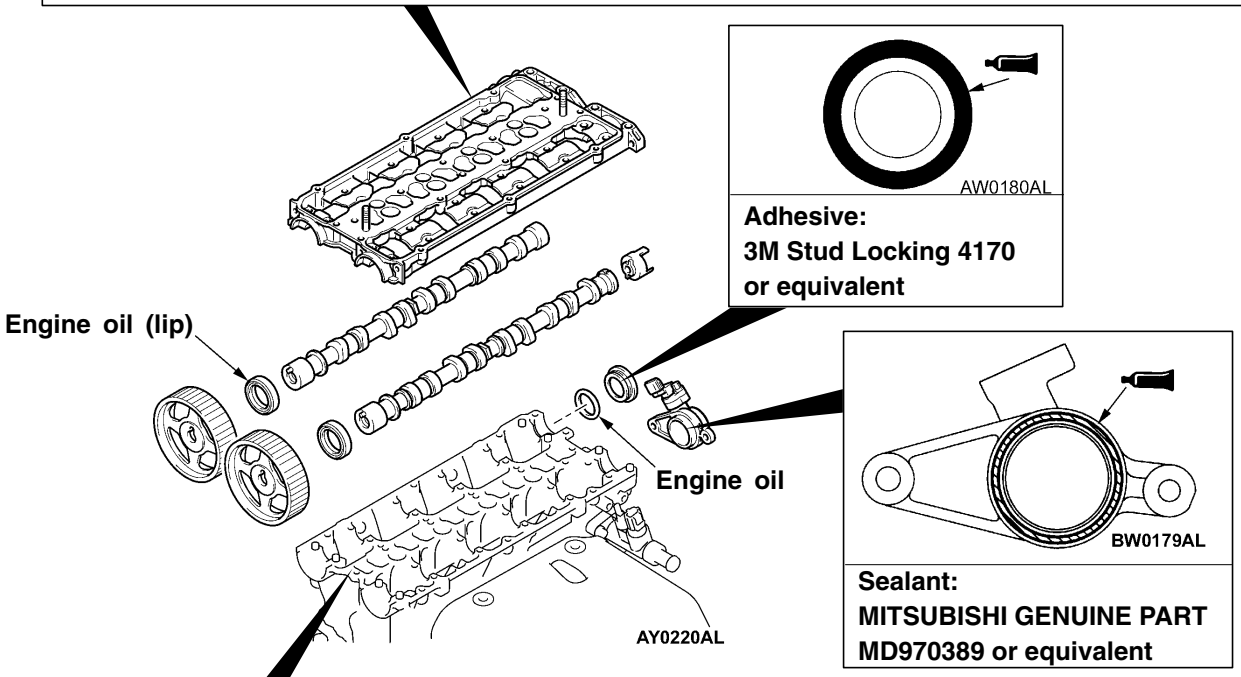
▶B◀ 32. Exhaust camshaft
- 33. Camshaft position sensing cylinder
- 34. Rocker arm

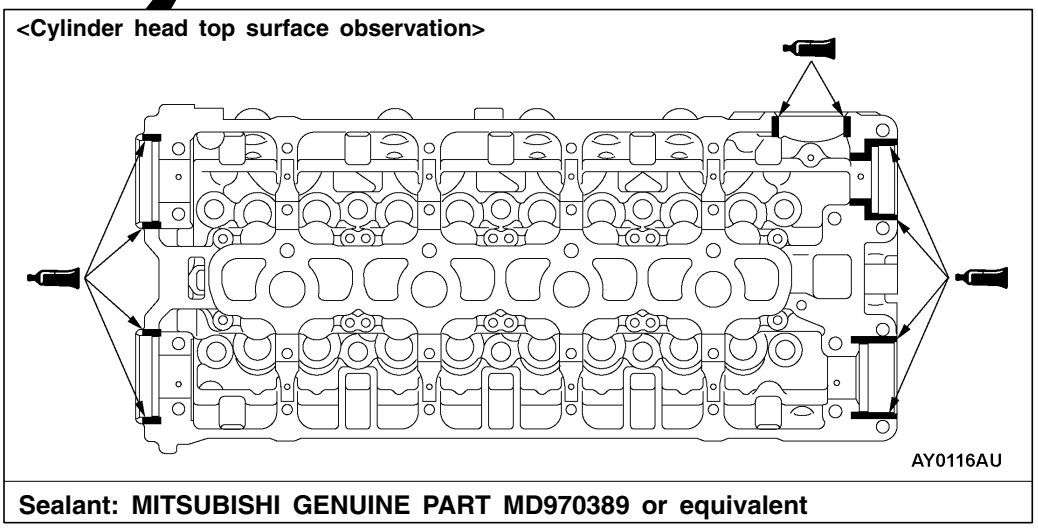
▶A◀ 35. Lash adjuster

LUBRICANT AND SEALANT APPLICATION LOCATIONS

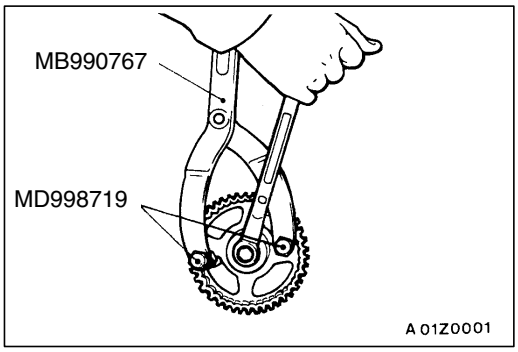


Sealant: MITSUBISHI GENUINE PART MD970389 or equivalent





Sealant: MITSUBISHI GENUINE PART MD970389 or equivalent



REMOVAL SERVICE POINT

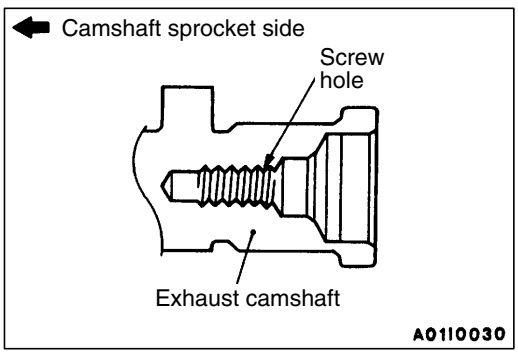
◀A▶ CAMSHAFT SPROCKET REMOVAL

Caution
To avoid the danger of damage caused by interference of the valve and the piston, rotate the crankshaft from No.1 cylinder compression top dead centre to 90° in the forward direction (clockwise).

INSTALLATION SERVICE POINTS

▶A◀ LASH ADJUSTER INSTALLATION

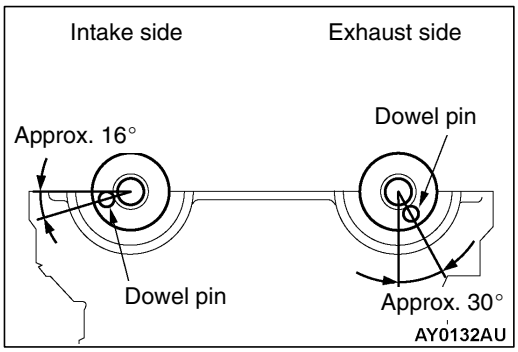
Caution
To use the lash adjuster again, be sure to clean and check it before installation.
(Refer to Engine Workshop Manual.)



▶B◀ EXHAUST CAMSHAFT/INTAKE CAMSHAFT INSTALLATION

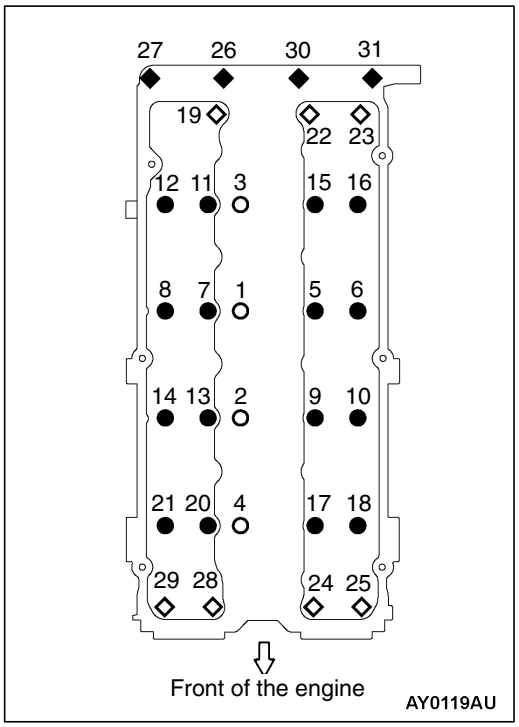
1. Apply engine oil to the cam and the journal of the camshaft.
2. Install the camshaft to the cylinder head.

Caution
Do not mistake the intake side for the exhaust side. There is a screw hole for the camshaft position sensing cylinder mounting bolt at the exhaust side of the camshaft.



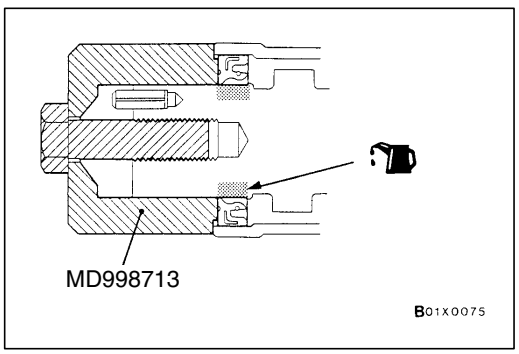
▶C◀ BEAM CAMSHAFT CAP INSTALLATION

1. Set the dowel pin of the camshaft at the position shown in the illustration.



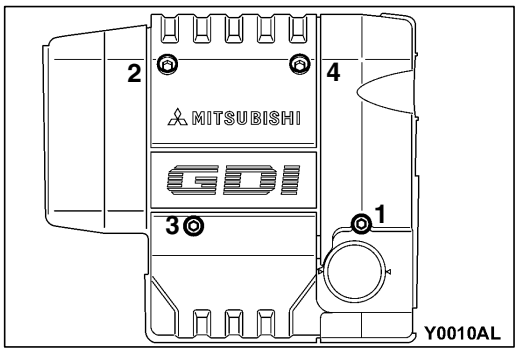
2. Tighten the beam camshaft cap mounting bolt to the specified torque in the order of the numbers shown in the illustration.

Symbol	Number of unit	Dimensions mm (Nominal diameter × nominal length)	Tightening torque Nm
○	4	8 × 32	19 – 23
●	16	6 × 35	10 – 12
◇	7	8 × 40	19 – 23
◆	4	8 × 40	



▶D◀ CAMSHAFT OIL SEAL INSTALLATION

1. Apply engine oil to the circumference of the oil seal lip.
2. Press-fit the oil seal as shown in the illustration.



▶E◀ ENGINE COVER INSTALLATION

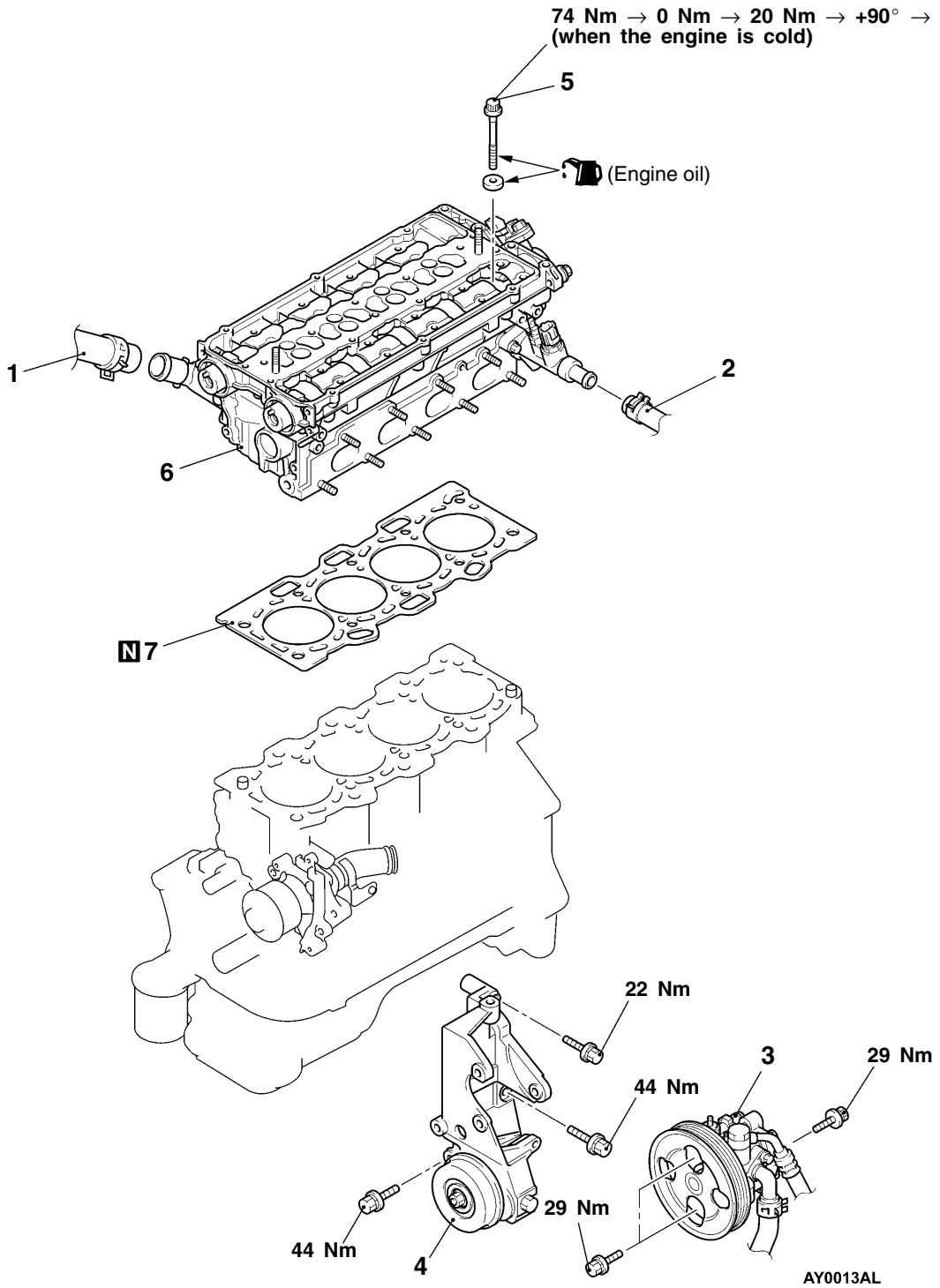
1. Tighten the mounting bolt temporarily in the order of the numbers shown in the illustration so that the engine cover can be moved by hand.
2. Tighten the mounting bolt to the specified torque in the order of the numbers shown in the illustration.

Tightening torque: 3.0 Nm

CYLINDER HEAD GASKET

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations
- Removal and Installation of Engine Cover (Refer to P.11A-5.)
- Fuel Overflow Prevention Operation <only for pre-removal>
- Fuel Leak Check <only for post-installation>
- Air Bleeding the High-pressure Fuel Line <only for post-installation>
  [Refer to GROUP 13A – Fuel Pump (High-pressure).]
- Removal and Installation of Under Cover
- Check and Adjustment of Drive Belt Tension <only for post-installation>
- Draining and Filling of Engine Coolant
- Removal and Installation of Timing Belt Rear Upper Cover (Refer to P.11A-6.)
- Removal and Installation of Fuel Pump (High-pressure) (Refer to GROUP 13A.)
- Removal and Installation of Exhaust Manifold
- Removal and Installation of Water Pipe
- Removal and Installation of EGR Valve and Support Assembly



Removal steps

◀A▶ ▶C◀ 1. Connection of radiator upper hose
2. Connection of heater hose
◀B▶ 3. Power steering oil pump
4. Power steering oil pump bracket
◀C▶ ▶B◀ 5. Cylinder head bolt
6. Cylinder head assembly
▶A◀ 7. Cylinder head gasket

REMOVAL SERVICE POINTS

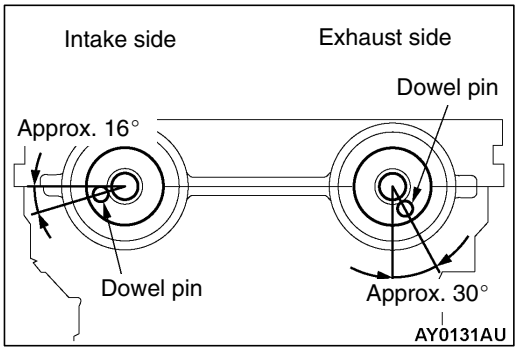
◀A▶ RADIATOR UPPER HOSE REMOVAL

Put mating marks on the radiator upper hose and the hose clamp for removal.

◀B▶ POWER STEERING OIL PUMP REMOVAL

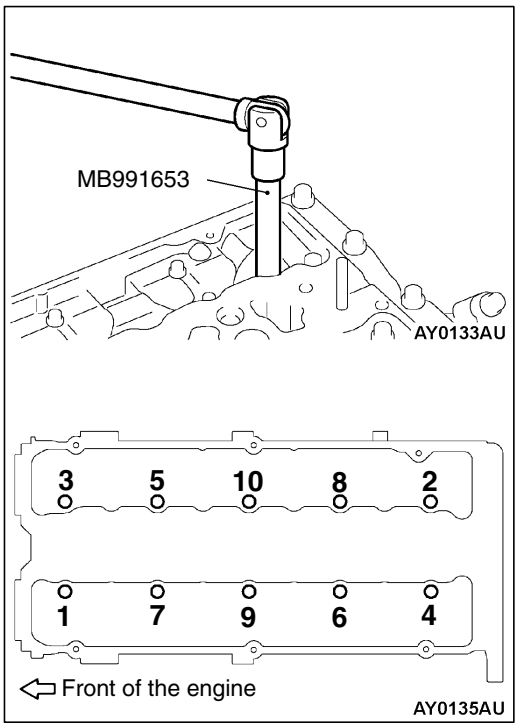
Remove the power steering oil pump with the hose attached from the bracket.

NOTE
Tie the removed power steering oil pump and the A/C compressor with strings to set aside so that they will not hinder the removal and installation of the engine assembly.



◀C▶ CYLINDER HEAD BOLT REMOVAL

1. Set the dowel pin of the camshaft at the position shown in the illustration.



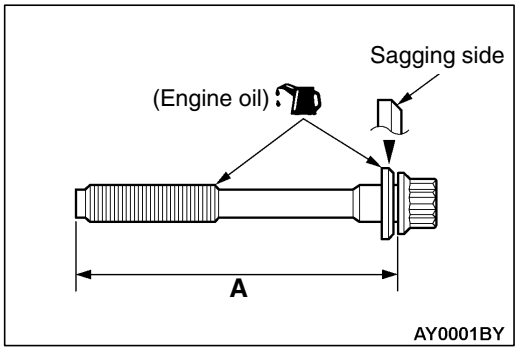
2. Use the special tool to loosen the bolt in the order of the numbers shown in the illustration in two to three stages for removal.

INSTALLATION SERVICE POINTS

▶A◀ CYLINDER HEAD GASKET INSTALLATION

1. Remove gasket attached on the mounting surface of the gasket.

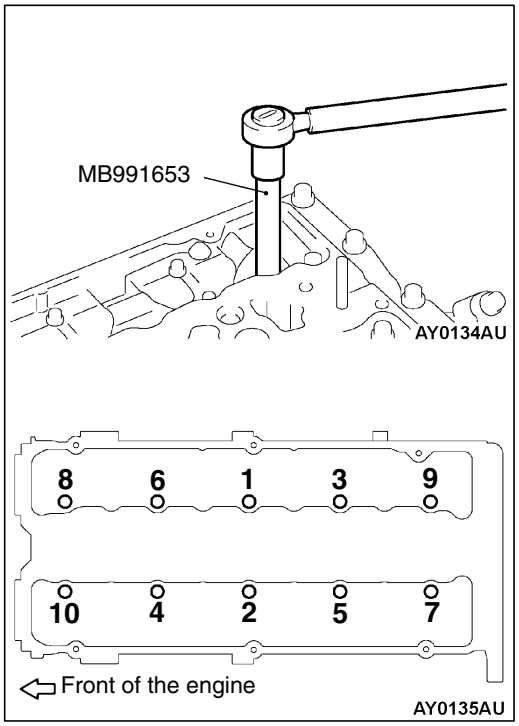
   Caution
   Be careful not to let foreign objects get inside the engine coolant and the oil line.
2. Install so that the each hole of the cylinder head is aligned with each hole of the cylinder head gasket.



▶B◀ CYLINDER HEAD BOLT INSTALLATION

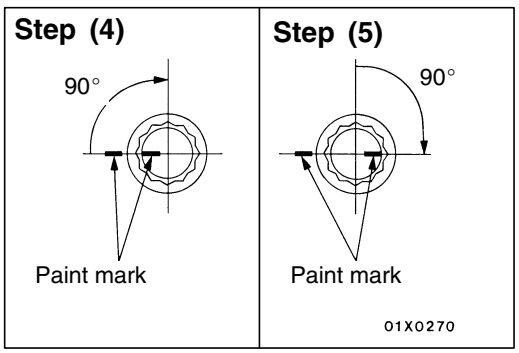
1. Check that the neck down length of the cylinder head bolt is within the limit. If it is outside the limit value, replace the bolt with a new one.

   Limit (A): 96.4 mm
2. Face the sagging side of the bored cylinder head bolt washer towards the direction shown in the illustration to install to the cylinder head bolt.
3. Apply a little amount of engine oil to the cylinder head bolt thread and the washer.



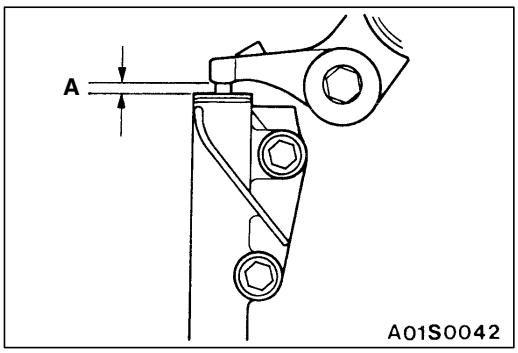
4. Use the special tool to tighten the bolt according to the following procedure (plasticity tightening).
   (1) Tighten the bolt to 74 Nm in the order of the numbers shown in the illustration.
   (2) Loosen the bolt completely in the reverse order of the numbers shown in the illustration.
   (3) Tighten the bolt to 20 Nm in the order of the numbers shown in the illustration.
   (4) Put the paint mark on the head of the cylinder head bolt and the cylinder to tighten to the 90° in the order of the numbers shown in the illustration.
   (5) Tighten to the 90° in the order of the numbers shown in the illustration so that the paint marks on the head of the cylinder head bolt and cylinder head are aligned.

   Caution
   1. If the tightening angle is less than 90°, the bolt is not sufficiently tightened.
   2. If the tightening angle is beyond the limit, remove the bolt and start from step 1 again.



▶C◀ RADIATOR UPPER HOSE INSTALLATION

1. Insert the radiator upper hose to the convex section of the water outlet fitting.
2. Align the mating mark on the radiator upper hose with that of the hose clamp to install.



TIMING BELT

INSTALLATION SERVICE POINT

Timing belt tension adjustment

Standard value (A): 4.8 – 5.5 mm

ENGINE
<4G9-MPI>

ENGINE
<4G9-MPI>

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GENERAL

OUTLINE OF CHANGE

The following contents have been established to correspond to the addition of vehicles with 4G9-MPI engine.

GENERAL INFORMATION

Items			Specification
Total displacement mL			1,834
Bore × Stroke mm			81.0 × 89.0
Compression ratio			10.0
Combustion chamber			Pentroof type
Camshaft arrangement			SOHC
Number of valve	Intake		8
	Exhaust		8
Valve timing	Intake	Opening	BTDC 14°
		Closing	ABDC 50°
	Exhaust	Opening	BBDC 58°
		Closing	ATDC 10°
Fuel system			Electronically controlled multipoint fuel injection
Rocker arm			Roller type
Auto-lash adjuster			Equipped

SERVICE SPECIFICATIONS

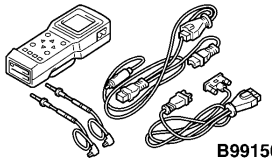
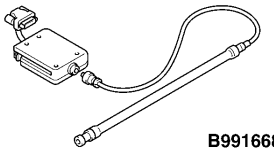
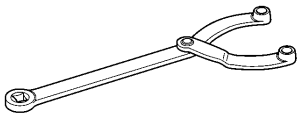
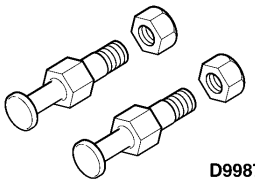
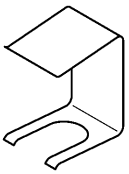
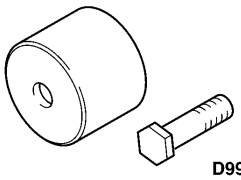
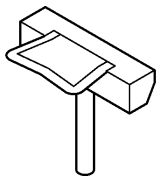
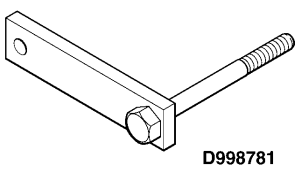
Items		Standard value	Limit
Alternator drive belt tension (When checked)	Vibration frequency Hz	143 – 185	–
	Tension N	294 – 490	–
	Deflection (Reference) mm	9.7 – 12.9	–
Alternator drive belt tension (When adjusted)	Vibration frequency Hz	155 – 175	–
	Tension N	343 – 441	–
	Deflection (Reference) mm	10.5 – 12.0	–
Alternator drive belt tension (When replaced)	Vibration frequency Hz	203 – 234	–
	Tension N	588 – 784	–
	Deflection (Reference) mm	6.7 – 8.5	–

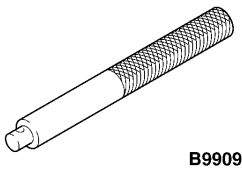
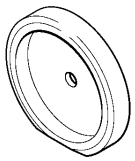
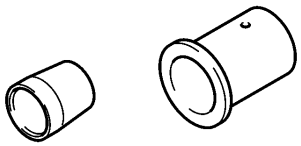
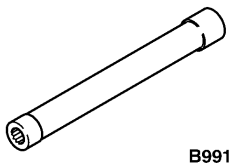
Items		Standard value	Limit
Power steering oil pump drive belt tension <Vehicles without A/C>, power steering oil pump and A/C compressor drive belt tension <Vehicles with A/C> (When checked)	Vibration frequency Hz	114 – 139	–
	Tension N	392 – 588	–
	Deflection (Reference) mm	10.0 – 12.0	–
Power steering oil pump drive belt tension <Vehicles without A/C>, power steering oil pump and A/C compressor drive belt tension <Vehicles with A/C> (When adjusted)	Vibration frequency Hz	121 – 133	–
	Tension N	441 – 539	–
	Deflection (Reference) mm	10.0 – 11.0	–
Power steering oil pump drive belt tension <Vehicles without A/C>, power steering oil pump and A/C compressor drive belt tension <Vehicles with A/C> (When replaced)	Vibration frequency Hz	145 – 166	–
	Tension N	637 – 833	–
	Deflection (Reference) mm	7.0 – 9.0	–
Basic ignition timing		5°BTDC ± 3°	–
Ignition timing		approx. 5°BTDC	–
Idle speed r/min		700 ± 100	–
CO contents %		0.1 or less	–
HC contents ppm		100 or less	–
Compression pressure (250 r/min) kPa		1370	Min. 1039
Compression pressure difference of all cylinder kPa		–	Max. 100
Intake manifold vacuum kPa		–	Min. 60
Cylinder head bolt shank length mm		–	96.4

SEALANTS

Items	Specified Sealants	Remarks
Camshaft position sensor support	MITSUBISHI GENUINE PART MD970389 or equivalent	Semi-drying sealant
Oil pan		
Flywheel bolt <M/T>	3M Stud Locking 4170 or equivalent	–
Drive plate bolt <A/T>		

SPECIAL TOOLS

Tool	Number	Name	Use
 B991502	MB991502	MUT-II sub assembly	• Engine idle speed check • Basic ignition timing check • Drive belt tension measurement
 B991668	MB991668	Belt tension meter set	Drive belt tension measurement (used together with MUT-II)
 B990767	MB990767	Front hub and flange yoke holder	• Holding the crankshaft sprocket • Holding the camshaft sprocket
 D998719	MD998719	Pin	
 D998443	MD998443	Auto lash adjuster holder	Holding the lash adjuster
 D998713	MD998713	Camshaft oil seal installer	Press-in of the camshaft oil seal
 D998727	MD998727	Oil pan cutter	Removal of oil pan
 D998781	MD998781	Flywheel stopper	Securing the flywheel <M/T> or drive plate <A/T>

Tool	Number	Name	Use
 B990938	MB990938	Installer bar	Press-in of the crankshaft rear oil seal
 D998776	MD998776	Crankshaft rear oil seal installer	
 D998717	MD998717	Crankshaft front oil seal installer	Press-in of the crankshaft front oil seal
 B991653	MB991653	Cylinder head bolt wrench	Cylinder head bolt removal and installation

ON-VEHICLE SERVICE

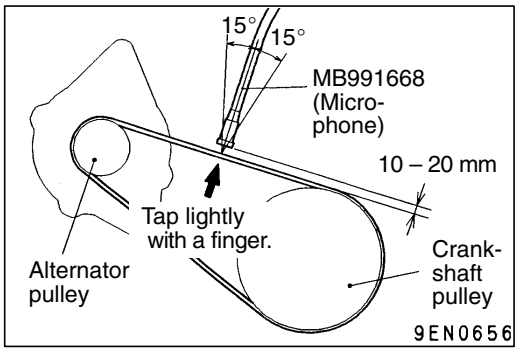
DRIVE BELT TENSION CHECK AND ADJUSTMENT

ALTERNATOR DRIVE BELT TENSION CHECK

Check the drive belt tension by the following procedure.

Standard value:

Vibration frequency Hz	143 – 185
Tension N	294 – 490
Deflection (Reference) mm	9.7 – 12.9

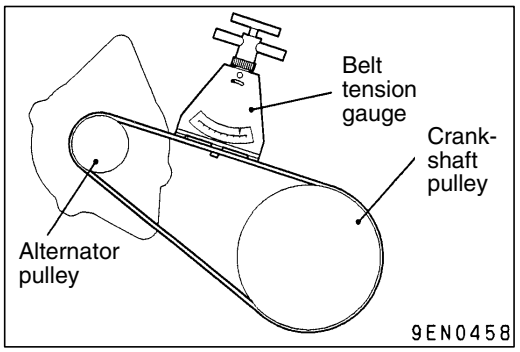


<When using the MUT-II>

1. Connect the special tool (MB991668) to the MUT-II.
2. Connect the MUT-II to the diagnosis connector.
3. Turn the ignition switch to ON and select "Belt Tension Measurement" from the menu screen.
4. Hold the microphone to the middle of the drive belt between the pulleys (at the place indicated by the arrow), about 10 – 20 mm away from the rear surface of the belt and so that it is perpendicular to the belt (within an angle of ± 15°).
5. Gently tap the middle of the belt between the pulleys (the place indicated by the arrow) with your finger as shown in the illustration, and check that the vibration frequency of the belt is within the standard value.

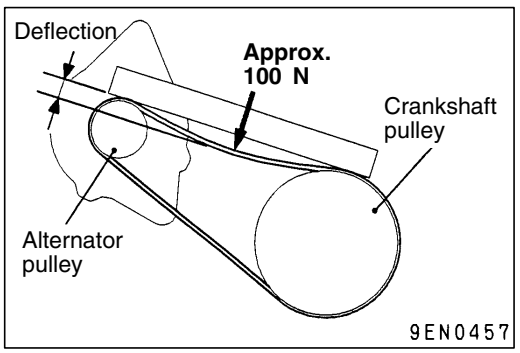
Caution

(1) The temperature of the surface of the belt should be as close as possible to normal temperature.
(2) Do not let any contaminants such as water or oil get onto the microphone.
(3) If strong gusts of wind blow against the microphone or if there are any loud sources of noise nearby, the values measured by the microphone may not correspond to actual values.
(4) If the microphone is touching the belt while the measurement is being made, the values measured by the microphone may not correspond to actual values.
(5) Do not take the measurement while the vehicle's engine is running.



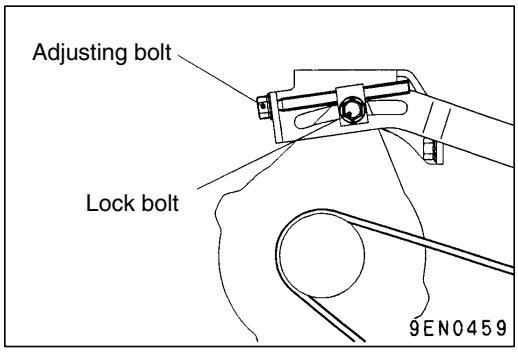
<When using a tension gauge>

Use a belt tension gauge to check that the belt tension is within the standard value.



<Belt deflection check>

Apply approx. 100 N of force to the middle of the drive belt between the pulleys (at the place indicated by the arrow) and check that the amount of deflection is within the standard value.



ALTERNATOR DRIVE BELT TENSION ADJUSTMENT

1. Loosen the nut of the alternator pivot bolt.
2. Loosen the lock bolt.
3. Use the adjusting bolt to adjust the belt tension and belt deflection to the standard values.

Standard value:

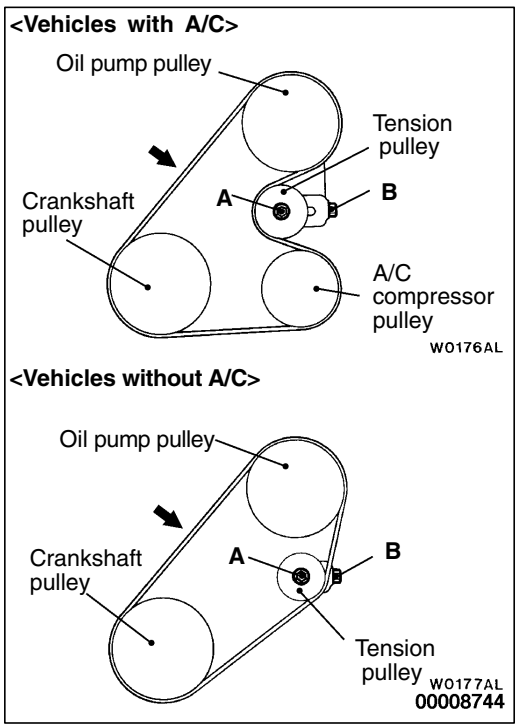
Items	When adjusted	When replaced
Vibration frequency Hz	155 – 175	203 – 234
Tension N	343 – 441	588 – 784
Deflection (Reference) mm	10.5 – 12.0	6.7 – 8.5

4. Tighten the nut of the alternator pivot bolt.

   Tightening torque: 44 ± 10 N·m
5. Tighten the lock bolt.

   Tightening torque: 23 ± 2 N·m
6. Tighten the adjusting bolt.

   Tightening torque: 5.0 ± 1.0 N·m



POWER STEERING OIL PUMP DRIVE BELT <Vehicles without A/C>, POWER STEERING OIL PUMP AND A/C COMPRESSOR DRIVE BELT <Vehicles with A/C> TENSION CHECK AND ADJUSTMENT

1. Check if the belt tension is within the standard value using one of the methods below.

Standard value:

Items	When checked	When adjusted	When replaced
Vibration frequency Hz	114 – 139	121 – 133	145 – 166
Tension N	392 – 588	441 – 539	637 – 833
Deflection (Reference) mm	10.0 – 12.0	10.0 – 11.0	7.0 – 9.0

<When measuring the vibration frequency>

With your finger tip lightly tap the centre of the belt between the pulleys in the location shown by the arrow in the illustration and then measure the belt vibration frequency.

NOTE
Refer to P.11B-6 for information regarding the vibration frequency measurement method using MUT-II.

<When measuring the tension>

Use a belt tension gauge to measure the belt tension.

<When measuring the deflection>

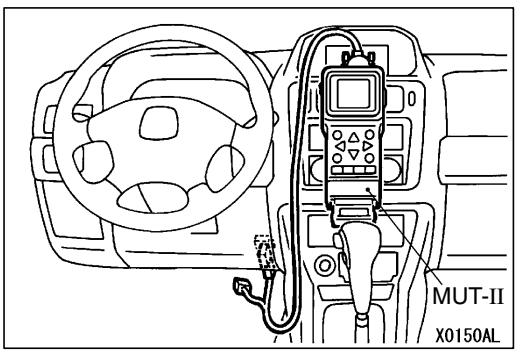
Apply approx. 100 N of pressure against the location between the pulleys shown by the arrow in the illustration and then measure the deflection.

2. If the tension or deflection is outside the standard value, adjust by the following procedure.
   (1) Loosen tensioner pulley fixing nut A.
   (2) Adjust the amount of belt deflection using adjusting bolt B.
   (3) Tighten fixing nut A.

   Tightening torque: 26 ± 4 N·m

   (4) Check the belt deflection amount and tension, and readjust if necessary.

   Caution
   Check after turning the crankshaft once or more clockwise (right turn).



IGNITION TIMING CHECK

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Turn the ignition switch to LOCK (OFF) position, and then connect the MUT-II to the diagnosis connector.
3. Set up a timing light.
4. Start the engine and run at idle.
5. Check that engine idle speed is within the standard value.

   Standard value: approx. 700 r/min

6. Select No.17 of the MUT-II Actuator test.
7. Check that basic ignition timing is within the standard value.

   Standard value: 5° BTDC ± 3°

8. If the basic ignition timing is outside the standard value, inspect the MPI system while referring to GROUP 13C – Troubleshooting.
9. Press the MUT-II clear key (Select a forced driving cancel mode) to release the Actuator test.

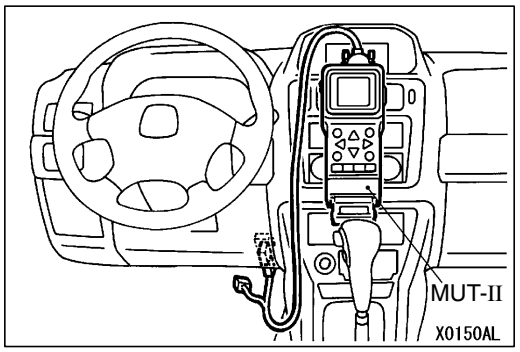
   Caution
   If the test is not cancelled, a forced driving will continue for 27 minutes. Driving under this condition may damage the engine.

10. Check that ignition timing is at the standard value.

    Standard value: approx. 10°BTDC

    NOTE
    (1) Ignition timing is variable within about ± 7°, even under normal operating.
    (2) And it is automatically further advanced by about 5° from standard value at higher altitudes.

11. Remove the timing light.
12. Turn the ignition switch to LOCK (OFF) position, and then remove the MUT-II.



IDLE SPEED CHECK

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Turn the ignition switch to LOCK (OFF) position, and then connect the MUT-II to the diagnosis connector.
3. Set up the timing light.
4. Check the ignition timing is within the standard value.

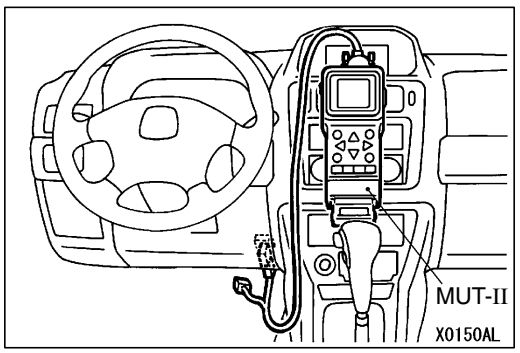
   Standard value: approx. 5° BTDC

5. Run the engine at idle for 2 minutes.
6. Check the idle speed. Select item No. 22 and take a reading of the idle speed.

   Curb idle speed: 700 ± 100 r/min

   NOTE
   The idle speed is controlled automatically by the idle speed control (ISC) system.

7. If the idle speed is outside the standard value, check the MPI components by referring to GROUP 13C – Troubleshooting.
8. Remove the timing light.
9. Turn the ignition switch to the LOCK (OFF) position, and then remove the MUT-II.



IDLE MIXTURE CHECK

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Turn the ignition switch to LOCK (OFF) position, and then connect the MUT-II to the diagnosis connector.
3. Set up the timing light.
4. Check that the ignition timing is within the standard value.

   Standard value: approx. 5° BTDC

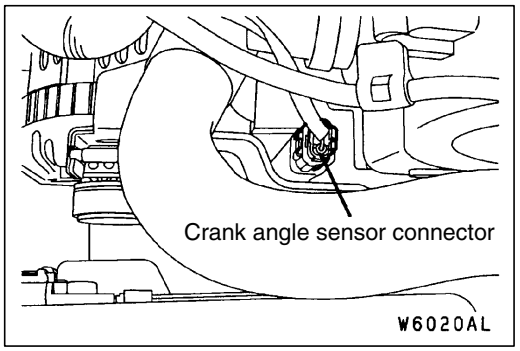
5. Run the engine at 2,500 r/min for 2 minutes.
6. Set the CO, HC tester.
7. Check the CO contents and the HC contents at idle.

   Standard value
   CO contents: 0.1 % or less
   HC contents: 100 ppm or less

8. If there is a deviation from the standard value, check the following items:
   - Diagnosis output
   - Closed-loop control (When the closed-loop control is normal, the output signal of the oxygen sensor changes between 0 – 400 mV and 600 – 1,000 mV at idle.)
   - Fuel pressure
   - Injector
   - Ignition coil, spark plug cable, spark plug
   - Evaporative emission control system
   - Compression pressure

   NOTE
   Replace the three way catalyst when the CO and HC contents are not within the standard value, even though the result of the inspection is normal on all items.

9. Remove the timing light.
10. Turn the ignition switch to the LOCK (OFF) position, and then remove the MUT-II.



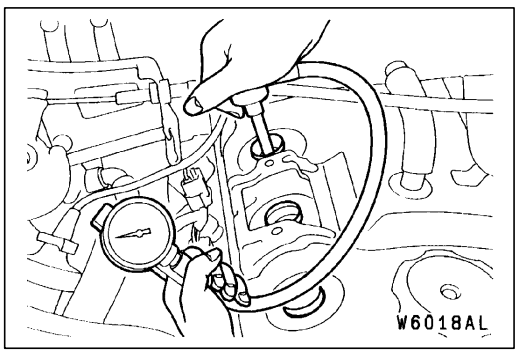
COMPRESSION PRESSURE CHECK

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Disconnect the ignition coil and spark plug cables.
3. Remove all of the spark plugs.
4. Disconnect the crank angle sensor connector.

   NOTE
   Doing this will prevent the engine-ECU from carrying out ignition and fuel injection.

5. Cover the spark plug hole with a shop towel etc., and after the engine has been cranked, check that no foreign material is adhering to the shop towel.

   Caution
   (1) Keep away from the spark plug hole when cranking.
   (2) If compression is measured with water, oil, fuel, etc., that has come from cracks inside the cylinder, these materials will become heated and will gush out from the spark plug hole, which is dangerous.



6. Set compression gauge to one of the spark plug holes.
7. Crank the engine with the throttle valve fully open and measure the compression pressure.

   Standard value (at engine speed of 250 r/min): 1370 kPa

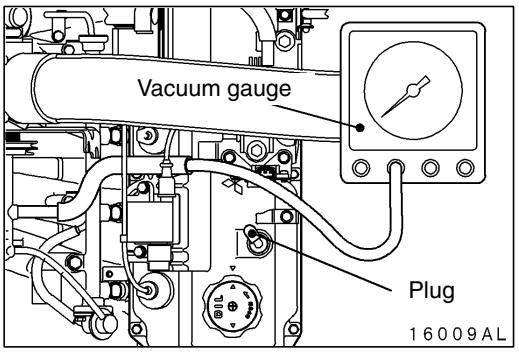
   Limit (at engine speed of 250 r/min): min. 1039 kPa

8. Measure the compression pressure for all the cylinders, and check that the pressure differences of the cylinders are below the limit.

   Limit: max. 100 kPa

9. If there is a cylinder with compression or a compression difference that is outside the limit, pour a small amount of engine oil through the spark plug hole, and repeat the operations in steps from (6) to (8).
   (1) If the compression increases after oil is added, the cause of the malfunction is a worn or damaged piston ring and/or cylinder inner surface.
   (2) If the compression does not rise after oil is added, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket.
10. Connect the crank angle sensor connector.
11. Install the spark plugs.
12. Install the ignition coils and spark plug cables.
13. Use the MUT-II to erase the diagnosis codes.

    NOTE
    This will erase the diagnosis code resulting from the crank angle sensor connector being disconnected.

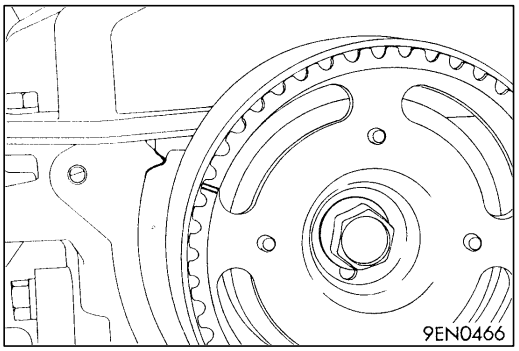


MANIFOLD VACUUM CHECK

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Turn the ignition switch to LOCK (OFF) position.
3. Connect the engine tachometer or connect the MUT-II to the diagnosis connector.
4. Disconnect the ventilation hose from the positive crankcase ventilation (PCV) valve, and then connect a vacuum gauge to the ventilation hose. Plug the positive crankcase ventilation (PCV) valve.
5. Check the intake manifold vacuum while the engine is idling.

   Limit: Min. 60 kPa

6. Turn the ignition switch to LOCK (OFF) position.
7. Remove the vacuum gauge, and then connect the ventilation hose to the positive crankcase ventilation (PCV) valve.
8. Remove the engine tachometer or the MUT-II.



TIMING BELT TENSION ADJUSTMENT

1. Remove the timing belt upper cover.
2. Turn the crankshaft clockwise to set the No. 1 cylinder to top dead compression centre.

   Caution
   As the purpose of this procedure is to apply the proper amount of tension to the timing belt by means of the cam drive torque, be sure not to rotate the crankshaft in the opposite direction.

3. Remove the access cover.
4. Loosen the timing belt tensioner fixing bolt to apply tension to the belt by means of the force of the tensioner spring.

   Caution
   The bolt can be loosened 90° – 180°.
   If the belt is loosened more than necessary, the bolt may fall inside the cover.

5. Tighten the timing belt tensioner fixing bolt.
6. Install the access cover.
7. Install the timing belt upper cover.

LASH ADJUSTER CHECK

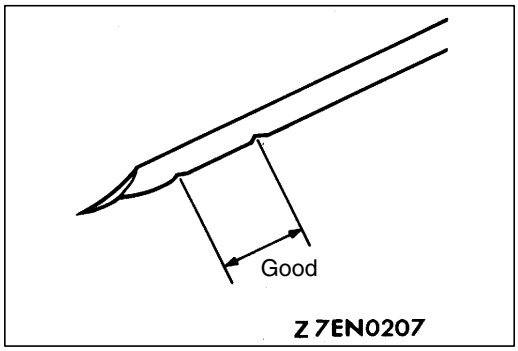
If an abnormal noise (knocking) that seems to be coming from the lash adjuster is heard after starting the engine and does not stop, carry out the following check.

NOTE
(1) The abnormal noise which is caused by a problem with the lash adjusters is generated after the engine is started, and will vary according to the engine speed. However, this noise is not related to the actual engine load.
Because of this, if the noise does not occur immediately after the engine is started, if it does not change in accordance with the engine speed, or if it changes in accordance with the engine load, the source of the noise is not the lash adjusters.
(2) If there is a problem with the lash adjusters, the noise will almost never disappear, even if the engine has been run at idle to let it warm up.
The only case where the noise might disappear is if the oil in the engine has not been looked after properly and oil sludge has caused the lash adjusters to stick.

1. Start the engine.
2. Check that the noise occurs immediately after the engine is started, and that the noise changes in accordance with changes in the engine speed.
If the noise does not occur immediately after the engine is started, or if it does not change in accordance with the engine speed, the problem is not being caused by the lash adjusters, so check for some other cause of the problem. Moreover, if the noise does not change in accordance with the engine speed, the cause of the problem is probably not with the engine. (In these cases, the lash adjusters are normal.)
3. While the engine is idling, check that the noise level does not change when the engine load is varied (for example, by shifting from N → D).
If the noise level changes, the cause of the noise is probably parts striking because of worn crankshaft bearings or connecting rod bearings. (In such cases, the lash adjusters are normal.)
4. After the engine has warmed up, run it at idle and check if any noise can be heard.
If the noise has become smaller or disappeared, oil sludge could make the lash adjusters stick. Clean the lash adjusters. (Refer to the Engine Workshop Manual.) If not improved, go to step 5.
5. Bleed air from the lash adjusters.
6. If the noise has not disappeared even after the air bleeding, clean the lash adjusters. (Refer to the Engine Workshop Manual.)

<LASH ADJUSTER AIR BLEEDING>

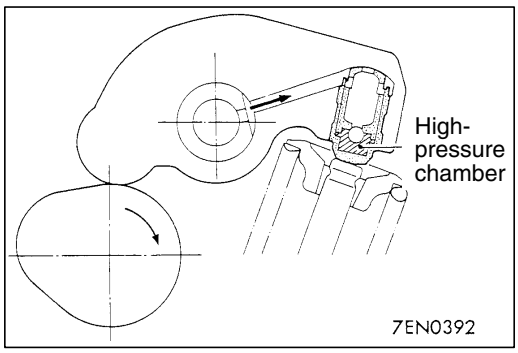
NOTE
(1) If the vehicle is parked on a slope for a long period of time, the amount of oil inside the lash adjuster will decrease, and air may get into the high pressure chamber when starting the engine.
(2) After parking the vehicle for long periods, the oil drains out of the oil passage, and it takes time for the oil to be supplied to the lash adjuster, so air can get into the high pressure chamber.
(3) If either of the above situations occur, the abnormal noise can be eliminated by bleeding the air from inside the lash adjusters.



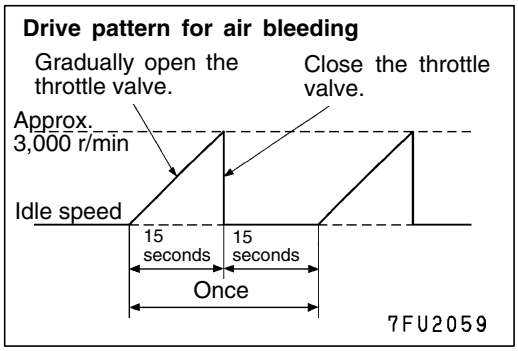
1. Check the engine oil and replenish or replace the oil if necessary.

NOTE
(1) If there is a only small amount of oil, air will be drawn in through the oil screen and will get into the oil passage.
(2) If the amount of oil is greater than normal, then the oil will being mixed by the crankshaft and a large amount of air may get mixed into the oil.

(3) If the oil is degenerated, air and oil will not separate easily in oil, and the amount of air mixed into the oil will increase.



(4) If the air which has been mixed in with the oil due to any of the above reasons gets into the high pressure chamber of the lash adjuster, the air inside the high pressure chamber will be compressed when the valve is open and the lash adjuster will over-compress, resulting in abnormal noise when the valve closes. This is the same effect as if the valve clearance is adjusted to be too large by mistake. If the air inside the lash adjusters is then released, the operation of the lash adjusters will return to normal.

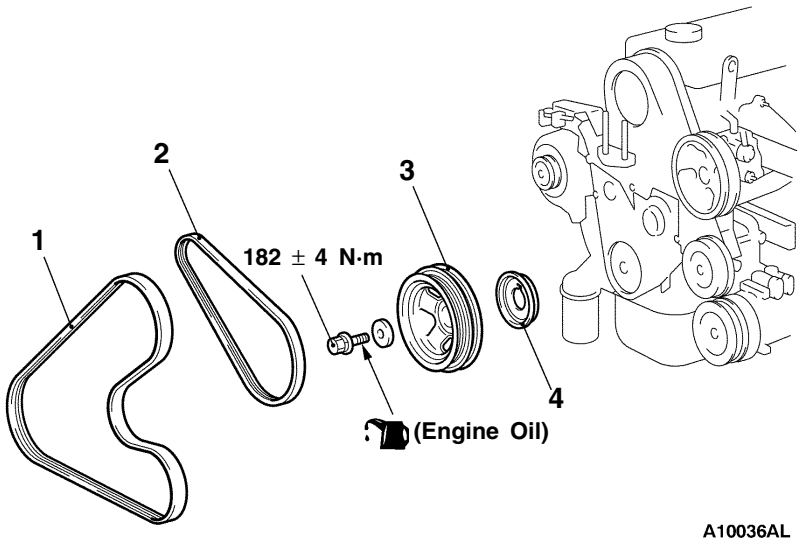


2. Run the engine at idle for 1 – 3 minutes to let it warm up.
3. With no load on the engine, repeat the drive pattern shown in the illustration at left and check if the abnormal noise disappears. (The noise should normally disappear after 10 – 30 repetitions, but if there is no change in the noise level after 30 repetitions or more, the problem is probably not due to air inside the lash adjusters.)
4. After the noise has disappeared, repeat the drive pattern shown in the illustration at left a further 5 times.
5. Run the engine at idle for 1 – 3 minutes and check that the noise has disappeared.

CRANKSHAFT PULLEY

REMOVAL AND INSTALLATION

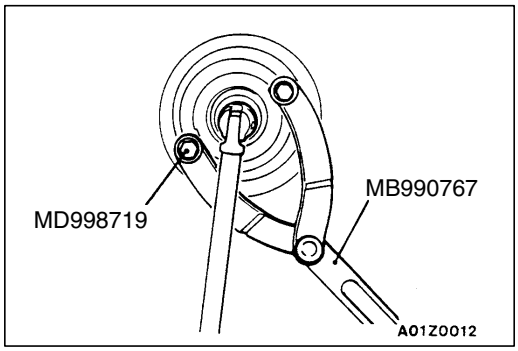
Pre-removal and Post-installation Operation
- Under Cover Removal and Installation
- Drive Belt Tension Adjustment (Refer to P.11B-5.) <only after installation>



Removal steps

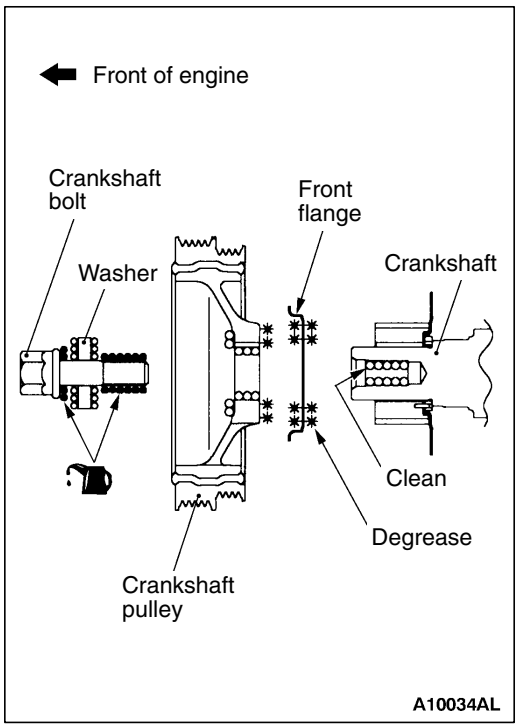
1. Power steering oil pump drive belt <Vehicles without A/C>, Power steering oil pump and A/C compressor drive belt <Vehicles with A/C>
2. Alternator drive belt
3. Crankshaft pulley
4. Front flange

◀A▶ ▶A◀ ▶A◀



REMOVAL SERVICE POINT

◀A▶ CRANKSHAFT PULLEY REMOVAL



INSTALLATION SERVICE POINT

▶A◀ FRONT FLANGE/CRANKSHAFT PULLEY INSTALLATION

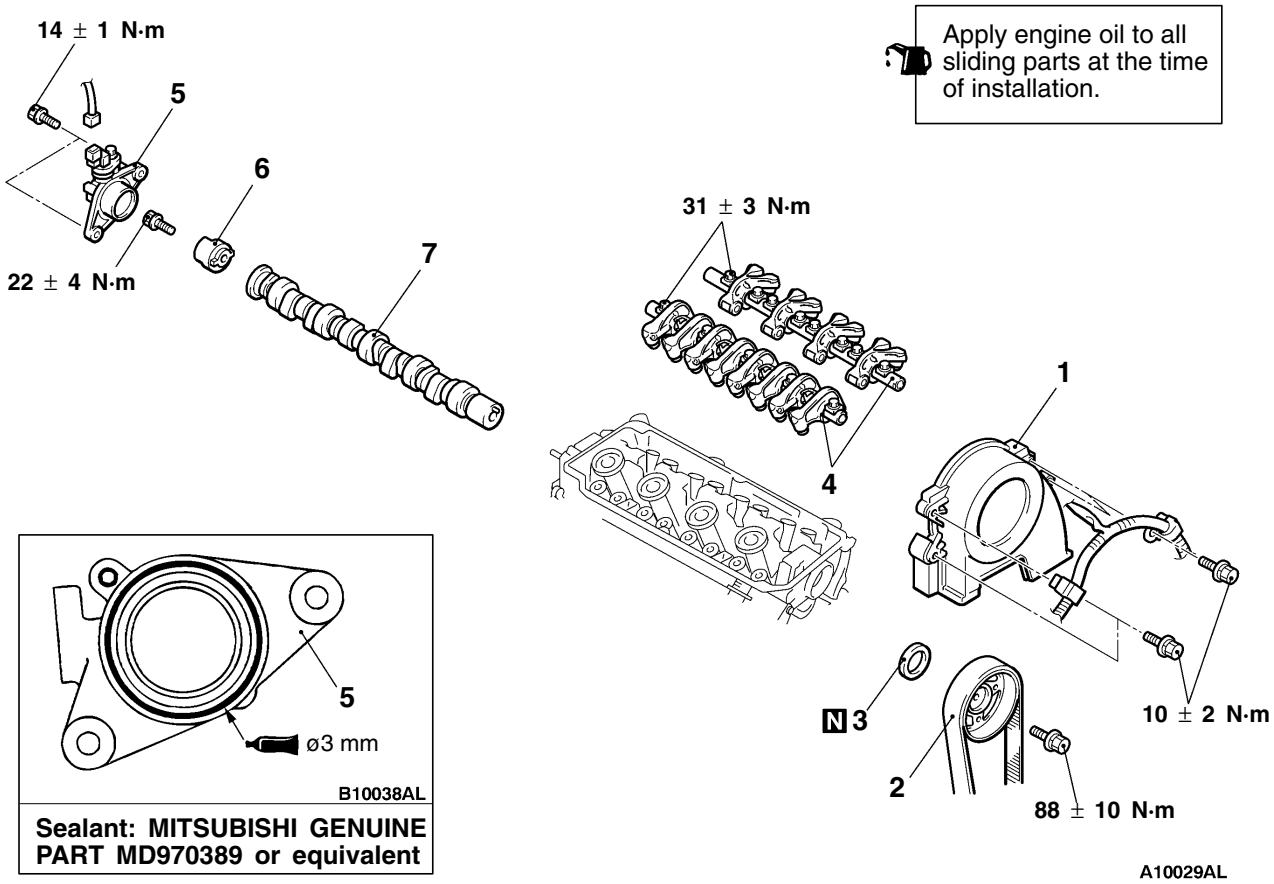
1. Clean and then degrease the front flange contacting surface of the crankshaft pulley.

   NOTE
   Degreasing is necessary to prevent decrease in the friction between contacting surfaces.
2. Clean the bolt hole in the crankshaft, the crankshaft contacting surface and washer contacting surface of the crankshaft pulley, and the washer.
3. Apply an appropriately small amount of oil to the threads and seating surface of the crankshaft bolt.
4. Use the special tools to stop the crankshaft pulley from turning in the same way as was done during removal, and then tighten the crankshaft bolt to the specified torque.

   Tightening torque: 182 ± 4 N·m

CAMSHAFT AND CAMSHAFT OIL SEAL

REMOVAL AND INSTALLATION



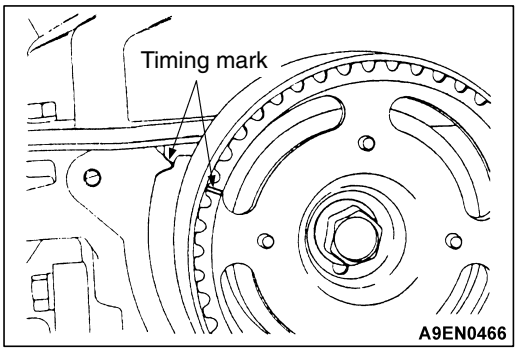
Camshaft oil seal removal steps

◀A▶ ▶D◀ 1. Timing belt upper cover
2. Camshaft sprocket and timing belt assembly
▶C◀ 3. Camshaft oil seal

Camshaft removal steps

- Cylinder head assembly (Refer to P.11B-25.)

◀B▶ ▶B◀ 4. Lash adjuster, rocker arm and shaft assembly
▶A◀ 5. Camshaft position sensor support
6. Camshaft position sensing cylinder
7. Camshaft

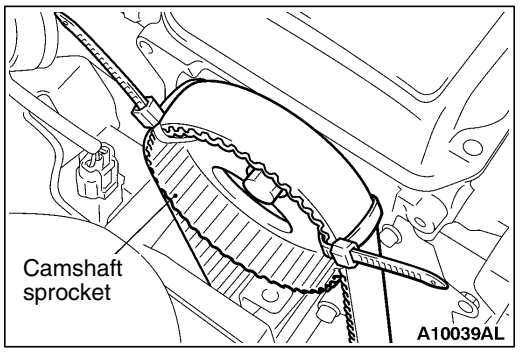


REMOVAL SERVICE POINTS

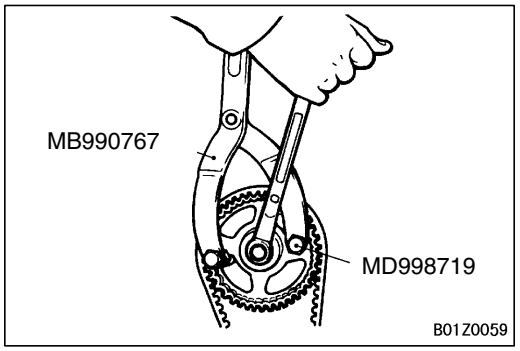
◀A▶ CAMSHAFT SPROCKET AND TIMING BELT ASSEMBLY REMOVAL

1. Turn the crankshaft clockwise (right turn) to align the timing mark and to set the No.1 cylinder at compression top dead center

Caution
The crankshaft should always be turned only clockwise.

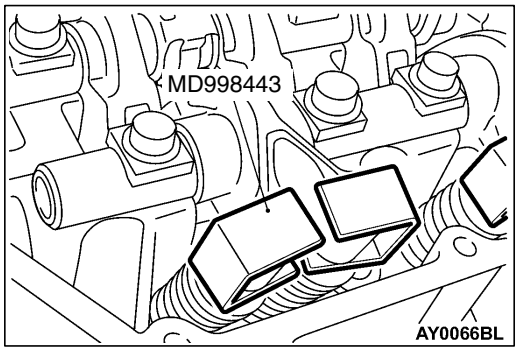


2. Tie the camshaft sprocket and timing belt with a band cable so that the position of the camshaft sprocket will not move with respect to the timing belt.



3. Use the special tools to remove the camshaft sprocket with the timing belt attached.

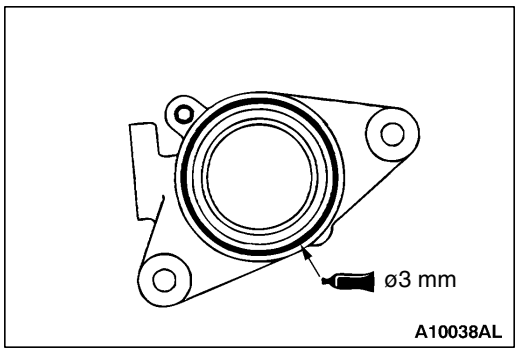
Caution
After removing the camshaft sprocket, be sure not to rotate the crankshaft.



◀B▶ LASH ADJUSTER, ROCKER ARM AND SHAFT ASSEMBLY REMOVAL

1. Before removing the lash adjuster, rocker arm and shaft assembly, install the special tools as shown in the illustration so that the lash adjusters will not fall out.
2. Loosen the lash adjuster, rocker arm and shaft assembly mounting bolt, and then remove the lash adjuster, rocker arm and shaft assembly with the bolt still attached.

Caution
Never disassemble the lash adjuster, rocker arm and shaft assembly.



INSTALLATION SERVICE POINTS

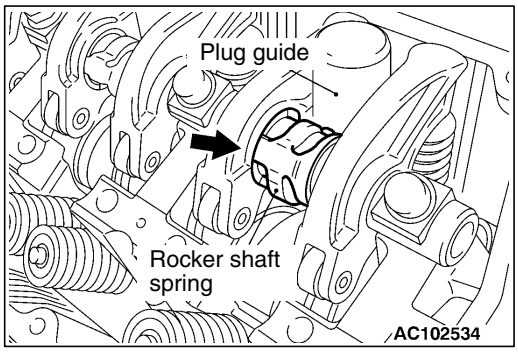
▶A◀ CAMSHAFT POSITION SENSOR SUPPORT INSTALLATION

1. Remove sealant remained on the camshaft position sensor support.
2. Apply sealant to the flange of the camshaft position sensor support and install to the cylinder head.

Specified sealant:
MITSUBISHI GENUINE PART MD970389 or equivalent

3. Tighten the camshaft position sensor support mounting bolt to the specified torque.

Tightening torque: 14 ± 1 N·m



▶B◀ LASH ADJUSTER, ROCKER ARM AND SHAFT ASSEMBLY INSTALLATION

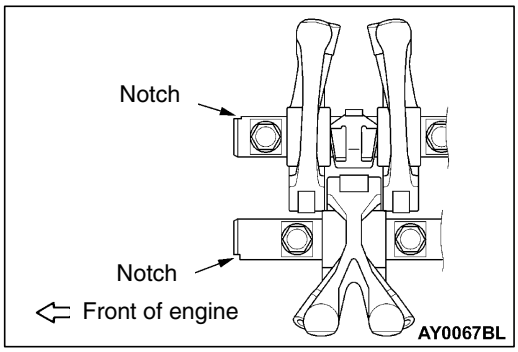
1. Remove the rocker shaft spring.
2. Tighten the lash adjuster, rocker arm and shaft assembly temporarily with mounting bolts so that all the rocker arms on the intake side will not push the valves.
3. Install the rocker shaft spring and plug guide so that they can meet at right angle to each other.
4. Tighten the lash adjuster, rocker arm and shaft assembly mounting bolt to the specified torque.

   Tightening torque: 31 ± 3 N·m

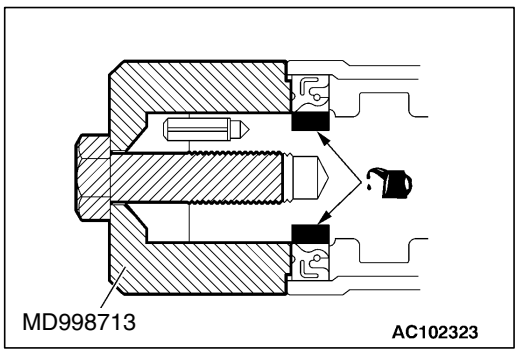
5. Install the the lash adjuster, rocker arm and shaft assembly on the exhaust side, and then tighten the bolt to the specified torque.

   Tightening torque: 31 ± 3 N·m

6. Remove the special tool used for retaining the lash adjuster.



7. Ensure that the notch at the rocker shaft points towards the direction as shown in the illustration.



▶C◀ CAMSHAFT OIL SEAL INSTALLATION

1. Apply engine oil to the camshaft oil seal lip.
2. Use the special tool to press-fit the camshaft oil seal.

▶D◀ CAMSHAFT SPROCKET AND TIMING BELT ASSEMBLY INSTALLATION

1. Use the special tools to stop the camshaft sprocket from turning in the same way as was done during removal, and then tighten the camshaft sprocket securing bolt to the specified torque.

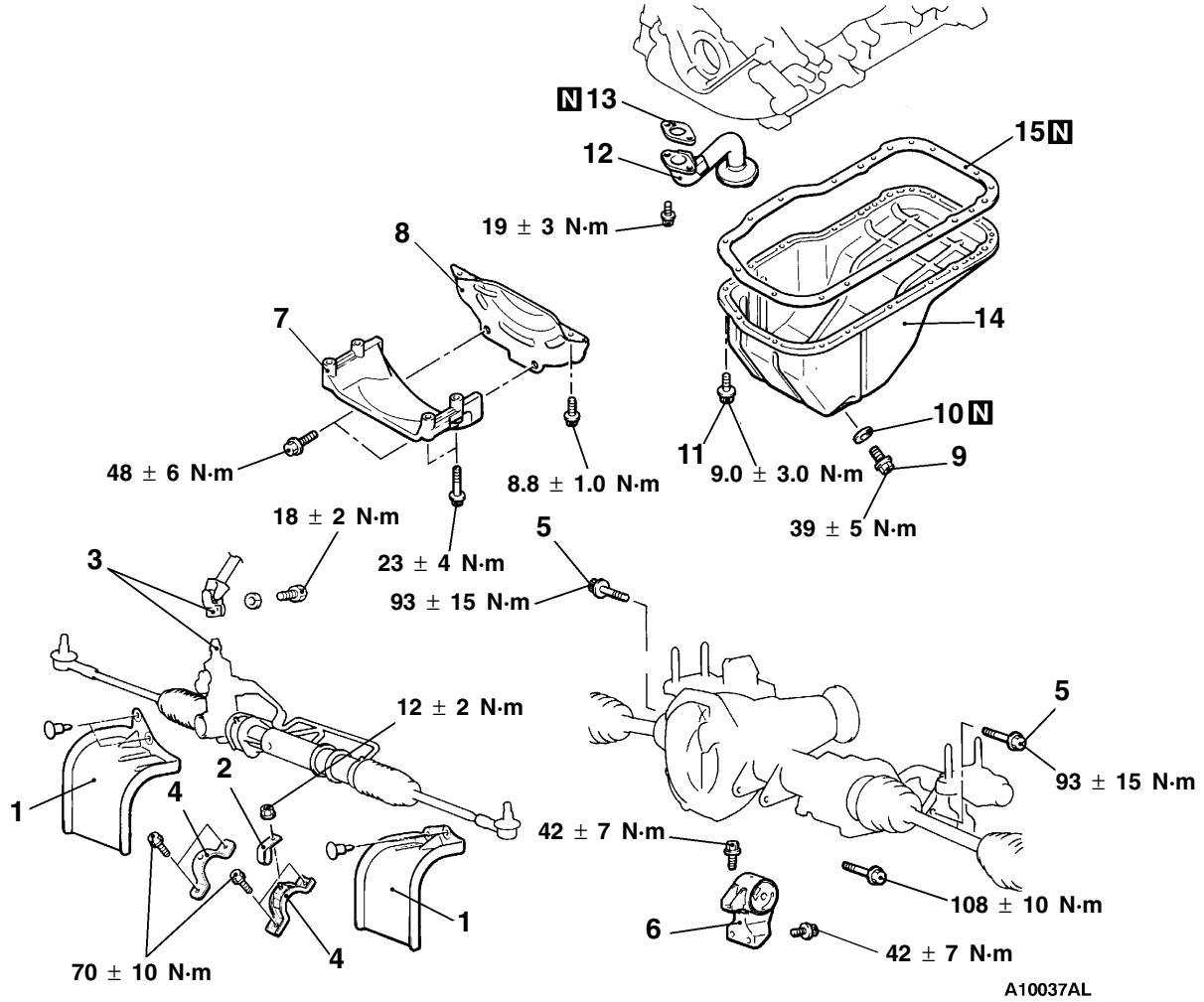
   Tightening torque: 88 ± 10 N·m

2. Remove the band cable which binds the camshaft sprocket and timing belt.

OIL PAN

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Under Cover Removal and Installation
- Engine Oil Draining and Supplying
- Oil Level Gauge Removal and Installation



Removal steps

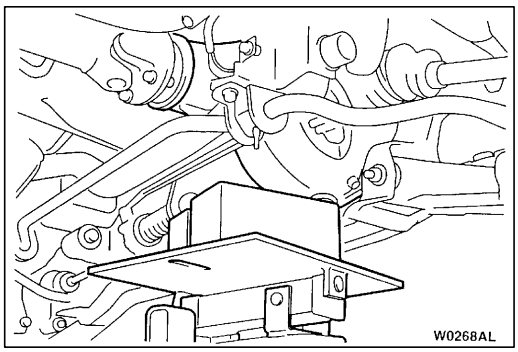
1. Splash shield
2. Power steering pressure hose clamp <R.H. drive vehicles>
3. Steering gear box and shaft connection
◀A▶ 4. Steering gear box installation bolts
◀B▶ 5. Front differential mount center bolt
◀B▶ 6. Front differential mount
7. Transmission stay
8. Bell housing cover
9. Drain plug
▶B◀ 10. Drain plug gasket
◀C▶ ▶A◀ 11. Oil pan installation bolts
◀C▶ ▶A◀ 12. Oil screen
◀C▶ ▶A◀ 13. Oil screen gasket
◀C▶ ▶A◀ 14. Oil pan
▶A◀ 15. Oil pan gasket

NOTE
Liquid-type gasket is used as the oil pan gasket for the vehicle shipped from the factory or the engine to be overhauled. If liquid gasket is used during the replacement of the oil pan gasket in the on-vehicle service, the sealing surfaces affect other parts, thereby resulting in oil leaks. So, be sure to use an oil pan gasket supplied as a spare part.

REMOVAL SERVICE POINTS

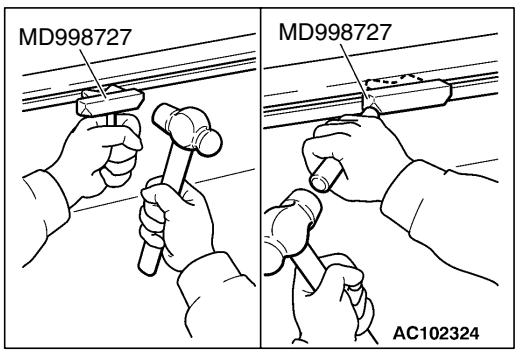
◀A▶ STEERING GEAR BOX INSTALLATION BOLT REMOVAL

Remove the steering gear box installation bolts and lower the steering gear box.



◀B▶ FRONT DIFFERENTIAL MOUNT CENTER BOLT/ FRONT DIFFERENTIAL MOUNT REMOVAL

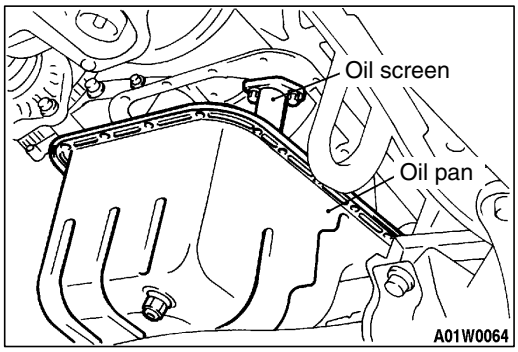
1. Support the front differential by a jack, and remove the front differential mount center bolts and the front differential mount.
2. Remove the jack and lower the front differential.



◀C▶ OIL PAN INSTALLATION BOLT/OIL SCREEN/OIL SCREEN GASKET/OIL PAN REMOVAL

1. After removing the oil pan installation bolts, use a special tool to remove the oil pan from the engine.

   Caution
   Perform this slowly to avoid deformation of the oil pan flange.

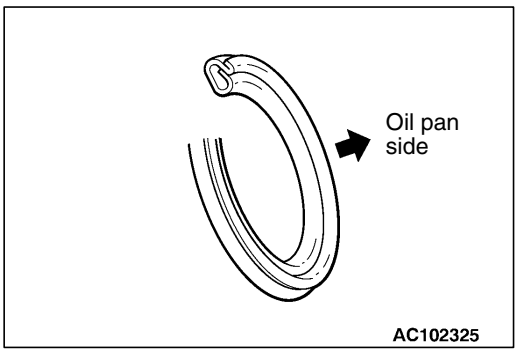


2. With the oil pan removed from the cylinder block, remove the oil screen installation bolts.
3. Remove the oil pan and the oil screen as a set.

INSTALLATION SERVICE POINTS

▶A◀ OIL PAN GASKET/OIL PAN/OIL SCREEN GASKET/OIL SCREEN/OIL PAN INSTALLATION BOLT INSTALLATION

1. Put the oil screen in the oil pan. With the oil pan gasket in position, place the oil pan between the cylinder block and front differential.
2. Install the oil screen gasket and oil screen to the cylinder block.
3. Install the oil pan to the cylinder block.

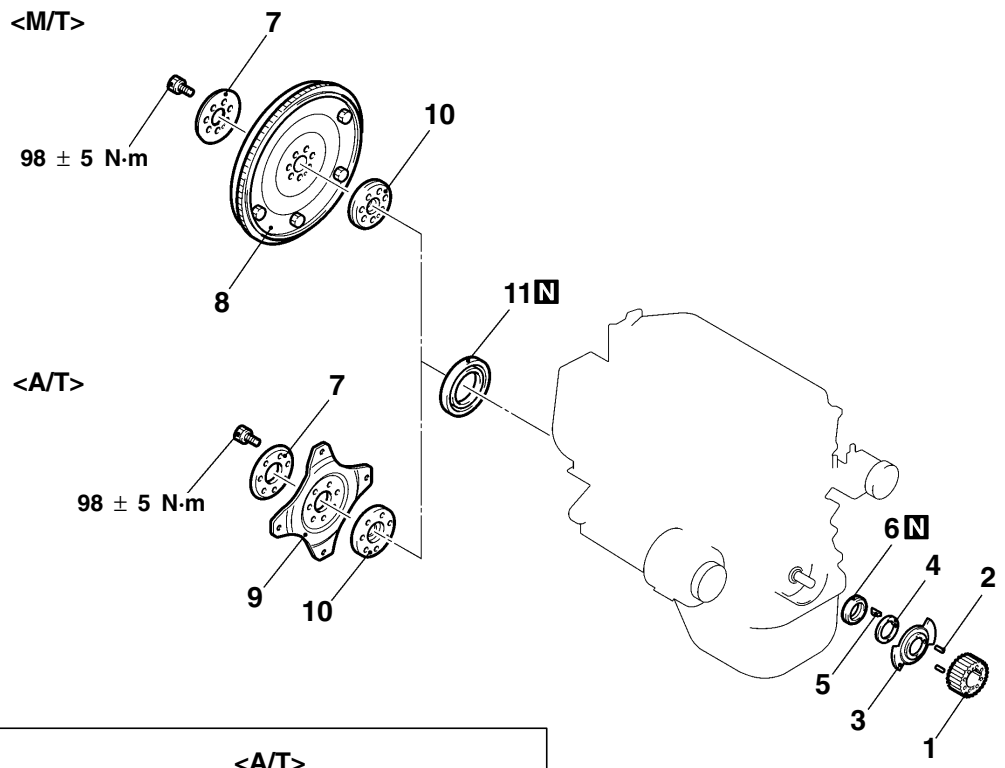


▶B◀ DRAIN PLUG GASKET INSTALLATION

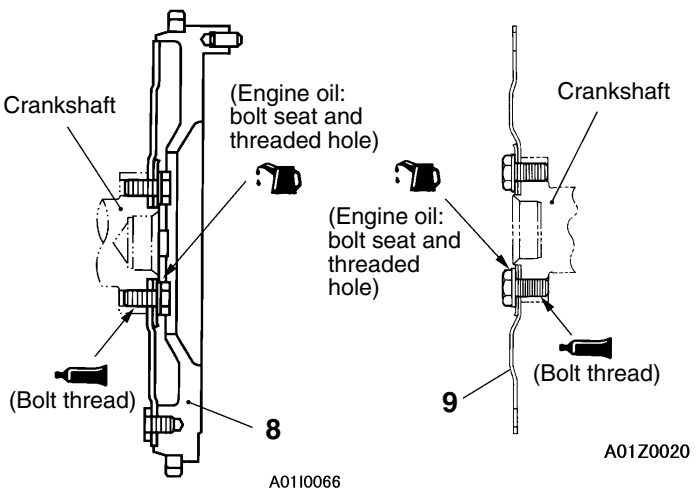
Install the drain plug gasket in the direction so that it faces as shown in the illustration.

CRANKSHAFT OIL SEAL

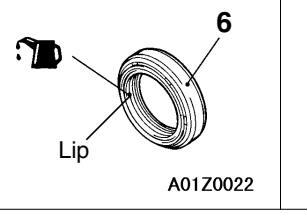
REMOVAL AND INSTALLATION

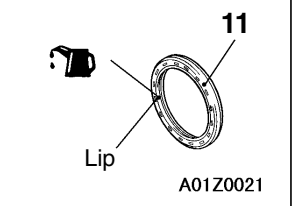


A10040AL



Sealant: 3M Stud Locking 4170 or equivalent





Engine oil

Crankshaft front oil seal removal steps

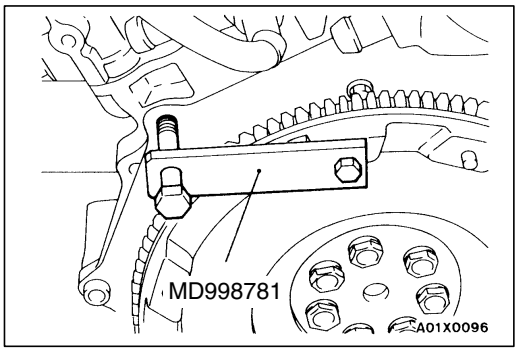
- Timing belt (Refer to P.11B-30.)
- Crank angle sensor (Refer to GROUP 16 – Ignition System.)

▶D◀ 1. Crankshaft sprocket
▶D◀ 2. Spring pin
▶D◀ 3. Crankshaft sensing blade
▶D◀ 4. Crankshaft spacer
5. Crankshaft key
▶C◀ 6. Crankshaft front oil seal

Crankshaft rear oil seal removal steps

- Transmission assembly
- Clutch cover and disc <M/T>

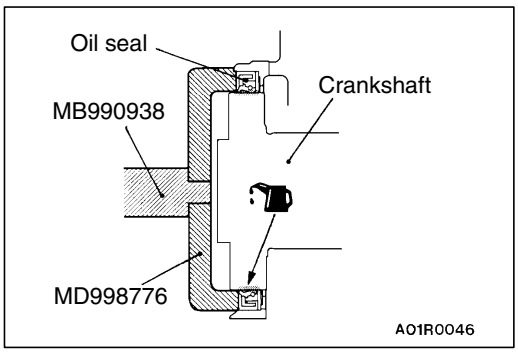
◀A▶ ▶B◀ 7. Adapter plate
◀A▶ ▶B◀ 8. Flywheel <M/T>
◀A▶ ▶B◀ 9. Drive plate <A/T>
◀A▶ ▶B◀ 10. Crankshaft adapter
▶A◀ 11. Crankshaft rear oil seal



REMOVAL SERVICE POINT

◀A▶ ADAPTER PLATE/FLYWHEEL <M/T>/DRIVE PLATE <A/T>/CRANKSHAFT ADAPTER REMOVAL

Use the special tool to secure the flywheel or drive plate, and remove the bolts.



INSTALLATION SERVICE POINTS

▶A◀ CRANKSHAFT REAR OIL SEAL INSTALLATION

1. Apply a small mount of engine oil to the entire circumference of the oil seal lip.
2. Install the oil seal by tapping it as far as the chamfered position of the oil seal case as shown in the illustration.

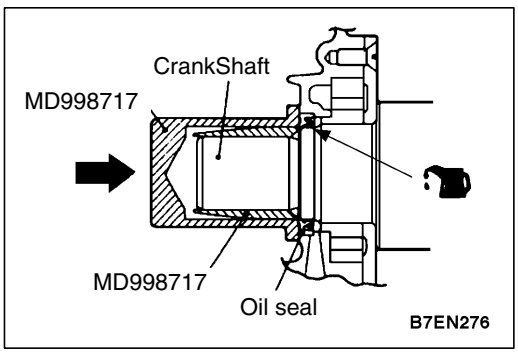
▶B◀ CRANKSHAFT ADAPTER /DRIVE PLATE <A/T>/ FLYWHEEL <M/T>/ADAPTER PLATE INSTALLATION

1. Clean off all sealant, oil and other substances which are adhering to the threaded bolts, crankshaft thread holes and the drive plate or flywheel.
2. Apply oil to the bearing surface of the drive plate bolts or flywheel bolts.
3. Apply oil to the crankshaft thread holes.
4. Apply sealant to the threaded mounting holes.

   Specified sealant: 3M Stud locking 4170 or equivalent

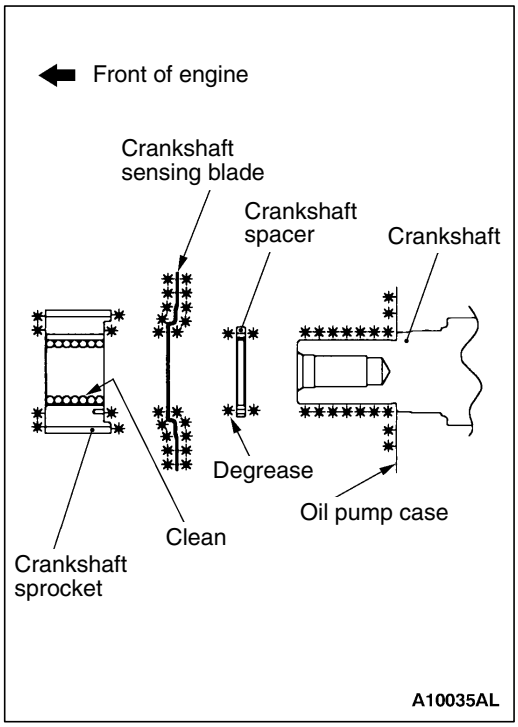
5. Use the same special tool as in the removal procedure to retain drive plate or flywheel, and tighten drive plate bolts or flywheel bolts to the specified torque.

   Tightening torque: 98 ± 5 N·m



▶C◀ CRANKSHAFT FRONT OIL SEAL INSTALLATION

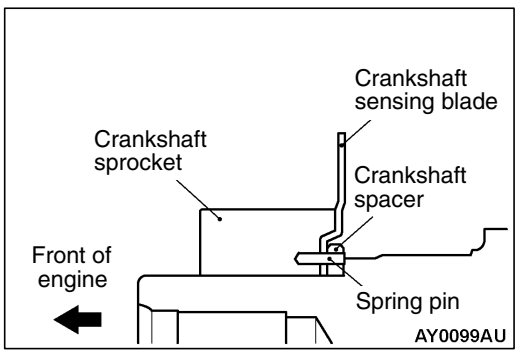
1. Apply a small amount of engine oil to the entire circumference of the oil seal lip.
2. Tap the oil seal unit it is flush with the oil seal case.



▶D◀ CRANKSHAFT SPACER/CRANKSHAFT SENSING BLADE/SPRING PIN/CRANKSHAFT SPROCKET INSTALLATION

1. Clean and then degrease the following surfaces and parts: front surface of oil pump case, sprocket mounting surface of crankshaft, crankshaft spacer, crankshaft sensing blade, and crankshaft sprocket.

   NOTE
   Degreasing is necessary to prevent decrease in the friction between contacting surfaces.
2. Clean the crankshaft contacting surface of crankshaft sprocket.

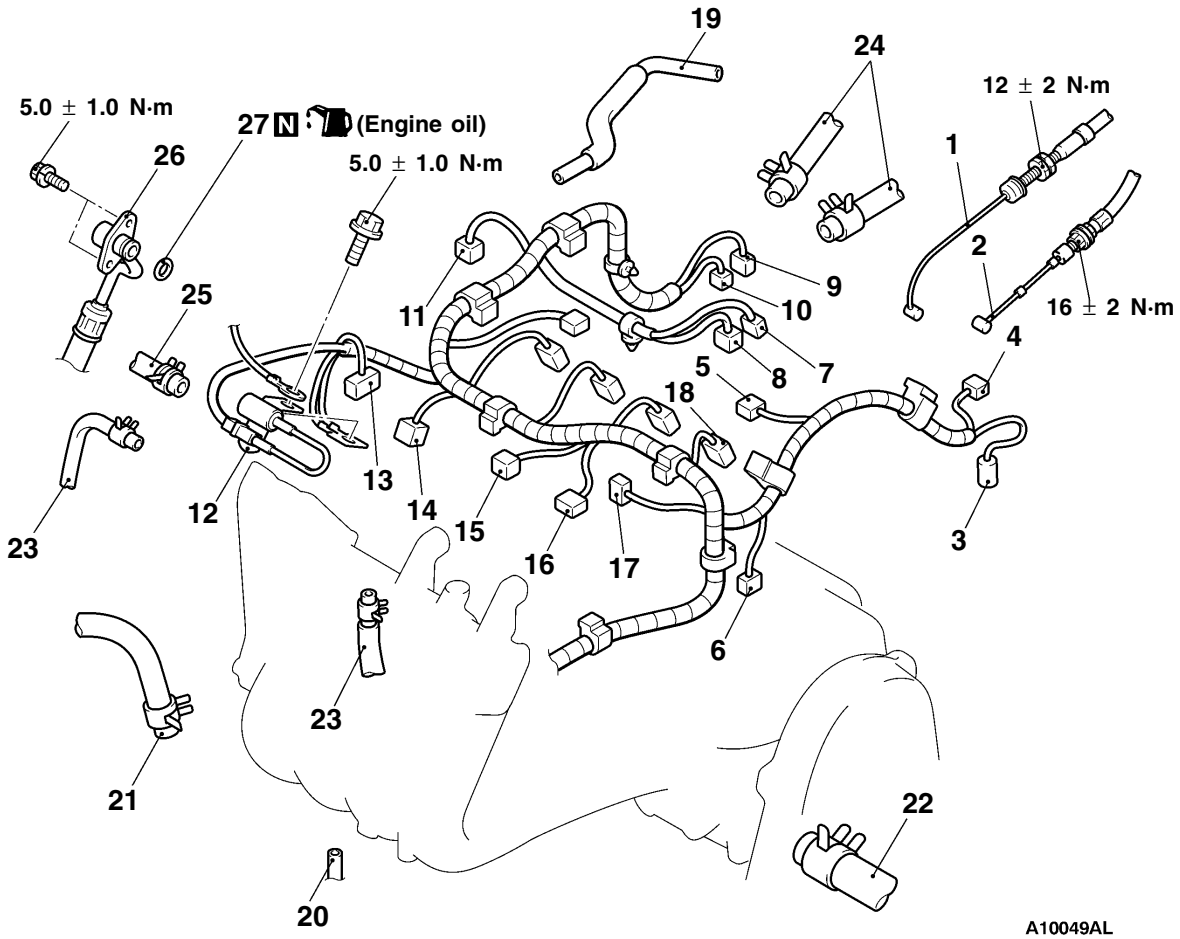


3. With spring pin, crankshaft sensing blade and crankshaft spacer assembled, install crankshaft sprocket on crankshaft.

CYLINDER HEAD GASKET

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Fuel Discharge Prevention (Refer to GROUP 13C – On-vehicle Service.) <Pre-removal only>
- Kickdown Cable Adjustment <A/T> (Refer to GROUP 23 – On-vehicle Service.) <Post-installation only>
- Accelerator Cable Adjustment (Refer to GROUP 17 – On-vehicle Service.) <Post-installation only>
- Engine Coolant Draining and Supplying
- Engine Oil Draining and Supplying
- Exhaust Manifold Removal and Installation (Refer to GROUP 15.)
- Thermostat Case Assembly Removal and Installation (Refer to GROUP 14 – Water Hose and Pipe.)
- Water By-pass Fitting Removal and Installation (Refer to GROUP 14 – Water Hose and Pipe.)



Removal steps

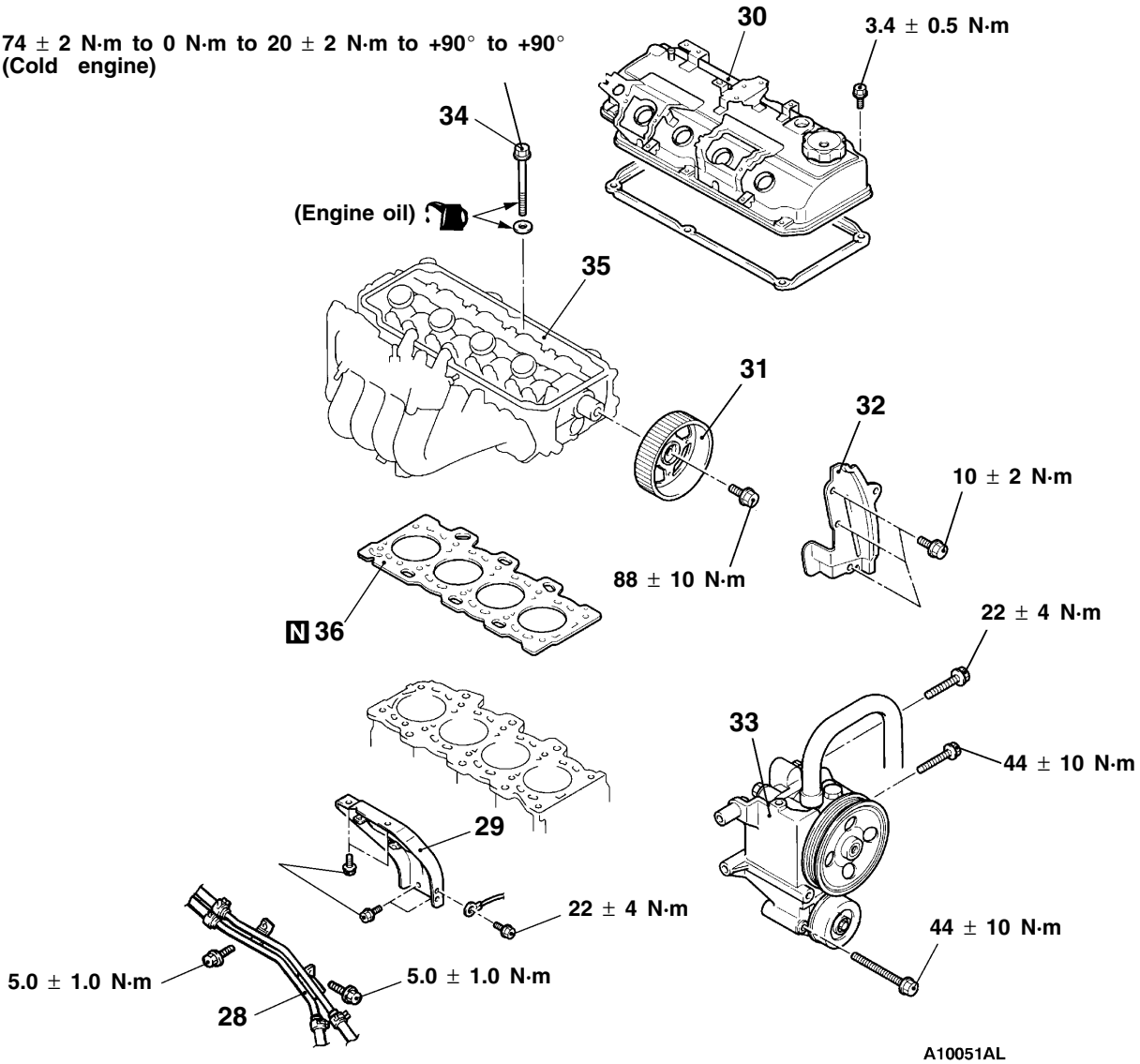
1. Accelerator cable connection
2. Kickdown cable connection <A/T>
3. Power steering oil pressure switch connector
4. A/C compressor magnetic clutch connector
5. Ignition coil connector
6. Crank angle sensor connector
7. Oxygen sensor connector
8. Ignition failure sensor connector
9. Engine coolant temperature sensor connector
10. Engine coolant temperature gauge unit connector
11. Camshaft position sensor connector
12. Capacitor
13. Throttle position sensor connector
14. Idle speed control servo connector
15. Purge control solenoid valve connector
16. EGR solenoid valve connector
17. Detonation sensor connector
18. Injector connector
19. PCV hose
20. Vacuum hoses connection
21. Brake booster vacuum hose connection

◀A▶ ▶E◀ 22. Radiator upper hose connection

23. Water hose connection
24. Heater hose connection
25. Fuel return hose connection

▶D◀ 26. Fuel high-pressure hose connection

▶D◀ 27. O-ring



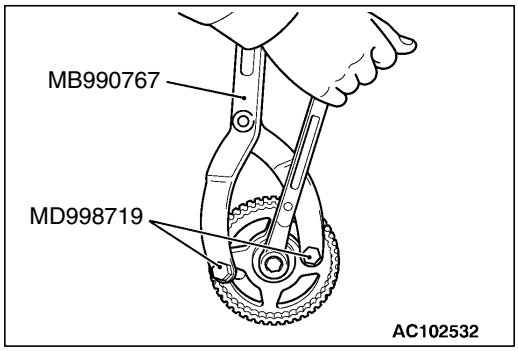
28. Oil cooler pipe connection <A/T>
29. Intake manifold stay
    - Ignition failure sensor (Refer to GROUP 16 – Ignition System.)
    - Ignition coil (Refer to GROUP 16 – Ignition System.)
    - Timing belt (Refer to P.11B-30.)
30. Rocker cover

◀B▶ ▶C◀ 31. Camshaft sprocket
32. Timing belt under upper cover
◀C▶ 33. Power steering oil pump and bracket assembly
◀D▶ ▶B◀ 34. Cylinder head bolt
35. Cylinder head assembly
▶A◀ 36. Cylinder head gasket

REMOVAL SERVICE POINTS

◀A▶ RADIATOR UPPER HOSE REMOVAL

After alignment marks are indicated on radiator upper hose and hose clamps, remove the hose.

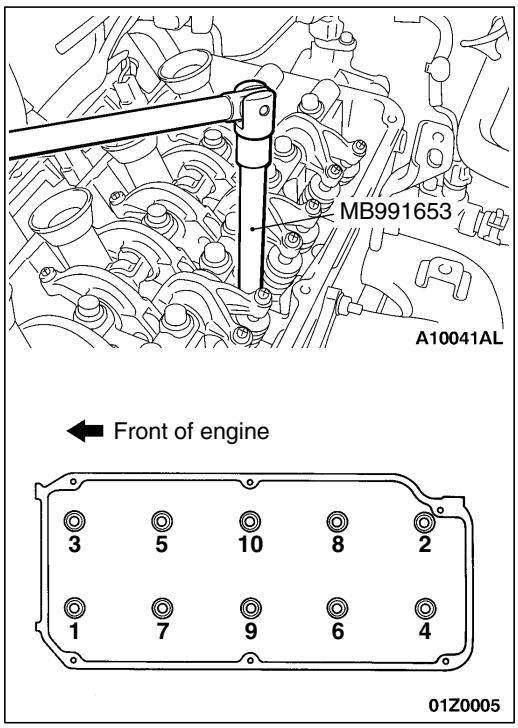


◀B▶ CAMSHAFT SPROCKET REMOVAL

◀C▶ POWER STEERING OIL PUMP AND BRACKET ASSEMBLY REMOVAL

Remove the power steering oil pump and bracket assembly from the engine with the hose attached.

NOTE
Place the removed power steering oil pump and bracket assembly in a place where it will not be a hindrance when removing and installing the cylinder head assembly, and tie it with a cord.



◀D▶ CYLINDER HEAD BOLT REMOVAL

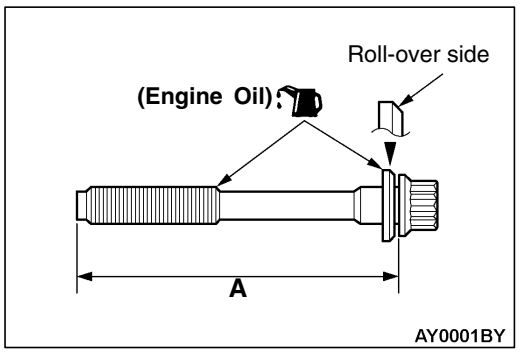
Use the special tool to loosen the bolts in two or three steps in the order of the numbers shown in the illustration, and then remove the bolts.
If the washer is caught on valve spring and the bolt is not removed, pull up the bolt slightly and remove the bolt while tilting the washer by using a magnet, etc.

INSTALLATION SERVICE POINTS

▶A◀ CYLINDER HEAD GASKET INSTALLATION

1. Wipe off all oil and grease from the gasket mounting surface.

   Caution
   Do not insert foreign objects into coolant, oil passage and cylinders.
2. Install so that the shapes of the respective cylinder head gasket holes match the shapes of the cylinder block holes.



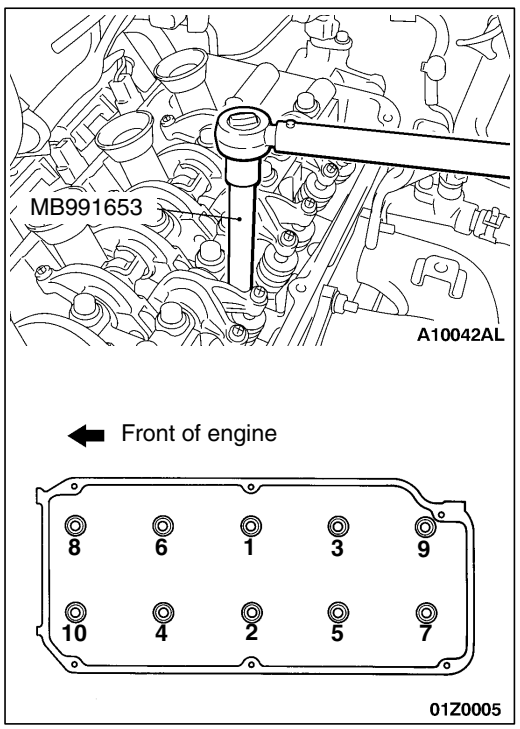
▶B◀ CYLINDER HEAD BOLT INSTALLATION

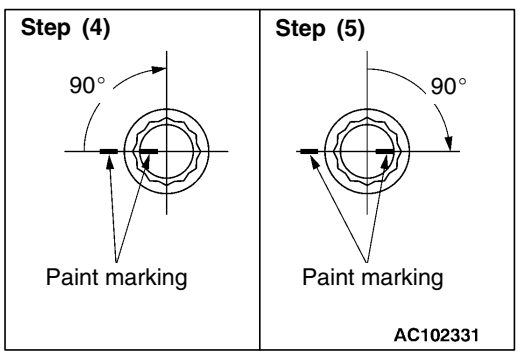
1. Ensure that the length under head of cylinder head bolts is under the limit value. When the measured value exceeds the limit value, replace the bolt with new one.

   Limit (A): 96.4 mm
2. With roll-over side of punched cylinder head bolt washer moved in the direction specified in the figure, install it on cylinder head bolt.
3. Apply small quantity of engine oil at the threads of cylinder head bolts and the washers.
4. Use special tool to tighten bolts according to the following procedure (tightening for plastic zone).
   (1) According to the sequence in the figure, tighten bolts to the specified torque 74 ± 2 N·m.
   (2) In the reverse sequence of the figure, fully loosen bolts.
   (3) According to the sequence specified in the figure, tighten bolts to the specified torque 20 ± 2 N·m.

   (4) Indicate paint markings on the heads of cylinder head bolts and cylinder head, and tighten bolts at the angle of 90 degrees in the sequence specified in the figure.
   (5) When bolts are tightened at the angle of 90 degrees according to the figure, ensure that the paint markings on the heads of cylinder head bolts and cylinder head are standing in line.

   Caution
   1) When the tightening angle is under 90 degree, the bolt is not sufficiently tightened.
   2) When the tightening angle exceeds the specified value, remove the bolt and repeat the same procedure beginning with Step 1.





▶C◀ CAMSHAFT SPROCKET INSTALLATION

Use the special tool to stop the the camshaft sprocket from turning in the same way as was done during removal, and then tighten the bolts to the specified torque.

Tightening torque: 88 ± 10 N·m

▶D◀ O-RING/FUEL HIGH-PRESSURE HOSE INSTALLATION

1. Apply a small amount of new engine oil to the O-ring.

   Caution
   Do not let any engine oil get into the delivery pipe.

2. While turning the fuel high-pressure hose to the right and left, install the delivery pipe, while being careful not to damage the O-ring. After installing, check that the hose turns smoothly.
3. If the hose does not turn smoothly, the O-ring is probably being clamped. Disconnect the fuel high-pressure hose and check the O-ring for damage. After this, re-insert the delivery pipe and check that the hose turns smoothly.
4. Tighten the fuel high-pressure hose mounting bolt to the specified torque.

   Tightening torque: 5.0 ± 1.0 N·m

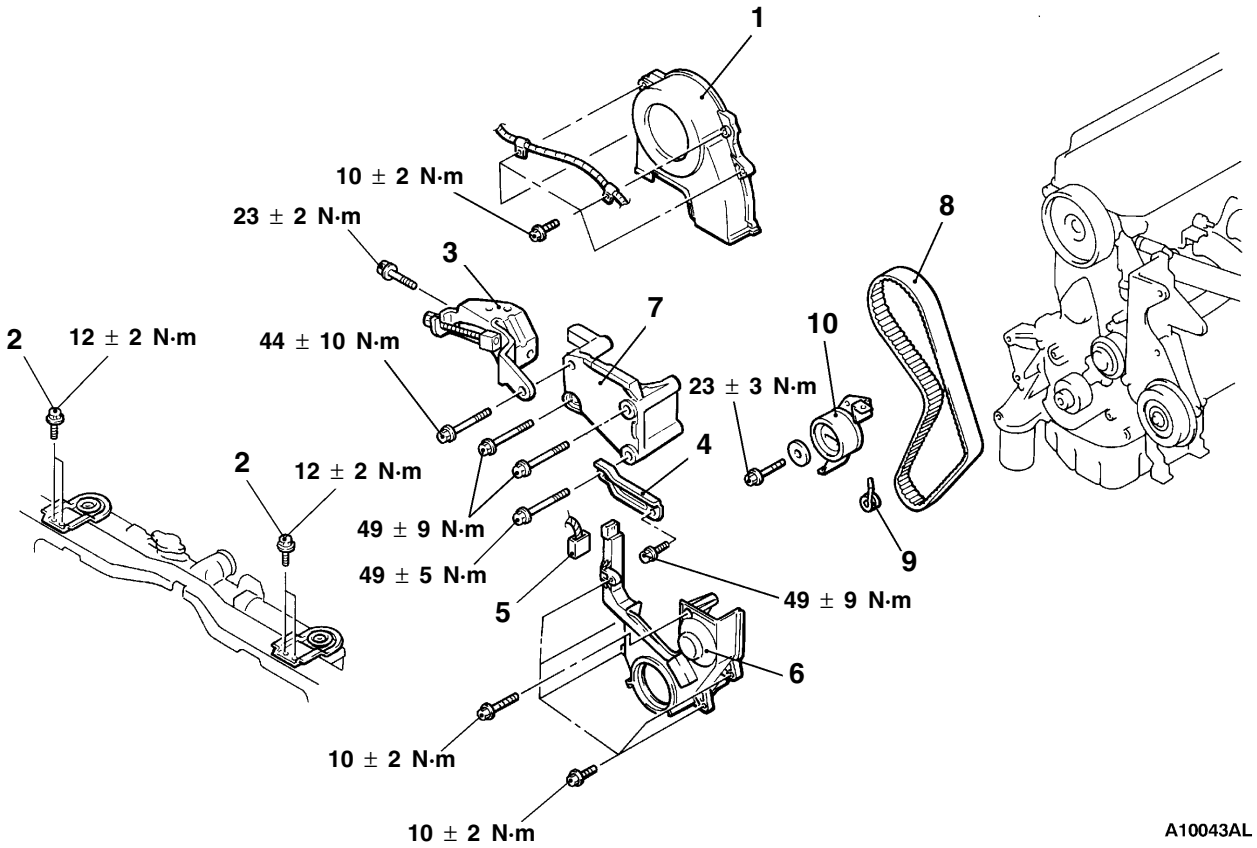
▶E◀ RADIATOR UPPER HOSE INSTALLATION

1. Insert the radiator upper hose to the protruded parts of the water outlet fitting.
2. Align the marks on the radiator upper hose and hose clamp drawn during removal when installing.

TIMING BELT

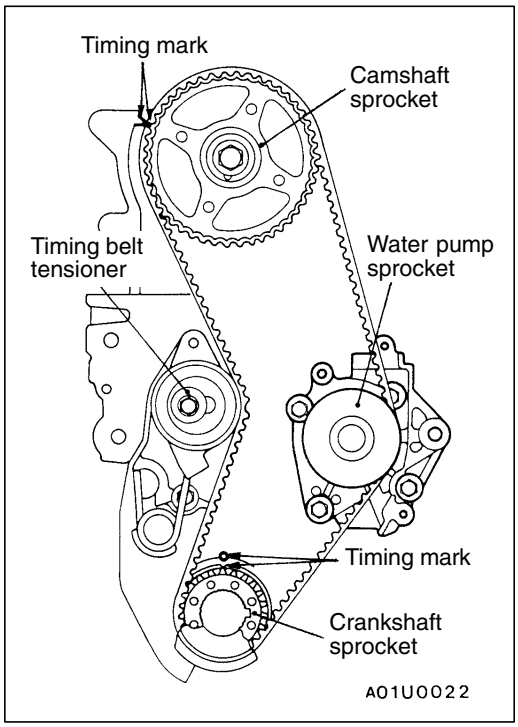
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Under Cover Removal and Installation
- Air Intake Pipe Removal and Installation (Refer to GROUP 15 – Air Cleaner.)
- Crankshaft Pulley Removal and Installation (Refer to P.11B-13.)



Removal steps

1. Timing belt front upper cover
2. Radiator upper installation bolts
3. Alternator brace
4. Power steering oil pump bracket stay
5. Crank angle sensor connector
- ▶C◀ 6. Timing belt front lower cover
7. Accessory mount
- ▶B◀ ● Timing belt tension adjustment
- ◀A▶ ▶A◀ 8. Timing belt
9. Tensioner spring
10. Timing belt tensioner

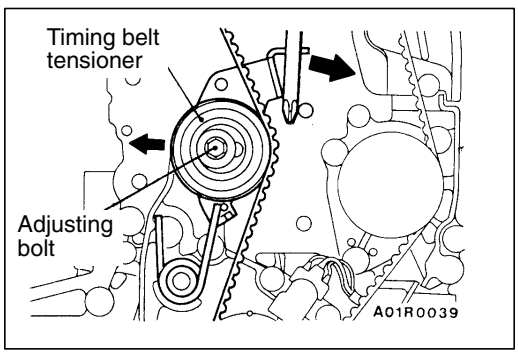


REMOVAL SERVICE POINT

◀A▶ TIMING BELT REMOVAL

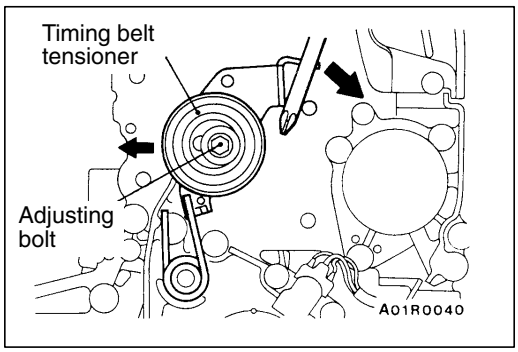
1. Turn the crankshaft clockwise (right turn) to align each timing mark and to set the No. 1 cylinder at compression top dead centre.

Caution
The crankshaft should always be turned only clockwise.



2. Loosen the adjusting bolt.
3. Set a screwdriver to the timing belt tensioner and press it fully back in the direction of the arrow.
4. Provisionally tighten the adjusting bolt.
5. Remove the timing belt.

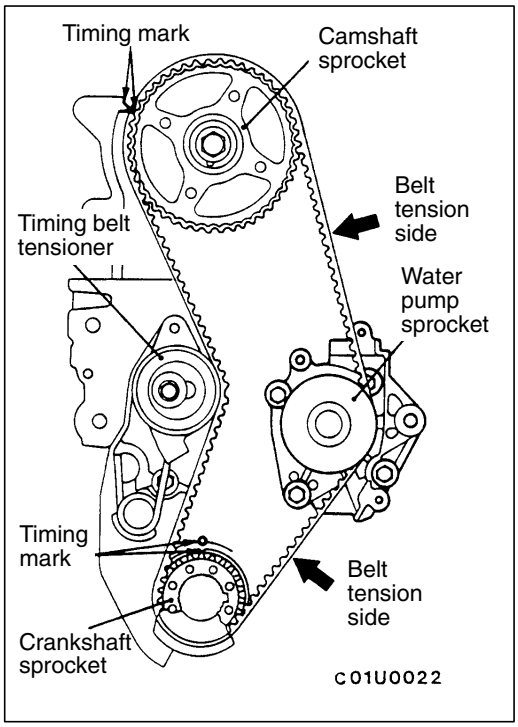
Caution
If the timing belt is to be re-used, use chalk to mark the flat side of the belt with an arrow indicating the direction of rotation (right turn).



INSTALLATION SERVICE POINTS

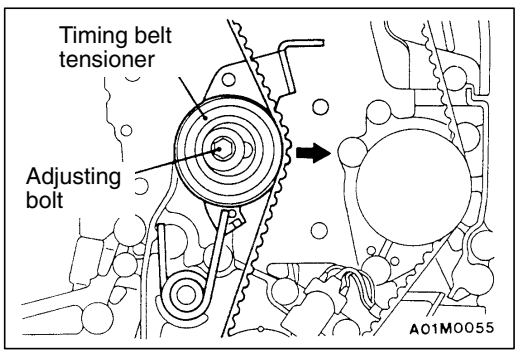
▶A◀ TIMING BELT INSTALLATION

1. Set a screwdriver to the timing belt tensioner and press it fully back in the direction of the arrow.
2. Provisionally tighten the adjusting bolt.



3. Align each of the camshaft sprocket and the crankshaft sprocket timing marks.
4. Install the timing belt in the following order, while making sure that the tension side of the belt is not slackened.
   (1) Crankshaft sprocket
   (2) Water pump sprocket
   (3) Camshaft sprocket
   (4) Tensioner pulley

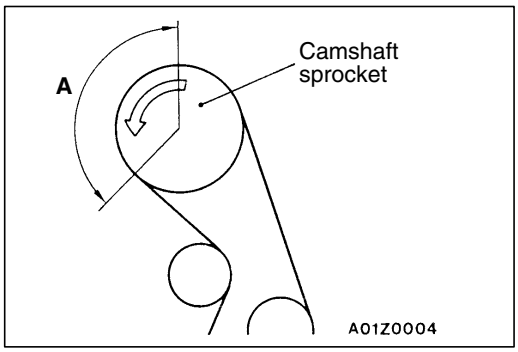
Caution
After installing the timing belt, apply force to turn the camshaft sprocket in the reverse direction, and recheck to be sure that the belt is fully tensioned and that each timing mark is in the proper position.



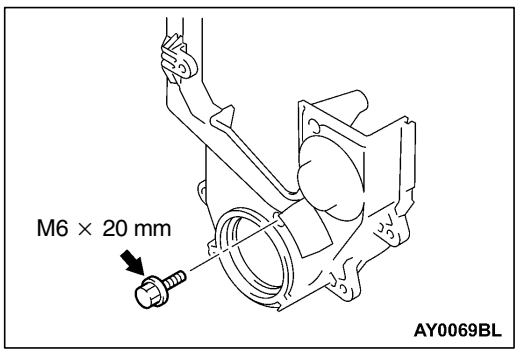
▶B◀ TIMING BELT TENSION ADJUSTMENT

1. Loosen the adjusting bolt of the temporarily secured timing belt tensioner by 1/4 – 1/2 turn, and use the force of the tensioner spring to apply tension to the belt.
2. Turn the crankshaft in the proper rotation direction (right turn) for two rotations, and recheck to be sure that the timing marks on each sprocket are aligned.

Caution
As the purpose of this procedure is to apply the proper amount of tension to the tension side of the timing belt by using the cam driving torque, turn the crankshaft only by the amount given above. Be sure not to turn the crankshaft in the opposite direction (left turn).



3. After checking to be sure that no belt teeth in the section marked with A are lifted up and that the teeth in each sprocket are engaged, secure the tensioner pulley.



▶C◀ TIMING BELT FRONT LOWER COVER INSTALLATION

1. Mount the bolt shown in the illustration first.
2. Mount the other bolts, and tighten them to the specified torque.

Tightening torque: 10 ± 2 N·m

ENGINE ASSEMBLY

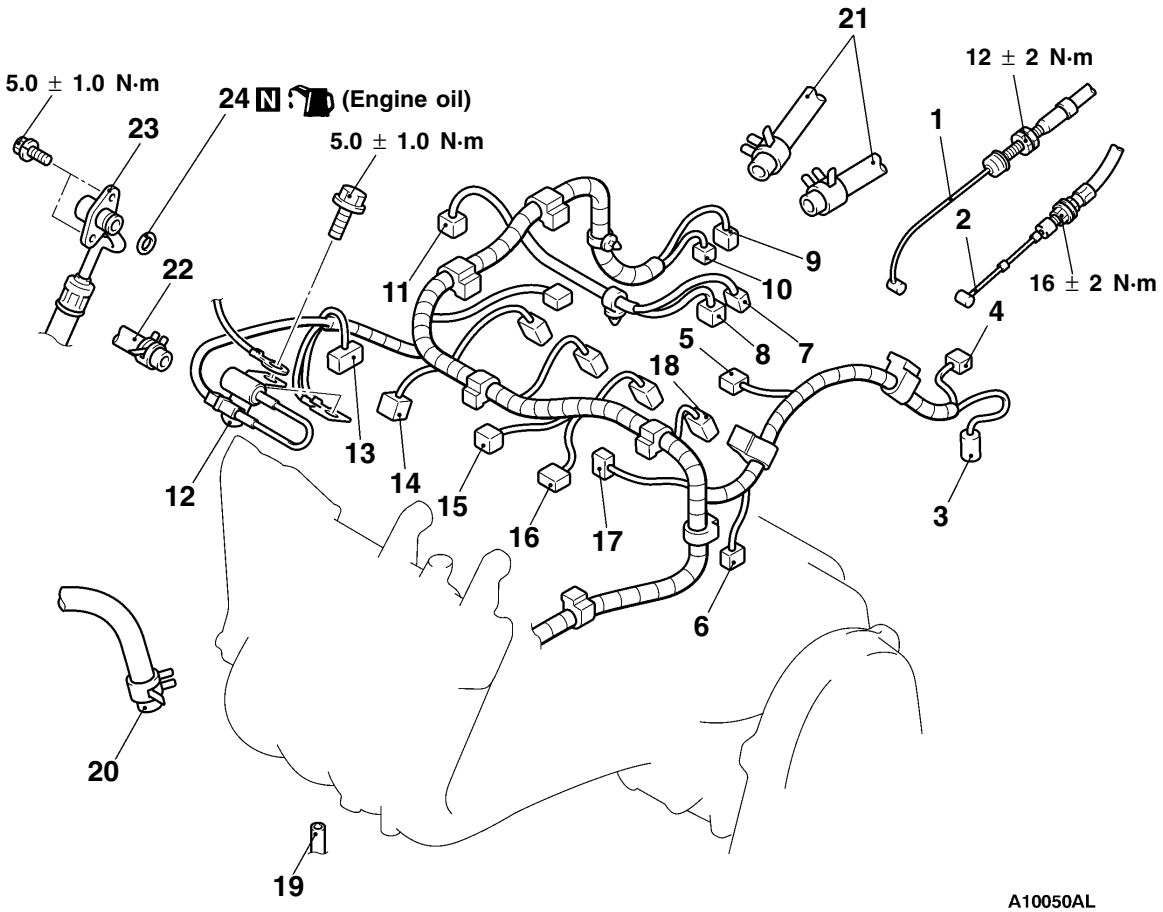
REMOVAL AND INSTALLATION

Caution

***: Indicates parts which should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**

Pre-removal and Post-installation Operation

- Fuel Discharge Prevention (Refer to GROUP 13C – On-vehicle Service.) <Pre-removal only>
- Kickdown Cable Adjustment <A/T> (Refer to GROUP 23 – On-vehicle Service.) <Post-installation only>
- Accelerator Cable Adjustment (Refer to GROUP 17 – On-vehicle Service.) <Post-installation only>
- Drive Belt Tension Check and Adjustment <Post-installation only> (Refer to P.11B-5.)
- Hood Removal and Installation
- Radiator Assembly Removal and Installation (Refer to GROUP 14.)
- Under Cover Removal and Installation
- Air Cleaner and Air Intake Pipe Removal and Installation (Refer to GROUP 15.)
- Front Exhaust Pipe Removal and Installation (Refer to GROUP 15.)

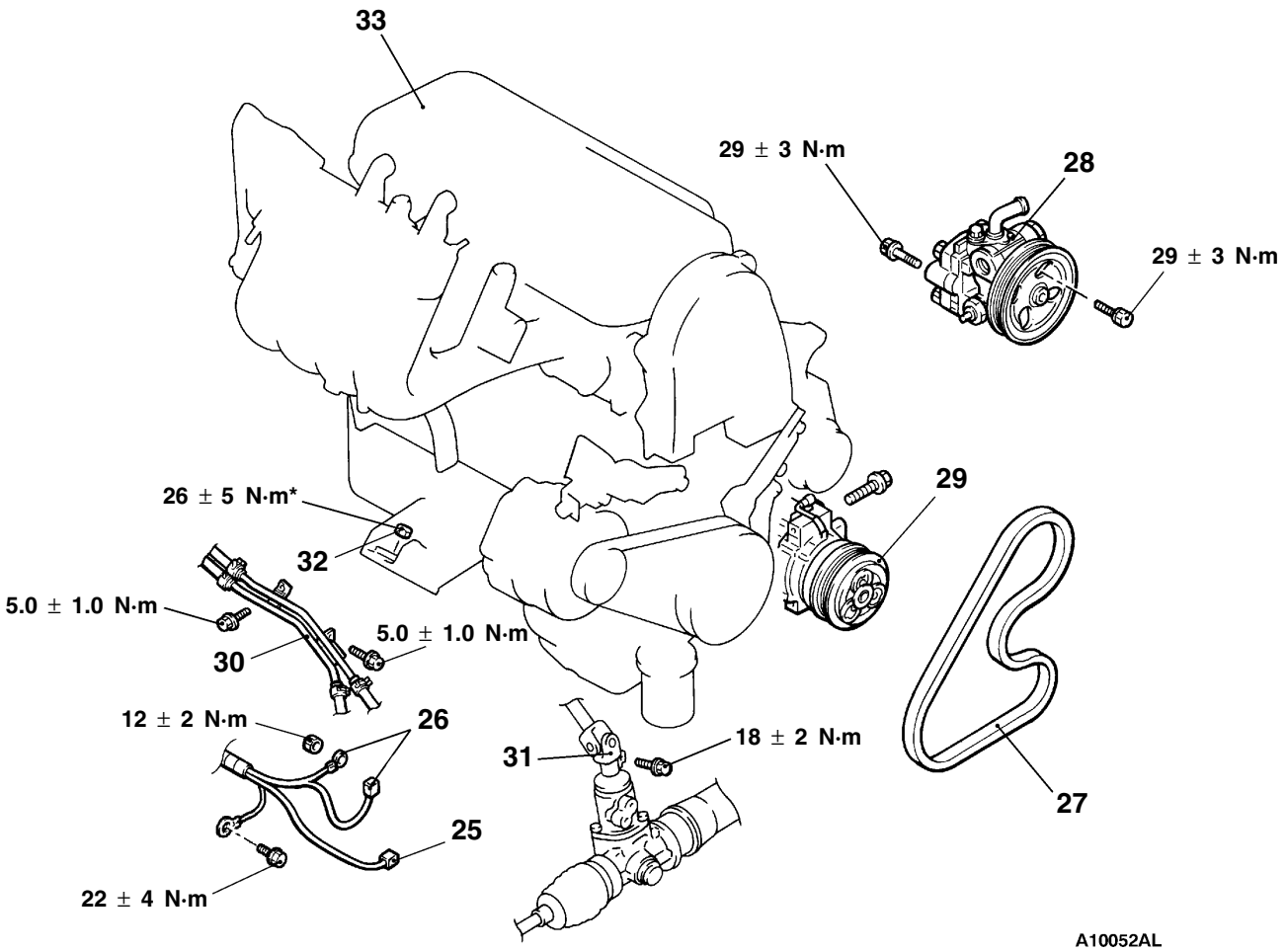


Removal steps

1. Accelerator cable connection
2. Kickdown cable connection <A/T>
3. Power steering oil pressure switch connector
4. A/C compressor magnetic clutch connector
5. Ignition coil connector
6. Crank angle sensor connector
7. Oxygen sensor connector
8. Ignition failure sensor connector
9. Engine coolant temperature sensor connector
10. Engine coolant temperature gauge unit connector
11. Camshaft position sensor connector
12. Capacitor
13. Throttle position sensor connector
14. Idle speed control servo connector
15. Purge control solenoid valve connector
16. EGR solenoid valve connector
17. Detonation sensor connector
18. Injector connector
19. Vacuum hoses connection
20. Brake booster vacuum hose connection
21. Heater hose connection
22. Fuel return hose connection

▶B◀ 23. Fuel high-pressure hose connection

▶B◀ 24. O-ring



25. Oil pressure switch connector
26. Alternator connector and terminal
27. Power steering oil pump drive belt <Vehicles without A/C>, Power steering oil pump and A/C compressor drive belt <Vehicles with A/C>

◀A▶ 28. Power steering oil pump

◀B▶ 29. A/C compressor

30. Oil cooler pipe connection <A/T>
    - Transmission assembly

31. Steering gear box and shaft connection
32. Engine mount installation nut

◀C▶ ▶A◀ 33. Engine assembly

REMOVAL SERVICE POINTS

◀A▶ POWER STEERING OIL PUMP REMOVAL

Remove the power steering oil pump with the hose attached from the engine.

NOTE
Place the removed power steering oil pump where it will not be a hindrance when removing and installing the engine assembly, and tie it with a cord.

◀B▶ A/C COMPRESSOR REMOVAL

Disconnect the A/C compressor connector and remove the compressor from the compressor bracket with the hose still attached.

NOTE
Place the removed A/C compressor where it will not be a hindrance when removing and installing the engine assembly, and tie it with a cord.

◀C▶ ENGINE ASSEMBLY REMOVAL

1. Check that all cables, hoses and harness connectors, etc. are disconnected from the engine.
2. Lift the chain block slowly to remove the engine assembly upward from the engine compartment.

INSTALLATION SERVICE POINTS

▶A◀ ENGINE ASSEMBLY INSTALLATION

Install the engine assembly, checking that the cables, hoses, and harness connectors are not clamped.

▶B◀ O-RING/FUEL HIGH-PRESSURE HOSE INSTALLATION

1. Apply a small amount of new engine oil to the O-ring.

   Caution
   Do not let any engine oil get into the delivery pipe.

2. While turning the fuel high-pressure hose to the right and left, install the delivery pipe, while being careful not to damage the O-ring. After installing, check that the hose turns smoothly.
3. If the hose does not turn smoothly, the O-ring is probably being clamped. Disconnect the fuel high-pressure hose and check the O-ring for damage. After this, re-insert the delivery pipe and check that the hose turns smoothly.
4. Tighten the fuel high-pressure hose mounting bolt to the specified torque.

   Tightening torque: 5.0 ± 1.0 N·m

NOTES

ENGINE LUBRICATION

ENGINE LUBRICATION

CONTENTS

GENERAL INFORMATION 2

SERVICE SPECIFICATIONS 3

SEALANT 3

LUBRICANTS 3

SPECIAL TOOLS 3

ON-VEHICLE SERVICE 4

Engine Oil Check 4

Engine Oil Replacement 4

Oil Filter Replacement 5

Oil Pressure Check 5

GENERAL INFORMATION

The lubrication method is a fully force-fed, full-flow filtration type. The oil pump is driven by the crankshaft via the timing belt.

ENGINE OILS

Health Warning

Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer. Adequate means of skin protection and washing facilities must be provided.

Recommended Precautions

The most effective precaution is to adapt working practices which prevent, as far as practicable, the risk of skin contact with mineral oils, for example by using enclosed systems for handling used engine oil and by decreasing components, where practicable, before handling them.
Other precautions:

- Avoid prolonged and repeated contact with oils, particularly used engine oils.
- Wear protective clothing, including impervious gloves where practicable.
- Avoid contaminating clothes, particularly underpants, with oil.
- Do not put oily rags in pockets, the use of overalls without pockets will avoid this.
- Do not wear heavily soiled clothing and oil-impregnated foot-wear. Overalls must be cleaned regularly and kept separate from personal clothing.
- Where there is a risk of eye contact, eye protection should be worn, for example, chemical goggles or face shields; in addition an eye wash facility should be provided.
- Obtain First Aid treatment immediately for open cuts and wounds.
- Wash regularly with soap and water to ensure all oil is removed, especially before meals (skin cleansers and nail brushes will help). After cleaning, the application of preparations containing lanolin to replace the natural skin oils is advised.
- Do not use petrol, kerosine, diesel fuel, gas oil, thinners or solvents for cleaning skin.
- Use barrier creams, applying them before each work period, to help the removal of oil from the skin after work.
- If skin disorders develop, obtain medical advice without delay.

SERVICE SPECIFICATIONS

Item		Standard value
Oil pressure kPa	at idle	29 or more
	at 3,500 r/min	294 – 686

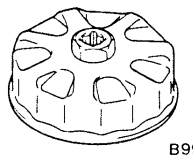
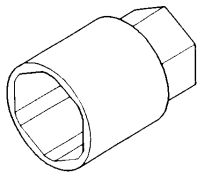
SEALANT

Item	Specified sealant
Oil pressure switch	3M ATD Part No. 8660 or equivalent

LUBRICANTS

Items		Specifications
Engine oil (API classification)		SG or higher
Engine oil quantity ℓ	Oil filter	0.3
	Total	3.8

SPECIAL TOOLS

Tool	Number	Name	Use
 B991396	MB991396	Oil filter wrench	Removal and installation of engine oil filter (When using the oil filter of MD135737)
	MD998054	Oil pressure switch wrench	Removal and installation of oil pressure switch

ON-VEHICLE SERVICE

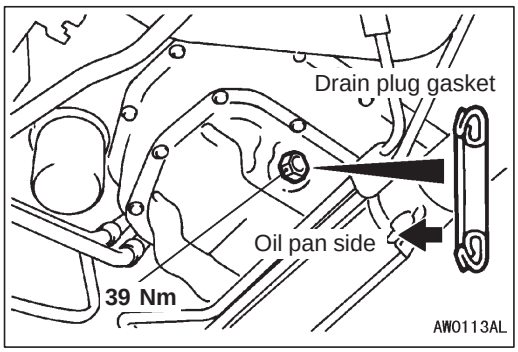
ENGINE OIL CHECK

1. Pull out the level gauge slowly and check that the oil level is in the illustrated range.
2. Check that the oil is not excessively dirty, that there is no coolant or gasoline mixed in, and that it has sufficient viscosity.

ENGINE OIL REPLACEMENT

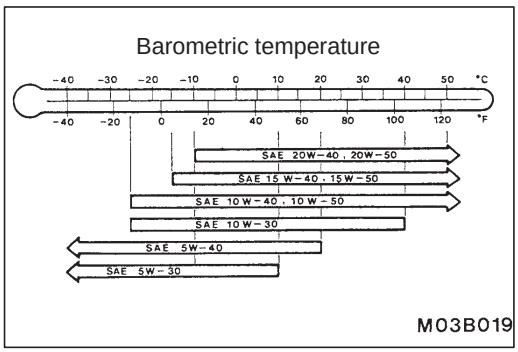
1. Start the engine and allow it to warm up until the temperature of the coolant reaches 80°C to 90°C.
2. Remove the engine oil filler cap.
3. Remove the drain plug to drain oil.

Caution
Use care as oil could be hot.



4. Install a new drain plug gasket so that it faces in the direction shown in the illustration, and then tighten the drain plug to the specified torque.

NOTE
Install the drain plug gasket so it faces in the direction shown in the illustration.

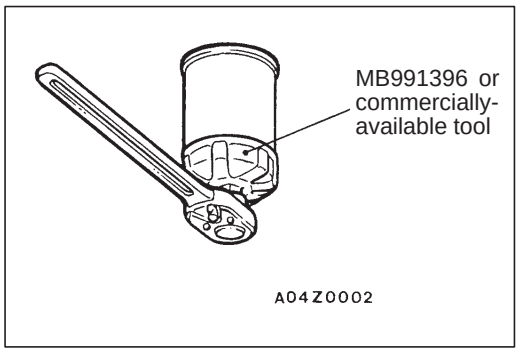


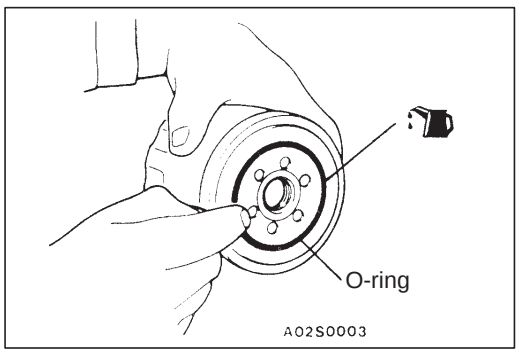
5. Refill with specified quantity of oil.

Specified Engine Oil (API classification):
SG or higher

Total quantity (Includes volume inside oil filter and oil cooler): 3.8 ℓ

6. Install the engine oil filler cap.
7. Check oil level.



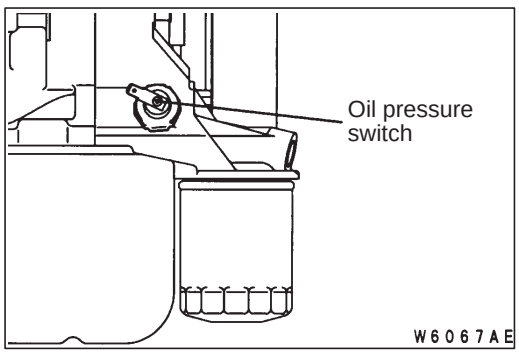


OIL FILTER REPLACEMENT

1. Start the engine and allow it to warm up until the temperature of the coolant reaches 80°C to 90°C.
2. Remove the engine oil filler cap.
3. Remove the drain plug to drain oil.

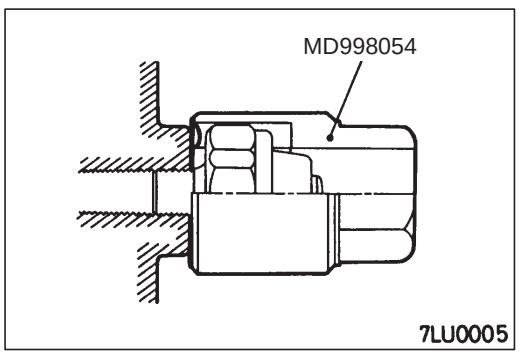
   Caution
   Use care as oil could be hot.
4. Remove the under cover.
5. Use the respective tool in the following table to remove the engine oil filter.
6. Clean the filter bracket side mounting surface.
7. Apply a small amount of engine oil to the O-ring of the new oil filter.
8. Once the O-ring of the oil filter is touching the flange, use the respective tool in the following table to tighten to the specified torque.
9. Install the drain plug and refill engine oil. (Refer to Engine Oil Replacement on P.12-4.)
10. Race the engine 2 – 3 times, and check to be sure that no engine oil leaks from installation section of the oil filter.

Number	Tool	Tightening torque
MD135737	MB991396 or equivalent tool	Approx. 1 turn (14 Nm)
MD136466	Commercially-available tool	Approx. 3/4 turn (17 Nm)
MD325714, MD332687	Commercially-available tool	Approx. 3/4 turn (17 Nm)
MD322508	Commercially-available tool	Approx. 3/4 turn (17 Nm)



OIL PRESSURE CHECK

1. Check engine oil quantity.
2. Remove the oil pressure switch terminal.



3. Use the special tool (oil pressure switch wrench) to remove the oil pressure switch.

   Caution
   Since sealant is applied to the thread of oil pressure switch, take care not to damage the oil pressure switch when removing it.

4. Install the oil pressure gauge.

   NOTE
   Use a adapter of PT 1/8 thread.

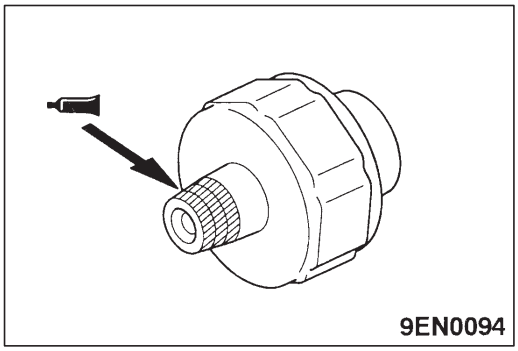
5. Run the engine to warm it.
6. After the engine has been warmed up, check that oil pressure is within the standard value.

   Standard value:

   At idle: 29 kPa or more

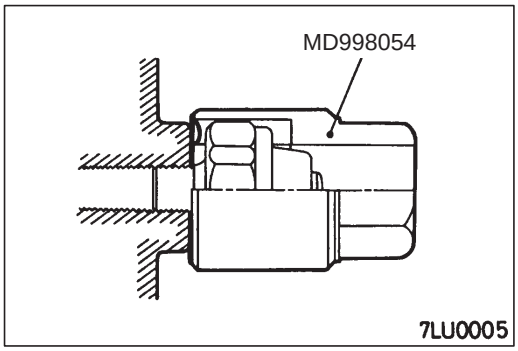
   At 3,500 r/min: 294 – 686 kPa

7. Remove the oil pressure gauge.



8. Apply the specified sealant to the thread of oil pressure switch.

   Specified sealant: 3M ATD Part No. 8660 or equivalent



9. Use the special tool to tighten the oil pressure switch to the specified torque.

   Tightening torque: 19 Nm

   Caution
   Do not start the engine within one hour after the oil pressure switch has been installed.

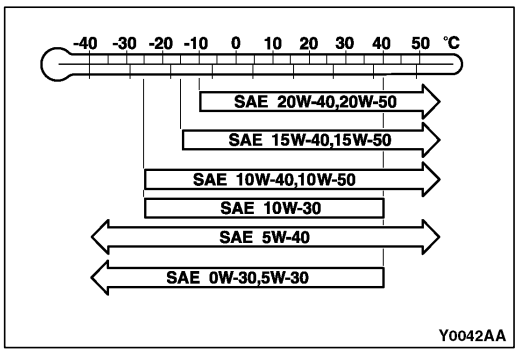
10. Install the oil pressure switch terminal.

GROUP 12
ENGINE LUBRICATION

GENERAL

OUTLINE OF CHANGE

A quality of the engine oil has been changed.



ON-VEHICLE SERVICE

Specified Engine Oil (ACEA and API classification):
ACEA A1, A2, A3/API SG or higher

NOTES

GASOLINE DIRECT INJECTION (GDI)

GASOLINE DIRECT INJECTION (GDI)

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GENERAL INFORMATION

The Gasoline Direct Injection System consists of sensors which detect the engine conditions, the engine-ECU which controls the system based on signals from these sensors, and actuators which operate under the control of the engine-ECU. The engine-ECU carries out activities such as fuel injection control, idle speed control and ignition timing control. In addition, the engine-ECU is equipped with several diagnosis modes which simplify troubleshooting when a problem develops.

FUEL INJECTION CONTROL

The injector drive times and injector timing are controlled so that the optimum air/fuel mixture is supplied to the engine to correspond to the continually-changing engine operation conditions.

A single injector for each cylinder is mounted at the cylinder head. The fuel is sent under pressure from the fuel tank to the fuel pressure regulator (low pressure) by the fuel pump (low pressure). The pressure is regulated by the fuel pressure regulator (low pressure) and the fuel regulated is then sent to the fuel pump (high pressure). The fuel under increased pressure generated by the fuel pump (high pressure) is then regulated by the fuel pressure regulator (high pressure) and is then distributed to each of the injectors via the delivery pipes.

Fuel injection is normally carried out once for each cylinder for every two rotations of the crankshaft. The firing order is 1-3-4-2. This is called sequential fuel injection.

When the engine is cold or under a severe load, the “open-loop” control keeps the air/fuel ratio at a richer than usual level to maintain driveability. When the engine is under low or medium loads, the air/fuel ratio becomes leaner to reduce fuel consumption. When the engine is running at medium or high loads after having warmed up, the “closed-loop” control uses the signal from the oxygen sensor to keep the air/fuel ratio at the optimum theoretical level.

THROTTLE VALVE OPENING ANGLE CONTROL

This system controls throttle valve opening angle electronically. The engine-ECU determines how deeply the accelerator pedal is depressed by means of the accelerator position sensor (APS). Then the engine-ECU sends a target value of the throttle valve opening angle to the throttle valve controller. The throttle valve control servo operates the throttle valve so that it reaches the target opening angle.

IDLE SPEED CONTROL

This system maintains engine idle speed at a predetermined condition by controlling the air flow that passes through the throttle valve according to engine idling condition and engine loads at idling.

The engine-ECU operates the throttle valve control servo so that engine speed is maintained within a map value. The map value is predetermined according to engine coolant temperature and air-conditioning load. In addition, if the A/C switch is turned on or off during engine idling, the engine-ECU compensates the engine speed by operating the throttle valve control servo as necessary.

IGNITION TIMING CONTROL

The power transistor located in the ignition primary circuit turns ON and OFF to control the primary current flow to the ignition coil. This controls the ignition timing in order to provide the optimum ignition timing with respect to the engine operating conditions. The ignition timing is determined by the engine-ECU from the engine speed, intake air volume, engine coolant temperature, atmospheric pressure and injection timing (intake stroke or compression stroke).

SELF-DIAGNOSIS FUNCTION

- When an abnormality is detected in one of the sensors or actuators related to emission control, the engine warning lamp (check engine lamp) illuminates as a warning to the driver.
- When an abnormality is detected in one of the sensors or actuators, a diagnosis code corresponding to the abnormality is output.
- The RAM data inside the engine-ECU that is related to the sensors and actuators can be read by means of the MUT-II. In addition, the actuators can be force-driven under certain circumstances.

OTHER CONTROL FUNCTIONS

1. Fuel Pump Control
   Turns the fuel pump relay ON so that current is supplied to the fuel pump while the engine is cranking or running.
2. A/C Relay Control
   Turns the compressor clutch of the A/C ON and OFF.
3. Fan Motor Control
   The revolutions of the radiator fan and condenser fan are controlled in response to the engine coolant temperature and vehicle speed.
4. Purge Control Solenoid Valve Control
   Refer to GROUP 17.
5. EGR Control Servo Control
   Refer to GROUP 17.

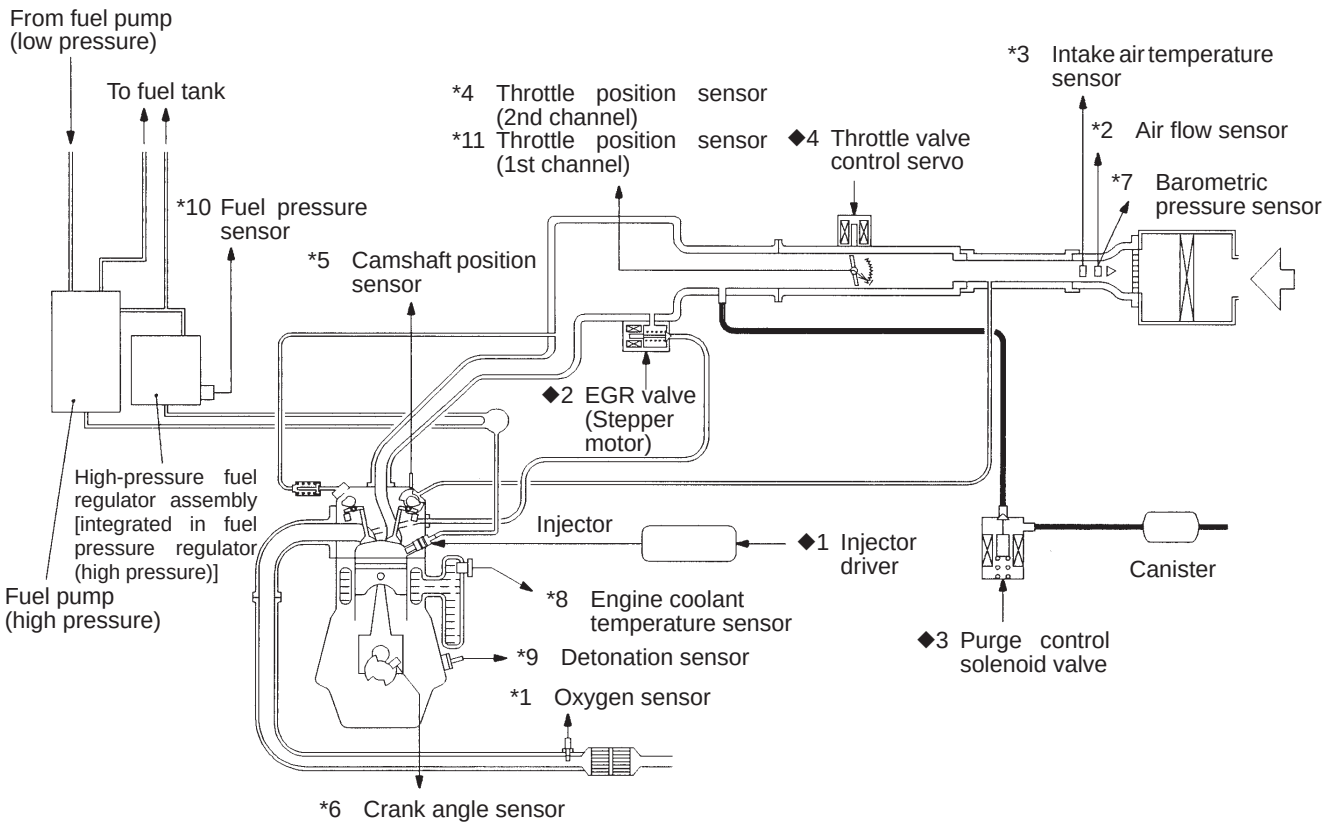
GENERAL SPECIFICATIONS

Items		Specifications
Throttle body	Throttle bore mm	60
	Throttle position sensor	Variable resistor type
	Throttle valve control servo	Torque motor type
Engine-ECU	Identification model No.	E2T71575
Sensors	Air flow sensor	Karman vortex type
	Barometric pressure sensor	Semiconductor type
	Intake air temperature sensor	Thermistor type
	Engine coolant temperature sensor	Thermistor type
	Oxygen sensor	Zirconia type
	Accelerator pedal position sensor	Variable resistor type
	Accelerator pedal position switch	Rotary contact type, within accelerator pedal position sensor
	Vehicle speed sensor	Magnetic resistive element type
	Inhibitor switch	Contact switch type
	Camshaft position sensor	Magnetic resistive element type
	Crank angle sensor	Hall element type
	Detonation sensor	Piezoelectric type
	Fuel pressure sensor	Metallic membrane type
	Power steering fluid pressure switch	Contact switch type

Items		Specifications
Actuators	Engine control relay type	Contact switch type
	Fuel pump relay type	Contact switch type
	Injector driver control relay	Contact switch type
	Injector type and number	Electromagnetic type, 4
	Injector identification mark	DIM 100G
	Throttle valve control servo relay	Contact switch type
	Throttle valve control servo	Torque motor type
	EGR control servo	Stepper motor type
	Purge control solenoid valve	Duty cycle type solenoid valve
Fuel pressure regulator (low pressure)	Regulator pressure kPa	324
Fuel pressure regulator (high pressure)	Regulator pressure MPa	5

GASOLINE DIRECT INJECTION SYSTEM DIAGRAM

*1 Oxygen sensor *2 Air flow sensor *3 Intake air temperature senor *4 Throttle position sensor (2nd channel) *5 Camshaft position sensor *6 Crank angle sensor *7 Barometric pressure sensor *8 Engine coolant temperature sensor *9 Detonation sensor *10 Fuel pressure sensor	● Power supply ● Ignition switch – IG ● Ignition switch – ST ● Accelerator pedal position sensor (1st channel) ● Accelerator pedal position switch ● Vehicle speed sensor ● A/C switch ● A/C thermo sensor ● Inhibitor switch ● Power steering fluid pressure switch ● Alternator FR terminal ● Stop lamp switch ● Small lamp switch ● Injector wire open circuit check signal ● Throttle valve controller ● A/T-ECU	⇨ Engine-ECU ⇨	◆1 Injector driver (Injector) ◆2 EGR valve (Stepper motor) ◆3 Purge control solenoid valve	● Engine control relay ● Fuel pump relay ● Injector driver relay ● Throttle valve control servo relay ● A/C relay ● Ignition coil ● Fan controller ● GDI ECO indicator lamp ● Engine warning lamp ● Diagnosis output ● Alternator G terminal ● Throttle valve controller ● A/T-ECU
*11 Throttle position sensor (1st channel)	● Power supply ● Ignition switch – IG ● Accelerator pedal position sensor (2nd channel) ● Engine-ECU	⇨ Throttle valve controller ⇨	◆4 Throttle valve control servo	● Engine-ECU



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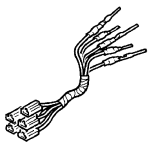
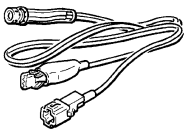
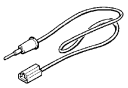
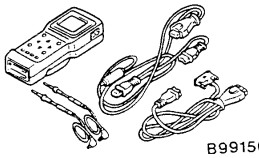
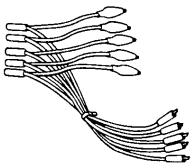
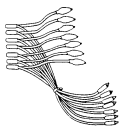
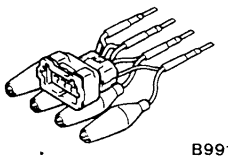
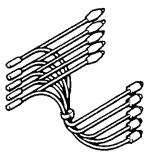
SERVICE SPECIFICATIONS

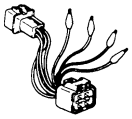
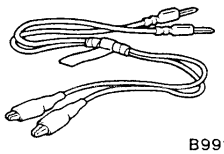
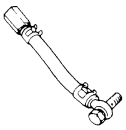
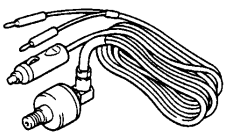
Item		Standard value
Adjustment voltage of throttle position sensor (1st channel) V		0.4 – 0.6
Adjustment voltage of throttle position sensor (2nd channel) V		4.2 – 4.8
Resistance of throttle position sensor kΩ		3.5 – 6.5
Adjustment voltages (1st channel) and (2nd channel) of accelerator pedal position sensor V		0.935 – 1.135
Resistance (1st channel) and (2nd channel) of accelerator pedal position sensor kΩ		3.5 – 6.5
Intake air temperature sensor resistance kΩ	at 20°C	2.3 – 3.0
	at 80°C	0.30 – 0.42
Engine coolant temperature sensor resistance kΩ	at 20°C	2.1 – 2.7
	at 80°C	0.26 – 0.36
Fuel pressure	High-pressure side MPa	4 – 6.9
	Low-pressure side kPa	Approximately 324
Injector coil resistance Ω		0.9 – 1.1
Oxygen sensor output voltage (at racing) V		0.6 – 1.0
Oxygen sensor heater resistance Ω		11 – 18
Throttle valve control servo resistance Ω		1.35 – 1.65

SEALANT

Item	Specified sealant	Remark
Engine coolant temperature sensor threaded portion	3M Nut Locking Part No. 4171 or equivalent	Drying sealant

SPECIAL TOOLS

Tool	Number	Name	Use
A  B  C  D  C991223	MB991223 A: MB991219 B: MB991220 C: MB991221 D: MB991222	Harness set A: Test harness B: LED harness C: LED harness adapter D: Probe	● Fuel gauge simple inspection A: Connector pin contact pressure inspection B: Power circuit inspection C: Power circuit inspection D: Commercial tester connection
 B991502	MB991502	MUT-II sub assembly	● Reading diagnosis code ● GDI system inspection
	MB991348	Test harness set	● Measurement of voltage during trouble-shooting ● Inspection using an analyzer
 MB991709	MB991709	Test harness	
	MB991519	Alternator harness connector	Measurement of voltage during troubleshooting
 B991536	MB991536	TPS adjustment harness	Adjustment of throttle position sensor
 B991658	MB991658	Test harness	● Measurement of voltage during troubleshooting ● Inspection using an analyzer ● Adjustment of accelerator pedal position sensor

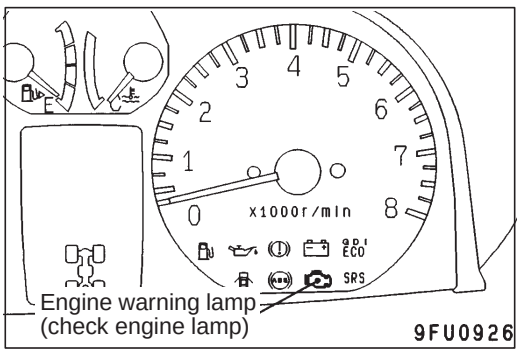
Tool	Number	Name	Use
	MD998464	Test harness (4-pin, square)	Oxygen sensor inspection
	MD998478	Test harness (3-pin, triangle)	• Measurement of voltage during trouble-shooting • Inspection using an analyzer
 B991529	MB991529	Diagnosis code check harness	Reading diagnosis code
	MD998709	Adaptor hose	Measurement of fuel pressure
	MD998742	Hose adaptor	
 B991637	MB991637	Fuel pressure gauge set	

TROUBLESHOOTING

DIAGNOSIS TROUBLESHOOTING FLOW

Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.

NOTE
If the ECU is replaced, the immobilizer-ECU and ignition key should replaced together with it. Each ECU has an individual information for immobilizer-ECU, and the individual information is registered in the immobilizer-ECU.



DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

If an abnormality occurs in any of the following items related to the Gasoline Direct Injection (GDI) system, the engine warning lamp will illuminate.
If the lamp remains illuminated or if the lamp illuminates while the engine is running, check the diagnosis code output.

Engine warning lamp inspection items

Oxygen sensor
Air flow sensor
Intake air temperature sensor
Throttle position sensor (1st channel)
Throttle position sensor (2nd channel)
Engine coolant temperature sensor
Crank angle sensor
Camshaft position sensor
Barometric pressure sensor
Detonation sensor
Injector
Abnormal combustion
Immobilizer system
Abnormal fuel pressure
Brake vacuum sensor
Fuel system malfunction
Accelerator pedal position sensor (1st channel)
Accelerator pedal position sensor (2nd channel)
Electronic-controlled throttle valve system

Throttle valve position feedback
Throttle valve control servo motor (1st motor)
Throttle valve control servo motor (2nd motor)
Communication line system with throttle valve controller
Engine-ECU

NOTE
When the electronic-controlled throttle valve system is stopped, the engine warning lamp flashes.

METHOD OF READING AND ERASING DIAGNOSIS CODES

Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.

INSPECTION USING MUT-II DATA LIST AND ACTUATOR TESTING

1. Carry out inspection by means of the data list and the actuator test function.
   If there is an abnormality, check and repair the chassis harnesses and components.
2. After repairing, re-check using the MUT-II and check that the abnormal input and output have returned to normal as a result of the repairs.
3. Erase the diagnosis code memory.
4. Remove the MUT-II.
5. Start the engine again and carry out a road test to confirm that the problem has disappeared.

FAIL-SAFE FUNCTION REFERENCE TABLE

If the diagnosis system detects any sensor malfunction, the vehicle can be driven safely by using a default control logic instead of the faulty sensors.

Defective part or function	What to do when a sensor is defective
Air flow sensor	(1) Disables lean-mixture combustion. (2) Determines injector basic operating time and basic ignition timing according to map value, which has been predetermined by throttle position sensor and crank angle sensor signals.
Intake air temperature sensor	Controls as the intake air temperature is 25°C.
Throttle position sensor (1st channel)	(1) Disables lean-mixture combustion. (2) Controls throttle valve opening angle by closed loop control by using the throttle position sensor (2nd channel) signal. (3) Disables the throttle valve opening angle control when the throttle position sensor (2nd channel) signal is also defective.
Throttle position sensor (2nd channel)	(1) Disables lean-mixture combustion. (2) Controls throttle valve opening angle by closed loop control by using the throttle position sensor (1st channel) signal. (3) Disables the throttle valve opening angle control when the throttle position sensor (1st channel) signal is also defective.
Engine coolant temperature sensor	Controls as if the engine coolant temperature is 80°C. (Note that this control will continue until the ignition switch is turned off even if the sensor signal return to normal.)
Camshaft position sensor	Controls according to the conditions before a failure is detected.
Vehicle speed sensor	(1) Disables lean-mixture combustion. However, if a predetermined time elapses at an engine speed of 1,500 r/min or more, the lean-mixture combustion will return to normal. (2) Disables lean-mixture combustion during engine idling.
Barometric pressure sensor	Controls as if the barometric pressure is 101 kPa.
Detonation sensor	Holds the ignition timing at that for standard petrol.
Injector	(1) Disables lean-mixture combustion. (2) Shuts down exhaust gas recirculation.
Abnormal combustion	Disables lean-mixture combustion.
Communication line with A/T-ECU	Disables ignition timing retard control (engine and transmission total control) during shift change.
Alternator FR terminal	Disables inhibition control of the alternator output according to electrical load (treats the alternator as if it is conventional one).
Fuel pressure sensor	(1) Controls as if the fuel pressure is 5 MPa (if there is open or short circuit). (2) Turns off the fuel pump relay (if the fuel pressure is excessively high). (3) Shuts off the fuel injection (If an excessively low pressure is detected or the engine speed exceeds 3,000 r/min).

Defective part or function	What to do when a sensor is defective
Accelerator pedal position sensor (1st channel)	(1) Disables lean-mixture combustion. (2) Controls the throttle valve position by using the accelerator pedal position sensor (2nd channel) signal. (3) Disables the electronic-controlled throttle valve system if the accelerator pedal position sensor (2nd channel) signal is also defective.
Accelerator pedal position sensor (2nd channel)	(1) Disables lean-mixture combustion. (2) Controls the throttle valve position by using the accelerator pedal position sensor (1st channel) signal. (3) Disables the electronic-controlled throttle valve system if the accelerator pedal position sensor (1st channel) signal is also defective.
Electronic-controlled throttle valve system	(1) Disables the electronic-controlled throttle valve system. (2) Disables lean-mixture combustion. (3) Disables engine speed feedback control.
Throttle valve position feedback	(1) Disables the electronic-controlled throttle valve system. (2) Disables lean-mixture combustion. (3) Disables engine speed feedback control. However, if the throttle valve opening is great, controls as follows: (1) Carries out lean-mixture combustion continuously. (2) Shuts off fuel supply for 2 cylinders continuously. (3) Shuts off fuel supply when engine speed exceeds 3,000 r/min.
Throttle valve control servo motor (1st motor) malfunction	Disables lean-mixture combustion.
Throttle valve control servo motor (2nd motor) malfunction	(1) Disables the electronic-controlled throttle valve system. (2) Disables lean-mixture combustion. (3) Disables engine speed feedback control.
Communication line with the throttle valve controller	(1) Error in communication from the throttle valve controller to engine-ECU ● Disables lean-mixture combustion. ● Shuts off fuel supply when engine speed exceeds 3,000 r/min. (2) Error in communication from the engine-ECU to throttle valve controller ● Disables lean-mixture combustion. ● Shuts off fuel supply when engine speed exceeds 3,000 r/min. ● The throttle valve controller controls the throttle valve opening angle by using the accelerator pedal position sensor (2nd channel) signal.

NOTE
When the electronic-controlled throttle valve system is stopped, the engine warning lamp flashes.

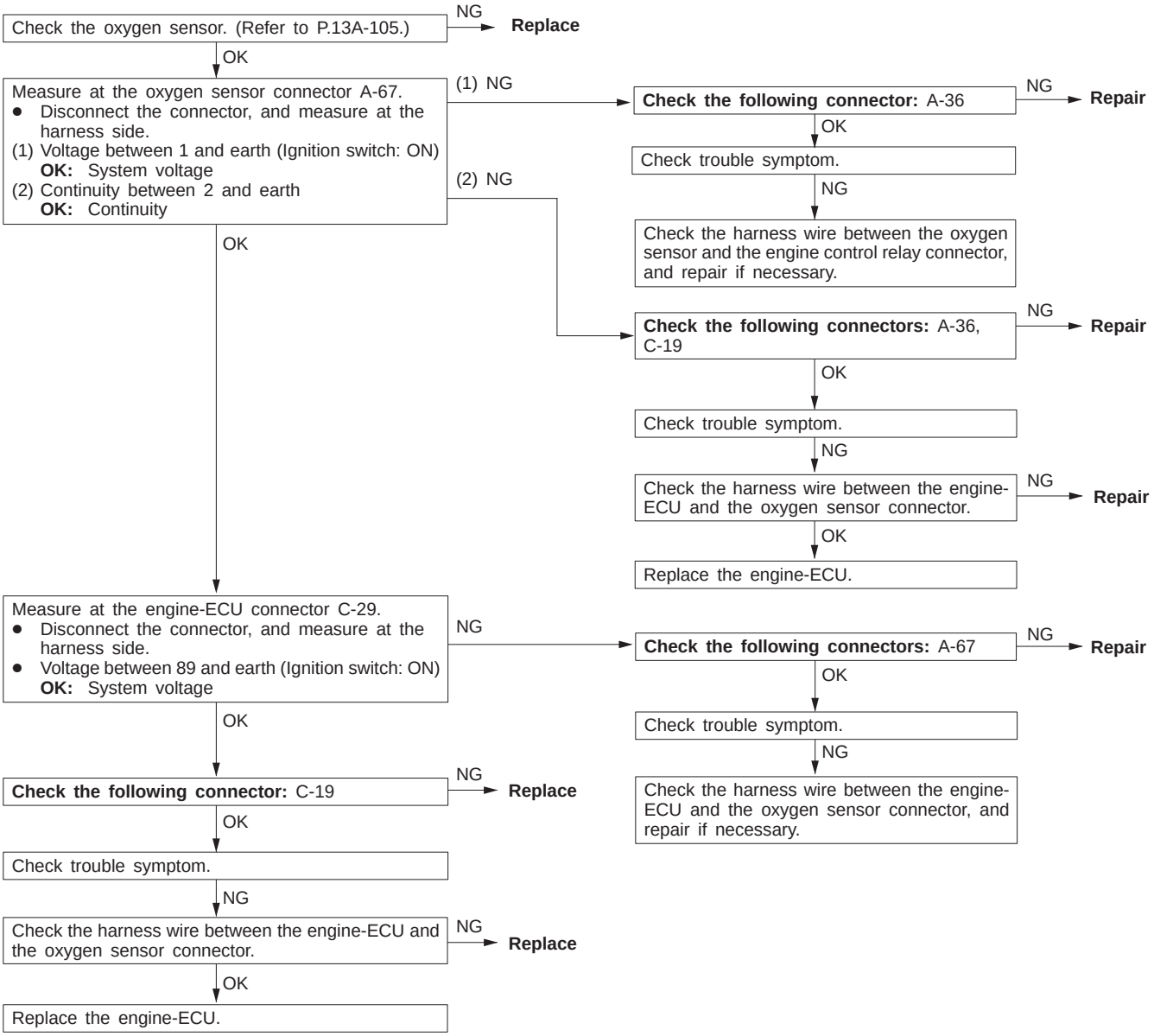
INSPECTION CHART FOR DIAGNOSIS CODES

Code No.	Diagnosis item	Reference page
11	Oxygen sensor system	13A-15
12	Air flow sensor system	13A-16
13	Intake air temperature sensor system	13A-17
14	Throttle position sensor (2nd channel) system	13A-18
21	Engine coolant temperature sensor system	13A-19
22	Crank angle sensor system	13A-20
23	Camshaft position sensor system	13A-21
24	Vehicle speed sensor system	13A-22
25	Barometric pressure sensor system	13A-23
31	Detonation sensor system	13A-24
41	Injector system	13A-25
44	Abnormal combustion	13A-27
54	Immobilizer system	13A-28
56	Abnormal fuel pressure system	13A-29
61	Communication line with A/T-ECU system	13A-31
64	Alternator FR terminal system	13A-31
66	Brake vacuum sensor system	13A-32
77	Accelerator pedal position sensor (2nd channel) system	13A-33
78	Accelerator pedal position sensor (1st channel) system	13A-34
79	Throttle position sensor (1st channel) system	13A-35
89	Abnormality in fuel pressure system	13A-36
91	Electronic-controlled throttle valve system	13A-36
92	Throttle valve position feedback system	13A-37
94	Communication line system with throttle valve controller	13A-37
95	Malfunction in throttle valve control servo motor (1st motor) system	13A-38
99	Malfunction in throttle valve control servo motor (2nd motor) system	13A-38

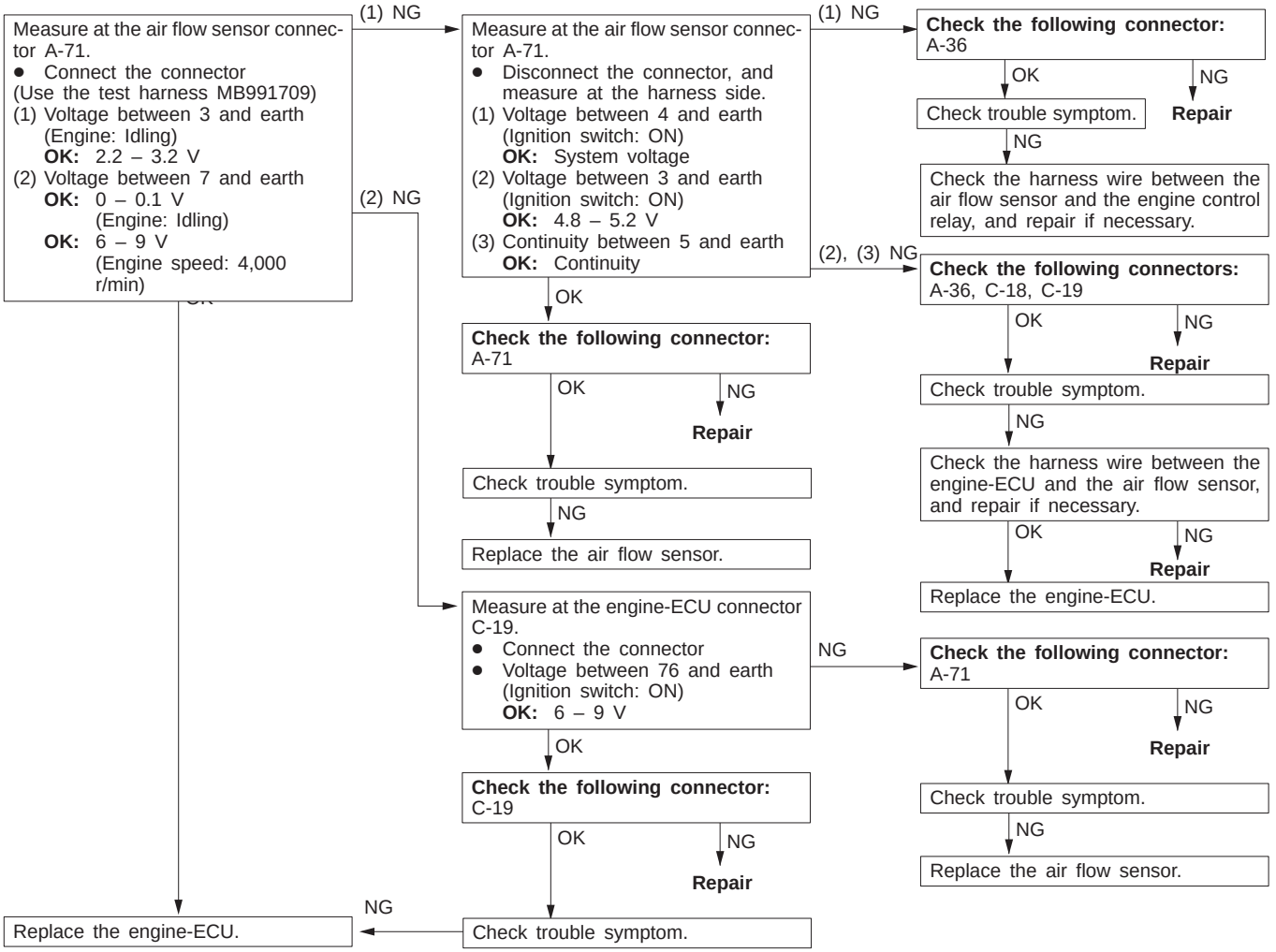
NOTE
Code No. 56 may be also output when air is sucked in high-pressure fuel line due to no fuel supply.

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

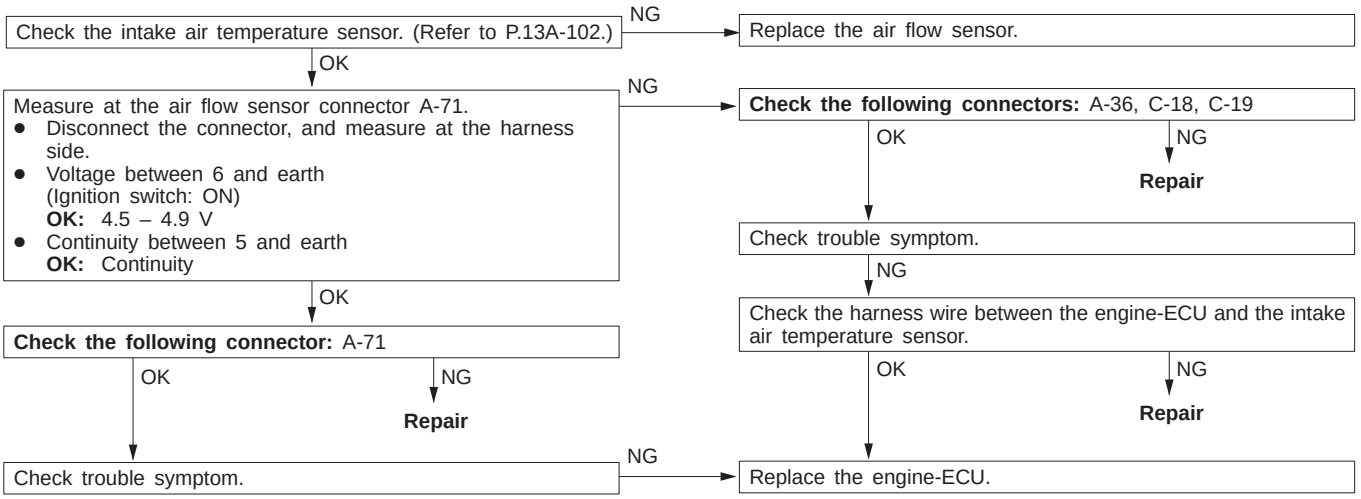
Code No.11 Oxygen sensor system	Probable cause
Range of check ● 3 minutes have passed after engine was started. ● Engine coolant temperature is approx. 80°C or more. ● Intake air temperature is 20 – 50°C. ● Engine speed is approx. 2,000 – 3,000 r/min. ● Vehicle is moving at constant speed on a flat, level road surface. Set conditions ● The oxygen sensor output voltage is around 0.6 V for 30 seconds (does not cross 0.6 V for 30 seconds). ● When the range of check operations given above which accompany starting of the engine are carried out four time in succession, a problem is detected after each operation.	● Malfunction of the oxygen sensor ● Improper connector contact, open circuit or short-circuited harness wire ● Malfunction of the engine-ECU



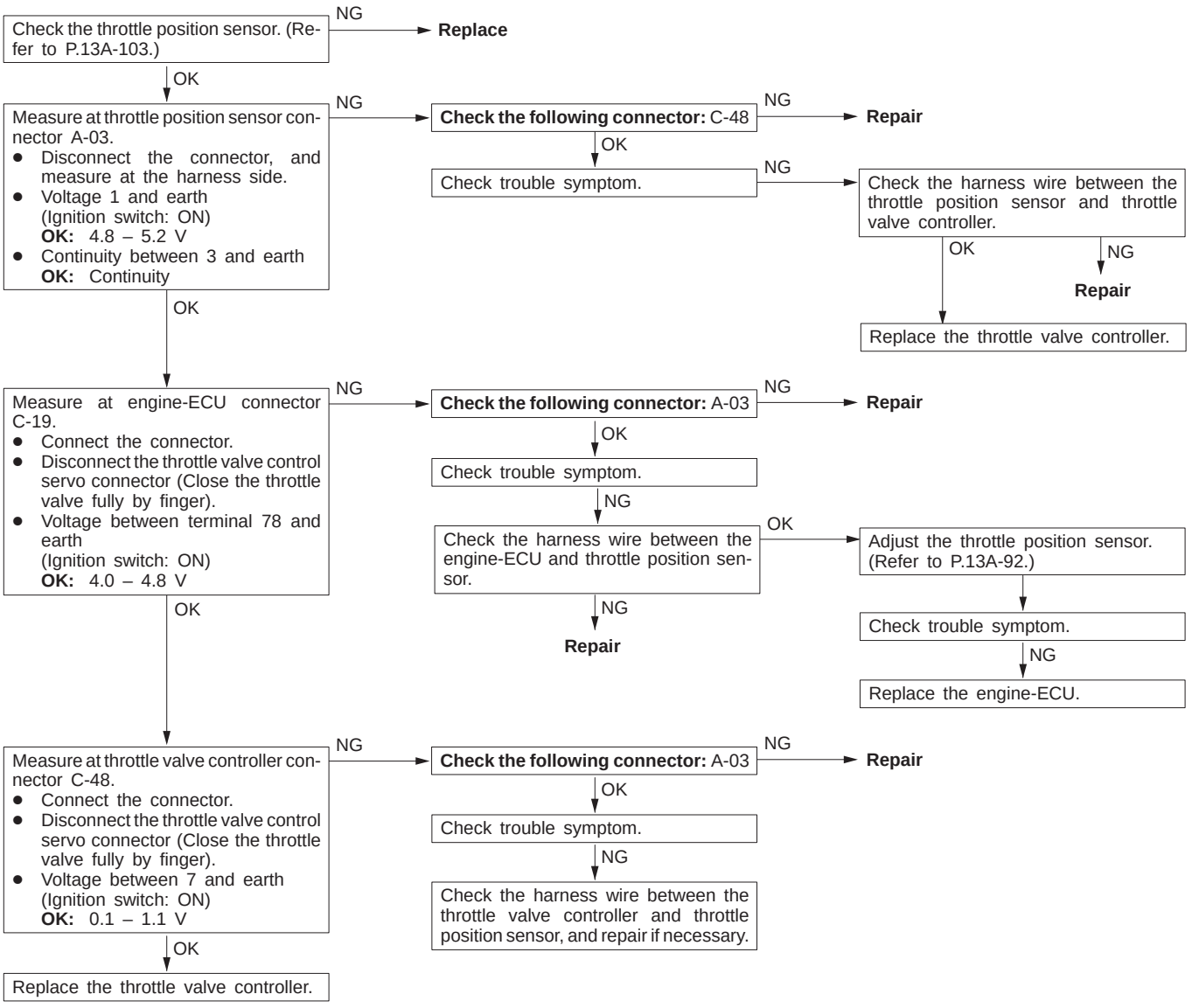
Code No.12 Air flow sensor system	Probable cause
Range of check ● Engine speed is 500 r/min or more. Set conditions ● Sensor output frequency is 3.3 Hz or less for 4 seconds.	● Malfunction of the air flow sensor ● Open circuit or short-circuited harness wire of air flow sensor circuit ● Malfunction of the engine-ECU



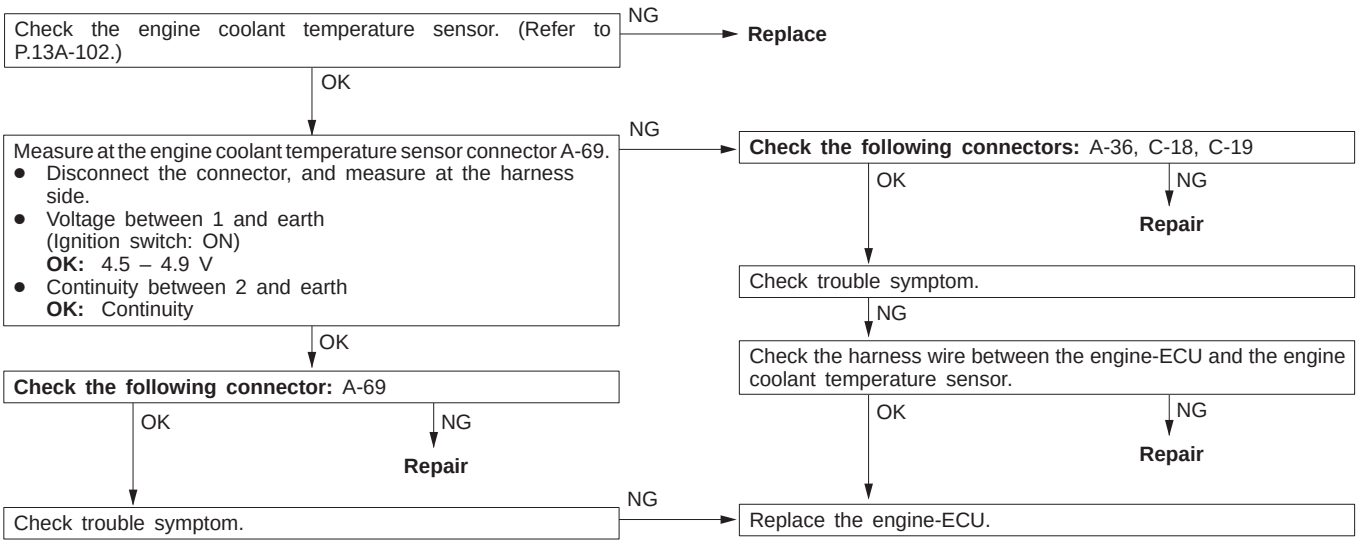
Code No.13 Intake air temperature sensor system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started Set conditions ● Sensor resistance is 0.14 kΩ or less for 4 seconds. or ● Sensor resistance is 50 kΩ or more for 4 seconds.	● Malfunction of the intake air temperature sensor ● Open circuit or short-circuited harness wire of the intake air temperature sensor circuit ● Malfunction of the engine-ECU



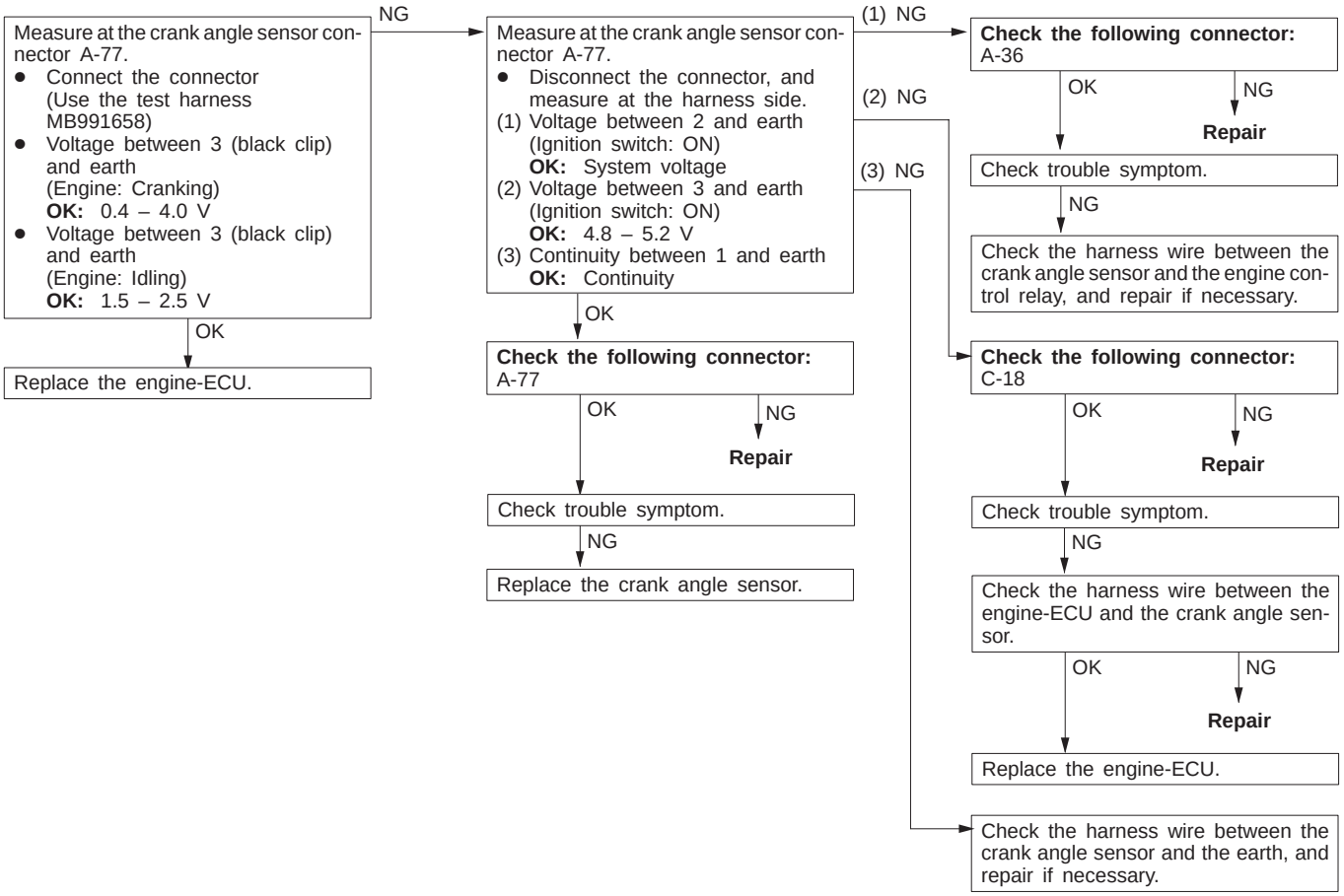
Code No.14 Throttle position sensor system (2nd channel)	Probable cause
The throttle valve controller determines whether a failure is present or not, and sends a signal indicating its result to the engine-ECU. Range of check ● Ignition switch: ON ● Throttle position sensor (1st channel) is normal Set conditions ● The throttle position sensor (1st channel) output voltage is 1.24 V or more, and the (2nd channel) output voltage is 4.6 V or more for one second. or ● The throttle position sensor (1st channel) output voltage is 3.53 V or less, and the (2nd channel) output voltage is 0.2 V or less for one second. or ● Throttle position sensor (1st and 2nd channels) output voltages are outside 4 to 6 V.	● Malfunction of throttle position sensor (2nd channel) ● Open circuit or short-circuited harness wire in throttle position sensor (2nd channel) or poor connector contact ● Faulty throttle valve controller ● Malfunction of the engine-ECU



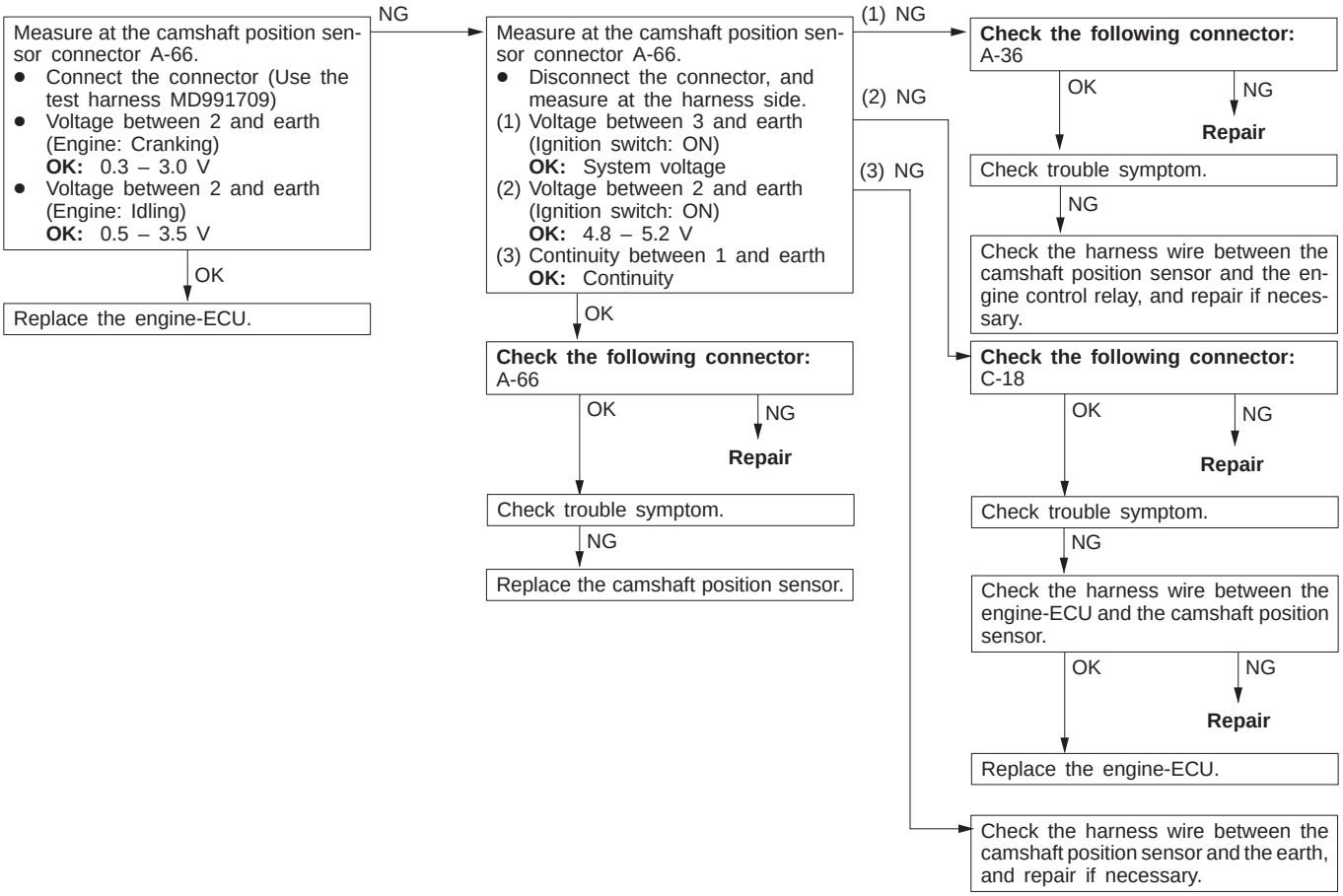
Code No.21 Engine coolant temperature sensor system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started Set conditions ● Sensor resistance is 50 Ω or less for 4 seconds. or ● Sensor resistance is 72 kΩ or more for 4 seconds.	● Malfunction of the engine coolant temperature sensor ● Open circuit or short-circuited harness wire of the engine coolant temperature sensor circuit ● Malfunction of the engine-ECU
Range of check ● After engine starts Set conditions ● After 5 minutes or more have passed since the engine coolant temperature after filtering has dropped from 40°C or more to less than this temperature	



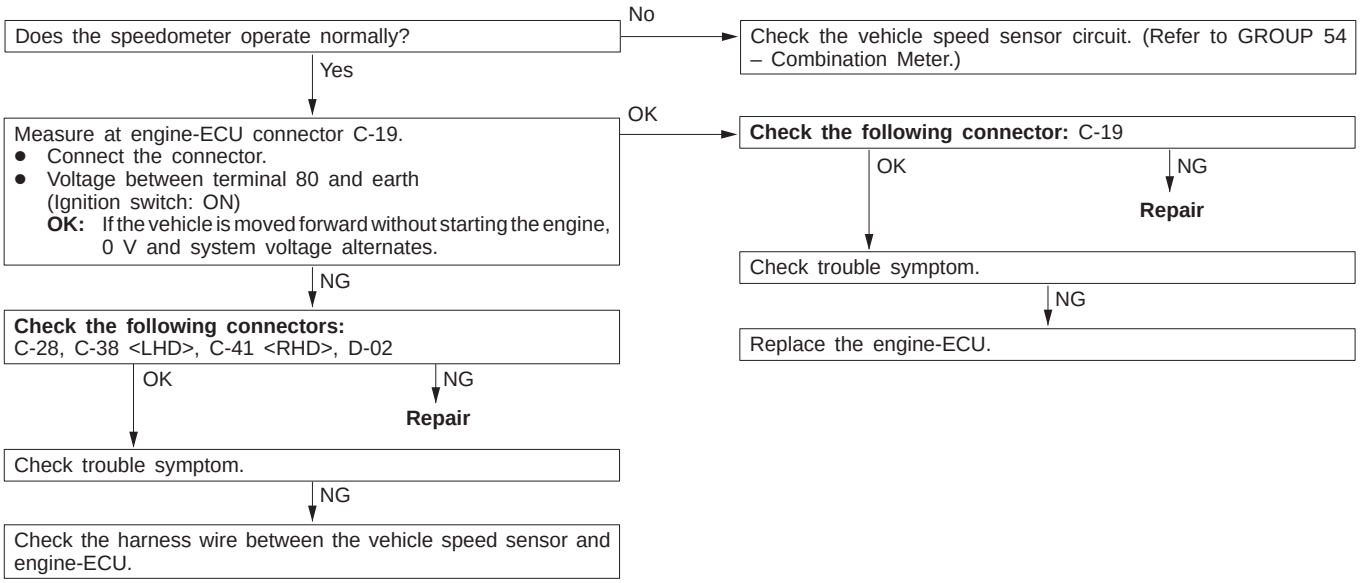
Code No.22 Crank angle sensor system	Probable cause
Range of check ● Engine: During cranking Set conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal is being input).	● Malfunction of the crank angle sensor ● Open circuit or short-circuited harness wire of the crank angle sensor circuit ● Malfunction of the engine-ECU



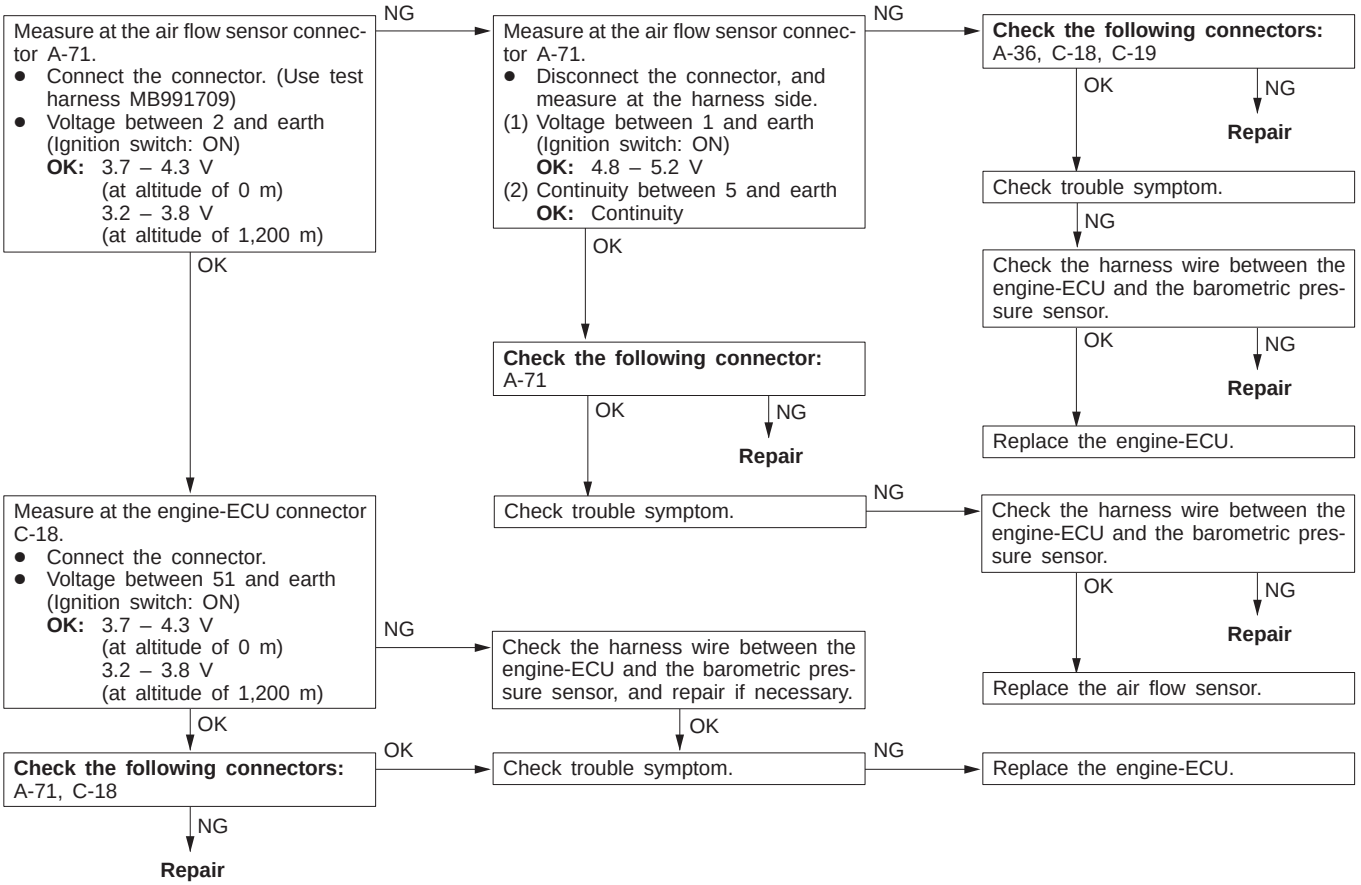
Code No.23 Camshaft position sensor system	Probable cause
Range of check ● While engine is cranking or running Set conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal is being input).	● Malfunction of the camshaft position sensor ● Open circuit or short-circuited harness wire of the camshaft position sensor circuit ● Malfunction of the engine-ECU



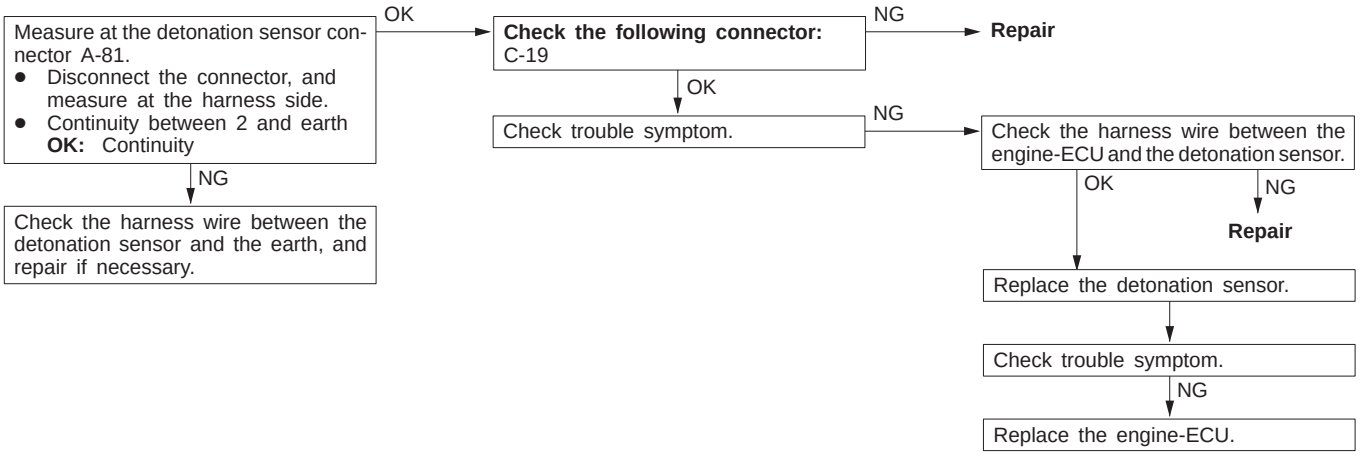
Code No. 24 Vehicles speed sensor system	Probable cause
Range of check ● Ignition switch: ON ● Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. ● Engine speed is 3,000 r/min or more. ● Driving under high engine load conditions. Set conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the vehicle speed sensor ● Improper connector contact, open circuit or short-circuited harness wire of the vehicle speed sensor circuit ● Malfunction of the engine-ECU



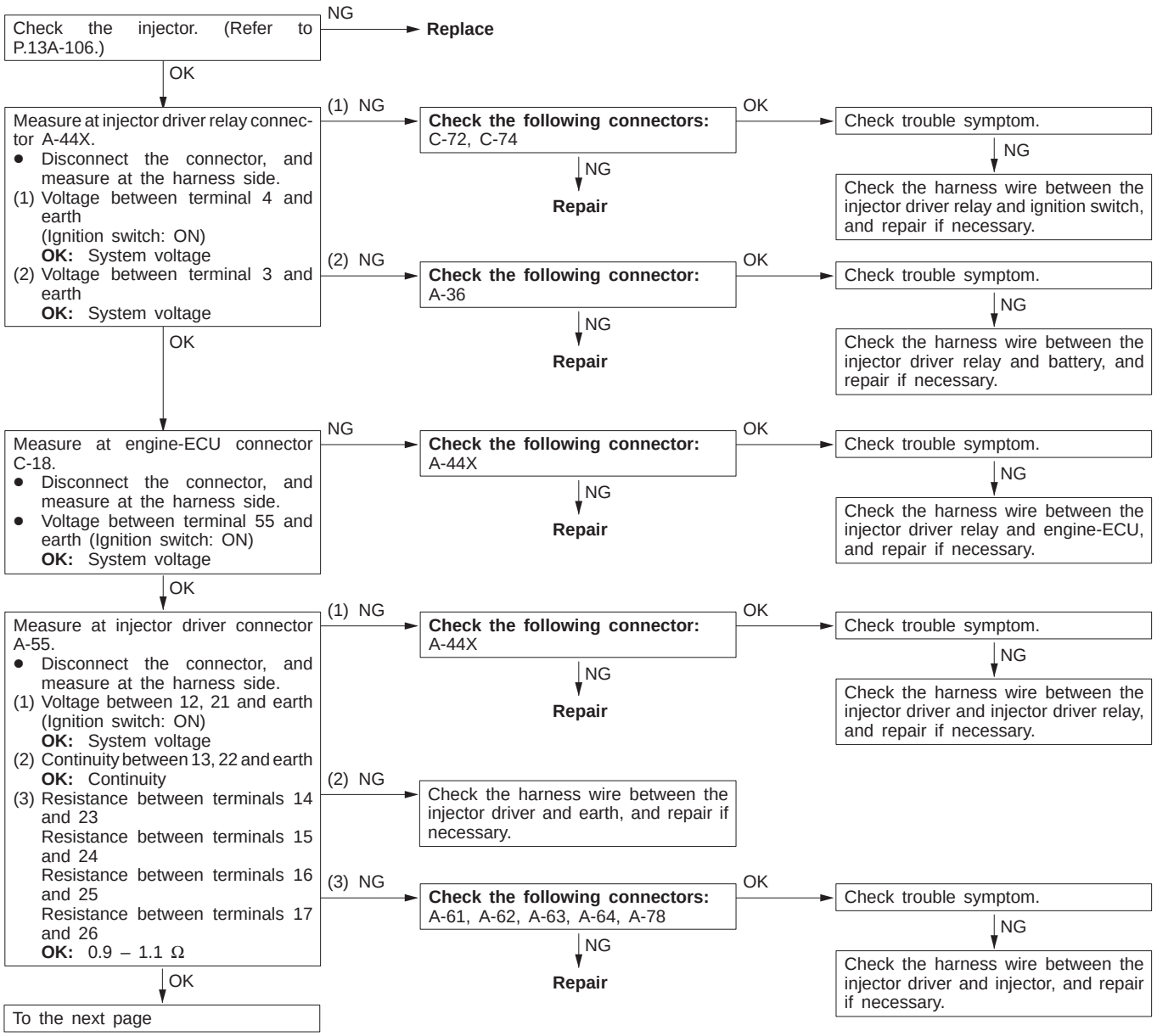
Code No.25 Barometric pressure sensor system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started ● Battery voltage is 8 V or more. Set conditions ● Sensor output voltage is 0.2 V or less for 4 seconds. (This condition corresponds to that the barometric pressure is 53 kPa or less.) or ● Sensor output voltage is 4.5 V or more for 4 seconds. (This condition corresponds to that the barometric pressure is 114 kPa or more.)	● Malfunction of the barometric pressure sensor ● Open circuit or short-circuited harness wire of the barometric pressure sensor ● Malfunction of the engine-ECU

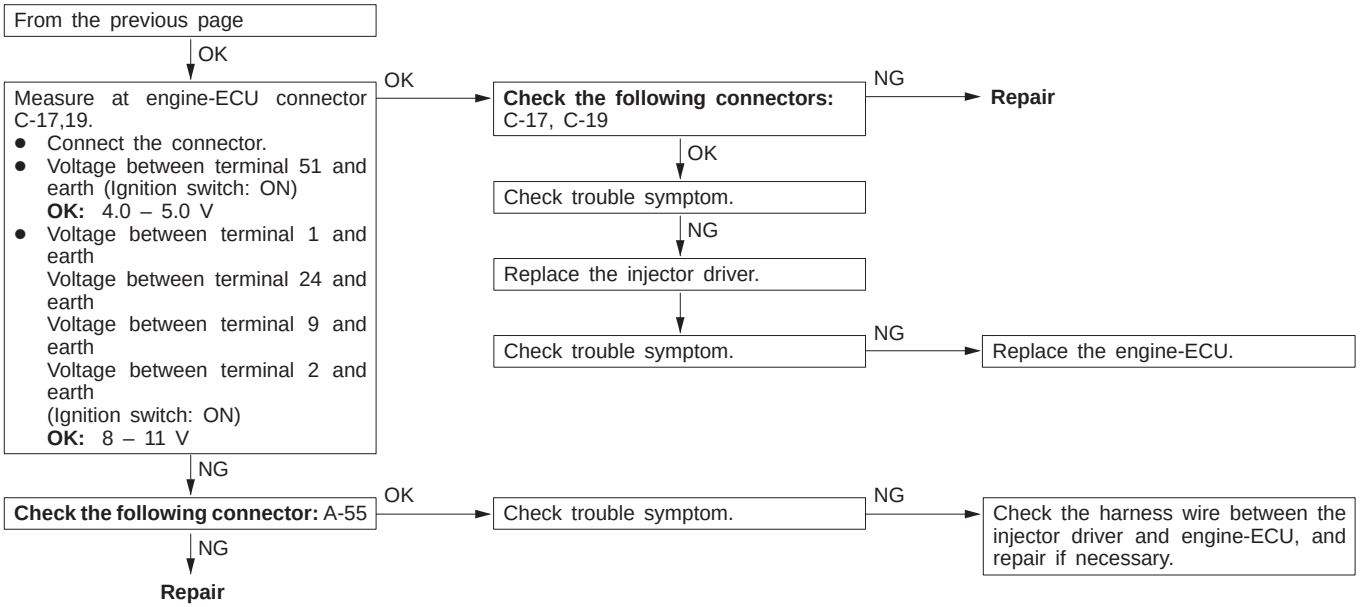


Code No.31 Detonation sensor system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started Set conditions ● Amount of change in the sensor output voltage (detonation sensor peak voltage for each half rotation of the crankshaft) is 0.06 V or less for 200 continuous times.	● Malfunction of the detonation sensor ● Open circuit or short-circuited harness wire of the detonation sensor ● Malfunction of the engine-ECU

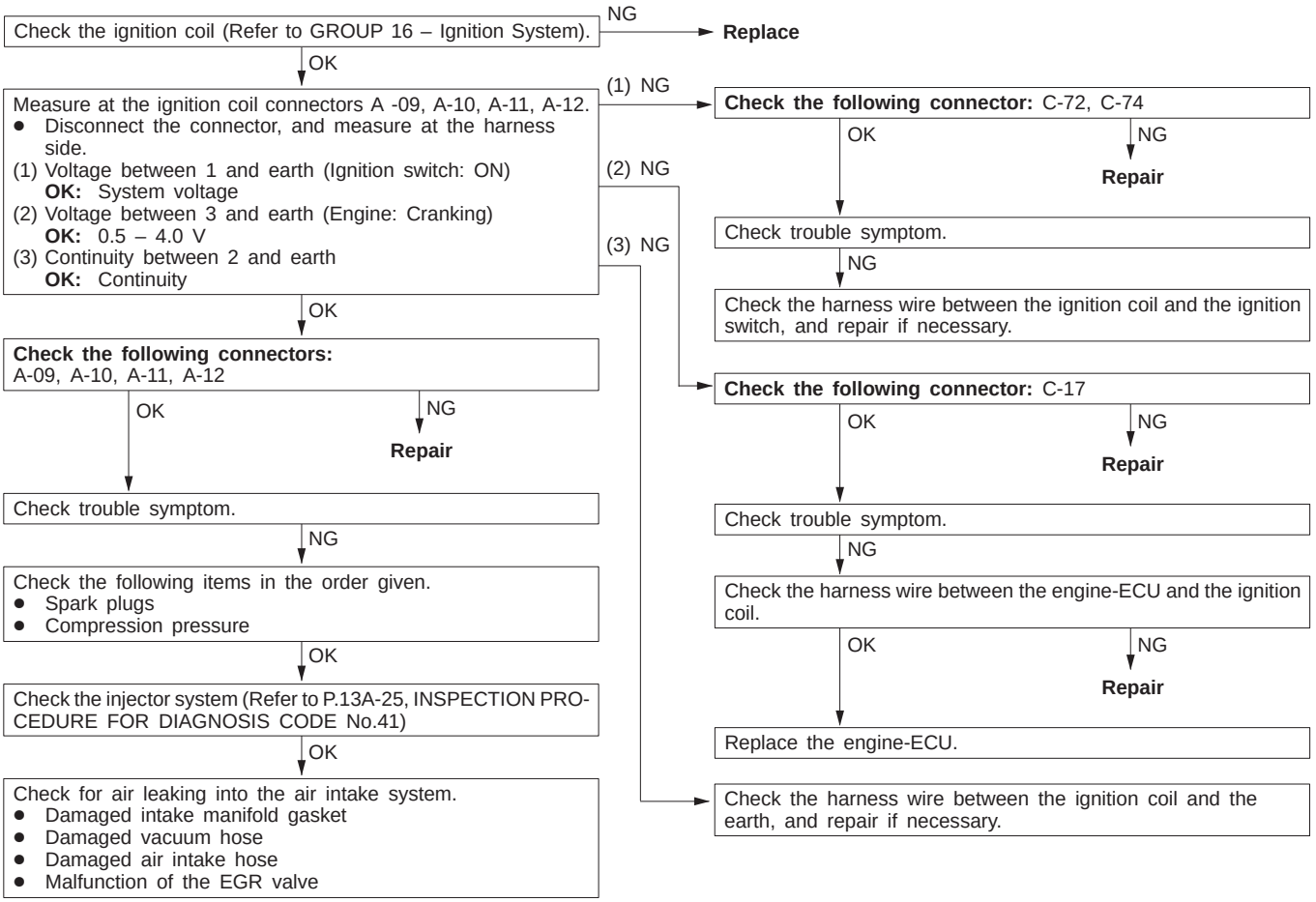


Code No.41 Injector system	Probable cause
Range of check ● Engine: while cranking, or running ● Engine speed: 4,000 r/min or less ● System voltage: 10 V or more ● Fuel shut off, or while forcible activating of injector (actuator test) is in operation. Set conditions ● Injector open circuit check signal is not output from the injector predetermined time(s).	● Malfunction of the injector ● Faulty injector driver relay ● Faulty injector driver ● Open circuit or short-circuited harness wire in the injector drive circuit, or poor connector contact ● Malfunction of the engine-ECU



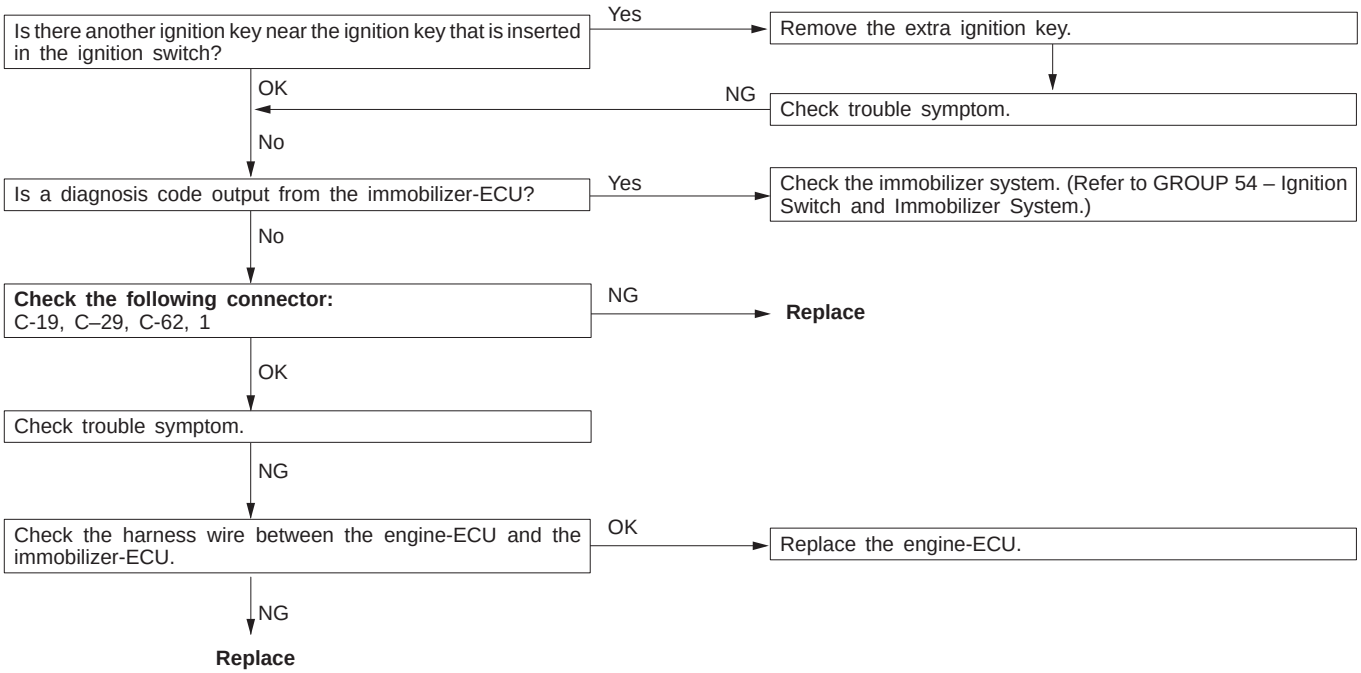

From the previous page
OK
Measure at engine-ECU connector C-17,19.
● Connect the connector.
● Voltage between terminal 51 and earth (Ignition switch: ON)
OK: 4.0 – 5.0 V
● Voltage between terminal 1 and earth
Voltage between terminal 24 and earth
Voltage between terminal 9 and earth
Voltage between terminal 2 and earth
(Ignition switch: ON)
OK: 8 – 11 V
OK
Check the following connectors: C-17, C-19
NG
Repair
OK
Check trouble symptom.
NG
Replace the injector driver.
Check trouble symptom.
NG
Replace the engine-ECU.
NG
Check the following connector: A-55
OK
Check trouble symptom.
NG
Check the harness wire between the injector driver and engine-ECU, and repair if necessary.
NG
Repair

Code No.44 Abnormal combustion	Probable cause
Range of check ● While engine is running during lean fuel combustion Set conditions ● Abnormal engine speed due to mis-firing is detected by the crank angle sensor	● Malfunction of the ignition coil ● Malfunction of the spark plug ● Malfunction of the EGR valve ● Open circuit or short-circuit in ignition primary circuit ● Malfunction of the engine-ECU

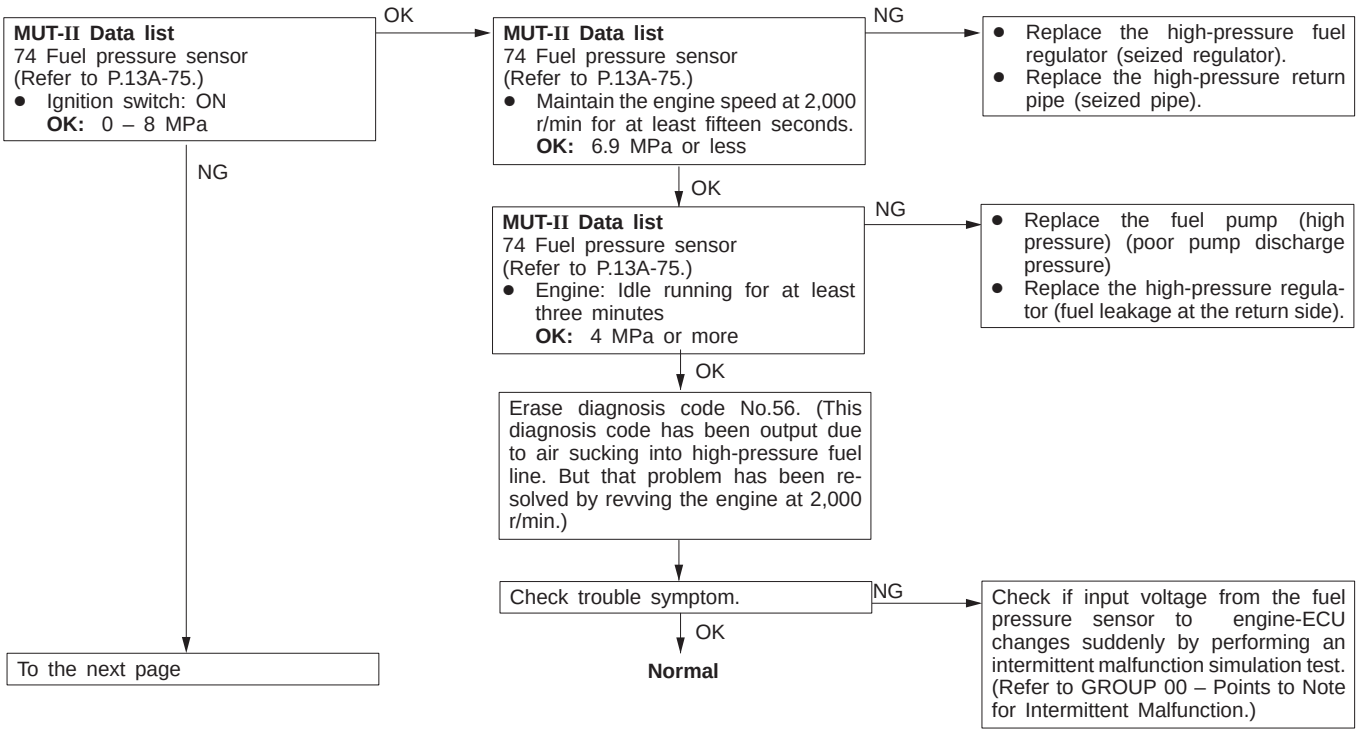


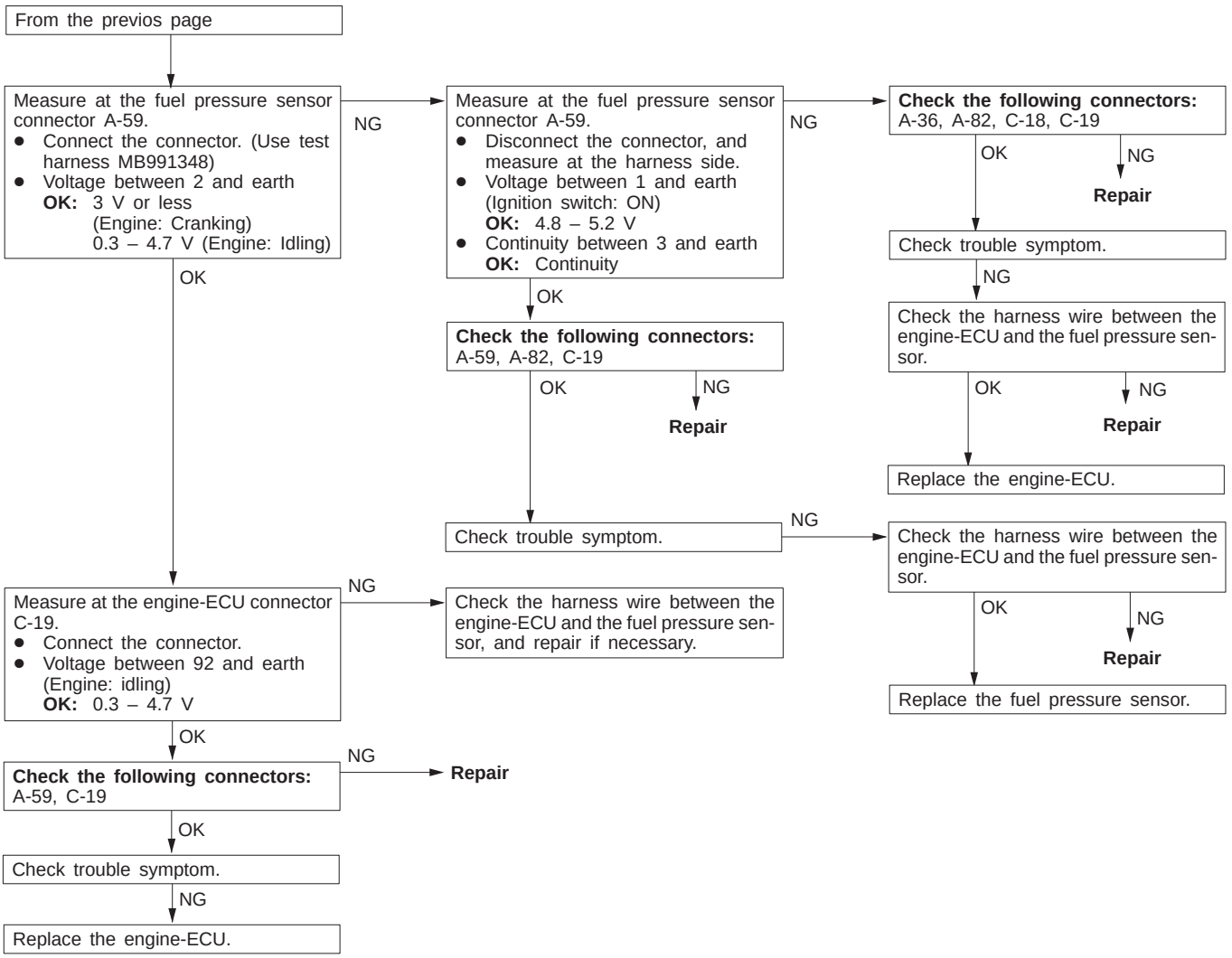
Code No.54 Immobilizer system	Probable cause
Range of check ● Ignition switch: ON Set conditions ● Improper communication between the engine-ECU and immobilizer-ECU	● Radio interference of ID codes ● Incorrect ID code ● Malfunction of harness or connector ● Malfunction of immobilizer-ECU ● Malfunction of engine-ECU

NOTE
(1) If the ignition switches are close each other when starting the engine, radio interference may cause this code to be displayed.
(2) This code may be displayed when registering the key ID code.

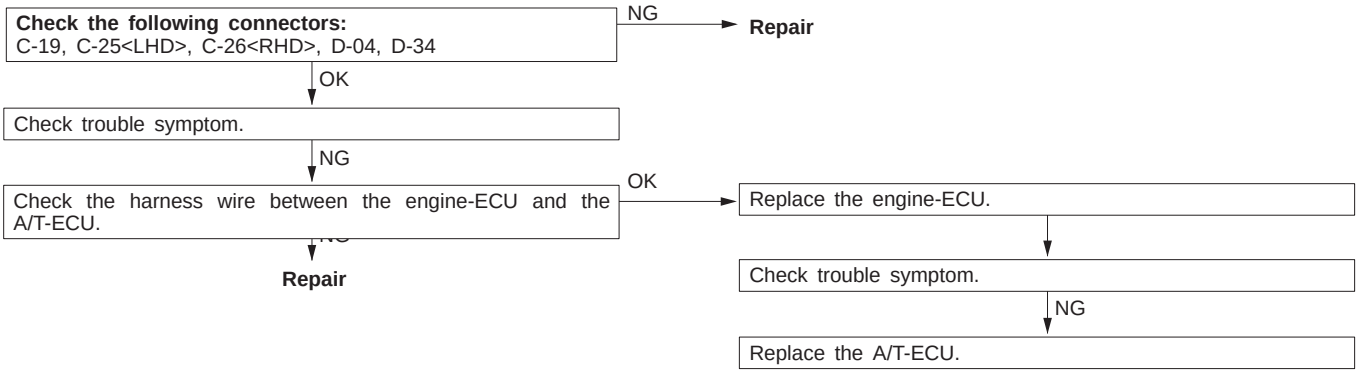


Code No.56 Abnormal fuel pressure	Probable cause
Range of check ● Ignition switch: ON Set conditions ● Sensor output voltage is 4.8 V or more for four seconds. or ● Sensor output voltage is 0.2 V or less for four seconds. Range of check ● After the engine is started, the following condition has been detected: (1) Engine speed: 1,000 r/min or more (2) Fuel pressure: 2 MPa or more ● While engine is running Set conditions ● Fuel pressure is 6.9 MPa or more for four seconds. or ● Fuel pressure is 2 MPa or less for four seconds.	● Malfunction of the fuel pressure sensor ● Open circuit or short-circuited harness wire of the fuel pressure sensor ● Malfunction of the engine-ECU ● Malfunction of the fuel pump (high pressure) ● Malfunction of the fuel pressure regulator (high pressure) ● Clogged high-pressure fuel line
This diagnosis code is also output when air is sucked in high-pressure fuel line due to no fuel supply. In this case, air can be bled by letting the engine run at 2,000 r/min for at least fifteen seconds. After the air bleeding, the diagnosis code must be erased by the MUT-II.	● Air sucking due to no fuel supply

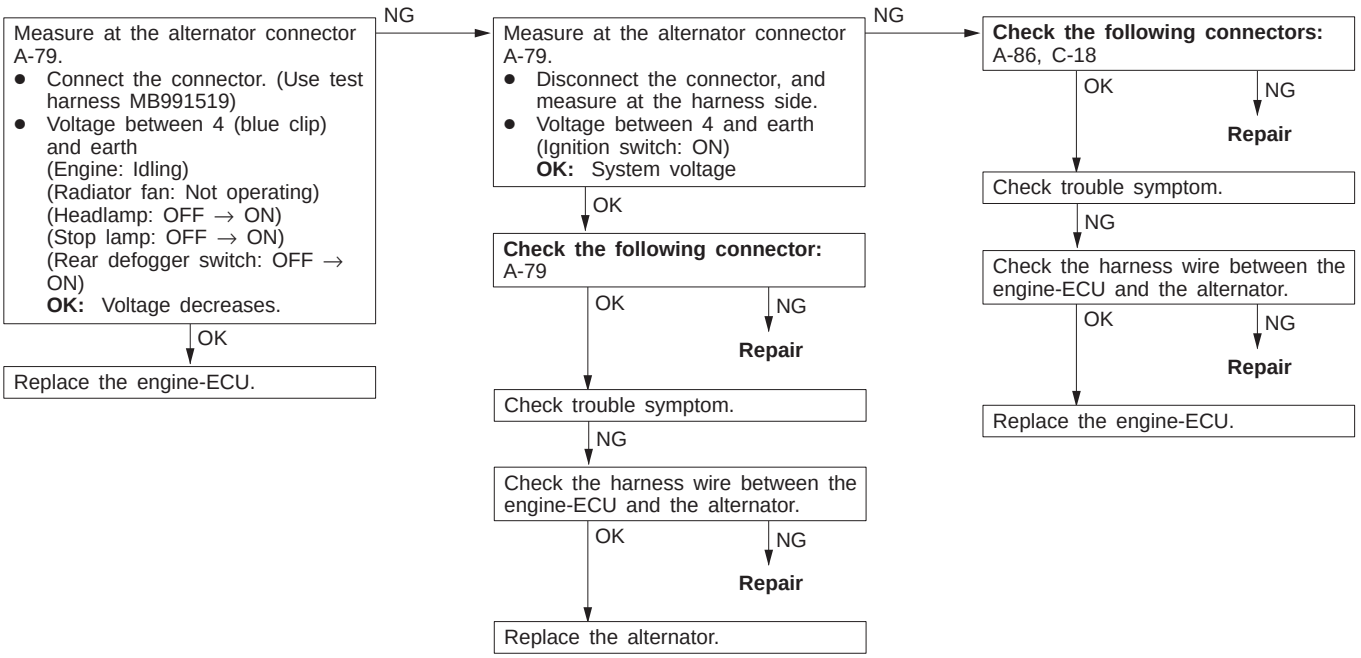



From the previos page
Measure at the fuel pressure sensor connector A-59.
● Connect the connector. (Use test harness MB991348)
● Voltage between 2 and earth
OK: 3 V or less (Engine: Cranking)
0.3 – 4.7 V (Engine: Idling)
NG
OK
Measure at the fuel pressure sensor connector A-59.
● Disconnect the connector, and measure at the harness side.
● Voltage between 1 and earth (Ignition switch: ON)
OK: 4.8 – 5.2 V
● Continuity between 3 and earth
OK: Continuity
NG
OK
Check the following connectors: A-59, A-82, C-19
OK
NG
Repair
Check trouble symptom.
NG
Check the following connectors: A-36, A-82, C-18, C-19
OK
NG
Repair
Check trouble symptom.
NG
Check the harness wire between the engine-ECU and the fuel pressure sensor.
OK
NG
Repair
Replace the engine-ECU.
Check the harness wire between the engine-ECU and the fuel pressure sensor.
OK
NG
Repair
Replace the fuel pressure sensor.
Measure at the engine-ECU connector C-19.
● Connect the connector.
● Voltage between 92 and earth (Engine: idling)
OK: 0.3 – 4.7 V
NG
Check the harness wire between the engine-ECU and the fuel pressure sensor, and repair if necessary.
OK
Check the following connectors: A-59, C-19
NG
Repair
OK
Check trouble symptom.
NG
Replace the engine-ECU.

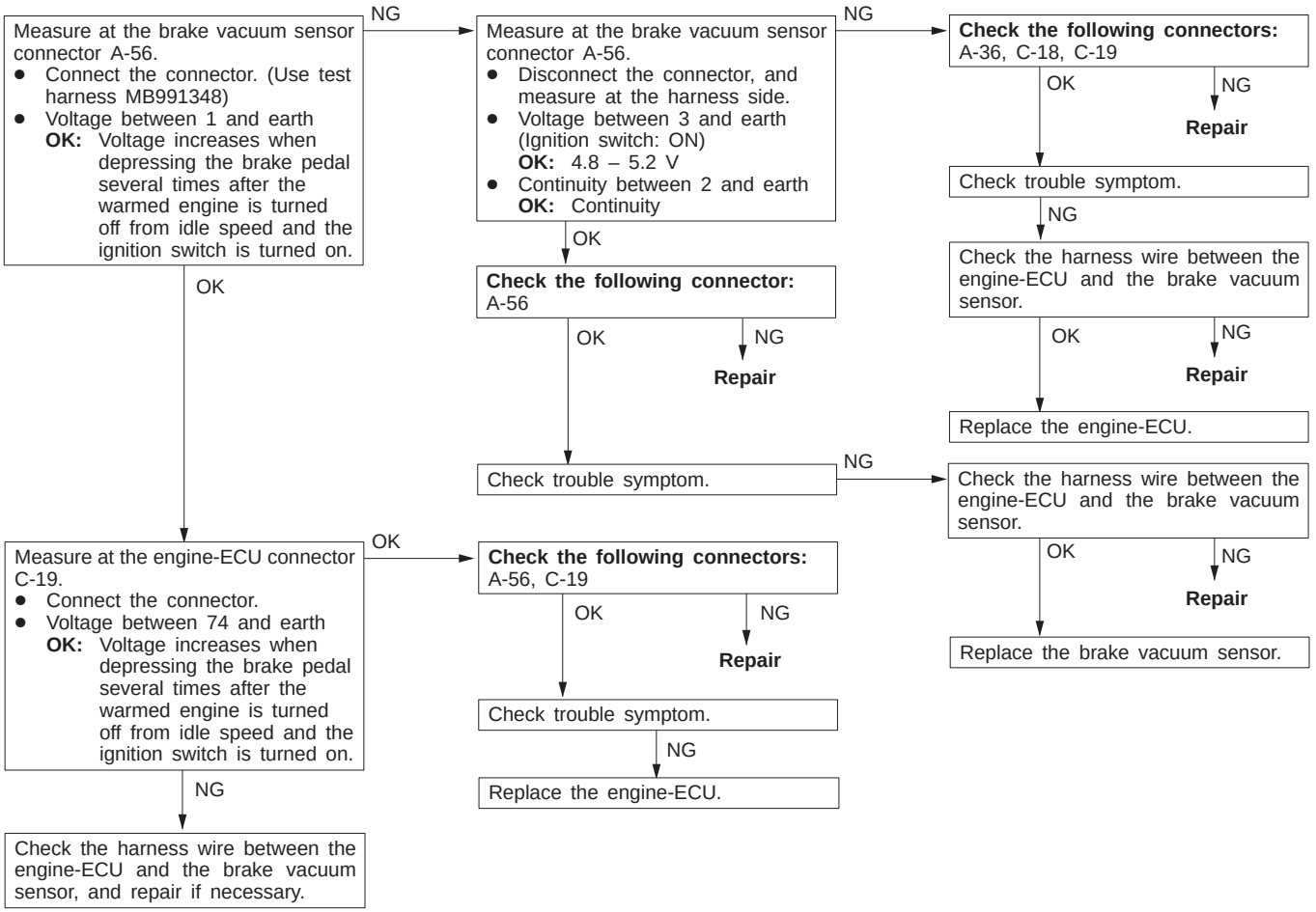
Code No.61 Communication wire with A/T-ECU system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started Set conditions ● Torque reduction request signal from A/T-ECU is input continuously for 1.5 seconds or more.	● Short circuit in ECU communication circuit ● Malfunction of the engine-ECU ● Malfunction of the A/T-ECU



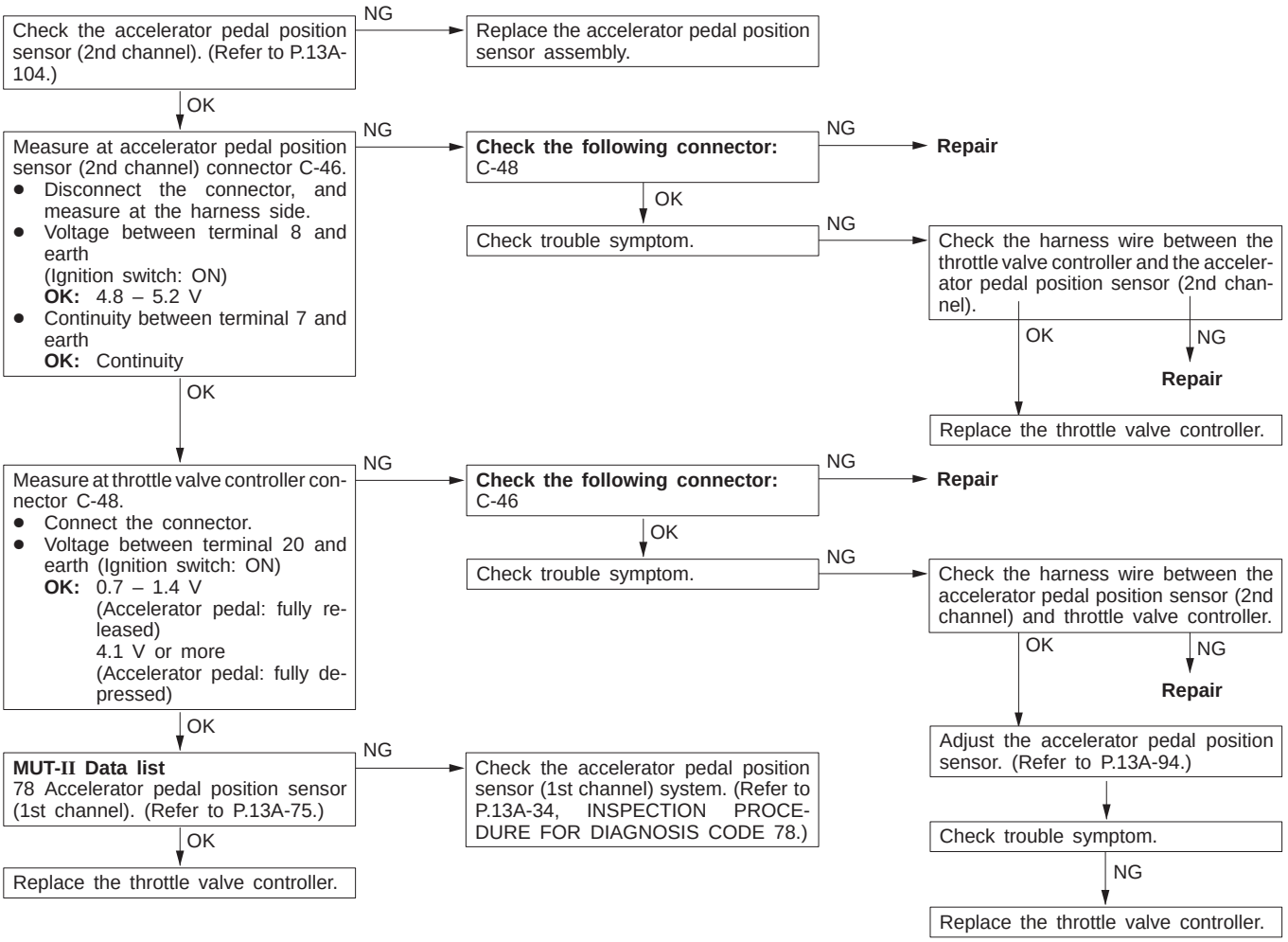
Code No.64 Alternator FR terminal system	Probable cause
Range of check ● Engine speed is 50 r/min or more. Set conditions ● Input voltage from the alternator FR terminal is system voltage for 20 seconds.	● Open circuit in alternator FR terminal circuit ● Malfunction of the engine-ECU



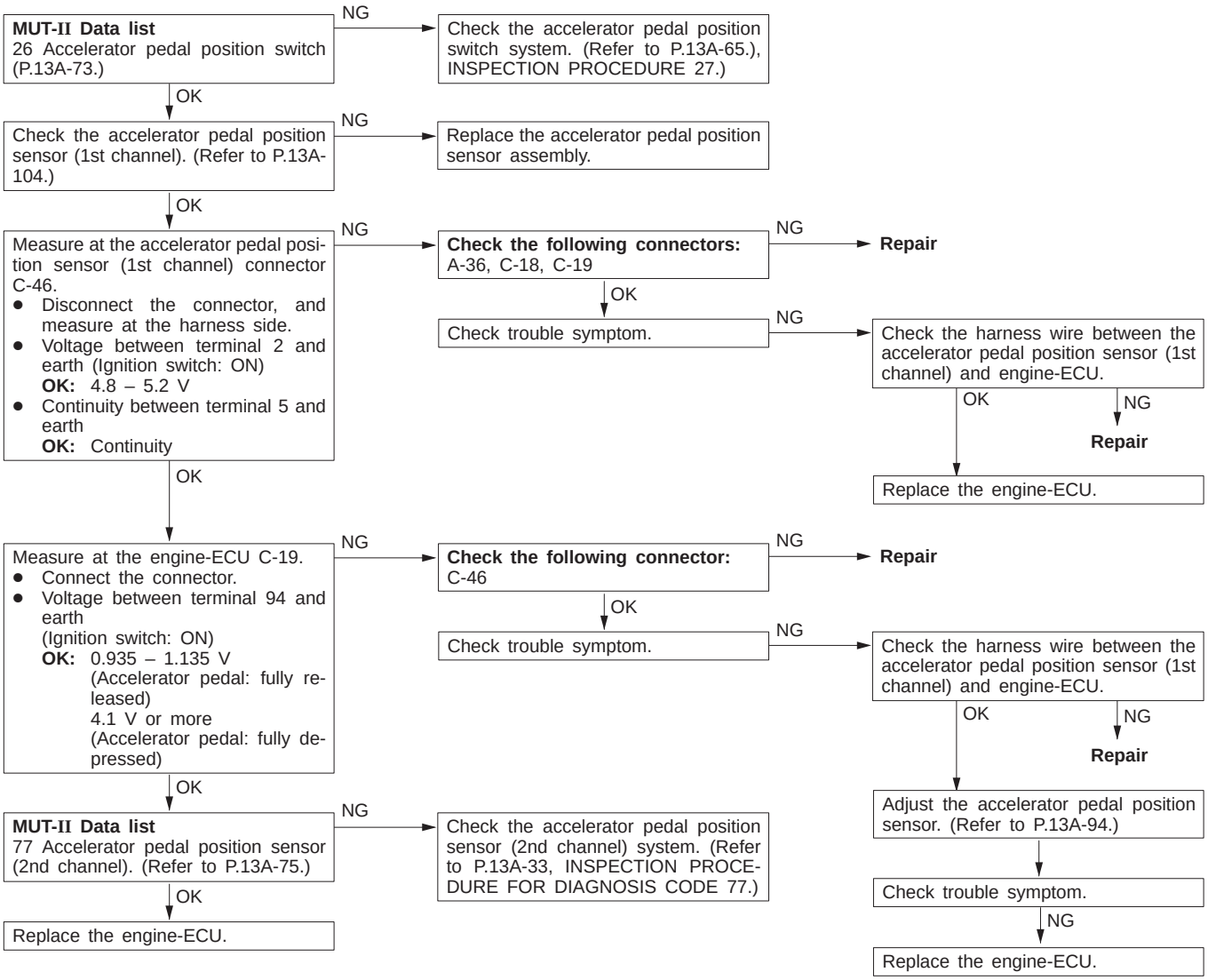
Code No.66 Brake vacuum sensor system	Probable cause
Range of check ● Ignition switch: ON Set conditions ● Sensor output voltage is 4.8 V or more. or ● Sensor output voltage is 0.2 V or less.	● Malfunction of the brake vacuum sensor ● Improper connector contact, open circuit or short-circuited harness wire of the brake vacuum sensor ● Malfunction of the engine-ECU



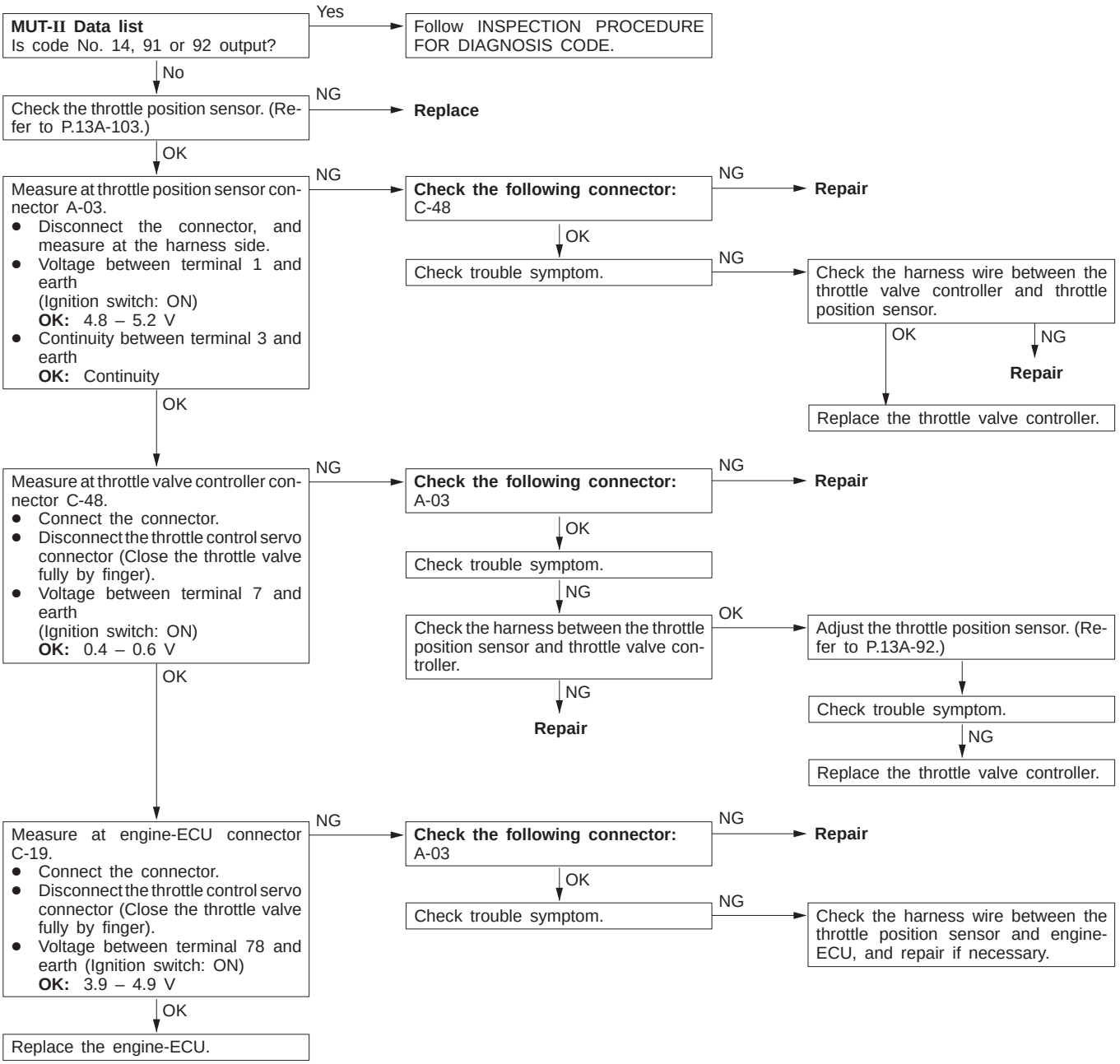
Code No.77 Accelerator pedal position sensor (2nd channel) system	Probable cause
Range of check ● Accelerator pedal position sensor (1st channel) system is normal. ● Communication between the engine-ECU and throttle valve controller is normal. Set conditions ● Output voltage of accelerator pedal position sensor (2nd channel) system is 0.2 V or less for one second. or ● Output voltage of the accelerator pedal position sensor (1st channel) is 2.5 V or less, and output voltage of the accelerator pedal position sensor (2nd channel) is 4.5 V or more for one second. or ● Difference between the accelerator pedal position sensor output voltages (1st and 2nd channels) exceeds 1.0 V (i.e. when the throttle valve opening angle changes slightly).	● Malfunction of the accelerator pedal position sensor (2nd channel) ● Open circuit or short-circuited harness wire in the accelerator pedal position sensor (2nd channel) system, or poor connector contact ● Malfunction of the throttle valve controller ● Malfunction of the engine-ECU



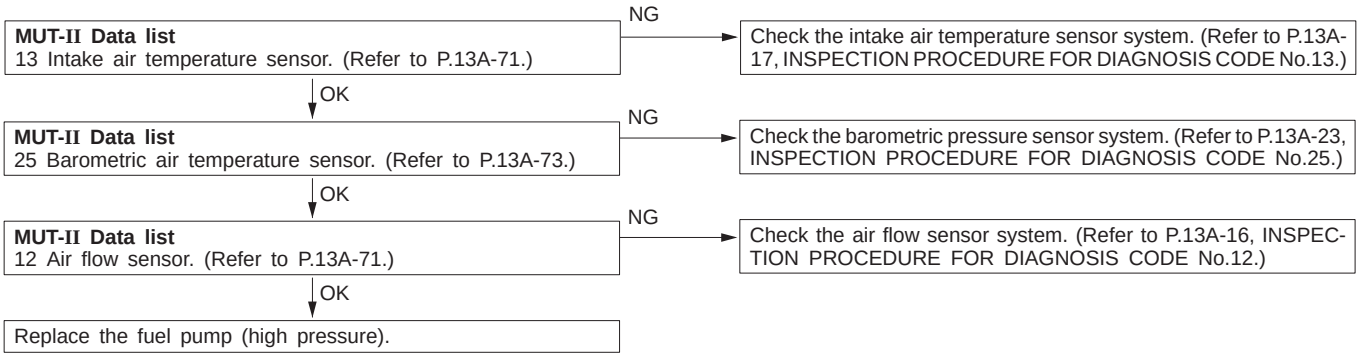
Code No.78 Accelerator pedal position sensor (1st channel) system	Probable cause
Range of check ● Accelerator pedal position sensor (2nd channel) system is normal. ● Communication between the engine-ECU and throttle valve controller is normal. Set conditions ● Output voltage of accelerator position sensor (1st channel) system is 0.2 V or less for one second. or ● Output voltage of the accelerator pedal position sensor (2nd channel) is 2.5 V or less, and (1st channel) output voltage of the accelerator pedal position sensor is 4.5 V or more for one second. or ● Difference between the accelerator pedal position sensor (1st and 2nd channels) output voltages exceeds 1.0 V (i.e. when the throttle valve opening angle changes slightly). or ● Although the accelerator pedal position switch is on, 1st-channel output voltage of the accelerator pedal position sensor exceeds 1.1 V for one second.	● Malfunction of the accelerator pedal position sensor (1st channel) ● Open circuit or short-circuited harness wire in the accelerator pedal position sensor (1st channel) system, or poor connector contact ● ON-seizure of the accelerator pedal position switch ● Malfunction of the throttle valve controller ● Malfunction of the engine-ECU



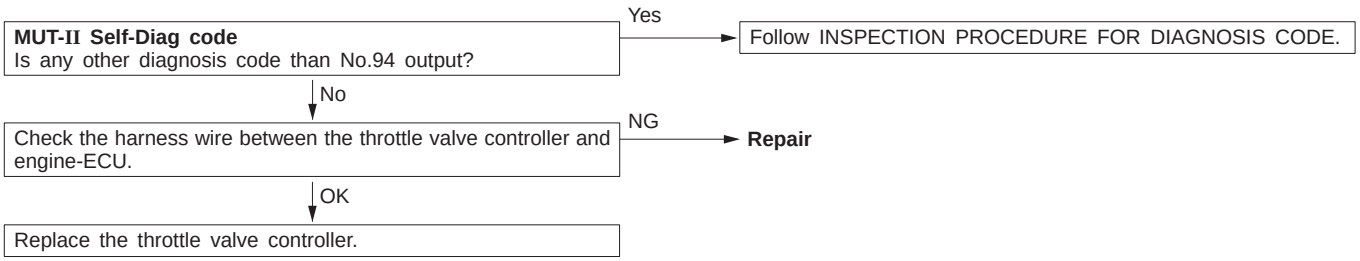
Code No.79 Throttle position sensor (1st channel) system	Probable cause
The throttle valve controller determines a failure, and sends it result to the engine-ECU. Range of check ● Ignition switch: ON ● System voltage: 8 V or more Set conditions ● Output voltage of the sensor remains 0.2 V for one second. or ● Output voltage of the sensor remains 4.9 V for one second. or ● Output voltage of the throttle position sensor (1st and 2nd channels) remains outside 4 – 6 V for four seconds.	● Malfunction of the throttle position sensor (1st channel) ● Open circuit or short-circuited harness wire in the throttle position sensor (1st channel), or poor connector contact ● Malfunction of the throttle valve controller ● Malfunction of the engine-ECU



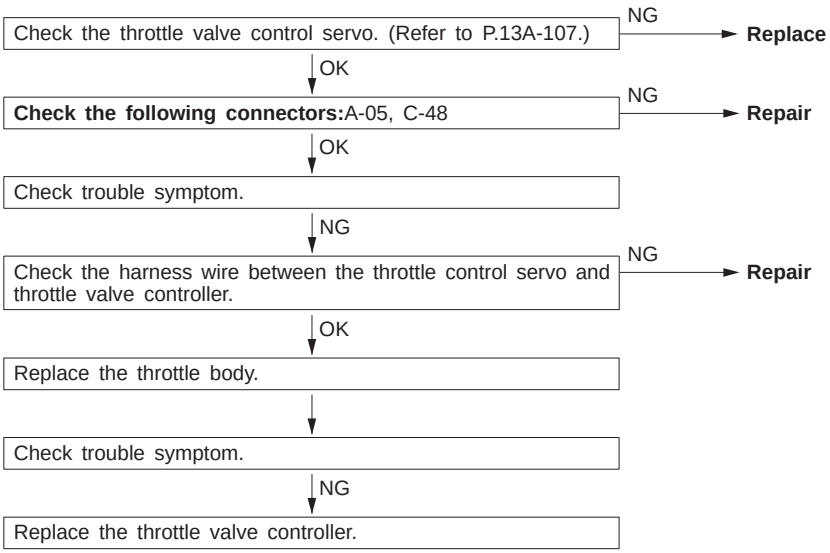
Code No.89 Abnormal fuel pressure system	Probable cause
Range of check ● Engine: Idling (during stoichio-feedback operation) Set conditions ● Fuel injection correction value remains excessively low for ten seconds or more. or ● Fuel injection correction value remains excessively high for ten seconds or more.	● Malfunction of the fuel pump (high pressure) ● Malfunction of the intake air temperature sensor ● Malfunction of the barometric pressure sensor ● Malfunction of the air flow sensor ● Malfunction of the engine-ECU



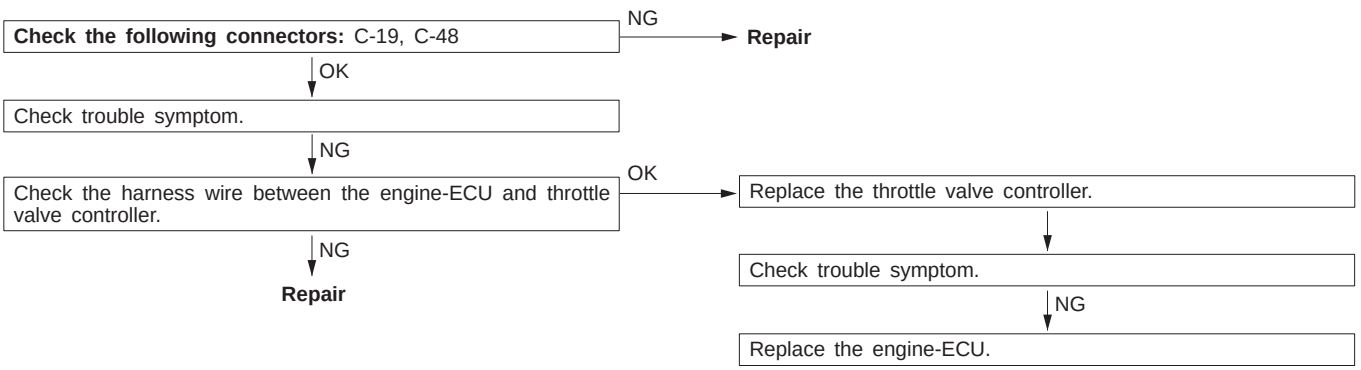
Code No.91 Electronic-controlled throttle valve system	Probable cause
Range of check ● Ignition switch: ON ● Error in communication from the engine-ECU to throttle valve controller Set conditions ● Output voltage of the throttle position sensor (2nd channel) fluctuates significantly (approx. 1 V or more) from an expected value. Range of check ● Ignition switch: ON ● Error in communication from the throttle valve controller to engine-ECU Set conditions ● The throttle valve opening angle (voltage) which the engine-ECU requested of the throttle valve controller is significantly different from output voltage of the (2nd channel) throttle position sensor (approx. one volt).	● Short in communication line ● Malfunction of the engine-ECU ● Malfunction of the throttle valve controller



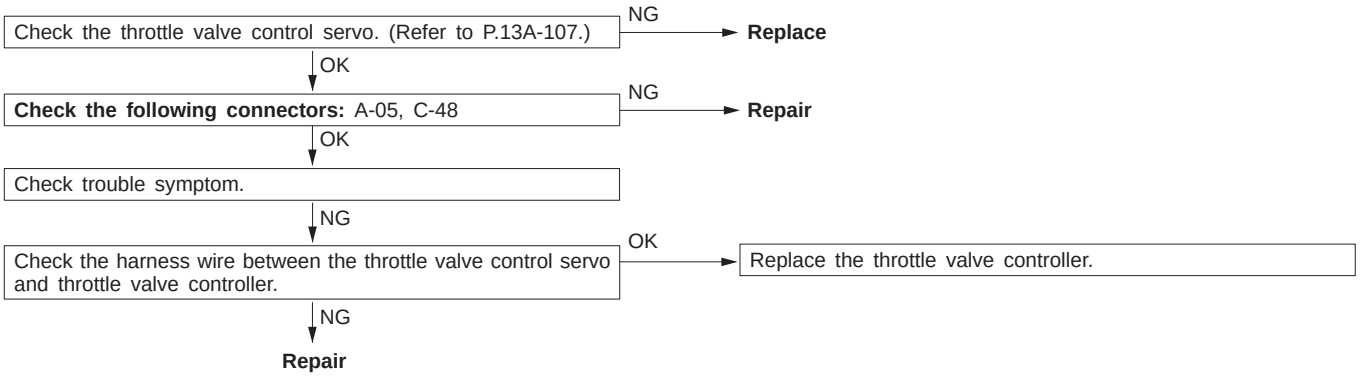
Code No.92 Throttle valve position feedback system	Probable cause
The throttle valve controller determines if a failure is present, and sends its result to the engine-ECU. Range of check ● Ignition switch: ON ● System voltage: 8 V or more Set condition ● Motor position feedback system is defective (System detects a motor overcurrent, or that actual and projected opening angles of the throttle position sensor (1st channel) are different by 1.0 V or more.	● Malfunction of the throttle position sensor (1st channel) ● Open circuit or short-circuited harness wire in the throttle position sensor system (1st channel), or poor connector contact ● Malfunction of the throttle valve controller



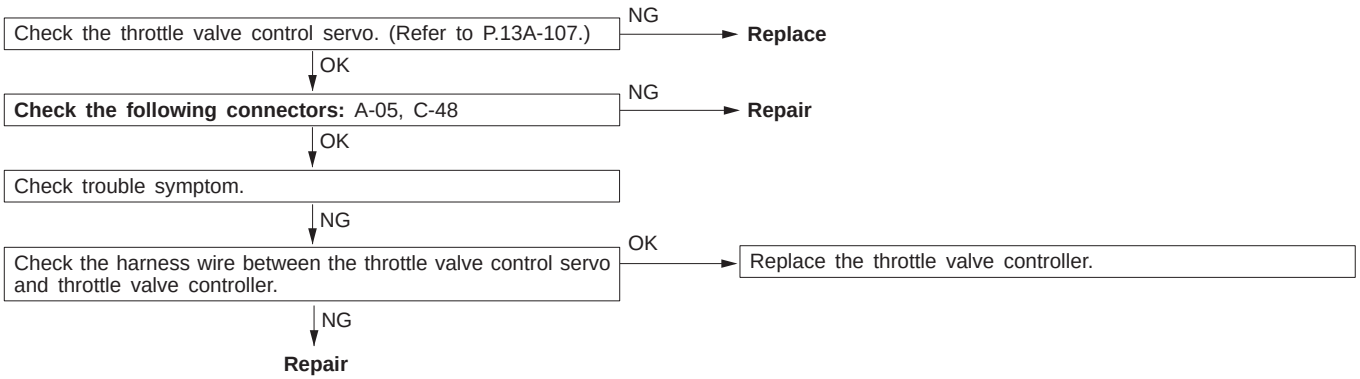
Code No.94 Communication line system with throttle valve controller	Probable cause
Range of check ● Ignition switch: ON ● System voltage: 8 V or more ● Engine: not cranking Set condition ● System detects an error in communication line between the engine-ECU and throttle valve controller.	● Short circuit in communication line ● Malfunction of the engine-ECU ● Malfunction of the throttle valve controller



Code No.95 Malfunction in throttle valve control servo motor (1st motor) system	Probable cause
Range of check ● Throttle valve control servo relay: ON ● System voltage: 8 V or more Set conditions ● Throttle valve control servo drive circuit is shorted to earth. ● Other power source interferences with throttle valve control servo drive circuit. ● Throttle valve control servo drive circuit is open circuit.	● Malfunction of the throttle valve control servo ● Open circuit or short-circuited harness wire in throttle valve control servo system, or poor connector contact ● Malfunction of the throttle valve controller



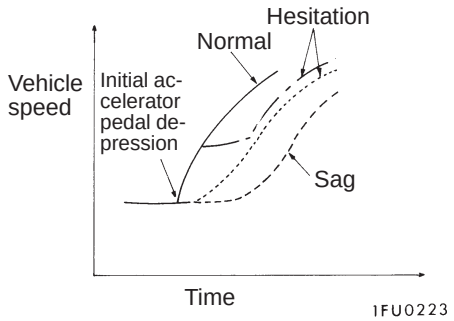
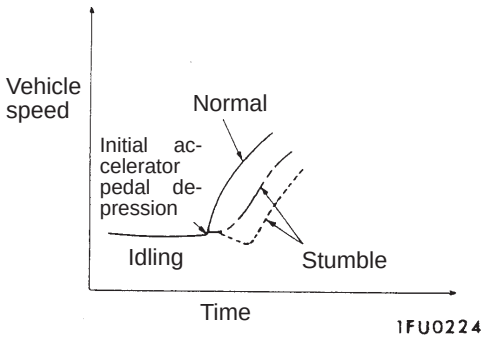
Code No.99 Malfunction in throttle valve control servo motor (2nd motor) system	Probable cause
Range of check ● Throttle valve control servo relay: ON ● System voltage: 8V or more Set conditions ● Throttle valve control servo drive circuit is shorted to earth. ● Other power source interferes with throttle valve control servo drive circuit. ● Throttle valve control servo drive circuit is open-circuited.	● Malfunction of the throttle valve control servo ● Open circuit or short-circuited harness wire in the throttle valve control servo system, or poor connector contact ● Malfunction of the throttle valve controller



INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is impossible.	Communication with all systems is not possible.	1	13A-41
	Communication with engine-ECU only is not possible.	2	13A-42
Engine warning lamp and related parts	The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position.	3	13A-42
	The engine warning lamp remains illuminating and never goes out.	4	13A-43
Starting	No initial combustion (starting impossible)	5	13A-43
	Initial combustion but no complete combustion (starting impossible)	6	13A-45
	Long time to start (improper starting)		
Idling stability (Improper idling)	Unstable idling (Rough idling, hunting)	7	13A-47
	Idling speed is high. (Improper idling speed)	8	13A-49
	Idling speed is low. (Improper idling speed)		
Idling stability (Engine stalls)	When the engine is cold, it stalls at idling. (Die out)	9	13A-50
	When the engine is hot, it stalls at idling. (Die out)	10	13A-51
	The engine stalls when starting the car. (Pass out)	11	13A-53
	The engine stalls when decelerating.	12	13A-54
Driving	Hesitation, sag or stumble	13	13A-55
	Poor acceleration		
	Surge		
	The feeling of impact or vibration when accelerating	14	13A-56
	The feeling of impact or vibration when decelerating	15	13A-57
	Knocking	16	13A-57
Dieseling		17	13A-57
Too high CO and HC concentration when idling		18	13A-58
Low alternator output voltage (approx. 12.3 V)		19	13A-59
Fans (radiator fan, A/C condenser fan) are inoperative		20	13A-60
GDI ECO indicator lamp	GDI ECO indicator lamp does not illuminate.	21	13A-61
	GDI ECO indicator lamp remains illuminated and does not go off.	22	13A-61

PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

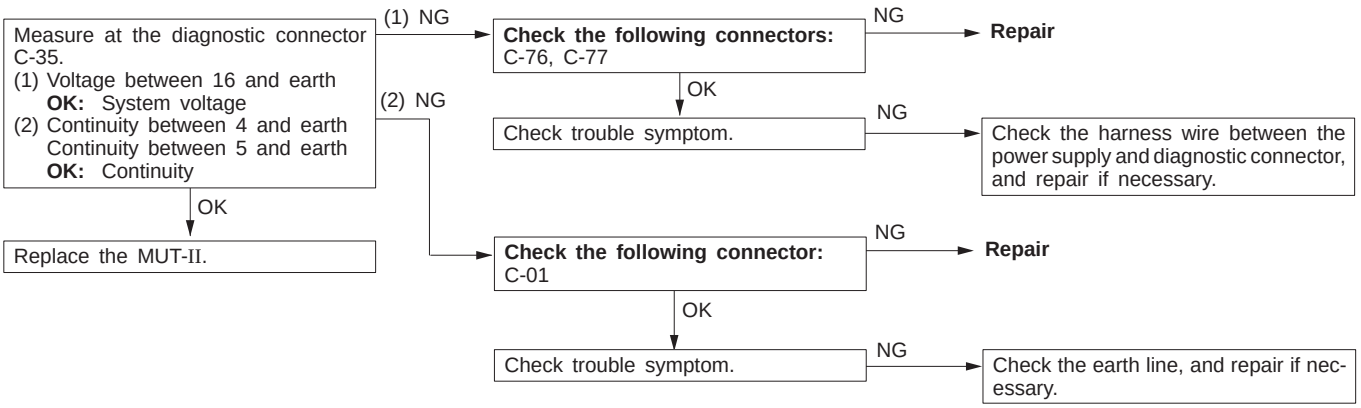
Items		Symptom
Starting	Won't start	The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.
	Fires up and dies	There is combustion within the cylinders, but then the engine soon stalls.
	Hard starting	Engine starts after cranking a while.
Idling stability	Hunting	Engine speed doesn't remain constant; changes at idle.
	Rough idle	Usually, a judgement can be based upon the movement of the tachometer pointer, and the vibration transmitted to the steering wheel, shift lever, body, etc. This is called rough idle.
	Incorrect idle speed	The engine doesn't idle at the usual correct speed.
	Engine stall (Die out)	The engine stalls when the foot is taken from the accelerator pedal, regardless of whether the vehicles is moving or not.
	Engine stall (Pass out)	The engine stalls when the accelerator pedal is depressed or while it is being used.
Driving	Hesitation, Sag	"Hesitation" is the delay in response of the vehicle speed (engine speed) that occurs when the accelerator is depressed in order to accelerate from the speed at which the vehicle is now traveling, or a temporary drop in vehicle speed (engine speed) during such acceleration. Serious hesitation is called "sag". 
	Poor acceleration	Poor acceleration is inability to obtain an acceleration corresponding to the degree of throttle opening, even though acceleration is smooth, or the inability to reach maximum speed.
	Stumble	Engine speed increase is delayed when the accelerator pedal is initially depressed for acceleration. 

Items		Symptom
Driving	Shock	The feeling of a comparatively large impact or vibration when the engine is accelerated or decelerated.
	Surge	This is repeated surging ahead during constant speed travel or during variable speed travel.
	Knocking	A sharp sound like a hammer striking the cylinder walls during driving and which adversely affects driving.
Stopping	Run on (“Dieseling”)	The condition in which the engine continues to run after the ignition switch is turned to OFF. Also called “Dieseling”.

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

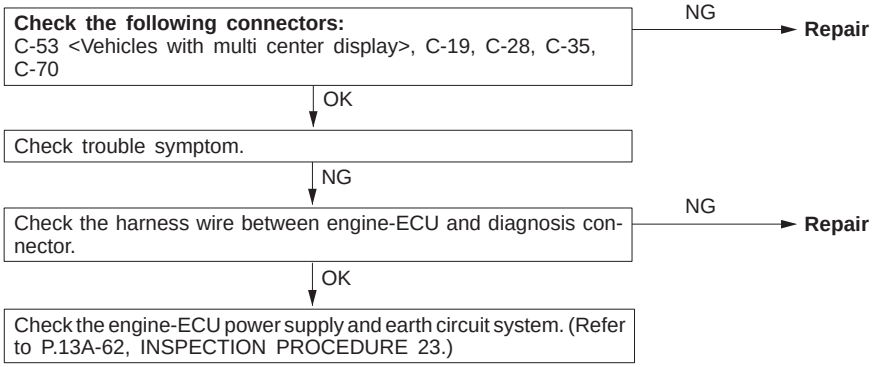
INSPECTION PROCEDURE 1

Communication with MUT-II is not possible. (Communication with all systems is not possible.)	**Probable cause**
The cause is probably a defect in the power supply system (including earth) for the diagnosis line.	• Malfunction of the connector • Malfunction of the harness wire • Malfunction of the MUT-II



INSPECTION PROCEDURE 2

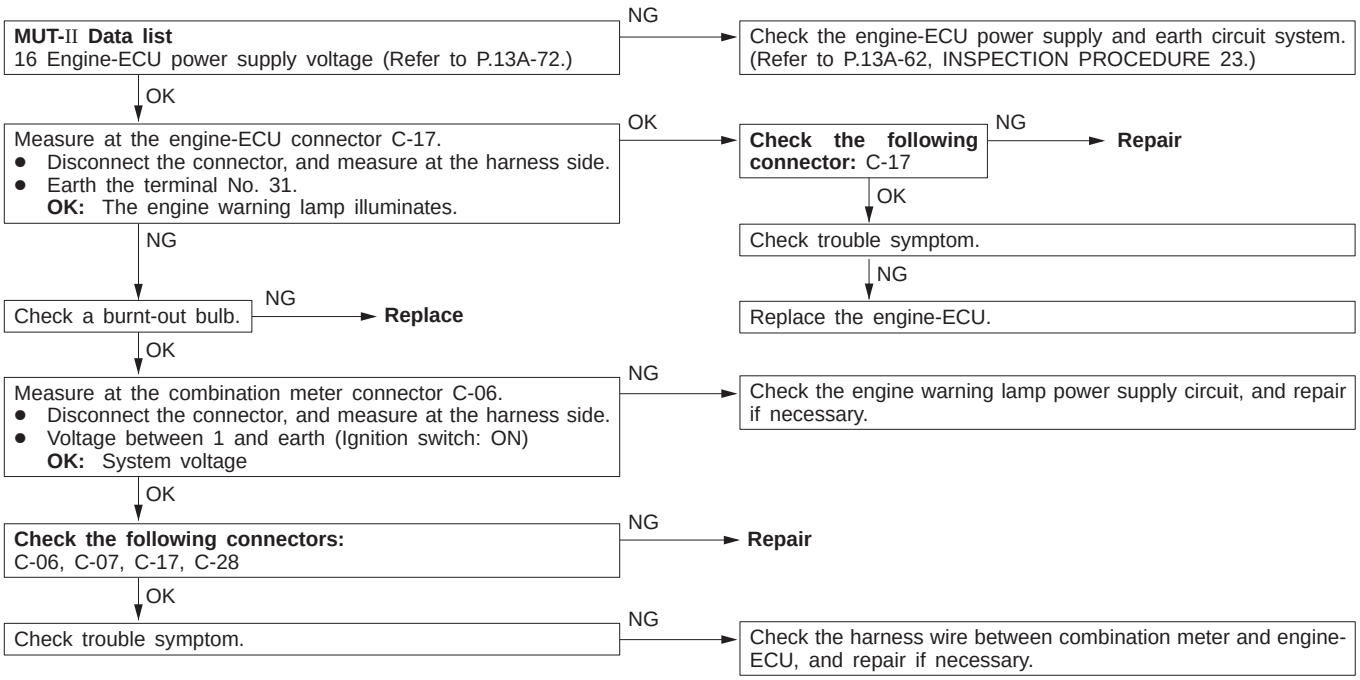
MUT-II communication with engine-ECU is impossible.	Probable cause
This may be caused by malfunction of engine-ECU power supply circuit and earth circuit.	• Malfunction of engine-ECU power supply circuit • Malfunction of engine-ECU • Open circuit between the engine-ECU and diagnosis connector



NOTE
On vehicles with multi center display, if a malfunction cannot be resolved after the procedure above, check the multi center display and replace if necessary. (Refer to GROUP 54 – Multi center display.)

INSPECTION PROCEDURE 3

The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position.	Probable cause
Because there is a burnt-out bulb, the engine-ECU causes the engine warning lamp to illuminate for five seconds immediately after the ignition switch is turned to ON. If the engine warning lamp does not illuminate immediately after the ignition switch is turned to ON, one of the malfunctions listed at right has probably occurred.	• Burnt-out bulb • Defective warning lamp circuit • Malfunction of the engine-ECU



INSPECTION PROCEDURE 4

The engine warning lamp remains illuminating and never goes out.	Probable cause
In cases such as the above, the cause is probably that the engine-ECU is detecting a problem in a sensor or actuator, or that one of the malfunctions listed at right has occurred.	• Short-circuit between the engine warning lamp and engine-ECU • Malfunction of the engine-ECU

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13A-14, INSPECTION CHART FOR DIAGNOSIS CODES
No ↓

Measure at the combination meter connector C-07.
- Disconnect the connector, and measure at the harness side.
- Disconnect the engine-ECU connector
- Continuity between 46 and earth
  OK: No continuity

NG → Check the harness wire between combination meter and engine-ECU connector, and repair if necessary.
OK ↓

Replace the engine-ECU.

INSPECTION PROCEDURE 5

No initial combustion (starting impossible)	Probable cause
This is caused by incorrect fuel supply into the combustion chamber, and improper ignition circuit. Besides that, foreign material may be contaminated in fuel.	• Malfunction of the fuel supply system • Malfunction of the ignition system • Malfunction of the engine-ECU

Check system voltage while the engine is cranking.
OK: 8 V or more
NG → Check the battery. (Refer to GROUP 55 – Battery.)
OK ↓

MUT-II Self-Diag code
Is a diagnosis code displayed?
Yes → Refer to P.13A-14, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

MUT-II Data list
16 System voltage (Refer to P.13A-72.)
NG → Check the engine control relay and ignition switch-IG system. (Refer to P.13A-62, INSPECTION PROCEDURE 24.)
OK ↓

Does the camshaft rotate when the engine is cranking?
No → Check if the timing belt is broken or damaged.
Yes ↓

MUT-II Actuator test
07 Fuel pump (low pressure) (Refer to P.13A-76.)
NG → Check the fuel pump (low pressure) system. (Refer to P.13A-66, INSPECTION PROCEDURE 28.)
OK ↓

MUT-II Data list
22 Crank angle sensor (Refer to P.13A-72.)
NG → Check the crank angle sensor system. (Refer to P.13A-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 22.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-72.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13A-19, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
OK ↓

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OK

MUT-II Data list
14 Throttle position sensor (2nd channel) (Refer to P.13A-72.)

NG → Check the throttle position sensor (2nd channel) system. (Refer to P.13A-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)

OK

Inspect engine start ability by cranking the engine while the accelerator pedal is slightly depressed.

OK → Clean around the throttle valve. (Refer to P.13A-92.)

NG

Check fuel leakage. (Refer to P.13A-99.)

NG → **Repair**

OK

Measure low fuel pressure between the fuel pump (low pressure) and fuel pump (high pressure). (Refer to P.13A-95.)

NG → **Repair**

OK

Measure at ignition coil connectors A-09, A-10, A-11, A-12.
- Connect the connector.
- Connect a timing light to the No.1 terminal of each connector in turn.
  (Engine cranking)
  OK: The timing light flashes.

NG → Check abnormal fuel combustion system. (Refer to P.13A-27, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 44.)

OK

Check ignition timing while the engine is cranking.
OK: Approx. 5° BTDC

NG → Check that the crank angle sensor and timing belt cover are properly installed.

OK

Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.

NG → Replace the ignition coil.

OK

Check all the following items:
- Spark plug
- Compression pressure
- Foreign material (such as water or kerosine) entered the fuel lines

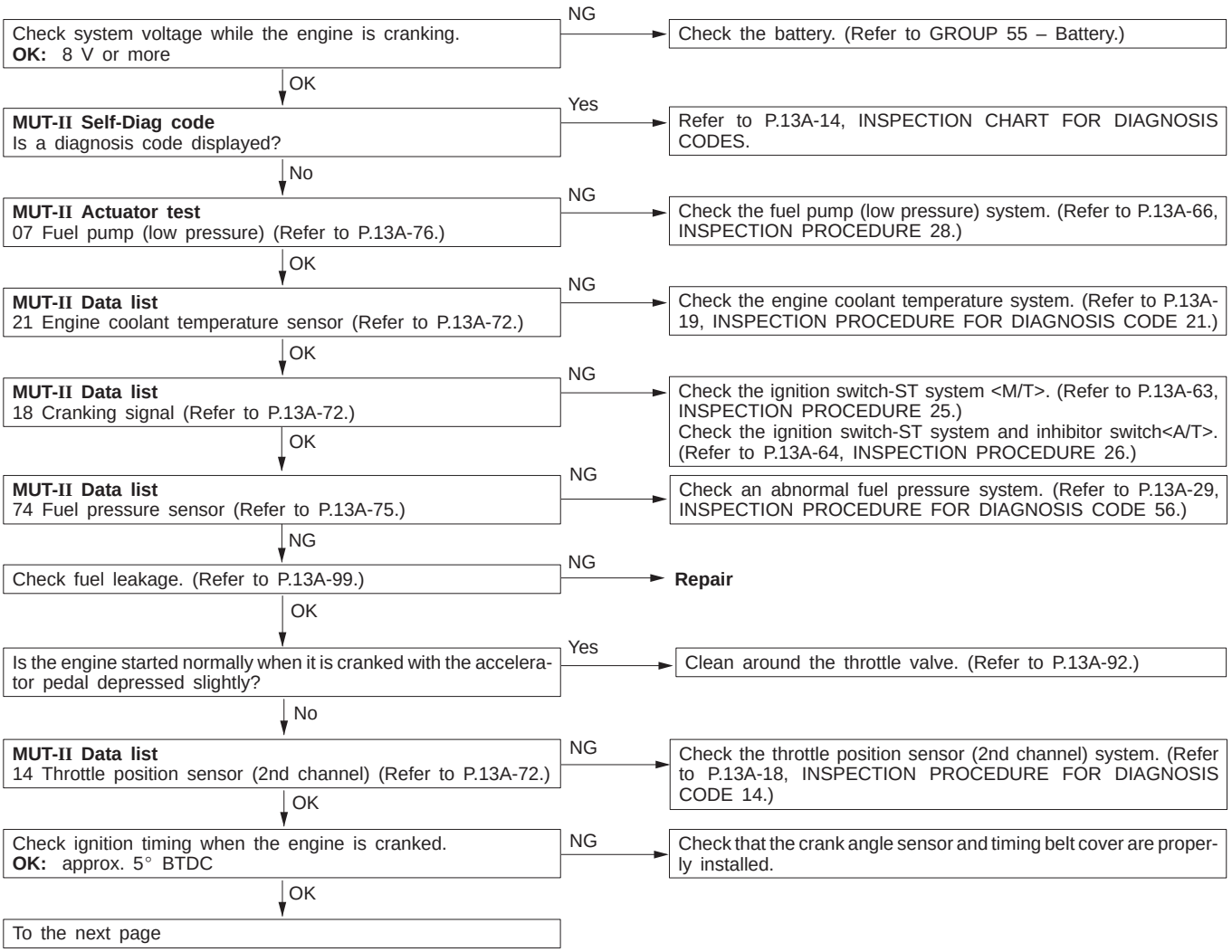
OK

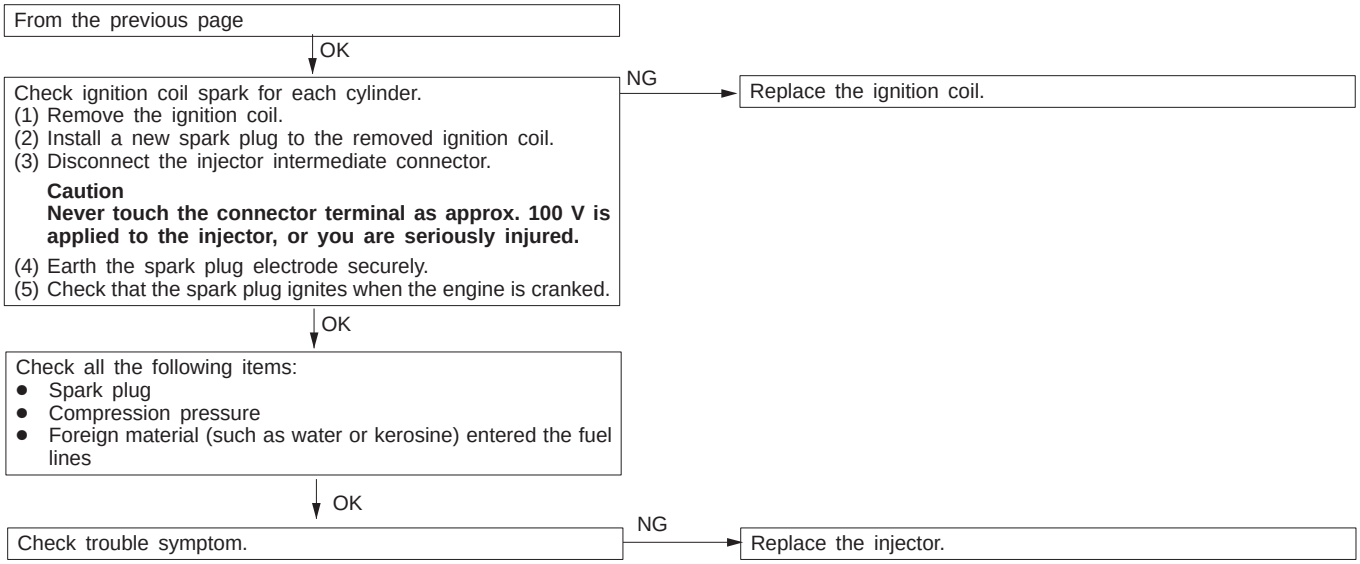
Check trouble symptom.

NG → Replace the injector.

INSPECTION PROCEDURE 6

Initial combustion takes place, but does not complete (start impossible), too long time to start (poor start)	Probable cause
This may be caused by improper spark plug ignition (poor spark), improper mixture during engine cranking, improper fuel pressure.	• Malfunction of the fuel supply system • Malfunction of the fuel pressure sensor • Malfunction of the ignition system • Malfunction of the electronic-controlled throttle vale system • Malfunction of the engine-ECU




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OK
Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.
Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.
(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.
NG
Replace the ignition coil.
OK
Check all the following items:
● Spark plug
● Compression pressure
● Foreign material (such as water or kerosine) entered the fuel lines
OK
Check trouble symptom.
NG
Replace the injector.

INSPECTION PROCEDURE 7

Unstable idling (rough idle, hunting)	Probable cause
This malfunction is probably caused by a faulty ignition system, improper air/fuel ratio, a faulty electronic-controlled throttle valve system, improper compression pressure, etc. As many causes can be suspected, diagnose from easier items.	• Malfunction of the ignition system • Malfunction of the air/fuel ratio control system • Malfunction of the electronic-control throttle valve system • Improper compression pressure • Air sucking into the air intake system

Has the battery been disconnected recently?
- Yes → Warm up the engine, and then let it run at idle for approx. ten minutes.
- No ↓

MUT-II Self-Diag code
Is a diagnosis code displayed?
- Yes → Refer to P.13A-14, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

Does the engine idle speed fluctuates excessively (excessive hunting)?
- Yes → Clean around the throttle valve. (Refer to P.13A-92.)
- No ↓

MUT-II Data list
14 Throttle position sensor (2nd channel) (Refer to P.13A-72.)
- NG → Check the throttle position sensor (2nd channel) system. (Refer to P.13A-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
- OK ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-75.)
- NG → Check the throttle valve position feedback system. (Refer to P.13A-37, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 92.)
- OK ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-73.)
- NG → Check the accelerator pedal position switch system. (Refer to P.13A-65, INSPECTION PROCEDURE 27.)
- OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-71.)
- NG → Check the intake air temperature sensor system. (Refer to P.13A-17, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
- OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-73.)
- NG → Check the barometric pressure sensor system. (Refer to P.13A-23, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-72.)
- NG → Check the engine coolant temperature sensor. (Refer to P.13A-19, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
- OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13A-76.)
- NG → Check the purge control solenoid valve system. (Refer to P.13A-68, INSPECTION PROCEDURE 30.)
- OK ↓

MUT-II Data list
11 Oxygen sensor
OK: 600 – 1,000 mV when the engine is suddenly raced
- NG → Check the oxygen sensor system. (Refer to P.13A-15, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 11.)
- OK ↓

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OK

MUT-II Data list
11 Oxygen sensor
OK: 0 – 400 mV and 600 – 1,000 mV alternates when the engine is idling (wait for four minutes after the engine started).

NG → Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-97.)

OK → Check that air is sucked in the air intake system.
- Broken intake manifold gasket
- Damaged vacuum hose
- Damaged air intake hose

NG → **Repair**

OK

MUT-II Data list
27 Power steering fluid pressure switch (Refer to P.13A-73.)

NG → Check the power steering fluid pressure switch system. (Refer to P.13A-69, INSPECTION PROCEDURE 31.)

OK

MUT-II Data list
28 A/C switch (Refer to P.13A-73.)

NG → Check the A/C switch and A/C relay system. (Refer to P.13A-69, INSPECTION PROCEDURE 32.)

OK

MUT-II Data list
29 Inhibitor switch (Refer to P.13A-73.)

NG → Check the ignition switch-ST and inhibitor switch. <A/T> (Refer to P.13A-64, INSPECTION PROCEDURE 26.)

OK

MUT-II Data list
67 Stop lamp switch (Refer to P.13A-74.)

NG → Check the stop lamp switch. (Refer to P.13A-70, INSPECTION PROCEDURE 33.)

OK

MUT-II Data list
31 Small lamp switch (Refer to P.13A-73.)

NG → Check the small lamp switch system. (Refer to P.13A-70, INSPECTION PROCEDURE 34.)

OK

MUT-II Data list
68 EGR valve (Refer to P.13A-74.)

NG → Check the EGR valve. (Refer to P.13A-67, INSPECTION PROCEDURE 29.)

OK

Check ignition timing. (Refer to GROUP 11A – Engine Adjustment.)

NG → Check that the crank angle sensor and timing belt cover are properly installed.

OK

Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.

NG → Replace the ignition coil.

OK

Clean around the throttle valve. (Refer to P.13A-92.)

Check trouble symptom.

NG

Check all the following items in that order.
(1) Spark plugs
(2) Exhaust gas emission control system
(3) EGR system
(4) Compression pressure
(5) Foreign material (such as water or kerosine)entered the fuel line.
(6) Air is sucked in the air intake system, or EGR gas leaks.
- Damaged intake manifold gasket
- Damaged air intake hose
- Damaged vacuum hose
- Faulty EGR valve seat

INSPECTION PROCEDURE 8

Idle speed is high or low (Improper idling)	Probable cause
The cause is probably that the intake air amount during idling is too great or too small.	• Malfunction of the electronic-controlled throttle valve system • Malfunction of the throttle body

MUT-II Self-Diag code
Is a diagnosis code displayed?
- Yes → Refer to P.13A-14, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

MUT-II Data list
14 Throttle position sensor (2nd channel) (Refer to P.13A-72.)
- NG → Check the throttle position sensor (2nd channel). (Refer to P.13A-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
- OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13A-76.)
- NG → Check the purge control solenoid valve. (Refer to P.13A-68, INSPECTION PROCEDURE 30.)
- OK ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-73.)
- NG → Check the accelerator pedal position switch system. (Refer to P.13A-65, INSPECTION PROCEDURE 27.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-72.)
- NG → Check the engine coolant temperature sensor. (Refer to P.13A-19, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
- OK ↓

MUT-II Data list
28 A/C switch (Refer to P.13A-73.)
- NG → Check the A/C switch and A/C relay system. (Refer to P.13A-69, INSPECTION PROCEDURE 32.)
- OK ↓

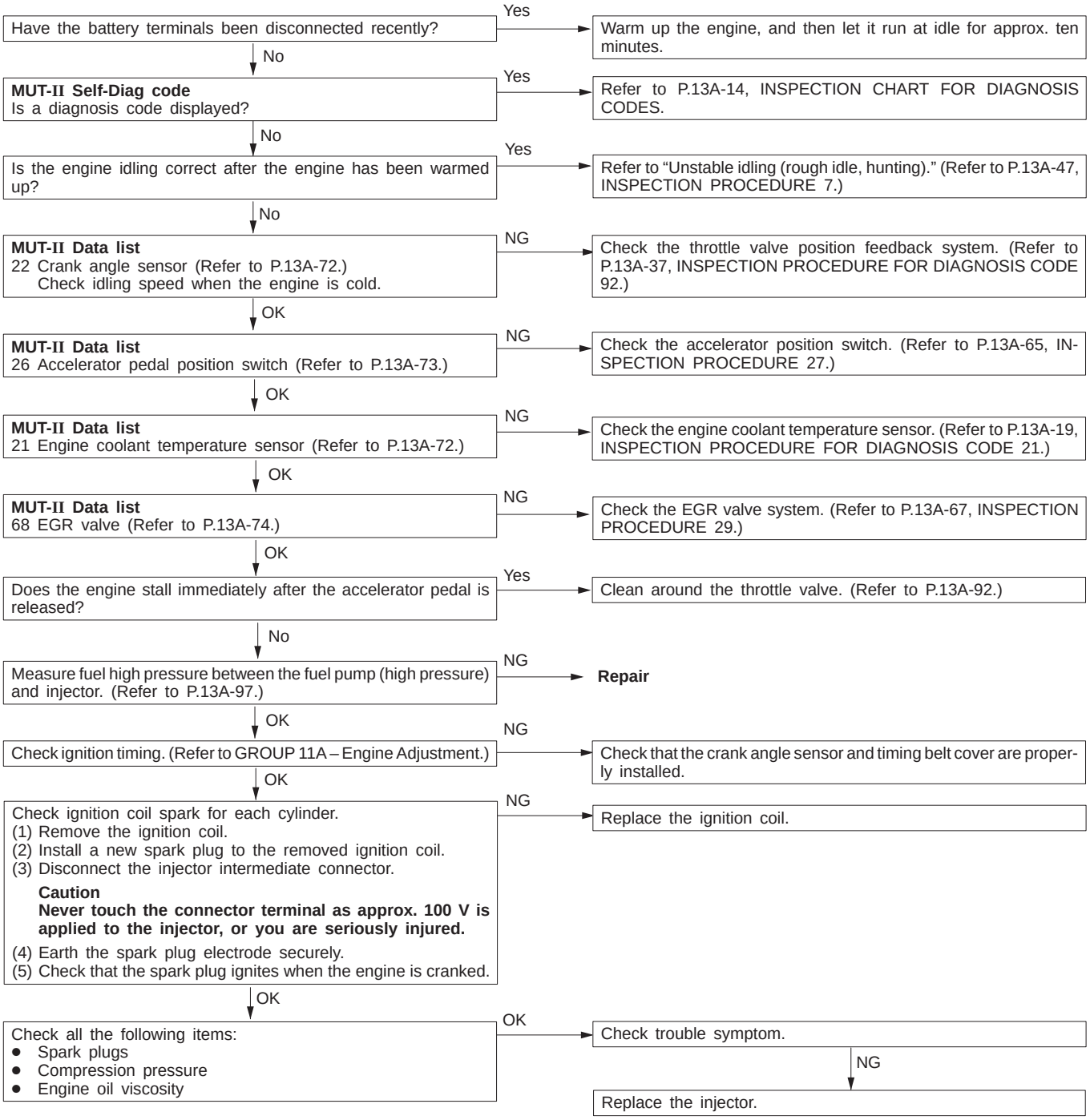
MUT-II Data list
29 Inhibitor switch (Refer to P.13A-73.)
- NG → Check the ignition switch-ST and inhibitor switch <A/T>. (Refer to P.13A-64, INSPECTION PROCEDURE 26.)
- OK ↓

MUT-II Data list
67 Stop lamp switch (Refer to P.13A-74.)
- NG → Check the stop lamp switch system. (Refer to P.13A-70, INSPECTION PROCEDURE 33.)
- OK ↓

- Clean around the throttle valve. (Refer to P.13A-92.)
- Adjust the throttle position sensor. (Refer to P.13A-92.)

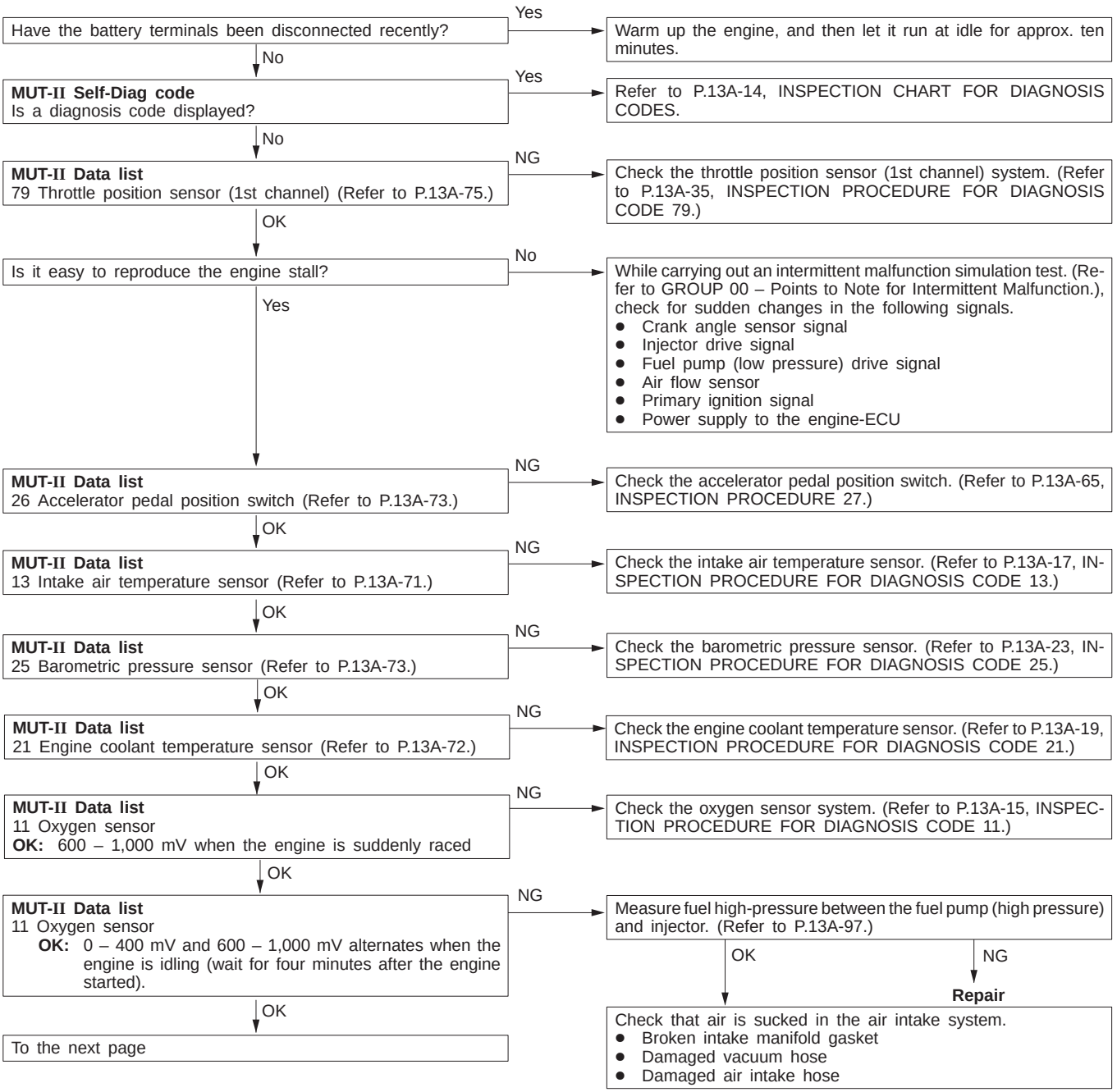
INSPECTION PROCEDURE 9

When the engine is cold, it stalls at idling. (Die out)	Probable cause
The cause is probably an incorrect air/fuel ratio or poor intake air amount when the engine is cold.	• Malfunction of the electronic-control throttle valve system • Malfunction of the throttle body



INSPECTION PROCEDURE 10

When the engine is hot, it stalls at idling. (Die out)	Probable cause
The cause is probably an improper air/fuel ratio, faulty electronic-controlled throttle valve system, compression pressure. In addition, if the engine stalls suddenly, another possible cause might be a poor connector contact.	• Malfunction of the ignition system • Malfunction of air/fuel ratio control system • Malfunction of electronic-controlled throttle valve system • Malfunction of the throttle body • Poor connector contact • Improper compression pressure • Air stuck in the air intake system



From the previous page

OK

MUT-II Data list
27 Power steering fluid pressure switch (Refer to P.13A-73.)

NG → Check the power steering fluid pressure switch system. (Refer to P.13A-69, INSPECTION PROCEDURE 31.)

OK

MUT-II Data list
28 A/C switch (Refer to P.13A-73.)

NG → Check the A/C switch and A/C relay system. (Refer to P.13A-69, INSPECTION PROCEDURE 32.)

OK

MUT-II Data list
29 Inhibitor switch (Refer to P.13A-73.)

NG → Check the ignition switch-ST and inhibitor switch <A/T>. (Refer to P.13A-64, INSPECTION PROCEDURE 26.)

OK

MUT-II Data list
31 Small lamp switch (Refer to P.13A-73.)

NG → Check the small lamp switch system. (Refer to P.13A-70, INSPECTION PROCEDURE 34.)

OK

MUT-II Data list
34 Air flow sensor reset signal (Refer to P.13A-73.)

NG → Check the air flow sensor system. (Refer to P.13A-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 12.)

OK

MUT-II Data list
68 EGR valve (Refer to P.13A-74.)

NG → Check the EGR valve system. (Refer to P.13A-67, INSPECTION PROCEDURE 29.)

OK

Does the engine stall immediately after the accelerator pedal is released?

Yes → Clean around the throttle valve. (Refer to P.13A-92.)

No

Check ignition timing. (Refer to GROUP 11A – Engine Adjustment.)

NG → Check that the crank angle sensor and timing belt cover are properly installed.

OK

Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.

NG → Replace the ignition coil.

OK

Check all the following items:
- Spark plugs
- Compression pressure
- Foreign material (such as water or kerosine) entered the fuel lines

INSPECTION PROCEDURE 11

The engine stalls when starting the car. (Pass out)	Probable cause
The cause is probably poor ignition due to a malfunctioning spark plug (weak spark), or an incorrect air/fuel ratio when the accelerator is depressed.	• Malfunction of the ignition system • Malfunction of the EGR valve • Air stuck in the air intake system

MUT-II Self-Diag code
Is a diagnosis code displayed?
→ Yes: Refer to P.13A-14, INSPECTION CHART FOR DIAGNOSIS CODES.
↓ No

MUT-II Data list
68 EGR valve (Refer to P.13A-74.)
→ NG: Check the EGR valve system. (Refer to P.13A-67, INSPECTION PROCEDURE 29.)
↓ OK

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13A-76.)
→ NG: Check the purge control solenoid valve system. (Refer to P.13A-68, INSPECTION PROCEDURE 30.)
↓ OK

Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.

→ NG: Replace the ignition coil.
↓ OK

Check all the following items:
(1) Spark plug
(2) Check if air is stuck in the air intake system.
- Damage intake manifold gasket
- Damaged or disconnected vacuum hose
- Damaged air intake hose

INSPECTION PROCEDURE 12

The engine stalls when decelerating.	Probable cause
The cause is probably an improper air/fuel ratio due to a faulty EGR system, or poor intake air volume due to a faulty electronic-controlled throttle valve system.	• Malfunction of the electronic-controlled throttle valve system • Malfunction of the EGR valve

Have the battery terminals been disconnected recently?
- Yes → Warm up the engine, and then let it run at idle for approx. ten minutes.
- No ↓

MUT-II Self-Diag code
Is a diagnosis code displayed?
- Yes → Refer to P.13A-14, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-73.)
- NG → Check the accelerator pedal position switch. (Refer to P.13A-65, INSPECTION PROCEDURE 27.)
- OK ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-75.)
- NG → Check the throttle valve position feedback system. (Refer to P.13A-37, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 92.)
- OK ↓

MUT-II Data list
68 EGR valve (Refer to P.13A-74.)
- NG → Check the EGR valve system. (Refer to P.13A-67, INSPECTION PROCEDURE 29.)
- OK ↓

Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.
- NG → Replace the ignition coil.
- OK ↓

Check all the following items:
- Spark plug
- Clean around the throttle valve (Refer to P.13A-92.)

INSPECTION PROCEDURE 13

Hesitation, sag, stumble, poor acceleration or surge	Probable cause
The cause is probably a malfunction of the ignition system, electronic-controlled throttle valve system, compression pressure, etc.	• Malfunction of the ignition system • Malfunction of the air/fuel ratio control system • Malfunction of the electronic-controlled throttle valve system • Improper compression pressure • Air stuck in the air intake system

MUT-II Self-Diag code
Is a diagnosis code displayed?
Yes → Refer to P.13A-14, INSPECTION CHART FOR DIAGNOSIS CODES.
NO ↓

Check ignition timing. (Refer to GROUP 11A – Engine Adjustment.)
NG → Check that the crank angle sensor and timing belt cover are properly installed.
OK ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-73.)
NG → Check the accelerator pedal position switch. (Refer to P.13A-65, INSPECTION PROCEDURE 27.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-71.)
NG → Check the intake air temperature sensor. (Refer to P.13A-17, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-73.)
NG → Check the barometric pressure sensor. (Refer to P.13A-23, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-72.)
NG → Check the engine coolant temperature sensor. (Refer to P.13A-19, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
OK ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-75.)
NG → Check the throttle valve position feedback system. (Refer to P.13A-38, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 99.)
OK ↓

MUT-II Data list
11 Oxygen sensor
OK: 600 – 1,000 mV when the engine is suddenly raced
NG → Check the oxygen sensor system. (Refer to P.13A-15, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 11.)
OK ↓

MUT-II Data list
11 Oxygen sensor
OK: 0 – 400 mV and 600 – 1,000 mV alternates when the engine is idling (wait for four minutes after the engine started).
NG → Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-97.)
OK ↓

Check that air is sucked in the air intake system.
- Broken intake manifold gasket
- Damaged vacuum hose
- Damaged air intake hose

OK ↓

MUT-II Data list
68 EGR valve (Refer to P.13A-74.)
NG → Check the EGR valve system. (Refer to P.13A-67, INSPECTION PROCEDURE 29.)
OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13A-76.)
NG → Check the purge control solenoid valve. (Refer to P.13A-68, INSPECTION PROCEDURE 30.)
OK ↓

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↓ OK

Measure high fuel pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-97.) — NG → **Repair**

↓ OK

Check ignition coil spark for each cylinder. — NG → Replace the ignition coil.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.

↓ OK

Check all the following items: — OK → Check trouble symptom. — NG → Replace the injector.
- Spark plug
- EGR system
- Compression pressure
- Clogged fuel filter, fuel line

INSPECTION PROCEDURE 14

The feeling of impact when accelerating	Probable cause
The cause is probably an ignition leak being generated in line with an increase in the spark plug request voltage during acceleration.	• Malfunction of the ignition system

MUT-II Self-Diag code
Is a diagnosis code displayed? — Yes → (Refer to P.13A-14, INSPECTION CHART FOR DIAGNOSIS CODES.)

↓ No

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-75.) — NG → Check the throttle valve position feedback system. (Refer to P.13A-37, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 92.)

↓ OK

Check ignition coil spark for each cylinder. — OK → Check all the following items:
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.

- Spark plug
- Ignition current leak

NG → Replace the ignition coil.

INSPECTION PROCEDURE 15

The feeling of impact when decelerating	Probable cause
The cause is probably insufficient intake air due to a faulty electronic-controlled throttle valve system.	• Malfunction of the electronic-controlled throttle valve system

MUT-II Self-Diag code
Is a diagnosis code displayed?
- Yes → Refer to P.13A-14, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-75.)
- NG → Check the throttle valve position feedback system. (Refer to P.13A-37, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 92.)
- OK ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-73.)
- NG → Check the accelerator pedal position switch system. (Refer to P.13A-65, INSPECTION PROCEDURE 27.)
- OK ↓

Clean around the throttle valve. (Refer to P.13A-92.)

INSPECTION PROCEDURE 16

Knocking	Probable cause
The cause is probably incorrect detonation control or improper heat range of the spark plugs.	• Malfunction of the detonation sensor • Improper heat range of the spark plugs

MUT-II Self-Diag code
Is a diagnosis code displayed?
- Yes → Refer to P.13A-14, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

Does knocking occur when the vehicle is driven with the detonation sensor disconnected?
(At this time, use the MUT-II to check whether the ignition timing is retarded from when the detonation sensor connector is connected.)
- No → Check the detonation sensor system. (Refer to P.13A-24, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 31.)
- Yes ↓

Check all the following items:
- Spark plug
- Foreign material (such as water or kerosine) entered the fuel lines

INSPECTION PROCEDURE 17

Run-on (dieseling)	Probable cause
The cause is probably fuel leak from injector(s)	• Malfunction of the injector

Replace the injector.

INSPECTION PROCEDURE 18

Too high CO and HC concentration when idling	Probable cause
The cause is probably an incorrect air/fuel ratio	• Malfunction of air/fuel ratio control system • Deterioration of the catalyst

MUT-II Self-Diag code
Is a diagnosis code displayed?
Yes → Refer to P.13A-14, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

Check ignition timing. (Refer to GROUP 11A – Engine Adjustment.)
NG → Check that the crank angle sensor and timing belt cover are properly installed.
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-72.)
NG → Check the engine coolant temperature sensor. (Refer to P.13A-19, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-71.)
NG → Check the intake air temperature sensor. (Refer to P.13A-17, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-73.)
NG → Check the barometric pressure sensor. (Refer to P.13A-23, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)
OK ↓

MUT-II Data list
11 Oxygen sensor
OK: 600 – 1,000 mV when the engine is suddenly raced
NG → Check the oxygen sensor system. (Refer to P.13A-15, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 11.)
OK ↓

MUT-II Data list
11 Oxygen sensor
OK: 0 – 400 mV and 600 – 1,000 mV alternates when the engine is idling (wait for four minutes after the engine started).
OK → Replace the oxygen sensor. → Check trouble symptom.
NG ↓

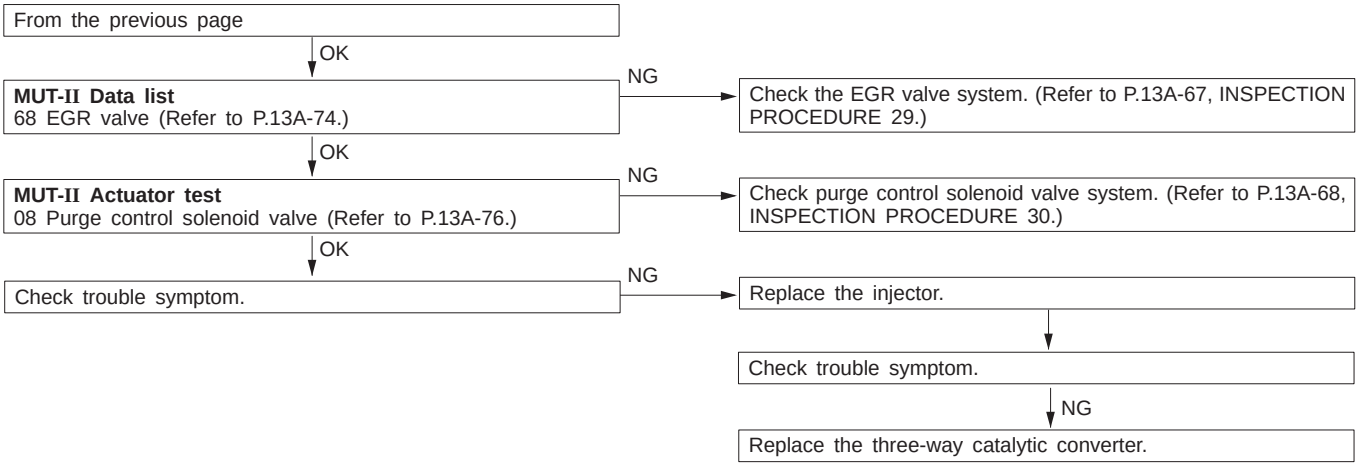
Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-97.)
NG → **Repair**
OK ↓

Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.
Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.
(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.
NG → Replace the ignition coil.
OK ↓

Check all the following items:
- Spark plug
- EGR system
- Compression pressure
- Clogged fuel filter or line

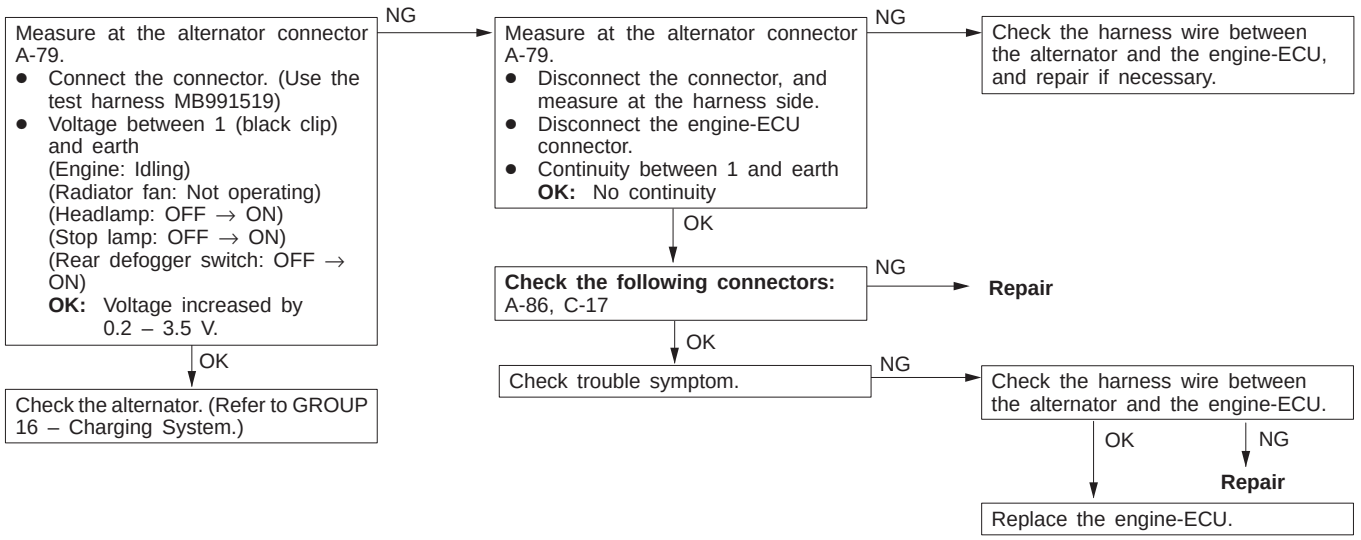
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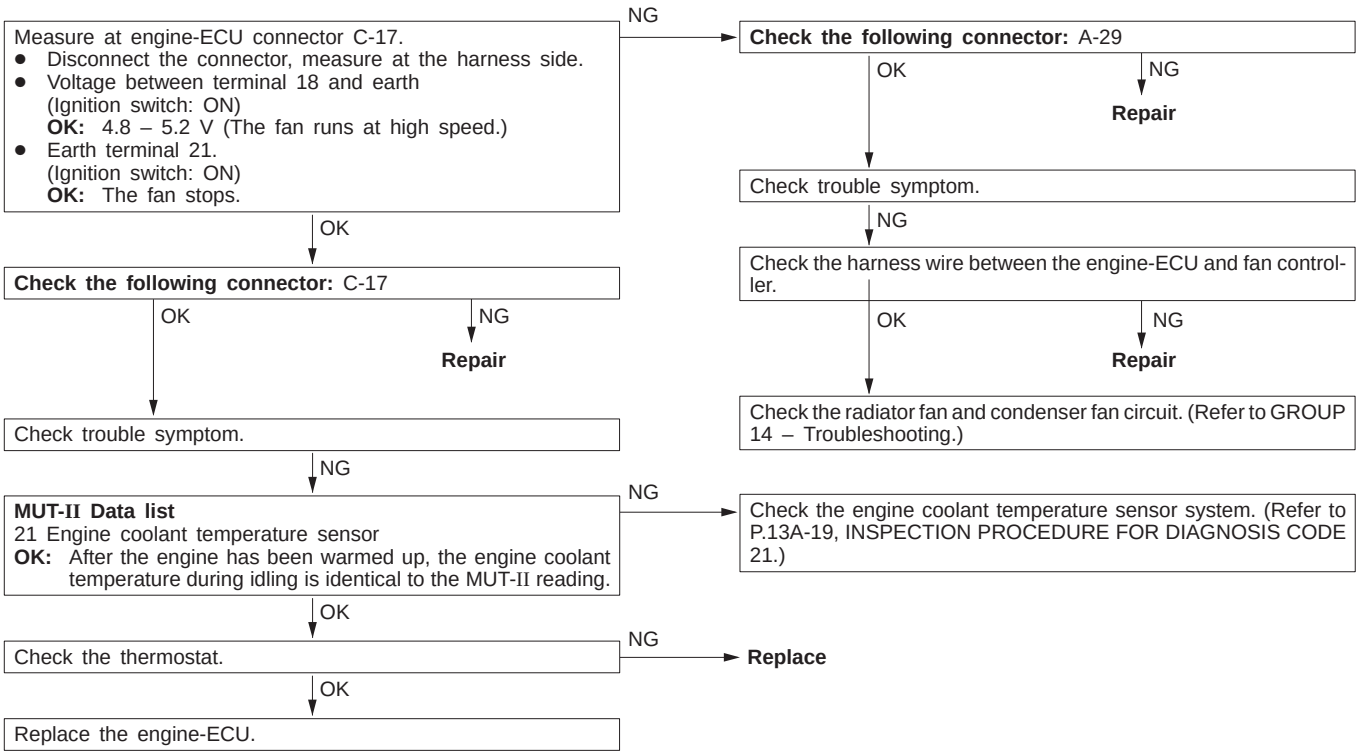
INSPECTION PROCEDURE 19

Low alternator output voltage (approx. 12.3 V)	Probable cause
The cause is probably a malfunction of the alternator or one of the problems listed at right.	• Malfunction of the charging system • Open circuit between the alternator G terminal and the engine-ECU • Malfunction of the engine-ECU



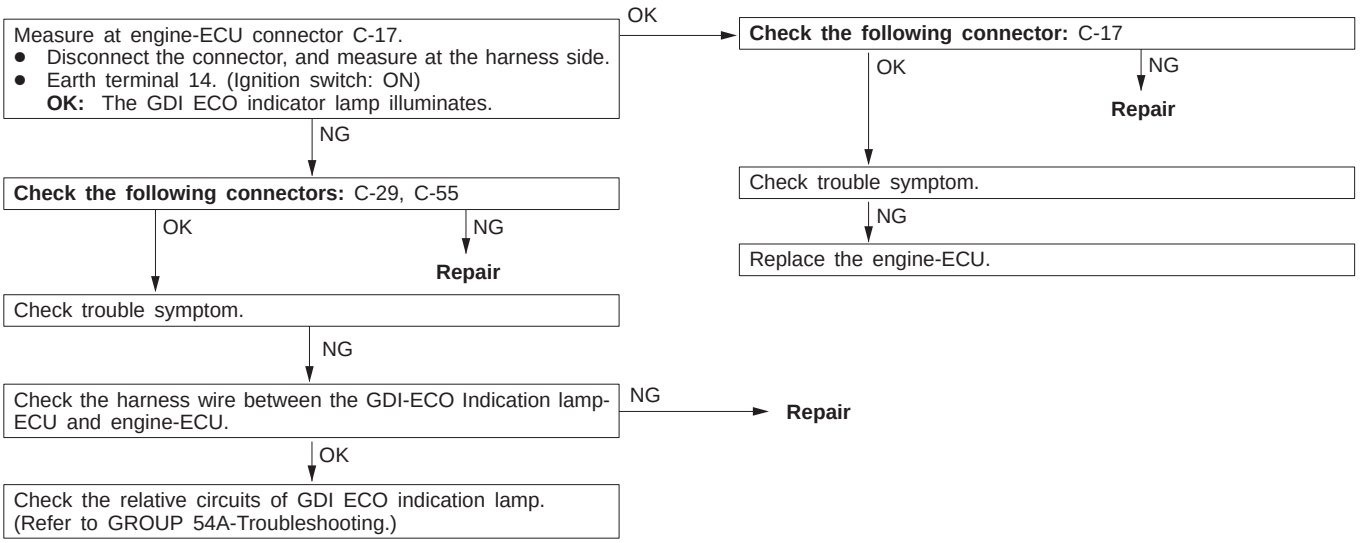
INSPECTION PROCEDURE 20

Fans (radiator fan, A/C condenser fan) are inoperative.	Probable cause
The engine-ECU sends a duty signal to the fan controller according to engine coolant temperature, vehicle speed, or A/C switch. The fan controller controls radiator fan and condenser fan speeds, based on this signal. (The closer the terminal voltage comes to 5 V, the higher the fan speed becomes.)	• Malfunction of the fan motor relay • Malfunction of the fan motor • Malfunction of the fan controller • Open or short circuit, or poor connector contact • Malfunction of the engine-ECU



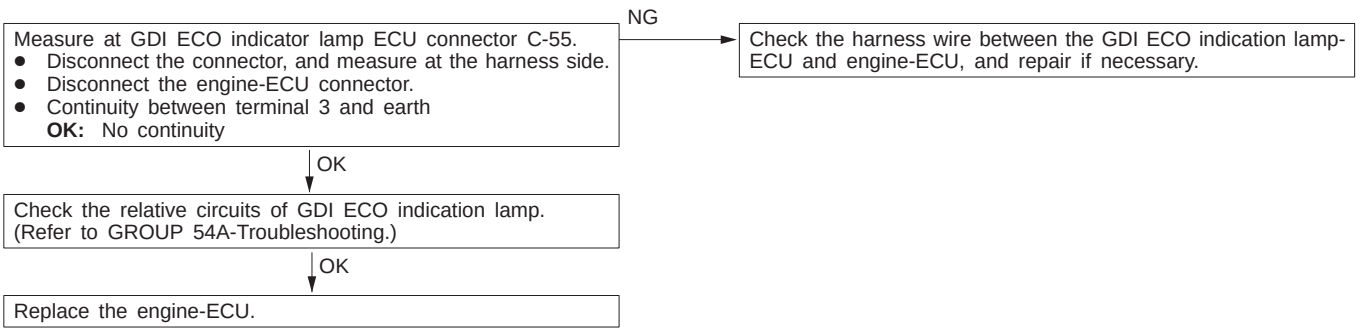
INSPECTION PROCEDURE 21

GDI ECO indicator lamp does not illuminate.	Probable cause
If the GDI ECO indicator lamp does not illuminate after turning switch, the causes listed in the right column are suspected.	• Burned-out GDI ECO indicator lamp bulb • Open circuit or short-circuited harness wire in the GDI ECO indicator lamp circuit • Malfunction of the engine-ECU • Malfunction of the GDI ECO indicator lamp ECU



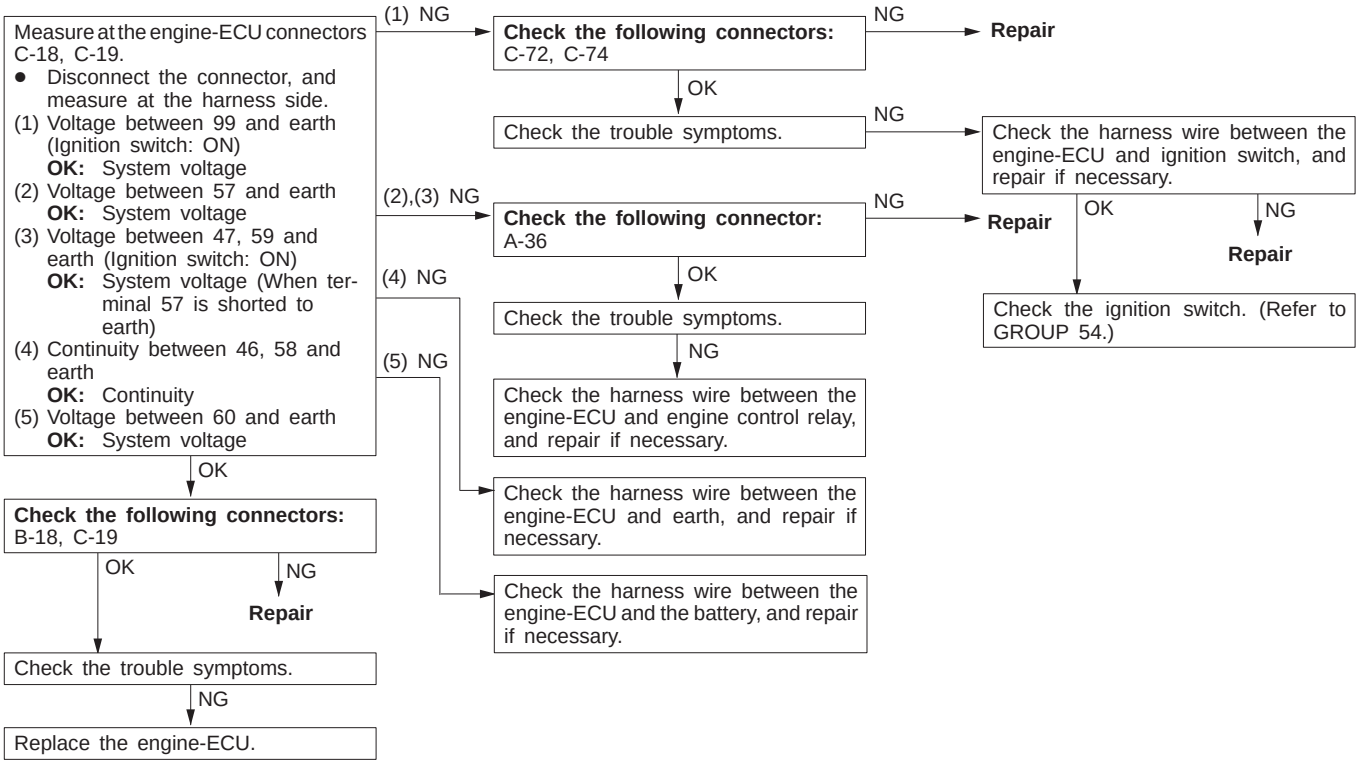
INSPECTION PROCEDURE 22

GDI ECO indicator lamp remains illuminated and does not go off.	Probable cause
If the GDI ECO indicator lamp does not go off during high load operation, the causes listed in the right column are suspected.	• Short circuit between the GDI ECO indicator lamp and engine-ECU • Malfunction of the engine-ECU • Malfunction of the GDI ECO indicator lamp ECU



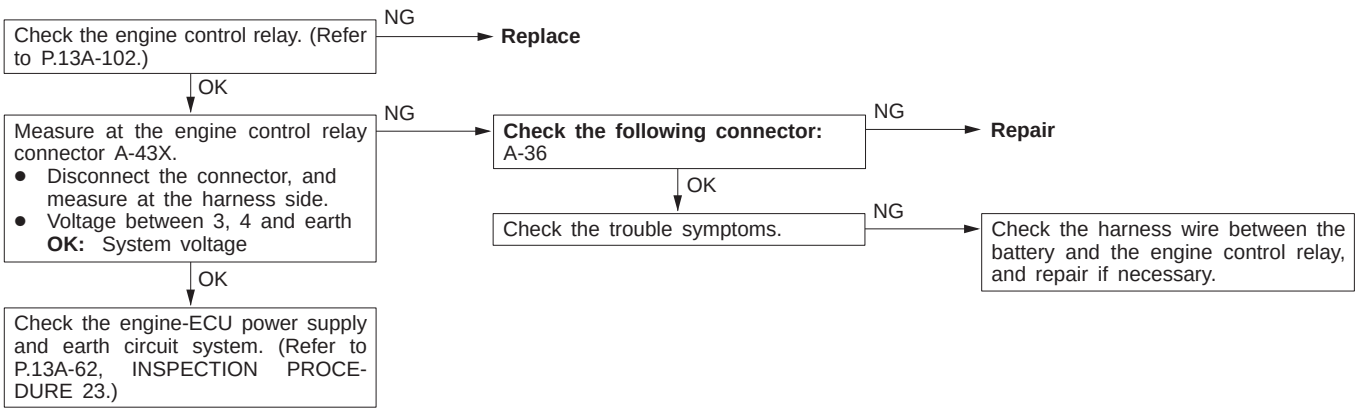
INSPECTION PROCEDURE 23

Engine-ECU power supply and earth circuit system	Probable cause
The cause is probably a malfunction of the engine-ECU or one of the problems listed at right.	• Open circuit or short-circuited harness wire in the engine-ECU power supply circuit • Open circuit or short-circuited harness wire in the engine-ECU earth circuit • Malfunction of the engine-ECU



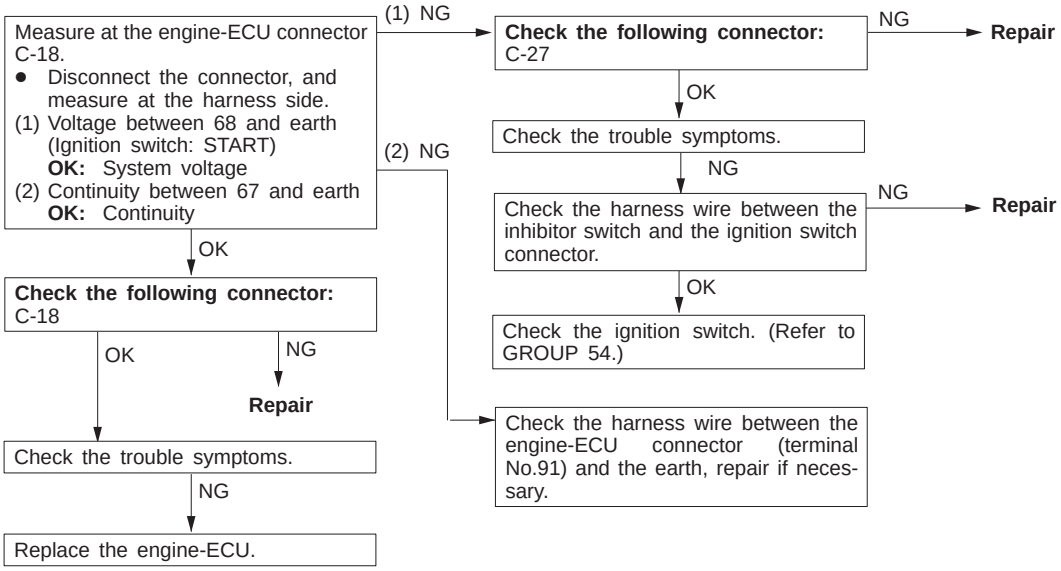
INSPECTION PROCEDURE 24

Engine control relay and ignition switch-IG system	Probable cause
When the ignition switch ON signal is input to the engine-ECU, the engine-ECU turns on the engine control relay. This causes system voltage to be supplied to the engine-ECU and to the sensors and actuators.	• Malfunction of the ignition switch • Malfunction of the engine control relay • Open circuit or short-circuited harness wire of the engine control relay circuit • Malfunction of the engine-ECU



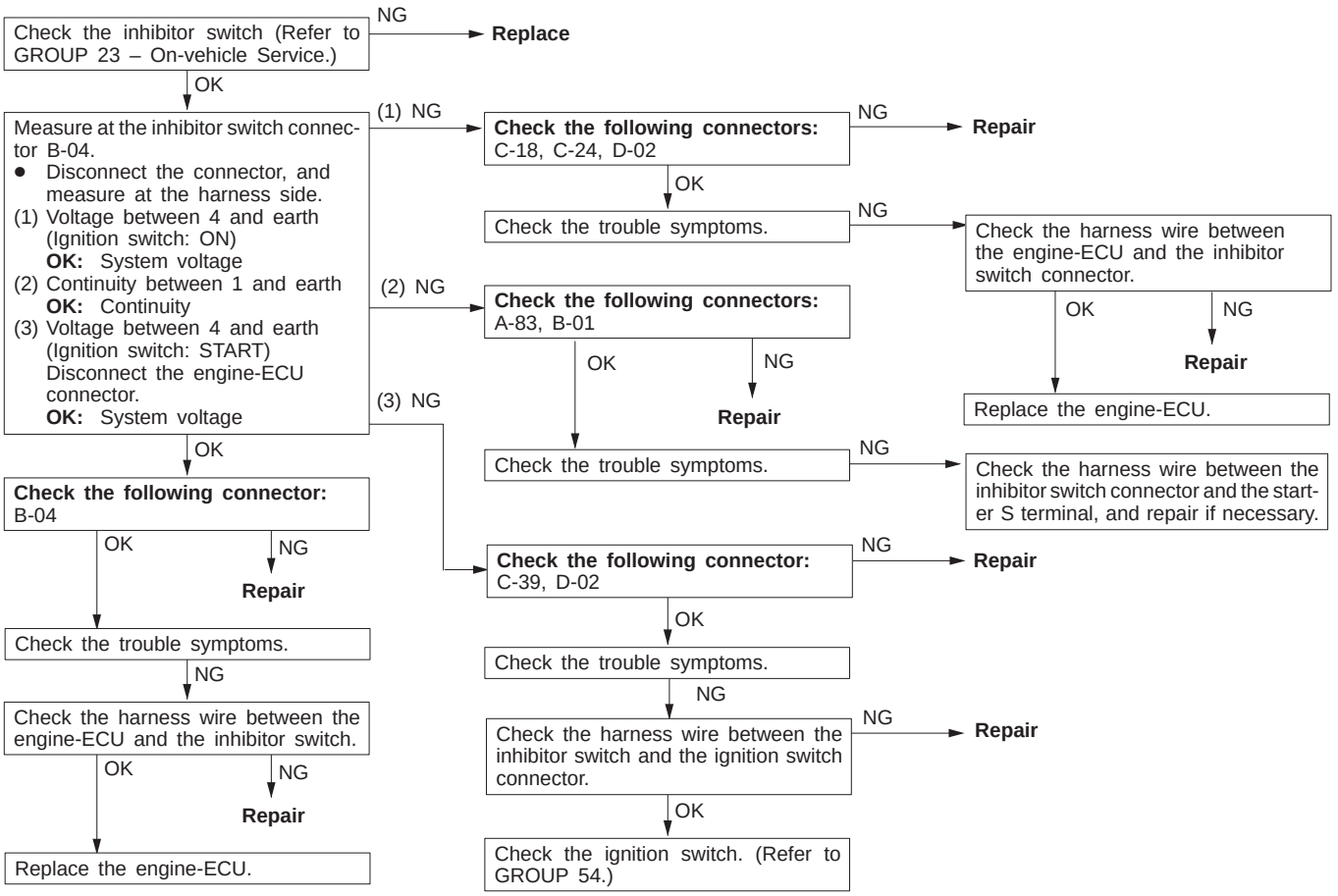
INSPECTION PROCEDURE 25

Ignition switch-ST system <M/T>	Probable cause
The ignition switch-ST outputs a HIGH signal to the engine-ECU while the engine is cranking, and the engine-ECU uses this signal to carry out functions such as fuel injection control during starting.	• Malfunction of the ignition switch • Open circuit or short-circuited harness wire between ignition switch • Malfunction of the engine-ECU



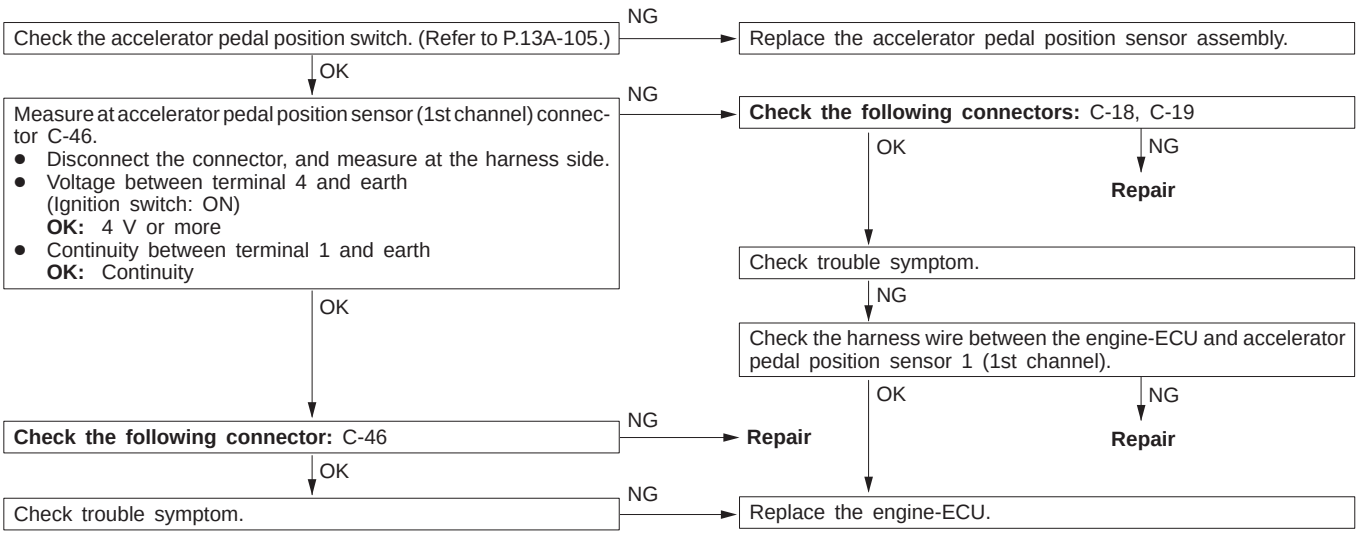
INSPECTION PROCEDURE 26

Ignition switch-ST and inhibitor switch system <A/T>	Probable cause
The ignition switch-ST outputs a HIGH signal to the engine-ECU while the engine is cranking, and the engine-ECU uses this signal to carry out functions such as fuel injection control during starting. The inhibitor switch inputs the position of the selector lever to the engine-ECU. The engine-ECU uses this signal to carry out idle speed control.	• Malfunction of the ignition switch • Malfunction of the inhibitor switch • Open circuit or short-circuited harness wire between ignition switch and inhibitor switch • Malfunction of the engine-ECU



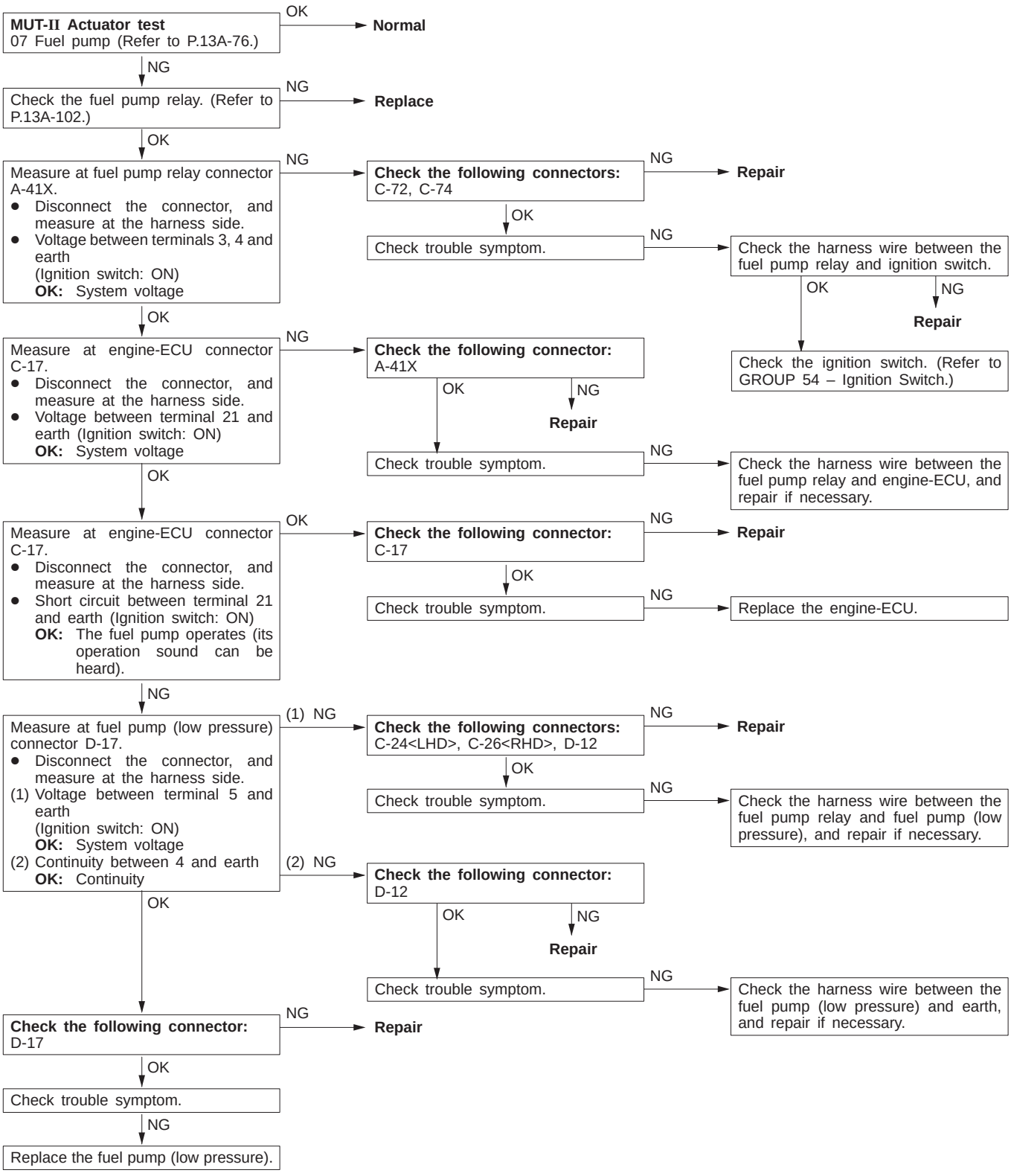
INSPECTION PROCEDURE 27

Accelerator pedal position switch system	Probable cause
The accelerator pedal position switch detects that the accelerator pedal is fully closed, and sends a signal to the engine-ECU. The engine-ECU controls idle speed, based on this signal.	• Maladjustment of the accelerator cable • Maladjustment of the accelerator pedal position switch • Open circuit or short-circuited harness wire in the accelerator pedal position switch system, or poor connector contact • Malfunction of the engine-ECU



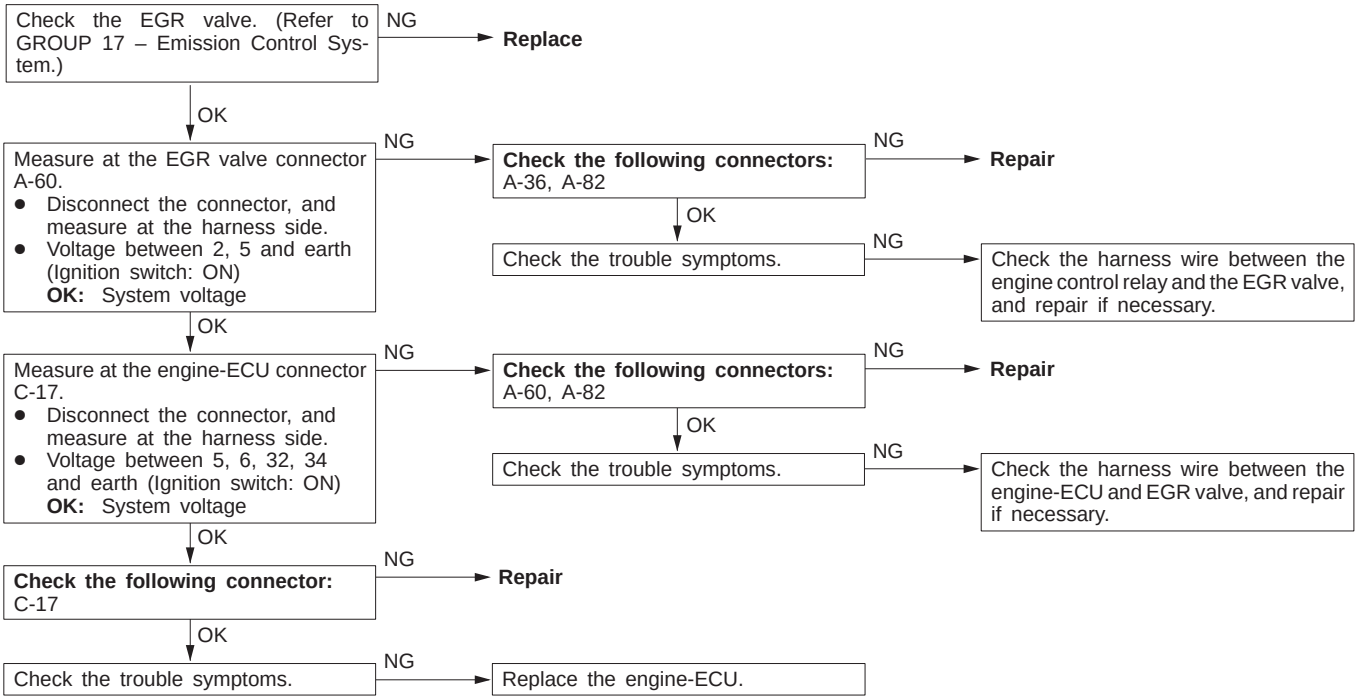
INSPECTION PROCEDURE 28

Fuel pump (low pressure) system	Probable cause
The engine-ECU turns on the fuel pump relay while the engine is cranking or running, and supplies power source to the fuel pump (low pressure).	• Malfunction of the fuel pump relay • Malfunction of the fuel pump (low pressure) • Open circuit or short-circuited harness wire in the fuel pump (low pressure) circuit, or poor connector contact • Malfunction of the engine-ECU



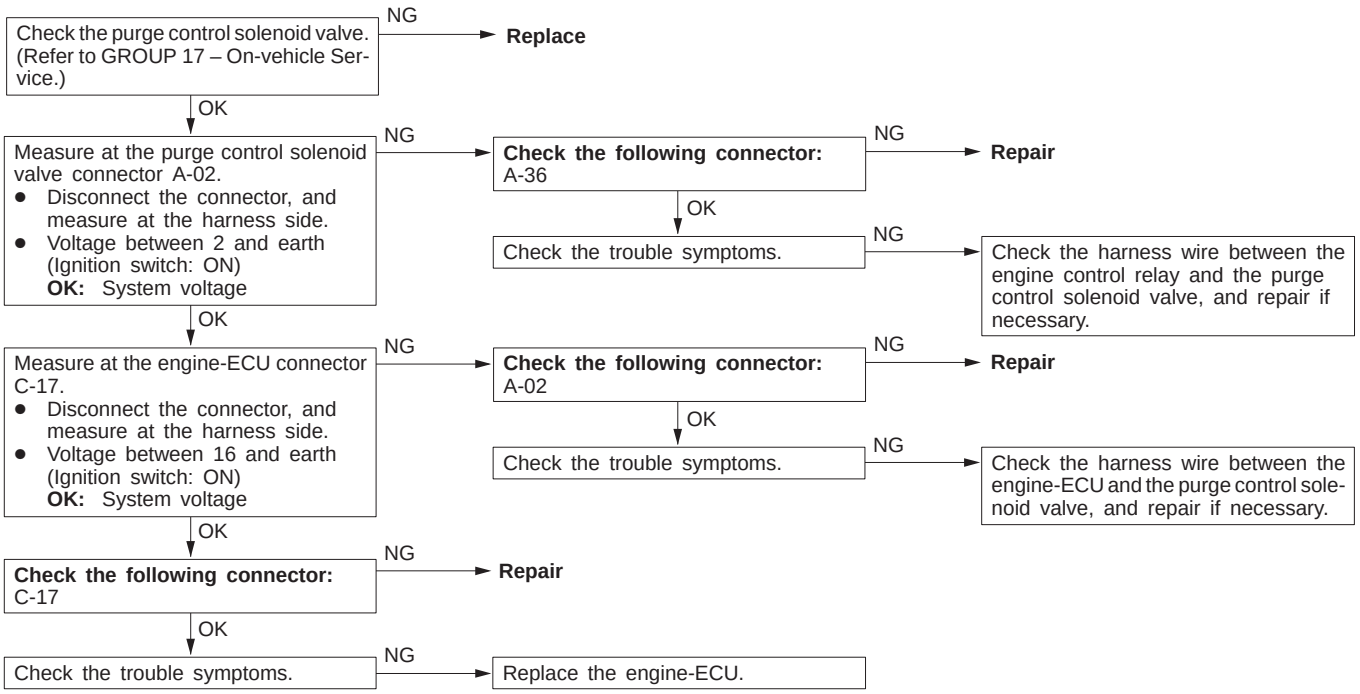
INSPECTION PROCEDURE 29

EGR valve system	Probable cause
The engine-ECU controls the EGR valve in order to control the amount of exhaust gas mixed in the intake air.	• Malfunction of the EGR valve • Open circuit or short-circuited harness wire in the EGR valve circuit • Malfunction of the engine-ECU



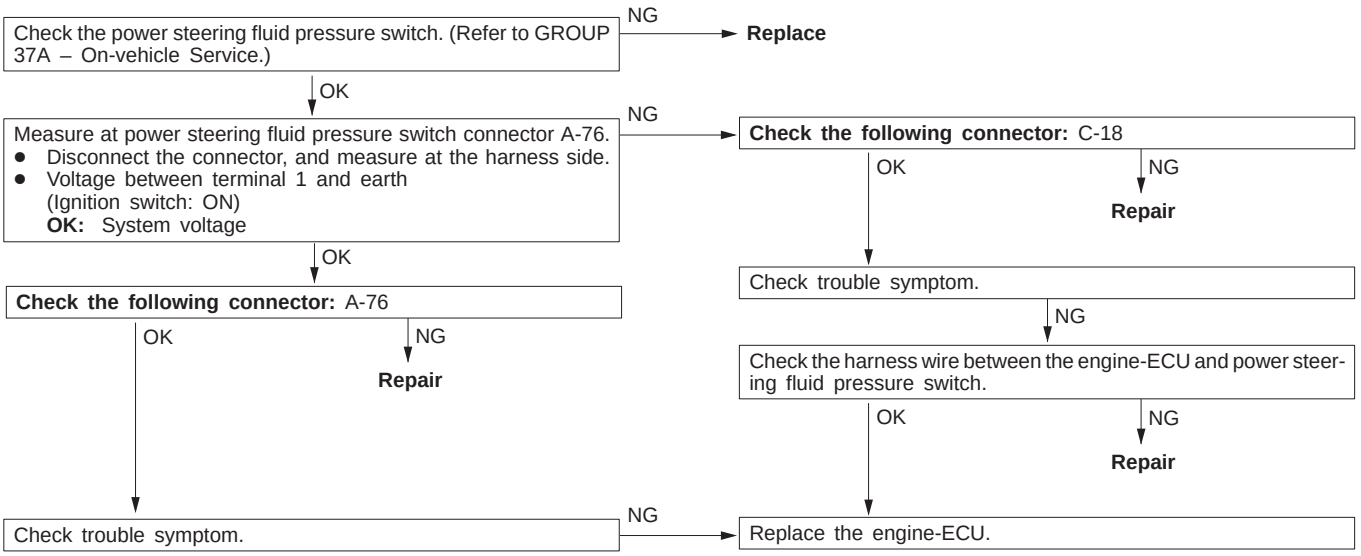
INSPECTION PROCEDURE 30

Purge control solenoid valve system	Probable cause
The engine-ECU controls the purge control solenoid valve in order to control the purge air coming from the canister.	• Malfunction of the purge control solenoid valve • Open circuit or short-circuited harness wire in the purge control solenoid valve circuit • Malfunction of the engine-ECU



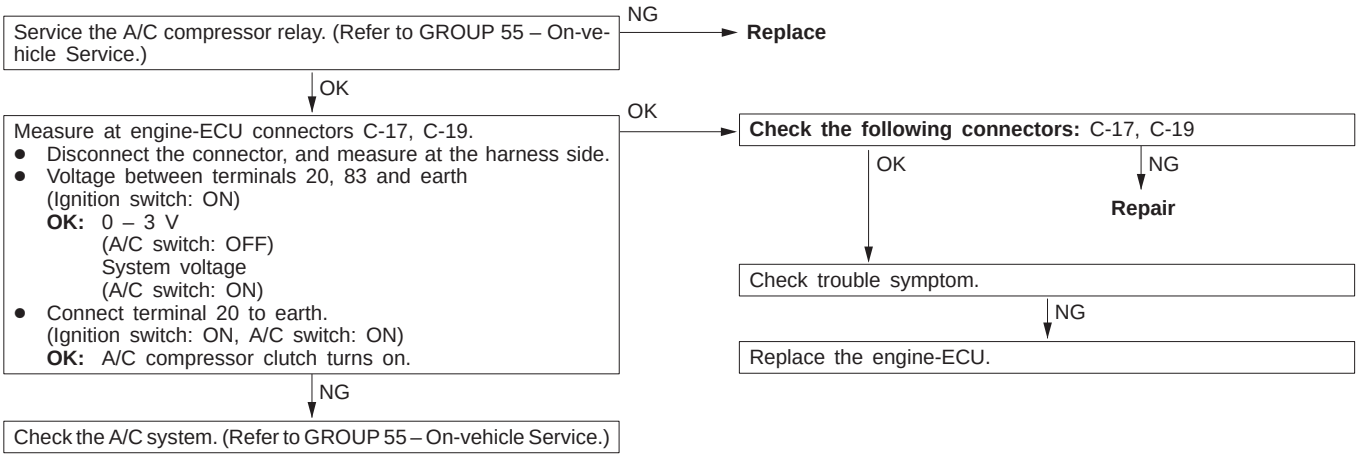
INSPECTION PROCEDURE 31

Power steering fluid pressure switch system	Probable cause
The power steering fluid pressure switch sends a signal to the engine-ECU according to power steering load. Based on this signal, the engine-ECU controls the throttle control servo so that idle speed increases when the power steering is in operation.	• Malfunction of the power steering fluid pressure switch • Open circuit or short-circuited harness wire in the power steering fluid pressure switch circuit, or poor connector contact • Malfunction of the engine-ECU



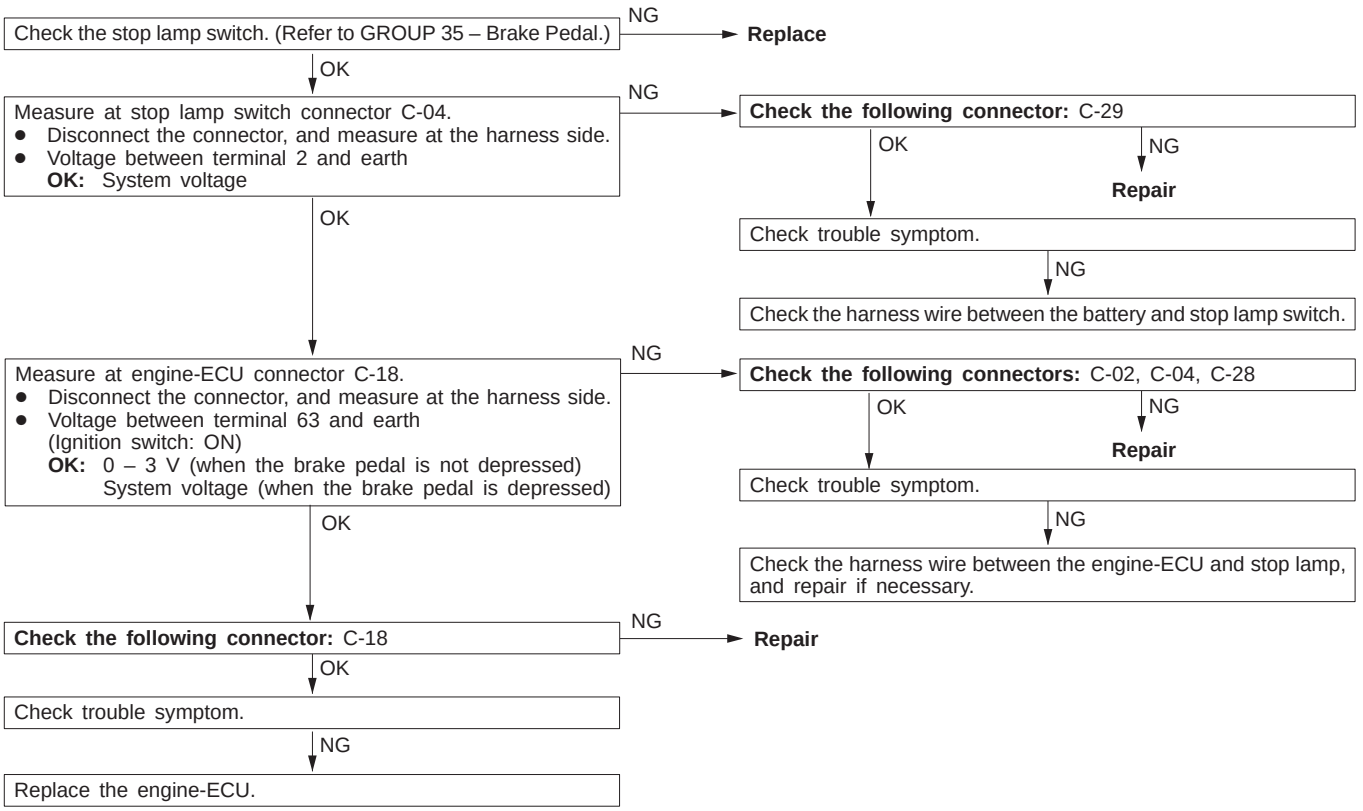
INSPECTION PROCEDURE 32

A/C switch and A/C relay system	Probable cause
If the engine-ECU receives a 'A/C on' signal, it operates the throttle control servo and A/C compressor magnetic clutch so that idle speed increases.	• Malfunction of the A/C control system • Malfunction of the A/C switch • Open circuit or short-circuited harness wire in the A/C switch circuit, or poor connector contact • Malfunction of the engine-ECU



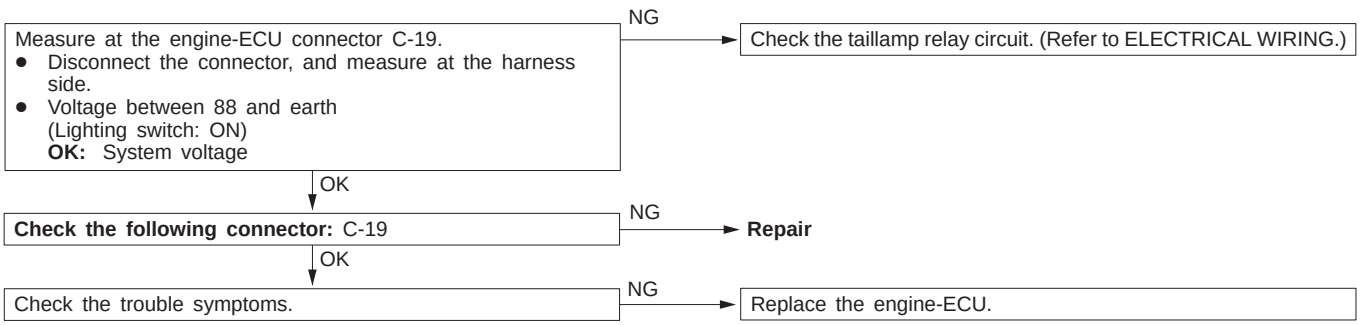
INSPECTION PROCEDURE 33

Stop lamp switch system	Probable cause
The engine-ECU determines whether the brake pedal is depressed or not, by means of the stop lamp switch input signal.	• Malfunction of the stop lamp switch • Open circuit or short-circuited harness wire in the stop lamp circuit, or poor connector contact • Malfunction of the engine-ECU



INSPECTION PROCEDURE 34

Small lamp switch	Probable cause
The engine-ECU determines whether the small lamp switch is on or off. According to that information, the engine-ECU controls alternator output current when the vehicle is started.	• Improper connector contact, open circuit or short-circuited harness wire in the taillamp relay circuit • Malfunction of the engine-ECU



DATA LIST REFERENCE TABLE

Caution
When shifting the select lever to D range, the brakes should be applied so that the vehicle does not move forward.

NOTE
*1: Within four minutes after starting the engine
*2: In a new vehicle [driven approximately 500 km or less], the injector drive time is sometimes 10% longer than the standard time.
*3: The accelerator pedal position switch normally turns off when the voltage of the accelerator pedal position sensor (1st channel) is 250 – 550 mV higher than the voltage at the idle position. If the accelerator pedal position switch turns back on after the accelerator pedal position sensor voltage has risen by 100 mV and the throttle valve has opened, the accelerator pedal position switch and the accelerator pedal position sensor (1st channel) need to be adjusted.

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
11	Oxygen sensor	Engine: After warm-up	Idling	0 mV*1	Code No.11	13A-15
			Sudden racing	600 – 1,000 mV		
			2,500 r/min	400 mV or less ↔ 600 – 1,000 mV (alternates)		
12	Air flow sensor	● Engine coolant temperature: 80 – 95°C ● Lamps, electric cooling fan and all accessories: OFF ● Transmission: Neutral (A/T: P range)	Idling	20 – 55 Hz	Code No.12	13A-16
			2,500 r/min	65 – 85 Hz		
			Racing	Frequency increases in response to racing.		
13	Intake air temperature sensor	Ignition switch: ON	Intake air temperature: –20°C	–20°C	Code No.13	13A-17
			Intake air temperature: 0°C	0°C		
			Intake air temperature: 20°C	20°C		
			Intake air temperature: 40°C	40°C		
			Intake air temperature: 80°C	80°C		

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
14	Throttle position sensor (2nd channel)	● Engine coolant temperature: 80 – 95°C ● Ignition switch: ON (Engine stopped)	Release the accelerator pedal.	4,000 – 4,800 mV	Code No.14	13A-18
			Depress the accelerator pedal gradually.	Voltage decreases in response to the pedal depression.		
			Depress the accelerator pedal fully.	100 – 1,100 mV		
16	Power supply voltage	Ignition switch: ON		System voltage	Procedure No.23	13A-62
18	Cranking signal (Ignition switch – ST)	Transmission: Neutral (A/T: P range)	Engine: Stopped	OFF	Procedure No.25 <M/T> Procedure No.26 <A/T>	13A-63 <M/T> 13A-64 <A/T>
			Engine: Cranking	ON		
21	Engine coolant temperature sensor	Ignition switch: ON	Engine coolant temperature: –20°C	–20°C	Code No.21	13A-19
			Engine coolant temperature: 0°C	0°C		
			Engine coolant temperature: 20°C	20°C		
			Engine coolant temperature: 40°C	40°C		
			Engine coolant temperature: 80°C	80°C		
22	Crank angle sensor	● Engine: cranking ● Tachometer: Connected	Compare the engine speed readings on the tachometer and the MUT-II.	Accord	Code No.22	13A-20
		● Engine: Idling ● Accelerator pedal position switch: ON ● Transmission: Neutral (A/T: P range)	Engine coolant temperature: –20°C	1,200 – 1,400 r/min		
			Engine coolant temperature: 0°C	1,100 – 1,300 r/min		
			Engine coolant temperature: 20°C	1,000 – 1,200 r/min		
			Engine coolant temperature: 50°C	750 – 950 r/min		
			Engine coolant temperature: 80°C	550 – 850 r/min*1		

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
25	Barometric pressure sensor	Ignition switch: ON	Altitude: 0 m	101 kPa	Code No.25	13A-23
			Altitude: 600 m	95 kPa		
			Altitude: 1,200 m	88 kPa		
			Altitude: 1,800 m	81 kPa		
26	Accelerator pedal position switch	Ignition switch: ON (Depress and release the accelerator pedal several times)	Release the accelerator pedal.	ON	Procedure No.27	13A-65
			Depress the accelerator pedal slightly.	OFF		
27	Power steering fluid pressure switch	Engine: Idling	Steering wheel stationary	OFF	Procedure No.31	13A-69
			Steering wheel turning	ON		
28	A/C switch	Engine: Idling (The A/C compressor is running when the A/C switch is on.)	A/C switch: OFF	OFF	Procedure No.32	13A-69
			A/C switch: ON	ON		
29	Inhibitor switch <A/T>	Ignition switch: ON	Selector lever: P or N	P, N	Procedure No.26	13A-64
			Selector lever: D, 2, L or R	D, 2, L, R		
31	Small lamp switch	Engine: Idling	Lighting switch: OFF	OFF	Procedure No.34	13A-70
			Lighting switch: ON	ON		
34	Air flow sensor reset signal	Engine: After having warmed up	Engine is idling	ON	Code No.12	13A-16
			3,000 r/min	OFF		
37	Volumetric efficiency	● Engine coolant temperature: 80 – 95°C ● Lamps, electric cooling fan and all accessories: OFF ● Transmission: Neutral (A/T: P range)	Engine is idling	30 – 50%	–	–
			2,500 r/min	30 – 50%		
			Engine is suddenly raced	Volumetric efficiency increases in response to racing		
38	Crank angle sensor	● Engine: Cranking [reading is possible at 2,000 r/min or less] ● Tachometer: Connected		Engine speeds displayed on the MUT-II and tachometer are identical.	–	–

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
41	Injector drive time *2	● Engine coolant temperature: 80 – 95°C ● Lamps, electric cooling fan and all accessories: OFF ● Transmission: Neutral (A/T: P range)	Idling	0.5 – 0.7 ms*1	Code No.41	13A-25
			2,500 r/min	0.4 – 0.8 ms		
			Sudden racing	Increases		
44	Ignition advance	● Engine: After warm-up ● Set a timing light.	Idling	12 – 20°BTDC *2	Code No.44	13A-27
			2,500 r/min	20 – 40°BTDC		
49	A/C relay	Engine: After warm-up, idling	A/C switch: OFF	OFF (compressor clutch is not operating)	Procedure No.32	13A-69
			A/C switch: ON	ON (compressor clutch is operating)		
66	Brake vacuum sensor	● Engine coolant temperature: 80 – 95°C ● Lamps, electric cooling fan and all accessories: OFF ● Transmission: Neutral (A/T: P range)	Stop the engine from idling speed, and then depress the brake pedal several times with the ignition switch on.	Displayed pressure increases.	Code No.66	13A-32
67	Stop lamp switch	Ignition switch: ON	Brake pedal: Depressed	OFF	Procedure No.33	13A-70
			Brake pedal: Released	ON		
68	EGR valve	● Engine coolant temperature: 80 – 95°C ● Lamps, electric cooling fan and all accessories: OFF ● Transmission: Neutral (A/T: P range)	Idling	0 – 15 STEP	Procedure No.29	13A-67
			2,500 r/min	0 – 10 STEP		

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
74	Fuel pressure sensor	● Engine coolant temperature: 80 – 95°C ● Lamps, electric cooling fan and all accessories: OFF ● Transmission: Neutral (A/T: P range)	After 3 minutes have passed at idling condition	4 – 6.9 MPa	Code No.56	13A-29
77	Accelerator pedal position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	700 – 1,400 mV	Code No.77	13A-33
			Depress the accelerator pedal gradually.	Increases in response to the pedal depression stroke.		
			Depress the accelerator pedal fully.	4,100 mV or more		
78	Accelerator pedal position sensor (1st channel)*3	Ignition switch: ON	Release the accelerator pedal.	935 – 1,135 mV	Code No.78	13A-34
			Depress the accelerator pedal gradually.	Increases in response to pedal depression stroke.		
			Depress the accelerator pedal fully.	4,100 mV or more		
79	Throttle position sensor (1st channel)	● Engine coolant temperature: 80 – 95°C ● Ignition switch: ON (Engine stopped)	Release the accelerator pedal.	450 – 800 mV	Code No.79	13A-35
			Depress the accelerator pedal gradually.	Increases in response to pedal depression stroke.		
			Depress the accelerator pedal fully.	3,900 – 4,900 mV		
		Engine: After warm-up, idling	No load	450 – 1,000 mV		
			A/C switch: OFF → ON	Increases by 100 – 600 mV.		
			Selector lever: N → D range	Increases by 0 – 200 mV.		
99	Fuel injection mode	Engine: After warm up	Idling (for several minutes after engine start)	Lean compression	–	–
			2,500 r/min	Stoichio metric feedback		
			Sudden racing after idle position	Open loop		

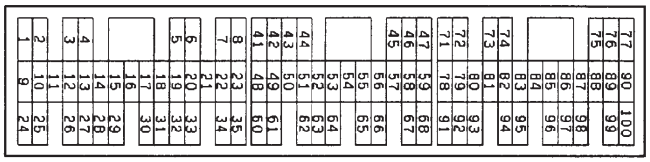
ACTUATOR TEST REFERENCE TABLE

Item No.	Inspection item	Drive contents	Inspection contents	Normal condition	Inspection procedure No.	Reference page
01	Injectors	Cut fuel to No. 1 injector	Engine: After having warmed up/Engine is idling (Cut the fuel supply to each injector in turn and check cylinders which don't affect idling.)	Idling condition becomes different (becomes unstable).	Code No. 41	13A-25
02		Cut fuel to No. 2 injector				
03		Cut fuel to No. 3 injector				
04		Cut fuel to No. 4 injector				
07	Fuel pump (low pressure)	Fuel pump operates and fuel is recirculated.	Ignition switch: ON	Sound of operation is heard.	Procedure No. 28	13A-66
08	Purge control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch: ON	Sound of operation can be heard when solenoid valve is driven.	Procedure No. 30	13A-68
17	Basic ignition timing	Set the engine-ECU to ignition timing adjustment mode	Engine: Idling Timing light is set	5°BTDC	–	–
21	Fan controller	Drive the fan motor	Ignition switch: ON	The fan motor operates	Procedure No.20	13A-60
34	Electronic-controlled throttle valve system	Close the throttle valve fully	Ignition switch: ON	Operation sound can be heard	Code No.91	13A-36

CHECK AT THE ENGINE-ECU TERMINALS

TERMINAL VOLTAGE CHECK CHART

Engine-ECU Connector Terminal Arrangement



7FU2119

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
1	No.1 injector	Engine: Warm up, and then depress the accelerator pedal suddenly from the idle speed.		Decreases slightly for short time from 9 – 13 V.
9	No.2 injector			
24	No.3 injector			
2	No.4 injector			
3	No.1 ignition coil	Engine: 3,000 r/min		0.1 – 2.0 V
13	No.2 ignition coil			
12	No.3 ignition coil			
4	No.4 ignition coil			
6	EGR valve (C)	Ignition switch: Immediately after turning ON		5 – 8 V (fluctuates for approx. three seconds)
5	EGR valve (D)			
34	EGR valve (A)			
32	EGR valve (B)			
8	Alternator G terminal	• Engine: Warm up, and then idling • Radiator fan: not operating • Headlamp: OFF → ON • Stop lamp: OFF → ON • Rear defogger switch: OFF → ON		Voltage increases by 0.2 – 3.5 V
14	GDI ECO indicator lamp	Engine: idling		0 – 3 V
		Engine: Depress the accelerator pedal suddenly from the idle speed.		System voltage
16	Purge control solenoid valve	• Engine coolant temperature: 80 – 95°C • Ignition switch: ON	Engine: stopped	System voltage
			Engine: Start the engine, and then increase engine speed up to 3,500 r/min.	Voltage decreases.
18	Fan controller	Radiator and condenser fans are not operating.		0 – 0.3 V
		Radiator and condenser fans are operating.		0.7 V or more
20	A/C relay	• Engine: idling • A/C switch: OFF → ON (Compressor is operating)		System voltage, or changes from momentarily 6 V or more to 0 – 3 V

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
21	Fuel pump relay	Ignition switch: ON	Engine: stopped	System voltage
			Engine: Idling	0 – 3 V
31	Engine warning lamp	Ignition switch: OFF → ON		0 – 3 V → System voltage (after several seconds)
41	Sensor power supply	Ignition switch: ON		4.5 – 5.5 V
42	Power supply to accelerator pedal position sensor	Ignition switch: ON		4.5 – 5.5 V
43	Crank angle sensor	Engine: Cranking		0.4 – 4.0 V
		Engine: Idling		1.5 – 2.5 V
44	Engine coolant temperature sensor	Ignition switch: ON	Engine coolant temperature: 0°C	3.2 – 3.8 V
			Engine coolant temperature: 20°C	2.3 – 2.9 V
			Engine coolant temperature: 40°C	1.3 – 1.9 V
			Engine coolant temperature: 80°C	0.3 – 0.9 V
45	Tachometer output	Engine: 3,000 r/min		2.0 – 9.0 V
47	Power supply	Ignition switch: ON		System voltage
59				
50	Camshaft position sensor	Engine: Cranking		0.3 – 3.0 V
		Engine: Idling		0.5 – 3.5 V
51	Barometric pressure sensor	Ignition switch: ON	Altitude: 0 m	3.7 – 4.3 V
			Altitude: 1,200 m	3.2 – 3.8 V
52	Alternator FR terminal	• Engine: Warm up, and then idling • Radiator fan: not operating • Headlamp: OFF → ON • Stop lamp: OFF → ON • Rear defogger switch: OFF → ON		Voltage decrease
54	Power steering fluid pressure switch	Engine: Warm up, and then idling	Steering wheel stationary	System voltage
			Steering wheel turning	0 – 3 V
55	Injector driver relay	Ignition switch: OFF		0 – 0.1 V
		Ignition switch: ON		0.5 – 1.0 V
56	Throttle valve control servo relay	Ignition switch: OFF		0 – 0.3 V
		Ignition switch: ON		0.5 – 1.0 V

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
57	Engine control relay	Ignition switch: OFF		System voltage
		Ignition switch: ON		0 – 3 V
60	Back-up power source	Ignition switch: OFF		System voltage
61	Air flow sensor	Engine: Idling		2.2 – 3.2 V
		Engine: 2,500 r/min		
62	Intake air temperature sensor	Ignition switch: ON	Intake air temperature: 0°C	3.2 – 3.8 V
			Intake air temperature: 20°C	2.3 – 2.9 V
			Intake air temperature: 40°C	1.5 – 2.1 V
			Intake air temperature: 80°C	0.4 – 1.0 V
63	Stop lamp switch	Depress the brake pedal.		System voltage
		Release the brake pedal.		0 – 3 V
67	Inhibitor switch <A/T>	Ignition switch: ON	Selector lever: P or N range	0 – 3 V
			Selector lever: Other than P or N range	8 – 14 V
68	Ignition switch – ST	Engine: Cranking		8 V or more
71	Oxygen sensor	Engine: Warm up, and then hold the engine speed at 2,500 r/min (Use a digital voltmeter).		0 V ↔ 0.8 V alternates
74	Brake vacuum sensor	Engine: Stop the engine from idle speed, turn the ignition switch ON, and then depress the brake pedal several times.		Voltage increases
76	Air flow sensor reset signal	Engine: Idling		0 – 1 V
		Engine: 3,000 r/min		6 – 9 V
78	Throttle position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	4.0 – 4.8 V
			Depress the accelerator pedal fully.	0.1 – 1.1 V
79	Accelerator pedal position switch	Ignition switch: ON	Release the accelerator pedal.	0 – 1 V
			Depress the accelerator pedal slightly.	4 V or more
80	Vehicle speed sensor	• Ignition switch: ON • Move the vehicle forward.		0 V ↔ Battery voltage (alternates repeatedly)

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
83	A/C switch	Engine: idling	A/C switch: OFF	0 – 3 V
			A/C switch: ON (Compressor is operating)	System voltage
88	Small lamp switch	Lighting switch: OFF		0 – 3 V
		Lighting switch: ON (Taillamp: ON)		System voltage
89	Oxygen sensor heater	Engine: Idling		0 – 3 V
		Engine: 3,500 r/min		System voltage
92	Fuel pressure sensor	Engine: Idling		0.3 – 4.7 V
94	Accelerator pedal position sensor (1st channel)	Ignition switch: ON	Release the accelerator pedal.	0.935 – 1.135 V
			Depress the accelerator pedal fully.	4.1 V or more
96	Injector open circuit check signal	Engine: Increase engine speed from idle speed to 4,000 r/min.		Decreases slightly (approx.0.7 V) from 4.5 V – 5.0 V.
97	A/C thermo sensor	● Temperature at sensing portion: Approx. 25°C ● Ignition switch: ON		2.0 – 2.9 V
99	Ignition switch – IG	Ignition switch: ON		System voltage

CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

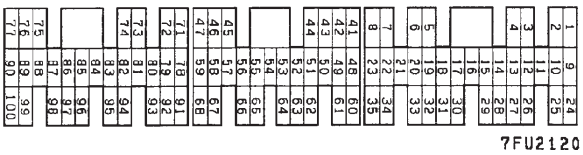
1. Turn the ignition switch to OFF.
2. Disconnect the engine-ECU connector.
3. Measure the resistance and check for continuity between the terminals of the engine-ECU harness-side connector while referring to the check chart.

   NOTE
   (1) When measuring resistance and checking continuity, a harness for checking contact pin pressure should be used instead of inserting a test probe.
   (2) Checking need not be carried out in the order given in the chart.

   Caution
   If the terminals that should be checked are mistaken, or if connector terminals are not correctly shorted to earth, damage may be caused to the vehicle wiring, sensors, engine-ECU and/or ohmmeter.
   Be careful to prevent this!

4. If the ohmmeter shows any deviation from the standard value, check the corresponding sensor, actuator and related electrical wiring, and then repair or replace.
5. After repair or replacement, recheck with the ohmmeter to confirm that the repair or replacement has corrected the problem.

Engine-ECU Harness Side Connector Terminal Arrangement

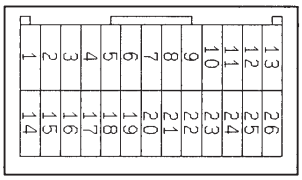


Terminal No.	Check item	Standard value, normal condition (check requirements)
6 – 47	EGR valve (C)	15 – 20 Ω (at 20°C)
5 – 47	EGR valve (D)	
34 – 47	EGR valve (A)	
32 – 47	EGR valve (B)	
16 – 47	Purge control solenoid valve	36 – 44 Ω (at 20°C)
44 – 72	Engine coolant temperature sensor	5.1 – 6.5 kΩ (when engine coolant temperature is 0°C)
		2.1 – 2.7 kΩ (when engine coolant temperature is 20°C)
		0.9 – 1.3 kΩ (when engine coolant temperature is 40°C)
		0.26 – 0.36 kΩ (when engine coolant temperature is 80°C)
46 – Body earth	Earth	Continuity (0 Ω)
58 – Body earth		
62 – 72	Intake air temperature sensor	5.3 – 6.7 kΩ (when intake air temperature is 0°C)
		2.3 – 3.0 kΩ (when intake air temperature is 20°C)
		1.0 – 1.5 kΩ (when intake air temperature is 40°C)
		0.30 – 0.42 kΩ (when intake air temperature is 80°C)
67 – Body earth	Inhibitor switch <A/T>	Continuity (when the selector lever is at P or N range)
		No continuity (when the selector lever is at a range other than P or N)
79 – 72	Accelerator pedal position switch	Continuity (when the accelerator pedal is released)
		No continuity (when the accelerator pedal is slightly depressed)
89 – 47	Oxygen sensor heater control	11 – 18 Ω (at 20°C)

CHECK AT THE THROTTLE VALVE CONTROLLER TERMINALS

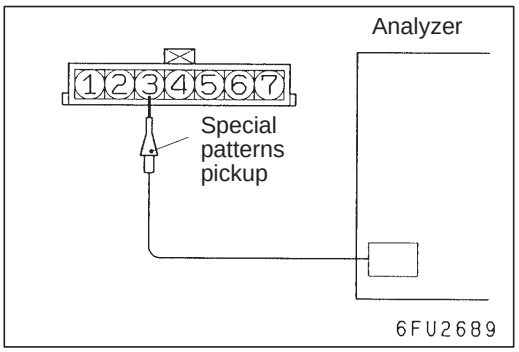
TERMINAL VOLTAGE CHECK CHART

Throttle Valve Controller Terminal Arrangement



7FU2121

Terminal No.	Check items	Requirements		Normal value
1	Throttle valve control servo (A+)	• Ignition switch: ON • Accelerator pedal: Fully opened → fully closed		Decreases slightly from system voltage.
9	Throttle valve control servo (B+)			
14	Throttle valve control servo (A–)	• Ignition switch: ON • Accelerator pedal: Fully closed → fully opened		Decreases slightly (approx. 2 V) from system voltage.
15	Throttle valve control servo (B–)			
2	Power supply to throttle valve control servo	Ignition switch: ON		System voltage
5	Power supply	Ignition switch: ON		System voltage
6	Sensor voltage	Ignition switch: ON		4.5 – 5.5 V
7	Throttle position sensor (1st channel)	Ignition switch: ON	Release the accelerator pedal.	0.45 – 0.8 V
			Depress the accelerator pedal fully.	3.9 – 4.9 V
20	Accelerator pedal position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	0.7 – 1.4 V
			Depress the accelerator pedal fully.	4 V or more
22	Ignition switch – IG	Ignition switch: ON		System voltage



INSPECTION PROCEDURE USING AN ANALYZER

AIR FLOW SENSOR (AFS)

Measurement Method

1. Disconnect the air flow sensor connector, and connect the special tool (test harness: MB991709) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to air flow sensor connector terminal 3.

Alternate Method (Test harness not available)

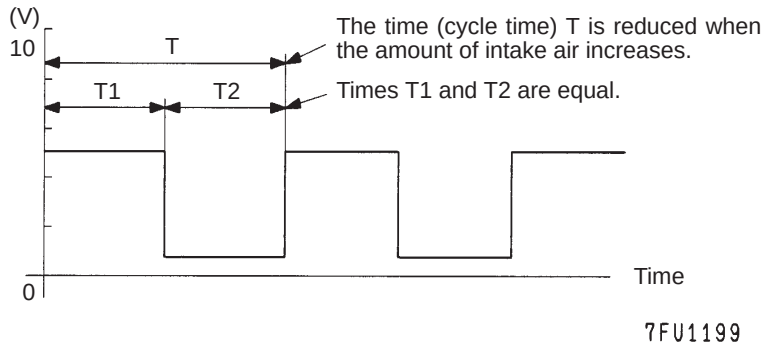
1. Connect the analyzer special patterns pickup to engine-ECU terminal 61.

Standard Wave Pattern

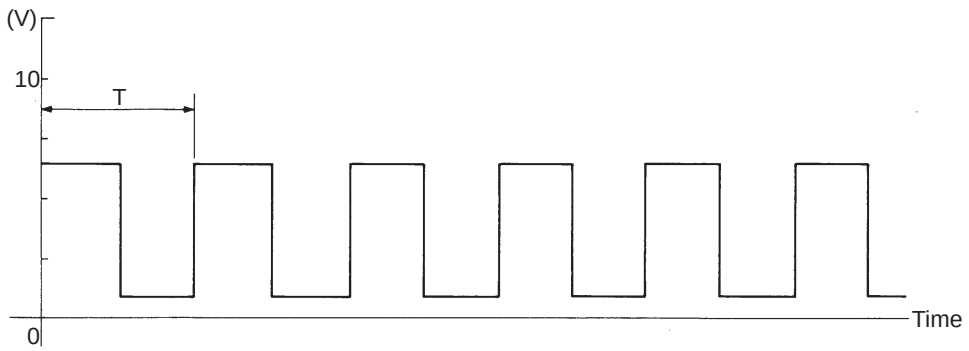
Observation conditions

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Idle speed

Standard wave pattern

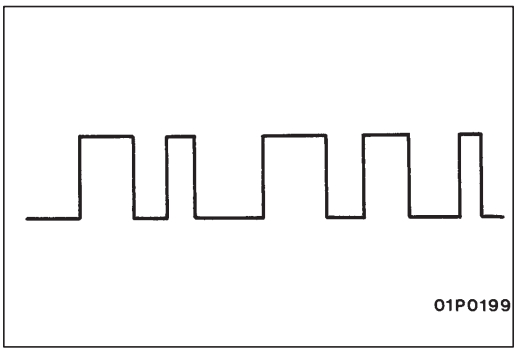


Observation conditions (from conditions above engine speed is increased by racing.)



Wave Pattern Observation Points

Check that cycle time T becomes shorter and the frequency increases when the engine speed is increased.



Examples of Abnormal Wave Patterns

- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

  Rectangular wave pattern is output even when the engine is not started.

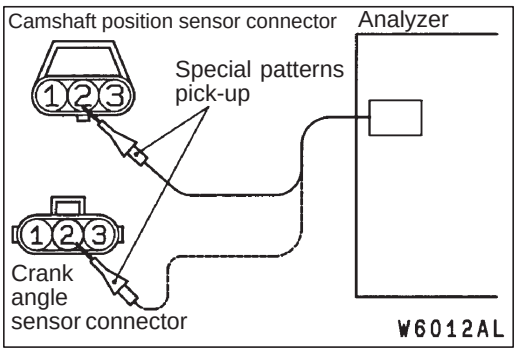
- Example 2

  Cause of problem

  Damaged rectifier or vortex generation column

  Wave pattern characteristics

  Unstable wave pattern with non-uniform frequency. However, when an ignition leak occurs during acceleration, the wave pattern will be distorted temporarily, even if the air flow sensor is normal.



CAMSHAFT POSITION SENSOR AND CRANK ANGLE SENSOR

Measurement Method

1. Disconnect the camshaft position sensor connector and connect the special tool (test harness: MB991709) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to camshaft position sensor terminal 2.
3. Disconnect the crank angle sensor connector and connect the special tool (test harness: MB991658) in between.
4. Connect the analyzer special patterns pickup to crank angle sensor terminal 2.

Alternate Method (Test harness not available)

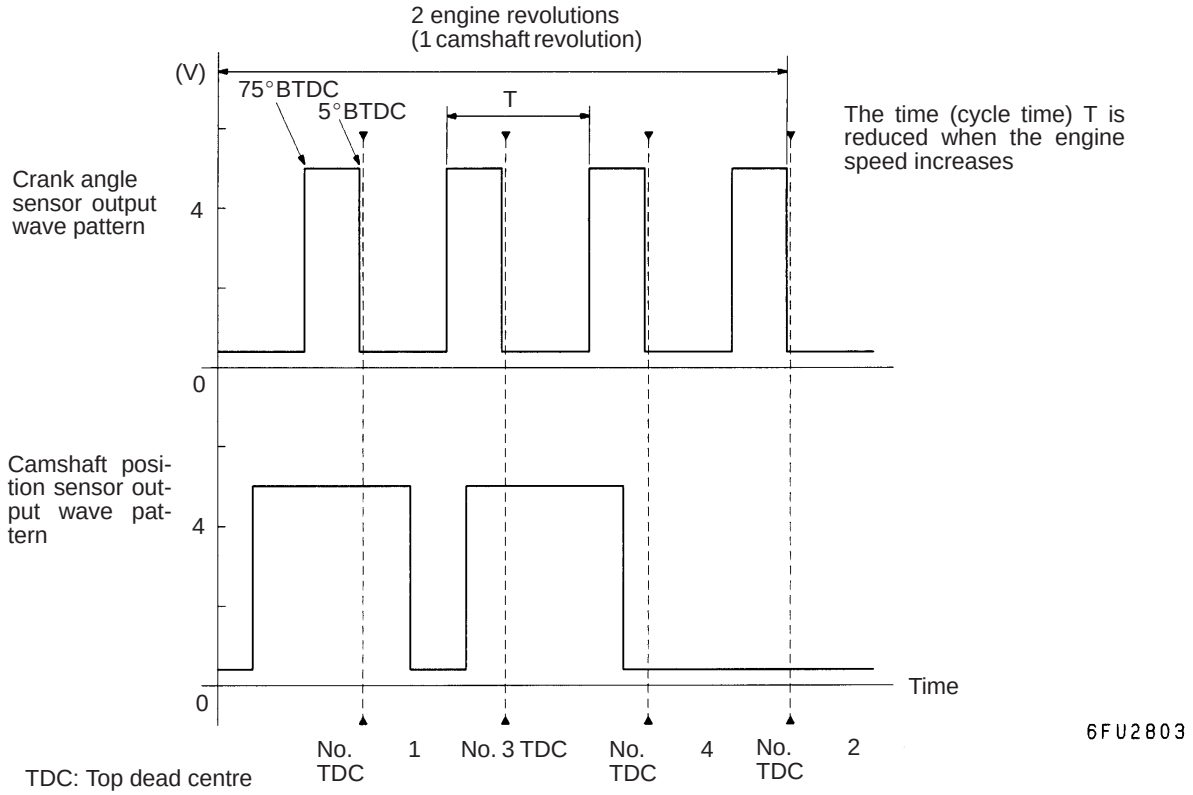
1. Connect the analyzer special patterns pickup to engine-ECU terminal 50. (When checking the camshaft position sensor signal wave pattern.)
2. Connect the analyzer special patterns pickup to engine-ECU terminal 43. (When checking the crank angle sensor signal wave pattern.)

Standard Wave Pattern

Observation conditions

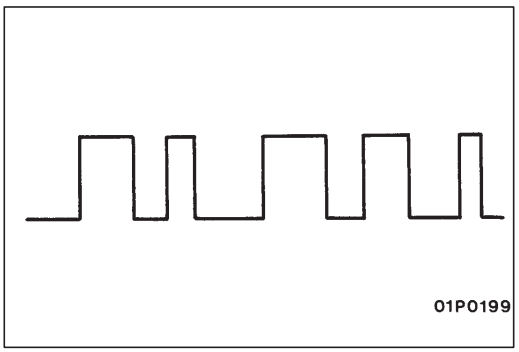
Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Idle speed

Standard wave pattern



Wave Pattern Observation Points

Check that cycle time T becomes shorter when the engine speed increases.



Examples of Abnormal Wave Patterns

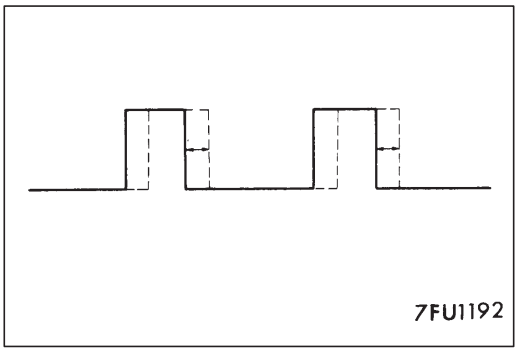
- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

  Rectangular wave pattern is output even when the engine is not started.



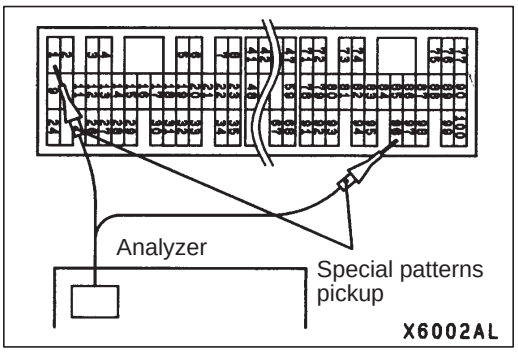
- Example 2

  Cause of problem

  Loose timing belt
  Abnormality in sensor disk

  Wave pattern characteristics

  Wave pattern is displaced to the left or right.



INJECTORS AND INJECTOR OPEN CIRCUIT CHECK SIGNAL

Measurement Method

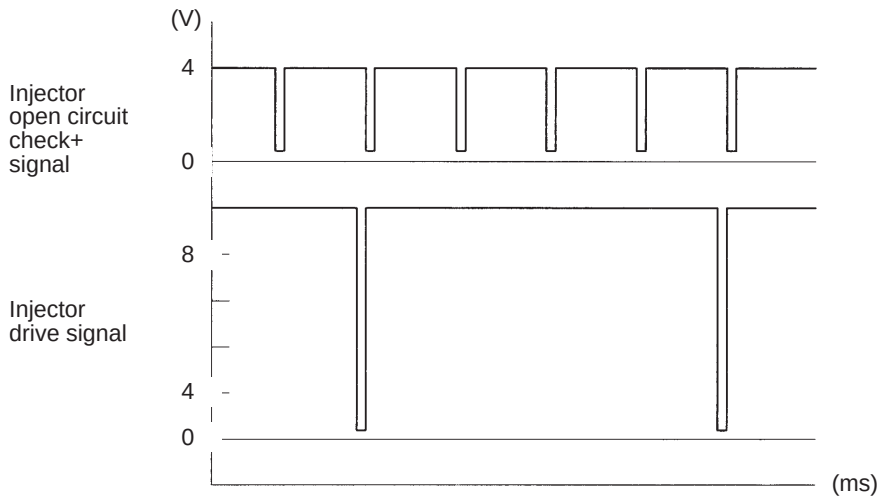
1. Connect the analyzer special patterns pickup to terminal 1 (No.1 injector) of the engine-ECU connector.
2. Connect the analyzer special patterns pickup to terminal 96 (injector open circuit check signal) of the engine-ECU connector.
3. After checking terminal 1, check terminal 9 (No.2 injector), terminal 24 (No.3 injector) and terminal 2 (No.4 injector).

Standard Wave Pattern

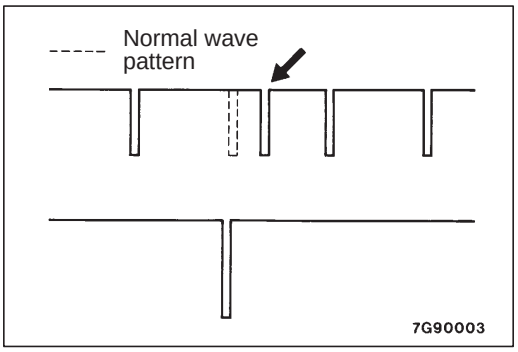
Observation conditions

Function	Special pattern
Pattern height	Low
Pattern selector	Display
Engine r/min	Idle speed

Standard wave pattern

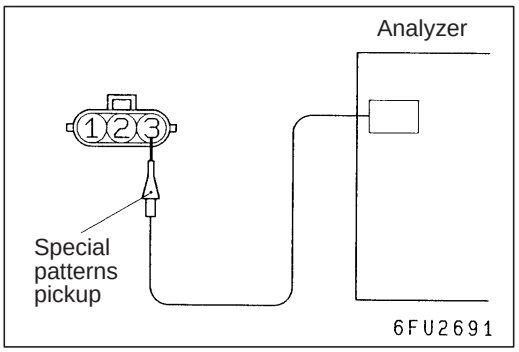


9FU0841



Wave Pattern Observation Points

- Check that the injector drive time is identical to the time displayed on the MUT-II.
- Check that the injector signals become greatly extended but soon return to their normal wave length when the engine is suddenly raced.
- Check that the injector open circuit check signal is synchronized with each rising portion of the injector drive signal.



IGNITION COIL AND POWER TRANSISTOR

Power transistor control signal

Measurement Method

1. Disconnect the ignition coil connector, and connect the special tool (test harness: MB991658) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to terminal 3 of each ignition coil connector in turn.

Alternate Method (Test harness not available)

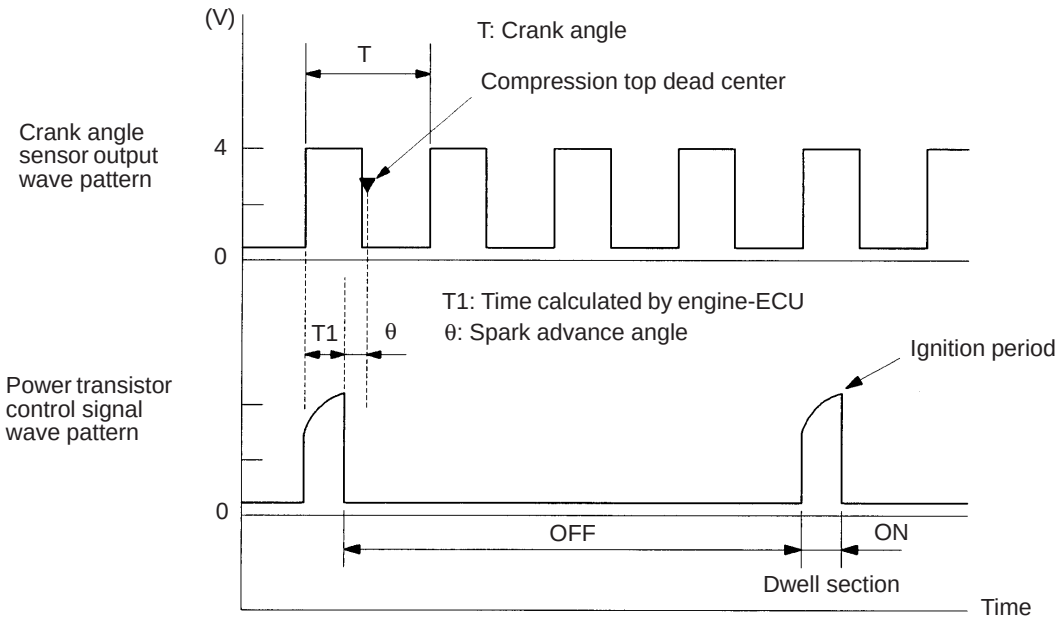
1. Connect the analyzer special patterns pickup to engine-ECU terminal 3 (No. 1 ignition coil), terminal 13 (No. 2 ignition coil), terminal 12(No. 3 ignition coil), terminal 4 (No. 4 ignition coil) respectively.

Standard Wave Pattern

Observation condition

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Approx. 1,200 r/min

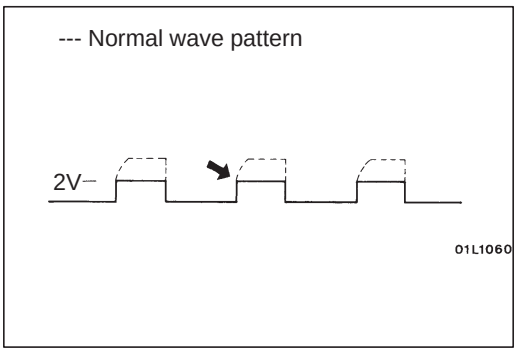
Standard wave pattern

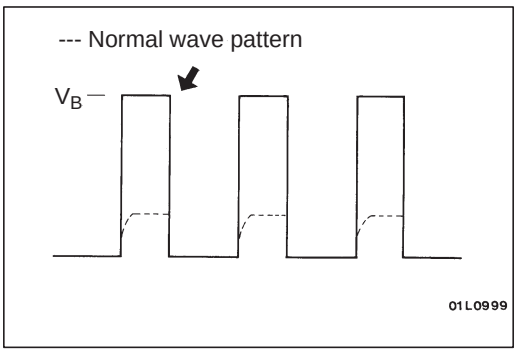


Wave Pattern Observation Points

Point: Condition of wave pattern build-up section and maximum voltage (Refer to abnormal wave pattern examples 1 and 2.)

Condition of wave pattern build-up section and maximum voltage	Probable cause
Rises from approx. 2V to approx. 4.5V at the top-right	Normal
2V rectangular wave	Open-circuit in ignition primary circuit
Rectangular wave at power voltage	Power transistor malfunction





Examples of Abnormal Wave Patterns

- Example 1

  Wave pattern during engine cranking

  Cause of problem

  Open-circuit in ignition primary circuit

  Wave pattern characteristics

  Top-right part of the build-up section cannot be seen, and voltage value is approximately 2V too low.

- Example 2

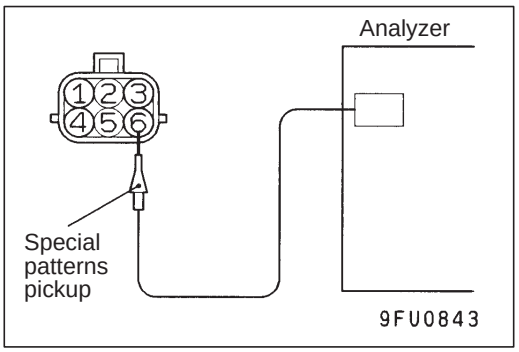
  Wave pattern during engine cranking

  Cause of problem

  Malfunction in power transistor

  Wave pattern characteristics

  Power voltage results when the power transistor is ON.



EGR VALVE (STEPPER MOTOR)

Measurement Method

1. Disconnect the EGR valve connector, and connect the special tool (test harness: MB991658) in between.
2. Connect the analyzer special patterns pickup to the EGR valve-side connector terminal 1, terminal 3, terminal 4 and terminal 6 respectively.

Alternate Method (Test harness not available)

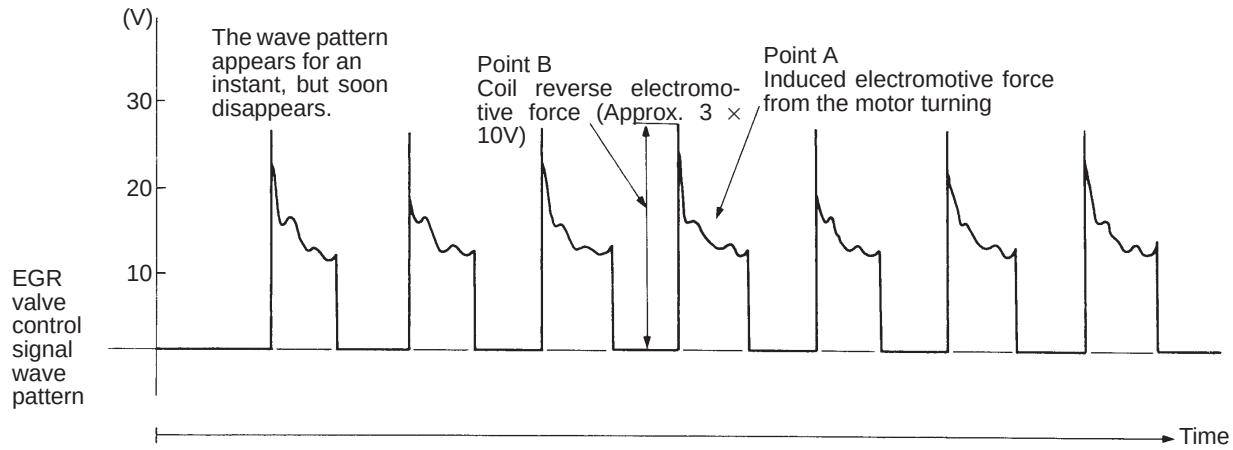
1. Connect the analyzer special patterns pickup to engine-ECU terminal 34, connection terminal 32, connection terminal 6, and connection terminal 5 respectively.

Standard Wave Pattern

Observation conditions

Function	Special patterns
Pattern height	High
Pattern selector	Display
Engine condition	Racing

Standard wave pattern



7FU1204

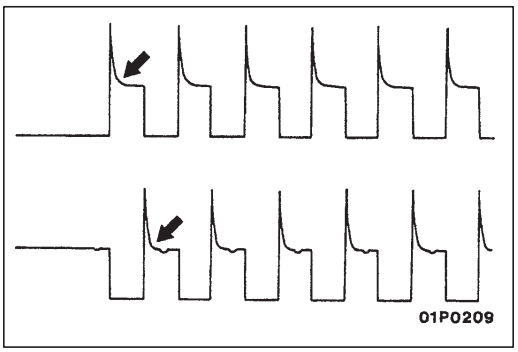
Wave Pattern Observation Points

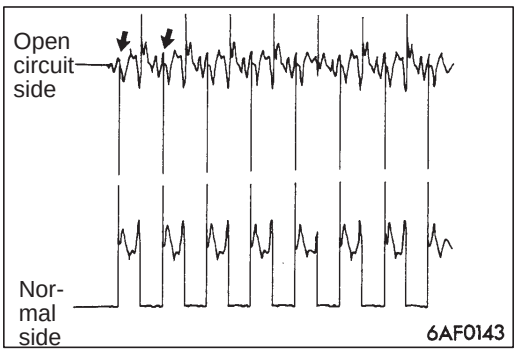
Check that the standard wave pattern appears when the EGR control servo is operating.
Point A: Presence or absence of induced electromotive force from the motor turning. (Refer to the abnormal wave pattern.)

Contrast with standard wave pattern	Probable cause
Induced electromotive force does not appear or is extremely small.	Motor is malfunctioning

Point B: Height of coil reverse electromotive force

Contrast with standard wave pattern	Probable cause
Coil reverse electromotive force does not appear or is extremely small.	Short in the coil





Examples of Abnormal Wave Pattern

- Example 1

  Cause of problem

  Motor is malfunctioning. (Motor is not operating.)

  Wave pattern characteristics

  Induced electromotive force from the motor turning does not appear.

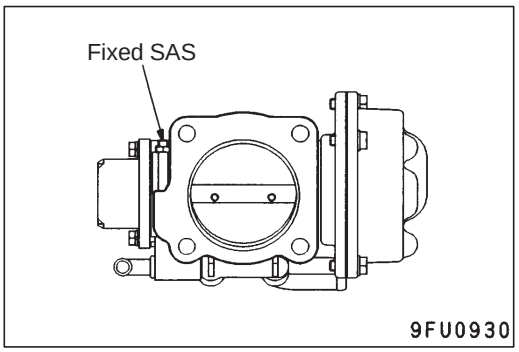
- Example 2

  Cause of problem

  Open circuit in the line between the EGR valve and the engine-ECU

  Wave pattern characteristics

  Current is not supplied to the motor coil on the open circuit side. (Voltage does not drop to 0 V.)
  Furthermore, the induced electromotive force waveform at the normal side is slightly different from the normal waveform.



ON-VEHICLE SERVICE

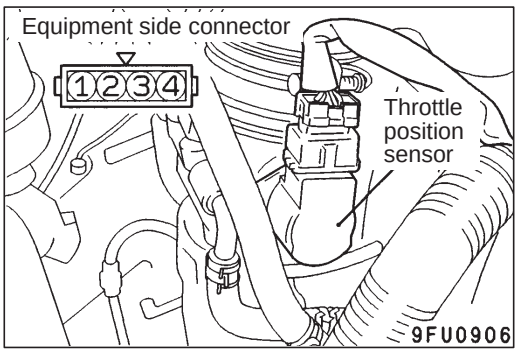
Caution

(1) Never attempt to tamper the fixed SAS. The fixed SAS is precisely adjusted at factory.

(2) Should it be tampered, the full closed position of the throttle valve will be changed. This causes the engine-ECU to learn a wrong position of the throttle valve.

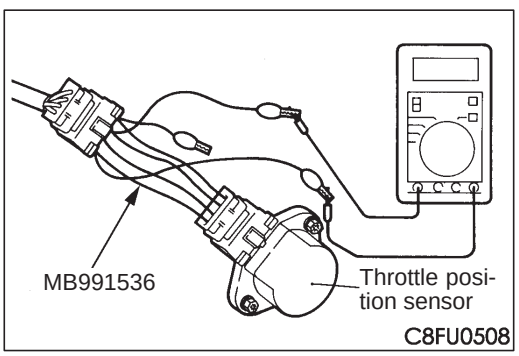
THROTTLE BODY (THROTTLE VALVE ARE) CLEANING

1. Start the engine, and warm it up until engine coolant temperature reaches 80°C. Then stop the engine.
2. Remove the air intake hose at the throttle body side.
3. Apply cleaning agent to the throttle valve through the intake port of the throttle valve, and then leave it for approx. five minutes.
4. Start the engine, race it several times, and then let it run at idle for approx. one minute.
5. If carbon deposits are not removed from the throttle vale area, repeat steps 3 and 4.
6. Install the air intake hose.
7. Use the MUT-II or disconnect the negative battery cable from the battery terminal in order to erase a diagnosis code. Wait for at least ten seconds, and then let the engine run at idle again for approx. ten minutes.



THROTTLE POSITION SENSOR ADJUSTMENT

1. Connect the MUT-II to the diagnosis connector.
   When not using the MUT-II, proceed as follows:

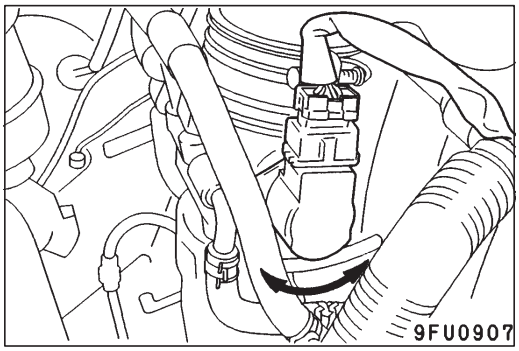


(1) Disconnect the throttle position sensor connector, and connect the special tool (test harness: MB991536) between the disconnected connector taking care not to confuse the terminal to be connected.

(2) Connect digital voltmeter between the terminal No.2 (sensor output: blue clip of special tool) and the terminal No.3 (sensor earth: white clip of special tool) of the throttle position sensor connector.

2. Disconnect the throttle valve control servo connector.
3. Turn the ignition switch to ON (but do not start the engine).
4. Check the output voltage of the throttle position sensor (1st channel) when the throttle valve is fully closed by your finger.

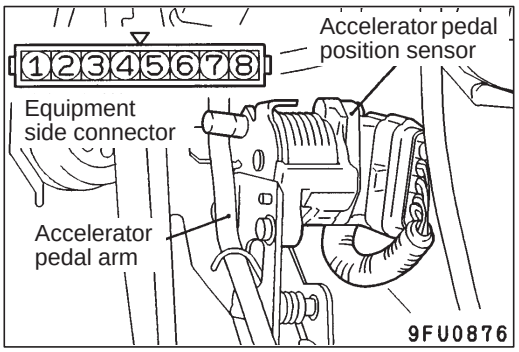
   Standard value: 0.4 – 0.6 V



5. If not within the standard value, loosen the throttle position sensor mounting bolts. Then rotate the sensor body to adjust.
6. Check the output voltage of the throttle position sensor (2nd channel) when the throttle valve is fully closed by your finger. When not using the MUT-II, connect digital voltmeter between the terminal No.4 (sensor output: black clip of special tool) and the terminal No.3 (sensor earth: white clip of special tool) of the throttle position sensor connector.

   Standard value: 4.2 – 4.8 V

7. If not within the standard value, replace the throttle position sensor.
8. Turn the ignition switch to OFF.
9. Reconnect the throttle valve control servo connector.
10. Remove the MUT-II. If the MUT-II is not used, remove the special tool, and then connect the throttle position sensor connector.
11. If a diagnosis code is displayed, erase the diagnosis code by using the MUT-II or disconnect the negative battery cable from the battery terminal and then leave it for at least ten seconds. After that, reconnect the battery cable.
12. Turn the ignition switch to ON and return it to OFF, and then leave it for at least ten seconds. In addition, if the battery cable is disconnected at step 11, let the engine run at idle for approx. ten minutes.

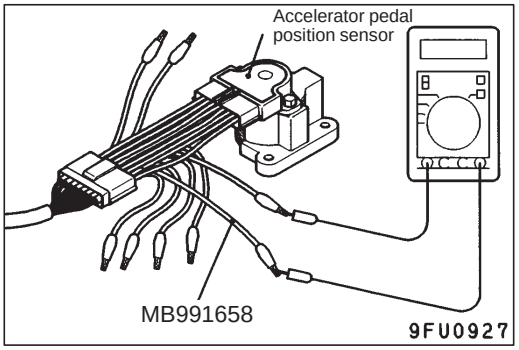


ACCELERATOR PEDAL POSITION SENSOR ADJUSTMENT

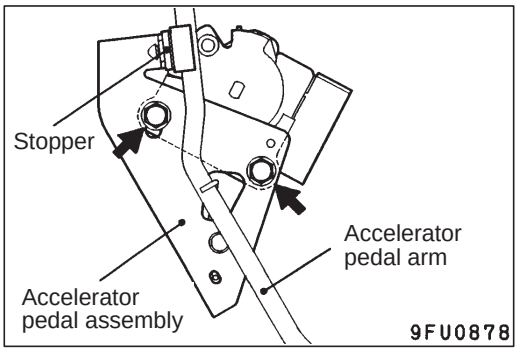
Caution

(1) Never attempt to tamper the accelerator pedal position sensor. The sensor position is precisely adjusted at factory.

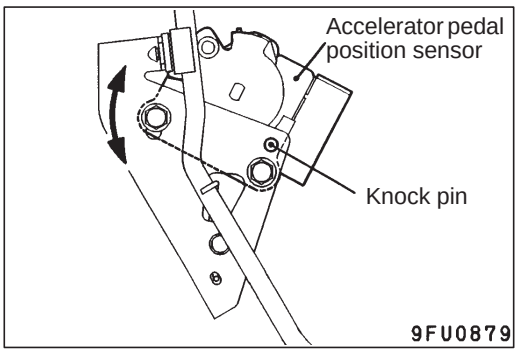
(2) Should it be tampered, follow the procedure below:



1. Connect the MUT-II to the diagnosis connector.
   When not using the MUT-II, proceed as follows:
   (1) Disconnect the accelerator pedal position sensor connector. Connect the special tool (test harness: MB991658) between the disconnected connectors, and then connect the digital voltmeter to the terminal No.3 [output terminal of accelerator pedal position sensor (1st channel)] and to the terminal No.1 [earth terminal of accelerator pedal position sensor (1st channel)].



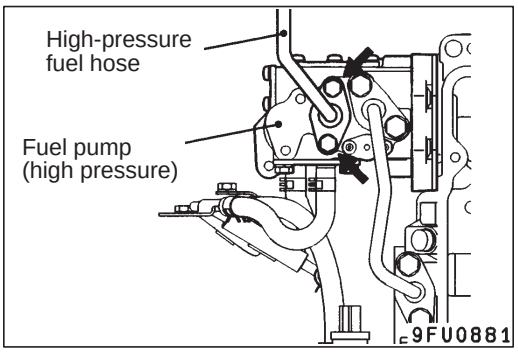
2. Loosen the accelerator pedal position sensor installation bolts.
3. Contact the accelerator pedal arm to the stopper.
4. Turn the ignition switch to the ON position (but do not start the engine).



5. Rotate the accelerator pedal position sensor with the knock pin as the centre, and adjust the output voltage of the accelerator pedal position sensor (1st channel) to the standard value.

   Standard value: 0.935 – 1.135 V

6. Tighten the accelerator pedal position sensor installation bolts fully.

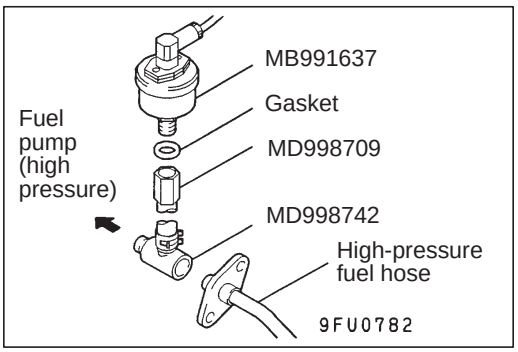


FUEL PRESSURE TEST

MEASUREMENT OF FUEL LOW PRESSURE BETWEEN FUEL PUMP (LOW PRESSURE) AND FUEL PUMP (HIGH PRESSURE)

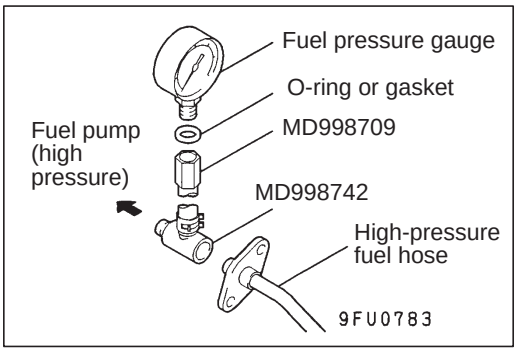
1. Release residual pressure from the fuel pipe line to prevent fuel gush out. (Refer to P.13A-99.)
2. Disconnect the high-pressure fuel hose at the fuel pump (high pressure) side.

Caution
Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.



3. Remove the union joint and bolt from the special tool (adapter hose) and instead attach the special tool (hose adapter) to the adapter hose.
4. Install the special tool (for measuring the fuel pressure) that was set up in step 3.

<When using the fuel pressure gauge set (special tool)>
(1) Install the special tool (for measuring the fuel pressure) between the high-pressure fuel hose and the fuel pump (high pressure).
(2) Install the fuel pressure gauge set (special tool) on the special tool (for measuring the fuel pressure) putting the gasket between them.
(3) Connect the lead wire of the fuel pressure gauge set (special tool) to the power supply (cigarette lighter socket) and to the MUT-II.



<When using the fuel pressure gauge>
(1) Install the fuel pressure gauge on the special tool (for measuring the fuel pressure) putting a suitable O-ring or gasket between them.
(2) Install the special tool which was set up in step (1) between the high-pressure fuel hose and the fuel pump (high pressure).

5. Connect the MUT-II to the diagnosis connector.
6. Turn the ignition switch to ON. (But do not start the engine.)
7. Select “Item No.07” from the MUT-II Actuator test to drive the fuel pump (low pressure) at the fuel tank side. Check that there are no fuel leaks from any parts.
8. Finish the actuator test or turn the ignition switch to OFF.
9. Start the engine and run at idle.
10. Measure fuel pressure while the engine is running at idle.

    Standard value: approximately 328 kPa

11. Check to see that fuel pressure at idle does not drop even after the engine has been raced several times.
12. If fuel pressure is out of the standard value, troubleshoot and repair according to the table below.

Symptom	Probable cause	Remedy
• Fuel pressure too low • Fuel pressure drops after racing	Clogged fuel filter	Replace fuel filter
	Fuel leaking to return side due to poor fuel pressure regulator (low pressure) valve seating or settled spring	Replace fuel pressure regulator (low pressure)
	Low fuel pump (low pressure) delivery pressure	Replace the fuel pump (low pressure)
Fuel pressure too high	Binding valve in fuel pressure regulator (low pressure)	Replace fuel pressure regulator (low pressure)
	Clogged fuel return hose or pipe	Clean or replace hose or pipe

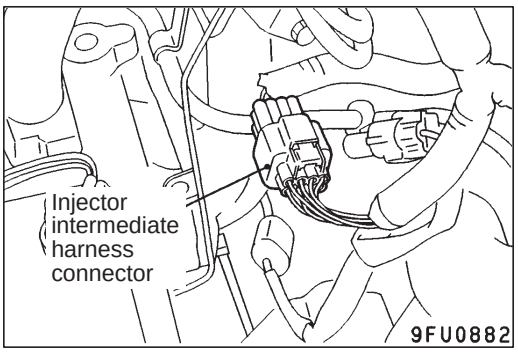
13. Stop the engine and check change of fuel pressure gauge reading. Normal if the reading does not drop within 2 minutes. If it does, observe the rate of drop and troubleshoot and repair according to the table below.

Symptom	Probable cause	Remedy
Fuel pressure drops gradually after engine is stopped	Leaky fuel pressure regulator (low pressure) valve seat	Replace fuel pressure regulator (low pressure)
Fuel pressure drops sharply immediately after engine is stopped	Check valve in fuel pump (low pressure) is held open	Replace the fuel pump (low pressure)

14. Release residual pressure from the fuel pipe line. (Refer to P.13A-99.)
15. Remove the fuel pressure gauge and special tools from the fuel pump (high pressure).

    Caution
    Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.

16. Replace the O-ring at the end of the high-pressure fuel hose with a new one. Furthermore, apply engine oil to the new O-ring before replacement.
17. Fit the high-pressure fuel hose to the fuel pump (high pressure) and tighten the mounting bolt to specified torque.
18. Check for any fuel leaks by following the procedure in step 7.
19. Disconnect the MUT-II.



MEASUREMENT OF FUEL HIGH PRESSURE BETWEEN FUEL PUMP (HIGH PRESSURE) AND INJECTORS

NOTE
Measurement of the fuel pressure between the fuel pump (high pressure) and the injectors should be carried out after checking that the fuel pressure between the fuel pump (low pressure) and the fuel pump (high pressure) is normal.

1. Connect the MUT-II to the diagnosis connector.
2. Disconnect the injector intermediate harness connector.
3. Turn the ignition switch to ON.
4. Select “Item No.74” from the MUT-II Data list.
5. Crank the engine continuously for 2 seconds or more, and visually check that there are no fuel leaks from any parts.

   Caution
   If any fuel leaks appear, stop cranking immediately and repair the source of the leak.

6. Crank the engine, and then measure the fuel pressure immediately after 20 seconds.

   Limit: Minimum 1 MPa

   Caution
   If the fuel pressure is less than 1 MPa, there may be a partial fuel leak in the high-pressure fuel system.

7. Turn the ignition switch to OFF.
8. Connect the injector intermediate harness connector.

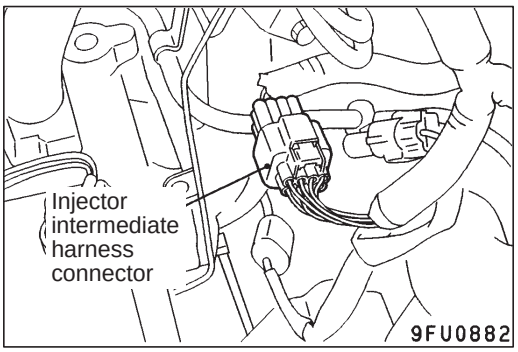
9. Start the engine and run at idle.
10. Measure fuel pressure while the engine is running at idle.

    Standard value: approximately 4 – 6.9 MPa

11. Check to see that fuel pressure at idle does not drop even after the engine has been raced several times.
12. If fuel pressure is out of the standard value, troubleshoot and repair according to the table below.

Symptom	Probable cause	Remedy
• Fuel pressure too low • Fuel pressure drops after racing	Fuel leaking to return side due to poor fuel pressure regulator (high pressure) valve seating or settled spring	Replace fuel pressure regulator (high pressure)
	Low fuel pump (high pressure) delivery pressure	Replace the fuel pump (high pressure)
Fuel pressure too high	Binding valve in fuel pressure regulator (high pressure)	Replace fuel pressure regulator (high pressure)
	Clogged fuel return hose or pipe	Clean or replace hose or pipe

13. Stop the engine and turn the ignition switch to OFF.
14. Disconnect the MUT-II.



FUEL LEAK CHECK

1. Connect the MUT-II to the diagnosis connector.
2. Disconnect the injector intermediate harness connector.
3. Turn the ignition switch to ON.
4. Select “Item No.74” from the MUT-II Data list.
5. Crank the engine continuously for two seconds or more, and visually check that there are no fuel leaks from any parts.

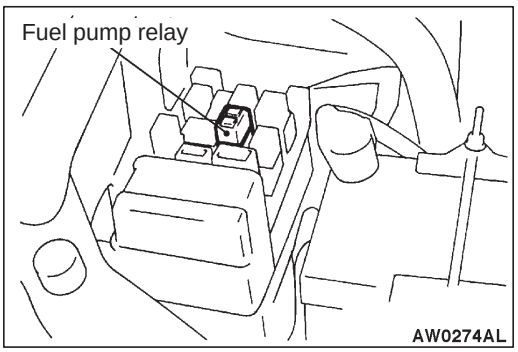
   Caution
   If any fuel leaks appear, stop cranking immediately and repair the source of the leak.

6. Crank the engine, and then measure fuel pressure immediately after 20 seconds.

   Limit: Minimum 1 MPa

   Caution
   If the fuel pressure is less than 1 MPa, there may be a partial fuel leak in the high-pressure fuel system.

7. Turn off the ignition switch.
8. Reconnect the injector intermediate connector.
9. Remove the MUT-II.



FUEL PUMP CONNECTOR DISCONNECTION (HOW TO REDUCE FUEL PRESSURE)

When removing the fuel pipe, hose, etc., since fuel pressure in the fuel pipe line is high, do the following operation so as to release fuel pressure in the line and prevent fuel from running out.

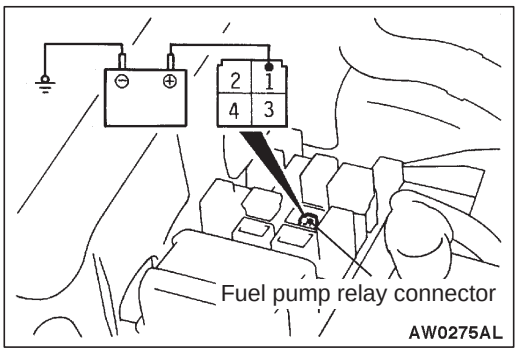
1. Remove the fuel filler cap to release pressure in the fuel tank.
2. Remove the fuel pump relay.
3. Connect the MUT-II to the diagnosis connector.

   Caution
   Turn off the ignition switch before disconnecting or connecting the MUT-II.

4. Turn off the ignition switch.
5. Select “Item No.74” from the MUT-II Data list.
6. Crank the engine for at least two seconds.
7. If the engine is not be started, use the MUT-II to make sure that the fuel pressure is 0.5 MPa or less. Then turn off the ignition switch.

8. If the engine is started, release fuel pressure by the following procedure:
   (1) Turn off the ignition switch, and then stop the engine.
   (2) Disconnect one of the ignition coil connectors.
   (3) Crank the engine for at least two seconds.
   (4) If the engine is not be started, use the MUT-II to make sure that the fuel pressure is 0.5 MPa or less. Then turn off the ignition switch.
   (5) If the engine is started, stop it by racing and use the MUT-II to make sure that the fuel pressure is 0.5 MPa or less. Then turn off the ignition switch.
   (6) Reconnect the ignition coil connector.

   Caution
   Clean the spark plug which corresponds to the disconnected ignition coil connector.
9. Remove the MUT-II.
10. Install the fuel pump relay.



FUEL PUMP OPERATION CHECK

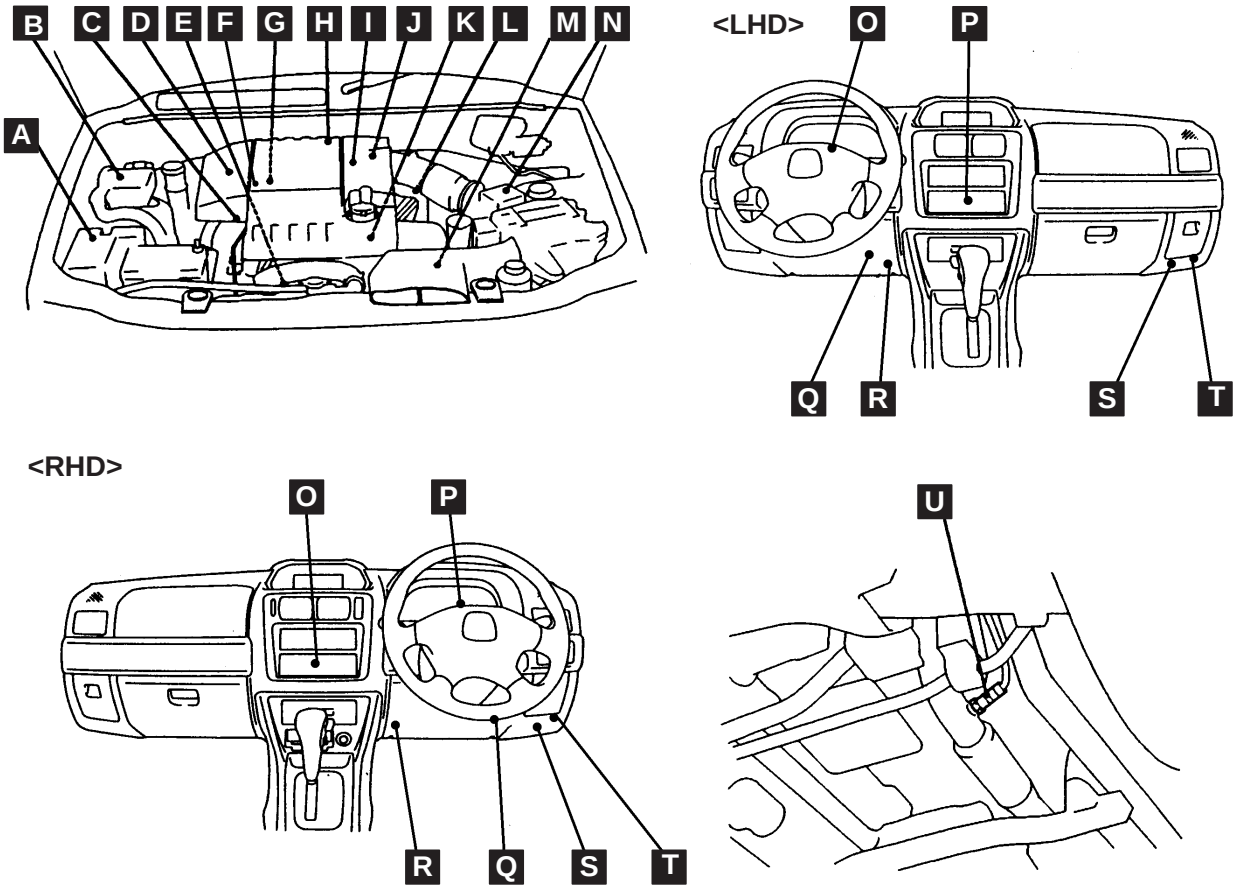
1. Check the operation of the fuel pump by using the MUT-II to force-drive the fuel pump.
2. If the fuel pump will not operate, check by using the following procedure, and if it is normal, check the drive circuit.
   (1) Turn off the ignition switch.
   (2) Remove the fuel pump relay. Connect the terminal No.1 of the harness-side connector to the battery. Check if the fuel pump operation sound can be heard at this time.

   NOTE
   As the fuel pump is an in-tank type, the fuel pump sound is hard to hear, so remove the fuel filler cap and check from the tank inlet.

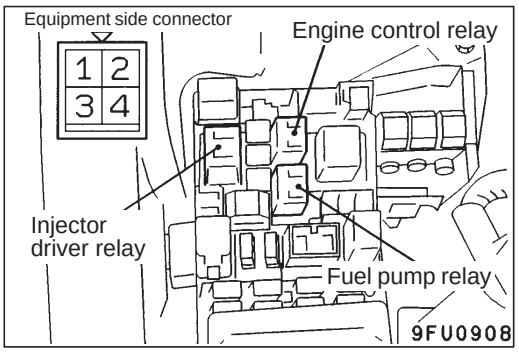
   (3) Check the fuel pressure by pinching the fuel hose with the fingertips.

COMPONENT LOCATION

Name	Symbol	Name	Symbol
A/C relay	A	Fuel pressure sensor	F
A/C switch	P	Fuel pump relay	A
Accelerator pedal position sensor (1st and 2nd channels)	Q	Ignition coil	I
		Inhibitor switch <A/T>	J
Air flow sensor (with intake air temperature sensor and barometric pressure sensor)	N	Injectors	G
		Injector driver	B
Camshaft position sensor	H	Injector driver relay	A
Crank angle sensor	E	Oxygen sensor	U
Detonation sensor	K	Power steering fluid pressure switch	M
Diagnosis connector	R	Purge control solenoid valve	C
EGR valve	F	Throttle position sensor	D
Engine control relay	A	Throttle valve controller	S
Engine coolant temperature sensor	L	Throttle valve control servo	D
Engine-ECU	S	Throttle valve control servo relay	T
Engine warning lamp (CHECK ENGINE lamp)	O	Vehicle speed sensor	J

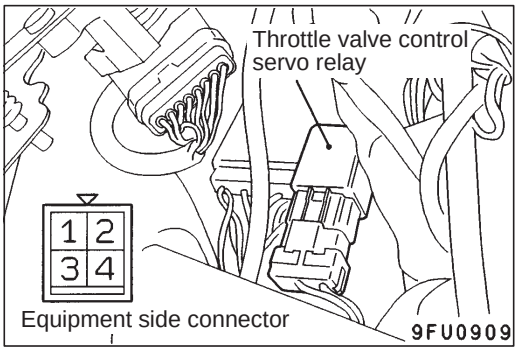


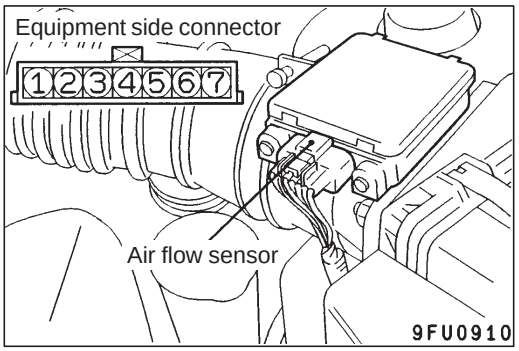
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ENGINE CONTROL RELAY, FUEL PUMP RELAY, INJECTOR DRIVER RELAY AND THROTTLE VALVE CONTROL SERVO RELAY CONTINUITY CHECK

Battery voltage	Terminal No.			
	1	2	3	4
Not supplied		○		○
Supplied	○	⊖	○	⊕

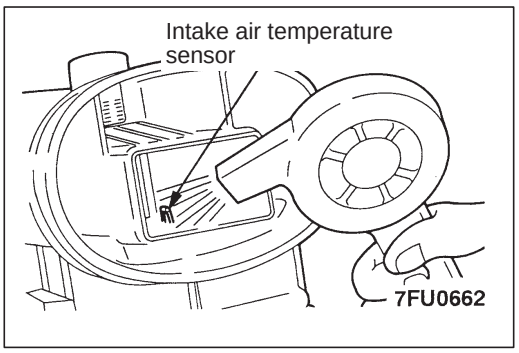




INTAKE AIR TEMPERATURE SENSOR CHECK

1. Disconnect the air flow sensor connector.
2. Measure resistance between terminals 5 and 6.

   Standard value:
   2.3 – 3.0 kΩ (at 20°C)
   0.30 – 0.42 kΩ (at 80°C)

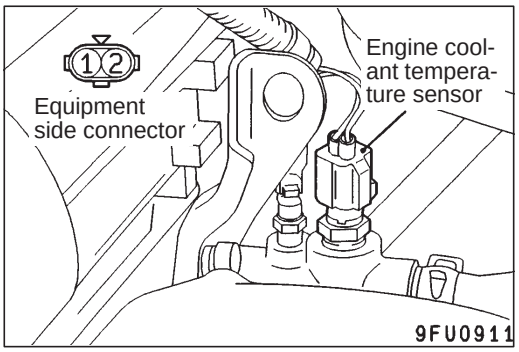


3. Measure resistance while heating the sensor using a hair drier.

   Normal condition:

Temperature (°C)	Resistance (kΩ)
Higher	Smaller

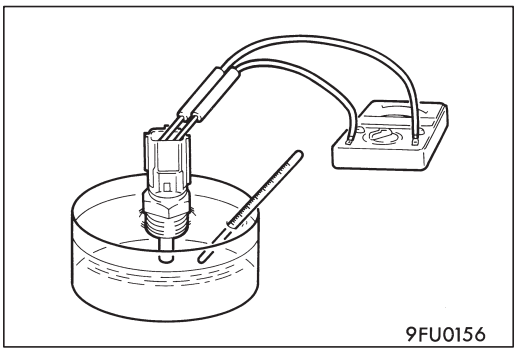
4. If the value deviates from the standard value or the resistance remains unchanged, replace the air flow sensor assembly.



ENGINE COOLANT TEMPERATURE SENSOR CHECK

Caution
Be careful not to touch the connector (resin section) with the tool when removing and installing.

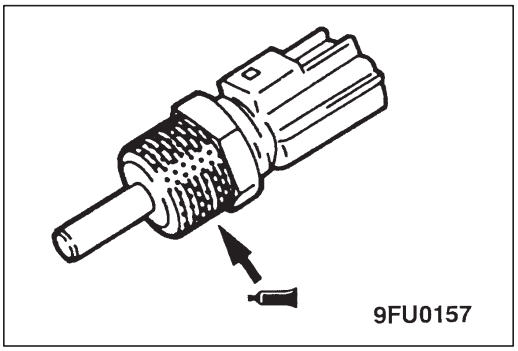
1. Remove the engine coolant temperature sensor.



2. With temperature sensing portion of engine coolant temperature sensor immersed in hot water, check resistance.

   Standard value:
   2.1 – 2.7 kΩ (at 20°C)
   0.26 – 0.36 kΩ (at 80°C)

3. If the resistance deviates from the standard value greatly, replace the sensor.

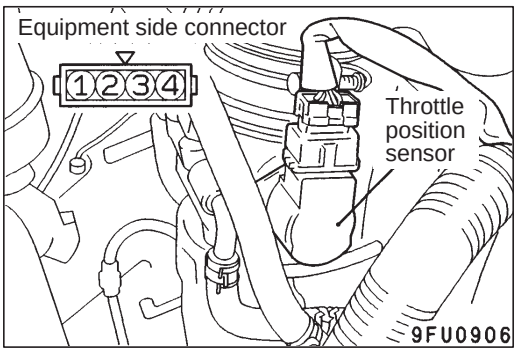


4. Apply sealant to threaded portion.

   Specified sealant:
   3M NUT Locking Part No.4171 or equivalent

5. Install the engine coolant temperature sensor and tighten it to the specified torque.

   Tightening torque: 29 Nm



THROTTLE POSITION SENSOR CHECK

1. Disconnect the throttle position sensor connector.
2. Measure the resistance between throttle position sensor side connector terminal 1 and terminal 3.

   Standard value: 3.5 – 6.5 kΩ

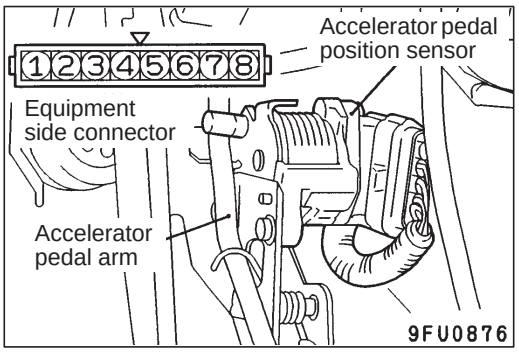
3. Measure resistance between terminal Nos. 1 and 2 as well as 1 and 4 of the throttle position sensor connector, respectively.

   Normal condition:

Throttle valve slowly open until fully open from the idle position	Changes smoothly in proportion to the opening angle of the throttle valve

4. If the resistance is outside the standard value, or if it doesn't change smoothly, replace the throttle position sensor.

   NOTE
   For the throttle position sensor adjustment procedure, refer to P.13A-92.



ACCELERATOR PEDAL POSITION SENSOR (1ST CHANNEL) CHECK

1. Disconnect the accelerator pedal position sensor connector.
2. Measure resistance between terminal No.2 (sensor power supply) and 1 (sensor earth) of the sensor connector.

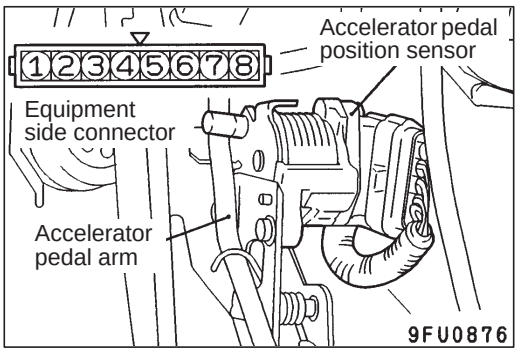
   Standard value: 3.5 – 6.5 kΩ
3. Measure resistance between terminal No.2 (sensor power supply) and 3 (sensor output) of the connector.

   Normal condition:

Depress the accelerator pedal slowly.	Resistance value changes in accordance with the accelerator pedal depression smoothly.

4. If not within the standard value, or resistance value does not change smoothly, replace the accelerator pedal position sensor assembly.

   NOTE
   After replacement, adjust the accelerator pedal position sensor. (Refer to P.13A-94.)



ACCELERATOR PEDAL POSITION SENSOR (2ND CHANNEL) CHECK

1. Disconnect the accelerator pedal position sensor connector.
2. Measure resistance between terminal No.8 (sensor power supply) and 7 (sensor earth) of the sensor connector.

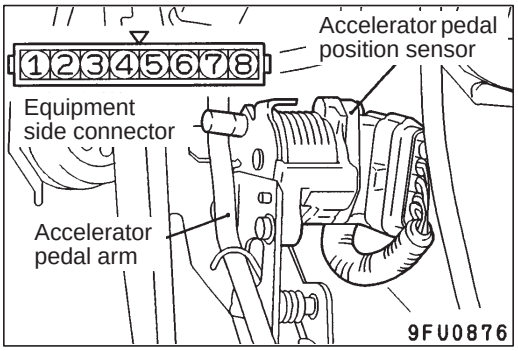
   Standard value: 3.5 – 6.5 kΩ
3. Measure resistance between terminal No.8 (sensor power supply) and 6 (sensor output) of the connector.

   Normal condition:

Depress the accelerator pedal slowly.	Resistance value changes in accordance with the accelerator pedal depression smoothly.

4. If not within the standard value, or resistance value does not change smoothly, replace the accelerator pedal position sensor assembly.

   NOTE
   After replacement, adjust the accelerator pedal position sensor. (Refer to P.13A-94.)



ACCELERATOR PEDAL POSITION SWITCH CHECK

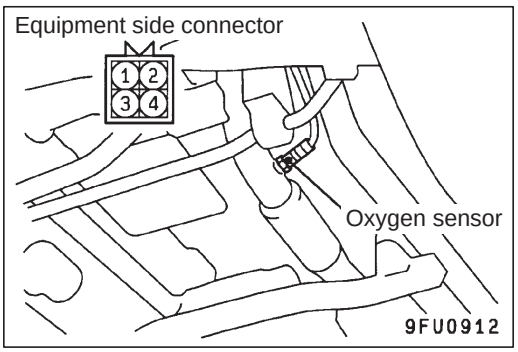
1. Disconnect the accelerator pedal position sensor connector.
2. Check continuity between terminal No.4 (accelerator pedal position switch) and 5 (sensor earth) of the connector.

Normal condition

Accelerator pedal	Continuity
Depressed	No continuity
Released	Continuity (0 Ω)

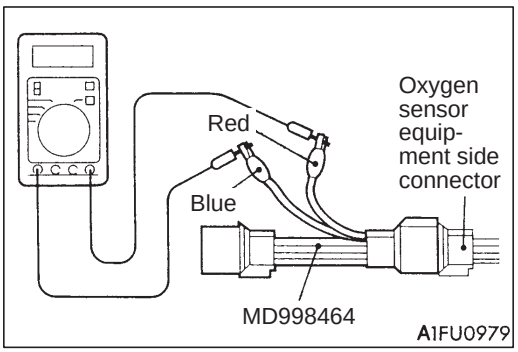
3. If defective, replace the accelerator pedal position sensor assembly.

NOTE
After replacement, adjust the accelerator pedal position sensor. (Refer to P.13A-94.)

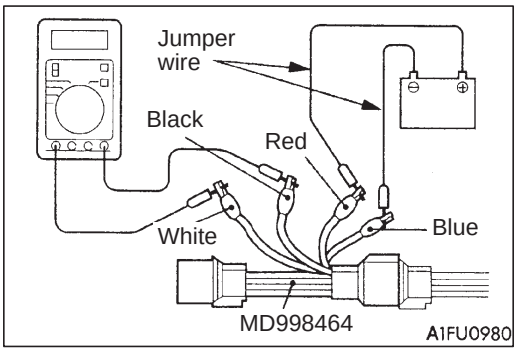


OXYGEN SENSOR CHECK

1. Disconnect the oxygen sensor connector and connect the special tool (test harness) to the connector on the oxygen sensor side.
2. Make sure that there is continuity (11 – 18 Ω at 20°C) between terminal 1 (red cip of special tool) and terminal 3 (blue clip of special tool) on the oxygen sensor connector.



3. If there is no continuity, replace the oxygen sensor.
4. Warm up the engine until engine coolant is 80°C or higher.



5. Use a jumper wire to connect terminal 1 (red clip) of the oxygen sensor connector to the battery (+) terminal and terminal 3 (blue clip) to the battery (–) terminal.

Caution
Be very careful when connecting the jumper wire; incorrect connection can damage the oxygen sensor.

6. Connect a digital voltage meter between terminal 2 (black clip) and terminal 4 (white clip).

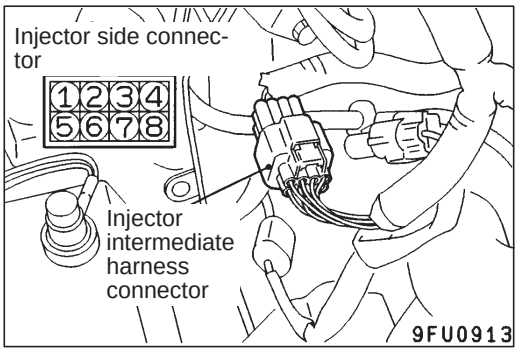
7. While repeatedly racing the engine, measure the oxygen sensor output voltage.

Standard value:

Engine	Oxygen sensor output voltage	Remarks
When racing the engine	0.6 – 1.0 V	If you make the air/fuel ratio rich by racing the engine repeatedly, a normal oxygen sensor will output a voltage of 0.6 – 1.0 V.

8. If the sensor is defective, replace the oxygen sensor.

NOTE
For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Pipe and Main Muffler.



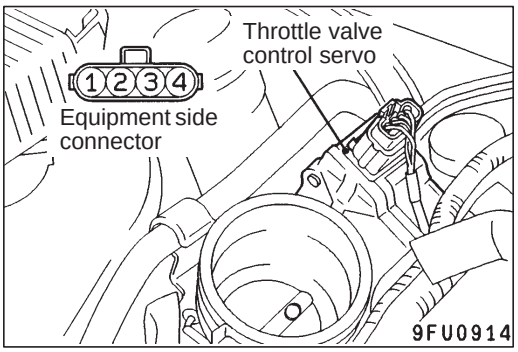
INJECTOR CHECK

1. Disconnect the injector intermediate harness connector.
2. Measure the resistance between each of the terminals.

Standard value: 0.9 – 1.1 Ω (at 20°C)

Injector	Measurement terminal
No.1 cylinder	1 – 2
No.2 cylinder	3 – 4
No.3 cylinder	5 – 6
No.4 cylinder	7 – 8

3. Connect the injector intermediate harness connector.



THROTTLE VALVE CONTROL SERVO CHECK

Operation Check

1. Disconnect the air intake hose from the throttle body.
2. Turn on the ignition switch.
3. Check that the throttle valve opens or closes in response to the accelerator pedal depression.

Check of Coil Resistance

1. Disconnect the throttle valve control servo connector.
2. Measure resistance between the throttle valve control servo connector terminals.

Standard value:

Terminals to be measured	Resistance value (Ω)
1 – 3	1.35 – 1.65 (at 20°C)
2 – 4	

3. Check that there is no continuity between the terminals and body.

PURGE CONTROL SOLENOID VALVE CHECK

Refer to GROUP 17 – Emission Control System.

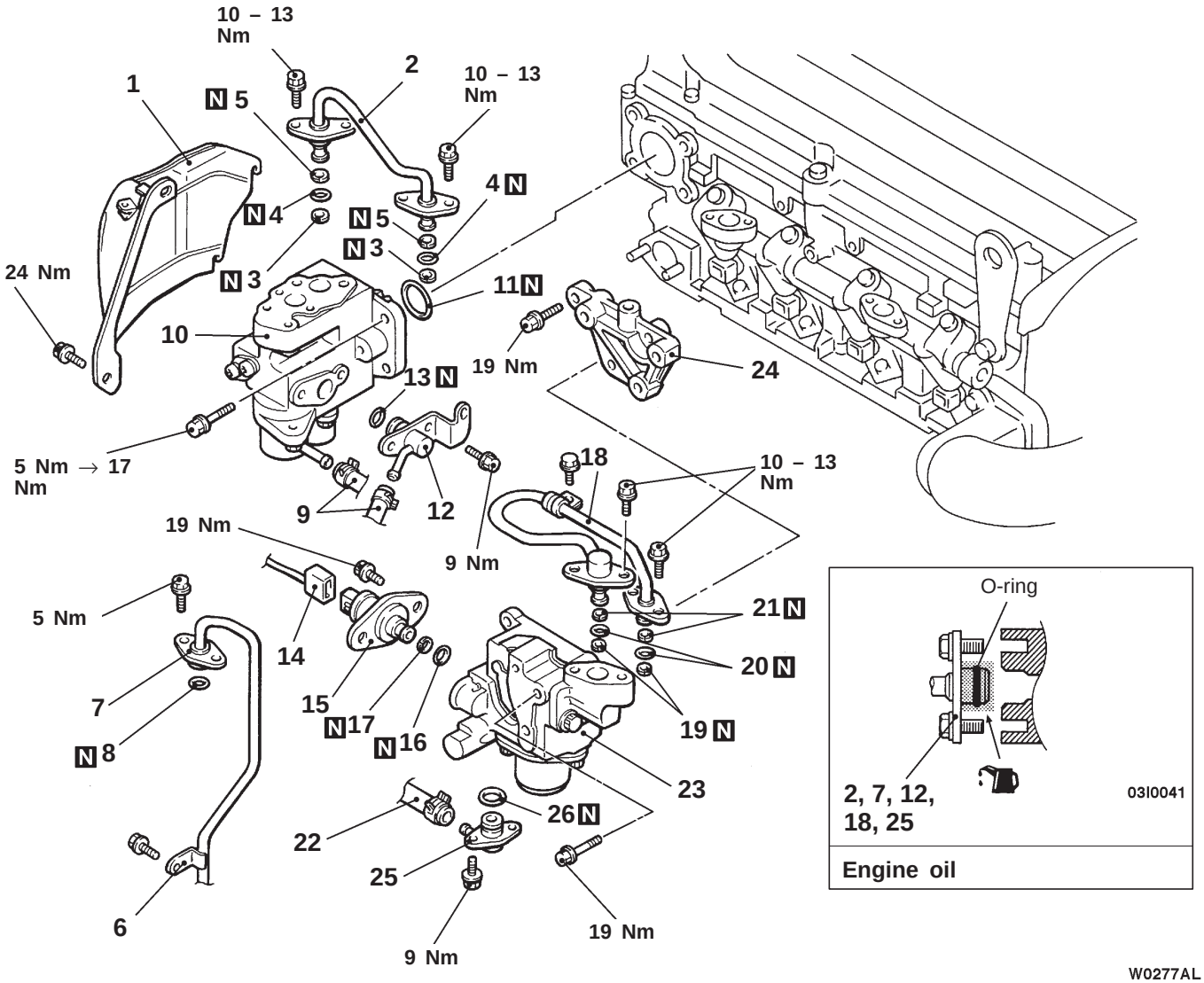
EGR VALVE CHECK

Refer to GROUP 17 – Emission Control System.

FUEL PUMP (HIGH PRESSURE) AND FUEL PRESSURE REGULATOR (HIGH PRESSURE)

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Fuel Discharge Prevention <before removal only> (Refer to P.13A-98.)
- Engine Cover Removal and Installation
- Resonance Tank Removal and Installation (Refer to GROUP 15.)
- Fuel Leak Check <after installation only> (Refer to P.13A-98.)



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Fuel pump (High pressure) removal steps

- ▶F◀ ● Fuel pump (high pressure) air bleeding
- ● Throttle body removal (Refer to P.13A-113.)
- ◀A▶ 1. Fuel pump protector
- ▶C◀ 2. Fuel feed pipe
- ▶B◀ 3. Back-up ring A
- ▶B◀ 4. O-ring
- ▶B◀ 5. Back-up ring B
- 6. Fuel pressure hose clamp
- ▶C◀ 7. Fuel pressure hose connection
- 8. O-ring
- 9. Fuel return hose connection
- ▶E◀ 10. Fuel pump (high pressure)
- 11. O-ring
- 12. Fuel pump return nipple
- 13. O-ring

Fuel pressure regulator (High pressure) removal steps

- ● Intake manifold assembly removal (Refer to GROUP 15.)
- 14. Fuel pressure sensor connector connection
- 15. Fuel pressure sensor
- ▶D◀ 16. O-ring
- ▶D◀ 17. Back-up ring
- ▶C◀ 18. Fuel return pipe
- ▶B◀ 19. Back-up ring A
- ▶B◀ 20. O-ring
- ▶B◀ 21. Back-up ring B
- 22. Fuel return hose connection
- ▶A◀ 23. Fuel pressure regulator (high pressure)
- 24. Spacer
- 25. Fuel nipple
- 26. O-ring

REMOVAL SERVICE POINT

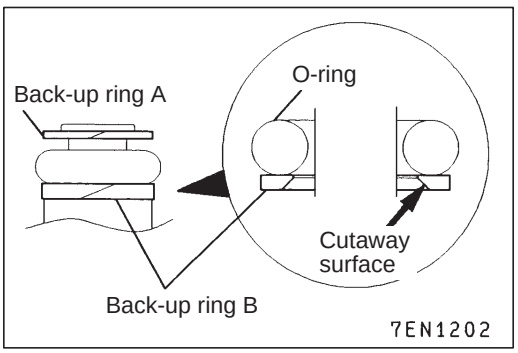
◀A▶ FUEL PUMP PROTECTOR REMOVAL

Lift up the transmission with a jack to create clearance between the engine and front deck, and then remove the fuel pump protector.

INSTALLATION SERVICE POINTS

▶A◀ FUEL PRESSURE REGULATOR (HIGH PRESSURE) INSTALLATION

1. Install provisionally the fuel pressure regulator (high pressure) to the spacer.
2. Install the fuel return pipe, and then tighten the fuel pressure regulator (high pressure) to the specified torque.



▶B◀ BACK-UP RING B/O-RING/BACK-UP RING A INSTALLATION

Install the back-up rings and the O-ring as shown in the illustration.

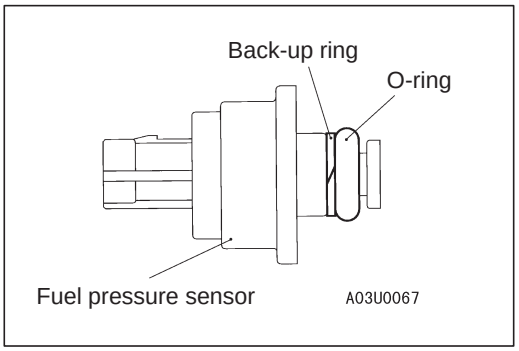
Caution

1. **Install the back-up ring B facing its cutaway surface toward the opposite side of the O-ring as shown in the illustration.**
2. **Confirm the outer diameter of the back-up ring A. Take care not to install the back-up ring for the fuel pressure sensor by mistake. (Outer diameter of the back-up ring A: 14.8 mm)**

▶C◀ FUEL RETURN PIPE/FUEL PRESSURE HOSE/FUEL FEED PIPE INSTALLATION

Apply a small amount of fresh engine oil to the O-ring.

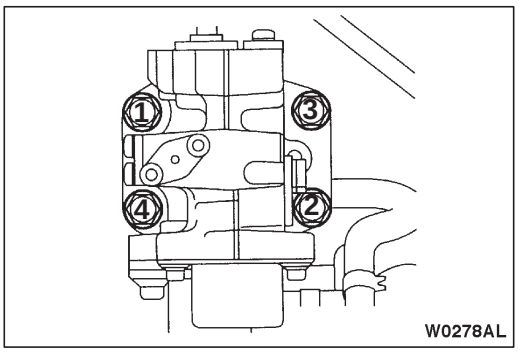
Caution
Take care not to let any of the engine oil get inside the fuel pump (high pressure), fuel pressure regulator (high pressure) or the delivery pipe assembly.



▶D◀ BACK-UP RING/O-RING INSTALLATION

Install the back-up ring and the O-ring as shown in the illustration.

Caution
Take care not to install the back-up ring A for the injector, fuel feed pipe or fuel return pipe by mistake. (Outer diameter of the back-up ring for the fuel pressure sensor: 15.1 mm)



▶E◀ FUEL PUMP (HIGH PRESSURE) INSTALLATION

1. Apply a small amount of fresh engine oil to the fuel pump (high pressure) roller and O-ring.
2. Install temporarily the fuel pump (high pressure) to the cylinder head.
3. Install the fuel feed pipe, and then tighten the fuel pump (high pressure) mounting bolts to 5 Nm in the order shown in the illustration.
4. Tighten the bolts to 17 Nm in the order shown in the illustration. The overall difference in tightening torque between the four bolts should be within 2 Nm.

▶F◀ FUEL PUMP (HIGH PRESSURE) AIR BLEEDING

1. Run the engine at 2,000 r/min for 15 seconds or more in order to bleed the air.

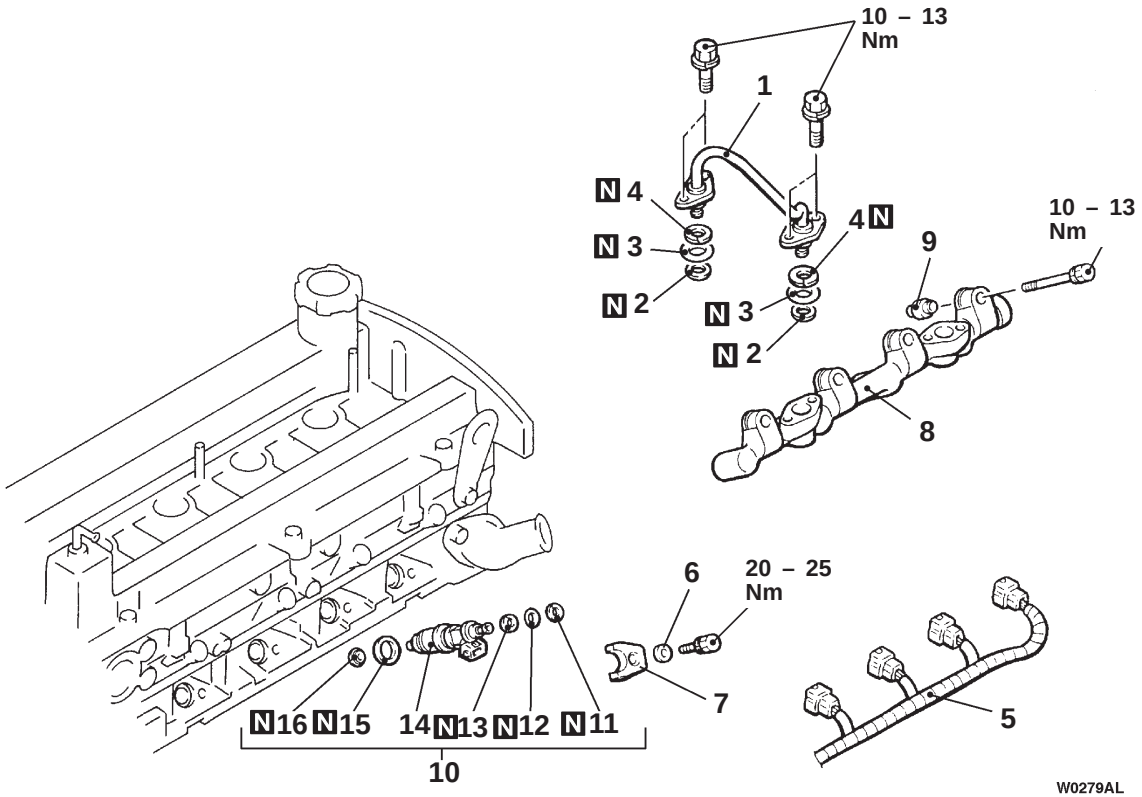
   NOTE
   When removing the fuel pump (high pressure), air may get into the fuel pump (high pressure). If air gets into the fuel pump (high pressure), diagnosis code No.56 for abnormal fuel pressure will be output.

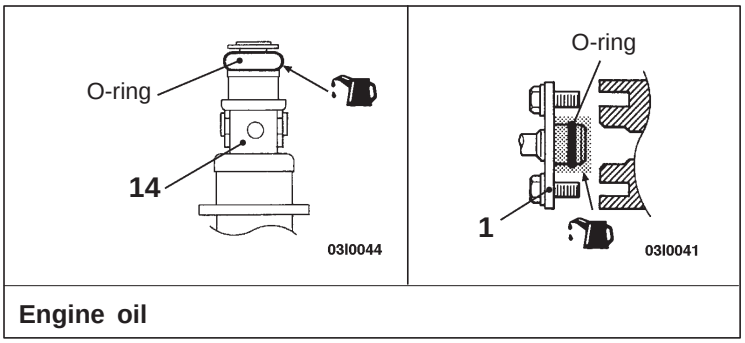
2. Use the MUT-II to check the diagnosis code. If the diagnosis code No.56 for fuel pressure sensor system defect is output, erase it.

INJECTOR

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Fuel Pressure Regulator (High Pressure) Removal and Installation (Refer to P.13A-107.)





Engine oil

Removal steps

- ▶D◀ 1. Fuel feed pipe
- ▶C◀ 2. Back-up ring A
- ▶C◀ 3. O-ring
- ▶C◀ 4. Back-up ring B
- ◀A▶ 5. Injector harness connector
- 6. Washer
- 7. Injector holder
- ◀B▶ ▶B◀ 8. Delivery pipe assembly
- 9. Insulator
- ◀B▶ ▶B◀ 10. Fuel injector assembly
- 11. Back-up ring
- 12. O-ring
- 13. Back-up ring
- 14. Fuel injector
- 15. Gasket
- ▶A◀ 16. Corrugated washer

REMOVAL SERVICE POINTS

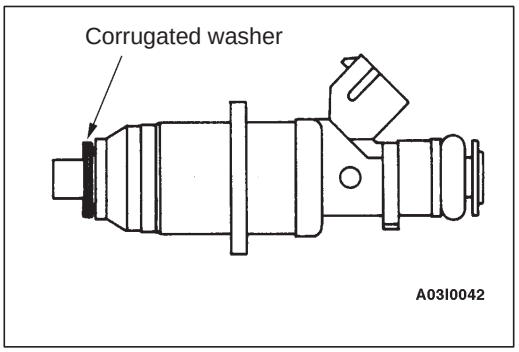
◀A▶ INJECTOR HARNESS CONNECTOR DISCONNECTION

Caution
Disconnect the battery (–) cable from its terminal before carrying out this operation.

◀B▶ DELIVERY PIPE ASSEMBLY/FUEL INJECTOR ASSEMBLY REMOVAL

Remove the delivery pipe assembly with the fuel injector assembly still attached.

Caution
Be careful not to drop the fuel injector assembly when removing the delivery pipe assembly.



INSTALLATION SERVICE POINTS

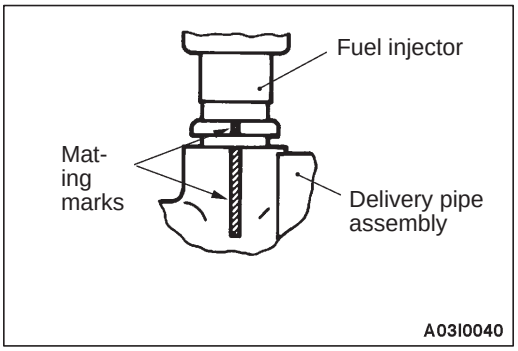
▶A◀ CORRUGATED WASHER INSTALLATION

Caution
The corrugated washer should always be replaced with a new part.

▶B◀ FUEL INJECTOR ASSEMBLY/DELIVERY PIPE ASSEMBLY INSTALLATION

1. Apply a small amount of fresh engine oil to the O-ring.

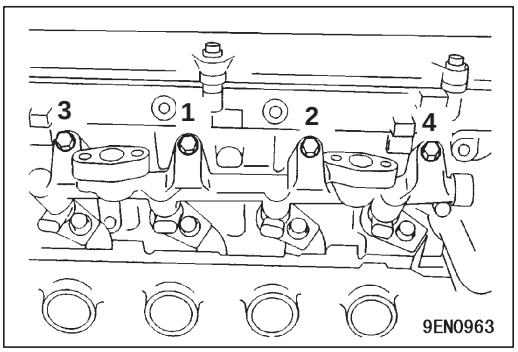
   Caution
   Take care not to let any of the engine oil get inside the delivery pipe assembly.
2. While being careful not to damage the O-ring, turn the fuel injector assembly to the left and right and connect it to the delivery pipe assembly. After connecting, check that the fuel injector turns smoothly.
3. If the fuel injector does not turn smoothly, the cause may be that the O-ring is getting caught. Remove the fuel injector, check the O-ring for damage and re-connect the fuel injector to the delivery pipe assembly and then re-check.



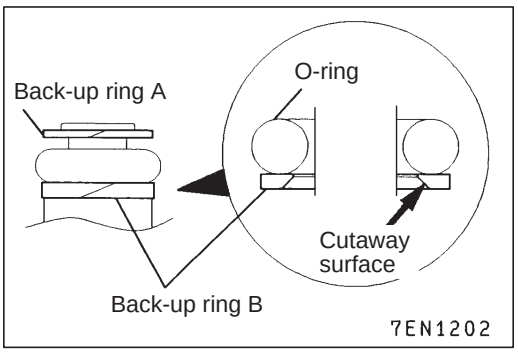
4. Align the mating marks on the delivery pipe assembly and the fuel injector, and then install the delivery pipe assembly with the injector assembly still attached.

5. Install the delivery pipe and fuel injectors to the cylinder head, and then tighten them provisionally.
6. Install the injector holders and washers, and then tighten them to the specified torque.

Caution
Observe the tightening torque.



7. Tighten the delivery pipe and fuel injectors to the specified torque in the order shown in the illustration.



▶C◀ BACK-UP RING B/O-RING/BACK-UP RING A INSTALLATION

Install the back-up rings and the O-ring as shown in the illustration.

Caution
Install the back-up ring B facing its cutaway surface toward the opposite side of the O-ring as shown in the illustration.

▶D◀ FUEL FEED PIPE INSTALLATION

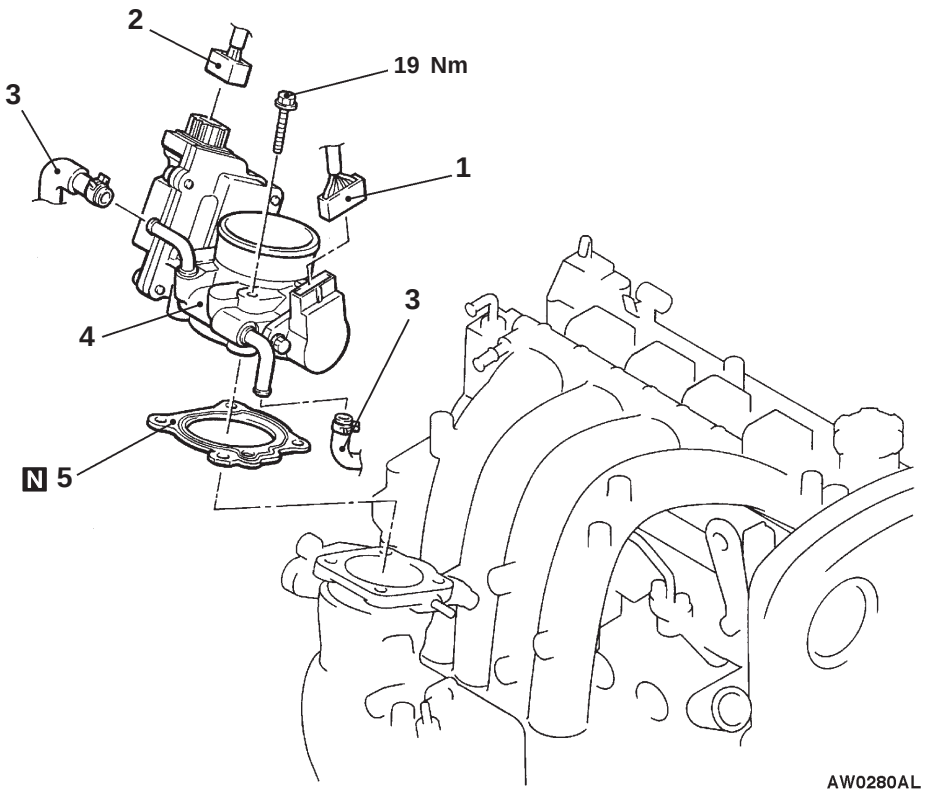
Apply a small amount of fresh engine oil to the O-ring.

Caution
Take care not to let any of the engine oil get inside the fuel pump (high pressure), fuel pressure regulator (high pressure) and delivery pipe.

THROTTLE BODY

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying (Refer to GROUP 14 – On-vehicle Service.)
- Resonance Tank Removal and Installation (Refer to GROUP 15.)



Removal steps
1. Throttle position sensor connector connection
2. Throttle control servo connector connection
3. Water hose connection
▶A◀ 4. Throttle body assembly
5. Throttle body gasket

INSTALLATION SERVICE POINT

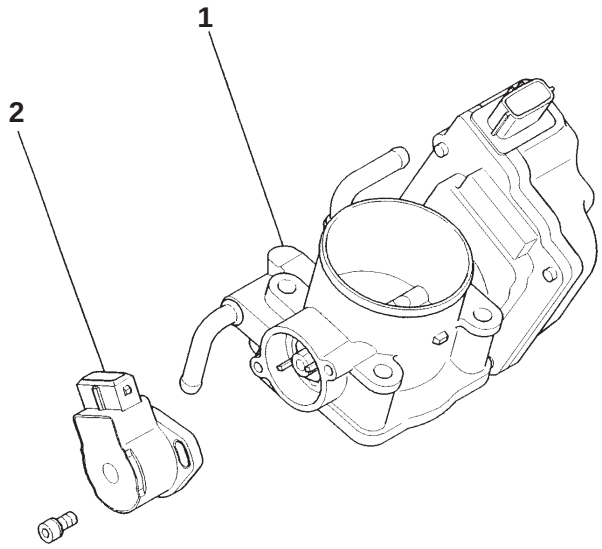
▶A◀ THROTTLE BODY INSTALLATION

If the throttle body is replaced, initialize the electronic-controlled throttle valve system.

Initialization

Turn on the ignition switch, and turn it to LOCK (OFF) position within one second. Then leave it for at least ten seconds with the ignition switch in LOCK (OFF) position.

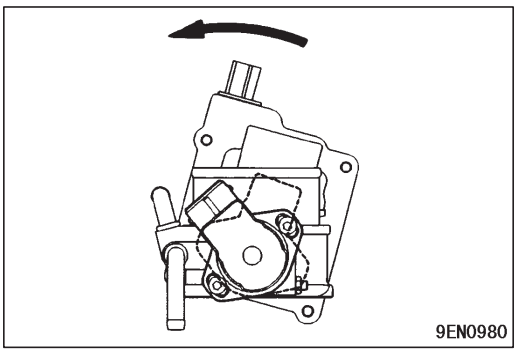
DISASSEMBLY AND REASSEMBLY



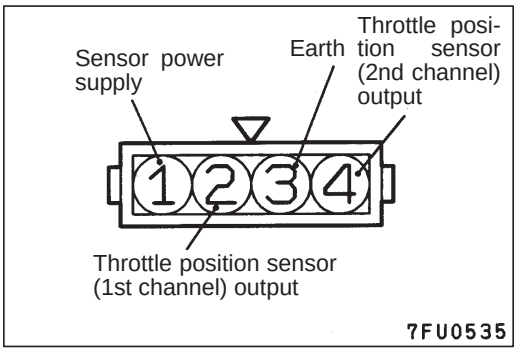
9EN0979

Disassembly steps

▶A◀ 1. Throttle position sensor
2. Throttle body



9EN0980



7FU0535

REASSEMBLY SERVICE POINTS

▶A◀ THROTTLE POSITION SENSOR

1. Position the throttle position sensor on the throttle body along the dotted line as shown in the illustration.
2. Rotate the throttle position sensor anticlockwise as shown in the illustration, and then tighten the screws.
3. Measure resistance value between terminal Nos. 1(sensor power supply) and 2 (throttle position sensor 1st-channel output) as well as 1 (sensor power supply) and 4 (throttle position sensor 2nd-channel output).

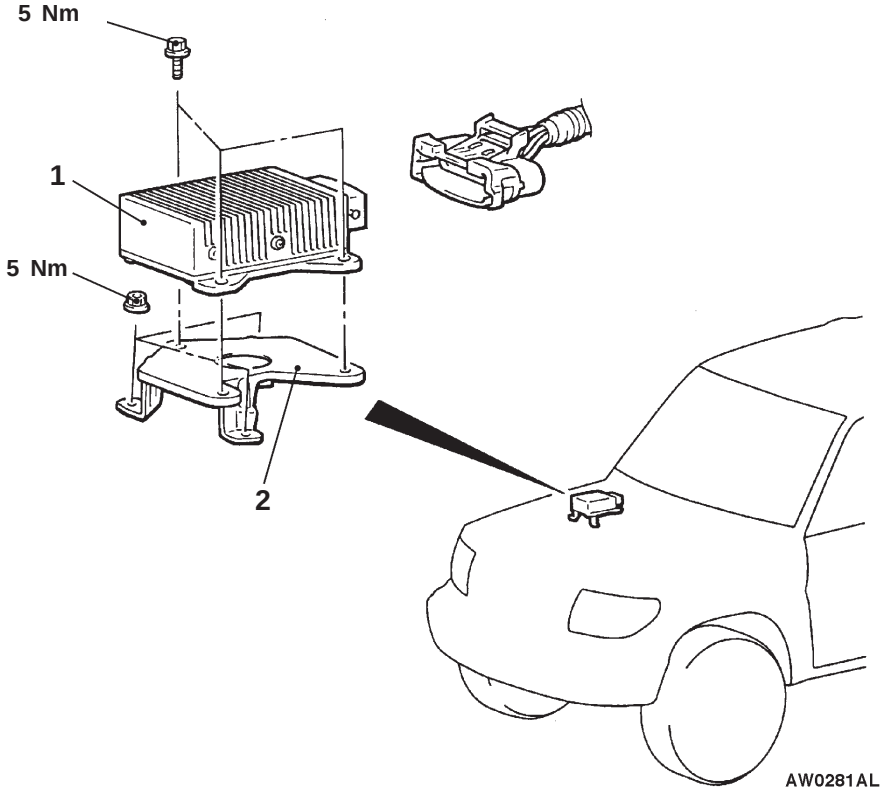
Normal condition

Open the throttle valve slowly from the idle position to full-open position.	Resistance value changes smoothly in response to throttle valve opening angle.

4. If the resistance value does not change smoothly, replace the throttle position sensor.

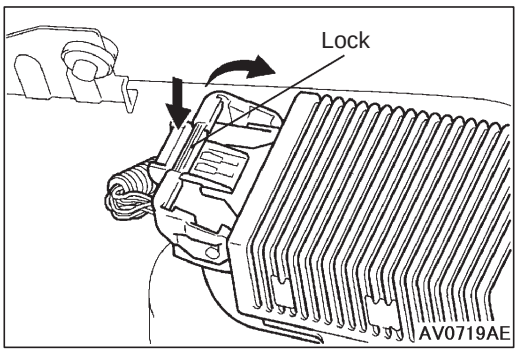
INJECTOR DRIVER

REMOVAL AND INSTALLATION



Removal steps

◀A▶ 1. Injector driver
2. Bracket



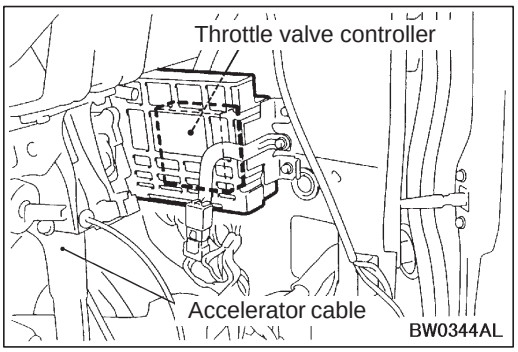
REMOVAL SERVICE POINT

◀A▶ INJECTOR DRIVER REMOVAL

Press the injector driver connector in the place shown in the illustration to disconnect the injector driver connector.

Caution

1. **Disconnect the battery (–) cable from its terminal before carrying out this operation.**
2. **High-tension current is flowing in the harness between the injector driver and the injector while engine is running, and the injector driver will become hot after the vehicle has been driven, so take care when handling it.**



THROTTLE VALVE CONTROLLER

INSTALLATION SERVICE POINT

If the throttle valve controller is replaced, initialize the electronic-controlled throttle valve system.

Initialization

Turn on the ignition switch, and turn it to LOCK (OFF) position within one second. Then leave it for at least ten seconds with the ignition switch in LOCK (OFF) position.

NOTES

GASOLINE DIRECT INJECTION (GDI)

CONTENTS

GENERAL 3
Outline of Changes 3
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Fuel Pressure Test 108
Component Location 112
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FUEL PUMP (HIGH PRESSURE) 114
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GENERAL

OUTLINE OF CHANGES

Due to the changes shown below, the service procedures regarding the different description from the previous version have been established.

- On-board Diagnostics System has been adopted to expand the diagnostic items and to change diagnosis code numbering system.
- Fuel pressure regulator (high-pressure) incorporate fuel pump (high-pressure) has been adopted.
- An oxygen sensor (rear) has been added.
- A ignition failure sensor has been added.

GENERAL INFORMATION

SELF-DIAGNOSIS FUNCTION

Following functions have been added.

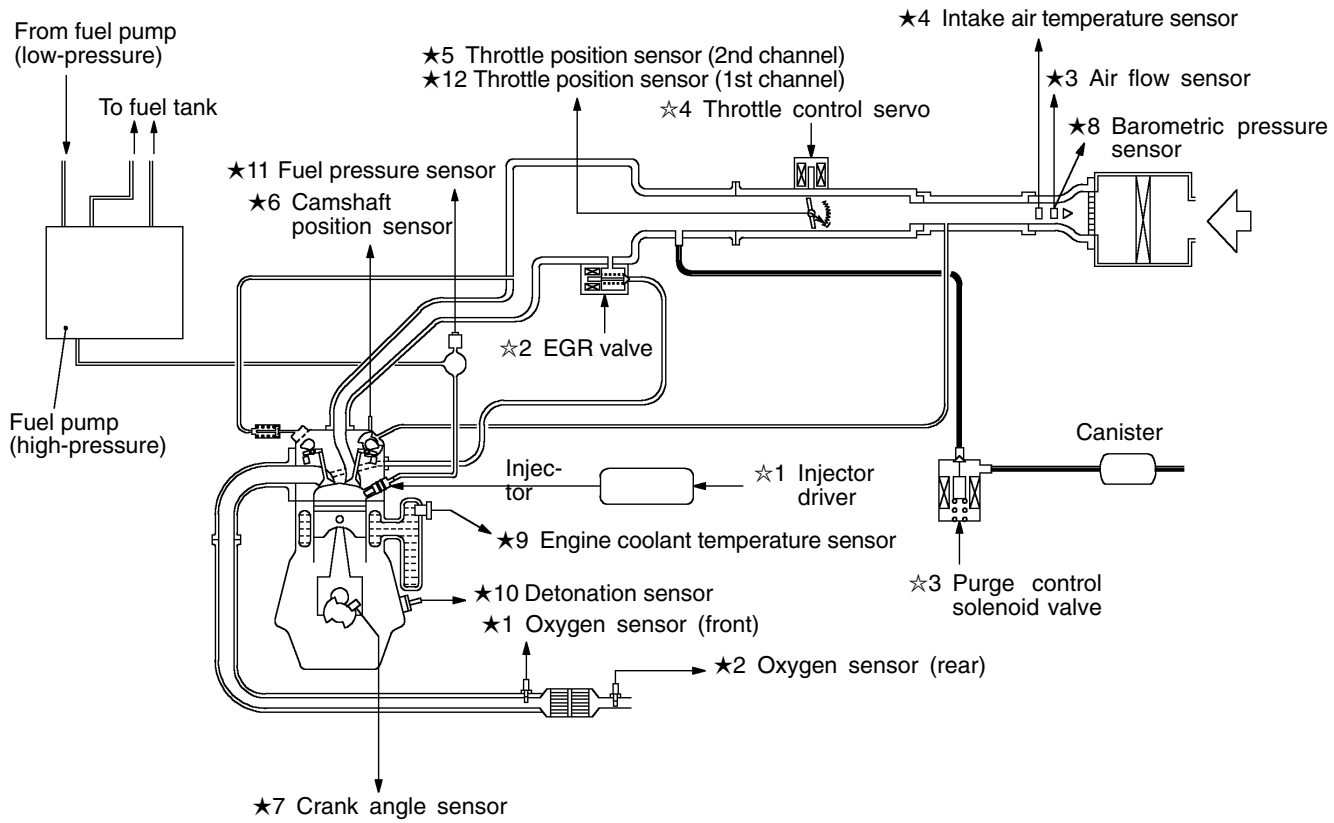
- The engine-ECU records the engine operating condition when the diagnosis code is set.
  This data is called “freeze frame” data.
  This data can be read by using the MUT-II, are can then be used in simulation tests for troubleshooting.

GENERAL SPECIFICATION

Items		Specification
Engine-ECU	Identification No.	E2T71582

GASOLINE DIRECT INJECTION SYSTEM DIAGRAM

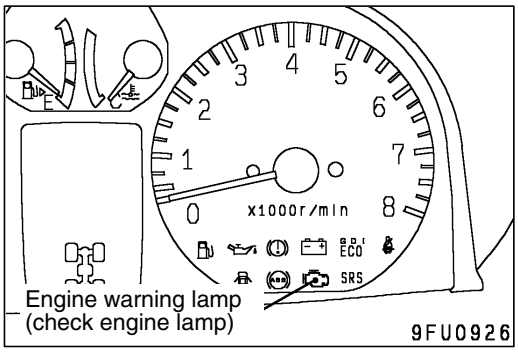
★1 Oxygen sensor (front) ★2 Oxygen sensor (rear) ★3 Air flow sensor ★4 Intake air temperature sensor ★5 Throttle position sensor (2nd channel) ★6 Camshaft position sensor ★7 Crank angle sensor ★8 Barometric pressure sensor ★9 Engine coolant temperature sensor ★10 Detonation sensor ★11 Fuel pressure sensor	• Power supply • Ignition switch-IG • Ignition switch-ST • Accelerator pedal position sensor (1st channel) • Accelerator pedal position switch • Vehicle speed sensor • A/C switch 1 • Inhibitor switch <A/T> • Power steering fluid pressure switch • Alternator FR signal • Stop lamp switch • Small lamp switch • Brake vacuum sensor • Injector open circuit check signal • Throttle valve controller • A/C thermo sensor	⇨ Engine-ECU ⇨	☆1 Injector driver (injector) ☆2 EGR valve (stepper motor) ☆3 Purge control solenoid valve	• Engine control relay • Fuel pump relay • Injector driver relay • Throttle control servo relay • A/C relay • Ignition coil • Fan controller • Engine warning lamp • GDI ECO indicator lamp • Diagnosis output • Alternator G terminal • Throttle valve controller • Oxygen sensor heater
★12 Throttle position sensor (1st channel)	• Power supply • Ignition switch-IG • Accelerator pedal position sensor (2nd channel) • Engine-ECU	⇨ Throttle valve controller ⇨	☆4 Throttle valve control servo	• Engine-ECU



Y6061AJ

SERVICE SPECIFICATIONS

Items			Standard value
Fuel pressure	High-pressure side MPa		4 – 6.9
	Low-pressure side kPa		Approximately 324
Oxygen sensor output voltage (during revving) V			0.6 – 1.0
Oxygen sensor heater resistance (at 20°C) Ω		Front	4.5 – 8.0
		Rear	11 – 18



TROUBLESHOOTING

DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

If an abnormality occurs in any of the following items related to the GDI system, the engine warning lamp will illuminate or flash. If the lamp remains illuminated or if the lamp illuminates while the engine is running, check the diagnosis code output. However, the warning lamp will illuminate as bulb check for five seconds whenever the ignition switch is turned to the ON position.

Engine warning lamp inspection items

Code No.	Diagnosis item
–	Engine-ECU
P0100	Air flow sensor system
P0105	Barometric pressure sensor system
P0110	Intake air temperature sensor system
P0115	Engine coolant temperature sensor system
P0120★	Throttle position sensor (1st channel) system
P0125	Feedback system
P0130	Oxygen sensor (front) system <sensor 1>
P0135	Oxygen sensor heater (front) system <sensor 1>
P0136	Oxygen sensor (rear) system <sensor 2>
P0141	Oxygen sensor heater (rear) system <sensor 2>
P0170	Abnormal fuel system
P0190★	Abnormal fuel pressure
P0201	No. 1 injector system
P0202	No. 2 injector system
P0203	No. 3 injector system
P0204	No. 4 injector system
P0220★	Accelerator pedal position sensor (1st channel) system
P0225★	Throttle position sensor (2nd channel) system
P0300★	Ignition coil (power transistor) system
P0301	No. 1 cylinder misfire detected
P0302	No. 2 cylinder misfire detected
P0303	No. 3 cylinder misfire detected
P0304	No. 4 cylinder misfire detected

Code No.	Diagnosis item
P0335	Crank angle sensor system
P0340	Camshaft position sensor system
P0403	EGR valve system
P0420	Catalyst malfunction
P0443	Purge control solenoid valve system
P1200	Injector driver system
P1220★	Electronic-controlled throttle valve system
P1221★	Throttle valve position feedback system
P1223★	Communication line with throttle valve controller
P1224★	Throttle valve control servo motor (motor 1st phase malfunction) system
P1225★	Accelerator pedal position sensor (2nd channel) system
P1228★	Throttle valve control servo motor (motor 2nd phase malfunction) system
P1515	Brake vacuum sensor system

NOTE

1. If the engine warning lamp illuminates because of a malfunction of the engine-ECU, communication between MUT-II and the engine-ECU is impossible. In this case, the diagnosis code cannot be read.
2. After the engine-ECU has detected a malfunction, the engine warning lamp illuminates when the engine is next turned on and the same malfunction is re-detected. However, for items marked with a "★" in the diagnosis code number column, the engine warning lamp illuminates only on the first detection of the malfunction.
   As for P1220, P1221, P1223, P1224, and P1228, the engine warning lamp flashes. If malfunctions are detected at the throttle position sensor (1st channel) and the throttle position sensor (2nd channel) at the same time, or malfunctions are detected at the accelerator pedal position sensor (1st channel) and the accelerator pedal position sensor (2nd channel) at the same time, the engine warning lamp will flash.
3. After the engine warning lamp illuminates, it will be switched off under the following conditions.
   (1) When the engine-ECU monitored the power train malfunction three times* and met set condition requirements, it detected no malfunction.
      *: In this case, "one time" indicates from engine start to stop.
   (2) For misfiring malfunction, when driving conditions (engine speed, engine coolant temperature, etc.) are similar to those when the malfunction was first recorded.
4. Sensor 1 indicates the sensor mounted at a position closest to the engine, and sensor 2 indicates the sensor mounted at the position second closest to the engine.

METHOD OF READING AND ERASING DIAGNOSIS CODES

Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.

DIAGNOSIS USING DIAGNOSIS 2 MODE

1. Switch the diagnosis mode of the engine control unit to DIAGNOSIS 2 mode using the MUT-II.
2. Carry out a road test.
3. Take a reading of the diagnosis code and repair the problem location.
4. Turn the ignition switch to OFF and then back to ON again.

   NOTE
   By turning the ignition switch to OFF, the engine-ECU will switch the diagnosis mode from DIAGNOSIS 2 mode to DIAGNOSIS 1 mode.

5. Erase the diagnosis codes.

INSPECTION USING MUT-II DATA LIST AND ACTUATOR TESTING

1. Carry out inspection by means of the data list and the actuator test function. If there is an abnormality, check and repair the chassis harnesses and components.
2. After repairing, re-check using the MUT-II and check that the abnormal input and output have returned to normal as a result of the repairs.
3. Erase the diagnosis code memory.
4. Remove the MUT-II, and then start the engine again and carry out a road test to confirm that the problem has disappeared.

FREEZE FRAME DATA

When the engine-ECU detects a malfunction and stores a diagnosis code, it also stores a current status of the engine. This function is called "Freeze frame data." By analyzing this "freeze frame" data with the MUT-II, an effective troubleshooting can be performed.
The display items of freeze frame data are shown below.
Display item list

Data item		Unit
Engine coolant temperature sensor		°C
Engine speed		r/min
Vehicle speed		km/h
Long-term fuel compensation (long-term fuel trim)		%
Short-term fuel compensation (short-term fuel trim)		%
Fuel control condition	Open loop	OL
	Closed loop	CL
	Open loop owing to drive condition	OL-DRV.
	Open loop owing to system malfunction	OL-SYS.
	Closed loop based on one oxygen sensor	CL-H02S
Calculation load value		%
Diagnosis code during data recording		–

NOTE
If malfunctions have been detected in multiple systems, store one malfunction only, which has been detected first.

READINESS TEST STATUS

The engine-ECU monitors the following main diagnosis items, judges if these items are in good condition or not, and the stores its history. This history can be read out by using MUT-II. (If the ECU has judged a item before, the MUT-II displays "Complete.")
In addition, if diagnosis codes are erased or the battery cable is disconnected, this history will also be erased (the memory will be reset).

- Catalyst: P0420
- Oxygen sensor: P0130
- Oxygen sensor heater: P0135, P0141

FAIL-SAFE FUNCTION REFERENCE TABLE

When the main sensor malfunctions are detected by the diagnosis function, the vehicle is controlled by means of the pre-set control logic to maintain safe conditions for driving.

Malfunctioning item	Control contents during malfunction
Air flow sensor	1. Suspends lean burn operation. 2. Uses the throttle position sensor signal and engine speed signal (crank angle sensor signal) to take reading of the basic injector drive time and basic ignition timing from the pre-set mapping.
Intake air temperature sensor	Controls as if the intake air temperature is 25°C.
Throttle position sensor (2nd channel)	1. Suspends lean burn operation. 2. Controls the throttle opening angle feedback (half as much as the opening rate in the normal condition) by using signals from the throttle position sensor (1st channel). However, this controlling system is not applied if the throttle position sensor (1st channel) and throttle position sensor (2nd channel) combination output voltage is outside 4 – 6 V. 3. Refrains from controlling the throttle opening angle feedback if the throttle position sensor (1st channel) is also defective.
Engine coolant temperature sensor	Controls as if the engine coolant temperature is 80°C. (Moreover, the control system is working until the ignition switch is turned OFF if the sensor signal returns to normal.)
Camshaft position sensor	Controls maintaining the condition before determined as failure. Fuel will be cut-off 4 seconds after a malfunction is detected. (However, only if No. 1 cylinder TDC has never been detected after the ignition switch is turned to the ON position)
Vehicle speed sensor	1. Suspends lean burn operation. However, the control is cancelled as a certain time passes by with the engine speed of 1,500 r/min or more. 2. Suspends lean burn operation during the engine idling.
Barometric pressure sensor	Controls as if the barometric pressure is 101 kPa.
Detonation sensor	Fixes the ignition timing as that for standard petrol.
Injector	1. Suspends lean burn operation. 2. Suspends the exhaust gas recirculation.
Communication line with A/T-ECU	Disable ignition timing retard control (engine and transmission total control) during shift change.
Ignition coil (incorporating power transistor)	1. Suspends lean burn operation. 2. Cuts off the fuel supply to cylinders with an abnormal ignition signal.
Fuel pressure sensor	1. Controls as if the fuel pressure is 5 MPa. (In case of open/short circuit) 2. Turns the fuel pump relay off. (In case of abnomality in high pressure) 3. Suspends fuel injection. (when the low pressure is detected and the engine speed is more than 3,000 r/min)
Alternator FR terminal	Refrains from controlling to suppress the alternator output to electrical load. (Operated as a normal alternator)
Accelerator pedal position sensor (2nd channel)	1. Suspends lean burn operation. 2. Controls the throttle valve position by using signals from the accelerator pedal position sensor (1st channel). (However, the control system is not applicable if the difference from the accelerator pedal position sensor (1st channel) output voltage is 1.0 V or higher.) 3. Suspends the electronic controlled throttle valve system if accelerator pedal position sensor (1st channel) is also defective.

Malfunctioning item	Control contents during malfunction
Accelerator pedal position sensor (1st channel)	1. Suspends lean burn operation. 2. Controls the throttle valve position by using signals from the accelerator pedal position sensor (2nd channel). (However, this control is not applicable if the voltage difference between the accelerator pedal position sensor (1st channel) and accelerator pedal position sensor (2nd channel) is 1.0 V or higher.) 3. Also suspends the electronic-controlled throttle valve system when the accelerator pedal position sensor (2nd channel) is defective.
Throttle position sensor (1st channel)	1. Suspends lean burn operation. 2. Controls throttle opening angle feedback by using signals from throttle position sensor (2nd channel). (However, the controlling system is not applied when the throttle position sensor (1st channel) and throttle position sensor (2nd channel) combination output voltage is outside 4 – 6 V.) 3. Refrains from controlling the throttle opening angle feedback when throttle position sensor (2nd channel) is also defective.
Electronic-controlled throttle valve system	1. Suspends the electronic controlled throttle valve system. 2. Suspends lean burn operation. 3. Suspends the idle speed feedback control.
Throttle valve position feedback	1. Suspends the electronic controlled throttle valve system. 2. Suspends lean burn operation. 3. Suspends the engine speed feedback control.
Communication line between the throttle valve controller and the engine-ECU	1. Communication error between the throttle valve controller and the engine-ECU ● Suspends lean burn operation. ● Cuts the fuel supply when the engine speed reaches 3,000 r/min or more. ● Suspends the cruise-control. 2. Communication error between the throttle valve controller and the engine-ECU ● Suspends lean burn operation. ● Cuts the fuel supply when the engine speed reaches 3,000 r/min or more. ● Suspends the cruise-control. ● The throttle valve controller controls the throttle valve opening angle by using signals from accelerator pedal position sensor (2nd channel).
Throttle control servo motor 1st phase malfunction	Bans lean burn operation.
Throttle control servo motor 2nd phase malfunction	1. Suspends electronic control throttle valve system. 2. Bans lean burn operation. 3. Bans engine speed feed back control.
Misfiring	If the detected misfiring causes damage to the catalyst, the misfiring cylinder will be shut down.

NOTE
If the electronic-controlled throttle valve system is suspended, the engine warning lamp will illuminate.

INSPECTION CHART FOR DIAGNOSIS CODES

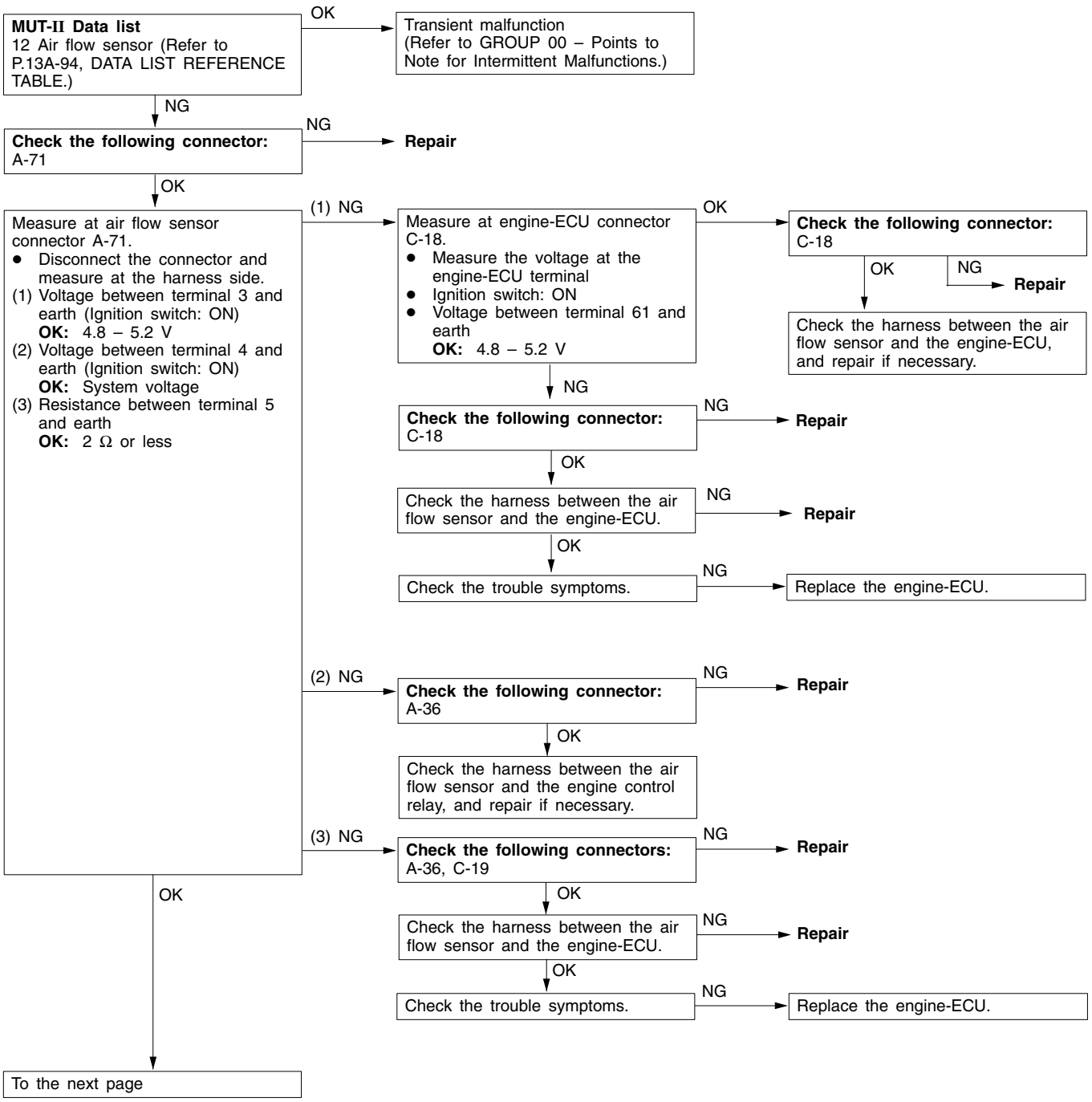
Code No.	Diagnosis item	Reference page
P0100	Air flow sensor system	13A-14
P0105	Barometric pressure sensor system	13A-16
P0110	Intake air temperature sensor system	13A-18
P0115	Engine coolant temperature sensor system	13A-19
P0120★	Throttle position sensor 1 (1st channel) system	13A-22
P0125	Feedback system	13A-24
P0130	Oxygen sensor (front) system <sensor 1>	13A-25
P0135	Oxygen sensor heater (front) system <sensor 1>	13A-27
P0136	Oxygen sensor (rear) system <sensor 2>	13A-28
P0141	Oxygen sensor heater (rear) system <sensor 2>	13A-30
P0170	Abnormal fuel system	13A-31
P0190★	Abnormal fuel pressure	13A-33
P0201	No. 1 injector system	13A-34
P0202	No. 2 injector system	13A-36
P0203	No. 3 injector system	13A-37
P0204	No. 4 injector system	13A-38
P0220★	Accelerator pedal position sensor (1st channel) system	13A-40
P0225★	Throttle position sensor (2nd channel) system	13A-43
P0300★	Ignition coil (power transistor) system	13A-44
P0301	No. 1 cylinder misfire detected	13A-46
P0302	No. 2 cylinder misfire detected	13A-46
P0303	No. 3 cylinder misfire detected	13A-46
P0304	No. 4 cylinder misfire detected	13A-46
P0325	Detonation sensor system	13A-47
P0335	Crank angle sensor system	13A-47
P0340	Camshaft position sensor system	13A-59
P0403	EGR valve system	13A-50
P0420	Catalyst malfunction	13A-51
P0443	Purge control solenoid valve system	13A-52
P0500	Vehicle speed sensor system	13A-53
P1200	Injector driver system	13A-53
P1220★	Electronic-controlled throttle valve system	13A-54

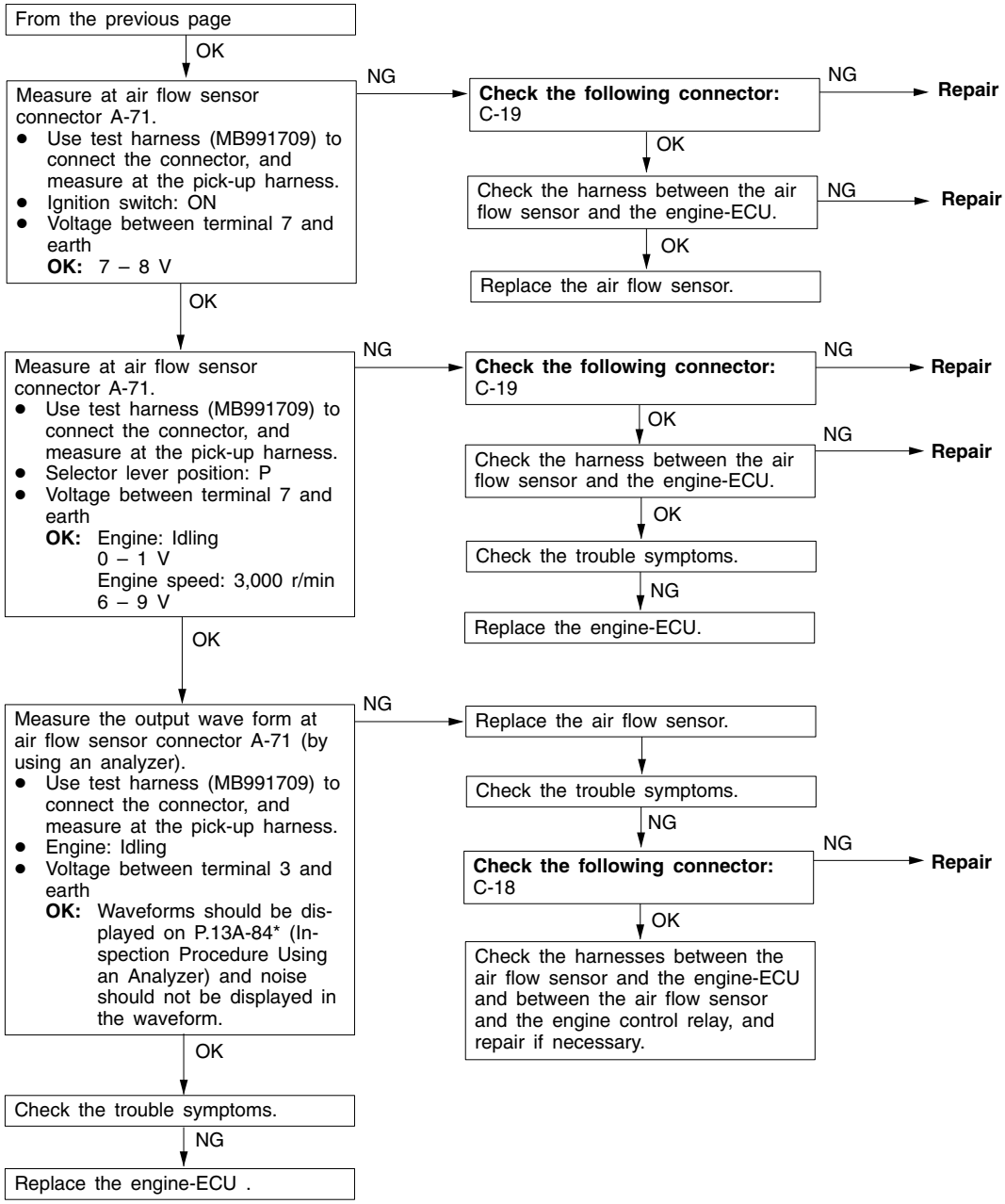
Code No.	Diagnosis item	Reference page
P1221★	Throttle valve position feedback system	13A-55
P1223★	Communication line with throttle valve controller	13A-56
P1224★	Throttle valve control servo motor (motor 1st phase malfunction) system	13A-57
P1225★	Accelerator pedal position sensor (2nd channel) system	13A-58
P1228★	Throttle valve control servo motor (motor 2nd phase malfunction) system	13A-60
P1500	Alternator FR terminal system	13A-61
P1515	Brake vacuum sensor system	13A-62
P1600	Communication wire with A/T-ECU system	13A-64
P1610	Immobilizer system	13A-64

NOTE
1. Do not replace the engine-ECU until a through terminal check reveals there are no short/open circuit.
2. Check that the engine-ECU earth circuit is normal before checking for the cause of the problem.
3. After the engine-ECU has detected a malfunction, a diagnosis code is recorded the next time the engine is started and the same malfunction is re-detected. However, for items marked with a "★", the diagnosis code is recorded on the first detection of the malfunction.
4. Sensor 1 indicates the sensor mounted at a position closest to the engine, and sensor 2 indicates the sensor mounted at the position second closest to the engine.

INSPECTION PROCEDURE CLASSIFIED BY DIAGNOSIS CODE

Code No. P0100 Air flow sensor system	Probable cause
Range of Check • Engine speed: 500 r/min or more Set Conditions • The sensor output frequency is 3.3 Hz or less for four seconds.	• Malfunction of air flow sensor • Open or short circuit in air flow sensor circuit or loose connector contact • Malfunction of engine-ECU

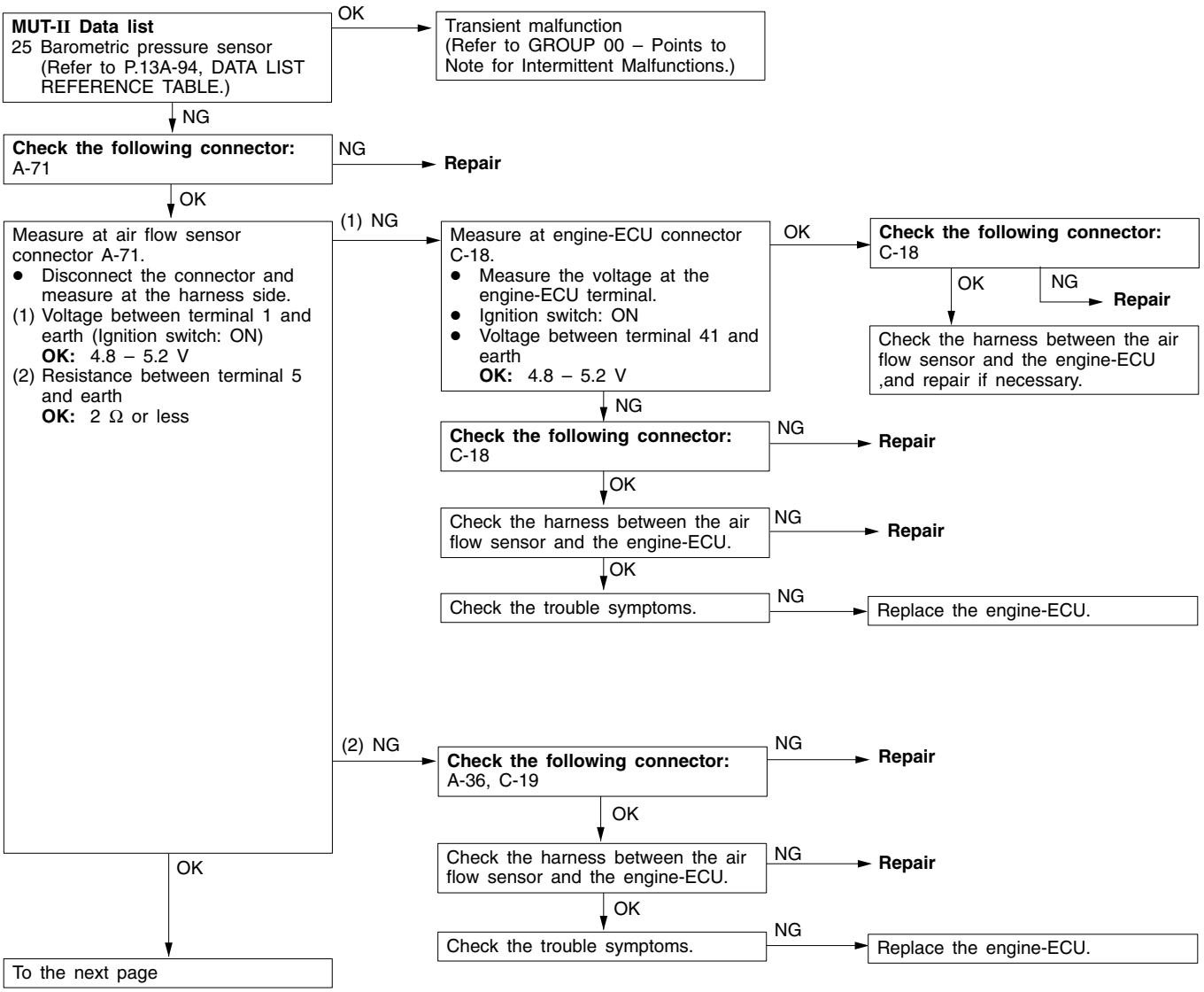


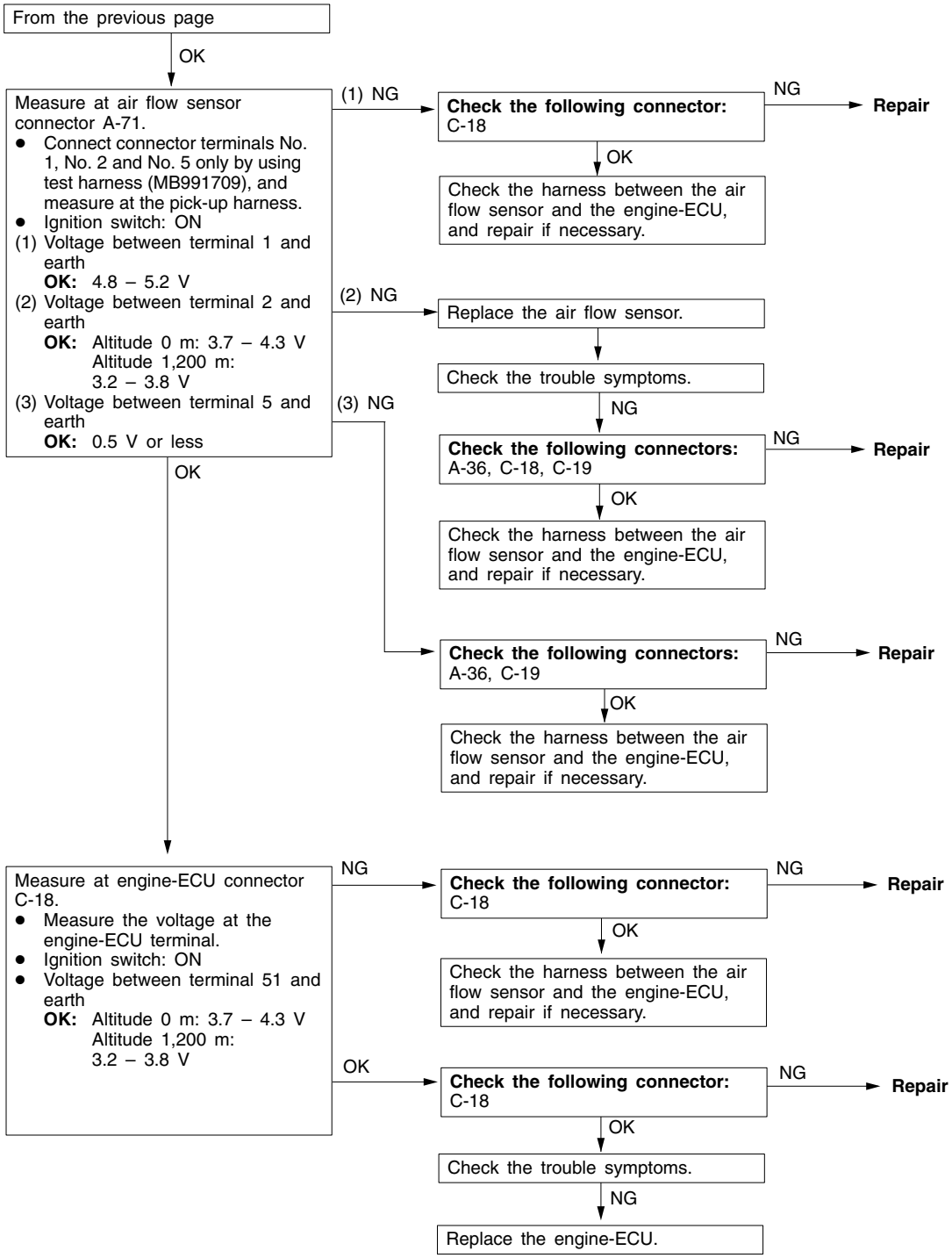


NOTE

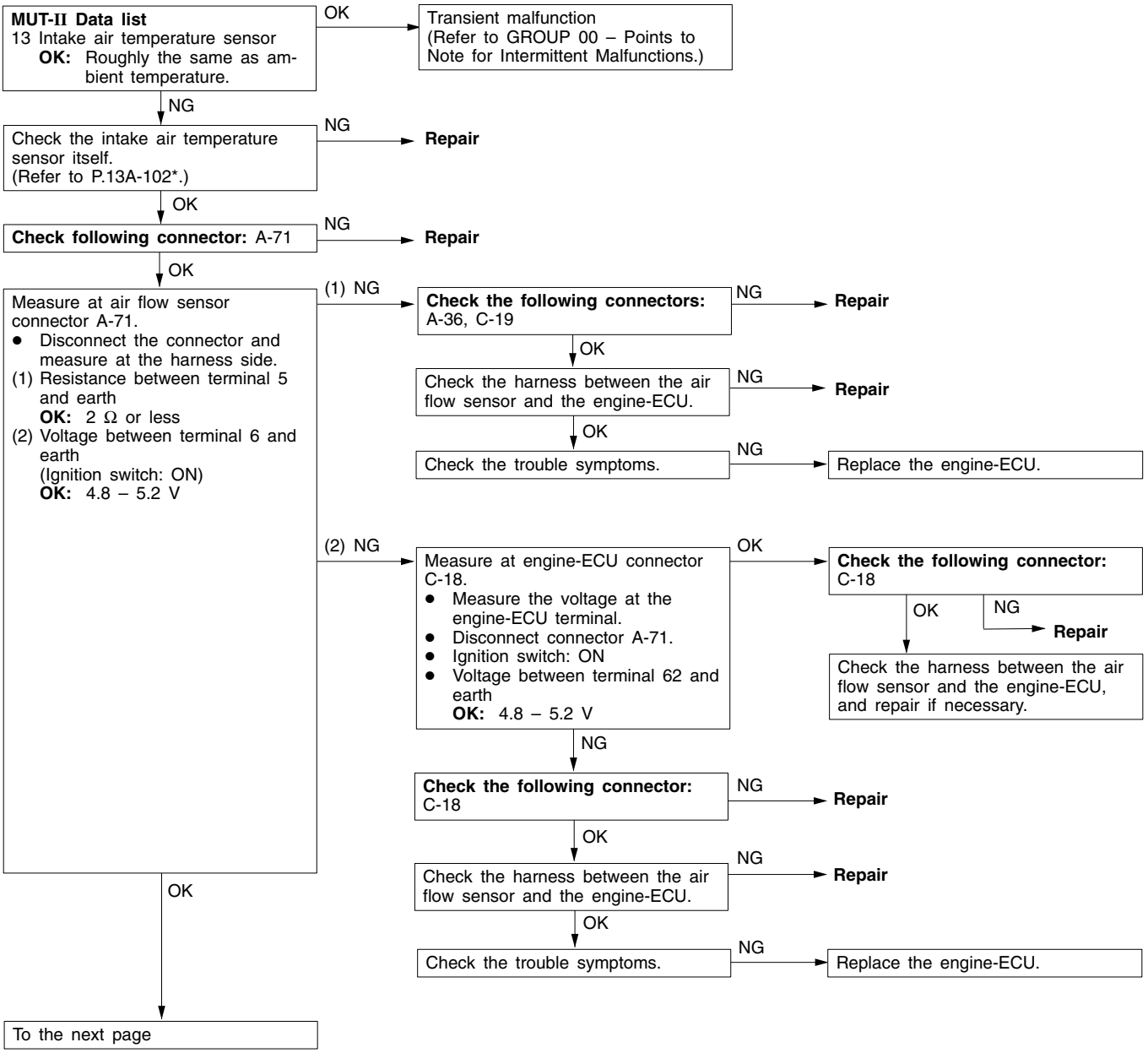
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1).

Code No. P0105 Barometric pressure sensor system	Probable cause
Range of Check ● Two seconds have passed since the ignition switch is turned ON or the engine starting process is completed. ● Battery voltage: 8 V or more Set Conditions ● The sensor output voltage is 4.5 V or more for four seconds (equivalent to 114 kPa of barometric pressure) or ● The sensor output voltage is 0.2 V or less (equivalent to 53 kPa of barometric pressure)	● Malfunction of barometric pressure sensor ● Open or short circuit in barometric pressure sensor circuit or loose connector contact ● Malfunction of engine-ECU

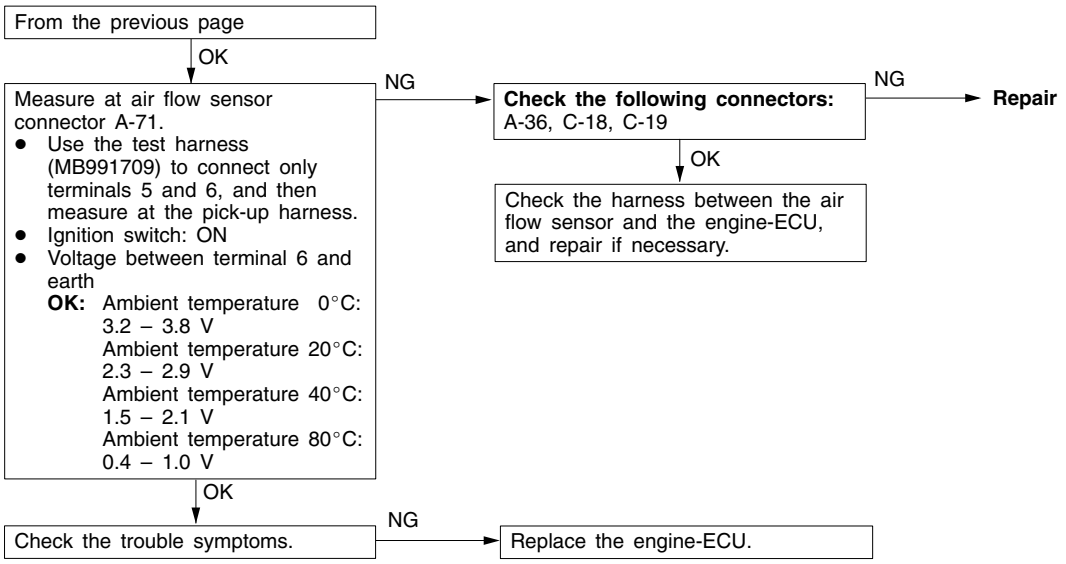



From the previous page
OK
Measure at air flow sensor connector A-71.
● Connect connector terminals No. 1, No. 2 and No. 5 only by using test harness (MB991709), and measure at the pick-up harness.
● Ignition switch: ON
(1) Voltage between terminal 1 and earth
OK: 4.8 – 5.2 V
(2) Voltage between terminal 2 and earth
OK: Altitude 0 m: 3.7 – 4.3 V
Altitude 1,200 m: 3.2 – 3.8 V
(3) Voltage between terminal 5 and earth
OK: 0.5 V or less
(1) NG
Check the following connector: C-18
NG
Repair
OK
Check the harness between the air flow sensor and the engine-ECU, and repair if necessary.
(2) NG
Replace the air flow sensor.
Check the trouble symptoms.
NG
Check the following connectors: A-36, C-18, C-19
NG
Repair
OK
Check the harness between the air flow sensor and the engine-ECU, and repair if necessary.
(3) NG
Check the following connectors: A-36, C-19
NG
Repair
OK
Check the harness between the air flow sensor and the engine-ECU, and repair if necessary.
OK
Measure at engine-ECU connector C-18.
● Measure the voltage at the engine-ECU terminal.
● Ignition switch: ON
● Voltage between terminal 51 and earth
OK: Altitude 0 m: 3.7 – 4.3 V
Altitude 1,200 m: 3.2 – 3.8 V
NG
Check the following connector: C-18
NG
Repair
OK
Check the harness between the air flow sensor and the engine-ECU, and repair if necessary.
OK
Check the following connector: C-18
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.

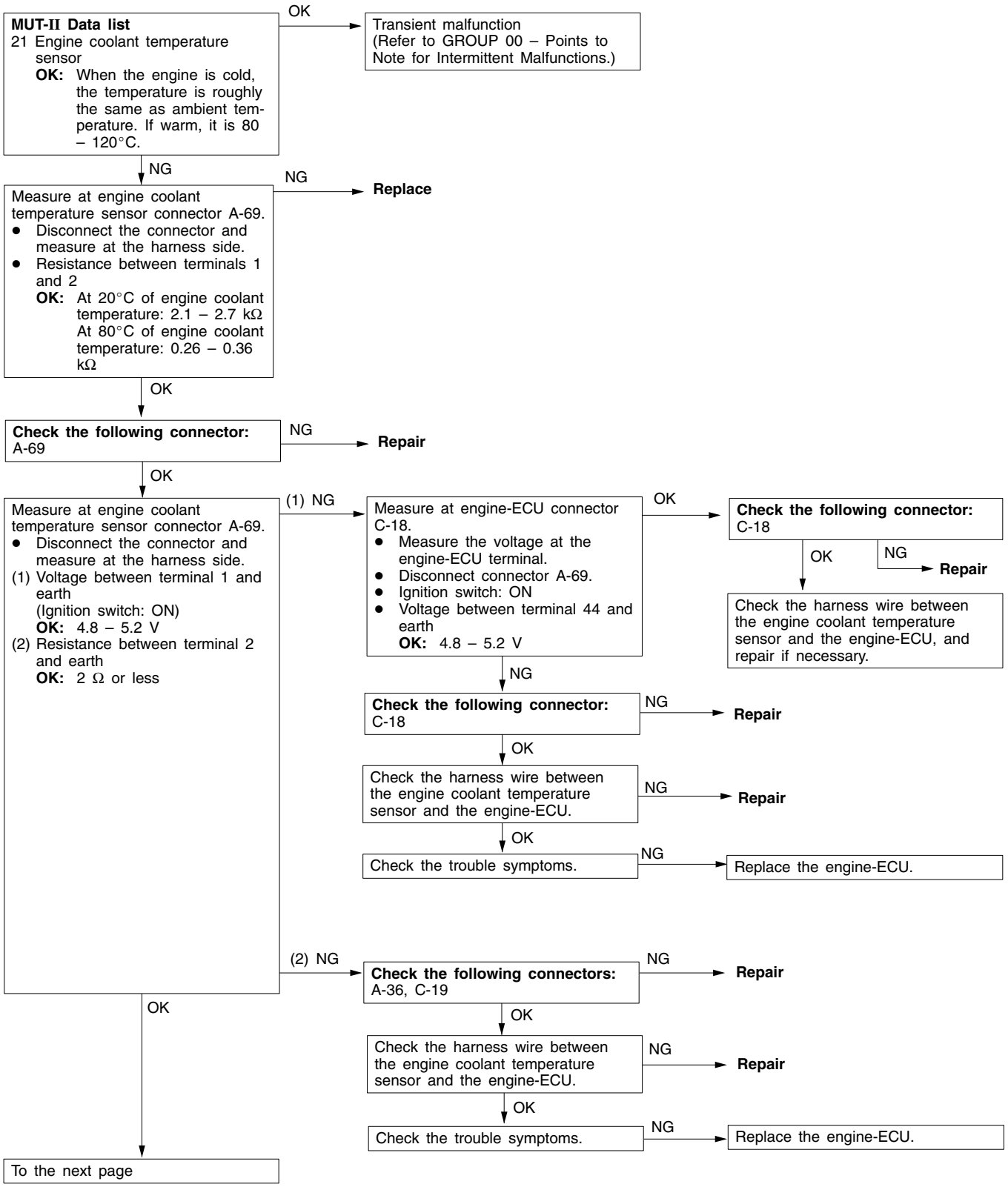
Code No. P0110 Intake air temperature sensor system	Probable cause
Range of Check • Two seconds have passed since the ignition switch is turned ON or the engine starting process is completed. Set Conditions • The sensor output voltage is 4.6 V or more for four seconds (equivalent to –45°C of intake air temperature) or • The sensor output voltage is 0.2 V or more for four seconds (equivalent to 125°C of intake air temperature)	• Malfunction of intake air temperature sensor • Open or short circuit in intake air temperature sensor or loose connector contact • Malfunction of engine-ECU

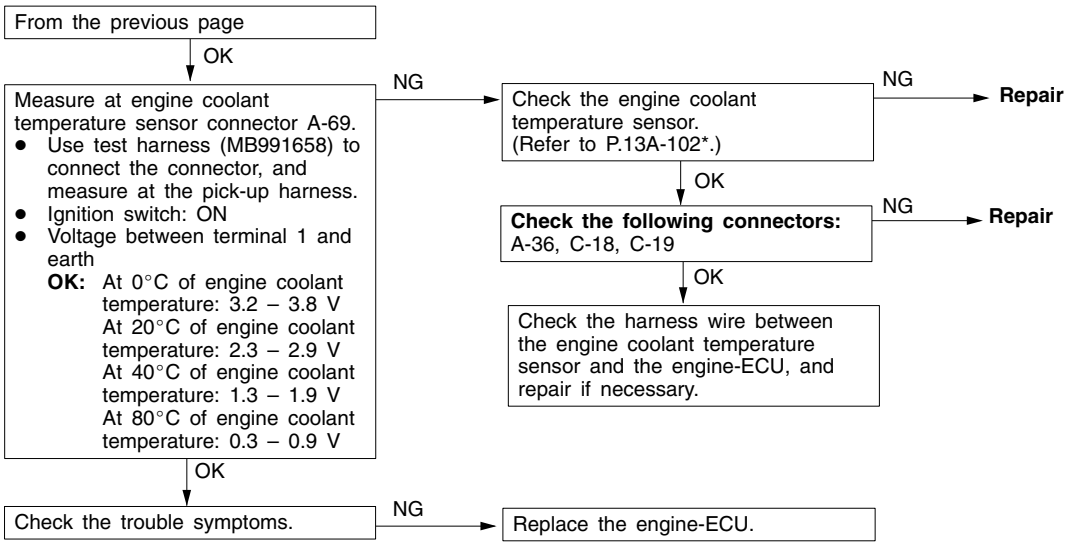


NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1).



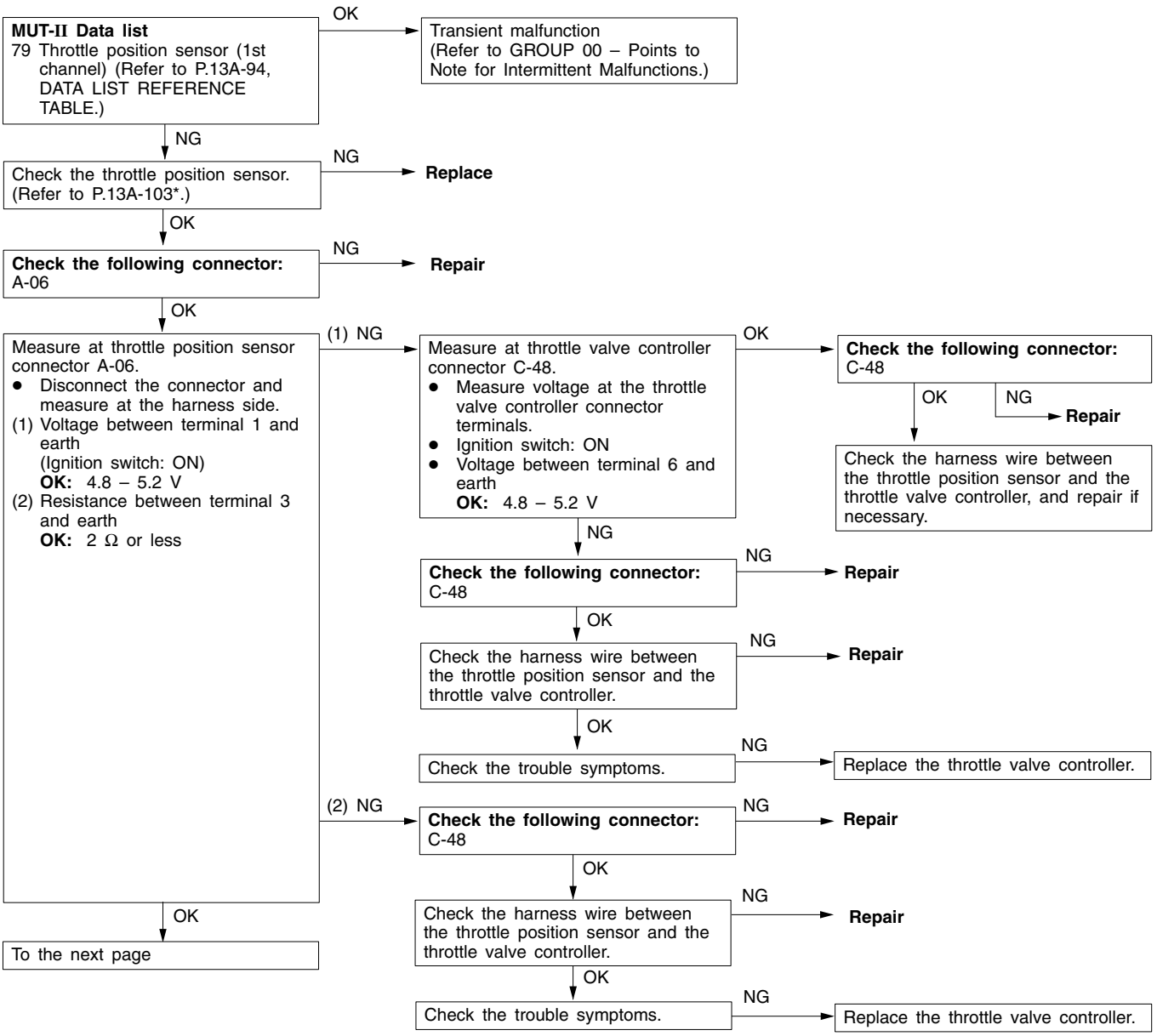
Code No. P0115 Engine coolant temperature sensor system	Probable cause
Range of Check ● Engine: Two seconds after the engine has been started Set Conditions ● The sensor output voltage is 4.6 V or more for four seconds (equivalent to –45°C of engine coolant temperature) or ● The sensor output voltage is 0.1 V or less for four seconds (equivalent to 140°C of engine coolant temperature)	● Malfunction of engine coolant temperature sensor ● Open or short circuit in the engine coolant temperature sensor circuit or loose connector contact ● Malfunction of engine-ECU
Range of Check ● Engine: After starting Set Conditions ● The engine coolant temperature has reduced from over 40°C to less than 40°C, and that condition has lasted for five minutes or more.	


MUT-II Data list
21 Engine coolant temperature sensor
OK: When the engine is cold, the temperature is roughly the same as ambient temperature. If warm, it is 80 – 120°C.
OK
Transient malfunction (Refer to GROUP 00 – Points to Note for Intermittent Malfunctions.)
NG
Measure at engine coolant temperature sensor connector A-69.
Disconnect the connector and measure at the harness side.
Resistance between terminals 1 and 2
OK: At 20°C of engine coolant temperature: 2.1 – 2.7 kΩ
At 80°C of engine coolant temperature: 0.26 – 0.36 kΩ
NG
Replace
OK
Check the following connector: A-69
NG
Repair
OK
Measure at engine coolant temperature sensor connector A-69.
Disconnect the connector and measure at the harness side.
(1) Voltage between terminal 1 and earth (Ignition switch: ON)
OK: 4.8 – 5.2 V
(2) Resistance between terminal 2 and earth
OK: 2 Ω or less
(1) NG
Measure at engine-ECU connector C-18.
Measure the voltage at the engine-ECU terminal.
Disconnect connector A-69.
Ignition switch: ON
Voltage between terminal 44 and earth
OK: 4.8 – 5.2 V
OK
Check the following connector: C-18
OK
NG
Repair
Check the harness wire between the engine coolant temperature sensor and the engine-ECU, and repair if necessary.
NG
Check the following connector: C-18
NG
Repair
OK
Check the harness wire between the engine coolant temperature sensor and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
(2) NG
Check the following connectors: A-36, C-19
NG
Repair
OK
Check the harness wire between the engine coolant temperature sensor and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
OK
To the next page

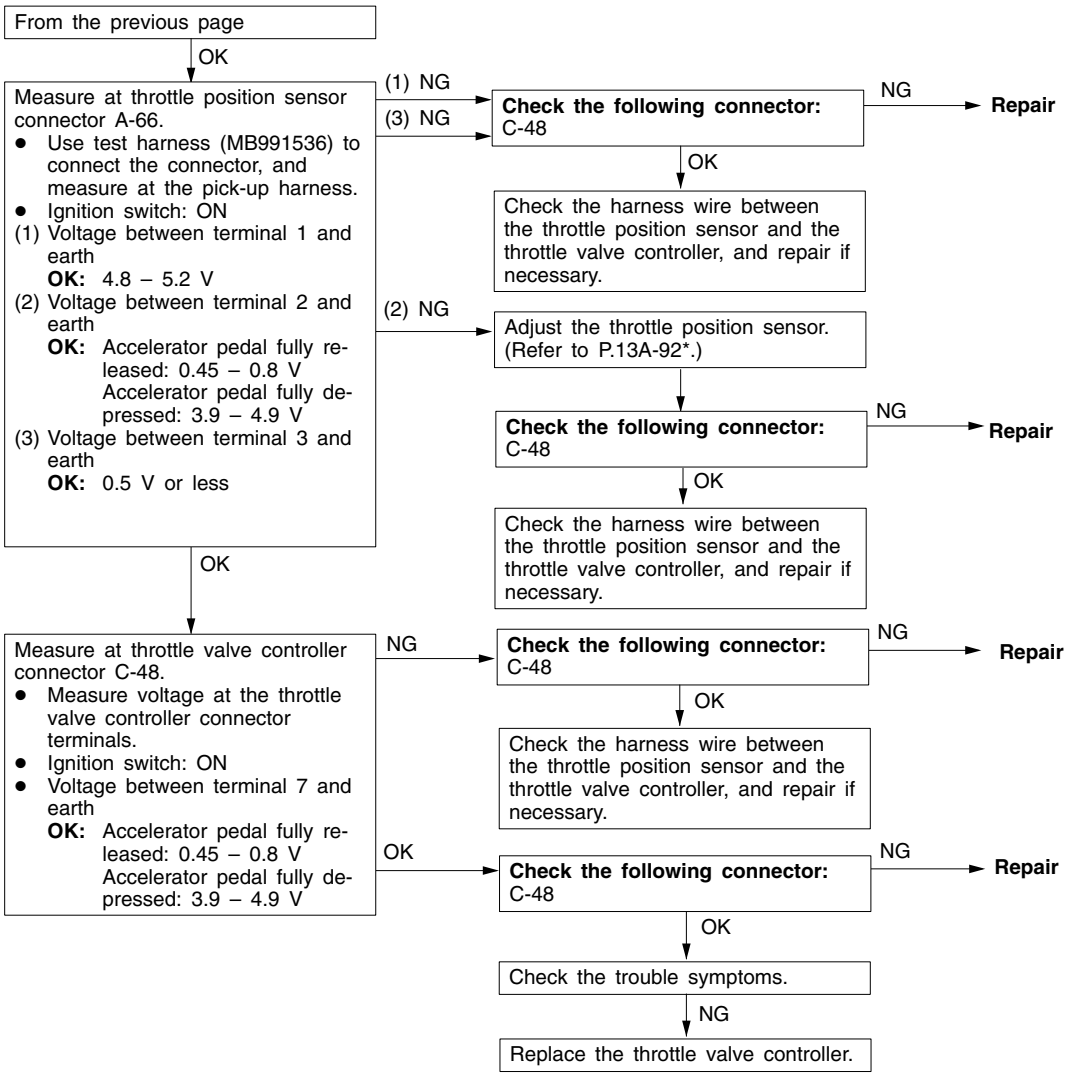


NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1).

Code No. P0120 Throttle position sensor (1st channel) system	Probable cause
The throttle valve controller judges a malfunction, and then transmit the result to the engine-ECU. Range of Check • Ignition switch: ON Set Conditions • The sensor output voltage is 0.2 V or less. or • The sensor output voltage is 4.9 V or more. or • The throttle position sensor (1st channel) and throttle position sensor (2nd channel) combination output voltage is outside 4 – 6 V. or • The output voltage of the throttle position sensor (1st channel) is significantly different (approx. 1V) from the throttle valve opening angle (voltage), which the engine-ECU request the throttle valve controller.	• Malfunction of throttle position sensor • Open or short circuit in the throttle position sensor (1st channel) circuit or loose connector contact • Malfunction of throttle valve controller • Malfunction of engine-ECU

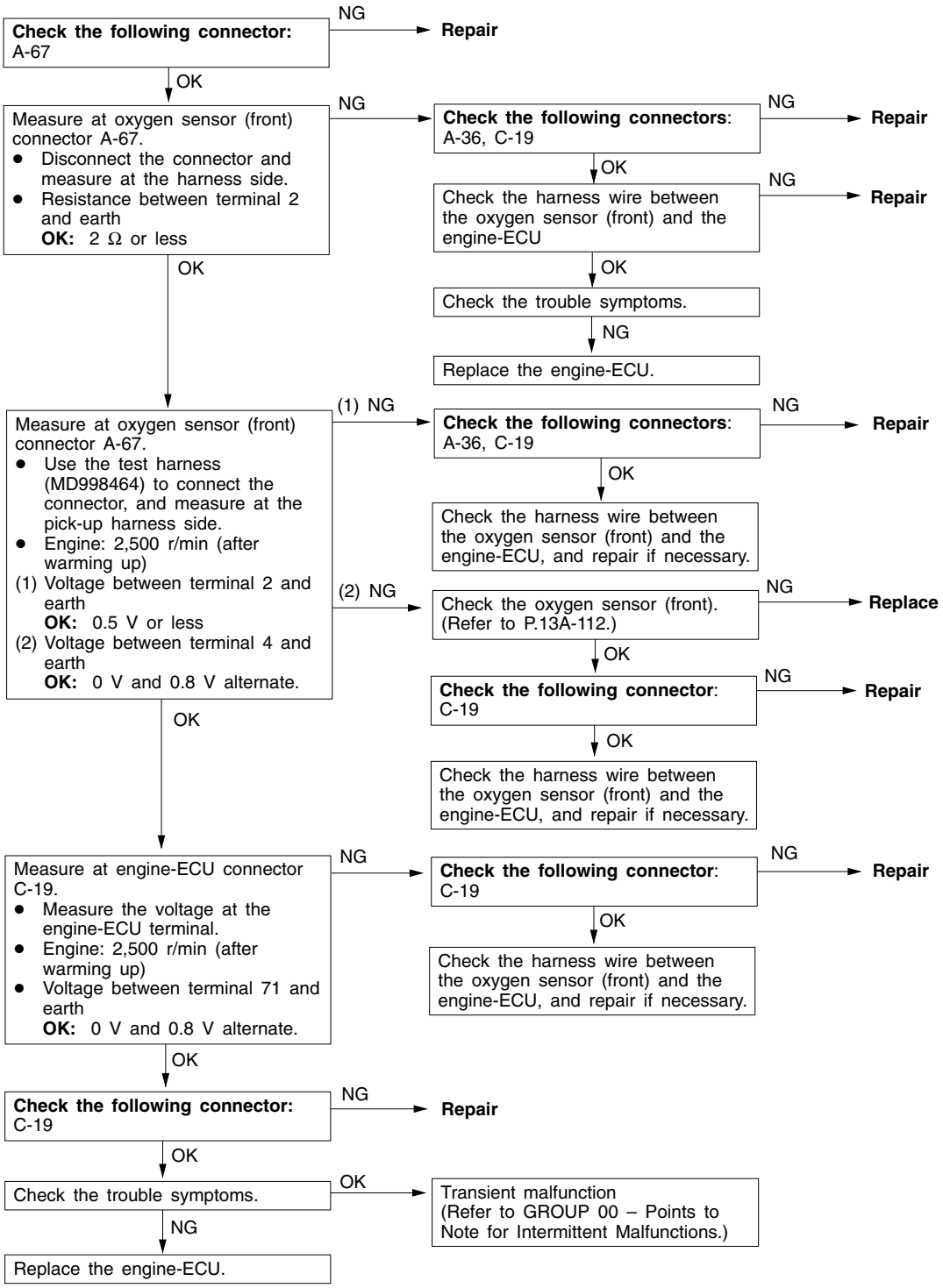


NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKPE00E1)

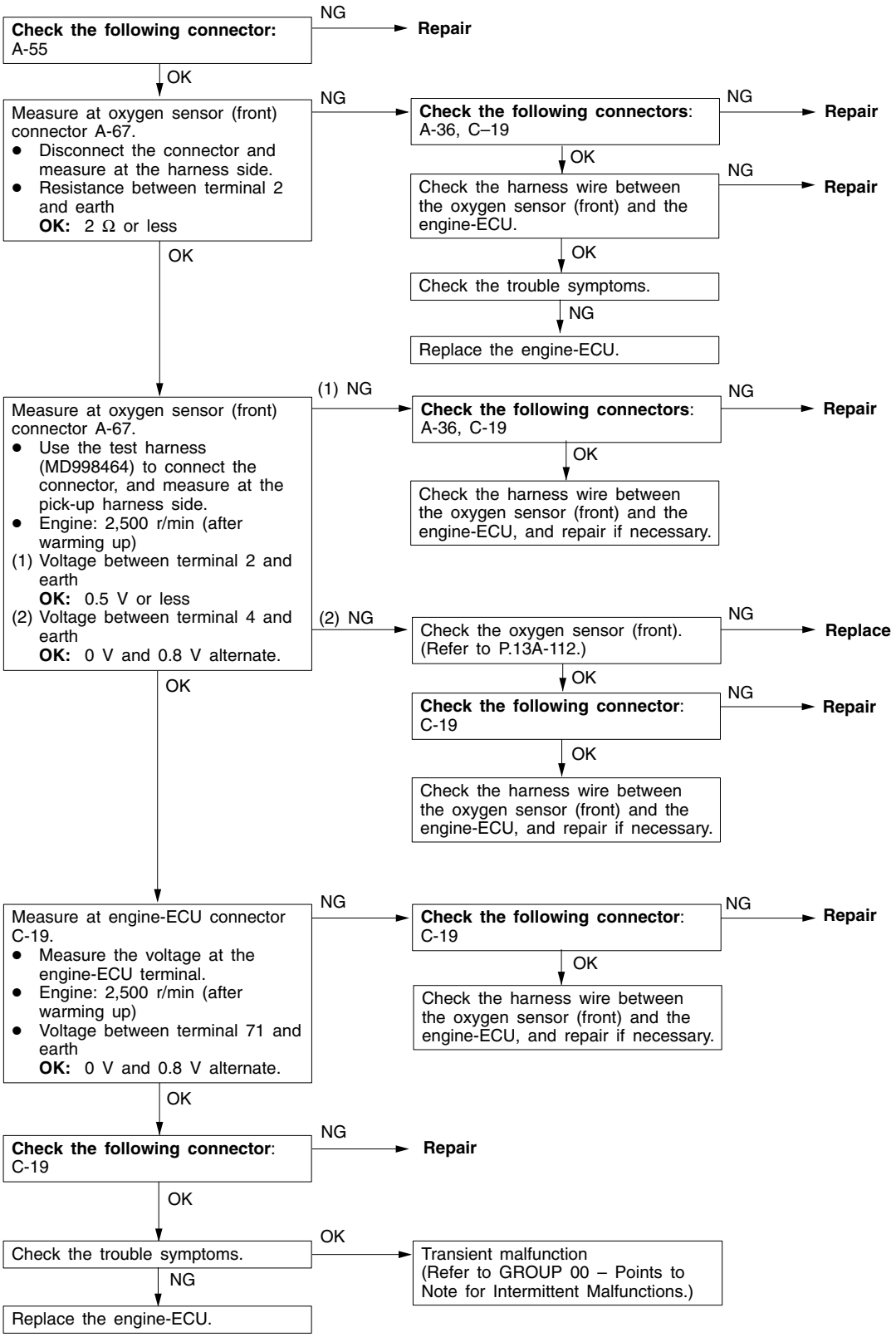


NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

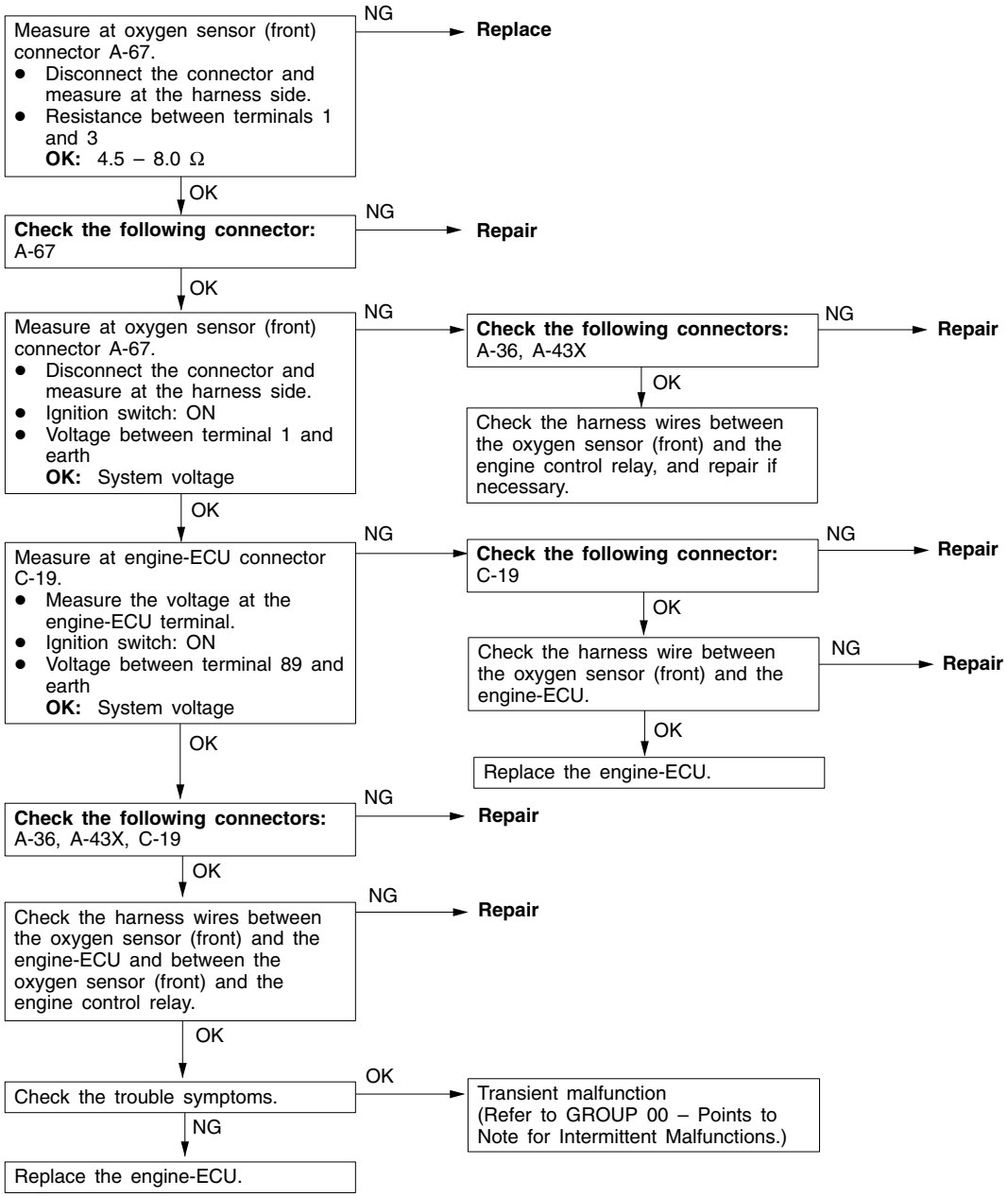
Code No. P0125 Feedback system	Probable cause
Range of Check ● The engine coolant temperature is approx. 80°C or more. ● During stoichiometric feedback control ● The vehicle is not being decelerated. Set Conditions ● Oxygen sensor (front) output voltage has been higher or lower than 0.5 V for at least thirty seconds.	● Malfunction of oxygen sensor (front) ● Open or short circuit in the oxygen sensor (front) circuit or loose connector contact ● Malfunction of engine-ECU



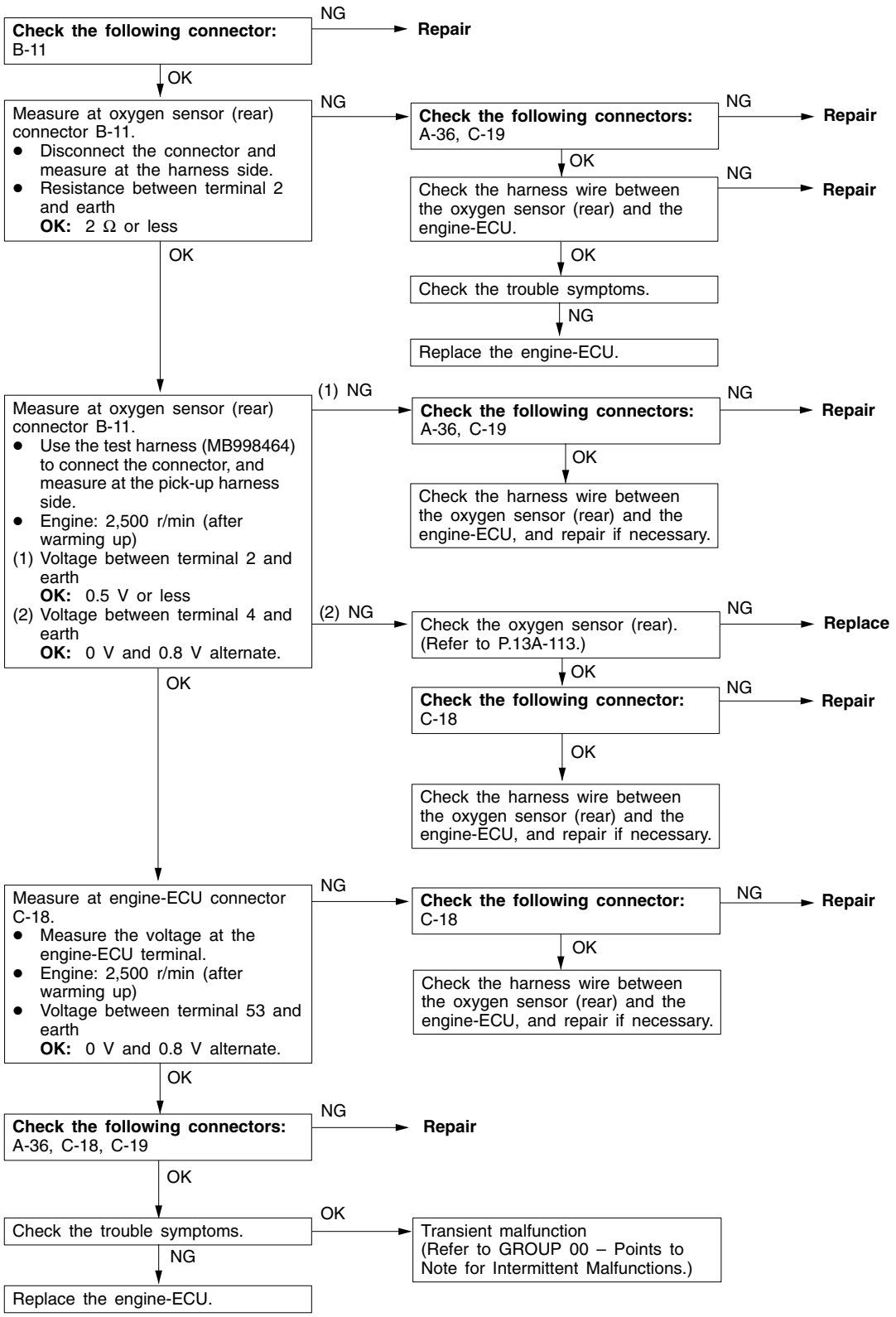
Code No. P0130 Oxygen sensor (front) system <sensor 1>	Probable cause
Range of Check ● Three minutes have been passed since the engine has been started. ● The engine coolant temperature is approx. 80°C or more. ● Intake air temperature is 20 – 50°C ● Engine speed is 1,200 r/min or more ● Driving on a level surface at constant speed. Set Conditions ● The oxygen sensor (front) output voltage is 4.5 V or more when the sensor output voltage is 0.2 V or less and a voltage of 5 V is applied to the oxygen sensor (front) inside the engine-ECU.	● Malfunction of oxygen sensor (front) ● Open or short circuit in the oxygen sensor (front) circuit or loose connector contact ● Malfunction of engine-ECU
Range of Check ● Engine speed is 3,000 r/min or less ● During driving ● During air/fuel ratio feedback control Set Conditions ● The oxygen sensor (front) output frequency is five or less per 12 seconds on average.	


Check the following connector: A-55
NG
Repair
OK
Measure at oxygen sensor (front) connector A-67.
• Disconnect the connector and measure at the harness side.
• Resistance between terminal 2 and earth
OK: 2 Ω or less
NG
Check the following connectors: A-36, C–19
NG
Repair
OK
Check the harness wire between the oxygen sensor (front) and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
OK
Measure at oxygen sensor (front) connector A-67.
• Use the test harness (MD998464) to connect the connector, and measure at the pick-up harness side.
• Engine: 2,500 r/min (after warming up)
(1) Voltage between terminal 2 and earth
OK: 0.5 V or less
(2) Voltage between terminal 4 and earth
OK: 0 V and 0.8 V alternate.
(1) NG
Check the following connectors: A-36, C-19
NG
Repair
OK
Check the harness wire between the oxygen sensor (front) and the engine-ECU, and repair if necessary.
(2) NG
Check the oxygen sensor (front). (Refer to P.13A-112.)
NG
Replace
OK
Check the following connector: C-19
NG
Repair
OK
Check the harness wire between the oxygen sensor (front) and the engine-ECU, and repair if necessary.
OK
Measure at engine-ECU connector C-19.
• Measure the voltage at the engine-ECU terminal.
• Engine: 2,500 r/min (after warming up)
• Voltage between terminal 71 and earth
OK: 0 V and 0.8 V alternate.
NG
Check the following connector: C-19
NG
Repair
OK
Check the harness wire between the oxygen sensor (front) and the engine-ECU, and repair if necessary.
OK
Check the following connector: C-19
NG
Repair
OK
Check the trouble symptoms.
OK
Transient malfunction (Refer to GROUP 00 – Points to Note for Intermittent Malfunctions.)
NG
Replace the engine-ECU.

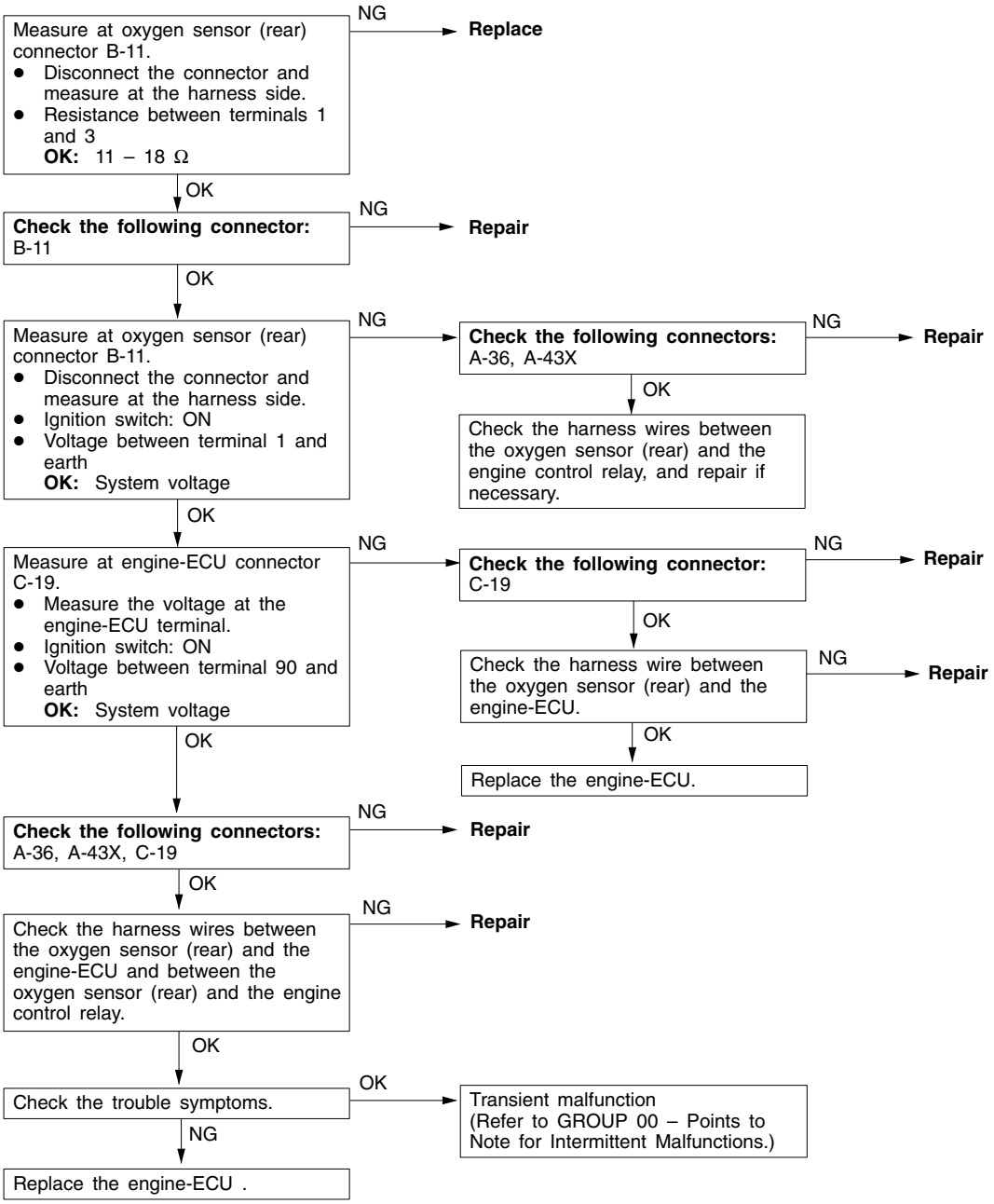
Code No. P0135 Oxygen sensor heater (front) system <sensor 1>	Probable cause
Range of Check ● The engine coolant temperature is approx. 20°C or more. ● The oxygen sensor heater (front) remains on. ● The engine speed is 50 r/min or more. ● Battery voltage is 11 – 16 V. Set Conditions ● The current, which flows through the oxygen sensor heater (front), is 0.2 A or less or 3.5 A or more for six seconds.	● Malfunction of oxygen sensor heater (front) ● Open or short circuit in the oxygen sensor heater (front) circuit or loose connector contact ● Malfunction of engine-ECU



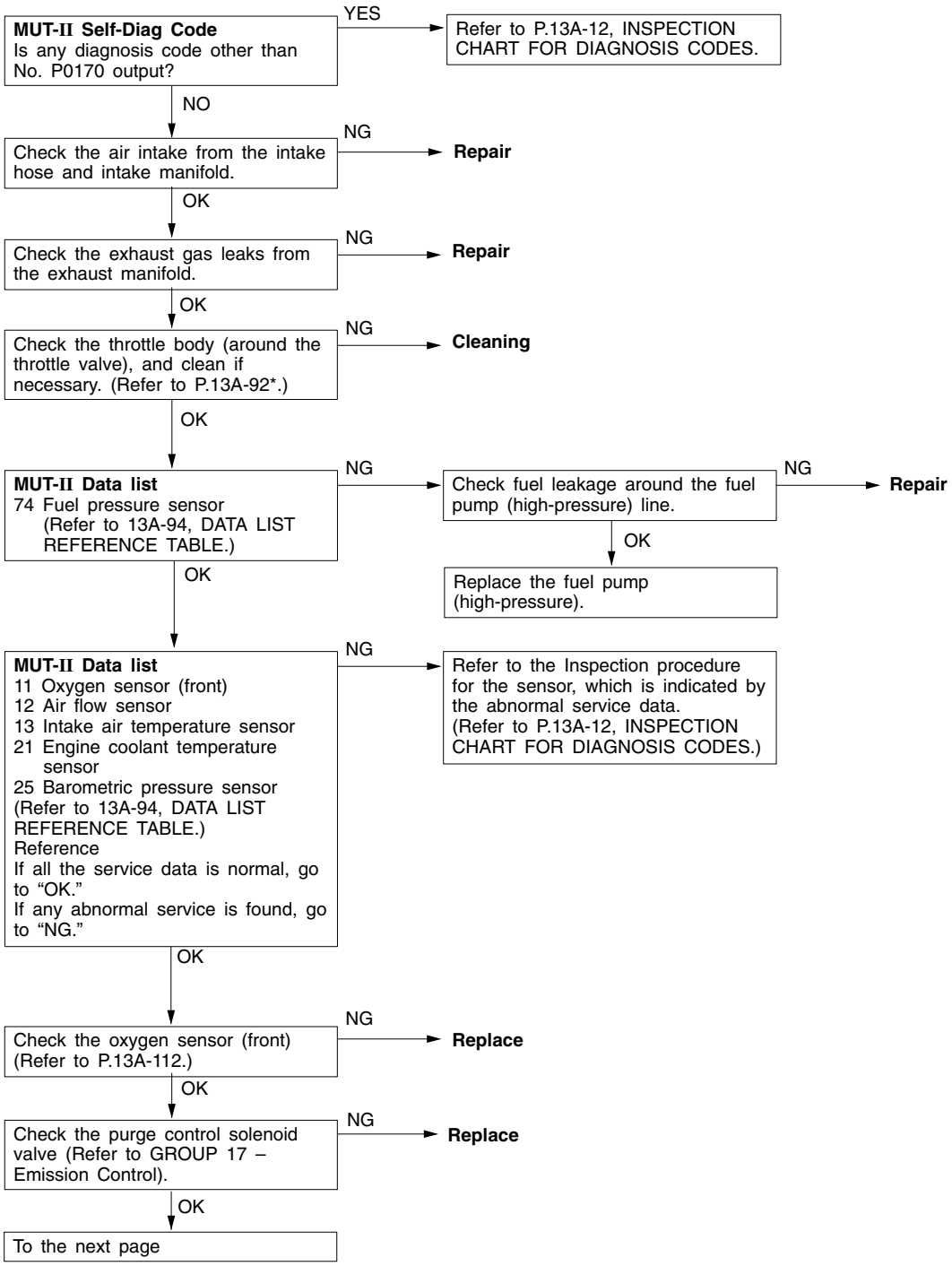
Code No. P0136 Oxygen sensor (rear) system <sensor 2>	Probable cause
Range of Check ● Three minutes have been passed since the engine has been started. ● The engine coolant temperature is approx. 80°C or more. ● Intake air temperature is 20 – 50°C ● Engine speed is 1,200 r/min or more ● Driving on a level surface at constant speed. Set Conditions ● The oxygen sensor (rear) output voltage is 4.5 V or more when the sensor output voltage is 0.2 V or less and a voltage of 5 V is applied to the oxygen sensor (rear) inside the engine-ECU.	● Malfunction of oxygen sensor (rear) ● Open or short circuit in the oxygen sensor (rear) circuit or loose connector contact ● Malfunction of engine-ECU
Range of Check ● Two seconds have passed after the engine-ECU detected an open circuit. ● When the oxygen sensor (front) is in good condition. Set Conditions ● When the air/fuel ratio is rich, the oxygen sensor (front) output voltage is 0.5 V or more, the oxygen sensor (rear) output voltage is less than 0.1 V, and the oxygen sensor (rear) output voltage fluctuates within 0.078 V.	


Check the following connector: B-11
NG
Repair
OK
Measure at oxygen sensor (rear) connector B-11.
• Disconnect the connector and measure at the harness side.
• Resistance between terminal 2 and earth
OK: 2 Ω or less
NG
Check the following connectors: A-36, C-19
NG
Repair
OK
Check the harness wire between the oxygen sensor (rear) and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
OK
Measure at oxygen sensor (rear) connector B-11.
• Use the test harness (MB998464) to connect the connector, and measure at the pick-up harness side.
• Engine: 2,500 r/min (after warming up)
(1) Voltage between terminal 2 and earth
OK: 0.5 V or less
(2) Voltage between terminal 4 and earth
OK: 0 V and 0.8 V alternate.
(1) NG
Check the following connectors: A-36, C-19
NG
Repair
OK
Check the harness wire between the oxygen sensor (rear) and the engine-ECU, and repair if necessary.
(2) NG
Check the oxygen sensor (rear). (Refer to P.13A-113.)
NG
Replace
OK
Check the following connector: C-18
NG
Repair
OK
Check the harness wire between the oxygen sensor (rear) and the engine-ECU, and repair if necessary.
OK
Measure at engine-ECU connector C-18.
• Measure the voltage at the engine-ECU terminal.
• Engine: 2,500 r/min (after warming up)
• Voltage between terminal 53 and earth
OK: 0 V and 0.8 V alternate.
NG
Check the following connector: C-18
NG
Repair
OK
Check the harness wire between the oxygen sensor (rear) and the engine-ECU, and repair if necessary.
OK
Check the following connectors: A-36, C-18, C-19
NG
Repair
OK
Check the trouble symptoms.
OK
Transient malfunction (Refer to GROUP 00 – Points to Note for Intermittent Malfunctions.)
NG
Replace the engine-ECU.

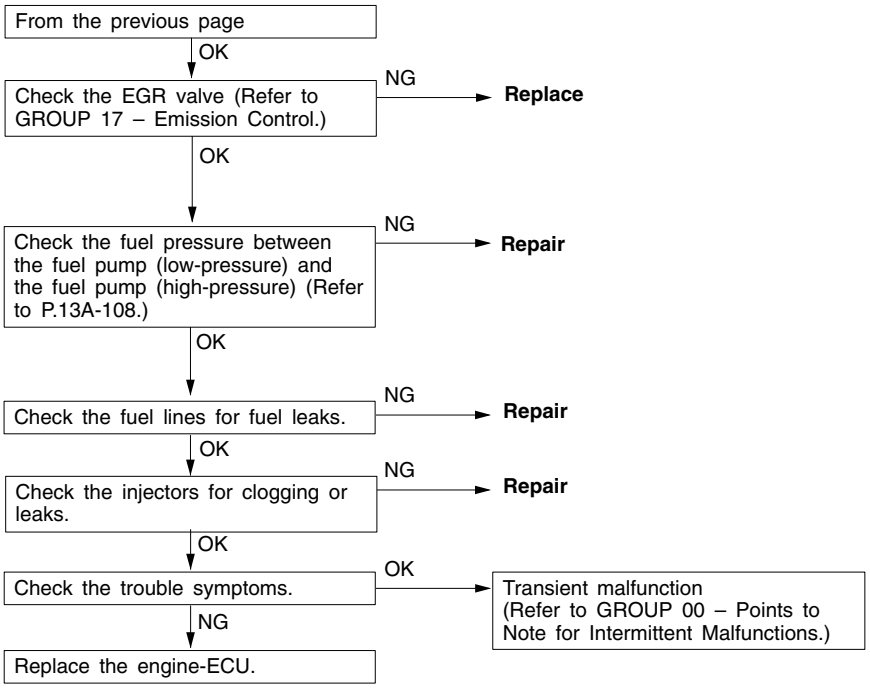
Code No. P0141 Oxygen sensor heater (rear) system <sensor 2>	Probable cause
Range of Check ● The engine coolant temperature is approx. 20°C or more. ● The oxygen sensor heater (rear) remains on. ● The engine speed is 50 r/min or more. ● Battery voltage is 11 – 16 V. Set Conditions ● The current, which flows through the oxygen sensor heater (rear), is 0.2 A or less or 3.5 A or more for six seconds.	● Malfunction of oxygen sensor heater (rear) ● Open or short circuit in the oxygen sensor heater (rear) circuit or loose connector contact ● Malfunction of engine-ECU



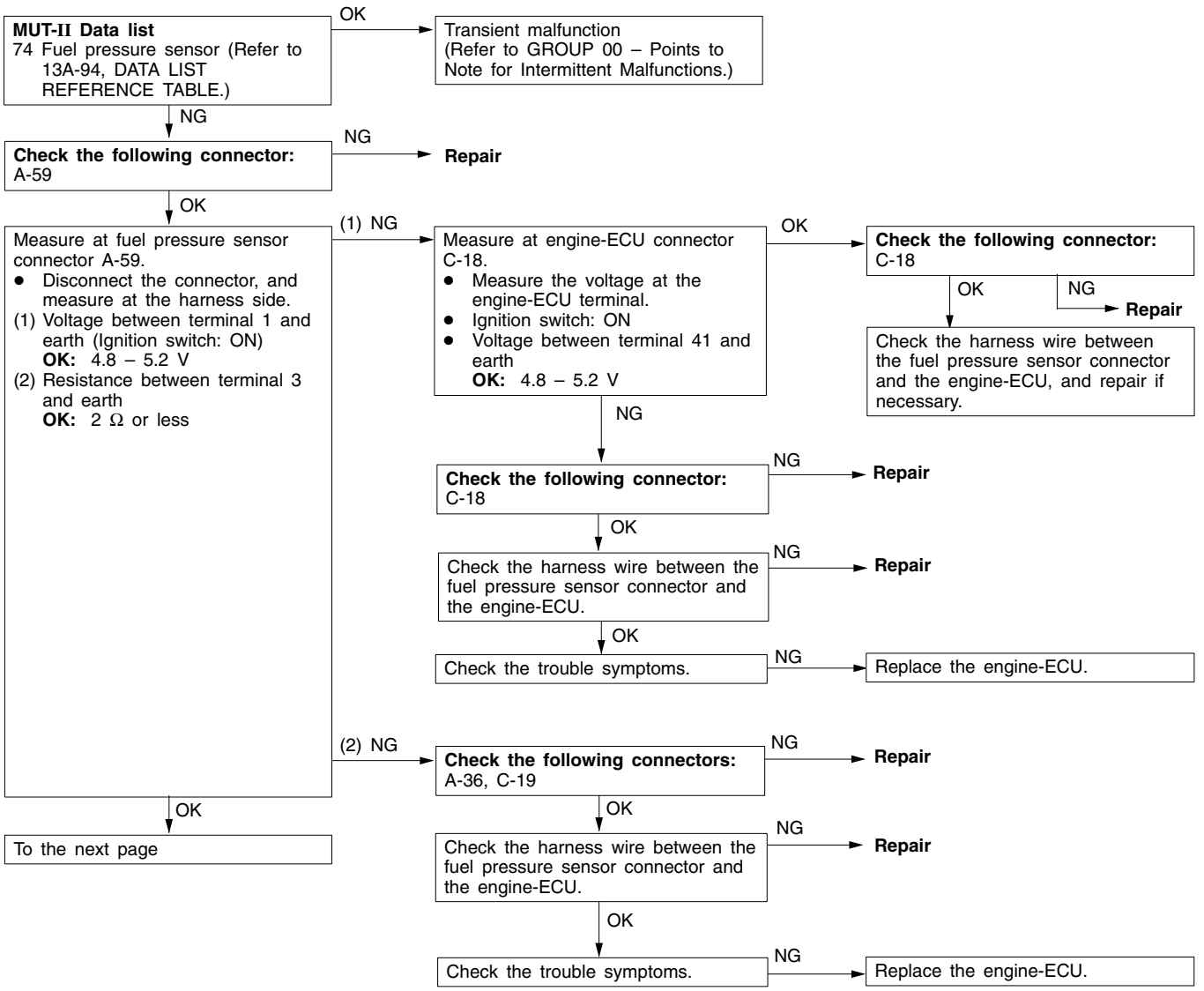
Code No. P0170 Abnormal fuel system	Probable cause
Range of Check • Engine: Being learning the air-fuel ratio Set Conditions • Ten seconds or more have been passed while the fuel injection amount compensation value is too low. or • Ten seconds or more have been passed while the fuel injection amount compensation value is too high.	• Malfunction of fuel supply system • Malfunction of oxygen sensor (front) • Malfunction of intake air temperature sensor • Malfunction of barometric pressure sensor • Malfunction of air flow sensor • Malfunction of engine-ECU

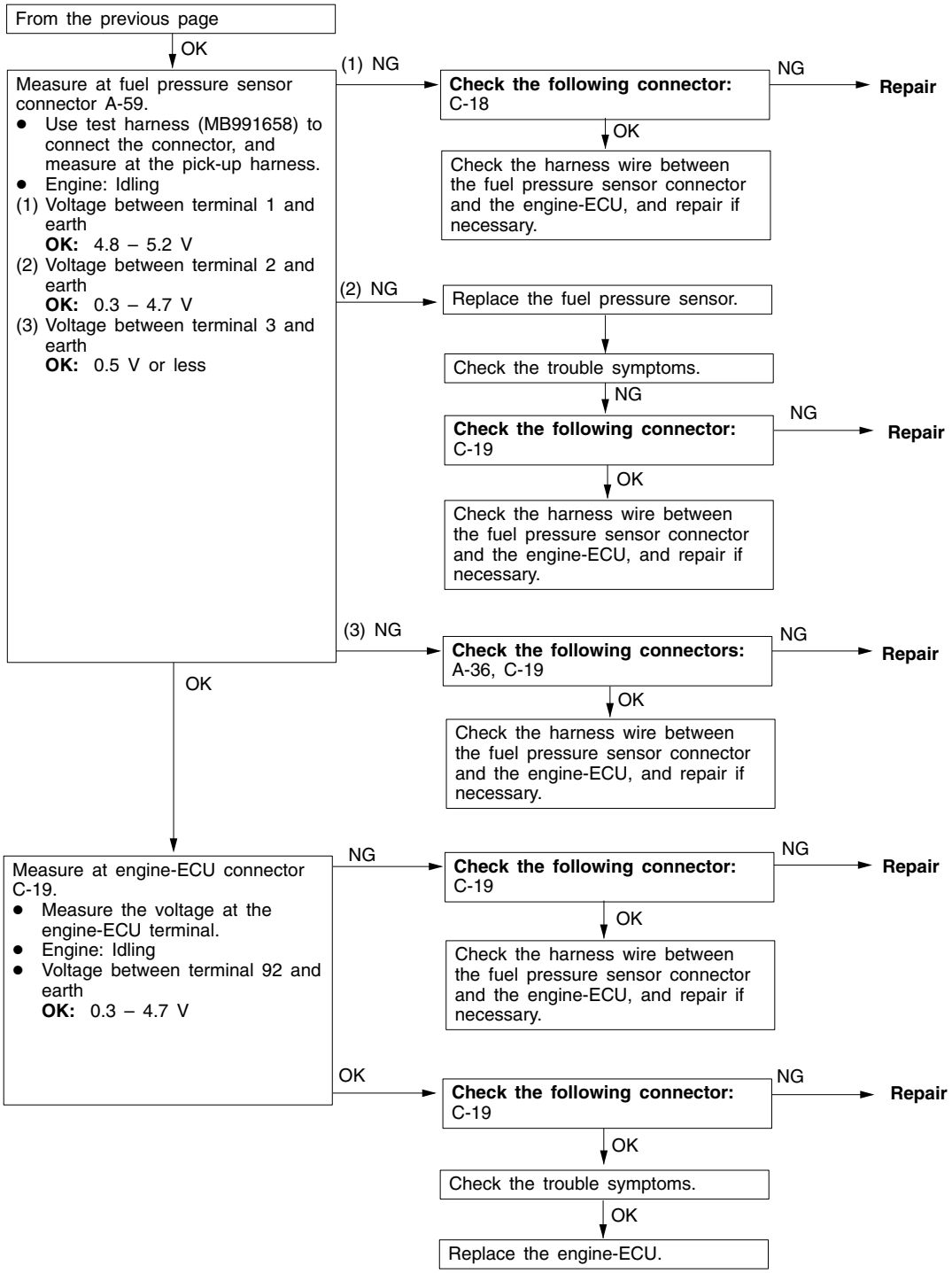


NOTE
*: Refer to the ’00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

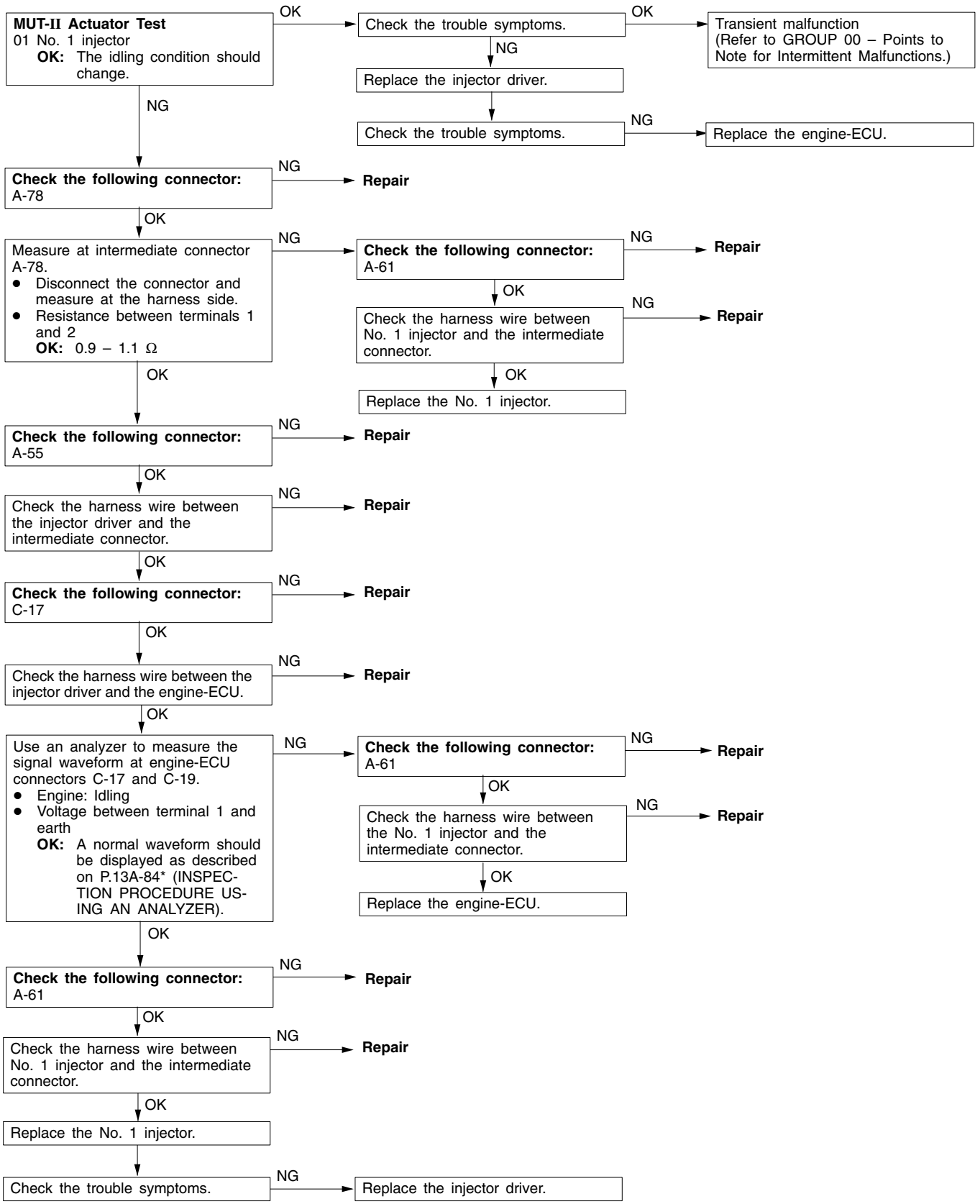

From the previous page
OK
Check the EGR valve (Refer to GROUP 17 – Emission Control.)
NG
Replace
OK
Check the fuel pressure between the fuel pump (low-pressure) and the fuel pump (high-pressure) (Refer to P.13A-108.)
NG
Repair
OK
Check the fuel lines for fuel leaks.
NG
Repair
OK
Check the injectors for clogging or leaks.
NG
Repair
OK
Check the trouble symptoms.
OK
Transient malfunction (Refer to GROUP 00 – Points to Note for Intermittent Malfunctions.)
NG
Replace the engine-ECU.

Code No. P0190 Abnormal fuel pressure	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● The sensor output voltage is 4.8 V or more, or 0.2 V or less for four seconds.	● Malfunction of of fuel pressure sensor ● Open or short circuit in the fuel pressure sensor circuit or loose connector contact ● Malfunction of engine-ECU
Range of Check ● The following conditions are detected temporarily after the engine has been started. (1) Engine speed: 1,000 r/min or more (2) Fuel pressure: 2 MPa or more ● Engine running Set Conditions ● The fuel pressure is 6.9 MPa or more, or 2 MPa or less for four seconds.	● Malfunction of high-pressure fuel pump ● Clogging of high-pressure fuel lines
This diagnosis code will also be output when air is trapped into the high-pressure fuel lines (such as poor fuel level). In that case, the air can be evacuated by operating the engine for at least 15 seconds at 2,000 r/min. After the repair, use the MUT-II to erase the diagnosis code.	● Air trapped due to poor fuel level





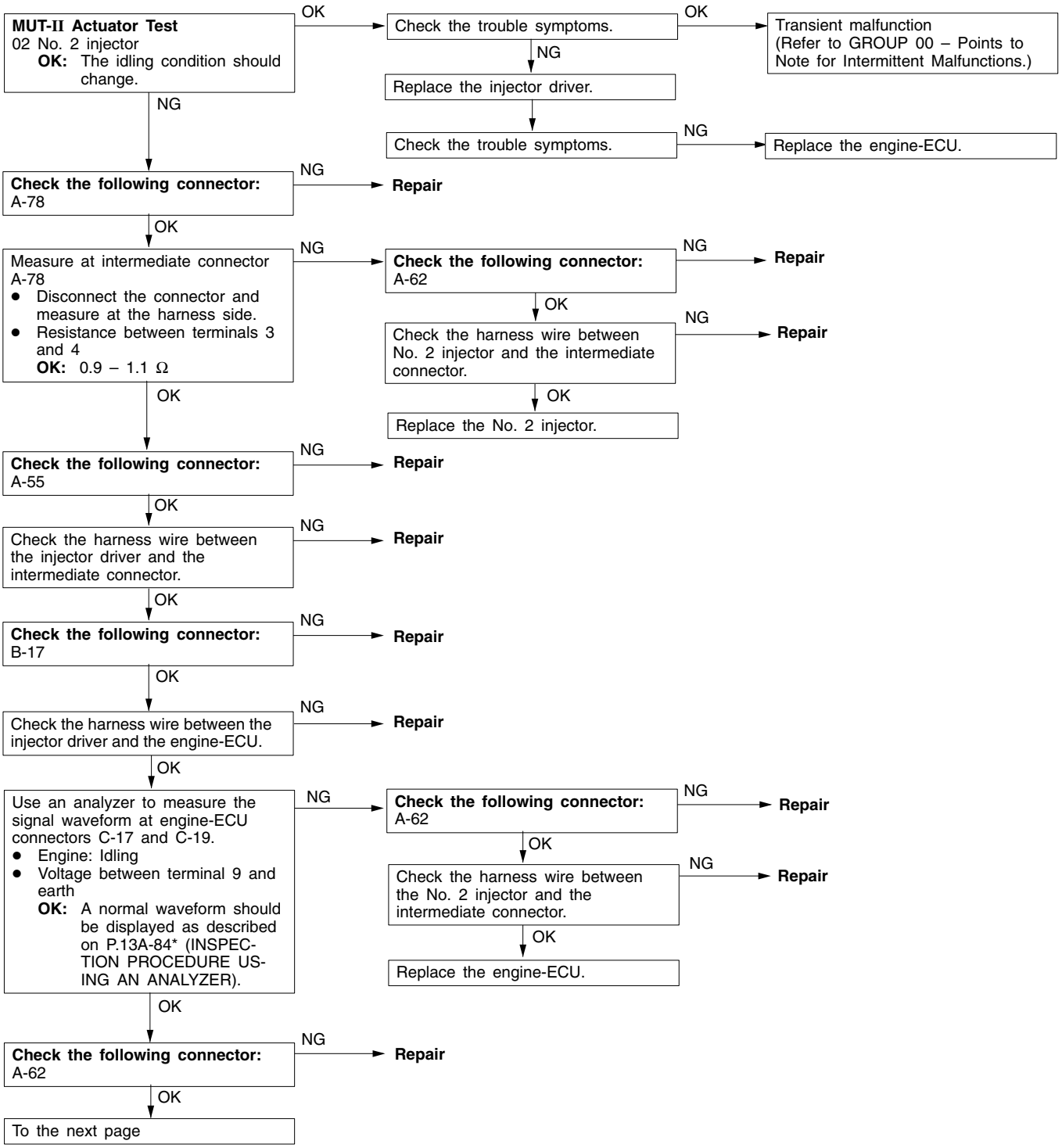
Code No. P0201 No. 1 injector system	Probable cause
Range of Check ● The engine speed is 4,000 r/min or less. ● The battery voltage is 10 V or more. ● The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. Set Conditions ● The injector driver is not transmitting a injector open circuit check signal for four seconds.	● Malfunction of No. 1 injector ● Open or short circuit in the No. 1 injector circuit or loose connector contact ● Malfunction of engine-ECU



NOTE

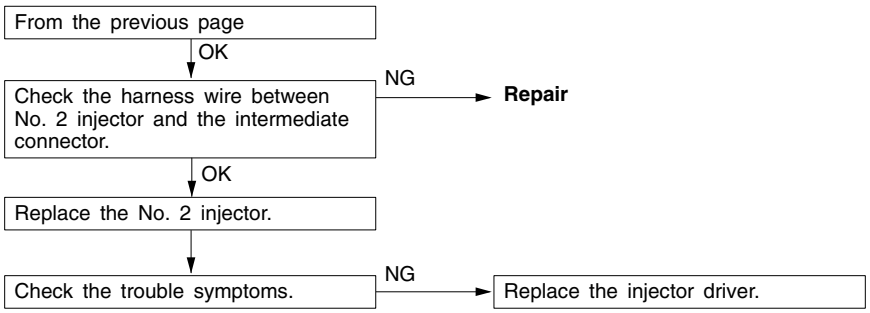
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

Code No. P0202 No. 2 injector system	Probable cause
Range of Check ● The engine speed is 4,000 r/min or less. ● The battery voltage is 10 V or more. ● The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. Set Conditions ● The injector driver is not transmitting a injector open circuit check signal for four seconds.	● Malfunction of No. 2 injector ● Open or short circuit in the No. 2 injector circuit or loose connector contact ● Malfunction of engine-ECU

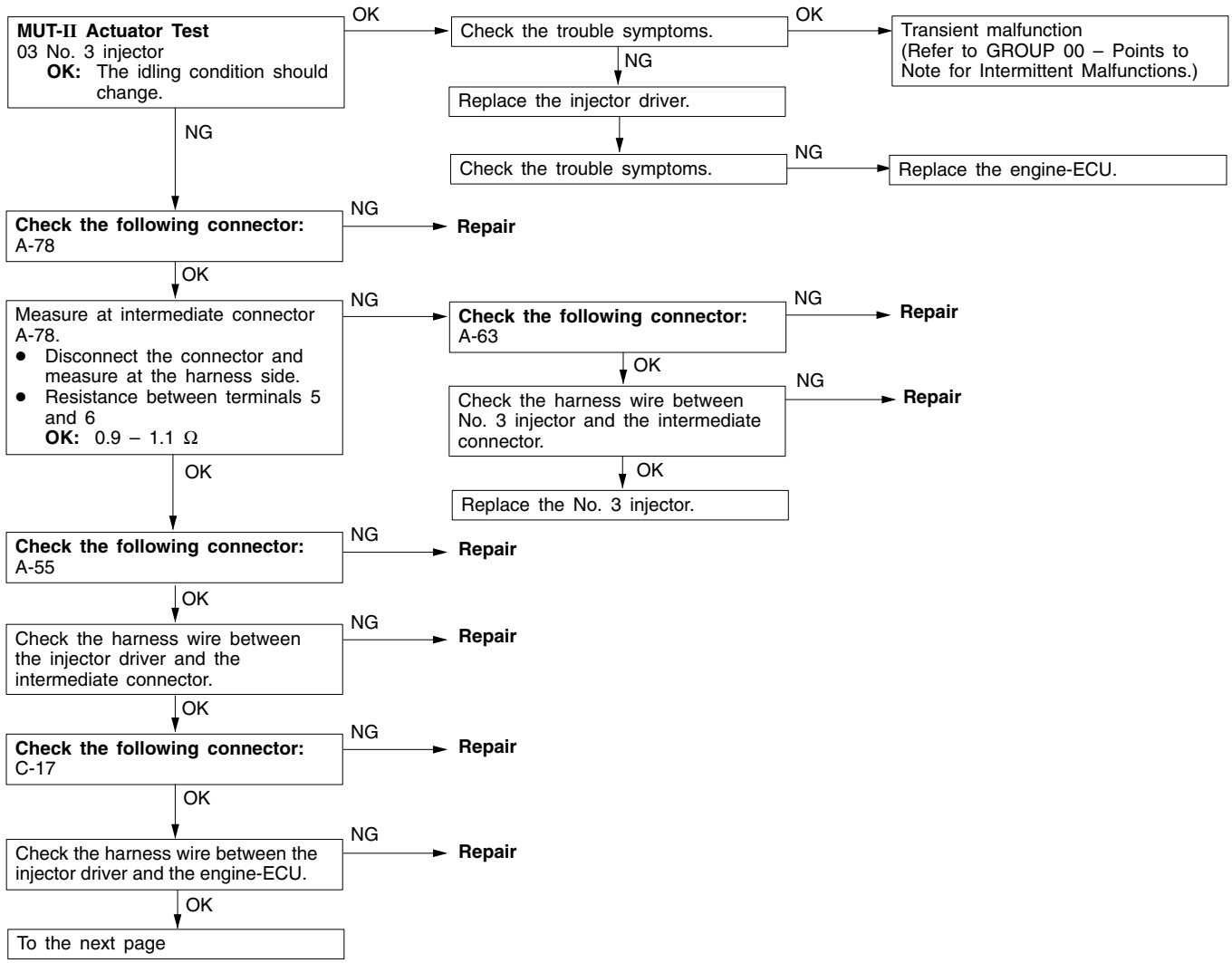


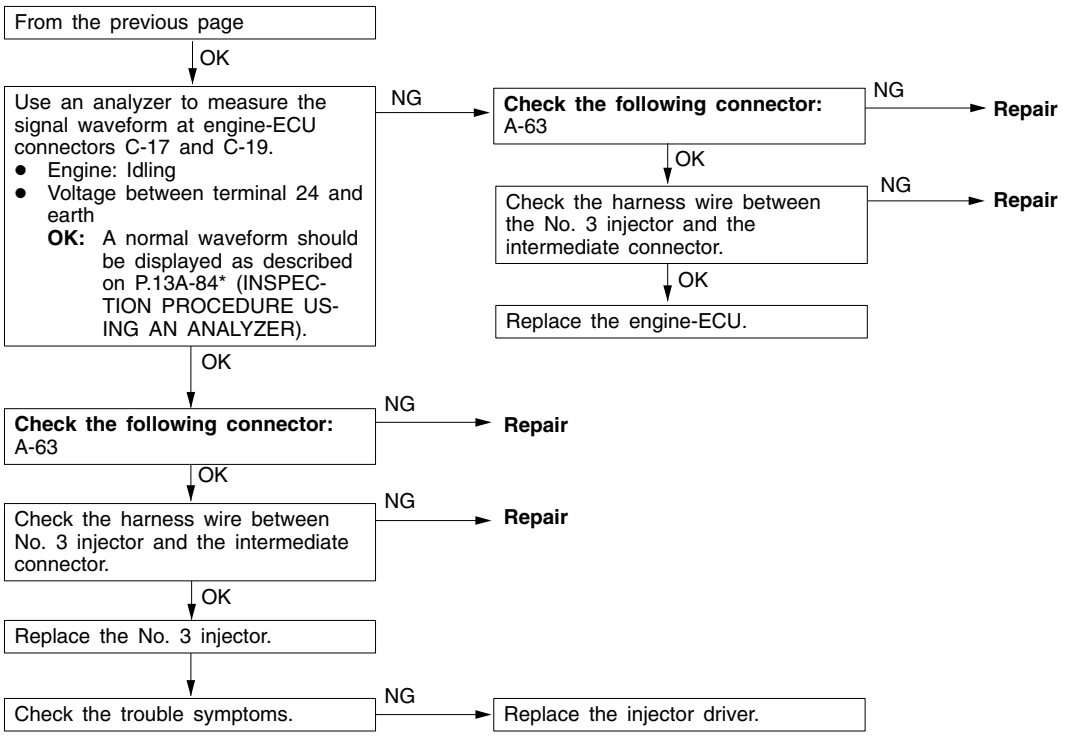
NOTE

*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)



Code No. P0203 No. 3 injector system	Probable cause
Range of Check • The engine speed is 4,000 r/min or less. • The battery voltage is 10 V or more. • The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. Set Conditions • The injector driver is not transmitting a injector open circuit check signal for four seconds.	• Malfunction of No. 3 injector • Open or short circuit in the No. 3 injector circuit or loose connector contact • Malfunction of engine-ECU

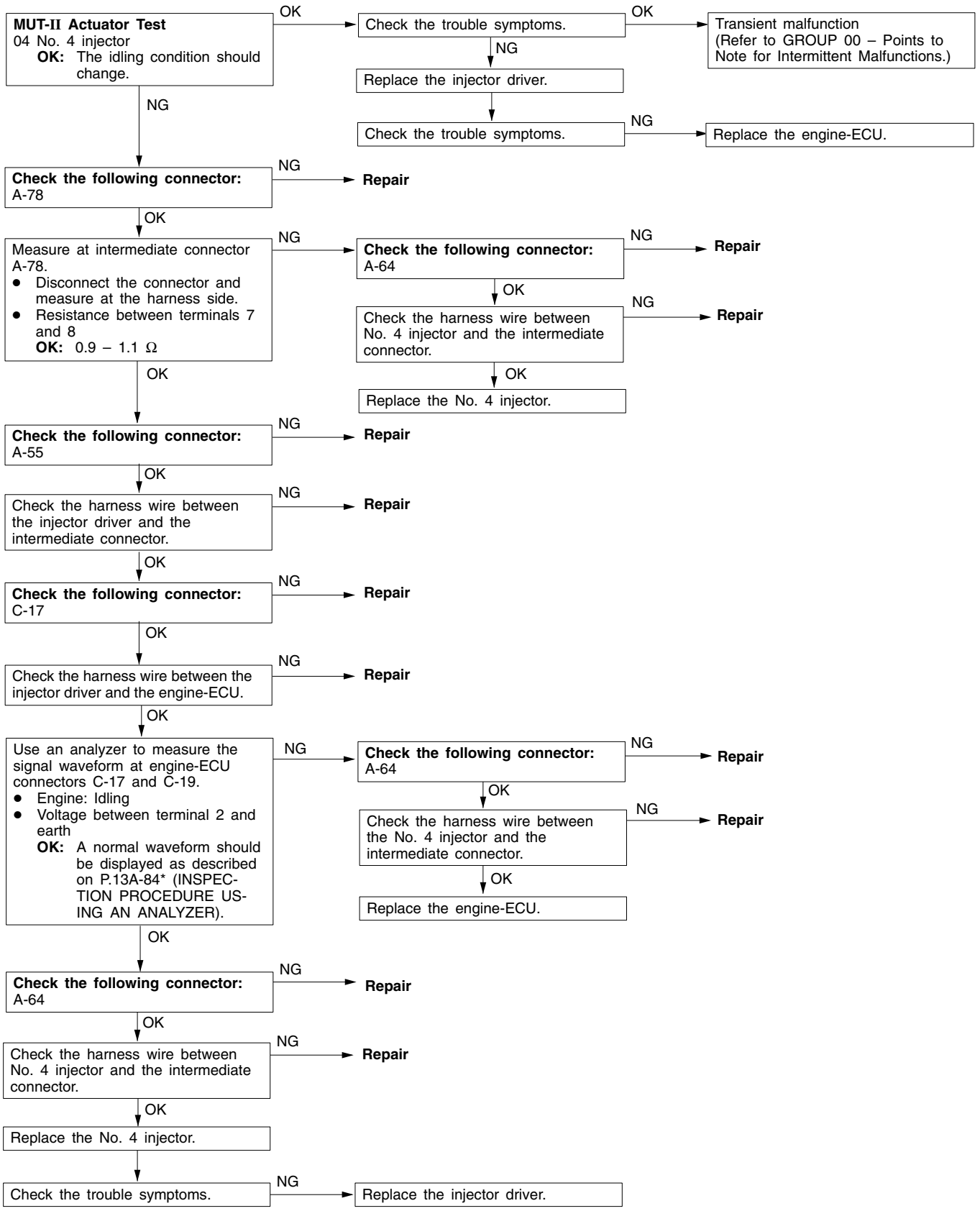




NOTE

*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

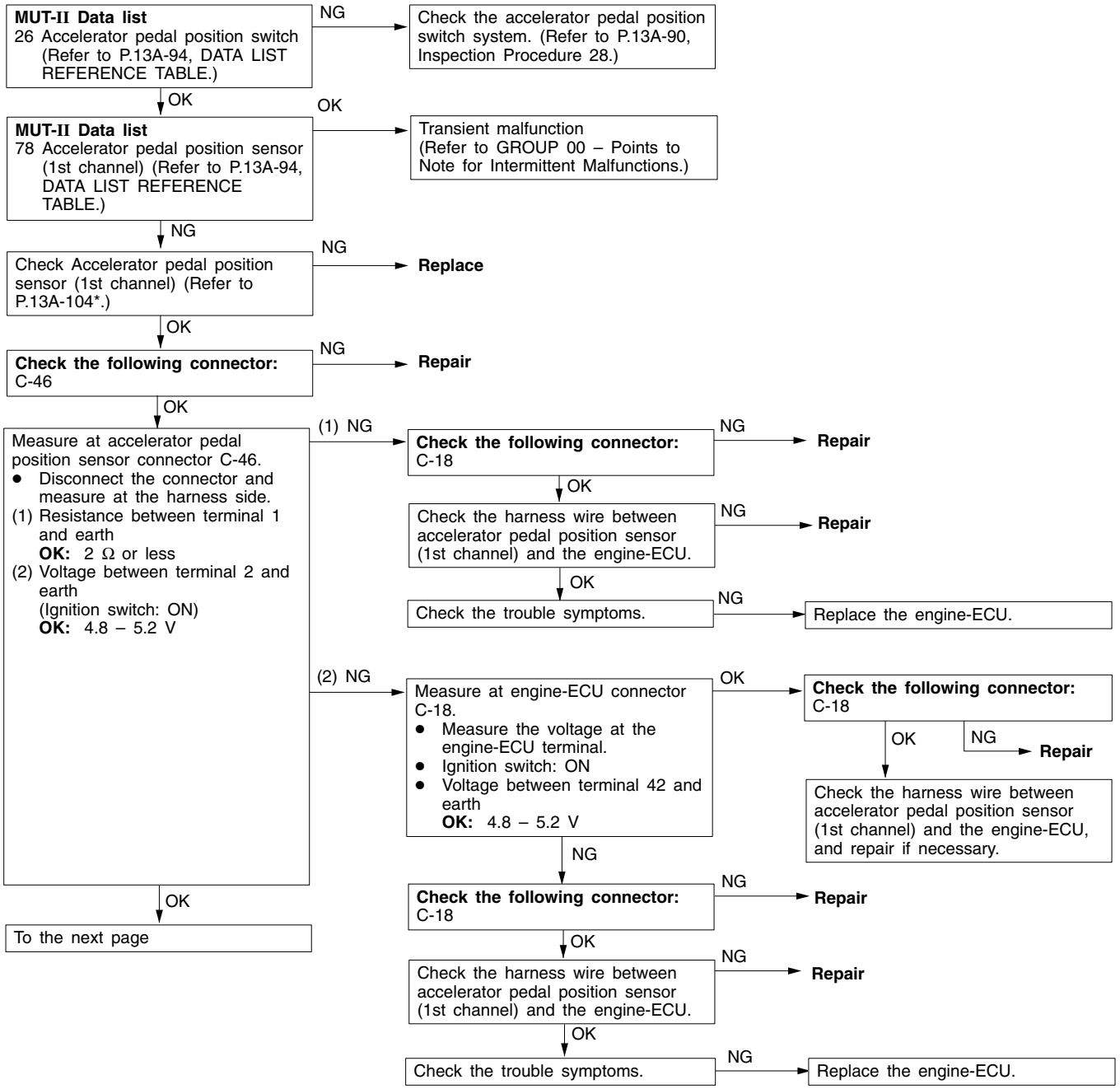
Code No. P0204 No. 4 injector system	Probable cause
Range of Check ● The engine speed is 4,000 r/min or less. ● The battery voltage is 10 V or more. ● The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. Set Conditions ● The injector driver is not transmitting a injector open circuit check signal for four seconds.	● Malfunction of No. 4 injector ● Open or short circuit in the No. 4 injector circuit or loose connector contact ● Malfunction of engine-ECU



NOTE

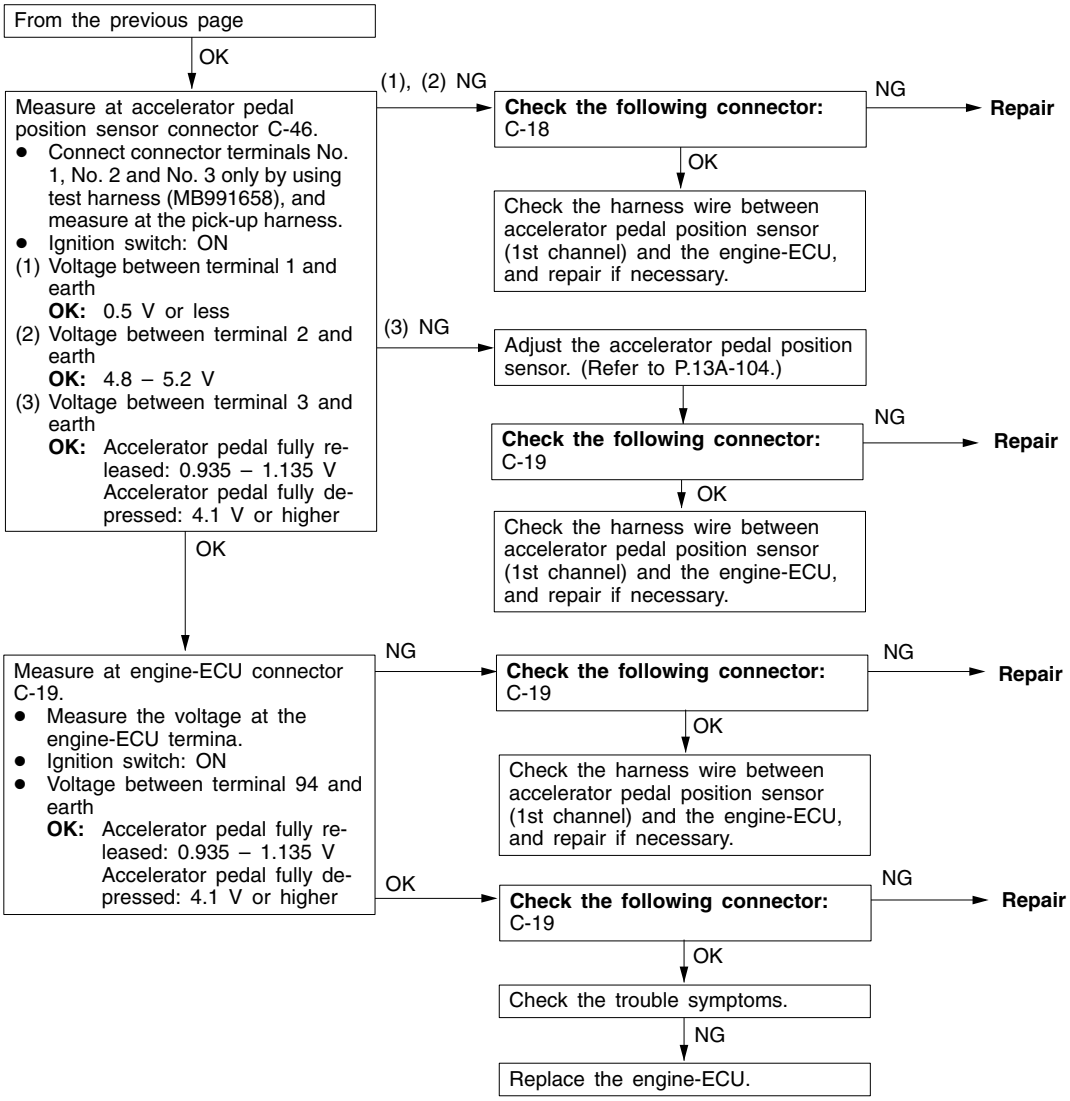
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

Code No. P0220 Accelerator pedal position sensor (1st channel) system	Probable cause
Range of Check ● Accelerator pedal position sensor (2nd channel) is normal. ● Communication between the engine-ECU and the throttle valve controller is normal. Set Conditions ● The output voltage of accelerator pedal position sensor (1st channel) is 0.2 V or less for one second. or ● The output voltage of accelerator pedal position sensor (2nd channel) is 2.5 V or less, and that of accelerator pedal position sensor (1st channel) is 4.5 V or more for one second or ● The difference between accelerator pedal position sensor (1st channel) and accelerator pedal position sensor (2nd channel) output voltages is 1.0 V or more (i.e. the throttle opening angle changes slightly). or ● The output voltage of accelerator pedal position sensor (1st channel) is 1.875 V or more for one second when the accelerator pedal position switch is turned on.	● Malfunction of accelerator pedal position sensor (1st channel) ● Open or short circuit in the accelerator pedal position sensor (1st channel) circuit or loose connector contact ● Accelerator pedal position switch seized ON ● Malfunction of throttle valve controller ● Malfunction of engine-ECU



NOTE

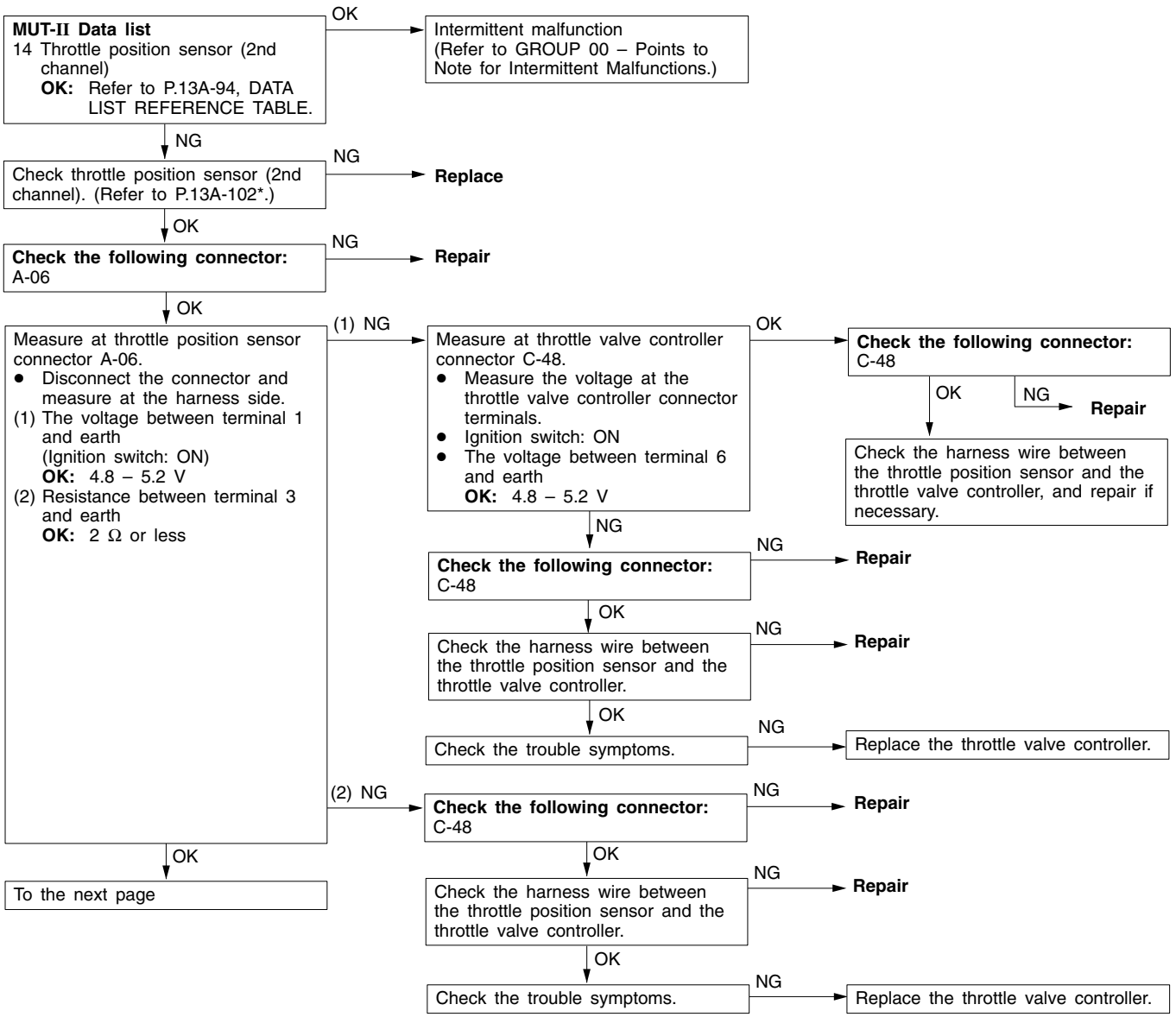
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)



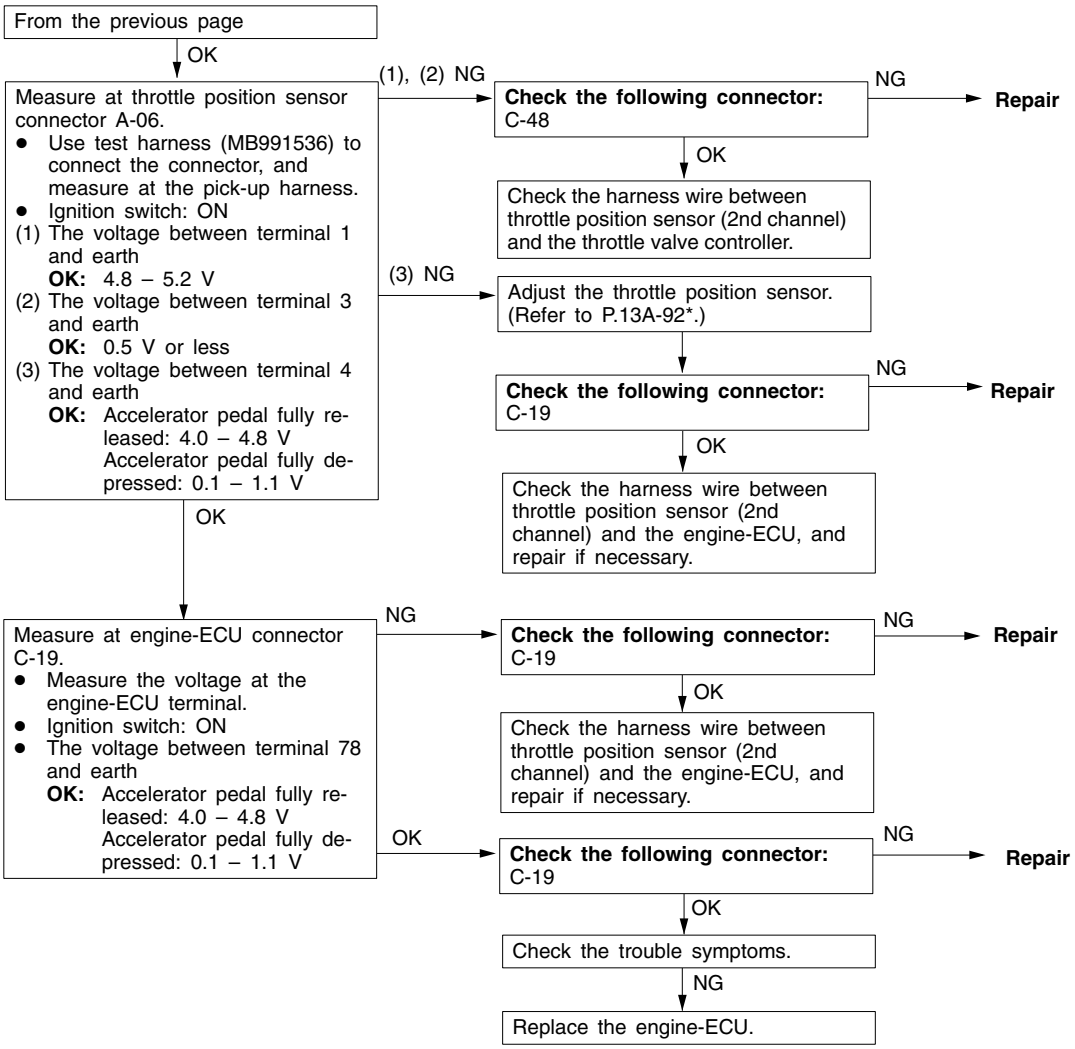
NOTE

*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

Code No. 0225 Throttle position sensor (2nd channel) system	Probable cause
The throttle valve controller judges a malfunction, and then transmit the result to the engine-ECU Range of Check • Ignition switch: ON • The throttle position sensor (1st channel) is normal. Set Conditions • The sensor output voltage is 0.2 V or less for four seconds. or • The sensor output voltage is 4.85 V or more for four seconds, and the output voltage of the throttle position sensor (1st channel) is 1.2 V or more. or • The throttle position sensor (1st channel) and throttle position sensor (2nd channel) combination output voltage is outside 4 – 6 V.	• Malfunction of throttle position sensor (2nd channel) • Open or short circuit in the throttle position sensor (2nd channel) circuit or loose connector contact • Malfunction of the throttle valve controller • Malfunction of the engine-ECU

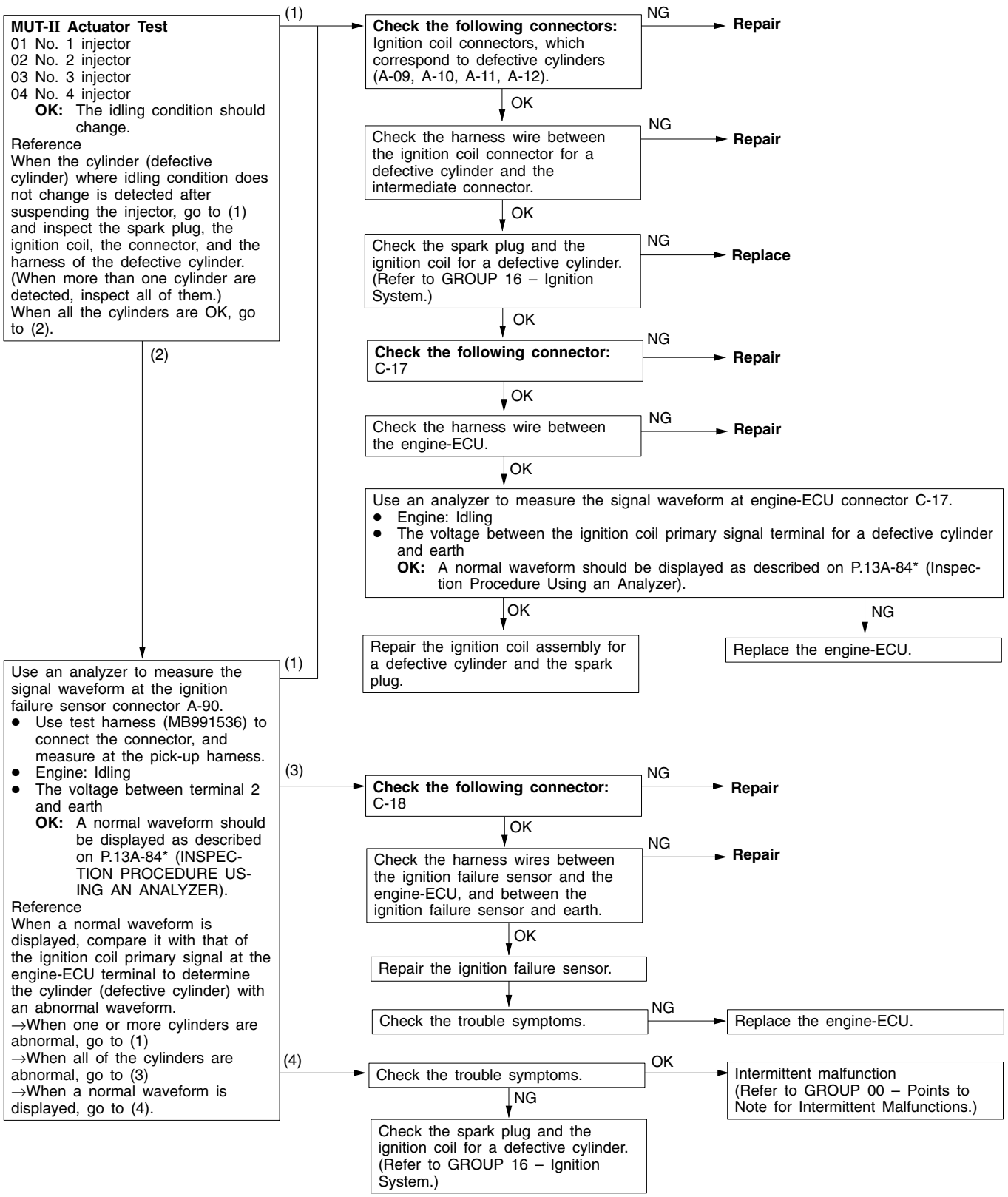


NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)



NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

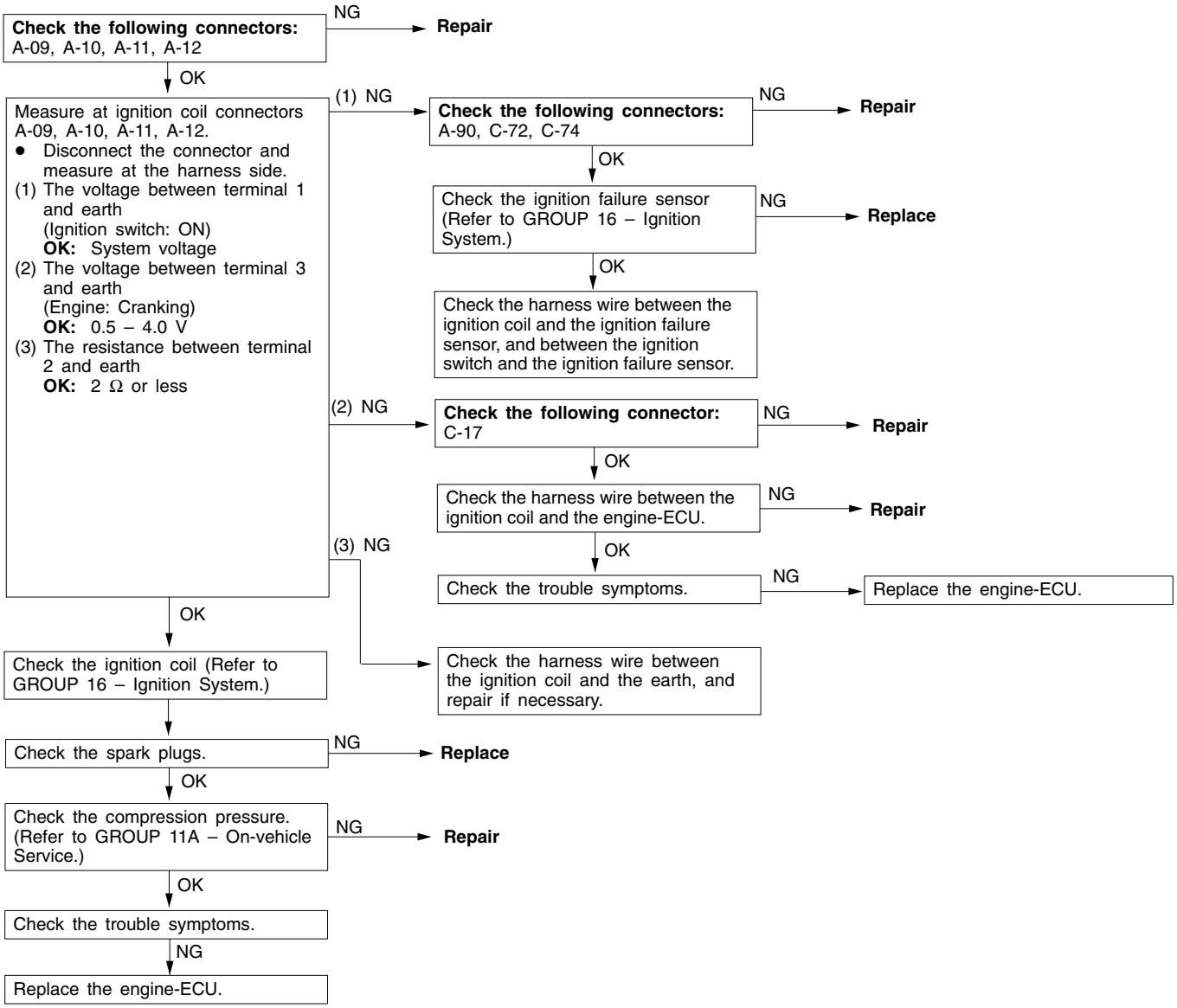
Code No. P0300 Ignition coil (power transistor) system	Probable cause
Range of Check ● Engine speed is approx. 50 – 4,000 r/min. ● Engine is not cranking. Set Conditions ● The ignition failure sensor does not send a signal about a certain cylinder for four seconds.	● Malfunction of the ignition coil ● Malfunction of the ignition failure sensor ● Malfunction of spark plug ● Open or short circuit in the primary ignition circuit or loose connector contact ● Malfunction of engine-ECU



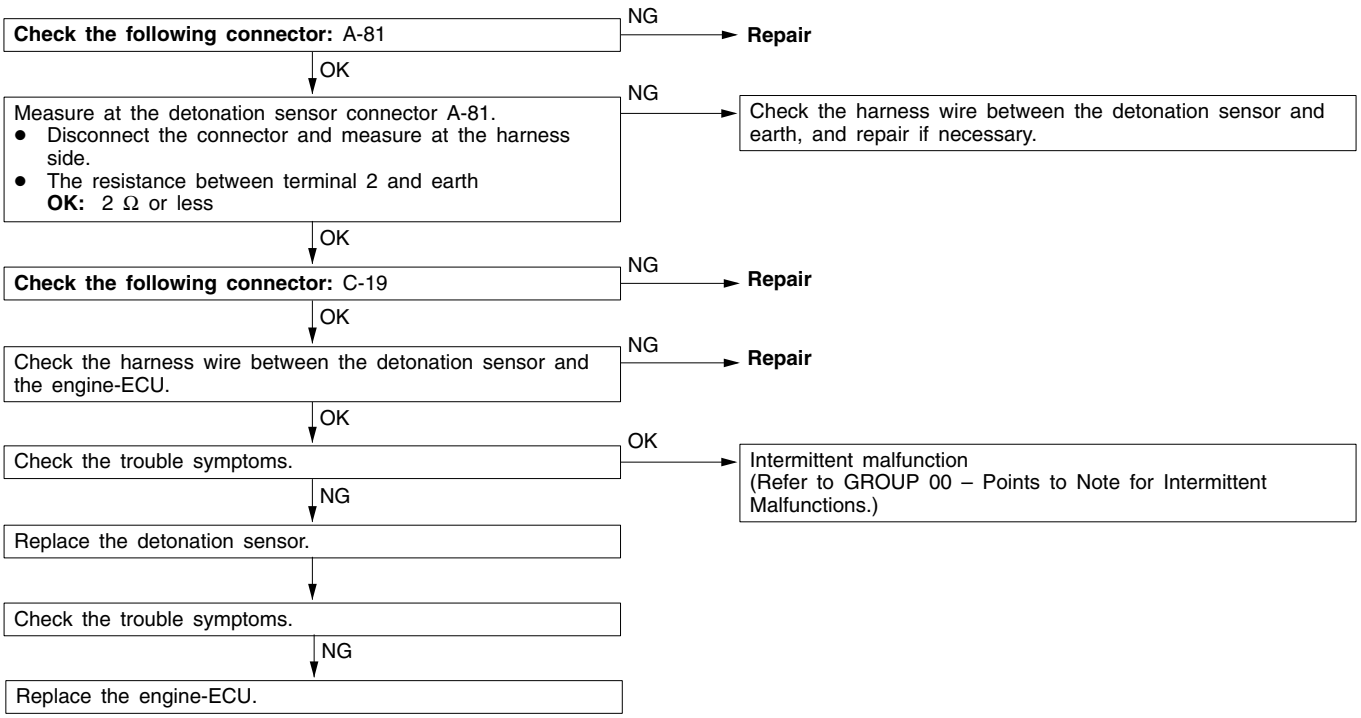
NOTE

*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

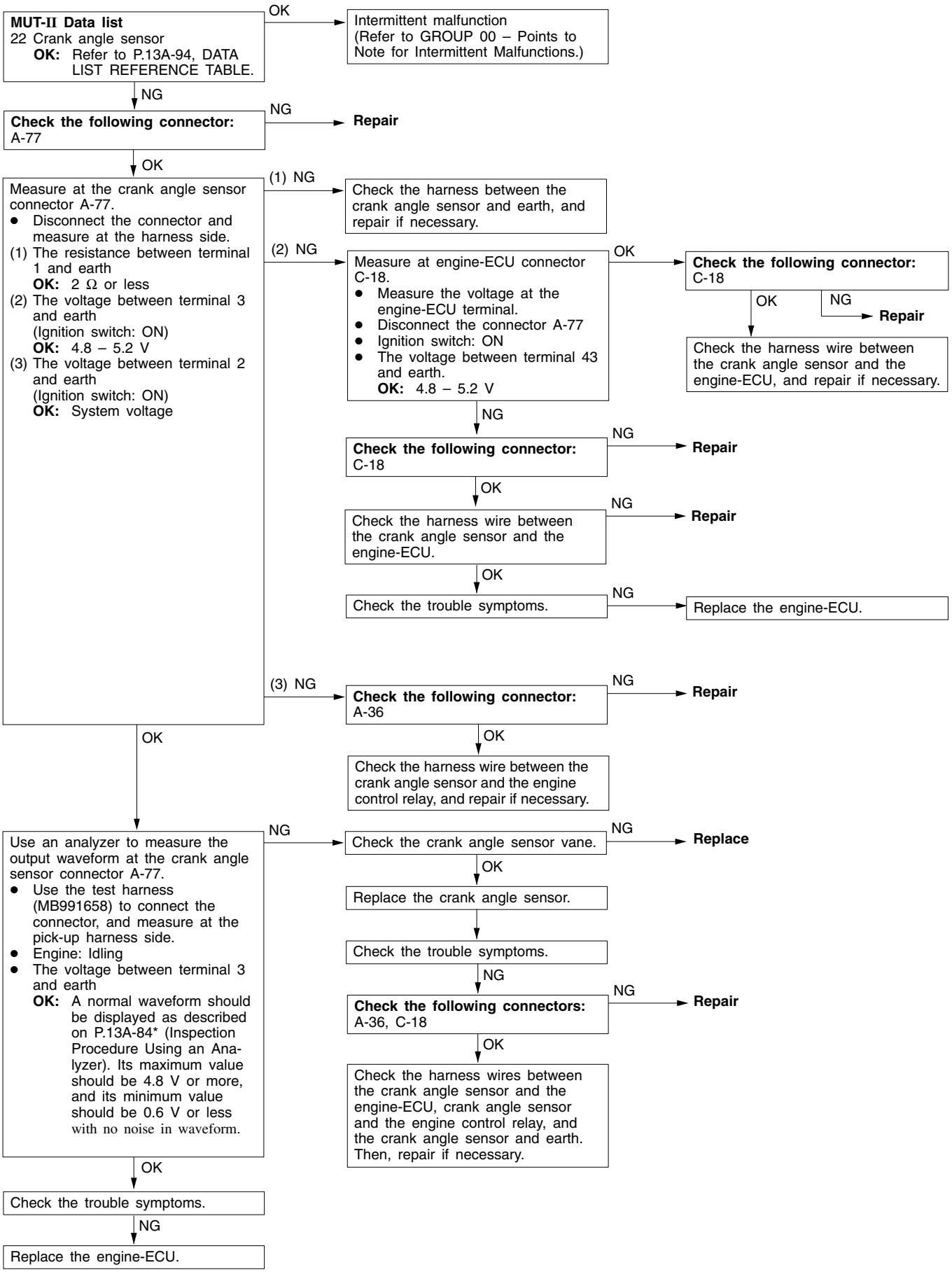
Code No. P0301 No. 1 cylinder misfire detected **Code No. P0302 No. 2 cylinder misfire detected** **Code No. P0303 No. 3 cylinder misfire detected** **Code No. P0304 No. 4 cylinder misfire detected**	**Probable cause**
Range of Check ● The engine speed is 500 – 4,500 r/min. ● While the engine is running except deceleration and sudden acceleration. Set Conditions ● The number of misfires exceeds a predetermined number per 200 engine revolutions (Misfire has occurred in only one cylinder). or ● The number of misfires exceeds a predetermined number per 100 engine revolutions (Misfire has occurred in only one cylinder).	● Malfunction of the ignition system ● Abnormal compression ● Malfunction of injector ● Malfunction of engine-ECU



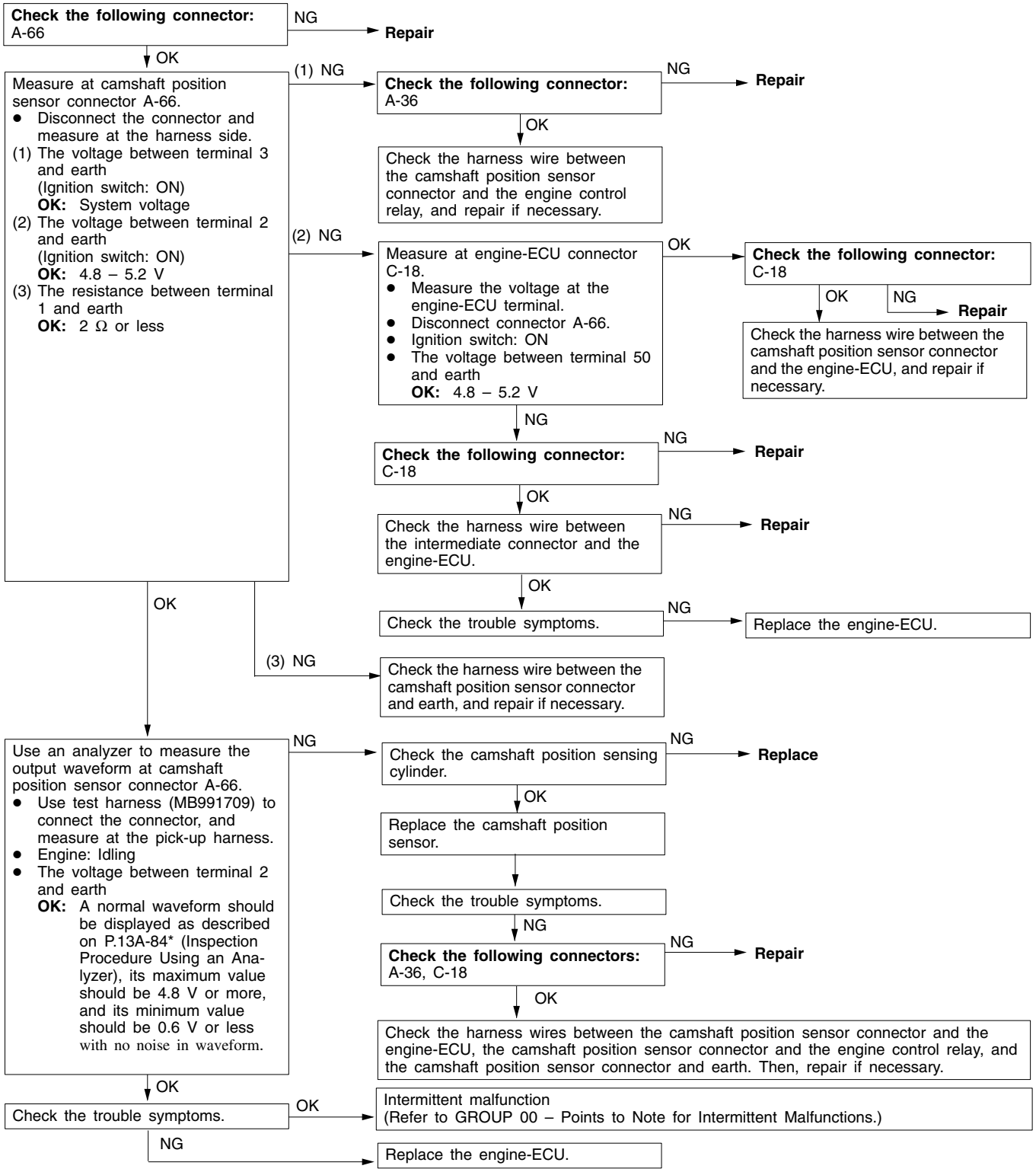
Code No. P0325 Detonation sensor system	Probable cause
Range of Check • Engine: Two seconds after the engine has been started Set Conditions • Changes in sensor output voltage (detonation sensor peak voltage per 1/3 crankshaft rotation) in 200 consecutive cycles are 0.08 V or less.	• Malfunction of the detonation sensor • Open or short circuit in the detonation sensor circuit or loose connector contact • Malfunction of engine-ECU



Code No. P0335 Crank angle sensor system	Probable cause
Range of Check • Engine is cranking Set Conditions • Sensor output voltage does not change for 4 seconds (no pulse signal input).	• Malfunction of the crank angle sensor. • Open or short circuit in the crank angle sensor circuit or loose connector contact. • Malfunction of engine-ECU

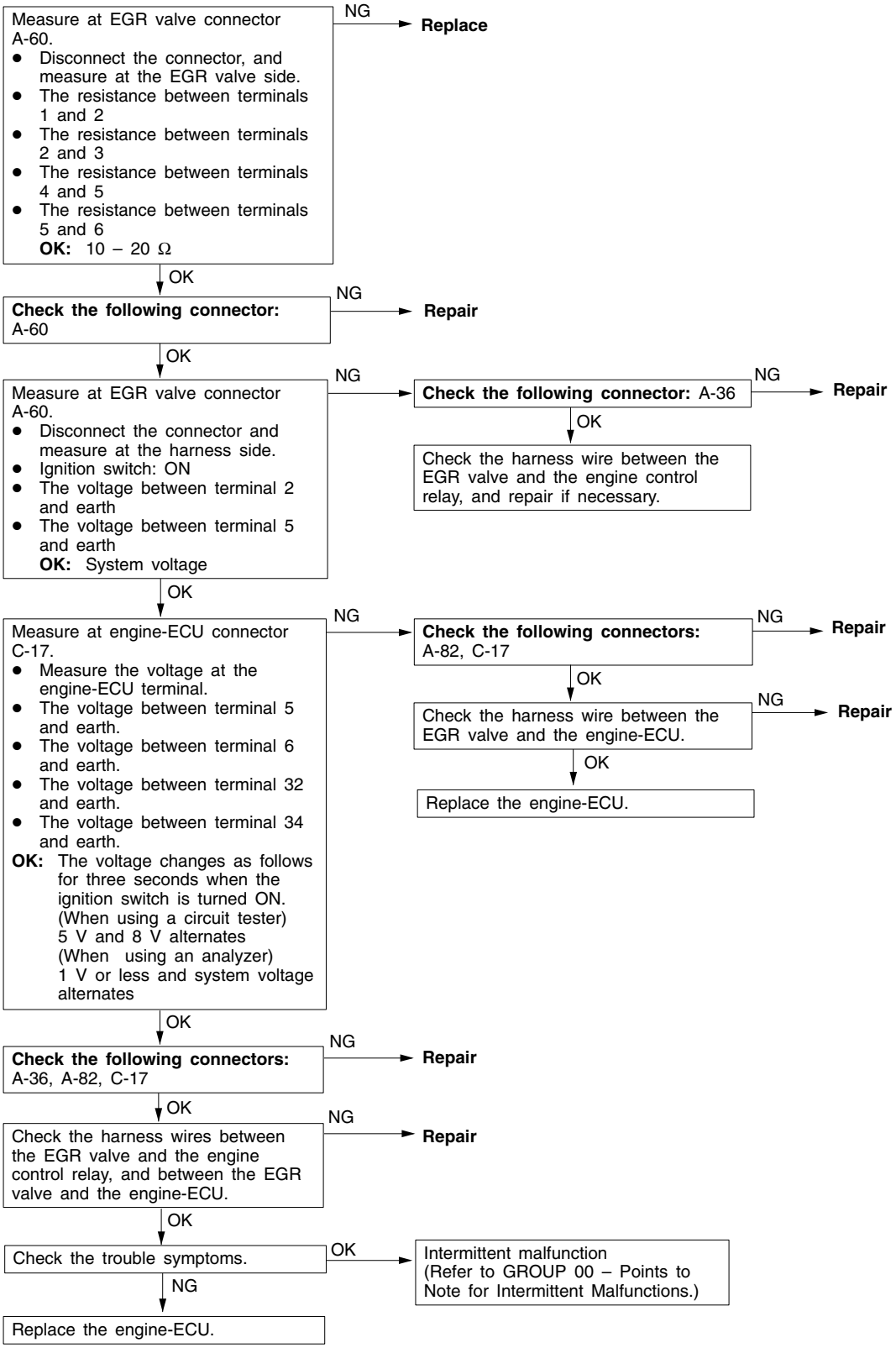

MUT-II Data list
22 Crank angle sensor
OK: Refer to P.13A-94, DATA LIST REFERENCE TABLE.
OK
Intermittent malfunction (Refer to GROUP 00 – Points to Note for Intermittent Malfunctions.)
NG
Check the following connector: A-77
NG
Repair
OK
Measure at the crank angle sensor connector A-77.
• Disconnect the connector and measure at the harness side.
(1) The resistance between terminal 1 and earth
OK: 2 Ω or less
(2) The voltage between terminal 3 and earth
(Ignition switch: ON)
OK: 4.8 – 5.2 V
(3) The voltage between terminal 2 and earth
(Ignition switch: ON)
OK: System voltage
(1) NG
Check the harness between the crank angle sensor and earth, and repair if necessary.
(2) NG
Measure at engine-ECU connector C-18.
• Measure the voltage at the engine-ECU terminal.
• Disconnect the connector A-77
• Ignition switch: ON
• The voltage between terminal 43 and earth.
OK: 4.8 – 5.2 V
OK
Check the following connector: C-18
OK
NG
Repair
Check the harness wire between the crank angle sensor and the engine-ECU, and repair if necessary.
NG
Check the following connector: C-18
NG
Repair
OK
Check the harness wire between the crank angle sensor and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
(3) NG
Check the following connector: A-36
NG
Repair
OK
Check the harness wire between the crank angle sensor and the engine control relay, and repair if necessary.
OK
Use an analyzer to measure the output waveform at the crank angle sensor connector A-77.
• Use the test harness (MB991658) to connect the connector, and measure at the pick-up harness side.
• Engine: Idling
• The voltage between terminal 3 and earth
OK: A normal waveform should be displayed as described on P.13A-84* (Inspection Procedure Using an Analyzer). Its maximum value should be 4.8 V or more, and its minimum value should be 0.6 V or less with no noise in waveform.
NG
Check the crank angle sensor vane.
NG
Replace
OK
Replace the crank angle sensor.
Check the trouble symptoms.
NG
Check the following connectors: A-36, C-18
NG
Repair
OK
Check the harness wires between the crank angle sensor and the engine-ECU, crank angle sensor and the engine control relay, and the crank angle sensor and earth. Then, repair if necessary.
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.

Code No. P0340 Camshaft position sensor system	Probable cause
Range of Check ● After the engine was started Set Conditions ● The sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the camshaft position sensor ● Open or short circuit in the camshaft position sensor circuit or loose connector contact. ● Malfunction of engine-ECU

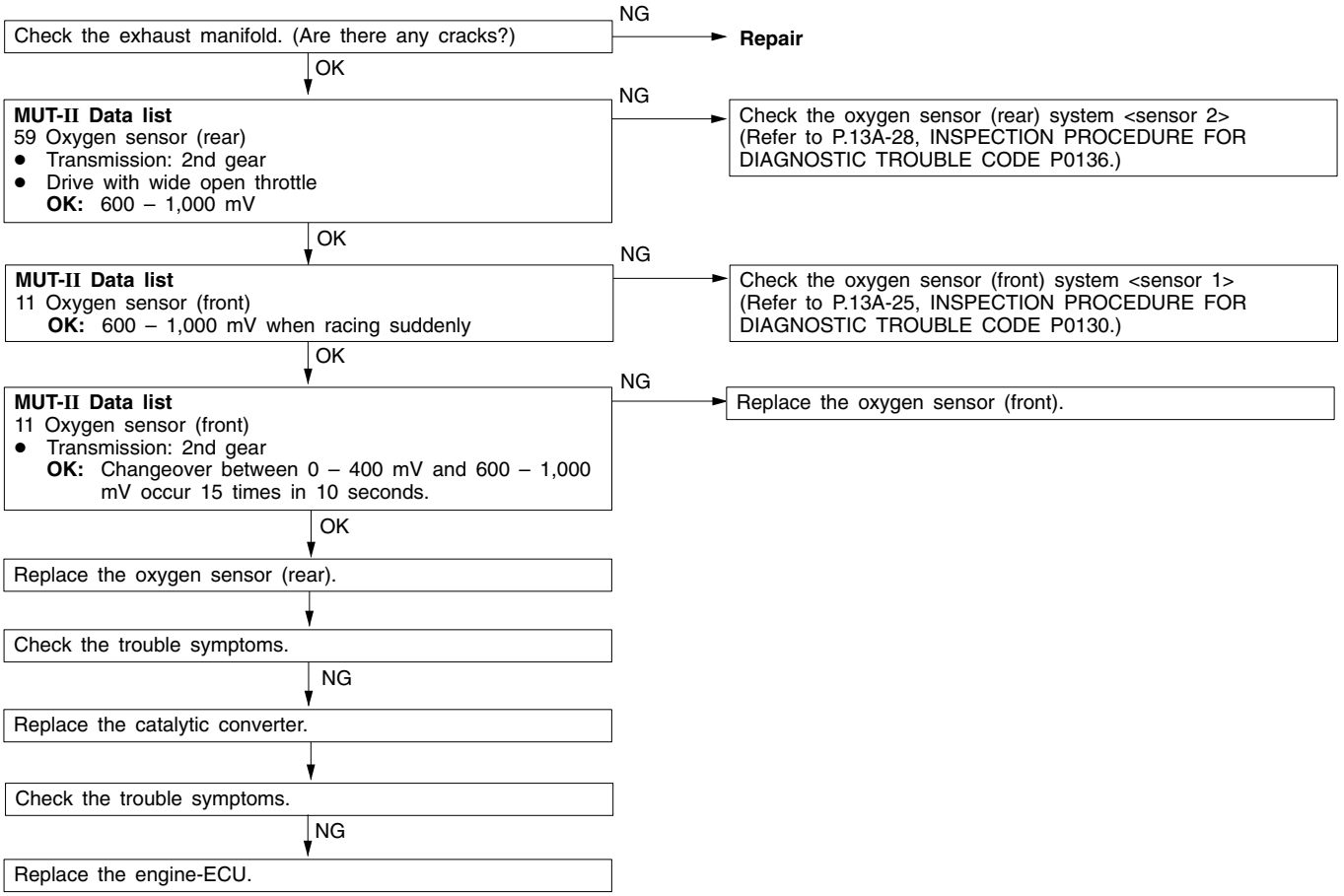


NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

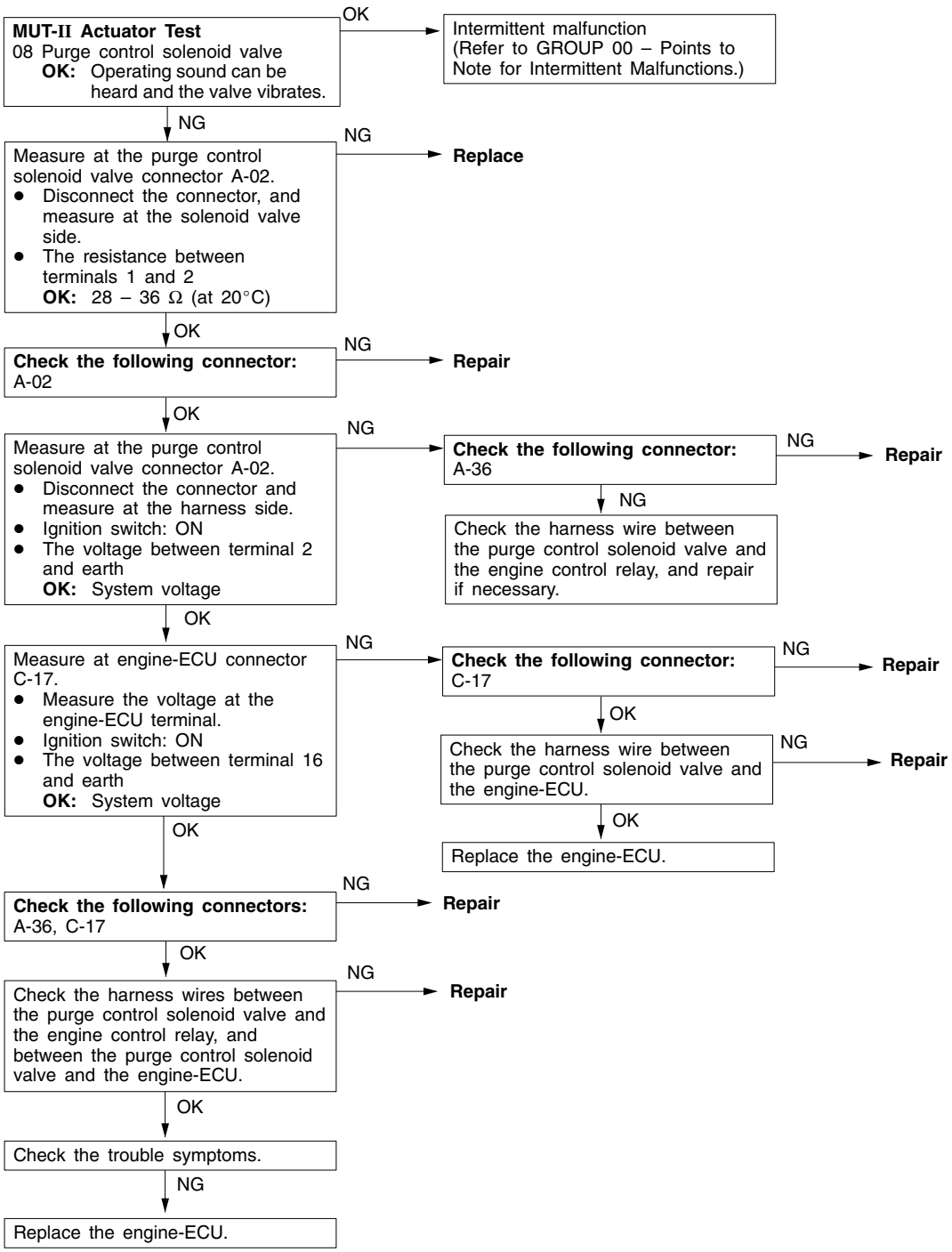
Code No. P0403 EGR valve system	Probable cause
Range of Check • Ignition switch: OFF to ON • EGR valve is in operation after the engine starting process is complete. Set Conditions • Off–surge voltage is not generated from the motor coil while the EGR valve control motor is running.	• Malfunction of the EGR valve • Open or short circuit in the EGR valve circuit or loose connector contact • Malfunction of engine-ECU



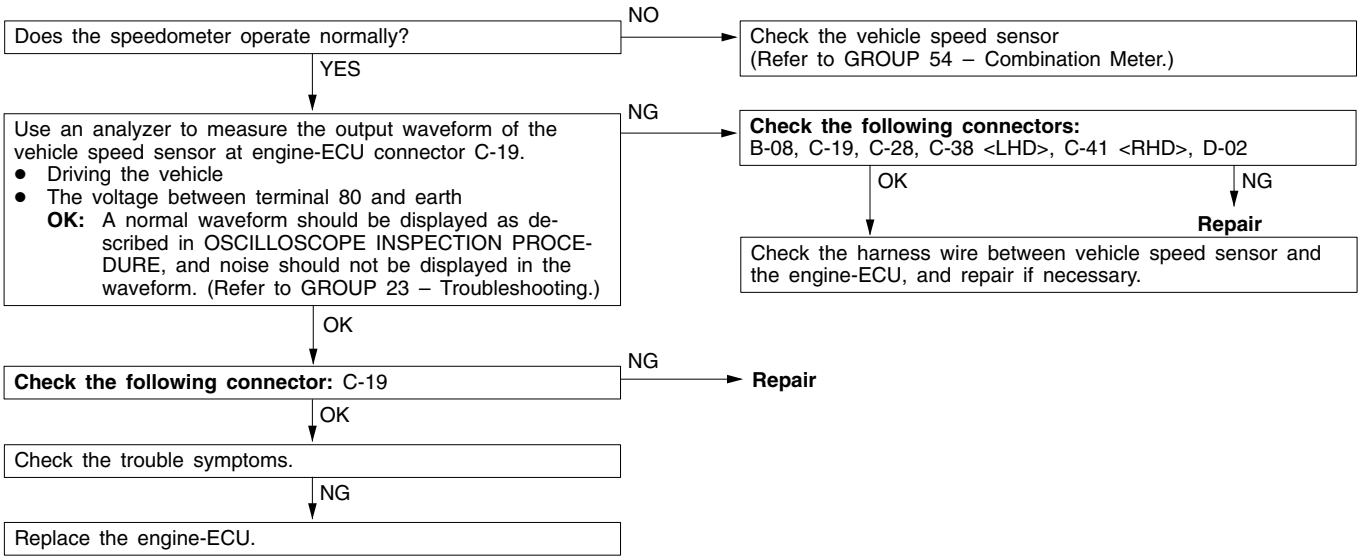
Code No. P0420 Catalyst malfunction	Probable cause
Range of Check • The engine speed is 3,000 r/min or less. • During driving • During air/fuel ratio feedback control Set Conditions • The ratio between the oxygen sensor (rear) and the oxygen sensor (front) output frequencies reaches 0.8 per 12 seconds on average.	• Malfunction of catalyst • Malfunction of the oxygen sensor (front) • Malfunction of the oxygen sensor (rear) • Malfunction of engine-ECU



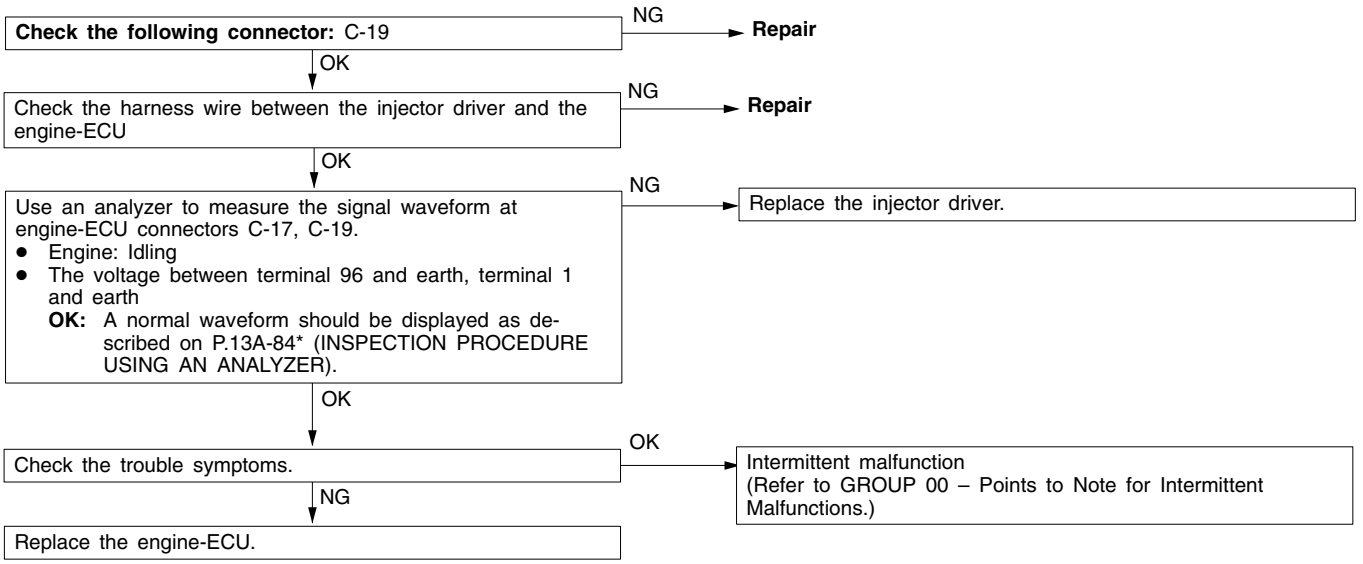
Code No. P0443 Purge control solenoid valve system	Probable cause
Range of Check • Ignition switch: ON • Battery voltage is 10 V or more. Set Conditions • The solenoid coil surge voltage (battery voltage + 2 V) is not detected when the purge control solenoid valve is turned from on to off.	• Malfunction of the purge control solenoid valve • Open or short circuit in the purge control solenoid valve circuit or loose connector contact • Malfunction of engine-ECU



Code No. P0500 Vehicle speed sensor system	Probable cause
Range of Check ● Engine: Two seconds after the engine was started ● Idle switch: OFF ● Engine speed: 2,500 r/min or more ● During high engine load Set Conditions ● The sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the vehicle speed sensor ● Open or short circuit in the vehicle speed sensor circuit or loose connector contact ● Malfunction of engine-ECU

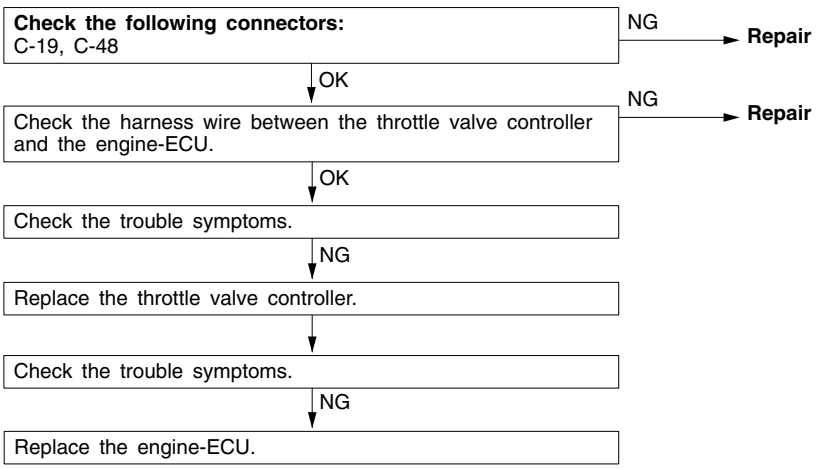


Code No. P1200 Injector driver system	Probable cause
Range of Check ● Engine speed: 4,000 r/mimn or less ● Battery voltage: 10 V or more ● The fuel cut operation and the injector operation (by carrying out the Actuator test) are not in progress. ● During high engine load Set Conditions ● Injector open circuit check signal is not output from the injector driver.	● Malfunction of the injector driver ● Open or short circuit, or loose connector contact ● Malfunction of engine-ECU

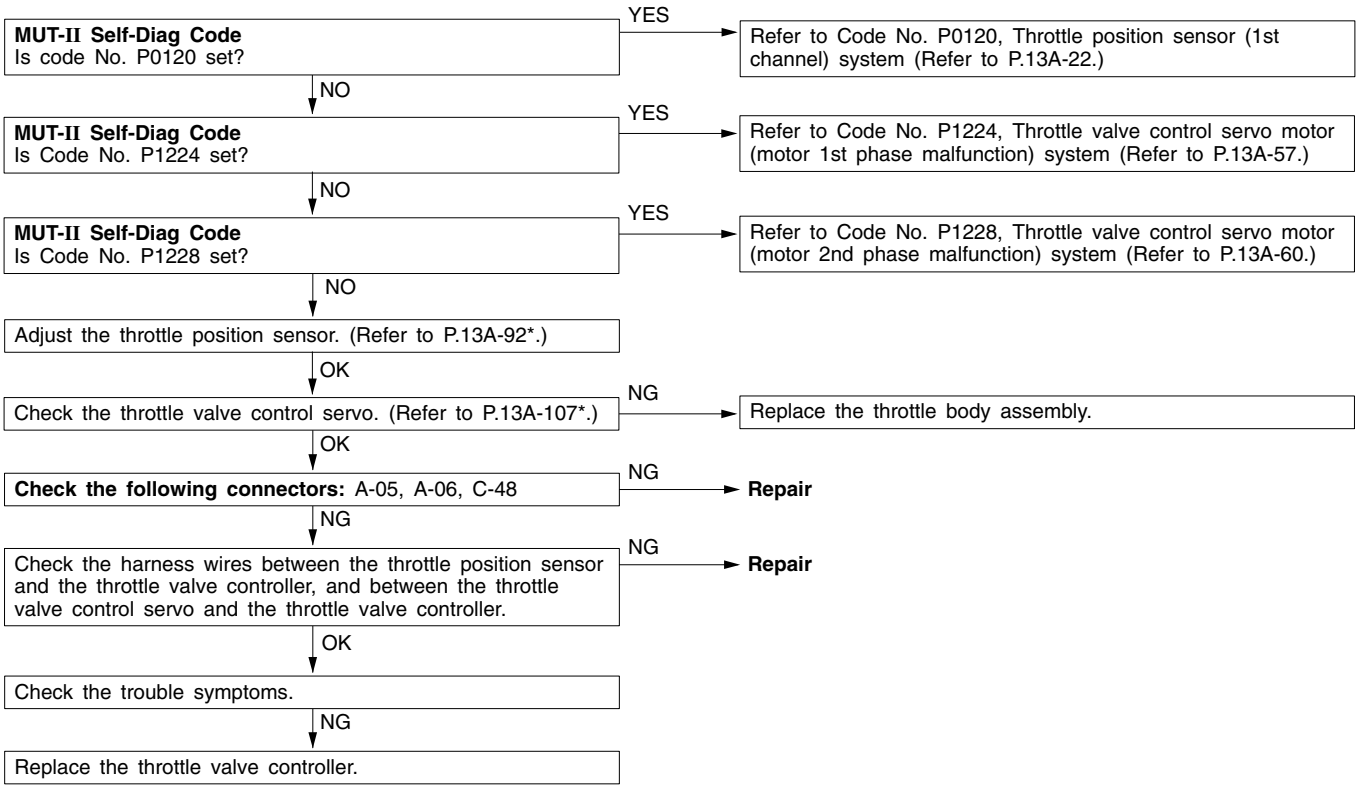


NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

Code No. P1220 Electronic-controlled throttle valve system	Probable cause
Range of Check • Ignition switch: ON • Error in communication between the engine-ECU and the throttle valve controller Set Conditions • Output voltage of throttle position sensor (2nd channel) fluctuates significantly (approx. 1 V or more) from an expected value, based on that of the accelerator pedal position sensor (2nd channel). Range of Check • Ignition switch: ON • Error in communication between the throttle valve controller and the engine-ECU Set Conditions • The output voltage of the throttle position sensor (2nd channel) is significantly different (approx. 1 V) from the throttle valve opening angle (voltage), which the engine-ECU request the throttle valve controller.	• Short in communication line • Malfunction of the engine-ECU • Malfunction of the throttle valve controller



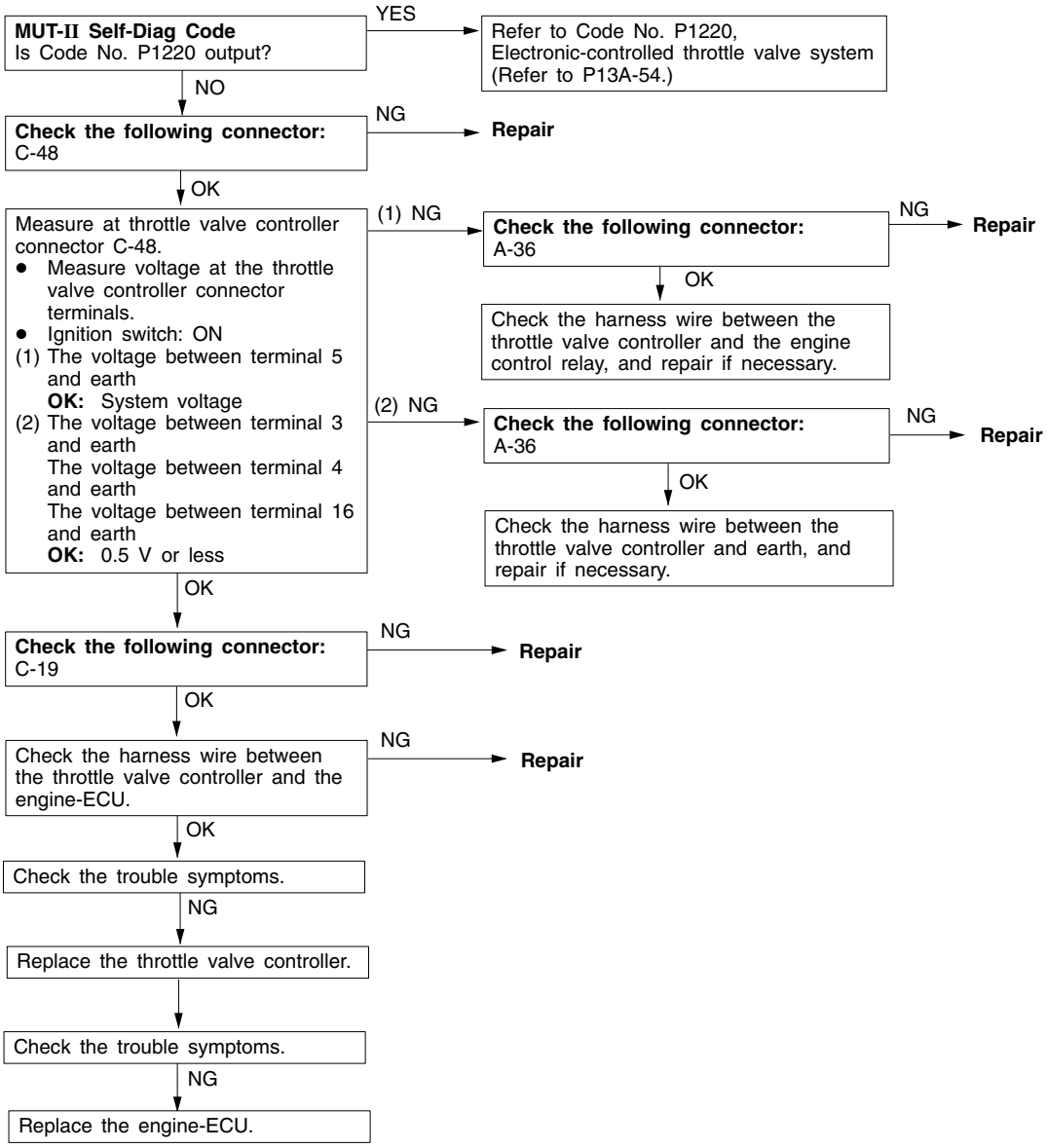
Code No. P1221 Throttle valve position feedback system	Probable cause
The throttle valve controller judges a malfunction, and then transmit the result to the engine-ECU. Range of Check • Ignition switch: ON • Battery voltage: 10 V or more Set Conditions • Failure in the motor position feedback (The engine-ECU detects that the current in the motor is excessive and the opening angle difference between the target value of throttle position sensor (1st channel) and the actual value of throttle position sensor (1st channel) is 1.0 V or more)	• Malfunction of throttle position sensor (1st channel) • Open or short circuit in the throttle position sensor (1st channel) circuit or loose connector contact • Malfunction of the throttle valve controller



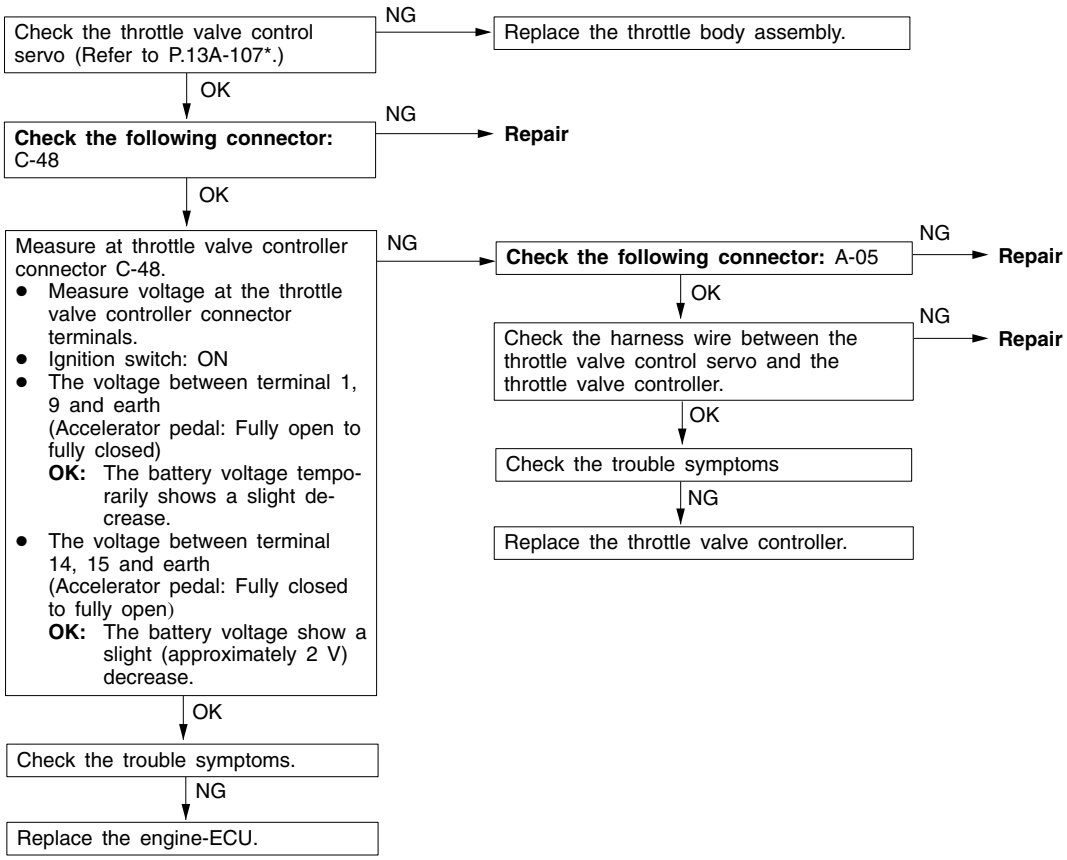
NOTE

*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

Code No. P1223 Communication line system with the throttle valve controller	Probable cause
Range of Check • Ignition switch: ON • Battery voltage: 8 V or more. • Engine: Not cranking Set Conditions • System detects an error in communication line between the engine-ECU and the throttle valve controller, and between the throttle valve controller and the engine-ECU.	• Short in communication line • Malfunction of engine-ECU • Malfunction of throttle valve controller



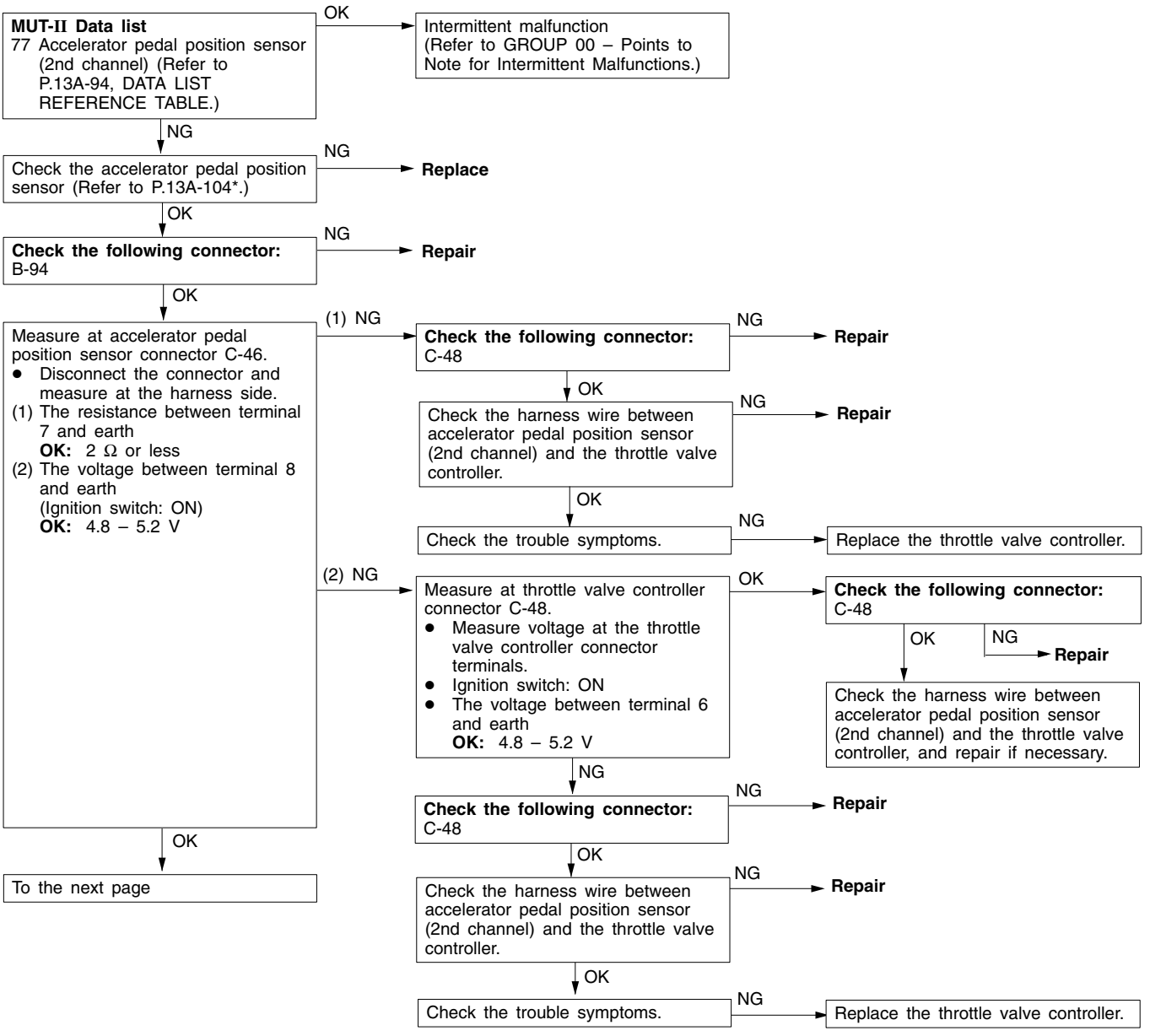
Code No. P1224 Throttle valve control servo motor (Motor 1st phase malfunction) system	Probable cause
Range of Check ● Throttle valve control servo relay: ON ● System voltage: 8 V or more. Set Conditions ● Throttle valve control servo drive circuit is shorted to earth. ● Other power source interferences with throttle valve control servo drive circuit. ● Throttle valve control servo drive circuit is open circuit.	● Malfunction of the throttle valve control servo ● Open circuit or short-circuited harness wire in throttle valve control servo system, or poor connector contact ● Malfunction of the throttle valve controller



NOTE

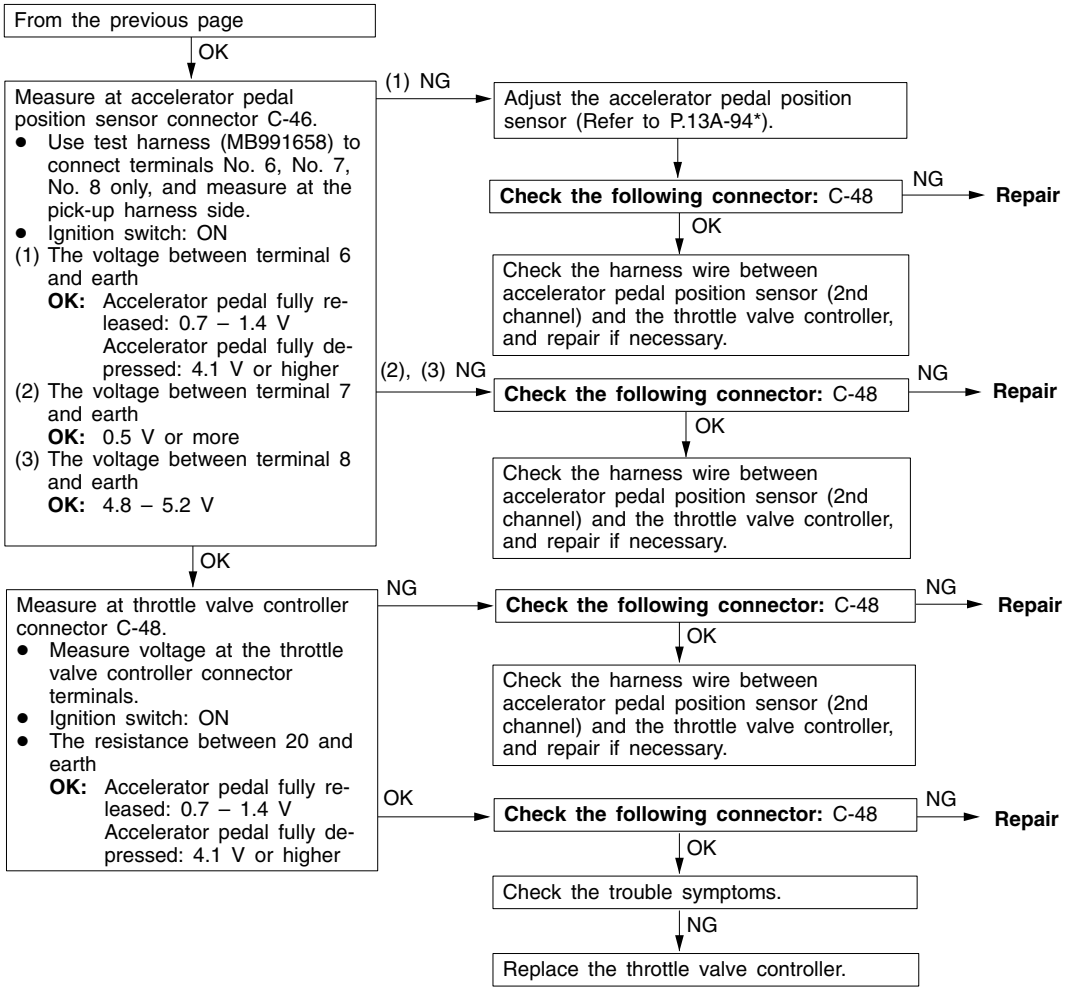
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

Code No. P1225 Accelerator pedal position sensor (2nd channel) system	Probable cause
Range of Check • Accelerator pedal position sensor (2nd channel) is normal. • Communication between the engine-ECU and the throttle valve controller is normal. Set Conditions • Output voltage of the accelerator pedal position sensor (2nd channel) is 0.2 V or less for one second or • Output voltage of the accelerator pedal position sensor (1st channel) is 2.5 V or less, and output voltage of the accelerator pedal position sensor (2nd channel) is 4.5 V or more for one second. or • Difference between the accelerator pedal position sensor (1st and 2nd channels) output voltages exceeds 1.0 V (i.e. when the throttle valve opening angle changes slightly).	• Malfunction of accelerator pedal position sensor (2nd channel) • Open or short circuit in accelerator pedal position sensor (2nd channel) circuit or loose connector contact • Malfunction of the throttle valve controller • Malfunction of engine-ECU

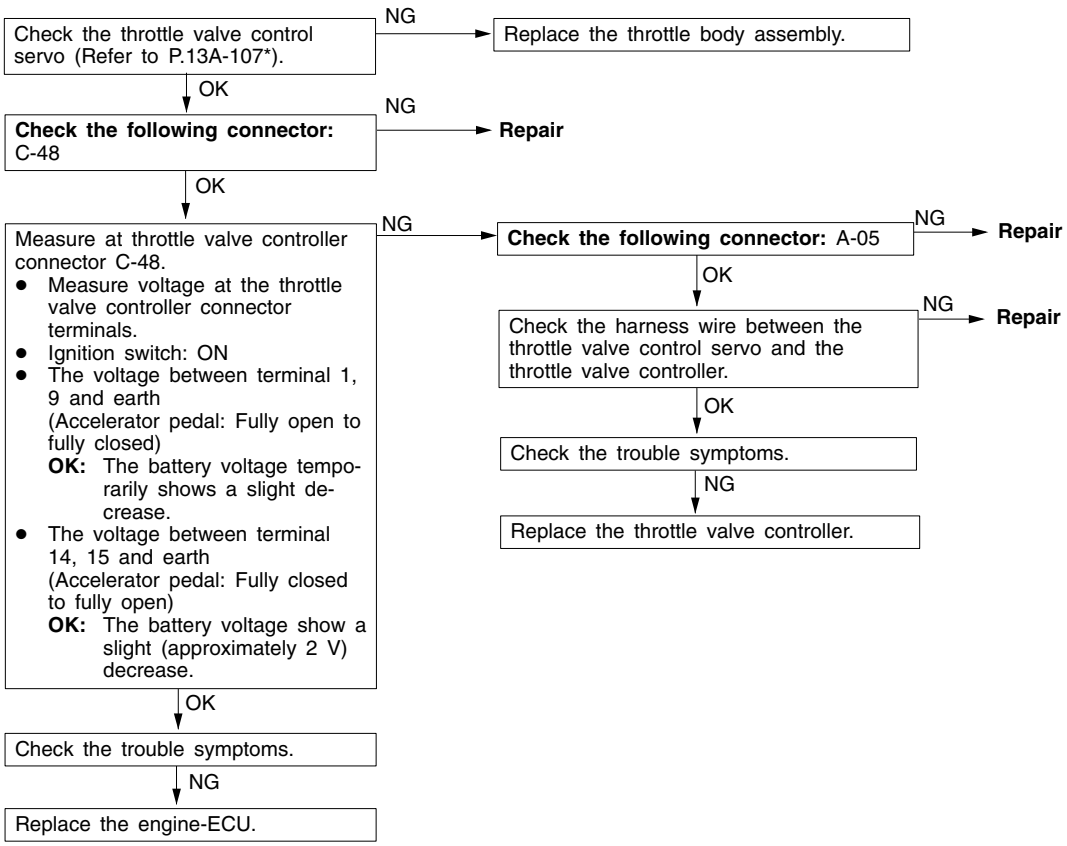


NOTE

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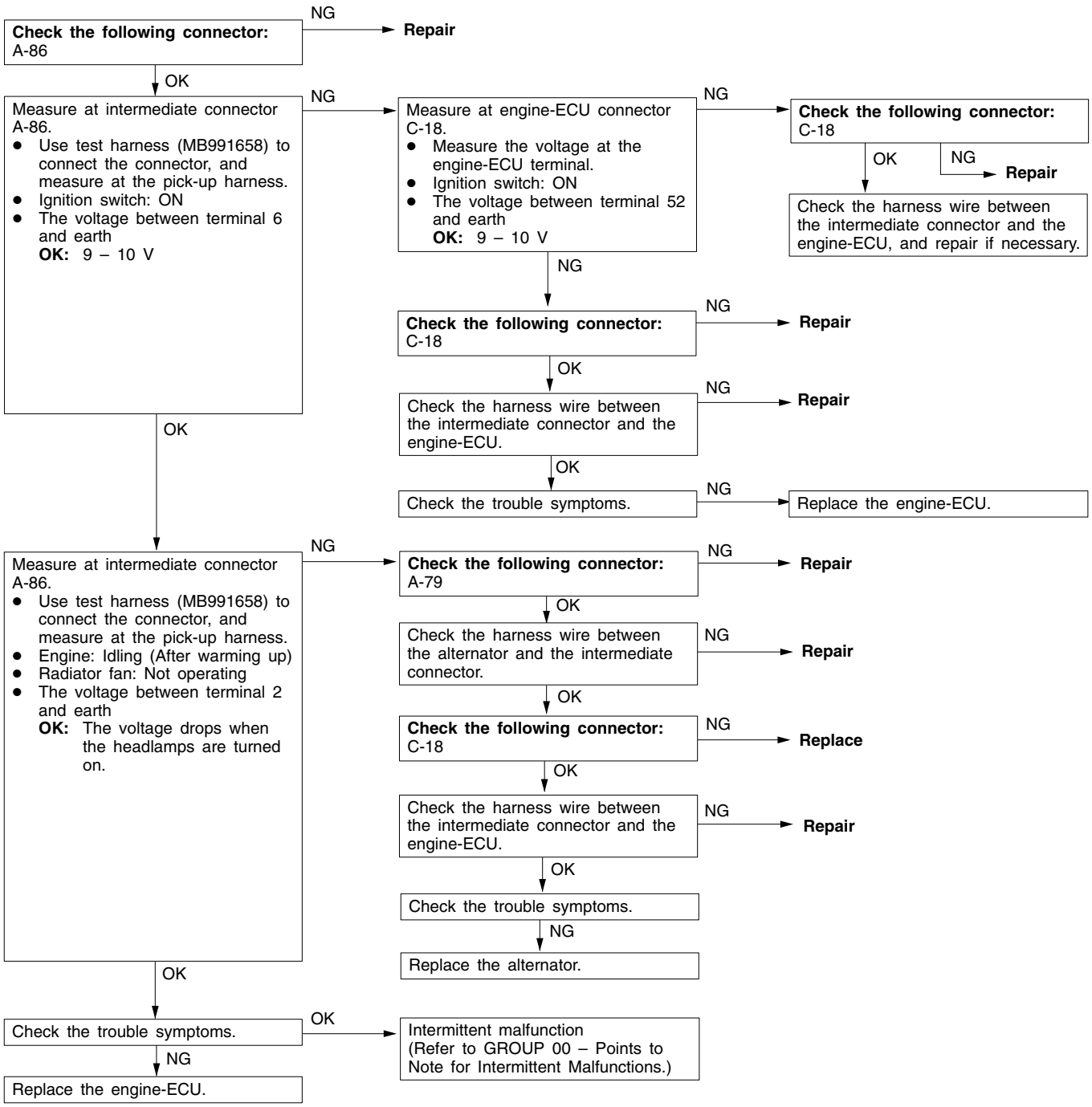

From the previous page
OK
Measure at accelerator pedal position sensor connector C-46.
● Use test harness (MB991658) to connect terminals No. 6, No. 7, No. 8 only, and measure at the pick-up harness side.
● Ignition switch: ON
(1) The voltage between terminal 6 and earth
OK: Accelerator pedal fully released: 0.7 – 1.4 V
Accelerator pedal fully depressed: 4.1 V or higher
(2) The voltage between terminal 7 and earth
OK: 0.5 V or more
(3) The voltage between terminal 8 and earth
OK: 4.8 – 5.2 V
(1) NG
Adjust the accelerator pedal position sensor (Refer to P.13A-94*).
Check the following connector: C-48
NG
Repair
OK
Check the harness wire between accelerator pedal position sensor (2nd channel) and the throttle valve controller, and repair if necessary.
(2), (3) NG
Check the following connector: C-48
NG
Repair
OK
Check the harness wire between accelerator pedal position sensor (2nd channel) and the throttle valve controller, and repair if necessary.
OK
Measure at throttle valve controller connector C-48.
● Measure voltage at the throttle valve controller connector terminals.
● Ignition switch: ON
● The resistance between 20 and earth
OK: Accelerator pedal fully released: 0.7 – 1.4 V
Accelerator pedal fully depressed: 4.1 V or higher
NG
Check the following connector: C-48
NG
Repair
OK
Check the harness wire between accelerator pedal position sensor (2nd channel) and the throttle valve controller, and repair if necessary.
OK
Check the following connector: C-48
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the throttle valve controller.

Code No. P1228 Throttle valve control servo motor (Motor 2nd phase malfunction) system	Probable cause
Range of Check ● Throttle valve control servo relay: ON ● System voltage: 8 V or more Set Conditions ● Throttle valve control servo drive circuit is shorted to earth. ● Other power source interferes with throttle valve control servo drive circuit. ● Throttle valve control servo drive circuit is open-circuit.	● Malfunction of the throttle valve control servo ● Open circuit or short-circuited harness wire in throttle valve control servo system, or poor connector contact ● Malfunction of the throttle valve controller

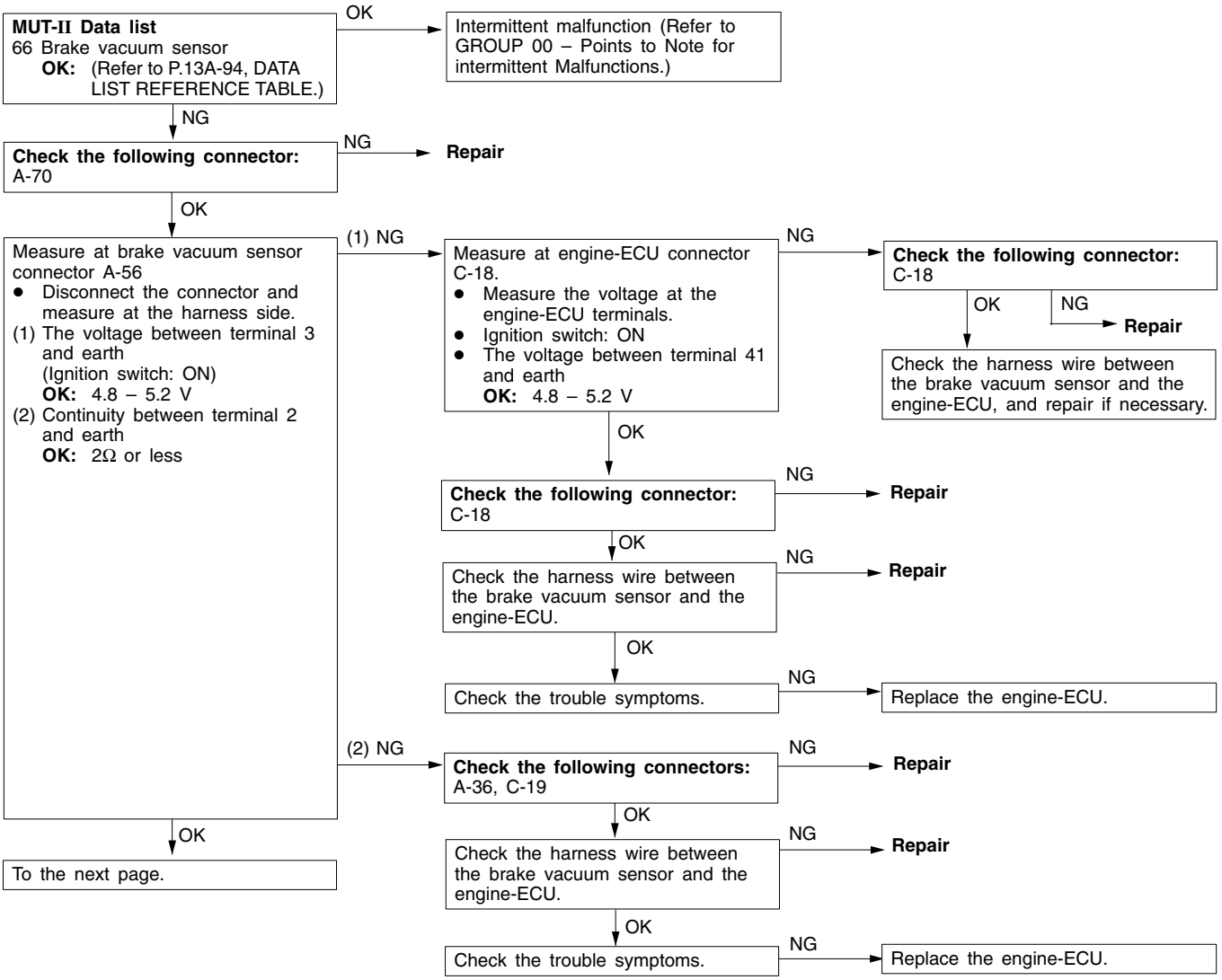


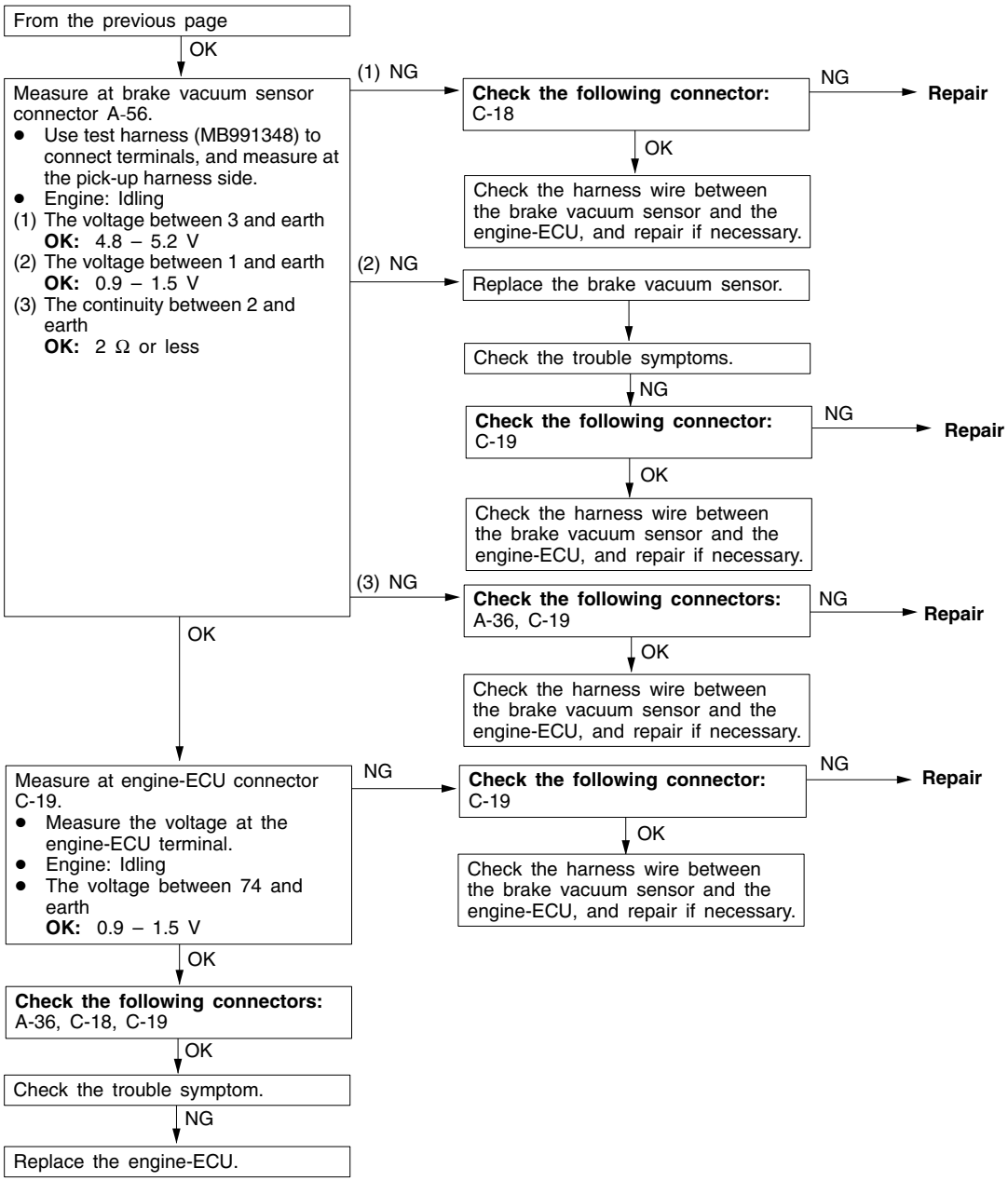
NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

Code No. P1500 Alternator FR terminal system	Probable cause
Range of Check • Engine speed: 50 r/min or more Set Conditions • Input voltage from the alternator FR terminal is system voltage for 20 seconds.	• Open circuit in alternator FR terminal circuit • Malfunction of engine-ECU

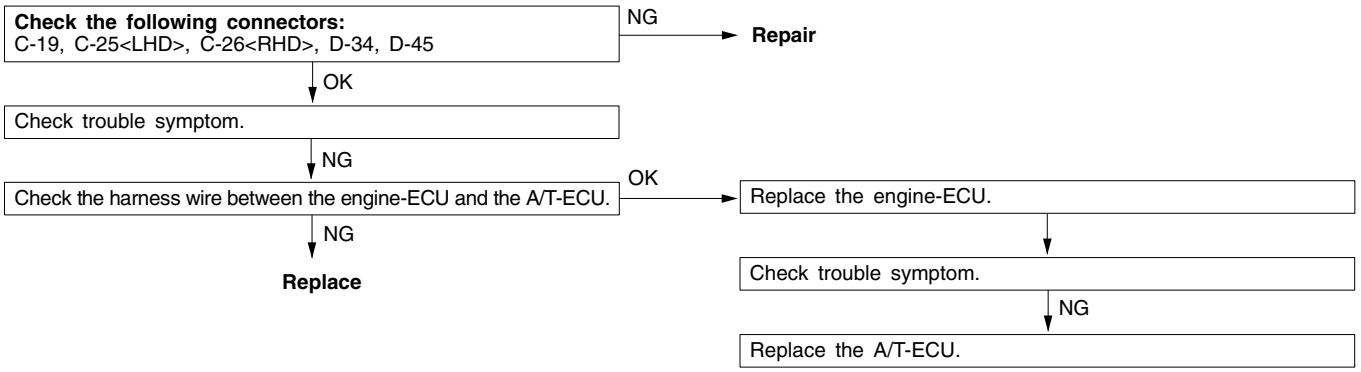


Code No. P1515 Brake vacuum sensor system	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● Sensor output voltage is 4.8 V or more. or ● Sensor output voltage is 0.2 V or less.	● Malfunction of the brake vacuum sensor ● Improper connector contact, open circuit or short-circuited harness wire of the brake vacuum sensor ● Malfunction of the engine-ECU



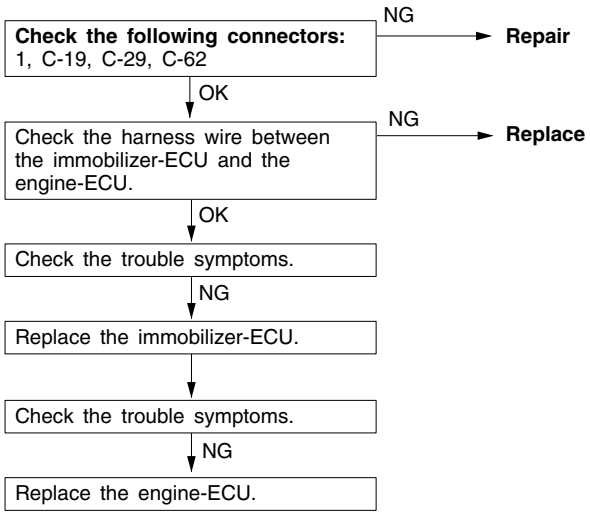

From the previous page
OK
Measure at brake vacuum sensor connector A-56.
● Use test harness (MB991348) to connect terminals, and measure at the pick-up harness side.
● Engine: Idling
(1) The voltage between 3 and earth
OK: 4.8 – 5.2 V
(2) The voltage between 1 and earth
OK: 0.9 – 1.5 V
(3) The continuity between 2 and earth
OK: 2 Ω or less
(1) NG
Check the following connector: C-18
NG
Repair
OK
Check the harness wire between the brake vacuum sensor and the engine-ECU, and repair if necessary.
(2) NG
Replace the brake vacuum sensor.
Check the trouble symptoms.
NG
Check the following connector: C-19
NG
Repair
OK
Check the harness wire between the brake vacuum sensor and the engine-ECU, and repair if necessary.
(3) NG
Check the following connectors: A-36, C-19
NG
Repair
OK
Check the harness wire between the brake vacuum sensor and the engine-ECU, and repair if necessary.
OK
Measure at engine-ECU connector C-19.
● Measure the voltage at the engine-ECU terminal.
● Engine: Idling
● The voltage between 74 and earth
OK: 0.9 – 1.5 V
NG
Check the following connector: C-19
NG
Repair
OK
Check the harness wire between the brake vacuum sensor and the engine-ECU, and repair if necessary.
OK
Check the following connectors: A-36, C-18, C-19
OK
Check the trouble symptom.
NG
Replace the engine-ECU.

Cord No. P1600 Communication wire with A/T-ECU system	Probable cause
Range of Check ● After 60 seconds have passed since the engine have started Set Conditions ● Torque reduction request signal from A/T-ECU is input continuously for 1.5 seconds or more.	● Short circuit in ECU communication circuit ● Malfunction of the engine-ECU ● Malfunction of the A/T-ECU



Cord No. P1610 Immobilizer system	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● Improper communication between the engine-ECU and the immobilizer-ECU	● Open or short circuit, or loose connector contact ● Malfunction of the immobilizer-ECU ● Malfunction of the engine-ECU

NOTE
(1) If the registered ignition keys are close each other when starting the engine, radio interference may cause this code to be displayed.
(2) This code may be displayed when registering the key ID code.



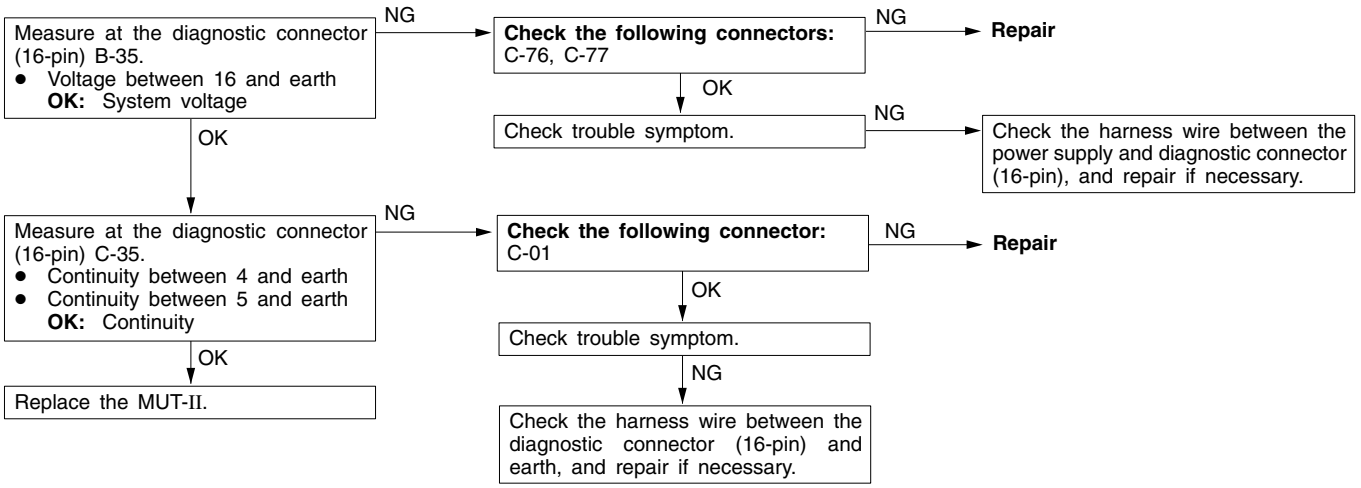
INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is impossible.	Communication with all systems is not possible.	1	13A-66
	Communication with engine-ECU only is not possible.	2	13A-66
Engine warning lamp and related parts	The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position.	3	13A-67
	The engine warning lamp remains illuminating and never goes out.	4	13A-67
Starting	No initial combustion (starting impossible)	5	13A-78
	Initial combustion but no complete combustion (starting impossible)	6	13A-70
	Long time to start (improper starting)		
Idling stability (Improper idling)	Unstable idling (Rough idling, hunting)	7	13A-71
	Idling speed is high. (Improper idling speed)	8	13A-73
	Idling speed is low. (Improper idling speed)		
Idling stability (Engine stalls)	When the engine is cold, it stalls at idling. (Die out)	9	13A-74
	When the engine is hot, it stalls at idling. (Die out)	10	13A-75
	The engine stalls when starting the car. (Pass out)	11	13A-77
	The engine stalls when decelerating.	12	13A-78
Driving	Hesitation, sag or stumble	13	13A-79
	Poor acceleration		
	Surge		
	The feeling of impact or vibration when accelerating	14	13A-80
	The feeling of impact or vibration when decelerating	15	13A-81
	Knocking	16	13A-81
Dieseling		17	13A-81
Too high CO and HC concentration when idling		18	13A-82
Low alternator output voltage (approx. 12.3 V)		19	13A-83
Fans (radiator fan, A/C condenser fan) are inoperative		20	13A-84
GDI ECO indicator lamp system	GDI ECO indicator lamp does not illuminate.	21	13A-85
	GDI ECO indicator lamp remains illuminated and does not go off.	22	13A-85

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

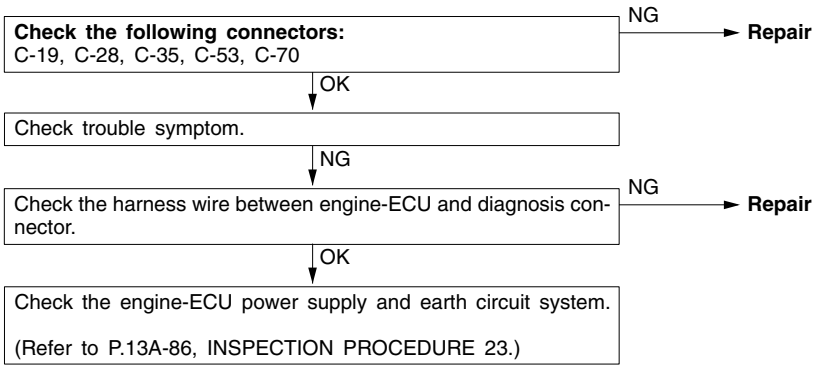
INSPECTION PROCEDURE 1

Communication with MUT-II is not possible. (Communication with all systems is not possible.)	Probable cause
The cause is probably a defect in the power supply system (including earth) for the diagnosis line.	• Malfunction of the connector • Malfunction of the harness wire • Malfunction of MUT-II



INSPECTION PROCEDURE 2

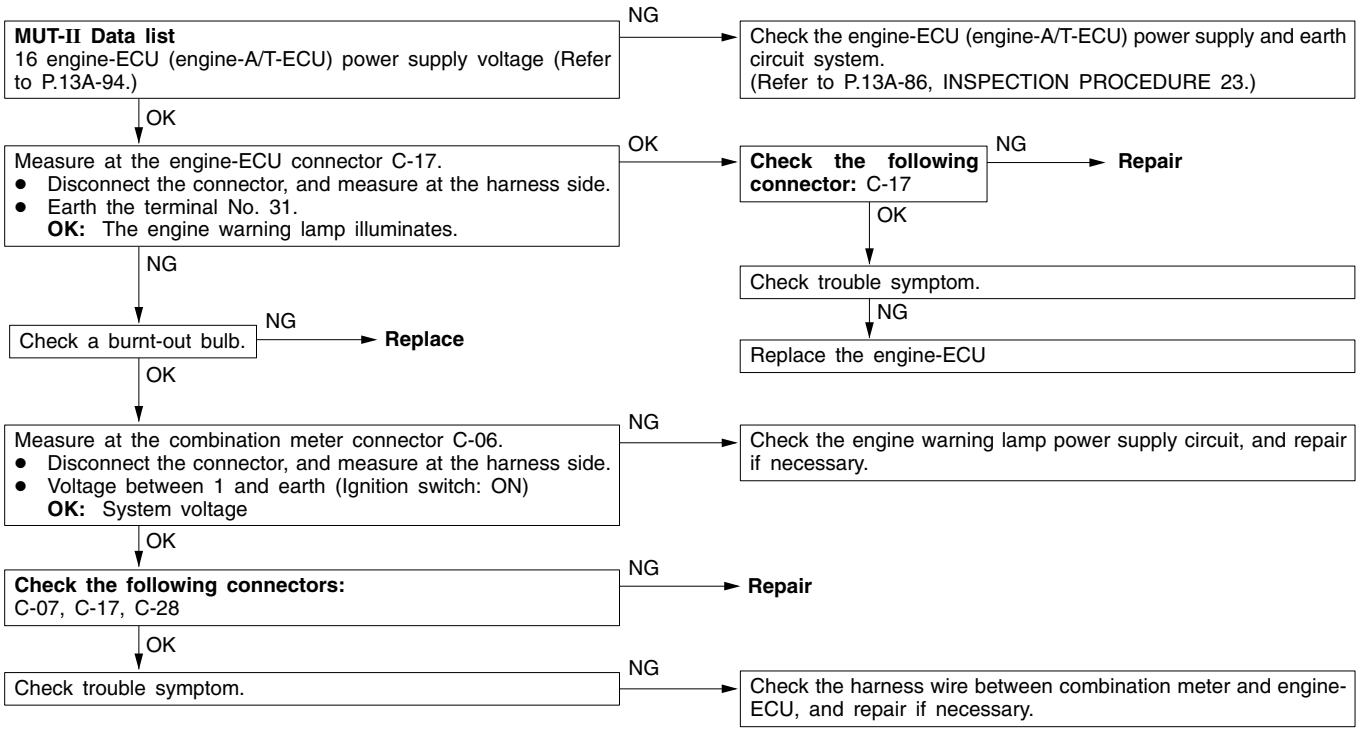
MUT-II communication with engine-ECU (engine-A/T-ECU) is impossible.	Probable cause
One of the following causes may be suspected. • No power supply to engine-ECU • Defective earth circuit of engine-ECU • Defective engine-ECU • Improper communication line between engine-ECU and MUT-II	• Malfunction of engine-ECU power supply circuit • Malfunction of engine-ECU • Open circuit between the engine-ECU and diagnosis connector



NOTE
On vehicles with multi center display, if a malfunction cannot be resolved after the procedure above, check the multi center display and replace if necessary. (Refer to GROUP 54 – Multi Center display.)

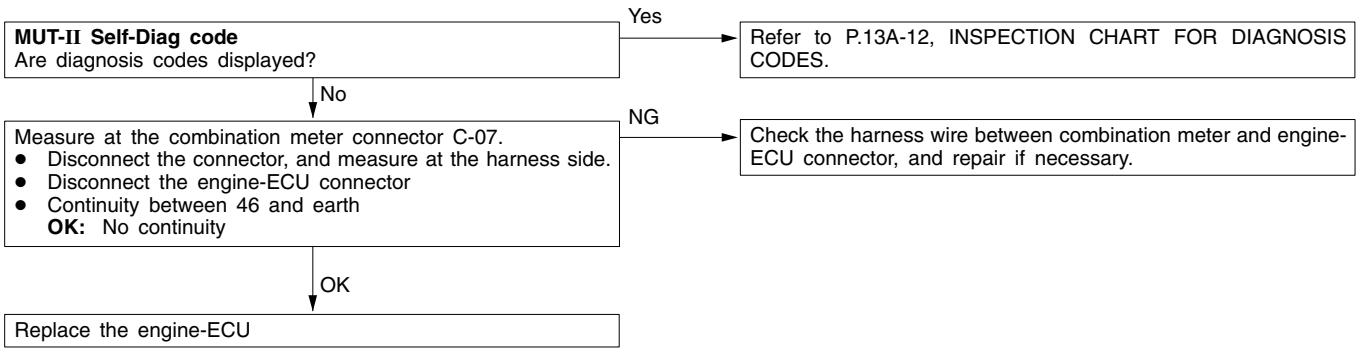
INSPECTION PROCEDURE 3

The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position.	Probable cause
Because there is a burnt-out bulb, the engine-ECU <M/T> or engine-A/T-ECU <A/T> causes the engine warning lamp to illuminate for five seconds immediately after the ignition switch is turned to ON. If the engine warning lamp does not illuminate immediately after the ignition switch is turned to ON, one of the malfunctions listed at right has probably occurred.	• Burnt-out bulb • Defective warning lamp circuit • Malfunction of the engine-ECU <M/T> • Malfunction of the engine-A/T-ECU <A/T>



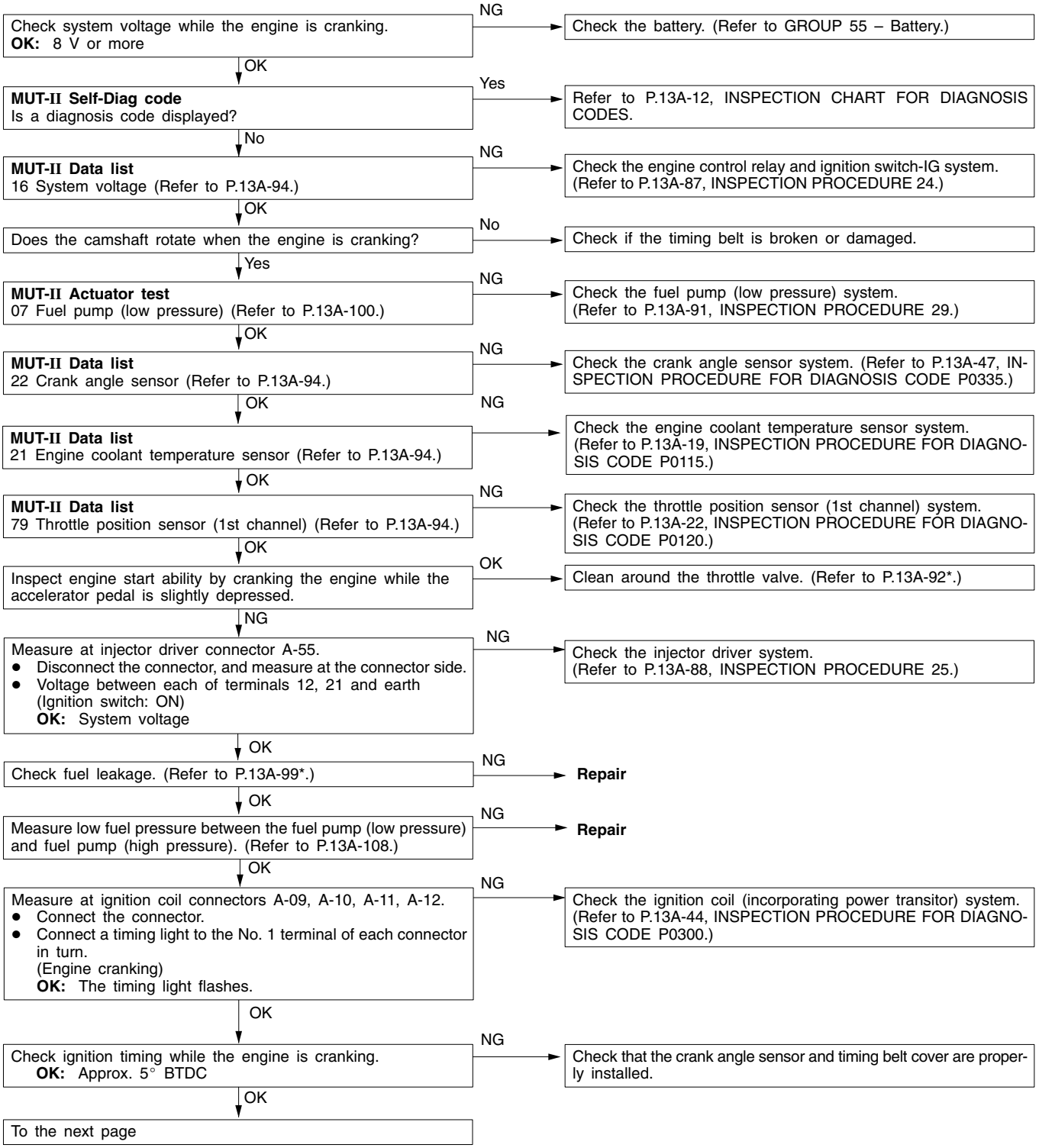
INSPECTION PROCEDURE 4

The engine warning lamp remains illuminating and never goes out.	Probable cause
In cases such as the above, the cause is probably that the engine-ECU is detecting a problem in a sensor or actuator, or that one of the malfunctions listed at right has occurred.	• Short-circuit between the engine warning lamp and engine-ECU • Malfunction of the engine-ECU



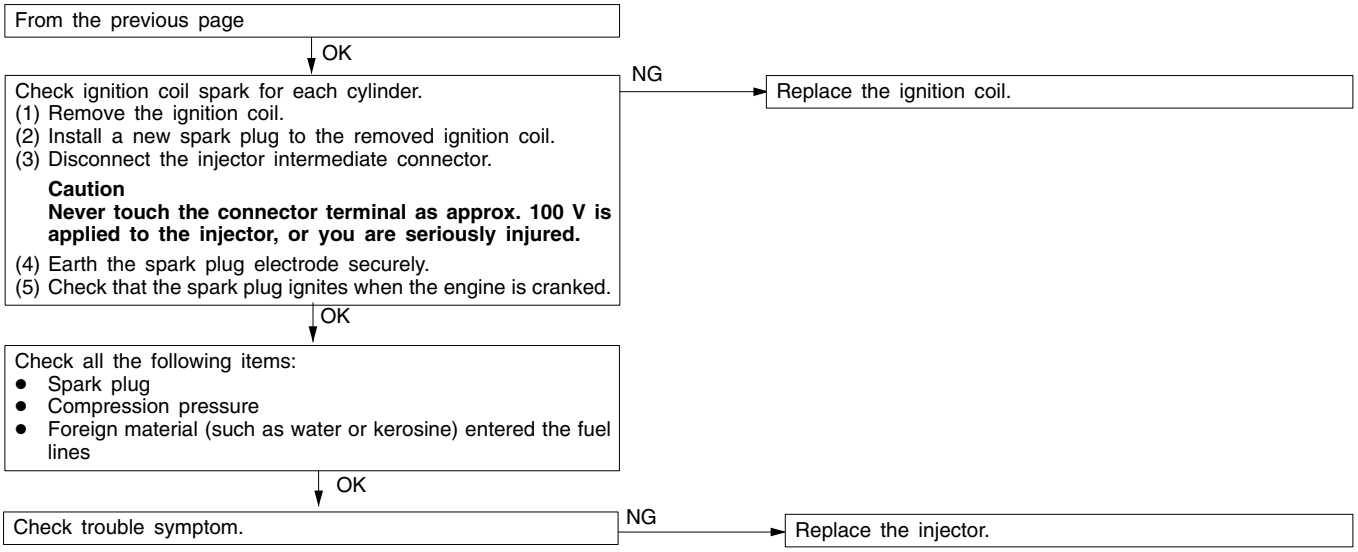
INSPECTION PROCEDURE 5

No initial combustion (starting impossible)	Probable cause
This is caused by incorrect fuel supply into the combustion chamber, and improper ignition circuit. Besides that, foreign material may be contaminated in fuel.	• Malfunction of the fuel supply system • Malfunction of the ignition system • Malfunction of the engine-ECU



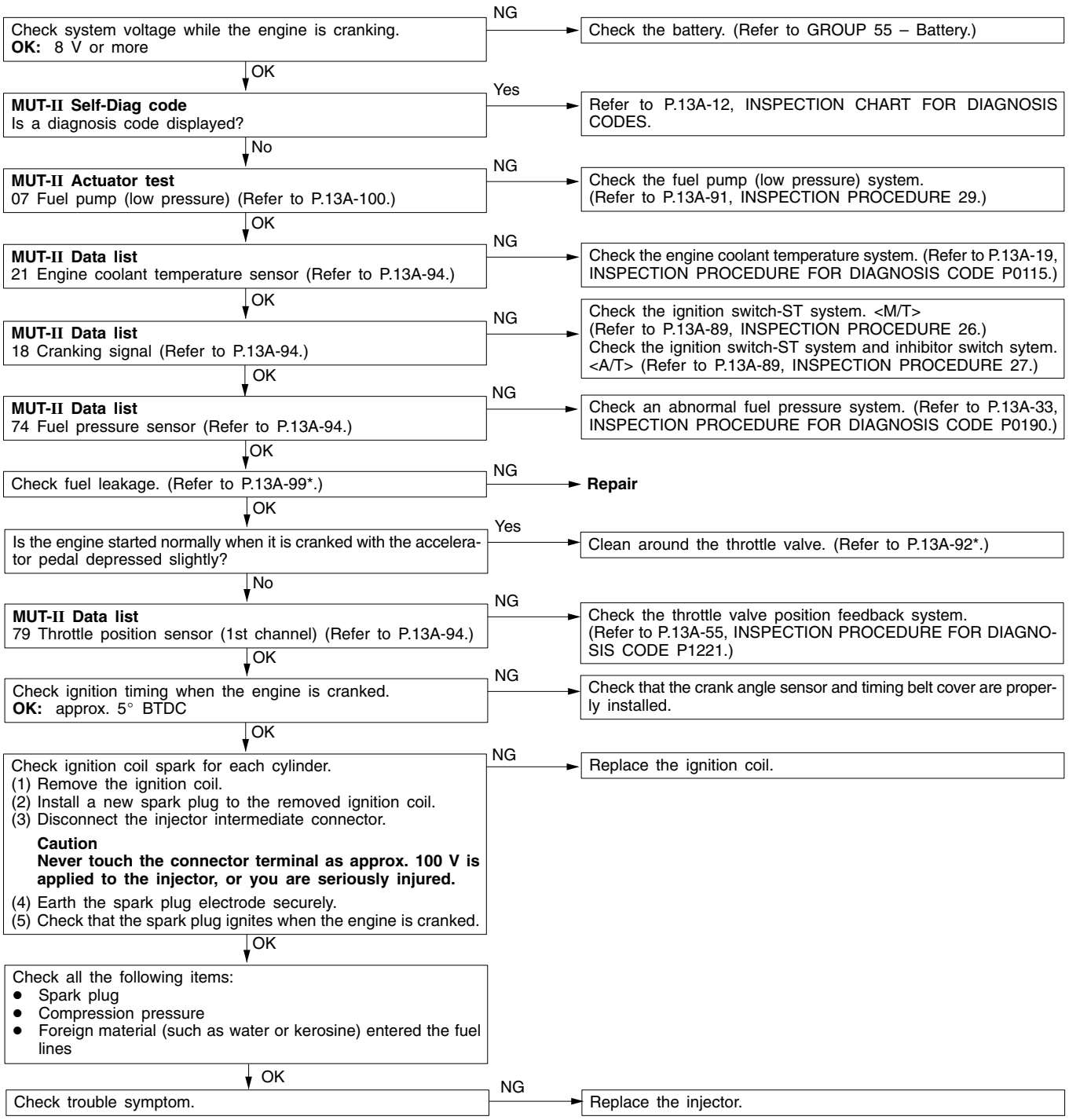
NOTE

*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)


From the previous page
OK
Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.
Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.
(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.
NG
Replace the ignition coil.
OK
Check all the following items:
● Spark plug
● Compression pressure
● Foreign material (such as water or kerosine) entered the fuel lines
OK
Check trouble symptom.
NG
Replace the injector.

INSPECTION PROCEDURE 6

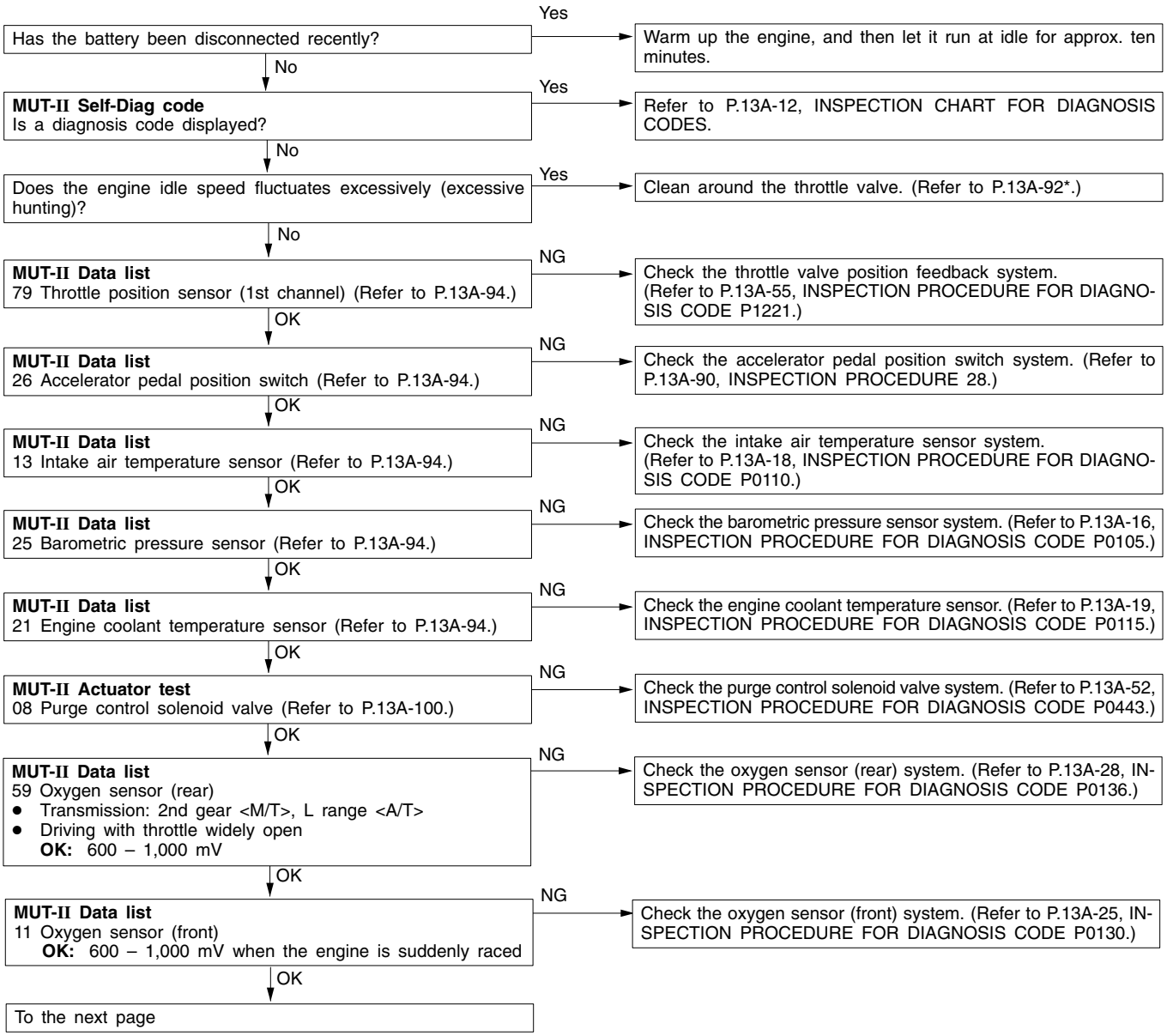
Initial combustion takes place, but does not complete (start impossible), too long time to start (poor start)	Probable cause
This may be caused by improper spark plug ignition (poor spark), improper mixture during engine cranking, improper fuel pressure.	• Malfunction of the fuel supply system • Malfunction of the fuel pressure sensor • Malfunction of the ignition system • Malfunction of the electronic-controlled throttle valve system • Malfunction of the engine-ECU <M/T> • Malfunction of the engine-A/T-ECU <A/T>



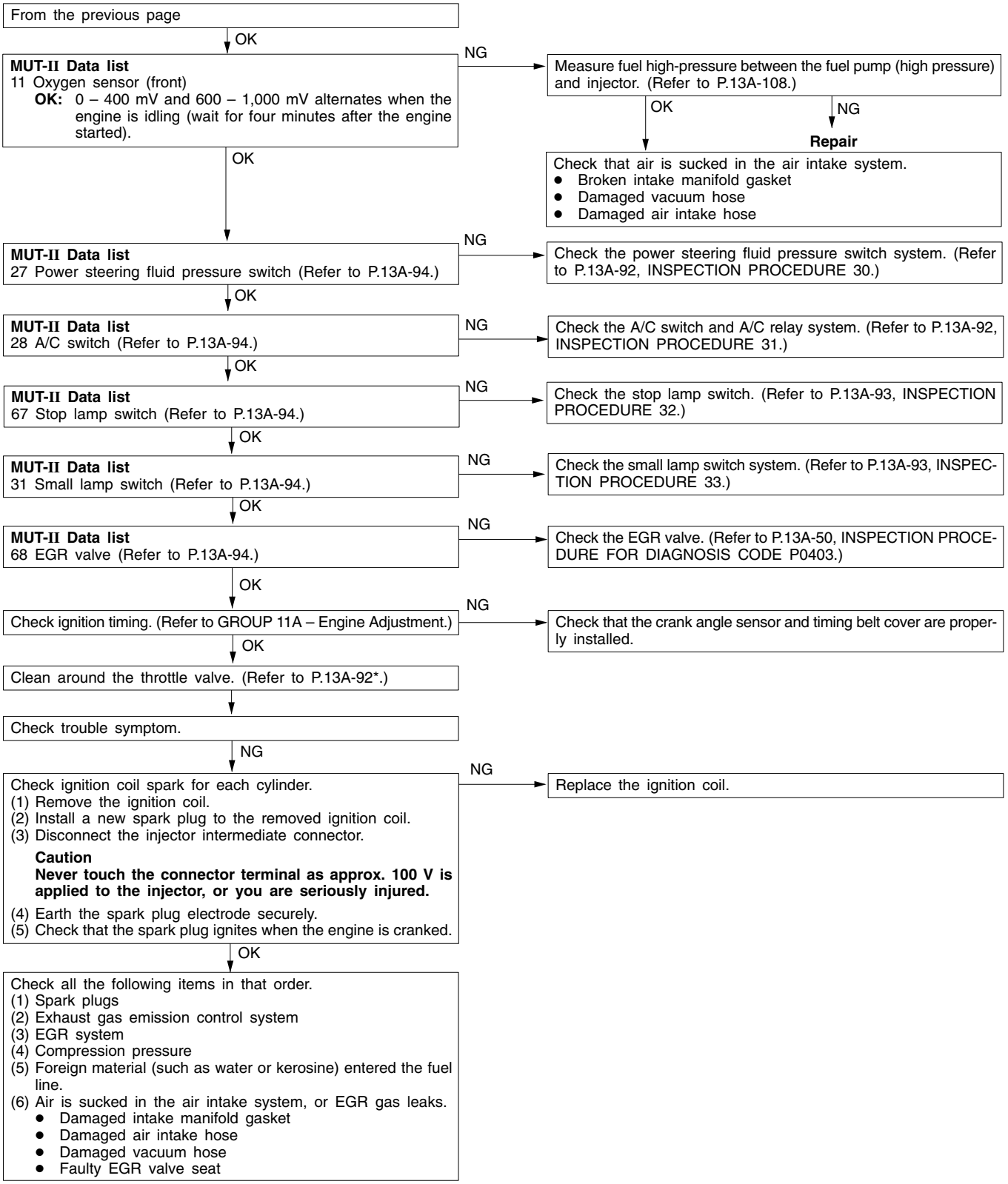
NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

INSPECTION PROCEDURE 7

Unstable idling (rough idle, hunting)	Probable cause
This malfunction is probably caused by a faulty ignition system, improper air/fuel ratio, a faulty electronic-controlled throttle valve system, improper compression pressure, etc. As many causes can be suspected, diagnose from easier items.	• Malfunction of the ignition system • Malfunction of the air/fuel ratio control system • Malfunction of the electronic-control throttle valve system • Improper compression pressure • Air sucking into the air intake system



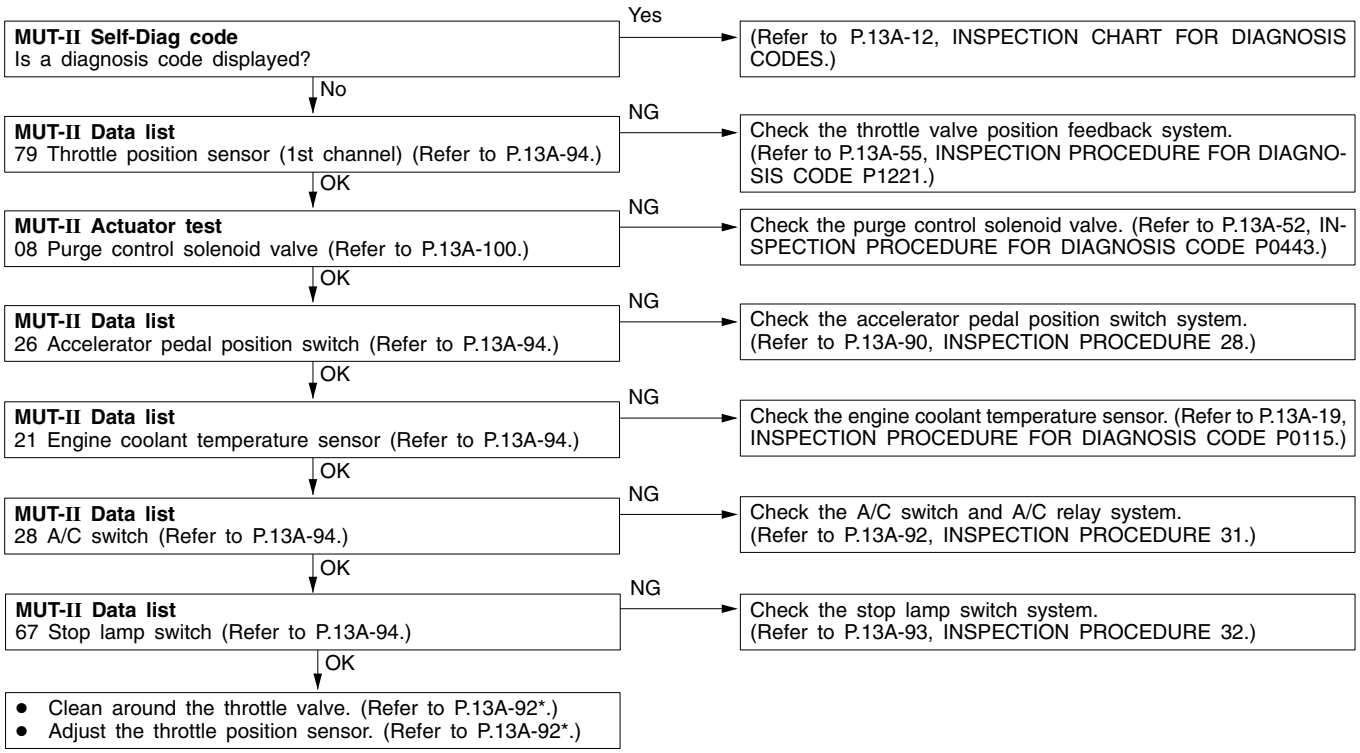
NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)



NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

INSPECTION PROCEDURE 8

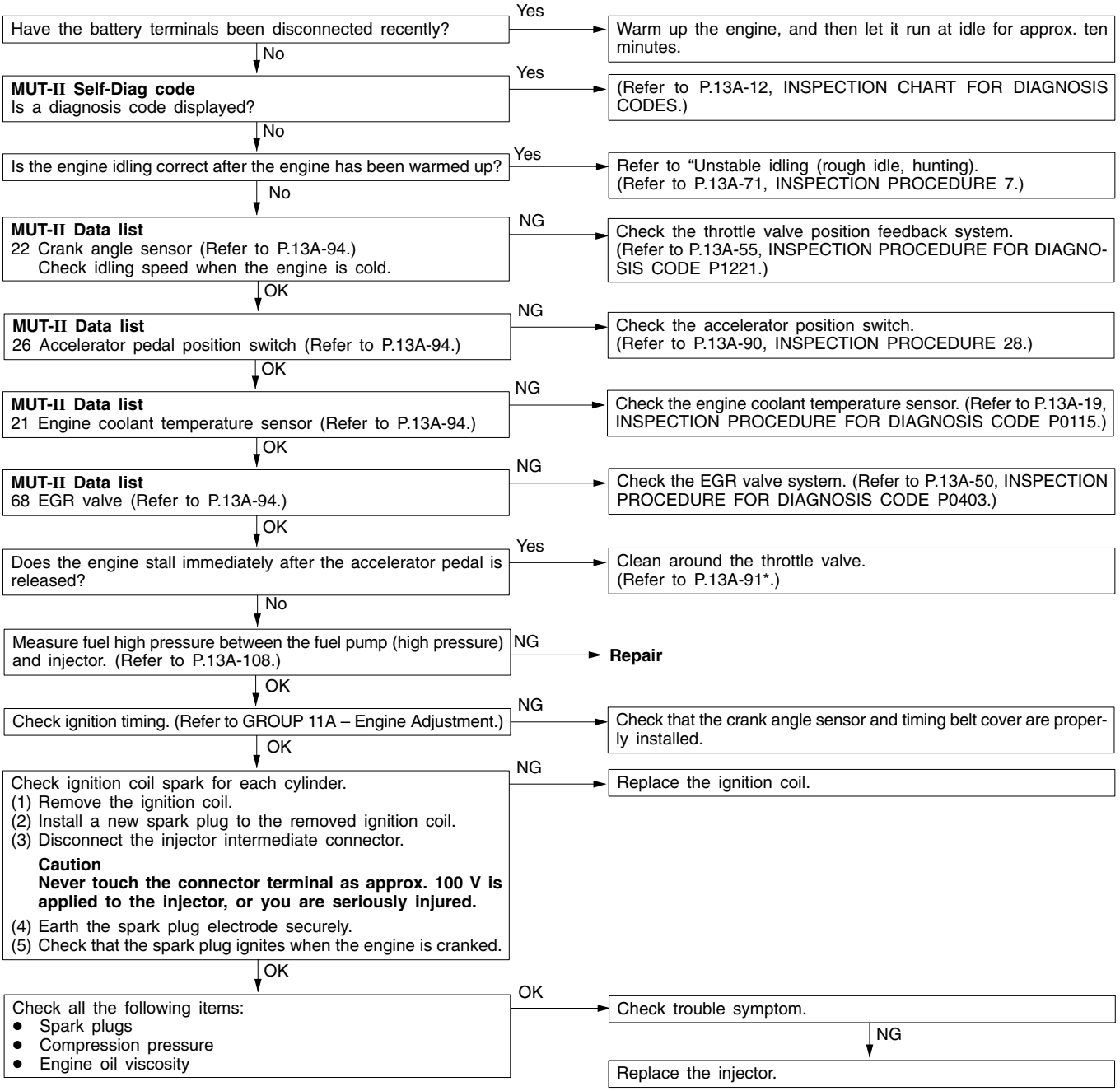
Idle speed is high or low (Improper idling)	Probable cause
The cause is probably that the intake air amount during idling is too great or too small.	• Malfunction of the electronic-controlled throttle valve system • Malfunction of the throttle body



NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

INSPECTION PROCEDURE 9

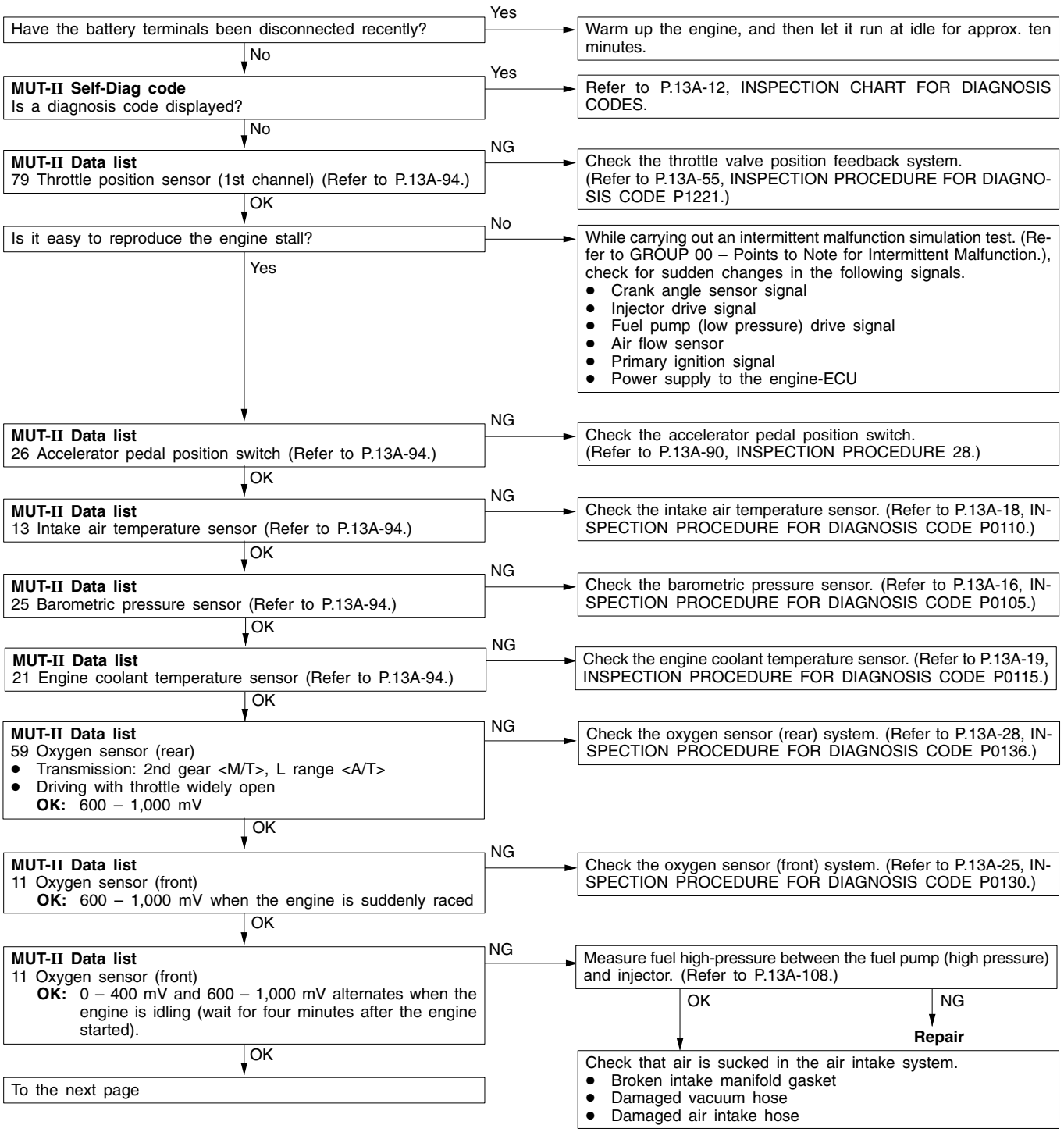
When the engine is cold, it stalls at idling. (Die out)	Probable cause
The cause is probably an incorrect air/fuel ratio or poor intake air amount when the engine is cold.	• Malfunction of the electronic-control throttle valve system • Malfunction of the throttle body

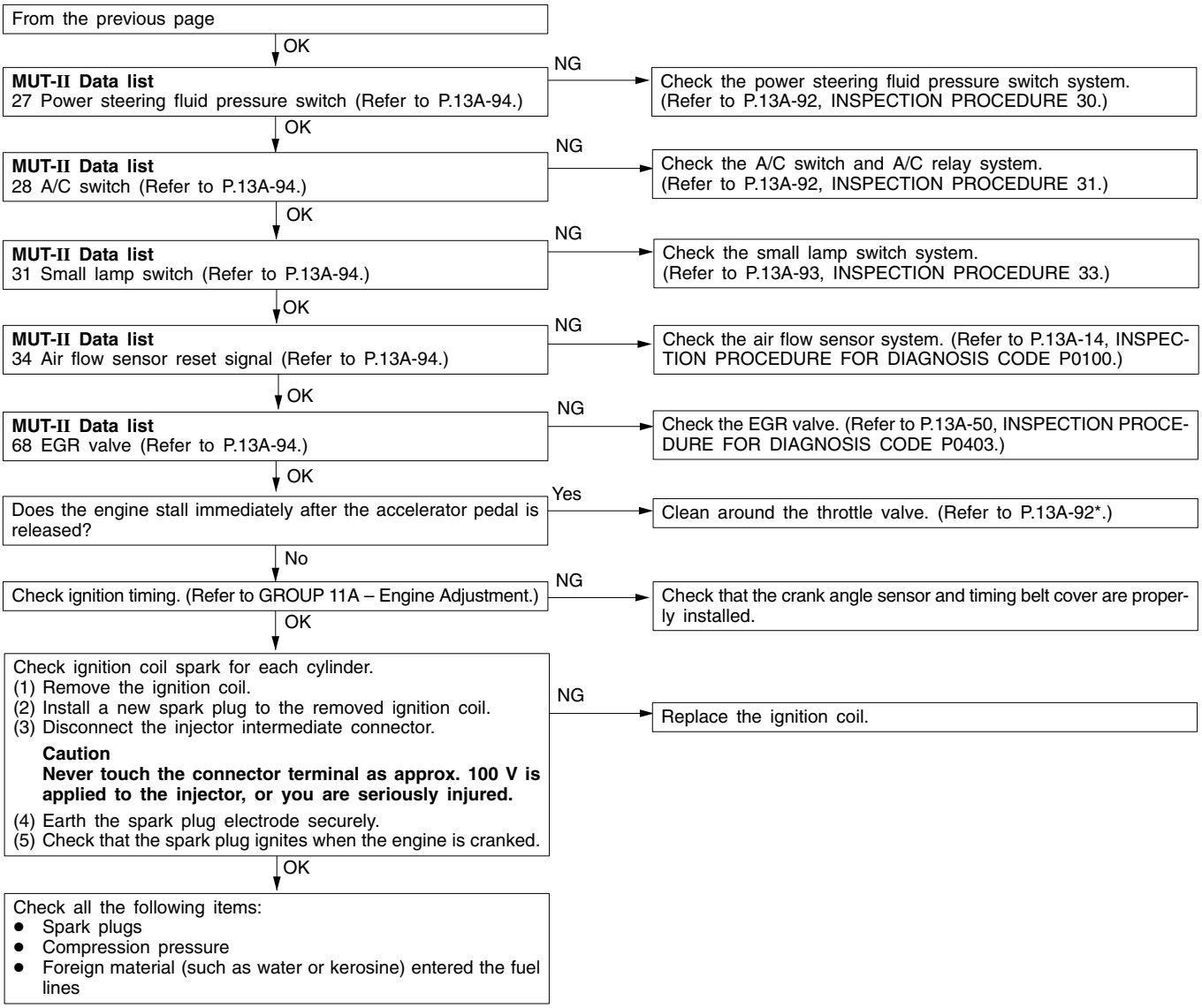


NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

INSPECTION PROCEDURE 10

When the engine is hot, it stalls at idling. (Die out)	Probable cause
The cause is probably an improper air/fuel ratio, faulty electronic-controlled throttle valve system, compression pressure. In addition, if the engine stalls suddenly, another possible cause might be a poor connector contact.	• Malfunction of the ignition system • Malfunction of air/fuel ratio control system • Malfunction of electronic-controlled throttle valve system • Malfunction of the throttle body • Poor connector contact • Improper compression pressure • Air stuck in the air intake system





NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

INSPECTION PROCEDURE 11

The engine stalls when starting the car. (Pass out)	Probable cause
The cause is probably poor ignition due to a malfunctioning spark plug (weak spark), or an incorrect air/fuel ratio when the accelerator is depressed.	• Malfunction of the ignition system • Malfunction of the EGR valve • Air stuck in the air intake system

MUT-II Self-Diag code
Is a diagnosis code displayed?
- Yes → (Refer to P.13A-12, INSPECTION CHART FOR DIAGNOSIS CODES.)
- No ↓

MUT-II Data list
68 EGR valve (Refer to P.13A-94.)
- NG → Check the EGR valve. (Refer to P.13A-50, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0403.)
- OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13A-100.)
- NG → Check the purge control solenoid valve system. (Refer to P.13A-52, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0443.)
- OK ↓

Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.

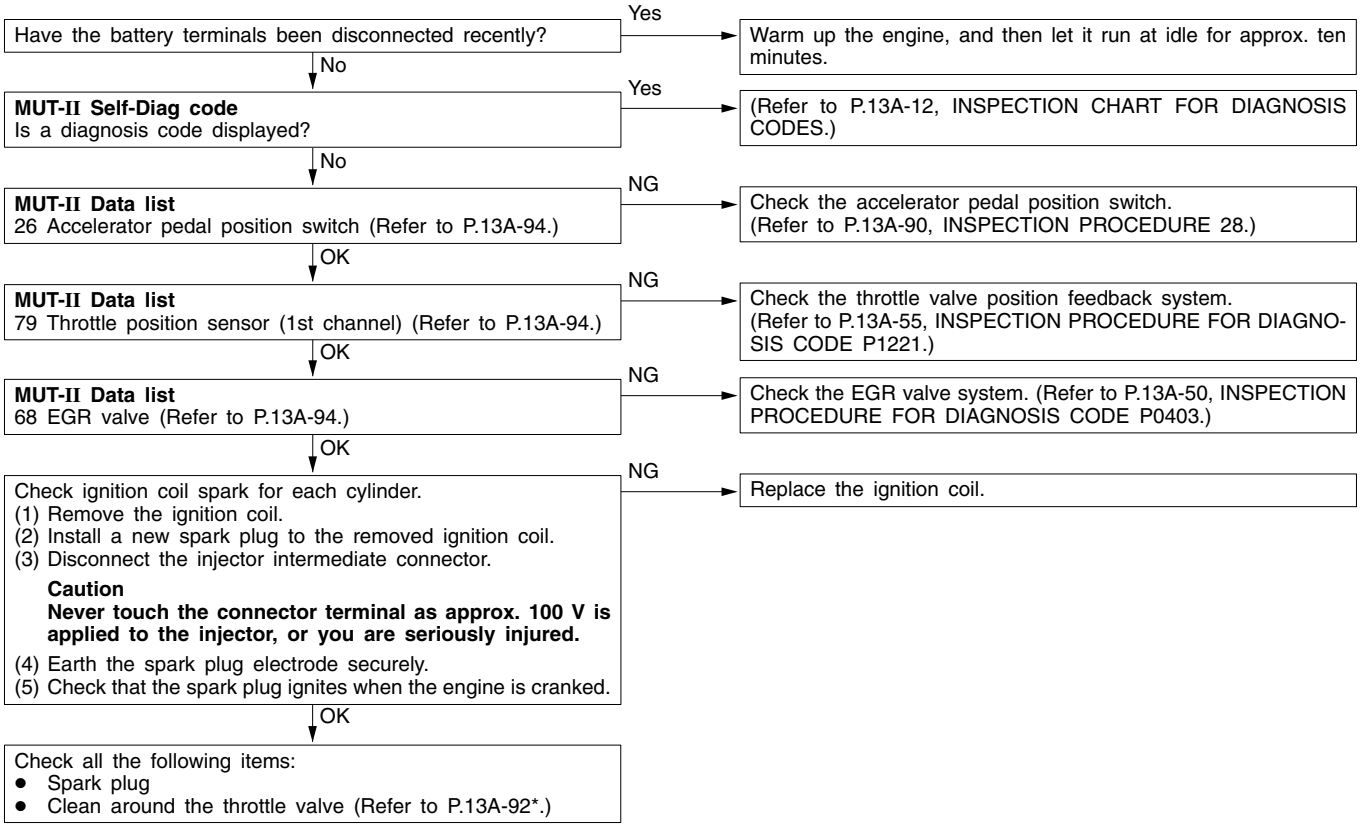
Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.
- NG → Replace the ignition coil.
- OK ↓

Check all the following items:
(1) Spark plug
(2) Check if air is stuck in the air intake system.
- Damage intake manifold gasket
- Damaged or disconnected vacuum hose
- Damaged air intake hose

INSPECTION PROCEDURE 12

The engine stalls when decelerating.	Probable cause
The cause is probably an improper air/fuel ratio due to a faulty EGR system, or poor intake air volume due to a faulty electronic-controlled throttle valve system.	• Malfunction of the electronic-controlled throttle valve system • Malfunction of the EGR valve



NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

INSPECTION PROCEDURE 13

Hesitation, sag, stumble, poor acceleration or surge	Probable cause
The cause is probably a malfunction of the ignition system, electronic-controlled throttle valve system, compression pressure, etc.	• Malfunction of the ignition system • Malfunction of the air/fuel ratio control system • Malfunction of the electronic-controlled throttle valve system • Improper compression pressure • Air stuck in the air intake system

MUT-II Self-Diag code
Is a diagnosis code displayed?
Yes → (Refer to P.13A-12, INSPECTION CHART FOR DIAGNOSIS CODES.)
No ↓

Check ignition timing. (Refer to GROUP 11A – Engine Adjustment.)
NG → Check that the crank angle sensor and timing belt cover are properly installed.
OK ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-94.)
NG → Check the accelerator pedal position switch. (Refer to P.13A-90, INSPECTION PROCEDURE 28.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-94.)
NG → Check the intake air temperature sensor. (Refer to P.13A-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0110.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-94.)
NG → Check the barometric pressure sensor. (Refer to P.13A-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0105.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-94.)
NG → Check the engine coolant temperature sensor. (Refer to P.13A-19, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0115.)
OK ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-94.)
NG → Check the throttle valve position feedback system. (Refer to P.13A-55, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P1221.)
OK ↓

MUT-II Data list
59 Oxygen sensor (rear)
- Transmission: 2nd gear <M/T>, L range <A/T>
- Driving with throttle widely open

OK: 600 – 1,000 mV
NG → Check the oxygen sensor (rear) system. (Refer to P.13A-28, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0136.)
OK ↓

MUT-II Data list
11 Oxygen sensor (front)
OK: 600 – 1,000 mV when the engine is suddenly raced
NG → Check the oxygen sensor (front) system. (Refer to P.13A-25, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0130.)
OK ↓

MUT-II Data list
11 Oxygen sensor (front)
OK: 0 – 400 mV and 600 – 1,000 mV alternates when the engine is idling (wait for four minutes after the engine started).
NG → Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-108.)
OK ↓
Check that air is sucked in the air intake system.
- Broken intake manifold gasket
- Damaged vacuum hose
- Damaged air intake hose

OK ↓

MUT-II Data list
68 EGR valve (Refer to P.13A-94.)
NG → Check the EGR valve. (Refer to P.13A-50, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0403.)
OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13A-100.)
NG → Check the purge control solenoid valve. (Refer to P.13A-52, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0443.)
OK ↓

To the next page

From the previous page

OK

Measure high fuel pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-108.)

NG → **Repair**

OK

Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.

NG → Replace the ignition coil.

OK

Check all the following items:
- Spark plug
- EGR system
- Compression pressure
- Clogged fuel filter, fuel line

OK → Check trouble symptom.

NG → Replace the injector.

INSPECTION PROCEDURE 14

The feeling of impact when accelerating	Probable cause
The cause is probably an ignition leak being generated in line with an increase in the spark plug request voltage during acceleration.	• Malfunction of the ignition system

MUT-II Self-Diag code
Is a diagnosis code displayed?

Yes → (Refer to P.13A-12, INSPECTION CHART FOR DIAGNOSIS CODES.)

No

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-94.)

NG → Check the throttle valve position feedback system. (Refer to P.13A-55, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P1221.)

OK

Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

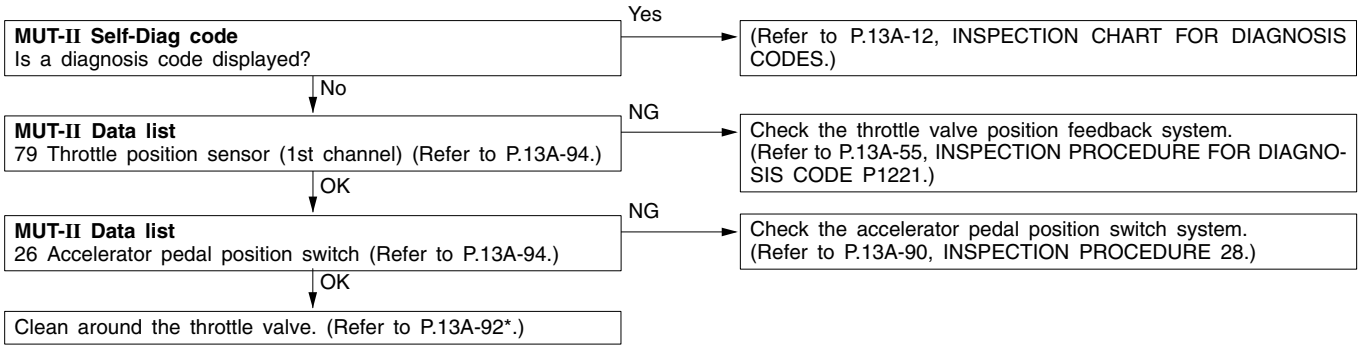
(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.

OK → Check all the following items:
- Spark plug
- Ignition current leak

NG → Replace the ignition coil.

INSPECTION PROCEDURE 15

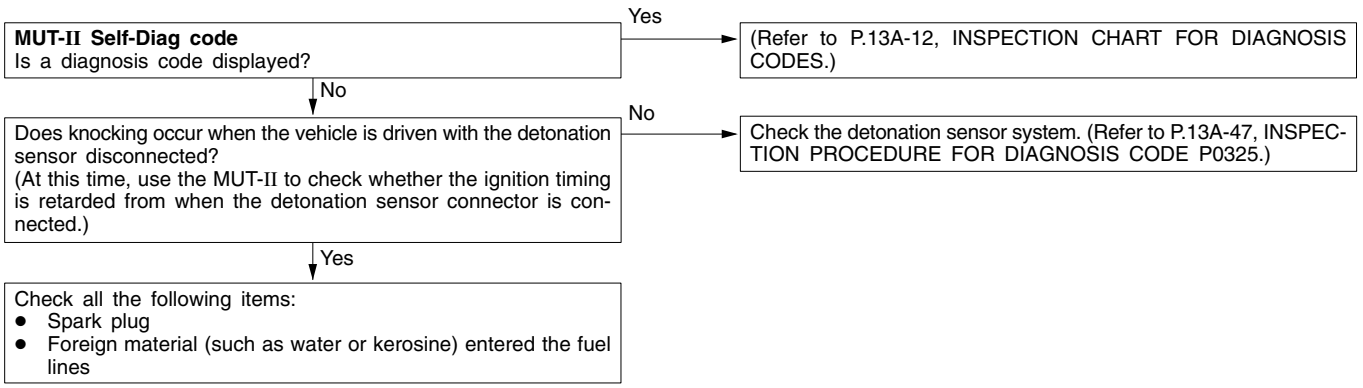
The feeling of impact when decelerating	Probable cause
The cause is probably insufficient intake air due to a faulty electronic-controlled throttle valve system.	• Malfunction of the electronic-controlled throttle valve system



NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

INSPECTION PROCEDURE 16

Knocking	Probable cause
The cause is probably incorrect detonation control or improper heat range of the spark plugs.	• Malfunction of the detonation sensor • Improper heat range of the spark plugs



INSPECTION PROCEDURE 17

Run-on (dieseling)	Probable cause
The cause is probably fuel leak from injector(s)	• Malfunction of the injector

Replace the injector.

INSPECTION PROCEDURE 18

Too high CO and HC concentration when idling	Probable cause
The cause is probably an incorrect air/fuel ratio	• Malfunction of air/fuel ratio control system • Deterioration of the catalyst

MUT-II Self-Diag code
Is a diagnosis code displayed?
Yes → (Refer to P.13A-12, INSPECTION CHART FOR DIAGNOSIS CODES.)
No ↓

Check ignition timing. (Refer to GROUP 11A – Engine Adjustment.)
NG → Check that the crank angle sensor and timing belt cover are properly installed.
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-94.)
NG → Check the engine coolant temperature sensor. (Refer to P.13A-19, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0115.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-94.)
NG → Check the intake air temperature sensor. (Refer to P.13A-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0110.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-94.)
NG → Check the barometric pressure sensor. (Refer to P.13A-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0105.)
OK ↓

MUT-II Data list
59 Oxygen sensor (rear)
- Transmission: 2nd gear <M/T>, L range <A/T>
- Driving with throttle widely open

OK: 600 – 1,000 mV
NG → Check the oxygen sensor (rear) system. (Refer to P.13A-28, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0136.)
OK ↓

MUT-II Data list
11 Oxygen sensor (front)
OK: 600 – 1,000 mV when the engine is suddenly raced
NG → Check the oxygen sensor (front) system. (Refer to P.13A-25, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0130.)
OK ↓

MUT-II Data list
11 Oxygen sensor (front)
OK: 0 – 400 mV and 600 – 1,000 mV alternates when the engine is idling (wait for four minutes after the engine started).
OK → Replace the oxygen sensor (front).
↓
Check trouble symptom.
NG ↓

NG ↓

Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-108.)
NG → **Repair**
OK ↓

Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.

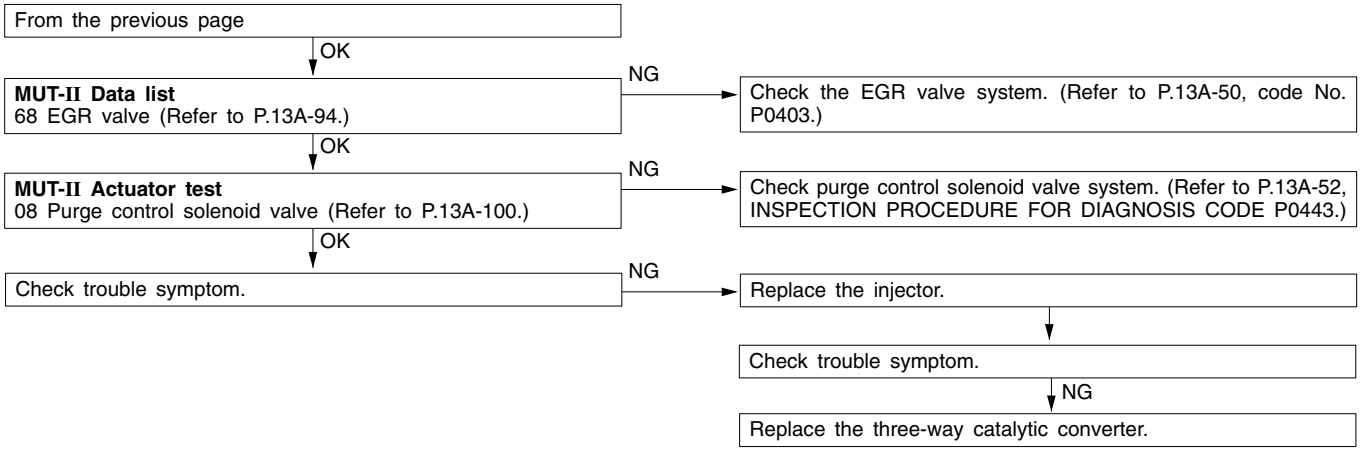
OK ↓
NG ↓

Check all the following items:
- Spark plug
- EGR system
- Compression pressure
- Clogged fuel filter or line

Replace the ignition coil.

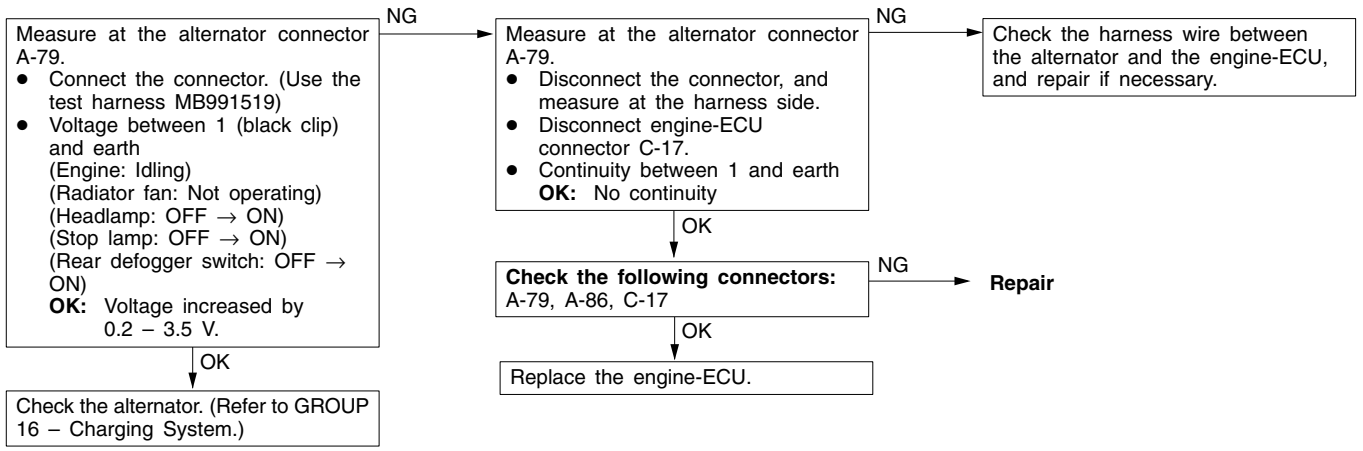
OK ↓

To the next page



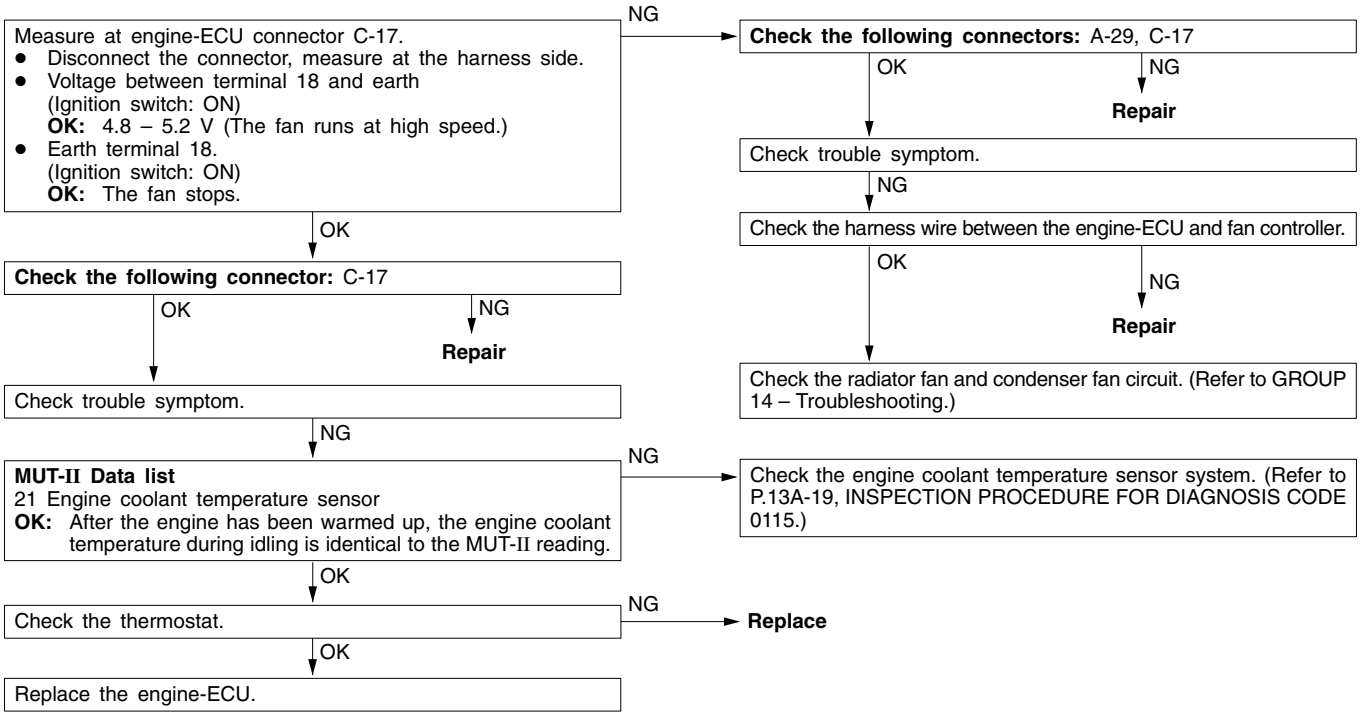
INSPECTION PROCEDURE 19

Low alternator output voltage (approx. 12.3 V)	Probable cause
The cause is probably a malfunction of the alternator or one of the problems listed at right.	• Malfunction of the charging system • Open circuit between the alternator G terminal and the engine-ECU • Malfunction of the engine-ECU



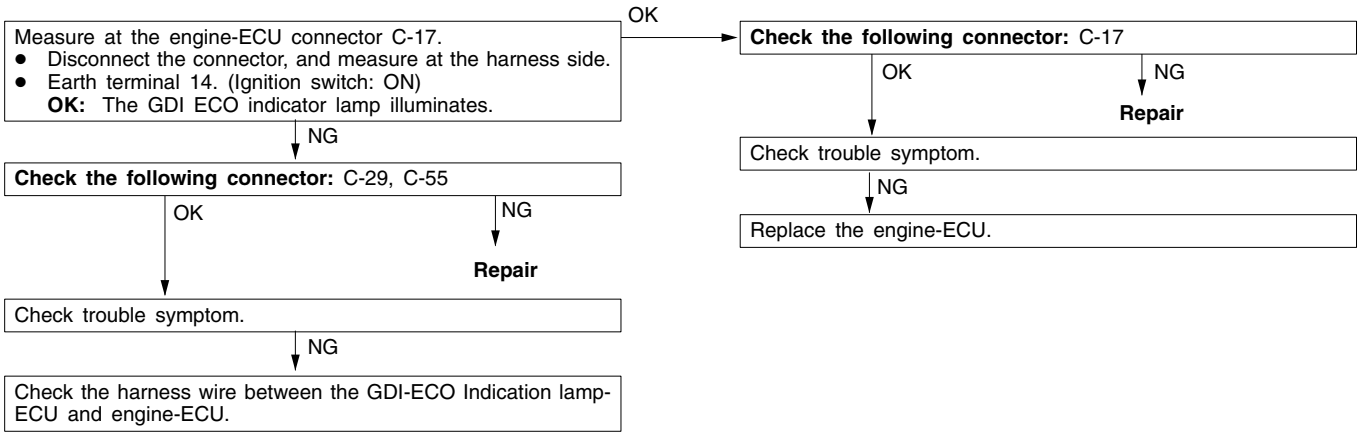
INSPECTION PROCEDURE 20

Fans (radiator fan, A/C condenser fan) are inoperative.	Probable cause
The engine-ECU sends a duty signal to the fan controller according to engine coolant temperature, vehicle speed, or A/C switch load. The fan controller controls radiator fan and condenser fan speeds, based on this signal. (The closer the terminal voltage comes to 5 V, the higher the fan speed becomes.)	• Malfunction of the fan motor relay • Malfunction of the fan motor • Malfunction of the fan controller • Open or short circuit, or poor connector contact • Malfunction of the engine-ECU



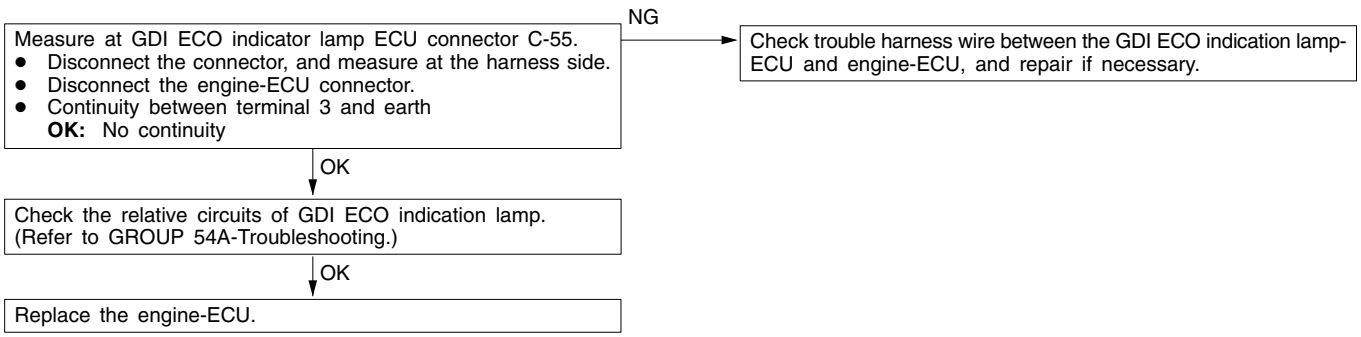
INSPECTION PROCEDURE 21

GDI ECO indicator lamp does not illuminate.	Probable cause
If the GDI ECO indicator lamp does not illuminate after turning switch, the causes listed in the right column are suspected.	• Burned-out GDI ECO indicator lamp bulb • Open circuit or short-circuited harness wire in the GDI ECO indicator lamp circuit • Malfunction of the engine-ECU • Malfunction of the GDI ECO indicator lamp ECU



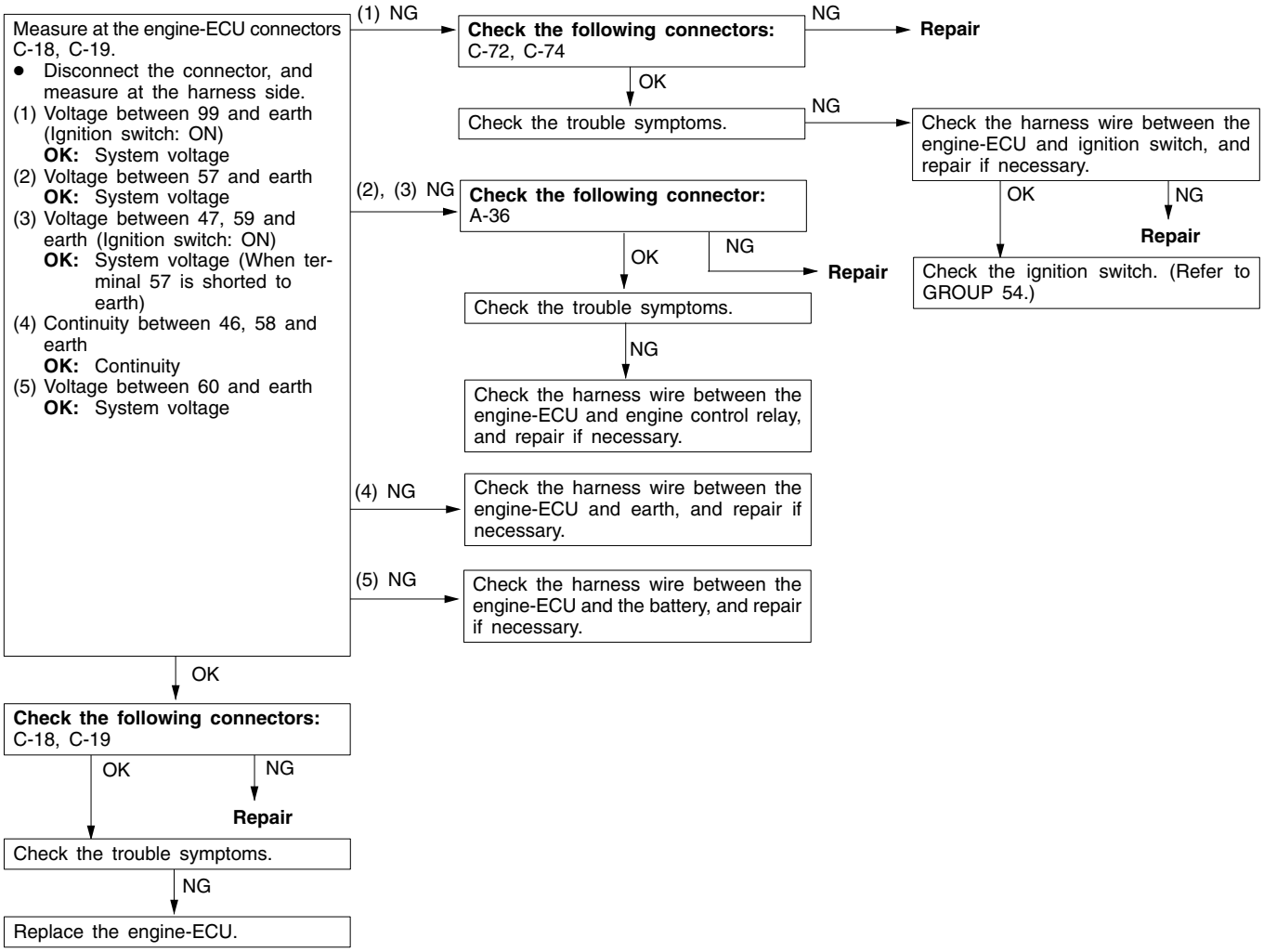
INSPECTION PROCEDURE 22

GDI ECO indicator lamp remains illuminated and does not go off.	Probable cause
If the GDI ECO indicator lamp does not gooff during high load operation, the causes listed in the right column are suspected.	• Short circuit between the GDI ECO indicator lamp and engine-ECU • Malfunction of the engine-ECU • Malfunction of the GDI ECO indicator lamp ECU



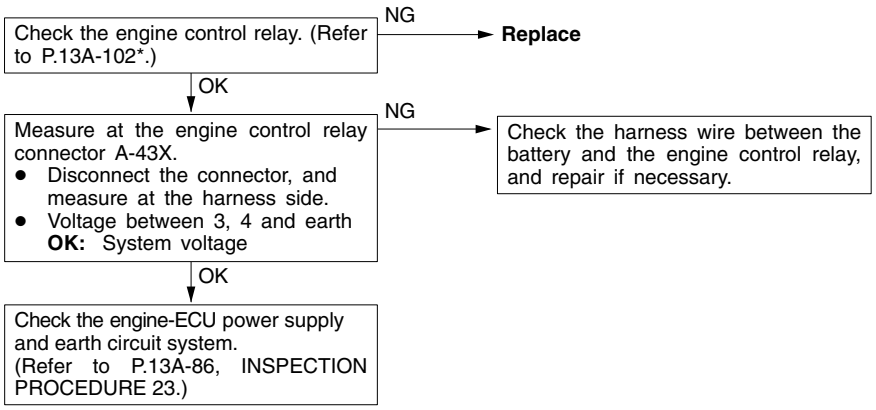
INSPECTION PROCEDURE 23

Engine-ECU power supply and earth circuit system	Probable cause
The cause is probably a malfunction of the engine-ECU or one of the problems listed at right.	• Open circuit or short-circuited harness wire in the engine-ECU power supply circuit • Open circuit or short-circuited harness wire in the engine-ECU earth circuit • Malfunction of the engine-ECU



INSPECTION PROCEDURE 24

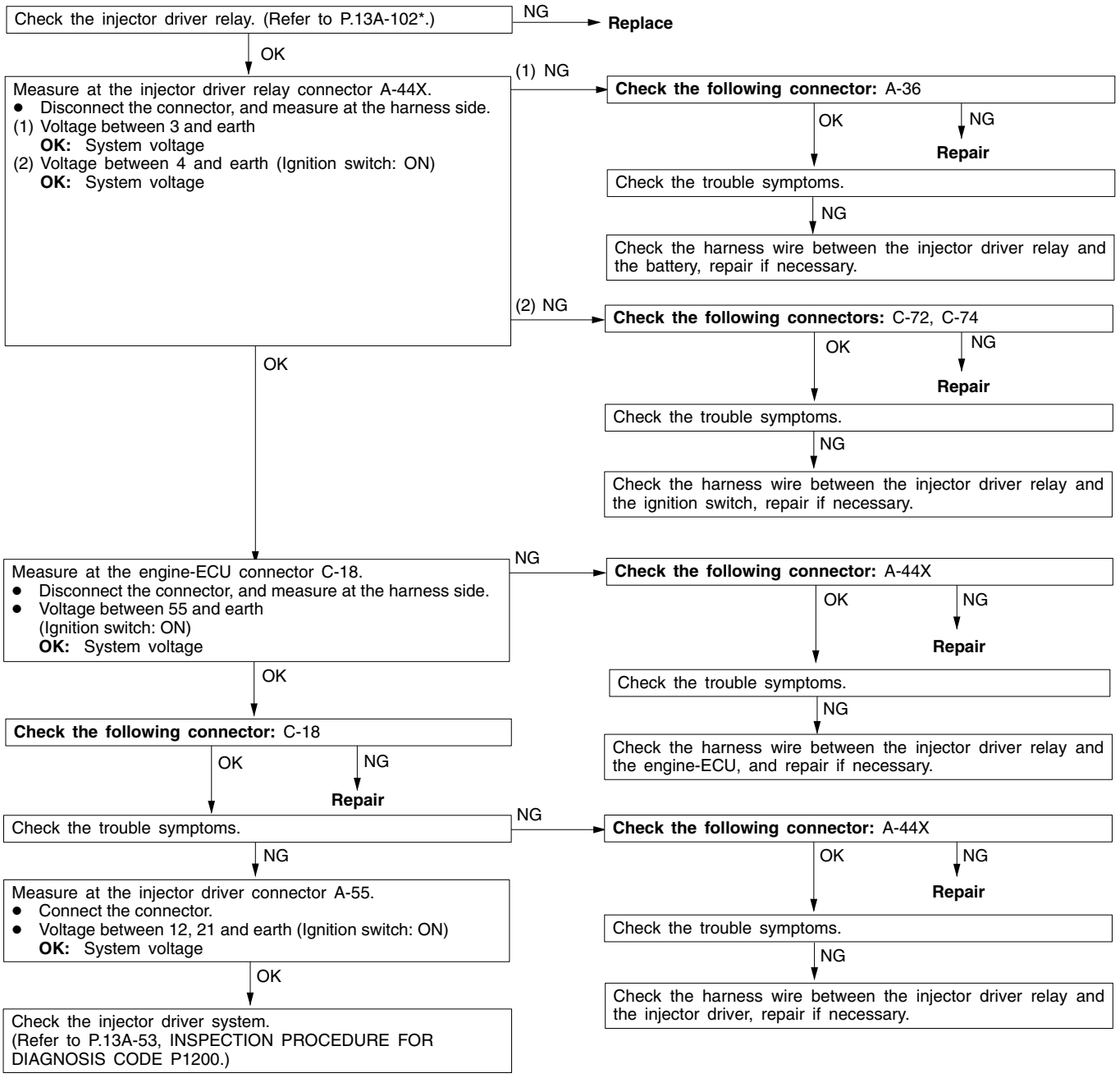
Engine control relay and ignition switch-IG system	Probable cause
When the ignition switch ON signal is input to the engine-ECU, the engine-ECU turns on the engine control relay. This causes system voltage to be supplied to the engine-ECU and to the sensors and actuators.	• Malfunction of the ignition switch • Malfunction of the engine control relay • Open circuit or short-circuited harness wire of the engine control relay circuit • Malfunction of the engine-ECU



NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

INSPECTION PROCEDURE 25

Injector driver relay system	Probable cause
When the ignition switch ON signal is input to the engine-ECU, engine-ECU turns on the injector driver relay. This causes system voltage to be supplied to the injector driver.	• Malfunction of the injector driver relay • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU

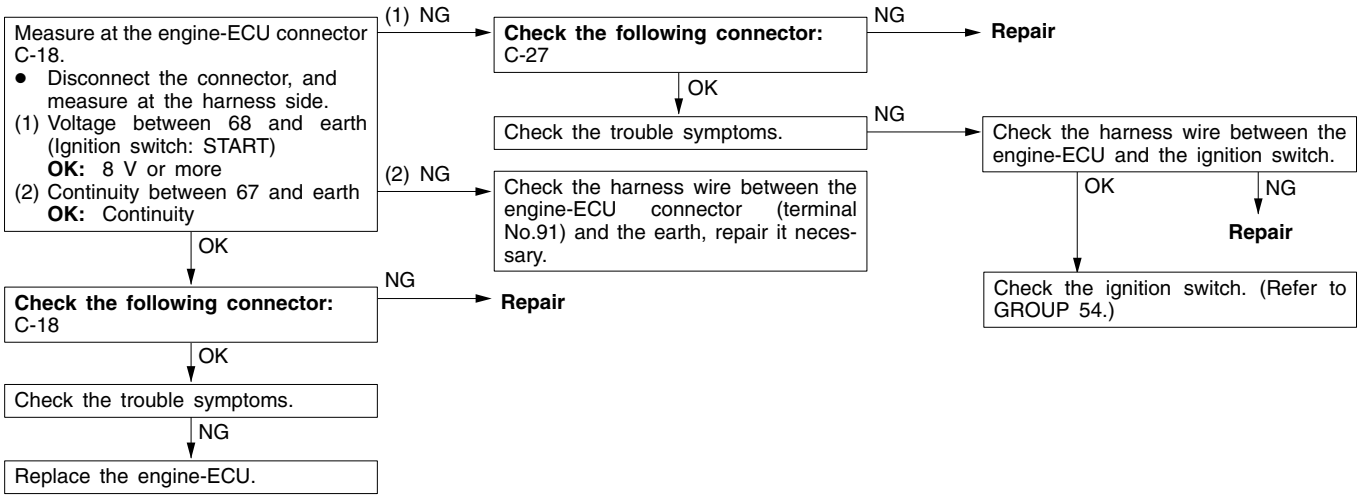


NOTE

*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE99E1)

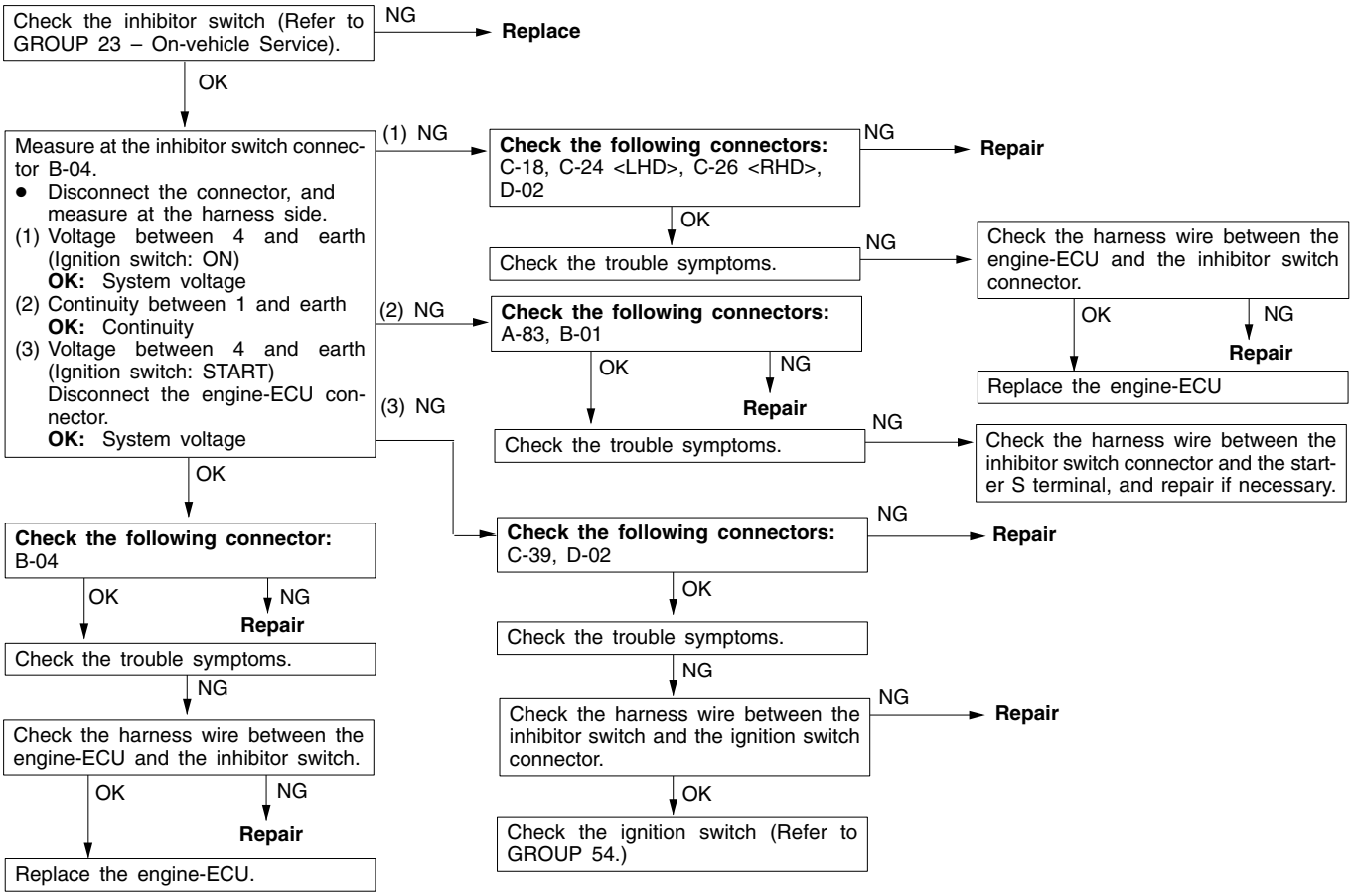
INSPECTION PROCEDURE 26

Ignition switch-ST system <M/T>	Probable cause
The ignition switch-ST outputs a HIGH signal to the engine-ECU while the engine is cranking. The engine-ECU uses this signal to carry out functions such as fuel injection control during starting.	• Malfunction of the ignition switch • Open circuit or short-circuited harness wire of the ignition switch circuit • Malfunction of the engine-ECU



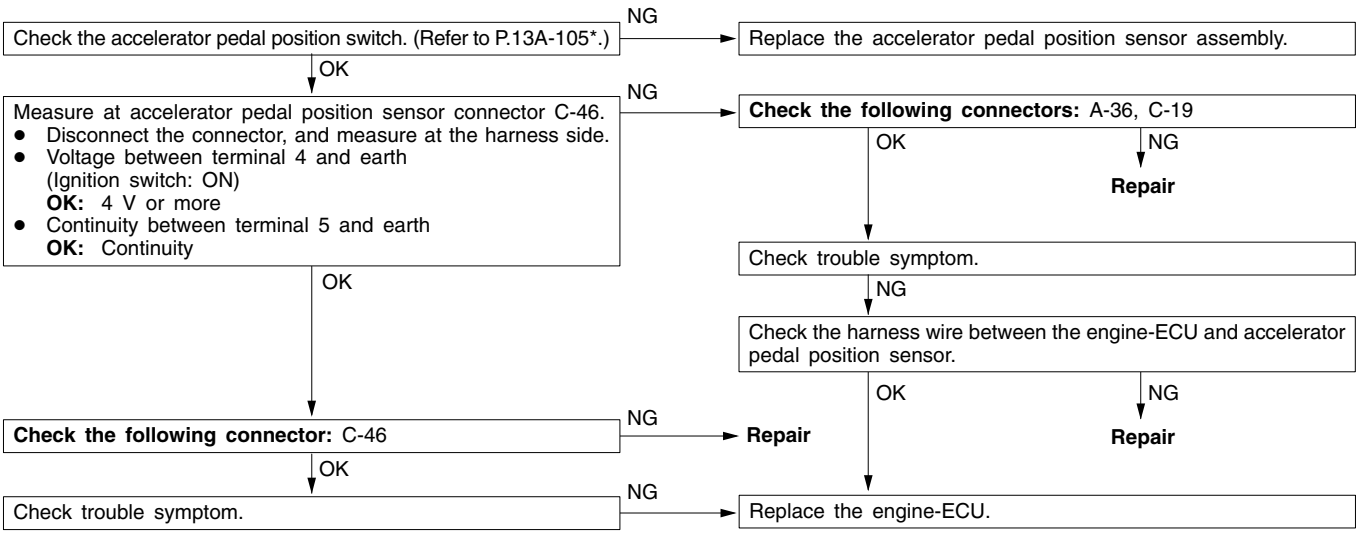
INSPECTION PROCEDURE 27

Ignition switch-ST and inhibitor switch system <A/T>	Probable cause
The ignition switch-ST outputs a HIGH signal to the engine-ECU while the engine is cranking, and the engine-ECU uses this signal to carry out functions such as fuel injection control during starting. The inhibitor switch inputs the position of the selector lever to the engine-ECU. The engine-ECU uses this signal to carry out idle speed control.	• Malfunction of the ignition switch • Malfunction of the inhibitor switch • Open circuit or short-circuited harness wire between ignition switch and inhibitor switch • Malfunction of the engine-ECU



INSPECTION PROCEDURE 28

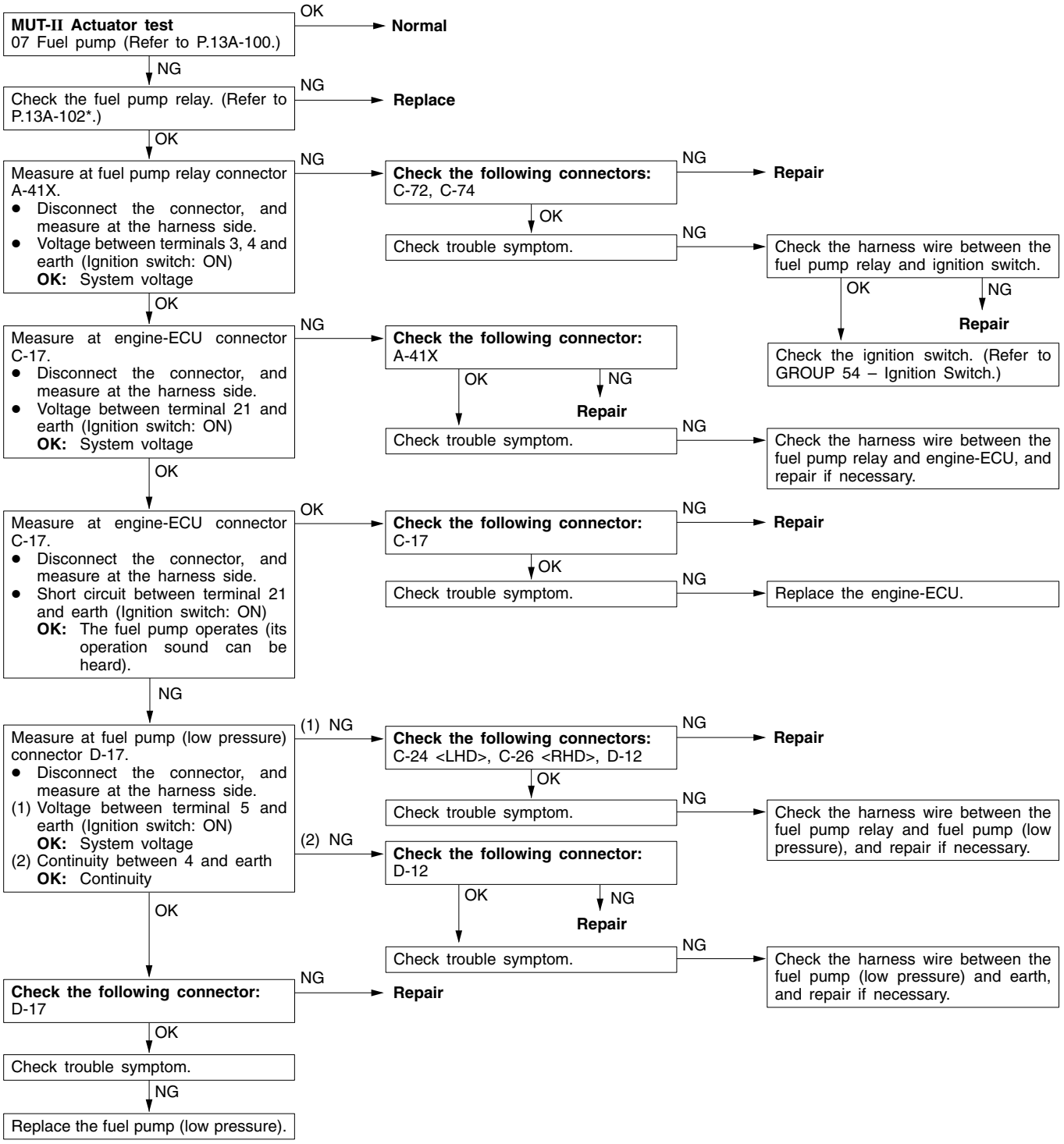
Accelerator pedal position switch system	Probable cause
The accelerator pedal position switch detects that the accelerator pedal is fully closed, and sends a signal to the engine-ECU. The engine-ECU controls idle speed, based on this signal.	● Maladjustment of the accelerator cable ● Maladjustment of the accelerator pedal position switch ● Open circuit or short-circuited harness wire in the accelerator pedal position switch system, or poor connector contact ● Malfunction of the engine-ECU



NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE99E1)

INSPECTION PROCEDURE 29

Fuel pump (low pressure) system	Probable cause
The engine-ECU turns on the fuel pump relay while the engine is cranking or running, and supplies power source to the fuel pump (low pressure).	• Malfunction of the fuel pump relay • Malfunction of the fuel pump (low pressure) • Open circuit or short-circuited harness wire in the fuel pump (low pressure) circuit, or poor connector contact • Malfunction of the engine-ECU

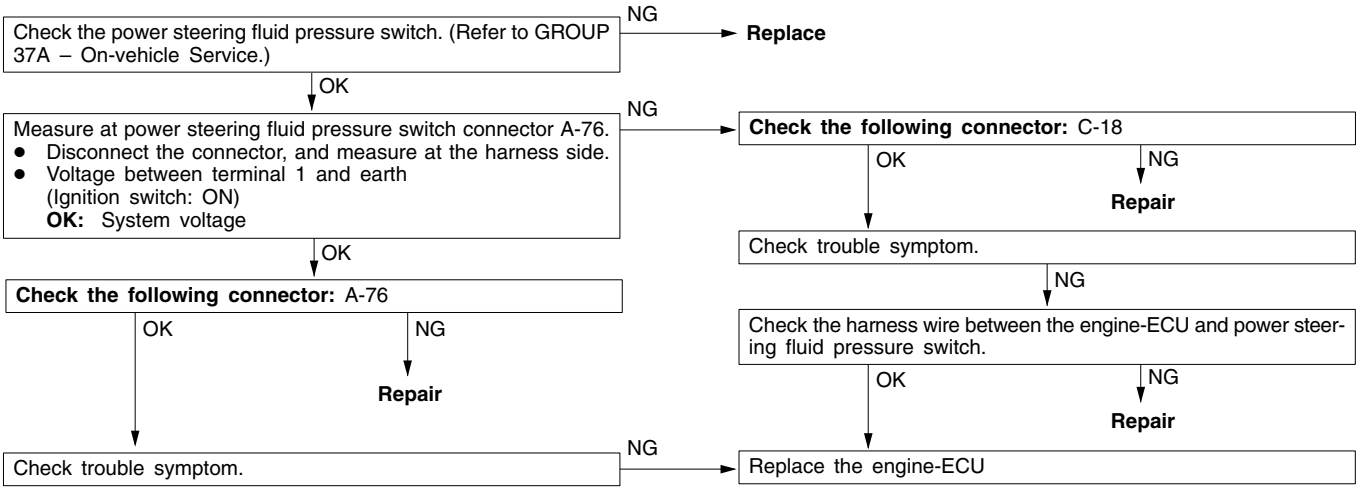


NOTE

*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

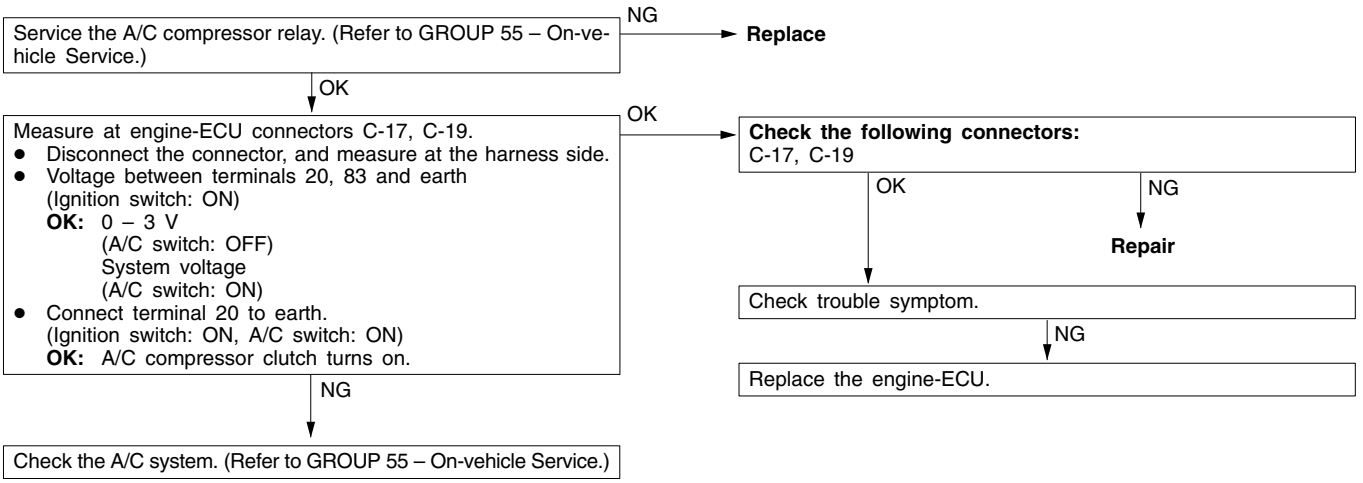
INSPECTION PROCEDURE 30

Power steering fluid pressure switch system	Probable cause
The power steering fluid pressure switch sends a signal to the engine-ECU according to power steering load. Based on this signal, the engine-ECU controls the throttle control servo so that idle speed increases when the power steering is in operation.	• Malfunction of the power steering fluid pressure switch • Open circuit or short-circuited harness wire in the power steering fluid pressure switch circuit, or poor connector contact • Malfunction of the engine-ECU



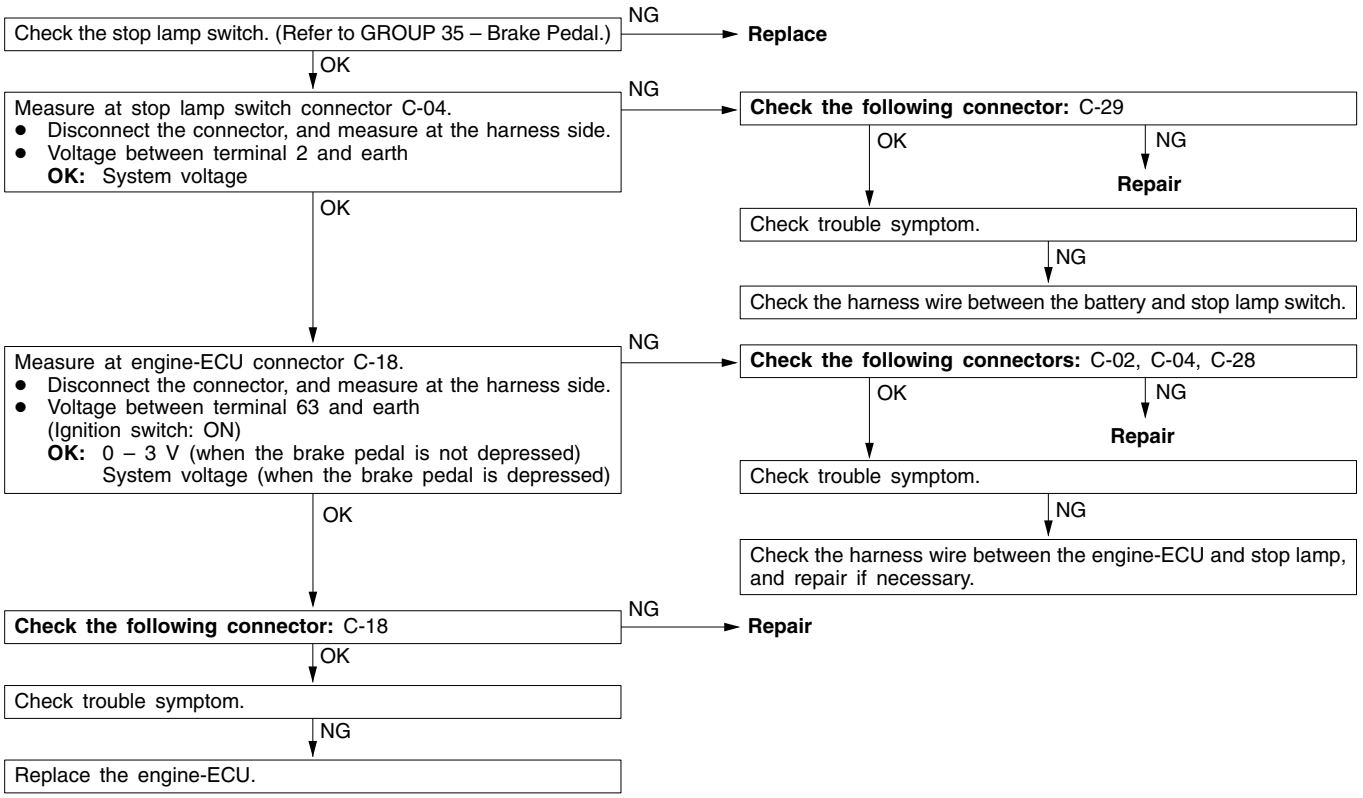
INSPECTION PROCEDURE 31

A/C switch and A/C relay system	Probable cause
If the engine-ECU receives a 'A/C on' signal, it operates the throttle control servo and A/C compressor magnetic clutch so that idle speed increases.	• Malfunction of the A/C control system • Malfunction of the A/C switch • Open circuit or short-circuited harness wire in the A/C switch circuit, or poor connector contact • Malfunction of the engine-ECU



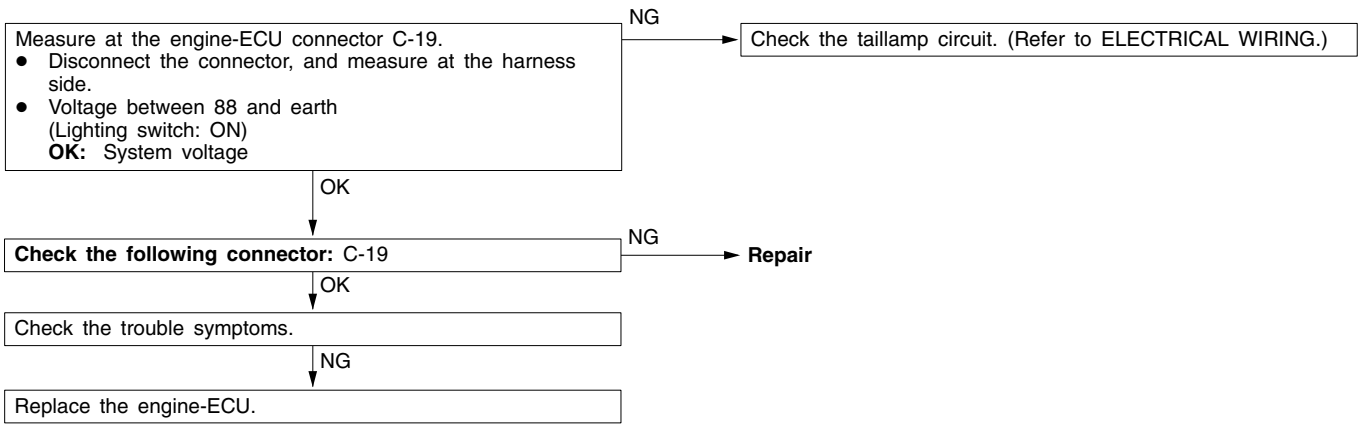
INSPECTION PROCEDURE 32

Stop lamp switch system	Probable cause
The engine-ECU determines whether the brake pedal is depressed or not, by means of the stop lamp switch input signal.	• Malfunction of the stop lamp switch • Open circuit or short-circuited harness wire in the stop lamp circuit, or poor connector contact • Malfunction of the engine-ECU



INSPECTION PROCEDURE 33

Small lamp switch system	Probable cause
The engine-ECU determines whether the small lamp switch is on or off. According to that information, the engine-ECU controls alternator output current when the vehicle is started.	• Improper connector contact, open circuit or short-circuited harness wire in the taillamp circuit • Malfunction of the engine-ECU



DATA LIST REFERENCE TABLE

Caution
When shifting the select lever to D range, the brakes should be applied so that the vehicle does not move forward.

NOTE
*1: Within four minutes after starting the engine
*2: In a new vehicle [driven approximately 500 km or less], the injector drive time is sometimes 10 % longer than the standard time.
*3: The accelerator pedal position switch normally turns off when the voltage of the accelerator pedal position sensor (1st channel) is 200 – 600 mV higher than the voltage at the idle position. If the accelerator pedal position switch turns back on after the accelerator pedal position sensor voltage has risen by 100 mV and the throttle valve has opened, the accelerator pedal position switch and the accelerator pedal position sensor (1st channel) need to be adjusted.

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
11	Oxygen sensor (front)	Engine: After warm-up	Idling	0 mV*1	Code No. P0130	13A-25
			Sudden racing	600 – 1,000 mV		
			2,500 r/min	400 mV or less and 600 – 1,000 mV alternates.		
12	Air flow sensor	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Idling	24 – 50 Hz	Code No. P0100	13A-14
			2,500 r/min	70 – 90 Hz		
			Racing	Frequency increases in response to racing.		
13	Intake air temperature sensor	Ignition switch: ON	Intake air temperature: –20°C	–20°C	Code No. P0110	13A-18
			Intake air temperature: 0°C	0°C		
			Intake air temperature: 20°C	20°C		
			Intake air temperature: 40°C	40°C		
			Intake air temperature: 80°C	80°C		

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
14	Throttle position sensor (2nd channel)	• Engine coolant temperature: 80 – 95°C • Ignition switch: ON (Engine stopped)	Release the accelerator pedal.	4,000 – 4,800	Code No. P0225	13A-43
			Depress the accelerator pedal gradually.	Voltage decreases in response to the pedal depression.		
			Depress the accelerator pedal fully.	100 – 1,100 mV		
16	Power supply voltage	Ignition switch: ON		System voltage	Procedure No. 23	13A-86
18	Cranking signal (Ignition switch – ST)	Transmission: Neutral (A/T: P range)	Engine: Stopped	OFF	Procedure No.26 <M/T> Procedure No.27 <A/T>	13A-89 <M/T> 13A-89 <A/T>
			Engine: Cranking	ON		
21	Engine coolant temperature sensor	Ignition switch: ON	Engine coolant temperature: –20°C	–20°C	Code No. P0115	13A-19
			Engine coolant temperature: 0°C	0°C		
			Engine coolant temperature: 20°C	20°C		
			Engine coolant temperature: 40°C	40°C		
			Engine coolant temperature: 80°C	80°C		
22	Crank angle sensor	• Engine: Cranking • Tachometer: Connected	Compare the engine speed readings on the tachometer and the MUT-II.	Accord	Code No. P0335	13A-47
		• Engine: Idling • Accelerator pedal position switch: ON	Engine coolant temperature: –20°C	1,200 – 1,400 r/min		
			Engine coolant temperature: 0°C	1,100 – 1,300 r/min		
			Engine coolant temperature: 20°C	1,000 – 1,200 r/min		
			Engine coolant temperature: 40°C	850 – 1,050 r/min		
			Engine coolant temperature: 80°C	550 – 750 r/min*1		
24	Vehicle speed sensor	Drive at 40 km/h		Approximately 40 km/h	Code No. P0500	13A-53

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
25	Barometric pressure sensor	Ignition switch: ON	Altitude: 0 m	101 kPa	Code No. P0105	13A-16
			Altitude: 600 m	95 kPa		
			Altitude: 1,200 m	88 kPa		
			Altitude: 1,800 m	81 kPa		
26	Accelerator pedal position switch	Ignition switch: ON (Depress and release the accelerator pedal several times)	Release the accelerator pedal.	ON	Procedure No. 28	13A-90
			Depress the accelerator pedal slightly.	OFF		
27	Power steering fluid pressure switch	Engine: Idling	Steering wheel stationary	OFF	Procedure No. 30	13A-92
			Steering wheel turning	ON		
28	A/C switch	Engine: Idling (The A/C compressor is running when the A/C switch is on.)	A/C switch: OFF	OFF	Procedure No. 31	13A-92
			A/C switch: ON	ON		
29	Inhibitor switch <A/T>	Ignition switch: ON	Selector lever: P or N	P, N	Procedure No. 27	13A-89
			Selector lever: D, 2, L or R	D, 2, L, R		
31	Small lamp switch	Engine: Idling	Lighting switch: OFF	OFF	Procedure No. 33	13A-93
			Lighting switch: ON	ON		
34	Air flow sensor reset signal	Engine: After having warmed up	Engine is idling	ON	Code No. P0100	13A-14
			3,000 r/min	OFF		
37	Volumetric efficiency	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Engine is idling	30 – 50 %	–	–
			2,500 r/min	10 – 30 %		
			Engine is suddenly raced	Volumetric efficiency increases in response to racing		
38	Crank angle sensor	• Engine: Cranking [reading is possible at 2,000 r/min or less] • Tachometer: Connected		Engine speeds displayed on the MUT-II and tachometer are identical.	–	–

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
41	Injector drive time*2	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Idling	0.35 – 0.55 ms*1	–	–
			2,500 r/min	0.4 – 0.6 ms		
			Sudden racing	Increases		
44	Ignition advance	• Engine: After warm-up • Set a timing light.	Idling	8 – 24°BTDC*1	Code No. P0300	13A-44
			2,500 r/min	15 – 35°BTDC		
49	A/C relay	Engine: After warm-up, idling	A/C switch: OFF	OFF (compressor clutch is not operating)	Procedure No. 31	13A-92
			A/C switch: ON	ON (compressor clutch is operating)		
59	Oxygen sensor (rear)	• Transmission: 2nd gear (A/T: L range) • Drive with throttle widely open	3,500 r/min	600 – 1,000 mV	Code No. P0136	13A-28
66	Brake vacuum sensor	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Stop the engine from idling speed, and then depress the brake pedal several times with the ignition switch on.	Displayed pressure increases.	Code No. P1515	13A-62
67	Stop lamp switch	Ignition switch: ON	Brake pedal: Depressed	OFF	Procedure No. 32	13A-93
			Brake pedal: Released	ON		
68	EGR valve	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Idling	2 – 17 STEP	Code No. P0403	13A-50
			2,500 r/min	0 – 9 STEP		

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
74	Fuel pressure sensor	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Engine: Idling	4 – 6.9 MPa	Code No. P0190	13A-33
77	Accelerator pedal position sensor (2nd channel)*3	Ignition switch: ON	Release the accelerator pedal.	700 – 1,400 mV	Code No. P1225	13A-58
			Depress the accelerator pedal gradually.	Increases in response to the pedal depression stroke.		
			Depress the accelerator pedal fully.	4,100 mV or more		
78	Accelerator pedal position sensor (1st channel)*3	Ignition switch: ON	Release the accelerator pedal.	985 – 1,135 mV	Code No. P0220	13A-40
			Depress the accelerator pedal gradually.	Increases in response to pedal depression stroke.		
			Depress the accelerator pedal fully.	4,100 mV or more		
79	Throttle position sensor (1st channel)	• Engine coolant temperature: 80 – 95°C • Ignition switch: ON (Engine stopped)	Release the accelerator pedal.	450 – 800 mV	Code No. P0120	13A-22
			Depress the accelerator pedal gradually.	Increases in response to pedal depression stroke.		
			Depress the accelerator pedal fully.	3,900 – 4,900 mV		
		Engine: After warm-up, idling	No load	450 – 1,000 mV		
			A/C switch: OFF → ON	Increases by 100 – 600 mV.		
			Selector lever: N → D range	Increases by 0 – 200 mV.		
81	Long-term fuel compensation	Engine: Warm, 2,500 r/min without any load (during closed loop)		–10 – 10 %	Code No. P0170	13A-31
82	Short-term fuel compensation	Engine: Warm, 2,500 r/min without any load (during closed loop)		–25 – 25 %	Code No. P0170	13A-31

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
85	Fuel pressure sensor	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Engine: Idling	4,000 – 6,900 kPa	Code No.P0190	13A-33
87	Calculation load value	Engine: Warm	Engine: Idling	15 – 35 %	–	–
			2,500 r/min	15 – 35 %		
88	Fuel control condition	Engine: Warm	2,500 r/min	Closed loop	Code No. P0125	13A-24
			When engine is suddenly raced	Open loop – drive condition		
99	Fuel injection mode	Engine: After warm up	Idling (after four minutes or more have passed since engine start)	Lean compression	–	–
			2,500 r/min	Stoichiometric metric feedback		
			Sudden racing after idle position	Open loop		
A1	Oxygen sensor (front)	Engine: After warm-up	Idling	0 V	Code No. P0130	13A-25
			Sudden racing	0.6 – 1.0 V		
			2,500 r/min	0.4 V or less and 0.6 – 1.0 V alternates		
A2	Oxygen sensor (rear)	• Transmission: 2nd gear <M/T>, L range <A/T> • Drive with throttle widely open	3,500 r/min	0.6 – 1.0 V	Code No. P0136	13A-28
8A	Throttle position sensor (1st channel) (Throttle valve opening angle)	• Engine coolant temperature: 80 – 95°C • Ignition switch: ON (Engine: stopped)	Release the accelerator pedal.	8 – 16 %	Code No. P0120	13A-22
			Depress the accelerator pedal gradually.	Increase in response to pedal depression stroke.		
			Depress the accelerator pedal fully.	80 – 100 %		
		Engine: After warm-up, idling	No load	8 – 18 %		
			A/C switch: OFF → ON	Rises by 2 – 10 %		

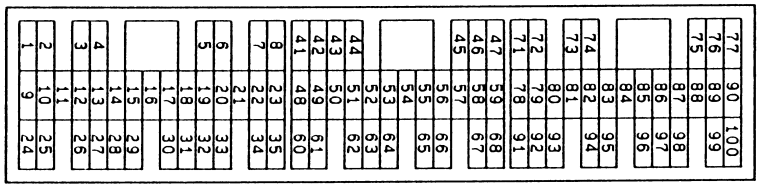
ACTUATOR TEST REFERENCE TABLE

Item No.	Inspection item	Drive contents	Inspection contents	Normal condition	Inspection procedure No.	Reference page
01	Injectors	Cut fuel to No. 1 injector	Engine: After having warmed up/Engine is idling (Cut the fuel supply to each injector in turn and check cylinders which don't affect idling.)	Idling condition becomes different (becomes unstable).	Code No. P0201	13A-34
02		Cut fuel to No. 2 injector			Code No. P0202	13A-36
03		Cut fuel to No. 3 injector			Code No. P0203	13A-37
04		Cut fuel to No. 4 injector			Code No. P0204	13A-38
07	Fuel pump (low pressure)	Fuel pump operates and fuel is recirculated.	Ignition switch: ON	Sound of operation is heard.	Procedure No. 29	13A-91
08	Purge control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch: ON	Sound of operation can be heard when solenoid valve is driven.	Code No. P0443	13A-52
17	Basic ignition timing	Set the engine-ECU to ignition timing adjustment mode	Idling after engine warm up	5°BTDC	–	–
21	Fan controller	Drive the fan motor	Ignition switch: ON	The fan motor operates	Procedure No. 20	13A-84
34	Electronic-controlled throttle valve system	Stop the throttle control servo.	Ignition switch: ON	Throttle valve is opened slightly.	Code No. P1220	13A-54

CHECK AT THE ENGINE-ECU TERMINALS

TERMINAL VOLTAGE CHECK CHART

Engine-ECU Connector Terminal Arrangement



7FU2119

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
1	No. 1 injector	Engine: Warm up, and then depress the accelerator pedal suddenly from the idle speed.		Decreases slightly for short time from 9 – 13 V
9	No. 2 injector			
24	No. 3 injector			
2	No. 4 injector			
3	No. 1 ignition coil	Engine: 3,000 r/min		0.3 – 3.0 V
13	No. 2 ignition coil			
12	No. 3 ignition coil			
4	No. 4 ignition coil			
5	EGR valve (D)	Ignition switch: Immediately after turning ON		5 – 8 V (fluctuates for approx. three seconds)
6	EGR valve (C)			
32	EGR valve (B)			
34	EGR valve (A)			
8	Alternator G terminal	• Engine: Warm up, and then idling • Radiator fan: Not operating • Headlamp: OFF → ON • Stop lamp: OFF → ON • Rear defogger switch: OFF → ON		Voltage increases by 0.2 – 3.5 V
14	GDI ECO indication lamp	Ignition switch: OFF → ON		0 – 3 V (System voltage after five seconds)
		Engine: When the accelerator pedal is suddenly depressed while the engine is idling		System voltage
16	Purge control solenoid valve	• Engine coolant temperature: 80 – 95°C • Ignition switch: ON	Engine: Stopped	System voltage
			Engine: Start the engine, and then increase engine speed up to 3,500 r/min.	Voltage decreases

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
18	Fan controller	Radiator and condenser fans are not operating.		0 – 0.3 V
		Radiator and condenser fans are operating.		0.7 V or more
20	A/C relay	• Engine: Idling • A/C switch: OFF → ON (Compressor is operating)		System voltage, or changes from momentarily 6 V or more to 0 → 3 V
21	Fuel pump relay	Ignition switch: ON	Engine: Stopped	System voltage
			Engine: Idling	0 – 3 V
31	Engine warning lamp	Ignition switch: OFF → ON		0 – 3 V → System voltage (after several seconds)
41	Sensor power supply	Ignition switch: ON		4.5 – 5.5 V
42	Power supply to accelerator pedal position sensor (1st channel)	Ignition switch: ON		4.5 – 5.5 V
43	Crank angle sensor	Engine: Cranking		0.4 – 4.0 V
		Engine: Idling		1.5 – 2.5 V
44	Engine coolant temperature sensor	Ignition switch: ON	Engine coolant temperature: 0°C	3.2 – 3.5 V
			Engine coolant temperature: 20°C	2.3 – 2.9 V
			Engine coolant temperature: 40°C	1.5 – 2.1 V
			Engine coolant temperature: 80°C	0.4 – 1.0 V
45	Engine ignition signal	Engine: 3,000 r/min		0.3 – 3.0 V
47	Power supply	Ignition switch: ON		System voltage
59				
50	Camshaft position sensor	Engine: Cranking		0.4 – 3.0 V
		Engine: Idling		0.5 – 2.0 V
51	Barometric pressure sensor	Ignition switch: ON	Altitude: 0 m	3.7 – 4.3 V
			Altitude: 1,200 m	3.2 – 3.8 V
52	Alternator FR terminal	• Engine: Warm up, and then idling • Radiator fan: Not operating • Headlamp: OFF → ON • Stop lamp: OFF → ON • Rear defogger: OFF → ON		Voltage decreases

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
53	Oxygen sensor (rear)	• Transmission: 2nd gear • Engine speed: 3,500 r/min or more • Driving with the throttle valve widely open		0.6 – 1.0 V
54	Power steering fluid pressure switch	Engine: Warm up, and then idling	Steering wheel stationary	System voltage
			Steering wheel turning	0 – 3 V
55	Injector driver relay	Ignition switch: OFF		0 – 0.1 V
		Ignition switch: ON		0.5 – 1.0 V
56	Throttle valve control servo relay	Ignition switch: OFF		0 – 0.3 V
		Ignition switch: ON		0.5 – 1.0 V
57	Engine control relay	Ignition switch: OFF		0 – 3 V
		Ignition switch: ON		System voltage
60	Back-up power source	Ignition switch: OFF		System voltage
61	Air flow sensor	Engine: Idling		2.2 – 3.2 V
		Engine: 2,500 r/min		
62	Intake air temperature sensor	Ignition switch: ON	Intake air temperature: 0°C	3.2 – 3.8 V
			Intake air temperature: 20°C	2.3 – 2.9 V
			Intake air temperature: 40°C	1.5 – 2.1 V
			Intake air temperature: 80°C	0.4 – 1.0 V
63	Stop lamp switch	Depress the brake pedal.		System voltage
		Release the brake pedal.		0 – 3 V
68	Ignition switch-ST	Engine: Cranking		8 V or more
71	Oxygen sensor (front)	Engine: Warm up, and then hold the engine speed at 2,500 r/min (Use a digital voltmeter).		0 ↔ 0.8 V alternates.
74	Brake vacuum sensor	Engine: Stop the engine from idle speed, turn the ignition switch ON, and then depress the brake pedal several times.		Voltage increases
76	Air flow sensor reset signal	Engine: Idling		0 – 1 V
		Engine: 3,000 r/min		6 – 9 V

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
78	Throttle position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	4.0 – 4.8 V
			Depress the accelerator pedal fully.	0.1 – 1.1 V
79	Accelerator pedal position switch	Ignition switch: ON	Release the accelerator pedal.	0 – 1 V
			Depress the accelerator pedal fully.	4 V or more
80	Vehicle speed sensor	• Ignition switch: ON • Move the vehicle forward.		0 ↔ system voltage alternates.
83	A/C switch	Engine: Idling	A/C switch: OFF	0 – 3 V
			A/C switch: ON (Compressor is operating)	System voltage
88	Small lamp switch	Lighting switch: OFF		0 – 3 V
		Lighting switch: ON (Taillamp: ON)		System voltage
89	Oxygen sensor heater (front)	Engine: Idling		0 – 3 V
		Engine: 3,500 r/min		System voltage
90	Oxygen sensor heater (rear)	Engine: Idling		0 – 3 V
		Engine: 3,500 r/min		System voltage
92	Fuel pressure sensor	Engine: Idling		0.3 – 4.7 V
94	Accelerator pedal position sensor (1st channel)	Ignition switch: ON	Release the accelerator pedal.	0.935 – 1.135 V*1
			Depress the accelerator pedal fully.	4.1 V or more*2
96	Injector open circuit check signal	Engine: Increase engine speed from idle speed to 4,000 r/min.		Decreases slightly (approx. 0.7 V) from 4.5 V – 5.0 V.
97	A/C thermo sensor	• Temperature at sensing portion: Approx 25°C • Ignition switch: ON		2.0 – 2.9 V
99	Ignition switch-IG	Ignition switch: ON		System voltage

NOTE
Check if the difference in output between *1 and *2 is 4 V or more.

CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

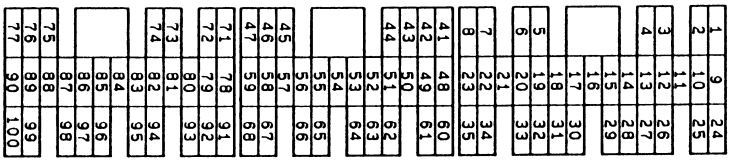
1. Turn the ignition switch to OFF.
2. Disconnect the engine-ECU connector.
3. Measure the resistance and check for continuity between the terminals of the engine-ECU harness-side connector while referring to the check chart.

   NOTE
   (1) When measuring resistance and checking continuity, a harness for checking contact pin pressure should be used instead of inserting a test probe.
   (2) Checking need not be carried out in the order given in the chart.

   Caution
   If the terminals that should be checked are mistaken, or if connector terminals are not correctly shorted to earth, damage may be caused to the vehicle wiring, sensors, engine-ECU and/or ohmmeter.
   Be careful to prevent this!

4. If the ohmmeter shows any deviation from the standard value, check the corresponding sensor, actuator and related electrical wiring, and then repair or replace.
5. After repair or replacement, recheck with the ohmmeter to confirm that the repair or replacement has corrected the problem.

Engine-ECU Harness Side Connector Terminal Arrangement

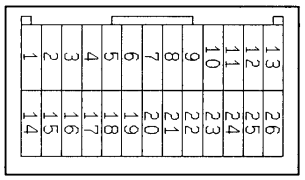


Terminal No.	Check item	Standard value, normal condition (check requirements)
5 – 47	EGR valve (D)	15 – 20 Ω (at 20°C)
6 – 47	EGR valve (C)	
32 – 47	EGR valve (B)	
34 – 47	EGR valve (A)	
16 – 47	Purge control solenoid valve	30 – 34 Ω (at 20°C)
44 – 72	Engine coolant temperature sensor	5.1 – 6.5 kΩ (when engine coolant temperature is 0°C)
		2.1 – 2.7 kΩ (when engine coolant temperature is 20°C)
		0.9 – 1.3 kΩ (when engine coolant temperature is 40°C)
		0.26 – 0.36 kΩ (when engine coolant temperature is 80°C)
46 – Body earth	Earth	Continuity (0 Ω)
58 – Body earth		
62 – 72	Intake air temperature sensor	5.3 – 6.7 kΩ (when intake air temperature is 0°C)
		2.3 – 3.0 kΩ (when intake air temperature is 20°C)
		1.0 – 1.5 kΩ (when intake air temperature is 40°C)
		0.30 – 0.42 kΩ (when intake air temperature is 80°C)
79 – 49	Accelerator pedal position switch	Continuity (when the accelerator pedal is released)
		No continuity (when the accelerator pedal is slightly depressed)
89 – 47	Oxygen sensor heater control (front)	4.5 – 8.0 Ω (at 20°C)
90 – 47	Oxygen sensor heater (rear)	11 – 18 Ω (at 20°C)

CHECK AT THE THROTTLE VALVE CONTROLLER TERMINALS

TERMINAL VOLTAGE CHECK CHART

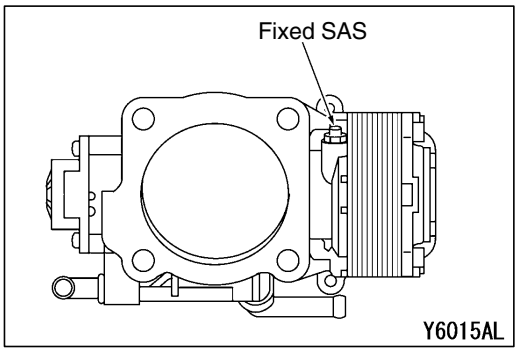
Throttle Valve Controller Terminal Arrangement



7FU2121

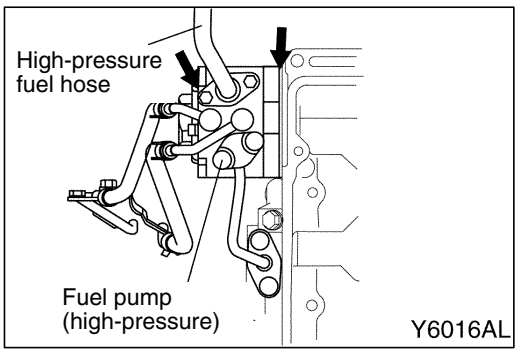
Terminal No.	Check items	Requirements		Normal value
1	Throttle valve control servo (A+)	• Ignition switch: ON • Accelerator pedal: Fully opened → fully closed		Decreases slightly from system voltage.
9	Throttle valve control servo (B+)			
14	Throttle valve control servo (A–)	• Ignition switch: ON • Accelerator pedal: Fully closed → fully opened		Decreases slightly (approx. 2 V) from system voltage.
15	Throttle valve control servo (B–)			
2	Power supply to throttle valve control servo	Ignition switch: ON		System voltage
19				
5	Power supply	Ignition switch: ON		System voltage
6	Sensor voltage	Ignition switch: ON		4.5 – 5.5 V
7	Throttle position sensor (1st channel)	Ignition switch: ON	Release the accelerator pedal.	0.45 – 0.8 V
			Depress the accelerator pedal fully.	3.9 – 4.9 V
20	Accelerator pedal position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	0.7 – 1.4 V*1
			Depress the accelerator pedal fully.	4.1 V or more*1

NOTE:
Check that the voltage difference between *1 and *2 is 4 V or more.



ON-VEHICLE SERVICE

Caution
(1) Never attempt to tamper the fixed SAS. The fixed SAS is precisely adjusted at factory.
(2) Should it be tampered, the full closed position of the throttle valve will be changed. This causes the engine-ECU to learn a wrong position of the throttle valve.



FUEL PRESSURE TEST

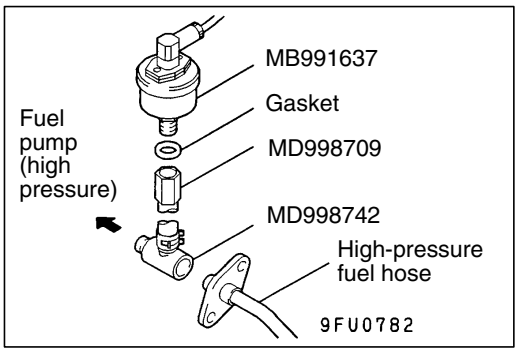
MEASUREMENT OF FUEL LOW PRESSURE BETWEEN FUEL PUMP (LOW PRESSURE) AND FUEL PUMP (HIGH PRESSURE)

1. Release residual pressure from the fuel pipe line to prevent fuel gush out.

   NOTE
   Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1) GROUP 13A – On-vehicle Service.

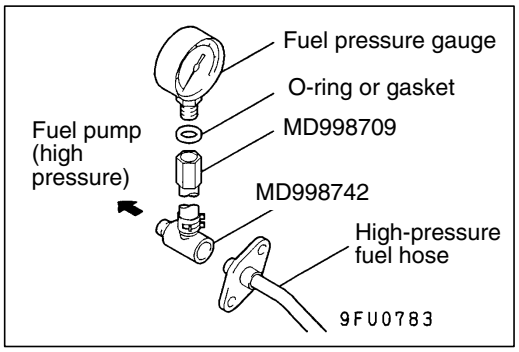
2. Disconnect the high-pressure fuel hose at the fuel pump (high pressure) side.

   Caution
   Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.



3. Remove the union joint and bolt from the special tool (adapter hose) and instead attach the special tool (hose adapter) to the adapter hose.
4. Install the special tool (for measuring the fuel pressure) that was set up in step 3.

   <When using the fuel pressure gauge set (special tool)>
   (1) Install the special tool (for measuring the fuel pressure) between the high-pressure fuel hose and the fuel pump (high pressure).
   (2) Install the fuel pressure gauge set (special tool) on the special tool (for measuring the fuel pressure) putting the gasket between them.
   (3) Connect the lead wire of the fuel pressure gauge set (special tool) to the power supply (cigarette lighter socket) and to the MUT-II.



<When using the fuel pressure gauge>
(1) Install the fuel pressure gauge on the special tool (for measuring the fuel pressure) putting a suitable O-ring or gasket between them.
(2) Install the special tool which was set up in step (1) between the high-pressure fuel hose and the fuel pump (high pressure).

5. Connect the MUT-II to the diagnosis connector.

Caution
Turn off the ignition switch before disconnecting or connecting the MUT-II.

6. Turn the ignition switch to ON. (But do not start the engine.)
7. Select "Item No. 07" from the MUT-II Actuator test to drive the fuel pump (low pressure) at the fuel tank side. Check that there are no fuel leaks from any parts.
8. Finish the actuator test or turn the ignition switch to OFF.
9. Start the engine and run at idle.
10. Measure fuel pressure while the engine is running at idle.

Standard value: approximately 324 kPa

11. Check to see that fuel pressure at idle does not drop even after the engine has been raced several times.
12. If fuel pressure is out of the standard value, troubleshoot and repair according to the table below.

Symptom	Probable cause	Remedy
• Fuel pressure too low • Fuel pressure drops after racing	Clogged fuel filter	Replace fuel filter
	Fuel leaking to return side due to poor fuel pressure regulator (low pressure) valve seating or settled spring	Replace fuel pressure regulator (low pressure)
	Low fuel pump (low pressure) delivery pressure	Replace the fuel pump (low pressure)
Fuel pressure too high	Binding valve in fuel pressure regulator (low pressure)	Replace fuel pressure regulator (low pressure)
	Clogged fuel return hose or pipe	Clean or replace hose or pipe

13. Stop the engine and check change of fuel pressure gauge reading. Normal if the reading does not drop within 2 minutes. If it does, observe the rate of drop and troubleshoot and repair according to the table below.

Symptom	Probable cause	Remedy
Fuel pressure drops gradually after engine is stopped	Leaky fuel pressure regulator (low pressure) valve seat	Replace fuel pressure regulator (low pressure)
Fuel pressure drops sharply immediately after engine is stopped	Check valve in fuel pump (low pressure) is held open	Replace the fuel pump (low pressure)

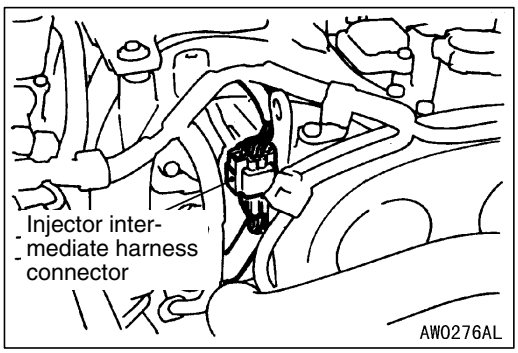
14. Release residual pressure from the fuel pipe line.

    NOTE
    Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1) GROUP 13A – On-vehicle Service.

15. Remove the fuel pressure gauge and special tools from the fuel pump (high pressure).

    Caution
    Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.

16. Replace the O-ring at the end of the high-pressure fuel hose with a new one. Furthermore, apply engine oil to the new O-ring before replacement.
17. Fit the high-pressure fuel hose to the fuel pump (high pressure) and tighten the mounting bolt to specified torque.
18. Check for any fuel leaks by following the procedure in step 7.
19. Disconnect the MUT-II.



MEASUREMENT OF FUEL HIGH PRESSURE BETWEEN FUEL PUMP (HIGH PRESSURE) AND INJECTORS

NOTE
Measurement of the fuel pressure between the fuel pump (high pressure) and the injectors should be carried out after checking that the fuel pressure between the fuel pump (low pressure) and the fuel pump (high pressure) is normal.

1. Connect the MUT-II to the diagnosis connector.
2. Disconnect the injector intermediate harness connector.
3. Turn the ignition switch to ON.
4. Select "Item No. 74" from the MUT-II Data list.
5. Crank the engine continuously for 2 seconds or more, and visually check that there are no fuel leaks from any parts.

   Caution
   If any fuel leaks appear, stop cranking immediately and repair the source of the leak.

6. Check if the fuel pressure is more than 1 MPa immediately after 20 seconds have passed since cranking was finished.
7. If the fuel pressure is lower than 1 MPa, it means that there is likely to be a leak in the high-pressure fuel system, so this system should be checked.

8. Turn the ignition switch to OFF.
9. Connect the injector intermediate harness connector.
10. Start the engine and run at idle.
11. Measure fuel pressure while the engine is running at idle.

    Standard value: 4 – 6.9 MPa

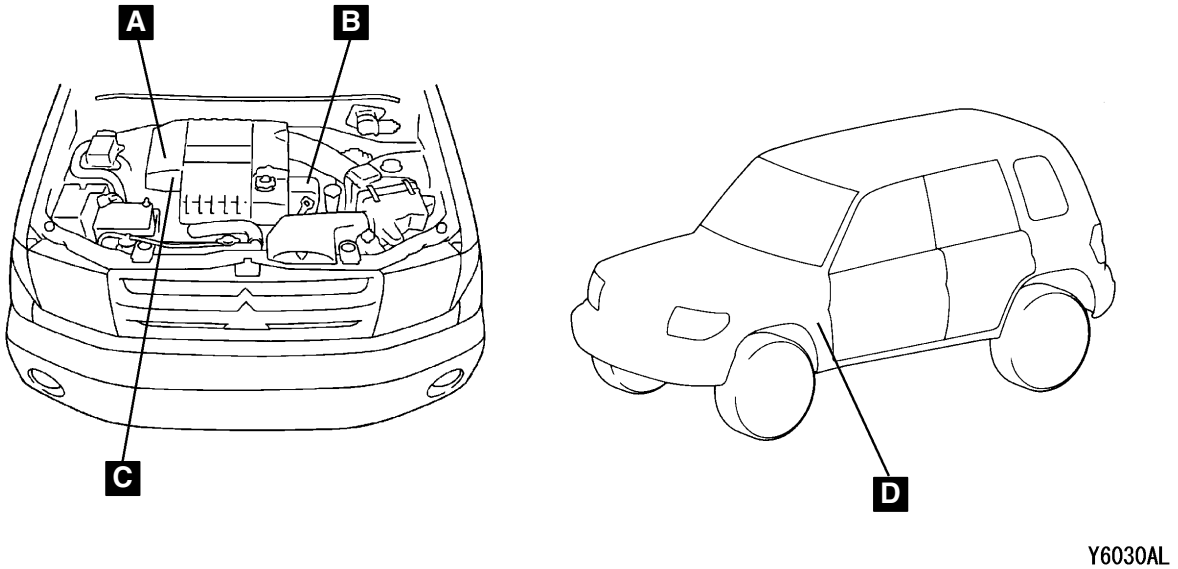
12. Check to see that fuel pressure at idle does not drop even after the engine has been raced several times.
13. If fuel pressure is out of the standard value, troubleshoot and repair according to the table below.

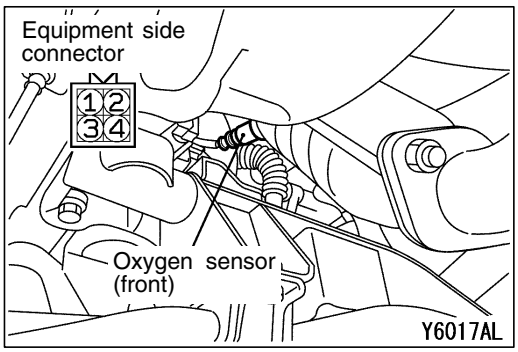
Symptom	Probable cause	Remedy
• Fuel pressure too low • Fuel pressure drops after racing	Fuel leaking to return side due to poor fuel pressure regulator valve seating or settled spring in the fuel pump (high pressure).	Replace the fuel pump (high pressure)
	Low fuel pump (high pressure) delivery pressure	Replace the fuel pump (high pressure)
Fuel pressure too high	Clogged fuel pressure regulator valve in the fuel pump (high pressure)	Replace the fuel pump (high pressure)
	Clogged fuel return hose or pipe	Clean or replace hose or pipe

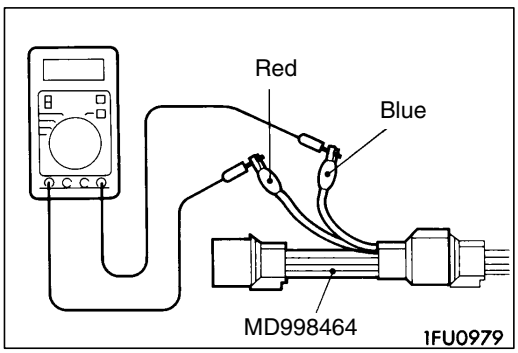
14. Stop the engine and turn the ignition switch to OFF.
15. Disconnect the MUT-II.

COMPONENT LOCATION

Name	Symbol	Name	Symbol
Fuel pressure sensor	C	Oxygen sensor (front)	B
Ignition failure sensor	A	Oxygen sensor (rear)	D



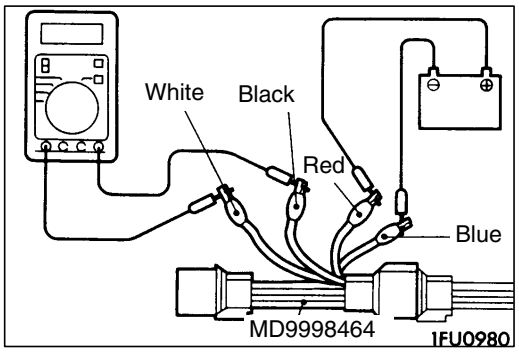




OXYGEN SENSOR CHECK

<Oxygen sensor (front)>

1. Disconnect the oxygen sensor connector and connect the special tool (test harness) to the connector on the oxygen sensor side.
2. Make sure that there is continuity (4.5 – 8.0 Ω at 20°C) between terminal 1 (red clip of special tool) and terminal 3 (blue clip of special tool) on the oxygen sensor connector.
3. If there is no continuity, replace the oxygen sensor.
4. Warm up the engine until engine coolant is 80°C or higher.



5. Use a jumper wire to connect terminal 1 (red clip) of the oxygen sensor connector to the battery (+) terminal and terminal 3 (blue clip) to the battery (–) terminal.

   Caution
   Be very careful when connecting the jumper wire; incorrect connection can damage the oxygen sensor.

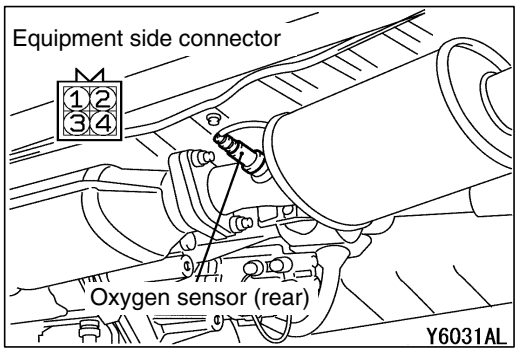
6. Connect a digital voltage meter between terminal 2 (black clip) and terminal 4 (white clip).
7. While repeatedly racing the engine, measure the oxygen sensor output voltage.

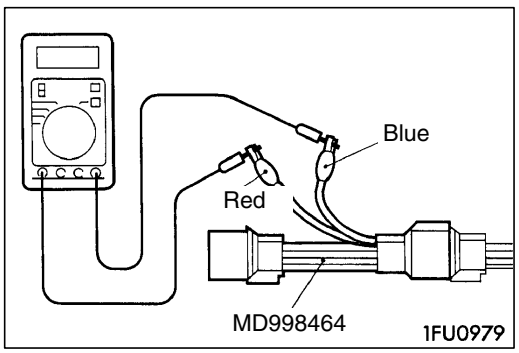
   Standard value:

Engine	Oxygen sensor output voltage	Remarks
When racing the engine	0.6 – 1.0 V	If you make the air/fuel ratio rich by racing the engine repeatedly, a normal oxygen sensor will output a voltage of 0.6 – 1.0 V.

8. If the sensor is defective, replace the oxygen sensor.

   NOTE
   For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Pipe and Main Muffler.





<Oxygen sensor (rear)>

1. Disconnect the oxygen sensor connector and connect the special tool (test harness set) to the connector on the oxygen sensor side.
2. Make sure that there is continuity (11 – 18 Ω at 20°C) between terminal 1 (red clip of special tool) and terminal 3 (blue clip of special tool) on the oxygen sensor connector.
3. If there is no continuity, replace the oxygen sensor.

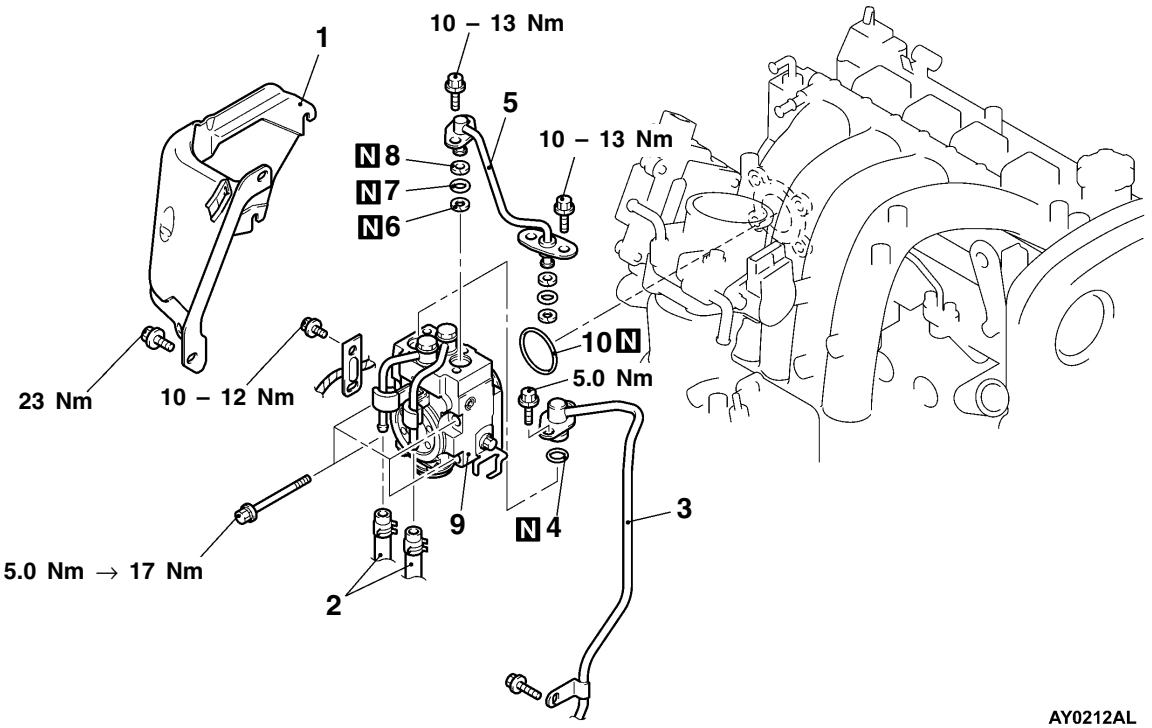
   NOTE
   (1) If the MUT-II does not display the standard value although no abnormality is found by the above mentioned continuity test and harness check, replace the oxygen sensor (rear).
   (2) For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Pipe and Main Muffler.

FUEL PUMP (HIGH PRESSURE)

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Cover Removal and Installation (Refer to GROUP 11A – Camshaft and Camshaft Oil Seal.)
- Prevention of Fuel Discharge <before removal only>
- Fuel Leak Check <after installation only>
- High-pressure Fuel Line Air Bleeding <after installation only> (P.13A-116.)
- Resonance Tank Removal and Installation

Apply engine oil to all O-rings during installation.



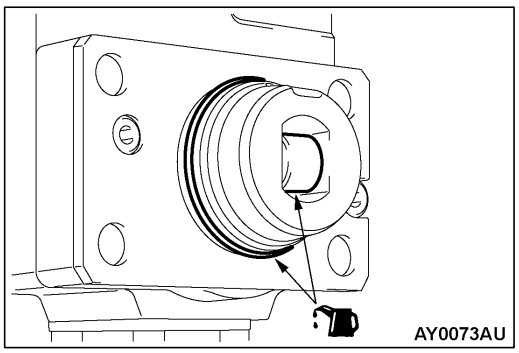
Removal steps

◀A▶ 1. Fuel pump protector
2. Furl return hose connection
▶C◀ 3. Fuel pressure hose connection
▶C◀ 4. O-ring
▶B◀ 5. Fuel pipe
▶B◀ 6. Back-up ring A
▶B◀ 7. O-ring
▶B◀ 8. Back-up ring B
▶A◀ 9. Fuel pump (high-pressure)
10. O-ring

REMOVAL SERVICE POINT

◀A▶ FUEL PUMP PROTECTOR REMOVAL

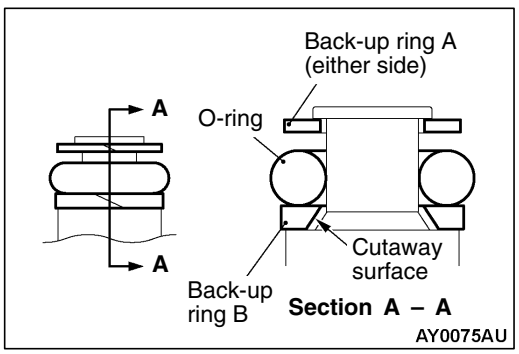
Jack up the transmission, and create sufficient clearance between the engine and the front deck. Then remove the fuel pump protector.



INSTALLATION SERVICE POINTS

▶A◀ FUEL PUMP (HIGH-PRESSURE) INSTALLATION

1. Apply clean engine oil to the O-ring and the roller of the fuel pump (high-pressure).
2. Insert the fuel pump (high-pressure) into the cylinder head mounting hole squarely, and finger-tighten the mounting bolts. The mounting bolts should be tightened securely at step ▶B◀.



▶B◀ BACK-UP RING B/O-RING/BACK-UP RING A/FUEL PIPE INSTALLATION

1. Install the back-up rings and the O-ring as shown in the illustration.

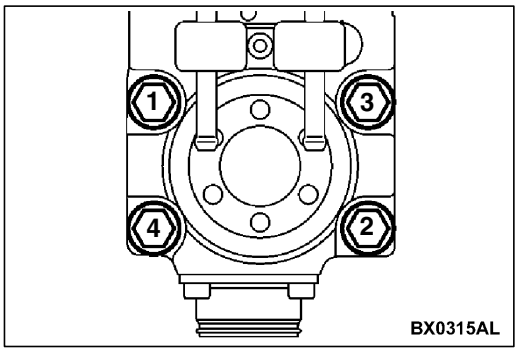
   Caution
   (1) Install the back-up ring B facing its cutaway surface toward the opposite side of the O-ring as shown in the illustration.
   (2) Confirm the outer diameter of the back-up ring A. Take care not to install the back-up ring for the fuel pressure sensor by mistake. (Outer diameter of the back-up ring A: 14.8 mm)

2. Apply a small amount of fresh engine oil to the O-ring.

   Caution
   Take care not to let any of the engine oil get inside the fuel pump (high-pressure) or the delivery pipe assembly.

3. Install the fuel pipe into the fuel pump (high pressure) and the delivery pipe ports squarely. Insert the pipe securely, being careful not to twisting it, and then tighten the mounting bolts to the specified torque.

   Tightening torque: 10 – 13 Nm



4. Tighten the fuel pump (high-pressure) mounting bolts to 5.0 Nm in the order shown.
5. Tighten the mounting bolts to 17 Nm in the sequence shown as second stage. The final tightening torques should not vary more than 2.0 Nm.

▶C◀ O-RING/FUEL PRESSURE HOSE INSTALLATION

1. Apply a small amount of fresh engine oil to the O-ring.

   Caution
   Take care not to let any of the engine oil get inside the fuel pump (high pressure).
2. While being careful not to damage the O-ring, turn the fuel pressure hose to the left and right and connect it to the fuel pump (high pressure). After connecting, check that the hose turns smoothly.
3. If the hose does not turn smoothly, the cause may be that the O-ring is getting caught. Disconnect the hose, check the O-ring for damage and re-connect the hose to the fuel pump (high pressure) and then re-check.
4. Tighten the fuel pressure hose mounting bolts to the specified toque.

   Tightening torque: 5.0 Nm

AIR-BLEEDING HIGH-PRESSURE FUEL LINE

1. Run the engine at 2000 r/min for at least 15 seconds in order to bleed air from the high-pressure fuel line.

   NOTE
   If air is trapped in the high-pressure fuel line due to the removal of fuel pipe, diagnosis code No. P.0190 will be set as abnormal fuel pressure.
2. Finally confirm diagnosis code by using the MUT-II. If diagnosis code, which indicates defective fuel pressure sensor system, has been set, erase the code.

INJECTOR

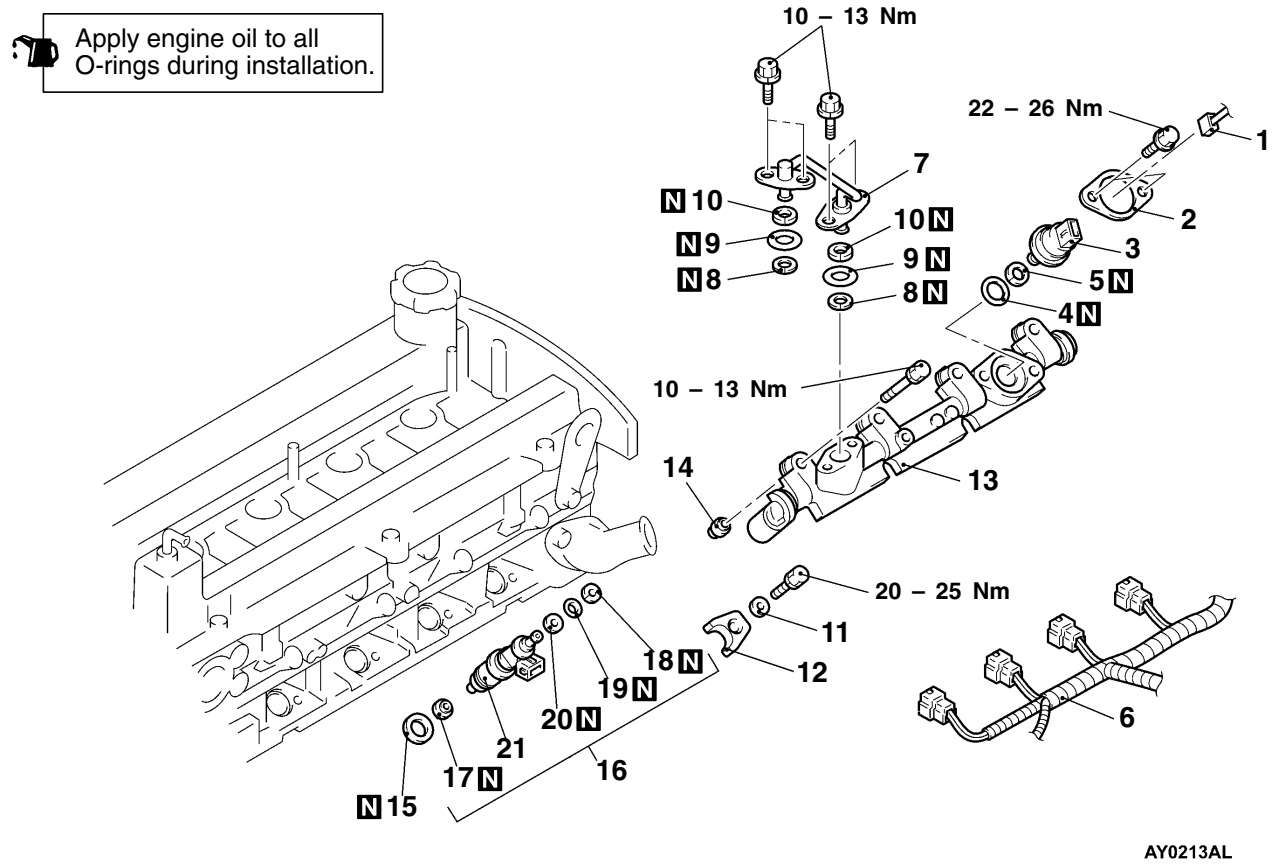
REMOVAL AND INSTALLATION

Caution

1. **Disconnect the negative battery cable prior to the service work.**
2. **The injector driver may be hot immediately after each operation, and high voltage and current flows between the injector driver and the injectors while the engine is running. Handle the injector driver carefully.**

Pre-removal and Post-installation Operation

- Engine Cover Removal and Installation (Refer to GROUP 11A – Camshaft and Camshaft Oil Seal.)
- Prevention of Fuel Discharge <before removal only>
- Fuel Leak Check <after installation only>
- High-pressure Fuel Line Air Bleeding <after installation only> (P.13A-116.)



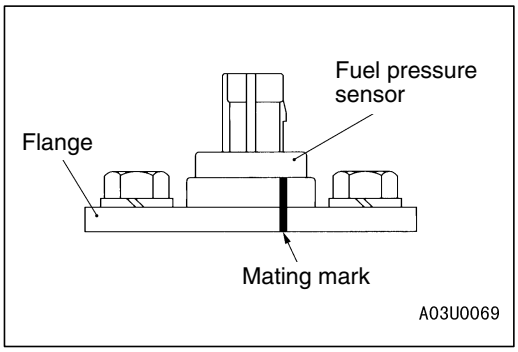
Fuel pressure sensor removal steps

◀A▶ ▶E◀ 1. Fuel pressure sensor connector
▶E◀ 2. Flange
▶E◀ 3. Fuel pressure sensor
▶D◀ 4. O-ring
▶D◀ 5. Back-up ring

Injector removal steps

- Intake manifold (Refer to GROUP 15.)

6. Injector connector
▶C◀ 7. Fuel pipe
▶C◀ 8. Back-up ring A
▶C◀ 9. O-ring
▶C◀ 10. Back-up ring B
▶B◀ 11. Injector washer
▶B◀ 12. Injector holder
◀B▶ ▶B◀ 13. Delivery pipe assembly
▶B◀ 14. Insulator
▶B◀ 15. Injector gasket
◀B▶ ▶B◀ 16. Injector assembly
▶A◀ 17. Corrugated washer
▶A◀ 18. Back-up ring A
▶A◀ 19. O-ring
▶A◀ 20. Back-up ring B
21. Injector



REMOVAL SERVICE POINT

◀A▶ FLANGE REMOVAL

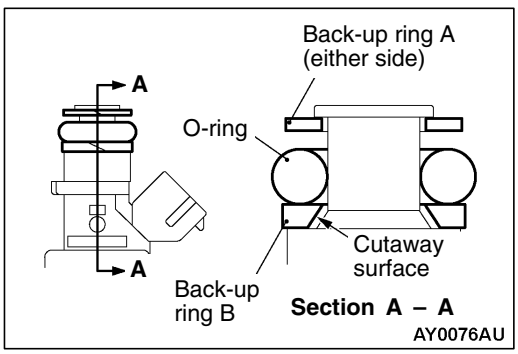
If the fuel pressure sensor is reused, make mating marks on the sensor and the flange before removal.

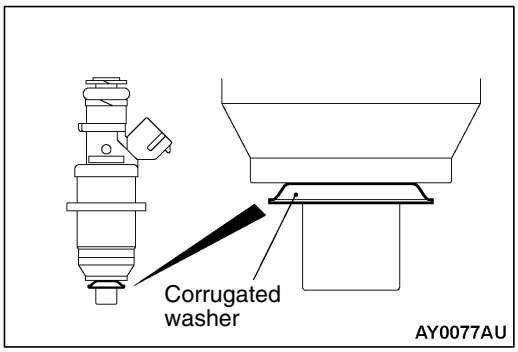
NOTE
The sealing performance and the installation rigidity of the fuel pressure sensor can be secured by deforming the flange when the sensor is installed. Therefore, the flange must be reinstalled on the same side and phase as it is removed. In addition, if the fuel pressure sensor is replaced, it should be always replaced together with the flange.

◀B▶ DELIVERY PIPE ASSEMBLY/INJECTOR ASSEMBLY REMOVAL

Remove the delivery pipe assembly with the injector assembly still attached.

Caution
Be careful not to drop the injector assembly when removing the delivery pipe assembly.





INSTALLATION SERVICE POINTS

▶A◀ BACK-UP RING B/O-RING/BACK-UP RING A /CORRUGATED WASHER INSTALLATION

1. Install the back-up rings and the O-ring as shown in the illustration.

   Caution
   (1) Install the back-up ring B facing its cutaway surface toward the opposite side of the O-ring as shown in the illustration.
   (2) Confirm the outer diameter of the back-up ring A. Take care not to install the back-up ring for the fuel pressure sensor by mistake. (Outer diameter of the back-up ring A: 14.8 mm)

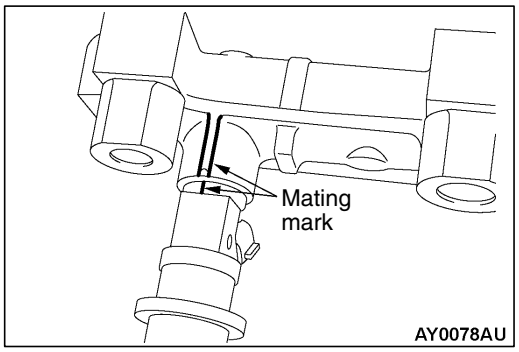
2. Apply petroleum jelly to the corrugated washer to prevent it from falling off, and install it in the direction shown.

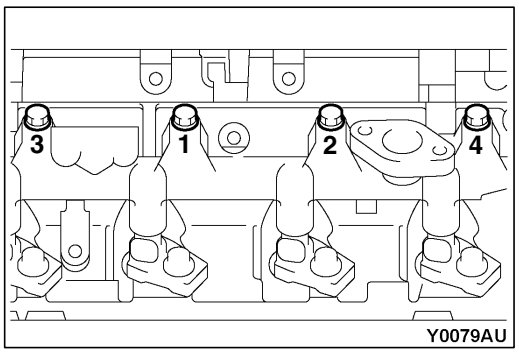
   Caution
   The corrugated washer should always be replaced with a new part. If the corrugated washer is reused, fuel or gas leak may occur.

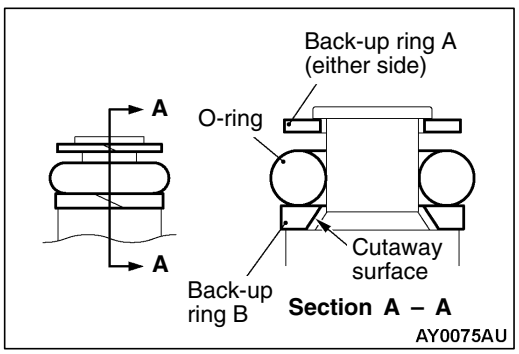
▶B◀ FUEL INJECTOR ASSEMBLY/INJECTOR GASKET/INSULATOR/DELIVERY PIPE ASSEMBLY/INJECTOR HOLDER/INJECTOR WASHER INSTALLATION

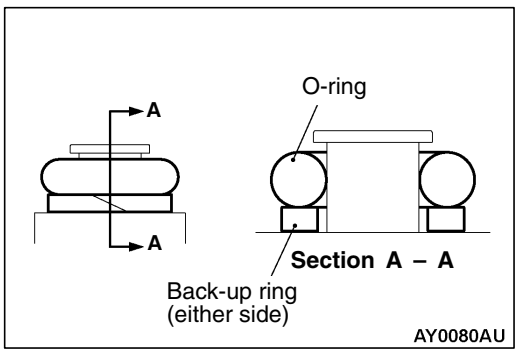
1. Apply a small amount of fresh engine oil to the O-ring.

   Caution
   Take care not to let any of the engine oil get inside the delivery pipe assembly.









2. Insert the injector assembly into the mounting hole on the delivery pipe squarely. Then check that the fuel injector turns smoothly.
3. If the injector does not turn smoothly, the cause may be that the O-ring is getting caught. Remove the fuel injector, check the O-ring for damage and re-connect the injector to the delivery pipe assembly and then re-check.
4. Align the injector assembly mating mark with the delivery pipe mating mark.
5. Install the injector gasket and the insulator to the cylinder head.
6. Assemble the delivery pipe and injector assembly to the cylinder head, then finger-tighten the mounting bolts.
7. Assemble the injector holder and the injector washer, then tighten the mounting bolts to the specified torque.

   Tightening torque: 20 – 25 Nm

8. Tighten the delivery pipe and injector assembly mounting bolts to the specified torque in the order shown.

   Tightening torque: 10 – 13 Nm

▶C◀ BACK-UP RING B/O-RING/BACK-UP RING A/FUEL PIPE INSTALLATION

1. Install the back-up rings and the O-ring as shown in the illustration.
   Caution
   (1) Install the back-up ring B facing its cutaway surface toward the opposite side of the O-ring as shown in the illustration.
   (2) Confirm the outer diameter of the back-up ring A. Take care not to install the back-up ring for the fuel pressure sensor by mistake. (Outer diameter of the back-up ring A: 14.8 mm)
2. Apply a small amount of fresh engine oil to the O-ring.

   Caution
   Take care not to let any of the engine oil get inside the fuel pump (high-pressure) or the delivery pipe assembly.

3. Install the fuel pipe into the fuel pump (high pressure) and the delivery pipe ports squarely. Insert the pipe securely, being careful not to twisting it, and then tighten the mounting bolts to the specified torque.

   Tightening torque: 10 – 13 Nm

▶D◀ BACK-UP RING/O-RING INSTALLATION

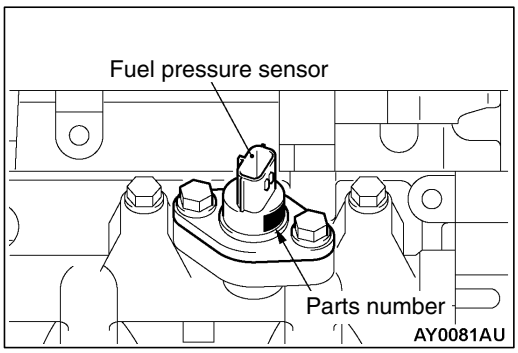
Assemble the back-up ring and the O-ring as shown.

Caution
Be careful not to confuse this back-up ring with back-up ring A for the injector or the fuel pipe. (Back-up ring outer diameter: 15.1 mm)

▶E◀ FUEL PRESSURE SENSOR/FLANGE INSTALLATION

1. Apply a small amount of fresh engine oil to the O-ring.

   Caution
   Be careful not to allow the engine oil to enter the delivery pipe.



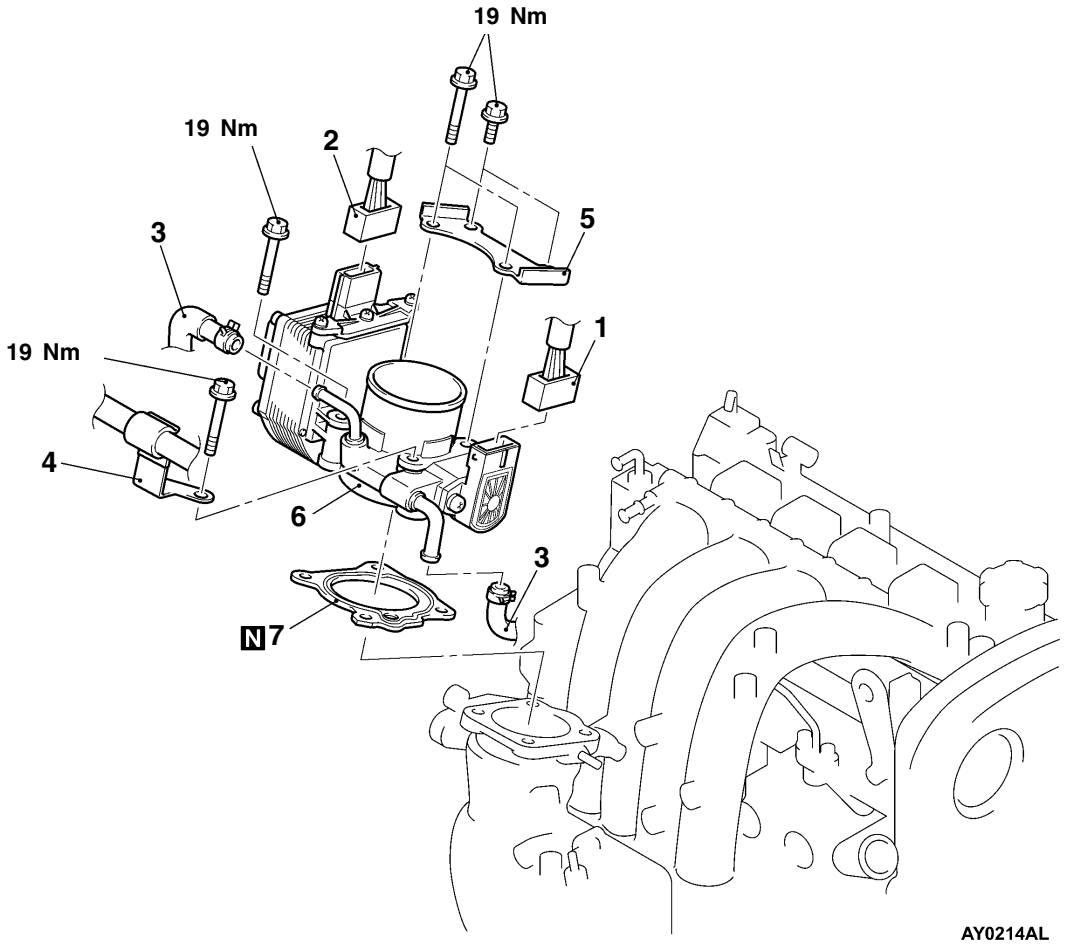
2. Make the part number on the fuel pressure sensor face as shown.
   If the fuel pressure sensor is reused, align the mating marks to install it to the delivery pipe.

   Caution
   If the fuel pressure sensor is replaced, always replace it together with the flange.

THROTTLE BODY

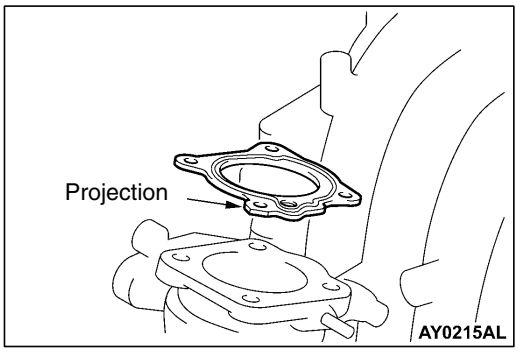
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying
- Resonance Tank Removal and Installation



Removal steps

1. Throttle position sensor connector
2. Throttle control servo connector
3. Water hose connection
4. Brake booster vacuum hose connection
5. Throttle body stay
▶B◀ 6. Throttle body assembly
▶A◀ 7. Throttle body gasket



INSTALLATION SERVICE POINTS

▶A◀ THROTTLE BODY GASKET INSTALLATION

Install the throttle body gasket with its projection facing as shown in the illustration.

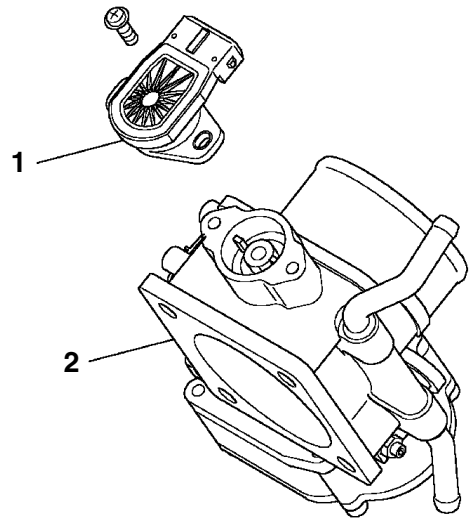
▶B◀ THROTTLE BODY ASSEMBLY INSTALLATION

If the throttle body assembly is replaced, initialize the electronic-controlled throttle valve system.

Initialization

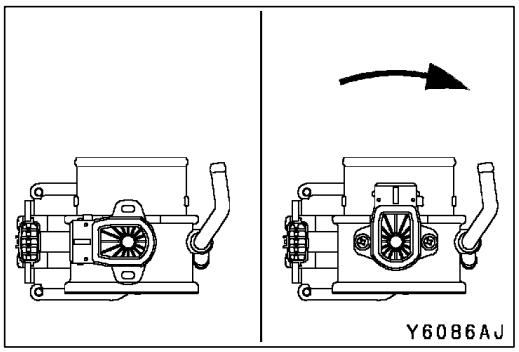
Turn on the ignition switch, and turn it to LOCK (OFF) position within one second. Then leave it for at least ten seconds with the ignition switch in LOCK (OFF) position.

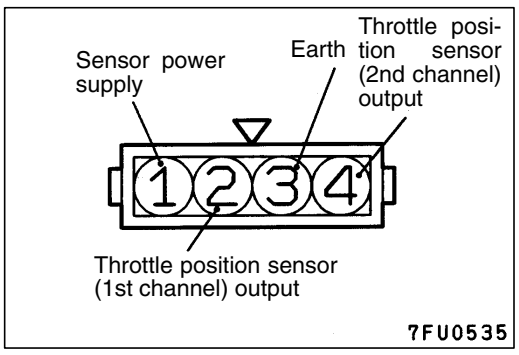
DISASSEMBLY AND REASSEMBLY



Disassembly steps

▶A◀ 1. Throttle position sensor
2. Throttle body





REASSEMBLY SERVICE POINT

▶A◀ THROTTLE POSITION SENSOR INSTALLATION

1. Position the throttle position sensor on the throttle body along the dotted line as shown in the illustration.
2. Rotate the throttle position sensor anticlockwise as shown in the illustration, and then tighten the screws.
3. Measure resistance value between terminal Nos. 1 (sensor power supply) and 2 (throttle position sensor 1st-channel output) as well as 1 (sensor power supply) and 4 (throttle position sensor 2nd-channel output).

Normal condition

Open the throttle valve slowly from the idle position to full-open position.	Resistance value changes smoothly in response to throttle valve opening angle.

4. If the resistance value does not change smoothly, replace the throttle position sensor.

SERVICE BULLETIN

MITSUBISHI MOTORS

QUALITY INFORMATION ANALYSIS
OVERSEAS SERVICE DEPT. MITSUBISHI MOTORS CORPORATION

SERVICE BULLETIN	**No.:** MSB-00E13-001	
	Date: 2001-06-03	**<Model>** / **<M/Y>**

Subject: AVAILABILITY OF DRIVE CYCLE PATTERNS FOR 2001 MODEL CARS

Group: FUEL

Draft No.: 00AL602317

INFORMATION

INTERNATIONAL CAR ADMINISTRATION OFFICE

T.MASAKI-MANAGER
TECHNICAL SERVICE PLANNING

<Model>	<M/Y>
(EC)GALANT(EA0)	01-10
(EC)SPACE STAR	
(EC) SPACE RUNNER/SPACE WAGON(N80, N90)	
(EC)PAJERO SPORT (K80W,K90W)	
(EC)PAJERO/ MONTERO (V60, V70)	
(EC)CARISMA	
(EC)PAJERO PININ (H60,H70)	

1. Description:

On the 2001 model cars equipped with the on-board diagnostics system, the drive cycle patterns have been made available.
Performing the running test of the car using these drive cycle patterns makes it possible to monitor all the diagnosis codes that are required for operation of the car in order to determine if the applicable system is operating properly or not.

2. Applicable Manuals:

Manual	Pub. No.	Language	Page(s)
2001 GALANT Workshop Manual Supplement	PWDE9611-B	(English)	4G64-GDI:13I-8 4G63-MPI:13A-7 6A13-MPI:13A-97
	PWDS9612-B	(Spanish)	
	PWDF9613-B	(French)	
	PWDG9614-B	(German)	
	PWDD9615-B	(Dutch)	
	PWDW9616-B	(Swedish)	
2001 SPACE RUNNER/ SPACE WAGON Workshop Manual Supplement	PWDE9803-C	(English)	4G64-GDI:13A-9 4G63-MPI:13D-12
	PWDS9804-C	(Spanish)	
	PWDF9805-C	(French)	
	PWDG9806-C	(German)	
	PWDD9807-C	(Dutch)	
	PWDW9808-C	(Swedish)	
2001 CARISMA Workshop Manual Supplement	PWDE9502-E	(English)	4G93-GDI:13J-8 4G92-MPI:13A-7
	PWDS9503-E	(Spanish)	
	PWDF9504-E	(French)	
	PWDG9505-E	(German)	
	PWDD9506-E	(Dutch)	
	PWDW9507-E	(Swedish)	
2001 SPACE STAR Workshop Manual Supplement	CMXE99E1-A	(English)	4G93-GDI:13A-9 4G13-MPI:13B-7
2001 COLT Workshop Manual Supplement	PWME9511-C	(English)	4G13-MPI:13A-7 4G93-MPI:13A-88
	PWMS9512-C	(Spanish)	
	PWMF9513-C	(French)	
	PWMG9514-C	(German)	
	PWMD9515-C	(Dutch)	
	PWMW9516-C	(Swedish)	
2001 PAJERO Workshop Manual VOL1	PWJE0001(1/2)	(English)	6G74-GDI:13A-12
2001 MONTERO Workshop Manual VOL1	PWJS0002(1/2)	(Spanish)	
2001 PAJERO/MONTERO Workshop Manual CD-ROM	PWJT0008R	(English)	
		(Spanish)	
		(French)	
		(German)	
2001 PAJERO SPORT Workshop Manual Supplement	PWJE9812-B	(English)	6G72-MPI:13A-8
	PWJS9813-B	(Spanish)	
	PWJF9814-B	(French)	
	PWJG9815-B	(German)	
2001 PAJERO PININ Workshop Manual Supplement	CKRE99E1-A	(English)	4G93-GDI: 13A-9

DRIVE CYCLE

Performing the running test of the car using the following five drive cycle patterns makes it possible to monitor all the diagnosis codes that are required for operation of the car in order to determine if the applicable system is operating properly or not.
In other words, doing such a drive allows to regenerate any kind of trouble which involves illuminating the Engine Warning Lamp (Check Engine Lamp) and to verify the repair procedure has eliminated the trouble [the Engine Warning Lamp (Check Engine Lamp) is no longer illuminated].

Caution
Two technicians should always be in the vehicle when carrying out a test drive.

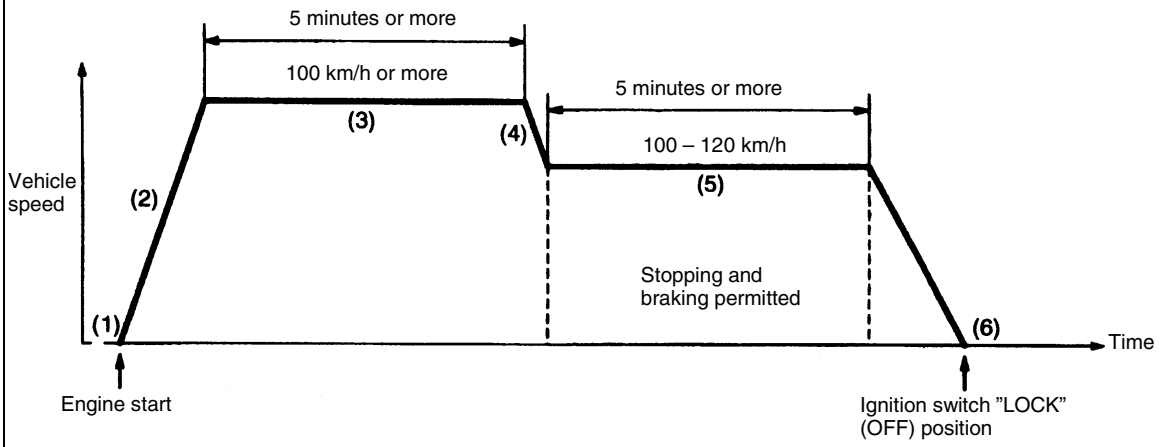
NOTE
Check that the diagnosis code is not output before traveling in the Drive cycle pattern. Erase the diagnosis code if it has been output.

DRIVE CYCLE PATTERN LIST

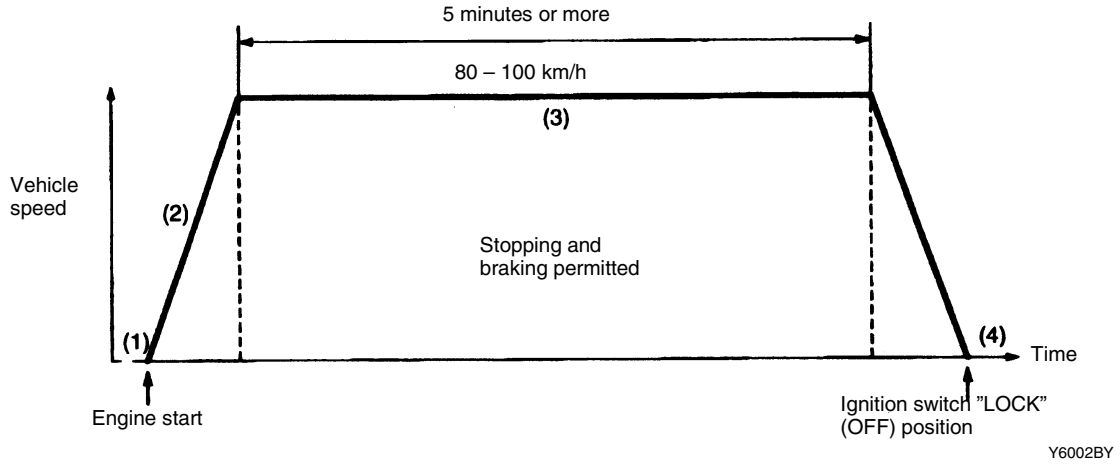
PROCEDURE	MONITOR ITEM	DIAGNOSIS CODE
1	Catalytic converter monitor	P0420
2	Heated oxygen sensor <front> monitor	P0130
3	Fuel trim monitor	P0170
4	Feed back monitor	P0125
5	Other monitor	P0136, P0201, P0202, P0203, P0204, P0300, P0301, P0302, P0303, P0304, P0325

NOTE
The vehicle speed sensor (P0500) and the power steering fluid pressure switch (P0551) are used to determine if the system is operating properly or not through use of the Data List function of the MUT-II.

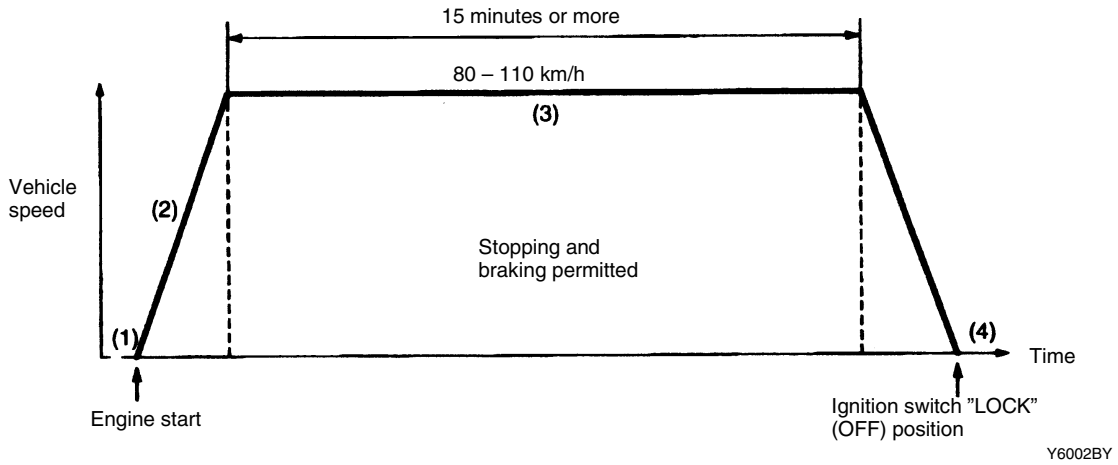
PROCEDURE 1

Monitor item	**CATALYTIC CONVERTER MONITOR (P0420)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 10 minutes or more. 
Inspection conditions	• Atmospheric temperature :-10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 100 km/h or more. 3. Travel for 5 minutes or more while keeping the vehicle speed is 100 km/h or more. 4. Decelerate until the vehicle speed is 100 – 120 km/h or less. 5. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 100 – 120 km/h and travel for 5 minutes or more. • Stopping and braking during this operation are permitted. 6. Return the vehicle to the shop, then turn the ignition switch “LOCK” (OFF) position.

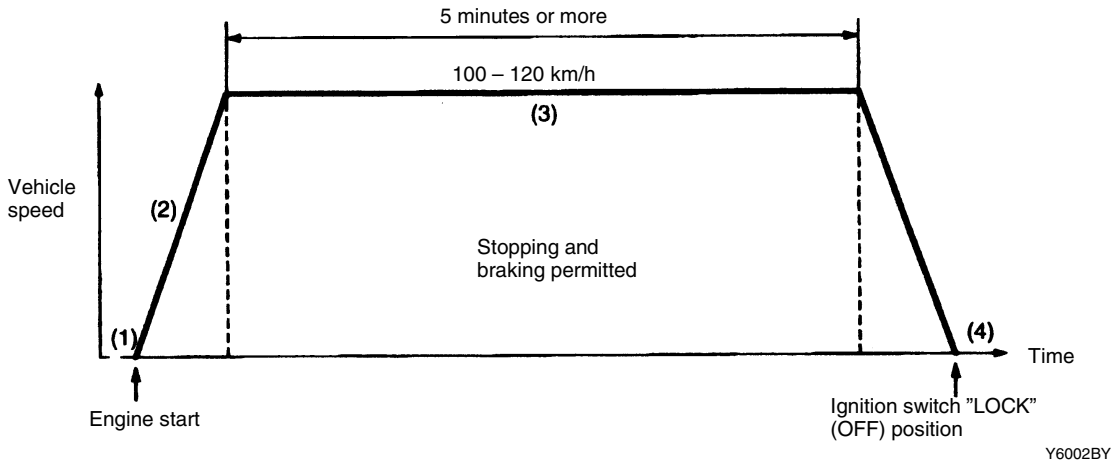
PROCEDURE 2

OXYGEN SENSOR <FRONT> MONITOR (P0130)	
Drive cycle pattern	One trip monitor [from start to ignition switch to "LOCK" (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 5 minutes or more. 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch "ON" position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 80 – 100 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 80 – 100 km/h and travel for 5 minutes or more. • Stopping and braking during this operation are permitted. Keep the accelerator pedal opening degree constant for 1 minute or more after each acceleration. 4. Return the vehicle to the shop, then turn the ignition switch "LOCK" (OFF) position.

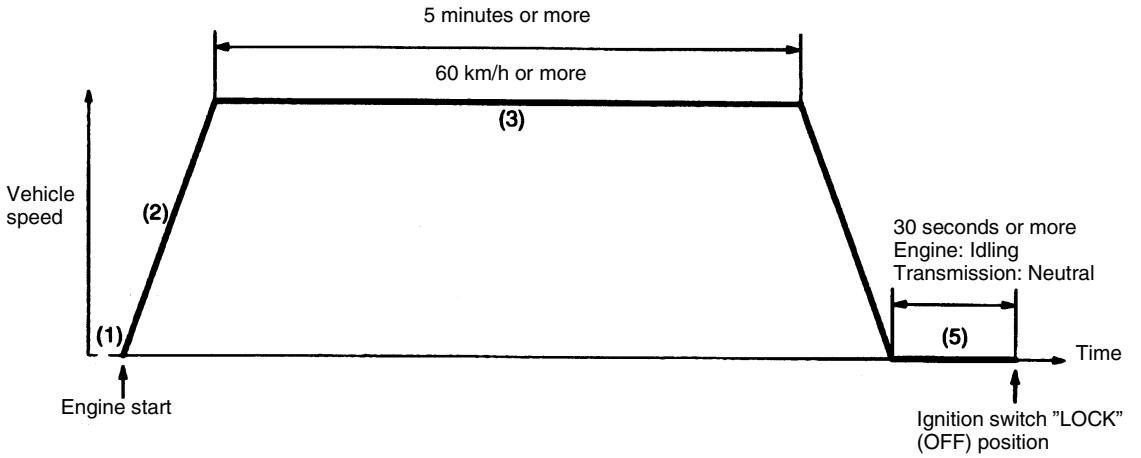
PROCEDURE 3

monitor item	**FUEL TRIM MONITOR (P0170)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 15 minutes or more. 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 80 – 110 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 80 – 110 km/h and travel for 15 minutes or more. 4. Return the vehicle to the shop, then turn the ignition switch “LOCK” (OFF) position.

PROCEDURE 4

monitor item	**FEED BACK MONITOR (PO125)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 5 minutes or more. 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 100 – 120 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 100 – 120 km/h and travel for 5 minutes or more. 4. Return the vehicle to the shop, then turn the ignition switch “LOCK” (OFF) position.

PROCEDURE 5

monitor item	**OTHER MONITOR**
Diagnosis code No.	P0136, P0201, P0202, P0203, P0204, P0300, P0301, P0302, P0303, P0304, P0325
Drive cycle pattern	One trip monitor [from start to ignition switch to "LOCK" (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 6 minutes or more.  Y6009BY
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch "ON" position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 60 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 60km/h or more and travel for 5 minutes or more. 4. Return the vehicle to the shop 5. After stopping the vehicle, continue idling for 30 seconds, and then turn the ignition switch to "LOCK" (OFF) position. • A/C switch : OFF • Light and all accessories : OFF • Transmission : Neutral

DRIVE CYCLE

Performing the running test of the car using the following five drive cycle patterns makes it possible to monitor all the diagnosis codes that are required for operation of the car in order to determine if the applicable system is operating properly or not.
In other words, doing such a drive allows to regenerate any kind of trouble which involves illuminating the Engine Warning Lamp (Check Engine Lamp) and to verify the repair procedure has eliminated the trouble [the Engine Warning Lamp (Check Engine Lamp) is no longer illuminated].

Caution
Two technicians should always be in the vehicle when carrying out a test drive.

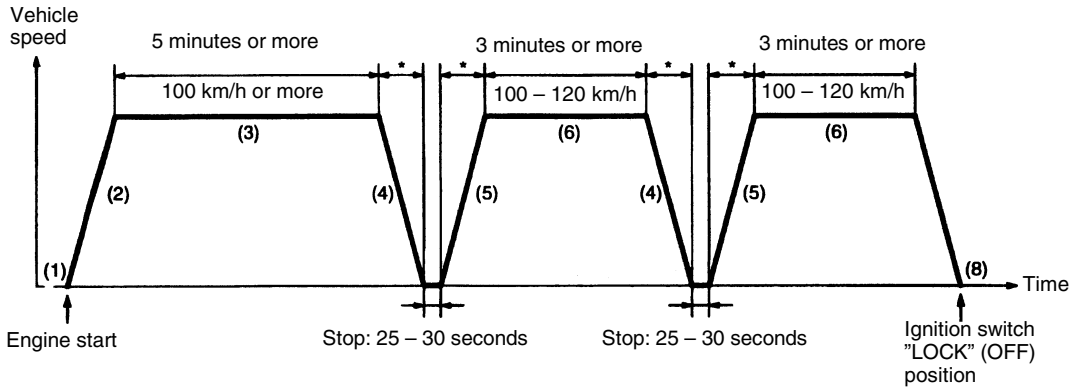
NOTE
Check that the diagnosis code is not output before traveling in the Drive cycle pattern. Erase the diagnosis code if it has been output.

DRIVE CYCLE PATTERN LIST

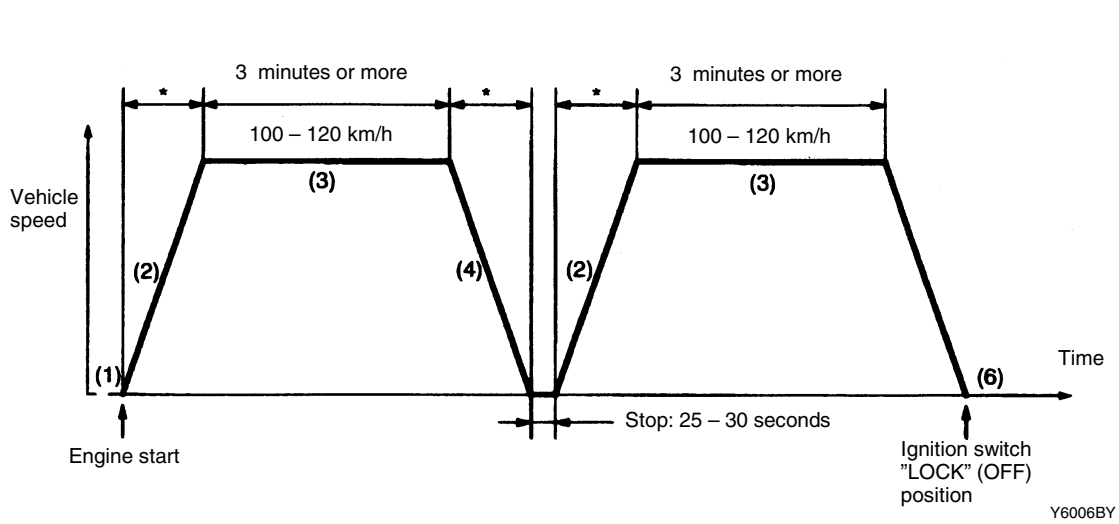
PROCEDURE	MONITOR ITEM	DIAGNOSIS CODE
1	Catalytic converter monitor	P0420
	Catalyst temperature sensor <M/T> monitor (DX only)	P0425
2	Heated oxygen sensor <front> monitor	P0130
3	Fuel trim monitor	P0170
4	Feed back monitor	P0125
5	Other monitor	P0136, P0201, P0202, P0203, P0204, P0300, P0301, P0302, P0303, P0304, P0325

NOTE
The vehicle speed sensor (P0500) and the power steering fluid pressure switch (P0551) are used to determine if the system is operating properly or not through use of the Data List function of the MUT-II.

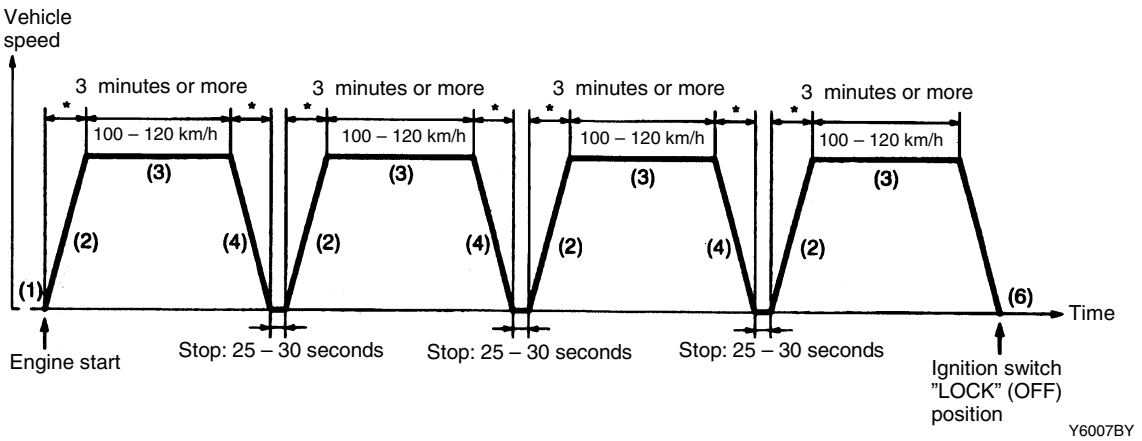
PROCEDURE 1

monitor item	**CATALYTIC CONVERTER MONITOR (P0420)** **CATALYTIC TEMPERATURE SENSOR <M/T> MONITOR (P0425)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 12 minutes or more. *: 1 minute or less  Y6004BY
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 100 km/h. 3. Travel for 5 minutes or more while keeping the vehicle speed is 100 km/h or more. 4. Decelerate until the vehicle speed is 0 km/h within 1 minute and stop for 25 – 30 seconds. 5. Accelerate until the vehicle speed at 100 – 120 km/h within 1 minute. 6. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 100 - 120 km/h and travel for 3 minutes or more. 7. Repeat the above procedure 4 – 6. 8. Return the vehicle to the shop, then turn the ignition switch ”LOCK” (OFF) position.

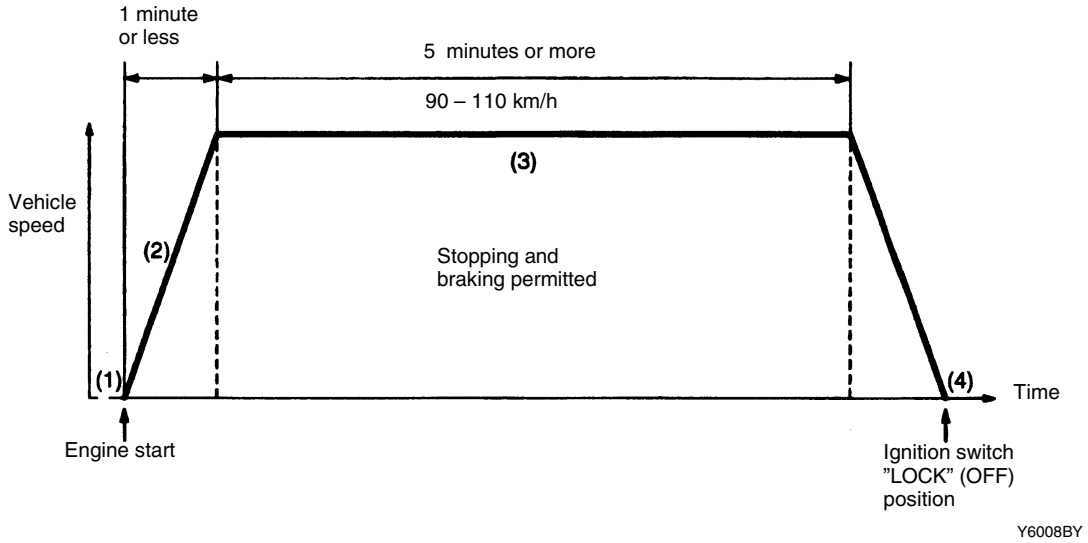
PROCEDURE 2

monitor item	**OXYGEN SENSOR <FRONT> MONITOR (P0130)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 7 minutes or more. 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 100 – 120 km/h within 1 minute. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 100 – 120 km/h and travel for 3 minutes or more. 4. Decelerate until the vehicle speed is 0 km/h within 1 minute and stop for 25 – 30 seconds. 5. Repeat the above procedure 2 – 3. 6. Return the vehicle to the shop, then turn the ignition switch “LOCK” (OFF) position.

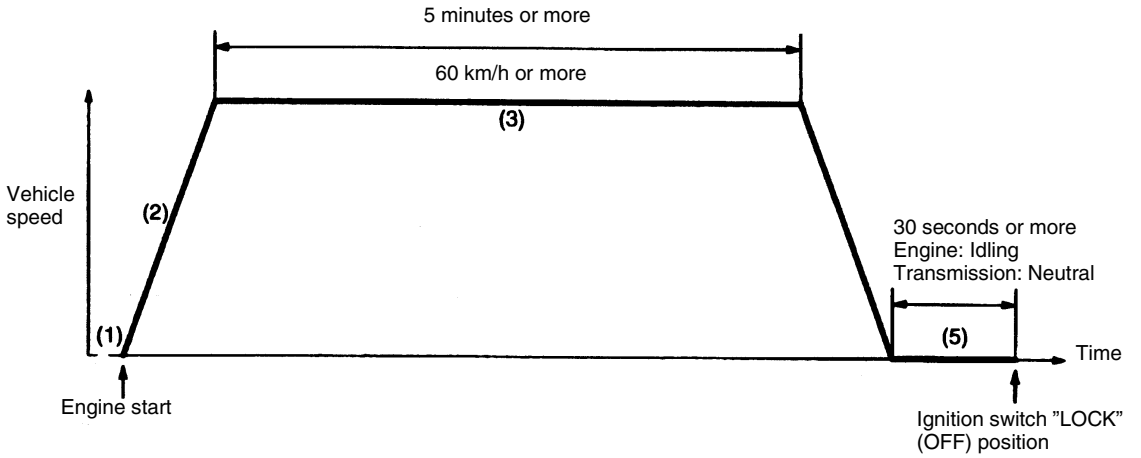
PROCEDURE 3

monitor item	**FUEL TRIM MONITOR (P0170)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 13 minutes or more. *: 1 minute or less 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 100 – 120 km/h within 1 minute. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 100 – 120 km/h and travel for 3 minutes or more. 4. Decelerate until the vehicle speed is 0 km/h within 1 minute and stop for 25 – 30 seconds. 5. Repeat the above procedure 2 - 4 two times and 2 - 3 one time. 6. Return the vehicle to the shop, then turn the ignition switch “LOCK” (OFF) position.

PROCEDURE 4

monitor item	**FEED BACK MONITOR (P0125)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 5 minutes or more. 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 90 – 110 km/h within 1 minute. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 90 – 110 km/h and travel for 5 minutes or more. 4. Return the vehicle to the shop, then turn the ignition switch “LOCK” (OFF) position.

PROCEDURE 5

OTHER MONITOR	
Diagnosis code No.	P0136, P0201, P0202, P0203, P0204, P0300, P0301, P0302, P0303, P0304, P0325
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 6 minutes or more. 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 60 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 60km/h or more and travel for 5 minutes or more. 4. Return the vehicle to the shop 5. After stopping the vehicle, continue idling for 30 seconds, and then turn the ignition switch to ”LOCK” (OFF) position. • A/C switch : OFF • Light and all accessories : OFF • Transmission : Neutral

DRIVE CYCLE

Performing the running test of the car using the following five drive cycle patterns makes it possible to monitor all the diagnosis codes that are required for operation of the car in order to determine if the applicable system is operating properly or not.
In other words, doing such a drive allows to regenerate any kind of trouble which involves illuminating the Engine Warning Lamp (Check Engine Lamp) and to verify the repair procedure has eliminated the trouble [the Engine Warning Lamp (Check Engine Lamp) is no longer illuminated].

Caution
Two technicians should always be in the vehicle when carrying out a test drive.

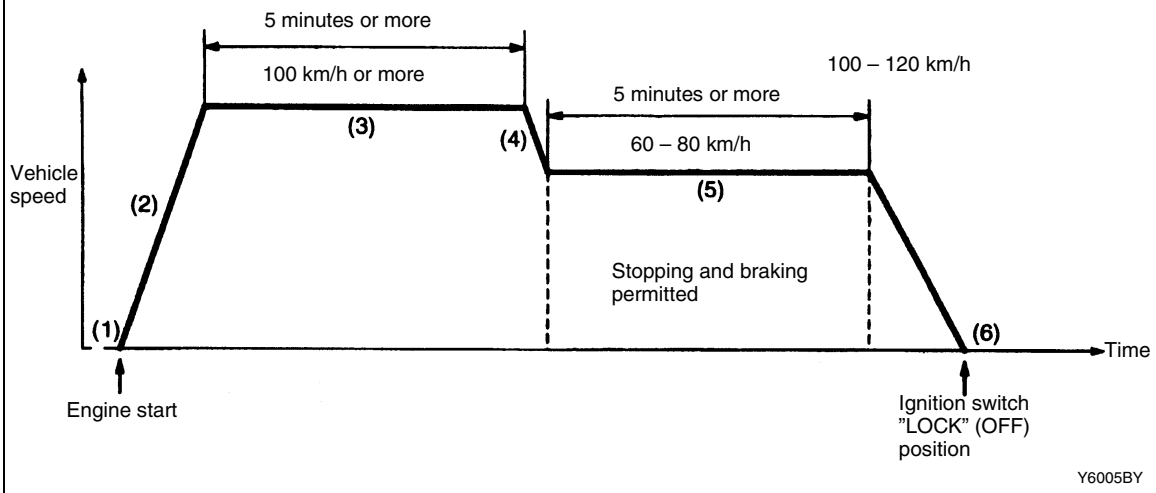
NOTE
Check that the diagnosis code is not output before traveling in the Drive cycle pattern. Erase the diagnosis code if it has been output.

DRIVE CYCLE PATTERN LIST

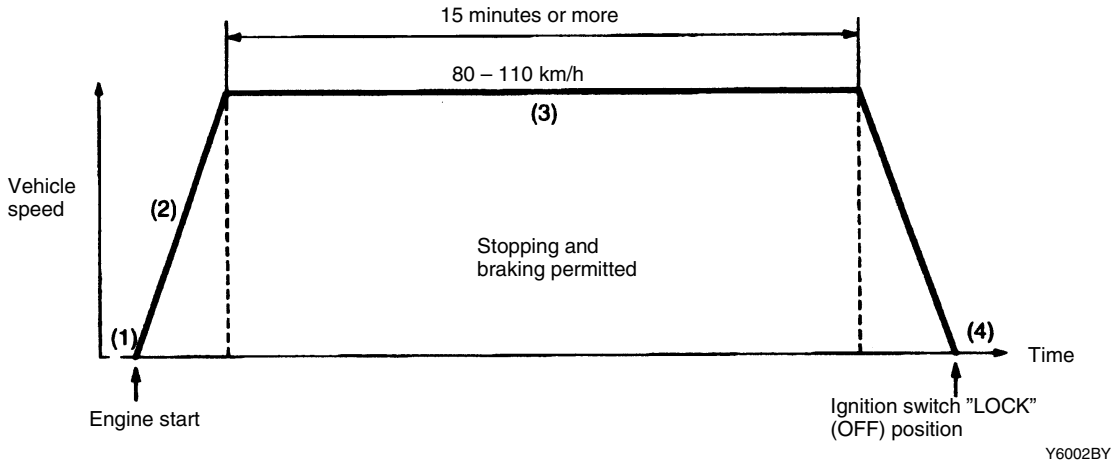
PROCEDURE	MONITOR ITEM	DIAGNOSIS CODE
1	Catalytic converter monitor	P0420
	Heated oxygen sensor <front> monitor	P0130
2	Fuel trim monitor	P0170
3	Feed back monitor	P0125
4	Other monitor	P0136, P0201, P0202, P0203, P0204, P0205, P0206, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0325

NOTE
The vehicle speed sensor (P0500) and the power steering fluid pressure switch (P0551) are used to determine if the system is operating properly or not through use of the Data List function of the MUT-II.

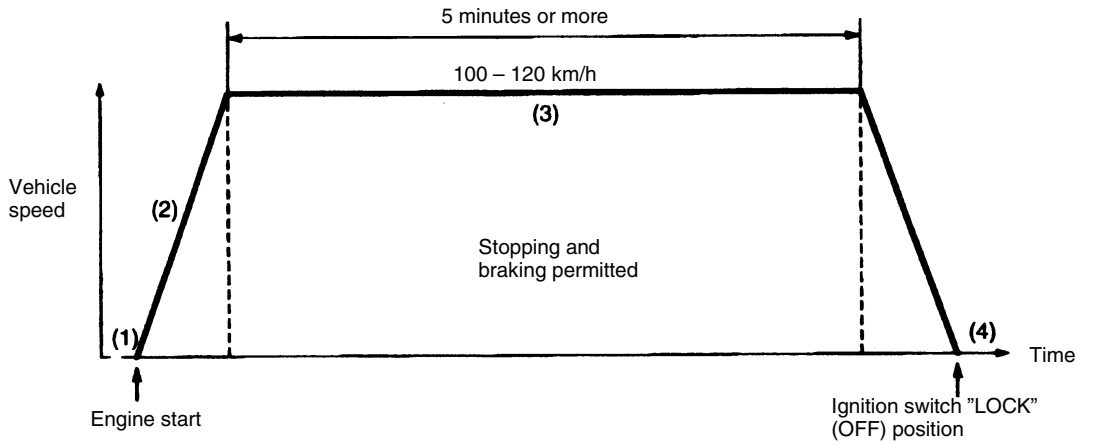
PROCEDURE 1

monitor item	**CATALYTIC CONVERTER MONITOR (P0420)** **OXYGEN SENSOR <FRONT> MONITOR (P0130)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 10 minutes or more. 
Inspection conditions	• Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 100 km/h or more. 3. Travel for 5 minutes or more while keeping the vehicle speed is 100 km/h or more. 4. Decelerate until the vehicle speed is 60 - 80 km/h or less. 5. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 60 - 80 km/h and travel for 5 minutes or more. • Stopping and braking during this operation are permitted. 6. Return the vehicle to the shop, then turn the ignition switch ”LOCK” (OFF) position.

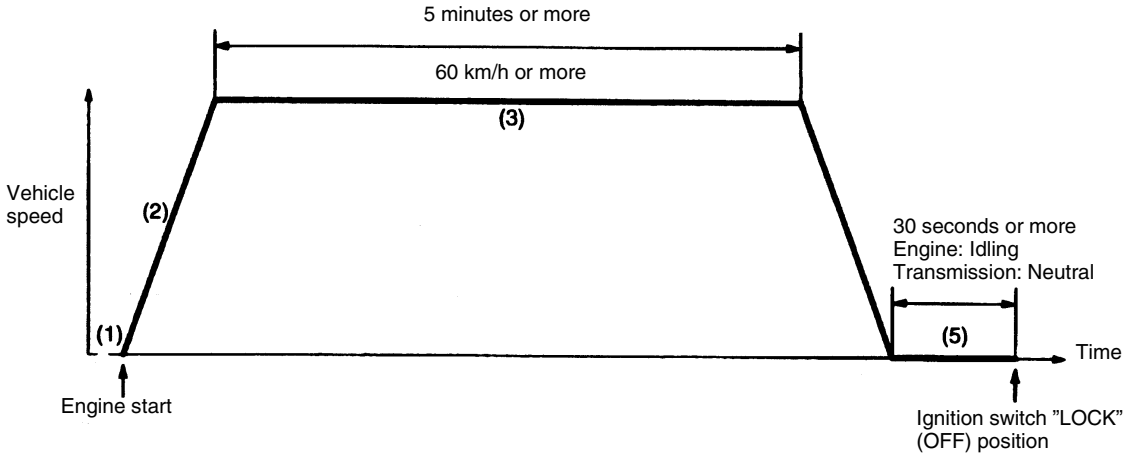
PROCEDURE 2

monitor item	**FUEL TRIM MONITOR (P0170)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 15 minutes or more. 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 80 – 110 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 80 – 110 km/h and travel for 15 minutes or more. 4. Return the vehicle to the shop, then turn the ignition switch “LOCK” (OFF) position.

PROCEDURE 3

monitor item	**FEED BACKK MONITOR (P0125)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 5 minutes or more. 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 100 – 120 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 100 – 120 km/h and travel for 5 minutes or more. 4. Return the vehicle to the shop, then turn the ignition switch “LOCK” (OFF) position.

PROCEDURE 4

monitor item	**OTHER MONITOR**
Diagnosis code No.	P0136, P0201, P0202, P0203, P0204, P0205, P0206, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0325
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 6 minutes or more.  Y6009BY
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 60 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 60 km/h or more and travel for 5 minutes or more. 4. Return the vehicle to the shop 5. After stopping the vehicle, continue idling for 30 seconds, and then turn the ignition switch to ”LOCK” (OFF) position. • A/C switch : OFF • Light and all accessories: OFF • Transmission : Neutral

DRIVE CYCLE

Performing the running test of the car using the following five drive cycle patterns makes it possible to monitor all the diagnosis codes that are required for operation of the car in order to determine if the applicable system is operating properly or not.
In other words, doing such a drive allows to regenerate any kind of trouble which involves illuminating the Engine Warning Lamp (Check Engine Lamp) and to verify the repair procedure has eliminated the trouble [the Engine Warning Lamp (Check Engine Lamp) is no longer illuminated].

Caution
Two technicians should always be in the vehicle when carrying out a test drive.

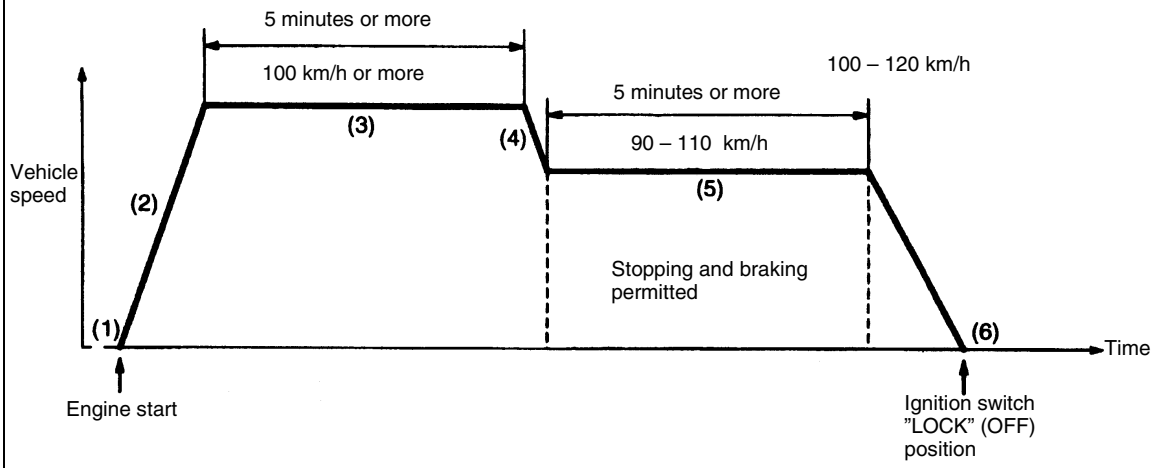
NOTE
Check that the diagnosis code is not output before traveling in the Drive cycle pattern. Erase the diagnosis code if it has been output.

DRIVE CYCLE PATTERN LIST

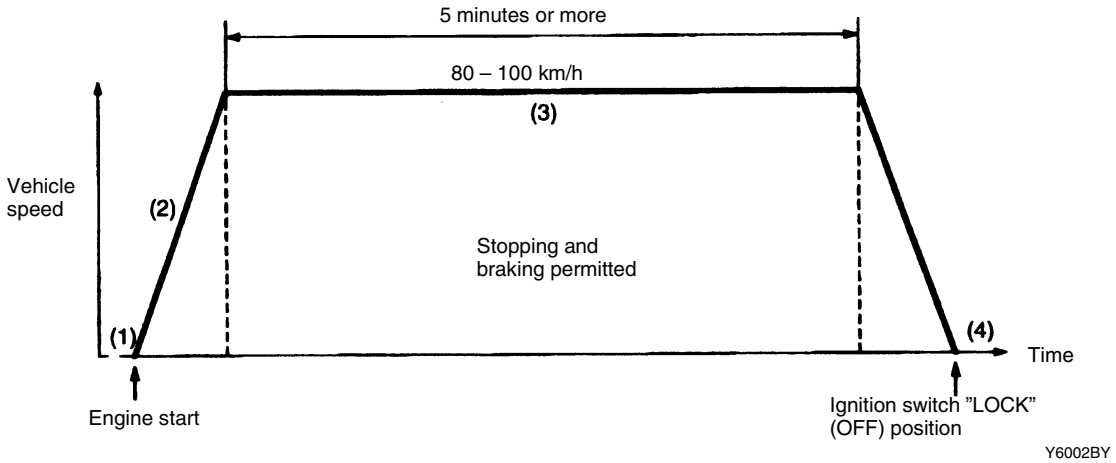
PROCEDURE	MONITOR ITEM	DIAGNOSIS CODE
1	Catalytic converter monitor	P0420
2	Heated oxygen sensor <front> monitor	P0130
3	Fuel trim monitor	P0170
4	Feed back monitor	P0125
5	Other monitor	P0136, P0201, P0202, P0203, P0204, P0300, P0301, P0302, P0303, P0304, P0325

NOTE
The vehicle speed sensor (P0500) and the power steering fluid pressure switch (P0551) are used to determine if the system is operating properly or not through use of the Data List function of the MUT-II.

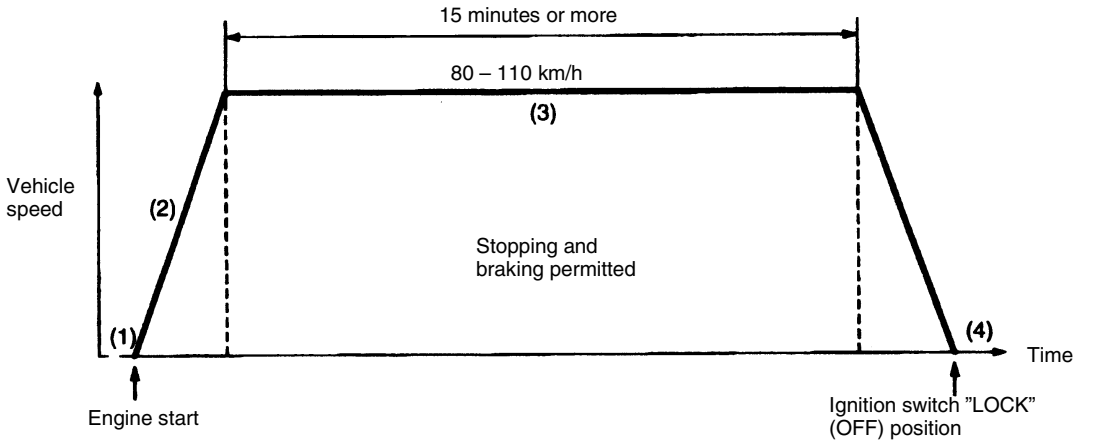
PROCEDURE 1

monitor item	**CATALYTIC CONVERTER MONITOR (P0420)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 10 minutes or more. 
Inspection conditions	• Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 100 km/h or more. 3. Travel for 5 minutes or more while keeping the vehicle speed is 100 km/h or more. 4. Decelerate until the vehicle speed is 90 –110 km/h or less. 5. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 90 - 110 km/h and travel for 5 minutes or more. • Stopping and braking during this operation are permitted. 6. Return the vehicle to the shop, then turn the ignition switch ”LOCK” (OFF) position.

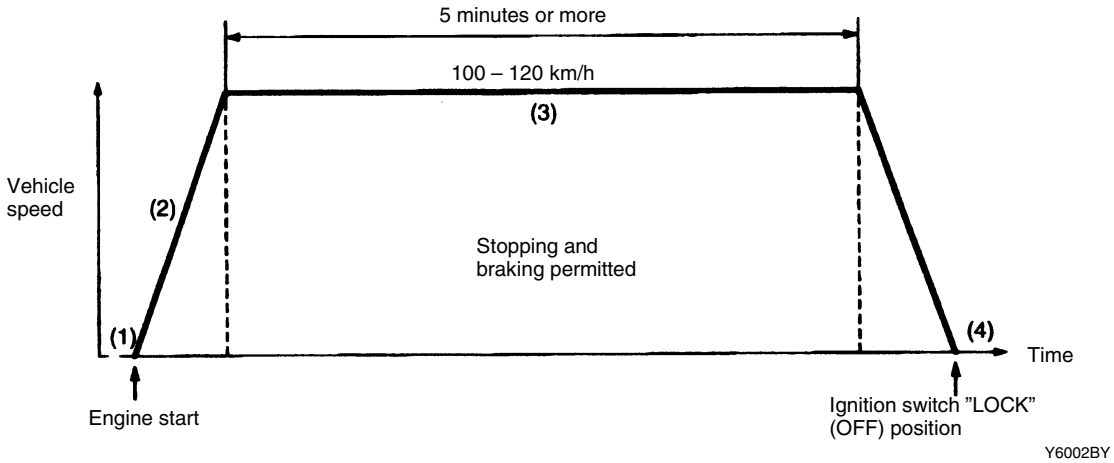
PROCEDURE 2

OXYGEN SENSOR <FRONT> MONITOR (P0130)	
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 5 minutes or more. 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 80 – 100 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 80 – 100 km/h and travel for 5 minutes or more. • Stopping and braking during this operation are permitted. Keep the accelerator pedal opening degree constant for 1 minute or more after each acceleration. 4. Return the vehicle to the shop, then turn the ignition switch “LOCK” (OFF) position.

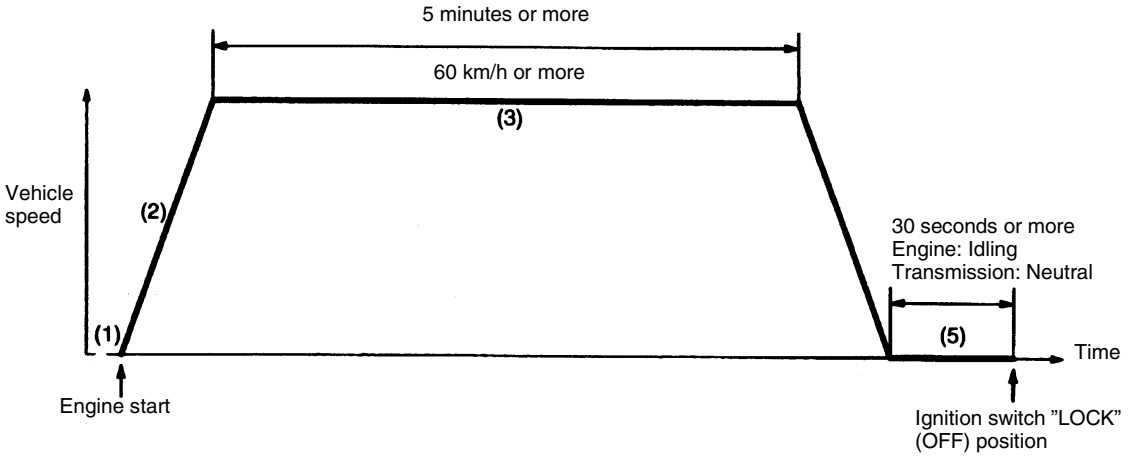
PROCEDURE 3

Monitor item	**FUEL TRIM MONITOR (P0170)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 15 minutes or more. 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 80 – 100 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 80 – 110 km/h and travel for 15 minutes or more. 4. Return the vehicle to the shop, then turn the ignition switch “LOCK” (OFF) position.

PROCEDURE 4

Monitor item	**FEED BACK MONITOR (P0125)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 5 minutes or more. 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 100 – 120 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 100 – 120 km/h and travel for 15 minutes or more. 4. Return the vehicle to the shop, then turn the ignition switch “LOCK” (OFF) position.

PROCEDURE 5

monitor item	**OTHER MONITOR**
Diagnosis code No.	P0136, P0201, P0202, P0203, P0204, P0300, P0301, P0302, P0303, P0304, P0325
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 6 minutes or more. 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 60 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 60 km/h or more and travel for 5 minutes or more. 4. Return the vehicle to the shop 5. After stopping the vehicle, continue idling for 30 seconds, and then turn the ignition switch to ”LOCK” (OFF) position. • A/C switch : OFF • Light and all accessories: OFF • Transmission : Neutral

DRIVE CYCLE

Performing the running test of the car using the following five drive cycle patterns makes it possible to monitor all the diagnosis codes that are required for operation of the car in order to determine if the applicable system is operating properly or not.
In other words, doing such a drive allows to regenerate any kind of trouble which involves illuminating the Engine Warning Lamp (Check Engine Lamp) and to verify the repair procedure has eliminated the trouble [the Engine Warning Lamp (Check Engine Lamp) is no longer illuminated].

Caution
Two technicians should always be in the vehicle when carrying out a test drive.

NOTE
Check that the diagnosis code is not output before traveling in the Drive cycle pattern. Erase the diagnosis code if it has been output.

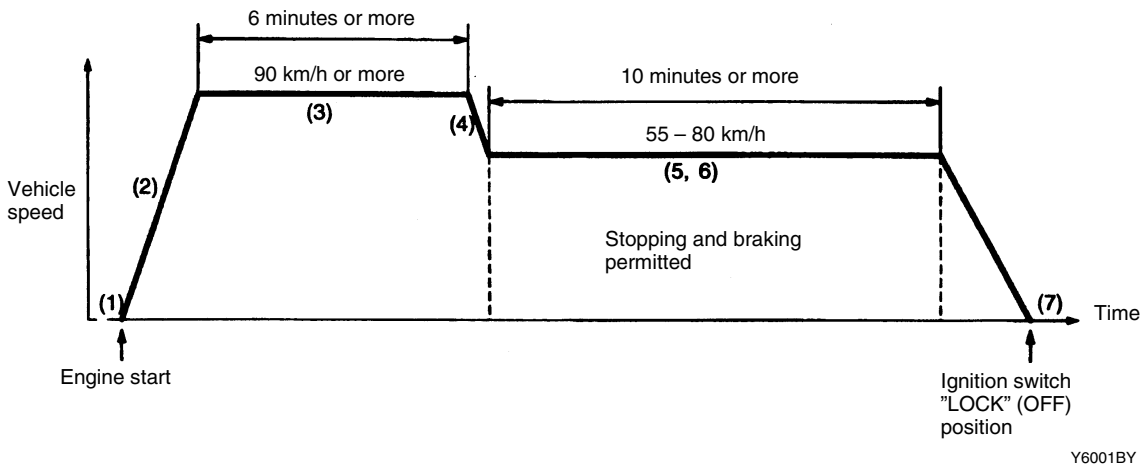
DRIVE CYCLE PATTERN LIST

PROCEDURE	MONITOR ITEM	DIAGNOSIS CODE (DTC)
1	Catalytic converter monitor	P0420*[1], P0421*[2], P0431*[3],
2	Heated oxygen sensor <front> monitor	P0130
3	Other monitor	P0136, P0201, P0202, P0203, P0204, P0205*[3], P0300, P0301, P0302, P0303, P0304, P0305*[3], P0306*[3], P0325*[4]

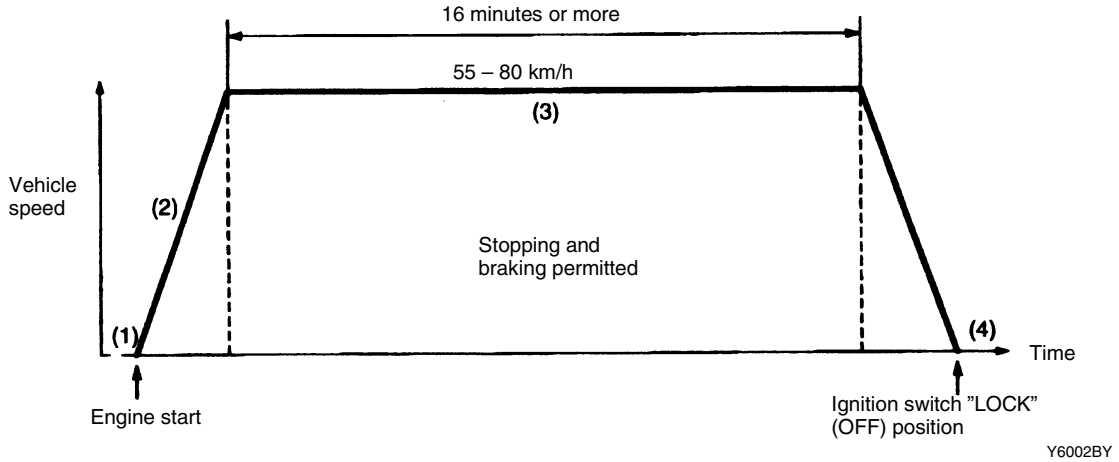
NOTE
*1: 4G63
*2: 4G13, 4G92, 4G93, 6A13, 6G72
*3: 6A13, 6G72
*4: 4G13, 4G63, 4G92, 4G93, 6A13

GDI - Troubleshooting

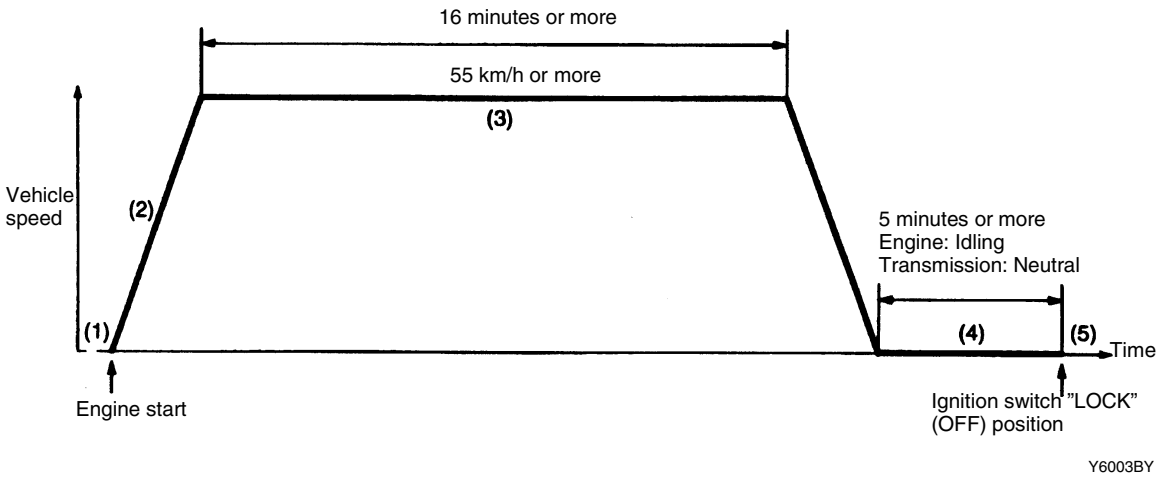
PROCEDURE 1

CATALYTIC CONVERTER MONITOR	
Diagnosis code No.	P0420, P0421, P0431
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 16 minutes or more. 
Inspection conditions	• Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 90 km/h or more. 3. Travel for 6 minutes or more while keeping the vehicle speed is 90 km/h or more. 4. Decelerate until the vehicle speed is 80 km/h or less. 5. While traveling at 55 – 80 km/h for 10 minutes or more, fully close the throttle at least once in 2 minutes and decelerate for 10 seconds or more. • Do not repeat deceleration too often. • Vehicle speed may go below 55 km/h after the deceleration. • Stopping and braking during this operation are permitted. (If stopped or drive at 55 km/h or less for more than 5 minutes the monitoring may be stopped. In this case please restart monitoring from the beginning.) 6. After completing the above deceleration, bring the vehicle speed back to 55 – 80 km/h and keep it in the range until starting the deceleration again. • Repeat the above deceleration at least 5 times. 7. Return the vehicle to the shop, the turn the ignition switch ”LOCK” (OFF) position.

PROCEDURE 2

OXYGEN SENSOR <FRONT> MONITOR	
Diagnosis code No.	P0130
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 16 minutes or more. 
Inspection conditions	• Engine coolant temperature : After engine warm up. • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 55 – 80 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 55 –80 km/h and travel for 16 minutes or more. • Stopping and braking during this operation are permitted. 4. Return the vehicle to the shop, then turn the ignition switch “LOCK” (OFF) position.

PROCEDURE 3

OTHER MONITOR	
Diagnosis code No.	P0136, P0201, P0202, P0203, P0204, P0205, P0206, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0325, P0500, P0551
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 21 minutes or more. 
Inspection conditions	• Engine coolant temperature : After engine warm up. • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 55 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 55 km/h or more and travel for 16 minutes or more. 4. Return the vehicle to the shop 5. After stopping the vehicle, continue idling for 5 minutes, and then turn the ignition switch to ”LOCK” (OFF) position.

FUEL SUPPLY

FUEL SUPPLY

CONTENTS

FUEL TANK **2**

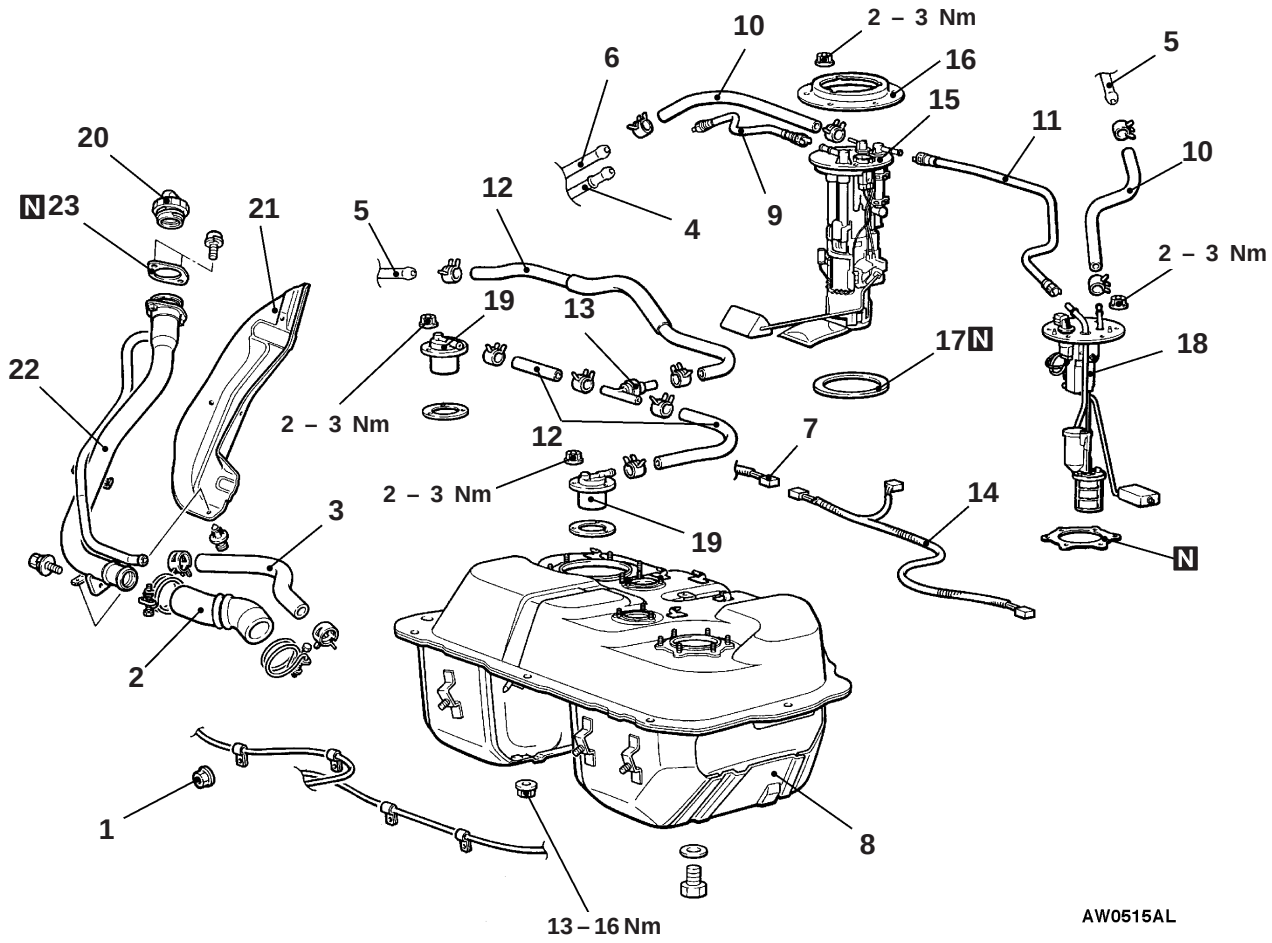
Fuel Pump Module 4

FUEL TANK

REMOVAL AND INSTALLATION

Pre-removal Operation
- Fuel Draining
- Reduce the Inner Pressure of Fuel Line and Hose (Refer to GROUP 13 – On-vehicle Service.)
- Center Exhaust Pipe Removal (Refer to GROUP 15.)
- Rear Propeller Shaft Removal (Refer to GROUP 25.)

Post-installation Operation
- Fuel Supplying.
- Checking for Fuel Leaks
- Rear Propeller Shaft Installation (Refer to GROUP 25.)
- Center Exhaust Pipe Installation (Refer to GROUP 15.)



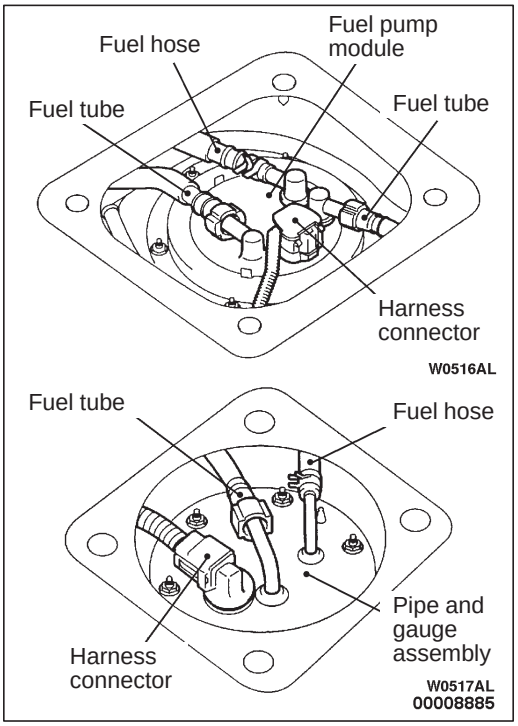
Removal steps

1. Parking brake cable clamp mounting nut
2. Filler hose
3. Leveling hose
▶A◀ 4. High pressure tube connection
5. Vapour hose connection
6. Return hose connection
7. Harness connector connection
8. Fuel tank assembly
▶A◀ 9. High pressure tube
10. Return hose
▶A◀ 11. Suction tube
12. Vapour hose
13. Fuel check valve
14. Fuel tank harness
15. Fuel pump module
16. Retainer plate
17. Packing
18. Pipe and gauge assembly
19. Valve assembly
20. Fuel filler cap
21. Filler neck protector
22. Filler neck assembly
23. Packing

INSTALLATION SERVICE POINT

▶A◀ SUCTION TUBE/HIGH PRESSURE TUBE CONNECTION

Caution
After the connection, pull the high pressure tube and suction tube gently in the direction of removal to check that they are firmly connected.



INSPECTION

FUEL PUMP MODULE/PIPE AND GAUGE ASSEMBLY REPLACEMENT

1. Remove the rear seat cushion.
2. Remove the service hole cover.
3. Disconnect the harness connector, fuel hose and tube.
4. Unscrew the mounting nuts, and then remove the pipe and gauge assembly and fuel pump module.
5. Install the pipe and gauge assembly and fuel pump module. Tighten the mounting nuts to the specified torque.

   Specified torque: 2 – 3 Nm

6. Connect the fuel hose, fuel tube and harness connector.

   Caution
   After the connection, pull the high pressure tube and suction tube gently in the direction of removal to check that they are firmly connected.

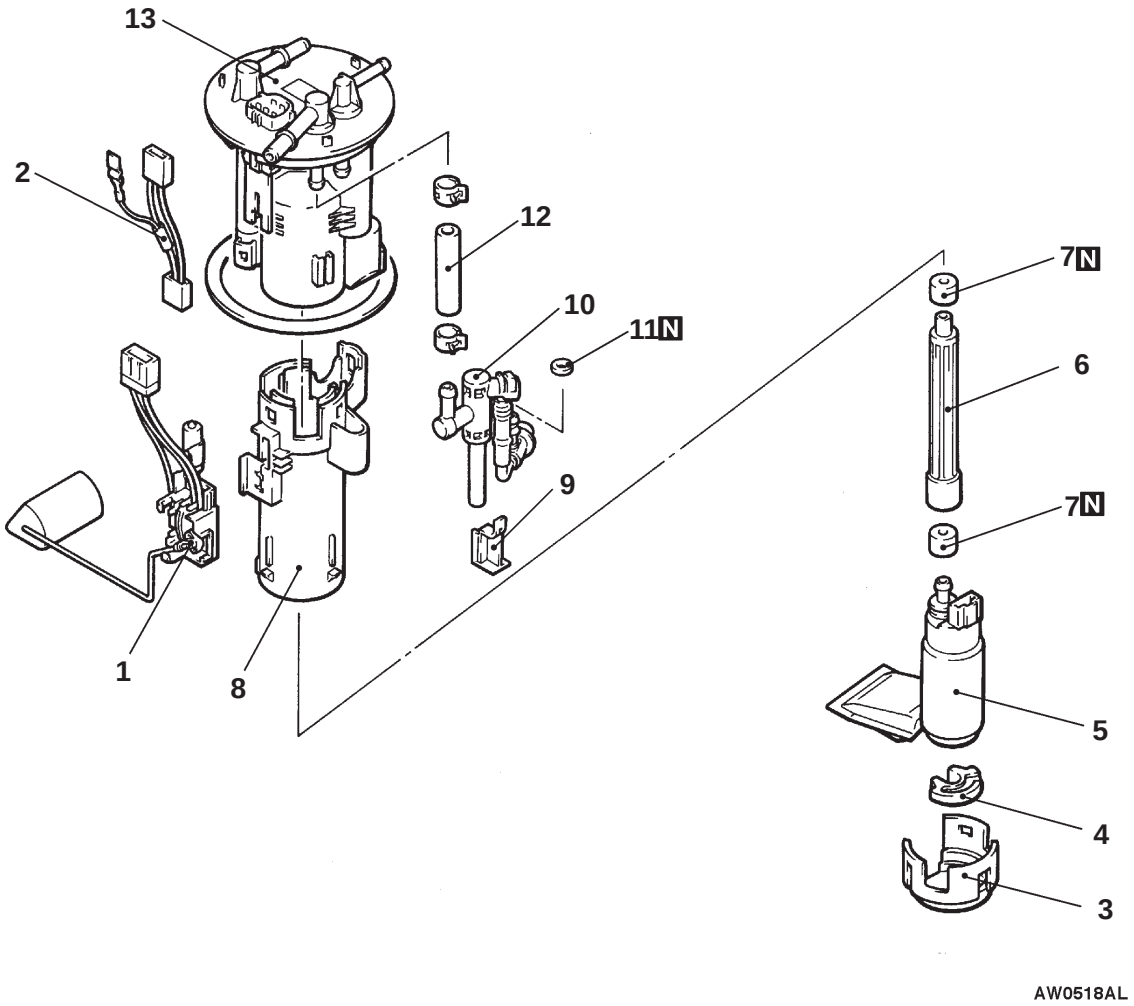
7. Install the service hole cover.
8. Install the rear seat cushion.

FUEL GAUGE UNIT CHECK

Refer to GROUP 54 – Combination Meter.

DISASSEMBLY AND REASSEMBLY

FUEL PUMP MODULE



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Disassembly steps

1. Fuel gauge unit
2. Gauge harness
3. Bracket
4. Cushion
5. Fuel pump (low-pressure)
6. Fuel tube
▶A◀ 7. Grommet
8. Housing
9. Stopper
10. Fuel pressure regulator (low-pressure) and assist pump assembly
▶A◀ 11. O-ring
12. Fuel hose
13. Fuel filter assembly

REASSEMBLY SERVICE POINT

▶A◀ O-RING/GROMMET INSTALLATION

Apply a fuel to O-ring and grommet before installing them, to prevent them from being damaged or twisted.

GROUP 13B
FUEL SUPPLY

GENERAL

OUTLINE OF CHANGES

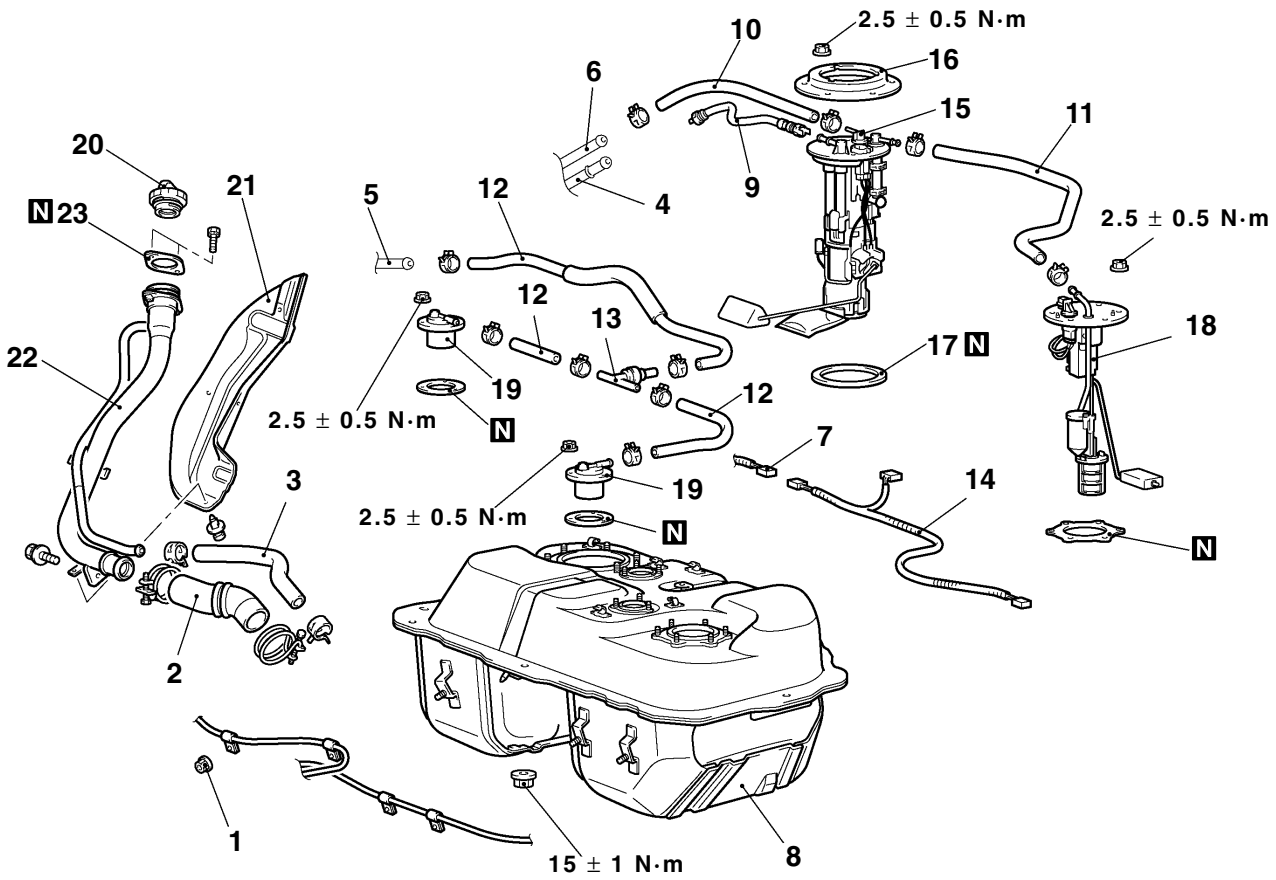
The following service procedures have been established due to the addition of the vehicles with 4G93-MPI engine.

FUEL TANK

REMOVAL AND INSTALLATION

Pre-removal Operation
- Fuel Draining
- Reduce the Inner Pressure of Fuel Line and Hose (Refer to GROUP 13C – On-vehicle Service.)
- Center Exhaust Pipe Removal (Refer to GROUP 15.)
- Rear Propeller Shaft Removal

Post-installation Operation
- Fuel Supplying.
- Checking for Fuel Leaks
- Rear Propeller Shaft Installation
- Center Exhaust Pipe Installation (Refer to GROUP 15.)



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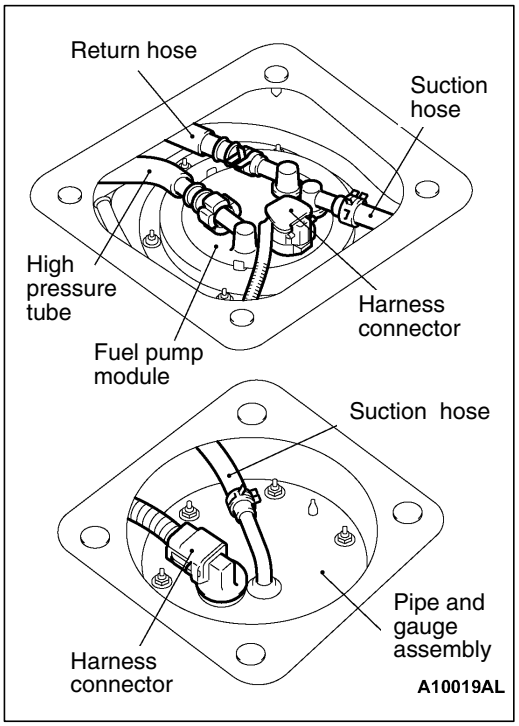
Removal steps

1. Parking brake cable clamp mounting nut
2. Filler hose
3. Leveling hose
- ▶A◀ 4. High pressure tube connection
5. Vapour hose connection
6. Return hose connection
7. Harness connector connection
8. Fuel tank assembly
- ▶A◀ 9. High pressure tube
10. Return hose
11. Suction hose
12. Vapour hose
13. Fuel check valve
14. Fuel tank harness
15. Fuel pump module
16. Retainer plate
17. Packing
18. Pipe and gauge assembly
19. Valve assembly
20. Fuel filler cap
21. Filler neck protector
22. Filler neck assembly
23. Packing

INSTALLATION SERVICE POINT

▶A◀ HIGH PRESSURE TUBE CONNECTION

Caution
After the connection, pull the high pressure tube gently in the direction of removal to check that is firmly connected.



INSPECTION

FUEL PUMP MODULE/PIPE AND GAUGE ASSEMBLY REPLACEMENT

1. Remove the rear seat cushion.
2. Remove the service hole cover.
3. Disconnect the harness connector, fuel hose and tube.
4. Unscrew the mounting nuts, and then remove the pipe and gauge assembly and fuel pump module.
5. Install the pipe and gauge assembly and fuel pump module. Tighten the mounting nuts to the specified torque.

   Tightening torque: 2.5 ± 0.5 N·m

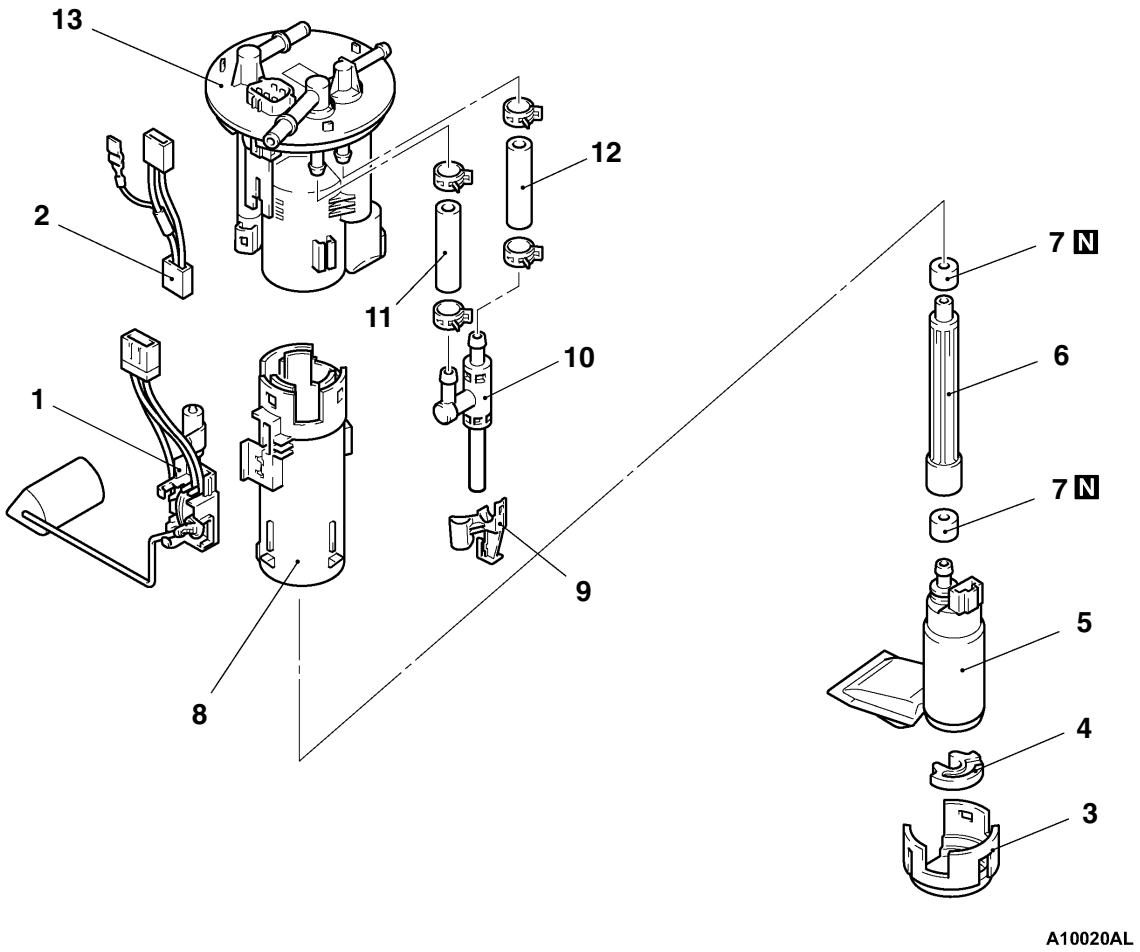
6. Connect the fuel hose, fuel tube and harness connector.

   Caution
   After the connection, pull the high pressure tube and suction tube gently in the direction of removal to check that they are firmly connected.

7. Install the service hole cover.
8. Install the rear seat cushion.

DISASSEMBLY AND REASSEMBLY

FUEL PUMP MODULE



Disassembly steps

1. Fuel gauge unit
2. Gauge harness
3. Bracket
4. Cushion
5. Fuel pump
6. Fuel tube
▶A◀ 7. Grommet
8. Housing
9. Stopper
10. Assist pump assembly
11. Fuel hose (suction)
12. Fuel hose (return)
13. Fuel filter assembly

REASSEMBLY SERVICE POINT

▶A◀ GROMMET INSTALLATION

Apply a fuel to grommet before installing them, to prevent them from being damaged or twisted.

NOTES

MULTIPOINT FUEL INJECTION (MPI) <4G9>

MULTIPOINT FUEL INJECTION (MPI) <4G9>

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EGR Control Solenoid Valve Check 108

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THROTTLE BODY 111

GENERAL

OUTLINE OF CHANGES

The following contents have been established to correspond to the addition of vehicles with 4G9-MPI engine.

GENERAL INFORMATION

The Multipoint Fuel Injection System consists of sensors which detect the engine conditions, the engine-ECU which controls the system based on signals from these sensors, and actuators which operate under the control of the engine-ECU. The engine-ECU carries out activities such as fuel injection control, idle speed control and ignition timing control. In addition, the engine-ECU is equipped with several diagnosis modes which simplify troubleshooting when a problem develops.

FUEL INJECTION CONTROL

The injector drive times and injector timing are controlled so that the optimum air/fuel mixture is supplied to the engine to correspond to the continually-changing engine operation conditions.

A single injector is mounted at the intake port of each cylinder. Fuel is sent under pressure from the fuel tank by the fuel pump, with the pressure being regulated by the fuel pressure regulator. The fuel thus regulated is distributed to each of the injectors.

Fuel injection is normally carried out once for each cylinder for every two rotations of the crankshaft. The firing order is 1-3-4-2. This is called sequential fuel injection. The engine-ECU provides a richer air/fuel mixture by carrying out “open-loop” control when the engine is cold or operating under high load conditions in order to maintain engine performance. In addition, when the engine is warm or operating under normal conditions, the engine-ECU controls the air/fuel mixture by using the oxygen sensor signal to carry out “closed-loop” control in order to obtain the theoretical air/fuel mixture ratio that provides the maximum cleaning performance from the three way catalyst.

IDLE AIR CONTROL

The idle speed is kept at the optimum speed by controlling the amount of air that bypasses the throttle valve in accordance with changes in idling conditions and engine load during idling. The engine-ECU drives the idle speed control (ISC) motor to keep the engine running at the pre-set idle target speed in accordance with the engine coolant temperature and air conditioner load. In addition, when the air conditioner switch is turned off and on while the engine is idling, the ISC motor operates to adjust the throttle valve bypass air amount in accordance with the engine load conditions in order to avoid fluctuations in the engine speed.

IGNITION TIMING CONTROL

The power transistor located in the ignition primary circuit turns ON and OFF to control the primary current flow to the ignition coil. This controls the ignition timing in order to provide the optimum ignition timing with respect to the engine operating conditions. The ignition timing is determined by the engine-ECU from the engine speed, intake air volume, engine coolant temperature and atmospheric pressure.

SELF-DIAGNOSIS FUNCTION

- When an abnormality is detected in one of the sensors or actuators related to emission control, the engine warning lamp (check engine lamp) illuminates as a warning to the driver.
- When an abnormality is detected in one of the sensors or actuators, a diagnosis code corresponding to the abnormality is output.
- The RAM data inside the engine-ECU that is related to the sensors and actuators can be read by means of the MUT-II. In addition, the actuators can be force-driven under certain circumstances.

OTHER CONTROL FUNCTIONS

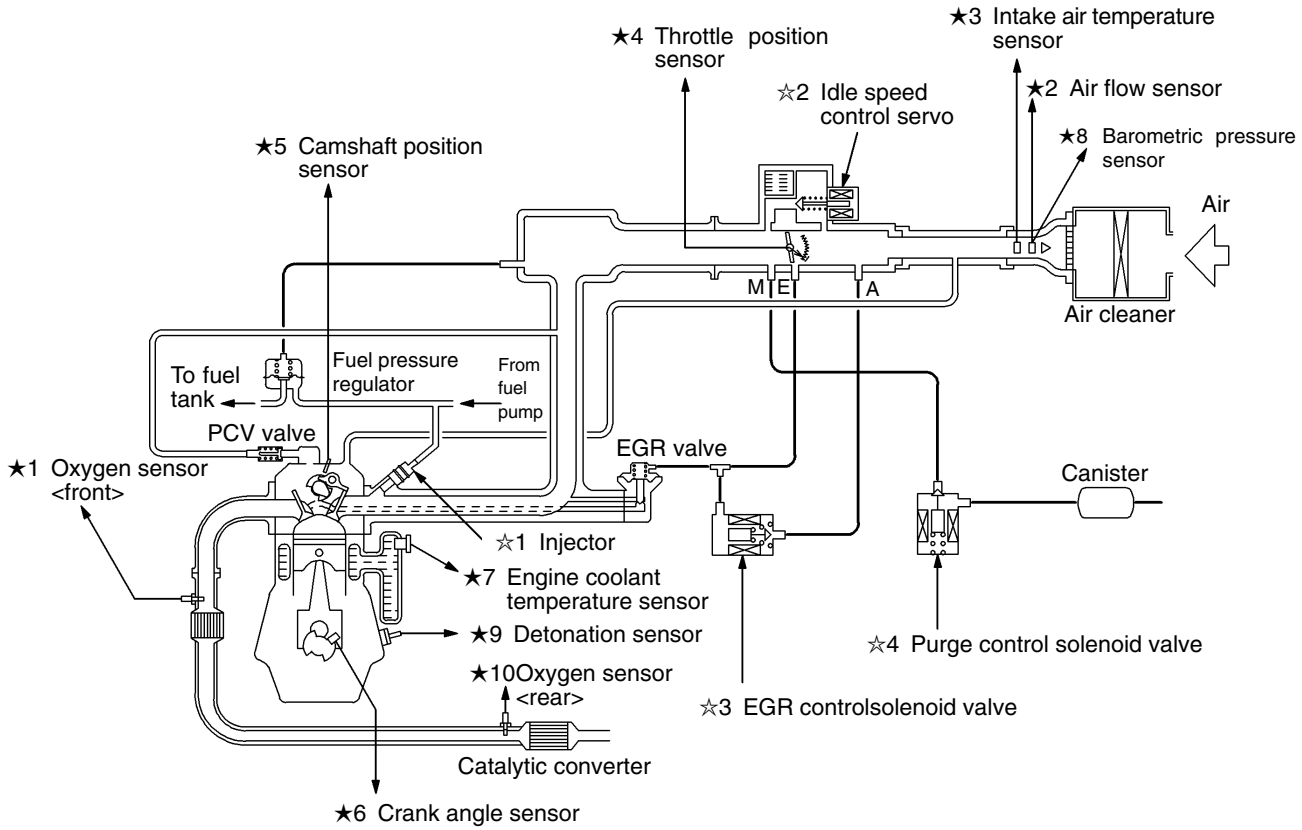
1. Fuel Pump Control
   Turns the fuel pump relay ON so that current is supplied to the fuel pump while the engine is cranking or running.
2. A/C Relay Control
   Turns the compressor clutch of the A/C ON and OFF.
3. Fan Motor Control
   The revolutions of the radiator fan and condenser fan are controlled in response to the engine coolant temperature and vehicle speed.
4. Purge Control Solenoid Valve Control
   Refer to GROUP 17.
5. EGR Control Solenoid Valve Control
   Refer to GROUP 17.

GENERAL SPECIFICATIONS

Items		Specifications
Throttle body	Throttle bore mm	50
	Throttle position sensor	Variable resistor type
	Idle speed control servo	Stepper motor type (Stepper motor type by-pass air control system)
Engine-ECU	Identification model No.	E2T74481
Sensors	Air flow sensor	Karman vortex type
	Barometric pressure sensor	Semiconductor type
	Intake air temperature sensor	Thermistor type
	Engine coolant temperature sensor	Thermistor type
	Oxygen sensor	Zirconia type
	Vehicle speed sensor	Magnetic resistive element type
	Inhibitor switch	Contact switch type
	Camshaft position sensor	Magnetic resistive element type
	Crank angle sensor	Hall element type
	Detonation sensor	Piezoelectric type
	Power steering fluid pressure switch	Contact switch type
Actuators	Control relay type	Contact switch type
	Fuel pump relay	Contact switch type
	Injector type and number	Electromagnetic type, 4
	Injector identification mark	CDH 210
	EGR control solenoid valve	Duty cycle type solenoid valve
	Purge control solenoid valve	Duty cycle type solenoid valve
Fuel pressure regulator	Regulator pressure kPa	329

CONTROL SYSTEM DIAGRAM

★1 Oxygen sensor <front> ★2 Air flow sensor ★3 Intake air temperature sensor ★4 Throttle position sensor ★5 Camshaft position sensor ★6 Crank angle sensor ★7 Engine coolant temperature sensor ★8 Barometric pressure sensor ★9 Detonation sensor ★10Oxygen sensor <rear>	• Power supply • Ignition switch-IG • Ignition switch-ST • Vehicle speed sensor • A/C switch • A/C thermo sensor • Inhibitor switch • Power steering fluid pressure switch • Alternator FR terminal • A/T-ECU	⇨ Engine-ECU ⇨	☆1 Injector ☆2 Idle speed control servo ☆3 EGR control solenoid valve ☆4 Purge control solenoid valve	• Engine control relay • Fuel pump relay • A/C relay • Ignition coil • Fan motor relay • Engine warning lamp • Tachometer • Diagnosis output • Alternator G terminal • A/T-ECU



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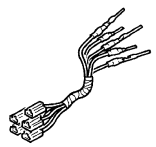
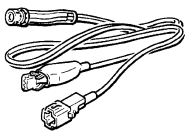
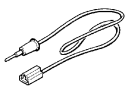
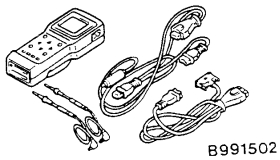
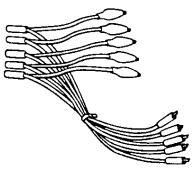
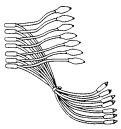
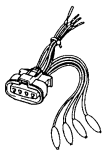
SERVICE SPECIFICATIONS

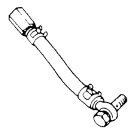
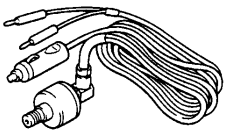
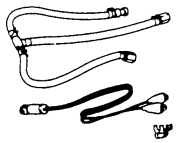
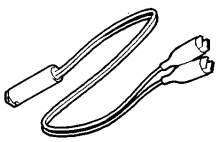
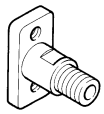
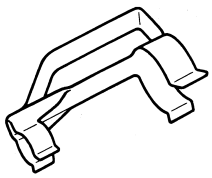
Items		Specifications
Basic idle speed r/min		700 ± 50
Throttle position sensor adjusting voltage mV		535 – 735
Throttle position sensor resistance kΩ		3.5 – 6.5
Idle speed control servo coil resistance Ω		27 – 33 (at 20°C)
Intake air temperature sensor resistance kΩ	–20°C	13 – 17
	0°C	5.3 – 6.7
	20°C	2.3 – 3.0
	40°C	1.0 – 1.5
	60°C	0.56 –0.76
	80°C	0.30 – 0.42
Engine coolant temperature sensor resistance kΩ	–20°C	14 – 17
	0°C	5.1 – 6.5
	20°C	2.1 – 2.7
	40°C	0.9 – 1.3
	60°C	0.48 – 0.68
	80°C	0.26 – 0.36
Oxygen sensor output voltage (at racing) V		0.6 – 1.0
Fuel pressure kPa	Vacuum hose disconnection	324 – 343 at curb idle
	Vacuum hose connection	Approx. 265 at curb idle
Injector coil resistance Ω		13 – 16 (at 20°C)

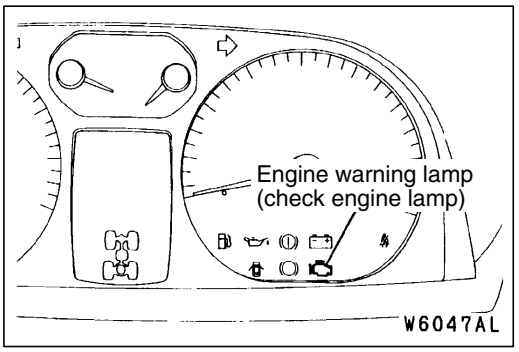
SEALANT

Item	Specified sealant	Remark
Engine coolant temperature sensor threaded portion	3M Nut Locking Part No. 4171 or equivalent	Drying sealant

SPECIAL TOOLS

Tool	Number	Name	Use
A  B  C  D  C991223	MB991223 A: MB991219 B: MB991220 C: MB991221 D: MB991222	Harness set A: Test harness B: LED harness C: LED harness adapter D: Probe	• Check at the ECU terminals A: Connector pin contact pressure inspection B: Power circuit inspection C: Power circuit inspection D: Commercial tester connection
 B991502	MB991502	MUT-II sub assembly	• Reading diagnosis code • MPI system inspection
	MB991348	Test harness set	• Measurement of voltage during trouble-shooting • Inspection using an analyzer
 MB991709	MB991709	Test harness	• Measurement of voltage during trouble-shooting • Inspection using an analyzer • Adjustment of throttle position sensor
	MB991519	Alternator harness connector	Measurement of voltage during troubleshoot-ing
	MD998478	Test harness (3-pin, triangle)	• Measurement of voltage during trouble-shooting • Inspection using an analyzer

Tool	Number	Name	Use
	MD998709	Adaptor hose	Measurement of fuel pressure
	MD998742	Hose adaptor	
 B991637	MB991637	Fuel pressure gauge set	
	MD998706	Injector test set	Checking the spray condition of injectors
 MB991607	MB991607	Injector test harness	
 MD998741	MD998741	Injector test adaptor	
	MB991608	Clip	



TROUBLESHOOTING

DIAGNOSIS TROUBLESHOOTING FLOW

Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Point.

NOTE
If the engine-ECU for vehicles for GCC is replaced, the immobilizer-ECU and ignition key should be replaced together with it.

DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

If an abnormality occurs in any of the following items related to the MPI system, the engine warning lamp will illuminate or flash. If the lamp remains illuminated or if the lamp illuminates while the engine is running, check the diagnosis code output. However, the warning lamp will illuminate as bulb check for five seconds whenever the ignition switch is turned to the ON position.

Engine warning lamp inspection items

Code No.	Diagnosis item
–	Engine-ECU
P0100	Air flow sensor system
P0105	Barometric pressure sensor system
P0110	Intake air temperature sensor system
P0115	Engine coolant temperature sensor system
P0120	Throttle position sensor system
P0125	Feedback system
P0130	Oxygen sensor (front) system <sensor 1>
P0135	Oxygen sensor heater (front) system <sensor 1>
P0136	Oxygen sensor (rear) system <sensor 2>
P0141	Oxygen sensor heater (rear) system <sensor 2>
P0170	Abnormal fuel system
P0201	No. 1 injector system
P0202	No. 2 injector system
P0203	No. 3 injector system
P0204	No. 4 injector system
P0300★	Ignition coil (power transistor) system
P0301	No. 1 cylinder misfire detected
P0302	No. 2 cylinder misfire detected
P0303	No. 3 cylinder misfire detected
P0304	No. 4 cylinder misfire detected
P0325	Detonation sensor system

Code No.	Diagnosis item
P0335	Crank angle sensor system
P0340	Camshaft position sensor system
P0403	EGR valve system
P0420	Catalyst malfunction
P0443	Purge control solenoid valve system
P0500	Vehicle speed sensor system
P0505	Idle speed control system
P0551	Power steering fluid pressure switch system
P1603	Battery backup line system

NOTE
1. If the engine warning lamp illuminates because of a malfunction of the engine-ECU, communication between MUT-II and the engine-ECU is impossible. In this case, the diagnosis code cannot be read.
2. After the engine-ECU has detected a malfunction, the engine warning lamp illuminates when the engine is next turned on and the same malfunction is re-detected. However, for items marked with a "★" in the diagnosis code number column, the engine warning lamp illuminates only on the first detection of the malfunction.
3. After the engine warning lamp illuminates, it will be switched off under the following conditions.
   (1) When the engine-ECU monitored the power train malfunction three times* and met set condition requirements, it detected no malfunction.
   *: In this case, "one time" indicates from engine start to stop.
   (2) For misfiring malfunction, when driving conditions (engine speed, engine coolant temperature, etc.) are similar to those when the malfunction was first recorded.
4. Sensor 1 indicates the sensor mounted at a position closest to the engine, and sensor 2 indicates the sensor mounted at the position second closest to the engine.

METHOD OF READING AND ERASING DIAGNOSIS CODES

Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.

INSPECTION USING MUT-II DATA LIST AND ACTUATOR TESTING

1. Carry out inspection by means of the data list and the actuator test function. If there is an abnormality, check and repair the chassis harnesses and components.
2. After repairing, re-check using the MUT-II and check that the abnormal input and output have returned to normal as a result of the repairs.
3. Erase the diagnosis code memory.
4. Remove the MUT-II, and then start the engine again and carry out a road test to confirm that the problem has disappeared.

FAIL-SAFE FUNCTION REFERENCE TABLE

When the main sensor malfunctions are detected by the diagnosis function, the vehicle is controlled by means of the pre-set control logic to maintain safe conditions for driving.

Malfunctioning item	Control contents during malfunction
Air flow sensor	1. Uses the throttle position sensor signal and engine speed signal (crank angle sensor signal) to take reading of the basic injector drive time and basic ignition timing from the pre-set mapping. 2. Fixes the ISC servo in the appointed position so idle control is not performed.
Intake air temperature sensor	Controls as if the intake air temperature is 25°C.
Throttle position sensor (TPS)	No increase in fuel injection amount during acceleration due to the throttle position sensor signal.
Engine coolant temperature sensor	Controls as if the engine coolant temperature is 80°C.
Camshaft position sensor	Injects fuel to all cylinders simultaneously. (However, after the ignition switch is turned to ON, the No.1 cylinder top dead centre is not detected at all.)
Barometric pressure sensor	Controls as if the barometric pressure is 101 kPa.
Detonation sensor	Switches the ignition timing from ignition timing for super petrol to ignition timing for standard petrol.
Ignition coil, power transistor	Cuts off the fuel supply to cylinders with an abnormal ignition.
Oxygen sensor (front)	Air/fuel ratio feedback control (closed loop control) is not performed.
Oxygen sensor (rear)	Performs the feedback control (closed loop control) of the air/fuel ratio by using only the signal of the oxygen sensor (front) installed on the front of the catalytic converter.
Alternator FR terminal	Does not control the output of the alternator according to an electrical load. (works as a normal alternator)
Misfiring	If the detected misfiring causes damage to the catalyst, the misfiring cylinder will be shut down.

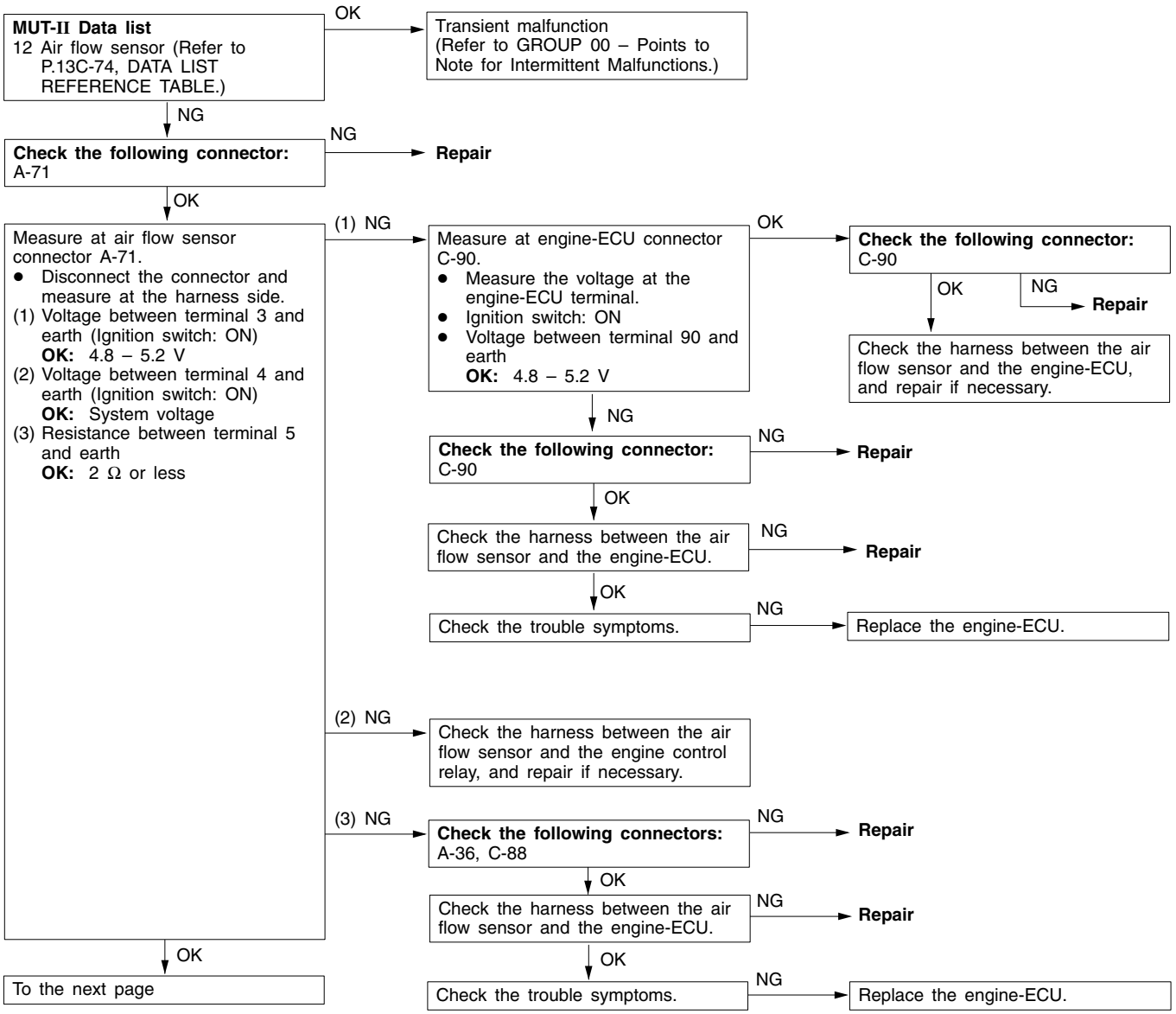
INSPECTION CHART FOR DIAGNOSIS CODES

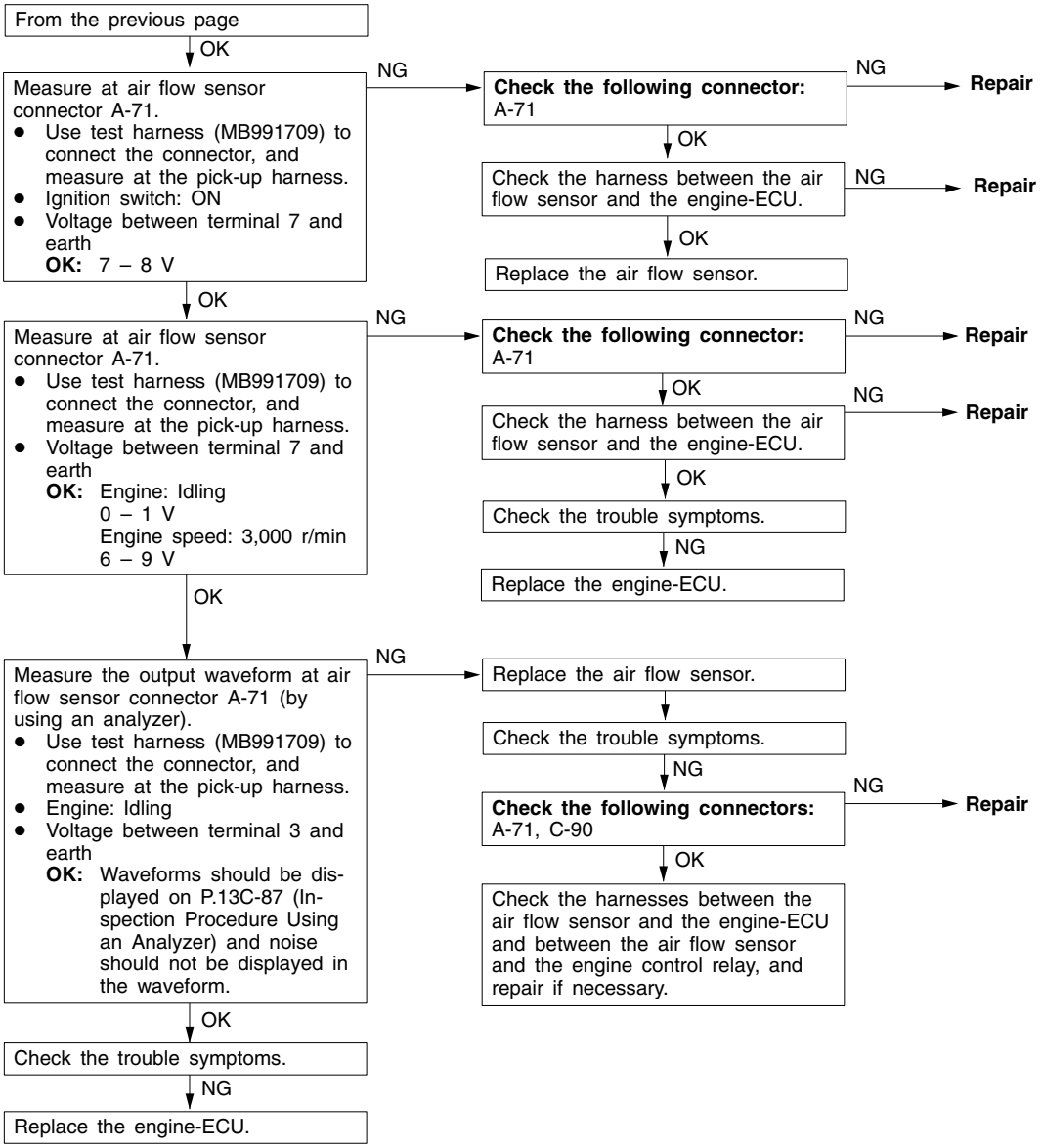
Code No.	Diagnosis item	Reference page
P0100	Air flow sensor system	13C-14
P0105	Barometric pressure sensor system	13C-16
P0110	Intake air temperature sensor system	13C-18
P0115	Engine coolant temperature sensor system	13C-20
P0120	Throttle position sensor 1 system	13C-22
P0125	Feedback system	13C-24
P0130	Oxygen sensor (front) system	13C-25
P0135	Oxygen sensor heater (front) system	13C-26
P0136	Oxygen sensor (rear) system	13C-27
P0141	Oxygen sensor heater (rear) system	13C-28
P0170	Abnormal fuel system	13C-29
P0201	No. 1 injector system	13C-30
P0202	No. 2 injector system	13C-30
P0203	No. 3 injector system	13C-30
P0204	No. 4 injector system	13C-30
P0300★	Ignition coil (power transistor) system	13C-31
P0301	No. 1 cylinder misfire detected	13C-32
P0302	No. 2 cylinder misfire detected	13C-32
P0303	No. 3 cylinder misfire detected	13C-32
P0304	No. 4 cylinder misfire detected	13C-32
P0325	Detonation sensor system	13C-33
P0335	Crank angle sensor system	13C-33
P0340	Camshaft position sensor system	13C-35
P0403	EGR valve system	13C-36
P0420	Catalyst malfunction	13C-37
P0443	Purge control solenoid valve system	13C-38
P0500	Vehicle speed sensor system	13C-39
P0505	Idle speed control system	13C-40
P0551	Power steering fluid pressure switch system	13C-43
P1603	Battery backup circuit malfunction	13C-44
P1610	Immobilizer system	13C-45

NOTE
1. Do not replace the engine-ECU until a through terminal check reveals there are no short/open circuit.
2. Check that the engine-ECU earth circuit is normal before checking for the cause of the problem.
3. After the engine-ECU has detected a malfunction, a diagnosis code is recorded the next time the engine is started and the same malfunction is re-detected. However, for items marked with a "★", the diagnosis code is recorded on the first detection of the malfunction.
4. Sensor 1 indicates the sensor mounted at a position closest to the engine, and sensor 2 indicates the sensor mounted at the position second closest to the engine.

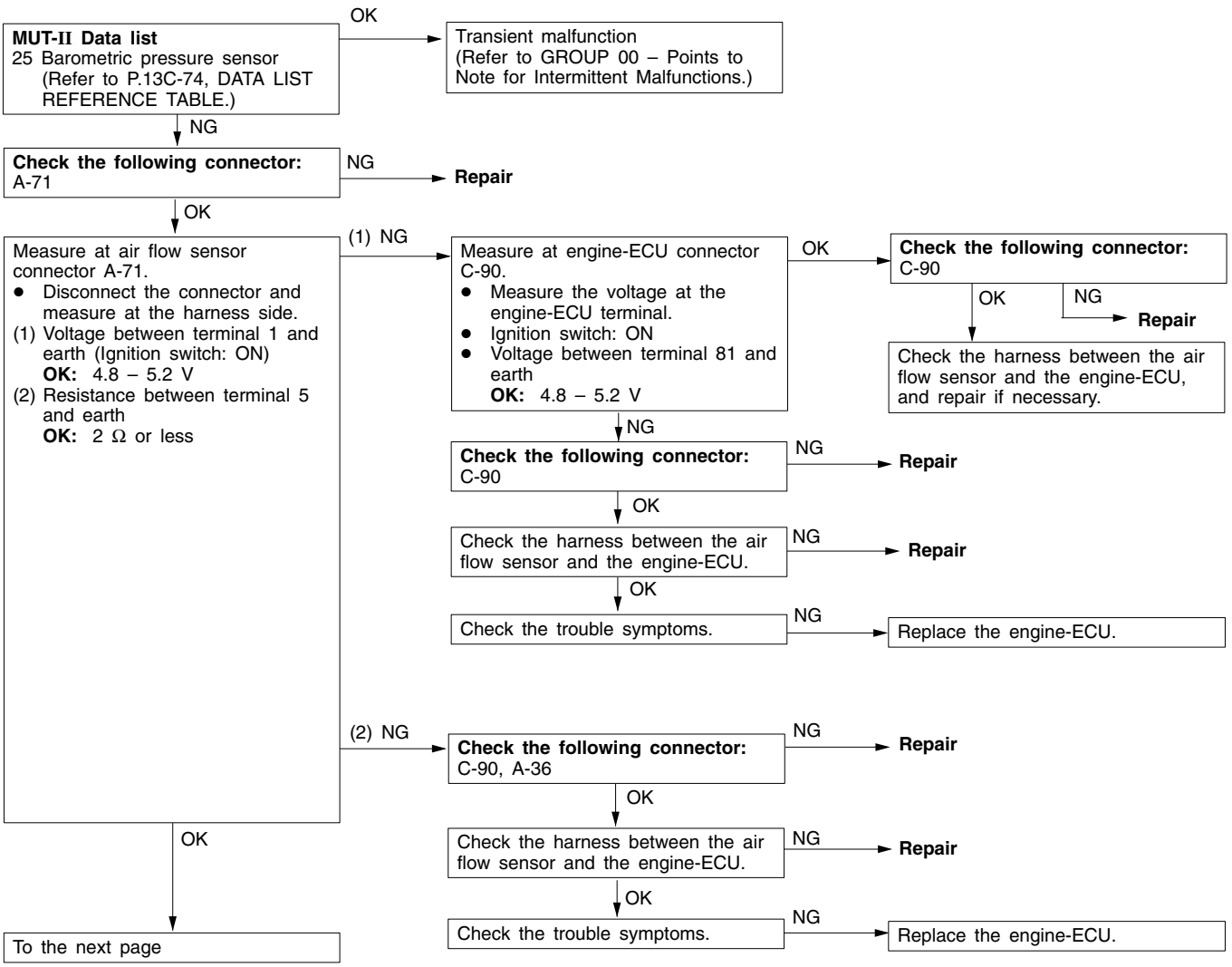
INSPECTION PROCEDURE CLASSIFIED BY DIAGNOSIS CODE

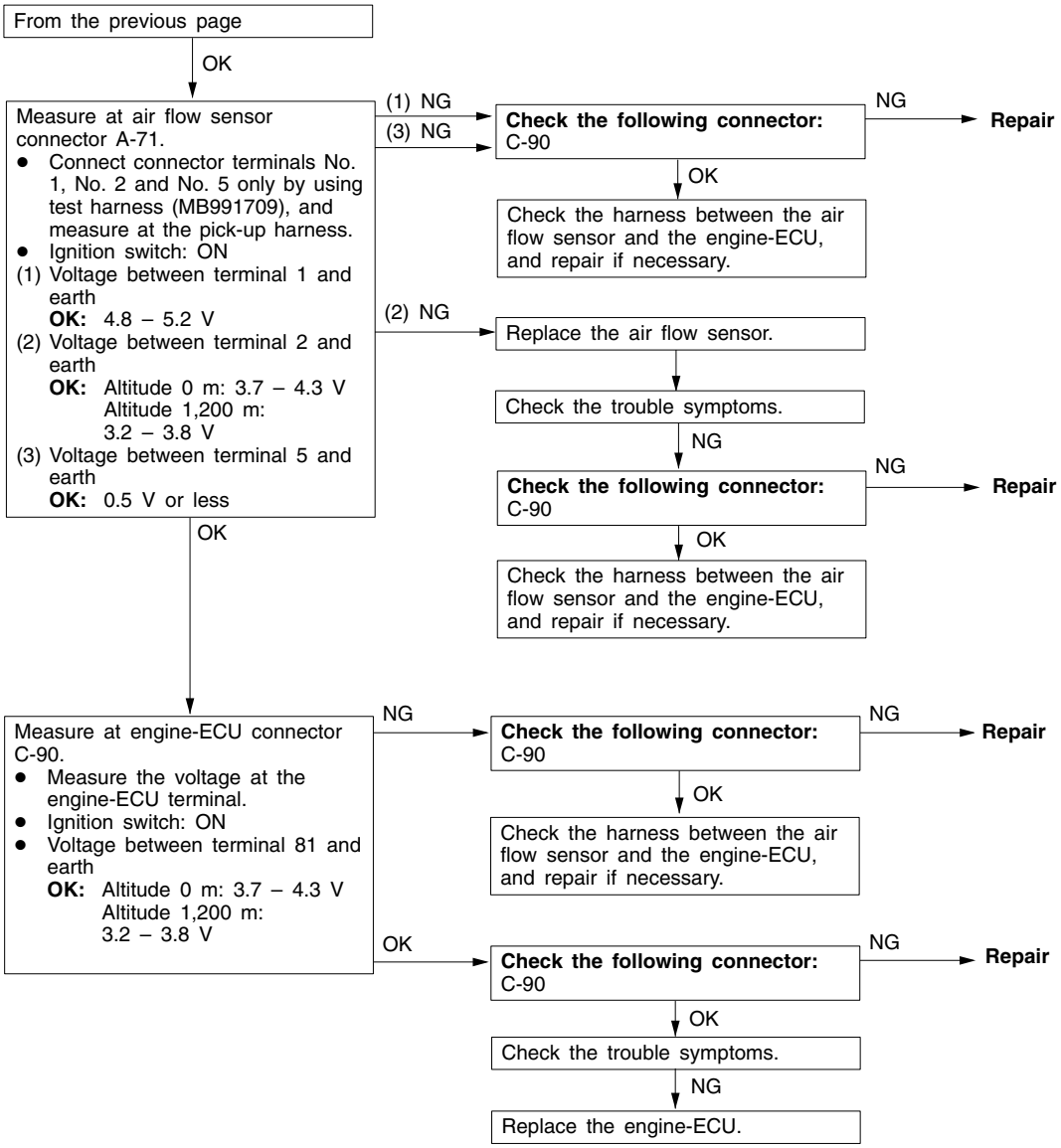
Code No. P0100 Air flow sensor system	Probable cause
Range of Check ● Engine speed: 500 r/min or more Set Conditions ● The sensor output frequency is 3.3 Hz or less for 4 seconds.	● Malfunction of air flow sensor ● Open or short circuit in air flow sensor circuit or loose connector contact ● Malfunction of engine-ECU



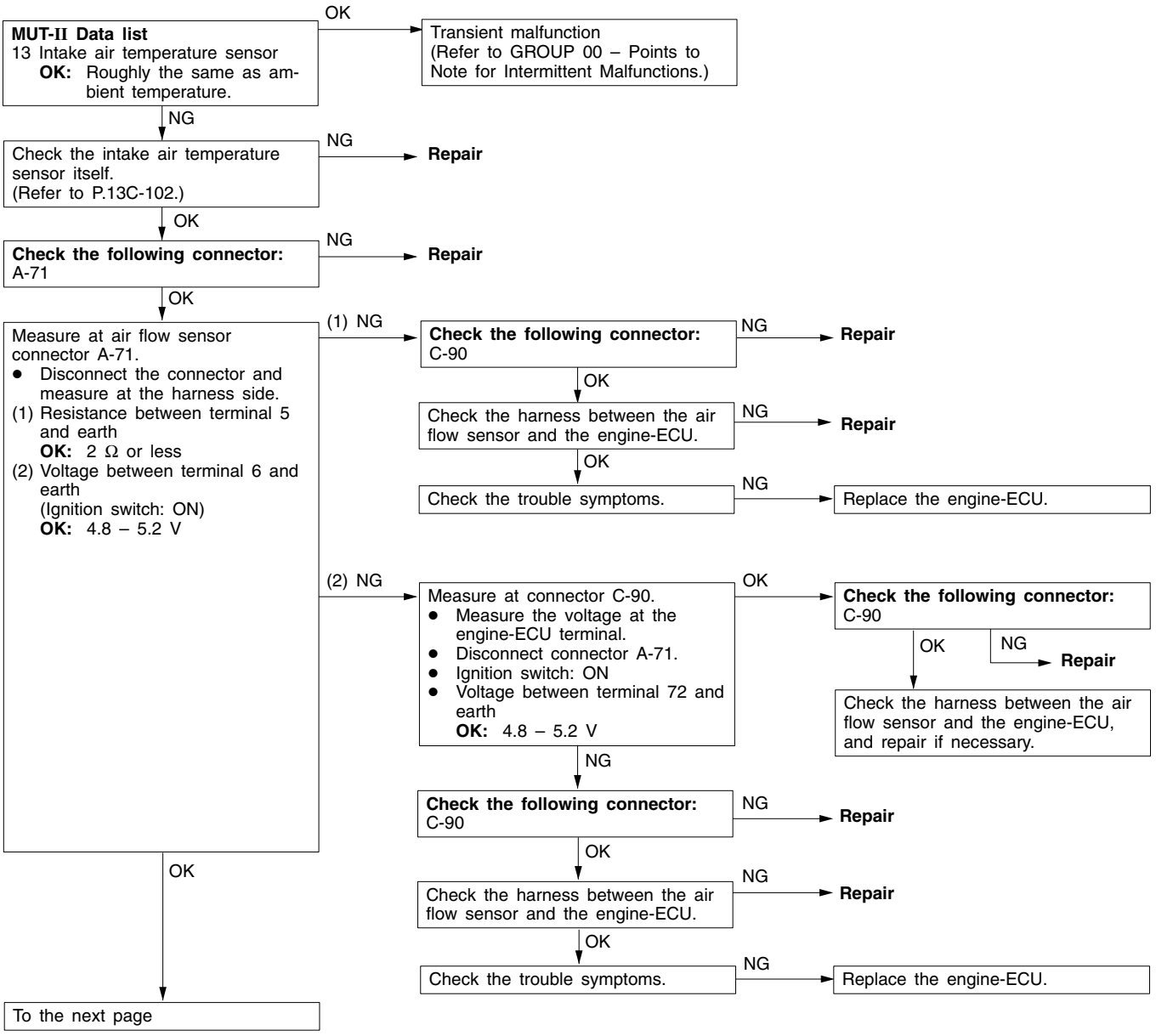

From the previous page
OK
Measure at air flow sensor connector A-71.
● Use test harness (MB991709) to connect the connector, and measure at the pick-up harness.
● Ignition switch: ON
● Voltage between terminal 7 and earth
OK: 7 – 8 V
NG
Check the following connector: A-71
NG
Repair
OK
Check the harness between the air flow sensor and the engine-ECU.
NG
Repair
OK
Replace the air flow sensor.
OK
Measure at air flow sensor connector A-71.
● Use test harness (MB991709) to connect the connector, and measure at the pick-up harness.
● Voltage between terminal 7 and earth
OK: Engine: Idling
0 – 1 V
Engine speed: 3,000 r/min
6 – 9 V
NG
Check the following connector: A-71
NG
Repair
OK
Check the harness between the air flow sensor and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
OK
Measure the output waveform at air flow sensor connector A-71 (by using an analyzer).
● Use test harness (MB991709) to connect the connector, and measure at the pick-up harness.
● Engine: Idling
● Voltage between terminal 3 and earth
OK: Waveforms should be displayed on P.13C-87 (Inspection Procedure Using an Analyzer) and noise should not be displayed in the waveform.
NG
Replace the air flow sensor.
Check the trouble symptoms.
NG
Check the following connectors: A-71, C-90
NG
Repair
OK
Check the harnesses between the air flow sensor and the engine-ECU and between the air flow sensor and the engine control relay, and repair if necessary.
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.

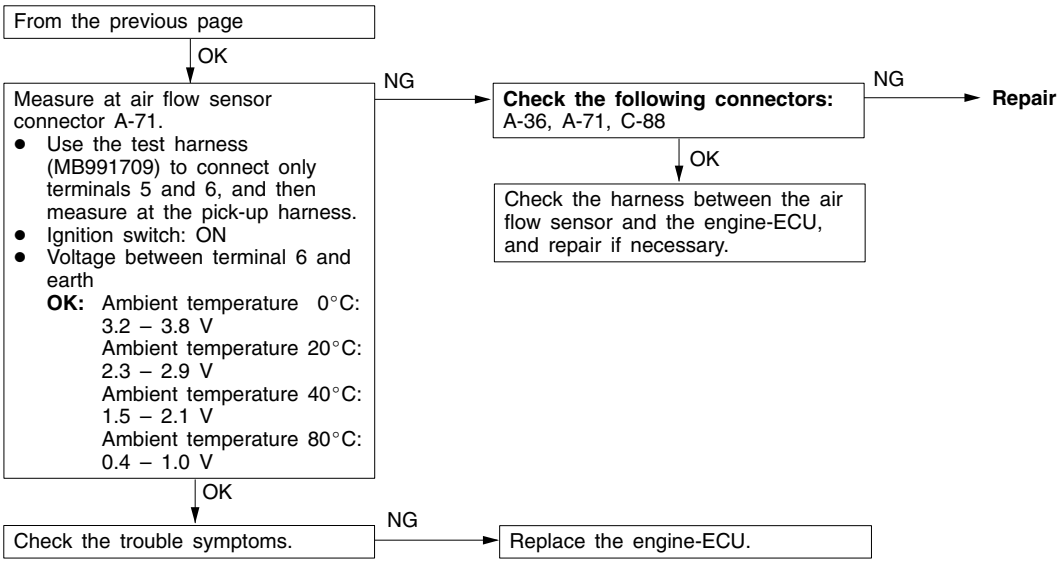
Code No. P0105 Barometric pressure sensor system	Probable cause
Range of Check ● Two seconds have passed since the ignition switch is turned ON or the engine starting process is completed. ● Battery voltage: 8 V or more Set Conditions ● The sensor output voltage is 4.5 V or more for 4 seconds (equivalent to 114 kPa of barometric pressure) or ● The sensor output voltage is 0.2 V or less (equivalent to 53 kPa of barometric pressure)	● Malfunction of barometric pressure sensor ● Open or short circuit in barometric pressure sensor circuit or loose connector contact ● Malfunction of engine-ECU



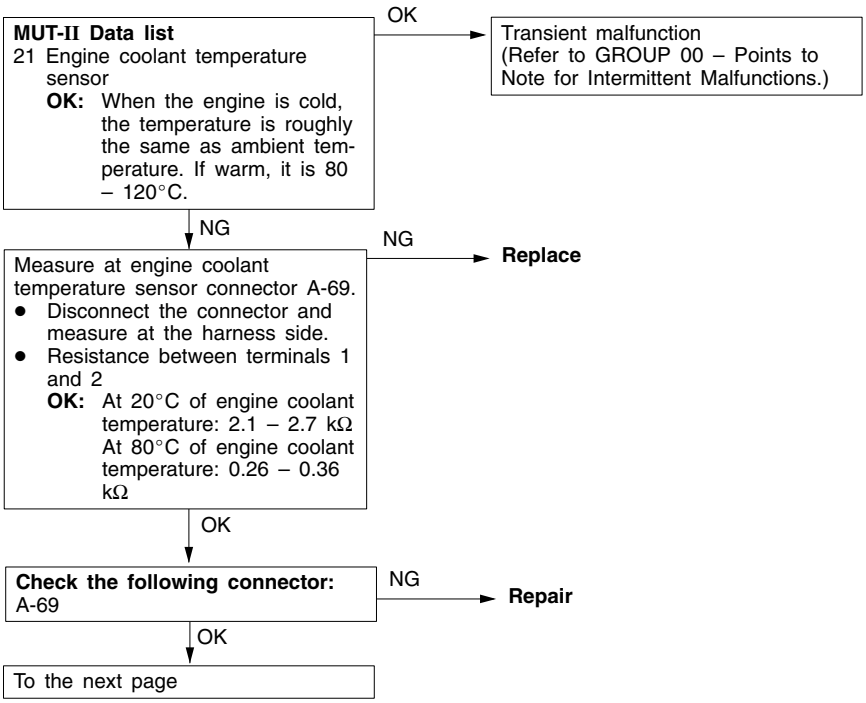

From the previous page
OK
Measure at air flow sensor connector A-71.
● Connect connector terminals No. 1, No. 2 and No. 5 only by using test harness (MB991709), and measure at the pick-up harness.
● Ignition switch: ON
(1) Voltage between terminal 1 and earth
OK: 4.8 – 5.2 V
(2) Voltage between terminal 2 and earth
OK: Altitude 0 m: 3.7 – 4.3 V
Altitude 1,200 m: 3.2 – 3.8 V
(3) Voltage between terminal 5 and earth
OK: 0.5 V or less
(1) NG
(3) NG
Check the following connector: C-90
NG
Repair
OK
Check the harness between the air flow sensor and the engine-ECU, and repair if necessary.
(2) NG
Replace the air flow sensor.
Check the trouble symptoms.
NG
Check the following connector: C-90
NG
Repair
OK
Check the harness between the air flow sensor and the engine-ECU, and repair if necessary.
OK
Measure at engine-ECU connector C-90.
● Measure the voltage at the engine-ECU terminal.
● Ignition switch: ON
● Voltage between terminal 81 and earth
OK: Altitude 0 m: 3.7 – 4.3 V
Altitude 1,200 m: 3.2 – 3.8 V
NG
Check the following connector: C-90
NG
Repair
OK
Check the harness between the air flow sensor and the engine-ECU, and repair if necessary.
OK
Check the following connector: C-90
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.

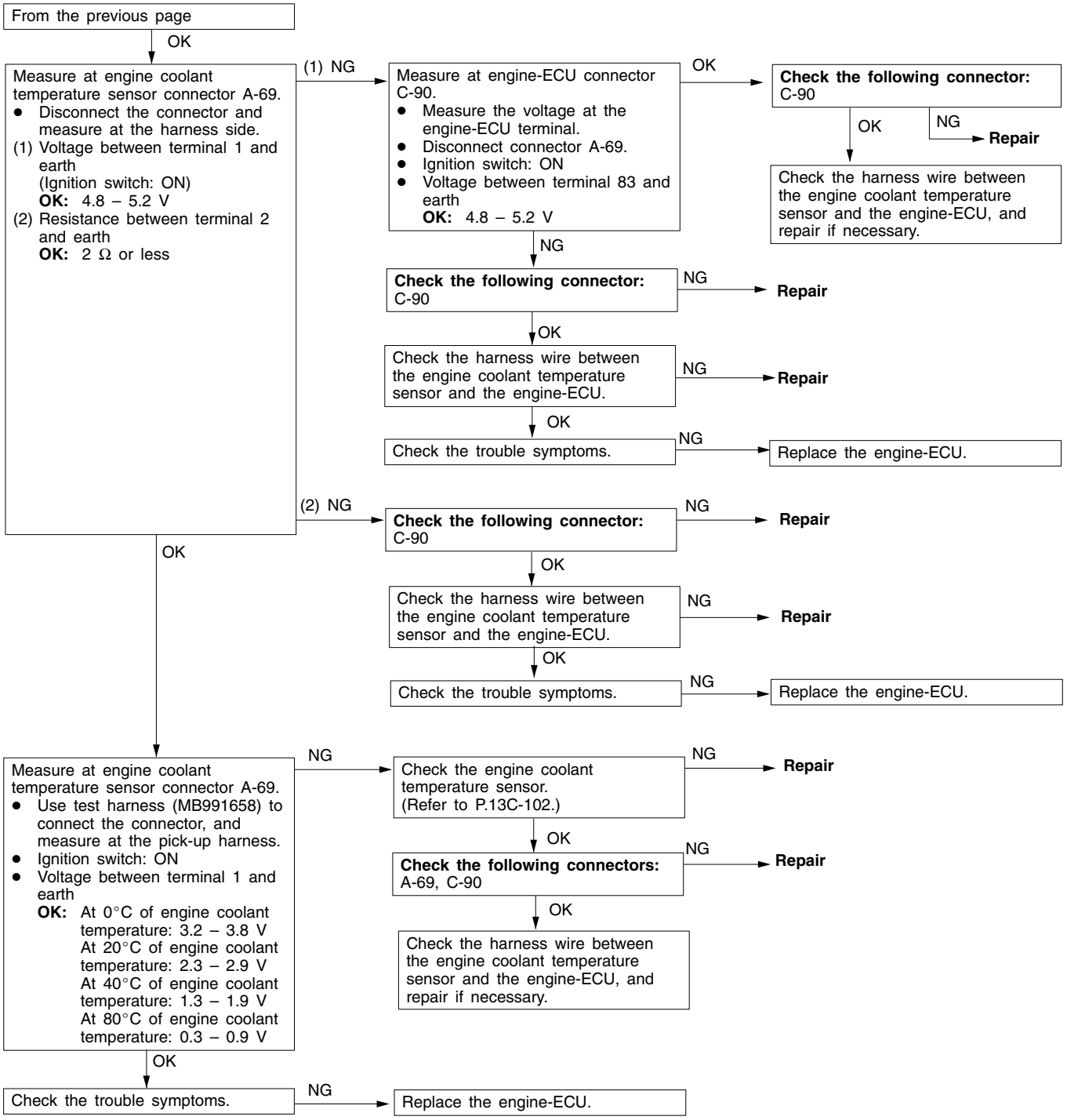
Code No. P0110 Intake air temperature sensor system	Probable cause
Range of Check • 2 seconds have passed since the ignition switch is turned ON or the engine starting process is completed. Set Conditions • The sensor output voltage is 4.6 V or more for four seconds (equivalent to –45°C of intake air temperature) or • The sensor output voltage is 0.2 V or more for four seconds (equivalent to 125°C of intake air temperature)	• Malfunction of intake air temperature sensor • Open or short circuit in intake air temperature sensor or loose connector contact • Malfunction of engine-ECU



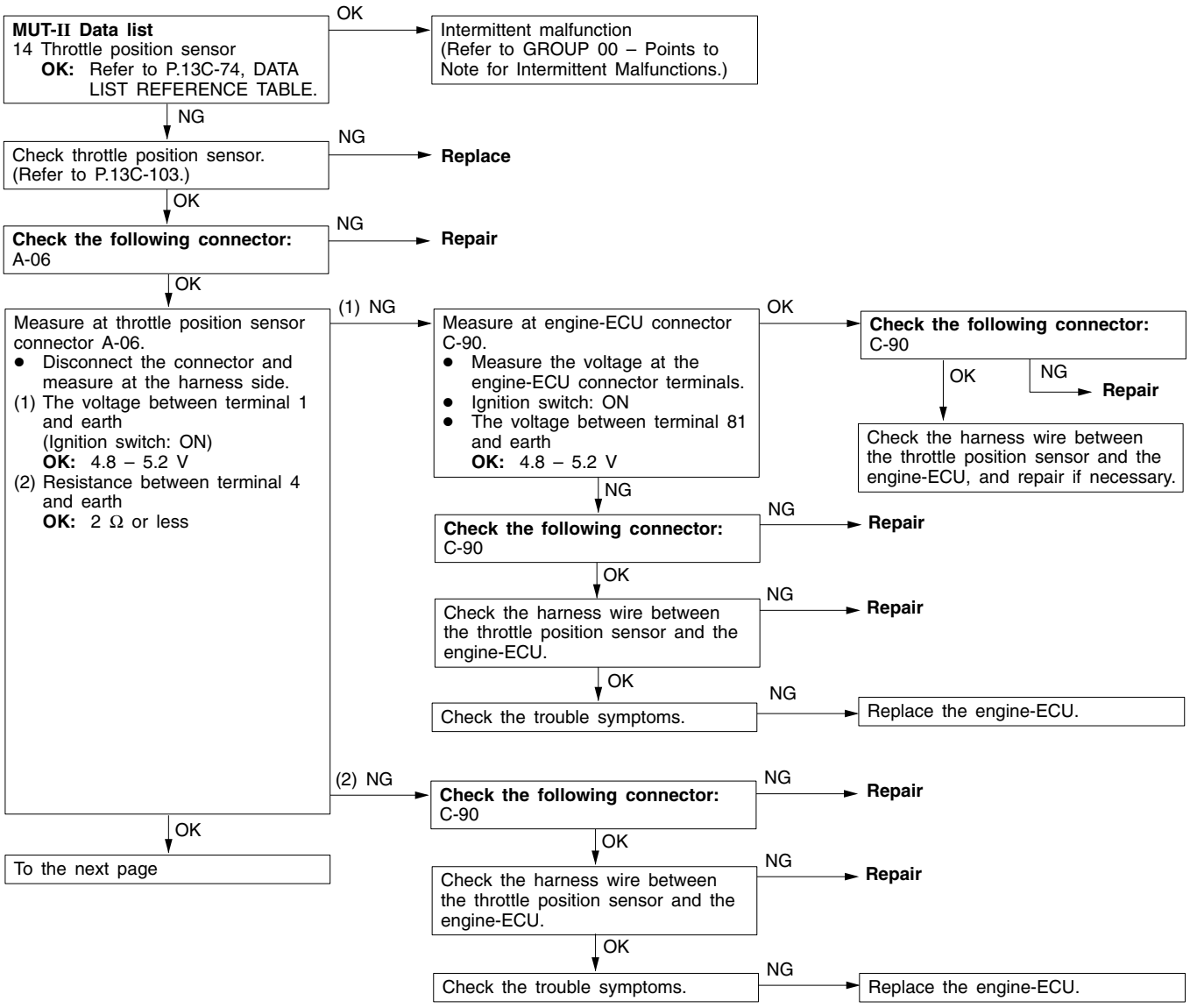

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OK
Measure at air flow sensor connector A-71.
● Use the test harness (MB991709) to connect only terminals 5 and 6, and then measure at the pick-up harness.
● Ignition switch: ON
● Voltage between terminal 6 and earth
OK: Ambient temperature 0°C: 3.2 – 3.8 V
Ambient temperature 20°C: 2.3 – 2.9 V
Ambient temperature 40°C: 1.5 – 2.1 V
Ambient temperature 80°C: 0.4 – 1.0 V
NG
Check the following connectors: A-36, A-71, C-88
NG
Repair
OK
Check the harness between the air flow sensor and the engine-ECU, and repair if necessary.
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.

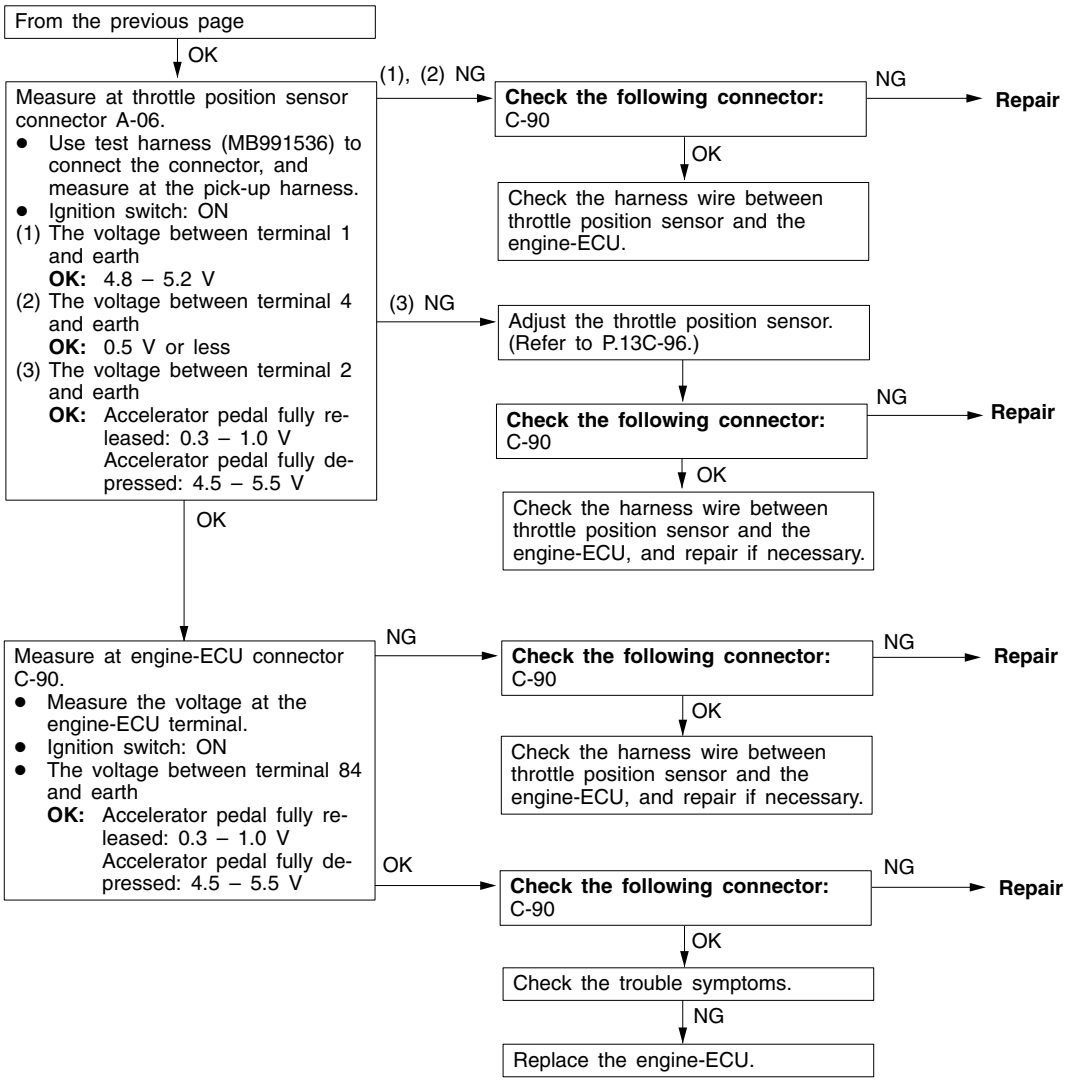
Code No. P0115 Engine coolant temperature sensor system	Probable cause
Range of Check ● Engine: Two seconds after the engine has been started Set Conditions ● The sensor output voltage is 4.6 V or more for four seconds (equivalent to –45°C or lower of engine coolant temperature) or ● The sensor output voltage is 0.1 V or less for four seconds (equivalent to 140°C or higher of engine coolant temperature)	● Malfunction of engine coolant temperature sensor ● Open or short circuit in the engine coolant temperature sensor circuit or loose connector contact ● Malfunction of engine-ECU
Range of Check ● Engine: After starting Set Conditions ● The engine coolant temperature has reduced from over 40°C to less than 40°C, and that condition has lasted for five minutes or more.	



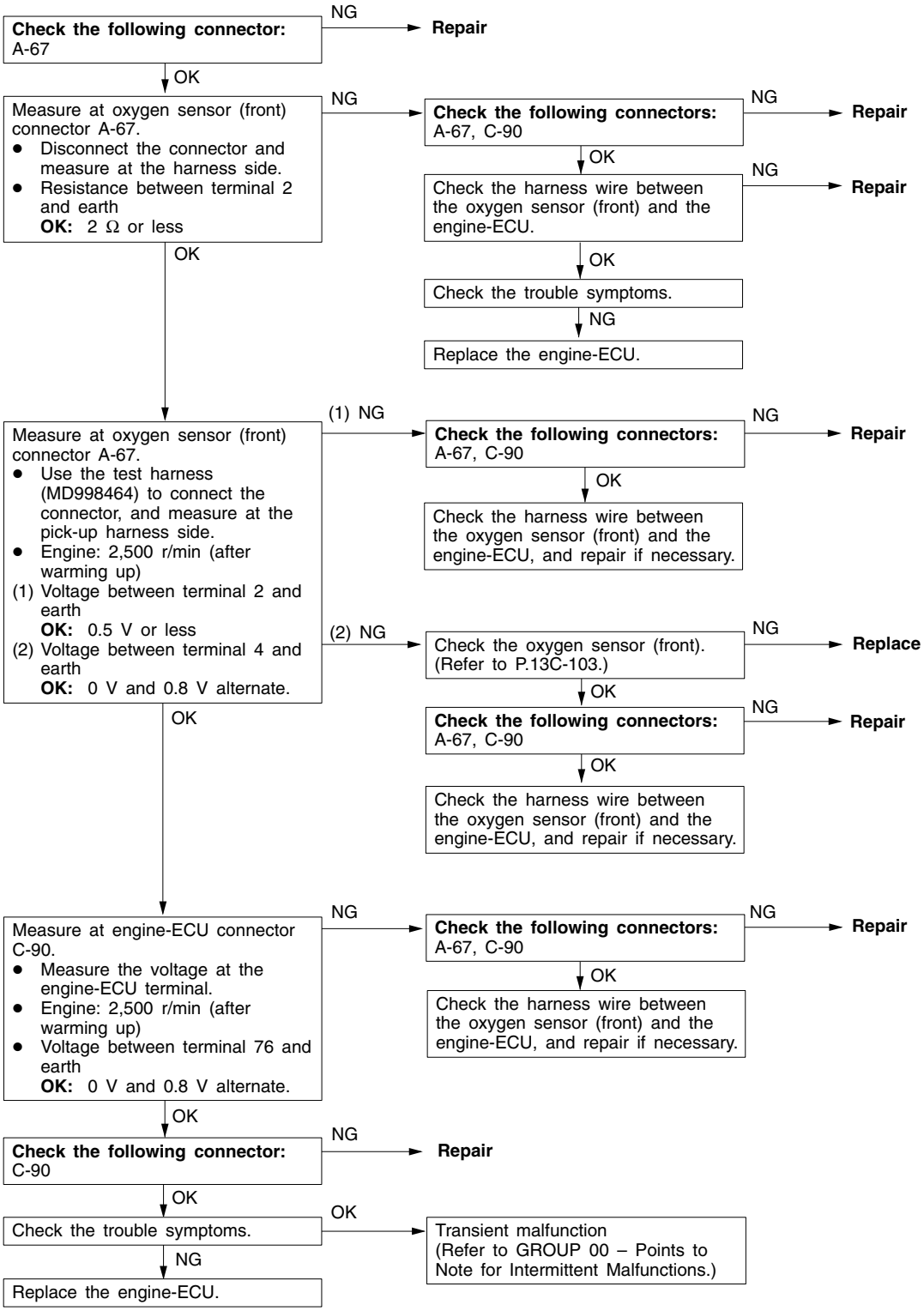

From the previous page
OK
Measure at engine coolant temperature sensor connector A-69.
● Disconnect the connector and measure at the harness side.
(1) Voltage between terminal 1 and earth
(Ignition switch: ON)
OK: 4.8 – 5.2 V
(2) Resistance between terminal 2 and earth
OK: 2 Ω or less
(1) NG
Measure at engine-ECU connector C-90.
● Measure the voltage at the engine-ECU terminal.
● Disconnect connector A-69.
● Ignition switch: ON
● Voltage between terminal 83 and earth
OK: 4.8 – 5.2 V
OK
Check the following connector: C-90
OK
NG
Repair
Check the harness wire between the engine coolant temperature sensor and the engine-ECU, and repair if necessary.
NG
Check the following connector: C-90
NG
Repair
OK
Check the harness wire between the engine coolant temperature sensor and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
(2) NG
Check the following connector: C-90
NG
Repair
OK
Check the harness wire between the engine coolant temperature sensor and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
OK
Measure at engine coolant temperature sensor connector A-69.
● Use test harness (MB991658) to connect the connector, and measure at the pick-up harness.
● Ignition switch: ON
● Voltage between terminal 1 and earth
OK: At 0°C of engine coolant temperature: 3.2 – 3.8 V
At 20°C of engine coolant temperature: 2.3 – 2.9 V
At 40°C of engine coolant temperature: 1.3 – 1.9 V
At 80°C of engine coolant temperature: 0.3 – 0.9 V
NG
Check the engine coolant temperature sensor. (Refer to P.13C-102.)
NG
Repair
OK
Check the following connectors: A-69, C-90
NG
Repair
OK
Check the harness wire between the engine coolant temperature sensor and the engine-ECU, and repair if necessary.
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.

Code No. 0120 Throttle position sensor system	Probable cause
Range of Check ● Excluding 2 seconds after the ignition switch is turned ON or immediately after the engine start. Set Conditions ● The sensor output voltage is 0.2 V or less for four seconds. or ● Volume efficiency is 60 percent or lower. ● Engine speed is lower than 1000 r/min. ● The sensor output voltage is 2.0 V or more. ● AFS: Normal	● Malfunction of throttle position sensor ● Open or short circuit in the throttle position sensor circuit or loose connector contact ● Malfunction of the engine-ECU

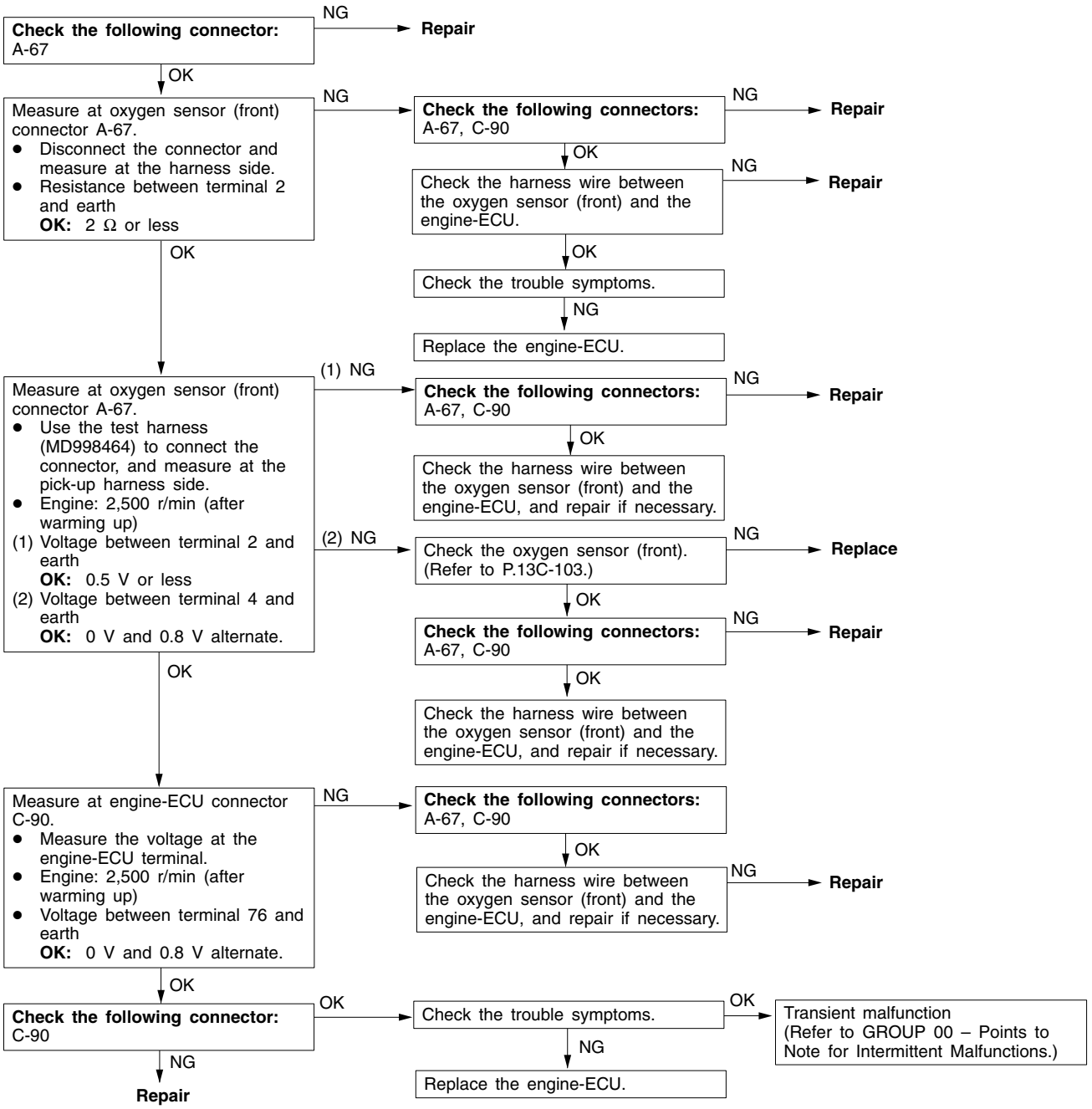



From the previous page
OK
Measure at throttle position sensor connector A-06.
● Use test harness (MB991536) to connect the connector, and measure at the pick-up harness.
● Ignition switch: ON
(1) The voltage between terminal 1 and earth
OK: 4.8 – 5.2 V
(2) The voltage between terminal 4 and earth
OK: 0.5 V or less
(3) The voltage between terminal 2 and earth
OK: Accelerator pedal fully released: 0.3 – 1.0 V
Accelerator pedal fully depressed: 4.5 – 5.5 V
(1), (2) NG
Check the following connector: C-90
NG
Repair
OK
Check the harness wire between throttle position sensor and the engine-ECU.
(3) NG
Adjust the throttle position sensor. (Refer to P.13C-96.)
Check the following connector: C-90
NG
Repair
OK
Check the harness wire between throttle position sensor and the engine-ECU, and repair if necessary.
OK
Measure at engine-ECU connector C-90.
● Measure the voltage at the engine-ECU terminal.
● Ignition switch: ON
● The voltage between terminal 84 and earth
OK: Accelerator pedal fully released: 0.3 – 1.0 V
Accelerator pedal fully depressed: 4.5 – 5.5 V
NG
Check the following connector: C-90
NG
Repair
OK
Check the harness wire between throttle position sensor and the engine-ECU, and repair if necessary.
OK
Check the following connector: C-90
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.

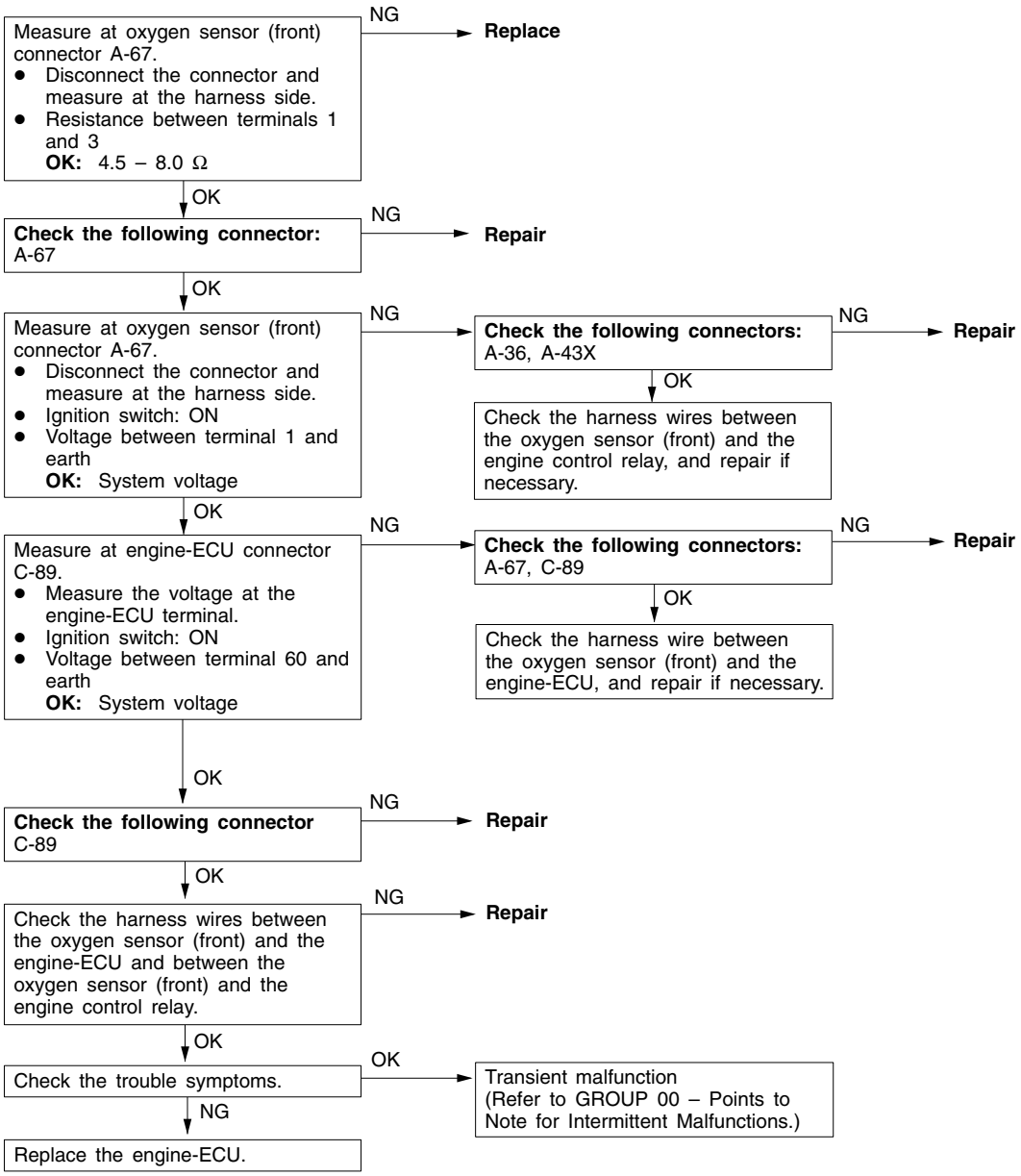
Code No. P0125 Feedback system	Probable cause
Range of Check • The engine coolant temperature is approx. 80°C or more. • During stoichiometric feedback control • The vehicle is not being decelerated. Set Conditions • Oxygen sensor (front) output voltage has been higher or lower than 0.5 V for at least thirty seconds.	• Malfunction of oxygen sensor (front) • Open or short circuit in the oxygen sensor (front) circuit or loose connector contact • Malfunction of engine-ECU



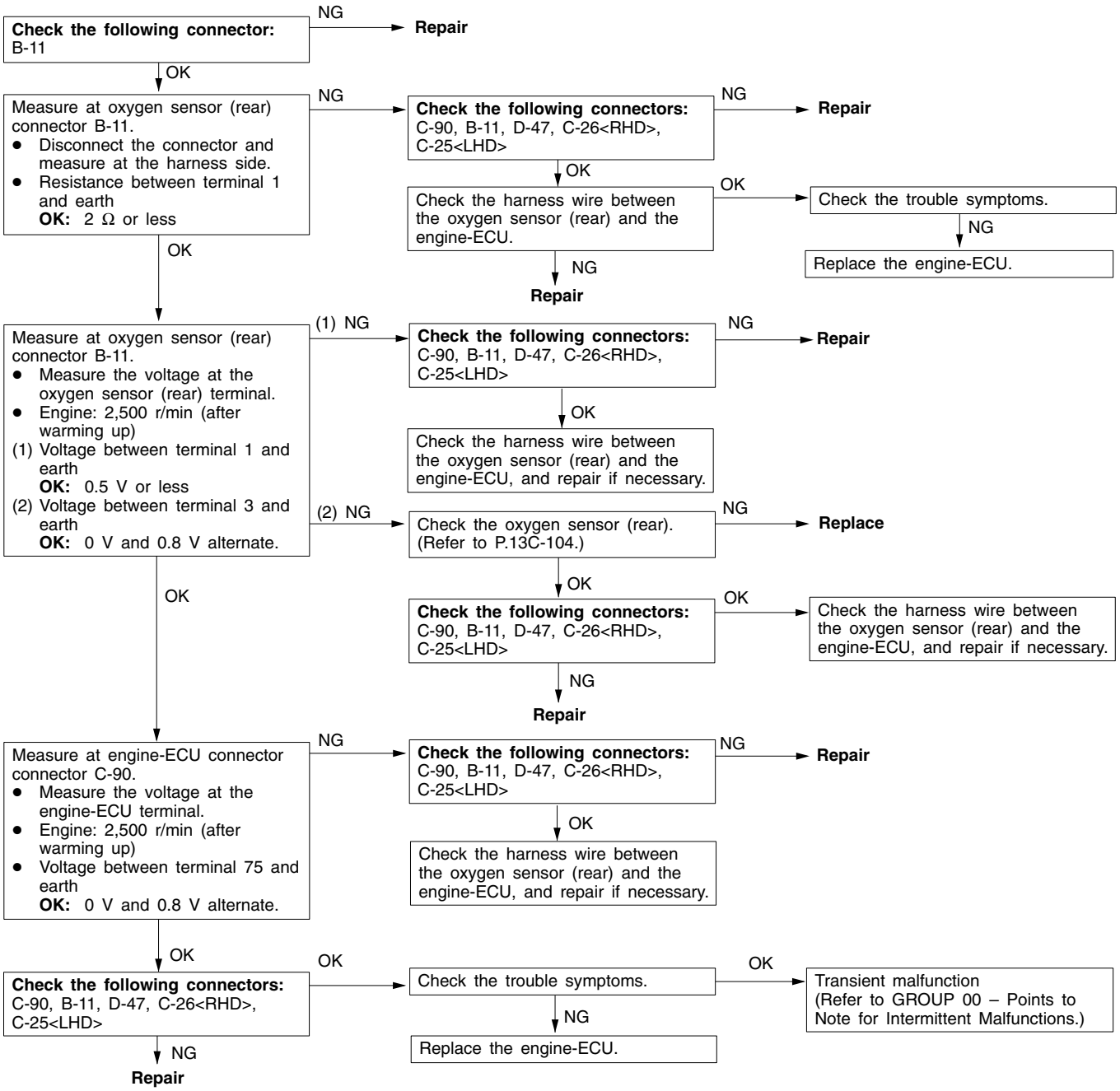
Code No. P0130 Oxygen sensor (front) system <sensor 1>	Probable cause
Range of Check ● Three minutes have been passed since the engine has been started. ● The engine coolant temperature is approx. 80°C or more. ● Engine speed is 1,200 r/min or more ● Driving on a level surface at constant speed. Set Conditions ● The oxygen sensor (front) output voltage is 4.5 V or more when the sensor output voltage is 0.2 V or less and a voltage of 5 V is applied to the oxygen sensor (front) inside the engine-ECU.	● Malfunction of oxygen sensor (front) ● Open or short circuit in the oxygen sensor (front) circuit or loose connector contact ● Malfunction of engine-ECU
Range of Check ● Engine speed is 3,000 r/min or less ● During driving ● During air/fuel ratio feedback control Set Conditions ● The oxygen sensor (front) output frequency is five or less per 12 seconds on average.	



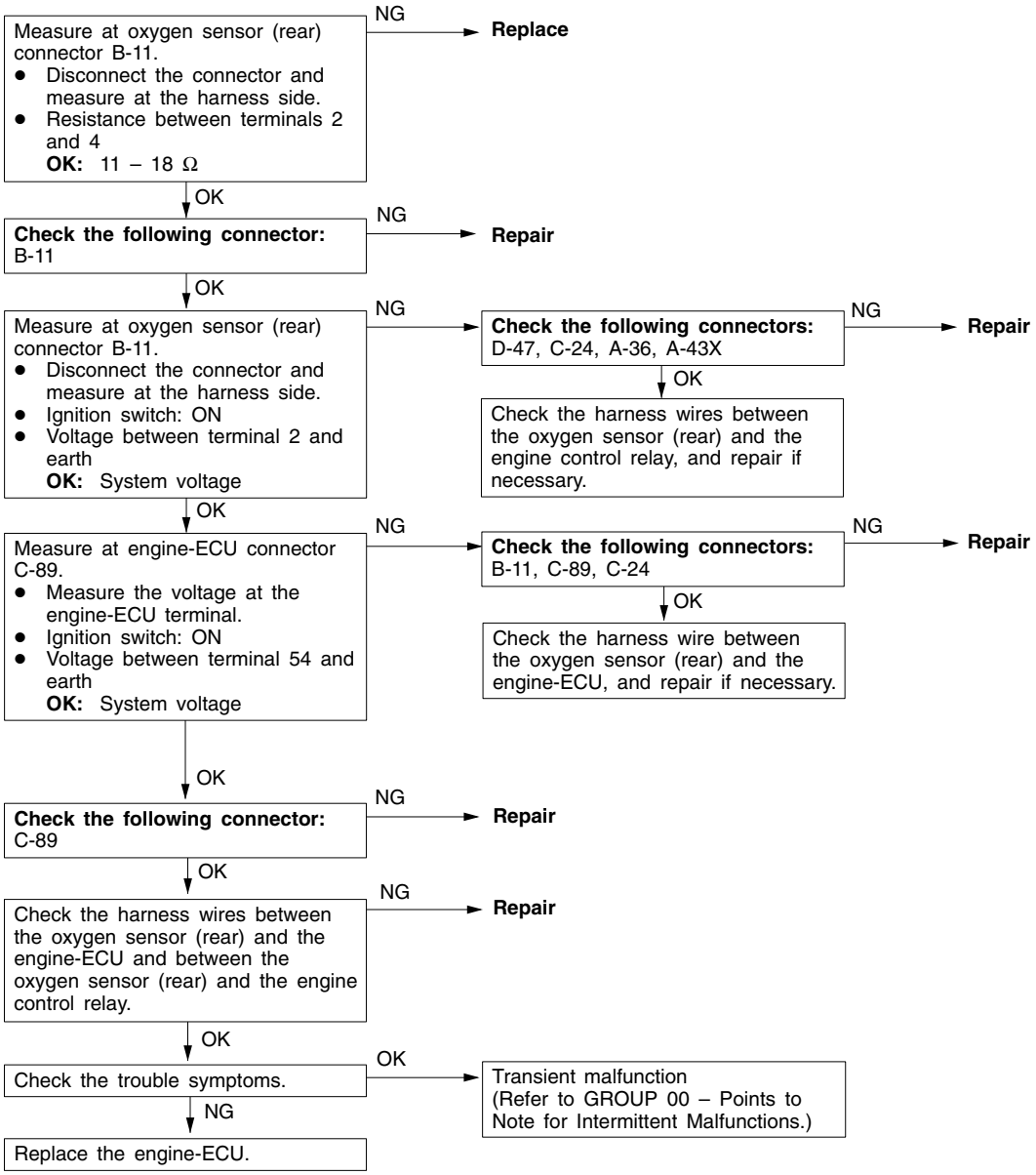
Code No. P0135 Oxygen sensor heater (front) system <sensor 1>	Probable cause
Range of Check ● The engine coolant temperature is approx. 20°C or more. ● The oxygen sensor heater (front) remains on. ● The engine speed is 50 r/min or more. ● Battery voltage is 11 – 16 V. Set Conditions ● The current, which flows through the oxygen sensor heater (front), is 0.2 A or less or 3.5 A or more for six seconds.	● Malfunction of oxygen sensor heater (front) ● Open or short circuit in the oxygen sensor heater (front) circuit or loose connector contact ● Malfunction of engine-ECU



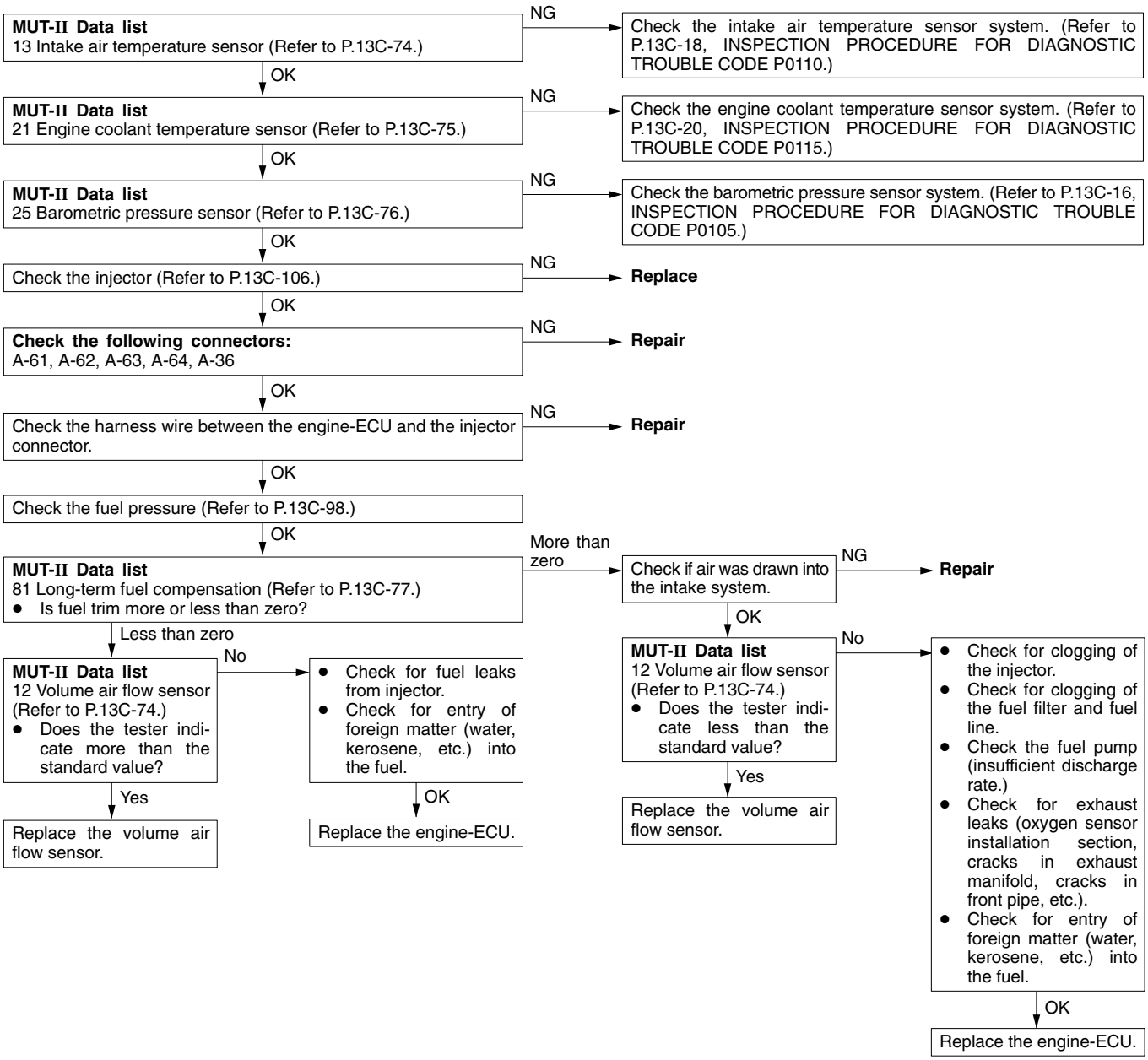
Code No. P0136 Oxygen sensor (rear) system <sensor 2>	Probable cause
Range of Check ● Three minutes have been passed since the engine has been started. ● The engine coolant temperature is approx. 80°C or more. ● Intake air temperature is 20 – 50°C ● Engine speed is 1,200 r/min or more ● Driving on a level surface at constant speed. Set Conditions ● The oxygen sensor (rear) output voltage is 4.5 V or more when the sensor output voltage is 0.2 V or less and a voltage of 5 V is applied to the oxygen sensor (rear) inside the engine-ECU.	● Malfunction of oxygen sensor (rear) ● Open or short circuit in the oxygen sensor (rear) circuit or loose connector contact ● Malfunction of engine-ECU
Range of Check ● Two seconds have passed after the engine-ECU detected an open circuit. ● When the oxygen sensor (front) is in good condition. Set Conditions ● When the air/fuel ratio is rich, the oxygen sensor (front) output voltage is 0.5 V or more, the oxygen sensor (rear) output voltage is less than 0.1 V, and the oxygen sensor (rear) output voltage fluctuates within 0.078 V.	



Code No. P0141 Oxygen sensor heater (rear) system <sensor 2>	Probable cause
Range of Check ● The engine coolant temperature is approx. 20°C or more. ● The oxygen sensor heater (rear) remains on. ● The engine speed is 50 r/min or more. ● Battery voltage is 11 – 16 V. Set Conditions ● The current, which flows through the oxygen sensor heater (rear), is 0.2 A or less or 3.5 A or more for six seconds.	● Malfunction of oxygen sensor heater (rear) ● Open or short circuit in the oxygen sensor heater (rear) circuit or loose connector contact ● Malfunction of engine-ECU



Code No. P0170 Abnormal fuel system	Probable cause
Range of Check ● Engine: Being learning the air-fuel ratio Set Conditions ● Ten seconds or more have been passed while the fuel injection amount compensation value is too low. or ● Ten seconds or more have been passed while the fuel injection amount compensation value is too high.	● Incorrect fuel pressure ● Malfunction of fuel supply system ● Malfunction of oxygen sensor (front) ● Malfunction of intake air temperature sensor ● Malfunction of barometric pressure sensor ● Malfunction of air flow sensor ● Malfunction of engine-ECU



Code No. P0201 No. 1 injector system Code No. P0202 No. 2 injector system Code No. P0203 No. 3 injector system Code No. P0204 No. 4 injector system	Probable cause
Range of Check ● Engine speed is approx. 50 – 1,000 r/min ● The throttle position sensor output voltage is 1.15 V or less. ● Actuator test by MUT-II is not carried out. Set Conditions ● Surge voltage of injector coil is not detected for 4 seconds.	● Malfunction of the injector ● Improper connector contact, open circuit or short-circuited harness wire of the injector circuit ● Malfunction of engine-ECU

MUT-II Actuator Test
01 No. 1 injector
02 No. 2 injector
03 No. 3 injector
04 No. 4 injector
OK: The idling condition should change
→ OK: Intermittent malfunction (Refer to GROUP 00 – Points to Note for Intermittent Malfunctions.)
↓ NG

Check the following connectors:
A-61, A-62, A-63, A-64
→ NG: **Repair**
↓ OK

Check the injector. (Refer to P.13C-106.)
→ NG: **Replace**
↓ OK

Measure at the injector connector A-61, A-62, A-63, A-64.
● Disconnect the connector, and measure at the harness side.
● Voltage between 1 and earth (Ignition switch: ON)
OK: System voltage
→ NG: Check the harness wire between the engine control relay and the injector connector, and repair if necessary.
↓ OK

Check the following connector: C-87
→ NG: **Repair**
↓ OK

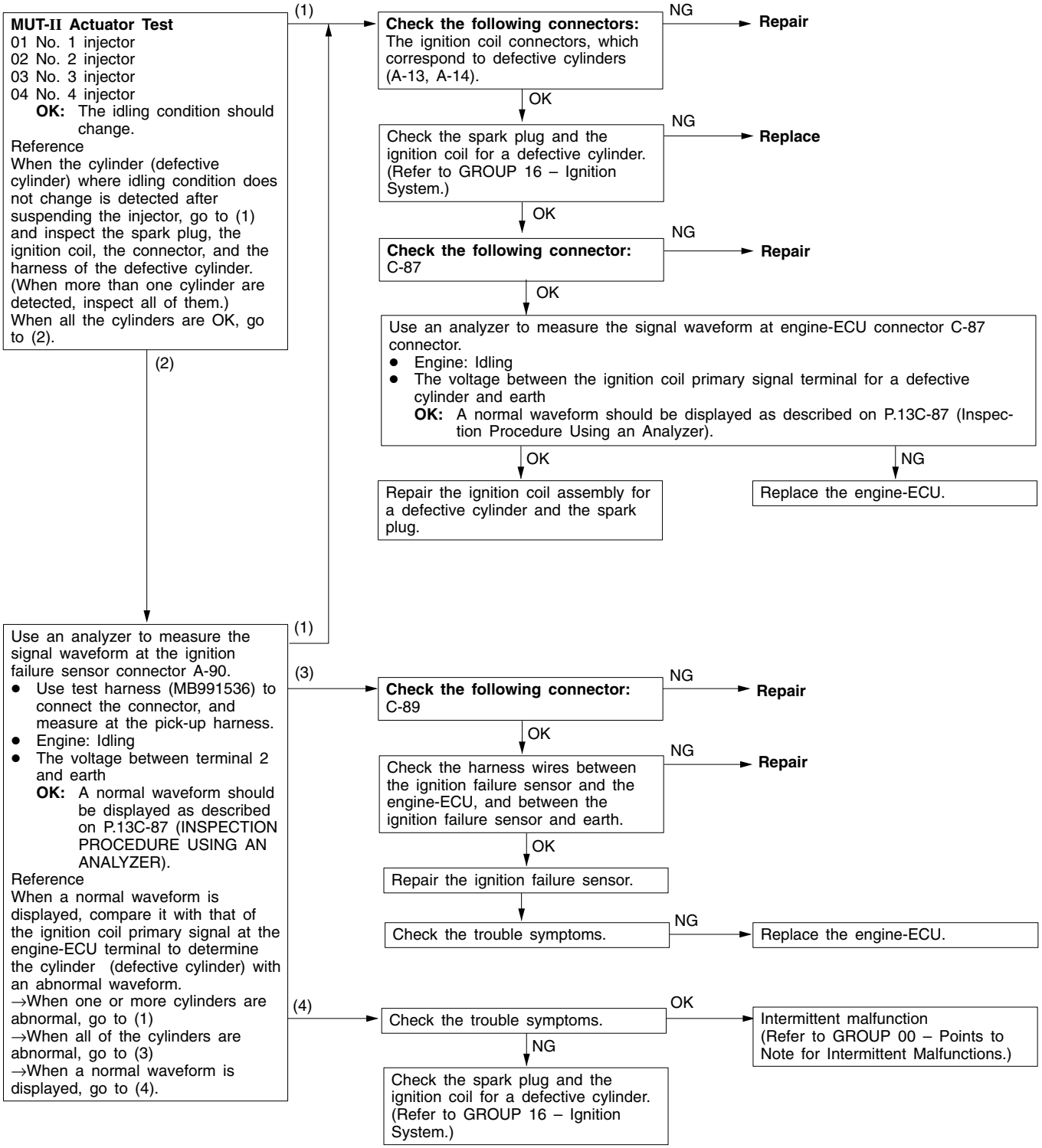
Measure at the engine-ECU connector C-87.
● Disconnect the connector, and measure at the harness side.
● Voltage between 1, 2, 14, 15 and earth (Ignition switch: ON)
OK: System voltage
→ NG: Check the harness wire between the engine-ECU and the injector connector, and repair if necessary.
↓ OK

Check the trouble symptoms.
↓ NG

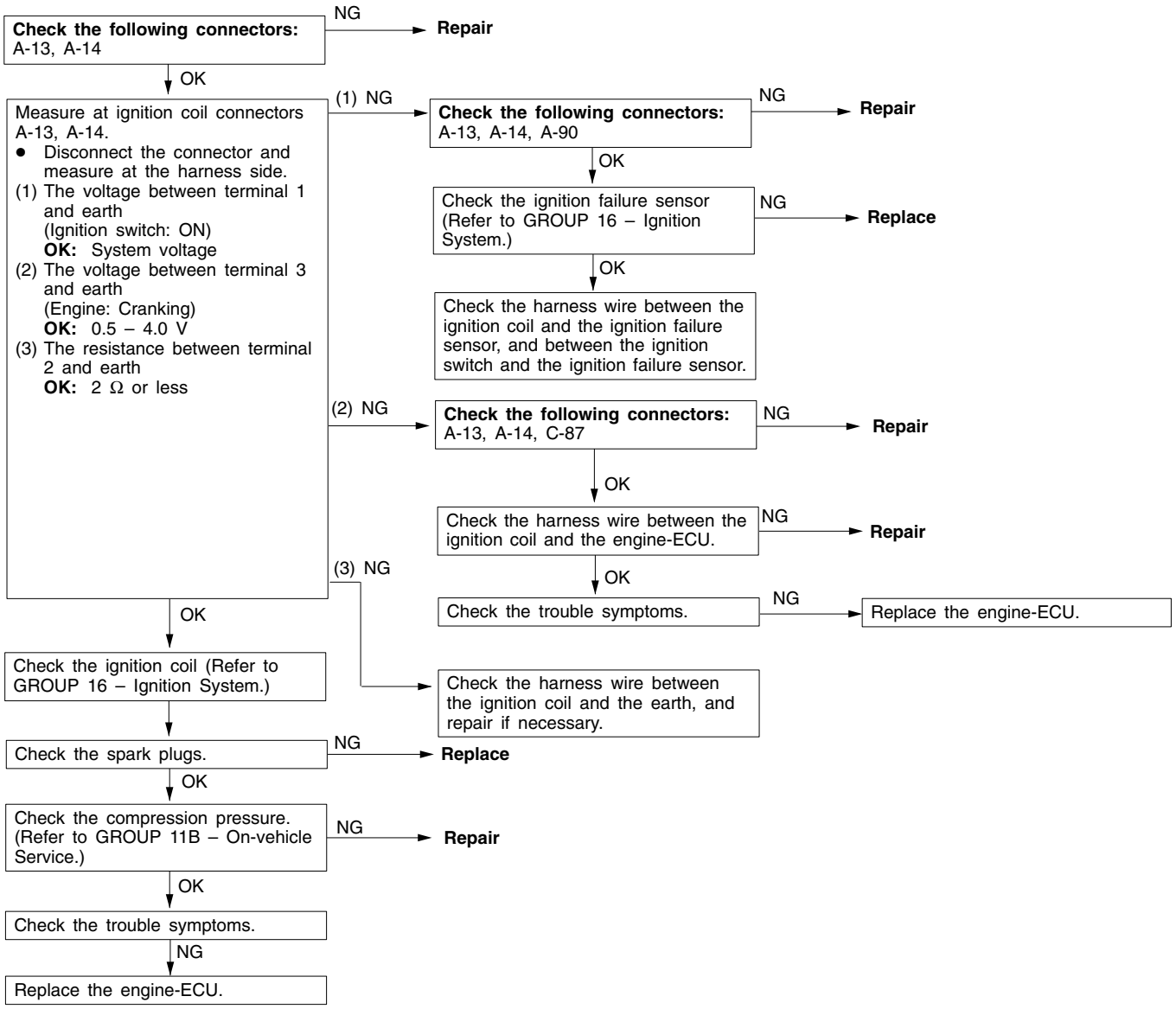
Use an analyzer to measure the signal waveform at injector connector A-61, A-62, A-63, A-64.
● Use a test harness (MB991348) to connect the connector, and measure at the pick-up harness side.
● Engine: Idling
● The voltage between terminal 2 and earth
OK: A normal waveform should be displayed as described on P.13C-87 (INSPECTION PROCEDURE USING AN ANALYZER).
→ OK: Intermittent malfunction (Refer to GROUP 00 – Points to Note for Intermittent Malfunctions.)
↓ NG

Replace the engine-ECU.

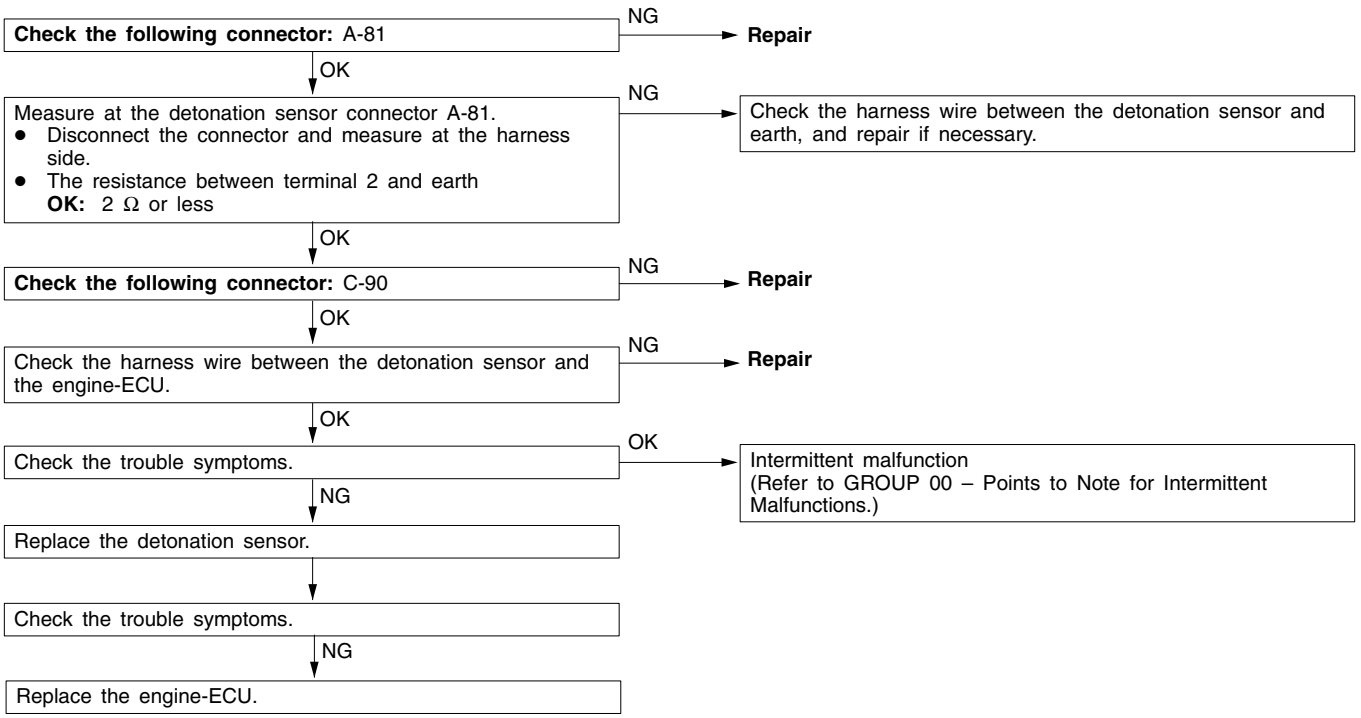
Code No. P0300 Ignition coil (power transistor) system	Probable cause
Range of Check ● Engine speed is approx. 50 – 4,000 r/min. ● Engine is not cranking. Set Conditions ● The ignition failure sensor does not send a signal about a certain cylinder for 4 seconds.	● Malfunction of the ignition coil ● Malfunction of the ignition failure sensor ● Malfunction of spark plug ● Open or short circuit in the primary ignition circuit or loose connector contact ● Malfunction of engine-ECU



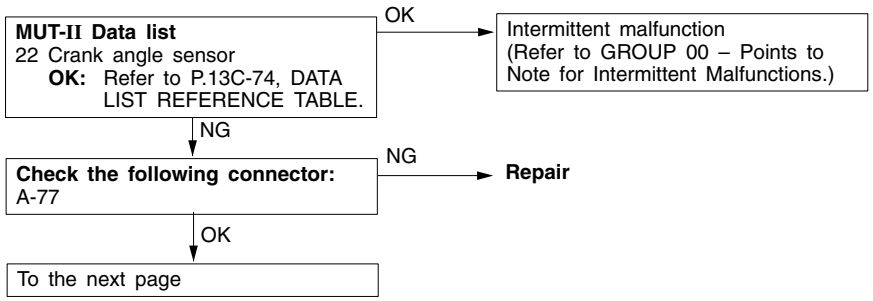
Code No. P0301 No. 1 cylinder misfire detected **Code No. P0302 No. 2 cylinder misfire detected** **Code No. P0303 No. 3 cylinder misfire detected** **Code No. P0304 No. 4 cylinder misfire detected**	**Probable cause**
Range of Check • The engine speed is 500 – 4,500 r/min. • While the engine is running except deceleration and sudden acceleration. Set Conditions • The number of misfires exceeds a predetermined number per 200 engine revolutions (Misfire has occurred in only one cylinder). or • The number of misfires exceeds a predetermined number per 100 engine revolutions (Misfire has occurred in only one cylinder).	• Malfunction of the ignition system • Abnormal compression • Malfunction of injector • Malfunction of engine-ECU

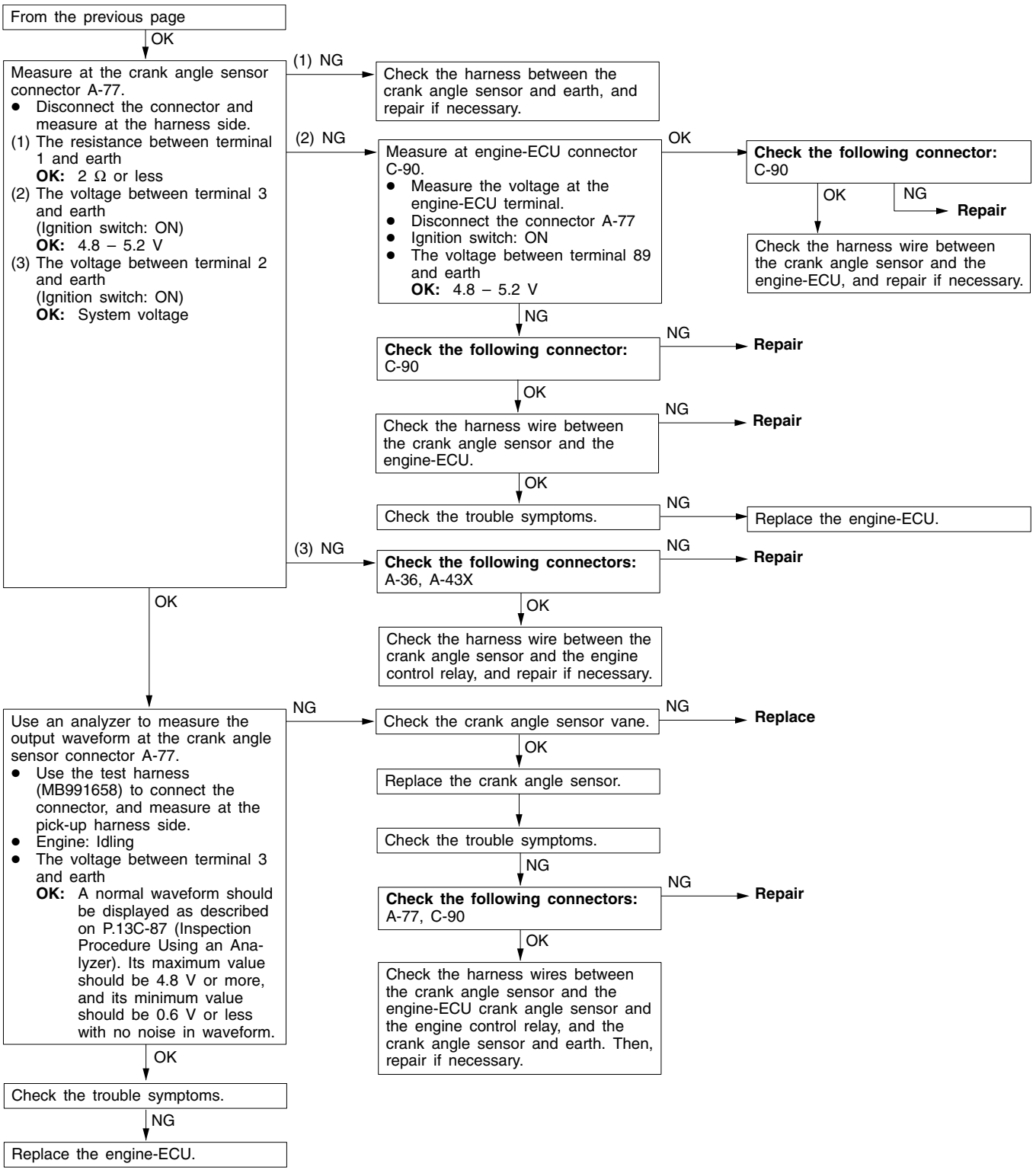


Code No. P0325 Detonation sensor system	Probable cause
Range of Check • Engine: Two seconds after the engine has been started Set Conditions • Changes in sensor output voltage (detonation sensor peak voltage per 1/2 crankshaft rotation) in 200 consecutive cycles are 0.06 V or less.	• Malfunction of the detonation sensor • Open or short circuit in the detonation sensor circuit or loose connector contact • Malfunction of engine-ECU

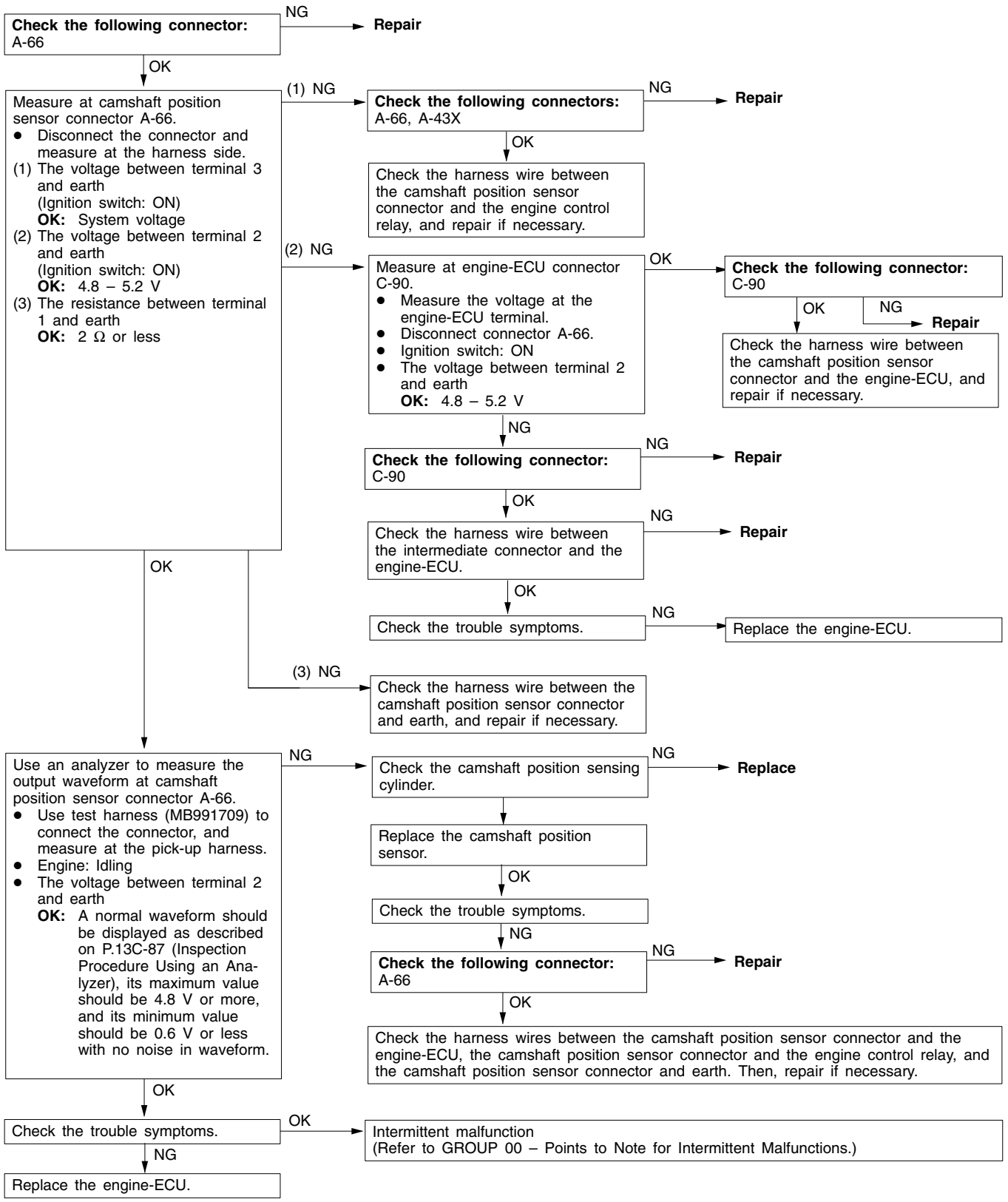


Code No. P0335 Crank angle sensor system	Probable cause
Range of Check • Engine is cranking Set Conditions • Sensor output voltage does not change for 4 seconds (no pulse signal input).	• Malfunction of the crank angle sensor. • Open or short circuit in the crank angle sensor circuit or loose connector contact. • Malfunction of engine-ECU

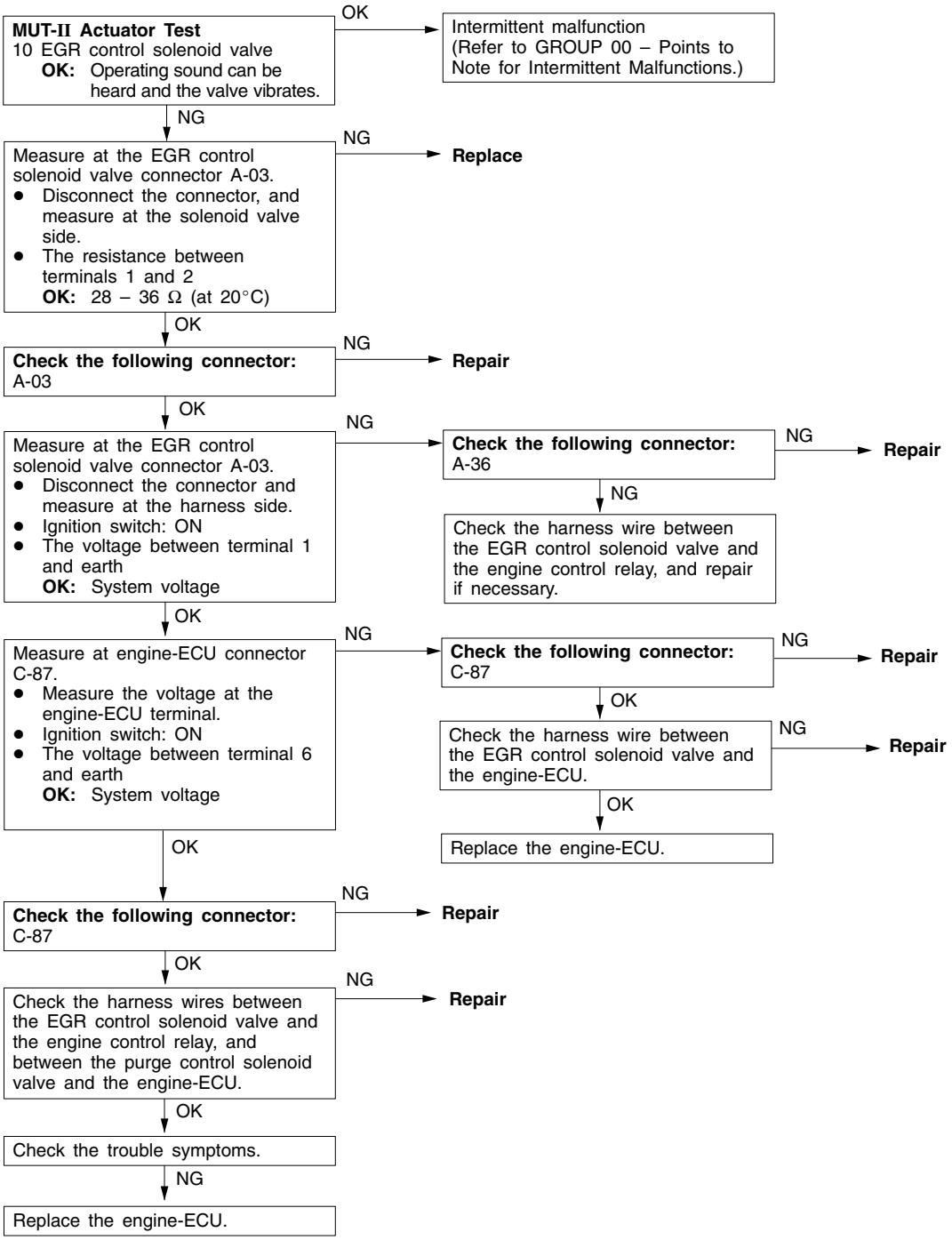



From the previous page
OK
Measure at the crank angle sensor connector A-77.
● Disconnect the connector and measure at the harness side.
(1) The resistance between terminal 1 and earth
OK: 2 Ω or less
(2) The voltage between terminal 3 and earth
(Ignition switch: ON)
OK: 4.8 – 5.2 V
(3) The voltage between terminal 2 and earth
(Ignition switch: ON)
OK: System voltage
(1) NG
Check the harness between the crank angle sensor and earth, and repair if necessary.
(2) NG
Measure at engine-ECU connector C-90.
● Measure the voltage at the engine-ECU terminal.
● Disconnect the connector A-77
● Ignition switch: ON
● The voltage between terminal 89 and earth
OK: 4.8 – 5.2 V
OK
Check the following connector: C-90
OK
NG
Repair
Check the harness wire between the crank angle sensor and the engine-ECU, and repair if necessary.
NG
Check the following connector: C-90
NG
Repair
OK
Check the harness wire between the crank angle sensor and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
(3) NG
Check the following connectors: A-36, A-43X
NG
Repair
OK
Check the harness wire between the crank angle sensor and the engine control relay, and repair if necessary.
OK
Use an analyzer to measure the output waveform at the crank angle sensor connector A-77.
● Use the test harness (MB991658) to connect the connector, and measure at the pick-up harness side.
● Engine: Idling
● The voltage between terminal 3 and earth
OK: A normal waveform should be displayed as described on P.13C-87 (Inspection Procedure Using an Analyzer). Its maximum value should be 4.8 V or more, and its minimum value should be 0.6 V or less with no noise in waveform.
NG
Check the crank angle sensor vane.
NG
Replace
OK
Replace the crank angle sensor.
Check the trouble symptoms.
NG
Check the following connectors: A-77, C-90
NG
Repair
OK
Check the harness wires between the crank angle sensor and the engine-ECU crank angle sensor and the engine control relay, and the crank angle sensor and earth. Then, repair if necessary.
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.

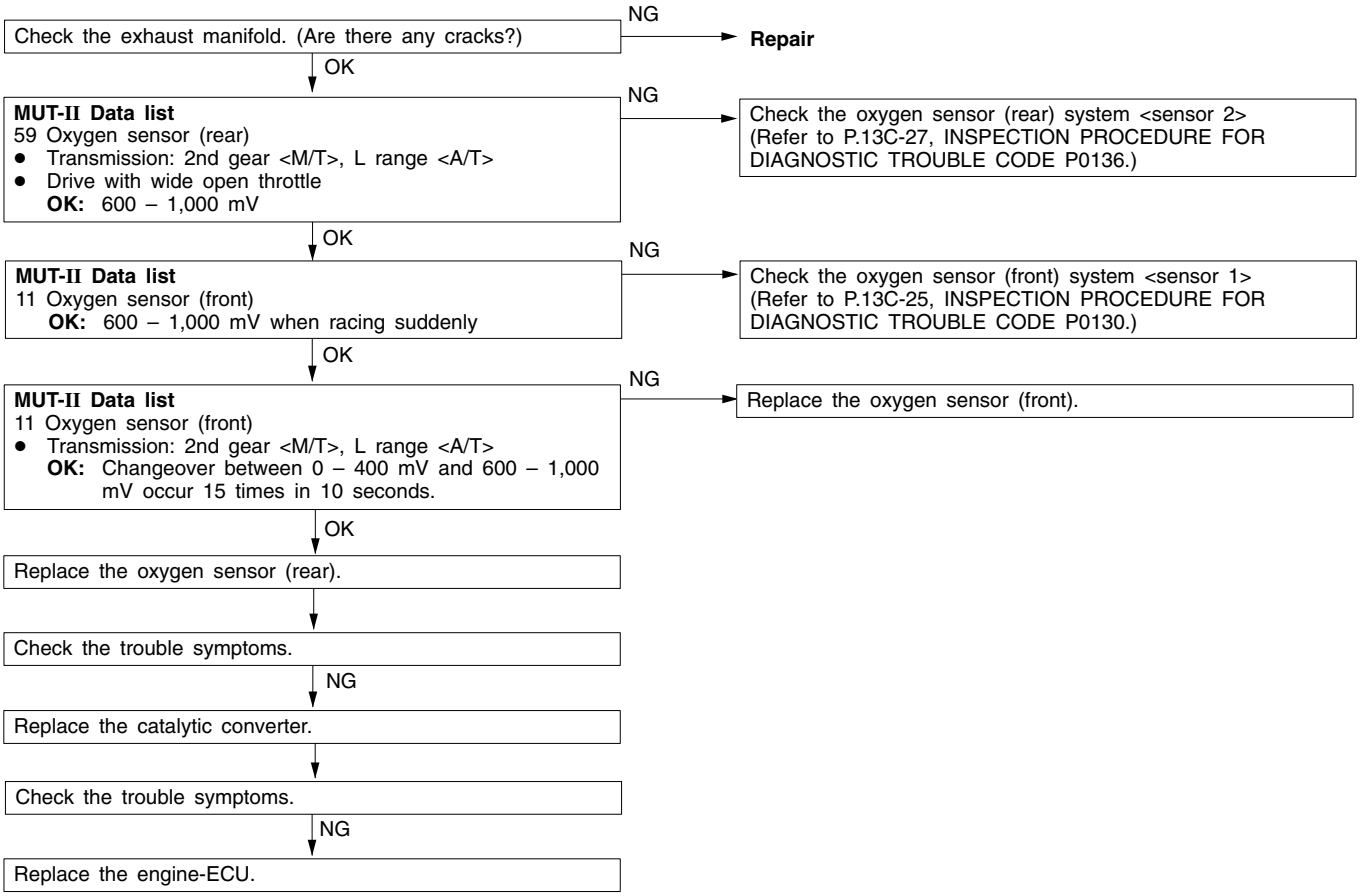
Code No. P0340 Camshaft position sensor system	Probable cause
Range of Check ● After the engine was started Set Conditions ● The sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the camshaft position sensor ● Open or short circuit in the camshaft position sensor circuit or loose connector contact. ● Malfunction of engine-ECU



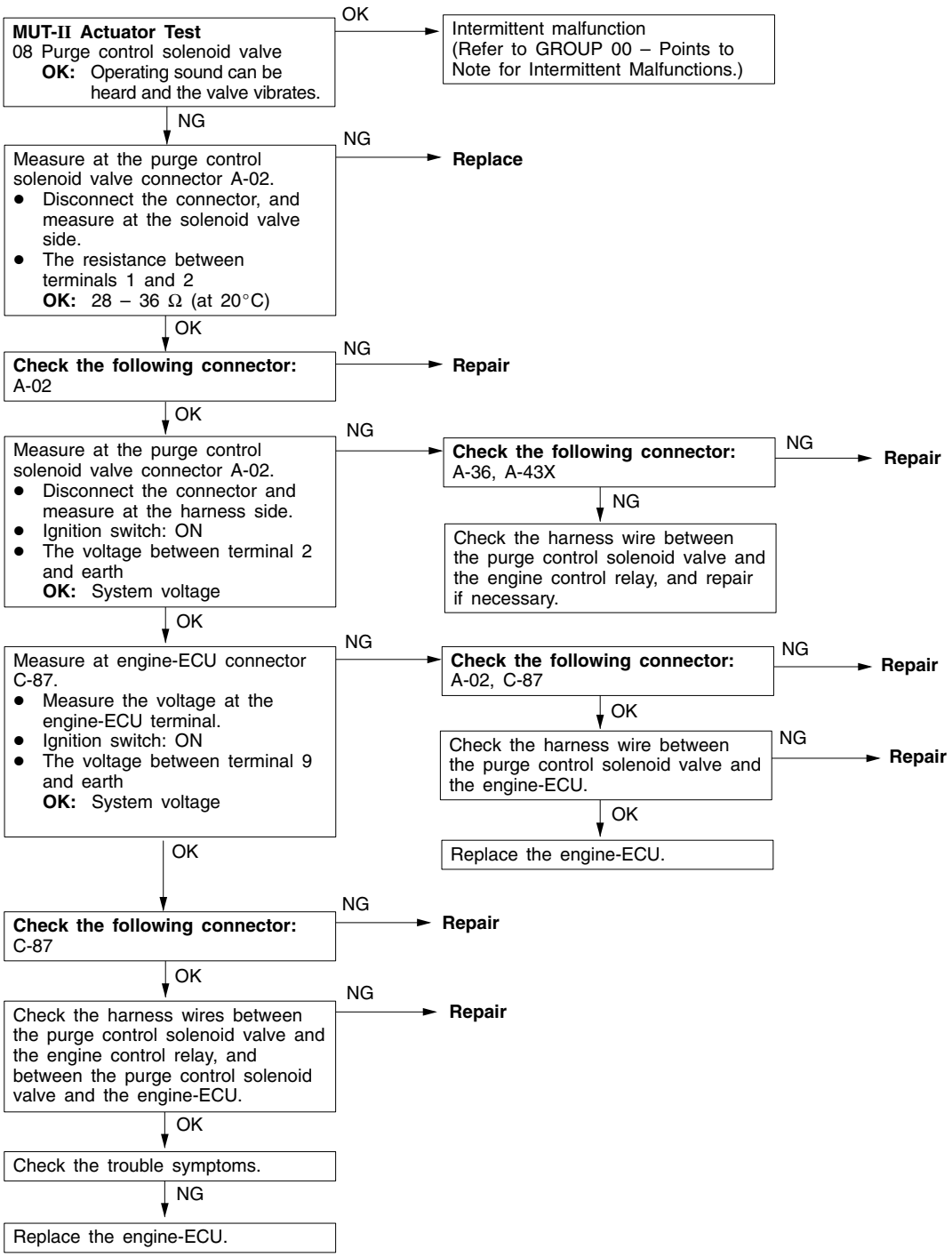
Code No. P0403 EGR control solenoid valve system	Probable cause
Range of Check ● Ignition switch: ON ● Battery voltage is 10 V or more. Set Conditions ● The solenoid coil surge voltage (battery voltage + 2 V) is not detected when the purge control solenoid valve is turned from on to off.	● Malfunction of the EGR control solenoid valve ● Open or short circuit in the EGR control solenoid valve circuit or loose connector contact ● Malfunction of engine-ECU



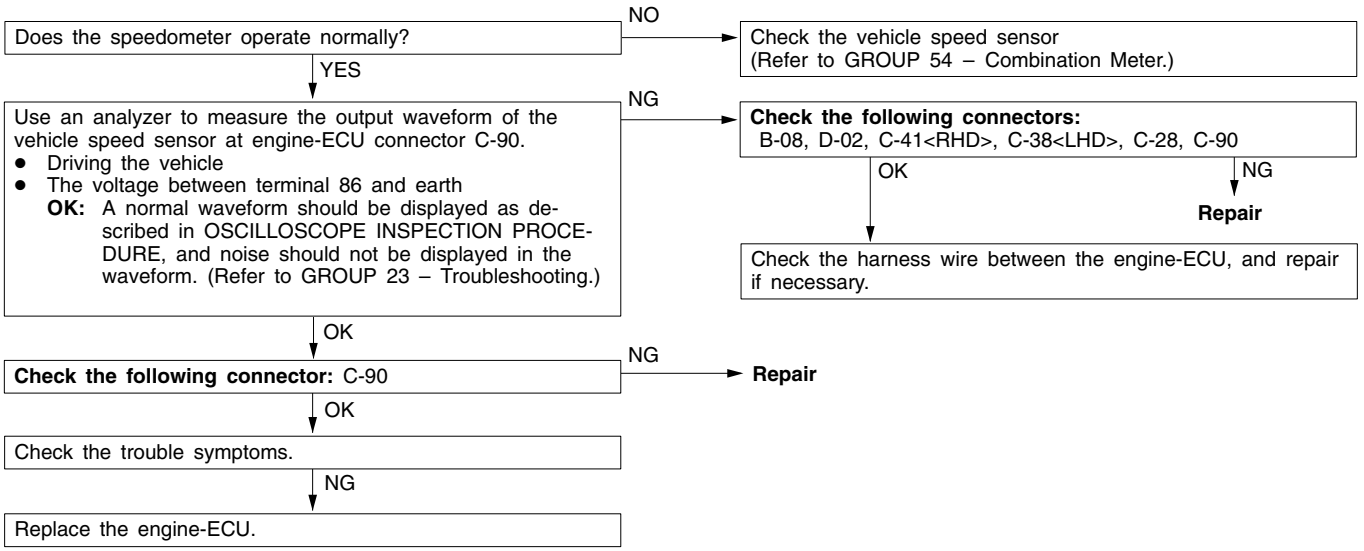
Code No. P0420 Catalyst malfunction	Probable cause
Range of Check • The engine speed is 3,000 r/min or less. • During driving • During air/fuel ratio feedback control Set Conditions • The ratio between the oxygen sensor (rear) and the oxygen sensor (front) output frequencies reaches 0.8 per 12 seconds on average.	• Malfunction of catalyst • Malfunction of the oxygen sensor (front) • Malfunction of the oxygen sensor (rear) • Malfunction of engine-ECU



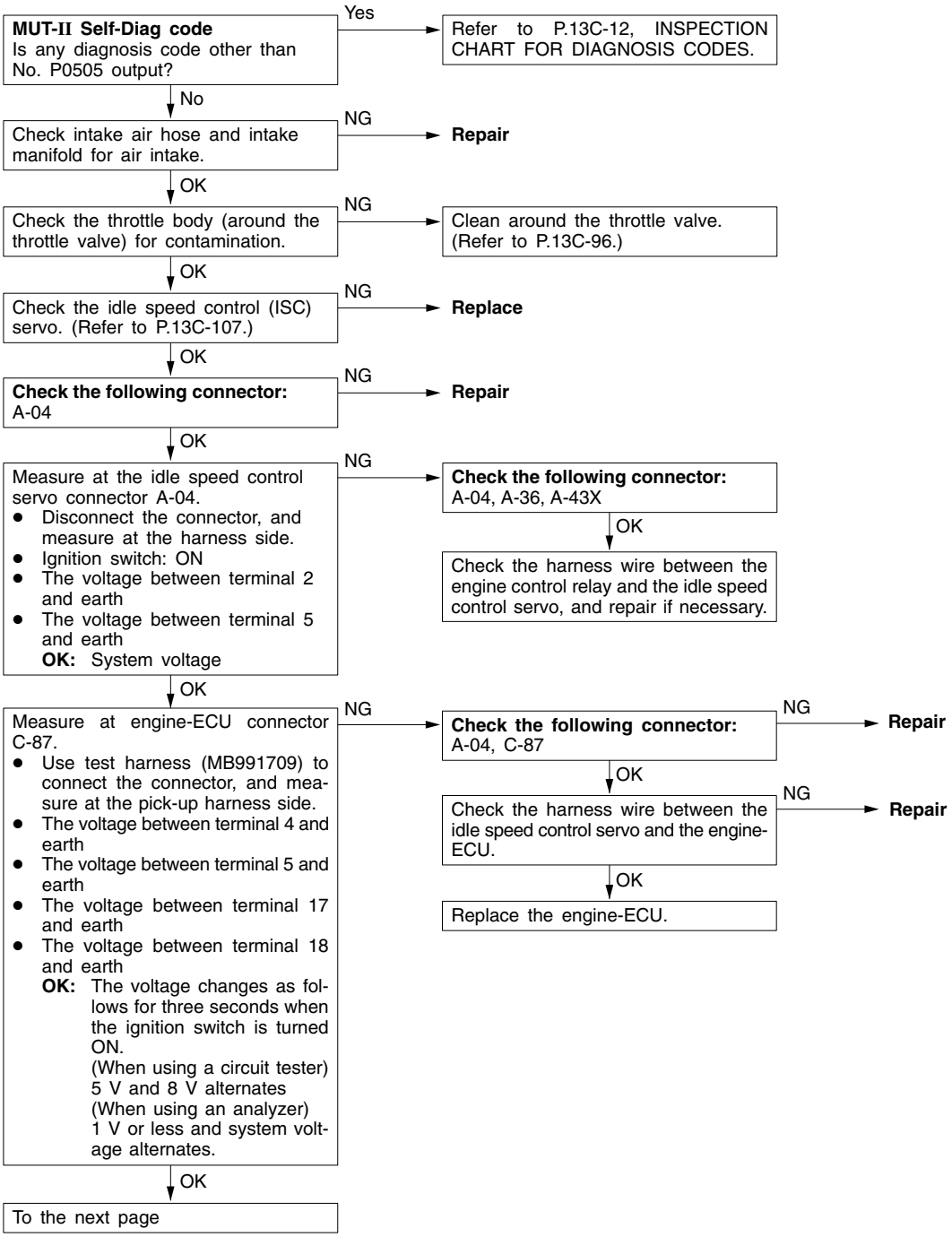
Code No. P0443 Purge control solenoid valve system	Probable cause
Range of Check ● Ignition switch: ON ● Battery voltage is 10 V or more. Set Conditions ● The solenoid coil surge voltage (battery voltage + 2 V) is not detected when the purge control solenoid valve is turned from on to off.	● Malfunction of the purge control solenoid valve ● Open or short circuit in the purge control solenoid valve circuit or loose connector contact ● Malfunction of engine-ECU

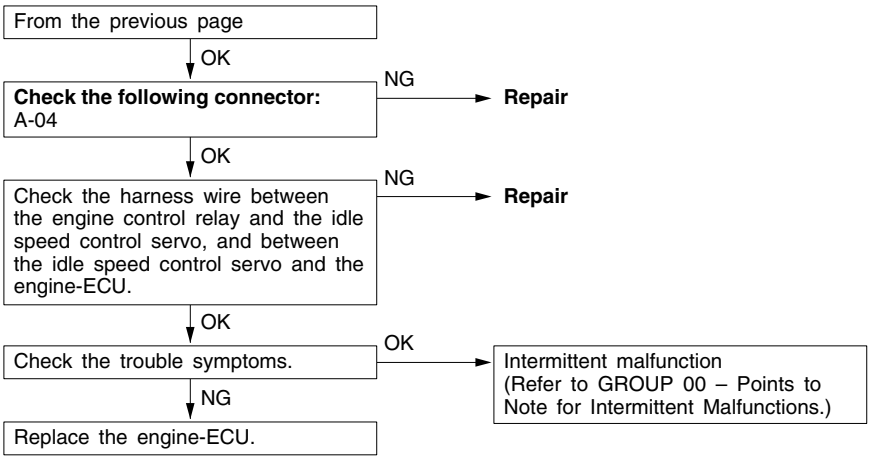


Code No. P0500 Vehicle speed sensor system	Probable cause
Range of Check ● Engine: Two seconds after the engine was started ● Idle switch: OFF ● Engine speed: 2,500 r/min or more ● During high engine load Set Conditions ● The sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the vehicle speed sensor ● Open or short circuit in the vehicle speed sensor circuit or loose connector contact ● Malfunction of engine-ECU

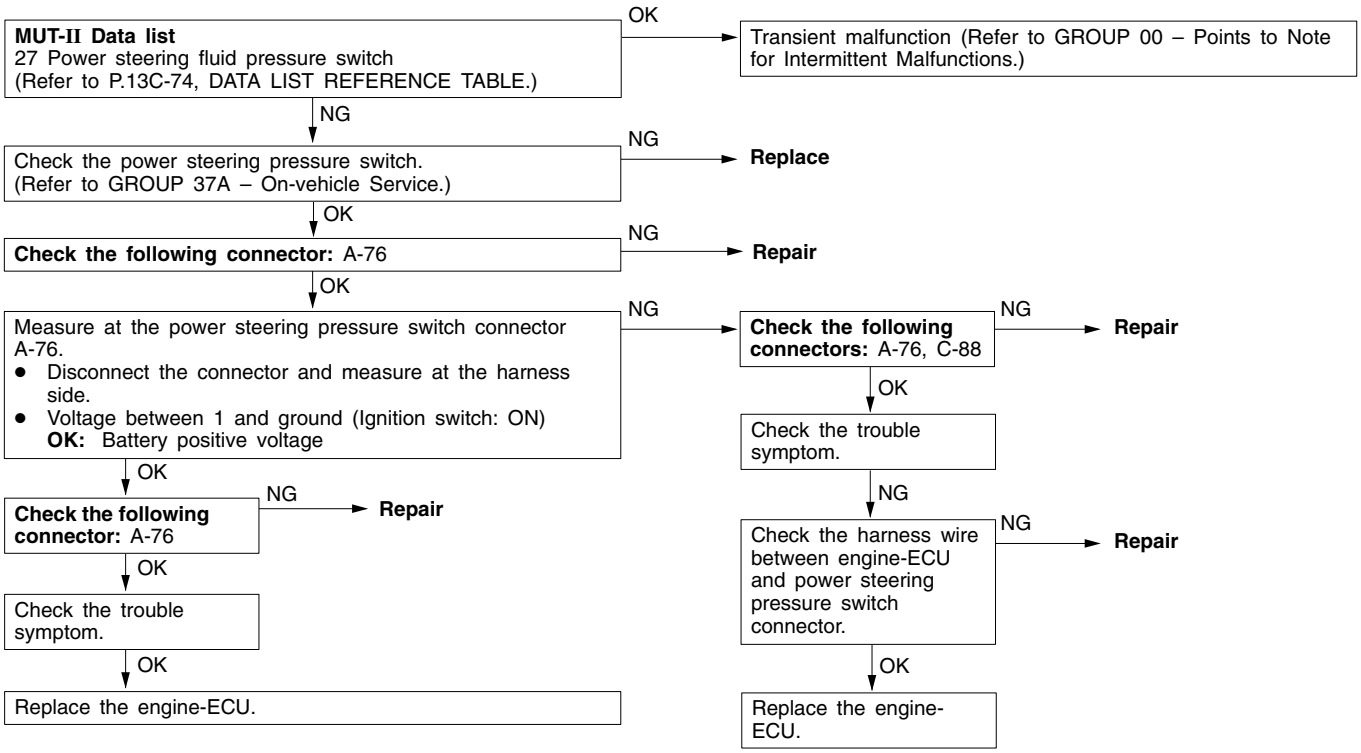


Code No. P0505 Idle speed control (ISC) system	Probable cause
Check Area ● Vehicle speed has reached 1.5 km/h at least once. ● Under the closed loop idle speed control. Judgment Criteria ● Actual idle speed has continued to be higher than the target idle speed by 300 r/min or more for 10 sec. Check Area ● Vehicle speed has reached 1.5 km/h at least once. ● During idle speed closed loop control. ● The highest temperature at the last drive is 45°C or less. ● Engine coolant temperature is approx. 80°C or more. ● Battery voltage is 10 V or more. ● Intake air temperature is –10°C or more. Judgment Criteria ● Actual idle speed has been minimum 200 r/min higher than the target idle speed for 10 seconds. Check Area ● During idle speed closed loop control. ● Engine coolant temperature is about 80°C or higher. ● Battery voltage is 10 V or higher. ● Power steering switch is off. ● Intake air temperature is –10°C or more. ● Volume efficiency is 40 percent or lower. ● Barometric pressure is 76 kPa or higher. Judgment Criteria ● Actual idle speed has been minimum 100 r/min higher than the target idle speed for 10 seconds.	● Malfunction of idle speed control (ISC) servo ● Improper connector contact, open circuit or short-circuit harness wire ● Malfunction of engine-ECU

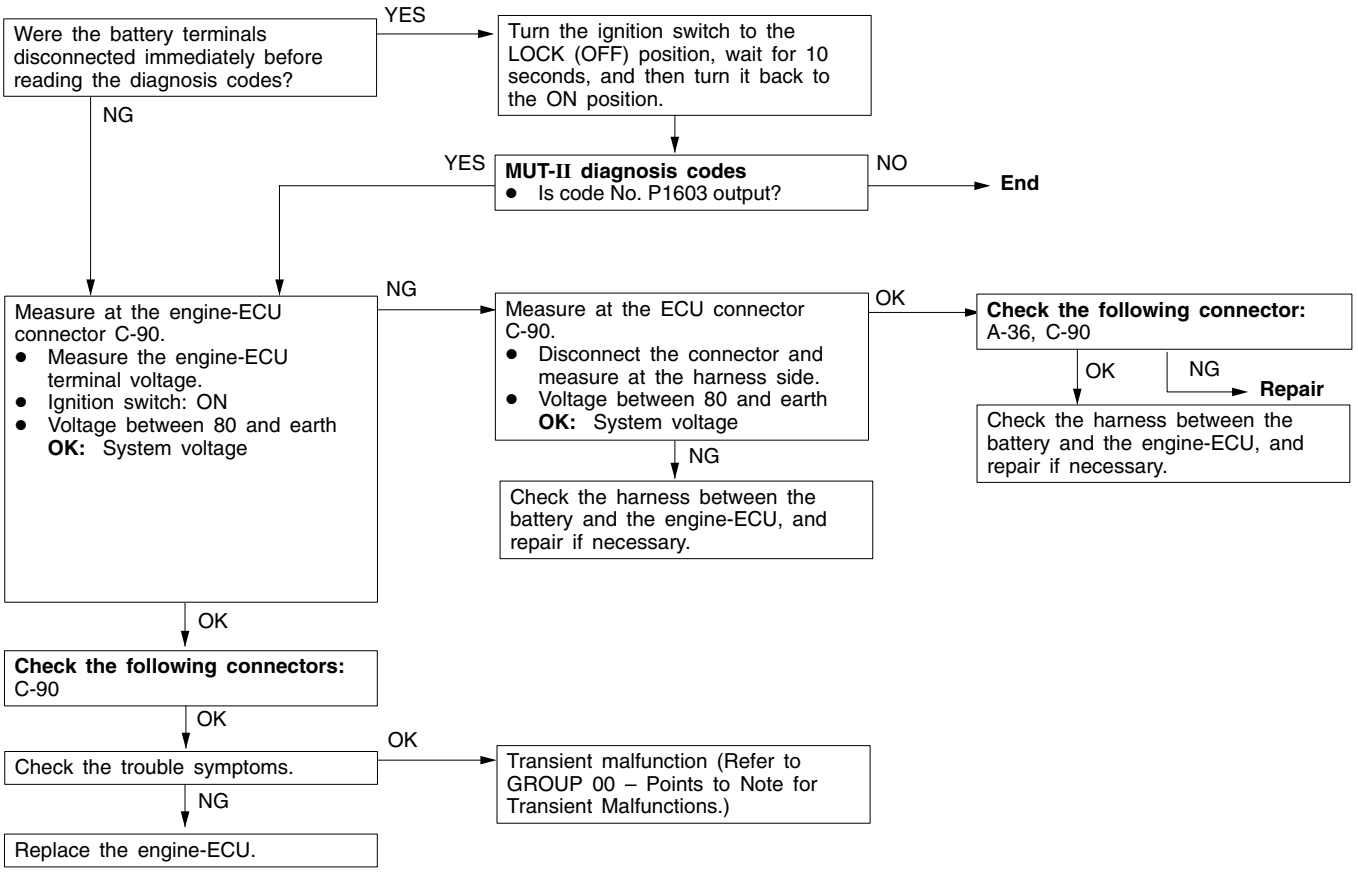

MUT-II Self-Diag code
Is any diagnosis code other than No. P0505 output?
Yes
Refer to P.13C-12, INSPECTION CHART FOR DIAGNOSIS CODES.
No
Check intake air hose and intake manifold for air intake.
NG
Repair
OK
Check the throttle body (around the throttle valve) for contamination.
NG
Clean around the throttle valve. (Refer to P.13C-96.)
OK
Check the idle speed control (ISC) servo. (Refer to P.13C-107.)
NG
Replace
OK
Check the following connector:
A-04
NG
Repair
OK
Measure at the idle speed control servo connector A-04.
Disconnect the connector, and measure at the harness side.
Ignition switch: ON
The voltage between terminal 2 and earth
The voltage between terminal 5 and earth
OK: System voltage
NG
Check the following connector:
A-04, A-36, A-43X
OK
Check the harness wire between the engine control relay and the idle speed control servo, and repair if necessary.
OK
Measure at engine-ECU connector C-87.
Use test harness (MB991709) to connect the connector, and measure at the pick-up harness side.
The voltage between terminal 4 and earth
The voltage between terminal 5 and earth
The voltage between terminal 17 and earth
The voltage between terminal 18 and earth
OK: The voltage changes as follows for three seconds when the ignition switch is turned ON.
(When using a circuit tester)
5 V and 8 V alternates
(When using an analyzer)
1 V or less and system voltage alternates.
NG
Check the following connector:
A-04, C-87
NG
Repair
OK
Check the harness wire between the idle speed control servo and the engine-ECU.
NG
Repair
OK
Replace the engine-ECU.
OK
To the next page


From the previous page
OK
Check the following connector:
A-04
NG
Repair
OK
Check the harness wire between the engine control relay and the idle speed control servo, and between the idle speed control servo and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
OK
Intermittent malfunction
(Refer to GROUP 00 – Points to Note for Intermittent Malfunctions.)
NG
Replace the engine-ECU.

Code No. P0551 Power Steering fluid Pressure Switch System	Probable cause
Check Area ● Intake air temperature is –10°C or higher. ● Barometric pressure is 76 kPa or higher. ● Engine coolant temperature is 30°C or more. ● Repeat *1 drive and *2 stop ten times or more. *1: Engine speed is 2,500 r/min or higher, volumetric efficiency is 55 % or higher and vehicle speed is 5 km/h or higher for 4 seconds or more. *2: Vehicle speed is 1.5 km/h or lower. Judgment Criteria ● Power steering pressure switch remains on.	● Power steering fluid pressure switch failed. ● Open or shorted power steering fluid pressure switch circuit or loose connector ● Malfunction of engine-ECU

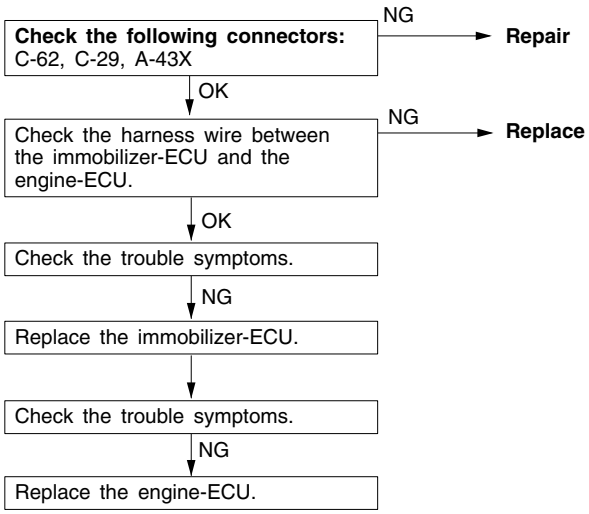


Code No. P1603 Battery backup line system	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● Backup RAM data which was set when the ignition switch was turned off the previous time has not been retained.	● Open circuit or short-circuit in the battery backup line, or loose connector contact ● Malfunction of the engine-ECU



Code No. P1610 Immobilizer system	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● Improper communication between the engine-ECU and the immobilizer-ECU	● Open or short circuit, or loose connector contact ● Malfunction of the immobilizer-ECU ● Malfunction of the engine-ECU

NOTE
(1) If the registered ignition keys are close each other when starting the engine, radio interference may cause this code to be displayed.
(2) This code may be displayed when registering the key ID code.



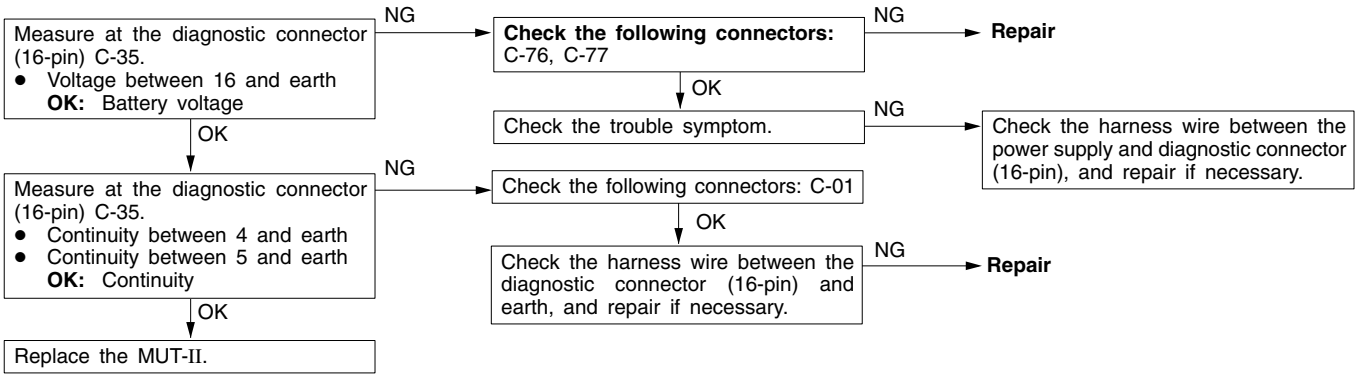
INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is impossible.	Communication with all systems is not possible.	1	13C-47
	Communication with engine-ECU only is not possible.	2	13C-47
Engine warning lamp and related parts	The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position.	3	13C48
	The engine warning lamp remains illuminating and never goes out.	4	13C-48
Starting	No initial combustion (starting impossible)	5	13C-49
	Initial combustion but no complete combustion (starting impossible)	6	13C-50
	Long time to start (improper starting)	7	13C-51
Idling stability (Improper idling)	Unstable idling (Rough idling, hunting)	8	13C-52
	Idling speed is high. (Improper idling speed)	9	13C-54
	Idling speed is low. (Improper idling speed)	10	13C-54
Idling stability (Engine stalls)	When the engine is cold, it stalls at idling. (Die out)	11	13C-55
	When the engine becomes hot, it stalls at idling. (Die out)	12	13C-56
	The engine stalls when starting the car. (Pass out)	13	13C-58
	The engine stalls when decelerating.	14	13C-58
Driving	Hesitation, sag or stumble	15	13C-59
	The feeling of impact or vibration when accelerating	16	13C-60
	The feeling of impact or vibration when decelerating	17	13C-60
	Poor acceleration	18	13C-61
	Surge	19	13C-63
	Knocking	20	13C-64
Dieseling		21	13C-64
Too high CO and HC concentration when idling		22	13C-65
Idling speed is improper when A/C is operating		23	13C-66
Fans (radiator fan, A/C condensor fan) are inoperative		24	13C-67

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

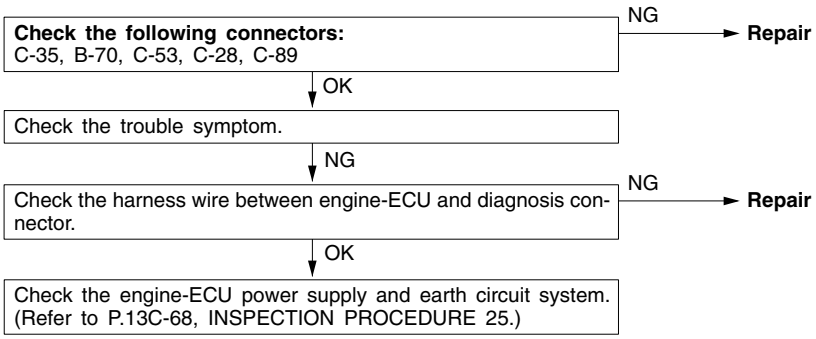
INSPECTION PROCEDURE 1

Communication with MUT-II is not possible. (Communication with all systems is not possible.)	Probable cause
The cause is probably a defect in the power supply system (including earth) for the diagnosis line.	• Malfunction of the connector • Malfunction of the harness wire



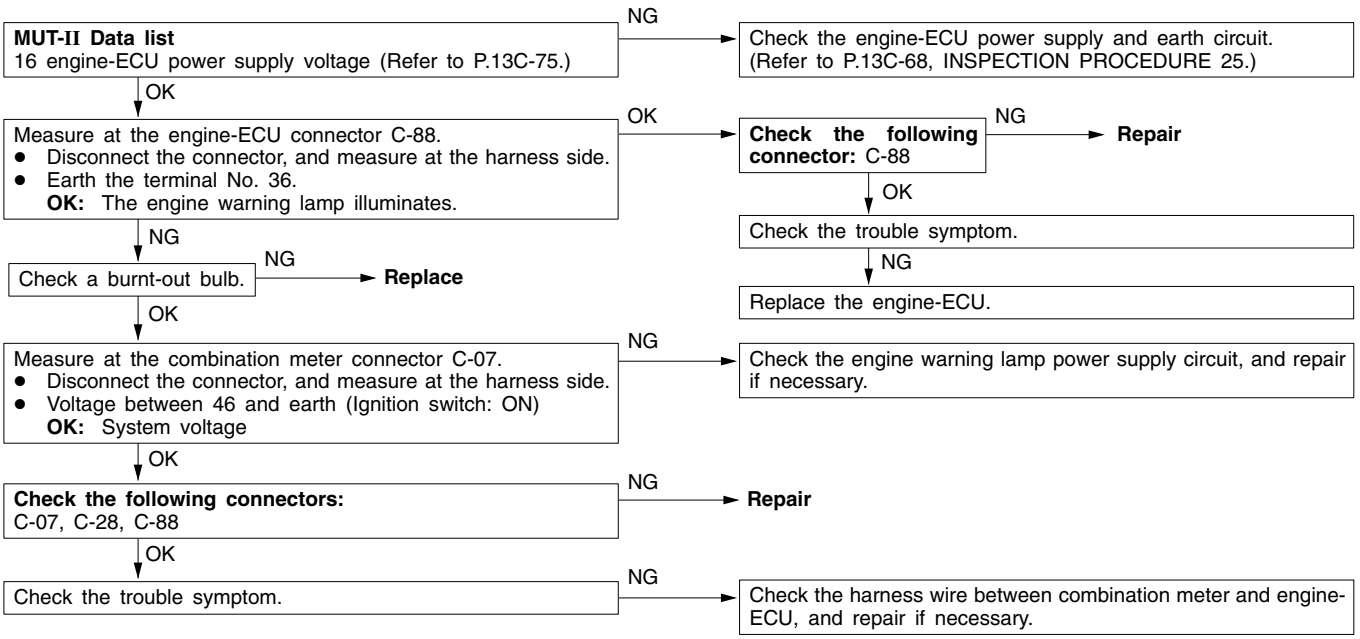
INSPECTION PROCEDURE 2

MUT-II communication with engine-ECU is impossible.	Probable cause
One of the following causes may be suspected. • No power supply to engine-ECU. • Defective earth circuit of engine-ECU. • Defective engine-ECU. • Improper communication line between engine-ECU and MUT-II	• Malfunction of engine-ECU power supply circuit • Malfunction of engine-ECU • Open circuit between the engine-ECU and diagnosis connector



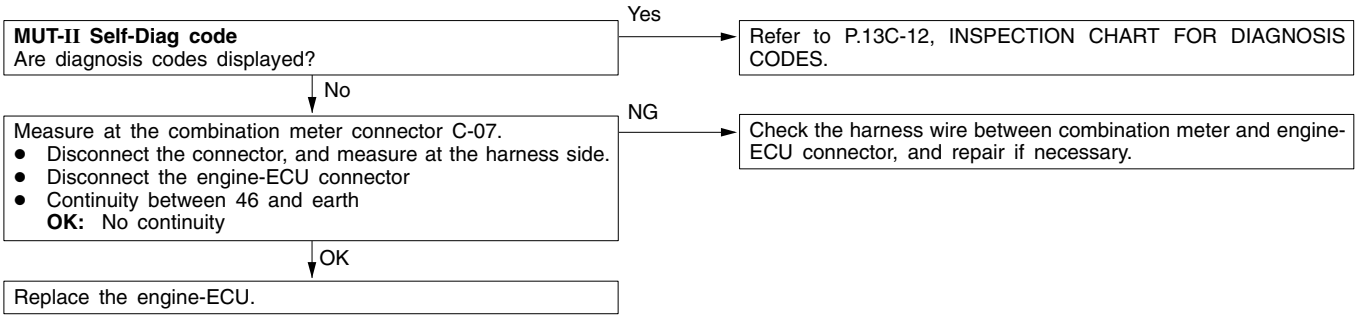
INSPECTION PROCEDURE 3

The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position.	Probable cause
Because there is a burnt-out bulb, the engine-ECU causes the engine warning lamp to illuminate for five seconds immediately after the ignition switch is turned to ON. If the engine warning lamp does not illuminate immediately after the ignition switch is turned to ON, one of the malfunctions listed at right has probably occurred.	• Burnt-out bulb • Defective warning lamp circuit • Malfunction of the engine-ECU



INSPECTION PROCEDURE 4

The engine warning lamp remains illuminating and never goes out.	Probable cause
In cases such as the above, the cause is probably that the engine-ECU is detecting a problem in a sensor or actuator, or that one of the malfunctions listed at right has occurred.	• Short-circuit between the engine warning lamp and engine-ECU • Malfunction of the engine-ECU



INSPECTION PROCEDURE 5

No initial combustion (starting impossible)	Probable cause
In cases such as the above, the cause is probably that a spark plug is defective, or that the supply of fuel to the combustion chamber is defective. In addition, foreign materials (water, kerosene, etc.) may be mixed with the fuel.	• Malfunction of the ignition system • Malfunction of the fuel pump system • Malfunction of the injectors • Malfunction of the engine-ECU • Malfunction of the immobilizer system • Foreign materials in fuel

Check battery voltage when cranking.
OK: 8 V or higher
NG → Check the battery. (Refer to GROUP 54 – Battery.)
OK ↓

Is immobilizer-ECU diagnosis code displayed?
Yes → Check the immobilizer. (Refer to GROUP 54 – Ignition Key and Immobilizer.)
No ↓

MUT-II Data list
16 Power supply voltage (Refer to P.13C-75.)
NG → Check the power supply and ignition switch-IG system. (Refer to P.13C-69, INSPECTION PROCEDURE 26.)
OK ↓

Does the camshaft rotate at the engine cranking? (When oil filler cap is removed.)
No → Check timing belt for breakage.
Yes ↓

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13C-12, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

MUT-II Data list
22 Crank angle sensor
OK: Cranking speed is displayed
No → Check the crank angle sensor system. (Refer to P.13A-113, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0335.)
OK ↓

MUT-II Actuator test
07 Fuel pump (Refer to P.13C-79.)
NG → Check the fuel pump system. (Refer to P.13C-69, INSPECTION PROCEDURE 27.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13C-75.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13C-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0115.)
OK ↓

Can any sound be heard from the injectors when cranking?
No → Check the injector system. (Refer to P.13C-30, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0201, P0202, P0203, P0204.)
Yes ↓

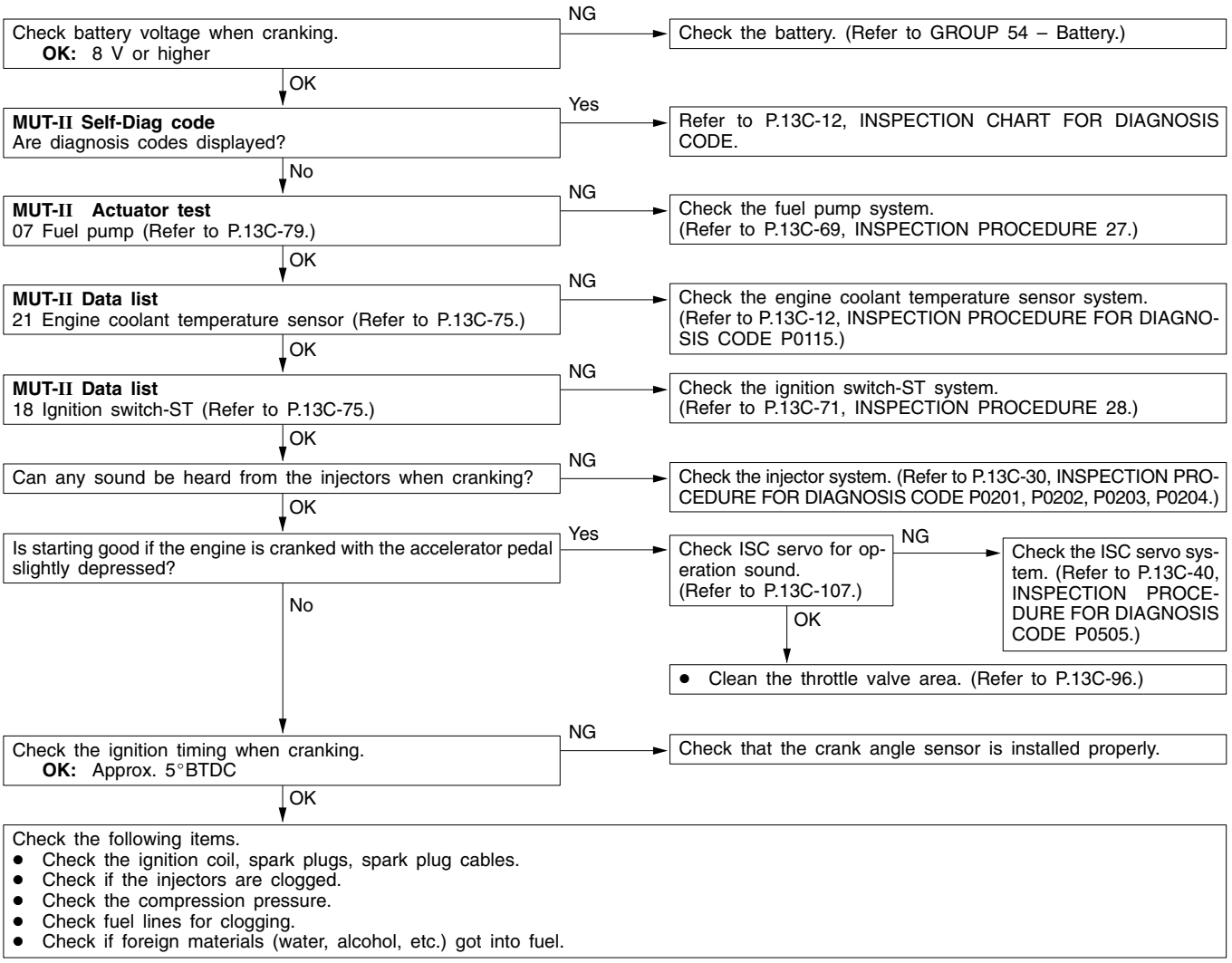
Measure at the ignition coil connectors A-13 and A-14
- Connectors connected
- Check by connecting the timing light to terminal 1 of each connector (Engine: Cranking)
  OK: The timing light flashes.

No → Check the ignition circuit system. (Refer to P.13C-72, INSPECTION PROCEDURE 30.)
OK ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check if the injectors are clogged.
- Check if foreign materials (water, alcohol, etc.) got into fuel.
- Check the compression pressure.
- Check the immobilizer system.

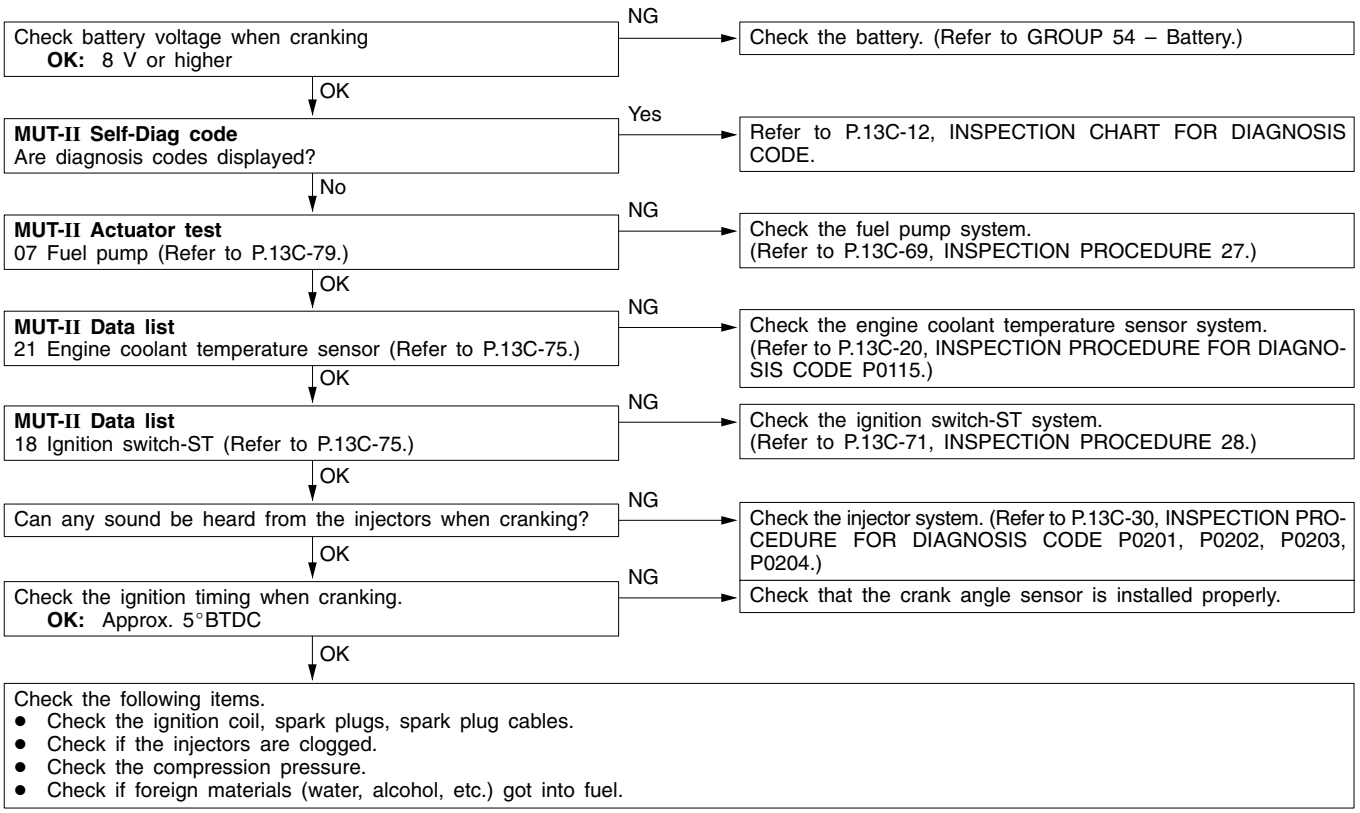
INSPECTION PROCEDURE 6

Initial combustion but no complete combustion (starting impossible)	Probable cause
In such cases as the above, the cause is probably that the spark plugs are generating sparks but the sparks are weak, or the initial mixture for starting is not appropriate.	• Malfunction of the ignition system • Malfunction of the injector system • Foreign materials in fuel • Poor compression • Malfunction of the engine-ECU



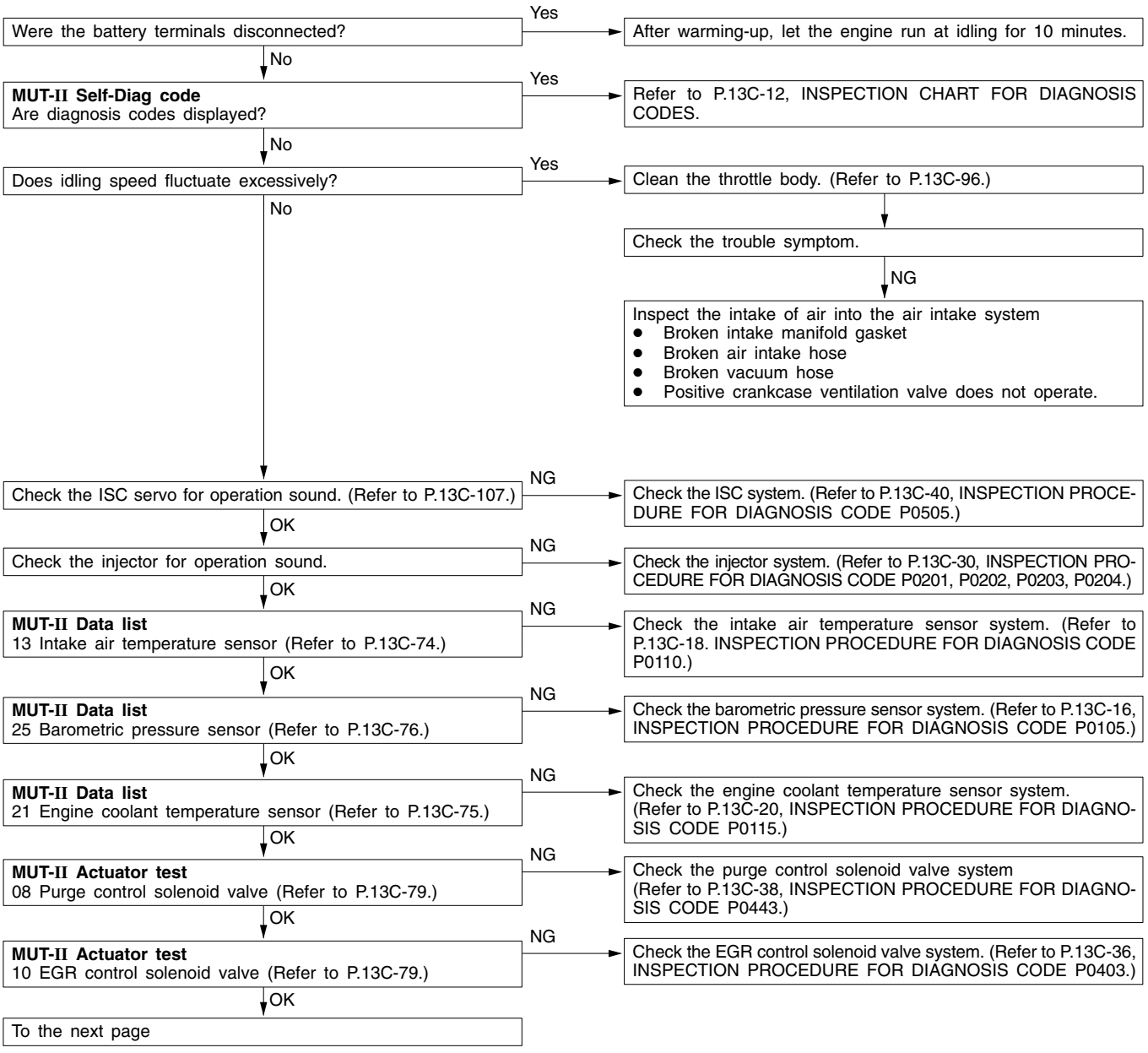
INSPECTION PROCEDURE 7

It takes too long time to start. (Incorrect starting)	Probable cause
In cases such as the above, the cause is probably that the spark is weak and ignition is difficult, the initial mixture for starting is not appropriate, or sufficient compression pressure is not being obtained.	• Malfunction of the ignition system • Malfunction of the injector system • Inappropriate gasoline use • Poor compression



INSPECTION PROCEDURE 8

Unstable idling (Rough idling, hunting)	Probable cause
In cases as the above, the cause is probably that the ignition system, air/fuel mixture, idle speed control (ISC) or compression pressure is defective. Because the range of possible causes is broad, inspection is narrowed down to simple items.	• Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the ISC system • Malfunction of the purge control solenoid valve system • Malfunction of the EGR solenoid valve system • Poor compression • Drawing air into exhaust system



From the previous page

OK

MUT-II Data list
59 Oxygen sensor (rear)
- Transmission: 2nd gear <M/T>, L range <A/T>
- Driving with throttle widely open

OK: 600 – 1,000 mV

NG → Check the oxygen sensor (rear) system. (Refer to P.13C-27, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0136.)

OK

MUT-II Data list
11 Oxygen sensor

OK: 600 – 1,000 mV during sudden racing

NG → Check the oxygen sensor (front) system. (Refer to P.13C-25, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0130.)

OK

MUT-II Data list
11 Oxygen sensor

OK: Changes between 0 – 400 mV and 600 – 1,000 mV during idling

NG → Check the fuel pressure. (Refer to P.13C-98.)

OK → 1. Inspect the intake of air into the air intake system.
- Broken intake manifold gasket
- Broken vacuum hose
- PCV valve does not operate.
- Broken air intake hose

2. Check the injector for clog.

OK

MUT-II Data list
27 Power steering fluid pressure switch (Refer to P.13C-76.)

NG → Check the power steering fluid pressure switch system. (Refer to P.13C-43, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0551.)

OK

MUT-II Data list
28 A/C switch (Refer to P.13C-76.)

NG → Check the A/C switch and A/C relay system. (Refer to P.13C-72, INSPECTION PROCEDURE 29.)

OK

MUT-II Data list
29 Inhibitor switch (Refer to P.13C-76.)

NG → Check the ignition switch-ST. (Refer to P.13C-71, INSPECTION PROCEDURE 28.)

OK

MUT-II Data list
45 ISC Servo position (Refer to P.13C-77.)

NG → Adjust the basic idle speed. (Refer to P.13C-97.)

OK

Check the ignition timing. (Refer to GROUP 11B – On-vehicle Service.)

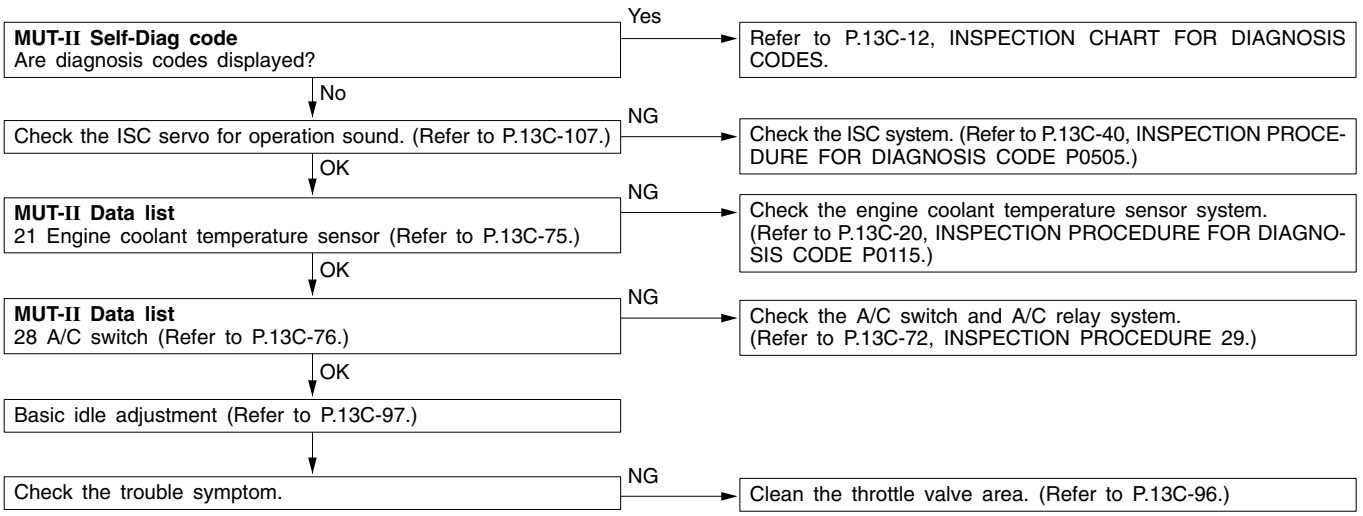
NG → Check that the crank angle sensor is installed properly.

OK

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the purge control system.
- Check the EGR control system.
- Check the compression pressure.
- Check if foreign materials (water, alcohol, etc.) got into fuel.

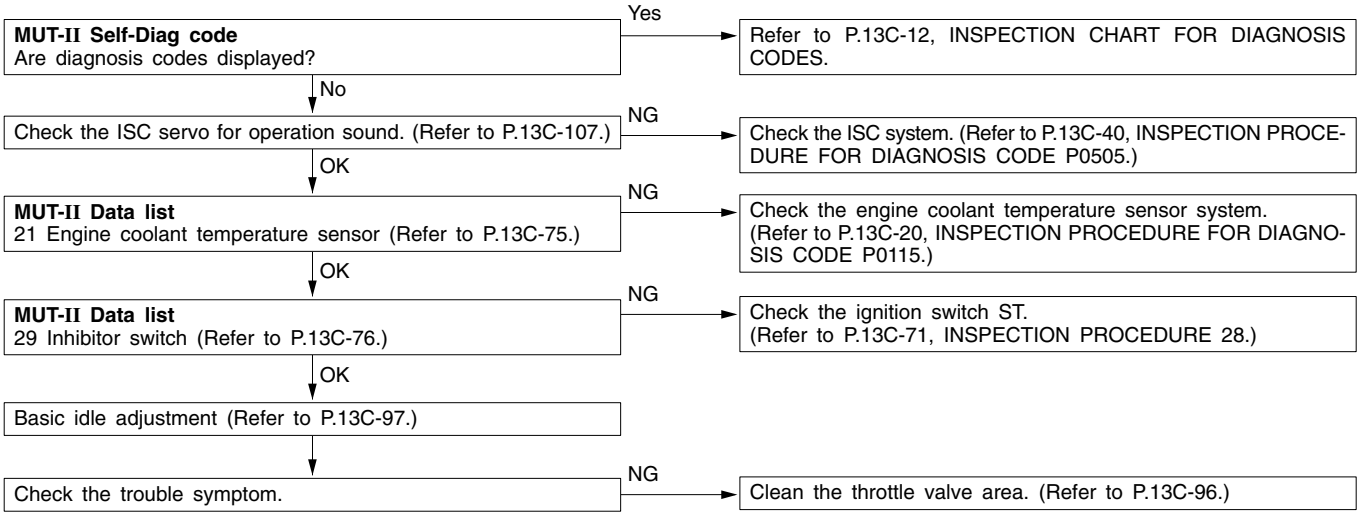
INSPECTION PROCEDURE 9

Idling speed is high. (Improper idling speed)	Probable cause
In such cases as the above, the cause is probably that the intake air volume during idling is too great.	• Malfunction of the ISC servo system • Malfunction of the throttle body



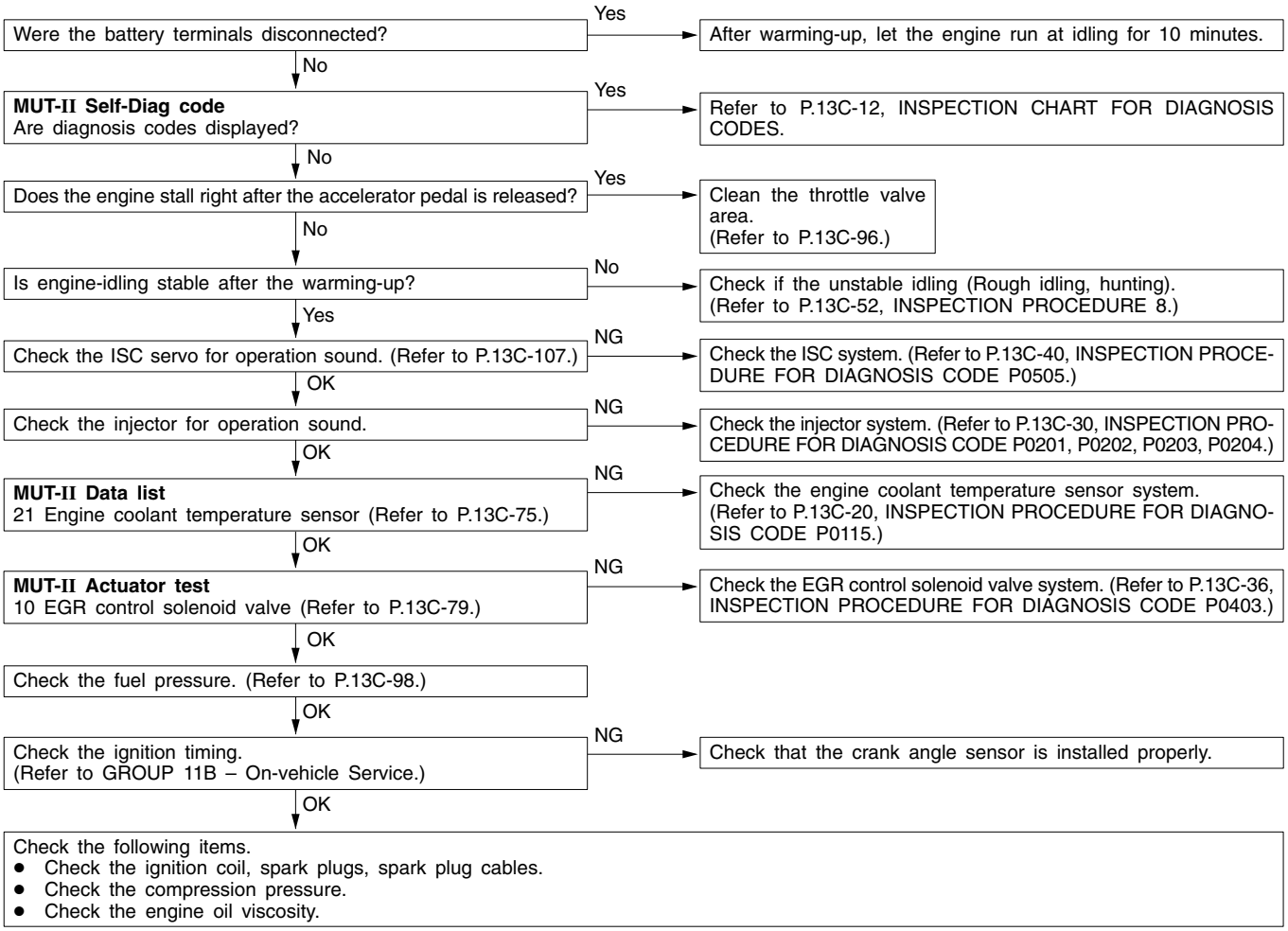
INSPECTION PROCEDURE 10

Idling speed is low. (Improper idling speed)	Probable cause
In cases such as the above, the cause is probably that the intake air volume during idling is too small.	• Malfunction of the ISC servo system • Malfunction of the throttle body



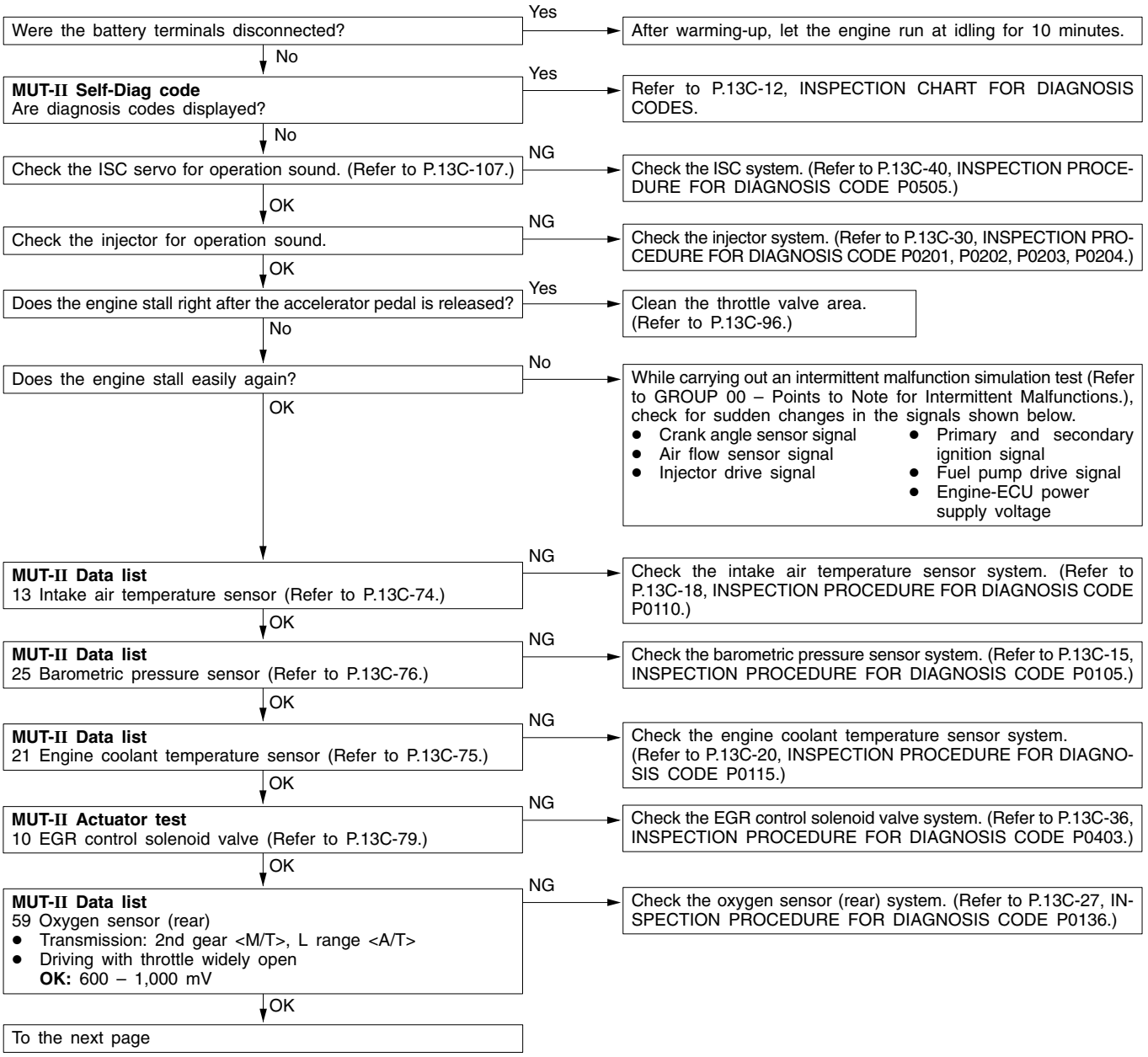
INSPECTION PROCEDURE 11

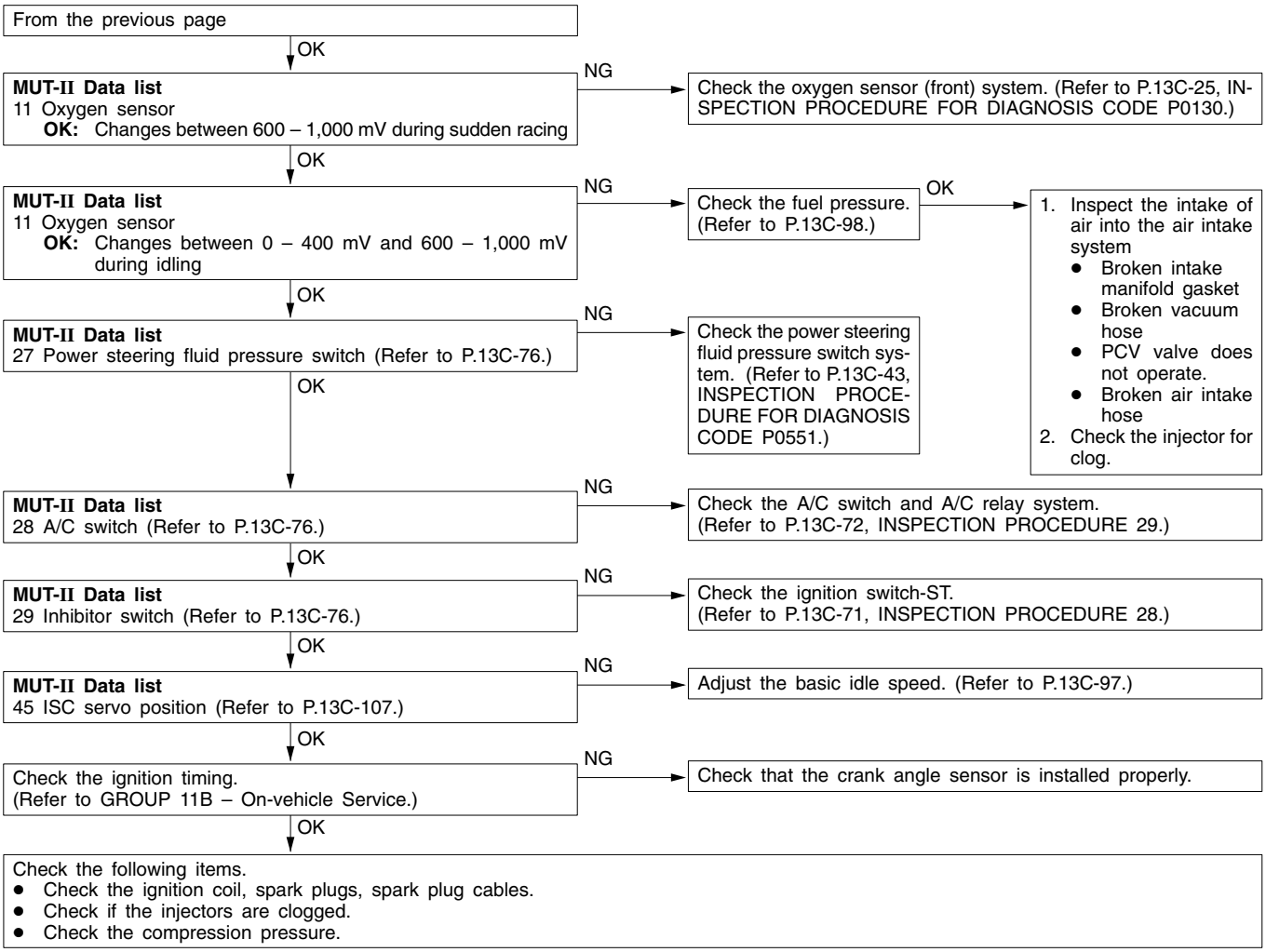
When the engine is cold, it stalls at idling. (Die out)	Probable cause
In such cases as the above, the cause is probably that the air/fuel mixture is inappropriate when the engine is cold, or that the intake air volume is insufficient.	• Malfunction of the ISC servo system • Malfunction of the throttle body • Malfunction of the injector system • Malfunction of the ignition system



INSPECTION PROCEDURE 12

When the engine is hot, it stalls at idling. (Die out)	Probable cause
In such cases as the above, the cause is probably that ignition system, air/fuel mixture, idle speed control (ISC) or compression pressure is defective. In addition, if the engine suddenly stalls, the cause may also be a defective connector contact.	• Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the ISC system • Drawing air into intake system • Improper connector contact




From the previous page
OK
MUT-II Data list
11 Oxygen sensor
OK: Changes between 600 – 1,000 mV during sudden racing
NG
Check the oxygen sensor (front) system. (Refer to P.13C-25, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0130.)
OK
MUT-II Data list
11 Oxygen sensor
OK: Changes between 0 – 400 mV and 600 – 1,000 mV during idling
NG
Check the fuel pressure. (Refer to P.13C-98.)
OK
1. Inspect the intake of air into the air intake system
● Broken intake manifold gasket
● Broken vacuum hose
● PCV valve does not operate.
● Broken air intake hose
2. Check the injector for clog.
OK
MUT-II Data list
27 Power steering fluid pressure switch (Refer to P.13C-76.)
NG
Check the power steering fluid pressure switch system. (Refer to P.13C-43, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0551.)
OK
MUT-II Data list
28 A/C switch (Refer to P.13C-76.)
NG
Check the A/C switch and A/C relay system. (Refer to P.13C-72, INSPECTION PROCEDURE 29.)
OK
MUT-II Data list
29 Inhibitor switch (Refer to P.13C-76.)
NG
Check the ignition switch-ST. (Refer to P.13C-71, INSPECTION PROCEDURE 28.)
OK
MUT-II Data list
45 ISC servo position (Refer to P.13C-107.)
NG
Adjust the basic idle speed. (Refer to P.13C-97.)
OK
Check the ignition timing. (Refer to GROUP 11B – On-vehicle Service.)
NG
Check that the crank angle sensor is installed properly.
OK
Check the following items.
● Check the ignition coil, spark plugs, spark plug cables.
● Check if the injectors are clogged.
● Check the compression pressure.

INSPECTION PROCEDURE 13

The engine stalls when starting the car. (Pass out)	Probable cause
In cases such as the above, the cause is probably misfiring due to a weak spark, or an inappropriate air/fuel mixture when the accelerator pedal is depressed.	• Drawing air into intake system • Malfunction of the ignition system

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13C-12, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13C-79.)
NG → Check the EGR control solenoid valve system. (Refer to P.13C-36, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0403.)
OK ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check if air was drawn into the intake system.
  - Broken intake manifold gasket
  - Broken or disconnected vacuum hose
  - Improper operation of the PCV valve
  - Broken air intake hose

INSPECTION PROCEDURE 14

The engine stalls when decelerating.	Probable cause
In cases such as the above, the cause is probably that the intake air volume is insufficient due to a defective idle speed control (ISC) servo system.	• Malfunction of the ISC system

Were the battery terminals disconnected?
Yes → After warming-up, let the engine run at idling for 10 minutes.
No ↓

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13C-12, INSPECTION CHART FOR DIAGNOSIS CODES.
OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13C-75.)
NG → Check the throttle position sensor system. (Refer to P.13C-22, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0120.)
OK ↓

MUT-II Data list
45 ISC servo position
- Is the idle speed control (ISC) servo position drops to 0 – 2 steps when decelerating (engine r/min less than 1,000)?

Yes → Check the vehicle speed sensor system. (Refer to P.13C-40, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0500.)
No ↓

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13C-79.)
NG → Check the EGR control solenoid valve system. (Refer to P.13C-36, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0403.)
OK ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Clean the throttle valve area.

INSPECTION PROCEDURE 15

Hesitation, sag or stumble	Probable cause
In cases such as the above, the cause is probably that ignition system, air/fuel mixture or compression pressure is defective.	• Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the fuel supply system • Malfunction of the EGR control solenoid valve system • Poor compression

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13C-12, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

Check the injectors for operation sound.
NG → Check the injector system. (Refer to P.13C-30, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0201, P0202, P0203, P0204.)
OK ↓

Check the ignition timing.
(Refer to GROUP 11B – On-vehicle Service.)
NG → Check that the crank angle sensor is installed properly.
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13C-75.)
NG → Check the intake air temperature sensor system. (Refer to P.13C-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0110.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13C-76.)
NG → Check the barometric pressure sensor system. (Refer to P.13C-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0105.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13C-75.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13C-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0115.)
OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13C-75.)
NG → Check the throttle position sensor system. (Refer to P.13C-22, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0120.)
OK ↓

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13C-79.)
NG → Check the EGR control solenoid valve system. (Refer to P.13C-36, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0403.)
OK ↓

MUT-II Data list
59 Oxygen sensor (rear)
- Transmission: 2nd gear <M/T>, L range <A/T>
- Driving with throttle widely open

OK: 600 – 1,000 mV
NG → Check the oxygen sensor (rear) system. (Refer to P.13C-27, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0136.)
OK ↓

MUT-II Data list
11 Oxygen sensor
OK: Changes between 600 – 1,000 mV during sudden racing
NG → Check the oxygen sensor (front) system. (Refer to P.13C-25, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0130.)
OK ↓

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↓OK

MUT-II Data list
11 Oxygen sensor
OK: Changes between 0 – 400 mV and 600 – 1,000 mV during idling

NG → Check the fuel pressure. (Refer to P.13C-98.)

OK → 1. Inspect the intake of air into the air intake system
- Broken intake manifold gasket
- Broken vacuum hose
- PCV valve does not operate.
- Broken air intake hose

2. Check the injector for clog.

↓OK

Check the fuel pressure. (Refer to P.13A-78.)

↓OK

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the EGR control system.
- Check the compression pressure.
- Check the fuel filter or fuel line for clogging.

INSPECTION PROCEDURE 16

The feeling of impact or vibration when accelerating	Probable cause
In cases such as the above, the cause is probably that there is an ignition leak accompanying the increase in the spark plug demand voltage during acceleration.	• Malfunction of the ignition system

MUT-II Self-Diag code
Are diagnosis codes displayed?

Yes → Refer to P.13C-12, INSPECTION CHART FOR DIAGNOSIS CODES.

↓No

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check for occurrence of ignition leak.

INSPECTION PROCEDURE 17

The feeling of impact or vibration when decelerating.	Probable cause
Malfunction of the ISC system is suspected.	• Malfunction of the ISC system

MUT-II Self-Diag code
Are diagnosis codes displayed?

Yes → Refer to P.13C-12, INSPECTION CHART FOR DIAGNOSIS CODES.

↓No

Check the ISC servo for operation sound. (Refer to P.13C-107.)

NG → Check the ISC system. (Refer to P.13C-40, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0505.)

↓OK

MUT-II Data list
14 Throttle position sensor (Refer to P.13C-75.)

NG → Check the throttle position sensor system. (Refer to P.13C-22, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0120.)

↓OK

Clean the throttle valve area. (Refer to P.13C-96.)

INSPECTION PROCEDURE 18

Poor acceleration	Probable cause
Defective ignition system, abnormal air-fuel ratio, poor compression pressure, etc. are suspected.	• Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the fuel supply system • Poor compression pressure • Clogged exhaust system

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13C-12, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

Check the injectors for operation sound.
NG → Check the injector system. (Refer to P.13C-30, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0201, P0202, P0203, P0204.)
OK ↓

Check the ignition timing.
(Refer to GROUP 11B – On-vehicle Service.)
NG → Check that the crank angle sensor is installed properly.
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13C-74.)
NG → Check the intake air temperature sensor system. (Refer to P.13C-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0110.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13C-76.)
NG → Check the barometric pressure sensor system. (Refer to P.13C-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0105.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13C-75.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13C-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0115.)
OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13C-75.)
NG → Check the throttle position sensor system. (Refer to P.13C-22, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0120.)
OK ↓

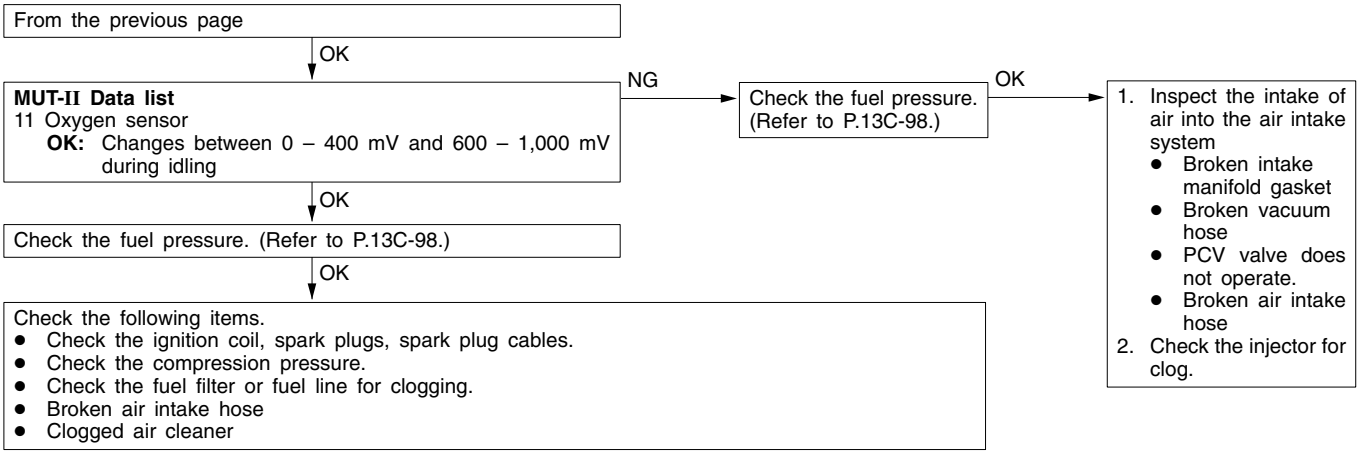
MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13C-79.)
NG → Check the EGR control solenoid valve system. (Refer to P.13C-36, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0403.)
OK ↓

MUT-II Data list
59 Oxygen sensor (rear)
- Transmission: 2nd gear <M/T>, L range <A/T>
- Driving with throttle widely open

OK: 600 – 1,000 mV
NG → Check the oxygen sensor (rear) system. (Refer to P.13C-27, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0136.)
OK ↓

MUT-II Data list
11 Oxygen sensor
OK: Changes between 600–1,000 mV during sudden racing
NG → Check the oxygen sensor (front) system. (Refer to P.13C-25, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0130.)
OK ↓

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OK
MUT-II Data list
11 Oxygen sensor
OK: Changes between 0 – 400 mV and 600 – 1,000 mV during idling
NG
Check the fuel pressure. (Refer to P.13C-98.)
OK
1. Inspect the intake of air into the air intake system
● Broken intake manifold gasket
● Broken vacuum hose
● PCV valve does not operate.
● Broken air intake hose
2. Check the injector for clog.
OK
Check the fuel pressure. (Refer to P.13C-98.)
OK
Check the following items.
● Check the ignition coil, spark plugs, spark plug cables.
● Check the compression pressure.
● Check the fuel filter or fuel line for clogging.
● Broken air intake hose
● Clogged air cleaner

INSPECTION PROCEDURE 19

Surge	Probable cause
Defective ignition system, abnormal air-fuel ratio, etc. are suspected.	• Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the EGR control solenoid valve system

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13C-12, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

Check the injectors for operation sound.
NG → Check the injector system. (Refer to P.13C-32, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0201, P0202, P0203, P0204.)
OK ↓

Check the ignition timing.
(Refer to GROUP 11C – On-vehicle Service.)
NG → Check that the crank angle sensor is installed properly.
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13C-74.)
NG → Check the intake air temperature sensor system. (Refer to P.13C-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0110.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13C-76.)
NG → Check the barometric pressure sensor system. (Refer to P.13C-16. INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0105.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13C-75.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13C-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0115.)
OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13C-75.)
NG → Check the throttle position sensor system. (Refer to P.13C-22, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0120.)
OK ↓

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13C-79.)
NG → Check the EGR control solenoid valve system. (Refer to P.13C-36, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0403.)
OK ↓

MUT-II Data list
59 Oxygen sensor (rear)
- Transmission: 2nd gear <M/T>, L range <A/T>
- Driving with throttle widely open

OK: 600 – 1,000 mV
NG → Check the oxygen sensor (rear) system. (Refer to P.13C-27, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0136.)
OK ↓

MUT-II Data list
11 Oxygen sensor
OK: Changes between 600 – 1,000 mV during sudden racing
NG → Check the oxygen sensor (front) system. (Refer to P.13C-25, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0130.)
OK ↓

MUT-II Data list
11 Oxygen sensor
OK: Changes between 0 – 400 mV and 600 – 1,000 mV during idling
NG → Check the fuel pressure. (Refer to P.13C-98.)
OK → 1. Inspect the intake of air into the air intake system
- Broken intake manifold gasket
- Broken vacuum hose
- PCV valve does not operate.
- Broken air intake hose

2. Check the injector for clog.

OK ↓

Check the fuel pressure. (Refer to P.13C-98.)
OK ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the EGR control system.

INSPECTION PROCEDURE 20

Knocking	Probable cause
In cases as the above, the cause is probably that the detonation control is defective or the heat value of the spark plug is inappropriate.	• Defective detonation sensor • Inappropriate heat value of the spark plug

MUT-II Self-Diag code
Are diagnosis codes displayed?
- Yes → Refer to P.13C-12, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

Does knocking occur when driving with the sensor disconnected? At this time, use the MUT-II to check if the timing is retarded compared to when the detonation sensor connector is connected.
- No → Check the detonation sensor system. (Refer to P.13C-33, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0325.)
- Yes ↓

Check the following items.
- Spark plugs
- Check if foreign materials (water, alcohol, etc.) got into fuel.

INSPECTION PROCEDURE 21

Dieseling	Probable cause
Fuel leakage from injectors is suspected.	• Fuel leakage from injectors

Check the injectors for fuel leakage.

INSPECTION PROCEDURE 22

Too high CO and HC concentration when idling	Probable cause
Abnormal air-fuel ratio is suspected.	• Malfunction of the air-fuel ratio control system • Deteriorated catalyst

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13C-12, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

Check the ignition timing.
(Refer to GROUP 11B – On-vehicle Service.)
NG → Check that the crank angle sensor is installed properly.
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor. (Refer to P.13C-75.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13C-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0115.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13C-74.)
NG → Check the intake air temperature sensor system. (Refer to P.13C-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0110.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13C-76.)
NG → Check the barometric pressure sensor system. (Refer to P.13C-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0105.)
OK ↓

MUT-II Data list
59 Oxygen sensor (rear)
- Transmission: 2nd gear <M/T>, L range <A/T>
- Driving with throttle widely open

OK: 600 – 1,000 mV
NG → Check the oxygen sensor (rear) system. (Refer to P.13C-27, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0136.)
OK ↓

MUT-II Data list
11 Oxygen sensor
OK: 600 – 1,000 mV when racing suddenly.
NG → Check the oxygen sensor (front) system. (Refer to P.13C-25, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0130.)
OK ↓

MUT-II Data list
11 Oxygen sensor
OK: Repeat 0 – 400 mV and 600 – 1,000 mV alternately when idling.
OK → Replace the oxygen sensor.
↓
Check the trouble symptom.
NG ↓

NG ↓

Check the fuel pressure. (Refer to P.13C-98.)
OK ↓

Check the following items.
- Check the injectors for operation sound.
- Check the injectors for fuel leakage.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the compression pressure.
- Check the positive crankcase ventilation system.
- Check the purge control system.
- Check the EGR control system.

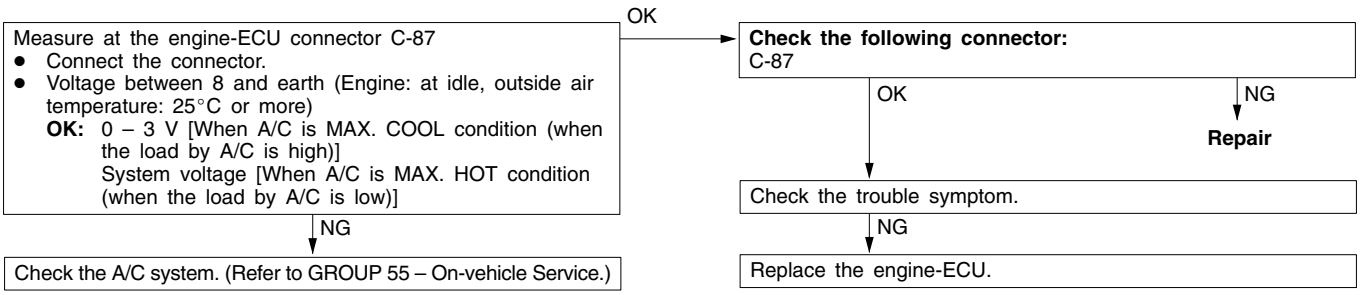
↓

Check the trouble symptom.
NG ↓

Replace the catalytic converter.

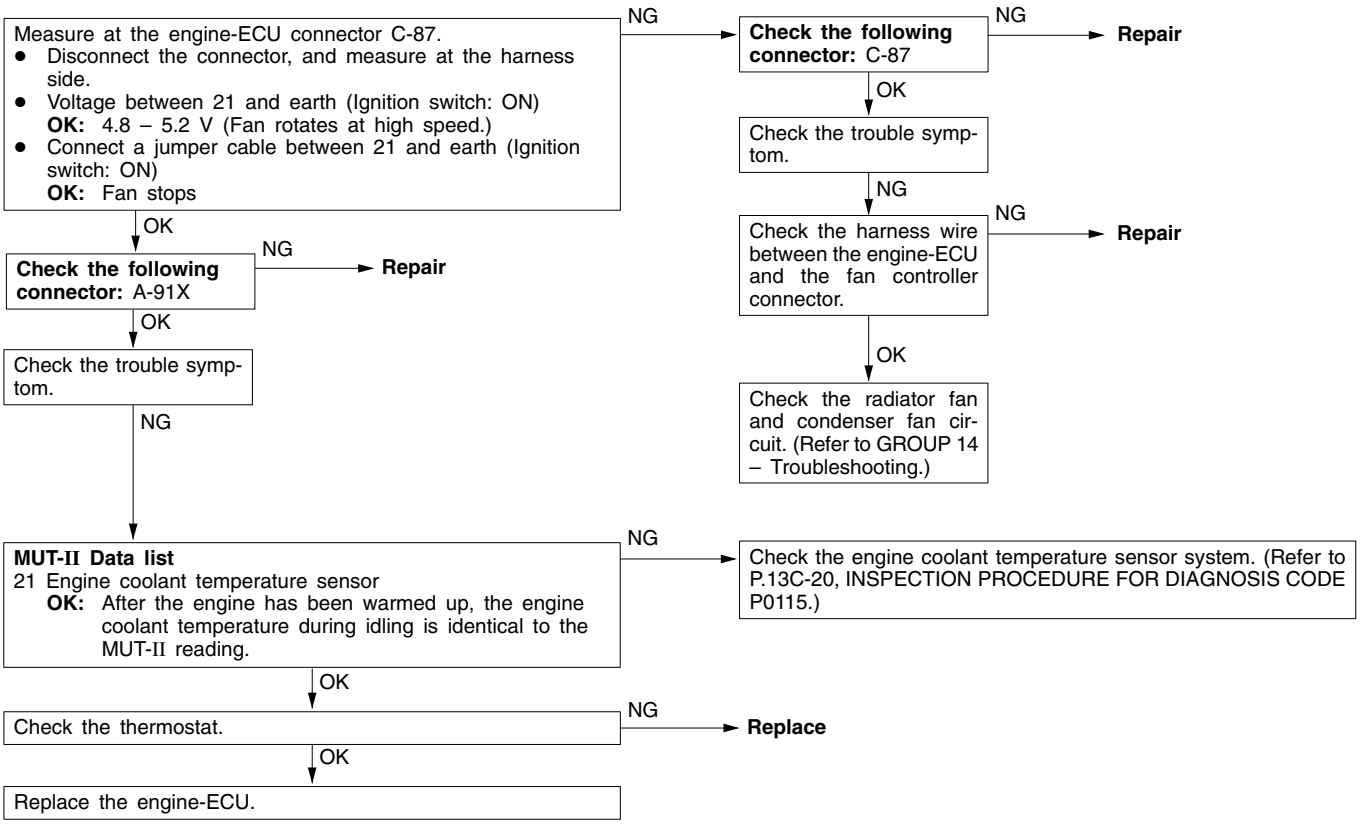
INSPECTION PROCEDURE 23

Idling speed is improper when A/C is operating	Probable cause
If the engine-ECU detects that the air conditioner is on, it activates the idle speed control (ISC) servo to control idle-up operation. The A/C-ECU judges if the load caused by air conditioner operation is high or low, and converts it to voltage signal (high or low voltage) and inputs the signal to the engine-ECU. Based on this voltage signal, the engine-ECU controls the idle-up speed (for high or low load).	• Malfunction of the A/C control system • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU



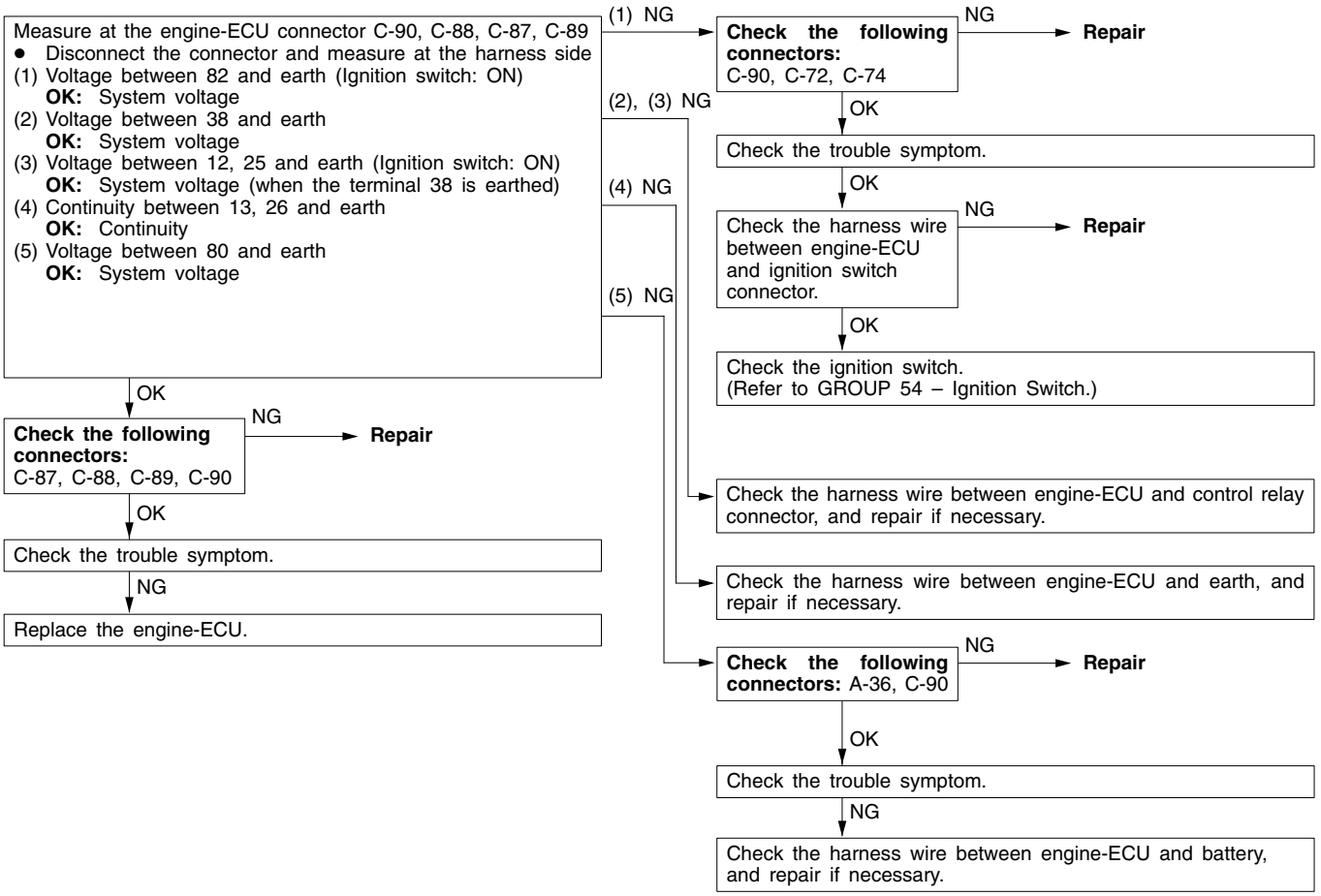
INSPECTION PROCEDURE 24

Fans (radiator fan, A/C condenser fan) are inoperative	Probable cause
The engine-ECU outputs a duty signal to the fan controller depending on the engine coolant temperature, vehicle speed, and air conditioner switch condition. Based on this signal, the fan controller controls the radiator fan and condenser fan speeds (The more the average voltage at the terminal approaches 5 V, the higher the fan speed become.)	• Malfunction of the fan motor relay • Malfunction of the fan motor • Malfunction of the fan controller • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU



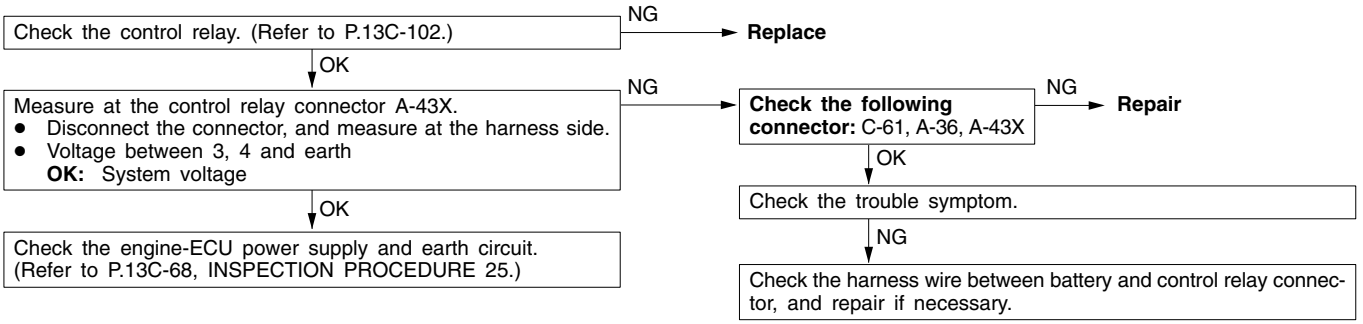
INSPECTION PROCEDURE 25

Engine-ECU power supply and earth circuit system	Probable cause
The engine-ECU may be defective, or that one of the malfunctions listed at right has occurred.	• Improper connector contact, open circuit or short-circuited harness wire in the engine-ECU power supply circuit. • Open circuit or short-circuited harness wire in the engine-ECU earth circuit • Malfunction of the engine-ECU



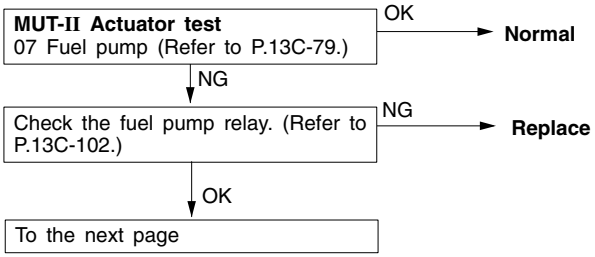
INSPECTION PROCEDURE 26

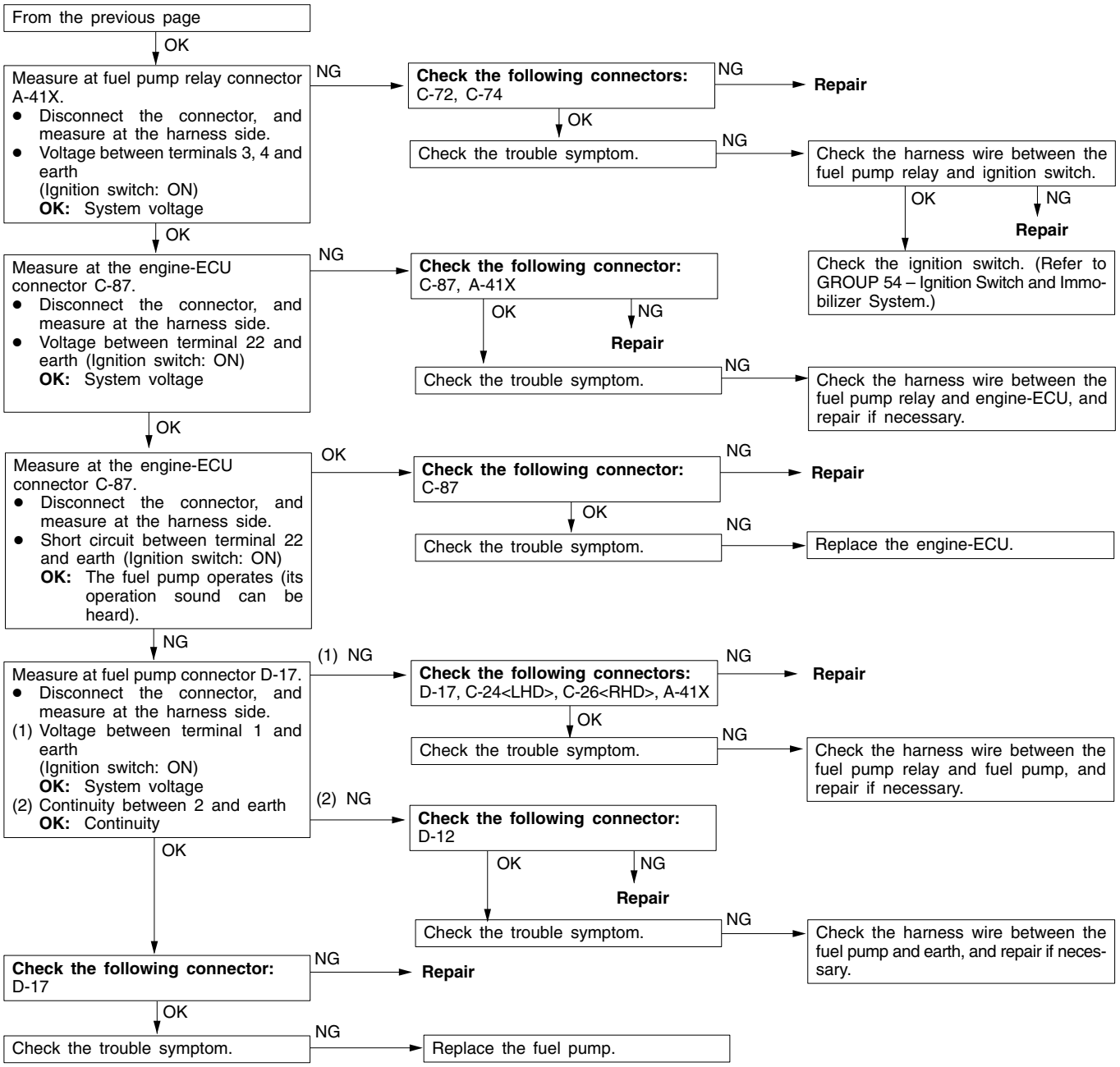
Power supply system and ignition switch-IG system	Probable cause
When an ignition switch ON signal is input to the engine-ECU, the engine-ECU turns the control relay ON. This causes battery voltage to be supplied to the engine-ECU, injectors and air flow sensor.	• Malfunction of the ignition switch • Malfunction of the control relay • Improper connector contact, open circuit or short-circuited harness wire • Disconnected engine-ECU earth wire • Malfunction of the engine-ECU



INSPECTION PROCEDURE 27

Fuel pump system	Probable cause
The engine-ECU turns the control relay ON when the engine is cranking or running, and this supplies power to drive the fuel pump.	• Malfunction of the fuel pump relay • Malfunction of the fuel pump • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU

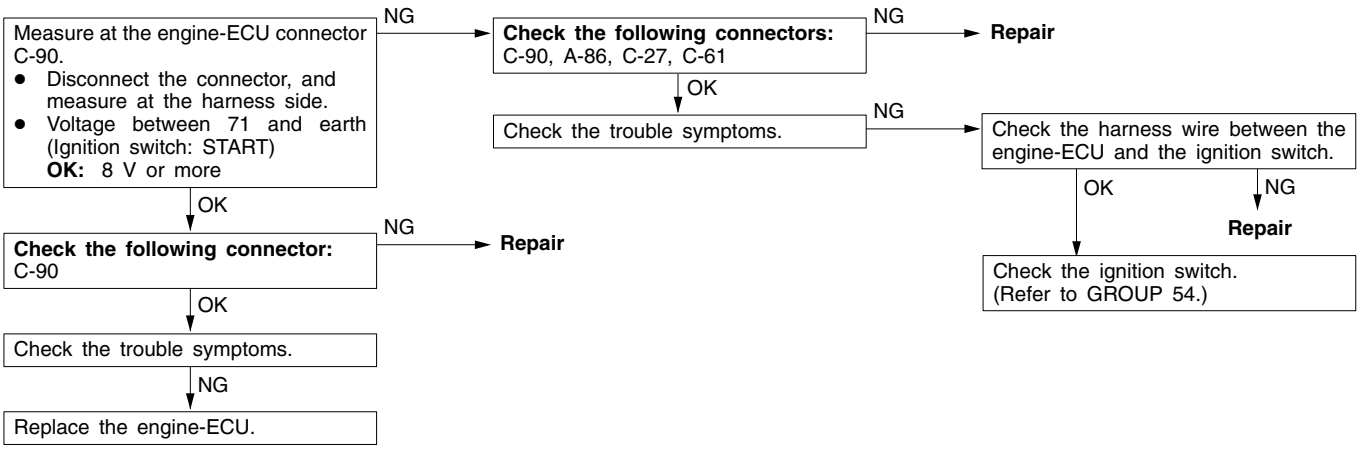



From the previous page
OK
Measure at fuel pump relay connector A-41X.
● Disconnect the connector, and measure at the harness side.
● Voltage between terminals 3, 4 and earth (Ignition switch: ON)
OK: System voltage
NG
Check the following connectors: C-72, C-74
NG
Repair
OK
Check the trouble symptom.
NG
Check the harness wire between the fuel pump relay and ignition switch.
OK
NG
Repair
Check the ignition switch. (Refer to GROUP 54 – Ignition Switch and Immobilizer System.)
OK
Measure at the engine-ECU connector C-87.
● Disconnect the connector, and measure at the harness side.
● Voltage between terminal 22 and earth (Ignition switch: ON)
OK: System voltage
NG
Check the following connector: C-87, A-41X
OK
NG
Repair
Check the trouble symptom.
NG
Check the harness wire between the fuel pump relay and engine-ECU, and repair if necessary.
OK
Measure at the engine-ECU connector C-87.
● Disconnect the connector, and measure at the harness side.
● Short circuit between terminal 22 and earth (Ignition switch: ON)
OK: The fuel pump operates (its operation sound can be heard).
OK
Check the following connector: C-87
NG
Repair
OK
Check the trouble symptom.
NG
Replace the engine-ECU.
NG
Measure at fuel pump connector D-17.
● Disconnect the connector, and measure at the harness side.
(1) Voltage between terminal 1 and earth (Ignition switch: ON)
OK: System voltage
(2) Continuity between 2 and earth
OK: Continuity
(1) NG
Check the following connectors: D-17, C-24<LHD>, C-26<RHD>, A-41X
NG
Repair
OK
Check the trouble symptom.
NG
Check the harness wire between the fuel pump relay and fuel pump, and repair if necessary.
(2) NG
Check the following connector: D-12
OK
NG
Repair
Check the trouble symptom.
NG
Check the harness wire between the fuel pump and earth, and repair if necessary.
OK
Check the following connector: D-17
NG
Repair
OK
Check the trouble symptom.
NG
Replace the fuel pump.

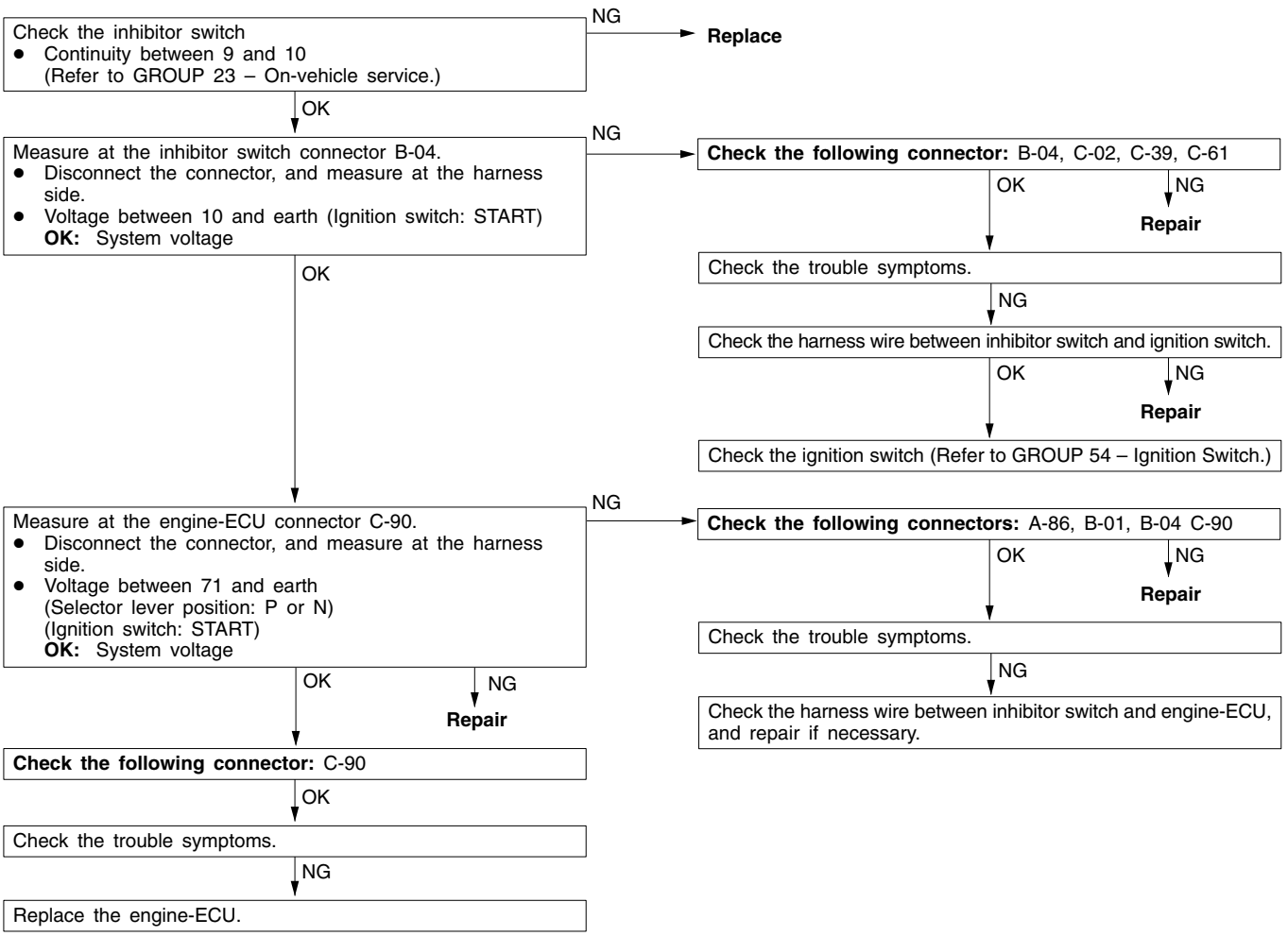
INSPECTION PROCEDURE 28

Ignition switch-ST system	Probable cause
The ignition switch-ST outputs a HIGH signal to the engine-ECU while the engine is cranking. The engine-ECU uses this signal to carry out functions such as fuel injection control during starting.	• Malfunction of the ignition switch • Malfunction of the inhibitor switch <A/T> • Open circuit or short-circuited harness wire of the ignition switch circuit • Malfunction of the engine-ECU

<M/T>

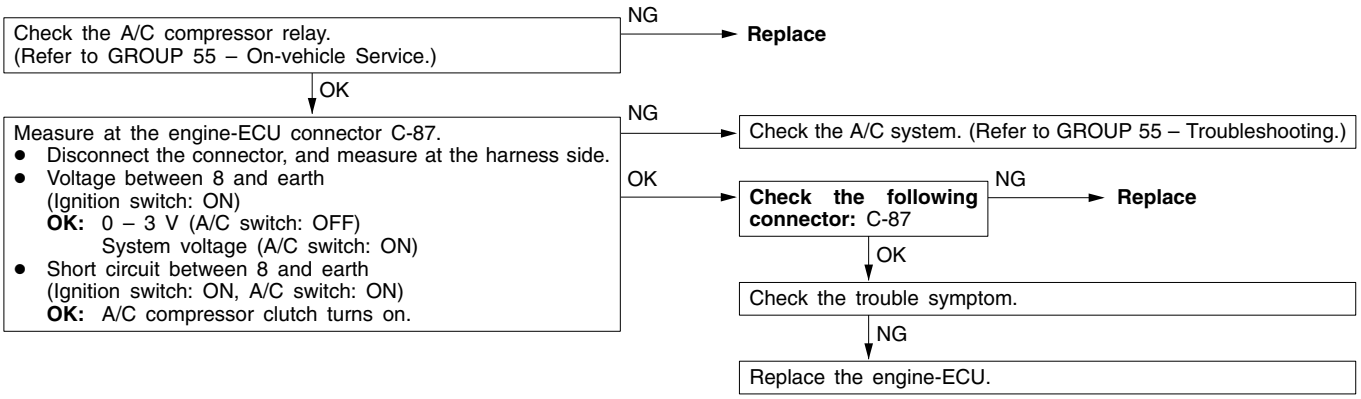


<A/T>



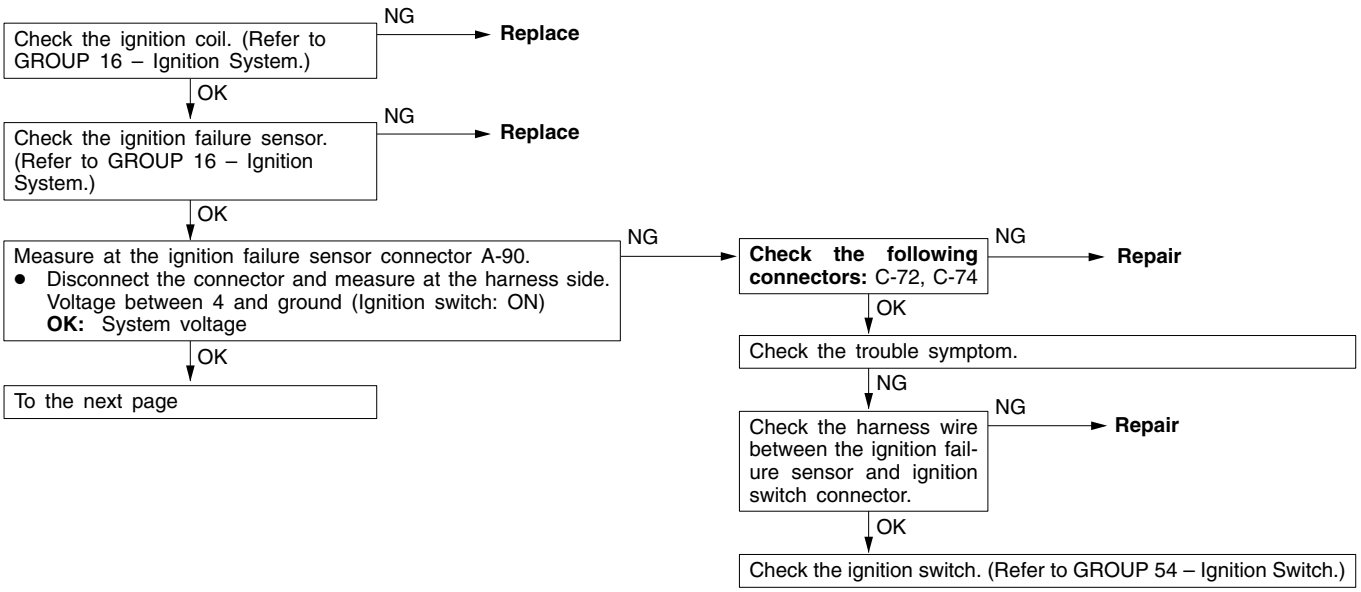
INSPECTION PROCEDURE 29

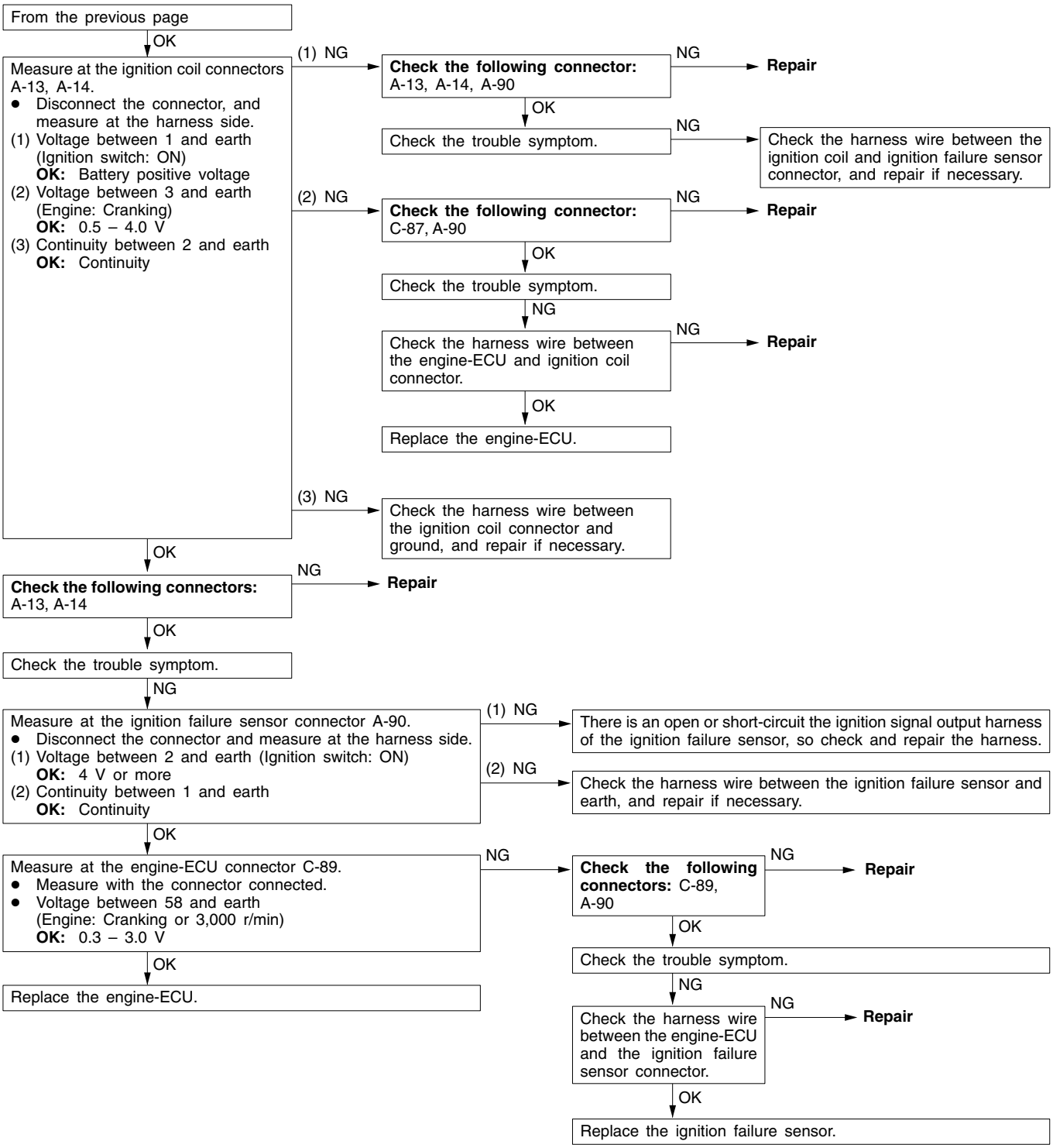
A/C switch and A/C relay system	Probable cause
When an A/C ON signal is input to the engine-ECU, the engine-ECU carries out control of the idle speed control (ISC) servo, and also operates the A/C compressor magnetic clutch.	• Malfunction of A/C control system • Malfunction of A/C switch • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU



INSPECTION PROCEDURE 30

Ignition circuit system	Probable cause
The engine-ECU interrupts the ignition coil primary current by turning the power transistor inside the engine-ECU ON and OFF.	• Malfunction of ignition coil. • Malfunction of ignition failure sensor. • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU




From the previous page
OK
Measure at the ignition coil connectors A-13, A-14.
● Disconnect the connector, and measure at the harness side.
(1) Voltage between 1 and earth (Ignition switch: ON)
OK: Battery positive voltage
(2) Voltage between 3 and earth (Engine: Cranking)
OK: 0.5 – 4.0 V
(3) Continuity between 2 and earth
OK: Continuity
(1) NG
Check the following connector: A-13, A-14, A-90
NG
Repair
OK
Check the trouble symptom.
NG
Check the harness wire between the ignition coil and ignition failure sensor connector, and repair if necessary.
(2) NG
Check the following connector: C-87, A-90
NG
Repair
OK
Check the trouble symptom.
NG
Check the harness wire between the engine-ECU and ignition coil connector.
NG
Repair
OK
Replace the engine-ECU.
(3) NG
Check the harness wire between the ignition coil connector and ground, and repair if necessary.
OK
Check the following connectors: A-13, A-14
NG
Repair
OK
Check the trouble symptom.
NG
Measure at the ignition failure sensor connector A-90.
● Disconnect the connector and measure at the harness side.
(1) Voltage between 2 and earth (Ignition switch: ON)
OK: 4 V or more
(2) Continuity between 1 and earth
OK: Continuity
(1) NG
There is an open or short-circuit the ignition signal output harness of the ignition failure sensor, so check and repair the harness.
(2) NG
Check the harness wire between the ignition failure sensor and earth, and repair if necessary.
OK
Measure at the engine-ECU connector C-89.
● Measure with the connector connected.
● Voltage between 58 and earth (Engine: Cranking or 3,000 r/min)
OK: 0.3 – 3.0 V
NG
Check the following connectors: C-89, A-90
NG
Repair
OK
Check the trouble symptom.
NG
Check the harness wire between the engine-ECU and the ignition failure sensor connector.
NG
Repair
OK
Replace the ignition failure sensor.
OK
Replace the engine-ECU.

DATA LIST REFERENCE TABLE

Caution
When shifting the select lever to D range, the brakes should be applied so that the vehicle does not move forward.

NOTE
*1. In a new vehicle [driven approximately 500 km or less], the air flow sensor output frequency is sometimes 10 % higher than the standard frequency.
*2. The injector drive time represents the time when the cranking speed is at 250 r/min or below when the power supply voltage is 11 V.
*3. In a new vehicle [driven approximately 500 km or less], the injector drive time is sometimes 10 % longer than the standard time.
*4. In a new vehicle [driven approximately 500 km or less], the step of the stepper motor is sometimes 30 steps greater than the standard value.
★ It will not be displayed when service data of the check mode is selected.

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
11	Oxygen sensor (front)	Engine: After having warmed up Air/fuel mixture is made leaner when decelerating, and is made richer when racing.	When at 4,000 r/min, engine is suddenly decelerated	200 mV or less	Code No. P0130	13C-25
			When engine is suddenly raced	600 – 1,000 mV		
		Engine: After having warmed up The oxygen sensor signal is used to check the air/fuel mixture ratio, and control condition is also checked by the ECU.	Engine is idling	400 mV or less (Changes) 600 – 1,000 mV		
			2,500 r/min			
12	Air flow sensor*1	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Engine is idling	12 – 38 Hz	–	–
			2,500 r/min	58 – 98 Hz		
			Engine is raced	Frequency increases in response to racing		
13	Intake air temperature sensor	Ignition switch: ON or with engine running	When intake air temperature is –20°C	–20°C	Code No. P0110	13C-18
			When intake air temperature is 0°C	0°C		
			When intake air temperature is 20°C	20°C		
			When intake air temperature is 40°C	40°C		
			When intake air temperature is 80°C	80°C		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
14	Throttle position sensor	Ignition switch: ON	Set to idle position	535 – 735 mV	Code No. P0120	13C-22
			Gradually open	Increases in proportion to throttle opening angle		
			Open fully	4,750 mV or more		
16	Power supply voltage	Ignition switch: ON		System voltage	Procedure No. 25	13C-68
18	Cranking signal (ignition switch-ST)	Ignition switch: ON	Engine: Stopped	OFF	Procedure No. 28	13C-71
			Engine: Cranking	ON		
21	Engine coolant temperature sensor	Ignition switch: ON or with engine running	When engine coolant temperature is –20°C	–20°C	Code No. P0115	13C-20
			When engine coolant temperature is 0°C	0°C		
			When engine coolant temperature is 20°C	20°C		
			When engine coolant temperature is 40°C	40°C		
			When engine coolant temperature is 80°C	80°C		
22	Crank angle sensor	• Engine: Cranking • Tachometer: Connected	Compare the engine speed readings on the tachometer and the MUT-II.	Accord	Code No. P0335	13C-33
		• Engine: Idling • Idle position switch: ON	When engine coolant temperature is –20°C	1,380 – 1,580 r/min		
			When engine coolant temperature is 0°C	1,320 – 1,520 r/min		
			When engine coolant temperature is 20°C	1,200 – 1,400 r/min		
			When engine coolant temperature is 40°C	1,100 – 1,300 r/min		
			When engine coolant temperature is 80°C	600 – 800 r/min		

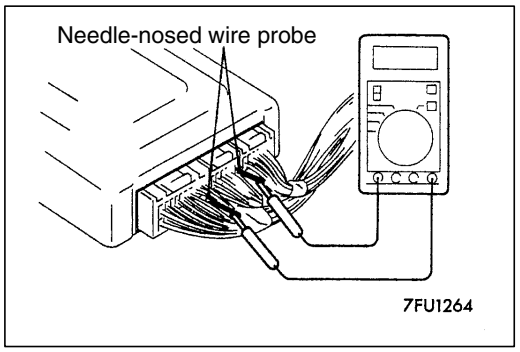
Item No.	Inspection item	Inspection contents			Normal condition	Inspection procedure No.	Reference page
24	Vehicle speed sensor	Drive at 40 km/h			Approximately 40 km/h	Code No. P0500	13C-39
25	Barometric pressure sensor	Ignition switch: ON	At altitude of 0 m		101 kPa	Code No. P0105	13C-16
			At altitude of 600 m		95 kPa		
			At altitude of 1,200 m		88 kPa		
			At altitude of 1,800 m		81 kPa		
27	Power steering fluid pressure switch	Engine: Idling	Steering wheel stationary		OFF	Code No. P0551	13C-43
			Steering wheel turning		ON		
28	A/C switch	Engine: Idling	A/C switch: OFF		OFF	Procedure No. 29	13C-72
			A/C switch: ON	A/C compressor does not operate	OFF		
				A/C compressor operates	ON		
29	Inhibitor switch <A/T>	Ignition switch: ON	P or N		P or N	Procedure No. 28	13C-71
			D, 2, L or R		D, 2, L or R		
41	Injectors*2	Engine: Cranking	When engine coolant temperature is 0°C (injection is carried out for all cylinders simultaneously)		14 – 21 ms	–	–
			When engine coolant temperature is 20°C		30 – 45 ms		
			When engine coolant temperature is 80°C		6.9 – 10.4 ms		
	Injectors*3	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Engine is idling		1.6 – 2.8 ms		
			2,500 r/min		1.4 – 2.6 ms		
			When engine is suddenly raced		Increases		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
44	Ignition coils and power transistors	• Engine: After having warmed up • Timing lamp is set. (The timing lamp is set in order to check actual ignition timing.)	Engine is idling	2 – 18°BTDC	Code No. P0300	–
			2,500 r/min	23 – 43°BTDC		
45	ISC (stepper) motor position*4	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range) • Idle position switch: ON • Engine: Idling • When A/C switch is ON, A/C compressor should be operating	A/C switch: OFF	2 – 25 STEP	–	–
			A/C switch: OFF → ON	Increases by 10 – 70 steps		
			• A/C switch: OFF • Select lever: N range → D range	Increases by 5 – 50 steps		
49	A/C relay	Engine: After having warmed up/Engine is idling	A/C switch: OFF	OFF	Procedure No. 29	13C-72
			A/C switch: ON / A/C compressor is not driven	OFF		
			A/C switch: ON / A/C compressor is driven	ON	Procedure No. 29	13C-72
59	Oxygen sensor (rear)	• Transmission: 2nd gear <M/T>, L range <A/T> • Drive with throttle widely open	3,500 r/min	600 – 1,000 mV	Code No. P0316	13C-27
24★	Vehicle speed sensor	Drive at 40 km/h		Approximately 40 km/h	Code No. P0500	13C-39
81★	Long-term fuel compensation	Engine: Warm, 2,500 r/min without any load (during closed loop)		–12.5 – 12.5 %	Code No. P0170	13C-29
82★	Short-term fuel compensation	Engine: Warm, 2,500 r/min without any load (during closed loop)		–25 – 25 %	Code No. P0170	13C-29
87★	Calculation load value	Engine: Warm	Engine: Idling	10 – 30 %	–	–
			2,500 r/min	17 – 37 %		
88★	Fuel control condition	Engine: Warm	2,500 r/min	Closed loop	Code No. P0125	13C-24
			When engine is suddenly raced	Open loop – drive condition		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
A1 ★	Oxygen sensor (sensor 1)	Engine: After warm-up	Idling	0.2 V or less	Code No. P0130	13C-25
			Sudden racing	0.6 – 1.0 V		
			2,500 r/min	0.4 V or less and 0.6 – 1.0 V alternates		
A2 ★	Oxygen sensor (sensor 2)	• Transmission: 2nd gear <M/T>, L range <A/T> • Drive with throttle widely open	3,500 r/min	0.6 – 1.0 V	Code No. P0136	13C-27
8A ★	Throttle position sensor (Throttle valve opening angle)	• Engine coolant temperature: 80 – 95°C • Ignition switch: ON (Engine: Stopped)	Release the accelerator pedal.	6 – 20 %	Code No. P0120	13C-22
			Depress the accelerator pedal gradually	Increase in response to pedal depression stroke.		
			Depress the accelerator pedal fully.	80 – 100 %		

ACTUATOR TEST REFERENCE TABLE

Item No.	Inspection item	Drive contents	Inspection contents		Normal condition	Inspection procedure No.	Reference page
01	Injectors	Cut fuel to No. 1 injector	Engine: After having warmed up/Engine is idling (Cut the fuel supply to each injector in turn and check cylinders which don't affect idling.)		Idling condition becomes different (becomes unstable).	Code No. P0201	13C-30
02		Cut fuel to No. 2 injector				Code No. P0202	13C-30
03		Cut fuel to No. 3 injector				Code No. P0203	13C-30
04		Cut fuel to No. 4 injector				Code No. P0204	13C-30
07	Fuel pump	Fuel pump operates and fuel is recirculated.	• Engine: Cranking • Fuel pump: Forced driving Inspect according to both the above conditions.	Pinch the return hose with fingers to feel the pulse of the fuel being recirculated.	Pulse is felt.	Procedure No. 27	13C-69
				Listen near the fuel tank for the sound of fuel pump operation.	Sound of operation is heard.		
08	Purge control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch: ON		Sound of operation can be heard when solenoid valve is driven.	Code No. P0443	13C-38
10	EGR control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch: ON		Sound of operation can be heard when solenoid valve is driven.	Code No. P0403	13C-36
17	Basic ignition timing	Set to ignition timing adjustment mode	Engine: Idling Timing light is set		5°BTDC	–	–
21	Fan relay	Drive the fan motor	Ignition switch: ON		Radiator fan and condenser fan operate at high speed	Procedure No. 24	13C-67



CHECK AT THE ENGINE-ECU TERMINALS

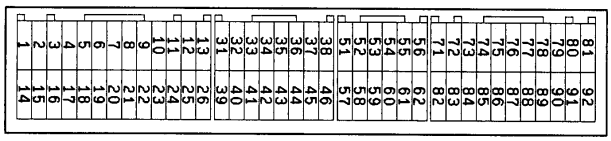
TERMINAL VOLTAGE CHECK CHART

1. Connect a needle-nosed wire probe (test harness: MB991223 or paper clip) to a voltmeter probe.
2. Insert the needle-nosed wire probe into each of the engine-ECU connector terminals from the wire side, and measure the voltage while referring to the check chart.

   NOTE
   (1) Make the voltage measurement with the engine-ECU connectors connected.
   (2) You may find it convenient to pull out the engine-ECU to make it easier to reach the connector terminals.
   (3) The checks can be carried out off the order given in the chart.

   Caution
   Short-circuiting the positive (+) probe between a connector terminal and earth could damage the vehicle wiring, the sensor, engine-ECU or all of them. Be careful to prevent this!
3. If voltmeter shows any division from standard value, check the corresponding sensor, actuator and related electrical wiring, then repair or replace.
4. After repair or replacement, recheck with the voltmeter to confirm that the repair has corrected the problem.

Engine-ECU Connector Terminal Arrangement



9FU0393

Terminal No.	Check item	Check condition (Engine condition)	Normal condition
1	No. 1 injector	While engine is idling after having warmed up, suddenly depress the accelerator pedal.	From 11 – 14 V, momentarily drops slightly
14	No. 2 injector		
2	No. 3 injector		
15	No. 4 injector		
4	Stepper motor coil <A>	Engine: Soon after the warmed up engine is started	System voltage ↔ 0 V (Changes repeatedly)
17	Stepper motor coil <B>		
5	Stepper motor coil <C>		
18	Stepper motor coil <D>		
6	EGR control solenoid valve	Ignition switch: ON	System Voltage
		While engine is idling, suddenly depress the accelerator pedal.	From system voltage, momentarily drops
8	A/C relay	• Engine: Idle speed • A/C switch: OFF → ON (A/C compressor is operating)	System voltage or momentarily 6 V or more → 0 – 3 V
9	Purge control solenoid valve	Ignition switch: ON	System voltage
		Running at 3,000 r/min while engine is warming up after having been started.	0 – 3 V
10	Ignition coil – No. 1, No. 4 (power transistor)	Engine r/min: 3,000 r/min	0.3 – 3.0 V
23	Ignition coil – No. 2, No. 3 (power transistor)		
12	Power supply	Ignition switch: ON	System voltage
25			
19	Air flow sensor reset signal	Engine: Idle speed	0 – 1 V
		Engine r/min: 3,000 r/min	6 – 9 V
20	Condenser motor relay (HI)	Radiator fan is not operating (Engine coolant temperature is 90°C or less)	System voltage
		Radiator fan is not operating (Engine coolant temperature is 105°C or less)	0 – 3 V

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
21	Radiator motor relay (LO)	Radiator fan and condenser fan are not operating (Engine coolant temperature is 90°C or less)		System voltage
		Radiator fan and condenser fan are not operating (Engine coolant temperature is 90 – 105°C or less)		0 – 3 V
22	Fuel pump relay	Ignition switch: ON		System voltage
		Engine: Idle speed		0 – 3 V
33	Alternator G terminal	• Engine: Warm, idle (radiator fan: OFF) • Headlamp: OFF to ON • Rear defogger switch: OFF to ON • Brake lamp: ON		Voltage rises by 0.2 – 3.5 V.
41	Alternator FR terminal	• Engine: Warm, idle (radiator fan: OFF) • Headlamp: OFF to ON • Rear defogger switch: OFF to ON • Brake lamp: ON		Voltage drops by 0.2 – 3.5 V.
36	Engine warning lamp	Ignition switch: “LOCK” (OFF) position → ON		0 – 3 V → 9 – 13 V (After several seconds have elapsed)
37	Power steering fluid pressure switch	Engine: Idling after warming up	When steering wheel is stationary	System voltage
			When steering wheel is turned	0 – 3 V
38	Control relay (Power supply)	Ignition switch: “LOCK” (OFF) position		System voltage
		Ignition switch: ON		0 – 3 V
45	A/C switch 1	Engine: Idle speed	Turn the A/C switch OFF	0 – 3 V
			Turn the A/C switch ON (A/C compressor is operating)	System voltage
58	Tachometer signal	Engine r/min: 3,000 r/min		0.3 – 3.0 V
60	Oxygen sensor (front) heater	Engine: Idling after warming up		0 – 3 V
		Engine r/min: 5,000 r/min		System voltage
54	Oxygen sensor (rear) heater	Engine: Idling after warming-up		0 – 3 V
		Engine r/min: 5,000 r/min		System voltage
71	Ignition switch – ST	Engine: Cranking		8 V or more

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
72	Intake air temperature sensor	Ignition switch: ON	When intake air temperature is 0°C	3.2 – 3.8 V
			When intake air temperature is 20°C	2.3 – 2.9 V
			When intake air temperature is 40°C	1.5 – 2.1 V
			When intake air temperature is 80°C	0.4 – 1.0 V
75	Oxygen sensor (rear)	• Transmission: 2nd gear <M/T>, L range <A/T> • Engine r/min: 3,500 r/min or more • Driving with the throttle valve widely open		0.6 – 1.0 V
76	Oxygen sensor (front)	Engine: Running at 2,500 r/min after warmed up (Check using a digital type voltmeter)		0 ↔ 0.8 V (Changes repeatedly)
77	A/C thermo sensor	• Ignition switch: ON • Temperature at sensor: 25°C (1.5 kΩ)		2.2 V
80	Backup power supply	Ignition switch: "LOCK" (OFF) position		System voltage
81	Sensor impressed voltage	Ignition switch: ON		4.5 – 5.5 V
82	Ignition switch – IG	Ignition switch: ON		System voltage
83	Engine coolant temperature sensor	Ignition switch: ON	When engine coolant temperature is 0°C	3.2 – 3.8 V
			When engine coolant temperature is 20°C	2.3 – 2.9 V
			When engine coolant temperature is 40°C	1.3 – 1.9 V
			When engine coolant temperature is 80°C	0.3 – 0.9 V
84	Throttle position sensor	Ignition switch: ON	Set throttle valve to idle position	0.3 – 1.0 V
			Fully open throttle valve	4.5 – 5.5 V

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
85	Barometric pressure sensor	Ignition switch: ON	When altitude is 0 m	3.7 – 4.3 V
			When altitude is 1,200 m	3.2 – 3.8 V
86	Vehicle speed sensor	• Ignition switch: ON • Move the vehicle slowly forward		0 ↔ 5 V (Changes repeatedly)
88	Camshaft position sensor	Engine: Cranking		0.4 – 3.0 V
		Engine: Idle speed		0.5 – 2.0 V
89	Crank angle sensor	Engine: Cranking		0.4 – 4.0 V
		Engine: Idle speed		1.5 – 2.5 V
90	Air flow sensor	Engine: Idle speed		2.2 – 3.2 V
		Engine r/min: 2,500 r/min		

CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

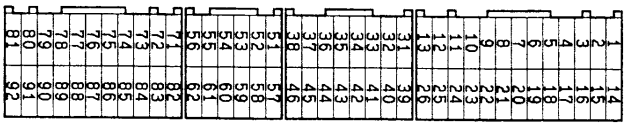
1. Turn the ignition switch to “LOCK” (OFF) position.
2. Disconnect the engine-ECU connector.
3. Measure the resistance and check for continuity between the terminals of the engine-ECU harness-side connector while referring to the check chart.

   NOTE
   (1) When measuring resistance and checking continuity, a harness for checking contact pin pressure should be used instead of inserting a test probe.
   (2) Checking need not be carried out in the order given in the chart.

Caution
If the terminals that should be checked are mistaken, or if connector terminals are not correctly shorted to earth, damage may be caused to the vehicle wiring, sensors, engine-ECU and/or ohmmeter.
Be careful to prevent this!

4. If the ohmmeter shows any deviation from the standard value, check the corresponding sensor, actuator and related electrical wiring, and then repair or replace.
5. After repair or replacement, recheck with the ohmmeter to confirm that the repair or replacement has corrected the problem.

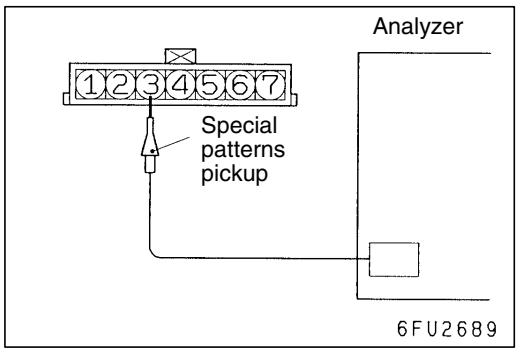
Engine-ECU Harness Side Connector Terminal Arrangement



9FU0392

Terminal No.	Inspection item	Normal condition (Check condition)
1 – 12	No. 1 injector	13 – 16 Ω (At 20°C)
14 – 12	No. 2 injector	
2 – 12	No. 3 injector	
15 – 12	No. 4 injector	
4 – 12	Stepper motor coil (A)	28 – 33 Ω (At 20°C)
17 – 12	Stepper motor coil (B)	
5 – 12	Stepper motor coil (C)	
18 – 12	Stepper motor coil (D)	
6 – 12	EGR control solenoid valve	29 – 35 Ω (At 20°C)
9 – 12	Purge control solenoid valve	29 – 35 Ω (At 20°C)
13 – Body earth	Engine-ECU earth	Continuity (0 Ω)
26 – Body earth	Engine-ECU earth	
60 – 12	Oxygen sensor (front) heater	4.5 – 8.0 Ω (At 20°C)
54 – 12	Oxygen sensor (rear) heater	11 – 18 Ω (At 20°C)

Terminal No.	Inspection item	Normal condition (Check condition)
72 – 92	Intake air temperature sensor	5.3 – 6.7 kΩ (When intake air temperature is 0°C)
		2.3 – 3.0 kΩ (When intake air temperature is 20°C)
		1.0 – 1.5 kΩ (When intake air temperature is 40°C)
		0.30 – 0.42 kΩ (When intake air temperature is 80°C)
83 – 92	Engine coolant temperature sensor	5.1 – 6.5 kΩ (When coolant temperature is 0°C)
		2.1 – 2.7 kΩ (When coolant temperature is 20°C)
		0.9 – 1.3 kΩ (When coolant temperature is 40°C)
		0.26 – 0.36 kΩ (When coolant temperature is 80°C)



INSPECTION PROCEDURE USING AN ANALYZER

AIR FLOW SENSOR (AFS)

Measurement Method

1. Disconnect the air flow sensor connector, and connect the special tool (test harness: MB991709) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to air flow sensor connector terminal 3.

Alternate Method (Test harness not available)

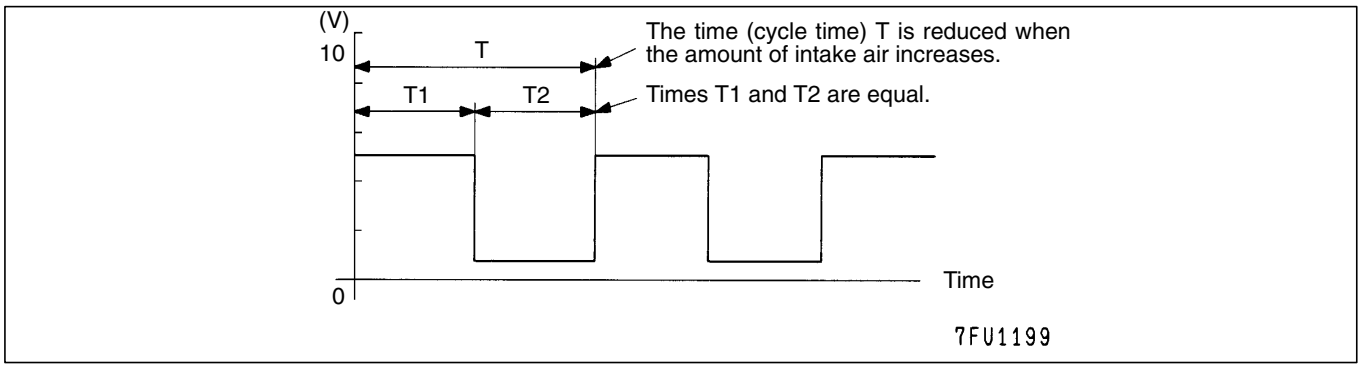
1. Connect the analyzer special patterns pickup to engine-ECU terminal 90.

Standard Wave Pattern

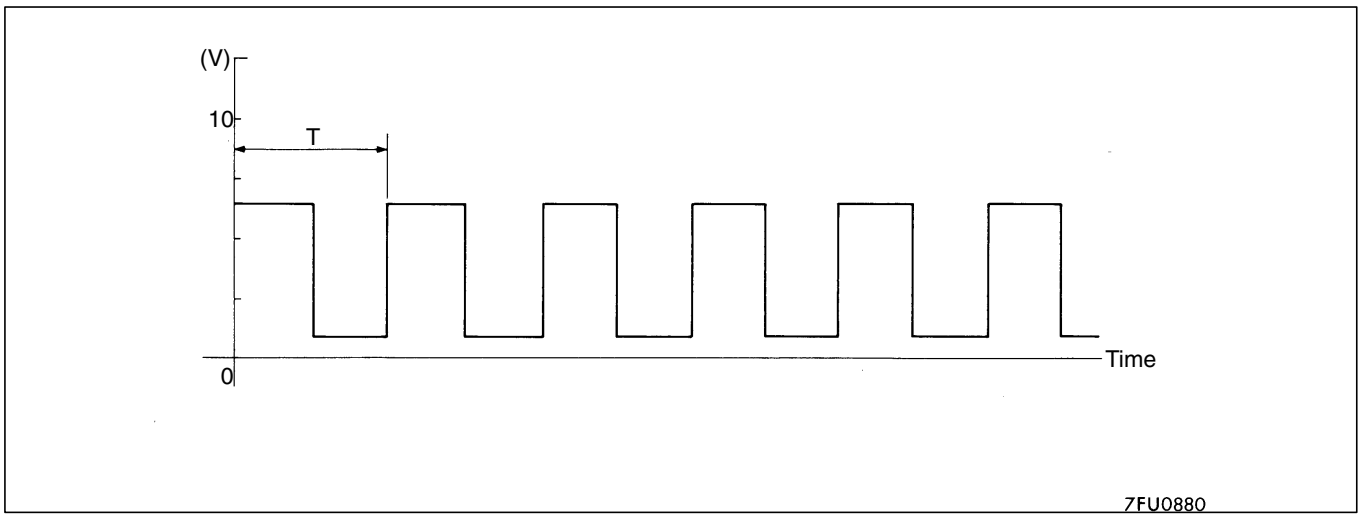
Observation conditions

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Idle speed

Standard wave pattern

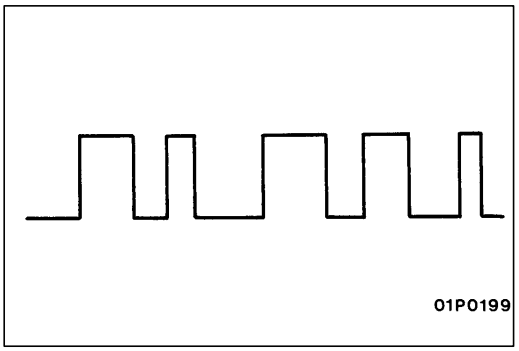


Observation conditions (from conditions above engine speed is increased by racing.)



Wave Pattern Observation Points

Check that cycle time T becomes shorter and the frequency increases when the engine speed is increased.



Examples of Abnormal Wave Patterns

- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

  Rectangular wave pattern is output even when the engine is not started.

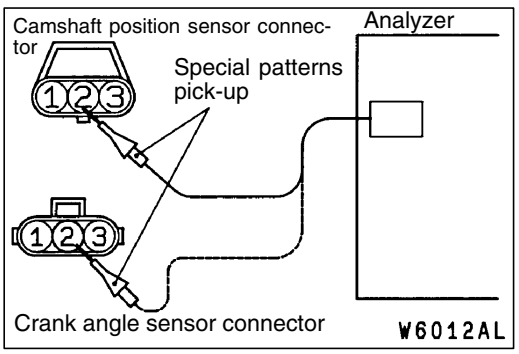
- Example 2

  Cause of problem

  Damaged rectifier or vortex generation column

  Wave pattern characteristics

  Unstable wave pattern with non-uniform frequency. However, when an ignition leak occurs during acceleration, the wave pattern will be distorted temporarily, even if the air flow sensor is normal.



CAMSHAFT POSITION SENSOR AND CRANK ANGLE SENSOR

Measurement Method

1. Disconnect the camshaft position sensor connector and connect the special tool (test harness: MB991659) and jumper wire in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to camshaft position sensor terminal 2.
3. Disconnect the crank angle sensor connector and connect the special tool (test harness: MB991658) in between.
4. Connect the analyzer special patterns pickup to crank angle sensor terminal 3.

Alternate Method (Test harness not available)

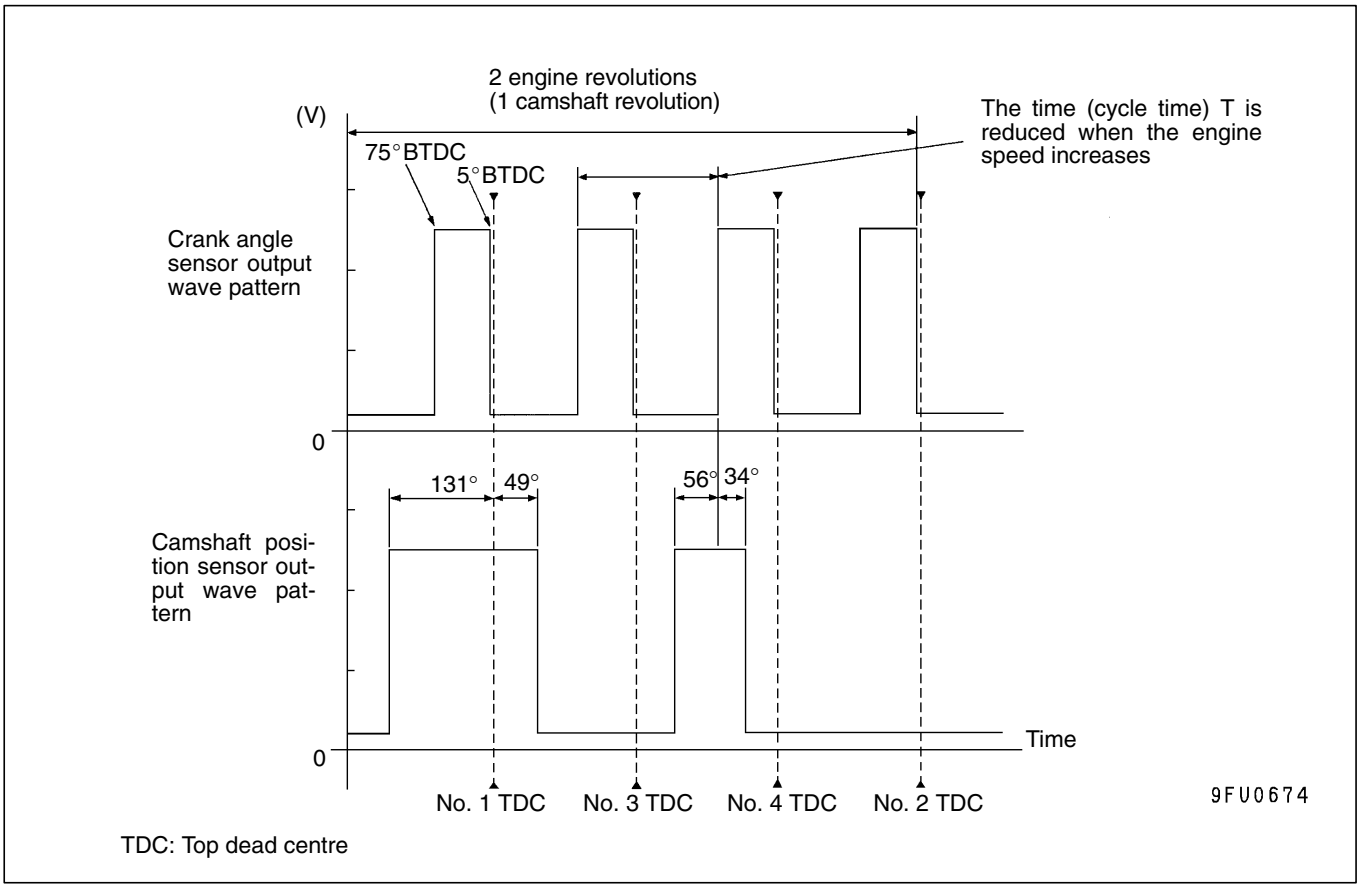
1. Connect the analyzer special patterns pickup to engine-ECU terminal 88. (When checking the camshaft position sensor signal wave pattern.)
2. Connect the analyzer special patterns pickup to engine-ECU terminal 89. (When checking the crank angle sensor signal wave pattern.)

Standard Wave Pattern

Observation conditions

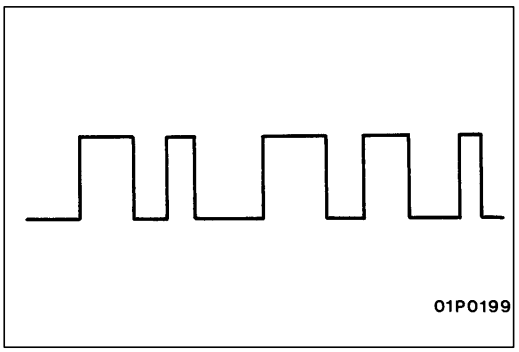
Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Idle speed

Standard wave pattern



Wave Pattern Observation Points

Check that cycle time T becomes shorter when the engine speed increases.



Examples of Abnormal Wave Patterns

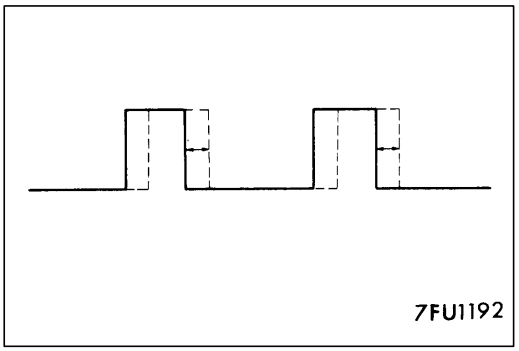
- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

  Rectangular wave pattern is output even when the engine is not started.



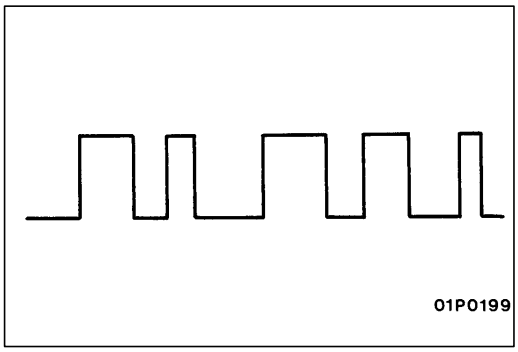
- Example 2

  Cause of problem

  Loose timing belt
  Abnormality in sensor disk

  Wave pattern characteristics

  Wave pattern is displaced to the left or right.



Examples of Abnormal Wave Patterns

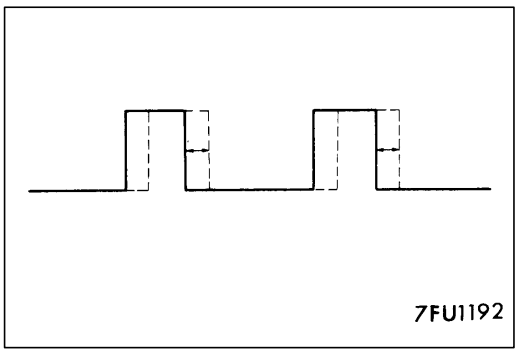
- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

  Rectangular wave pattern is output even when the engine is not started.



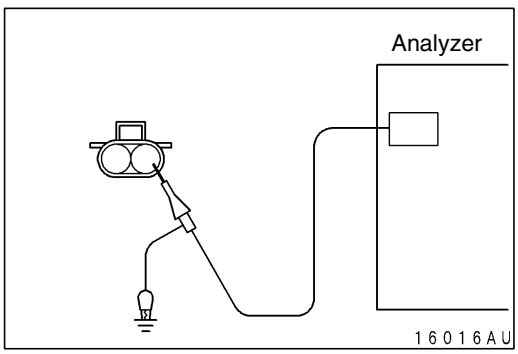
- Example 2

  Cause of problem

  Loose timing belt
  Abnormality in sensor disk

  Wave pattern characteristics

  Wave pattern is displaced to the left or right.



INJECTOR

Measurement Method

1. Disconnect the injector connector, and then connect the special tool (test harness: MB991348) in between. (Both the power supply side and engine-ECU side should be connected.)
2. Connect the analyzer special patterns pickup to terminal 2 of the injector connector.

Alternate Method (Test harness not available)

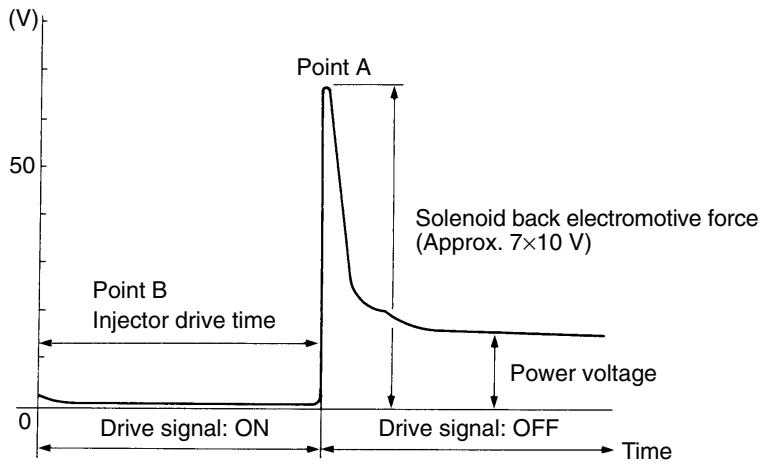
1. Connect the analyzer special patterns pickup to engine-ECU terminal 1. (When checking the No. 1 cylinder.)
2. Connect the analyzer special patterns pickup to engine-ECU terminal 14. (When checking the No. 2 cylinder.)
3. Connect the analyzer special patterns pickup to engine-ECU terminal 2. (When checking the No. 3 cylinder.)
4. Connect the analyzer special patterns pickup to engine-ECU terminal 15. (When checking the No. 4 cylinder.)

Standard Wave Pattern

Observation conditions

Function	Special patterns
Pattern height	Variable
Variable knob	Adjust while viewing the wave pattern
Pattern selector	Display
Engine r/min	Idle speed

Standard wave pattern

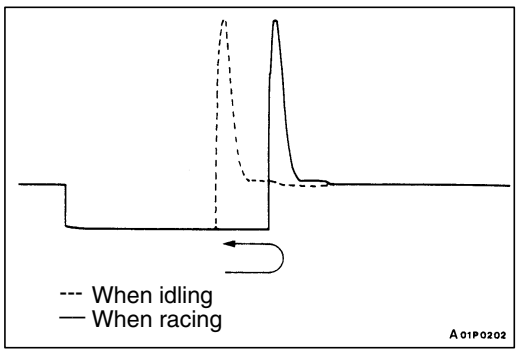


Wave Pattern Observation Points

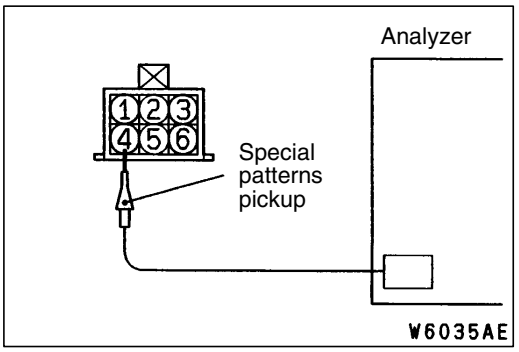
Point A: Height of solenoid back electromotive force

Contrast with standard wave pattern	Probable cause
Solenoid coil back electromotive force is low or doesn't appear at all.	Short in the injector solenoid

Point B: Injector drive time



- The injector drive time will be synchronized with the MUT-II tester display.
- When the engine is suddenly raced, the drive time will be greatly extended at first, but the drive time will soon match the engine speed.



IDLE SPEED CONTROL (ISC) SERVO (STEPPER MOTOR)

Measurement Method

1. Disconnect the ISC servo connector, and connect the special tool (test harness: MB991709) in between.
2. Connect the analyzer special patterns pickup to the ISC servo-side connector terminal 1, terminal 3, terminal 4 and terminal 6 respectively.

Alternate Method (Test harness not available)

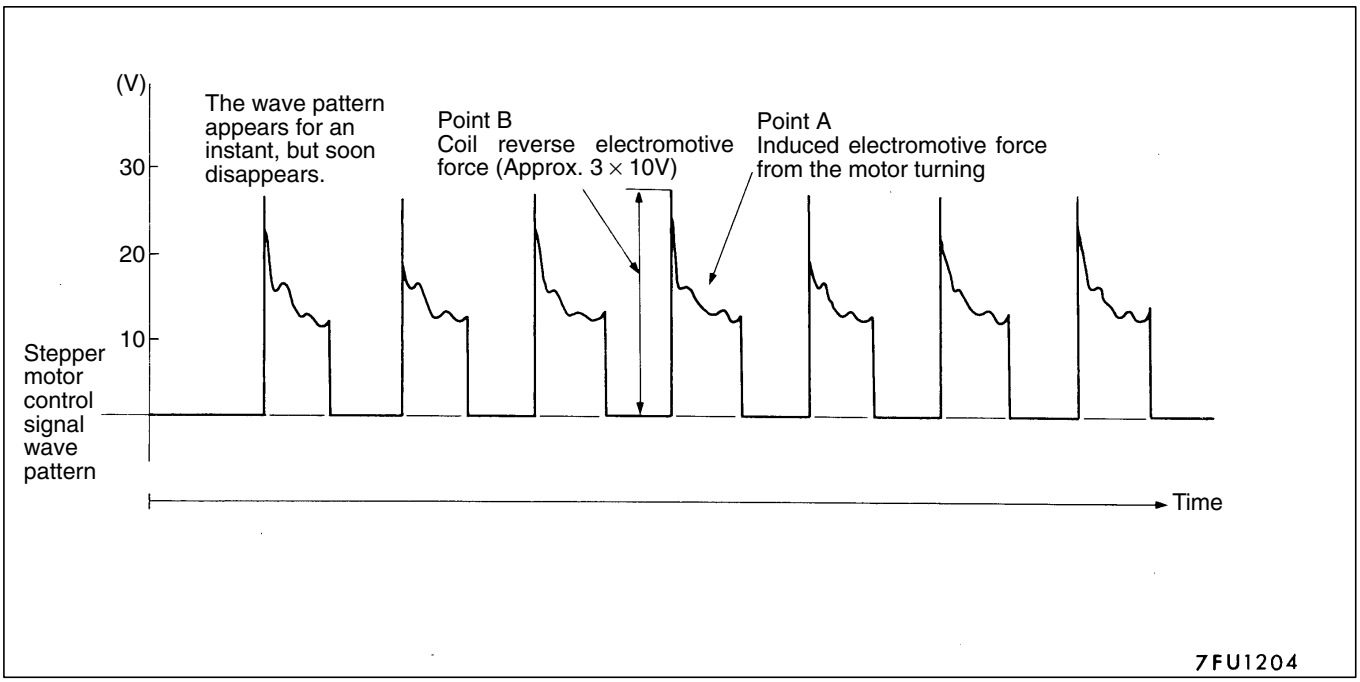
1. Connect the analyzer special patterns pickup to engine-ECU terminal 4, connection terminal 5, connection terminal 17, and connection terminal 18 respectively.

Standard Wave Pattern

Observation conditions

Function	Special patterns
Pattern height	High
Pattern selector	Display
Engine condition	When the engine coolant temperature is 20°C or below, turn the ignition switch from LOCK (OFF) position to ON (without starting the engine).
	While the engine is idling, turn the A/C switch to ON.
	Immediately after starting the warm engine

Standard wave pattern



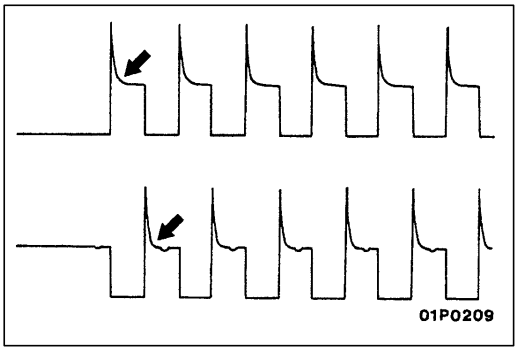
Wave Pattern Observation Points

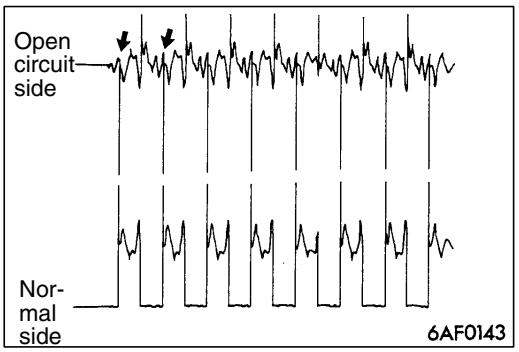
Check that the standard wave pattern appears when the stepper motor is operating.
Point A: Presence or absence of induced electromotive force from the motor turning. (Refer to the abnormal wave pattern.)

Contrast with standard wave pattern	Probable cause
Induced electromotive force does not appear or is extremely small.	Motor is malfunctioning

Point B: Height of coil reverse electromotive force

Contrast with standard wave pattern	Probable cause
Coil reverse electromotive force does not appear or is extremely small.	Short in the coil





Examples of Abnormal Wave Pattern

- Example 1

  Cause of problem

  Motor is malfunctioning. (Motor is not operating.)

  Wave pattern characteristics

  Induced electromotive force from the motor turning does not appear.

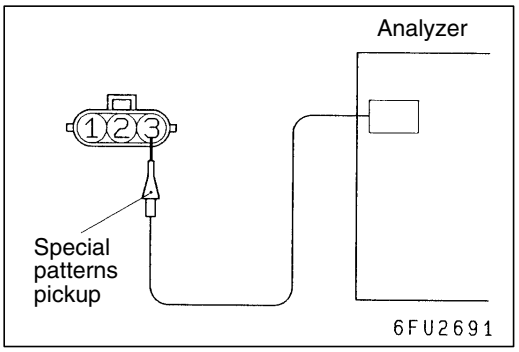
- Example 2

  Cause of problem

  Open circuit in the line between the stepper motor and the engine-ECU.

  Wave pattern characteristics

  Current is not supplied to the motor coil on the open circuit side. (Voltage does not drop to 0 V.)
  Furthermore, the induced electromotive force waveform at the normal side is slightly different from the normal waveform.



IGNITION COIL AND POWER TRANSISTOR

- Ignition coil primary signal
  Refer to GROUP 16 – Ignition system.
- Power transistor control signal

Measurement Method

1. Disconnect the ignition coil connector, and connect the special tool (test harness: MB991348) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to terminal 3 of each ignition coil connector in turn.

Alternate Method (Test harness not available)

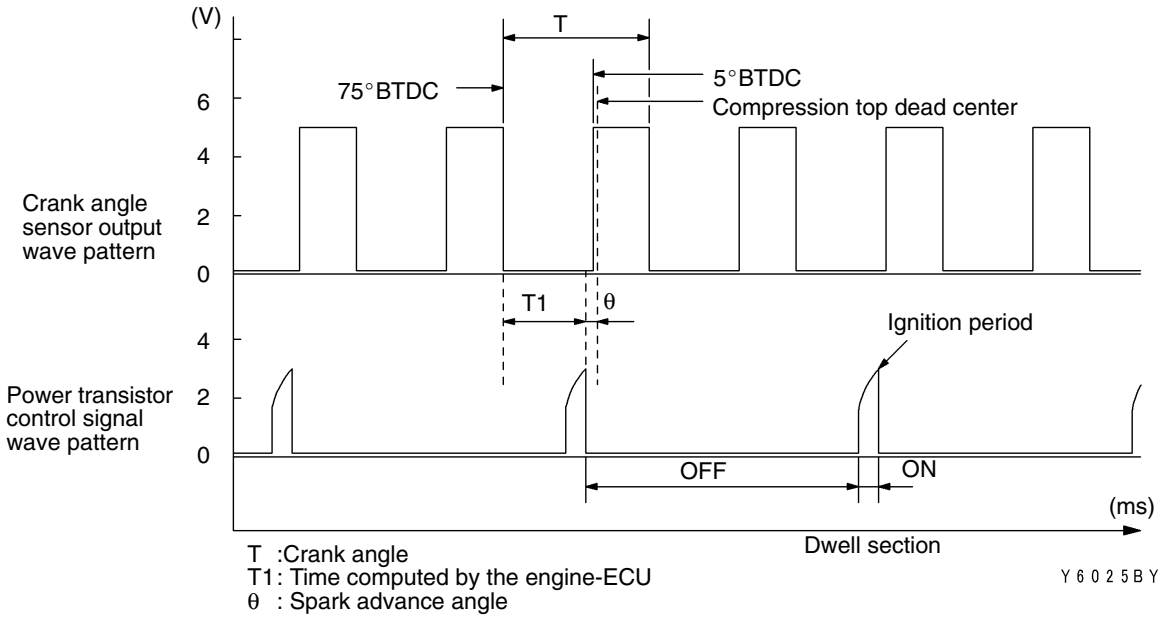
1. Connect the analyzer special patterns pickup to engine-ECU terminal 10 (No. 1 – No. 4), terminal 23 (No. 2 – No. 3) respectively.

Standard Wave Pattern

Observation condition

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Approx. 1,200 r/min

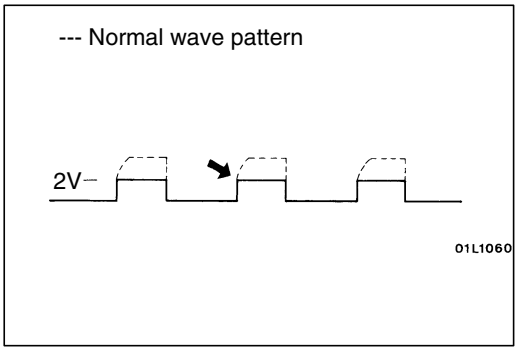
Standard wave pattern

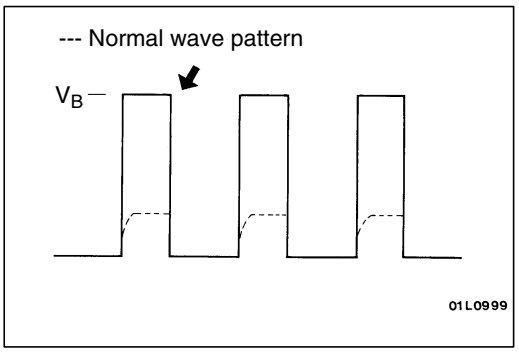


Wave Pattern Observation Points

Point: Condition of wave pattern build-up section and maximum voltage (Refer to abnormal wave pattern examples 1 and 2.)

Condition of wave pattern build-up section and maximum voltage	Probable cause
Rises from approx. 2 V to approx. 4.5 V at the top-right	Normal
2 V rectangular wave	Open-circuit in ignition primary circuit
Rectangular wave at power voltage	Power transistor malfunction





Examples of Abnormal Wave Patterns

- Example 1

  Wave pattern during engine cranking

  Cause of problem

  Open-circuit in ignition primary circuit

  Wave pattern characteristics

  Top-right part of the build-up section cannot be seen, and voltage value is approximately 2 V too low.

- Example 2

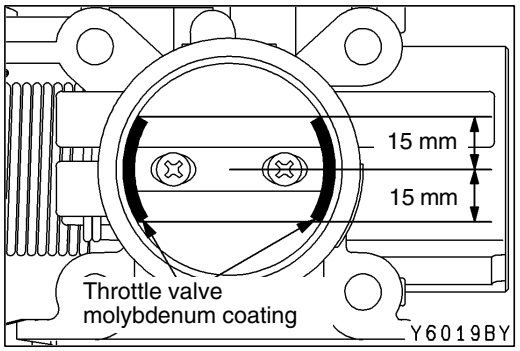
  Wave pattern during engine cranking

  Cause of problem

  Malfunction in power transistor

  Wave pattern characteristics

  Power voltage results when the power transistor is ON.

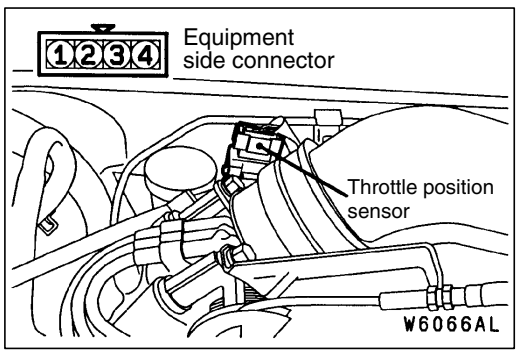


ON-VEHICLE SERVICE

THROTTLE BODY (THROTTLE VALVE AREA) CLEANING

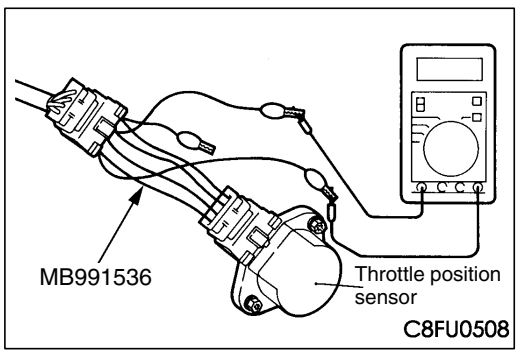
1. Disconnect the air intake hose from the throttle body.
2. Apply some detergent to a clean cloth.
3. Use the clean cloth with detergent to wipe the area around the throttle valve until it is clean.

   Caution
   (1) Do not let any of the detergent get directly onto the throttle valve.
   (2) Take care not to let any detergent get into the motor through the bypass passage. Furthermore, do not let it get to the sensor through the shaft.
   (3) Do not wipe the molybdenum coating which is located around the throttle valve shaft.
4. Connect the air intake hose.
5. Adjust the standard idle speed.



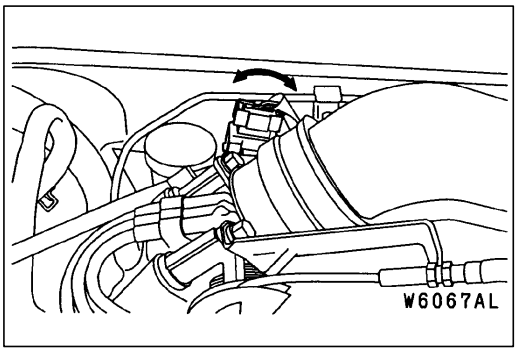
THROTTLE POSITION SENSOR ADJUSTMENT

1. Turn the ignition switch to LOCK (OFF) position.
2. Connect the MUT-II to the diagnosis connector.
   When not using the MUT-II, proceed as follows:



   (1) Disconnect the throttle position sensor connector, and connect the special tool (throttle position sensor test harness: MB991536) between the disconnected connector taking care not to confuse the terminal to be connected.
   (2) Connect digital voltmeter between the terminal No.2 (sensor output: blue clip of special tool) and the terminal No.4 (sensor earth: black clip of special tool) of the throttle position sensor connector.
3. Turn the ignition switch to ON (but do not start the engine).
4. Check the output voltage of the throttle position sensor.

   Standard value: 535 – 735 mV



5. If not within the standard value, loosen the throttle position sensor mounting bolts. Then rotate the sensor body to adjust.
6. Turn the ignition switch to LOCK (OFF) position.
7. Remove the MUT-II. If the MUT-II is not used, remove the special tool, and then connect the throttle position sensor connector.
8. If a diagnosis code is displayed, erase the diagnosis code by using the MUT-II or disconnect the negative battery cable from the battery terminal and then leave it for at least ten seconds. After that, reconnect the battery cable, and then let the engine run at idle for approx. ten minutes.

BASIC IDLE SPEED ADJUSTMENT

NOTE
(1) The standard idling speed has been adjusted by the speed adjusting screw (SAS) by the manufacturer, and there should usually be no need for readjustment.
(2) If the adjustment has been changed by mistake, the idle speed may become too high or the idle speed may drop too low when loads from components such as the A/C are placed on the engine. If this occurs, adjust by the following procedure.
(3) The adjustment, if made, should be made after first confirming that the spark plugs, the injectors, the idle speed control servo, the compression pressure, etc., are all normal.

1. Before inspection and adjustment, set the vehicle to the pre-inspection condition.
2. Turn the ignition switch to LOCK (OFF) position.
3. Connect the MUT-II to the diagnosis connector (16-pin).

NOTE
When the MUT-II is connected, the diagnosis control terminal should be earthed.

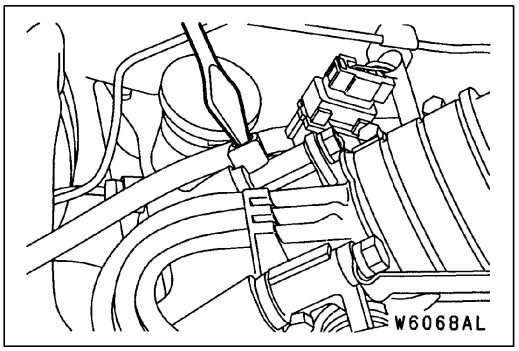
4. Start the engine and run at idle.
5. Select the item No.30 of the MUT-II Actuator test.

NOTE
This holds the ISC servo at the basic step to adjust the basic idle speed.

6. Check the idle speed.

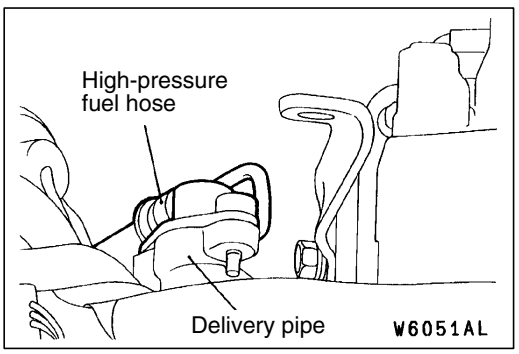
Standard value: 700 ± 50 r/min

NOTE
(1) The engine speed may be 20 to 100 r/min lower than indicated above for a new vehicle [driven approximately 500 km or less], but no adjustment is necessary.
(2) If the engine stalls or the engine speed is low even though the vehicle has been driven approximately 500 km or more, it is probable that deposits are adhered to the throttle valve, so clean it. (Refer to P.13C-96.)



7. If not within the standard value range, turn the speed adjusting screw (SAS) to make the necessary adjustment.
8. Press the MUT-II clear key, and release the ISC servo from the Actuator test mode.

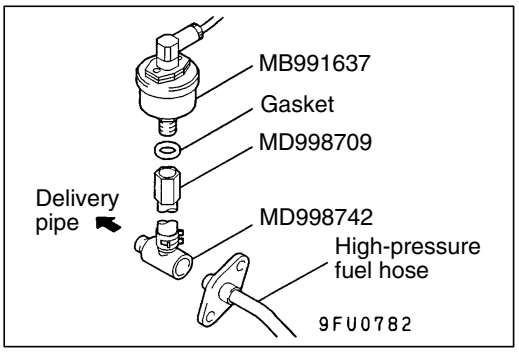
   NOTE
   Unless the ISC servo is released, the Actuator test mode will continue 27 minutes.
9. Turn the ignition switch to LOCK (OFF) position.
10. Disconnect the MUT-II.
11. Start the engine again and let it run at idle speed for about 10 minutes; check that the idling condition is normal.



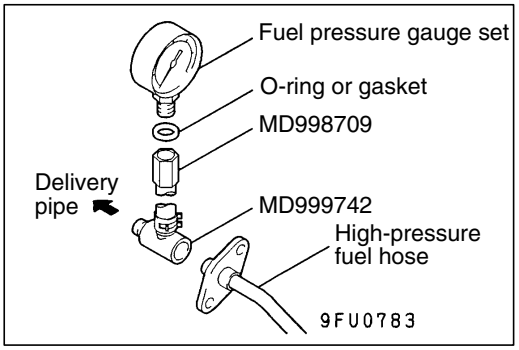
FUEL PRESSURE TEST

1. Release residual pressure from the fuel pipe line to prevent fuel gush out. (Refer to P.13C-70.)
2. Disconnect the high-pressure fuel hose at the delivery pipe side.

   Caution
   Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.



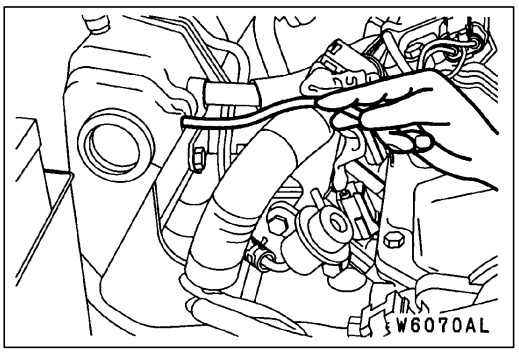
3. Remove the union joint and bolt from the special tool (adapter hose) and instead attach the special tool (hose adapter) to the adapter hose.
4. Install the special tool (for measuring the fuel pressure) that was set up in step 3.
   <When using the fuel pressure gauge set (special tool)>
   (1) Install the special tool (for measuring the fuel pressure) between the high-pressure fuel hose and the delivery pipe.
   (2) Install the fuel pressure gauge set (special tool) on the special tool (for measuring the fuel pressure) putting the gasket between them.
   (3) Connect the lead wire of the fuel pressure gauge set (special tool) to the power supply (cigarette lighter socket) and to the MUT-II.



<When using the fuel pressure gauge>
(1) Install the fuel pressure gauge on the special tool (for measuring the fuel pressure) putting a suitable O-ring or gasket between them.
(2) Install the special tool which was set up in step (1) between the high-pressure fuel hose and the delivery pipe.

5. Connect the MUT-II to the diagnosis connector.
6. Turn the ignition switch to ON. (But do not start the engine.)
7. Select "Item No.07" from the MUT-II Actuator test to drive the fuel pump. Check that there are no fuel leaks from any parts.
8. Finish the actuator test or turn the ignition switch to LOCK (OFF) position.
9. Start the engine and run at idle.
10. Measure fuel pressure while the engine is running at idle.

Standard value: Approx. 265 kPa



11. Disconnect the vacuum hose from the fuel pressure regulator and measure fuel pressure with the hose end closed by a finger.

Standard value: 324–349 kPa

12. Check to see that fuel pressure at idle does not drop even after the engine has been raced several times.
13. Racing the engine repeatedly, hold the fuel return hose lightly with fingers to feel that fuel pressure is present in the return hose.

NOTE
If the fuel flow rate is low, there will be no fuel pressure in the return hose.

14. If any of fuel pressure measured in steps 10 to 13 is out of specification, troubleshoot and repair according to the table below.

Symptom	Probable cause	Remedy
• Fuel pressure too low • Fuel pressure drops after racing • No fuel pressure in fuel return hose	Clogged fuel filter	Replace fuel filter
	Fuel leaking to return side due to poor fuel regulator valve seating or settled spring	Replace fuel pressure regulator
	Low fuel pump delivery pressure	Replace fuel pump
Fuel pressure too high	Binding valve in fuel pressure regulator	Replace fuel pressure regulator
	Clogged fuel return hose or pipe	Clean or replace hose or pipe
Same fuel pressure when vacuum hose is connected and when disconnected	Damaged vacuum hose or clogged nipple	Replace vacuum hose or clean nipple

15. Stop the engine and check change of fuel pressure gauge reading. Normal if the reading does not drop within 2 minutes. If it does, observe the rate of drop and troubleshoot and repair according to the table below.

Symptom	Probable cause	Remedy
Fuel pressure drops gradually after engine is stopped	Leaky injector	Replace injector
	Leaky fuel regulator valve seat	Replace fuel pressure regulator
Fuel pressure drops sharply immediately after engine is stopped	Check valve in fuel pump is held open	Replace fuel pump

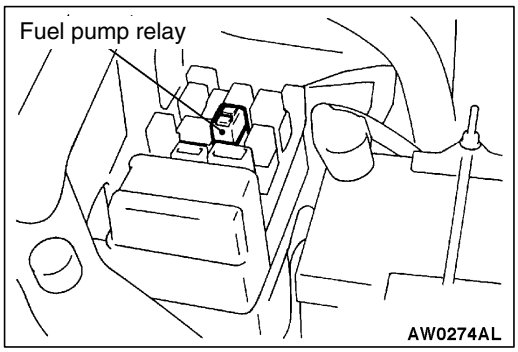
16. Release residual pressure from the fuel pipe line. (Refer to P.13C-70.)
17. Remove the fuel pressure gauge and special tool from the delivery pipe.

    Caution
    Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.

18. Replace the O-ring at the end of the fuel high pressure hose with a new one. Furthermore, apply engine oil to the new O-ring before replacement.
19. Fit the fuel high pressure hose over the delivery pipe and tighten the bolt to specified torque.

    Tightening torque: 9.0 ± 2.0 Nm

20. Check for any fuel leaks by following the procedure in step 7.
21. Disconnect the MUT-II.



FUEL PUMP CONNECTOR DISCONNECTION (HOW TO REDUCE THE FUEL PRESSURE)

When removing the fuel pipe, hose, etc., since fuel pressure in the fuel pipe line is high, do the following operation so as to release the fuel pressure in the line and prevent fuel from running out.

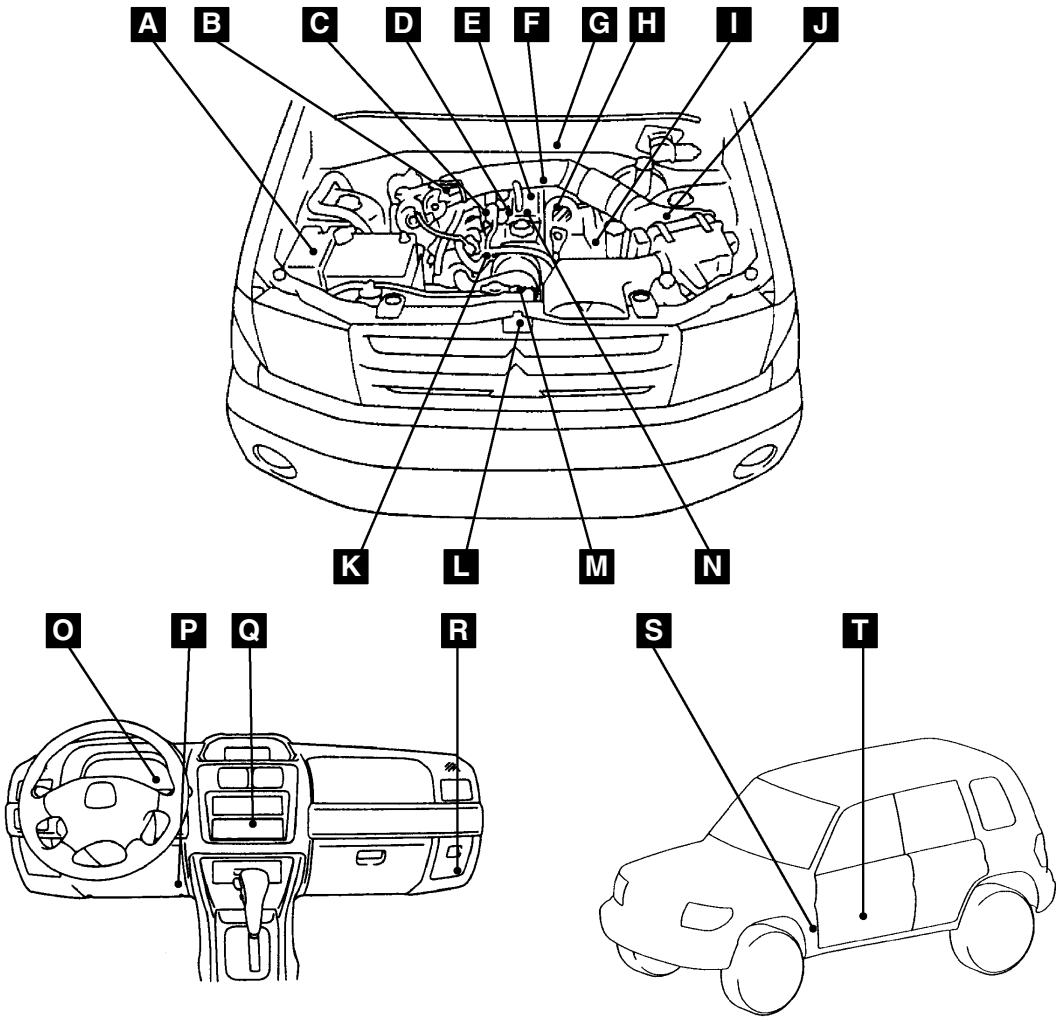
1. Remove the fuel pump relay.
2. After starting the engine and letting it run until it stops naturally, turn the ignition switch to LOCK (OFF) position.
3. Install the fuel pump relay.

FUEL PUMP OPERATION CHECK

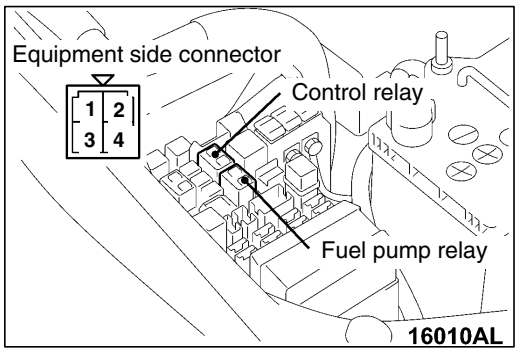
Refer to GROUP 13A – On-vehicle Service.

COMPONENT LOCATION

Name	Symbol	Name	Symbol
A/C relay	A	Engine warning lamp (check engine lamp)	O
A/C switch	Q	Idle speed control servo	B
Air flow sensor (With intake air temperature sensor and barometric pressure sensor)	J	Ignition coil	N
		Ignition failure sensor	E
Camshaft position sensor	F	Inhibitor switch <A/T>	G
Control relay and fuel pump relay	A	Injectors	D
Crank angle sensor	L	Oxygen sensor (front)	I
Detonation sensor	K	Oxygen sensor (rear)	S
Diagnosis connector	P	Power steering fluid pressure switch	M
EGR control solenoid valve	C	Purge control solenoid valve	C
Engine coolant temperature sensor	H	Throttle position sensor	B
Engine-ECU	R	Vehicle speed sensor	T

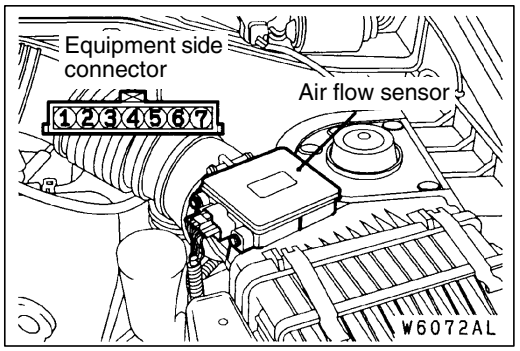


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CONTROL RELAY AND FUEL PUMP RELAY CONTINUITY CHECK

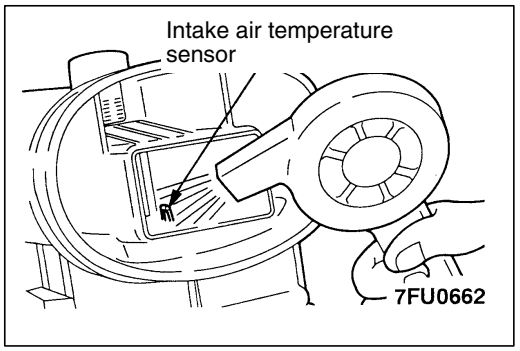
Battery voltage	Terminal No.			
	1	2	3	4
Not supplied		○		○
Supplied	○		○	
		⊖		⊕



INTAKE AIR TEMPERATURE SENSOR CHECK

1. Disconnect the air flow sensor connector.
2. Measure resistance between terminals 5 and 6.

   Standard value:
   13 – 17 kΩ (at –20°C)
   5.7 – 6.7 kΩ (at 0°C)
   2.3 – 3.0 kΩ (at 20°C)
   1.0 – 1.5 kΩ (at 40°C)
   0.56 – 0.76 kΩ (at 60°C)
   0.30 – 0.42 kΩ (at 80°C)

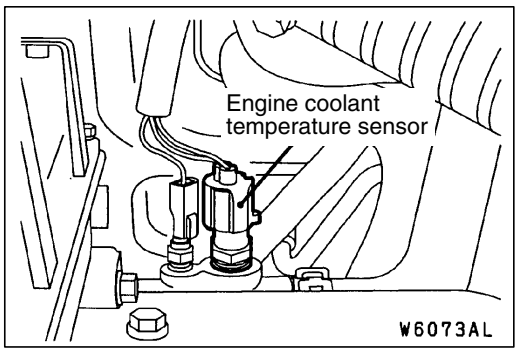


3. Measure resistance while heating the sensor using a hair drier.

   Normal condition:

Temperature (°C)	Resistance (kΩ)
Higher	Smaller

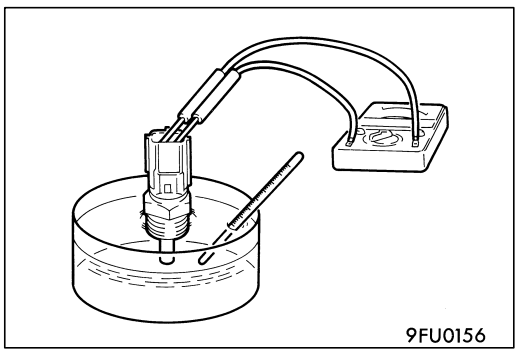
4. If the value deviates from the standard value or the resistance remains unchanged, replace the air flow sensor assembly.



ENGINE COOLANT TEMPERATURE SENSOR CHECK

Caution
Be careful not to touch the connector (resin section) with the tool when removing and installing.

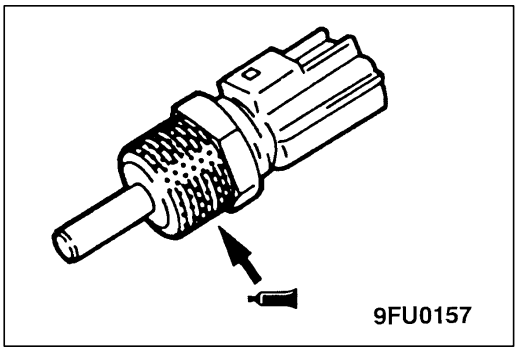
1. Remove the engine coolant temperature sensor.



2. With temperature sensing portion of engine coolant temperature sensor immersed in hot water, check resistance.

Standard value:
14 – 17 kΩ (at –20°C)
5.1 – 6.5 kΩ (at 0°C)
2.1 – 2.7 kΩ (at 20°C)
0.9 – 1.3 kΩ (at 40°C)
0.48 – 0.68 kΩ (at 60°C)
0.26 – 0.36 kΩ (at 80°C)

3. If the resistance deviates from the standard value greatly, replace the sensor.

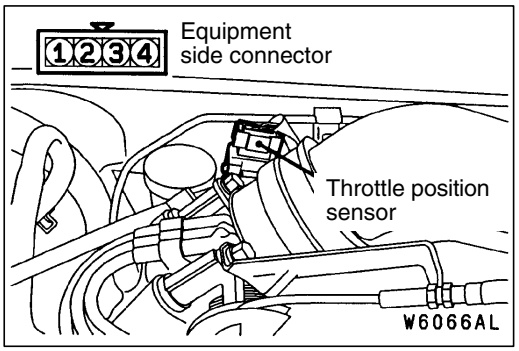


4. Apply sealant to threaded portion.

Specified sealant:
3M Nut Locking Part No.4171 or equivalent

5. Install the engine coolant temperature sensor and tighten it to the specified torque.

Tightening torque: 29 ± 9 N·m



THROTTLE POSITION SENSOR CHECK

1. Disconnect the throttle position sensor connector.
2. Measure the resistance between the throttle position sensor side connector terminal 1 and terminal 4.

Standard value: 3.5 – 6.5 kΩ

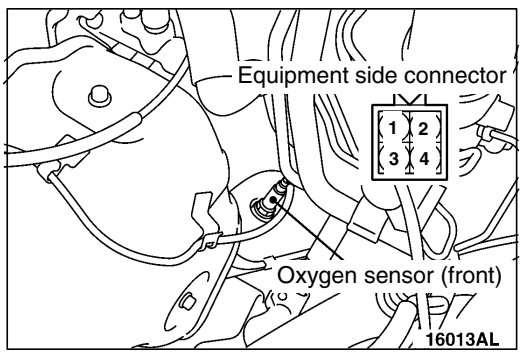
3. Measure the resistance between the throttle position sensor side connector terminal 2 and terminal 4.

Normal condition:

Throttle valve slowly open until fully open from the idle position	Changes smoothly in proportion to the opening angle of the throttle valve

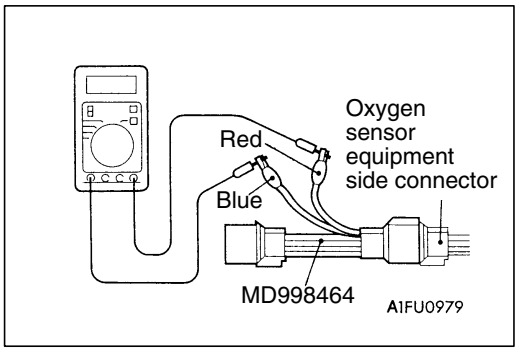
4. If the resistance is outside the standard value, or if it doesn't change smoothly, replace the throttle position sensor.

NOTE
For the throttle position sensor adjustment procedure, refer to P.13C-96.

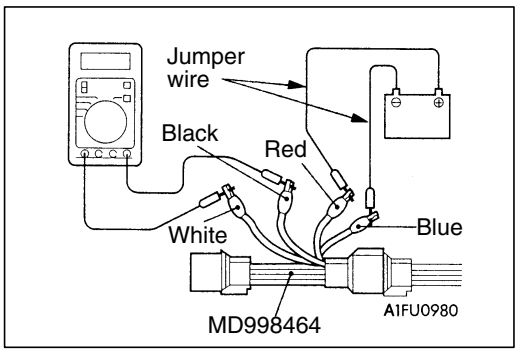


OXYGEN SENSOR CHECK <Oxygen sensor (front)>

1. Disconnect the oxygen sensor connector and connect the special tool (test harness) to the connector on the oxygen sensor side.
2. Make sure that there is continuity (4.8 – 8.0 Ω at 20°C) between terminal 1 (red clip of special tool) and terminal 3 (blue clip of special tool) on the oxygen sensor connector.



3. If there is no continuity, replace the oxygen sensor.
4. Warm up the engine until engine coolant is 80°C or higher.



5. Use the jumper wire to connect terminal 1 (red clip) of the oxygen sensor connector to the battery (+) terminal and terminal 3 (blue clip) to the battery (–) terminal.

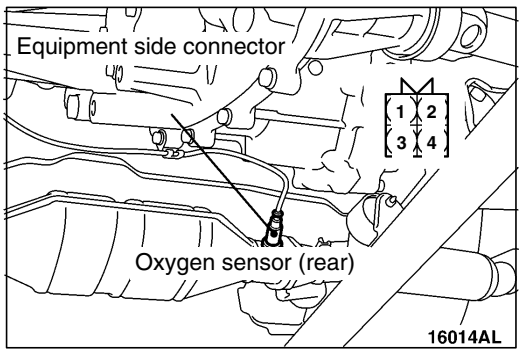
   Caution
   Be very careful when connecting the jumper wire; incorrect connection can damage the oxygen sensor.
6. Connect a digital voltage meter between terminal 2 (black clip) and terminal 4 (white clip).
7. While repeatedly racing the engine, measure the oxygen sensor output voltage.

   Standard value:

Engine	Oxygen sensor output voltage	Remarks
When racing the engine	0.6 – 1.0 V	If you make the air/fuel ratio rich by racing the engine repeatedly, a normal oxygen sensor will output a voltage of 0.6 – 1.0 V.

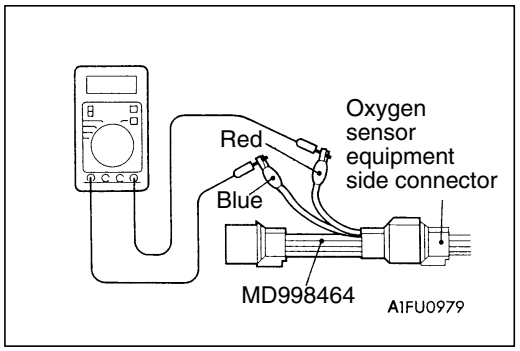
8. If the sensor is defective, replace the oxygen sensor.

   NOTE
   For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Pipe and Main Muffler.

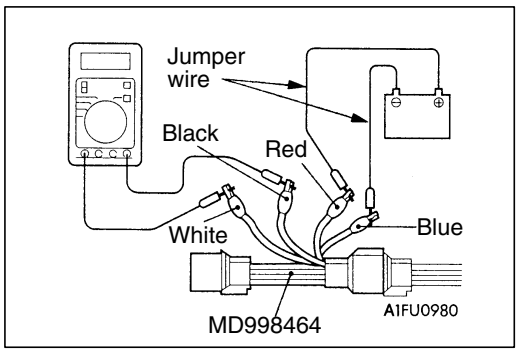


<Oxygen sensor (rear)>

1. Disconnect the oxygen sensor connector and connect the special tool (test harness) to the connector on the oxygen sensor side.
2. Make sure that there is continuity (11 – 18 Ω at 20°C) between terminal 1 (red clip of special tool) and terminal 3 (blue clip of special tool) on the oxygen sensor connector.



3. If there is no continuity, replace the oxygen sensor.
4. Warm up the engine until engine coolant is 80°C or higher.



5. Use the jumper wire to connect terminal 1 (red clip) of the oxygen sensor connector to the battery (+) terminal and terminal 3 (blue clip) to the battery (–) terminal.

   Caution
   Be very careful when connecting the jumper wire; incorrect connection can damage the oxygen sensor.

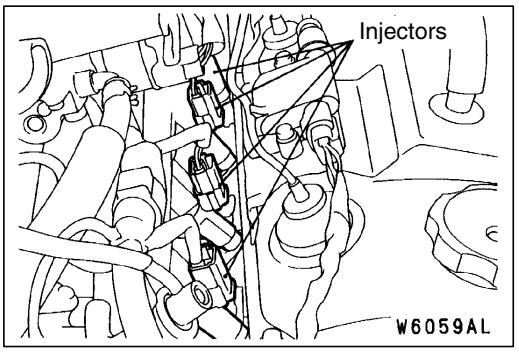
6. Connect a digital voltage meter between terminal 2 (black clip) and terminal 4 (white clip).
7. While repeatedly racing the engine, measure the oxygen sensor output voltage.

   Standard value:

Engine	Oxygen sensor output voltage	Remarks
When racing the engine	0.6 – 1.0 V	If you make the air/fuel ratio rich by racing the engine repeatedly, a normal oxygen sensor will output a voltage of 0.6 – 1.0 V.

8. If the sensor is defective, replace the oxygen sensor.

   NOTE
   For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Pipe and Main Muffler.



INJECTOR CHECK

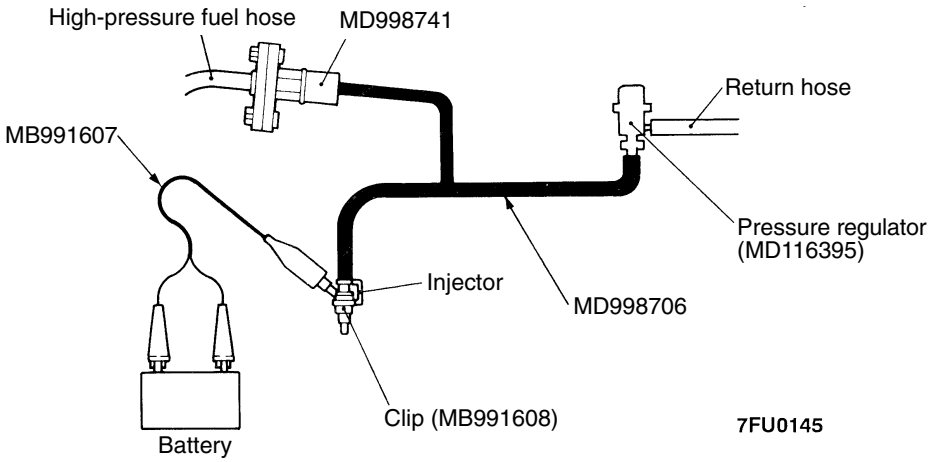
Measurement of Resistance between Terminals

1. Remove the injector connector.
2. Measure the resistance between terminals.

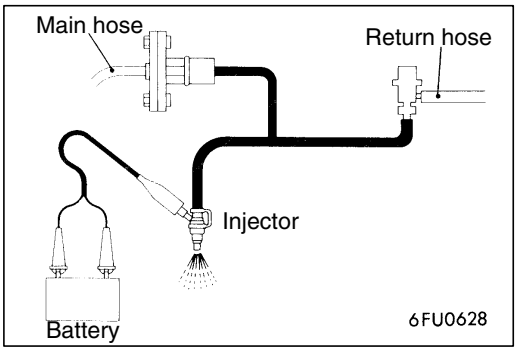
   Standard value: 13 – 16 Ω (at 20°C)
3. Install the injector connector.

Checking the Injection Condition

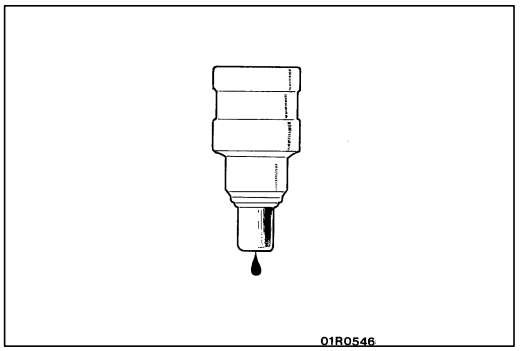
1. Following the steps below, bleed out the residual pressure within the fuel pipe line to prevent flow of the fuel. (Refer to P.13C-100.)
2. Remove the injector.
3. Arrange the special tool (injector test set), adaptor, fuel pressure regulator and clips as shown in the illustration below.



4. Connect the MUT-II to the diagnosis connector.
5. Turn the ignition switch to ON. (But do not start the engine.)
6. Select “Item No.7” from the MUT-II Actuator test to drive the fuel pump.



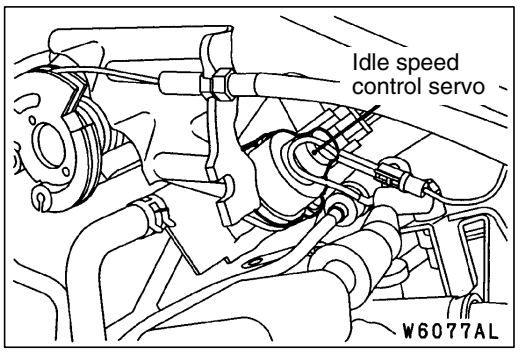
7. Activate the injector and check the atomized spray condition of the fuel.
   The condition can be considered satisfactory unless it is extremely poor.



8. Stop the actuation of the injector, and check for leakage from the injector's nozzle.

   Standard value: 1 drop or less per minute

9. Activate the injector without activating the fuel pump; then, when the spray emission of fuel from the injector stops, disconnect the special tool and restore it to its original condition.
10. Disconnect the MUT-II.



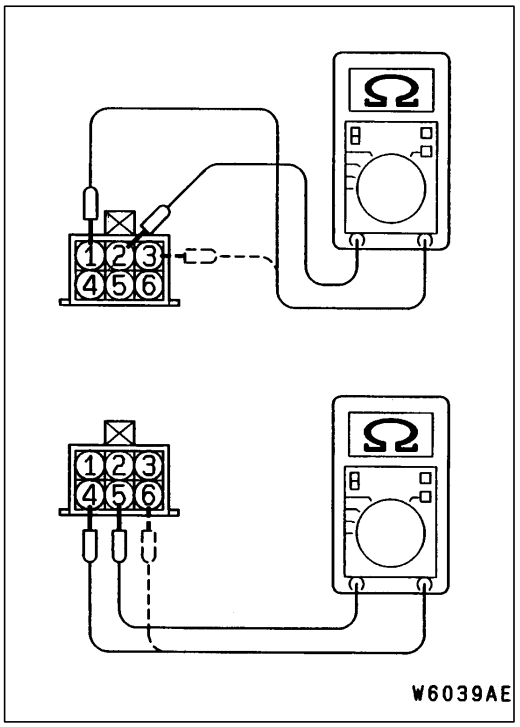
IDLE SPEED CONTROL (ISC) SERVO (STEPPER MOTOR) CHECK

Checking the Operation Sound

1. Check that the engine coolant temperature is 20°C or below.

   NOTE
   Disconnecting the engine coolant temperature sensor connector and connecting the harness-side of the connector to another engine coolant temperature sensor that is at 20°C or below is also okay.

2. Check that the operation sound of the stepper motor can be heard after the ignition is switched ON. (But do not start the engine.)
3. If the operation sound cannot be heard, check the stepper motor's activation circuit.
   If the circuit is normal, it is probable that there is a malfunction of the stepper motor or of the engine control unit.



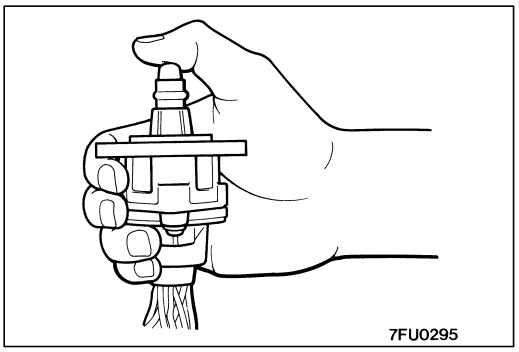
Checking the Coil Resistance

1. Disconnect the idle speed control servo connector.
2. Measure the resistance between terminal 2 and either terminal 1 or terminal 3 of the connector at the idle speed control servo side.

   Standard value: 27 – 33 Ω (at 20°C)

3. Measure the resistance between terminal 5 and either terminal 6 or terminal 4 of the connector at the idle speed control servo side.

   Standard value: 27 – 33 Ω (at 20°C)



Operation Check

1. Remove the throttle body.
2. Remove the stepper motor.
3. Connect the special tool (test harness: MB991709) to the idle speed control servo connector.
4. Connect the positive (+) terminal of a power supply (approx. 6 V) to the terminals 2 and 5.
5. With the idle speed control servo as shown in the illustration, connect the negative (–) terminal of the power supply to each clip as described in the following steps, and check whether or not a vibrating feeling (a feeling of very slight vibration of the stepper motor) is generated as a result of the activation of the stepper motor.
   (1) Connect the negative (–) terminal of the power supply to the red and black clip.
   (2) Connect the negative (–) terminal of the power supply to the blue and black clip.
   (3) Connect the negative (–) terminal of the power supply to the blue and yellow clip.
   (4) Connect the negative (–) terminal of the power supply to the red and yellow clip.
   (5) Connect the negative (–) terminal of the power supply to the red and black clip.
   (6) Repeat the tests in sequence from (5) to (1).
6. If, as a result of these tests, vibration is detected, the stepper motor can be considered to be normal.

PURGE CONTROL SOLENOID VALVE CHECK <Vehicles with catalytic converter>

Refer to GROUP 17 – Emission Control System.

EGR CONTROL SOLENOID VALVE CHECK

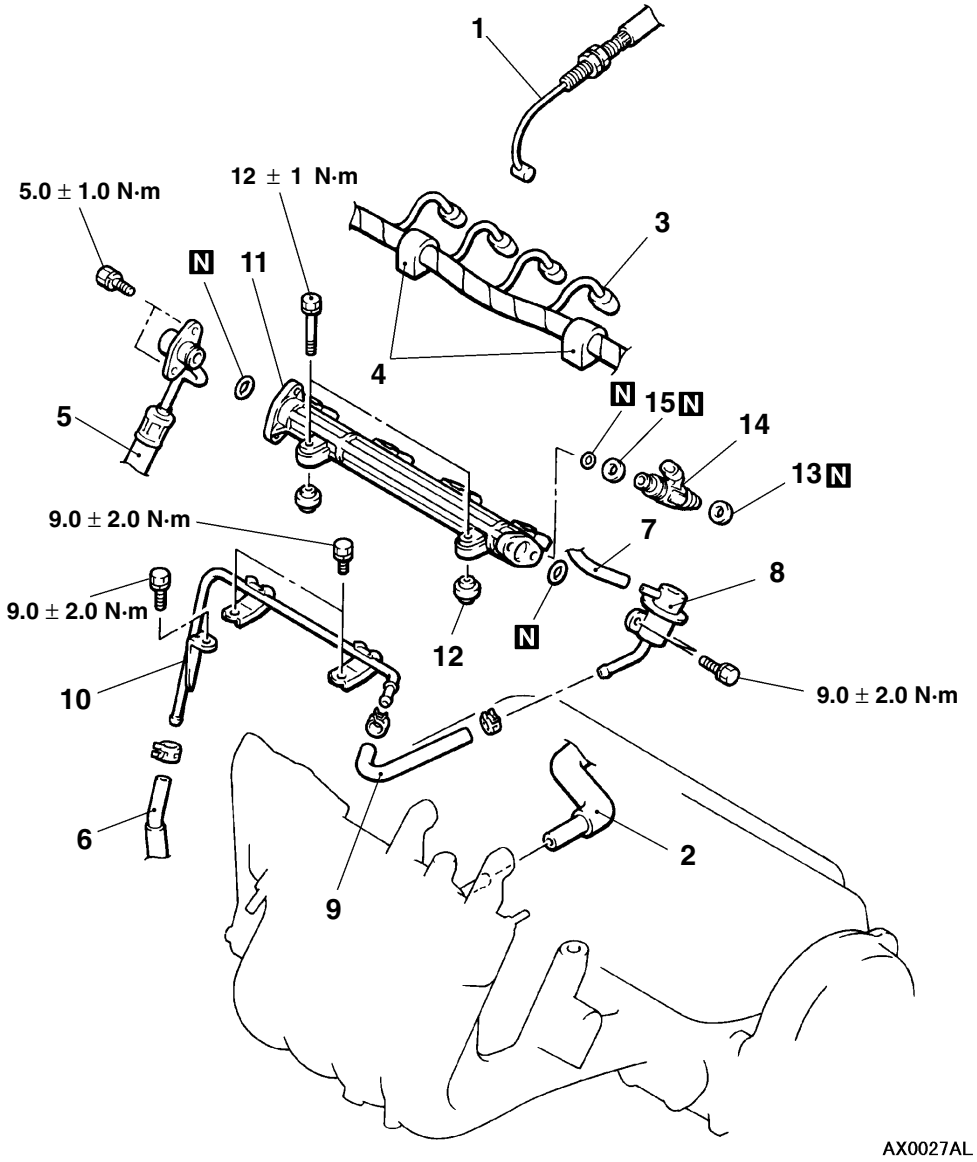
Refer to GROUP 17 – Emission Control System.

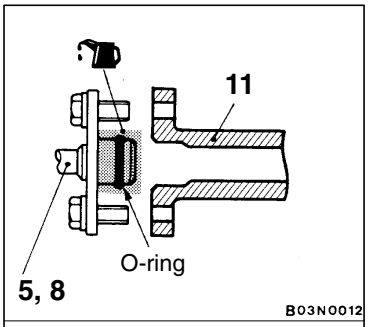
INJECTOR

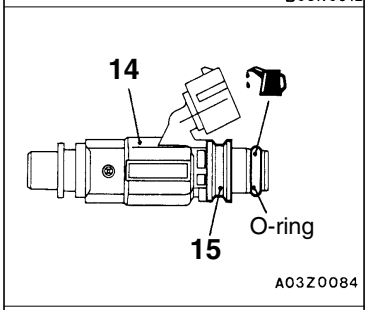
REMOVAL AND INSTALLATION

Pre-removal Operation
- Fuel Discharge Prevention (Refer to P.13C-100)
- Air Cleaner and Air Intake Pipe Removal (Refer to GROUP 15.)

Post-installation Operation
- Air Cleaner and Air Intake Pipe Installation (Refer to GROUP 15.)
- Accelerator Cable Adjustment (Refer to GROUP 17 – On-vehicle Service.)







Engine oil

Removal steps

1. Accelerator cable connection
2. PCV hose
3. Injector connector
4. Injector harness clamp
▶A◀ 5. High-pressure fuel hose connection
6. Fuel return hose connection
7. Vacuum hose connection
▶A◀ 8. Fuel pressure regulator
9. Fuel hose
10. Fuel return pipe
◀A▶ 11. Delivery pipe
12. Insulator
13. Insulator
◀A▶ ▶A◀ 14. Injector
15. Grommet

REMOVAL SERVICE POINT

◀A▶ DELIVERY PIPE/INJECTOR REMOVAL

Remove the delivery pipe (with the injectors attached to it).

Caution
Care must be taken, when removing the delivery pipe, not to drop the injector.

INSTALLATION SERVICE POINT

▶A◀ INJECTOR/FUEL PRESSURE REGULATOR/ HIGH-PRESSURE FUEL HOSE INSTALLATION

1. Apply a drop of new engine oil to the O-ring.

   Caution
   Be sure not to let engine oil in the delivery pipe.

2. While turning the injector, high-pressure fuel hose and fuel pressure regulator to the right and left, install the delivery pipe, while being careful not to damage the O-ring. After installing, check that the hose turns smoothly.
3. If it does not turn smoothly, the O-ring may be trapped, remove the injector, high-pressure fuel hose or fuel pressure regulator and then re-insert it into the delivery pipe and check once again.
4. Tighten the high-pressure fuel hose and fuel pressure regulator to the specified torque.

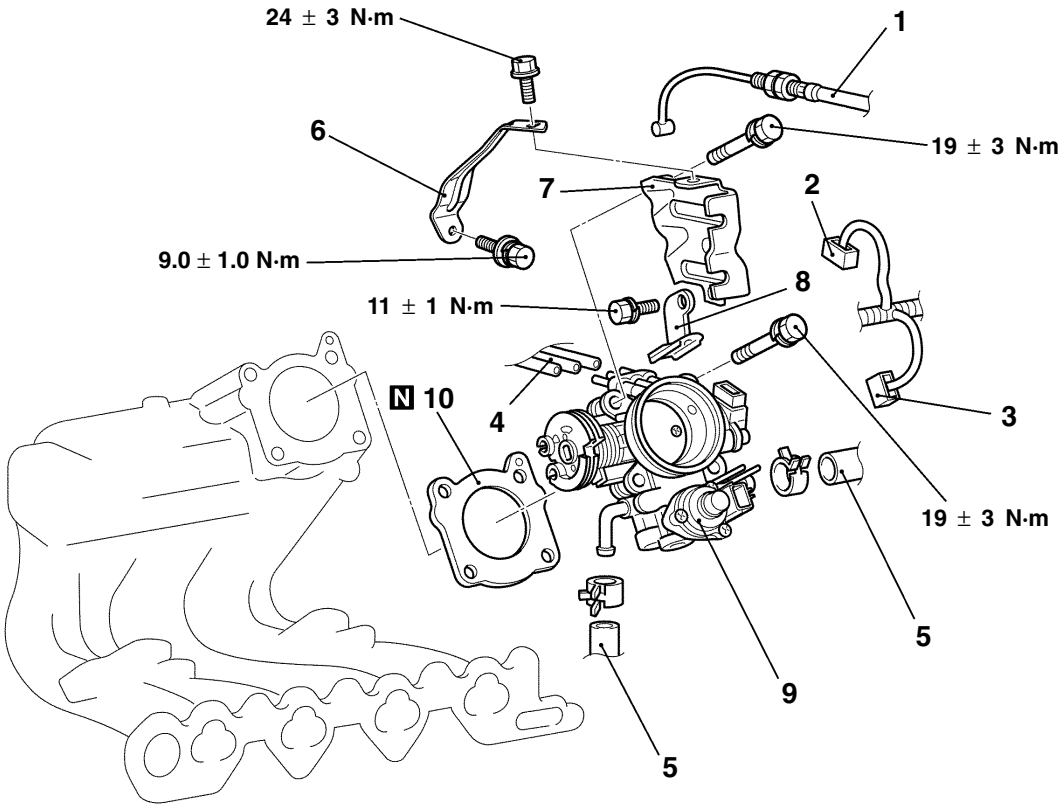
   Tightening torque:
   9.0 ± 2.0 N·m (Fuel pressure regulator)
   5.0 ± 1.0 N·m (High-pressure fuel hose)

THROTTLE BODY

REMOVAL AND INSTALLATION

Pre-removal Operation
- Engine Coolant Draining (Refer to GROUP 14 – On-vehicle Service.)
- Air Cleaner and Air Intake Pipe Removal (Refer to GROUP 15.)

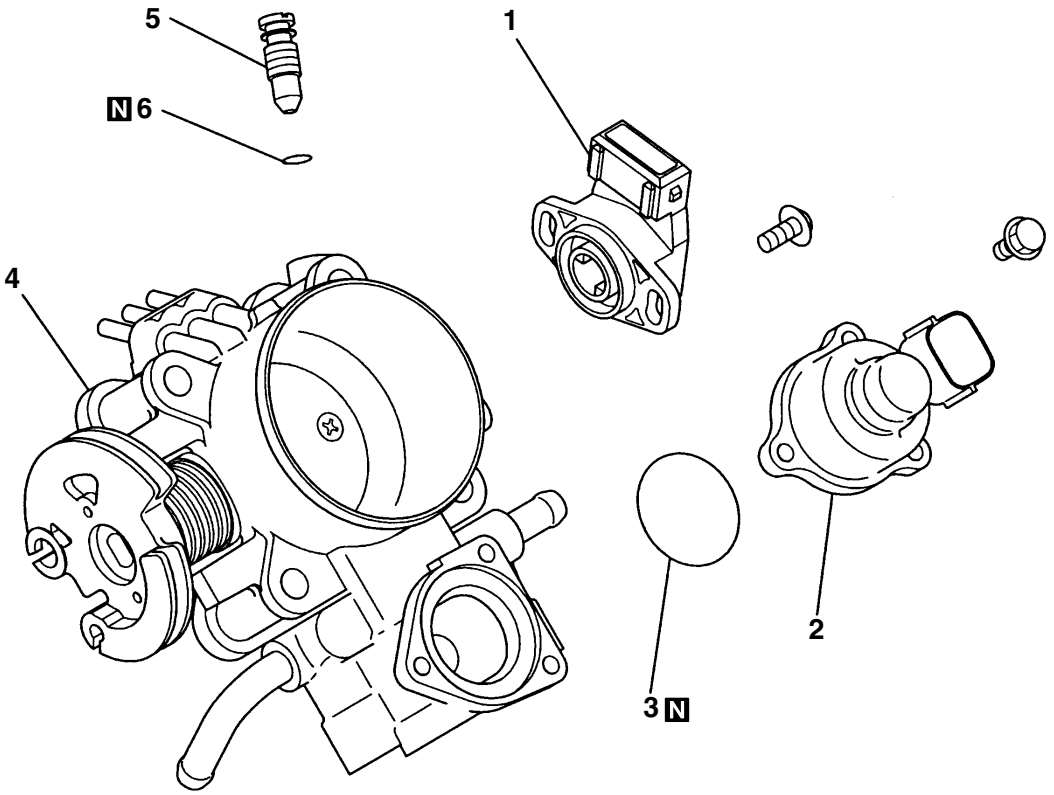
Post-installation Operation
- Air Cleaner and Air Intake Pipe Installation (Refer to GROUP 15.)
- Engine Coolant Supplying (Refer to GROUP 14 – On-vehicle Service.)
- Accelerator Cable Adjustment (Refer to GROUP 17 – On-vehicle Service.)



Removal steps

1. Accelerator cable connection
2. Throttle position sensor connector
3. Idle speed control servo connector
4. Vacuum hose connection
5. Water hose connection
6. Stay
7. Throttle cable bracket
8. Harness Clamp
9. Throttle body
10. Throttle body gasket

DISASSEMBLY AND REASSEMBLY



Disassembly steps

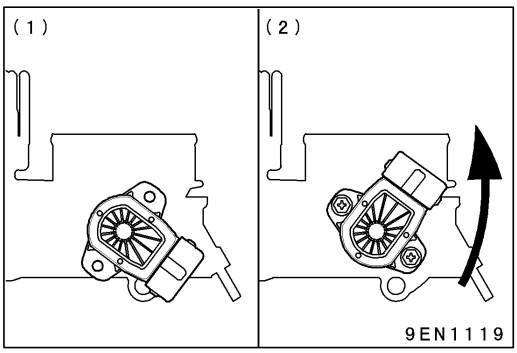
▶A◀ 1. Throttle position sensor
2. Idle speed control body assembly
3. O-ring
4. Throttle body
5. Speed adjusting screw
6. O-ring

NOTE
1. The speed adjusting screw is correctly adjusted at the factory and should not be removed.
2. If the speed adjusting screw has been removed, carry out fixed SAS adjustment.
3. If the speed adjusting screw should happen to have been removed, carry out speed adjusting screw adjustment.

CLEANING THROTTLE BODY PARTS

1. Clean all throttle body parts.
   Do not use solvent to clean the following parts:
   - Throttle position sensor
   - Accelerator pedal position sensor
   - Idle speed control body assembly

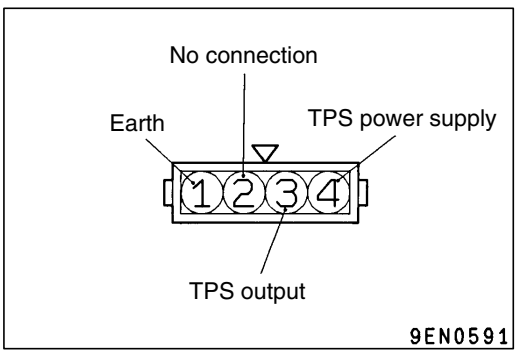
   If these parts are immersed in solvent, their insulation will deteriorate.
   Wipe them with cloth only.
2. Check if the vacuum port or passage is clogged. Use compressed air to clean the vacuum passage.



REASSEMBLY SERVICE POINT

▶A◀ THROTTLE POSITION SENSOR (TPS) INSTALLATION

1. Install the TPS to the throttle body as shown by (1) in the illustration.
2. Turn the TPS so that it is at the position shown by (2) in the illustration, and then tighten the screw.



3. Connect a multimeter between terminal (4) (TPS power supply) and terminal (3) (TPS output) of the TPS connector, and check that the resistance increases gradually as the throttle valve is opened slowly to the fully-open position.
4. If there is an abnormality, replace the TPS.

NOTES

ENGINE COOLING

ENGINE COOLING

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SERVICE SPECIFICATIONS 2

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THERMOSTAT 12

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WATER HOSE AND WATER PIPE 15

RADIATOR 18

GENERAL INFORMATION

The cooling system is designed to keep every part of the engine at appropriate temperature in whatever condition the engine may be operated.
The cooling method is of the water-cooled, pressure forced circulation type in which the water pump pressurizes coolant and circulates it throughout the engine. If the coolant temperature exceeds the prescribed temperature, the thermostat opens to circulate the coolant through the radiator as well so that the heat absorbed by the coolant may be radiated into the air.

The water pump is of the centrifugal type and is driven by the timing belt from the crankshaft.
The radiator is the corrugated fin, down flow type and is cooled by the electrical radiator fan.
The cooling fans are controlled by a fan controller and the engine-ECU depending on driving conditions.

Items			Specifications
Radiator	Performance kJ/h	M/T	152,791
		A/T	169,535
A/T oil cooler	Performance kJ/h		5,652

NOTE
*: Vehicles with optional radiator

SERVICE SPECIFICATIONS

Items		Standard value	Limit
Radiator cap opening pressure kPa		74 – 103	64
Range of coolant antifreeze concentration of radiator %		30 – 60	–
Thermostat	Valve opening temperature of thermostat °C	82 ± 1.5	–
	Full-opening temperature of thermostat °C	95	–
	Valve lift (at 95°C) mm	8.5 or more	–

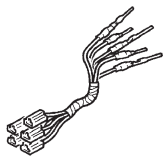
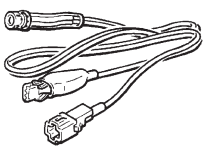
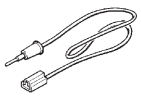
LUBRICANT

Items	Quantity ℓ
MITSUBISHI GENUINE COOLANT or equivalent	6

SEALANTS

Items	Specified sealant	Remarks
Cylinder block drain plug	3M Nut Locking Part No. 4171 or equivalent	Drying sealant
Water pump	Mitsubishi Genuine Parts No. MD970389 or equivalent	Semi-drying sealant
Water fitting		
Water outlet fitting		
Water by-pass fitting		

SPECIAL TOOL

Tool	Number	Name	Use
A  B  C  D  C991223	MB991223 A: MB991219 B: MB991220 C: MB991221 D: MB991222	Harness set A: Test harness B: LED harness C: LED harness adapter D: probe	Measurement of terminal voltage A: Connector pin contact pressure inspection B: Power circuit inspection C: Power circuit inspection D: Commercial tester connection

TROUBLESHOOTING

INSPECTION CHART FOR TROUBLE SYMPTOMS

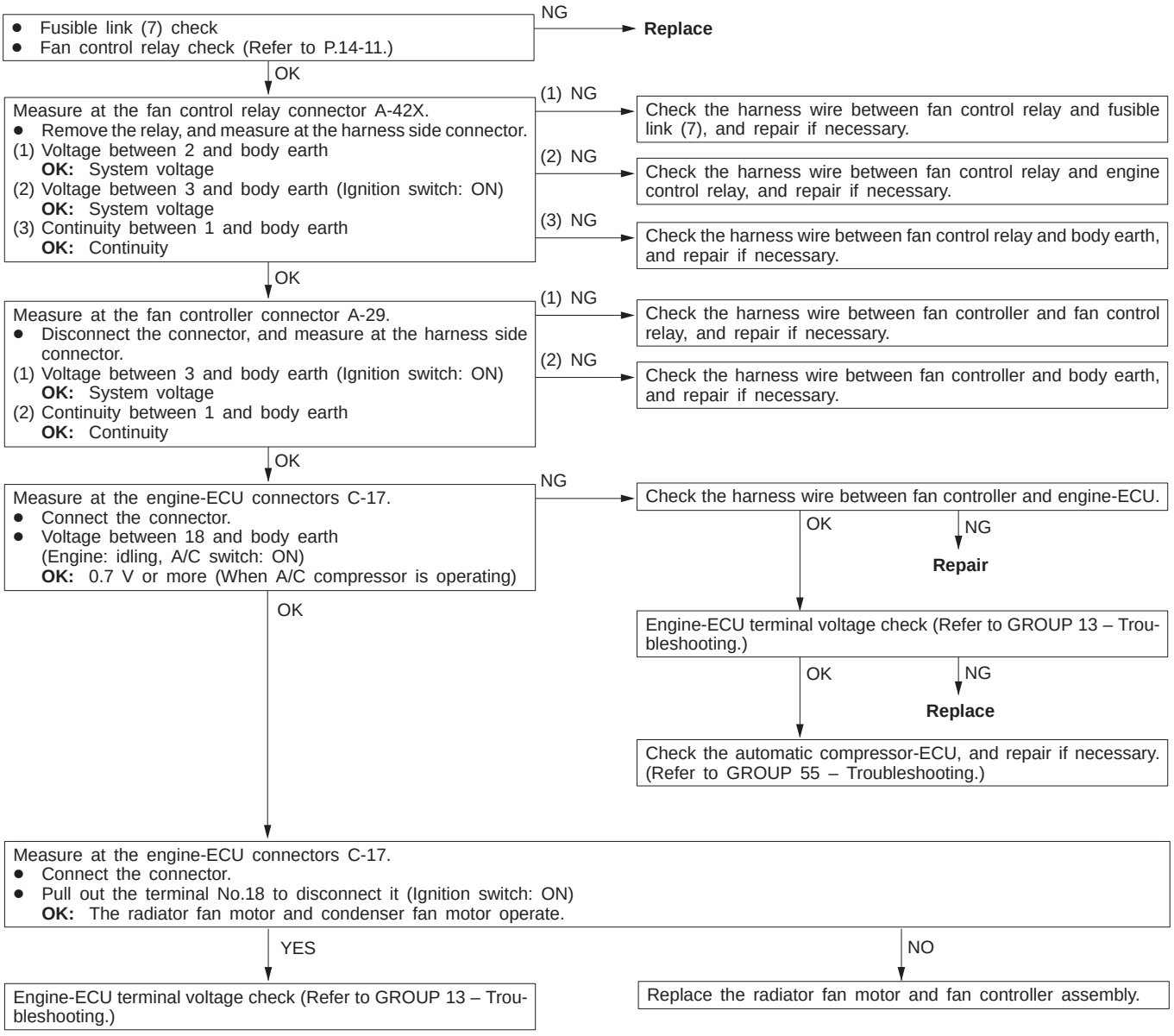
Trouble symptoms	Inspection procedure No.	Reference page
Radiator fan and condenser fan do not operate. <Vehicles with A/C> Radiator fan does not operate. <Vehicles without A/C>	1	14-4
Radiator fan and condenser fan do not change speed or stop. <Vehicles with A/C> Radiator fan does not change speed or stop. <Vehicles without A/C>	2	14-6
Radiator fan does not operate. <Vehicles with A/C>	3	14-7
Condenser fan does not operate. <Vehicles with A/C>	4	14-7

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

Inspection Procedure 1

Radiator fan and condenser fan do not operate. <Vehicles with A/C> Radiator fan does not operate. <Vehicles without A/C>	Probable cause
The cause could be a malfunction of the fan controller power supply or earth circuit. The cause could also be a malfunction of the fan controller or the engine-ECU.	● Malfunction of fusible link ● Malfunction of fan control relay ● Malfunction of fan controller ● Malfunction of engine-ECU ● Malfunction of wiring harness or connector

<Vehicles with A/C>



<Vehicles without A/C>

- Fusible link (7) check
- Fan control relay check (Refer to P.14-11.)

NG → **Replace**

OK ↓

Measure at the fan control relay connector A-42X.
- Remove the relay, and measure at the harness side connector.

(1) Voltage between 2 and body earth
OK: System voltage
(2) Voltage between 3 and body earth (Ignition switch: ON)
OK: System voltage
(3) Continuity between 1 and body earth
OK: Continuity

(1) NG → Check the harness wire between fan control relay and fusible link (7), and repair if necessary.
(2) NG → Check the harness wire between fan control relay and engine control relay, and repair if necessary.
(3) NG → Check the harness wire between fan control relay and body earth, and repair if necessary.

OK ↓

Measure at the fan controller connector A-29.
- Disconnect the connector, and measure at the harness side connector.

(1) Voltage between 3 and body earth (Ignition switch: ON)
OK: System voltage
(2) Continuity between 1 and body earth
OK: Continuity

(1) NG → Check the harness wire between fan controller and fan control relay, and repair if necessary.
(2) NG → Check the harness wire between fan controller and body earth, and repair if necessary.

OK ↓

Measure at the engine-ECU connectors C-17.
- Connect the connector.
- Voltage between 18 and body earth (Engine: idling)
OK: 0.7 V or more (When radiator fan is operating)

NG → Check the harness wire between fan controller and engine-ECU.
OK → Engine-ECU terminal voltage check (Refer to GROUP 13 – Troubleshooting.)
NG → **Repair**

OK ↓

Measure at the engine-ECU connectors C-17.
- Connect the connector.
- Pull out the terminal No.18 to disconnect it (Ignition switch: ON).
OK: The radiator fan motor operates.

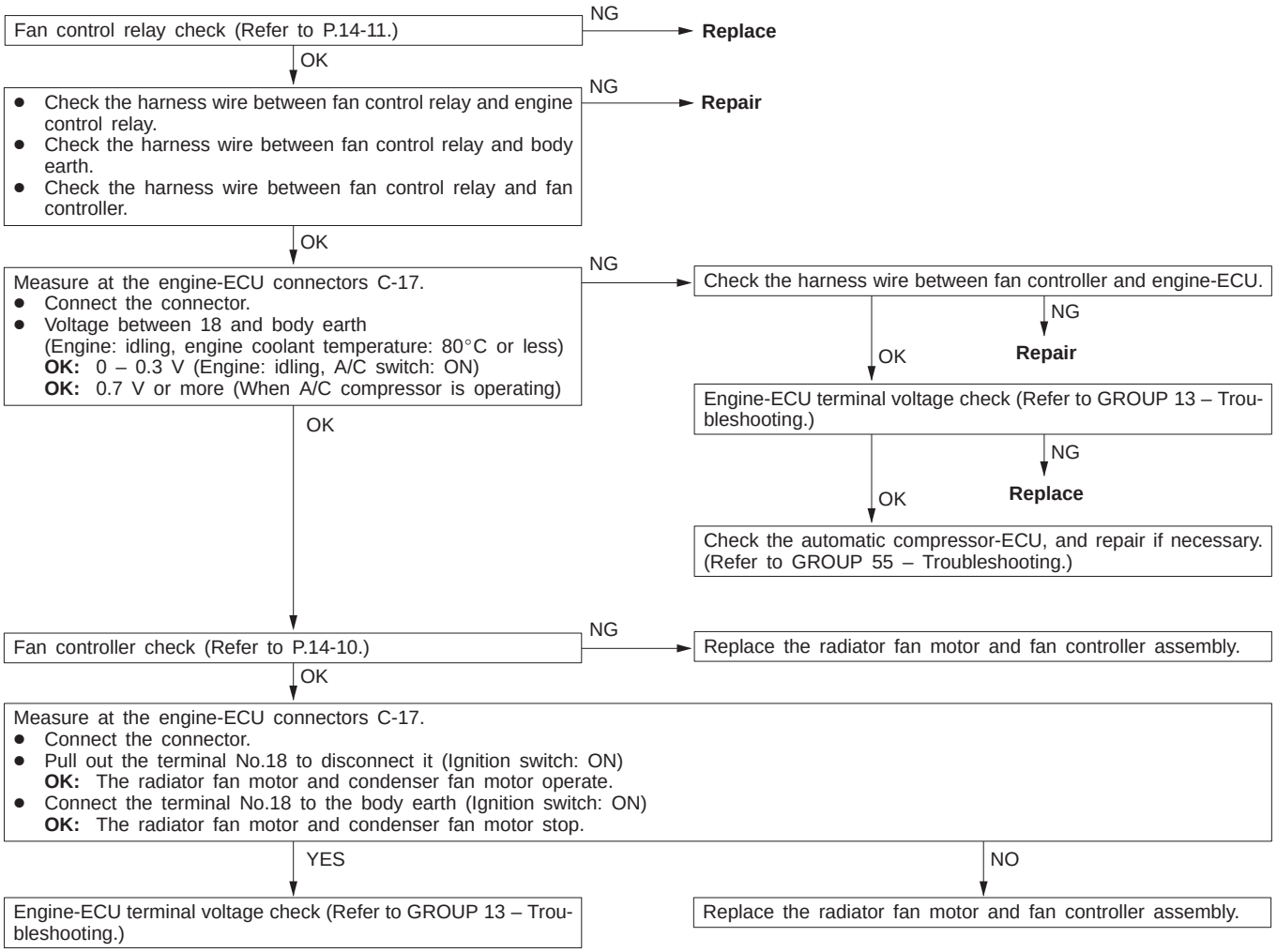
YES ↓ Engine-ECU terminal voltage check (Refer to GROUP 13 – Troubleshooting.)

NO ↓ Replace the radiator fan motor and fan controller assembly.

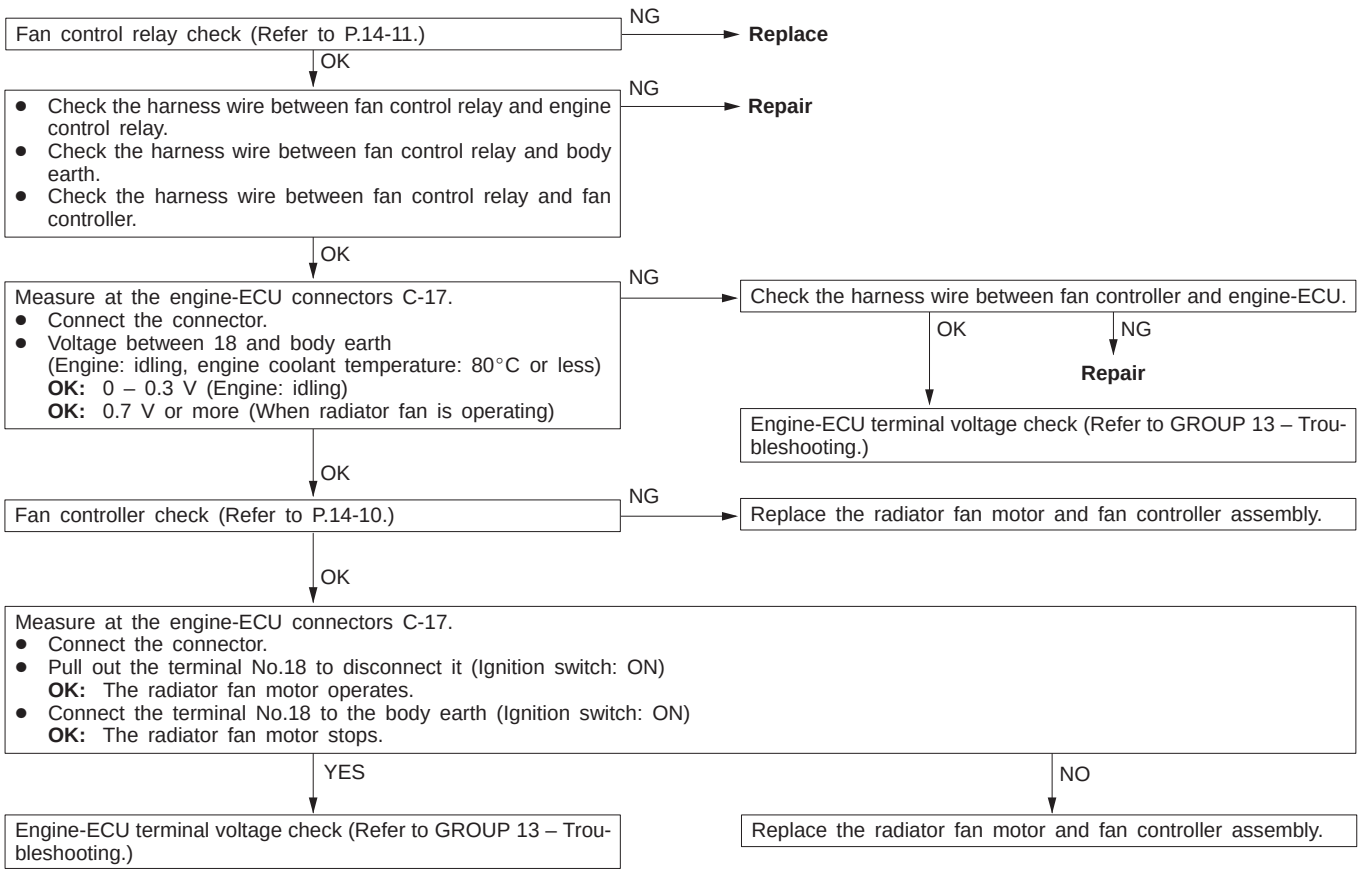
Inspection Procedure 2

Radiator fan and condenser fan do not change speed or stop. <Vehicles with A/C> Radiator fan does not change speed or stop. <Vehicles without A/C>	Probable cause
The fan controller carries out step-free control of the radiator fan motor and the condenser fan motor speeds using signals transmitted from the engine-ECU.	● Malfunction of fan control relay ● Malfunction of fan controller ● Malfunction of engine-ECU ● Malfunction of wiring harness or connector

<Vehicles with A/C>



<Vehicles without A/C>



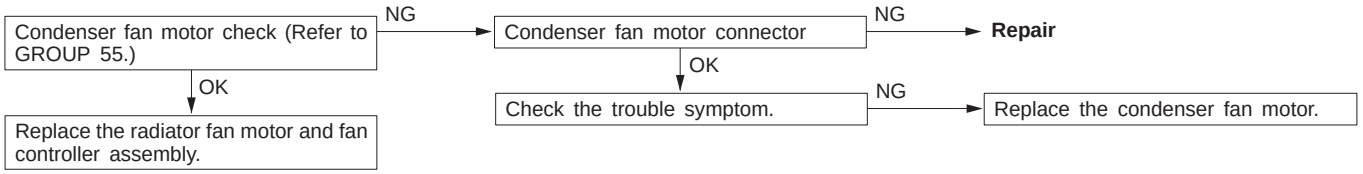
Inspection Procedure 3

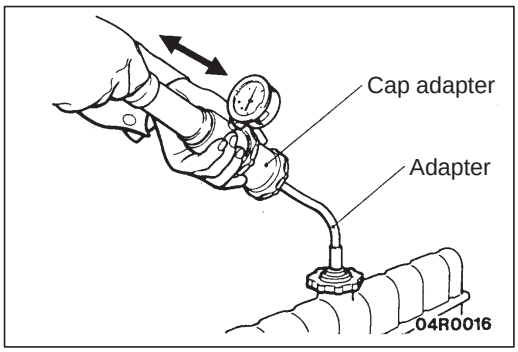
Radiator fan does not operate. <Vehicles with A/C>	Probable cause
The cause could be a malfunction of the radiator fan motor or an open circuit between the fan controller and the radiator fan motor.	• Malfunction of radiator fan motor • Open circuit between fan controller and radiator fan motor

Replace the radiator fan motor and fan controller assembly.

Inspection Procedure 4

Condenser fan does not operate. <Vehicles with A/C>	Probable cause
The cause could be a malfunction of the condenser fan motor or of the fan controller.	• Malfunction of condenser fan motor • Malfunction of fan controller • Malfunction of wiring harness or connector





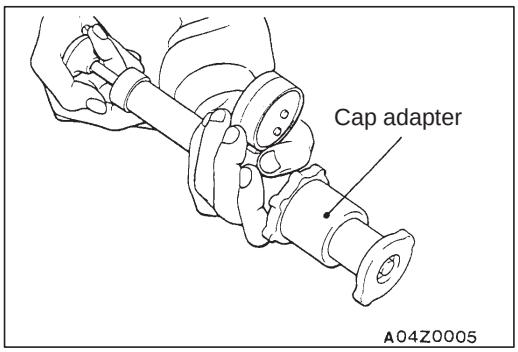
ON-VEHICLE SERVICE

ENGINE COOLANT LEAK CHECKING

1. Confirm that the coolant level is up to the filler neck. Install a radiator cap tester, adapter and cap adapter to the filler neck, and apply 160 kPa pressure, and then check for leakage from the radiator hose or connections.

   Caution
   (1) Be sure to completely clean away any moisture from the places checked.
   (2) When the tester is taken out, be careful not to spill any coolant from it.
   (3) Be careful, when installing and removing the tester and when testing, not to deform the radiator filler neck.

2. If there is leakage, repair or replace the appropriate part.



RADIATOR CAP VALVE OPENING PRESSURE CHECK

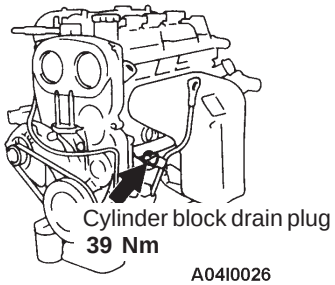
1. Use a cap adapter to attach the cap to the radiator cap tester.
2. Increase the pressure until the indicator of the gauge stops moving.

   Standard value: 75 – 105 kPa

   Limit: 65 kPa

3. Replace the radiator cap if the reading does not remain at or above the limit.

   NOTE
   Be sure that the cap is clean before testing, since rust or other foreign material on the cap seal will cause an improper indication.



ENGINE COOLANT REPLACEMENT

1. Drain the engine coolant by removing the drain plug and then the radiator cap.
2. Remove the drain plug from the cylinder block to drain the engine coolant.
3. Remove the reserve tank to drain the engine coolant.
4. When the engine coolant has drained, pour in water from the radiator cap to clean the engine coolant line.
5. Coat the thread of the cylinder block drain plug with the specified sealant and tighten to the specified torque.

   Specified sealant:

   3M Nut Locking Part No. 4171 or equivalent

6. Securely tighten the radiator drain plug.
7. Install the reserve tank.
8. Slowly pour the engine coolant into the mouth of the radiator until the radiator is full, and pour also into the reserve tank up to the FULL line.

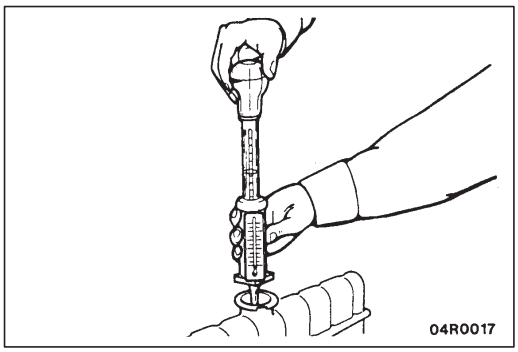
   Recommended antifreeze:

   MITSUBISHI GENUINE COOLANT or equivalent

   Quantity: 6 ℓ

   Caution
   Do not use alcohol or methanol anti-freeze or any engine coolants mixed with alcohol or methanol anti-freeze. The use of an improper anti-freeze can cause the corrosion of the aluminium components.

9. Install the radiator cap securely.
10. Start the engine and warm the engine until the thermostat opens. (Touch the radiator hose with your hand to check that warm water is flowing.)
11. After the thermostat opens, race the engine several times, and then stop the engine.
12. Cool down the engine, and then pour engine coolant into the reserve tank until the level reaches the FULL line. If the level is low, repeat the operation from step 11.



CONCENTRATION MEASUREMENT

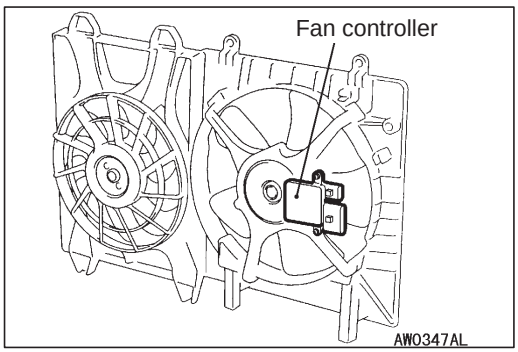
Measure the temperature and specific gravity of the engine coolant to check the antifreeze concentration.

Standard value: 30–60% (allowable concentration range)

RECOMMENDED ANTIFREEZE

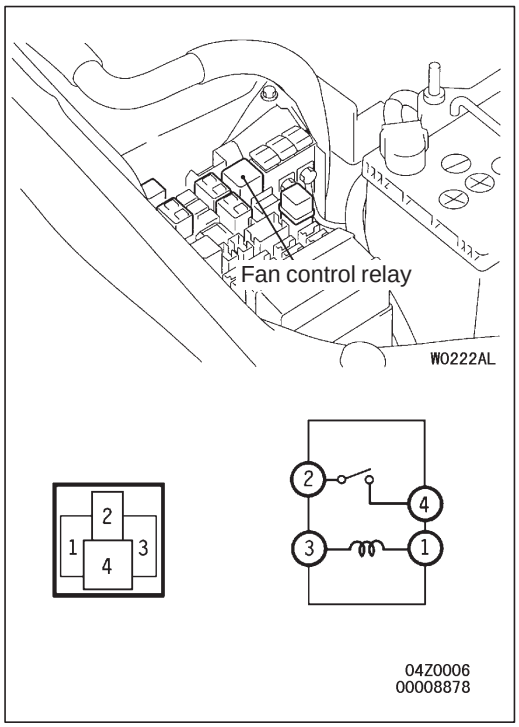
Antifreeze	Allowable concentration
MITSUBISHI GENUINE COOLANT or equivalent	30–60%

Caution
If the concentration of the antifreeze is below 30 %, the anti-corrosion property will be adversely affected. In addition, if the concentration is above 60 %, both the anti-freezing and engine cooling properties will decrease, affecting the engine adversely. For these reasons, be sure to maintain the concentration level within the specified range.



FAN CONTROLLER CHECK

1. Disconnect the condenser fan motor connector.
2. Start the engine and run it at idle.
3. Turn the A/C switch to ON and maintain the coolant temperature at 80°C or less.
4. When measuring the voltage between the fan controller-side connector terminals, check that the value changes repeatedly as indicated by (1) – (3) below.
   (1) 0 V
   (2) 8.2 ± 2.6 V
   (3) Battery voltage ± 2.6 V
5. If the voltage does not repeatedly change as indicated, replace the radiator fan motor and the fan controller assembly.



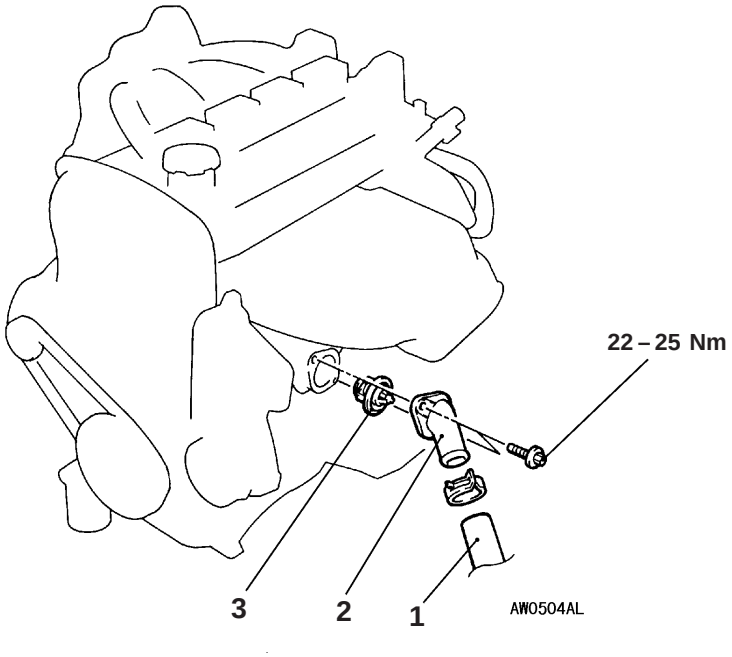
FAN CONTROL RELAY CONTINUITY CHECK

Battery voltage	Terminal No.			
	1	2	3	4
When current is not supplied	○		○	
When current is supplied	⊖	○	⊕	○

THERMOSTAT

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying (Refer to P.14-9.)
- Engine Cover and Under Cover Removal and Installation
- Air Cleaner Removal and Installation (Refer to GROUP 15.)



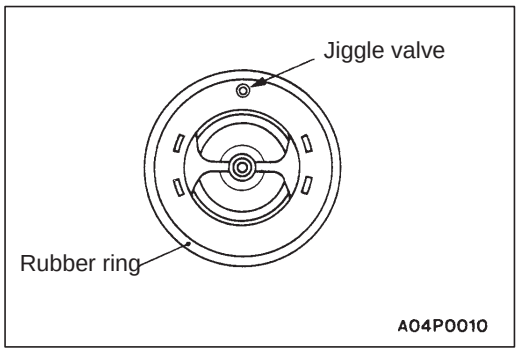
Removal steps

◀A▶ ▶B◀ 1. Radiator lower or upper hose connection
2. Water inlet or outlet fitting
▶A◀ 3. Thermostat

REMOVAL SERVICE POINT

◀A▶ RADIATOR LOWER OR UPPER HOSE DISCONNECTION

After making mating marks on the radiator hose and the hose clamp, disconnect the radiator hose.



INSTALLATION SERVICE POINTS

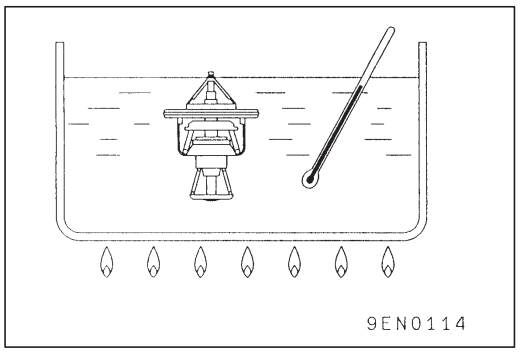
▶A◀ THERMOSTAT INSTALLATION

Install the thermostat so that the jiggle valve is facing straight up.

Caution
Make absolutely sure that no oil is adhering to the rubber ring of the thermostat. In addition, be careful not to fold over or scratch the rubber ring when inserting. If the rubber ring is damaged, replace the thermostat.

▶B◀ RADIATOR LOWER OR UPPER HOSE CONNECTION

1. Insert each hose as far as the projection of the water inlet fitting.
2. Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.

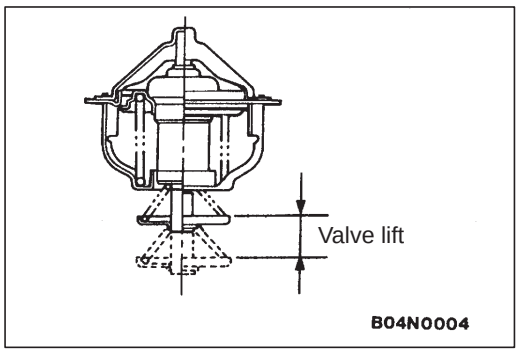


INSPECTION

THERMOSTAT CHECK

1. Immerse the thermostat in water, and heat the water while stirring. Check the thermostat valve opening temperature.

   Standard value:
   Valve opening temperature: 82 ± 1.5°C



2. Check that the amount of valve lift is at the standard value when the water is at the full-opening temperature.

   Standard value:

   Full-opening temperature: 95°C

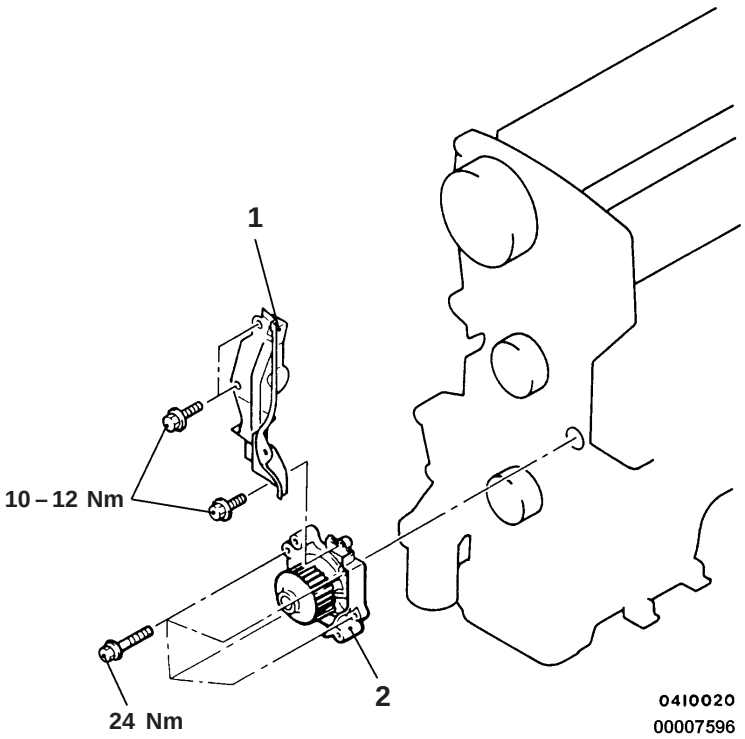
   Amount of valve lift: 8.5 mm or more

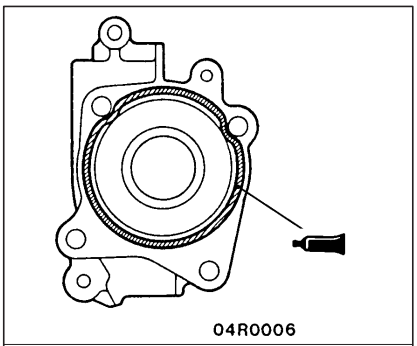
   NOTE
   Measure the valve height when the thermostat is fully closed, and use this measurement to calculate the valve height when the thermostat is fully open.

WATER PUMP

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying (Refer to P.14-9.)
- Timing Belt Removal and Installation (Refer to GROUP 11.)
- Idler Pulley Removal and Installation (Refer to GROUP 11A.)





Sealant:
Mitsubishi Genuine Part No. MD970389 or equivalent

Removal steps
1. Timing belt rear cover
▶A◀ 2. Water pump

INSTALLATION SERVICE POINT

▶A◀ WATER PUMP INSTALLATION

Squeeze out the sealant from the tube evenly and apply it so that there is not too much sealant and no places without sealant.

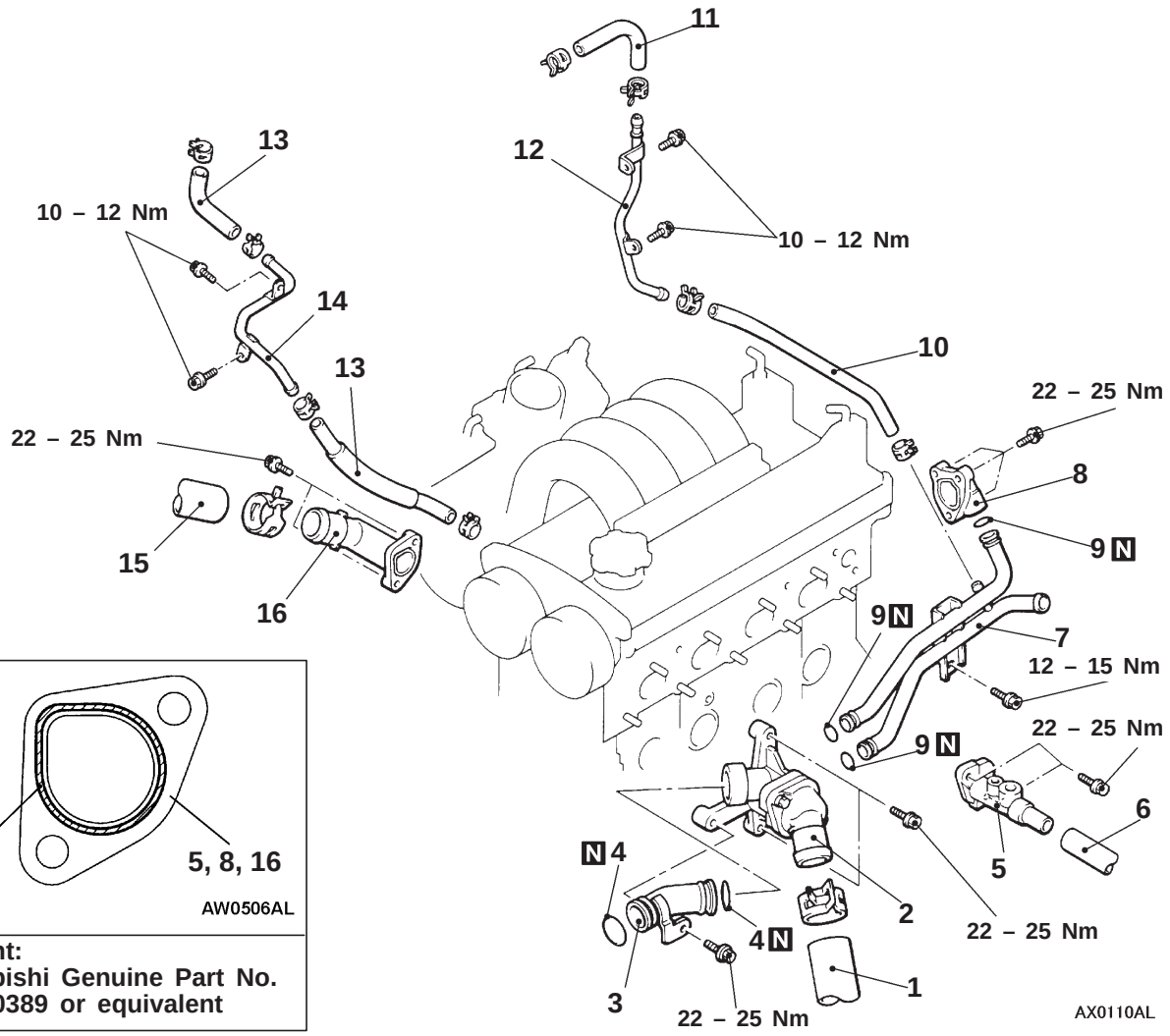
Specified Sealant:

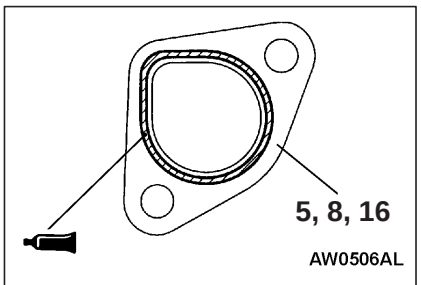
Mitsubishi Genuine Parts No. MD970389 or equivalent

WATER HOSE AND WATER PIPE

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Suppling (Refer to P.14-9.)
- Engine Cover Removal and Installation
- Air Cleaner Removal and Installation (Refer to GROUP 15.)
- Exhaust Manifold Removal and Installation (Refer to GROUP 15.)





Sealant:
Mitsubishi Genuine Part No. MD970389 or equivalent

Removal steps

◀A▶ ▶B◀ 1. Radiator lower hose connection
2. Thermostat case assembly
3. Water pipe
▶C◀ 4. O-ring
5. Water fitting
6. Heater hose connection
7. Water pipe assembly
▶A◀ 8. Water by-pass fitting
▶C◀ 9. O-ring
- EGR valve (Refer to GROUP 17.)

10. Water hose
11. Water hose
12. Water pipe
13. Water hose
14. Water pipe
▶B◀ 15. Radiator upper hose connection
▶A◀ 16. Water outlet fitting

REMOVAL SERVICE POINT

◀A▶ RADIATOR UPPER HOSE/RADIATOR LOWER HOSE DISCONNECTION

After making mating marks on the radiator hose and the hose clamp, disconnect the radiator hose.

INSTALLATION SERVICE POINTS

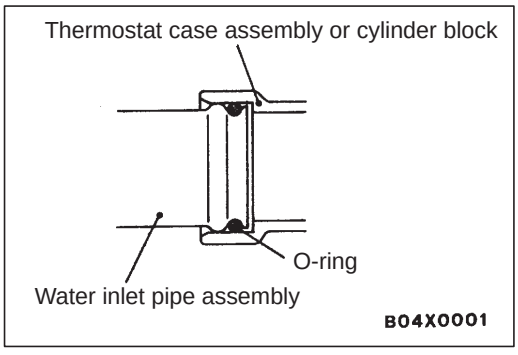
▶A◀ WATER OUTLET FITTING/WATER BY-PASS FITTING/WATER FITTING INSTALLATION

1. Use a gasket scraper or wire brush to eliminate completely foreign materials adhered to the gasket surface.
2. Apply the specified sealant continuously.

   Specified sealant:
   Mitsubishi Genuine Parts No. MD970389 or equivalent
3. Install the water fitting, water bypass fitting and the water outlet fitting while the sealant is wet (within 15 minutes after applying the sealant). Do not apply sealant to the positions other than the required.

▶B◀ RADIATOR UPPER HOSE/RADIATOR LOWER HOSE CONNECTION

1. Insert each hose as far as the projection of the water inlet fitting.
2. Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.



▶C◀ O-RING INSTALLATION

Insert the O-ring to the water inlet pipe assembly, and coat the outer circumference of the O-ring with water or engine coolant.

Caution
Do not allow engine oil or other greases to adhere to the O-ring

INSPECTION

WATER PIPE AND HOSE CHECK

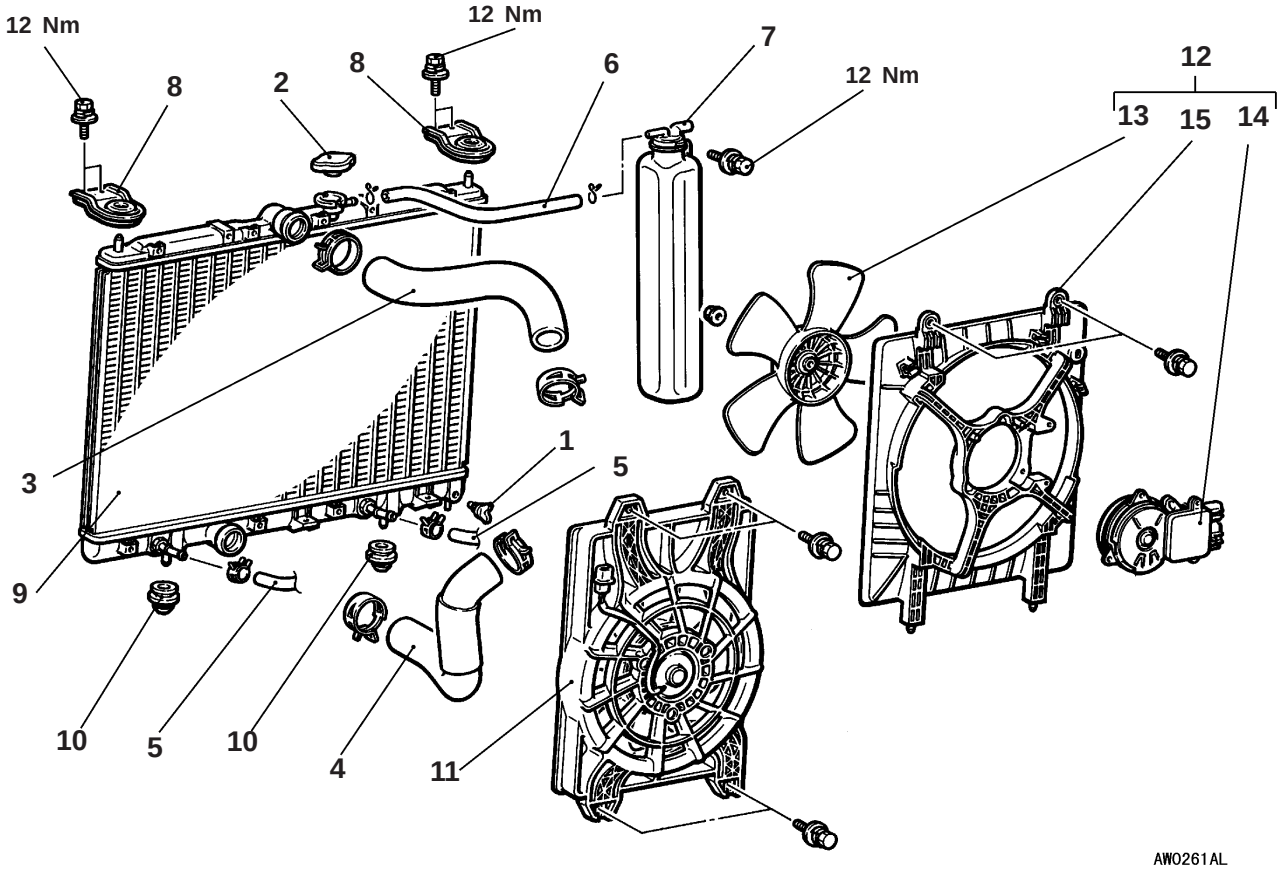
Check the water pipe and hose for cracks, damage, clog and replace them if necessary.

RADIATOR

REMOVAL AND INSTALLATION

Pre-removal Operations
- Engine Coolant Draining (Refer to P.14-9.)
- Engine Cover and Under Cover Removal
- Air Cleaner Removal (Refer to GROUP 15.)

Post-installation Operations
- Air Cleaner Installation (Refer to GROUP 15.)
- Engine cover and Under Cover Installation
- Engine Coolant Supplying (Refer to P.14-9.)
- A/T Fluid Supplying (Refer to GROUP 23 – On-vehicle Service.)



Radiator removal steps

1. Drain plug
2. Radiator cap
◀A▶ ▶A◀ 3. Radiator upper hose
◀A▶ ▶A◀ 4. Radiator lower hose
◀B▶ 5. A/T oil cooler hose connection
6. Rubber hose
7. Condense tank
8. Upper insulator
9. Radiator assembly
10. Lower insulator
11. Condenser fan motor assembly
12. Radiator fan motor assembly

Radiator fan motor, fan controller assembly removal steps

12. Radiator fan motor assembly
13. Fan
14. Radiator fan motor and fan controller assembly
15. Shroud

REMOVAL SERVICE POINTS

◀A▶ RADIATOR UPPER HOSE/RADIATOR LOWER HOSE DISCONNECTION

After making mating marks on the radiator hose and the hose clamp, disconnect the radiator hose.

◀B▶ A/T OIL COOLER HOSE REMOVAL

After removing the hose from the radiator, plug the hose and the radiator nipple to prevent dust or foreign particles from getting in.

INSTALLATION SERVICE POINT

▶A◀ RADIATOR LOWER HOSE/RADIATOR UPPER HOSE CONNECTION

1. Insert each hose as far as the projection of the water inlet fitting.
2. Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.

NOTES

GROUP 14
ENGINE COOLING

GENERAL

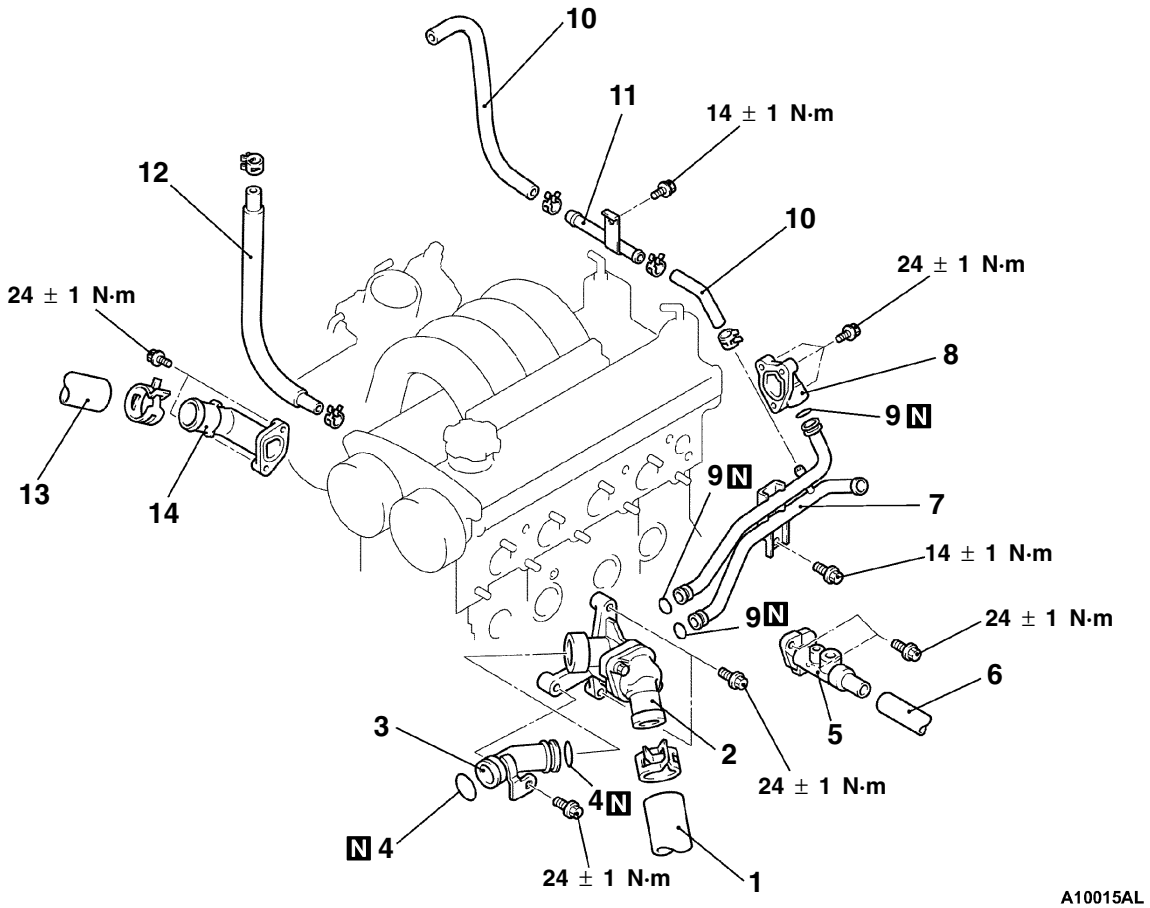
OUTLINE OF CHANGES

The following service procedures have been established due to the addition of vehicles with 4G9-MPI engine. Other service procedures are the same as the vehicles with GDI engine.

WATER HOSE AND WATER PIPE

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Suppling
- Air Cleaner Removal and Installation (Refer to GROUP 15.)
- Exhaust Manifold Removal and Installation (Refer to GROUP 15.)



Removal steps

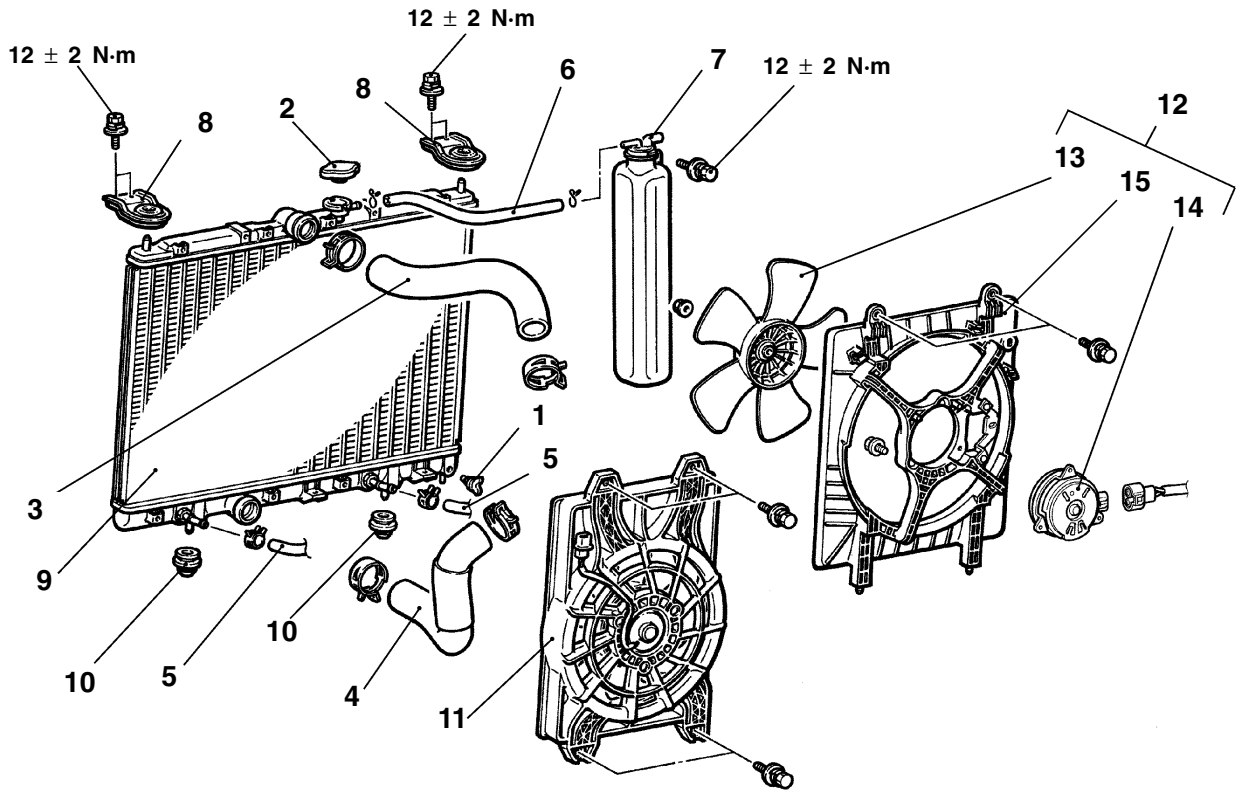
1. Radiator lower hose connection
2. Thermostat case assembly
3. Water pipe
4. O-ring
5. Water fitting
6. Heater hose connection
7. Water pipe assembly
8. Water by-pass fitting
9. O-ring
10. Water hose
11. Water pipe
12. Water hose
13. Radiator upper hose connection
14. Water outlet fitting

RADIATOR

REMOVAL AND INSTALLATION

Pre-removal Operations
- Engine Coolant Draining
- Engine Cover and Under Cover Removal
- Air Cleaner Removal

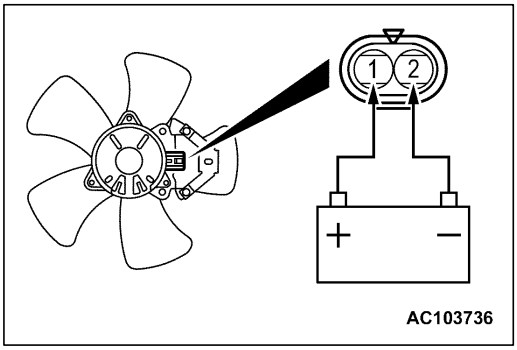
Post-installation Operations
- Air Cleaner Installation
- Engine Cover and Under Cover Installation
- Engine Coolant Supplying
- A/T Fluid Supplying

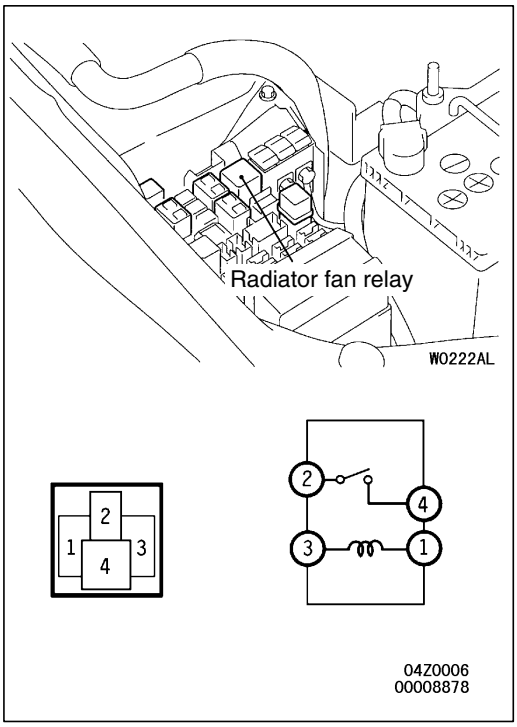


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Radiator removal steps
1. Drain plug
2. Radiator cap
3. Radiator upper hose
4. Radiator lower hose
5. A/T oil cooler hose connection
6. Rubber hose
7. Condense tank
8. Upper insulator
9. Radiator assembly
10. Lower insulator
11. Condenser fan motor assembly
12. Radiator fan motor assembly

Radiator fan motor assembly removal steps
12. Radiator fan motor assembly
13. Fan
14. Radiator fan motor
15. Shroud





INSPECTION

RADIATOR FAN MOTOR CHECK

1. Check to be sure that the radiator fan rotates when battery voltage is applied between terminals (as shown in the figure).
2. Check to see that abnormal noises are not produced, while motor is turning.

RADIATOR FAN RELAY CONTINUITY CHECK

Battery voltage	Terminal No.			
	1	2	3	4
When current is not supplied	○		○	
When current is supplied	⊖	○	⊕	○

NOTES

INTAKE AND EXHAUST

INTAKE AND EXHAUST

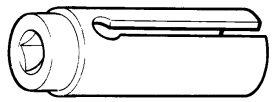
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SPECIAL TOOL 2
AIR CLEANER 3
INTAKE MANIFOLD 4
EXHAUST MANIFOLD 6
EXHAUST PIPE AND MAIN MUFFLER 7
CATALYTIC CONVERTER ..... Refer to GROUP 35A

SERVICE SPECIFICATION

Items	Standard value	Limit
Distortion of the intake manifold installation surface mm	0.15 or less	0.20

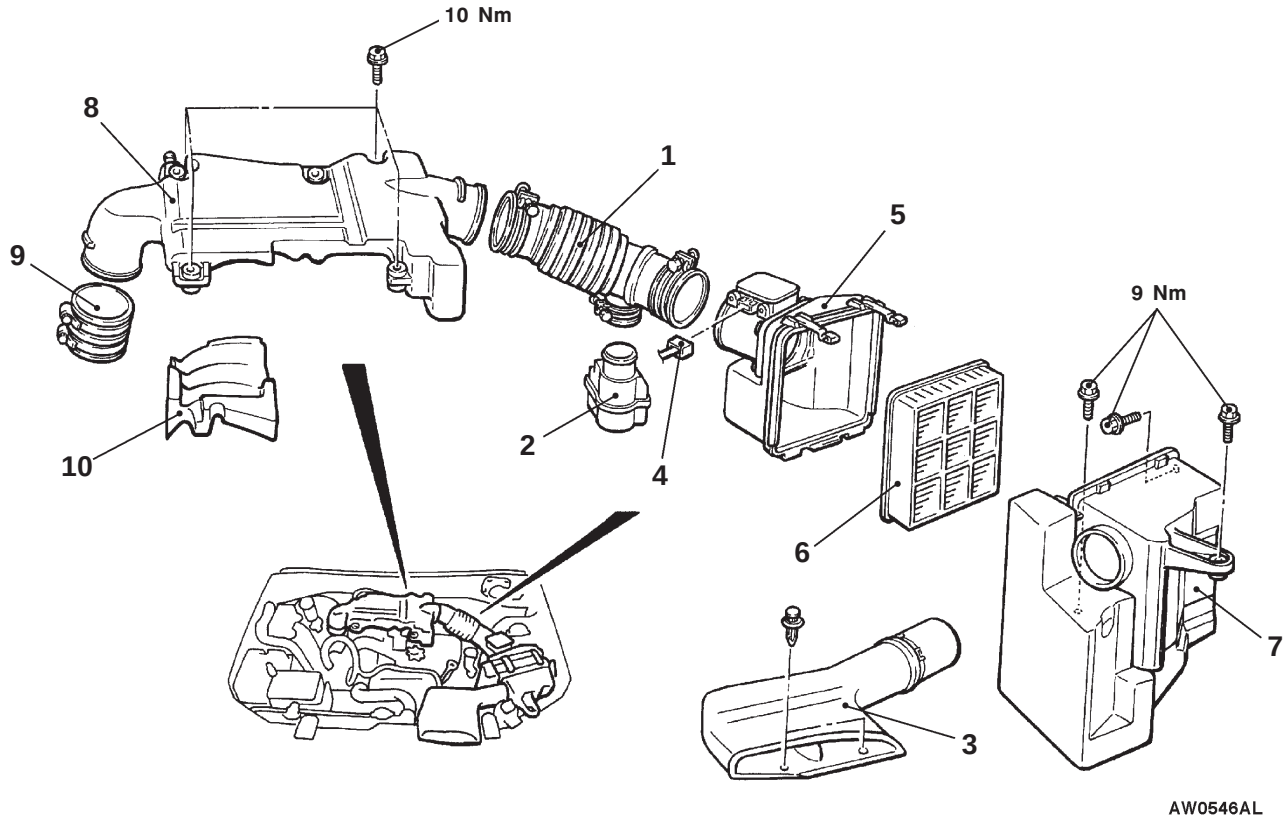
SPECIAL TOOL

Tool	Number	Name	Use
	MD998770	Oxygen sensor wrench	Removal and installation of oxygen sensor

AIR CLEANER

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Engine Cover Removal and Installation



Air cleaner removal steps

1. Air intake hose
2. Resonator
3. Air duct
4. Air flow sensor connector connection
5. Air cleaner cover
6. Air cleaner element
7. Air cleaner

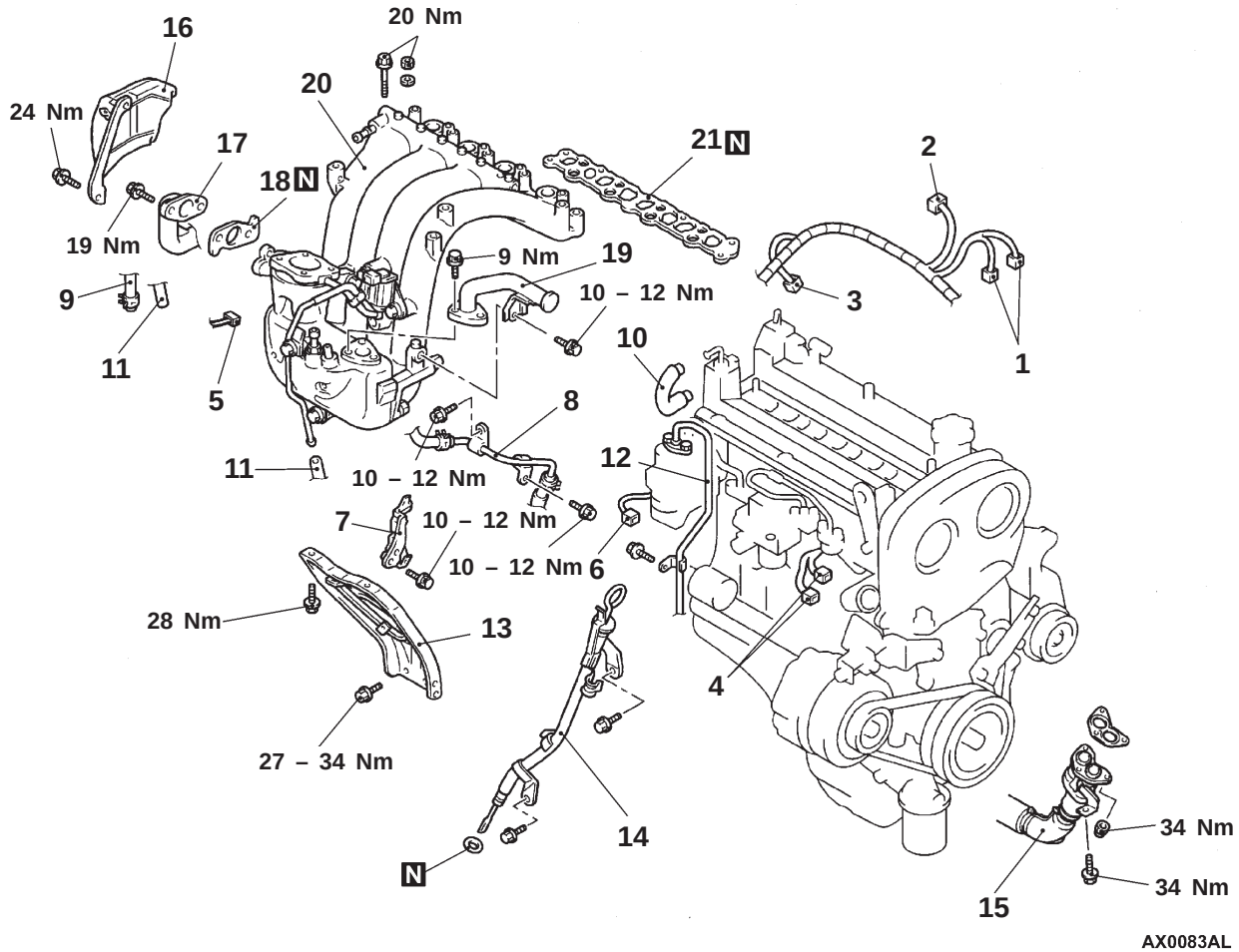
Resonance tank removal steps

8. Resonance tank
9. Air hose
10. Insulator

INTAKE MANIFOLD

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying (Refer to GROUP 14 – On-vehicle Service.)
- Engine Cover and Under Cover Removal and Installation
- Resonance Tank Removal and Installation (Refer to P.15-3.)
- Ignition Coil Removal and Installation (Refer to GROUP 16.)
- Throttle Body Removal and Installation (Refer to GROUP 13A.)



Removal steps

1. Engine coolant temperature sensor connector connection
2. Condenser connector connection
3. Camshaft position sensor connector connection
4. Injector harness connector connection
5. Purge control solenoid connector connection
6. EGR valve connector connection
7. Harness connector bracket
8. Water hose and pipe
9. Brake booster vacuum hose
10. PCV hose connection
11. Vacuum hose connection
12. Fuel hose clamp
13. Intake manifold stay
14. A/T fluid level gauge guide
15. Front exhaust pipe connection

◀A▶

16. Fuel pump protector
17. EGR valve support connection
18. Gasket
19. Branch tube
20. Intake manifold assembly
21. Intake manifold gasket

REMOVAL SERVICE POINT

◀A▶ FUEL PUMP PROTECTOR REMOVAL

Lift up the transmission with a jack to create clearance between the engine and the front deck, and remove the fuel pump protector.

INSPECTION

Check the following points; replace the part if a problem is found.

INTAKE MANIFOLD CHECK

1. Check for damage or cracking of any part.
2. Using a straight edge and thickness gauge, check for distortion of the cylinder head installation surface.

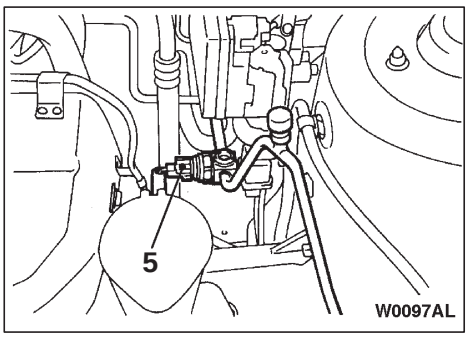
   Standard value: 0.15 mm or less

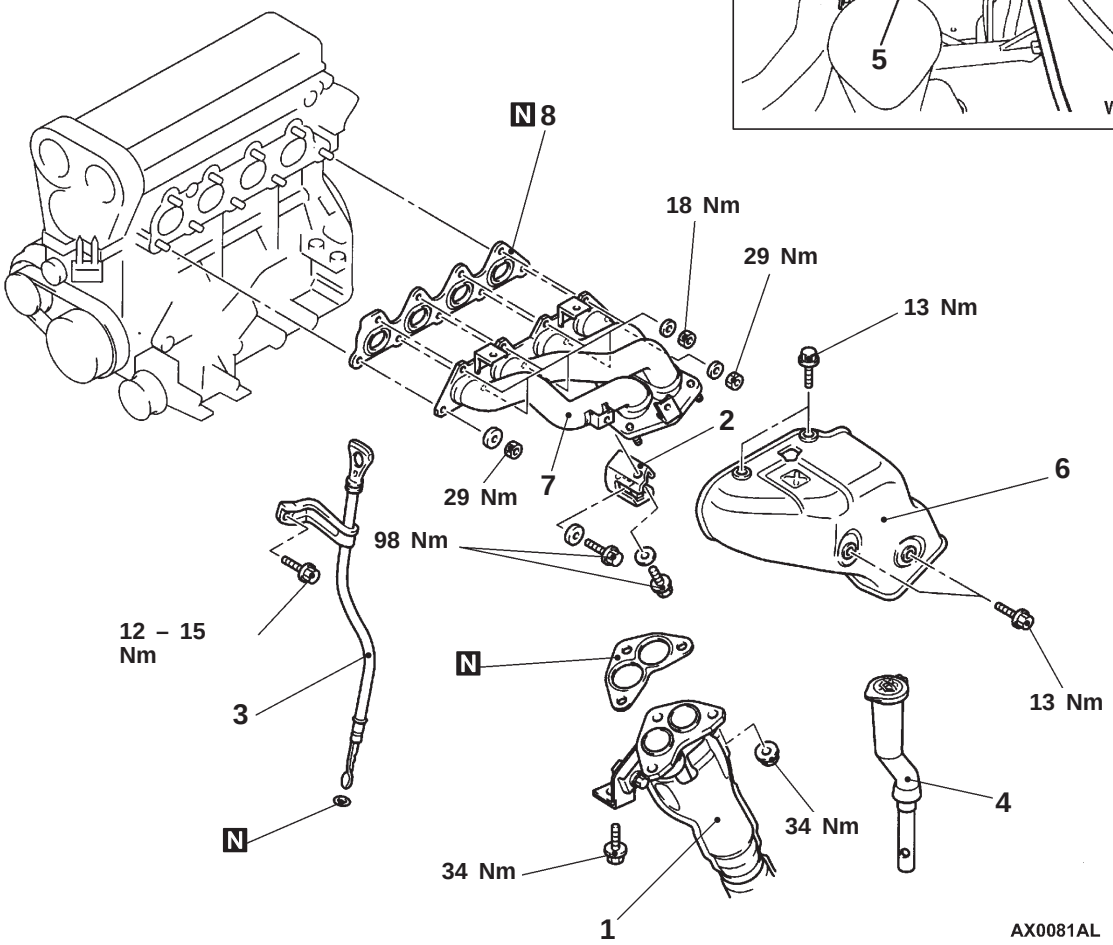
   Limit: 0.20 mm

EXHAUST MANIFOLD

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Cover and Under Cover Removal and Installation
- Air Cleaner Removal and Installation (Refer to P.15-3.)





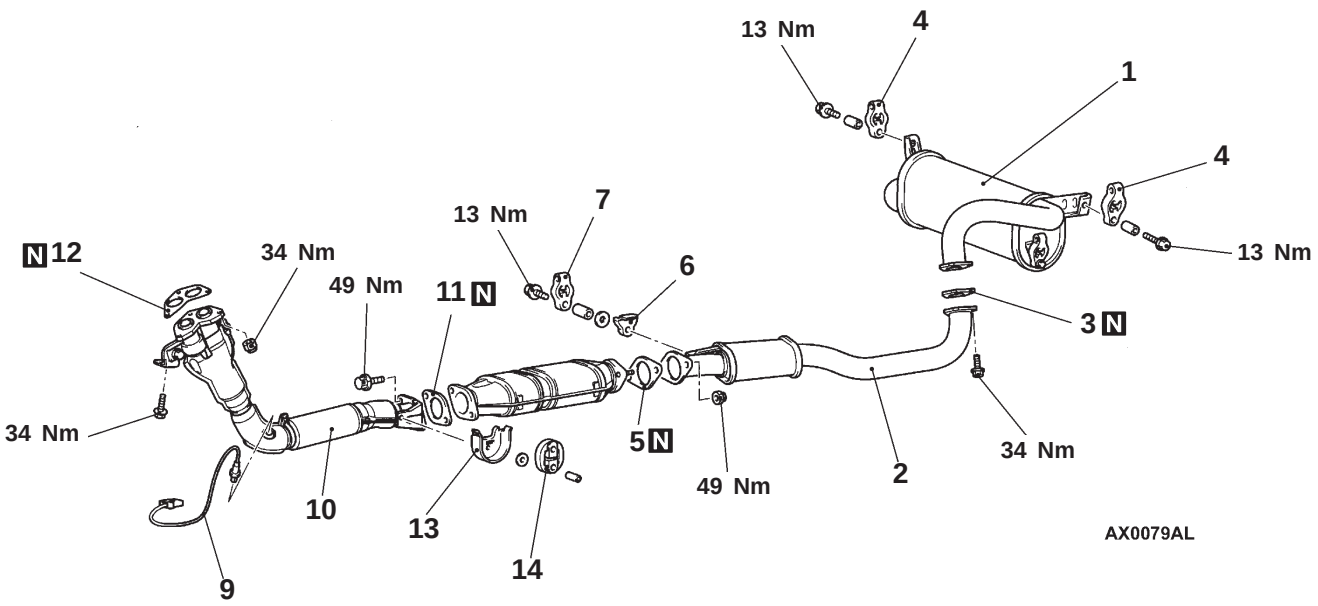
Removal steps

1. Front exhaust pipe connection
2. Exhaust manifold bracket
3. Engine oil level gauge guide
4. Washer tank filler tube
5. A/C pressure switch connector connection
6. Exhaust manifold cover
7. Exhaust manifold
8. Exhaust manifold gasket

EXHAUST PIPE AND MAIN MUFFLER

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Engine Cover and Under Cover Removal and Installation

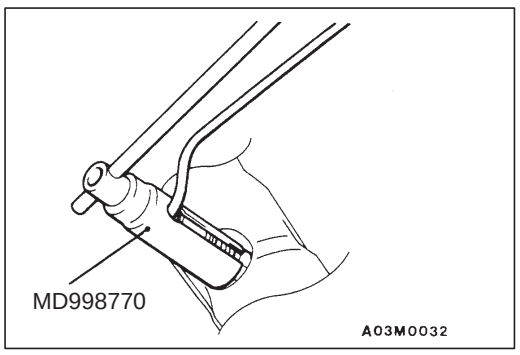


Main muffler removal steps
1. Main muffler
3. Gasket
4. Hanger

Center exhaust pipe removal steps
2. Center exhaust pipe
3. Gasket
5. Gasket
6. Protector
7. Hanger

Pre-muffler removal steps
8. Pre-muffler
11. Gasket

Center exhaust pipe removal steps
◀A▶ ▶A◀ 9. Oxygen sensor
10. Front exhaust pipe
11. Gasket
12. Gasket
13. Heat protector
14. Hanger



REMOVAL SERVICE POINT
◀A▶ OXYGEN SENSOR REMOVAL

INSTALLATION SERVICE POINT
▶A◀ OXYGEN SENSOR INSTALLATION

NOTES

GROUP 15
INTAKE AND EXHAUST

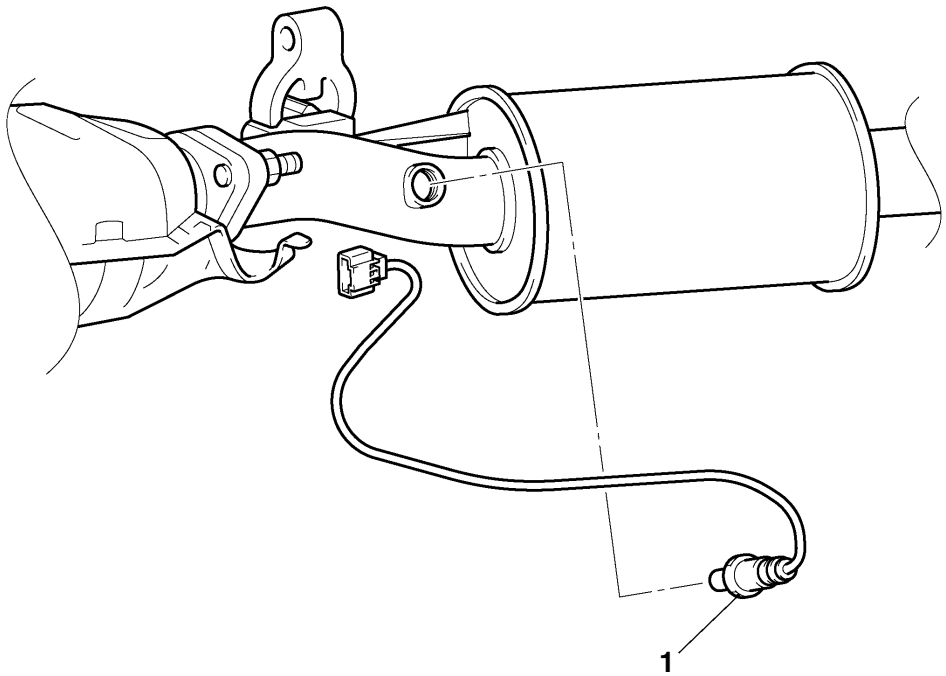
GENERAL

OUTLINE OF CHANGE

Due to the introduction of the oxygen sensor (rear), the following service procedure has been added. The other service procedures are the same as before.

EXHAUST PIPE AND MAIN MUFFLER

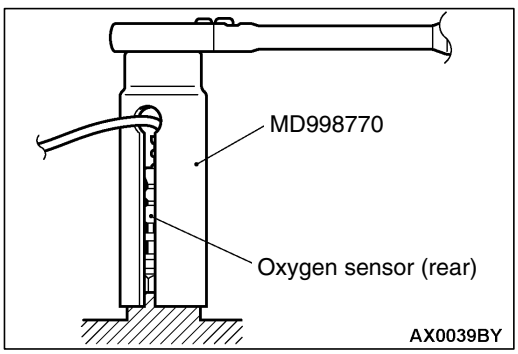
REMOVAL AND INSTALLATION



AY0211AL

Removal step

◀A▶ 1. Oxygen sensor (rear)



REMOVAL SERVICE POINT

◀A▶ OXYGEN SENSOR (REAR) REMOVAL

GROUP 15
INTAKE AND EXHAUST

GENERAL

OUTLINE OF CHANGES

The following service procedures have been established due to the addition of vehicle with 4G9-MPI engine. Other contents are the same as 4G9-GDI engine.

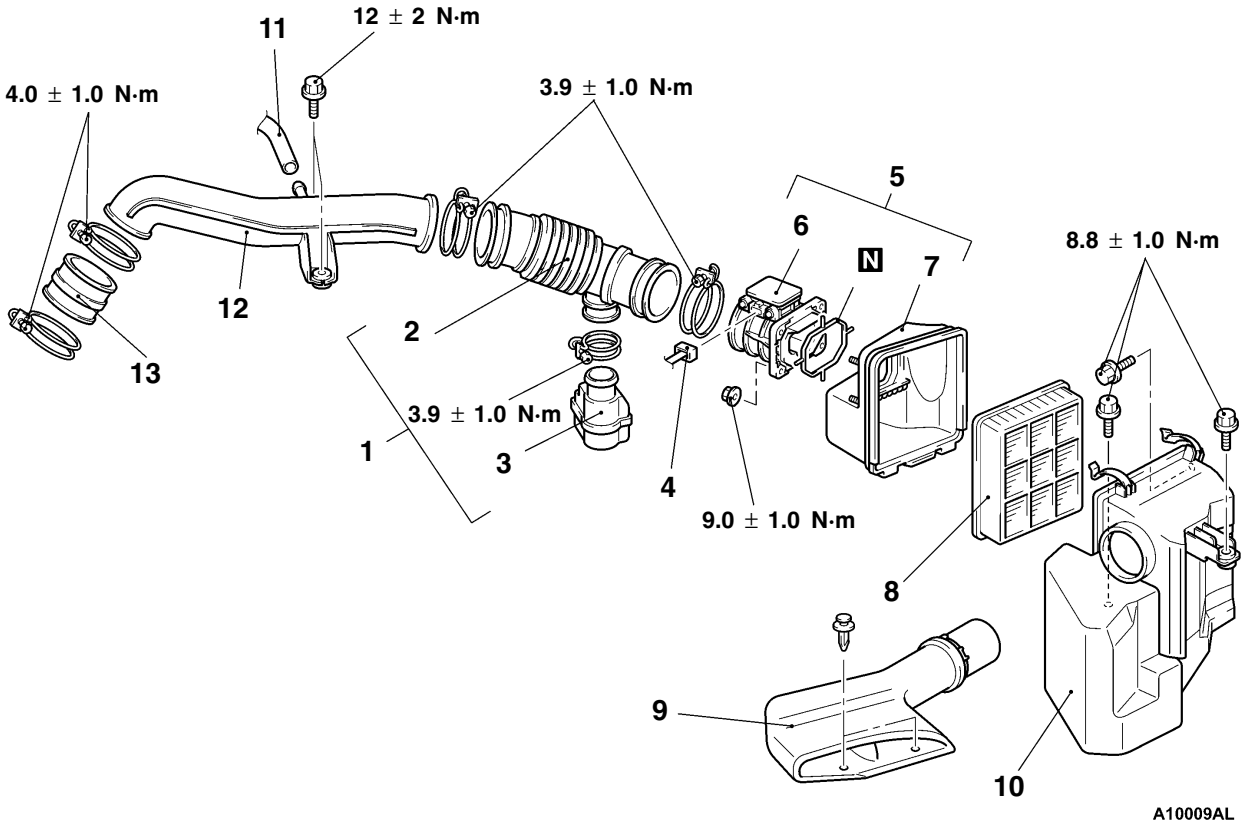
SERVICE SPECIFICATION

Items	Standard value	Limit
Distortion of the intake manifold installation surface mm	0.15 or less	0.20

AIR CLEANER

REMOVAL AND INSTALLATION

<4G9-MPI>



Removal steps

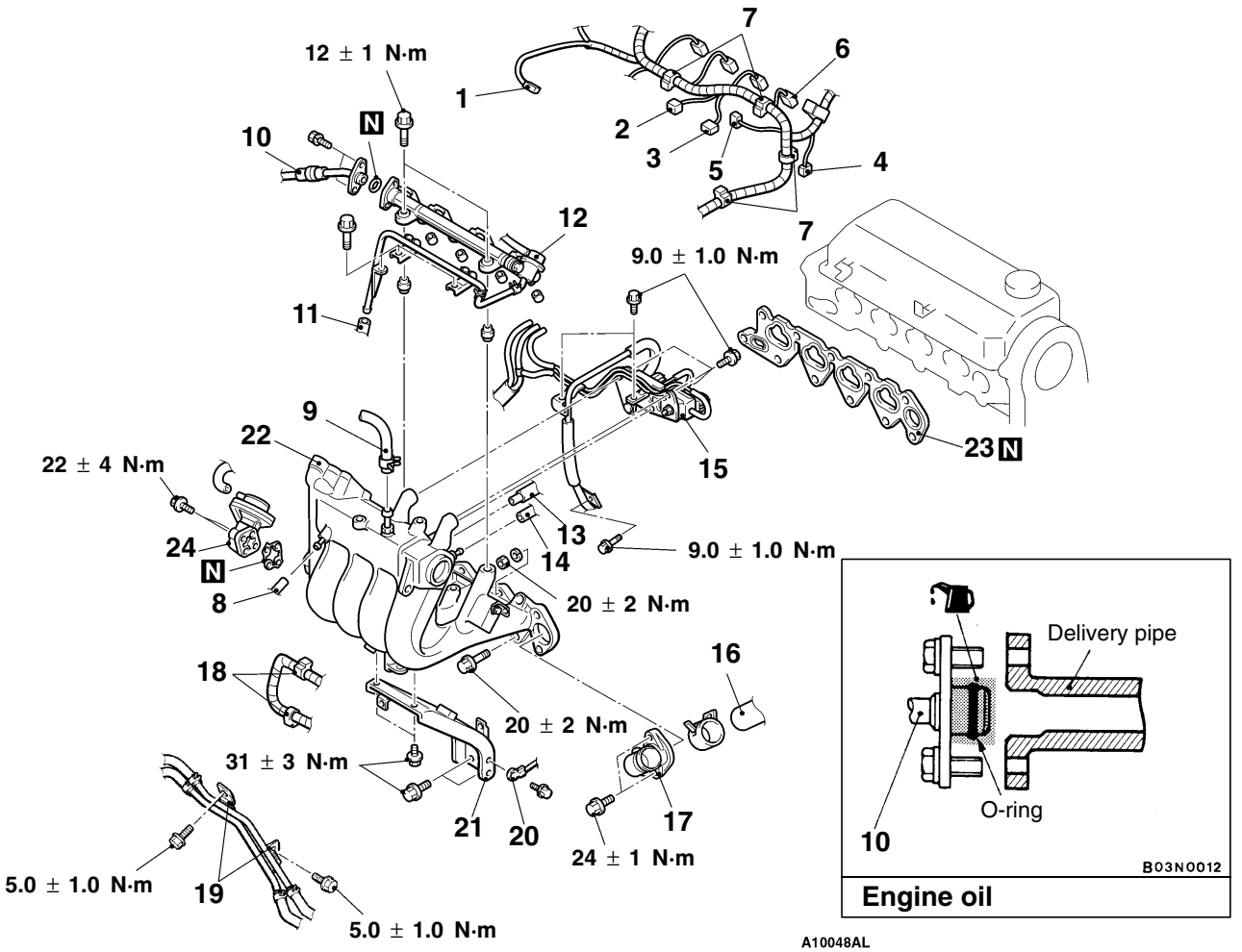
1. Air intake hose and resonator
2. Air intake hose
3. Resonator
4. Air flow sensor connector
5. Air flow sensor and air cleaner cover
6. Air flow sensor
7. Air cleaner cover
8. Air cleaner element
9. Air duct
10. Air cleaner
11. Breather hose connection
12. Air intake pipe
13. Air hose

INTAKE MANIFOLD

REMOVAL AND INSTALLATION

<4G9-MPI>

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying
- Under Cover Removal and Installation
- Air Cleaner Removal and Installation (Refer to P.15-2.)
- Throttle Body and Throttle Cable Bracket Removal and Installation (Refer to GROUP 13C.)



Removal steps

1. Noise condenser connector
2. Purge control solenoid valve connector
3. EGR solenoid valve connector
4. Crank angle sensor connector
5. Detonation sensor connector
6. Injector connector
7. Control harness clamp
8. Intake manifold vacuum hose connection
9. Brake booster vacuum hose connection

▶A◀ 10. Fuel pressure hose

11. Return hose

◀B▶ 12. Delivery pipe, injector and fuel pressure regulator assembly
13. PCV hose connection
14. Vacuum hose connection
15. Solenoid valve and bracket assembly
16. Radiator upper hose
17. Water outlet fitting
18. Battery harness clamp
19. A/T oil cooler pipe clamp <A/T>
20. Earth cable connection
21. Intake manifold stay
22. Intake manifold assembly
23. Intake manifold gasket
24. EGR valve

REMOVAL SERVICE POINT

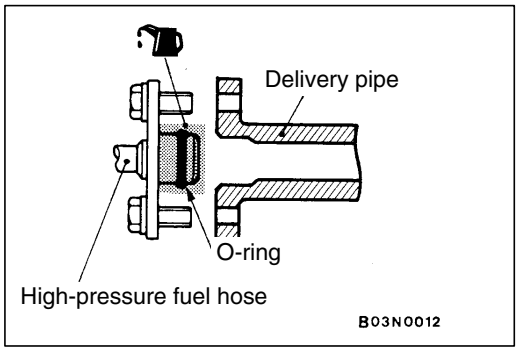
◀A▶ FUEL PUMP PROTECTOR REMOVAL

Lift up the transmission with a jack to create clearance between the engine and the front deck, and remove the fuel pump protector.

◀B▶ DELIVERY PIPE, INJECTOR AND FUEL PRESSURE REGULATOR ASSEMBLY REMOVAL

Remove the delivery pipe (with the injectors and fuel pressure regulator attached to it).

Caution
Care must be taken, when removing the delivery pipe, not to drop the injector.



INSTALLATION SERVICE POINT

▶A◀ HIGH-PRESSURE FUEL HOSE INSTALLATION

1. When connecting the high-pressure fuel hose to the delivery pipe, apply a small amount of new engine oil to the O-ring and then insert the high-pressure fuel hose, being careful not to damage the O-ring.

   Caution
   Be careful not to let any engine oil get into the delivery pipe.
2. While turning the high-pressure fuel hose to the left and right, install it to the delivery pipe.
3. Check to be sure that the high-pressure fuel hose turns smoothly.
   If it does not turn smoothly, the O-ring may be trapped, remove the high-pressure fuel hose and then re-insert it into the delivery pipe and check once again.

INSPECTION

Check the following points; replace the part if a problem is found.

INTAKE MANIFOLD CHECK

1. Check for damage or cracking of any part.
2. Check for obstruction of the negative pressure (vacuum) outlet port, and for obstruction of the water passage or gas passage.
3. Using a straight edge and thickness gauge, check for distortion of the cylinder head installation surface.

   Standard value: 0.15 mm or less

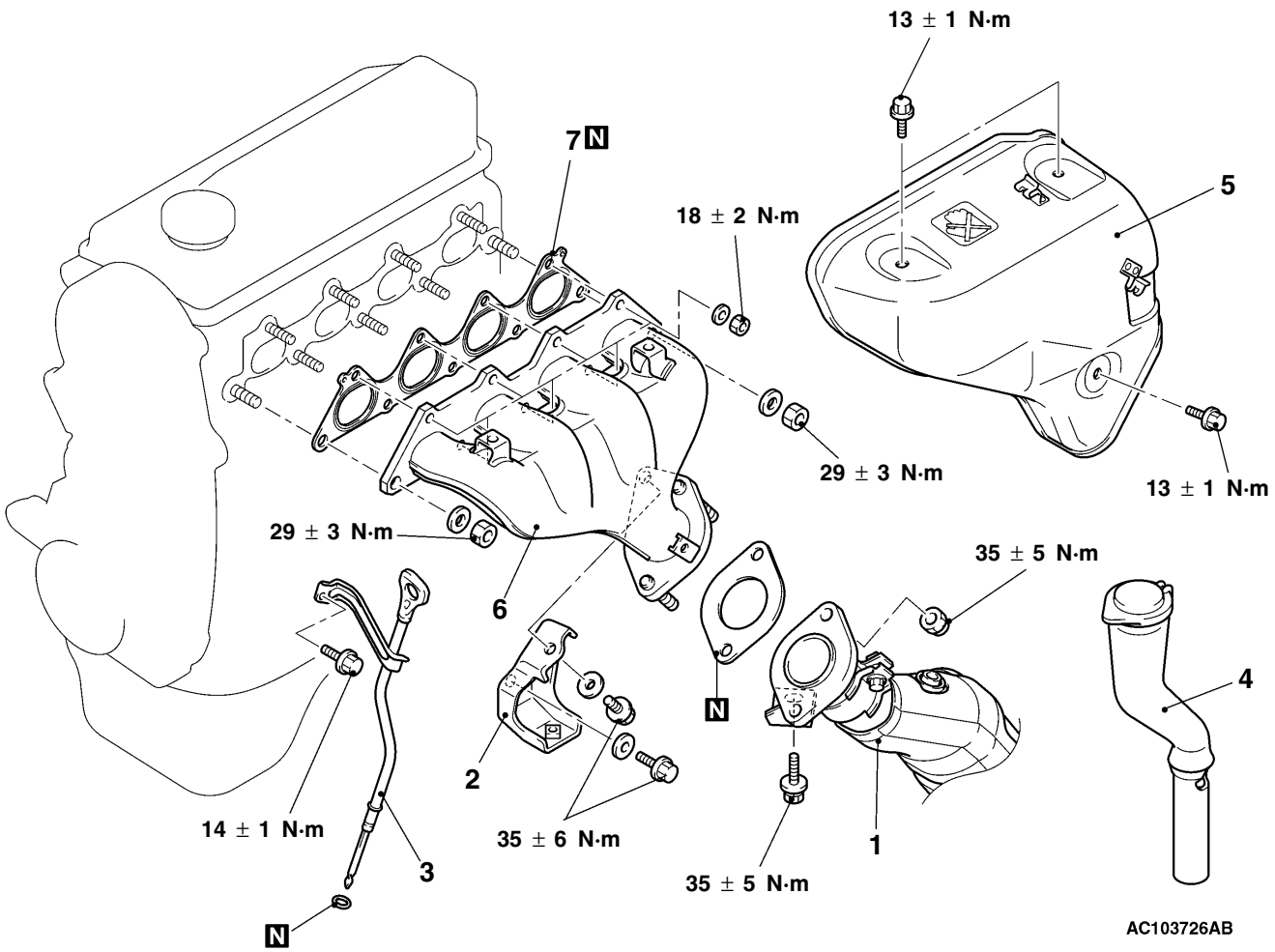
   Limit: 0.20 mm

EXHAUST MANIFOLD

REMOVAL AND INSTALLATION

<4G9-MPI>

Pre-removal and Post-installation Operation
- Under Cover Removal and Installation
- Air Cleaner Removal and Installation (Refer to P.15-2.)
- Power Steering Oil Pump Bracket Removal and Installation



Removal steps

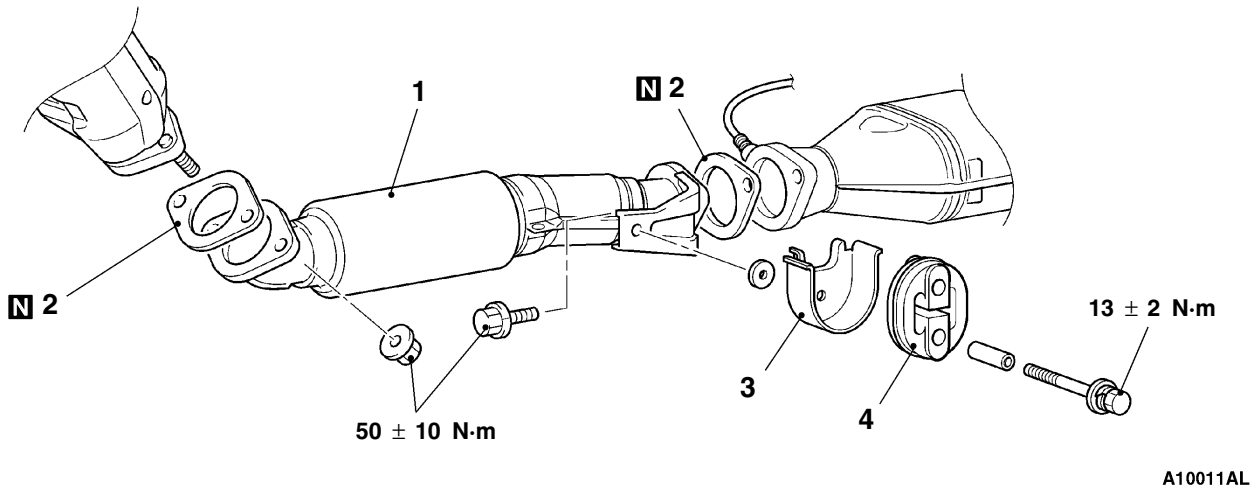
1. Front exhaust pipe connection
2. Exhaust manifold bracket
3. Engine oil level gauge guide
4. Washer tank filler tube
5. Exhaust manifold cover
6. Exhaust manifold
7. Exhaust manifold gasket

EXHAUST PIPE AND MAIN MUFFLER

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Under Cover Removal and Installation

<4G9-MPI>



Front exhaust pipe removal steps

1. Front exhaust pipe
2. Gasket
3. Heat protector
4. Hanger

NOTES

ENGINE ELECTRICAL

ENGINE ELECTRICAL

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CRANK ANGLE SENSOR 32

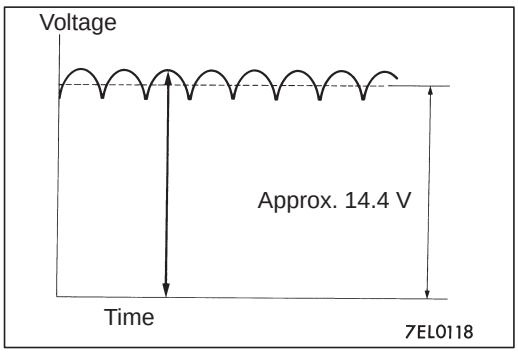
CAMSHAFT POSITION SENSOR 32

DETONATION SENSOR 33

CHARGING SYSTEM

GENERAL INFORMATION

The charging system uses the alternator output to keep the battery charged at a constant level under various electrical loads.

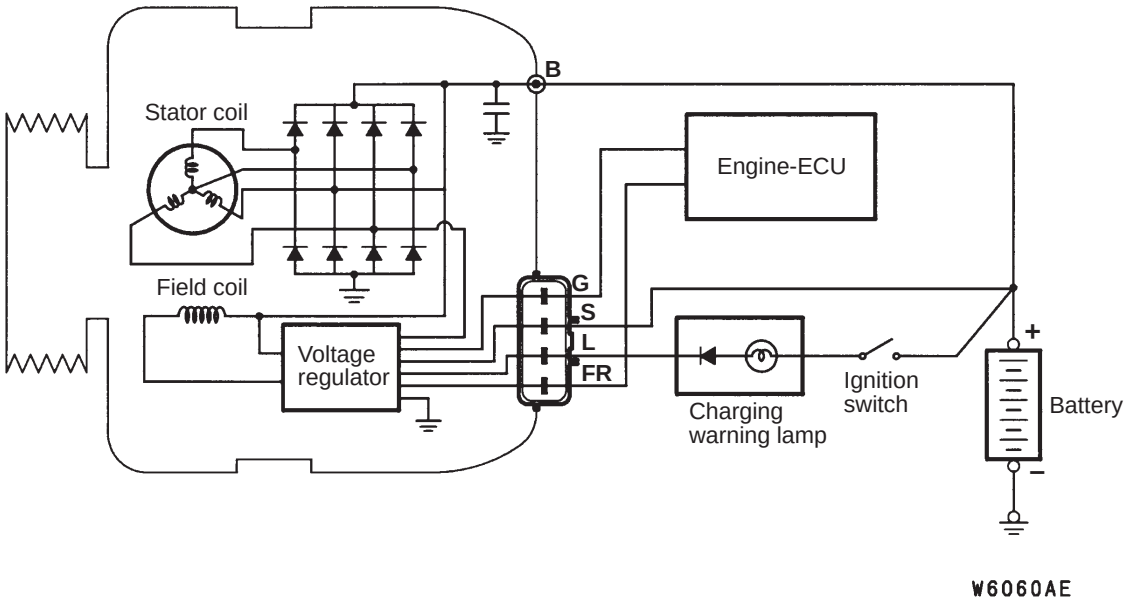


OPERATION

Rotation of the excited field coil generates AC voltage in the stator.
This alternating current is rectified through diodes to DC voltage having a waveform shown in the illustration at left. The average output voltage fluctuates slightly with the alternator load condition.

When the ignition switch is turned on, current flows in the field coil and initial excitation of the field coil occurs.
When the stator coil begins to generate power after the engine is started, the field coil is excited by the output current of the stator coil.
The alternator output voltage rises as the field current increases and it falls as the field current decreases. When the battery voltage (alternator S terminal voltage) reaches a regulated voltage of approx. 14.4 V, the field current is cut off. When the battery voltage drops below the regulated voltage, the voltage regulator regulates the output voltage to a constant level by controlling the field current.
In addition, when the field current is constant, the alternator output voltage rises as the engine speed increases.

SYSTEM DIAGRAM



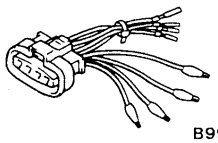
ALTERNATOR SPECIFICATIONS

Items	Specifications
Type	Battery voltage sensing
Rated output V/A	12/100
Voltage regulator	Electronic built-in type

SERVICE SPECIFICATIONS

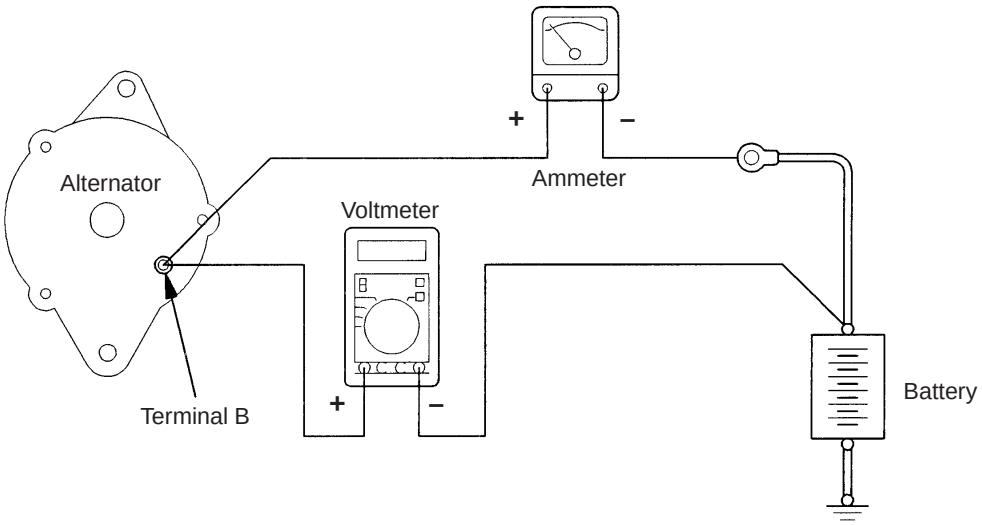
Items		Standard value	Limit
Alternator output line voltage drop (at 30 A) V		–	Max. 0.3
Regulated voltage ambient temp. at voltage regulator V	–20°C	14.2–15.4	–
	20°C	13.9–14.9	–
	60°C	13.4–14.6	–
	80°C	13.1–14.5	–
Output current		–	70% of normal output current

SPECIAL TOOL

Tool	Number	Name	Use
 B991519	MB991519	Alternator test harness	Checking the alternator (S terminal voltage)

ON-VEHICLE SERVICE

ALTERNATOR OUTPUT LINE VOLTAGE DROP TEST



This test determines whether the wiring from the alternator “B” terminal to the battery (+) terminal (including the fusible line) is in a good condition or not.

(1) Always be sure to check the following before the test.
- Alternator installation
- Alternator drive belt tension
- Fusible link
- Abnormal noise from the alternator while the engine is running

(2) Turn the ignition switch to the LOCK (OFF) position.

(3) Disconnect the negative battery cable.

(4) Disconnect the alternator output wire from the alternator “B” terminal and connect a DC test ammeter with a range of 0–100 A in series between the “B” terminal and the disconnected output wire. (Connect the (+) lead of the ammeter to the “B” terminal, and then connect the (–) lead of the ammeter to the disconnected output wire.)

NOTE
An inductive-type ammeter which enables measurements to be taken without disconnecting the alternator output wire should be recommended. Using this equipment will lessen the possibility of a voltage drop caused by a loose “B” terminal connection.

(5) Connect a digital-type voltmeter between the alternator “B” terminal and the battery (+) terminal. (Connect the (+) lead of the voltmeter to the “B” terminal and the connect the (–) lead of the voltmeter to the battery (+) cable.)

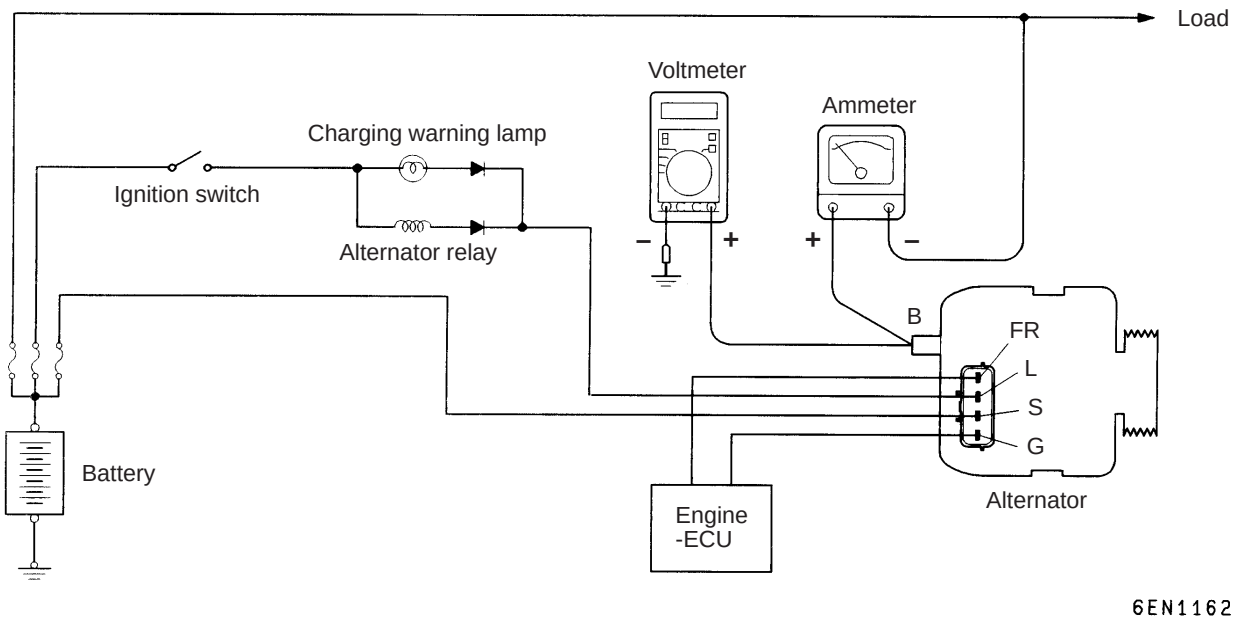
(6) Reconnect the negative battery cable.
(7) Connect a tachometer or the MUT-II.
(8) Leave the hood open.
(9) Start the engine.
(10) With the engine running at 2,500 r/min, turn the headlamps and other lamps on and off to adjust the alternator load so that the value displayed on the ammeter is slightly above 30 A.
Adjust the engine speed by gradually decreasing it until the value displayed on the ammeter is 30 A. Take a reading of the value displayed on the voltmeter at this time.

Limit: max. 0.3 V

NOTE
When the alternator output is high and the value displayed on the ammeter does not decrease until 30 A, set the value to 40 A. Read the value displayed on the voltmeter at this time. When the value range is 40 A, the limit is max. 0.4 V.

(11) If the value displayed on the voltmeter is above the limit value, there is probably a malfunction in the alternator output wire, so check the wiring between the alternator "B" terminal and the battery (+) terminal (including fusible link).
If a terminal is not sufficiently tight or if the harness has become discolored due to overheating, repair and then test again.
(12) After the test, run the engine at idle.
(13) Turn off all lamps and the ignition switch.
(14) Remove the tachometer or the MUT-II.
(15) Disconnect the negative battery cable.
(16) Disconnect the ammeter and voltmeter.
(17) Connect the alternator output wire to the alternator "B" terminal.
(18) Connect the negative battery cable.

OUTPUT CURRENT TEST



This test determines whether the alternator output current is normal.

(1) Before the test, always be sure to check the following.
- Alternator installation
- Battery

NOTE
The battery should be slightly discharged. The load needed by a fully-charged battery is insufficient for an accurate test.

- Alternator drive belt tension
- Fusible link
- Abnormal noise from the alternator while the engine is running.

(2) Turn the ignition switch to the LOCK (OFF) position.
(3) Disconnect the negative battery cable.
(4) Disconnect the alternator output wire from the alternator "B" terminal. Connect a DC test ammeter with a range of 0–100 A in series between the "B" terminal and the disconnected output wire. (Connect the (+) lead of the ammeter to the "B" terminal. Connect the (–) lead of the ammeter to the disconnected output wire.)

Caution
Never use clips but tighten bolts and nuts to connect the line. Otherwise loose connections (e.g. using clips) will lead to a serious accident because of high current.

NOTE
An inductive-type ammeter which enables measurements to be taken without disconnecting the alternator output wire should be recommended.

(5) Connect a voltmeter with a range of 0–20 V between the alternator "B" terminal and the earth. (Connect the (+) lead of the voltmeter to the "B" terminal, and then connect the (–) lead of the voltmeter to the earth.)
(6) Connect the negative battery cable.
(7) Connect a tachometer or the MUT-II.
(8) Leave the hood open.
(9) Check that the reading on the voltmeter is equal to the battery voltage.

NOTE
If the voltage is 0 V, the cause is probably an open circuit in the wire or fusible link between the alternator "B" terminal and the battery (+) terminal.

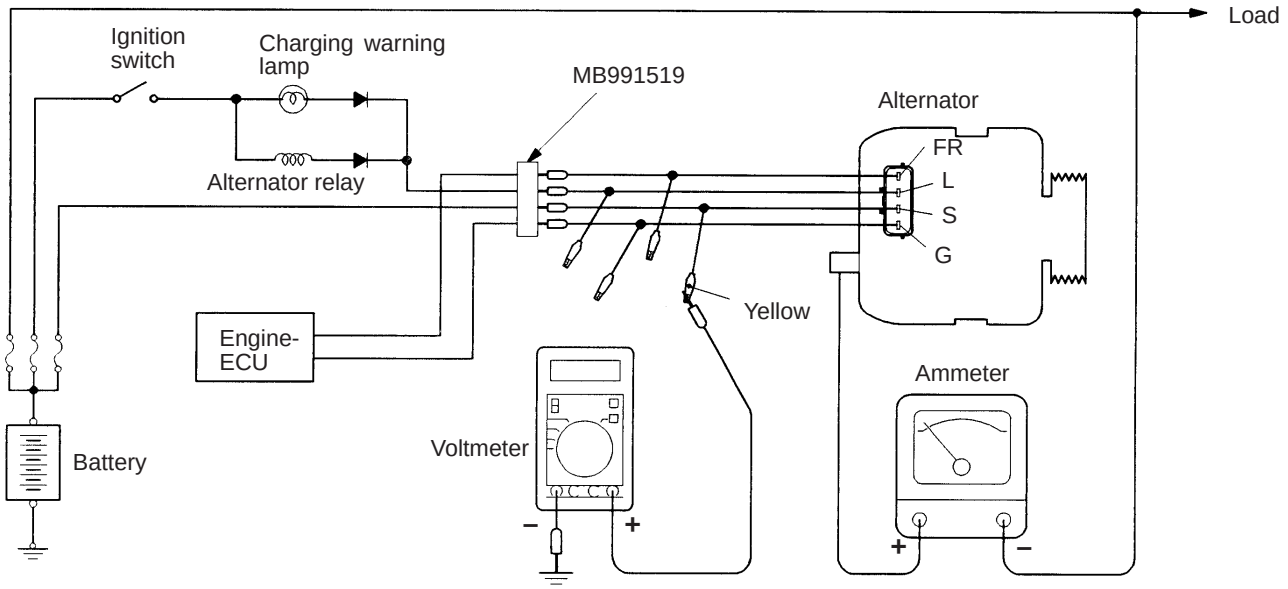
(10) Turn the light switch on to turn on headlamps and then start the engine.
(11) Immediately after setting the headlamps to high beam and turning the heater blower switch to the high revolution position, increase the engine speed to 2,500 r/min and read the maximum current output value displayed on the ammeter.

Limit: 70% of normal current output

NOTE
- For the nominal current output, refer to the Alternator Specifications.
- Because the current from the battery will soon drop after the engine is started, the above step should be carried out as quickly as possible in order to obtain the maximum current output value.
- The current output value will depend on the electrical load and the temperature of the alternator body.
- If the electrical load is small while testing, the specified level of current may not be output even though the alternator is normal. In such cases, increase the electrical load by leaving the headlamps turned on for some time to discharge the battery or by using the lighting system in another vehicle, and then test again.
- The specified level of current also may not be output if the temperature of the alternator body or the ambient temperature is too high. In such cases, cool the alternator and then test again.

(12) The reading on the ammeter should be above the limit value. If the reading is below the limit value and the alternator output wire is normal, remove the alternator from the engine and check the alternator.
(13) Run the engine at idle after the test.
(14) Turn the ignition switch to the LOCK (OFF) position.
(15) Remove the tachometer or the MUT-II.
(16) Disconnect the negative battery cable.
(17) Disconnect the ammeter and voltmeter.
(18) Connect the alternator output wire to the alternator "B" terminal.
(19) Connect the negative battery cable.

REGULATED VOLTAGE TEST



6EN1163

This test determines whether the voltage regulator is correctly controlling the alternator output voltage.

(1) Always be sure to check the following before the test.
- Alternator installation
- Check that the battery installed in the vehicle is fully charged.
- Alternator drive belt tension
- Fusible link
- Abnormal noise from the alternator while the engine is running

(2) Turn the ignition switch to the LOCK (OFF) position.
(3) Disconnect the negative battery cable.
(4) Use the special tool (Alternator test harness: MB991519) to connect a digital voltmeter between the alternator S terminal and earth. (Connect the (+) lead of the voltmeter to the "S" terminal, and then connect the (–) lead of the voltmeter to a secure earth or to the battery (–) terminal.)
(5) Disconnect the alternator output wire from the alternator "B" terminal.
(6) Connect a DC test ammeter with a range of 0–100 A in series between the "B" terminal and the disconnected output wire. (Connect the (+) lead of the ammeter to the "B" terminal. Connect the (–) lead of the ammeter to the disconnected output wire.)
(7) Reconnect the negative battery cable.
(8) Connect a tachometer or the MUT-II.
(9) Turn the ignition switch to the ON position and check that the reading on the voltmeter is equal to the battery voltage.

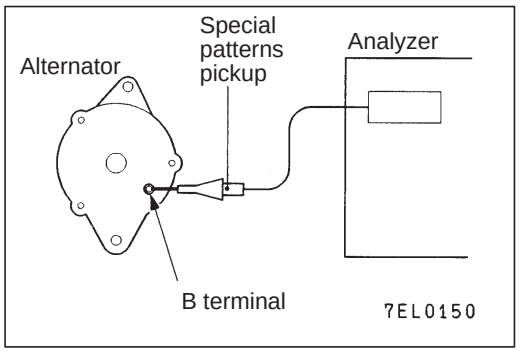
NOTE
If the voltage is 0 V, the cause is probably an open circuit in the wire or fusible link between the alternator "S" terminal and the battery (+) terminal.

(10) Turn all lamps and accessories off.
(11) Start the engine.
(12) Increase the engine speed to 2,500 r/min.
(13) Read the value displayed on the voltmeter when the alternator output current alternator becomes 10 A or less.
(14) If the voltage reading conforms to the value in the voltage regulation, then the voltage regulator is operating normally.
If the voltage is not within the standard value, there is a malfunction of the voltage regulator or of the alternator.
(15) After the test, lower the engine speed to the idle speed.
(16) Turn the ignition switch to the LOCK (OFF) position.
(17) Remove the tachometer or the MUT-II.
(18) Disconnect the negative battery cable.
(19) Disconnect the ammeter and voltmeter.
(20) Connect the alternator output wire to the alternator "B" terminal.
(21) Remove the special tool, and return the connector to the original condition.
(22) Connect the negative battery cable.

Voltage Regulation Table

Standard value:

Inspection terminal	Voltage regulator ambient temperature °C	Voltage V
Terminal "S"	–20	14.2–15.4
	20	13.9–14.9
	60	13.4–14.6
	80	13.1–14.5



WAVEFORM CHECK USING AN ANALYZER

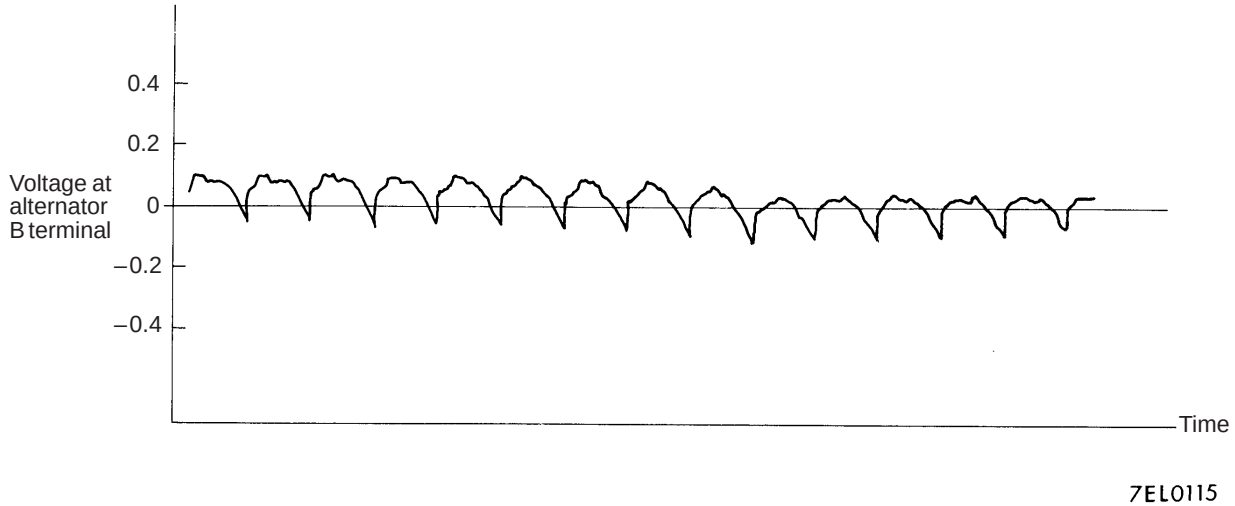
MEASUREMENT METHOD

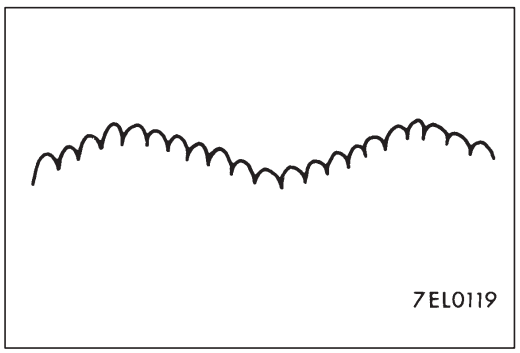
Connect the analyzer special patterns pick-up to the alternator B terminal.

STANDARD WAVEFORM

Observation Conditions

FUNCTION	SPECIAL PATTERNS
PATTERN HEIGHT	VARIABLE
VARIABLE knob	Adjust while viewing the waveform.
PATTERN SELECTOR	RASTER
Engine speed	Curb idle speed





NOTE

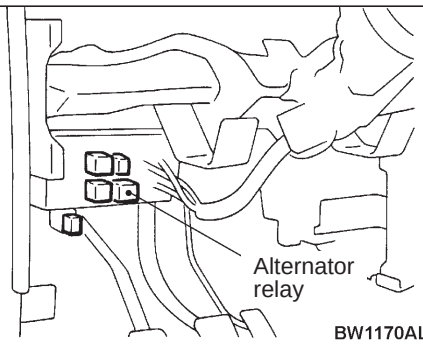
The voltage waveform of the alternator “B” terminal can undulate as shown at left. This waveform is produced when the regulator operates according to fluctuations in the alternator load (current), and is normal for the alternator.

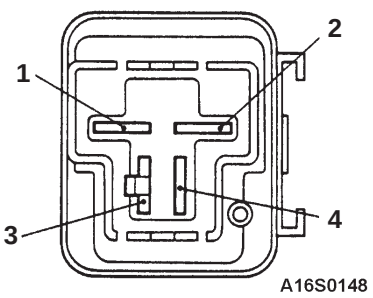
In addition, when the voltage waveform reaches an excessively high value (approx. 2 V or higher at idle), it often indicates an open circuit due to a brown fuse between alternator “B” terminal and battery, but not a defective alternator.

EXAMPLES OF ABNORMAL WAVEFORMS

NOTE
1. The size of the waveform patterns differs largely, depending on the adjustment of the variable knob on the analyzer.
2. Identification of abnormal waveforms is easier when there is a large output current (regulator is not operating). (Waveforms can be observed when the headlamps are illuminated.)
3. Check the conditions of the charging warning lamp (illuminated/not illuminated). Also, check the charging system totally.

Abnormal waveforms	Problem cause	Abnormal waveforms	Problem cause
Example 1  A7EL0120	Open diode	Example 4  A7EL0123	Short in stator coil
Example 2  A7EL0121	Short in diode	Example 5  A7EL0124 At this time, the charging warning lamp is illuminated.	Open supplementary diode
Example 3  A7EL0122	Broken wire in stator coil		





ALTERNATOR RELAY CONTINUITY CHECK

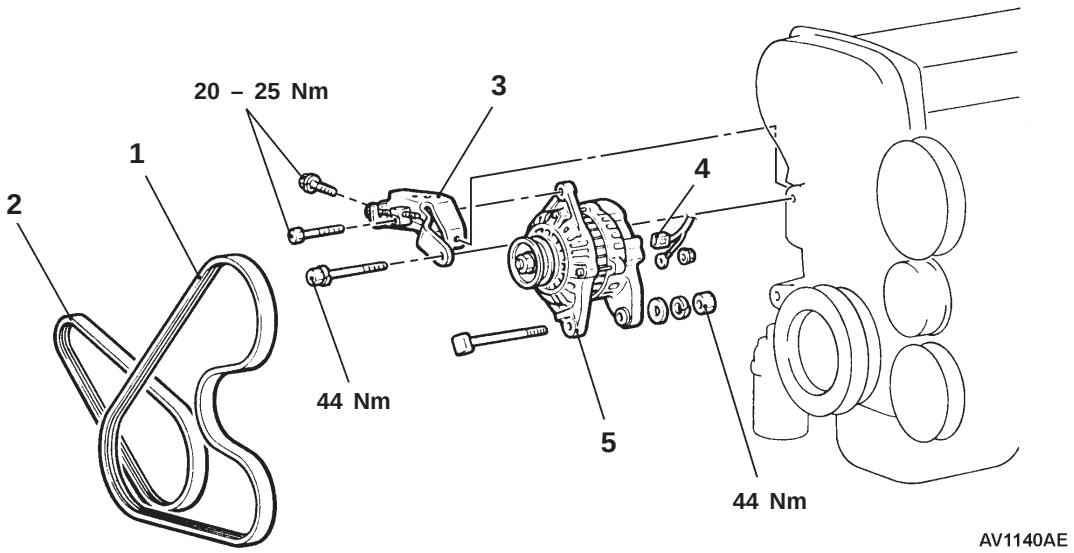
1. Remove the alternator relay from the relay box inside the instrument panel.
2. Set the analogue-type circuit tester to the Ω range and check that there is continuity when the (+) terminal of the tester is connected to terminal 2 of the alternator relay and the (–) terminal is connected to terminal 4.
3. Next, check that there is no continuity when the (+) terminal is connected to terminal 4 and the (–) terminal is connected to terminal 2.
4. If the continuity checks in steps 2 and 3 show a defect, replace the alternator relay.

ALTERNATOR

REMOVAL AND INSTALLATION

Pre-removal Operation
Under Cover Removal

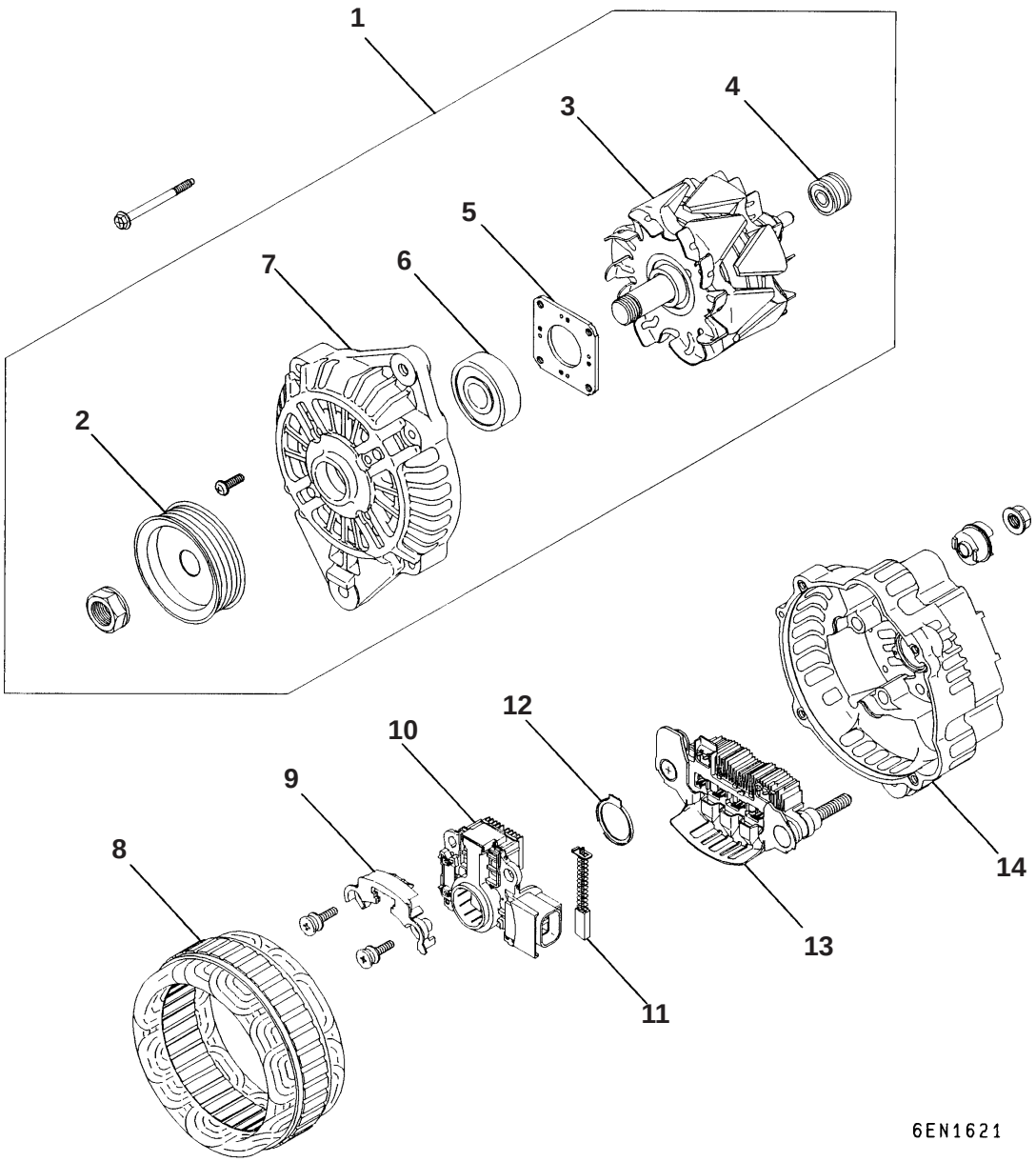
Post-installation Operation
- Drive Belt Tension Adjustment
- Under Cover Installation



Disassembly steps

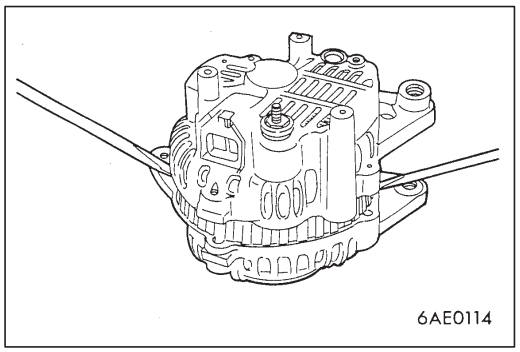
1. Drive belt (Power steering, A/C)
2. Drive belt (Alternator)
3. Alternator brace
4. Alternator connector
5. Alternator

DISASSEMBLY AND REASSEMBLY



Disassembly steps

◀A▶ 1. Front bracket assembly
◀B▶ 2. Alternator pulley
▶B◀ 3. Rotor
4. Rear bearing
5. Bearing retainer
6. Front bearing
7. Front bracket
◀C▶ 8. Stator
9. Plate
◀C▶ ▶A◀ 10. Regulator assembly
11. Brush
12. Slinger
13. Rectifier
14. Rear bracket

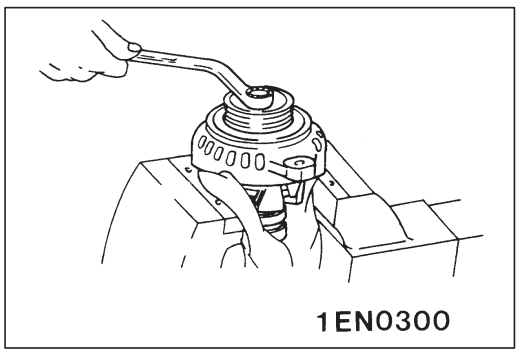


DISASSEMBLY SERVICE POINTS

◀A▶ FRONT BRACKET ASSEMBLY REMOVAL

Insert a flat tip screwdriver, etc., in the clearance between the front bracket assembly and stator core, to pry open and separate the stator and front bracket.

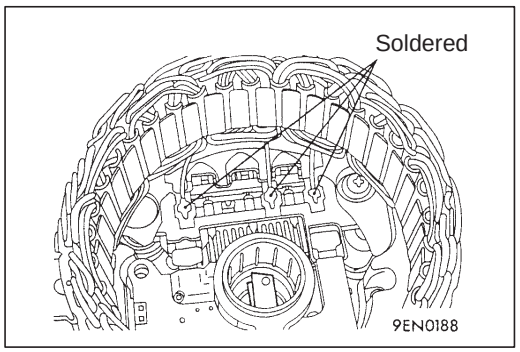
Caution
The stator coil could be damaged so do not insert the screwdriver too far.



◀B▶ ALTERNATOR PULLEY REMOVAL

Face the pulley side upward, fix the rotor with a work bench and remove the pulley.

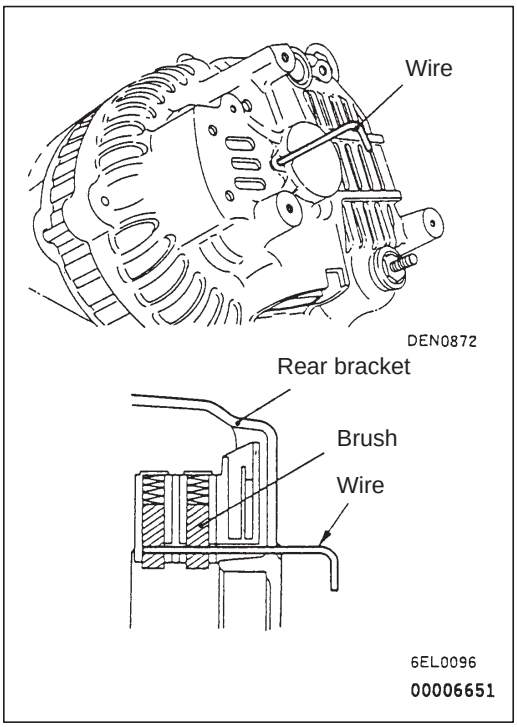
Caution
Use care so that the rotor is not damaged.



◀C▶ STATOR/REGULATOR ASSEMBLY REMOVAL

1. Use a soldering iron (180 to 250 W) to unsolder the stator. This work should complete within approximately four seconds to prevent heat from transferring to the diode.
2. When removing the rectifier from the regulator assembly, remove the soldered sections of the rectifier.

   Caution
   (1) Use care to make sure that the heat of the soldering iron is not transmitted to the diodes for a long period.
   (2) Use care that no undue force is exerted to the lead wires of the diodes.

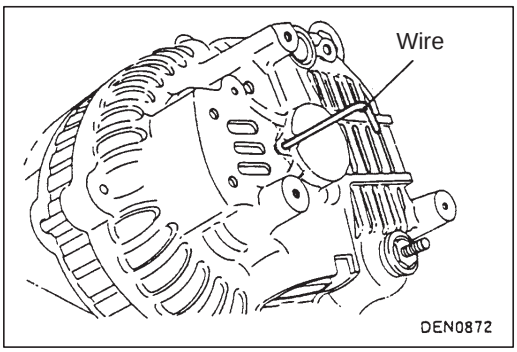


REASSEMBLY SERVICE POINTS

▶A◀ REGULATOR ASSEMBLY INSTALLATION

After installing the regulator assembly, insert a wire into the hole provided on the rear bracket while pressing in the brush to fix the brush.

NOTE
The brush is fixed when a wire is inserted, making rotor installation easier.



▶B◀ ROTOR INSTALLATION

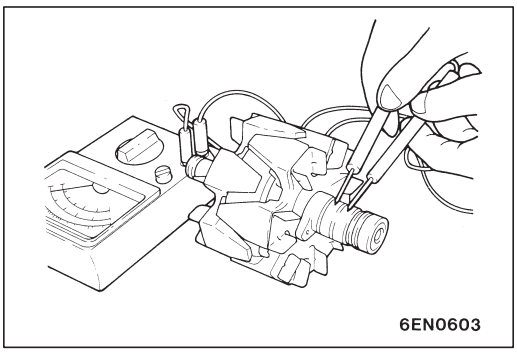
After installing the rotor, remove the wire used to fix the brush.

INSPECTION

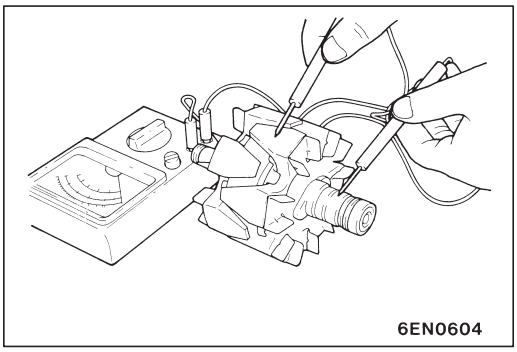
ROTOR CHECK

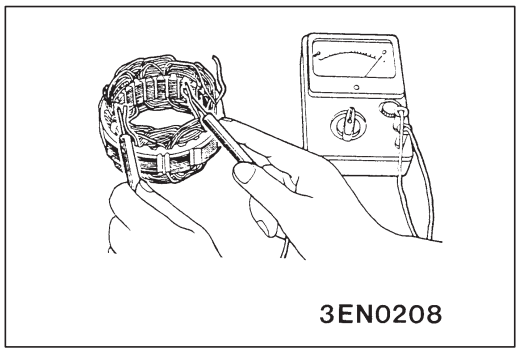
1. Check the continuity between the rotor coil slip rings, and replace the rotor if the resistance value is not at the standard value.

   Standard value: 3 – 5 Ω



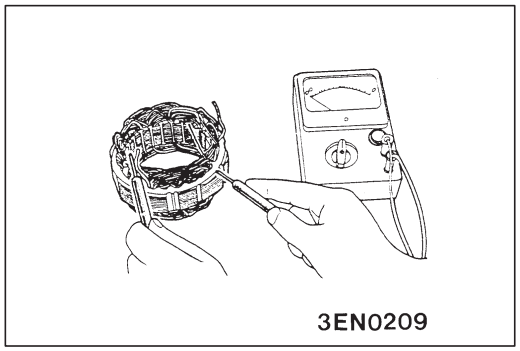
2. Check the continuity between the slip ring and core, and if there is continuity, replace the rotor.



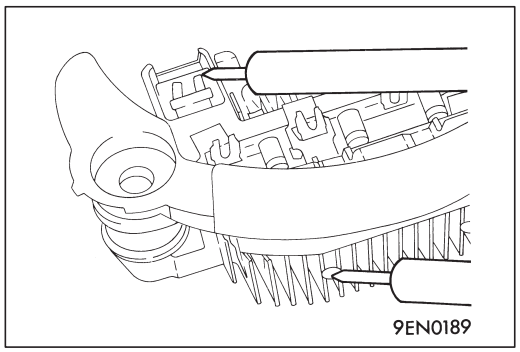


STATOR CHECK

1. Check the continuity between the coil leads, and if there is continuity, replace the stator.

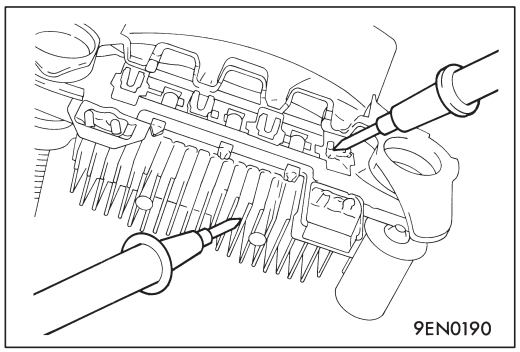


2. Check the continuity between the coil and core, and if there is continuity, replace the stator.

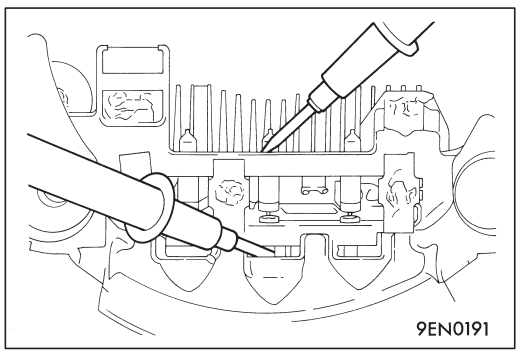


RECTIFIER CHECK

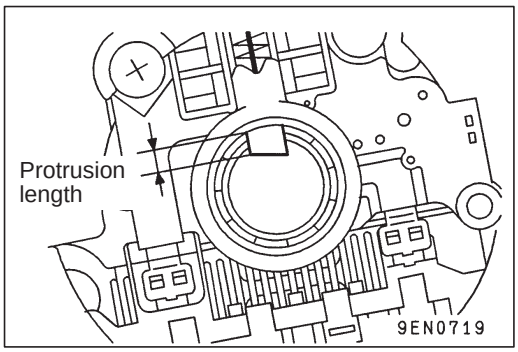
1. Inspect the (+) heat sink by checking the continuity between the (+) heat sink and stator coil lead wire connection terminal using a tester probe.
   If there is a continuity at both, the diode is short circuited, so replace the rectifier.



2. Inspect the (–) heat sink by checking the continuity between the (–) heat sink and stator coil lead wire connection terminal using a tester probe.
   If there is a continuity at both, the diode is short circuited, so replace the rectifier.



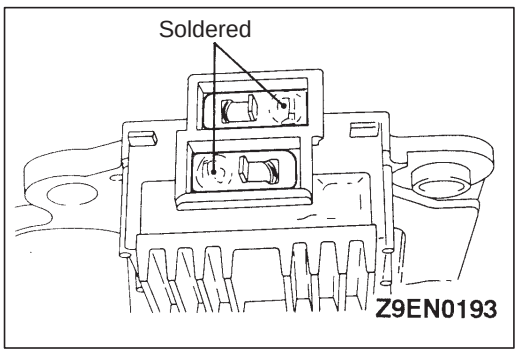
3. Check the diode trio by connecting an ohmmeter to both ends of each diode and check the continuity of the three diodes.
   If there is a continuity at both ends, or if there is no continuity, the diode is damaged so replace the rectifier.



BRUSH CHECK

1. Measure the length of the brush protrusion shown in the illustration, and replace the brush if the measured value is below the limit value.

   Limit: 2 mm or less



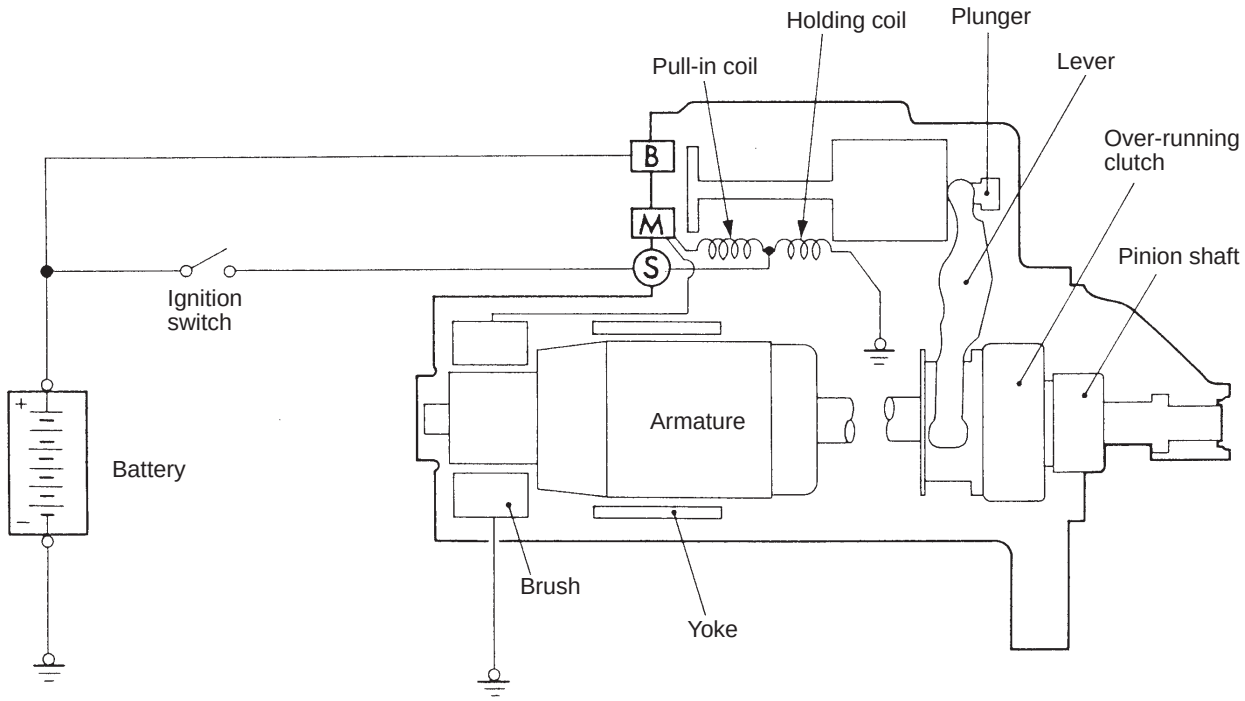
2. The brush can be removed if the solder of the brush lead wire is removed.
3. When installing a new brush, insert the brush into the holder as shown in the illustration, and then solder the lead wires.

STARTING SYSTEM

GENERAL INFORMATION

If the ignition switch is turned to the "START" position, current flows in the pull-in and holding coils provided inside magnetic switch, attracting the plunger. When the plunger is attracted, the lever connected to the plunger is actuated to engage the starter clutch.
On the other hand, attracting the plunger will turn on the magnetic switch, allowing the B-terminal and M-terminal to conduct. Thus, current flows to engage the starter motor.
When the ignition switch is returned to the "ON" position after starting the engine, the starter clutch is disengaged from the ring gear.
An overrunning clutch is provided between the pinion and the armature shaft, to prevent damage to the starter.

SYSTEM DIAGRAM



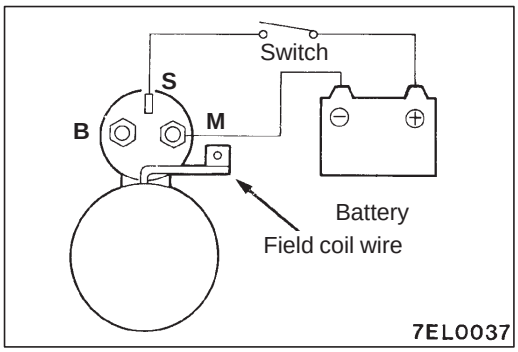
6EN0939

STARTER MOTOR SPECIFICATIONS

Items	Specifications
Type	Reduction drive with planetary gear
Rated output kW/V	1.2/12
No. of pinion teeth	8

SERVICE SPECIFICATIONS

Items	Standard value	Limit
Pinion gap mm	0.5–2.0	–
Commutator outer diameter mm	29.4	28.8
Commutator runout mm	–	0.05
Commutator undercut mm	0.5	0.2



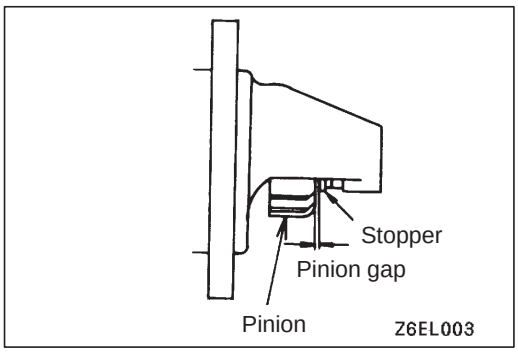
STARTER MOTOR

INSPECTION

PINION GAP ADJUSTMENT

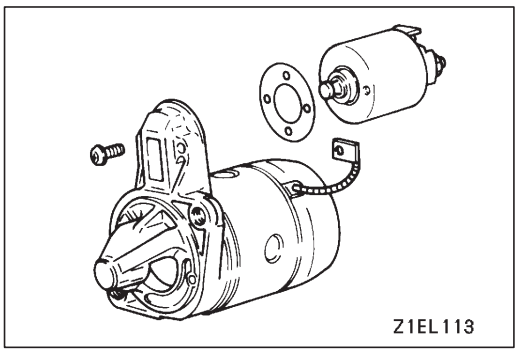
1. Disconnect field coil wire from M-terminal of magnetic switch.
2. Connect a 12-volt battery between S-terminal and M-terminal.
3. Set switch to “ON”, and pinion will move out.

Caution
This test must be performed quickly (in less than 10 seconds) to prevent coil from burning.

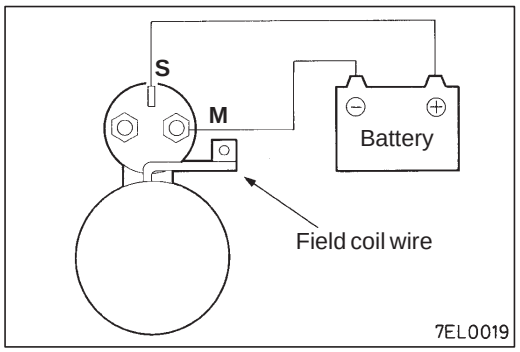


4. Check pinion to stopper clearance (pinion gap) with a thickness gauge.

   Standard value: 0.5 – 2.0 mm



5. If pinion gap is out of specification, adjust by adding or removing gaskets between magnetic switch and front bracket.

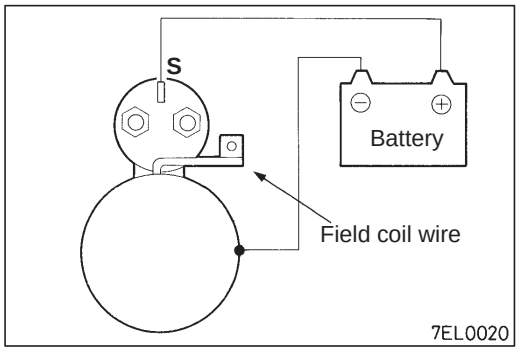


MAGNETIC SWITCH PULL-IN TEST

1. Disconnect field coil wire from M-terminal of magnetic switch.
2. Connect a 12-volt battery between S-terminal and M-terminal.

   Caution
   This test must be performed quickly (in less than 10 seconds) to prevent coil from burning.

3. If pinion moves out, then pull-in coil is good. If it doesn't, replace magnetic switch.

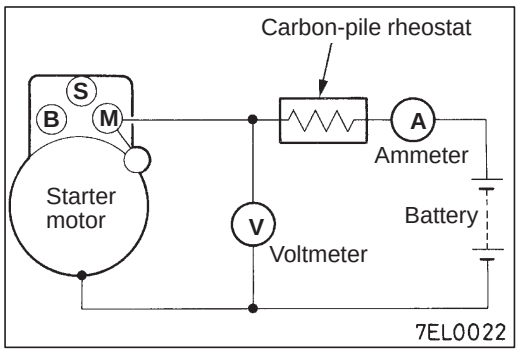


MAGNETIC SWITCH HOLD-IN TEST

1. Disconnect field coil wire from M-terminal of magnetic switch.
2. Connect a 12-volt battery between S-terminal and body.

   Caution
   This test must be performed quickly (in less than 10 seconds) to prevent coil from burning.

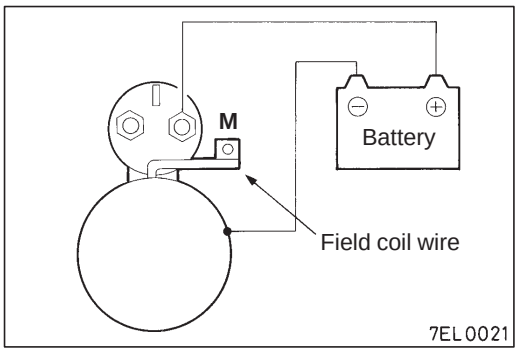
3. Manually pull out the pinion as far as the pinion stopper position.
4. If pinion remains out, everything is in order. If pinion moves in, hold-in circuit is open. Replace magnetic switch.



FREE RUNNING TEST

1. Place starter motor in a vise equipped with soft jaws and connect a fully-charged 12-volt battery to starter motor as follows:
2. Connect a test ammeter (100-ampere scale) and carbon pile rheostat in series with battery positive post and starter motor terminal.
3. Connect a voltmeter (15-volt scale) across starter motor.
4. Rotate carbon pile to full-resistance position.
5. Connect battery cable from battery negative post to starter motor body.
6. Adjust the rheostat until the battery voltage shown by the voltmeter is 11-volt.
7. Confirm that the maximum amperage is within the specifications and that the starter motor turns smoothly and freely.

   Current: max. 90 A



MAGNETIC SWITCH RETURN TEST

1. Disconnect field coil wire from M-terminal of magnetic switch.
2. Connect a 12-volt battery between M-terminal and body.

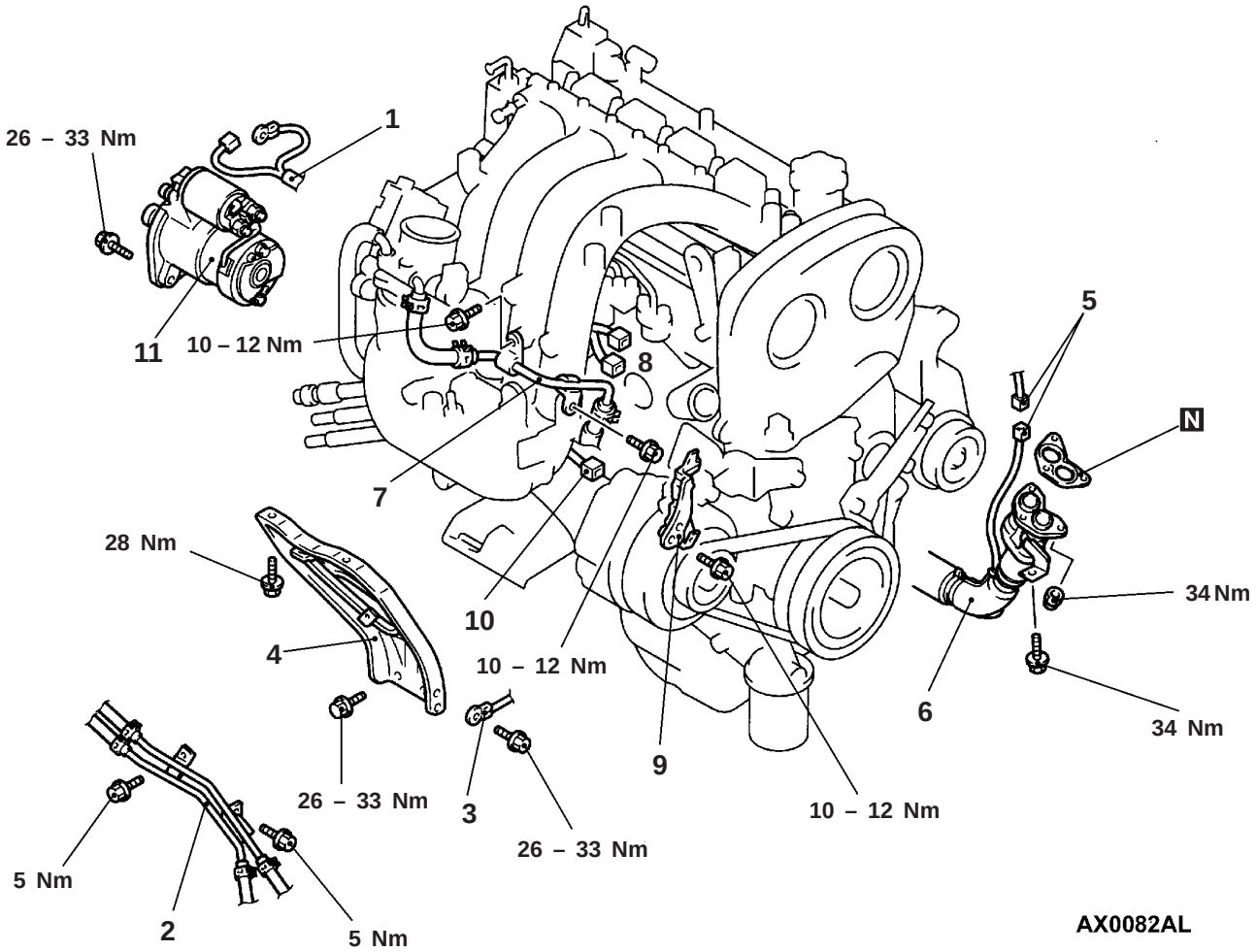
   Caution
   This test must be performed quickly (in less than 10 seconds) to prevent coil from burning.

3. Pull pinion out and release. If pinion quickly returns to its original position, everything is in order. If it doesn't, replace magnetic switch.

   Caution
   Be careful not to get your fingers caught when pulling out the pinion.

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Cover and Under Cover Removal and Installation
- Front Propeller Shaft Removal and Installation (Refer to GROUP 25.)



Disassembly steps

1. Starter harness connection
2. A/T oil pipe clamp
3. Earth cable connection
4. Intake manifold stay
5. Oxygen sensor connector connection
6. Front exhaust pipe connection
◀A▶ ▶A◀ • Transmission mount crossmember
7. Water pipe clamp
8. Injector harness connector connection
9. Harness connector bracket
10. Detonation sensor connector connection
◀B▶ 11. Starter motor assembly

REMOVAL SERVICE POINTS

◀A▶ TRANSMISSION MOUNT CROSSMEMBER REMOVAL

1. Remove the transmission mount crossmember. (Refer to GROUP 32.)
2. Lower the jack holding the engine and transmission assembly to create clearance enough to remove the starter motor installation bolts.

◀B▶ STARTER MOTOR ASSEMBLY REMOVAL

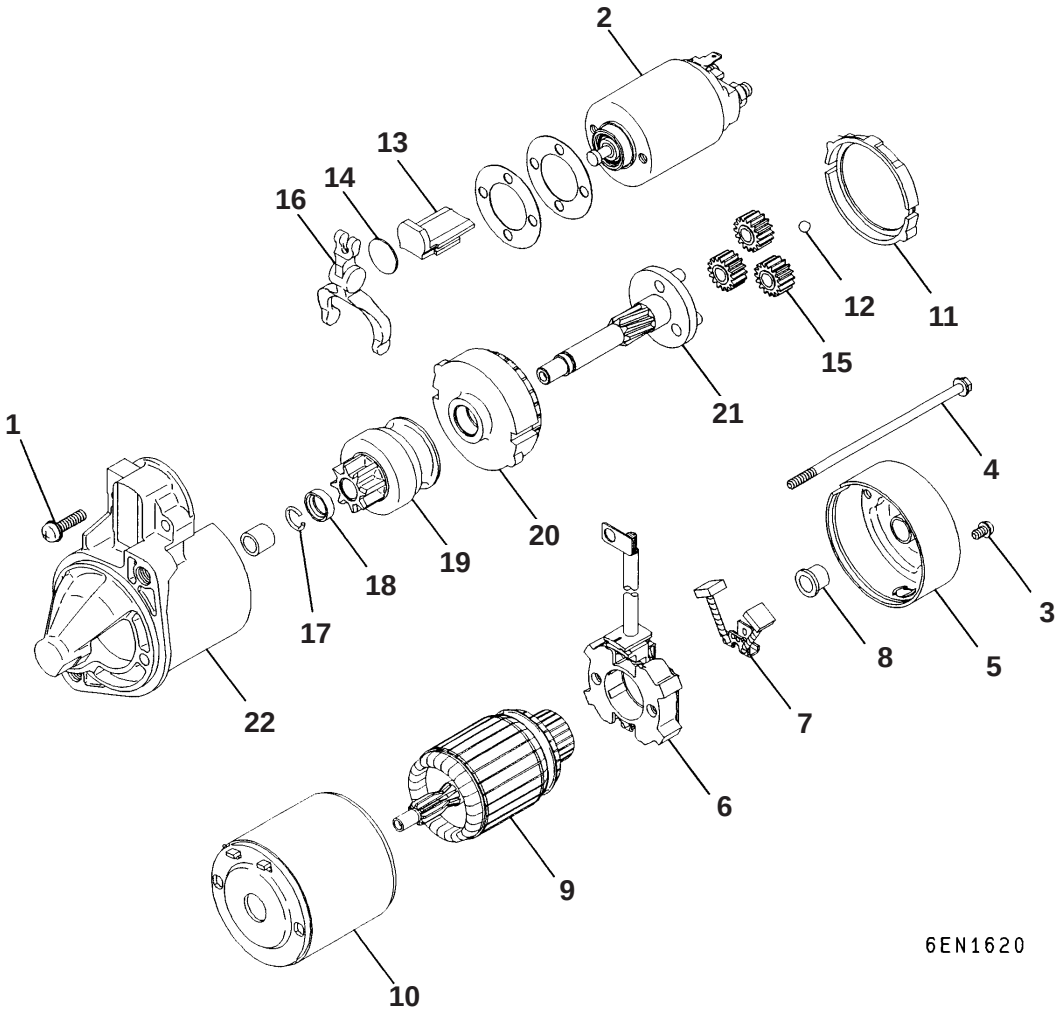
Pull the starter motor assembly out of space between the intake manifold and cylinder block.

INSTALLATION SERVICE POINT

▶A◀ TRANSMISSION MOUNT CROSSMEMBER INSTALLATION

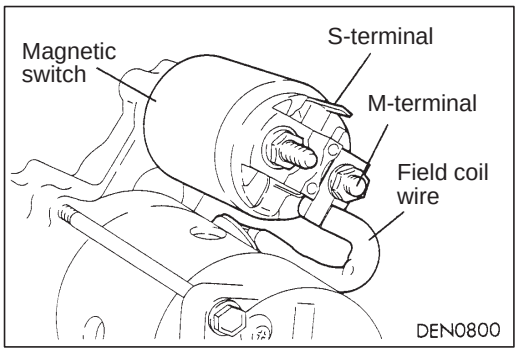
Refer to GROUP 32.

DISASSEMBLY AND REASSEMBLY



Disassembly steps

1. Screw
◀A▶ 2. Magnetic switch
3. Screw
4. Through bolt
5. Rear bracket
6. Brush holder
7. Brush
8. Rear bearing
◀B▶ 9. Armature
10. Yoke assembly
◀B▶ 11. Ball
12. Packing A
13. Packing B
14. Plate
15. Planetary gear
16. Lever
◀C▶ ▶A◀ 17. Snap ring
◀C▶ ▶A◀ 18. Stop ring
19. Overrunning clutch
20. Internal gear
21. Planetary gear holder
22. Front bracket



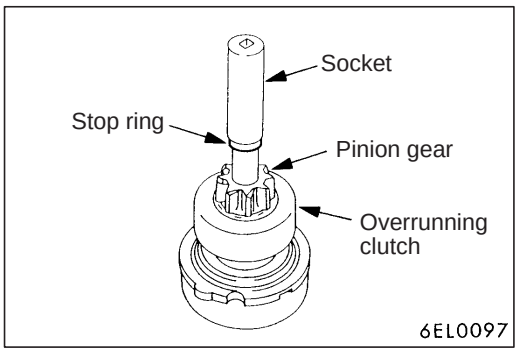
DISASSEMBLY SERVICE POINTS

◀A▶ MAGNETIC SWITCH REMOVAL

Disconnect the field coil wire from M-terminal of the magnetic switch.

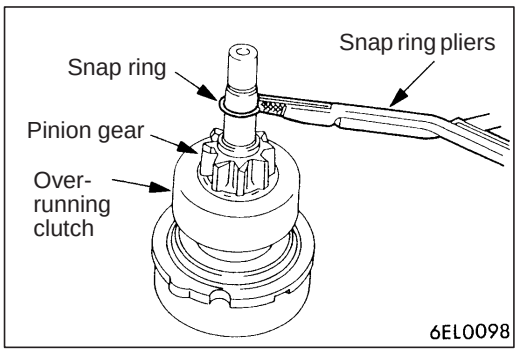
◀B▶ ARMATURE AND BALL REMOVAL

When removing the armature, do not lose the ball placed at the end as a bearing.



◀C▶ SNAP RING/STOP RING REMOVAL

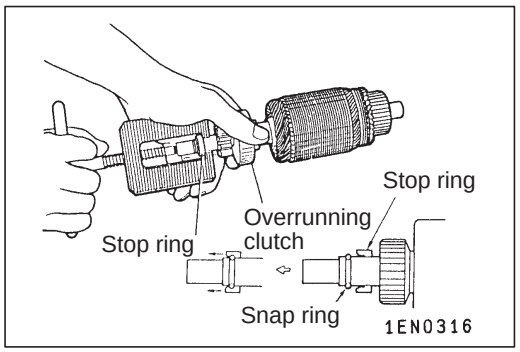
1. Using an appropriate wrench socket, push the stop ring toward the overrunning clutch.



2. Remove the snap ring with snap ring pliers and then remove the stop ring and overrunning clutch.

STARTER MOTOR PARTS CLEANING

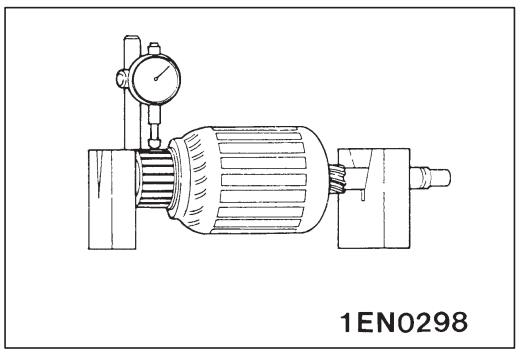
1. Do not immerse the parts in cleaning solvent. Immersing the yoke and field coil assembly and/or armature will damage insulation. Wipe these parts with a cloth only.
2. Do not immerse the drive unit in cleaning solvent. The overrunning clutch is pre-lubricated at the factory and solvent will wash lubrication from clutch.
3. The drive unit may be cleaned with a brush moistened with cleaning solvent and wiped dry with a cloth.



REASSEMBLY SERVICE POINTS

▶A◀ STOP RING/SNAP RING INSTALLATION

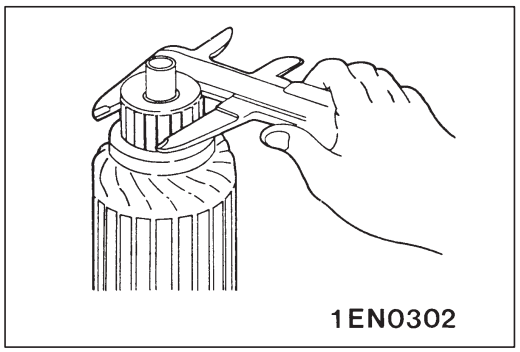
Using an appropriate tool, pull the stop ring over the snap ring.



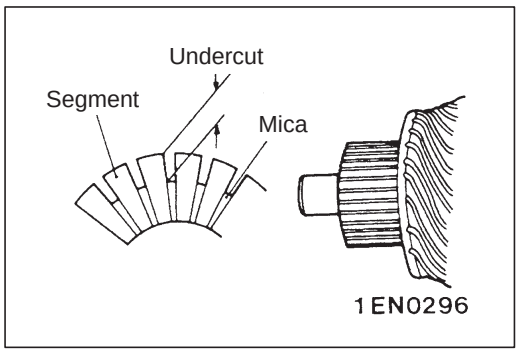
INSPECTION

COMMUTATOR

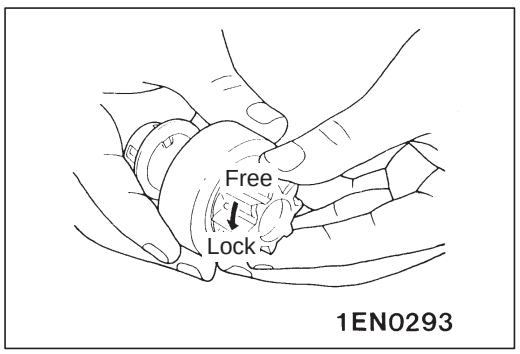
1. Place the armature in a pair of “V” blocks and check the runout with a dial indicator.
   Standard value: 0.05 mm
   Limit: 0.1 mm



2. Measure the commutator outer diameter.
   Standard value: 29.4 mm
   Limit: 28.8 mm

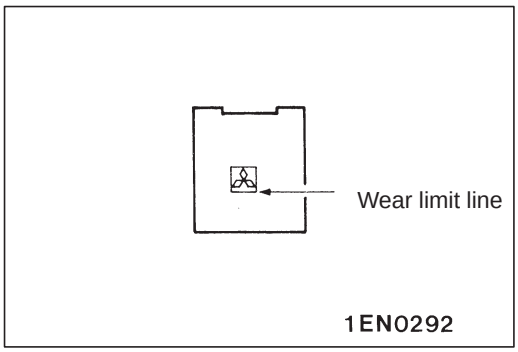


3. Check the undercut depth between segments.
   Standard value: 0.5 mm
   Limit: 0.2 mm



OVERRUNNING CLUTCH

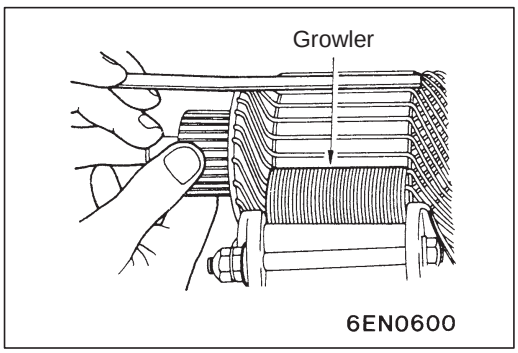
1. Check that the pinion locks when it is turned anti-clockwise and moves smoothly when it is turned clockwise.
2. Check the pinion for wear or damage.



BRUSH

1. Check the brush for roughness of the surface that contacts the commutator and check the brush length.

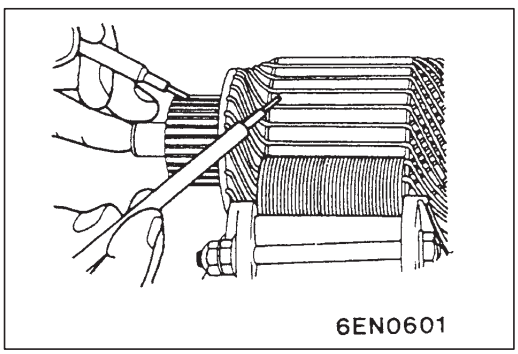
   Limit: Wear limit line
2. In case the contacting surface has been corrected or the brush has been replaced, correct the contacting surface by winding sandpaper around the commutator.



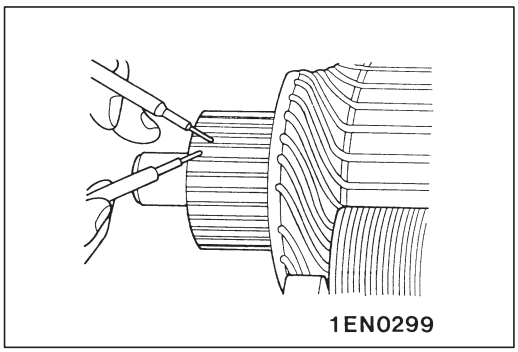
ARMATURE COIL SHORT-CIRCUIT TEST

1. Place armature in a growler.
2. Hold a thin steel blade parallel and just above while rotating armature slowly in growler. A shorted armature will cause blade to vibrate and be attracted to the core. Replace shorted armature.

   Caution
   Clean the armature surface thoroughly before checking.



3. Check the insulation between each commutator segment and armature coil core.
   If there is no continuity, the insulation is in order.



ARMATURE COIL OPEN-CIRCUIT INSPECTION

Check the continuity between segments. If there is continuity, the coil is in order.

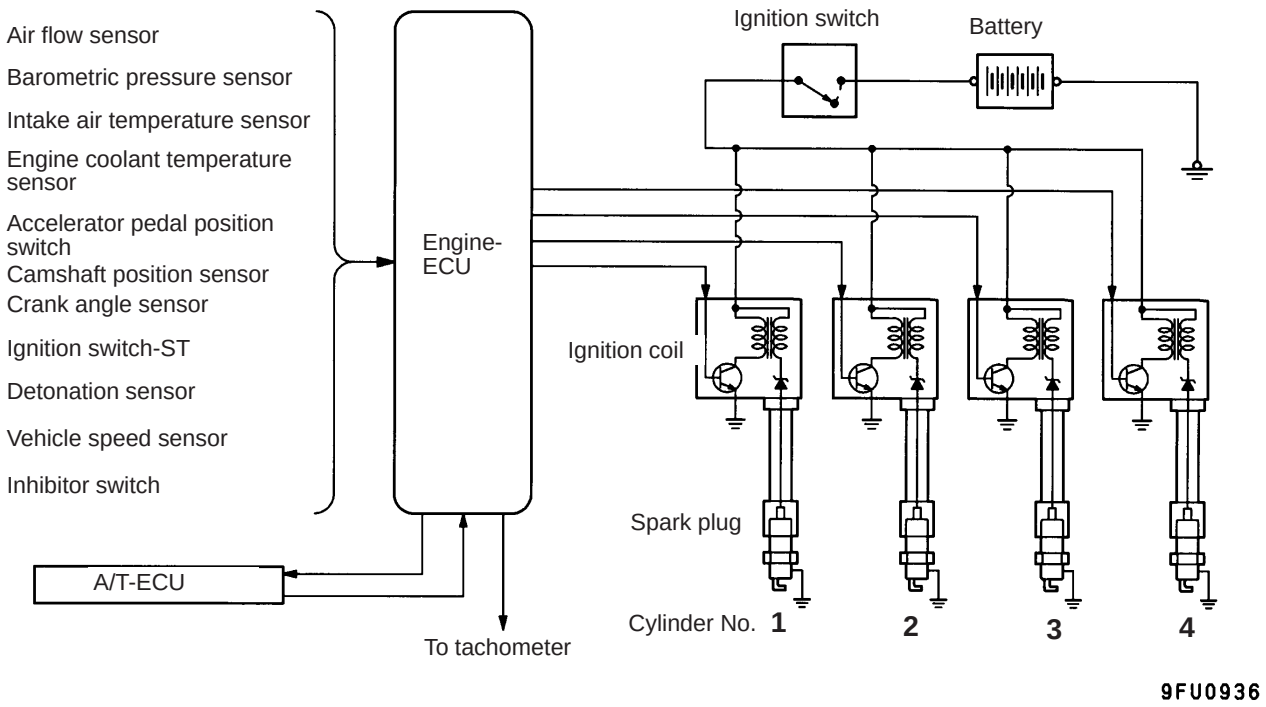
IGNITION SYSTEM

GENERAL INFORMATION

This system is equipped with four ignition coils with built-in power transistors for each of the cylinders. Interruption of the primary current flowing in the primary side of an ignition coil generates a high voltage in the secondary side of the ignition coil. The high voltage thus generated is applied to the spark plugs to generate sparks.
The engine-ECU turns the power transistors inside the ignition coils alternately on and off. This causes the primary currents in the ignition coils to be alternately interrupted and allowed to flow to fire the cylinders in the order 1 – 3 – 4 – 2.

The engine-ECU determines which ignition coil should be controlled by means of the signals from the camshaft position sensor and the crank angle sensor. It also detects the crankshaft position, in order to provide ignition at the most appropriate timing in response to the engine operation conditions.
When the engine is cold or running at high altitudes, the ignition timing is slightly advanced to provide optimum performance. Furthermore, if knocking occurs, the ignition timing is gradually retarded until knocking ceases.

SYSTEM DIAGRAM



IGNITION COIL SPECIFICATIONS

Items	Specifications
Type	Molded 4-coil

SPARK PLUG SPECIFICATIONS

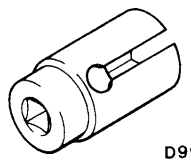
Items	Specifications
NGK	IZFR6B

SERVICE SPECIFICATIONS

SPARK PLUG

Items	Standard value	Limit
Spark plug gap mm	0.5 – 0.6	0.75
Spark plug insulation resistance MΩ	–	1

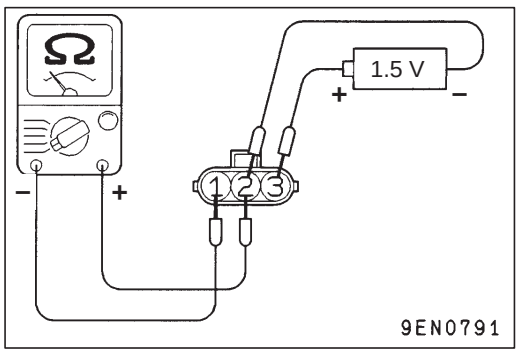
SPECIAL TOOL

Tool	Number	Name	Use
 D998773	MD998773	Detonation sensor wrench	Detonation sensor removal and installation

ON-VEHICLE SERVICE

IGNITION COIL (WITH BUILT-IN POWER TRANSISTOR) CHECK

Check by the following procedure, and replace if there is a malfunction.



PRIMARY COIL AND POWER TRANSISTOR CONTINUITY CHECK

NOTE
1. An analogue-type circuit tester should be used.
2. Connect the negative (–) prove of the circuit tester to terminal 1.

Caution
This test must be performed quickly (in less than 10 seconds) to prevent coil from burning and power transistor from breakage.

Voltage: 1.5V	Terminal No.		
	1	2	3
When current is flowing	○	⊖	⊕
When current is not flowing			

SECONDARY COIL CHECK

NOTE
It is impossible to check the secondary coil through the continuity check as a diode is integrated in the secondary coil circuit of this ignition coil. So, check the secondary coil in the following procedure.

1. Disconnect the ignition coil connector.
2. Remove the ignition coil and install a new spark plug to the ignition coil.
3. Connect the ignition coil connector.
4. Earth the side electrode of the spark plug and crank the engine.
5. Check that spark is produced between the electrodes of the spark plug.
6. If no spark is produced, replace the ignition coil with a new one and recheck.
7. If spark is produced with the new ignition coil, replace the old one as it is faulty. If no spark is produced again, the ignition circuit is suspected as faulty. Check the ignition circuit.

SPARK PLUG CHECK AND CLEANING

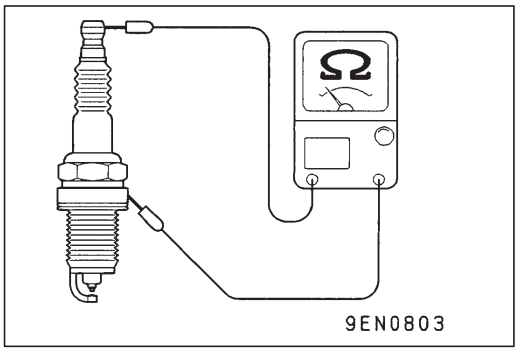
CAUTION

1. **Do not adjust the gap for iridium plugs.**
2. **The iridium tips may become damaged when iridium plugs are cleaned. Accordingly, if the plugs are sooty and need to be cleaned, use a plug cleaner in order to protect the terminals, and do not clean for more than 20 seconds. Tools such as wire brushes must never be used.**
3. **The terminals of iridium plugs may become blackened, even when the plugs are functioning normally. However, the carbon which is deposited onto these plugs burns off more easily than for conventional spark plugs, so such blackening is not normally a problem. Measure the insulation resistance of the spark plug to judge if the plug is still usable or not.**

(1) Check the plug gap, and replace the plug if the gap is greater than the limit value.

Standard Valve : 0.5 – 0.6 mm

Limit : 0.75 mm



(2) Measure the insulation resistance of the spark plug, and replace the plug if the resistance is below the limit value.

Limit : 1 MΩ

CAMSHAFT POSITION SENSOR CHECK

Refer to GROUP 13A – Troubleshooting.

CRANK ANGLE SENSOR CHECK

Refer to GROUP 13A – Troubleshooting.

DETONATION SENSOR CHECK

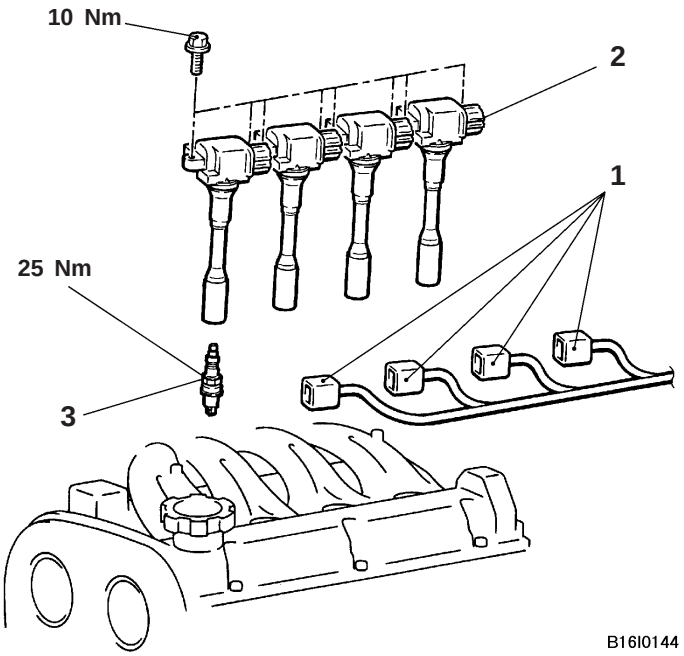
Check the detonation sensor circuit if self-diagnosis code, No. 31 is shown.

NOTE
For information concerning the self-diagnosis codes, refer to GROUP 13A – Troubleshooting .

IGNITION COIL

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Cover Removal and Installation
- Resonance Tank Removal and Installation (Refer to GROUP 15.)
- Air Cleaner Assembly and Air Intake Hose Removal and Installation



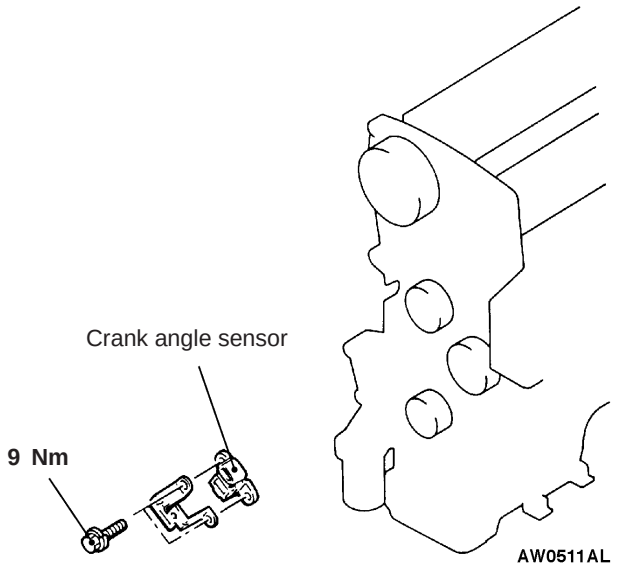
Disassembly steps

1. Ignition Coil Connector
2. Ignition Coil
3. Spark Plug

CRANK ANGLE SENSOR

REMOVAL AND INSTALLATION

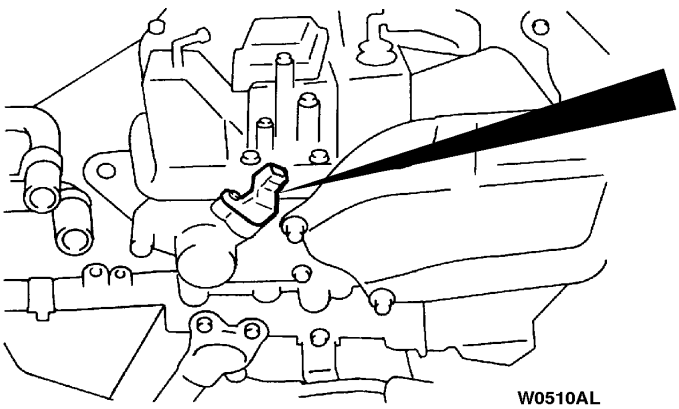
Pre-removal and Post-installation Operation
Timing Belt Front Lower Cover Removal and Installation
(Refer to GROUP 11.)

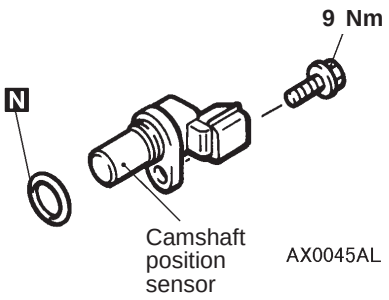


CAMSHAFT POSITION SENSOR

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Engine Cover Removal and Installation

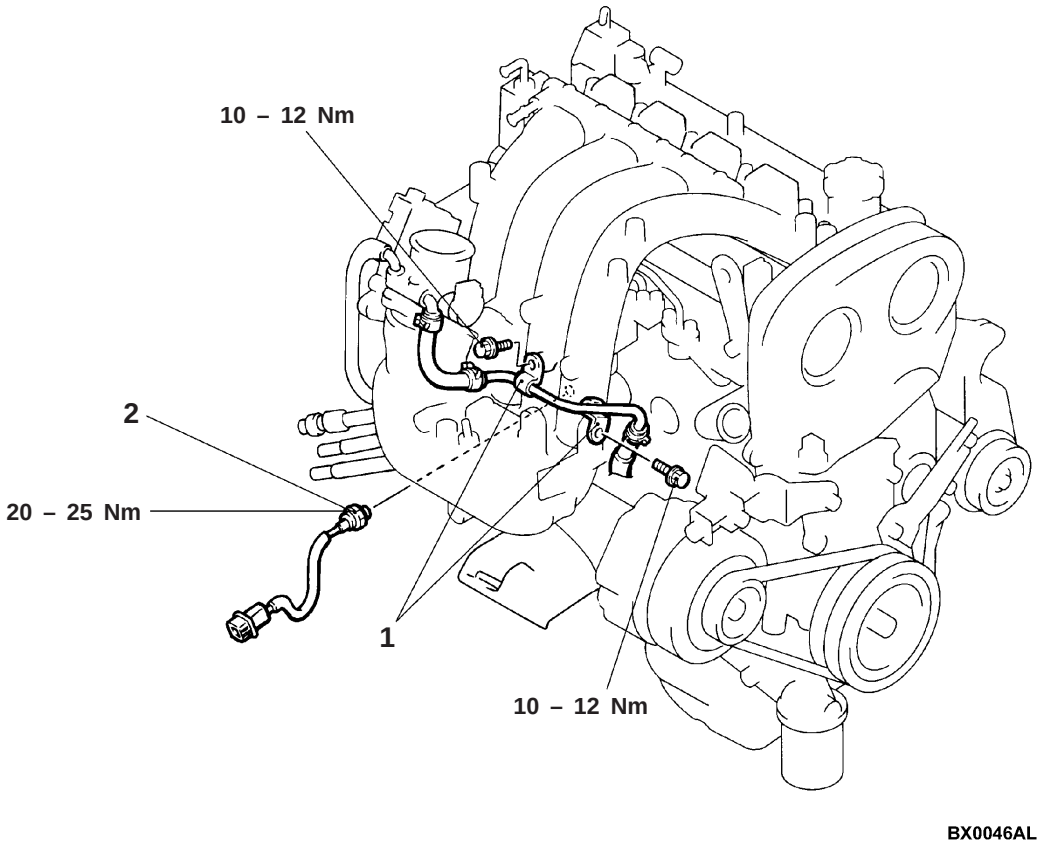




DETONATION SENSOR

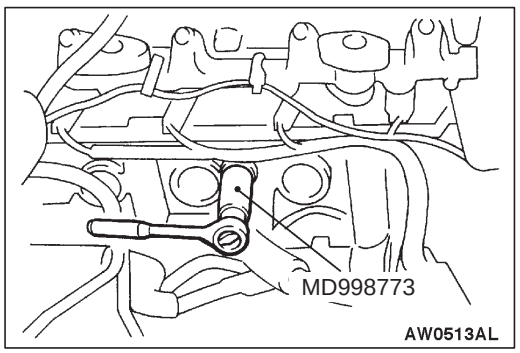
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Cover Removal and Installation



Disassembly steps

◀A▶ ▶A◀ 1. Water pipe clamp
2. Detonation sensor



REMOVAL SERVICE POINT
◀A▶ DETONATION SENSOR REMOVAL

INSTALLATION SERVICE POINT
▶A◀ DETONATION SENSOR INSTALLATION

NOTES

GROUP 16
ENGINE ELECTRICAL

IGNITION SYSTEM

GENERAL

OUTLINE OF CHANGES

The 4G93-GDI engine has been replaced with the 4G94-GDI engine. Due to this, the following service adjustment procedures have been changed. Other procedures are the same as the conventional 4G93-GDI engine.

- An ignition failure sensor has been added.
- The spark plug type has been changed.

GENERAL INFORMATION

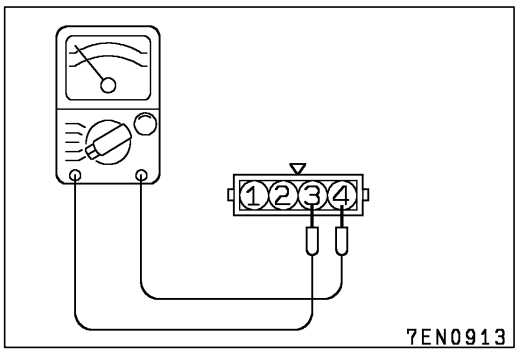
SPARK PLUG SPECIFICATION

Items	Specifications
NGK	IZFR5B

SERVICE INFORMATION

IGNITION FAILURE SENSOR

Items	4G94-GDI
Resistance Ω	0.1 or less



ON-VEHICLE SERVICE

IGNITION FAILURE SENSOR CHECK

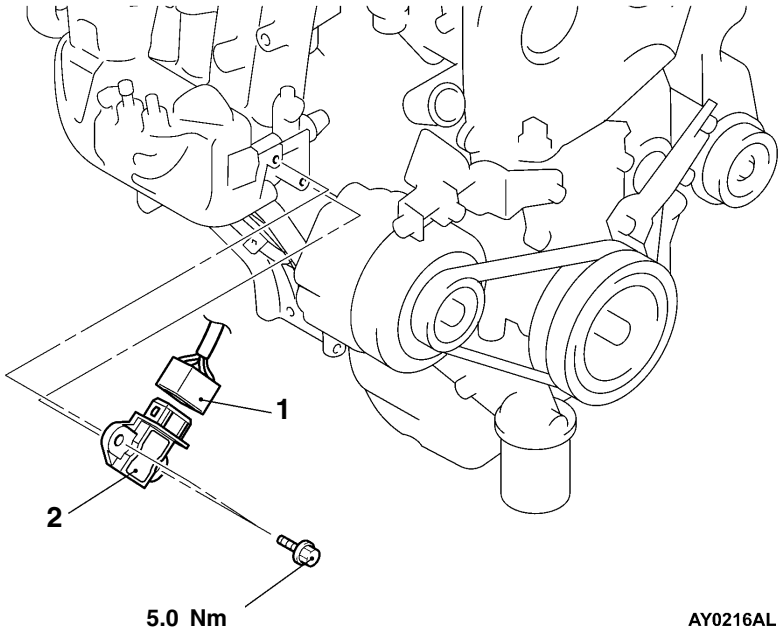
NOTE
An analog-type circuit tester should be used.

Check that the resistance between terminals 3 and 4 is at the standard value.

Standard value: 0.1 Ω or less

IGNITION FAILURE SENSOR

REMOVAL AND INSTALLATION



Removal steps

1. Ignition failure sensor connector
2. Ignition failure sensor

ENGINE ELECTRICAL

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CHARGING SYSTEM

GENERAL

OUTLINE OF CHANGES

The following contents have been established to correspond to the addition of vehicles with 4G9-MPI engine. Other specifications are the same as for the 4G9-GDI engine.

GENERAL INFORMATION

ALTERNATOR SPECIFICATIONS

Items	4G9-MPI
Type	Battery voltage sensing
Rated output V/A	12/85
Voltage regulator	Electronic built-in type

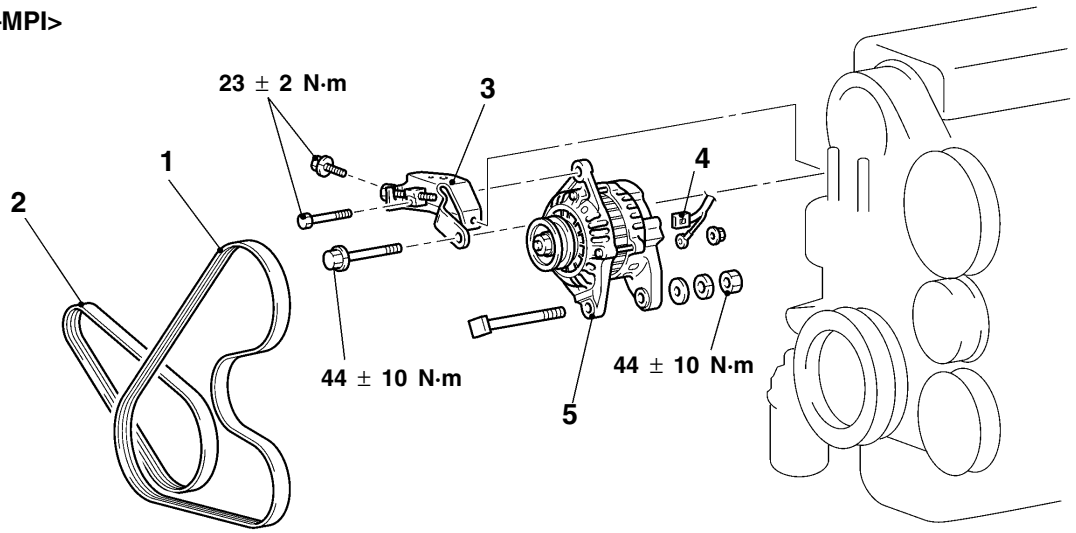
ALTERNATOR

REMOVAL AND INSTALLATION

Pre-removal Operation
Under Cover Removal

Post-installation Operation
- Drive Belt Tension Adjustment
- Under Cover Installation

<4G9–MPI>

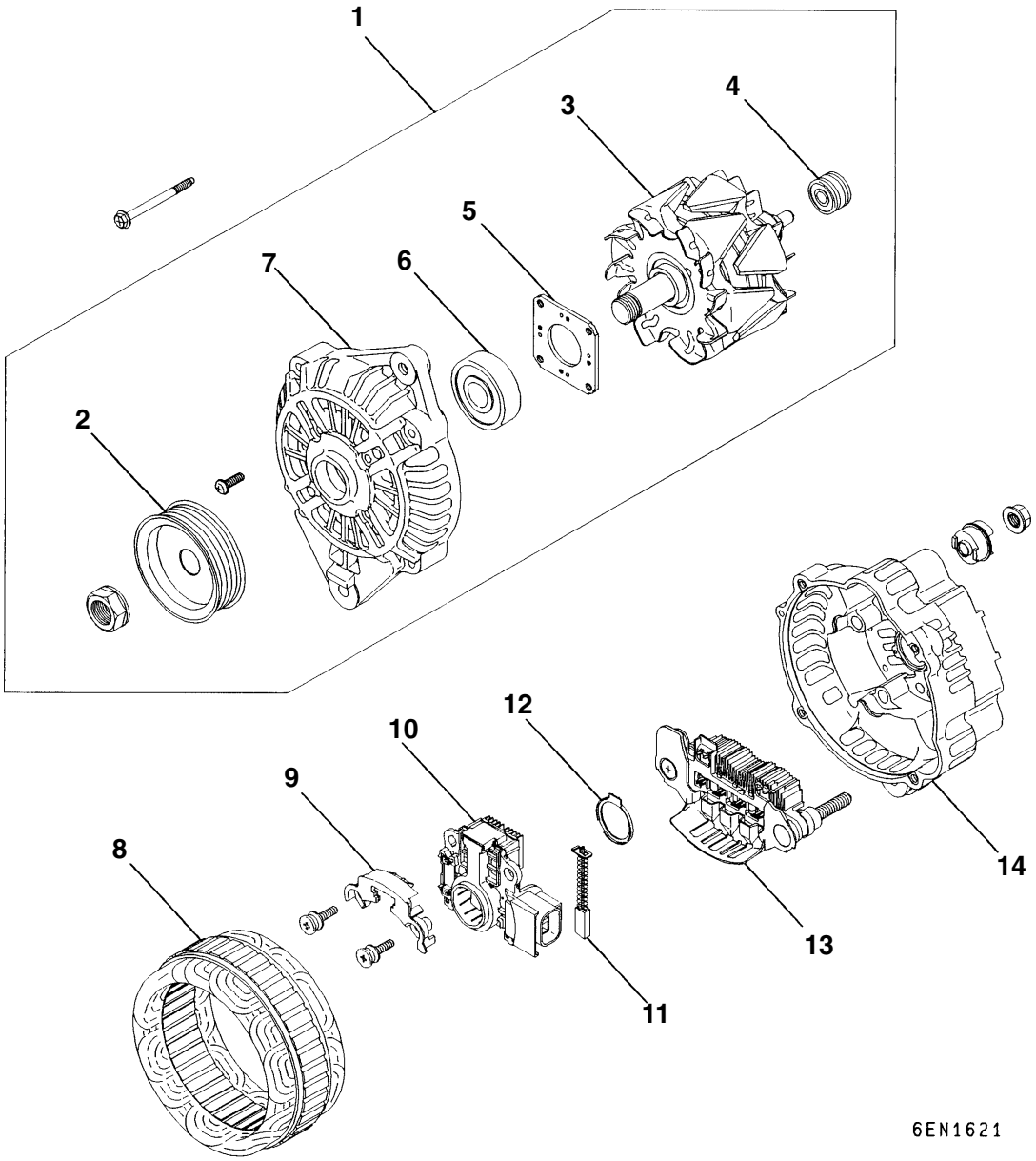


AC103722AB

Disassembly steps

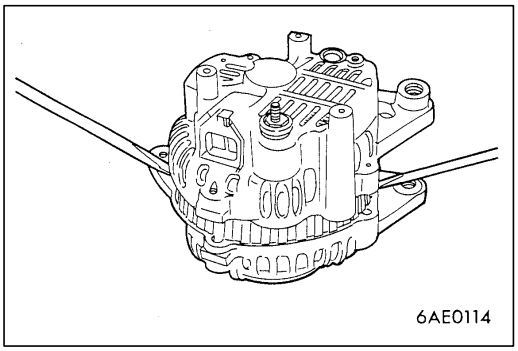
1. Drive belt (Power steering, A/C)
2. Drive belt (Alternator)
3. Alternator brace
4. Alternator connector
5. Alternator

DISASSEMBLY AND REASSEMBLY



Disassembly steps

◀A▶ ◀B▶ 1. Front bracket assembly
2. Alternator pulley
▶B◀ 3. Rotor
4. Rear bearing
5. Bearing retainer
6. Front bearing
7. Front bracket
◀C▶ 8. Stator
9. Plate
◀C▶ ▶A◀ 10. Regulator assembly
11. Brush
12. Slinger
13. Rectifier
14. Rear bracket

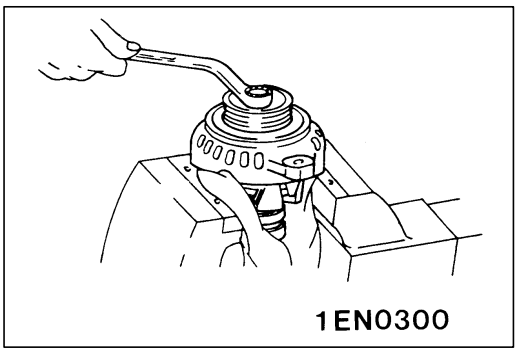


DISASSEMBLY SERVICE POINTS

◀A▶ FRONT BRACKET ASSEMBLY REMOVAL

Insert a flat tip screwdriver, etc., in the clearance between the front bracket assembly and stator core, to pry open and separate the stator and front bracket.

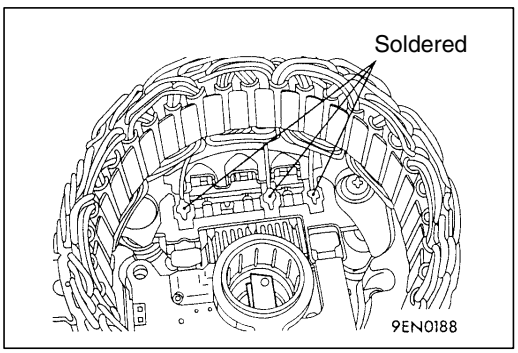
Caution
The stator coil could be damaged so do not insert the screwdriver too far.



◀B▶ ALTERNATOR PULLEY REMOVAL

Face the pulley side upward, fix the rotor with a work bench and remove the pulley.

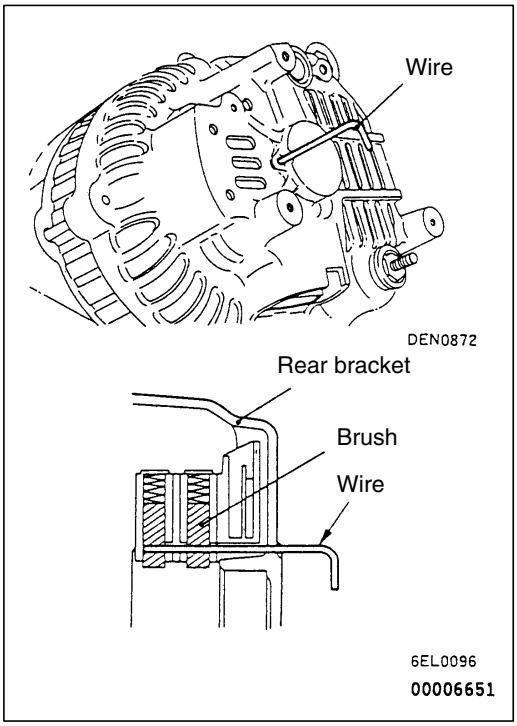
Caution
Use care so that the rotor is not damaged.



◀C▶ STATOR/REGULATOR ASSEMBLY REMOVAL

1. Use a soldering iron (180 to 250 W) to unsolder the stator. This work should complete within approximately four seconds to prevent heat from transferring to the diode.
2. When removing the rectifier from the regulator assembly, remove the soldered sections of the rectifier.

   Caution
   (1) Use care to make sure that the heat of the soldering iron is not transmitted to the diodes for a long period.
   (2) Use care that no undue force is exerted to the lead wires of the diodes.

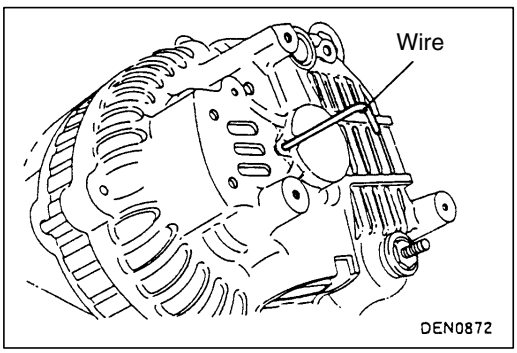


REASSEMBLY SERVICE POINTS

▶A◀ REGULATOR ASSEMBLY INSTALLATION

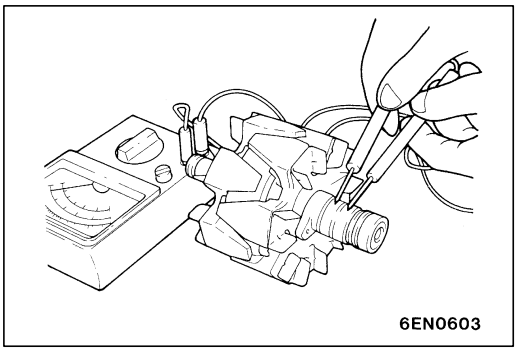
After installing the regulator assembly, insert a wire into the hole provided on the rear bracket while pressing in the brush to fix the brush.

NOTE
The brush is fixed when a wire is inserted, making rotor installation easier.



▶B◀ ROTOR INSTALLATION

After installing the rotor, remove the wire used to fix the brush.

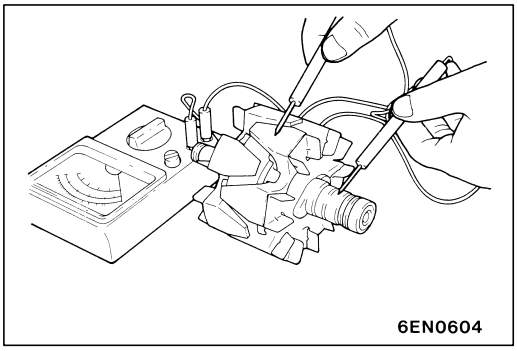


INSPECTION

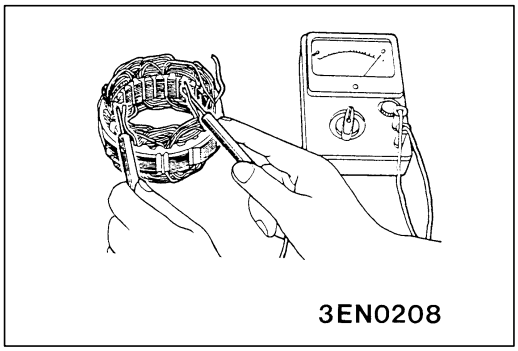
ROTOR CHECK

1. Check the continuity between the rotor coil slip rings, and replace the rotor if the resistance value is not at the standard value.

   Standard value: 3 – 5 Ω

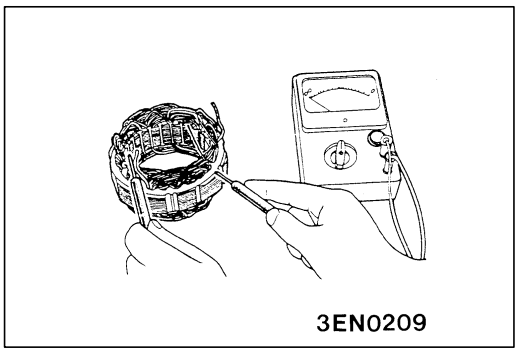


2. Check the continuity between the slip ring and core, and if there is continuity, replace the rotor.

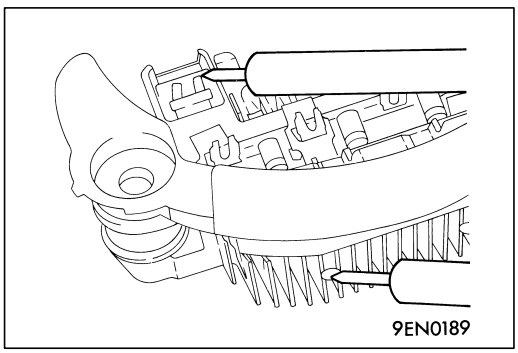


STATOR CHECK

1. Check the continuity between the coil leads, and if there is continuity, replace the stator.

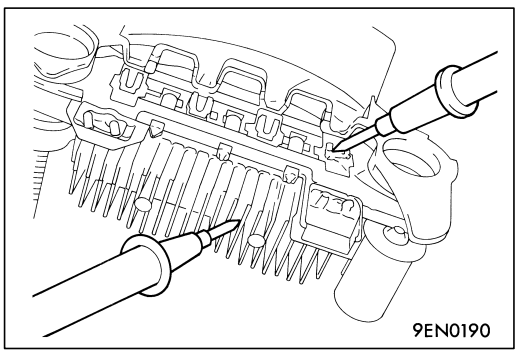


2. Check the continuity between the coil and core, and if there is continuity, replace the stator.

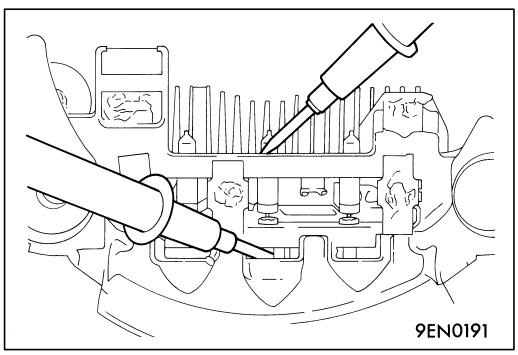


RECTIFIER CHECK

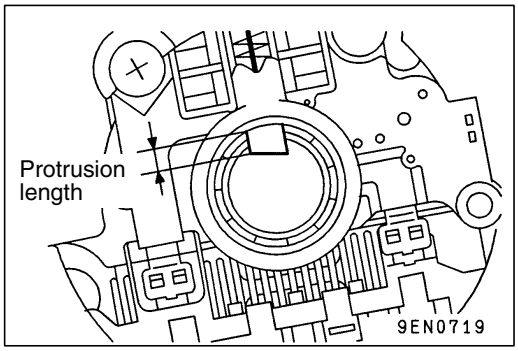
1. Inspect the (+) heat sink by checking the continuity between the (+) heat sink and stator coil lead wire connection terminal using a tester probe.
   If there is a continuity at both, the diode is short circuited, so replace the rectifier.



2. Inspect the (–) heat sink by checking the continuity between the (–) heat sink and stator coil lead wire connection terminal using a tester probe.
   If there is a continuity at both, the diode is short circuited, so replace the rectifier.



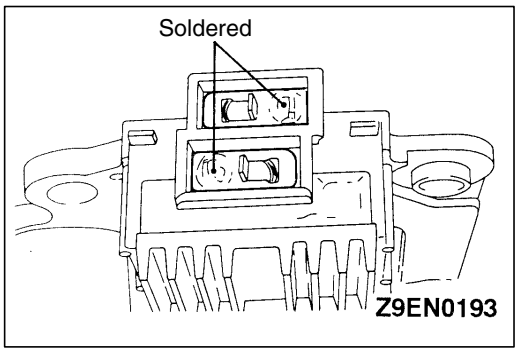
3. Check the diode trio by connecting an ohmmeter to both ends of each diode and check the continuity of the three diodes.
   If there is a continuity at both ends, or if there is no continuity, the diode is damaged so replace the rectifier.



BRUSH CHECK

1. Measure the length of the brush protrusion shown in the illustration, and replace the brush if the measured value is below the limit value.

   Limit: 2 mm or less



2. The brush can be removed if the solder of the brush lead wire is removed.
3. When installing a new brush, insert the brush into the holder as shown in the illustration, and then solder the lead wires.

STARTING SYSTEM

GENERAL

OUTLINE OF CHANGES

The following service procedures have been established due to the adoption of the 4G9-MPI engine. The other service procedures are the same as for the 4G9-GDI engine.

SERVICE SPECIFICATION

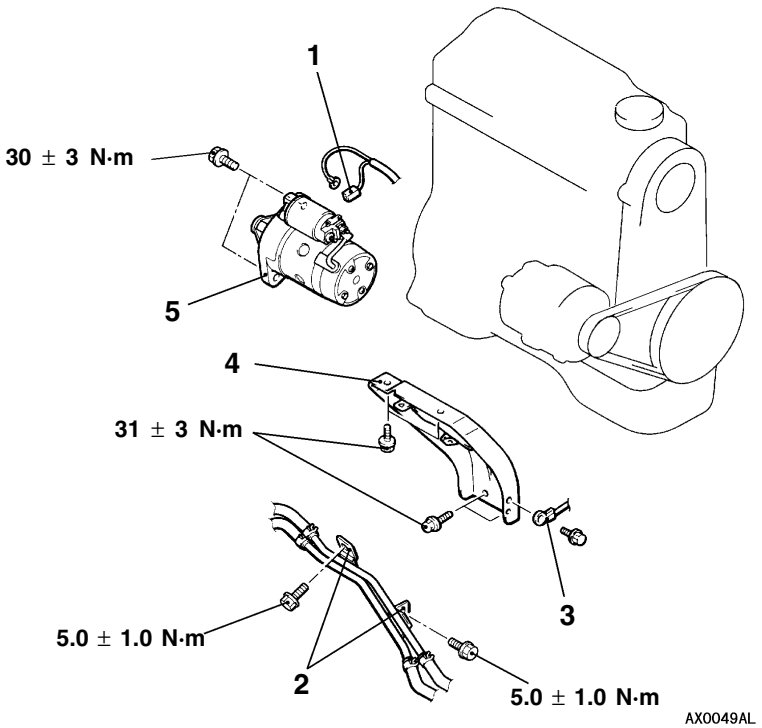
Items	Standard value	Limit
Commutator runout mm	0.05	0.1
Commutator outer diameter mm	29.4	28.8
Commutator undercut mm	0.5	0.2
Brush length mm	–	7.0

STARTER

REMOVAL AND INSTALLATION

<4G9-MPI>

Pre-removal and Post-installation Operation
- Battery Removal and Installation
- Under Cover Removal and Installation
- Front Propeller Shaft Removal and Installation



Disassembly steps

1. Starter motor connector
2. A/T oil cooler pipe clamp <A/T>
3. Earth cable connection
4. Intake manifold stay
- Front catalytic converter (Refer to GROUP 17.)

◀A▶ ▶A◀
- Transmission mount crossmember
- Detonation sensor connector

5. Starter motor assembly

REMOVAL SERVICE POINTS

◀A▶ TRANSMISSION MOUNT CROSSMEMBER REMOVAL

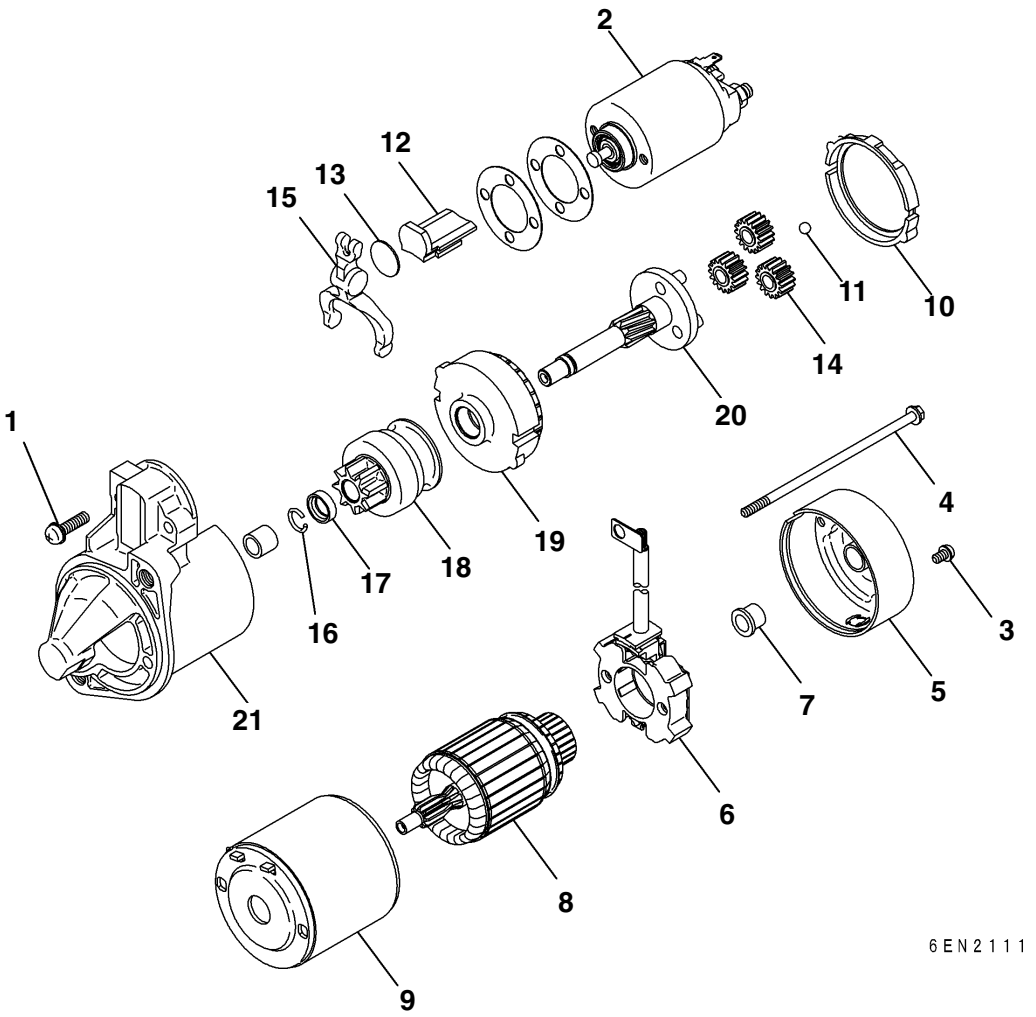
1. Remove the transmission mount crossmember. (Refer to GROUP 32.)
2. Lower the jack holding the engine and transmission assembly to create clearance enough to remove the starter motor installation bolts.

INSTALLATION SERVICE POINT

▶A◀ TRANSMISSION MOUNT CROSSMEMBER INSTALLATION

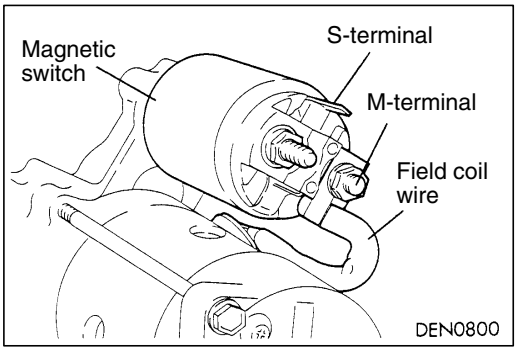
Refer to GROUP 32.

DISASSEMBLY AND REASSEMBLY



Disassembly steps

1. Screw
◀A▶ 2. Magnetic switch
3. Screw
4. Through bolt
5. Rear bracket
6. Brush holder
7. Rear bearing
◀B▶ 8. Armature
9. Yoke assembly
◀B▶ 10. Ball
11. Packing A
12. Packing B
13. Plate
14. Planetary gear
15. Lever
◀C▶ ▶A◀ 16. Snap ring
◀C▶ ▶A◀ 17. Stop ring
18. Overrunning clutch
19. Internal gear
20. Planetary gear holder
21. Front bracket



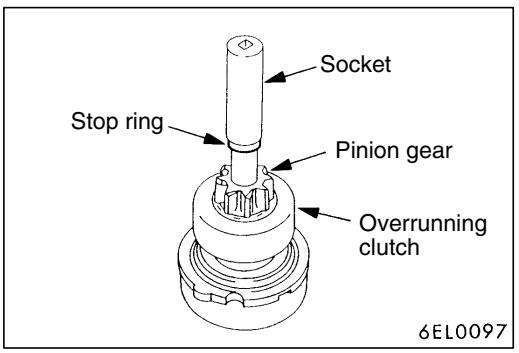
DISASSEMBLY SERVICE POINTS

◀A▶ MAGNETIC SWITCH REMOVAL

Disconnect the field coil wire from M-terminal of the magnetic switch.

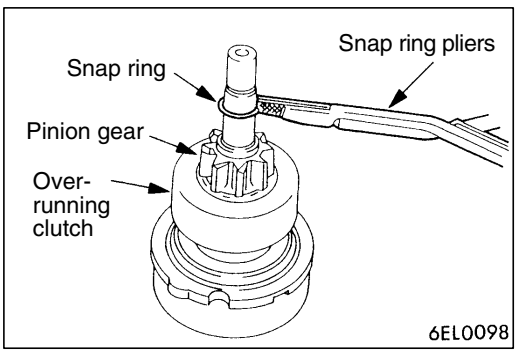
◀B▶ ARMATURE AND BALL REMOVAL

When removing the armature, do not lose the ball placed at the end as a bearing.



◀C▶ SNAP RING/STOP RING REMOVAL

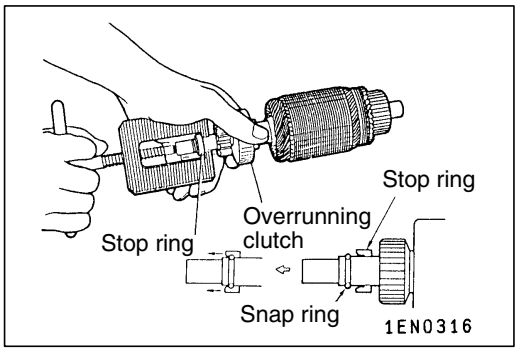
1. Using an appropriate wrench socket, push the stop ring toward the overrunning clutch.



2. Remove the snap ring with snap ring pliers and then remove the stop ring and overrunning clutch.

STARTER MOTOR PARTS CLEANING

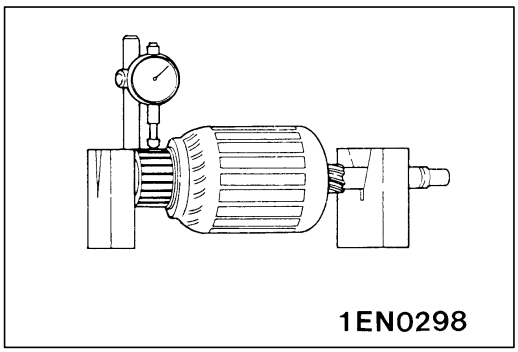
1. Do not immerse the parts in cleaning solvent. Immersing the yoke and field coil assembly and/or armature will damage insulation. Wipe these parts with a cloth only.
2. Do not immerse the drive unit in cleaning solvent. The overrunning clutch is pre-lubricated at the factory and solvent will wash lubrication from clutch.
3. The drive unit may be cleaned with a brush moistened with cleaning solvent and wiped dry with a cloth.



REASSEMBLY SERVICE POINTS

▶A◀ STOP RING/SNAP RING INSTALLATION

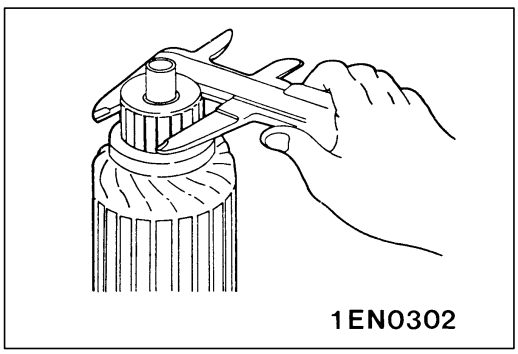
Using an appropriate tool, pull the stop ring over the snap ring.



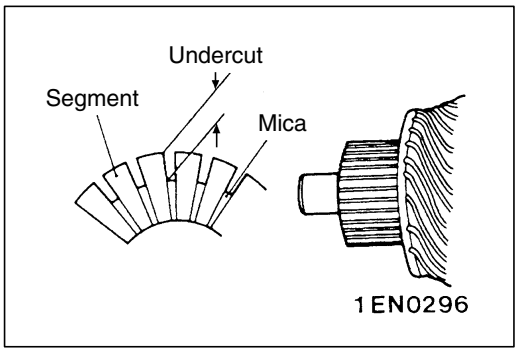
INSPECTION

COMMUTATOR

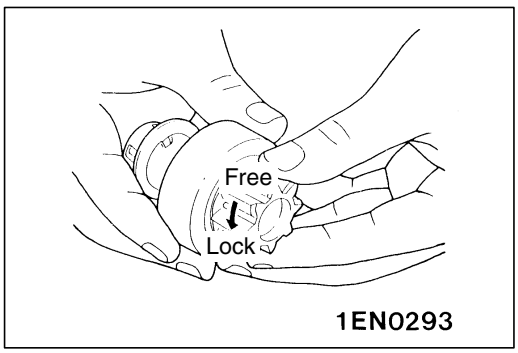
1. Place the armature in a pair of "V" blocks and check the runout with a dial indicator.
   Standard value: 0.05 mm
   Limit: 0.1 mm



2. Measure the commutator outer diameter.
   Standard value: 29.4 mm
   Limit: 28.8 mm

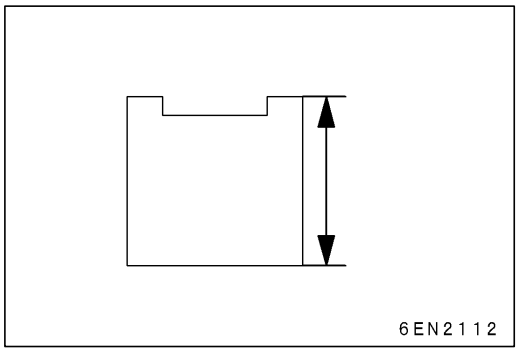


3. Check the undercut depth between segments.
   Standard value: 0.5 mm
   Limit: 0.2 mm



OVERRUNNING CLUTCH

1. Check that the pinion locks when it is turned anti-clockwise and moves smoothly when it is turned clockwise.
2. Check the pinion for wear or damage.

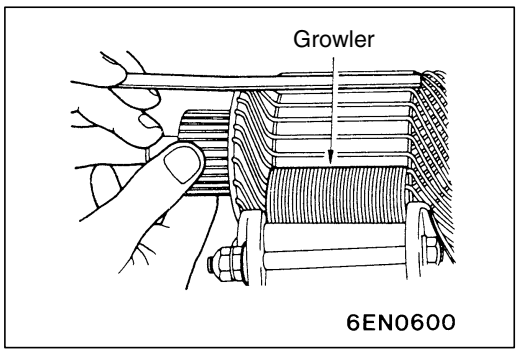


BRUSH

1. Check the brush for roughness of the surface that contacts the commutator and check the brush length.

   Minimum limit: 7.0 mm

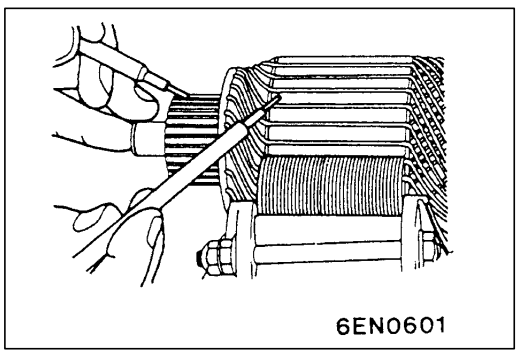
2. In case the contacting surface has been corrected or the brush has been replaced, correct the contacting surface by winding sandpaper around the commutator.



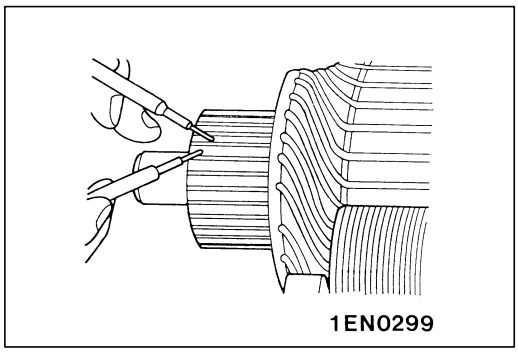
ARMATURE COIL SHORT-CIRCUIT TEST

1. Place armature in a growler.
2. Hold a thin steel blade parallel and just above while rotating armature slowly in growler. A shorted armature will cause blade to vibrate and be attracted to the core. Replace shorted armature.

   Caution
   Clean the armature surface thoroughly before checking.



3. Check the insulation between each commutator segment and armature coil core.
   If there is no continuity, the insulation is in order.



ARMATURE COIL OPEN-CIRCUIT INSPECTION

Check the continuity between segments. If there is continuity, the coil is in order.

IGNITION SYSTEM

GENERAL

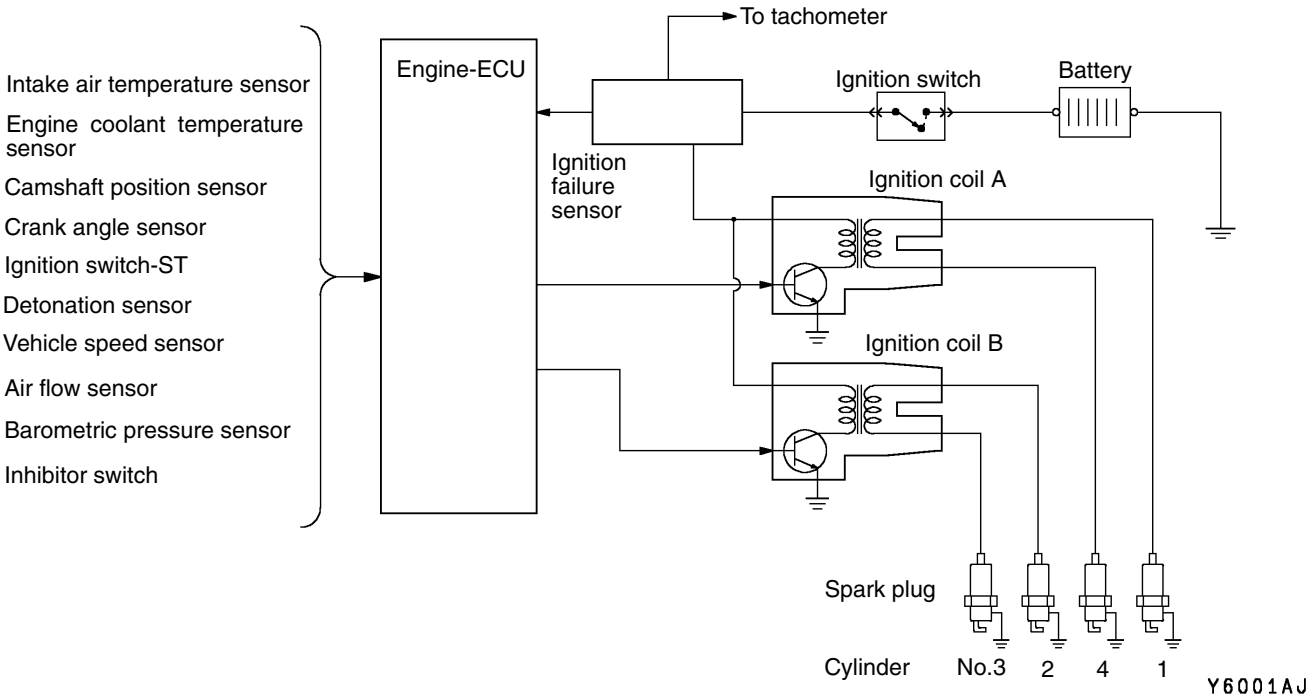
OUTLINE OF CHANGES

The following service procedures have been established to correspond to the addition of vehicles with 4G9-MPI engine. Other service procedures are the same as for the 4G9-GDI engine.

GENERAL INFORMATION

This system is equipped with two ignition coils (A and B) with built-in power transistors for the No. 1 and No. 4 cylinders and the No. 2 and No. 3 cylinders respectively.
Interruption of the primary current flowing in the primary side of ignition coil A generates a high voltage in the secondary side of ignition coil A.
The high voltage thus generated is applied to the spark plugs of No. 1 and No. 4 cylinders to generate sparks. At the time that the sparks are generated at both spark plugs, if one cylinder is at the compression stroke, the other cylinder is at the exhaust stroke, so that ignition of the compressed air/fuel mixture occurs only for the cylinder which is at the compression stroke.
In the same way, when the primary current flowing in ignition coil B is interrupted, the high voltage thus generated is applied to the spark plugs of No. 2 and No. 3 cylinders.
The engine-ECU turns the two power transistors inside the ignition coils alternately on and off. This causes the primary currents in the ignition coils to be alternately interrupted and allowed to flow to fire the cylinders in the order 1–3–4–2.
The engine-ECU determines which ignition coil should be controlled by means of the signals from the camshaft position sensor which is incorporated in the camshaft and from the crank angle sensor which is incorporated in the crankshaft. It also detects the crankshaft position in order to provide ignition at the most appropriate timing in response to the engine operation conditions. It also detects the crankshaft position in order to provide ignition at the most appropriate timing in response to the engine operation conditions.
When the engine is cold or operated at high altitudes, the ignition timing is slightly advanced to provide optimum performance.
When the automatic transmission shifts gears, the ignition timing is also retarded in order to reduce output torque, thereby alleviating shifting shocks.

SYSTEM DIAGRAM



IGNITION COIL SPECIFICATIONS

Items	Specifications
Type	Molded 2-coil

SPARK PLUG SPECIFICATIONS

Items	Specifications
NGK	BKR5E-11
DENSO	K16PR-U11

SERVICE SPECIFICATIONS

IGNITION COIL

Items	Standard value
Secondary coil resistance kΩ	8.5 – 11.5

SPARK PLUG

Items	Standard value
Spark plug gap mm	1.0 – 1.1

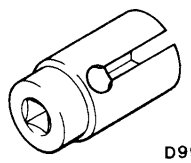
RESISTIVE CORD

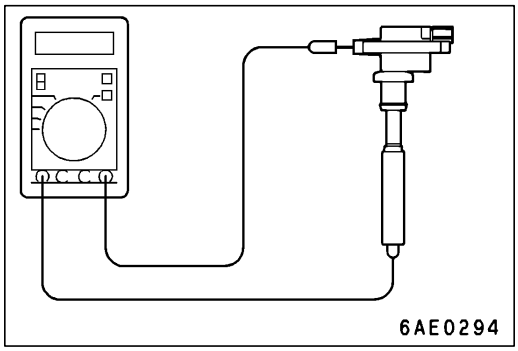
Items	Limit
Resistance kΩ	Max.22

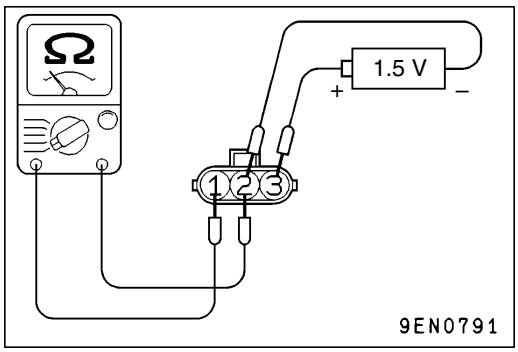
IGNITION FAILURE SENSOR

Items	Standard value
Resistance Ω	0.1 or less

SPECIAL TOOL

Tool	Number	Name	Use
 D998773	MD998773	Detonation sensor wrench	Detonation sensor removal and installation





ON-VEHICLE SERVICE

IGNITION COIL (WITH BUILT-IN POWER TRANSISTOR) CHECK

Check by the following procedure, and replace if there is a malfunction.

SECONDARY COIL RESISTANCE CHECK

Measure the resistance between the high-voltage terminals of the ignition coil.

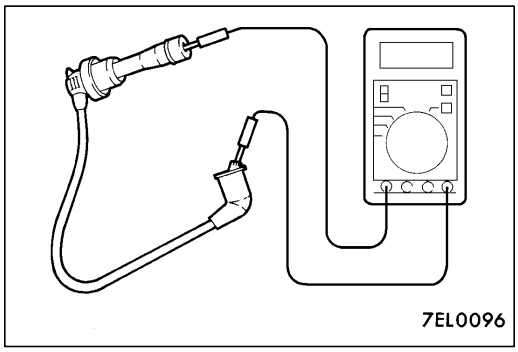
Standard value: 8.5 – 11.5 kΩ

PRIMARY COIL AND POWER TRANSISTOR CONTINUITY CHECK

NOTE
1. An analogue-type circuit tester should be used.
2. Connect the negative (–) prove of the circuit tester to terminal 1.

Caution
This test must be performed quickly (in less than 10 seconds) to prevent coil from burning and power transistor from breakage.

Voltage: 1.5V	Terminal No.		
	1	2	3
When current is flowing	○	⊖	⊕
When current is not flowing			



RESISTIVE CORD CHECK

Measure the resistance of the all spark plug cables.
1. Check cap and coating for cracks.
2. Measure resistance.

   Limit: Max. 22 kΩ

SPARK PLUG CHECK AND CLEANING

1. Remove the ignition coils and spark plug cables.

   Caution
   When pulling off the spark plug cable from the plug always hold the cable cap, not the cable.

2. Remove the spark plugs.
3. Check for burned out electrode or damaged insulator. Check for even burning.
4. Remove carbon deposits with wire brush or plug cleaner. Remove sand from plug screw with compressed air.
5. Use a plug gap gauge to check that the plug gap is within the standard value range.

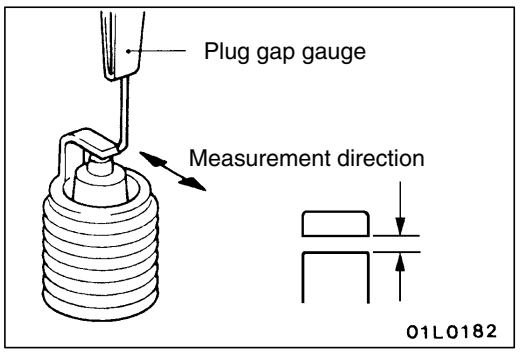
   Standard value: 1.0 – 1.1 mm

   If the plug gap is not within the standard value range, adjust by bending the earth electrode.

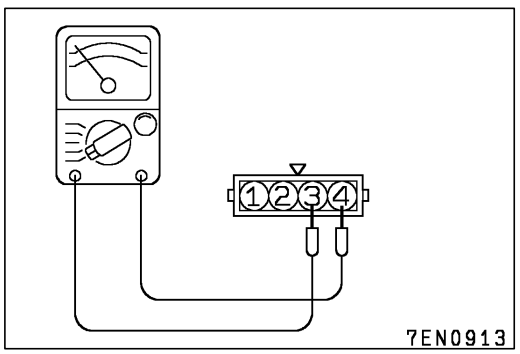
6. Clean the engine plug holes.

   Caution
   Be careful not to allow foreign matter in cylinders.

7. Install the spark plugs.
8. Install the ignition coils and spark plug cables.



IGNITION FAILURE SENSOR CHECK



NOTE
An analog-type circuit tester should be used.
Check that the resistance between terminals 3 and 4 is at the standard value.

Standard value: 0.1 Ω or less

CAMSHAFT POSITION SENSOR CHECK

Refer to GROUP 13C – Troubleshooting. <4G9-MPI>

CRANK ANGLE SENSOR CHECK

Refer to GROUP 13C – Troubleshooting. <4G9-MPI>

DETONATION SENSOR CHECK

Check the detonation sensor circuit if self-diagnosis code, No. 31 is shown.

NOTE
For information concerning the self-diagnosis codes, refer to GROUP 13C – Troubleshooting <4G9-MPI>.

WAVEFORM CHECK USING AN ANALYZER

Ignition Secondary Voltage Waveform Check

MEASUREMENT METHOD

1. Clamp the secondary pickup around the spark plug cable.

   NOTE
   (1) The peak ignition voltage will be reversed when the spark cables No. 2 and No. 4, or No. 1 and No. 3 cylinders are clamped.
   (2) Because of the two-cylinder simultaneous ignition system, the waveforms for two cylinders in each group appear during waveform observation (No. 1 cylinder – No. 4 cylinder, No. 2 cylinder – No. 3 cylinder). However, waveform observation is only applicable for the cylinder with the spark plug cable clamped by the secondary pickup.
   (3) Identifying which cylinder waveform is displayed can be difficult. For reference, remember that the waveform of the cylinder attached to the secondary pickup will be displayed as stable.

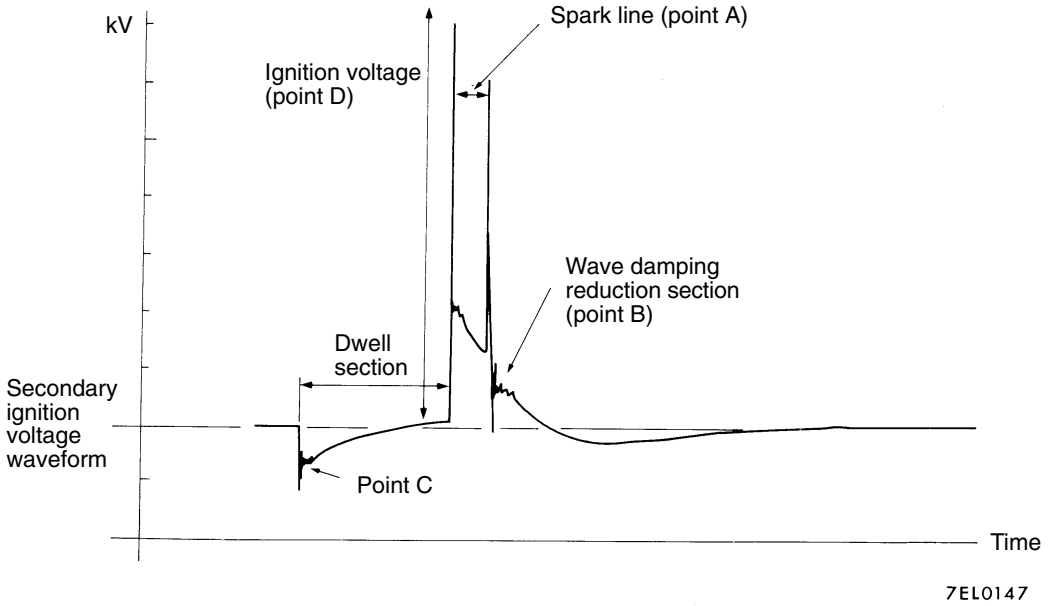
2. Clamp the spark plug cable with the trigger pickup.

   NOTE
   Clamp the trigger pickup to the same spark plug cable clamped by the secondary pickup.

STANDARD WAVEFORM

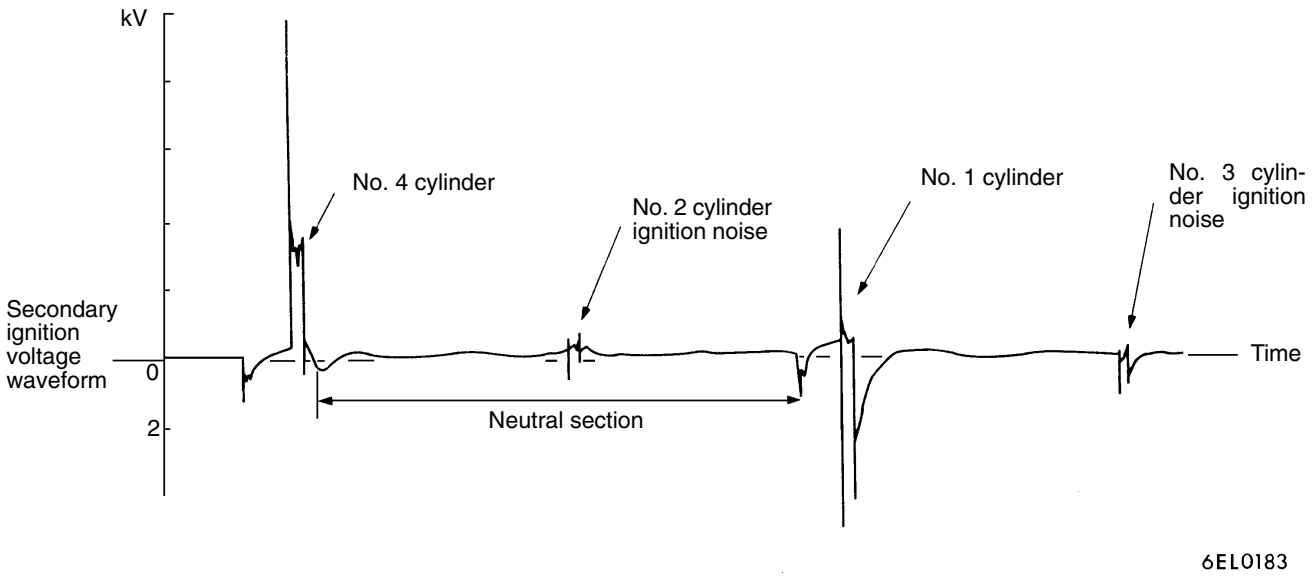
Observation Conditions

Function	Secondary
Pattern height	High (or Low)
Pattern selector	Raster
Engine revolutions	Curb idle speed



Observation Condition (The only change from above condition is the pattern selector.)

Pattern selector	Display



WAVEFORM OBSERVATION POINTS

Point A: The height, length and slope of the spark line show the following trends (Refer to abnormal waveform examples, 1, 2, 3 and 4).

Spark line		Plug gap	Condition of electrode	Compression force	Concentration of air mixture	Ignition timing	Spark plug cable
Length	Long	Small	Normal	Low	Rich	Advanced	Leak
	Short	Large	Large wear	High	Lean	Retarded	High resistance
Height	High	Large	Large wear	High	Lean	Retarded	High resistance
	Low	Small	Normal	Low	Rich	Advanced	Leak
Slope		Large	Plug is fouled	–	–	–	–

Point B: Number of vibration in reduction vibration section (Refer to abnormal waveform example 5)

Number of vibrations	Coil and condenser
Three or more	Normal
Except above	Abnormal

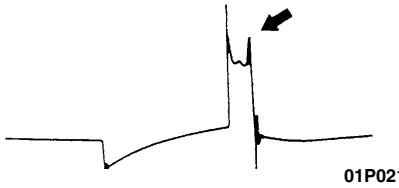
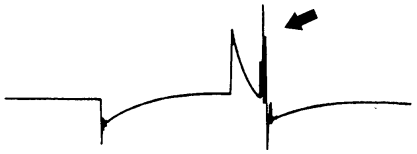
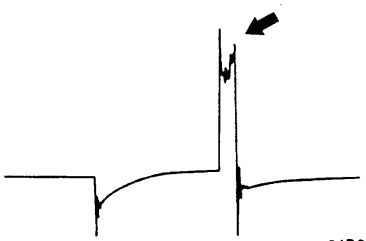
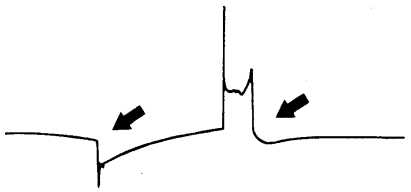
Point C: Number of vibrations at beginning of dwell section (Refer to abnormal waveform example 5)

Number of vibrations	Coil
5–6 or higher	Normal
Except above	Abnormal

Point D: Ignition voltage height (distribution per each cylinder) shows the following trends.

Ignition voltage	Plug gap	Condition of electrode	Compression force	Concentration of air mixture	Ignition timing	Spark plug cable
High	Large	Large wear	High	Lean	Retarded	High resistance
Low	Small	Normal	Low	Rich	Advanced	Leak

EXAMPLES OF ABNORMAL WAVEFORMS

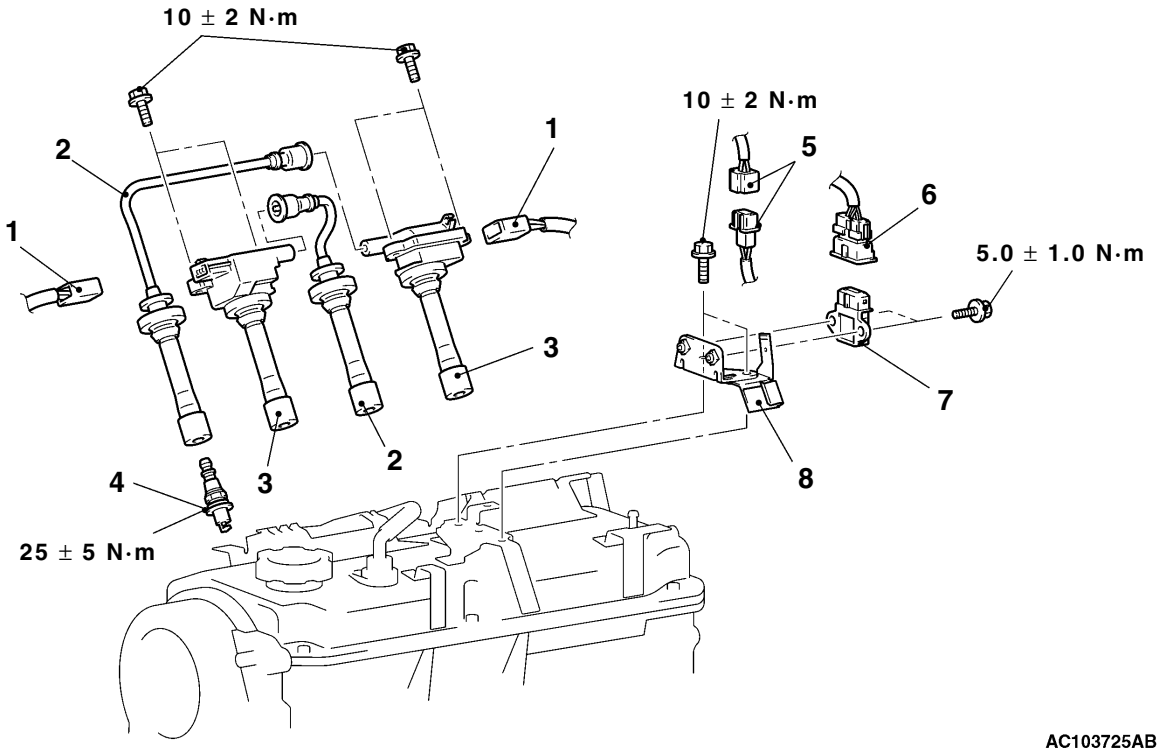
Abnormal waveform	Wave characteristics	Cause of problem
Example 1  01P0215	Spark line is high and short.	Spark plug gap is too large.
Example 2  01P0216	Spark line is low and long, and is sloping. Also, the second half of the spark line is distorted. This could be a result of misfiring.	Spark plug gap is too small.
Example 3  01P0217	Spark line is low and long, and is sloping. However, there is almost no spark line distortion.	Spark plug gap is fouled.
Example 4  01P0218	Spark line is high and short. Difficult to distinguish between this and abnormal waveform example 1.	Spark plug cable is nearly falling off. (Causing a dual ignition)
Example 5  01P0219	No waves in wave damping section.	Layer short in ignition coil

IGNITION COIL AND IGNITION FAILURE SENSOR

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Air Cleaner Assembly and Air Intake Hose Removal and Installation

<4G9-MPI>



Disassembly steps

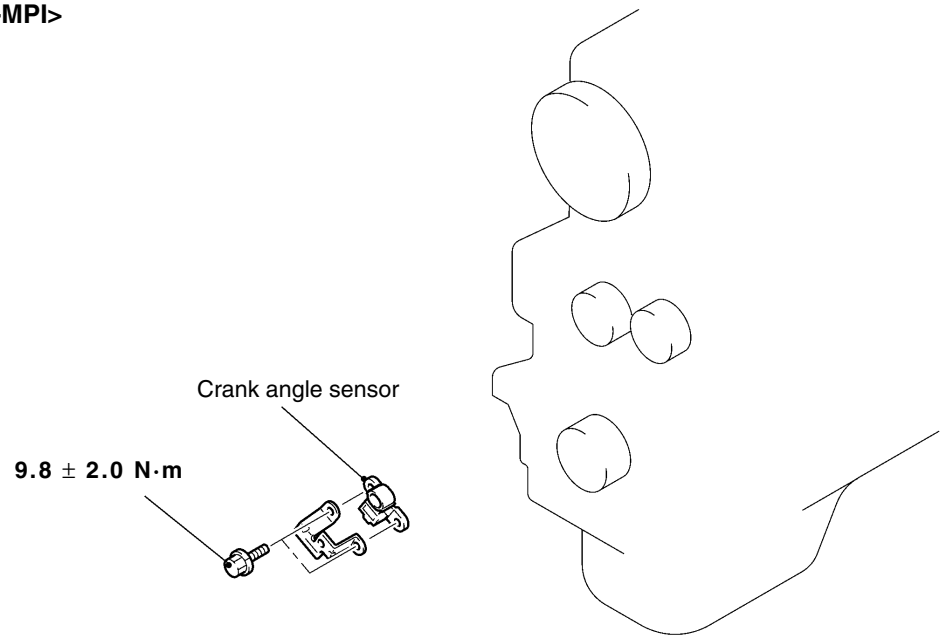
1. Ignition coil connector
2. Spark plug cable
3. Ignition coil
4. Spark plug
5. Oxygen sensor connector
6. Ignition failure sensor connector
7. Ignition failure sensor
8. Ignition failure sensor bracket

CRANK ANGLE SENSOR

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Timing Belt Front Lower Cover Removal and Installation (Refer to GROUP 11.)

<4G9-MPI>



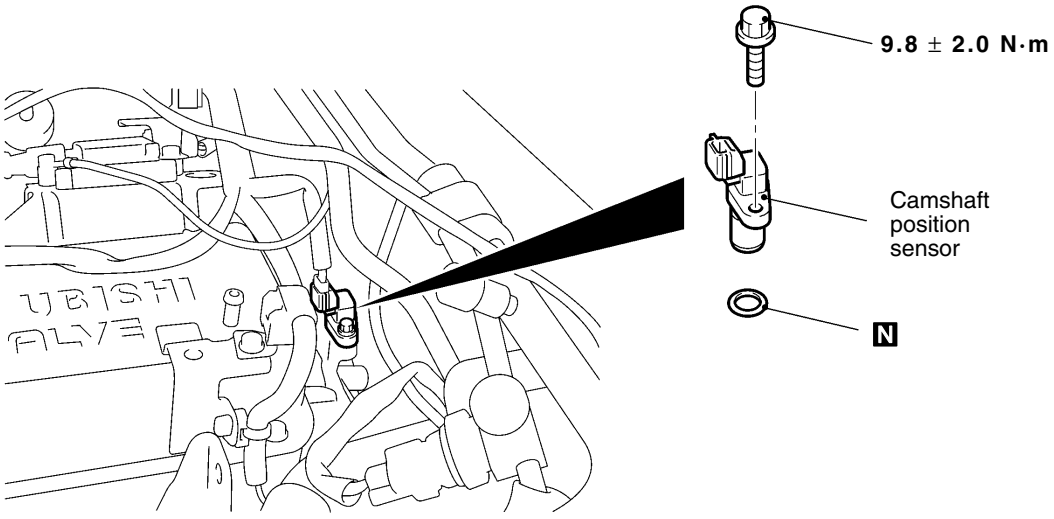
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CAMSHAFT POSITION SENSOR

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Air Cleaner Assembly and Air Intake Hose Removal and Installation

<4G9-MPI>



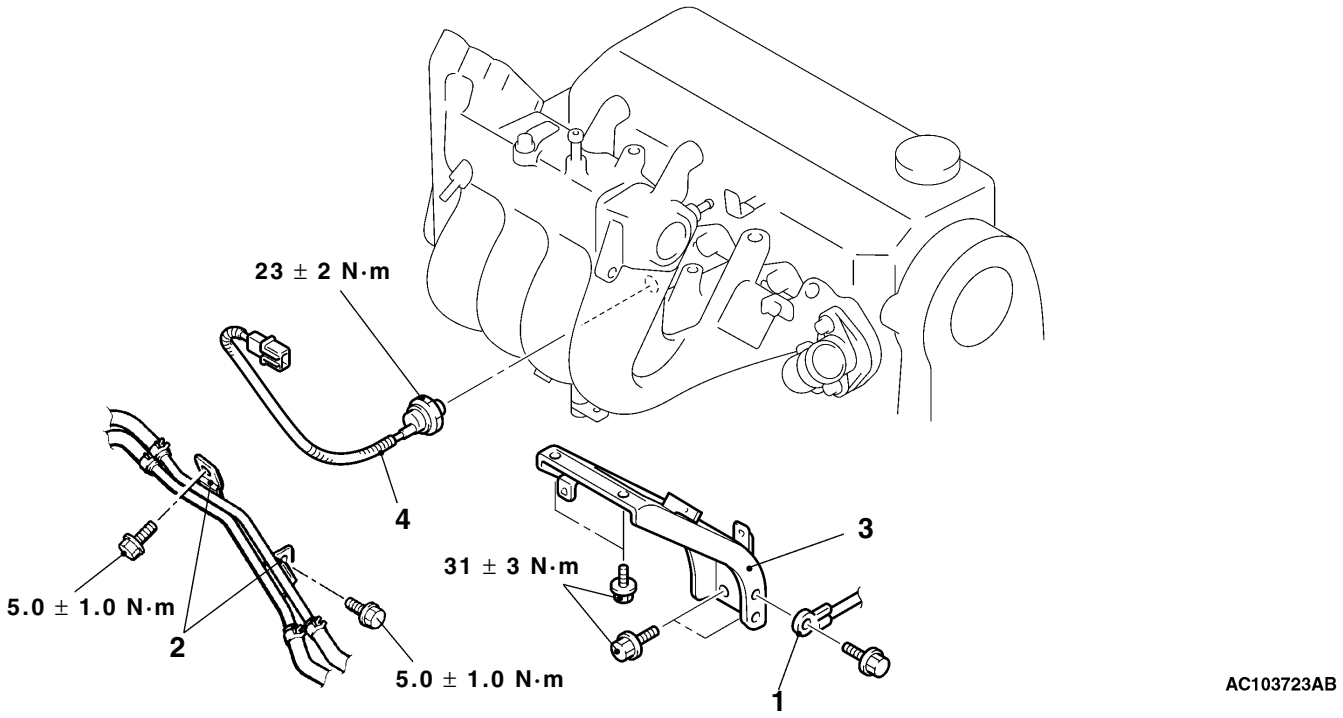
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DETONATION SENSOR

REMOVAL AND INSTALLATION

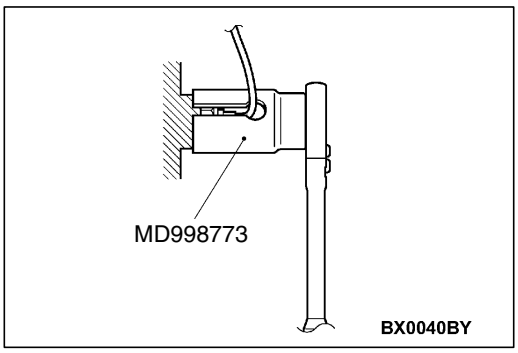
Pre-removal and Post-installation Operation
- Under Cover Removal and Installation

<4G9-MPI>



Disassembly steps

1. Earth cable connection
2. A/T oil cooler pipe clamp <A/T>
3. Intake manifold stay
◀A▶ ▶A◀ 4. Detonation sensor



REMOVAL SERVICE POINT

◀A▶ DETONATION SENSOR REMOVAL

INSTALLATION SERVICE POINT

▶A◀ DETONATION SENSOR INSTALLATION

ENGINE AND EMISSION CONTROL

ENGINE AND EMISSION CONTROL

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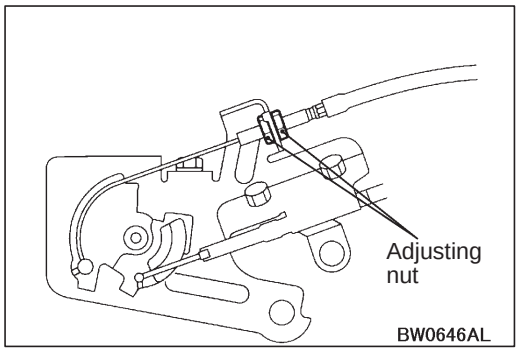
EGR VALVE 16

CATALYTIC CONVERTER 17

ENGINE CONTROL SYSTEM

SERVICE SPECIFICATION

Items	Standard value
Accelerator cable play mm	1 – 2



ON-VEHICLE SERVICE

ACCELERATOR CABLE CHECK AND ADJUSTMENT

1. Check the accelerator cable play when the accelerator pedal is released.

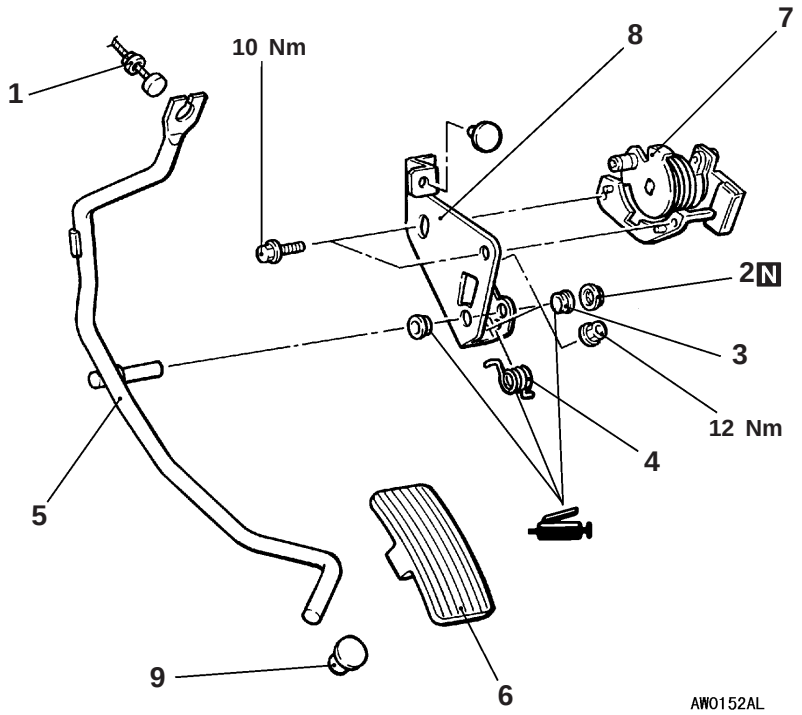
   Standard value: 1 – 2 mm

2. If the play is not within the standard value, turn the adjusting nut to adjust the play to the standard value.

ACCELERATOR CABLE AND PEDAL

REMOVAL AND INSTALLATION

Post-installation Operation
- Accelerator Pedal Position Sensor Check and Adjustment (Refer to GROUP 13A – On-vehicle Service.)
- Kickdown Cable Adjustment (Refer to GROUP 23 – On-vehicle Service.)



Removal steps

1. Kickdown cable connection
2. Spring nut
3. Bushing
4. Return spring
5. Accelerator pedal
6. Accelerator pedal pad
7. Accelerator pedal position sensor
8. Accelerator pedal bracket
9. Accelerator pedal stopper

EMISSION CONTROL SYSTEM

GENERAL INFORMATION

The emission control system consists of the following subsystems:
- Crankcase emission control system
- Evaporative emission control system
- Exhaust emission control system

Items	Name	Specification
Crankcase emission control system	Positive crankcase ventilation (PCV) valve	Variable flow type (Purpose: HC reduction)
Evaporative emission control system	Canister Purge control solenoid valve	Equipped Duty cycle type solenoid valve (Purpose: HC reduction)
Exhaust emission control system	Air-fuel ratio control device–GDI system	Oxygen sensor feedback type (Purpose: CO, HC, NOx reduction)
	Exhaust gas recirculation system ● EGR valve	Equipped Stepper motor type (Purpose: NOx reduction)
	Catalytic converter	Monolith type (Purpose: CO, HC, NOx reduction)

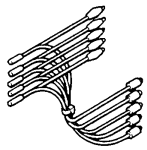
EMISSION CONTROL DEVICE REFERENCE TABLE

Related parts	Crankcase emission control system	Evaporative emission control system	Air/fuel ratio control system	Catalytic converter	Exhaust gas recirculation system	Reference page
PCV valve	×					17-9
Purge control solenoid valve		×				17-12
GDI system component		×	×			GROUP 13A
Catalytic converter				×		17-17
EGR valve					×	17-14

SERVICE SPECIFICATIONS

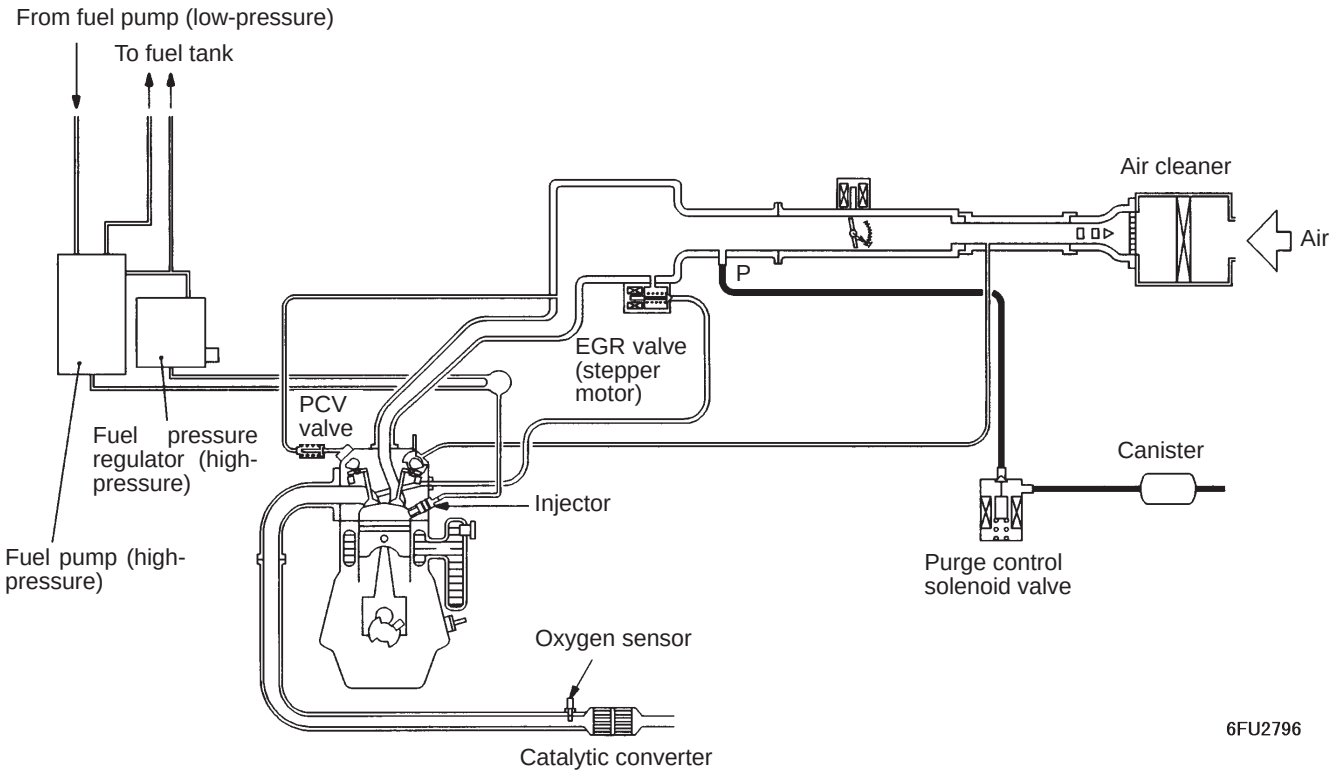
Items	Standard value
Purge control solenoid valve coil resistance (at 20°C) Ω	36 – 44
EGR valve (stepper motor) coil resistance (at 20°C) Ω	10 – 20

SPECIAL TOOL

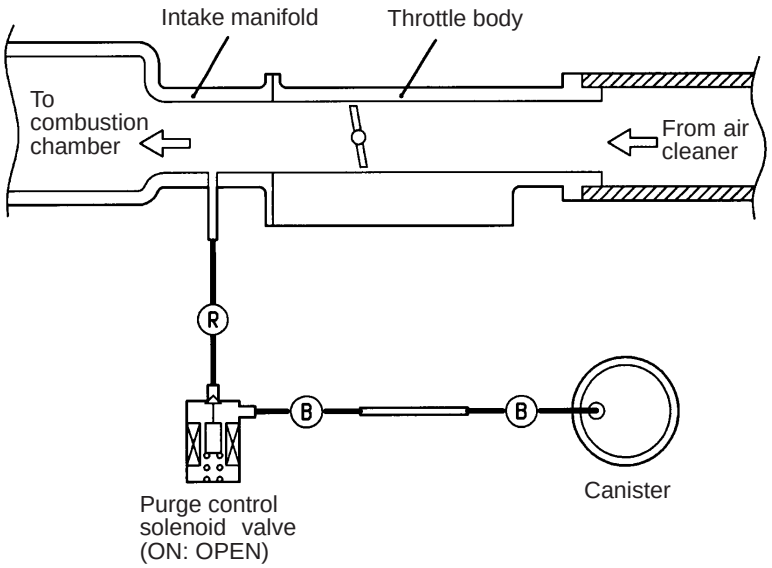
Tool	Number	Name	Use
 B991658	MB991658	Test harness set	Inspection of EGR valve

VACUUM HOSE

VACUUM HOSE PIPING DIAGRAM



VACUUM CIRCUIT DIAGRAM



Vacuum hose colour
B: Black
R: Red

W6048AE

VACUUM HOSE CHECK

1. Using the piping diagram as a guide, check to be sure that the vacuum hoses are correctly connected.
2. Check the connection condition of the vacuum hoses, (removed, loose, etc.) and check to be sure that there are no bends or damage.

VACUUM HOSE INSTALLATION

1. When connecting the vacuum hoses, they should be securely inserted onto the nipples.
2. Connect the hoses correctly, using the vacuum hose piping diagram as a guide.

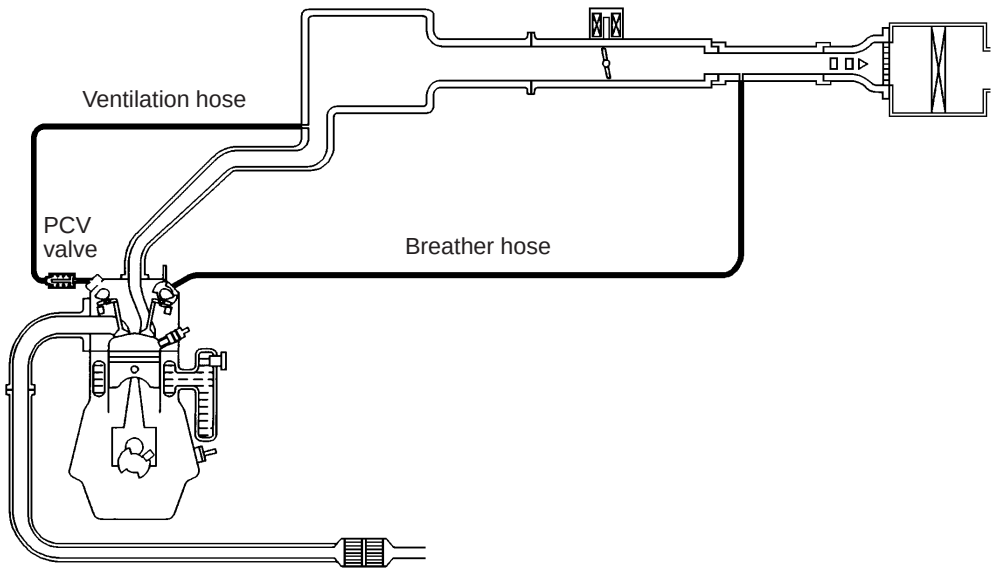
CRANKCASE EMISSION CONTROL SYSTEM

GENERAL INFORMATION

The crankcase emission control system prevents blow-by gases from escaping inside the crankcase into the atmosphere.
Fresh air is sent from the air cleaner into the crankcase through the breather hose. The air becomes mixed with the blow-by gases inside the crankcase.
The blow-by gas inside the crankcase is drawn into the intake manifold through the positive crankcase ventilation (PCV) valve.

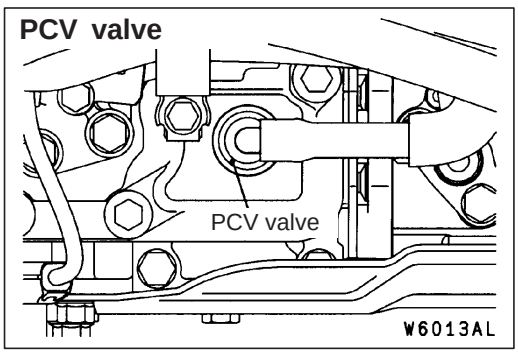
The PCV valve lifts the plunger according to the intake manifold vacuum so as to regulate the flow of blow-by gas properly. In other words, the blow-by gas flow is regulated during low load engine operation to maintain engine stability, while the flow is increased during high load operation to improve the ventilation performance.

SYSTEM DIAGRAM



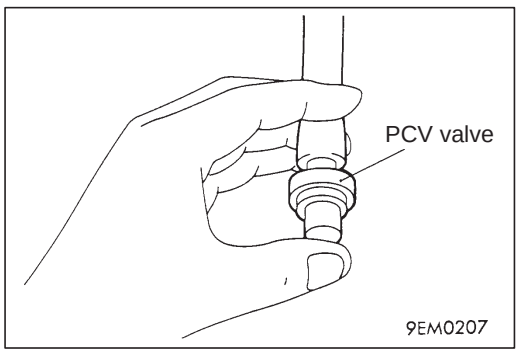
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COMPONENT LOCATION



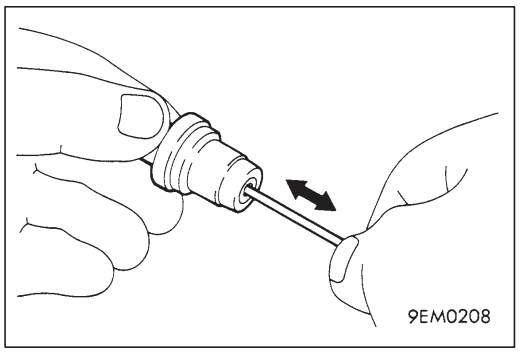
POSITIVE CRANKCASE VENTILATION SYSTEM CHECK

1. Remove the ventilation hose from the PCV valve.
2. Remove the PCV valve from the rocker cover.
3. Reinstall the PCV valve at the ventilation hose.
4. Start the engine and run at idle.



5. Place a finger at the opening of the PCV valve and check that vacuum of the intake manifold is felt.

   NOTE
   At this moment, the plunger in the PCV valve moves back and forth.
6. If vacuum is not felt, clean the PCV valve or replace it.



PCV VALVE CHECK

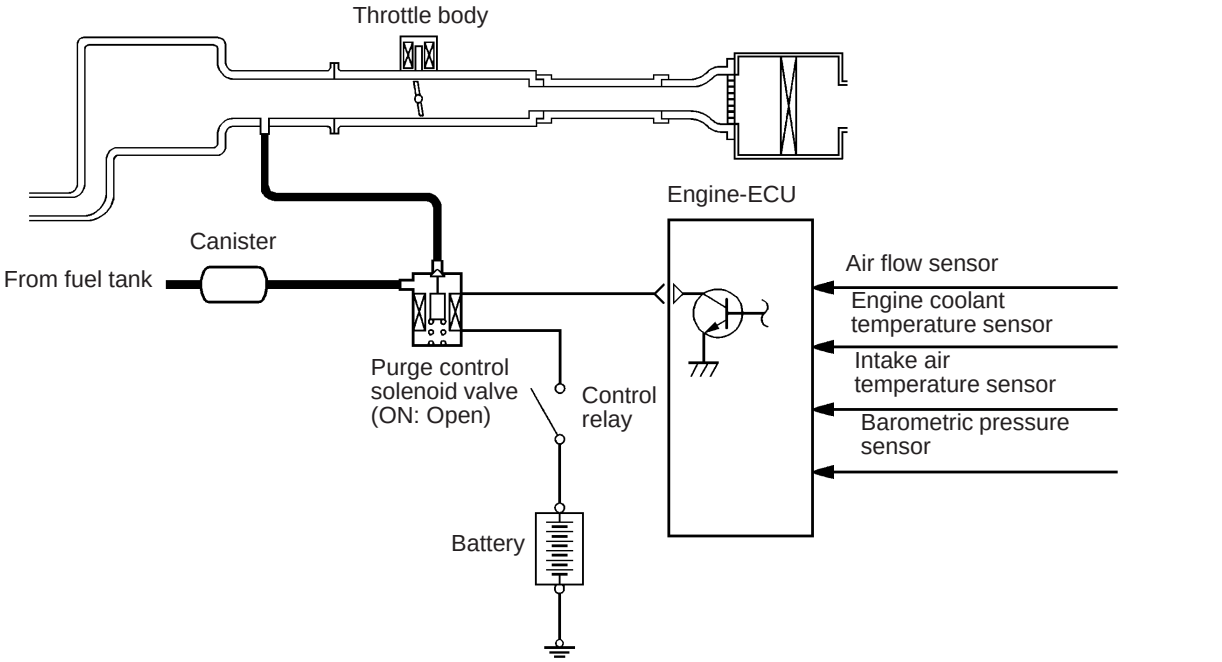
1. Insert a thin rod into the PCV valve from the side shown in the illustration (rocker cover installation side), and move the rod back and forth to check that the plunger moves.
2. If the plunger does not move, there is clogging in the PCV valve. In this case, clean or replace the PCV valve.

EVAPORATIVE EMISSION CONTROL SYSTEM

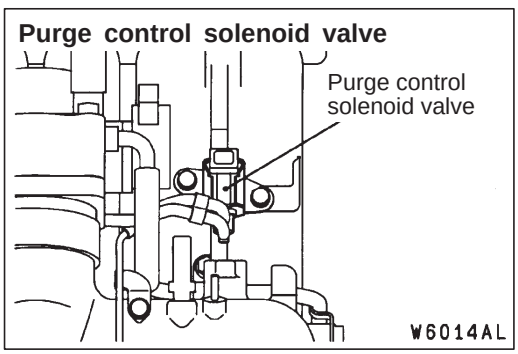
GENERAL INFORMATION

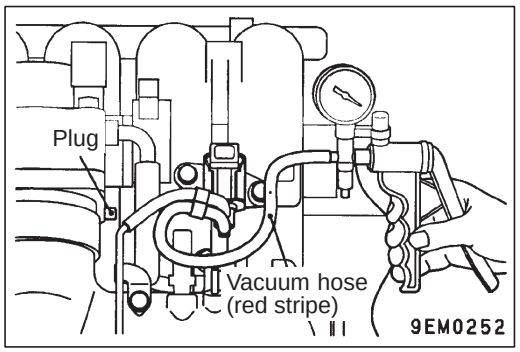
The evaporative emission control system prevents fuel vapours generated in the fuel tank from escaping into the atmosphere.
Fuel vapours from the fuel tank flow through the fuel tank pressure control valve and vapour pipe/hose to be stored temporarily in the canister. When driving the vehicle, fuel vapours stored in the canister flow through the purge solenoid and purge port and go into the intake manifold to be sent to the combustion chamber.
When the engine coolant temperature is low or when the intake air quantity is small (when the engine is at idle, for example), the engine control unit turns the purge solenoid off to shut off the fuel vapour flow to the intake manifold.
This does not only insure the driveability when the engine is cold or running under low load but also stabilize the emission level.

SYSTEM DIAGRAM



COMPONENT LOCATION





PURGE CONTROL SYSTEM CHECK

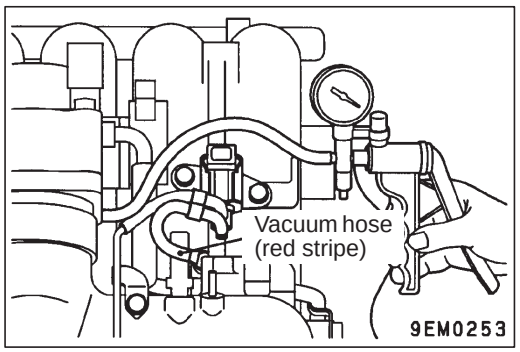
1. Disconnect the vacuum hose (red stripe) from the throttle body and connect it to a hand vacuum pump.
2. Plug the nipple from which the vacuum hose was removed.
3. When the engine is cold or hot, apply a vacuum of 53 kPa, and check the condition of the vacuum.

When engine is cold
(Engine coolant temperature: 40°C or less)

Engine condition	Normal condition
At idle	Vacuum is maintained
3,000 r/min	

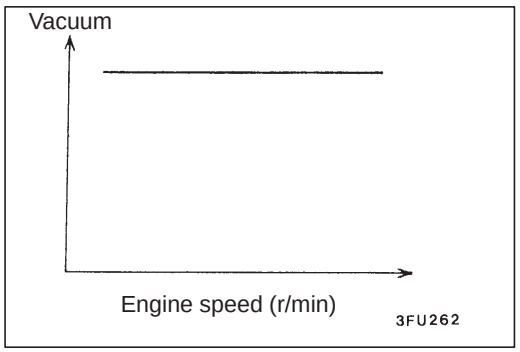
When engine is hot
(Engine coolant temperature: 80°C or higher)

Engine condition	Normal condition
At idle	Vacuum is maintained
3,000 r/min (fore approximately 3 minutes after the engine is started.)	Vacuum will leak.

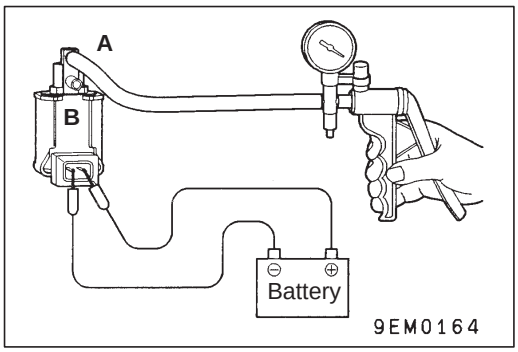


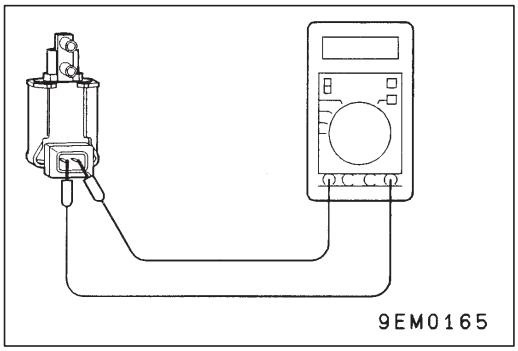
PURGE PORT VACUUM CHECK

1. Disconnect the vacuum hose (red stripe) from the throttle body purge vacuum nipple and connect a hand vacuum pump to the nipple.



2. Start the engine.
3. Check that vacuum is produced almost constantly regardless of engine revolution.
4. When the vacuum is not produced, clean the hose as it may be clogged.





PURGE CONTROL SOLENOID VALVE CHECK

NOTE
When disconnecting the vacuum hose, always make a mark so that it can be reconnected at original position.

1. Disconnect the vacuum hose (black stripe, red stripe) from the solenoid valve.
2. Disconnect the harness connector.
3. Connect a hand vacuum pump to nipple (A) of the solenoid valve (refer to the illustration at left).
4. Check airtightness by applying a vacuum with voltage applied directly from the battery to the purge control solenoid valve and without applying voltage.

Jumper wire	Nipple B	Normal condition
Connected	Open	Vacuum leaks
	Closed	Vacuum maintained
Disconnected	Open	Vacuum maintained

5. Measure the resistance between the terminals of the solenoid valve.

   Standard value: 36 – 44 Ω (at 20°C)

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

GENERAL INFORMATION

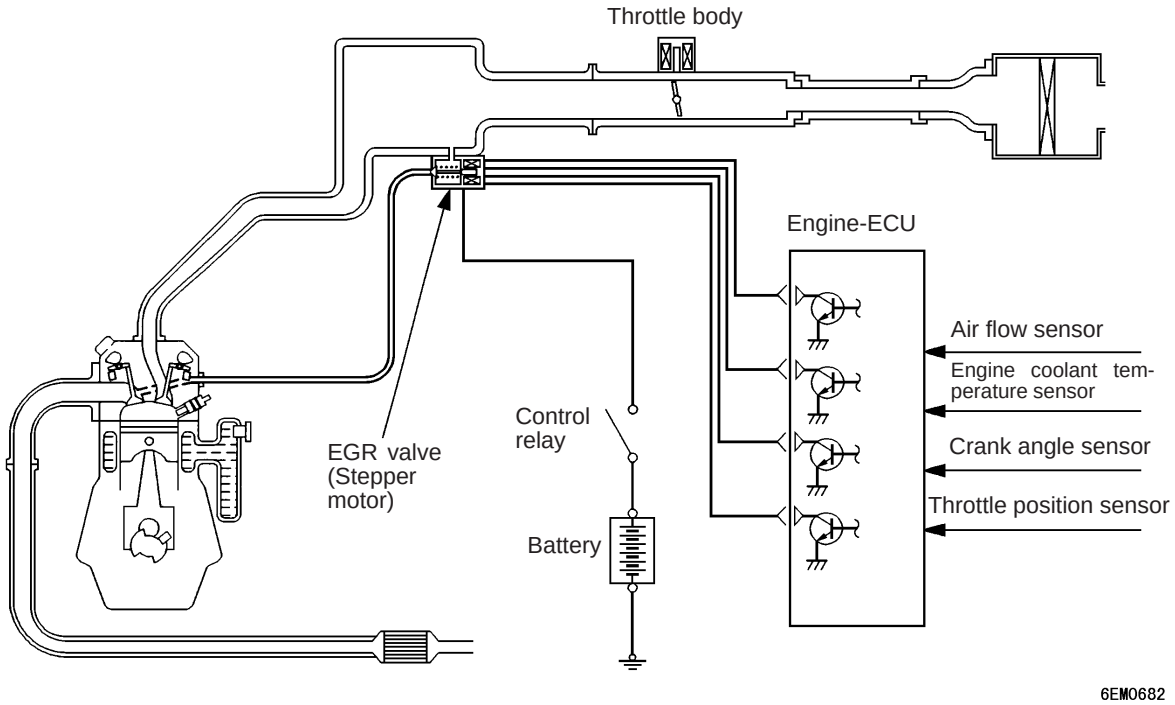
The exhaust gas recirculation (EGR) system lowers the nitrogen oxide (NOx) emission level. When the air/fuel mixture combustion temperature is high, a large quantity of nitrogen oxides (NOx) is generated in the combustion chamber. Therefore, this system recirculates part of emission gas from the exhaust port of the cylinder head to the combustion chamber through the intake manifold to decrease the air/fuel mixture combustion temperature, resulting in reduction of NOx.
The EGR flow rate is controlled by the EGR valve so as not to decrease the driveability.

OPERATION

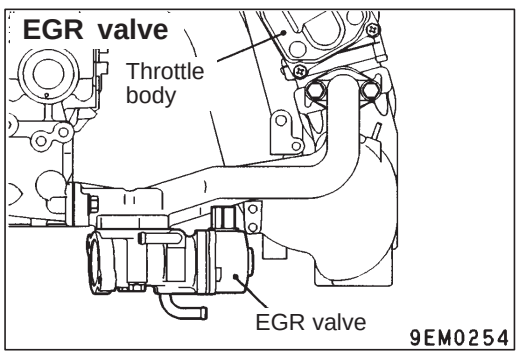
The EGR valve is being closed and dose not recirculate exhaust gases under one of the following conditions. Otherwise, the EGR valve is opened and recirculate exhaust gases.

- The engine coolant temperature is low.
- The engine is at idle.
- The throttle valve is widely opened.

SYSTEM DIAGRAM

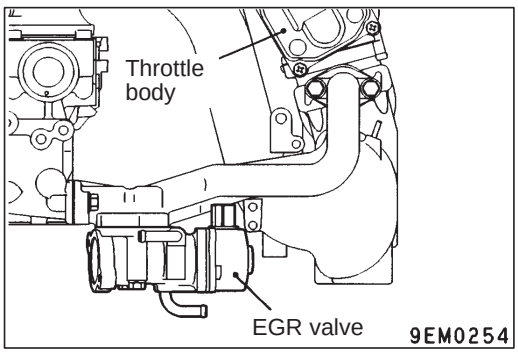


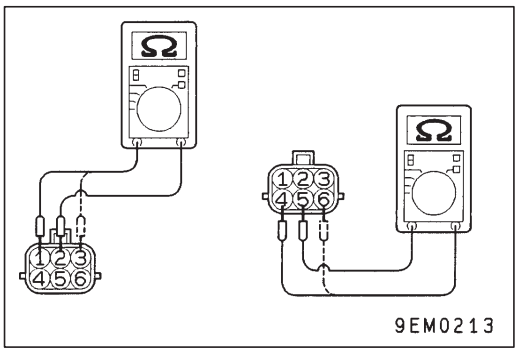
COMPONENT LOCATION



EXHAUST GAS RECIRCULATION (EGR) CONTROL SYSTEM CHECK

Refer to GROUP 13A – Troubleshooting.





EGR VALVE (STEPPER MOTOR) CHECK

Checking the Operation Sound

1. Check that the operation sound of the stepper motor can be heard from the EGR valve when the ignition switch is turned to ON (without starting the engine).
2. If the operation sound cannot be heard, check the stepper motor drive circuit.

   NOTE
   If the circuit is normal, the cause is probably a malfunction of the stepper motor or of the engine-ECU.

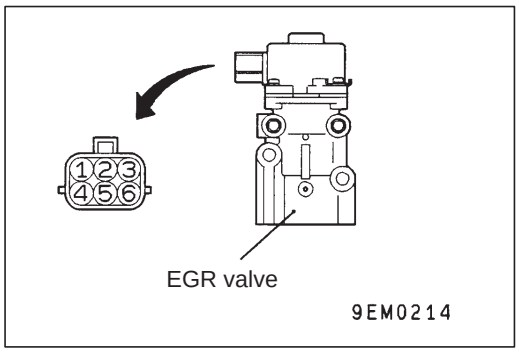
Checking the Coil Resistance

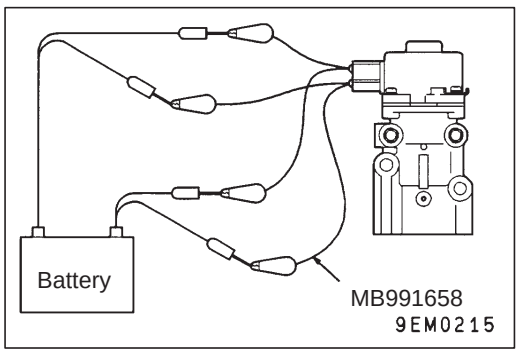
1. Disconnect the EGR valve connector.
2. Measure the resistance between the EGR valve-side connector terminal No.2 and terminal No.1 or terminal No.3.

   Standard value: 10 – 20 Ω (at 20°C)

3. Measure the resistance between the EGR valve-side connector terminal No.5 and terminal No.4 or terminal No.6.

   Standard value: 10 – 20 Ω (at 20°C)





Operation Check

1. Remove the EGR valve.
2. Connect the special tool (test harness set) to the EGR valve-side connector.
3. Connect terminal No.2 and terminal No.5 to the positive (+) terminal of power supply of approximately 6 V.
4. Connect each clip to the negative (–) terminal of power supply in the order given below to test if any vibration occurs (as though the stepper motor is shaking slightly) due to the operation of the stepper motor.
   (1) Connect terminal No.1 and terminal No.4 to the negative (–) terminal of the power supply.
   (2) Connect terminal No.3 and terminal No.4 to the negative (–) terminal of the power supply.
   (3) Connect terminal No.3 and terminal No.6 to the negative (–) terminal of the power supply.
   (4) Connect terminal No.1 and terminal No.6 to the negative (–) terminal of the power supply.
   (5) Connect terminal No.1 and terminal No.4 to the negative (–) terminal of the power supply.
   (6) Repeat the test in the order from (5) to (1).
5. If the results of testing show that the vibration could be felt, the stepper motor is normal.

Cleaning the EGR Valve

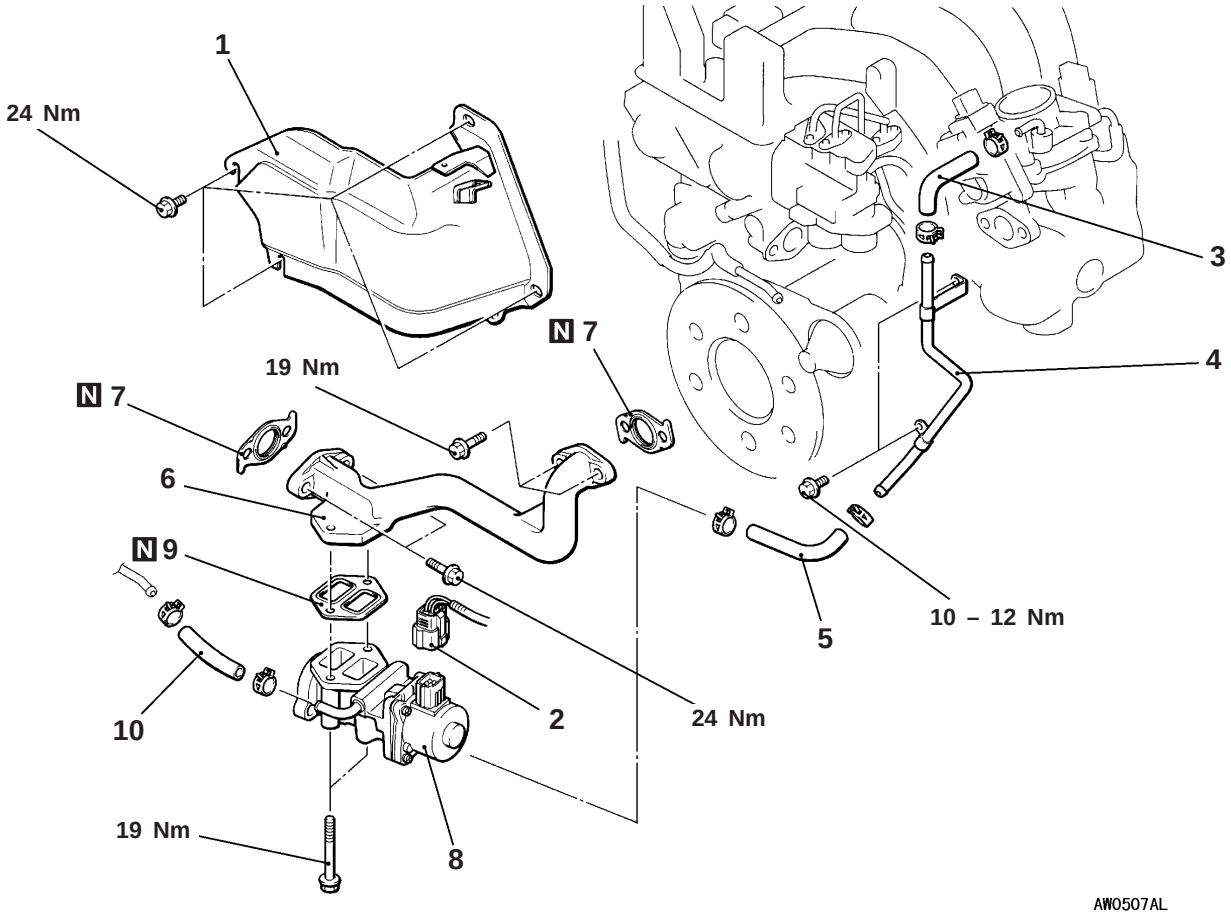
Remove the EGR valve, and then check if the EGR valve is stuck and carbon is accumulated in it. If so, use a wire brush to clean the EGR valve.

Caution
Do not use a cleaning solvent. Solvent will penetrate to the motor and malfunction of EGR valve will result.

EGR VALVE

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying (Refer to GROUP 14 – On-vehicle Service.)
- Engine Cover Removal and Installation



Removal steps

◀A▶ 1. Fuel pump protector
2. EGR valve harness connector connection
3. Water hose
4. Water pipe
5. Water hose
6. EGR valve and support assembly
7. EGR pipe gasket
8. EGR valve
9. EGR valve gasket
10. Water hose

REMOVAL SERVICE POINT

◀A▶ FUEL PUMP PROTECTOR REMOVAL

Lift up the transmission with a jack to create clearance between the engine and front deck, and then remove the fuel pump protector.

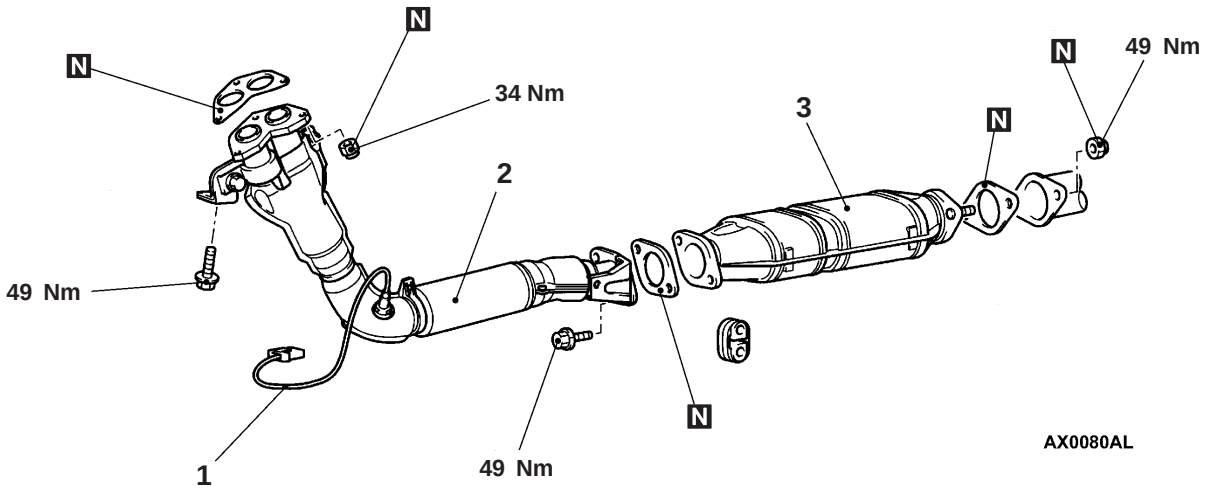
CATALYTIC CONVERTER

GENERAL INFORMATION

The three-way catalytic converter, together with the closed loop air-fuel ratio control based on the oxygen sensor signal, oxidizes carbon monoxides (CO) and hydrocarbons (HC) and reduces nitrogen oxides (NOx).

When the mixture is controlled at stoichiometric air-fuel ratio, the three-way catalytic converter provides the highest purification against the three constituents, namely, CO, HC and NOx.

REMOVAL AND INSTALLATION



Removal steps

1. Oxygen sensor harness connector connection
2. Front exhaust pipe
3. Catalytic converter

NOTES

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EMISSION CONTROL SYSTEM

GENERAL

OUTLINE OF CHANGE

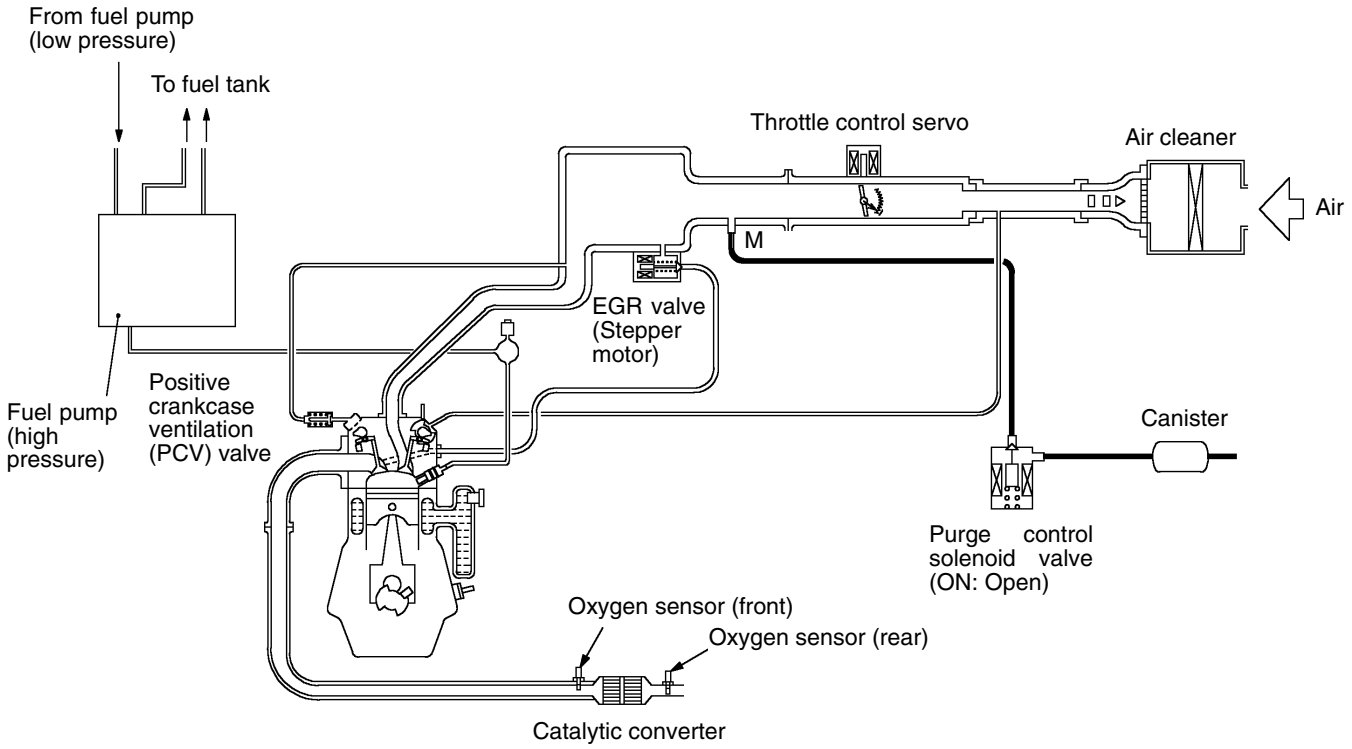
The flow rate of the purge control solenoid valve has been increased and the vacuum line routing has been changed. Due to these changes, the following service procedures have been established. Other items are the same as before.

SERVICE SPECIFICATION

Items	Standard value
EGR control solenoid valve coil resistance (at 20 °C) Ω	30 – 34

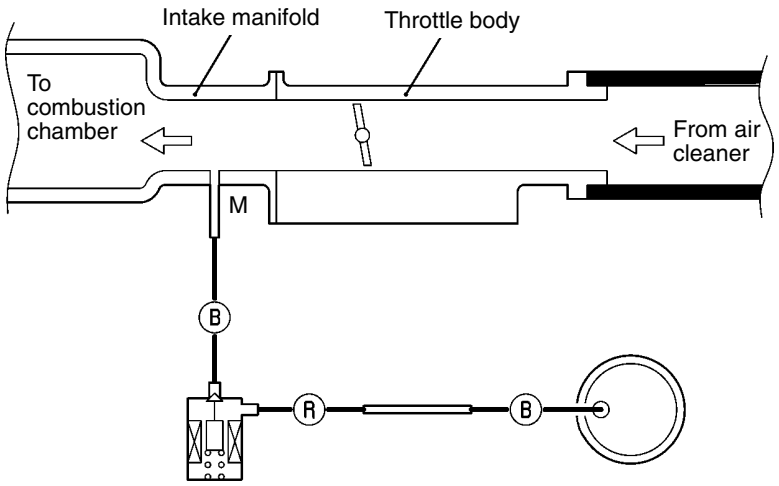
VACUUM HOSE

VACUUM HOSE PIPING DIAGRAM

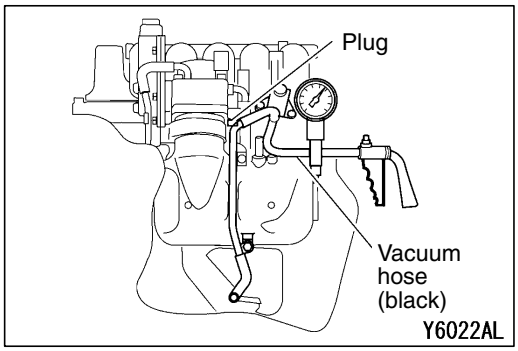


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VACUUM CIRCUIT DIAGRAM



Vacuum hose colour
B: Black
R: Red



EVAPORATIVE EMISSION CONTROL SYSTEM

PURGE CONTROL SYSTEM CHECK

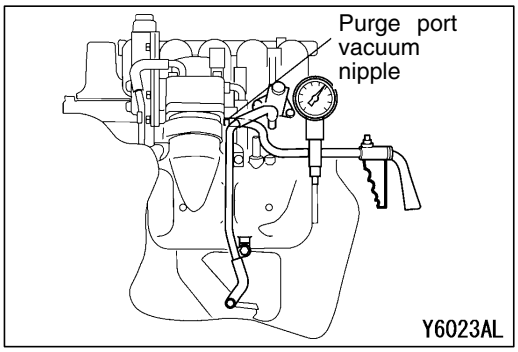
1. Disconnect the vacuum hose (black) from the intake manifold and connect it to a hand vacuum pump.
2. Plug the nipple from which the vacuum hose was removed.
3. When the engine is cold or hot, apply a vacuum of 53 kPa, and check the condition of the vacuum.

When engine is cold
(Engine coolant temperature: 40°C or less)

Engine condition	Normal condition
At idle	Vacuum is maintained
3,000 r/min	

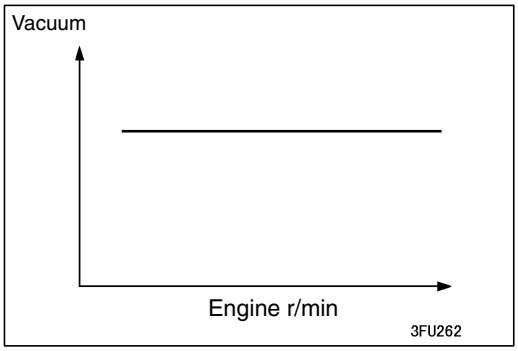
When engine is hot
(Engine coolant temperature: 80°C or higher)

Engine condition	Normal condition
• At idle • Within 4 minutes after the engine has been started	Vacuum is maintained
• 3,000 r/min • Within 3 minutes after the engine has been started	Vacuum will leak.



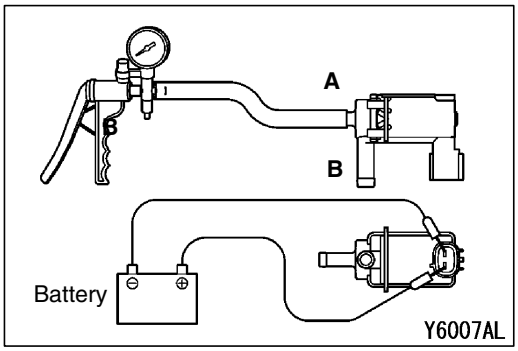
PURGE PORT VACUUM CHECK

1. Disconnect the vacuum hose (black) from the intake manifold purge vacuum nipple and connect a hand vacuum pump to the nipple.



2. Start the engine and check that the vacuum remains fairly constant after racing the engine.

   NOTE
   If vacuum changes, it is possible that the intake manifold purge port may be clogged and require cleaning.

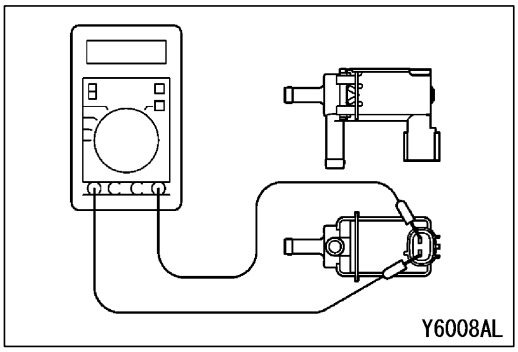


PURGE CONTROL SOLENOID VALVE CHECK

NOTE
When disconnecting the vacuum hose, always make a mark so that it can be reconnected at original position.

1. Disconnect the vacuum hose (black stripe, red stripe) from the solenoid valve.
2. Disconnect the harness connector.
3. Connect a hand vacuum pump to nipple (A) of the solenoid valve (refer to the illustration at left).
4. Check airtightness by applying a vacuum with voltage applied directly from the battery to the purge control solenoid valve and without applying voltage.

Battery voltage	Normal condition
Applied	Vacuum leaks
Not applied	Vacuum maintained



5. Measure the resistance between the terminals of the solenoid valve.

   Standard value: 30 – 34 Ω (at 20°C)

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ENGINE CONTROL SYSTEM

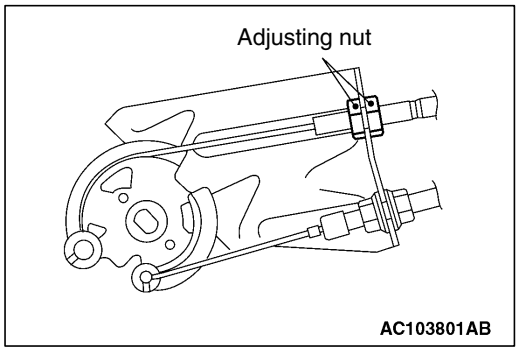
GENERAL

OUTLINE OF CHANGES

The following service procedures have been established due to the addition of vehicles with 4G9-MPI engine. The other contents are the same as the 4G9-GDI engine.

SERVICE SPECIFICATION

Items	Standard value
Accelerator cable play mm	1 – 2



ON-VEHICLE SERVICE

ACCELERATOR CABLE CHECK AND ADJUSTMENT <4G9-MPI>

1. Check the accelerator cable play when the accelerator pedal is released.

   Standard value: 1 – 2 mm

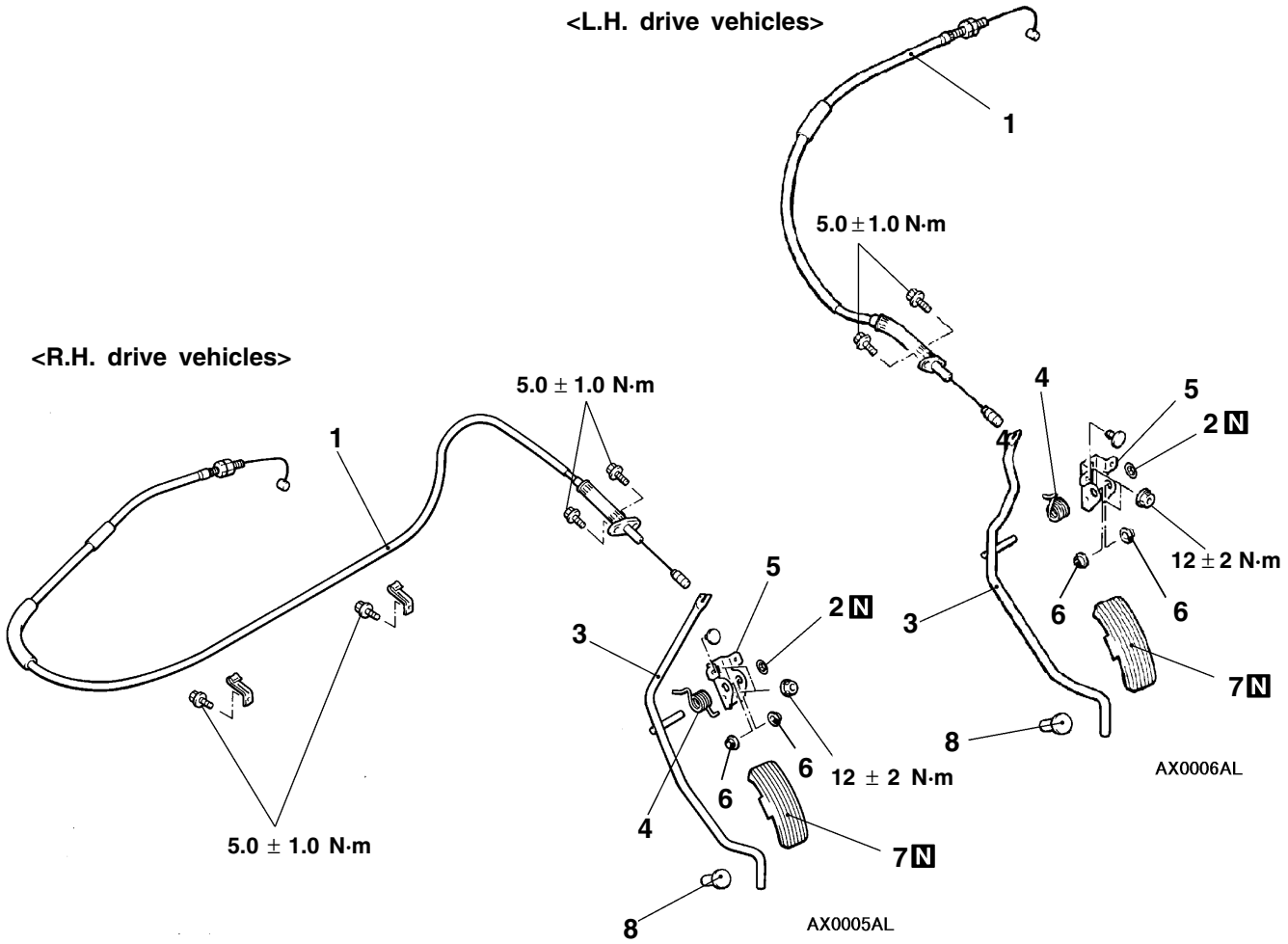
2. If the play is not within the standard value, turn the adjusting nut to adjust the play to the standard value.

ACCELERATOR CABLE AND PEDAL

REMOVAL AND INSTALLATION

<4G9-MPI>

Post-installation Operation
Accelerator Cable Adjustment (Refer to P.17-2.)



Removal steps

1. Accelerator cable
2. Push-on spring nut
3. Accelerator arm assembly
4. Spring
5. Accelerator pedal bracket
6. Bushing
7. Pedal pad

▶A◀ 8. Accelerator pedal stopper

INSTALLATION SERVICE POINT

◀A▶ ACCELERATOR PEDAL STOPPER INSTALLATION

Heat up the claw of the accelerator pedal pad with a drier and etc. before installation.

NOTE

Apply some soapsuds to the claw to facilitate installation if there is any difficulty.

EMISSION CONTROL SYSTEM <MPI>

GENERAL

OUTLINE OF CHANGES

The following contents have been established to correspond to the addition of vehicles with 4G9-MPI engine. The other contents are the same as before.

GENERAL INFORMATION

The emission control system consists of the following subsystems:
- Crankcase emission control system
- Evaporative emission control system
- Exhaust emission control system

Items	Name	Specification
Crankcase emission control system	Positive crankcase ventilation (PCV) valve	Variable flow type (Purpose: HC reduction)
Evaporative emission control system	Canister Purge control solenoid valve	Equipped Duty cycle type solenoid valve (Purpose: HC reduction)
Exhaust emission control system	Air-fuel ratio control device – MPI system	Oxygen sensor feedback type (Purpose: CO, HC, NOx reduction)
	Exhaust gas recirculation system • EGR valve • EGR control solenoid valve	Equipped Single type Duty cycle type solenoid valve (Purpose: NOx reduction)
	Catalytic converter	Monolith type (Purpose: CO, HC, NOx reduction)

EMISSION CONTROL DEVICE REFERENCE TABLE

Related parts	Crankcase emission control system	Evaporative emission control system	Air/fuel ratio control system	Catalytic converter	Exhaust gas recircula-tion system	Reference page
PCV valve	×					17-9*
Purge control solenoid valve		×				17-9
MPI system component		×	×			GROUP 13B
Catalytic converter				×		17-14
EGR valve					×	17-12
EGR control solenoid valve					×	17-13

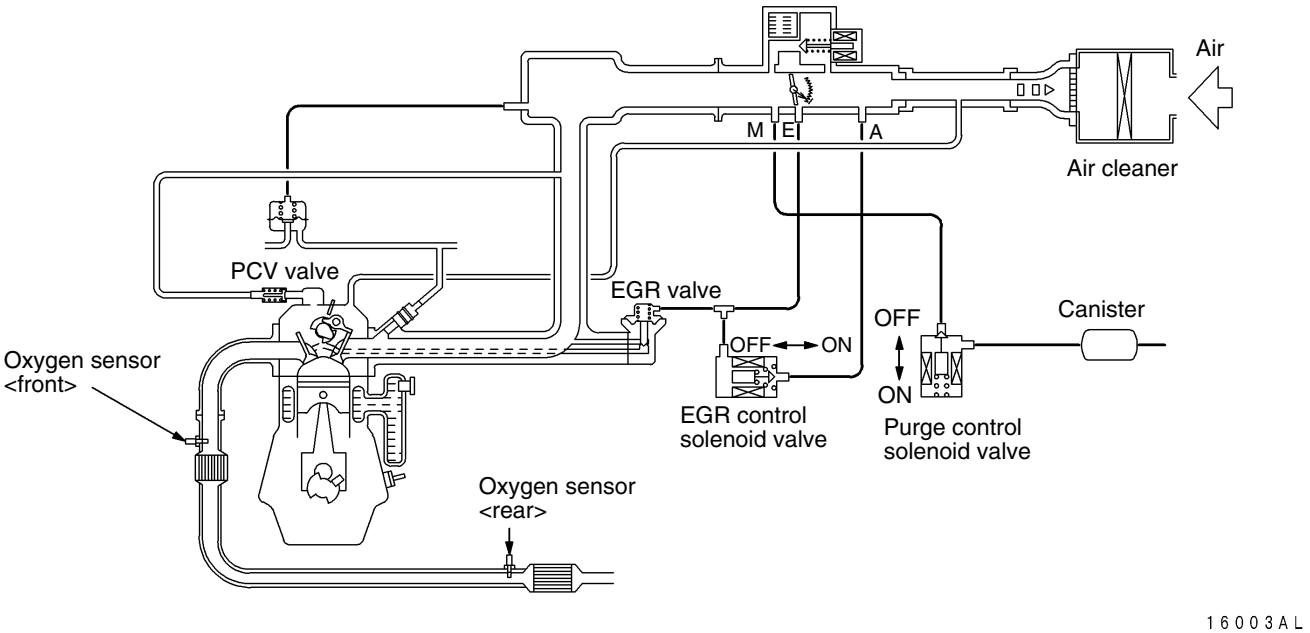
NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

SERVICE SPECIFICATIONS

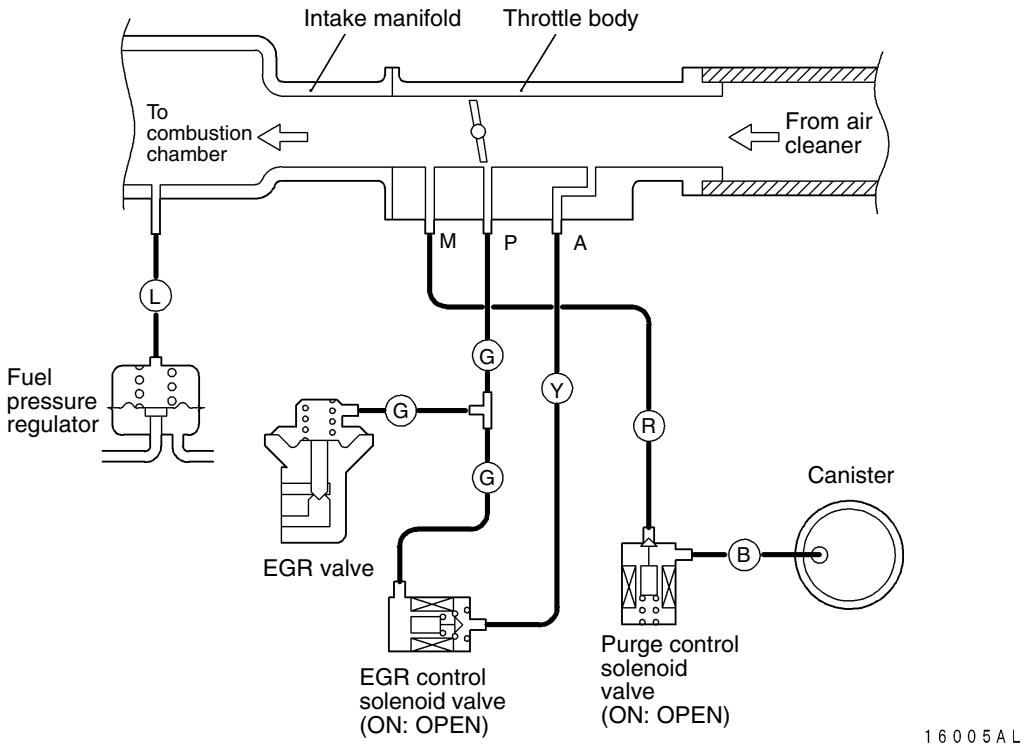
Items	Standard value
Purge control solenoid valve coil resistance (at 20°C) Ω	36 – 44
EGR control solenoid valve coil resistance (at 20°C) Ω	36 – 44

VACUUM HOSE

VACUUM HOSE PIPING DIAGRAM



VACUUM CIRCUIT DIAGRAM



Vacuum hose colour
B: Black
G: Green
L: Light blue
R: Red
Y: Yellow

VACUUM HOSE CHECK

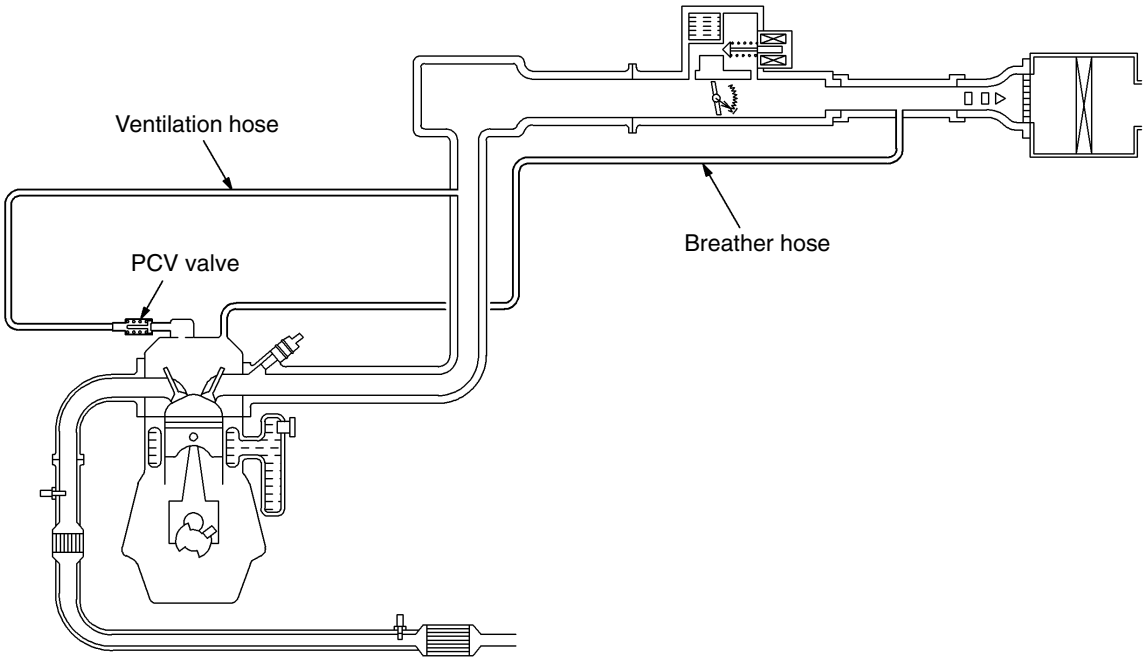
1. Using the piping diagram as a guide, check to be sure that the vacuum hoses are correctly connected.
2. Check the connection condition of the vacuum hoses, (removed, loose, etc.) and check to be sure that there are no bends or damage.

VACUUM HOSE INSTALLATION

1. When connecting the vacuum hoses, they should be securely inserted onto the nipples.
2. Connect the hoses correctly, using the vacuum hose piping diagram as a guide.

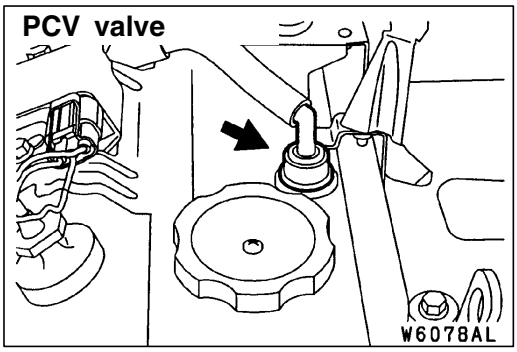
CRANKCASE EMISSION CONTROL SYSTEM

SYSTEM DIAGRAM



16004AL

COMPONENT LOCATION

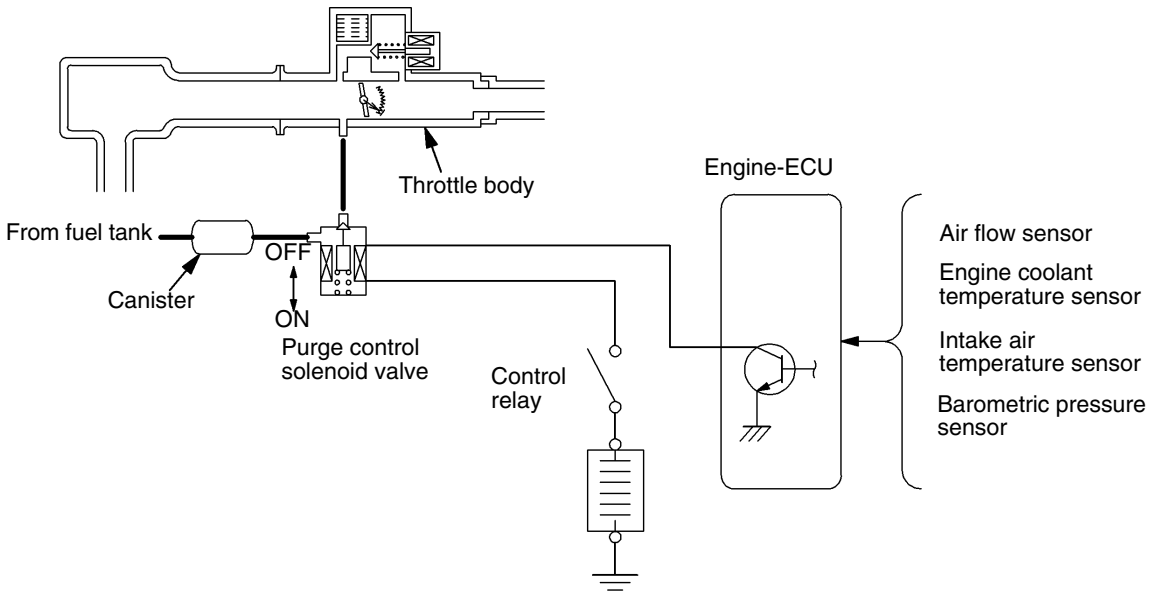


EVAPORATIVE EMISSION CONTROL SYSTEM

GENERAL INFORMATION

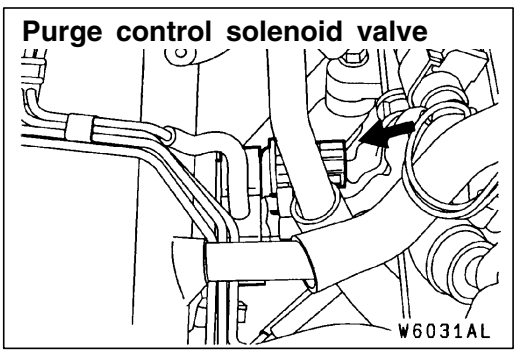
The evaporative emission control system prevents fuel vapours generated in the fuel tank from escaping into the atmosphere.
Fuel vapours from the fuel tank flow through the fuel tank pressure control valve and vapour pipe/hose to be stored temporarily in the canister. When driving the vehicle, fuel vapours stored in the canister flow through the purge solenoid and purge port and go into the intake manifold to be sent to the combustion chamber.
When the engine coolant temperature is low or when the intake air quantity is small (when the engine is at idle, for example), the engine control unit turns the purge solenoid off to shut off the fuel vapour flow to the intake manifold.
This does not only insure the driveability when the engine is cold or running under low load but also stabilize the emission level.

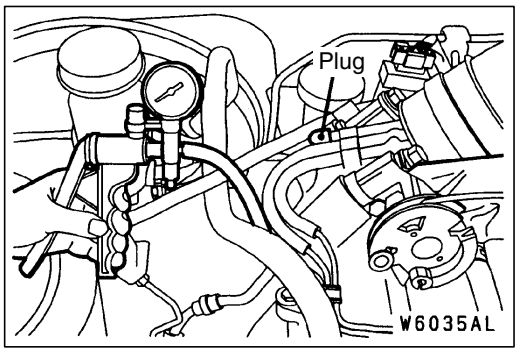
SYSTEM DIAGRAM



16006AL

COMPONENT LOCATION





PURGE CONTROL SYSTEM CHECK

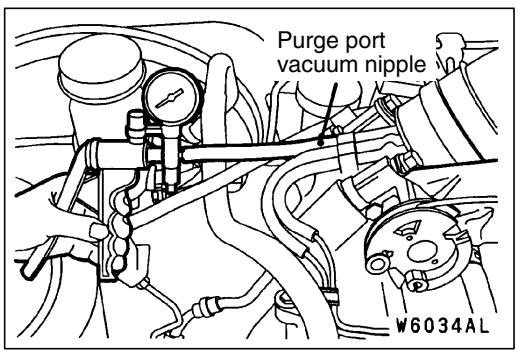
1. Disconnect the vacuum hose (red stripe) from the throttle body and connect it to a hand vacuum pump.
2. Plug the nipple from which the vacuum hose was removed.
3. When the engine is cold or hot, apply a vacuum of 53 kPa, and check the condition of the vacuum.

When engine is cold
(Engine coolant temperature: 40°C or less)

Engine condition	Normal condition
At idle	Vacuum is maintained
3,000 r/min	

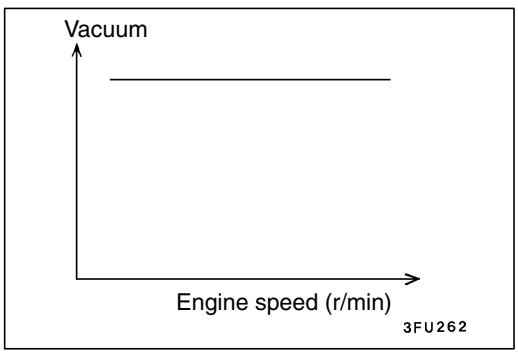
When engine is hot
(Engine coolant temperature: 80°C or higher)

Engine condition	Normal condition
At idle	Vacuum is maintained
3,000 r/min (fore approximately 3 minutes after the engine is started.)	Vacuum will leak.



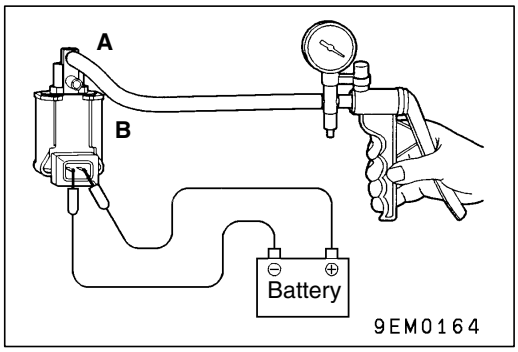
PURGE PORT VACUUM CHECK

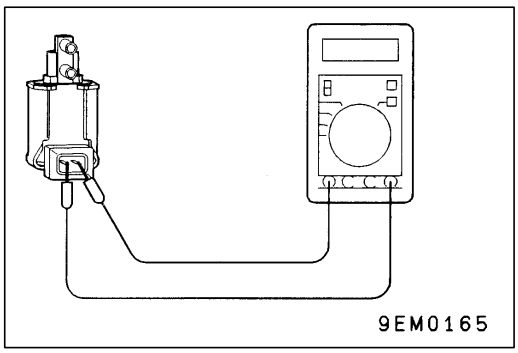
1. Disconnect the vacuum hose (red stripe) from the throttle body purge vacuum nipple and connect a hand vacuum pump to the nipple.



2. Start the engine and check that the vacuum remains fairly constant after racing the engine.

   NOTE
   If vacuum changes, it is possible that the throttle body purge port may be clogged and require cleaning.





PURGE CONTROL SOLENOID VALVE CHECK

NOTE
When disconnecting the vacuum hose, always make a mark so that it can be reconnected at original position.

1. Disconnect the vacuum hose (black, red stripe) from the solenoid valve.
2. Disconnect the harness connector.
3. Connect a hand vacuum pump to nipple (A) of the solenoid valve (refer to the illustration at left).
4. Check airtightness by applying a vacuum with voltage applied directly from the battery to the purge control solenoid valve and without applying voltage.

Battery voltage	Normal condition
Applied	Vacuum leaks
Not applied	Vacuum maintained

5. Measure the resistance between the terminals of the solenoid valve.

   Standard value: 36 – 44 Ω (at 20°C)

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

GENERAL INFORMATION

The exhaust gas recirculation (EGR) system lowers the nitrogen oxide (NOx) emission level. When the air/fuel mixture combustion temperature is high, a large quantity of nitrogen oxides (NOx) is generated in the combustion chamber. Therefore, this system recirculates part of emission gas from the exhaust port of the cylinder head to the combustion chamber through the intake manifold to decrease the air/fuel mixture combustion temperature, resulting in reduction of NOx.

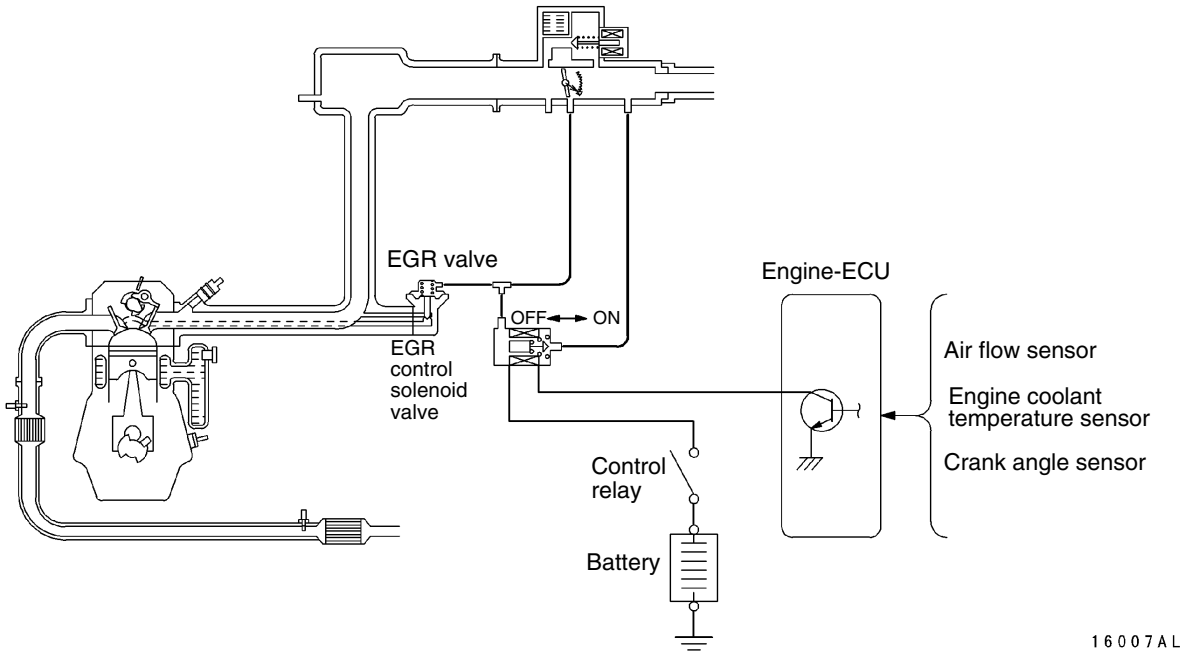
The EGR flow rate is controlled by the EGR valve so as not to decrease the driveability.

OPERATION

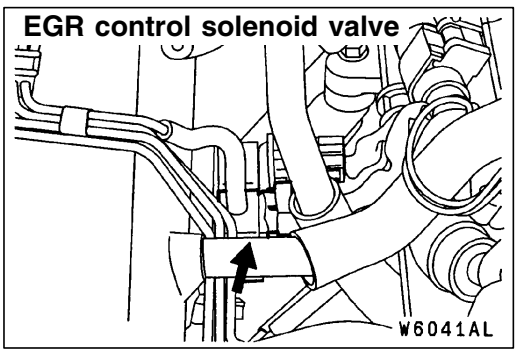
The EGR valve is being closed and does not recirculate exhaust gases under one of the following conditions. Otherwise, the EGR valve is opened and recirculates exhaust gases.

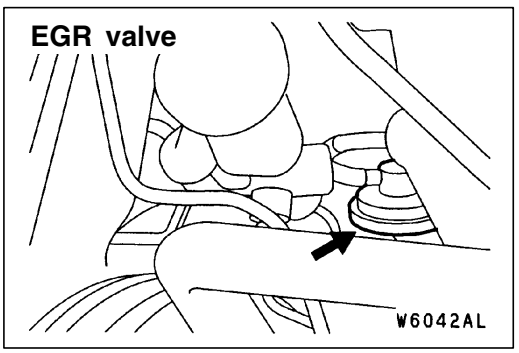
- The engine coolant temperature is low.
- The engine is at idle.
- The throttle valve is widely opened.

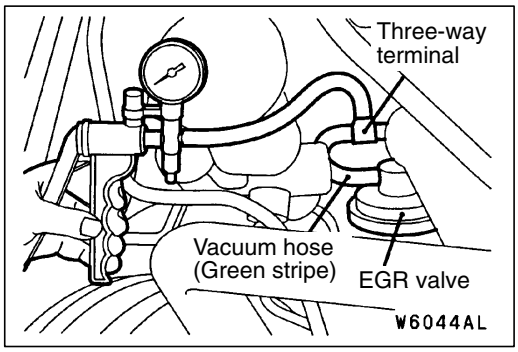
SYSTEM DIAGRAM



COMPONENT LOCATION







EXHAUST GAS RECIRCULATION (EGR) CONTROL SYSTEM CHECK

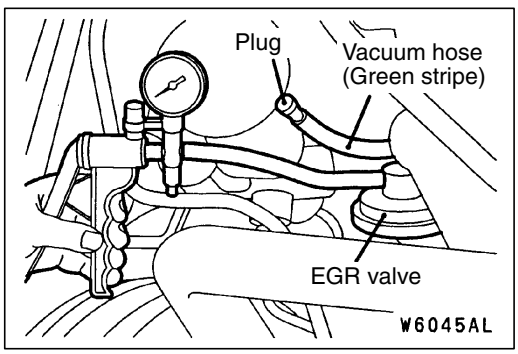
1. Disconnect the vacuum hose (green stripe) from the EGR valve, and then connect a hand vacuum pump via the three-way terminal.
2. When the engine is hot or cold, check the condition of vacuum by racing the engine.

When engine is cold
(Engine coolant temperature: 20°C or less)

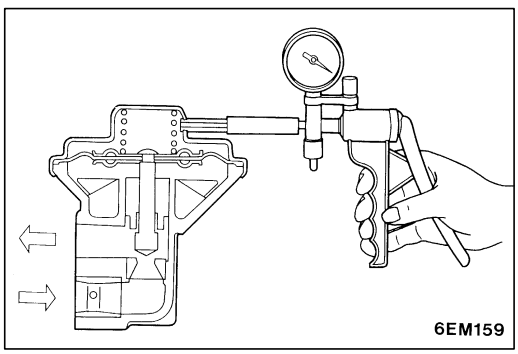
Throttle valve	Normal vacuum condition
Open quickly	No vacuum will generate (the same as barometric pressure.)

When engine is hot
(Engine coolant temperature: 80°C or higher)

Throttle valve	Normal vacuum condition
Open quickly	It will momentarily rise over 13 kPa



3. Disconnect the three-way terminal.
4. Connect the hand vacuum pump to the EGR valve.
5. Check whether the engine stalls or the idling is unstable when a vacuum of 30 kPa or higher is applied during idling.



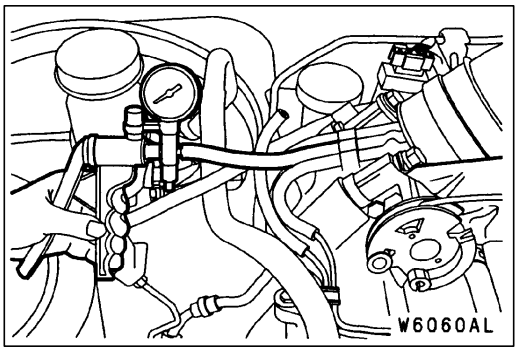
EGR VALVE CHECK

1. Remove the EGR valve and inspect for sticking, carbon deposits, etc. If found, clean with a suitable solvent so that the valve seats correctly.
2. Connect a hand vacuum pump to the EGR valve.
3. Apply 67 kPa of vacuum, and check that the vacuum is maintained.
4. Apply a vacuum and check the passage of air by blowing through one side of the EGR passage.

Vacuum	Passage of air
5.0 kPa or less	Air is not blown out
27 kPa or more	Air is blown out

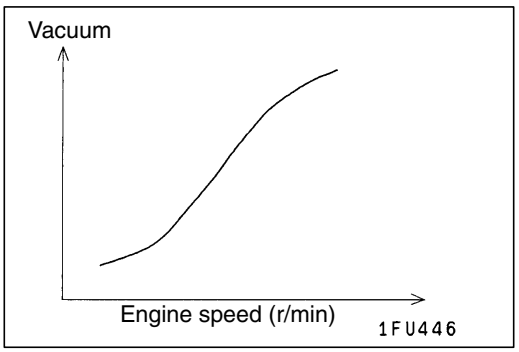
5. Replace the gasket, and tighten to the specified torque.

Tightening torque: 22 ± 5 N·m



EGR PORT VACUUM CHECK

1. Disconnect the vacuum hose (Green) from the throttle body EGR vacuum nipple and connect a hand vacuum pump to the nipple.



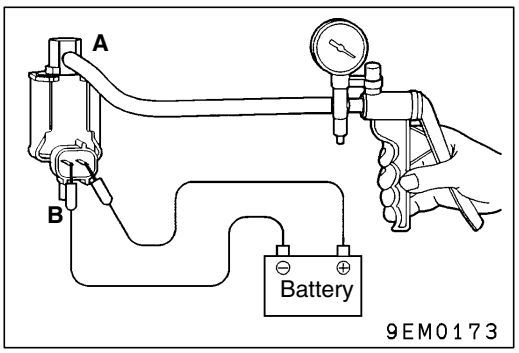
2. Start the engine and check that, after raising the engine speed by racing the engine, purge vacuum raises according to engine speed.

   NOTE
   If there is a problem with the change in vacuum, the throttle body EGR port may be clogged and require cleaning.

EGR CONTROL SOLENOID VALVE CHECK

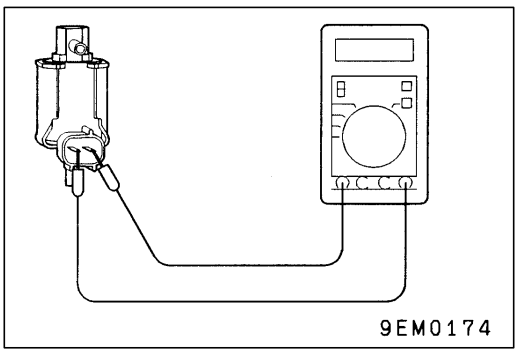
NOTE
When disconnecting the vacuum hose, always make a mark so that it can be reconnected at original position.

1. Disconnect the vacuum hose (yellow stripe, green stripe) from the solenoid valve.
2. Disconnect the harness connector.



3. Connect a hand vacuum pump to the nipple (A) of the solenoid valve (refer to the illustration at left).
4. Check airtightness by applying a vacuum with voltage applied directly from the battery to the EGR control solenoid valve and without applying voltage.

Battery voltage	Normal condition
Not applied	Vacuum maintained
Applied	Vacuum leaks

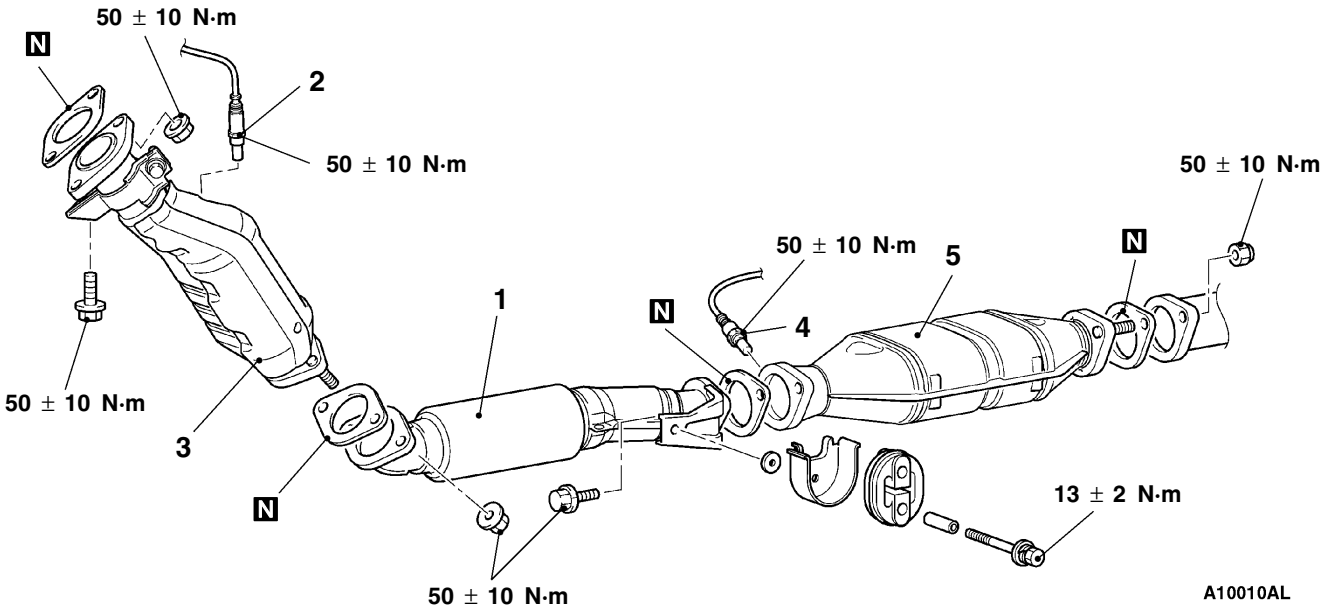


5. Measure the resistance between the terminals of the solenoid valve.

   Standard value: 36 – 44 Ω (at 20°C)

CATALYTIC CONVERTER

REMOVAL AND INSTALLATION



Front catalytic converter removal steps

1. Front pipe
2. Oxygen sensor (front)
3. Front catalytic converter

Catalytic converter removal steps

1. Front pipe
4. Oxygen sensor (rear)
5. Catalytic converter

CLUTCH

CLUTCH

CONTENTS

GENERAL INFORMATION 2

SERVICE SPECIFICATIONS 2

LUBRICANTS 2

ON-VEHICLE SERVICE 2

Clutch Pedal Inspection and Adjustment 2

Bleeding 3

CLUTCH PEDAL 4

CLUTCH CONTROL 5

Clutch Master Cylinder 7

GENERAL INFORMATION

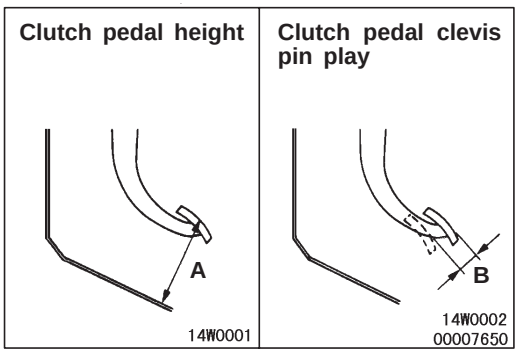
The clutch is a dry single-disc, diaphragm type; hydraulic pressure is used for the clutch control.

SERVICE SPECIFICATIONS

Items	Standard value
Clutch pedal height mm	212 – 215 <L.H. drive vehicles> 202 – 205 <R.H. drive vehicles>
Clutch pedal clevis pin play mm	1 – 3
Clutch pedal free play mm	6 – 13
Distance between the clutch pedal and the toeboard when the clutch is disengaged mm	110 or more

LUBRICANTS

Items	Specified lubricants	Quantity
Clutch fluid	Brake fluid DOT3 or DOT4	As required
Push rod assembly	Rubber grease	
Release cylinder push rod	MITSUBISHI genuine grease Part No. 0101011	



ON-VEHICLE SERVICE

CLUTCH PEDAL INSPECTION AND ADJUSTMENT

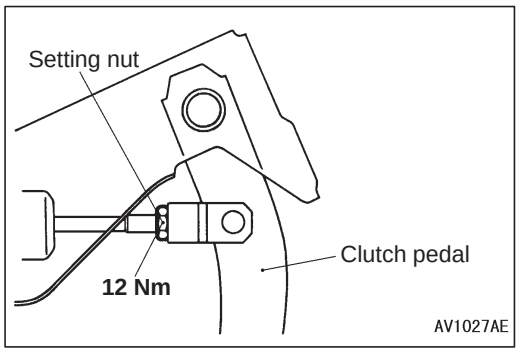
1. Turn up the carpet, etc. under the clutch pedal.
2. Measure the clutch pedal height and the clutch pedal clevis pin play.

Standard value (A):

212 – 215 <L.H. drive vehicles>

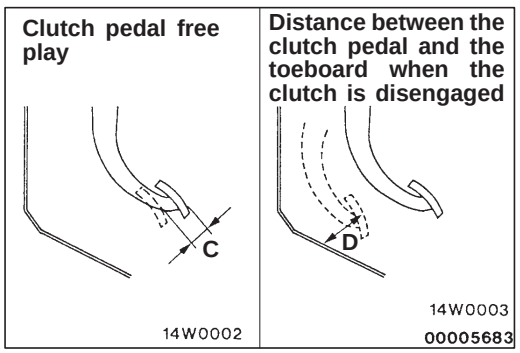
202 – 205 <R.H. drive vehicles>

Standard value (B): 1 – 3 mm



3. If the clutch pedal height and the clutch pedal clevis pin play are outside the standard value, turn the setting nut to adjust them to the standard value.

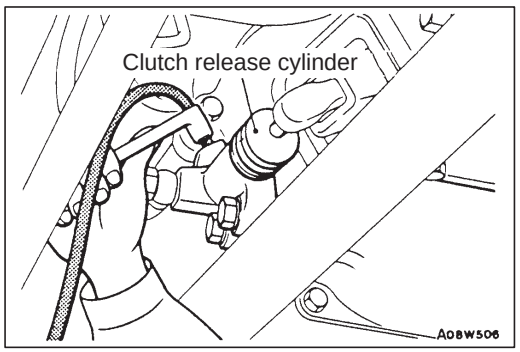
Caution
Do not push in the master cylinder push rod at this time, otherwise the clutch will not operate properly.



4. After completing the adjustments, confirm that the clutch pedal free play (measured at the face of the pedal pad) and the distance between the clutch pedal (the face of the pedal pad) and the toeboard when the clutch is disengaged are within the standard value ranges.

Standard value (C): 6 – 13 mm
Standard value (D): 110 mm or more

5. If the clutch pedal free play and the distance between the clutch pedal and the toeboard when the clutch is disengaged do not agree with the standard values, it is probably the result of either air in the hydraulic system or a faulty master cylinder, release cylinder or clutch. Bleed the air, or disassemble and inspect the master cylinder, release cylinder or clutch.
6. Turn back the carpet, etc.



BLEEDING

Specified fluid: Brake fluid DOT 3 or DOT 4

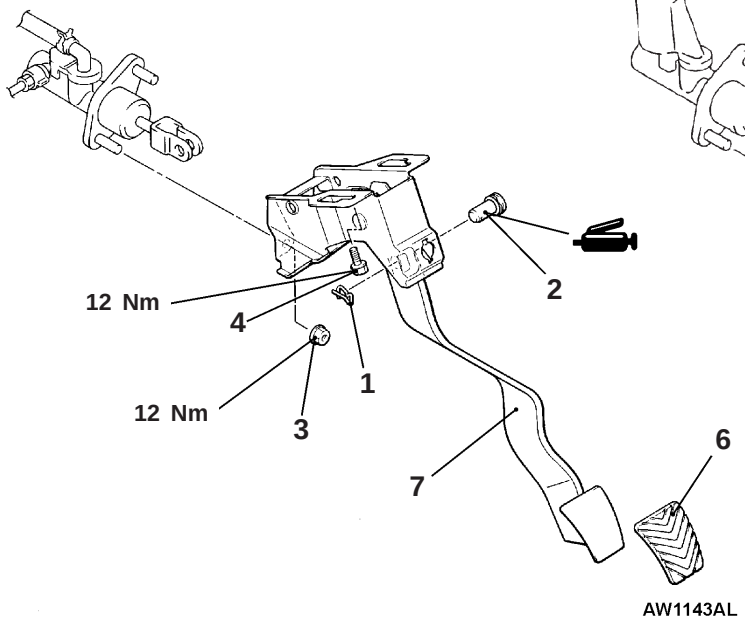
Caution
Use the specified brake fluid. Avoid using a mixture of the specified fluid and other fluid.

CLUTCH PEDAL

REMOVAL AND INSTALLATION

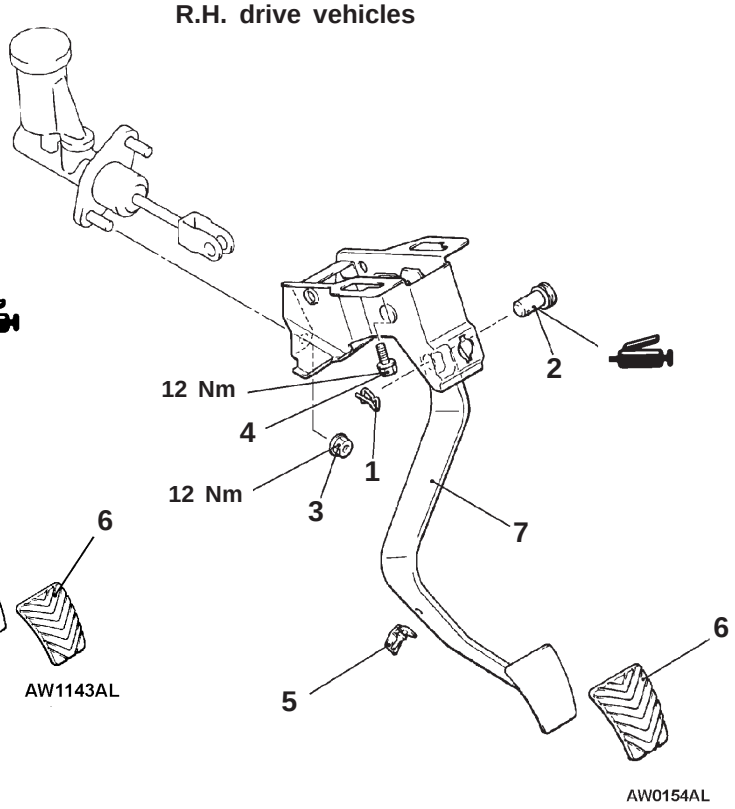
Post-installation Operation
Clutch Pedal Adjustment (Refer to P.21-2.)

L.H. drive vehicles



AW1143AL

R.H. drive vehicles



AW0154AL

Removal steps

1. Snap pin
2. Clevis pin
3. Clutch master cylinder mounting nut
4. Master cylinder member mounting bolt
5. Stopper <R.H. drive vehicles>
6. Pedal pad
7. Clutch pedal assembly

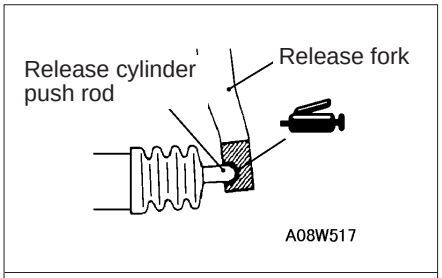
CLUTCH CONTROL

REMOVAL AND INSTALLATION

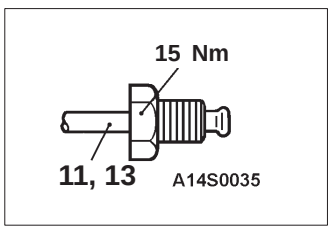
Pre-removal Operation
Clutch Fluid Draining

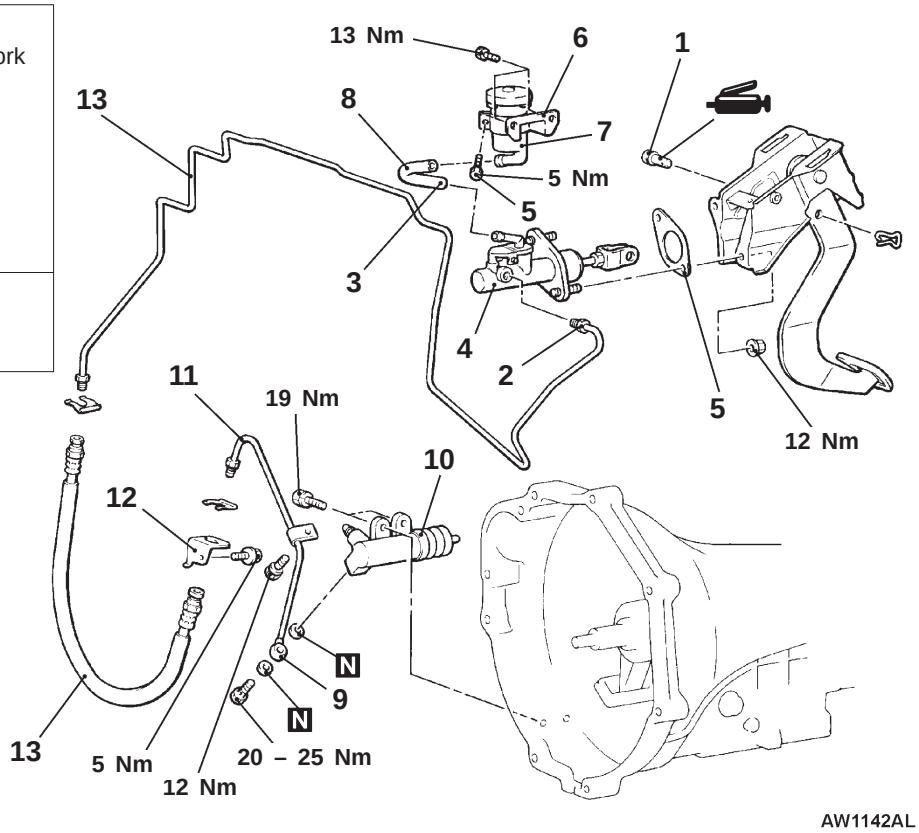
Post-installation Operation
- Clutch Fluid Supplying
- Clutch Line Bleeding (Refer to P.21-3.)
- Clutch Pedal Adjustment (Refer to P.21-2.)

<L.H. drive vehicles>



Specified grease:
MITSUBISHI genuine grease Part No. 0101011





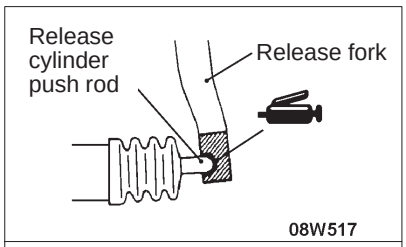
Clutch master cylinder assembly removal steps
1. Clevis pin
2. Clutch pipe connection
3. Breather hose connection
4. Clutch master cylinder assembly
5. Sealer

Reservoir tank removal steps
3. Breather hose connection
5. Bolt
6. Reservoir bracket
7. Reservoir tank
8. Breather hose

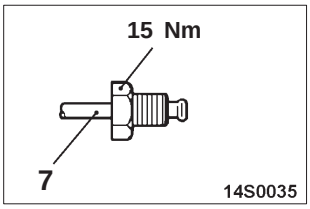
Clutch release cylinder assembly removal steps
9. Clutch pipe connection
10. Clutch release cylinder assembly

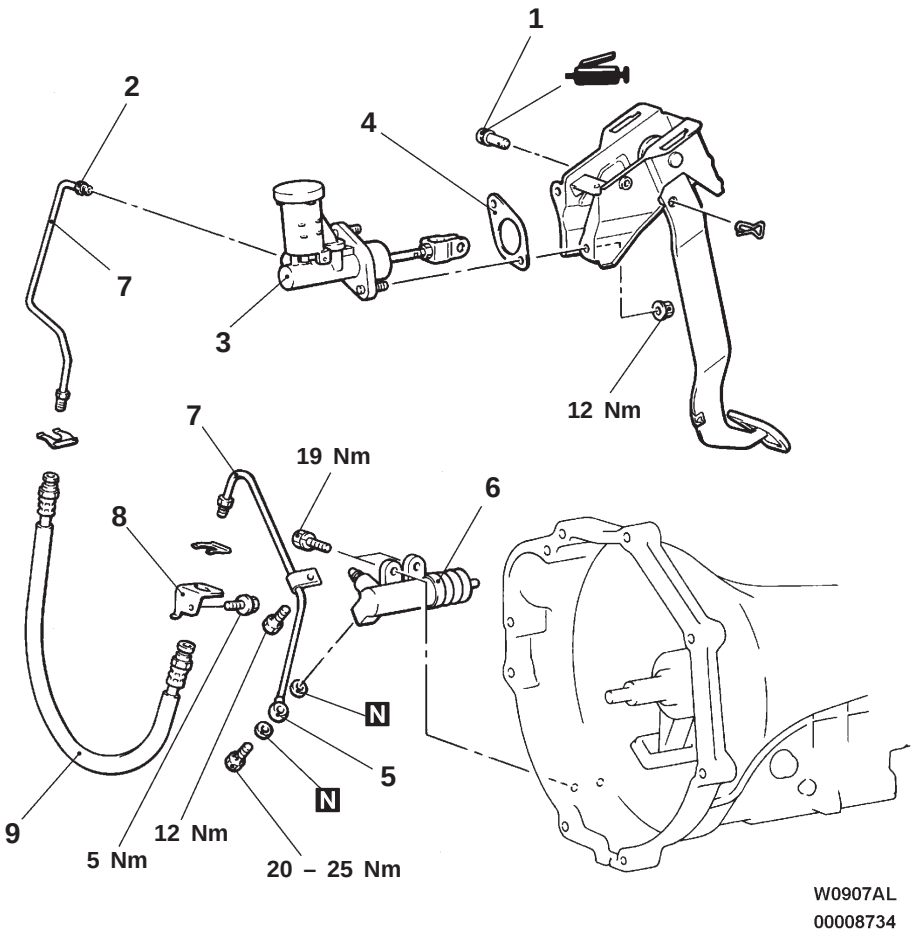
Clutch line removal steps
11. Clutch pipe
12. Bracket
13. Clutch hose

<R.H. drive vehicles>



Specified grease:
MITSUBISHI genuine grease Part No. 0101011





Clutch master cylinder assembly removal steps

1. Clevis pin
2. Clutch pipe connection
3. Clutch master cylinder assembly
4. Sealer

Clutch release cylinder assembly removal steps

5. Clutch pipe connection
6. Clutch release cylinder assembly

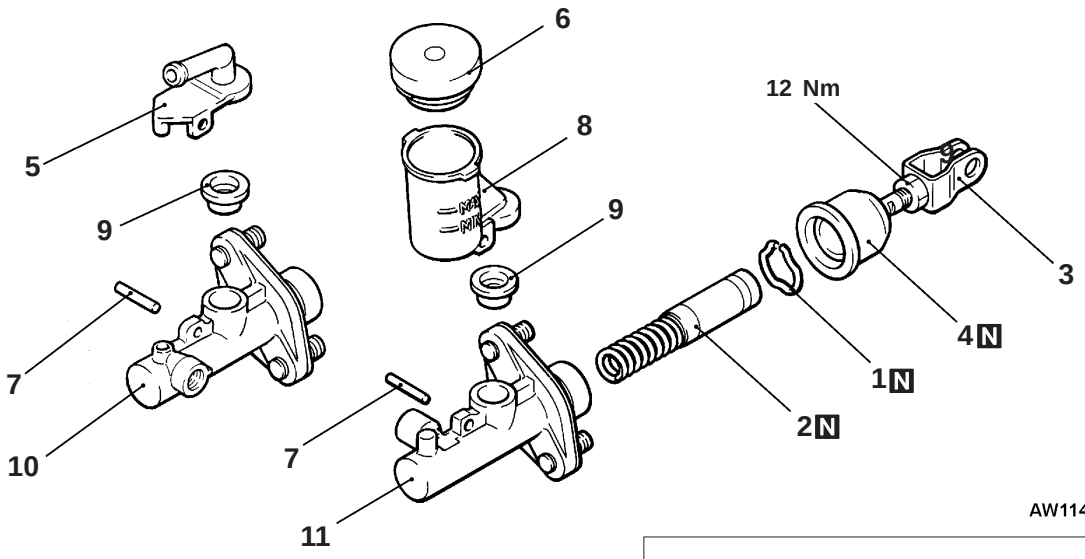
Clutch line removal steps

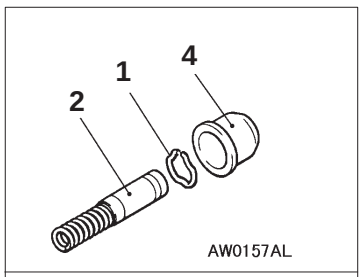
7. Clutch pipe
8. Bracket
9. Clutch hose

DISASSEMBLY AND REASSEMBLY

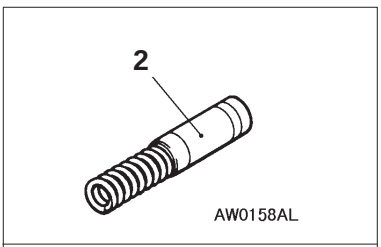
CLUTCH MASTER CYLINDER

Caution
Do not disassemble piston assembly.

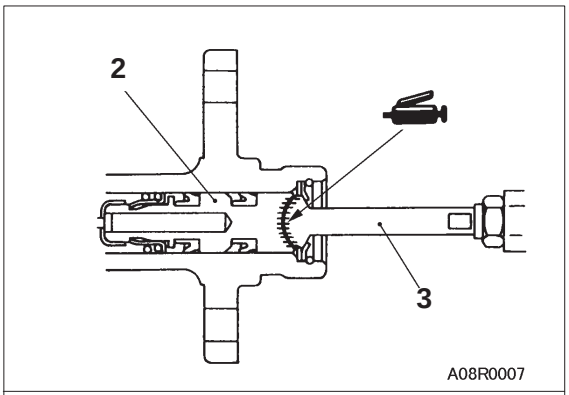




Piston repair kit



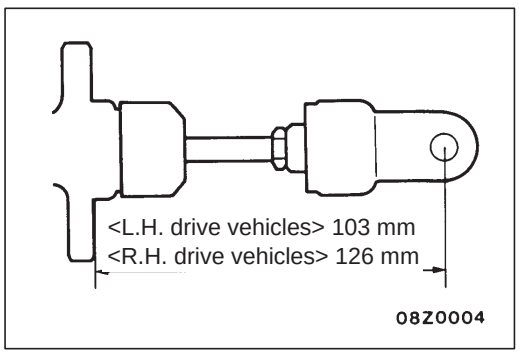
Clutch fluid:
Brake fluid DOT3 or DOT4



Grease: Rubber grease

Disassembly steps

1. Piston stopper ring
2. Piston assembly
▶A◀ 3. Push rod assembly
4. Boot
5. Nipple <L.H. drive vehicles>
6. Reservoir cap <R.H. drive vehicles>
7. Spring pin
8. Reservoir tank <R.H. drive vehicles>
9. Seal
10. Master cylinder body <L.H. drive vehicles>
11. Master cylinder body <R.H. drive vehicles>



INSTALLATION SERVICE POINT

▶A◀ PUSH ROD ASSEMBLY INSTALLATION

Set the length of the push rod assembly to the shown dimension to make the adjustment of clutch pedal easier.

NOTES

MANUAL TRANSMISSION

MANUAL TRANSMISSION

CONTENTS

LUBRICANT 2

SEALANTS AND ADHESIVES 2

ON-VEHICLE SERVICE 2

Transmission Oil Check 2

Transmission Oil Change 2

Transfer Oil Check 3

Transfer Oil Change 3

TRANSMISSION CONTROL 4

TRANSMISSION AND TRANSFER ASSEMBLY 8

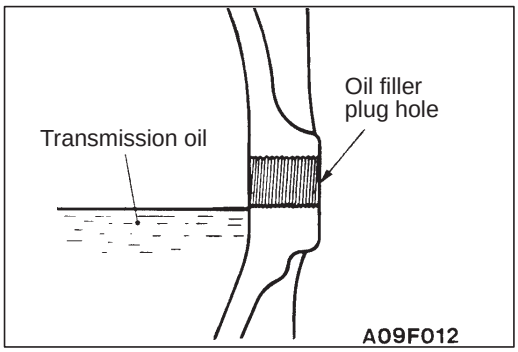
4WD INDICATOR CONTROL UNIT 9

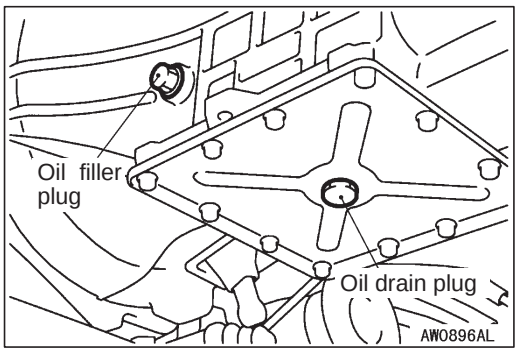
LUBRICANT

Items	Specified lubricants	Quantity ℓ
Transmission oil	Hypoid gear oil SAE 75W – 90 or 75W – 85W conforming to API GL-4	2.4
Transfer oil		2.2

SEALANTS AND ADHESIVES

Items	Specified sealant	Remarks
Contact surface between transmission and transmission control lever, thread (except outer surface) of stopper bracket assembly installation bolts and transfer control lever gasket	3M ATD Part No.8660 or equivalent	Semi-drying sealant
Thread of stopper bracket assembly installation bolts and thread of transfer control lever assembly installation bolts	3M Stud Locking No.4170 or equivalent	Anaerobic sealant





ON-VEHICLE SERVICE

TRANSMISSION OIL CHECK

1. Remove the oil filler plug.
2. Oil level should be at the lower portion of the oil filler plug hole.
3. Check that the transmission oil is not noticeably dirty, and that it has a suitable viscosity.
4. Tighten the oil filler plug to the specified torque.

   Tightening torque: 29 – 34 Nm

TRANSMISSION OIL CHANGE

1. Remove the oil drain plug to drain oil.
2. Tighten the oil drain plug to the specified torque.

   Tightening torque: 39 Nm

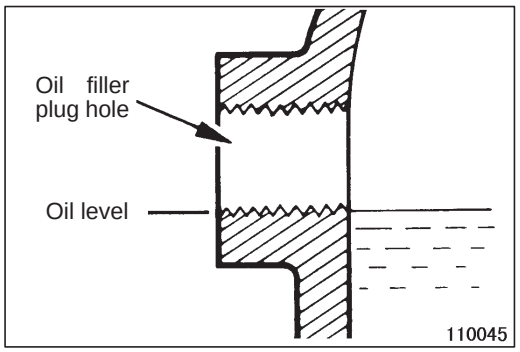
3. Remove the oil filler plug and fill with specified oil till the level comes to the lower portion of oil filler plug hole.

   Specified oil:
   Hypoid gear oil SAE 75W – 90 or 75W – 85W conforming to API GL-4

   Quantity: 2.4 ℓ

4. Tighten the oil filler plug to the specified torque.

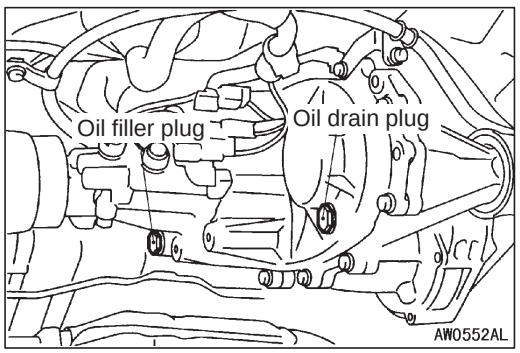
   Tightening torque: 29 – 34 Nm



TRANSFER OIL CHECK

1. Remove the oil filler plug.
2. Oil level should be at the lower portion of the oil filler plug hole.
3. Check that the transfer oil is not noticeably dirty, and it has a suitable viscosity.
4. Install the oil filler plug, and then tighten it to the specified torque.

   Tightening torque: 29 – 34 Nm



TRANSFER OIL CHANGE

1. Remove the oil drain plug to drain oil.
2. Install the oil drain plug, and then tighten it to the specified torque.

   Tightening torque: 29 – 34 Nm

3. Remove the oil filler plug, and then fill with specified oil till the level comes to the lower portion of oil filler plug hole.

   Specified oil:
   Hypoid gear oil SAE 75W – 90 or 75W – 85W conforming to API GL-4

   Quantity: 2.2 ℓ

4. Install the oil filler plug, and then tighten it to the specified torque.

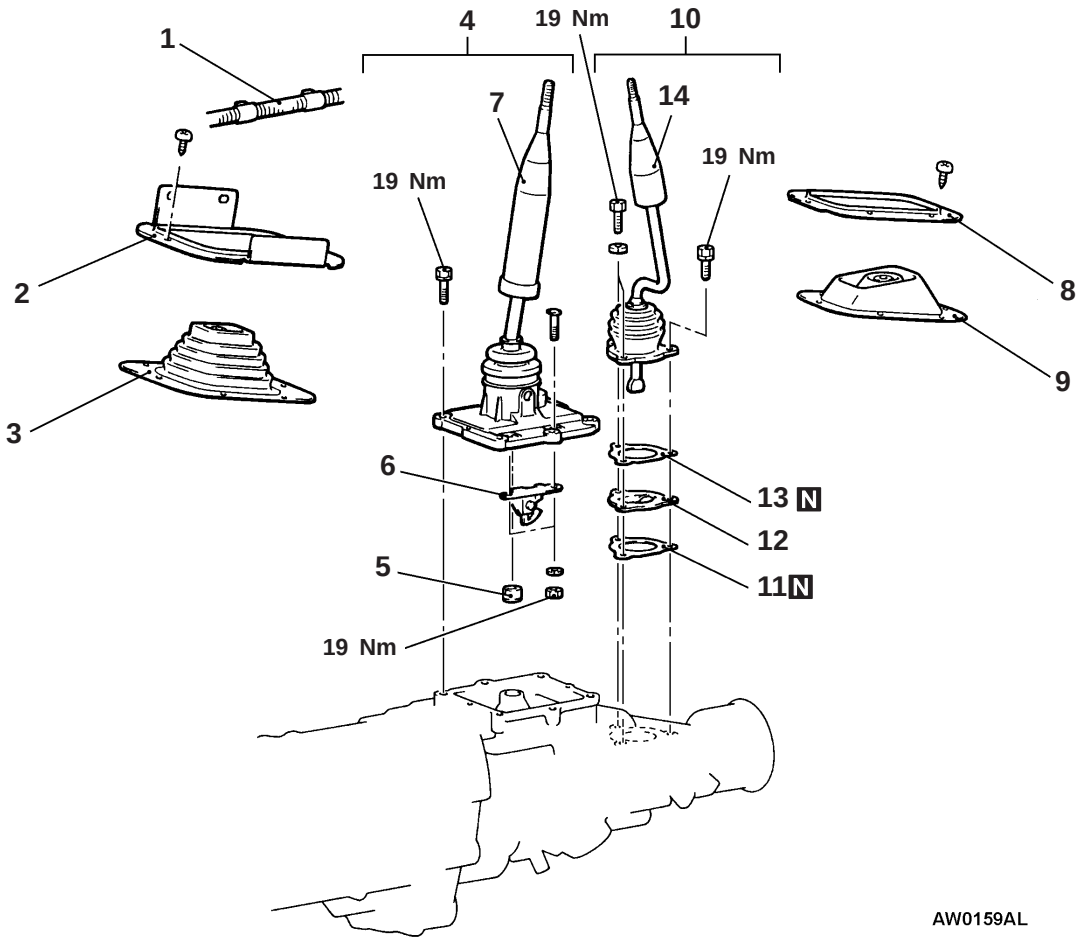
   Specified torque: 29 – 34 Nm

TRANSMISSION CONTROL

REMOVAL AND INSTALLATION

Pre-removal Operation
Move the transmission control lever and transfer control lever to the following positions.
- Transmission control lever: Neutral
- Transfer control lever: 4H

Post-installation Operation
Check that the transmission control lever and the transfer control lever are moved to each position smoothly and correctly.



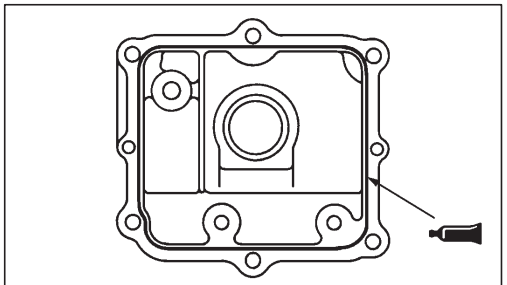
Transmission control lever assembly removal steps
- Front floor console and rear floor console (Refer to GROUP 52A.)

1. Harness connection
2. Retainer
3. Shift lever cover
◀A▶ 4. Transmission control lever assembly
5. Control lever bushing
▶C◀ 6. Stopper bracket assembly
7. Transmission control lever

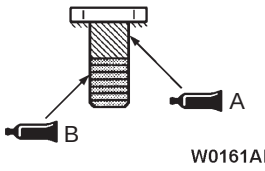
Transfer control lever assembly removal steps
- Rear floor console (Refer to GROUP 52A.)

8. Retainer
9. Transfer lever inner boots
▶B◀ 10. Transfer control lever assembly
11. Gasket
▶A◀ 12. Stopper plate
13. Gasket
14. Transfer control lever

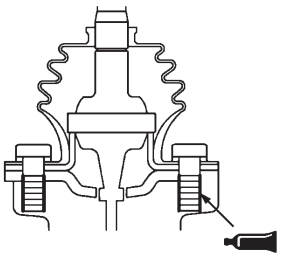
SEALANT APPLICATION POINTS



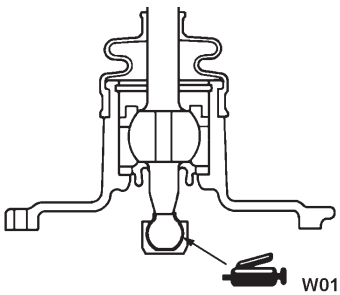
Sealant:
3M ATD Part No.8660 or equivalent

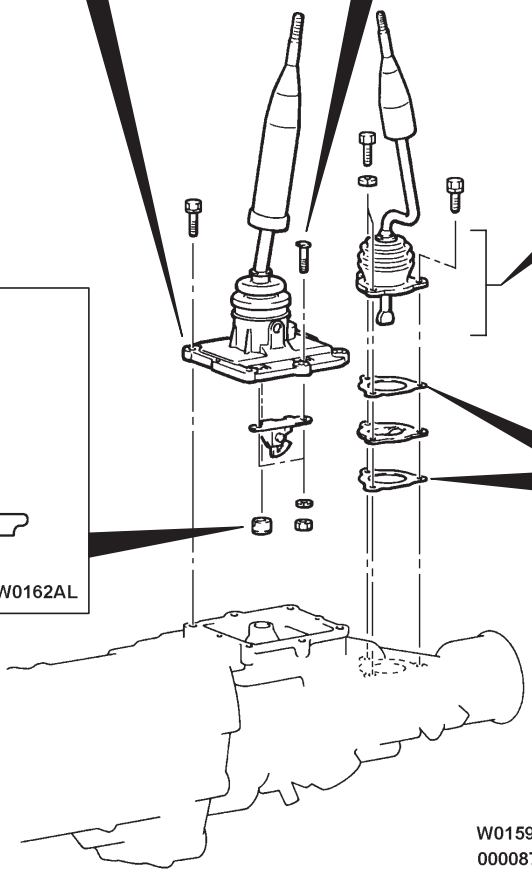


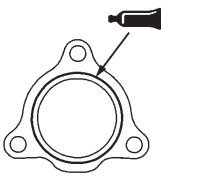
A: Sealant:
3M ATD Part No.8660 or equivalent
B: Sealant:
3M Stud Locking No.4170 or equivalent



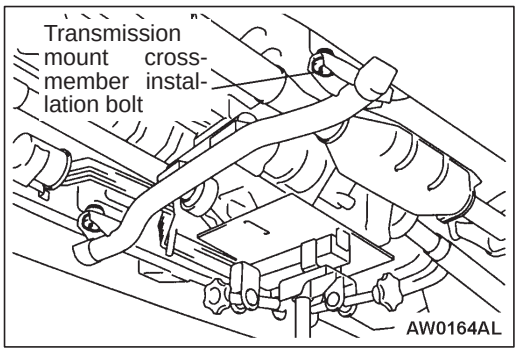
Sealant:
3M Stud Locking No.4170 or equivalent







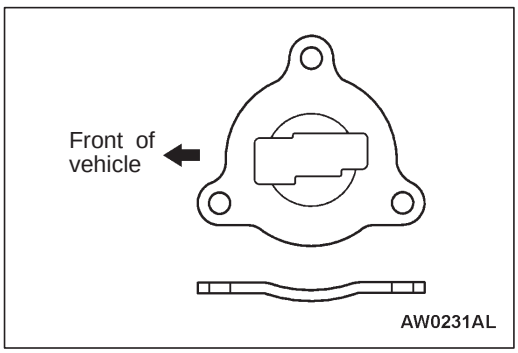
Sealant:
3M ATD Part No.8660 or equivalent



REMOVAL SERVICE POINT

◀A▶ TRANSMISSION CONTROL LEVER ASSEMBLY REMOVAL

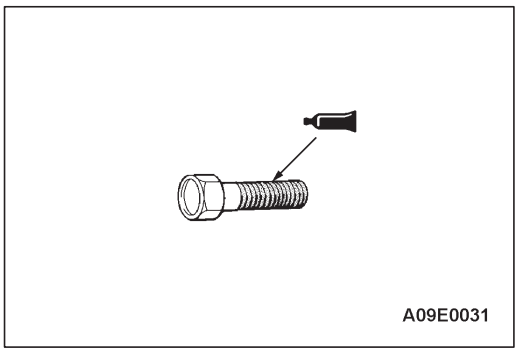
1. Support the transfer with a transmission jack, and then remove the transmission mount crossmember installation bolt.
2. Lower the transmission until the transmission control lever assembly installation bolts can be removed.
3. Remove the bolts, and then remove the transmission control lever assembly.



INSTALLATION SERVICE POINTS

▶A◀ STOPPER PLATE INSTALLATION

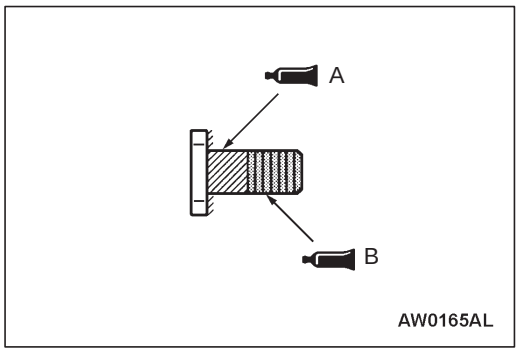
Install the stopper plate as shown in the illustration.



▶B◀ TRANSFER CONTROL LEVER ASSEMBLY INSTALLATION

1. Eliminate adhesive adhered to the transfer control lever assembly installation bolts.
2. Use a tap (M8 × 1.25) to eliminate adhesive adhered to the threaded holes of the control housing, and then clean the holes with a compressed air.
3. Apply the specified adhesive to the transfer control lever assembly installation bolts, and then install the transfer control lever assembly.

Specified adhesive:
3M Stud Locking No.4170 or equivalent



▶C◀ STOPPER BRACKET ASSEMBLY INSTALLATION

1. Eliminate sealant and adhered to the stopper bracket assembly installation bolts.
2. Use a tap (M8 × 1.25) to eliminate adhesive adhered to the threaded holes of the stopper bracket assembly installation nuts, and then clean the holes with a compressed air.
3. Apply the specified sealant to the stopper bracket assembly installation bolts (A shown in the illustration) and the specified adhesive to the threaded part of the stopper bracket assembly installation bolts (B shown in the illustration), and then install the stopper bracket assembly.

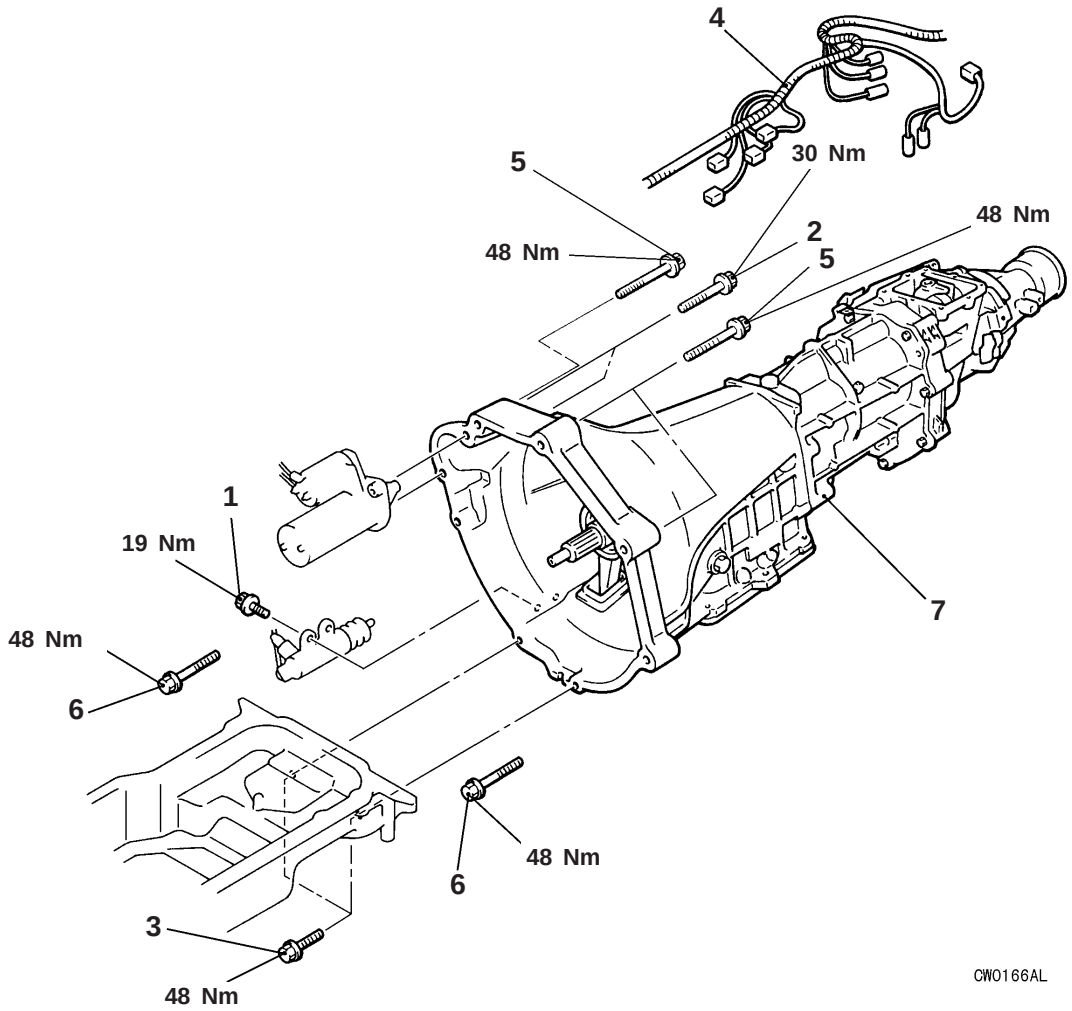
Specified sealant (A):
3M ATD Part No.8660 or equivalent

Specified adhesive (B):
3M Stud Locking No.4170 or equivalent

TRANSMISSION AND TRANSFER ASSEMBLY

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Transmission Oil and Transfer Oil Draining and Refilling (Refer to P.22-2, 3.)
- Transmission Control Lever Assembly and Transfer Control Lever Assembly Removal and Installation (Refer to P.22-4.)
- Front Propeller Shaft and Rear Propeller Shaft Removal and Installation (Refer to GROUP 25.)
- Front Exhaust Pipe and Catalytic Converter Removal and Installation (Refer to GROUP 17 – Emission Control.)
- Shift Lever Operation Check <only after installation>
- Instruments Operation Check <only after installation>

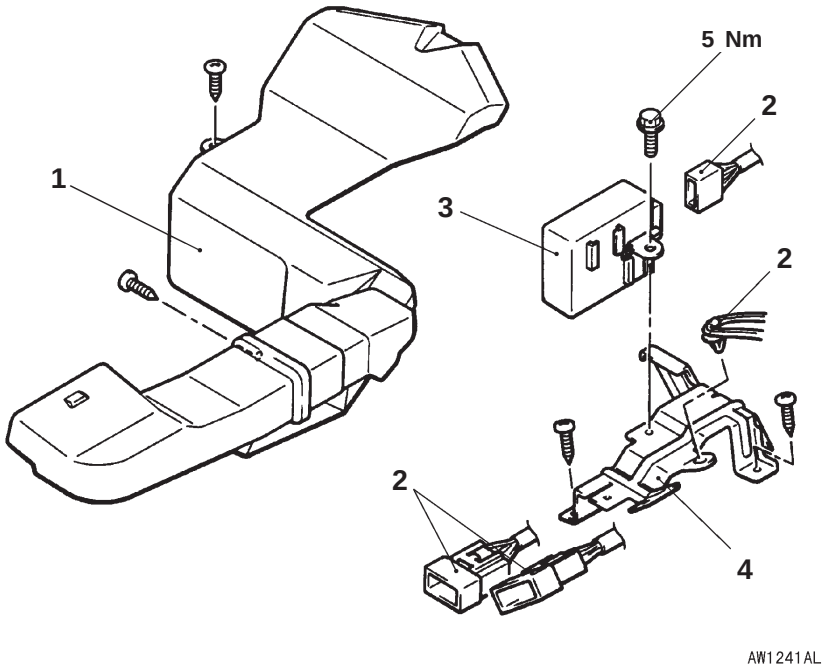


Removal steps
1. Clutch release cylinder installation bolts
2. Starter motor installation bolts
3. Oil pan connection bolts
- Adapter (Refer to GROUP 32 – Transmission mount.)
4. Transmission harness connector connection
5. Transmission assembly upper coupling bolts
6. Transmission assembly lower coupling bolts
7. Transmission and transfer assembly

4WD INDICATOR CONTROL UNIT

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Seat Assembly (Driver's side) and Rear Seat Cushion Removal and Installation (Refer to GROUP 52A – Seat.)
- Front Scuff Plate (Right) and Quarter Trim (Right) Removal and Installation (Refer to GROUP 52A – Trims.)
- Front Floor Console and Rear Floor Console Removal and Installation (Refer to GROUP 52A.)



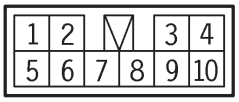
Removal steps

1. Rear heater duct (right)
   - Turn up the carpet.
2. Harness connector connection
3. 4WD indicator control unit
4. Bracket

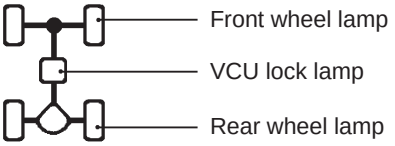
NSPECTION

4WD INDICATOR CONTROL UNIT CHECK

Measure terminal voltage on each condition. Connect the harness to the control unit. Insert the probe from the back side of the connector and measure the voltage between the terminal No.8 (earth terminal) and each terminal.



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Terminal No.	Check item		Check condition 1: Ignition switch	Check condition 2: Transfer lever position	Normal condition
1	High/Low detection switch		ON	Move from $4HL_C$ to $4LL_C$ or vice versa	System voltage*
				$4HL_C$, $4LL_C$	0 V
2	4WD operation detection switch		ON	2H	System voltage*
				4H	0 V
3	Ignition switch		OFF	–	0 V
			ON	–	System voltage
4	4WD indicator lamp	VCU lock lamp	ON	4H	System voltage
				$4HL_C$	1.5 V or lower
5	VCU lock detection switch		ON	4H	System voltage*
				$4HL_C$	0 V
6	Free wheel engage switch		ON	2WD condition	System voltage*
				4WD condition	0 V
7	VCU lock operation detection switch		ON	4H	System voltage*
				$4HL_C$	0 V
9	4WD indicator lamp	Rear wheel	ON	Move from $4HL_C$ to $4LL_C$ or vice versa	0 V
				$4HL_C$, $4LL_C$	System voltage*
10	4WD indicator lamp	Front wheel	ON	2WD condition	0 V
				4WD condition	System voltage*

NOTE
System voltage marked with * is low slightly (from 1 V to 2 V).

GROUP 22
MANUAL TRANSMISSION

GENERAL

OUTLINE OF CHANGE

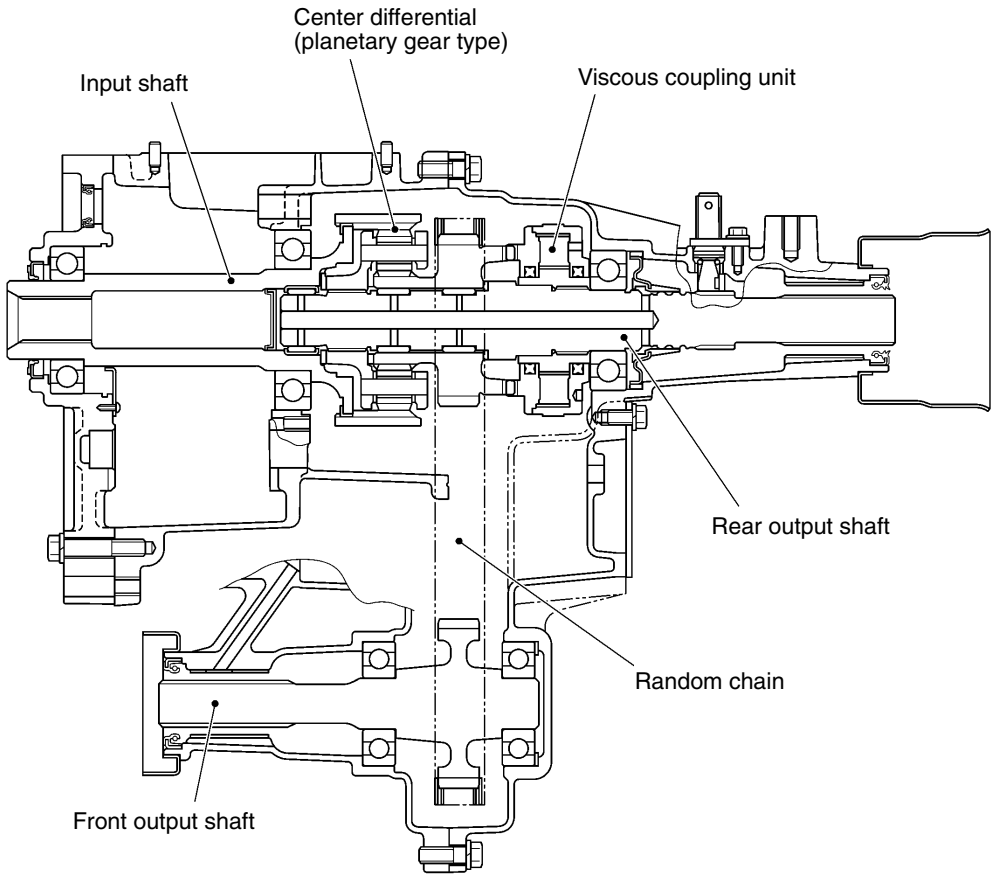
Due to the addition of the vehicles with the 4G93-MPI engine, the V5M21 type transmission has been adopted. This transmission is basically the same as that of the vehicles with 4G94 engine except for the following items.

- A full-time 4WD model has been added.
- Due to the adoption of a full-time 4WD, the transfer control lever and the 4WD indicator control unit have been discontinued.

GENERAL INFORMATION

TRANSFER

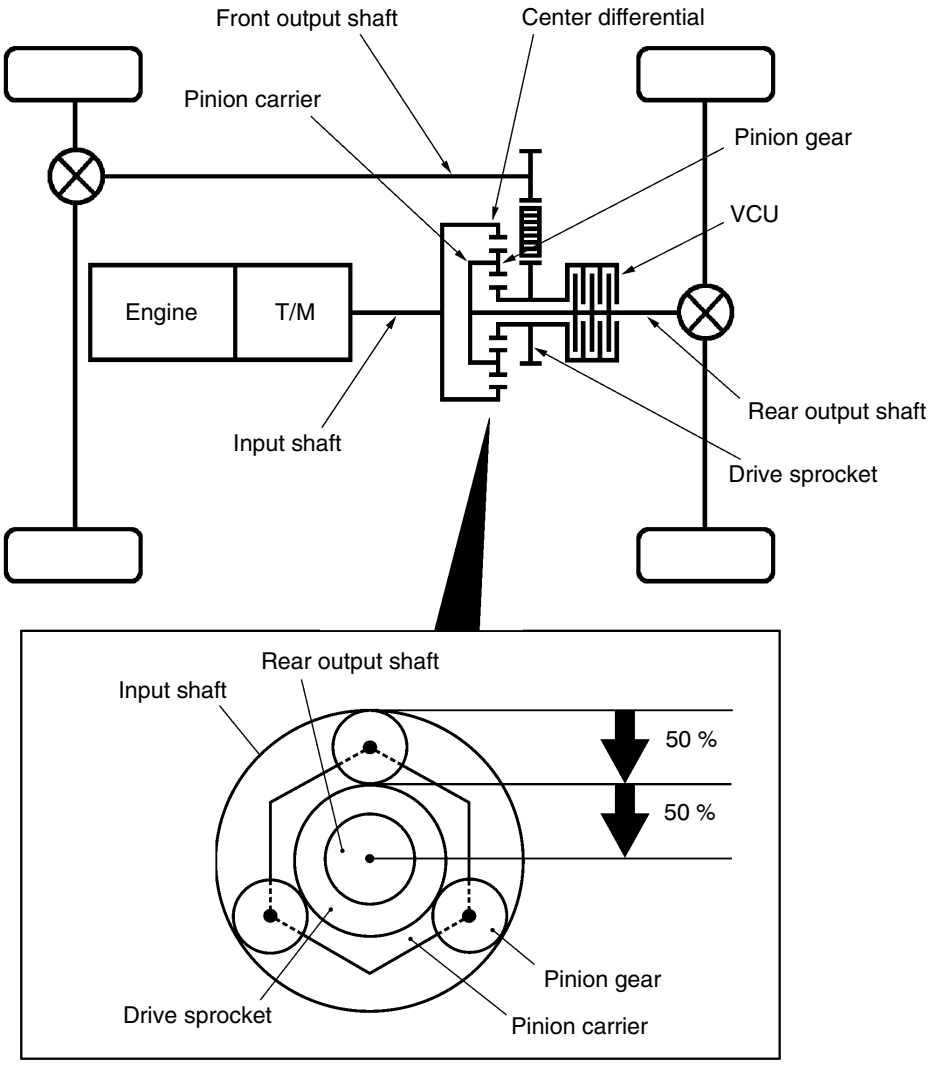
SECTIONAL VIEW



A10022AL

CENTRE DIFFERENTIAL (PLANETARY GEAR TYPE)

The planetary gear type has been adopted for the center differential.
Driving power transmitted from the transmission to the input shaft passes on the pinion gear of the center differential. Then, driving power is transmitted to the front output shaft via the drive sprocket and to the rear output shaft via the pinion carrier.
The drive sprocket and the pinion carrier are driven by the pinion gear simultaneously while 50% of driving power is distributed to the drive sprocket (front output shaft) and the remaining 50% of driving power is distributed to the pinion carrier (rear output shaft).
VCU is installed between the drive sprocket and the rear output shaft so that driving power can be properly distributed if there are any discrepancies in driving power between the front output shaft and the rear output shaft.



10028AL

AUTOMATIC TRANSMISSION

AUTOMATIC TRANSMISSION

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4WD INDICATOR CONTROL UNIT 60

WARNING REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLES

WARNING!

(1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to driver and passenger (from rendering the SRS inoperative).

(2) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.

(3) MITSUBISHI dealer personnel must thoroughly review this manual, and especially its GROUP 52B – Supplemental Restraint System (SRS) before beginning any service or maintenance of any component of the SRS or any SRS-related component.

NOTE

The SRS includes the following components: SRS-ECU, SRS warning lamp, air bag module, clock spring, and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents by an asterisk (*).

SERVICE SPECIFICATIONS

Items			Standard value
Clearance between inner cable stopper and dust cover end surface mm			0.8 – 1.5
Input shaft speed sensor resistance (at 20°C) Ω			620 ± 60
Output shaft speed sensor resistance (at 20°C) Ω			430 ± 43
A/T fluid temperature sensor resistance Ω	at 25°C		1,100
	at 120°C		57
Coil resistance of solenoid valve No.1 (at 25°C) Ω			13 ± 2
Coil resistance of solenoid valve No.2 (at 25°C) Ω			13 ± 2
Coil resistance of solenoid valve No.3 (at 25°C) Ω			13 ± 2
Stall speed r/min			2,320 – 2,620
Line pressure kPa	at idle speed	D range	373 – 422
		R range	520 – 579
	at stall speed	D range	765 – 863
		R range	1,383 – 1,628

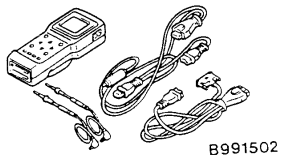
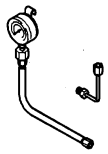
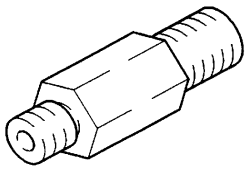
LUBRICANTS

Items	Specified lubricant	Quantity ℓ
Transmission fluid	DEXRON II or equivalent	7.2
Transfer oil	Hypoid gear oil SAE 75W-90 or 75W-85W conforming to API GL-4	2.3

SEALANTS AND ADHESIVES

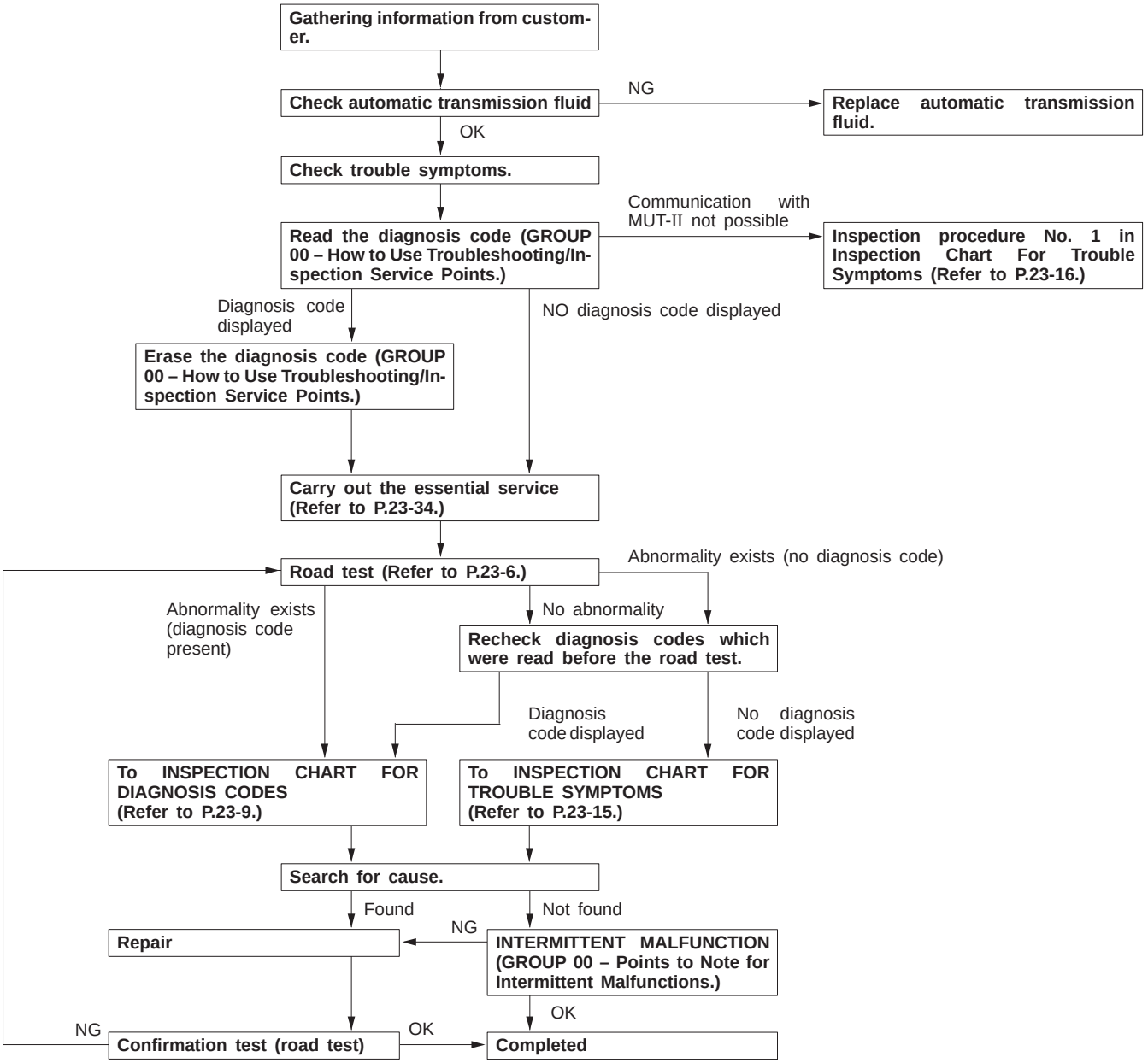
Items	Specified sealant	Remarks
Transfer control lever gasket	3M ATD Part No.8660 or equivalent	Semi-drying sealant
Transfer control lever assembly installation bolt	3M Stud Locking No.4170 or equivalent	Anaerobic sealant

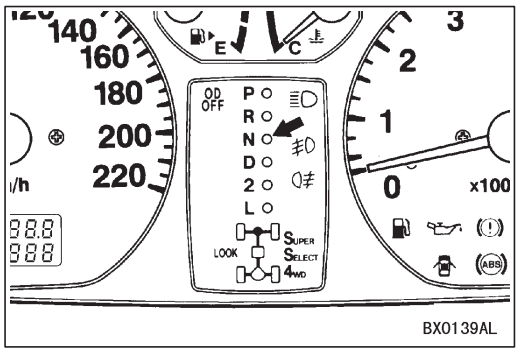
SPECIAL TOOLS

Tool	Number	Name	Use
	MB991502	MUT-II sub assembly	Checking of the diagnosis code
	MD998330 (including MD998331)	Oil pressure gauge (2,942 kPa)	Measurement of oil pressure
	MD998920	Adapter	Connection of oil pressure gauge

TROUBLESHOOTING <A/T>

STANDARD FLOW OF DIAGNOSIS TROUBLESHOOTING





DIAGNOSIS FUNCTION

N RANGE LAMP

The N range lamp flashes at a frequency of approximately 1 Hz if there is an abnormality in any of the items in the table below which are related to the A/T system. Check the diagnosis code output if the N range lamp is flashing at a frequency of approximately 1 Hz.

N range lamp flashing items

Input shaft speed sensor
Output shaft speed sensor
Each solenoid valve

Caution
If the N range lamp is flashing at a frequency of approximately 2 Hz (faster than at 1 Hz), it means that the A/T fluid temperature is too high. Stop the vehicle in a safe place and wait until the N range lamp switches off.

METHOD OF READING THE DIAGNOSIS CODE

Use the MUT-II or the N range lamp to take a reading of the diagnosis codes. (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.)

ROAD TEST

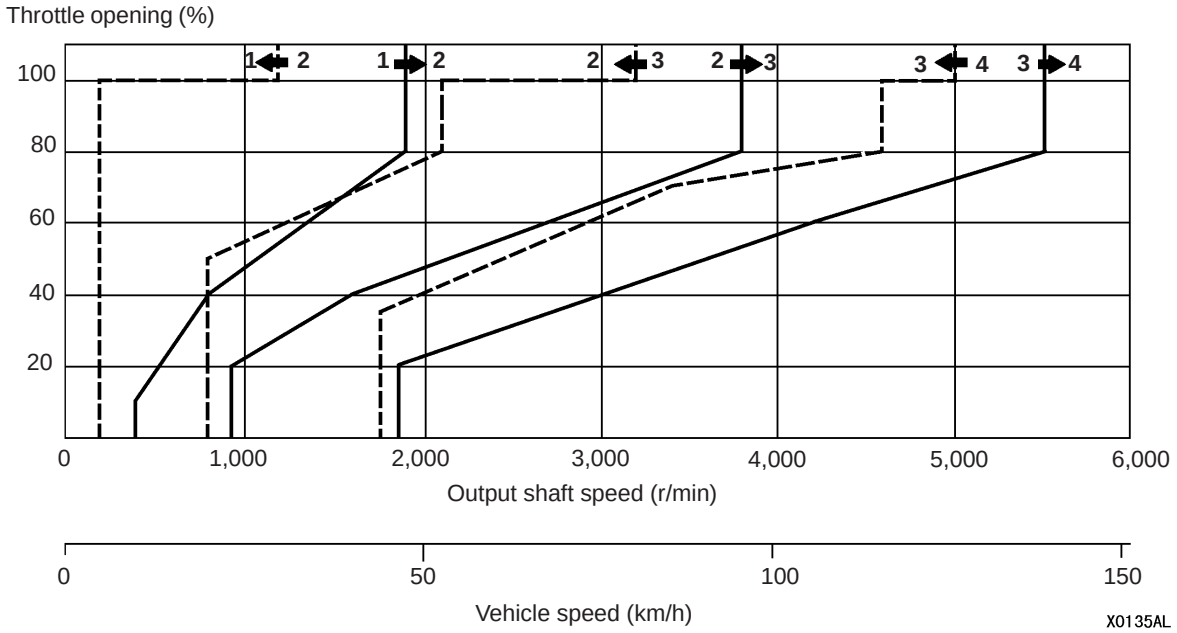
No.	State prior to test and operation	Test and operation	Judgement value	Check item	Inspection item if there is an abnormality
1	Ignition switch: ON Engine: Stopped	Ignition switch (1) ON (2) OFF	Data list No. 14 (1) Approx. 5V (2) 0V	APS (Power supply voltage)	Code No.13, 14 APS system (P.23-10)
		Overdrive switch (1) ON (2) OFF	Data list No. 35 (1) OD (2) OD-OFF	Overdrive switch	Overdrive switch system (P.23-25)
		Selector lever position (1) P (2) R (3) N (4) D (5) 2 (6) L	Data list No. 37 (1) P, R, D (2) P, R, D (3) N (4) P, R, D (5) 2 (6) L	Inhibitor switch	Inhibitor switch system (P.23-25)
		Brake pedal (1) Depressed (2) Released	Data list No. 28 (1) ON (2) OFF	Stop lamp switch	Stop lamp switch system (P.23-26)
2	Ignition switch: ST Engine: Stopped	Starting test with selector lever P or N position	Starting should be possible	Starting possible or impossible	Does not move (P.23-17)
					Lockup malfunction (P.23-24)
3	Engine: Warmed up	Drive for 15 minutes or more so that the automatic fluid temperature becomes 70 – 90°C.	Data list No. 15 Gradually rises to 70 – 90°C	A/T fluid temperature sensor	A/T fluid temperature sensor system (P.23-10)
4	Engine: Idling Selector lever position: N	Accelerator pedal (1) Released (2) Half depressed (3) Fully depressed (approx. 2 seconds)	Data list No. 13 (1) 0 – 5 % (2) Gradually rises from (1) (3) 85 – 100 %	APS (Throttle opening angle)	Code No.13, 14 APS system (P.23-10)
			Data list No. 22 (1) OFF (2) ON	Wide open throttle switch	Wide open throttle switch system (P.23-11)
		Selector lever position (1) N → D (2) N → R	Should be no abnormal shifting shocks Time lag should be within 2 seconds	Does not move	Does not move forward and reverse (P.23-17)
					Does not move forward only (P.23-18)
					Does not reverse only (P.23-18)
				Shocks when shifting	Large shocks (P.23-22)
5	Engine: Idling (Vehicle stopped) Selector lever position: D	Accelerator pedal (1) Released	Data list No. 27 (1) 1st	Solenoid valve No.1	Code No.41, 42 Solenoid valve No.1 system (P.23-13)
				Solenoid valve No.2	Code No.43, 44 Solenoid valve No.2 system (P.23-13)

No.	State prior to test and operation	Test and operation	Judgement value	Check item	Inspection item if there is an abnormality
6	Selector lever position: D Overdrive switch: OFF	Shift position and vehicle speed (1) Idling (Vehicle stopped) (2) Driving at 5 km/h (3) Driving at constant speed of 50 km/h (20 seconds or more) (4) Driving at constant speed of 40 km/h with the selector lever in 2 position	Data list No. 27 (1) 1st (2) 1st (3) 3rd (4) 2nd	Solenoid valve No.1	Code No.41, 42 Solenoid valve No.1 system (P.23-13)
				Solenoid valve No.2	Code No.43, 44 Solenoid valve No.2 system (P.23-13)
			Data list No. 31 (3) 1,800 – 2,000 rpm	Input shaft speed sensor	Input shaft speed sensor system (P.23-11)
			Data list No. 32 (3) 1,800 – 2,000 rpm	Output shaft speed sensor	Output shaft speed sensor system (P.23-11)
			Data list No. 41 (2) ON (3) OFF (4) ON	Solenoid valve No.1	Code No.41, 42 Solenoid valve No.1 system (P.23-13)
			Data list No. 43 (2) OFF (3) ON (4) ON	Solenoid valve No.2	Code No.43, 44 Solenoid valve No.2 system (P.23-13)
			Data list No. 47 (1) OFF (2) OFF (3) ON (4) Accelerates smoothly and no abnormal shocks should occur.	Solenoid valve No.3 Malfunction when shifting	Code No.47, 48 Solenoid valve No.3 system (P.23-13) Shifting point abnormality (P.23-20)
					Slippage (vibration) (P.23-23)
7	Selector lever position: D Overdrive switch: ON	Shift position and vehicle speed (1) Driving at constant speed of 50 km/h (20 seconds or more)	Data list No. 27 (1) 4th	Solenoid valve No.1	Code No.41, 42 Solenoid valve No.1 system (P.23-13)
				Solenoid valve No.2	Code No.43, 44 Solenoid valve No.2 system (P.23-13)
			Data list No. 41 (1) OFF	Solenoid valve No.1	Code No.41, 42 Solenoid valve No.1 system (P.23-13)
			Data list No. 43 (1) OFF	Solenoid valve No.2	Code No.43, 44 Solenoid valve No.2 system (P.23-13)

No.	State prior to test and operation	Test and operation	Judgement value	Check item	Inspection item if there is an abnormality
8	Selector lever position: D Overdrive switch: ON	Monitor data list No. 13, 27, and 32 with the MUT-II. (1) Accelerate to 4th gear at APS opening angle of 30 %. (2) Gently decelerate to a standstill. (3) Accelerate to 4th gear at APS opening angle of 50 %. (4) While driving at 50 km/h in 4th gear, set the overdrive switch to OFF position. (5) While driving at 50 km/h in 3rd gear, move the selector lever to 2 position. (6) While driving at 20 km/h in 2nd gear, move the selector lever to L position.	For (1), (2) and (3), the reading should be the same as the specified output shaft speed (vehicle speed) and no abnormal shocks should occur. For (4), (5) and (6), downshifting should occur immediately after the shifting operation is made.	Malfunction when shifting	Upshifting does not occur (P.23-19)
					Downshifting does not occur (P.23-20)
					Shifting point abnormality (P.23-20)
					Upshifting occurs spontaneously (P.23-19)
					Incorrect drive gear position (P.23-21)
				Malfunction when driving the vehicle	Large shocks (P.23-22)
					Slippage (vibration) (P.23-23)
					Lockup malfunction (P.23-24)
					Abnormal engine braking (P.23-24)

SHIFT PATTERN

D range (Overdrive switch: ON)

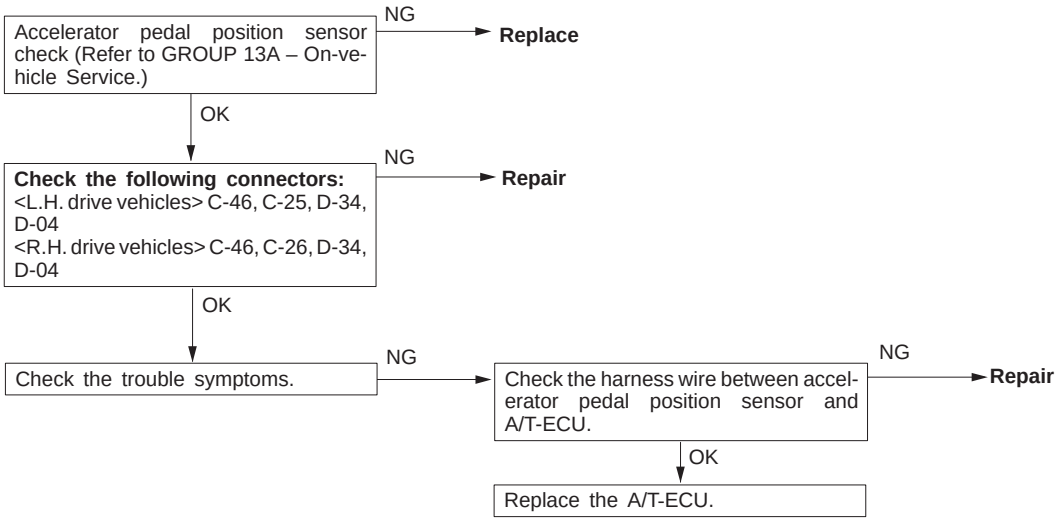


INSPECTION CHART FOR DIAGNOSIS CODE

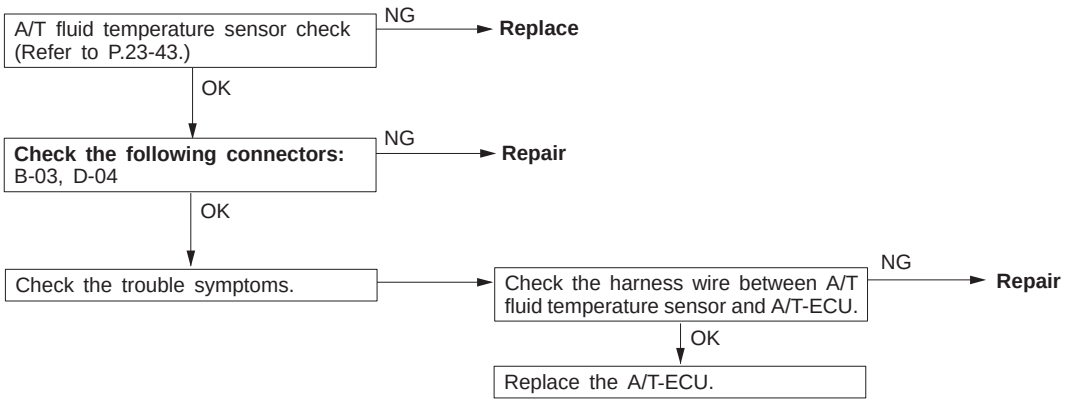
Code	Diagnosis item		Reference page
13	Accelerator pedal position sensor system (Throttle opening voltage)	Sensor malfunction, open circuit, short circuit	23-10
14	Accelerator pedal position sensor system (Throttle power supply voltage)	Open circuit, short circuit	23-10
15	A/T fluid temperature sensor system	Open circuit	23-10
16	A/T fluid temperature sensor system	Short circuit	23-10
22	Wide open throttle switch	Open circuit, short circuit	23-11
31	Input shaft speed sensor system	Open circuit	23-11
32	Output shaft speed sensor system	Open circuit	23-11
38	Vehicle speed sensor system	Open circuit	23-12
41	Solenoid valve No.1 system	Open circuit	23-13
42	Solenoid valve No.1 system	Short circuit	23-13
43	Solenoid valve No.2 system	Open circuit	23-13
44	Solenoid valve No.2 system	Short circuit	23-13
47	Solenoid valve No.3 system	Open circuit	23-13
48	Solenoid valve No.3 system	Short circuit	23-13
55	Abnormal communication with engine-ECU	Open circuit	23-14

INSPECTION PROCEDURES FOR DIAGNOSIS CODES

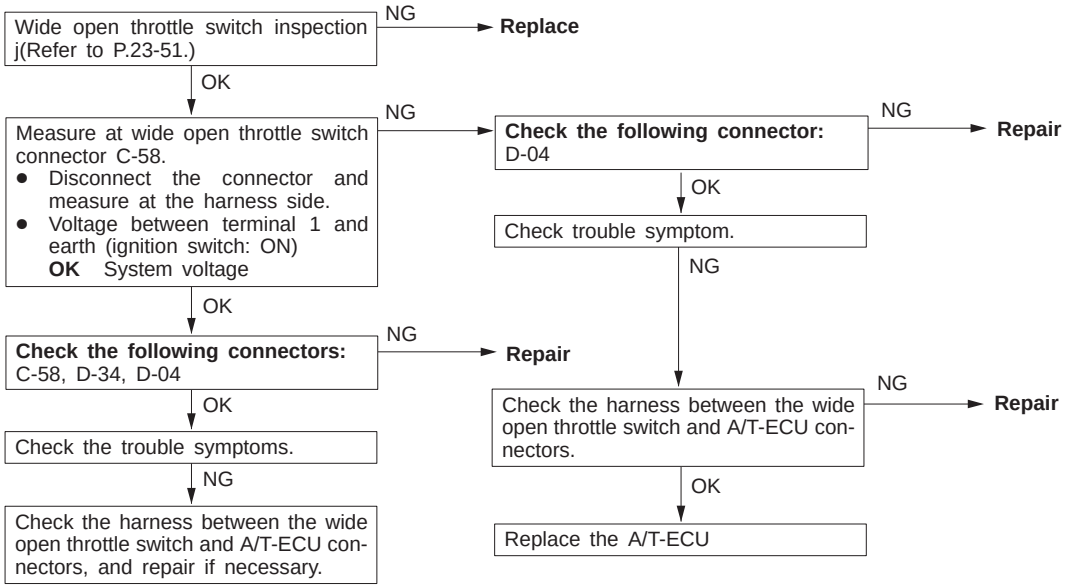
Code No. 13, 14 Accelerator pedal position sensor (APS)	Probable cause
If the APS output voltage (APS opening voltage) is 4.8 V or higher when the engine is idling, the output voltage is judged to be too high and diagnosis code No. 13 is output. If the APS output voltage (APS opening voltage) is 0.335 V or lower when the engine is idling, the output voltage is judged to be too low and diagnosis code No. 13 is output. If the APS output voltage (APS power supply voltage) is 3.0 V or lower or if it is 5.7 V or higher when the engine is idling, the APS is judged to be faulty and diagnosis code No. 14 is output.	• Malfunction of the accelerator pedal position sensor • Malfunction of harness or connector • Malfunction of the A/T-ECU



Code No. 15, 16 A/T fluid temperature sensor system	Probable cause
If the A/T fluid temperature sensor output is 10°C or less (5.6 kΩ or more) even after running the engine for 15 minutes or more, it is judged that there is an open circuit in the A/T fluid temperature sensor and diagnosis code No. 15 is output. If the A/T fluid temperature sensor output is 240°C or more (10 Ω or less), it is judged that there is a short circuit in the A/T fluid temperature sensor and diagnosis code No. 16 is output.	• Malfunction of the A/T fluid temperature sensor • Malfunction of harness or connector • Malfunction of the A/T-ECU

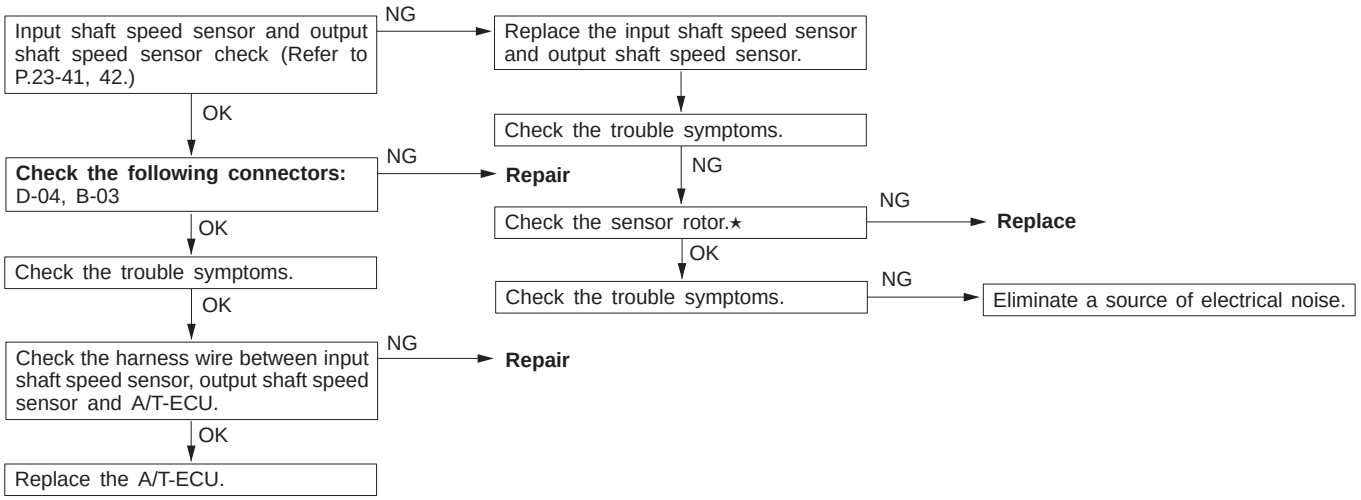


Code No. 22 Wide open throttle switch system	Probable cause
If the wide open throttle switch does not turn OFF when the accelerator pedal is not depressed, there is a short circuit in the wide open throttle switch and diagnosis code No. 25 is output.	• Malfunction of wide open throttle switch • Malfunction of connector • Malfunction of the A/T-ECU

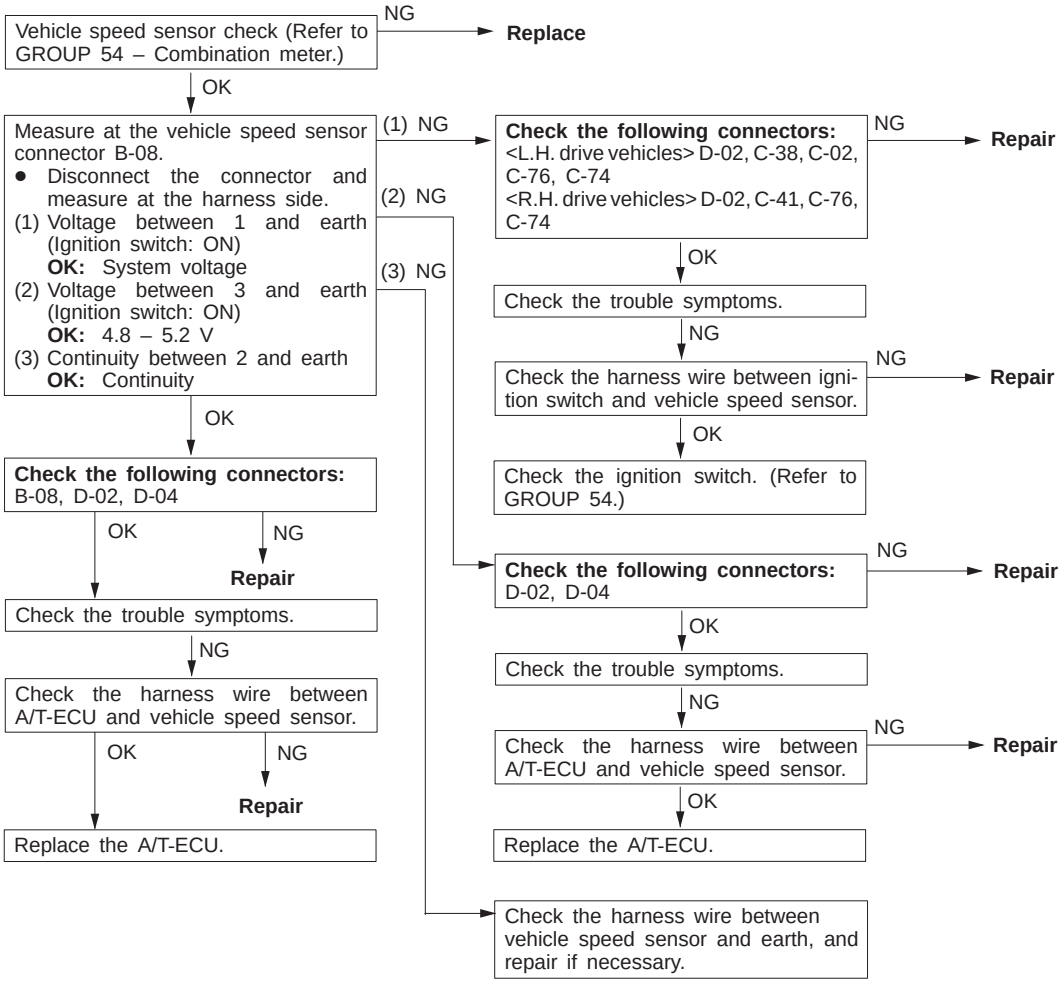


Code No. 31, 32 Input shaft speed sensor system, output shaft speed sensor system	Probable cause
If no output pulse is detected from the input shaft speed sensor for 120 seconds or more while driving in 3rd gear at a speed of 60 km/h or more, there is judged to be an open circuit in the input shaft speed sensor and diagnosis code No. 31 is output. If no output pulse is detected from the output shaft speed sensor for 120 seconds or more while driving in 3rd gear at a speed of 60 km/h or more, there is judged to be an open circuit in the output shaft speed sensor and diagnosis code No. 32 is output.	• Malfunction of the input shaft speed sensor or output shaft speed sensor • Malfunction of harness or connector • Malfunction of the sensor rotor • Malfunction of A/T-ECU • Electrical noise

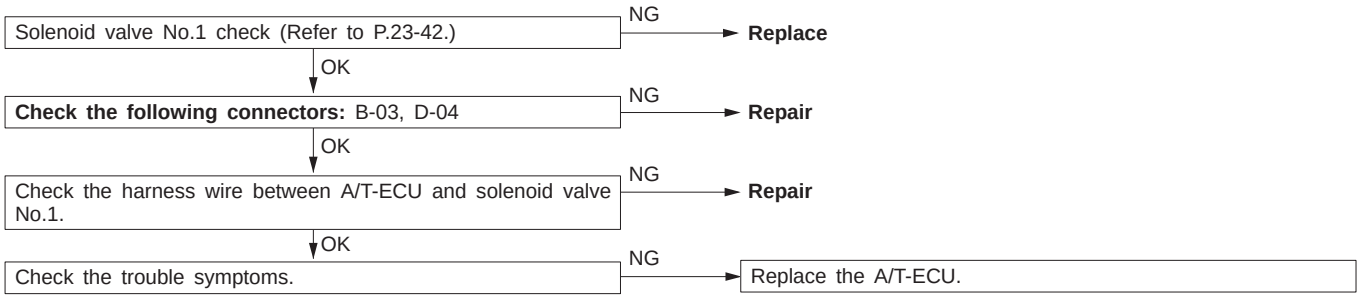
★: Refer to the Transmission Workshop Manual.



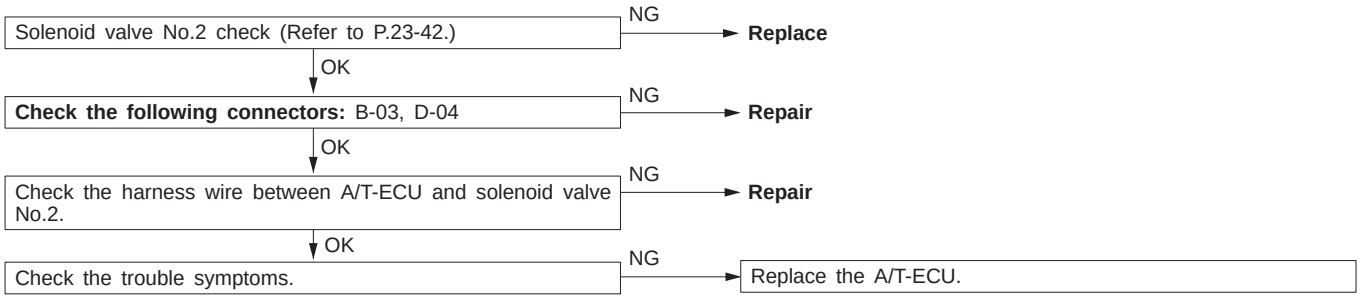
Code No. 38 Vehicle speed sensor system	Probable cause
If no output pulse is detected from the vehicle speed sensor for 120 seconds or more continuously while driving at a speed of 60 km/h or more, there is judged to be an open circuit in the vehicle speed sensor and diagnosis code No. 38 is output.	● Malfunction of the vehicle speed sensor ● Malfunction of harness or connector ● Malfunction of the A/T-ECU ● Malfunction of the ignition switch



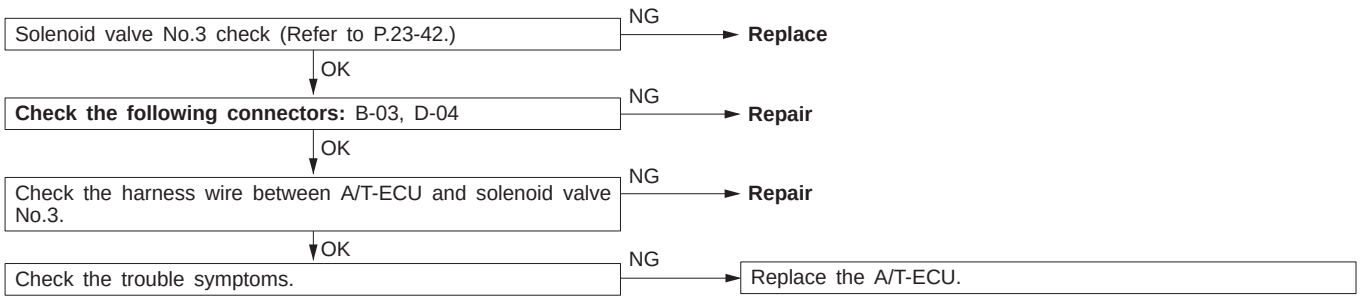
Code No. 41, 42 Solenoid valve No.1 system	Probable cause
If the resistance value for a solenoid valve No.1 is too large, it is judged that there is an open circuit in the solenoid valve No.1 and the diagnosis code No.41 is output. If the resistance value for a solenoid valve No.1 is too small, it is judged that there is a short-circuit in the solenoid valve No.1 and the diagnosis code No.42 is output.	• Malfunction of solenoid valve No.1 • Malfunction of harness or connector • Malfunction of the A/T-ECU



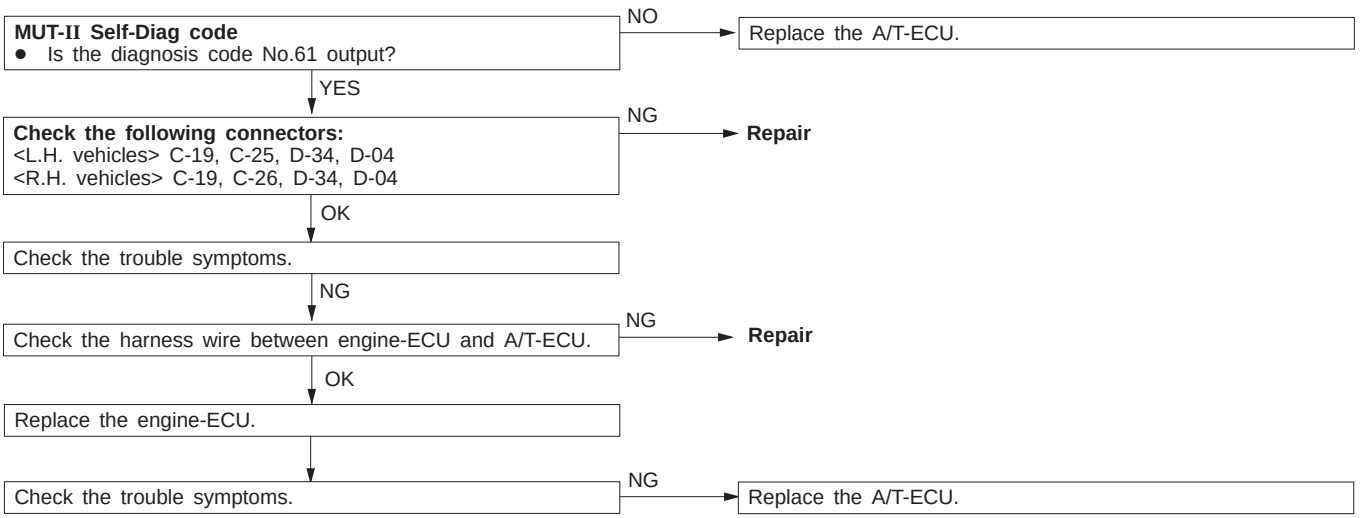
Code No. 43, 44 Solenoid valve No.2 system	Probable cause
If the resistance value for a solenoid valve No.2 is too large, it is judged that there is an open circuit in the solenoid valve No.2 and the diagnosis code No.43 is output. If the resistance value for a solenoid valve No.2 is too small, it is judged that there is a short-circuit in the solenoid valve No.2 and the diagnosis code No.44 is output.	• Malfunction of solenoid valve No.2 • Malfunction of harness or connector • Malfunction of the A/T-ECU



Code No. 47, 48 Solenoid valve No.3 system	Probable cause
If the resistance value for a solenoid valve No.3 is too large, it is judged that there is an open circuit in the solenoid valve No.3 and the diagnosis code No.47 is output. If the resistance value for a solenoid valve No.3 is too small, it is judged that there is a short-circuit in the solenoid valve No.3 and the diagnosis code No.48 is output.	• Malfunction of solenoid valve No.3 • Malfunction of harness or connector • Malfunction of the A/T-ECU



Code No. 55 Abnormal communication with engine-ECU	Probable cause
If normal communication is not possible for a continuous period of 1 second or more when the ignition switch is at the ON position and the battery voltage is 10 V or more, diagnosis code No. 55 is output. Diagnosis code No. 55 is also output if the data being received is abnormal for a continuous period of 1 second under the same conditions.	• Malfunction of harness or connector • Malfunction of the engine-ECU • Malfunction of the A/T-ECU



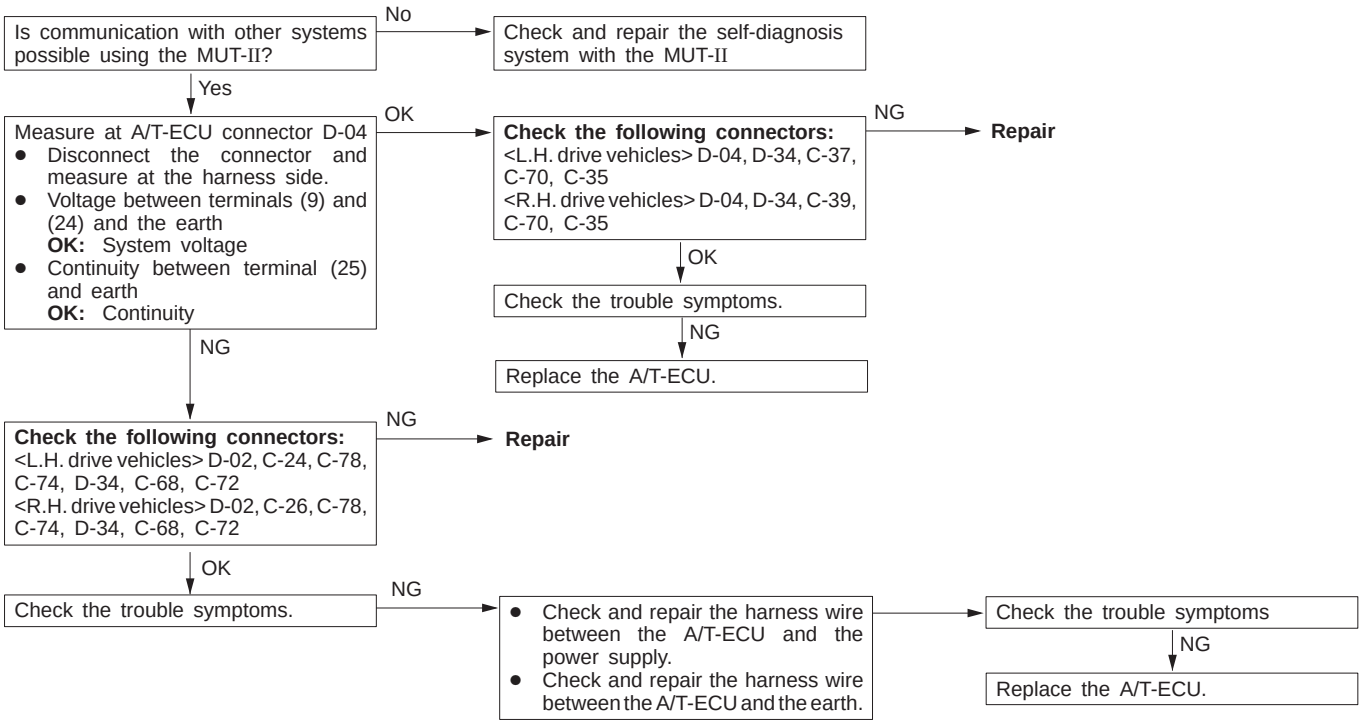
INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.	Reference page
Communication with the MUT-II is not possible		1	23-16
Does not move	Does not move forward and reverse	2	23-17
	Does not move forward only	3	23-18
	Does not reverse only	4	23-18
Malfunction when shifting	Upshifting does not occur	5	23-19
	Downshifting does not occur	6	23-20
	Shifting point abnormality	7	23-20
	Upshifting occurs spontaneously	8	23-21
	Incorrect drive gear position	9	23-21
Large shocks		10	23-22
Slippage (vibration)		11	23-23
Lockup malfunction		12	23-24
Abnormal engine braking		13	23-24
Electronic circuit systems	Inhibitor switch system	14	23-25
	Overdrive switch system	15	23-25
	Stop lamp switch system	16	23-26

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURE 1

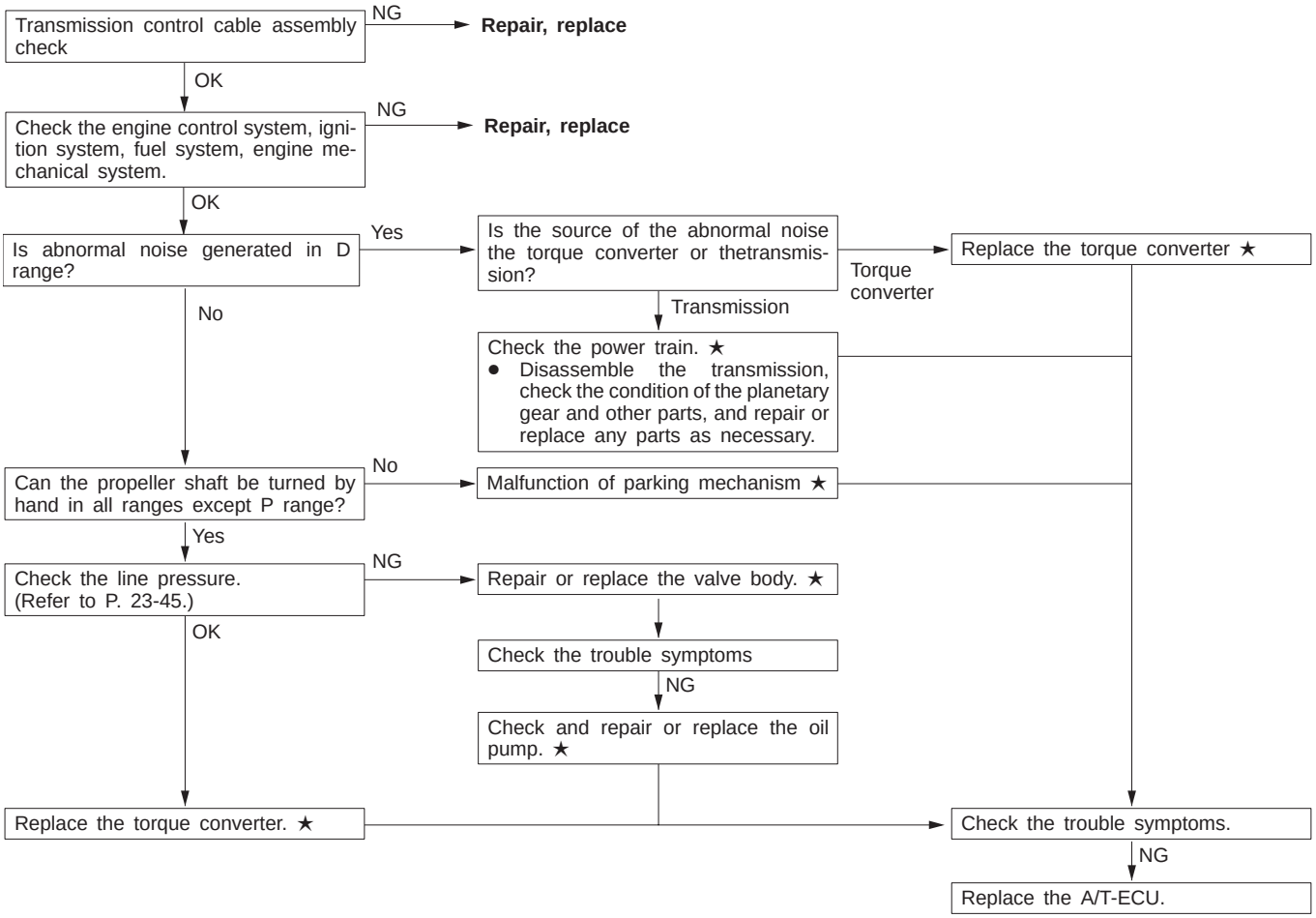
Communication with the MUT-II is not possible	Probable cause
If communication with the MUT-II is not possible, the cause is probably a malfunction in the self-diagnosis system or the A/T-ECU is not functioning.	• Malfunction of self-diagnosis system • Malfunction of A/T-ECU power circuit • Malfunction of A/T-ECU earth circuit • Malfunction of A/T-ECU • Malfunction of harness and connector



INSPECTION PROCEDURE 2

Does not move forward and reverse	Probable cause
When the engine is idling, the vehicle does not move forward and reverse even if the selector lever is shifted from N to D, 2, L or R positionj. In such cases, the cause is probably abnormal line pressure, or a malfunction of the transmission control cable, torque converter, oil pump, parking mechanism or the power train.	• Malfunction of transmission control cable • Abnormal line pressure • Malfunction of power train • Malfunction of oil pump • Malfunction of valve body • Malfunction of parking mechanism • Malfunction of torque converter • Malfunction of A/T-ECU

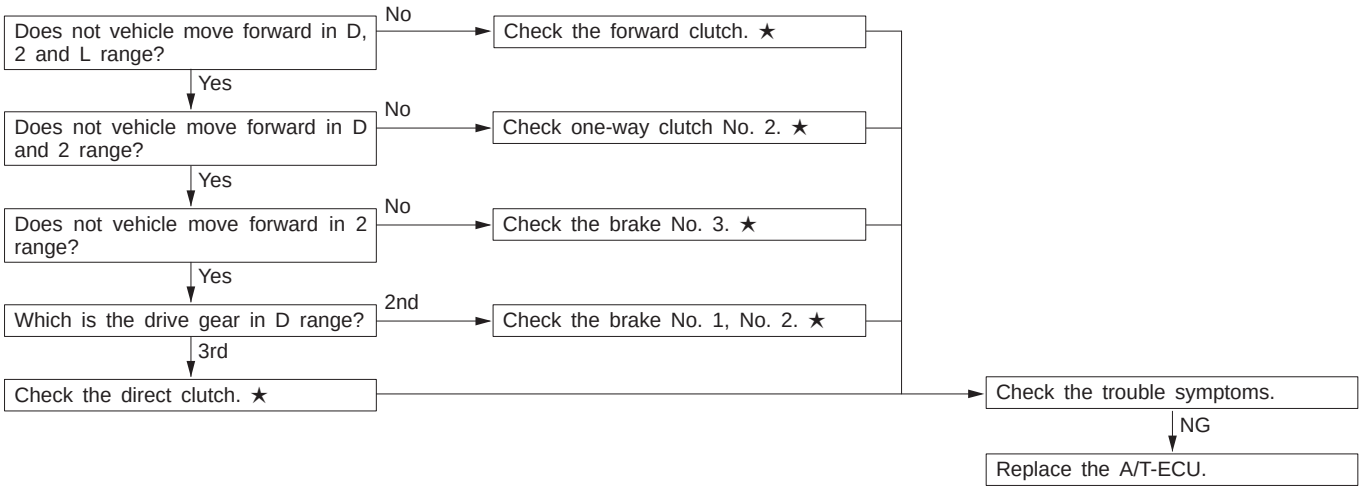
★: Refer to the Transmission Workshop Manual.



INSPECTION PROCEDURE 3

Does not move forward only	Probable cause
When the engine is idling, the vehicle does not move forward even if the selector lever is shifted from N to D, 2 or L range. In such cases, the cause is probably a malfunction of the clutch or brake.	● Malfunction of forward clutch ● Malfunction of direct clutch ● Malfunction of one-way clutch No. 2 ● Malfunction of brake No. 1, No. 2, No. 3 ● Malfunction of A/T-ECU

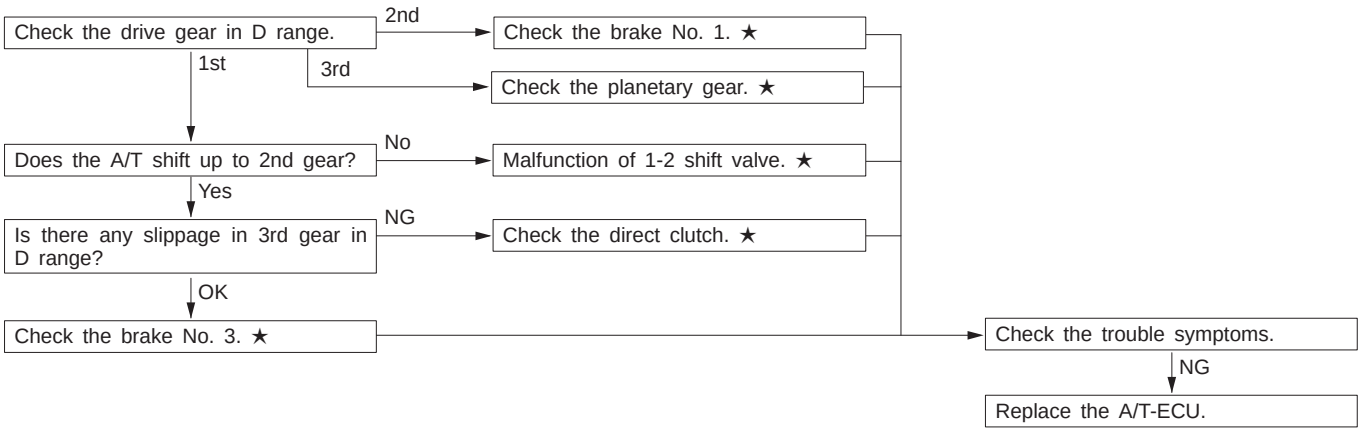
★: Refer to the Transmission Workshop Manual.



INSPECTION PROCEDURE 4

Does not reverse only	Probable cause
When the engine is idling, the vehicle does not reverse even if the selector lever is shifted from N to R range. In such cases, the cause is probably a malfunction of a clutch, brake or the valve body.	● Malfunction of brake No. 1, No. 3 ● Malfunction of direct clutch ● Malfunction of valve body ● Malfunction of planetary gear ● Malfunction of A/T-ECU

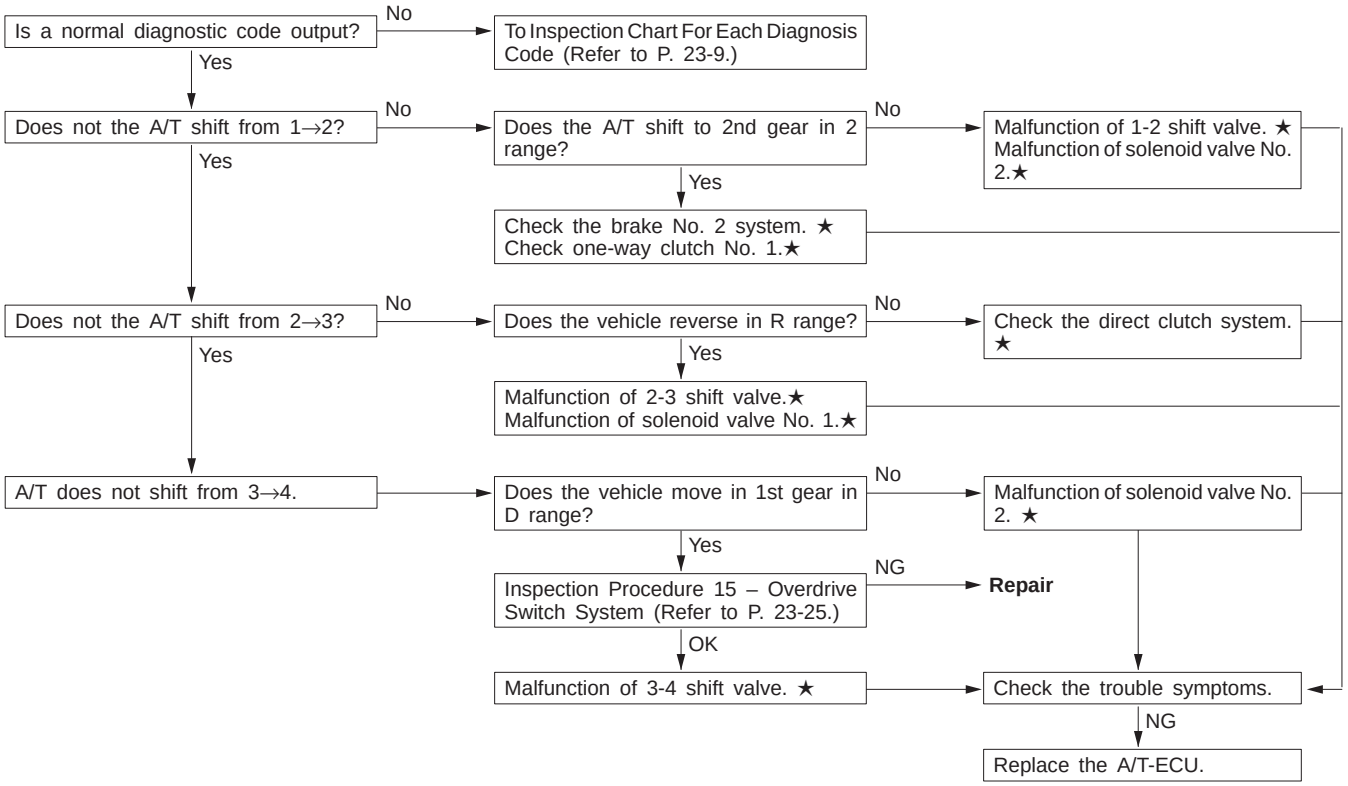
★: Refer to Transmission Workshop Manual.



INSPECTION PROCEDURE 5

Upshifting does not occur	Probable cause
Upshifting does not occur under conditions when upshifting should occur. Check shifting from 1→2, 2→3 and 3→4 respectively.	• Malfunction of solenoid valve No. 1, No. 2 • Malfunction of A/T-ECU • Malfunction of power train internal parts

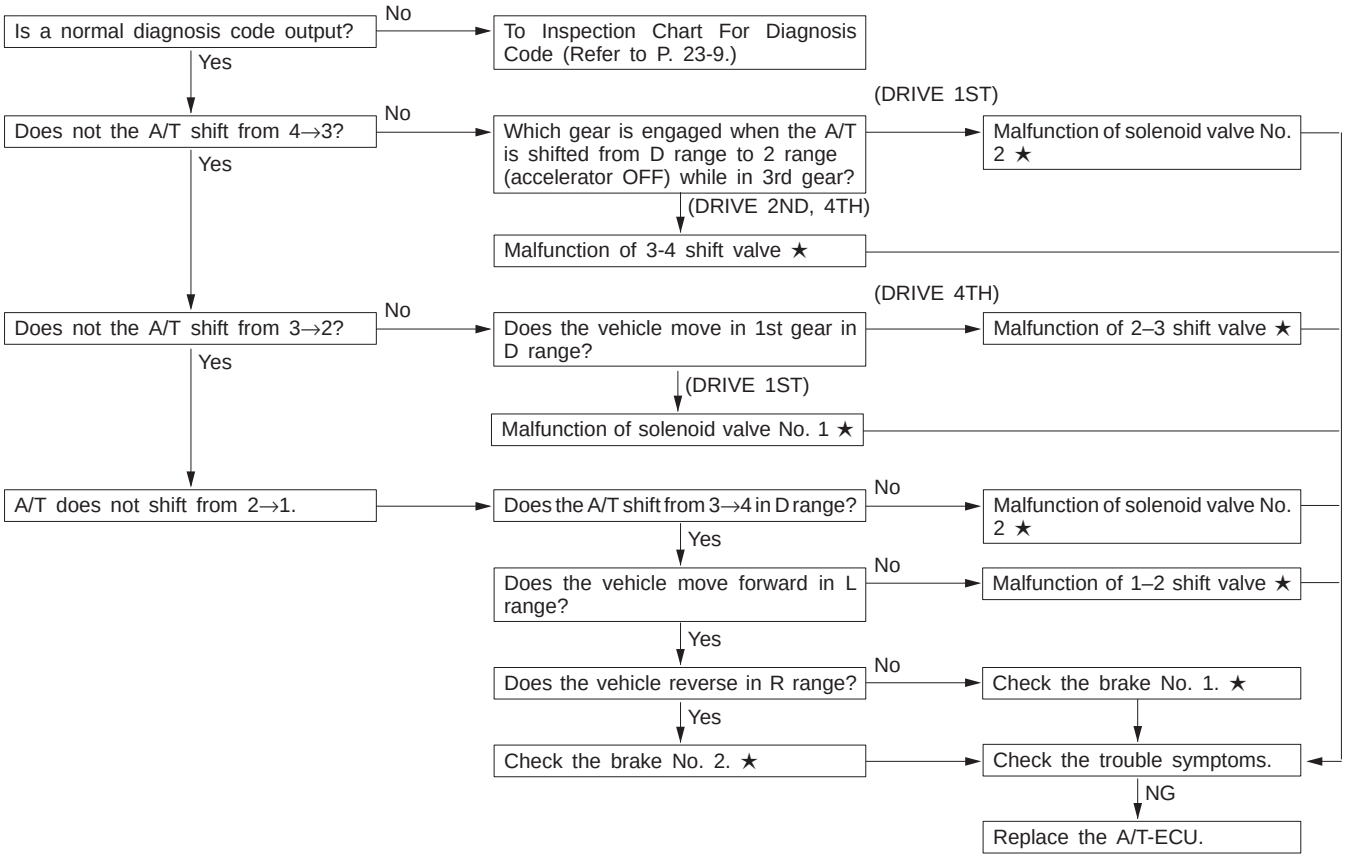
★: Refer to the Transmission Workshop Manual.



INSPECTION PROCEDURE 6

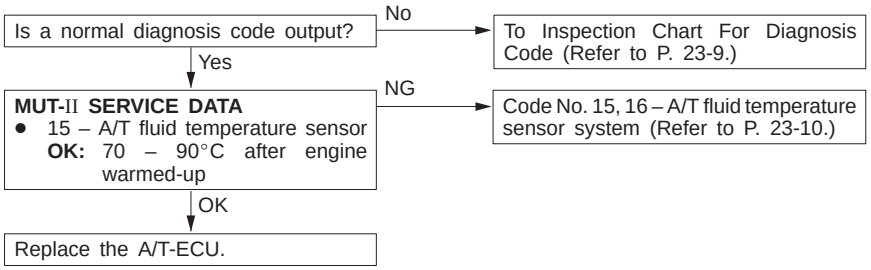
Downshifting does not occur	Probable cause
Downshifting does not occur under conditions when downshifting should occur. Check shifting from 2→1, 3→2 and 4→3 respectively.	● Malfunction of solenoid No. 1, No. 2 ● Malfunction of A/T-ECU ● Malfunction of power train internal parts

★: Refer to the Transmission Workshop Manual.



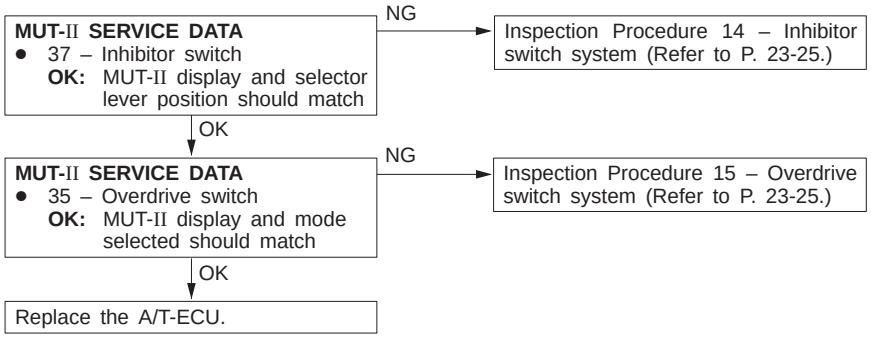
INSPECTION PROCEDURE 7

Shifting point abnormality	Probable cause
Shifting occurs at points which are different from the shift pattern. Note that the shift pattern will vary in different modes and at high A/T fluid temperatures.	● Malfunction of A/T fluid temperature sensor ● Malfunction of A/T-ECU



INSPECTION PROCEDURE 8

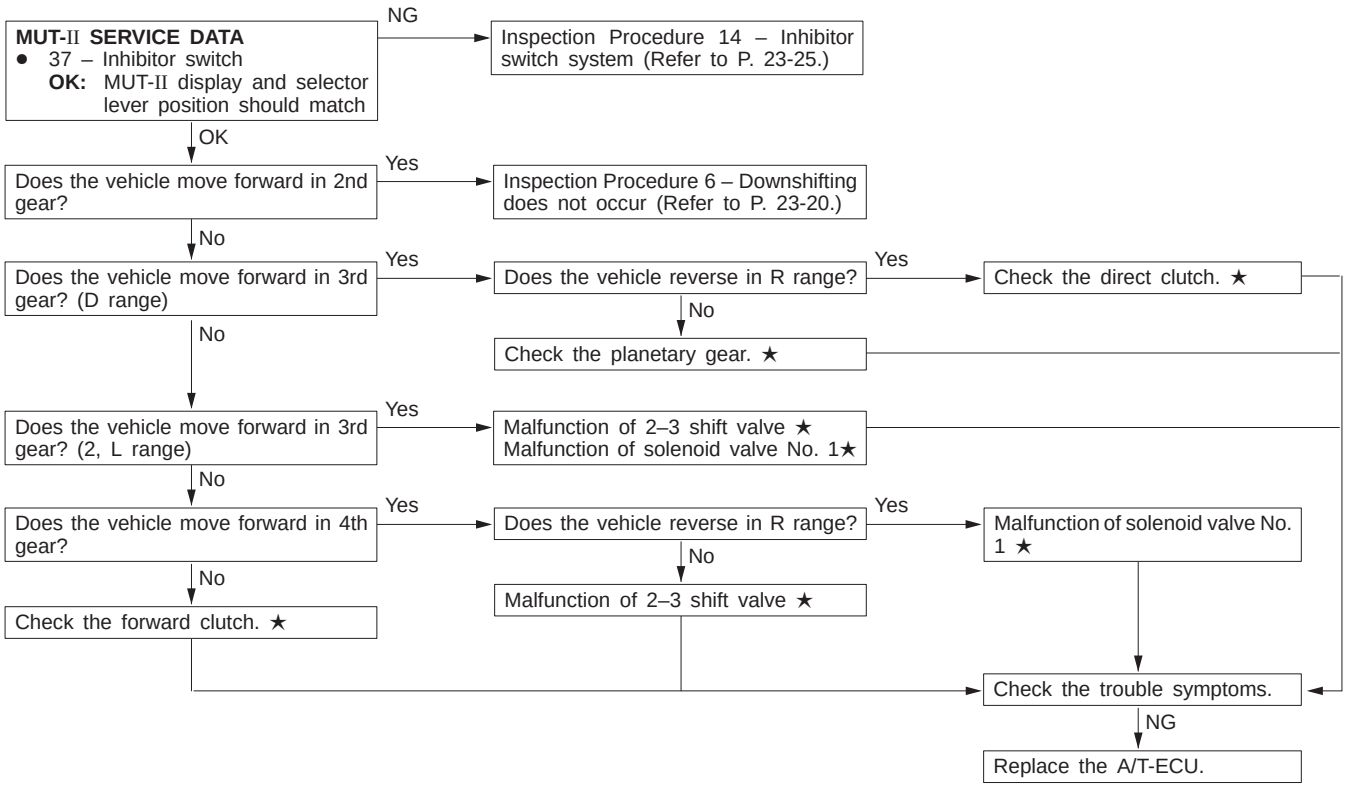
Upshifting occurs spontaneously	Probable cause
Upshifting occurs in ranges where upshifting should not occur, e. g. upshifting to 2nd gear in L range, 3rd gear in 2 range or 4th gear in D range when overdrive is disconnected.	• Malfunction of inhibitor switch • Malfunction of overdrive switch • Malfunction of A/T-ECU



INSPECTION PROCEDURE 9

Incorrect drive gear position	Probable cause
Vehicle starts off in 2nd, 3rd or 4th gear when in D range. Often occurs when starting off is not smooth.	• Malfunction of inhibitor switch • Malfunction of direct clutch • Malfunction of planetary gear • Malfunction of valve body • Malfunction of forward clutch • Malfunction of solenoid valve No. 1 • Malfunction of A/T-ECU

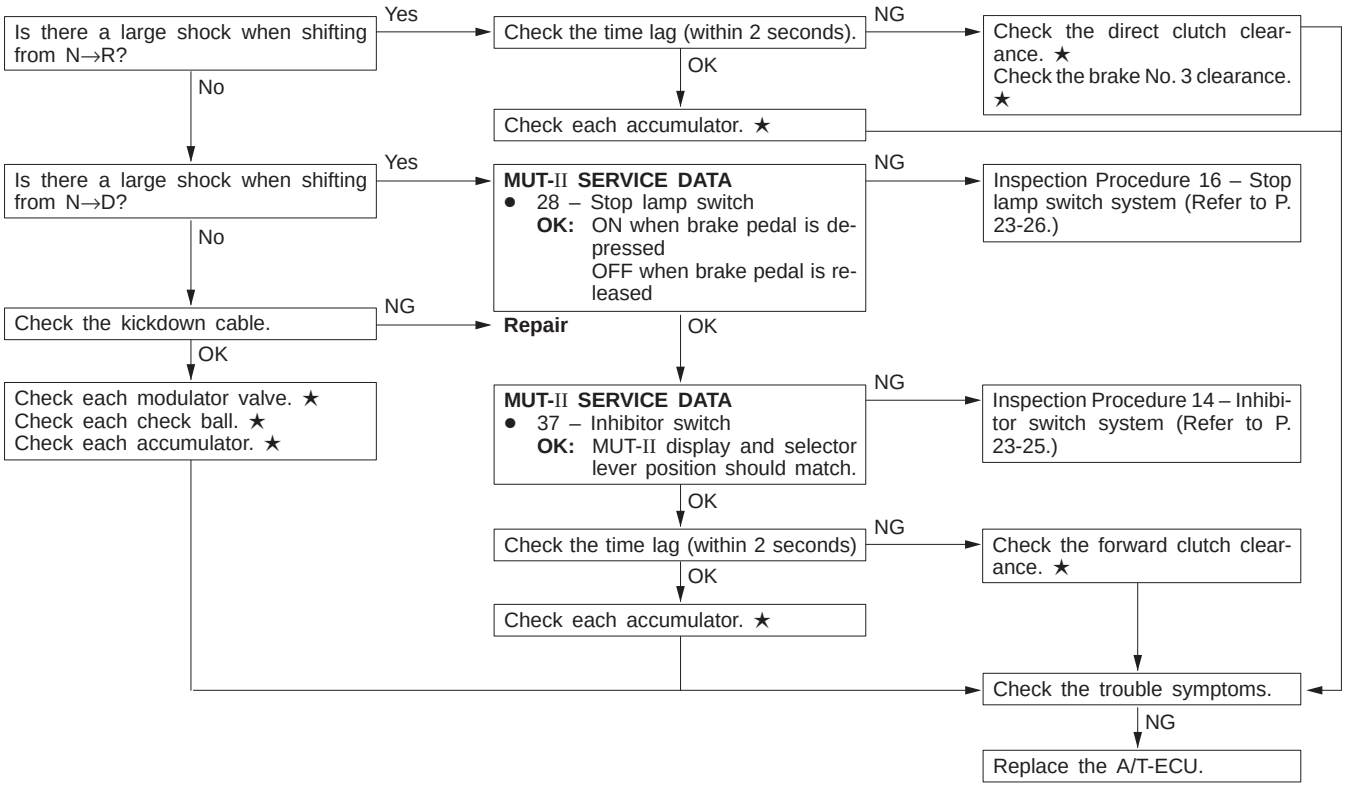
★: Refer to the Transmission Workshop Manual.



INSPECTION PROCEDURE 10

Large shocks	Probable cause
Shocks accompany shifting from N→D, N→R and during each upshift and downshift.	● Malfunction of direct clutch ● Malfunction of brake No. 3 ● Malfunction of stop lamp switch ● Malfunction of inhibitor switch ● Malfunction of forward clutch ● Malfunction of valve body ● Malfunction of A/T-ECU

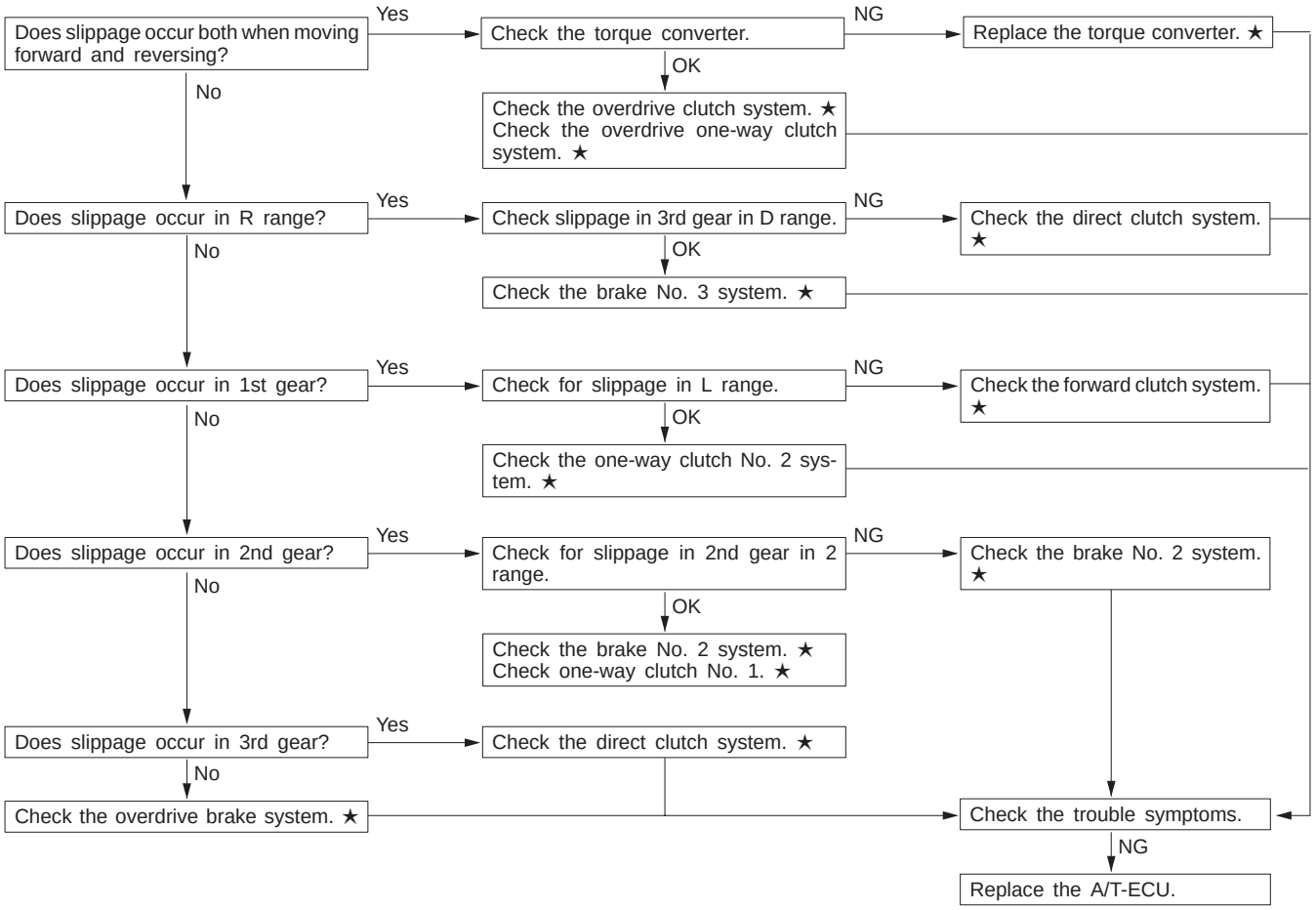
★: Refer to the Transmission Workshop Manual.



INSPECTION PROCEDURE 11

Slippage (vibration)	Probable cause
Occurs when a clutch or brake does not fully engage due to low hydraulic pressure or a worn facing. Appears as vibration when the problem is slight.	• Malfunction of torque converter • Malfunction of direct clutch • Malfunction of forward clutch • Malfunction of one-way clutch No. 1, No. 2 • Malfunction of overdrive brake • Malfunction of brake No. 1, No. 2, No. 3 • Malfunction of overdrive one-way clutch • Malfunction of A/T-ECU

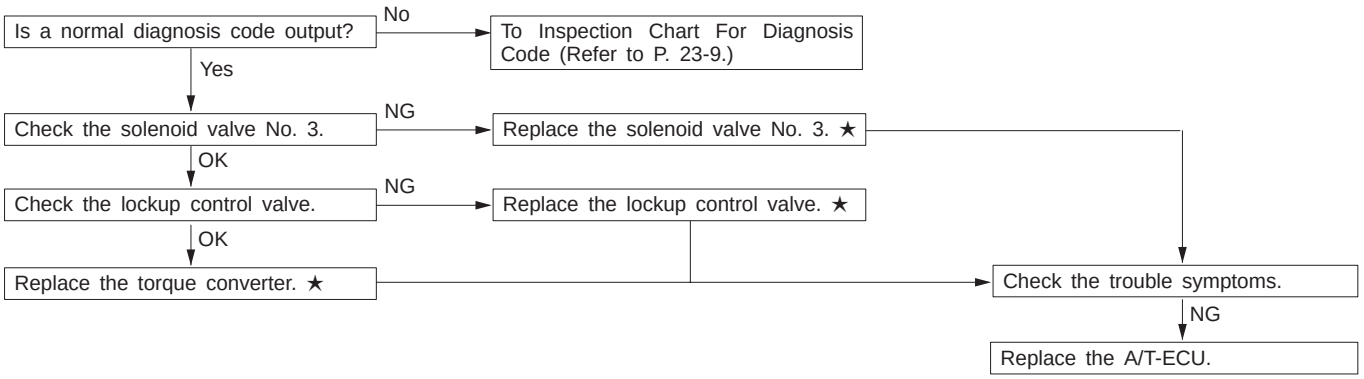
★: Refer to the Transmission Workshop Manual.



INSPECTION PROCEDURE 12

Lockup abnormality	Probable cause
When lockup does not operate even though in the lockup range, and also when lockup is operating and the engine is idling but then stalls.	● Malfunction of torque converter ● Malfunction of valve body ● Malfunction of A/T-ECU

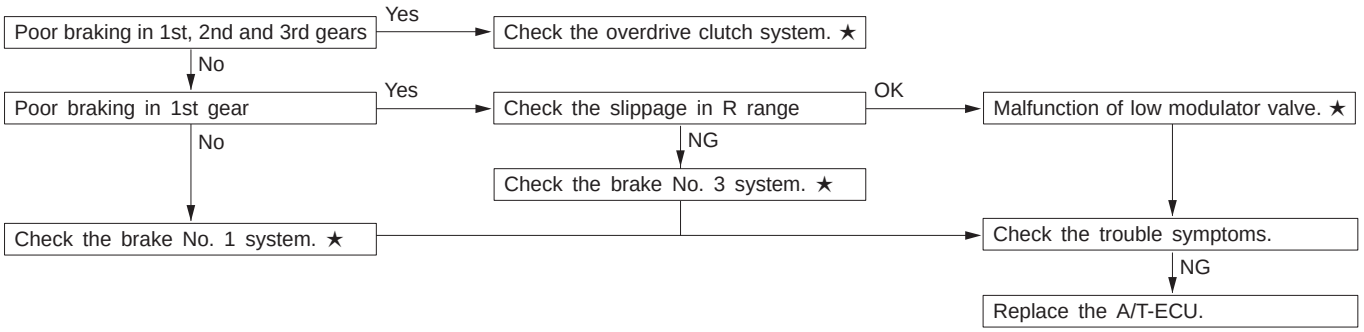
★: Refer to the Transmission Workshop Manual.



INSPECTION PROCEDURE 13

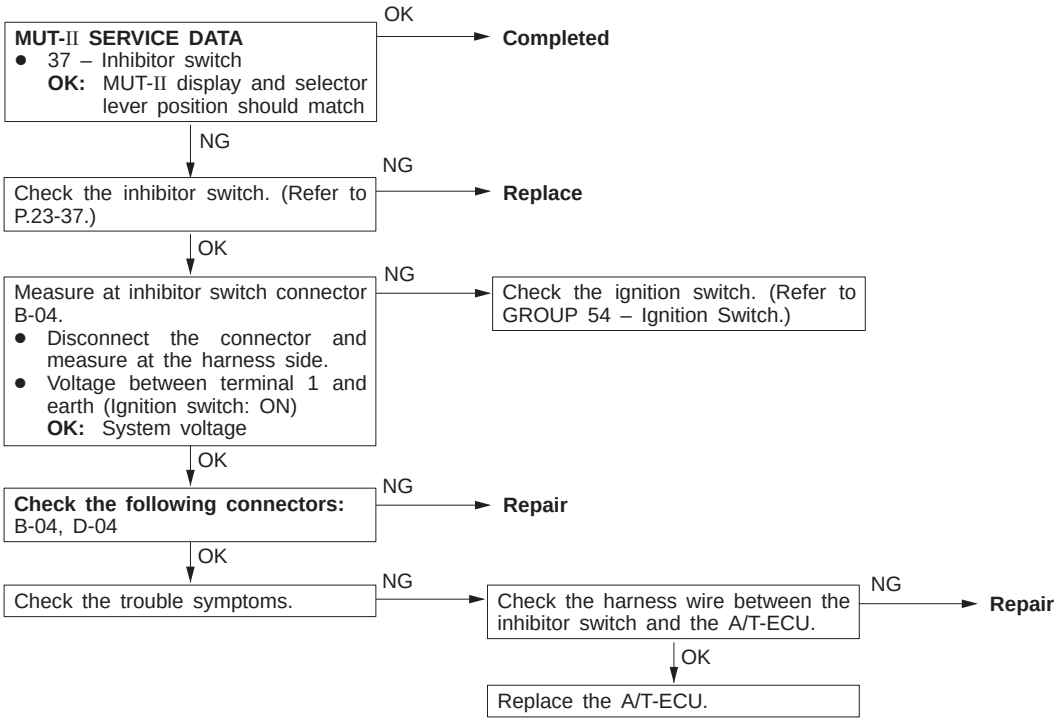
Abnormal engine braking	Probable cause
Engine braking effectiveness is poor after downshifting has occurred.	● Malfunction of overdrive clutch ● Malfunction of brake No. 1, No. 3 ● Malfunction of valve body ● Malfunction of A/T-ECU

★: Refer to the Transmission Workshop Manual.



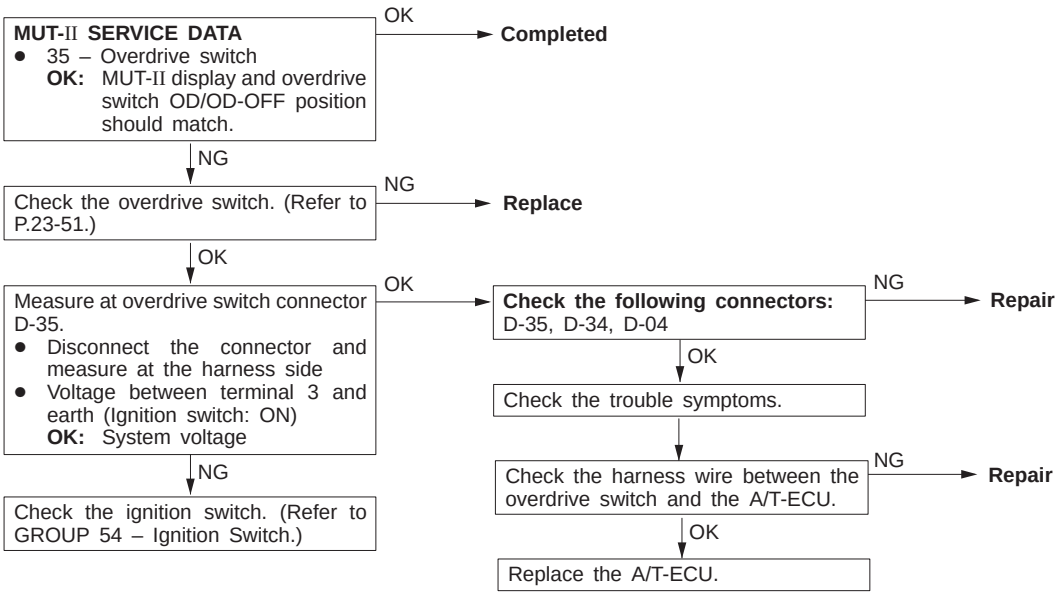
INSPECTION PROCEDURE 14

Inhibitor switch system	Probable cause
If the engine does not start in P or N range, the cause is probably a problem in the inhibitor switch system.	• Malfunction of inhibitor switch • Malfunction of harness or connector • Malfunction of A/T-ECU



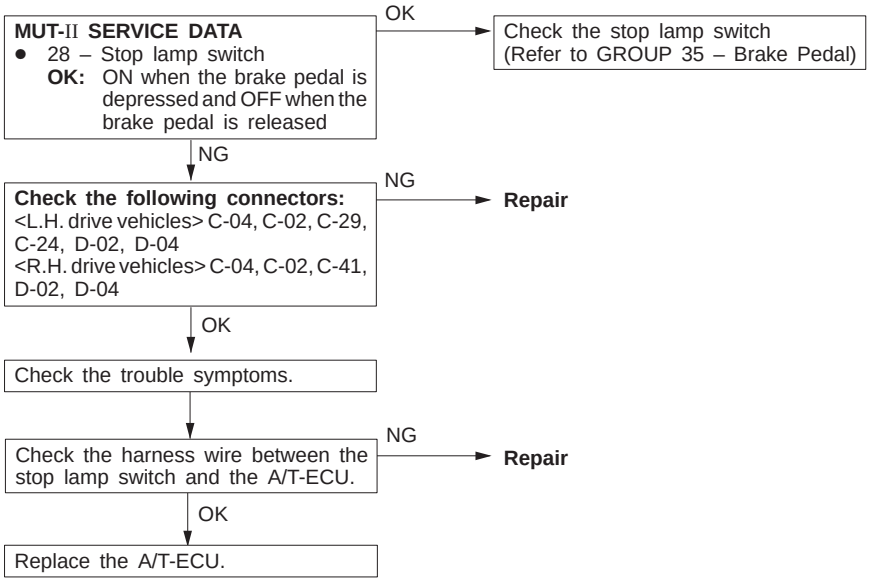
INSPECTION PROCEDURE 15

Overdrive switch system	Probable cause
If downshifting does not occur when overdrive switch is turned off while driving in 4th gear, or if shifting to 4th gear is not possible, the cause is probably a problem in the overdrive switch system.	• Malfunction of overdrive switch • Malfunction of harness or connector • Malfunction of A/T-ECU • Malfunction of ignition switch



INSPECTION PROCEDURE 16

Stop lamp switch system	Probable cause
If large shocks occur during squat control, the cause is probably a problem with the stop lamp switch.	• Malfunction of stop lamp switch • Malfunction of harness or connector • Malfunction of A/T-ECU



SERVICE DATA REFERENCE TABLE

Item No.	Inspection item	Inspection conditions		Normal value
13	Accelerator pedal position sensor (throttle opening voltage)	Engine: Idle Selector lever position: N	Accelerator pedal: Fully released	0 – 5 %
			Accelerator pedal: Depressed	Gradually rises from the above value
			Accelerator pedal: Fully depressed (up to 2 seconds)	85 – 100 %
14	Accelerator pedal position sensor (power supply voltage)	Ignition switch: ON Engine: Stopped	Ignition switch: ON	Approx. 5 V
			Ignition switch: OFF	0 V
15	A/T fluid temperature sensor	Driving with engine warmed up	Drive for 15 minutes or more until the A/T fluid temperature is 70 – 90°C.	Gradually increases to 70 – 90°C
22	Wide open throttle switch	Accelerator pedal position	Released	OFF
			Depressed	ON
27	Shift position signal	Accelerator pedal: Fully released Engine: Idle (Vehicle stopped) Selector lever position: N Brake pedal: Depressed	Shifting from N to D	1st→3rd→1st
		Selector lever position: L	Idle (Vehicle stopped)	1st
		Selector lever position: 2	Idle (Vehicle stopped)	1st
			Driving at 40 km/h (20 seconds or more)	2nd
		Selector lever position: D Overdrive switch: OFF	Driving at constant speed of 50 km/h (20 seconds or more)	3rd
		Selector lever position: D Overdrive switch: OFF	Driving at constant speed of 50 km/h (20 seconds or more)	4th
28	Stop lamp switch	Ignition switch: ON Engine: Stopped	Brake pedal: Depressed	ON
			Brake pedal: Released	OFF
31	Input shaft speed sensor	Selector lever position: D Overdrive switch: OFF	Driving at constant speed of 50 km/h	1,800 – 2,000 r/min
32	Output shaft speed sensor	Selector lever position: D Overdrive switch: OFF	Driving at constant speed of 50 km/h	1,800 – 2,000 r/min
35	Overdrive switch	Ignition switch: ON Engine: Stopped	Overdrive switch: OFF	OD-OFF
			Overdrive switch: ON	OD

Item No.	Inspection item	Inspection conditions		Normal value
37	Inhibitor switch	Ignition switch: ON Engine: Stopped	Selector lever position: P	P, R, D
			Selector lever position: R	P, R, D
			Selector lever position: N	N
			Selector lever position: D	P, R, D
			Selector lever position: 2	2
			Selector lever position: L	L
38	Vehicle speed sensor	Selector lever position: L, D Overdrive switch: OFF	Idling in 1st gear (Vehicle stopped)	0 r/min
			Driving at constant speed of 50 km/h (3rd gear)	450 – 550 r/min
41	Solenoid valve No. 1	Selector lever position: D Overdrive switch: ON	Driving at constant speed of 5 km/h (1st gear)	ON
			Driving at constant speed of 50 km/h (4th gear)	OFF
43	Solenoid valve No. 2	Selector lever position: D Overdrive switch: OFF	Driving at constant speed of 5 km/h (1st gear)	OFF
			Driving at constant speed of 50 km/h (3rd gear)	ON
47	Solenoid valve No. 3	Selector lever position: D Overdrive switch: ON	Driving at constant speed of 5 km/h (1st gear)	OFF
			Driving at constant speed of 50 km/h (4th gear)	ON
53	N range switch	Ignition switch: ON Engine: Stopped	Selector lever position: N	ON
			Selector lever position: Other than N	OFF
55	2 range switch		Selector lever position: 2	ON
			Selector lever position: Other than 2	OFF
56	L range switch		Selector lever position: L	ON
			Selector lever position: Other than L	OFF
61	Free-wheeling engage switch	Ignition switch: ON Engine: Stopped	Transfer lever position: Other than 4WD	4WD
			Transfer lever position: 4WD	2WD
63	Dual-pressure switch	Engine: Stopped Selector lever position: N	A/C switch: ON	ON
			A/C switch: OFF	OFF

REFERENCE FOR FAIL-SAFE/BACKUP FUNCTIONS

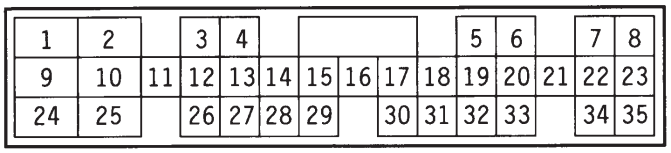
When malfunctions of the main sensors or actuators are detected by the diagnosis system, the vehicle is controlled by means of the pre-set control logic to maintain safe conditions for driving.

Malfunctioning item	Control contents during malfunction
Output shaft speed sensor	If there is an open circuit in the output shaft speed sensor, upshifting to 4th gear and lockup control is stopped.
Inhibitor switch	If there is an open circuit in the N, 2 or L signal line, driving is possible in the case of 2 and L (same as D range) so that control can be performed as if the range is D range, and driving is not possible in N range. If more than one of the N, 2 or L signals are input, the order of priority for control is L→2→N.
Accelerator pedal position sensor	If the output is 0.335 V or less or 4.8 V or more during idling condition, gear shifting control when throttle is fully closed is carried out.
Solenoid valve No. 3	If a problem is detected, lockup is stopped over the whole range and the solenoid is turned off to prevent the engine from stalling during idling.
Solenoid valve No. 1, No. 2	If a problem is detected, each solenoid stops operating and is turned off. The gear shifting logic when a problem is detected is given in the table below

Selector lever position	Normal			When the solenoid valve No. 1 has broken			When the solenoid valve No. 2 has broken			When the solenoid valves No. 1 and No. 2 have broken		
	Gear	S1	S2	Gear	S1	S2	Gear	S1	S2	Gear	S1	S2
D	1	○	×	3		×→○	1	○		O/D		
	2	○	○	3		○	O/D	○→×		O/D		
	3	×	○	3		○	O/D	×		O/D		
	O/D	×	×	O/D		×	O/D	×		O/D		
2	1	○	×	3		×→○	1	○		3		
	2	○	○	3		○	3	○→×		3		
	3	×	○	3		○	3	×		3		
L	1	○	×	1		×	1	○		1		
	2	○	○	2		○	1	○		1		

○ : Energized (ON)
× : Not energized (OFF)

A/T-ECU TERMINAL VOLTAGE REFERENCE CHART



W0181AG

Terminal No.	Inspection item	Inspection conditions	Standard value
1	Solenoid valve No. 1	When in 1st or 2nd gear	System voltage
		When in 3rd or 4th gear	0 V
2	Solenoid valve No. 2	When in 2nd or 3rd gear	System voltage
		When in 1st or 4th gear	0 V
3	Wide open throttle switch	Accelerator pedal: Released	4.5 – 5.5 V
		Accelerator pedal: Depressed	Less than 0.4 V
4	Output shaft speed sensor earth	–	–
5	Stop lamp switch	Brake pedal: Depressed	System voltage
		Brake pedal: Released	0 V
6	Free-wheeling engage switch	Transfer lever position: Other than 4WD	System voltage
		Transfer lever position: 4WD	0 V
8	Inhibitor switch (L)	Selector lever position: L	System voltage
		Selector lever position: Other than L	0 V
9	Back-up power supply	Ignition switch: OFF	System voltage
10	Solenoid valve No. 3	When lockup clutch is operating	System voltage
		When lockup clutch is not operating	0 V
11	Diagnosis control terminal	–	–
12	A/T fluid temperature sensor earth	–	–
13	Output shaft speed sensor	Vehicle: Stopped	Approx. 2.5 V
		Vehicle: Driving	Other than 2.5 V
14	Dual-pressure switch	A/C switch: OFF	0 V
		A/C switch: ON	System voltage
15	Input shaft speed sensor earth	–	–
16	Input shaft speed sensor	Ignition switch: OFF	0 V
		Ignition switch: ON	2.5 V

Terminal No.	Inspection item	Inspection conditions	Standard value
19	Communication with input signals from engine-ECU	Engine: Idling Selector lever position: D	Other than 0 V
21	Communication with output signals to engine-ECU	Engine: Idling Selector lever position: D	Other than 0 V
23	Inhibitor switch (2)	Selector lever position: 2	System voltage
		Selector lever position: Other than 2	0 V
24	Power supply	Ignition switch: OFF	0 V
		Ignition switch: ON	System voltage
25	Earth	Engine: Idling	0 V
27	Vehicle speed sensor	Vehicle: Slowly moving forward	Alternates between 0↔Approx. 5 V
28	A/T fluid temperature sensor	ATF temperature: 120°C	Approx. 0.3 V
		ATF temperature: 150°C	Approx. 0.15 V
29	Overdrive switch	Overdrive switch: ON	System voltage
		Overdrive switch: OFF	0 V
30	Accelerator pedal position sensor (throttle opening voltage)	Accelerator pedal: Released	Approx. 1 V
		Accelerator pedal: Fully depressed	Approx. 4 V
31	Accelerator pedal position sensor (power supply voltage)	Ignition switch: ON	Approx. 5 V
		Ignition switch: OFF	0 V
32	Diagnostic output terminal	–	–
33	N range lamp	Ignition switch: ON	System voltage
		Ignition switch: OFF	0 V
34	Inhibitor switch (N)	Selector lever position: N	System voltage
		Selector lever position: Other than N	0 V

TROUBLESHOOTING <A/T KEY INTERLOCK AND SHIFT LOCK MECHANISMS>

INSPECTION CHART FOR TROUBLE SYMPTOMS

Problem	Inspection Procedure No.	Reference page
Selector lever can be moved from P to R without depressing brake pedal when ignition key is at positions other than LOCK (OFF).	1	23-32
Selector lever cannot be moved from P to R with brake pedal depressed when ignition key is at positions other than LOCK (OFF).	2	23-32
Selector lever can be moved from P to R with brake pedal depressed when ignition key is at LOCK (OFF) position.	3	23-33
Selector lever cannot be moved from P to R smoothly.	4	23-33
Selector lever cannot be moved from R to P.	5	23-33
Ignition key cannot be turned to LOCK (OFF) position when selector lever is at P position.	6	23-33
Ignition key can be turned to LOCK (OFF) position when selector lever is at positions other than P.	7	23-33

INSPECTION CHART FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURE 1

Selector lever can be moved from P to R without depressing brake pedal when ignition key is at positions other than LOCK (OFF).	**Probable cause**
Lock cam or shift lock cable may be defective.	• Malfunction of lock cam • Malfunction of shift lock cable

Check items described in the column “Probable cause”.

INSPECTION PROCEDURE 2

Selector lever cannot be moved from P to R with brake pedal depressed when ignition key is at positions other than LOCK (OFF).	**Probable cause**
Selector lever assembly, shift lock cable, key interlock cable, transmission control cable or lock cam may be defective.	• Malfunction of selector lever assembly • Malfunction of shift lock cable • Malfunction of key interlock cable • Malfunction of transmission control cable • Malfunction of lock cam

Check items described in the column “Probable cause”.

INSPECTION PROCEDURE 3

Selector lever can be moved from P to R with brake pedal depressed when ignition key is at LOCK (OFF) position.	Probable cause
Lock cam or key interlock cable may be defective.	• Malfunction of lock cam • Malfunction of key interlock cable

Check items described in the column “Probable cause”.

INSPECTION PROCEDURE 4

Selector lever cannot be moved from P to R smoothly.	Probable cause
Key interlock cable, shift lock cable, lock cam, or selector lever assembly may be defective.	• Malfunction of key interlock cable • Malfunction of shift lock cable • Malfunction of lock cam • Malfunction of selector lever assembly

Check items described in the column “Probable cause”.

INSPECTION PROCEDURE 5

Selector lever cannot be moved from R to P.	Probable cause
Selector lever assembly or transmission control cable may be defective.	• Malfunction of selector lever assembly • Malfunction of transmission control cable

Check items described in the column “Probable cause”.

INSPECTION PROCEDURE 6

Ignition key cannot be turned to LOCK (OFF) position when selector lever is at P position.	Probable cause
Lock cam, key interlock cable or key cylinder slider may be defective.	• Malfunction of lock cam • Malfunction of key interlock cable • Malfunction of key cylinder slider

Check items described in the column “Probable cause”.

INSPECTION PROCEDURE 7

Ignition key can be turned to LOCK (OFF) position when selector lever is at positions other than P.	Probable cause
Lock cam, key cylinder cover or key interlock cable may be defective.	• Malfunction of lock cam • Malfunction of key cylinder cover • Malfunction of key interlock cable

Check items described in the column “Probable cause”.

ON-VEHICLE SERVICE

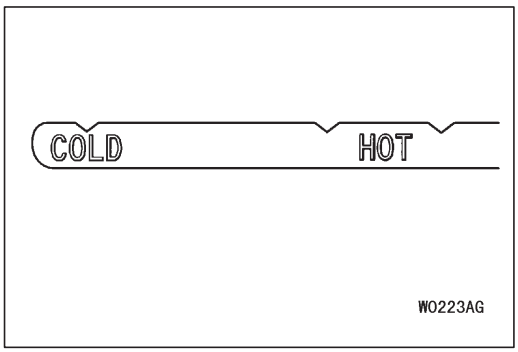
ESSENTIAL SERVICE

AUTOMATIC TRANSMISSION FLUID CHECK

Caution
When the transmission has been replaced or overhauled, or driving has been carried out under the severe condition, the A/T fluid cooler line flushing should always be carried out and also, the A/T fluid should always be replaced.

1. Drive the vehicle until the A/T fluid temperature rises to the normal temperature (70 – 90°C).
2. Park the vehicle on a level surface.
3. Move the selector lever through all positions to fill the torque converter and the hydraulic circuits with A/T fluid, and then move the selector lever to the N position.
4. After wiping off any dirt around the oil level gauge, remove the oil level gauge and check the condition of the A/T fluid.

   NOTE
   If the A/T fluid smells as if it is burning, it means that the A/T fluid has been contaminated by the particles from the bushes and friction materials, a transmission overhaul and flushing the A/T fluid cooler line may be necessary.

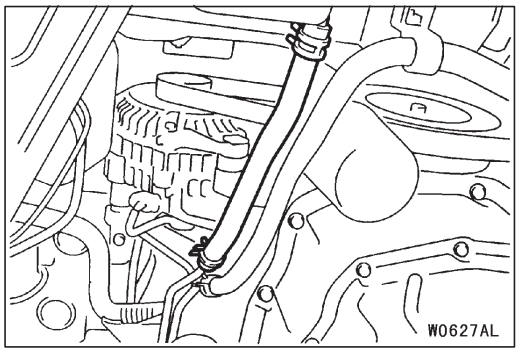


5. Check that the A/T fluid level is at the HOT mark on the oil level gauge. If the A/T fluid level is lower than this, pour in more A/T fluid until the level reaches the HOT mark.

   Automatic transmission fluid:
   DEXRON II or equivalent

   NOTE
   If the A/T fluid level is low, the oil pump will draw in air along with the A/T fluid, which will cause bubbles to form inside the hydraulic circuit. This will in turn cause the hydraulic pressure to drop, which will result in late shifting and slipping of the clutches and brakes.
   If there is too much A/T fluid, the gears can churn it up into foam and cause the same conditions that can occur with low A/T fluid levels.
   In either case, air bubbles can cause overheating and oxidation of the A/T fluid which can interfere with normal valve, clutch, and brake operation. Foaming can also result in A/T fluid escaping from the transmission vent hole, in which case it may be mistaken for a leak.

6. Securely insert the oil level gauge.



AUTOMATIC TRANSMISSION FLUID REPLACEMENT

Caution
When the transmission has been replaced or overhauled, the A/T fluid cooler line flushing should always be carried out before installing the A/T fluid cooler hose.

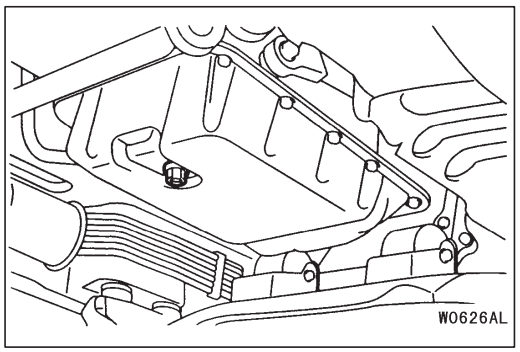
If you have a A/T fluid changer, use this changer to replace the A/T fluid. If you do not have a A/T fluid changer, replace the A/T fluid by the following procedure.

1. Disconnect the hose shown in the illustration which connects the transmission and the A/T fluid cooler (inside the radiator).
2. Start the engine and let the A/T fluid drain out.

   Running conditions: N range with engine idling

   Caution
   The engine should be stopped within one minute after it is started. If the A/T fluid has all drained out before then, the engine should be stopped at that point.

   Discharge volume: Approx. 3.4 ℓ



3. Remove the drain plug from the bottom of the transmission case to drain the A/T fluid.

   Discharge volume: Approx. 0.8 ℓ

4. Install the drain plug via a new gasket, and tighten it to the specified torque.

   Tightening torque: 20.1 Nm

5. Pour the new A/T fluid in through the oil filler tube.

   Adding volume: Approx. 4.2 ℓ

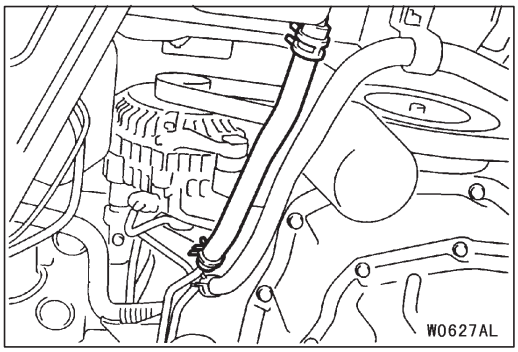
   Caution
   Stop pouring if the full volume of A/T fluid cannot be poured in.

6. Repeat the procedure in step 2.

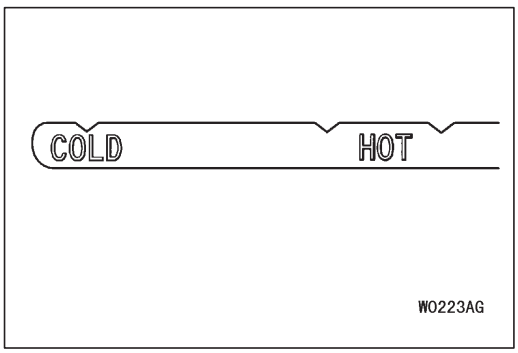
   NOTE
   Drain the A/T fluid from the cooler hose 6.0 ℓ at least in steps 2 and 5. Then drain the A/T fluid a little and check the A/T fluid for dirt.
   If it has been contaminated, repeat the steps 5 and 6.

7. Pour the new A/T fluid in through the oil filler tube.

   Adding volume: Approx. 3.4 ℓ

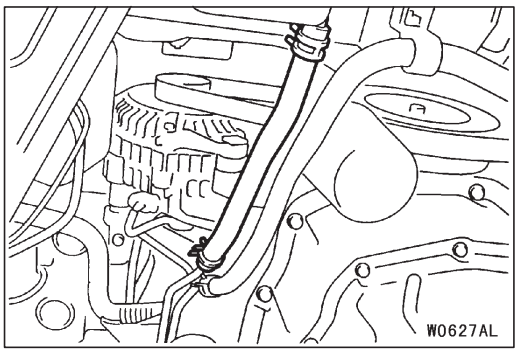


8. Reconnect the hose which was disconnected in step 1 above, and firmly replace the oil level gauge.
9. Start the engine and run it at idle for 1 – 2 minutes.
10. Move the selector lever through all positions, and then move it to the N position.



11. Check that the A/T fluid level is at the COLD mark on the oil level gauge. If the level is lower than this, pour in more A/T fluid.
12. Drive the vehicle until the A/T fluid temperature rises to the normal temperature (70 – 90°C), and then check the A/T fluid level again.
    The A/T fluid level must be at the HOT mark.

    NOTE
    The COLD level is for reference only; the HOT level should be regarded as the standard level.
13. Firmly insert the oil level gauge into the oil filler tube.



AUTOMATIC TRANSMISSION FLUID COOLER LINE FLUSHING

Caution
When the transmission has been replaced or overhauled, or A/T fluid is contaminated, the A/T fluid cooler line flushing should always be carried out.

1. Disconnect the hose shown in the illustration which connects the transmission and the A/T fluid cooler (inside the radiator).
2. Start the engine and let the A/T fluid drain out.

   Running conditions: N range with engine idling

   Caution
   The engine should be stopped within one minute after it is started. If the A/T fluid has all drained out before then, the engine should be stopped at that point.

   Discharge volume: Approx. 3.4 ℓ
3. Pour the new A/T fluid in through the oil filler tube.

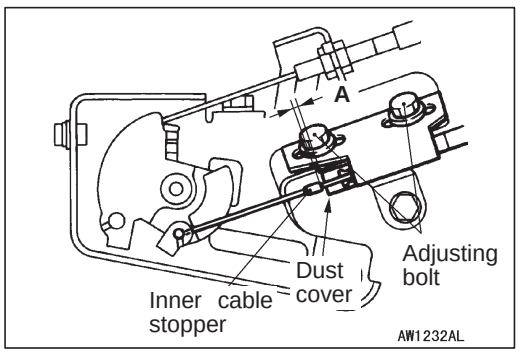
   Adding volume: Approx. 3.4 ℓ

   Caution
   Stop pouring if the full volume of A/T fluid cannot be poured in.

4. Repeat the procedure in step 2.

   NOTE
   Drain the A/T fluid from the cooler hose 6.0 ℓ at least in step 2. Then drain the A/T fluid a little and check the A/T fluid for dirt.
   If it has been contaminated, repeat the steps 3 and 4.

5. Follow the automatic transmission fluid replacement procedure from the step 3.

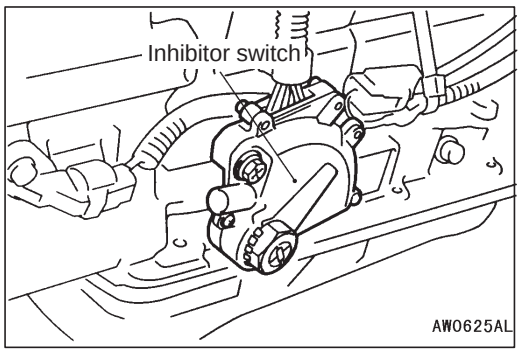


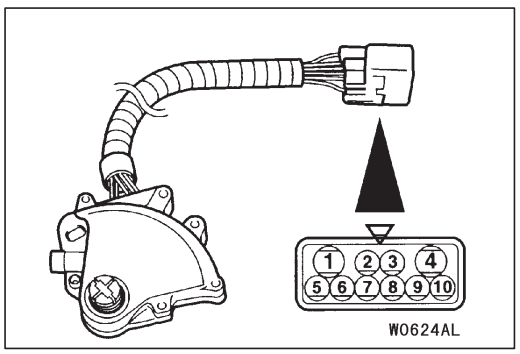
KICKDOWN CABLE CHECK AND ADJUSTMENT

1. Release the accelerator pedal.
2. Loosen the adjusting nut or adjusting bolt. Move the outer cable of the kickdown cable to adjust the clearance (A) between the inner cable stopper and dust cover end to the standard value, and then tighten the adjusting nut or adjusting bolt to secure the kickdown cable.

   Standard value: 0.8 – 1.5 mm

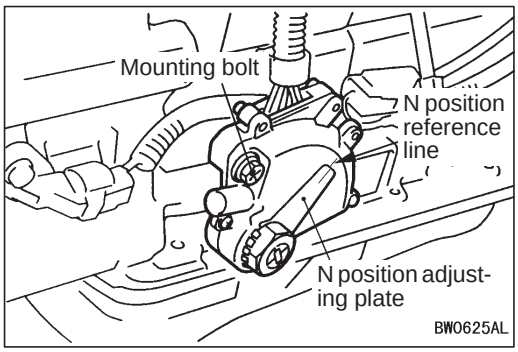
   Caution
   Adjust the accelerator cable assembly after the kickdown cable adjustment.





INHIBITOR SWITCH CONTINUITY CHECK

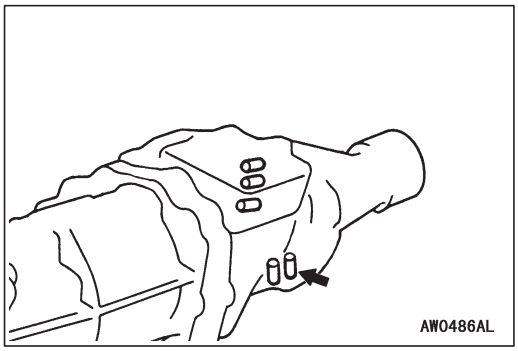
Position	Terminal No.									
	1	2	3	4	5	6	7	8	9	10
P	○			○		○		○		
R							○	○		
N	○			○	○			○		
D		○						○		
2								○		○
L			○					○		



INHIBITOR SWITCH AND CONTROL CABLE ADJUSTMENT

1. Set the manual control lever to the N position.
2. Loosen the inhibitor switch mounting bolt.
3. Turn the inhibitor switch to align the N position reference line on the inhibitor switch with the scratched line on the N position adjusting plate.
4. Tighten the mounting bolt to the specified torque.

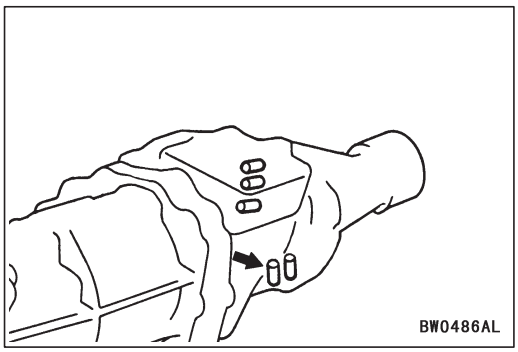
   Tightening torque: 5.4 Nm



VCU LOCK DETECTION SWITCH CONTINUITY CHECK

Check the continuity between the terminal of the brown connector installed in the side of transfer case (shown in the illustration) and the transfer case.

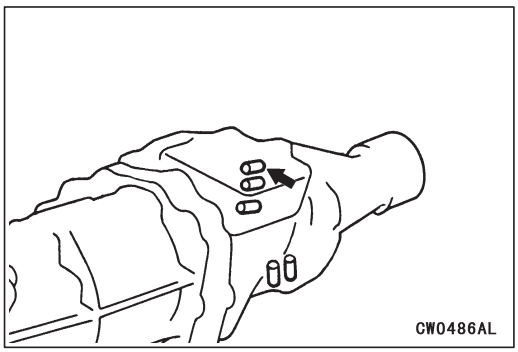
Transfer lever position	Continuity
4H	No continuity
4HLc	Continuity



2WD/4WD DETECTION SWITCH CONTINUITY CHECK

Check the continuity between the terminal of the white connector installed in the side of transfer case (shown in the illustration) and the transfer case.

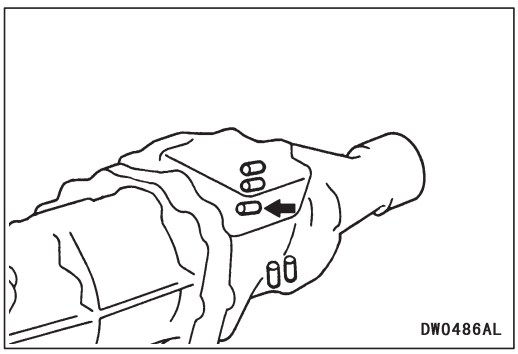
Transfer lever position	Continuity
2H	Continuity
4H	No continuity



VCU LOCK OPERATION DETECTION SWITCH CONTINUITY CHECK

Check the continuity between the terminal of the brown connector installed in the top of transfer case (shown in the illustration) and the transfer case.

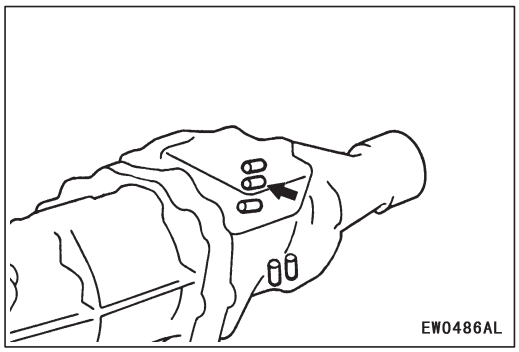
Transfer lever position	Continuity
4H	No continuity
4HLc	Continuity



4WD OPERATION DETECTION SWITCH CONTINUITY CHECK

Check the continuity between the terminal of the white connector installed in the top of transfer case (shown in the illustration) and the transfer case.

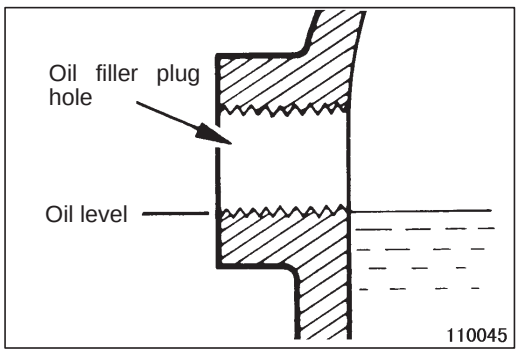
Transfer lever position	Continuity
2H	No continuity
4H	Continuity



HIGH/LOW DETECTION SWITCH CONTINUITY CHECK

Check the continuity between the terminal of the black connector installed in the top of transfer case (shown in the illustration) and the transfer case.

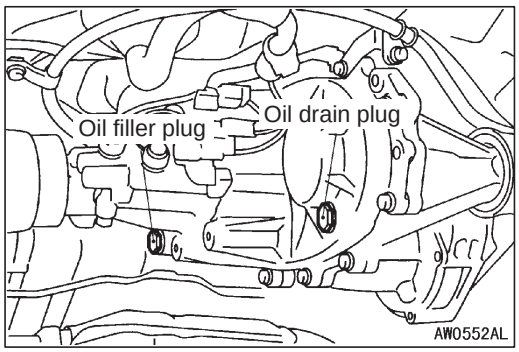
Transfer lever position	Continuity
4HLc	Continuity
Between 4HLc and 4LLc	No continuity
4LLc	Continuity



TRANSFER OIL CHECK

1. Remove the oil filler plug.
2. Check that the oil level is at the lower portion of the oil filler plug hole.
3. Check that the oil is not noticeably dirty, and that it has a suitable viscosity.
4. Tighten the oil filler plug to the specified torque.

   Tightening torque: 29 – 34 Nm



TRANSFER OIL REPLACEMENT

1. Remove the oil drain plug to drain oil.
2. Tighten the oil drain plug to the specified torque.

   Tightening torque: 29 – 34 Nm

3. Remove the oil filler plug and fill with specified oil till the level comes to the lower portion of oil filler plug hole.

   Specified oil:
   Hypoid gear oil SAE 75W - 90 or 75W - 85W conforming to API GL-4

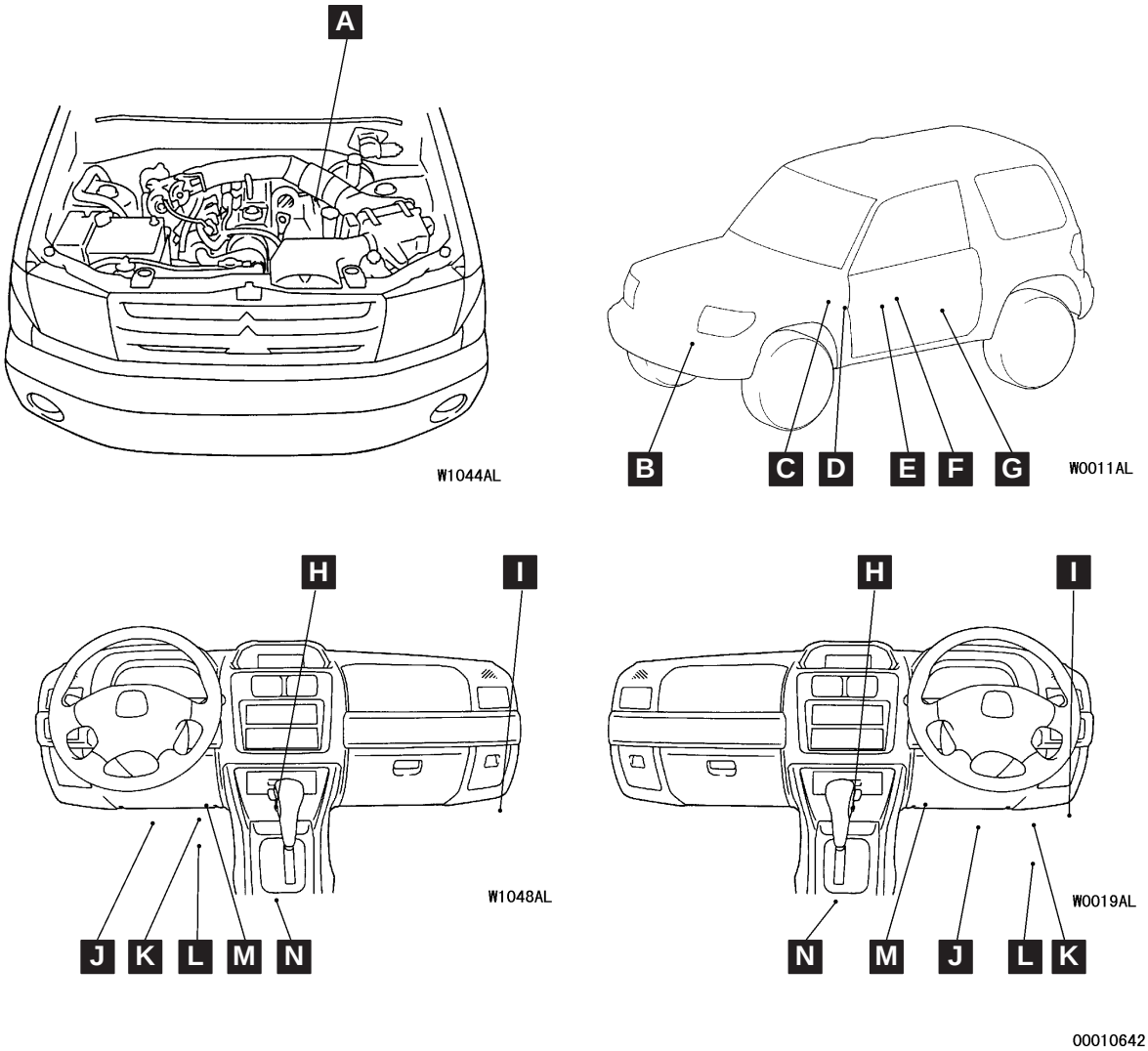
   Quantity: 2.2 ℓ

4. Tighten the oil filler plug to the specified torque.

   Tightening torque: 29 – 34 Nm

A/T CONTROL COMPONENT LOCATION

Name	Symbol	Name	Symbol
Accelerator pedal position sensor (APS)	K	Inhibitor switch	D
		Input shaft speed sensor	C
A/T-ECU	N	Output shaft speed sensor	F
A/T fluid temperature sensor	E	Overdrive switch	H
Diagnosis connector	M	Solenoid valves	E
Dual-pressure switch	A	Stop lamp switch	J
Engine-ECU	I	Vehicle speed sensor	G
Free wheeling engage switch	B	Wide open throttle position switch	L



A/T CONTROL COMPONENT CHECK

OVERDRIVE SWITCH CHECK

Refer to P.23-51.

WIDE OPEN THROTTLE SWITCH CHECK

Refer to P23-51.

ACCELERATOR PEDAL POSITION SENSOR (APS) CHECK

Refer to GROUP 13A – On-vehicle Service.

INHIBITOR SWITCH CHECK

Refer to P.23-37.

STOP LAMP SWITCH CHECK

Refer to GROUP 35 – On-vehicle Service.

VEHICLE SPEED SENSOR CHECK

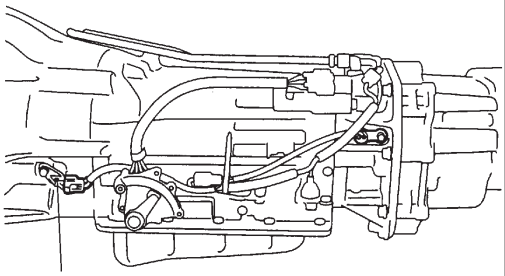
Refer to GROUP 54 – On-vehicle Service.

DUAL-PRESSURE SWITCH CHECK

Refer to GROUP 55 – On-vehicle Service.

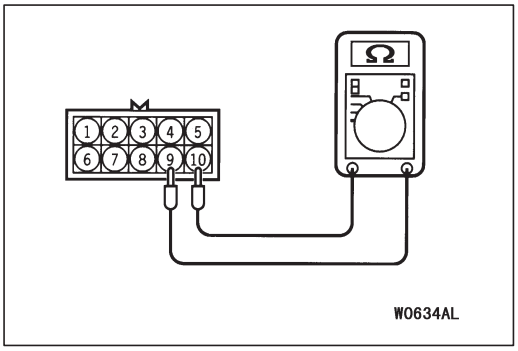
FREE WHEELING ENGAGE SWITCH CHECK

Refer to GROUP 26 – On-vehicle Service.



INPUT SHAFT SPEED SENSOR CHECK

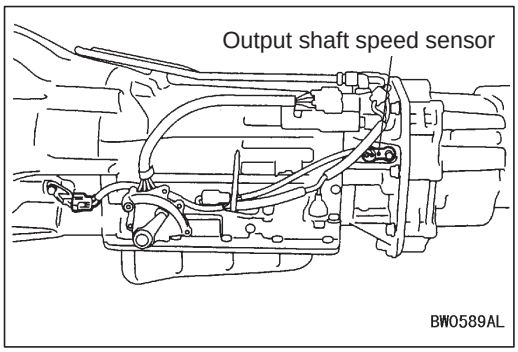
1. Disconnect the input shaft speed sensor connector.



2. Measure the resistance between terminals 9 and 10 of the input shaft speed sensor connector.

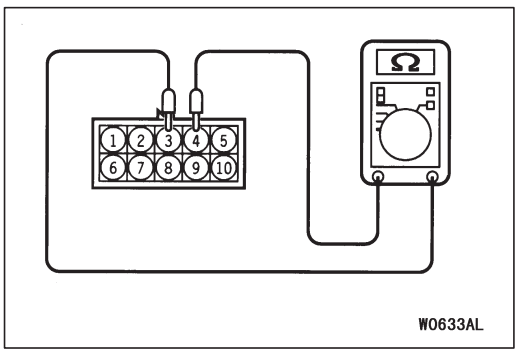
   Standard value: 620 ± 60 Ω (at 20 °C)

3. If the resistance is not within the standard value, replace the input shaft speed sensor.



OUTPUT SHAFT SPEED SENSOR CHECK

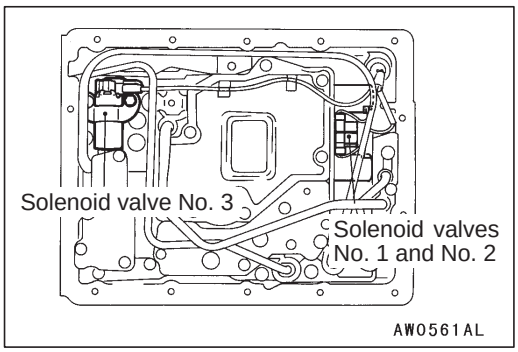
1. Disconnect the output shaft speed sensor connector.



2. Measure the resistance between terminals 3 and 4 of the output shaft speed sensor connector.

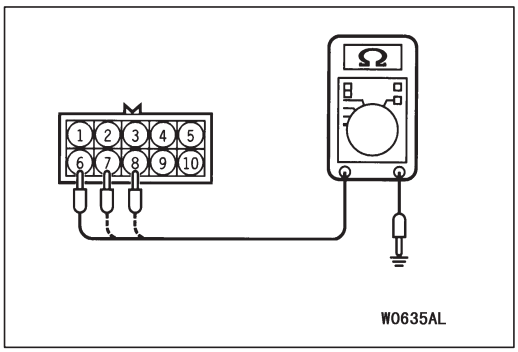
   Standard value: 430 ± 43 Ω (at 20 °C)

3. If the resistance is not within the standard value, replace the output shaft speed sensor.



SOLENOID VALVE CHECK

1. Disconnect the solenoid valve connector.

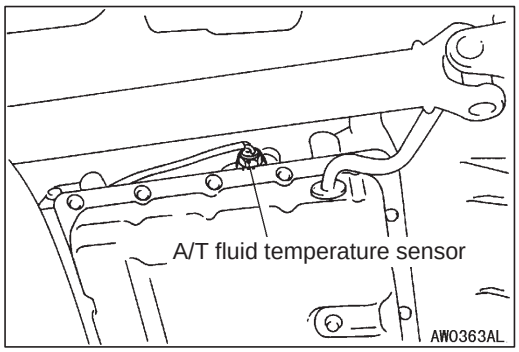


2. Measure the solenoid valve resistance.

   Standard value:

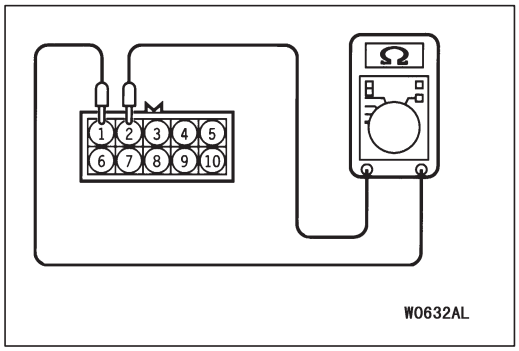
Item	Measurement terminal	Resistance
Solenoid valve No. 1	Between terminal 6 and earth	13 ± 2 Ω (at 25°C)
Solenoid valve No. 2	Between terminal 7 and earth	
Solenoid valve No. 3	Between terminal 8 and earth	

3. If the resistance is not within the standard value, replace the solenoid valve assembly.



A/T FLUID TEMPERATURE SENSOR CHECK

1. Disconnect the A/T fluid temperature sensor connector.

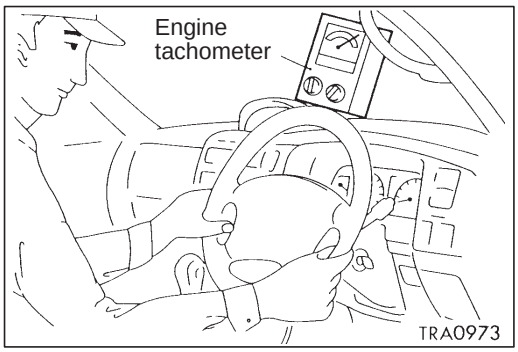


2. Measure the resistance between terminals 1 and 2 of the A/T fluid temperature sensor connector.

   Standard value

Temperature (°C)	Resistance
25	1,100 Ω
120	57 Ω

3. If the resistance is not the standard value, replace the A/T fluid temperature sensor.



CONVERTER STALL TEST

In this test, the engine maximum speed when the torque converter stalls with the selector lever in the “D” or “R” range is measured to check operation of the torque converter, starter and one-way clutch and check holding performance of the transmission clutch (including brake).

Caution
Do not stand in front or at rear of the vehicle during this test.

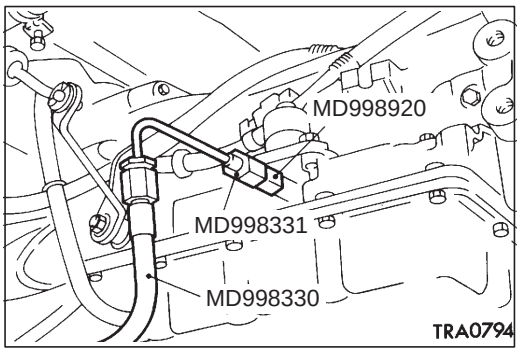
1. Check the transmission fluid level. The fluid temperature should be at the level after normal operation (70 – 90°C). The engine coolant temperature should also be at the level after normal operation (80 – 95°C).
2. Apply chocks to the rear wheels (right and left).
3. Mount an engine tachometer.
4. Apply fully the parking and service brakes.
5. Start the engine.
6. With the selector lever in the “D” range, fully depress the accelerator pedal and read off the engine maximum speed.

   NOTE
   When doing so, do not keep the engine running with throttle full open for more than 5 seconds. If two or more stall tests are needed, place the selector lever in the “N” position and run the engine at about 1,000 r/min to allow the transmission fluid to cool before another stall test.

   Standard value: 2,320 – 2,620 r/min
7. Place the selector lever in the “R” range and perform the test as above.

JUDGEMENT OF STALL TEST RESULTS

Stall speed in “D” and “R” range is equal to each other but lower than the nominal value.	(1) Engine output is low. (2) Starter one-way clutch is faulty. (Faulty torque converter is suspected if it is lower than nominal by more than 600 r/min)
Stall speed in “D” range is higher than nominal.	(1) Overdrive clutch slipping (2) Overdrive one-way clutch faulty (3) Forward clutch slipping (4) One-way clutch No. 2 faulty (5) Low line pressure
Stall speed in “R” range is higher than nominal.	(1) Overdrive clutch slipping (2) Overdrive one-way clutch faulty (3) Direct clutch slipping (4) Brake No. 3 slipping (5) Low line pressure



HYDRAULIC PRESSURE TEST

The hydraulic pressure test is important in determining the causes of transmission failures. Before conducting the test, fluid level and condition and throttle cable adjustment, etc. must be checked for defects or abnormalities. When conducting the test, the engine and transmission should be at correct operating temperatures, (engine coolant 80 – 95°C, transmission fluid 70 – 90°C.)

LINE PRESSURE TEST

1. Place the vehicle on a chassis dynamometer.
2. Remove the plug from the line pressure take off port.
3. Install special tools as shown in the figure and place the meter inside vehicle.
4. Apply the parking brake.
5. Start the engine.
6. Place the selector lever in the “D” range.
7. Depress the brake pedal firmly by the left foot and operate the accelerator pedal by the right foot to measure the line pressure at each engine r/min. If the measured pressure is not nominal, check adjustment of the throttle cable and readjust if necessary before conducting the test again.
8. Place the selector lever in the “R” range and test as above.

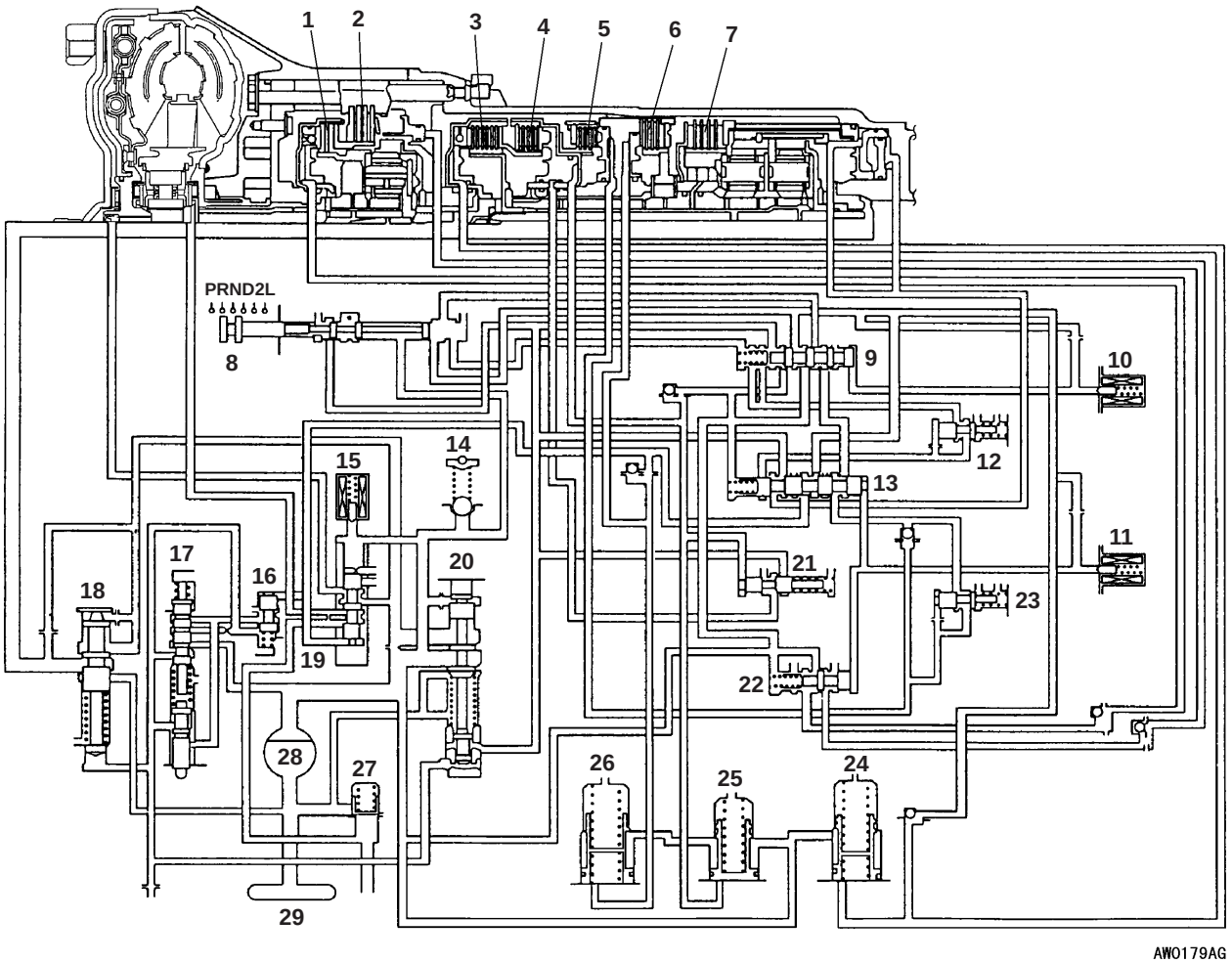
Standard value:

Items	Line pressure kPa	
	“D” range	“R” range
At idle	373 – 422	520 – 579
At stall	765 – 863	1,383 – 1,628

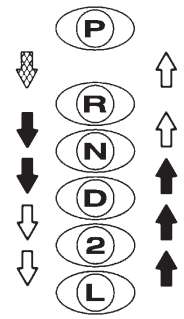
JUDGEMENT BY LINE PRESSURE

Hydraulic pressure higher than nominal in all ranges	(1) Regulator valve faulty (2) Throttle valve faulty (3) Throttle cable incorrectly adjusted
Hydraulic pressure lower than nominal in all ranges	(1) Oil pump faulty (2) Regulator valve faulty (3) Throttle valve faulty (4) Throttle cable incorrectly adjusted (5) Overdrive clutch faulty
Hydraulic pressure lower than nominal in “D” range	(1) Large fluid leaks in “D” range hydraulic circuit (2) Forward clutch faulty (3) Overdrive clutch faulty
Hydraulic pressure lower than nominal in “R” range	(1) Large fluid leaks in “R” range hydraulic circuit (2) Brake No. 3 faulty (3) Direct clutch faulty (4) Overdrive clutch faulty

HYDRAULIC CIRCUIT



1. Overdrive clutch
2. Overdrive brake
3. Forward clutch
4. Direct clutch
5. Brake No. 1
6. Brake No. 2
7. Brake No. 3
8. Manual valve
9. 2-3 shift valve
10. Solenoid valve No. 1
11. Solenoid valve No. 2
12. Low coast modulator valve
13. 1-2 shift valve
14. Pressure relief valve
15. Solenoid valve No. 3
16. Cut-back valve
17. Throttle valve
18. Secondary regulator valve
19. Lockup control valve
20. Primary regulator valve
21. Reverse clutch sequence valve
22. 3-4 shift valve
23. Intermediate modulator valve
24. Accumulator C1
25. Accumulator C2
26. Accumulator B2
27. Oil cooler bypass valve
28. Oil pump
29. Oil strainer



BW1199AL

Turn the ignition switch to any position other than LOCK (OFF), and operate the selector lever with the brake pedal depressed and the push button pushed.

Operate the selector lever without pushing the push button.

Operate the selector lever with the push button pushed.

SELECTOR LEVER OPERATION CHECK

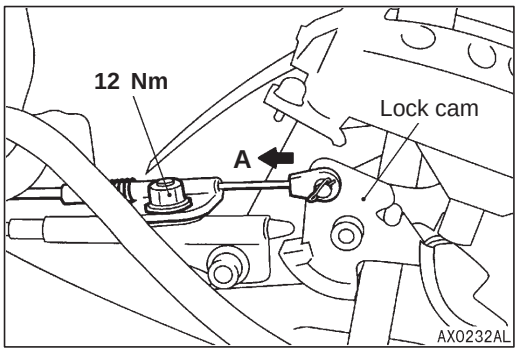
1. Apply the parking brake lever.
2. Move the selector lever from N position to each of D, 2 and L positions to check that the selector lever moves smoothly.
3. Check that the engine starts when the selector lever is in each of N and P positions, and that the engine does not start when the selector lever is in positions other than N and P.
4. Start the engine and release the parking brake. Check that the vehicle moves forward when the selector lever is moved from N position to each of D, 2 and L positions, and moves backward when the selector lever is moved to R position.
5. Stop the engine.
6. Turn the ignition switch to ON position. Check that the backup lamp illuminates and the buzzer sounds when the selector lever is moved from P position to R position.

NOTE
Because of the inclusion of an A/T mis-operation prevention device, the select or lever cannot be moved from the P position to an other position unless you turn the ignition key to a position other than LOCK (OFF) and depress the brake pedal first.

KEY INTERLOCK MECHANISM CHECK

1. Carry out the following inspection:

Inspection procedure	Requirements		Normal condition
1	Brake pedal: Depressed	Ignition key: LOCK (OFF) or removed	The selector lever push button can not be pushed, and the selector lever should not be moved from P position.
2		Ignition key: Other than above	If the selector lever push button is pushed, the selector lever can be moved from P position.
3	Brake pedal: Not depressed	Selector lever: Other than P	The ignition key can not be turned to LOCK (OFF) position.
4		Selector lever: P	The ignition key can be turned to LOCK (OFF) position.



2. If there is a problem on the inspection above, adjust the key interlock cable as follows:
   (1) Remove the rear floor console. (Refer to GROUP 52A.)
   (2) Move the selector lever to P position.
   (3) Turn the ignition key to LOCK (OFF) position.
   (4) Loosen the key interlock cable fixing nut.
   (5) Tighten the key interlock cable fixing nut to the specified torque with the lock cam pushed in the direction A (shown in the illustration).

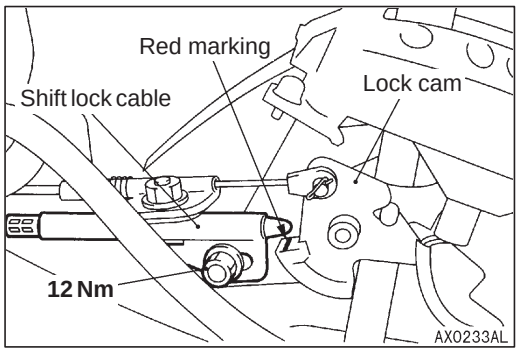
   Tightening torque: 12 Nm

   (6) Install the rear floor console. (Refer to GROUP 52A.)

SHIFT LOCK MECHANISM CHECK

1. Carry out the following inspection:

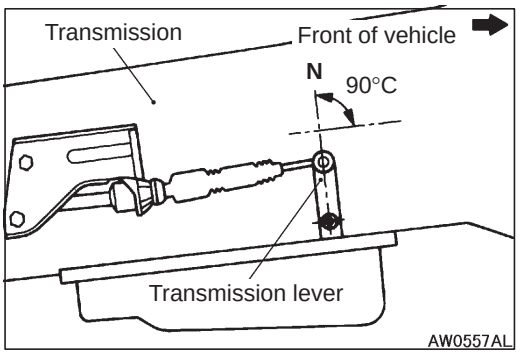
Inspection procedure	Requirements		Normal condition
1	Brake pedal: Depressed	Ignition key: ACC	If the selector lever push button is not pushed, the selector lever can not be moved from P position.
2			If the selector lever push button is pushed, the selector lever can be moved from P position.
3	Brake pedal: Not depressed		If the selector lever push button is pushed, the selector lever can be moved from R position to P position.



2. If there is a problem on the inspection above, adjust the shift lock cable as follows:
   (1) Remove the rear floor console. (Refer to GROUP 52A.)
   (2) Move the selector lever to P position.
   (3) Loosen the shift lock cable fixing nut.
   (4) Move the shift lock cable to position the shift lock cable end above the red marking painted on the lock cam, and then tighten the shift lock cable fixing nut to the specified torque.

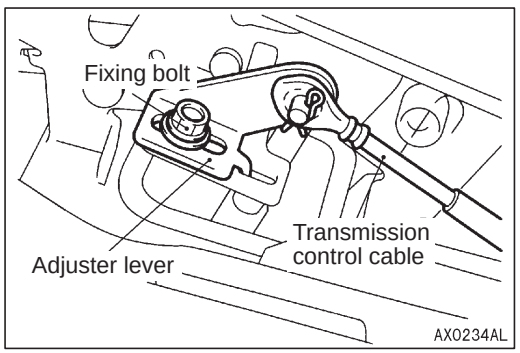
       Tightening torque: 12 Nm

   (5) Install the rear floor console. (Refer to GROUP 52A.)



TRANSMISSION CONTROL CABLE ADJUSTMENT

1. Move the selector lever to N position, and set the transmission lever to N position.

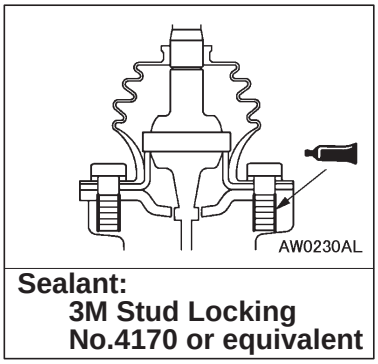


2. Loosen the fixing bolt. Adjust the adjuster lever position so that the transmission control cable will be tight, and then tighten the fixing bolt.

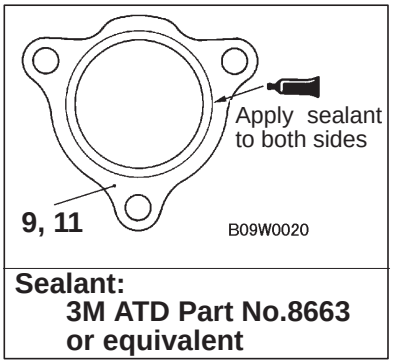
TRANSMISSION CONTROL

REMOVAL AND INSTALLATION

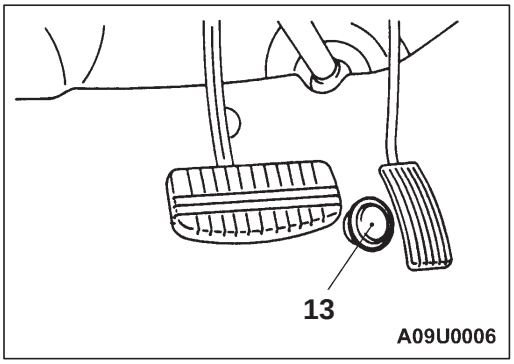
Caution
Do not strike the SRS-ECU when removing and installing the transmission control cable, key interlock cable, shift lever assembly and the A/T-ECU.

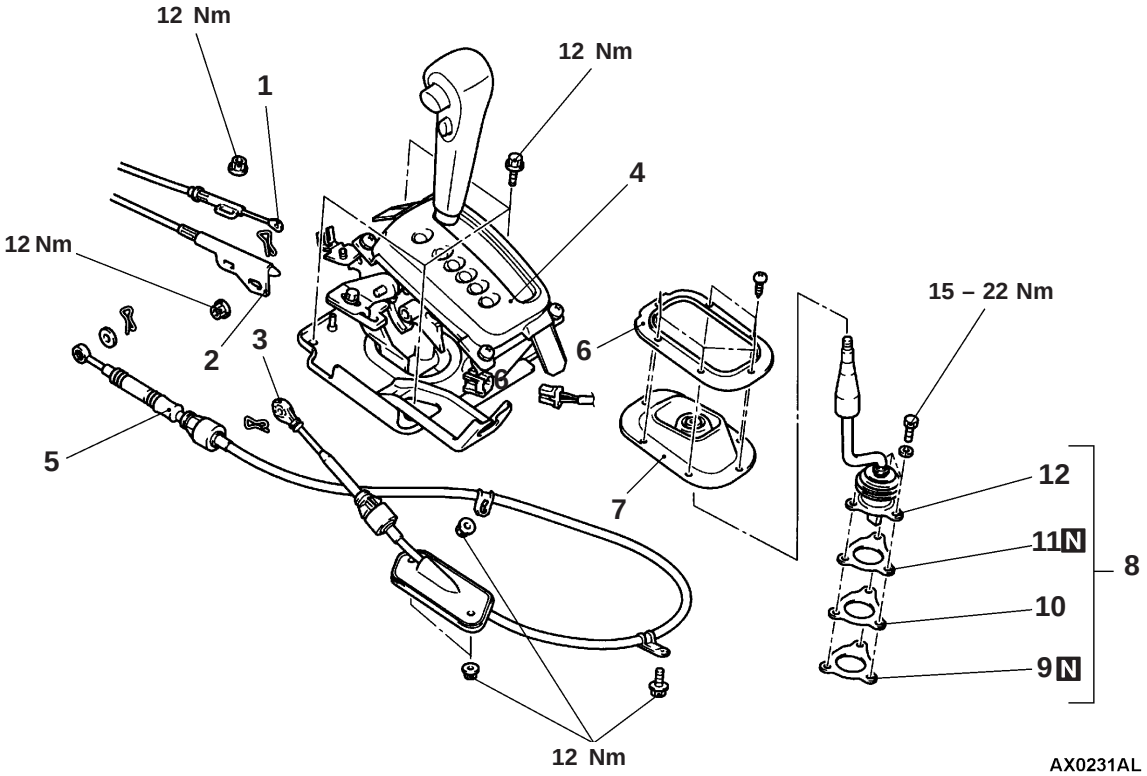


Sealant:
3M Stud Locking No.4170 or equivalent



Sealant:
3M ATD Part No.8663 or equivalent





Selector lever assembly and transmission control cable assembly removal steps

- Rear floor console assembly (Refer to GROUP 52A.)

1. Key interlock cable connection
2. Shift lock cable connection
3. Transmission control cable connection (selector lever side)
4. Selector lever assembly
5. Transmission control cable connection (transmission side)

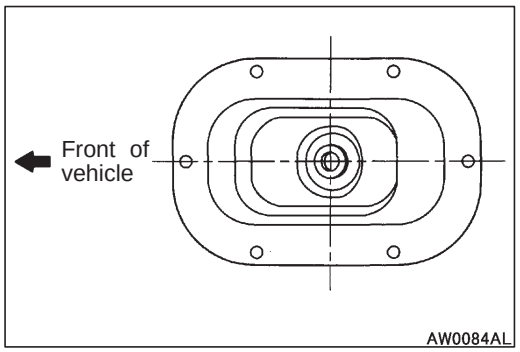
Transfer control lever assembly removal steps

- Front floor console assembly (Refer to GROUP 52A.)

6. Retainer plate
▶A◀ 7. Transfer lever inner boot
8. Transfer control lever assembly
9. Gasket
10. Stopper plate
11. Gasket
12. Transfer control lever

Wide open throttle switch removal

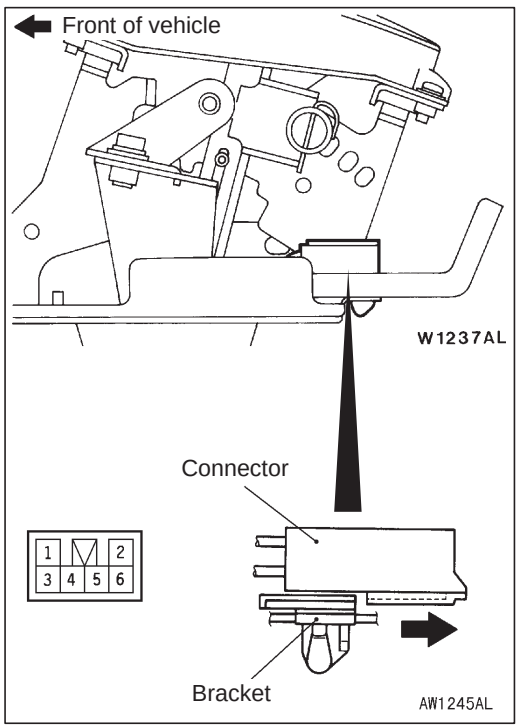
13. Wide open throttle switch



INSTALLATION SERVICE POINT

▶A◀ TRANSFER LEVER INNER BOOT INSTALLATION

Install the transfer lever inner boot as shown in the illustration.



INSPECTION

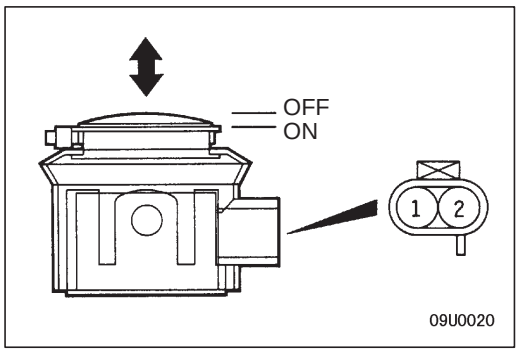
Slide the connector in the direction of arrow shown in the illustration to remove it from the bracket.

POSITION INDICATOR LAMP CHECK

Check requirement	Terminal No.	
	1	2
Always	○	○

OVERDRIVE SWITCH CHECK

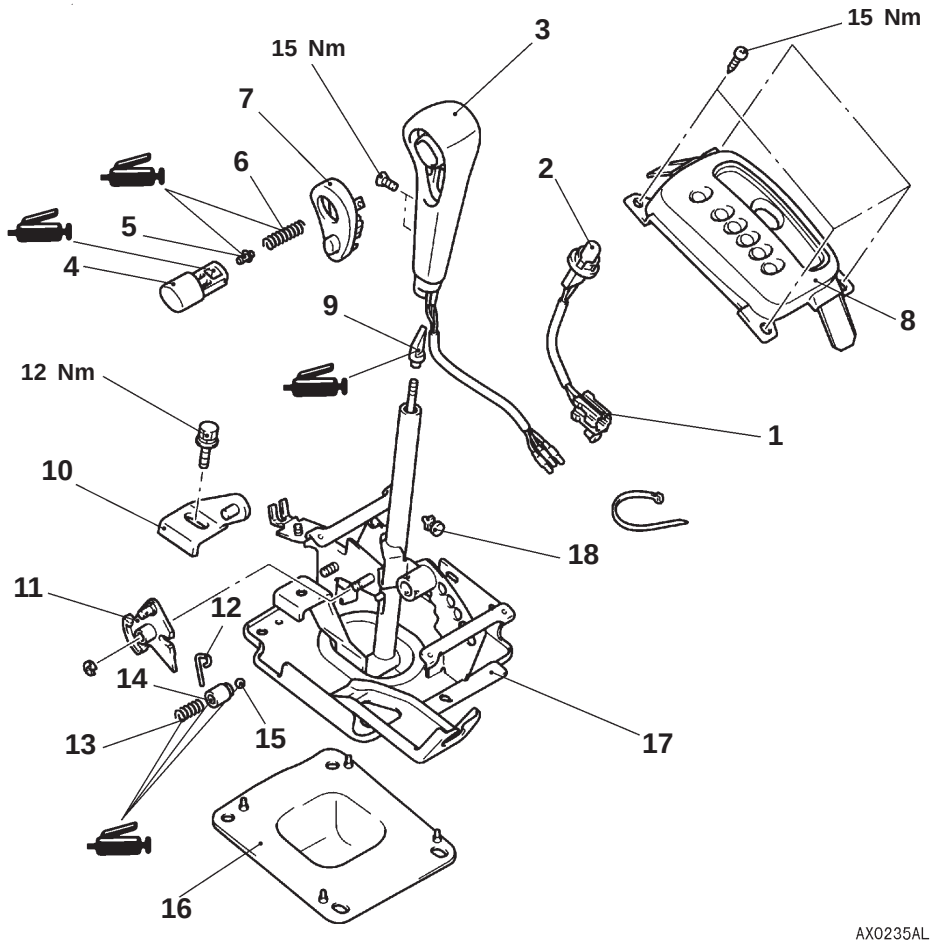
Switch position	Terminal No.		
	3	4	5
ON	○	○	
OFF	○		○



WIDE OPEN THROTTLE SWITCH CHECK

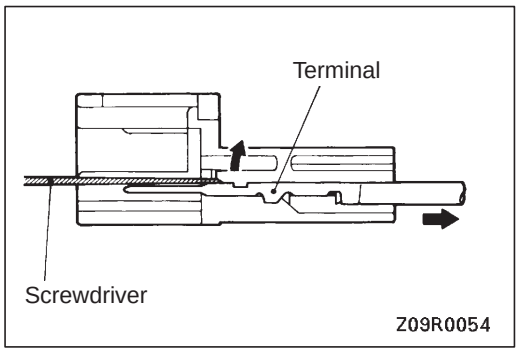
Switch position	Terminal No.	
	1	2
OFF		
ON	○	○

SELECTOR LEVER ASSEMBLY
DISASSEMBLY AND REASSEMBLY



Disassembly steps

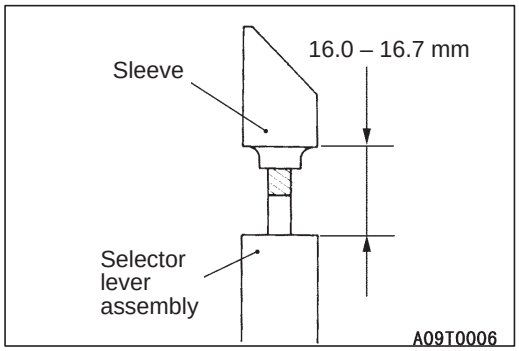
◀A▶ 1. Position indicator socket assembly
2. Bulb
3. Shift knob
4. Push button
5. Stopper
6. Spring
7. Overdrive switch
8. Indicator panel assembly
▶A◀ 9. Sleeve
10. Adjuster lever
11. Lock cam
12. Pin
13. Ball spring
14. Ball support
15. Ball
16. Packing
17. Selector lever assembly
18. Stopper



DISASSEMBLY SERVICE POINT

◀A▶ POSITION INDICATOR SOCKET ASSEMBLY REMOVAL

Use a flat-tipped screwdriver, etc. to remove the terminal of shift knob side from the position indicator socket assembly connector.



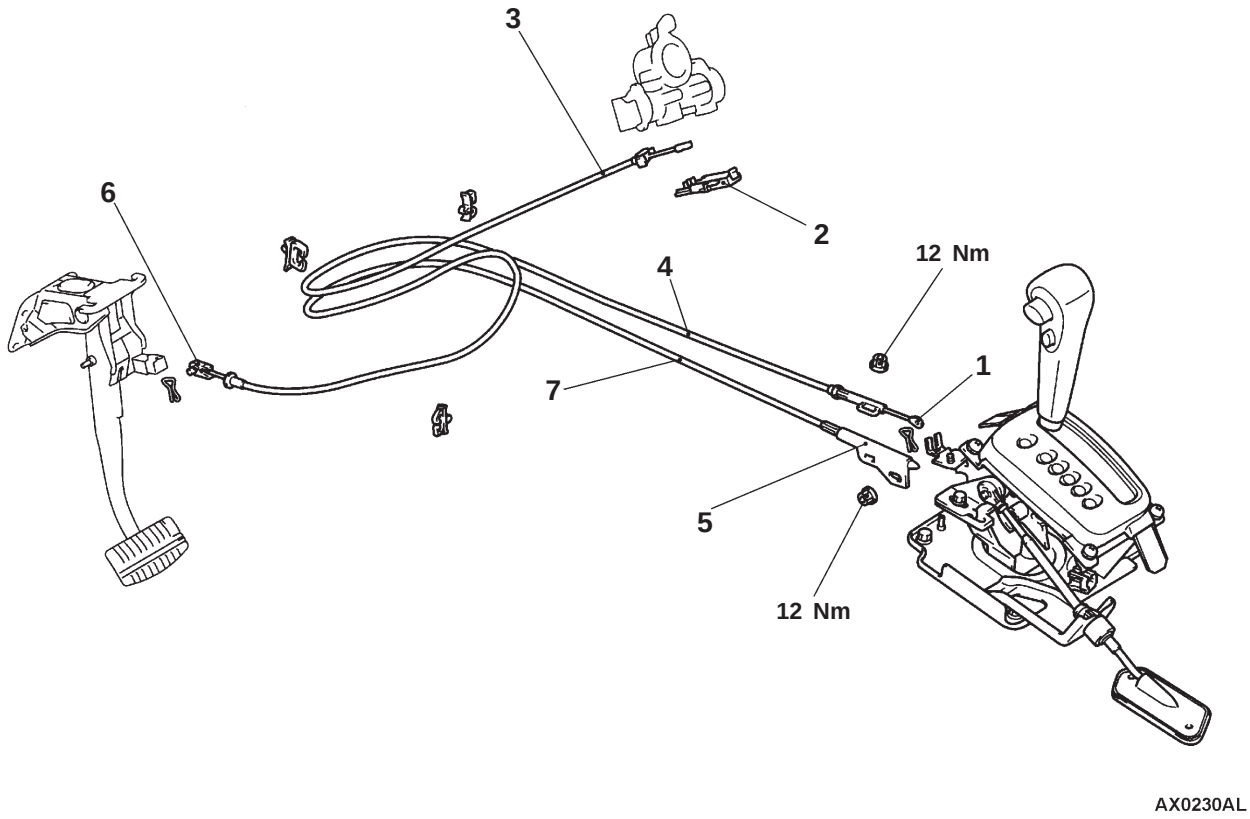
REASSEMBLY SERVICE POINT

▶A◀ SLEEVE INSTALLATION

Shift the selector lever to the N position, and then turn the sleeve so that the clearance between the sleeve and lever assembly end is within the dimension shown in the illustration.

A/T KEY INTERLOCK AND SHIFT LOCK MECHANISMS

REMOVAL AND INSTALLATION



Key interlock cable removal steps

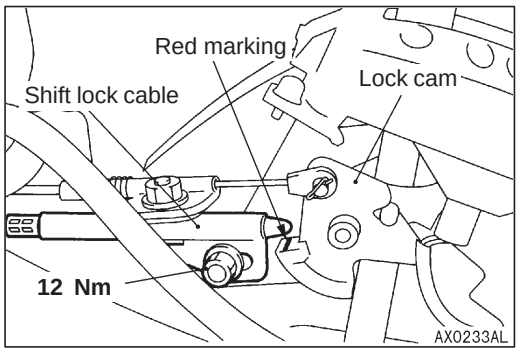
- Front floor console (Refer to GROUP 52A.)
- Instrument under cover (Refer to GROUP 52A.)
- Lower column cover (Refer to GROUP 37A – Steering Wheel and Shaft.)

▶C◀ 1. Key interlock cable connection (selector lever side)
2. Cover
▶B◀ 3. Key interlock cable connection (steering lock cylinder side)
4. Key interlock cable

Shift lock cable removal steps

- Front floor console (Refer to GROUP 52A.)

▶A◀ 5. Shift lock cable connection (selector lever side)
6. Shift lock cable connection (brake pedal side)
7. Shift lock cable



INSTALLATION SERVICE POINTS

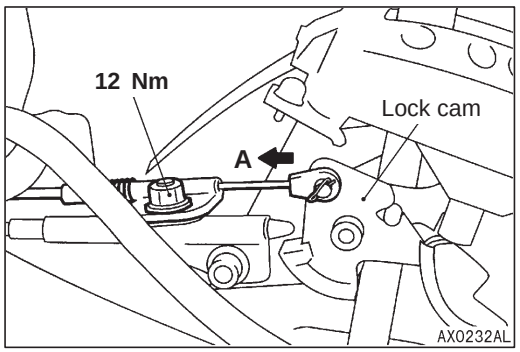
▶A◀ SHIFT LOCK CABLE (SELECTOR LEVER SIDE) INSTALLATION

1. Move the selector lever to P position.
2. Move the shift lock cable to position the shift lock cable end above the red marking painted on the lock cam, and then tighten the shift lock cable fixing nut to the specified torque.

   Tightening torque: 12 Nm
3. Check that the shift lock mechanism operates normally. (Refer to P. 23-49.)

▶B◀ KEY INTERLOCK CABLE (STEERING LOCK CYLINDER SIDE) INSTALLATION

Turn the ignition key to LOCK (OFF) position, and then install the key interlock cable.



▶C◀ KEY INTERLOCK CABLE (SELECTOR LEVER SIDE) INSTALLATION

1. Move the selector lever to P position.
2. Turn the ignition key to LOCK (OFF) position.
3. Connect the key interlock cable end to the lock cam.
4. Install the key interlock cable temporarily.
5. Tighten the key interlock cable fixing nut to the specified torque with the lock cam pushed in the direction A (shown in the illustration).

   Tightening torque: 12 Nm
6. Check that the key interlock mechanism operates normally. (Refer to P. 23-48.)

TRANSMISSION ASSEMBLY

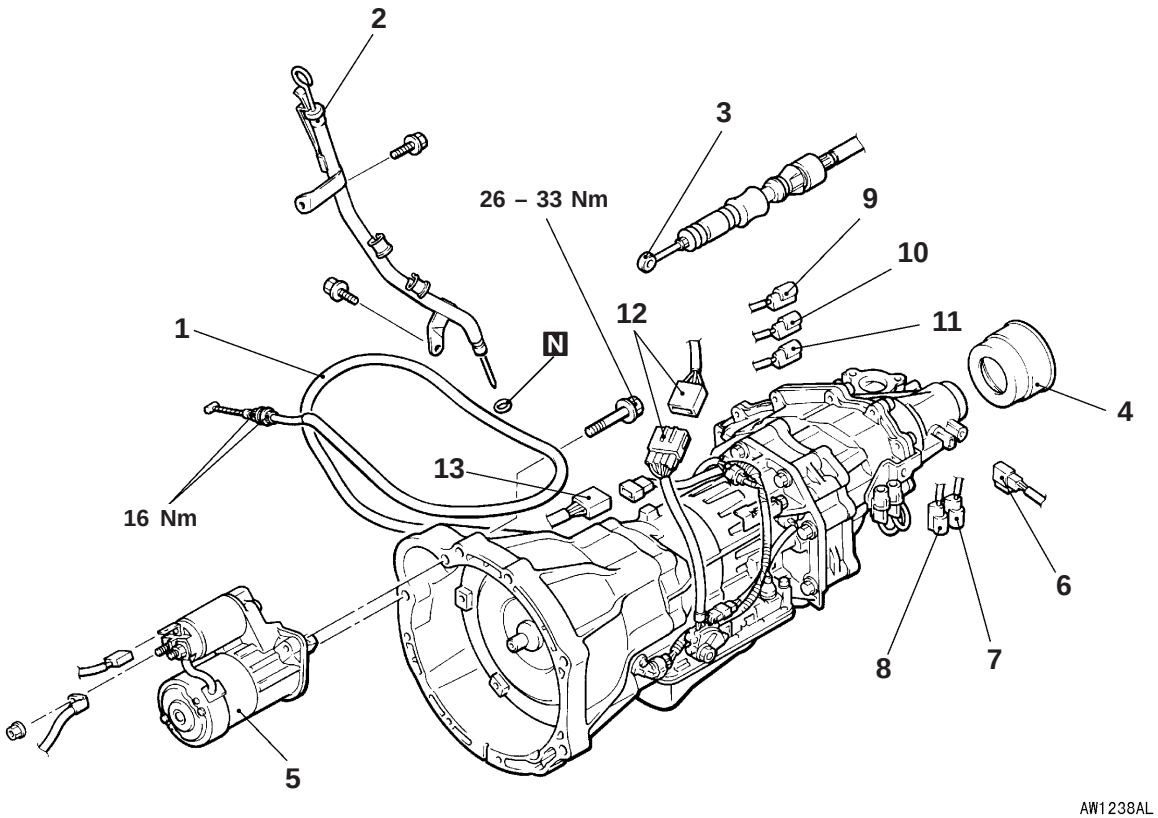
REMOVAL AND INSTALLATION

Caution

Mounting locations marked by * should be provisionally tightened, and then fully tightened after placing the vehicle horizontally and loading the full weight of the transmission on the vehicle body.

Pre-removal and Post-installation Operation

- Transfer Control Lever Assembly Removal and Installation (Refer to P.23-50.)
- Under Cover Removal and Installation
- Transmission Fluid and Transfer Oil Draining and Filling (Refer to P.23-35, 39.)
- Front and Rear Propeller Shaft Removal and Installation (Refer to GROUP 25.)
- Air Cleaner Removal and Installation (Refer to GROUP 15 – Air Cleaner and Resonance Tank.)
- Front Exhaust Pipe and Catalytic Converter Removal and Installation (Refer to GROUP 15.)
- Vacuum Actuator Assembly Removal and Installation (Refer to GROUP 26 – Main Shaft.)
- Kick-down Cable Adjustment <Only after installation> (Refer to P.23-37.)
- Accelerator Cable Assembly Check and Adjustment <Only after installation> (Refer to GROUP 17 – On-vehicle Service.)

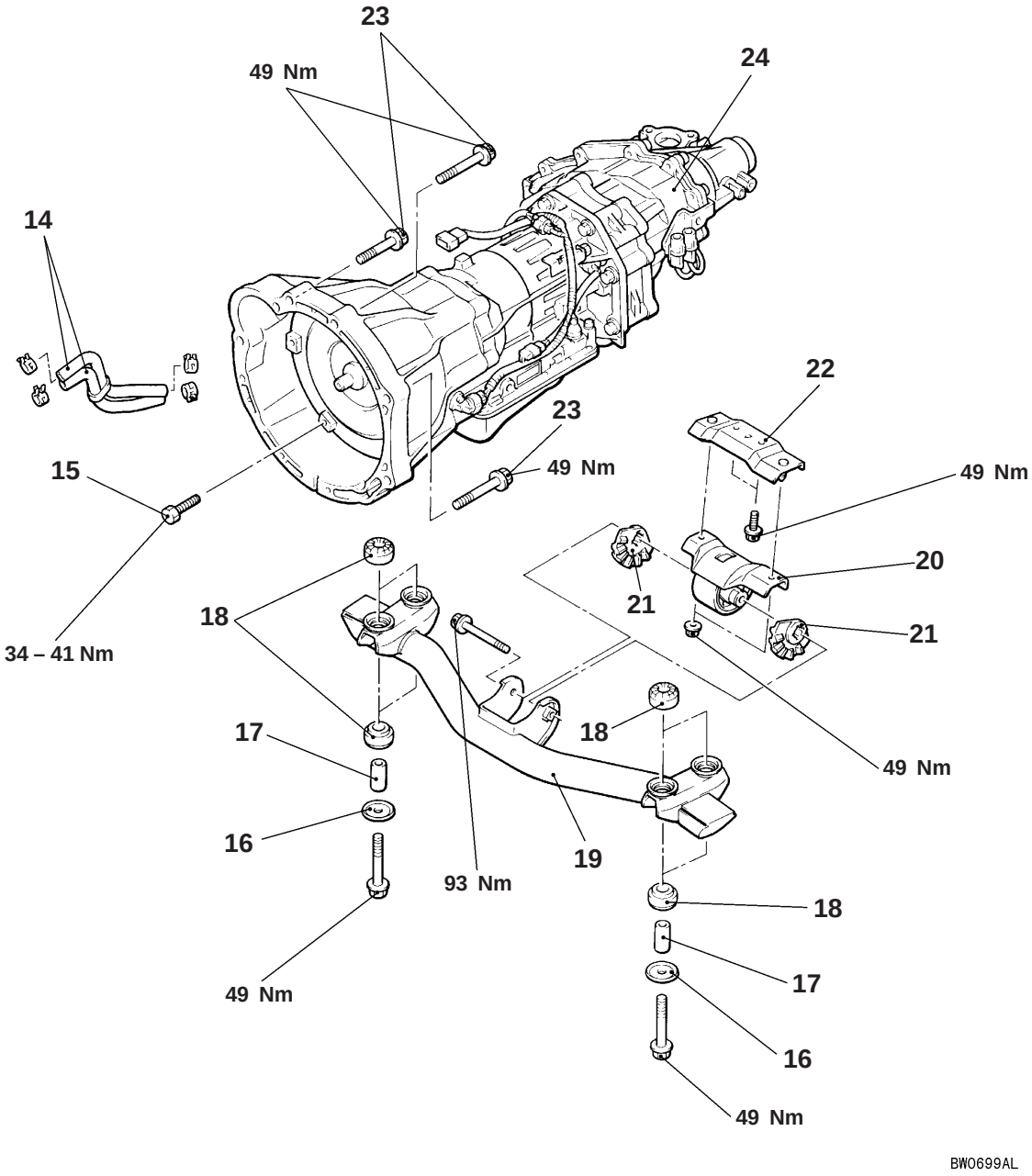


Removal steps

1. Kick-down cable connection
2. Oil level gauge assembly
3. Transmission control cable connection
4. Dust shield guard

◀A▶ 5. Starter motor

6. Vehicle speed sensor connector
7. VCU lock detection switch connector
8. 2WD/4WD detection switch connector
9. VCU lock operation detection switch connector
10. High/Low detection switch connector
11. 4WD operation detection switch connector
12. Harness connector
13. Inhibitor switch connector



14. Oil cooler hose
    - Oil pan removal (Refer to GROUP 11A.)

◀B▶ 15. Drive plate connection bolt
    - Support the transmission with a transmission jack
16. Washer
17. Spacer
18. Transmission mount bushing
19. Transmission mount crossmember
20. Transmission mount insulator assembly

▶B◀ 21. Transmission mount stopper

22. Adapter
23. Transmission upper part coupling bolts

▶A◀ 24. Transmission assembly

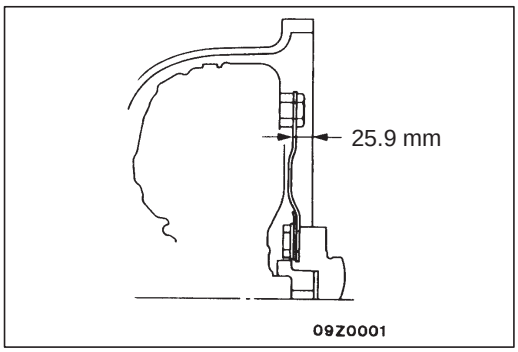
REMOVAL SERVICE POINTS

◀A▶ STARTER MOTOR REMOVAL

Remove the starter motor with the starter motor harnesses still connected, and secure it inside the engine compartment.

◀B▶ DRIVE PLATE CONNECTION BOLTS REMOVAL

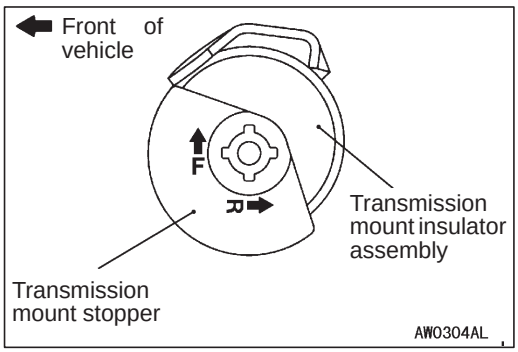
1. Remove the connection bolts (6 places) while turning the crankshaft.
2. Press in the torque converter to the transmission side so the torque converter does not remain on the engine side.



INSTALLATION SERVICE POINTS

▶A◀ TRANSMISSION ASSEMBLY INSTALLATION

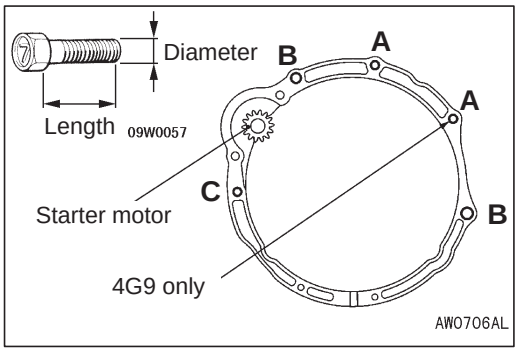
Press in the torque converter to the transmission side completely, and then install the transmission assembly to the engine.



▶B◀ TRANSMISSION MOUNT STOPPER INSTALLATION

1. Install the transmission mount stopper so that the arrow faces the direction shown.

   NOTE
   Disregard F and R stamped as a shared part.



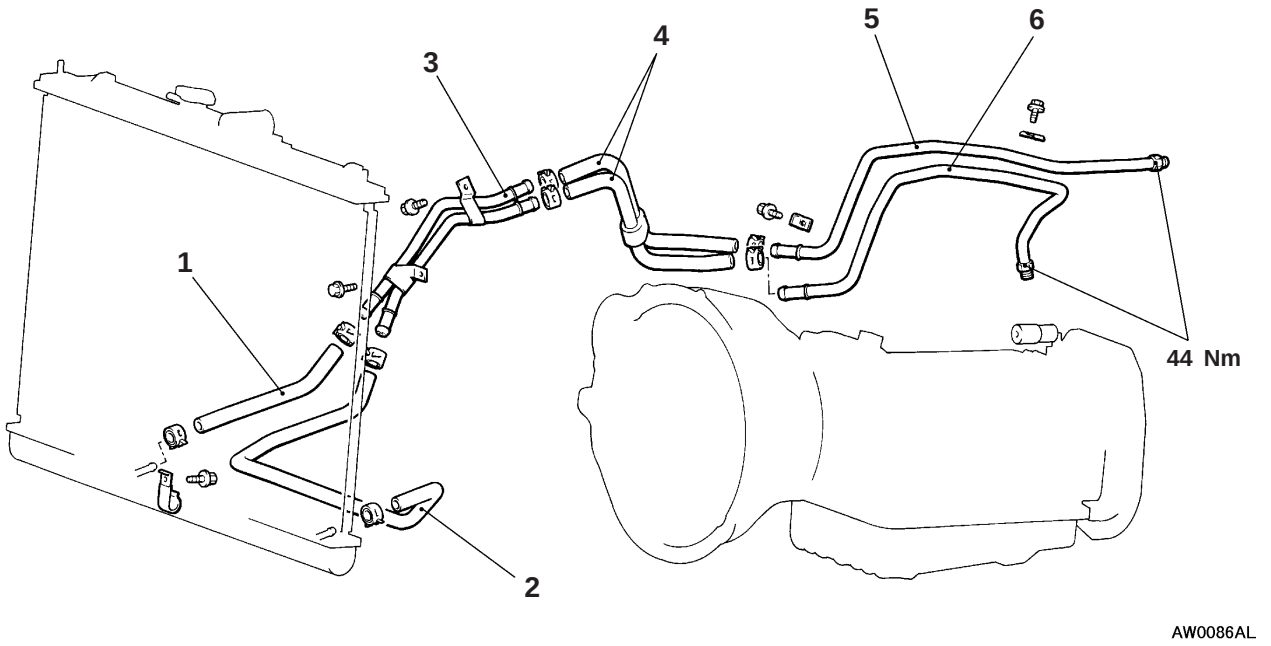
2. The sizes of the mounting bolts are different. So be sure not to confuse them.

Bolt	Diameter x Length mm
A	10 x 50
B	10 x 60
C	10 x 40

TRANSMISSION OIL COOLER

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Transmission Fluid Draining and Supplying (Refer to P.23-35.)
- Under Cover Removal and Installation



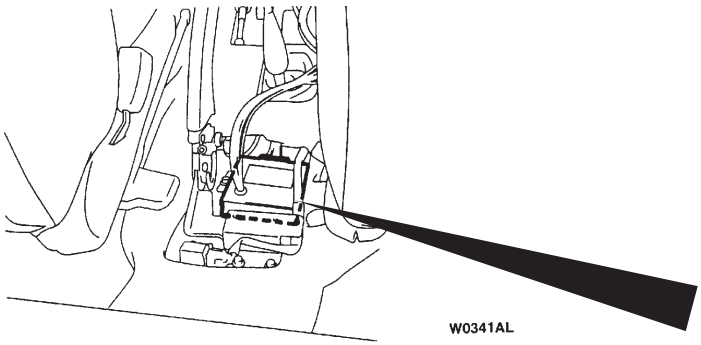
Removal steps
1. Return hose
2. Feed hose
3. Oil cooler pipe assembly
4. Hose assembly
- Transmission assembly (Refer to P.23-56.)
5. Oil return pipe
6. Oil feed pipe

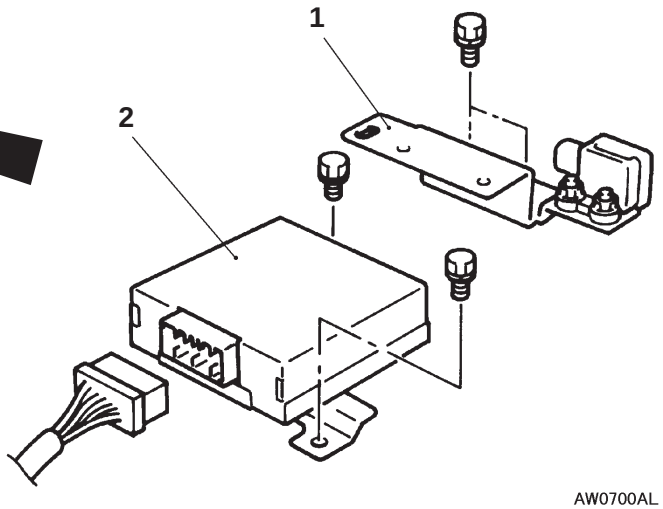
A/T-ECU

REMOVAL AND INSTALLATION

Caution
Do not strike the G sensor when removing and installing the A/T-ECU.

Pre-removal and Post-installation Operation
Rear Floor Console Removal and Installation





Removal steps
1. Floor console bracket
2. A/T-ECU

4WD INDICATOR CONTROL UNIT

REMOVAL AND INSTALLATION

Refer to GROUP 22.

AUTOMATIC TRANSMISSION

CONTENTS

GENERAL **2**
Outline of Changes 2
TROUBLESHOOTING <A/T> **2**

GENERAL

OUTLINE OF CHANGES

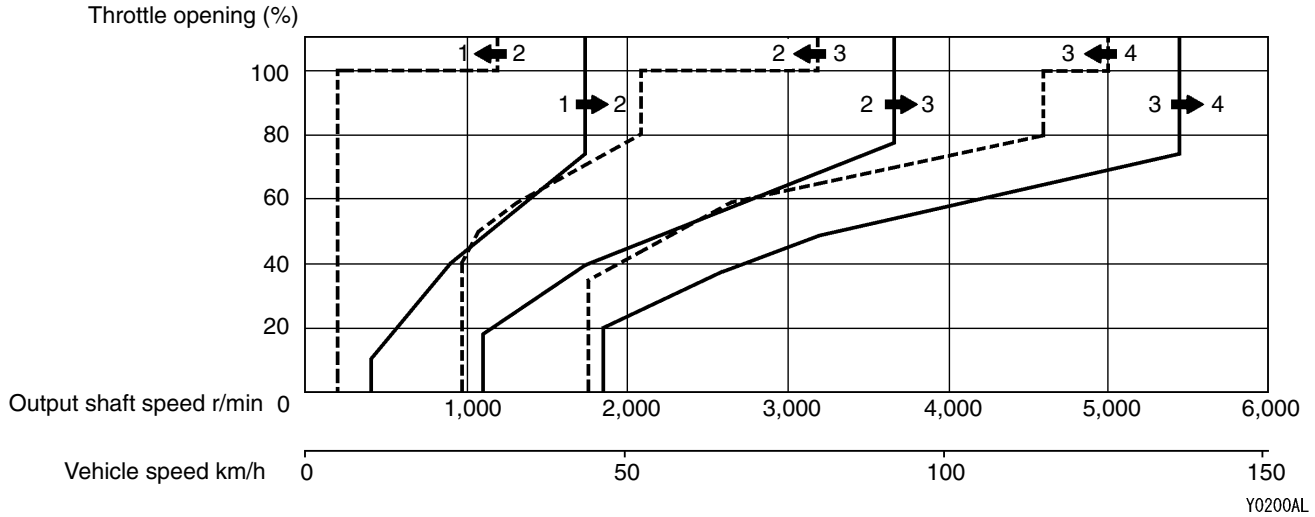
The following service procedures for items which are different from before have been established to correspond to the following changes:

- The A/T-ECU has been changed.
- The shift pattern has been changed.

TROUBLESHOOTING <A/T>

SHIFT PATTERN

D range (Overdrive switch: ON)



INSPECTION CHART FOR DIAGNOSIS CODE

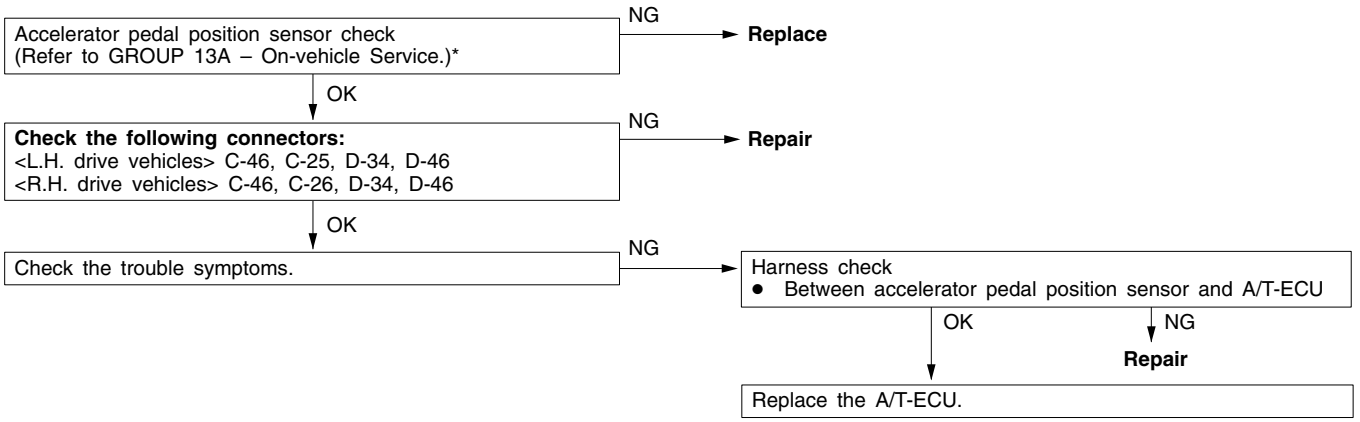
Code	Diagnosis item		Reference page
13	Accelerator pedal position sensor system (Throttle opening voltage)	Sensor malfunction/ open circuit/short circuit	23-3
14	Accelerator pedal position sensor system (Throttle power supply voltage)	Open circuit/short circuit	23-3
15	A/T fluid temperature sensor system	Open circuit	23-4
16	A/T fluid temperature sensor system	Short circuit	23-4
22	Wide open throttle system	Open circuit/short circuit	23-4
29	Inhibitor switch system	Open circuit	23-5
30	Inhibitor switch system	Short circuit	23-5
31	Input shaft speed sensor system	Open circuit	23-6
32	Output shaft speed sensor system	Open circuit	23-6
38	Vehicle speed sensor system	Open circuit	23-7
41	Solenoid valve No. 1 system	Open circuit	23-8
42	Solenoid valve No. 1 system	Short circuit	23-8

Code	Diagnosis item		Reference page
43	Solenoid valve No. 2 system	Open circuit	23-8
44	Solenoid valve No. 2 system	Short circuit	23-8
47	Solenoid valve No. 3 system	Open circuit	23-8
48	Solenoid valve No. 3 system	Short circuit	23-8
55	Abnormal communication with engine-ECU	Open circuit	23-9

INSPECTION PROCEDURES FOR DIAGNOSIS CODES

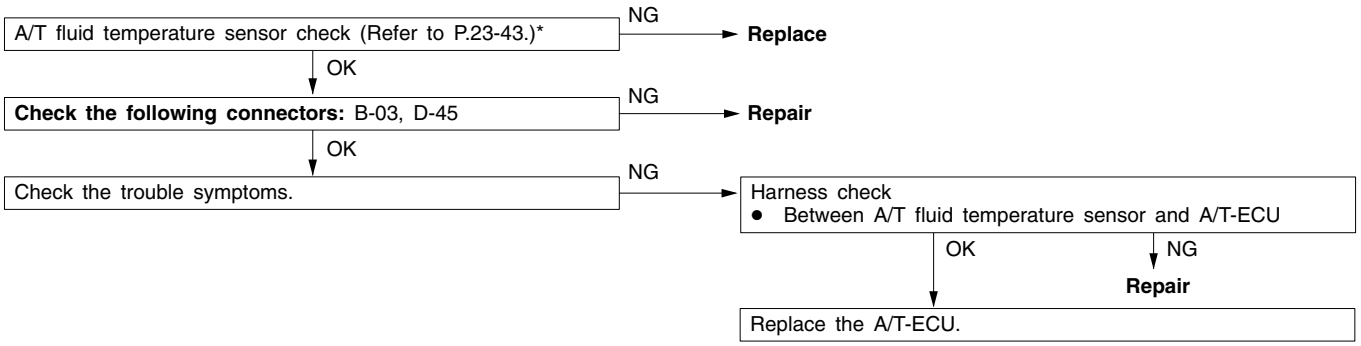
Code No. 13, 14 Accelerator pedal position sensor (APS)	Probable cause
If the APS output voltage (APS opening voltage) is 4.8 V or higher when the engine is idling, the output voltage is judged to be too high and diagnosis code No. 13 is output. If the APS output voltage (APS opening voltage) is 0.335 V or lower when the engine is idling, the output voltage is judged to be too low and diagnosis code No. 13 is output. If the APS output voltage (APS power supply voltage) is 3.0 V or lower or if it is 5.7 V or higher when the engine is idling, the APS is judged to be faulty and diagnosis code No. 14 is output.	• Malfunction of the accelerator pedal position sensor • Malfunction of harness or connector • Malfunction of the A/T-ECU

*: Refer to '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1).



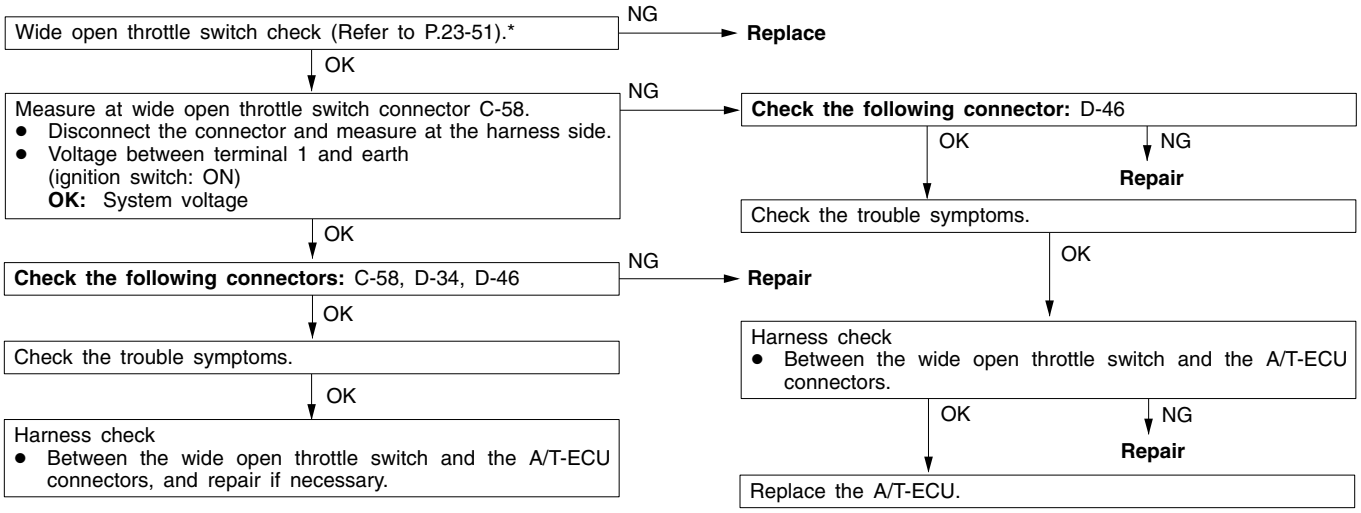
Code No. 15, 16 A/T fluid temperature sensor system	Probable cause
If the A/T fluid temperature sensor output is 10°C or less (5.6 kΩ or more) even after running the engine for 15 minutes or more, it is judged that there is an open circuit in the A/T fluid temperature sensor and diagnosis code No. 15 is output. If the A/T fluid temperature sensor output is 240°C or more (10 kΩ or less), it is judged that there is a short circuit in the A/T fluid temperature sensor and diagnosis code No. 16 is output.	• Malfunction of the A/T fluid temperature sensor • Malfunction of harness or connector • Malfunction of the A/T-ECU

*: Refer to '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1).



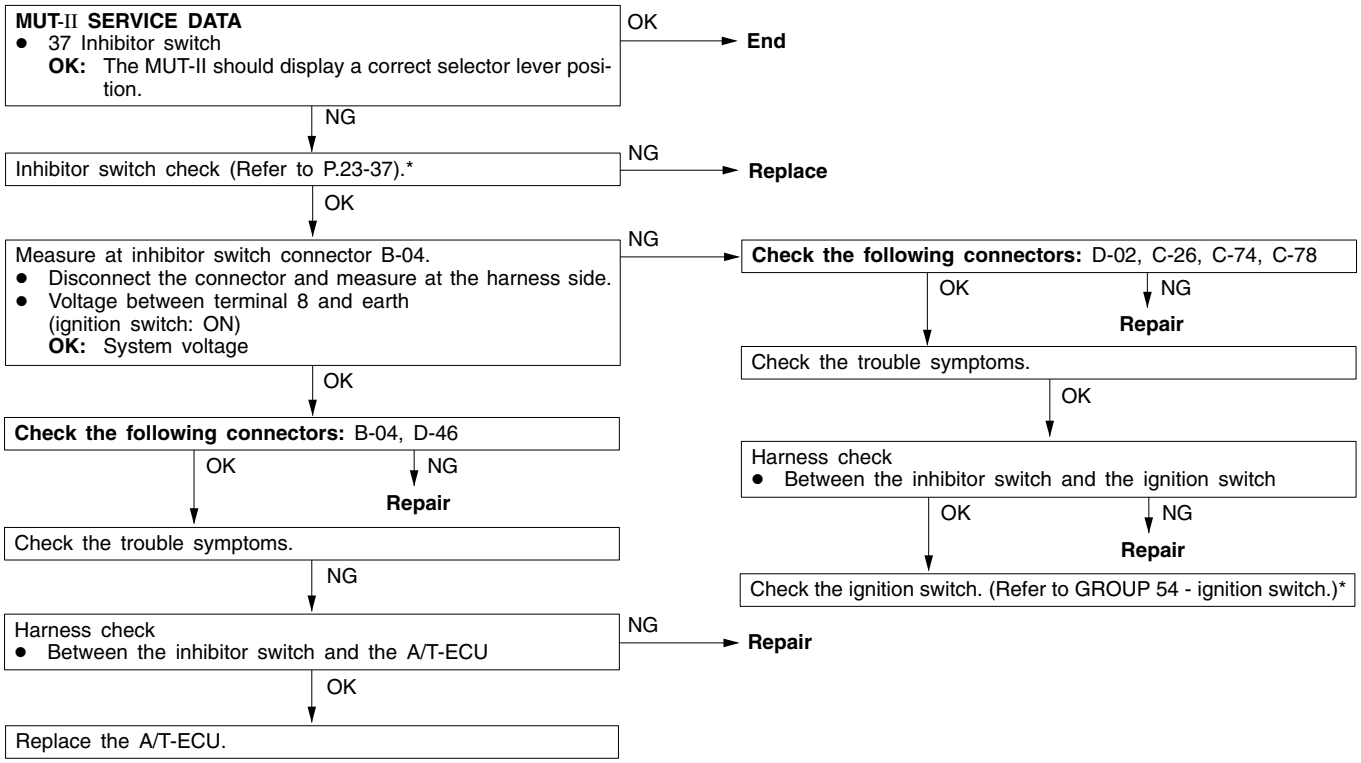
Code No. 22 Wide open throttle switch system	Probable cause
If the wide open throttle switch dose not turn OFF with the accelerator pedal is not depressed, there is a short circuit in the wide open throttle switch and diagnosis code No. 22 is output.	• Malfunction of the wide open throttle switch • Malfunction of harness or connector • Malfunction of the A/T-ECU

*: Refer to '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1).



Code No. 29, 30 Inhibitor switch system	Probable cause
If the inhibitor switch has not sent any signal for 2 seconds while the ignition switch is on, it is judged that there is an open circuit in the inhibitor switch and diagnosis code No.29 is set. If the inhibitor switch has sent at least two signals simultaneously for 2 seconds while the ignition switch is on, it is judged that there is an short circuit in the inhibitor switch and diagnosis code No.30 is set.	• Malfunction of the inhibitor switch • Malfunction of harness or • Malfunction of the A/T-ECU

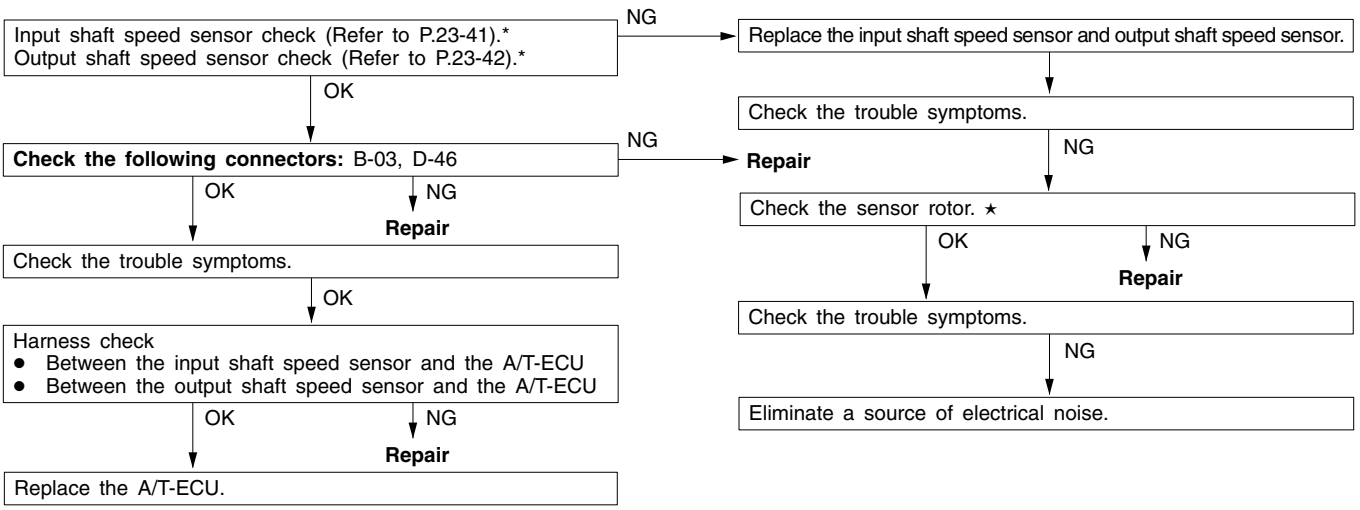
*: Refer to '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1).



Code No. 31, 32 Input shaft speed sensor system, output shaft speed sensor system	Probable cause
If no output pulse is detected from the input shaft speed sensor for 120 seconds or more while driving in 3rd gear at a speed of 60 km/h or more, there is judged to be an open circuit in the input shaft speed sensor and diagnosis code No. 31 is output. If not output pulse is detected from the output shaft speed sensor for 120 seconds or more while driving in 3rd gear at a speed of 60 km/h or more, there is judged to be an open circuit in the output shaft speed sensor and diagnosis code No. 32 is output.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of harness or connector • Malfunction of the sensor rotor • Malfunction of A/T-ECU • Electrical noise

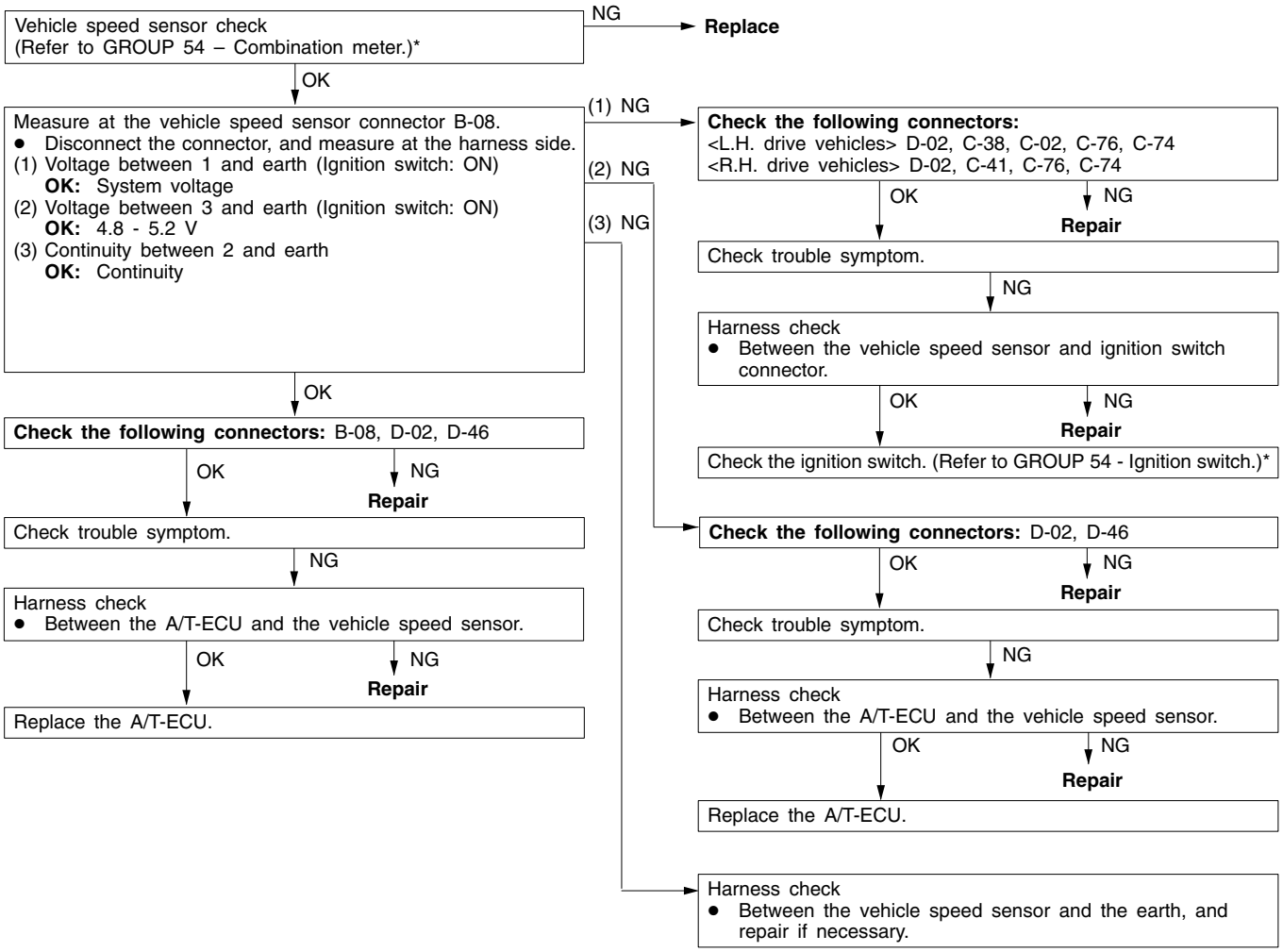
*: Refer to '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1).

★: Refer to the Transmission Workshop Manual



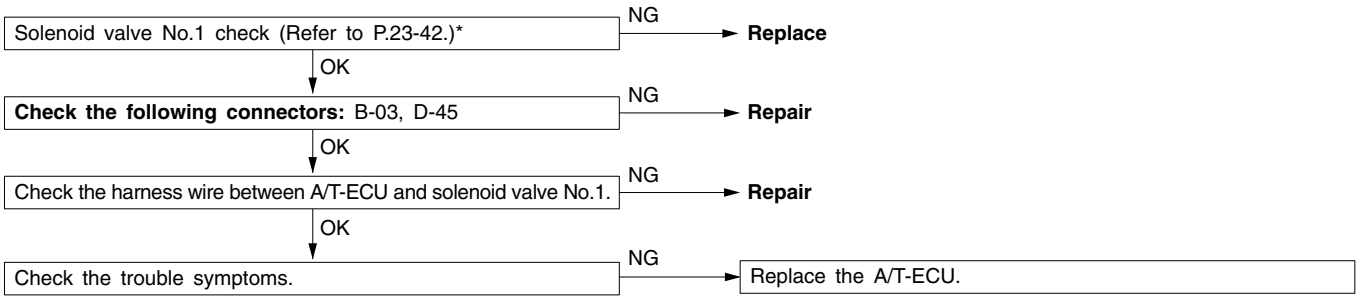
Code No. 38 Vehicle speed sensor system	Probable cause
If no output pulse is detected from the vehicle speed sensor for 120 seconds or more continuously while driving at a speed of 60 km/h or more, there is judged to be an open circuit in the vehicle speed sensor and diagnosis code No. 38 is output.	• Malfunction of the vehicle speed sensor • Malfunction of harness or connector • Malfunction of the A/T-ECU • Malfunction of the ignition switch

*: Refer to '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1).



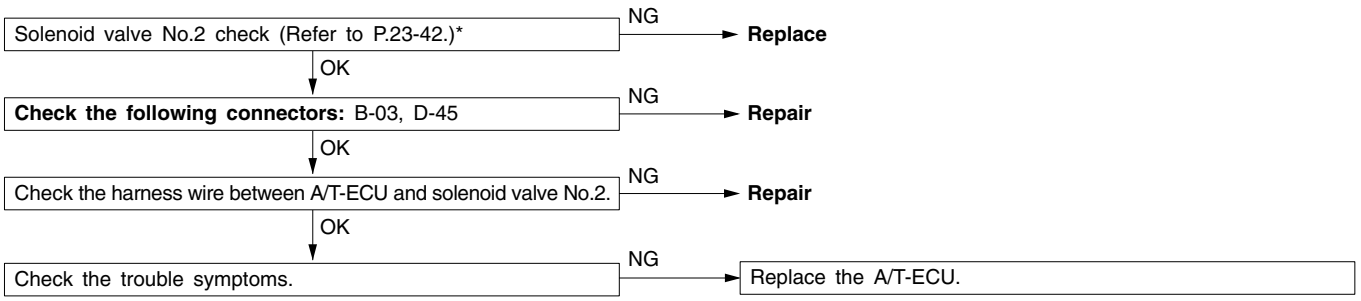
Code No. 41, 42 Solenoid valve No.1 system	Probable cause
If the resistance value for a solenoid valve No.1 is too large, it is judged that there is an open circuit in the solenoid valve No.1 and the diagnosis code No.41 is output. If the resistance value for a solenoid valve No.1 is too small, it is judged that there is a short-circuit in the solenoid valve No.1 and the diagnosis code No.42 is output.	• Malfunction of solenoid valve No.1 • Malfunction of harness or connector • Malfunction of the A/T-ECU

*: Refer to '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1).



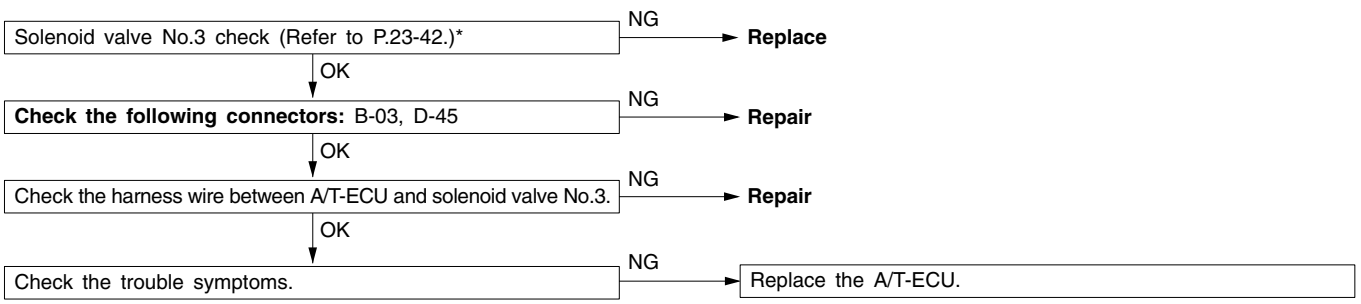
Code No. 43, 44 Solenoid valve No.2 system	Probable cause
If the resistance value for a solenoid valve No.2 is too large, it is judged that there is an open circuit in the solenoid valve No.2 and the diagnosis code No.43 is output. If the resistance value for a solenoid valve No.2 is too small, it is judged that there is a short-circuit in the solenoid valve No.2 and the diagnosis code No.44 is output.	• Malfunction of solenoid valve No.2 • Malfunction of harness or connector • Malfunction of the A/T-ECU

*: Refer to '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1).

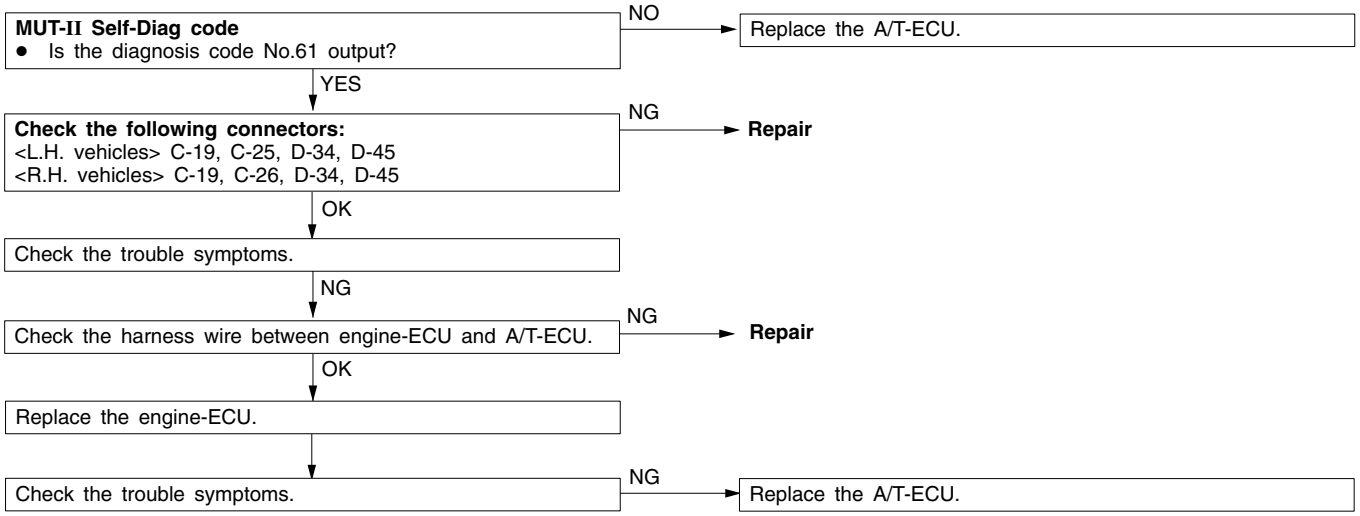


Code No. 47, 48 Solenoid valve No.3 system	Probable cause
If the resistance value for a solenoid valve No.3 is too large, it is judged that there is an open circuit in the solenoid valve No.3 and the diagnosis code No.47 is output. If the resistance value for a solenoid valve No.3 is too small, it is judged that there is a short-circuit in the solenoid valve No.3 and the diagnosis code No.48 is output.	• Malfunction of solenoid valve No.3 • Malfunction of harness or connector • Malfunction of the A/T-ECU

*: Refer to '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1).



Code No. 55 Abnormal communication with engine-ECU	Probable cause
If normal communication is not possible for a continuous period of 1 second or more when the ignition switch is at the ON position and the battery voltage is 10 V or more, diagnosis code No. 55 is output. Diagnosis code No. 55 is also output if the data being received is abnormal for a continuous period of 1 second under the same conditions.	• Malfunction of harness or connector • Malfunction of the engine-ECU • Malfunction of the A/T-ECU



INSPECTION CHART FOR TROUBLE SYMPTOMS

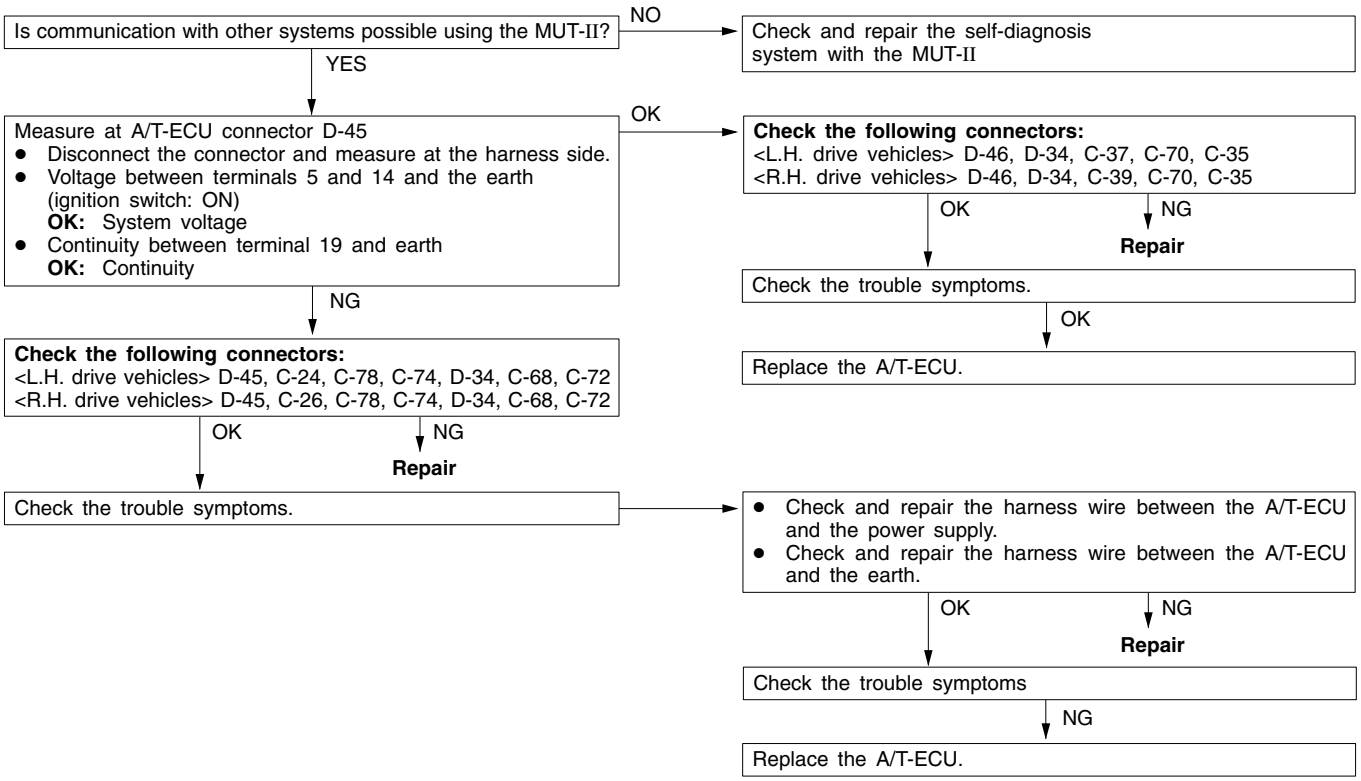
*: Refer to '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1).

Trouble symptom		Inspection procedure No.	Reference page
Communication with the MUT-II is not possible		1	23-10
Does not move	Does not move forward and reverse	2	23-17*
	Does not move forward only	3	23-18*
	Does not reverse only	4	23-18*
Malfunction when shifting	Upshifting does not occur	5	23-19*
	Downshifting does not occur	6	23-20*
	Shifting point abnormality	7	23-20*
	Upshifting occurs spontaneously	8	23-21*
	Incorrect drive gear position	9	23-21*
Large shocks		10	23-22*
Slippage (vibration)		11	23-23*
Lockup malfunction		12	23-24*
Abnormal engine braking		13	23-24*
Electronic circuit systems	Overdrive switch system	14	23-11
	Stop lamp switch system	15	23-11

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURE 1

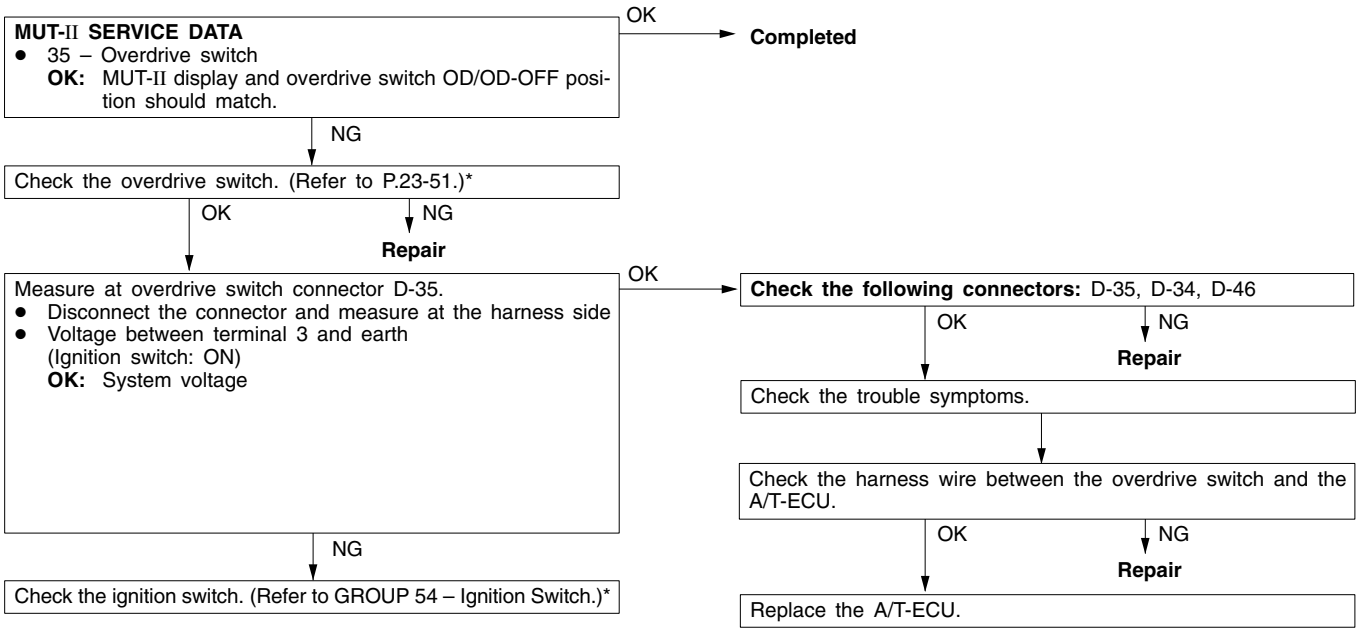
Communication with the MUT-II is not possible	Probable cause
If communication with the MUT-II is not possible, the cause is probably a malfunction in the self-diagnosis system or the A/T-ECU is not functioning.	• Malfunction of self-diagnosis system • Malfunction of A/T-ECU power circuit • Malfunction of A/T-ECU earth circuit • Malfunction of A/T-ECU • Malfunction of harness and connector



INSPECTION PROCEDURE 14

Overdrive switch system	Probable cause
If downshifting does not occur when overdrive switch is turned off while driving in 4th gear, or if shifting to 4th gear is not possible, the cause is probably a problem in the overdrive switch system.	• Malfunction of overdrive switch • Malfunction of harness or connector • Malfunction of A/T-ECU • Malfunction of ignition switch

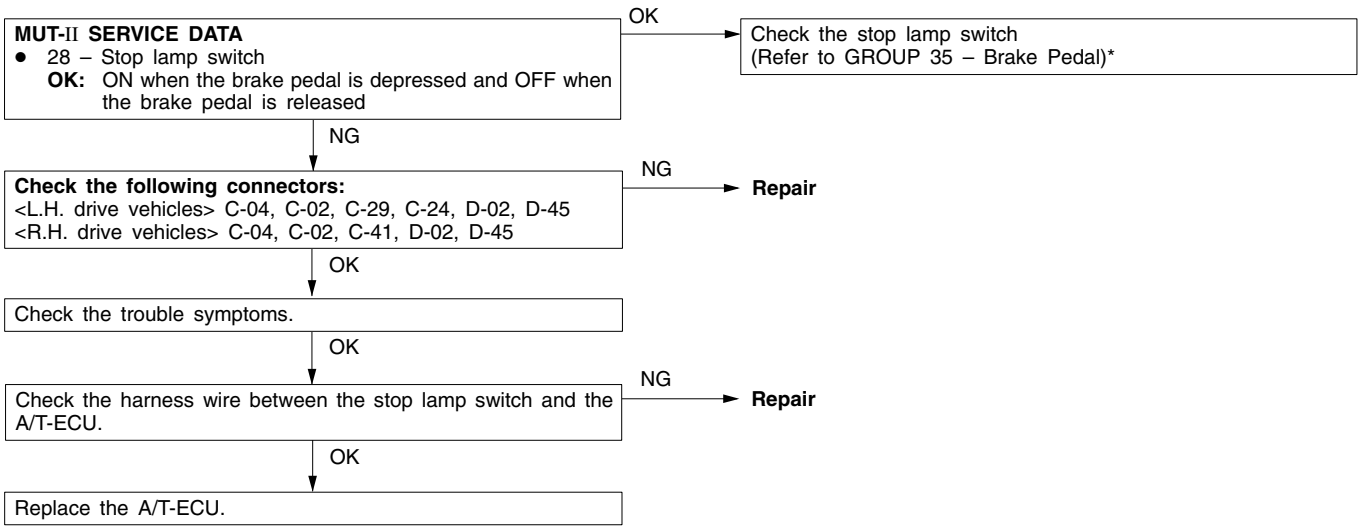
*: Refer to '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1).



INSPECTION PROCEDURE 15

Stop lamp switch system	Probable cause
If large shocks occur during squat control, the cause is probably a problem with the stop lamp switch.	• Malfunction of stop lamp switch • Malfunction of harness or connector • Malfunction of A/T-ECU

*: Refer to '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1).

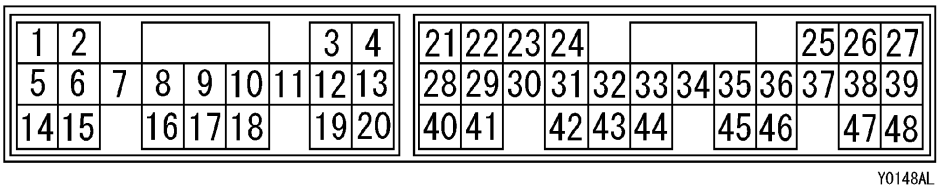


SERVICE DATA REFERENCE TABLE

Item No. 37 has been changed since the A/T-ECU has been changed. The other SERVICE DATA are the same as before.

Item No.	Inspection item	Inspection conditions		Normal value
37	Inhibitor switch	Ignition switch: ON Engine: Stopped	Selector lever position: P	P
			Selector lever position: R	R
			Selector lever position: N	N
			Selector lever position: D	D
			Selector lever position: 2	2
			Selector lever position: L	L

A/T-ECU TERMINAL VOLTAGE REFERENCE CHART



Y0148AL

Terminal No.	Inspection item	Inspection conditions	Standard value
1	Solenoid valve No. 1	When in 1st or 2nd gear	System voltage
		When in 3rd or 4th gear	0 V
2	Solenoid valve No. 2	When in 2nd or 3rd gear	System voltage
		When in 1st or 4th gear	0 V
3	Free-wheeling engage switch	Transfer lever position: Other than 4WD	System voltage
		Transfer lever position: 4WD	0 V
5	Back-up power supply	Ignition switch: OFF	System voltage
6	Solenoid valve No. 3	When lockup clutch is operating	System voltage
		When lockup clutch is not operating	0 V
11	Communication with input signals from engine-ECU	Engine: Idling Selector lever position: D	Other than 0 V
13	A/T fluid temperature sensor	ATF temperature: 120°C	Approx. 0.3 V
		ATF temperature: 150°C	Approx. 0.15 V
14	Power supply	Ignition switch: OFF	0 V
		Ignition switch: ON	System voltage
17	Communication with output signals to engine-ECU	Engine: Idling Selector lever position: D	Other than 0 V

Terminal No.	Inspection item	Inspection conditions	Standard value
18	Stop lamp switch	Brake pedal: Depressed	System voltage
		Brake pedal: Released	0 V
19	Earth	Engine: Idling	0 V
20	A/T fluid temperature sensor earth	–	–
21	Diagnostic output terminal	–	–
23	Input shaft speed sensor	Ignition switch: OFF	0 V
		Ignition switch: ON	2.5 V
24	Output shaft speed sensor	Vehicle: Stopped	Approx. 2.5 V
		Vehicle: Driving	Other than 2.5 V
25	Overdrive switch	Overdrive switch: ON	System voltage
		Overdrive switch: OFF	0 V
26	Inhibitor switch P	Selector lever position: P	System voltage
		Selector lever position: Other than P	0 V
27	Inhibitor switch R	Selector lever position: R	System voltage
		Selector lever position: Other than R	0 V
30	Input shaft speed sensor earth	–	–
31	Output shaft speed sensor earth	–	–
33	Wide open throttle switch	Accelerator pedal: Released	4.5 – 5.5 V
		Accelerator pedal: Depressed	Less than 0.4 V
34	Dual-pressure switch	A/C switch: OFF	0 V
		A/C switch: ON	System voltage
37	N range lamp	Ignition switch: ON	System voltage
		Ignition switch: OFF	0 V
38	Inhibitor switch N	Selector lever position: N	System voltage
		Selector lever position: Other than N	0 V
39	Inhibitor switch D	Selector lever position: D	System voltage
		Selector lever position: Other than D	0 V
41	Diagnosis control terminal	–	–
42	Accelerator pedal position sensor (power supply voltage)	Ignition switch: ON	Approx. 5 V
		Ignition switch: OFF	0 V

Terminal No.	Inspection item	Inspection conditions	Standard value
43	Accelerator pedal position sensor (throttle opening voltage)	Accelerator pedal: Released	Approx. 1 V
		Accelerator pedal: Fully depressed	Approx. 4 V
44	Vehicle speed sensor	Vehicle: Slowly moving forward	Alternates between 0↔Approx. 5 V
47	Inhibitor switch 2	Selector lever position: 2	System voltage
		Selector lever position: Other than 2	0 V
48	Inhibitor switch L	Selector lever position: L	System voltage
		Selector lever position: Other than L	0 V

AUTOMATIC TRANSMISSION

CONTENTS

GENERAL 2
Outline of Changes 2
TROUBLESHOOTING <A/T> 2
ON-VEHICLE SERVICE 4
Kickdown Cable Check and Adjustment 4

GENERAL

OUTLINE OF CHANGES

Since the vehicles with the 4G93-MPI engine have been added, the V4AW4 type transmission has been adopted. This transmission is basically the same as that of the vehicles with 4G94 engine.
Due to the changes shown below, some new service procedures have been added.

- On the vehicles with 4G93-MPI engine, the APS has been used for the transmission control (input signal of the throttle opening angle). Due to this, the road test, the inspection procedures for diagnosis codes, and the service data have been reviewed.
- On the vehicles with 4G93-MPI engine, the shift pattern has been established. On the vehicles with 4G94 engine, the shift pattern has been changed.
- On the vehicles with 4G93-MPI engine, the kick-down cable adjustment procedure has been established.
- A full-time 4WD model has been added to the vehicles with 4G93-MPI engine (Refer to GROUP 22 – Manual Transmission).
- Due to the addition of a full-time 4WD model, the transfer control lever and the 4WD indicator control unit on the vehicles with 4G93-MPI engine have been discontinued.
- On all models, the quantity of the transfer oil has been changed from 2.3 litre to 2.2 litre.
- On all models, the wide open throttle switch has been discontinued.

TROUBLESHOOTING <A/T>

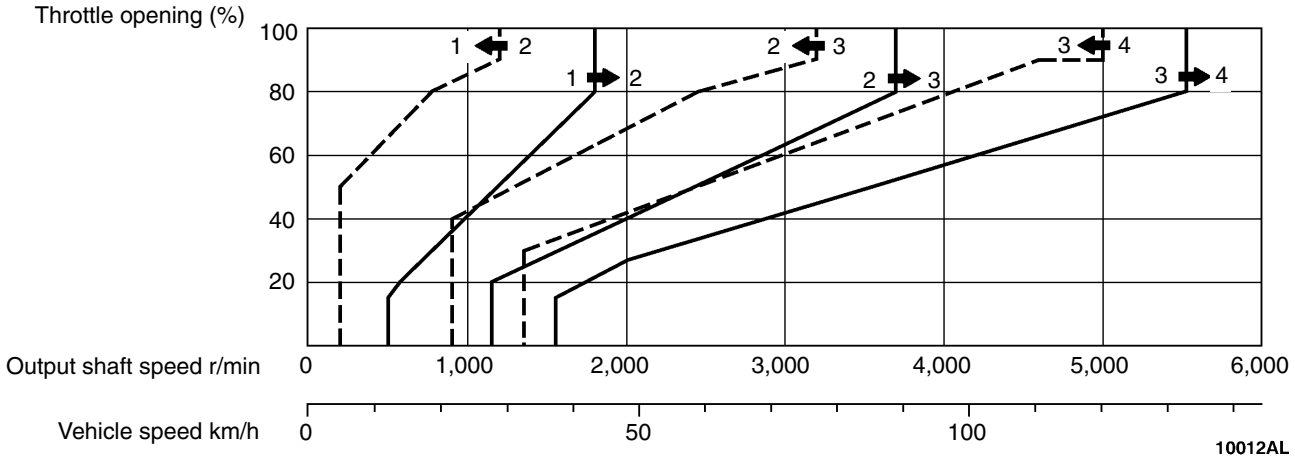
ROAD TEST

No.	State prior to test and operation	Test and operation	Judgement value	Check item	Inspection item if there is an abnormality
1	Ignition switch: ON Engine: Stopped	Ignition switch (1) ON (2) OFF	Data list No.12 (1) Approx. 5V (2) 0V	APS (Power supply voltage)	Code No.11, 12 APS system (P.23-4)
4	Engine: Idling Selector lever position: N	Accelerator pedal (1) Released (2) Half depressed (3) Fully depressed (approx. 2 seconds)	Data list No.11 (1) 0 - 5 % (2) Gradually rises from (1) (3) 85 - 100 %	APS (Throttle opening angle)	Code No.11, 12 APS system (P.23-4)

SHIFT PATTERN

<4G93 – MPI>

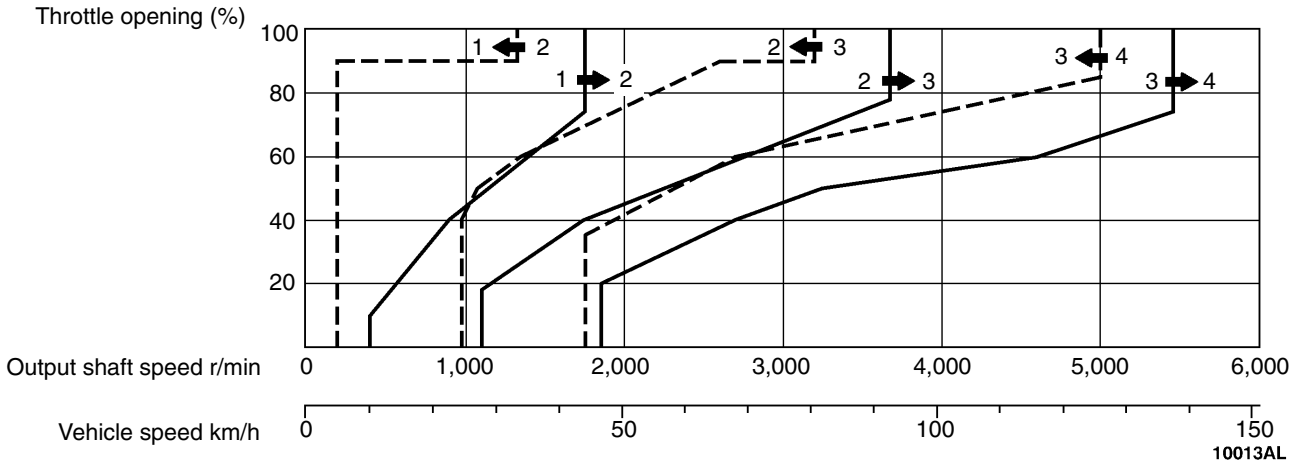
D range (Overdrive switch: ON)



<4G94>

D range (Overdrive switch: ON)

DOWNSHIFT PATTERN

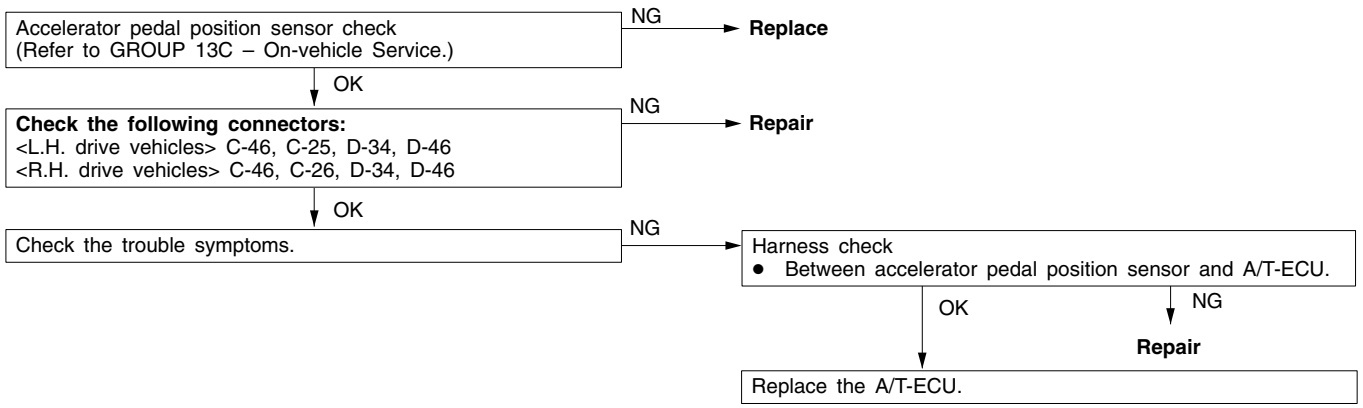


INSPECTION CHART FOR DIAGNOSIS CODE

Code	Diagnosis item		Reference page
11	Accelerator pedal position sensor system (APS) (Throttle opening voltage)	Sensor malfunction/ open circuit/short circuit	23-3
12	Accelerator pedal position sensor system (APS) (Throttle power supply voltage)	Open circuit/short circuit	23-3

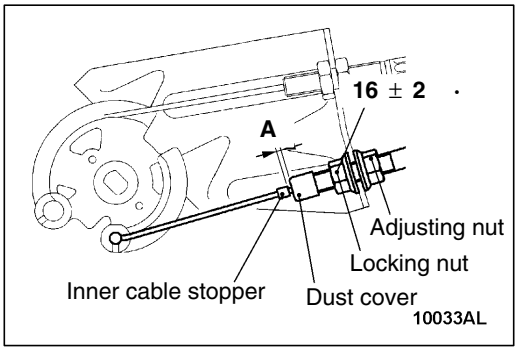
INSPECTION PROCEDURES FOR DIAGNOSIS CODES

Code No.11, 12 Accelerator pedal position sensor (APS)	Probable cause
If the APS output voltage (APS opening voltage) is 4.8 V or higher when the engine is idling, the output voltage is judged to be too high and diagnosis code No. 13 is output. If the APS output voltage (APS opening voltage) is 0.335 V or lower when the engine is idling, the output voltage is judged to be too low and diagnosis code No. 13 is output. If the APS output voltage (APS power supply voltage) is 3.0 V or lower or if it is 5.7 V or higher when the engine is idling, the APS is judged to be faulty and diagnosis code No. 14 is output.	• Malfunction of the accelerator pedal position sensor • Malfunction of harness or connector • Malfunction of the A/T-ECU



SERVICE DATA REFERENCE TABLE

Item No.	Inspection item	Inspection conditions		Normal value
11	Accelerator pedal position sensor (Throttle opening voltage)	Engine: Idle Selector lever position: N	Accelerator pedal: Fully released	0 – 5 %
			Accelerator pedal: Depressed	Gradually rises from the adove value
			Accelerator pedal: Fully depressed (up to 2 seconds)	85 – 100 %
12	Accelerator pedal position sensor (Power supply voltage)	Ignition switch: ON Engine: Stopped	Ignition switch: ON	Approx. 5
			Ignition switch: OFF	0 V



ON-VEHICLE SERVICE

KICKDOWN CABLE CHECK AND ADJUSTMENT

1. Release the accelerator pedal.
2. Loosen the adjusting nut and locking nut. Move the outer cable of the kickdown cable to adjust the clearance (A) between the inner cable stopper and dust cover end to the standard value, and then tighten the adjusting nut to secure the kickdown cable.
3. Tighten the locking nut to the specified torque.

   Standard value: 0.8 – 1.5 mm

   Caution
   Adjust the accelerator cable assembly after the kickdown cable adjustment.

PROPELLER SHAFT

PROPELLER SHAFT

CONTENTS

GENERAL INFORMATION 2
SERVICE SPECIFICATIONS 2
LUBRICANT 2
SPECIAL TOOL 2
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GENERAL INFORMATION

A two-joint propeller shaft was used for both the front and rear.

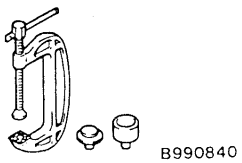
SERVICE SPECIFICATIONS

Items		Standard value	Limit
Propeller shaft runout mm	Front	–	0.5
	Rear	–	0.4
Length of rear propeller shaft mm		630 ± 1.5	–
Clearance of snap ring groove mm	Front	0 – 0.06	–
	Rear	0.02 – 0.06	–

LUBRICANT

Items	Specified lubricant	Quantity
Front propeller shaft sleeve yoke	Hypoid gear oil SAE 75W–90 or 75W–85W or 80W conforming to API GL–4	As required

SPECIAL TOOL

Tool	Number	Name	Use
 B990840	MB990840	Universal joint remover and installer	Disassembly and reassembly of the universal joint

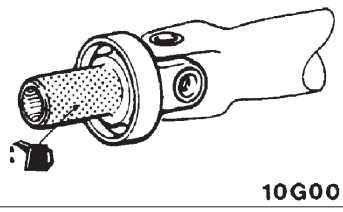
PROPELLER SHAFT

REMOVAL AND INSTALLATION

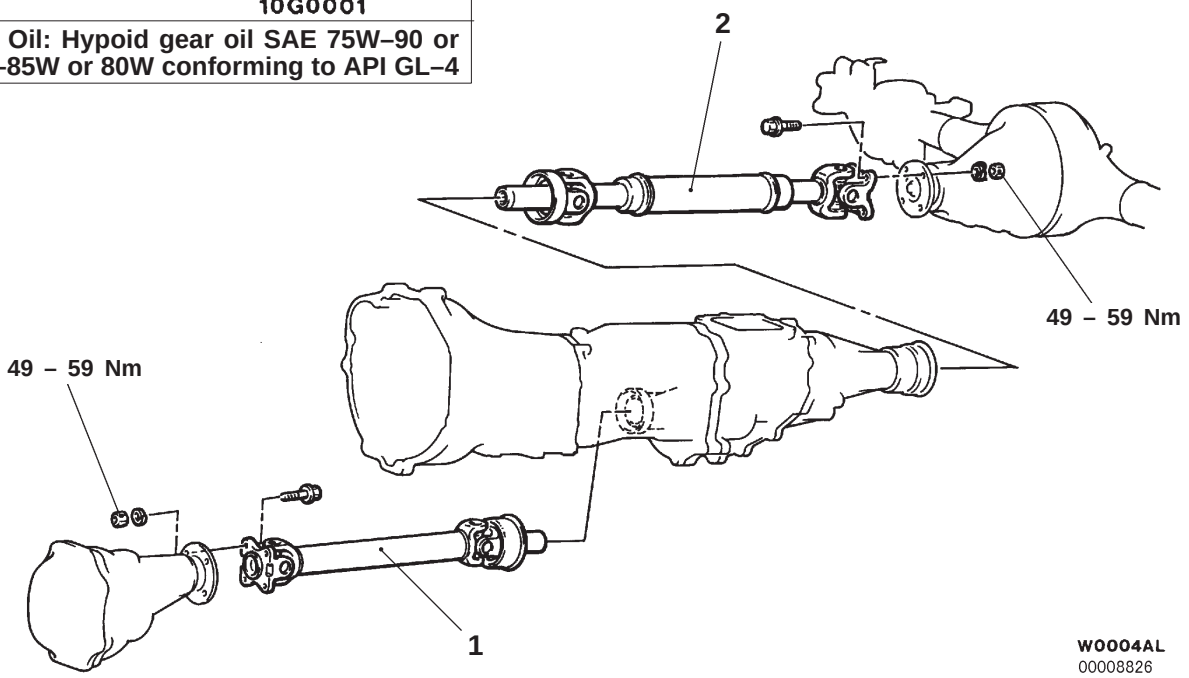
Caution
Do not reuse the rear propeller shaft already shrunk due to a big impact. The rear propeller shaft has impact-absorption mechanism (shrinkage).

Pre-removal Operation
- Shift the lever to "2H"
- Transfer Gear Oil Draining
  (M/T: Refer to GROUP 22 – On-vehicle Service.)
  (A/T: Refer to GROUP 23 – On-vehicle Service.)

Post-installation Operation
Transfer Gear Oil Supplying
(M/T: Refer to GROUP 22 – On-vehicle Service.)
(A/T: Refer to GROUP 23 – On-vehicle Service.)



Gear Oil: Hypoid gear oil SAE 75W–90 or 75W–85W or 80W conforming to API GL–4



Removal steps

◀A▶ ▶A◀ 1. Front propeller shaft assembly
◀A▶ ▶A◀ 2. Rear propeller shaft assembly

REMOVAL SERVICE POINT

◀A▶ FRONT PROPELLER SHAFT ASSEMBLY/REAR PROPELLER SHAFT ASSEMBLY REMOVAL

1. Make mating marks on the differential companion flange and flange yoke, and then remove the propeller shaft assembly.
2 Cover the transmission and transfer not to allow foreign materials to enter.

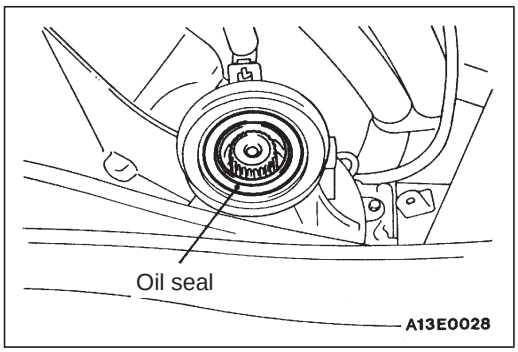
INSTALLATION SERVICE POINT

▶A◀ REAR PROPELLER SHAFT ASSEMBLY/FRONT PROPELLER SHAFT ASSEMBLY INSTALLATION

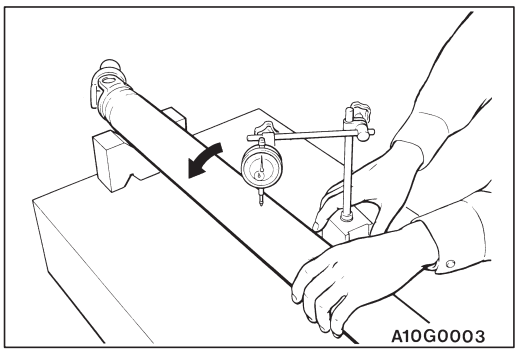
When reusing the propeller shaft, align the mating marks made during the removal and install the propeller shaft assembly to the companion flange.

Caution

1. Wipe out oil and grease on the threads of the mounting bolts and nuts before tightening, or they will loosen.



2. Do not damage the oil seal lips of the transmission and transfer.

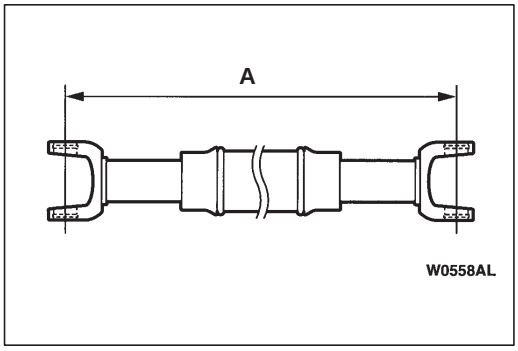


INSPECTION

PROPELLER SHAFT RUNOUT

Limit:

Front propeller shaft: 0.5 mm
Rear propeller shaft: 0.4 mm



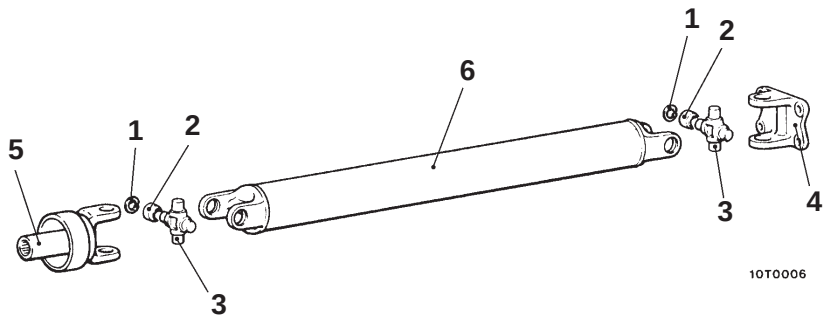
REAR PROPELLER SHAFT

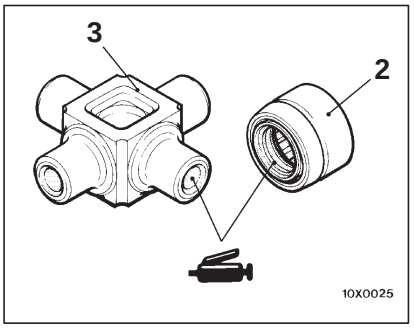
1. Measure length A.

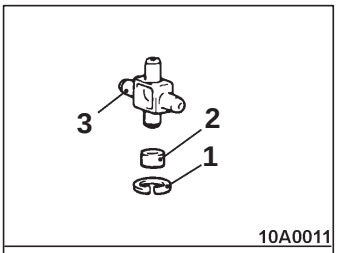
   Standard value:
   630 ± 1.5 mm

2. If the standard value is not met, replace the rear propeller shaft.

DISASSEMBLY AND REASSEMBLY





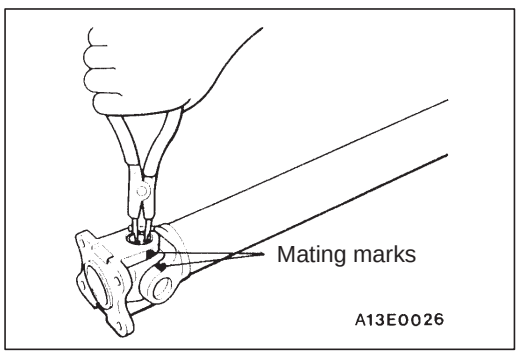


Universal joint repair kit

00008827

Disassembly steps

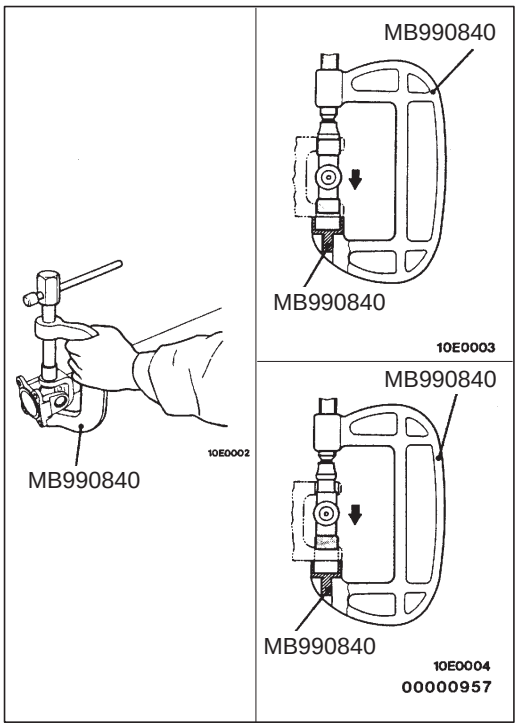
◀A▶ ▶B◀ 1. Snap ring
◀B▶ ▶A◀ 2. Journal bearing
3. Journal
4. Flange yoke
5. Sleeve yoke
6. Propeller shaft



DISASSEMBLY SERVICE POINTS

◀A▶ SNAP RING REMOVAL

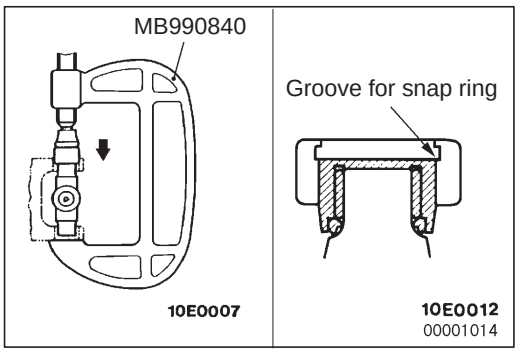
Make mating marks on the flange yoke, sleeve yoke and propeller shaft. Then, remove the snap rings.



◀B▶ JOURNAL BEARING REMOVAL

1. Using the special tools, press in the journal bearing to remove the journal bearing on the opposite side.
2. Set the special tools reverse to press in the journal. Then, pull out the journal bearing pressed in step 1.

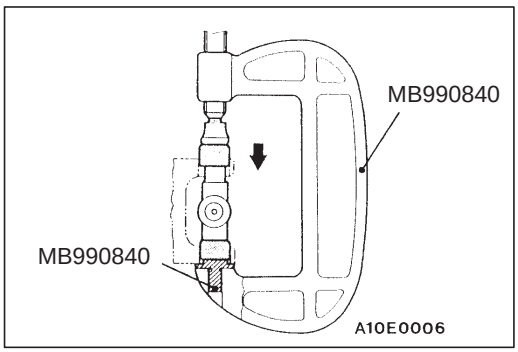
Caution
Do not tap the journal bearing to remove. Tapping the journal bearing will upset the balance of the propeller shaft.



REASSEMBLY SERVICE POINTS

▶A◀ JOURNAL BEARING INSTALLATION

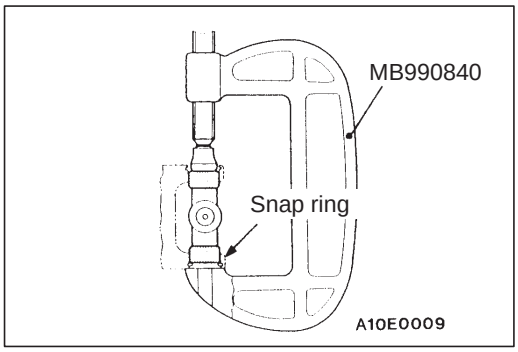
1. Using the special tool, press in the journal bearing to the yoke until the snap ring groove can be seen completely.



2. Using the special tools, press in the journal bearing on the opposite side to the yoke.

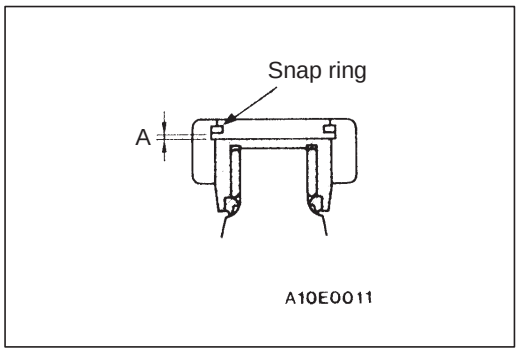
Caution
Press in the journal bearing straight, or the journal could damage the inside of the journal bearing.

3. Align the mating marks on the yoke and propeller shaft. On the propeller shaft side, install the journal bearing in the same steps of 1 and 2.



▶B◀ SNAP RING INSTALLATION

1. Install the snap ring to one side of the journal.
2. Using the special tool, press in the journal bearing toward the snap ring from the opposite side which the snap ring has been installed on.



3. Install the snap ring on the opposite side and measure the clearance of the snap ring groove with a thickness gauge.

Standard value:
Front propeller shaft (A) 0 – 0.06 mm
Rear propeller shaft (A) 0.02 – 0.06 mm

Caution
Always use snap rings of the same thickness on both sides.

4. If the standard value(s) are not met, use other snap rings to adjust the clearance.

Items	Thickness mm	Identification colour
Front propeller shaft, Rear propeller shaft	1.28	–
	1.31	Yellow
	1.34	Blue
	1.37	Purple
Rear propeller shaft	1.40	Brown

NOTES

GROUP 25
PROPELLER SHAFT

GENERAL

OUTLINE OF CHANGE

Specifications for 5 door models have been added.

SERVICE SPECIFICATIONS

Items		Standard value	Limit
Propeller shaft runout mm	Front	–	0.5
	Rear	–	0.4
Length of rear propeller shaft mm		790 ± 1.5	–
Clearance of snap ring groove mm	Front	0 – 0.06	–
	Rear	0.02 – 0.06	–

GROUP 25
PROPELLER SHAFT

GENERAL

OUTLINE OF CHANGE

Specifications for 1800-MPI models have been added.

SERVICE SPECIFICATIONS

Items		Standard value	Limit
Propeller shaft runout mm	Front	–	0.5
	Rear	–	0.4
Length of rear propeller shaft mm		642.5 ± 1.5 <3 door models> 814.5 ± 1.5 <5 door models>	–
Clearance of snap ring groove mm	Front	0 – 0.06	–
	Rear	0.02 – 0.06	–

NOTES

FRONT AXLE

FRONT AXLE

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- Front Axle Total Backlash Check 10
- Front Axle Gear Oil Level Check 11
- Hub Bolt Replacement 11
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FREE-WHEELING CLUTCH ASSEMBLY 45

SOLENOID VALVE, VACUUM PIPES AND VACUUM TANK 48

FRONT DIFFERENTIAL MOUNT 50

GENERAL INFORMATION

The front axle consists of the hub assembly, drive shaft, inner shaft, front differential, and free-wheeling clutch.
The features are:

- The free-wheeling mechanism enables 2WD and 4WD to be switched over during driving, thus improving fuel efficiency and reducing vibration at the 2WD mode.
- The drive shaft uses a B.J.-D.O.J.-type constant velocity ball joint which has high power transmission efficiency and reduces vibration and noise.
- For vehicles with ABS, the ABS rotor for detecting the wheel speed has been pressed in the B.J. joint.
- The axle is supported by the ball bearing and the front hub, which is pressed in the knuckle axle housing.
- The ball bearing is of a double-row angular contact ball bearing which features high thrust load resistance.
- The differential carrier is supported elastically at three points, thus reducing vibration and noise.

FRONT AXLE

Item			Specifications
Wheel bearing	Type		Double-row angular contact ball bearing
	Bearing (O.D. × I.D.) mm		74 × 40
Drive shaft	Joint type	Outer	B.J.
		Inner	D.O.J.
	Shaft length*1 × Shaft diameter mm	Right side	316 × 24*2, 293 × 24*3
		Left side	435 × 24*2, 428 × 24*3
Inner shaft	Shaft length × Shaft diameter mm		383 × 25
	Bearing (O.D. × I.D.) mm		62 × 35

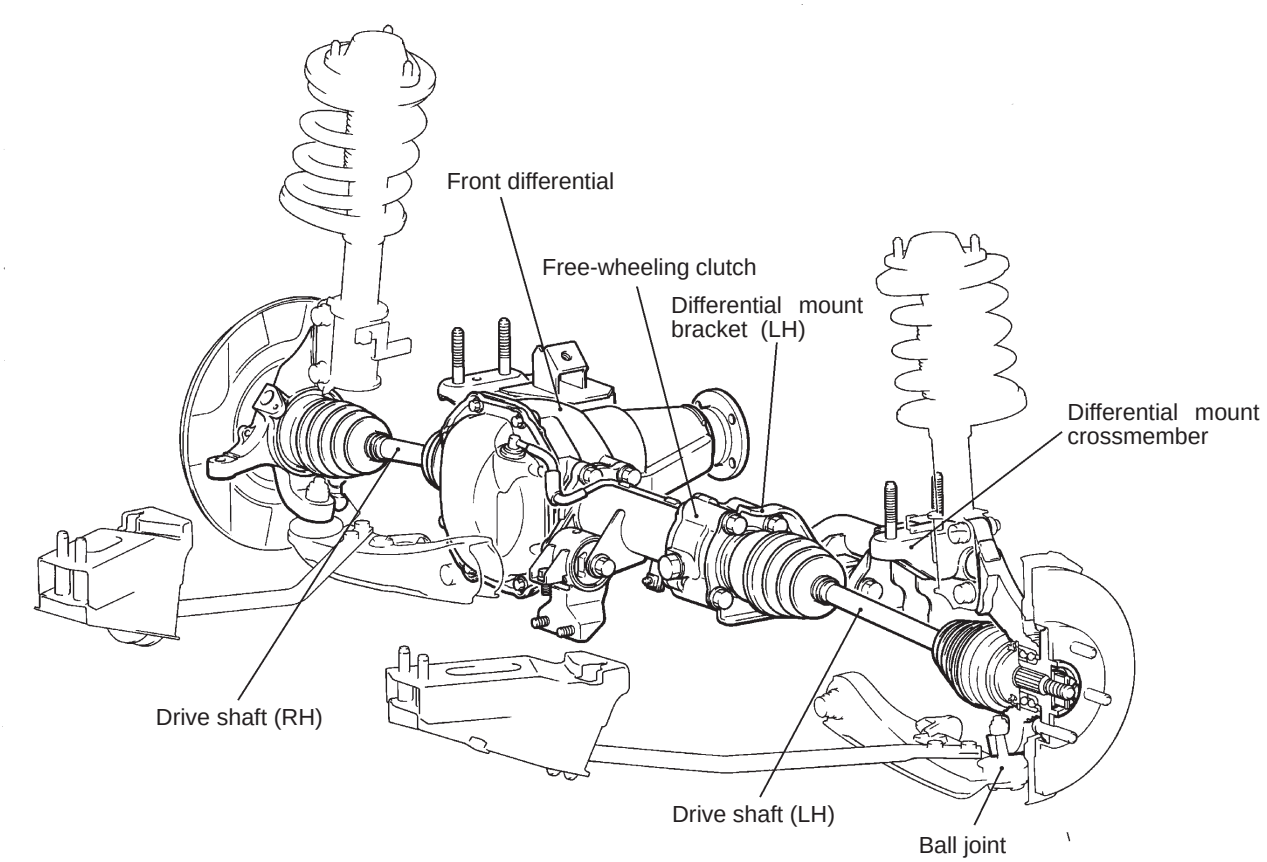
NOTE
*1: shows the distance between the centres of the joints.
*2: A/T
*3: M/T

FRONT DIFFERENTIAL

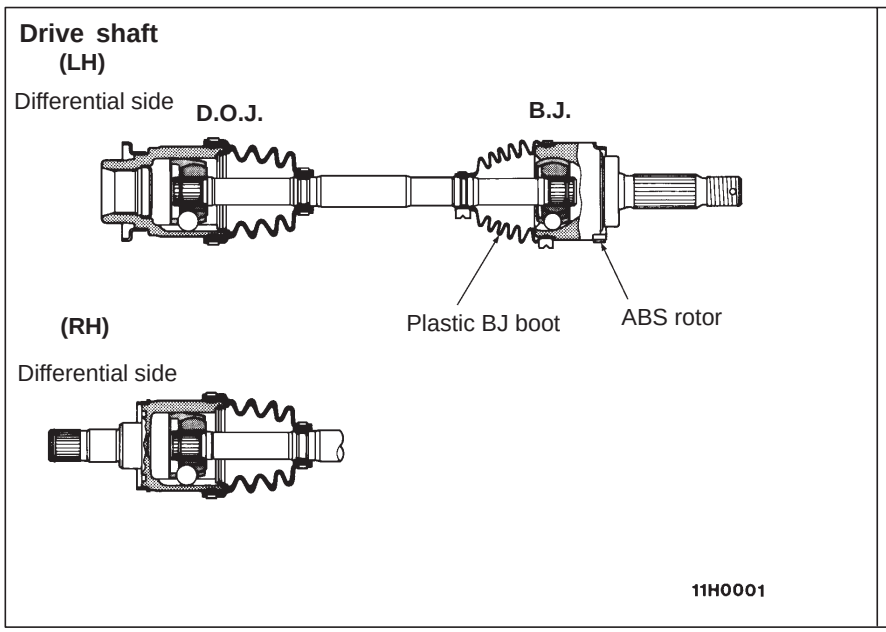
Item			Specifications
Drive gear type			Hypoid gear
Reduction ratio			4.875
Differential gear type			Straight bevel gear
Number of teeth	Drive gear		39
	Drive pinion		8
	Side gear		14
	Pinion gear		10
Bearing (O.D. × I.D.) mm		Side	72.0 × 35.0*1, 80.0 × 45.0*2
		Front	62.0 × 25.0*1, 64.0 × 30.0*2
		Rear	72.0 × 35.0*1, 76.0 × 36.5*2

NOTE
*1: A/T
*2: M/T

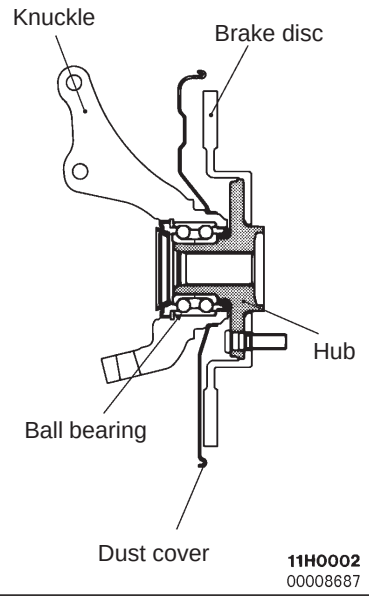
CONSTRUCTION DIAGRAM



W0003AL



11H0001



11H0002
00008687

SERVICE SPECIFICATIONS

Items			Standard value	Limit
Front axle total backlash mm			–	5
Wheel bearing axial play mm			–	0.2
Solenoid valve resistance Ω			36 – 46	–
Hub rotation starting torque Nm			1.6	–
Setting of D.O.J. boot length mm			80 ± 3	–
Special tool (MB991561) opening dimension mm		With B.J. boot band (small) crimped	2.9	–
		With B.J. boot band (large) crimped	3.2	–
B.J. boot crimping dimension mm			2.4 – 2.8	–
Clearance between B.J. boot (large) and step on B.J. housing mm			0.1 – 1.55	–
Final drive gear backlash mm			0.11 – 0.16	–
Drive gear runout mm			–	0.05
Differential gear backlash mm			0 – 0.076	0.2
Drive pinion turning torque Nm	Without oil seal	When replacing (with anti-rust agent)	0.88 – 1.17*1, 0.29 – 0.49*2	–
		When replacing or reusing (with gear oil applied)	0.39 – 0.49*1 0.147 – 0.245*2	–
	With oil seal	When replacing (with anti-rust agent)	0.98 – 1.27*1 0.49 – 0.69*2	–
		When replacing or reusing (with gear oil applied)	0.49 – 0.58*1 0.343 – 0.441*2	–

NOTE
*1: A/T
*2: M/T

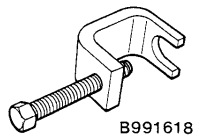
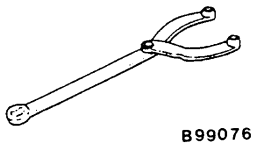
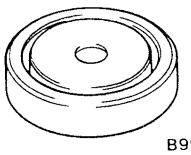
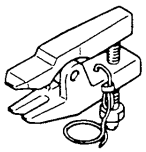
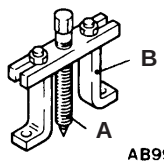
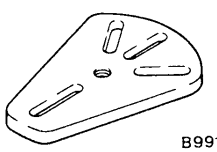
LUBRICANTS

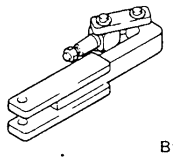
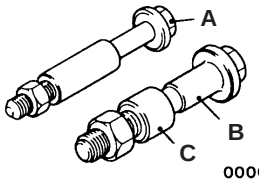
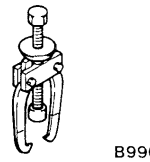
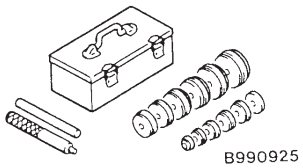
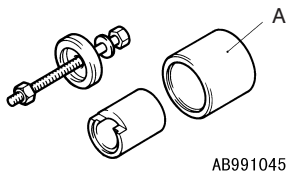
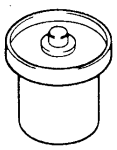
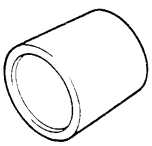
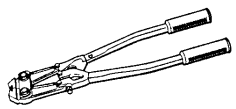
Items		Specified lubricants	Quantity
Gear oil	Front differential	Hypoid gear oil API classification GL-5 or higher SAE viscosity No.90, 80W	0.83 ℓ
	Free-wheeling clutch		0.12 ℓ
D.O.J.		Repair kit grease	<A/T> 85 g <M/T> 100 g
B.J.		Repair kit grease	<A/T> 85 g <M/T> 110 g

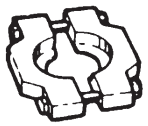
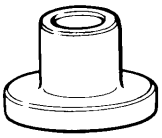
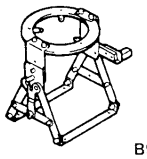
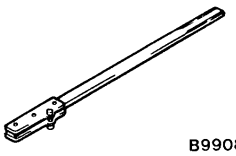
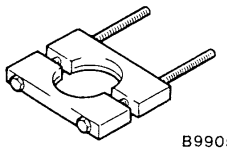
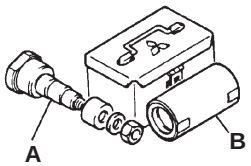
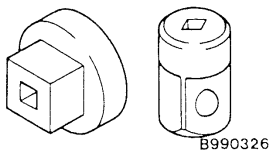
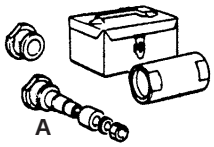
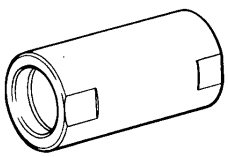
SEALANTS AND ADHESIVES

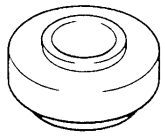
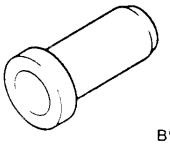
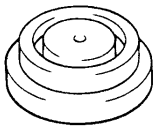
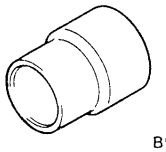
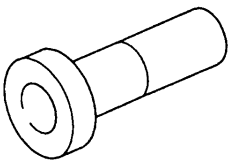
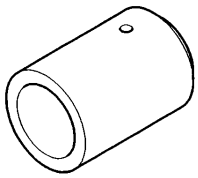
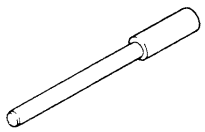
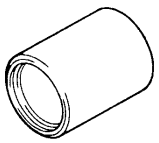
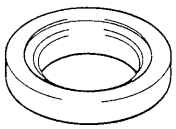
Items	Specified sealants and adhesives	Remarks
Front housing assembly and free-wheeling hosing assembly	3M ATD Part No.8661 or equivalent	Semi-drying sealant
Front housing assembly and differential carrier		
Vent plug		
Differential cover		
Drive gear and differential case mating surface	3M Stud Locking 4170 or equivalent	Anaerobic sealant

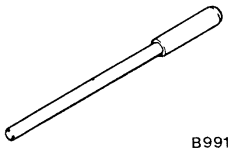
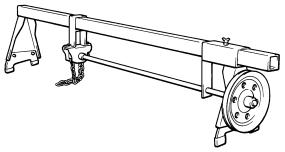
SPECIAL TOOLS

Tool	Number	Name	Use
 B991618	MB991618	Hub bolt remover	Hub bolt removal
 B990767	MB990767	Front hub and flange yoke holder	Hub fixing
 B990955	MB991115	Oil seal installer	• Front axle hub oil seal press-fitting (Used together with MB990938) • Housing tube dust seal press-fitting
 B991113	MB991406 or MB991113	Steering linkage puller	Ball joint disconnection
 AB990241	MB990241 A: MB990242 B: MB990244	Axle shaft puller A: Puller shaft B: Puller bar	Drive shaft removal
 B991354	MB991354	Puller body	

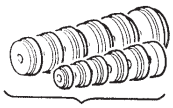
Tool	Number	Name	Use
 B991056	MB991056 or MB991355	Knuckle arm bridge	Hub removal
 00005697	A: MB991017 B: MB990998 C: MB991000	A, B: Front hub remover and installer C: Spacer	● Hub removal and press-fitting. ● Wheel bearing provisional holding (MB991000, which belongs to MB990998, should be used as a spacer.)
 B990810	MB990810	Side bearing puller	● Side bearing inner race removal ● Companion flange removal
 B990925	MB990925	Bearing and oil seal installer set	● Outer wheel bearing inner race installation ● Oil seal installation ● Front housing assembly oil seal installation ● Drive pinion front and rear bearing outer race removal and installation ● Final drive gear backlash check
 AB991045	MB991045 A: MB991050	Bush remover installer A: Base (B)	Wheel bearing pressing-in (Used together with base B)
 B991387	MB991387	Bush remover installer	Outer oil seal pressing-in
 B991389	MB991389	Bush remover base	Inner oil seal pressing-in
	MB991561	Boot band clipping tool	Plastic boot band installation

Tool	Number	Name	Use
	MB990673	Front bearing remover	Bearing removal
	MB990663	Rear axle shaft bearing and retainer ring installer	Bearing installation
 B990909	MB990909	Working base assembly	Differential carrier fixing
 B990850	MB990850	End yoke holder	Companion flange removal and installation
 B990560	MB990560	Rear axle shaft bearing remover	Drive pinion bearing inner race removal
 A B AB990835	MB990835 A: MB990836 B: MB990392	Dummy pinion set A: Drive pinion gauge assembly B: Cylinder gauge	• Drive pinion rotation starting torque check • Drive pinion height measurement <A/T>
 B990326	MB990326	Pre-load socket	Drive pinion turning torque measurement
 A	MB990901 A: MB990903	Pinion height gauge set	Pinion height adjustment <M/T>
	MB991170	Cylinder gauge	Pinion height adjustment <M/T>

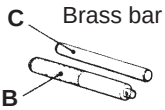
Tool	Number	Name	Use
 B990829	MB990829	Pinion and side bearing installer	• Drive pinion rear bearing inner race pressing-in • Side bearing inner race pressing-in
 B990727	MB990727	Oil seal installer	Drive pinion oil seal pressing-in
 B991015	MB991015	Knuckle oil seal installer	Oil seal pressing-in
 B990799	MB990799	Ball joint remover and installer	Free-wheeling clutch gear and bearing installation
	MD999547	Oil seal installer	Front differential mount insulator <front> removal
	MD999570	Crankshaft front oil seal installer	Front differential mount insulator <rear> removal
 B990947	MB990947	Lower arm bushing arbour	Front differential mount insulator <front> pressing-in
 B990847	MB990847	Rear suspension bushing remover and installer base	
 B990884	MB990981	Mount bushing remover and installer ring	

Tool	Number	Name	Use
 B991318	MB991318	Lower arm bushing arbour	Front differential mount insulator <rear> pressing-in
	MB991183	Bushing arbour	
	MB990843	Drag link bushing remover and installer	
	GENERAL SERVICE TOOL MZ203827	Engine lifter	Supporting the engine assembly when the differential carrier is removed and installed

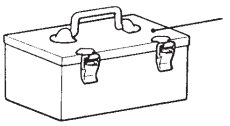
MB990925



A
Installer adapter



Bar (snap-in type)



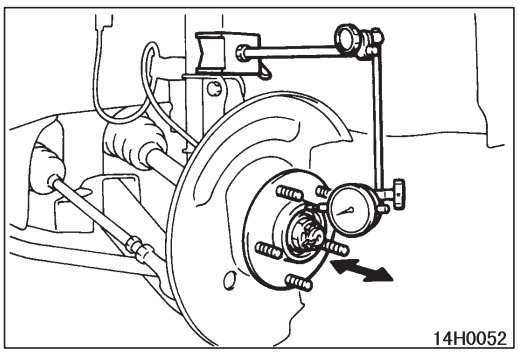
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Type	Tool number	O.D. mm	Type	Tool number	O.D. mm
A	MB990926	39	A	MB990933	63.5
	MB990927	45		MB990934	67.5
	MB990928	49.5		MB990935	71.5
	MB990929	51		MB990936	75.5
	MB990930	54		MB990937	79
	MB990931	57	B	MB990938	–
	MB990932	61	C	MB990939	–

ON-VEHICLE SERVICE

WHEEL BEARING AXIAL PLAY CHECK

1. Remove the disc brake caliper and suspend it with a wire.
2. Remove the brake disc from the front hub.



3. Attach a dial gauge as shown in the illustration, and then measure the axial play while moving the hub in the axial direction.

   Limit: 0.2 mm

4. If axial play exceeds the limit, disassemble the hub and knuckle to inspect each component.

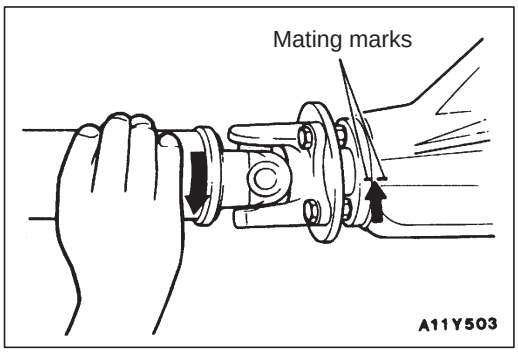
FRONT AXLE TOTAL BACKLASH CHECK

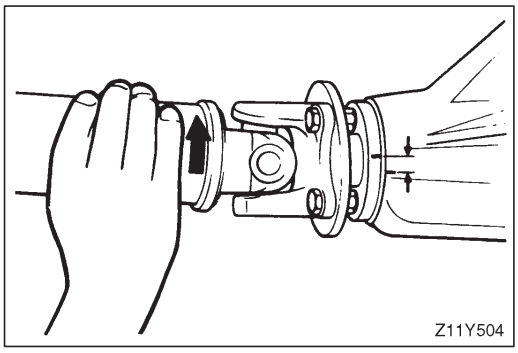
If the propeller shaft is rotated by hand while the ignition switch is OFF, the front wheel actuator will lock the front wheels. To prevent this, follow the procedures below:

1. Turn the ignition switch to the OFF position, and then place the transfer shift lever in the 2H position to lock the front wheels.

   Caution
   Do not jack up the vehicle.

2. Rotate the propeller shaft until a click is heard to lock the free-wheeling differential.
3. Rotate the propeller shaft fully clockwise, and then make mating marks on the companion flange dust cover and the gear carrier.





4. Rotate the propeller shaft fully anticlockwise, and measure the difference between the mating marks with a scale.

   Limit: 5 mm

5. If the measured value exceeds the limit value, check the following.
   - Final drive gear backlash
   - Differential gear backlash
   - Play in the serrations and spline of the side gears, drive shaft, inner shaft and drive flange

FRONT AXLE GEAR OIL LEVEL CHECK

Top up the specified gear oil if the gear oil level does not reach the bottom of the filler plug.

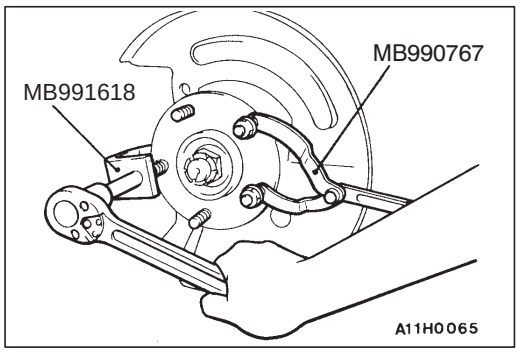
Specified gear oil:

Hypoid gear oil API classification GL-5 or higher, SAE viscosity No.90, 80W

NOTE
SAE 90 for 10 °C or higher, SAE80 for 10 °C or lower

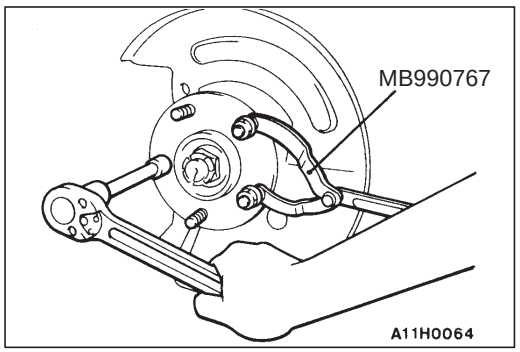
Capacity:

Front differential: Approx. 0.83 ℓ
Free-wheeling clutch: 0.12 ℓ

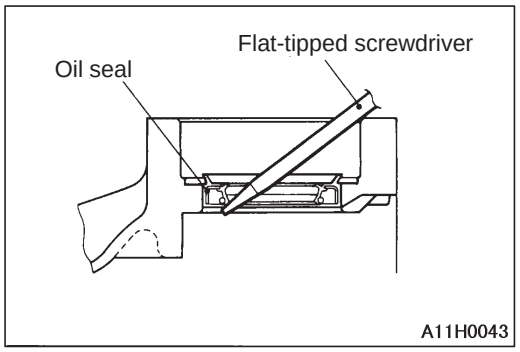


HUB BOLT REPLACEMENT

1. Rotate the hub to align each hub bolt with the cutout section of the dust cover, and push out each hub bolt while locking the hub with the special tool.

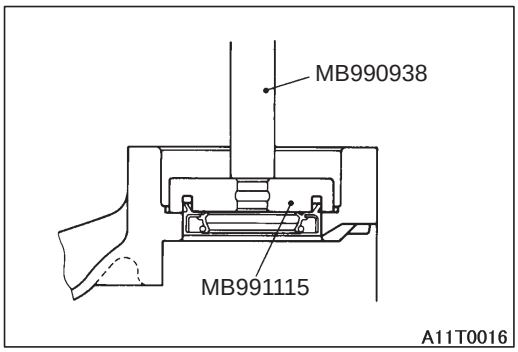


2. To press in the hub bolt, install each hub bolt at the cutout section of the dust cover, and tighten the hub bolt with the hub nut as shown.

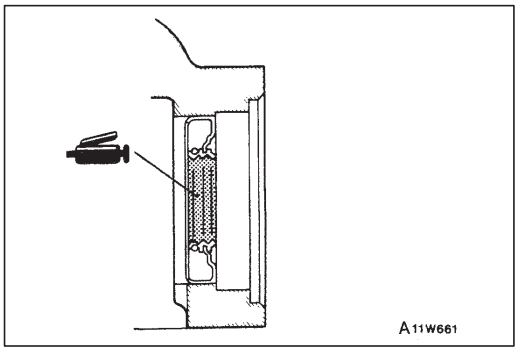


DIFFERENTIAL CARRIER OIL SEAL REPLACEMENT

1. Remove the front housing assembly. (Refer to P.26-26.)
2. Remove the drive shaft <RH>. (Refer to P.26-19.)
3. Use a flat-tipped screwdriver or the like to remove the oil seal.



4. Use the special tools to install a new oil seal.

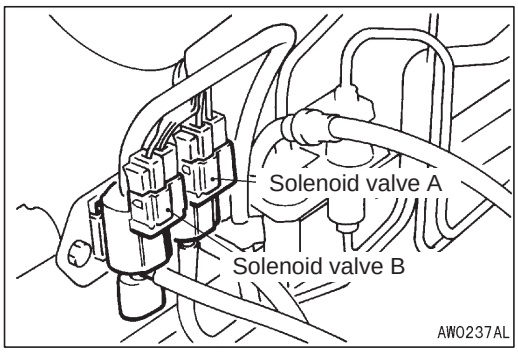


5. Apply multi-purpose grease to the oil seal lip, and then install the right drive shaft (Refer to P.26-19) and the front housing assembly (Refer to P.26-26).

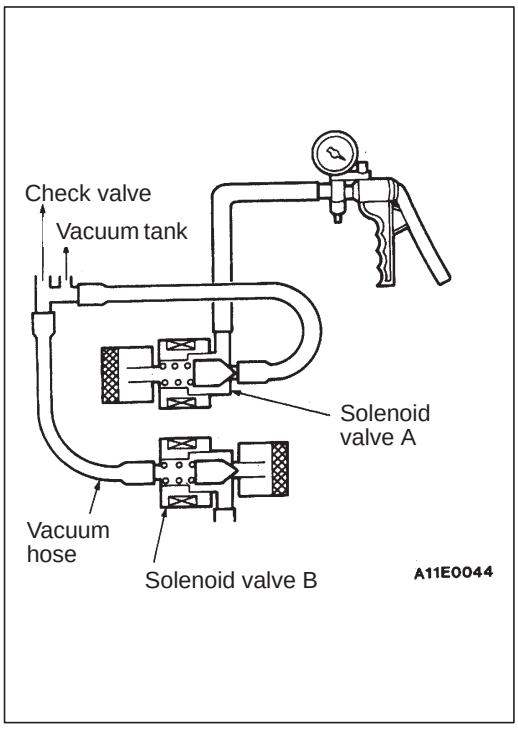
Caution

(1) Be careful not to scratch the oil seal lip.
(2) Always replace the circlip, which is installed on the D.O.J.-side spline of the right drive shaft, with a new one.

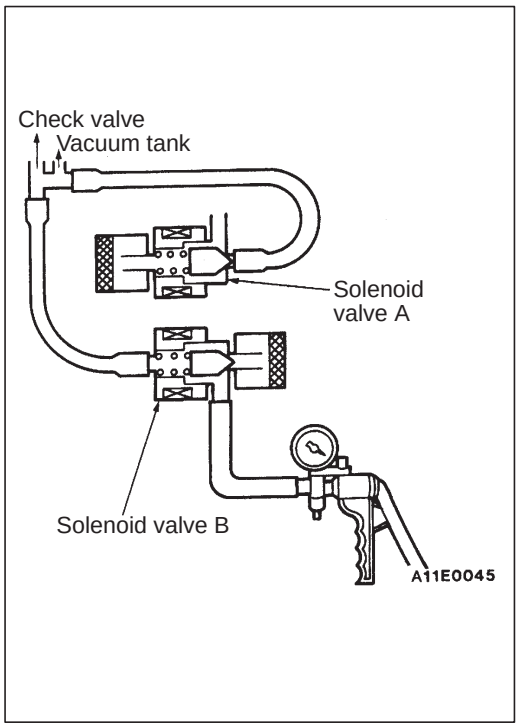
SOLENOID VALVE OPERATION CHECK



1. Remove the vacuum hoses (blue stripe, yellow stripe) from the solenoid valves.
2. Disconnect the harness connectors.



3. Connect a hand vacuum pump to solenoid valve A, and carry out the following inspections.
   (1) When battery voltage is not applied to any terminals, the negative pressure is not be held.
   (2) The negative pressure is not held when battery voltage is applied to solenoid valve A. However, when the vacuum hose of solenoid valve B is restricted by bending it, the pressure is held.
   (3) The negative pressure is held when battery voltage is applied to solenoid valves A and B.

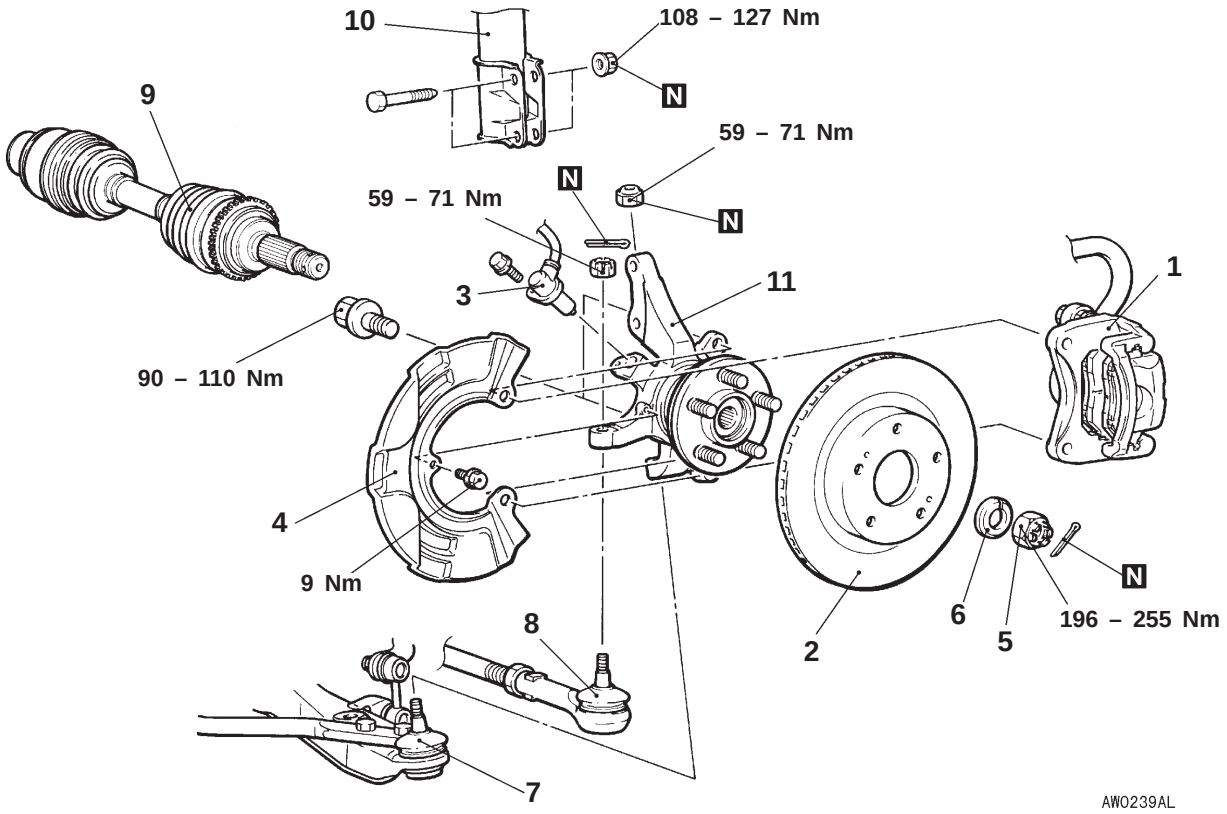


4. Connect a hand vacuum pump to solenoid valve B. Apply negative pressure and carry out the following inspections.
   (9) When battery voltage is not applied to any terminals, the negative pressure is held.
   (10) When battery voltage is applied to solenoid valve B, the negative pressure is not held.
   (11) When battery voltage is applied to solenoid valve A, the negative pressure is not held.
5. Measure the resistance of solenoid valves A and B.
   Standard value: 36 – 46 Ω

HUB AND KNUCKLE ASSEMBLY

REMOVAL AND INSTALLATION

Post-installation Operation
Press the Dust Cover with a Finger to Check Whether the Dust Cover is Cracked or Damaged.



Removal steps

1. Disc brake assembly
2. Brake disc
3. Wheel speed sensor <Vehicles with ABS>
4. Dust cover

◀A▶ ▶A◀ 5. Castle nut

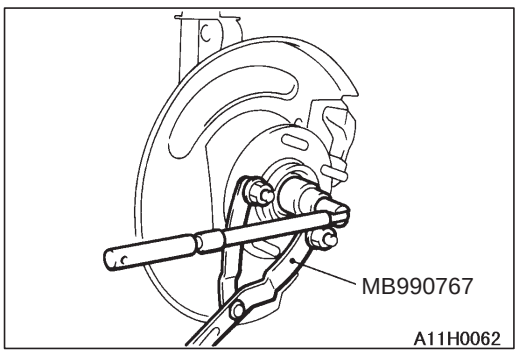
▶A◀ 6. Washer

◀B▶ 7. Lower arm and hub/knuckle assembly connection

◀B▶ 8. Tie rod end and hub/knuckle assembly connection

◀C▶ 9. Drive shaft and hub/knuckle assembly connection

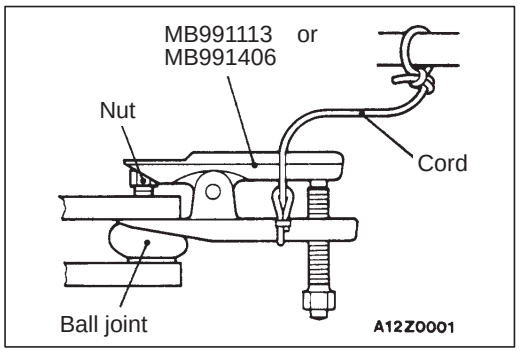
10. Strut assembly and hub/knuckle assembly connection
11. Hub/knuckle assembly



REMOVAL SERVICE POINTS

◀A▶ CASTLE NUT REMOVAL

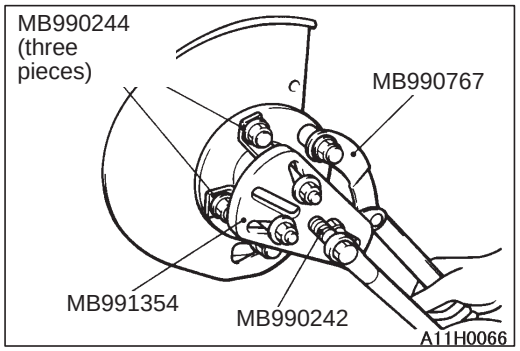
Caution
Never apply the vehicle weight to the wheel bearing while the castle nut is loosened. If the vehicle weight is applied, the wheel bearing will be damaged.



◀B▶ TIE ROD END/LOWER ARM REMOVAL

Caution

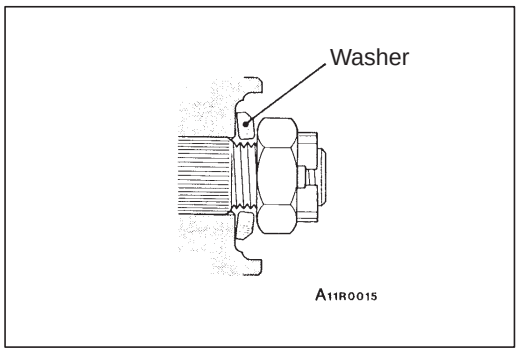
1. **Only loosen the ball joint nut, but do not remove it. Use the special tool.**
2. **Suspend the special tool with a cord to prevent it from dropping.**



◀C▶ DRIVE SHAFT REMOVAL

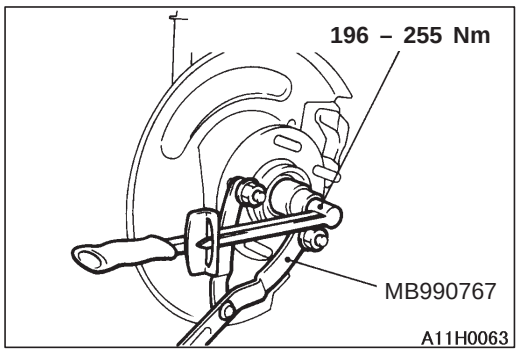
Use the special tools when the drive shaft can not be separated from the knuckle easily due to seizure.

INSTALLATION SERVICE POINTS



▶A◀ WASHER/CASTLE NUT INSTALLATION

1. Face the chamfered side of the washer against the castle nut.



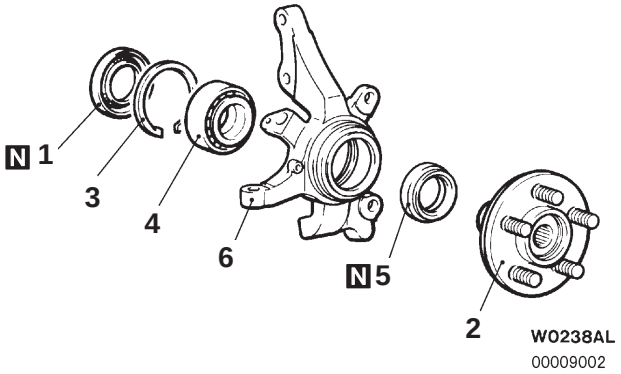
2. Use the special tool to tighten the castle nut securely.

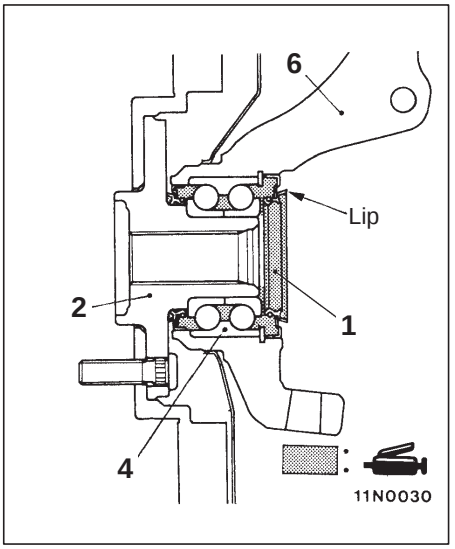
   Caution

   Never apply the vehicle weight to the wheel bearing while the castle nut is loosened. If the vehicle weight is applied, the wheel bearing will be damaged.

3. If the split pin hole is not aligned with the castle nut slit, always tighten the nut further within a torque of 255 Nm, and assemble the split pin in the first aligned slit and the hole.

DISASSEMBLY AND REASSEMBLY



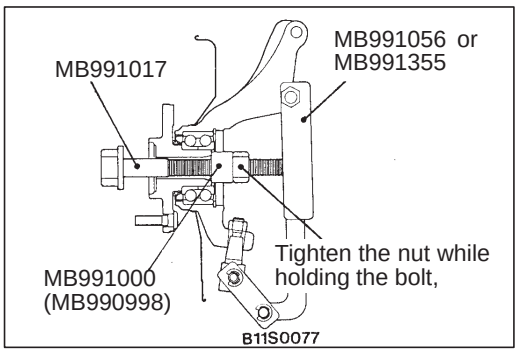


Disassembly steps

1. Inner oil seal
◀A▶ 2. Hub
3. Snap ring
◀B▶ 4. Wheel bearing
5. Outer oil seal
6. Knuckle

Reassembly steps

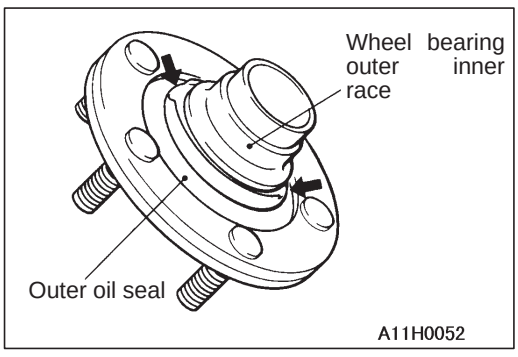
6. Knuckle
▶A◀ 4. Wheel bearing
3. Snap ring
▶B◀ 5. Outer oil seal
2. Hub
▶C◀ • Hub rotation starting torque check
▶D◀ • Wheel bearing axial play check
▶E◀ 1. Inner oil seal



DISASSEMBLY SERVICE POINTS

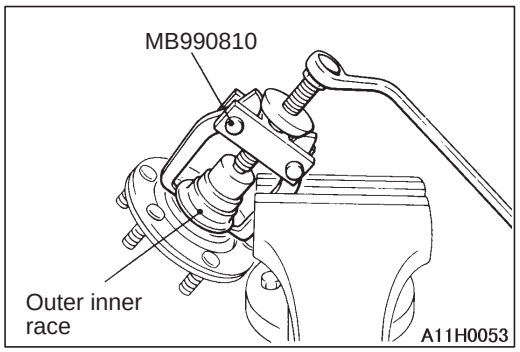
◀A▶ HUB REMOVAL

Caution
When the hub is removed, the wheel bearing may be damaged. Therefore, if the hub is withdrawn, the wheel bearing should be always be replaced with a new one.



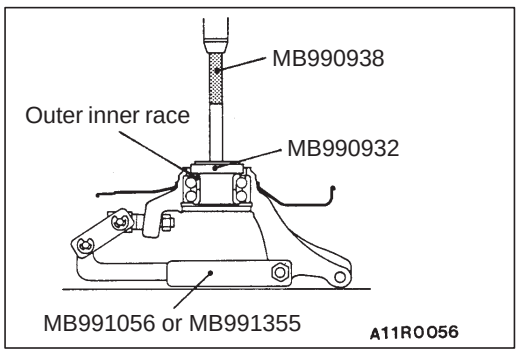
◀B▶ WHEEL BEARING REMOVAL

1. Pry the outer oil seal at the shown positions with a screwdriver so that the jaws of the special tool can hook the wheel bearing outer inner race.



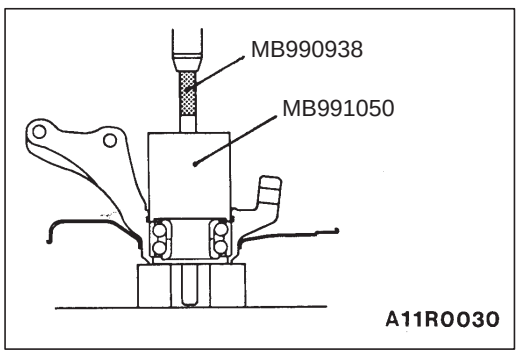
2. Use the special tool to remove the wheel bearing outer inner race from the hub.

Caution
Be careful not to drop the hub when the outer inner race is pressed out.



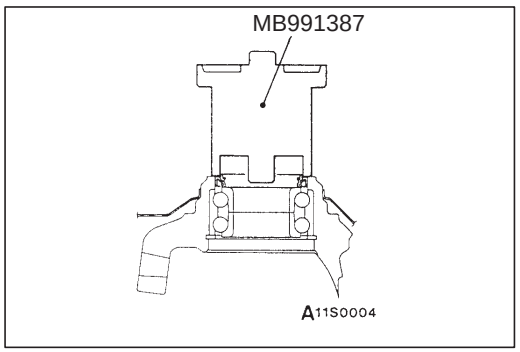
3. Assemble the removed outer inner race to the wheel bearing, and then use the special tools to remove the wheel bearing.

REASSEMBLY SERVICE POINTS

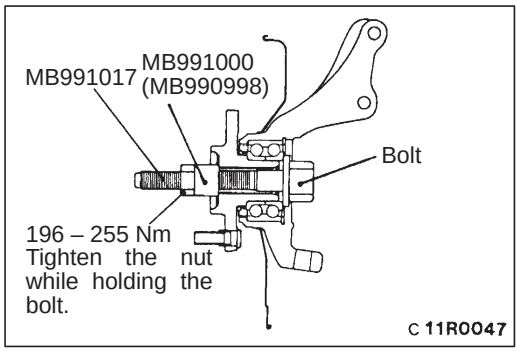


▶A◀ WHEEL BEARING INSTALLATION

Caution
When the wheel bearing is pressed in, its outer race should be pushed in.

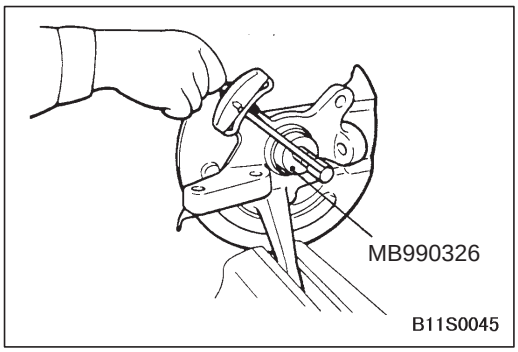


▶B◀ OUTER OIL SEAL INSTALLATION

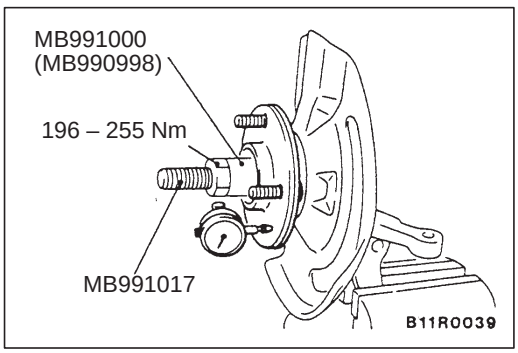


▶C◀ HUB ROTATION STARTING TORQUE CHECK

1. Tighten the special tools to the specified torque to press the hub into the knuckle.
2. Rotate the hub so that the hub is lubricated sufficiently.

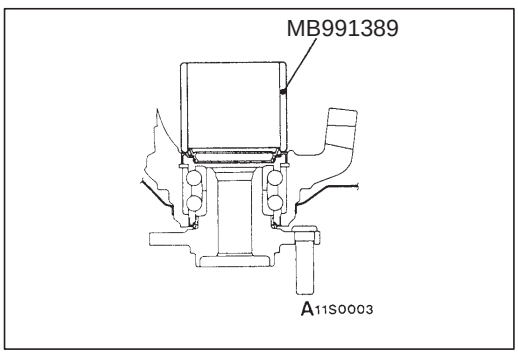


3. Use the special tool to measure the hub rotation starting torque.
   Limit: within 1.6 Nm
4. Make sure that the hub rotation starting torque is within the limit, and the hub turns smoothly.



▶D◀ WHEEL BEARING AXIAL PLAY CHECK

1. Clamp the knuckle in a vise, and measure the axial play while moving the hub in the axial direction.
   Limit: 0.2 mm
2. If the limit value can not be obtained after tightening the special tool within 196 – 255 Nm, the wheel bearing, the knuckle and the hub may be improperly assembled. Disassemble these parts to replace the bearing, and then assemble them again.



▶E◀ INNER OIL SEAL INSTALLATION

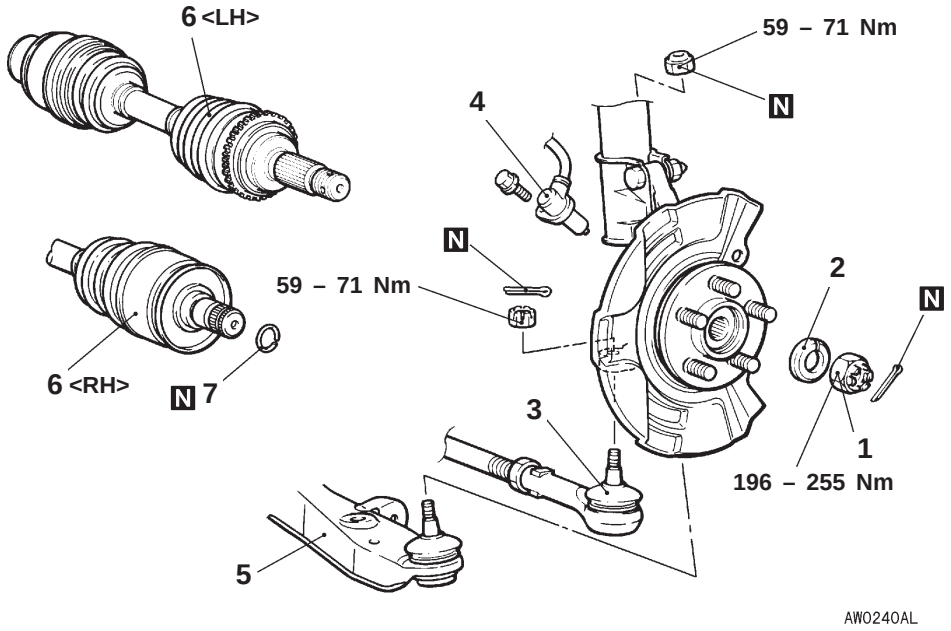
DRIVE SHAFT

REMOVAL AND INSTALLATION

Caution
On the vehicles with ABS, when the drive shaft is removed or installed, be careful not to interfere with the ABS rotor installed to the B.J. outer race to prevent the rotor from damage.

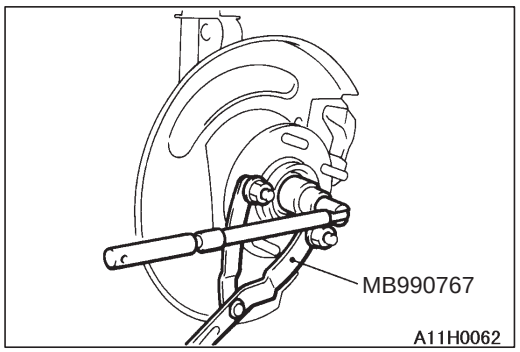
Pre-removal Operation
- Disengage the Stabilizer Link from the Strut Bar (Refer to GROUP 33 – Strut Bar and Lower Arm.)
- Brake Disc Removal (Refer to P.26-14.)

Post-installation Operation
- Press the Dust Cover with a Finger to Check Whether the Dust Cover is Cracked or Damaged.
- Engage the Stabilizer Link with the Strut Bar (Refer to GROUP 33 – Strut Bar and Lower Arm.)
- Brake Disc Installation (Refer to P.26-14.)



Removal steps

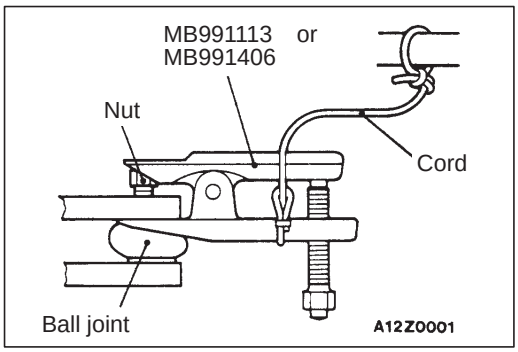
◀A▶ ▶A◀ 1. Castle nut
▶A◀ 2. Washer
◀B▶ 3. Tie rod end and hub/knuckle assembly connection
4. Wheel speed sensor
◀B▶ 5. Lower arm and hub/knuckle assembly connection
◀C▶ 6. Drive shaft
7. Circlip



REMOVAL SERVICE POINTS

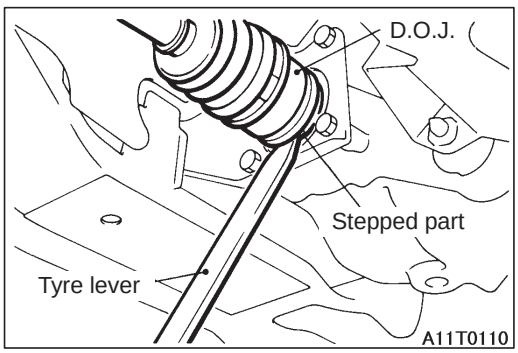
◀A▶ CASTLE NUT REMOVAL

Caution
Never apply the vehicle weight to the wheel bearing while the castle nut is loosened. If the vehicle weight is applied, the wheel bearing will be damaged.



◀B▶ TIE ROD END AND HUB/KNUCKLE ASSEMBLY/LOWER ARM AND HUB/KNUCKLE ASSEMBLY DISCONNECTION

Caution
1. Only loosen the ball joint nut, but do not remove it. Use the special tool.
2. Tie the special tool with a cord not to let it fall off.



◀C▶ DRIVE SHAFT REMOVAL

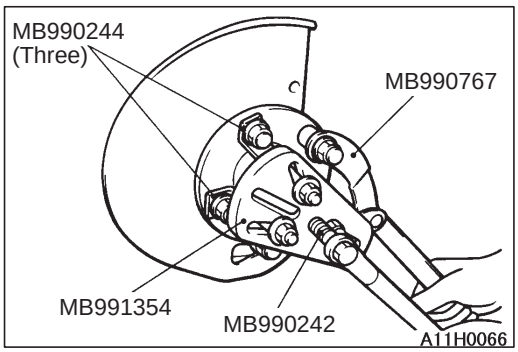
1. For the left side drive shaft, pry the D.O.J. stepped part with a tyre lever, and then withdraw the drive shaft from the free-wheeling hub assembly.

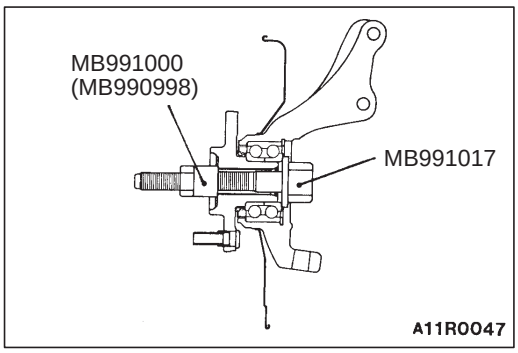
   Caution
   Always use a tyre lever. When the drive shaft is withdrawn from the B.J. assembly, the D.O.J. may be damaged.

2. For the right side drive shaft, install the drive shaft with the castle nut loosely. Then pull the strut, the hub/knuckle assembly and the lower arm towards you, and then withdraw the drive shaft from the front differential.

   Caution
   Be sure to maintain the drive shaft horizontally not to bend the D.O.J. at extreme angle when the drive shaft is withdrawn.

3. If it is difficult to withdraw the drive shaft from the hub/knuckle assembly, use the special tools.





Caution
Do not apply the vehicle weight to the wheel bearing as possible while the drive shaft is removed. If it is impossible, use the special tool to hold the the wheel bearing as shown in the illustration.

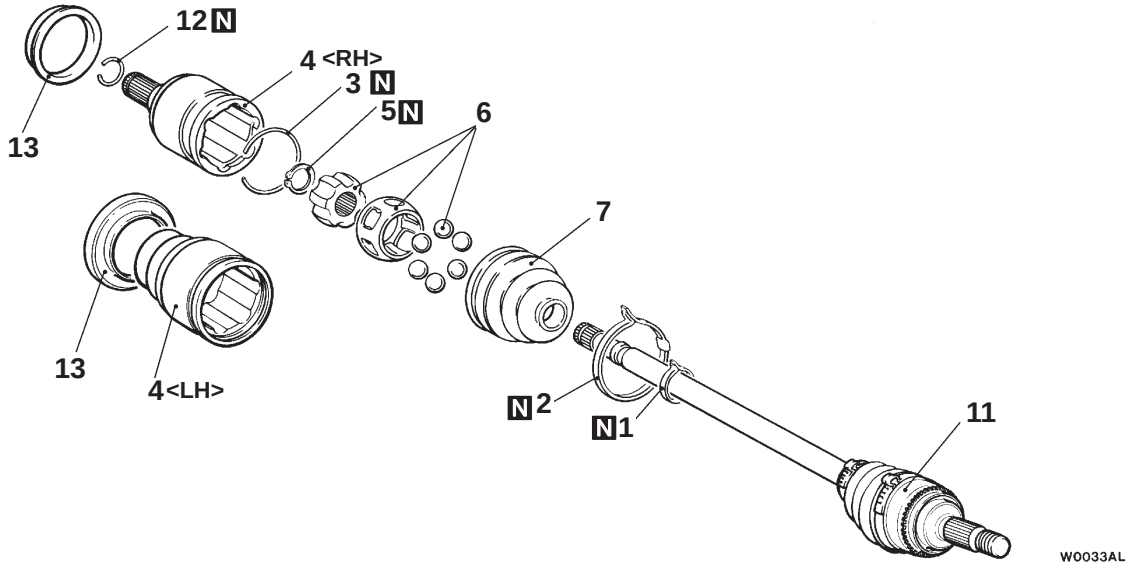
INSTALLATION SERVICE POINT

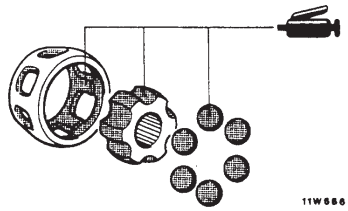
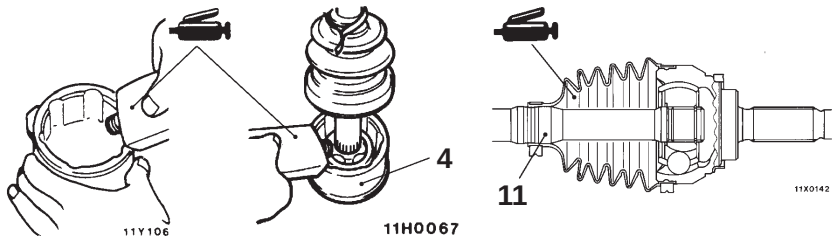
▶A◀ WASHER/CASTLE NUT INSTALLATION

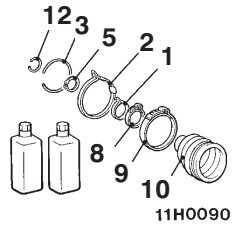
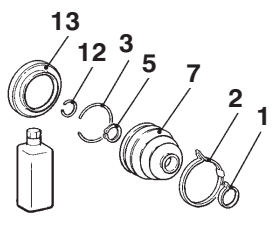
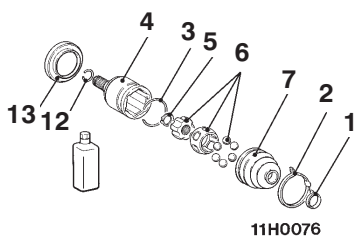
Refer to P. 26-15.

DISASSEMBLY AND REASSEMBLY

Caution
The B.J. assembly is non-serviceable and requires replacement if defective. B.J. boot can be replaced.



	
Grease: Repair kit grease	**Grease: Repair kit grease** **Quantity:** **<A/T> B.J.: 85 g (40 g for joint, 45 g for boot)** **D.O.J.: 85 g (50 g for joint, 35 g for boot)** **<M/T> B.J.: 110 g (55 g for joint, 55 g for boot)** **D.O.J.: 100 g (60 g for joint, 40 g for boot)**
Caution **The joint is filled with a special grease. Do not mix the grease with an old one or other grease.**	

		
B.J. boot repair kit	**D.O.J. boot repair kit**	**D.O.J. repair kit**

00009003

Disassembly steps

▶B◀ 1. D.O.J. boot band (small)
▶B◀ 2. D.O.J. boot band (large)
3. Circlip
4. D.O.J. outer race
5. Snap ring
6. Inner race, cage, ball assembly
◀A▶ ▶A◀ 7. D.O.J. boot
8. B.J. boot band (small)
9. B.J. boot band (large)
10. B.J. boot
11. B.J. assembly
12. Circlip
13. Dust cover

DISASSEMBLY SERVICE POINT

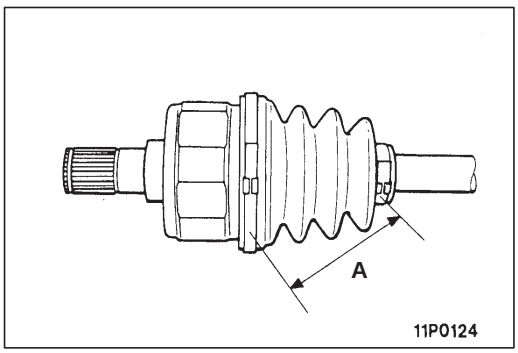
◀A▶ D.O.J. BOOT REMOVAL

Wrap a plastic tape around the B.J. assembly spline to prevent the boot from damage.

REASSEMBLY SERVICE POINTS

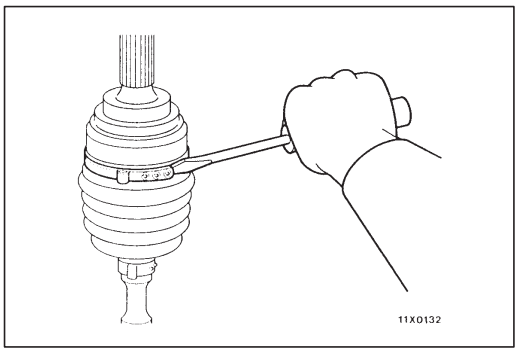
▶A◀ D.O.J. BOOT INSTALLATION

Wrap a plastic tape around the B.J. assembly spline to prevent damage, and then install the boot.



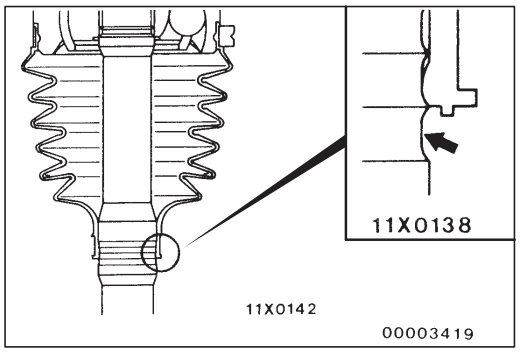
▶B◀ D.O.J. BOOT BAND/BOOT BAND INSTALLATION

1. Slide the D.O.J. outer race so that the distance between the boot bands meet the standard value in order to adjust the air amount inside the D.O.J. boot.
   Standard value (A): 80 ± 3 mm
2. Remove the boot partially from the D.O.J. outer race in order to bleed the air from the boot.

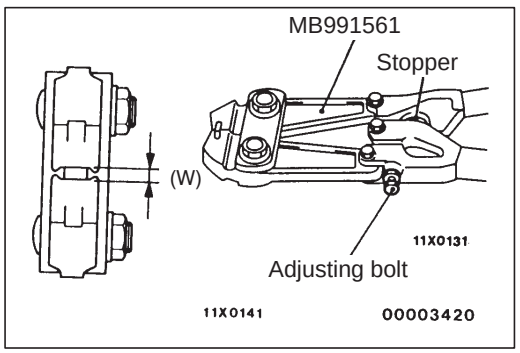


B.J. BOOT (PLASTIC BOOT) REPLACEMENT

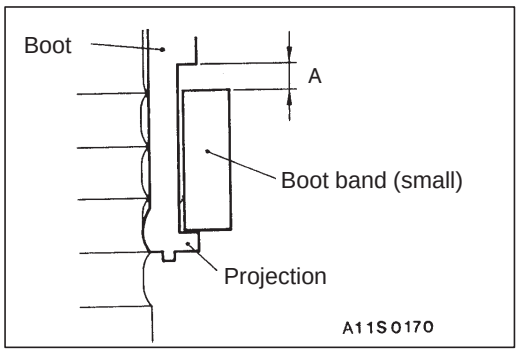
1. Remove the boot bands (small and large).
   NOTE
   The boot bands are non-reusable parts.
2. Remove the plastic boot.



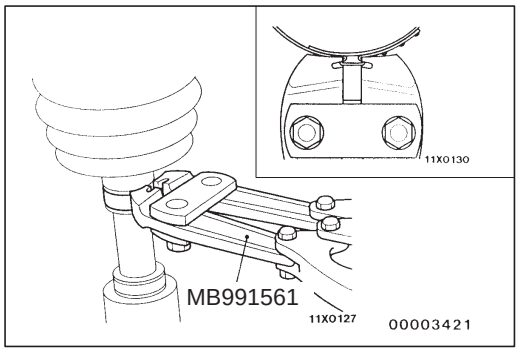
3. Position the plastic boot small end so that one drive shaft groove is visible.



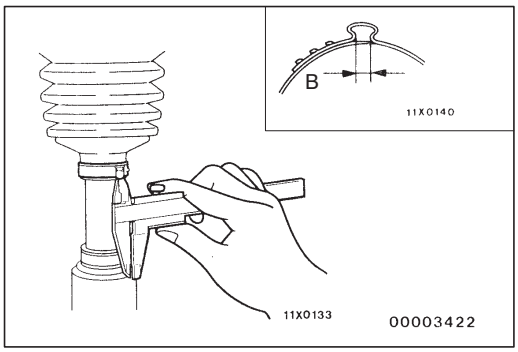
4. Turn the adjusting bolt of the special tool so that the opening distance (W) meets the standard value.
   Standard value (W): 2.9 mm
   <More than 2.9 mm>
   Tighten the adjusting bolt.
   <Less than 2.9 mm>
   Loosen the adjusting bolt
   NOTE
   (1) Turning the adjusting bolt changes the opening distance (W) by approx. 0.7 mm.
   (2) Do not turn the adjusting bolt more than one turn.



5. Butt the boot band (small) against the boot end projection so that a certain clearance (A) is obtained.



6. Use the special tool to crimp the boot band (small).
   Caution
   (1) Secure the drive shaft in an upright position and clamp the part of the B.J. boot band to be crimped securely in the jaws of the special tool.
   (2) Crimp the B.J. boot band until the special tool stopper closes.



7. Check that the crimping amount (B) of the B.J. boot band is at the standard value.

   Standard value (B): 2.4 – 2.8 mm

   <If the crimping amount is larger than 2.8 mm>
   Readjust the value of (W) in step 4 according to the following formula, and then repeat the operation in step 6.
   W = 5.5 mm – B
   Example: If B = 2.9 mm, then W = 2.6 mm.

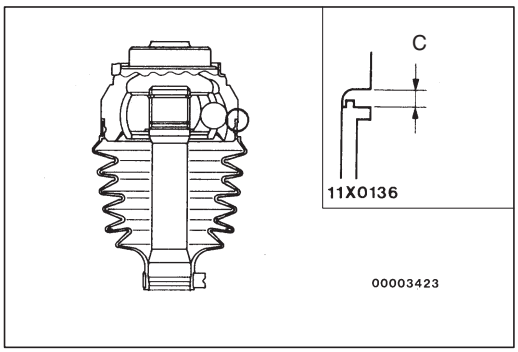
   <If the crimping amount is smaller than 2.4 mm>
   Remove the B.J. boot band, readjust the value of (W) in step 4 according to the following formula, and then repeat the operations in steps 5 and 6 using a new B.J. boot band.
   W = 5.5 mm – B
   Example: If B = 2.3 mm, then W = 3.2 mm.

8. Check that the B.J. boot band is not sticking out past the place where it has been installed.
   If the B.J. boot band is sticking out, remove it and then repeat the operations in steps 4 to 7 using a new B.J. boot band.

9. Fill the inside of the B.J. boot with the specified amount of the specified grease.

   Specified grease: Repair kit grease

   Amount to use:
   <A/T> 85 g (50 g for joint, 35 g for boot)
   <M/T> 110 g (55 g for joint, 55 g for boot)

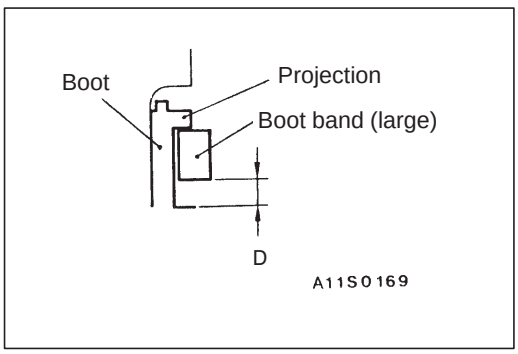


10. Position the boot so that the difference between the boot big end and the housing stepped part (C) meets the standard value.

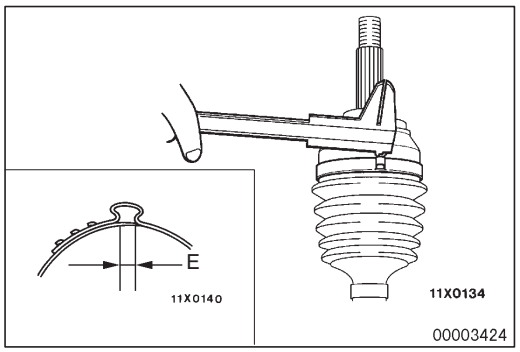
    Standard value (C) : 0.1 – 1.55 mm

11. Follow the same procedure as in step 4 to adjust the size of the opening (W) on the special tool so that it is at the standard value.

    Standard value (W): 3.2 mm



12. Place the B.J. boot band (large) against the projection at the edge of the boot, and then secure it so that there is a clearance left as shown by (D) in the illustration.
13. Use the special tool to crimp the B.J. boot band (large) in the same way as in step 6.



14. Check that the crimping amount (E) of the B.J. boot band is at the standard value.

    Standard value (E): 2.4 – 2.8 mm

    <If the crimping amount is larger than 2.8 mm>
    Readjust the value of (W) in step 11 according to the following formula, and then repeat the operation in step 13.
    W = 5.8 mm – E
    Example: If E = 2.9 mm, then W = 2.9 mm.

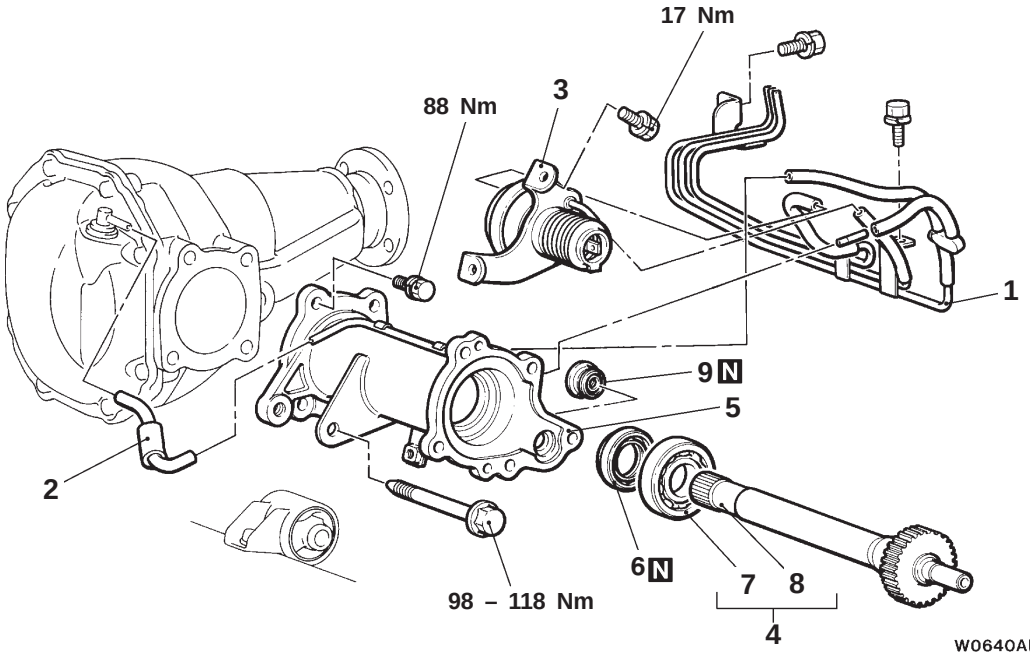
    <If the crimping amount is smaller than 2.4 mm>
    Remove the B.J. boot band, readjust the value of (W) in step 11 according to the following formula, and then repeat the operations in steps 12 and 13 using a new B.J. boot band.
    W = 5.8 mm – E
    Example: If E = 2.3 mm, then W = 3.5 mm.

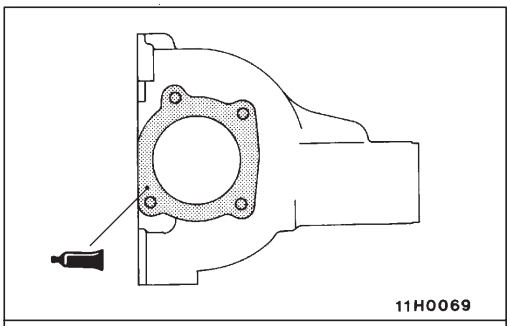
15. Check that the B.J. boot band is not sticking out past the place where it has been installed.
    If the B.J. boot band is sticking out, remove it and then repeat the operations in steps 12 to 14 using a new B.J. boot band.

MAIN SHAFT

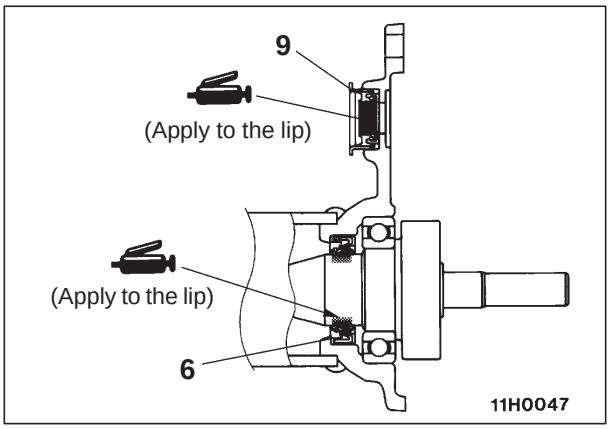
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Drive Shaft Removal and Installation (Refer to P.26-19.)
- Free-wheeling Clutch Housing Assembly Removal and Installation (Refer to P.26-45.)
- Gear Oil Draining and Refilling (Refer to P.26-11.)





Sealant:
3M ATD Part No.8661 or equivalent

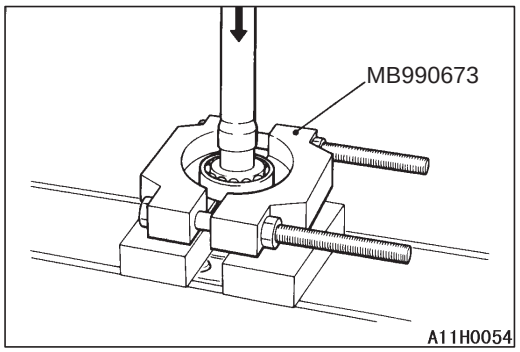


00009004

Removal steps

1. Vacuum pipe assembly
2. Vacuum hose assembly
3. Vacuum actuator assembly
4. Inner shaft assembly
5. Front housing assembly

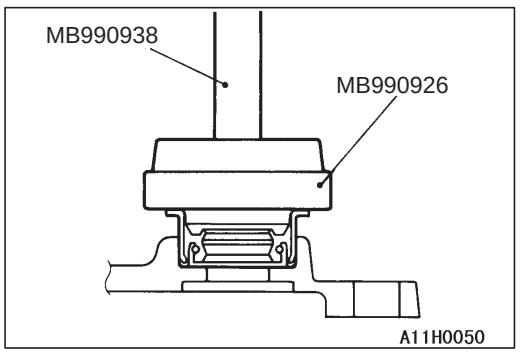
◀A▶ ▶C◀ 6. Oil seal
▶B◀ 7. Bearing
8. Main shaft
▶A◀ 9. Oil seal



REMOVAL SERVICE POINT

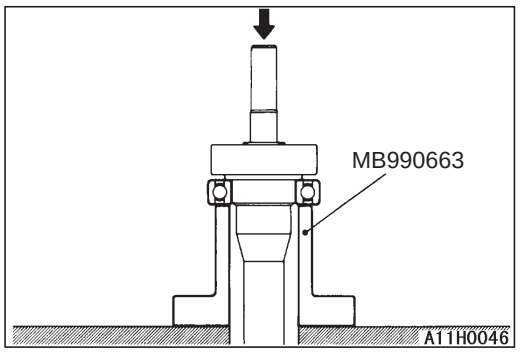
◀A▶ BEARING REMOVAL

Install the special tool as shown in the illustration, and use a press to drive out the bearing from the main shaft.

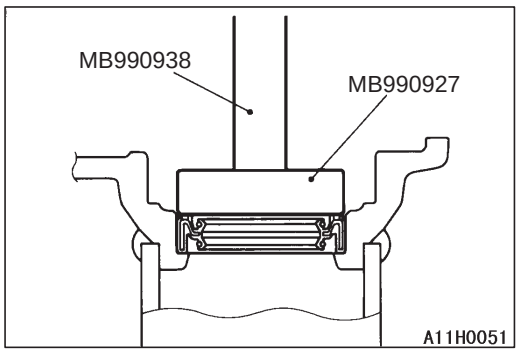


INSTALLATION SERVICE POINTS

▶A◀ OIL SEAL INSTALLATION



▶B◀ BEARING INSTALLATION



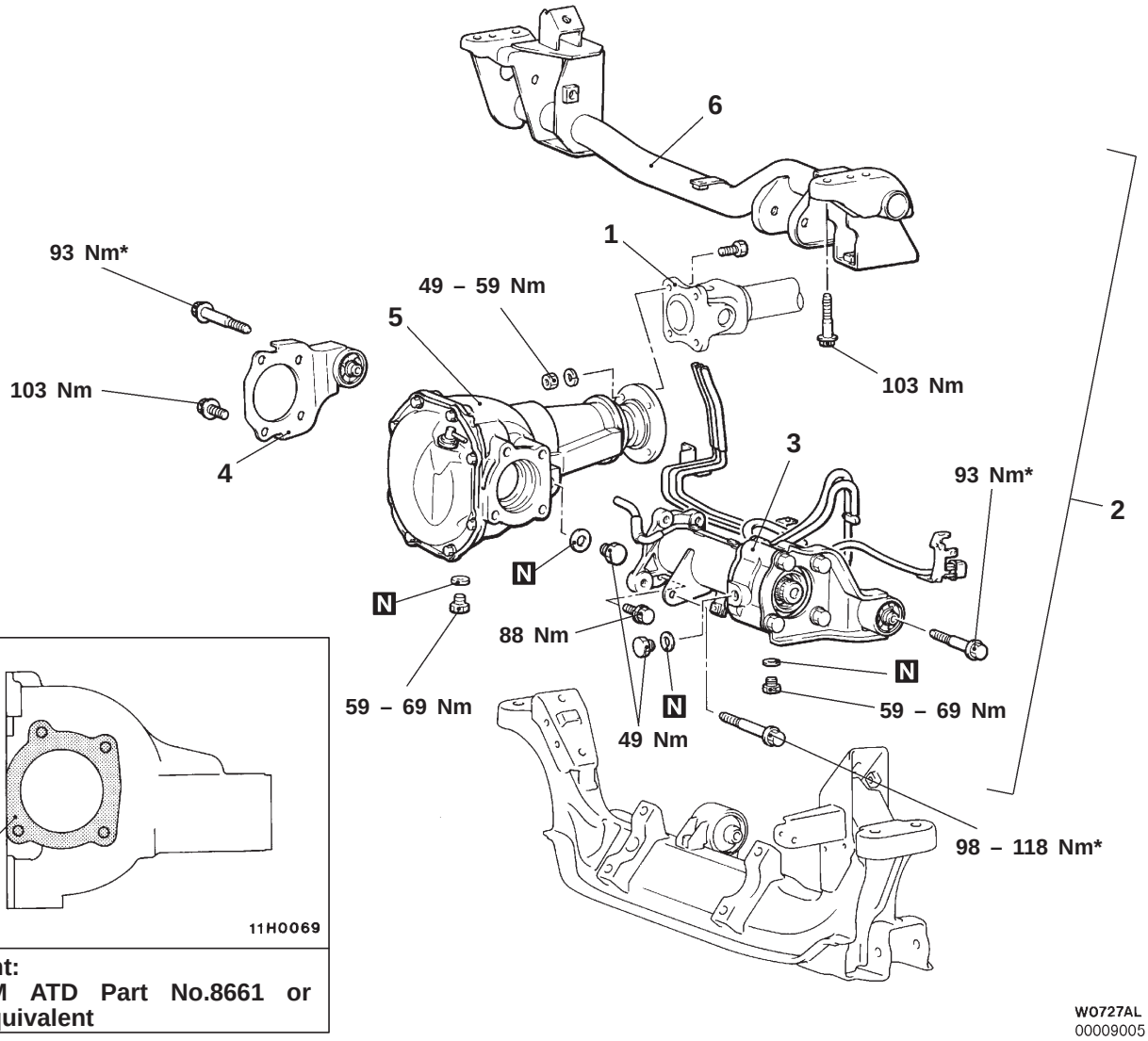
▶C◀ OIL SEAL INSTALLATION

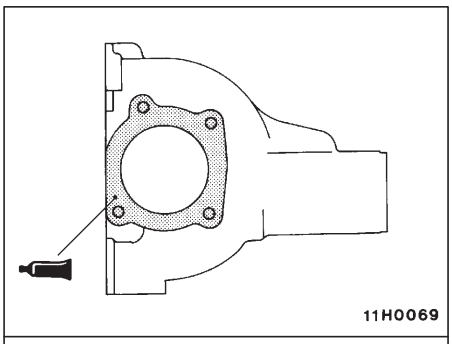
DIFFERENTIAL CARRIER

REMOVAL AND INSTALLATION

Caution
To prevent bushings from breakage, the parts indicated by * should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.

Pre-removal and Post-installation Operation
- Drive Shaft Removal and Installation (Refer to P.26-19.)
- Stabilizer Bar Removal and Installation (Refer to GROUP 33A.)
- Gear Oil Draining and Refilling (Refer to P.26-11.)

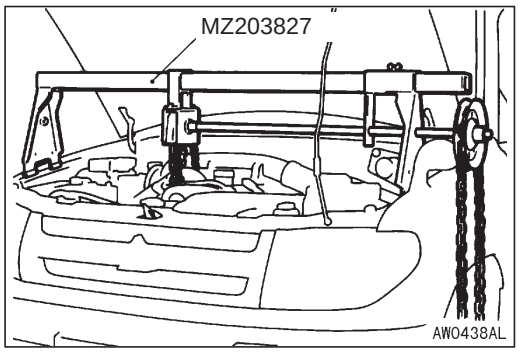




Sealant:
3M ATD Part No.8661 or equivalent

Removal steps

◀A▶ ● Support the Engine Assembly
1. Front propeller shaft connection
2. Front differential assembly and differential mount crossmember assembly
3. Free-wheeling clutch assembly
4. Differential mount bracket assembly <RH>
5. Differential carrier
6. Differential mount crossmember assembly

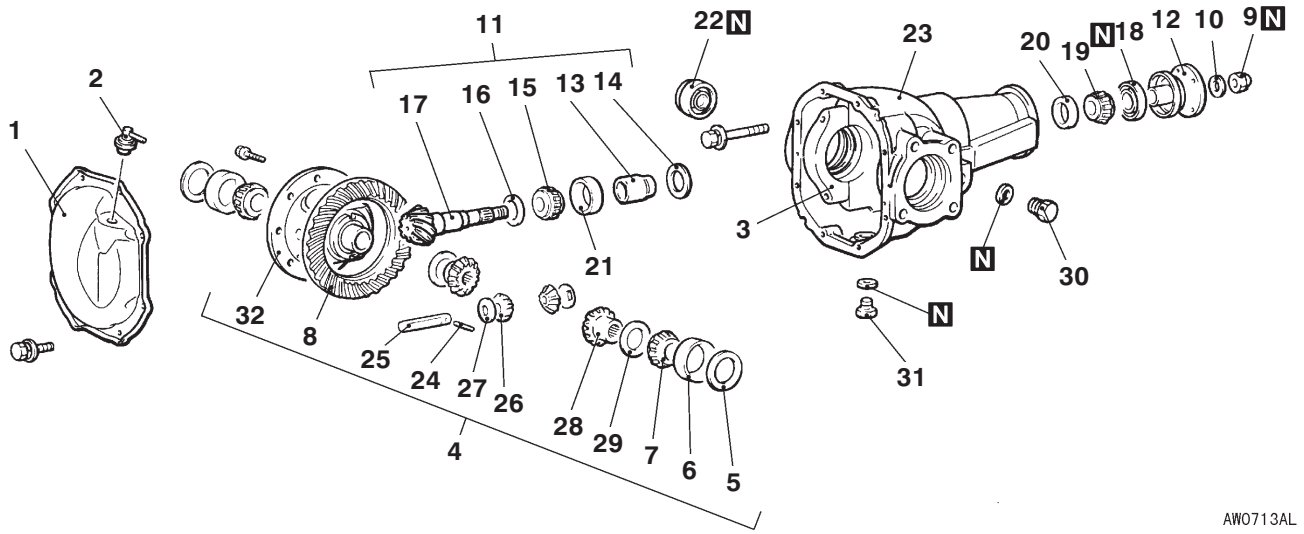


REMOVAL SERVICE POINT

◀A▶ ENGINE ASSEMBLY SUPPORT

Use the special tool to raise the engine assembly until the mount insulators are free from load.

DISASSEMBLY



Disassembly steps

- ● Inspection before disassembly
1. Cover
2. Vent plug
3. Bearing cap

◀A▶ 4. Differential case assembly

5. Side bearing spacer

◀B▶ 6. Side bearing outer race

◀C▶ 7. Side bearing inner race

◀D▶ 8. Drive gear

9. Self-locking nut

10. Washer

◀E▶ 11. Drive pinion assembly

12. Companion flange

13. Drive pinion spacer

14. Drive pinion rear shim (For drive pinion rotation torque adjustment)

◀F▶ 15. Drive pinion front bearing inner race

16. Drive pinion front shim (For drive pinion height adjustment)

17. Drive pinion

◀G▶ 18. Oil seal

◀G▶ 19. Drive pinion rear bearing inner race

◀G▶ 20. Drive pinion rear bearing outer race

◀H▶ 21. Drive pinion front bearing outer race

22. Oil seal

23. Differential carrier

◀I▶ 24. Lock pin

25. Pinion shaft

26. Pinion gear

27. Pinon washer

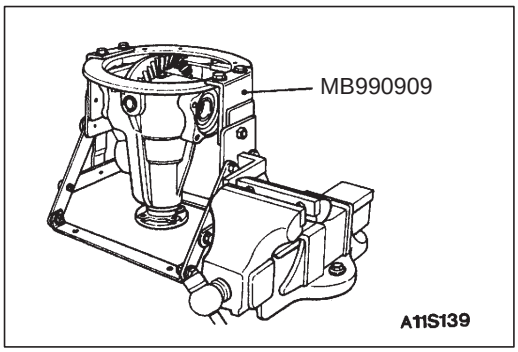
28. Side gear

29. Side gear spacer

30. Filler plug

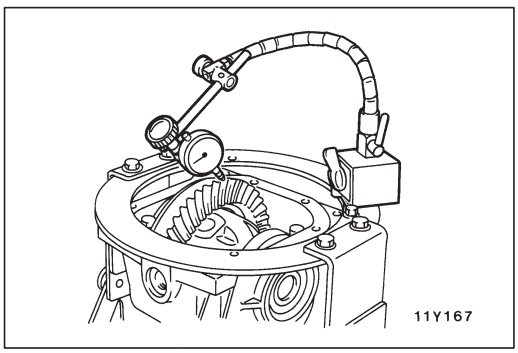
31. Drain plug

32. Differential case



INSPECTION BEFORE DISASSEMBLY

1. Remove the cover.
2. Hold the special tool in a vise, and install the differential carrier assembly to the special tool.

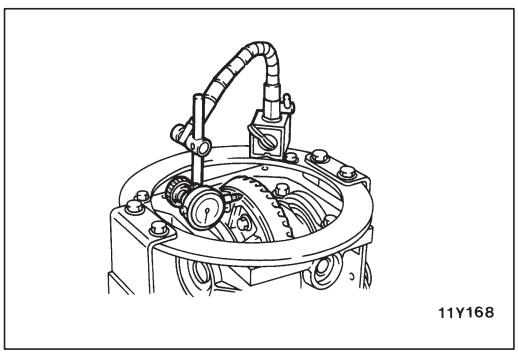


DRIVE GEAR BACKLASH

1. With the drive pinion locked in place, use a dial gauge to measure the drive gear backlash in four or more places on the drive gear.

   Standard value: 0.11 – 0.16 mm

2. If the backlash is not within the standard value, adjust the backlash of the final drive gear (Refer to P.26-42).
3. After adjustment, inspect the drive gear tooth contact.

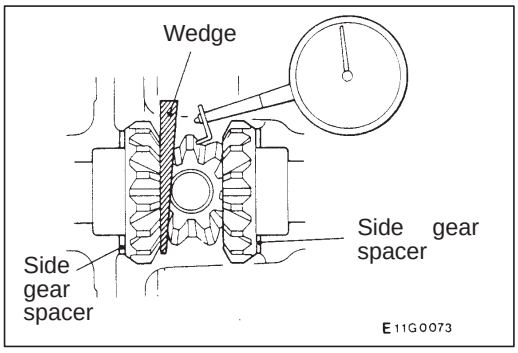


DRIVE GEAR RUNOUT

1. Measure the drive gear runout at the shoulder on the reverse side of the drive gear.

   Limit: 0.05 mm

2. When runout exceeds the limit value, check for foreign object between drive gear rear side and differential case, or for loose drive gear installation bolts.
3. When check (2) gives normal results, reposition drive gear and differential case and remeasure.
4. If adjustment is impossible, replace differential case, or replace drive gear and pinion as a set.



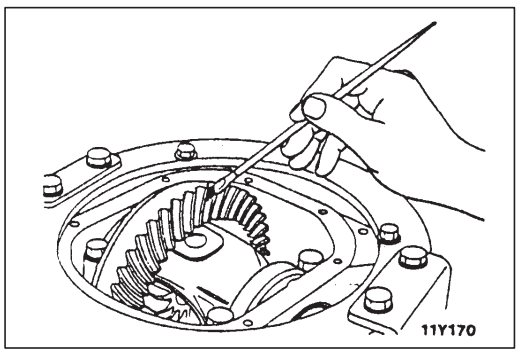
DIFFERENTIAL GEAR BACKLASH

1. While locking the side gear with the wedge, measure the differential gear backlash with a dial indicator on the pinion gear.

   Standard value: 0 – 0.076 mm
   Limit: 0.2 mm

   Repeat the same procedure for other pinion gear.

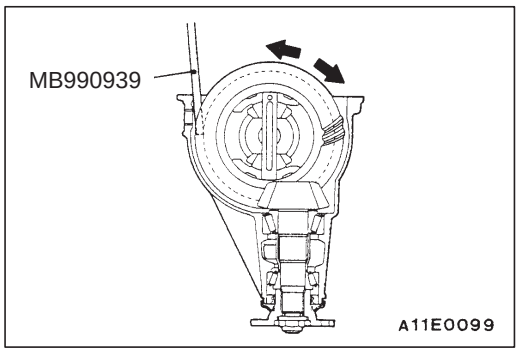
2. If the backlash exceeds the limit, adjust the differential gear backlash (Refer to P.26-41).
3. If adjustment is impossible, replace the side gear and pinion gear as a set.



DRIVE GEAR TOOTH CONTACT

Check the tooth contact of drive gear by following the steps below.

1. Apply a thin, uniform coat of machine blue to both surfaces of the drive gear teeth.

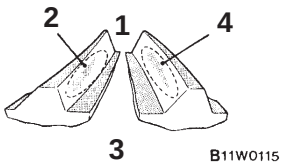


2. Insert the special tool between the differential carrier and the differential case, and then rotate the companion flange by hand (once in the normal direction, and then once in the reverse direction) while applying a load to the drive gear so that the revolution torque (approximately 2.5 – 2.9 Nm) is applied to the drive pinion.

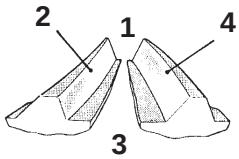
   Caution
   If the drive gear is rotated too much, the tooth contact pattern will become unclear and difficult to check.

3. Check the tooth contact condition of the drive gear and drive pinion.

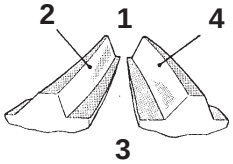
<table>
<tr><th>Standard tooth contact pattern</th><th>Problem</th><th>Solution</th></tr>
<tr><td rowspan="2">1 Narrow tooth side
2 Drive-side tooth surface (the side applying power during forward movement)
3 Wide tooth side
4 Coast-side tooth surface (the side applying power during reverse movement)

B11W0115</td><td>Tooth contact pattern resulting from excessive pinion height

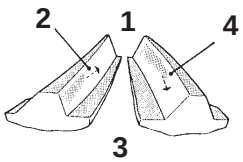
 

B11W0116

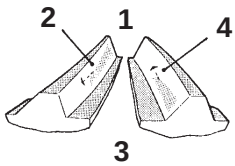
The drive pinion is positioned too far from the centre of the drive gear.</td><td> 

B11W0118

Increase the thickness of the drive pinion rear shim, and position the drive pinion closer to the centre of the drive gear. Also, for backlash adjustment, position the drive gear farther from the drive pinion.</td></tr>
<tr><td>Tooth contact pattern resulting from insufficient pinion height.

B11W0117

The drive pinion is positioned too close to the centre of the drive gear.</td><td> 

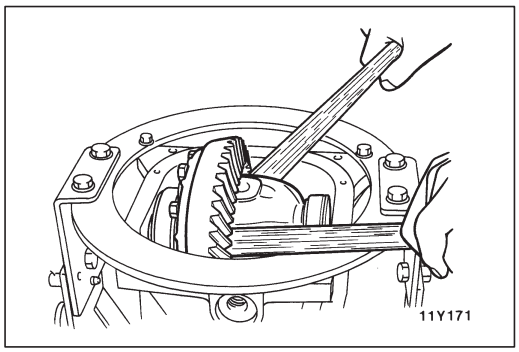
B11W0119

Decrease the thickness of the drive pinion rear shim, and position the drive pinion farther from the centre of the drive gear. Also, for backlash adjustment, position the drive gear closer to the drive pinion.</td></tr>
</table>

NOTE

Checking the tooth contact pattern is the way to confirm that the adjustments of the pinion height and backlash have been done properly. Continue to adjust the pinion height and backlash until the tooth contact pattern resembles the standard pattern.

If, even after adjustments have been made, the correct tooth contact pattern cannot be obtained, it means that the drive gear and the drive pinion have become worn beyond the allowable limit. Replace the gear set.



DISASSEMBLY SERVICE POINTS

◀A▶ DIFFERENTIAL CASE ASSEMBLY REMOVAL

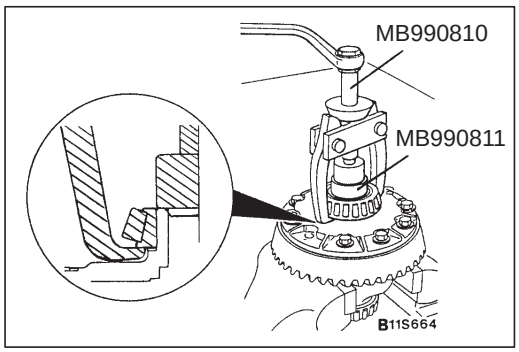
Remove the differential case assembly with a hammer handle or the like.

Caution

When taking out the differential case assembly, be careful not to drop and damage the side bearing outer races.

NOTE

Keep the right and left side bearing outer races and side bearing spacers separate, so that they do not become mixed at the time of reassembly.

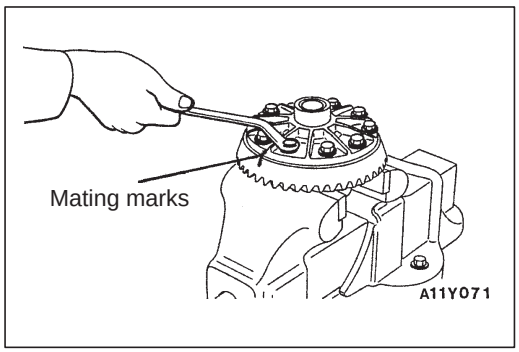


◀B▶ SIDE BEARING INNER RACE REMOVAL

NOTE

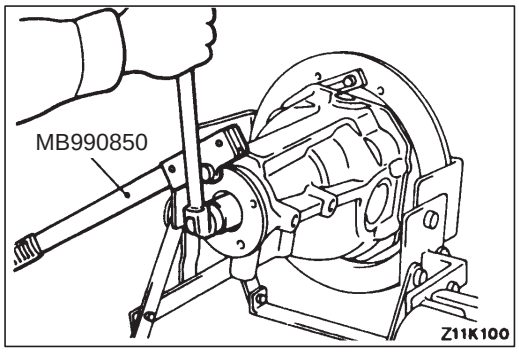
There are two notches provided (at the differential case side) for the jaws of the special tool; use the special tool at that position.

If the special tool jaws cannot be inserted between the differential case and the bearing inner race, file the jaw tips as necessary.

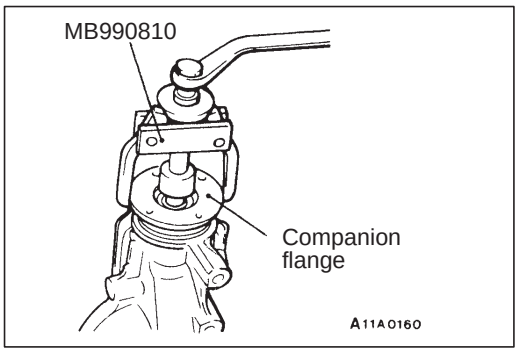


◀C▶ DRIVE GEAR REMOVAL

1. Make the mating marks on the differential case and the drive gear.
2. Loosen the drive gear attaching bolts in diagonal sequence to remove the drive gear.



◀D▶ SELF-LOCKING NUT REMOVAL

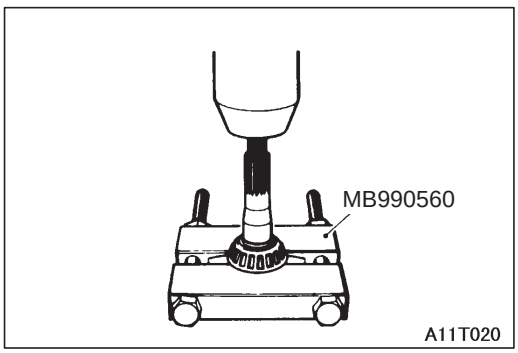


◀E▶ DRIVE PINION ASSEMBLY REMOVAL

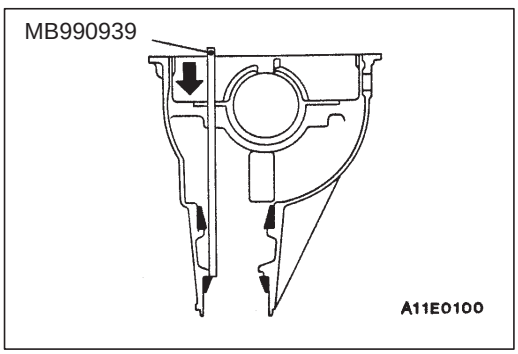
1. Make mating marks on the drive pinion and the companion flange.

   Caution
   The mating mark must not be on the coupling surface of the companion flange and the front propeller shaft.

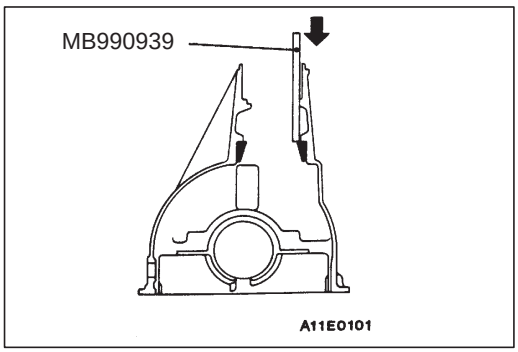
2. Use the special tool to drive out the drive pinion.



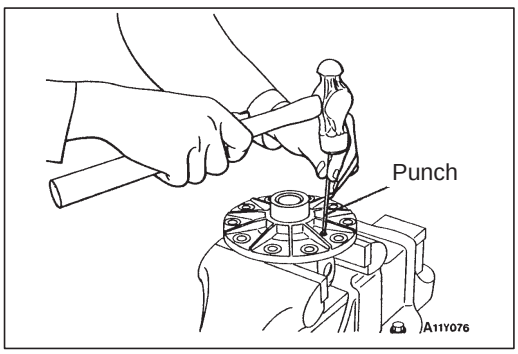
◀F▶ DRIVE PINION FRONT BEARING INNER RACE REMOVAL



◀G▶ OIL SEAL/DRIVE PINION REAR BEARING INNER RACE/DRIVE PINION REAR BEARING OUTER RACE REMOVAL

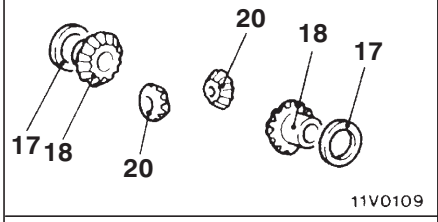


◀H▶ DRIVE PINION FRONT BEARING OUTER RACE REMOVAL

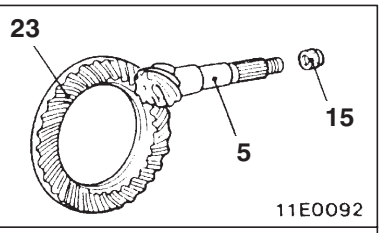


◀I▶ LOCK PIN DRIVE OUT

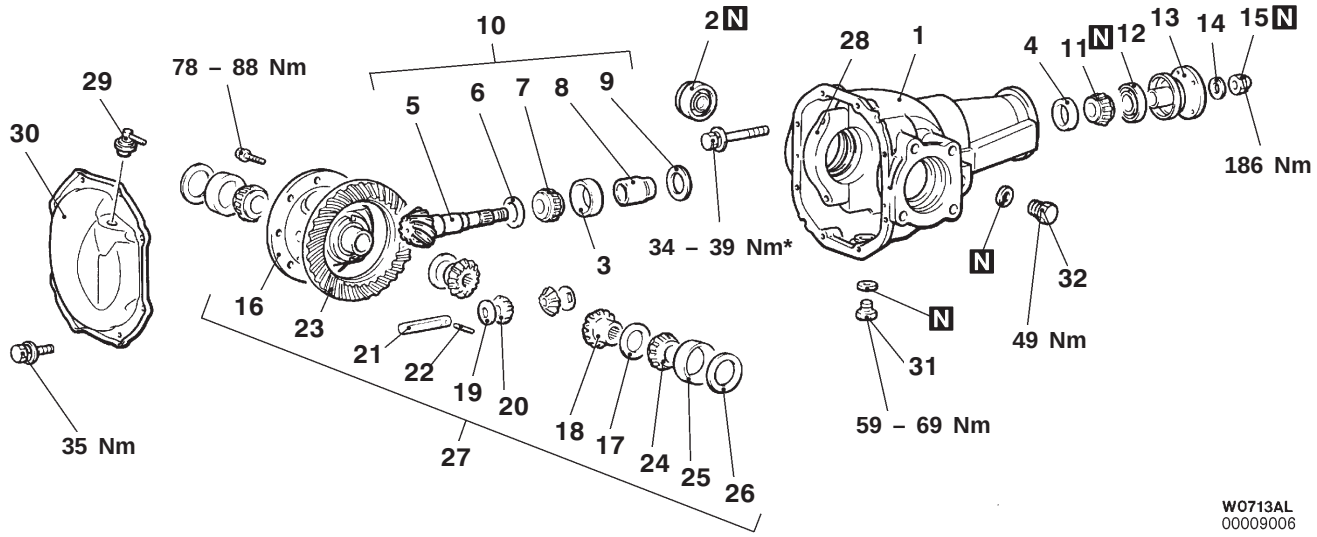
REASSEMBLY



Differential gear set



Final drive gear set

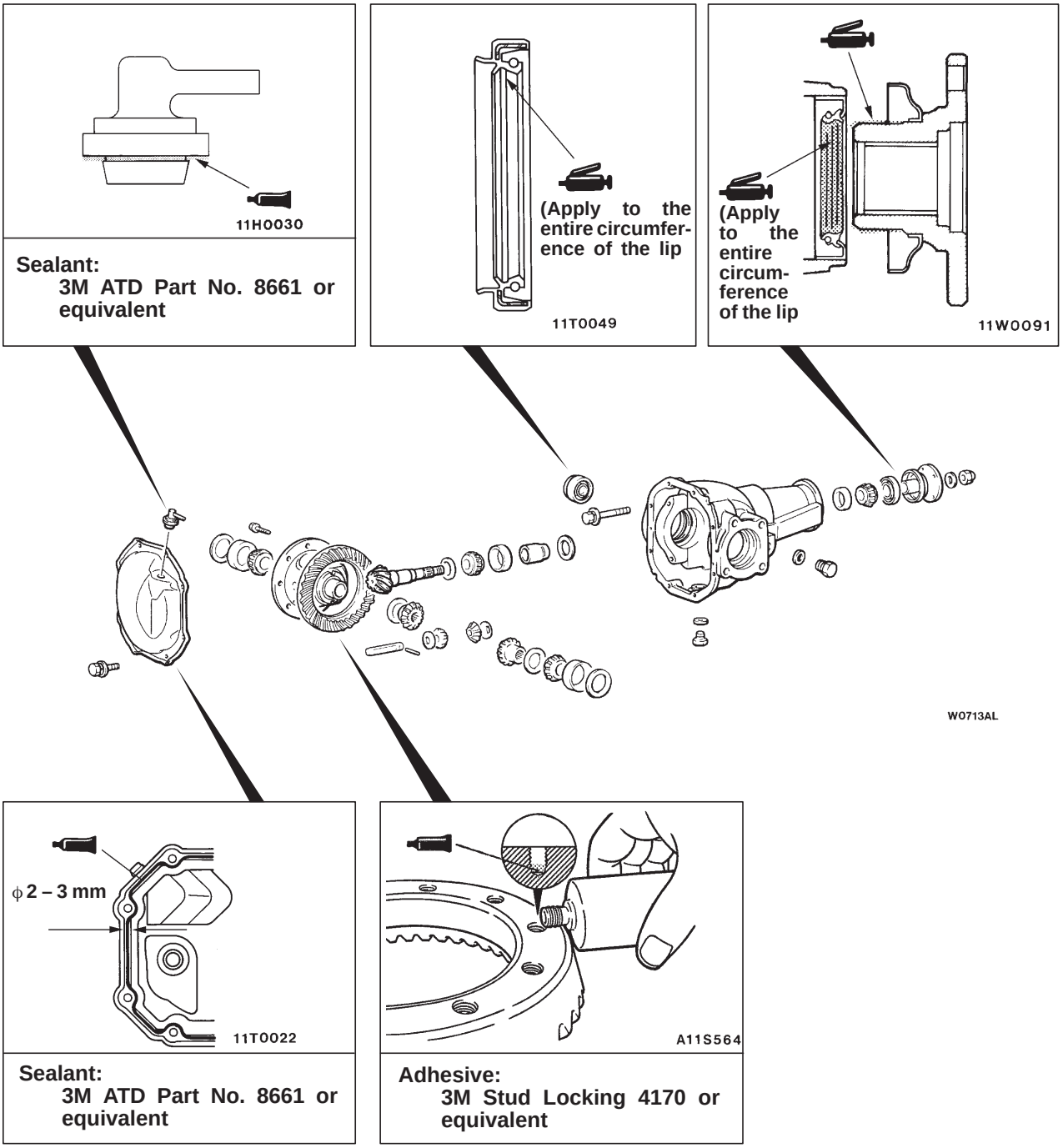


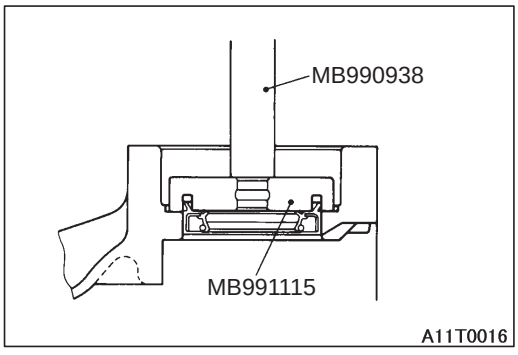
Reassembly steps

1. Differential carrier
- ▶A◀ 2. Oil seal
- ▶B◀ 3. Drive pinion front bearing outer race
- ▶C◀ 4. Drive pinion rear bearing outer race
- ▶D◀ ● Drive pinion height adjustment
5. Drive pinion
6. Drive pinion front shim (for drive pinion height adjustment)
7. Drive pinion front bearing inner race
8. Drive pinion spacer
- ▶E◀ ● Drive pinion rotation torque adjustment
9. Drive pinion rear shim (for drive pinion rotation torque adjustment)
10. Drive pinion assembly
11. Drive pinion rear bearing inner race
12. Oil seal
13. Companion flange
14. Washer
15. Self-locking nut
16. Differential case
- ▶F◀ ● Differential gear backlash adjustment
17. Side gear spacer
18. Side gear
19. Pinion washer
20. Pinion gear
21. Pinion shaft
- ▶G◀ 22. Lock pin
- ▶H◀ 23. Drive gear
- ▶I◀ 24. Side bearing inner race
25. Side bearing outer race
- ▶J◀ ● Final drive gear backlash adjustment
26. Side bearing spacer
27. Differential case assembly
28. Bearing cap
29. Vent plug
30. Cover
31. Drain plug
32. Filler plug

NOTE
The fasteners marked by * should be tightened when the differential gear oil is applied.

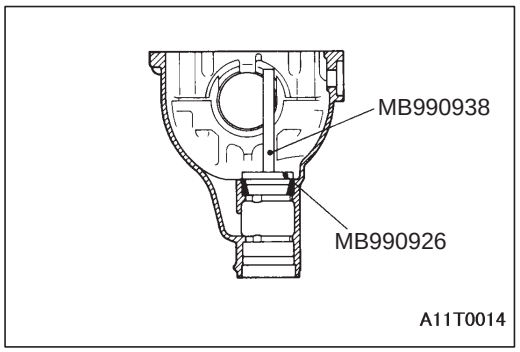
LUBRICATION, SEALANT AND ADHESIVE POINTS



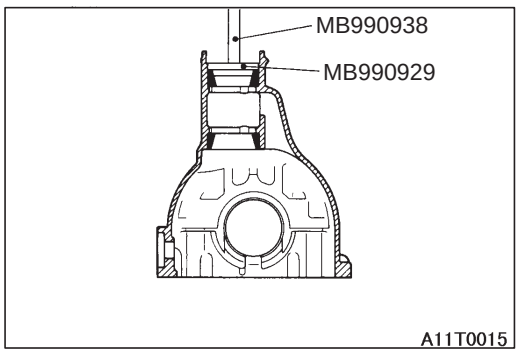


REASSEMBLY SERVICE POINTS

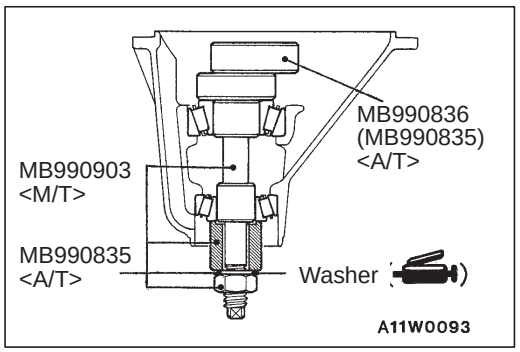
▶A◀ OIL SEAL INSTALLATION



▶B◀ DRIVE PINION FRONT BEARING OUTER RACE INSTALLATION



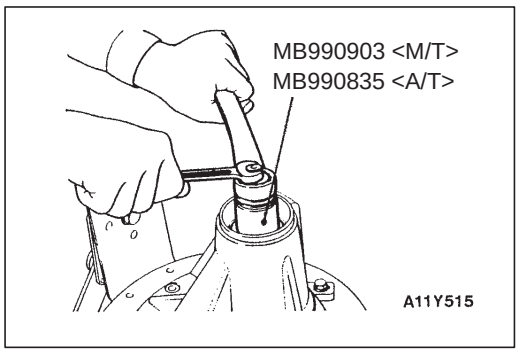
▶C◀ DRIVE PINION REAR BEARING OUTER RACE INSTALLATION



▶D◀ DRIVE PINION HEIGHT ADJUSTMENT

Adjust the drive pinion height by the following procedure.

1. Apply multipurpose grease to the washer of the special tool.
2. Install the special tool, drive pinion front and rear bearing inner races to the gear carrier.

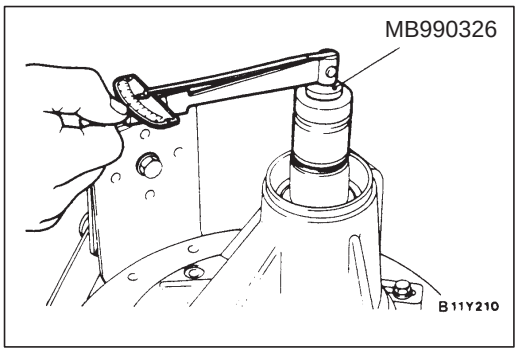


3. Tighten the nut of the special tool while measuring the rotation torque of the drive pinion. Gradually keep tightening the nut of the special tool until the rotation torque of the drive pinion (without oil seal) is at the standard value.

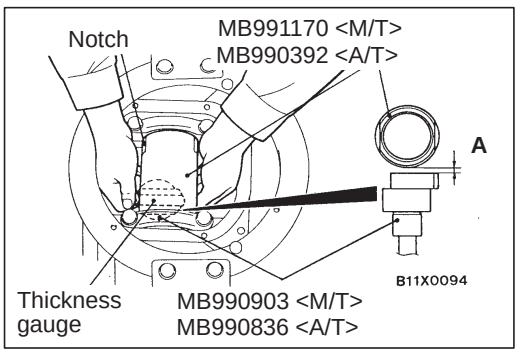
Standard value:

Bearing division	Bearing lubrication	Rotation torque Nm
New	None (With anti-rust agent)	0.88 – 1.17*1 0.29 – 0.49*2
New or reused	Gear oil applied	0.39 – 0.49*1 0.147 – 0.245*2

NOTE
*1: A/T
*2: M/T



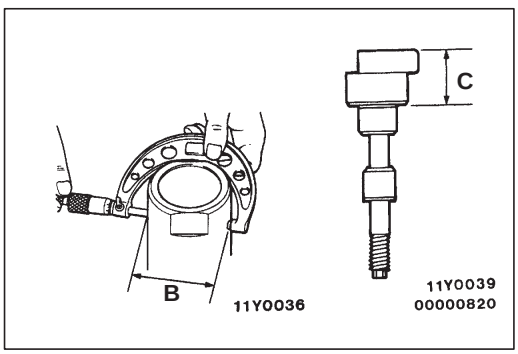
NOTE
The special tool cannot be turned a full revolution, so turn it several times within the range of movement to run in the bearing, and then measure the rotation torque.



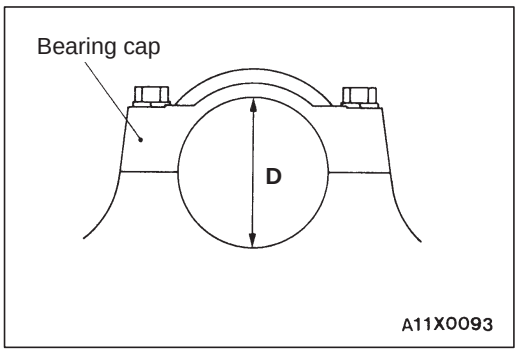
4. Clean the side bearing hub.
5. Install the special tools to the side bearing hub of the gear carrier, and then install the bearing cap.

NOTE
Always check that the notch is in the shown position and that the special tools are touching firmly against the side bearing hub.

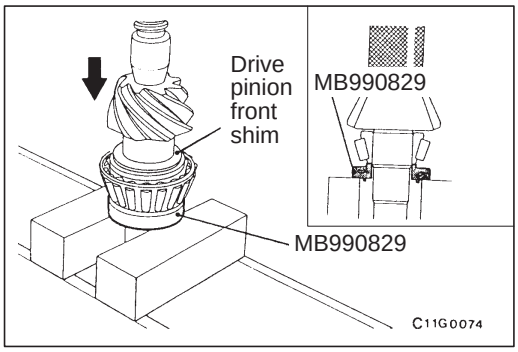
6. Use a thickness gauge to measure the clearance (A) between the special tools.



7. Remove the special tools.
8. Use a micrometer to measure the special tool in the places (B, C) shown in the illustration.



9. Install the bearing cap, and then use a cylinder gauge and micrometer to measure the inside diameter (D) of the bearing cap as shown in the illustration.
10. Calculate the thickness (E) of the required drive pinion front shim by the following formula, and then select a shim which most closely matches this thickness.
E = A + B + C–1/2D–86.0



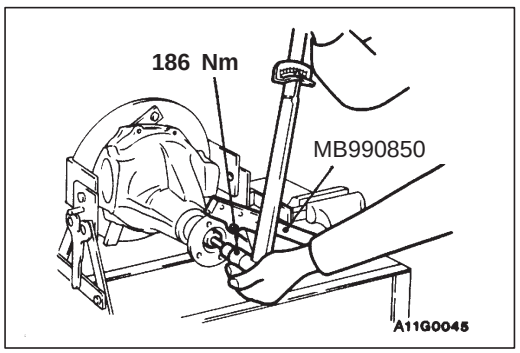
11. Fit the selected drive pinion front shim(s) to the drive pinion, and press-fit the drive pinion front bearing inner race by using the special tool.

▶E◀ DRIVE PINION ROTATION TORQUE ADJUSTMENT

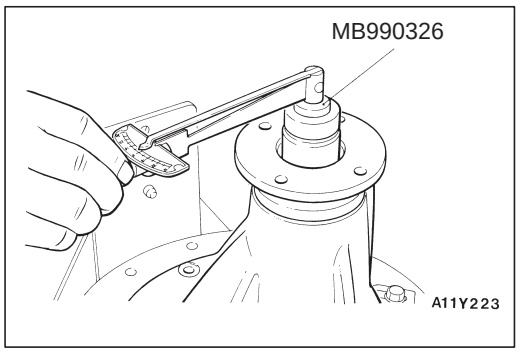
Adjust the drive pinion rotation torque by using the following procedure:

1. Insert the drive pinion into the gear carrier, and then install the drive pinion spacer, the drive pinion rear shim, the drive pinion rear bearing inner race, and the companion flange in that order.

   NOTE
   Do not install the oil seal.



2. Use the special tool to hold companion flange, and then tighten the self-locking nut to the specified torque.

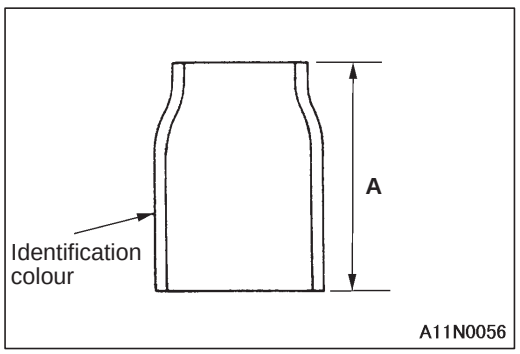


3. Measure the drive pinion rotation torque (without the oil seal) by using the special tool.

   Standard value:

Bearing division	Bearing lubrication	Rotation torque Nm
New	None (With anti-rust agent)	0.88 – 1.17*1 0.29 – 0.49*2
New/reused	Gear oil applied	0.39 – 0.49*1 0.147 – 0.245*2

   NOTE
   *1: A/T
   *2: M/T

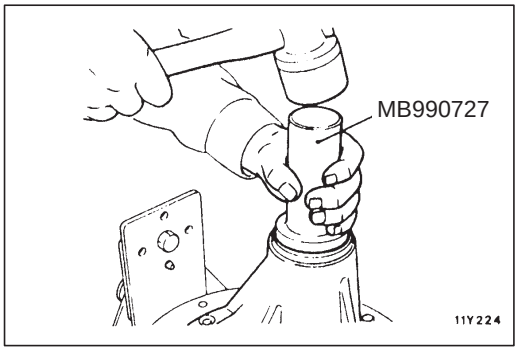


4. If the drive pinion rotation torque is not within the range of the standard value, adjust it by replacing the drive pinion rear shim(s) or the drive pinion spacer.

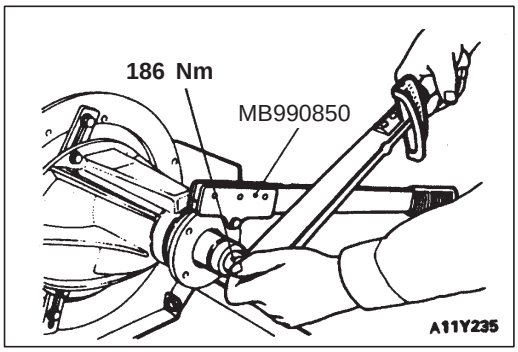
   NOTE
   When selecting the drive pinion rear shims, if the number of shims is large, reduce the number of shims to a minimum by selecting the drive pinion spacers. Also, select the drive pinion spacer from the following two types.

Drive pinion spacer height (A) mm	Identification colour
46.67*1	White
47.01*1	–
57.72*2	–
57.08*2	Red

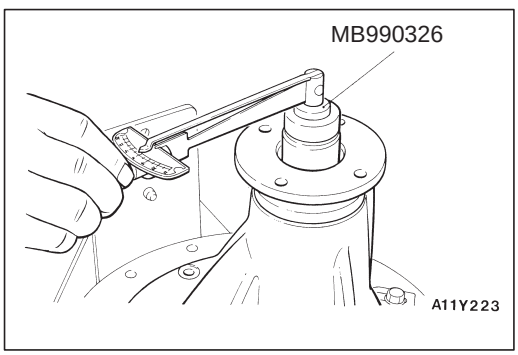
NOTE
*1: M/T
*2: A/T



5. Remove the companion flange and drive pinion again. Then, after inserting the drive pinion rear bearing inner race into the gear carrier, use the special tool to press-fit the oil seal.



6. Install the drive pinion assembly and companion flange with mating marks properly aligned, and use the special tool to hold the companion flange, and then tighten the self-locking nut to the specified torque.



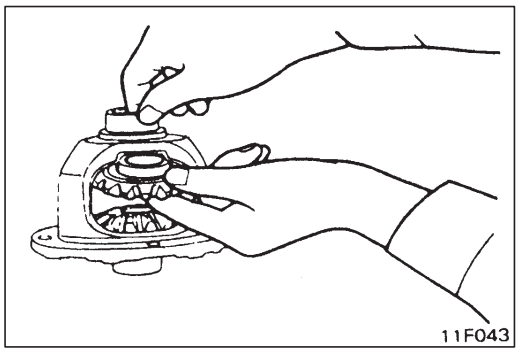
7. Measure the drive pinion rotation torque (with the oil seal) by using the special tool.

Standard value:

Bearing division	Bearing lubrication	Rotation torque Nm
New	None (With anti-rust agent)	0.98 – 1.27*1 0.49 – 0.69*2
New/reused	Gear oil applied	0.49 – 0.58*1 0.343 – 0.441*2

NOTE
*1: A/T
*2: M/T

8. If the drive pinion rotation torque is not within the standard value, check the tightening torque of the companion flange self-locking nut and the oil seal installation condition.

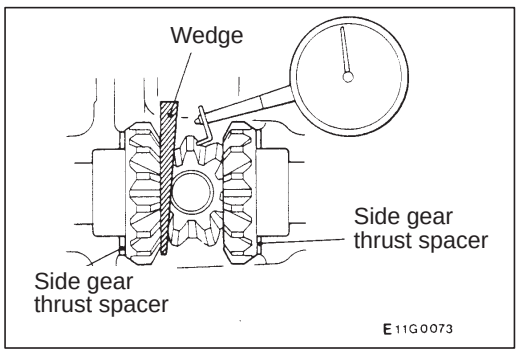


▶F◀ DIFFERENTIAL GEAR BACKLASH ADJUSTMENT

Follow the procedures below to adjust the differential gear backlash.

1. Assemble the side gears, side gear spacers, pinion gears and pinion washers into the differential case.
2. Temporarily install the pinion shaft.

   NOTE
   Do not drive in the lock pin yet.

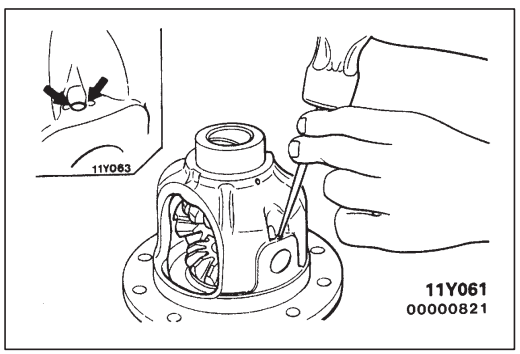


3. Insert a wedge between the side gear and the pinion shaft to lock the side gear.
4. Measure the differential gear backlash with a dial indicator on the pinion gear.

   Standard value: 0 – 0.076 mm

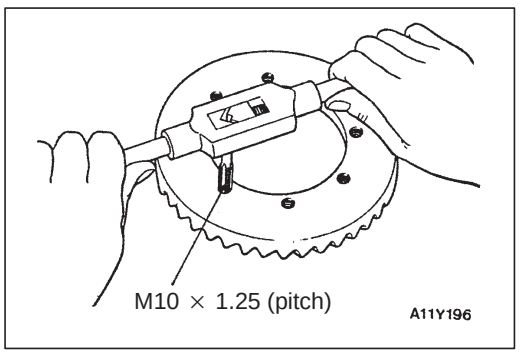
   Limit: 0.2 mm

   Repeat the steps above for the other pinion gear.
5. If the differential gear backlash exceeds the limit, adjust the backlash by changing the side gear spacers.
6. If adjustment is not possible, replace the side gears and pinion gears as a set.
7. Confirm that the differential gear backlash is correct, and that the differential gear turns smoothly.



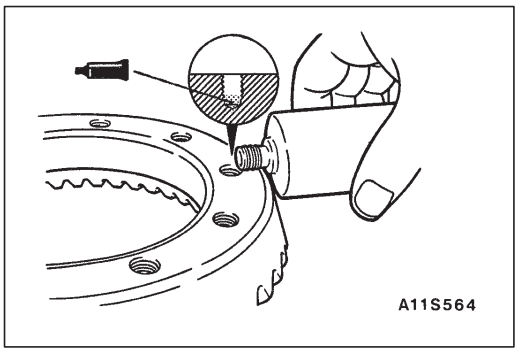
▶G◀ LOCK PIN INSTALLATION

1. Align the pinion shaft lock pin hole with the differential case lock pin hole, and drive in the lock pin.
2. Stake the lock pin with a punch at two points.



▶H◀ DRIVE GEAR INSTALLATION

1. Clean the drive gear attaching bolts.
2. Remove the adhesive adhered to the threaded holes of the drive gear by turning a tap (M10 x 1.25), and then clean the threaded holes by applying compressed air.

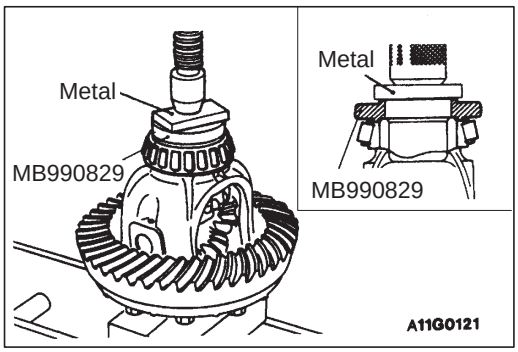


3. Clean the drive gear attaching surface, and then apply the specified adhesive to the threaded holes of the drive gear.

   Specified sealant:
   3M Stud Locking 4170 or equivalent

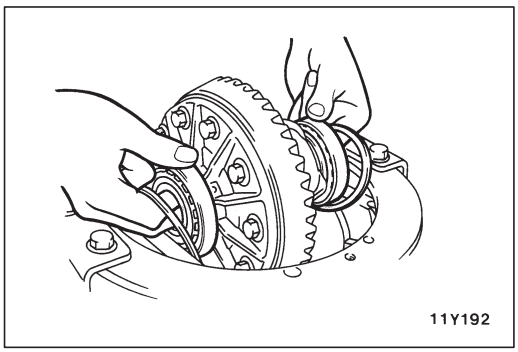
4. Install the drive gear onto the differential case with the mating marks properly aligned.
5. Tighten the drive gear attaching bolts provisionally, and then tighten them to the specified torque in a diagonal sequence.

   Tightening torque: 78 – 88 Nm



▶I◀ SIDE BEARING INNER RACE INSTALLATION

Use the special tool to press the side bearing inner race into the differential case.

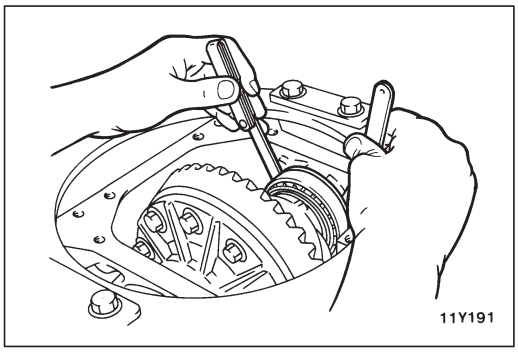


▶J◀ DRIVE GEAR BACKLASH ADJUSTMENT

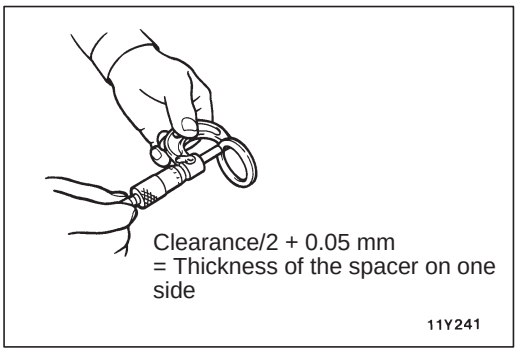
Adjust the drive gear backlash by the following procedures:

1. Install the side bearing spacers, which are thinner than those removed, to the side bearing outer races, and then mount the differential case assembly into the gear carrier.

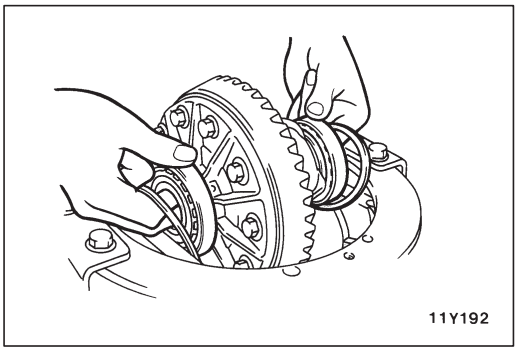
   NOTE
   Select side bearing spacers with the same thickness for both the drive gear sides.



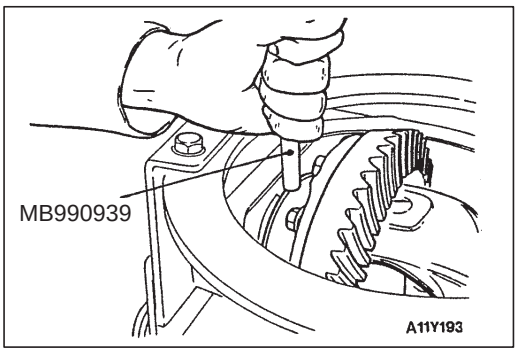
2. Push the differential case assembly to one side, and measure the clearance between the gear carrier and the side bearing spacer with a thickness gauge.



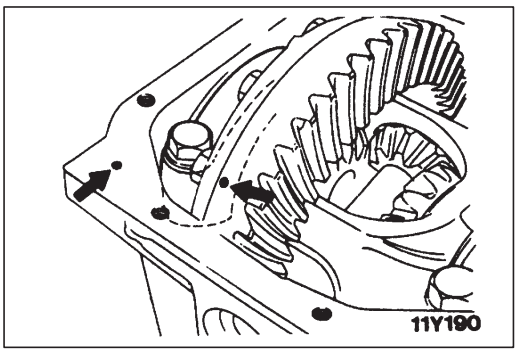
3. Measure the thickness of the side bearing spacers on one side, select two pairs of spacers which correspond to that thickness plus one half of the clearance plus 0.05 mm, and then install one pair each to the drive pinion side and the drive gear side.



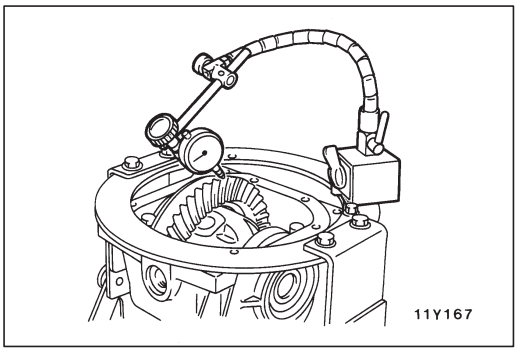
4. Install the selected side bearing spacers and differential case assembly, as shown in the illustration, to the gear carrier.



5. Tap the side bearing spacers with the special tool to fit them to the side bearing outer race.



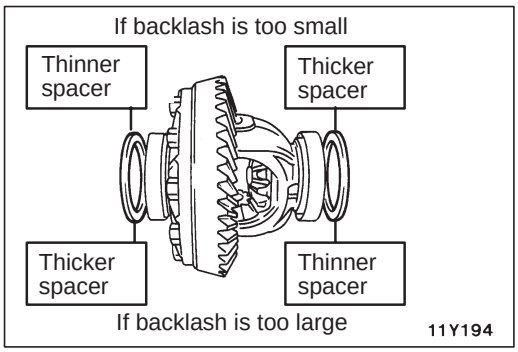
6. Align the mating marks on the gear carrier and the bearing cap, and then tighten the bearing cap.



7. With the drive pinion locked in place, measure the drive gear backlash with a dial indicator on the drive gear.

   NOTE
   Measure at four points or more on the circumference of the drive gear.

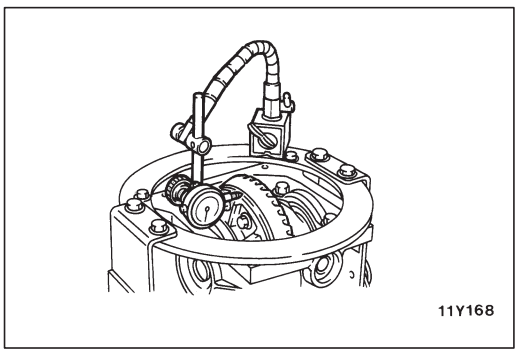
   Standard value: 0.11 – 0.16 mm



8. Change the side bearing spacers as illustrated, and then adjust the drive gear backlash.

   NOTE
   When increasing the number of side bearing spacers, decrease the same number of the side bearing spacers for opposite side.

9. Check the drive gear and drive pinion for tooth contact. If poor contact is evident, make adjustment. (Refer to P. 26-31.)



10. Measure the drive gear runout at the shoulder on the reverse side of the drive gear.

    Limit: 0.05 mm

11. If the drive gear runout exceeds the limit, reinstall by changing the phase of the drive gear and differential case, and remeasure.
12. If adjustment is not possible, replace the differential case or replace the drive gear and drive pinion as a set.

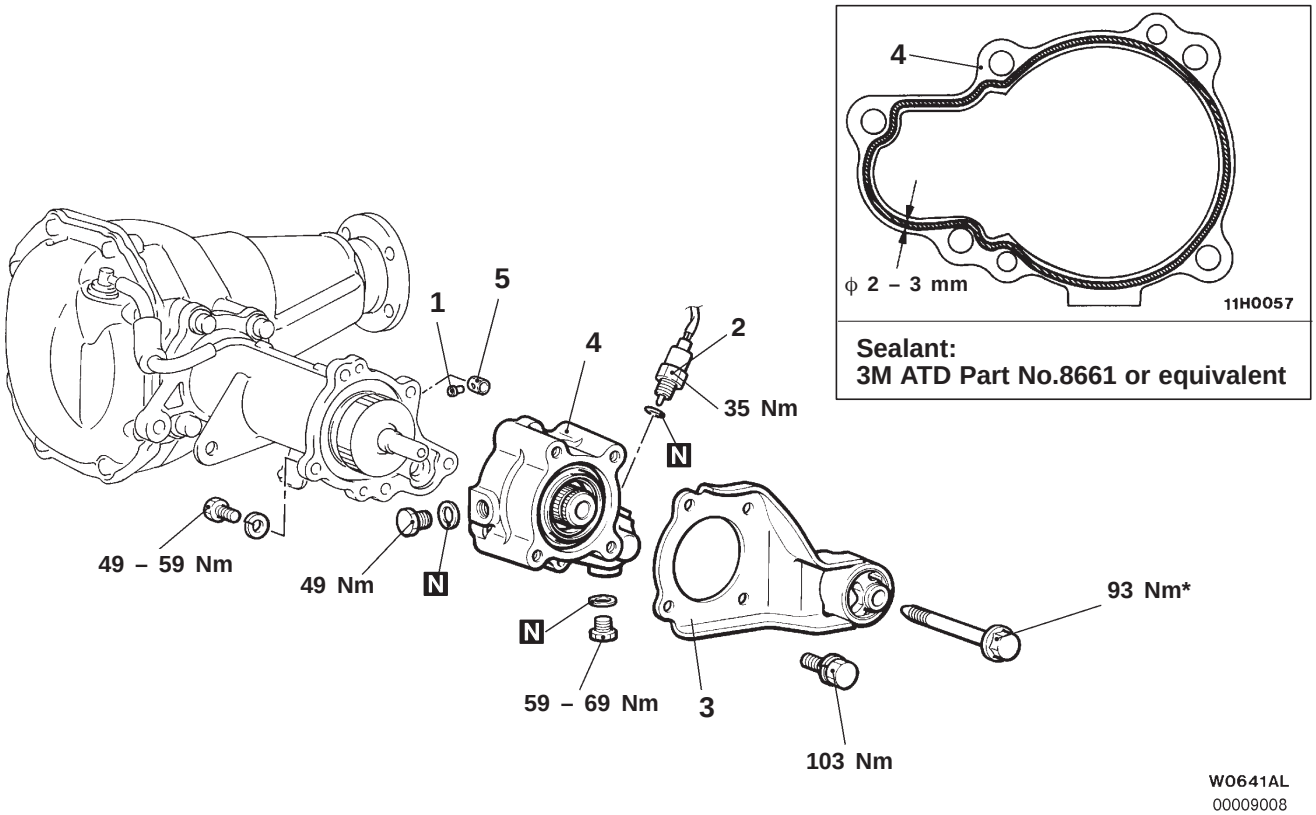
FREE-WHEELING CLUTCH ASSEMBLY

REMOVAL AND INSTALLATION

Caution

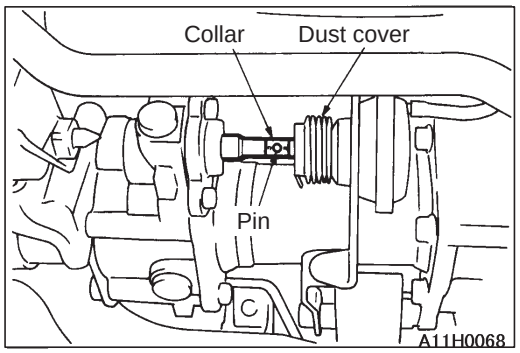
To prevent bushings from breakage, the parts indicated by * should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.

Pre-removal and Post-installation Operation
- Gear Oil Draining and Refilling (Refer to P.26-11.)
- Drive Shaft Removal and Installation (Refer to P.26-19.)



Removal steps

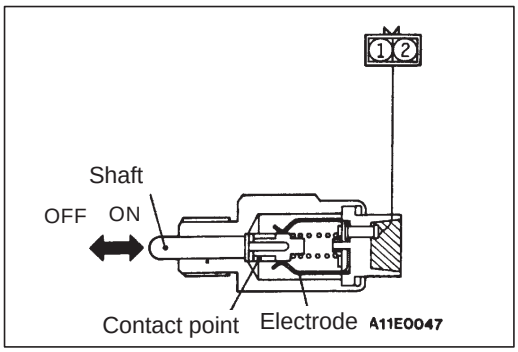
◀A▶ 1. Pin
2. Free-wheeling engage switch assembly
3. Differential mount bracket assembly <LH>
4. Free-wheeling clutch housing assembly
5. Collar



REMOVAL SERVICE POINT

◀A▶ PIN REMOVAL

1. Remove the one side of the dust cover from the vacuum actuator assembly.
2. Align the pin with the pin hole of the collar, and then drive out the pin with a punch.

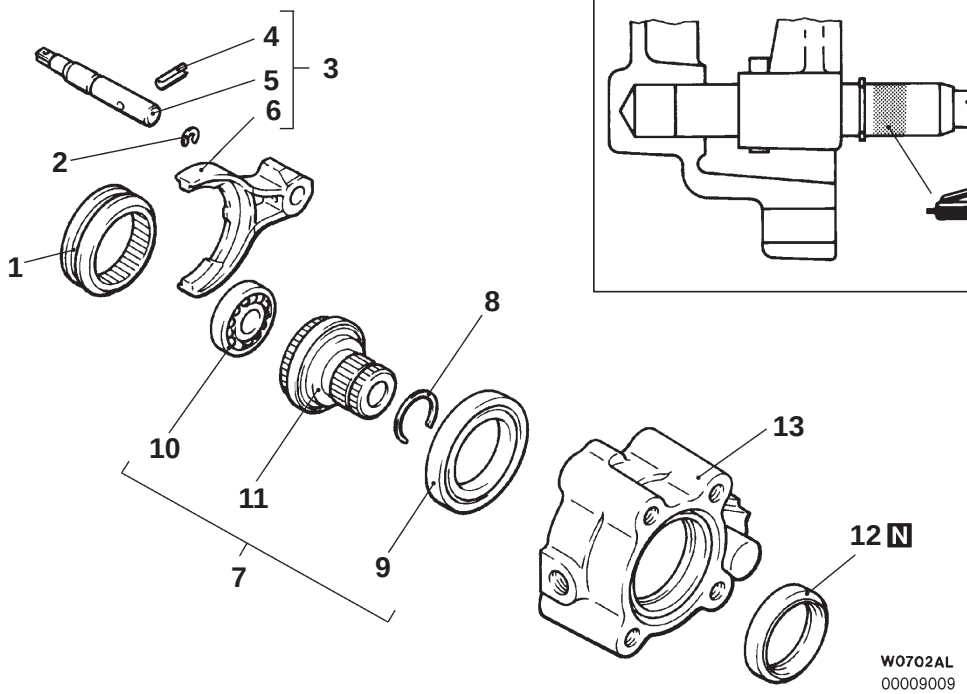


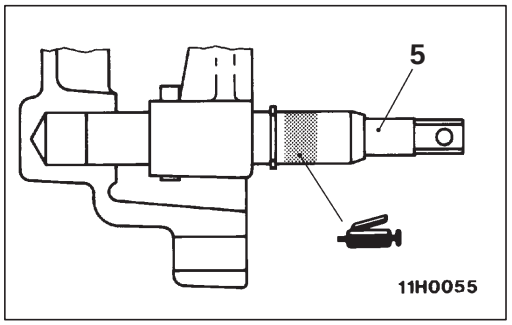
INSPECTION

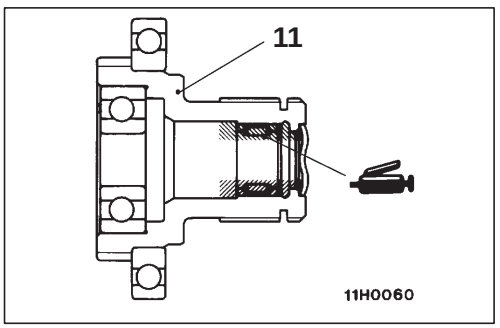
FREE-WHEELING ENGAGE SWITCH CONTINUITY CHECK

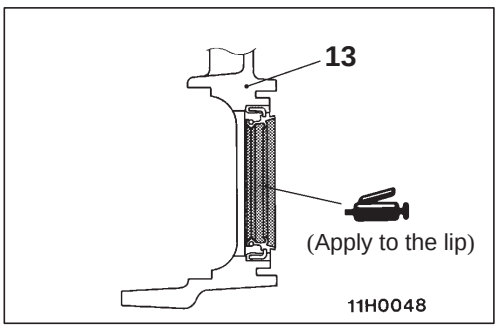
Shaft (switch) position	Terminal number	
	1	2
Pushed (ON)	○	○
Released (OFF)		

DISASSEMBLY AND REASSEMBLY



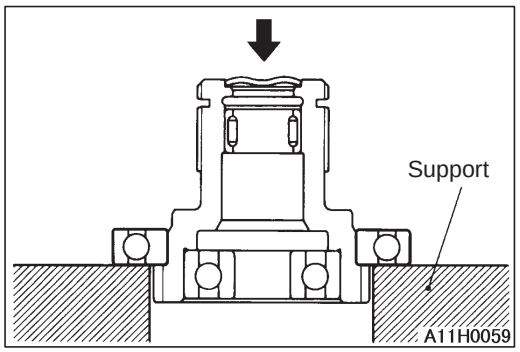






Disassembly steps

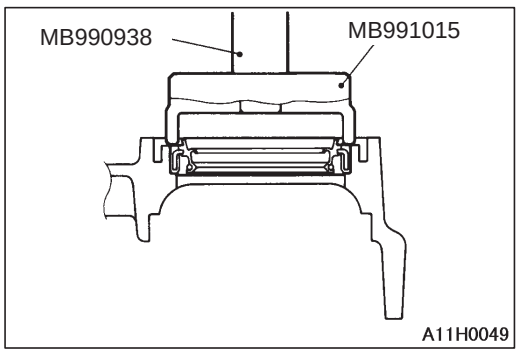
- ▶D◀ 1. Clutch sleeve
- 2. Snap ring
- 3. Shift fork assembly
- ▶C◀ 4. Spring pin
- 5. Shift rod
- 6. Shift fork
- 7. Clutch gear assembly
- 8. Circlip
- ◀A▶ ▶B◀ 9. Bearing
- 10. Bearing
- 11. Clutch gear
- ▶A◀ 12. Oil seal
- 13. Free-wheeling clutch housing



DISASSEMBLY SERVICE POINT

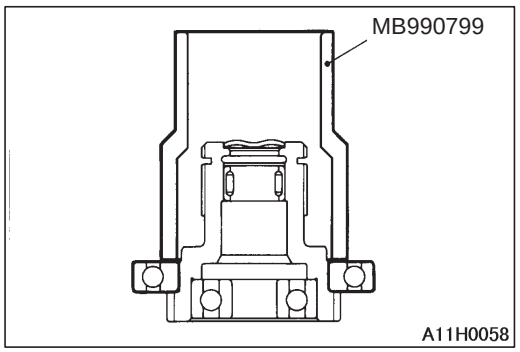
◀A▶ BEARING REMOVAL

Position the bearing inner race on a support. Then use a press to separate the clutch gear from the bearing.



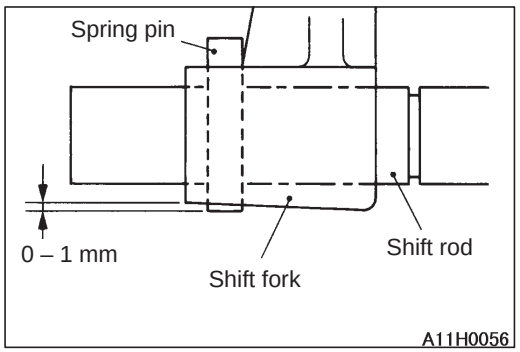
REASSEMBLY SERVICE POINTS

▶A◀ OIL SEAL INSTALLATION



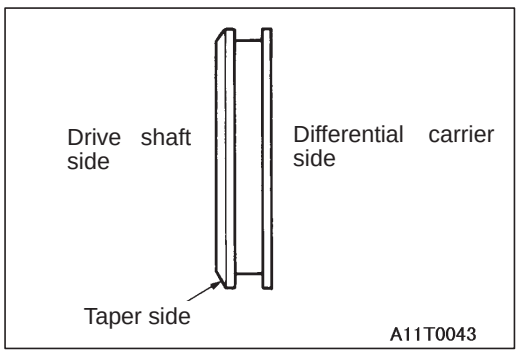
▶B◀ BEARING INSTALLATION

Use the special tool to press-fit the bearing to the shoulder of the clutch gear.



▶C◀ SPRING PIN INSTALLATION

Insert the spring pin into the pin hole (with chamfered surface) of the shift rod, and then tap the spring pin in as shown in the illustration.

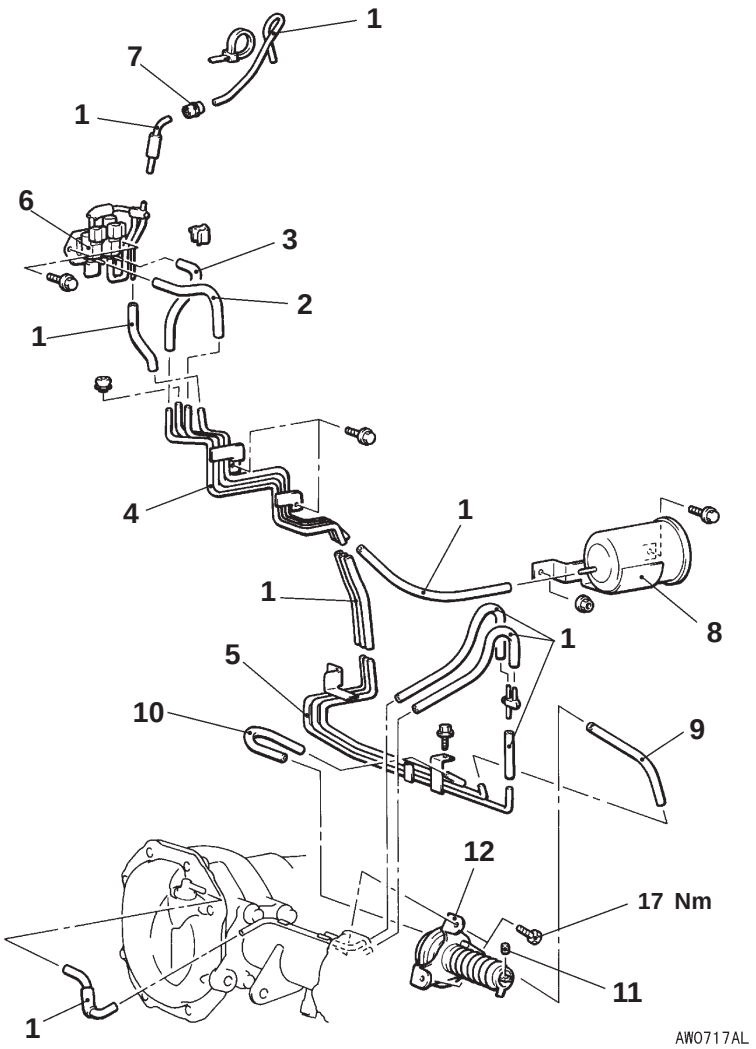


▶D◀ CLUTCH SLEEVE INSTALLATION

Face the clutch sleeve tapered side towards the drive shaft to install the clutch sleeve.

SOLENOID VALVE, VACUUM PIPES AND VACUUM TANK

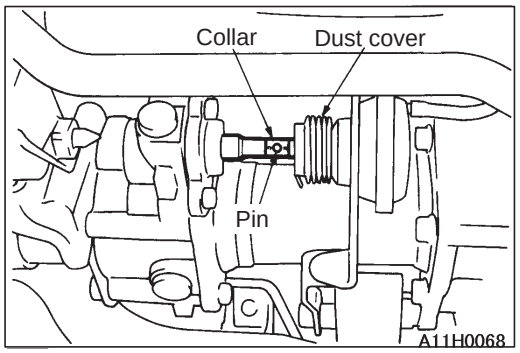
REMOVAL AND INSTALLATION



1. Vacuum hose
▶A◀ 2. Vacuum hose <blue stripe>
▶A◀ 3. Vacuum hose <yellow stripe>
4. Vacuum pipe assembly
5. Vacuum pipe assembly
6. Solenoid valve assembly
▶B◀ 7. Check valve
8. Vacuum tank assembly

Vacuum actuator assembly removal steps

▶A◀ 9. Vacuum hose <blue stripe> connection
▶A◀ 10. Vacuum hose <yellow stripe> connection
◀A▶ 11. Pin
12. Vacuum actuator assembly



REMOVAL SERVICE POINT

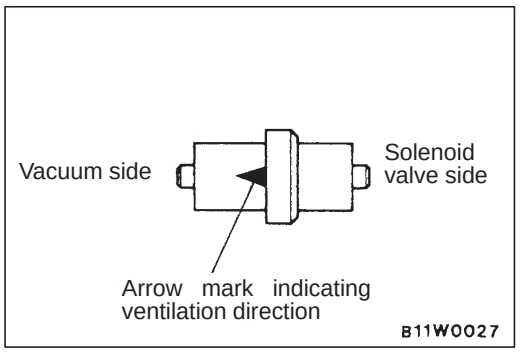
◀A▶ PIN REMOVAL

1. Remove the one side of the dust cover from the vacuum actuator assembly.
2. Align the pin with the pin hole of the collar, and then drive out the pin with a punch.

INSTALLATION SERVICE POINTS

▶A◀ VACUUM HOSE INSTALLATION

Connect the vacuum hoses, the solenoid valve and the vacuum pipes according to their identification colours.



▶B◀ CHECK VALVE INSTALLATION

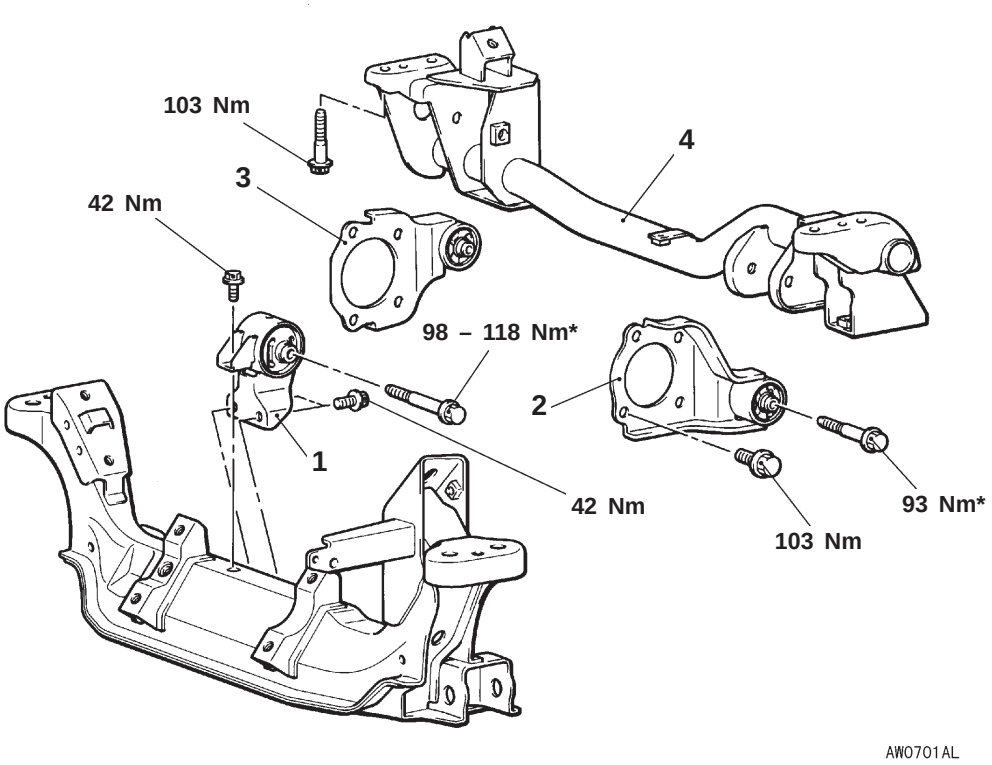
Face the arrow mark to the vacuum side.

FRONT DIFFERENTIAL MOUNT

REMOVAL AND INSTALLATION

Caution

1. **To remove the differential mount crossmember assembly, support the front differential assembly with a jack.**
2. **To prevent bushings from breakage, the parts indicated by * should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**



Differential mount bracket assembly (front) removal steps

- Free-wheeling clutch assembly removal (Refer to P. 26-45.)

1. Differential mount bracket assembly <front>

Differential mount bracket assembly (LH, RH) removal steps

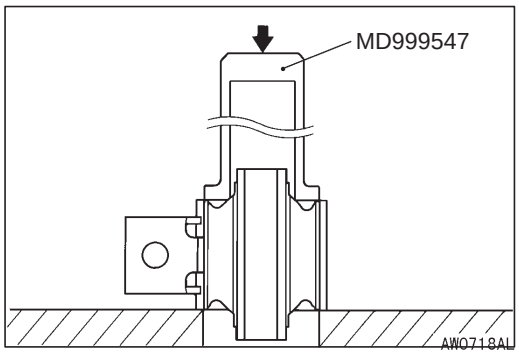
- Drive shaft assembly removal (Refer to P. 26-19.)

2. Differential mount bracket assembly <Rear – LH>
3. Differential mount bracket <Rear – RH>

Differential mount crossmember assembly removal steps

- Front propeller shaft removal (Refer to GROUP 25.)

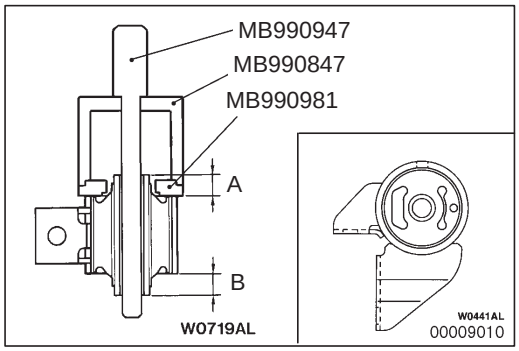
4. Differential mount crossmember assembly



DIFFERENTIAL MOUNT INSULATOR REPLACEMENT

FRONT

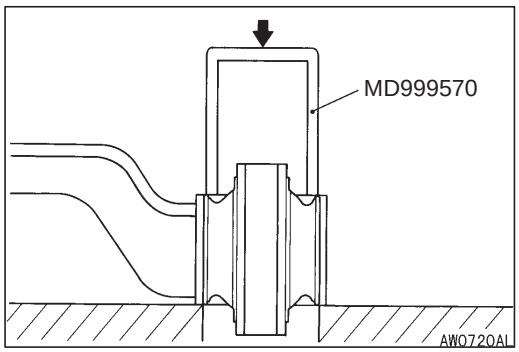
1. Use the special tool to drive out the insulator.

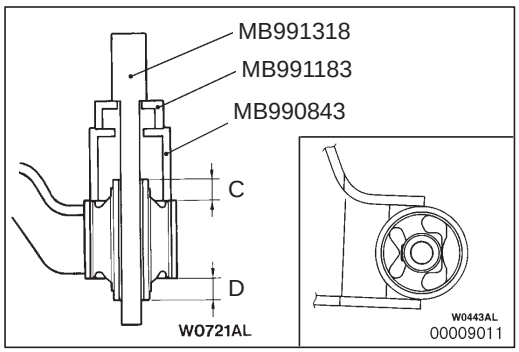


2. Use the special tools and a press to press-fit the insulators so that their hollow portion points to the shown direction and the insulator protrudes evenly (Distance A is equal to distance B).

REAR

1. Use the special tool to drive out the insulator.





2. Use the special tools and a press to press-fit the insulators so that their hollow portion points to the shown direction and the insulator protrudes evenly (Distance C is equal to distance D).

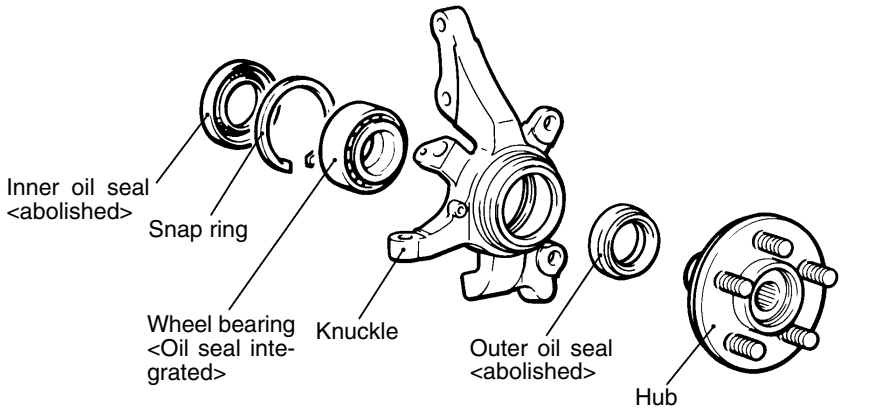
NOTES

GROUP 26

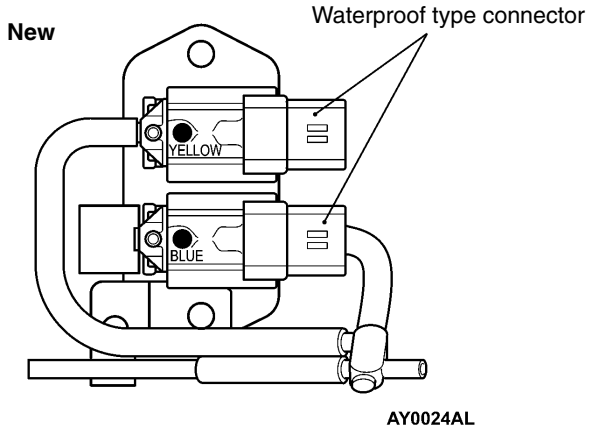
GENERAL

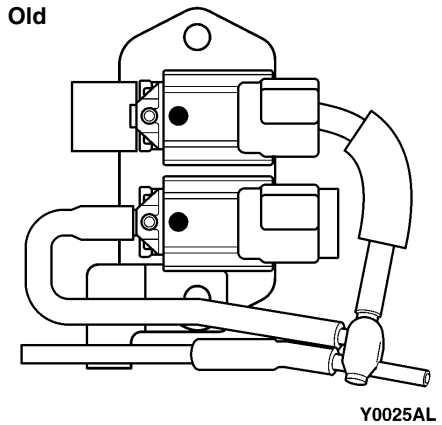
OUTLINE OF CHANGE

- The front differential reduction gear ratio has been changed due to the introduction of 2000-mL engine.
- The service procedure has been changed since the wheel bearing has been changed from the previous oil seal separate type to the integrated type.



- The solenoid valve for the free-wheeling mechanism has been changed.





GENERAL INFORMATION

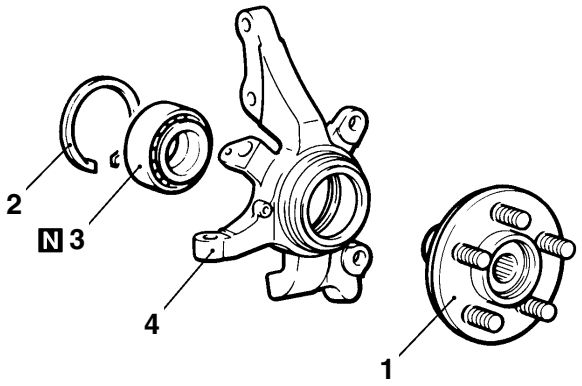
FRONT DIFFERENTIAL

Item		New	Old
Reduction ratio		4.636*1, 4.900*2	4.875
Number of teeth	Drive gear	51*1, 49*2	39
	Drive pinion	11*1, 10*2	8

NOTE
*1: M/T, *2: A/T

HUB AND KNUCKLE ASSEMBLY

DISASSEMBLY AND REASSEMBLY

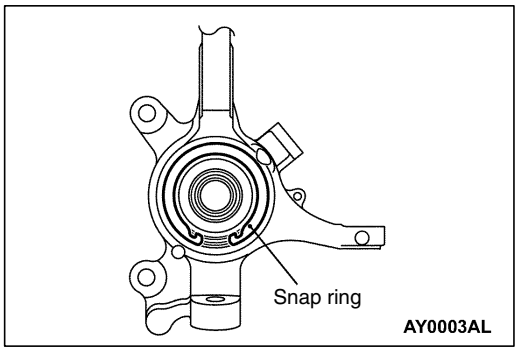


BW0238AL

Disassembly steps

▶D◀ • Hub rotation starting torque check
▶ ◀ • Wheel bearing axial play check
◀ ▶ 1. Hub
▶ ◀ 2. Snap ring
◀ ▶ ▶ ◀ 3. Wheel bearing
4. Knuckle

NOTE
The disassembly service points are the same as before.



AY0003AL

REASSEMBLY SERVICE POINTS

Only the service procedure below has been added. The other service procedures are the same as before.

▶B◀ SNAP RING INSTALLATION

The notch in the snap ring should face down.

Caution
The sealing performance between the snap ring and the bearing seal can be ensured by making the snap ring face down. If the snap ring notches face toward the different direction, the sealing performance may be impaired.

FRONT AXLE

CONTENTS

GENERAL 2
Outline of Change 2
GENERAL INFORMATION 2
SERVICE SPECIFICATIONS 3
LUBRICANT 3
SPECIAL TOOLS 4
ON-VEHICLE SERVICE 5
Front Axle Total Backlash Check 5
DRIVE SHAFT 6
FRONT AXLE SHAFT 7
DIFFERENTIAL CARRIER 9
VACUUM PIPES 13

GENERAL

OUTLINE OF CHANGE

The following service procedures have been established due to the addition of the vehicles with 1800-MPI engine. Other service procedures are the same as before.

GENERAL INFORMATION

FRONT AXLE

Item			1800-MPI
Drive shaft	Shaft length* × Shaft diameter mm	Right side	316 × 24
		Left side	435 × 24
Front axle shaft	Shaft length × Shaft diameter mm		389 × 25
	Bearing (O.D. × I.D.) mm		62 × 35

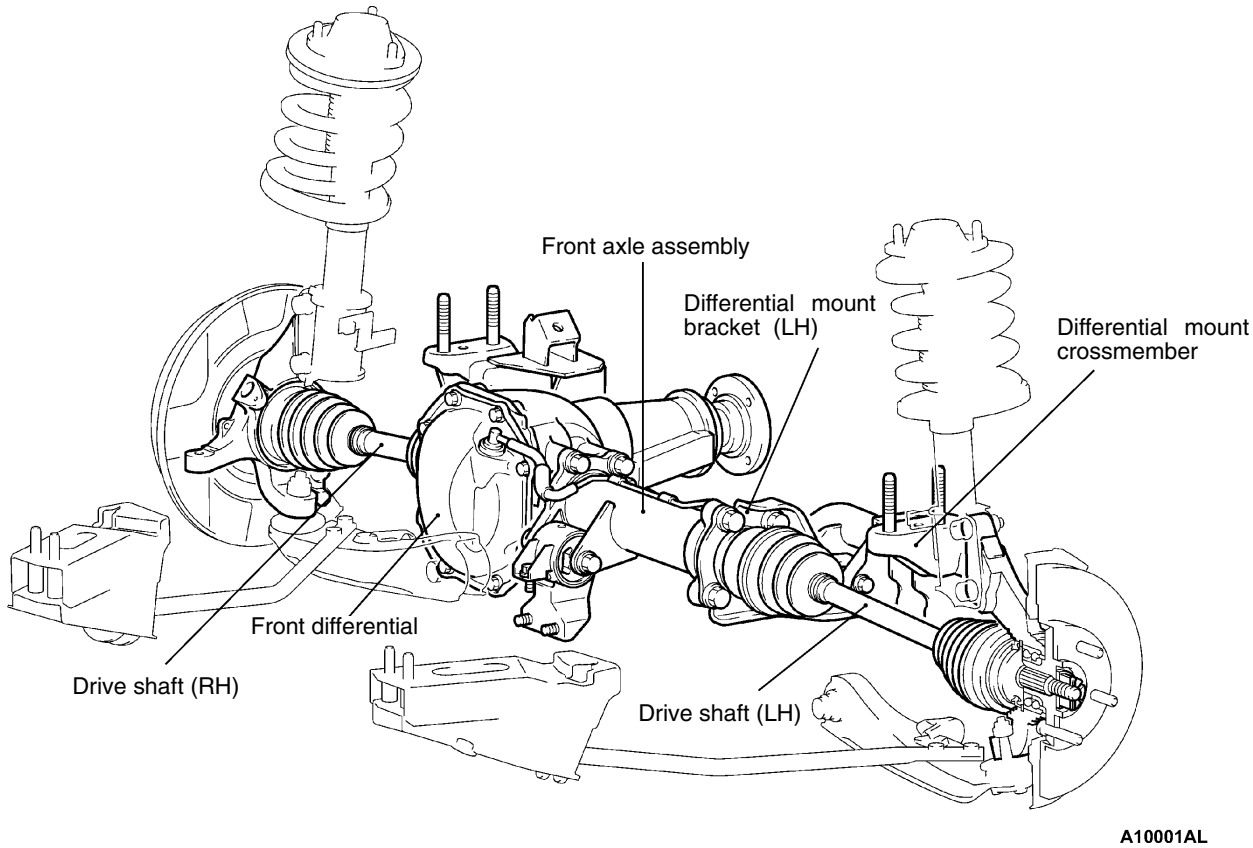
NOTE
*: shows the distance between the centres of the joints.

FRONT DIFFERENTIAL

Item			1800-MPI
Reduction ratio			4.636*1, 5.111*2
Number of teeth	Drive gear		51*1, 46*2
	Drive pinion		11*1, 9*2
Bearing (O.D. × I.D.) mm		Side	72.0 × 35.0
		Front	62.0 × 25.0
		Rear	72.0 × 35.0

NOTE
*1: M/T
*2: A/T

CONSTRUCTION DIAGRAM



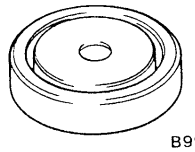
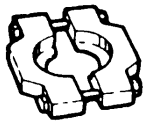
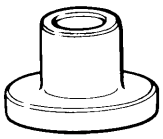
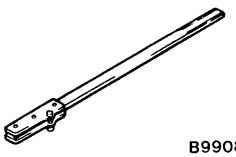
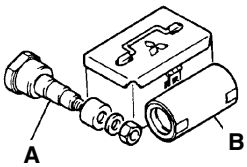
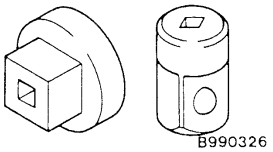
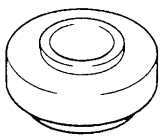
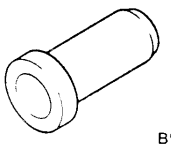
SERVICE SPECIFICATIONS

Items			Standard value	Limit
Drive pinion turning torque N·m	Without oil seal	When replacing (with anti-rust agent)	0.88 – 1.17	–
		When replacing or reusing (with gear oil applied)	0.39 – 0.49	–
	With oil seal	When replacing (with anti-rust agent)	0.98 – 1.27	–
		When replacing or reusing (with gear oil applied)	0.49 – 0.58	–

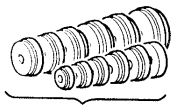
LUBRICANT

Items	Specified lubricants	Quantity
D.O.J./B.J.	Repair kit grease	85 g

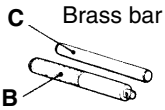
SPECIAL TOOLS

Tool	Number	Name	Use
 B990955	MB991115	Oil seal installer	Front axle oil seal press-fitting (Used together with MB990938)
	MB990673	Front bearing remover	Bearing removal
	MB990663	Rear axle shaft bearing and retainer ring installer	Bearing installation
 B990850	MB990850	End yoke holder	Companion flange removal and installation
 A B AB990835	MB990835 A: MB990836 B: MB990392	Dummy pinion set A: Drive pinion gauge assembly B: Cylinder gauge	• Drive pinion rotation starting torque check • Drive pinion height measurement
 B990326	MB990326	Pre-load socket	Drive pinion turning torque measurement
 B990829	MB990829	Pinion and side bearing installer	• Drive pinion rear bearing inner race pressing-in • Side bearing inner race pressing-in
 B990727	MB990727	Oil seal installer	Drive pinion oil seal pressing-in

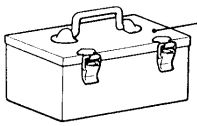
MB990925



A
Installer adapter

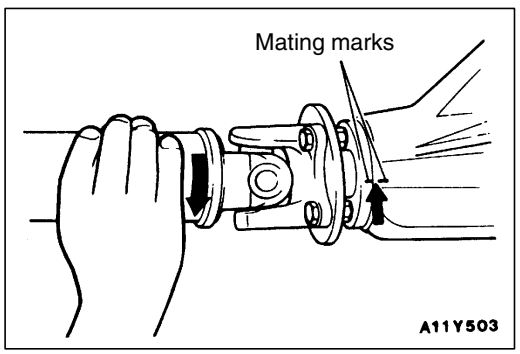


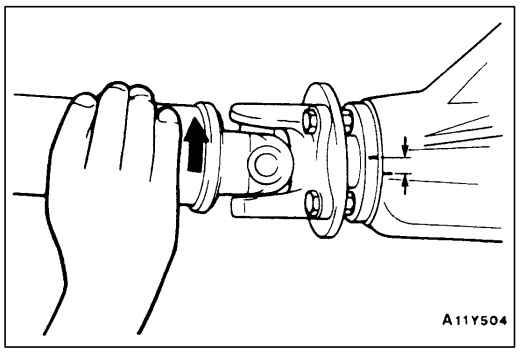
Installer bar (snap-in type)



A11W0113

Type	Tool number	O.D. mm	Type	Tool number	O.D. mm
A	MB990926	39	A	MB990933	63.5
	MB990927	45		MB990934	67.5
	MB990928	49.5		MB990935	71.5
	MB990929	51		MB990936	75.5
	MB990930	54		MB990937	79
	MB990931	57	B	MB990938	–
	MB990932	61	C	MB990939	–





ON-VEHICLE SERVICE

FRONT AXLE TOTAL BACKLASH CHECK

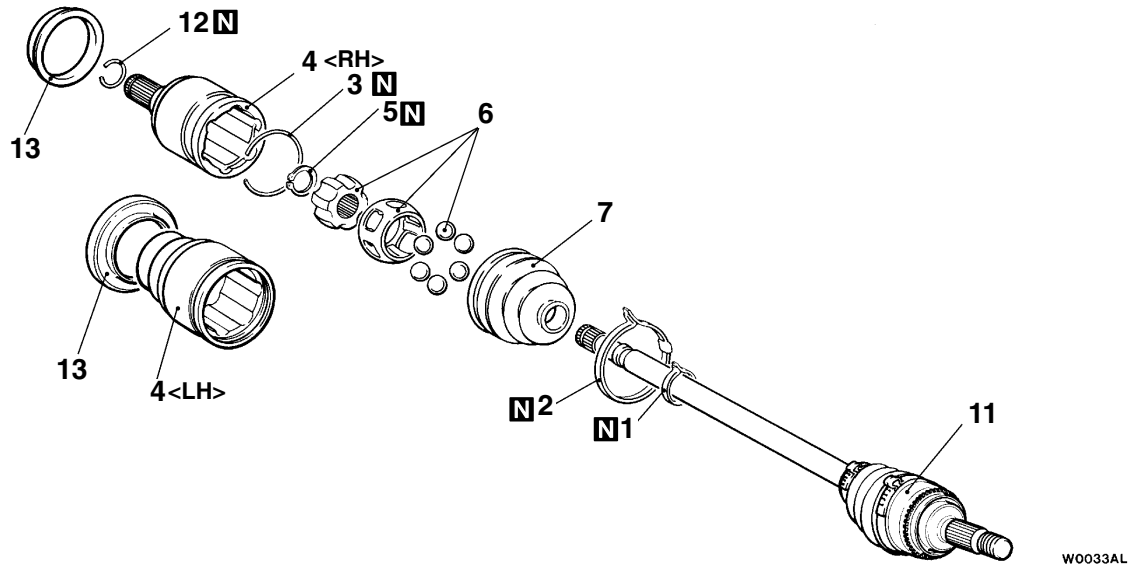
1. Place the transmission shift lever in the neutral position, apply the parking brake and then jack up the vehicle.
2. Manually turn the propeller shaft clockwise as far as it will go and make mating marks on the companion flange dust cover and the differential carrier.
3. Manually turn the propeller shaft anti-clockwise as far as it will go and measure the movement of the mating marks.

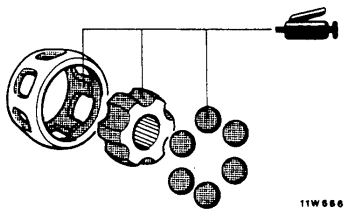
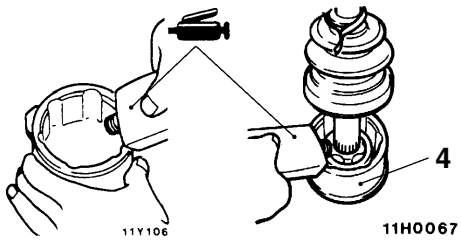
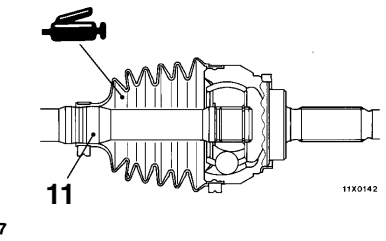
   Limit: 5 mm
4. If the backlash exceeds the limit, remove the differential carrier assembly, and then carry out the following checks.
   - Final drive gear backlash
   - Differential gear backlash
   - Play in the serrations and spline of the side gears, drive shaft, inner shaft and drive flange

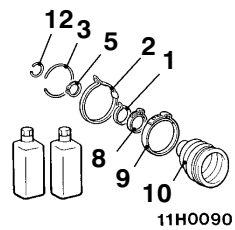
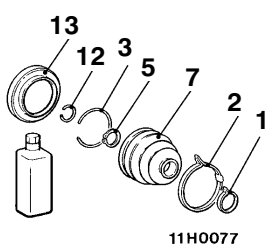
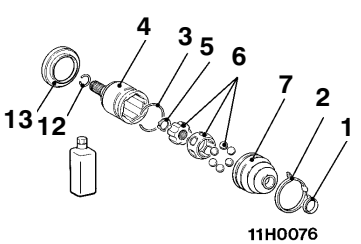
DRIVE SHAFT

DISASSEMBLY AND REASSEMBLY

Caution
The B.J. assembly is non-serviceable and requires replacement if defective. B.J. boot can be replaced.



 11W686	 11Y106  11H0067 11X0142
Grease: Repair kit grease	Grease: Repair kit grease Quantity: B.J.: 85 g (40 g for joint, 45 g for boot) D.O.J.: 85 g (50 g for joint, 35 g for boot)
Caution **The joint is filled with a special grease. Do not mix the grease with an old one or other grease.**	

 11H0090	 11H0077	 11H0076
B.J. boot repair kit	D.O.J. boot repair kit	D.O.J. repair kit

00009003

Disassembly steps

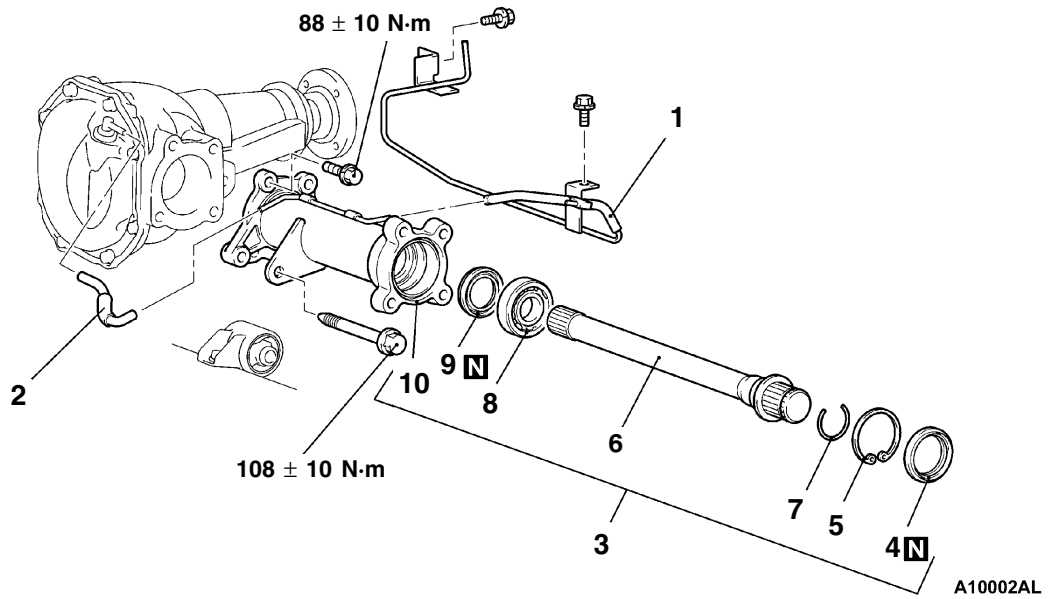
▶B◀ 1. D.O.J. boot band (small)
▶B◀ 2. D.O.J. boot band (large)
3. Circlip
4. D.O.J. outer race
5. Snap ring
6. Inner race, cage, ball assembly
◀A▶ ▶A◀ 7. D.O.J. boot
8. B.J. boot band (small)
9. B.J. boot band (large)
10. B.J. boot
11. B.J. assembly
12. Circlip
13. Dust cover

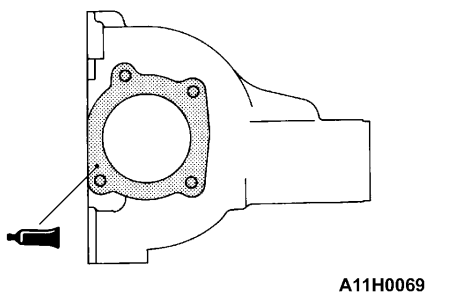
NOTE
Removal and installation service points are the same as before.

FRONT AXLE SHAFT

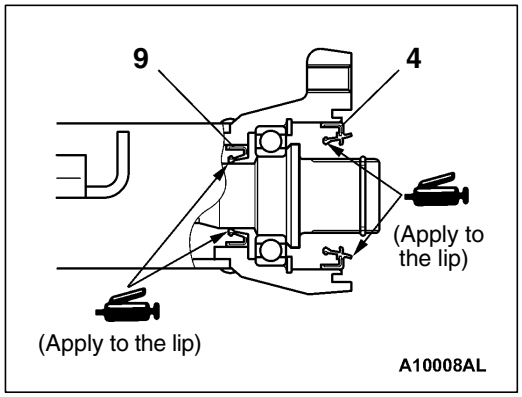
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Drive Shaft Removal and Installation
- Gear Oil Draining and Refilling





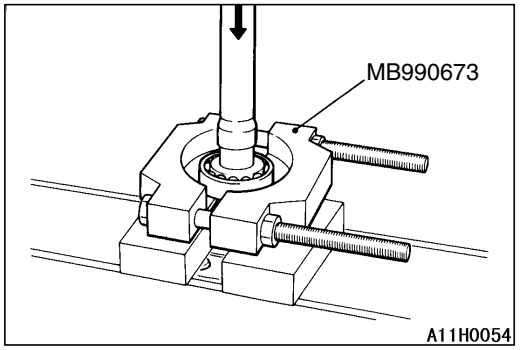
Sealant:
3M ATD Part No.8661 or equivalent



Removal steps

- Front differential assembly and differential mount crossmember assembly(Refer to P.26-9)

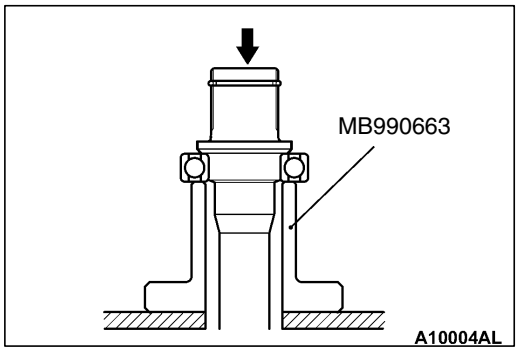
1. Vacuum pipe assembly
2. Vacuum hose assembly
3. Front axle assembly
▶C◀ 4. Oil seal
5. Snap ring
6. Front axle shaft
7. Clip
▶B◀ 8. Oil seal
◀A▶ ▶A◀ 9. Bearing
10. Front housing assembly



REMOVAL SERVICE POINT

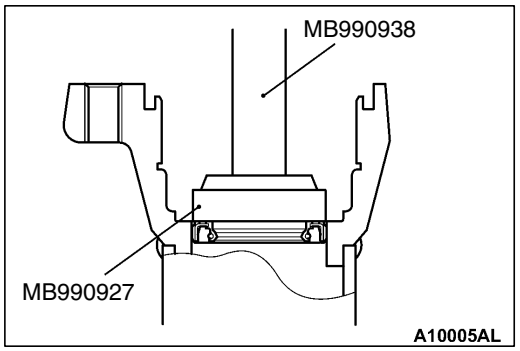
◀A▶ BEARING REMOVAL

Install the special tool as shown in the illustration, and use a press to drive out the bearing from the main shaft.

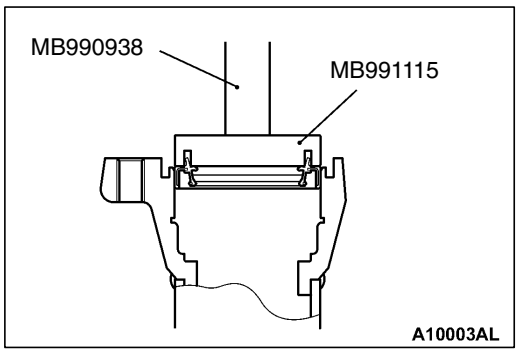


INSTALLATION SERVICE POINTS

▶A◀ BEARING INSTALLATION



▶B◀ OIL SEAL INSTALLATION



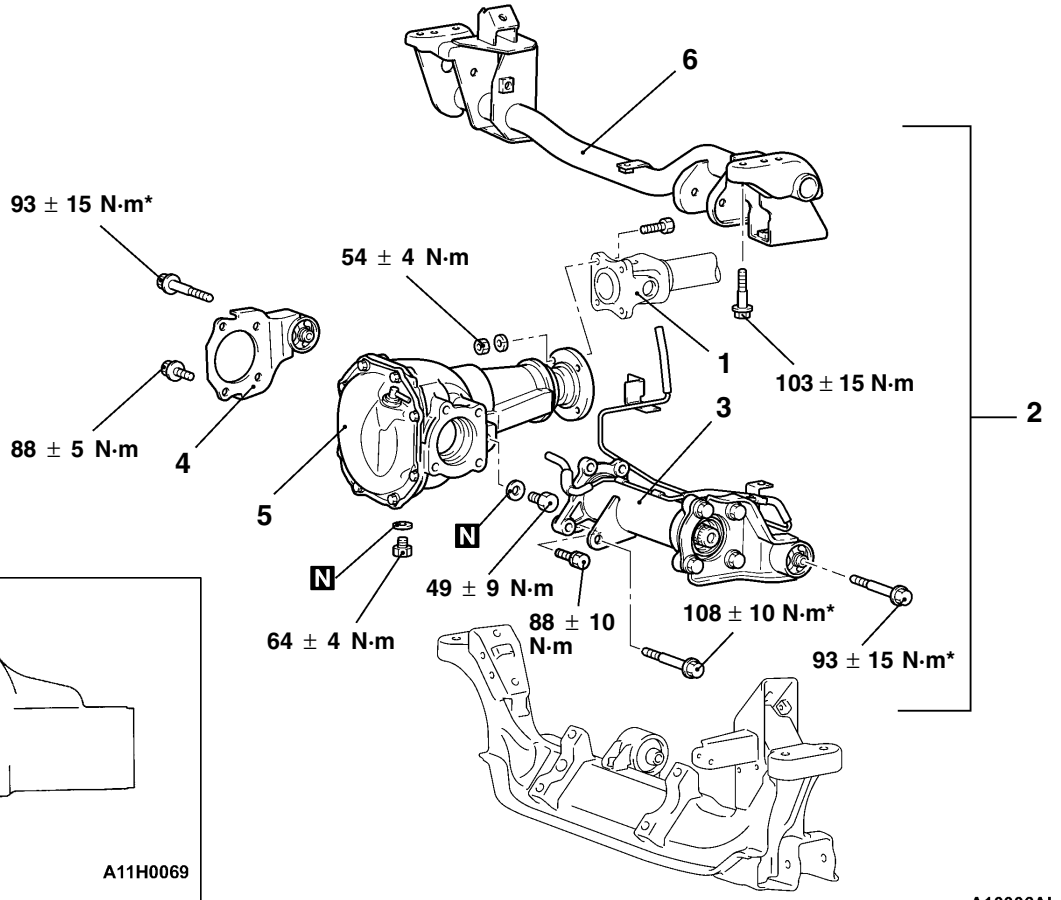
▶C◀ OIL SEAL INSTALLATION

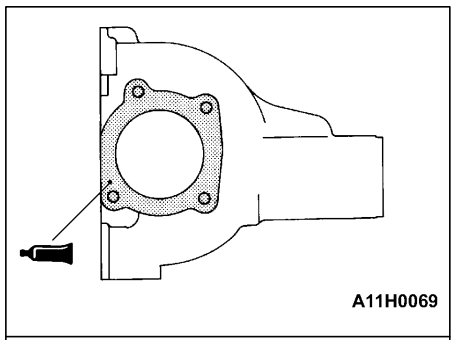
DIFFERENTIAL CARRIER

REMOVAL AND INSTALLATION

Caution
To prevent bushings from breakage, the parts indicated by * should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.

Pre-removal and Post-installation Operation
- Drive Shaft Removal and Installation
- Stabilizer Bar Removal and Installation
- Gear Oil Draining and Refilling



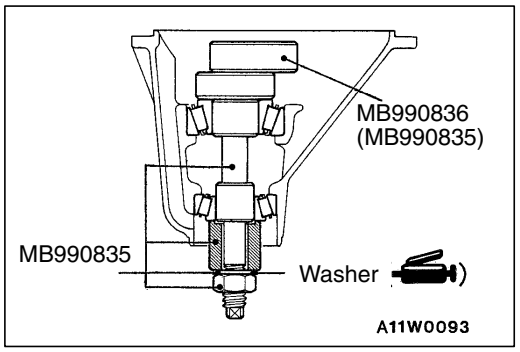


Sealant:
3M ATD Part No.8661 or equivalent

Removal steps

◀A▶ • Support the Engine Assembly
1. Front propeller shaft connection
2. Front differential assembly and differential mount crossmember assembly
3. Front axle assembly
4. Differential mount bracket assembly <RH>
5. Differential carrier
6. Differential mount crossmember assembly

NOTE
Removal service points are the same as before.



DISASSEMBLY AND REASSEMBLY

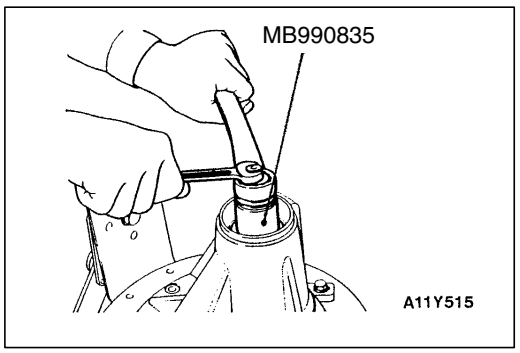
Service procedures except following are the same as before.

REASSEMBLY SERVICE POINTS

▶D◀ DRIVE PINION HEIGHT ADJUSTMENT

Adjust the drive pinion height by the following procedure.

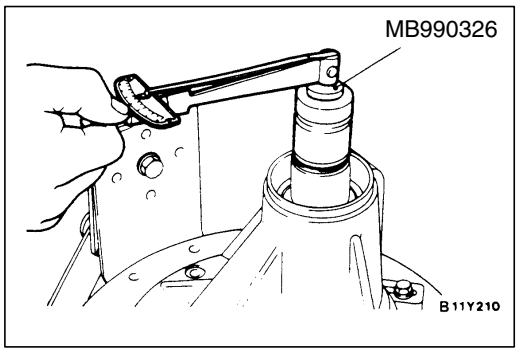
1. Apply multipurpose grease to the washer of the special tool.
2. Install the special tool, drive pinion front and rear bearing inner races to the gear carrier.



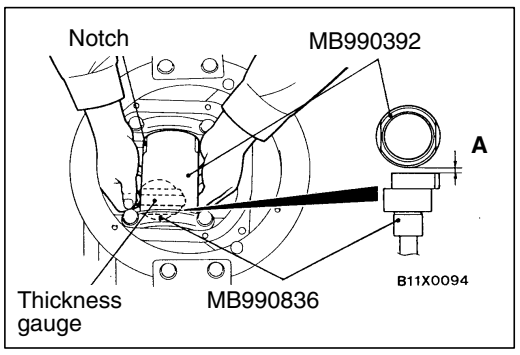
3. Tighten the nut of the special tool while measuring the rotation torque of the drive pinion. Gradually keep tightening the nut of the special tool until the rotation torque of the drive pinion (without oil seal) is at the standard value.

Standard value:

Bearing division	Bearing lubrication	Rotation torque N·m
New	None (With anti-rust agent)	0.88 – 1.17
New or reused	Gear oil applied	0.39 – 0.49

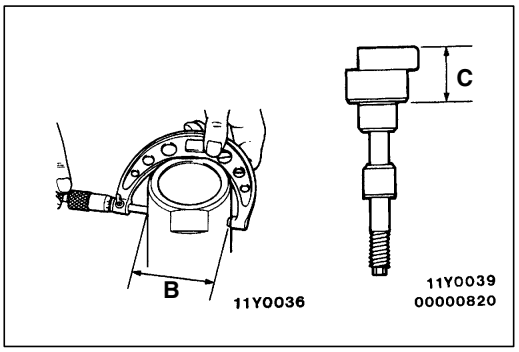


NOTE
The special tool cannot be turned a full revolution, so turn it several times within the range of movement to run in the bearing, and then measure the rotation torque.

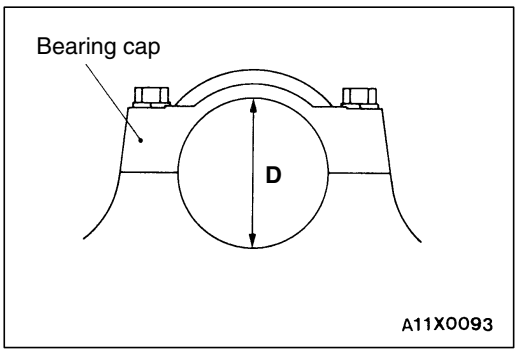


4. Clean the side bearing hub.
5. Install the special tools to the side bearing hub of the gear carrier, and then install the bearing cap.

   NOTE
   Always check that the notch is in the shown position and that the special tools are touching firmly against the side bearing hub.
6. Use a thickness gauge to measure the clearance (A) between the special tools.

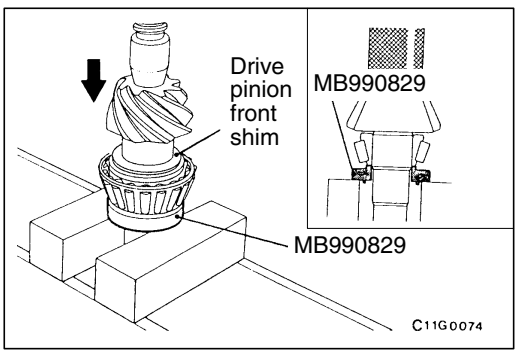


7. Remove the special tools.
8. Use a micrometer to measure the special tool in the places (B, C) shown in the illustration.



9. Install the bearing cap, and then use a cylinder gauge and micrometer to measure the inside diameter (D) of the bearing cap as shown in the illustration.
10. Calculate the thickness (E) of the required drive pinion front shim by the following formula, and then select a shim which most closely matches this thickness.

    $E = A + B + C - 1/2D - 86.0$



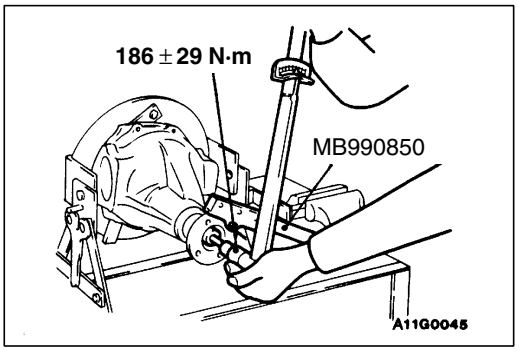
11. Fit the selected drive pinion front shim(s) to the drive pinion, and press-fit the drive pinion front bearing inner race by using the special tool.

▶E◀ DRIVE PINION ROTATION TORQUE ADJUSTMENT

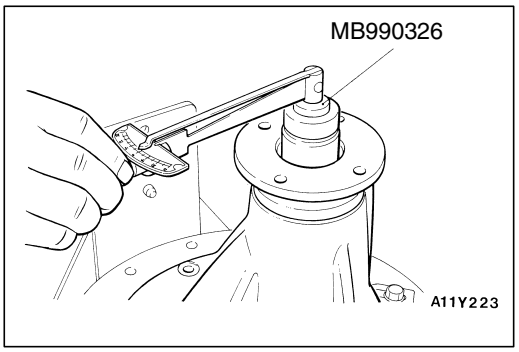
Adjust the drive pinion rotation torque by using the following procedure:

1. Insert the drive pinion into the gear carrier, and then install the drive pinion spacer, the drive pinion rear shim, the drive pinion rear bearing inner race, and the companion flange in that order.

   NOTE
   Do not install the oil seal.



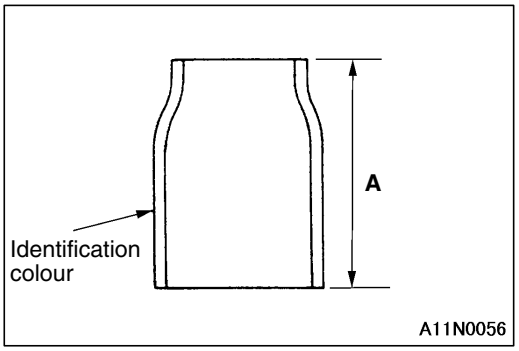
2. Use the special tool to hold companion flange, and then tighten the self-locking nut to the specified torque.



3. Measure the drive pinion rotation torque (without the oil seal) by using the special tool.

Standard value:

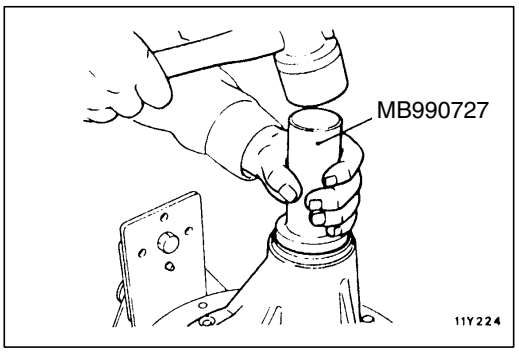
Bearing division	Bearing lubrication	Rotation torque N·m
New	None (With anti-rust agent)	0.88 – 1.17
New/reused	Gear oil applied	0.39 – 0.49



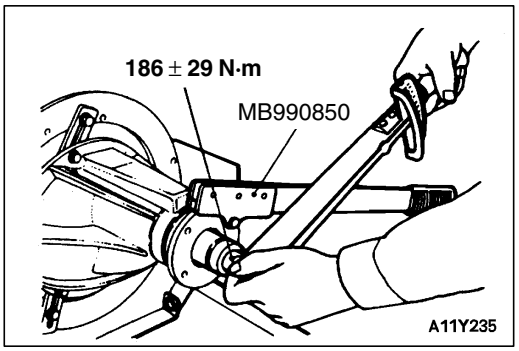
4. If the drive pinion rotation torque is not within the range of the standard value, adjust it by replacing the drive pinion rear shim(s) or the drive pinion spacer.

NOTE
When selecting the drive pinion rear shims, if the number of shims is large, reduce the number of shims to a minimum by selecting the drive pinion spacers. Also, select the drive pinion spacer from the following two types.

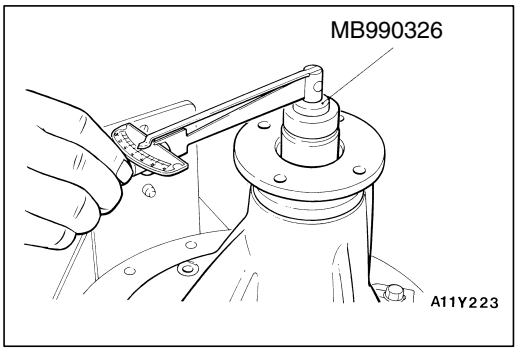
Drive pinion spacer height (A) mm	Identification colour
57.72	–
57.08	Red



5. Remove the companion flange and drive pinion again. Then, after inserting the drive pinion rear bearing inner race into the gear carrier, use the special tool to press-fit the oil seal.



6. Install the drive pinion assembly and companion flange with mating marks properly aligned, and use the special tool to hold the companion flange, and then tighten the self-locking nut to the specified torque.



7. Measure the drive pinion rotation torque (with the oil seal) by using the special tool.

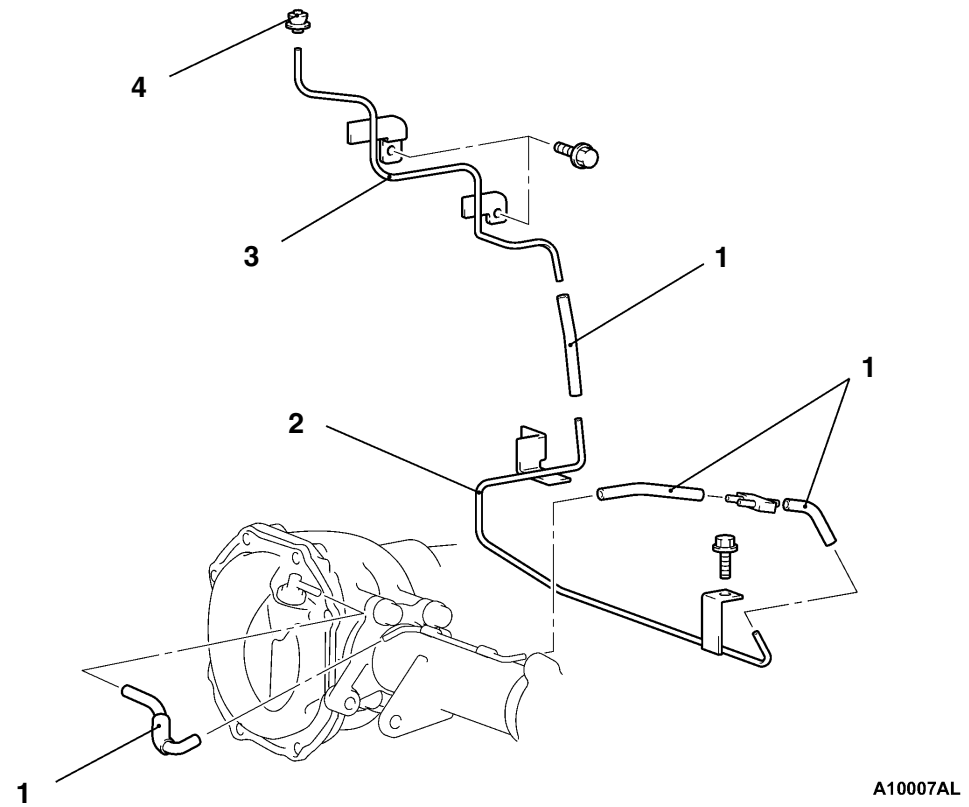
Standard value:

Bearing division	Bearing lubrication	Rotation torque N·m
New	None (With anti-rust agent)	0.98 – 1.27
New/reused	Gear oil applied	0.49 – 0.58

8. If the drive pinion rotation torque is not within the standard value, check the tightening torque of the companion flange self-locking nut and the oil seal installation condition.

VACUUM PIPES

REMOVAL AND INSTALLATION



Removal step

1. Vacuum hose
2. Vacuum pipe assembly
3. Vacuum pipe assembly
4. Breather cap

NOTES

REAR AXLE

REAR AXLE

CONTENTS

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SERVICE SPECIFICATIONS 3

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SPECIAL TOOLS 4

ON-VEHICLE SERVICE 6

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Gear Oil Level Check 7
Wheel Bearing Axial Play Check 7
Axle Housing Oil Seal Replacement 7

AXLE ASSEMBLY 9

AXLE SHAFT 11

DIFFERENTIAL CARRIER 15

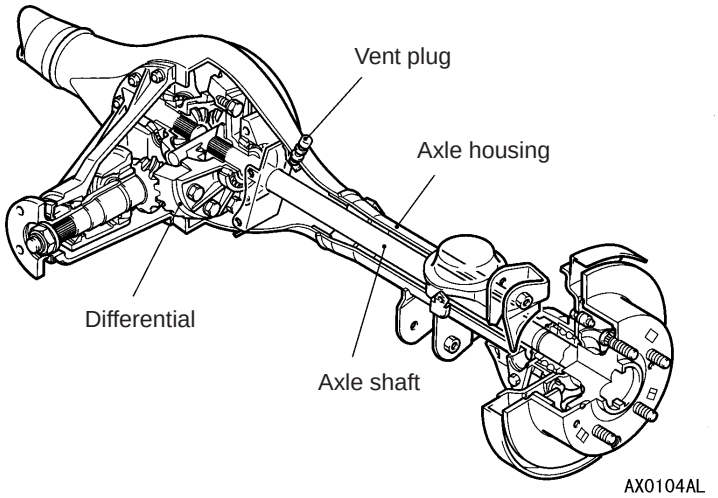
GENERAL INFORMATION

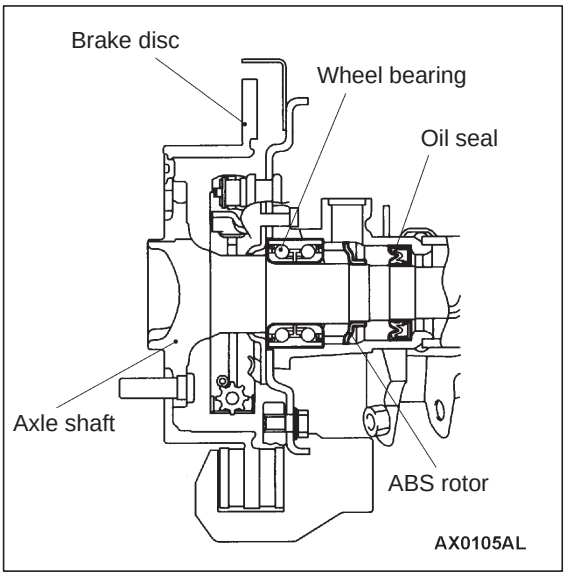
The rear axle is a banjo-type semi-floating type and provides the following characteristics:

- The rear wheel bearing is of an anti-mud enhanced type.
- In order to improve driveability at muddy road, helical LSD are available as optional equipment.
- For vehicles with ABS, the ABS rotor is press-fitted to the axle shaft.
- In order to improve stream-crossing performance, a vent plug is fitted to the upper part of the axle housing.

Item		Conventional differential	Helical LSD
Drive gear type		Hypoid gear	Hypoid gear
Reduction ratio		4.875	4.875
Limited slip differential type		–	Torque sensitive type
Differential gear type (Type × quantity)	Side gear	Straight bevel gear × 2	Helical gear × 2
	Pinion gear	Straight bevel gear × 2	Long pinion × 4, Short pinion × 4
Number of teeth	Drive gear	39	39
	Drive pinion	8	8
	Side gear	14	14
	Pinion gear	10	10
Bearing (O.D. × I.D.) mm	Side	80.0 × 45.2	80.0 × 45.2
	Front	68.3 × 30.2	68.3 × 30.2
	Rear	76.2 × 36.5	76.2 × 36.5

CONSTRUCTION DIAGRAM





SERVICE SPECIFICATIONS

Items			Standard value	Limit
Rear axle total backlash mm			–	4.2
Wheel bearing axial play mm			–	0.025
Final drive gear backlash mm			0.08 – 0.13	–
Drive gear runout mm			–	0.05
Differential gear backlash mm			0.01 – 0.25	0.2
Drive pinion turning torque Nm	Without oil seal	When replacing with a new bearing (with rust-prevention oil)	0.59 – 0.88	–
		When using a new bearing or when reusing (gear oil application)	0.39 – 0.49	–
	With oil seal	When replacing with a new bearing (with rust-prevention oil)	0.83 – 1.13	–
		When using a new bearing or when reusing (gear oil application)	0.64 – 0.74	–

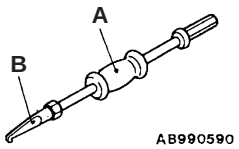
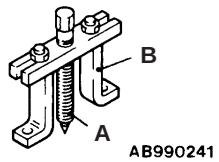
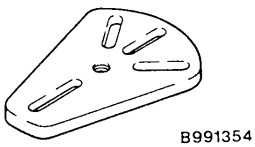
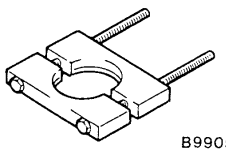
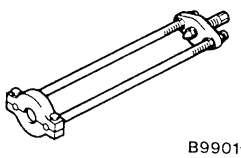
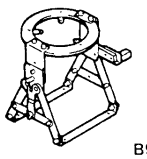
LUBRICANTS

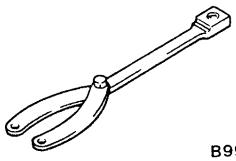
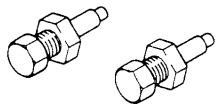
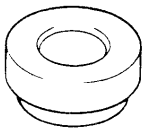
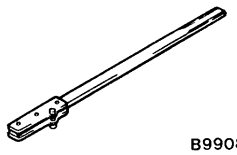
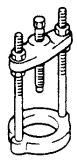
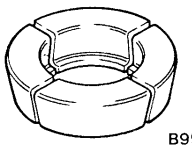
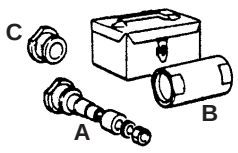
Items	Specified lubricant	Quantity
Gear oil	Hypoid gear oil API classification GL-5 or higher SAE viscosity No. 90, 80W	Approx. 1.7 ℓ

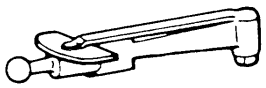
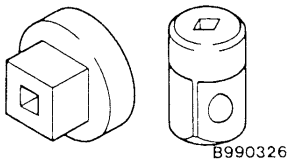
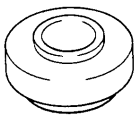
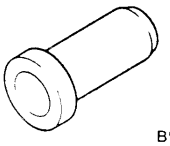
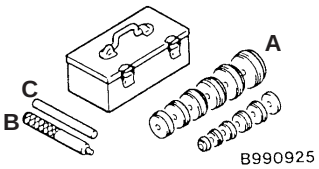
SEALANTS AND ADHESIVES

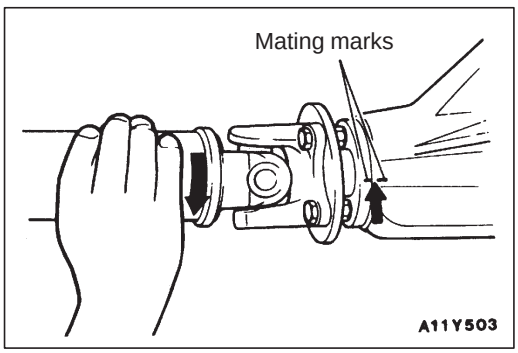
Items	Specified sealants and adhesives	Specified sealants and adhesives
Bearing case	3M ATD Part No. 8661 or equivalent	Semi-drying sealant
Axle housing (Differential carrier installation surface)		
Drive gear threaded holes	3M Stud Locking 4170 or equivalent	Anaerobic sealant

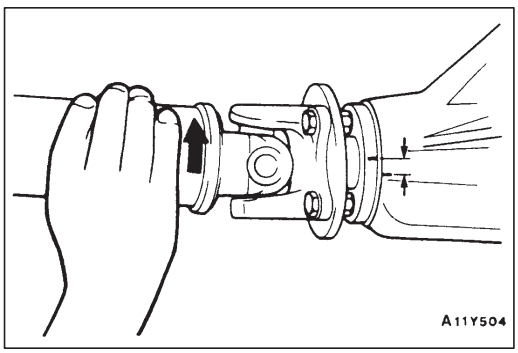
SPECIAL TOOLS

Tool	Number	Name	Use
	MB990590 A: MB990211 B: MB990212	Rear axle shaft oil seal remover A: Slide hammer B: Adapter	● Axle shaft removal ● Axle housing oil seal removal
	MB990241 A: MB990242 B: MB990244	Axle shaft puller A: Puller shaft B: Puller bar	Axle shaft removal
	MB991354	Puller body	
	MB990560	Rear axle shaft bearing remover	Rotor removal
	MB991284	Axle shaft bearing puller set	Axle shaft wheel bearing removal
	MB990909	Working base	Differential carrier fixing

Tool	Number	Name	Use
 B991367	MB991367	Special spanner	Side bearing nut removal and installation
 B991385	MB991385	Pin	
 B990810	MB990810	Side bearing puller	• Side bearing inner race removal • Companion flange removal
 B990811	MB990811	Side bearing cup	Side bearing inner race removal
 B990850	MB990850	End yoke holder	• Self-locking nut removal • Drive pinion turning torque adjustment
 B990339	MB990339	Bearing puller	Drive pinion rear bearing inner race removal
 B990374	MB990648	Bearing remover	
	MB991171 A: MB990819 B: MB991170 C: MB991169	Drive pinion setting gauge set A: Drive pinion gauge B: Cylinder gauge C: Drive pinion gauge attachment	Drive pinion height adjustment

Tool	Number	Name	Use
	MB990685	Torque wrench	Drive pinion turning torque adjustment
 B990326	MB990326	Preload socket	
 B990802	MB990802	Bearing installer	● Drive pinion rear bearing inner race press-fitting ● Side bearing inner race press-fitting
 B990727	MB990727	Oil seal installer	Drive pinion oil seal press-fitting
 B990925	MB991171 A: MB990926 to MB990937 B: MB990938 C: MB990939	Bearing and oil seal installer set A: Installer adapter B: Bar C: Brass bar	● Oil seal press-fitting ● Bearing inner and outer race removal and press-fitting For the details of installer, refer to GROUP 26 – Special Tool.



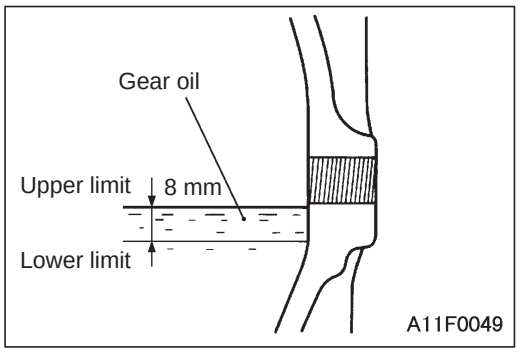


ON-VEHICLE SERVICE

REAR AXLE TOTAL BACKLASH CHECK

1. Place the transmission shift lever and the transfer shift lever in the neutral position, apply the parking brake and then jack up the vehicle.
2. Manually turn the propeller shaft clockwise as far as it will go and make mating marks on the companion flange dust cover and the differential carrier.
3. Manually turn the propeller shaft anti-clockwise as far as it will go and measure the movement of the mating marks.

   Limit: 4.2 mm
4. If the backlash exceeds the limit, remove the differential carrier assembly, and then carry out the following checks.
   Final drive gear backlash (Refer to P.27-16.)
   Differential gear backlash (Refer to P.27-16.)



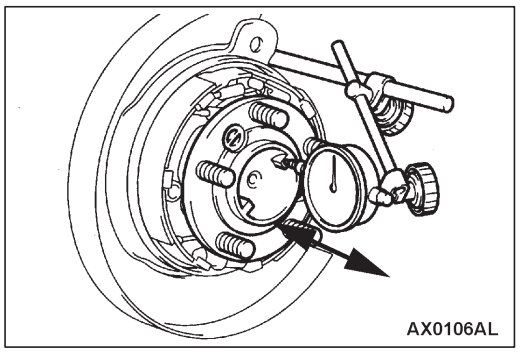
GEAR OIL LEVEL CHECK

1. Remove the filler plug.
2. Check that the gear oil level is between the upper limit (the bottom of a filler plug) and the lower limit.
3. If the gear oil level is not between the upper limit and the lower limit, add the specified gear oil until the gear oil level reaches the bottom of the filler plug.

   Specified gear oil:

   Hypoid gear oil API classification GL-5 or higher SAE viscosity No. 90, 80W
4. Install the filler plug, and then tighten it to the specified torque.

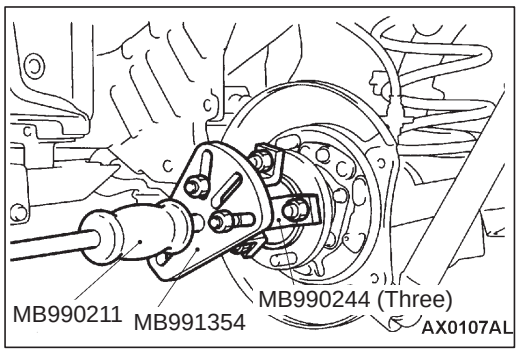
   Tightening torque: 49 Nm



WHEEL BEARING AXIAL PLAY CHECK

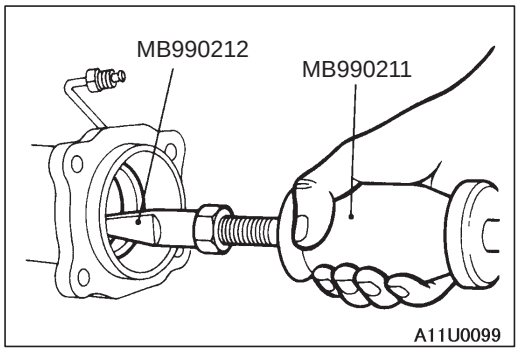
1. Place a dial gauge against the axle shaft as shown in the illustration, and then move the axle shaft in the axial direction and check the axial play.

   Limit: 0.025 mm
2. If the axial play exceeds the limit, check the backing plate to axle housing tightening torque. If it is correct, replace the bearing.

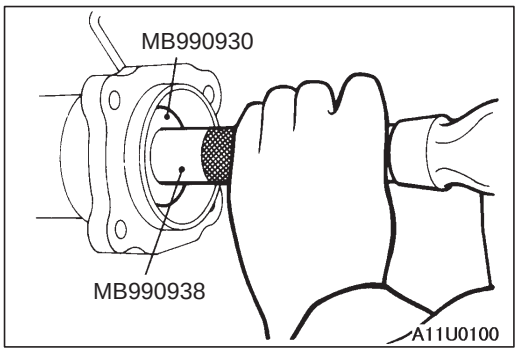


AXLE HOUSING OIL SEAL REPLACEMENT

1. Use the special tools to remove the axle shaft assembly. (Refer to P.27-11.)



2. Use the special tools to remove the oil seal.
3. Apply multipurpose grease to the oil seal contact surface of the axle housing.



4. Use the special tools to install a new oil seal in position.
5. Apply multipurpose grease to the lip section of the oil seal.
6. Install the axle shaft assembly. (Refer to P.27-11.)

AXLE ASSEMBLY

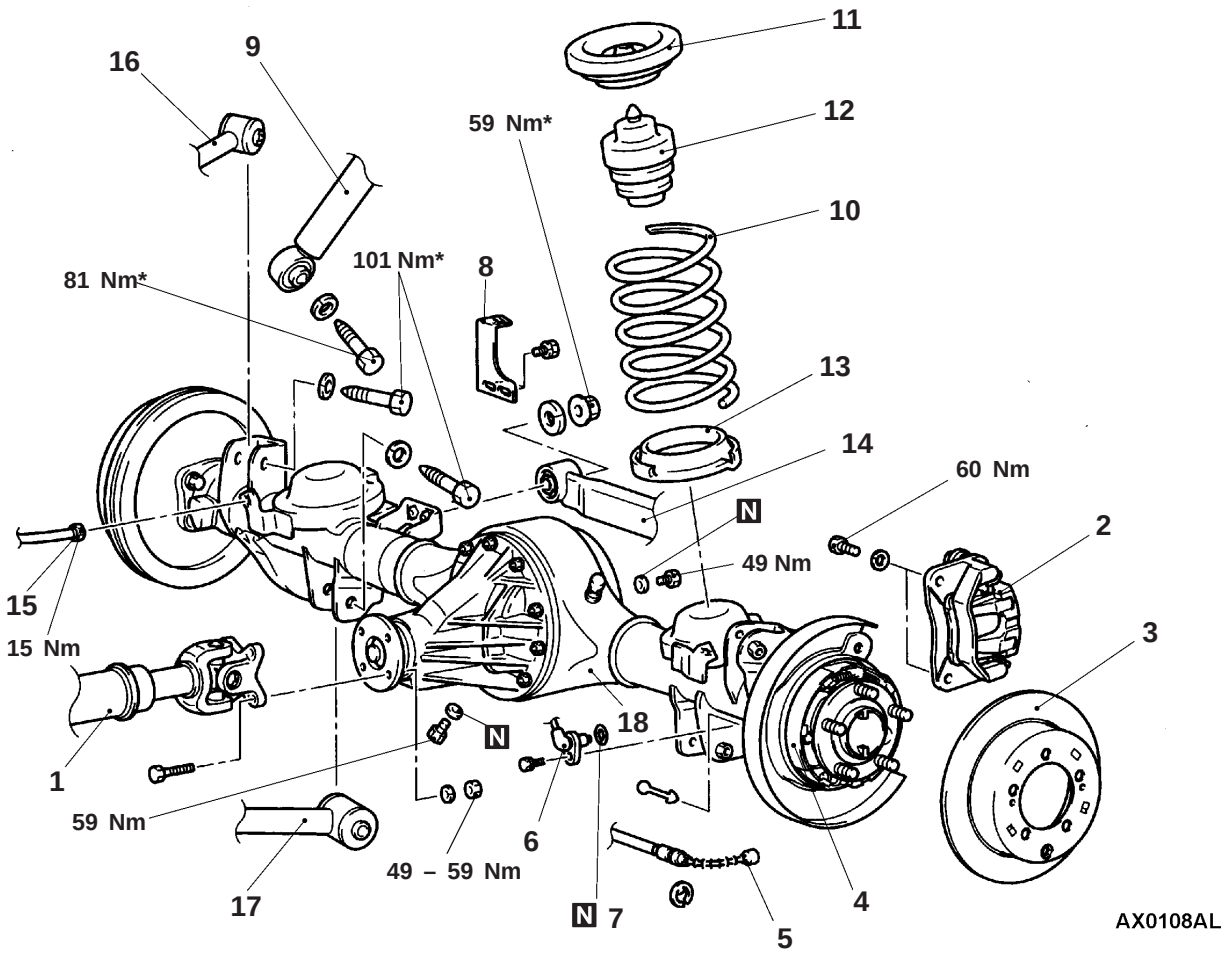
REMOVAL AND INSTALLATION

Caution

1. **To prevent bushings from breakage, the parts indicated by * should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**
2. **Be careful not to strike the pole piece at the tip of the wheel speed sensor against the other parts when removing and installing the wheel speed sensor.**

Pre-removal Operation
- Brake Fluid Draining (Refer to GROUP 35A – On-vehicle Service.)
- Differential Gear Oil Draining

Post-installation Operation
- Brake Fluid Filling and Air Bleeding (Refer to GROUP 35A – On-vehicle Service.)
- Parking Brake Lever Stroke Adjustment (Refer to GROUP 36 – On-vehicle Service.)
- Differential Gear Oil Filling (Refer to P.27-7.)



Removal steps

◀A▶
1. Rear propeller shaft connection
2. Caliper assembly
3. Brake disc
4. Parking brake shoe assembly (Refer to GROUP 36 – Parking Brake Drum.)
5. Parking brake cable connection
6. Wheel speed sensor <Vehicles with ABS>
7. O-ring <Vehicles with ABS>
8. Spring support

◀B▶
9. Shock absorber connection
10. Coil spring (Refer to GROUP 34 – Rear Suspension Assembly.)
11. Silencer sheet
12. Bump stopper
13. Lower spring pad

◀C▶
14. Lateral rod connection
15. Rear brake pipe and hose connection
16. Upper arm connection
17. Lower arm connection

◀D▶
18. Axle assembly

REMOVAL SERVICE POINTS

◀A▶ REAR PROPELLER SHAFT DISCONNECTION

Make mating marks on the companion flange and the flange yoke, and then disconnect the propeller shaft from the companion flange.

Caution
Use a wire, etc. to suspend the propeller shaft from the body to prevent it from falling.

◀B▶ SHOCK ABSORBER DISCONNECTION

Support the axle housing with a jack before removing the shock absorber lower mounting nut.

◀C▶ LATERAL ROD DISCONNECTION

Disconnect the lateral rod from the axle assembly, and then use a wire, etc. to suspend the lateral rod to prevent it from falling.

◀D▶ AXLE ASSEMBLY REMOVAL

Take out the axle assembly toward the rear of vehicle.

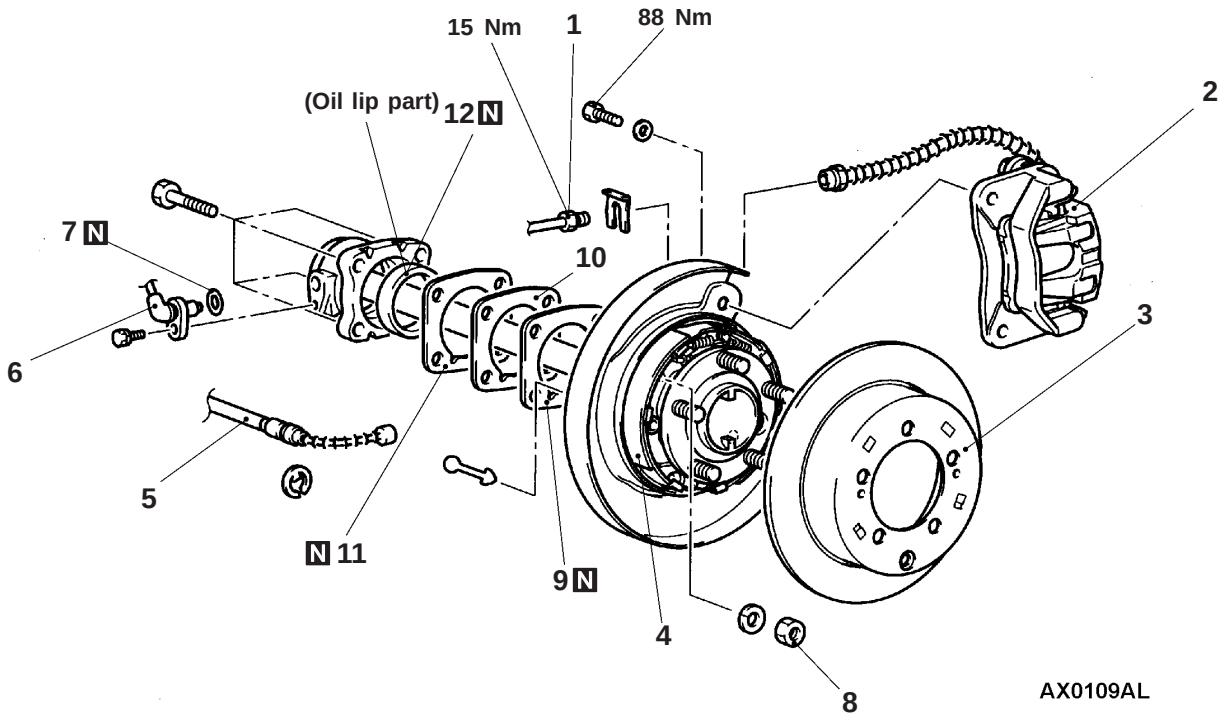
Caution
Take out the axle assembly carefully and slowly. The axle assembly is heavy and unstable and may fall.

AXLE SHAFT

REMOVAL AND INSTALLATION

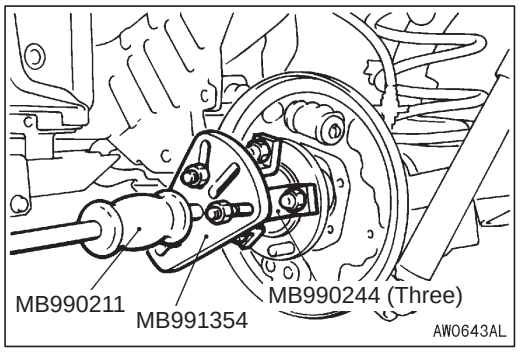
Pre-removal Operation
Brake Fluid Draining (Refer to GROUP 35A – On-vehicle Service.)

Post-installation Operation
- Brake Fluid Filling and Air Bleeding (Refer to GROUP 35A – On-vehicle Service.)
- Parking Brake Lever Stroke Adjustment (Refer to GROUP 36 – On-vehicle Service.)



Removal steps

1. Brake tube
2. Caliper assembly
3. Brake disc
4. Parking brake shoe (Refer to Group 36 – Parking brake drum.)
5. Parking brake cable connection
6. Wheel speed sensor <Vehicles with ABS>
7. O-ring <Vehicles with ABS>
- ◀A▶ 8. Axle shaft assembly
- ▶B◀ 9. Packing(s)
- ▶B◀ 10. Shim(s)
- ▶B◀ 11. Packing(s)
- ◀B▶ ▶A◀ 12. Oil seal

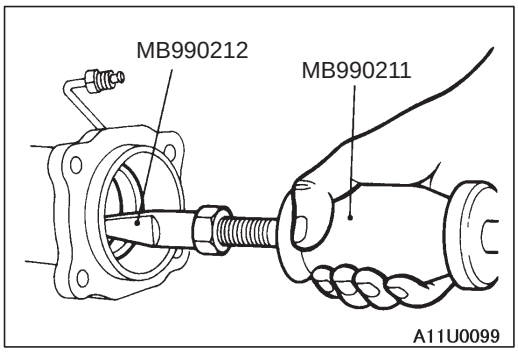


REMOVAL SERVICE POINTS

◀A▶ AXLE SHAFT ASSEMBLY REMOVAL

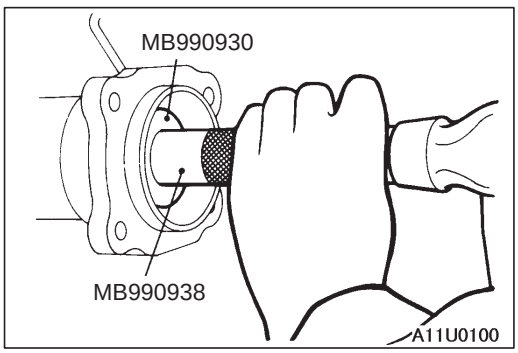
Use the special tools to remove the axle shaft assembly.

Caution
Be careful not to damage the oil seal when pulling the axle shaft.



◀B▶ OIL SEAL REMOVAL

Use the special tools to remove the oil seal.



INSTALLATION SERVICE POINTS

▶A◀ OIL SEAL INSTALLATION

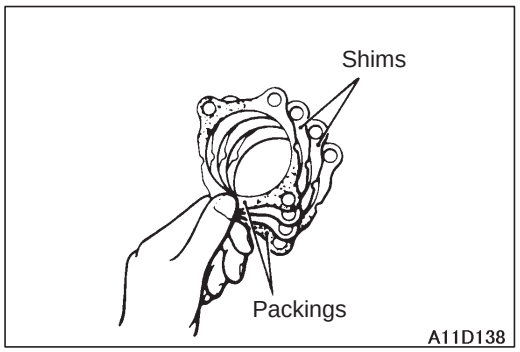
Use the special tools to tap in the oil seal.

▶B◀ PACKING/SHIM INSTALLATION

1. When only removing and reinstalling the axle shaft, the same thickness and number of shims as before should be used.
2. When replacing the axle shaft or the wheel bearing, select the packing(s) and shim(s) to adjust the bearing outer retainer tightening condition by the following procedure.
   (1) Insert the axle shaft assembly into the axle housing without packing(s) and shim(s). Temporarily tighten the installation nuts to half of specified torque (until the bearing outer race contacts the axle housing) evenly in diagonal order in two steps.
   (2) Use a thickness gauge to measure the clearance between the axle housing and the backing plate, and then select the packing(s) and shim(s) according to the following table.

   NOTE
   New packing is 0.27 mm to 0.33 mm in thickness, and new shim is 0.3 mm in thickness.

Clearance mm	Number of packing	Number of shim
0.2	0	0
0.2 – 0.5	1	0
0.5 – 0.75	2	0
0.75 – 1.0	2	1
1.0 – 1.25	2	2

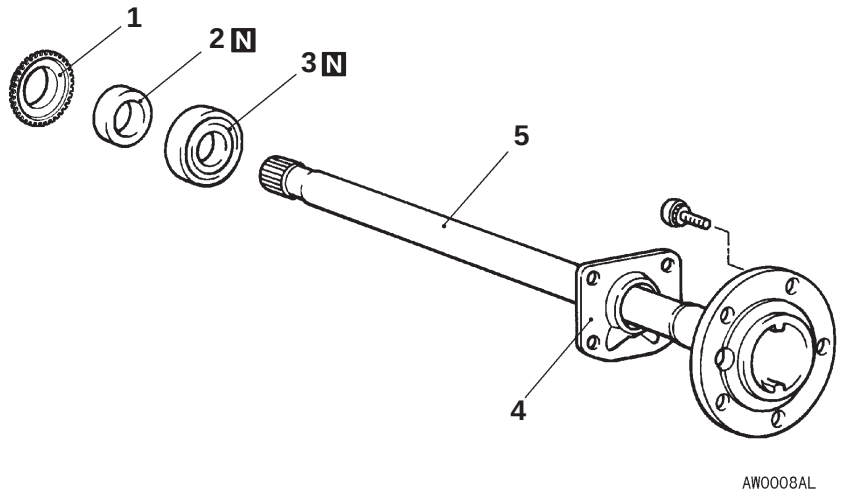


(3) If using the shim(s), sandwich the shim(s) between the packings as shown in the illustration.

3. Install the axle shaft assembly. Tighten the nuts in a diagonal order to the specified torque.

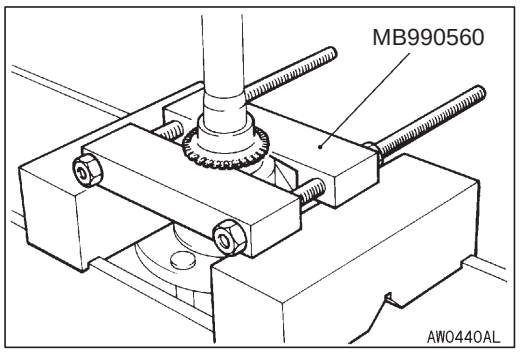
Tightening torque: 29 Nm

DISASSEMBLY AND REASSEMBLY



Disassembly steps

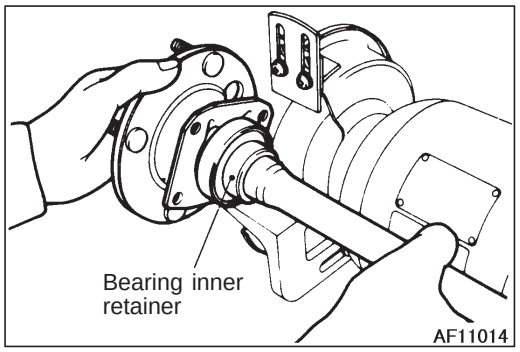
◀A▶ 1. ABS rotor <Vehicles with ABS>
◀B▶ ▶A◀ 2. Bearing inner retainer
◀C▶ ▶A◀ 3. Wheel bearing
▶A◀ 4. Bearing outer retainer
5. Axle shaft



DISASSEMBLY SERVICE POINTS

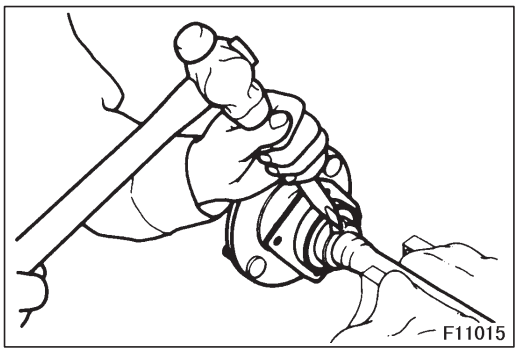
◀A▶ ABS ROTOR REMOVAL

Use the special tool to press out the ABS rotor.



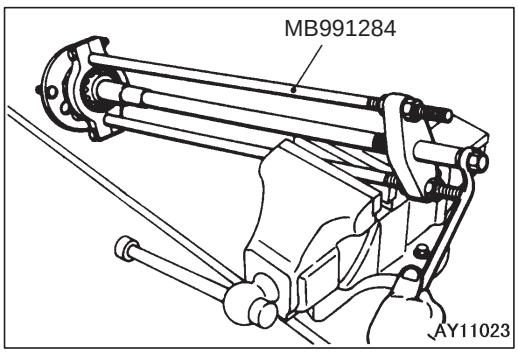
◀B▶ BEARING INNER RETAINER REMOVAL

1. Use a grinder to shave off a part of the bearing inner retainer until its thickness becomes 1 to 1.5 mm.



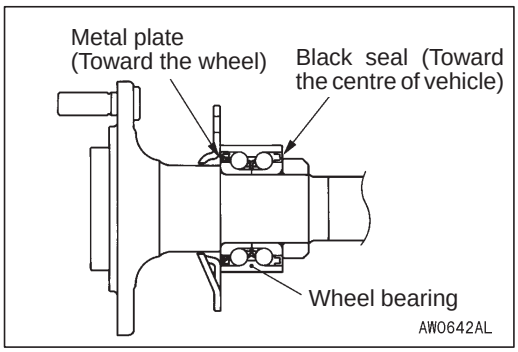
2. Use a chisel to cut the shaven part of the bearing inner retainer, and then remove the bearing inner retainer.

Caution
Be careful not to damage the axle shaft.



◀C▶ WHEEL BEARING REMOVAL

Use the special tool to remove the wheel bearing.



REASSEMBLY SERVICE POINT

▶A◀ BEARING OUTER RETAINER/WHEEL BEARING/ BEARING INNER RETAINER INSTALLATION

1. Install the bearing outer retainer, wheel bearing and the bearing inner retainer to the axle shaft in that order, as shown in the illustration.
2. Press-fit the bearing inner retainer to the axle shaft.

Caution
Install the wheel bearing as shown in the illustration.

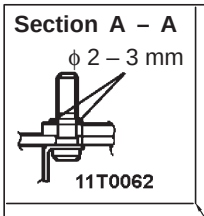
DIFFERENTIAL CARRIER

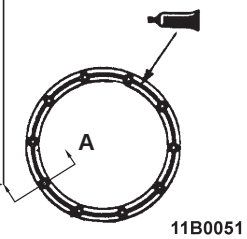
REMOVAL AND INSTALLATION

Pre-removal Operation
- Differential Gear Oil Draining
- Axle Shaft Removal (Refer to P.27-11.)
- Brake Fluid Draining (Refer to GROUP 35A – On-vehicle Service.)

Post-installation Operation
- Brake Fluid Filling and Air Bleeding (Refer to GROUP 35A – On-vehicle Service.)
- Axle Shaft Installation (Refer to P.27-11.)
- Differential Gear Oil Filling (Refer to P.27-7.)

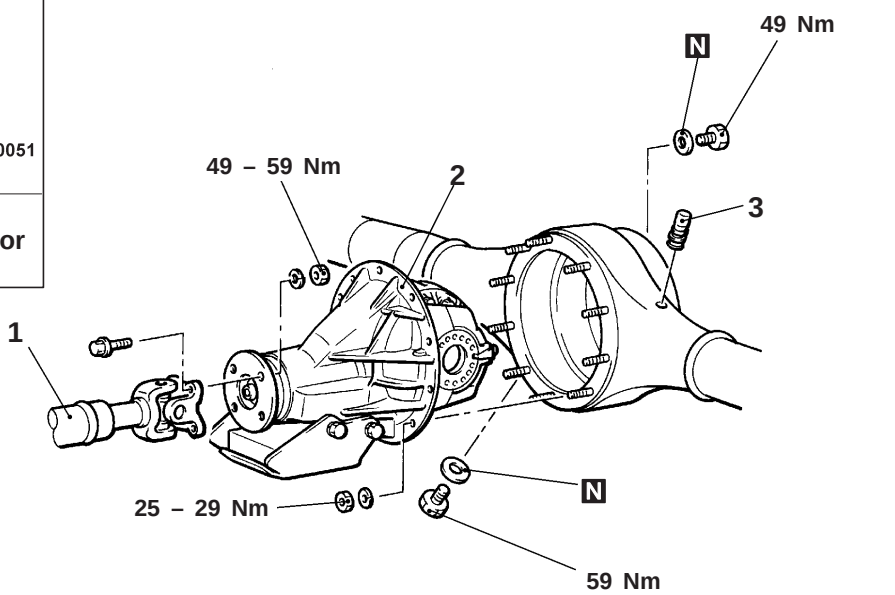
Section A – A





Flange surface of axle housing

Sealant:
3M ATD Part No. 8661 or equivalent



AW0714AL

Removal steps

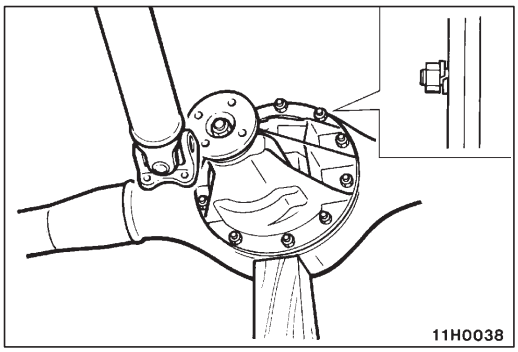
◀A▶ ▶A◀ ◀B▶
1. Rear propeller shaft connection
2. Differential carrier assembly
3. Vent plug

REMOVAL SERVICE POINTS

◀A▶ REAR PROPELLER SHAFT DISCONNECTION

Make mating marks on the companion flange and the flange yoke, and then disconnect the propeller shaft from the companion flange.

Caution
Use a wire, etc. to suspend the propeller shaft from the body to prevent it from falling.



◀B▶ DIFFERENTIAL CARRIER REMOVAL

Loosen the differential carrier mounting nuts to the end of each stud bolt, and then strike the lower part of differential carrier with a piece of timber several times to separate the differential carrier from the axle housing.

Caution

1. **Do not remove the differential carrier mounting nuts so that the differential carrier will not fall when separating it from the axle housing.**
2. **Do not strike the companion flange.**

INSTALLATION SERVICE POINT

▶A◀ REAR PROPELLER SHAFT CONNECTION

Connect the propeller shaft so that the mating marks on the flange yoke and the companion flange of differential carrier are aligned.

INSPECTION BEFORE DISASSEMBLY

For the inspection procedure except for the standard values below, refer to GROUP 26 – Inspection Before Disassembly.

FINAL DRIVE GEAR BACKLASH

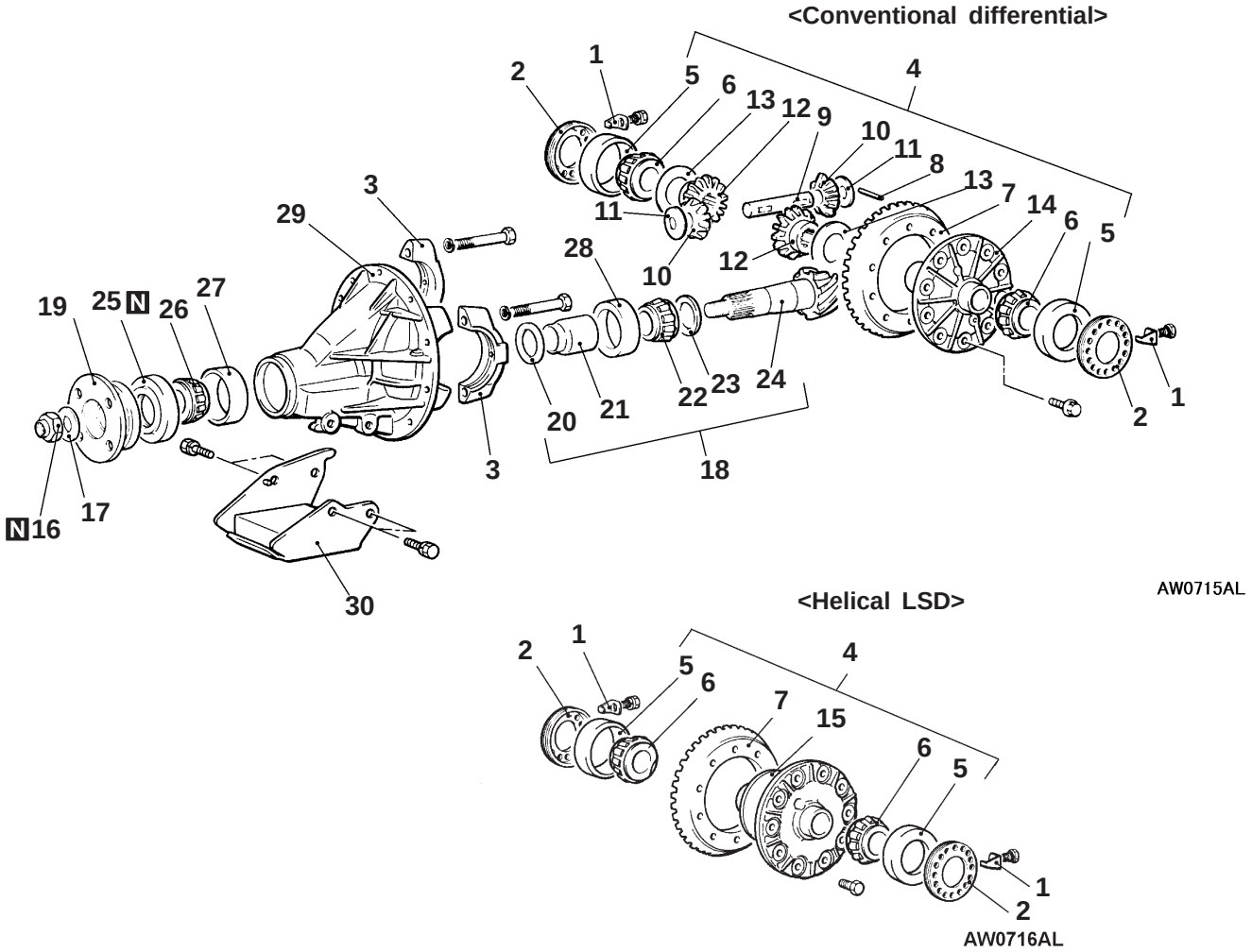
Standard value: 0.08 – 0.13 mm

DIFFERENTIAL GEAR BACKLASH

Standard value: 0.01 – 0.25 mm

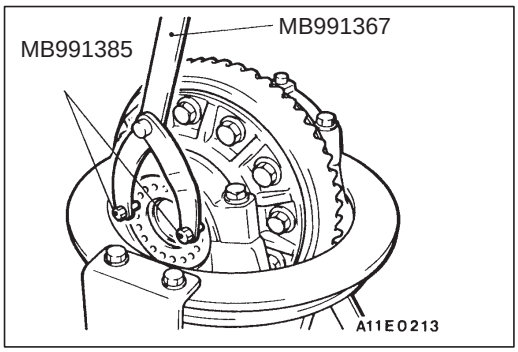
DISASSEMBLY

Caution
Do not disassemble the limited slip differential case assembly (helical gear type), because it is not possible to assemble.



Disassembly steps

- Inspection before disassembly (Refer to P.27-17.)
1. Locking plate
◀A▶ 2. Side bearing nut
3. Bearing cap
◀B▶ 4. Differential case assembly
5. Side bearing outer race
◀C▶ 6. Side bearing inner race
◀D▶ 7. Drive gear
8. Lock pin
9. Pinion shaft
10. Pinion gear
11. Pinion washer
12. Side gear
13. Side gear spacer
14. Differential case
15. Limited slip differential case assembly
◀E▶ 16. Self-locking nut
17. Washer
◀F▶ 18. Drive pinion assembly
◀F▶ 19. Companion flange
20. Drive pinion front shim (for drive pinion turning torque adjustment)
21. Drive pinion spacer
◀G▶ 22. Drive pinion rear bearing inner race
23. Drive pinion rear shim (for drive pinion height adjustment)
24. Drive pinion
◀H▶ 25. Oil seal
◀H▶ 26. Drive pinion front bearing inner race
◀H▶ 27. Drive pinion front bearing outer race
◀I▶ 28. Drive pinion rear bearing outer race
29. Differential carrier
30. Dynamic damper

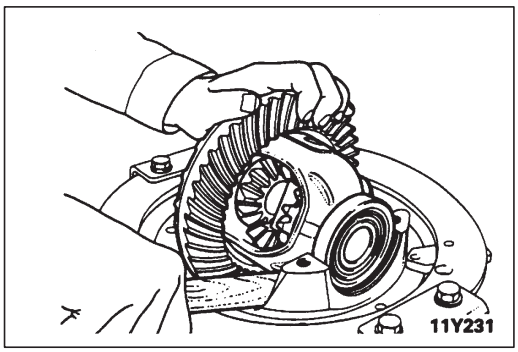


DISASSEMBLY SERVICE POINTS

◀A▶ SIDE BEARING NUT REMOVAL

Use the special tools to remove the side bearing nuts.

NOTE
Keep the right and left side bearing nuts separate, so that they will not be confused when assembling.

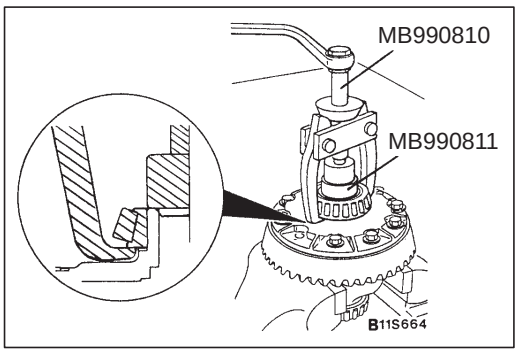


◀B▶ DIFFERENTIAL CASE ASSEMBLY REMOVAL

Use the handle of hammer to pry up the differential case assembly.

Caution
Remove the differential case assembly, slowly and carefully so that the side bearing outer races are not dropped.

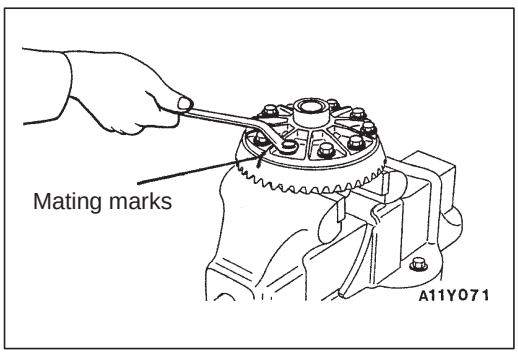
NOTE
Keep the right and left side bearing outer races separate, so that they will not be confused when assembling.



◀C▶ SIDE BEARING INNER RACE REMOVAL

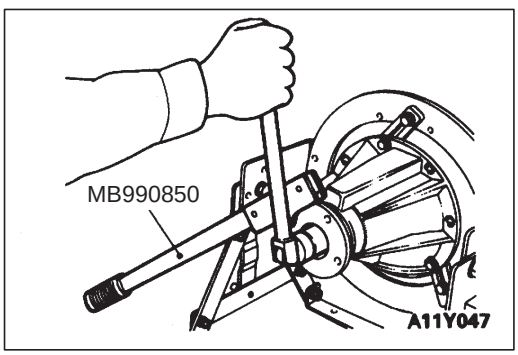
Use the special tools to pull out the side bearing inner race.

NOTE
Position the two prongs of the special tool under the bottom of the side bearing inner race through the two notches in the differential case.



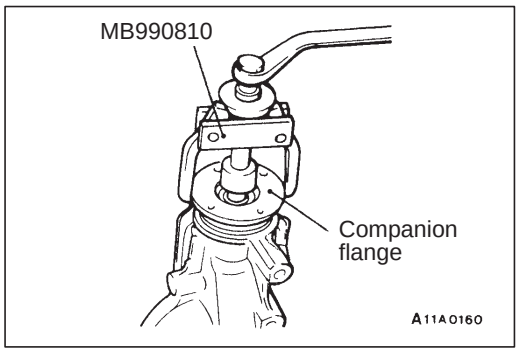
◀D▶ DRIVE GEAR REMOVAL

1. Make the mating marks to the differential case and the drive gear in order to position the drive gear correctly when assembling it.
2. Loosen the drive gear attaching bolts in diagonal sequence to remove the drive gear.



◀E▶ SELF-LOCKING NUT REMOVAL

Use the special tool to hold the companion flange, and then remove the self-locking nut.

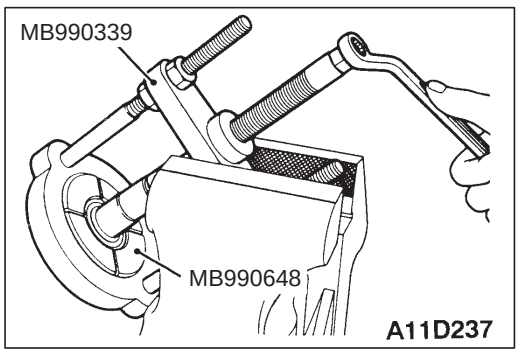


◀F▶ DRIVE PINION ASSEMBLY/COMPANION FLANGE REMOVAL

1. Make the mating marks on the drive pinion and the companion flange in order to position the companion flange correctly when assembling it.

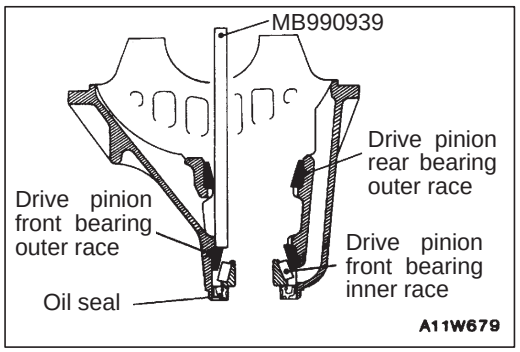
   Caution
   Do not make mating mark on the surface that contacts with the propeller shaft.

2. Use the special tool to remove the companion flange.



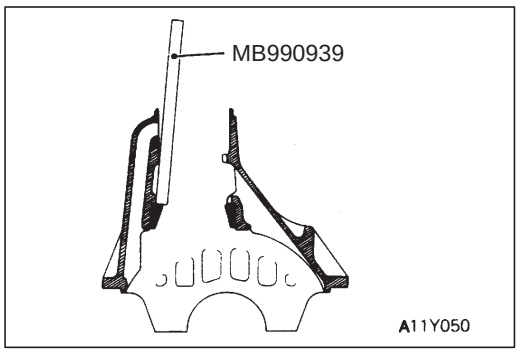
◀G▶ DRIVE PINION REAR BEARING INNER RACE REMOVAL

Use the special tools to remove the drive pinion rear bearing inner race.



◀H▶ OIL SEAL/DRIVE PINION FRONT BEARING INNER RACE/DRIVE PINION FRONT BEARING OUTER RACE REMOVAL

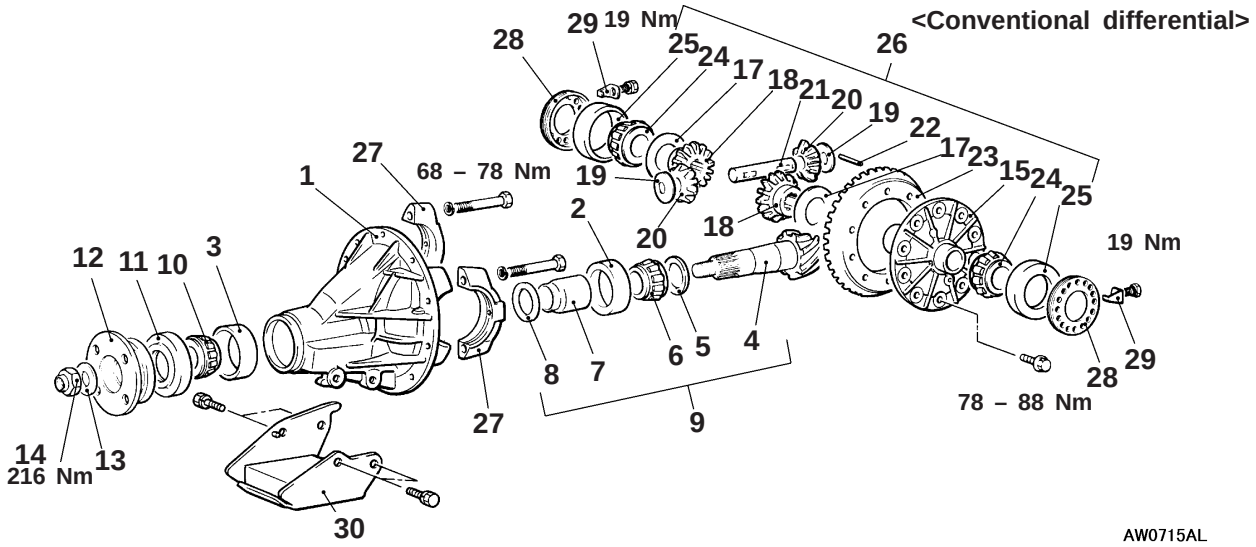
Use the special tool to remove the drive pinion front bearing outer race, drive pinion front bearing inner race and oil seal.

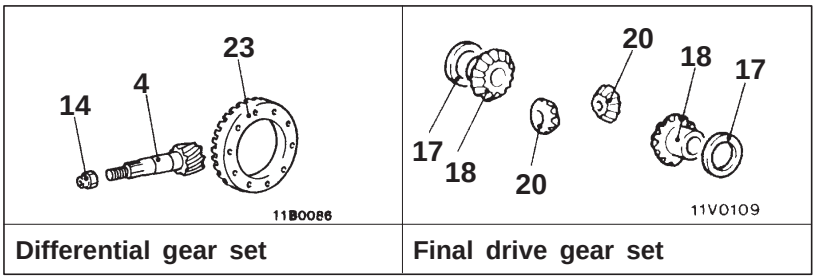


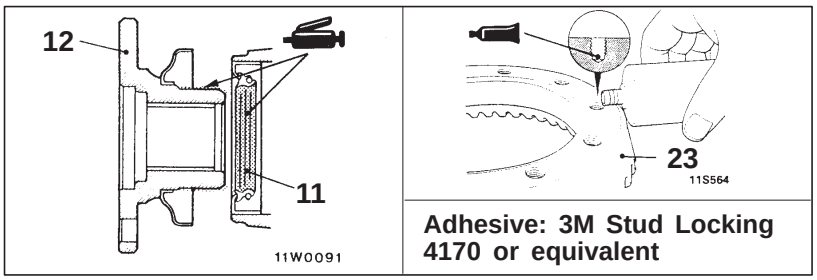
◀I▶ DRIVE PINION REAR BEARING OUTER RACE REMOVAL

Use the special tool to remove the drive pinion rear bearing outer race.

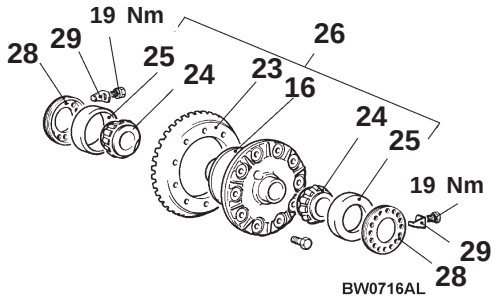
REASSEMBLY





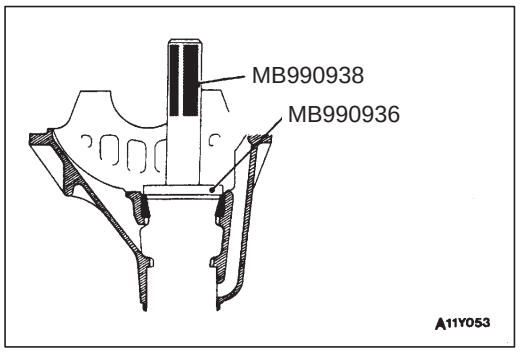


<Helical LSD>



Reassembly steps

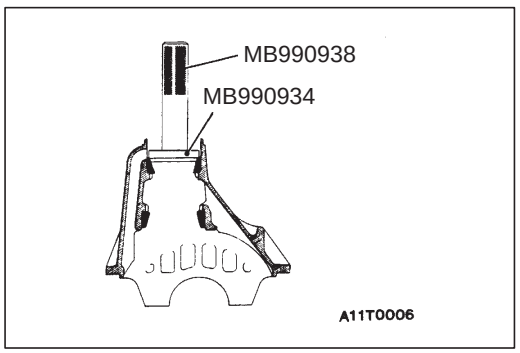
1. Differential carrier
- ▶A◀ 2. Drive pinion rear bearing outer race
- ▶B◀ 3. Drive pinion front bearing outer race
- ▶C◀ ● Drive pinion height adjustment
4. Drive pinion
5. Drive pinion rear shim (for drive pinion height adjustment)
6. Drive pinion rear bearing inner race
7. Drive pinion spacer
- ▶D◀ ● Drive pinion turning torque adjustment
8. Drive pinion front shim (for drive pinion turning torque adjustment)
9. Drive pinion assembly
10. Drive pinion front bearing inner race
11. Oil seal
12. Companion flange
13. Washer
14. Self-locking nut
15. Differential case
16. Limited slip differential case assembly
- ▶E◀ ● Differential gear backlash adjustment
17. Side gear spacer
18. Side gear
19. Pinion washer
20. Pinion gear
21. Pinion shaft
22. Lock pin
- ▶F◀ 23. Drive gear
- ▶G◀ 24. Side bearing inner race
25. Side bearing outer race
26. Differential case assembly
- ▶H◀ 27. Bearing cap
- ▶I◀ ● Drive gear backlash adjustment
28. Side bearing nut
29. Locking plate
30. Dynamic damper



REASSEMBLY SERVICE POINTS

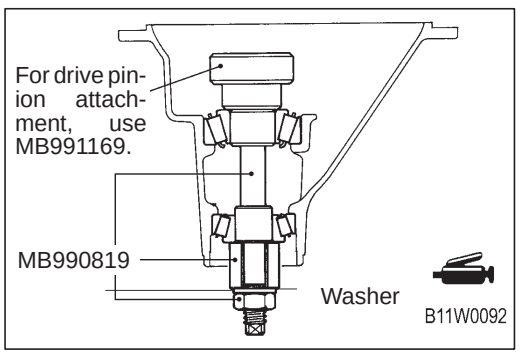
▶A◀ DRIVE PINION REAR BEARING OUTER RACE PRESS-FITTING

Use the special tools to tap in the drive pinion rear bearing outer race.



▶B◀ DRIVE PINION FRONT BEARING OUTER RACE PRESS-FITTING

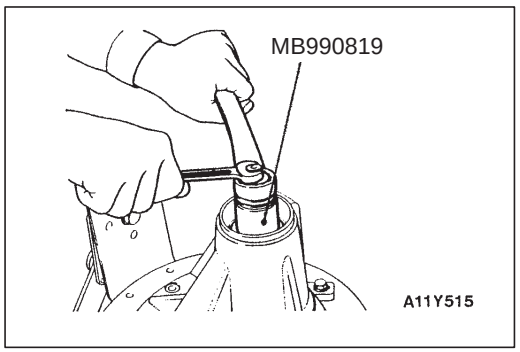
Use the special tools to tap in the drive pinion front bearing outer race.



▶C◀ DRIVE PINION HEIGHT ADJUSTMENT

Adjust the drive pinion height by the following procedures:

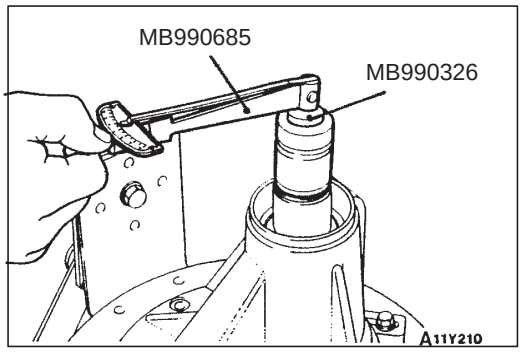
1. Apply multipurpose grease to the washer of special tool.
2. Install the special tools and drive pinion front and rear bearing inner races to the differential carrier in the sequence shown in the illustration.

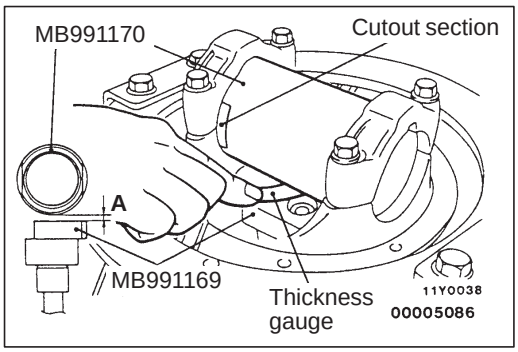


3. Gradually tighten the nut of the special tool while checking the drive pinion turning torque until the standard value of drive pinion turning torque (without oil seal) is obtained.

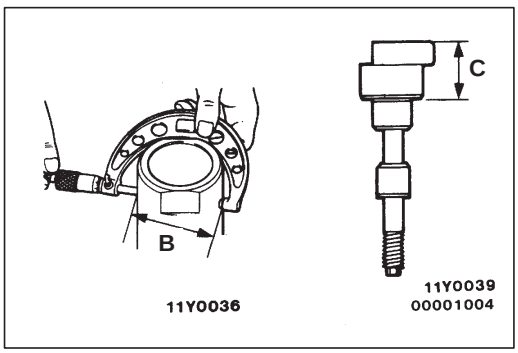
Standard value:

Bearing	Bearing lubrication	Turning torque Nm
New	None (with anti-rust agent)	0.59 – 0.88
New or reusing	Gear oil applied	0.39 – 0.49

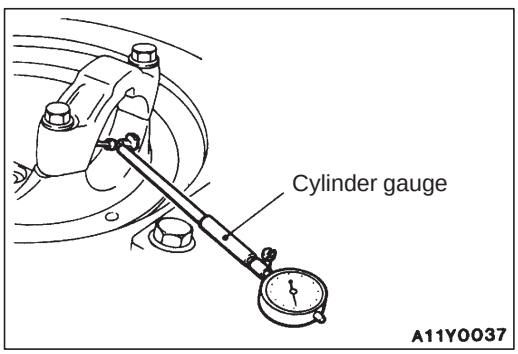




4. Clean the side bearing seat thoroughly.
5. Set the special tool on the side bearing seats, and position the cutout section as shown in the illustration. Then confirm that the special tool contacts with the side bearing seats completely.
6. Use a thickness gauge to measure the clearance (A) between the special tools.

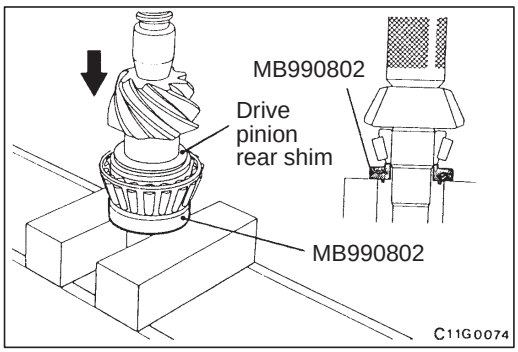


7. Remove special tools MB990720, MB990858, MB991169 and MB991170.
8. Use a micrometer to measure dimensions (B) and (C) of the special tools.



9. Install the bearing cap, and then use a cylinder gauge and the micrometer to measure the inside diameter (D) of the bearing cap as shown in the illustration.
10. Calculate the thickness (F) of the drive pinion rear shim from the following equation, and select the shim that is closest in thickness to this value.

    F = A + B + C – 1/2 D – 100



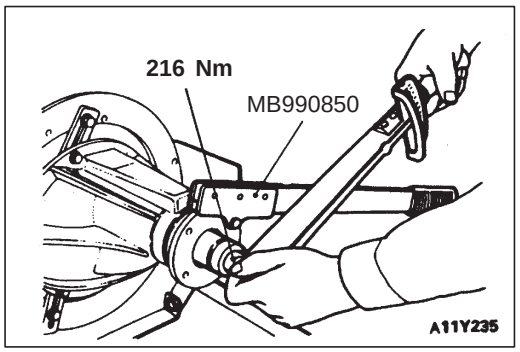
11. Fit the selected drive pinion rear shim(s) to the drive pinion, and press-fit the drive pinion rear bearing inner race by using the special tool.

▶D◀ DRIVE PINION TURNING TORQUE ADJUSTMENT

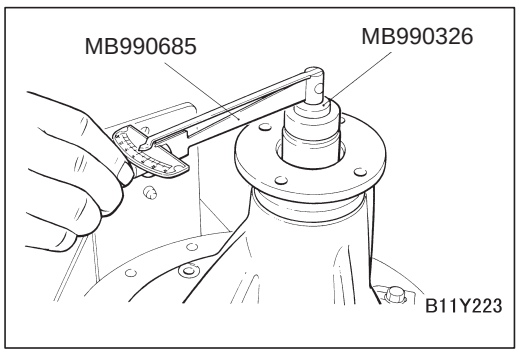
Adjust the drive pinion turning torque by using the following procedure:

1. Insert the drive pinion into the differential carrier, and then install the drive pinion spacer, the drive pinion front shim, the drive pinion front bearing inner race, and the companion flange in that order.

   NOTE
   Do not install the oil seal.



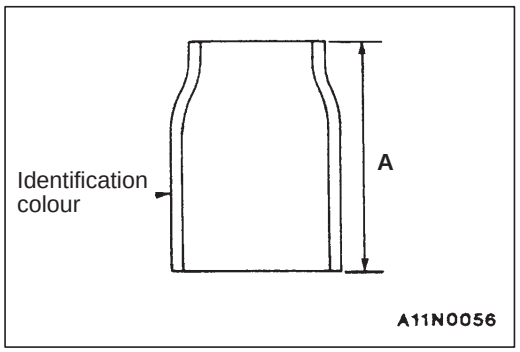
2. Use the special tool to hold the companion flange, and then tighten the companion flange self-locking nut to the specified torque.



3. Use the special tool to measure the drive pinion turning torque (without the oil seal).

Standard value:

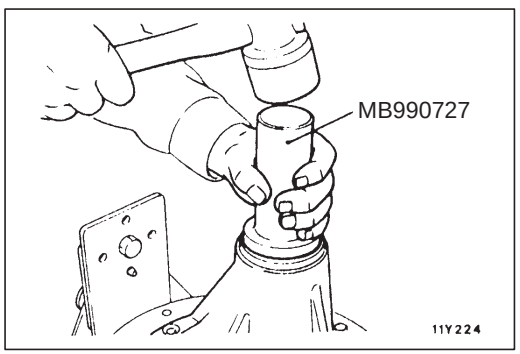
Bearing	Bearing lubrication	Turning torque Nm
New	None (with anti-rust agent)	0.59 – 0.88
New or reusing	Gear oil applied	0.39 – 0.49



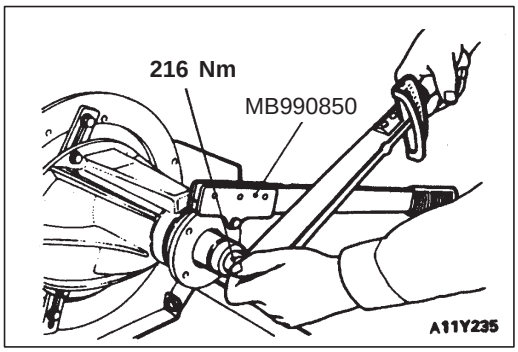
4. If the drive pinion turning torque is not within the standard value, adjust the turning torque by replacing the drive pinion front shim(s) or the drive pinion spacer.

NOTE
When selecting the drive pinion front shims, if the number of shims is large, reduce the number of shims to a minimum by selecting the drive pinion spacer.
Select either of the following drive pinion spacers.

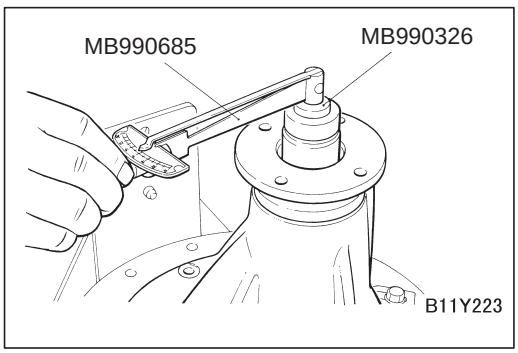
Height (A) of drive pinion spacer mm	Identification colour
56.67	–
57.01	White



5. Remove the companion flange and drive pinion once again. Insert the drive pinion front bearing inner race into the differential carrier, and then use the special tool to tap in the oil seal into the differential carrier.



6. Install the drive pinion assembly and the companion flange with mating marks properly aligned. Install the new self-locking nut, then use the special tool to hold the companion flange, and tighten the self-locking nut to the specified torque.

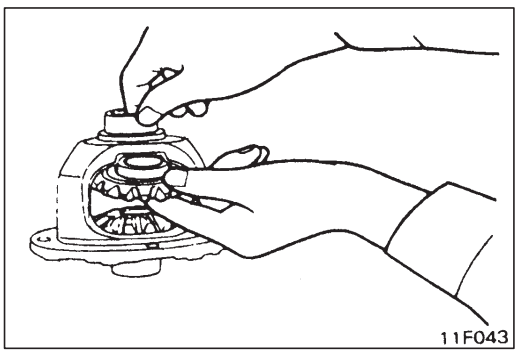


7. Use the special tool to check that the drive pinion turning torque (with the oil seal) is within the standard value.

   Standard value:

Bearing	Bearing lubrication	Turning torque Nm
New	None (with anti-rust agent)	0.83 – 1.13
New or reusing	Gear oil applied	0.64 – 0.74

8. If the drive pinion turning torque is not within the standard value, check the tightening torque of the companion flange self-locking nut and the oil seal installation condition.

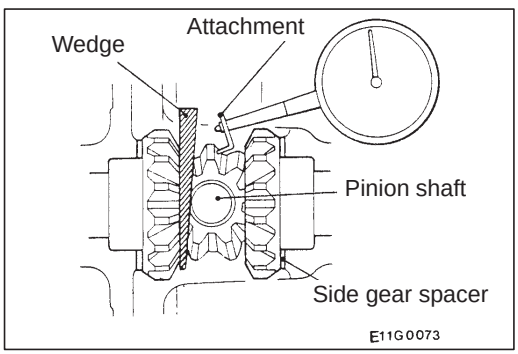


▶E◀ DIFFERENTIAL GEAR BACKLASH ADJUSTMENT

Adjust the differential gear backlash by the following procedures:

1. Assemble the side gears, side gear spacers, pinion gears and pinion washers into the differential case.
2. Temporarily install the pinion shaft.

   NOTE
   Do not drive in the lock pin yet.



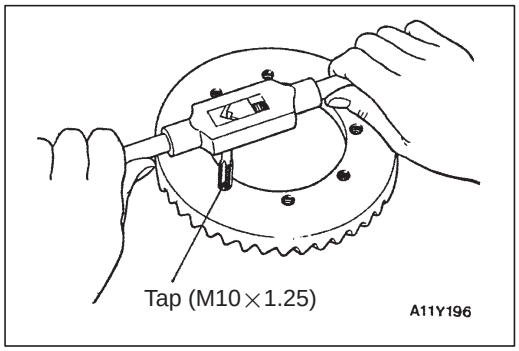
3. Insert a wooden wedge between the side gear and the pinion shaft to lock the side gear.
4. Measure the differential gear backlash with a dial indicator on the pinion gear.

   NOTE
   The measurement should be made for both pinion gears individually.

   Standard value: 0.01 – 0.25 mm

   Limit: 0.2 mm

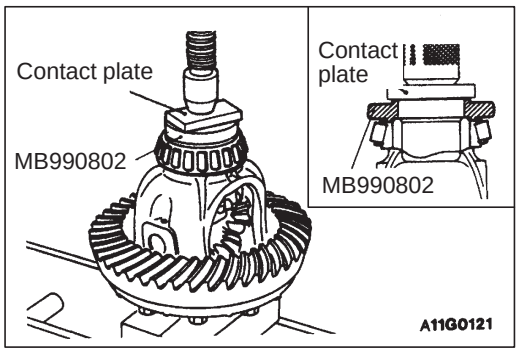
5. If the differential gear backlash exceeds the limit, adjust the backlash by replacing the side gear spacers.
6. If adjustment is not possible, replace the side gears and pinion gears as a set.
7. After adjustment, check that the backlash does not exceed the limit and the differential gear turns smoothly.



▶F◀ DRIVE GEAR INSTALLATION

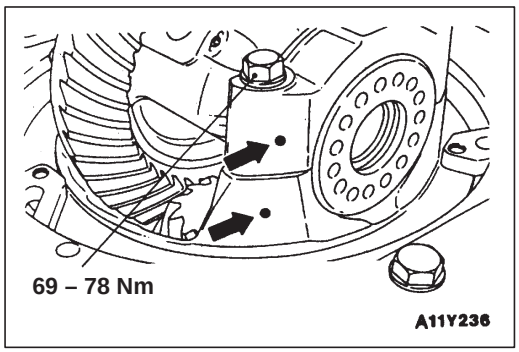
1. Clean the drive gear attaching bolts.
2. Remove the adhesive adhered to the threaded holes of the drive gear by using a tap, and then clean the threaded holes by applying compressed air.
3. Install the drive gear onto the differential case with the mating marks properly aligned.

   Tightening torque: 78 – 88 Nm



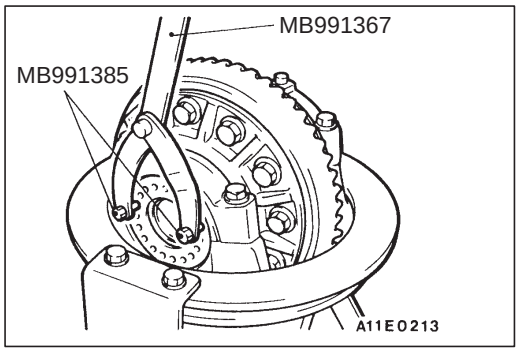
▶G◀ SIDE BEARING INNER RACE INSTALLATION

Use the special tool to press-fit the side bearing inner races into the differential case.



▶H◀ BEARING CAP INSTALLATION

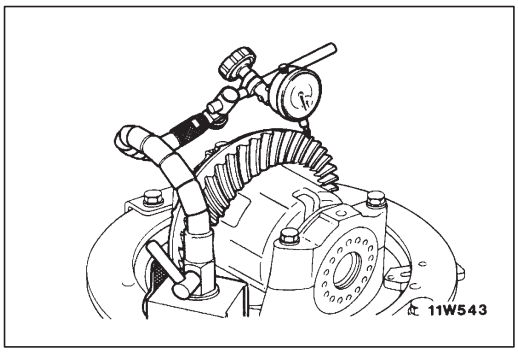
Install the bearing caps with the mating marks properly aligned, and then tighten the bearing caps installation bolts to the specified torque.



▶I◀ DRIVE GEAR BACKLASH ADJUSTMENT

Adjust the drive gear backlash by the following procedures:

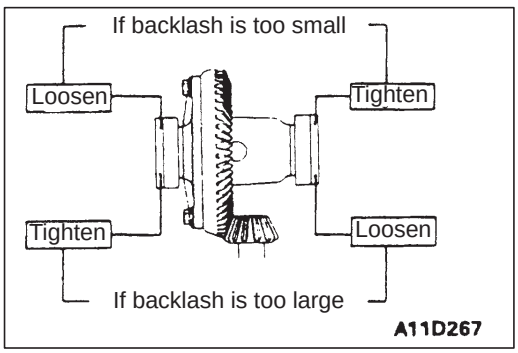
1. Use the special tools to tighten the side bearing nut to the position where a preload will start to be applied to the side bearing.



2. With the drive pinion locked in place, measure the drive gear backlash with a dial indicator on the drive gear.

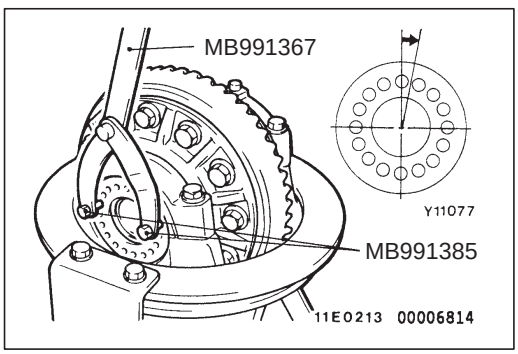
   NOTE
   Measure at four points or more on the circumference of the drive gear.

   Standard value: 0.08 – 0.13 mm

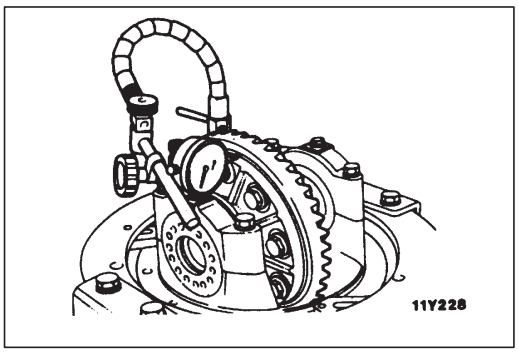


3. If the drive gear backlash is not within the standard value, use the special tools (MB991367 and MB991385) to tighten or loosen the side bearing nuts as shown in the illustration, in order to adjust the backlash.

   NOTE
   First loosen the side bearing nut, then tighten the side bearing nut the same amount as when it was loosened.



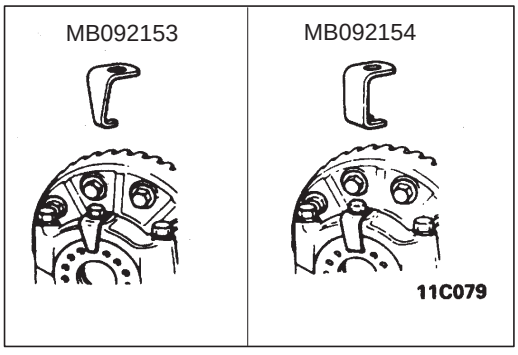
4. Use the special tools to turn down both right and left side bearing nuts on half the distance between centres of two neighboring holes, in order to apply the preload to the side bearing.



5. Measure the drive gear runout at the shoulder on the reverse side of the drive gear.

   Limit: 0.05 mm

6. If the drive gear runout exceeds the limit, reinstall by changing the phase of the drive gear and differential case, and remeasure.
7. If adjustment is not possible, replace the differential case or limited slip differential case, or replace the drive gear and drive pinion as a set.



8. Select either of the lock plates, and then install it.
9. Check the drive gear tooth contact. If poor contact is evident, adjust the drive gear tooth contact. (Refer to GROUP 26 – Differential carrier.)

GROUP 27
REAR AXLE

GENERAL

OUTLINE OF CHANGE

- The rear differential reduction gear ratio has been changed due to the introduction of 2000-mL engine.
- A rear stabilizer bracket has been added to the rear axle housing due to the introduction of the rear stabilizer bar. Because of this, the service procedure has been added. <5-door models>

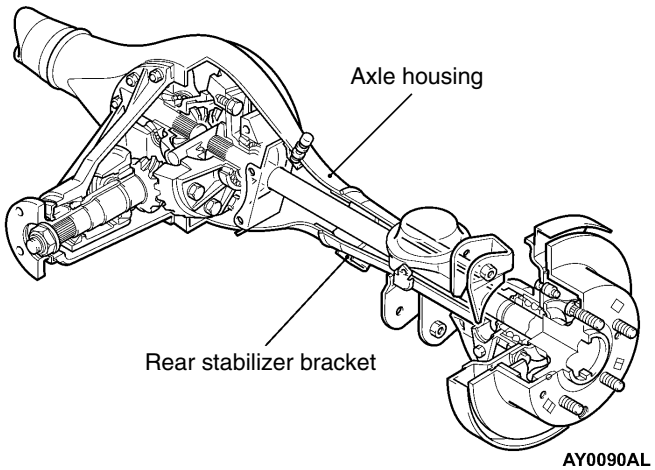
GENERAL INFORMATION

REAR DIFFERENTIAL

Item		New	Old
Reduction ratio		4.636*1, 4.900*2	4.875
Number of teeth	Drive gear	51*1, 49*2	39
	Drive pinion	11*1, 10*2	8

NOTE
*1: M/T
*2: A/T

CONSTRUCTION DIAGRAM



AXLE ASSEMBLY<5-DOOR MODELS>

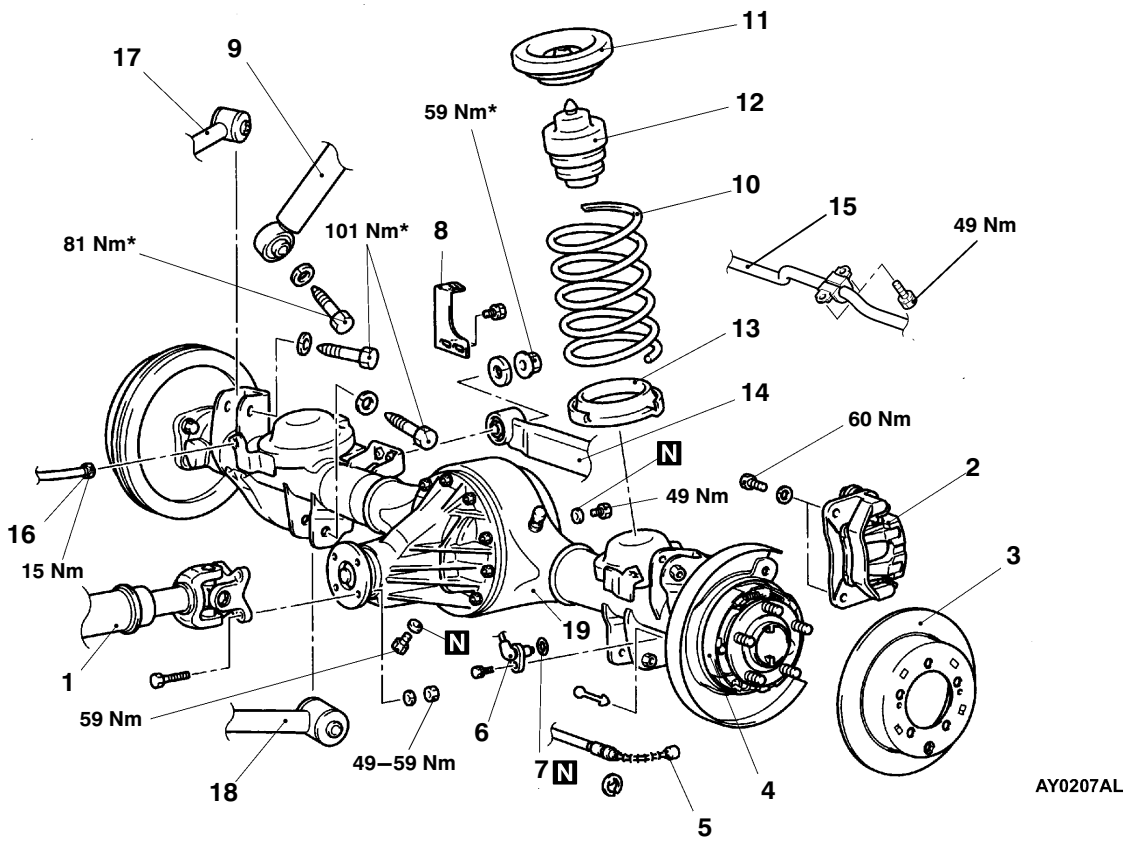
REMOVAL AND INSTALLATION

Caution

1. **To prevent bushings from breakage, the parts indicated by * should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**
2. **Be careful not to strike the pole piece at the tip of the wheel speed sensor against the other parts when removing and installing the wheel speed sensor.**

Pre-removal Operation
- Brake Fluid Draining (Refer to GROUP 35A – On-vehicle Service.)
- Differential Gear Oil Draining

Post-installation Operation
- Brake Fluid Filling and Air Bleeding (Refer to GROUP 35A – On-vehicle Service.)
- Parking Brake Lever Stroke Adjustment (Refer to GROUP 36 – On-vehicle Service.)
- Differential Gear Oil Filling



Removal steps

◀A▶
1. Rear propeller shaft connection
2. Caliper assembly
3. Brake disc
4. Parking brake shoe assembly (Refer to GROUP 36 – Parking Brake Drum.)
5. Parking brake cable connection
6. Wheel speed sensor <Vehicles with ABS>
7. O-ring <Vehicles with ABS>
8. Spring support <Vehicles without ABS>

◀B▶
9. Shock absorber connection
10. Coil spring (Refer to GROUP 34 – Rear Suspension Assembly.)
11. Silencer sheet
12. Bump stopper
13. Lower spring pad

◀C▶
14. Lateral rod connection
15. Rear stabilizer bar connection (Refer to GROUP 34 – Rear stabilizer.)
16. Rear brake pipe and hose connection
17. Upper arm connection
18. Lower arm connection

◀D▶
19. Axle assembly

NOTE
The removal service points are the same as before.

REAR AXLE

CONTENTS

GENERAL 2
Outline of Change 2
GENERAL INFORMATION 2
AXLE ASSEMBLY <1800-MPI> 3
AXLE SHAFT <1800-MPI> 4
DIFFERENTIAL CARRIER <1800-MPI> 5

GENERAL

OUTLINE OF CHANGE

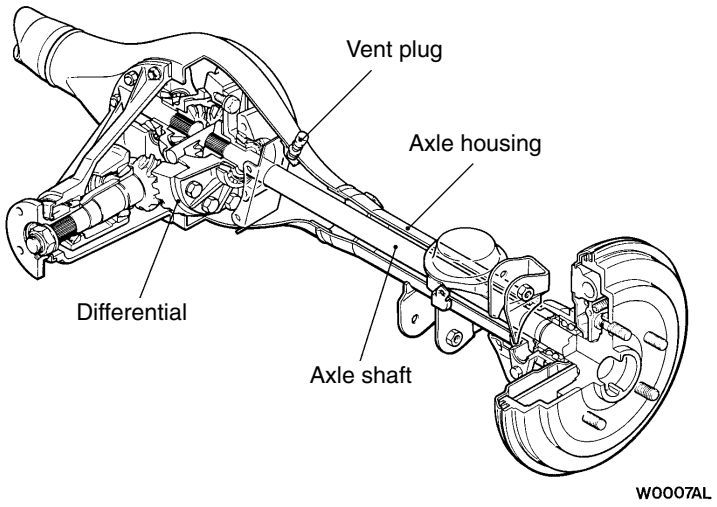
The service procedures have been established due to the addition of vehicles with 1800-MPI engine. The other service procedures are the same as before.

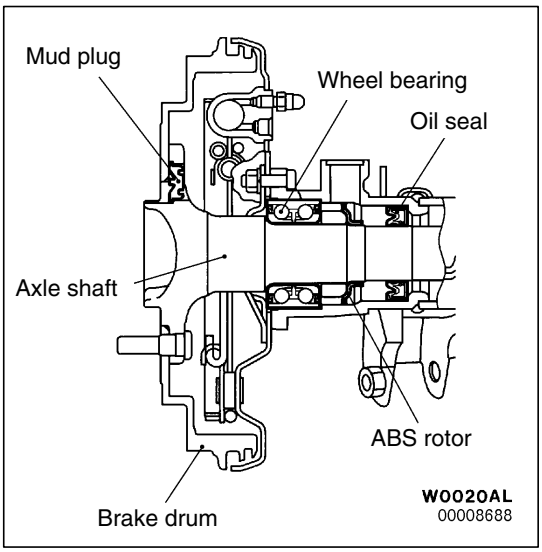
GENERAL INFORMATION

Item		1800-MPI
Reduction ratio		4.636*1, 5.111*2
Number of teeth	Drive gear	51*1, 46*2
	Drive pinion	11*1, 9*2
Bearing (O.D. × I.D.) mm	Side	73.4 × 41.3
	Front	64.3 × 30.2
	Rear	76.2 × 36.5

NOTE
*1: M/T
*2: A/T

CONSTRUCTION DIAGRAM





AXLE ASSEMBLY <1800-MPI>

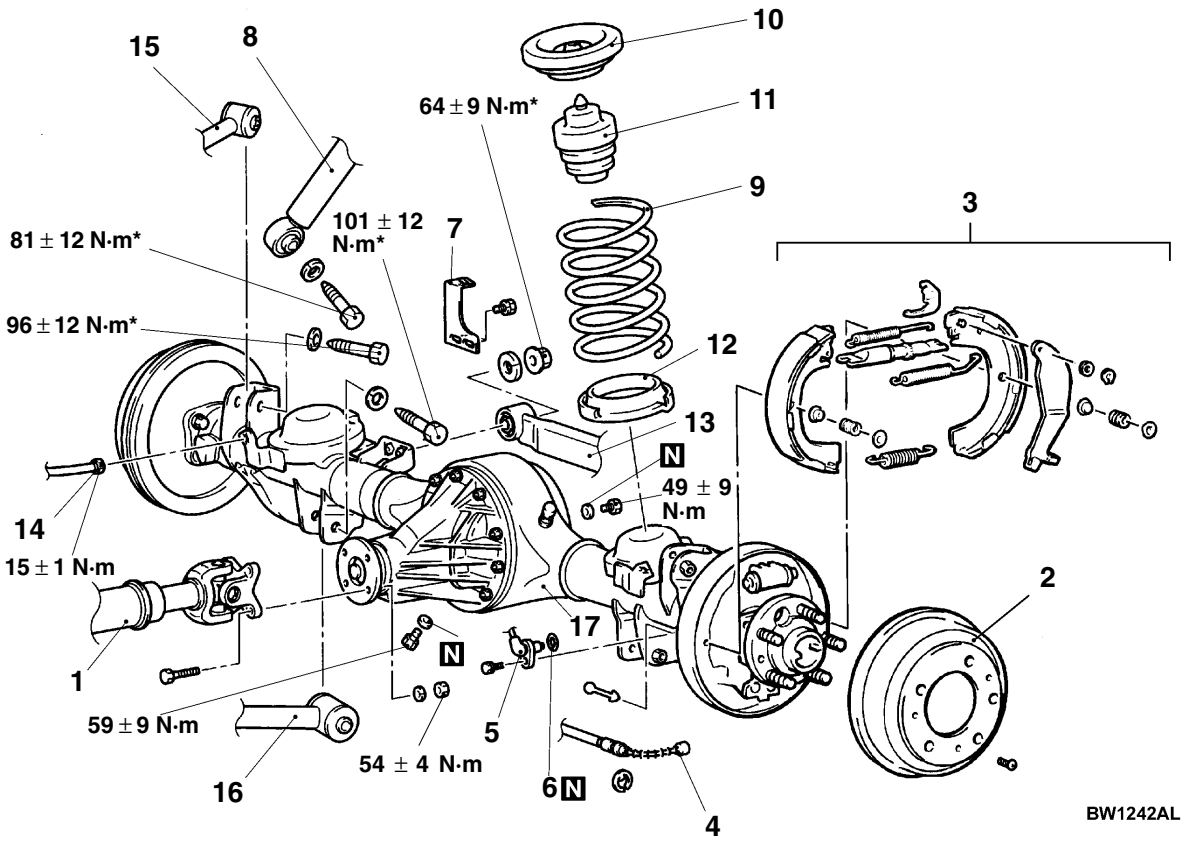
REMOVAL AND INSTALLATION

Caution

1. **To prevent bushings from breakage, the parts indicated by * should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**
2. **Be careful not to strike the pole piece at the tip of the wheel speed sensor against the other parts when removing and installing the wheel speed sensor.**

Pre-removal Operation
- Brake Fluid Draining
- Differential Gear Oil Draining

Post-installation Operation
- Brake Fluid Filling and Air Bleeding
- Parking Brake Lever Stroke Adjustment(Refer to GROUP36 – On Vehicle Service.)
- Differential Gear Oil Filling



Removal steps

◀A▶
1. Rear propeller shaft connection
2. Brake drum
3. Shoe and lining assembly (Refer to GROUP 35A – Rear Drum Brake.)
4. Parking brake cable connection
5. Wheel speed sensor<Vehicles with ABS>
6. O-ring<Vehicles with ABS>
7. Load sensing proportioning valve spring support<Vehicles without ABS>

◀B▶
8. Shock absorber connection
9. Coil spring
10. Silencer sheet
11. Bump stopper
12. Lower spring pad

◀C▶
13. Lateral rod connection
14. Rear brake pipe and hose connection
15. Upper arm connection
16. Lower arm connection

◀D▶
17. Axle assembly

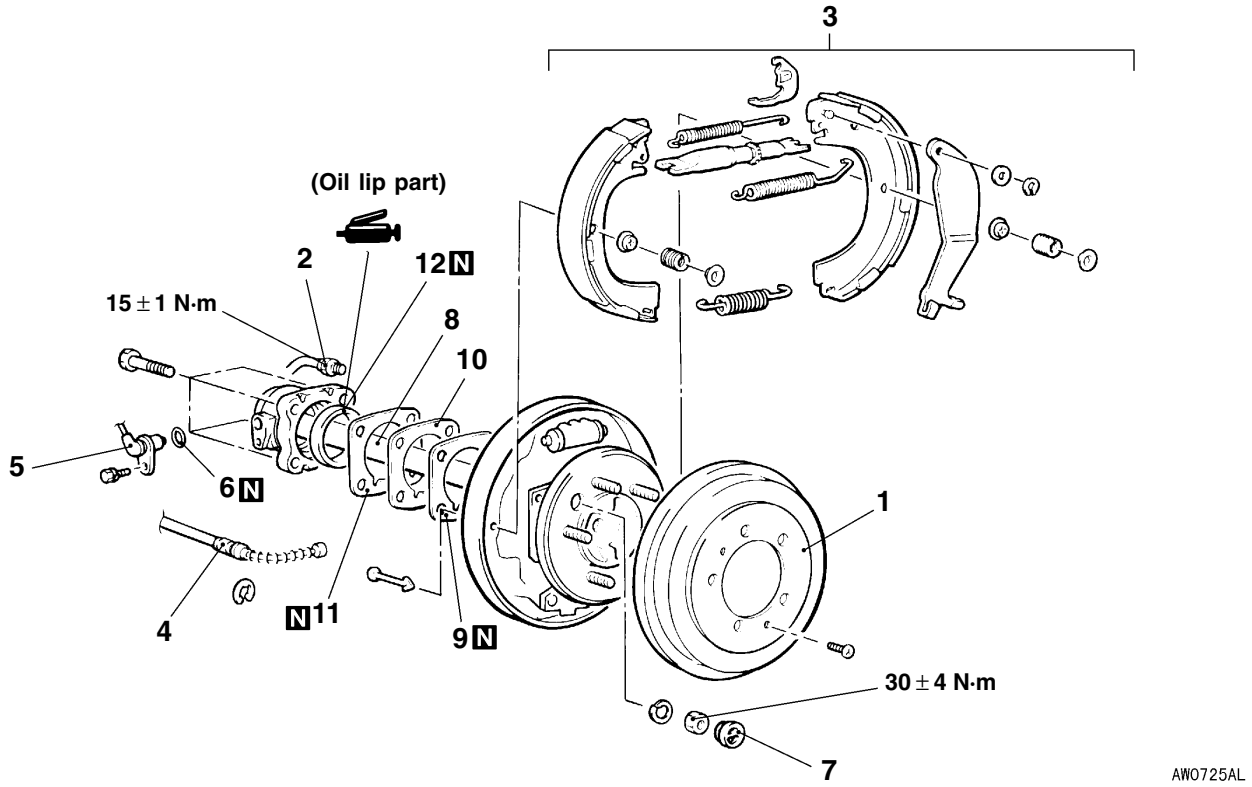
NOTE
Removal service points are the same as before.

AXLE SHAFT <1800-MPI>

REMOVAL AND INSTALLATION

Pre-removal Operation
Brake Fluid Draining

Post-installation Operation
- Brake Fluid Filling and Air Bleeding
- Parking Brake Lever Stroke Adjustment



Removal steps

1. Brake drum
2. Rear brake pipe connection
3. Shoe and lining assembly (Refer to GROUP 35A – Rear Drum Brake.)
4. Parking brake cable connection
5. Wheel speed sensor<Vehicles with ABS>
6. O-ring<Vehicles with ABS>
7. Plug

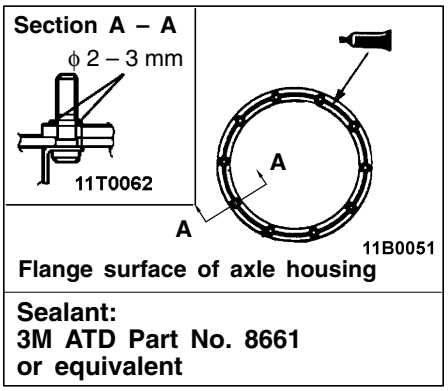
◀A▶ 8. Axle shaft assembly
▶B◀ 9. Packing(s)
▶B◀ 10. Shim(s)
▶B◀ 11. Packing(s)
◀B▶ ▶A◀ 12. Oil seal

NOTE
Removal and installation service points are the same as before.

DIFFERENTIAL CARRIER <1800-MPI>

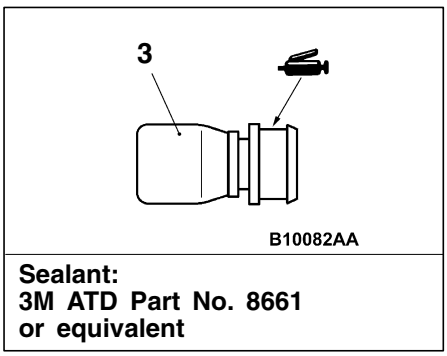
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Differential Gear Oil Draining and Refilling
- Axle Shaft Removal and Installation (Refer to P.27-4.)
- Brake Fluid Draining, Refilling and Air Bleeding

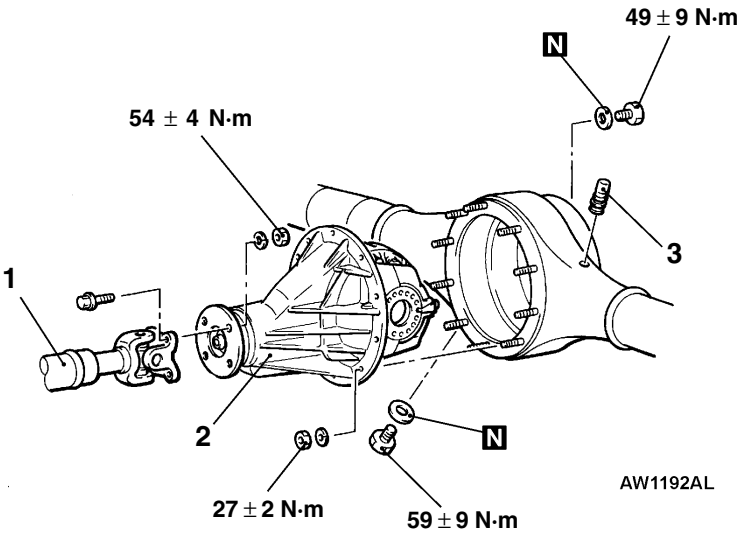


Flange surface of axle housing

Sealant:
3M ATD Part No. 8661
or equivalent



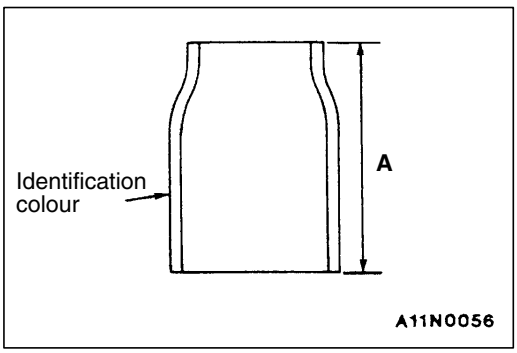
Sealant:
3M ATD Part No. 8661
or equivalent



Removal steps

◀A▶ ▶A◀ ◀B▶
1. Rear propeller shaft connection
2. Differential carrier assembly
3. Vent plug

NOTE
Removal and installation service points are the same as before.



DISASSEMBLY AND REASSEMBLY

REASSEMBLY SERVICE POINTS

Service procedures except following are the same as before.

▶C◀ DRIVE PINION HEIGHT ADJUSTMENT

If the drive pinion turning torque is not within the standard value, adjust the turning torque by replacing the drive pinion front shim(s) or the drive pinion spacer.

NOTE
When selecting the drive pinion front shims, if the number of shims is large, reduce the number of shims to a minimum by selecting the drive pinion spacer.
Select either of the following drive pinion spacers.

Height (A) of drive pinion spacer mm	Identification colour
46.67	White
47.01	–

WHEEL AND TYRE

WHEEL AND TYRE

CONTENTS

GENERAL INFORMATION 2

SERVICE SPECIFICATIONS 2

TROUBLESHOOTING 3

ON-VEHICLE SERVICE 4

Tyre Inflation Pressure Check 4

Tyre Wear Check 4

Wheel Runout Check 4

WHEEL AND TYRE 4

GENERAL INFORMATION

The wheels and tyres of the following specifications have been established.

SPECIFICATIONS

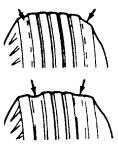
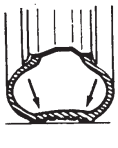
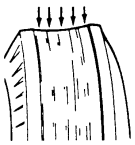
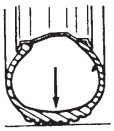
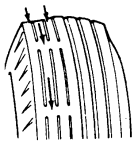
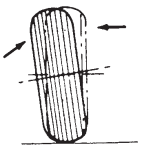
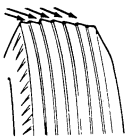
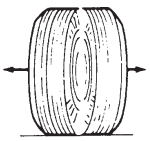
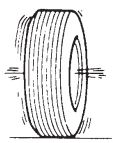
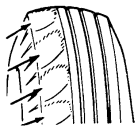
Items		Specification
Wheel	Type	Steel Aluminium*
	Size	16 × 6JJ
	Amount of wheel offset mm	46
	Pitch circle diameter (P.C.D.) mm	114.3
Tyre	Size	215/65R16 98S

NOTE
*: Optional items

SERVICE SPECIFICATIONS

Items		Limit
Tread depth of tyre mm		1.6
Wheel runout (Radial runout) mm	Steel wheel	1.2 or less
	Aluminium wheel	1.0 or less
Wheel runout (Lateral runout) mm	Steel wheel	1.2 or less
	Aluminium wheel	1.0 or less

TROUBLESHOOTING

Symptom		Probable cause		Remedy	Reference page
Rapid wear at shoulders	 11X0109	Under-inflation or lack of rotation	 11X0116	Adjust the tyre pressure.	31-4.
Rapid wear at centre	 11X0110	Over-inflation or lack of rotation	 11X0117		
Cracked treads	 11X0111	Under-inflation		Adjust the tyre pressure.	31-4.
Wear on one side	 11X0112	Excessive camber	 11X0118	Inspect the camber.	Refer to GROUP 33A – On-vehicle Service.
Feathered edge	 11X0113	Incorrect toe-in	 11X0119	Adjust the toe-in.	
Bald spots	 11X0114	Unbalanced wheel	 11X0120	Adjust the imbalanced wheels.	–
Scalloped wear	 11X0115	Lack of rotation of tyres or worn or out-of-alignment suspension		Rotate the tyres and check the front suspension alignment.	Refer to GROUP 33A – On-vehicle Service.

ON-VEHICLE SERVICE

TYRE INFLATION PRESSURE CHECK

NOTE
For information on tyre inflation pressure, refer to the label attached near the driver's side door striker.

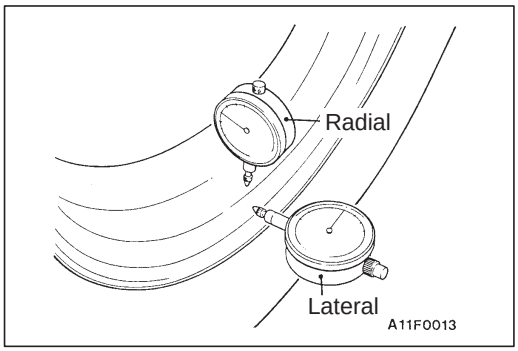
TYRE WEAR CHECK

Measure the tread depth of tyres.

Limit: 1.6 mm

If the remaining tread depth is less than the limit, replace the tyre.

NOTE
When the tread depth of tyres is reduced to 1.6 mm or less, wear indicators will appear.



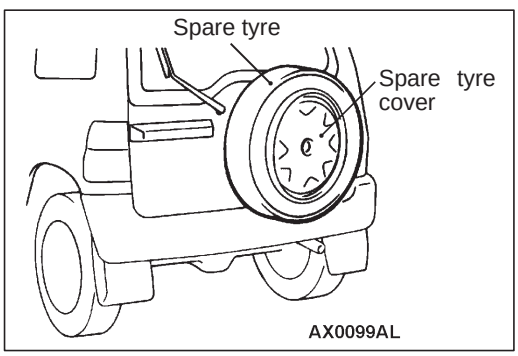
WHEEL RUNOUT CHECK

Jack up the vehicle so that the wheels are clear of the floor. While slowly turning the wheel, measure wheel runout with a dial indicator.

Limit:

Item	Steel wheel	Aluminium wheel
Radial runout mm	1.2	1.0
Lateral runout mm	1.2	1.0

If wheel runout exceeds the limit, replace the wheel.



WHEEL AND TYRE

INSTALLATION SERVICE POINT

Tighten the wheel nut to the specified torque.

Tightening torque: 98 Nm

When installing the spare tyre and spare tyre cover to the spare tyre carrier, tighten the wheel nut, lock cylinder and bolt to the specified torque.

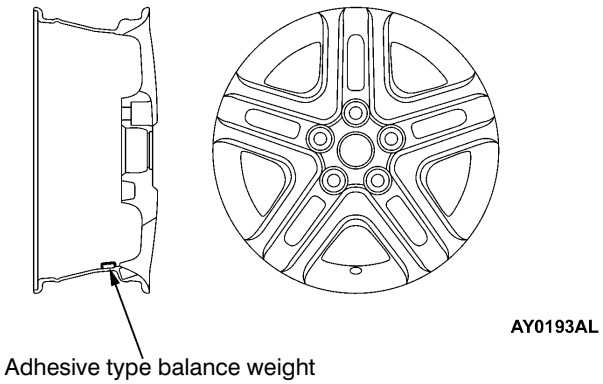
Tightening torque: 46 Nm

GROUP 31
WHEEL AND TYRE

GENERAL

OUTLINE OF CHANGE

A newly designed aluminium wheel has been added. Its appearance has been improved by attaching a balance weight on the rim inside surface.



GENERAL INFORMATION

SPECIFICATIONS

Items		Specification
Wheel	Type	Aluminium type*
	Size	16 × 6J
	Amount of wheel offset mm	46
	Pitch circle diameter (P.C.D.) mm	114.3

NOTE
*: Optional items

POWER PLANT MOUNT

POWER PLANT MOUNT

CONTENTS

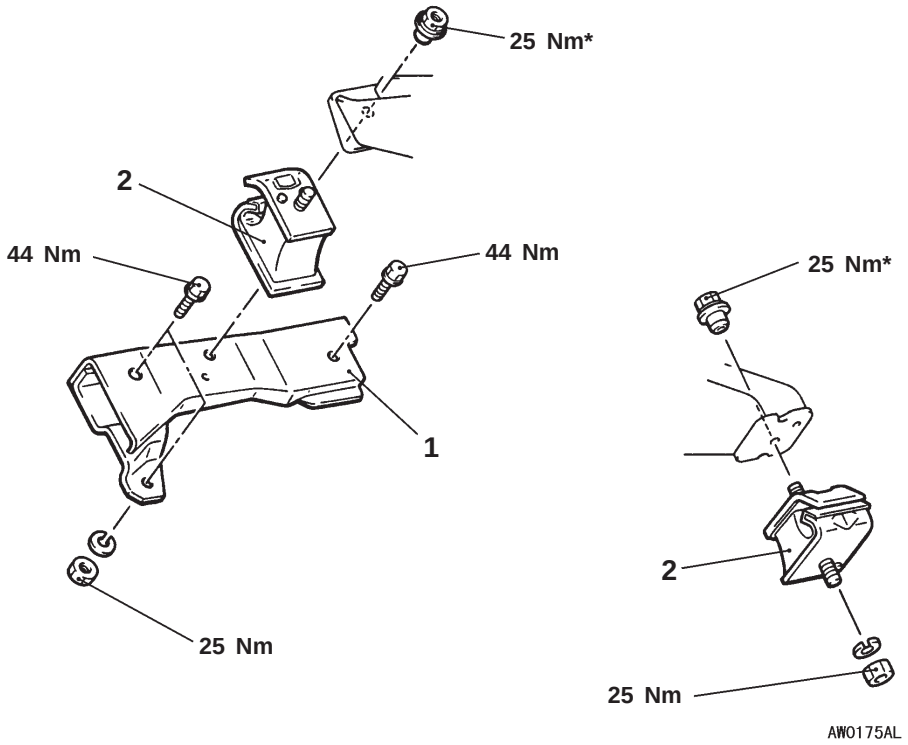
ENGINE MOUNTING 2
TRANSMISSION MOUNTING 3

ENGINE MOUNTING

REMOVAL AND INSTALLATION

Caution
Provisionally tighten the parts marked by an asterisk (*), and then fully tighten after loading the full weight of the engine on the vehicle body.

Pre-removal and Post-installation Operation
Crossmember Removal and Installation (Refer to GROUP 33.)



Removal steps

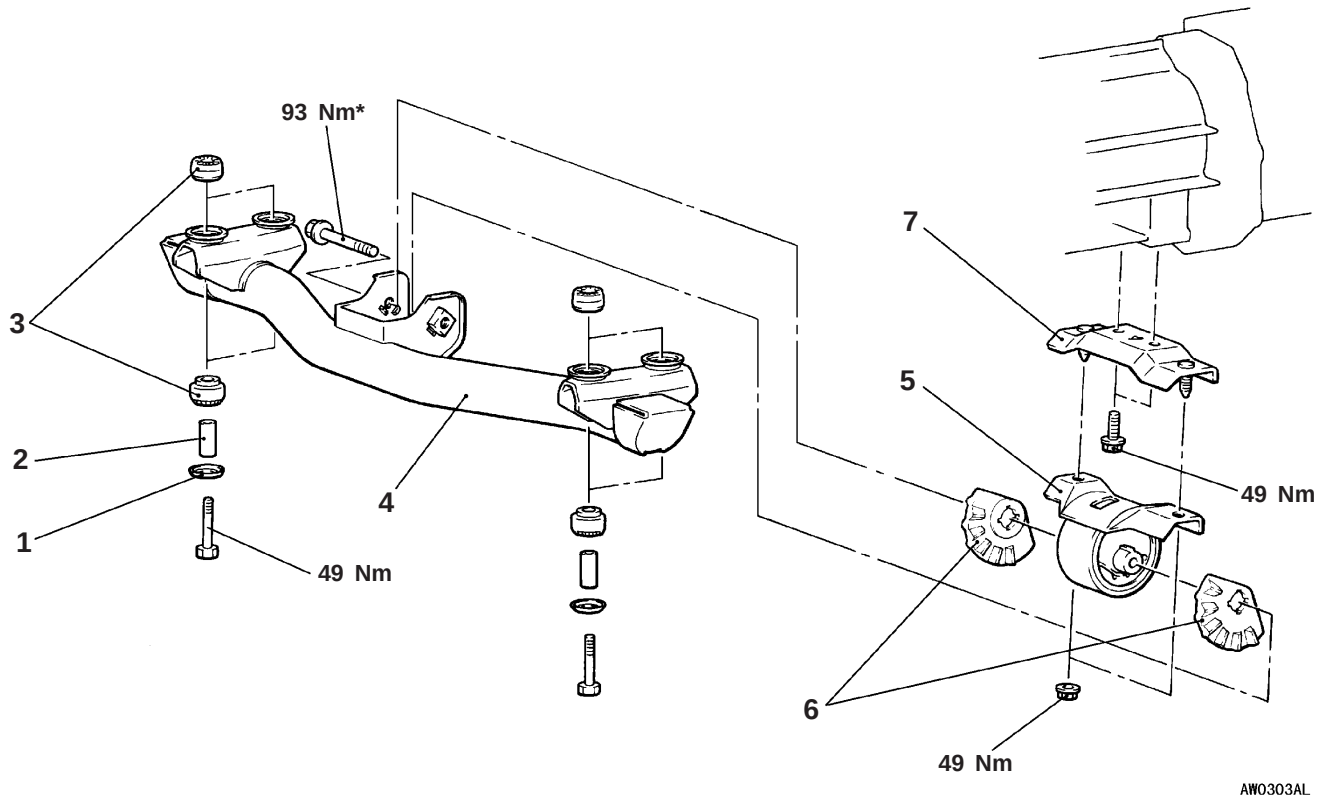
1. Engine mount bracket
2. Engine mount insulator

TRANSMISSION MOUNTING

REMOVAL AND INSTALLATION

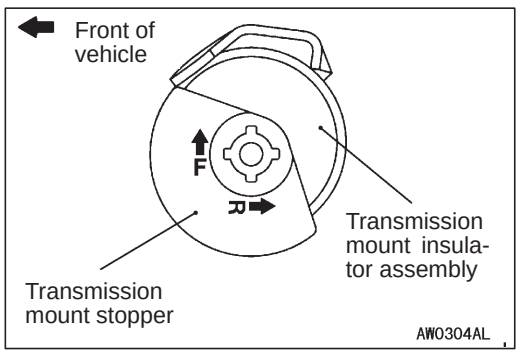
Caution
Provisionally tighten the parts marked by an asterisk (*), and then fully tighten after loading the full weight of the transmission on the vehicle body.

Pre-removal and Post-installation Operation
Jack up the Engine and Transmission Assembly until there is no weight on the Engine Mount Bracket Insulator.



Removal steps

1. Washer
2. Spacer
3. Transmission mount bushing
4. Transmission mount crossmember assembly
5. Transmission mount insulator assembly
▶A◀ 6. Transmission mount stopper
7. Adaptor



INSTALLATION SERVICE POINT

▶A◀ TRANSMISSION MOUNT STOPPER INSTALLATION

Install the transmission mount stopper so that the arrow faces the direction shown.

NOTE
Disregard F and R stamped as a shared part.

NOTES

GROUP 32
POWER PLANT MOUNT

GENERAL

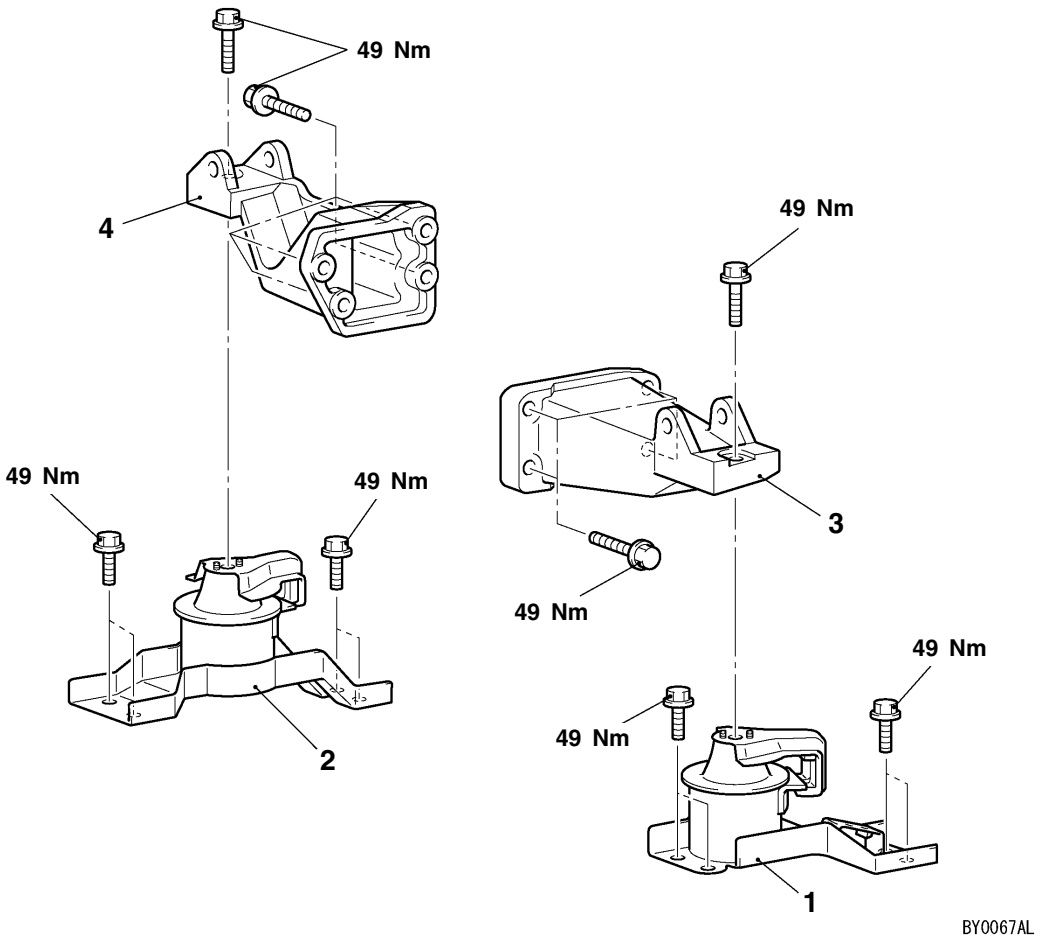
OUTLINE OF CHANGE

The following service procedures have been added due to the change of the engine mount and transmission mount.

ENGINE MOUNTING

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Crossmember Removal and Installation



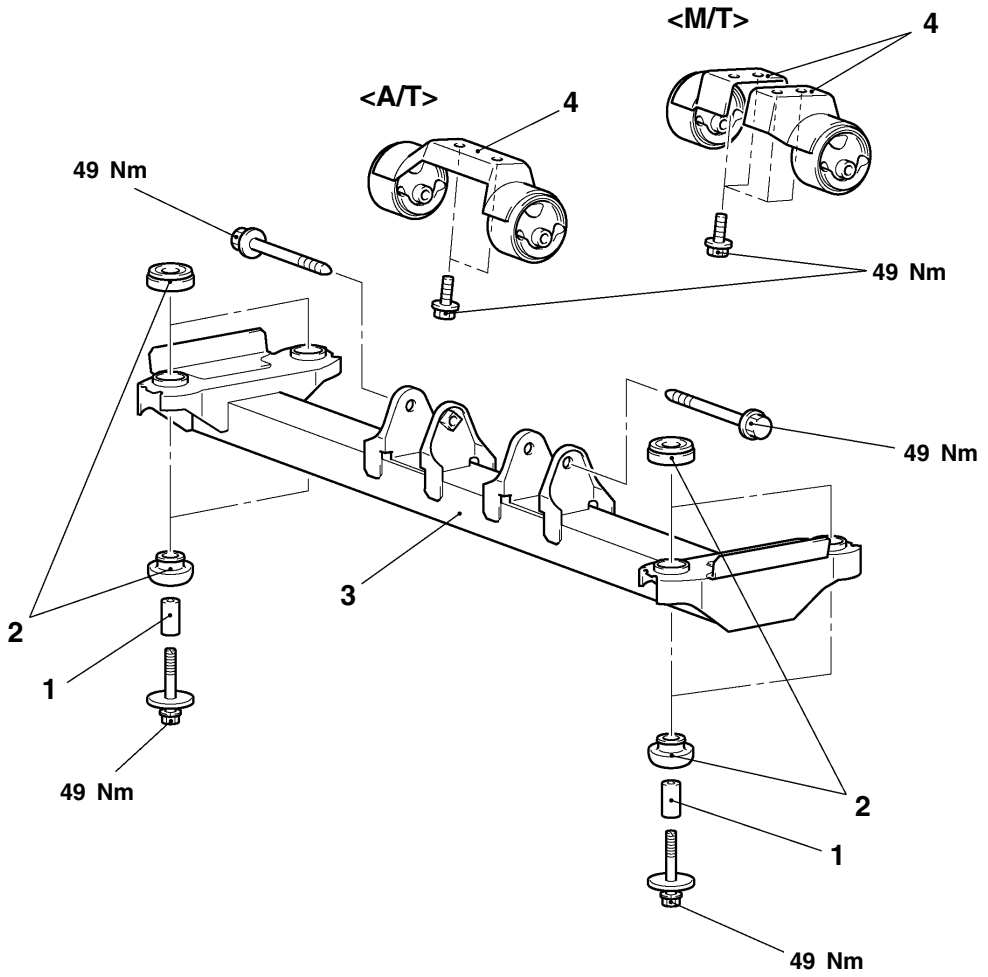
Removal steps

1. Engine mount insulator Assembly (L.H.)
2. Engine mount insulator Assembly (R.H.)
3. Engine mount bracket (L.H.)
4. Engine mount bracket (R.H.)

TRANSMISSION MOUNTING

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Jack up the Engine and Transmission Assembly until there is no weight on the Engine Mount Bracket Insulator.



Removal steps

1. Collar
2. Transmission mount bushing
3. Transmission mount crossmember Assembly
4. Transmission mount insulator Assembly

GROUP 32
POWER PLANT MOUNT

GENERAL

OUTLINE OF CHANGE

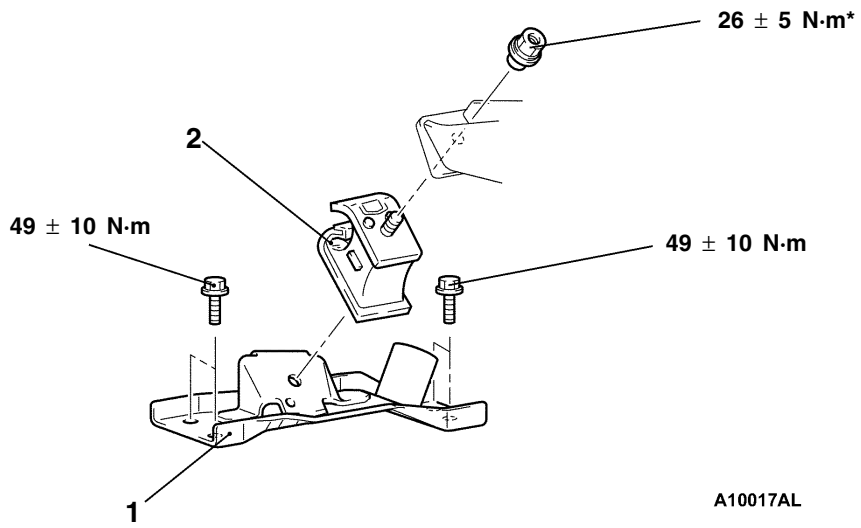
The following service procedures have been established due to the addition of vehicles with 4G9-MPI engine. The other service procedures are the same as the vehicles with GDI engine.

ENGINE MOUNTING

REMOVAL AND INSTALLATION

Caution
Provisionally tighten the parts marked by an asterisk (*), and then fully tighten after loading the full weight of the engine on the vehicle body.

Pre-removal and Post-installation Operation
Crossmember Removal and Installation
(Refer to GROUP 33.)



Removal steps

1. Engine mount bracket <RH>
2. Engine mount insulator

NOTES

FRONT SUSPENSION

FRONT SUSPENSION

CONTENTS

GENERAL INFORMATION 2

SERVICE SPECIFICATIONS 3

SPECIAL TOOLS 3

ON-VEHICLE SERVICE 4

Wheel Alignment Check and Adjustment 4

Ball Joint Dust Cover Check 6

STRUT ASSEMBLY 7

STRUT BAR AND LOWER ARM 10

STABILIZER BAR 13

CROSSMEMBER 15

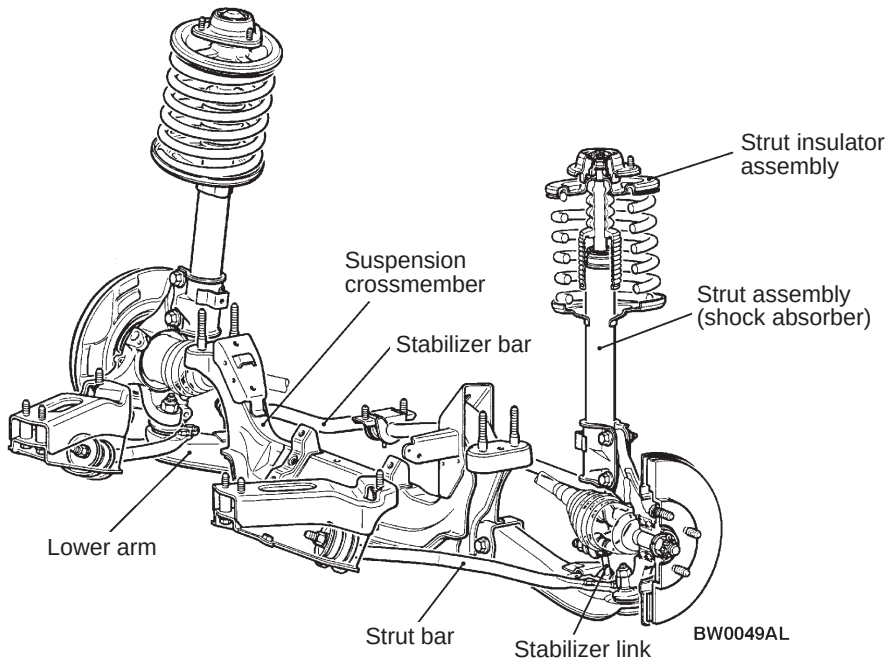
GENERAL INFORMATION

The front suspension is a McPherson strut with coil spring. The shock absorber is gas-filled hydraulic double-acting type.

COIL SPRING

Items	Specification
Wire diameter × average diameter × free length mm	14 × 160 × 365

CONSTRUCTION DIAGRAM

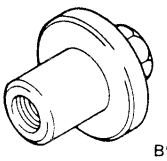
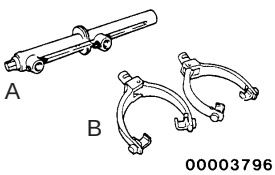
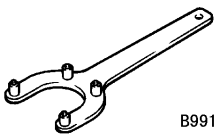
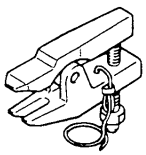
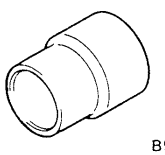


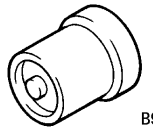
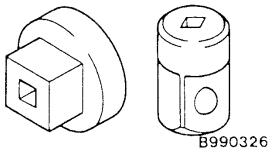
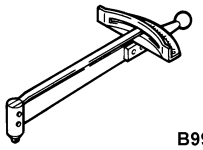
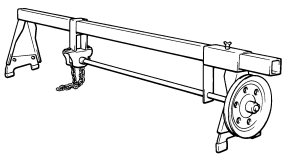
SERVICE SPECIFICATIONS

Items		Standard value
Toe-in	At the centre of tyre tread mm	3 ± 2
	Toe-angle (per wheel)	0°07' ± 05'
Toe-out angle on turns (inner wheel when outer wheel at 20°)		21°04'
Camber		0°30' ± 30'*
Caster		3°00' ± 30'*
Side slip mm (per 1 m)		0 ± 3
Kingpin inclination		11°04'
Lower arm ball joint rotation starting torque Nm		1.0 – 5.9
Stabilizer link ball joint turning torque Nm		1.7 – 3.1

NOTE
*: difference between right and left wheels: less than 30'

SPECIAL TOOLS

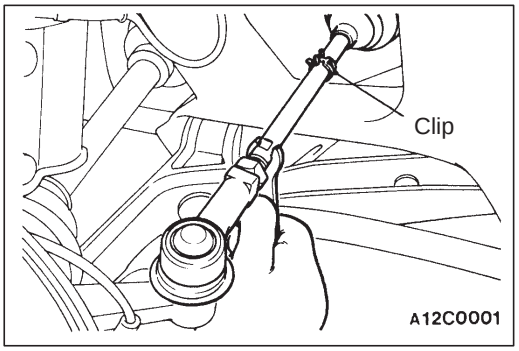
Tools	Number	Name	Use
 B991004	MB991004	Wheel alignment gauge attachment	Wheel alignment measurement <Vehicles with aluminium wheels>
 A B 00003796	A: MB991237 B: MB991238	A: Spring compressor body B: Arm set	Coil spring compression
 B991176	MB991176	Spring seat holder	Disassembly and assembly of the strut assembly
 B991113	MB991406 or MB991113	Steering linkage puller	Tie rod end disconnection
 B990799	MB990799	Ball joint remover & installer	Lower arm bushing press-in and press-out

Tools	Number	Name	Use
 B990996	MB990996	Lower arm bushing arbor	Lower arm bushing press-in and press-out
 B99099	MB990997	Lower arm bushing installer support	
 B990326	MB990326	Preload socket	• Lower arm ball joint rotation starting torque measurement • Stabilizer link ball joint rotation torque measurement
 B990968	MB990968	Torque wrench	
	GENERAL SERVICE TOOL MZ203827	Engine lifter	Supporting the engine assembly during removal and installation of the crossmember

ON-VEHICLE SERVICE

WHEEL ALIGNMENT CHECK AND ADJUSTMENT

Measure the wheel alignment with the vehicle parked on a level surface.
The front suspension, steering system, and wheels should be serviced to normal condition prior to measurement of wheel alignment.



TOE-IN

Standard value:

At the centre of tyre tread 3 ± 2 mm
Toe angle (per wheel) 0°07' ± 05'

1. If the toe-in is not within the standard value, adjust the toe-in by undoing the clip and turning the left and right tie rod turnbuckles by the same amount (in opposite directions).

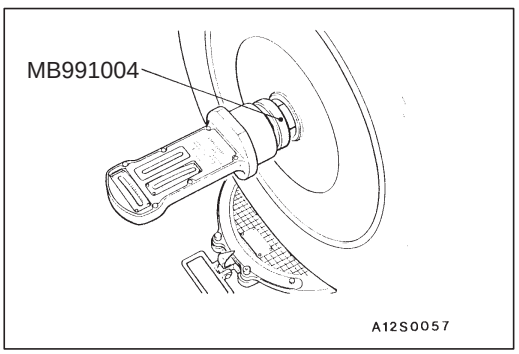
   NOTE
   The toe will move out as the left turnbuckle is turned toward the front of the vehicle and the right turnbuckle is turned toward the rear of the vehicle.

2. Use a turning radius gauge to check that the steering angle is at the standard value.
   (Refer to GROUP 37A – On-vehicle Service.)

TOE-OUT ANGLE ON TURNS

To check the steering linkage, especially after the vehicle has been involved in an accident or if an accident is presumed, it is advisable to check the toe-out angle on turns in addition to the wheel alignment.
Conduct this test on the left turn as well as on the right turn.

Standard value (inner wheel when outer wheel at 20°): 21°04'



CAMBER, CASTER AND KINGPIN INCLINATION

Standard value:

Item	Specification
Camber (difference between right and left wheel: less than 30')	0°30' ± 30'
Caster (difference between right and left wheel: less than 30')	3°00' ± 30'
Kingpin inclination	11°04'

NOTE
1. Camber and caster are preset at the factory and cannot be adjusted.
2. If camber is not within the standard value, check and replace bent or damaged parts.
3. For vehicles with aluminium type wheels, attach the camber/caster/kingpin gauge to the drive shaft by using the special tool. Tighten the special tool to the same torque 226 Nm as the drive shaft nut.

Caution
To prevent the wheel bearing from damage, never subject the wheel bearings to the vehicle load when the drive shaft nuts are loosened.

SIDE SLIP

Measure the side slip with a side slip tester.

Standard value: 0 ± 3 mm

BALL JOINT DUST COVER CHECK

1. Check the dust cover for cracks or damage by pushing it with finger.
2. If the dust cover is cracked or damaged, replace the lower arm assembly or stabilizer link.

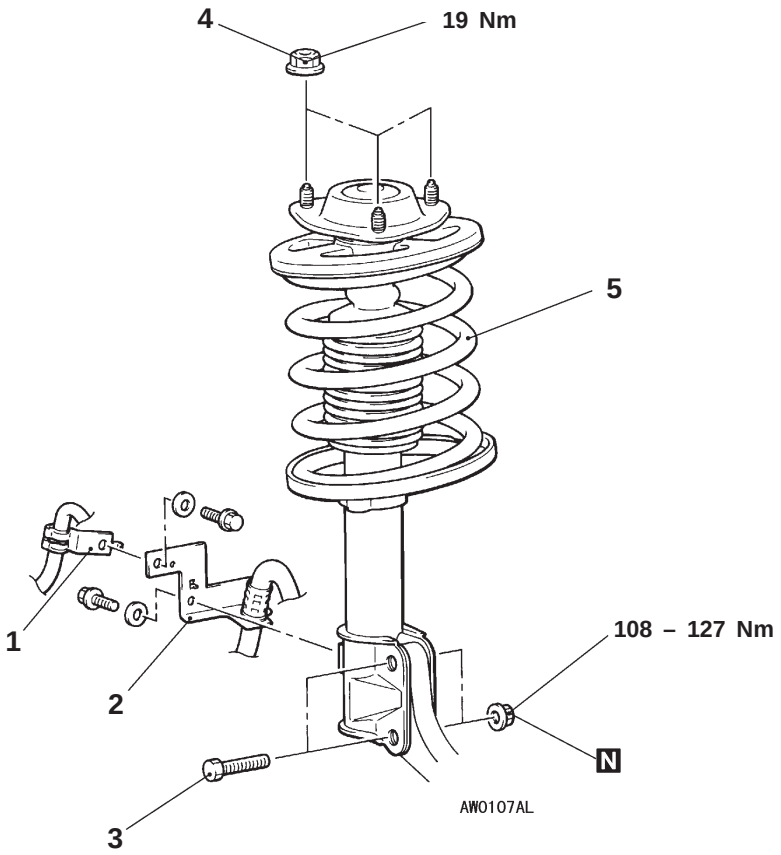
   NOTE
   Cracks or damage of the dust cover may cause damage of the ball joint.

STRUT ASSEMBLY

REMOVAL AND INSTALLATION

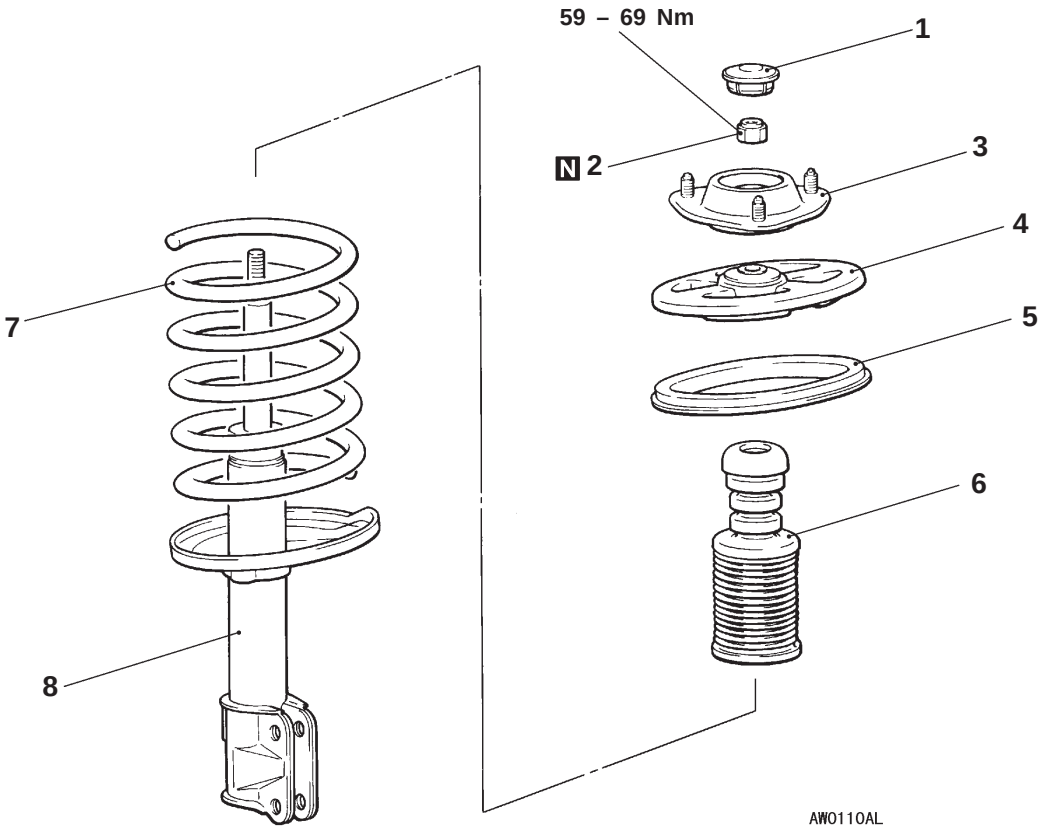
Pre-removal Operation
Injector Driver Removal <right side>
(Refer to GROUP 13A.)

Post-installation Operation
- Injector Driver Installation <right side>
  (Refer to GROUP 13A.)
- Check the Dust Cover for Cracks or Damage by Pushing it with Fingers.
- Wheel Alignment Check and Adjustment
  (Refer to P.33A-4.)



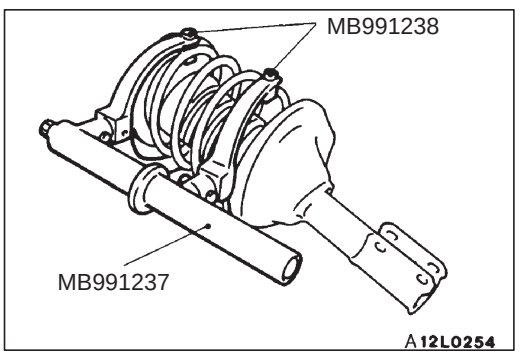
Removal steps
1. Front wheel speed sensor harness bracket <Vehicles with ABS>
2. Brake hose bracket
3. Knuckle connection
4. Strut installation nut
5. Strut assembly

DISASSEMBLY AND REASSEMBLY



Disassembly steps

1. Dust cover
◀A▶ ▶A◀ 2. Self-locking nut
3. Strut insulator assembly
4. Upper spring seat assembly
5. Upper spring pad
6. Bump rubber
7. Coil spring
◀B▶ 8. Strut assembly

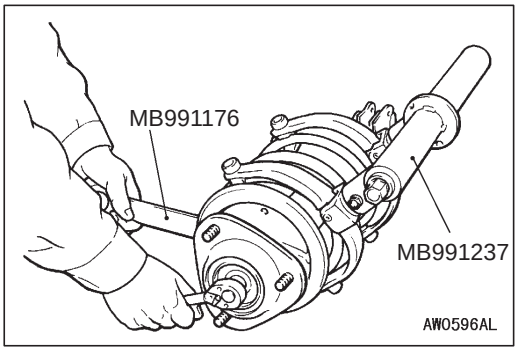


DISASSEMBLY SERVICE POINT

◀A▶ SELF-LOCKING NUT REMOVAL

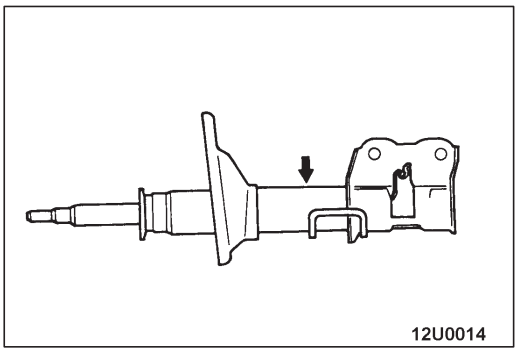
1. Use the special tools to compress the coil spring.

Caution
Install the special tools evenly, and so that the maximum length will be attained within the installation range.



2. Holding the upper spring seat with the special tool, loosen the self-locking nut.

Caution
Do not use an impact wrench as it will cause the bolt of the special tool to be seized.

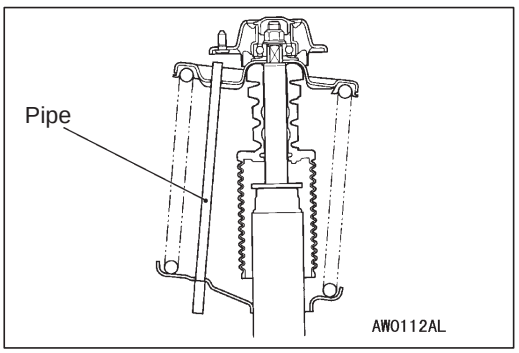


◀B▶ STRUT ASSEMBLY REMOVAL

To discard the strut assembly, place the assembly horizontally with its piston rod extended. Then drill a hole approx. 3 mm in diameter at the location shown in the illustration and discharge the gas.

Caution
The gas itself is harmless but it may issue out of the hole together with chips generated by the drill. Therefore, be sure to wear goggles.

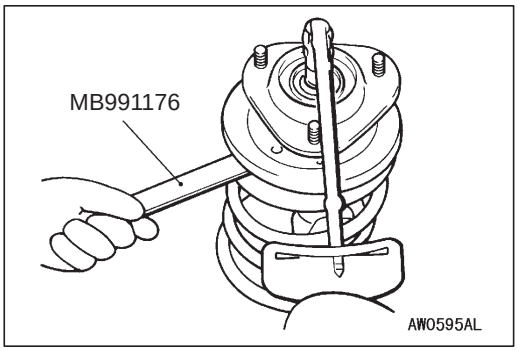
REASSEMBLY SERVICE POINT



▶A◀ SELF-LOCKING NUT INSTALLATION

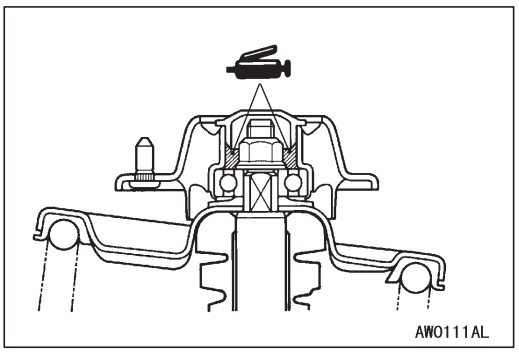
1. While the coil spring is being compressed by the special tools, provisionally tighten the self-locking nut.
2. Line up the hole in the strut assembly lower spring seat with the hole in the upper spring seat.

   NOTE
   Using a pipe as shown facilitates the alignment.



3. Correctly align both ends of the coil spring with the grooves in the spring seat, and then loosen the special tools.
4. Using the special tool, tighten the self-locking nut to the specified torque.

   Tightening torque: 59 – 69 Nm



5. Apply multipurpose grease to the bearing of the strut insulator.

Caution
When applying the grease, take care that grease does not adhere to the insulator's rubber.

STRUT BAR AND LOWER ARM

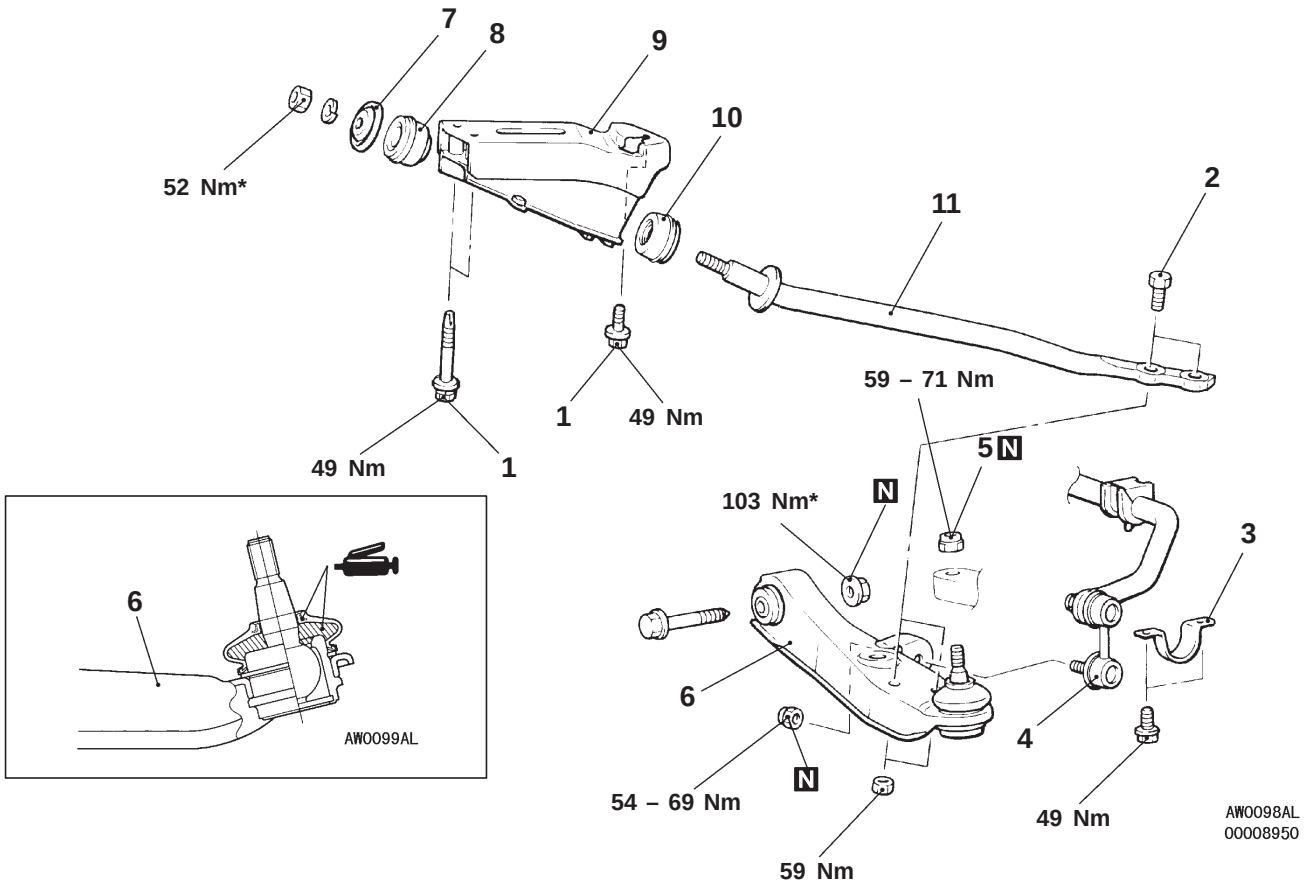
REMOVAL AND INSTALLATION

Caution

***: To prevent bushings from breakage, the parts indicated by * should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**

Pre-removal Operation
Under Cover Removal

Post-installation Operation
- Check the Dust Cover for Cracks or Damage by Pushing it with Finger.
- Wheel Alignment Check and Adjustment (Refer to GROUP 33A-4.)
- Under Cover Installation

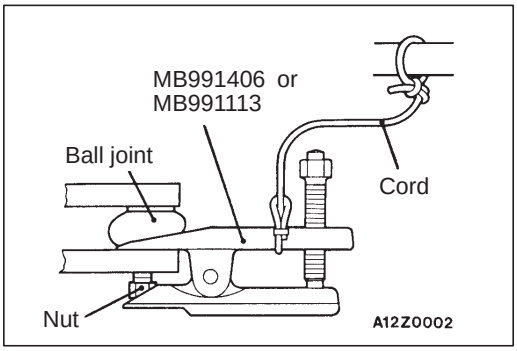


Lower arm removal steps

1. Strut bar bracket installation bolt
2. Strut bar installation bolt
3. Fixture
▶B◀ 4. Stabilizer link connection
◀A▶ 5. Lower arm assembly and knuckle connection
6. Lower arm assembly

Strut bar removal steps

1. Strut bar bracket installation bolt
2. Strut bar installation bolt
7. Washer
▶A◀ 8. Strut bar bushing A
9. Strut bar bracket
▶A◀ 10. Strut bar bushing B
11. Strut bar

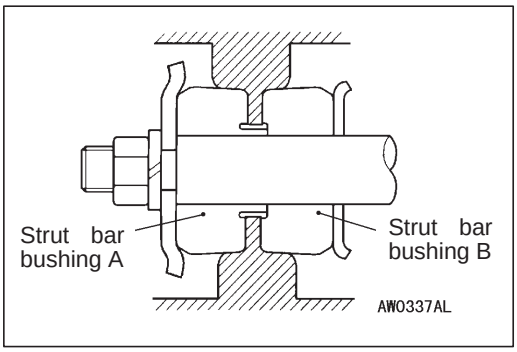


REMOVAL SERVICE POINT

◀A▶ LOWER ARM ASSEMBLY AND KNUCKLE DISCONNECTION

Caution

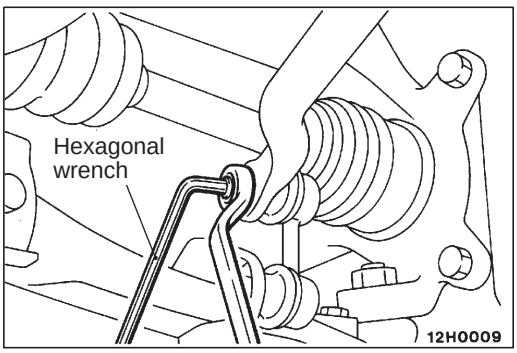
1. **Loosen the nut but do not remove it.**
2. **Support the special tool with a cord to prevent it from coming off.**



INSTALLATION SERVICE POINTS

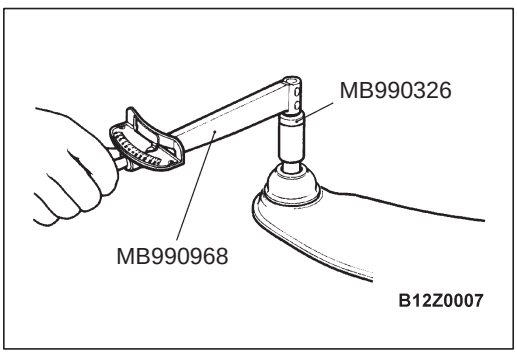
▶A◀ STRUT BAR BUSHING B AND STRUT BAR BUSHING A INSTALLATION

Install the bushings A and B as shown in the illustration confirming there shapes.



▶B◀ STABILIZER LINK INSTALLATION

Use a hexagonal wrench to hold the stabilizer link stud so that it does not turn, and then tighten the nut.



INSPECTION

LOWER ARM BALL JOINT ROTATION STARTING TORQUE CHECK

1. After shaking the ball joint stud several times, install the nut to the stud and use the special tools to measure the rotation starting torque of the ball joint.

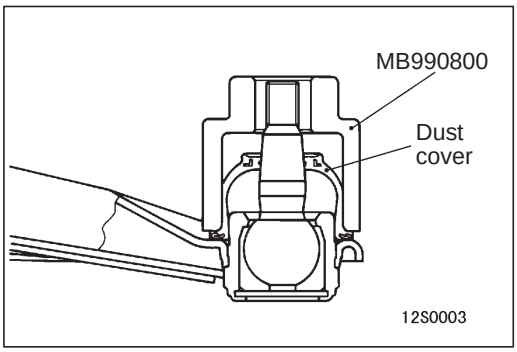
   Standard value: 1.0 – 5.9 Nm

2. When the measured value exceeds the standard value, replace the lower arm assembly.
3. When the measured value is lower than the standard value, check that the ball joint turns smoothly without excessive play. If so, it is possible to reuse that ball joint.

LOWER ARM BALL JOINT DUST COVER CHECK

1. Check the dust cover for cracks or damage by pushing it with finger.
2. If the dust cover is cracked or damaged, replace the lower arm assembly.

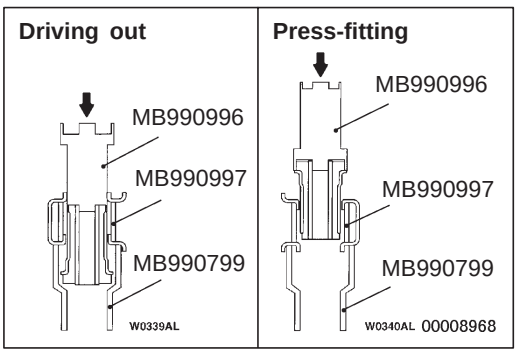
NOTE
Cracks or damage of the dust cover may cause damage of the ball joint. When it is damaged during service work, replace the dust cover.



LOWER ARM BALL JOINT DUST COVER REPLACEMENT

Only when the dust cover is damaged accidentally during service work, replace the dust cover as follows:

1. Remove the dust cover.
2. Apply multipurpose grease to the lip and inside of the dust cover.
3. Using the special tool, press the dust cover until it contacts the snap ring.
4. Check the dust cover for cracks or damage by pushing it with finger.



LOWER ARM BUSHING REPLACEMENT

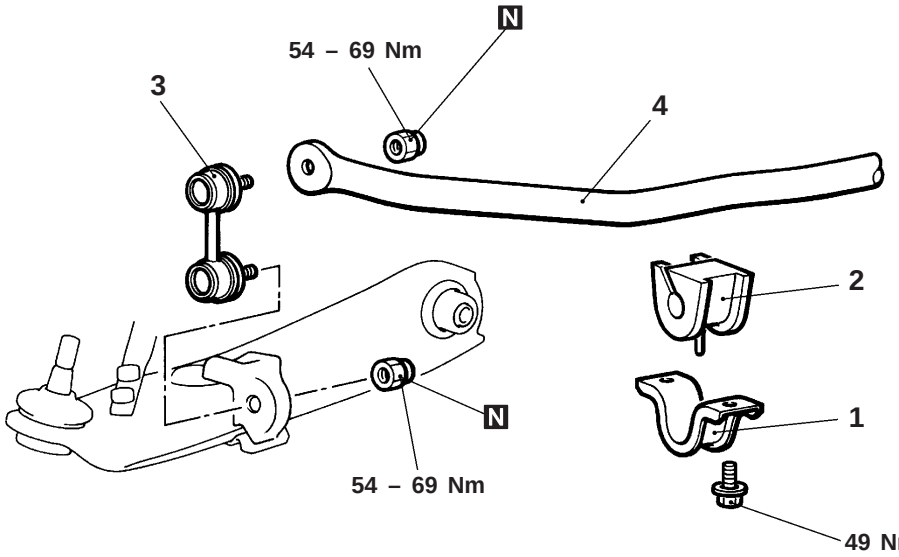
Use the special tools to drive out and press in the bushing.

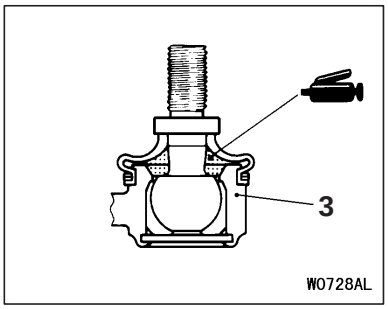
STABILIZER BAR

REMOVAL AND INSTALLATION

Pre-removal Operation
Under Cover Removal

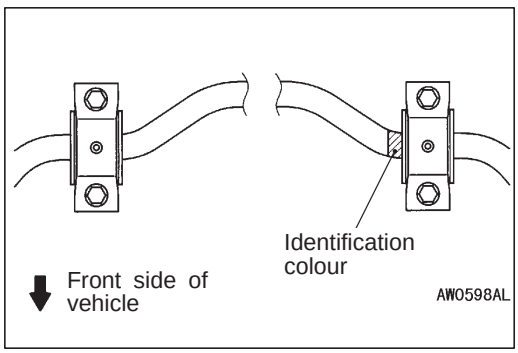
Post-installation Operation
- Check the Dust Cover for Cracks or Damage by Pushing it with Finger.
- Under Cover Installation





Removal steps

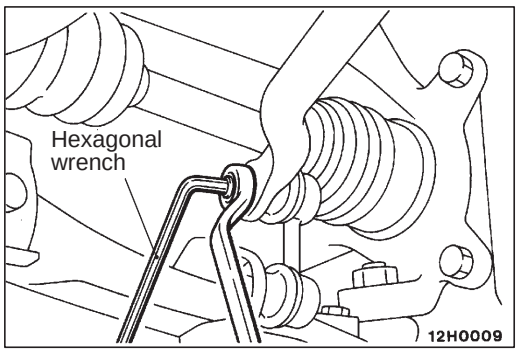
▶A◀ 1. Fixture
▶A◀ 2. Bushing
▶B◀ 3. Stabilizer link
▶A◀ 4. Stabilizer bar



INSTALLATION SERVICE POINTS

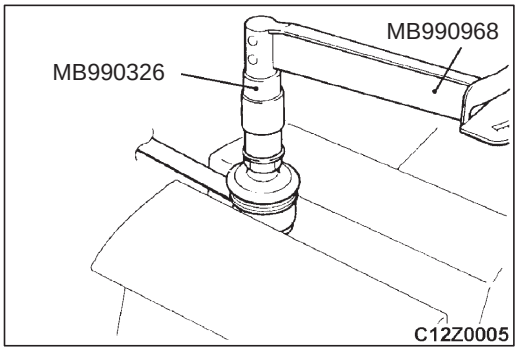
▶A◀ STABILIZER BAR/BUSHING/FIXTURE INSTALLATION

Position the stabilizer bar so that the right end of the identification colour is aligned with the left end of the bushing as shown, and tighten the stabilizer bar fixture mounting bolt.



▶B◀ STABILIZER LINK INSTALLATION

Use a hexagonal wrench to hold the stabilizer link stud so that it will not turn, and then tighten the nut.



INSPECTION

STABILIZER LINK BALL JOINT TURNING TORQUE CHECK

1. After shaking the ball joint stud several times, install the nut to the stud and use the special tools to measure the turning torque of the ball joint.

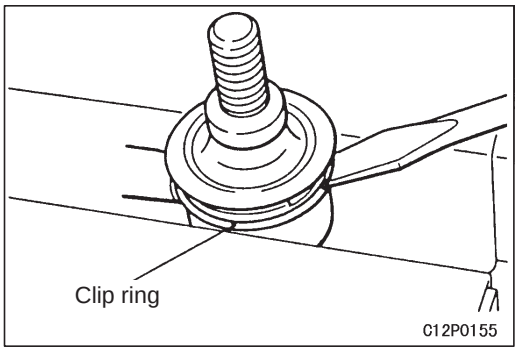
   Standard value: 1.7 – 3.1 Nm

2. When the measured value exceeds the standard value, replace the stabilizer link.
3. When the measured value is lower than the standard value, check that the ball joint turns smoothly without excessive play. If so, it is possible to reuse that ball joint.

STABILIZER LINK BALL JOINT DUST COVER CHECK

1. Check the dust cover for cracks or damage by pushing it with finger.
2. If the dust cover is cracked or damaged, replace the stabilizer link.

   NOTE
   Cracks or damage of the dust cover may cause damage of the ball joint. When it is damaged during service work, replace the dust cover.



STABILIZER LINK BALL JOINT DUST COVER REPLACEMENT

Only when the dust cover is damaged accidentally during service work, replace the dust cover as follows:

1. Remove the clip ring and the dust cover.
2. Apply multipurpose grease to the inside of the dust cover.
3. Wrap plastic tape around the stabilizer link stud, and then install the dust cover to the stabilizer link.
4. Secure the dust cover by the clip ring.
5. Check the dust cover for cracks or damage by pushing it with finger.

CROSSMEMBER

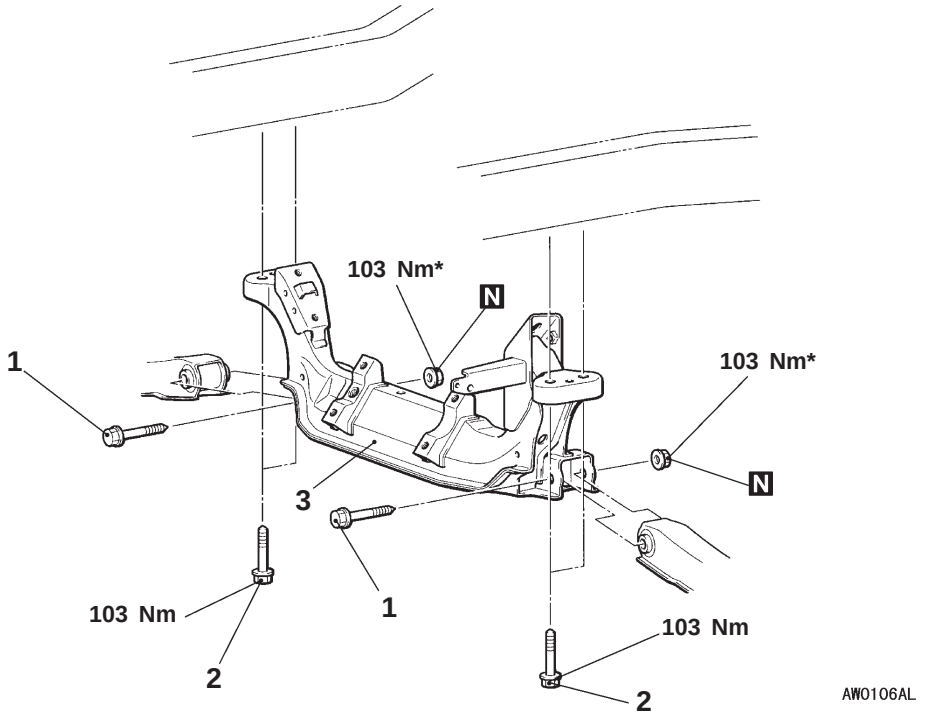
REMOVAL AND INSTALLATION

Caution

***: To prevent bushings from breakage, the parts indicated by * should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**

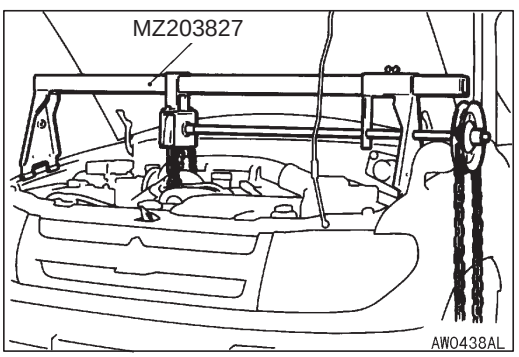
Pre-removal and Post-installation Operation

- Steering Gear Box and Linkage Removal and Installation (Refer to GROUP 37A.)
- Strut Bar and Lower Arm Disconnection (Refer to P.33A-10.)
- Stabilizer Bar Removal and Installation(Refer to P.33A-13.)
- Front Differential Mounting Bracket Removal and Installation (Refer to GROUP 26 – Differential Carrier.)



Removal steps

◀A▶ ● Engine assembly holding
1. Lower arm installation bolts
2. Crossmember installation bolts
3. Crossmember



REMOVAL SERVICE POINT

◀A▶ ENGINE ASSEMBLY HOLDING

Use the general service tool to lift the engine assembly until the engine weight will not be applied to the engine mount insulators.

NOTES

GROUP 33A
FRONT SUSPENSION

GENERAL

OUTLINE OF CHANGE

- The coil spring specifications have been changed. <3-door models>
- The coil spring specifications have been added. <5-door models>

GENERAL INFORMATION

COIL SPRING<3-door models>

Items	New	Old
Wire diameter × average diameter × free length mm	14 × 160 × 365*1	14 × 160 × 365
	14 × 160 × 376*2	14 × 160 × 365

COIL SPRING<5-door models>

Items	Specifiations
Wire diameter × average diameter × free length mm	14 × 160 × 376*1
	14 × 160 × 386*2

NOTE
*1: L.H.D. Vehicles, R.H.D. Vehicles L.H. side
*2: R.H.D. Vehicles R.H. side

GROUP 33A
FRONT SUSPENSION

GENERAL
OUTLINE OF CHANGE

The specification of front coil spring has been established due to the addition of vehicles with 1800-MPI engine.

GENERAL INFORMATION
COIL SPRING

Items	1800-MPI	
	L.H. drive vehicles	R.H. drive vehicles
Wire dia. × O.D. × free length mm	14 × 160 × 365	14 × 160 × 365 <L.H.> 14 × 160 × 376 <R.H.>

NOTES

SERVICE BULLETIN

PUBLICATION GROUP, AFTER SALES SERVICE DEP.
MITSUBISHI MOTOR SALES EUROPE BV

SERVICE BULLETIN	No.: ESB-99E33-503	
	Date: 2000-04-15	<Model>: (EC) PAJERO PININ (H6,H7) <M/Y>: 99-10
Subject: CORRECTION TO FRONT SUSPENSION CAMBER VALUE		
Group: FRONT SUSPENSION		
CORRECTION	O. Kai - E.V.P. & G.M. After Sales Service Dept.	

1. Description:

This Service Bulletin informs you that the camber value of the front suspension has been corrected.

2. Applicable Manuals:

Manual	Pub. No.	Language	Page(s)
'99 PAJERO PININ Workshop Manual	CKRE00E1	(English)	33A-3, 5
	CKRS00E1	(Spanish)	
	CKRF00E1	(French)	
	CKRG00E1	(German)	
	CKRD00E1	(Dutch)	
	CKRI00E1	(Italian)	

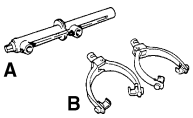
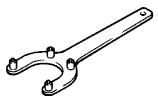
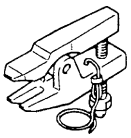
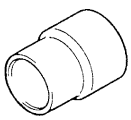
3. Details:

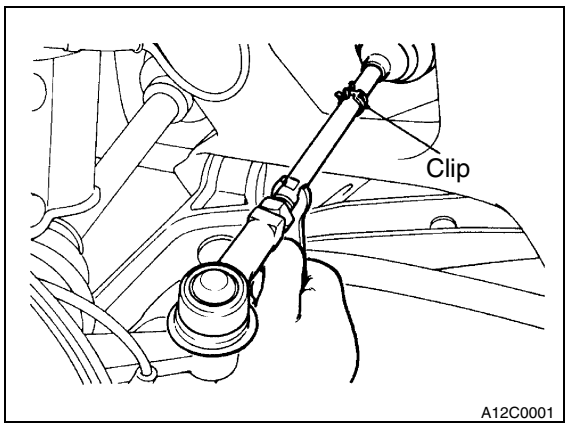
SERVICE SPECIFICATIONS

Items		Standard value
Toe-in	At the centre of tyre tread mm	3 ± 2
	Toe-angle (per wheel)	0°07' ± 05'
Toe-out angle on turns (inner wheel when outer wheel at 20°)		21°04' -0°30' ± 30'* **<Correct>**
Camber		~~0°30' ± 30'*~~ **<Incorrect>**
Caster		3°00' ± 30'*
Side slip mm (per 1 m)		0 ± 3
Kingpin inclination		11°04'
Lower arm ball joint rotation starting torque Nm		1.0 – 5.9
Stabilizer link ball joint turning torque Nm		1.7 – 3.1

NOTE
*: difference between right and left wheels: less than 30'

SPECIAL TOOLS

Tools	Number	Name	Use
 B991004	**MB991004**	Wheel alignment gauge attachment	Wheel alignment measurement <Vehicles with aluminium wheels>
 00003796	**A: MB991237** **B: MB991238**	A: Spring compressor body B: Arm set	Coil spring compression
 B991176	**MB991176**	Spring seat holder	Disassembly and assembly of the strut assembly
 B991113	**MB991406 or MB991113**	Steering linkage puller	Tie rod end disconnection
 B990799	**MB990799**	Ball joint remover & installer	Lower arm bushing press-in and press-out



TOE-IN

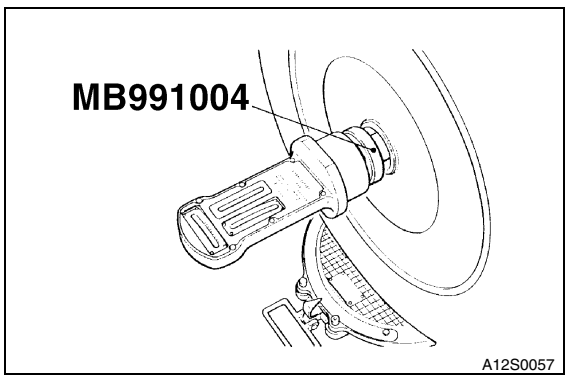
Standard value:
At the centre of tyre tread 3 ± 2 mm
Toe angle (per wheel) 0°07' ± 05'

1. If the toe-in is not within the standard value, adjust the toe-in by undoing the clip and turning the left and right tie rod turnbuckles by the same amount (in opposite directions).

   NOTE
   The toe will move out as the left turnbuckle is turned toward the front of the vehicle and the right turnbuckle is turned toward the rear of the vehicle.
2. Use a turning radius gauge to check that the steering angle is at the standard value.
   (Refer to GROUP 37A – On-vehicle Service.)

TOE-OUT ANGLE ON TURNS
To check the steering linkage, especially after the vehicle has been involved in an accident or if an accident is presumed, it is advisable to check the toe-out angle on turns in addition to the wheel alignment.
Conduct this test on the left turn as well as on the right turn.

Standard value (Inner wheel when outer wheel at 20°): 21°04'



CAMBER, CASTER AND KINGPIN INCLINATION

Standard value: -0°30' ± 30' **<Correct>**

Item	Specification
Camber (difference between right and left wheel: less than 30')	~~0°30' ± 30'*~~ **<Incorrect>**
Caster (difference between right and left wheel: less than 30')	3°00' ± 30'
Kingpin inclination	11°04'

NOTE
1. Camber and caster are preset at the factory and cannot be adjusted.
2. If camber is not within the standard value, check and replace bent or damaged parts.
3. For vehicles with aluminium type wheels, attach the camber/caster/kingpin gauge to the drive shaft by using the special tool. Tighten the special tool to the same torque 226 Nm as the drive shaft nut.

REAR SUSPENSION

REAR SUSPENSION

CONTENTS

GENERAL INFORMATION 2
SPECIAL TOOLS 3
REAR SUSPENSION ASSEMBLY 4

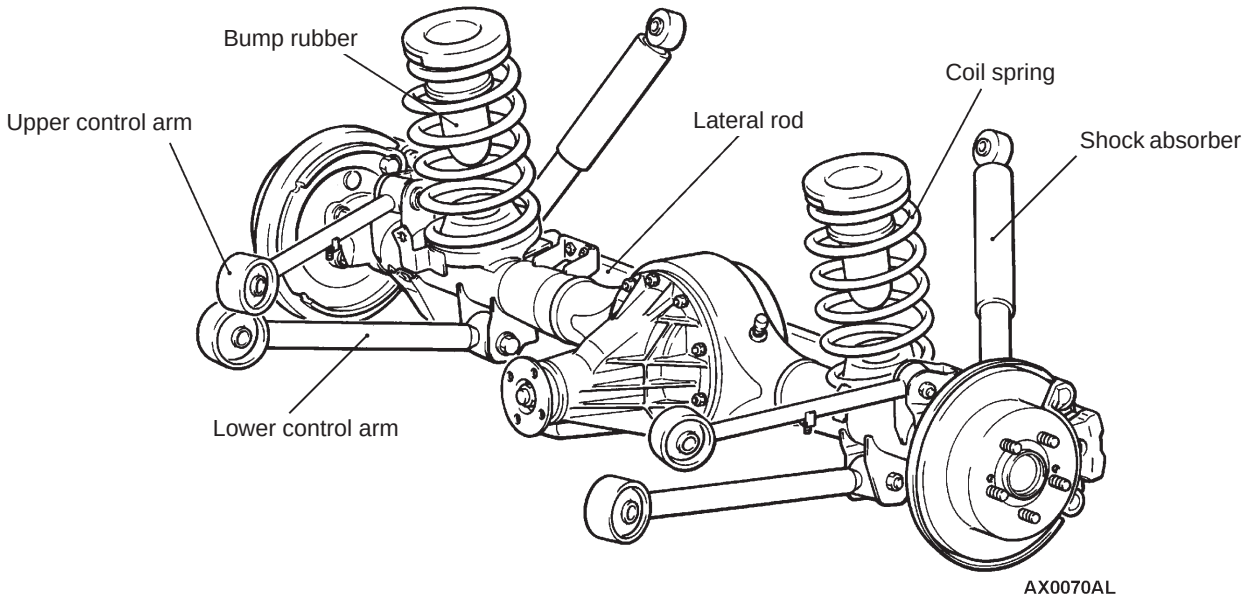
GENERAL INFORMATION

The rear suspension is a 5-link coil spring type axle suspension, which assures comfortable ride and outstanding steering stability.

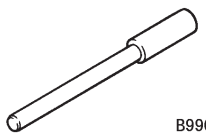
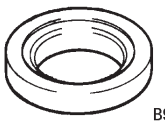
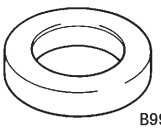
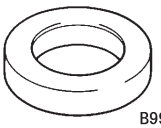
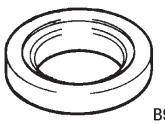
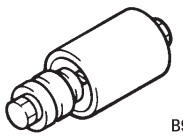
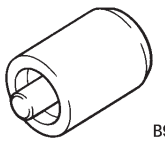
COIL SPRING

Items	Specification
Wire diameter × outer diameter × free length mm	11 × 131 × 306

CONSTRUCTION DIAGRAM



SPECIAL TOOLS

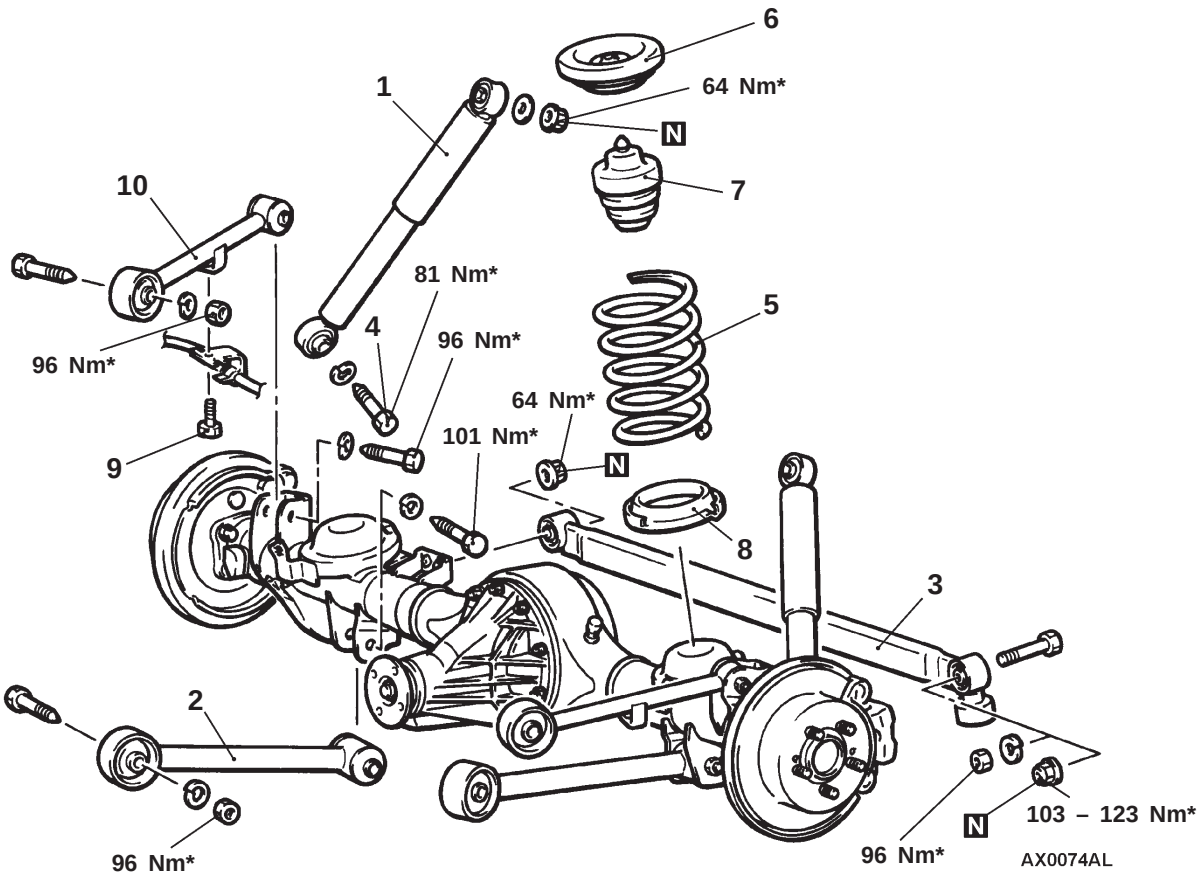
Tool	Number	Name	Use
 B990847	MB990847	Rear suspension bushing remover and installer base	• Upper arm rear bushing driving out and press-fitting • Lower arm rear bushing driving out and press-fitting
 B990947	MB990947	Lower arm bushing arbor	
 B990831	MB990832	Lower arm rear bushing remover and installer ring	Upper arm rear bushing driving out and press-fitting
 B991154	MB991154	Upper arm bushing guide	
 B991154	MB991155	Lower arm bushing guide	Lower arm rear bushing driving out and press-fitting
 B990831	MB990831	Upper arm bushing remover and installer ring	
 B990958	MB990958	Bushing remover and installer	• Upper arm front bushing driving out and press-fitting • Lower arm front bushing driving out and press-fitting
 B990983	MB990983	Bushing remover and installer arbor	

REAR SUSPENSION ASSEMBLY

REMOVAL AND INSTALLATION

Caution

***: To prevent bushings from breakage, the parts indicated by * should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**



1. Shock absorber
2. Lower arm
3. Lateral rod
4. Shock absorber installation bolt

Coil spring removal steps

4. Shock absorber installation bolt
▶A◀ 5. Coil spring
6. Silencer sheet
7. Bump stopper
8. Lower spring pad

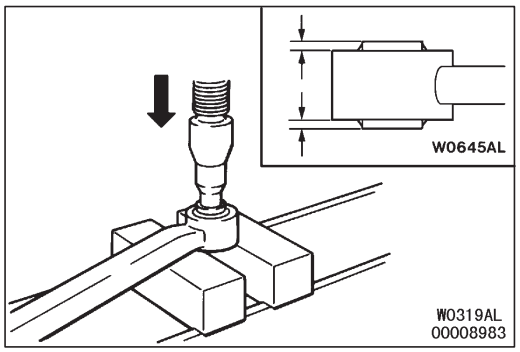
Upper arm removal steps

5. Coil spring
9. Rear wheel speed sensor installation bolt <Vehicles with ABS>
10. Upper arm

INSTALLATION SERVICE POINT

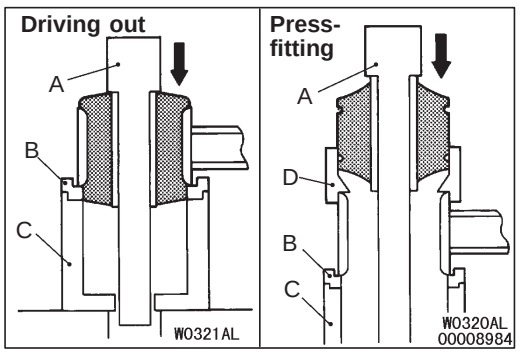
▶A◀ COIL SPRING INSTALLATION

Install the coil spring so that its end with identification colour faces upward.



LATERAL ROD BUSHING REPLACEMENT

1. Use a press to press in and out the bushing.
2. Apply ample amount of soapy water to the outer surface of the bushing and inner surface of the lateral rod pipe, and then press-fit the bushing so that both ends protrude evenly.



UPPER ARM BUSHING/LOWER ARM BUSHING REPLACEMENT

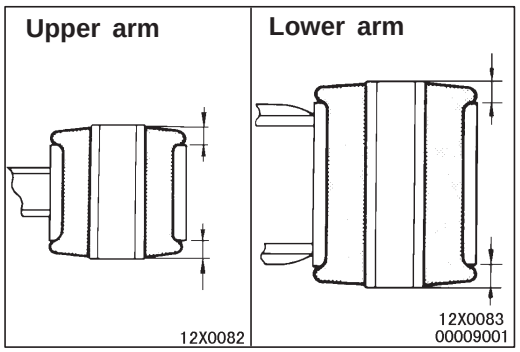
UPPER ARM REAR BUSHING, LOWER ARM REAR BUSHING

1. Use the special tools and a press to press in and out the bushing.

   SPECIAL TOOL

Item	Upper arm rear bushing	Lower arm rear bushing
A	MB990947	MB990947
B	MB990832	MB990831
C	MB990847	MB990847
D	MB991154	MB991155

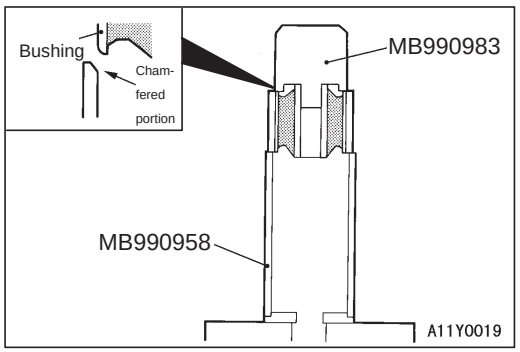
2. Apply ample amount of soapy water to the outer surface of bushing and inner surface of arm pipe, and then press-fit the bushing so that both ends protrude evenly.



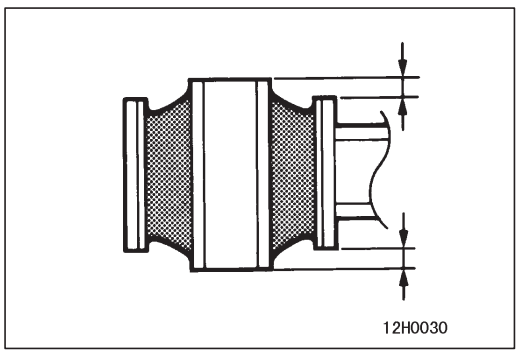
UPPER ARM FRONT BUSHING, LOWER ARM FRONT BUSHING

1. Use a press and the special tools to press in and out the bushing.

   NOTE
   Press in the bushing from the chamfered side of the arm pipe.



2. Install the bushing so that both ends protrude evenly.



NOTES

GROUP 34
REAR SUSPENSION

GENERAL

OUTLINE OF CHANGE

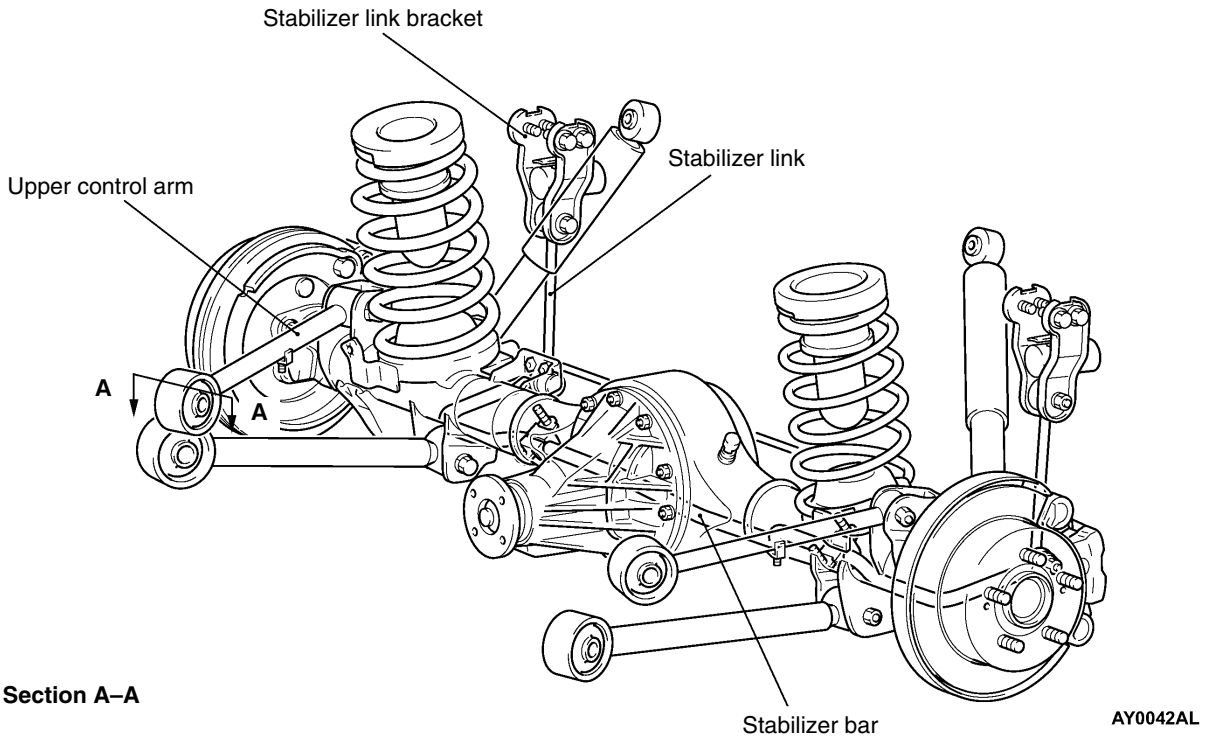
- The coil spring specification has been added. <5-door models>
- The service procedures have been added due to the introduction of the rear stabilizer. <5-door models>
- The bushing of the upper control arm has been reshaped.

GENERAL INFORMATION

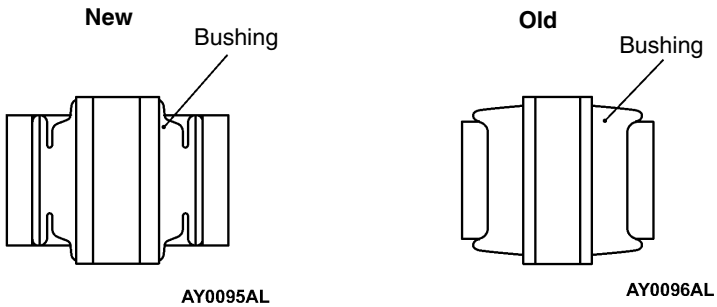
COIL SPRING<5-door models>

Items	Specification
Wire diameter × average diameter × free length mm	11 × 131 × 305

CONSTRUCTION DIAGRAM



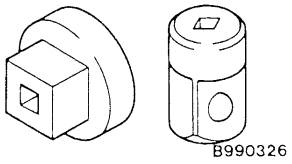
Section A–A



SERVICE SPECIFICATION

Items	Standard value
Stabilizer link ball joint turning torque Nm	1.7 – 3.1

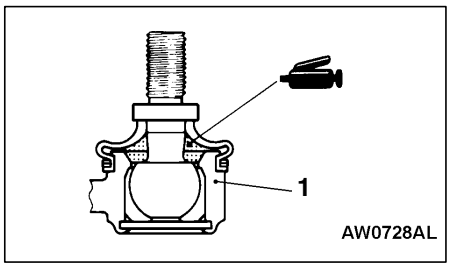
SPECIAL TOOL

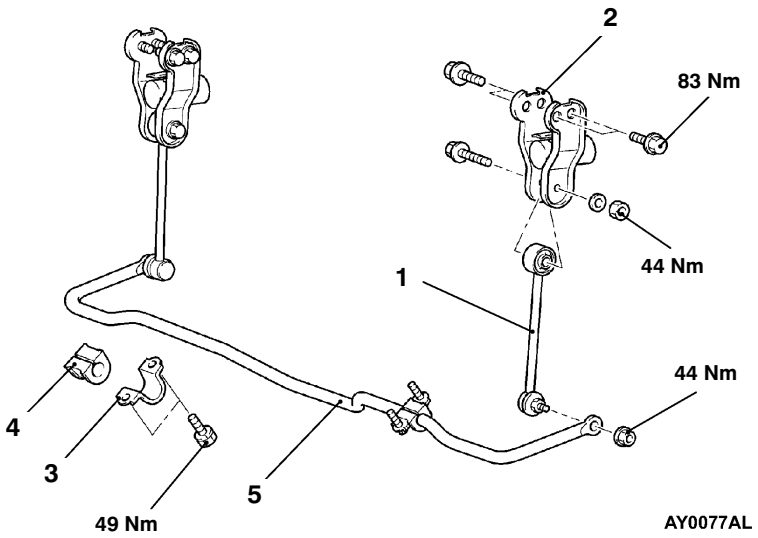
Tool	Number	Name	Use
 B990326	MB990326	Preload socket	Stabilizer link ball joint turning torque measurement

STABILIZER BAR

REMOVAL AND INSTALLATION

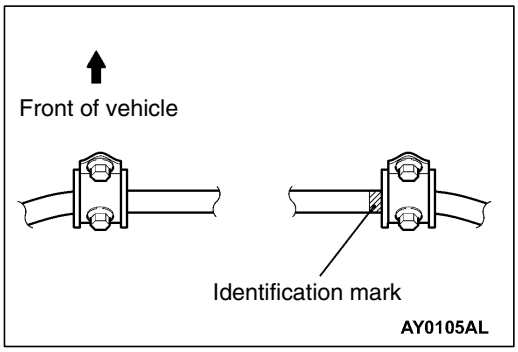
Post-installation Operations
Press the dust cover with your finger to check that there are no cracks or damage in the dust cover.





Removal steps

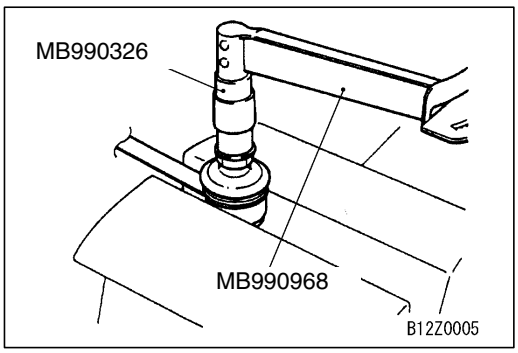
1. Stabilizer link assembly
2. Stabilizer link bracket
▶A◀ 3. Stabilizer bracket
▶A◀ 4. Bushing
▶A◀ 5. Stabilizer bar



INSTALLATION SERVICE POINT

▶A◀ STABILIZER BAR/BUSHING/STABILIZER BRACKET INSTALLATION

Align the identification mark of stabilizer bar with the left end of the bushing, before tightening the mounting bolts.



INSPECTION

STABILIZER LINK BALL JOINT TURNING TORQUE CHECK

1. After shaking the ball joint stud several times, install the nut to the stud and use the special tools to measure the turning torque of the ball joint.

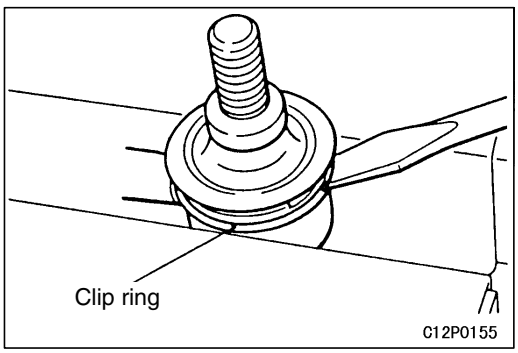
   Standard value: 1.7 – 3.1 Nm

2. When the measured value exceeds the standard value, replace the stabilizer link.
3. When the measured value is lower than the standard value, check that the ball joint turns smoothly without excessive play. If so, it is possible to reuse that ball joint.

STABILIZER LINK BALL JOINT DUST COVER CHECK

1. Check the dust cover for cracks or damage by pushing it with finger.
2. If the dust cover is cracked or damaged, replace the stabilizer link.

   NOTE
   Cracks or damage of the dust cover may cause damage of the ball joint. When it is damaged during service work, replace the dust cover.



STABILIZER LINK BALL JOINT DUST COVER REPLACEMENT

Only when the dust cover is damaged accidentally during service work, replace the dust cover as follows:

1. Remove the clip ring and the dust cover.
2. Apply multipurpose grease to the inside of the dust cover.
3. Wrap plastic tape around the stabilizer link stud, and then install the dust cover to the stabilizer link.
4. Secure the dust cover by the clip ring.
5. Check the dust cover for cracks or damage by pushing it with finger.

BASIC BRAKE SYSTEM

BASIC BRAKE SYSTEM

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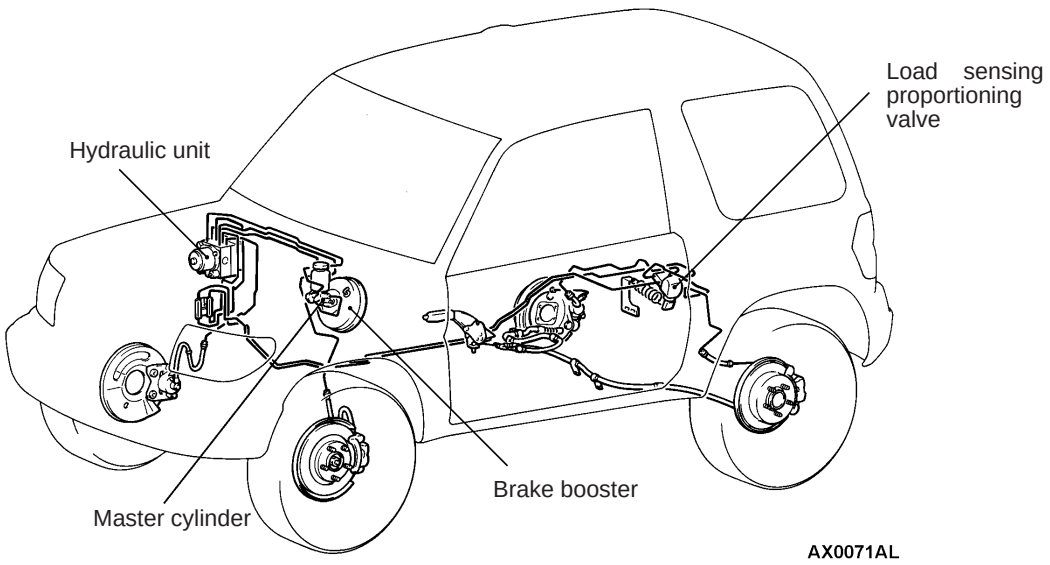
LOAD SENSING PROPORTIONING VALVE 31

GENERAL INFORMATION

The brake system offers high dependability and durability along with improved braking performance and brake sensitivity.

Items		Specifications
Master cylinder	Type	Tandem type
	I.D. mm	22.2
Brake booster	Type	Vacuum type, single
	Effective dia. of power cylinder mm	230
	Boosting ratio	4.5
Load sensing proportioning valve	Type	Dual type
	Decompression ratio	0.25
Front disc brakes	Type	Floating caliper, 1-piston, ventilated disc
	Disc effective dia. × thickness mm	236 × 22
	Wheel cylinder I.D. mm	57.2
	Pad thickness mm	10.0
	Clearance adjustment	Automatic
Rear disc brakes	Type	Floating caliper,1-piston, solid disc
	Disc effective dia. × thickness	222 × 9.4
	Wheel cylinder I.D. mm	34.93
	Pad thickness mm	10.0
	Clearance adjustment	Automatic
Brake fluid		DOT3 or DOT4

CONSTRUCTION DIAGRAM



SERVICE SPECIFICATIONS

Items			Standard value	Limit
Brake pedal height mm	L.H. drive vehicles		201 – 204	–
	R.H. drive vehicles		201.7 – 204.7	–
Brake pedal play mm			3 – 8	–
Brake pedal to floorboard clearance when the brake pedal is depressed mm			105 or more	–
Brake booster push rod protrusion amount mm		L.H. drive vehicles with ABS	22.7 – 22.9	–
		L.H. drive vehicles without ABS and R.H. drive vehicles	23.93 – 24.18	–
Load sensing proportioning valve output fluid pressure (Input fluid pressure) MPa	When load sensing spring length is 199 mm (when unladen)		4.2 – 6.0 (9.8)	–
	When load sensing spring length is 217 mm (when laden)		9.7 – 10.5 (9.8)	–
			14.5 – 16.3 (16.7)	–
	Output fluid pressure difference between left and right MPa		–	0.39
Load sensing spring length <Distance between spring ends> mm			194 – 198	–
Front disc brake	Pad thickness mm		10.0	2.0
	Disc thickness mm		22.0	20.4
	Disc runout mm		–	0.06
	Drag force N		69	–
Rear disc brake	Pad thickness mm		10.0	2.0
	Disc thickness mm		9.4	7.8
	Disc runout mm		–	0.08
	Drag force N		34	–
Front hub end play mm			–	0.2
Rear hub end play mm			–	0.025

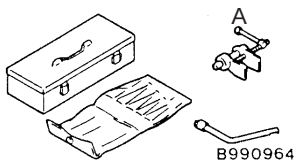
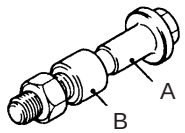
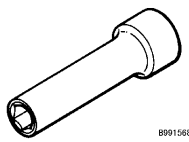
LUBRICANTS

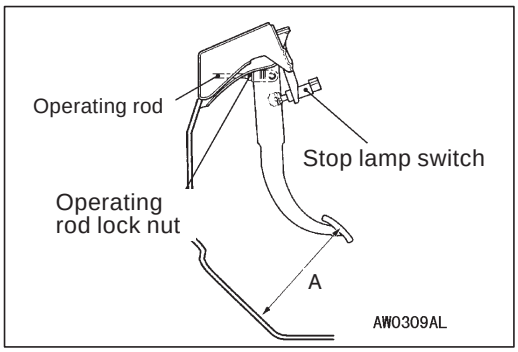
Items	Specified Lubricant	Quantity
Brake fluid	DOT3 or DOT4	As required
Vacuum sensor grommet	Silicone grease	
Brake booster seal		
Piston boot, piston seal	Repair kit grease	
Guide pin, lock pin		
Piston, wheel cylinder body	DOT3 or DOT4	

SEALANT

Items	Specified sealant	Remarks
Fitting	3M ATD Part No. 8661 or equivalent	Semi-drying sealant

SPECIAL TOOLS

Tool	Number	Name	Use
	MB990964 A: MB990520	Brake tool set	Pushing-in of the disc brake piston
	A: MB990998 B: MB991000	A: Front hub remover and installer B: Spacer	When bearing provisional holding MB991000, which belongs to MB990998, should be used as a spacer.
	MB991568	Push rod adjusting socket	Adjustment of the brake booster push rod protrusion amount



ON-VEHICLE SERVICE

BRAKE PEDAL CHECK AND ADJUSTMENT

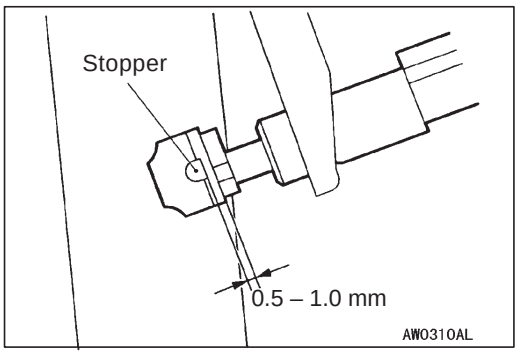
BRAKE PEDAL HEIGHT

1. Turn up the carpet, etc. under the brake pedal.
2. Measure the brake pedal height as illustrated.

   Standard value (A):
   <L.H. drive vehicles> 201 – 204 mm
   <R.H. drive vehicles> 201.7 – 204.7 mm

3. If the brake pedal height is not within the standard value, follow the procedure below.
   (1) Disconnect the stop lamp switch connector.
   (2) Loosen the stop lamp switch by turning it approx. 1/4 turns anticlockwise.
   (3) Remove the pin, and then adjust so that the brake pedal height meets the standard value by turning the clevis.

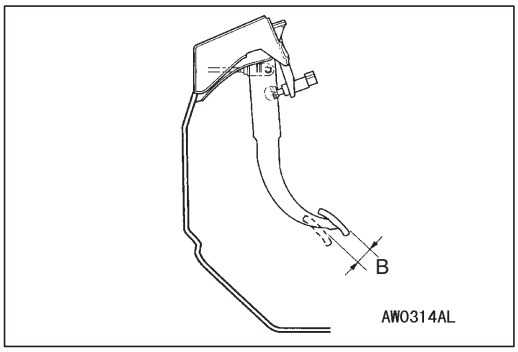
   NOTE
   When the clevis is turned 180°, the pedal height is changed approximately 2.3 mm.



   (4) Screw in the stop lamp switch until it touches the stopper. At this time, support the brake pedal to the highest position by hand.
   (5) Lock the stop lamp switch by turning it approx. 1/4 turns clockwise, and confirm that the clearance between the switch plunger and the stopper is as shown.
   (6) Connect the connector at the stop lamp switch.

   Caution
   Check that the stop lamp does not illuminate when the brake pedal is not depressed.

4. For A/T, check the key interlock and shift lock mechanisms. (Refer to GROUP 23 – On-vehicle Service.)
5. Return the carpet, etc.

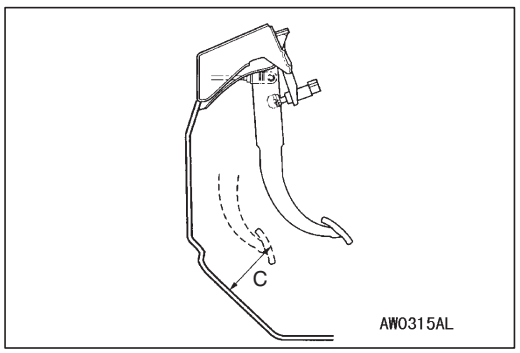


BRAKE PEDAL FREE PLAY

1. With the engine stopped, depress the brake pedal two or three times. After eliminating the vacuum in the power brake booster, press the pedal down by hand, and confirm that the amount of movement before resistance is met (the free play) is within the standard value range.

   Standard value (B): 3 – 8 mm

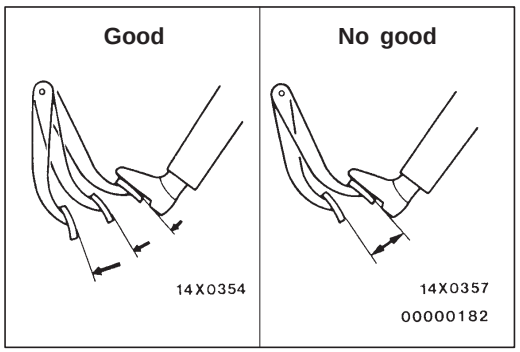
2. If the brake pedal play is not within the standard value, check the following, and adjust or replace if necessary:
   - Excessive play between the brake pedal and the clevis pin, or between the clevis pin and the brake booster operating rod
   - Brake pedal height
   - Installation position of the stop lamp switch, etc.



CLEARANCE BETWEEN BRAKE PEDAL AND FLOOR BOARD

1. Turn up the carpet etc. under the brake pedal.
2. Start the engine, depress the brake pedal with approximately 490 N of force, and measure the clearance between the brake pedal and the floorboard.

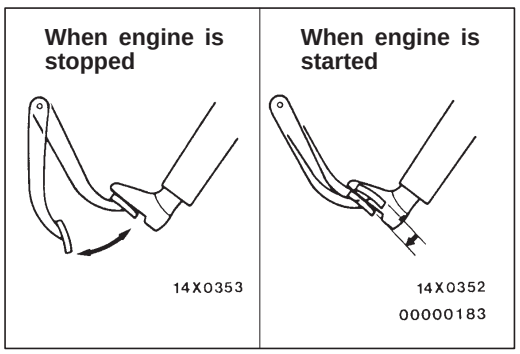
   Standard value (C): 105 mm or more
3. If the clearance is outside the standard value, check for air trapped in the brake line, thickness of the disc brake pad or the drum brake lining and dragging in the parking brake.
   Adjust and replace defective parts as required.
4. Return the carpet, etc.



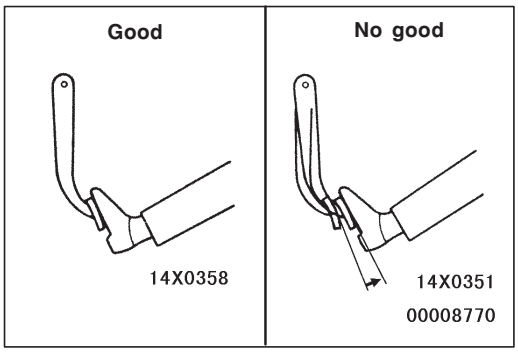
BRAKE BOOSTER OPERATING TEST

For simple checking of the brake booster operation, carry out the following tests:

1. Run the engine for one or two minutes, and then stop it.
   If the pedal depresses fully the first time but gradually becomes higher when depressed succeeding times, the booster is operating properly. If the pedal height remains unchanged, the booster is defective.



2. With the engine stopped, step on the brake pedal several times.
   Then start the engine while the brake pedal is stepped on.
   If the pedal moves downward slightly, the booster is in good condition. If there is no change, the booster is defective.



3. With the engine running, step on the brake pedal and then stop the engine.
   Hold the pedal depressed for 30 seconds. If the pedal height does not change, the booster is in good condition. If the pedal rises, the booster is defective.

If the above three tests are okay, the booster performance can be determined as good.
If one of the above three tests is not okay at least, the check valve, vacuum hose, or booster will be defective.

CHECK VALVE OPERATION CHECK

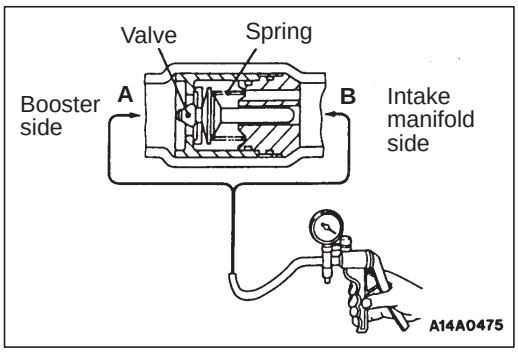
1. Remove the vacuum hose. (Refer to P.35A-15, 16.)

   Caution
   The check valve should not be disassembled from the vacuum hose as they are united as one part.

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

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

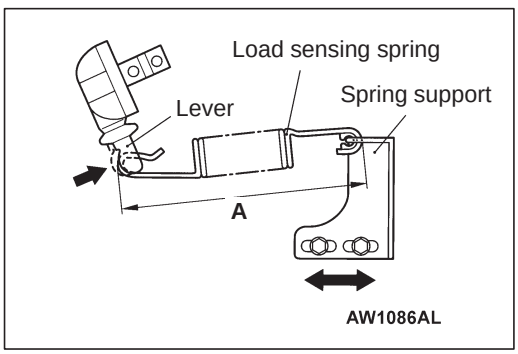
Caution
If the check valve is defective, always replace it as an assembly unit together with the vacuum hose.



LOAD SENSING SPRING LENGTH CHECK AND ADJUSTMENT

1. Park the vehicle on a level ground. The vehicle should be unloaded and supported only by wheels.

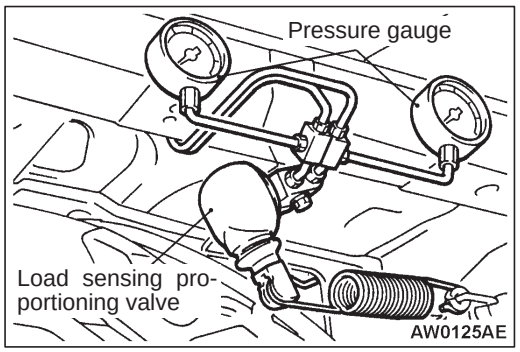
   Caution
   Never support the vehicle with jacks or other similar means.



2. With the lever pressed all the way to the load sensing proportioning valve side, check whether or not the length (shown in the figure) of the spring (the length between its ends) is the standard value.

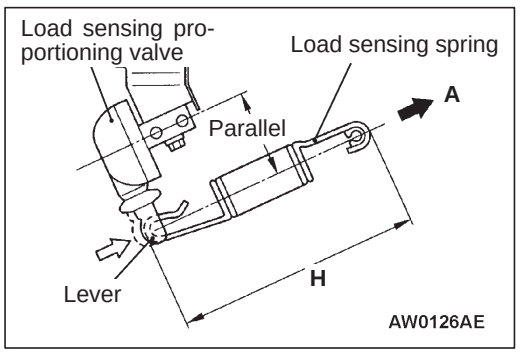
   Standard value (A): 194 – 198 mm

3. If the spring length is not within the standard value, loosen the bolt attaching the support and adjust the distance by moving the support.



LOAD SENSING PROPORTIONING VALVE FUNCTION TEST

1. Connect pressure gauges to the input and output ports of the load sensing proportioning valve.
2. Bleed the system. (Refer to P.35A-10.)
3. Disconnect the spring at the support side.



4. Place the spring so that it is in parallel with the load sensing proportioning valve, and then pull in the direction indicated by arrow A so that its length H shown in the figure (the length between its ends) is as noted below.

   NOTE
   At this time the lever is pressed all the way to the load sensing proportioning valve side.

5. Check at this time whether or not the output fluid's pressure, relative to the load sensing proportioning valve's input fluid pressure, is within the standard value.

   Standard value:

Spring length H mm	Input fluid pressure MPa	Output fluid pressure MPa
199*1	9.8	4.2 – 6.0
217*2	9.8	9.7 – 10.5
	16.7	14.5 – 16.3

   NOTE
   *1 and *2 indicate the applicable lengths for unladen and laden vehicles respectively.

6. Measure each output fluid pressure at both valves, and check that the difference between the two is at the limit value or less.

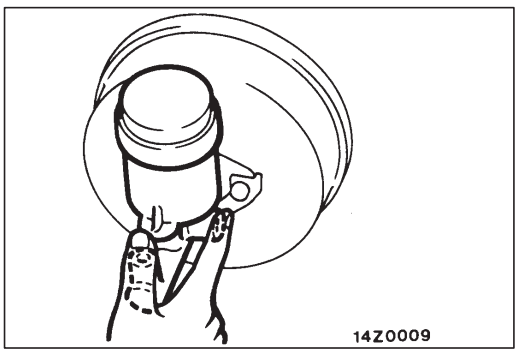
   Limit: 0.39 MPa

7. After making the check, install the spring. Disconnect the pressure gauges from the load sensing proportioning valve and bleed air.

BLEEDING

Caution

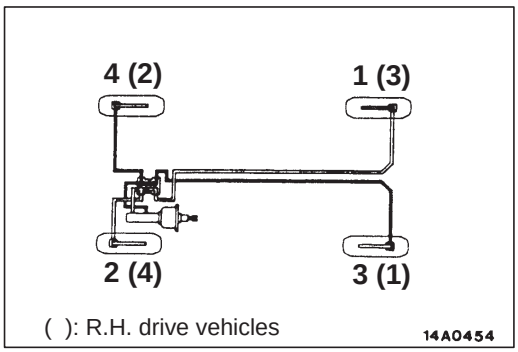
Specified brake fluid: DOT3 or DOT4
Always use the specified brake fluid. Avoid using a mixture of the specified brake fluid and other fluid.



MASTER CYLINDER BLEEDING

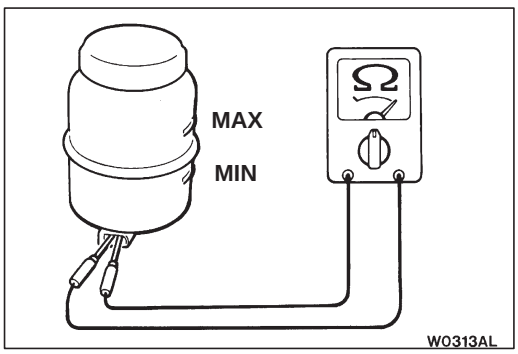
The master cylinder used has no check valve, so if bleeding is carried out by the following procedure, bleeding of air from the brake pipeline will become easier. (When brake fluid is not contained in the master cylinder.)

1. Fill the reserve tank with brake fluid.
2. Keep the brake pedal depressed.
3. Have another person cover the master cylinder outlet with a finger.
4. With the outlet still closed, release the brake pedal.
5. Repeat steps 2 – 4 three or four times to fill the inside of the master cylinder with brake fluid.



BRAKE PIPE LINE BLEEDING

Bleed the air in the sequence shown in the figure.

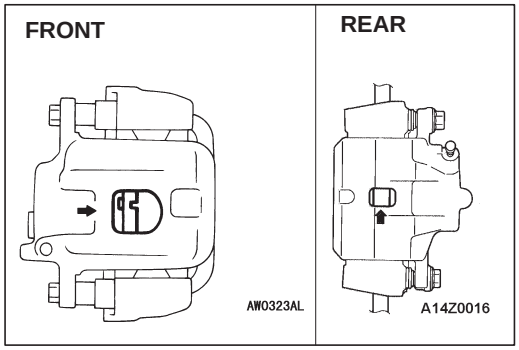


BRAKE FLUID LEVEL SENSOR CHECK

The brake fluid level sensor is in good condition if there is no continuity when the float surface is above “MIN” and if there is continuity when the float surface is below “MIN”.

DISC BRAKE PAD CHECK AND REPLACEMENT

NOTE
The brake pads have wear indicators that contact the brake disc when the brake pad thickness reaches approximately 2 mm and emit a squealing sound to warn the driver.

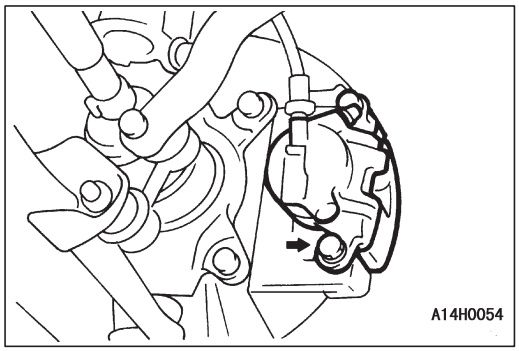


1. Check the brake pad thickness through the caliper body check port.

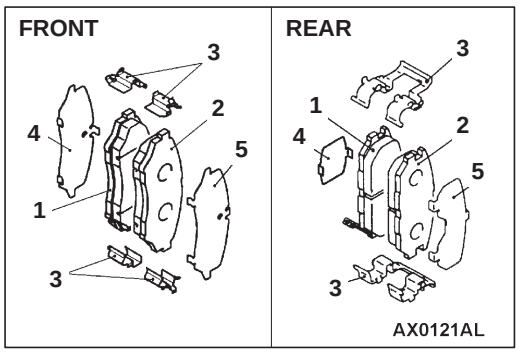
   Standard value: 10.0 mm

   Limit: 2.0 mm

2. When the thickness is less than the limit, always replace the pads at an axle set.



3. Remove the guide lock pin bolt. Pivot the caliper assembly and hold it with wires.



4. Remove the following parts from the caliper support.
   1. Pad and wear indicator assembly
   2. Pad assembly
   3. Clip
   4. Inner shim
   5. Outer shim

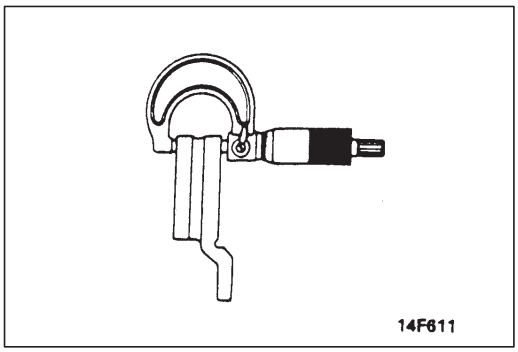
5. In order to measure the brake drag force after pad installation, measure the rotary-sliding resistance of the hub with the pads removed. (Refer to P.35A-20, 25.)
6. Install the pads and caliper assembly, and then check the brake drag force. (Refer to P.35A-21, 26.)

DISC BRAKE ROTOR CHECK

Caution
When servicing disc brakes, it is necessary to exercise caution to keep the disc brakes within the allowable service values in order to maintain normal brake operation.

Before re-finishing or re-processing the brake disc surface, the following conditions should be checked.

Inspection items	Remarks
Scratches, rust, saturated lining materials and wear	● If the vehicle is not driven for a certain period, the sections of the discs that are not in contact with lining will become rusty, causing noise and shuddering. ● If grooves resulting from excessive disc wear and scratches are not removed prior to installing a new pad assembly, there will momentarily be inappropriate contact between the disc and the lining (pad).
Run-out or drift	Excessive run-out or drift of the discs will increase the pedal depression resistance due to piston knock-back.
Change in thickness (parallelism)	If the thickness of the disc changes, this will cause pedal pulsation, shuddering and surging.
Inset or warping (flatness)	Overheating and improper handling while servicing will cause inset or warping.



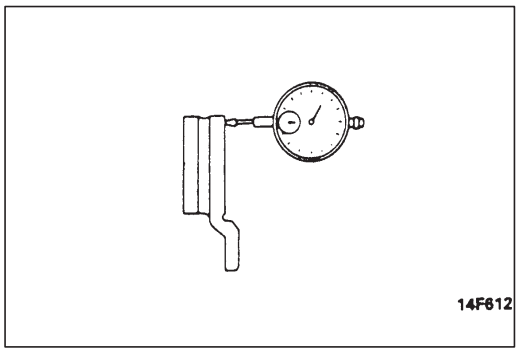
BRAKE DISC THICKNESS CHECK

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

   Brake disc thickness

Item	Standard value	Limit
Front	22.0	20.4
Rear	9.4	7.8

   Thickness variation (at least 8 positions)
   The difference between any thickness measurements should not be more than 0.015 mm.
2. If the disc is beyond the limits for thickness, remove it and install a new one. If thickness variation exceeds the specification, replace the brake disc or grind it with on-the-car type brake lathe (“MAD, DL-8700PF” or equivalent).



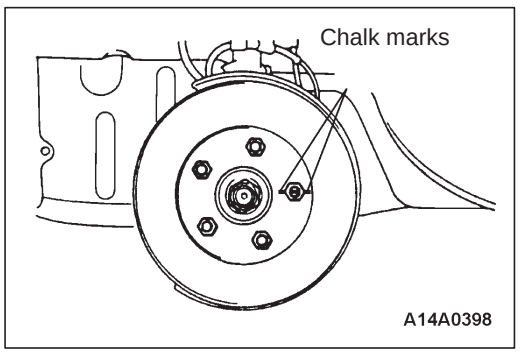
BRAKE DISC RUN-OUT CHECK AND CORRECTION

1. Remove the brake assembly, and then hold it with wire.
2. Place a dial gauge approximately 5 mm from the outer circumference of the brake disc, and measure the run-out of the disc.

   Limit: <Front> 0.06 mm or less,
   <Rear> 0.08 mm or less

3. If the brake disc run-out exceeds the limit, correct it as follows:

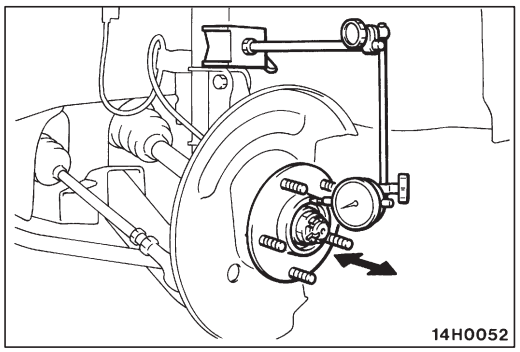
   (1) Chalk phase marks on the wheel stud and the brake disc, which run-out is excessive as shown.



   (2) Remove the brake disc. Then place a dial gauge as shown, and measure the end play by pushing and pulling the wheel hub.

   Limit: <Front> 0.2 mm, <Rear> 0.025 mm

   (3) If the end play exceeds the limit, disassemble the hub and knuckle assembly to check each part.
   (4) If the end play does not exceed the limit, dephase the brake disc and secure it. Then recheck the brake disc run-out.

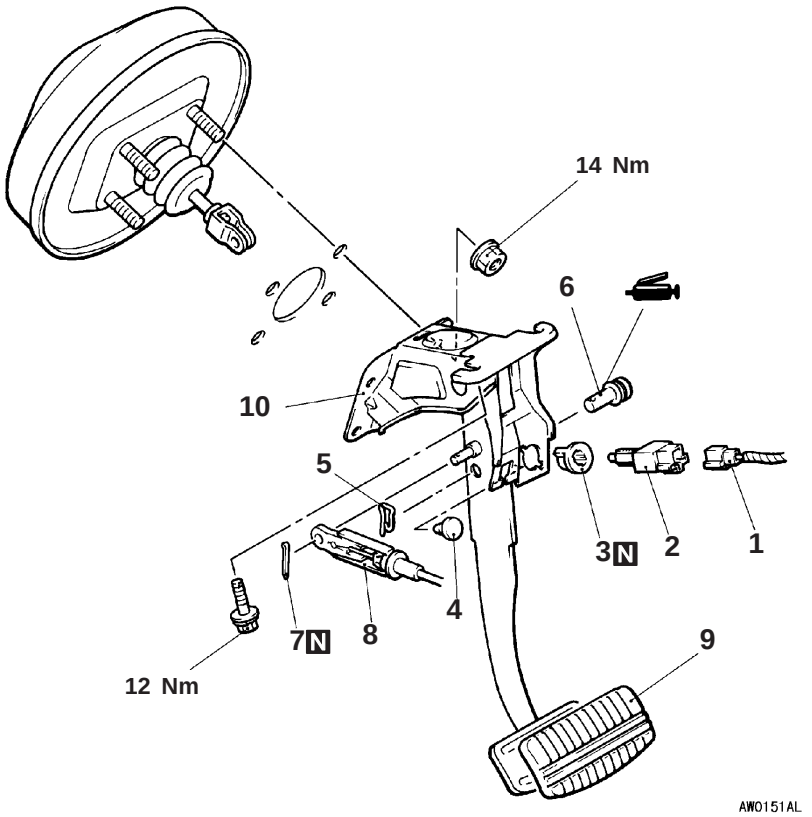


4. If the run-out cannot be corrected by changing the phase of the brake disc, replace the brake disc or grind it with the on-the-car type brake lathe (”MAD, DL-8700PF” or equivalent).

BRAKE PEDAL

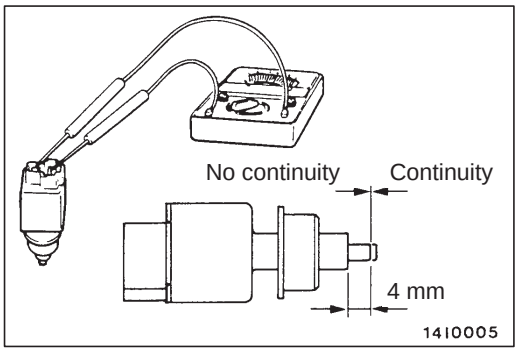
REMOVAL AND INSTALLATION

Post-installation Operation
Brake Pedal Adjustment (Refer to P.35A-6.)



Removal steps

1. Harness connector
2. Stop lamp switch
3. Adjuster
4. Pedal stopper
5. Snap pin
6. Pin assembly
7. Split pin <A/T>
8. Shift lock cable connection <A/T>
9. Pedal pad
10. Brake pedal and pedal support member



INSPECTION

STOP LAMP SWITCH CHECK

1. Connect an ohmmeter between the stop lamp switch connector terminals.
2. There should be no continuity between the terminals when the plunger is pushed in as shown. There should be continuity when it is released.

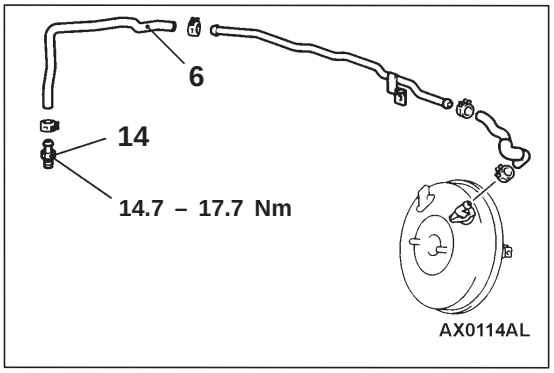
MASTER CYLINDER AND BRAKE BOOSTER

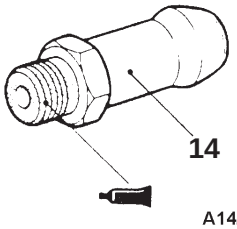
REMOVAL AND INSTALLATION

<L.H. drive vehicles with ABS>

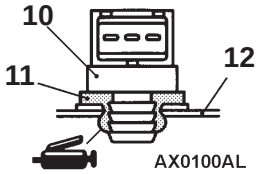
Pre-removal Operation
Brake Fluid Draining

Post-installation Operation
- Brake Fluid Supplying and Air Bleeding (Refer to P.35A-10.)
- Brake Pedal Adjustment (Refer to P.35A-6.)

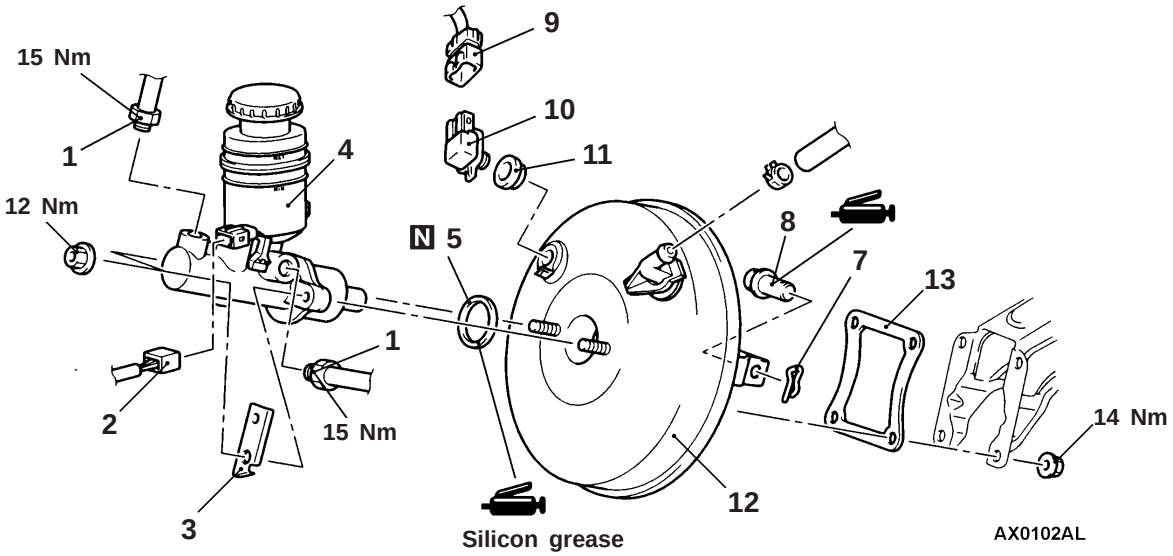




Specified Sealant: 3M ATD Part No.8661 or equivalent



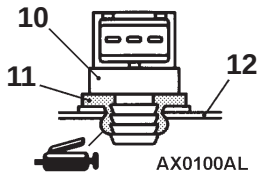
Grease: Silicone grease



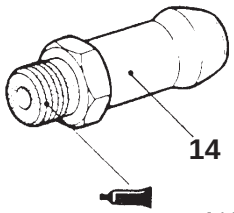
<L.H. drive vehicles without ABS and R.H. drive vehicles>

Pre-removal Operation
Brake Fluid Draining

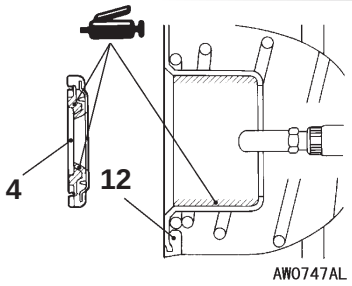
Post-installation Operation
- Brake Fluid Supplying and Air Bleeding (Refer to P.35A-10.)
- Brake Pedal Adjustment (Refer to P.35A-6.)



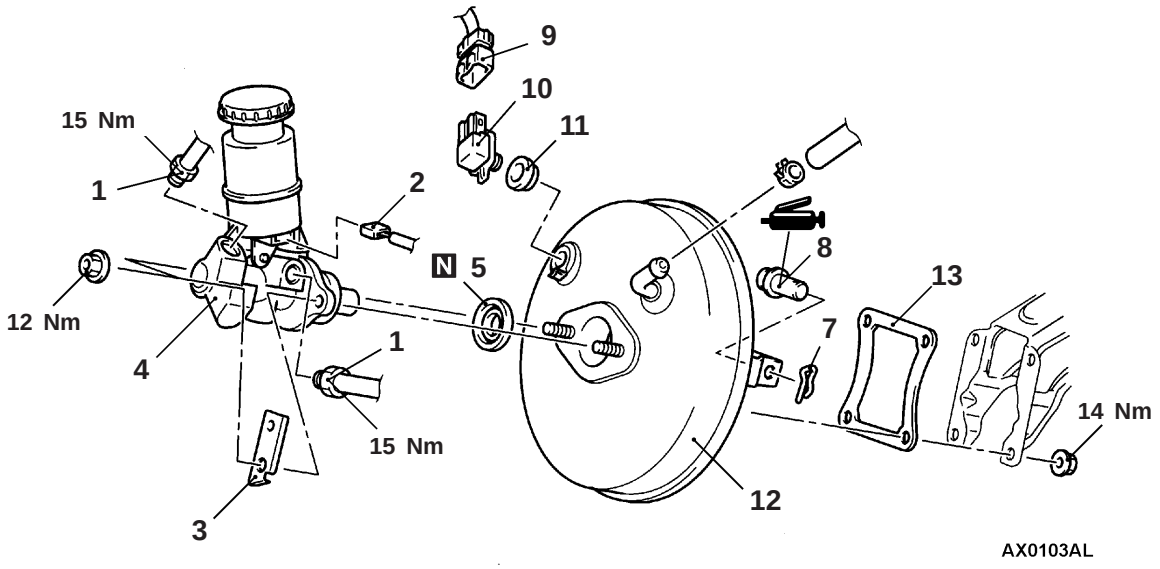
Grease: Silicone grease



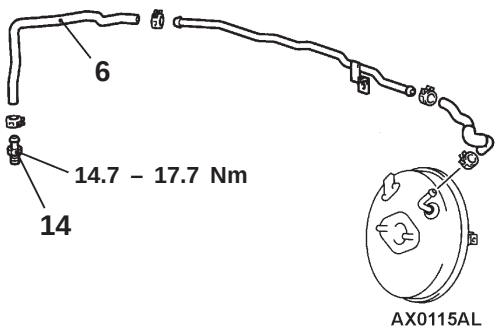
Specified Sealant: 3M ATD Part No.8661 or equivalent



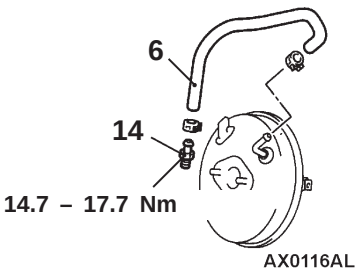
Grease: Silicone grease



<L.H. drive vehicles>



<R.H. drive vehicles>



Master cylinder removal steps

1. Brake pipe connection
2. Brake fluid level sensor connector
3. Bracket <L.H. drive vehicles>
4. Master cylinder

▶C◀ 5. Seal

Brake booster removal steps

1. Brake pipe connection
2. Brake fluid level sensor connector
3. Bracket <L.H. drive vehicles>
4. Master cylinder

▶C◀ 5. Seal

▶B◀ ● Push rod protrusion amount check and adjustment

▶A◀ 6. Vacuum hose (With built-in check valve)
7. Snap pin
8. Pin assembly
9. Vacuum sensor connector
10. Vacuum sensor
11. Grommet
12. Brake booster
13. Sealer

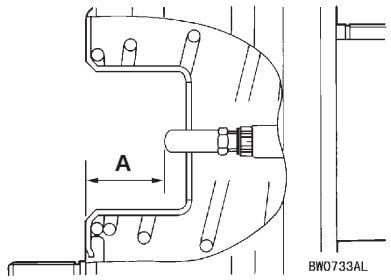
Fitting removal

14. Fitting

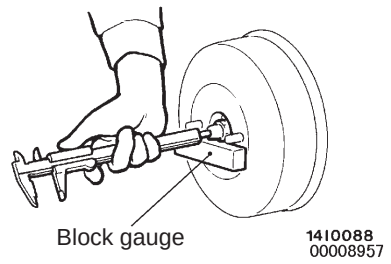
INSTALLATION SERVICE POINTS

▶A◀ VACUUM HOSE CONNECTION

Insert the vacuum hose to the fitting with its paint mark facing forward <L.H. drive vehicles>/upward <R.H. drive vehicles> until the hose end reaches the edge of the hexagonal part of the fitting, and then secure the hose by using the hose clip.



Measuring distance A

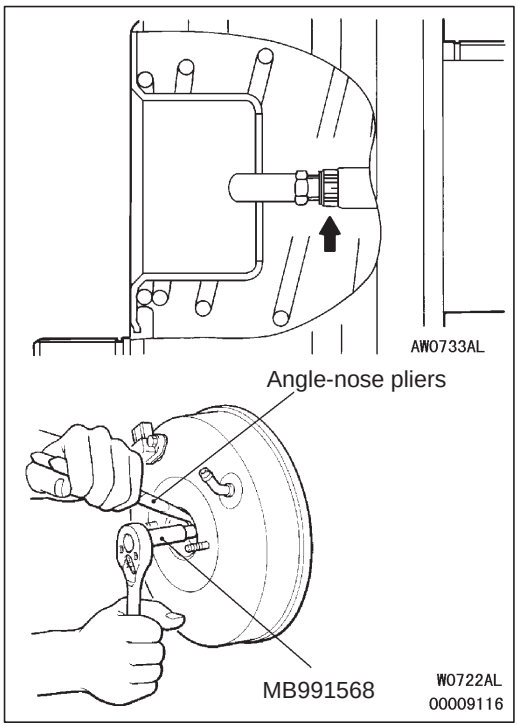


▶B◀ PUSH ROD PROTRUSION AMOUNT CHECK AND ADJUSTMENT

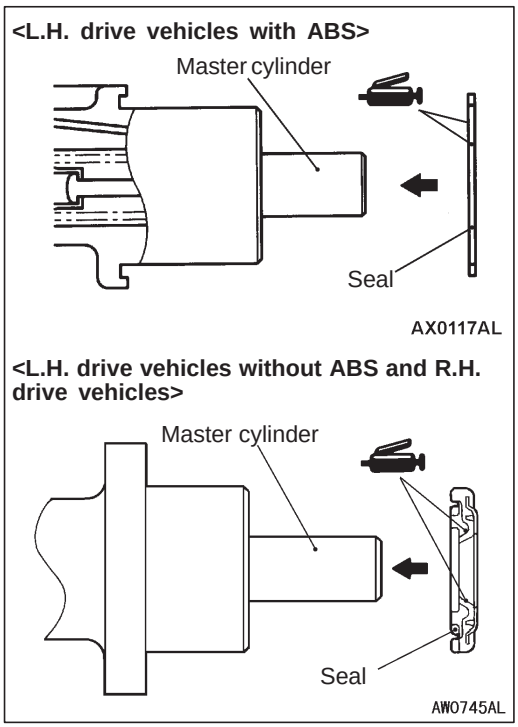
1. Measure dimension (A).

   Standard value (A) :
   <L.H. drive vehicles with ABS> 22.7 – 22.9 mm
   <L.H. drive vehicles without ABS and R.H. drive vehicles> 23.93 – 24.18 mm

   NOTE
   When a negative pressure of 66.7 kPa is applied to the brake booster, the push rod should protrude 22.2 – 22.4 mm <L.H. drive vehicles with ABS>/23.48 – 23.73 mm <L.H. drive vehicles without ABS and R.H. drive vehicles>.



2. If the protrusion amount is not within the standard value range, adjust the push rod length by turning the push rod. Use the special tool to turn the push rod while holding the rod spline with angle-nose pliers.



▶C◀ SEAL INSTALLATION

1. Apply silicone grease to the seal.
2. Install the seal to the master cylinder as shown.

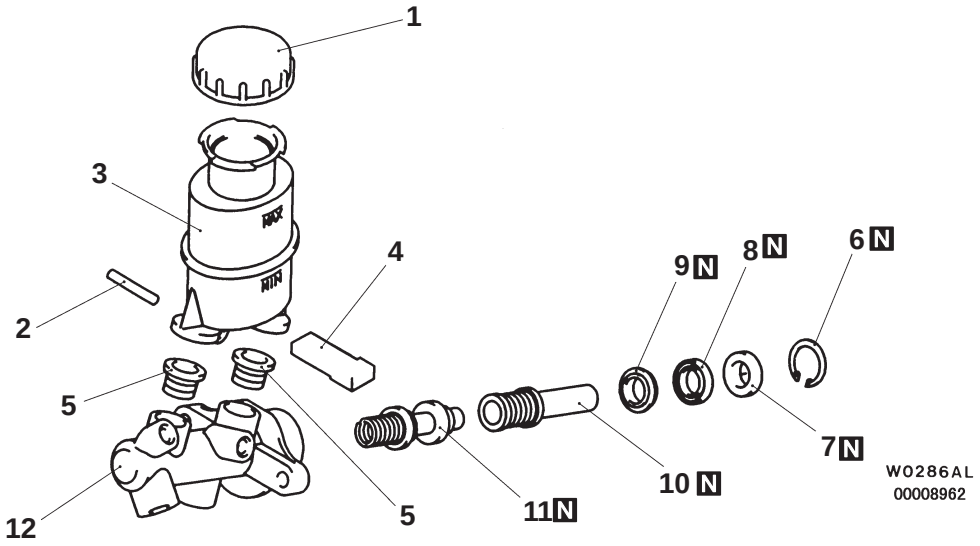
INSPECTION

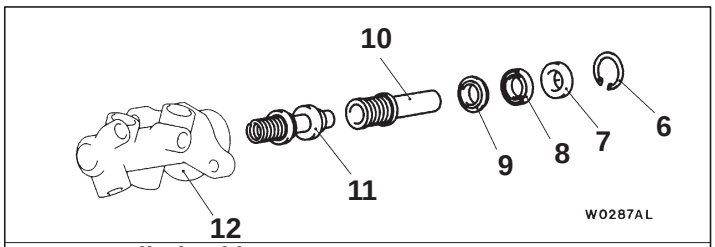
VACUUM SENSOR CHECK

Refer to GROUP 13A – Troubleshooting.

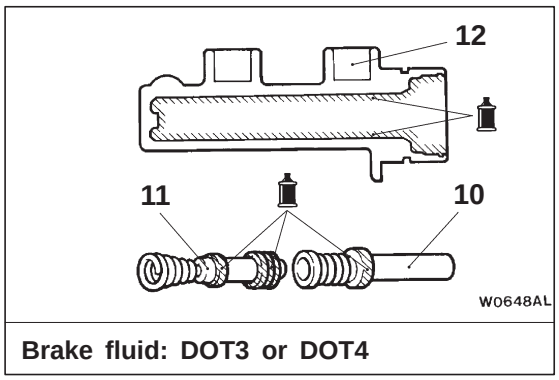
NOTE
The vacuum sensor is monitored by the engine-ECU. Diagnosis code is output when the vacuum sensor has a malfunction.

MASTER CYLINDER <L.H. drive vehicles without ABS and R.H. drive vehicles>
DISASSEMBLY AND REASSEMBLY





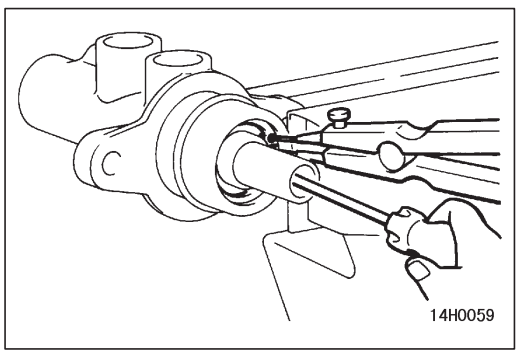
Master cylinder kit



Brake fluid: DOT3 or DOT4

Disassembly steps

1. Reservoir cap
2. Pin
3. Reservoir tank
4. Brake fluid level sensor
5. Reservoir seal
◀A▶ 6. Stopper ring
7. Piston guide
8. Cylinder cup
9. Plate
10. Primary piston assembly
11. Secondary piston assembly
12. Master cylinder body



DISASSEMBLY SERVICE POINT

◀A▶ STOPPER RING REMOVAL

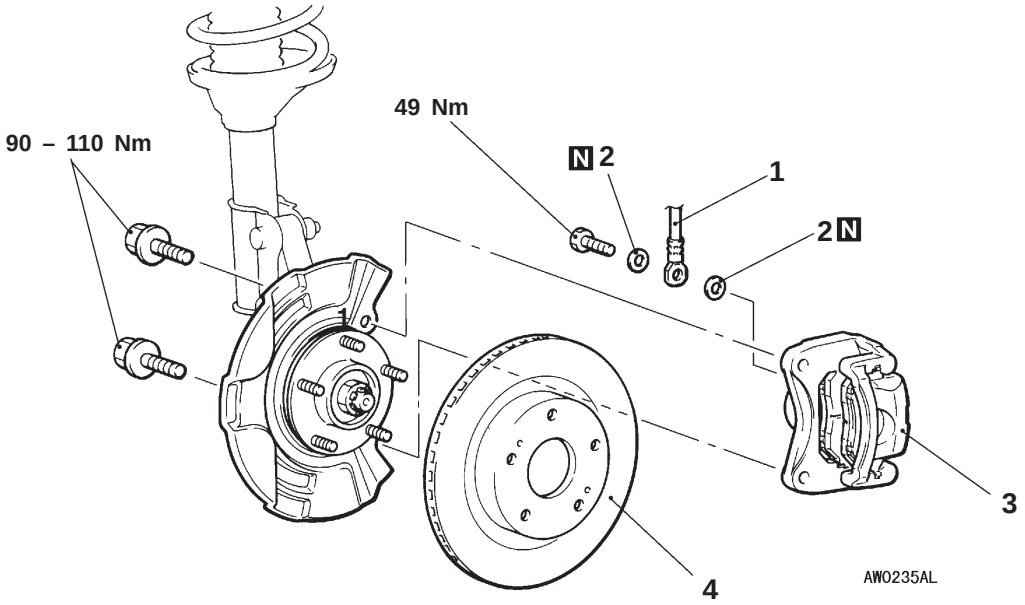
Push the primary piston assembly and remove the stopper ring.

FRONT DISC BRAKE

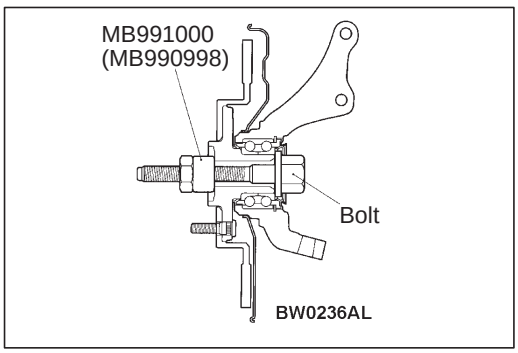
REMOVAL AND INSTALLATION

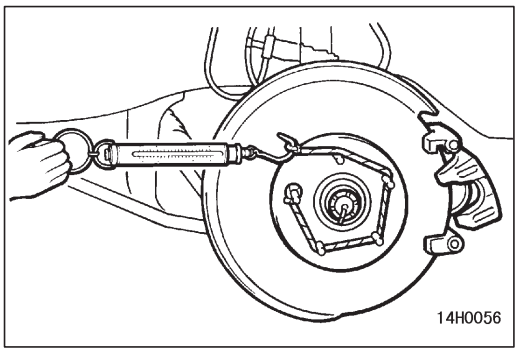
Pre-removal Operation
Brake Fluid Draining

Post-installation Operation
Brake Fluid Supplying and Air Bleeding
(Refer to P.35A-10.)



Removal steps
1. Brake hose connection
2. Gasket
▶A◀ 3. Disc brake assembly
4. Brake disc





INSTALLATION SERVICE POINT

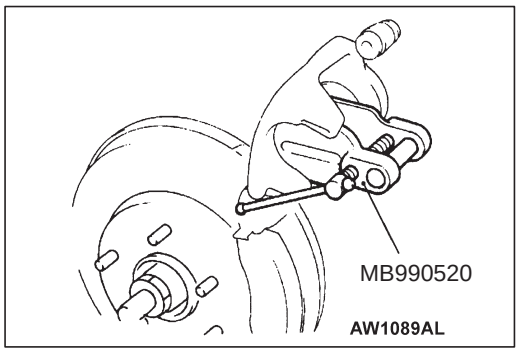
▶A◀ DISC BRAKE ASSEMBLY INSTALLATION

1. In order to measure the brake drag force after pad installation, measure the rotary-sliding resistance of the hub by the following procedure with the pads removed.
   (1) Withdraw the drive shaft. (Refer to GROUP 26 – Front Axle.)
   (2) Attach the special tool to the front hub assembly as shown in the illustration, and tighten it to the specified torque.

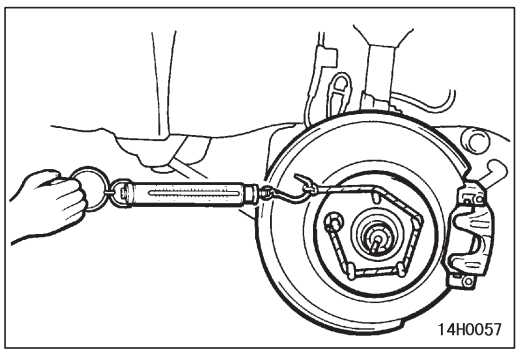
   Tightening torque: 196 – 255 Nm

   (3) Use a spring balance to measure the rotary-sliding resistance of the hub in the forward direction.
2. Install the caliper support to the knuckle, and then assemble the pad clip and the pad to the caliper support.

Caution
Do not contaminate the friction surfaces of the pads and brake discs by any oil or grease.



3. Clean the piston and insert it into the cylinder with the special tool.
4. Be careful that the piston boot does not become caught, when lowering the caliper assembly and install the guide pin to the caliper.
5. Start the engine, and then depress the brake pedal two or three times strongly. Then stop the engine.
6. Turn the brake disc forward 10 times.

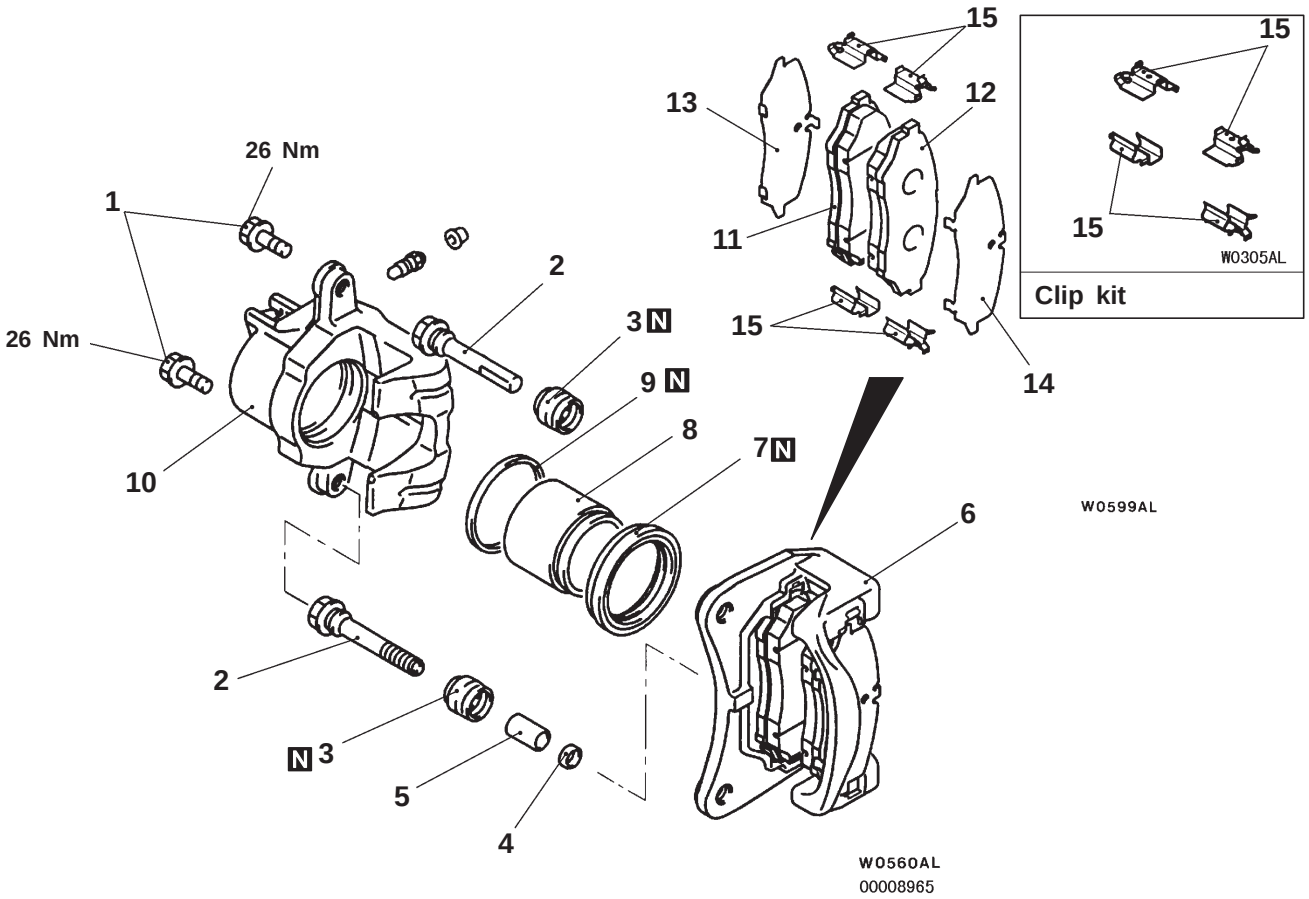


7. Use a spring balance to measure the rotary-sliding resistance of the hub.
8. Calculate the drag force of the disc brake [difference between the values measured at steps 1 and 7].

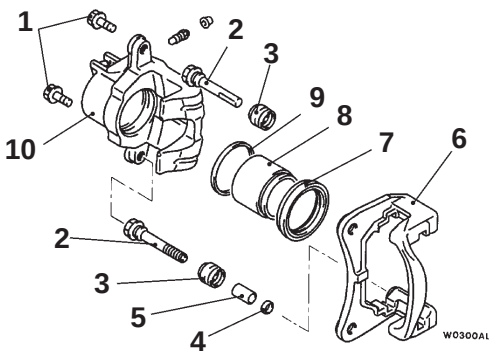
   Standard value: 69 N

9. If that drag force exceeds the standard value, disassemble the piston assembly. Then check the piston for contamination or rust, and confirm if the piston or the piston seal is deteriorated, and if the lock pin and the guide pin slide smoothly.

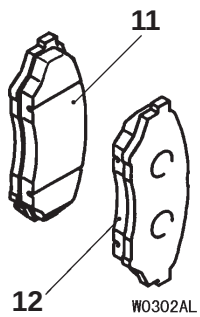
DISASSEMBLY AND REASSEMBLY



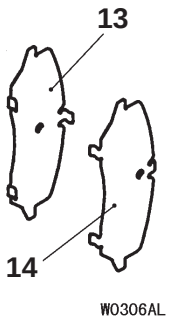
Clip kit



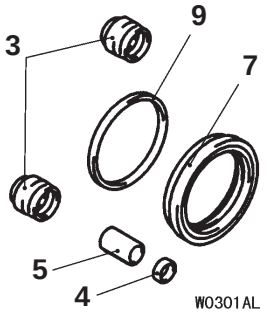
Brake caliper kit



Pad set



Shim kit



Seal and boot kit

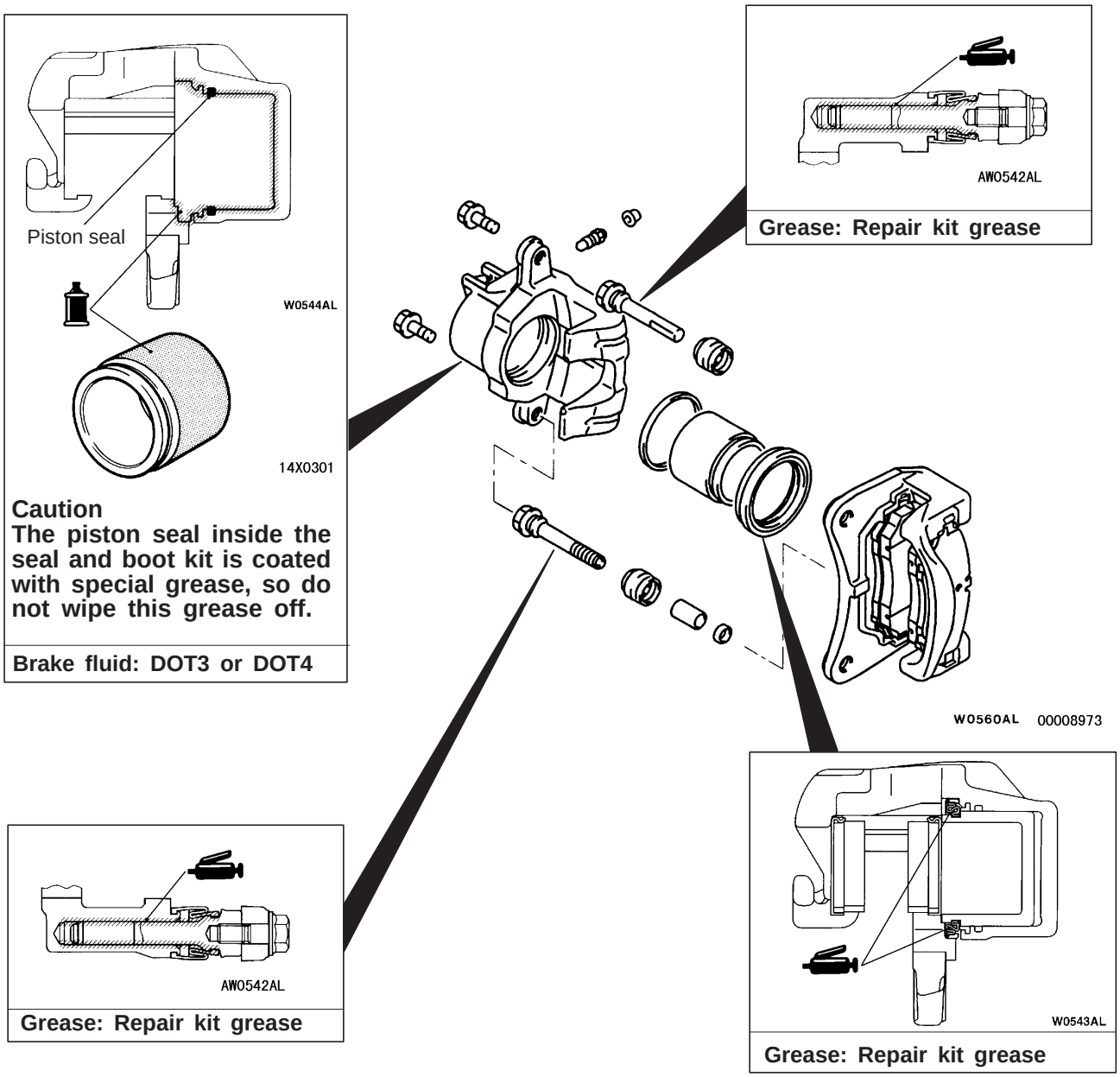
Disassembly steps

1. Guide pin lock bolt
2. Guide pin
3. Boot
4. Bushing
5. Bushing retainer
6. Caliper support (including pad, clip, and shim)

◀A▶ 7. Piston boot

◀A▶ ◀B▶ 8. Piston
9. Piston seal
10. Caliper body
11. Pad and wear indicator assembly
12. Pad assembly
13. Inner shim
14. Outer shim
15. Clip

LUBRICATION POINTS



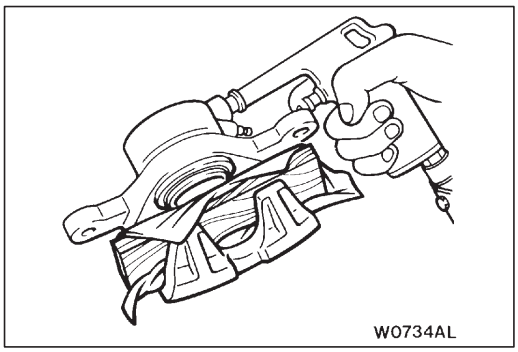
Caution
The piston seal inside the seal and boot kit is coated with special grease, so do not wipe this grease off.

Brake fluid: DOT3 or DOT4

Grease: Repair kit grease

Grease: Repair kit grease

Grease: Repair kit grease

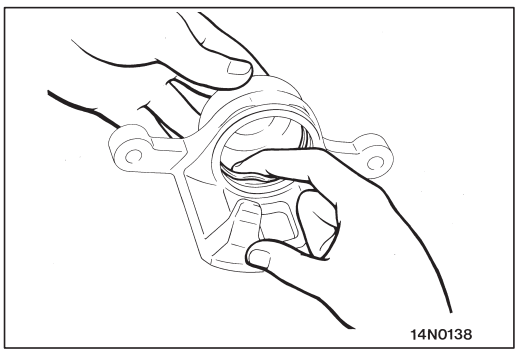


DISASSEMBLY SERVICE POINTS

◀A▶ PISTON BOOT/PISTON REMOVAL

Use a piece of wood to protect the caliper body outer side, and then apply compressed air through the brake hose connection hole to withdraw the piston and piston boot.

Caution
If air is blown into the caliper body suddenly, the piston will pop out, causing damage to the caliper body. Be sure to apply compressed air gradually.



◀B▶ PISTON SEAL REMOVAL

1. Remove the piston seal with finger tip.

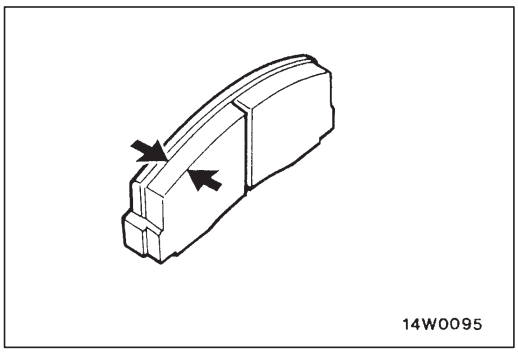
   Caution
   Do not use a flat-tipped screwdriver or other tool to prevent damage to inner cylinder.

2. Clean piston surface and inner bore with trichloroethylene, alcohol or the specified brake fluid.

   Specified brake fluid: DOT3 or DOT4

INSPECTION

- Check the cylinder for wear, damage or rust.
- Check the piston surface for wear, damage or rust.
- Check the caliper body or sleeve for wear.
- Check pad for damage or adhesion of grease, check the backing metal for damage.



PAD WEAR CHECK

Measure thickness at the thinnest and worn area of the pad. Replace the pad assembly if the pad thickness is less than the limit value.

Standard value: 10 mm

Limit: 2.0 mm

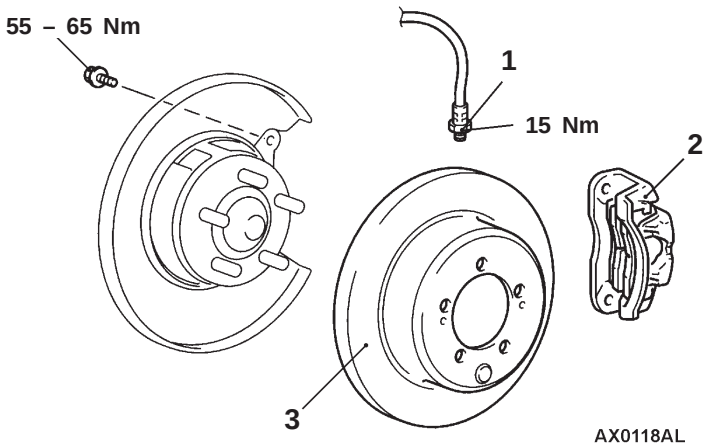
Caution
1. **Always replace the brake pads as an axle set.**
2. **If an excessive difference is found in the thickness between the right and left brake pads, check moving parts.**

REAR DISC BRAKE

REMOVAL AND INSTALLATION

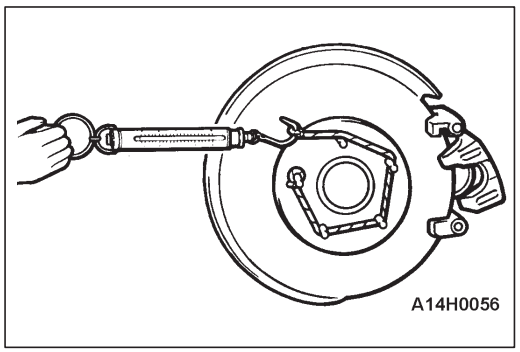
Pre-removal Operation
- Brake Fluid Draining

Post-installation Operation
- Brake Fluid Supplying and Air Bleeding (Refer to P.35A-10.)



Removal steps

1. Brake hose connection
▶A◀ 2. Disc brake assembly
3. Brake disc

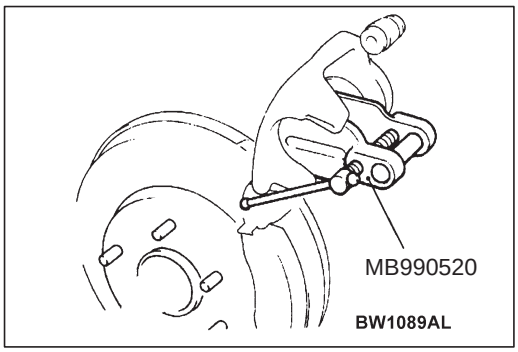


INSTALLATION SERVICE POINT

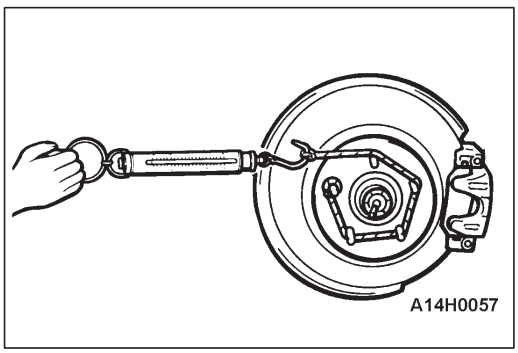
▶A◀ DISC BRAKE ASSEMBLY INSTALLATION

1. In order to measure the brake drag force after pad installation, use a spring balance to measure the rotary-sliding resistance of the hub with the pads removed.
2. Install the caliper support to the backing plate, and then assemble the pad clip and the pad to the caliper support.

Caution
Do not contaminate the friction surfaces of the pads and brake discs by any oil or grease.



3. Clean the piston and insert it into the cylinder with the special tool.
4. Be careful that the piston boot does not become caught, when lowering the caliper assembly and install the guide pin to the caliper.
5. Start the engine, and then depress the brake pedal two or three times strongly. Then stop the engine.
6. Turn the brake disc forward 10 times.

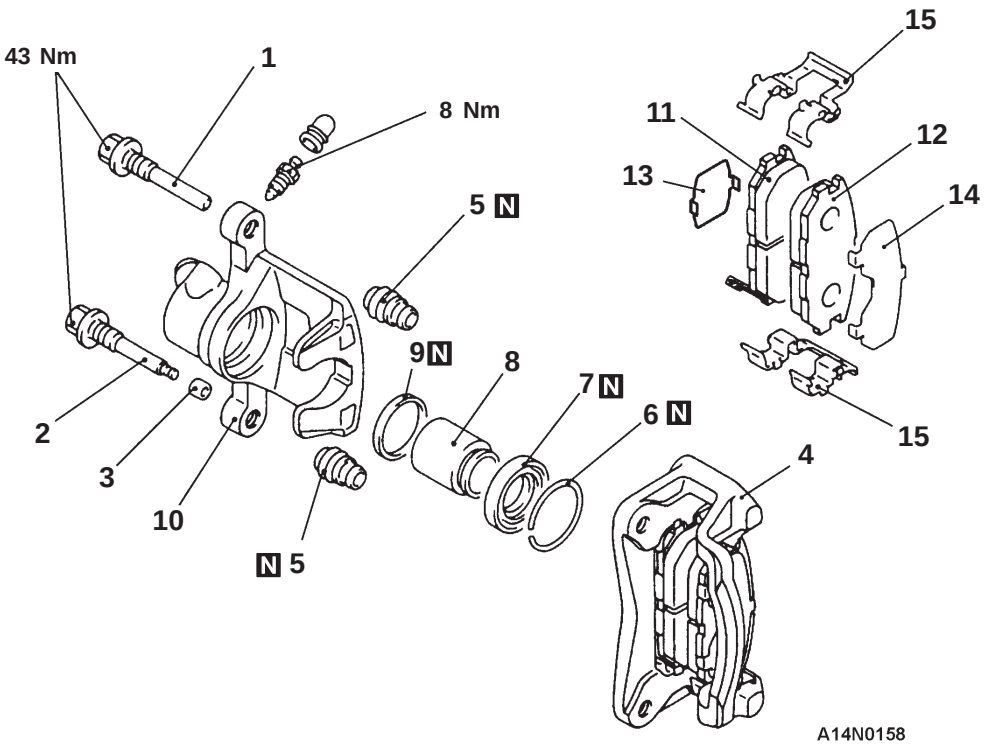


7. Use a spring balance to measure the rotary-sliding resistance of the hub.
8. Calculate the drag force of the disc brake [difference between the values measured at steps 1 and 7].

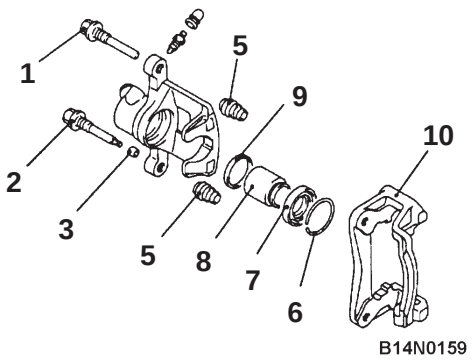
   Standard value: 34 N

9. If that drag force exceeds the standard value, disassemble the piston assembly. Then check the piston for contamination or rust, and confirm if the piston or the piston seal is deteriorated, and if the lock pin and the guide pin slide smoothly.

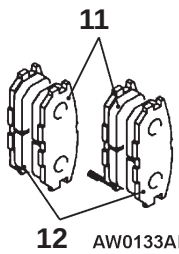
DISASSEMBLY AND REASSEMBLY



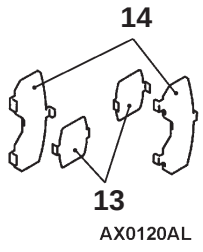
Clip set



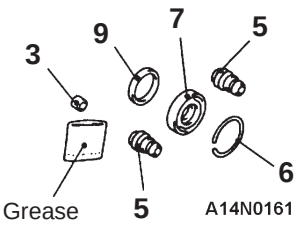
Brake caliper kit



Pad set



Shim set

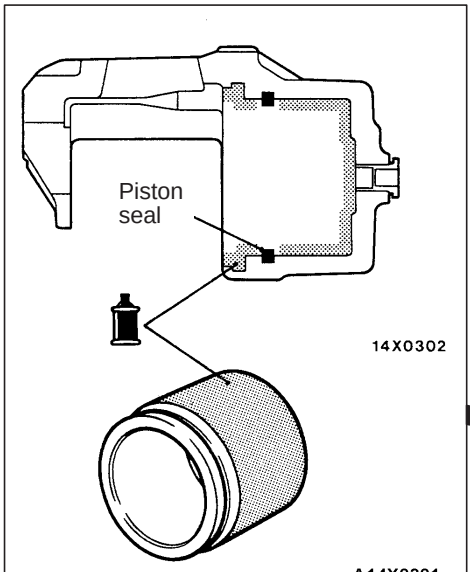


Seal and boots kit

Disassembly steps

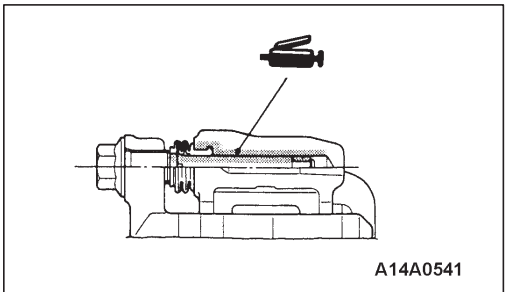
- ▶A◀ 1. Guide pin
- ▶A◀ 2. Lock pin
- 3. Bushing
- 4. Caliper support (pad, clip, shim)
- 5. Pin boot
- 6. Boot ring
- ◀A▶ 7. Piston boot
- ◀A▶ 8. Piston
- ◀B▶ 9. Piston seal
- 10. Caliper body
- 11. Pad and wear indicator assembly
- 12. Pad assembly
- 13. Inner shim
- 14. Outer shim
- 15. Clip

LUBRICATION POINTS

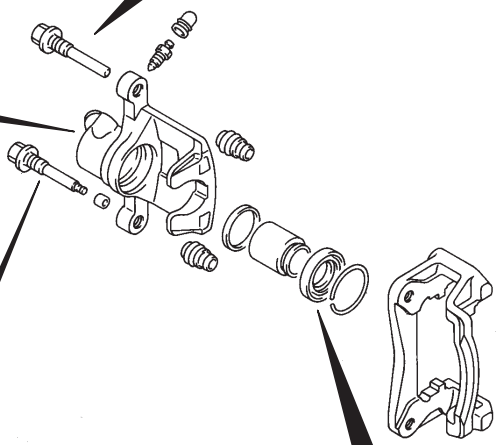


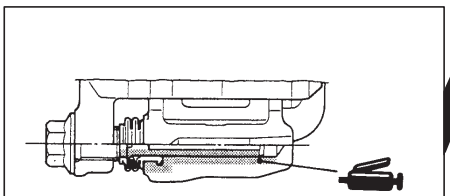
Caution
The piston seal inside the seal and boot kit is coated with special grease, so do not wipe this grease off.

Brake fluid: DOT3 or DOT4

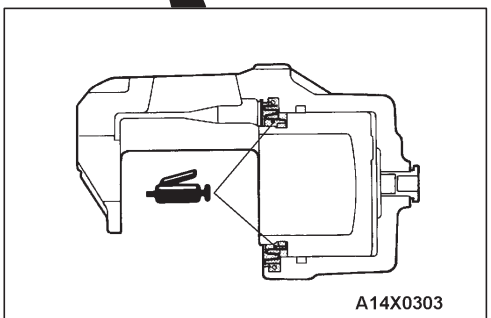


Grease: Repair kit grease

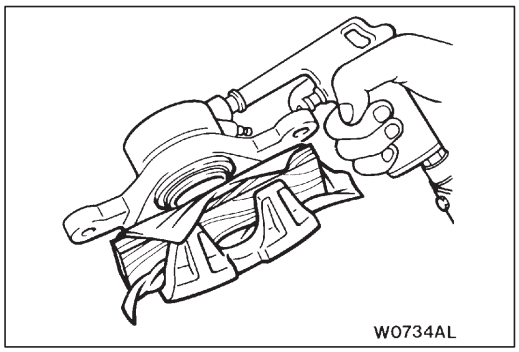




Grease: Repair kit grease



Grease: Repair kit grease

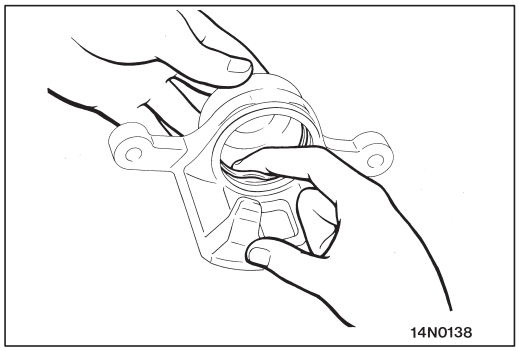


DISASSEMBLY SERVICE POINTS

◀A▶ PISTON BOOT/PISTON REMOVAL

Use a piece of wood to protect the caliper body outer side, and then apply compressed air through the brake hose connection hole to withdraw the piston and piston boot.

Caution
If air is blown into the caliper body suddenly, the piston will pop out, causing damage to the caliper body. Be sure to apply compressed air gradually.



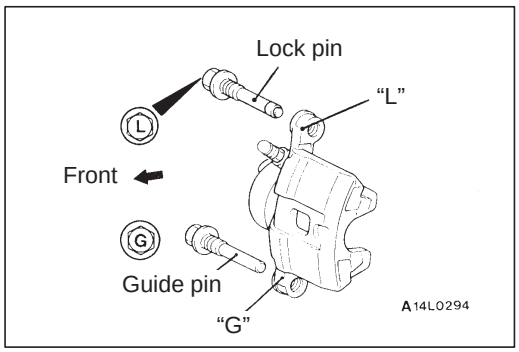
◀B▶ PISTON SEAL REMOVAL

1. Remove the piston seal with finger tip.

   Caution
   Do not use a flat-tipped screwdriver or other tool to prevent damage to inner cylinder.

2. Clean piston surface and inner bore with trichloroethylene, alcohol or the specified brake fluid.

   Specified brake fluid: DOT3 or DOT4



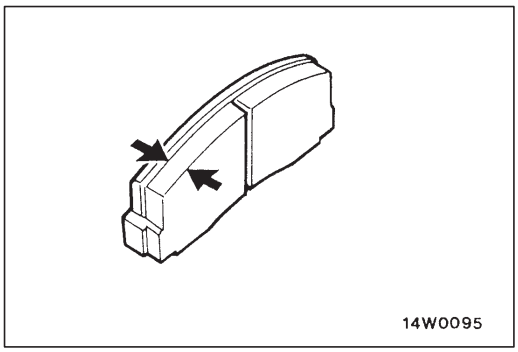
REASSEMBLY SERVICE POINT

▶A◀ LOCK PIN/GUIDE PIN INSTALLATION

Install the guide pin and lock pin as illustrated that each head mark of the guide pin and the lock pin matches the indication mark ("G" or "L") located on the caliper body.

INSPECTION

- Check the cylinder for wear, damage or rust.
- Check the piston surface for wear, damage or rust.
- Check the caliper body or sleeve for wear.
- Check pad for damage or adhesion of grease, check the backing metal for damage.



PAD WEAR CHECK

Measure thickness at the thinnest and worn area of the pad. Replace the pad assembly if the pad thickness is less than the limit value.

Standard value: 10 mm

Limit: 2.0 mm

Caution

1. **Always replace the brake pads as an axle set.**
2. **If an excessive difference is found in the thickness between the right and left brake pads, check moving parts.**

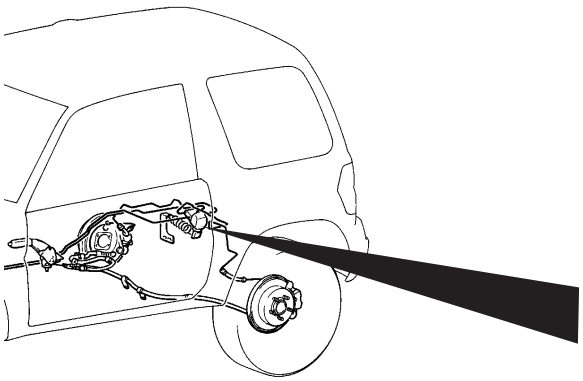
LOAD SENSING PROPORTIONING VALVE

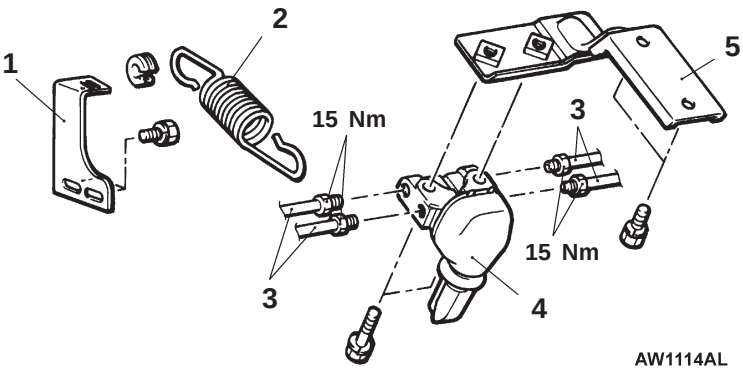
REMOVAL AND INSTALLATION

Caution
Do not disassemble the load sensing proportioning valve.

Pre-removal Operation
Brake Fluid Draining

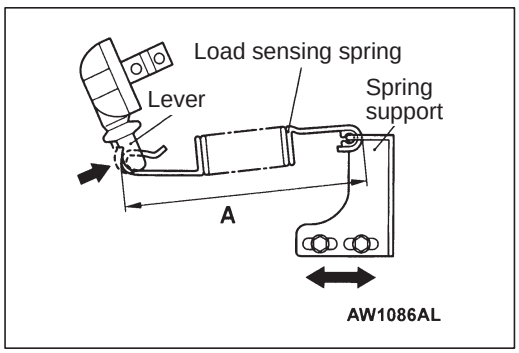
Post-installation Operation
- Brake Fluid Supplying
- Brake Line Bleeding (Refer to P.35A-10.)





Removal steps

▶A◀ 1. Spring support
2. Load sensing spring
3. Brake pipe connection
4. Load sensing proportioning valve
5. Bracket



INSTALLATION SERVICE POINT

▶A◀ SPRING SUPPORT INSTALLATION

1. Install the load sensing spring, and then tighten the spring support to the axle assembly temporarily.
2. Insert the lever of the load sensing proportioning valve fully into the valve side and hold it. Then adjust the spring support so that the spring length (the distance between the two ends of the spring) is at the standard value.

   Standard value (A): 194 – 198 mm

NOTES

BASIC BRAKE SYSTEM

CONTENTS

GENERAL 2
Outline of Change 2
GENERAL INFORMATION 2
SERVICE SPECIFICATIONS 2
LUBRICANTS 2
SPECIAL TOOL 2
ON-VEHICLE SERVICE <1800-MPI> 3
Brake Lining Thickness Check 3
Brake Drum Inside Diameter Check 3
Brake Lining and Brake Drum Contact Check ... 3
MASTER CYLINDER AND BRAKE BOOSTER <1800-MPI> 4
REAR DRUM BRAKE 6

GENERAL

OUTLINE OF CHANGE

The following service procedures have been established due to the adoption of the rear drum brake. <1800-MPI>

GENERAL INFORMATION

Items		1800-MPI
Rear drum brakes	Type	Leading trailing
	Drum I.D. mm	228
	Wheel cylinder I.D. mm	22.2
	Lining thickness mm	4.9
	Clearance adjustment	Automatic

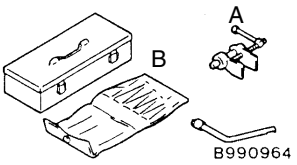
SERVICE SPECIFICATIONS

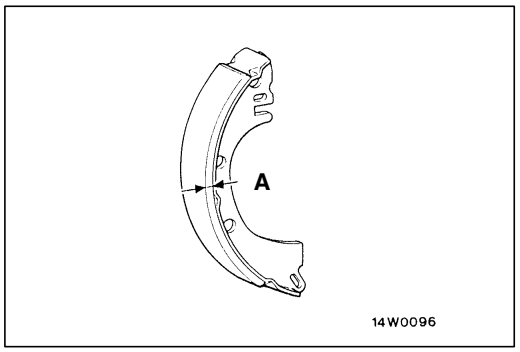
Items		Standard value	Limit
Rear drum brake	Lining thickness mm	4.9	1.0
	Drum inside diameter mm	228.6	230.6

LUBRICANTS

Items	Specified Lubricant	Quantity
Backing plate	Brake grease SAE J310, NLGI No.1	As required
Shoe and lining assembly		
Automatic adjuster assembly		

SPECIAL TOOL

Tool	Number	Name	Use
	MB990964 A: MB990520 B: MB990619	Brake tool set	• Pushing-in of the disc brake piston • Installation of drum brake wheel cylinder piston cup



ON-VEHICLE SERVICE <1800-MPI>

BRAKE LINING THICKNESS CHECK

1. Remove the brake drum.
2. Measure the thickness of the brake lining at the place worn the most.

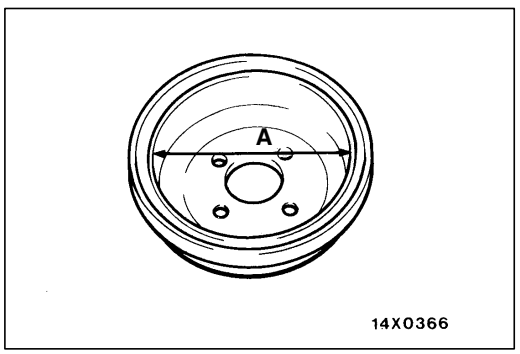
   Standard value (A): 4.9 mm

   Limit (A): 1.0 mm

3. Replace the shoe and lining assembly as an axle set if brake lining thickness is less than the limit. For information concerning the procedures for installation of the shoe and lining assembly, refer to P.35A-26.

   Caution

   If there is a significant difference in the thickness of the shoe and lining assemblies on the left and right sides, check the sliding condition of the piston.



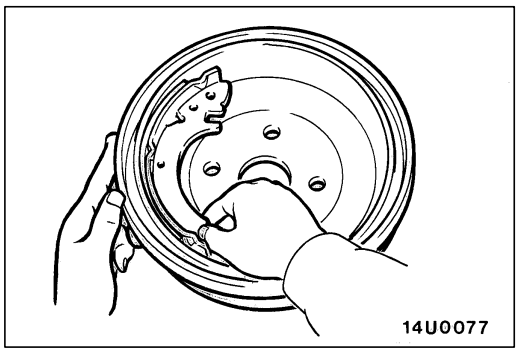
BRAKE DRUM INSIDE DIAMETER CHECK

1. Remove the brake drum.
2. Measure the inside diameter of the brake drum at two or more locations.

   Standard value (A) : 228.6 mm

   Limit (A) : 230.6 mm

3. Replace the brake drum when the inside diameter exceeds the limit value or the brake drum is worn unevenly.



BRAKE LINING AND BRAKE DRUM CONTACT CHECK

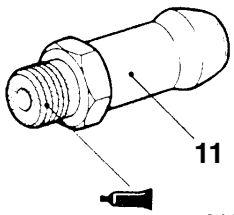
1. Remove the shoe and lining assembly. (Refer to P.35A-6.)
2. Chalk inner surface of brake drum and rub with shoe and lining assembly.
3. Replace shoe and lining assembly or brake drums if there are any irregular contact area.
4. Clean off chalk after check.

MASTER CYLINDER AND BRAKE BOOSTER <1800-MPI>

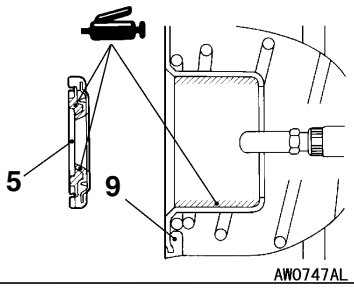
REMOVAL AND INSTALLATION

Pre-removal Operation
Brake Fluid Draining

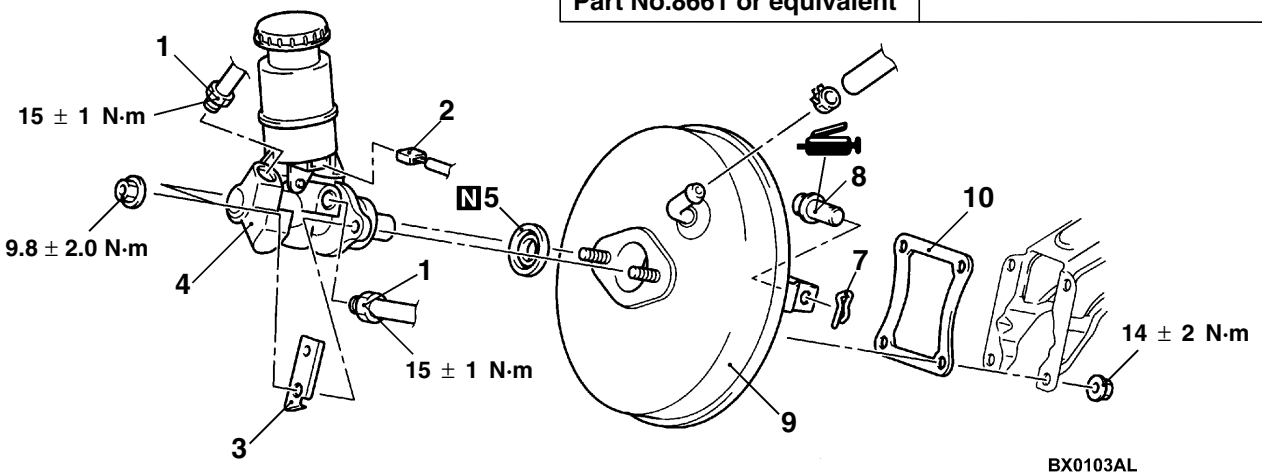
Post-installation Operation
- Brake Fluid Supplying and Air Bleeding (Refer to P.35A-11.)*
- Brake Pedal Adjustment (Refer to P.35A-7.)*



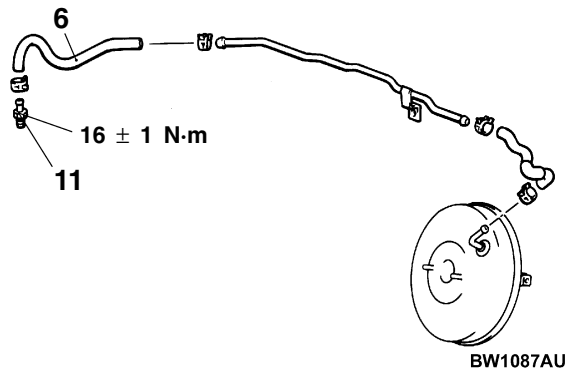
Specified Sealant: 3M ATD Part No.8661 or equivalent



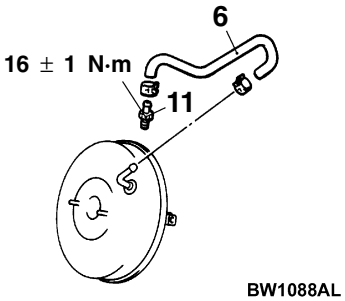
Grease: Silicone grease



<L.H. drive vehicles>



<R.H. drive vehicles>



Master cylinder removal steps

1. Brake pipe connection
2. Brake fluid level sensor connector
3. Bracket <L.H. drive vehicles>
4. Master cylinder

▶C◀ 5. Seal

Brake booster removal steps

1. Brake pipe connection
2. Brake fluid level sensor connector
3. Bracket <L.H. drive vehicles>
4. Master cylinder

▶C◀ 5. Seal

▶B◀ • Push rod protrusion amount check and adjustment

▶A◀ 6. Vacuum hose (With built-in check valve)

7. Snap pin
8. Pin assembly
9. Brake booster
10. Sealer

Fitting removal

11. Fitting

NOTE

(1) *: Refer to PAJERO PININ '00 Workshop Manual (Pub. No. CKRE00E1).

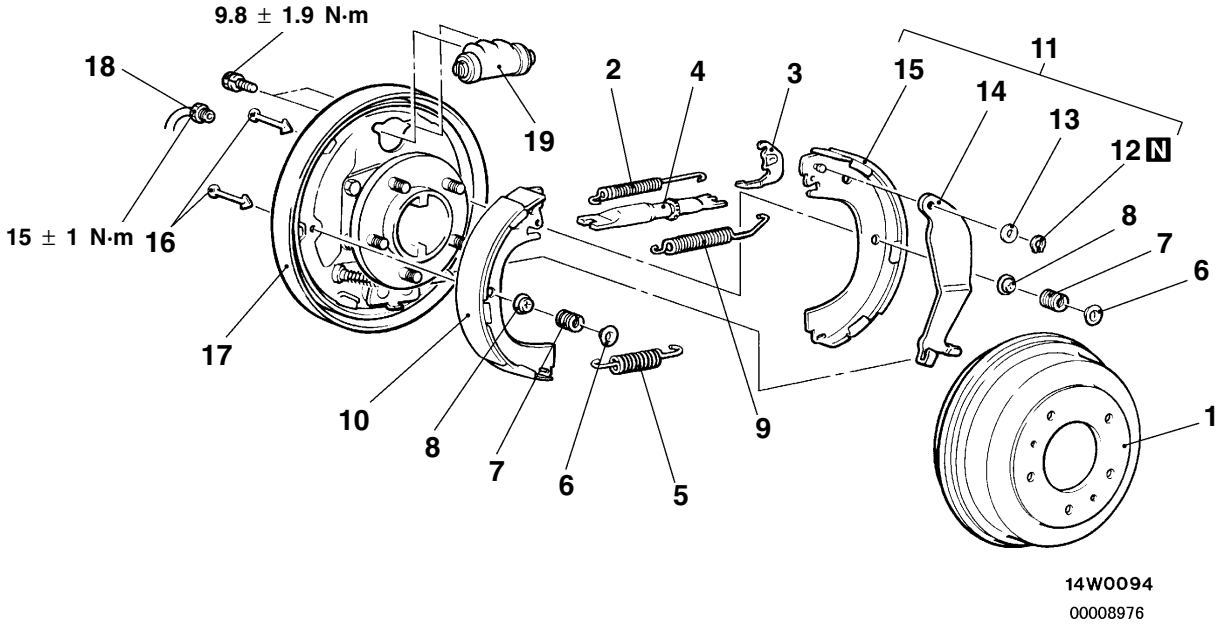
(2) The installation service points are the same as before.

REAR DRUM BRAKE

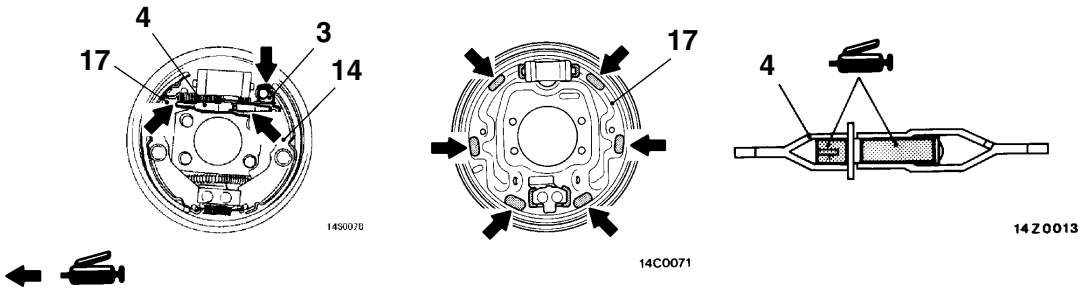
REMOVAL AND INSTALLATION

Pre-removal Operation
- Loosening the Parking Brake Cable Adjusting Nut. (Refer to GROUP 36 – On-vehicle Service)
- Brake Fluid Draining

Post-installation Operation
- Parking Brake Lever Stroke Adjustment (Refer to GROUP 36 – On-vehicle Service)
- Brake Fluid Supplying and Air Bleeding (Refer to P.35A-11.)*



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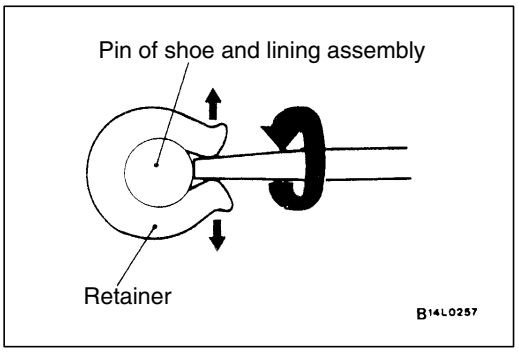
Specified grease: Brake grease SAE J310, NLGI No.1

Removal steps
1. Brake drum
2. Shoe-to-shoe spring
3. Adjuster lever
4. Auto-adjuster assembly
5. Retainer spring
6. Shoe hold-down cup
7. Shoe hold-down spring
8. Shoe hold-down cup
9. Shoe-to-shoe spring
10. Shoe and lining assembly
11. Shoe and lever assembly

◀A▶ ▶B◀ 12. Retainer
▶A◀ 13. Wave washer
14. Parking lever
15. Shoe and lining assembly
16. Shoe hold-down pin
17. Backing plate (Refer to GROUP 27 – Rear Axle Shaft.)

Wheel cylinder removal steps
1. Brake drum
18. Brake pipe connection
19. Wheel cylinder assembly

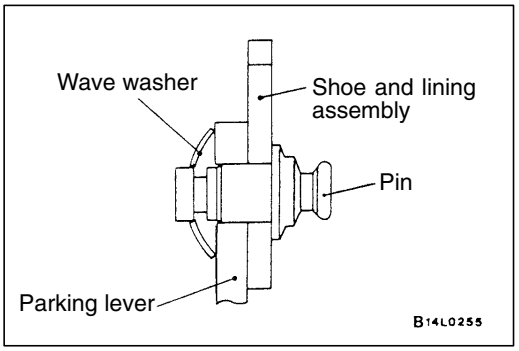
NOTE
*: Refer to PAJERO PININ '00 Workshop Manual (Pub. No. CKRE00E1).



REMOVAL SERVICE POINT

◀A▶ RETAINER REMOVAL

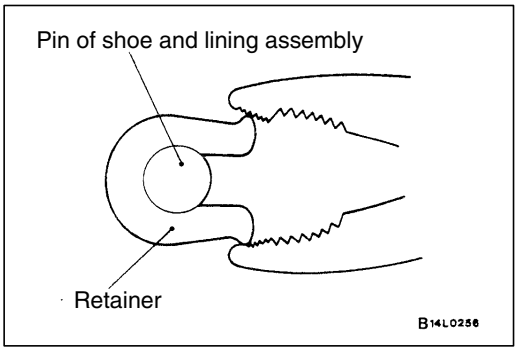
Use a flat-tipped screwdriver or the like to open up the retainer joint, and remove the retainer.



INSTALLATION SERVICE POINTS

▶A◀ WAVE WASHER INSTALLATION

Install the wave washer in the direction shown in the illustration.



▶B◀ RETAINER INSTALLATION

Use pliers or the like to crimp the retainer or the pin positively.

INSPECTION

BRAKE LINING THICKNESS CHECK

Refer to P.35A-3.

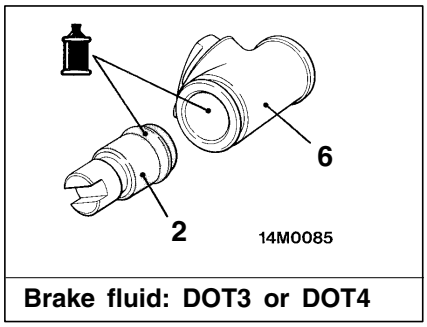
BRAKE DRUM INSIDE DIAMETER CHECK

Refer to P.35A-3.

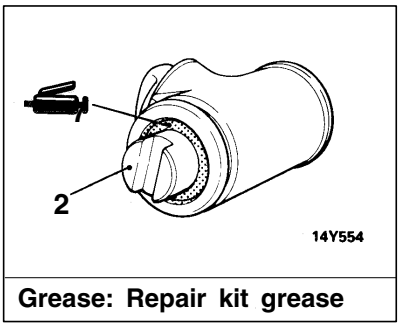
BRAKE LINING AND BRAKE DRUM CONTACT CHECK

Refer to P.35A-3.

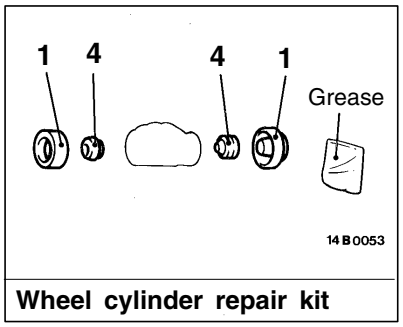
WHEEL CYLINDER
DISASSEMBLY AND REASSEMBLY



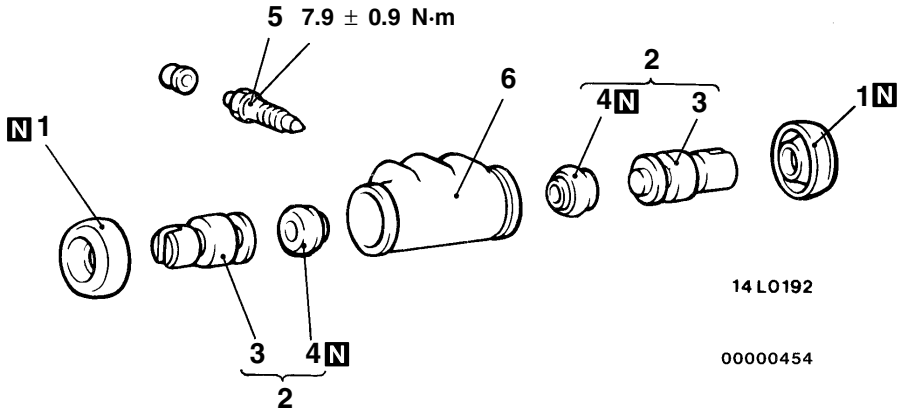
Brake fluid: DOT3 or DOT4



Grease: Repair kit grease

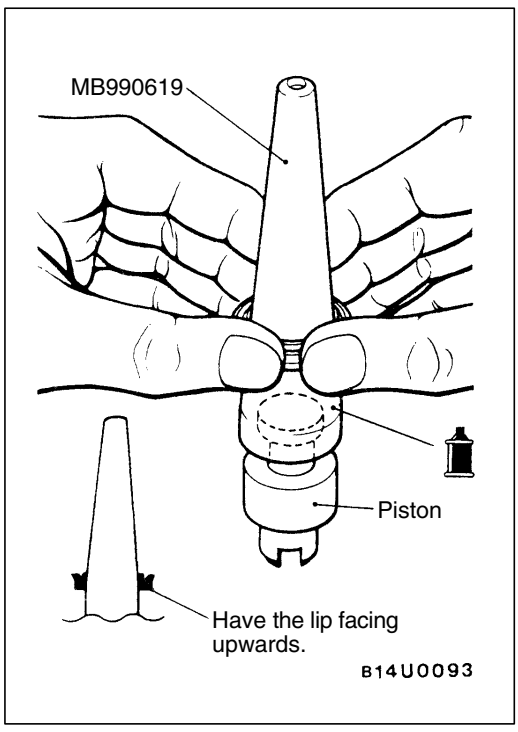


Wheel cylinder repair kit



Disassembly steps

1. Boots
2. Piston assembly
3. ▶A◀ Pistons
4. ▶A◀ Piston cups
5. Spring
6. Wheel cylinder body



REASSEMBLY SERVICE POINT

▶A◀ PISTON CUPS/PISTONS REASSEMBLY

1. Use trichloroethylene, alcohol or the specified brake fluid to clean the piston.

   Specified brake fluid: DOT3 or DOT4
2. Apply the specified brake fluid to the piston cups and the outer circumference of the special tool.
3. Set the piston cup on the special tool with the lip of the cup facing up, fit the cup onto the special tool.
4. Slide the piston cup down the outside of the tool into the piston groove carefully, making sure that the piston cup is twisted or slanted.

INSPECTION

Check the piston and wheel cylinder walls for rust or damage, and if there is any abnormality, replace the entire wheel cylinder assembly.

SERVICE BULLETIN

PUBLICATION GROUP, AFTER SALES SERVICE DEP.
MITSUBISHI MOTOR SALES EUROPE BV

SERVICE BULLETIN	**No.:** ESB-01E35-001	
	Date: 2001-07-03	**<Model>** / **<M/Y>**
Subject: REPLACEMENT AND CLEANING FOR BRAKE BOOSTER VACUUM NIPPLE ON 4G93 GDI EQUIPPED VEHICLES		(EC)CARISMA 98-10 (EC)SPACE STAR (EC)PAJERO PININ
Group: SERVICE BRAKE	**draftno.:** 01AL005	
INFORMATION	O. Kai - E.V.P. & G.M. After Sales Service Dept.	

1. Description:

On 4G93-GDI engine-equipped vehicles for Europe, the vacuum nipple of the brake booster must be replaced and cleaned periodically. This Service Bulletin covers the replacement and cleaning procedures which should be added in On-Vehicle Service as shown below.

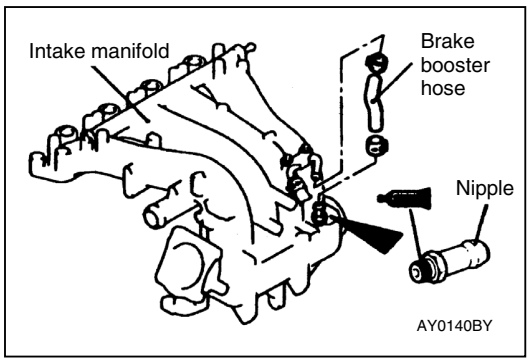
2. Applicable Manuals:

Manual	Pub. No.	Language	Page(s)
'98 CARISMA GDI Workshop Manual chassis	PWDE9502-C	(English)	35A-1
	PWDS9503-C	(Spanish)	35A-1
	PWDF9504-C	(French)	35A-1
	PWDG9505-C	(German)	35A-1
	PWDD9505-C	(Dutch)	35A-1
	PWDW9506-C	(Swedish)	35A-1
	PWDI96E1-C	(Italian)	35A-1
'99 SPACE STAR Workshop Manual chassis	CMXE99E1	(English)	35A-14
	CMXS99E1	(Spanish)	35A-14
	CMXF99E1	(French)	35A-14
	CMXG99E1	(German)	35A-14
	CMXD99E1	(Dutch)	35A-14
	CMXW99E1	(Swedish)	35A-14
	CMXI99E1	(Italian)	35A-14
'00 PAJERO PININ Workshop Manual chassis	CKRE00E1	(English)	35A-13
'00 MONTERO io Workshop Manual chassis	CKRS00E1	(Spanish)	35A-13
'00 PAJERO PININ Workshop Manual chassis	CKRF00E1	(French)	35A-13
	CKRG00E1	(German)	35A-13
	CKRD00E1	(Dutch)	35A-13
	CKRW00E1	(Swedish)	35A-13
	CKRI00E1	(Italian)	35A-13

GROUP 35A
BASIC BRAKE SYSTEM

GENERAL
OUTLINE OF CHANGES
The following maintenance service points have been established to correspond to the addition of a pressure sensor. Maintenance service procedures not listed below are the same as before.

<Added>



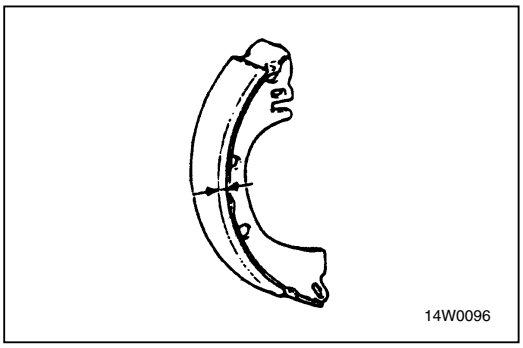
ON-VEHICLE SERVICE

BRAKE BOOSTER VACUUM NIPPLE REPLACEMENT
1. Remove the brake booster hose from the intake manifold.
2. Replace the nipple with a new one, using a sealing agent and tighten to 15 – 18 N.m

   Specified sealant:
   3M ATD Part No.8661 or equivalent

   Caution
   Take care when applying the thread sealant as too much could block the nipple.

3. After replacement, re-install the brake booster hose.


14W0096

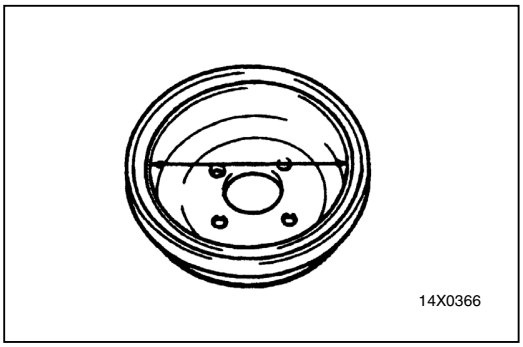
BRAKE LINING THICKNESS CHECK 35100300241

1. Remove the brake drum.
2. Measure the wear of the brake lining at the place worn the most.

   Standard value: 4.38 mm
   Limit: 1.0 mm

   Replace the shoe and lining assembly if brake lining thickness is less than the limit if it is not worn evenly. For information concerning the procedures for installation of the shoe and lining assembly, refer to P.35A-22.

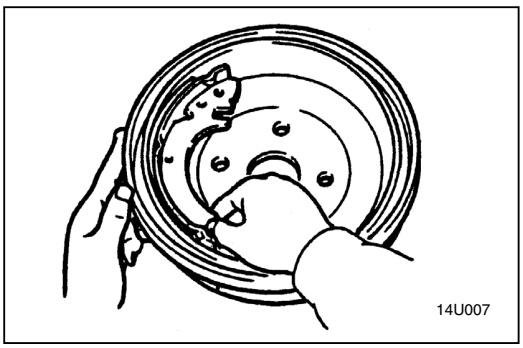
   Caution
   (1) Whenever the shoe and lining assembly is replaced, replace both RH and LH assemblies as a set to prevent car from pulling to one side when braking.
   (2) If there is a significant difference in the thickness of the shoe and lining assemblies on the left and right sides, check the sliding condition of the piston.


14X0366

BRAKE DRUM INSIDE DIAMETER CHECK 35100320049

1. Remove the brake drum.
2. Measure the inside diameter of the brake drum at two or more locations

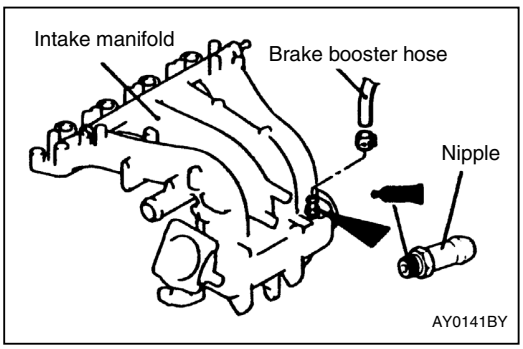
   Standard value: 203 mm
   Limit: 205 mm
3. Replace brake drums, shoe and lining assembly when wear exceeds the limit value or is badly imbalanced.


14U007

BRAKE LINING AND BRAKE DRUM CONNECTION CHECK 35100310053

1. Remove the brake drum.
2. Remove the shoe and lining assembly. (Refer to P.35A-22.)
3. Chalk inner surface of brake drum and rub with shoe and lining assembly.
4. Replace shoe and lining assembly or brake drums if there are any irregular contact area.
   NOTE
   Clean off chalk after check.

<Added>



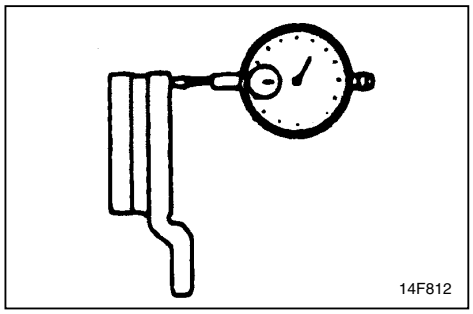
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BRAKE BOOSTER VACUUM NIPPLE REPLACEMENT

1. Remove the brake booster hose from the intake manifold.
2. Replace the nipple with a new one, using a sealing agent and tighten to 15 – 18 N.m

   Specified sealant:
   3M ATD Part No.8661 or equivalent.

   Caution
   Take care when applying the thread sealant as too much could block the nipple.
3. After replacement, re-install the brake booster hose.

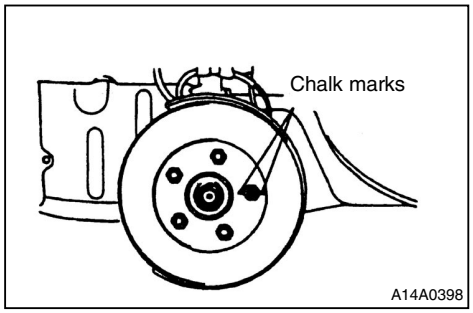


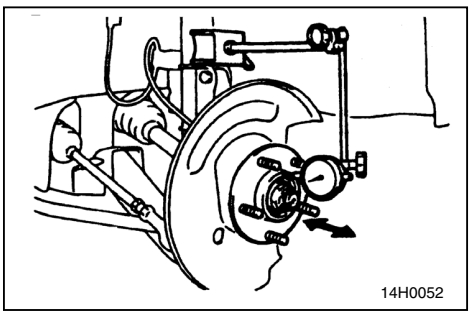
BRAKE DISC RUN-OUT CHECK AND CORRECTION

1. Remove the brake assembly, and then hold it with wire.
2. Place a dial gauge approximately 5 mm from the outer circumference of the brake disc, and measure the run-out of the disc.

   Limit: <Front> 0.06 mm or less,
   <Rear> 0.08 mm or less
3. If the brake disc run-out exceeds the limit, correct it as follows:

   (1) Chalk phase marks on the wheel stud and the brake disc, which run-out is excessive as show





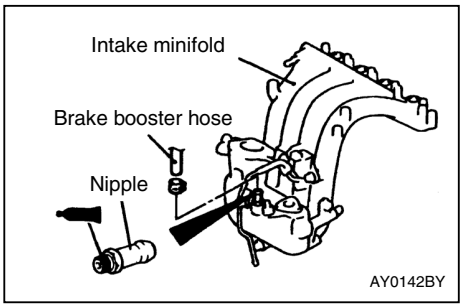
   (2) Remove the brake disc. Then place a dial gauge as shown, and measure the end play by pushing and pulling the wheel hub.

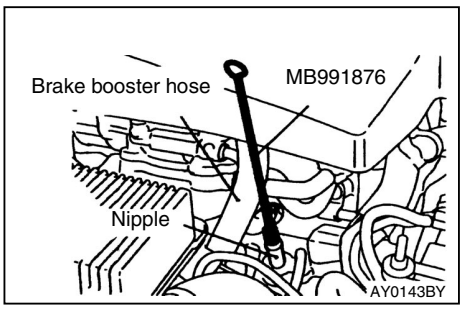
   Limit: <Front> 0.2 mm, <Rear> 0.025 mm

   (3) If the end play exceeds the limit, disassemble the hub and knuckle assembly to check each part.

   (4) If the end play does not exceed the limit, dephase the brake disc and secure it. Then recheck the brake disc run-out.
4. If the run-out cannot be corrected by changing the phase of the brake disc, replace the brake disc or grind it with the on-the-car type brake lathe ("MAD, DL-8700PF" or equivalent.

<Added>





BRAKE BOOSTER VACUUM NIPPLE REPLACEMENT <SCREW TYPE NIPPLE>

1. Remove the brake booster hose from the intake manifold.
2. Replace the nipple with a new one, using a sealing agent and tighten to 15 – 18 N.m.

   Specified sealant:
   3M ATD Part No.8661 or equivalent

   Caution
   Take care when applying the thread sealant as too much could block the nipple.
3. After replacement, re-install the brake booster hose.

BRAKE BOOSTER VACUUM NIPPLE CLEANING <PRESS FIT TYPE NIPPLE>

1. Remove the brake booster hose from the intake manifold.
2. Insert special tool into the nipple and remove the carbon deposit by rotating and reciprocating of the special tool.

   Caution
   The special tool should be inserted more than 50 mm and confirm that it goes through into the intake manifold.
3. Make sure that no parts of the special tool remain in the manifold.
4. After cleaning, re-install the brake booster hose.

ANTI-SKID BRAKING SYSTEM (ABS) <4WD>

ANTI-SKID BRAKING SYSTEM (ABS) <4WD>

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SEALANTS ..... Refer to GROUP 35A

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- Brake Booster Operating Test ..... Refer to GROUP 35A
- Check Valve Operation Check ..... Refer to GROUP 35A
- Load Sensing Spring Length Check and Adjustment ..... Refer to GROUP 35A
- Load Sensing Proportioning Valve Function Test ..... Refer to GROUP 35A
- Brake Fluid Level Sensor Check ..... Refer to GROUP 35A
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REAR DISC BRAKE .... Refer to GROUP 35A

LOAD SENSING PROPORTIONING VALVE ..... Refer to GROUP 35A

HYDRAULIC UNIT AND ABS-ECU 26

WHEEL SPEED SENSOR 29

G SENSOR 31

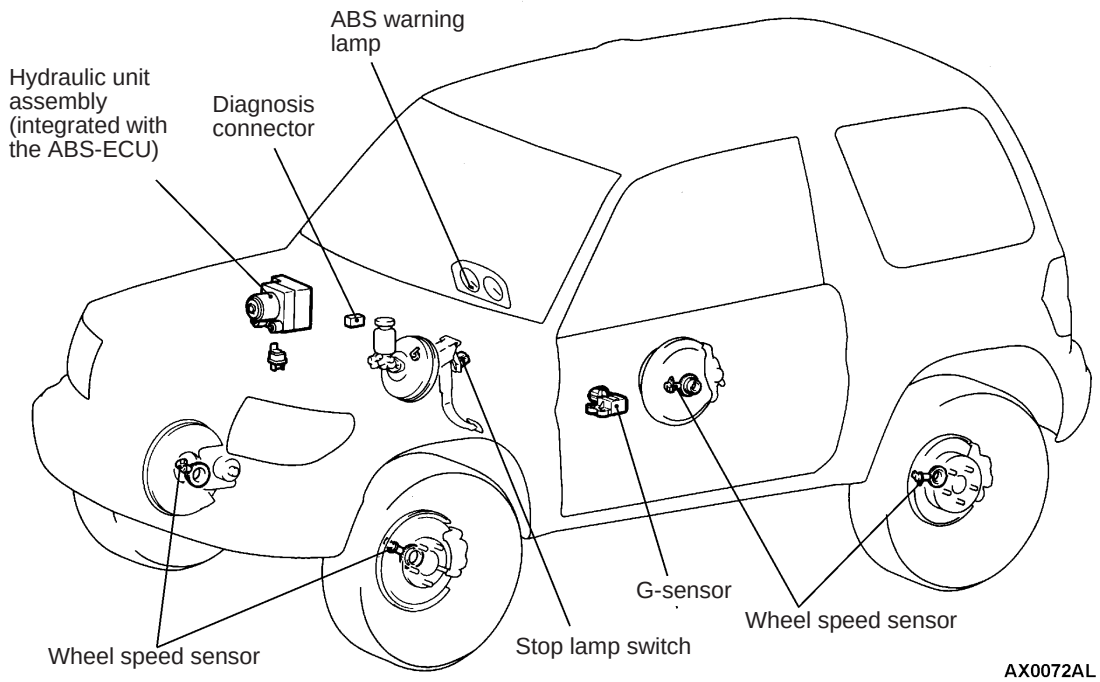
GENERAL INFORMATION

The ABS consists of components such as the wheel speed sensors, stop lamp switch, hydraulic unit assembly (integrated with the ABS-ECU) and the ABS warning lamp. If a problem occurs in the system, the malfunctioning components can be identified and the trouble symptoms will be memorized by the diagnosis function.
In addition, reading of diagnosis codes and service data and actuator testing are possible by using the MUT-II.

WHEEL SPEED SENSOR

Type	Magnet coil type
ABS rotor teeth	43

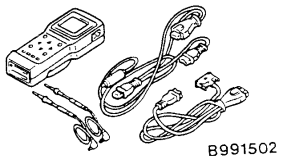
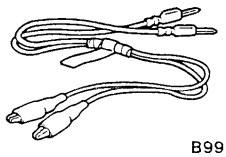
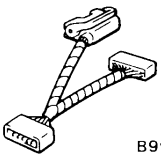
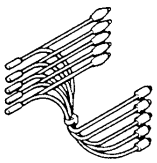
CONSTRUCTION DIAGRAM



SERVICE SPECIFICATIONS

Items		Standard value
Wheel speed sensor internal resistance kΩ		1.30 – 1.58
Wheel speed sensor insulation resistance kΩ		100 or more
G sensor output voltage V	When labeled surface is faced to vertical direction	2.4 – 2.6
	When labeled surface is faced straight down	3.3 – 3.7

SPECIAL TOOLS

Tool	Number	Name	Use
 B991502	MB991502	MUT-II sub assembly	For checking of ABS (Diagnosis code display when using the MUT-II)
 B991529	MB991529	Diagnosis code check harness	For checking of ABS (Diagnosis code display when using the ABS warning lamp)
 B991547	MB991547	ABS check harness	For measuring of ABS-ECU terminal voltage
 B991348	MB991348	Test harness set	For checking of G sensor

TROUBLESHOOTING

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING

Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.

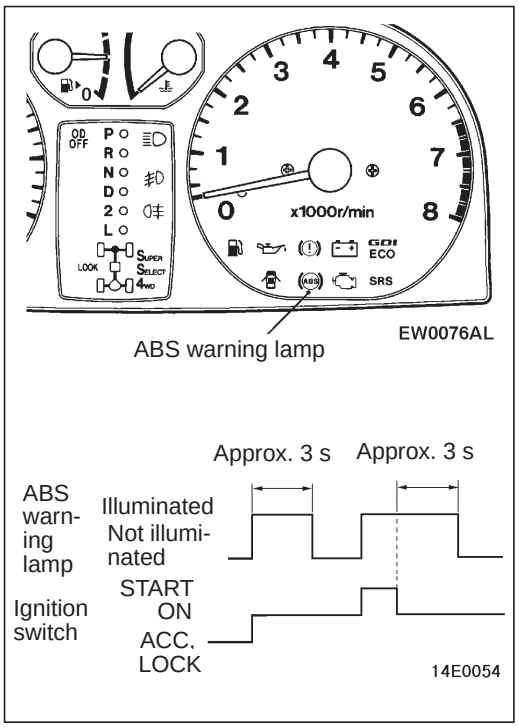
NOTES WITH REGARD TO DIAGNOSIS

1. The phenomena listed in the following table are not abnormal.

Phenomenon	Explanation of phenomenon
System check sound	When starting the engine, a thudding sound can sometimes be heard coming from inside the engine compartment, but this is because the system operation check is being performed, and is not an abnormality.
ABS operation sound	1. Sound of the motor inside the ABS hydraulic unit operation. (whine) 2. Sound is the generated along with vibration of the brake pedal. (scraping) 3. When ABS operates, sound is generated from the vehicle chassis due to repeated brake application and release. (Thump: suspension; squeak: tyres)
System check sound	When depressing the brake pedal during driving, a shock is sometime felt.

2. For road surfaces such as snow-covered roads and gravel roads, the braking distance for vehicles with ABS can sometimes be longer than that for other vehicles. Accordingly, advise the customer to drive safely on such roads by lowering the vehicle speed and not being too overconfident.
3. Diagnosis detection condition can vary depending on the diagnosis code.
   Make sure that checking requirements listed in the “Comment” are satisfied when checking the trouble symptom again.

Caution
Use the special tool (MB991547) when checking the terminal voltage and resistance of ABS-ECU.



ABS WARNING LAMP INSPECTION

Check that the ABS warning lamp illuminates as follows.

1. When the ignition key is turned to "ON", the ABS warning lamp illuminates for approximately 3 seconds and then switches off.
2. When the ignition key is turned to "START", the ABS warning lamp remains illuminated.
3. When the ignition key is turned from "START" back to "ON", the ABS warning lamp illuminates for approximately 3 seconds and then switches off.

   NOTE
   The ABS warning lamp may remain on until the vehicle reaches a speed of several km/h. This is limited to cases where diagnosis code Nos.21 to 24, 53 or 55 have been recorded because of a previous problem occurring. In this case, the ABS-ECU keeps the warning lamp illuminated until the problem corresponding to that diagnosis code can be detected.

4. If the illumination is other than the above, check the diagnosis codes.

DIAGNOSIS FUNCTION

READING DIAGNOSIS CODES

Read a diagnosis code by the MUT-II or ABS warning lamp. (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.)

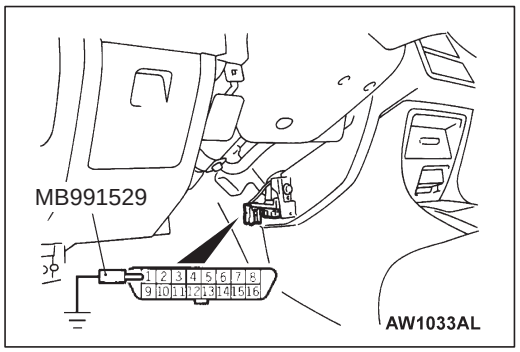
NOTE
Connect the MUT-II to the diagnosis connector (16-pin).

ERASING DIAGNOSIS CODES

When using the MUT-II

Connect the MUT-II to the diagnosis connector (16-pin) and erase the diagnosis code.

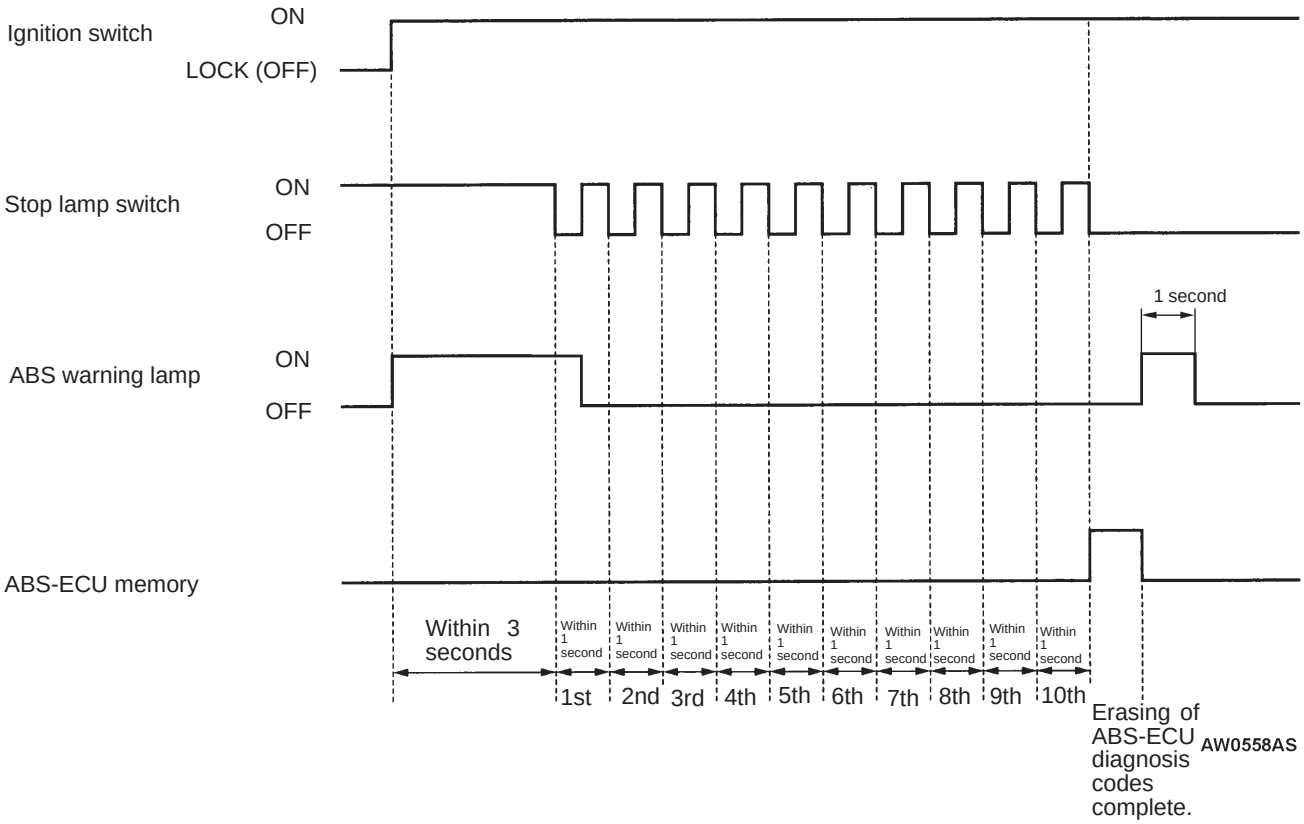
Caution
Turn the ignition key to the LOCK (OFF) position before connecting or disconnecting the MUT-II.



When not using the MUT-II

1. Stop the engine.
2. Use the special tool to earth terminal (1) (diagnosis control terminal) of the diagnosis connector.
3. Turn on the stop lamp switch. (Depress the brake pedal.)
4. After carrying out steps 1. to 3., turn the ignition switch to ON. Within 3 seconds after turning the ignition switch to ON, turn off the stop lamp switch (release the brake pedal). Then, turn the stop lamp switch on and off a total of 10 times.

   NOTE
   If the ABS-ECU function has been stopped because of fail-safe operation, it will not be possible to erase the diagnosis codes.



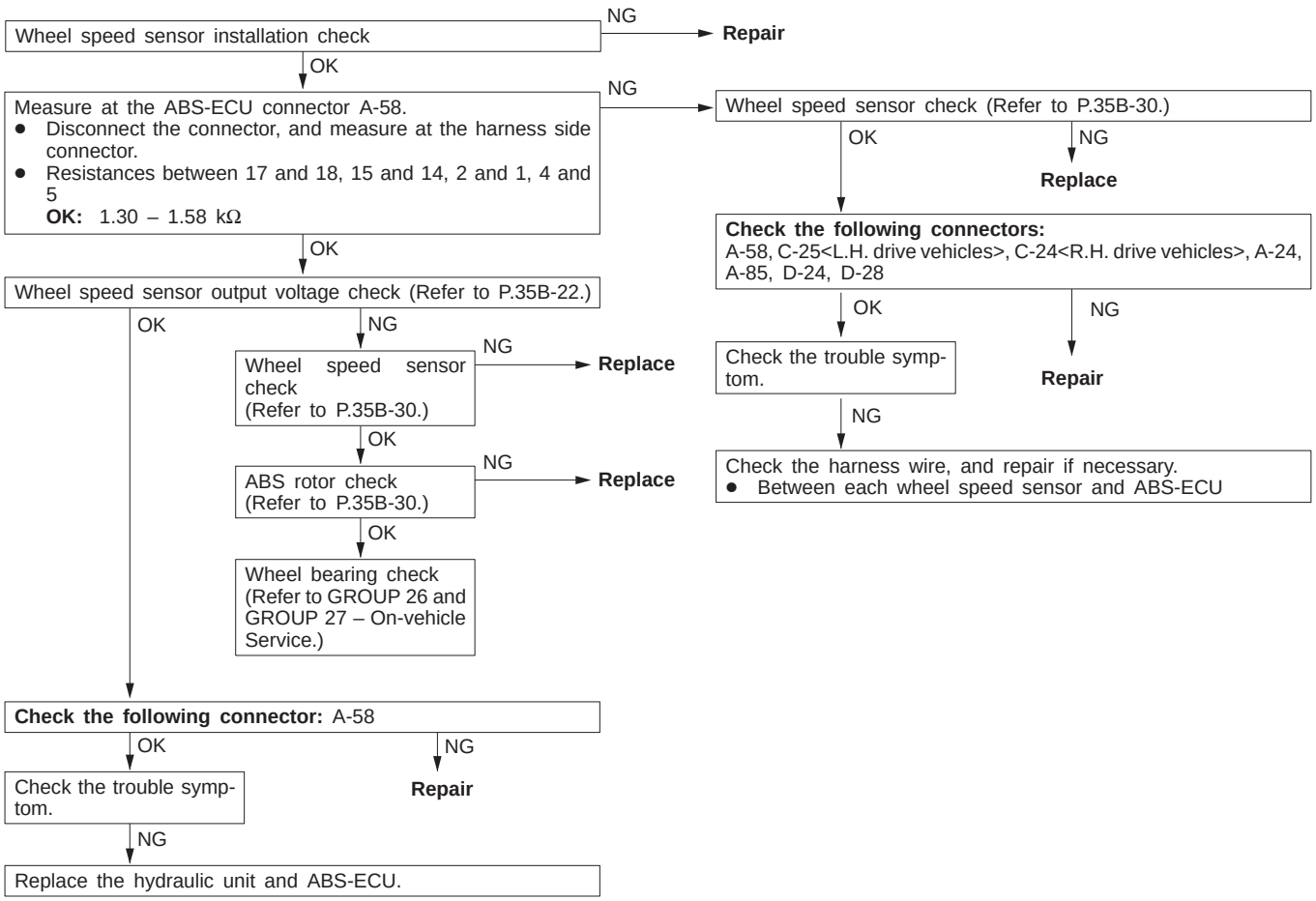
INSPECTION CHART FOR DIAGNOSIS CODES

Diagnosis code No.	Inspection item		Reference page
11	Front right wheel speed sensor (Open circuit or short circuit)		35B-9
12	Front left wheel speed sensor (Open circuit or short circuit)		35B-9
13	Rear right wheel speed sensor (Open circuit or short circuit)		35B-9
14	Rear left wheel speed sensor (Open circuit or short circuit)		35B-9
15	Wheel speed sensor (Abnormal output signal)		35B-10
16*	ABS-ECU power supply system (Abnormal voltage drop or rise)		35B-11
21	Front right wheel speed sensor		35B-9
22	Front left wheel speed sensor		35B-9
23	Rear right wheel speed sensor		35B-9
24	Rear left wheel speed sensor		35B-9
32	G sensor system		35B-12
33	Stop lamp switch system		35B-13
41	Front right solenoid valve	The diagnosis codes are output when there is no response to the drive signals for respective solenoid valves or the ABS-ECU power supply system is defective.	35B-13
42	Front left solenoid valve		
43	Rear right solenoid valve		
44	Rear left solenoid valve		
51	Valve relay problem (stays on)		35B-26, 27 (Replace the hydraulic unit and ABS-ECU.)
52	Valve relay problem (stays off) or ABS-ECU power supply system problem		35B-13
53	Motor relay problem (stays off) or ABS-ECU power supply system problem		
54	Motor relay problem (stays on)		35B-26, 27 (Replace the hydraulic unit and ABS-ECU.)
55	Motor system (seized pump motor) or ABS-ECU power supply system problem		35B-13
63	ABS-ECU		35B-26, 27 (Replace the hydraulic unit and ABS-ECU.)

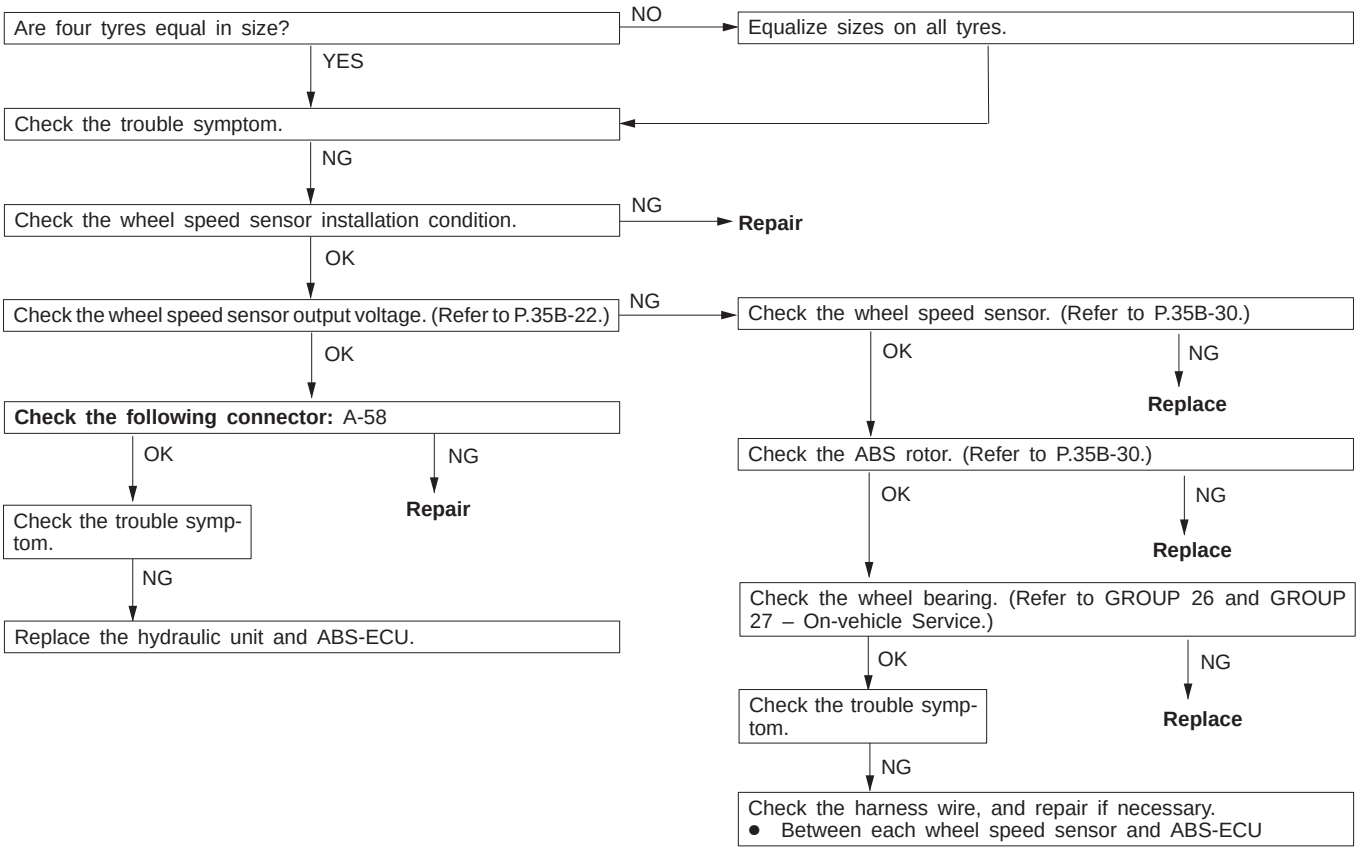
NOTE
*: Turning the ignition switch to ACC will erase the diagnosis code No.16.

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code Nos.11, 12, 13 and 14 Wheel speed sensor (open circuit or short circuit) **Code Nos.21, 22, 23 and 24 Wheel speed sensor**	**Probable cause**
Code Nos. 11, 12, 13 and 14 are output if the ABS-ECU detects an open circuit or short-circuit in the (+) wire or (–) wire in any one of the four wheel speed sensors.	● Malfunction of wheel speed sensor ● Malfunction of wiring harness or connector ● Malfunction of hydraulic unit and ABS-ECU
Code Nos. 21, 22, 23 and 24 are output in the following cases. ● When there is no input from any one of the four wheel speed sensors when travelling at several km/h or more, even though open circuit can not be verified. ● When a chipped or blocked-up ABS rotor is detected and if the anti-lock system operates continuously because a malfunctioning sensor or a warped ABS rotor is causing sensor output to drop.	● Malfunction of wheel speed sensor ● Malfunction of wiring harness or connector ● Malfunction of ABS rotor ● Too much gap between the sensor and the ABS rotor ● Malfunction of hydraulic unit and ABS-ECU ● Malfunction of wheel bearing

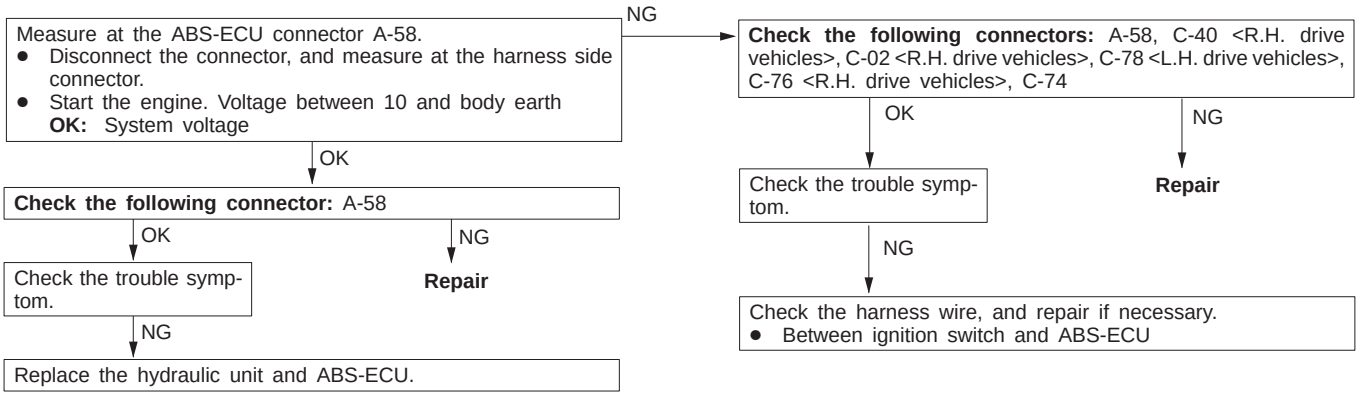


Code No.15 Wheel speed sensor (Abnormal output signal)	Probable cause
This code is output if the output signal of any wheel speed sensor is abnormal (other than an open circuit or short circuit).	● Unequal tyre size ● Improper installation of wheel speed sensor ● Malfunction of wheel speed sensor ● Malfunction of wiring harness or connector ● Malfunction of ABS rotor ● Malfunction of wheel bearing ● Malfunction of hydraulic unit and ABS-ECU

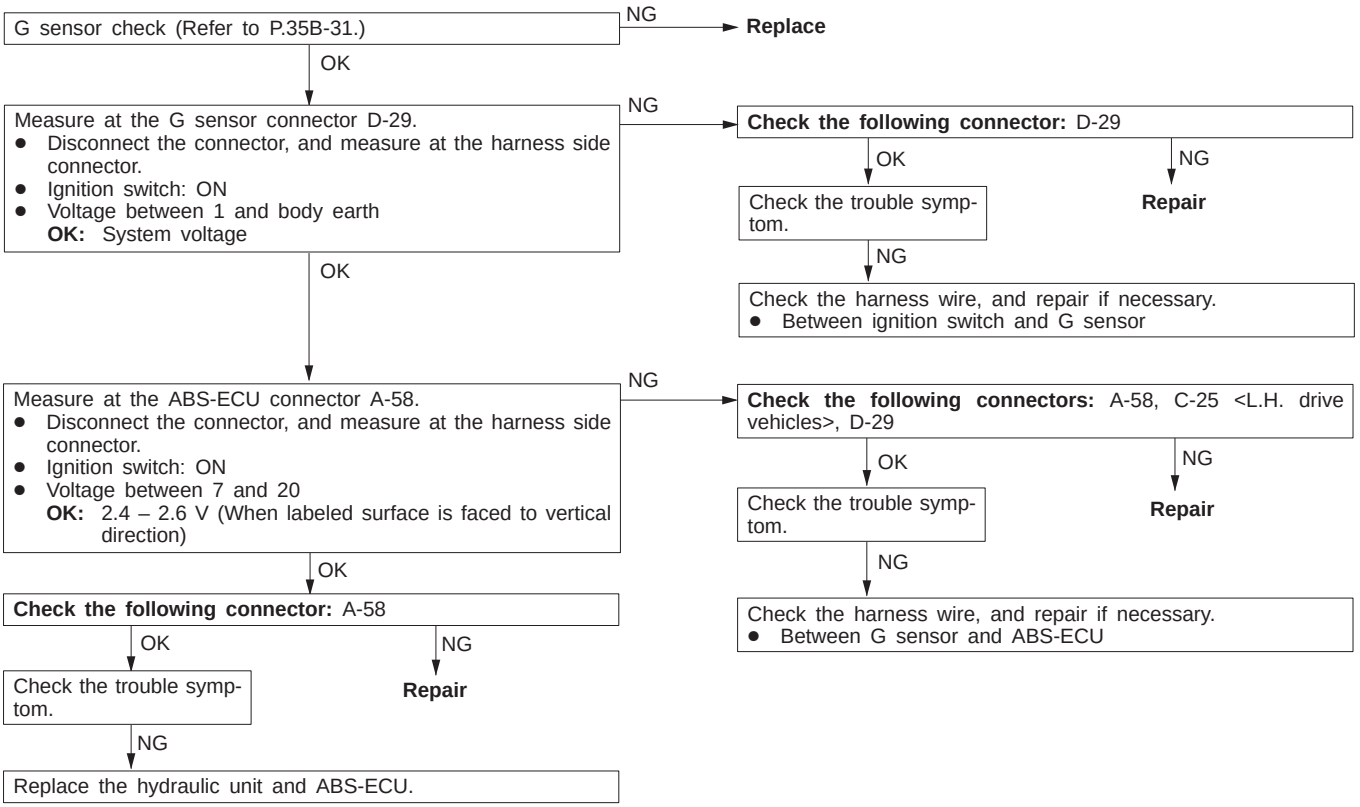


Code No.16 ABS-ECU power supply system (abnormal voltage drop or rise)	Probable cause
This code is output if the ABS-ECU power supply voltage drops below or rises above the rated values. Furthermore, turning the ignition switch to ACC will erase this code.	• Malfunction of battery • Malfunction of wiring harness or connector • Malfunction of hydraulic unit and ABS-ECU

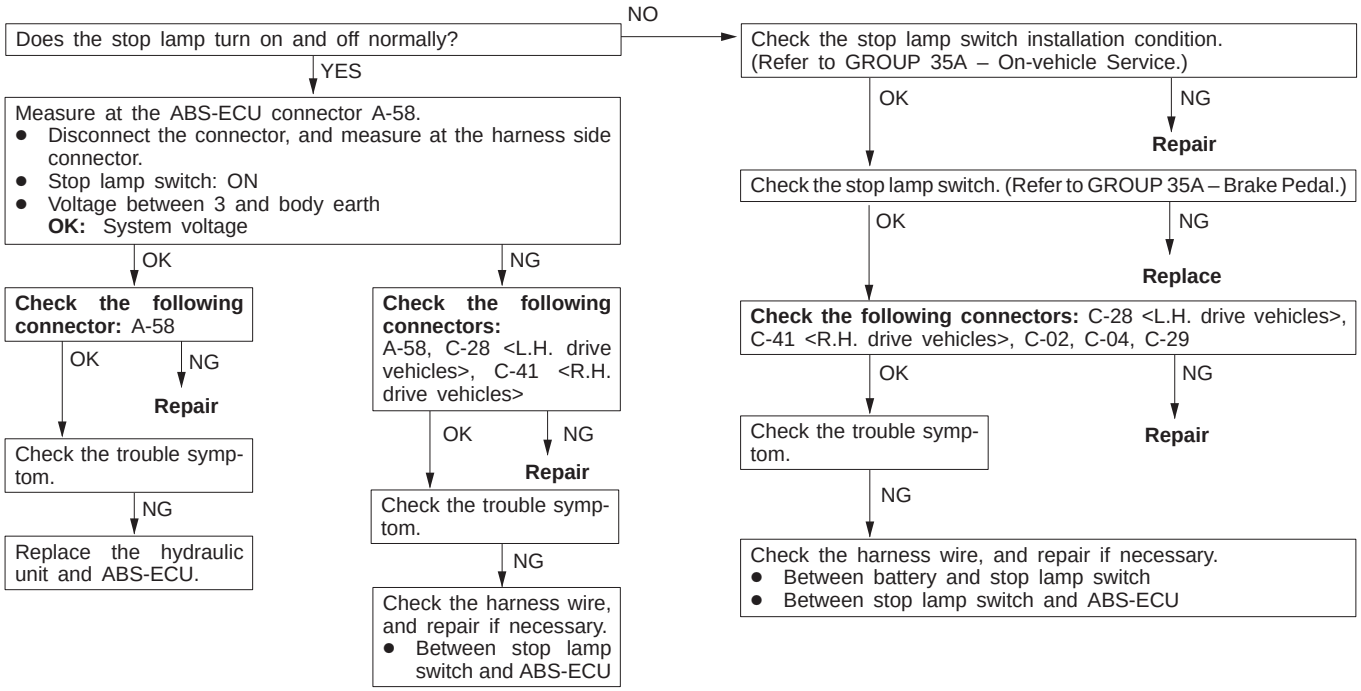
Caution
If battery voltage drops or rises during inspection, this code will be output as well. If the voltage returns to standard value, this code is no longer output.
Before carrying out the following inspection, check the battery level, and refill it if necessary.



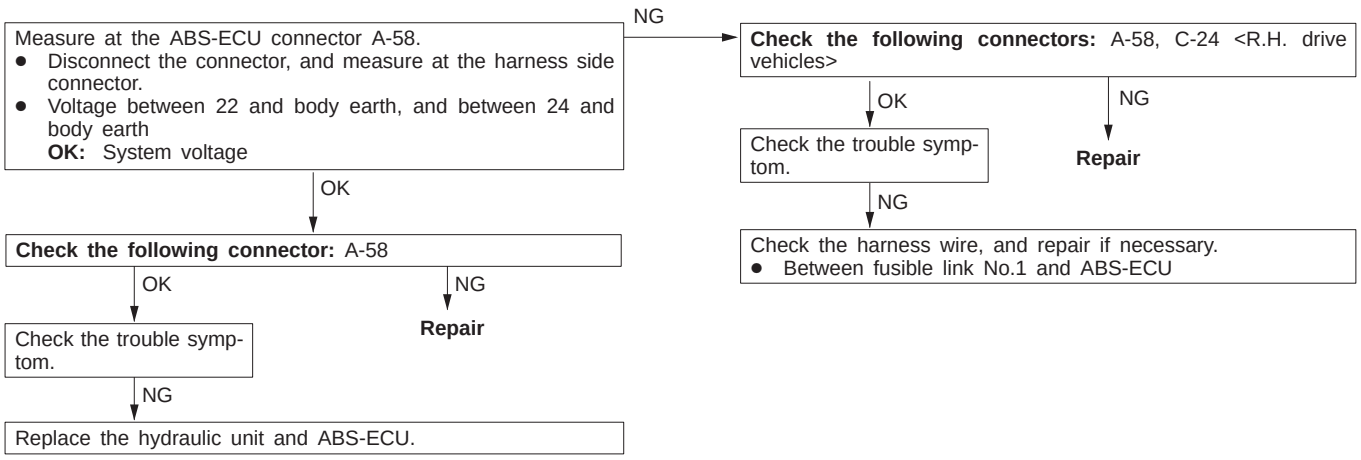
Code No.32 G sensor system	Probable cause
This code is output in the following cases. ● G sensor output voltage is less than 0.5 V or more than 4.5 V. (An open or short circuit is present in the G sensor circuit.) ● G sensor output voltage does not change. (G sensor output voltage is abnormal.)	● Malfunction of G sensor ● Malfunction of wiring harness or connector ● Malfunction of hydraulic unit and ABS-ECU



Code No.33 Stop lamp switch system	Probable cause
This code is output in the following cases. ● If the stop lamp switch is continuously on for 15 minutes or more even though the ABS system is not operating. ● If there is an open circuit in the stop lamp switch input circuit harness.	● Malfunction of stop lamp switch ● Malfunction of wiring harness or connector ● Malfunction of hydraulic unit and ABS-ECU



Code Nos.41, 42, 43 and 44 Solenoid valve Code No.52 Valve relay problem (stays off) Code No.53 Motor relay problem (stays off) Code No.55 Motor system (seized pump motor)	Probable cause
These codes are output if there is an open circuit or short-circuit in the ABS-ECU power supply circuit (power supply circuit for solenoid valve and motor), or the internal circuit in the hydraulic unit and ABS-ECU is defective.	● Malfunction of wiring harness or connector ● Malfunction of hydraulic unit and ABS-ECU



INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptoms	Inspection procedure No.	Reference page
Communication between the MUT-II and the whole system is not possible.	1	35B-14
Communication between the MUT-II and the ABS-ECU is not possible.	2	35B-15
When the ignition key is turned to "ON" (engine stopped), the ABS warning lamp does not illuminate.	3	35B-16
Even after the engine is started, the ABS warning lamp remains illuminated.	4	35B-17
Faulty ABS operation	5	35B-18

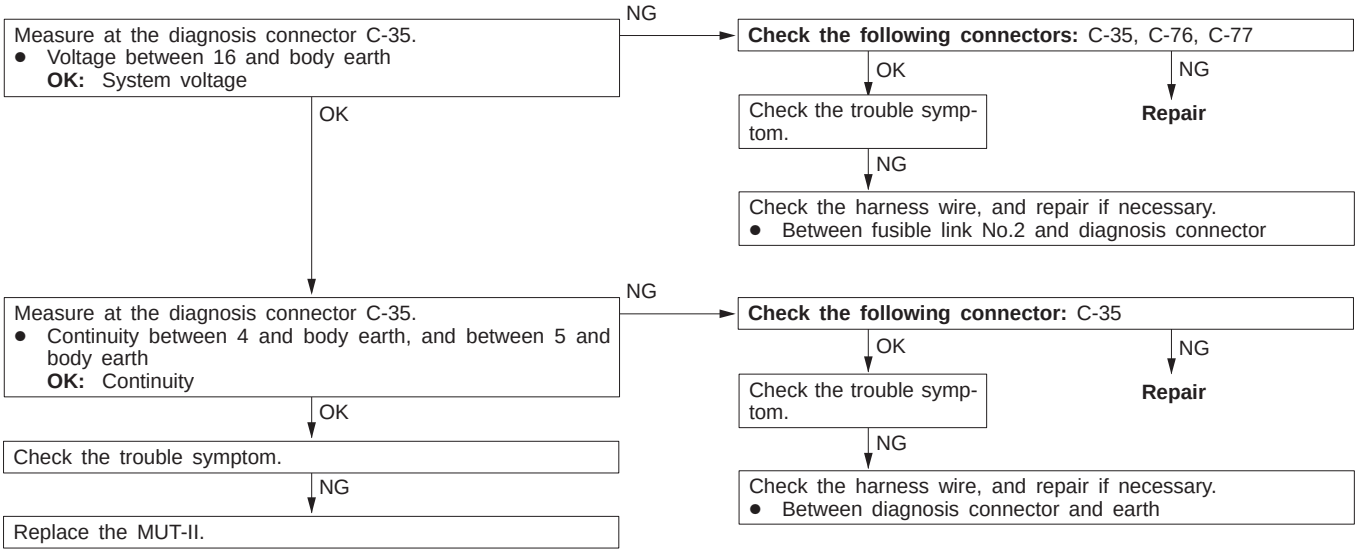
Caution

1. **If steering movements are made when driving at high speed, or when driving on road surfaces with low frictional resistance, or when passing over bumps, the ABS may operate even though sudden braking is not being applied. Because of this, when getting information from the customer, check if the problem occurred while driving under such conditions as these.**
2. **During ABS operation, the brake pedal may vibrate or may not be able to be depressed. Such phenomena are due to intermittent changes in hydraulic pressure inside the brake line to prevent the wheels from locking and is not an abnormality.**

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

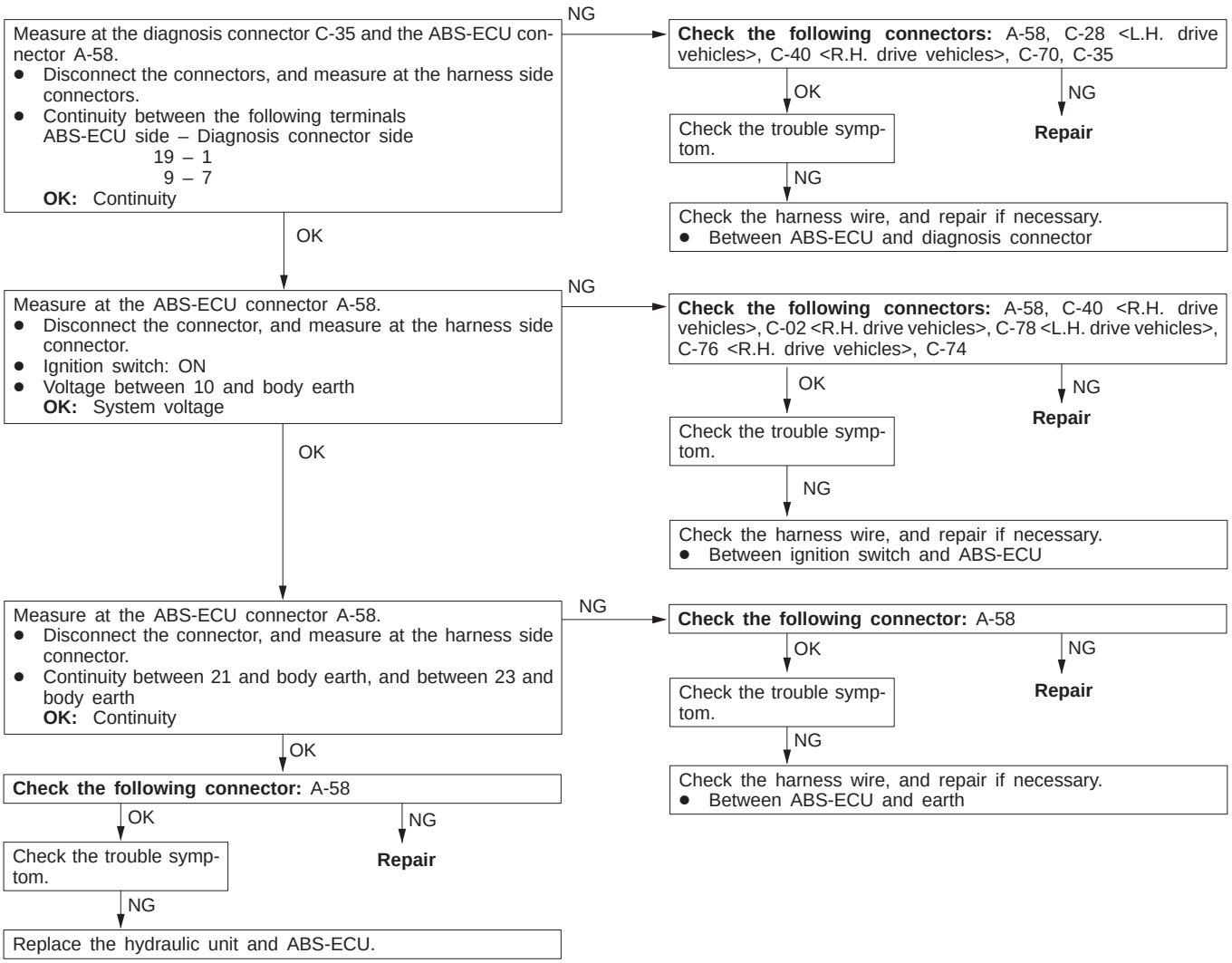
Inspection Procedure 1

Communication between the MUT-II and the whole system is not possible.	**Probable cause**
The cause may be a malfunction of the power supply circuit or the earth circuit of the diagnosis connector.	• Malfunction of diagnosis connector • Malfunction of wiring harness or connector



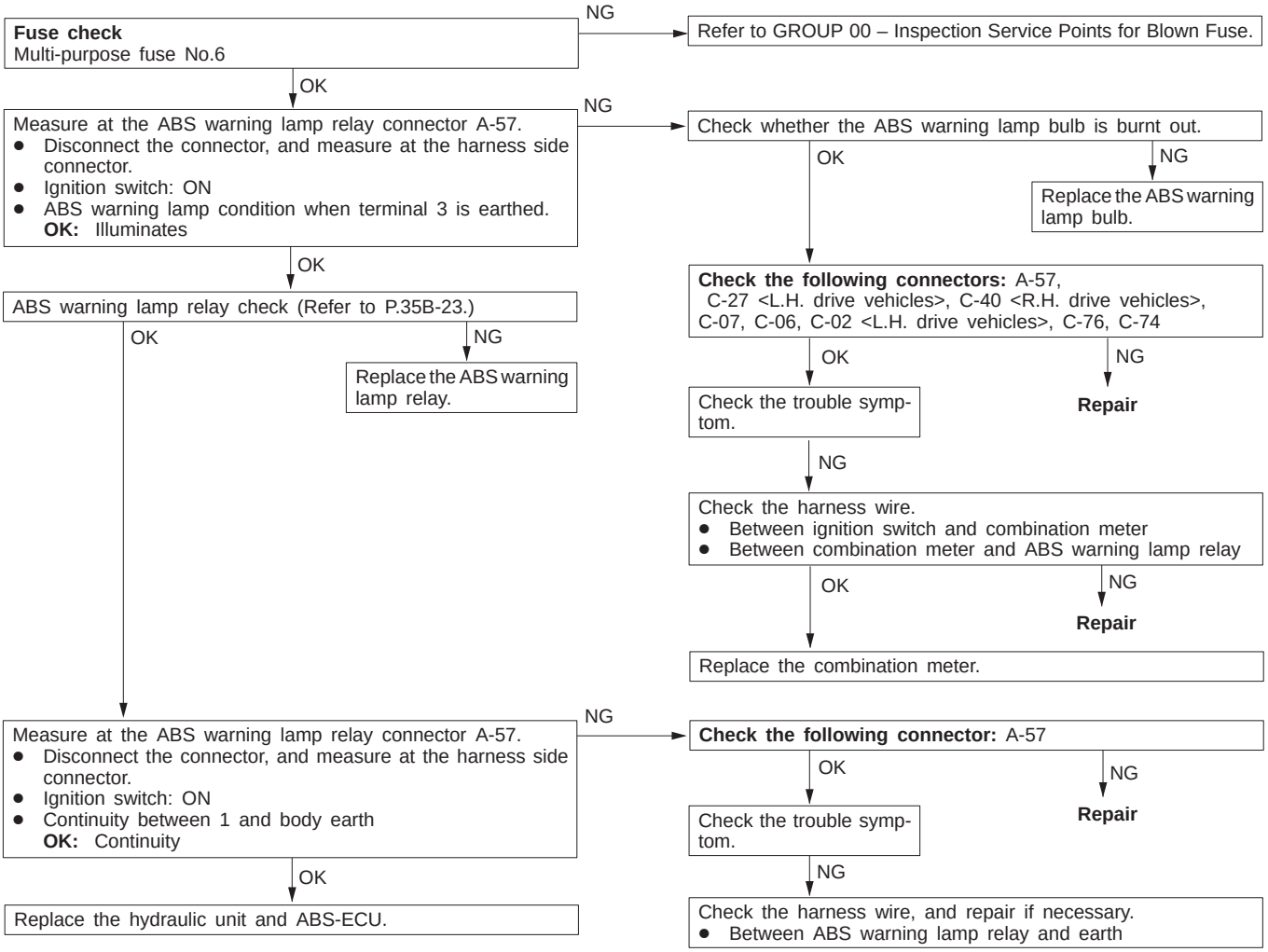
Inspection Procedure 2

Communication between MUT-II and the ABS-ECU is not possible.	Probable cause
The cause may be an open circuit in the ABS-ECU power supply circuit or an open circuit in the diagnosis output circuit.	• Blown fuse • Malfunction of wiring harness or connector • Malfunction of hydraulic unit and ABS-ECU



Inspection Procedure 3

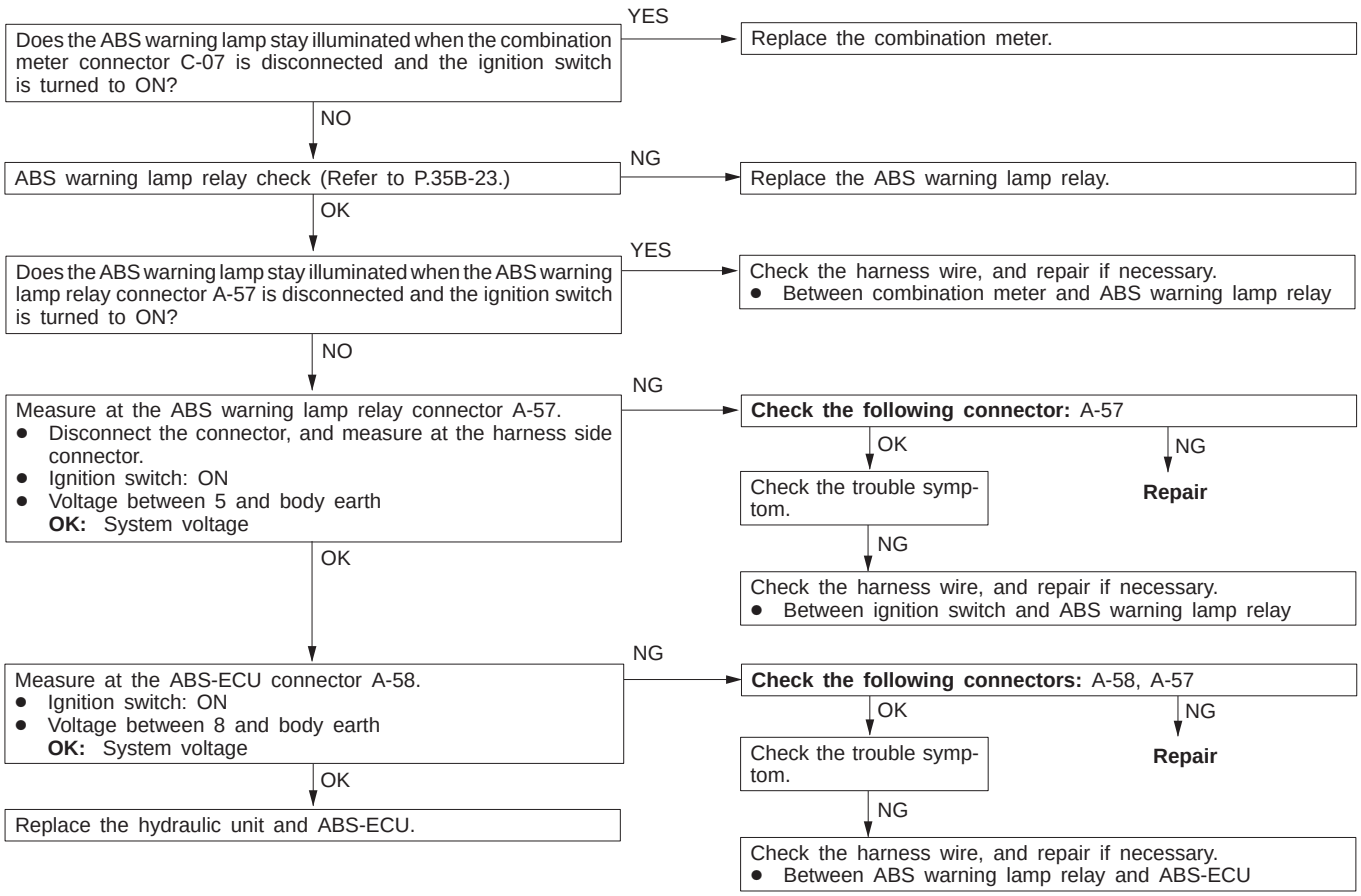
When the ignition key is turned to "ON" (engine stopped), the ABS warning lamp does not illuminate.	Probable cause
The cause may be an open circuit in the lamp power supply circuit, a blown lamp, a malfunction of the ABS warning lamp relay or an open circuit between the ABS warning lamp and the earth.	• Blown fuse • Burn out ABS warning lamp bulb • Malfunction of ABS warning lamp relay • Malfunction of wiring harness or connector • Malfunction of hydraulic unit and ABS-ECU



Inspection Procedure 4

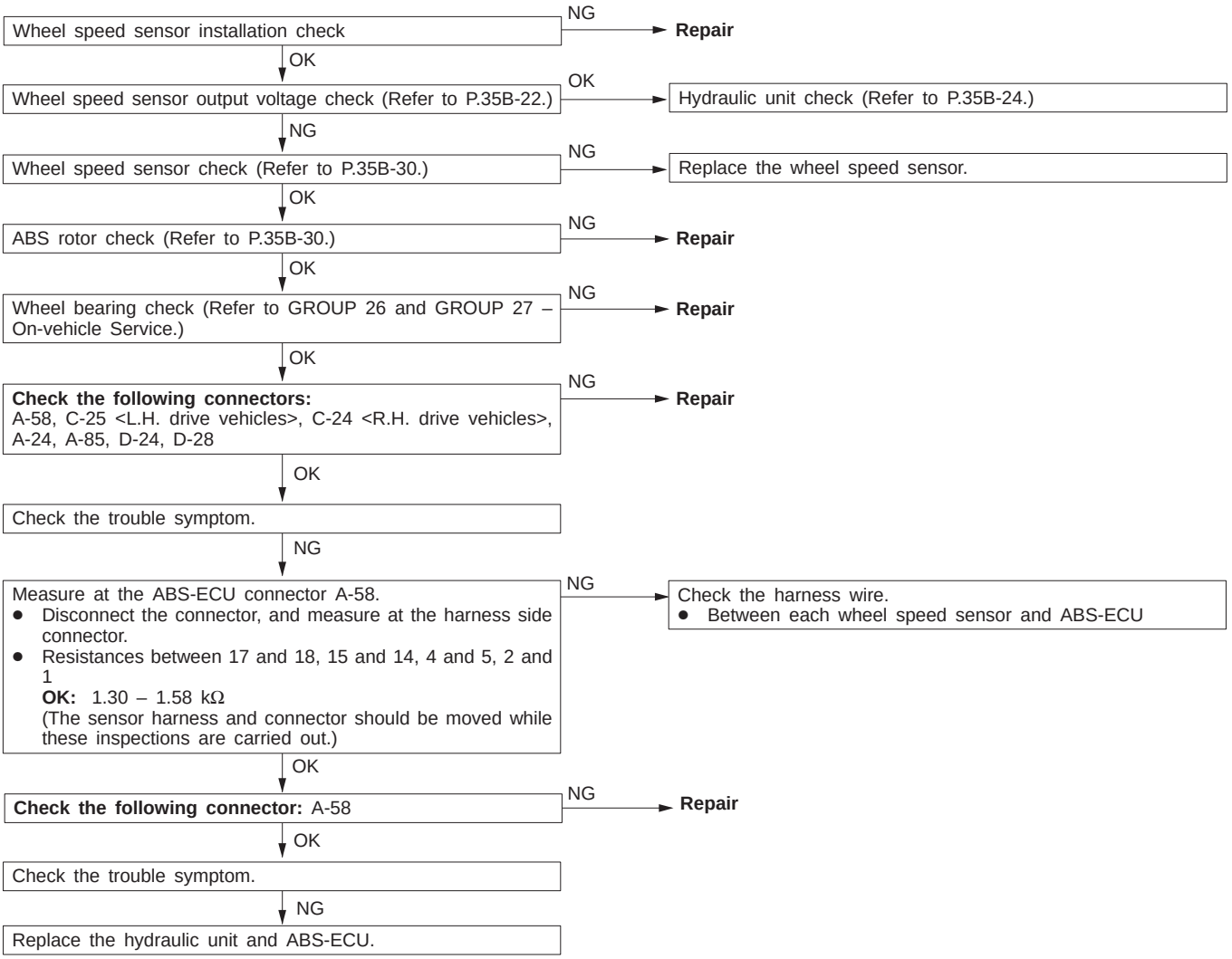
Even after the engine is started, the ABS warning lamp remains illuminated.	Probable cause
The cause is probably a short-circuit in the ABS warning lamp illumination circuit.	● Malfunction of combination meter ● Malfunction of ABS warning lamp relay ● Malfunction of wiring harness (short circuit) ● Malfunction of hydraulic unit and ABS-ECU

NOTE
This trouble symptom is limited to cases where communication with the MUT-II is possible (ABS-ECU power supply is normal) and the diagnosis code is a normal diagnosis code.



Inspection Procedure 5

Faulty ABS operation	Probable cause
This varies depending on the driving conditions and the road surface conditions, so problem diagnosis is difficult. However, if a normal diagnosis code is displayed, carry out the following inspection.	● Improper installation of wheel speed sensor ● Malfunction of wiring harness or connector ● Malfunction of wheel speed sensor ● Malfunction of ABS rotor ● Foreign material adhering to wheel speed sensor ● Malfunction of wheel bearing ● Malfunction of hydraulic unit and ABS-ECU



DATA LIST REFERENCE TABLE

The following items can be read by the MUT-II from the ABS-ECU input data.

1. When the system is normal

Item No.	Check item	Checking requirements	Normal value
11	Front-right wheel speed sensor	Perform a test run	Vehicle speeds displayed on the speedometer and MUT-II are identical.
12	Front-left wheel speed sensor		
13	Rear-right wheel speed sensor		
14	Rear-left wheel speed sensor		
16	ABS-ECU power supply voltage	Ignition switch: ON	9.2 – 17.5 V
32	G sensor	Vehicle is stopped.	2.4 – 2.6 V
		Vehicle is running.	0.5 – 4.5 V
33	Stop lamp switch	Depress the brake pedal.	ON
		Release the brake pedal.	OFF

2. When the ABS-ECU shut off ABS operation.

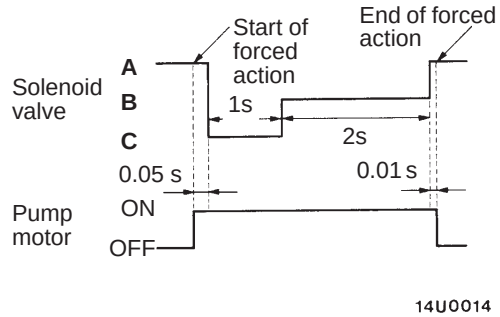
When the diagnosis system stops the ABS-ECU, the MUT-II display data will be unreliable.

ACTUATOR TEST REFERENCE TABLE

The MUT-II activates the following actuators for testing.

NOTE
1. If the ABS-ECU runs down, actuator testing cannot be carried out.
2. Actuator testing is only possible when the vehicle is stationary.

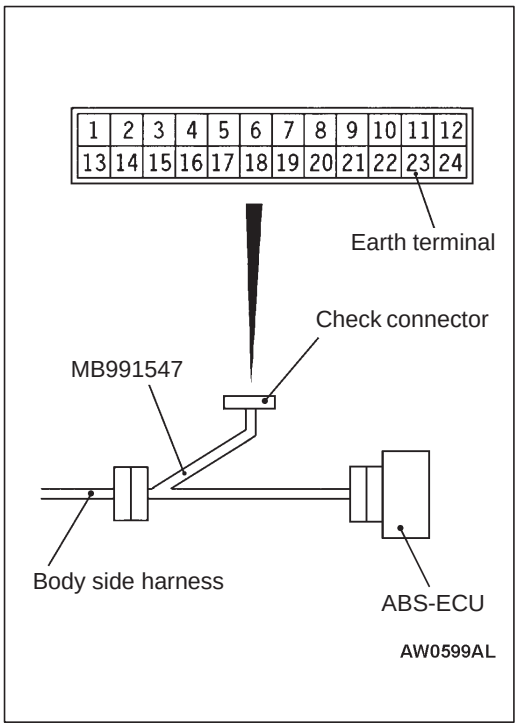
Activation pattern



NOTE
A: Hydraulic pressure increase
B: Hydraulic pressure holds
C: Hydraulic pressure decrease

ACTUATOR TEST SPECIFICATIONS

No.	Item	
01	Solenoid valve for front-right wheel	Solenoid valves and pump motors in the hydraulic unit (simple inspection mode)
02	Solenoid valve for front-left wheel	
03	Solenoid valve for rear-right wheel	
04	Solenoid valve for rear-left wheel	

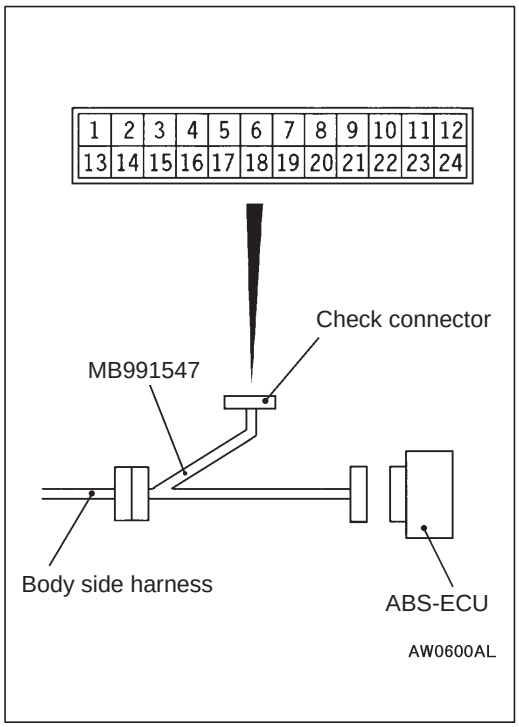


CHECK AT ABS-ECU

TERMINAL VOLTAGE CHECK CHART

1. Disconnect the ABS-ECU connector. (Refer to P. 35B-27.)
2. Use the special tool to measure the voltage between each terminal and earth (terminal No.23).
3. The terminal layout is shown in the illustration.

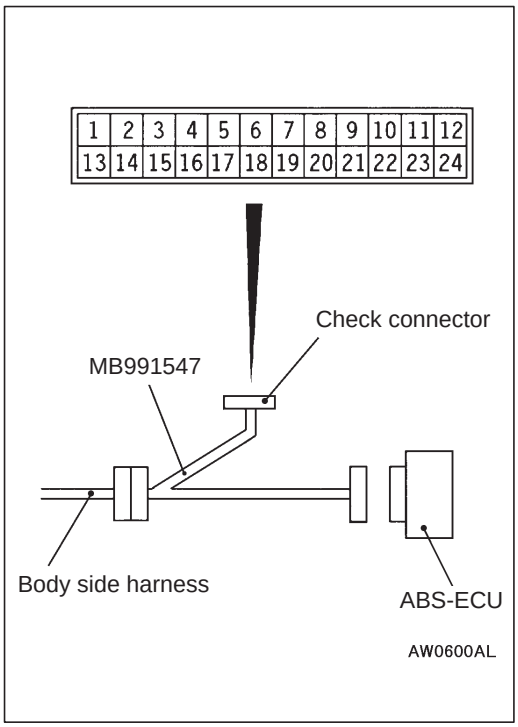
Terminal No.	Check item	Checking requirements		Normal condition
3	Stop lamp switch input	Ignition switch: ON	Stop lamp switch: ON	System voltage
			Stop lamp switch: OFF	1 V or less
7	Input from G sensor	Ignition switch: ON Vehicle is horizontal		2.4 – 2.6 V
8	ABS warning lamp relay transistor output	Ignition switch: ON	When the lamp is switched off	2 V or less
			When the lamp is illuminated	System voltage
9	MUT-II	When the MUT-II is connected		Serial communication with MUT-II
		When the MUT-II is not connected		1 V or less
10	ABS-ECU power supply	Ignition switch: ON		System voltage
		Ignition switch: START		0 V
19	Diagnosis changeover input	When the MUT-II is connected		0 V
		When the MUT-II is not connected		Approx. 12 V
20	G sensor earth	Always		0 V
22	Solenoid valve power supply	Always		System voltage
24	Motor power supply	Always		System voltage



RESISTANCE AND CONTINUITY BETWEEN HARNESS-SIDE CONNECTOR TERMINALS

1. Turn the ignition key to the LOCK (OFF) position.
2. Disconnect the ABS-ECU connector. (Refer to P. 35B-27.)
3. Use the special tool to check the resistance and continuity between the terminals indicated in the table below.
4. The terminal layout is shown in the illustration.

ABS–ECU terminal No.	Signal	Normal condition
1 – 2	Wheel speed sensor (rear left)	1.30 – 1.58 kΩ
4 – 5	Wheel speed sensor (rear right)	
14 – 15	Wheel speed sensor (front left)	
17 – 18	Wheel speed sensor (front right)	
21 – Body earth	Earth	Continuity
23 – Body earth	Earth	



ON-VEHICLE SERVICE

WHEEL SPEED SENSOR OUTPUT VOLTAGE CHECK

1. Lift up the vehicle and release the parking brake.
2. Disconnect the ABS-ECU connector and then connect the special tool to the harness side connector. (Refer to P. 35B-27.)
3. Rotate the wheel to be measured at approximately 1/2 – 1 rotation per second, and check the output voltage using a circuit tester or an oscilloscope.

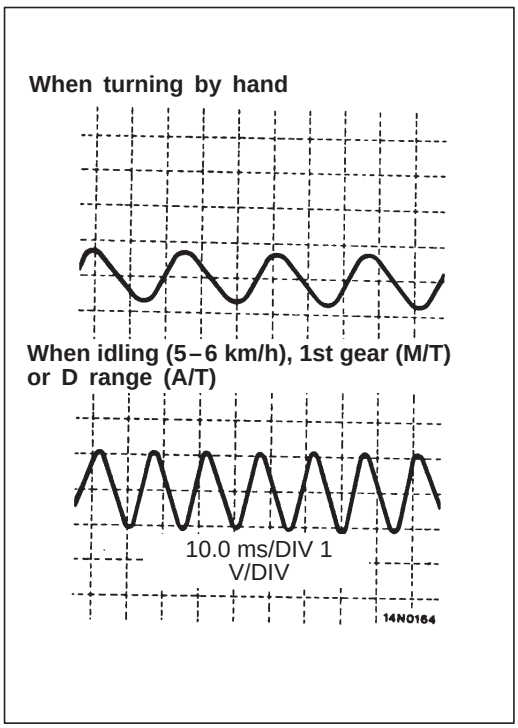
Wheel speed sensor	Front left	Front right	Rear left	Rear right
Terminal No.	15	17	2	4
	14	18	1	5

Output voltage

When measuring with a circuit tester:
42 mV or more

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

4. The followings are suspected if the output voltage is lower than the value described above. Check the wheel speed sensor, and replace if necessary.
   - Too large clearance between the pole piece of the wheel speed sensor and ABS rotor
   - Faulty wheel speed sensor



Inspecting Waveforms With An Oscilloscope

Use the following method to observe the output voltage waveform from each wheel speed sensor with an oscilloscope.

- Start the engine, and rotate the rear wheels by engaging 1st gear (vehicles with manual transmission) or D range (vehicles with automatic transmission). Turn the front wheels manually so that they rotate at a constant speed.

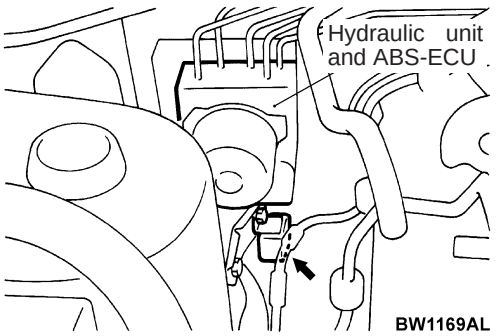
NOTE
1. The waveform measurements can also be taken while the vehicle is actually moving.
2. The output voltage will be small when the wheel speed is low, and similarly it will be large when the wheel speed is high.

Points In Waveform Measurement

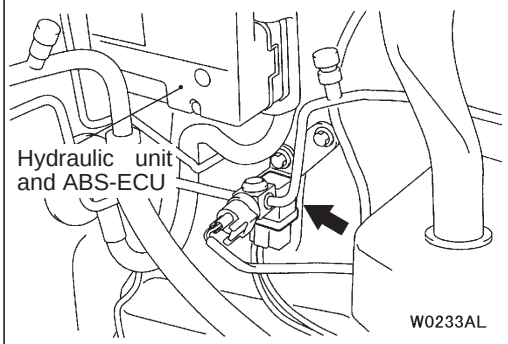
Symptom	Probable causes	Remedy
Too small or zero waveform amplitude	Faulty wheel speed sensor	Replace sensor
Waveform amplitude fluctuates excessively (this is no problem if the minimum amplitude is 100 mV or more)	Axle hub eccentric or with large runout	Replace hub
	Faulty ABS-ECU earth	Repair
Noisy or disturbed waveform	Open circuit in sensor	Replace sensor
	Open circuit in harness	Correct harness
	Incorrectly mounted wheel speed sensor	Mount correctly
	ABS rotor with missing or damaged teeth	Replace ABS rotor

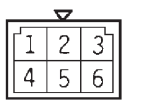
Caution
Because the wheel speed sensor cables move together with the front and rear suspension, they vibrate greatly when driving over poor road surfaces. As a result, the sensor harnesses should also be shaken when monitoring of output waveforms of the wheel speed sensors in order to simulate conditions such as driving over poor road surfaces.

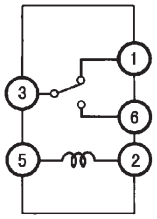
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ABS WARNING LAMP RELAY CONTINUITY CHECK

Battery voltage	Terminal No.			
	1	2	3	5
Power is not supplied	○		○	
		○		○
Power is supplied	⊕		⊖	

HYDRAULIC UNIT CHECK

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

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

2. Turn the ignition key to the LOCK (OFF) position and set the MUT-II.

   Caution
   Turn the ignition key to the LOCK (OFF) position before connecting or disconnecting the MUT-II.

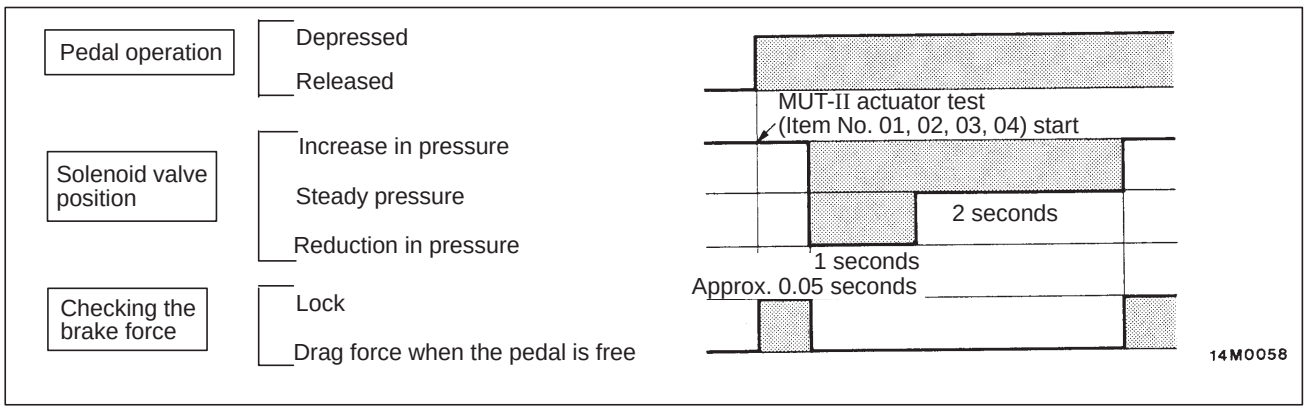
3. After checking that the shift lever <M/T> or the selector lever <A/T> is in neutral, start the engine.
4. Use the MUT-II to force-drive the actuator.

   NOTE
   (1) During the actuator test, the ABS warning lamp will illuminate and the anti-skid control will be cancelled.
   (2) When the ABS has been interrupted by the fail-safe function, the MUT-II actuator testing cannot be used.

5. Turn the wheel by hand and check the change in braking force when the brake pedal is depressed. When using the braking force tester, depress the brake pedal until the braking force is at the following values, and check that the braking force decreases when the actuator is force-driven.

Front wheel	785 – 981 N
Rear wheel	588 – 784 N

The result should be as shown in the following diagram.



6. If the result of inspection is abnormal, correct according to the “Diagnosis Table”.

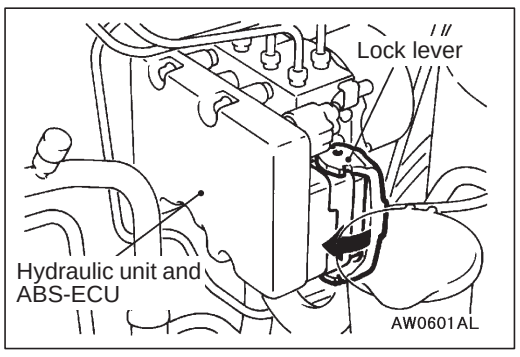
Diagnosis Table

No.	Operation	Judgement – Normal	Judgement – Abnormal	Probable cause	Remedy
01	(1) Depress brake pedal to lock wheel. (2) Using the MUT-II, select the wheel to be checked and force the actuator to operate. (3) Turn the selected wheel manually to check the change of brake force.	Brake force released for 3 seconds after locking.	Wheel does not lock when brake pedal is depressed.	Clogged brake line other than hydraulic unit	Check and clean brake line
02				Clogged hydraulic circuit in hydraulic unit	Replace hydraulic unit assembly
03			Brake force is not released	Incorrect hydraulic unit brake tube connection	Connect correctly
04				Hydraulic unit solenoid valve not functioning correctly	Replace hydraulic unit assembly

7. After inspection, disconnect the MUT-II immediately after turning the ignition switch to OFF.

REMEDY FOR A FLAT BATTERY

When booster cables are used to start the engine when the battery is completely flat and then the vehicle is immediately driven without waiting for the battery to recharge itself to some extent, the engine may misfire, and driving might not be possible.
This happens because ABS consumes a great amount of current for its self-check function; the remedy is to either allow the battery to recharge sufficiently, or to disconnect the ABS-ECU connector, thus disabling the anti-skid brake system.
The ABS warning lamp will illuminate when the ABS-ECU connector is disconnected.
After the battery has sufficiently recharged, connect the ABS-ECU connector and restart the engine; then check to be sure the ABS warning lamp is not illuminated.



DISCONNECTING ABS-ECU CONNECTOR

Move the lock lever of the ABS-ECU connector as shown in the illustration, and then disconnect the ABS-ECU connector.

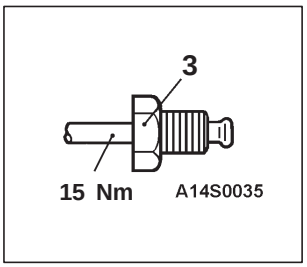
HYDRAULIC UNIT AND ABS-ECU

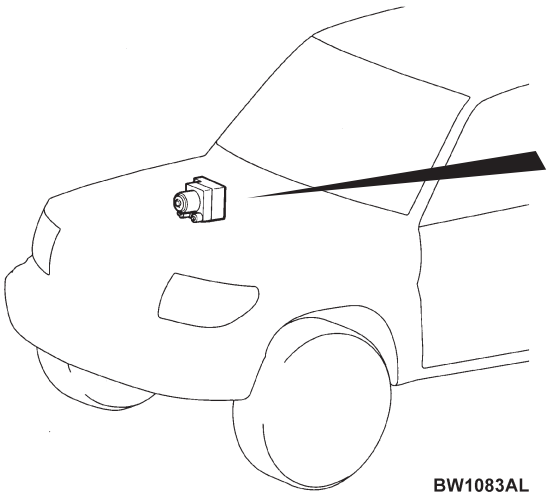
REMOVAL AND INSTALLATION

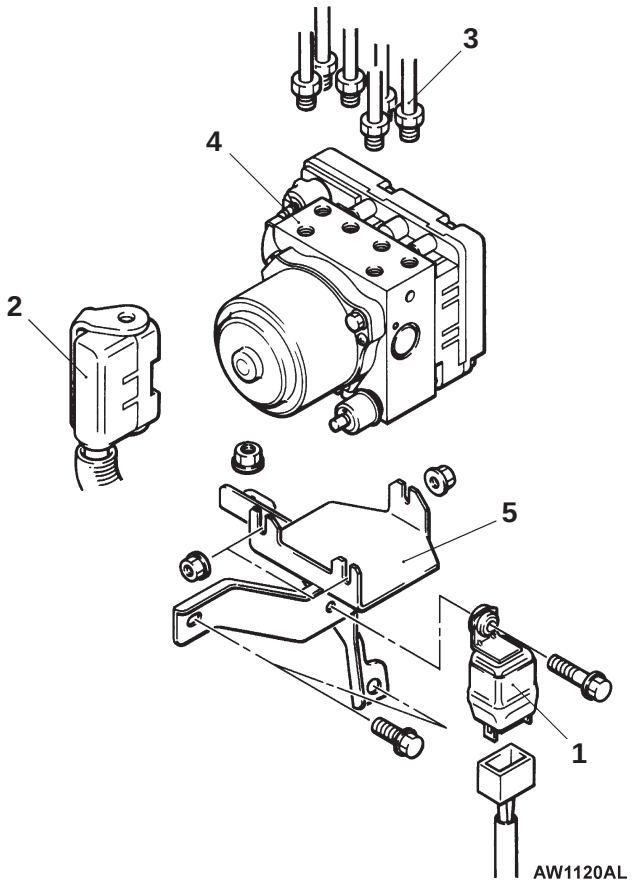
Pre-removal Operation
- Brake Fluid Draining
- Air Cleaner Removal (Refer to GROUP 15.)

Post-installation Operation
- Brake Fluid Supplying and Brake Line Bleeding (Refer to GROUP 35A – On-vehicle Service.)
- Hydraulic Unit Inspection (Refer to P.35B-24.)
- Air Cleaner Installation (Refer to GROUP 15.)

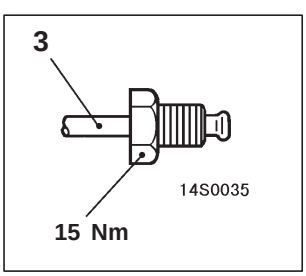
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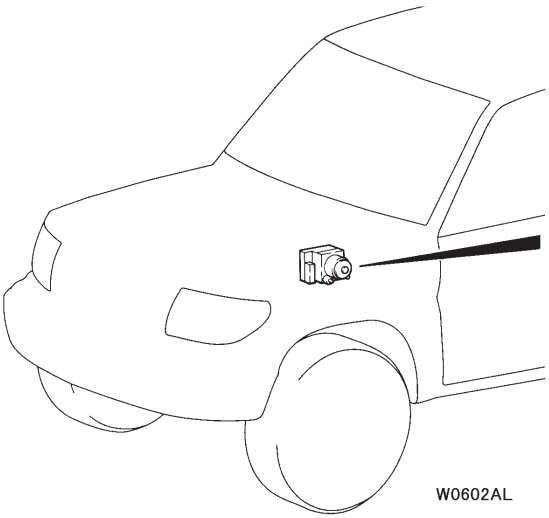


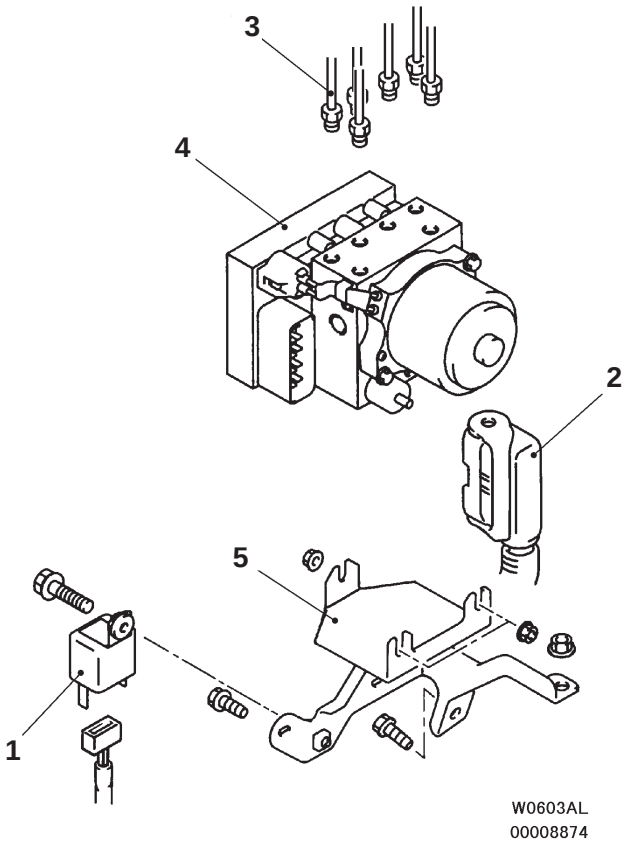




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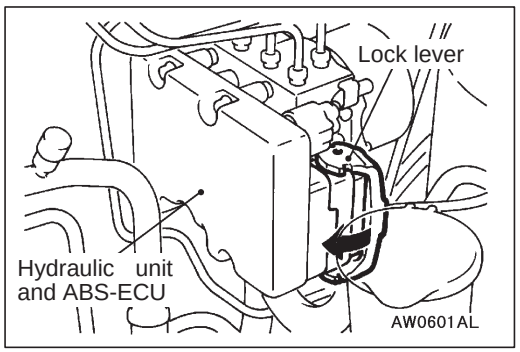




Removal steps

◀A▶ 1. ABS warning lamp relay
2. Harness connector
▶A◀ 3. Brake pipe connection

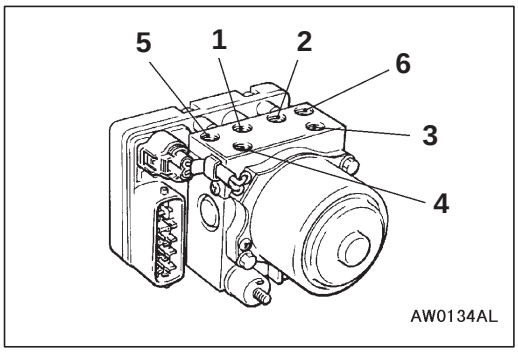
◀B▶ 4. Hydraulic unit and ABS-ECU
5. Hydraulic unit bracket assembly



REMOVAL SERVICE POINTS

◀A▶ HARNESS CONNECTOR DISCONNECTION

Move the lock lever of the ABS-ECU connector as shown in the illustration, and then disconnect the harness connector.



◀B▶ HYDRAULIC UNIT AND ABS-ECU REMOVAL

Caution

1. **The hydraulic unit assembly is heavy, and so care should be taken when removing it.**
2. **The hydraulic unit assembly is not to be disassembled; its nuts and bolts should absolutely not be loosened.**
3. **The hydraulic unit assembly must not be dropped or otherwise subjected to impact shocks.**
4. **The hydraulic unit assembly must not be turned upside down or laid on its side.**

INSTALLATION SERVICE POINT

▶A◀ BRAKE PIPE CONNECTION

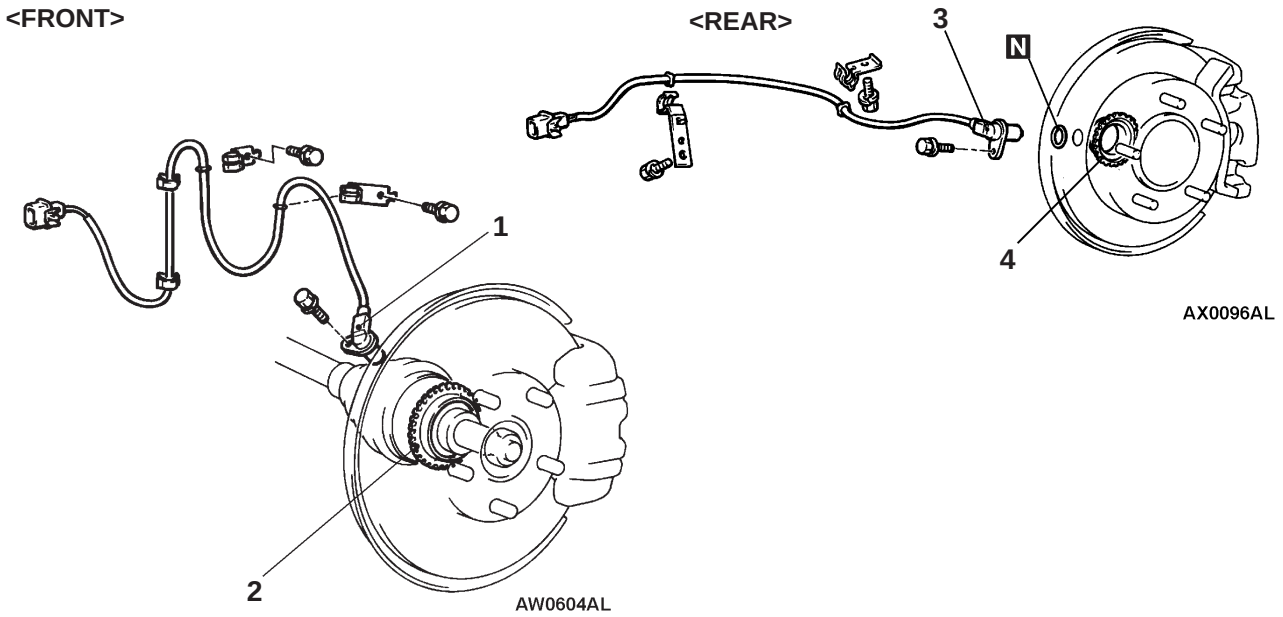
Connect the pipes to the hydraulic unit assembly as shown in the illustration.

1. To the proportioning valve (Rear brake, LH)
2. To the proportioning valve (Rear brake, RH)
3. From the master cylinder (Primary)
4. From the master cylinder (Secondary)
5. To the front brake (RH)
6. To the front brake (LH)

WHEEL SPEED SENSOR

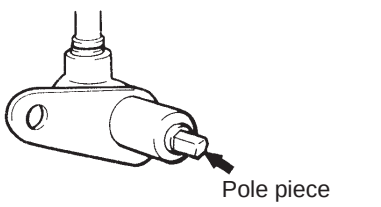
REMOVAL AND INSTALLATION

Post-installation Operation
Wheel Speed Sensor Output Voltage Check
(Refer to P.35B-22.)



◀A▶ 1. Front wheel speed sensor
2. Front ABS rotor (Refer to GROUP 26 – Drive Shaft.)
◀A▶ 3. Rear wheel speed sensor
4. Rear ABS rotor (Refer to GROUP 27 – Axle Shaft.)

NOTE
The front ABS rotor is integrated with the drive shaft. Do not disassemble it.



REMOVAL SERVICE POINT

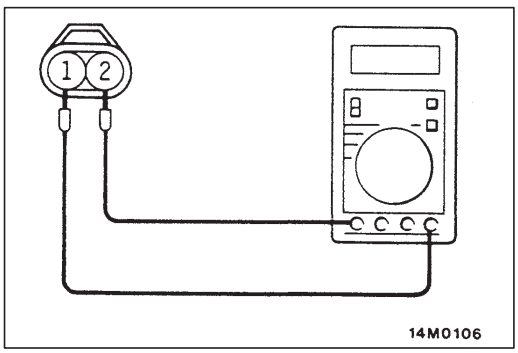
◀A▶ FRONT WHEEL SPEED SENSOR/REAR WHEEL SPEED SENSOR REMOVAL

Caution
Do not strike the pole piece at the tip of the wheel speed sensor against the ABS rotor tooth surface or other parts when removing the wheel speed sensor.

INSPECTION

CHECK OF RESISTANCE BETWEEN WHEEL SPEED SENSOR TERMINALS

Caution
The pole piece can become magnetized because of the magnet built into the wheel speed sensor, with the result that metallic foreign material easily adheres to it. Moreover, the pole piece may not be able to function to correctly sense the wheel rotation speed if it is damaged.

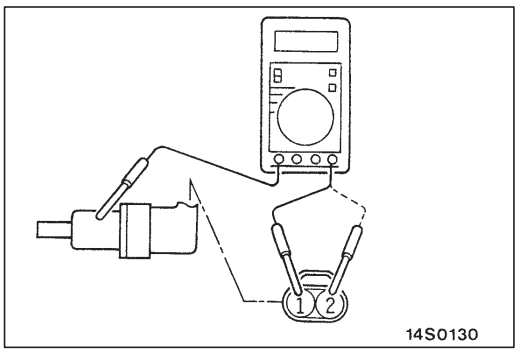


1. Measure the resistance between the wheel speed sensor terminals.

   Standard value: 1.30 – 1.58 kΩ

   If the internal resistance of the wheel speed sensor is not within the standard value, replace with a new wheel speed sensor.
2. Check the wheel speed sensor cable for breakage, damage or disconnection; replace with a new one if a problem is found.

   NOTE
   When checking for cable damage, remove the cable clamp part from the body and then bend and pull the cable near the clamp to check whether or not temporary disconnection occurs.



WHEEL SPEED SENSOR INSULATION INSPECTION

1. Remove all connections from the wheel speed sensor, and then measure the resistance between terminals 1 and 2 and the body of the wheel speed sensor.

   Standard value: 100 kΩ or more
2. If the speed sensor insulation resistance is outside the standard value range, replace with a new speed sensor.

ABS ROTOR CHECK

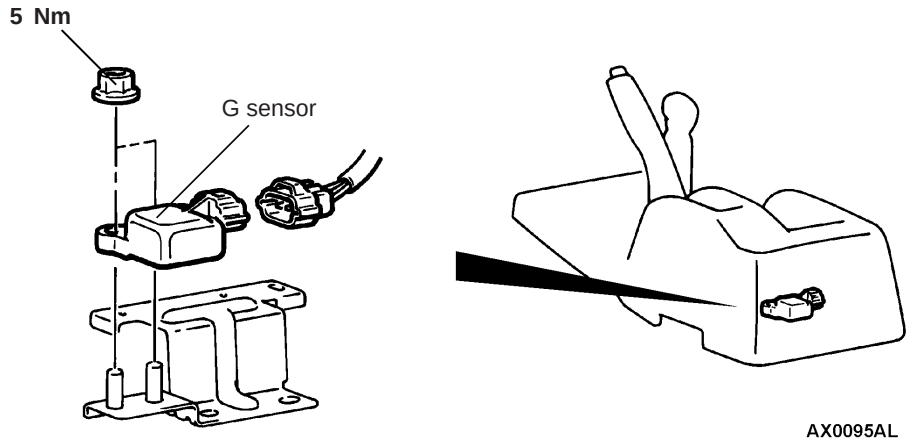
Check whether ABS rotor teeth are broken or deformed, and, if so, replace the B.J. assembly or the ABS rotor.

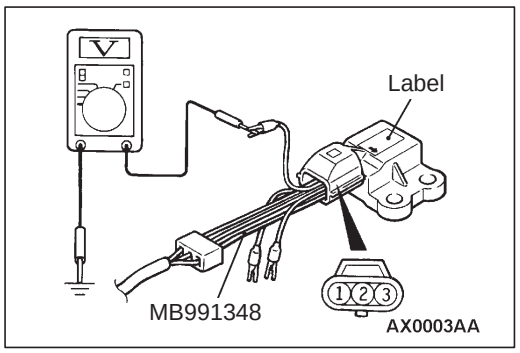
G SENSOR

REMOVAL AND INSTALLATION

Caution
Do not drop the G sensor or subject it to any shocks.

Pre-removal and Post-installation Operation
Rear floor console removal and installation
(Refer to Group 52A.)

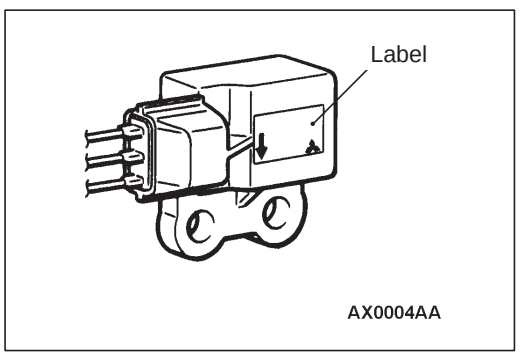




INSPECTION

1. Remove the G sensor.
2. Connect the special tool between the disconnected connectors, and then place the G sensor horizontally as shown in the illustration.
3. Turn on the ignition switch, and then measure the voltage between terminal No.2 and body earth.

   Standard value: 2.4 – 2.6 V



4. Face the labeled surface straight down with the special tool still connected. Measure the voltage between terminal No.2 and body earth with the labeled surface faced straight down.

   Standard value: 3.3 – 3.7 V

5. If not within the standard value, check the power supply line and earth condition, and then replace the G sensor.

NOTES

ANTI-SKID BRAKING SYSTEM (ABS) <4WD>

CONTENTS

GENERAL 2
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Wheel Speed Sensor Output Voltage Check 14
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GENERAL

OUTLINE OF CHANGES

- The hydraulic unit (integrated with the ABS-ECU) has been reshaped. In addition, the troubleshooting has been changed due to the change on the ABS-ECU connector.
- The Electronic Brake-force Distribution (EBD) has been adopted. The EBD makes it possible to maintain the maximum amount of braking force for the rear wheels even when the vehicle's load is unevenly distributed

GENERAL INFORMATION

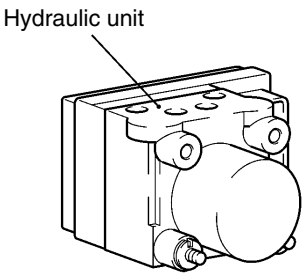
EBD CONTROL

In ABS, electronic control method is used whereby the rear wheel brake hydraulic pressure during braking is regulated by rear wheel control solenoid valves in accordance with the vehicle's rate of deceleration and the front and rear wheel slippage which are calculated from the signals received from the various wheel sensors. EBD control is a control system which provides a high level of control for both vehicle braking force and vehicle stability. The system has the following features.

- Because the system provides the optimum rear wheel braking force regardless of the vehicle laden condition and the condition of the road surface, the system reduces the required pedal depression force, particularly when the vehicle is heavily laden or driving on road surfaces with high frictional coefficients.
- Because the duty placed on the front brakes has been reduced, the increases in pad temperature can be controlled during front brakes applying to improve the wear resistance characteristics of the pad.
- Control valves such as the proportioning valve are no longer required.

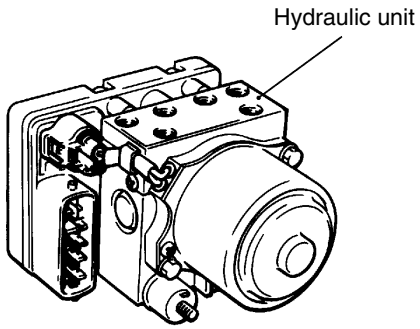
HYDRAULIC UNIT

New



AY0103AL

Old



AW0134AL

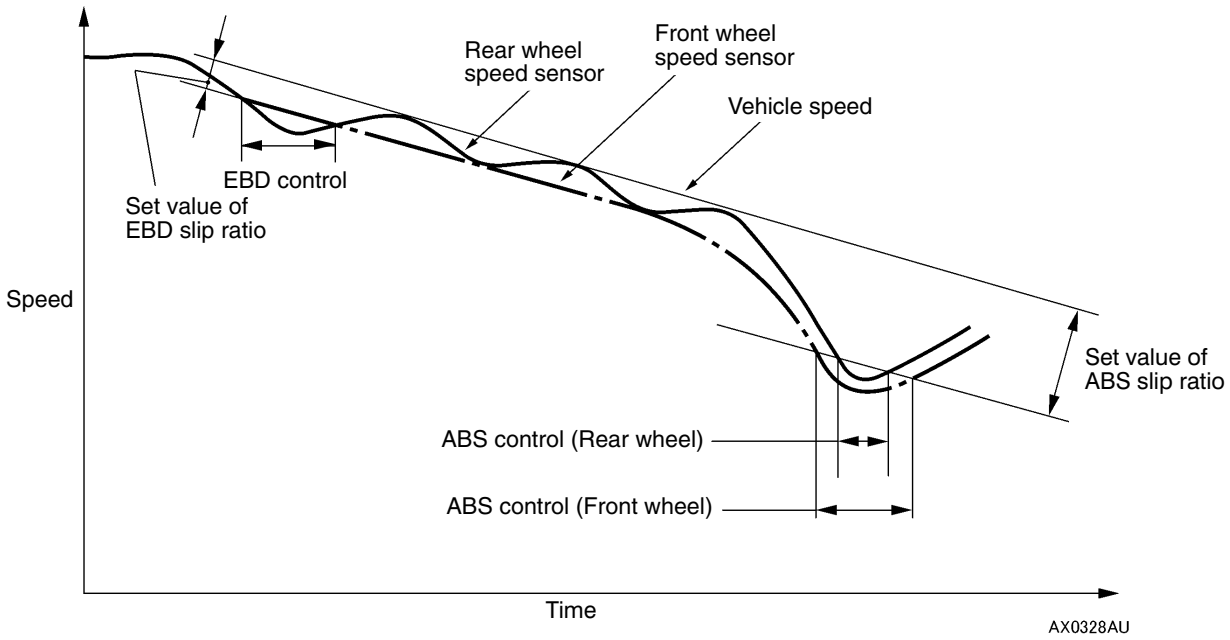
ABS-ECU

EBD HYDRAULIC PRESSURE CONTROL

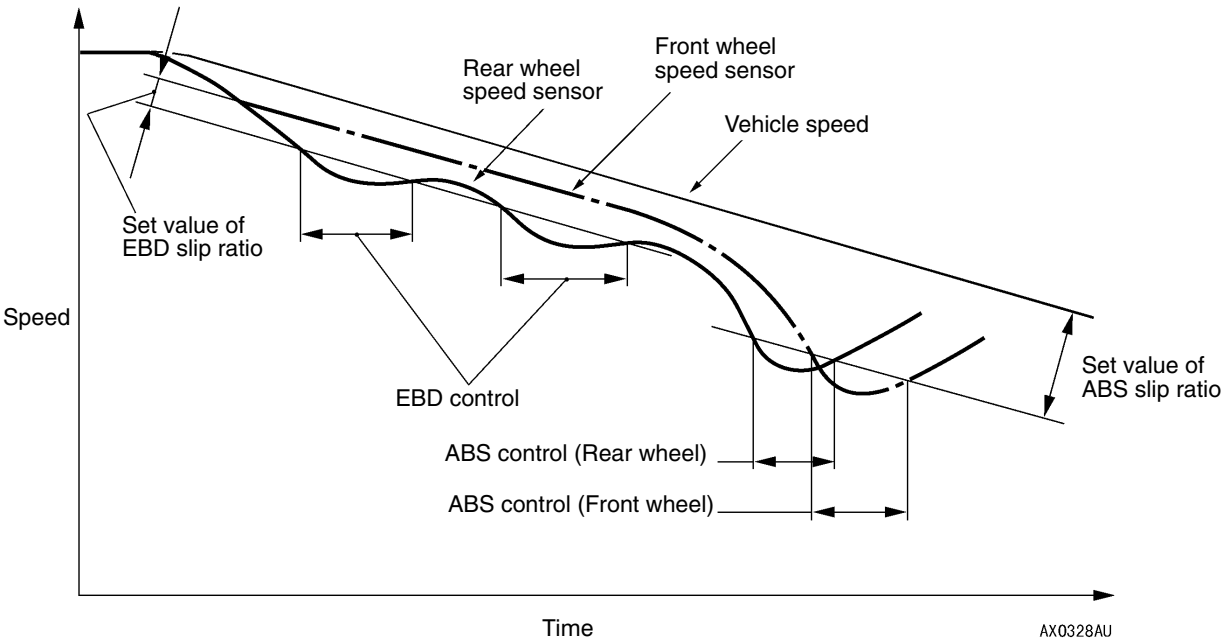
The procedures are the same as that used in PAJERO except for the items shown below.

Item	PAJERO-PININ	PAJERO
EBD control condition	When the difference between the rear wheel speed and the vehicle speed exceeds the set value.	When the difference between the rear wheel speed and the front wheel speed exceeds the set value.

<PAJERO-PININ>



<PAJERO>



FAIL-SAFE FUNCTION

The procedures are the same as that used in PAJERO except for the items shown below.

Item	PAJERO-PININ	PAJERO
Warning lamp during fail-safe operation	ABS warning lamp	Brake warning lamp

Diagnosis code No.	Item	Action during fail-safe operation		
		ABS control	EBD control	ABS warning lamp
11	Open circuit or short-circuit in wheel speed sensor (FR)	If faulty wheels include two rear wheels: Control stopped in all wheels Other than the above: Control stopped in faulty wheels	If faulty wheels include two rear wheels: Control stopped Other than the above: Control carried out	Illuminated
12	Open circuit or short-circuit in wheel speed sensor (FL)			
13	Open circuit or short-circuit in wheel speed sensor (RR)			
14	Open circuit or short-circuit in wheel speed sensor (RL)			
15	Problem with any one of the four wheel speed sensors			
16	Abnormal drop or rise in ABS-ECU power supply voltage	Control stopped	Control stopped	Illuminated
21	Wheel speed sensor (FR) system	If faulty wheels include two rear wheels: Control stopped in all wheels Other than the above: Control stopped in faulty wheels	If faulty wheels include two rear wheels: Control stopped Other than the above: Control carried out	Illuminated
22	Wheel speed sensor (FL) system			
23	Wheel speed sensor (RR) system			
24	Wheel speed sensor (RL) system			
32	G sensor system	Control stopped	Control carried out	Illuminated
33	Stop lamp switch system	Control stopped	Control carried out	Illuminated
41	Solenoid valve (FR) system	System interrupted	System interrupted	Illuminated
42	Solenoid valve (FL) system			
43	Solenoid valve (RR) system			
44	Solenoid valve (RL) system			
51	Valve relay ON problem	Control stopped	Control carried out	Illuminated
52	Valve relay OFF problem	System interrupted	System interrupted	Illuminated
53	Motor relay OFF problem	Control stopped	Control carried out	Illuminated
54	Motor relay ON problem	System interrupted	Control carried out	Illuminated
55	Motor system	Control stopped	Control carried out	Illuminated
63	ABS-ECU abnormality	System interrupted	System interrupted	Illuminated

NOTE
Control stopped: Control is not carried out until the ignition switch is turned to the “LOCK” (OFF) position. However, if the problem returns to normal, control is carried out again.
System interrupted: Control is not carried out until the valve relay turns off and the ignition switch is turned to the “LOCK” (OFF) position.

TROUBLESHOOTING

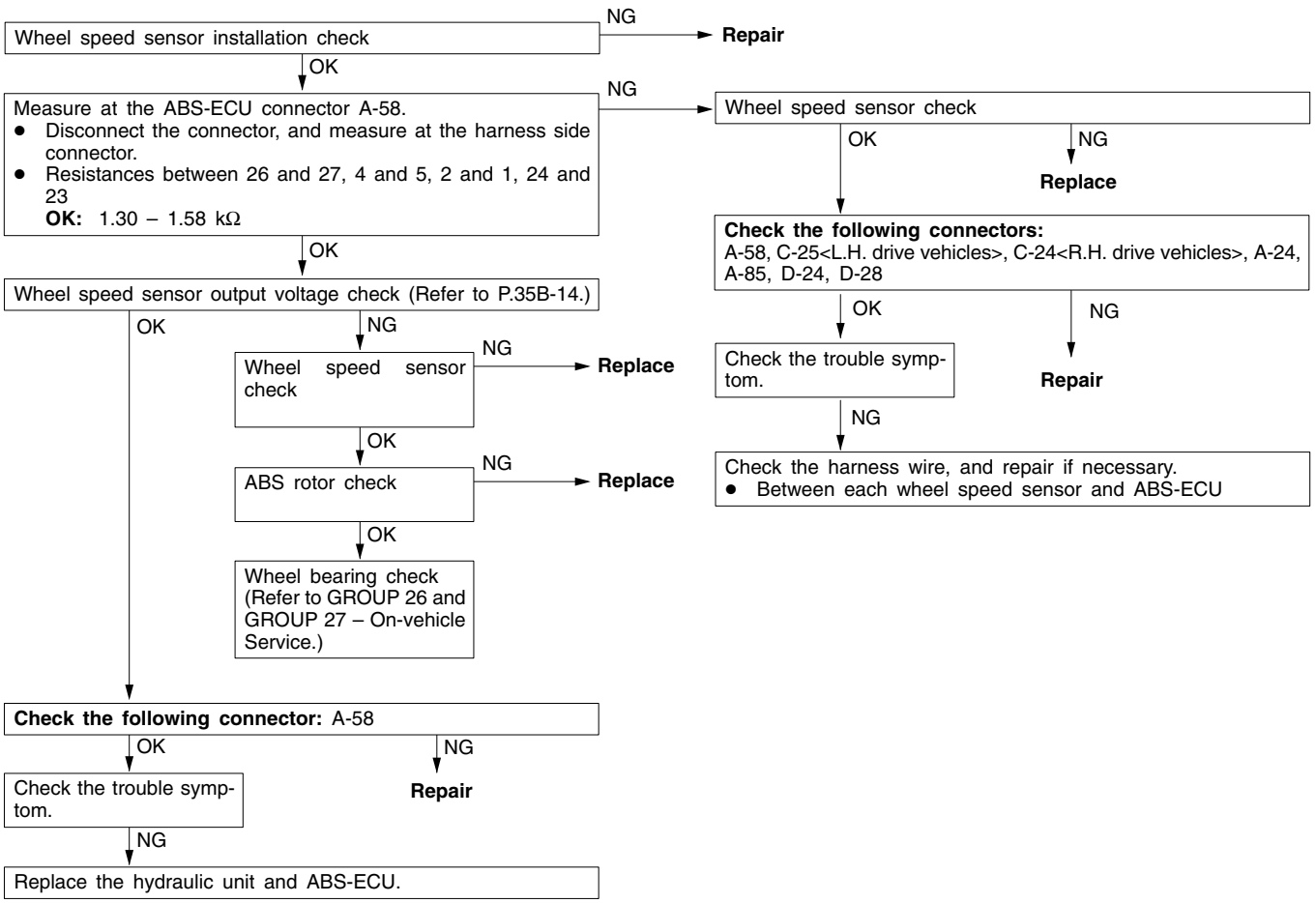
INSPECTION CHART FOR DIAGNOSIS CODES

Diagnosis code No.	Inspection item		Reference page
11	Front right wheel speed sensor (Open circuit or short circuit)		35B-6
12	Front left wheel speed sensor (Open circuit or short circuit)		35B-6
13	Rear right wheel speed sensor (Open circuit or short circuit)		35B-6
14	Rear left wheel speed sensor (Open circuit or short circuit)		35B-6
15	Wheel speed sensor (Abnormal output signal)		–
16*	ABS-ECU power supply system (Abnormal voltage drop or rise)		35B-7
21	Front right wheel speed sensor		35B-6
22	Front left wheel speed sensor		35B-6
23	Rear right wheel speed sensor		35B-6
24	Rear left wheel speed sensor		35B-6
32	G sensor system		35B-7
33	Stop lamp switch system		–
41	Front right solenoid valve	The diagnosis codes are output when there is no response to the drive signals for respective solenoid valves or the ABS-ECU power supply system is defective.	35B-8
42	Front left solenoid valve		
43	Rear right solenoid valve		
44	Rear left solenoid valve		
51	Valve relay problem (stays on)		–
52	Valve relay problem (stays off) or ABS-ECU power supply system problem		35B-8
53	Motor relay problem (stays off) or ABS-ECU power supply system problem		
54	Motor relay problem (stays on)		–
55	Motor system (seized pump motor) or ABS-ECU power supply system problem		35B-8
63	ABS-ECU		–

NOTE
*: Turning the ignition switch to ACC will erase the diagnosis code No.16.

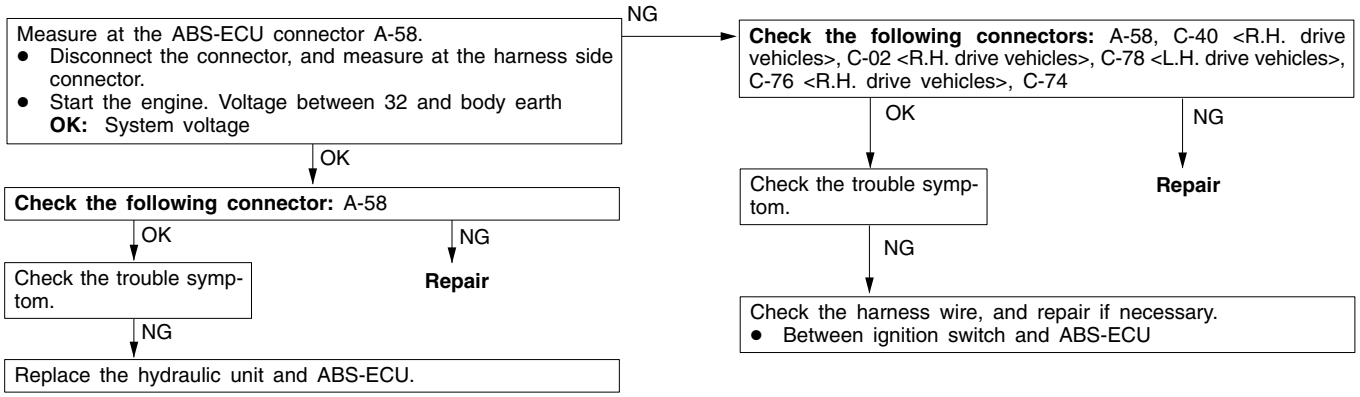
INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code Nos.11, 12, 13 and 14 Wheel speed sensor (open circuit or short circuit) **Code Nos.21, 22, 23 and 24 Wheel speed sensor**	**Probable cause**
Code Nos. 11, 12, 13 and 14 are output if the ABS-ECU detects an open circuit or short-circuit in the (+) wire or (–) wire in any one of the four wheel speed sensors.	• Malfunction of wheel speed sensor • Malfunction of wiring harness or connector • Malfunction of hydraulic unit and ABS-ECU
Code Nos. 21, 22, 23 and 24 are output in the following cases. • When there is no input from any one of the four wheel speed sensors when travelling at several km/h or more, even though open circuit can not be verified. • When a chipped or blocked-up ABS rotor is detected and if the anti-lock system operates continuously because a malfunctioning sensor or a warped ABS rotor is causing sensor output to drop.	• Malfunction of wheel speed sensor • Malfunction of wiring harness or connector • Malfunction of ABS rotor • Too much gap between the sensor and the ABS rotor • Malfunction of hydraulic unit and ABS-ECU • Malfunction of wheel bearing

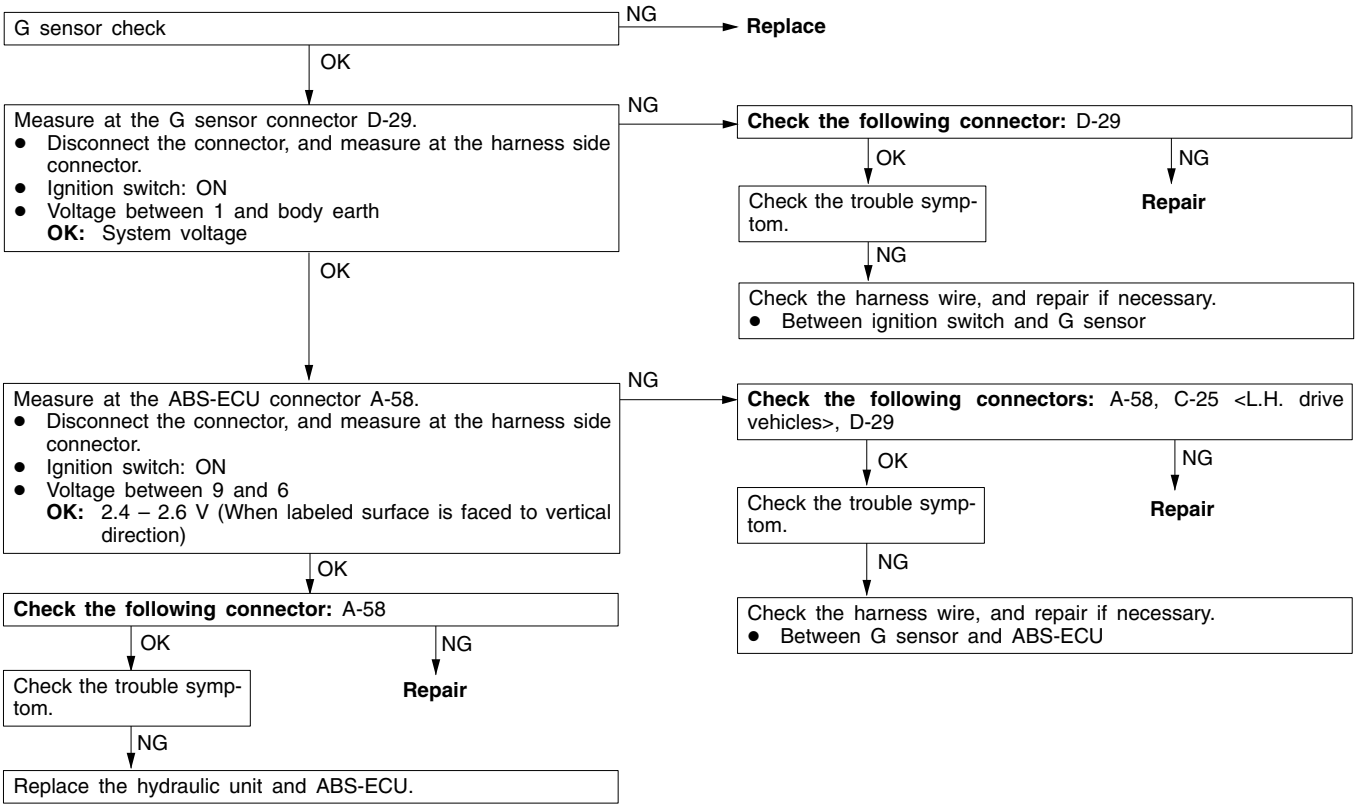


Code No.16 ABS-ECU power supply system (abnormal voltage drop or rise)	Probable cause
This code is output if the ABS-ECU power supply voltage drops below or rises above the rated values. Furthermore, turning the ignition switch to ACC will erase this code.	• Malfunction of battery • Malfunction of wiring harness or connector • Malfunction of hydraulic unit and ABS-ECU

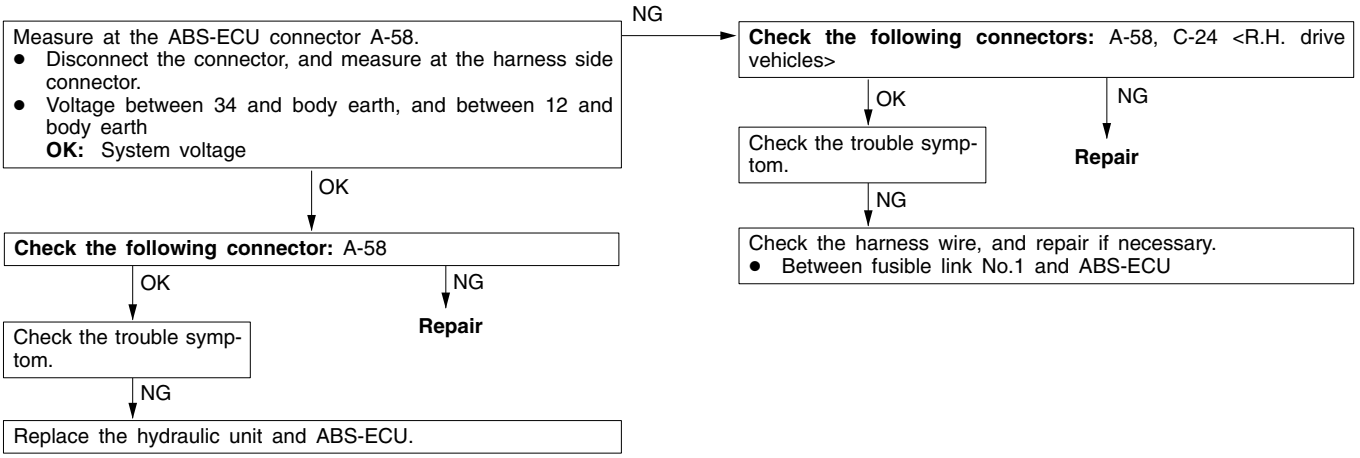
Caution
If battery voltage drops or rises during inspection, this code will be output as well. If the voltage returns to standard value, this code is no longer output.
Before carrying out the following inspection, check the battery level, and refill it if necessary.



Code No.32 G sensor system	Probable cause
This code is output in the following cases. ● G sensor output voltage is less than 0.5 V or more than 4.5 V. (An open or short circuit is present in the G sensor circuit.) ● G sensor output voltage does not change. (G sensor output voltage is abnormal.)	● Malfunction of G sensor ● Malfunction of wiring harness or connector ● Malfunction of hydraulic unit and ABS-ECU



Code Nos.41, 42, 43 and 44 Solenoid valve Code No.52 Valve relay problem (stays off) Code No.53 Motor relay problem (stays off) Code No.55 Motor system (seized pump motor)	Probable cause
These codes are output if there is an open circuit or short-circuit in the ABS-ECU power supply circuit (power supply circuit for solenoid valve and motor), or the internal circuit in the hydraulic unit and ABS-ECU is defective.	● Malfunction of wiring harness or connector ● Malfunction of hydraulic unit and ABS-ECU



INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptoms	Inspection procedure No.	Reference page
Communication between the MUT-II and the whole system is not possible.	1	–
Communication between the MUT-II and the ABS-ECU is not possible.	2	35B-10
When the ignition key is turned to "ON" (engine stopped), the ABS warning lamp does not illuminate.	3	–
Even after the engine is started, the ABS warning lamp remains illuminated.	4	35B-11
Faulty ABS operation	5	35B-12

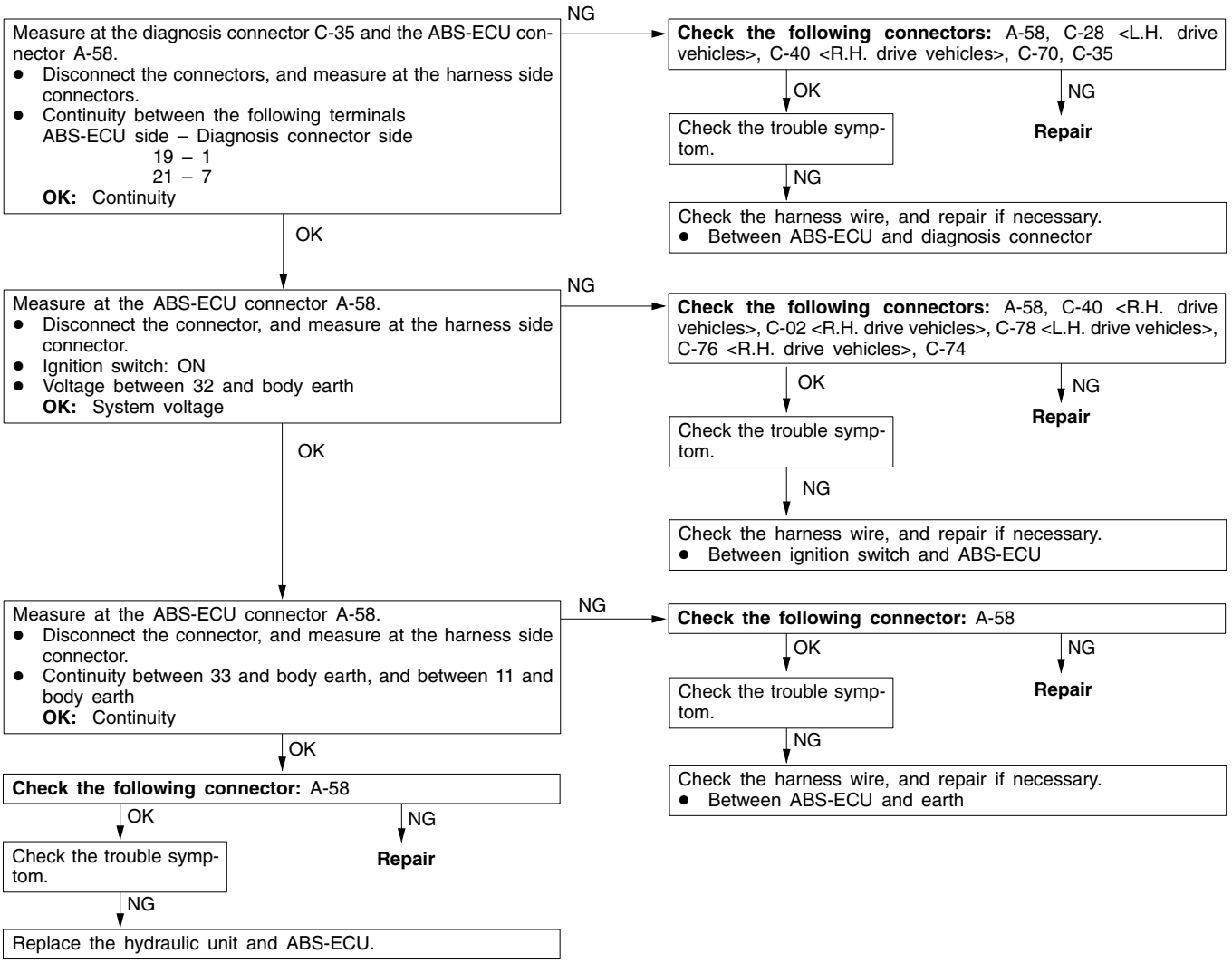
Caution

1. **If steering movements are made when driving at high speed, or when driving on road surfaces with low frictional resistance, or when passing over bumps, the ABS may operate even though sudden braking is not being applied. Because of this, when getting information from the customer, check if the problem occurred while driving under such conditions as these.**
2. **During ABS operation, the brake pedal may vibrate or may not be able to be depressed. Such phenomena are due to intermittent changes in hydraulic pressure inside the brake line to prevent the wheels from locking and is not an abnormality.**

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

Inspection Procedure 2

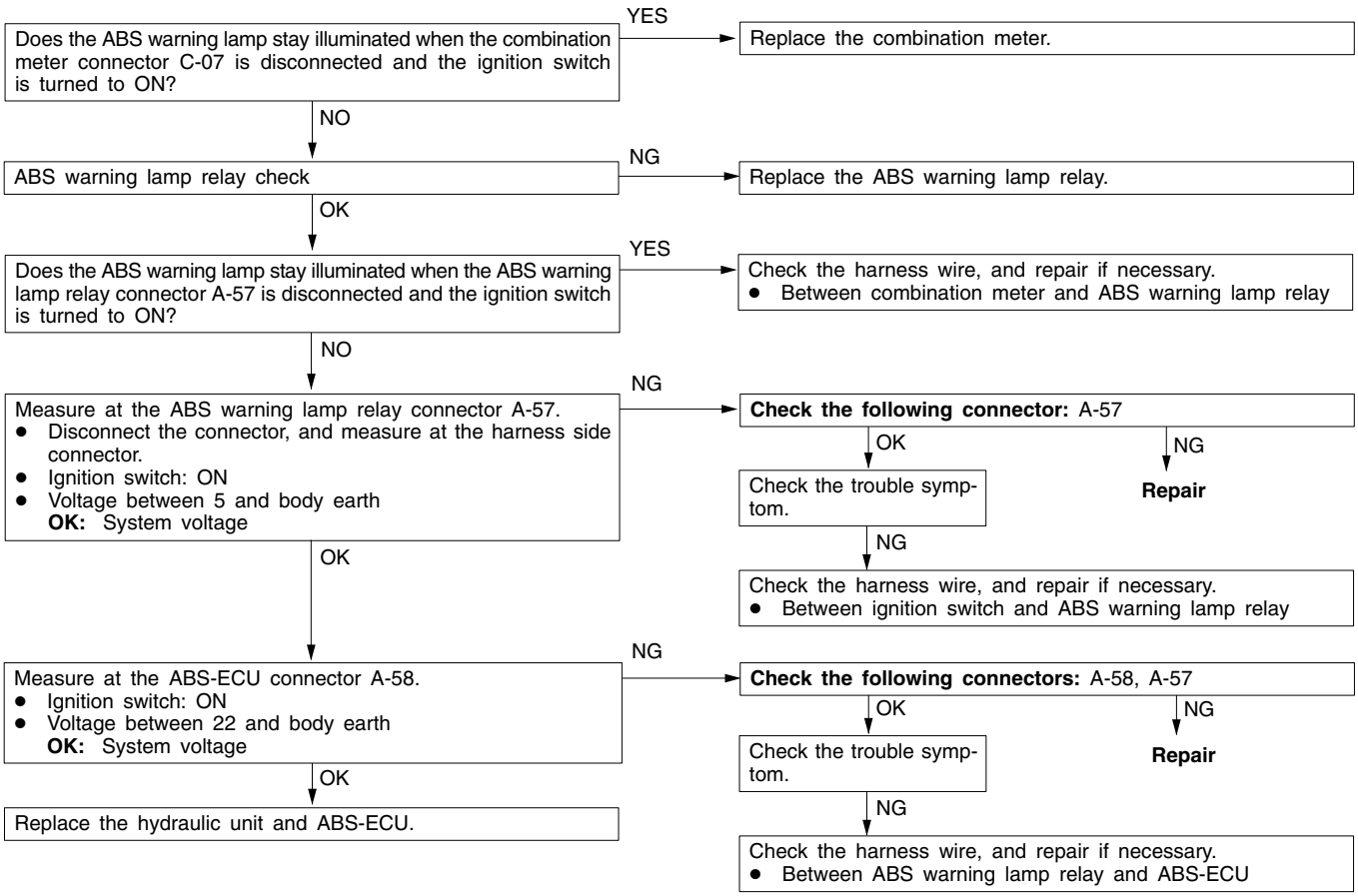
Communication between MUT-II and the ABS-ECU is not possible.	Probable cause
The cause may be an open circuit in the ABS-ECU power supply circuit or an open circuit in the diagnosis output circuit.	• Blown fuse • Malfunction of wiring harness or connector • Malfunction of hydraulic unit and ABS-ECU



Inspection Procedure 4

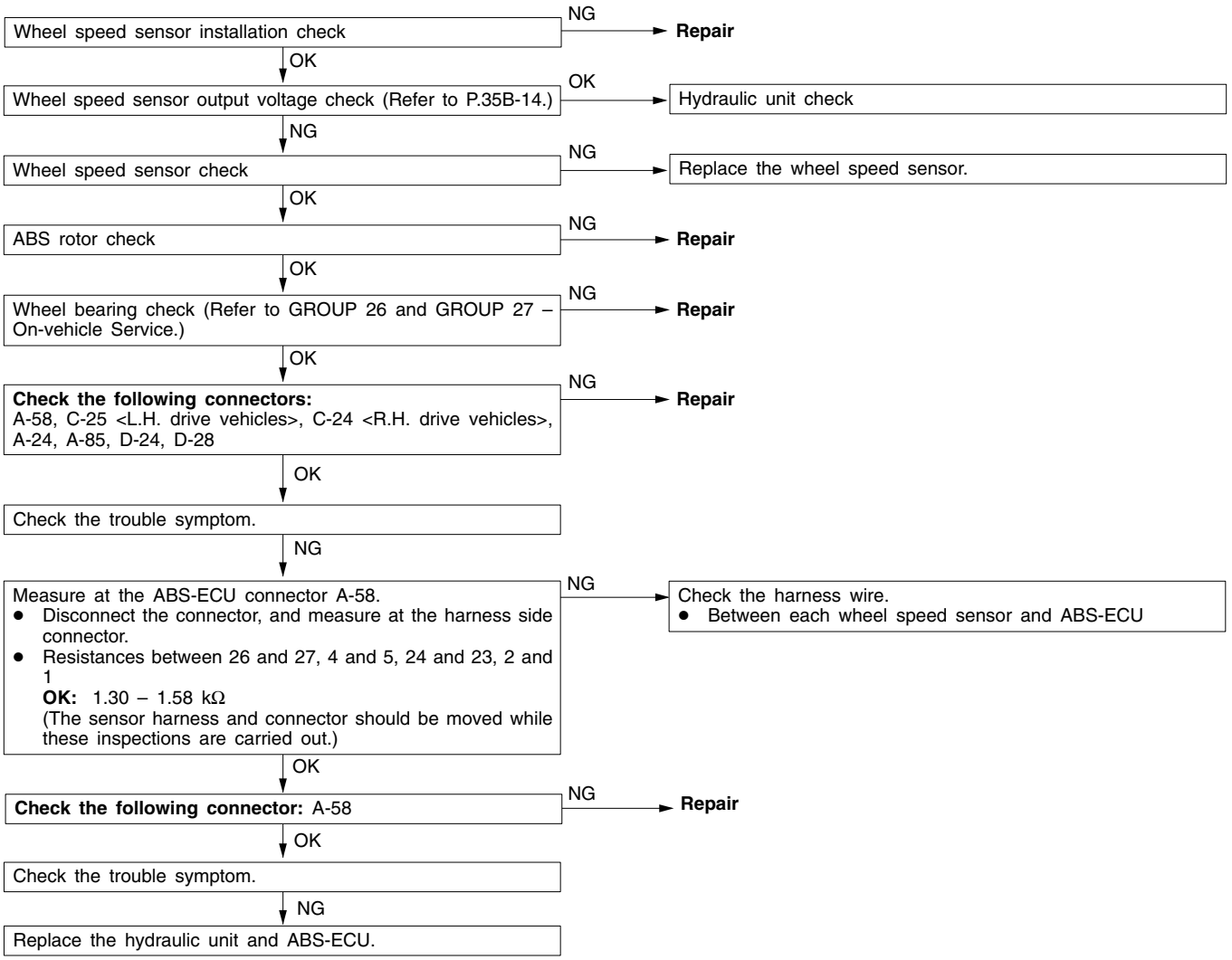
Even after the engine is started, the ABS warning lamp remains illuminated.	Probable cause
The cause is probably a short-circuit in the ABS warning lamp illumination circuit.	• Malfunction of combination meter • Malfunction of ABS warning lamp relay • Malfunction of wiring harness (short circuit) • Malfunction of hydraulic unit and ABS-ECU

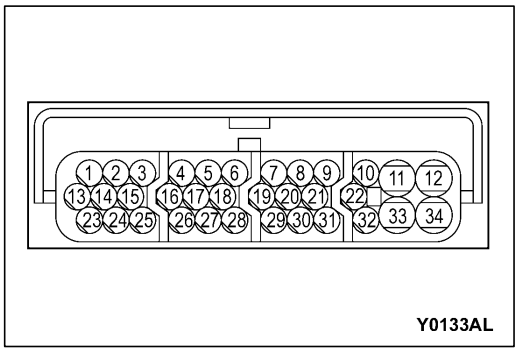
NOTE
This trouble symptom is limited to cases where communication with the MUT-II is possible (ABS-ECU power supply is normal) and the diagnosis code is a normal diagnosis code.



Inspection Procedure 5

Faulty ABS operation	Probable cause
This varies depending on the driving conditions and the road surface conditions, so problem diagnosis is difficult. However, if a normal diagnosis code is displayed, carry out the following inspection.	• Improper installation of wheel speed sensor • Malfunction of wiring harness or connector • Malfunction of wheel speed sensor • Malfunction of ABS rotor • Foreign material adhering to wheel speed sensor • Malfunction of wheel bearing • Malfunction of hydraulic unit and ABS-ECU



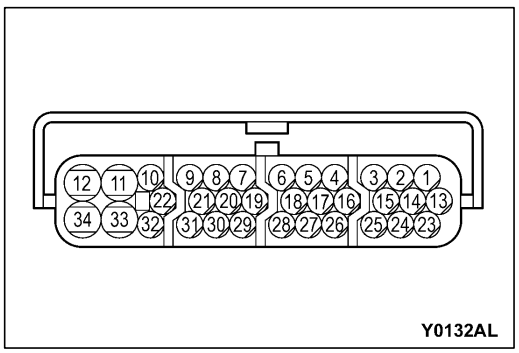


CHECK AT ABS-ECU

TERMINAL VOLTAGE CHECK CHART

1. Measure the voltages between the respective terminal and earth.
2. The terminal layout is shown in the illustration.

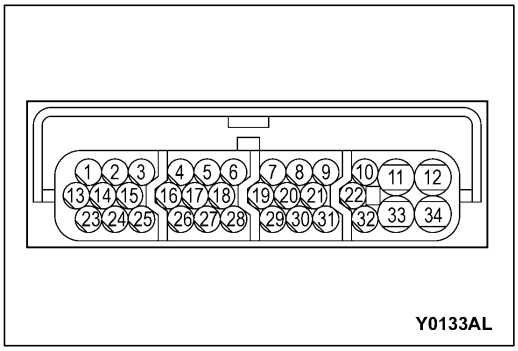
Terminal No.	Check item	Checking requirements		Normal condition
3	Stop lamp switch input	Ignition switch: ON	Stop lamp switch: ON	System voltage
			Stop lamp switch: OFF	1 V or less
6	G sensor earth	Always		0 V
9	Input from G sensor	Ignition switch: ON Vehicle is horizontal		2.4 – 2.6 V
12	Solenoid valve power supply	Always		System voltage
19	Diagnosis changeover input	When the MUT-II is connected		0 V
		When the MUT-II is not connected		Approx. 12 V
21	MUT-II	When the MUT-II is connected		Serial communication with MUT-II
		When the MUT-II is not connected		1 V or less
22	ABS warning lamp relay transistor output	Ignition switch: ON	When the lamp is switched off	2 V or less
			When the lamp is illuminated	System voltage
32	ABS-ECU power supply	Ignition switch: ON		System voltage
		Ignition switch: START		0 V
34	Motor power supply	Always		System voltage



RESISTANCE AND CONTINUITY BETWEEN HARNESS-SIDE CONNECTOR TERMINALS

1. Turn the ignition key to the LOCK (OFF) position.
2. Disconnect the ABS-ECU connector.
3. Check the resistance and continuity between the terminals indicated in the table below.
4. The terminal layout is shown in the illustration.

ABS-ECU terminal No.	Signal	Normal condition
1 – 2	Wheel speed sensor (rear left)	1.30 – 1.58 kΩ
23 – 24	Wheel speed sensor (rear right)	
4 – 5	Wheel speed sensor (front left)	
26 – 27	Wheel speed sensor (front right)	
11 – Body earth	Earth	Continuity
33 – Body earth	Earth	



ON-VEHICLE SERVICE

WHEEL SPEED SENSOR OUTPUT VOLTAGE CHECK

1. Lift up the vehicle and release the parking brake.
2. Disconnect the ABS-ECU connector.
3. Rotate the wheel to be measured at approximately 1/2–1 rotation per second, and check the output voltage using a circuit tester or an oscilloscope.

Wheel speed sensor	Front left	Front right	Rear left	Rear right
Terminal No.	4	26	2	24
	5	27	1	23

Output voltage

When measuring with a circuit tester:
42 mV or more

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

4. The followings are suspected if the output voltage is lower than the value described above. Check the wheel speed sensor, and replace if necessary.
   - Too large clearance between the pole piece of the wheel speed sensor and ABS rotor
   - Faulty wheel speed sensor

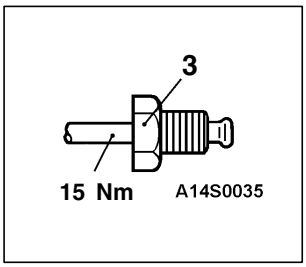
HYDRAULIC UNIT AND ABS-ECU

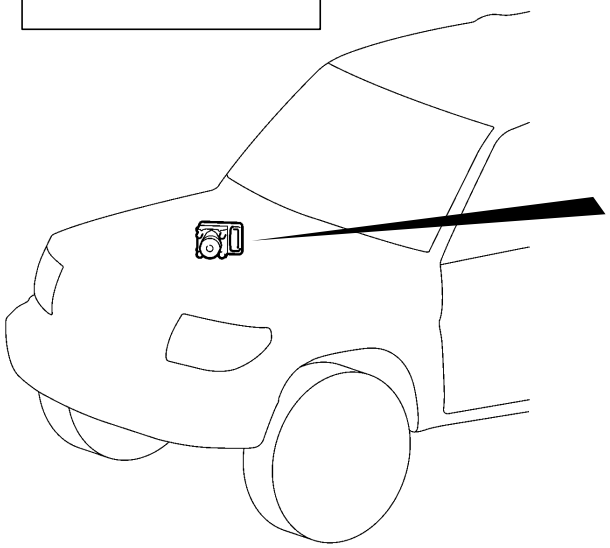
REMOVAL AND INSTALLATION

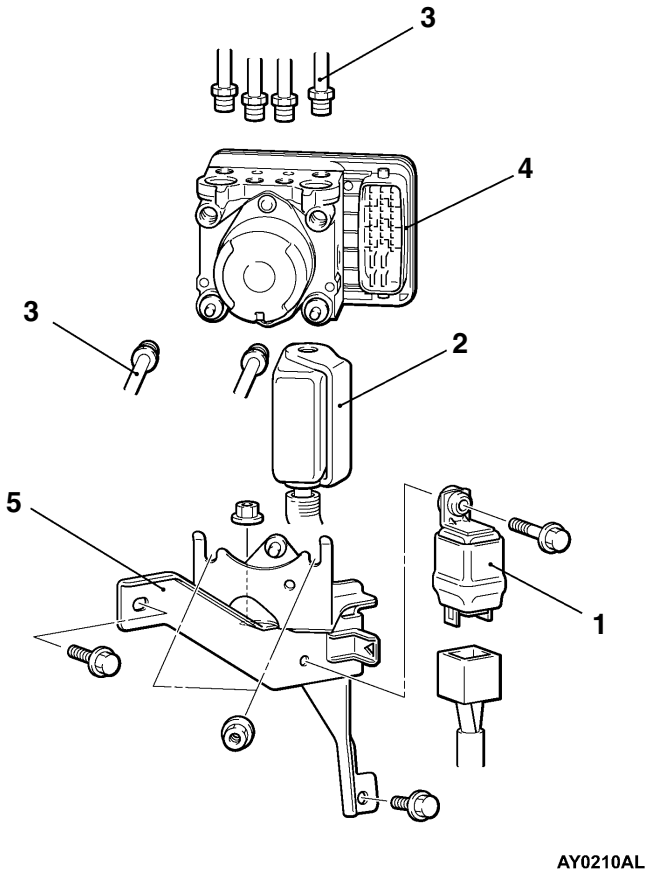
Pre-removal Operation
- Brake Fluid Draining
- Air Cleaner Removal (Refer to GROUP 15.)

Post-installation Operation
- Brake Fluid Supplying and Brake Line Bleeding (Refer to GROUP 35A – On-vehicle Service.)
- Hydraulic Unit Inspection
- Air Cleaner Installation (Refer to GROUP 15.)

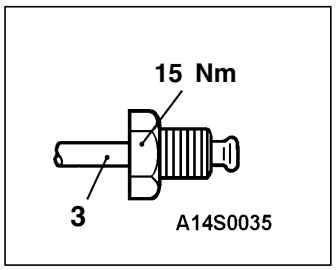
<L.H. drive vehicles>

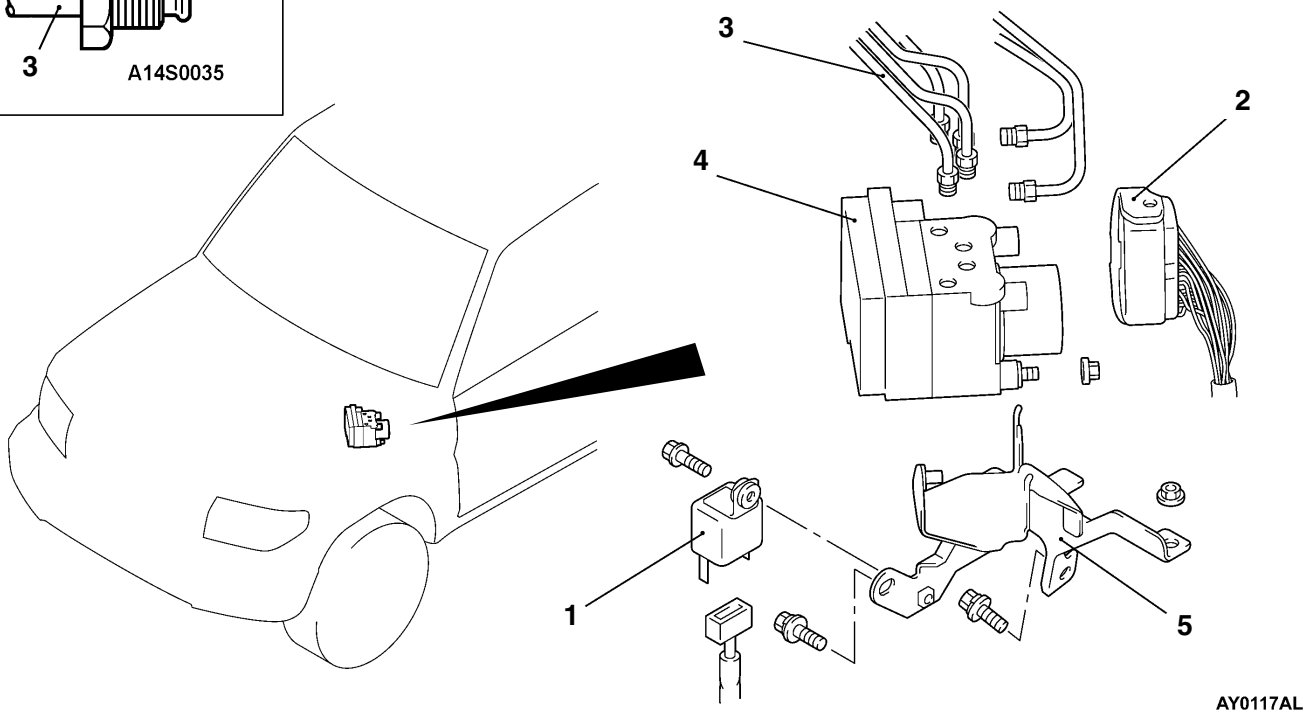






<R.H. drive vehicles>

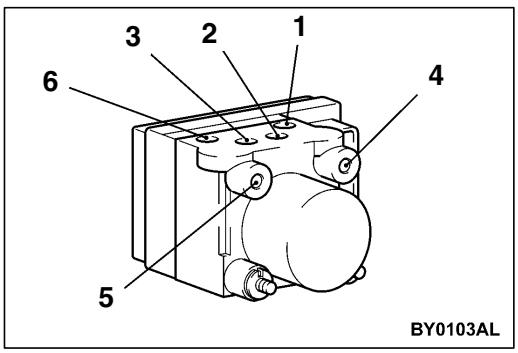




Removal steps

1. ABS warning lamp relay
◀A▶ 2. Harness connector
▶A◀ 3. Brake pipe connection
◀B▶ 4. Hydraulic unit and ABS-ECU
5. Hydraulic unit bracket assembly

NOTE
The removal service points are the same as before.



INSTALLATION SERVICE POINT

▶A◀ BRAKE PIPE CONNECTION

Connect the pipes to the hydraulic unit assembly as shown in the illustration.

1. To the front brake (L.H.)
2. To the proportioning valve (Rear brake, R.H.)
3. To the proportioning valve (Rear brake, L.H.)
4. From the master cylinder (Primary)
5. From the master cylinder (Secondary)
6. To the front brake (R.H.)

PARKING BRAKES

PARKING BRAKES

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SERVICE SPECIFICATIONS 2

LUBRICANTS 2

ON-VEHICLE SERVICE 3

Parking Brake Lever Stroke Check and Adjustment 3

Parking Brake Switch Check 4

Lining Runing-In 4

PARKING BRAKE LEVER 5

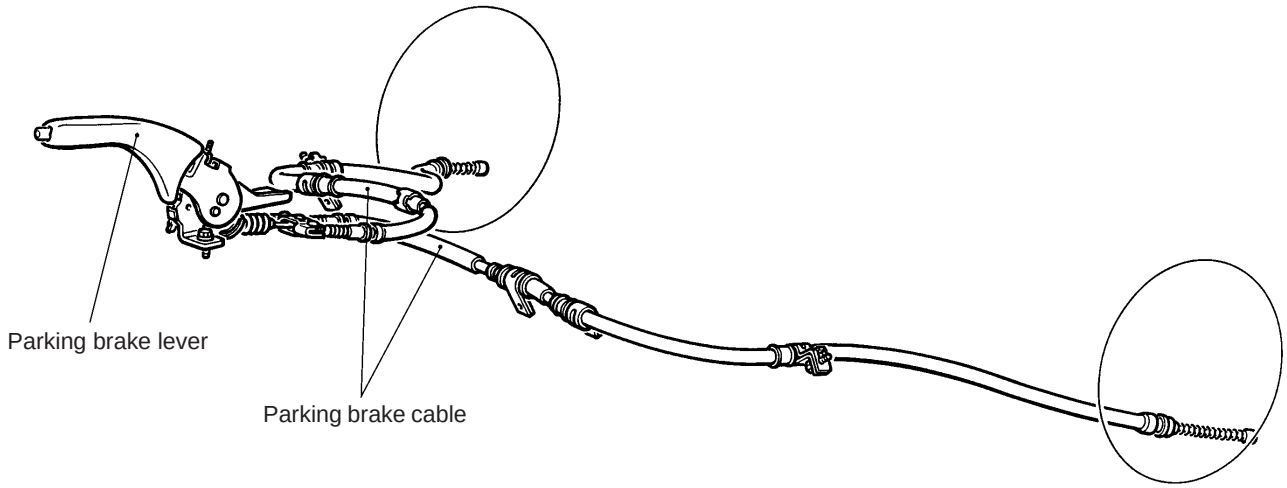
PARKING BRAKE CABLE 6

PARKING BRAKE DRUM 8

GENERAL INFORMATION

The parking brake is of a mechanical control type acting on the rear wheels. A lever is used to apply the parking brake.

CONSTRUCTION DIAGRAM



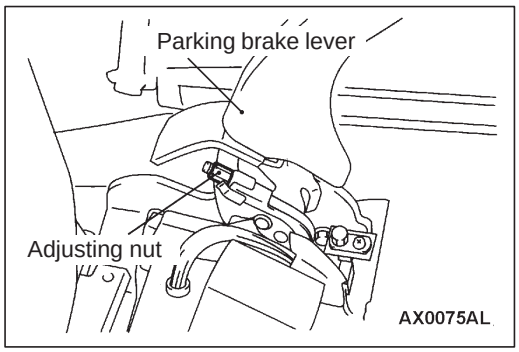
AW0051AL

SERVICE SPECIFICATIONS

Items	Standard value	Limit
Parking brake lever stroke	3 – 5 notches	–
Rear brake lining thickness mm	2.8	1.0
Rear drum inside diameter mm	168.0	169.0

LUBRICANTS

Items	Specified lubricants
Backing plate	Multipurpose grease
Shoe and lining assembly	
Adjuster	



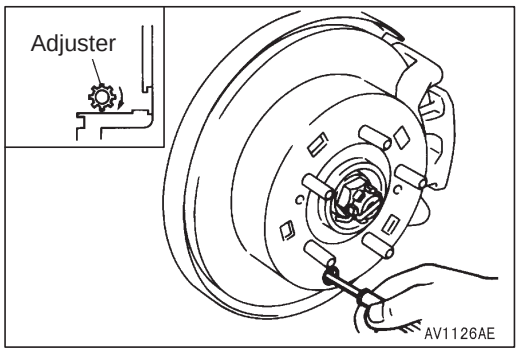
ON-VEHICLE SERVICE

PARKING BRAKE LEVER STROKE CHECK AND ADJUSTMENT

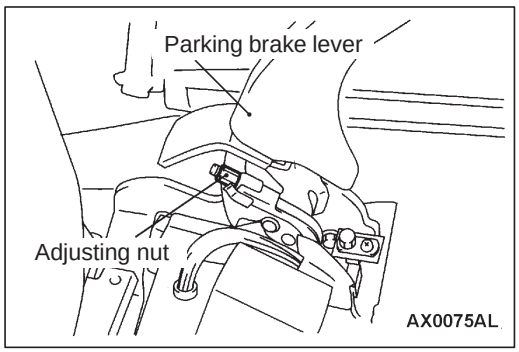
1. Pull the parking brake lever with a force of approx. 196 N and count the number of notches.

   Standard value: 3 – 5 notches

2. If the parking brake lever stroke is not the standard value, adjust as described below.
   (1) Remove the rear floor console, and then loosen the adjusting nut to move it to the cable rod end so that the cable will be free.
   (2) Remove the rear wheels.



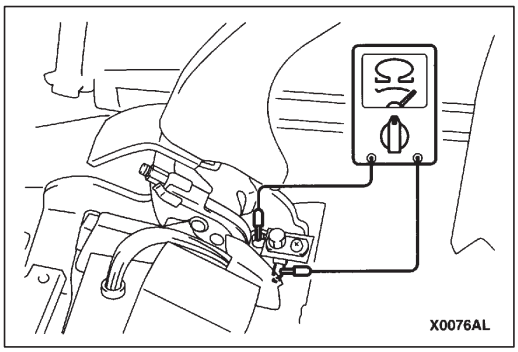
   (3) Remove the adjustment hole plug, and then use a flat-tip (–) screwdriver to turn the adjuster in the direction of the arrow (the direction which expands the shoe) so that the disc will not rotate.
   Return the adjuster five notches in the direction opposite to the direction of the arrow.



   (4) Turn the adjusting nut to adjust the parking brake lever stroke to the standard value. After adjusting, check that there is no space between the adjusting nut and the parking brake lever.

   Caution
   If the parking brake lever stroke is below the standard value and the braking is too firm, the rear brakes may drag.

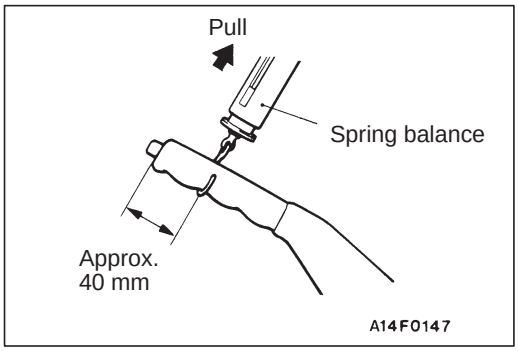
   (5) Release the parking brake and turn the rear wheels to check that the rear brakes are not dragging.



PARKING BRAKE SWITCH CHECK

Check for continuity between the parking brake switch terminal and the switch mounting bolt.

When parking brake lever is pulled	Continuity
When parking brake lever is released	No continuity



LINING RUNNING-IN

Carry out running-in by the following procedure when replacing the parking brake linings or the rear brake disc rotors, or when brake performance is insufficient.

Caution
Carry out running-in in a place with good visibility, and pay careful attention to safety.

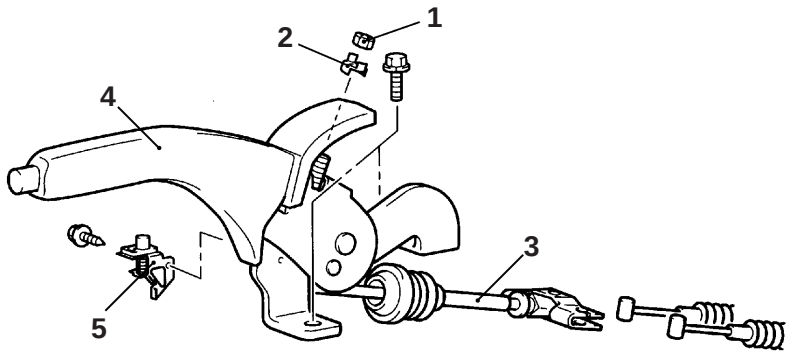
1. Adjust the parking brake stroke to the specified value.
   Standard value [Operation force: Approx. 196 N] : 3 – 5 notches
2. Hook a spring balance onto the centre of the parking brake lever grip and pull it with a force of 98 – 147 N in a direction perpendicular to the handle.
3. Drive the vehicle at a constant speed of 35 – 50 km/h for 100 metres.
4. Release the parking brake and let the brakes cool for 5 – 10 minutes.
5. Repeat the procedure in steps 2. to 4. 4 – 5 times.

PARKING BRAKE LEVER

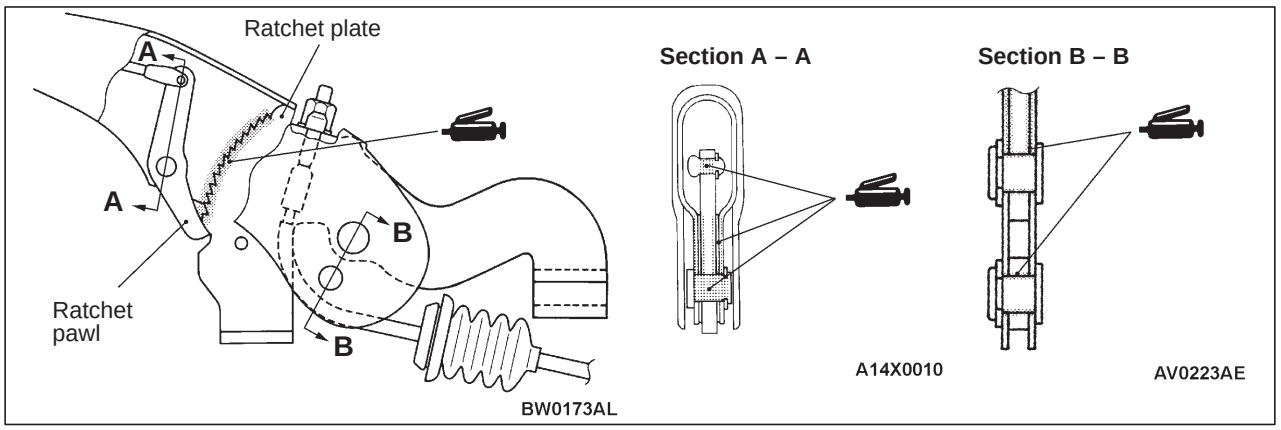
REMOVAL AND INSTALLATION

Pre-removal Operation
Rear Floor Console Removal
(Refer to GROUP 52A.)

Post-installation Operation
- Parking Brake Lever Stroke Adjustment (Refer to P.36-3.)
- Rear Floor Console Installation (Refer to GROUP 52A.)



AX0077AL



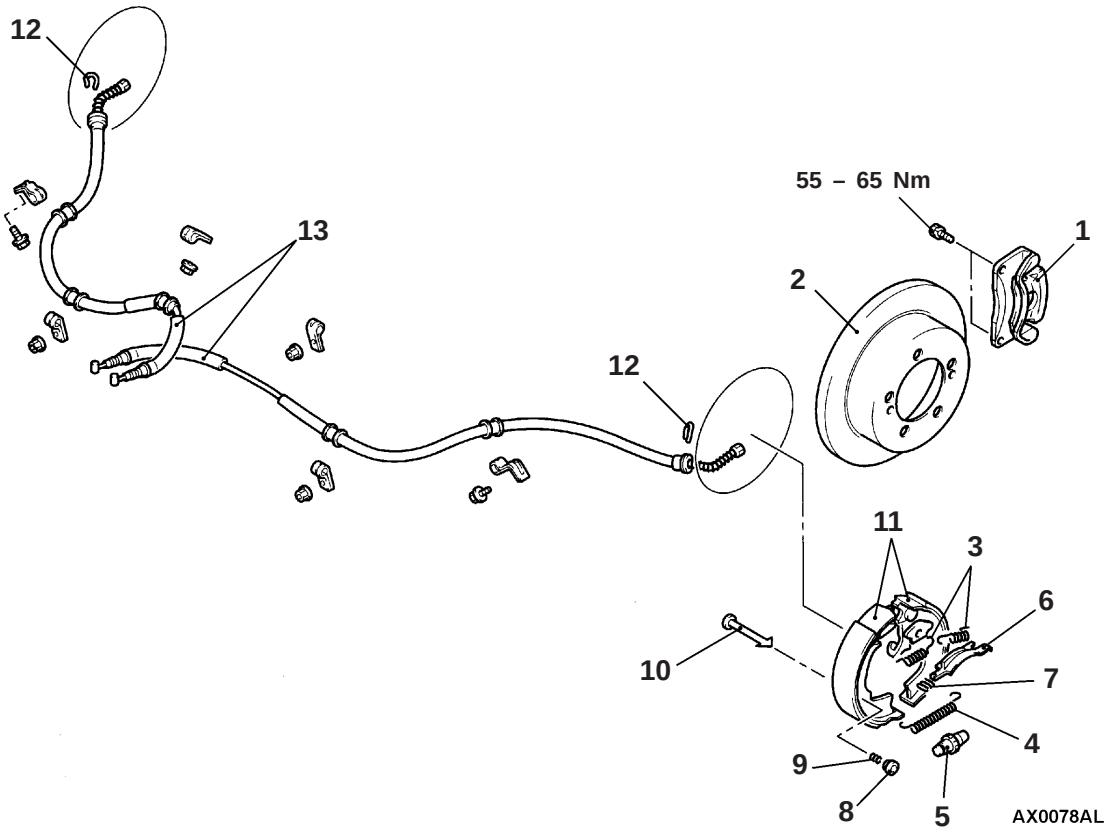
Removal steps
1. Adjusting nut
2. Nut holder
3. Parking brake front cable assembly connection
4. Parking brake lever assembly
5. Parking brake switch

PARKING BRAKE CABLE

REMOVAL AND INSTALLATION

Pre-removal Operation
Rear Floor Console Removal
(Refer to GROUP 52A.)

Post-installation Operation
- Parking Brake Lever Stroke Check and Adjustment (Refer to P.36-3.)
- Rear Floor Console Installation (Refer to GROUP 52A.)



Removal steps

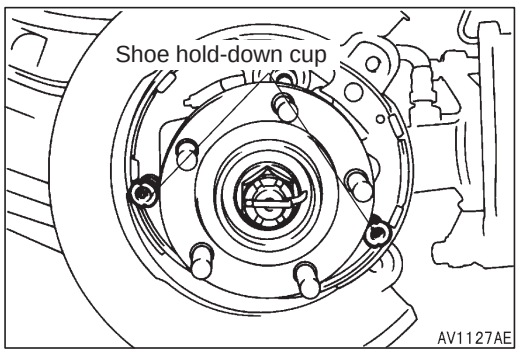
◀A▶ 1. Rear brake caliper assembly
2. Rear brake disc
▶B◀ 3. Shoe-to-anchor spring
4. Adjusting screw spring
▶A◀ 5. Adjuster
6. Strut
7. Strut return spring

◀B▶ 8. Shoe hold-down cup
9. Shoe hold-down spring
10. Shoe hold-down pin
11. Shoe and lining assembly
12. Clip
13. Parking brake cable

REMOVAL SERVICE POINTS

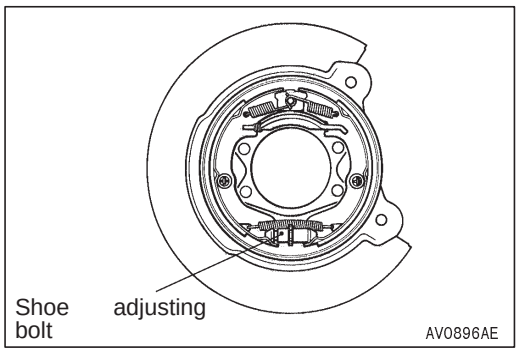
◀A▶ REAR BRAKE CALIPER ASSEMBLY REMOVAL

Remove the rear brake caliper assembly and support it with wire or similar.



◀B▶ SHOE HOLD-DOWN CUP REMOVAL

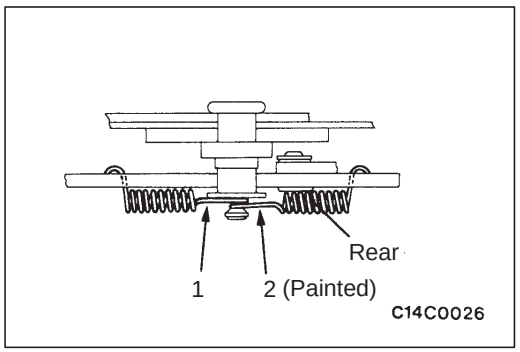
Extend the shoe and lining assembly, and remove the shoe hold-down cup.



INSTALLATION SERVICE POINTS

▶A◀ ADJUSTER INSTALLATION

Install the adjuster so that the shoe adjusting bolt of left hand wheel is attached towards the front of the vehicle, and the shoe adjusting bolt of right hand wheel is towards the rear of the vehicle.



▶B◀ SHOE-TO-ANCHOR SPRING INSTALLATION

Install the shoe-to-anchor springs in the order shown in the illustration.

Caution
The load on the respective shoe-to-anchor springs is different, so the spring in the figure has been painted.

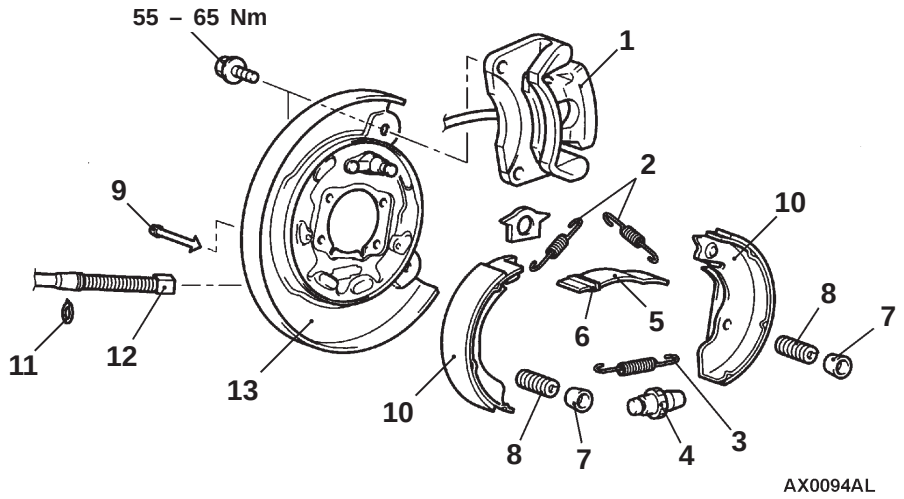
NOTE
The figure shows the left wheel; for the right wheel, the position is symmetrical.

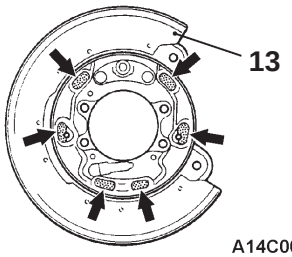
PARKING BRAKE DRUM

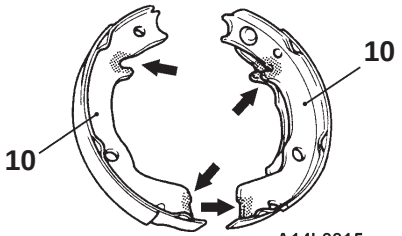
REMOVAL AND INSTALLATION

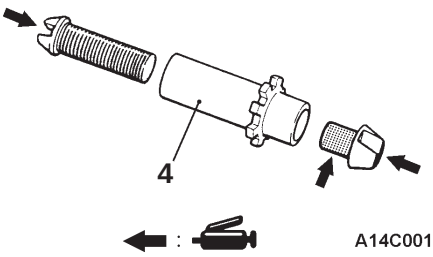
Pre-removal Operation
Drive Shaft Removal (Refer to GROUP 27B.)

Post-installation Operation
- Drive Shaft Installation (Refer to GROUP 27B.)
- Parking Brake Lever Stroke Check and Adjustment (Refer to P.36-3.)





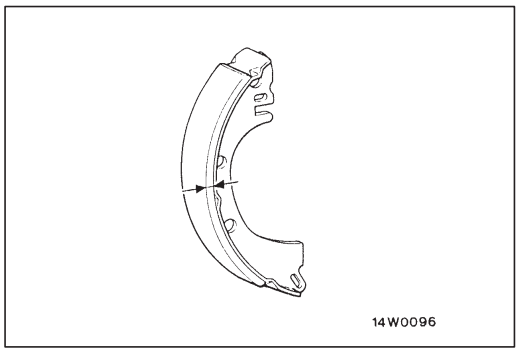


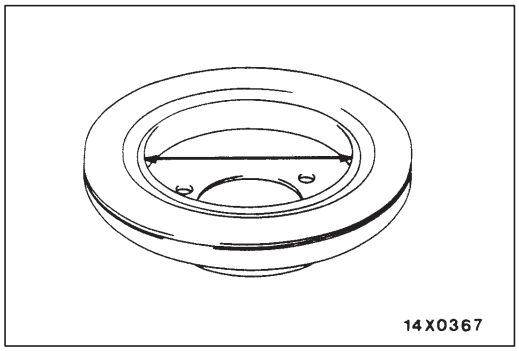


Brake grease: Multipurpose grease

Removal steps

1. Rear brake caliper assembly (Refer to P.36-7)
2. Shoe-to-anchor spring (Refer to P.36-7)
3. Adjusting screw spring
4. Adjuster (Refer to P.36-7)
5. Strut
6. Strut return spring
7. Shoe hold-down cup (Refer to P.36-7)
8. Shoe hold-down spring
9. Shoe hold-down pin
10. Shoe and lining assembly
11. Clip
12. Parking brake cable
13. Backing plate





INSPECTION

BRAKE LINING AND BRAKE DRUM CHECK

1. Measure the thickness of the brake lining at several places.

   Standard value: 2.8 mm

   Limit: 1.0 mm

2. If the thickness of the brake lining has worn down to the limit value or more, replace the shoe and lining assemblies on both sides of the vehicle.

3. Measure the inside diameter of the brake disc in two places or more.

   Standard value: 168.0 mm

   Limit: 169.0 mm

4. If the inside of the brake disc has worn down to the limit value or more, or if it is excessively worn on one side, replace the brake disc.

NOTES

GROUP 36
PARKING BRAKES

GENERAL

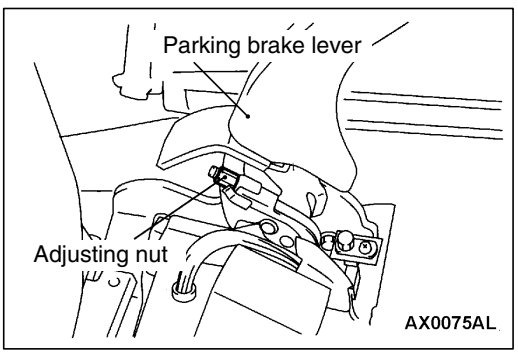
OUTLINE OF CHANGE

The following service procedures have been established due to the adoption of rear drum brake. <1800-MPI>

- Parking brake lever stroke check and adjustment
- Parking brake cable removal and installation

SERVICE SPECIFICATIONS

Items	1800-MPI	
	Standard value	Limit
Parking brake lever stroke	5 – 7 notches	–
Rear brake lining thickness mm	4.9	1.0
Rear drum inside diameter mm	228.6	230.6



ON-VEHICLE SERVICE

PARKING BRAKE LEVER STROKE CHECK AND ADJUSTMENT <1800-MPI>

LEVER STROKE CHECK (WITH FORCE OF 196 N APPLIED)

Standard value: 5 – 7 notches

LEVER STROKE ADJUSTMENT

1. Loosen the adjusting nut up to the cable end to free the cable.
2. Depress the brake pedal hard two or three times.

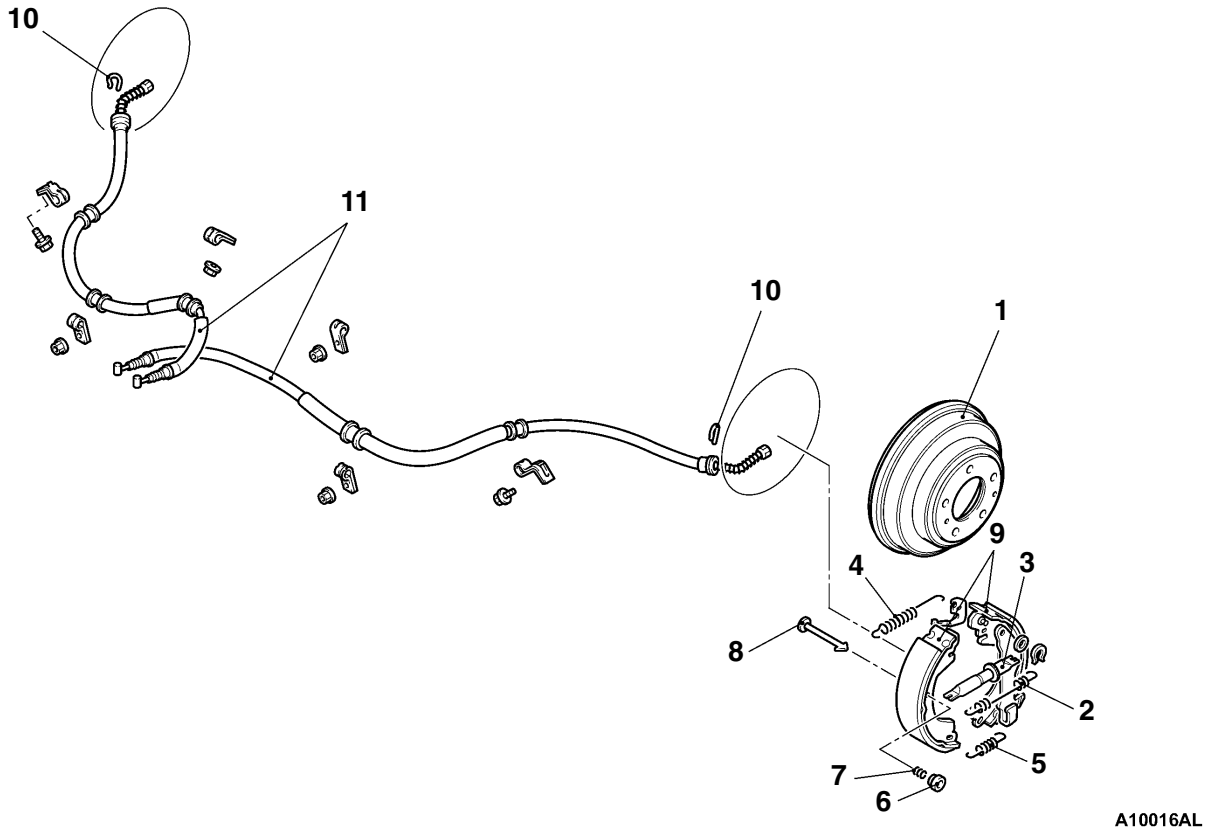
   NOTE
   Depressing the brake pedal allows the shoe clearance to be adjusted correctly.
3. Adjust the parking brake lever stroke. Then, jack up the vehicle in its rear. Release the parking brake and rotate the rear tyres to check that no drag exists.

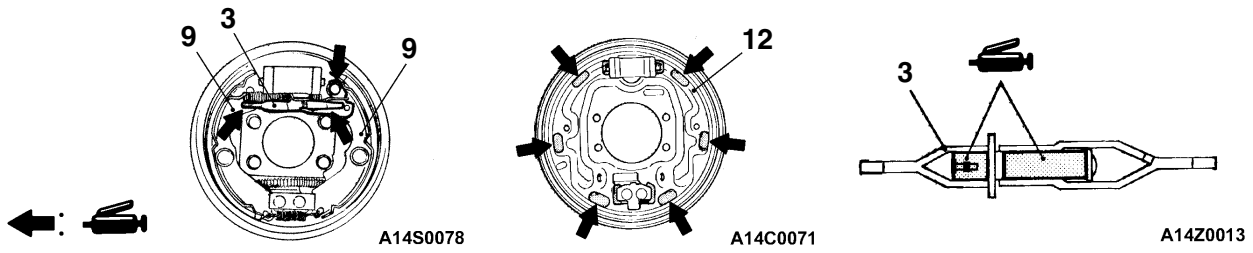
PARKING BRAKE CABLE <1800-MPI>

REMOVAL AND INSTALLATION

Pre-removal Operation
Rear Floor Console Removal

Post-installation Operation
- Parking Brake Lever Stroke Check (Refer to P.36-1.)
- Rear Floor Console Installation





Brake grease: Multipurpose grease

Removal steps

1. Brake drum
2. Shoe-to-lever spring
3. Auto-adjuster assembly
4. Shoe-to-shoe spring
5. Retainer spring
6. Shoe hold-down cup
7. Shoe hold-down spring
8. Shoe hold-down pin
9. Shoe and lining assembly
10. Clip
11. Parking brake cable
12. Backing plate

STEERING

STEERING

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SERVICE SPECIFICATIONS 4

LUBRICANTS 4

SEALANT AND ADHESIVE 4

SPECIAL TOOLS 5

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- Steering Angle Check 7
- Tie Rod End Ball Joint Starting Torque Check 7
- Stationary Steering Effort Check 8
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- Ball Joint Dust Cover Check 11

STEERING WHEEL AND SHAFT* 12

POWER STEERING GEAR BOX AND LINKAGE 15

POWER STEERING OIL PUMP 29

POWER STEERING OIL HOSES 32

WARNINGS REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLES

WARNING!

(1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver and passenger (from rendering the SRS inoperative).

(2) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.

(3) MITSUBISHI dealer personnel must thoroughly review this manual, and especially its GROUP 52B – Supplemental Restraint System (SRS) before beginning any service or maintenance of any component of the SRS or any SRS-related component.

NOTE

The SRS includes the following components: SRS-ECU, SRS warning lamp, air bag module, clock spring and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents by an asterisk (*).

GENERAL INFORMATION

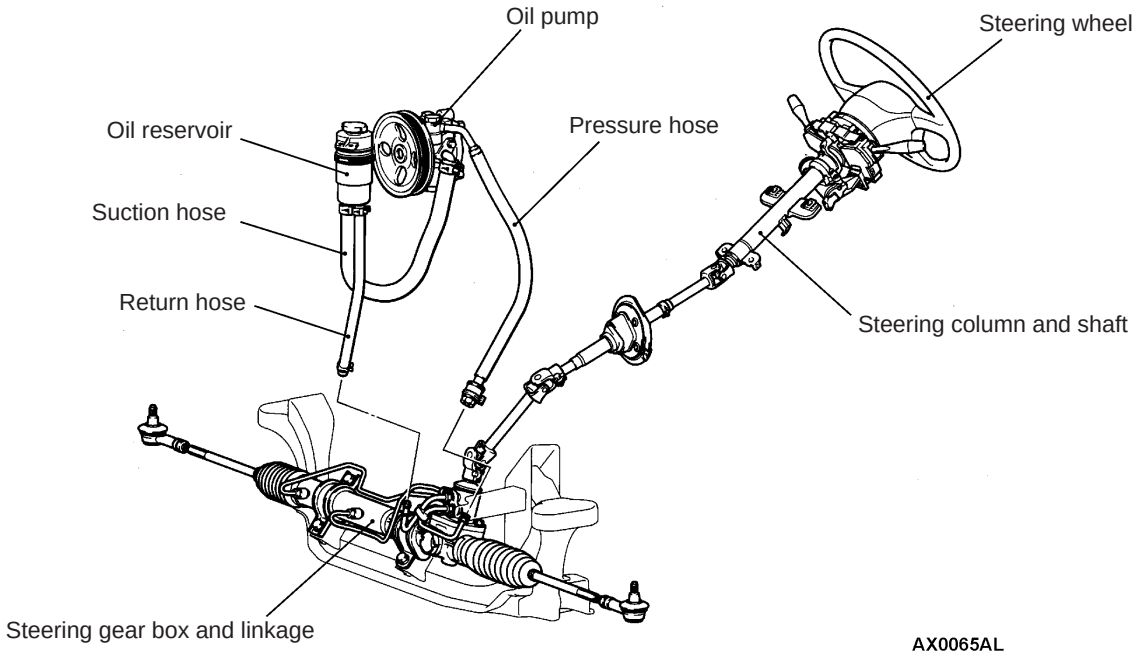
A 4-spoke type steering wheel has been mounted. The power steering is an integral rack and pinion type that combines the steering gear and linkage into one light-weight and compact assembly.

The steering system uses a vane oil pump with a fluid flow control system, so that steering effort varies with engine speed.

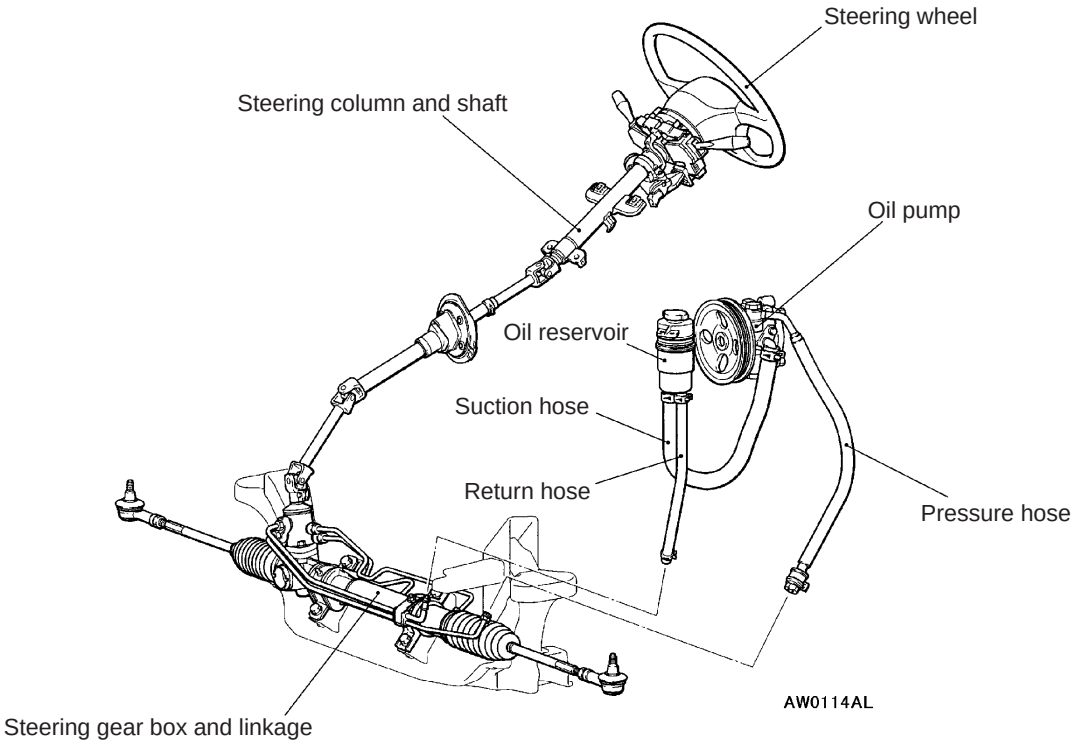
Item		Specifications
Steering gear and linkage	Type	Integral type
	Gear type	Rack and pinion
Oil pump	Type	Vane type
	Displacement mℓ/rev.	7.2
	Relief set pressure Mpa	8.3 – 9.0

CONSTRUCTION DIAGRAM

<L.H. drive vehicles>



<R.H. drive vehicles>



SERVICE SPECIFICATIONS

Item		Standard value	Limit
Steering wheel free play mm	with engine running	–	30 or less
	with engine stopped	0 – 10	–
Steering angle	Inner wheel	34°40' ± 2°	–
	Outer wheel <For reference>	32°10'	–
Ball joint turning torque Nm		0.5 – 2.5	–
Stationary steering effort N	Steering effort	27 or less	30 or less
	Fluctuation allowance	5.9 or less	–
Oil pump relief pressure MPa		8.8	–
Pressure under no-load condition MPa		0.2 – 0.7	–
Steering gear retention hydraulic pressure MPa		8.8	–
Oil pressure switch operating pressure MPa	OFF→ON	1.5 – 2.0	–
	ON→OFF	0.7 – 2.0	–
Pinion total rotation torque Nm	Total rotation torque	0.6 – 1.5	–
	Torque variation	0.5 or less	–
Tie rod joint swing resistance N (Tie rod joint swing torque Nm)		5 – 17 (1.5 – 4.9)	–
Special tool aperture dimension (MB991561) mm		2.9	–
Band crimped width mm		2.4 – 2.8	–

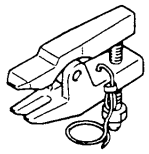
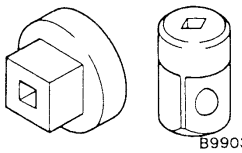
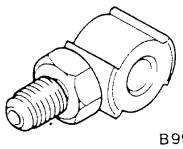
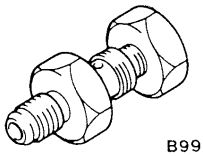
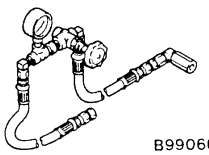
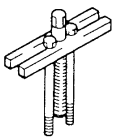
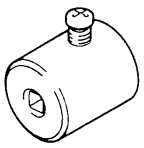
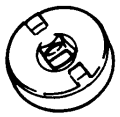
LUBRICANTS

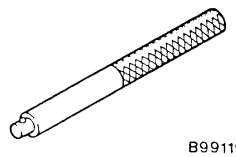
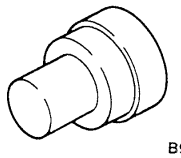
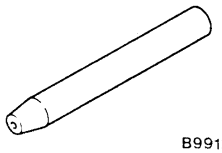
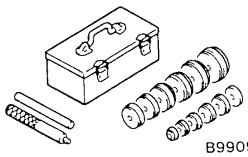
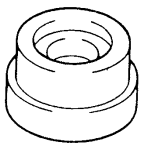
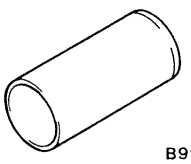
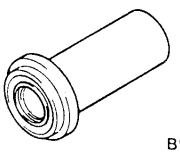
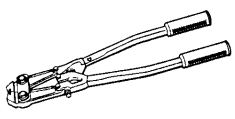
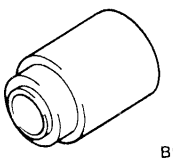
Item	Specified lubricant	Quantity
Power steering	Automatic transmission fluid DEXRON or DEXRON II	Approx. 0.6 ℓ
Tie rod bellows	Silicone grease	As required
Pinion and valve assembly	Repair kit grease	As required
Rack assembly	Repair kit grease	As required

SEALANT AND ADHESIVE

Item	Specified sealant	Remarks
Rack support cover end plug	3M ATD Part No. 8661 or equivalent	Semi-drying sealant
Gear housing mounting rubber	3M ATD Part No. 8155 or equivalent	Quick fix adhesive

SPECIAL TOOLS

Tool	Number	Name	Use
 B991113	MB990635, MB991113 or MB991406	Steering linkage puller	Tie rod end disconnection
 B990326	MB990326	Preload socket	Ball joint turning torque measurement
 B990993	MB990993	Power steering oil pressure gauge adapter (pump side)	Oil pressure measurement
 B990994	MB990994	Power steering oil pressure gauge adapter (hose side)	
 B990662	MB990662	Oil pressure gauge assembly	
 B990803	MB990803	Steering wheel puller	Steering wheel disconnection
 B991006	MB991006	Preload socket	Total pinion torque measurement
 B991621	MB991621	Rack support cover wrench	• Rack support cover removal • Total pinion torque adjustment

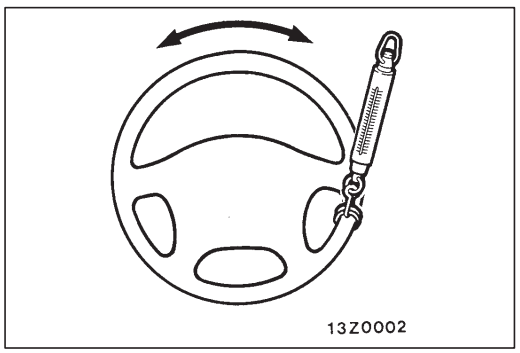
Tool	Number	Name	Use
 B991197	MB991197	Bar (long type)	Gear housing oil seal press fitting
 B991198	MB991199	Oil seal installer	
 B991212	MB991213	Oil seal protector	Rack assembly installation
 B990925	MB990925	Bearing and oil seal installer set	Oil seal and bearing press fitting (Refer to GROUP 26 – Special Tools.)
 B991203	MB991203	Oil seal and bearing installer	Valve housing oil seal and bearing press fitting
 B991317	MB991317	Seal ring installer	Pinion seal ring compression
 B990941	MB990941	Torque tube bearing installer	Valve housing lower oil seal press fitting
	MB991561	Boot band crimping tool	Bellows band installation
 B990776	MB990776	Front axle base	Dust cover press fitting

ON-VEHICLE SERVICE

STEERING WHEEL FREE PLAY CHECK

1. With the engine running (hydraulic pressure operating), put the front wheels in straight-ahead position.
2. Lightly turn the steering wheel left and right to measure circumferential play on the steering wheel before the wheels start to move.

   Limit: 30 mm or less



3. When the play exceeds the limit, check steering shaft connections and steering linkage for looseness. Repair or replace if necessary.
4. If the play still exceeds the limit, put the steering wheel in straight-ahead position with the engine stopped. Then, load 5 N in the circumferential direction on the steering wheel and measure circumferential play.

   Standard value: 0 – 10 mm
5. In case the play exceeds the standard value again, remove the steering gear box and linkage. Then, check and adjust total pinion torque. (Refer to P.37A-18.)

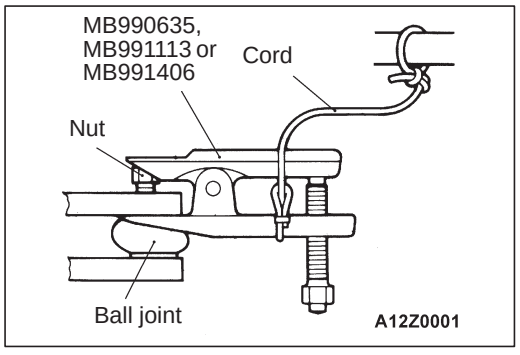
STEERING ANGLE CHECK

1. Put the front wheels on a turning radius gauge and measure steering angle.

   Standard value:

Inner wheels	34°40' ± 2°
Outer wheels <For reference>	32°10'

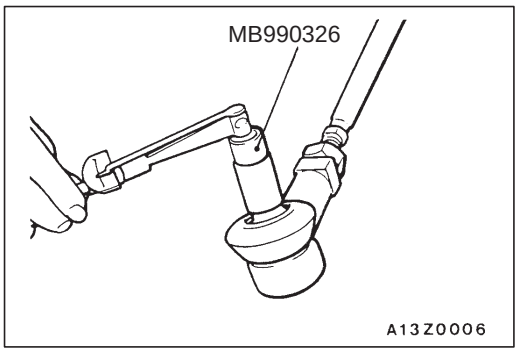
2. If the standard values are not met, toe-in is probably incorrect. Adjust the toe-in, seeing GROUP 33A – On-vehicle Service, and recheck the steering angle.



TIE ROD END BALL JOINT STARTING TORQUE CHECK

1. Use the special tool to disconnect the tie rod and knuckle.

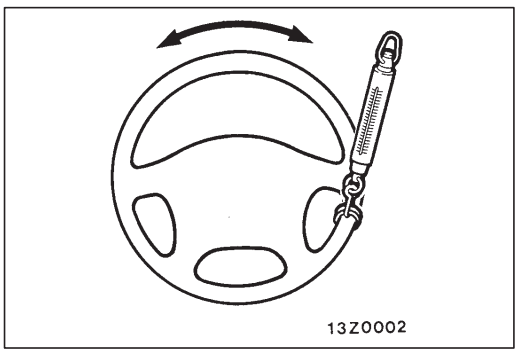
   Caution
   (1) In order not to damage the ball joint thread, the tie rod end mounting nut must be only loosened but not removed from the ball joint. Also, be sure to use the special tool.
   (2) Tie the special tool with a cord so as not to fall off.



2. After swinging the ball joint stud several times, install the nut on the stud. Then, measure ball joint turning torque with the special tool.

   Standard value: 0.5 – 2.5 Nm

3. When the torque is over the standard value, replace the tie rod end.
4. When the torque is below the standard value, check the ball joint for looseness or ratcheting. If none of these found, the ball joint is still serviceable.



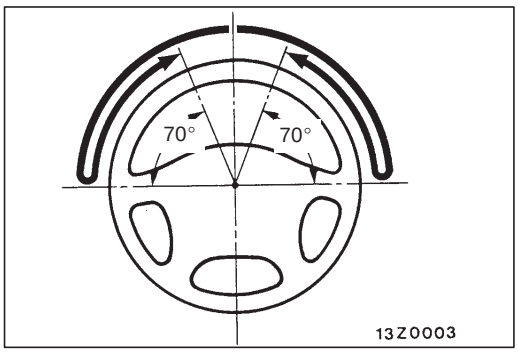
STATIONARY STEERING EFFORT CHECK

1. With the vehicle stopped on a flat, paved surface, put the steering wheel in straight–ahead position.
2. Start the engine and keep it at 1,000±100 r/min.
3. Attach a spring balance to the steering wheel outer bar. Measure steering effort required to turn the steering wheel from the straight-ahead position to the left and right (within a range of 1.5 turns). Also see that no significant fluctuation is present in the steering effort.

   Standard value:

Steering effort	27 N or less <Limit: 30 N or less>
Fluctuation	5.9 N or less

4. If the standard values are not met, check and adjust the related parts.



STEERING WHEEL RETURNABILITY CHECK

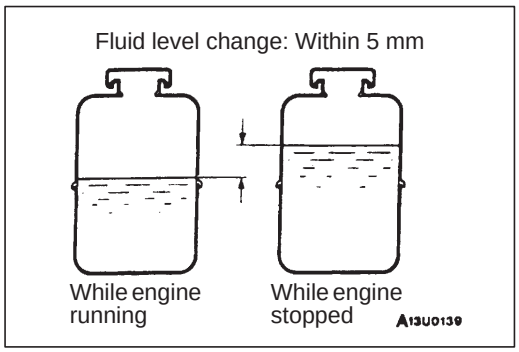
Check returnability as follows on road test:

1. Make both gradual and sudden turns and see by your own feeling that the steering effort and returnability have no difference between the left and right turns.
2. At a speed of about 35 km/h, turn the steering wheel 90°, keep it there for 1 to 2 seconds and release. When the steering wheel returns more than 70°, it has a good returnability.

   NOTE
   You may have momentary increase in effort when turning the steering wheel quickly, which is normal. This happens due to insufficient job of the oil pump when the engine is running at low speed such as idling.

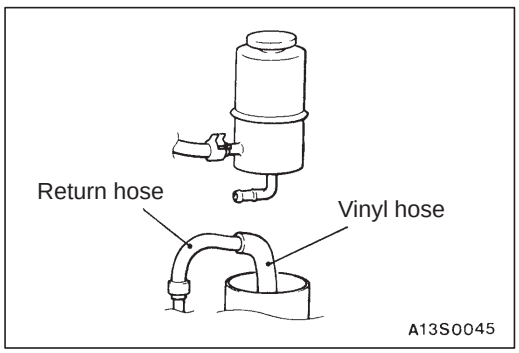
OIL PUMP BELT TENSION CHECK

Refer to GROUP 11A – On-vehicle Service.



POWER STEERING FLUID LEVEL CHECK

1. Park the vehicle on a flat, level surface and start the engine. Without the vehicle moving, turn the steering wheel several times until the fluid reaches 50 to 60°C.
2. With the engine running, turn the wheel fully left and right several times.
3. Check the fluid in the oil reservoir for foaming or milkiness.
4. Check difference in fluid level between the engine stopped and running. If the difference is 5 mm or more, bleed air.



POWER STEERING FLUID REPLACEMENT

1. Jack up the vehicle and support the front wheels with rigid racks.
2. Disconnect the return hose.
3. Connect a vinyl hose to the return hose and drain fluid into a container.
4. Disconnect the ignition coil connectors. (Refer to GROUP16 – Ignition System.)
5. Cranking the engine several times intermittently with the starter, turn the steering wheel fully left and right to drain the fluid.
6. Connect the return hose and secure it with the clip.
7. Fill the oil reservoir with specified fluid up to between “MAX” and “MIN” marks, and then bleed air.

Specified fluid:
Automatic transmission fluid
DEXRON or DEXRON II

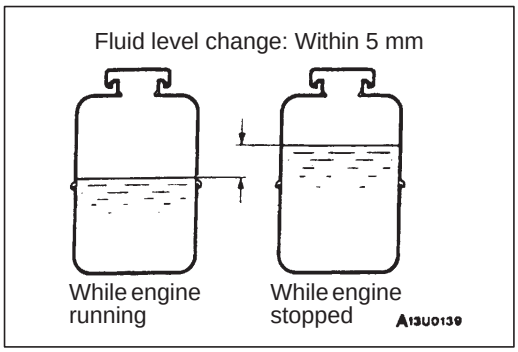
Caution
Do not use ATF-SP II as it damages the components of the power steering.

POWER STEERING SYSTEM BLEEDING

1. Jack up the vehicle and support the front wheels with rigid racks.
2. Disconnect the ignition coil connectors. Cranking the engine with the starter several times intermittently (during 15 to 20 seconds), turn the steering wheel left and right fully five or six times.

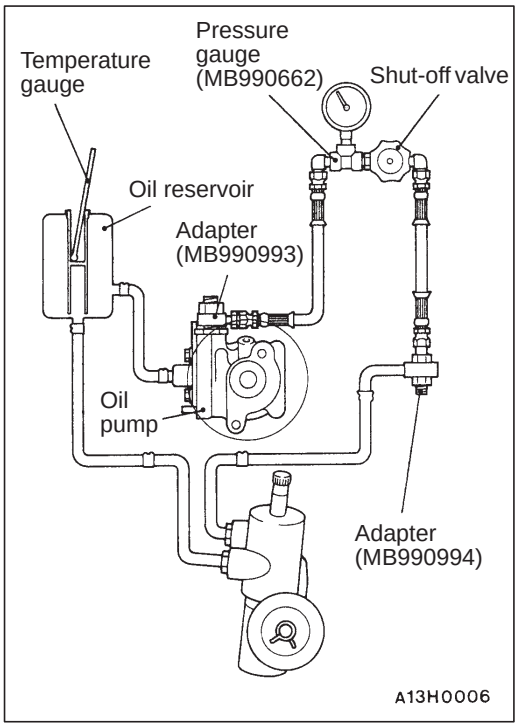
Caution
(1) During the bleeding, refill the fluid so that the level is always above “MIN” mark on the oil reservoir.
(2) Be sure to bleed air only while cranking. If the bleeding is done with the engine running, the air will be broken up and absorbed into the fluid.

3. Connect the ignition coil connectors and idle the engine.
4. Turn the steering wheel left and right fully until no bubbles comes out in the oil reservoir.
5. See that the fluid is not milky and that the fluid level is between “MAX” and “MIN” marks.
6. See that the fluid level changes little when the steering wheel is turned left and right.
7. Check difference in fluid levels between the engine stopped and running.



8. If the level changes more than 5 mm, the air is badly bled. So, bleed air again.

Caution
(1) If the fluid level rises suddenly after the engine is stopped, the bleeding is incomplete.
(2) Incomplete bleeding causes abnormal noises from the pump and the flow-control valve. This could lessen the life of the pump and the other parts.



OIL PUMP PRESSURE TEST

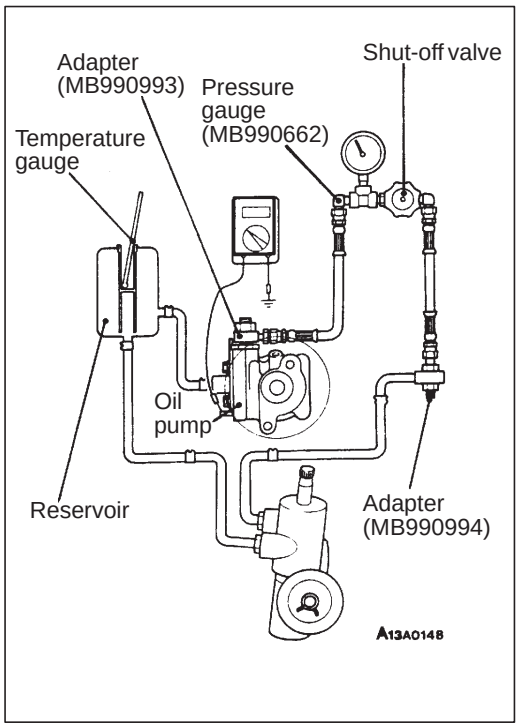
1. Disconnect the pressure hose from the oil pump, and then connect the special tools.
2. Bleed air. Without the vehicle moving, turn the steering wheel several times to raise the fluid temperature to 50 to 60°C.
3. Start the engine and idle at 1,000±100 r/min.
4. Fully close the shut-off valve of the pressure gauge and measure the oil pump relief pressure.

   Standard value: 8.3 – 9.0 MPa
5. If the standard value is not met, disassemble and assemble the oil pump again. Then, remeasure oil pressure.
6. With the pressure gauge shut–off valve fully open, check the hydraulic pressure in unladen condition.

   Standard value: 0.2 – 0.7 MPa
7. If the standard value is not met, the oil line or steering gear is probably defective. So, repair and measure oil pressure again.
8. Turn the steering wheel fully either left or right and check the retention hydraulic pressure.

   Standard value: 8.3 – 9.0 MPa
9. If the pressure is below the standard value, disassemble and reassemble the steering gear. If above, disassemble and reassemble the components of the oil pump flow control valve. Then, measure oil pressure again.
10. Remove the special tools, and tighten the pressure hose to the specified torque.

    Tightening torque: 57 Nm
11. Bleed the system.



POWER STEERING OIL PRESSURE SWITCH CHECK

1. Disconnect the pressure hose from the oil pump and connect the special tools.
2. Bleed air. Without the vehicle moving, turn the steering wheel several times to raise the fluid temperature to 50 to 60°C.
3. Idle the engine.
4. Disconnect the oil pressure switch connector and set an ohmmeter in position.
5. Gradually close the shut-off valve in the pressure gauge to increase hydraulic pressure. Check that the hydraulic pressure activating the switch meets the standard value.

   Standard value: 1.5 – 2.0 MPa
6. Gradually open the shut-off valve and reduce the hydraulic pressure. Check that the hydraulic pressure deactivating the switch meets the standard value.

   Standard value: 0.7 – 2.0 MPa
7. Remove the special tools and tighten the pressure hose to the specified torque.

   Tightening torque: 57 Nm
8. Bleed the system.

BALL JOINT DUST COVER CHECK

1. Check the dust cover for cracks or damage by pushing it with finger.
2. If the dust cover is cracked or damaged, replace the tie rod end.

   NOTE
   A cracked or damaged dust cover may damage the ball joint.

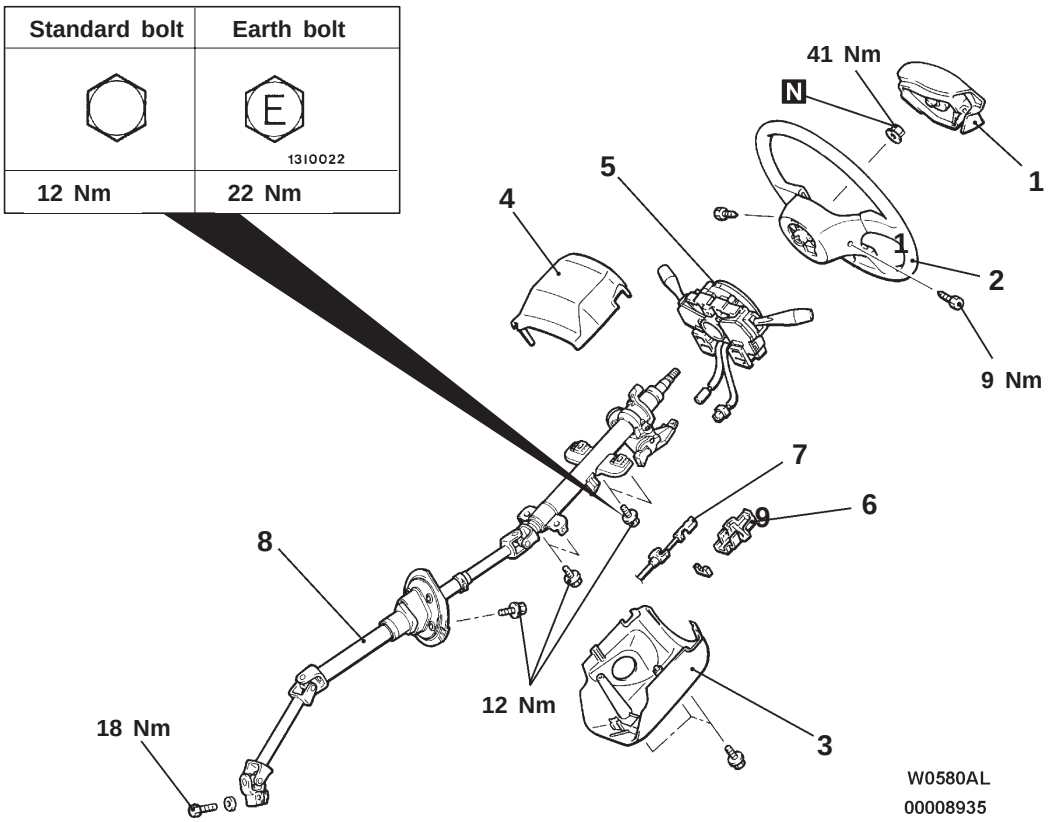
STEERING WHEEL AND SHAFT

REMOVAL AND INSTALLATION

Caution:
1. **Before removing the air bag module and clock spring, refer to GROUP 52B – Service Precautions and Air Bag Module and Clock Spring.**
2. **Use an earth bolt for one of the steering shaft assembly mounting bolts. The earth bolt has mark "E" on its head.**

Pre-removal Operation
Instrument Under Cover Removal
(Refer to GROUP 52A.)

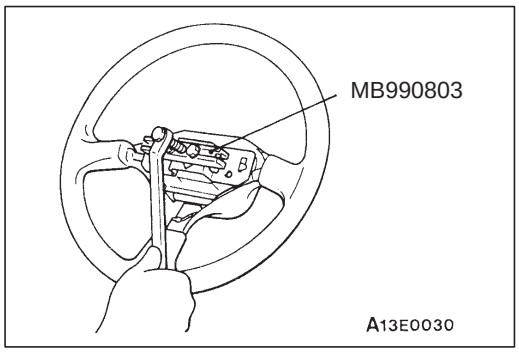
Post-installation Operation
- Instrument Under Cover Installation (Refer to GROUP 52A.)
- Checking Steering Wheel Position with Wheels Straight Ahead



Removal steps

1. Air bag module <Refer to GROUP 52B>
◀A▶ 2. Steering wheel
3. Lower column cover
4. Upper column cover
5. Clock spring and column switch assembly <Refer to GROUP 52B>
6. Cover <A/T>
7. Key interlock cable <A/T>
8. Steering column shaft assembly

NOTE
When the air bag module assembly must be removed, refer to GROUP 52B – Air Bag Modules and Clock Spring.

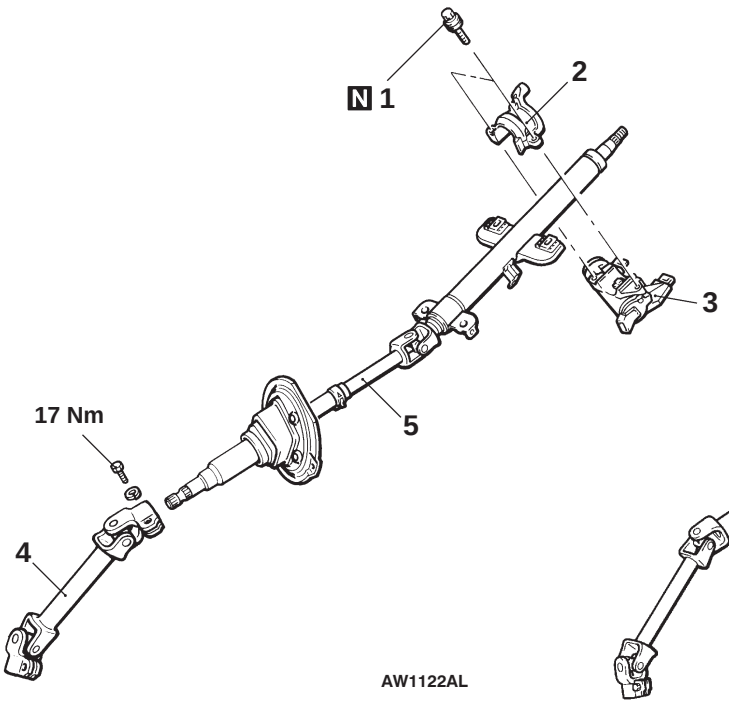


REMOVAL SERVICE POINTS

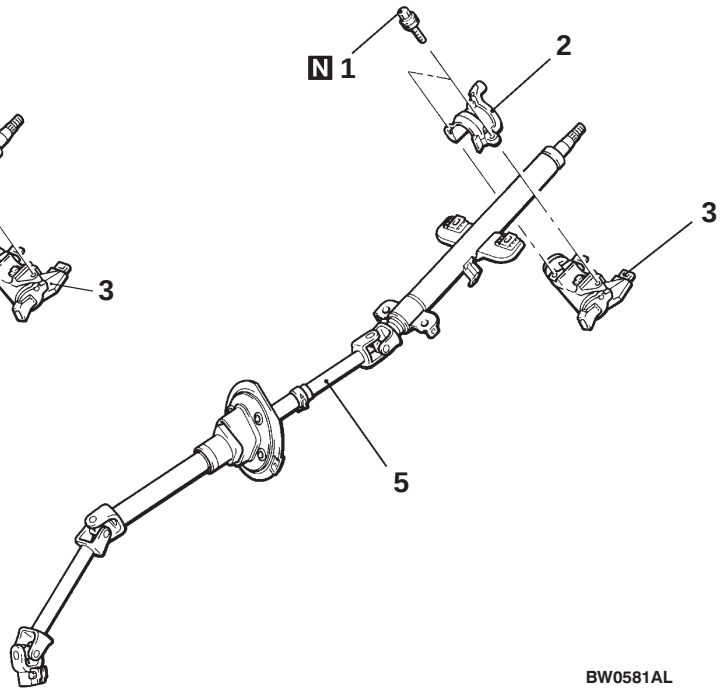
◀A▶ STEERING WHEEL REMOVAL

DISASSEMBLY AND REASSEMBLY

<L.H. drive vehicles>

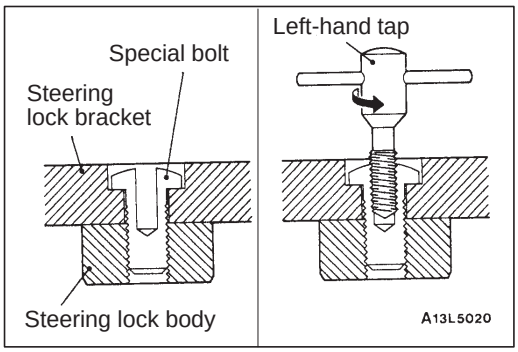


<R.H. drive vehicles>



Disassembly steps

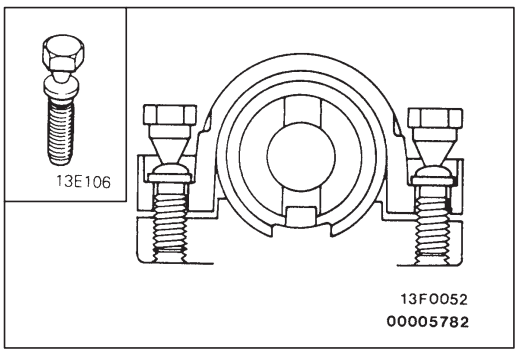
◀A▶ ▶A◀ 1. Special bolt
▶A◀ 2. Steering lock bracket
▶A◀ 3. Steering lock cylinder assembly
4. Shaft assembly <L.H. drive vehicles>
5. Steering column shaft assembly



DISASSEMBLY SERVICE POINT

◀A▶ SPECIAL BOLT REMOVAL

1. In the special bolt, drill a hole deep enough for the tap to stand.
2. Using a left-hand tap, remove the special bolt.



REASSEMBLY SERVICE POINT

▶A◀ STEERING LOCK CYLINDER ASSEMBLY/ STEERING LOCK BRACKET/SPECIAL BOLT INSTALLATION

1. When installing the steering lock cylinder assembly and steering lock bracket to the steering column assembly, temporarily install the steering lock in alignment with the column boss.
2. Check that the steering lock works properly. Then, tighten the special bolts until the heads twists off.

POWER STEERING GEAR BOX AND LINKAGE

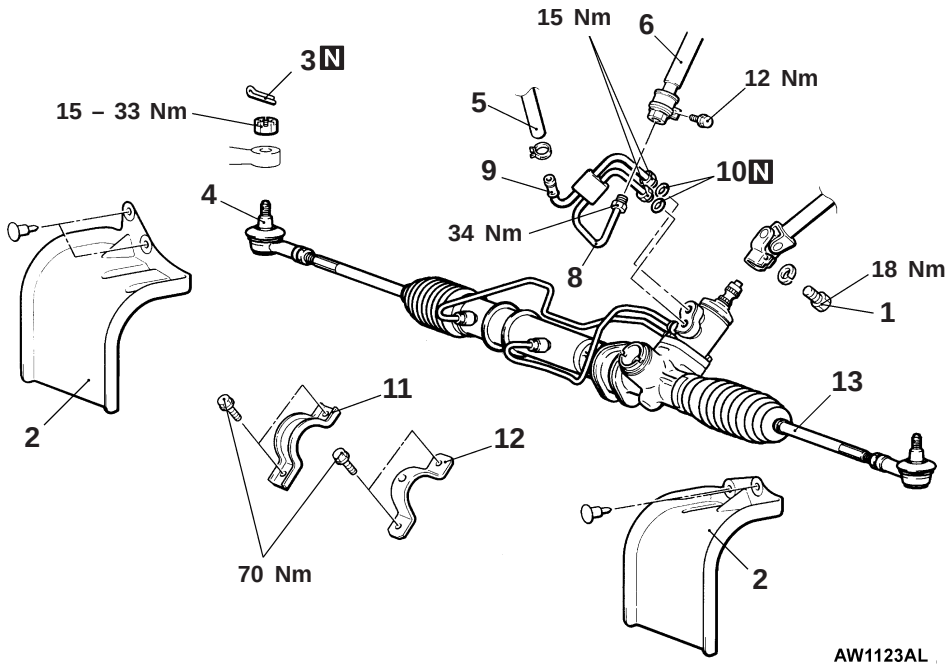
REMOVAL AND INSTALLATION

Caution: SRS
On vehicles with SRS, before removing steering gear box, refer to GROUP 52B. Also, put the front wheels in straight–ahead position and remove the ignition key. Failure to do so may damage the SRS clock spring and render the SRS air bag inoperative, which results serious driver injury.

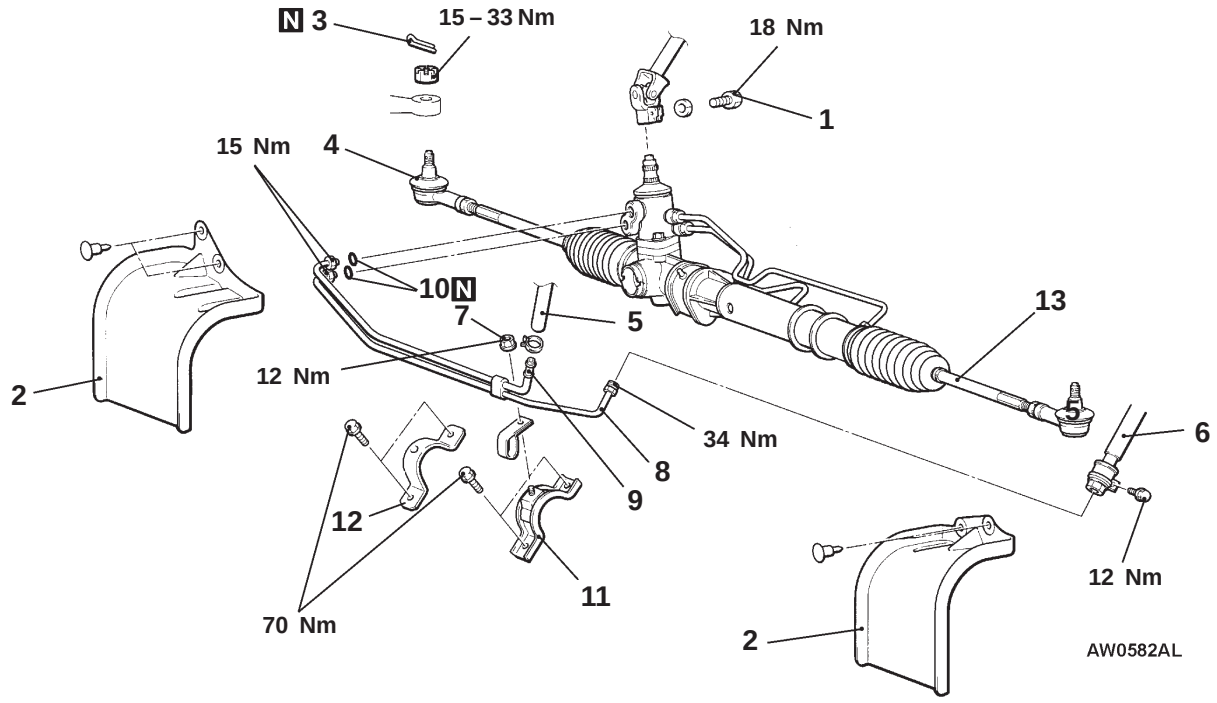
Pre-removal Operation
- Power Steering Fluid Draining (Refer to P.37A-9.)
- Under Cover Removal

Post-installation Operation
- Check the Dust Cover for Cracks or Damage by Pushing it with Finger.
- Under Cover Installation
- Power Steering Fluid Supplying and bleeding (Refer to P.37A-9.)
- Checking Steering Wheel Position with Wheels Straight Ahead
- Front Wheel Alignment Check and Adjustment (Refer to GROUP 33A – On-vehicle Service.)

<L.H. drive vehicles>



<R.H. drive vehicles>



Removal steps

1. Steering gear and joint connecting bolt
2. Splash shield
3. Split pin

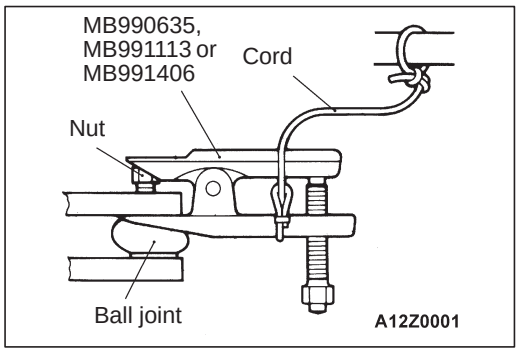
◀A▶ 4. Tie rod end and knuckle connection

▶B◀ 5. Return hose

▶A◀ 6. Pressure hose

7. Nut <R.H drive vehicles>
8. Pressure tube
9. Return tube
10. O-ring
11. Cylinder clamp
12. Gear housing clamp

◀B▶ 13. Steering and gear linkage



REMOVAL SERVICE POINTS

◀A▶ TIE ROD END AND KNUCKLE DISCONNECTION

Caution

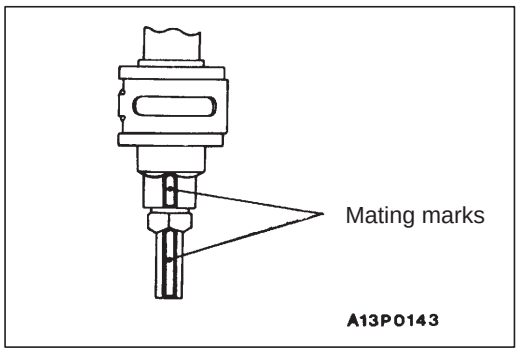
(1) In order not to damage the ball joint thread, the tie rod end mounting nut must be only loosened but not removed from the ball joint. Be sure to use the special tool.

(2) Tie the special tool with a cord so as not to fall off.

◀B▶ STEERING GEAR BOX AND LINKAGE REMOVAL

Caution

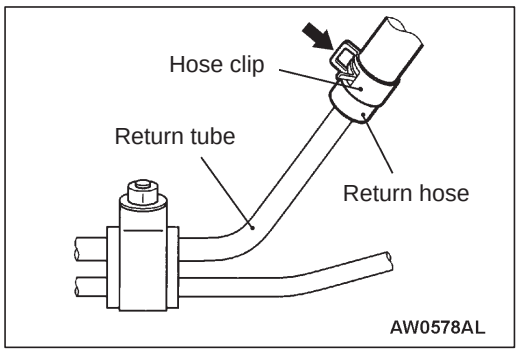
Do not damage the boots when removing the steering gear box and linkage.



INSTALLATION SERVICE POINTS

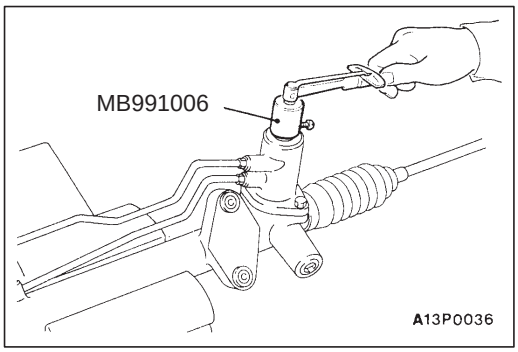
▶A◀ PRESSURE HOSE CONNECTION

Connect the pressure hose and pressure tube with their mating marks aligned.



▶B◀ RETURN HOSE CONNECTION

Connect the return hose so that the claws of the hose clip are positioned as shown.



INSPECTION

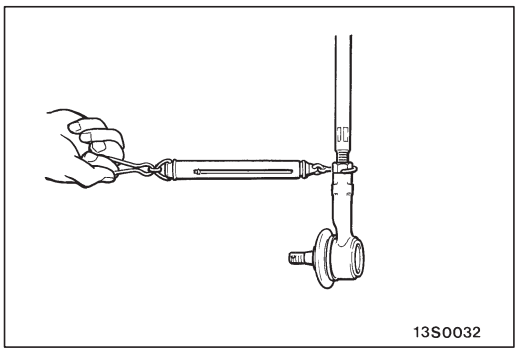
GEAR BOX PINION TOTAL ROTATION TORQUE CHECK

1. Using the special tool, turn the pinion gear at a speed of one rotation per 4 to 6 seconds to measure total rotation torque.

   Standard values:
   Total rotation torque: 0.6 – 1.5 Nm
   Torque fluctuation: 0.5 Nm or less

   NOTE
   (1) Remove the bellows from the rack housing before measuring.
   (2) Measure the total rotation torque by turning the special tool left and right 180° from the neutral position.
2. If the standard values are not met, adjust the pinion total rotation torque. (Refer to P.37-26.)
3. In case the adjustment is impossible, disassemble and check the components, and repair if necessary.

   Caution
   Secure the steering gear box and linkage in their mounting positions only. Otherwise, deformation or damage could result.



TIE ROD SWING RESISTANCE CHECK

1. Swing the tie rod 10 times hardly.
2. With the tie rod end downwards as shown, use a spring scale to measure swing resistance (swing torque).

   Standard value: 5 – 17 N (1.5 – 4.9 Nm)
3. If the measured value is above the standard value, replace the tie rod.
4. If below, check the ball joint for looseness or ratcheting. The tie rod is still serviceable when the ball joint swings smoothly.

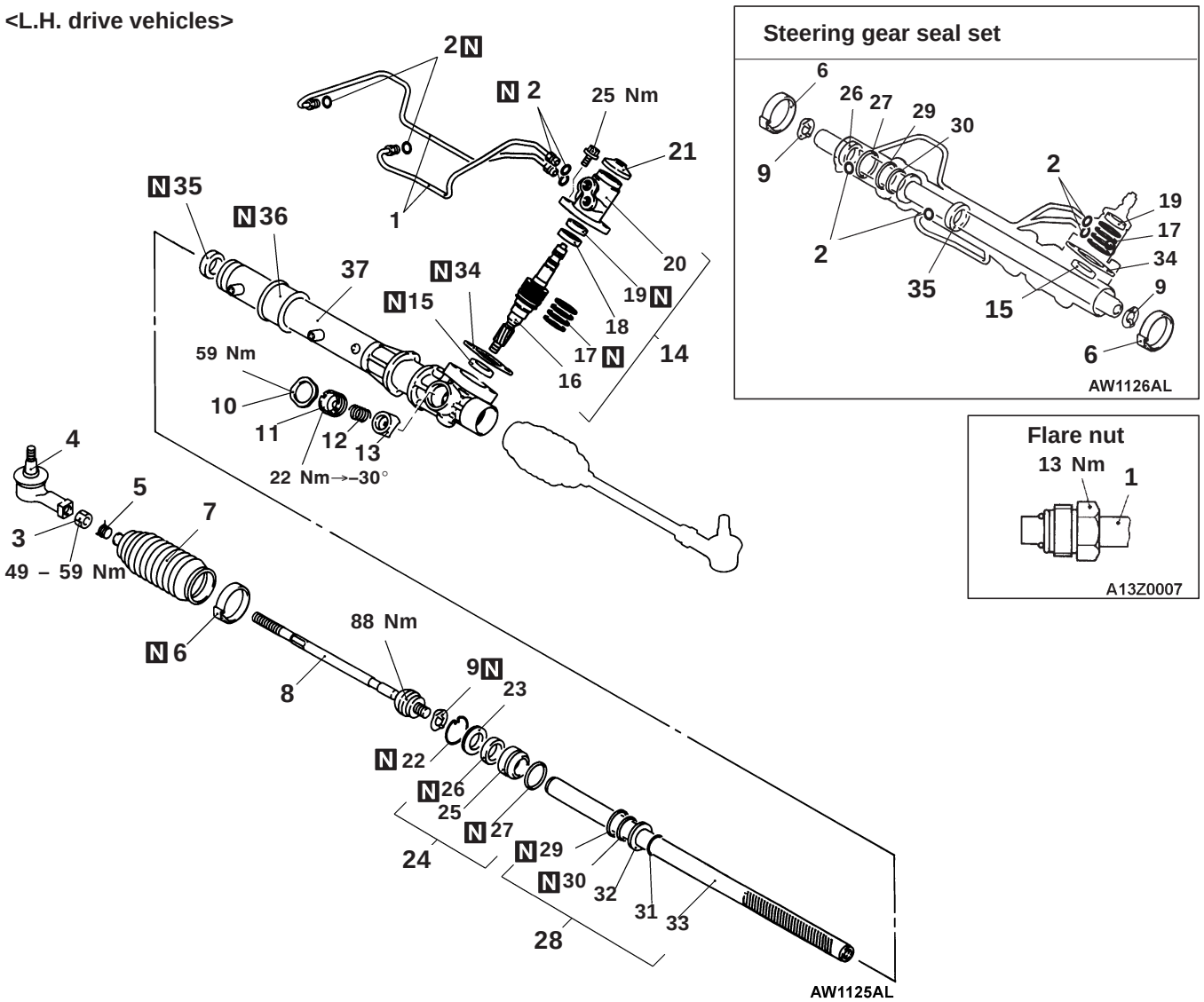
TIE ROD END BALL JOINT DUST COVER CHECK

1. Check the dust cover for cracks or damage by pushing it with finger.
2. If the dust cover is cracked or damaged, replace the tie rod end. (Refer to P.37A-19, 20.)

   NOTE
   A cracked or damaged dust cover may damage the ball joint. Replace the dust cover when it is damaged during service work.

DISASSEMBLY AND REASSEMBLY

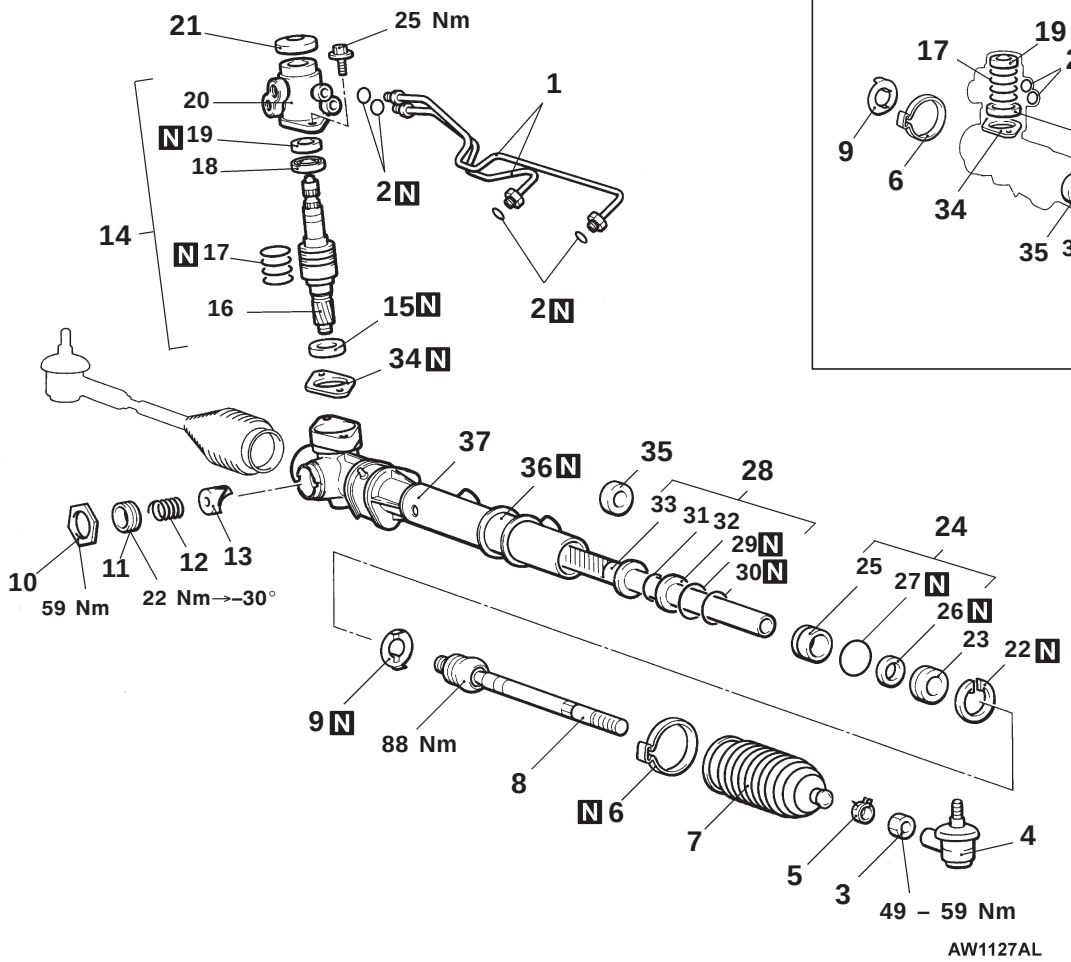
<L.H. drive vehicles>



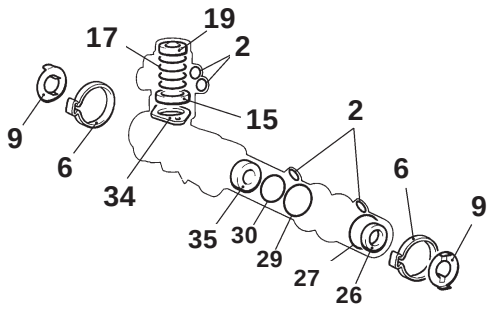
Disassembly steps

- 1. Feed pipe
- 2. O-ring
- ▶M◀ 3. Locking nut
- ▶M◀ 4. Tie rod end
- 5. Clip
- ▶L◀ 6. Band
- 7. Bellows
- ▶K◀ 8. Tie rod
- ▶K◀ 9. Tab washer
- ▶J◀ ● Total pinion torque adjustment
- ▶I◀ 10. Locking nut
- ◀A▶ ▶I◀ 11. Rack support cover
- 12. Rack support spring
- 13. Rack support
- 14. Valve assembly
- ◀B▶ ▶H◀ 15. Lower oil seal
- ◀B▶ 16. Pinion and valve assembly
- ◀C▶ ▶G◀ 17. Seal ring
- ◀D▶ ▶F◀ 18. Upper bearing
- ◀D▶ ▶F◀ 19. Upper oil seal
- 20. Valve housing
- 21. Dust cover
- ◀E▶ ▶E◀ 22. Circlip
- ◀F▶ 23. Rack stopper
- ◀F▶ ▶D◀ 24. Rack bushing assembly
- ◀F▶ ▶D◀ 25. Rack bushing
- ◀F▶ ▶D◀ 26. Oil seal
- ◀F▶ 27. O-ring
- ◀F▶ ▶C◀ 28. Rack assembly
- 29. Piston ring
- 30. O-ring
- 31. Circlip
- 32. Pistion
- 33. Rack
- 34. Gasket
- ◀G▶ ▶B◀ 35. Oil seal
- ▶A◀ 36. Gear housing mounting rubber
- 37. Gear Housing

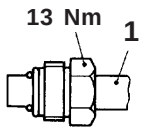
<R.H. drive vehicles>



Steering gear seal set



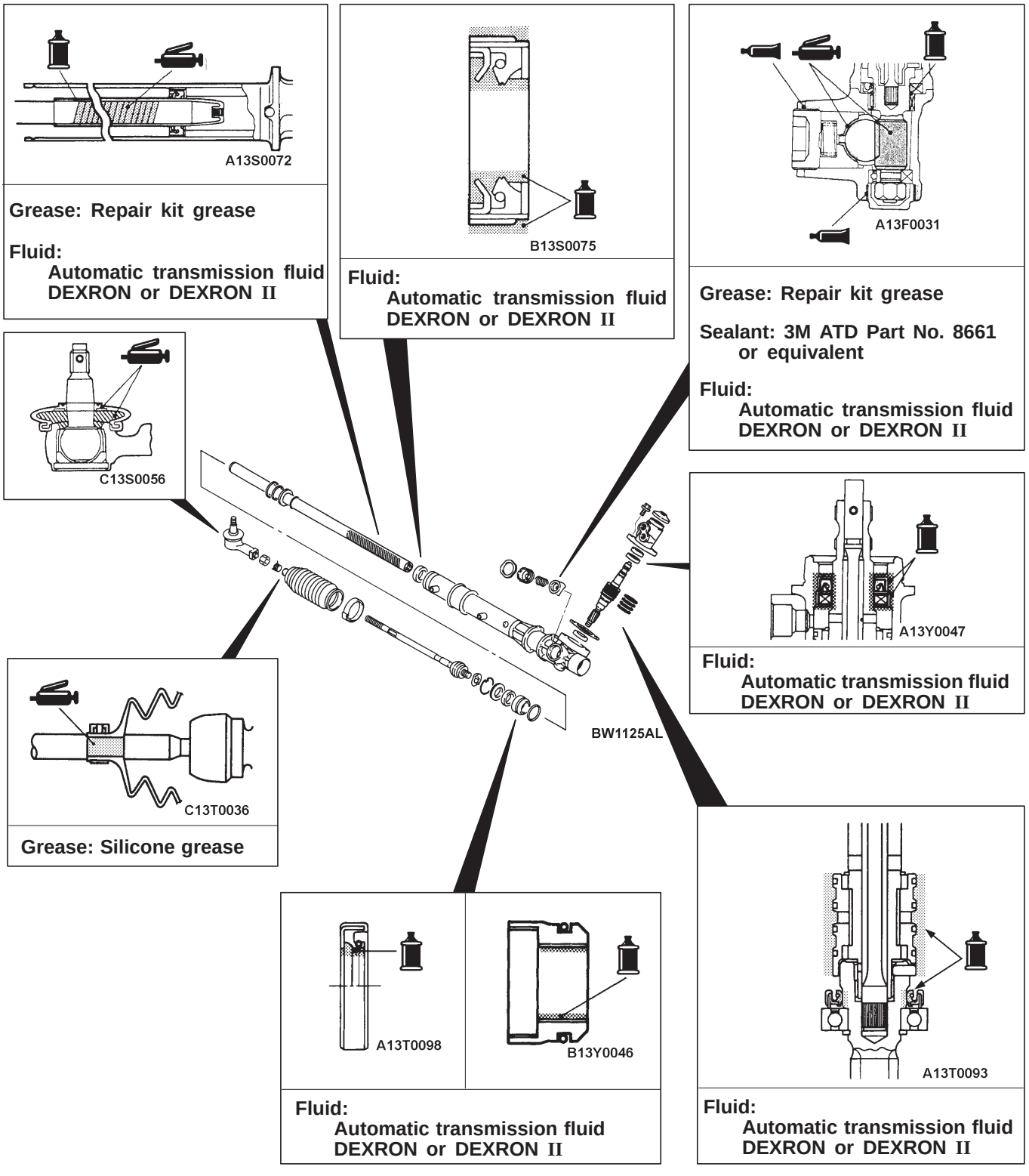
Flare nut

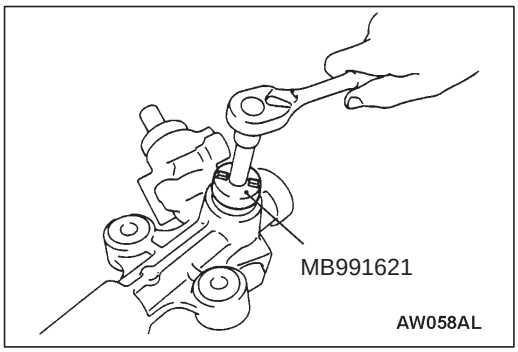


Disassembly steps

1. Feed pipe
2. O-ring
3. ▶M◀ Locking nut
4. ▶M◀ Tie rod end
5. Clip
6. ▶L◀ Band
7. Bellows
8. ▶K◀ Tie rod
9. ▶K◀ Tab washer
- ▶J◀ ● Total pinion torque adjustment
10. ▶I◀ Locking nut
11. ◀A▶ ▶I◀ Rack support cover
12. Rack support spring
13. Rack support
14. Valve assembly
15. ◀B▶ ▶H◀ Lower oil seal
16. ◀B▶ Pinion and valve assembly
17. ◀C▶ ▶G◀ Seal ring
18. ◀D▶ ▶F◀ Upper bearing
19. ◀D▶ ▶F◀ Upper oil seal
20. Valve housing
21. Dust cover
22. ◀E▶ ▶E◀ Circlip
23. ◀F▶ Rack stopper
24. ◀F▶ ▶D◀ Rack bushing assembly
25. ◀F▶ ▶D◀ Rack bushing
26. ◀F▶ ▶D◀ Oil seal
27. ◀F▶ O-ring
28. ◀F▶ ▶C◀ Rack assembly
29. Piston ring
30. O-ring
31. Circlip
32. Pistion
33. Rack
34. Gasket
35. ◀G▶ ▶B◀ Oil seal
36. ▶A◀ Gear housing mounting rubber
37. Gear Housing

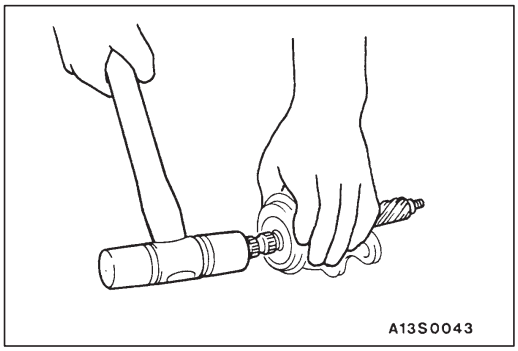
Lubrication and Sealing Points





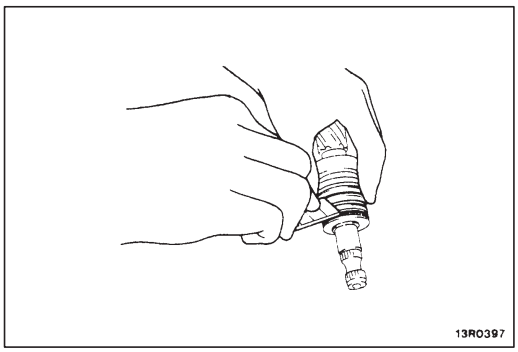
DISASSEMBLY SERVICE POINTS

◀A▶ RACK SUPPORT COVER REMOVAL



◀B▶ OIL SEAL/PINION AND VALVE ASSEMBLY REMOVAL

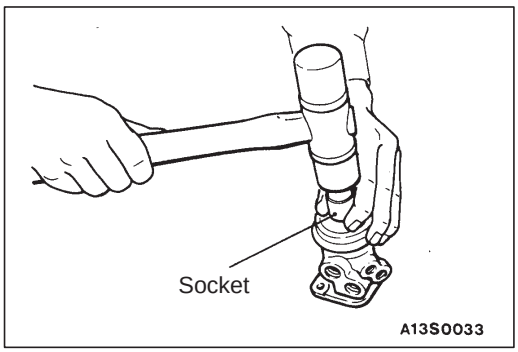
With a plastic hammer, lightly tap the pinion and valve assembly in its spline to remove the lower oil seal and pinion and valve assembly from the valve housing.



◀C▶ SEAL RING REMOVAL

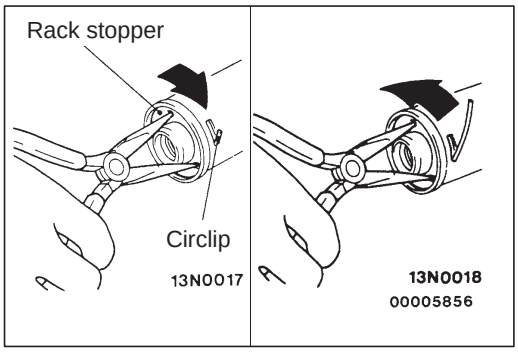
Cut the seal ring to remove from the pinion and valve assembly.

Caution
When cutting the seal ring, be careful not to damage the pinion and valve assembly.



◀D▶ UPPER BEARING/UPPER OIL SEAL REMOVAL

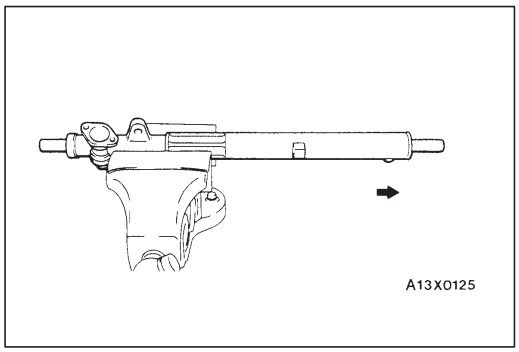
Using a socket, pull out the upper oil seal and bearing from the valve housing.



◀E▶ CIRCLIP REMOVAL

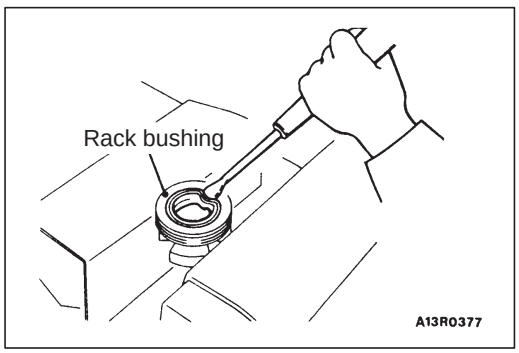
1. Turn the rack stopper clockwise until the circlip end comes out of the slot in the rack housing.
2. Turn the rack stopper anticlockwise to remove the circlip.

Caution
Do not turn the rack stopper anticlockwise first. Otherwise, the circlip will get caught in the slot in the housing, which makes the rack stopper unable to turn.



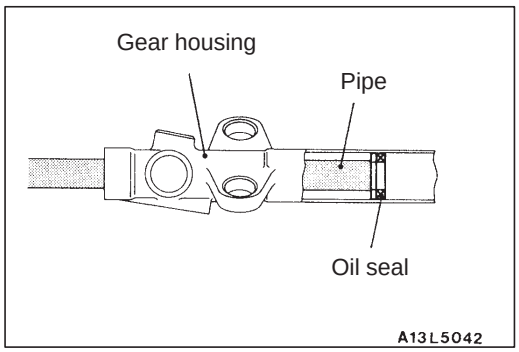
◀F▶ RACK STOPPER/RACK BUSHING ASSEMBLY/ RACK BUSHING/OIL SEAL/O-RING/RACK REMOVAL

1. Remove the rack stopper, rack bushing, oil seal and O-ring together by pulling out the rack gently.



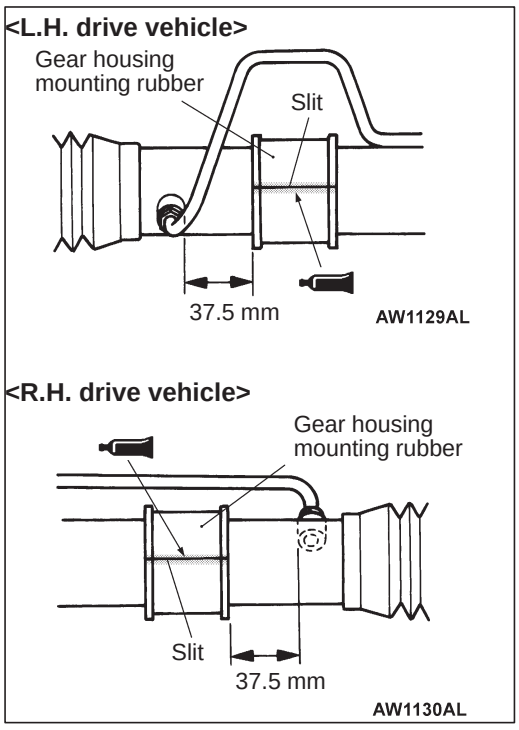
2. Partially bend the oil seal to remove from the rack bushing.

Caution
Use care not to damage the oil seal press-fitting surface of the rack bushing.



◀G▶ OIL SEAL REMOVAL

Use a pipe or the like to pull out the oil seal.



REASSEMBLY SERVICE POINTS

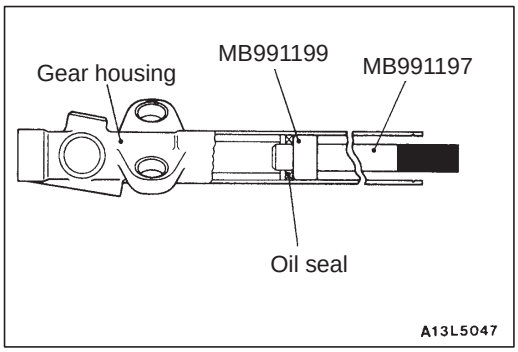
▶A◀ GEAR HOUSING MOUNTING RUBBER INSTALLATION

1. Install the gear housing mounting rubber on the rack housing so that the dimension shown is achieved.

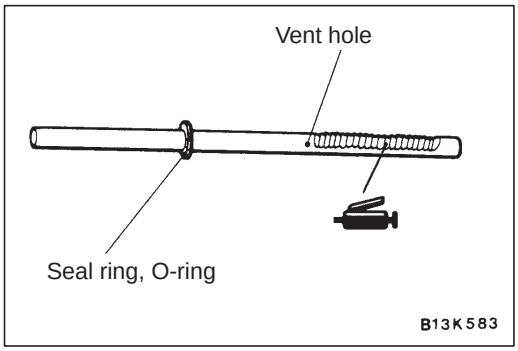
   NOTE
   The gear housing mounting rubber can be installed regardless of the installation direction of the slit.

2. Apply specified adhesive to the slit of the gear housing mounting rubber.

   Specified adhesive:
   3M ATD Part No.8155 or equivalent



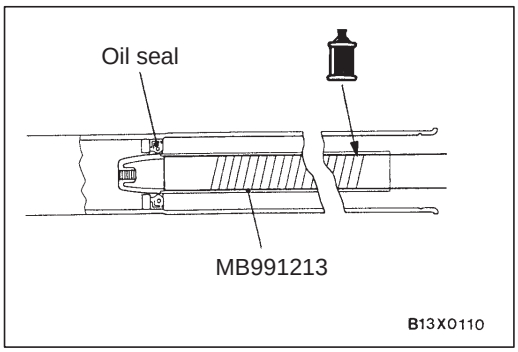
▶B◀ OIL SEAL INSTALLATION



▶C◀ RACK ASSEMBLY INSTALLATION

1. Apply repair kit grease to the teeth of the rack assembly.

   Caution
   Use care not to close the vent hole in the rack with grease.

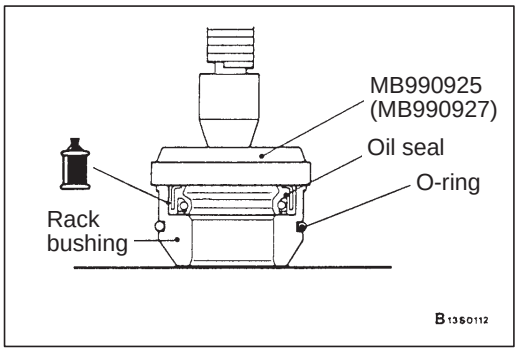


2. Cover the serrations of the rack assembly with the special tool.
3. Apply specified fluid to the outer surfaces of the special tool, seal ring and O-ring.

   Specified fluid:
   Automatic transmission fluid
   DEXRON or DEXRON II

4. Slowly insert the rack covered with the special tool from the power cylinder side of the gear housing.

   Caution
   Carefully push in the rack with the oil seal centre and the special tool end matched. This is to avoid the retainer spring coming off.

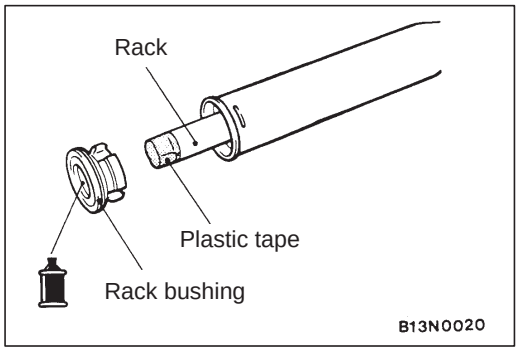


▶D◀ OIL SEAL/RACK BUSHING/RACK BUSHING ASSEMBLY INSTALLATION

1. Apply specified fluid to the outer surface of the oil seal. Using the special tool, press in the oil seal until it is flush with the bushing end face.

   Specified fluid:
   Automatic transmission fluid
   DEXRON or DEXRON II

Caution
Do not use Dia Queen ATF SPII and ATF SPII M as they damage the components of the power steering.

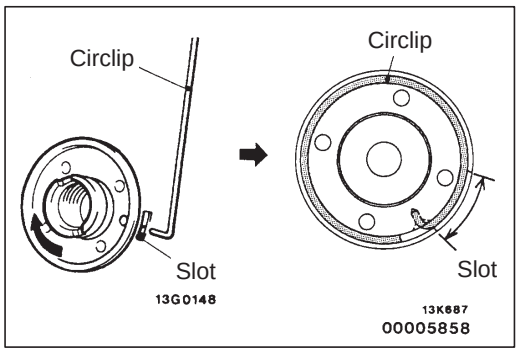


2. Apply the specified fluid to the oil seal inner surface and the O-ring.

   Specified fluid:
   Automatic transmission fluid
   DEXRON or DEXRON II

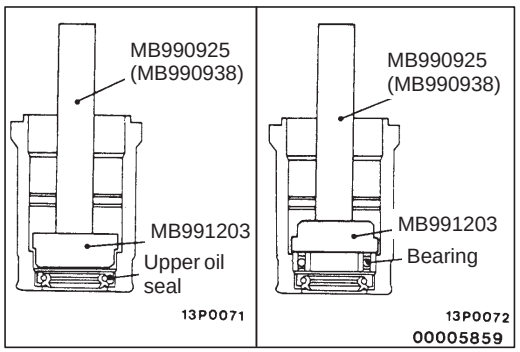
   Caution
   Do not use Dia Queen ATF SPII and ATF SPII M as they damage the components of the power steering.

3. Wrap the rack end with plastic tape, and push the rack bushing onto the rack.

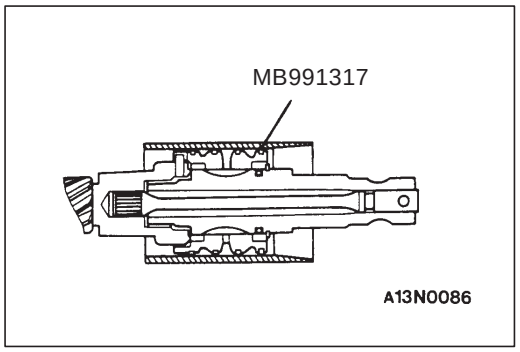


▶E◀ CIRCLIP INSTALLATION

Align the mark on the rack stopper and the slot in the cylinder. Then, insert the circlip into the rack stopper hole through the cylinder hole. Turn the rack stopper clockwise and insert the circlip firmly.

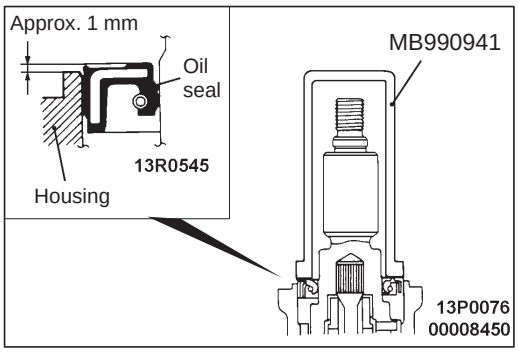


▶F◀ UPPER OIL SEAL/UPPER BEARING INSTALLATION



▶G◀ SEAL RING INSTALLATION

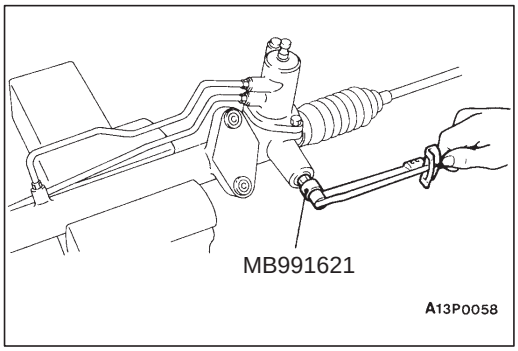
After installation, using the special tool or by hand, compress seal rings that expand during installation.



▶H◀ LOWER OIL SEAL INSTALLATION

Using the special tool, press the oil seal into the valve housing. The upper surface of the oil seal must project outwards about 1 mm from the housing end surface.

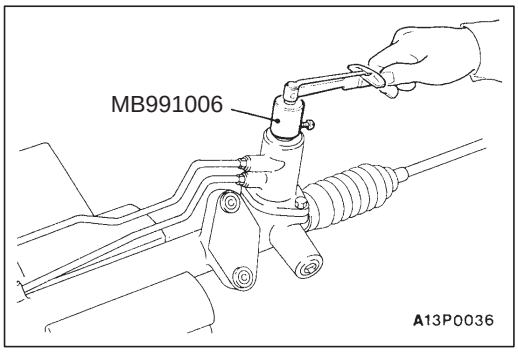
Caution
When the oil seal is flush with or lower than the housing edge, reassemble the components. Otherwise, oil leaks will result.



▶I◀ RACK SUPPORT COVER/LOCKING NUT INSTALLATION

1. Apply specified sealant to the rack cover support thread.

   Specified fluid:
   3M ATD Part No.8661 or equivalent
2. Using the special tool, tighten the rack support cover to 22 Nm.
3. Return the rack support cover by about 30°.
4. Tighten the locking nut to the specified torque, using the special tool to prevent the rack support cover from spinning.

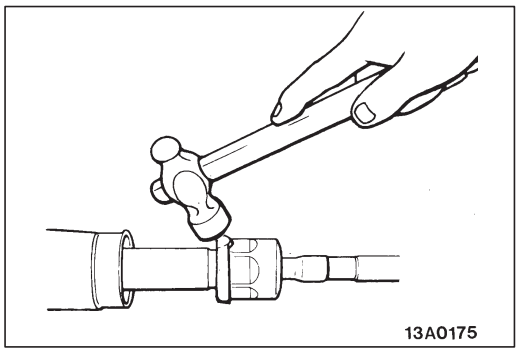


▶J◀ PINION TOTAL ROTATION TORQUE ADJUSTMENT

1. Using the special tool, measure total rotation torque by turning the pinion gear at a speed of one rotation per 4 to 6 seconds.

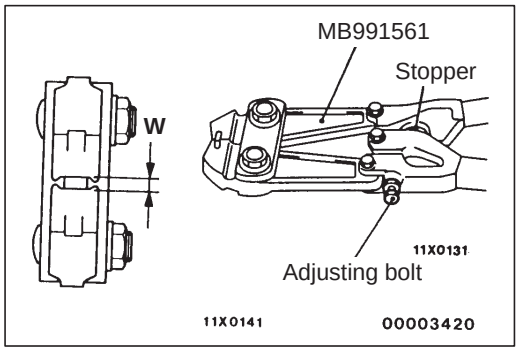
   Standard value:
   Total rotation torque: 0.6 – 1.5 Nm
   Torque fluctuation: 0.5 Nm or less
2. If the total rotation torque or torque fluctuation does not meet the standard values, adjust by returning the rack support cover within a range of 0 to 30°.

   Caution
   (1) Adjust around the maximum limit of the standard values.
   (2) See that no ratcheting or catching are present when operating the rack towards the shaft direction.
   (3) Measure the total pinion torque through the whole stroke of the rack.
3. If the adjustment is impossible in the given range, check the components of the rack support cover, and replace if necessary.



▶K◀ TAB WASHER/TIE ROD INSTALLATION

After installing the tie rod to the rack, fold the tab washer end (2 locations) to the tie rod notch.



▶L◀ BELLOWS BAND INSTALLATION

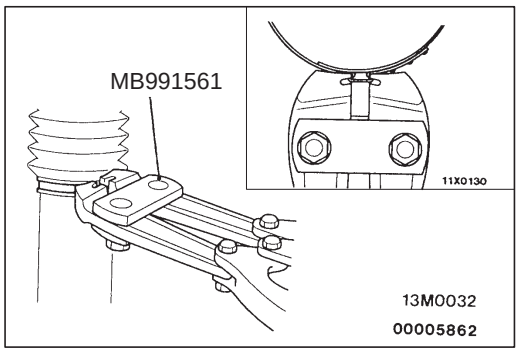
1. Turn the adjusting bolt of the special tool to adjust the opening dimension (W) to the standard value.

   Standard value (W): 2.9 mm
   <When more than 2.9 mm>
   Screw in the adjusting bolt.
   <When less than 2.9 mm>
   Loosen the adjusting bolt.

   NOTE
   (1) The dimension (W) is adjusted by about 0.7 mm per one turn.
   (2) Do not turn the adjusting bolt more than one turn.

2. Use the special tool to crimp the bellows band.

   Caution
   (1) Hold the rack housing, and use the special tool to crimp the bellows band securely.
   (2) Crimp the bellows band until the special tool touches the stopper.



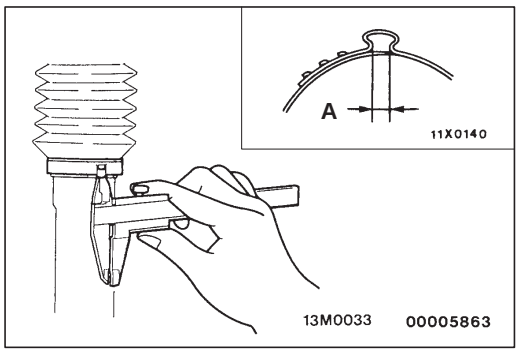
3. See that the crimped width (A) meets the standard value.

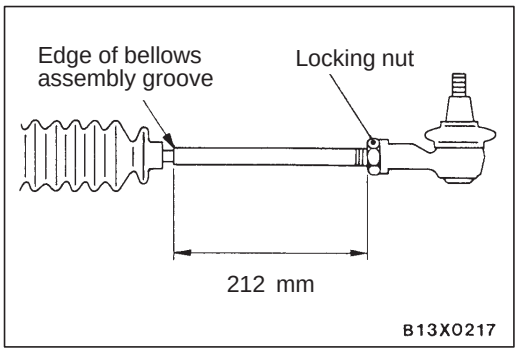
   Standard value (A): 2.4 – 2.8 mm
   <When more than 2.8 mm>
   Readjust the dimension (W) of step (1) to the value calculated by the following equation, and repeat step (2).

   W = 5.5 mm – A [Example: If (A) is 2.9 mm, (W) is 2.6 mm.]

   <When less than 2.4 mm>
   Remove the bellows band, readjust the dimension (W) of step (1) to the value calculated by the following equation, and use a new bellows band to repeat steps (2) to (3).

   W = 5.5 mm – A [Example: If (A) is 2.3 mm, (W) is 3.2 mm.]

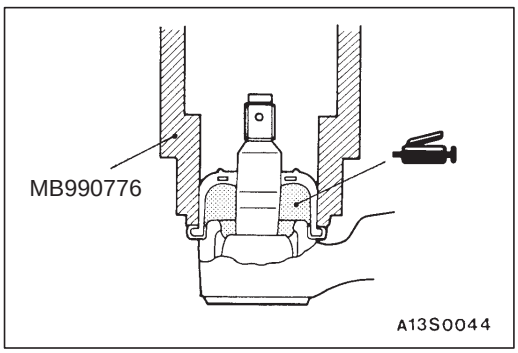




▶M◀TIE ROD END/LOCKING NUT INSTALLATION

Screw in the tie rod end until the dimension shown is achieved. Then, temporarily tighten with the locking nut.

NOTE
The locking nut must be tightened securely only after the power steering gear box and linkage are installed to the vehicle and toe–in is adjusted.



TIE ROD END BALL JOINT DUST COVER REPLACEMENT

Only when the dust cover is damaged accidentally during service work, replace the dust cover as follows:

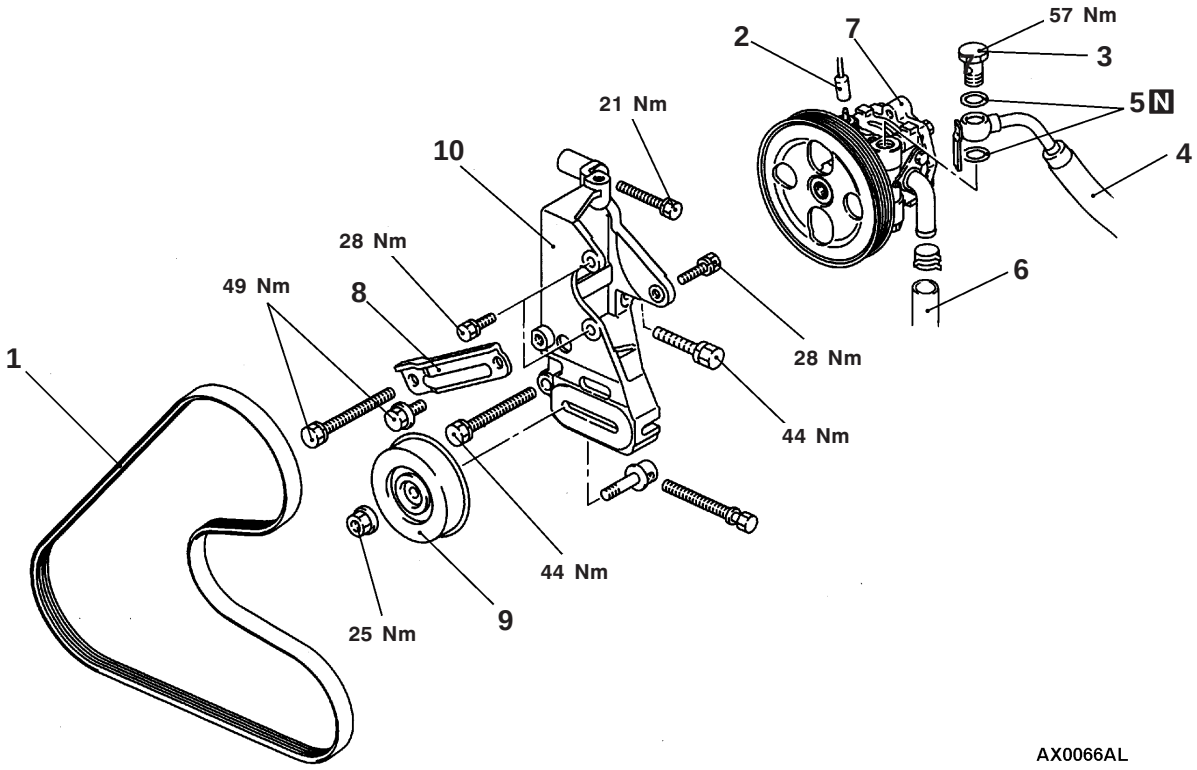
1. Apply grease inside a new dust cover.
2. Using the special tool, press in the dust cover to the tie rod end.
3. Check the dust cover for cracks or damage by pushing it with finger.

POWER STEERING OIL PUMP

REMOVAL AND INSTALLATION

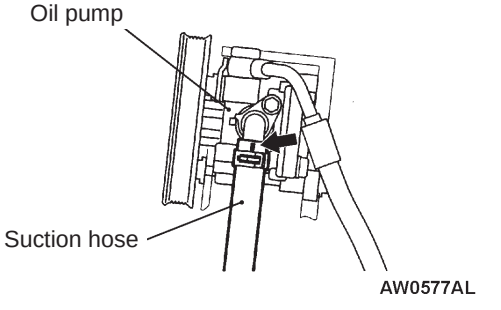
Pre-removal Operation
Power Steering Fluid Draining (Refer to P.37A-9.)

Post-installation Operation
- Power Steering Fluid Supplying and Bleeding (Refer to P.37A-9.)
- Drive Belt Tension Adjusting (Refer to GROUP 11A.)



Removal steps
- Air intake duct
1. Drive belt
2. Pressure switch connector
3. Eye bolt
4. Pressure hose
5. Gasket

▶A◀ 6. Suction hose
7. Oil pump assembly
8. Oil pump stay
9. Tensioner pulley
10. Oil pump bracket



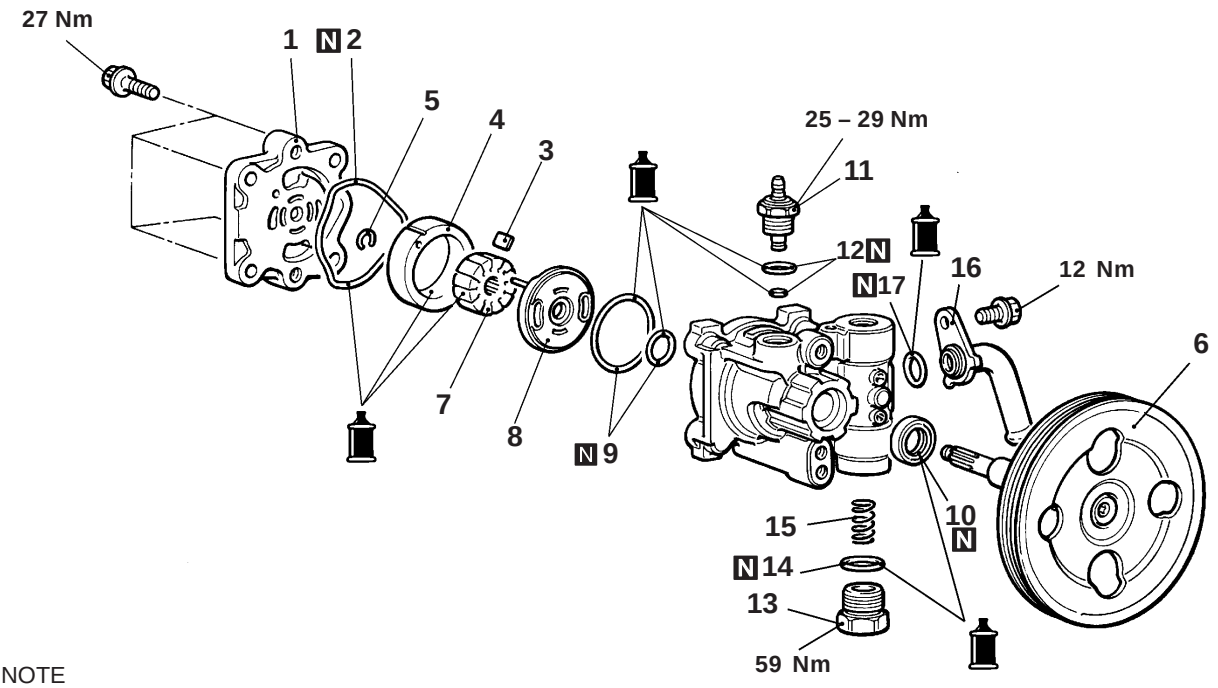
INSTALLATION SERVICE POINT

▶A◀ SUCTION HOSE INSTALLATION

Install so that the mark on the suction hose is positioned as shown.

DISASSEMBLY AND REASSEMBLY

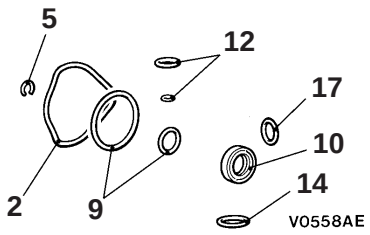
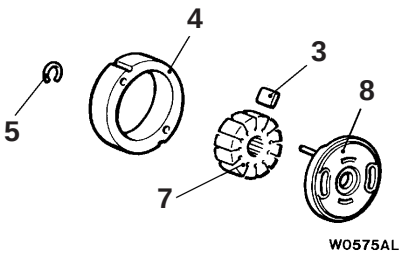
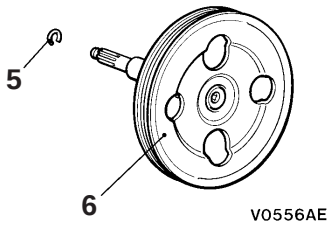
Caution
Never disassemble the terminal assembly unable to be reassembled.



NOTE

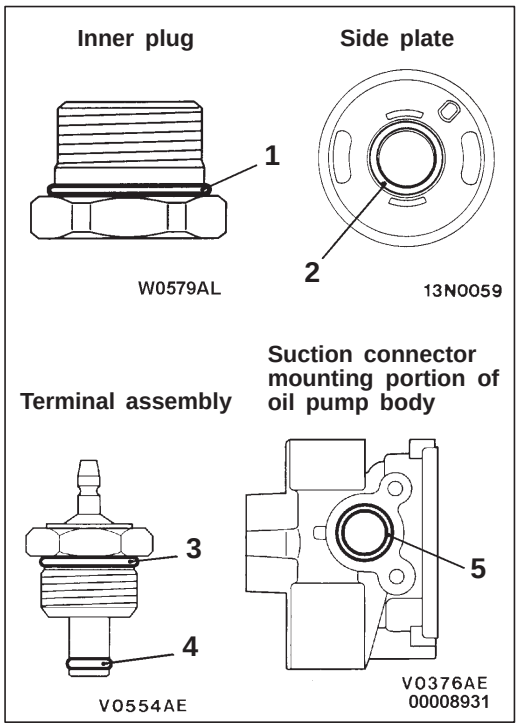
: Automatic transmission fluid DEXRON or DEXRON II

W0574AL
00008929

		
Oil pump seal kit	**Oil pump cartridge kit**	**Oil pump pulley and shaft kit**

Disassembly steps

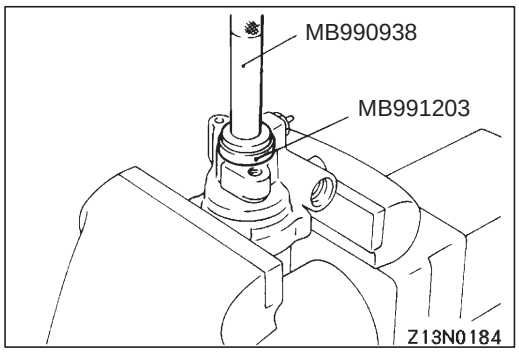
1. Pump cover
2. O-ring
- ▶E◀ 3. Vanes
- ▶D◀ 4. Cam ring
5. Snap ring
6. Pulley and shaft
- ▶C◀ 7. Rotor
8. Side plate
- ▶A◀ 9. O-ring
- ▶B◀ 10. Oil seal
11. Terminal assembly
- ▶A◀ 12. O-ring
13. Inner plug
- ▶A◀ 14. O-ring
15. Flow control spring
16. Suction connector
- ▶A◀ 17. O-ring



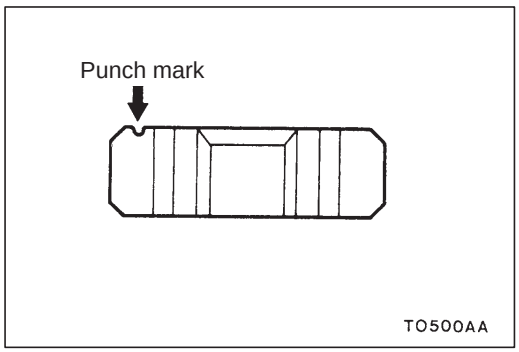
REASSEMBLY SERVICE POINTS

▶A◀ O-RING INSTALLATION

No.	ID × Width mm
1	21.0 × 1.9
2	14.8 × 2.4
3	14.8 × 1.9
4	3.8 × 1.9
5	15.8 × 2.4

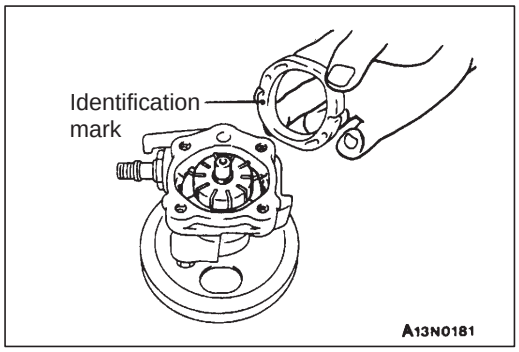


▶B◀ OIL SEAL INSTALLATION



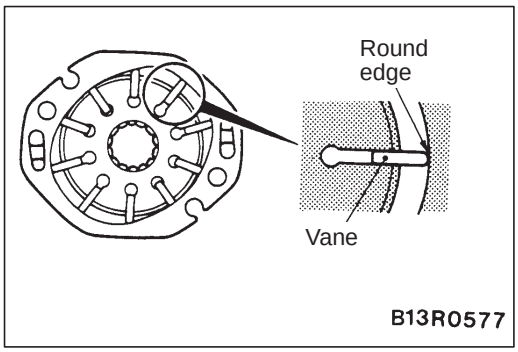
▶C◀ ROTOR INSTALLATION

Install the rotor with its punch mark towards the side plate.



▶D◀ CAM RING INSTALLATION

Install the cam ring with its identification mark towards the side plate.



▶E◀ VANE INSTALLATION

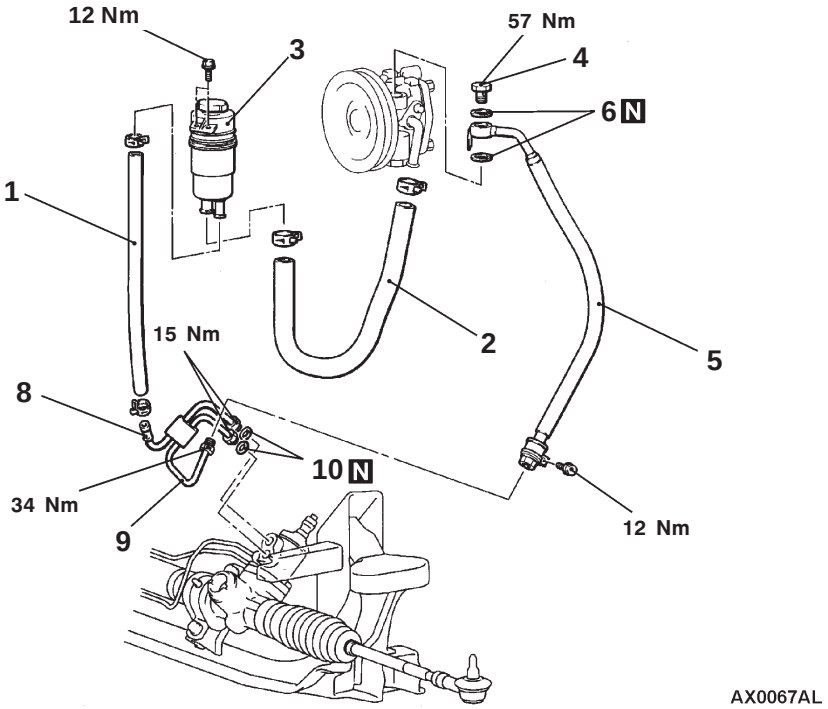
Install the vane to the rotor with its round edge outwards (towards cam ring).

POWER STEERING OIL HOSES

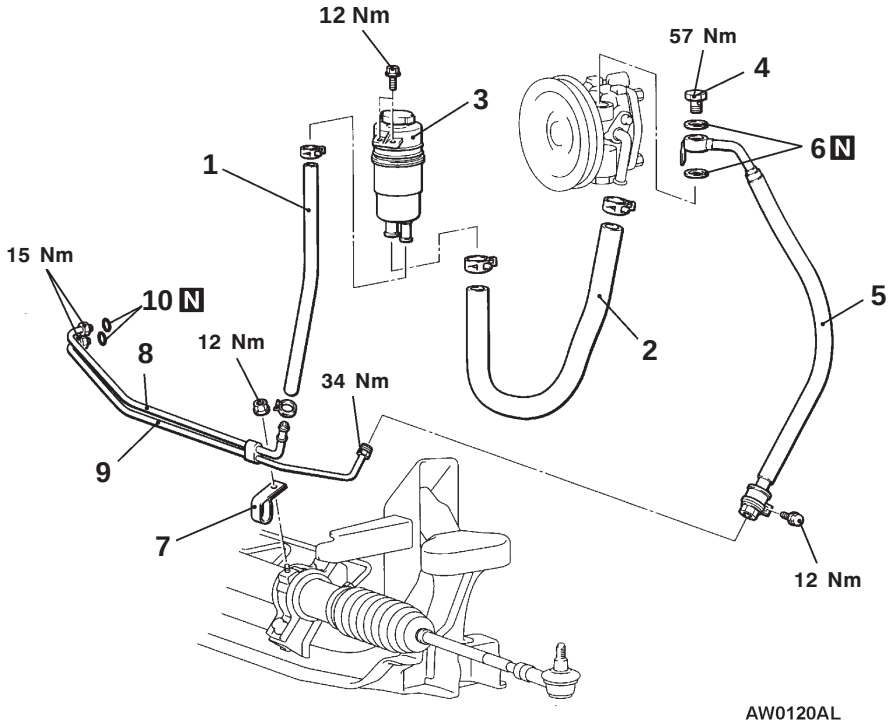
REMOVAL AND INSTALLATION

Pre–removal and Post–installation Operations
- Power Steering Fluid Draining and Supplying, and Bleeding (Refer to P.37A–9.)
- Under Cover Removal and Installation
- Air Intake Hose, Resonator, Air Duct, Air Cleaner Cover Removal and Installation (Refer to GROUP 15.)

<L.H. drive vehicles>

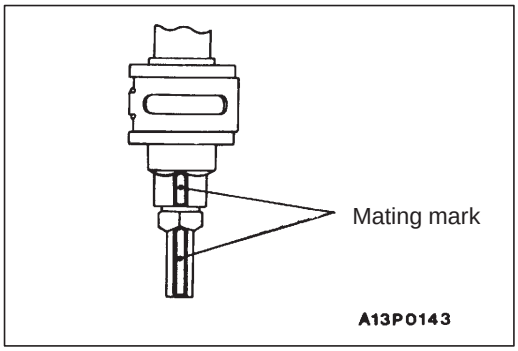


<R.H. drive vehicles>



Removal steps

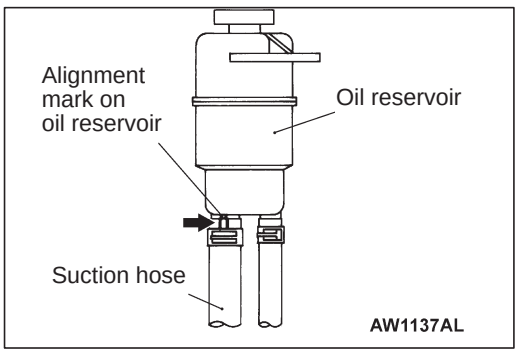
▶C◀ 1. Return hose
▶B◀ 2. Suction hose
3. Oil reservoir
● Splash shield (Refer to P.37A-15, 16.)
4. Eye bolt
▶A◀ 5. Pressure hose
6. Gasket
7. Clip
8. Return tube
9. Pressure tube
10. O-ring



INSTALLATION SERVICE POINTS

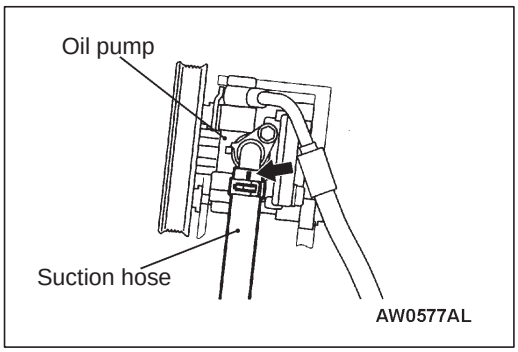
▶A◀ PRESSURE HOSE INSTALLATION

Install with the marks on the pressure hose and pressure tube aligned.

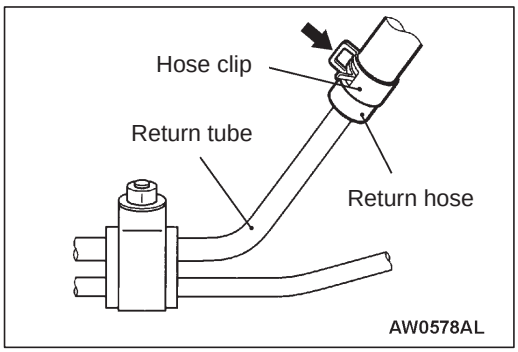


▶B◀ SUCTION HOSE INSTALLATION

1. Install with the mark at the end of the hose (oil reservoir side) and the alignment mark on the oil reservoir aligned.



2. Install so that the mark at the end of the hose(oil pump side) is positioned as shown.



▶C◀ RETURN HOSE INSTALLATION

Install so that the hose clip claws are placed as shown.

BODY

BODY

CONTENTS

HOOD 3

FENDER* 4

- **SEALANT 4**
- **FENDER 5**

FUEL FILLER DOOR 6

WINDOW GLASS 8

- **ADHESIVE 8**
- **SPECIAL TOOLS 8**
- **WINDOW REPAIR 8**
- **WINDSHIELD 10**
- **QUARTER WINDOW GLASS 14**
- **BACK DOOR GLASS 16**

DOOR 18

- **SERVICE SPECIFICATIONS 18**
- **SEALANT 18**
- **SPECIAL TOOLS 18**
- **TROUBLESHOOTING 18**
- **ON-VEHICLE SERVICE 19**
  - Door Fit Adjustment 19
  - Door Window Glass Adjustment 19
  - Defective Power Window Adjustment and Replacement 20
  - Power Window Safety Mechanism Check 20
  - Door Outside Handle Play Check 20
  - Power Window Operation Current Check ... 21
  - Circuit Breaker (Incorporated in the Power Window Motor) Check 21
  - Door Inside Handle Play Check and Adjustment 21

CONTINUED ON NEXT PAGE

WARNINGS REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLES

WARNING!

(1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver and passenger (from rendering the SRS inoperative).

(2) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.

(3) MITSUBISHI dealer personnel must thoroughly review this manual, and especially its GROUP 52B – Supplemental Restraint System (SRS) before beginning any service or maintenance of any component of the SRS or any SRS-related component.

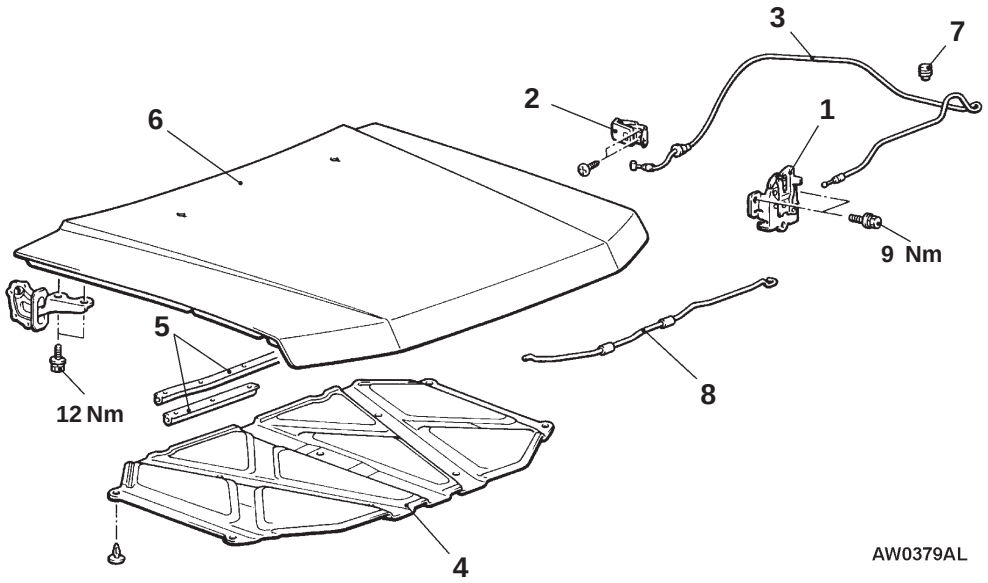
NOTE

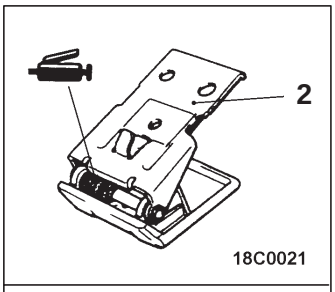
The SRS includes the following components: SRS-ECU, SRS warning lamp, air bag module, clock spring, side impact sensors and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents by an asterisk (*).

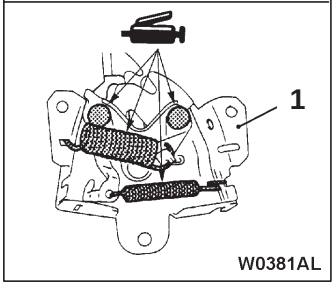
DOOR ASSEMBLY 22
DOOR TRIM AND WATERPROOF FILM 23
DOOR GLASS AND REGULATOR 26
DOOR HANDLE AND LATCH 30
WINDOW GLASS RUNCHANNEL AND DOOR OPENING WEATHERSTRIP 32
BACK DOOR 33
SERVICE SPECIFICATION 33
SEALANT 33
SPECIAL TOOL 33
TROUBLESHOOTING 33
ON-VEHICLE SERVICE 33
Back Door Fit Adjustment 33
Back Door Handle Play Check 33
BACK DOOR ASSEMBLY 34
BACK DOOR TRIM AND WATERPROOF FILM 36
BACK DOOR HANDLE AND LATCH 37
KEYLESS ENTRY SYSTEM 38
TROUBLESHOOTING 38
ON-VEHICLE SERVICE 38
How to Replace a Battery of the Transmitter 38
Encrypted Code Registration Method 39
Hazard Lamp Answerback Adjustment 40
KEYLESS ENTRY SYSTEM 41
SUNROOF 42
SERVICE SPECIFICATION 42
TROUBLESHOOTING 42
ON-VEHICLE SERVICE 46
Water Test 46
Sunroof Fit Adjustment 46
SUNROOF 47

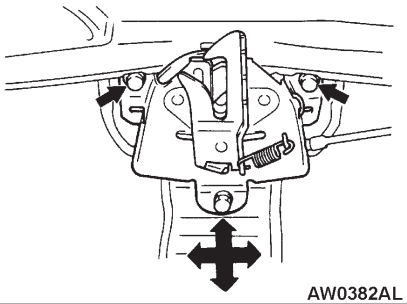
HOOD

REMOVAL AND INSTALLATION

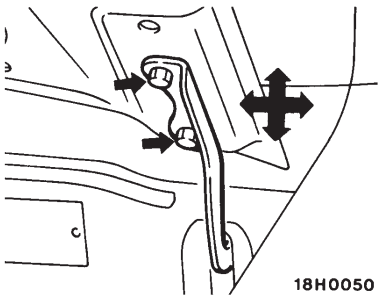




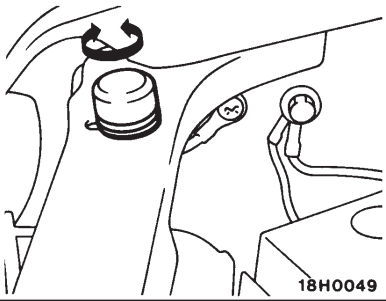




Adjustment of hood step and hood striker linkage



Adjustment of clearance around hood



Adjustment of hood height

Hood latch removal steps

- Front grille (Refer to GROUP 51.)

1. Hood latch

Hood lock release cable removal steps

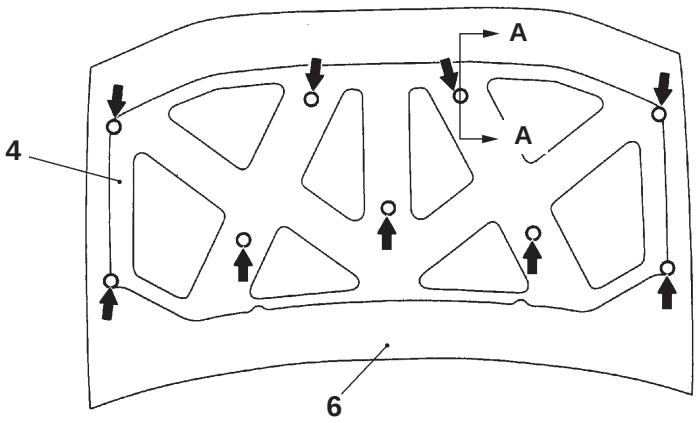
2. Hood lock release handle
3. Hood lock release cable

Hood removal steps

4. Hood silencer
5. Hood weatherstrip
- Washer hose (Refer to GROUP 51.)

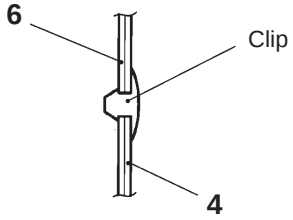
6. Hood
7. Hood bumper
8. Hood support rod

Clip positions



W0383AL

Section A – A



: Clip positions

V1110AE
00008889

FENDER

SEALANT

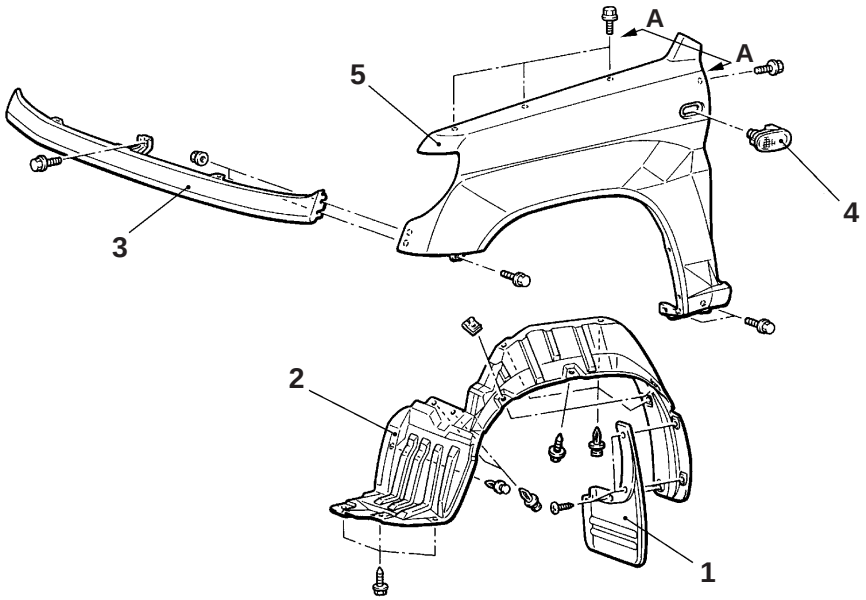
Item	Specified sealant	Remark
Splash shield	3M ATD Part No. 8625 or equivalent	Ribbon sealer

FENDER

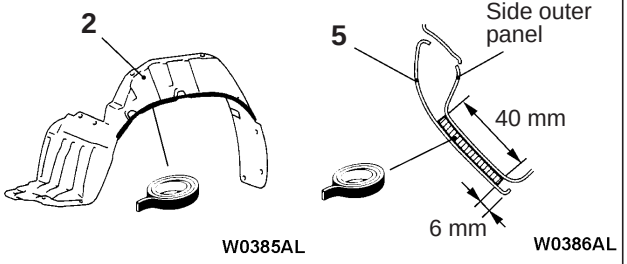
REMOVAL AND INSTALLATION

Caution: SRS
Do not strike the front impact sensor when removing or installing the fender.

Pre-removal and Post-installation Operation
- Front Bumper Removal and Installation (Refer to GROUP 51.)

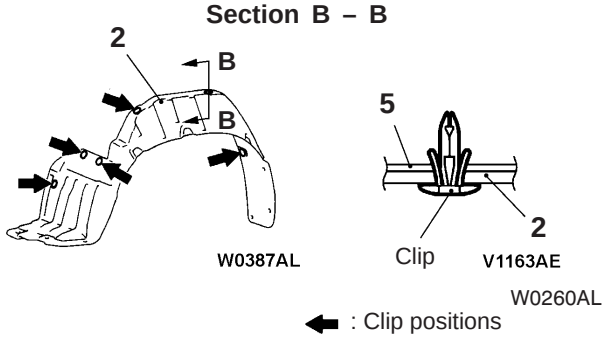


Section A – A



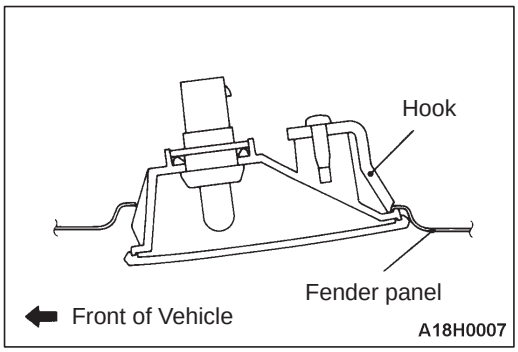
Sealant: 3M ATD Part No. 8625 or equivalent

Section B – B



Removal steps

1. Mud guard
2. Splash shield
3. Grille filler panel
- ▶A◀ 4. Side turn signal lamp (Refer to GROUP 54.)
5. Fender



INSTALLATION SERVICE POINT

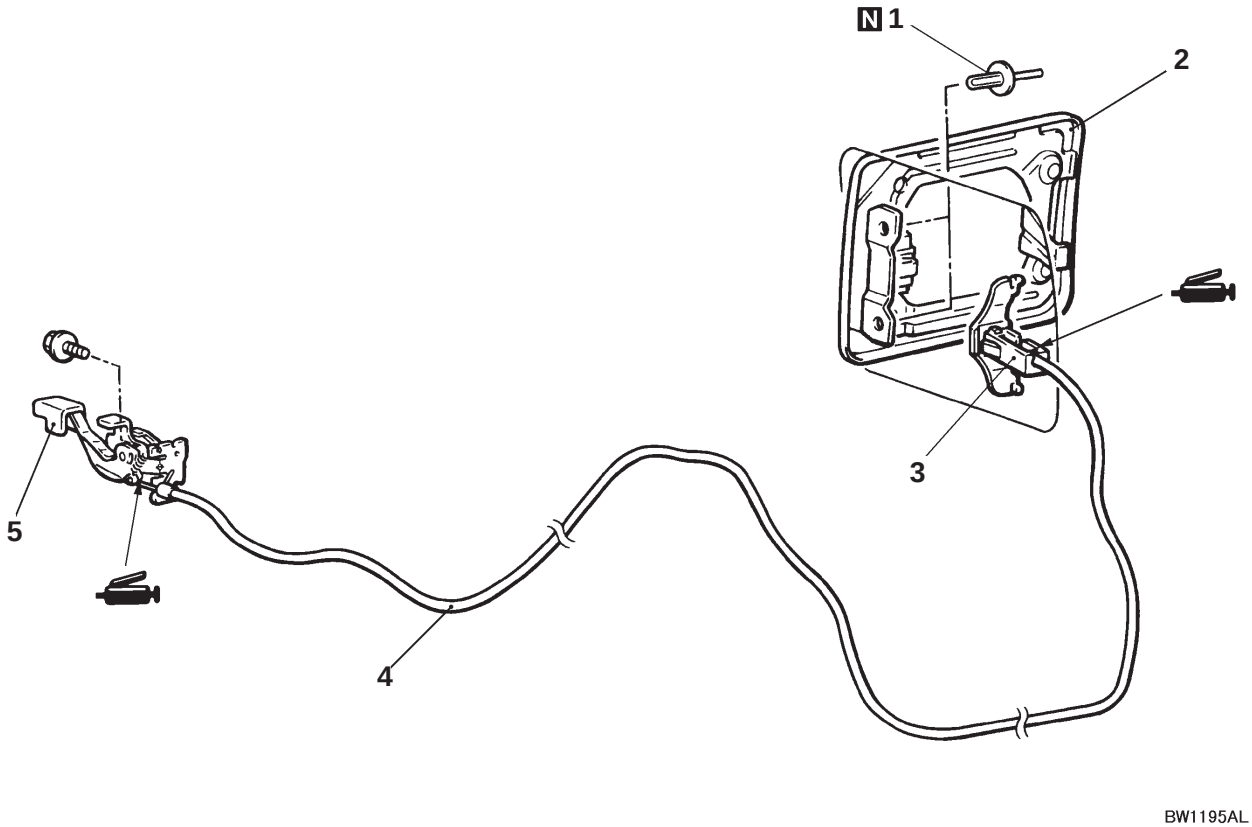
◀A▶ SIDE TURN SIGNAL LAMP REMOVAL

Engage the hook with the fender panel.

FUEL FILLER DOOR

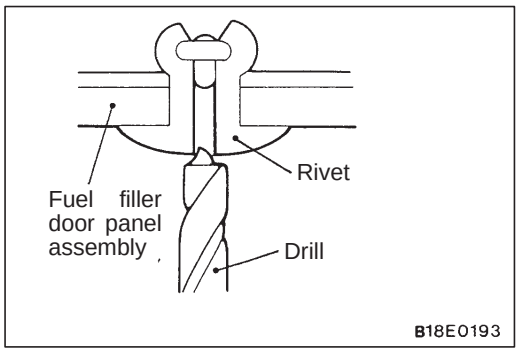
REMOVAL AND INSTALLATION

Pre–removal and Post–installation Operations
- Rear Floor Console Removal and Installation (Refer to GROUP 52A.)
- Front Seat (Driver's side), Rear Seat Removal and Installation (Refer to GROUP 52A.)
- Quarter Trim, Lower (R.H.) Removal and Installation (Refer to GROUP 52A.)



Removal steps

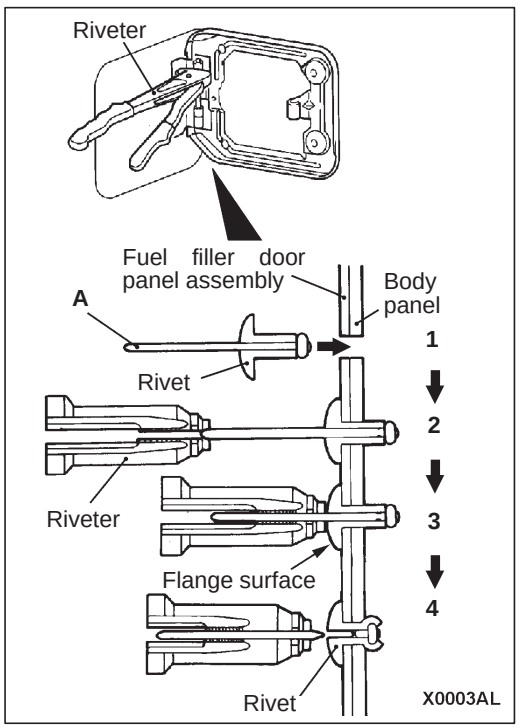
◀A▶ ▶A◀ 1. Rivet
2. Fuel filler door panel assembly
3. Fuel filler door lock assembly
4. Fuel filler door lock release cable
5. Lid lock release handle



REMOVAL SERVICE POINT

◀A▶ RIVET REMOVAL

Use a drill (Ø4.0 – 5.5 mm) to break the rivet by drilling a hole, and then remove the rivet.



INSTALLATION SERVICE POINT

▶A◀ RIVET INSTALLATION

Use a riveter shown to install rivets as follows:

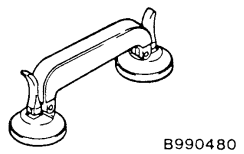
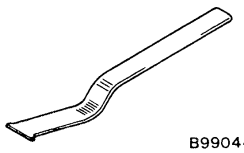
1. Insert a rivet in the body panel and fuel filler door panel assembly.
2. Insert the riveter to the rod (A shown) of a rivet.
3. Pressing the flange surface of the rivet with the riveter, handle the riveter.
4. The rod is cut at its thinnest point and the rivet is held in position.

WINDOW GLASS

ADHESIVE

Items	Specified adhesive
Windshield	3M ATD Part No. 8609 Super Fast Urethane Auto Glass Sealant or equivalent
Quarter window glass	
Back door glass	

SPECIAL TOOLS

Tool	Number	Name	Use
 B990480	MB990480	Window glass holder	Removal and installation of windshield
 B990449	MB990449	Window moulding remover	Removal of roof drip moulding

WINDOW REPAIR

The following glass parts are installed with a liquid urethane adhesive method:

- Windshield
- Quarter window glass
- Back door window glass

ITEMS NEEDED

Name	Remarks
Adhesive	3M ATD Part No. 8609 Super Fast Urethane Auto Glass Sealant or equivalent
Primer	3M ATD Part No. 8608 Super Fast Urethane Primer or equivalent
Spacers	Available as service part
Dam	Available as service part
Anti-rust solvent (or Tectyl 506T...Valvoline Oil Company)	For rust prevention
Isopropyl alcohol	For grease removal from bonded surface
Steel piano wire	Dia. × length...0.6mm × 1m For cutting adhesive
Adhesive gun	For pressing-out adhesive

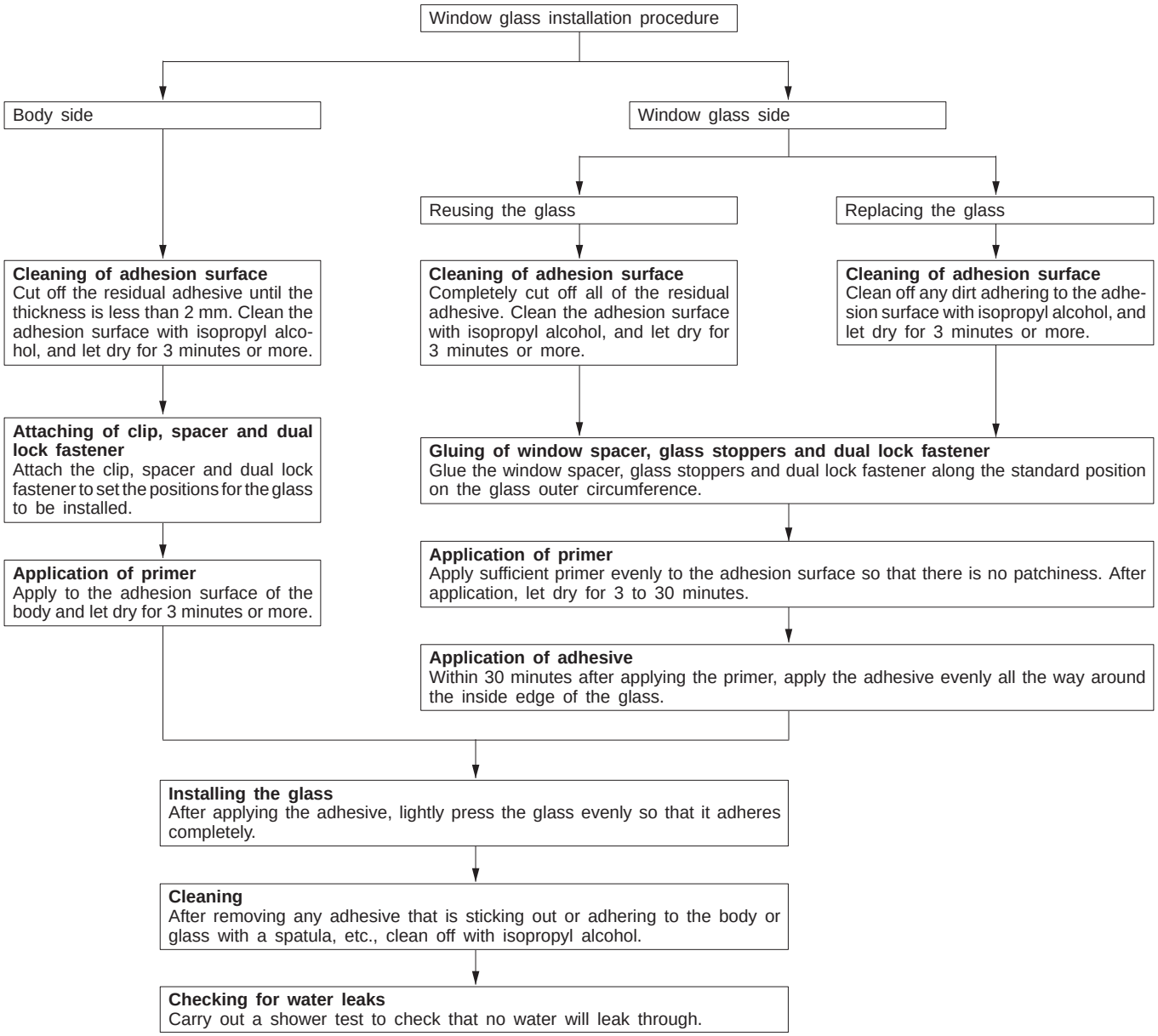
HANDLING OF AUTO WINDOW SEALER

Keep the sealant in a cool place, not exposed to the direct rays of the sun. Do not place any heavy article on the sealant nor press it, otherwise it will become deformed. Avoid storing the sealant for more than 6 months, because it will lose its sealing effect.

BODY PINCH-WELD FLANGE SERVICING

Before servicing the body pinch-weld flange, remove old adhesive completely. If the flange requires painting, bake it after painting is completed.

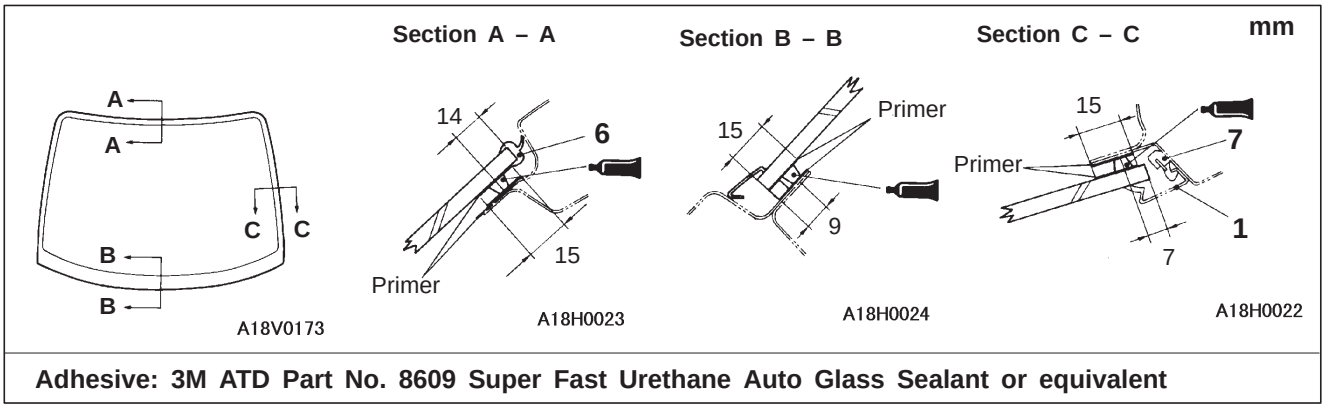
WORKING PROCESS



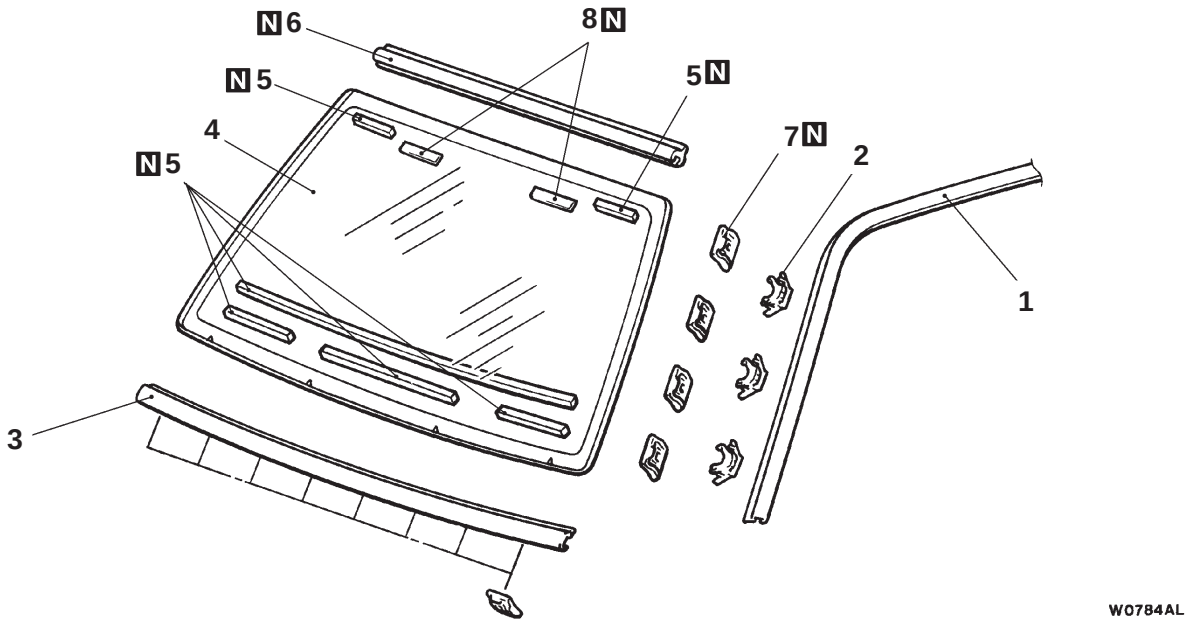
WINDSHIELD

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations
- Front Pillar Trim Removal and Installation (Refer to GROUP 52A.)
- Headlining Removal and Installation (Refer to GROUP 52A.)

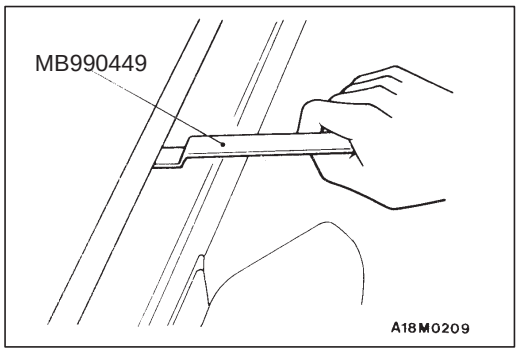


Adhesive: 3M ATD Part No. 8609 Super Fast Urethane Auto Glass Sealant or equivalent



Removal steps

◀A▶ 1. Roof drip moulding (Refer to GROUP 51.)
2. Roof drip moulding clip
3. Windshield lower moulding
◀B▶ ▶A◀ 4. Windshield
▶A◀ 5. Windshield spacer
▶A◀ 6. Windshield upper moulding
▶A◀ 7. Clip
▶A◀ 8. Glass stopper

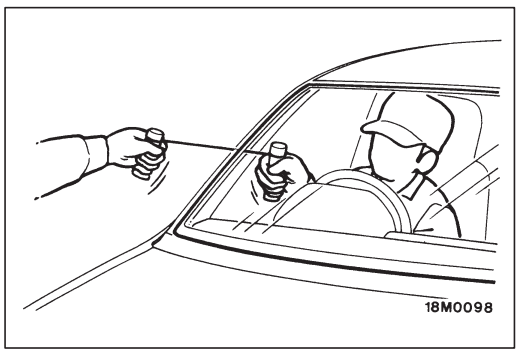


REMOVAL SERVICE POINTS

◀A▶ ROOF DRIP MOULDING REMOVAL

Use the special tool to lever out the moulding.

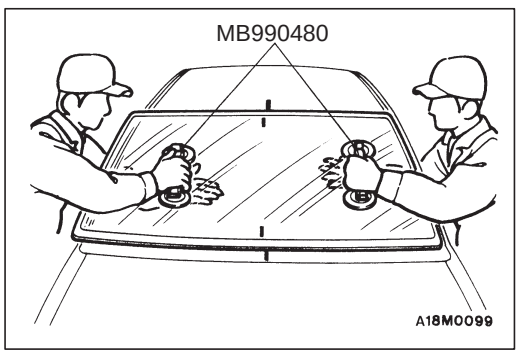
Caution
If the moulding has become warped, it should not be reused.



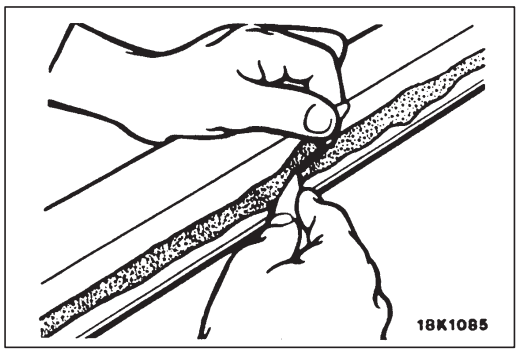
◀B▶ WINDSHIELD REMOVAL

1. In order to protect the body (paint surface), apply cloth tape to all body areas around the installed windshield.
2. Using a sharp-point drill, make hole in the windshield adhesive.
3. Pass the piano wire from the inside of the vehicle through the hole.
4. Pull the piano wire alternately from the inside and outside along the windshield to cut the adhesive.

   Caution
   Do not let the piano wire touch the edge of the windshield.



5. Make alignment marks on the windshield and body.
6. Use the special tool to remove the windshield.



7. Use a knife to cut away remaining adhesive to 2 mm thick or less around the entire circumference of the body flange.
8. Smooth the flange surface.

   Caution
   (1) Use care not to remove more adhesive than necessary, or the adhesive could weaken.
   (2) Be careful also not to damage the paintwork on the body surface with the knife. If the paintwork is damaged, repair the damaged area with repair paint or anti-rust agent.

9. When reusing windshield, remove the remaining adhesive on the windshield completely. Then, decrease the windshield with isopropyl alcohol.
10. Decrease the body flange in the same way.

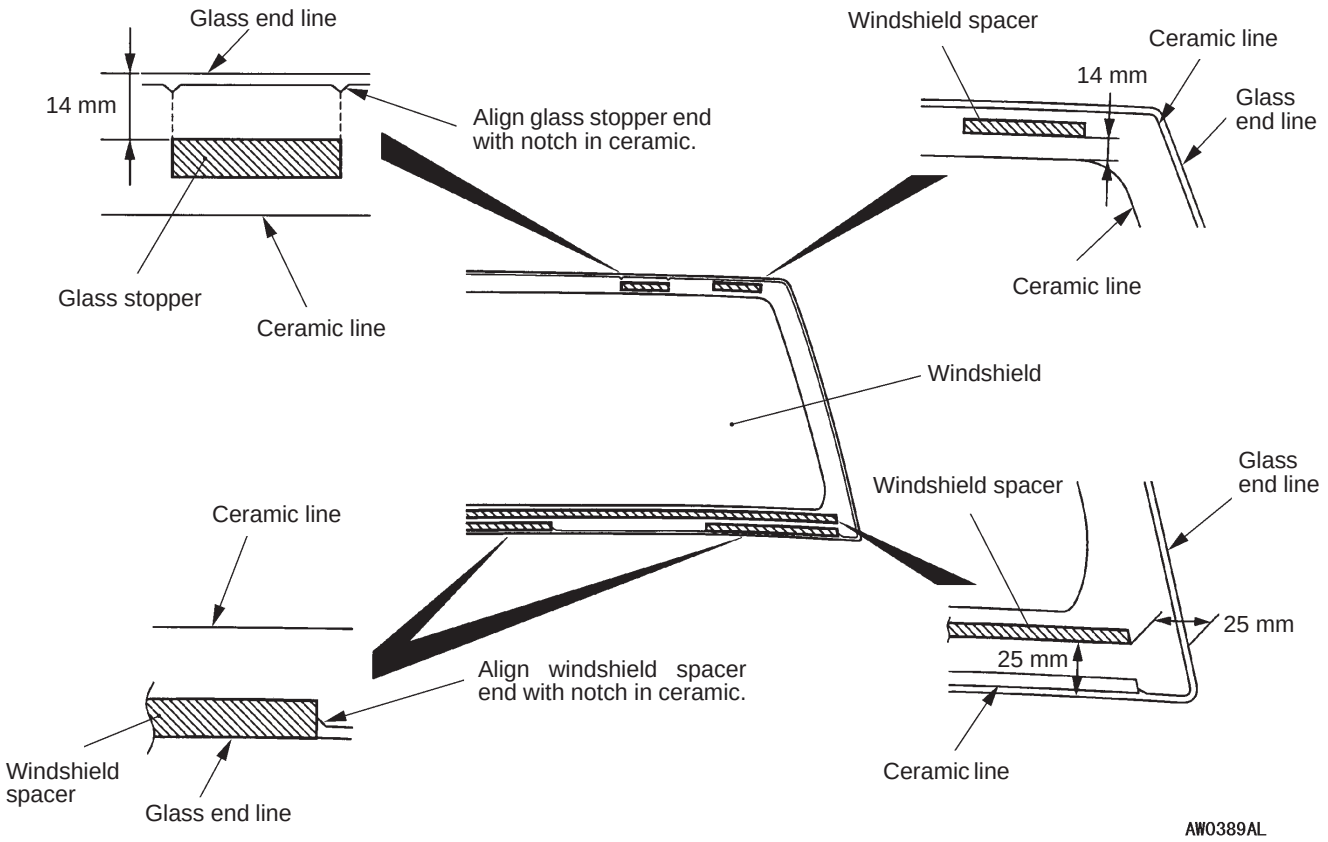
    Caution
    Before the next job, leave the decreased parts for 3 minutes or more to dry. Also, do not touch any cleaned surface.

INSTALLATION SERVICE POINTS

▶A◀ GLASS STOPPER/CLIP/WINDSHIELD UPPER MOULDING/WINDSHIELD SPACER/WINDSHIELD INSTALLATION

1. When installing new windshield, temporarily position the windshield on the body. Make alignment marks on the windshield and body.
2. Use isopropyl alcohol to degrease the inside of windshield circumference, and also the body flanges.
3. Apply primer soaked in a sponge evenly to the specified positions on the windshield and body flange.
4. Dry 3 minutes or more.
5. Install the glass stoppers and windshield spacers as shown to prevent the inside of windshield from warp or separation.

Glass stopper and windshield spacer installation position

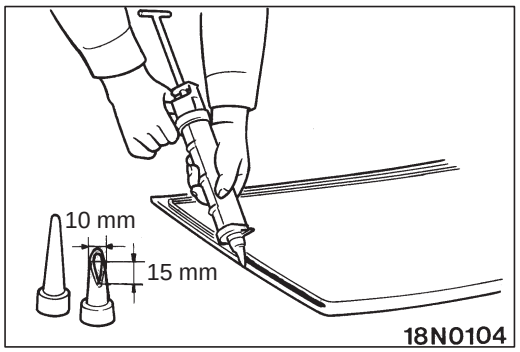


Caution

(1) Be sure to apply the primer to strengthen adhesion evenly around the entire position. Note that too thick application weakens the adhesion.

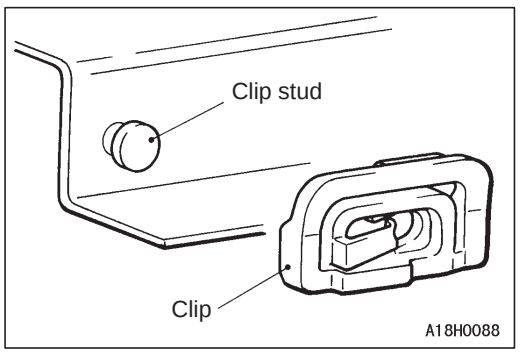
(2) Never touch the surfaces where the primer is applied.

6. Install the windshield upper moulding to the windshield.



7. Fill a sealant gun with adhesive. Then apply the adhesive evenly around the windshield within 30 minutes after applying the primer.

   NOTE
   Cut the tip of the sealant gun nozzle into a V shape to simplify adhesive application.



8. Install the clip to the clip stud.
9. After applying the adhesive, align the alignment marks on the windshield and body. Then, press the windshield gently to seat.
10. Use a spatula or the like to remove any excessive adhesive. Then clean the surface with isopropyl alcohol. Install the windshield moulding before the adhesive hardens.
11. Wait 30 minutes or more, and then test for water leakage.

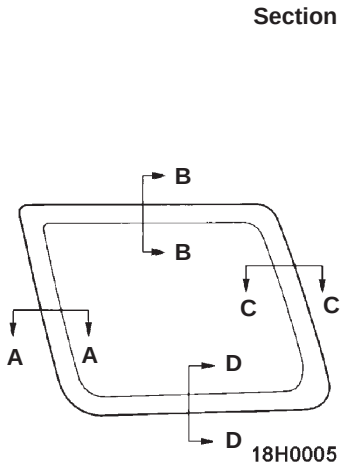
    Caution
    (1) Do not move the vehicle unless necessary. If doing so, move it very gently.
    (2) When testing for water leakage, do not pinch the end of the hose to spray the water.

QUARTER WINDOW GLASS

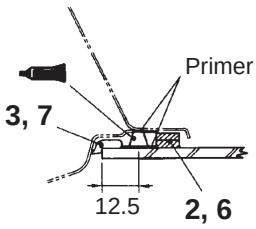
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Quarter Trim, Lower (R.H.) Removal and Installation (Refer to GROUP 52A.)
- Headlining Removal and Installation (Refer to GROUP 52A.)

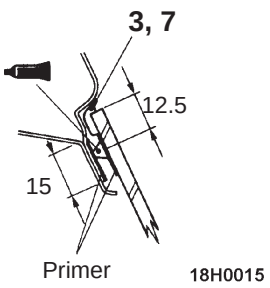
mm



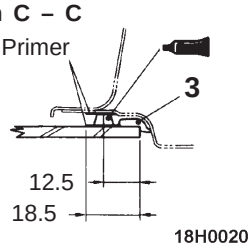
Section A – A



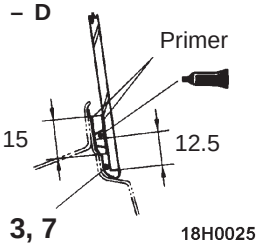
Section B – B



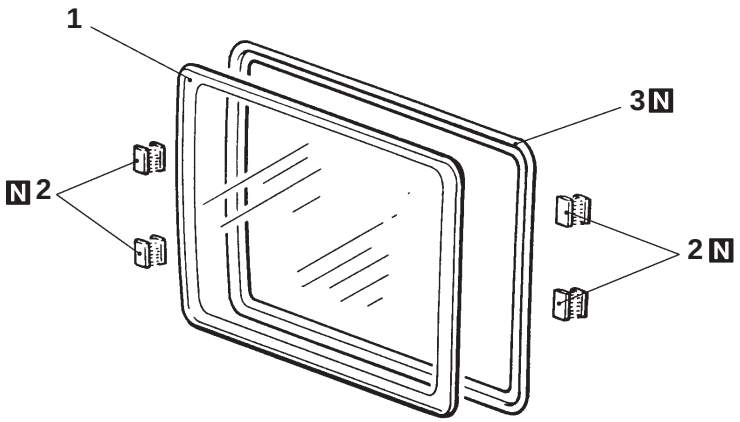
Section C – C



Section D – D



Adhesive: 3M ATD Part No. 8609 Super Fast Urethane Auto Glass Sealant or equivalent



W0390AL
00008893

Removal steps

◀A▶ ▶A◀ 1. Quarter window glass
▶A◀ 2. Dual lock fastener
▶A◀ 3. Window dam

REMOVAL SERVICE POINT

◀A▶ QUARTER WINDOW GLASS REMOVAL

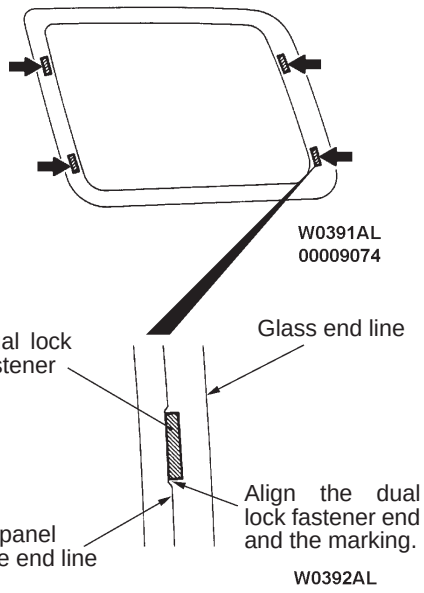
Remove the quarter window glass in the same manner as for the windshild. (Refer to P.42-11.)

INSTALLATION SERVICE POINT

▶A◀ WINDOW DAM/DUAL LOCK FASTENER/ QUARTER WINDOW GLASS INSTALLATION

1. Use a isopropyl alcohol to decrease the glass and body surfaces where the window dam and dual lock fasteners are installed.
2. Install the window dam.

Dual lock fastener installation positions



⬅ : Dual lock fastener installation positions

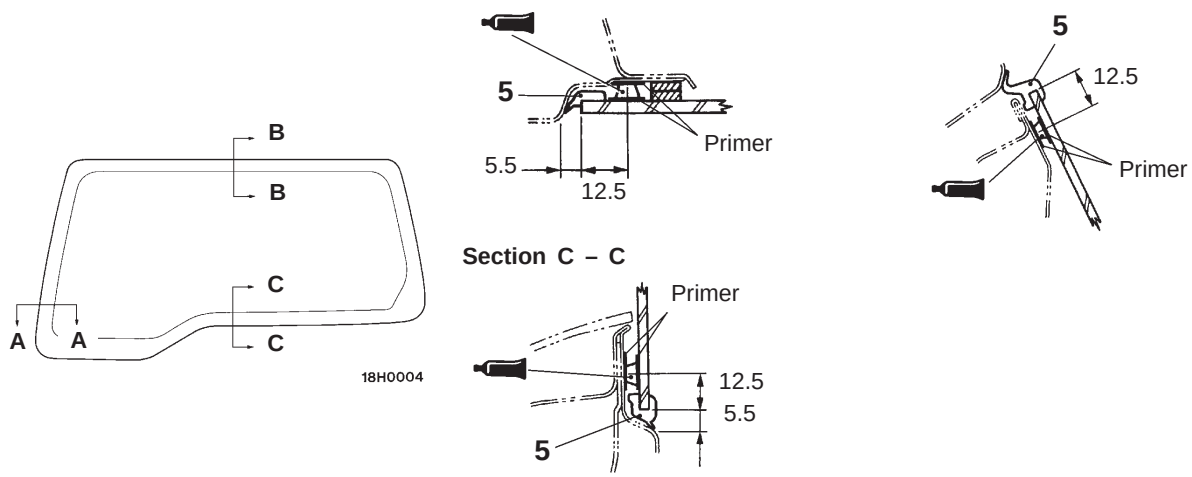
3. Install the dual lock fasteners to the body flange in the specified positions.
4. Install the dual lock fasteners to the windshield in the positions corresponding to the ones on the body flange where the dual lock fasteners have been installed.
5. Apply the primer and adhesive.
6. Install the glass in the same manner as for the windshield. (Refer to P.42-12.)

BACK DOOR GLASS

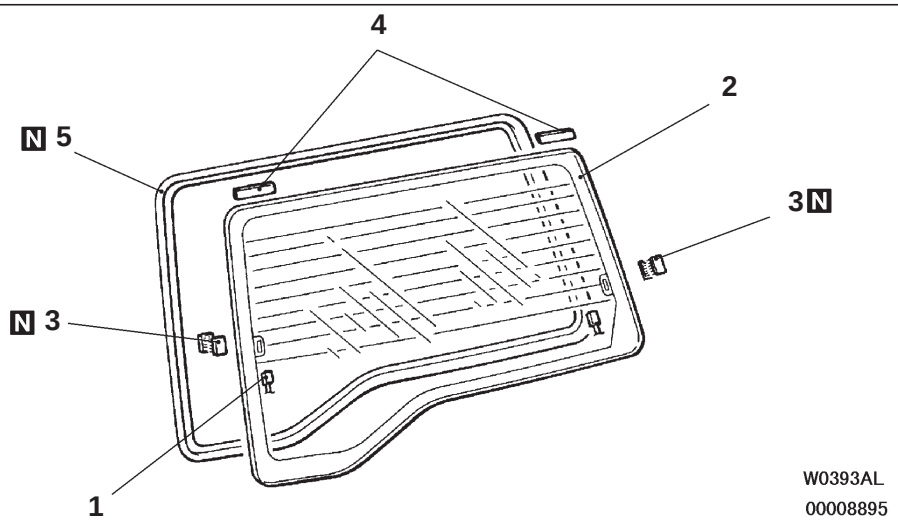
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- High-mounted Stop Lamp Assembly Removal and Installation (Refer to GROUP 52A.)
- Back Door Trim Removal and Installation (Refer to P.42-34.)

mm



Adhesive: 3M ATD Part No. 8609 Super Fast Urethane Auto Glass Sealant or equivalent



Removal steps

◀A▶ ▶A◀ 1. Harness connector
2. Back door glass
▶A◀ 3. Dual lock fastener
▶A◀ 4. Glass stopper
▶A◀ 5. Window dam

REMOVAL SERVICE POINT

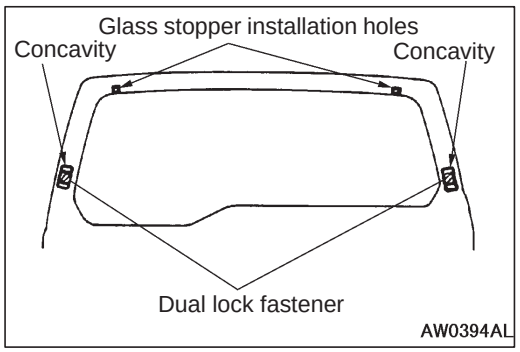
◀A▶ BACK DOOR GLASS REMOVAL

Remove the back door glass in the same manner as for the windshield. (Refer to P42-11.)

INSTALLATION SERVICE POINT

▶A◀ WINDOW DAM/DUAL LOCK FASTENER/GLASS STOPPER/BACK DOOR GLASS INSTALLATION

1. Use a isopropyl alcohol to decrease the glass and body surfaces where the window dam, dual lock fasteners and glass stoppers are installed.
2. Install the window dam.



3. Install the dual lock fasteners to the concavities on the body panel and the glass stoppers to the hole on the body panel respectively.
4. Install the dual lock fasteners to the windshield in the positions corresponding to the ones on the body panel where the dual lock fasteners have been installed.
5. Apply the primer and adhesive.
6. Install the glass in the same manner as for the windshield. (Refer to P.42–12.)

DOOR

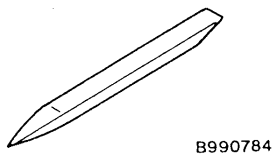
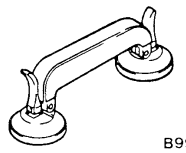
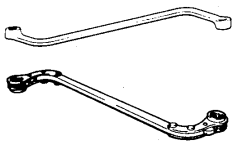
SERVICE SPECIFICATIONS

Items		Standard value
Door outside handle play mm		3.7 or more
Power window operating current A		5.3 ± 2 (power supply 14.5 V ± 0.3 V at 23°C)
Door inside handle play mm		5.3 or more
Glass pad and glass holder installation position mm	Between glass holder and glass rear end (A)	55.0
	Between glass holders (B)	419.0 – 421.0
	Between glass holder and glass front end (C)	55.0

SEALANT

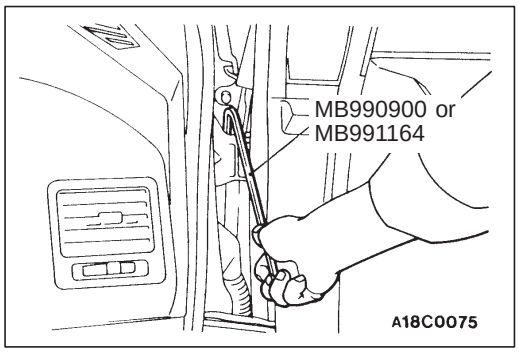
Items	Specified sealant	Remark
Waterproof film	3M ATD Part No. 8625 or equivalent	Ribbon sealer

SPECIAL TOOLS

Tool	Number	Name	Use
 B990784	MB990784	Ornament remover	Door trim removal
 B990480	MB990480	Window glass holder	Power window regulator and motor assembly removal
 00003936	MB990900 or MB991164	Door hinge adjusting wrench	Adjustment of door fit

TROUBLESHOOTING

The power window and central door locking is controlled by the Smart Wiring System (SWS). For troublesshooting, refer to GROUP 54B – Troubleshooting.

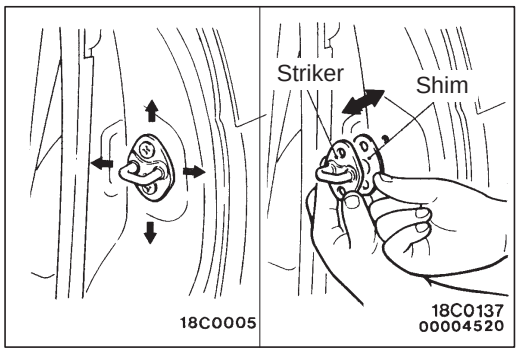


ON-VEHICLE SERVICE

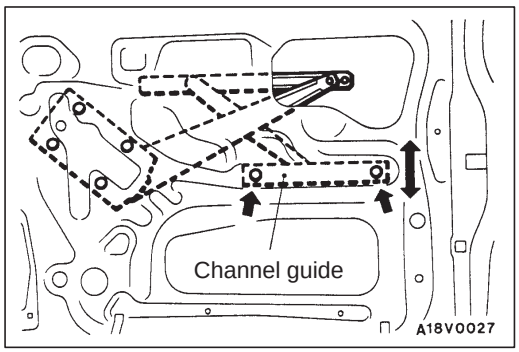
DOOR FIT ADJUSTMENT

1. If clearance between the door and body is uneven, affix protective tape to the fender around the hinge and to the edge of the door. Then use the special tool to loosen the door hinge mounting bolts on the body, and adjust the clearance around the door so that it becomes even.
2. If the door and body are not flush with each other, use the special tool to loosen the door hinge mounting bolts on the door. Then align the door.

Caution
Do not load more than 98 Nm on the special tool.



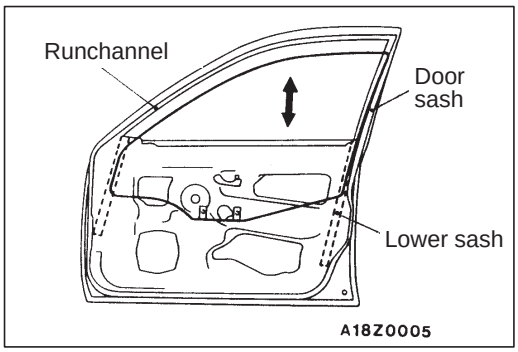
3. If the door opening and closing is heavy, adjust the meshing of the striker and the door latch (forward and backward) by adding shims to the striker and by moving the striker up and down or to the left and right.



DOOR WINDOW GLASS ADJUSTMENT

Check that the door glass moves securely along the door glass runchannel when the window glass is fully raised and fully lowered. If the glass does not move correctly, adjust as follows:

1. Remove the door trim and the waterproof film. (Refer to P.42-23.)
2. Close the door window glass. Loosen the channel guide mounting bolts, and then adjust the inclination of glass.



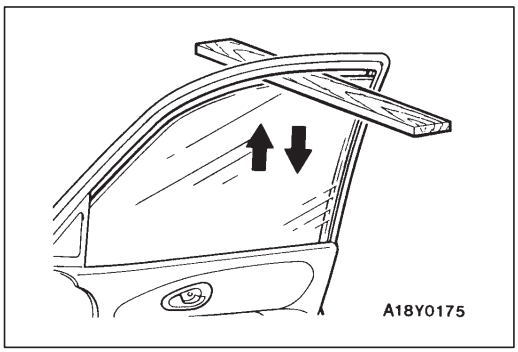
DEFECTIVE POWER WINDOW ADJUSTMENT AND REPLACEMENT

If the window glass wrongly, automatically lowers while being raised, adjust or replace as follows:

1. Remove the door trim and the waterproof film. (Refer to P.42-23.)
2. Remove the window regulator assembly from the door window glass, and then raise and lower the door window glass by hand to check the operation force.

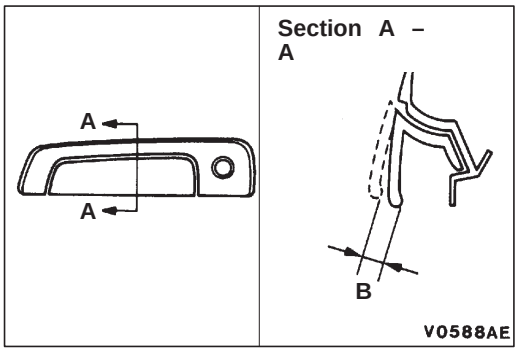
   NOTE
   Insert soft stuff like cushion to prevent damage to the glass if it falls down.
3. If the door window glass does not move up and down smoothly, do as follows:
   - Check the installation condition of the runchannel.
   - Straighten twist in the door sash.
   - Check the installation condition of the lower sash or the center sash.

   NOTE
   The lower sash cannot normally be adjusted, but it may be possible to adjust the sash span slightly within the range allowed by manufacturing tolerances by pushing the lower sash outwards while re-installing it.
4. If repair or adjustment is impossible, replace the door assembly.



POWER WINDOW SAFETY MECHANISM CHECK

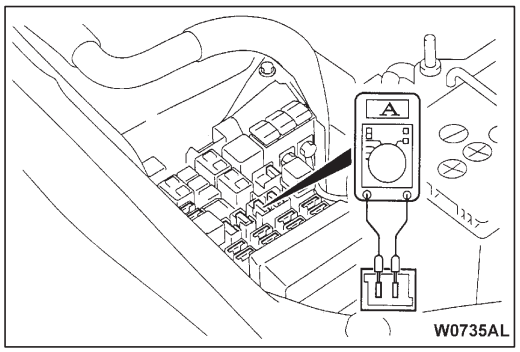
1. Place a wooden board about 10 mm thick as shown. Then, raise the window glass.
2. Check that the window lowers by about 150 mm when the window clamps the board. If this doesn't happen, do troubleshooting. (Refer to GROUP 54B.)



DOOR OUTSIDE HANDLE PLAY CHECK

1. Measure the door outside handle play.

   Standard value (B): 3.7 mm or more
2. If the play is not within the standard value, check the door outside handle or the door latch assembly. Replace, if necessary.



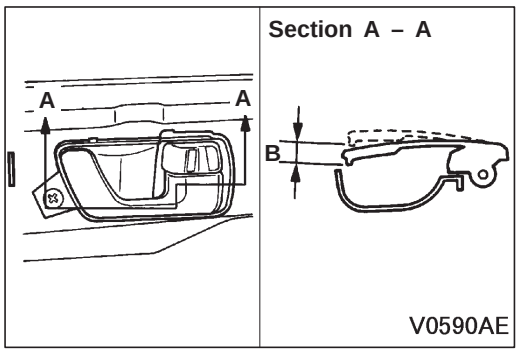
POWER WINDOW OPERATION CURRENT CHECK

1. Remove the power window fuse and connect a circuit tester as shown.
2. Measure the operation current. When the power window switch is turned to UP, much current flows at the beginning and end of the operation. So, measure the operation current in between these points.

   Standard value:
   5.3 ± 2 A (power supply voltage 14.5 ± 0.3 V at 23°C)
3. If the operation current is not within the standard value, do troubleshooting. (Refer to GROUP 54B.)

CIRCUIT BREAKER (INCORPORATED IN POWER WINDOW MOTOR) CHECK

1. Turn the power window switch to UP to close the window glass. Keep the switch at the fully-closed position for another 10 seconds.
2. Release the power window switch and immediately turn it to DOWN. Under this condition if the window glass starts to lower within 60 seconds, the circuit breaker can be judged good.



DOOR INSIDE HANDLE PLAY CHECK AND ADJUSTMENT

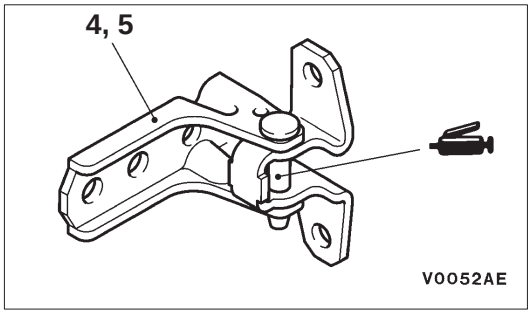
1. Measure the door inside handle play.

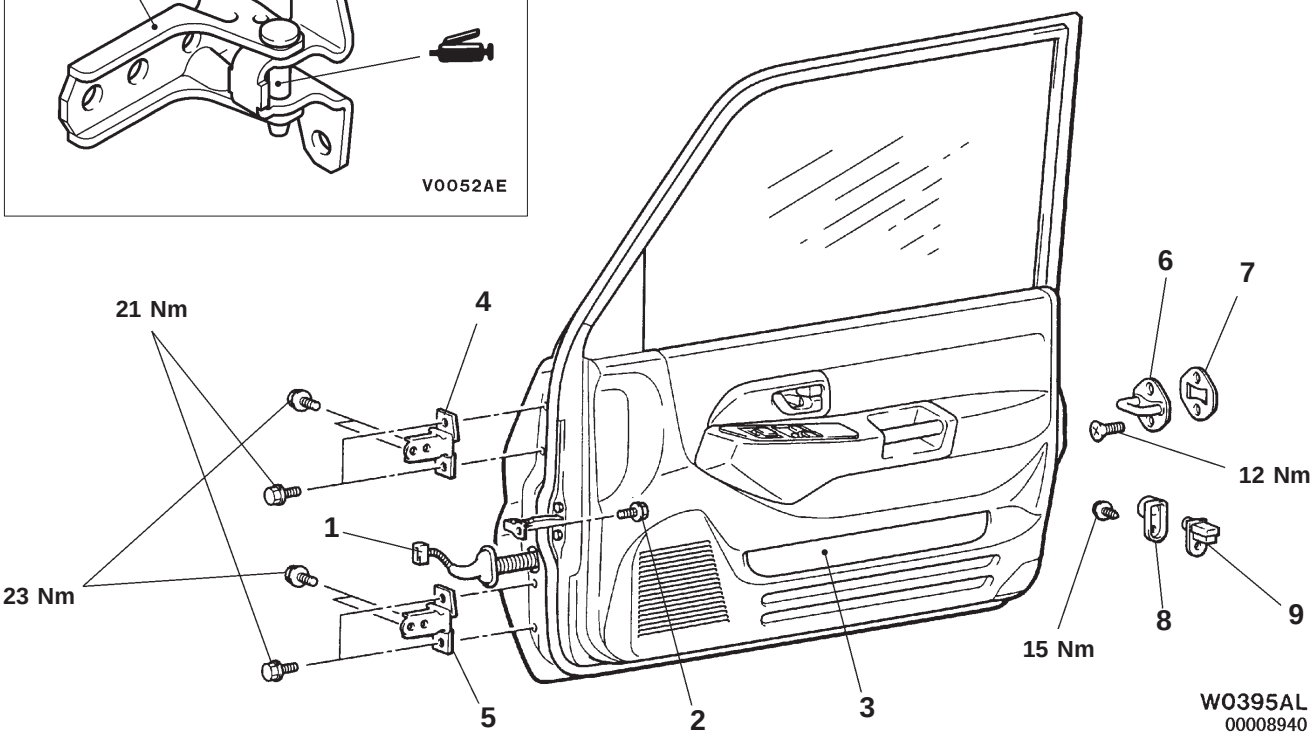
   Standard value (B): 5.3 mm or more
2. If the play is not within the standard value, remove the door trim. (REfer to P.42-23.)
3. Adjust the door inside handle play with the clip connecting the inside handle and the rod.

DOOR ASSEMBLY

REMOVAL AND INSTALLATION

Post-installation Operation
Door Fit Adjustment (Refer to P.42-19.)

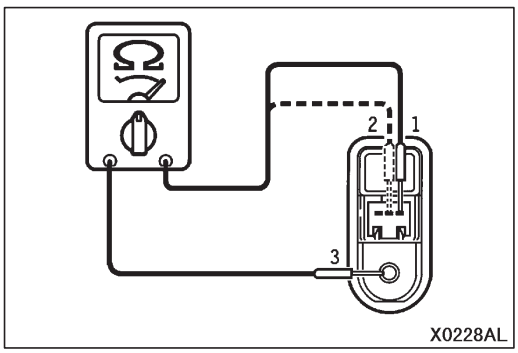




Door assembly removal steps
1. Harness connector
2. Door check connecting bolt
3. Door assembly
4. Door upper hinge
5. Door lower hinge

Striker removal steps
6. Striker
7. Striker shim

Door switch removal steps
8. Door switch cap
9. Door switch

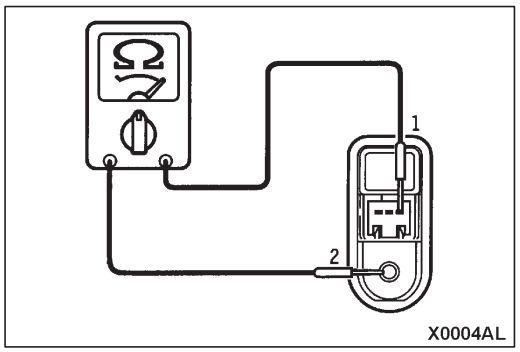


INSPECTION

DOOR SWITCH CONTINUITY CHECK

Driver's side

Switch position	Terminal number		
	1	2	3 (Earth)
Released (ON)	○	○	○
Depressed (OFF)			

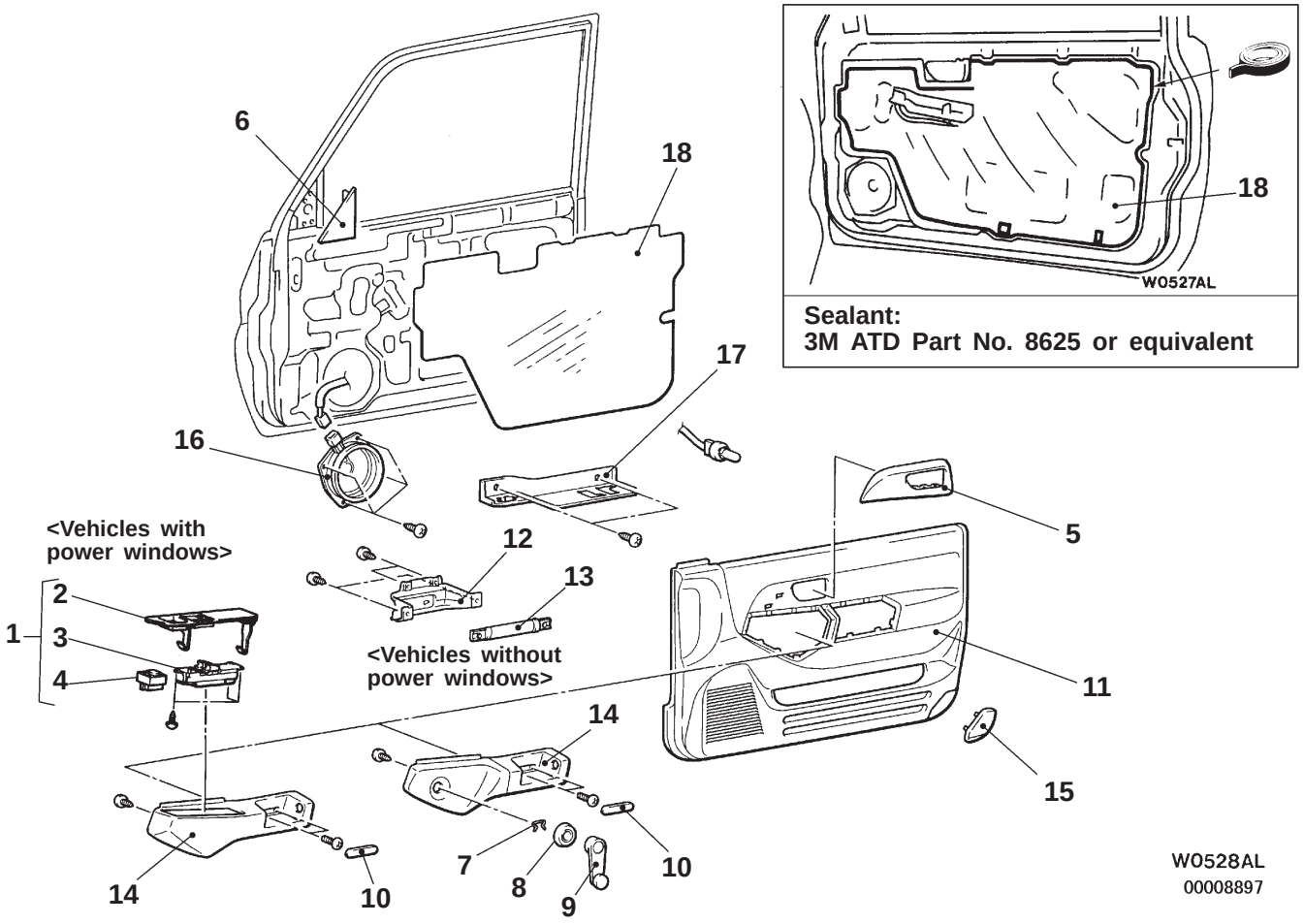


Passenger's side

Switch position	Terminal number	
	1	2 (Earth)
Released (ON)	○———	———○
Depressed (OFF)		

DOOR TRIM AND WATERPROOF FILM

REMOVAL AND INSTALLATION

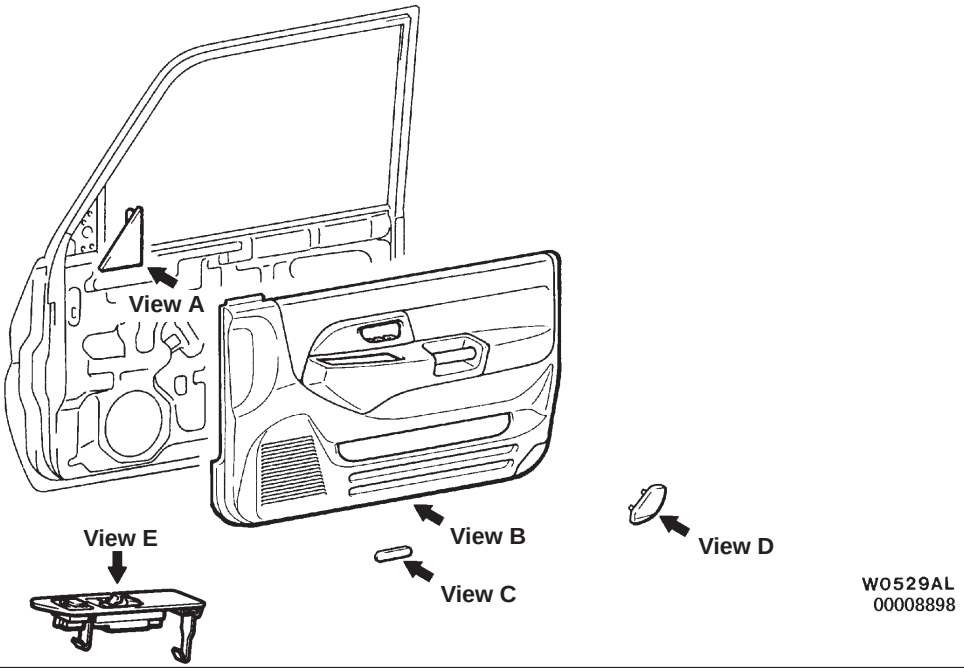


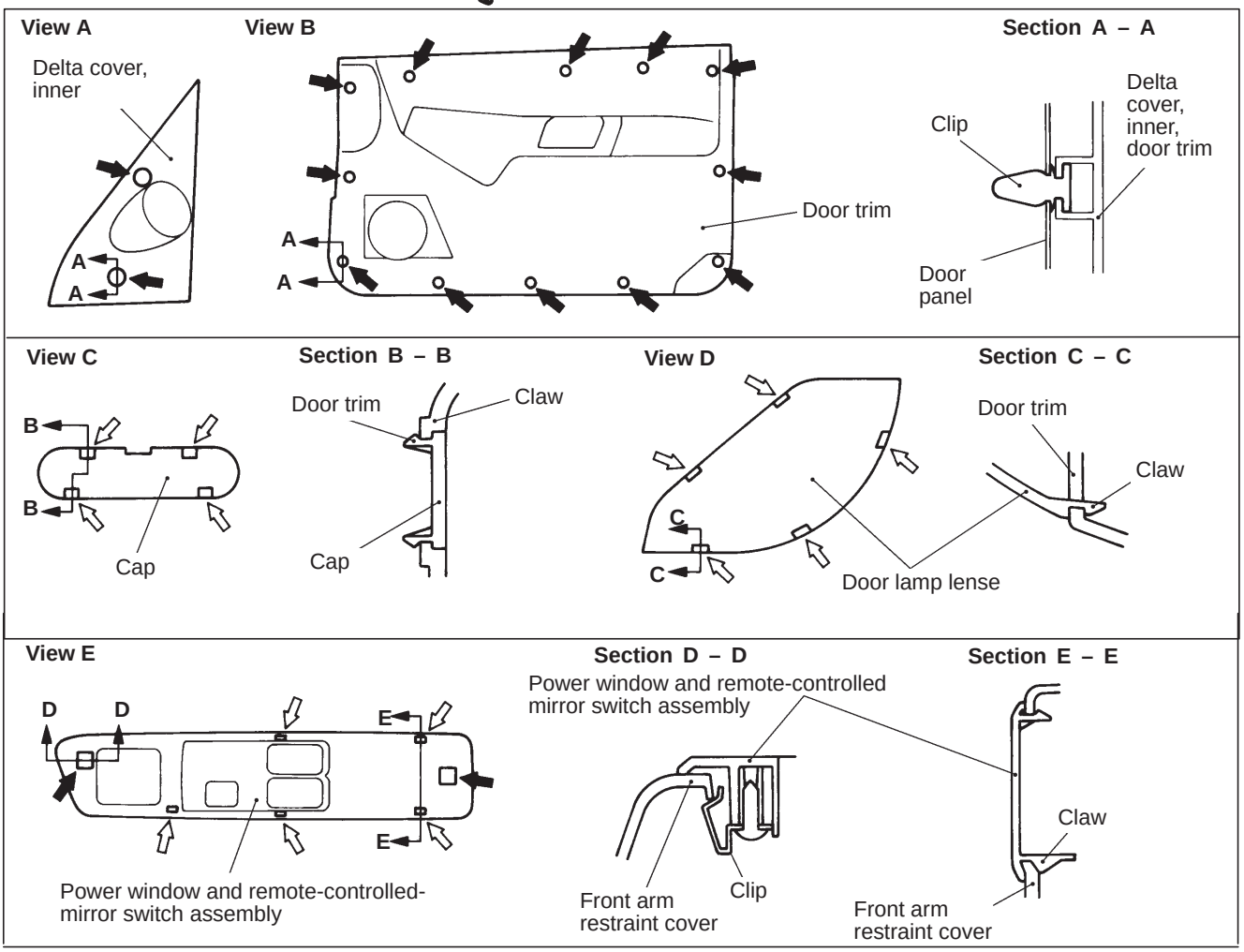
Sealant:
3M ATD Part No. 8625 or equivalent

Removal steps

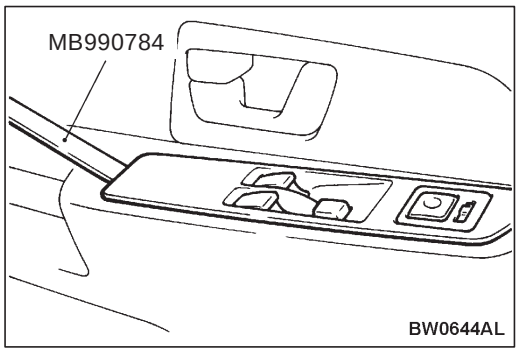
◀A▶ 1. Power window and remote-controlled mirror switch assembly
2. Power window switch panel assembly
3. Power window switch
4. Remote-controlled mirror switch
◀B▶ 5. Door inside handle cover
6. Delta cover, inner
◀C▶ ▶B◀ 7. Clip
▶B◀ 8. Escutcheon
▶B◀ 9. Regulator handle
10. Cap
11. Door trim
12. Grip bracket
13. Door grip
14. Front arm restraint cover
15. Door lamp lense
16. Speaker
17. Power window switch bracket
▶A◀ 18. Waterproof film

CLIP AND CLAW POSITIONS





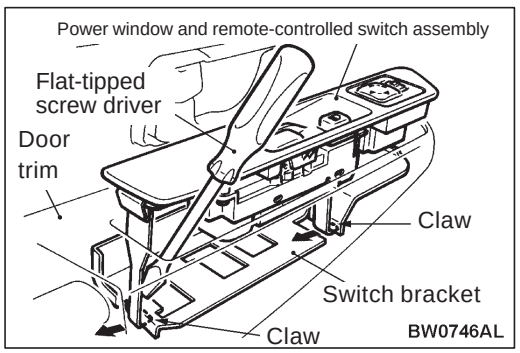
NOTE
⬅ : Clips positions
⇦ : Claws positions



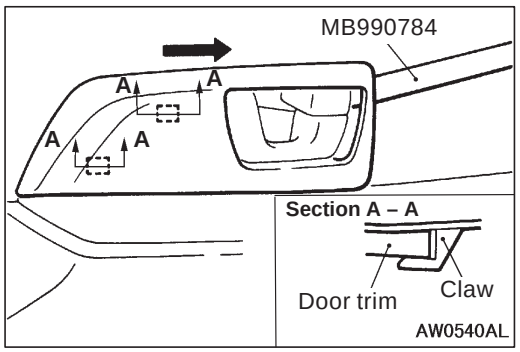
REMOVAL SERVICE POINTS

◀A▶ POWER WINDOW AND REMOTE-CONTROLLED MIRROR SWITCH ASSEMBLY/POWER WINDOW SWITCH PANEL ASSEMBLY REMOVAL

1. Use the special tool to pry out the power window and remote-controlled mirror switch assembly, first at the front and then at the rear. (Refer to P.42-24, CLAW AND CLIP POSITIONS.)

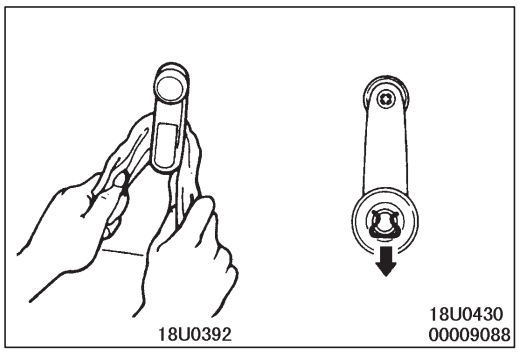


2. Use a flat-tipped screwdriver to disengage the lower claws of the power window and remote-controlled mirror switch assembly as shown in the illustration, and then remove the power window and remote-controlled mirror switch assembly.



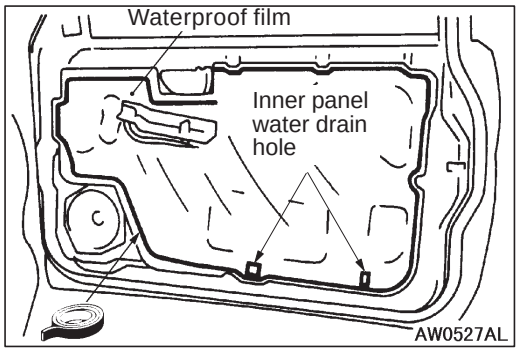
◀B▶ DOOR INSIDE HANDLE COVER REMOVAL

Use the special tool to pry out the rear part of door inside handle cover, and then slide the door inside handle cover in the direction of arrow shown to remove it.



◀C▶ CLIP REMOVAL

Use a cloth to remove the clip as shown in the illustration.



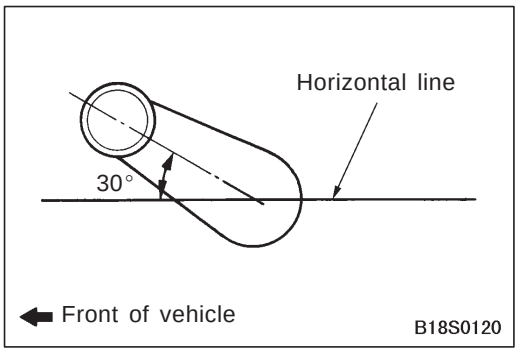
INSTALLATION SERVICE POINTS

▶A◀ WATERPROOF FILM INSTALLATION

Apply the specified sealant to the shown positions of waterproof film, and then attach the waterproof film.

Specified sealant: 3M ATD Part No. 8625 or equivalent

Caution
Be sure to apply the sealant below the inner panel water drain holes so as not to plug them.



▶B◀ REGULATOR HANDLE/ESCUTCHEON/CLIP INSTALLATION

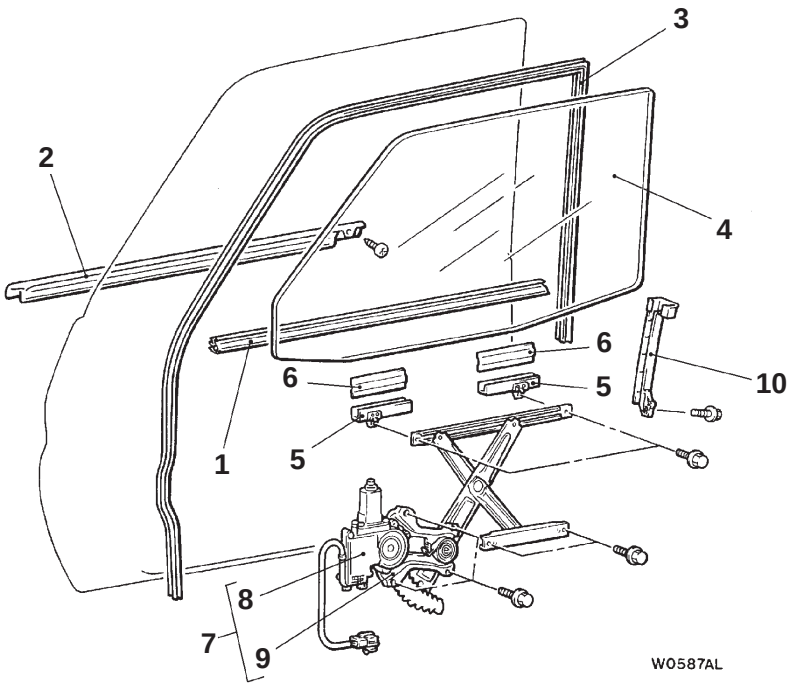
1. Install the clip and escutcheon to the regulator handle.
2. Close the front door window glass fully, and then install the regulator handle as shown in the illustration.

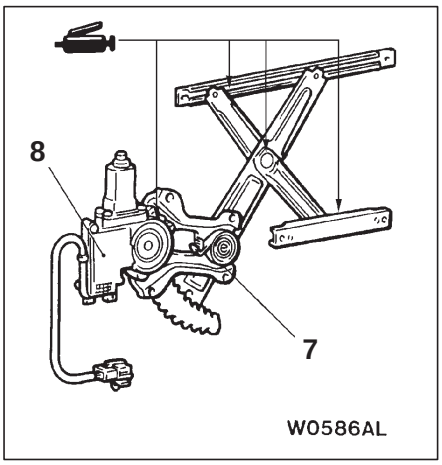
DOOR GLASS AND REGULATOR

REMOVAL AND INSTALLATION

Pre-removal Operation
- Door Mirror Removal (Refer to GROUP 51.)
- Door Trim and Waterproof Film Removal (Refer to P.42-23.)

Post-installation Operation
- Door Window Glass Adjustment (Refer to P.42-19.)
- Door Trim and Waterproof Film Installation (Refer to P.42-23.)
- Door Mirror Installation (Refer to GROUP 51.)





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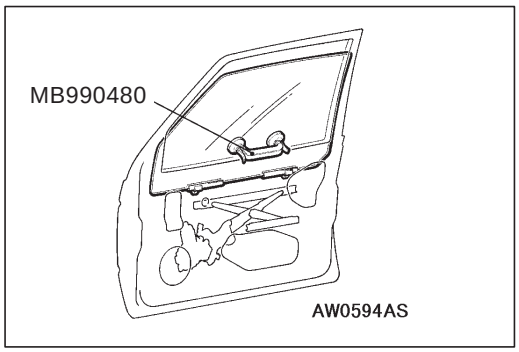
Door window glass removal steps

▶D◀ ● limit switch set-up
1. Door window inner weather strip
2. Door belt line moulding assembly
3. Door window glass runchannel

▶C◀ 4. Door window glass
▶C◀ 5. Glass holder
▶C◀ 6. Door glass pad

Power window regulator and motor assembly removal steps

◀A▶ 7. Power window regulator and motor assembly
▶B◀ 8. Power window motor assembly
▶B◀ 9. Power window regulator assembly
▶A◀ 10. Rear lower sash



REMOVAL SERVICE POINT

◀A▶ POWER WINDOW REGULATOR AND MOTOR ASSEMBLY REMOVAL

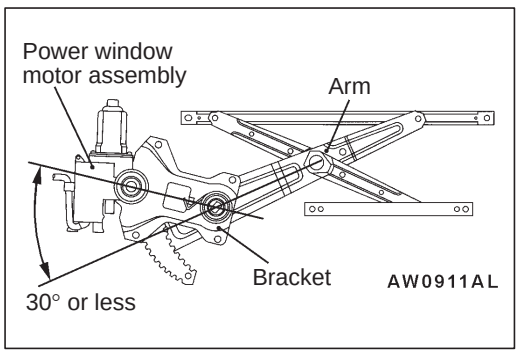
1. Remove the door window glass assembly installation bolts.
2. Lift up the door window glass assembly, and then install the special tool to the window glass as shown in the illustration to prevent the window glass falling.

   Caution
   If a film, etc. is attached to the door window glass, install the special tool to the outside of window glass in order to prevent the film peeling.
3. Remove the power window regulator and motor assembly.

INSTALLATION SERVICE POINTS

▶A◀ REAR LOWER SASH INSTALLATION

Be sure to insert the rear lower sash to the window rear sash (at door) securely.

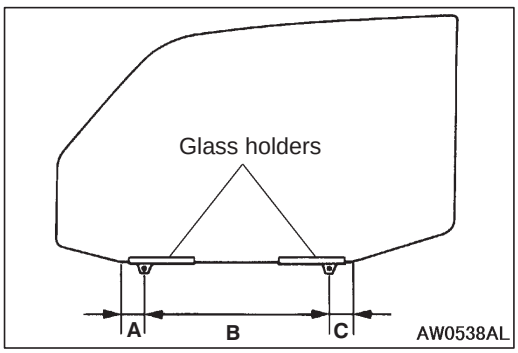


▶B◀ POWER WINDOW MOTOR ASSEMBLY/POWER WINDOW REGULATOR ASSEMBLY INSTALLATION

Adjust the power window motor assembly and power window regulator assembly positions as follows:

1. Connect the power window motor assembly connector and the power window switch connector to the wiring harness of body side.
2. Turn on the power window switch to operate the power window motor for 3 seconds in the direction which the window glass closes.
3. Disconnect the power window motor assembly connector and the power window switch connector from the wiring harness of body side.
4. Assemble the power window motor assembly and the power window regulator so that the arm and bracket are positioned as shown in the illustration, and then install the power window motor assembly.

Caution
When installing the power window regulator, do not set it in the window glass fully-closed position. If installing the power window regulator in that condition, the window glass safety mechanism will not functions correctly.



▶C◀ DOOR WINDOW GLASS/GLASS HOLDER/DOOR GLASS PAD INSTALLATION

1. Install the door glass pads and glass holders to the window glass in the positions shown.

   Standard value (A): 55.0 mm

   Standard value (B): 419.0 – 421.0 mm

   Standard value (C): 55.0 mm

2. Install the glass to the window regulator assembly.

   Caution
   Do not activate the window regulator assemble before installing the glass as the resetting in the limit switch is cancelled.

▶D◀LIMIT SWITCH SETTING

1. Fully close the window glass.

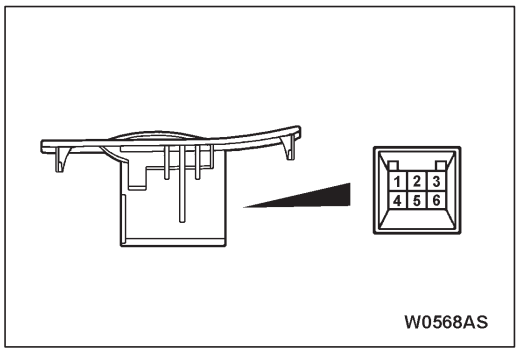
   NOTE
   The limit switch learning operation is complete once the window glass is fully closed.

2. Check that the limit switch operates normally. (Refer to P.42-20.)

INSPECTION

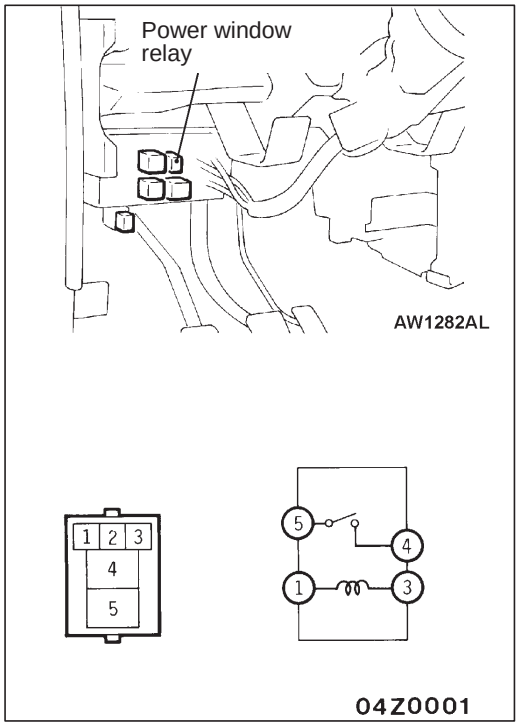
POWER WINDOW MAIN SWITCH CONTINUITY CHECK

NOTE
Since the power window main switch uses the SWS system, check the continuity with the input signal check method. Refer to GROUP 54B – Troubleshooting.



POWER WINDOW SUB SWITCH CONTINUITY CHECK

Switch position	Terminal No.		
	1	4	6
UP		○	○
DOWN	○	○	



POWER WINDOW RELAY CONTINUITY CHECK

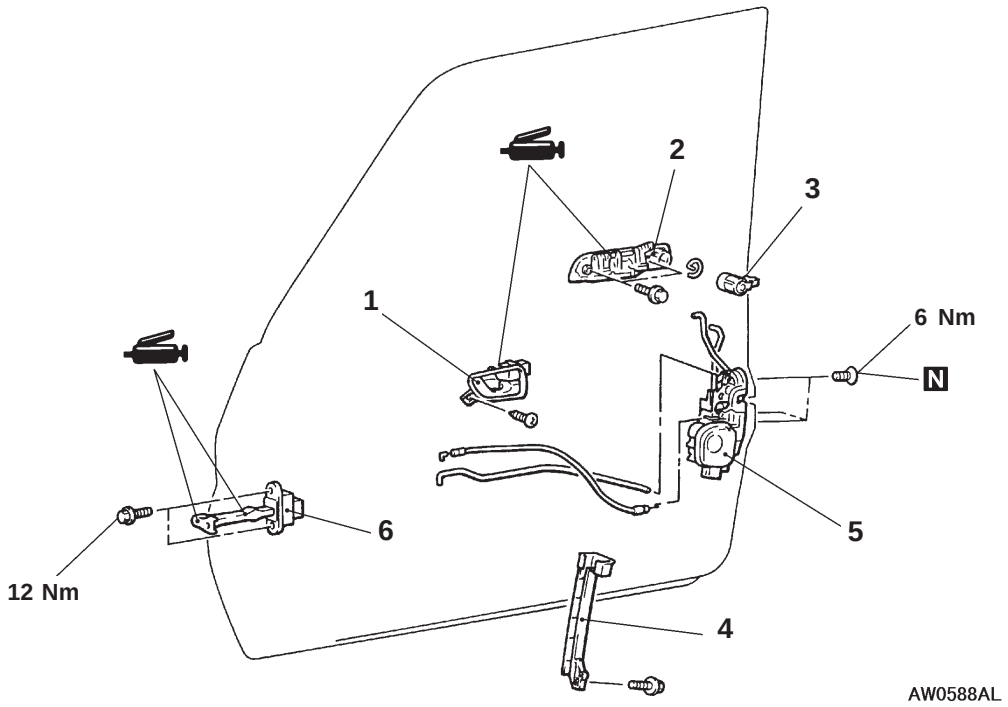
Battery voltage	Terminal No.			
	1	3	4	5
Not applied	○	○		
Applied	⊕	⊖	○	○

DOOR HANDLE AND LATCH

REMOVAL AND INSTALLATION

Pre-removal Operation
Door Trim Removal (Refer to P.42-23.)

Post-installation Operation
- Door Inside Handle Play Check (Refer to P.42-21.)
- Door Outside Handle Play Check (Refer to P.42-20.)
- Door Trim Installation (Refer to P.42-23.)



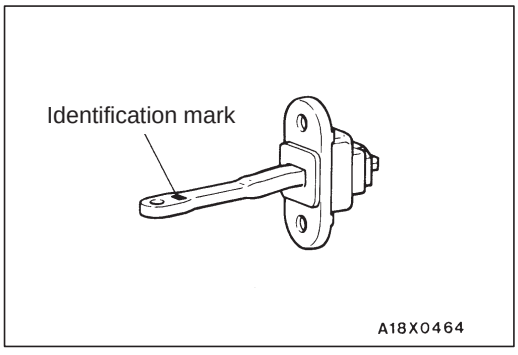
Door handle and door latch assembly removal steps

▶C◀ 1. Door inside handle
- Waterproof film (Refer to P.42-23.)

2. Door outside handle
3. Door lock key cylinder
▶B◀ 4. Rear lower sash
5. Door latch assembly

Door check removal steps
- Waterproof film (Refer to P.42-23.)

▶A◀ 6. Door check



INSTALLATION SERVICE POINTS

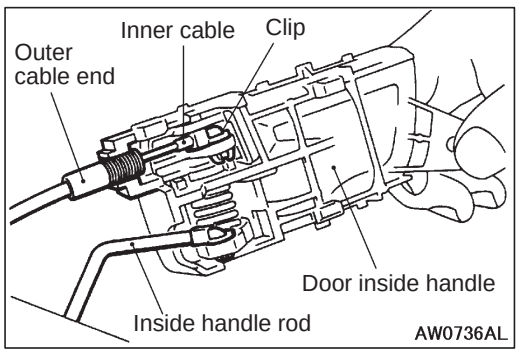
▶A◀ DOOR CHECK INSTALLATION

Install with the following identification marks upward.

Items	Identification mark
Left door	21L
Right door	21R

▶B◀ REAR LOWER SASH INSTALLATION

Be sure to install the rear lower sash to the window rear sash (at door) securely.



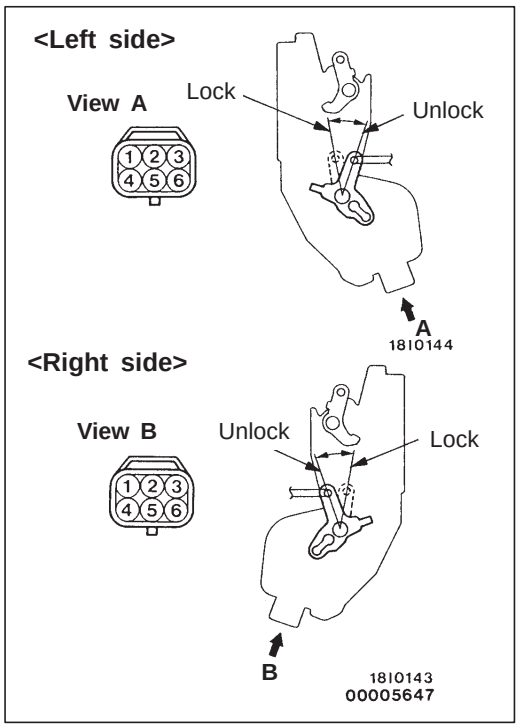
▶C◀ DOOR INSIDE HANDLE INSTALLATION

1. Install the inside lock cable to the door inside handle as follows:
   (1) Install the inner cable end in the inside lock cable to the clip in the door inside handle.
   (2) Turn the inside lock knob to the door lock position.
   (3) Install the outer cable end to the door inside handle securely.
   (4) Install the clip to the inner cable.
2. Install the inside handle rod to the door inside handle.
3. Install the door inside handle to the door.

INSPECTION

DOOR LOCK ACTUATOR CHECK

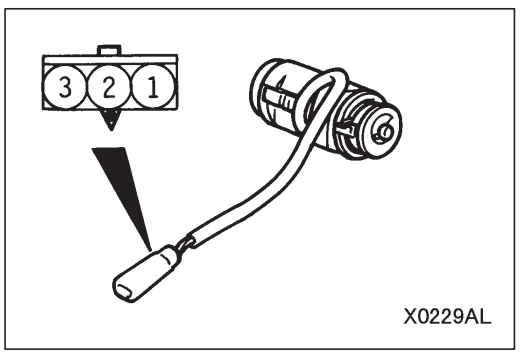
<Left side>



Rod position	Terminal No.		Rod operation
	4	6	
LOCK	⊖	⊕	LOCK to UNLOCK
UNLOCK	⊕	⊖	UNLOCK to LOCK

<Right side>

Rod position	Terminal No.					Rod operation
	1	2	3	4	6	
LOCK				⊖	⊕	LOCK to UNLOCK
UNLOCK				⊕	⊖	UNLOCK to LOCK
LOCK	○		○			
UNLOCK		○	○			



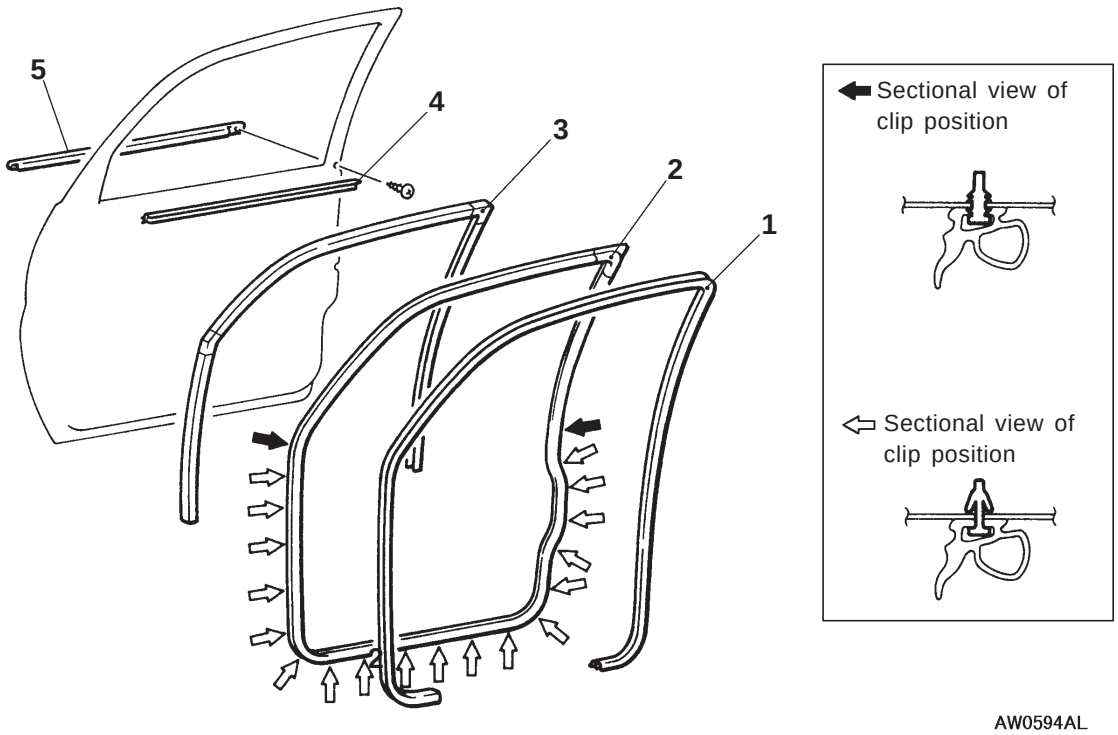
DOOR LOCK KEY CYLINDER SWITCH CONTINUITY CHECK <Vehicles with central door locking system>

Passenger's side only

Switch position	Terminal No.		
	1	2	3
LOCK	○	○	
Neutral (OFF)			
UNLOCK		○	○

WINDOW GLASS RUNCHANNEL AND DOOR OPENING WHETHERSTRIP

REMOVAL AND INSTALLATION



Door inner opening weatherstrip removal steps

- Scuff plate (Refer to GROUP 52A.)
- Cowl side trim (Refer to GROUP 52A.)
- Center pillar lower trim (Refer to GROUP 52A.)

1. Door inner opening weatherstrip

Door outer opening weatherstrip removal

◀A▶ 2. Door outer opening weatherstrip

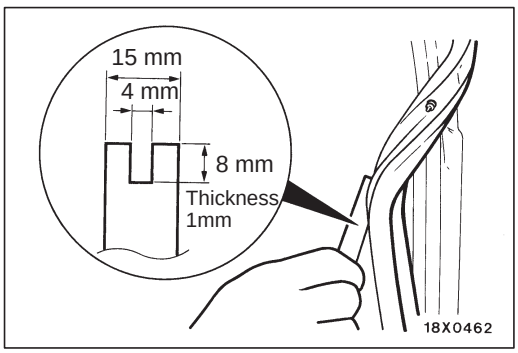
Door window glass runchannel removal steps

3. Door window glass runchannel
4. Door window glass lower runchannel

Door beltline moulding removal steps

- Outside rear view mirror (Refer to GROUP 51.)

5. Door beltline moulding



REMOVAL SERVICE POINT

◀A▶ DOOR OUTER OPENING WEATHERSTRIP REMOVAL

Make a tool as shown and remove the door opening weatherstrip.

BACK DOOR

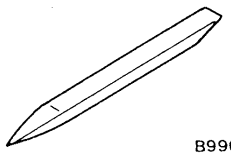
SERVICE SPECIFICATION

Item	Standard value
Back door handle play mm	2.0 – 8.0

SEALANT

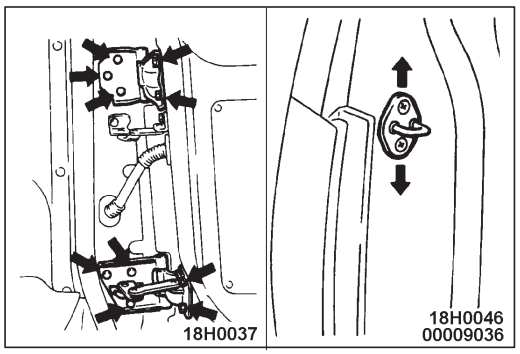
Item	Specified sealant	Remark
Waterproof film	3M ATD Part No. 8625 or equivalent	Ribbon sealer

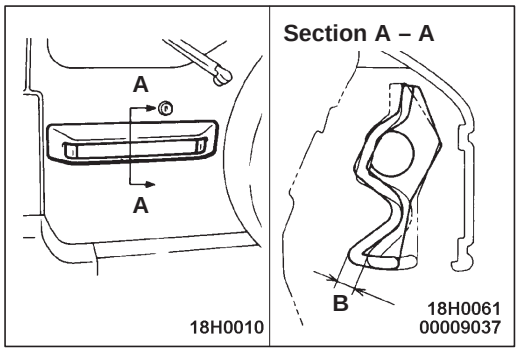
SPECIAL TOOL

Tool	Number	Name	Use
 B990784	MB990784	Ornament remover	Back door trim removal

TROUBLESHOOTING

The central door locking (back door) is controlled by the Smart Wiring System (SWS). For troublesshooting, refer to GROUP 54B – Troubleshooting.





ON-VEHICLE SERVICE

BACK DOOR FIT ADJUSTMENT

1. If the striker and latch mesh badly, move the striker forward and backward or right and left to adjust.
2. If uneven clearance is present between back door and body, reposition the hinge and striker and/or change the thickness of shim (change the number of shim) to adjust the clearance.

BACK DOOR HANDLE PLAY CHECK

1. Measure the back door handle play.

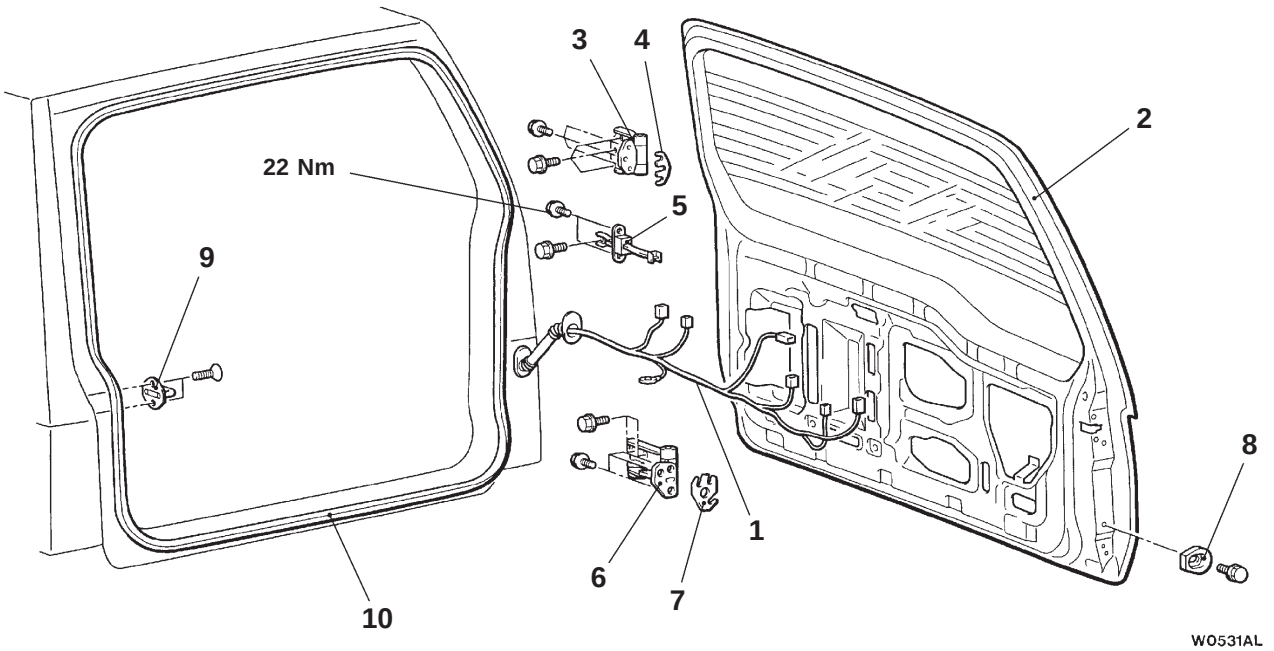
   Standard value (B): 2.0 – 8.0 mm
2. If the back door handle play is not within the standard value, check the back door handle and door latch assembly. Replace if necessary.

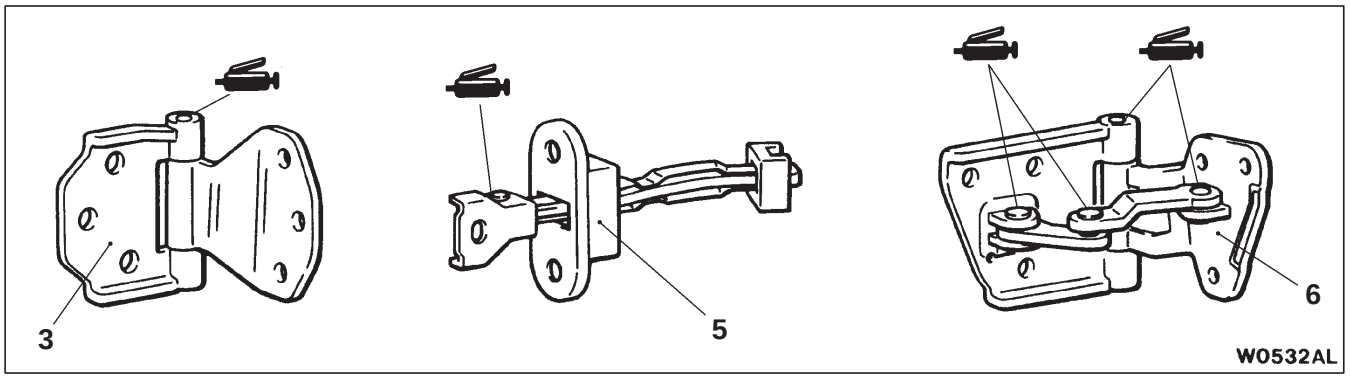
BACK DOOR ASSEMBLY

REMOVAL AND INSTALLATION

Pre–removal Operation
- High–mounted Stop Lamp Removal (Refer to GROUP 54A.)
- Spare Tyre Carrier Removal (Refer to GROUP 51.)

Post–installation Operation
- High–mounted Stop Lamp Installation (Refer to GROUP 54A.)
- Spare Tyre Carrier Installation (Refer to GROUP 51.)
- Back Door Fit Adjustment (Refer to P.42-33.)





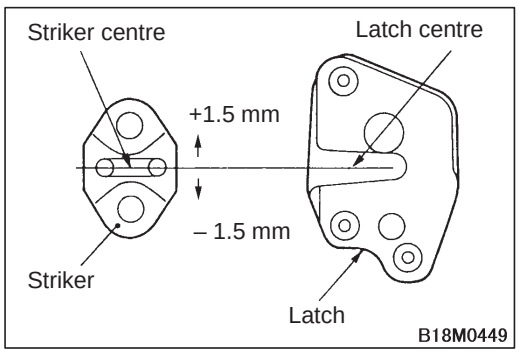
Removal steps
- Back door trim and waterproof film (Refer to P.42-36.)

1. Harness connector
2. Back door assembly
3. Back door upper hinge
4. Shim
5. Door check
6. Back door lower hinge
7. Shim
8. Damper mail
- ▶B◀ 9. Striker
- ▶A◀ 10. Back door opening weatherstrip

INSTALLATION SERVICE POINT

▶A◀ BACK DOOR OPENING WEATHERSTRIP INSTALLATION

Align the marking section on the back door opening weatherstrip with the centre of the body.

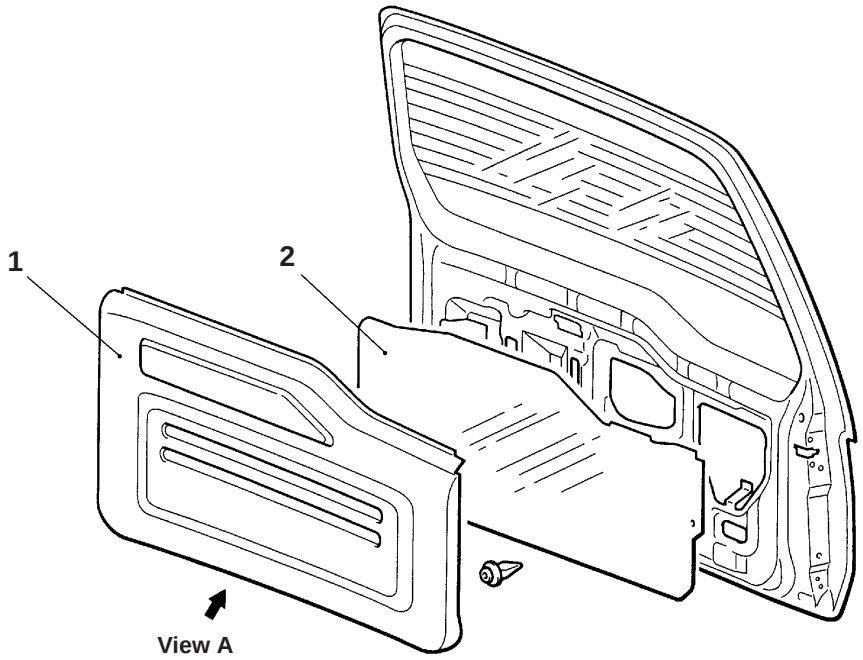


▶B◀ STRIKER INSTALLATION

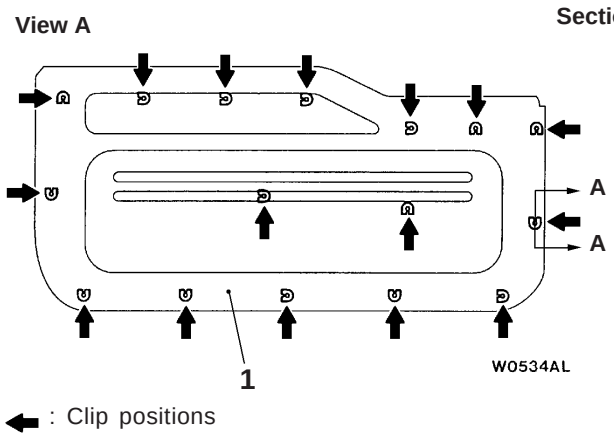
Install the striker so that the striker centre does not deviate more than ± 1.5 mm from the latch centre.

BACK DOOR TRIM AND WATERPROOF FILM

REMOVAL AND INSTALLATION

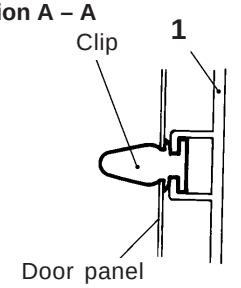


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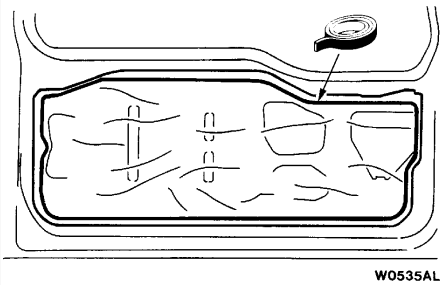


W0534AL

: Clip positions



V0630AE



W0535AL

Sealant:
3M ATD Part No. 8625 or equivalent

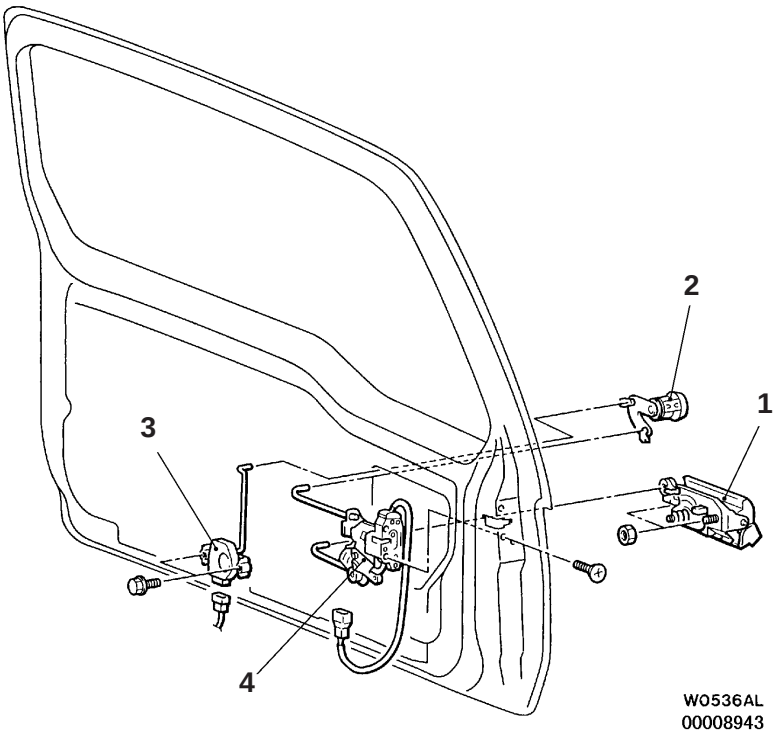
Removal steps

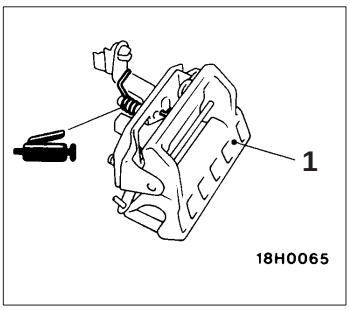
1. Back door trim
2. Waterproof film

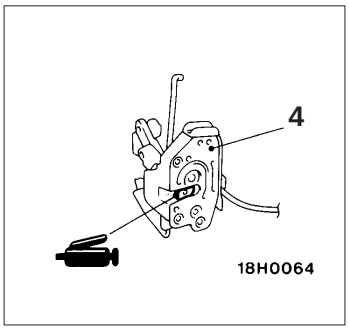
BACK DOOR HANDLE AND LATCH

REMOVAL AND INSTALLATION

Post-installation Operation
Back Door Handle Play Check (Refer to P.42-33.)







Back door handle and lock key cylinder removal steps

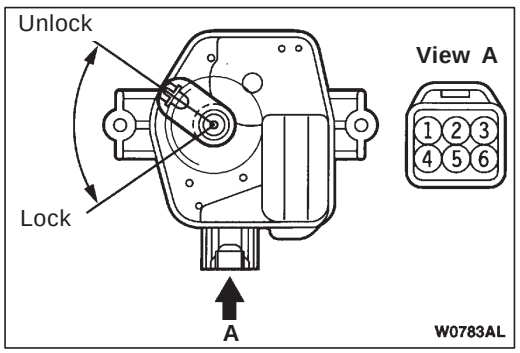
- Back door trim and waterproof film (Refer to P.42-36.)

1. Back door handle
2. Back door lock key cylinder

Back door latch removal steps

- Back door trim and waterproof film (Refer to P.42-36.)

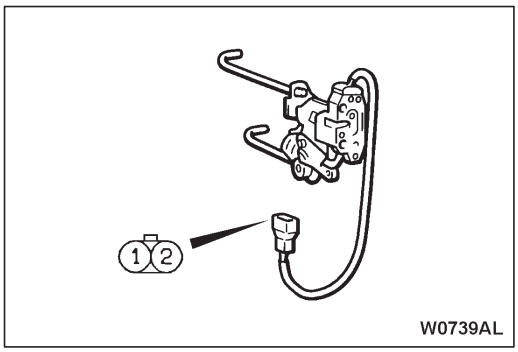
3. Back door lock actuator
4. Back door latch assembly



INSPECTION

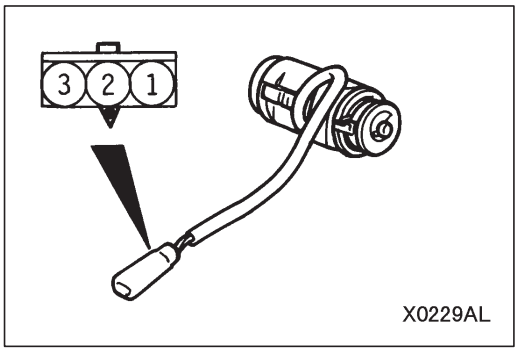
BACK DOOR LOCK ACTUATOR CHECK

Rod position	Terminal No.		Rod operation
	4	6	
LOCK	⊕	⊖	LOCK to UNLOCK
UNLOCK	⊖	⊕	UNLOCK to LOCK



BACK DOOR LATCH CONTINUITY CHECK

Switch position	Terminal No.	
	4	6
Back door opend		
Back door closed	○———	———○



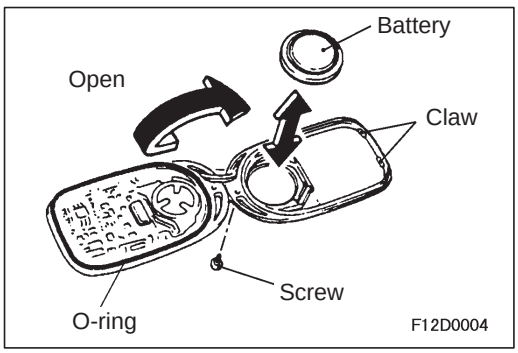
DOOR LOCK KEY CYLINDER SWITCH CONTINUITY CHECK <Vehicles with central door locking system>

Switch position	Terminal No.		
	1	2	3
LOCK	○———	———○	
Neutral (OFF)			
UNLOCK		○———	———○

KEYLESS ENTRY SYSTEM

TROUBLESHOOTING

The keyless entry system is controlled by the Smart Wiring System (SWS). For troublesshooting, refer to GROUP 54B – Troubleshooting.



ON-VEHICLE SERVICE

HOW TO REPLACE A BATTERY OF THE TRANSMITTER

1. Remove the set screw to remove the battery from the transmitter.
2. Install a battery with its (+) side face-down.

   Battery required for replacement:
   Coin type battery CR2032
3. Insert the claw first, and with care not to displace the O-ring, assemble the transmitter.
4. Check to see if the keyless entry system operates.

   NOTE
   (1) Do not let water or dust stick to the inside of the transmitter when it is open. Also, do not touch the precision electronic device.
   (2) If the O-ring is displaced during the assembly of the transmitter, water or dust penetrates in it causing trouble.

ENCRYPTED CODE REGISTRATION METHOD

Each individual encrypted code is registered inside the transmitter, and so it is necessary to register these codes with the EEPROM inside the ETACS-ECU in the following cases.

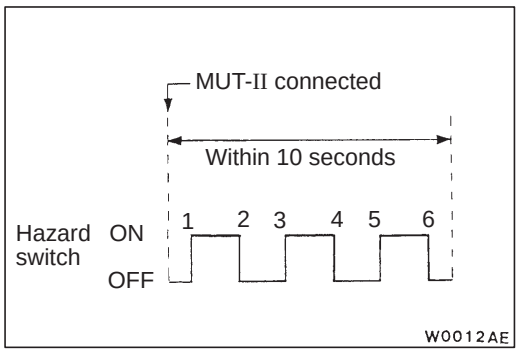
- When either the transmitter or ETACS-ECU is replaced;
- If a second transmitter is to be used;
- If it appears that a problem is occurring because of faulty registration of a code.

A maximum of four different codes can be stored in the memory area of the EEPROM (four different transmitters can be used). When the code for the first transmitter is registered, the previously-registered codes for four transmitters are cleared. Therefore, if you are using more than two transmitters or are adding a second transmitter, the codes for all the transmitters must be registered at the same time.

1. Check that the doors lock normally when the ignition key is inserted into the door key cylinder and turned.
2. Insert the ignition key in the ignition switch.
3. Connect the MUT-II to the diagnosis connector.

   NOTE
   This sets the system in encrypted code registration standby mode. If MUT-II is not used, connect terminal No.1 of the diagnosis connector to earth.

   Caution
   Always turn the ignition switch to LOCK (OFF) position before connecting and disconnecting the MUT-II or earth.



4. Within 10 seconds after connecting the MUT-II or earth, press the hazard switch six times.

   NOTE
   (1) The doors will lock and unlock once after pressing the hazard switch six times, and the system will switch to registration mode.
   (2) The hazard switch alternates between ON and OFF each time pressing the hazard switch (Refer to illustration).

5. Press the lock switch or unlock switch of the transmitter switch, and then press it two times within 10 seconds of the first press. This will register the code.
6. After registration is completed, the doors will be automatically locked and unlocked once.
7. If you are using more than two transmitters or have added a second transmitter, the same registration procedure should be carried out for the remaining transmitters, and it should be carried out within one minute after registration of the code for the first transmitter has been completed. The registration procedure are all the same for all transmitters.

8. Registration mode will be terminated under the following conditions.
   - When the encrypted codes for four transmitters have been registered;
   - When one minute has passed after registration mode started;
   - When the MUT-II is disconnected (earth is released);
   - When the ignition key is removed;
9. After registration mode has been completed, carry out the followings to make sure that the keyless entry system operates.
   - Pull the ignition key out.
   - Close all of the doors.

HAZARD LAMP ANSWERBACK ADJUSTMENT

The following functions can be adjusted by operating input switches. The adjustments will be stored in the ECU memory even after a battery cable is disconnected:
- Switching of keyless entry answerback function (From activation to desactivation, or viceversa)
- Initialization of all the ETACS functions (From desactivation to activation)

1. Entry conditions to the adjustment mode
   The ETACS-ECU sounds a buzzer once when all of the following conditions are satisfied, and then enters the adjustment mode:
   - Hazard warning lamp switch: OFF
   - Diagnosis control: ON (Connect the MUT-II or earth the diagnosis connector No.1 terminal.)
   - Key reminder switch: OFF
   - Ignition switch: LOCK (OFF)
   - Driver's door switch: OFF (Close the driver's door.)
   - If all of the conditions above are satisfied, the windshield washer switch will be turned on for more than 10 seconds.
2. Exit conditions from the adjustment mode
   The ETACS-ECU cancels the adjustment mode when any of the following conditions is satisfied:
   - Diagnosis control: ON (Disconnect the MUT-II or disconnect the diagnosis connector No.1 terminal from the earth.)
   - Key reminder switch: ON (Pull out the ignition key.)
   - Ignition switch: Other than LOCK (OFF)
   - Driver's door switch: ON (Open the driver's door.)
   - After the ETACS-ECU has entered the adjustment mode, no adjustment is made within 3 minutes (If any adjustment is made within 3 minutes, the ETACS-ECU monitors a adjustment operation for other 3 minutes.)
   - Other warning buzzer(s) sounds

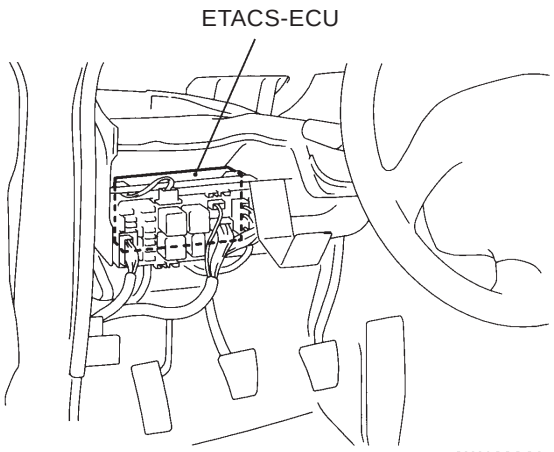
3. Adjustment of functions

Function	Adjustment procedure
Keyless entry answerback function	When the transmitter lock switch is turned on twice continuously within 2 seconds, the lock answerback function toggles on and off. ● If the function toggles on, the buzzer sounds once (default condition). ● If the function toggles off, the buzzer sounds twice, When the transmitter unlock switch is turned on twice continuously within 2 seconds, the unlock answerback function toggles on and off. ● If the function toggles on, the buzzer sounds once (default condition). ● If the function toggles off, the buzzer sounds twice,
Initialization of all the ETACS functions (From desactivation to activation)	When the windshield washer switch remains on for more than 20 seconds, the buzzer sounds twice and then all of the following functions will be initialized. ● Automatic lighting sensor sensitivity ● Automatic headlamp switch-off function ● Vehicle-speed dependent wiper ● Outside mirror automatic rest function The buzzer will sound in 10 seconds (indicating that the ETACS-ECU enters the adjustment mode), but the washer switch must remains off for 20 seconds in order to initialize all the functions. If the windshield washer switch remains on for more than 20 seconds without entering the adjustment mode, the system enters the adjustment mode in 10 seconds, but does not initialize all of the functions.

KEYLESS ENTRY SYSTEM

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Side Cover Removal and Installation
(See GROUP 52A – Instrument Panel.)



SUNROOF

SERVICE SPECIFICATION

Items	Standard value
Roof lid glass operating current A (at 20°C)	7 or less

TROUBLESHOOTING

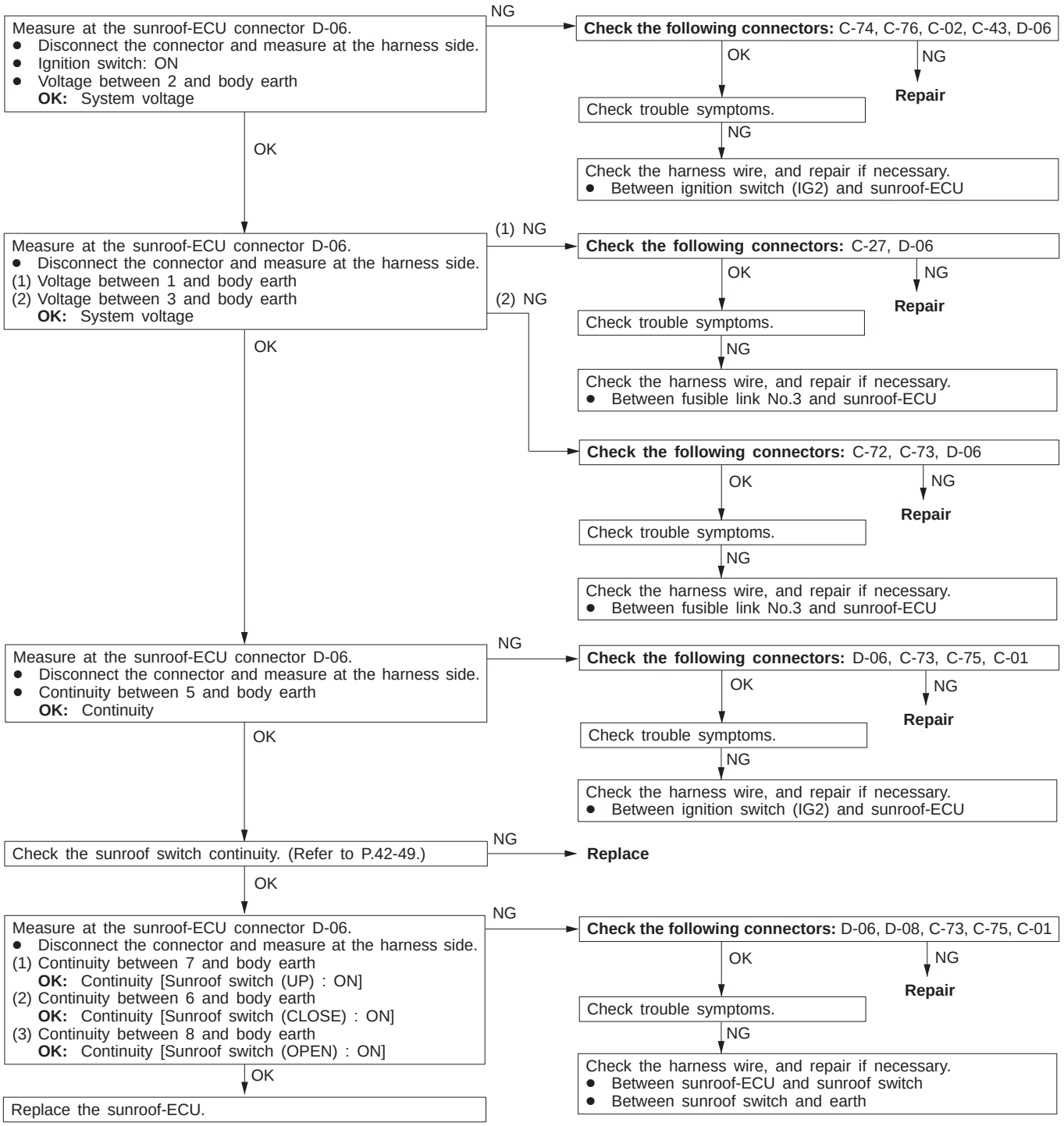
INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom	Inspection procedure	Reference page
The sunroof does not operate when the ignition switch is turned to ON.	1	42-43
The motor does not reverse its direction when a load of 140 N or more is applied while the sunroof is closing.	2	42-44
The timer does not operate during 30 seconds after the ignition switch is turned to LOCK (OFF) position.	3	42-44
Opening or closing of the sunroof is possible immediately after turning the ignition switch to LOCK (OFF) position, but the timer function does not operate continuously for another 30 seconds if the driver's side door is opened within 30 seconds.	4	42-44

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURE 1

The sunroof does not operate when the ignition switch is turned to ON.	Probable cause
The cause may be a malfunction of a sunroof switch, sunroof-ECU power supply circuit or earth circuit.	• Malfunction of sunroof switch • Malfunction of sunroof-ECU • Malfunction of wiring harness or connector



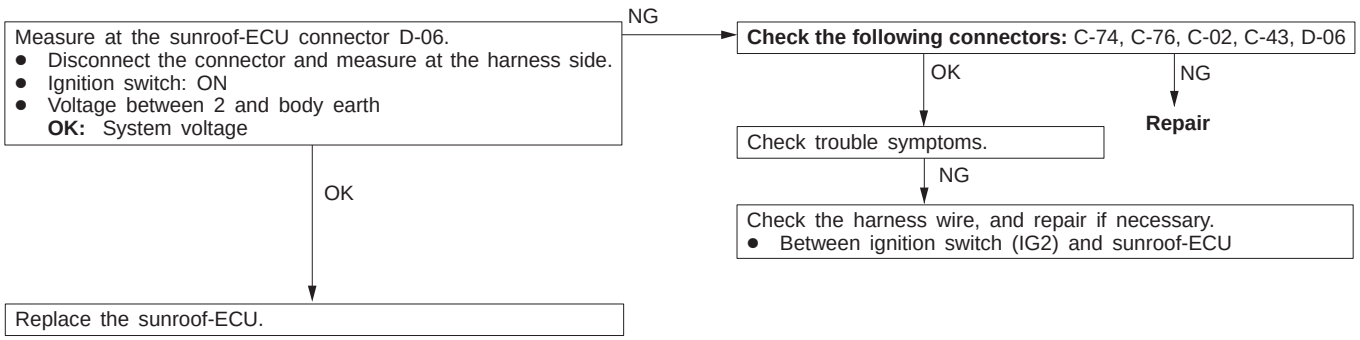
INSPECTION PROCEDURE 2

The motor does not reverse its direction when a load of 140 N or more is applied while the sunroof is closing.	Probable cause
The sunroof-ECU monitors the load conditions from the amount of current flowing to the motor. If more than the constant amount of current is flowing, the direction of motor operation is reversed to prevent jamming. If the motor does not reverse direction even when an excessive load is being applied, the cause may be a malfunction of the sunroof-ECU.	• Malfunction of sunroof-ECU

Replace the sunroof-ECU.

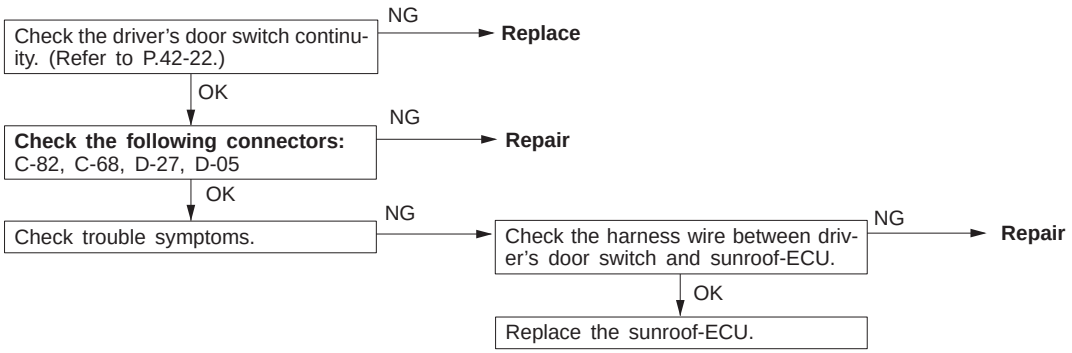
INSPECTION PROCEDURE 3

The timer does not operate during 30 seconds after the ignition switch is turned to LOCK (OFF) position.	Probable cause
The sunroof-ECU has a timer function which operates during 30 seconds after the ignition switch is turned to LOCK (OFF) position. If the timer does not operate, the cause may be a malfunction of the sunroof-ECU or of the wiring harness or connector.	• Malfunction of wiring harness or connector • Malfunction of sunroof-ECU

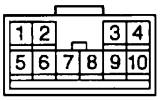


INSPECTION PROCEDURE 4

Opening or closing of the sunroof is possible immediately after turning the ignition switch to LOCK (OFF) position, but the timer function does not operate continuously for another 30 seconds if the driver's side door is opened within 30 seconds.	Probable cause
The operation period for the sunroof timer is extended when an on signal is output from the driver's-side door switch. Because of this, if the timer operation period is not extended, the cause may be a malfunction of the door switch input circuit.	• Malfunction of wiring harness or connector • Malfunction of driver's door switch • Malfunction of sunroof-ECU



SUNROOF-ECU TERMINAL VOLTAGE CHART



V1334AE

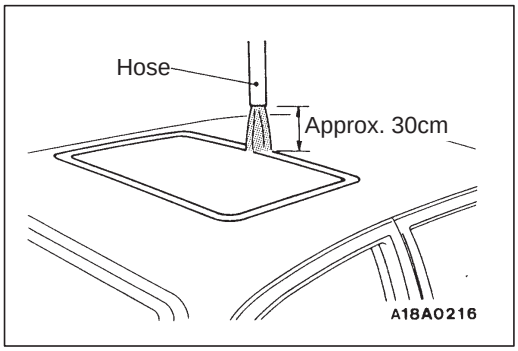
Terminal No.	Check Item	Check Condition		Normal Condition
1	ECU power supply	Always		System voltage
2	Sensor power supply	Ignition switch: ON		System voltage
5	Earth	Always		0 V
6	Sunroof switch (CLOSE, DOWN input)	Sunroof switch (close position or down position)	ON	0 V
			OFF	System voltage
7	Sunroof switch (UP input)	Sunroof switch (up position)	ON	0 V
			OFF	System voltage
8	Sunroof switch (OPEN input)	Sunroof switch (open position)	ON	0 V
			OFF	System voltage
9	Driver’s door switch	Driver’s door	Open	Continuity
			Close	No continuity

ON-VEHICLE SERVICE

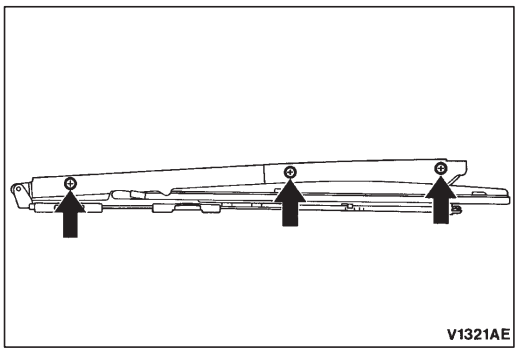
WATER TEST

Check if there are any leaks in the sunroof by the following procedure.

1. Fully close the roof lid glass.
2. Adjust the water pressure so that water comes out of the hose to a height of approximately 50 cm when the hose is held vertically facing upwards.



3. Hold the end of the hose approximately 30 cm above the roof and let the water run onto the weatherstrip for 5 minutes or more.
4. While doing this, check if any water leaks through into the passenger compartment from around the roof lid glass.



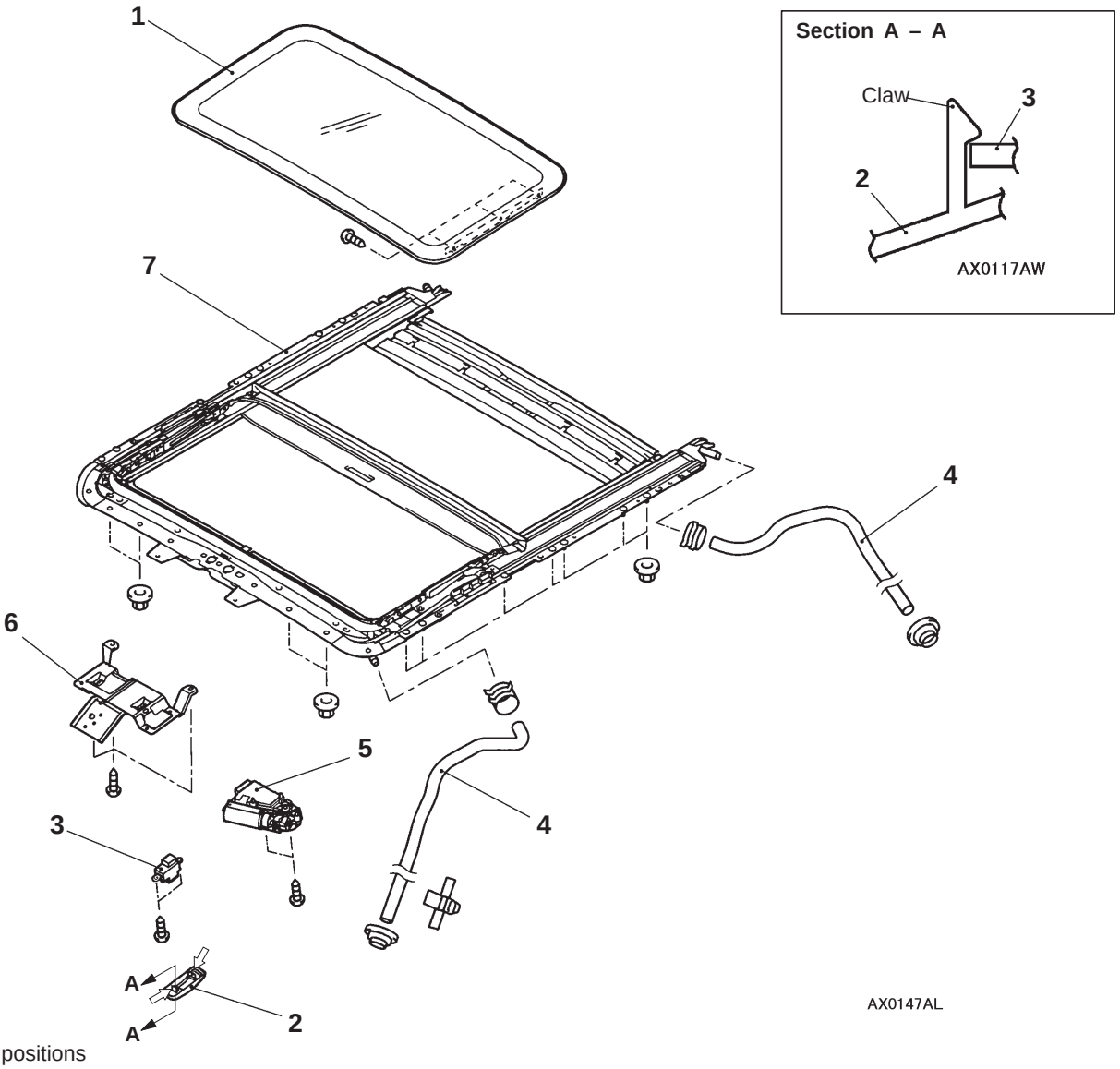
SUNROOF FIT ADJUSTMENT

1. Fully close the roof lid glass.
2. Fully open the sunshade.
3. Loosen the roof lid glass assembly mounting screws, and then slide the roof lid glass assembly along the slot in the mechanish assembly to adjust the height of the roof lid glass.
4. After adjustment, check to be sure that the sunroof operates smoothly.

SUNROOF

REMOVAL AND INSTALLATION

Post-installation Operation
- Sunroof Water Test (Refer to P.42-46.)
- Sunroof Fit Adjustment (Refer to P.42-46.)



NOTE
⇦ : Claw positions

1. Roof lid glass assembly

Sunroof switch removal steps

2. Sunroof switch cover
3. Sunroof switch

Drain hose removal steps

- Headlining (Refer to GROUP 52A.)
- Splash shield (Rear drain hose)
- Cowl side trim and instrument lower panel (Refer to GROUP 52A.)
- Engine-ECU, throttle servo relay and throttle controller (Driver's-side drain hose)

◀A▶ ▶A◀ 4. Drain hose

Sunroof motor assembly removal steps

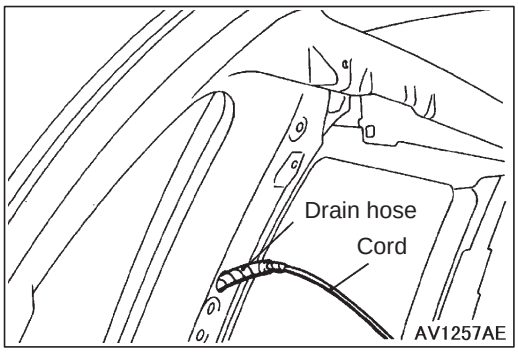
- Headlining (Refer to GROUP 52A.)

◀B▶ ▶B◀ 5. Sunroof motor assembly

Sunroof assembly removal steps

- Headlining (Refer to GROUP 52A.)

◀A▶ ▶A◀ 4. Drain hose
6. Room lamp bracket
7. Sunroof assembly



REMOVAL SERVICE POINTS

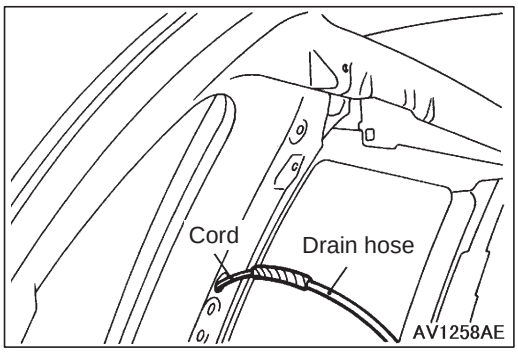
◀A▶ DRAIN HOSE REMOVAL

Tie a cord to the end of the drain hose, and wind tape around it so that there is no unevenness. Then pull the drain hose out from the passenger compartment.

◀B▶ SUNROOF MOTOR ASSEMBLY REMOVAL

Caution
Always close the roof lid glass fully before removing the sunroof motor. If the fully-closed positions of the roof lid glass and the sunroof motor are not the same, the sunroof will not operate properly.

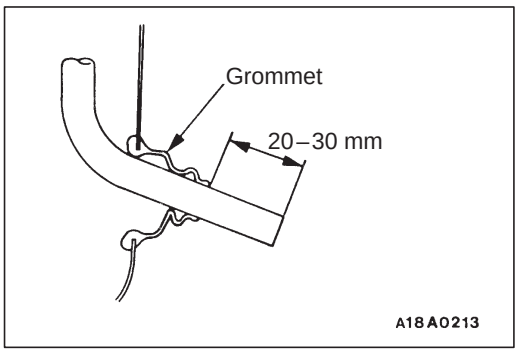
NOTE
If there is a problem with the sunroof motor so that the roof lid glass cannot close fully, use an Allen key to turn the gear section of the sunroof motor to fully close the roof lid glass.



INSTALLATION SERVICE POINTS

▶A◀ DRAIN HOSE INSTALLATION

1. Tie the cord that was used during removal to the end of the drain hose, and wind tape around it so that there is no unevenness.
2. Pull the cord to pull through the drain hose



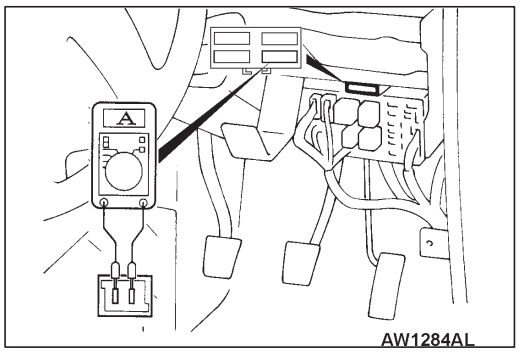
3. Install the grommet, and then position the drain hose so that it protrudes from the grommet as shown in the illustration.

▶B◀ SUNROOF MOTOR ASSEMBLY INSTALLATION

If the fully-closed position of the sunroof motor assembly is incorrect, set the sunroof motor to the fully-closed position by the following procedure, and then install the sunroof motor.

1. Set the sunroof to full tilt-up position by using the close switch. The roof lid glass moves full tilt position only step by step with about 30 mm steps.
2. Hold the close switch for about 3 seconds at full tilt positon. Do not release the switch at hard stop position before initialization is compleyed.
3. Set the sunroof to full close position by using the close switch.
4. Set the sunroof to full open position by using the open switch. Do not stop the sunroof while it is moving.
5. Set the sunroof to full close position by using the close switch. Do not stop the sunroof while it is moving.

NOTE
Sunroof-ECU will initialize when the sunroof motor stops.

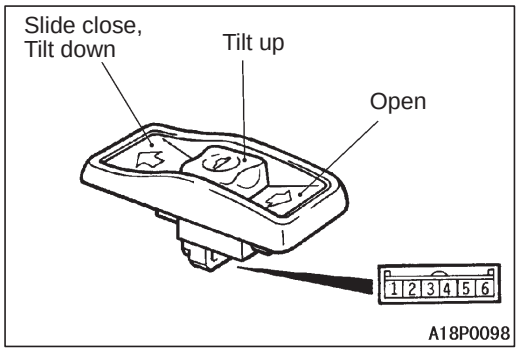


INSPECTION

ROOF LID GLASS OPERATION CURRENT CHECK

1. Remove the sunroof fuse and connect a circuit analyser as shown in the illustration.
2. Press the sunroof switch to operate the sunroof, and then measure the operation current while the roof lid glass is moving (except when the sunroof starts to operate, when it is fully open, when it is fully closed and when it is fully tilted up).

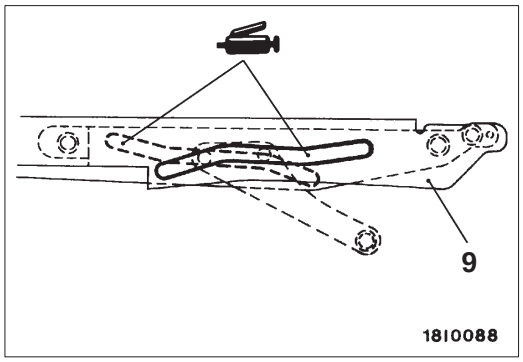
   Standard value: 7 A or less (at 20°C)
3. If the operation current is not within the standard value, check the following points.
   - Installation condition, warping or jamming of sunroof assembly
   - Sticking of drive cable
   - Tilt of roof lid glass

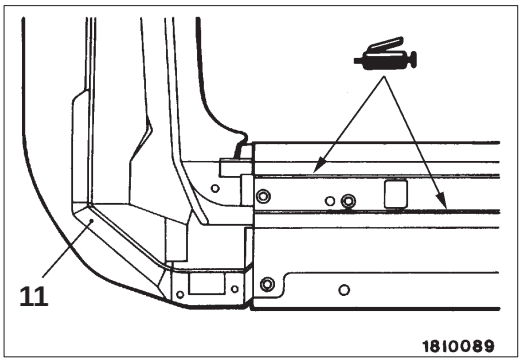


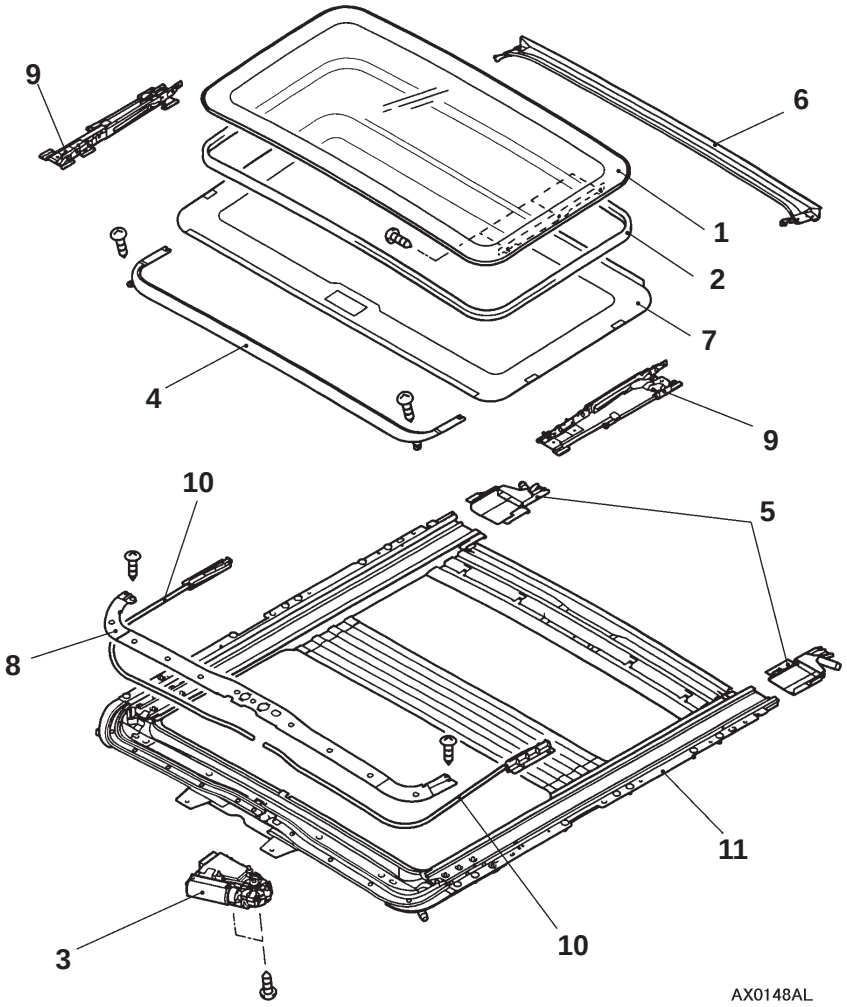
SUNROOF SWITCH CONTINUITY CHECK

Switch position	Terminal No.			
	3	4	5	6
Open		○	○	
Off				
Tilt up	○	○		
Slide close, Tilt down		○		○

DISASSEMBLY AND REASSEMBLY







Disassembly steps

1. Roof lid glass assembly
2. Weatherstrip
3. Sunroof motor assembly
4. Roof wind deflector panel
5. Rail end
6. Roof drip channel
7. Sunshade assembly
8. Drive unit cover
9. Mechanish assembly
10. Drive unit assembly
11. Frame assembly

BODY

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GENERAL

OUTLINE OF CHANGES

Due to the introduction of 5-door models, the following service procedures have been added. The other items are the same as before.

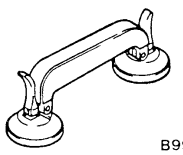
- Quarter window glass removal and installation
- Rear door assembly removal and installation
- Front door trim removal and installation
- Rear door trim and waterproof film removal and installation
- Front door glass and regulator installation service points
- Rear door glass and regulator removal and installation
- Rear door handle and latch removal and installation
- Sunroof removal and installation

WINDOW GLASS

ADHESIVE

Items	Specified adhesive
Quarter window glass	3M ATD Part No. 8609 Super Fast Urethane Auto Glass Sealant or equivalent

SPECIAL TOOLS

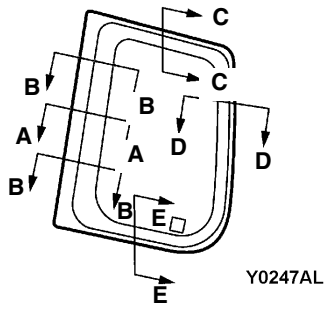
Tool	Number	Name	Use
 B990480	MB990480	Quarter window glass	Removal and installation of quarter window glass

QUARTER WINDOW GLASS

REMOVAL AND INSTALLATION

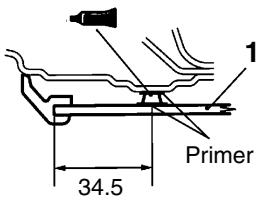
Pre-removal and Post-installation Operation
- Quarter Trim, Lower (R.H.) Removal and Installation (Refer to GROUP 52A.)
- Headlining Removal and Installation (Refer to GROUP52A.)

mm



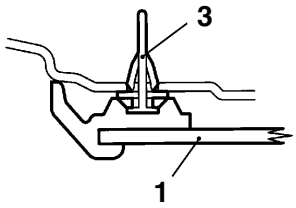
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Section A – A



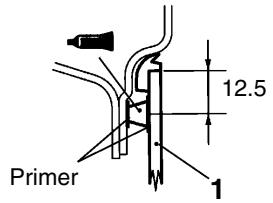
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Section B – B



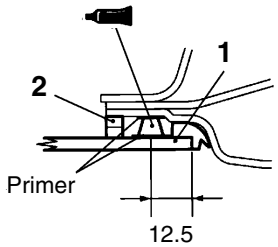
W0843AL

Section C – C



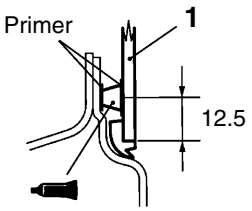
W0847AL

Section D – D



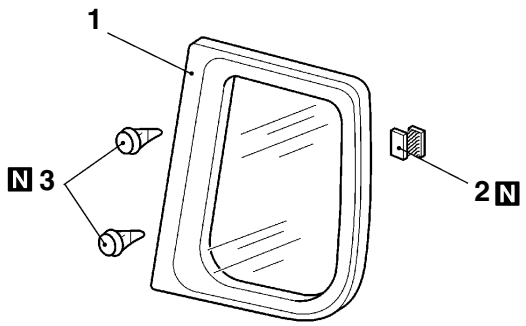
W0846AL

Section E – E



W0844AL

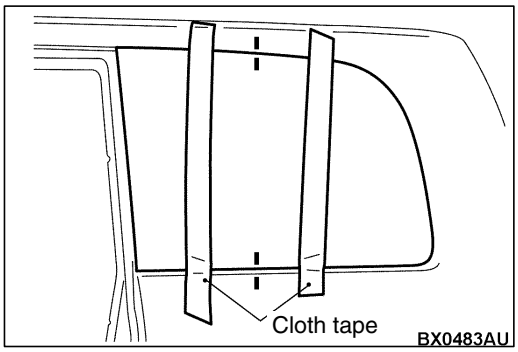
Adhesive: 3M™ ATD Part No. 8609 Super Fast Urethane Auto Glass Sealant or equivalent



AY0246AL

Removal steps

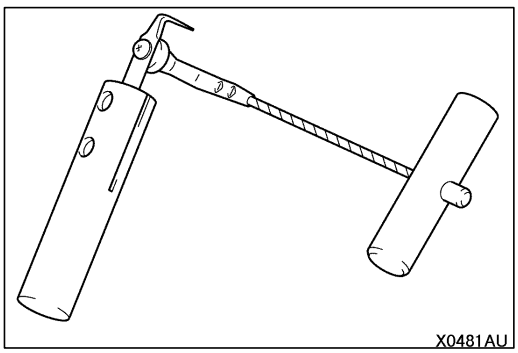
◀A▶ ▶A◀ 1. Quarter window glass
▶A◀ 2. Dual lock fastener
▶A◀ 3. Clip



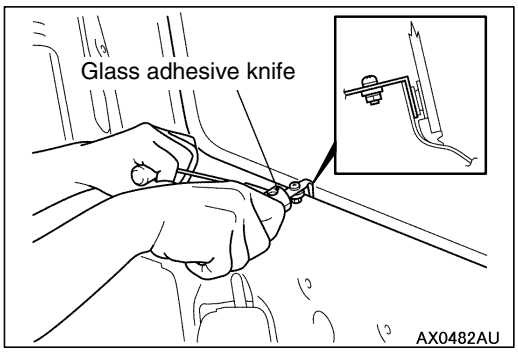
REMOVAL SERVICE POINT

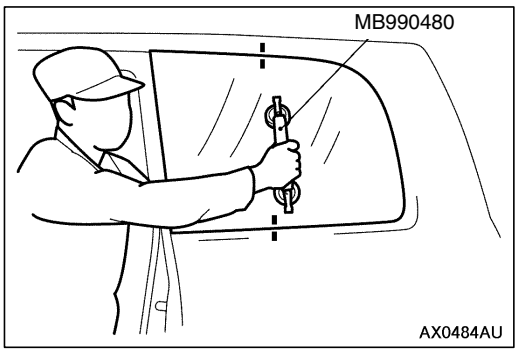
◀A▶ QUARTER WINDOW GLASS REMOVAL

1. Apply cloth tape to protect quarter window glass.
2. Make mating marks on the quarter window glass and body.

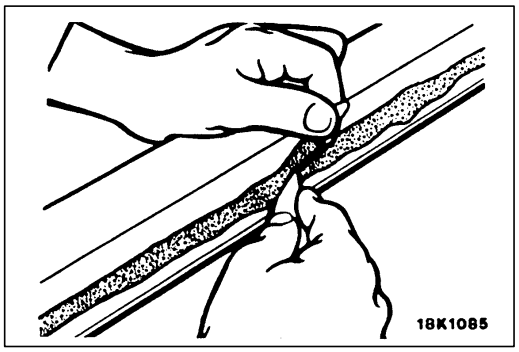


3. Use glass adhesive knife to cut away adhesive.
   Keep glass adhesive knife at right angles with body flange (from inside the vehicle),and put the blade at body flange. Then cut away adhesive along the body flange.





4. Use special tool MB990480 to remove the quarter window glass.



5. Use a knife to cut away the remaining adhesive so that the thickness is within 2 mm around the entire circumference of the body flange.
6. Finish the flange surfaces so that they are smooth.

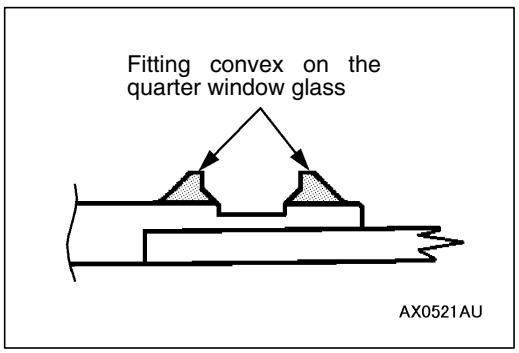
   Caution
   (1) Use care not to remove more adhesive than necessary, or the adhesive could weaken.
   (2) Be careful also not to damage the paintwork on the body surface with the knife. If the paintwork is damaged, repair the damaged area with repair paint or anti-rust agent.
7. When reusing quarter window glass, remove the remaining adhesive on the quarter window glass completely. Then, decrease the windshield with isopropyl alcohol.
8. Decrease the body flange in the same way.

   Caution
   Before the next job, leave the decreased parts for 3 minutes or more to dry. Also, do not touch any cleaned surface.

INSTALLATION SERVICE POINT

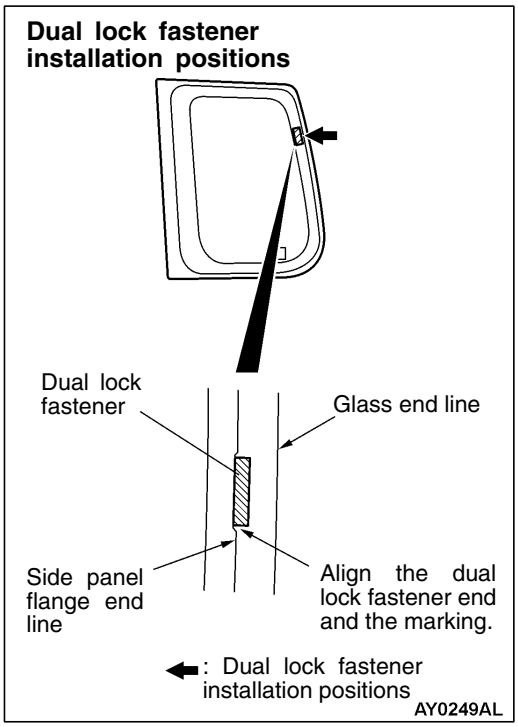
▶A◀ CLIP/DUAL LOCK FASTENER/ QUARTER WINDOW GLASS INSTALLATION

1. Carry out the following procedure to re-install quarter window glass.
   (1) Fit the clip into the body.



   (2) Cut away the clip fitting convex on the quarter window glass.

   NOTE
   If you fail to cut away the convexes, the glass may be fitted improperly.
2. Use a unleaded gasoline to degrease the glass and the vehicle body, which the dual-lock fasteners are adhered to.



3. Install the dual lock fasteners to the body flange in the specified positions.
4. Install the dual lock fasteners to the windshield in the positions corresponding to the ones on the body flange where the dual lock fasteners have been installed.
5. Apply the primer and adhesive.
6. Install the glass in the same manner as for the windshield.

DOOR

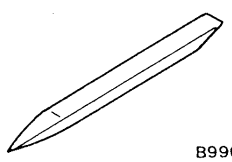
SERVICE SPECIFICATIONS

Items			Standard value
Glass pad and glass holder installation position mm	Between glass holder and glass rear end	Front	50.0
		Rear	–
	Between glass holders	Front	419.0 – 421.0
		Rear	–
	Between glass holder and glass front end	Front	45.0
		Rear	53.0

SEALANT

Items	Specified sealant	Remark
Waterproof film	3M™ ATD Part No. 8625 or equivalent	Ribbon sealer

SPECIAL TOOL

Tool	Number	Name	Use
 B990784	MB990784	Ornament remover	Door trim removal

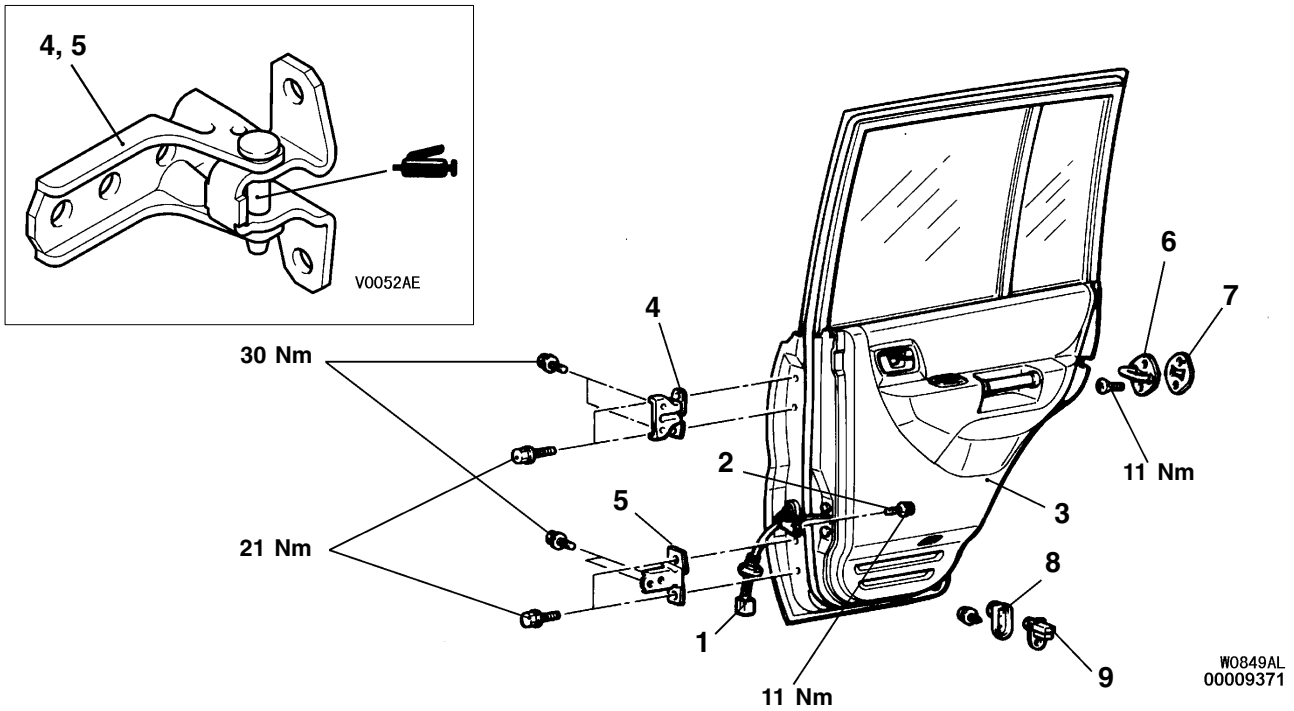
TROUBLESHOOTING

The power window and central door locking is controlled by ETACS-ECU. For troubleshooting, refer to GROUP 54B – Troubleshooting.

REAR DOOR ASSEMBLY

REMOVAL AND INSTALLATION

Post-installation Operation
Door Fit Adjustment



Door assembly removal steps

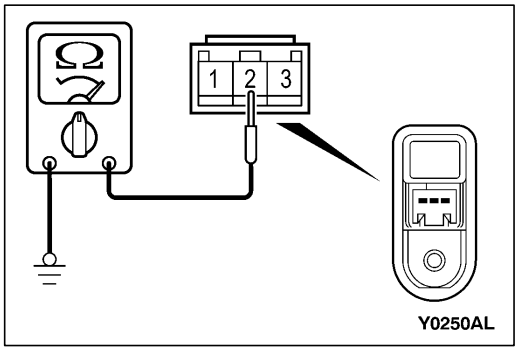
1. Harness connector
2. Door check connecting bolt
3. Door assembly
4. Door upper hinge
5. Door lower hinge

Striker removal steps

6. Striker
7. Striker shim

Door switch removal steps

8. Door switch cap
9. Door switch



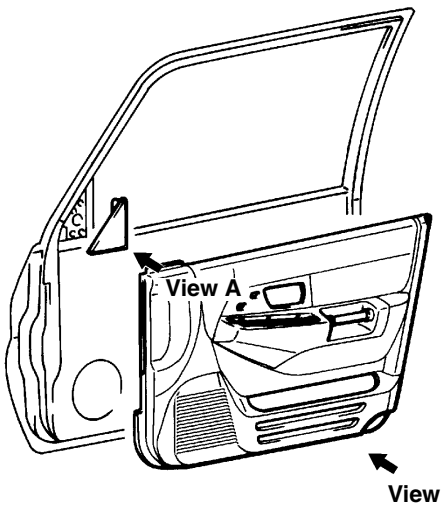
INSPECTION

DOOR SWITCH CONTINUITY CHECK

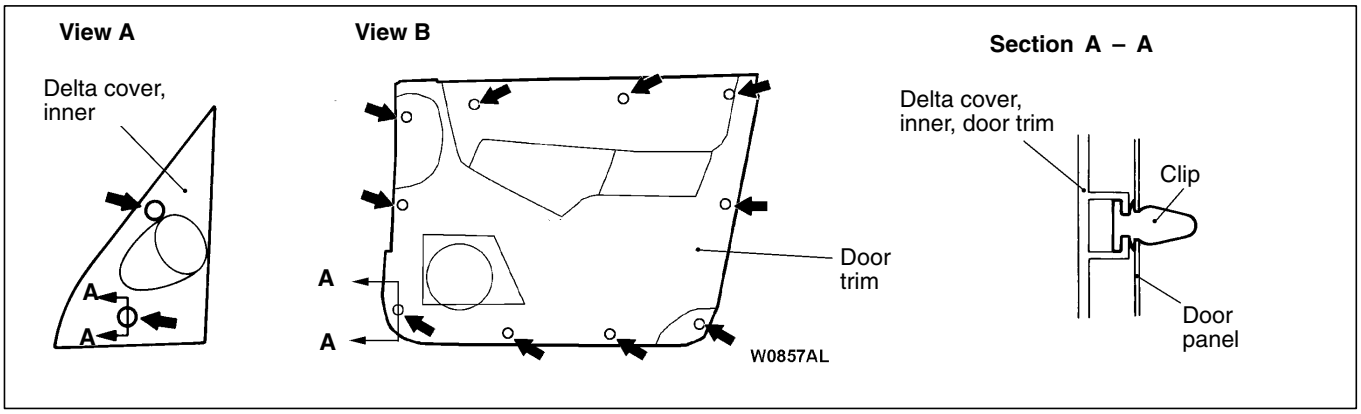
Switch position	Terminal number	
	2	Earth
Released (ON)	○	○
Depressed (OFF)		

FRONT DOOR TRIM AND WATERPROOF FILM

CLIP AND CLAW POSITIONS



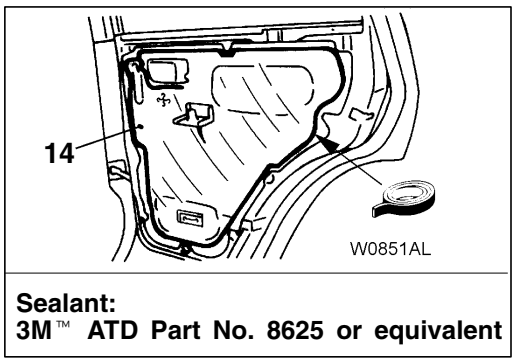
W0855AL
00009375



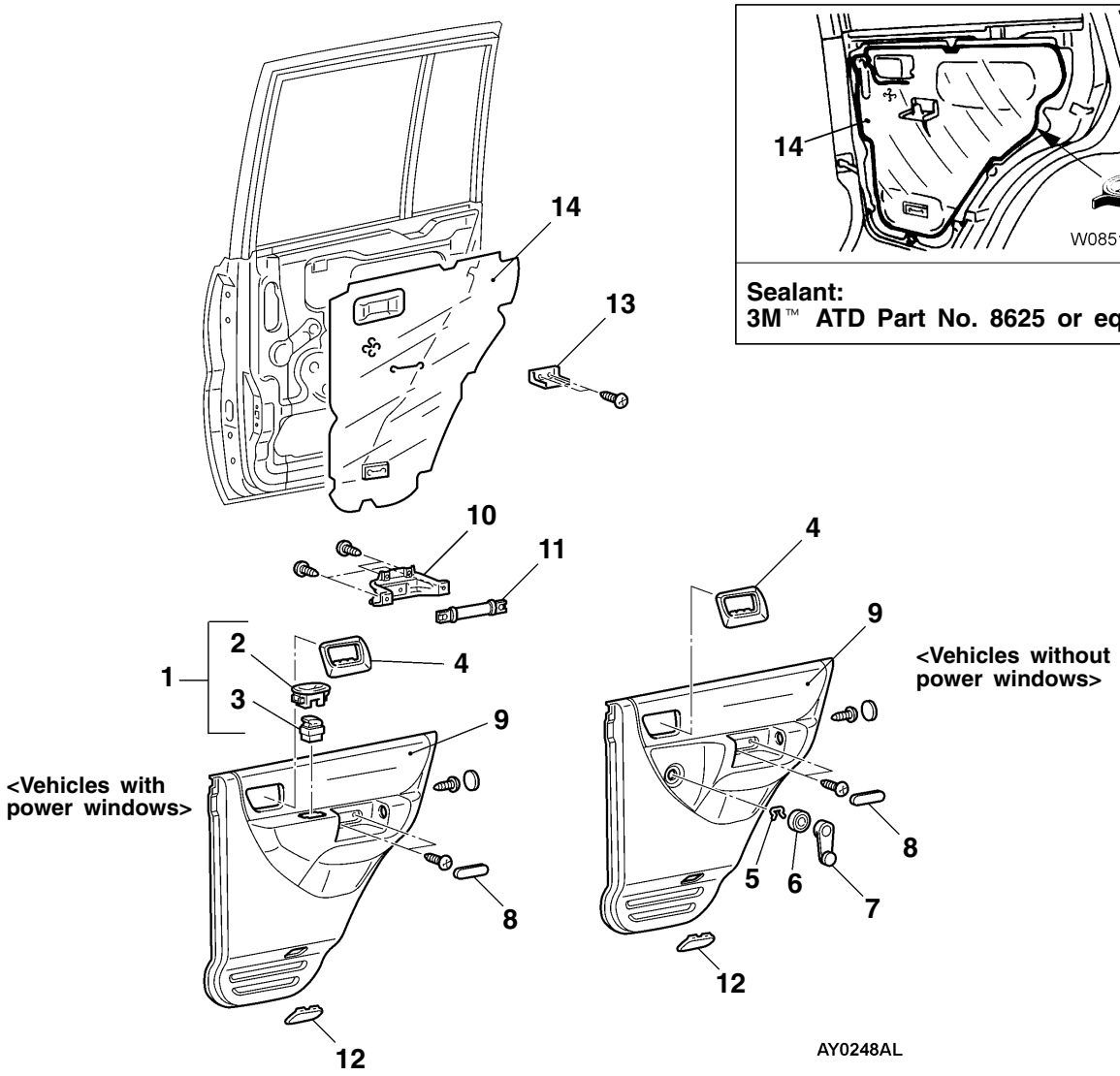
NOTE
⬅ Clips
⇦ Claws

REAR DOOR TRIM AND WATERPROOF FILM

REMOVAL AND INSTALLATION



Sealant:
3M™ ATD Part No. 8625 or equivalent



Removal steps

1. Power window switch panel assembly
2. Power window switch panel
3. Power window switch
4. Door inside handle cover

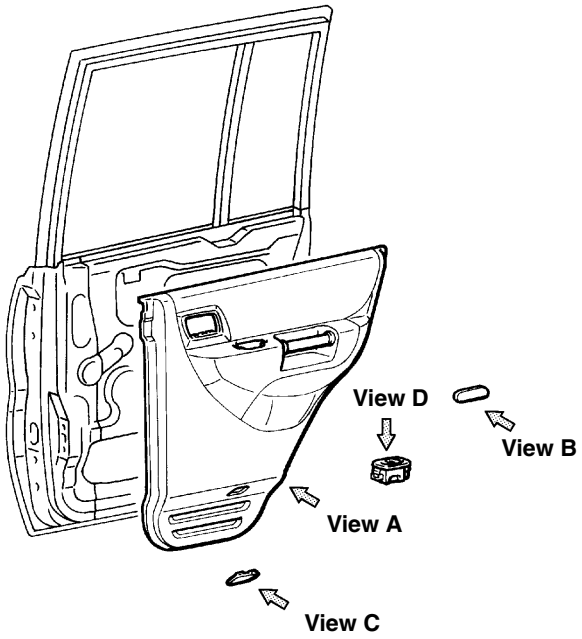
◀A▶ ◀B▶ ▶B◀ 5. Clip

▶B◀ 6. Escutcheon

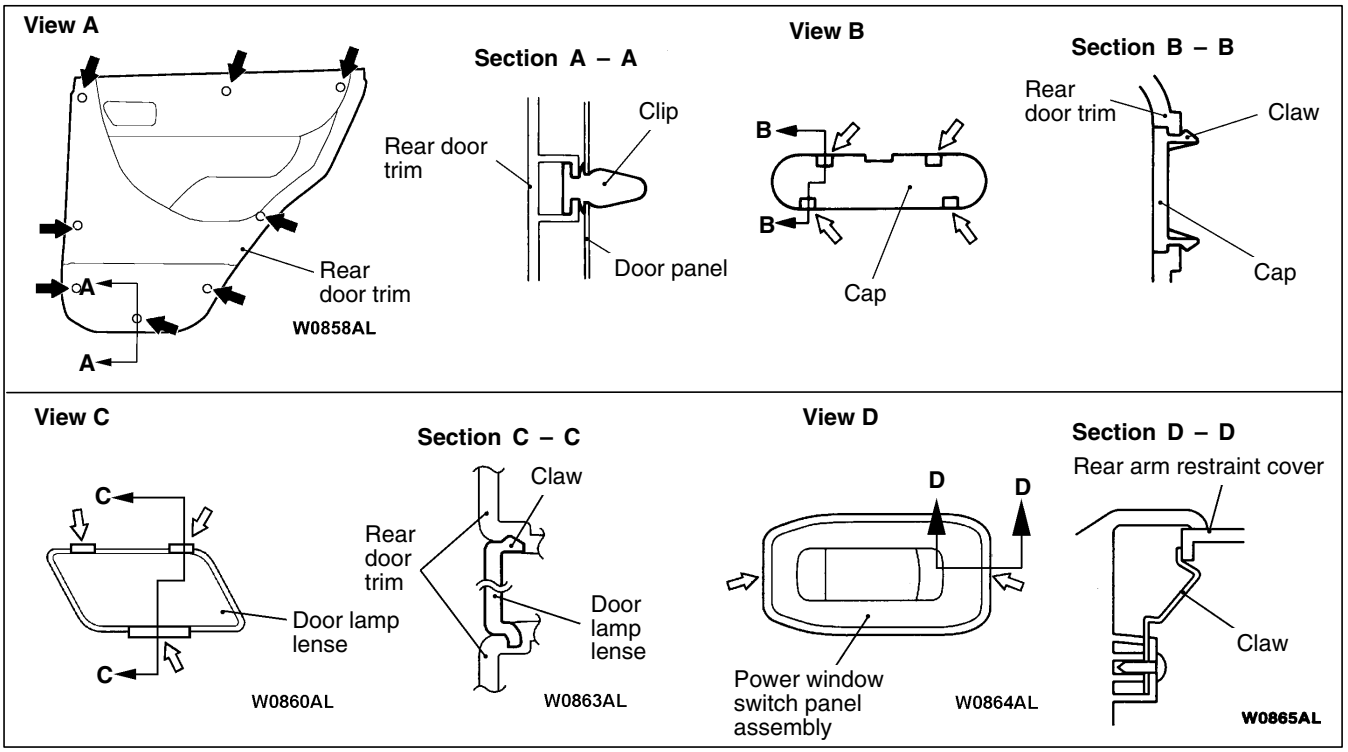
▶B◀ 7. Regulator handle

8. Cap
9. Door trim
10. Grip bracket
11. Door grip
12. Door lamp lense
13. Power window switch bracket

▶A◀ 14. Waterproof film

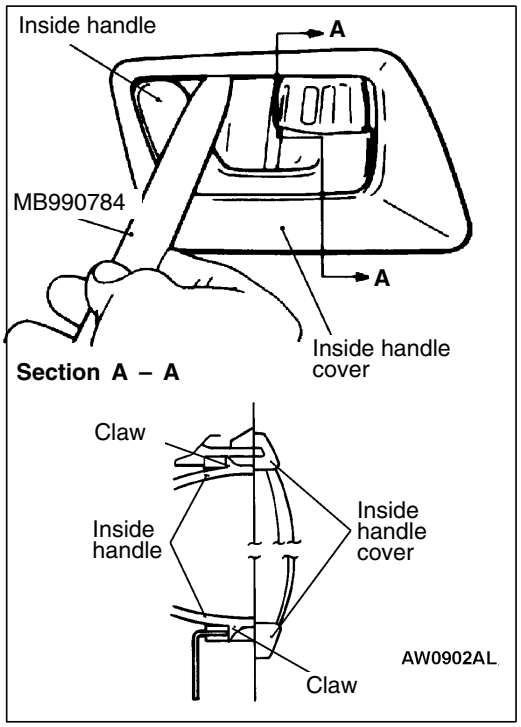


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NOTE
⬅ Clips
⇦ Claws

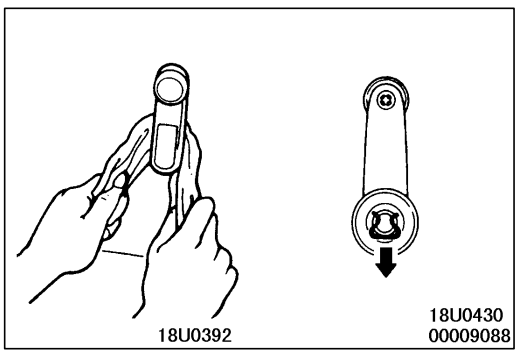
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REMOVAL SERVICE POINTS

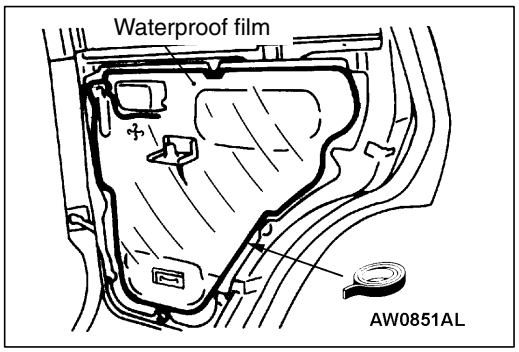
◀A▶ DOOR INSIDE HANDLE COVER REMOVAL

1. Insert the special tool between the inside handle upper part and the inside handle cover, and then disengage the upper claw of the inside handle.
2. Disengage the lower claw of the inside handle in the same manner as for the upper claw.
3. Remove the door trim.
4. Remove the inside handle cover from the door trim.



◀B▶ CLIP REMOVAL

Use a cloth to remove the clip as shown in the illustration.



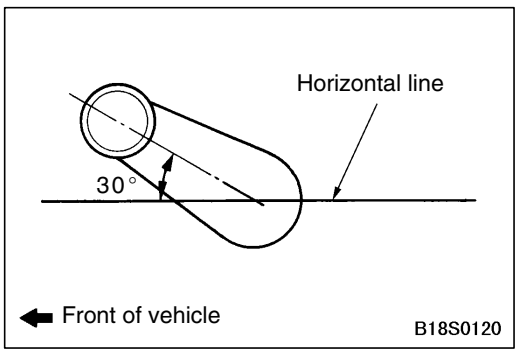
INSTALLATION SERVICE POINTS

▶A◀ WATERPROOF FILM INSTALLATION

Apply the specified sealant to the shown positions of waterproof film, and then attach the waterproof film.

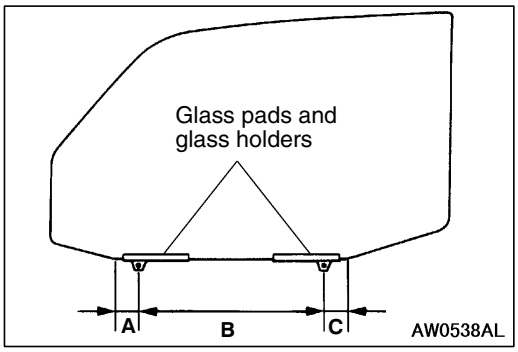
Specified sealant: 3M™ ATD Part No. 8625 or equivalent

Caution
Be sure to apply the sealant below the inner panel water drain holes so as not to plug them.



▶B◀ REGULATOR HANDLE/ESCUTCHEON/CLIP INSTALLATION

1. Install the clip and escutcheon to the regulator handle.
2. Close the front door window glass fully, and then install the regulator handle as shown in the illustration.



FRONT DOOR GLASS AND REGULATOR

DOOR WINDOW GLASS/GLASS HOLDER/DOOR GLASS PAD INSTALLATION

1. Install the door glass pads and glass holders to the window glass in the positions shown.

   Standard value (A): 50.0 mm

   Standard value (B): 419.0 – 421.0 mm

   Standard value (C): 45.0 mm

2. Install the glass to the window regulator assembly.

   Caution
   Do not activate the window regulator assemble before installing the glass as the resetting in the limit switch is cancelled.

INSPECTION

POWER WINDOW MAIN SWITCH CONTINUITY CHECK

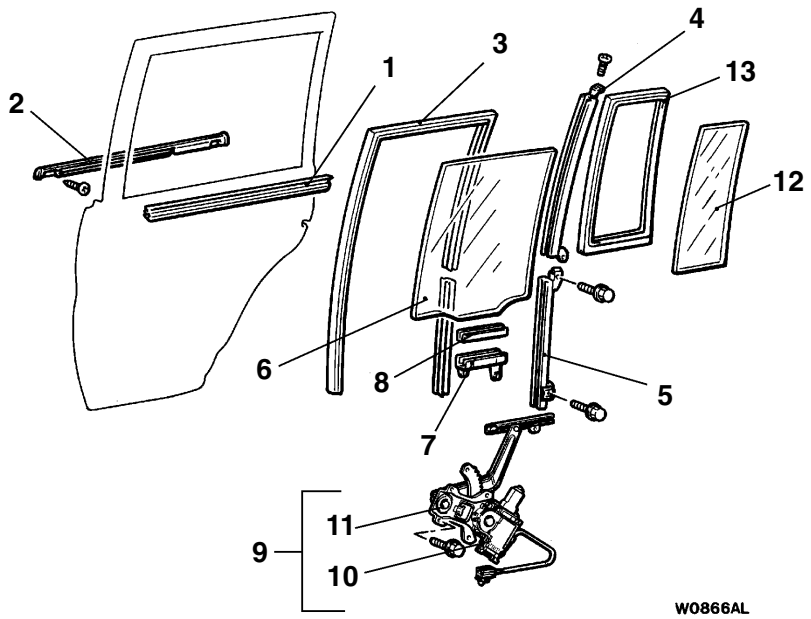
NOTE
Since the power window main switch uses the SWS system, check the continuity with the input signal check method. Refer to GROUP 54B – Troubleshooting.

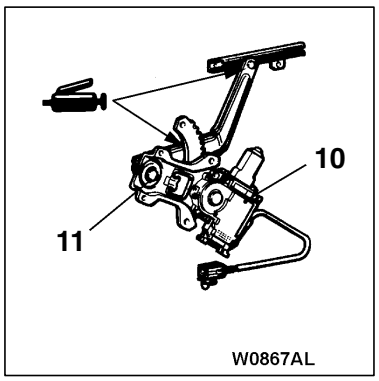
REAR DOOR GLASS AND REGULATOR

REMOVAL AND INSTALLATION

Pre-removal Operation
- Door Trim and Waterproof Film Removal (Refer to P.42-9.)

Post-installation Operation
- Door Window Glass Adjustment
- Door Trim and Waterproof Film Installation (Refer to P.42-9.)





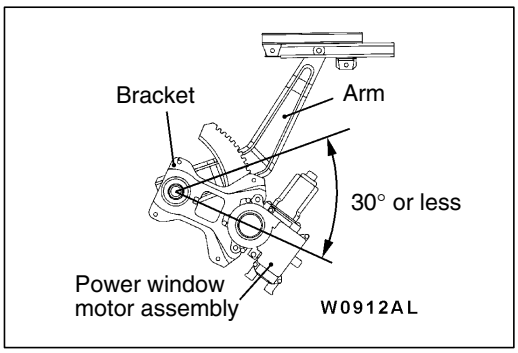
00009377

Door window glass removal steps
1. Door window inner weather strip
2. Door belt line moulding assembly
3. Door window glass runchannel
4. Rear center sash
5. Rear lower sash
▶B◀ 6. Rear door window glass
▶B◀ 7. Glass holder
▶B◀ 8. Door glass pad

Power window regulator and motor assembly removal steps
9. Power window regulator and motor assembly
▶A◀ 10. Power window motor assembly
▶A◀ 11. Power window regulator assembly
12. Stationary window glass
13. Stationary window glass weather strip

INSTALLATION SERVICE POINTS

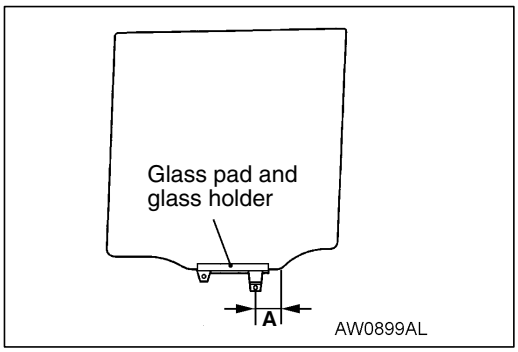
▶A◀ POWER WINDOW MOTOR ASSEMBLY/POWER WINDOW REGULATOR ASSEMBLY INSTALLATION



Adjust the power window motor assembly and power window regulator assembly positions as follows:

1. Connect the power window motor assembly connector and the power window switch connector to the wiring harness of body side.
2. Turn on the power window switch to operate the power window motor for 3 seconds in the direction which the window glass closes.
3. Disconnect the power window motor assembly connector and the power window switch connector from the wiring harness of body side.
4. Assemble the power window motor assembly and the power window regulator so that the arm and bracket are positioned as shown in the illustration, and then install the power window motor assembly.

Caution
When installing the power window regulator, do not set it in the window glass fully-closed position. If installing the power window regulator in that condition, the window glass safety mechanism will not functions correctly.



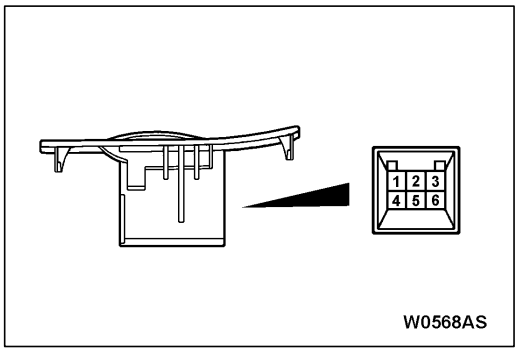
▶B◀ REAR DOOR WINDOW GLASS/GLASS HOLDER/DOOR GLASS PAD INSTALLATION

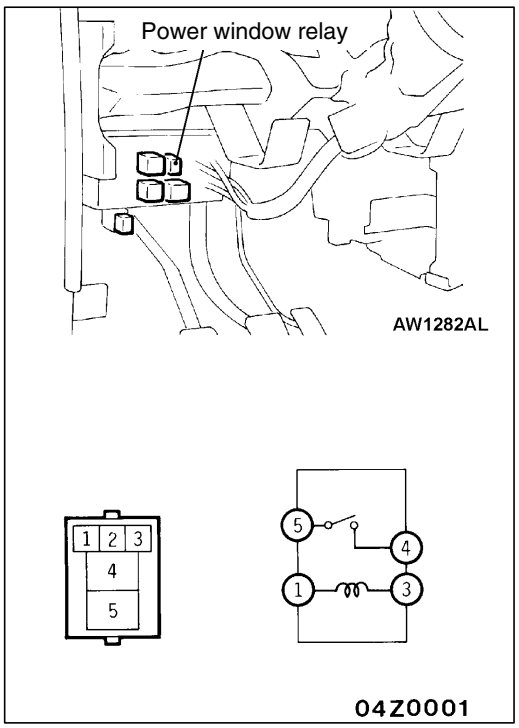
1. Install the door glass pad and glass holder to the window glass in the position shown.

   Standard value (A): 53.0 mm

2. Install the glass to the window regulator assembly.

Caution
Do not activate the window regulator assemble before installing the glass as the resetting in the limit switch is cancelled.





INSPECTION

POWER WINDOW SUB SWITCH CONTINUITY CHECK

Switch position	Terminal No.		
	1	4	6
UP		○	○
DOWN	○	○	

POWER WINDOW RELAY CONTINUITY CHECK

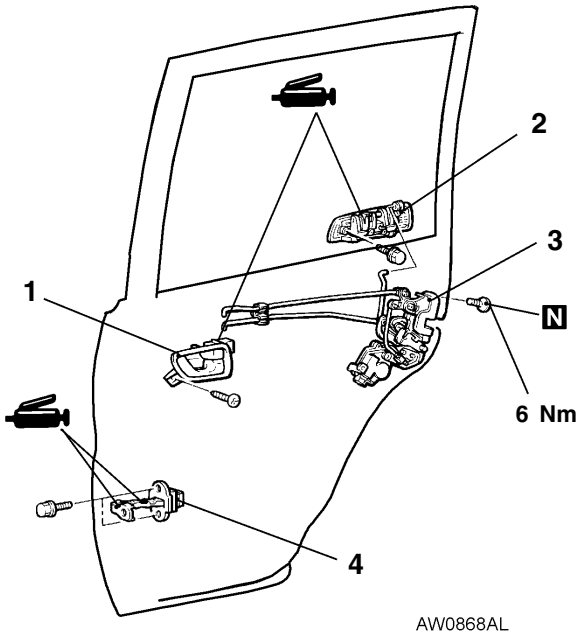
Battery voltage	Terminal No.			
	1	3	4	5
Not applied	○	○		
Applied	⊕	⊖	○	○

REAR DOOR HANDLE AND LATCH

REMOVAL AND INSTALLATION

Pre-removal Operation
Door Trim Removal (Refer to P.42-9.)

Post-installation Operation
- Door Inside Handle Play Check
- Door Outside Handle Play Check
- Door Trim Installation (Refer to P.42-9.)



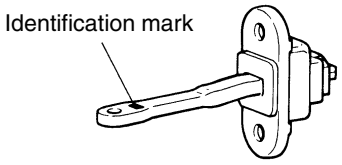
Door handle and door latch assembly removal steps

▶B◀ 1. Door inside handle
- Waterproof film (Refer to P.42-9.)

2. Door outside handle
3. Door latch assembly

Door check removal steps
- Waterproof film (Refer to P.42-9.)

▶A◀ 4. Door check

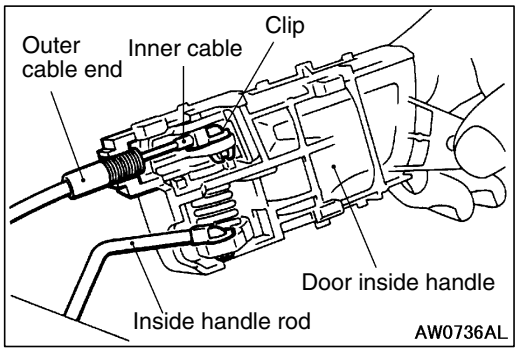


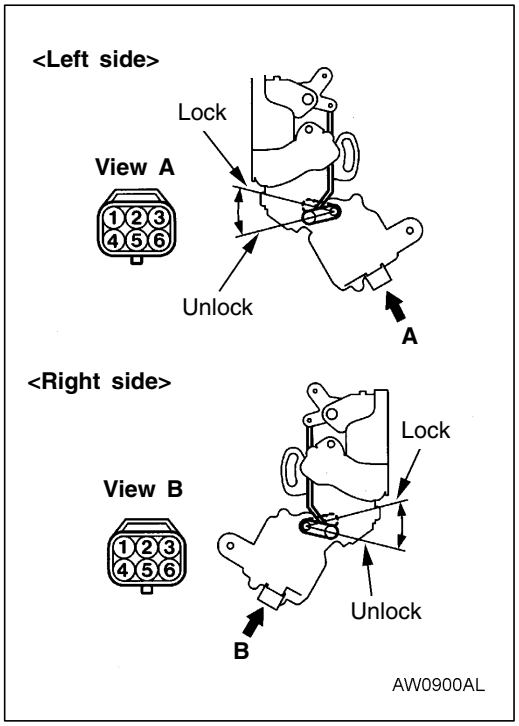
INSTALLATION SERVICE POINTS

▶A◀ DOOR CHECK INSTALLATION

Install with the following identification marks upward.

Items	Identification mark
Left door	26L
Right door	26R





▶B◀ DOOR INSIDE HANDLE INSTALLATION

1. Install the inside lock cable to the door inside handle as follows:
   (1) Install the inner cable end in the inside lock cable to the clip in the door inside handle.
   (2) Turn the inside lock knob to the door lock position.
   (3) Install the outer cable end to the door inside handle securely.
   (4) Install the clip to the inner cable.
2. Install the inside handle rod to the door inside handle.
3. Install the door inside handle to the door.

INSPECTION

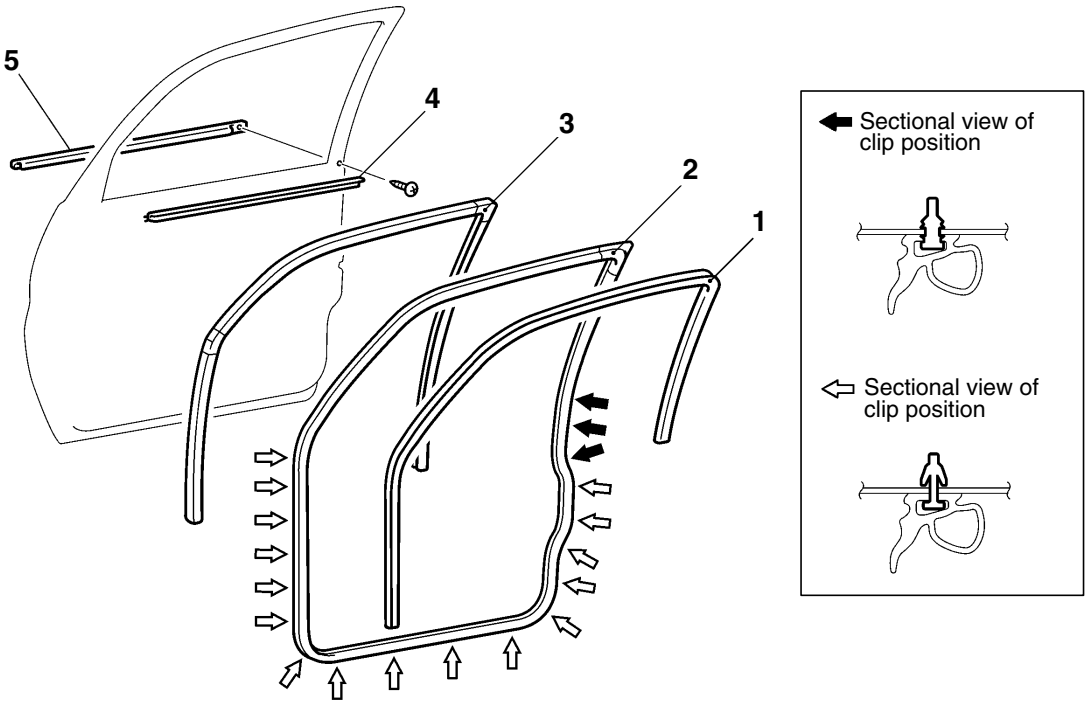
DOOR LOCK ACTUATOR CHECK

Rod position	Terminal No.		Rod operation
	2	3	
LOCK	⊖	⊕	LOCK to UNLOCK
UNLOCK	⊕	⊖	UNLOCK to LOCK

WINDOW GLASS RUNCHANNEL AND DOOR OPENING WHETHERSTRIP

REMOVAL AND INSTALLATION

<FRONT DOOR>



Door inner opening weatherstrip removal steps

- Scuff plate (Refer to GROUP 52A.)
- Cowl side trim (Refer to GROUP 52A.)
- Center pillar lower trim (Refer to GROUP 52A.)

1. Door inner opening weatherstrip

Door outer opening weatherstrip removal

◀A▶ 2. Door outer opening weatherstrip

Door window glass runchannel removal steps

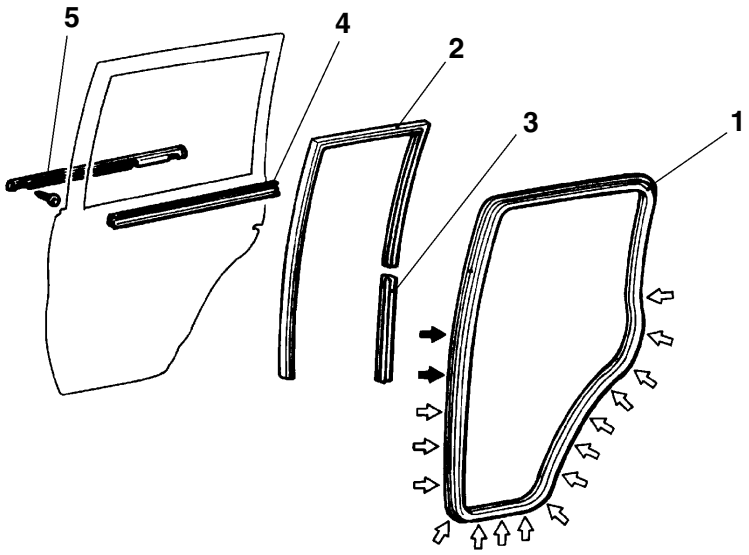
3. Door window glass runchannel
4. Door window glass lower runchannel

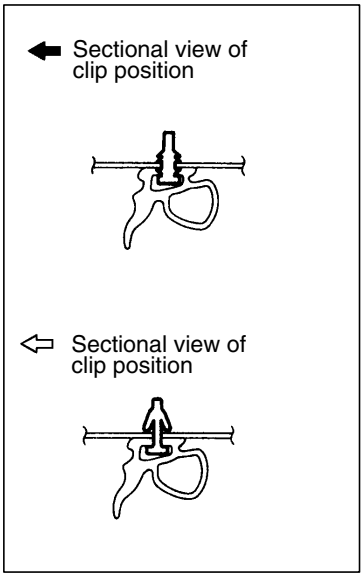
Door beltline moulding removal steps

- Outside rear view mirror

5. Door beltline moulding

<REAR DOOR>





◀A▶ 1. Door outer opening weatherstrip

Door window glass runchannel removal steps

2. Door window glass runchannel
- Door lower sash (Refer to P.42-13.)

3. Door window glass lower runchannel

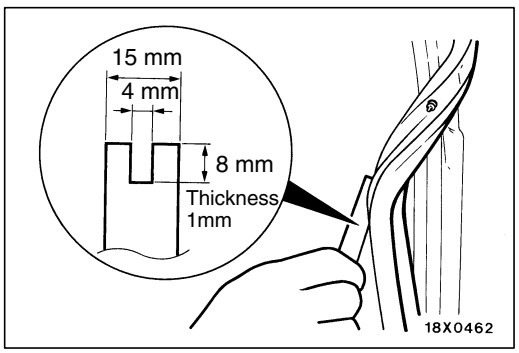
Door beltline inner weatherstrip removal steps

- Door trim (Refer to P.42-9.)

4. Door beltline inner weatherstrip

Door beltline moulding removal

5. Door beltline moulding



REMOVAL SERVICE POINT

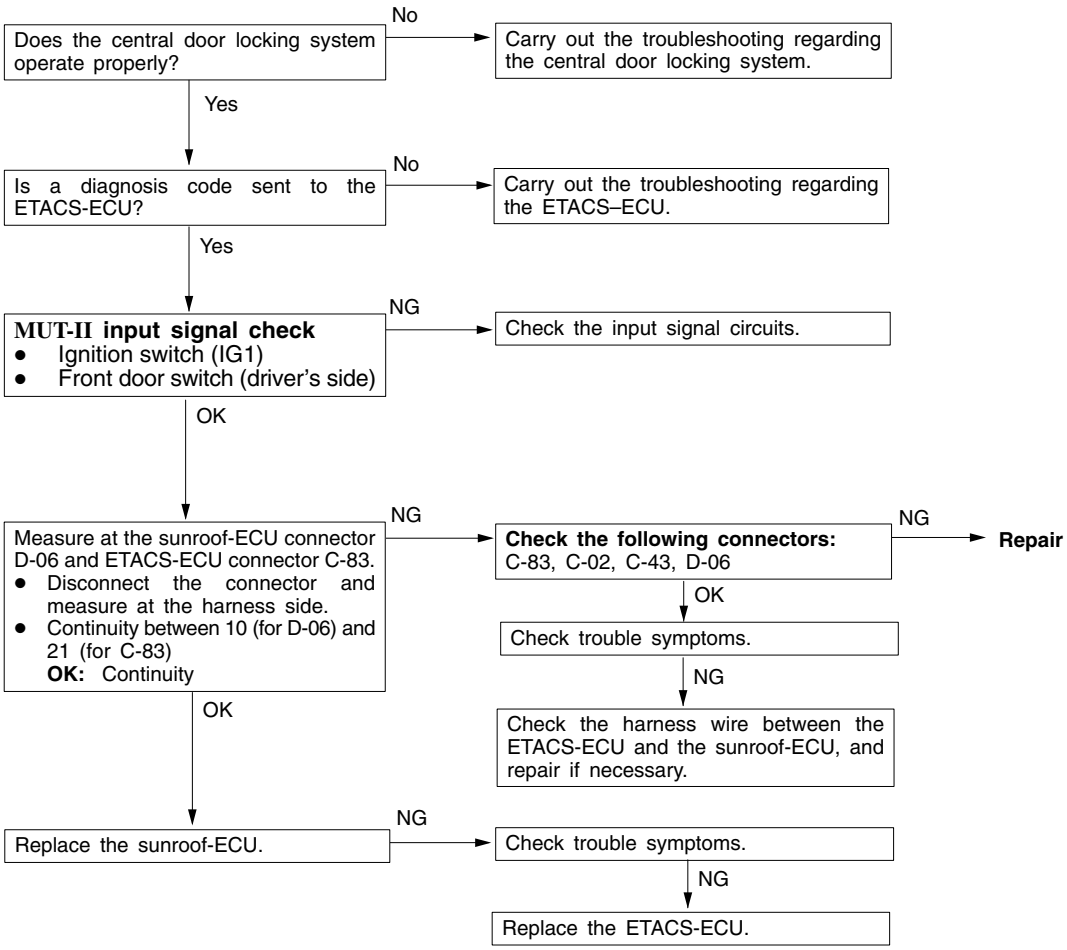
◀A▶ DOOR OUTER OPENING WEATHERSTRIP REMOVAL

Make a tool as shown and remove the door opening weatherstrip.

SUNROOF

TROUBLESHOOTING

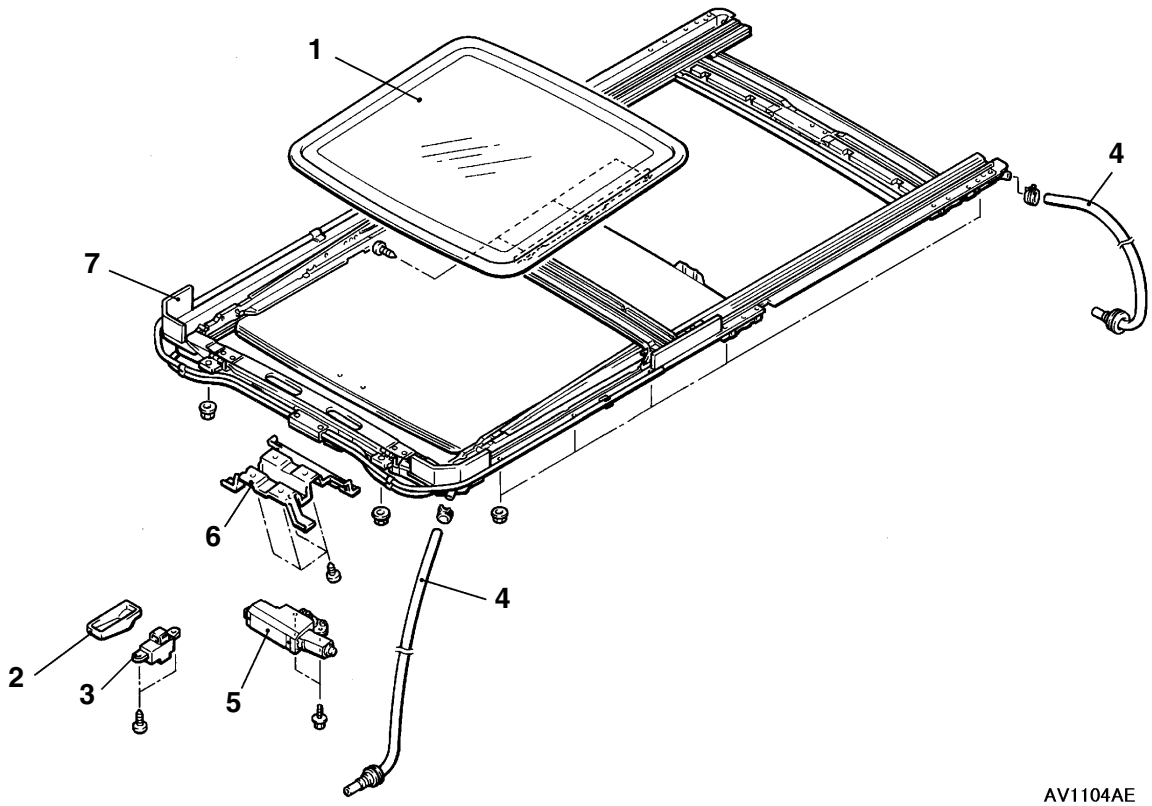
The timer does not operate for 30 seconds after the ignition switch is turned to LOCK (OFF) position. (When the ignition switch is turned on, the sunroof operates.)	Probable cause
The sunroof-ECU has a timer function which operates during 30 seconds after the ignition switch is turned to LOCK (OFF) position. If the timer does not operate, the cause may be a malfunction of the ETACS-ECU, sunroof-ECU or of the wiring harness or connector.	• Malfunction of wiring harness or connector • Malfunction of sunroof-ECU • Malfunction of the ETACS-ECU



SUNROOF

REMOVAL AND INSTALLATION

Post-installation Operation
- Sunroof Water Test
- Sunroof Fit Adjustment



AV1104AE

1. Roof lid glass assembly

Sunroof switch removal steps

2. Sunroof switch cover
3. Sunroof switch

Drain hose removal steps

- Headlining
- Splash shield (Rear drain hose)
- Cowl side trim and instrument lower panel
- Engine-ECU, throttle valve control relay and throttle valve controller (Driver's-side drain hose)

◀A▶ ▶A◀ 4. Drain hose

Sunroof motor assembly removal steps

- Headlining

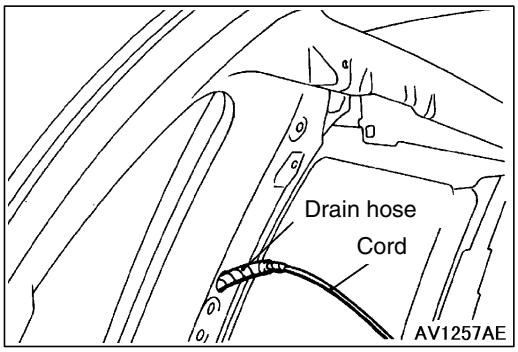
◀B▶ ▶B◀ 5. Sunroof motor assembly

Sunroof assembly removal steps

- Headlining

◀A▶ ▶A◀ 4. Drain hose

6. Room lamp bracket
7. Sunroof assembly



REMOVAL SERVICE POINTS

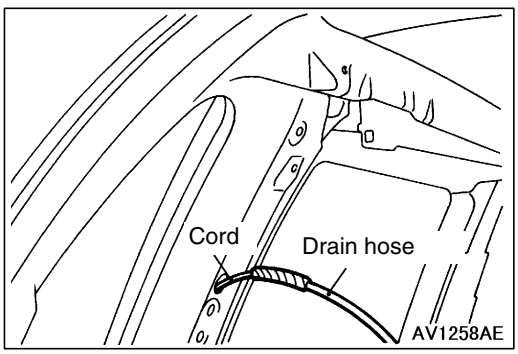
◀A▶ DRAIN HOSE REMOVAL

Tie a cord to the end of the drain hose, and wind tape around it so that there is no unevenness. Then pull the drain hose out from the passenger compartment.

◀B▶ SUNROOF MOTOR ASSEMBLY REMOVAL

Caution
Always close the roof lid glass fully before removing the sunroof motor. If the fully-closed positions of the roof lid glass and the sunroof motor are not the same, the sunroof will not operate properly.

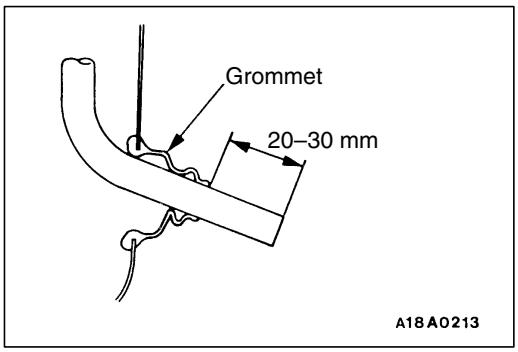
NOTE
If there is a problem with the sunroof motor so that the roof lid glass cannot close fully, use an Allen key to turn the gear section of the sunroof motor to fully close the roof lid glass.



INSTALLATION SERVICE POINTS

▶A◀ DRAIN HOSE INSTALLATION

1. Tie the cord that was used during removal to the end of the drain hose, and wind tape around it so that there is no unevenness.
2. Pull the cord to pull through the drain hose



3. Install the grommet, and then position the drain hose so that it protrudes from the grommet as shown in the illustration.

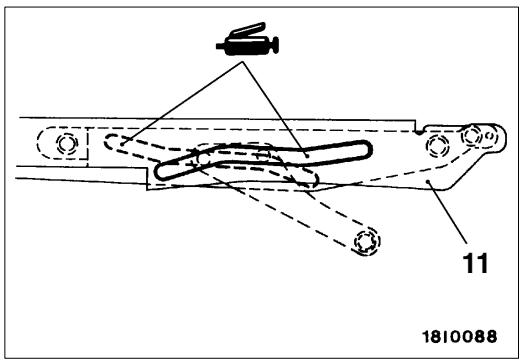
▶B◀ SUNROOF MOTOR ASSEMBLY INSTALLATION

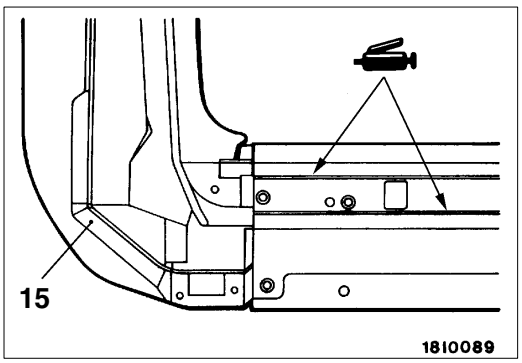
If the fully-closed position of the sunroof motor assembly is incorrect, set the sunroof motor to the fully-closed position by the following procedure, and then install the sunroof motor.

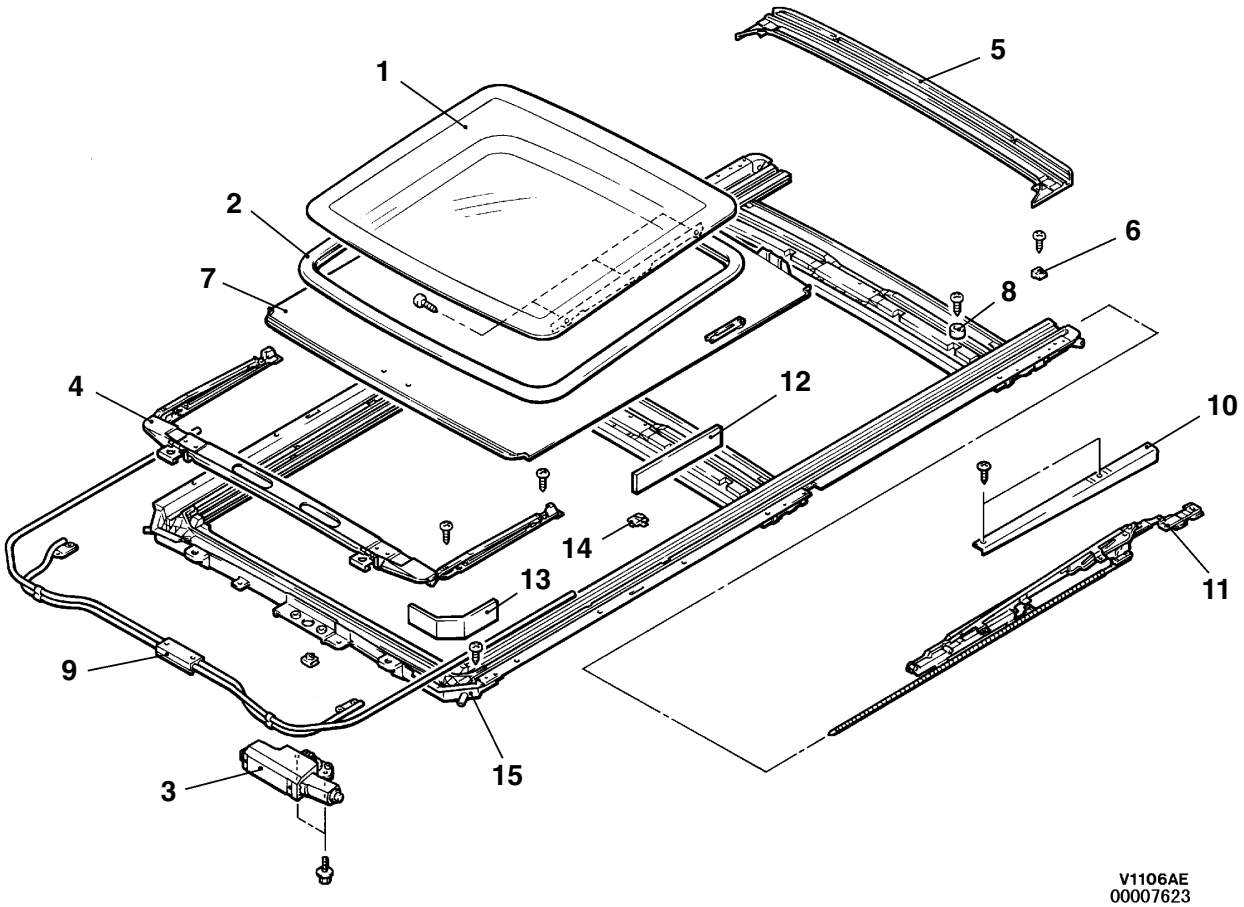
1. Remove the sunroof motor assembly with the connector still connected.
2. Set the roof lid glass to the fully-closed position.
3. Continue to push the sunroof close switch until the sunroof motor stops turning. Then install the sunroof motor assembly.

   NOTE
   Sunroof-ECU will initialize when the sunroof motor stops.

DISASSEMBLY AND REASSEMBLY







Disassembly steps

1. Roof lid glass assembly
2. Weatherstrip
3. Sunroof motor
4. Roof wind deflector panel
5. Roof drip channel
6. Panel stopper
7. Sunshade assembly
8. Guide rail stopper
9. Cable guide casing
10. Side deflector
11. Drive cable assembly
12. Seal
13. Seal
14. Clamp
15. Guide rail sub assembly

BODY

CONTENTS

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TROUBLESHOOTING 2

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DOOR TRIM AND WATERPROOF FILM 8

DOOR GLASS AND REGULATOR 9

GENERAL

OUTLINE OF CHANGES

The following service procedures have been added. The other items are the same as before.
- Troubleshooting
- On-vehicle service
- Door trim and waterproof film inspection
- Door glass and regulator inspection

DOOR

TROUBLESHOOTING

The central door locking is controlled by the Smart Wiring System (SWS). For troubleshooting, refer to GROUP 54B – Troubleshooting.

DIAGNOSIS FUNCTION

INPUT SIGNAL CHECK POINTS <VEHICLES WITH ETACS-ECU>

1. Connect the MUT-II or a voltmeter to the diagnosis connector to check input signal. (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.)
2. The following input signals can be checked:
   Door lock actuator
   - LOCK
   - UNLOCK

   NOTE
   If all the input signals cannot be check by using the MUT-II, the diagnosis circuit may be defective.

INSPECTION CHART FOR TROUBLE SYMPTOMS

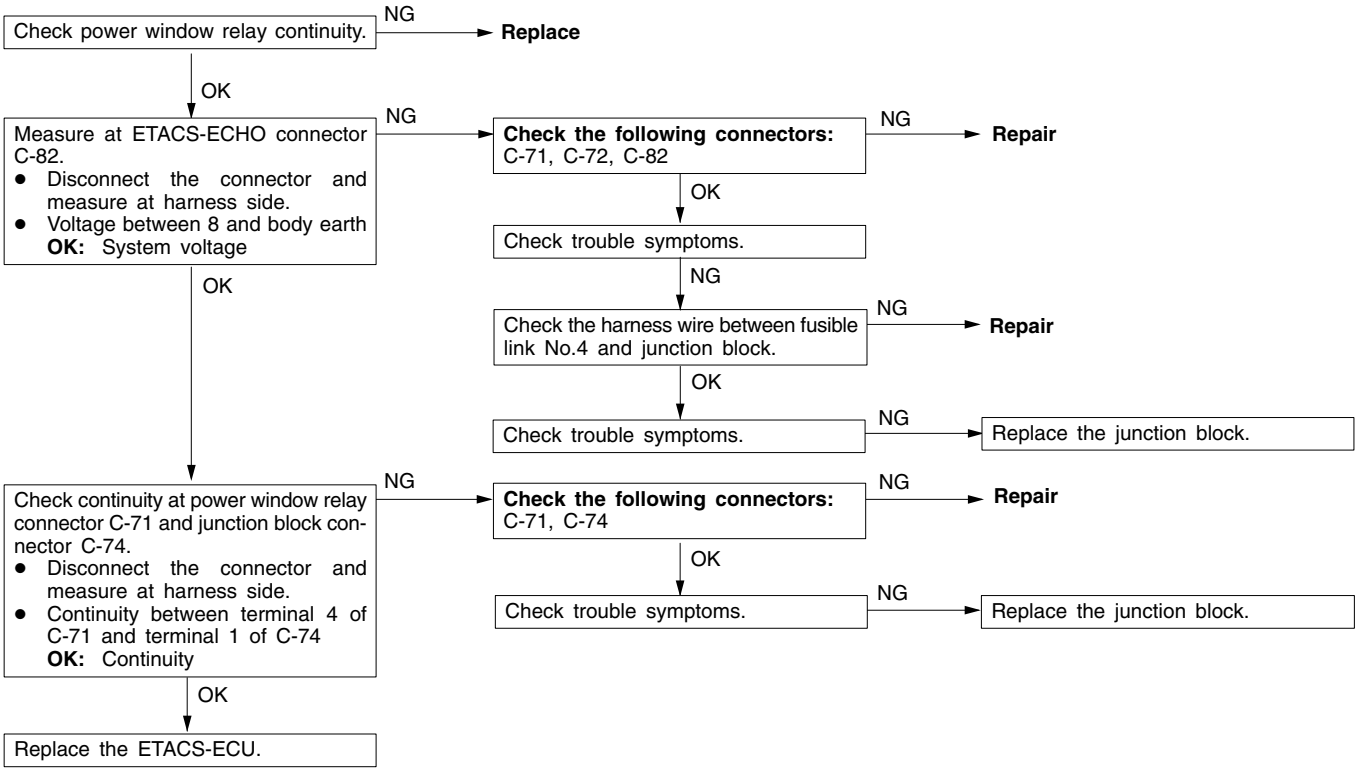
POWER WINDOWS

Symptom	Inspection procedure	Reference page
None of power window switches can operate any of windows.	1	42-3
Power window main switch can not operate any of windows. (However, each power window sub-switch can operate window.)	2	42-4
Power window main switch can not operate driver's window. (However, power window main switch can operate window except driver's window.)	3	42-4
Power window main switch can not operate passenger's window. (However, passenger's power window sub-switch can operate passenger's window.)	4	42-5
Power window main switch can not operate rear door windows. (However, rear power window sub-switches can operate rear door windows.)	5	42-5
Passenger's power window sub-switch can not operate passenger's window. (However, power window main switch can operate passenger's window.)	6	42-6
Rear power window sub-switches can not operate rear door windows. (However, power window main switch can operate rear door windows.)	7	42-7

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

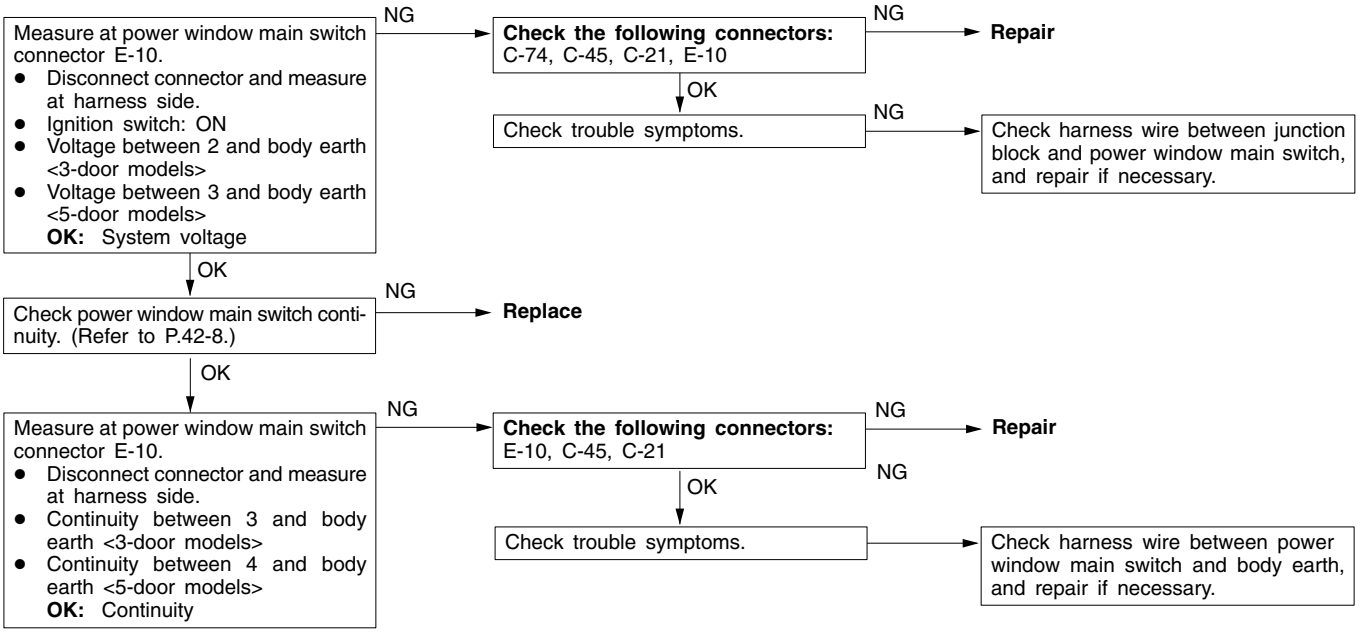
Inspection Procedure 1

None of power window switches can operate any of windows.	Probable cause
Power window relay, power window relay drive circuit or ETACS-ECU may be defective.	• Malfunction of power window relay • Malfunction of ETACS-ECU • Malfunction of junction block • Malfunction of wiring harness or connector



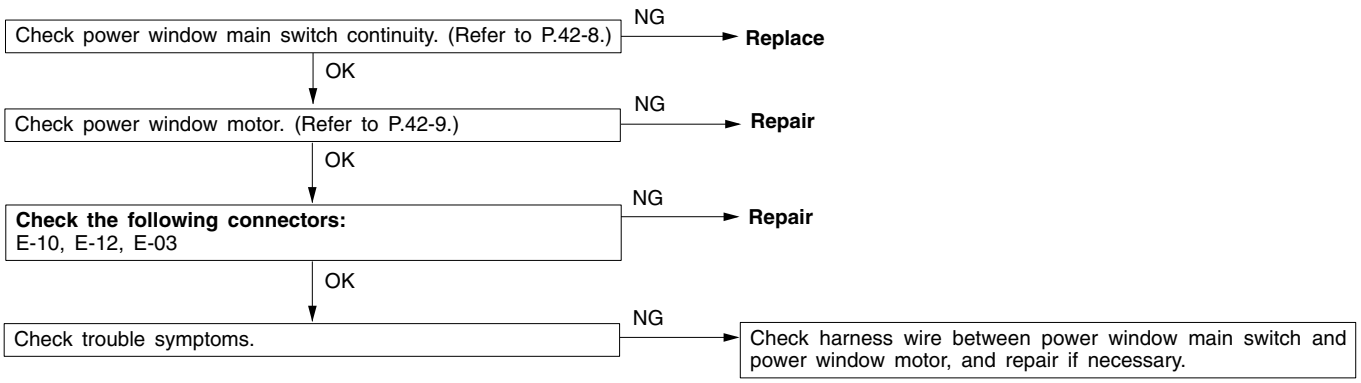
Inspection Procedure 2

Power window main switch can not operate any of windows. (However, each power window sub-switch can operate window.)	Probable cause
Power window main switch or its power supply circuit or earth circuit may be defective.	• Malfunction of power window main switch • Malfunction of wiring harness or connector



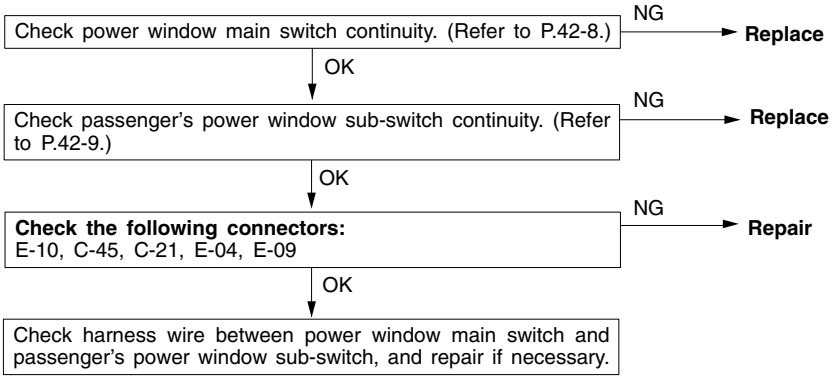
Inspection Procedure 3

Power window main switch can not operate driver's window. (However, power window main switch can operate window except driver's window.)	Probable cause
Power window main switch, power window motor, or harness or connector between power window main switch and power window motor may be defective.	• Malfunction of power window main switch • Malfunction of power window motor • Malfunction of wiring harness or connector



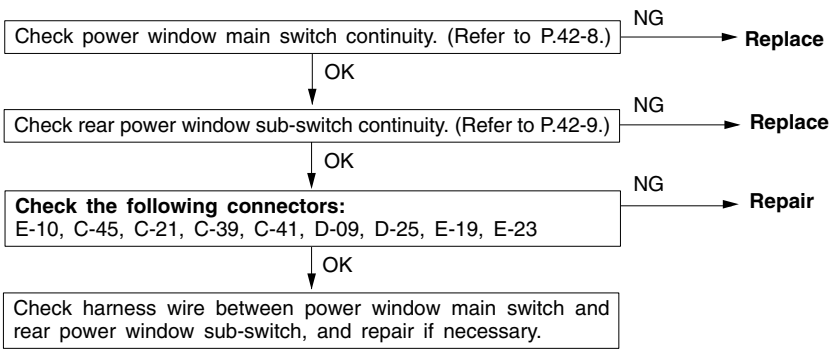
Inspection Procedure 4

Power window main switch can not operate passenger's window. (However, passenger's power window sub-switch can operate passenger's window.)	Probable cause
There may be short circuit or open circuit in communication line from the power window main switch to passenger's power window sub-switch, or passenger's power window sub-switch or power window main switch may be defective.	• Malfunction of power window main switch • Malfunction of passenger's power window sub-switch • Malfunction of wiring harness or connector



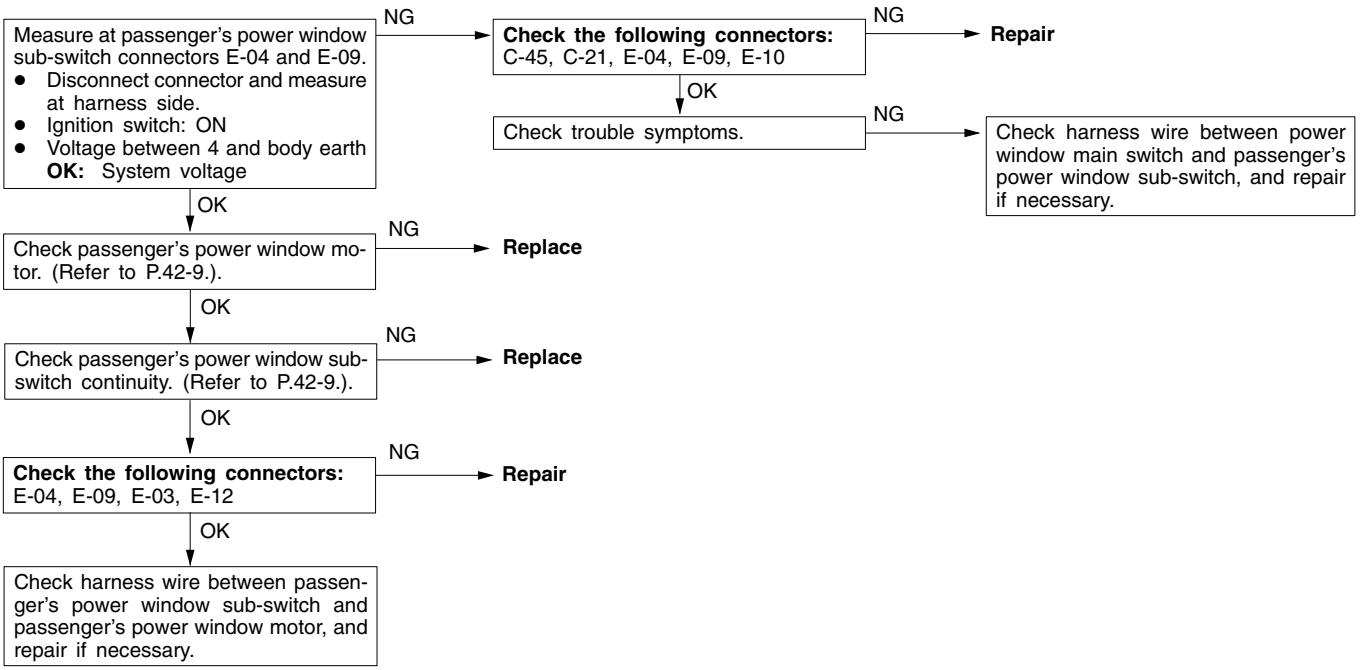
Inspection Procedure 5

Power window main switch can not operate rear door windows. (However, rear power window sub-switches can operate rear door windows.)	Probable cause
There may be short circuit or open circuit in communication line from the power window main switch to rear power window sub-switch, or rear power window sub-switch or power window main switch may be defective.	• Malfunction of power window main switch • Malfunction of rear power window sub-switch • Malfunction of wiring harness or connector



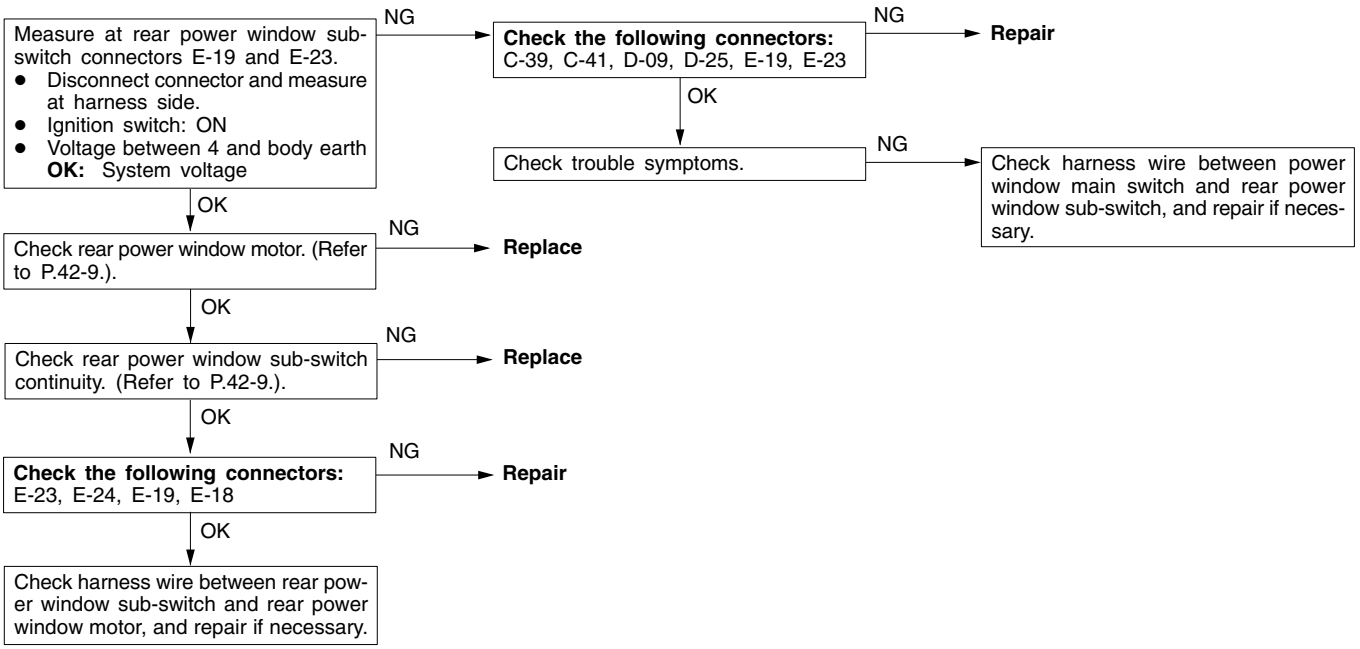
Inspection Procedure 6

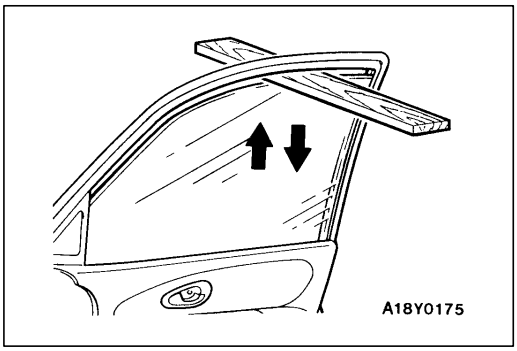
Passenger's power window sub-switch can not operate passenger's window. (However, power window main switch can operate passenger's window.)	Probable cause
Power supply circuit or earth circuit of the passenger's power window sub-switch, passenger's power window sub-switch or passenger's power window motor may be defective.	• Malfunction of passenger's power window sub-switch • Malfunction of passenger's power window motor • Malfunction of wiring harness or connector



Inspection Procedure 7

Rear power window sub-switches can not operate rear door windows. (However, power window main switch can operate rear door windows.)	Probable cause
Power supply circuit or earth circuit of the rear power window sub-switches, rear power window sub-switches or rear power window motors may be defective.	• Malfunction of rear power window sub-switches • Malfunction of rear power window motors • Malfunction of wiring harness or connector





ON-VEHICLE SERVICE

POWER WINDOW SAFETY MECHANISM CHECK <FRONT DRIVER'S SIDE POWER WINDOW>

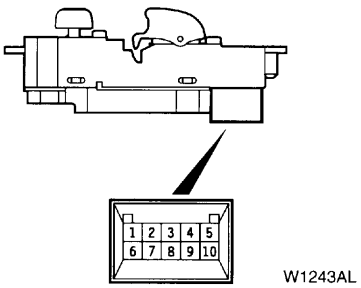
1. Place a wooden board about 10 mm thick as shown. Then, raise the window glass.
2. Check that the window lowers by about 150 mm when the window clamps the board. If this doesn't happen, do troubleshooting. (Refer to GROUP 54B.)

DOOR TRIM AND WATERPROOF FILM

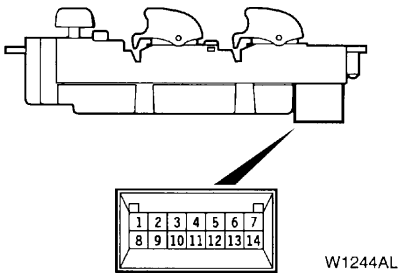
INSPECTION

POWER WINDOW MAIN SWITCH CONTINUITY CHECK

<3-door models>



<5-door models>

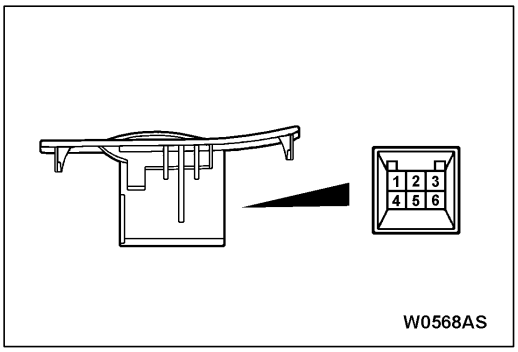


<3-door models>

Switch position		Terminal No.			
		Passenger side			
		3	4	5	9
Unlock	UP	○	○	○	○
	OFF	○	○		○
	DOWN	○	○	○	○
Lock	UP	○			○
	OFF	○	○		○
	DOWN	○	○		

<5-door models>

Switch position		Terminal No.															
		Front door								Rear door							
		Driver side				Passenger side				Driver side				Passenger side			
		3	5	7	8	1	3	5	14	3	5	6	13	2	3	5	9
Un-lock	UP	○	○—○	○	○	○	○	○—○	○	○	○—○	○	○	○	○	○	○
	OFF	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	DOWN	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Lock	UP	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	OFF	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	DOWN	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○



POWER WINDOW SUB SWITCH CONTINUITY CHECK

Switch position	Terminal No.				
	1	2	4	5	6
UP	○	○	○		○
OFF	○		○	○	○
DOWN	○	○		○	○

DOOR GLASS AND REGULATOR

INSPECTION

POWER WINDOW MOTOR CHECK

1. Connect the battery directly to the motor terminals.
2. Check that the motor rotates smoothly.
3. Reconnect the battery to the motor terminals vice versa.
4. Check that the motor rotates in the reverse direction.
5. If malfunction is present, replace the window regulator assembly.

NOTES

SERVICE BULLETIN

MITSUBISHI MOTORS

QUALITY INFORMATION ANALYSIS
OVERSEAS SERVICE DEPT. MITSUBISHI MOTORS CORPORATION

SERVICE BULLETIN	**No.:** ESB-00E51-501	
	Date: 2001-08-28	**<Model>** (EC)PAJERO PININ/ MONTERO iO (H60, H70) **<M/Y>** 00-10
Subject: CORRECTION TO MAINTENANCE PROCEDURE FOR BACK DOOR GLASS		
Group: EXTERIOR	**Draft No.:** 00SY091416	
CORRECTION	**INTERNATIONAL CAR ADMINISTRATION OFFICE**	O. Kai - E.V.P. & G.M. After Sales Service Dept.

1. Description:

This Service Bulletin informs you that correction has been made to the maintenance procedure for back door glass.

2. Applicable Manuals:

Manual	Pub. No.	Language	Page(s)
'00 PAJERO PININ Workshop Manual Chassis	CKRE00E1	(English)	42-16, 17
	CKRF00E1	(French)	
	CKRG00E1	(German)	
	CKRD00E1	(Dutch)	
	CKRI00E1	(Italian)	
'00 MONTERO iO Workshop Manual Chassis	CKRS00E1	(Spanish)	

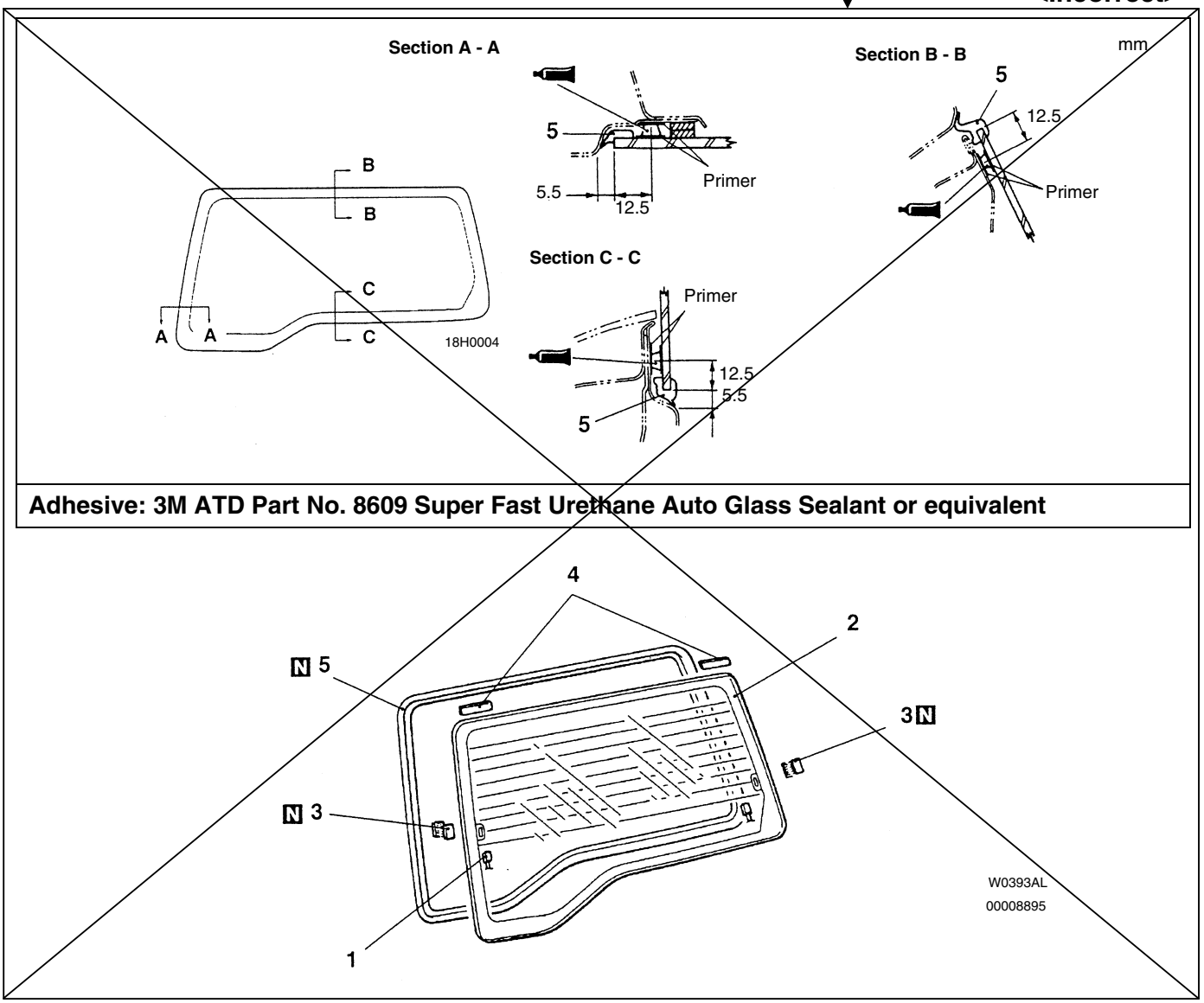
BACK DOOR GLASS

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- High-mounted Stop Lamp Assembly Removal and Installation (Refer to GROUP 52A).
- Back Door Trim Removal and Installation (Refer to P. 42-34).

See next page.

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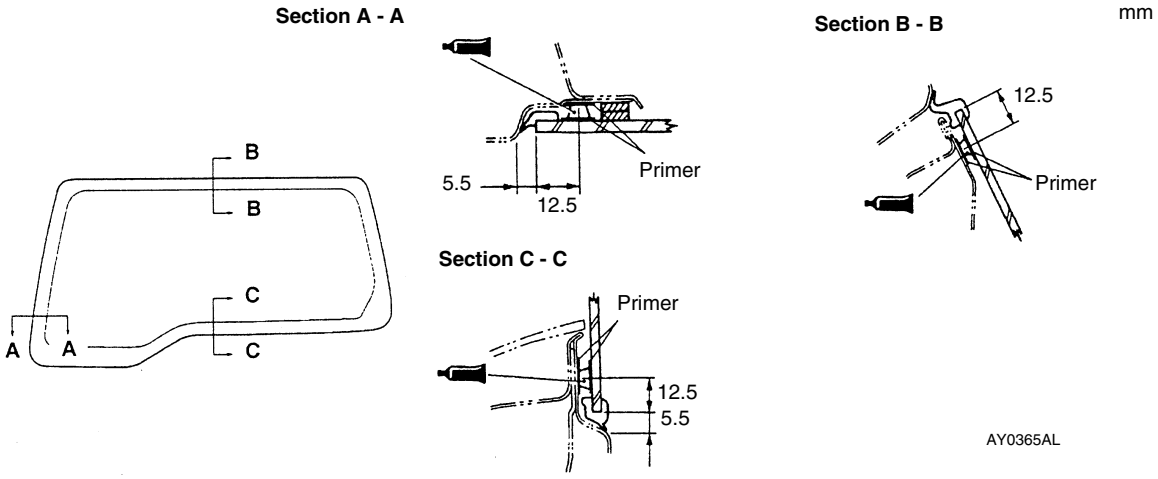


Adhesive: 3M ATD Part No. 8609 Super Fast Urethane Auto Glass Sealant or equivalent

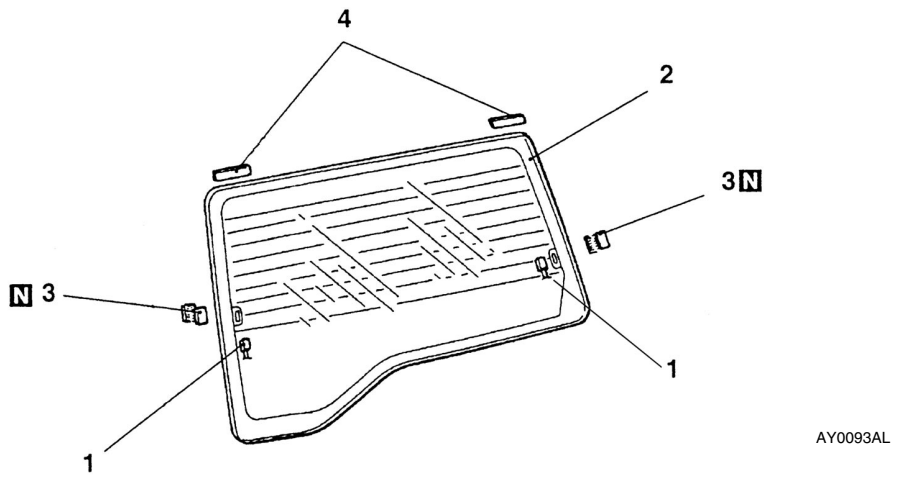
Removal steps

◄A►►A◄ 1. Harness connector
◄A►►A◄ 2. Back door glass
►A◄ 3. Dual lock fastener
►A◄ 4. Glass stopper
~~►A◄ 5. Window dam~~

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Adhesive: 3M ATD Part No. 8609 Super Fast Urethane Auto Glass Sealant or equivalent



REMOVAL SERVICE POINT

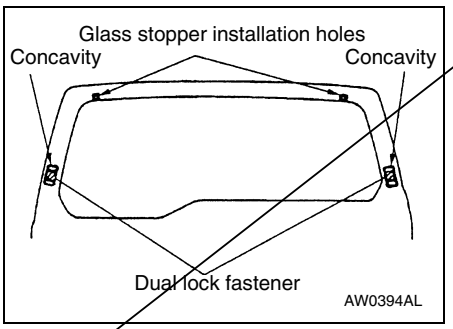
◄A► BACK DOOR GLASS REMOVAL

Remove the back door glass in the same manner as for the windshield. (Refer to P 42-11.)

INSTALLATION SERVICE POINT

►A◄ WINDOW DAM/DUAL LOCK FASTENER/GLASS STOPPER/BACK DOOR GLASS INSTALLATION

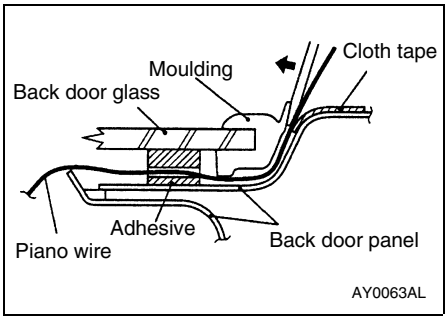
1. Use a isopropyl alcohol to decrease the glass and body surfaces where the window dam, dual lock fasteners and glass stoppers are installed.
2. Install the window dam.



3. Install the dual lock fasteners to the concavities on the body panel and the glass stoppers to the hole on the body panel respectively.
4. Install the dual lock fasteners to the windshield in the positions corresponding to the ones on the body panel where the dual lock fasteners have been installed.
5. Apply the primer and adhesive.
6. Install the glass in the same manner as for the windshield. (Refer to P.42 –12.)

<Incorrect>

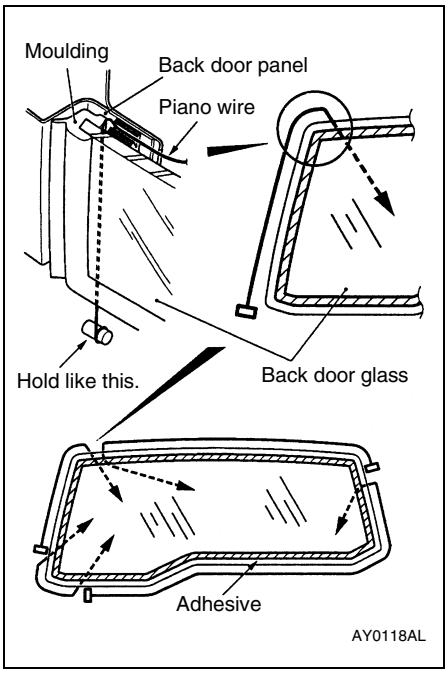
See next page.



REMOVAL SERVICE POINT

◄A► BACK DOOR GLASS REMOVAL

1. Put matchmarks on the back door and the back door glass.
2. For protection of painted surface of the back door, apply cloth tape all around the back door on which the back door glass is fitted.
3. Using a pointed drill, make a hole in the bonded portion of the back door.
4. From inside the vehicle, pass the piano wire through the hole.



5. Put the piano wire along the bonded surface from outside the vehicle, and hold it at its end.
6. Slowly pull the piano wire inside the vehicle in the direction in which the piano wire outside the vehicle is held, and remove the adhesive in the numerical order as shown.
   (1) From left up to left down direction, pull the piano wire inside the vehicle, and remove the adhesive.
   (2) From left up to right up direction, pull the piano wire inside the vehicle, and remove the adhesive.
   (3) From right up to right down to left down direction, pull the piano wire inside the vehicle, and remove the adhesive.
   (4) Pass the piano wire outside the vehicle through the inside of the vehicle, pull both ends of the piano wire toward the inside of the vehicle, and remove the adhesive.

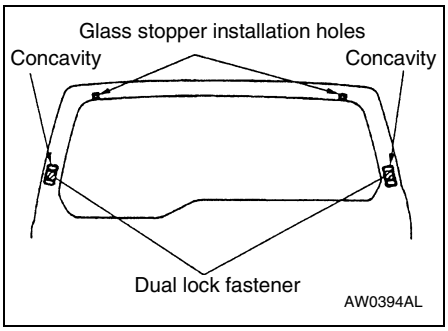
Caution
When the adhesive is removed, do not alternately pull the piano wires. This may give damage to the moulding.

7. Remove the back door glass from the back door panel.
8. Remove the body to windshield adhesive by the same procedure as for the windshield. (Refer to P.42 –11.)

INSTALLATION SERVICE POINT

►A◄ GLASS STOPPER/DUAL LOCK FASTENER/BACK DOOR GLASS INSTALLATION

1. Using unleaded gasoline, degrease the glass and body surface on which the dual lock fasteners and the glass stoppers are installed.



2. Install the dual lock fasteners correctly on the specified locations of the body flange (convexities on the body panel).
3. Install the dual lock fasteners and the glass stoppers on the back door glass at the positions that correspond to those of the body flange on which the dual lock fasteners and the glass stoppers are installed.
4. Using the sponge saturated with primer, apply primer evenly to the specified areas around entire surface of the back door glass and the body.
5. Install the back door glass by the same procedures as for the windshield. (Refer to P.42 –12.)

EXTERIOR

EXTERIOR

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FRONT BUMPER 2
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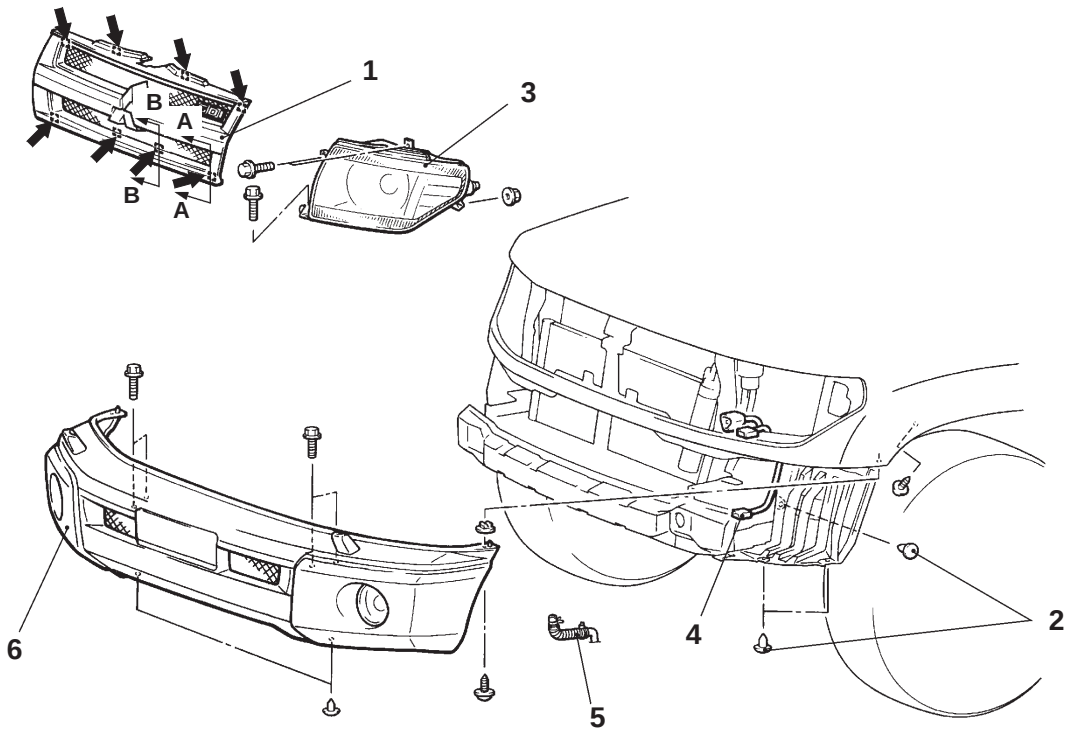
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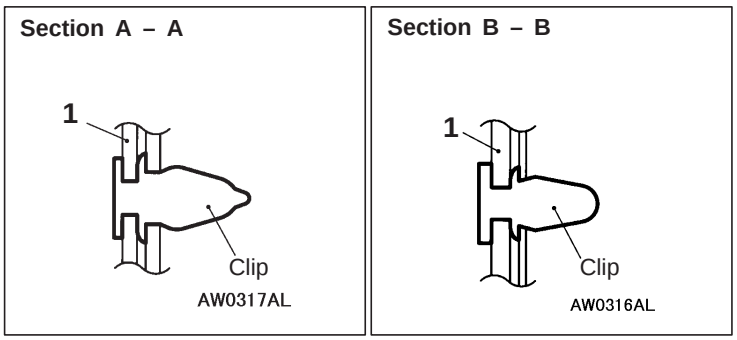
FRONT BUMPER

REMOVAL AND INSTALLATION



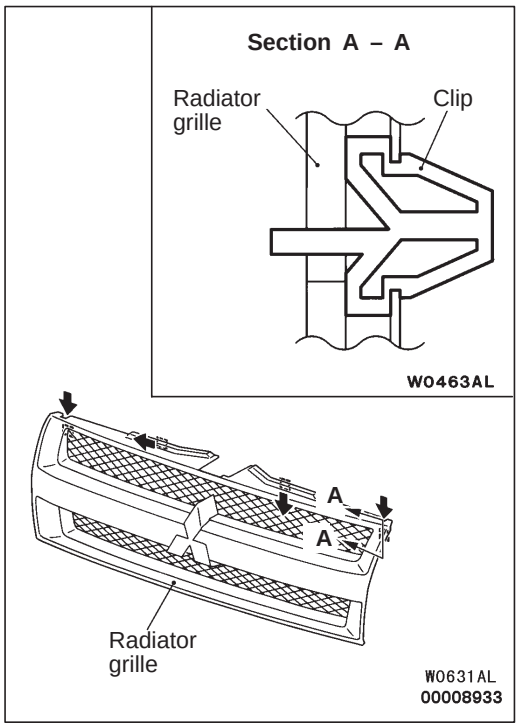
AX0087AL

NOTE
◀▬ : Clip positions



Removal steps

◀A▶ 1. Radiator grille
2. Splash shield installation clips
3. Headlamp
4. Fog lamp connector
5. Headlamp washer hose connection <Vehicles with headlamp washer>
6. Front bumper assembly

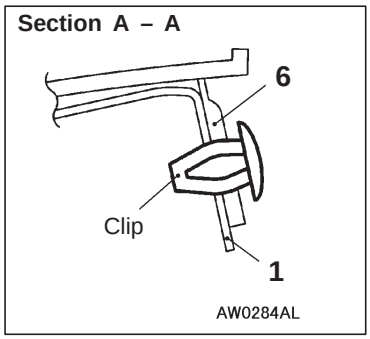


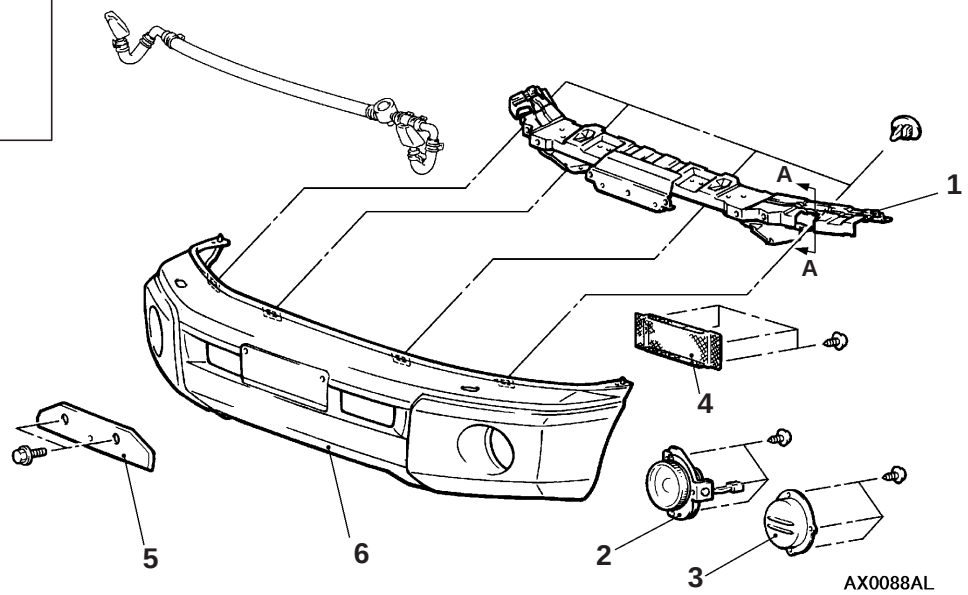
REMOVAL SERVICE POINT

◀A▶ RADIATOR GRILLE REMOVAL

Remove the radiator grille by pushing the tab of the radiator grille clips in the direction of the arrows with a flat-tipped screwdriver, while lightly pulling the radiator grille towards you.

DISASSEMBLY AND REASSEMBLY



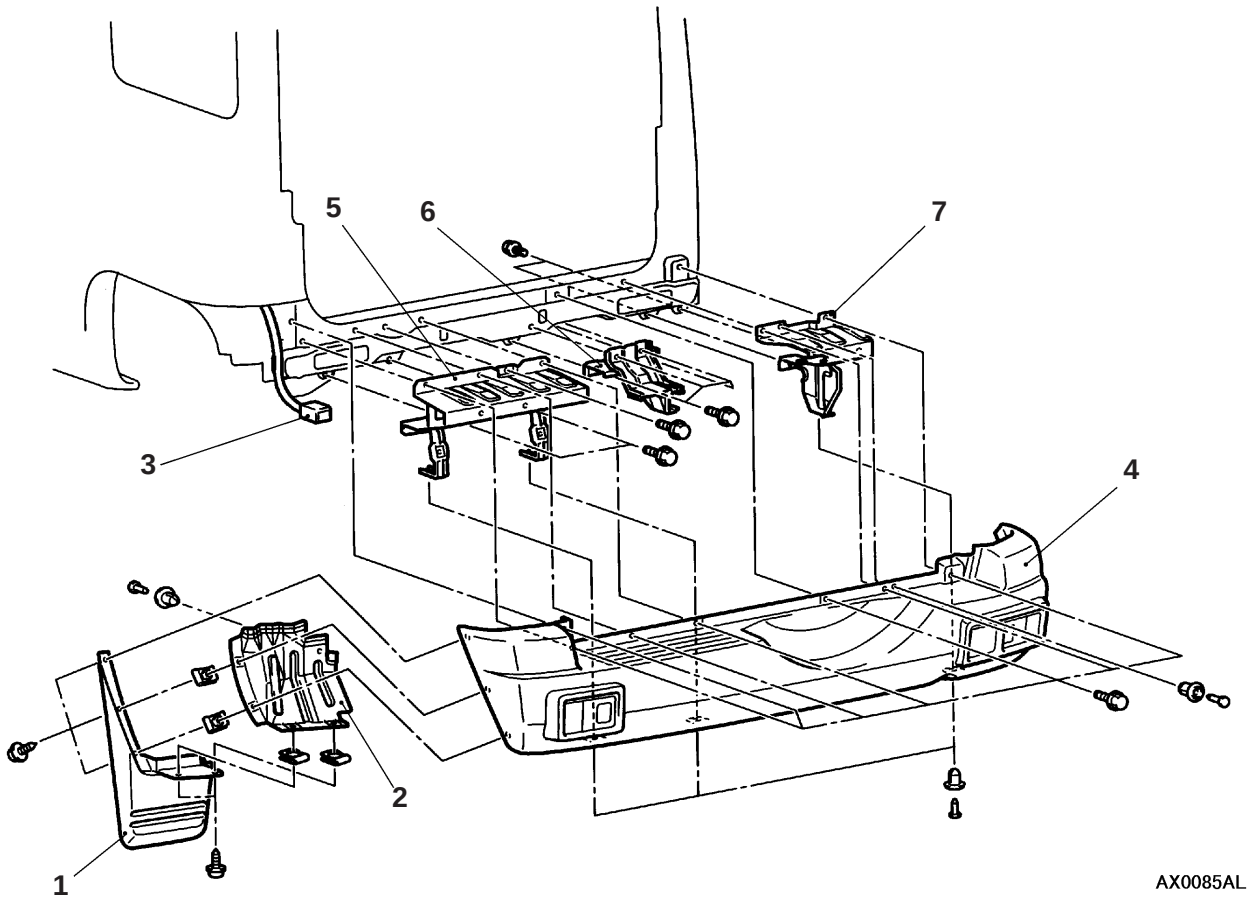


Disassembly steps

1. Front bumper reinforcement assembly
● Headlamp washer assembly <Vehicles with headlamp washer> (Refer to P.51-17)
2. Fog lamp
3. Fog lamp cover <Vehicles without fog lamp>
4. Bumper net
5. Licence plate bracket
6. Front bumper face

REAR BUMPER

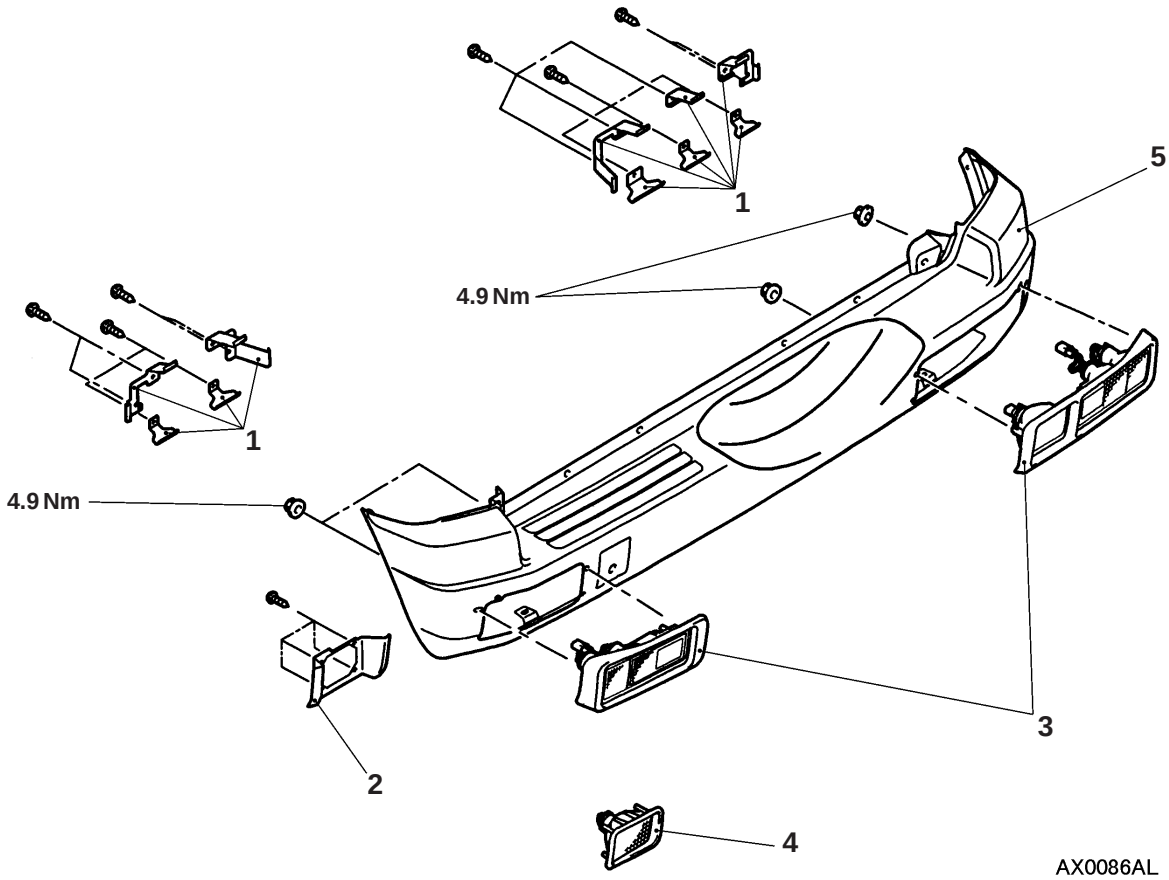
REMOVAL AND INSTALLATION



Removal steps

1. Rear mud guard
2. Rear splash shield
3. Rear combination lamp or rear fog lamp connection
4. Rear bumper assembly
5. Bumper step reinforcement assembly
6. Bumper center reinforcement assembly
7. Bumper side reinforcement assembly

DISASSEMBLY AND REASSEMBLY

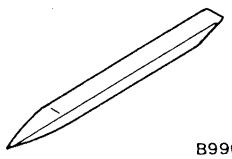


Disassembly steps

1. Bracket <R.H. drive vehicles>
2. Bracket <L.H. drive vehicles>
3. Rear combination lamp assembly <R.H. drive vehicles>
4. Rear fog assembly <L.H. drive vehicles>
5. Rear bumper face

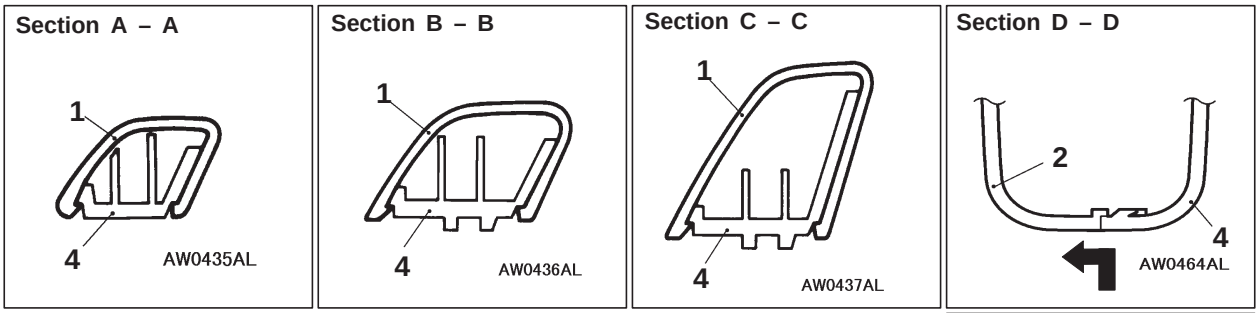
EXTERIOR PARTS

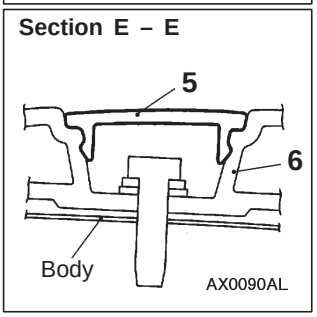
SPECIAL TOOL

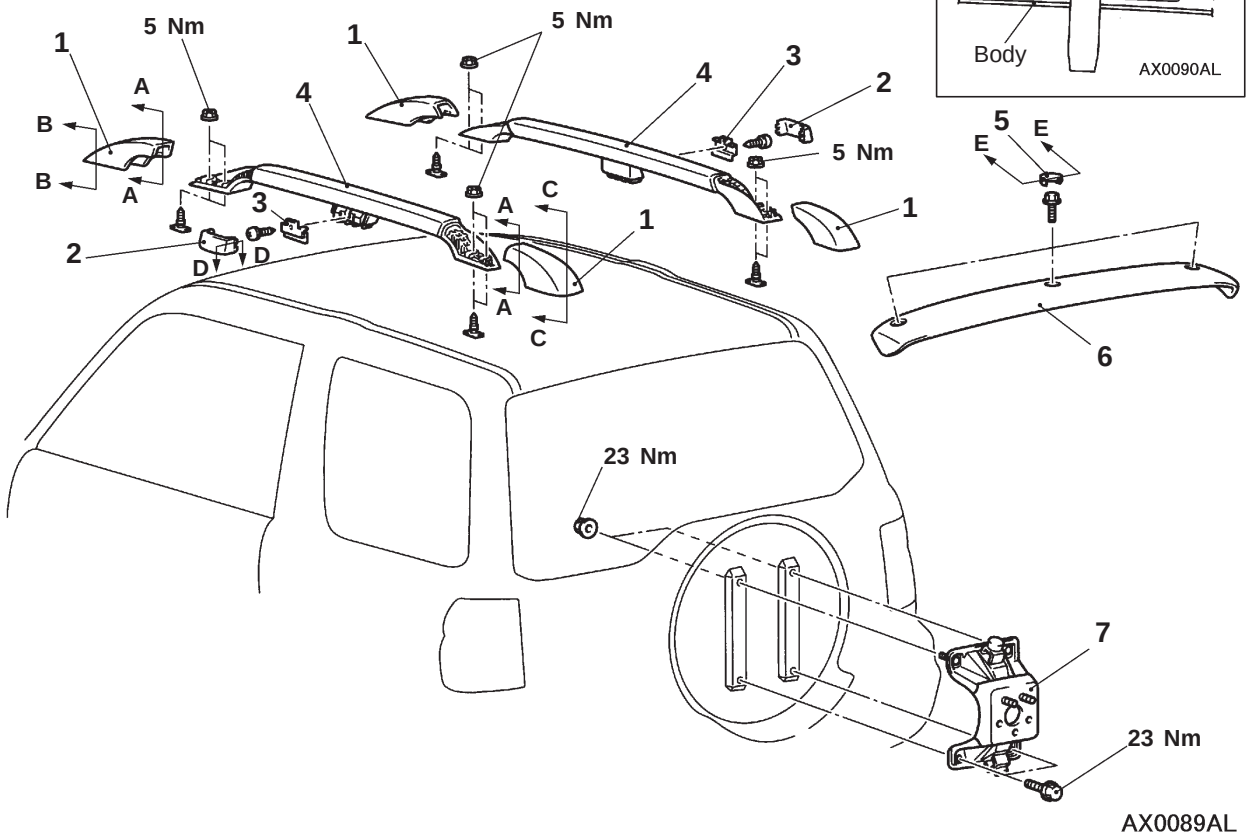
Tool	Number	Name	Use
 B990784	MB990784	Ornament remover	Removal of roof rack cover.

EXTERIOR PARTS

REMOVAL AND INSTALLATION







Roof rail removal steps

◀A▶ 1. Roof rack cover (front, rear)
2. Roof rack cover (side)
3. Center bracket
4. Roof bar

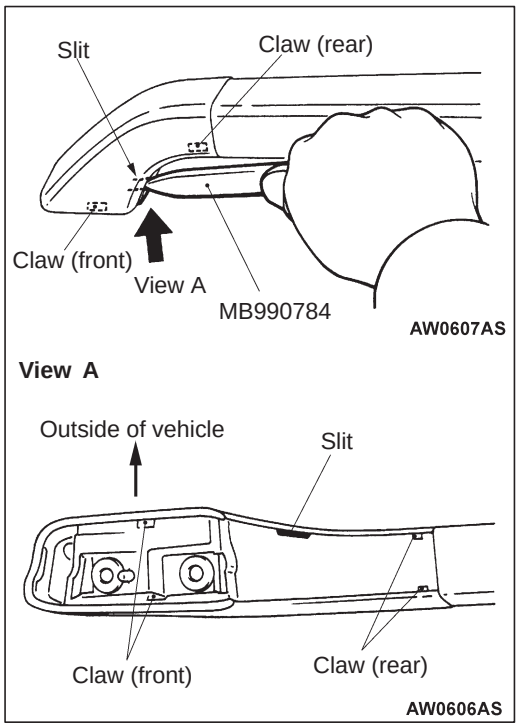
Roof spoiler removal steps

5. cover
6. Roof spoiler

Spare tyre carrier removal steps

- Spare tyre cover (Refer to GROUP 31.)
- Spare tyre
- Back door trim and waterproof film (Refer to GROUP 42.)

7. Spare tyre carrier



REMOVAL SERVICE POINT

◀A▶ ROOF RACK COVER (FRONT, REAR) REMOVAL

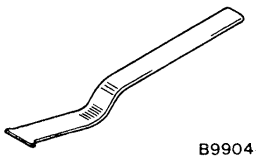
1. Insert the special tool into the slit.

   NOTE
   The roof rack assembly has the slit.
2. Insert the special tool as far as possible and remove the claw (front) by prying the roof rack cover toward you.
3. Remove the claw (rear).

   Caution
   Spread out the roof rack cover sufficiently and pull it upward, otherwise the claws will be broken.

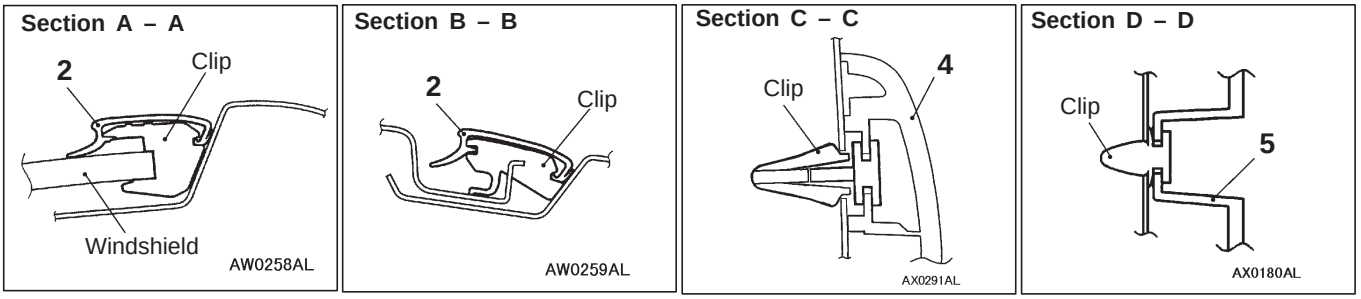
MOULDING AND GARNISH

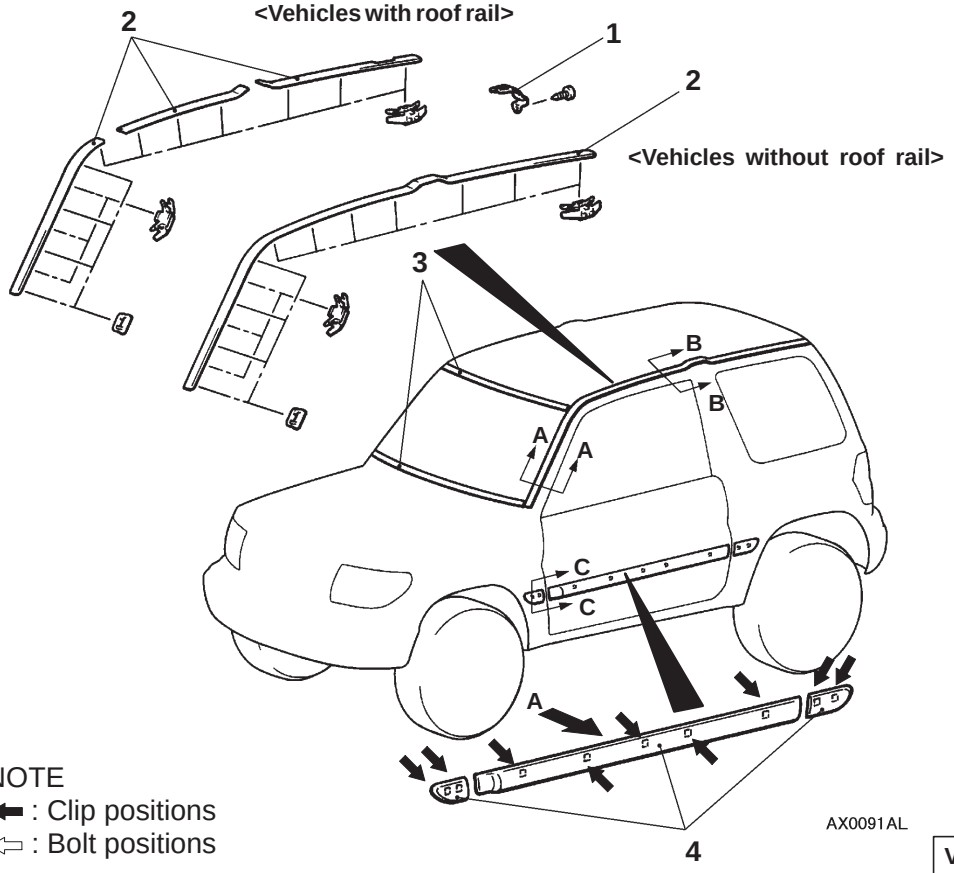
SPECIAL TOOL

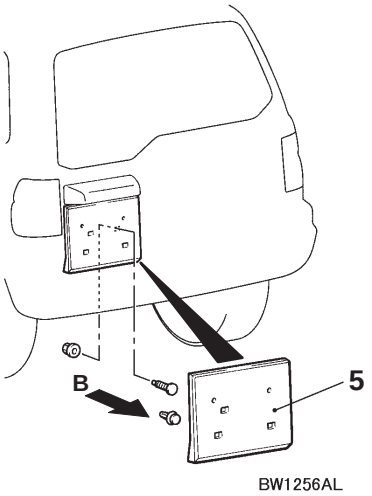
Tool	Number	Name	Use
	MB990449	Window moulding remover	Removal of roof drip moulding.

MOULDING AND GARNISH

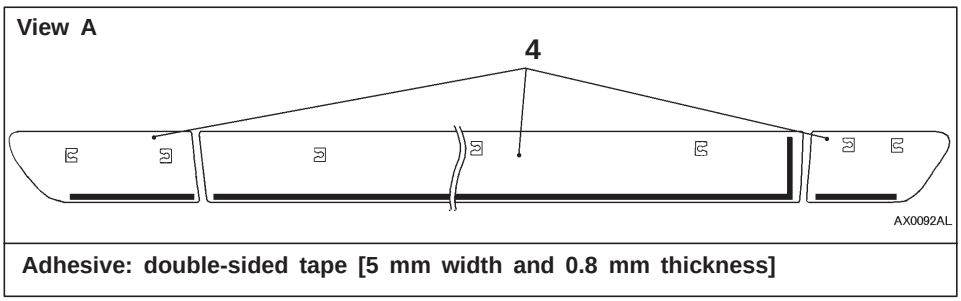
REMOVAL AND INSTALLATION



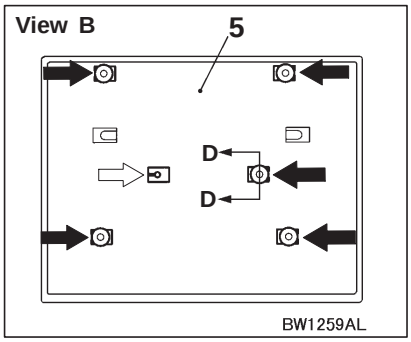




NOTE
⬅ : Clip positions
⇦ : Bolt positions



Adhesive: double-sided tape [5 mm width and 0.8 mm thickness]



Roof drip moulding removal steps

- Roof rail assembly <Vehices with roof rail> (Refor to P.51-6)

◀A▶
1. Roof drip cover
2. Roof drip moulding
3. Windshield moulding (Refer to GROUP 42 – Windshield.)

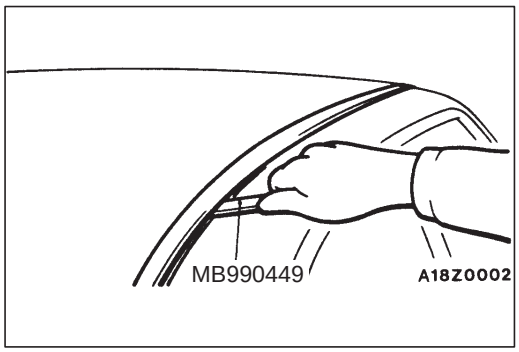
◀B▶ ▶A◀
4. Side protector moulding

Side protector moulding removal

Rear licence plate garnish removal steps

- Back door trim (Refer to GROUP 42 – Back door.)

5. Rear licence plate garnish

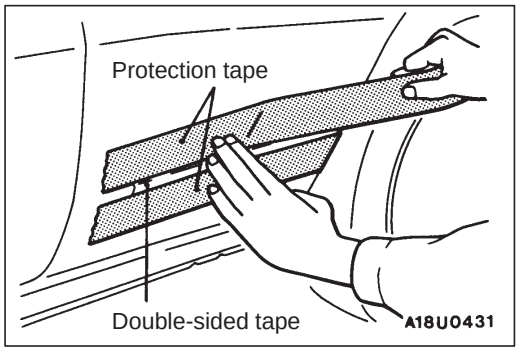


REMOVAL SERVICE POINT

◀A▶ ROOF DRIP MOULDING REMOVAL

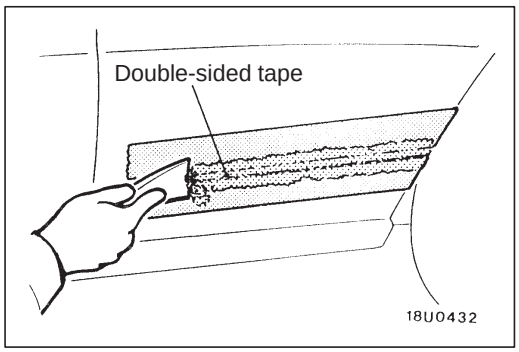
Use the special tool to lever out the moulding.

Caution
If the moulding has become warped, it should not be reused.

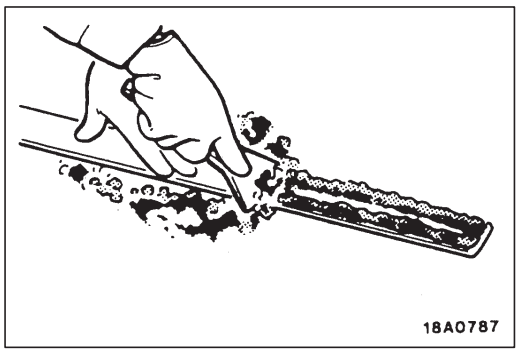


◀B▶ SIDE PROTECT MOULDING REMOVAL

1. Attach protection tape all the way along the edges of the double-sided tape which is still adhering to the body.



2. Use a resin spatula to scrape off the double-sided tape.
3. Peel off the protection tape.
4. Wipe the body surface and clean it with a rag moistened with isopropyl alcohol.



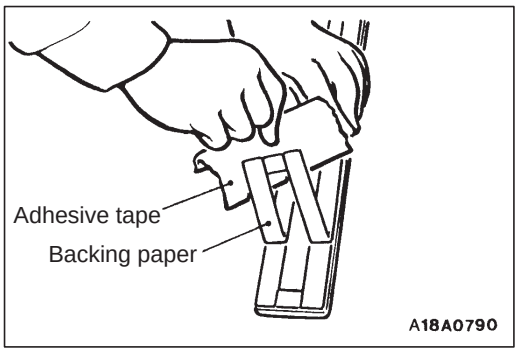
INSTALLATION SERVICE POINTS

▶A◀ SIDE PROTECT MOULDING INSTALLATION

Double-sided tape affixing to the side protect moulding (when reusing)

1. Scrape off the double-sided tape with a resin spatula or gasket scraper.
2. Wipe off the side protect moulding adhesion surface and clean it with a shop towel moistened with isopropyl alcohol.
3. Affix the specified double sided tape to the side protect moulding. (Refer to P.51-8.)

Specified adhesive tape:
Double-sided tape: 5 mm width and 0.8 mm thickness



4. Remove strip paper from the pressure sensitive double-sided tape.

   NOTE
   Affix double-sided tape to the end of strip paper for ease of strip paper removal. (Refer to P.51-8.)

5. Install the side protect moulding.

   NOTE
   If it is hard to affix the double-sided tape in winter, heat the application surfaces at both the vehicle body and the side protect moulding.

   Body 40 – 60°C

   Side protect moulding 20 – 30 °C

   Apply pressure fully to the side protect moulding.

WINDSHIELD WIPER AND WASHER

SERVICE SPECIFICATIONS

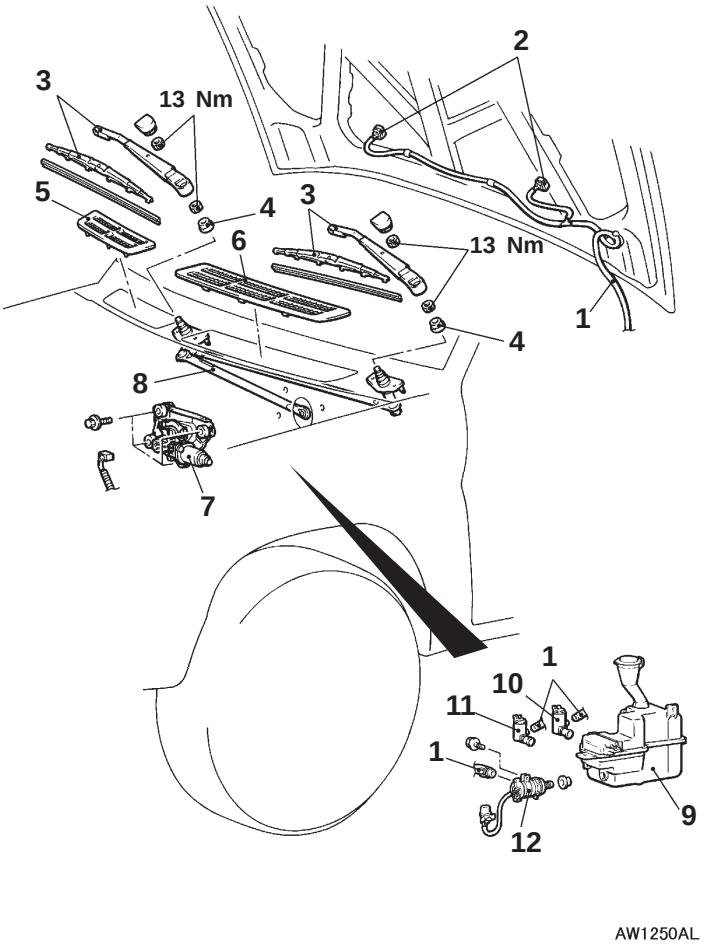
Items		Standard value
Park position of windshield wiper arm and blade assembly (Distance between wiper blade and windshield lower moulding) mm	Driver's side	20 ± 5 < L.H. drive vehicles> 30 ± 5 < R.H. drive vehicles >
	Passenger's side	20 ± 5 <L.H. drive vehicles > 30 ± 5 <R.H. drive vehicles >

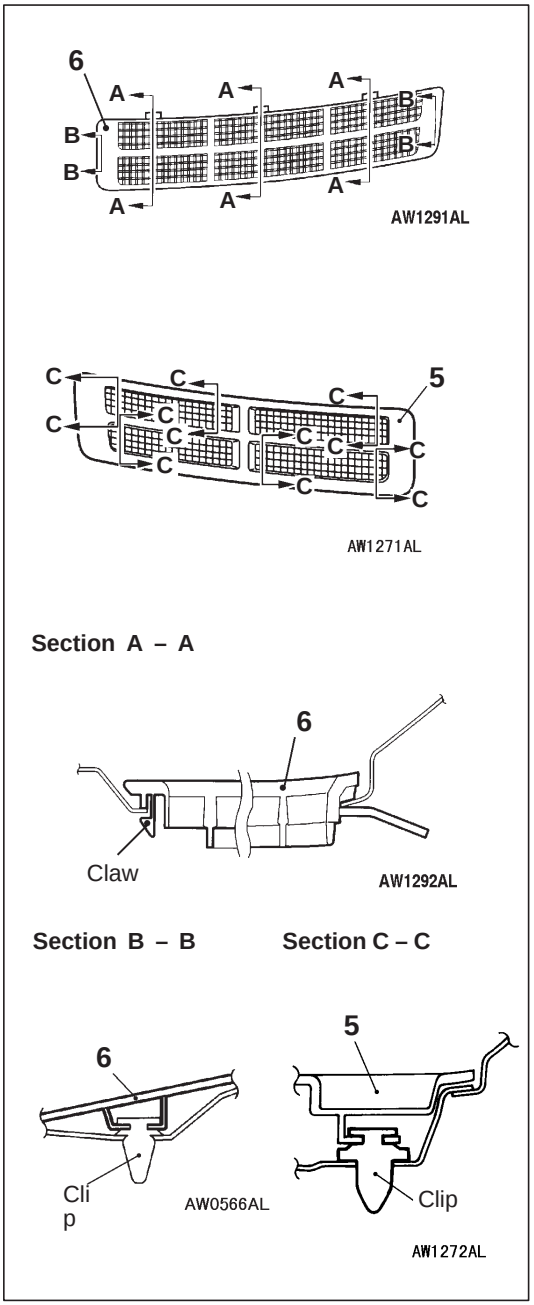
TROUBLESHOOTING

The windshield wiper and washer is controlled by the Smart Wiring System (SWS). For troublesshooting, refer to GROUP 54B – Troubleshooting.

WINDSHIELD WIPER AND WASHER

REMOVAL AND INSTALLATION





1. Washer hose connection
2. Washer nozzle

Wiper motor and linkage removal steps

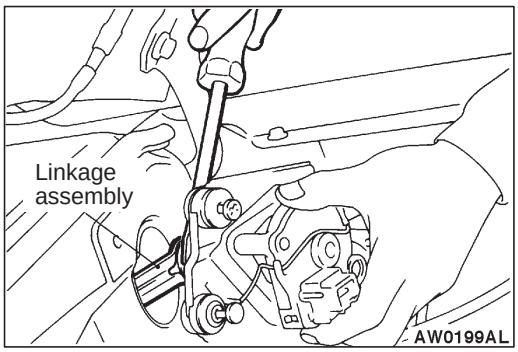
▶A◀ 3. Wiper arm and blade assembly
4. Washer
5. Front deck garnish <R.H. drive vehicles>
6. Front deck garnish <L.H. drive vehicles>
◀A▶ 7. Wiper motor
8. Linkage assembly

Washer tank removal steps

- Air cleaner
- Intake duct

1. Washer hose connection
9. Headlamp washer motor <Vehicles with headlamp washer>
10. Front washer motor
11. Rear washer motor
12. Washer tank assembly

NOTE
For removal and installation of the column switch assembly (wiper and washer switch), refer to GROUP 37A – Steering Wheel and Shaft.

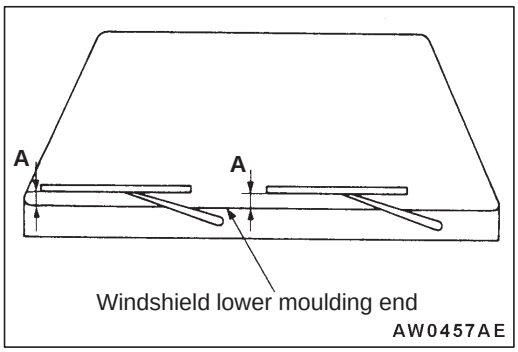


REMOVAL SERVICE POINT

◀A▶ WIPER MOTOR REMOVAL

1. Remove the wiper motor mounting bolts.
2. Use a flat-tipped screwdriver to separate the wiper motor crank arm from the linkage assembly, and then remove the wiper motor.

Caution
Because the installation angle of the crank arm and the wiper motor has been set, do not remove them unless it is necessary to do so. If they must be removed, remove them only after marking their mounting positions.

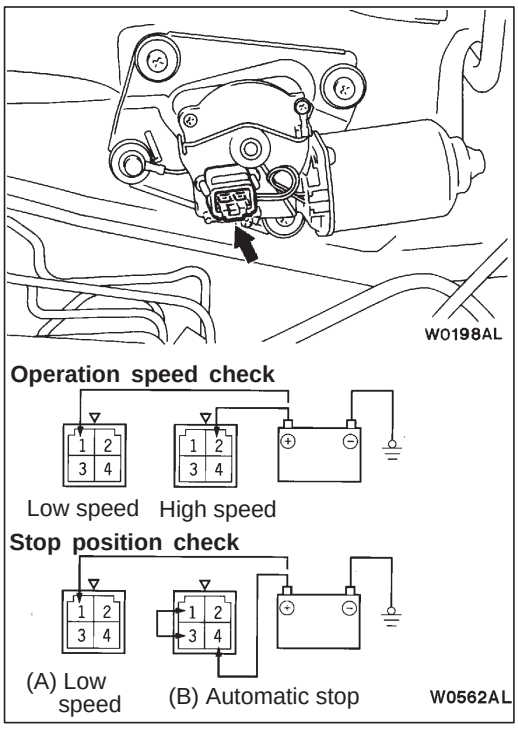


INSTALLATION SERVICE POINTS

▶A◀ WIPER ARM AND BLADE ASSEMBLY INSTALLATION

Install the wiper blade so that the wipers stops at the specified stop position (standard value) as shown in the illustration.

Standard value (A): 20 ± 5 mm <L.H. drive vehicles>
30 ± 5 mm <R.H. drive vehicles>



INSPECTION

WIPER MOTOR CHECK

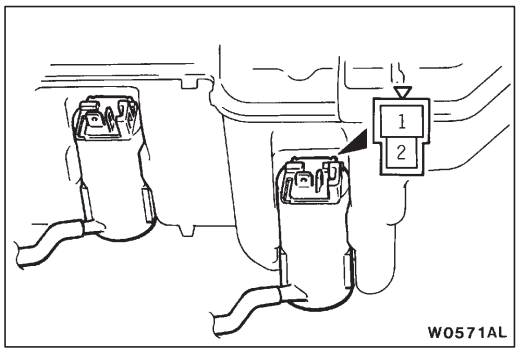
Disconnect the wiring harness connector, and then check the wiper motor operation with the wiper motor remaining installed to the body.

Wiper Motor Operation Speed

Connect a battery to the wiper motor as shown in the illustration and check the operation speed.

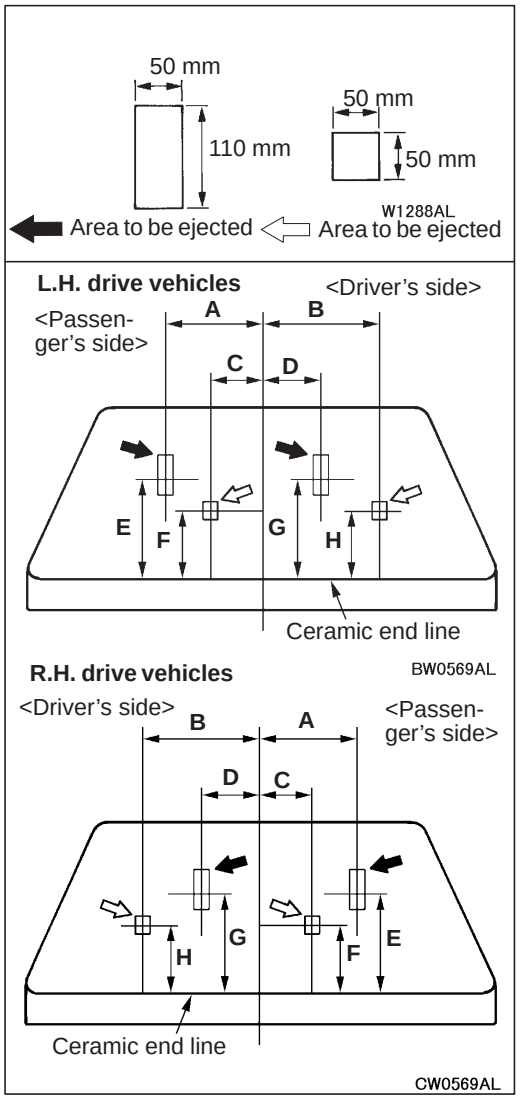
Stop Position

1. Connect a battery to the wiper motor as shown in the (A) of the illustration. While the wiper motor operates at low speed, disconnect the battery to stop the wiper motor.
2. Connect the terminals via a jumper wire and a battery to the wiper motor as shown in the (B) of the illustration. After the motor starts turning at low speed, it should stop at the automatic stop position.



WASHER MOTOR CHECK

1. With the washer motor installed to the washer tank, fill the washer tank with water.
2. Check that the water squirts out strongly when battery voltage is applied to terminal (2) and terminal (1) is earthed.



WASHER FLUID EJECTION POINT CHECK

Adjust the ejection angle by moving the nozzle.

Item	Distance mm	Item	Distance mm
A	350	E	320
B	475	F	200
C	165	G	310
D	200	H	200

REAR WIPER AND WASHER

SERVICE SPECIFICATION

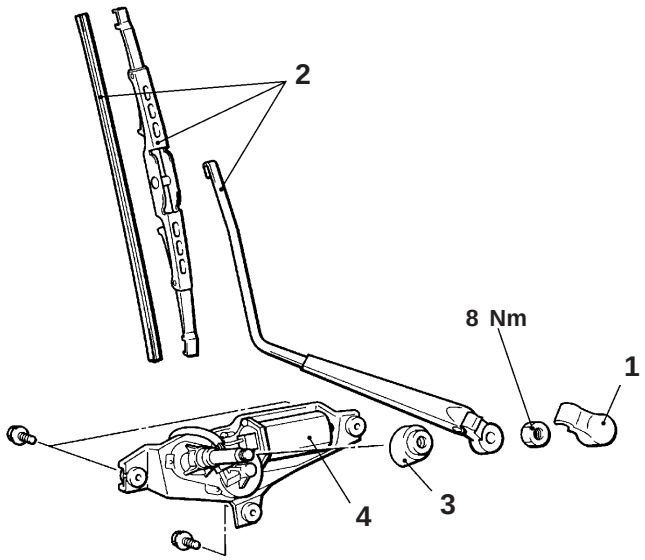
Items	Standard value
Park position of rear wiper arm and blade assembly (Distance between wiper blade and back door glass ceramic end line) mm	33 ± 5

TROUBLESHOOTING

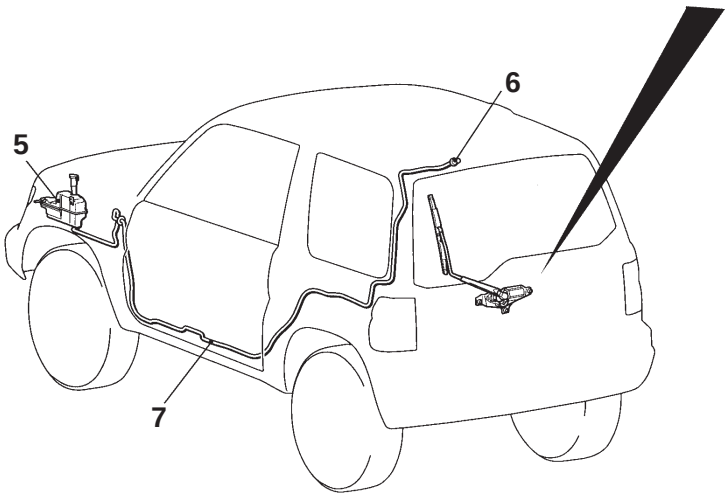
The rear wiper and washer is controlled by the Smart Wiring System (SWS). For troublesshooting, refer to GROUP 54B – Troubleshooting.

REAR WIPER AND WASHER

REMOVAL AND INSTALLATION



AW0193AL



AW0192AL

Wiper motor assembly removal steps

- Back door trim (Refer to GROUP 42.)

1. Cover
2. ▶A◀ Wiper arm and blade assembly
3. ▶B◀ Grommet
4. Wiper motor assembly

Washer tank and washer motor removal

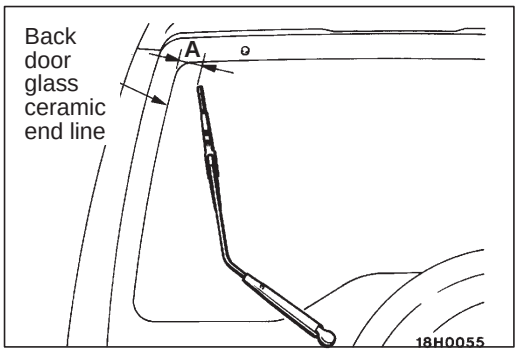
5. Washer tank and washer motor (Refer to P.51-11.)

Rear washer hose removal steps

- Rear seat (Refer to GROUP 52A.)
- Scuff plate and quarter trim (Refer to GROUP 52A.)
- Headlining (Refer to GROUP 52A.)

6. Washer nozzle
7. Washer hose

NOTE
For removal and installation of the column switch assembly (wiper and washer switch), refer to GROUP 37A – Steering Wheel and Shaft.

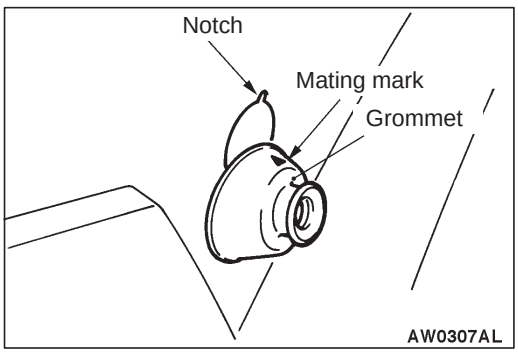


INSTALLATION SERVICE POINT

▶A◀ WIPER ARM AND BLADE ASSEMBLY INSTALLATION

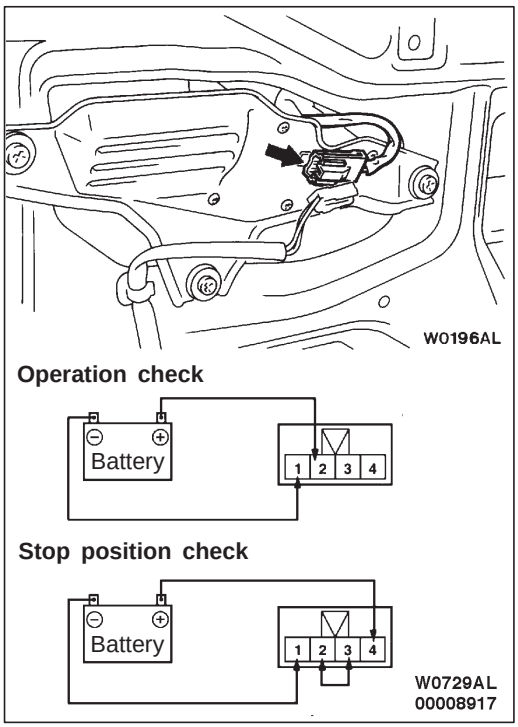
Install so that the wiper blade is positioned at the shown position when the wiper arm stops.

Standard value (A): 33 ± 5 mm



▶B◀ GROMMET INSTALLATION

Align the mating mark of grommet and the notch of installation hole.



INSPECTION

WIPER MOTOR CHECK

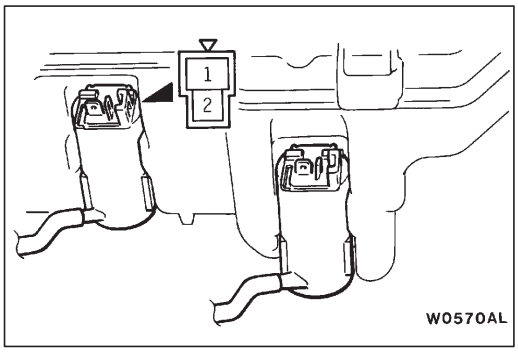
Disconnect the wiring harness connector, and check the wiper motor operation with the wiper motor remaining installed to the body.

Wiper Motor Operation

Connect a battery to the wiper motor as shown in the illustration and check the motor operation.

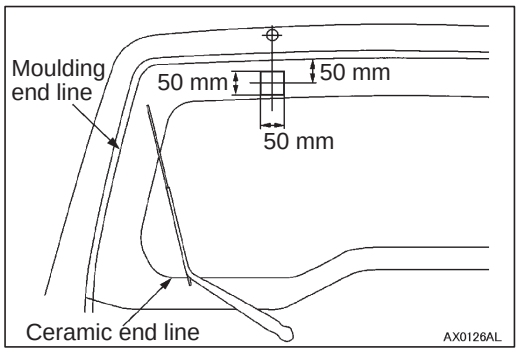
Wiper Motor Stop Position

1. Operate the wiper motor, and then disconnect the battery to stop the wiper motor while the wiper motor is operating.
2. Reconnect the battery as shown in the illustration, and confirm that after the motor starts turning, it stops at the automatic stop position.



WASHER MOTOR CHECK

1. With the washer motor installed to the washer tank, fill the washer tank with water.
2. Check that the water squirts out strongly when system voltage is applied to terminal 2 and terminal 1 is earthed.



WASHER FLUID EJECTION POINT CHECK

Adjust the ejection angle by moving the nozzle.

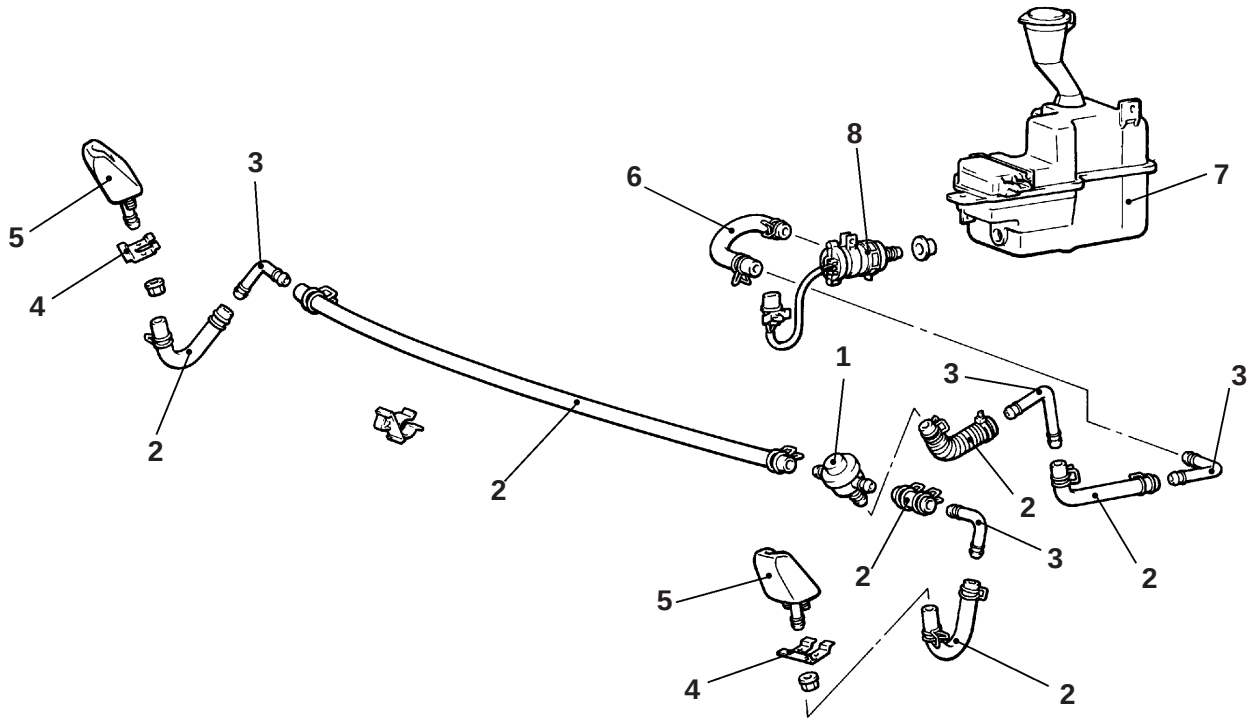
HEADLAMP WASHER

TROUBLESHOOTING

The headlamp washer is controlled by the Smart Wiring System (SWS). For troublesshooting, refer to GROUP 54B – Troubleshooting.

HEADLAMP WASHER

REMOVAL AND INSTALLATION



Nozzle and check valve removal steps

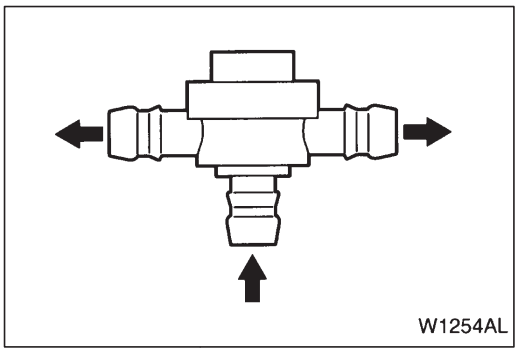
- Draining of washer fluid
- Front bumper (Refer to P.51-2.)

1. Check valve
2. Washer hose
3. Joint
4. Bracket
5. Nozzle

Washer tank removal steps

- Draining of washer fluid
- Air cleaner
- Intake duct

6. Washer hose
7. Washer tank assembly
8. Headlamp washer motor

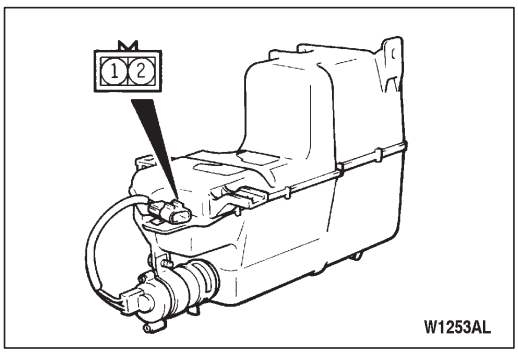


INSPECTION

CHECK VALVE CHECK

Apply pressure to the inlet of the check valve to check its opening pressure.

Opening pressure: 78 kPa

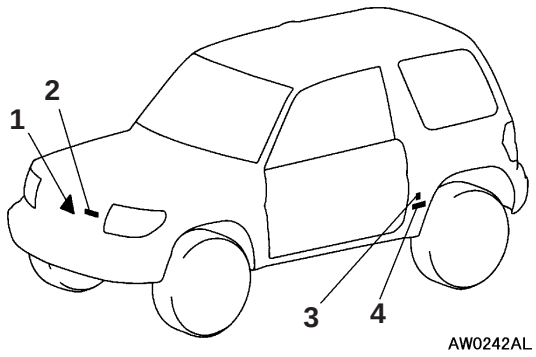


HEADLAMP WASHER MOTOR CHECK

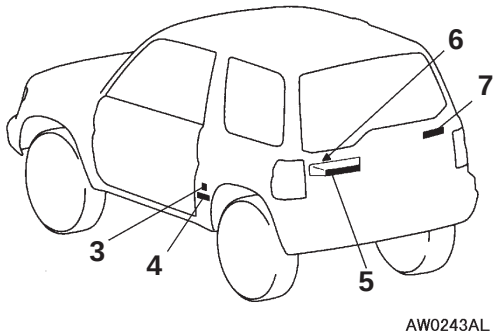
1. With the washer motor installed to the washer tank, fill the washer tank with water.
2. Connect battery (+) and (–) cables to terminals (1) and (2) respectively to see that the washer motor runs and water is injected.

MARKS

REMOVAL AND INSTALLATION



AW0242AL



AW0243AL

1. Three diamonds mark
2. “GDI” mark
3. Pininfarina mark
4. Pininfarina logo mark

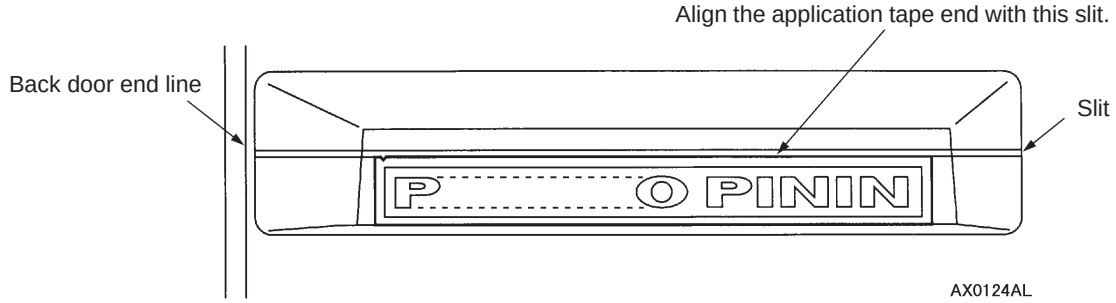
▶A◀ 5. Vehicle name decal
▶A◀ 6. Three diamonds mark
▶A◀ 7. “GDI” mark

INSTALLATION SERVICE POINT

▶A◀ INSTALLATION OF MARKS

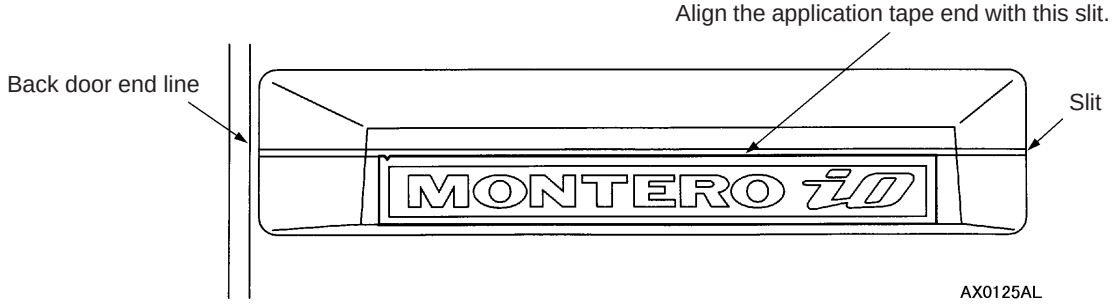
1. APPLICATION POSITION

(5) Vehicle name decal
<Vehices except for Spain>



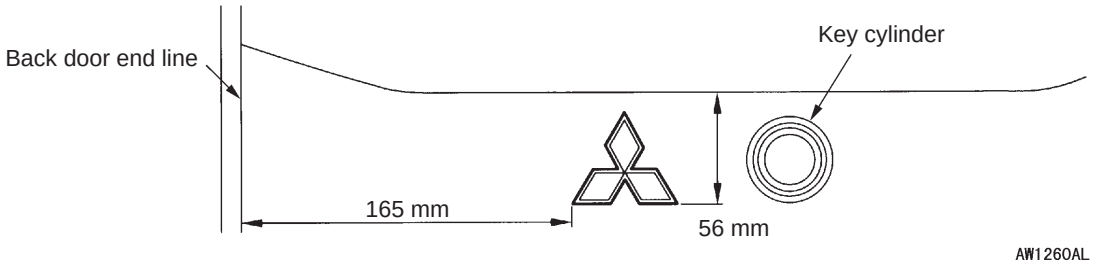
AX0124AL

<Vehicles for Spain>

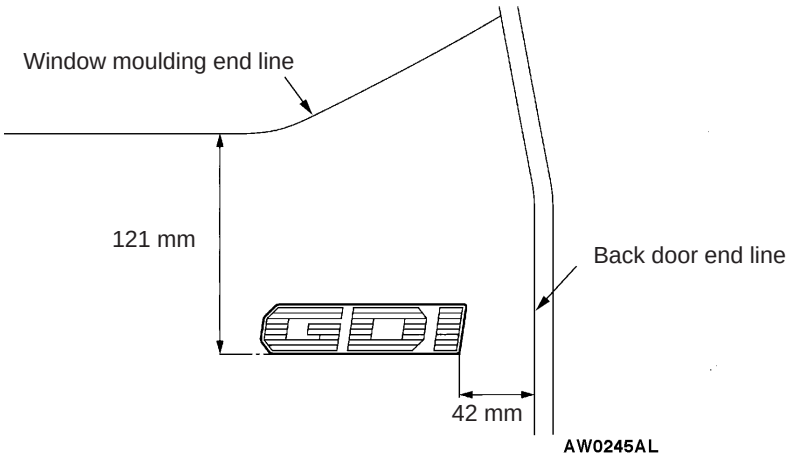


AX0125AL

(6) Three diamonds mark



(7) GDI mark



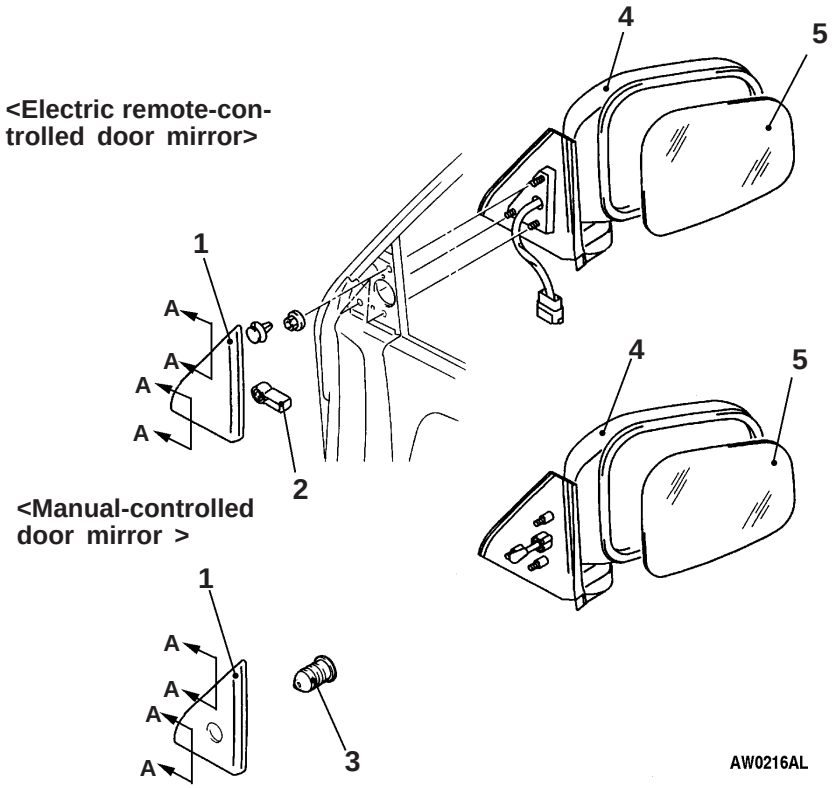
2. INSTALLATION PROCEDURE

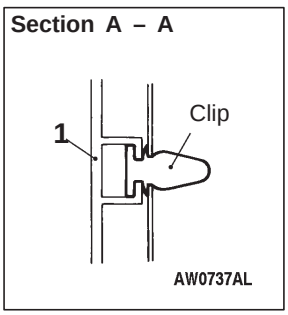
(1) Clean the mark installation surfaces on the body with unleaded petrol.
(2) Peel off the backing paper from the reverse side of the marks, and then attach the marks to the vehicle body so that they fit properly into position.

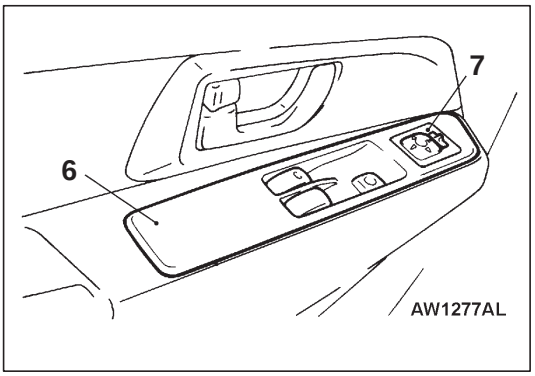
Caution
When attaching the marks, the surrounding temperature should be 20–38°C and the air should be completely free from dust.
If the surrounding temperature is lower than 20°C, the marks and the places on the body where the marks are to be attached should be heated to 20–38°C.
When the marks are attached, care should be used not to allow bubble to enter between tape and the body.

OUTSIDE DOOR MIRROR

REMOVAL AND INSTALLATION







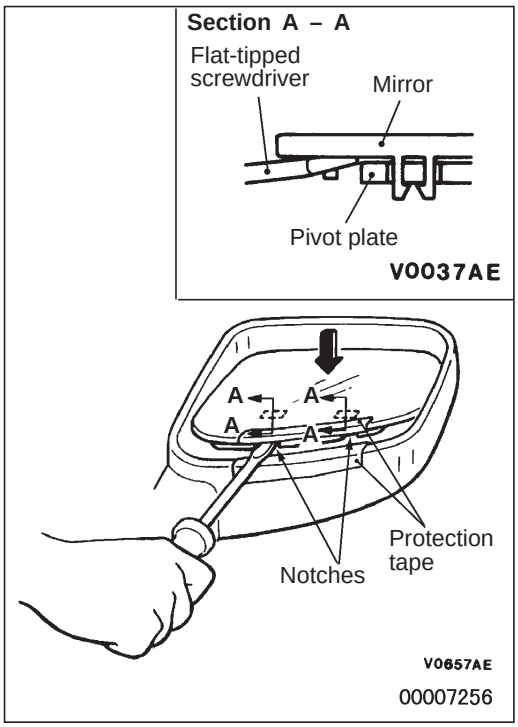
Door mirror removal steps

1. Delta inner cover
2. Clip
3. Boot
4. Mirror assembly

◀A▶ ▶A◀ 5. Mirror

Electric remote-controlled mirror switch removal steps

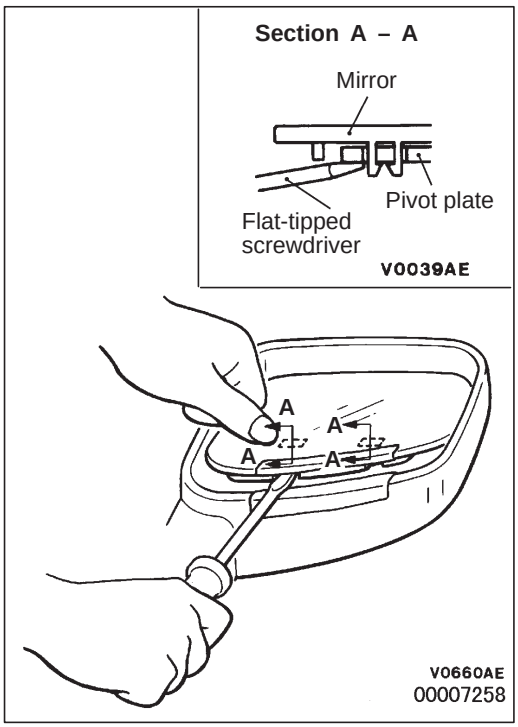
6. Power window and remote-controlled mirror switch assembly (Refer to GROUP 42 – Door trim and water proof film.)
7. Electric remote-controlled mirror switch



REMOVAL SERVICE POINT

◀A▶ MIRROR REMOVAL

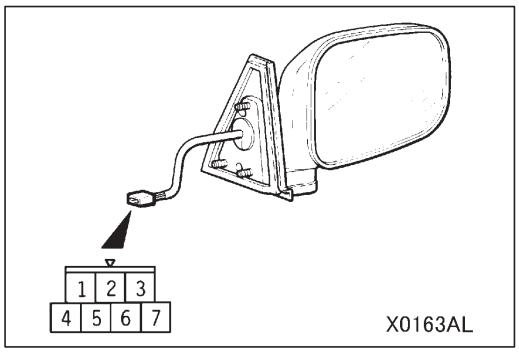
Using a hand, push the upper part of mirror to tilt it. Apply a protection tape as shown in the illustration. Insert a flat-tipped screwdriver between a notch behind the mirror and the pivot plate, and then pry off the lower part of mirror from the pivot plate.



INSTALLATION SERVICE POINT

▶A◀ MIRROR INSTALLATION

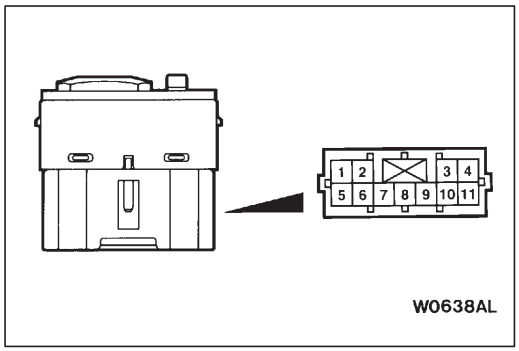
While holding the pivot plate with a flat-tipped screwdriver, push the mirror to engage the clips at its lower part with the pivot plate.



INSPECTION

ELECTRIC REMOTE-CONTROLLED MIRROR OPERATION CHECK

Battery connection terminal					Direction of operation
1	2	3	6	7	
⊕		⊖			UP
⊖		⊕			DOWN
⊕	⊖				LEFT
⊖	⊕				RIGHT
			○	○	Vehicles with heater mirror



ELECTRIC REMOTE-CONTROLLED MIRROR SWITCH CONTINUITY CHECK

Switch	Switch position	Terminal No.									
		Left mirror					Right mirror				
		1	6	9	10	11	1	2	3	6	9
Adjustment switch	UP	○	○				○			○	
				○		○			○		○
	DOWN		○	○			○		○		
		○				○				○	○
	RIGHT		○	○			○	○			
		○			○					○	○
	LEFT	○	○				○			○	
				○	○			○			○

NOTES

GROUP 51
EXTERIOR

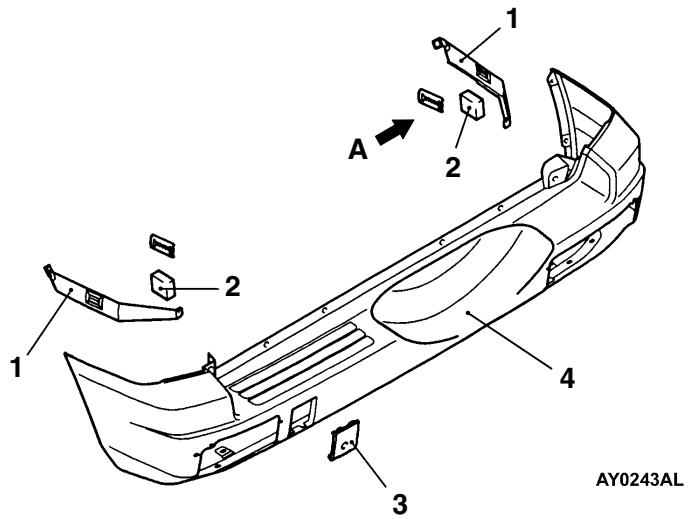
GENERAL

OUTLINE OF CHANGES

- Due to the introduction of 5-door models, the rear bumper service procedure has been added.
- Due to the introduction of 5-door models, the service procedures for the roof drip moulding and the side protector moulding have been added.
- Due to the change on the front deck garnish, the service procedure has been changed.
- The side protector moulding for 5-door models has a “Pininfarina” mark and “Pininfarina” logo mark. Due to this, the service procedure has been established.
- Due to the change on the GDI mark, the service procedure has been changed.

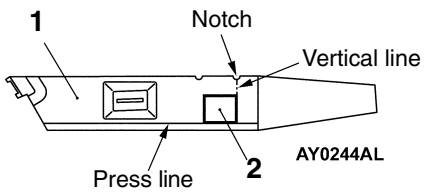
REAR BUMPER

DISASSEMBLY AND REASSEMBLY



AY0243AL

View A
Location of rear bumper pad)



AY0244AL

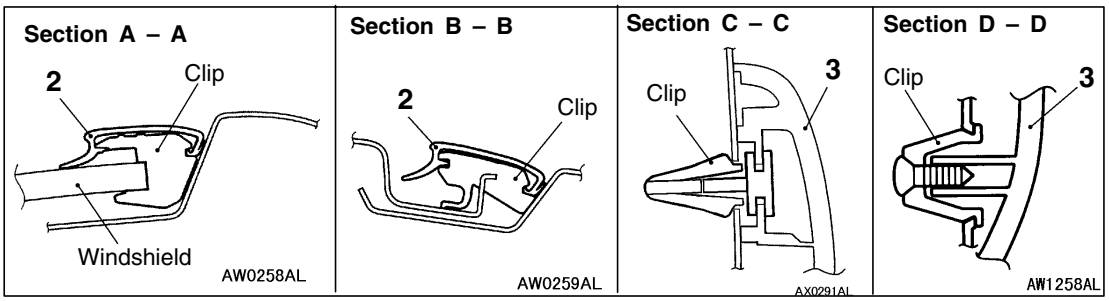
Disassembly steps

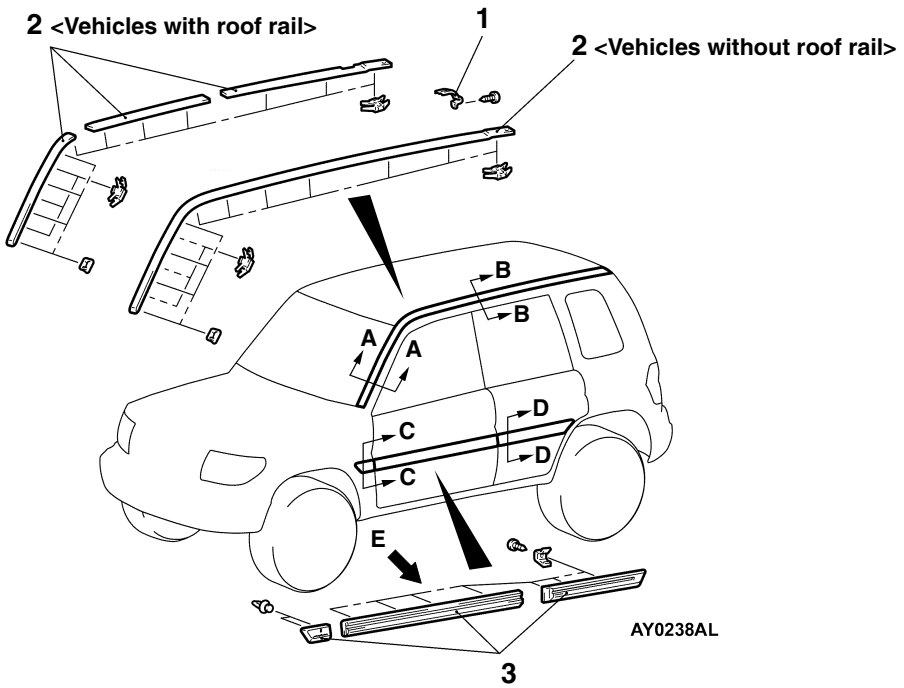
- Rear combination lamp assembly and rear combination lamp assembly bracket <R.H. drive vehicles>
- Rear fog assembly and rear fog assembly bracket <L.H. drive vehicles>

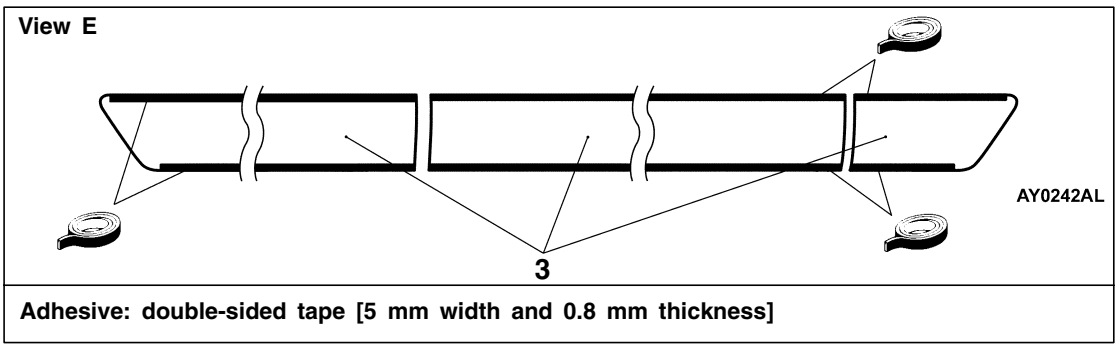
1. Rear bumper face side bracket
2. Rear bumper pad
3. Rear bumper cover
4. Rear bumper face

MOULDING

REMOVAL AND INSTALLATION







Adhesive: double-sided tape [5 mm width and 0.8 mm thickness]

Roof drip moulding removal steps

- Roof rail assembly

1. Roof drip cover

◀A▶ 2. Roof drip moulding

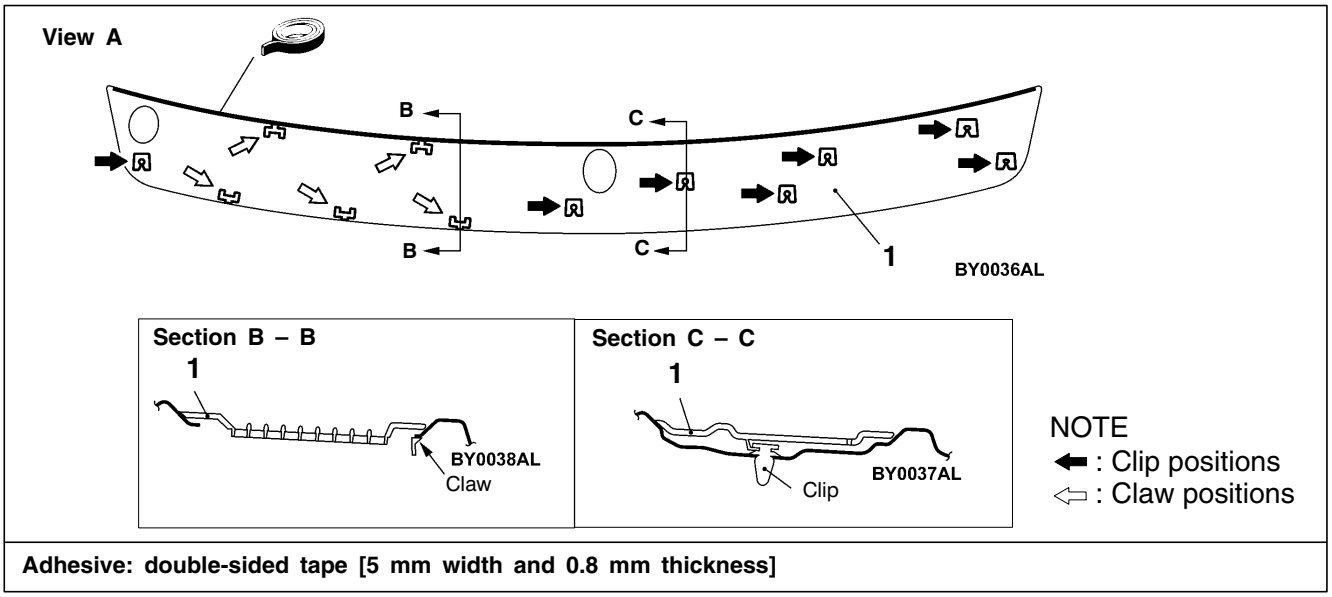
Side protector moulding removal

◀B▶ ▶A◀ 3. Side protector moulding

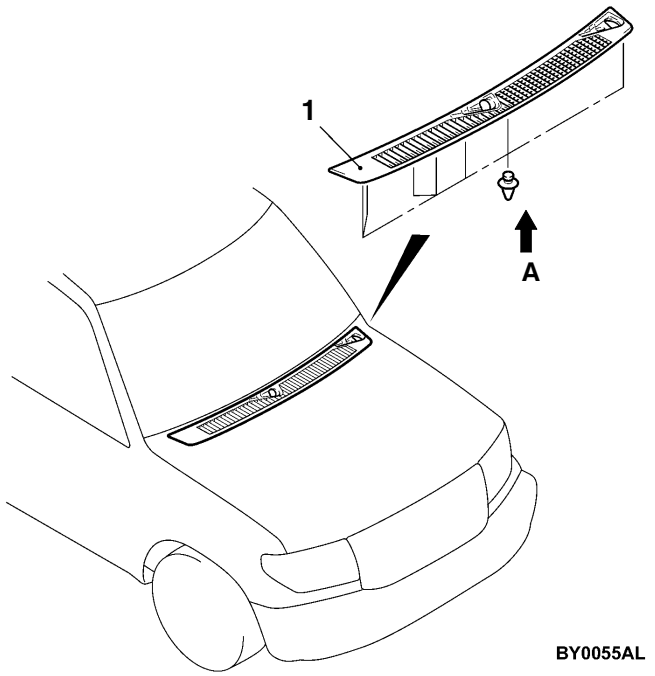
NOTE
For the removal and installation service points of the roof drip moulding and the side protector moulding, refer to the Basic Manual.

GARNISH

REMOVAL AND INSTALLATION



Adhesive: double-sided tape [5 mm width and 0.8 mm thickness]



Front deck garnish removal steps

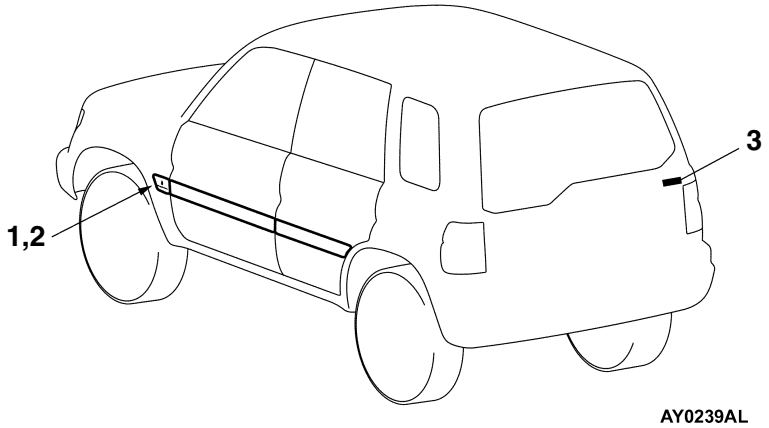
- Wiper arm and blade assembly

◀A▶ ▶A◀ 1. Front deck garnish

NOTE
For the removal and installation service points of the side protector moulding, refer to the Basic Manual.

MARKS

REMOVAL AND INSTALLATION

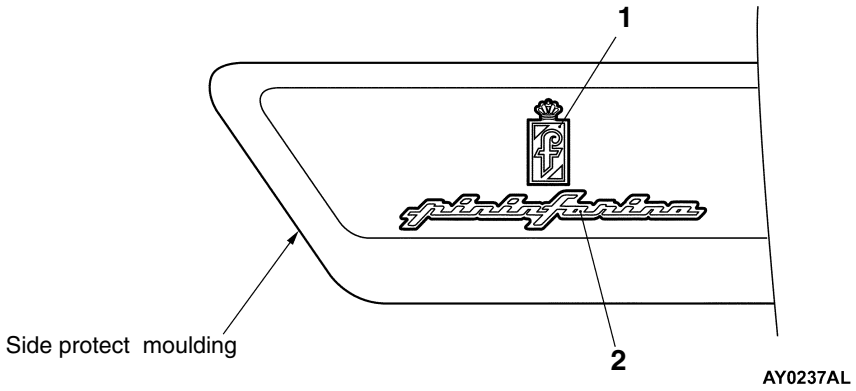


▶A◀ 1. Pininfarina mark
▶A◀ 2. Pininfarina logo mark
▶A◀ 3. GDI mark

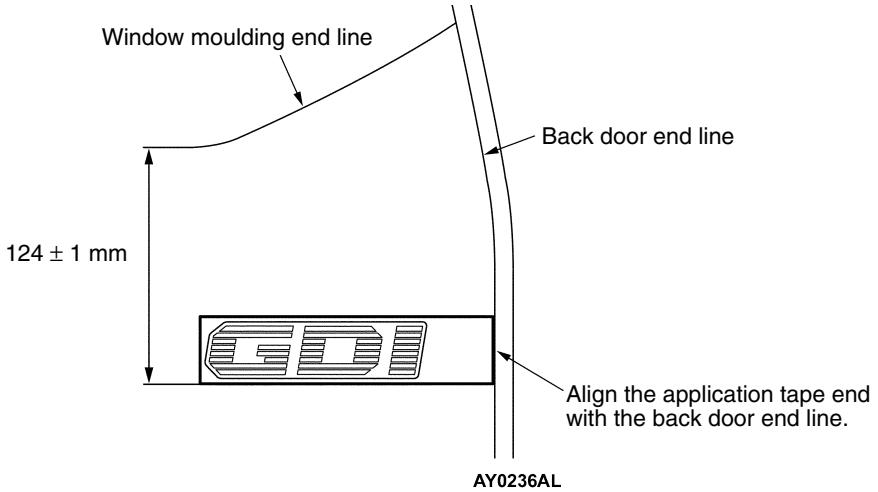
INSTALLATION SERVICE POINT

▶A◀ MARK INSTALLATION

(1) PININFARINA MARK,(2) PININFARINA LOGO MARK



(3) GDI MARK



1. Clean the mark installation surfaces on the body with unleaded petrol.
2. Peel off the backing paper from the reverse side of the marks, and then attach the marks to the vehicle body so that they fit properly into position.

Caution
When attaching the marks, the surrounding temperature should be 20 – 38°C and the air should be completely free from dust.
If the surrounding temperature is lower than 20°C, the marks and the places on the body where the marks are to be attached should be heated to 20 – 38°C.

NOTES

GROUP 51
EXTERIOR

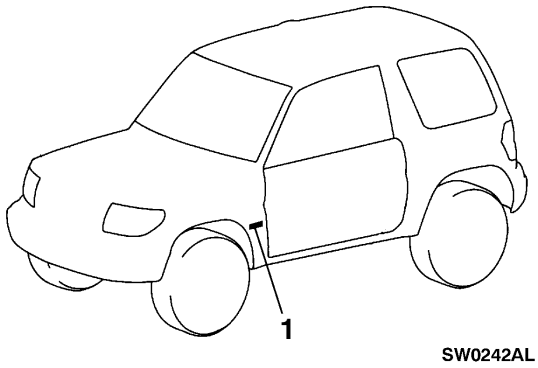
GENERAL

OUTLINE OF CHANGES

The following service procedures have been changed due to the addition of marks.

MARKS

REMOVAL AND INSTALLATION



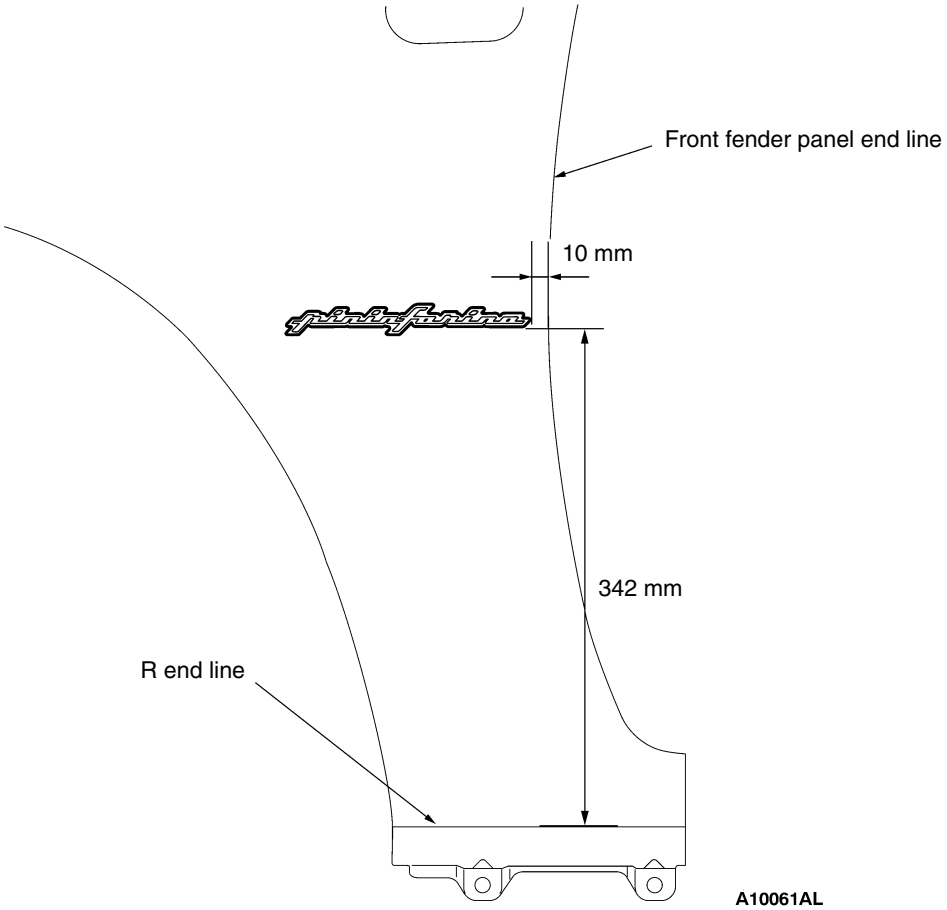
▶A◀ 1. Pininfarina logo mark <Vehicles for MPI>

INSTALLATION SERVICE POINT

▶A◀ INSTALLATION OF MARK

1. APPLICATION POSITION

(1) Pininfarina mark



2. INSTALLATION PROCEDURE

(1) Clean the mark installation surfaces on the body with unleaded petrol.

(2) Peel off the backing paper from the reverse side of the marks, and then attach the marks to the vehicle body so that they fit properly into position.

Caution
When attaching the marks, the surrounding temperature should be 20 – 38°C and the air should be completely free from dust.
If the surrounding temperature is lower than 20°C, the marks and the places on the body where the marks are to be attached should be heated to 20 – 38°C. When the marks are attached, care should be used not to allow bubble to enter between tape and the body.

INTERIOR

INTERIOR

CONTENTS

SPECIAL TOOL 3

INSTRUMENT PANEL* 3

FLOOR CONSOLE 7

TRIMS 9

INSIDE REAR VIEW MIRROR 11

HEADLINING 11

SEAT 12

Front Seat* 12

Rear Seat 15

SEAT BELT 17

Front Seat Belt 17

Rear Seat Belt 18

WARNINGS REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLES

WARNING!

(1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver and passenger (from rendering the SRS inoperative).

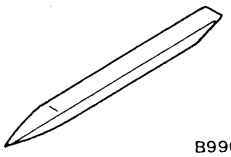
(2) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.

(3) MITSUBISHI dealer personnel must thoroughly review this manual, and especially its GROUP 52B – Supplemental Restraint System (SRS) before beginning any service or maintenance of any component of the SRS or any SRS-related component.

NOTE

The SRS includes the following components: SRS-ECU, SRS warning lamp, air bag module, clock spring, side impact sensors and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents by an asterisk (*).

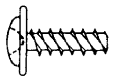
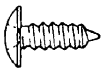
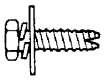
SPECIAL TOOL

Tool	Number	Name	Use
 B990784	MB990784	Ornament remover	Removal of switch, trim, etc.

INSTRUMENT PANEL

REMOVAL AND INSTALLATION

For installation of the instrument panel, the bolts and screws described below are used. They are indicated by symbols in the illustration.

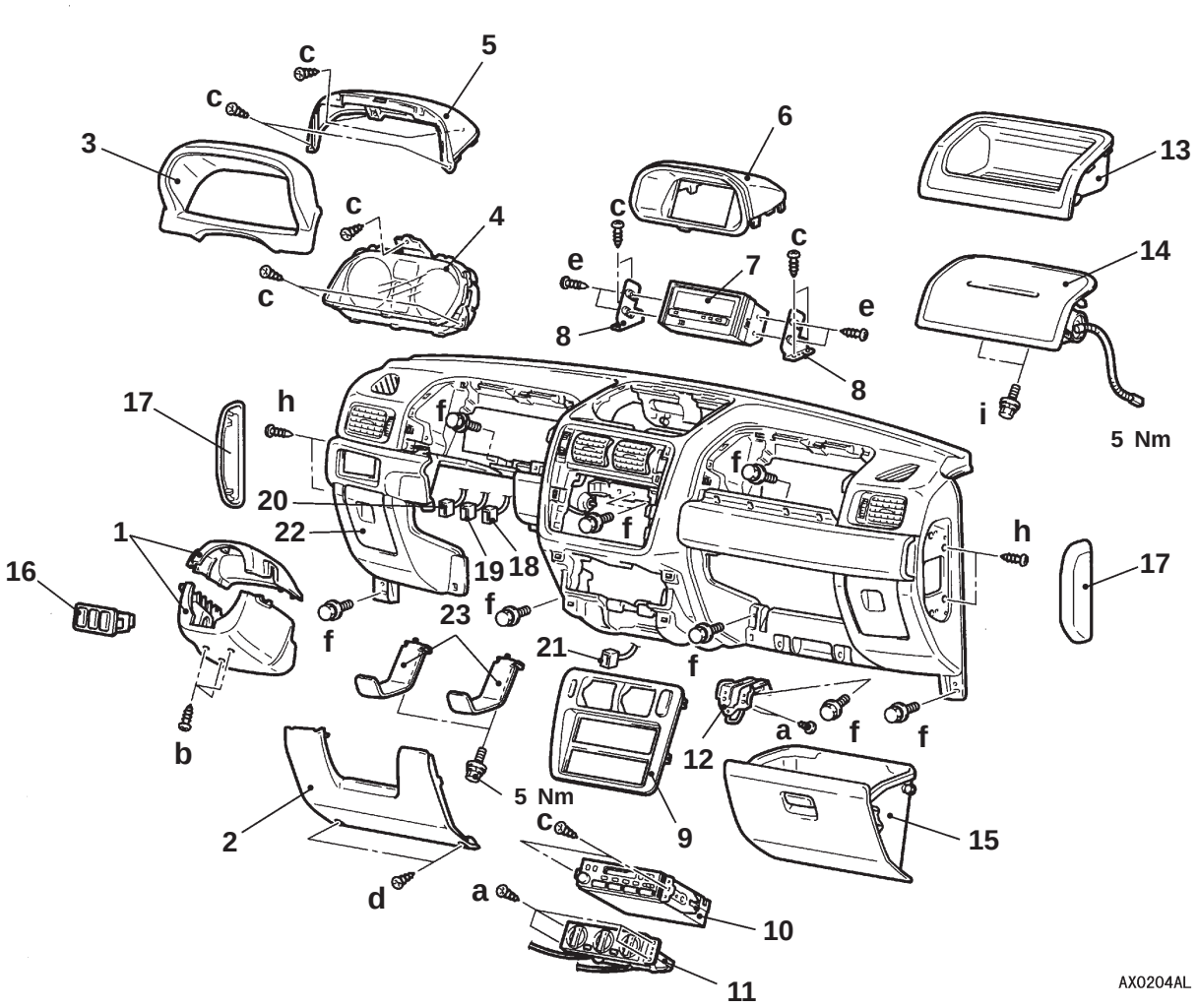
Name	Symbol	Size mm (D × L)	Colour	Shape
Tapping screw	a	5 × 12	–	 19Z0022
	b	5 × 20	–	
	c	5 × 16	–	 19Z0004
	d	5 × 16	Black	
Washer-assembled screw	e	5 × 10	–	 19Z0007
Washer-assembled bolt	f	6 × 16	–	 19Z0005
	g	8 × 20	–	
	h	5 × 12	–	 19Z0010
	i	6 × 16	–	

D = Thread diameter
L = Effective thread length

Caution: SRS

1. **For the passenger side air bag module removal/installation, always observe the service procedures of GROUP 52B – Air Bag Module.**
2. **Do not subject the SRS-ECU to any shocks when removing or installing the instrument panel.**

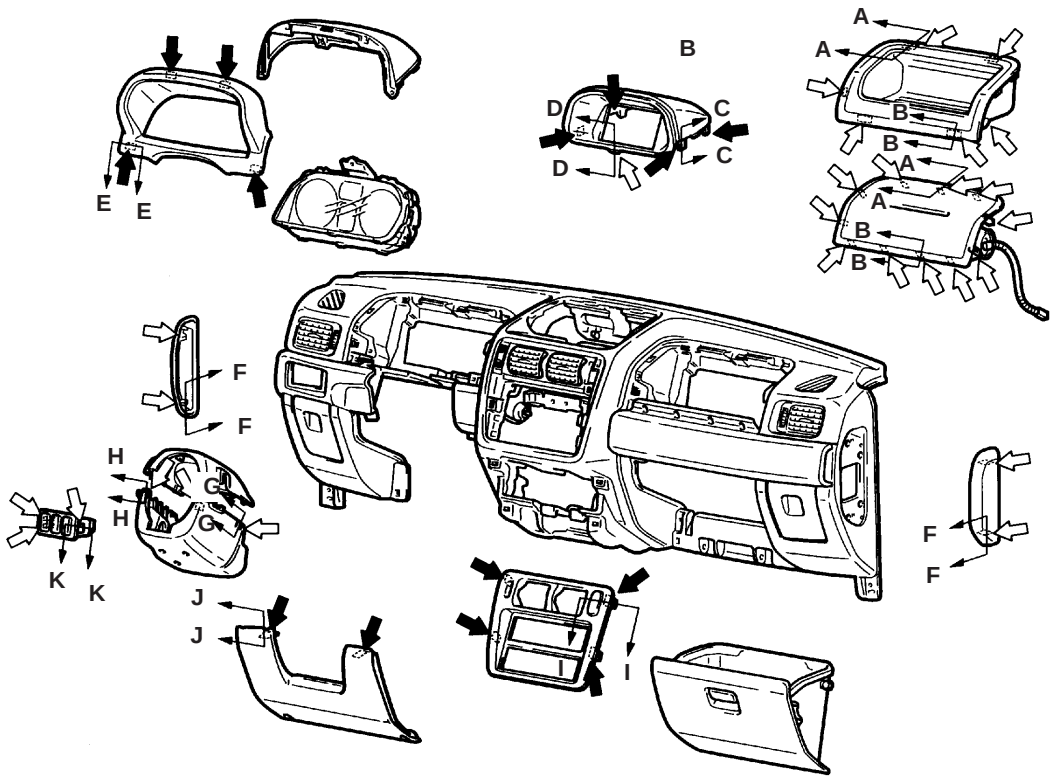
Pre-removal and Post-installation Operation
Steering Column Mounting Bolt Removal and Installation



Removal steps

1. Column cover
2. Under cover
3. Meter hood B
4. Combination meter
5. Meter hood A
6. Multi-center display hood
7. Multi-center display
8. Multi-display bracket
9. Center panel
10. Radio and tape player
11. Heater control assembly or automatic A/C control panel assembly
12. Glove box striker
13. Instrument tray <Vehicles without front air bag module>
14. Passenger's side air bag module <Vehicles with front air bag module>
15. Glove box
16. Switch panel assembly <Vehicles with fog lamp>
17. Instrument panel side cover
    - Scuff plate (Refer to P.52A-9.)
    - Cowl side trim (Refer to P.52A-9.)
    - Floor console (Refer to P.52A-7.)
    - Front pillar trim (Refer to P.52A-9.)
18. Rheostat connector
19. Leveling switch connector
20. Fog lamp switch connector <Vehicles with fog lamp>
21. Hazard lamp switch connector
22. Instrument panel assembly
23. Knee protector bracket

CLIP AND CLAW POSITIONS



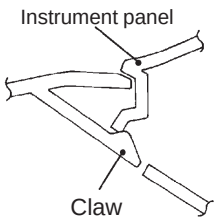
AX0205AL

NOTE

⬅ : Clip positions

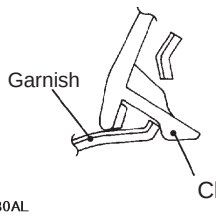
⇦ : Claw positions

Section A – A



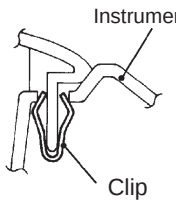
W0980AL

Section B – B



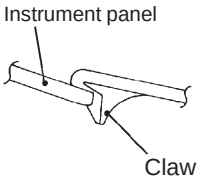
W0981AL

Section C – C



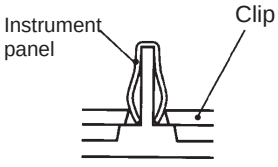
W0982AL

Section D – D



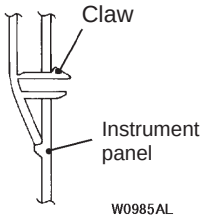
W0983AL

Section E – E



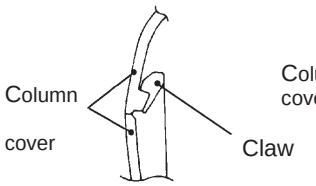
W0984AL

Section F – F



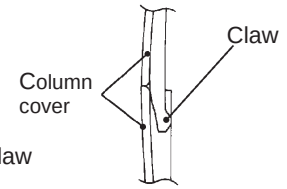
W0985AL

Section G – G



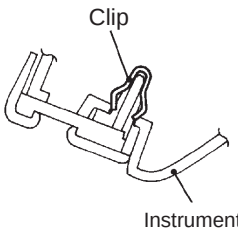
W0986AL

Section H – H



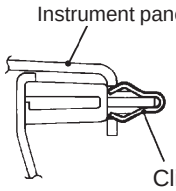
W0987AL

Section I – I



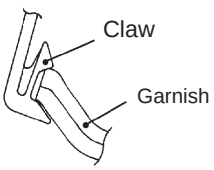
W0988AL

Section J – J



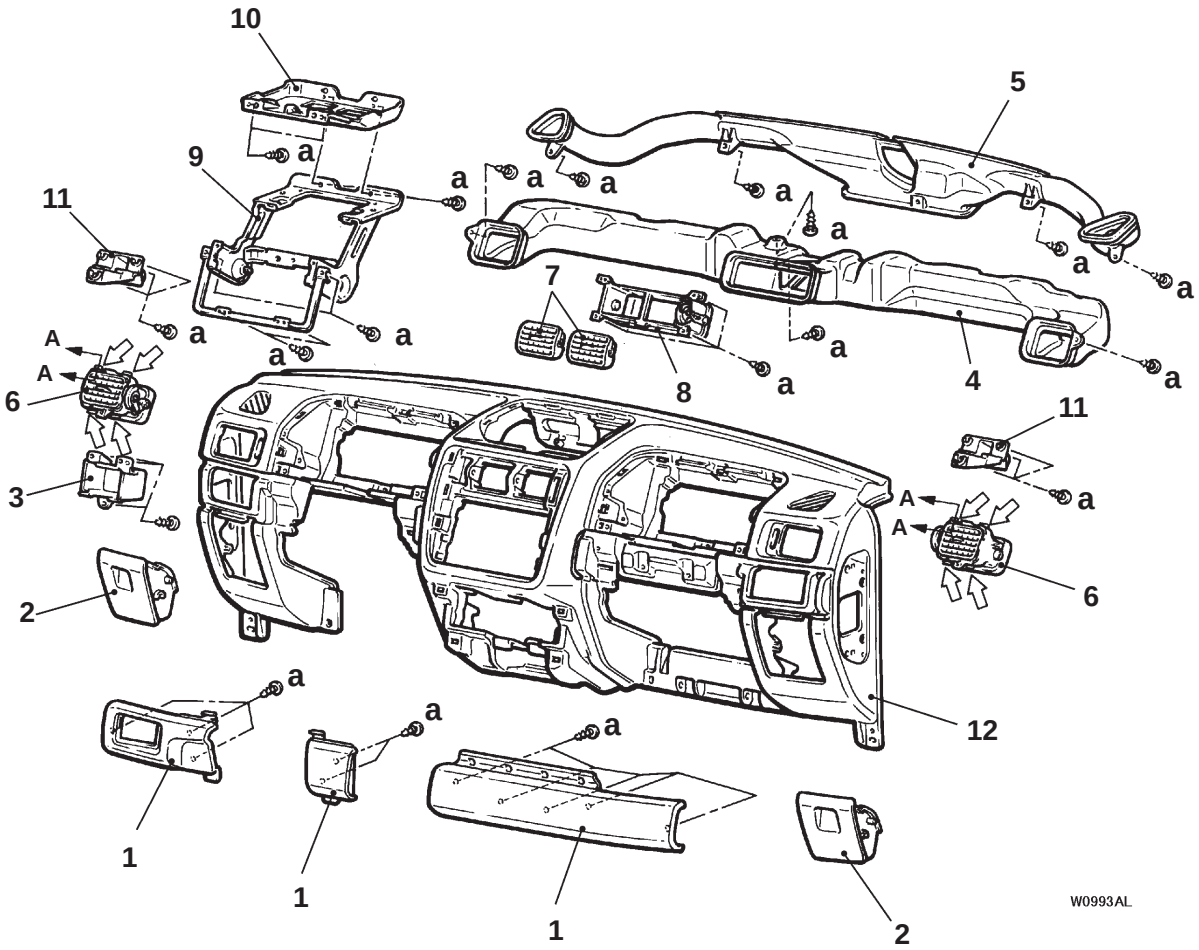
W0989AL

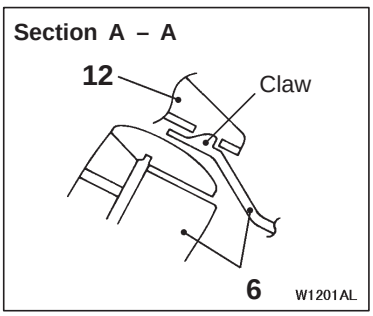
Section K – K



W0990AL

DISASSEMBLY AND REASSEMBLY





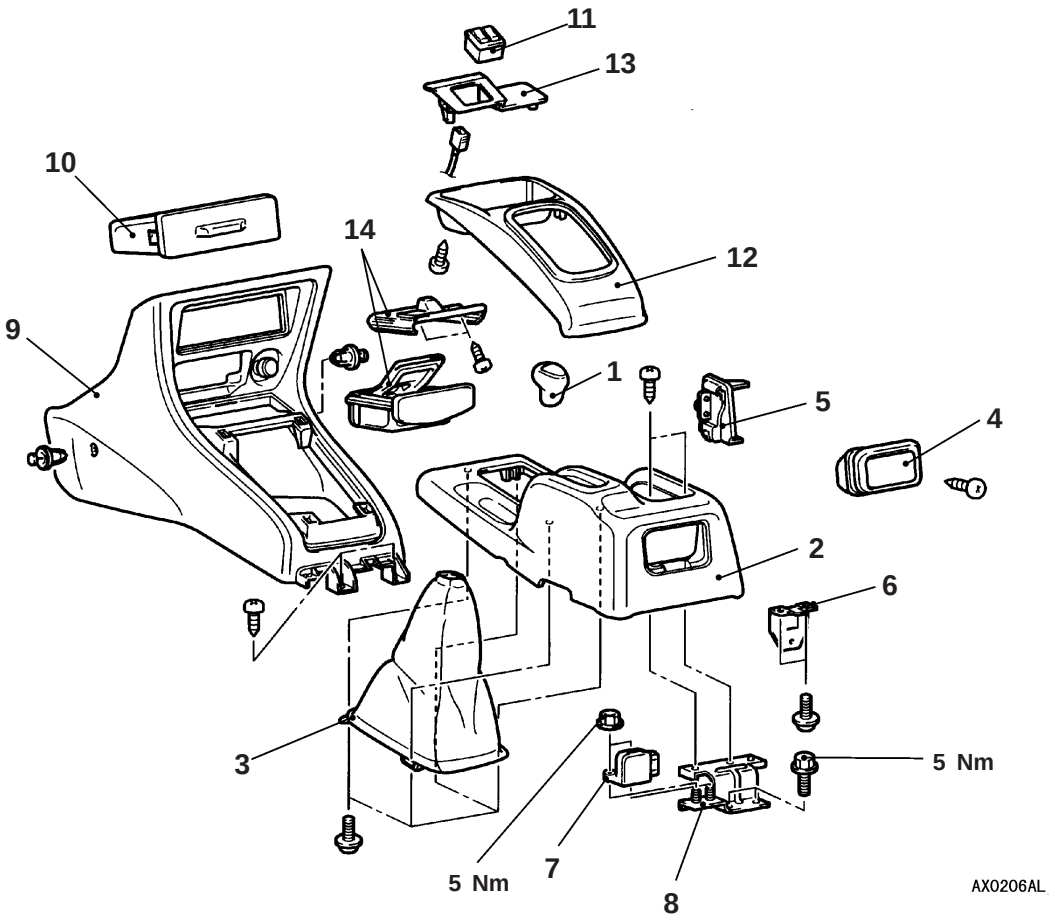
NOTE
⇦ : Claw positions

Disassembly steps

1. Garnish
2. Parcel box
3. Connector holder
4. Distribution duct
5. Defroster duct
6. Side air outlet assembly
7. Center air outlet
8. Center air outlet case
9. Instrument panel reinforcement
10. Center support panel
11. Instrument panel side support bracket
12. Instrument panel

FLOOR CONSOLE

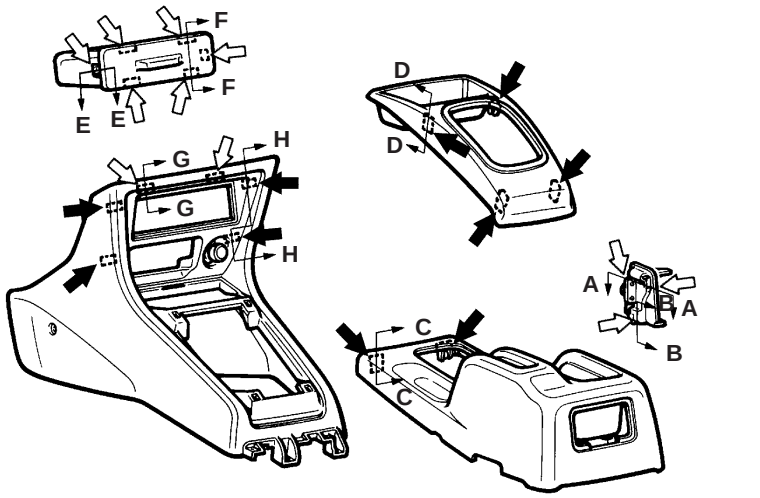
REMOVAL AND INSTALLATION



Removal steps

1. Selector nob <M/T>
2. Rear floor console
3. Transfer lever cover <M/T>
4. Rear ashtray assembly
5. Holder
6. Ashtray bracket
7. G sensor <Vehicles with ABS>
8. Floor console bracket <Vehicles with ABS>
9. Front floor console
10. Box with lid
11. Heated seat switch <Vehicles with heated seat>
12. A/T panel or M/T panel
13. Switch panel <Vehicles with heated seat>
14. Front ashtray assembly

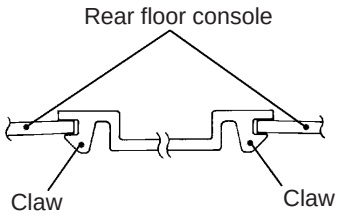
CLIP AND CLAW POSITIONS



W0250AL

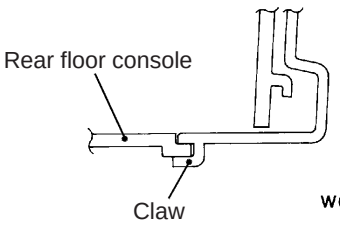
NOTE
⬅ : Clip positions
⇦ : Claw positions

Section A – A



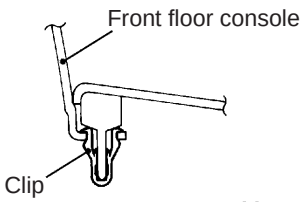
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Section B – B



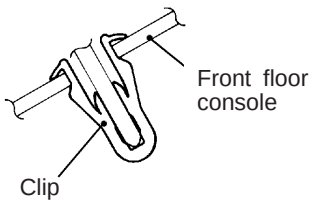
W0256AL

Section C – C



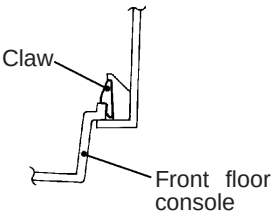
W0255AL

Section D – D



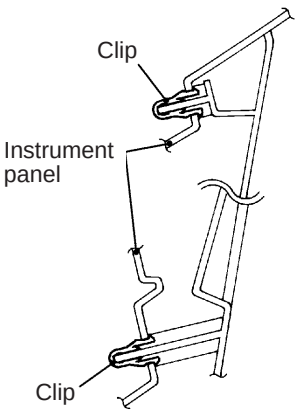
W0254AL

Section E – E



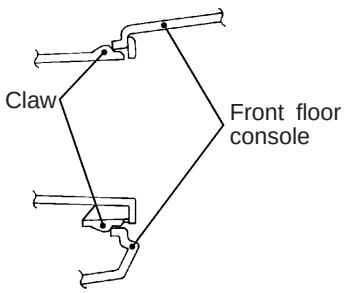
W0252AL

Section H – H



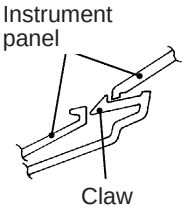
W0257AL

Section F – F



W0253AL

Section G – G

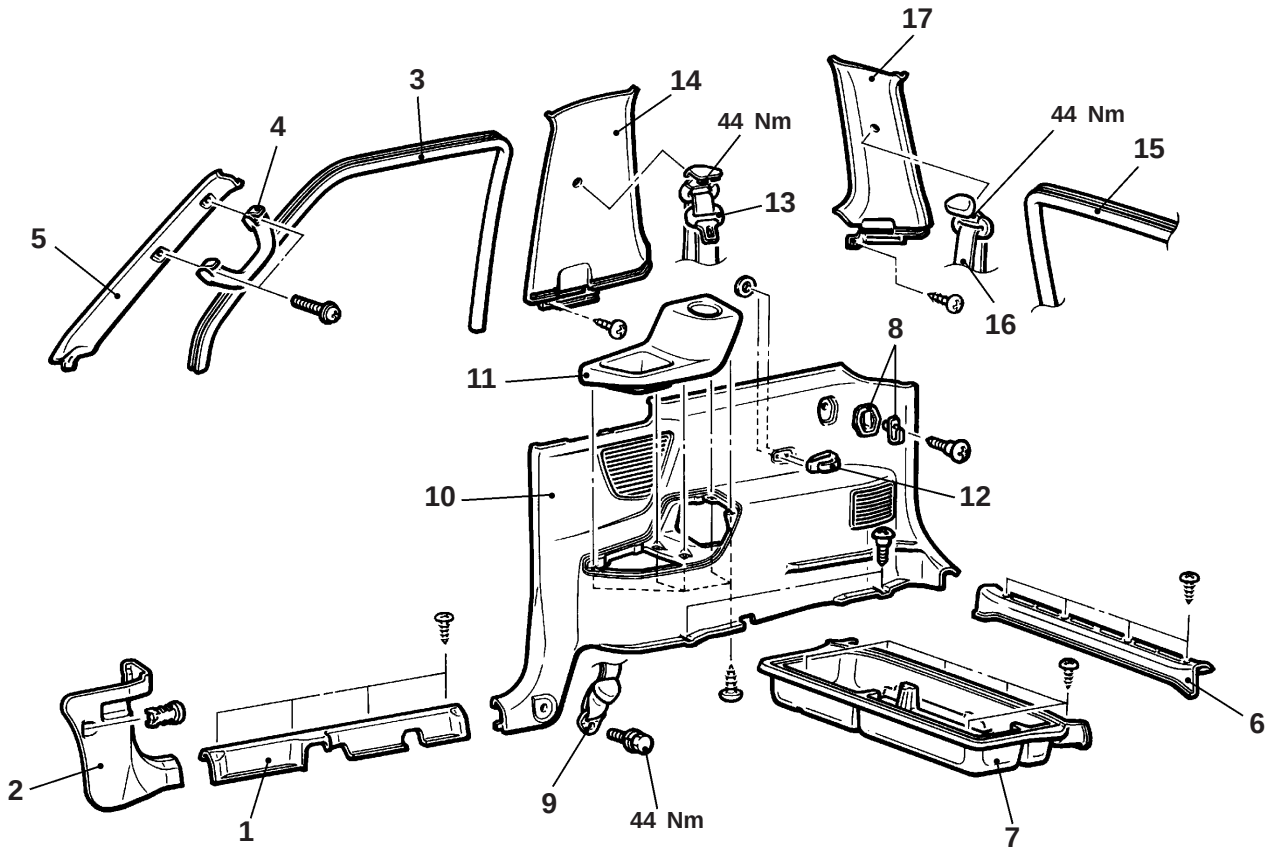


W0262AL

00008903

TRIMS

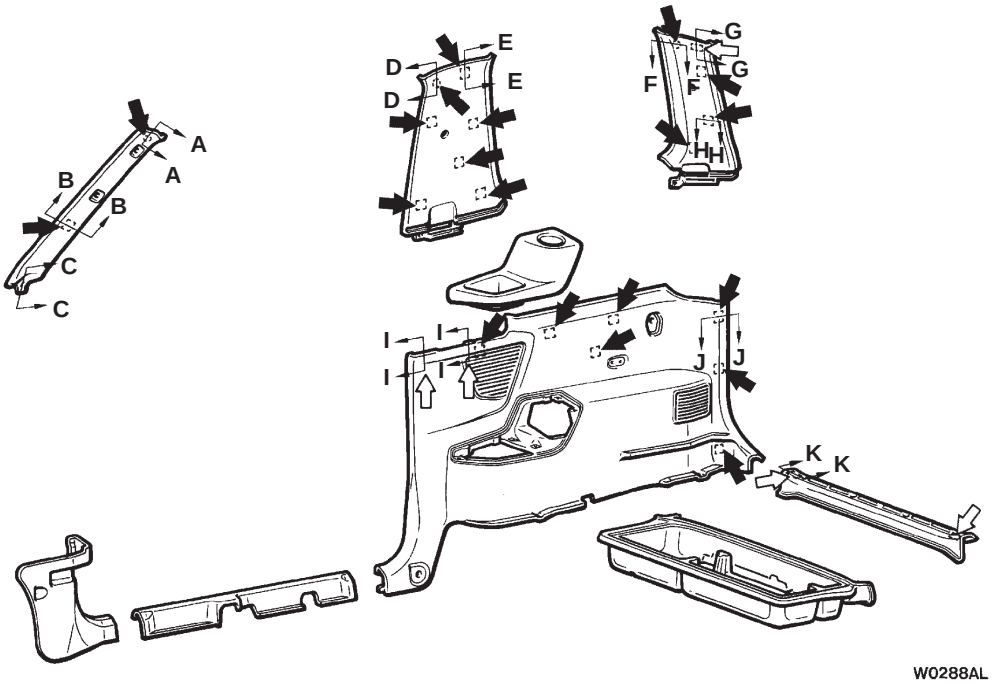
REMOVAL AND INSTALLATION



1. Scuff plate
2. Cowl side trim
3. Front door opening trim
4. Assist grip
5. Front pillar trim
6. Rear step plate
   <Vehicles without luggage floor box>
- Rear seat
  (Refer to P.52A-15.)

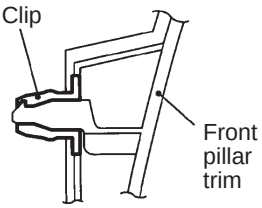
7. Luggage floor box <Option>
8. Luggage room hook
9. Front seat belt connection
10. Quarter trim
11. Quarter box
12. Hook
13. Front seat belt connection
14. Center pillar trim
15. Rear door opening trim
16. Rear seat belt connection
17. Rear pillar trim

CLIP AND CLAW POSITIONS

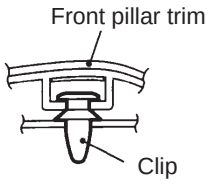


NOTE
⬅ : Clip positions
⇦ : Claw positions
For door trim, refer to GROUP 42.

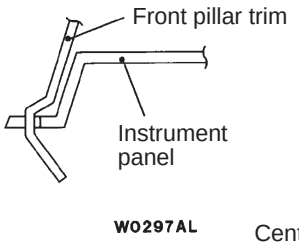
Section A – A



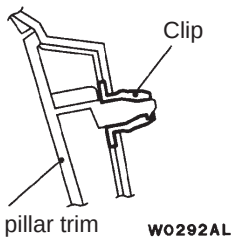
Section B – B



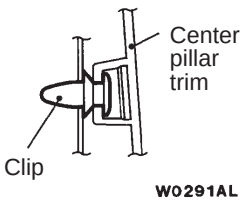
Section C – C



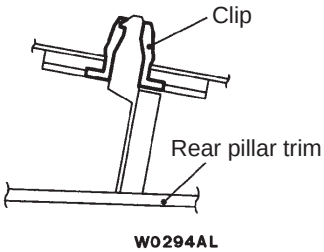
Section D – D



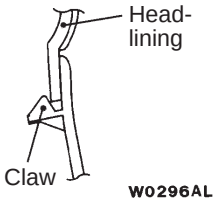
Section E – E



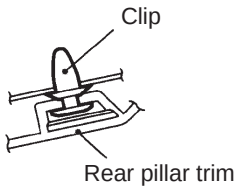
Section F – F



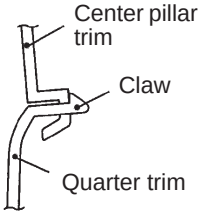
Section G – G



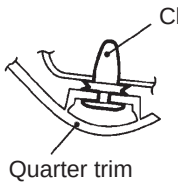
Section H – H



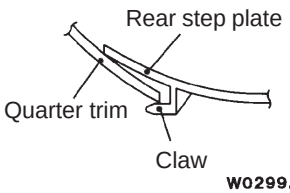
Section I – I



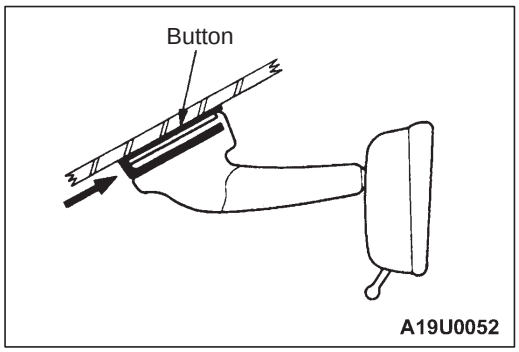
Section J – J



Section K – K



00008904



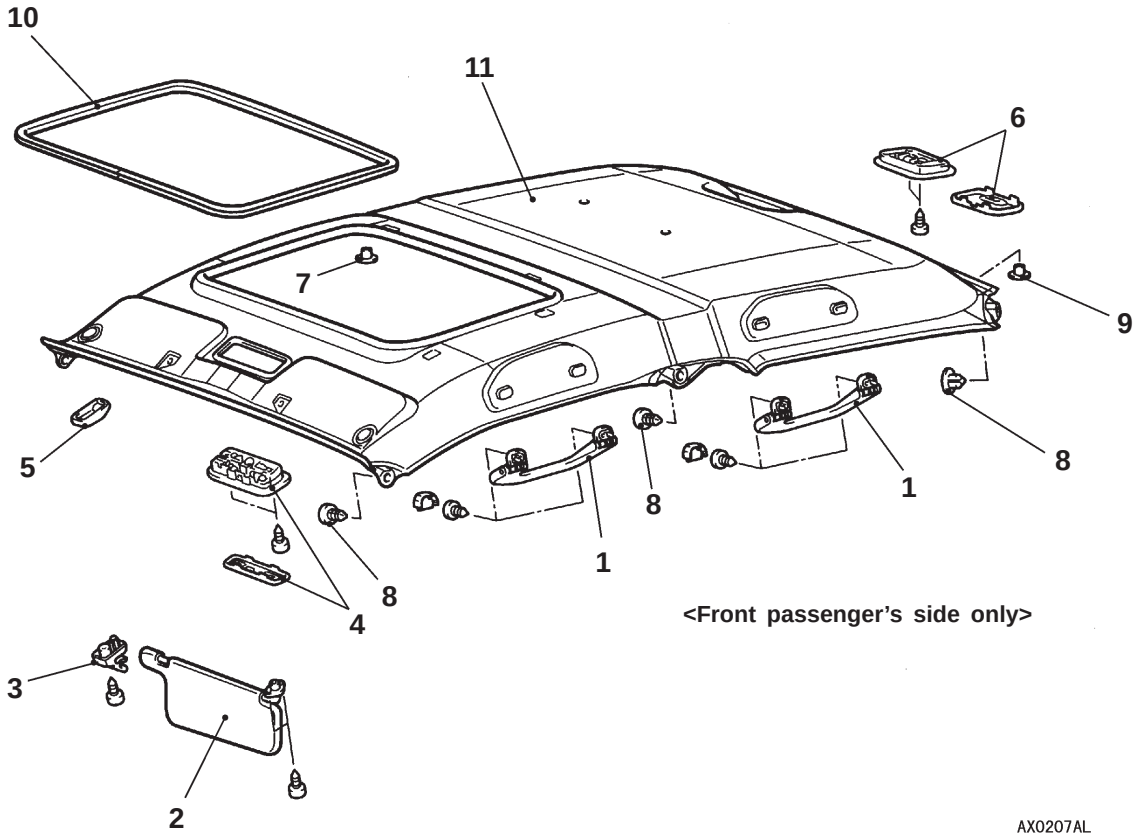
INSIDE REAR VIEW MIRROR

REMOVAL SERVICE POINT

Remove by pushing in the direction of the arrow in the illustration.

HEADLINING

REMOVAL AND INSTALLATION



Removal steps

1. Assist grip
2. Sun visor assembly
3. Sun visor holder
4. Front room lamp assembly
5. Sunroof switch cover <Vehicles with sunroof>
6. Rear room lamp assembly
- Front pillar trim (Refer to P.52A-9.)
- Center pillar trim (Refer to P.52A-9.)
- Rear pillar trim (Refer to P.52A-9.)

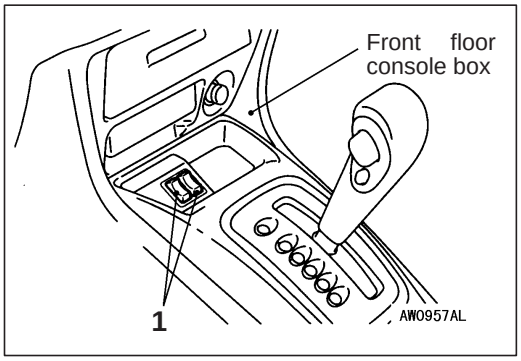
7. Trim clip <Vehicles without sunroof>
8. Clip
9. Trim clip
10. Sunroof drip moulding <Vehicles with sunroof>
11. Headlining

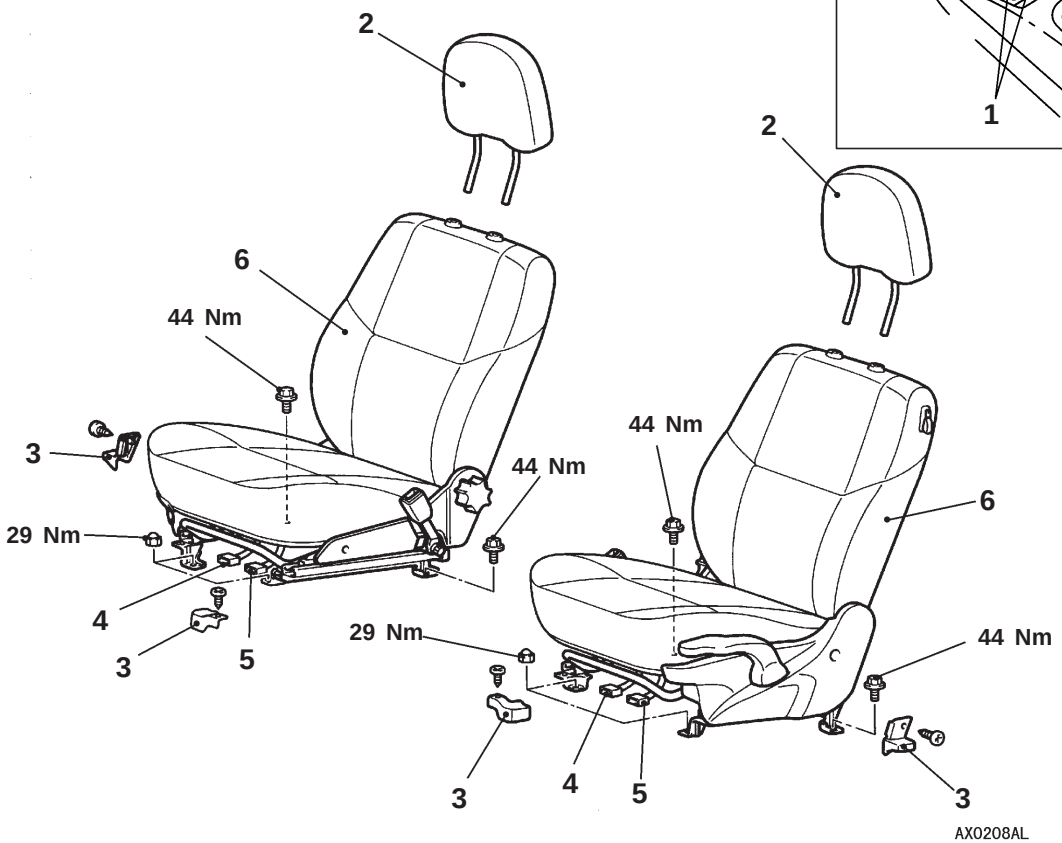
SEAT

FRONT SEAT

REMOVAL AND INSTALLATION

Caution: SRS
Before removal of the seat equipped with the side air bag module, refer to GROUP 52B – SRS Service Precautions and Air Bag Module.



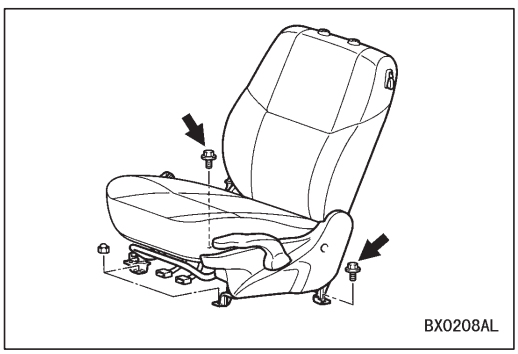


1. Heated seat switch <Vehicles with heated seat>
2. Headrestraint

Front seat assembly removal steps

3. Front seat anchor cover
4. Heated seat harness connector <Vehicles with heated seat>
5. Side air bag module harness connector <Vehicles with SRS side air bag>

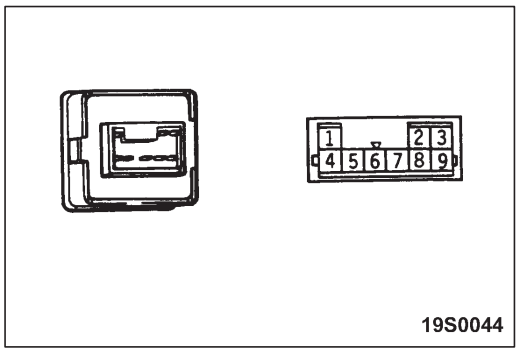
▶A◀ 6. Front seat assembly



INSTALLATION SERVICE POINT

▶A◀ FRONT SEAT ASSEMBLY INSTALLATION

Temporarily tighten the mounting nuts and bolts, and then tighten them to the specified torque. Note that the bolts shown in the illustration should be tightened with no load on the seat cushion.

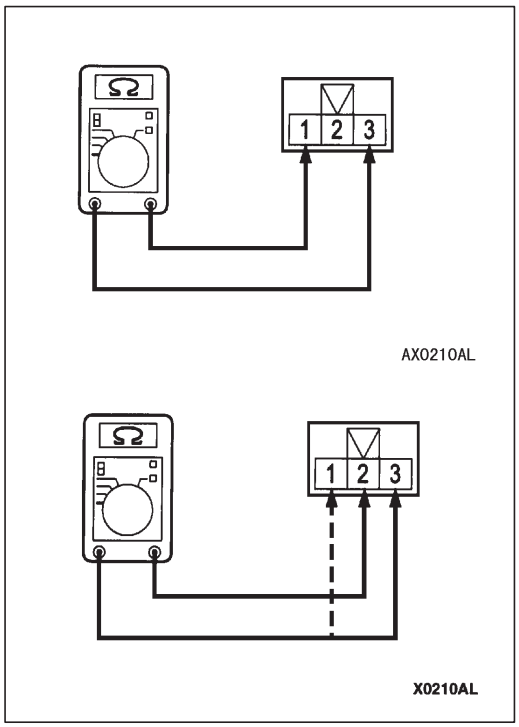


INSPECTION

HEATED SEAT SWITCH CONTINUITY CHECK

Switch position		Terminal No.									
		1	3	4	5	–	8	9	2	–	6
Driver's seat switch	HI	○	○		○	⊖ ▶ ⊕	○				
	LO		○		○	⊖ ▶ ⊕			○ ⌇ ○		
Passen-ger's seat switch	HI			○	○	⊖ ▶ ⊕	○	○			
	LO				○	⊖ ▶ ⊕		○			

NOTE
To inspect the diode, match the polarity of the circuit tester with the (+) (–) polarities in the table.



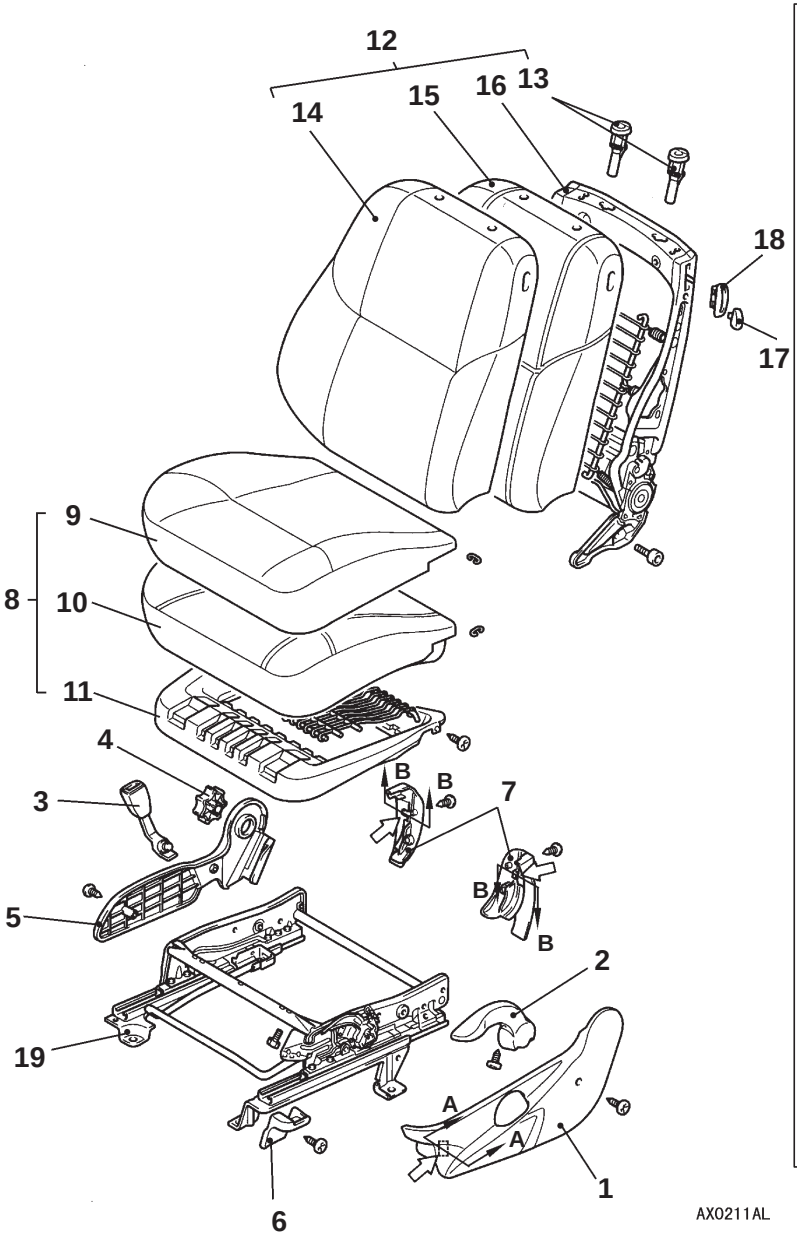
HEATER CHECK

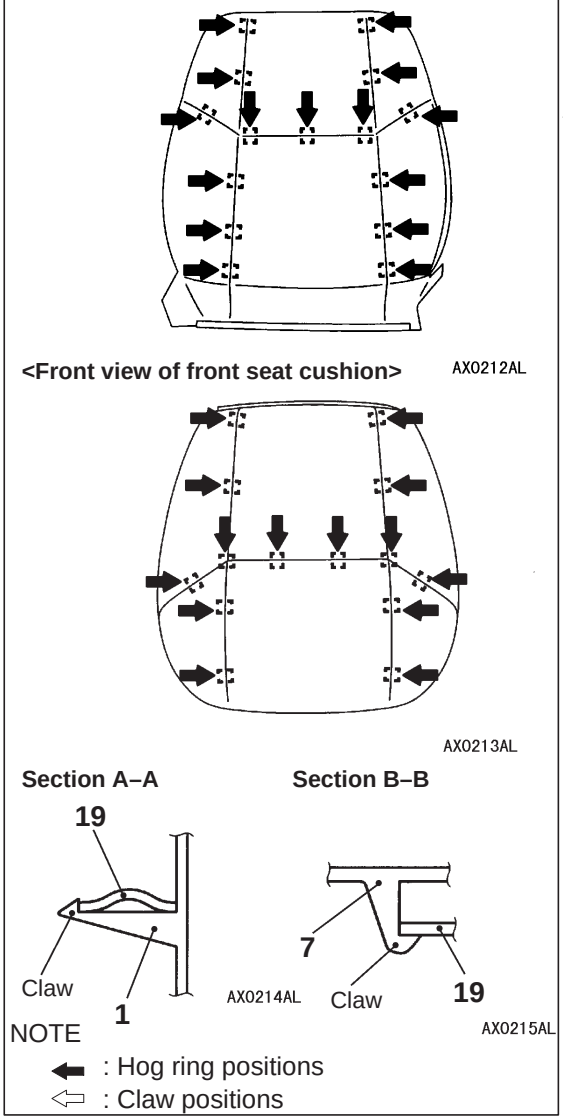
Measure the resistance between terminals.

Standard value:

Between terminals 1 and 3: Approx. 5.4 Ω
Between terminals 1 and 2: Approx. 4.2 Ω
Between terminals 2 and 3: Approx. 9.6 Ω

DISASSEMBLY AND REASSEMBLY



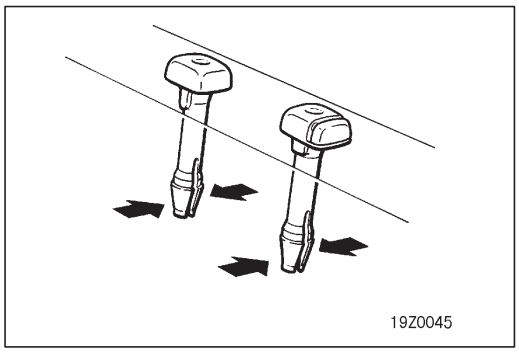


Disassembly steps

1. Front seat side shield cover
2. Height adjuster lever
3. Inner seat belt
4. Reclining adjuster lever
5. Front seat hinge cover
6. Front cover
7. Recliner cover
8. Front seat cushion assembly
9. Front seat cushion cover

◀A▶

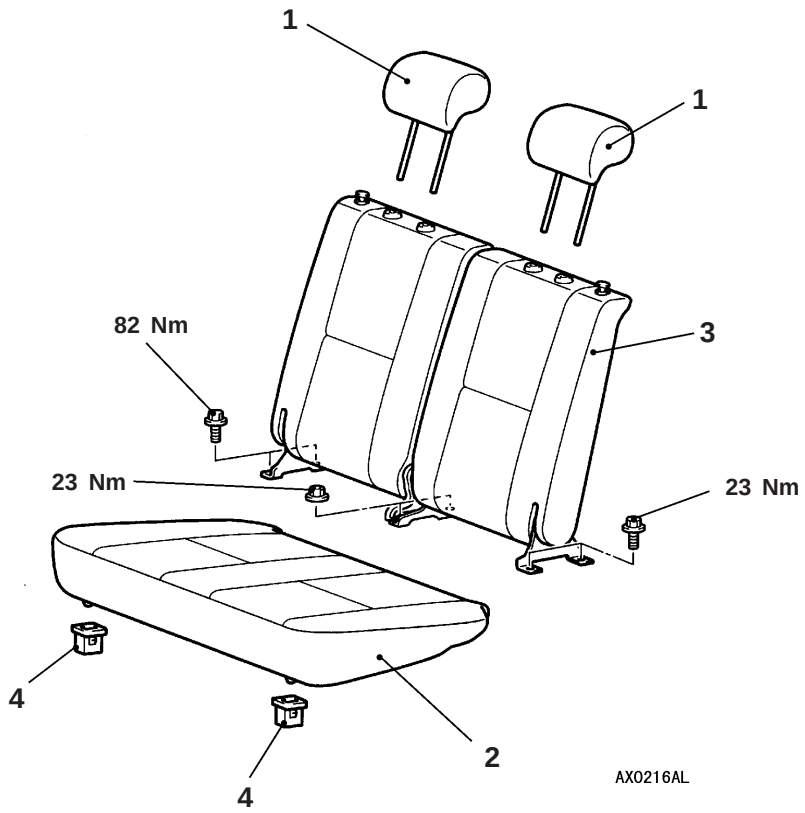
10. Front seat cushion pad
11. Front seat cushion frame
12. Front seat back assembly
13. Headrestraint guide
14. Front seat back cover
15. Front seat back pad
16. Front seat back frame
17. Release lever knob
18. Release lever trim
19. Seat slide adjuster



REMOVAL SERVICE POINT

◀A▶ HEADRESTRAINT GUIDE REMOVAL

REAR SEAT
REMOVAL AND INSTALLATION

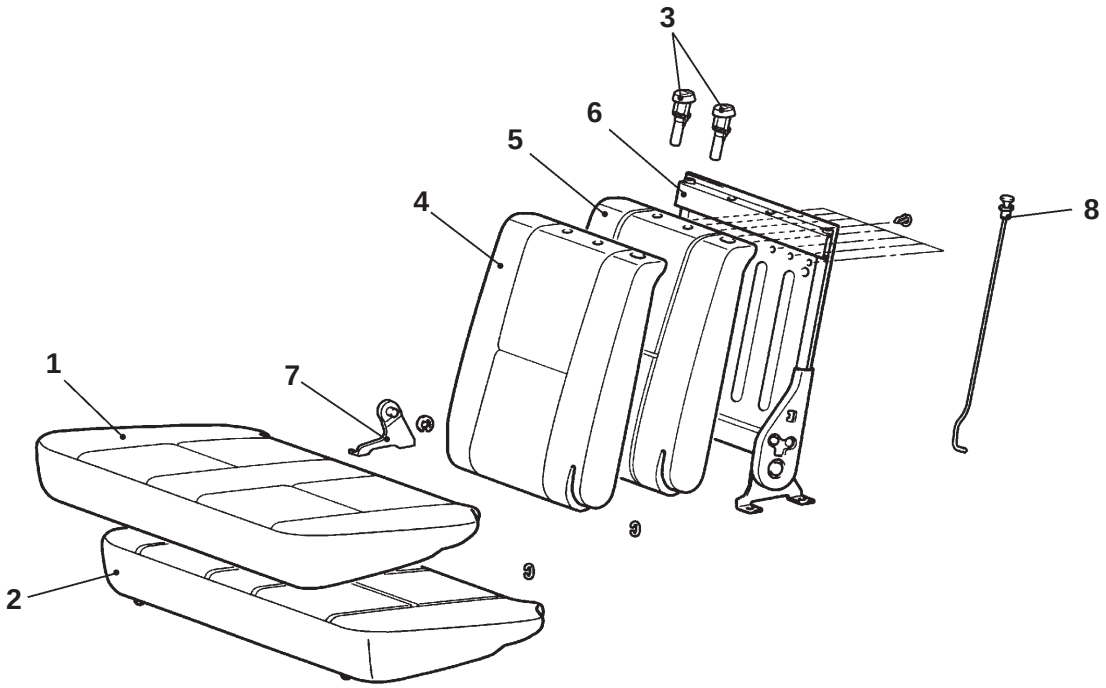


1. Headrestraint

Rear seat assembly removal steps

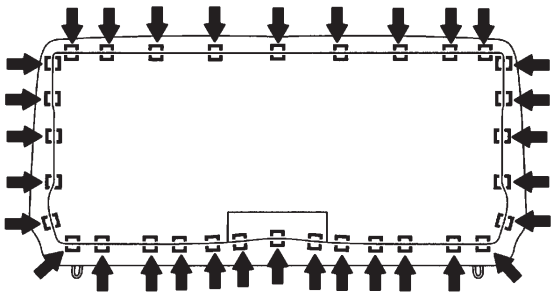
2. Rear seat cushion assembly
3. Rear seat back assembly
4. Rear seat stopper

DISASSEMBLY AND REASSEMBLY



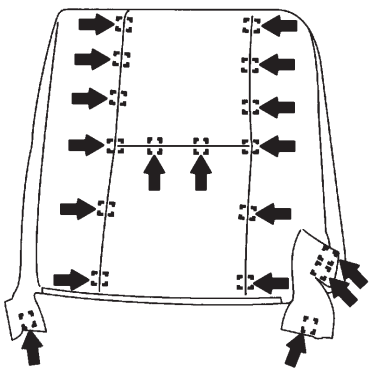
AX0217AL

<Back view of rear seat cushion>



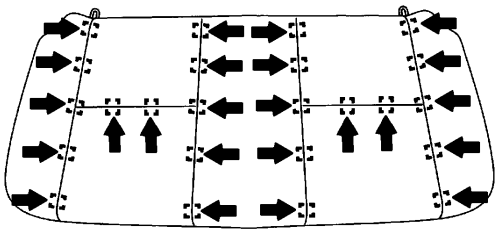
AX0218AL

<Front view of rear seat back>



AX0220AL

<Front view of rear seat cushion>



AX0219AL

NOTE
◀ : Hog ring positions

Disassembly steps

1. Rear seat cushion cover
2. Rear seat cushion pad
3. Headrestraint guide
4. Rear seat back cover
5. Rear seat back pad
6. Rear seat back frame assembly
7. Rear seat center hinge
8. Folding knob assembly

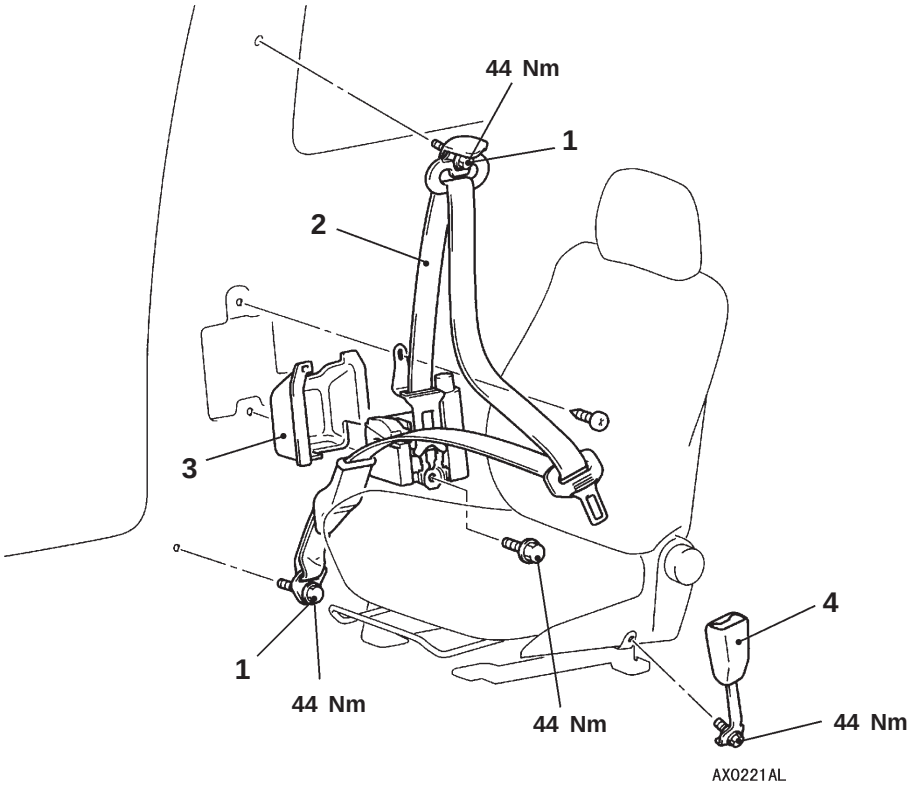
◀A▶

SEAT BELT

FRONT SEAT BELT

REMOVAL AND INSTALLATION

Caution: SRS
Before removal of the seat belt pre-tensioner, refer to GROUP 52B – SRS Service Precautions and Seat Belt with Pre-tensioner.



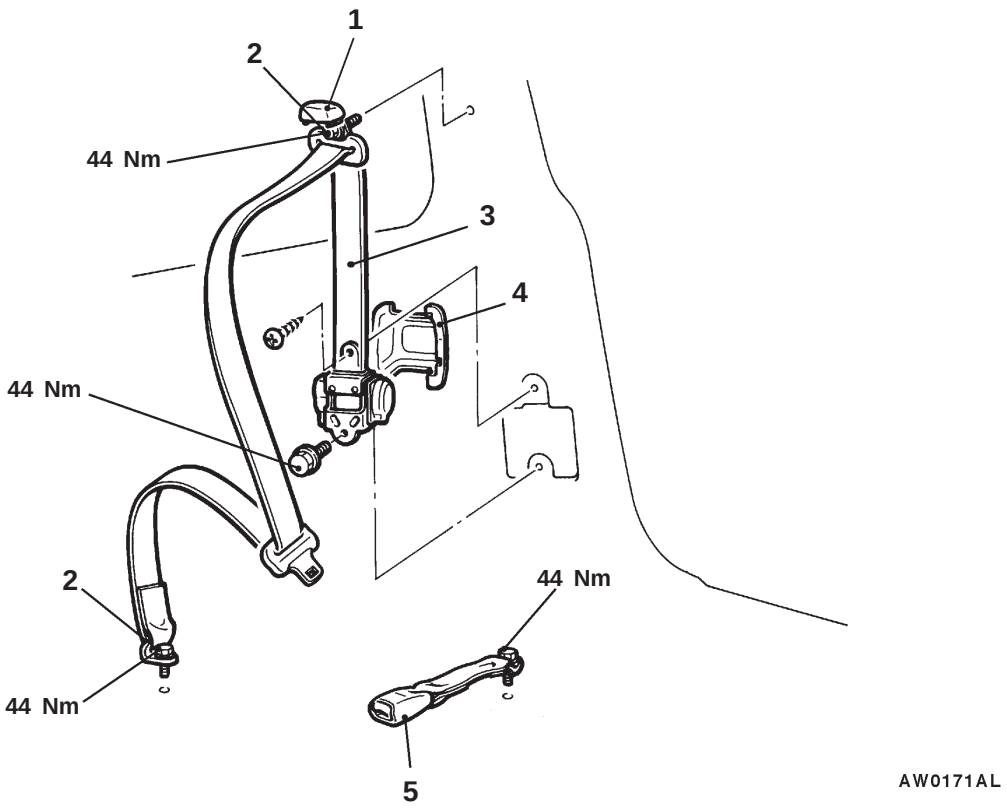
Outer seat belt removal steps

1. Outer seat belt connection
● Quarter trim (Refer to P.52A-9.)
2. Outer seat belt
3. Front noise protector

Inner seat belt removal

4. Inner seat belt

REAR SEAT BELT
REMOVAL AND INSTALLATION



Removal steps

- Rear seat cushion assembly (Refer to P.52A-15.)
1. Sash guide cover
2. Outer seat belt connection
- Luggage floor box <Option> (Refer to P.52A-9.)
- Rear pillar trim (Refer to P.52A-9.)
- Quarter trim (Refer to P.52A-9.)
3. Outer seat belt
4. Rear noise protector
5. Inner seat belt

GROUP 52A
INTERIOR

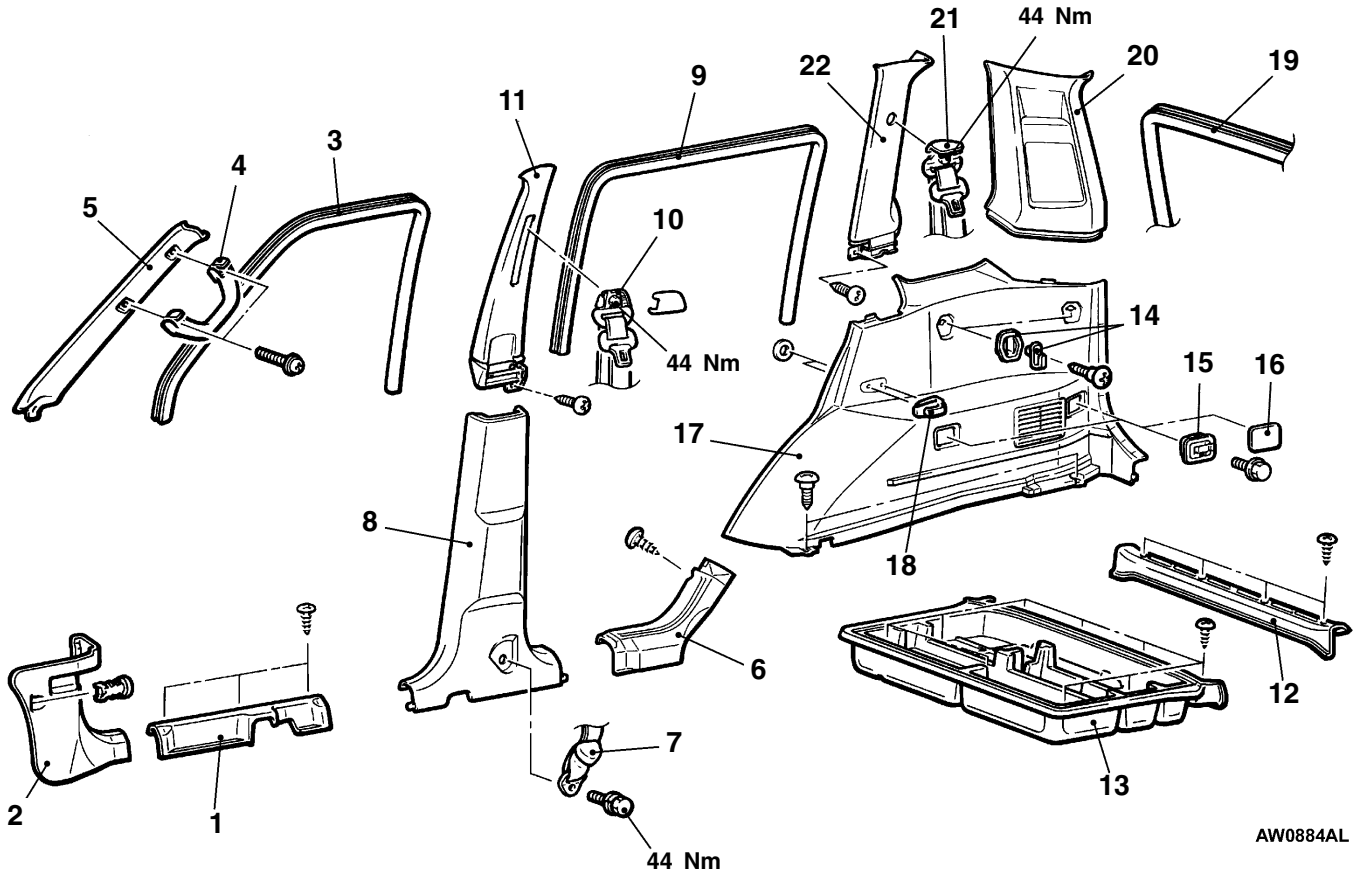
GENERAL

OUTLINE OF CHANGE

- Due to the introduction of 5-door models, the service procedures for the trims, the headlining, the seat and the seat belts have been added. The other items are the same as before.

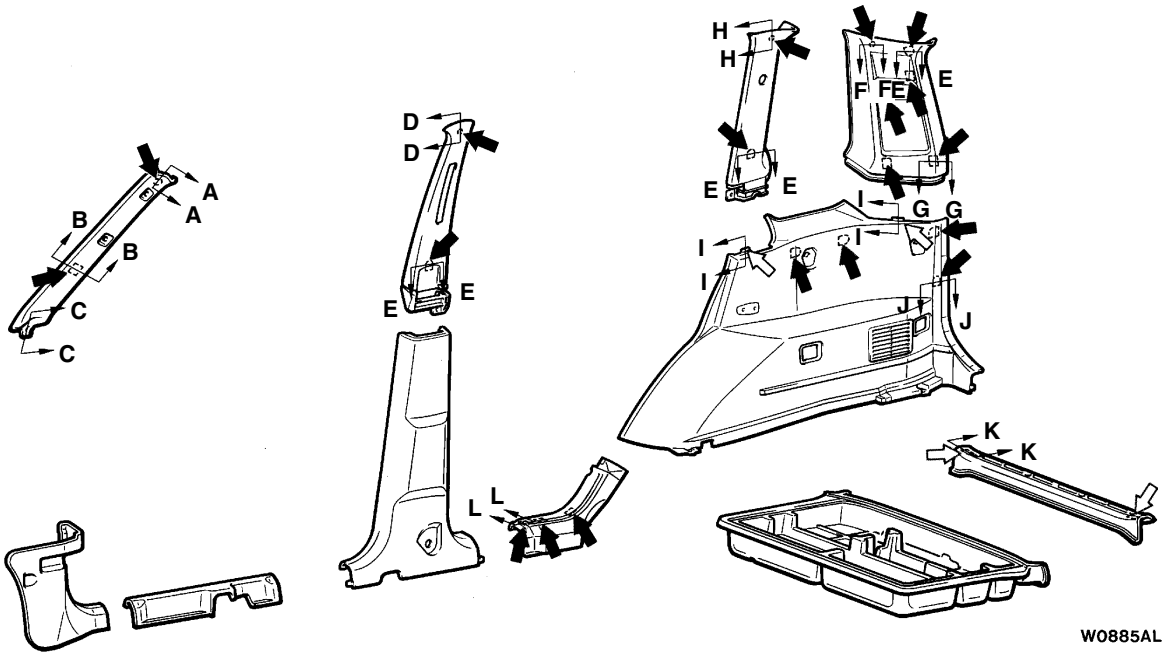
TRIMS <5-DOOR MODELS>

REMOVAL AND INSTALLATION



1. Front scuff plate
2. Cowl side trim
3. Front door opening trim
4. Assist grip (front)
5. Front pillar trim
6. Rear scuff plate
7. Front seat belt connection
8. Center pillar lower trim
9. Rear door opening trim
10. Front seat belt connection
11. Center pillar upper trim
12. Rear step plate
- Rear seat (Refer to '00 PAJERO PININ Workshop Manual <pub.No. CKRE00E1> Group 52A)
13. Luggage floor box <Option>
14. Luggage room hook
15. Net hook <Option>
16. Cover
17. Quarter lower trim
18. Hook
19. Back door opening trim
20. Rear pillar trim
21. Rear seat belt connection
22. Quarter pillar upper trim

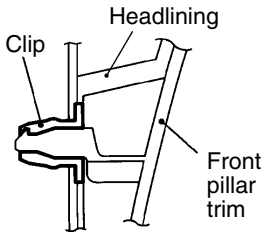
CLIP AND CLAW POSITIONS



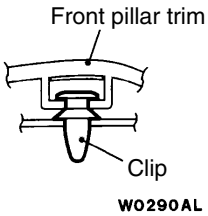
00009437

NOTE
⬅ : Clip positions
⇦ : Claw positions
For door trim, refer to GROUP 42.

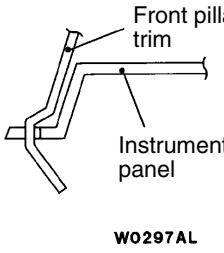
Section A – A



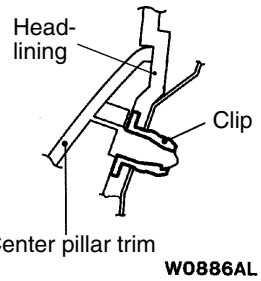
Section B – B



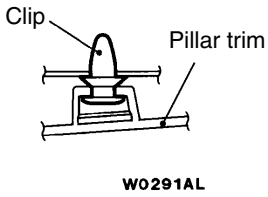
Section C – C



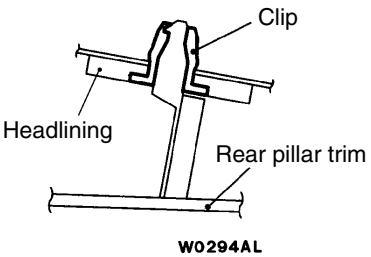
Section D – D



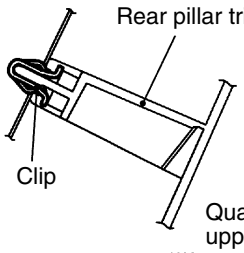
Section E – E



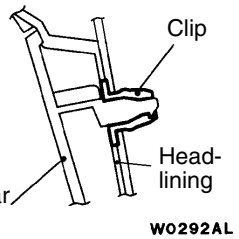
Section F – F



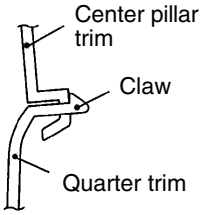
Section G – G



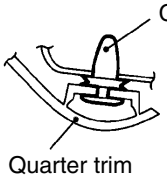
Section H – H



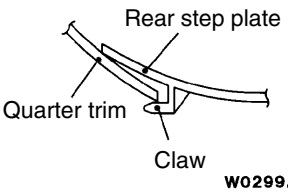
Section I – I



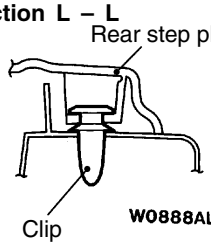
Section J – J



Section K – K

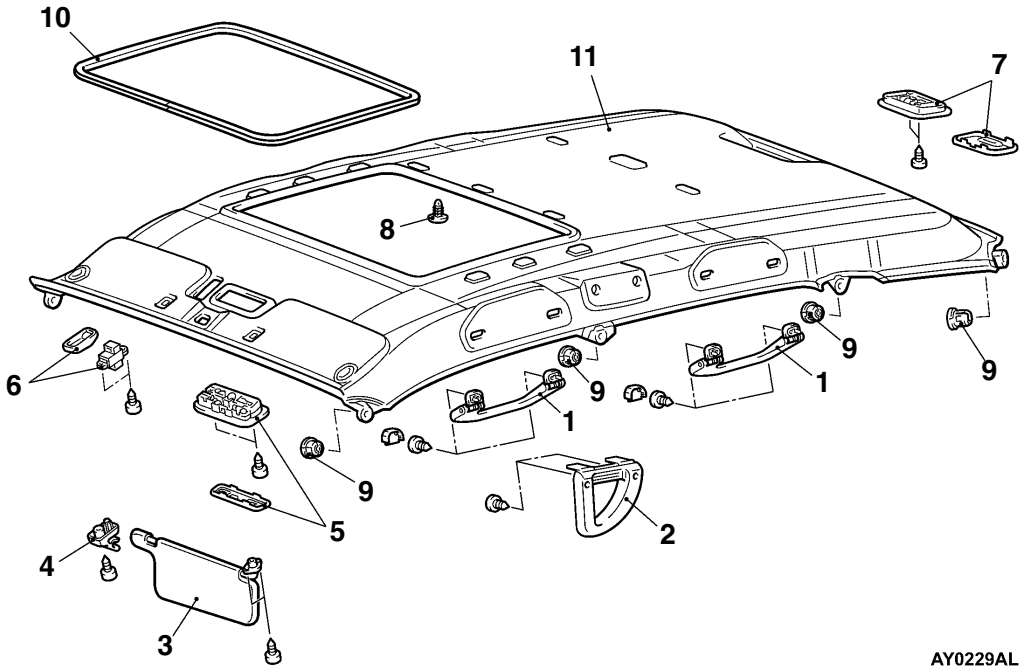


Section L – L



HEADLINING <5-DOOR MODELS>

REMOVAL AND INSTALLATION



Removal steps

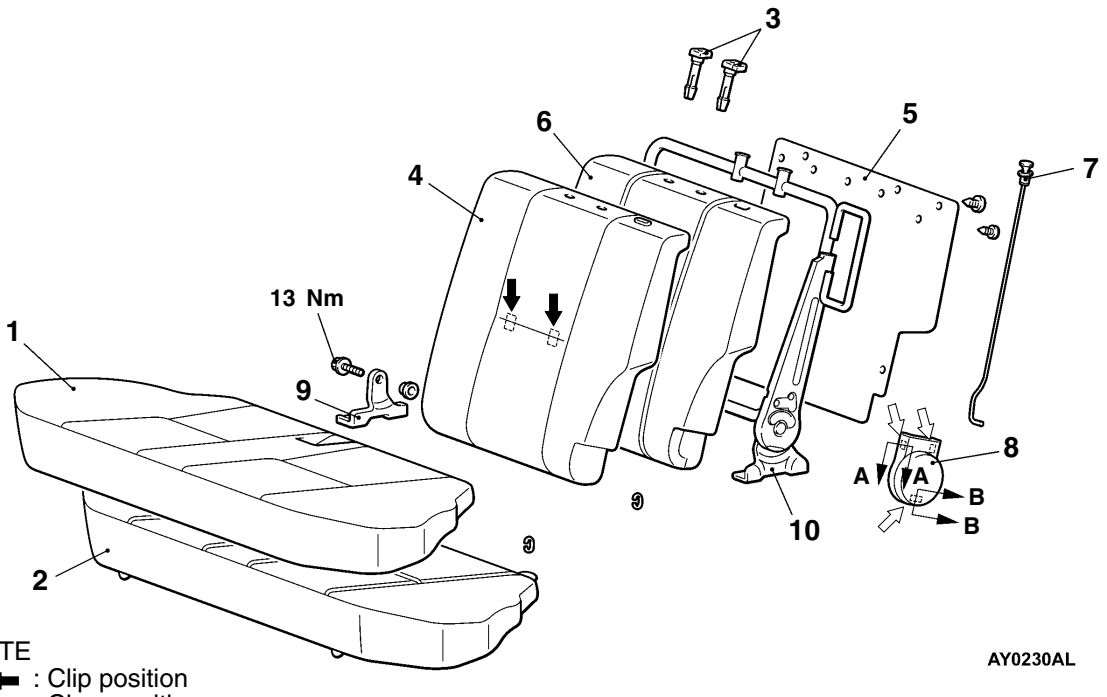
1. Assist grip
2. Grip (rear)
3. Sun visor assembly
4. Sun visor holder
5. Front room lamp assembly
6. Sunroof switch <Vehicles with sunroof>
7. Rear room lamp assembly
- Front pillar trim (Refer to P.52A-1.)
- Center pillar trim (Refer to P.52A-1.)
- Quarter pillar upper trim (Refer to P.52A-1.)
- Rear pillar trim (Refer to P.52A-1.)

8. Trim clip <Vehicles without sunroof>
9. Clip
10. Sunroof drip moulding <Vehicles with sunroof>
11. Headlining

SEAT <5-DOOR MODELS>

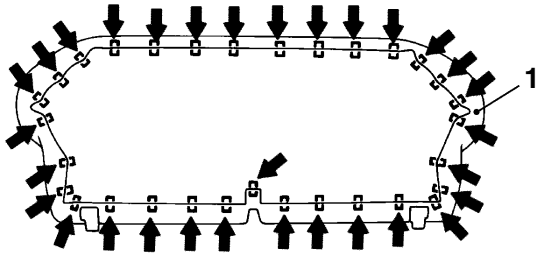
REAR SEAT

DISASSEMBLY AND REASSEMBLY

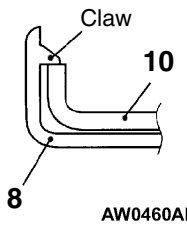


NOTE
⬅ : Clip position
⇦ : Claw position

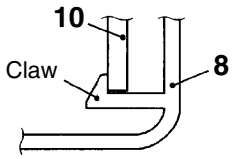
<Back view of rear seat cushion>



Section A – A

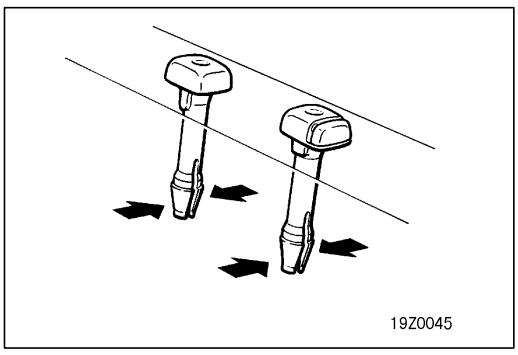


Section B – B



Disassembly steps

1. Rear seat cushion cover
2. Rear seat cushion pad
◀A▶ 3. Headrestraint guide
4. Rear seat back cover
5. Rear seat back panel
6. Rear seat back pad
7. Folding knob assembly
8. Reclining adjuster cover
9. Rear seat center hinge
10. Rear seat back frame assembly



REMOVAL SERVICE POINT

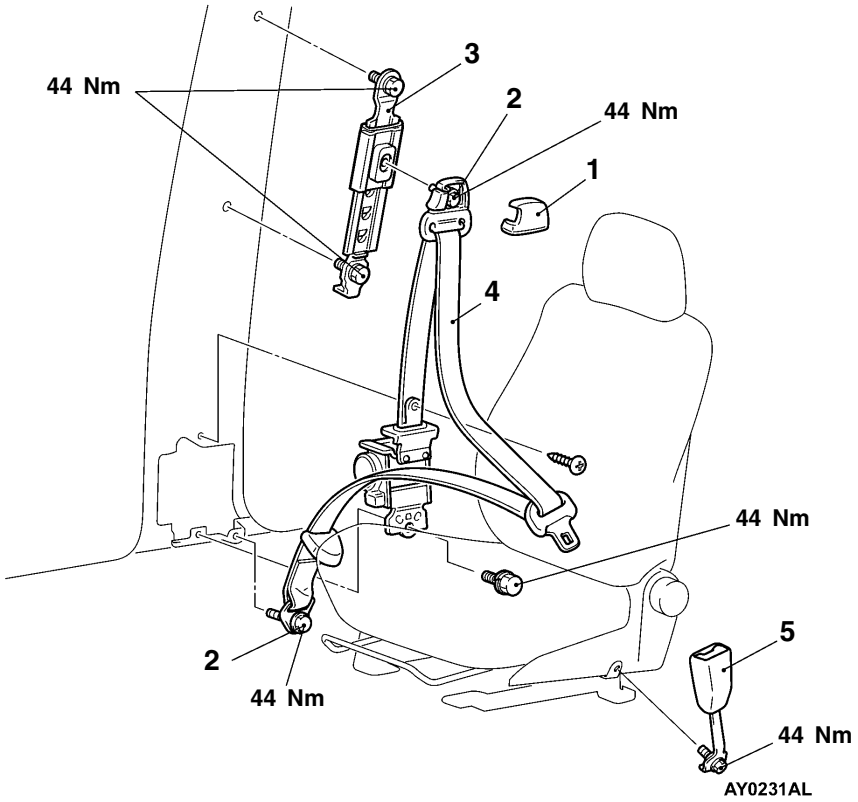
◀A▶ HEADRESTRAINT GUIDE REMOVAL

SEAT BELT <5-DOOR MODELS>

FRONT SEAT BELT

REMOVAL AND INSTALLATION

Caution: SRS
Before removal of the seat belt pre-tensioner, refer to GROUP 52B – SRS Service Precautions and Seat Belt with Pre-tensioner.



Outer seat belt removal steps

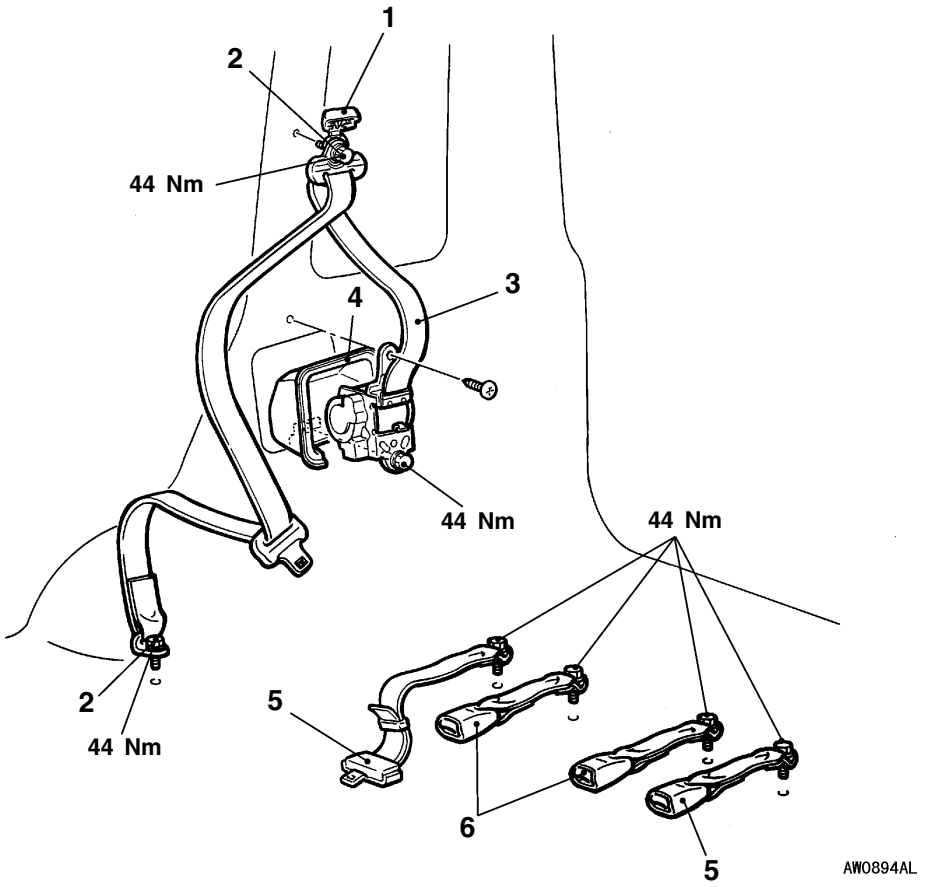
1. Sash guide cover
2. Outer seat belt connection
- Center pillar lower trim (Refer to P.52A-1.)
- Center pillar upper trim (Refer to P.52A-1.)

3. Adjustable seat belt anchor
4. Outer seat belt

Inner seat belt removal

5. Inner seat belt

REAR SEAT BELT
REMOVAL AND INSTALLATION



Removal steps

- Rear seat cushion assembly (Refer to P.52A-1.)
1. Sash guide cover
2. Outer seat belt connection
- Luggage floor box <Option> (Refer to P.52A-1.)
- Quarter lower trim (Refer to P.52A-1.)
- Quarter pillar upper trim (Refer to P.52A-1.)
3. Outer seat belt
4. Rear noise protector
5. Rear center seat belt
6. Inner seat belt

SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

CONTENTS

GENERAL INFORMATION 2

SRS SERVICE PRECAUTIONS 4

SPECIAL TOOLS 6

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TROUBLESHOOTING 8

SRS MAINTENANCE 23

POST-COLLISION DIAGNOSIS 27

INDIVIDUAL COMPONENT SERVICE 30

WARNING/CAUTION LABELS 31

FRONT IMPACT SENSORS 32

SRS AIR BAG CONTROL UNIT (SRS-ECU) 34

AIR BAG MODULES AND CLOCK SPRING 36

SEAT BELT WITH PRE-TENSIONER 44

SIDE IMPACT SENSOR 46

AIR BAG MODULE AND SEAT BELT PRE-TENSIONER DISPOSAL PROCEDURES 48

- Undeployed Air Bag Module and Seat Belt Pre-tensioner Disposal 48
- Deployed Air Bag Module or Operated Seat Belt Pre-tensioner Disposal Procedures 60

CAUTION

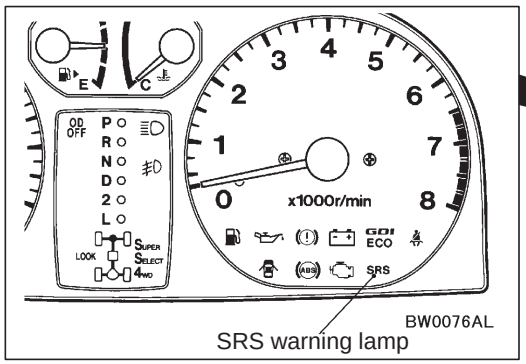
- **Carefully read and observe the information in the SERVICE PRECAUTIONS (P.52B-4.) prior to any service.**
- **For information concerning troubleshooting or maintenance, always observe the procedures in the Troubleshooting (P.52B-8.) section.**
- **If any SRS components are removed or replaced in connection with any service procedures, be sure to follow the procedures in the INDIVIDUAL COMPONENT SERVICE section (P.52B-30.) for the components involved.**
- **If you have any questions about the SRS, please contact your local distributor.**

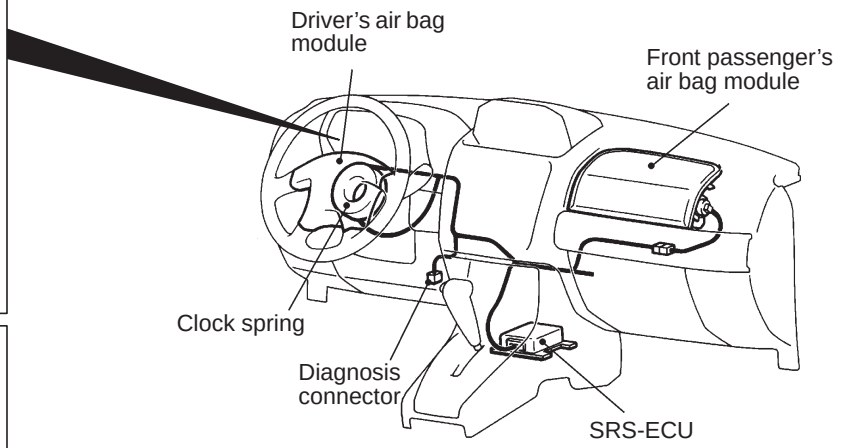
GENERAL INFORMATION

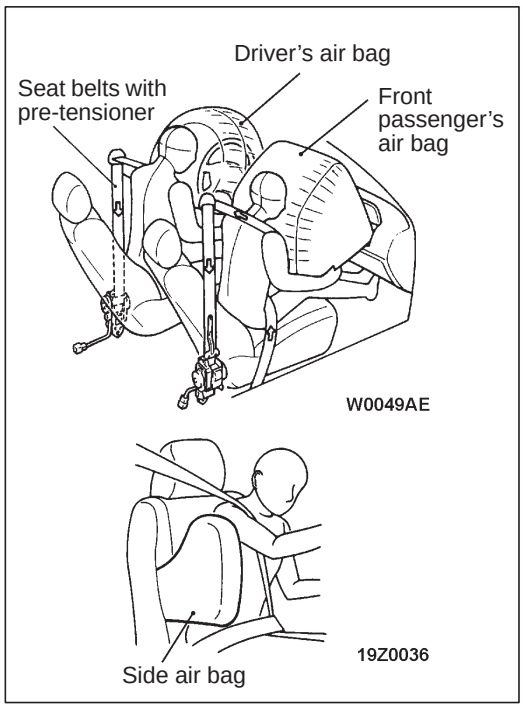
To improve safety, the SRS and seat belts with pre-tensioner are available as optional parts. These systems enhance collision safety by restraining the front passengers in case of an accident. The SRS works with the pre-tensioner simultaneously when a collision is detected.

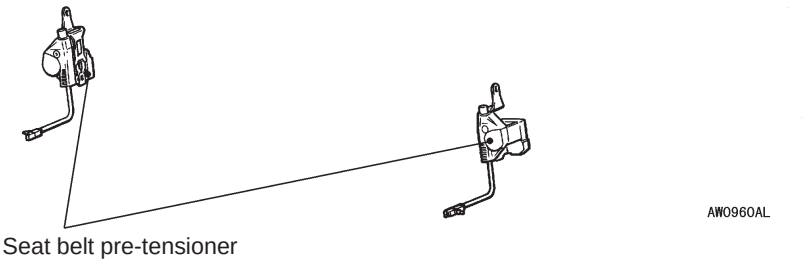
The SRS consists of four air bag modules, SRS air bag control unit (SRS-ECU), front impact sensors, side impact sensors, SRS warning lamp and clock spring. The air bags are located in the centre of the steering wheel, above the glove box, and built into the front seat back assemblies. Each air bag has a folded air bag and an inflator unit. The SRS-ECU under the floor console monitors the system and has a safing G sensor and an analog G sensor. The front impact sensors are installed on the front side member. The side impact sensor inside the quarter panels, inner monitors any shocks coming from the side of the vehicle. The warning lamp on the instrument panel indicates the operational status of the SRS. The clock spring is installed in the steering column.

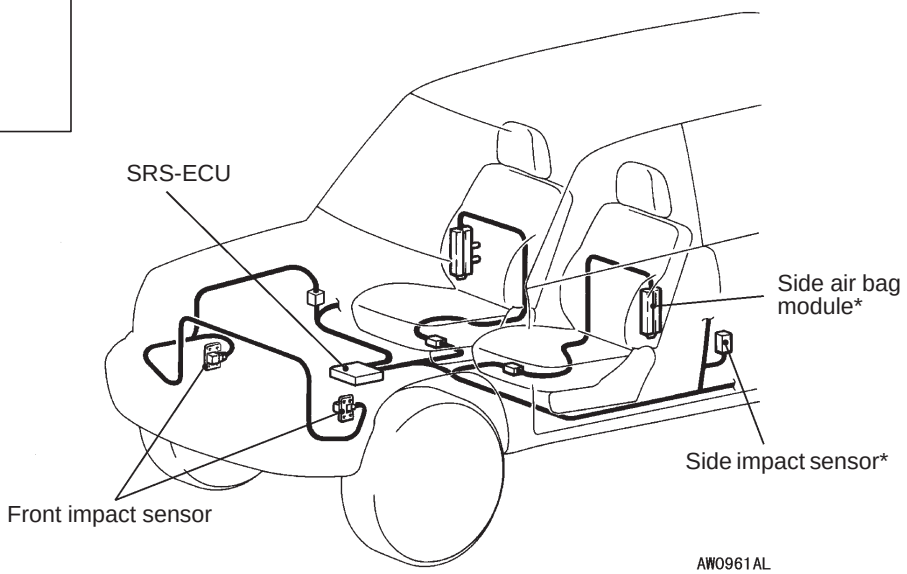
The SRS side air bag deploys if an impact received at the side of the vehicle is stronger than a certain set value, in order to protect the upper bodies of front seat passengers in the event of a collision. The seat belt pre-tensioner is built into the front seat belt retractor. Only authorized service personnel should do work on or around the SRS components and seat belt with pre-tensioner. Those service personnel should read this manual carefully before starting any such work. Extreme care must be used when servicing the SRS to avoid injury to the service personnel (by inadvertent deployment of the air bags or inadvertent operation of the seat belt with pre-tensioner) or the driver (by rendering the SRS or the seat belt with pre-tensioner inoperative).









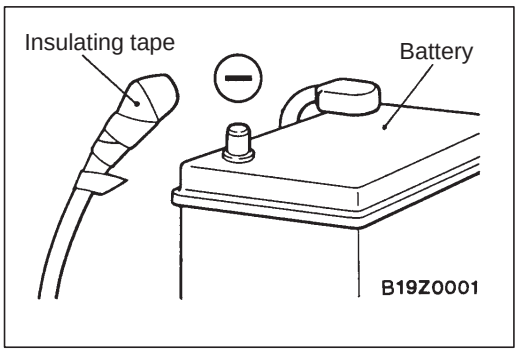


NOTE
*: Indicates the parts equipped on the right and left sides.

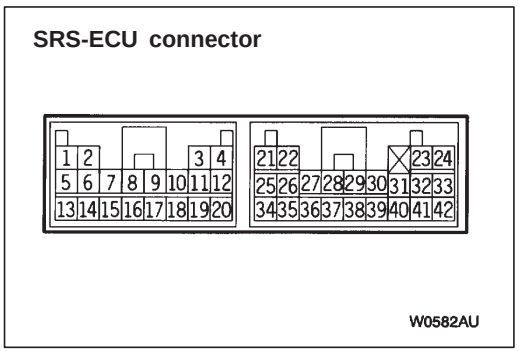
SRS SERVICE PRECAUTIONS

1. In order to avoid injury to yourself or others from accidental deployment of the air bag during servicing, read and carefully follow all the precautions and procedures described in this manual.
2. Do not use any electrical test equipment on or near SRS components, except those specified on P.52B-7.
3. **Never Attempt to Repair the Following Components:**
   - SRS air bag control unit (SRS-ECU)
   - Front impact sensor
   - Clock spring
   - Driver's and front passenger's air bag modules
   - Side air bag module
   - Side impact sensor
   - Seat belt with pre-tensioner

   NOTE
   If any of these components are diagnosed as faulty, they should only be replaced, in accordance with the INDIVIDUAL COMPONENTS SERVICE procedures in this manual. (Refer to P.52B-30.)



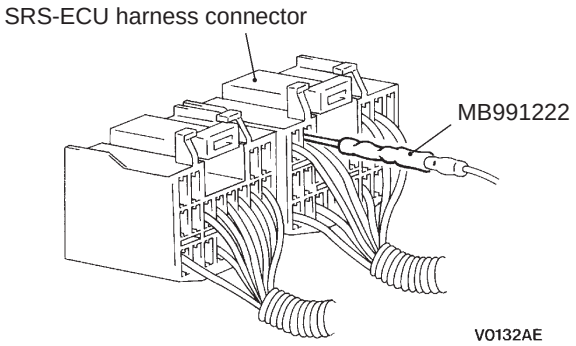
4. **After disconnecting the negative (–) battery cable, wait 60 seconds at least before any service and insulate the disconnected cable with tape. The SRS retain enough voltage to deploy the air bag for a short time even after disconnection of the battery. So, serious injury may result by accidental air bag deployment if a work is done on the SRS just after the disconnection of the battery.**



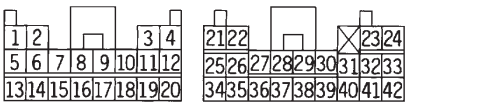
5. Do not attempt to repair the wiring harness connectors of the SRS. If the connector(s) are diagnosed as defective, replace the wiring harness(es). If the harness(es) are diagnosed as faulty, replace or repair the wiring harness(es) according to the following table.

SRS-ECU Terminal No.	Destination of harness	Corrective action
1, 2, 3, 4	Instrument panel wiring harness → Front wiring harness → Front impact sensor	Repair or replace each wiring harness.
7	Instrument panel wiring harness → Earth	
8	Instrument panel wiring harness → Combination meter (SRS warning lamp)	
9, 10	Instrument panel wiring harness → Front passenger's air bag module	
11, 12	Instrument panel wiring harness → Clock spring → Driver's air bag module	Repair or replace the dash wiring harness. Replace clock spring.
13	Instrument panel wiring harness → Junction block (fuse No.8)	Repair or replace each wiring harness.
16	Instrument panel wiring harness → Junction block (fuse No.6)	
20	Instrument panel wiring harness → Diagnosis connector	
21, 22	Body wiring harness → Side air bag module (L.H.)	
23, 24	Body wiring harness → Side air bag module (R.H.)	
27, 28	Body wiring harness → Seat belt with pre-tensioner (R.H.)	
29, 30	Body wiring harness → Seat belt with pre-tensioner (L.H.)	
34, 35, 36	Body wiring harness → Side impact sensor (L.H.)	
40, 41, 42	Body wiring harness → Side impact sensor (R.H.)	

6. Inspection of the SRS-ECU harness connector should be carried out by the following procedure.
   Insert the special tool (probe, MB991222, in the harness set) into connector from harness side (rear side), and connect the tester to this probe. If any tool than special is used, damage to the harness and other components will result. Furthermore, measurement should not be carried out by touching the probe directly against the terminals from the front of the connector. The terminals are plated to increase their conductivity, so that if they are touched directly by the probe, the plating may break, which will cause drops in reliability.



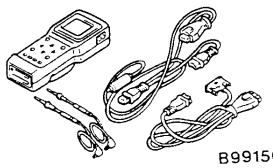
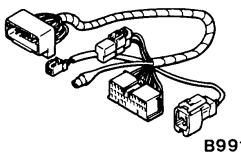
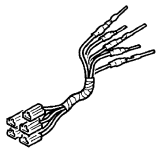
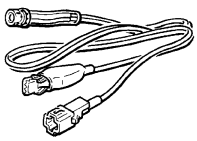
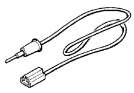
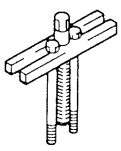
SRS-ECU harness connector (rear view)

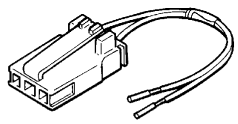
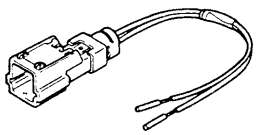
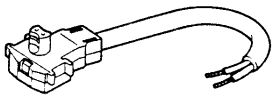


7. SRS components and seat belt with pre-tensioner should not be subjected to heat, so remove the front impact sensor, SRS-ECU, air bag module (driver's side and front passenger's side), clock spring, side impact sensors, front seat assemblies (side air bag module), and seat belts with pre-tensioner before drying or baking the vehicle after painting.
   - Front impact sensor, SRS-ECU, air bag module, clock spring, side impact sensor: 93°C or more
   - Seat belt with pre-tensioner: 90°C or more
8. Whenever you finish servicing the SRS, check warning lamp operation to make sure that the system functions properly. (Refer to P.52B-8.)
9. Make certain that the ignition switch is OFF when the MUT-II is connected or disconnected.
10. If you have any questions about the SRS, please contact your local distributor.

NOTE
SERIOUS INJURY CAN RESULT FROM UNINTENDED AIR BAG DEPLOYMENT, SO USE ONLY THE PROCEDURES AND EQUIPMENT SPECIFIED IN THIS MANUAL.

SPECIAL TOOLS

Tool	Number	Name	Use
 B991502	MB991502	MUT-II sub assembly	• Reading diagnosis codes • Erasing diagnosis code • Reading trouble period • Reading erase times
 B991613	MB991613	SRS check harness	Checking the SRS electrical circuitry
A  B  C  D  C991223	MB991223 A: MB991219 B: MB991220 C: MB991221 D: MB991222	Harness set A: Check harness B: LED harness C: LED harness adapter D: Probe	Checking the continuity and measuring the voltage at the SRS-ECU harness connector
 B990803	MB990803	Steering wheel puller	Steering wheel removal

Tool	Number	Name	Use
 R372530	MR372530	SRS air bag adapter harness	Deployment of driver's side air bag module inside the vehicle
 B686560	MB686560	SRS air bag adapter harness	Deployment of front passenger's side air bag module inside or outside the vehicle
 B628919	MR203491 or MB628919	SRS air bag adapter harness	Deployment of driver's side air bag module outside the vehicle

TEST EQUIPMENT

Tool	Name	Use
 13R0746	Digital multi-meter	Checking the SRS electrical circuitry Use a multi-meter for which the maximum test current is 2 mA or less at the minimum range of resistance measurement

TROUBLESHOOTING

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING

Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.

DIAGNOSIS FUNCTION

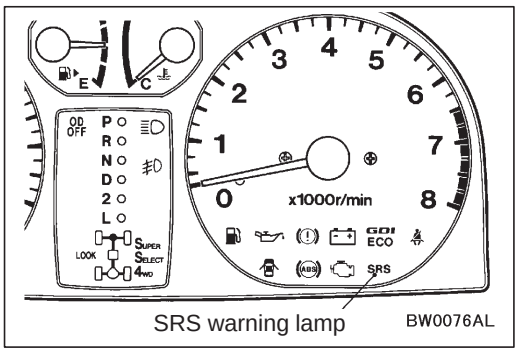
DIAGNOSIS CODES CHECK

Connect the MUT-II to the diagnosis connector (16-pin) under the instrument under cover, then check diagnosis codes.
(Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.)

ERASING DIAGNOSIS CODE

Connect the MUT-II to the diagnosis connector and erase the diagnosis code.

Caution
Turn off the ignition switch before connecting or disconnecting the MUT-II.



SRS WARNING LAMP INSPECTION

1. Check to be sure that the SRS warning lamp illuminates when the ignition switch is in the ON position.
2. Check to be sure that it illuminates for approximately 7 seconds and then switches off.
3. If the above is not the cause, inspect the diagnosis codes.

INSPECTION CHART FOR DIAGNOSIS CODES

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

Code No.	Diagnosis item	Reference page
11, 12, 13	Front impact sensor system	52B-10
14	Analog G-sensor system in the SRS-ECU	52B-11
15,16	Front impact safing G-sensor system inside SRS-ECU	52B-11
17	Side impact safing G-sensor system inside SRS-ECU	52B-11
21*2, 22*2, 61*2, 62*2	Driver's side air bag module (squib) system	52B-12
24*2, 25*2, 64*2, 65*2	Front passenger's side air bag module (squib) system	52B-13
26*2, 27*2, 66, 67	Driver's side pre-tensioner (squib) system	52B-14
28*2, 29*2, 68, 69	Front passenger's side pre-tensioner (squib) system	52B-15
31, 32	SRS-ECU capacitor system	52B-11
34*1	Connector lock system	52B-16
35	SRS-ECU (deployed air bag) system	52B-16

Code No.	Diagnosis item		Reference page
41*1	Power circuit system (fuse No.6 circuit)		52B-16
42*1	Power circuit system (fuse No.8 circuit)		52B-16
43*1	SRS warning lamp drive circuit system	Lamp does not illuminate.	52B-17
		Lamp does not switch off.	52B-17
44*1	SRS warning lamp drive circuit system		52B-17
45	Internal circuit system of non-volatile memory (EEPROM) inside SRS-ECU		52B-11
51, 52	Driver's side air bag module (squib ignition drive circuit) system		52B-11
54, 55	Front passenger's side air bag module (squib ignition drive circuit) system		52B-11
56, 57	Driver's side pre-tensioner (squib ignition drive circuit) system		52B-11
58, 59	Front passenger's side pre-tensioner (squib ignition drive circuit) system		52B-11
71*2, 72*2, 75, 76	Side air bag module (R.H.) (squib) system		52B-18
73, 74	Side air bag module (R.H.) (squib ignition drive circuit) system		52B-11
79, 93	Side impact sensor (L.H.) communication system		52B-19
81*2, 82*2, 85, 86	Side air bag module (L.H.) (squib) system		52B-19
83, 84	Side air bag module (L.H.) (squib ignition drive circuit) system		52B-11
89, 96	Side impact sensor (R.H.) communication system		52B-20
91*1	Side impact sensor (L.H.) power supply circuit system		52B-21
92	Side impact sensor (L.H.) system		52B-21
94*1	Side impact sensor (R.H.) power supply circuit system		52B-21
95	Side impact sensor (R.H.) system		52B-21

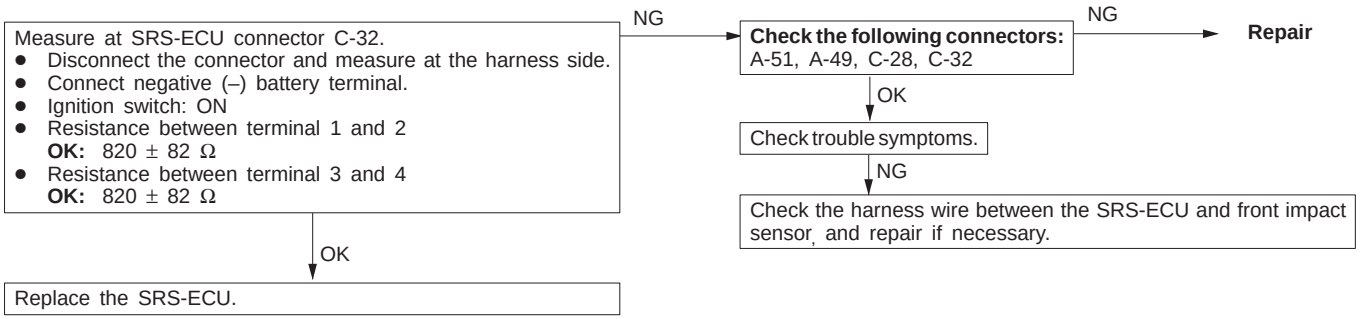
NOTE
(1) *1: If the vehicle condition returns to normal, the diagnosis code will be automatically erased, and the SRS warning lamp will return to normal.
(2) *2: If the trouble(s) are extinguished, the SRS warning lamp go out with diagnosis code history stored.
(3) If the vehicle has a discharged battery it will store the diagnosis codes 41 or 42. When these diagnosis codes are displayed, check the battery.

INSPECTION PROCEDURE CLASSIFIED BY DIAGNOSIS CODE

Code No.11, 12 or 13 Front impact sensor system	Probable cause
These diagnostic trouble codes are output if there is abnormal resistance between the input terminals of the front impact sensors. The trouble causes for each diagnosis code No. are as follows.	• Malfunction of front impact sensor • Malfunction of wiring harness of connectors • Malfunction of SRS-ECU

Code No.	Trouble Symptom
11	• Short circuit in front impact sensor or harness • Short circuit in front impact sensor harness leading to the vehicle body ground • Short circuit in front impact sensor harness leading to the power supply
12	• Open circuit in either left or right front impact sensor or harness • Short circuit in front impact sensor harness leading to the power supply
13	• Open circuit in both left or right front impact sensor or harness • Short circuit in front impact sensor harness leading to the power supply

Front impact sensor check. (Refer to P.52B-33)



Code No.14, 15, 16, 17, 31, 32, 45, 51, 52, 54, 55, 56, 57, 58, 59, 73, 74, 83, 84 System inside SRS-ECU	Probable cause
These diagnostic trouble codes are output when a fault is detected in the SRS-ECU. The defective parts and trouble causes for each diagnosis code No. are as follows.	• Malfunction of SRS-ECU

Code No.	Defective parts	Trouble causes
14	Analog G-sensor	• Analog G-sensor is not operating • Analog G-sensor characteristics are abnormal • Analog G-sensor output is abnormal
15	Front impact safing G-sensor	• Short circuit in the safing G-sensor
16		• Open circuit in the safing G-sensor
17	Side impact safing G-sensor	• Safing G sensor is not operating • Safing G sensor characteristics are abnormal • Safing G sensor output is abnormal
31	Capacitor	• Voltage at the capacitor terminal is higher than the specified value for five seconds or more
32		• Voltage at the capacitor terminal is lower than the specified value for five seconds or more (this is not detected if diagnosis code No.41 or 42 indicating battery voltage drop has been output.)
45	Non-volatile memory (EEPROM)	• Non-volatile memory (EEPROM) is abnormal
51	Driver's side air bag module (squib ignition drive circuit)	• Short circuit in the squib ignition drive circuit
52		• Open circuit in the squib ignition drive circuit
54	Front passenger's side air bag module (squib ignition drive circuit)	• Short circuit in the squib ignition drive circuit
55		• Open circuit in the squib ignition drive circuit
56	Driver's side pre-tensioner (squib ignition drive circuit)	• Short circuit in the squib ignition drive circuit
57		• Open circuit in the squib ignition drive circuit
58	Front passenger's side pre-tensioner (squib ignition drive circuit)	• Short circuit in the squib ignition drive circuit
59		• Open circuit in the squib ignition drive circuit
73	Side air bag module (R.H.) (squib ignition drive circuit)	• Short circuit in the squib ignition drive circuit
74		• Open circuit in the squib ignition drive circuit
83	Side air bag module (R.H.) (squib ignition drive circuit)	• Short circuit in the squib ignition drive circuit
84		• Open circuit in the squib ignition drive circuit

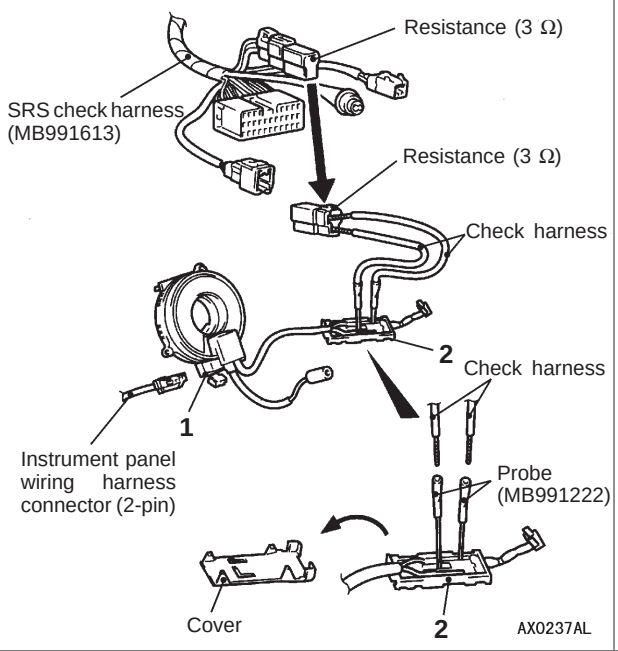
Replace the SRS-ECU.

Code No.21, 22, 61, 62 Driver's air bag module (squib) system	Probable cause
Abnormal resistance is present between input terminals of driver's air bag module (squib). See table below for what each code tells. However, once trouble is extinguished, SRS-warning lamp will go out. (Diagnosis code will remain stored)	• Malfunction of clock spring • Partially open as clock spring is not in neutral position • Defective wiring harnesses or connectors • Malfunction of driver's air bag module (squib) • Malfunction of SRS-ECU

Code No.	Trouble causes
21	• Short in driver's air bag module (squib) or harness short • Short in clock spring • Defective connector*
22	• Open in driver's side air bag module (squib) or open harness • Open in clock spring • Disconnected driver's air bag module (squib) connector • Partially open as clock spring is not in neutral position • Poor connector contact*
61	• Driver's air bag module (squib) harness shorted to power supply
62	• Driver's air bag module (squib) harness short to the earth

NOTE
*: The shorting bars, which short positive (+) and negative (–) wires to prevent the air bags from accidental deployment during the disconnection of the connector, are set in the squib circuit connectors. In a defective connector, the short-bar may be still working even after the connection of the connector.

Check clock spring. (Refer to P.52B-42.)
NG → **Replace**
NO



MUT-II Self-diag code
- Connect clock spring connector No.1 C-65 and the harness side connector (2-pin).
- Remove the cover from the No. 2 connector of the clock spring, and then insert the probes (MB991222) and connect check harness to the probe.

Caution
Never insert the probe directly to the terminals from the front of the connector.

- Disconnect the resistance connector from the SRS check harness (MB991613) and connect to the check harness.
- Connect the negative (–) battery terminal.
- Erase diagnosis code memory.

Is code Nos.21, 22, 61 or 62 displayed?

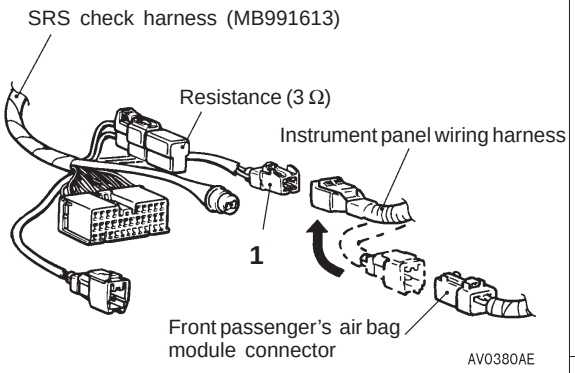
YES
Check the following connectors: C-32, C-65
OK
Check trouble symptoms.
NG
Check wiring harness between clock spring and SRS-ECU.
OK
Replace SRS-ECU.
NG
Repair
NG
Repair

NO
Replace driver's air bag module (squib).

Code No.24, 25, 64, 65 Front passenger's air bag module (squib) system	Probable cause
Abnormal resistance is present between input terminals of front passenger's air bag module (squib). See table below for what each code tells. However, once trouble is extinguished, SRS-warning lamp will go out. (Diagnosis code will remain stored)	• Defective wiring harnesses or connectors • Malfunction of front passenger's air bag module (squib) • Malfunction of SRS-ECU

Code No.	Trouble causes
24	• Short in front passenger's air bag module (squib) or short harness
25	• Open in front passenger's air bag module (squib) or open harness • Poor connector contact*
64	• Short-circuit in front passenger's air bag module (squib) harness to power supply
65	• Short-circuit in front passenger's air bag module (squib) harness to earth

NOTE
*: The shorting bars, which short positive (+) and negative (–) wires to prevent the air bags from accidental deployment during the disconnection of the connector, are set in the squib circuit connectors. In a defective connector, the short-bar may be still working even after the connection of the connector.



MUT-II Self-diag code
- Disconnect front passenger's air bag module connector C-15, and connect the harness side connector to SRS check harness (MB991613) connector No.1.
- Connect negative (–) battery terminal.
- Erase diagnosis code memory.

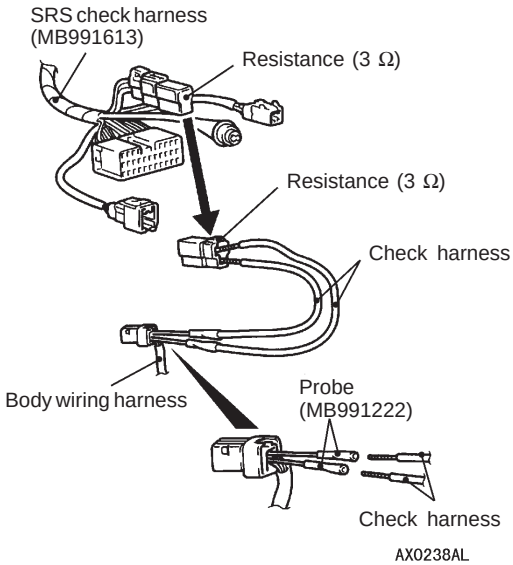
Is code Nos.24, 25, 64 or 65 output?

YES → **Check the following connectors:** C-15, C-32
- OK → Check trouble symptoms.
  - NG → **Repair**
- NG → Check wiring harness between the front passenger's air bag module and SRS-ECU.
  - OK → Replace SRS-ECU.
  - NG → **Repair**

NO → Replace the front passenger's air bag module (squib).

Code No.26, 27, 66 or 67 Driver's side pre-tensioner (squib) system	Probable cause
These diagnosis codes are output if there is abnormal resistance between the input terminals of the driver's side pre-tensioner (squib). The trouble causes for each diagnosis code No. are as follows.	• Malfunction of wiring harnesses or connectors • Malfunction of driver's side pre-tensioner (squib) • Malfunction of SRS-ECU

Code No.	Trouble causes
26	• Short in driver's side pre-tensioner (squib) or harness short
27	• Open circuit in driver's side pre-tensioner (squib) or open harness • Malfunction of connector contact
66	• Short in driver's side pre-tensioner (squib) harness leading to the power supply
67	• Short in driver's side pre-tensioner (squib) harness leading to the earth



MUT-II Self-diag code

- Disconnect the driver's side pre-tensioner connector D-41 <L.H. drive vehicles>, D-38 <R.H. drive vehicles>
- Insert the probe (MB991222) from the rear of the harness side connector and connect the check harness to the probe.

Caution
Never insert the probe directly to the terminals from the front of the connector.

- Disconnect the resistance connector from the SRS check harness (MB991613) and connect to the check harness.
- Connect the negative (–) battery terminal.
- Erase diagnosis code memory.

Is code No.26, 27, 66 or 67 displayed?

YES

Check the following connectors: D-36, D-41 <L.H. drive vehicles>, D-38 <R.H. drive vehicles>

OK

Check trouble symptoms.

NG

Check wiring harness between the driver's side pre-tensioner and SRS-ECU.

OK

Replace SRS-ECU.

NG

Repair

NG

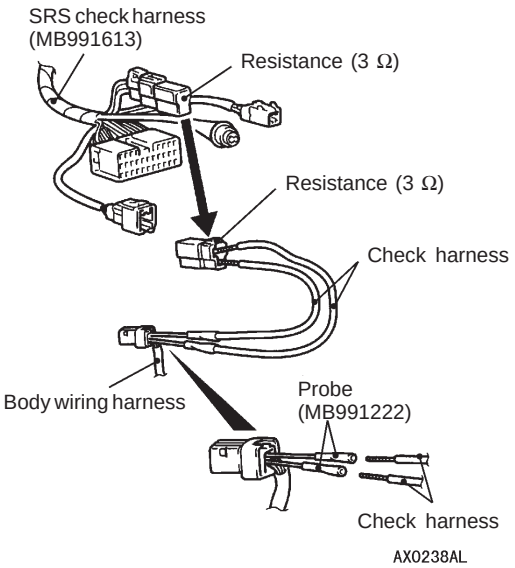
Repair

NO

Replace the driver's side pre-tensioner.

Code No.28, 29, 68 or 69 Front passenger's side pre-tensioner (squib) system	Probable cause
These diagnosis codes are output if there is abnormal resistance between the input terminals of the front passenger's side pre-tensioner (squib). The trouble causes for each diagnosis code No. are as follows.	• Malfunction of wiring harnesses or connectors • Malfunction of front passenger's side pre-tensioner (squib) • Malfunction of SRS-ECU

Code No.	Trouble causes
28	• Short in front passenger's side pre-tensioner (squib) or harness short
29	• Open circuit in front passenger's side pre-tensioner (squib) or open harness • Malfunction of connector contact
68	• Short in front passenger's side pre-tensioner (squib) harness leading to the power supply
69	• Short in front passenger's side pre-tensioner (squib) harness leading to the earth



MUT-II Self-diag code

- Disconnect the front passenger's side pre-tensioner connector D-38 <L.H. drive vehicles>, D-41 <R.H. drive vehicles>
- Insert the probe (MB991222) from the rear of the harness side connector and connect the check harness to the probe.

Caution
Never insert the probe directly to the terminals from the front of the connector.

- Disconnect the resistance connector from the SRS check harness (MB991613) and connect to the check harness.
- Connect the negative (–) battery terminal.
- Erase diagnosis code memory.

Is code No.28, 29, 68 or 69 displayed?

YES

Check the following connectors: D-36, D-38 <L.H. drive vehicles>, D-41 <R.H. drive vehicles>

OK

Check trouble symptoms.

NG

Check wiring harness between the front passenger's side pre-tensioner and SRS-ECU.

OK

Replace SRS-ECU.

NG

Repair

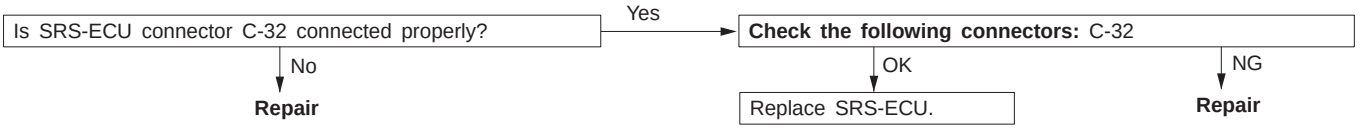
NG

Repair

NO

Replace the front passenger's side pre-tensioner.

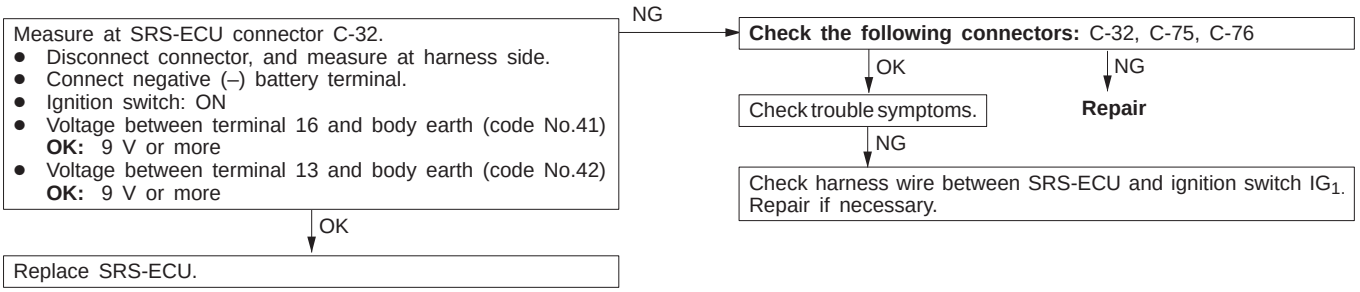
Code No.34 Connector lock system	Probable cause
SRS-ECU is poorly connected. However, when vehicle condition returns to normal, this code will be automatically erased, and the SRS warning lamp will go out.	• Defective connectors • Malfunction of SRS-ECU



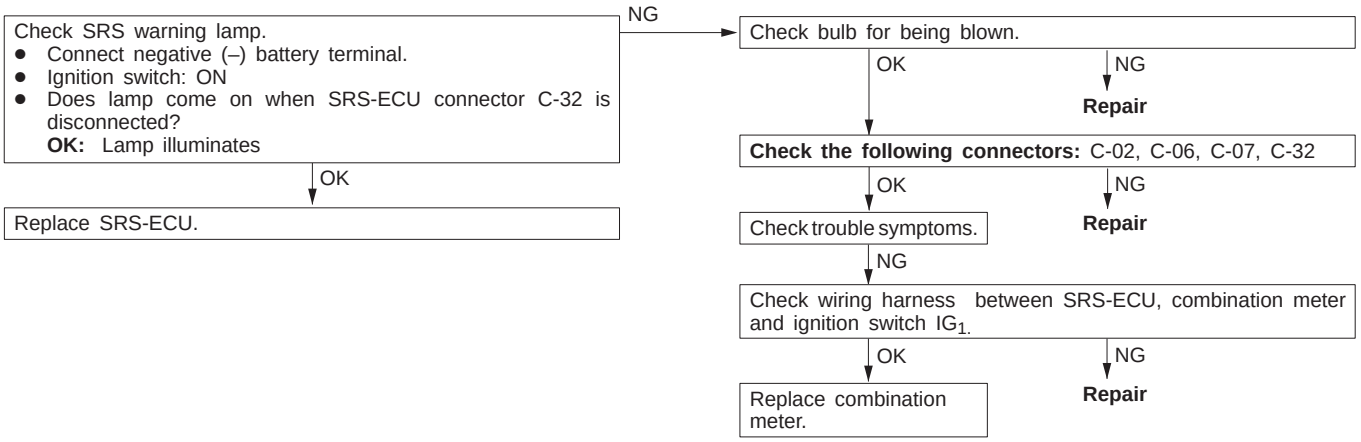
Code No.35 SRS-ECU (deployed air bag) system	Probable cause
This code is displayed after deployment of air bags. If displayed before deployment, the code indicates malfunction probably present in SRS-ECU.	• Malfunction of SRS-ECU

Replace the SRS-ECU.

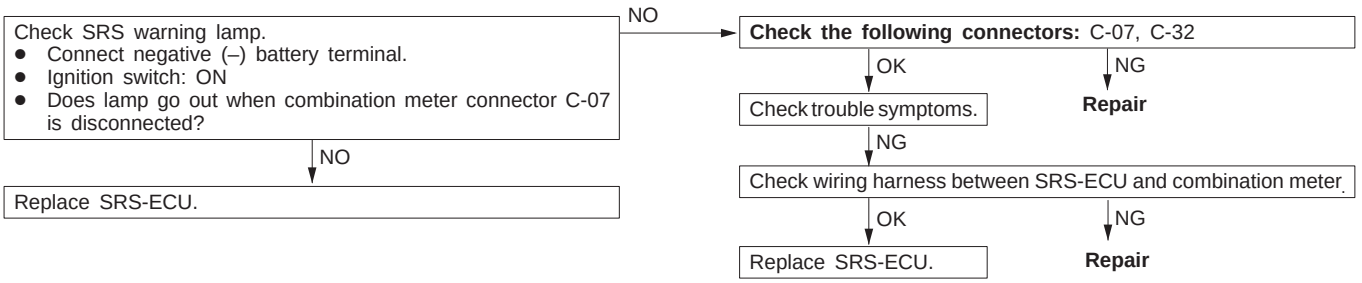
Code No.41 Power circuit system (fuse No.6 circuit) Code No.42 Power circuit system (fuse No.8 circuit)	Probable cause
Code No.41 is displayed if voltage between IG_1 terminal (SRS–ECU, terminal 12) and earth is lower than specified for five successive seconds or more. Code No.42 is displayed if voltage between IG_1 terminal (SRS–ECU, terminal 9) and earth is lower than specified for five successive seconds or more. However, once trouble is extinguished, these codes will be automatically erased, and SRS warning lamp will go out. If codes 41 and 42 are displayed together, check the battery first as vehicle may have discharged battery.	• Defective wiring harnesses or connectors • Malfunction of SRS-ECU



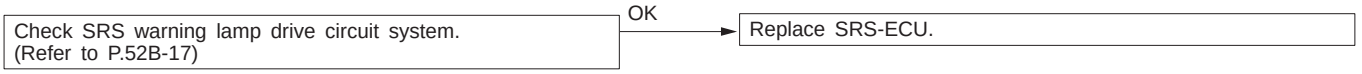
Code No.43 SRS warning lamp drive circuit system (Lamp does not come on)	Probable cause
Open circuit is present for 5 successive seconds or more in SRS warning lamp drive circuit. However, once trouble is extinguished, this code, if displayed due to open circuit, will be automatically erased.	• Defective wiring harnesses or connectors • Blown bulb • Malfunction of SRS-ECU • Malfunction of combination meter



Code No.43 SRS warning lamp drive circuit system (Lamp does not go out.)	Probable cause
Harness between SRS warning lamp and SRS-ECU is being shorted to earth. However, once trouble is extinguished, this code will be automatically erased, and SRS warning lamp will go out.	• Defective wiring harnesses or connectors • Malfunction of SRS-ECU • Malfunction of combination meter

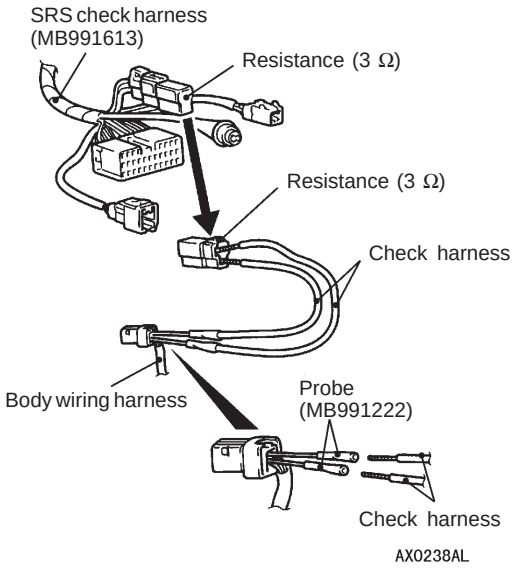


Code No.44 SRS warning lamp drive circuit system	Probable cause
Short is present in SRS warning lamp drive circuit, or output transistor in SRS-ECU is defective. However, once trouble is extinguished, this code will be automatically erased, and SRS warning lamp will go out.	• Defective wiring harnesses or connectors • Malfunction of SRS-ECU



Code No.71, 72, 75, 76 Side air bag module (R.H.) (squib) system	Probable cause
Abnormal resistance is present between input terminals of SRS-ECU for side air bag module (R.H.) (squib). See table below for what each code tells. However, as for code Nos. 71 and 72, once trouble is extinguished, SRS warning lamp will go out. (Diagnosis code will remain stored)	• Malfunction of wiring harnesses or connectors • Malfunction of side air bag module (R.H.) (squib) • Malfunction of SRS-ECU

Code No.	Trouble causes
71	• Short in side air bag module (R.H.) (squib) or harness short
72	• Open in side air bag module (R.H.) (squib) or open harness • Poor connector contact
75	• Side air bag module (R.H.) (squib) harness short to power supply
76	• Side air bag module (R.H.) (squib) harness short to earth



MUT-II Self-diag code
- Disconnect the side air bag module (R.H.) connector D-01
- Insert the probe (MB991222) from the rear of the harness side connector and connect the check harness to the probe.

Caution
Never insert the probe directly to the terminals from the front of the connector.

- Disconnect the resistance connector from the SRS check harness (MB991613) and connect to the check harness.
- Connect the negative (–) battery terminal.
- Erase diagnosis code memory.

Is code No.71, 72, 75 or 77 displayed?

YES

Check the following connectors: D-01, D-36

OK

Check trouble symptoms.

NG

Repair

NG

Check wiring harness between the side air bag module (R.H.) and SRS-ECU.

OK

Replace SRS-ECU.

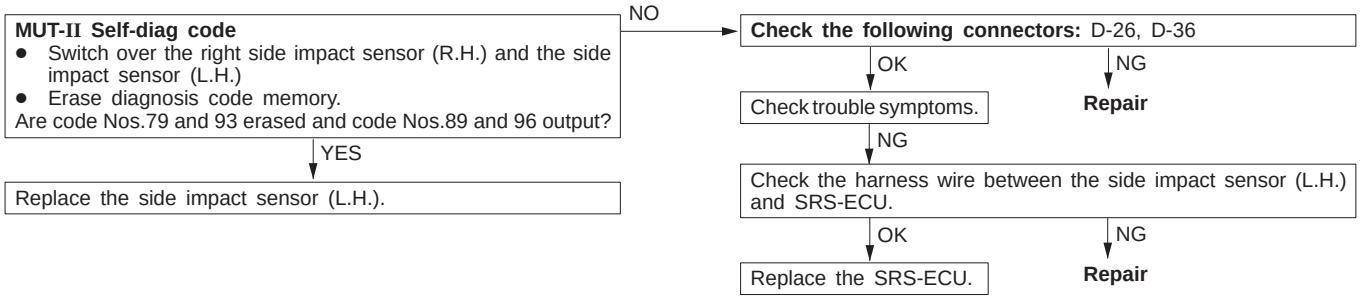
NG

Repair

NO

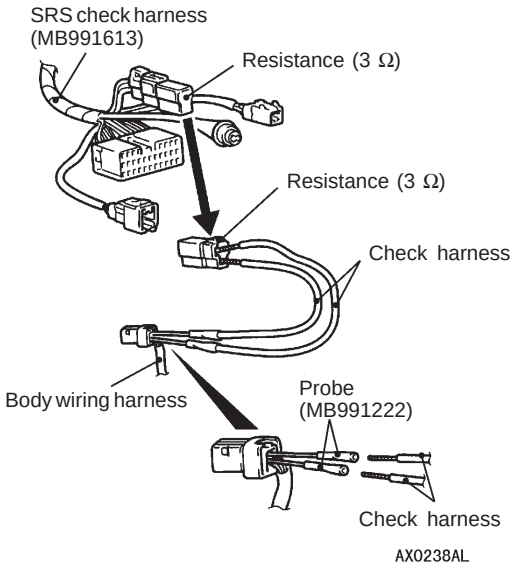
Replace the seat back assembly (R.H.)

Code No.79 or No.93 Side impact sensor (L.H.) communication system	Probable cause
These diagnosis code are output if communication between the side impact sensor (L.H.) and the SRS–ECU is not possible (code No.79) or abnormal (code No.93).	• Malfunction of wiring harnesses or connectors • Malfunction of side impact sensor (L.H.) • Malfunction of SRS-ECU



Code No.81, 82, 85, 86 Side air bag module (L.H.) (squib) system	Probable cause
Abnormal resistance is present between input terminals of SRS-ECU for side air bag module (L.H.) (squib). See table below for what each code tells. However, as for code Nos. 81 and 82, once trouble is extinguished, SRS warning lamp will go out. (Diagnosis code will remain stored)	• Defective wiring harnesses or connectors • Malfunction of side air bag module (L.H.) (squib) • Malfunction of SRS-ECU

Code No.	Trouble causes
81	• Short in side air bag module (L.H.) (squib) or harness short
82	• Open circuit in side air bag module (L.H.) (squib) or open harness • Poor connector contact
85	• Side air bag module (L.H.) (squib) harness short to power supply
86	• Side air bag module (L.H.) (squib) harness short to earth



MUT-II Self-diag code
- Disconnect the side air bag module (L.H.) connector D-32
- Insert the probe (MB991222) from the rear of the harness side connector and connect the check harness to the probe.

Caution
Never insert the probe directly to the terminals from the front of the connector.

- Disconnect the resistance connector from the SRS check harness (MB991613) and connect to the check harness.
- Connect the negative (–) battery terminal.
- Erase diagnosis code memory.

Is code No.81, 82, 85 or 86 displayed?

YES

Check the following connectors: D-32, D-36

OK

Check trouble symptoms.

NG

Check wiring harness between the side air bag module (L.H.) and SRS-ECU.

OK

Replace SRS-ECU.

NG

Repair

NG

Repair

NO

Replace the seat back assembly (L.H.)

Code No.89 or No.96 Side impact sensor (R.H.) communication system	Probable cause
These diagnosis codes are output if communication between the side impact sensor (R.H.) and the SRS–ECU is not possible (code No.89) or abnormal (code No.96)	• Malfunction of wiring harnesses or connectors • Malfunction of side impact sensor (R.H.) • Malfunction of SRS-ECU

MUT-II Self-diag code
- Switch over the side impact sensor (R.H.) and the side impact sensor (L.H.).
- Erase diagnosis code memory.

Are code Nos.89 and 96 erased and code Nos.79 and 93 output?

YES

Replace the side impact sensor (R.H.).

NO

Check the following connectors: D-10, D-36

OK

Check trouble symptoms.

NG

Repair

NG

Check the harness wire between the side impact sensor (L.H.) and SRS-ECU.

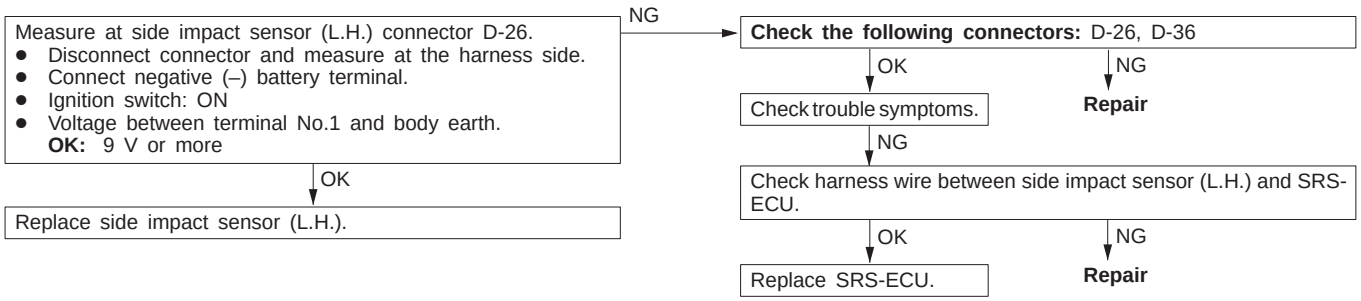
OK

Replace the SRS-ECU.

NG

Repair

Code No.91 Side impact sensor (L.H.) power supply circuit system	Probable cause
Power supply voltage of side impact sensor (L.H.) is lower than specified for five successive seconds or more. However, once trouble is extinguished, this code will be automatically erased, and SRS warning lamp will go out.	• Defective wiring harnesses or connectors • Malfunction of side impact sensor (L.H.) • Malfunction of SRS-ECU

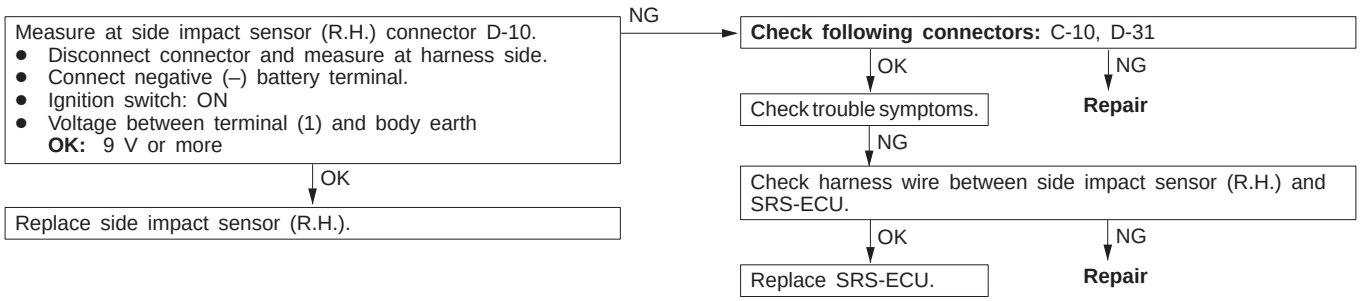


Code No.92, 95 Side impact sensor system	Probable cause
Code No.92 is displayed when malfunction is present inside side impact sensor (L.H.). Code No.95 is displayed when malfunction is present inside side impact sensor (R.H.). See INSPECTION CHART 6, below, for what each code tells.	• Malfunction of side impact sensor (L.H.) (Code No.92) • Malfunction of side impact sensor (R.H.) (Code No.95)

Code No.	Defective parts	Trouble
92	Side impact analog G-sensor	• Not working • Having abnormal • Having abnormal output
95		

Replace side impact sensor (L.H.) (code No.92).
Replace side impact sensor (R.H.) (code No.95).

Code No.94 Side impact sensor (R.H.) power supply circuit system	Probable cause
Power supply voltage of side impact sensor (R.H.) is lower than specified for successive five seconds or more. However, once trouble is extinguished, this code will be automatically erased, and SRS warning lamp will go out.	• Defective wiring harnesses or connectors • Malfunction of side impact sensor (R.H.) • Malfunction of SRS-ECU



INSPECTION CHART FOR TROUBLE SYMPTOMS

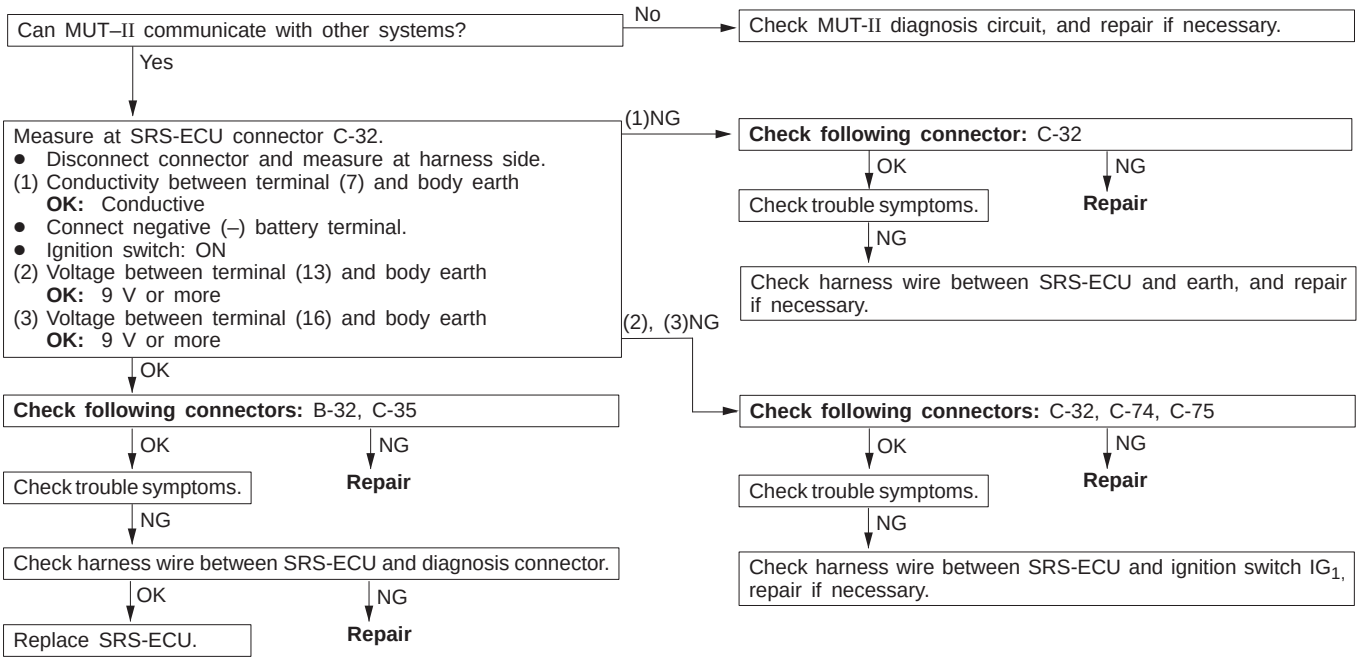
Get an understanding of the trouble symptoms and check according to the inspection procedure chart.

Trouble	Inspection procedure No(s).	Reference page
Communication with MUT-II is impossible.	1	52B-22
SRS warning lamp does not come on.	See diagnosis code No.43.	52B-17
SRS warning lamp does not go out.	See diagnosis code Nos.43, 44.	52B-17

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

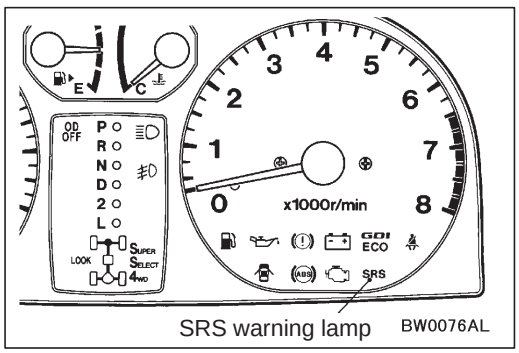
Inspection Procedure 1

Communication with MUT-II is impossible.	Probable cause
When communication with all systems is impossible, diagnosis circuit is suspected as faulty. When only communication with SRS air bags is impossible, open in diagnosis output circuit or power supply circuit including earth circuit may be present.	• Defective wiring harness(es) or connector(s) • Malfunction of SRS-ECU



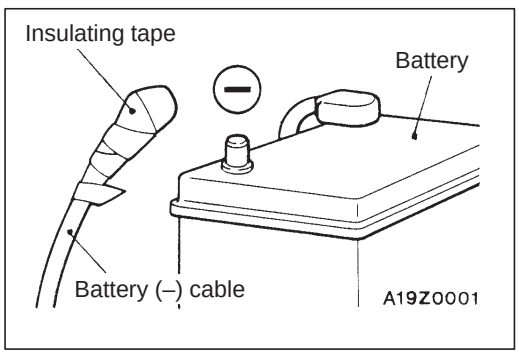
SRS MAINTENANCE

The SRS must be inspected by an authorized dealer 10 years after the date of vehicle registration.



SRS WARNING LAMP CHECK

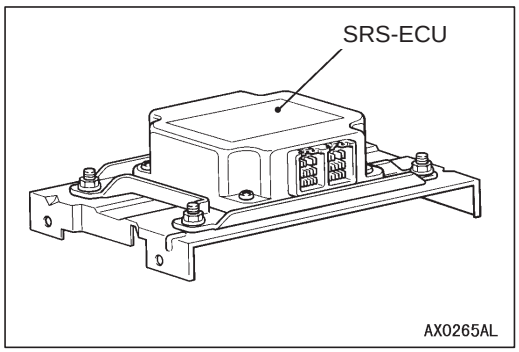
Turn the ignition switch to the “ON” position. Does the SRS warning lamp illuminate for about 7 seconds, turn off and then remain extinguished for at least 5 seconds? If yes, SRS system is functioning properly. If no, consult page 52B-8.



SRS COMPONENT VISUAL CHECK

Turn the ignition key to LOCK (OFF) position, disconnect the negative battery cable and tape the terminal.

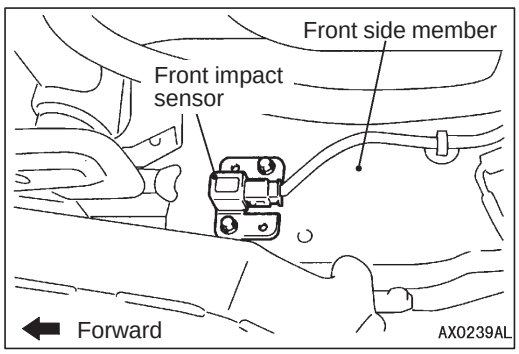
Caution
Wait at least 60 seconds after disconnecting the battery cable before doing any further work. (Refer to P.52B-4.)



SRS CONTROL UNIT (SRS-ECU)

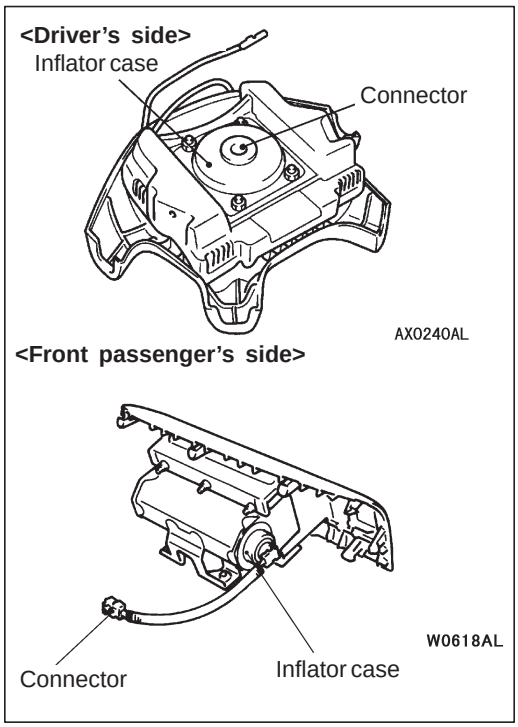
1. Check SRS-ECU case and brackets for dents, cracks, deformation or rust.

   Caution
   The SRS may not activate if the SRS-ECU is not installed properly, which could result in serious injury or death to the vehicle’s driver or front passenger.
2. Check connector for damage, and terminals for deformation or rust.
   Replace SRS-ECU if it fails visual check.
   (Refer to P.52B-34.)



FRONT IMPACT SENSORS

1. Check the front side member for deformation or rest.
2. Check the front impact sensor for dents, cracks, deformation or rust.
3. Check the sensor harnesses for binding, the connectors for damage, and the terminals for deformation.

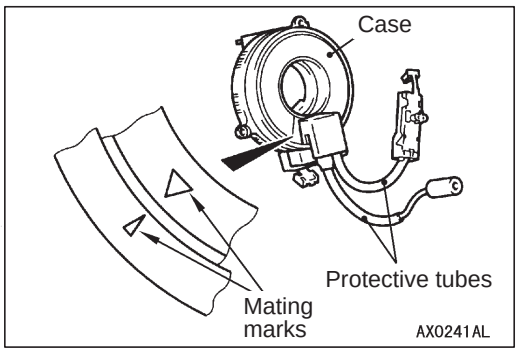


AIR BAG MODULES, STEERING WHEEL AND CLOCK SPRING

1. Remove the air bag modules, steering wheel and clock spring. (Refer to P.52B-36.)

   Caution
   The removed air bag modules should be stored in a clean, dry place with the cover face up.

2. Check cover for dents, cracks or deformation.
3. Check connector for damage, terminals deformities, and harness for binds.
4. Check air bag inflator case for dents, cracks or deformities.
5. Check harness and connectors for damage, and terminals for deformation.



6. Check clock spring connectors and protective tube for damage, and terminals for deformation.
7. Visually check the clock spring case for damage.
8. Align the mating marks of the clock spring and, after turning the vehicle's front wheels to straight-ahead position, install the clock spring to the column switch.

   Mating Mark Alignment

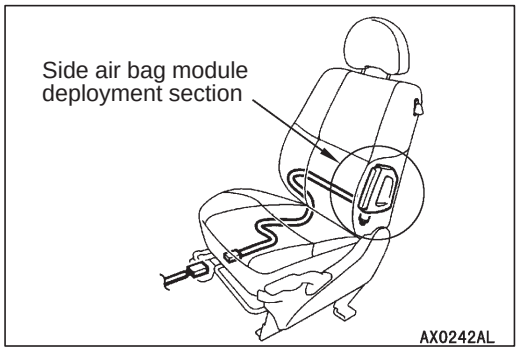
   Turn the clock spring clockwise fully, and then turn back it approx. 3 times counterclockwise to align the mating marks.

   Caution
   If the clock spring's mating mark is not properly aligned, the steering wheel may not be completely rotational during a turn, or the flat cable within the clock spring may be severed, obstructing normal operation of the SRS and possibly leading to serious injury to the vehicle's driver or front passenger.

9. Install the steering column covers, steering wheel and the air bag module.
10. Check steering wheel for noise, binds of difficult operation.

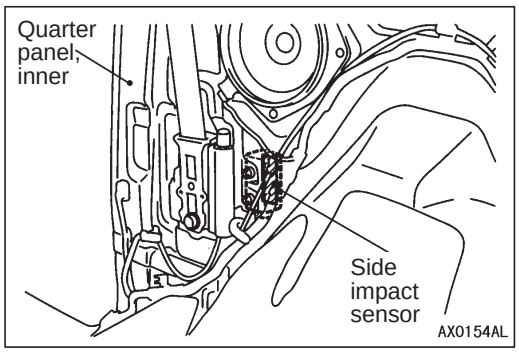
11. Check steering wheel for excessive free play.
    REPLACE ANY VISUALLY INSPECTED PART IF IT FAILS THAT INSPECTION. (Refer to P.52B-41.)

Caution
The SRS may not activate if any of the above components is not installed properly, which could result in serious injury or death to the vehicle's driver or front passenger.



FRONT SEAT BACK ASSEMBLY (SIDE AIR BAG MODULE)

1. Check that there is no abnormality in the seat air bag module deployment section.
2. Check that there is no connector damage, bent terminals or clamping of the harness.



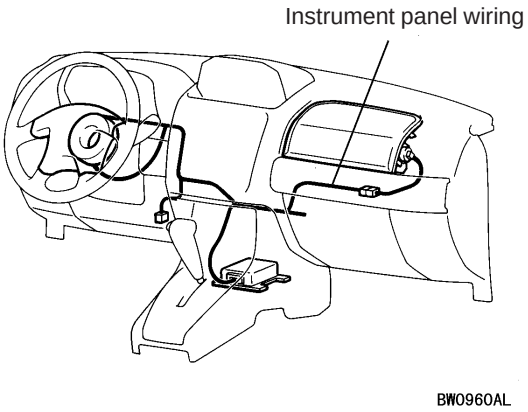
SIDE IMPACT SENSORS

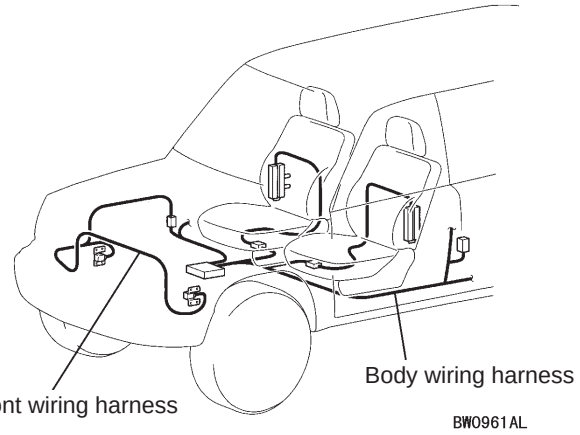
1. Check that there is no bending or corrosion in the quarter panel, inner.
2. Check that there is no denting, breakage, bending or corrosion of the side impact sensor.
3. Check that there is no clamping of the harness, connector damage or bent terminals.

NOTE
The illustration at left shows the side impact sensor (R.H.). The position of the side impact sensor (L.H.) is symmetrical to this.

Caution
The SRS may not activate if the side impact sensors are not installed properly, which could result in serious injury or death to the vehicle's driver or front passenger.

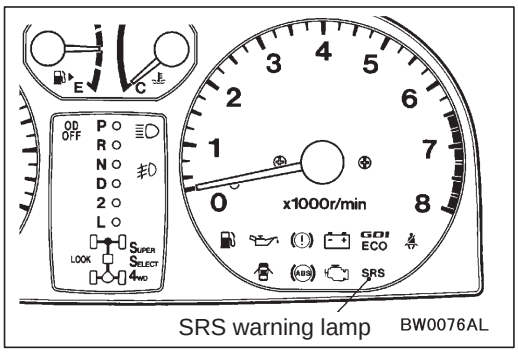
INSTRUMENT PANEL WIRING HARNESS/FRONT WIRING HARNESS/ASSIST WIRING HARNESS/BODY WIRING HARNESS





1. Check connector for poor connection.
2. Check harnesses for binds, connectors for damage, and terminals for deformation.
   REPLACE ANY CONNECTORS OR HARNESS THAT FAIL THE VISUAL INSPECTION. (Refer to P.52B-4.)

Caution
The SRS may not activate if SRS harnesses or connectors are damaged or improperly connected, which could result in serious injury or death to the vehicle's driver or front passenger.



POST-INSTALLATION INSPECTION

Reconnect the negative battery terminal. Turn the ignition switch to the "ON" position. Does the SRS warning lamp illuminate for about 7 seconds, turn off and then remain extinguished for at least 5 seconds? If yes, SRS system is functioning properly. If no, consult page 52B-8.

POST-COLLISION DIAGNOSIS

Whether or not the air bags have deployed, check and service the vehicle after collision as follows:

SRS-ECU MEMORY CHECK

1. Connect the MUT-II to the diagnosis connector. (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.)

   Caution
   Refer to that the ignition switch is LOCK (OFF) when connecting or disconnecting MUT-II.

2. Read (and write down) all displayed diagnosis codes. (Refer to P.52B-8.)

   NOTE
   If battery power supply has been shut down by the collision, the MUT-II cannot communicate with the SRS-ECU. Check and, repair if necessary, the instrument panel wiring harness before the next job.

3. Use the the MUT-II to read the data list (how long trouble(s) have continued and how often memory have been erased).

Data list

No	Service Data Item	Applicability
92	Number indication how often the memory is cleared.	Maximum time to be stored: 250
93	How long problem have lasted (How long it takes from the occurrence of the problem till the first air bag squib igniting signal)	Maximum time to be stored: 9,999 minutes (approximately 7 days)
94	How long problem(s) have lasted (How long it takes from the first air bag squib igniting signal till now.)	

4. Erase the diagnosis codes and after waiting 5 seconds or more read (and write down) all displayed diagnosis codes. (Refer to P.52B-8.)

REPAIR PROCEDURE

WHEN AIR BAGS (DRIVER'S SIDE AND FRONT PASSENGER'S SIDE) DEPLOY OR SEAT BELT PRE-TENSIONER OPERATES IN A COLLISION.

1. Replace the following parts with new ones.
   - SRS-ECU (Refer to P.52B-34.)
   - Driver's side air bag module (Refer to P.52B-36.)
   - Front passenger's side air bag module (Refer to P.52B-36.)
   - Front impact sensor (Refer to P.52B-32.)
   - Seat belt with pre-tensioner (Refer to P.52B-44.)

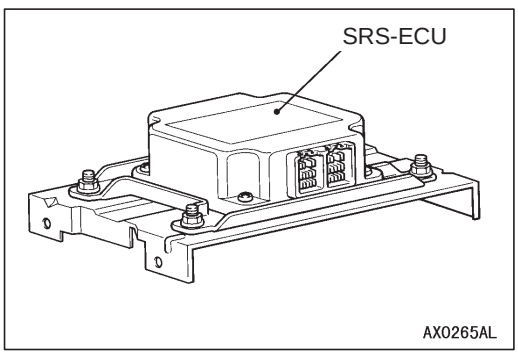
2. Check the following parts and replace if there are any malfunctions.
   - Clock spring (Refer to P.52B-36.)
   - Steering wheel, steering column and intermediate joint
     (1) Check wiring harness (built into steering wheel) and connectors for damage, and terminals for deformation.
     (2) Install air bag module to check fit or alignment with steering wheel.
     (3) Check steering wheel for noise, binds or difficult operation and excessive free play.
3. Check harnesses for binding, connectors for damage, poor connections, and terminals for deformation. (Refer to P.52B-4.)

DEPLOYED SIDE AIR BAGS

1. Replace the following parts with new ones:
   - SRS-ECU (Refer to P.52B-34.)
   - Side impact sensors (Refer to P.52B-46.)
   - Front seat back assemblies (Refer to P.52B-36.)
2. Check harnesses for binding, connectors for damage, poor connections, and terminals for deformation. (Refer to P.52B-4.)

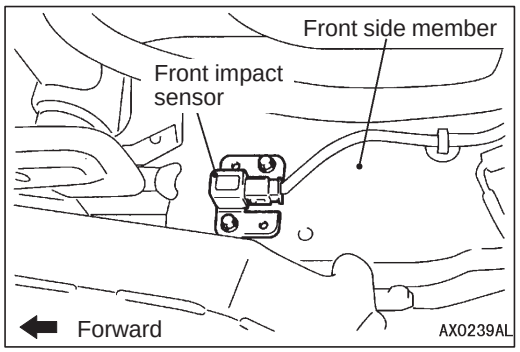
UNDEPLOYED AIR BAGS IN LOW-SPEED COLLISION

Check the SRS components. If visible damage such as dents, cracks, or deformation are found on the SRS components, replace them with new ones. Concerning parts removed for inspection, replacement with new parts and cautions in working, refer to INDIVIDUAL COMPONENT SERVICE, P.52B-30.



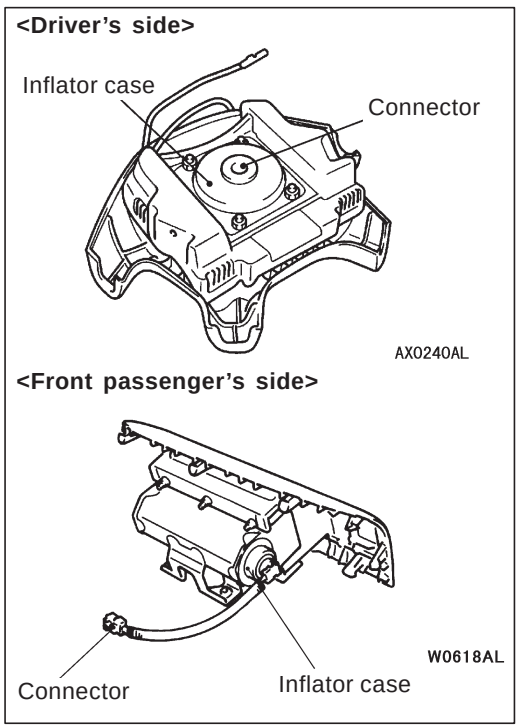
SRS-ECU

1. Check the SRS-ECU case and bracket for dents, cracks or deformation.
2. Check the connector for damage, and terminals for deformation.
3. Check the SRS-ECU and bracket for proper installation.



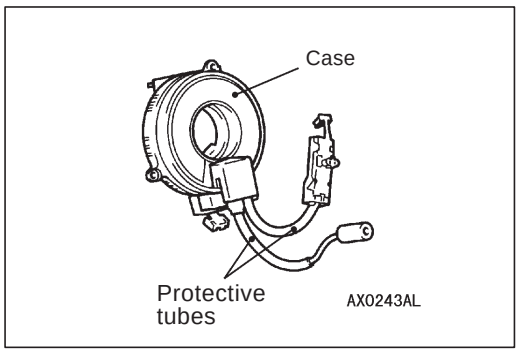
FRONT IMPACT SENSORS

1. Check the front side member for deformation or rest.
2. Check the front impact sensor for dents, cracks, deformation or rust.
3. Check the sensor harnesses for binding, the connectors for damage, and the terminals for deformation.



Driver's and passenger's air bag modules

1. Check the covers for dents, cracks or deformation.
2. Check the connectors for damage, the terminals deformities, and the harness for binds.
3. Check the air bag inflator cases for dents, cracks or deformities.
4. Check the air bag modules for proper installation.



Clock spring

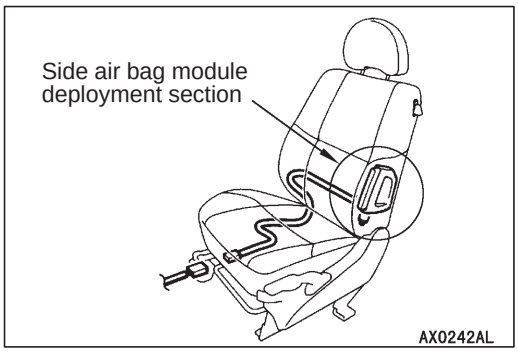
1. Check the clock spring connectors and protective tubes for damage, and terminals for deformation.
2. Visually check the case for damage.

Steering wheel, steering column and intermediate joint

1. Check the driver's air bag module for proper installation to the steering wheel.
2. Check the steering wheel for noise, binds or difficult operation and excessive free play.

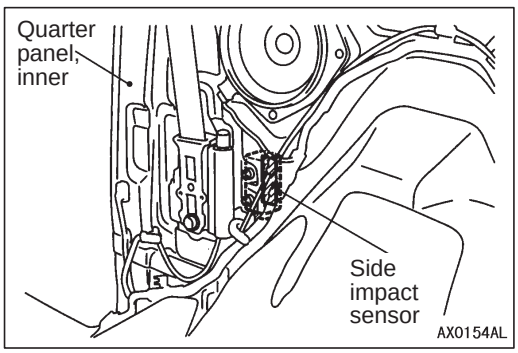
Harness connector (Instrument panel wiring harness)

Check the harness for binds, the connector for damage and the terminals for deformation. (Refer to P.52B-4.)



Front seat back assembly (side air bag module)

1. Check the side air bag module deployment section in the seat for dents and deformation.
2. Check the harness for binds, the connector for damage and the terminals for deformation.



Side impact sensor

1. Check the quarter panel, inner for deformation or rust.
2. Check the side impact sensors for dents, cracks, deformation and rust.
3. Check the connector for damage and the terminals for deformation.

NOTE
The figures show side impact sensors (L.H.).

Harness connector (Instrument panel wiring harness and side air bag wiring harness)

Check the harness for binds, the connector for damage and the terminals for deformation. (Refer to P.52B-4.)

Seat belt with pre-tensioner

1. Check the seat belt for damage or deformation.
2. Check the pre-tensioner for cracks or deformation.
3. Check that the unit is installed correctly to the vehicle body.

INDIVIDUAL COMPONENT SERVICE

If the SRS components and seat belt with pre-tensioner are to be removed or replaced as a result of maintenance, troubleshooting, etc., follow each procedure (P.52B-32 – P.52B-47.)

Caution

1. SRS components and seat belt with pre-tensioner should not be subjected to heat, so remove the front impact sensor, SRS-ECU, air bag modules (driver's side and front passenger's side), front seat assemblies (side air bag module), clock spring, side impact sensors and seat belts with pre-tensioner before drying or baking the vehicle after painting.
- **Front impact sensor, SRS-ECU, Air bag module, clock spring, side impact sensor: 93°C or more**
- **Seat belt with pre-tensioner: 90°C or more**

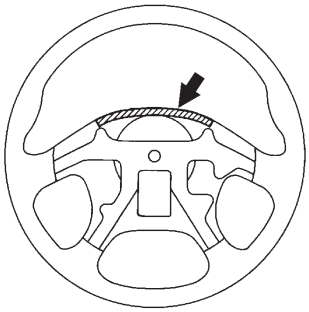
Recheck SRS system operability after re-installing them.

2. If the SRS components and seat belts with pre-tensioner are removed for the purpose of check, sheet metal repair, painting, etc., they should be stored in a clean, dry place until they are reinstalled.

WARNING/CAUTION LABELS

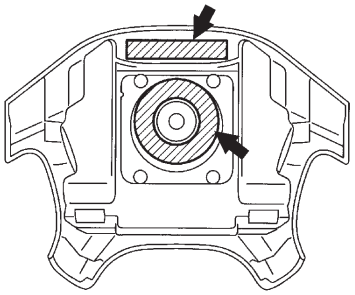
Caution labels on the SRS are attached in the vehicle as shown. Follow label instructions when servicing the SRS. If the label(s) are dirty or damaged, replace with new one(s).

Steering wheel



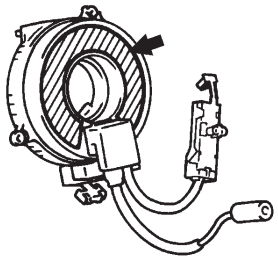
BW0968AL

Driver's air bag module



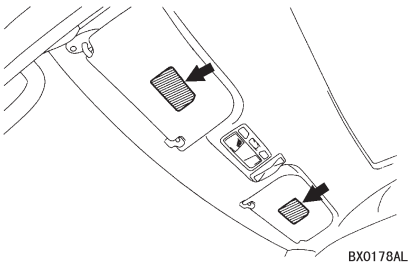
BW0969AL

Clock spring



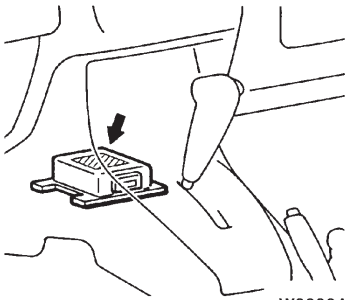
BW0965AL

Sun visor



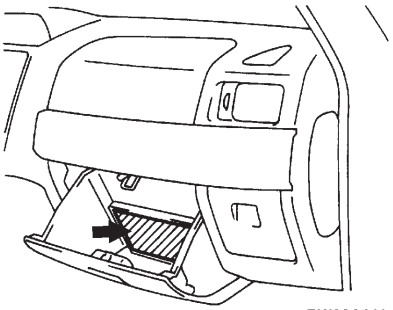
BX0178AL

SRS-ECU



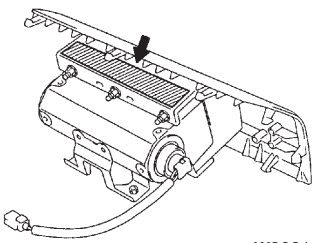
W0202AL

Glove box



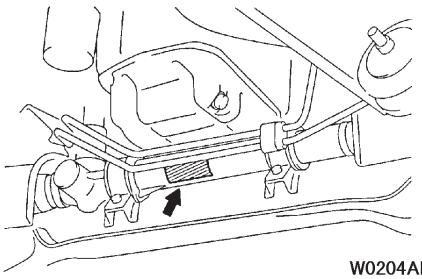
BW0964AL

Front passenger's air bag module



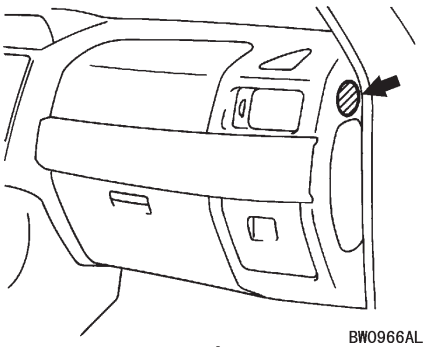
W0201AL

Steering gear box



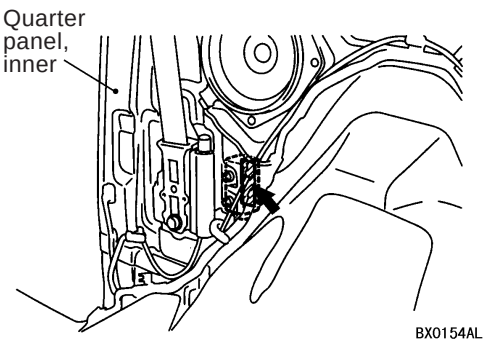
W0204AL

Instrument panel



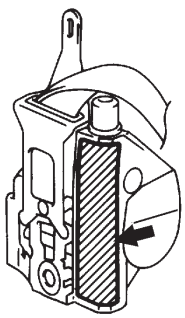
BW0966AL

Side impact sensor



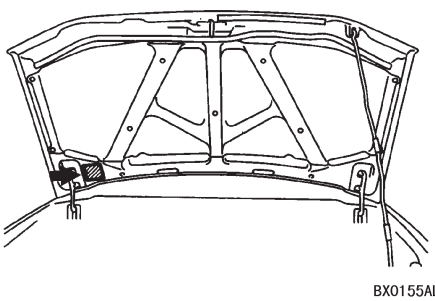
BX0154AL

Seat belt with pre-tensioner



BW0967AL

Hood



BX0155AL

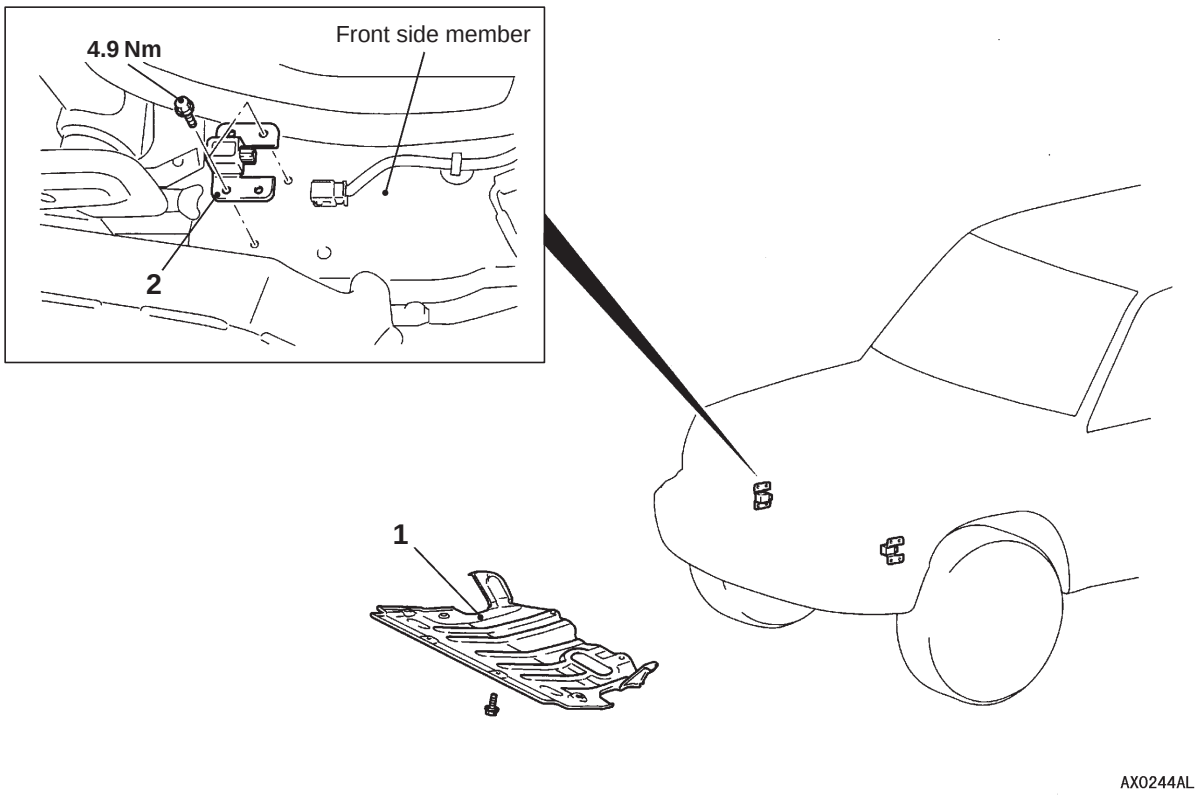
FRONT IMPACT SENSORS

Caution

1. **Disconnect the battery (–) terminal and wait for 60 seconds or more before starting work. Furthermore, the disconnected battery terminal should be covered with tape to insulate it. (Refer to P.52B-4.)**
2. **Never attempt to disassemble or repair the front impact sensor. If faulty, replace it.**
3. **Do not drop or subject the front impact sensor to impact or vibration. If denting, cracking, deformation, or rust are discovered in the front impact sensor, replace it with a new front impact sensor. Discard the old one.**
4. **After deployment of an air bag, replace the front impact sensor with a new one.**

REMOVAL AND INSTALLATION

Pre-removal Operation
- Turn Ignition Key to LOCK (OFF) position.
- Disconnect the Negative (–) Battery Terminal.



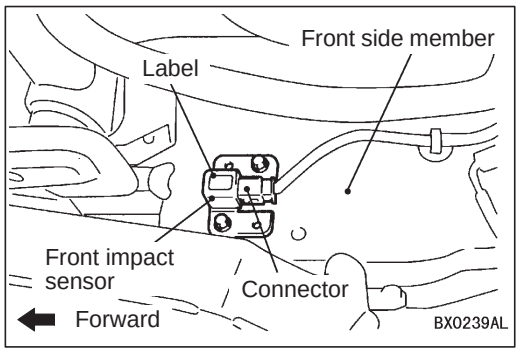
Removal steps
1. Under cover
2. Front impact sensor

Installation steps
- ▶A◀ Pre-installation inspection
- ▶B◀ 2. Front impact sensor
- 1. Under cover
- Negative (–) battery cable connection
- ▶C◀ Post-installation inspection

INSTALLATION SERVICE POINTS

▶A◀ PRE-INSTALLATION INSPECTION

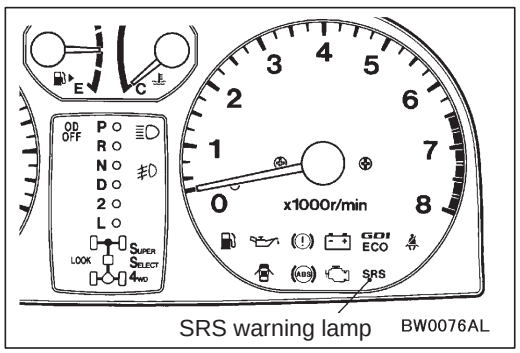
To mount the new front impact sensor, visually check it and measure the resistance between the terminals. (Refer to the previous item “INSPECTION”)



▶B◀FRONT IMPACT SENSOR INSTALLATION

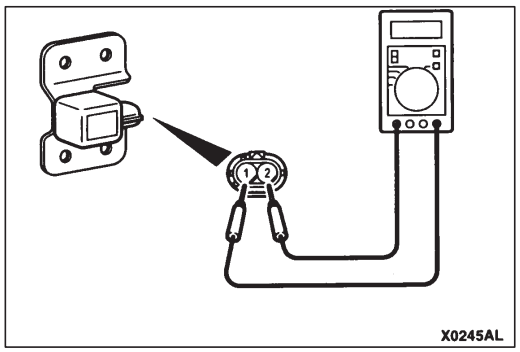
1. Securely connect the connector.
2. Position the front impact sensor facing toward the front of the vehicle as shown by the arrow on the label, and install it securely.

Caution
The SRS may not activate properly if a front impact sensor is not installed properly, which could result in serious injury or death to the vehicle's driver.



▶C◀ POST-INSTALLATION INSPECTION

1. Reconnect the negative battery terminal.
2. Turn the ignition key to the "ON" position.
3. Does the "SRS" warning lamp illuminate for about 7 seconds, and then remain extinguished for at least 5 seconds after turning OFF?
4. If yes, SRS system if functioning properly.
   If no, consult page 52B-8.



INSPECTION

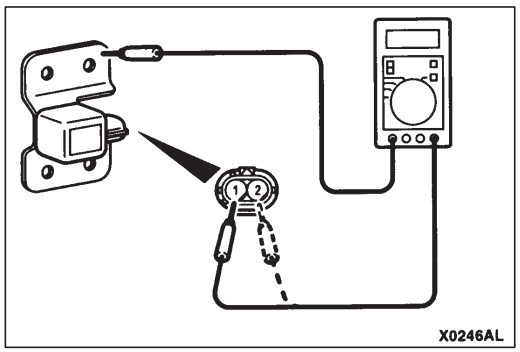
1. Check the front impact sensor for dents, cracks, deformation or rust.

   Caution
   If a dent, crack, deformation or rust is detected, replace with a new sensor.

2. Measure the resistance between terminals and check whether it is within the standard value.

   Standard value: 820 ± 82 Ω

   Caution
   Always replace the sensor with a new one if the resistance is not within the standard value.



3. Check front side member for deformation or rust.
4. Check the continuity between the terminal and bracket. If there is a continuity, the insulation is malfunctioned, and replace the sensor with a new one.

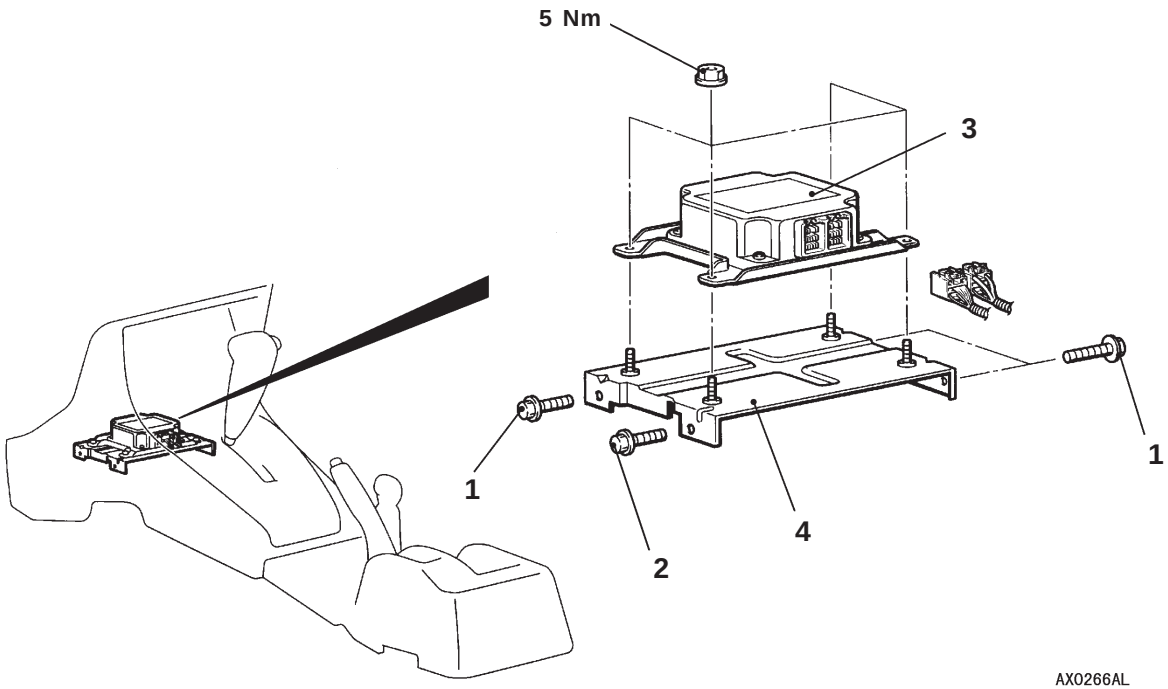
SRS AIR BAG CONTROL UNIT (SRS-ECU)

Caution

1. **Disconnect the negative (–) battery terminal and wait for 60 seconds or more before starting work. Also, the disconnected battery terminal should be insulated with tape. (Refer to P.52B-4.)**
2. **Never attempt to disassemble or repair the SRS-ECU. If faulty, just replace with a new one.**
3. **Do not drop or subject the SRS-ECU to impact or vibration.**
   If denting, cracking, deformation, or rust are found in the SRS-ECU, replace it with a new one. Discard the old one.
4. **After deployment of the air bags, replace the SRS-ECU with a new one.**
5. **Never use an ohmmeter on or near the SRS-ECU, and use only the special test equipment described on P.52B-7.**

REMOVAL AND INSTALLATION

Pre-removal Operation
- Turn Ignition Key to LOCK (OFF) Position.
- Disconnect the Negative (–) Battery Terminal.



Removal steps
- Floor console (Refer to GROUP 52A.)

1. Bracket mounting bolts
2. Bracket mounting bolt (Earth bolt)
3. SRS-ECU
4. SRS-ECU bracket

Installation steps

4. SRS-ECU bracket

▶A◀ 3. SRS-ECU

▶B◀ 2. Bracket mounting bolt (Earth bolt)

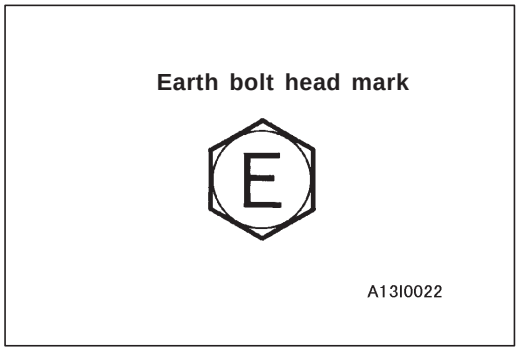
1. Bracket mounting bolt
- Floor console (Refer to GROUP 52A.)
- Negative (–) battery cable connection

▶C◀ • Post-installation inspection

INSTALLATION SERVICE POINTS

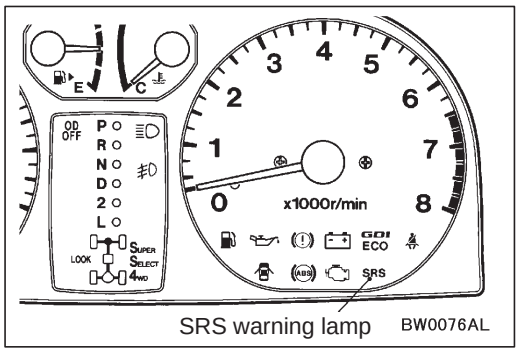
▶A◀ SRS-ECU INSTALLATION

Caution
Be sure to install the SRS-ECU properly. Otherwise, the SRS air bags do not activate, which results in serious injury or death of vehicle's occupants.



▶B◀ BRACKET MOUNTING BOLT (EARTH BOLT) INSTALLATION

Before installation, Refer to that the bolt is stamped mark "E" on the head.



▶C◀ POST-INSTALLATION CHECK

1. Turn the ignition switch to ON.
2. Does the SRS warning lamp illuminate for about 7 seconds and then go out for more than 5 seconds?
3. Yes: The SRS warning lamp is working properly
   No: Go to Troubleshooting. (Refer to P.52B-8.)

INSPECTION

1. Check the SRS-ECU and brackets for dents, cracks or deformation.
2. Check connector for damage, and terminals for deformation.

Caution
If a dent, crack, deformation or rust are present, replace the SRS-ECU with a new one.

NOTE
To check the SRS-ECU in other items than described above, go to Troubleshooting. (Refer to P.52B-8.)

AIR BAG MODULES AND CLOCK SPRING

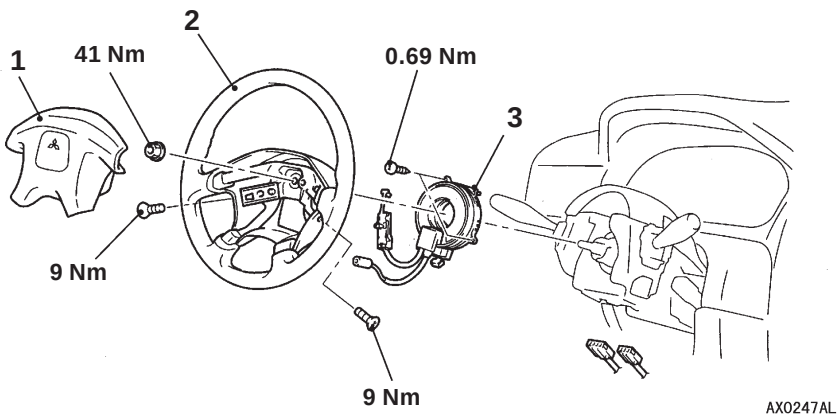
Caution

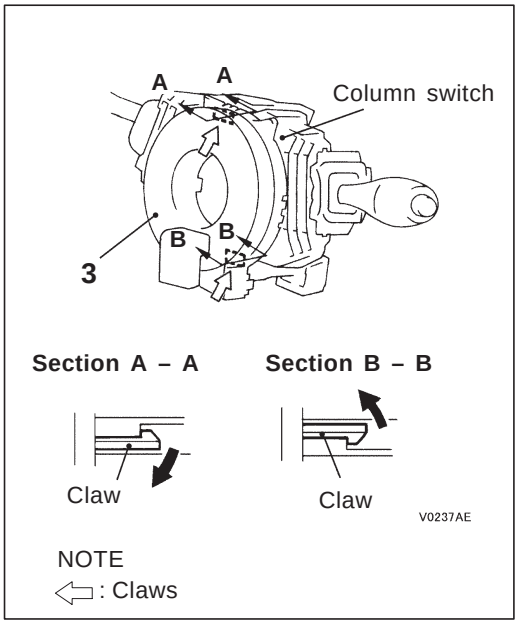
1. **Disconnect the negative (–) battery terminal and wait for 60 seconds or more before starting work. Also, the disconnected battery terminal should be insulated with tape. (Refer to P.52B-4.)**
2. **Never attempt to disassemble or repair the air bag modules and clock spring.**
   If faulty, just replace with new one(s).
3. **Do not drop the air bag modules or clock spring or allow contact with water, grease or oil.**
   Replace if a dent, crack, deformation or rust are present.
4. **Store the air bag modules on a flat surface with the deployment surface facing up.**
   Do not place anything on top of them.
5. **Do not store the air bag modules in a place more than 93°C.**
6. **When the driver's and front passenger's air bags have been deployed, replace the driver's and passenger's air bag modules with new ones.**
7. **Put on gloves and safety glasses when handling deployed air bags.**
8. **When discarding the undeployed air bag module(s), be sure to deploy the air bag(s) in advance as specified in the service procedure.**
   (Refer to to P.52B-48.)

REMOVAL AND INSTALLATION

<Driver's air bag module, clock spring>

Pre-removal Operation
- Put Steering Wheel and Front Wheels in Straight-ahead Position. Remove Ignition Key.
- Disconnect the Negative (–) Battery Terminal.





Driver's air bag module removal steps

◀A▶ 1. Driver's air bag module
◀B▶ 2. Steering wheel

Clock spring removal steps

◀A▶ 1. Drive's air bag module
◀B▶ 2. Steering wheel
- Lower column cover

◀C▶ 3. Clock spring

Driver's air bag module installation steps

▶A◀ • Pre-installation inspection
▶C◀ 2. Steering wheel
1. Driver's air bag module
- Negative (–) battery cable connection

▶D◀ • Post-installation check

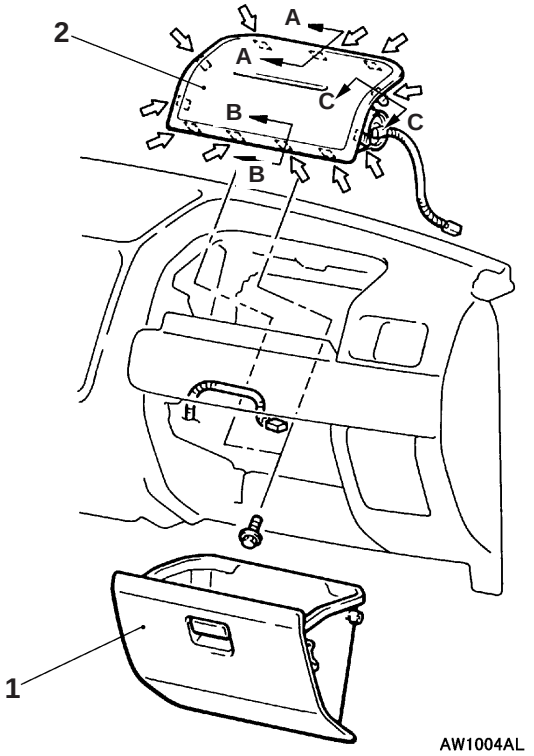
Clock spring installation steps

▶A◀ • Pre-installation check
▶B◀ 3. Clock spring
- Lower column cover

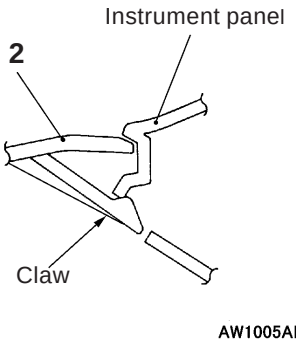
▶C◀ 2. Steering wheel
1. Driver's air bag module
- Negative (–) battery cable connection

▶D◀ • Post-installation inspection

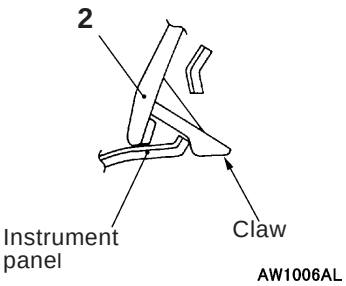
<Front passenger's air bag module>



Sections A – A and C – C



Section B – B



NOTE

⇦ : Claws

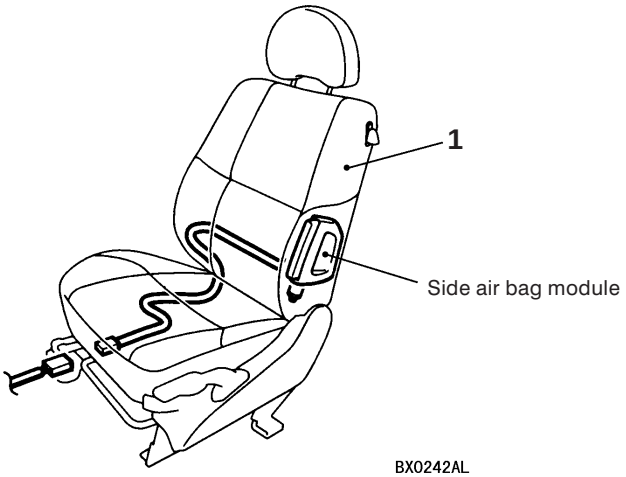
Removal steps

1. Glove box
◀D▶ 2. Passenger's air bag module

Installation steps

▶A◀ ● Pre-installation inspection
2. Passenger's air bag module
1. Glove box
● Negative (–) battery cable connection
▶D◀ ● Post-installation inspection

<Front seat back assembly with side air bag module (Vehicles with side air bag)>

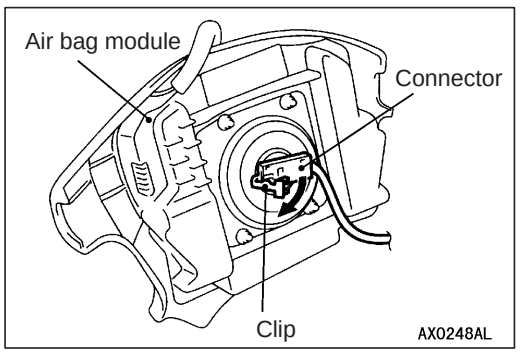


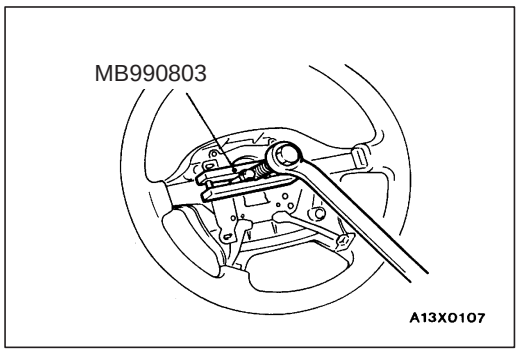
Removal

◀E▶ 1. Front seat back assembly

Installation steps

▶A◀ ● Pre-installation inspection
1. Front seat back assembly
● Negative (–) battery cable connection
▶D◀ ● Post-installation inspection





REMOVAL SERVICE POINTS

◀A▶ DRIVER'S AIR BAG MODULE REMOVAL

After removing the clip shown in the illustration, disconnect the connector.

Caution

1. The air bag module must not be measured with such equipment as an ohmmeter, nor disassembled.
2. The removed air bag module should be stored in a clean, dry place with the deployment surface facing up.

◀B▶ STEERING WHEEL REMOVAL

Caution

Do not hammer on the steering wheel. Doing so may damage the collapsible column mechanism.

◀C▶ CLOCK SPRING REMOVAL

Caution

The removed clock spring should be stored in a clean, dry place.

◀D▶PASSENGER'S AIR BAG MODULE REMOVAL

Caution
The removed air bag module should be stored in a clean, dry place with the deployment surface facing up.

◀E▶FRONT SEAT BACK ASSEMBLY REMOVAL

Refer to GROUP 52A – Seat.

Caution
1. **When the side air bag module is required replacing, replace the front seat back assembly.**
2. **The removed front seat back assembly should be stored in clean, dry place with its back touching the ground.**

INSTALLATION SERVICE POINTS

▶A◀ PRE-INSTALLATION INSPECTION

1. Even new air bag modules and a clock spring require inspection before installation. (Refer to P.52B-41.)

   Caution
   When discarding the air bag module or seat back assembly, deploy the air bag as specified in the service procedure. (Refer to P.52B-48.)

2. Connect the negative (–) battery terminal.
3. Connect the MUT-II to the diagnosis connector (16-pin).

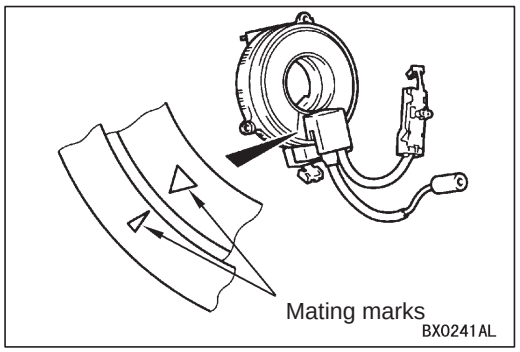
   Caution
   Turn the ignition switch to LOOK (OFF) position when connecting and disconnecting the MUT-II.

4. Turn the ignition switch to ON.
5. Read a diagnostic code to Refer to that the SRS is operating properly except an open in the air bag module circuit.
6. Turn the ignition switch to LOCK (OFF) position. Disconnect the negative (–) battery cable and insulate with tape.

   Caution
   Wait at least 60 seconds after the disconnection of the battery cable before any further job. (Refer to P.52B-4.)

▶B◀ CLOCK SPRING INSTALLATION

Align the mating marks on the clock spring as mentioned in the next step. Then, after putting the front wheels in straight-ahead position, install the clock spring to the column switch.



Clock Spring Centring

Fully turn the clock spring clockwise and then turn it back about 3 times counterclockwise to align the mating marks.

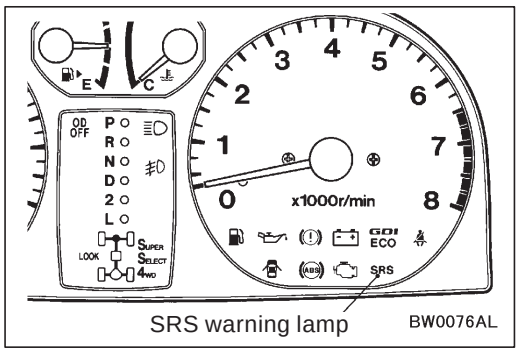
Caution
Unless the mating marks are properly aligned, the steering wheel gets stuck amid a turn or the flat cable in the clock spring is cut. These hinder the SRS air bag from proper operation, resulting in serious injury to the vehicle's driver.

▶C◀ STEERING WHEEL INSTALLATION

1. Refer to first that the clock spring has been centred properly. Then, install the steering wheel.

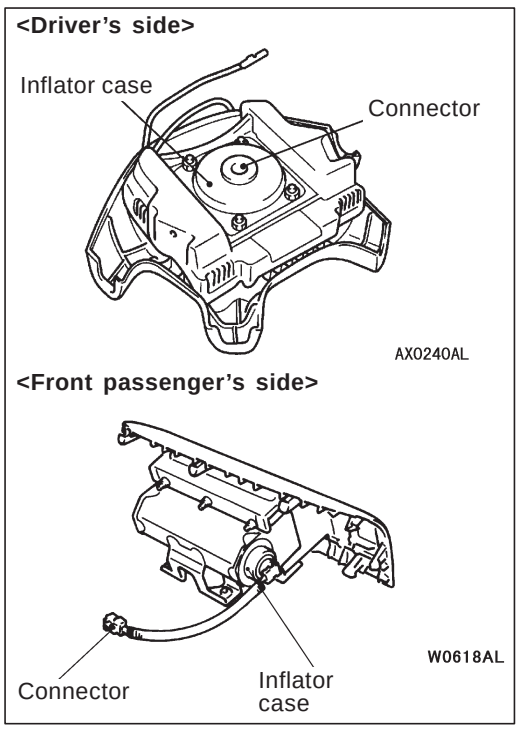
   Caution
   Be sure, when installing the steering wheel, not to have the clock spring harness caught or tangled.

2. After the installation, check the steering wheel for proper operation by turning it fully right and left.



▶D◀ POST-INSTALLATION CHECK

1. Lightly turn the steering wheel right and left to Refer to that noise and malfunction are not present.
2. Turn the ignition switch to "ON".
3. Does the SRS warning lamp illuminate for about 7 seconds and then go out for 5 seconds or more?
4. Yes: The SRS is working properly.
   No: Go to Troubleshooting (Refer to P.52-8.)



INSPECTION

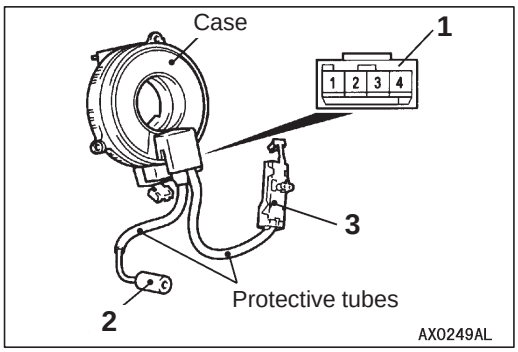
DRIVER'S AND PASSENGER'S AIR BAG MODULE INSPECTION

If any malfunction is found in the following inspection, replace the air bag module(s) with new one(s).
Discard the old one(s) after deployment as specified in the service procedure. (Refer to P.52B-48.)

Caution
Never measure circuit resistance in the air bag modules (squib) even with the specified tester. Measuring the circuit resistance with a tester causes accidental air bag deployment due to current that flows or static, resulting in serious personal injury.

1. Check the cover for dents, cracks or deformation.
2. Check the connectors for damage, terminals for deformation, and harness for binds.
3. Check the air bag inflator cases for dents, cracks or deformation.
4. Install the driver's air bag module to the steering wheel and check fit or alignment with the steering wheel.
5. Install the front passenger's air bag module to instrument panel and crossmember and check fit and alignment.

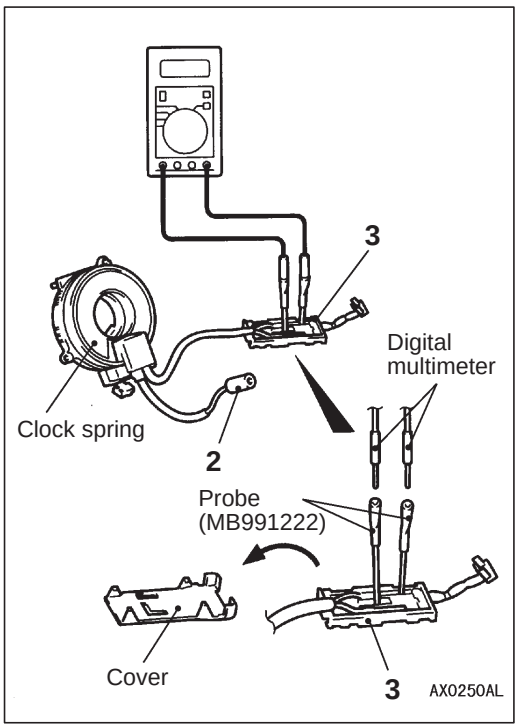
Caution
If dents, cracks, deformation, or rust are present in the air bag module(s), replace with new one(s). Discard the old one(s) as specified in the service procedure. (Refer to P.52B-48.)



CLOCK SPRING CHECK

If any malfunction is found in the following inspections, replace the clock spring with a new one.

1. Check the connectors and protective tubes for damage, and terminals for deformation.
2. Visually check the case for damage.
3. Refer to that the clock spring has continuity between connector No.2 and terminal No.4 of connector No.1.

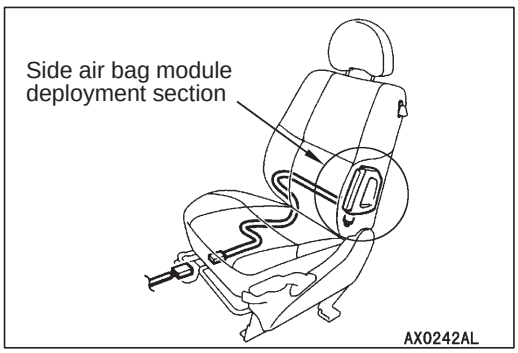


4. Remove the cover from the No. 3 connector of the clock spring, and then insert the probes (MB991222).

   Caution
   The probe must not be inserted directly to the terminals from the front of the connector.

5. Connect a digital multimeter to the probe (MB991222), as shown, to check that.

   Standard value: 0.62 ± 0.12 Ω



FRONT SEAT BACK ASSEMBLY WITH SIDE AIR BAG MODULE

If any malfunction is found in the following inspections, replace the front seat back assembly.
To discard the removed front seat back assembly, deploy the side air bag first as specified in the service procedure. (Refer to P.52B-48.)

Caution
Never measure circuit resistance in the air bag modules (squib) even with the specified tester. Measuring the circuit resistance with a tester causes accidental air bag deployment due to current that flows or static, resulting in serious personal injury.

1. Check the side air bag module deployment section for dents and deformation.
2. Check the harness and connector for damage and the terminals for deformation.

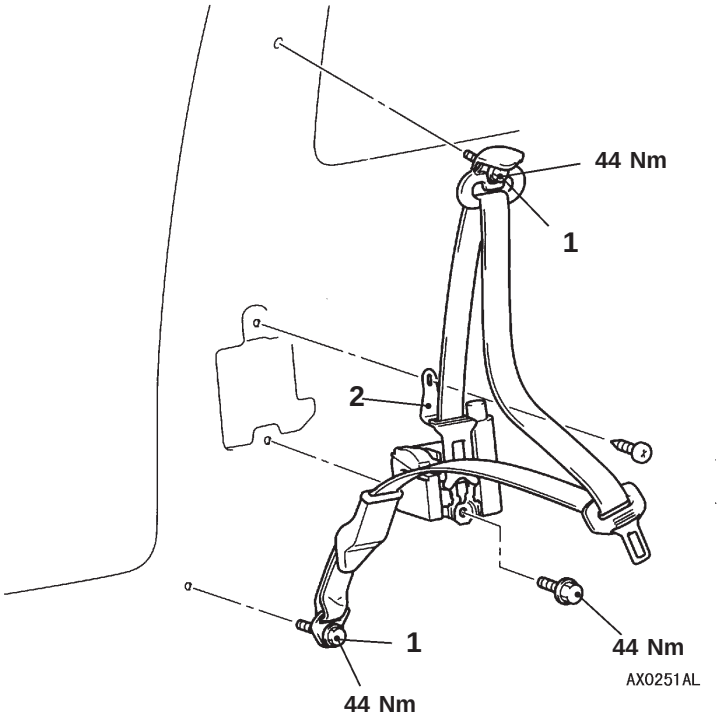
SEAT BELT WITH PRE-TENSIONER

Caution

1. **Never attempt to disassemble or repair the seat belt with pre-tensioner. If faulty, replace it.**
2. **Be extremely careful when handling the seat belt with pre-tensioner. Do not subject it to shocks, drop it, bring it close to strong magnets or allow contact with water, grease or oil. Always replace it with a new part if any dents, cracks or deformation is found.**
3. **Do not place anything on top of the seat belt pre-tensioner.**
4. **Do not expose the seat belt with pre-tensioner to temperatures over 90°C.**
5. **After operating the seat belt pre-tensioner, replace the seat belt pre-tensioner with a new part.**
6. **Gloves and protective goggles should be worn when handling a pre-tensioner once it has been used.**
7. **If disposing of a seat belt with pre-tensioner which has not yet been used, its pre-tensioner should be operated first before disposal. (Refer to P.52B-48.)**

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Turn Ignition Key to LOCK (OFF) Position
- Disconnect the Negative (–) Battery Terminal.



Removal steps

1. Outer seat belt connection
- Quarter Trim (Refer to GROUP 52A.)
2. Seat belt with pre-tensioner

Installation steps

▶A◀ - Post-installation inspection
2. Seat belt with pre-tensioner
- Quarter Trim (Refer to GROUP 52A.)
1. Outer seat belt connection
- Negative (–) battery cable connection

▶B◀ - Pre-installation inspection

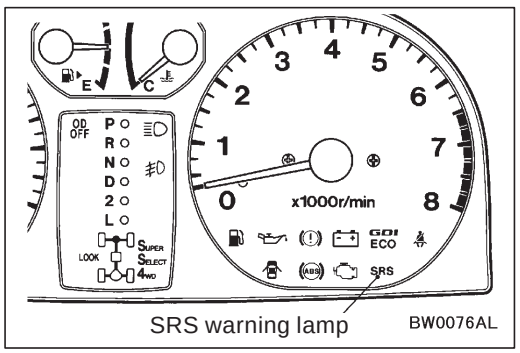
NOTE
The figure shows the seat belt with pre-tensioner (R.H.)

INSTALLATION SERVICE POINTS

▶A◀ PRE-INSTALLATION INSPECTION

When installing a new seat belt with pre-tensioner refer to “INSPECTION”.

Caution
Disposal of the pre-tensioner must be carried out as stated in the procedure. (Refer to P.52B-48.)



SRS warning lamp BW0076AL

▶B◀ POST-INSTALLATION INSPECTION

1. Reconnect the negative battery terminal.
2. Turn the ignition key to the “ON” position.
3. Does the “SRS” warning lamp illuminate for about 7 seconds, and then remain extinguished for at least 5 seconds after turning OFF?
4. If yes, SRS system is functioning properly. If no, consult page 52B-8.

INSPECTION

SEAT BELT WITH PRE-TENSIONER CHECK

If any part is found to be faulty during the inspection, it must be replaced with a new one.
Dispose of the old one according to the specified procedure. (Refer to P.52B-48.)

- Check seat belt pre-tensioner for dents, cracks or deformation.

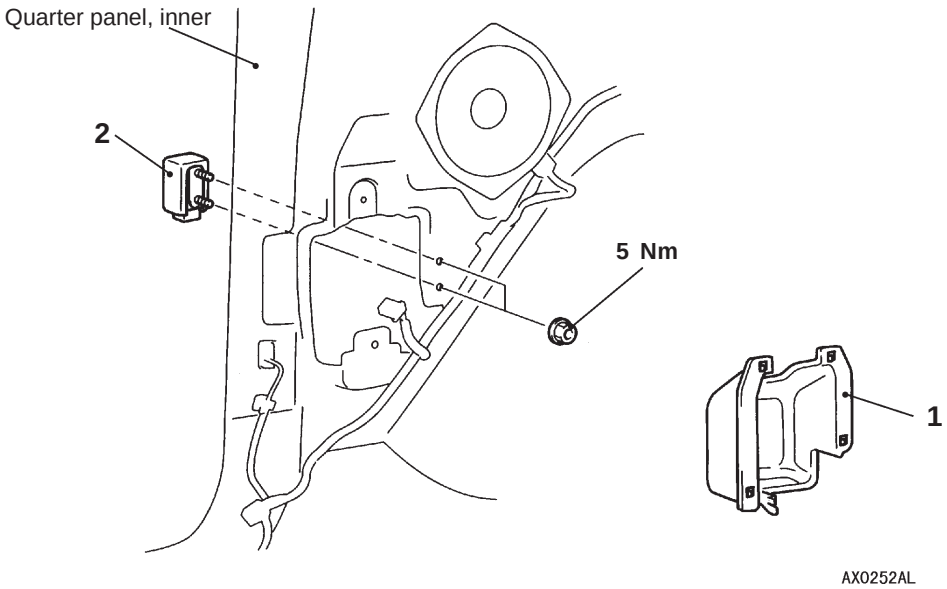
SIDE IMPACT SENSOR

Caution

1. **Disconnect the negative (–) battery terminal and wait for 60 seconds or more before starting work. Also, the disconnected battery terminal should be insulated with tape. (Refer to P.52B-4.)**
2. **Never attempt to disassemble or repair the side impact sensors. If faulty, just replace with new ones.**
3. **Do not drop or subject the side impact sensors to impact or vibration. If denting, cracking, deformation, or rust are found in the side impact sensors, replace it with new ones. Discard the old ones.**
4. **After deployment of the air bags, replace the side impact sensors with new ones.**
5. **Never use an ohmmeter on or near the side impact sensors, and use only the special test equipment described on P.52B-7.**

REMOVAL AND INSTALLATION

Pre-removal Operation
- Turn Ignition Switch to LOCK (OFF) Position.
- Disconnect the Negative (–) Battery Terminal.



Removal steps
- Front seat belt (Refer to GROUP 52A.)

1. Front noise protector
2. Side impact sensor

Installation steps

▶A◀
- Pre-installation inspection

▶B◀

2. Side impact sensor

1. Front noise protector
- Front seat belt (Refer to GROUP 52A.)
- Negative (–) battery cable connection

▶C◀
- Post-installation inspection

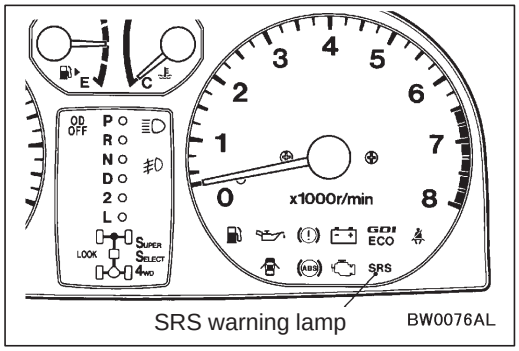
NOTE
The figure shows the side impact sensor (R.H.).

▶A◀ PRE-INSTALLATION INSPECTION

Even new side impact sensor requires inspection before installation. (Refer to Inspection.)

▶B◀ SIDE IMPACT SENSOR INSTALLATION

Caution
The side impact sensor, unless properly installed, does not operate properly, thereby resulting in serious injury or death of the vehicle's occupants.



▶C◀ POST-INSTALLATION INSPECTION

1. Turn the ignition switch to ON.
2. Does the SRS warning lamp illuminate for about 7 seconds and go off for 5 seconds or more?
3. YES: The system is working properly.
   NO: Go to Troubleshooting. (Refer to P.52B-8.)

INSPECTION

If any malfunction is found in the following inspections, replace the side impact sensor(s) with new one(s).

1. Check the side impact sensors for dents, cracks, deformation and rust.
2. Check the connector for damage and the terminals for deformation.
3. Check the center pillar or quarter panel, inner for deformation and rust.

NOTE
For other inspections than described above, go to Troubleshooting. (P.52B-8.)

AIR BAG MODULE AND SEAT BELT PRE-TENSIONER DISPOSAL PROCEDURES

Before disposing of a vehicle which is equipped with air bags or seat belts with pre-tensioner, or when disposing of the air bags or seat belt pre-tensioner themselves, the following procedures must be used to deploy the air bags or operate the seat belt pre-tensioners before disposal.

UNDEPLOYED AIR BAG MODULE AND SEAT BELT PRE-TENSIONER DISPOSAL

Caution

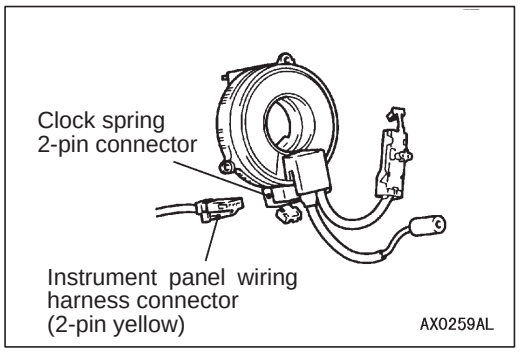
1. **If the vehicle is to be scrapped or otherwise disposed of, deploy the air bags inside the vehicle, and operate the seat belt pre-tensioners outside the vehicle. If the vehicle will continue to be operated and only the air bag modules and seat belt pre-tensioner are to be disposed of, deploy the air bags and operate the seat belt pre-tensioners outside the vehicle.**
2. **Since a large amount of smoke is produced when the air bag are deployed or the seat belt pre-tensioner is operated, avoid residential areas whenever possible.**
3. **Since there is a loud noise when the air bags are deployed and when the seat belt pre-tensioners are operated, avoid residential areas whenever possible. If anyone is nearby, give warning of the impending noise.**
4. **Suitable ear protection should be worn by personnel performing these procedures or by people in the immediate area.**

DEPLOYMENT INSIDE THE VEHICLE

1. Move the vehicle to an isolated spot.
2. Disconnect the negative (–) and positive (+) battery cables from the battery terminals, and then remove the battery from the vehicle.

   Caution
   Wait at least 60 seconds after disconnecting the battery cables before doing any further work.
   (Refer to P.52B-4.)

3. Deploy each air bag module as specified in the service procedures that follows.

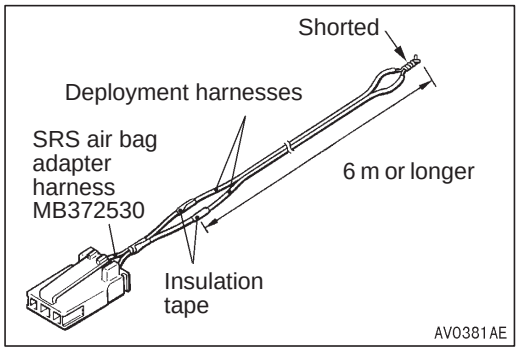


Driver's air bag module

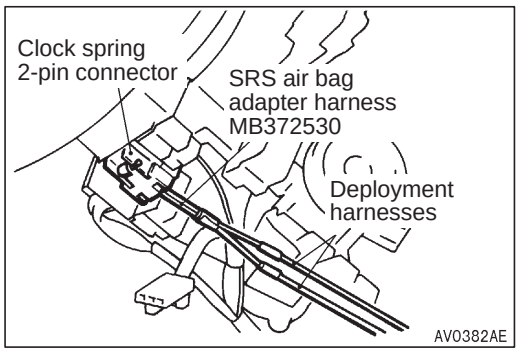
(1) Remove the steering column cover, lower.
(Refer to GROUP 52A – Instrument Panel.)

(2) Disconnect the clock spring 2-pin connector and instrument panel wiring harness connector (2-pin, yellow).

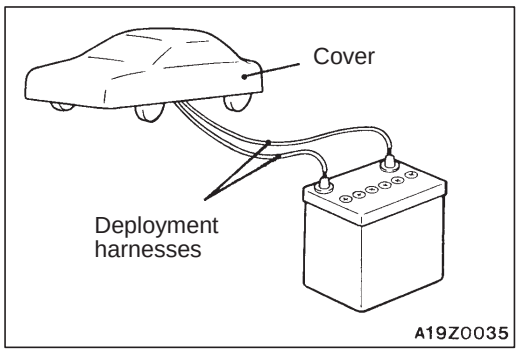
NOTE
Once disconnected from the instrument panel wiring harness, both electrodes of the clock spring connector short automatically. This prevents the driver's air bag from accidental deployment caused by static, etc.



(3) Connect deployment harnesses longer than 6 m to each SRS air bag adapter harness and insulate the connections with plastic tape.
Also, connect the deployment harnesses in the other ends to short, thereby preventing the driver's air bag from accidental deployment caused by static etc.



(4) Connect the SRS air bag adapter harness to the clock spring 2-pin connector and route the deployment harnesses out of the vehicle.



(5) Close all the doors with the windows fully closed and put a cover over the vehicle to minimize report.

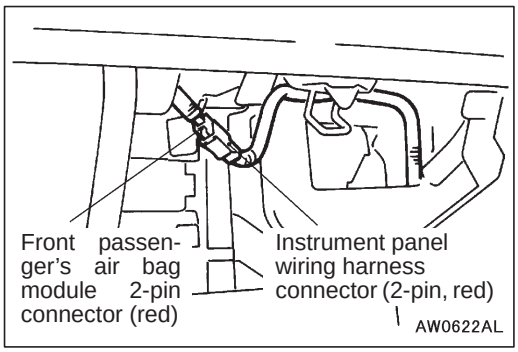
Caution
The cover is required as the glass, if already damaged, may break.

(6) Separate the deployment harnesses as far from the vehicle as possible and connect to the terminals of the battery removed from the vehicle. Then deploy.

Caution
1) Before deploying the air bag, see that no one is in and near the vehicle. Also, put on safety glasses.
2) The deployment makes the inflator of the driver's air bag very hot. Before handling the inflator, wait more than 30 minutes for cooling.
3) If the air bag module fails to deploy although the procedure is respected, do not go near the module. Contact your local distributor.

(7) After deployment of the driver's air bag module, discard as specified in the procedure (Refer to P.52B-60).

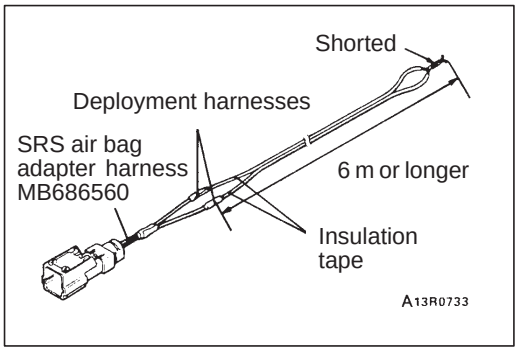
Front passenger's air bag module



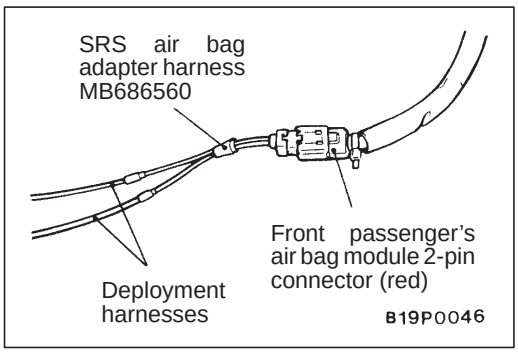
(1) Remove the glove box.
(Refer to GROUP 52A – Instrument Panel.)

(2) Disconnect the front passenger's air bag module 2-pin connector (red) and instrument panel wiring harness connector (2-pin, red).

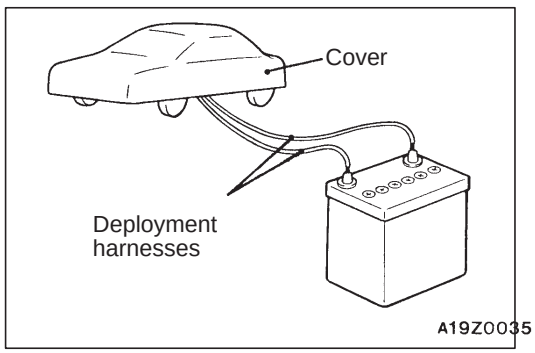
NOTE
Once disconnected from the instrument panel wiring harness, both electrodes of the front passenger's air bag module short automatically. This prevents the front passenger air bag from accidental deployment caused by static, etc.



(3) Connect deployment harnesses longer than 6 m to each SRS air bag adapter harness and insulate the connections with plastic tape.
Also, connect the deployment harnesses in the other ends to short, thereby preventing the front passenger's air bag from accidental deployment caused by static etc.



(4) Connect the SRS air bag adapter harness to the front passenger's air bag module 2-pin connector and route the deployment harnesses out of the vehicle.



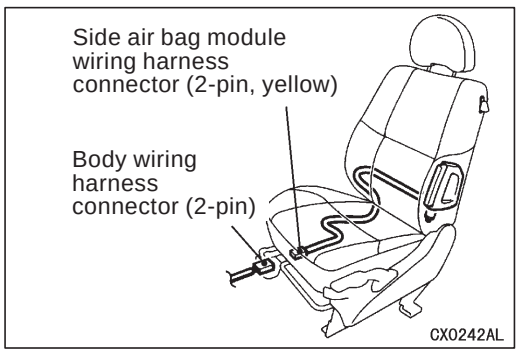
(5) Close all the doors with the windows fully closed and put a cover over the vehicle to minimize report.

Caution
The cover is required as the glass, if already damaged, may break.

(6) Separate the deployment harnesses as far from the vehicle as possible and connect to the terminals of the battery removed from the vehicle. Then deploy.

Caution
1) Before deploying the air bag, see that no one is in and near the vehicle. Also, put on safety glasses.
2) The deployment makes the inflator of the front passenger's air bag very hot. Before handling the inflator, wait more than 30 minutes for cooling.
3) If the air bag module fails to deploy although the procedure is respected, do not go near the module. Contact your local distributor.

(7) After deployment of the front passenger's air bag module, discard as specified in the procedure (Refer to P.52B-60).

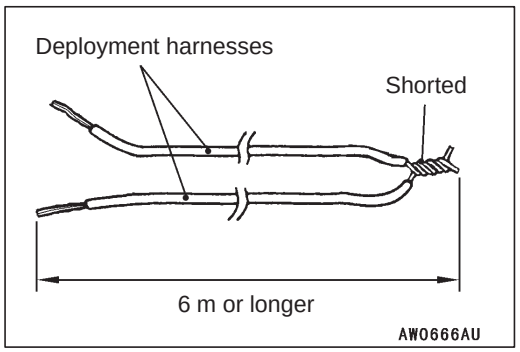


Side air bag module

(1) Disconnect the side air bag module wiring harness connector (2-pin, yellow) and body wiring harness connector (2-pin).

Caution
The side air bag modules both in the driver's and passenger's sides should be deployed.

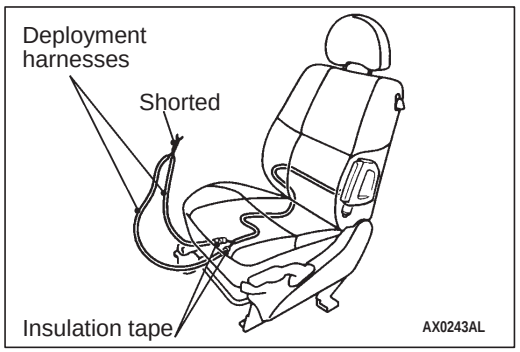
NOTE
Once disconnected from the side air bag wiring harness, both electrode of the side air bag module connector short automatically. This prevents the side air bag from accidental deployment caused by static etc.



(2) Prepare two wires longer than 6 m for deployment and connect the terminals in one end to short-circuit. This is to prevent accidental deployment caused by static etc.

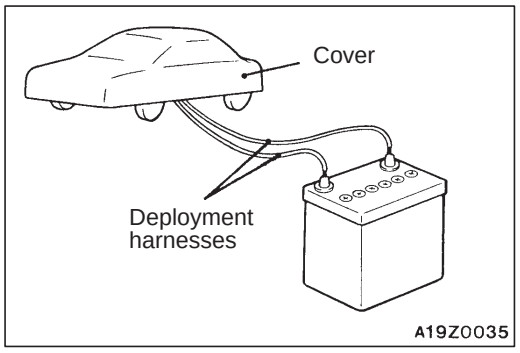
(3) Touch the vehicle's body with bare hands to discharge static in you.

Caution
Never fail to do Step (3) in order to prevent accidental deployment caused by static.



(4) Using pliers, cut the side air bag module connector from the harnesses. Connect the deployment harnesses to each harness that has been cut and insulate the connections with plastic tape.

(5) Route the deployment harnesses out of the vehicle.



(6) Close all the doors with the windows fully closed and put a cover over the vehicle to minimize report.

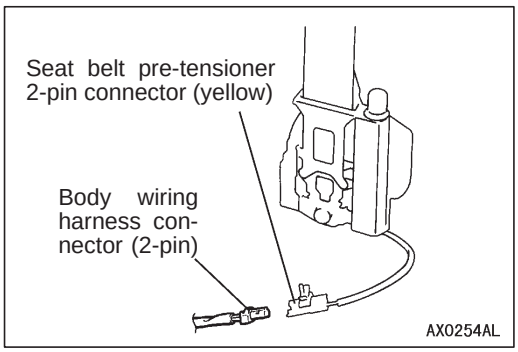
Caution
The cover is required as the glass, if already damaged, may break.

(7) Disconnect the deployment wires as far from the vehicle as possible and connect the wires to the terminals of the battery removed from the vehicle. Deploy the side air bag module.

Caution

1) Before deploying the air bag in this manner, first check to be sure that there is no one in or near the vehicle. Wear safety glasses.
2) The deployment of the side air bag makes the inflator very hot. Before handling the inflator, wait more than 30 minutes for cooling.
3) If the air bag module fails to deploy when the procedures above are followed, do not go near the module. Contact your local distributor.

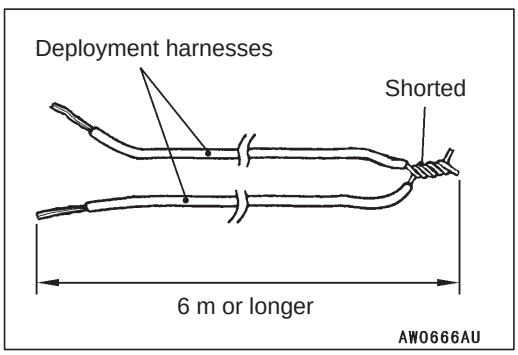
(8) Remove the deployed side air bag module from the seat back assembly and discard as specified in the procedure (Refer to P.52B-60).



Seat belt pre-tensioner

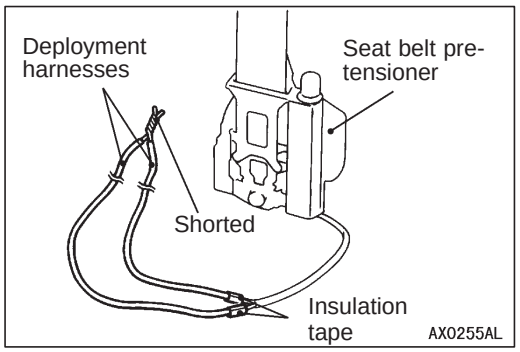
(1) Remove the quarter trim. (Refer to GROUP 52A)
(2) Remove the connection between the seat belt pre-tensioner 2-pin connector (yellow) and the body wiring harness connector (2-pin).

NOTE
If the seat belt pre-tensioner connector is disconnected from the body wiring harness, both electrodes of the seat belt pre-tensioner connector will be automatically shorted to prevent unintended operation of the seat belt pre-tensioner due to static electricity, etc.

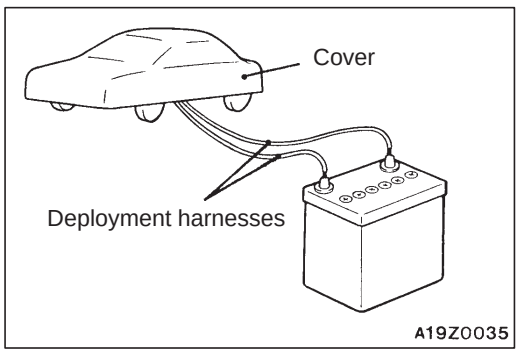


(3) Prepare two wires longer than 6 m for deployment and connect the terminals in one end to short-circuit. This is to prevent accidental operation caused by static etc.
(4) Touch the vehicle's body with bare hands to discharge static in you.

Caution
Never fail to do Step (3) in order to prevent accidental operation caused by static.



(5) Using pliers, cut the seat belt pre-tensioner connector from the harnesses. Connect the deployment harnesses to each harness that has been cut and insulate the connections with plastic tape.
(6) Route the deployment harness out of the vehicle.



(7) Fully close all door windows, close the doors and place a cover over the vehicle to minimize the amount of noise.

Caution
If the glass is damaged, it may break, so the car must be covered.

(8) Disconnect the deployment harnesses as far from the vehicle as possible and connect the wires to the terminals of the battery removed from the vehicle. Operate the seat belt pre-tensioner.

Caution
1) Before operating the seat belt pre-tensioner in this manner, first check to be sure that there is no one in or near the vehicle. Wear safety glasses.
2) The operation of the seat belt pre-tensioner makes the inflator very hot. Before handling the inflator, wait more than 30 minutes for cooling.
3) If the seat belt pre-tensioner fails to operate when the procedures above are followed, do not go near the seat belt pre-tensioner. Contact your local distributor.

(9) After operation of the seat belt pre-tensioner, discard as specified in the procedure (Refer to P.52B-60).

DEPLOYMENT OUTSIDE THE VEHICLE

Caution

1. **This should be carried out in a wide, flat area at least 6 m away from obstacles and other people.**
2. **Do not deploy outside if wind is high. Even in a soft wind, ignite to windward of the air bag modules, front seat back assembly with side air bag module or seat belt pre-tensioner.**

1. Disconnect the negative (–) and positive (+) battery cables from the battery terminals, and then remove the battery from the vehicle.

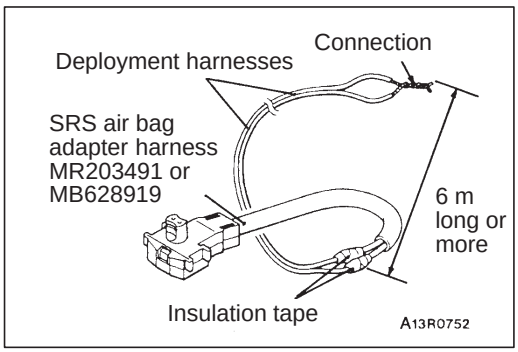
   Caution
   Wait at least 60 seconds after disconnecting the battery cables before doing any further work. (Refer to P.52B-4.)

2. Deploy each air bag module, seat belt pre-tensioner in the following procedures.

Driver's air bag module

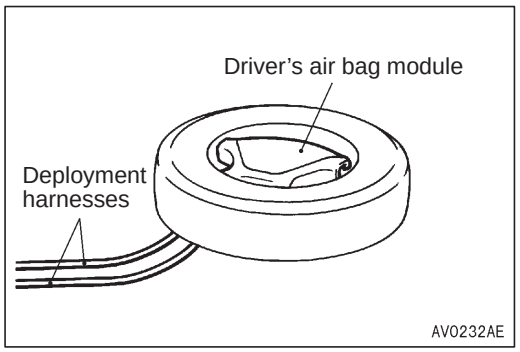
(1) Remove the driver's air bag module from the vehicle. (Refer to P.52B-36.)

Caution
The driver's air bag module should be stored on a flat surface and placed so that the air bag deployment surfaces are facing upward. Do not place anything on top of them.



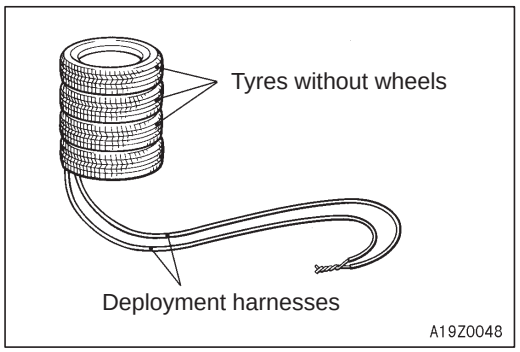
(2) Connect two wires, each six meters or longer, to the two leads of SRS air bag adapter harness and cover the connections with insulation tape. The other ends of the two wires should be connected to each other (short-circuited), to prevent sudden unexpected deployment of the driver's air bag.

(3) Install a nut to the bolt behind the driver's air bag module and tie thick wire for securing to the wheel.

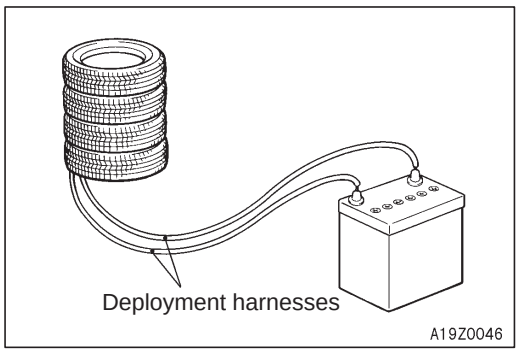


(4) Take the SRS air bag adapter harness that is connected to the wires, pass it beneath the old tyre wheel assembly, and connect it to the drive's air bag module.
(5) With the driver's air bag module upwards, place it in the wheel of old tyre and secure with the wire tied to the bolt.

Caution
Slack the deployment harnesses below the wheel. If deployment harnesses are tight, the reaction when the air bag deploys could damage the adaptor harness.



(6) Place three old tyres without wheels on top of the tyre secured to the driver's air bag module.



(7) Disconnect the deployment harnesses as far from the driver's air bag module as possible and connect the wires to the terminals of the battery removed from the vehicle. Then deploy.

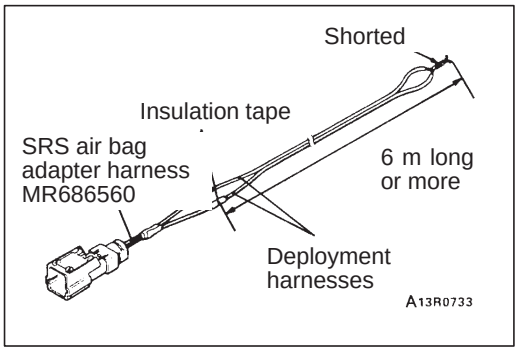
Caution
1) Before the deployment, be sure that no one is near the driver's air bag module.
2) The deployment of the driver's air bag makes the inflator very hot. Before handling the inflator, wait more than 30 minutes for cooling.
3) If the driver's air bag module fails to deploy when the procedures above are followed, do not go near the module. Contact your local distributor.

(8) After deployment of the driver's air bag module, discard as specified in the procedure (Refer to P.52B-60).

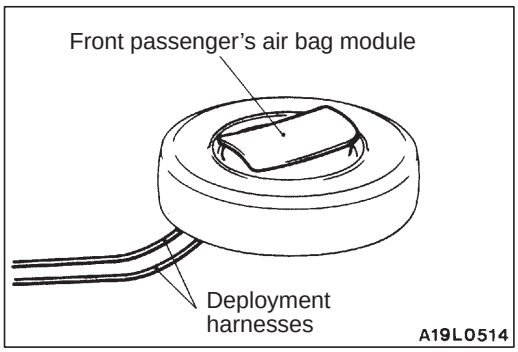
Front passenger's air bag module

(1) Remove the front passenger's air bag module from the vehicle. (Refer to P.52B-36.)

Caution
Once disconnected, both electrodes of the front passenger's air bag module connector short automatically to prevent accidental deployment caused by static etc. Still, in consideration of the accidental deployment, store the air bag module on flat place with deployment surface facing up. Also, do not put anything on it.

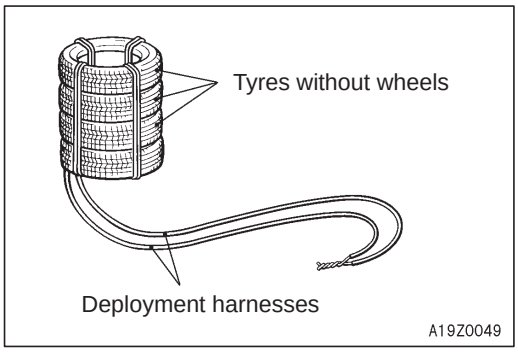


(2) Connect deployment wires 6 m or longer with the SRS air bag adapter harness respectively. Insulate the connection with tape.
Also, connect the other ends of the deployment harness each other to short, thereby preventing the front passenger's air bag from accidental deployment caused by static etc.



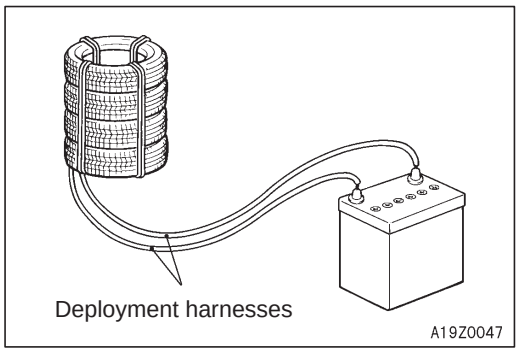
(3) Route the SRS air bag adapter harness with the deployment harnesses beneath an old tyre and wheel assembly. Then, connect the harnesses to the front passenger's air bag module.
(4) Route a thick wire through the holes in the front passenger's air bag module bracket. With the deployment surface facing up, secure the front passenger's air bag module to the old tyre and wheel assembly.

Caution
1) The deployment harnesses must not be tight below the wheel. Otherwise, the adapter harness could get damaged at deployment.
2) Place the connector of the SRS air bag adapter harness so that it is not clamped by the tyre at deployment.



(5) Put three old tyres without wheels on the tyre secured to the front passenger's air bag module. Secure all the tyres with ropes (4 locations).

NOTE
The tyres must be bound because the passenger's air bag inflates more than the driver's air bag.



(6) Disconnect the deployment harnesses as far from the front passenger's air bag module as possible and connect the harnesses to the battery removed from the vehicle.

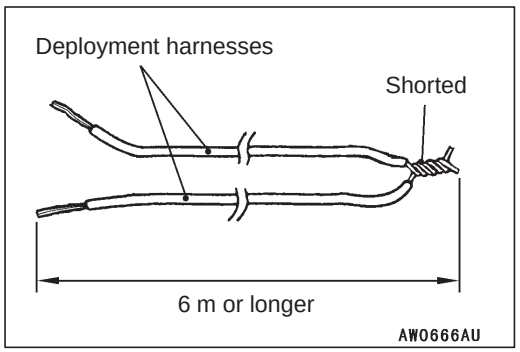
Caution
1) Before the deployment, see that no one is near the front passenger's air bag module.
2) The deployment makes the inflator of the front passenger's air bag very hot. Before handling the inflator, wait more than 30 minutes for cooling.
3) If the front passenger's air bag module fails to deploy although the procedure is respected, do not go near the module. Contact your local distributor.

(7) After deployment of the front passenger's air bag module, discard as specified in the procedure (Refer to P.52B-60).

Side air bag module

(1) Remove the front seat back assembly with side air bag module from the vehicle. (Refer to P.52B-36.)

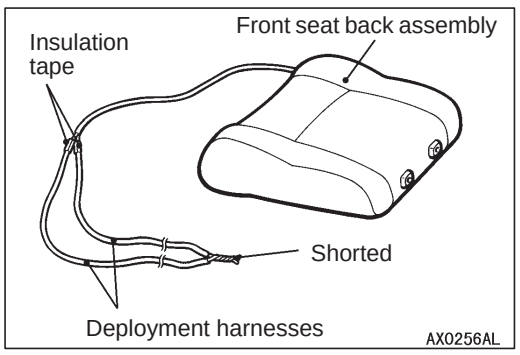
Caution
Once disconnected, both electrodes of the side air bag module connector short automatically to prevent accidental deployment caused by static etc. Still, in consideration of the accidental deployment, store the air bag module on flat place with deployment surface facing up. Also, do not put anything on it.



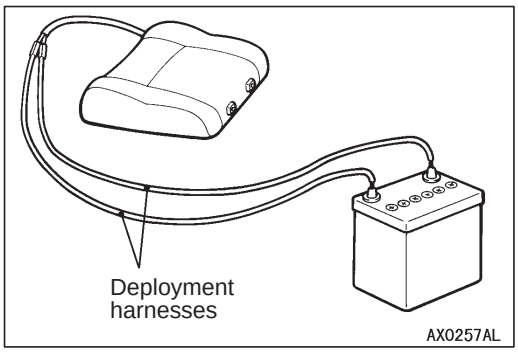
(2) Prepare two wires longer than 6 m for deployment and connect the terminals in one end to short-circuit. This is to prevent accidental deployment caused by static etc.

(3) Touch the vehicle's body with bare hands to discharge static in you.

Caution
Never fail to do Step (3) in order to prevent accidental deployment caused by static.



(4) Using pliers, cut the side air bag module connector from the harnesses. Connect the deployment harnesses to each harness that has been cut and insulate the connections with plastic tape.



(5) Disconnect the deployment harnesses as far from the front seat back assembly possible and connect the harnesses to the battery removed from the vehicle. Then, deploy.

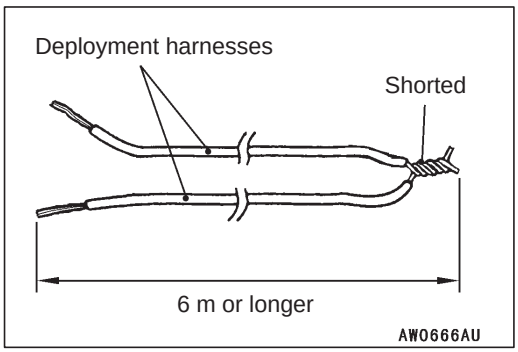
Caution
1) Before the deployment, see that no one is near the front seat back assembly.
2) The deployment makes the inflator of the side air bag very hot. Before handling the inflator, wait more than 30 minutes for cooling.
3) If the side air bag module fails to deploy although the procedure is respected, do not go near the module. Contact your local distributor.

(6) Remove the deployed side air bag module from the seat back assembly and discard as specified in the procedure (Refer to P.52B-60.).

Seat belt pre-tensioner

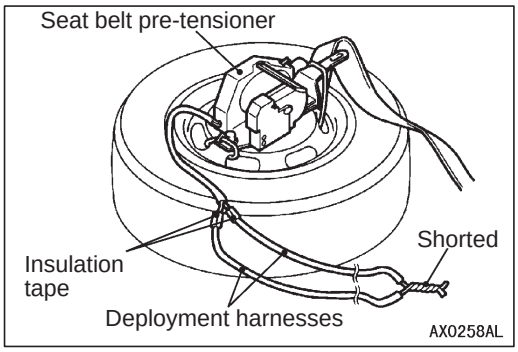
(1) Remove the seat belt pre-tensioner from the vehicle. (Refer to P.52B-44.)

Caution
The seat belt pre-tensioner should be stored on a flat surface and placed so that the air bag operation surfaces are facing upward. Do not place anything on top of them.

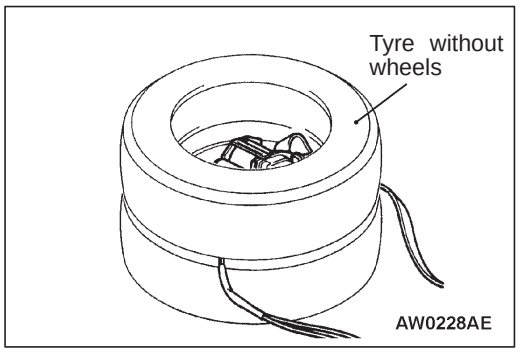


(2) Prepare two wires longer than 6 m for deployment and connect the terminals in one end to short-circuit. This is to prevent accidental operation caused by static etc.
(3) Touch the vehicle's body with bare hands to discharge static in you.

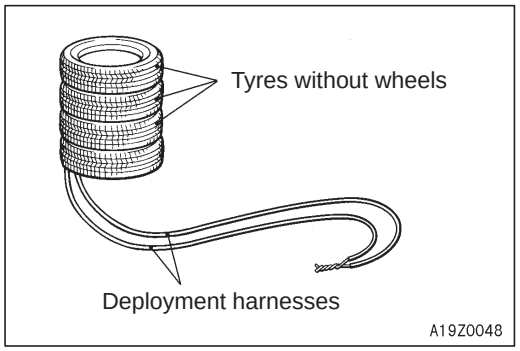
Caution
Never fail to do Step (3) in order to prevent accidental operation caused by static.



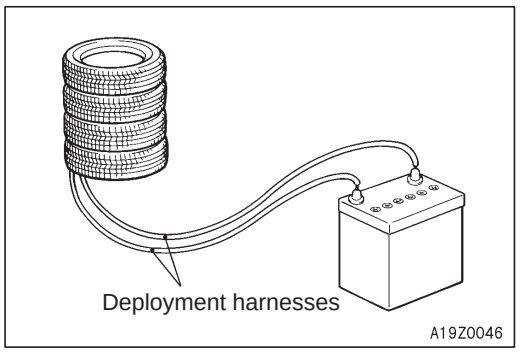
(4) Using pliers, cut the seat belt pre-tensioner connector from the harnesses. Connect the deployment harnesses to each harness that has been cut and insulate the connections with plastic tape.
(5) Pass the wires through the hole on the seat belt retractor bracket and secure them to the front (raised part) of the old tyre wheel assembly on two places.



Caution
Pull the seat belt out the outside of the tyre, and then place one tyre without a wheel on top of the existing tyre.



(6) Place three old tyres without wheels on top of the tyre secured to the seat belt pre-tensioner.



(7) Disconnect the deployment harnesses as far from the seat belt pre-tensioner as possible and connect the wires to the terminals of the battery removed from the vehicle, and operate.

Caution
1) Before the operation, be sure that no one is near the seat belt pre-tensioner.
2) The operation of the seat belt pre-tensioner makes itself very hot. Before handling the seat belt pre-tensioner, wait more than 30 minutes for cooling.
3) If the seat belt pre-tensioner fails to deploy when the procedures above are followed, do not go near the seat belt pre-tensioner. Contact your local distributor.

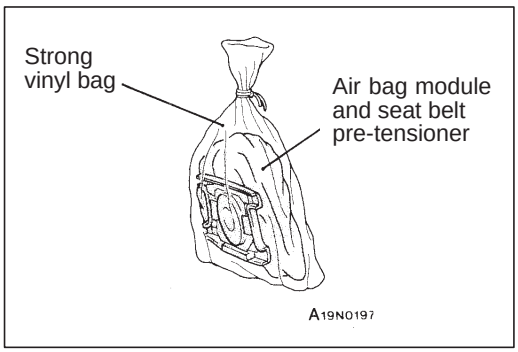
(8) After operation of the seat belt pre-tensioner, discard as specified in the procedure (Refer to P.52B-60).

DEPLOYED AIR BAG MODULE OR OPERATED SEAT BELT PRE-TENSIONER DISPOSAL PROCEDURES

After deployment or operation, the air bag module and the seat belt pre-tensioner should be disposed of in the same manner as any other scrap parts, adhering to local laws and/or legislation that may be in force except that the following points should be carefully noted during disposal.

1. The inflator will be quite hot immediately following deployment, so wait at least 30 minutes to allow it cool before attempting to handle it.
2. Do not put water or oil on the air bag after deployment or on the seat belt pre-tensioner after operation.
3. There may be, adhered to the deployed air bag module or the operated seat belt pre-tensioner, material that could irritate the eye and/or skin, so wear gloves and safety glasses when handling a deployed air bag module or a operated seat belt pre-tensioner.

   Caution
   If after following these precautions, any material does get into the eyes or on the skin, immediately rinse the affected area with a large amount of clean water. If any irritation develops, seek medical attention.



4. Tightly seal the air bag module and seat belt pre-tensioner in a strong vinyl bag for disposal.
5. Be sure to always wash your hands after completing this operation.

SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

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GENERAL 2
Outline of Change 2
SEAT BELT WITH PRE-TENSIONER 2
SIDE IMPACT SENSOR 3

CAUTION

- **Carefully read and observe the information in the SERVICE PRECAUTIONS (Refer to '00 PAJERO PININ Workshop Manual <Pub.No.CKRE00E1> P.52B-4.) prior to any service.**
- **For information concerning troubleshooting or maintenance, always observe the procedures in the Troubleshooting (Refer to '00 PAJERO PININ Workshop Manual <Pub.No.CKRE00E1> P.52B-8.) section.**
- **If any SRS components are removed or replaced in connection with any service procedures, be sure to follow the procedures in the INDIVIDUAL COMPONENT SERVICE section (Refer to '00 PAJERO PININ Workshop Manual <Pub.No.CKRE00E1> P.52B-30.) for the components involved.**
- **If you have any questions about the SRS, please contact your local distributor.**

GENERAL

OUTLINE OF CHANGE

- Due to the introduction of 5-door models, the removal and installation procedures for seat belt with pre-tensioner and side impact sensor have been added. The other items are the same as before.

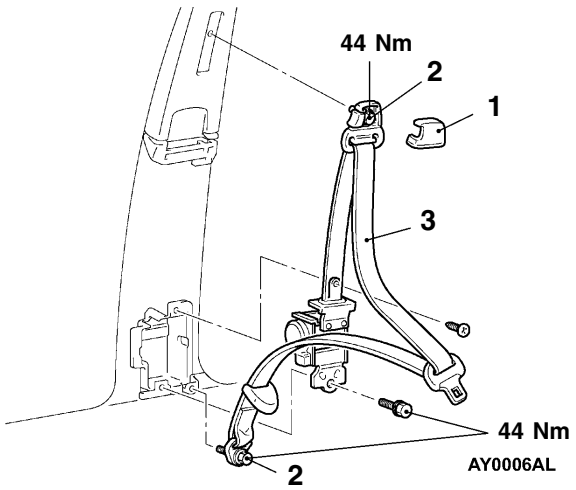
SEAT BELT WITH PRE-TENSIONER

Caution

1. **Never attempt to disassemble or repair the seat belt with pre-tensioner. If faulty, replace it.**
2. **Be extremely careful when handling the seat belt with pre-tensioner. Do not subject it to shocks, drop it, bring it close to strong magnets or allow contact with water, grease or oil. Always replace it with a new part if any dents, cracks or deformation is found.**
3. **Do not place anything on top of the seat belt pre-tensioner.**
4. **Do not expose the seat belt with pre-tensioner to temperatures over 90°C.**
5. **After operating the seat belt pre-tensioner, replace the seat belt pre-tensioner with a new part.**
6. **Gloves and protective goggles should be worn when handling a pre-tensioner once it has been used.**
7. **If disposing of a seat belt with pre-tensioner which has not yet been used, its pre-tensioner should be operated first before disposal. (Refer to '00 PAJERO PININ Workshop Manual <Pub. No. CKRE00E1> P.52B-48.)**

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Turn Ignition Key to LOCK (OFF) Position
- Disconnect the Negative (–) Battery Terminal.



Removal steps

1. Sash guide cover
2. Outer seat belt connection
- Center pillar lower trim (Refer to P.52A-1.)
3. Seat belt with pre-tensioner

Installation steps

▶A◀ - Post-installation inspection
3. Seat belt with pre-tensioner
- Center pillar lower trim (Refer to P.52A–1.)
2. Outer seat belt connection
1. Sash guide cover
- Negative (–) battery cable connection

▶B◀ - Pre-installation inspection

NOTE
The figure shows the seat belt with pre-tensioner (R.H.).
For service points, refer to Basic Manual.

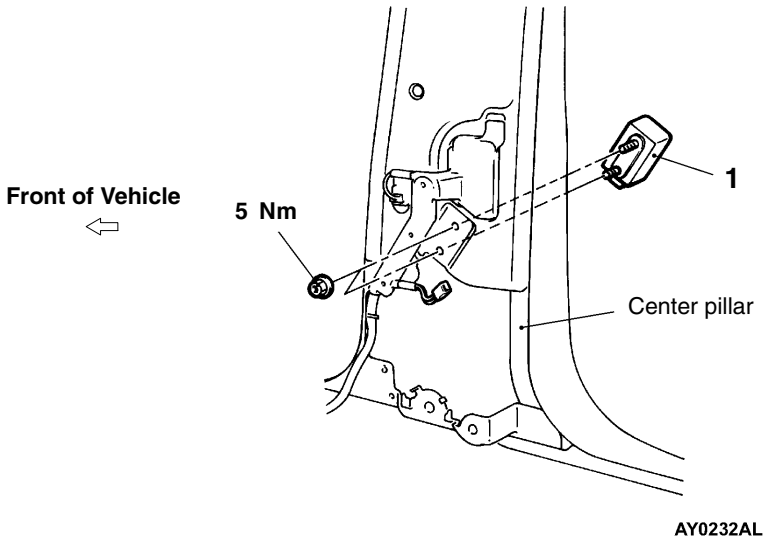
SIDE IMPACT SENSOR

Caution

1. **Disconnect the negative (–) battery terminal and wait for 60 seconds or more before starting work. Also, the disconnected battery terminal should be insulated with tape. (Refer to '00 PAJERO PININ Workshop Manual <Pub. No. CKRE00E1> P.52B-4.)**
2. **Never attempt to disassemble or repair the side impact sensors. If faulty, just replace with new ones.**
3. **Do not drop or subject the side impact sensors to impact or vibration. If denting, cracking, deformation, or rust are found in the side impact sensors, replace it with new ones. Discard the old ones.**
4. **After deployment of the air bags, replace the side impact sensors with new ones.**
5. **Never use an ohmmeter on or near the side impact sensors, and use only the special test equipment described on '00 PAJERO PININ Workshop Manual <Pub. No. CKRE00E1> P.52B-7.**

REMOVAL AND INSTALLATION

Pre-removal Operation
- Turn Ignition Switch to LOCK (OFF) Position.
- Disconnect the Negative (–) Battery Terminal.



Removal steps
- Front seat belt (Refer to GROUP 52A.)

1. Side impact sensor

Installation steps

▶A◀ • Pre-installation inspection
▶B◀ 1. Side impact sensor
- Front seat belt (Refer to GROUP 52A.)
- Negative (–) battery cable connection

▶C◀ • Post-installation inspection

NOTE
The figure shows the side impact sensor (R.H.). For service points, refer to Basic Manual.

CHASSIS ELECTRICAL

CHASSIS ELECTRICAL

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WARNINGS REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLES

WARNING!

(1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver and passenger (from rendering the SRS inoperative).

(2) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.

(3) MITSUBISHI dealer personnel must thoroughly review this manual, and especially its GROUP 52B – Supplemental Restraint System (SRS) before beginning any service or maintenance of any component of the SRS or any SRS-related component.

NOTE

The SRS includes the following components: SRS-ECU, SRS warning lamp, air bag module, clock spring and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents by an asterisk (*).

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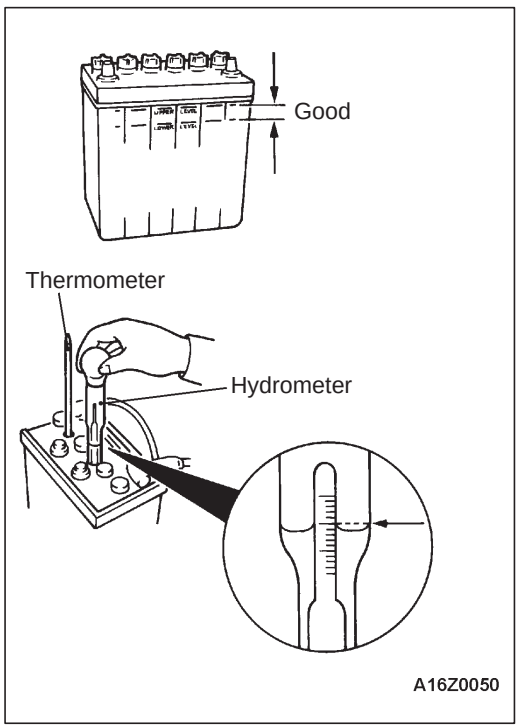
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BATTERY

SERVICE SPECIFICATION

Item	Specification
Specific gravity of the battery fluid	1.220 – 1.290 [20°C]



ON-VEHICLE SERVICE

FLUID LEVEL AND SPECIFIC GRAVITY CHECK

1. Inspect whether or not the battery fluid is between the UPPER LEVEL and LOWER LEVEL marks.

   Caution
   (1) If the battery fluid is below the LOWER LEVEL, the battery could explode in using.
   (2) If the battery fluid is over the UPPER LEVEL, leakage could result.

2. Use a hydrometer and thermometer to check the specific gravity of the battery fluid.

   Standard value: 1.220 – 1.290 [20°C]

   The specific gravity of the battery fluid varies with the temperature, so use the following formula to calculate the specific gravity for 20°C. Use the calculated value to determine whether or not the specific gravity is satisfactory.

   D20 = (t – 20) × 0.0007 + Dt

   D20: Specific gravity of the battery fluid calculated for 20°C.

   Dt: Actually measured specific gravity

   t: Actually measured temperature

CHARGING

1. When charging a battery while still installed in the vehicle, disconnect the battery cables to prevent damage to electrical parts.
2. The current normally used for charging a battery should be approximately 1/10th of the battery capacity. When performing a quick-charging due to lack of time, etc., the charging current should never exceed the battery capacity as indicated in amperes.

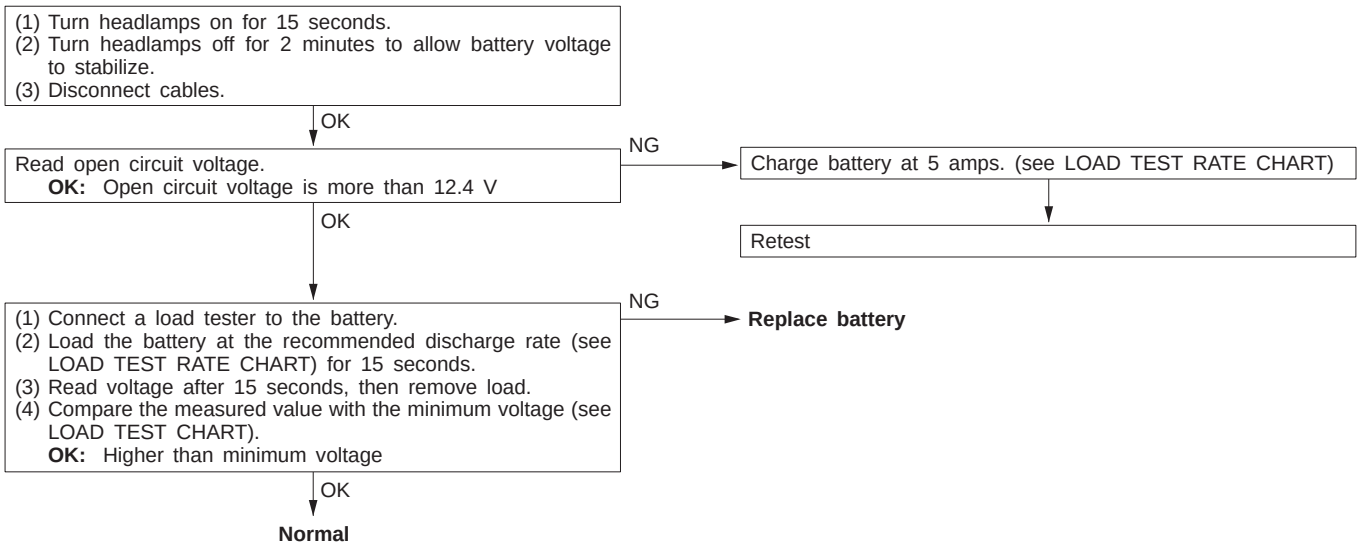
Battery type	Capacity (5 HR)	Normal charging current	Quick-charging current
65D23L	52 Ah	5.2 A	53 A

3. Determining if charging is completed.
   (1) If the specific gravity of the battery fluid reaches 1.250 – 1.290 and remains constant for at least one hour.
   (2) If the voltage of each cell reaches 2.5 – 2.8 V and remains constant for at least one hour.

Caution
(1) Remove the battery caps during charging.
(2) Be careful since the battery fluid level may rise during charging.
(3) Keep all sources of fire away while charging because there is a danger of explosion.
(4) Be careful not to do anything that could generate sparks while charging.
(5) When charging is completed, replace the battery caps, pour clean water over the battery to remove any sulfuric acid and dry.
(6) Perform the charging in the well-ventilated place.
(7) Do not raise the battery fluid temperature more than approximately 45°C (In case of quick-charging: approximately 55°C).

BATTERY TESTING PROCEDURE

TEST STEP



LOAD TEST RATE CHART

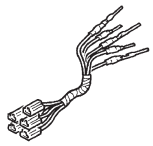
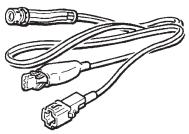
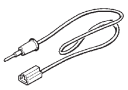
Battery type	65D23L
Charging time when fully discharged h [5-amp rated current charging]	11
Load test (Amps)	300

LOAD TEST CHART

Temperature °C	21 and above	16	10	4	–1	–7	–12	–18
Minimum voltage V	9.6	9.5	9.4	9.3	9.1	8.9	8.7	8.5

IGNITION SWITCH AND IMMOBILIZER SYSTEM

SPECIAL TOOL

Tool	Number	Name	Use
	MB991502	MUT-II sub assembly	● Immobilizer system check (Diagnosis display using the MUT-II) ● Registration of the encrypted code
A  B  C  D  C991223	MB991223 A: MB991219 B: MB991220 C: MB991221 D: MB991222	Harness set A: Test harness B: LED harness C: LED harness adapter D: Probe	● Fuel gauge simple check A: Connector pin contact pressure check B: Power circuit check C: Power circuit check D: Commercial tester connection

TROUBLESHOOTING

Caution
The encrypted code should always be re-registered when replacing the immobilizer-ECU.

STANDARD FLOW OF DIAGNOSIS TROUBLESHOOTING

Refer to GROUP 00 – How To Use Troubleshooting/Inspection Service Points.

DIAGNOSIS FUNCTION

DIAGNOSIS CODES CHECK

Refer to GROUP 00 – How To Use Troubleshooting/Inspection Service Points.

ERASING DIAGNOSIS CODES

Refer to GROUP 00 – How To Use Troubleshooting/Inspection Service Points.

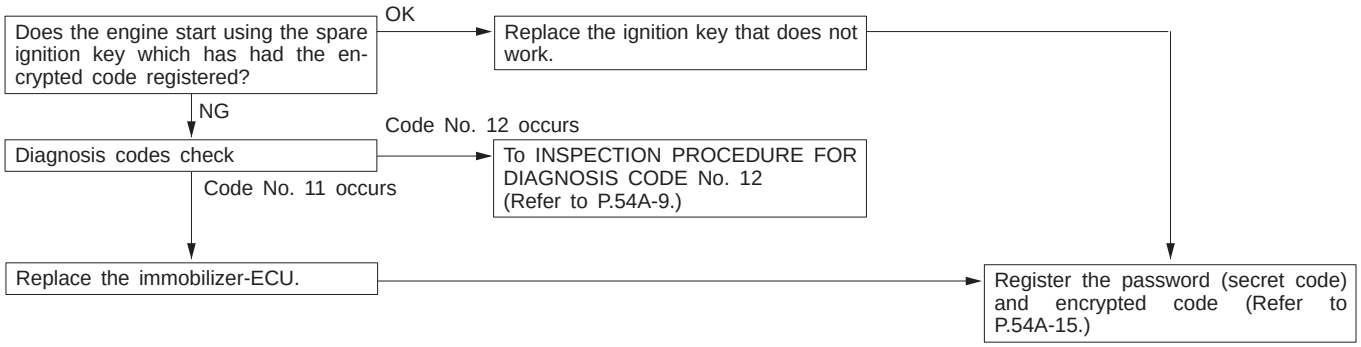
Caution
The diagnosis codes which result from disconnecting the battery cables cannot be erased.

INSPECTION CHART FOR DIAGNOSIS CODES

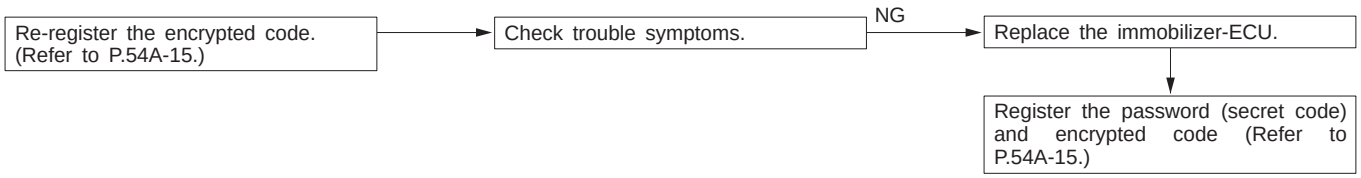
Diagnosis code No.	Inspection items	Reference page
11	Transponder communication system	54A-9
12	Encrypted code are not the same or are not registered	54A-9

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code No. 11 Transponder communication system	Probable cause
The encrypted code of the transponder is not sent to the immobilizer-ECU immediately after the ignition switch is turned to the ON position.	• Malfunction of the transponder • Malfunction of the ignition key ring antenna • Malfunction of the immobilizer-ECU



Code No. 12 Encrypted code are not the same or are not registered	Probable cause
The encrypted code which is sent from the transponder is not the same as the encrypted code which is registered in the immobilizer-ECU.	• The encrypted code in the ignition key being used has not been properly registered. • Malfunction of the immobilizer-ECU



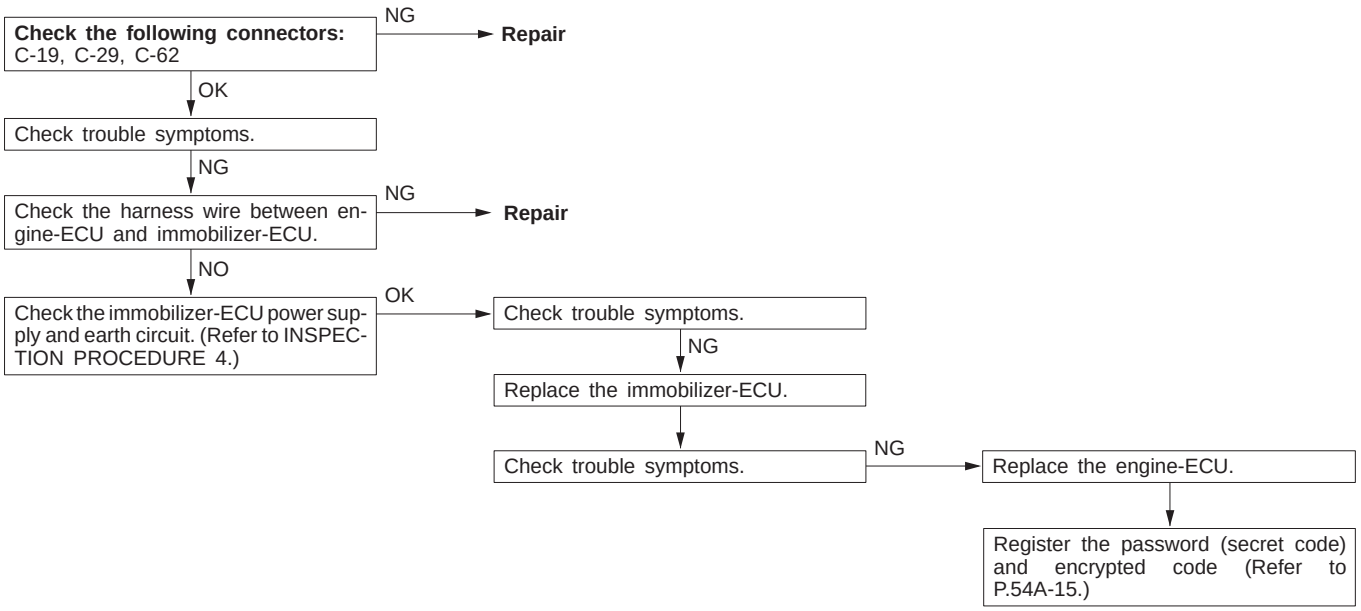
INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom	Inspection procedure No.	Reference page
Communication with MUT-II is impossible.	–	GROUP 13B, 13C – Troubleshooting
Diagnosis code No. 54 has been generated by the engine-ECU.	1	54A-10
Encrypted code cannot be registered using the MUT-II.	2	54A-10
Engine does not start (Cranking but no initial combustion).	3	54A-11
Malfunction of the immobilizer-ECU power supply and earth circuit	4	54A-11

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

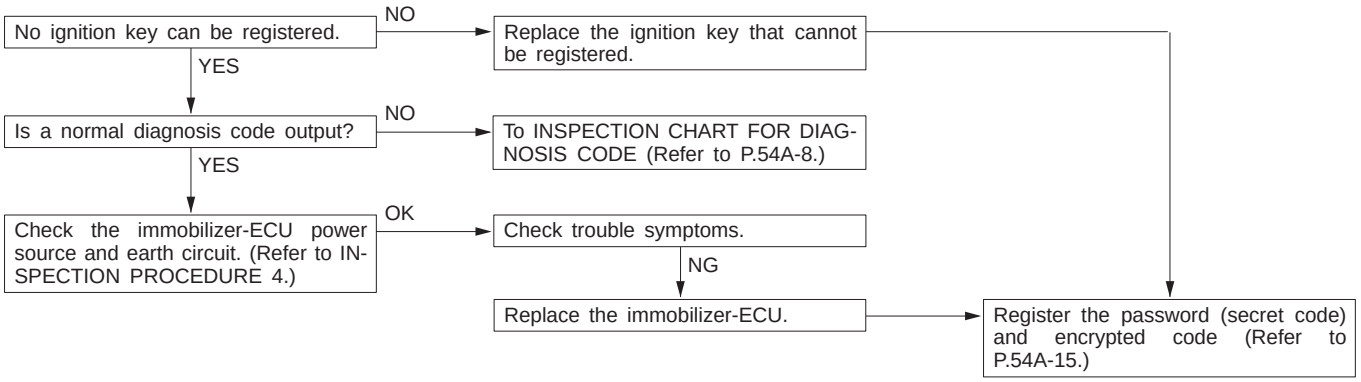
Inspection Procedure 1

Diagnosis code No. 54 has been generated by the engine-ECU.	Probable cause
There is a problem with communication between the engine-ECU and the immobilizer-ECU.	• Malfunction of harness or connector • Malfunction of the immobilizer-ECU • Malfunction of the engine-ECU



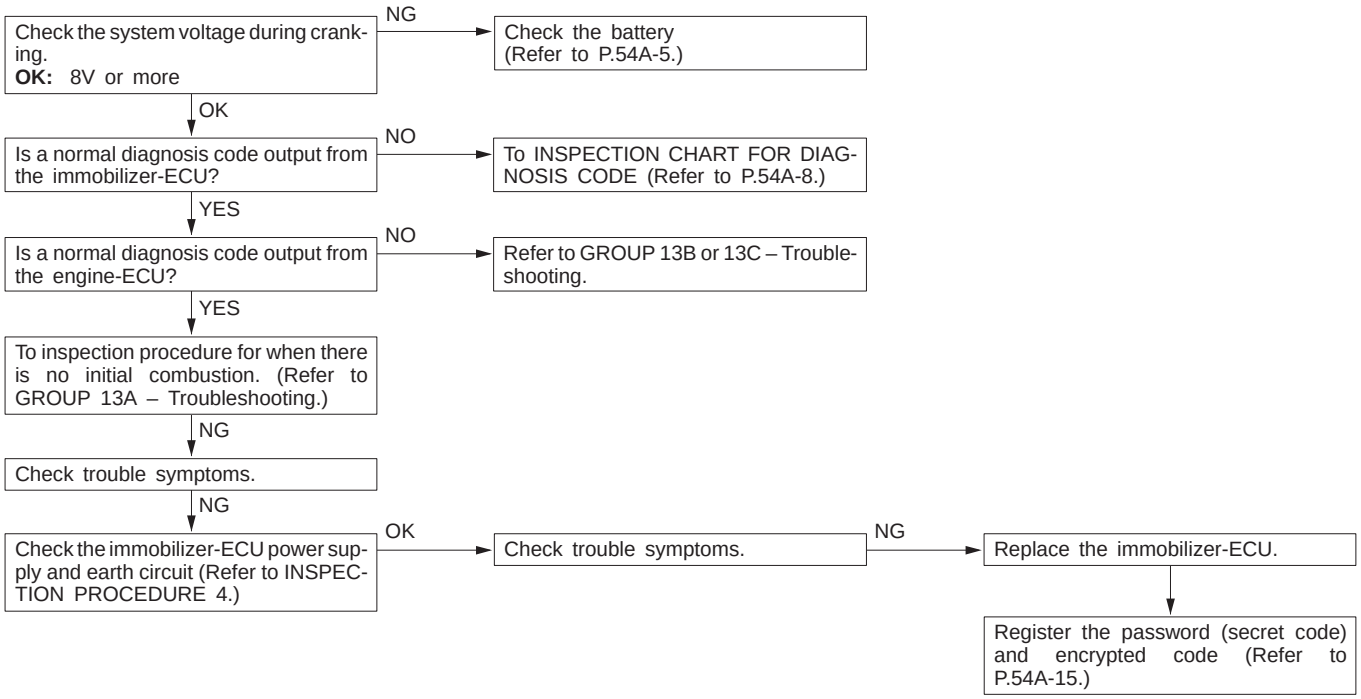
Inspection Procedure 2

Encrypted code cannot be registered using the MUT-II.	Probable cause
The cause is probably that there is no encrypted code registered in the immobilizer-ECU, or there is a malfunction of the immobilizer-ECU.	• Malfunction of the transponder • Malfunction of the ignition key ring antenna • Malfunction of harness or connector • Malfunction of the immobilizer-ECU



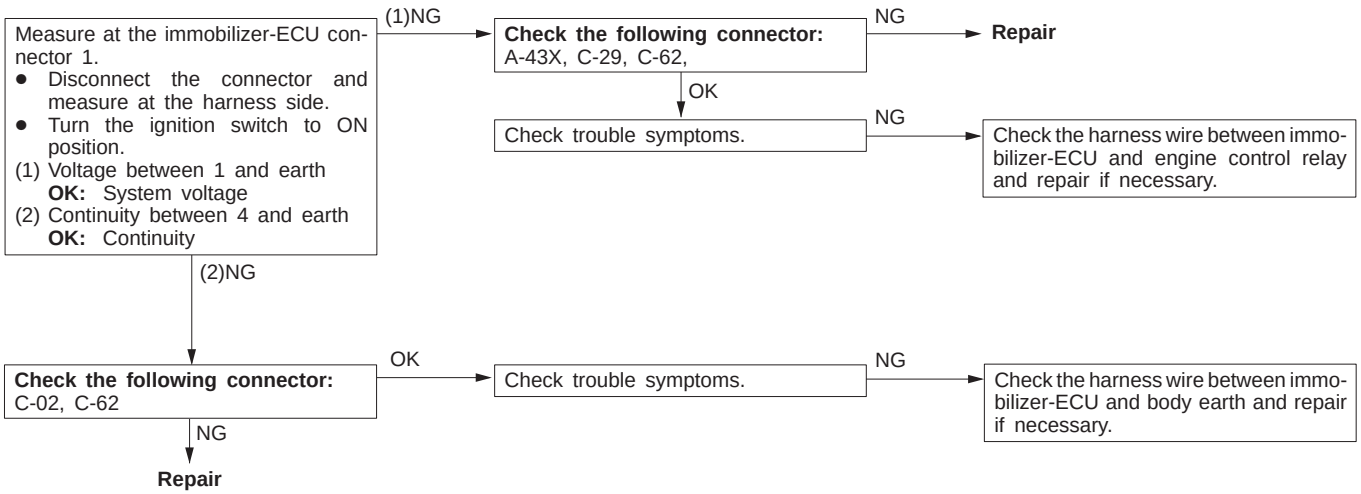
Inspection Procedure 3

Engine does not start (cranking but no initial combustion).	Probable cause
If the fuel injectors are not operating, there might be a problem with the MPI system in addition to a malfunction of the immobilizer system. It is normal for this to occur if an attempt is made to start the engine using a key that has not been properly registered.	• Malfunction of the MPI system • Malfunction of the immobilizer-ECU



Inspection Procedure 4

Malfunction of the immobilizer-ECU power supply and earth circuit



CHECK AT IMMOBILIZER-ECU

TERMINAL VOLTAGE CHECK CHART



W0599AE

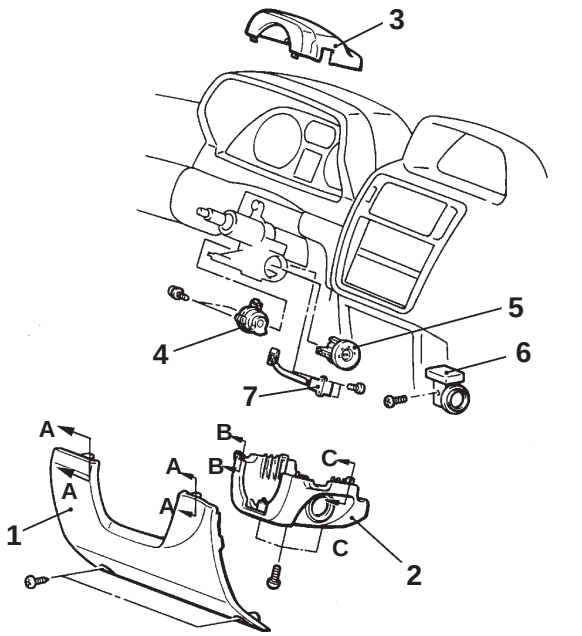
Terminal No.	Signal	Checking requirements	Terminal voltage
1	Immobilizer-ECU power supply	Ignition switch: ON	System voltage
2	–	–	–
3	Engine-ECU	–	–
4	Immobilizer-ECU earth	Always	0 V

IGNITION SWITCH AND IMMOBILIZER SYSTEM

REMOVAL AND INSTALLATION

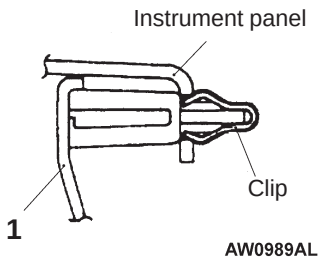
Caution: SRS
Before removal of air bag module and clock spring, refer to GROUP 52B – Service Precautions and Air Bag Module and Clock Spring.

Pre-removal and Post-installation Operation
Clock Spring and Column Switch Removal and Installation (Refer to GROUP 52B – Air Bag Modules and Clock Spring.)



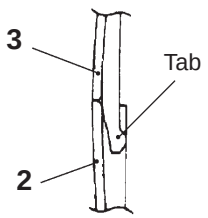
AX0131AL

Section A – A



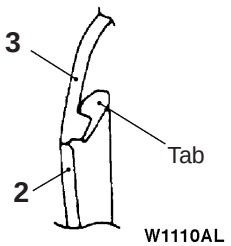
AW0989AL

Section B – B



W1109AL

Section C – C



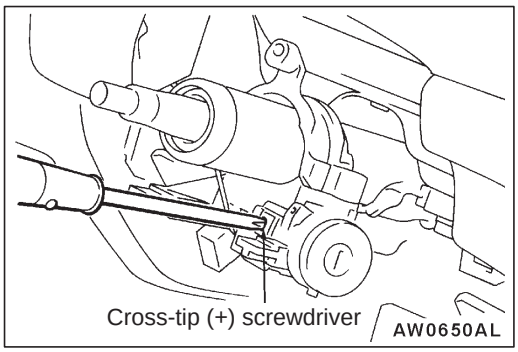
W1110AL

Removal steps

1. Instrument under cover
2. Column cover, lower
3. Column cover, upper
4. Ignition switch

◀A▶

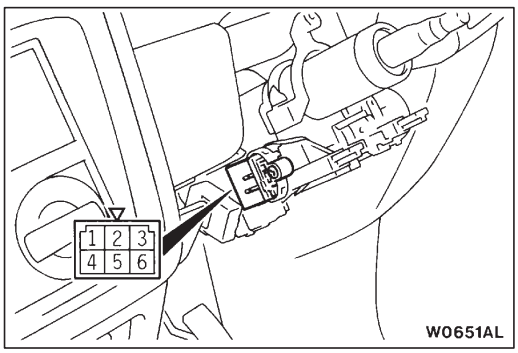
5. Steering lock cylinder
6. Immobilizer-ECU
7. Key reminder switch



REMOVAL SERVICE POINTS

◀A▶ STEERING LOCK CYLINDER REMOVAL

1. Insert the key in the steering lock cylinder and turn it to the “ACC” position.
2. Using a cross-tip (+) screwdriver (small) or a similar tool, push the lock pin of the steering lock cylinder inward and then pull the steering lock cylinder toward you.

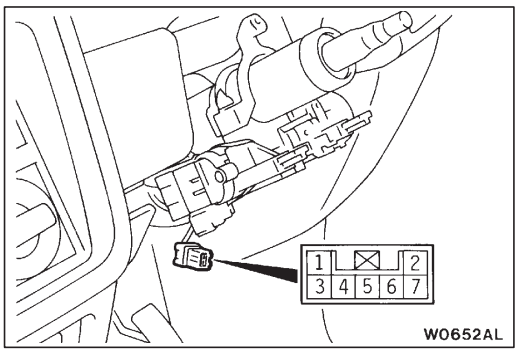


INSPECTION

IGNITION SWITCH CONTINUITY CHECK

1. Remove the column cover lower and upper.
2. Disconnect the wiring connector from the ignition switch.
3. Operate the switch, and check the continuity between the terminals.

Ignition key position	Terminal No.				
	1	2	4	5	6
LOCK					
ACC	○				○
ON	○	○	○		○
START	○	○		○	



KEY REMINDER SWITCH CONTINUITY CHECK

Disconnect the key reminder switch connector with the switch attached to the vehicle, and then check the continuity between the terminals.

Ignition key	Terminal No.	
	4	6
Removed	○	○
Inserted		

ENCRYPTED CODE REGISTRATION METHOD AND RESETTING THE CODE TO THE FACTORY SETTING

Register the encrypted code in the immobilizer-ECU and then reset the code to the factory setting after parts have been replaced.

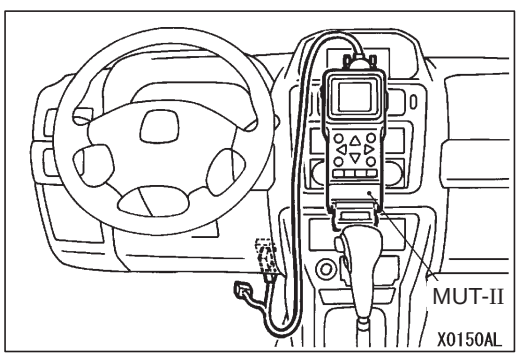
Replacement part	Encrypted code
Ignition key	Necessary
Immobilizer-ECU	Necessary
Engine-ECU*	Necessary

NOTE
*: If the engine-ECU is replaced, the immobilizer-ECU and ignition key should be replaced together with it.
Each engine-ECU has an individual information for immobilizer-ECU, and the individual information is registered in the immobilizer-ECU and ignition key.

ENCRYPTED CODE REGISTRATION METHOD

If using an ignition key that has just been newly purchased, or if the immobilizer-ECU has been replaced, you will need to register the encrypted codes for each ignition key being used into the immobilizer-ECU. (A maximum of eight different encrypted codes can be registered.)
Moreover, when the immobilizer-ECU has been replaced, you will need to use the MUT-II to input the vehicle secret code and to register the password (secret code) that the user specifies into the immobilizer-ECU. (Refer to the "MUT-II REFERENCE MANUAL" or "MUT-II OPERATING INSTRUCTIONS")

Caution
If registering of the encrypted codes is carried out after all previously-registered codes have been erased, you should have ready all of the ignition keys that have already been registered.



1. Connect the MUT-II to the diagnosis connector.

   Caution
   Turn the ignition switch to LOCK (OFF) position before connection or disconnection of the MUT-II.
2. Check that the diagnosis code No.54 is not being generated by the engine-ECU. If it is being generated check according to the Troubleshooting Procedures.
3. Use the ignition key that is to be registered to turn on the ignition switch.

4. Use the MUT-II to register the encrypted code. To register the second or subsequent key, leave the MUT-II connected and remove the first registered key. Within 5 seconds insert the key to be registered and turn on the ignition switch.

   NOTE
   After 5 seconds have elapsed, the key registration must be repeated from the beginning because the key registration mode terminates.
5. This completes the registration operation. Turn the ignition switch to LOCK (OFF) position and wait for approx. 10 seconds.
6. Check that the engine can be started with each of the ignition keys.
7. Check the diagnosis output from engine-ECU, and erase code No.54 if it appears.

COMBINATION METERS

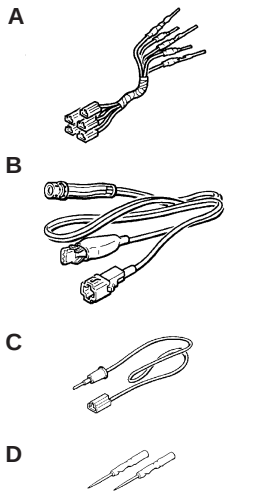
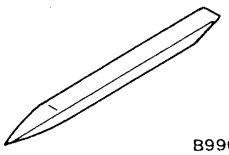
SERVICE SPECIFICATIONS

Items		Items	Standard value
Speedometer indication error km/h(mph)		40 (20)	40 – 48 (20 – 25)
		80 (40)	80 – 92 (40 – 47)
		120 (60)	120 – 136 (60 – 69)
		160 (80)	160 – 180 (80 – 91)
		– (100)	– (100 – 114)
Tachometer indication error r/min		700	±100
		3,000	+150 –100
		5,000	+325 –125
		6,000	+375 –125
Fuel gauge unit resistance Ω	Main	Float point F	1 – 3
		Float point E	49.7 – 51.7
	Sub	Float point F	1– 3
		Float point E	55.3 – 57.3
Fuel gauge unit float height mm	Main	A (Float point F)	44.5 – 52.5
		B (Float point E)	220.3 – 228.3
	Sub	A (Float point F)	30.4 – 36.4
		B (Float point E)	238.5 – 244.5
Engine coolant temperature gauge unit resistance (at 70°C) Ω			104 ± 13.5
Fuel gauge resistance Ω	Power supply and earth		233.3
	Power supply and fuel gauge		108.3
	Fuel gauge and earth		125.0
Engine coolant temperature gauge resistance Ω	Power supply and earth		178.9
	Power supply and engine coolant temperature gauge		54
	Engine coolant temperature gauge and earth		232.9

SEALANT

Items	Specified sealant	Remark
Engine coolant temperature gauge unit threaded portion	3M Adhesive nut locking No. 4171 or equivalent	Drying sealant

SPECIAL TOOLS

Tool	Number	Name	Use
A B C D  C991223	MB991223 A: MB991219 B: MB991220 C: MB991221 D: MB991222	Harness set A: Test harness B: LED harness C: LED harness adapter D: Probe	● Fuel gauge simple check A: Connector pin contact pressure check B: Power circuit check C: Power circuit check D: Commercial tester connection
 B990784	MB990784	Ornament remover	Removal of meter hood

TROUBLESHOOTING

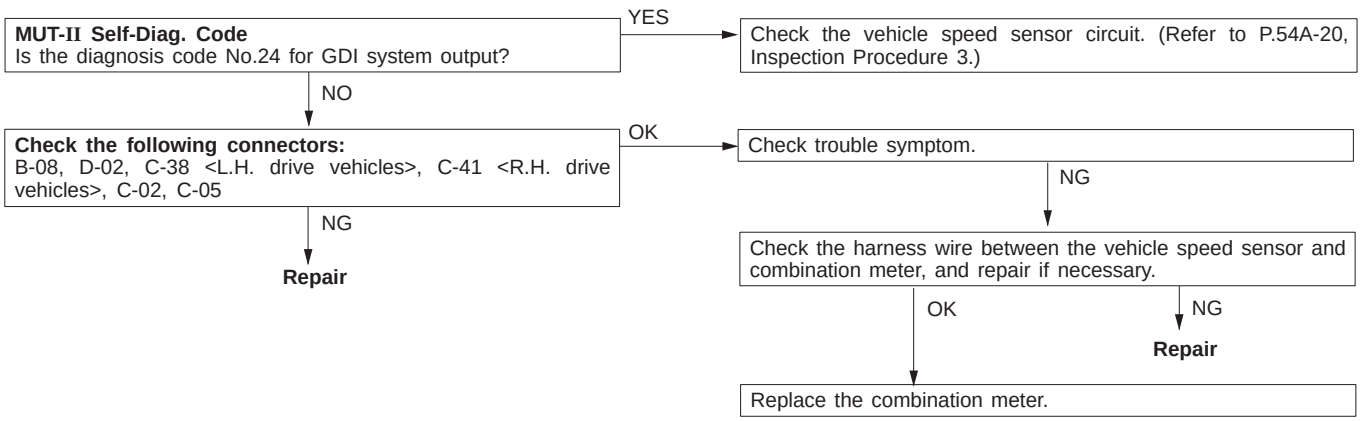
INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom	Inspection procedure	Reference page
Speedometer does not work.	1	54A-19
Tachometer does not work.	2	54A-20
Fuel gauge does not operate.	4	54A-21
Engine coolant temperature gauge does not operate.	5	54A-22
GDI ECO indication lamp does not illumination	6	54A-23

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

Inspection Procedure 1

Speedometer does not work.	Probable cause
The cause may be a defective vehicle speed sensor circuit system or a defective speedometer. Vehicle speed sensor is co-used among the engine-ECU and A/T-ECU.	• Malfunction of vehicle speed sensor • Malfunction of speedometer • Malfunction of harness or connector



Inspection Procedure 2

Tachometer does not work.	Probable cause
The ignition signal may not be input from the engine, or there may be a malfunction in the power supply or earth circuit.	• Malfunction of tachometer • Malfunction of harness or connector

MUT-II Self-Diag. Code
Is the diagnosis code No.44 for GDI system output?
- YES → Check the ignition coil and power transistor unit system. (Refer to GROUP 13A – Troubleshooting, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 44.)
- OK ↓

Measure at the combination meter connectors C-06 and C-07.
- Disconnect the connector, and measure at the harness side.
- Turn the ignition switch ON position.

(1) Voltage between the terminal No.45 and body earth
OK: 5 V
(2) Continuity between terminal No.52 and body earth
OK: Continuity
(3) Voltage between the terminal No.1 and body earth
OK: System voltage

- OK → Replace the tachometer.
- (1) NG → **Check the following connectors:** C-07, C-18, C-28
  - OK → Check trouble symptom.
    - NG → Check the harness wire between the combination meter and engine-ECU, and repair if necessary.
  - NG → **Repair**
- (2) NG → **Check the following connector:** C-07
  - OK → Check trouble symptom.
    - NG → Check the harness wire between the combination meter and body earth, and repair if necessary.
  - NG → **Repair**
- (3) NG → **Check the following connectors:** C-06, C-02 <L.H. drive vehicles>, C-76, C-74
  - OK → Check trouble symptom.
    - NG → Check the harness wire between the ignition switch (IG1) and combination meter, and repair if necessary.
  - NG → **Repair**

Inspection Procedure 3

Vehicle speed sensor circuit system inspection

Vehicle speed sensor inspection (Refer to P.54A-27.)
- NG → **Replace**
- OK ↓

Measure at the vehicle speed sensor connector B-08.
- Disconnect the connector, and measure at the harness side.
- Turn the ignition switch to ON position.

(1) Voltage between the terminal No.3 and body earth
OK: 4.5 V or more
(2) Continuity between terminal No.2 and body earth
OK: Continuity
(3) Voltage between the terminal No.1 and body earth
OK: System voltage

- (1) NG → **Check the following connectors:** B-08, D-02, C-38 <L.H. drive vehicles>, C-41 <R.H. drive vehicles>, C-02, C-05
  - NG → Check trouble symptom.
    - NG → Check the harness wire between the vehicle speed sensor and combination meter, and repair if necessary.
  - NG → **Repair**
- (2) NG → **Check the following connector:** B-08
  - OK → Check trouble symptom.
    - NG → Check the harness wire between the vehicle speed sensor and body earth, and repair if necessary.
  - NG → **Repair**
- (3) NG → **Check the following connectors:** B-08, D-02, C-38 <L.H. drive vehicles>, C-41 <R.H. drive vehicles>, C-02, C-76, C-74
  - OK → Check trouble symptom.
    - NG → Check the harness wire between the vehicle speed sensor and power supply, and repair if necessary.
  - NG → **Repair**

Inspection Procedure 4

Fuel gauge does not operate.	Probable cause
If speedometer and tachometer operate normally, the harness from power supply to combination meter is normal.	• Malfunction of fuel gauge unit • Malfunction of fuel gauge • Malfunction of harness or connector

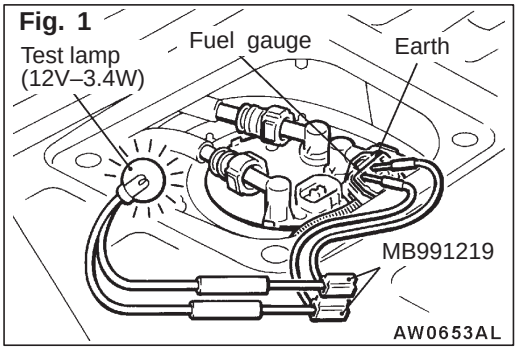
Do the speedometer and tachometer operate normally?
- NO → Check the speedometer and tachometer circuit. (Refer to P.54A-18.)
- YES ↓

Check the fuel gauge circuit.
- Disconnect the fuel gauge unit connector D-17.
- Use the special tool to connect a test lamp (12 V – 3.4 W) to the harness-side connector. (Refer to Fig. 1.)
- Ignition switch: ON

(1) Test lamp condition
OK: Illuminates
(2) Fuel gauge needle condition
OK: Moves to the middle position.

- OK → Replace the fuel gauge unit.
- (1) NG → **Check the following connectors:** D-17, D-23, D-12, C-38 <L.H. drive vehicles>, C-40 <R.H. drive vehicles>, C-02, C-05
  - OK ↓ Check trouble symptom.
    - NG ↓ Check the harness between the combination meter and fuel gauge, and repair if necessary.
  - NG → **Repair**
- (2) NG ↓ Replace the fuel gauge.

Fig. 1



Inspection Procedure 5

Engine coolant temperature gauge does not operate.	Probable cause
If speedometer and tachometer operate normally, the harness from power supply to combination meter is normal.	• Malfunction of engine coolant temperature gauge unit • Malfunction of engine coolant temperature gauge • Malfunction of harness or connector

Do the speedometer and tachometer operate normally?
- NO → Check the speedometer and tachometer circuit. (Refer to P.54A-19.)
- YES ↓

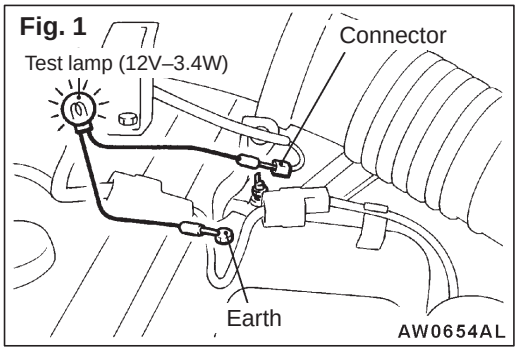
Check the engine coolant temperature gauge circuit.
- Disconnect the engine coolant temperature gauge unit connector A-68.
- Use the special tool to connect a test lamp (12 V – 3.4 W) to the harness-side connector. (Refer to Fig. 1.)
- Ignition switch: ON

(1) Test lamp condition
OK: Illuminates
(2) Engine coolant temperature gauge needle condition
OK: Moves to the middle position.

- OK → Replace the engine coolant temperature gauge unit.
- (1) NG → **Check the following connectors:** A-68, C-29, C-06
  - OK → Check trouble symptom.
    - NG → Check the harness between the combination meter and engine coolant temperature gauge, and repair if necessary.
  - NG → **Repair**
- (2) NG ↓

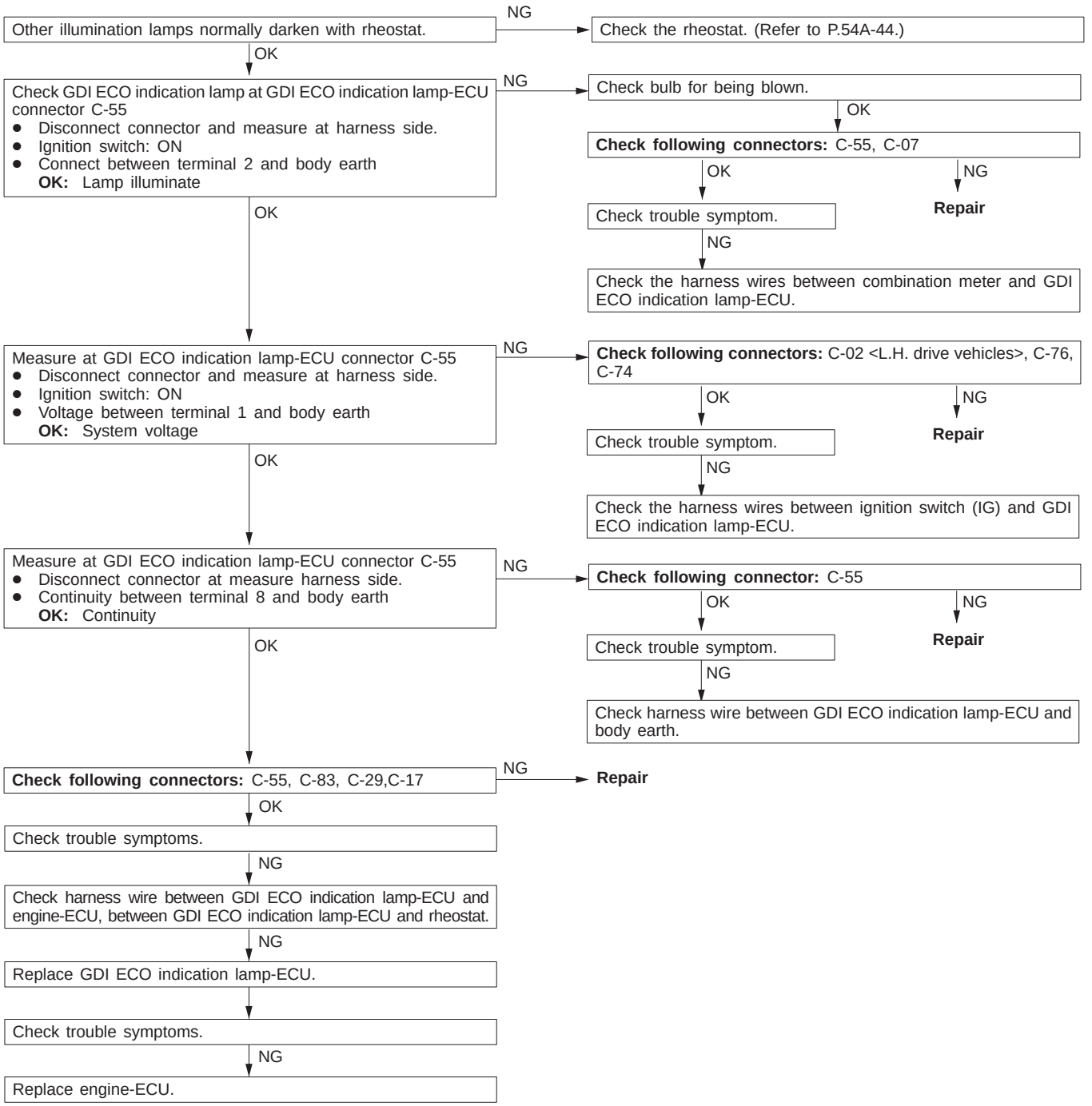
Replace the engine coolant temperature gauge.

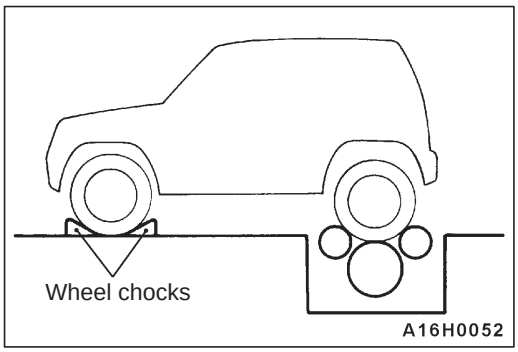
Fig. 1



Inspection Procedure 6

GDI ECO indication lamp does not illuminate.	Probable cause
GDI ECO indication lamp is illuminated by GDI ECO indication lamp-ECU. When it does not illuminates, GDI ECO indication lamp bulb may be blown, or combination meter, power supply circuit of GDI ECO indication lamp-ECU or GDI ECO indication lamp-ECU may be malfunctioning.	• ECO indication lamp bulb blown • Malfunction of combination meter • Malfunction of GDI ECO indication lamp • Malfunction of engine-ECU • Damaged harness or connectors

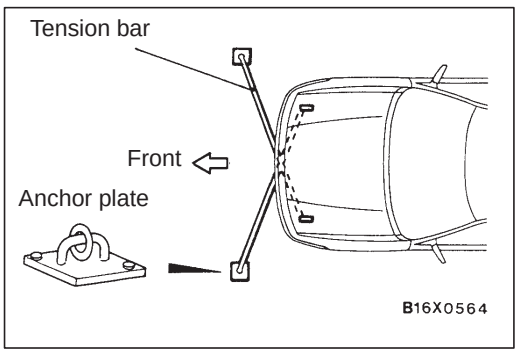




ON-VEHICLE SERVICE

SPEEDOMETER CHECK

1. Adjust the pressure of the tyres to the specified level. (Refer to GROUP 31 – Service Specifications.)
2. Set the vehicle onto a speedometer tester.
3. Use wheel chocks to hold the front wheels, and apply the parking brake firmly.

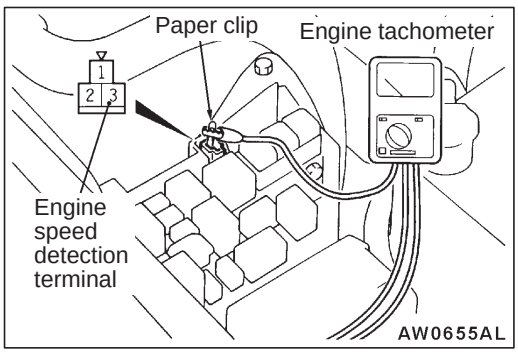


4. To prevent the front wheels from moving from side to side, attach tension bars to the tie-down hooks, and secure both ends to anchor plates.
5. To prevent the vehicle from launching, attach a chain or wire to the rear retraction hook, and make sure the end of the chain or wire is secured firmly.
6. Check if the speedometer indicator range is within the standard values.

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

Standard values:

Standard indication km/h (mph)	Allowable range km/h (mph)
40 (20)	40 – 48 (20 – 25)
80 (40)	80 – 92 (40 – 47)
120 (60)	120 – 136 (60 – 69)
160 (80)	160 – 180 (80 – 91)
– (100)	– (100 – 114)



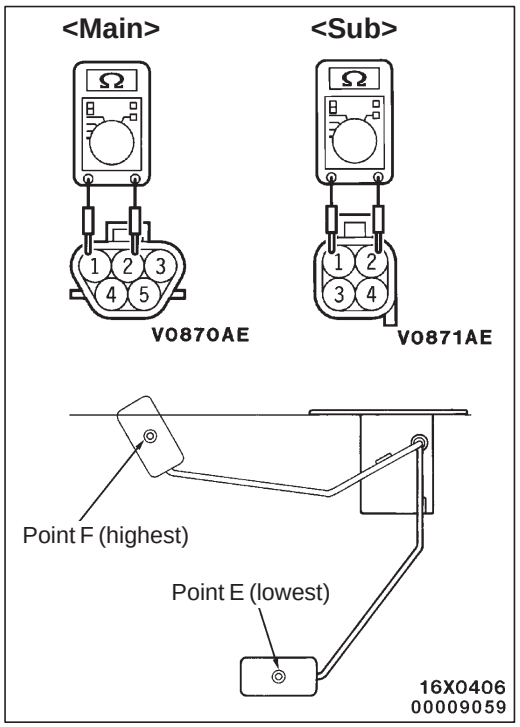
TACHOMETER CHECK

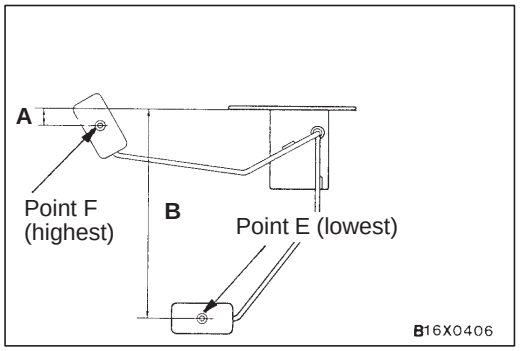
1. Insert a paper clip in the engine speed detection connector from the harness side, and attach the engine speedometer.

   NOTE
   For tachometer check, use of a fluxmeter-type engine speedometer is recommended. (Because a fluxmeter only needs to be clipped to the high tension cable.)

2. Compare the readings of the engine speedometer and the tachometer at every engine speed, and check if the variations are within the standard values.

Standard values:
700 r/min: ±100 r/min
3,000 r/min: +150 r/min
–100 r/min
5,000 r/min: +325 r/min
–125 r/min
6,000 r/min: +375 r/min
–125 r/min





FUEL GAUGE UNIT CHECK

Remove the fuel gauge unit from the fuel tank. (Refer to GROUP 13C.)

FUEL GAUGE UNIT RESISTANCE

1. Check that resistance value between the fuel gauge terminal and earth terminal is at standard value when fuel gauge unit float is at point F (highest) and point E (lowest).

   Standard value:

Items		Standard value Ω
Main	Float point F	1 –3
	Float point E	49.7 – 51.7
Sub	Float point F	1 – 3
	Float point E	55.3 – 57.3

2. Check that resistance value changes smoothly when float moves slowly between point F (highest) and point E (lowest).

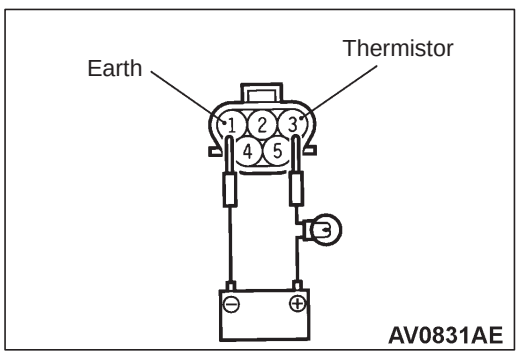
FUEL GAUGE UNIT FLOAT HEIGHT

1. Move float and measure the height A at point F (highest) and B at point E (lowest) with float arm touching stopper.

   Standard value:

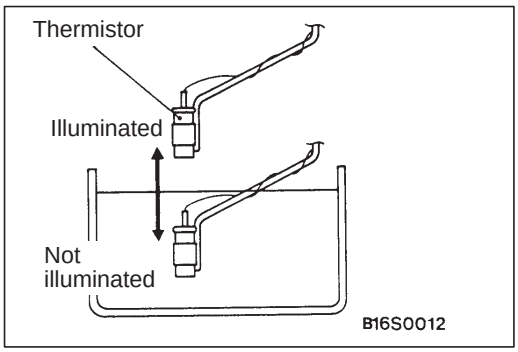
Items		Standard value mm
Main	Float point F	44.5 – 52.5
	Float point E	220.3 – 228.3
Sub	Float point F	30.4 – 36.4
	Float point E	238.5 – 244.5

2. Check that resistance value changes smoothly when float moves slowly between point F (highest) and point E (lowest).



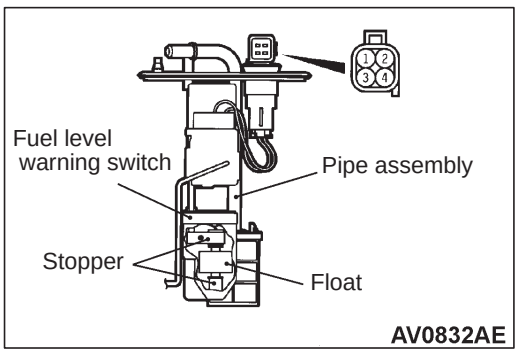
FUEL LEVEL SENSOR (THERMISTOR)

1. Connect the battery to the main fuel gauge unit connector via test lamp (12 V – 3.4 W) as shown in the illustration.



2. Condition is good if the test lamp goes off when the thermistor is immersed in water and comes on when it is taken out of water.

Caution
After finishing this test, wipe the unit dry and install it in the fuel tank.



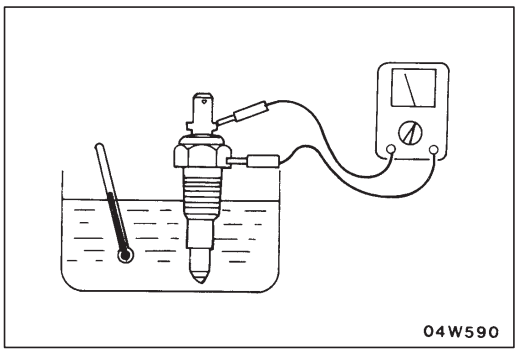
FUEL LEVEL WARNING SWITCH CHECK

1. Remove the sub fuel gauge unit pipe assembly. (Refer to GROUP 13B – Fuel Tank.)

NOTE
Moving up and down of the float makes the reed switch of fuel level warning switch turned on and off.

2. Check the continuity between the terminals.

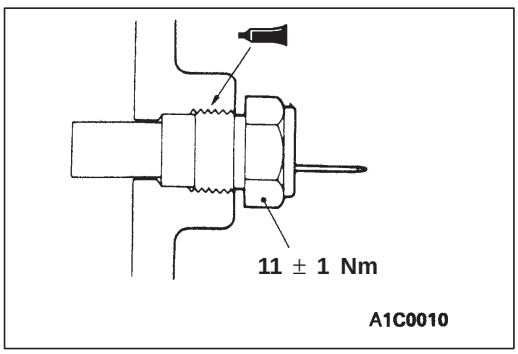
Float position	Terminal No.	
	3	4
When float is in contact with upper stopper		
When float is in contact with lower stopper	○	○



ENGINE COOLANT TEMPERATURE GAUGE UNIT CHECK

1. Bleed the engine coolant. (Refer to GROUP 14 – On-vehicle Service.)
2. Remove the engine coolant temperature gauge unit.
3. Immerse the unit in 70°C water to measure the resistance.

Standard value: 104 ± 13.5 Ω



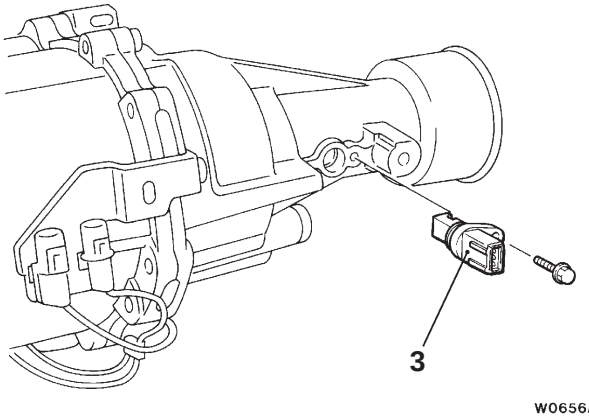
4. After checking, apply the specified adhesive around the thread of engine coolant temperature gauge unit.

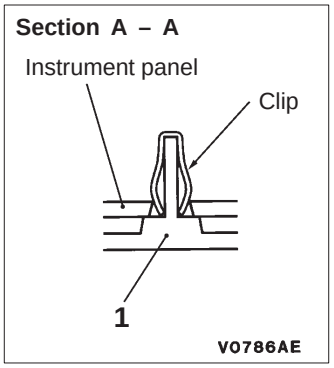
Specified sealant:
3M Adhesive Nut Locking No. 4171 or equivalent

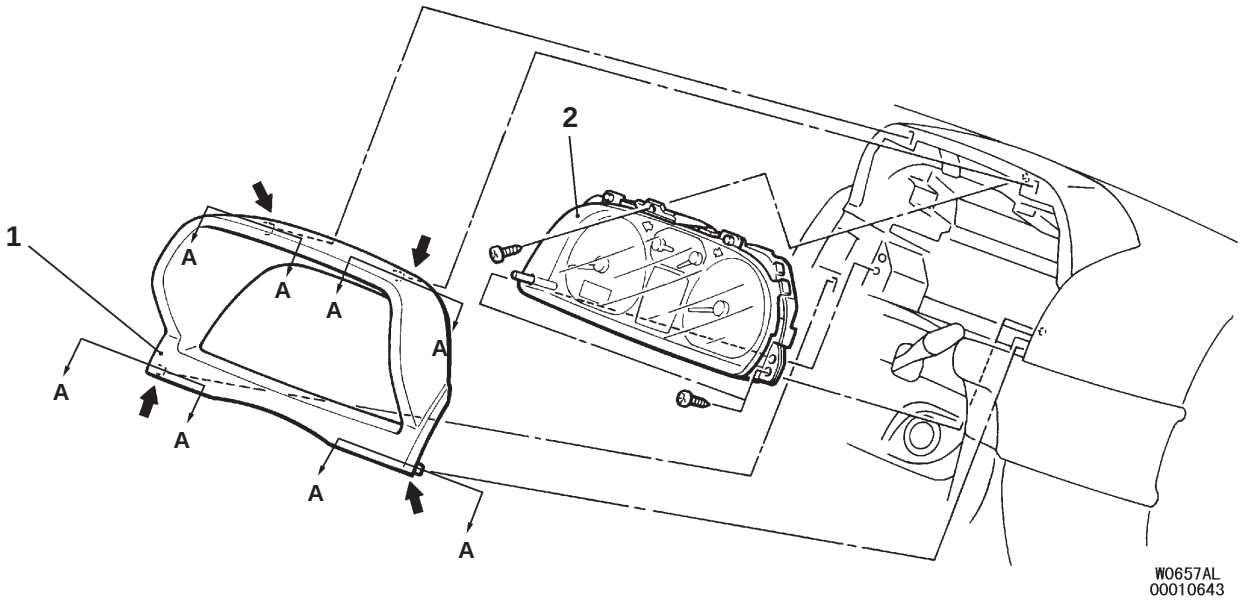
5. Add engine coolant. (Refer to GROUP 14 – On-vehicle Service.)

COMBINATION METERS

REMOVAL AND INSTALLATION







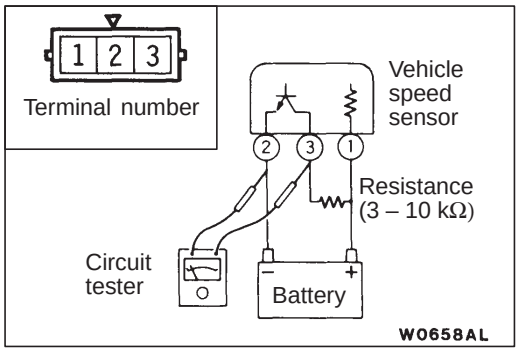
⬅ Clip position

Combination meter removal steps

1. Meter hood
2. Combination meter

Vehicle speed sensor removal

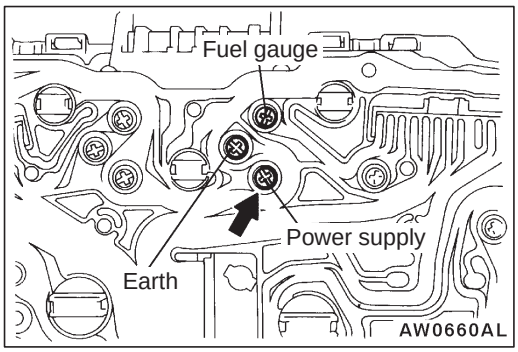
3. Vehicle speed sensor



INSPECTION

VEHICLE SPEED SENSOR INSPECTION

1. Lift up the vehicle.
2. Remove the vehicle speed sensor, and then connect the vehicle speed sensor and a resistance (3 – 10 kΩ) as shown in the illustration.
3. Use a circuit tester to check that the voltage between terminal 2 and terminal 3 changes when turning a shaft of the vehicle speed sensor (4 pulses per each one turn).

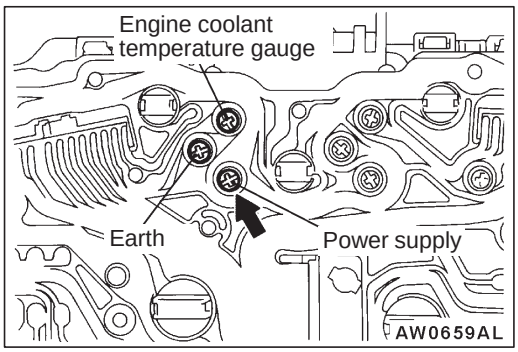


FUEL GAUGE RESISTANCE CHECK

1. Remove the power supply tightening screw.
2. Use an ohmmeter to measure the resistance value between the terminals.

Standard value:
Power supply – Earth: 233.3 Ω
Power supply – Fuel gauge: 108.3 Ω
Fuel gauge – Ground: 125.0 Ω

Caution
When inserting the testing probe into the power supply terminal, be careful not to touch the printed board.



ENGINE COOLANT TEMPERATURE GAUGE RESISTANCE CHECK

1. Remove the power supply tightening screw.
2. Use an ohmmeter to measure the resistance value between the terminals.

Standard value:
Power supply – Earth: 178.9 Ω
Power supply – Engine coolant temperature gauge: 54 Ω
Engine coolant temperature gauge – Earth: 232.9 Ω

Caution
When inserting the testing probe into the power supply terminal, be careful not to touch the printed board.

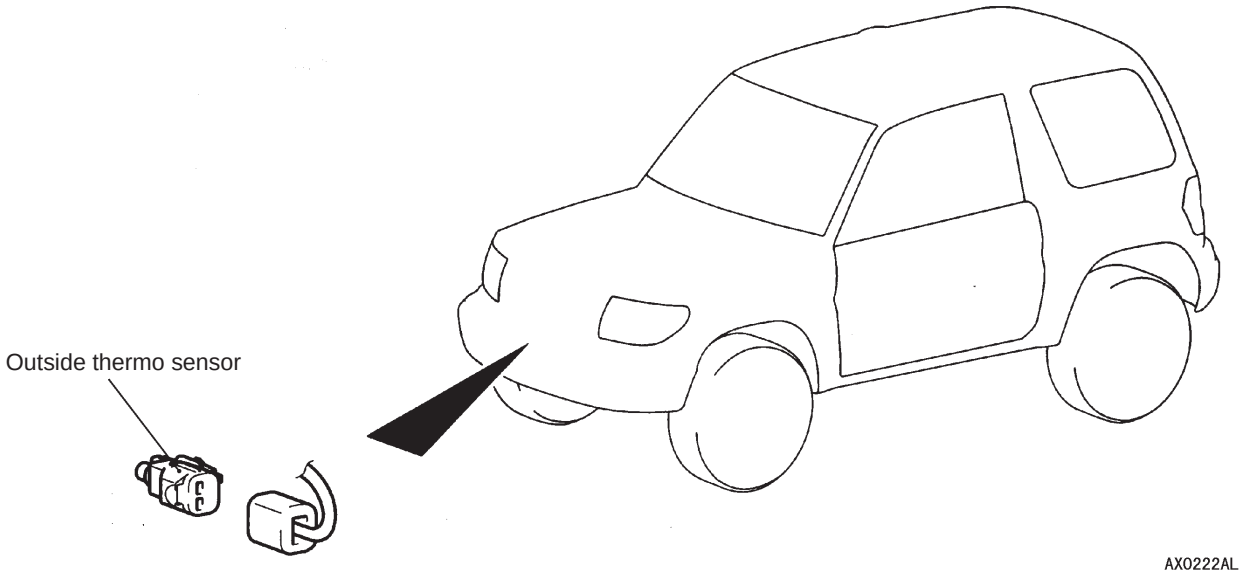
OUTSIDE THERMO SENSOR

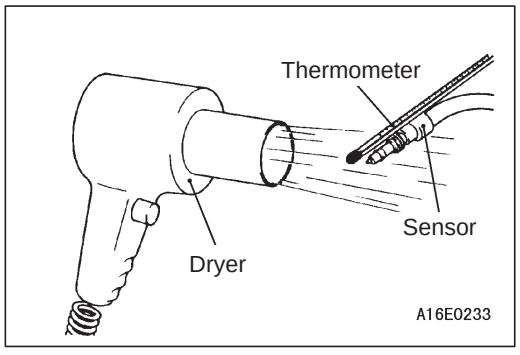
SERVICE SPECIFICATIONS

Items		Standard value
Internal resistance of outside thermo sensor Ω	At 25 °	Approx. 1,700

OUTSIDE THERMO SENSOR

REMOVAL AND INSTALLATION





INSPECTION

OUTSIDE THERMO SENSOR INTERNAL RESISTANCE CHECK

Check the internal resistance of the outside thermo sensor are at the standard value at temperatures of 25 °C.

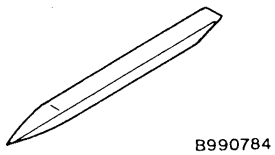
Standard value:
Approx. 1,700 Ω (at 25 °C)

HEADLAMP, FRONT TURN-SIGNAL LAMP AND FRONT FOG LAMP

SERVICE SPECIFICATIONS

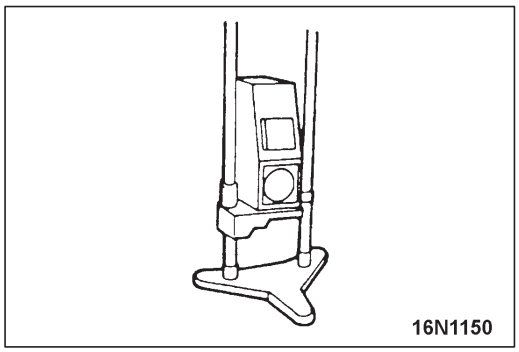
Items		Standard value	Limit
Headlamp aiming for low beam	Vertical direction	60 mm below horizontal (H)	–
	Horizontal direction	Position where the 15° sloping section intersects the vertical line (V)	–
Headlamp intensity cd		–	30,000 or more
Front fog lamp aiming	Vertical direction	100 mm below horizontal (H)	–
	Horizontal direction	Parallel to direction of vehicle travel	–

SPECIAL TOOL

Tool	Number	Name	Use
 B990784	MB990784	Ornament remover	Removal of switch garnish

TROUBLESHOOTING

The headlamp, turn-signal lamp and front fog lamp are controlled by the smart wiring system (SWS). For troubleshooting, refer to GROUP 54B – Troubleshooting.



ON-VEHICLE SERVICE

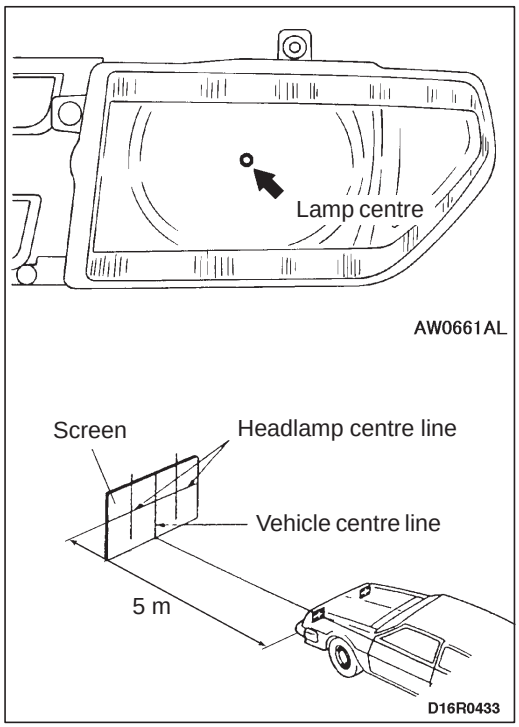
HEADLAMP AIMING

<USING A BEAM SETTING EQUIPMENT>

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

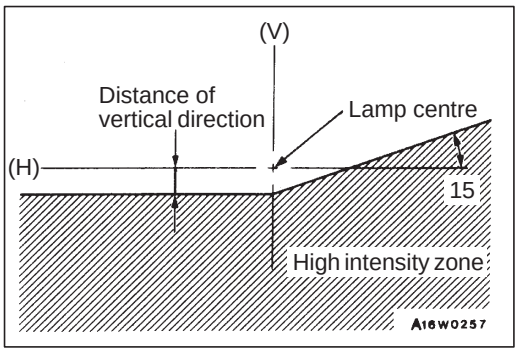
   NOTE
   If there are any regulations pertinent to the aiming of headlamps in the area where the vehicle is to be used, adjust so as to meet those requirements.

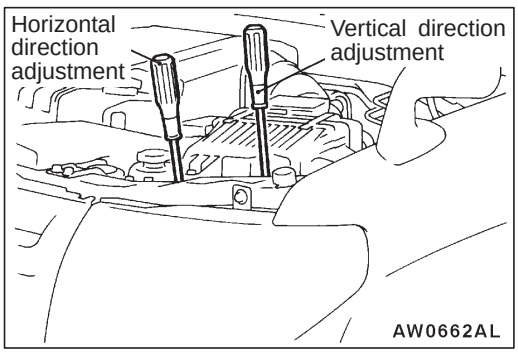
2. Alternately turn the adjusting screw to adjust the headlamp aiming. (Refer to P.54A-32.)



<USING A SCREEN>

1. Inflate the tyres to the specified pressures and there should be no other load in the vehicles other than driver or substituted weight of approximately 75 kg placed in driver's position.
2. Put the headlamp leveling switch in "0" position.
3. Set the distance between the screen and the centre marks of the headlamps as shown in the illustration.





4. Check if the beam shining onto the screen is at the standard value.

   Standard value:
   (Vertical direction)
   60 mm below horizontal (H)
   (Horizontal direction)
   Position where the 15° sloping section intersects the vertical line (V)

   NOTE
   The illustration shows L.H. drive vehicles. For R.H. drive vehicles, it is symmetrical.
5. Alternately turn the adjusting screw to adjust the headlamp aiming.

   Caution
   Be sure to adjust the aiming adjustment screw in the tightening direction.

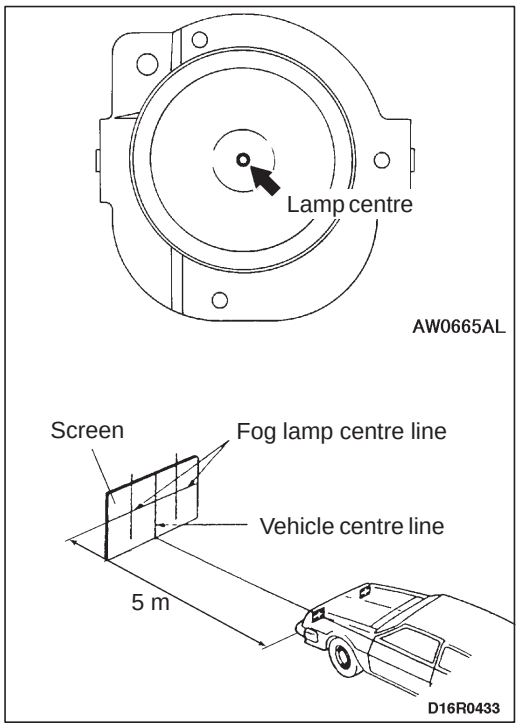
HEADLAMP INTENSITY MEASUREMENT

Using a photometer, and following its manufacture's instruction manual, measure the headlamp intensity and check to be sure that the limit value is satisfied.

Limit: 30,000 cd or more

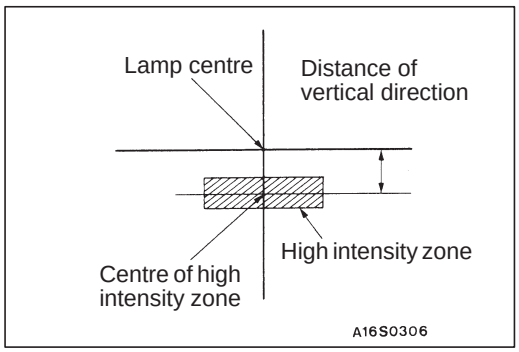
NOTE
1. When measuring the intensity, maintain an engine speed of 2,000 r/min, with the battery in the charging condition.
2. There may be special local regulations pertaining to headlamp intensity, be sure to make any adjustments necessary to satisfy such regulations.
3. If an illuminometer is used to make the measurements, convert its values to photometer values by using the following formula.

   $I = Er^2$ Where:
   I=intensity (cd)
   E=illumination (lux)
   r=distance (m) from headlamps to illuminometer



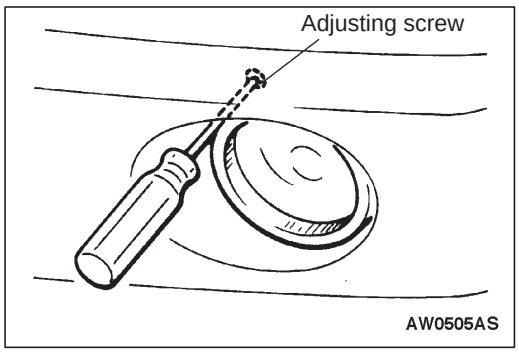
FRONT FOG LAMP AIMING

1. Measure the centre of the front fog lamps, as shown in the illustration.
2. Set the distance between the screen and the centre of the front fog lamps as shown in the illustration.
3. Inflate the tyres to the specified pressures and there should be no other load in the vehicles other than driver or substituted weight of approximately 75 kg placed in the driver's position.
4. With the engine running at 2,000 r/min, aim the front fog lamp.



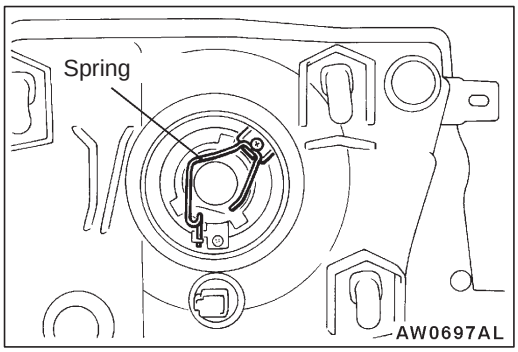
5. Check if the beam shining onto the screen is at the standard value.

Standard value:
(Vertical direction)
100 mm below horizontal (H)
(Horizontal direction)
Parallel to direction of vehicle travel



NOTE
The horizontal direction is non-adjustable. If the deviation of the light beam axis exceeds the standard value, check to be sure that the mounting location or some other point is not defective.

Caution
When making the aiming adjustment, be sure to mask those lamps which are not being adjusted.

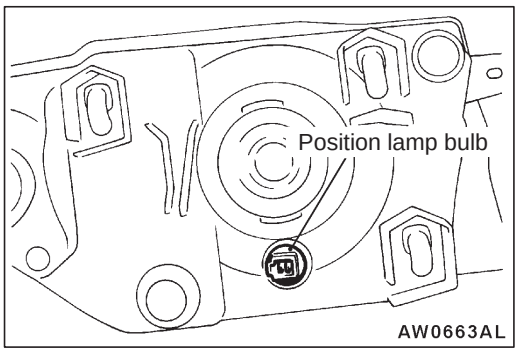


BULB REPLACEMENT

<Headlamp Bulb>

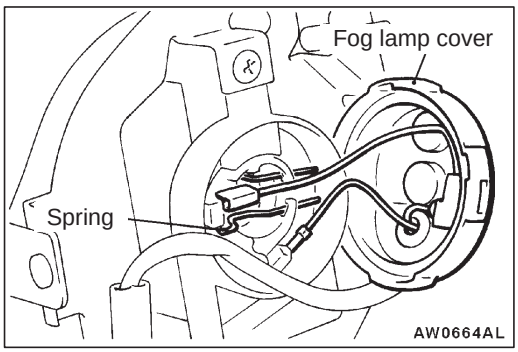
1. Disconnect the connector.
2. Remove the socket cover.
3. Remove the bulb mounting spring, and then withdraw the bulb.
4. Install new bulb, and then connect the connector securely.

Caution
Do not touch the surface of the bulb with hands or dirty gloves. If the surface does become dirty, clean it with alcohol or thinner, and let it dry thoroughly before installing.



<Position Lamp Bulb>

Remove the lamp socket by turning it anti-clockwise, then pull out the bulb from the socket.



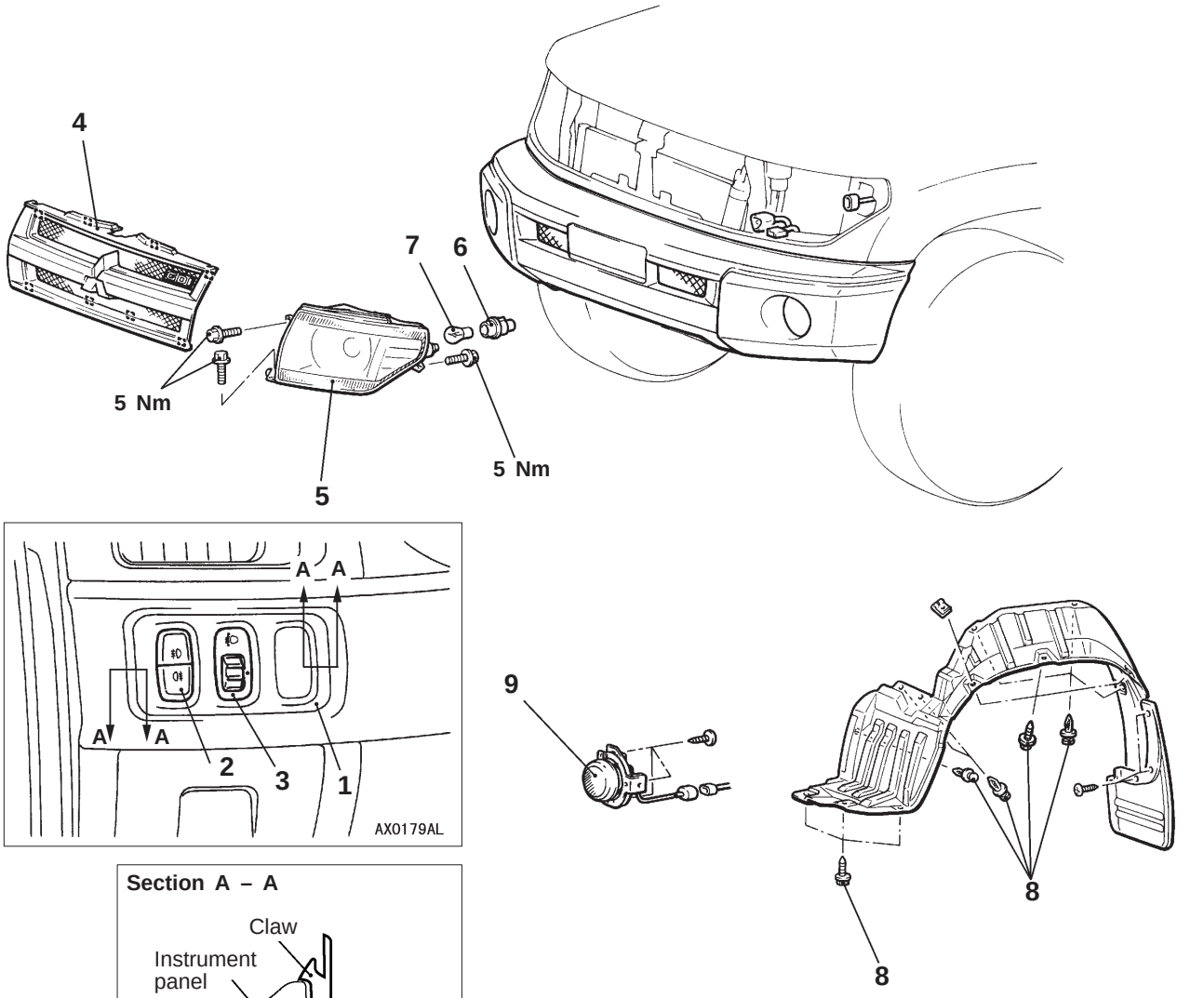
<Front fog lamp Bulb>

1. Remove the front fog lamp.
2. Remove the front fog lamp cover.
3. Remove the front bulb mounting spring, and then withdraw the bulb.
4. Disconnect the connector, and then replace the bulb.

Caution
(1) Always use the genuine part for replacement.
(2) Do not touch the surface of the bulb with hands or dirty gloves. If the surface does become dirty, clean it with alcohol or thinner, and let it dry thoroughly before installing.
(3) Be sure to install the socket cap. If the socket cap is improperly installed, the lens will be fogged or water may enter the lamp unit.

HEADLAMP, FRONT TURN-SIGNAL LAMP AND FRONT FOG LAMP

REMOVAL AND INSTALLATION



Fog lamp switch and headlamp leveling switch removal steps

1. Switch panel
2. Fog lamp switch
3. Headlamp leveling switch

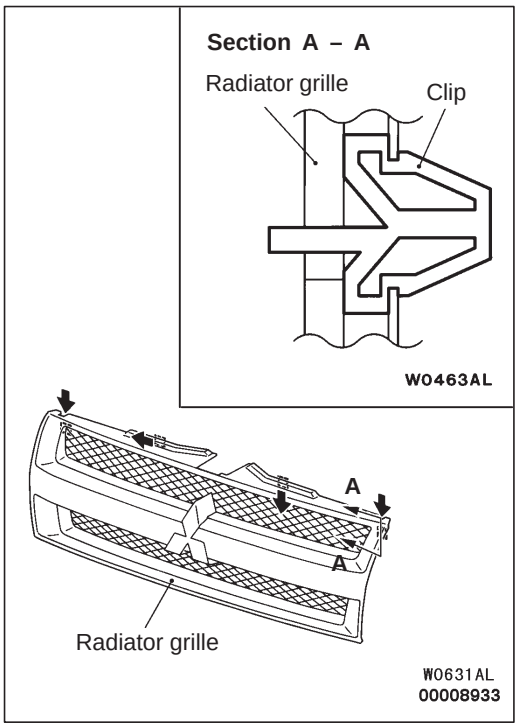
Headlamp removal steps

◀A▶ 4. Radiator grille
5. Headlamp
6. Front turn-signal lamp socket
7. Front turn-signal lamp bulb

Front fog lamp removal steps

8. Splash shield front part mounting clips and screws
9. Front fog lamp

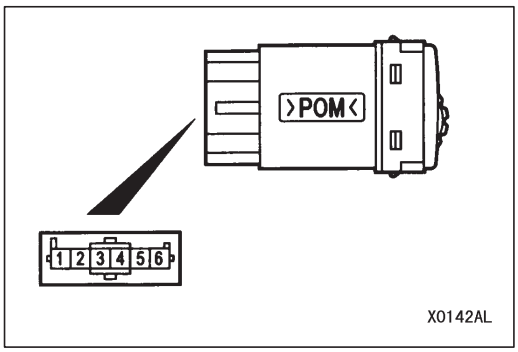
NOTE
For removal and installation of the column switch (lighting switch), refer to GROUP 37A – Steering Wheel and Shaft.



REMOVAL SERVICE POINT

◀A▶ RADIATOR GRILLE REMOVAL

1. Pull the radiator grille toward you gently, and press the clip tab with a flat-tipped screwdriver toward the arrow to remove the radiator grille.
2. Remove the clips from the body, and install them to the radiator grille temporarily for reinstallation.

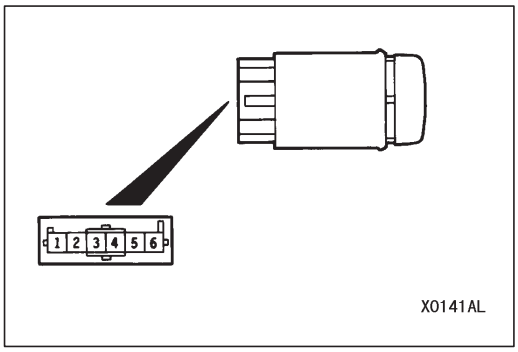


INSPECTION

HEADLAMP LEVELING SWITCH CONTINUITY CHECK

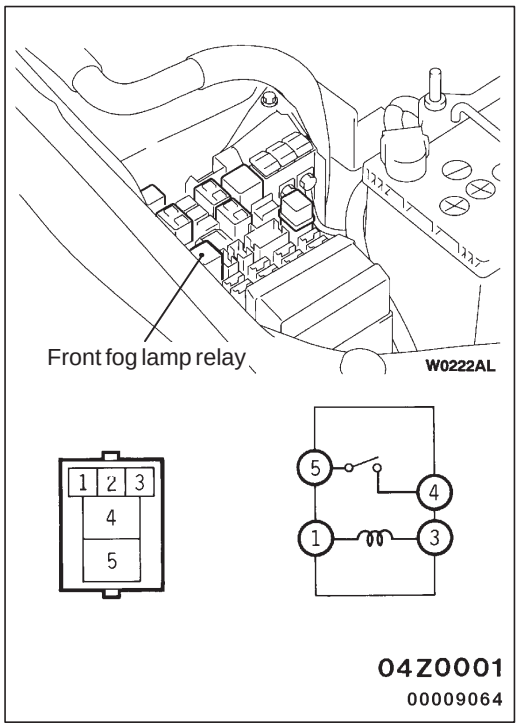
1. Check the continuity between terminals 4 and 5 (illumination circuit).
2. Operating the headlamp leveling switch, check that the resistance between terminals 4 and 5 meets the condition below.

Switch position	Resistance value
0	12 kΩ
1	5.1 kΩ
2	2.7 kΩ
3	1.5 kΩ
4	620 Ω



FOG LAMP SWITCH CONTINUITY CHECK

Switch position	Terminal No.				
	1	2	3	ILL	4
Released			○	○	○
Pressed	○	○	○	○	○

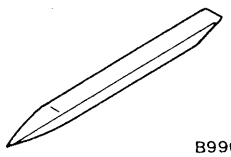


FRONT FOG LAMP RELAY CONTINUITY CHECK

Battery voltage	Terminal No.			
	1	3	4	5
Not supplied	○	○		
Supplied	⊕	⊖	○	○

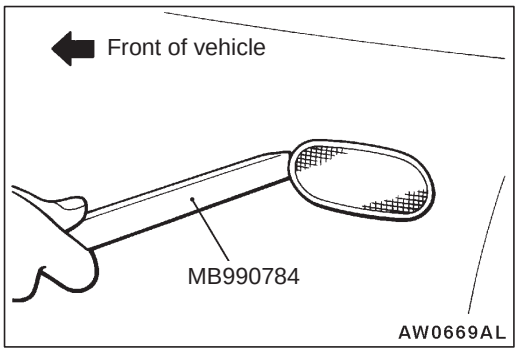
SIDE TURN-SIGNAL LAMP

SPECIAL TOOL

Tool	Number	Name	Use
 B990784	MB990784	Ornament remover	Removal of side turn-signal lamp

TROUBLESHOOTING

The side turn-signal lamp is controlled by the smart wiring system (SWS).
For troubleshooting, refer to GROUP 54B – Troubleshooting.



SIDE TURN-SIGNAL LAMP

REMOVAL SERVICE POINT

SIDE TURN-SIGNAL LAMP REMOVAL

Use a special tool to remove the lock from the fender panel, and then remove the side turn-signal lamp.

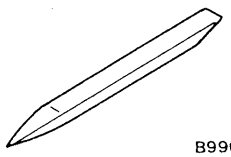
ROOM LAMP

TROUBLESHOOTING

The room lamp is controlled the smart wiring system (SWS).
For troubleshooting, refer to GROUP 54B – Troubleshooting.

REAR COMBINATION LAMP, REAR FOG LAMP

SPECIAL TOOLS

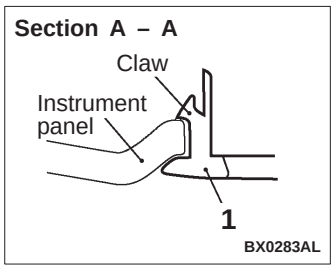
Tool	Number	Name	Use
	MB990784	Ornament remover	Removal of side turn-signal lamp

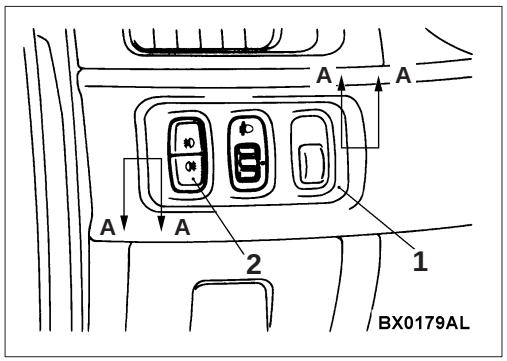
TROUBLESHOOTING

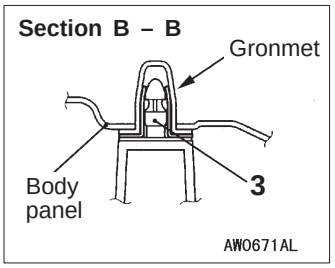
The tail lamp, turn-signal lamp and rear fog lamp are controlled by the smart wiring system (SWS). For troubleshooting, refer to GROUP 54B – Troubleshooting.

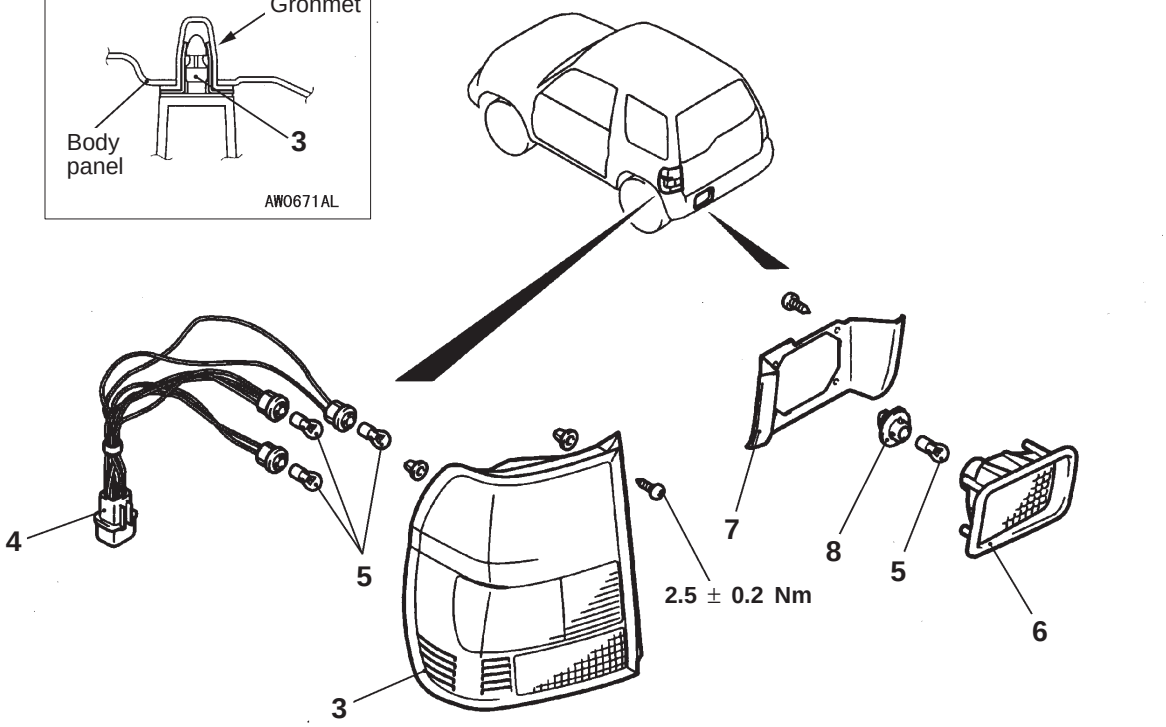
REAR COMBINATION LAMP, REAR FOG LAMP

REMOVAL AND INSTALLATION <L.H. drive vehicles>









Fog lamp switch removal steps

1. Switch panel
2. Fog lamp switch

Rear combination lamp removal steps

- Quarter Trim Removal and Installation (Refer to GROUP 52A)

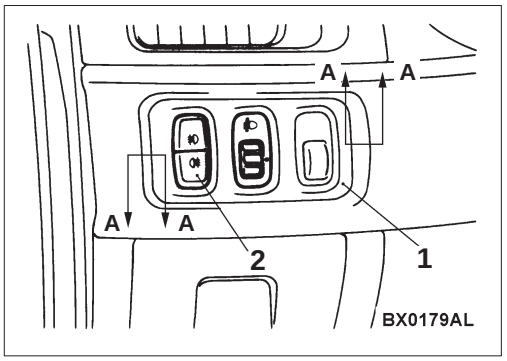
3. Rear combination lamp
4. Socket assembly
5. Bulb

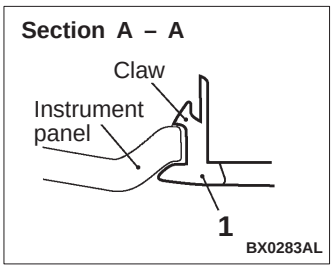
Rear fog lamp removal steps

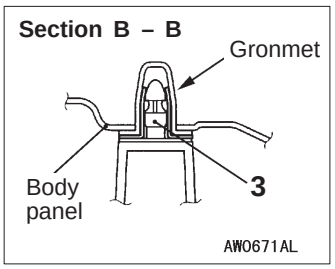
- Rear mad guard (Refer to GROUP 51)
- Rear splash shield

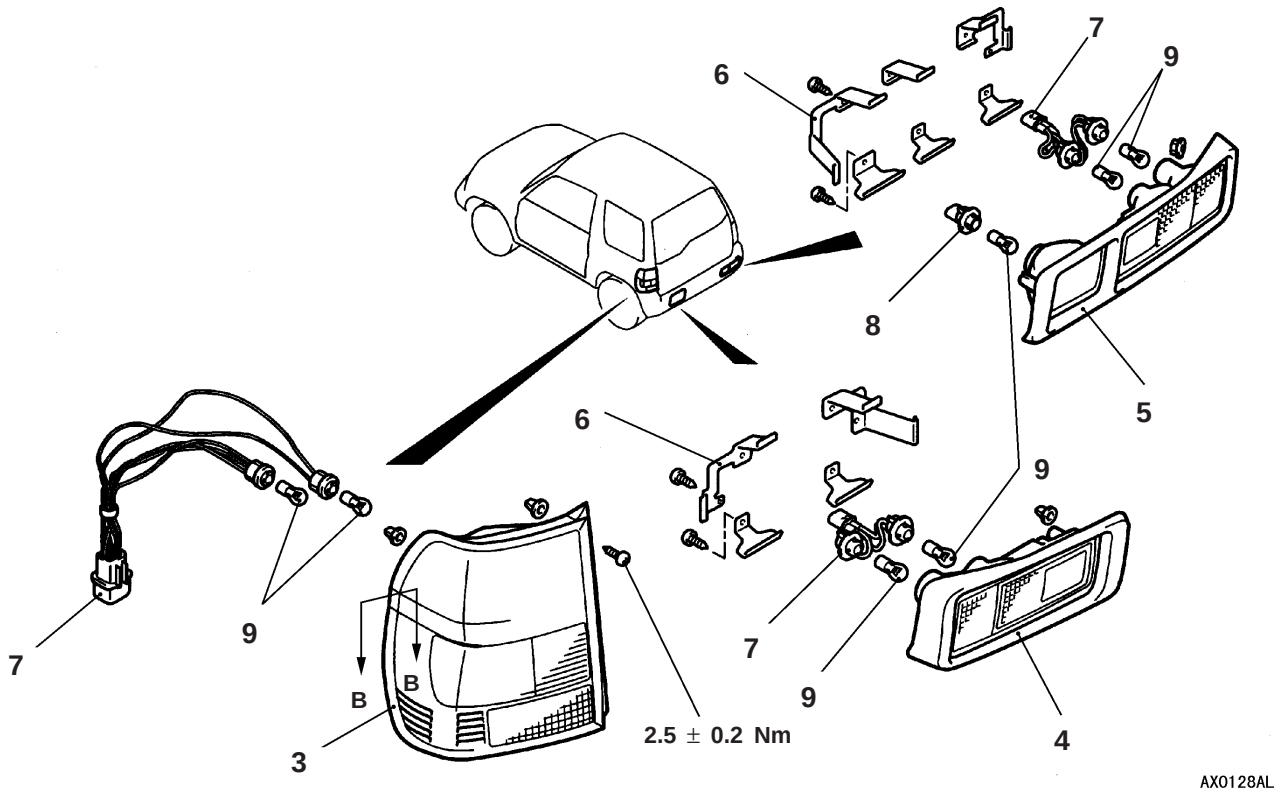
6. Rear fog lamp
7. Bracket
8. Socket

REMOVAL AND INSTALLATION <R.H. drive vehicles>









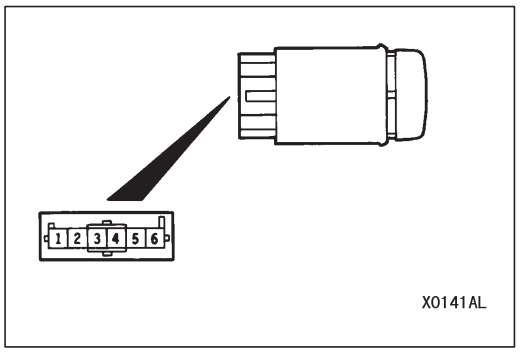
Fog lamp switch removal steps

1. Switch panel
2. Fog lamp switch

Rear combination lamp removal steps

- Quarter trim removal and installation (Refer to GROUP 52A)

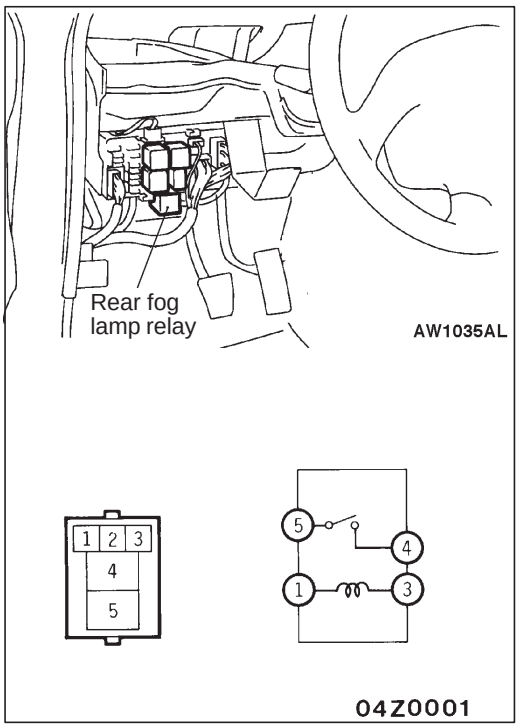
3. Rear combination lamp (Stop and back up lamp)
4. Rear combination lamp (Turn-signal and tail lamp)
5. Rear combination lamp (Rear fog lamp, turn-signal lamp and tail lamp)
6. Bracket
7. Socket assembly
8. Socket
9. Bulb



INSPECTION

FOG LAMP SWITCH CONTINUITY CHECK

	Terminal No.				
	3	ILL	4	5	6
Relased	○	○	○		
Pressed	○	○	○	○	○



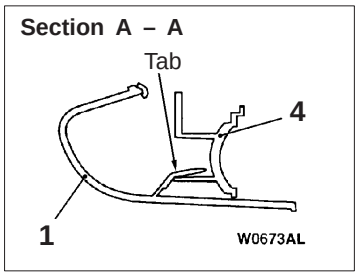
INSPECTION

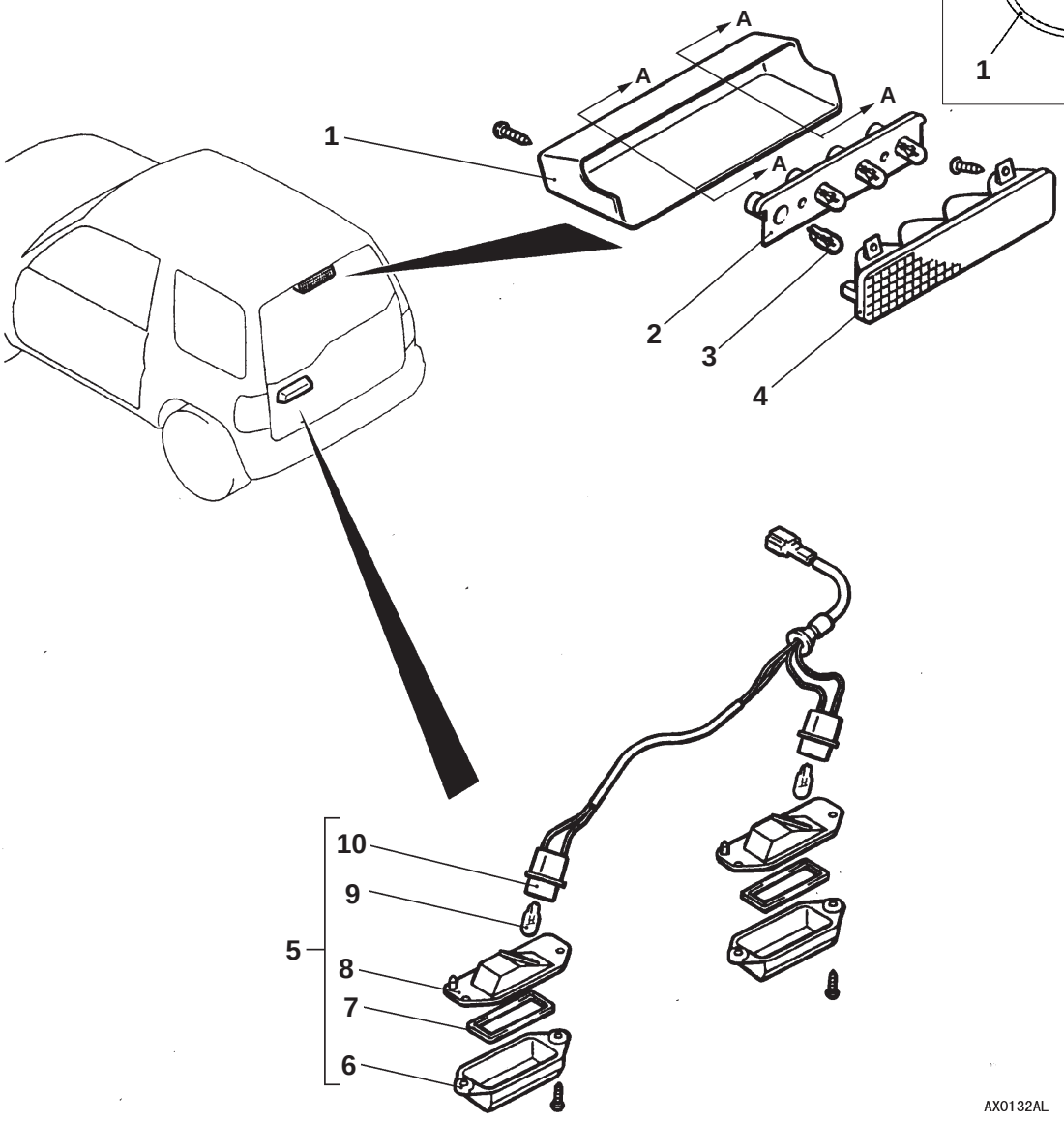
REAR FOG LAMP RELAY CONTINUITY CHECK

Battery voltage	Terminal No.			
	1	3	4	5
Not supplied	○	○		
Supplied	⊕	⊖	○	○

HIGH-MOUNTED STOP LAMP AND LICENCE PLATE LAMP

REMOVAL AND INSTALLATION





High-mounted stop lamp removal steps

1. High-mounted stop lamp cover
2. Socket assembly
3. Bulb
4. High-mounted stop lamp

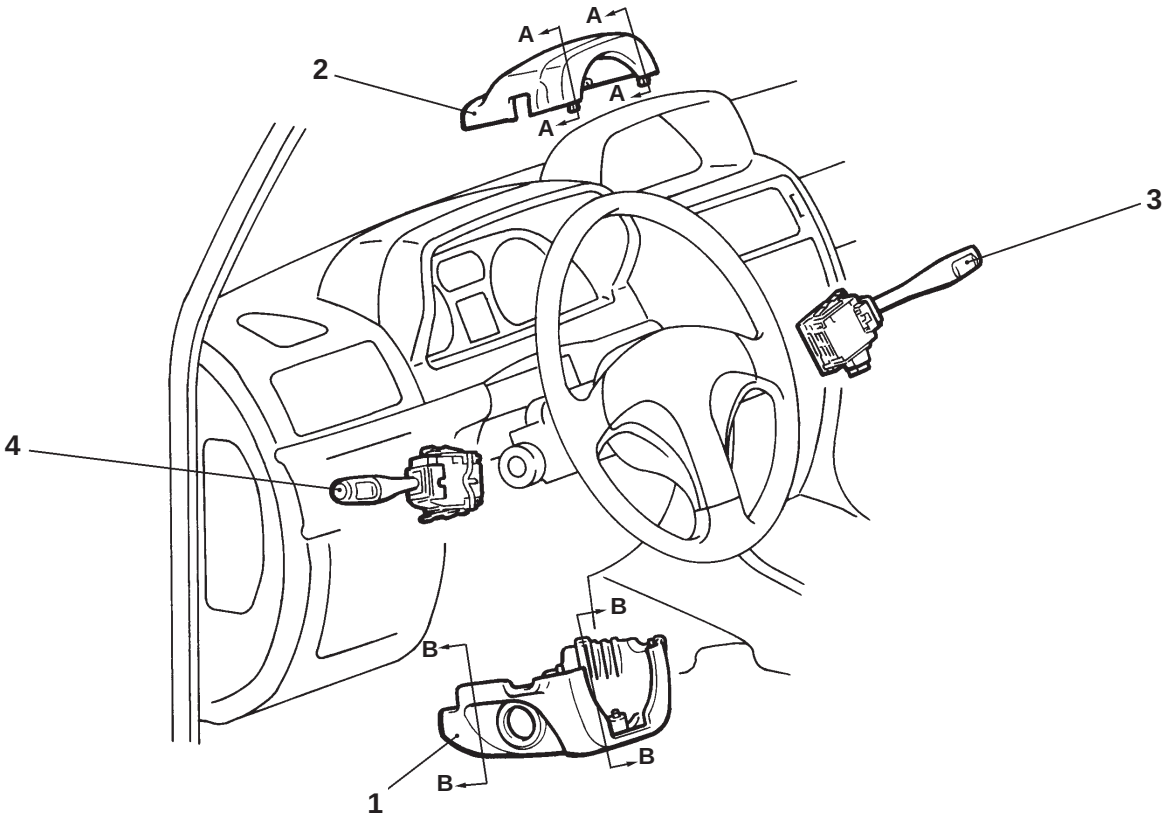
Licence plate lamp removal steps

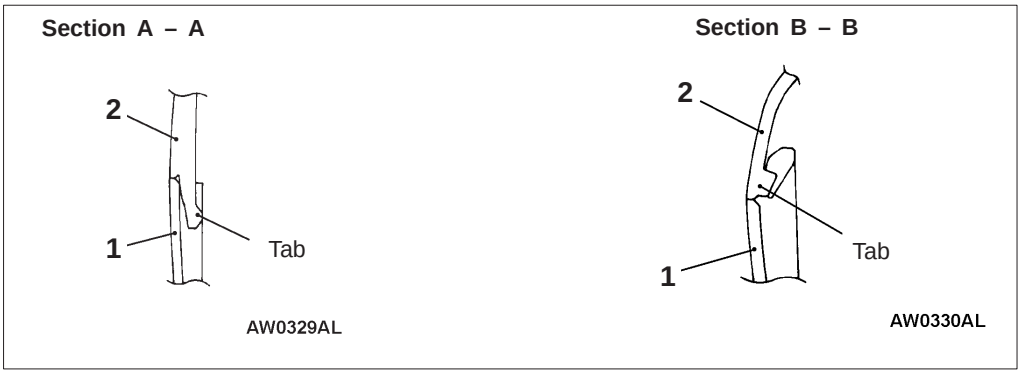
- Back door trim and waterproof film (Refer to GROUP 42.)
- Licence plate lamp garnish (Refer to GROUP 42 – Back Door.)

5. Licence plate lamp assembly
6. Lens
7. Packing
8. Licence plate lamp
9. Bulb
10. Socket assembly

COLUMN SWITCH

REMOVAL AND INSTALLATION





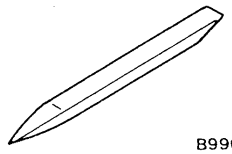
AW1051AL

Removal steps

1. Column cover, lower
2. Column cover, upper
3. Wiper and washer switch
4. Lighting switch

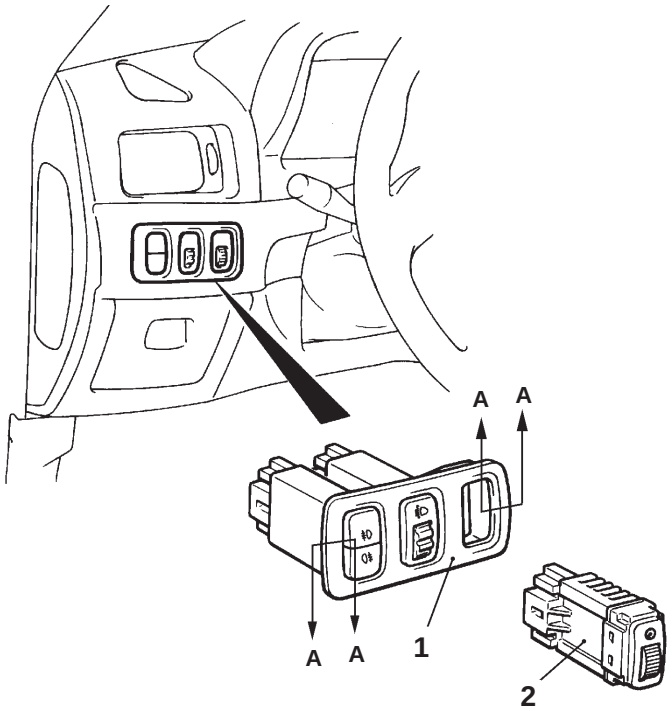
RHEOSTAT

SPECIAL TOOL

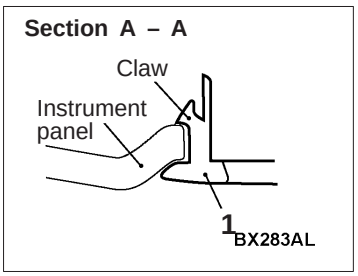
Tool	Number	Name	Use
 B990784	MB990784	Ornament remover	Removal of switch garnish

RHEOSTAT

REMOVAL AND INSTALLATION

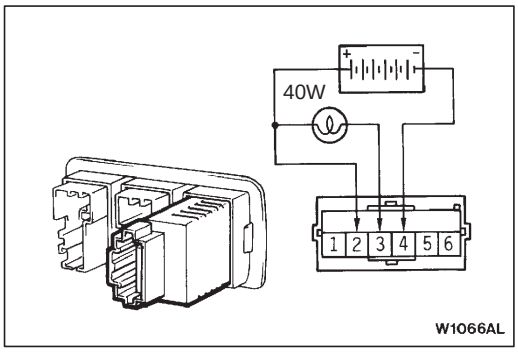


AX0144AL



Removal steps

1. Switch panel
2. Rheostat

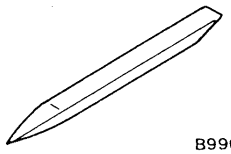


INSPECTION

1. Connect the battery and the test bulb (40W) as shown in the illustration.
2. Operate the rheostat, and if the brightness changes smoothly without switching off, then the rheostat function is normal.

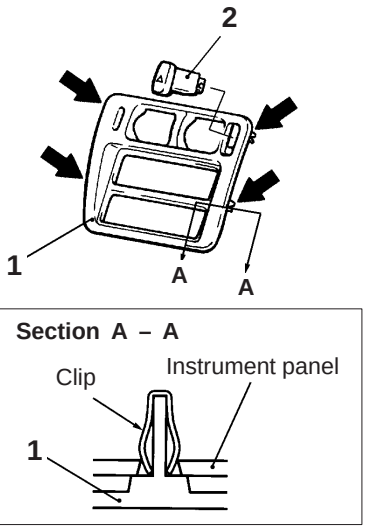
HAZARD WARNING LAMP SWITCH

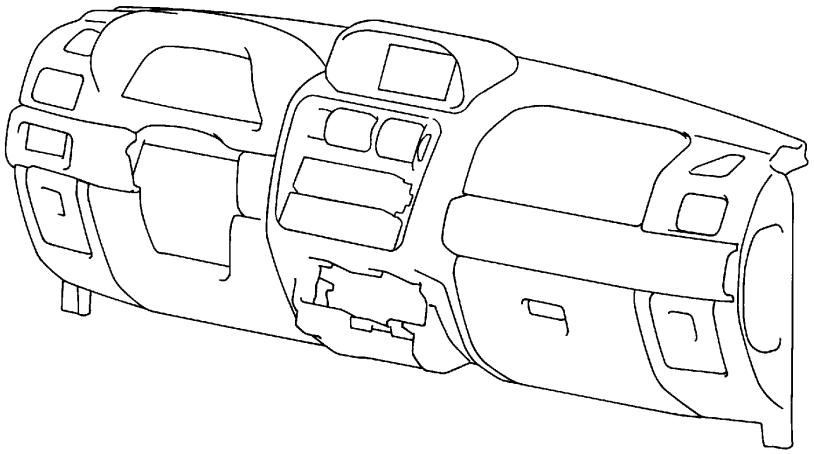
SPECIAL TOOL

Tool	Number	Name	Use
 B990784	MB990784	Ornament remover	Removal of center panel

HAZARD WARNING LAMP SWITCH

REMOVAL AND INSTALLATION



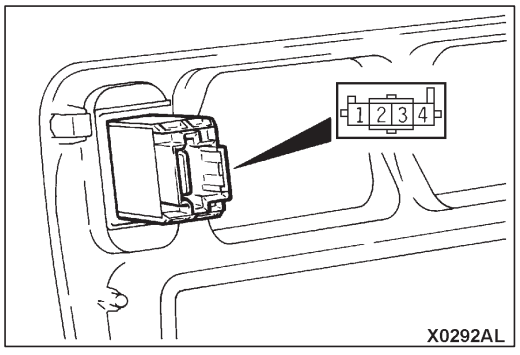


: shows clips.

AW1049AL

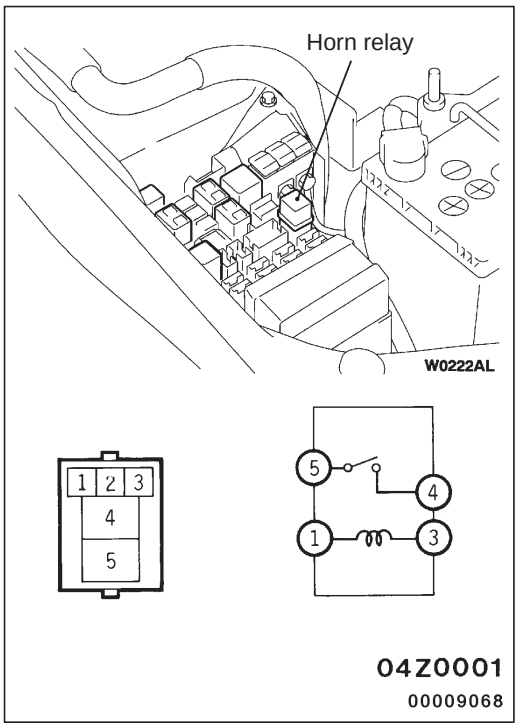
Removal steps

1. Center panel
2. Hazard warning lamp switch



INSPECTION

Switch position	Terminal No.				
	1	2	3		4
OFF				ILL	
ON				ILL	



HORN

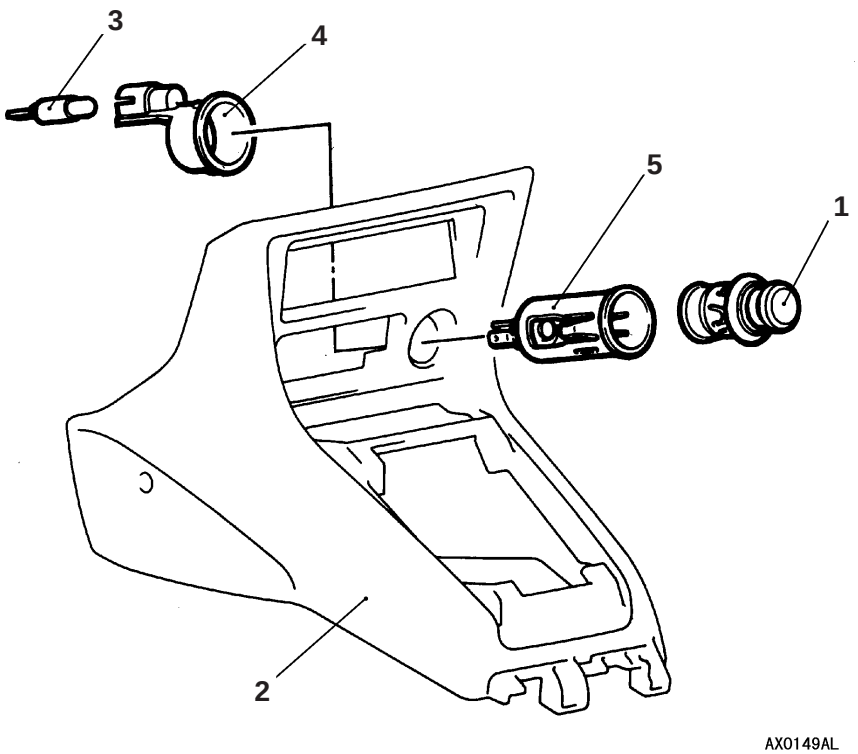
INSPECTION

HORN RELAY CONTINUITY CHECK

Battery voltage	Terminal No.			
	1	3	4	5
Not supplied	○	○		
Supplied	⊕	⊖	○	○

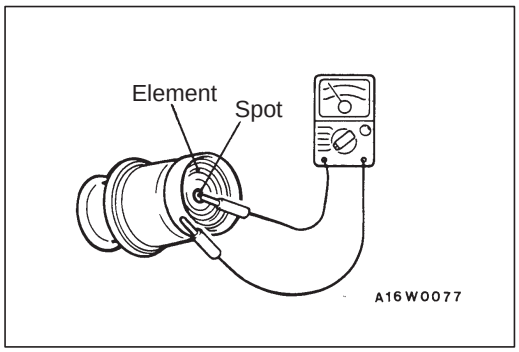
CIGARETTE LIGHTER

REMOVAL AND INSTALLATION



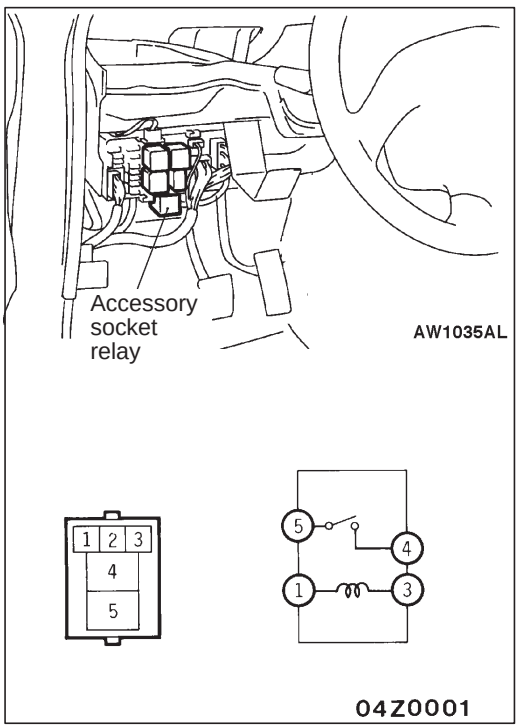
Removal steps

1. Plug
2. Floor console (Refer to GROUP 52A)
3. Bulb
4. Socket case
5. Socket



INSPECTION

- Take out the plug, and check for a worn edge on the element spot connection, and for shreds of tobacco or other material on the element.
- Using a circuit tester, check the continuity of the element.



ACCESSORY SOCKET

INSPECTION

ACCESSORY SOCKET RELAY CONTINUITY CHECK

Battery voltage	Terminal No.			
	1	3	4	5
Not supplied	○	○		
Supplied	⊕	⊖	○	○

RADIO AND TAPE PLAYER

TROUBLESHOOTING

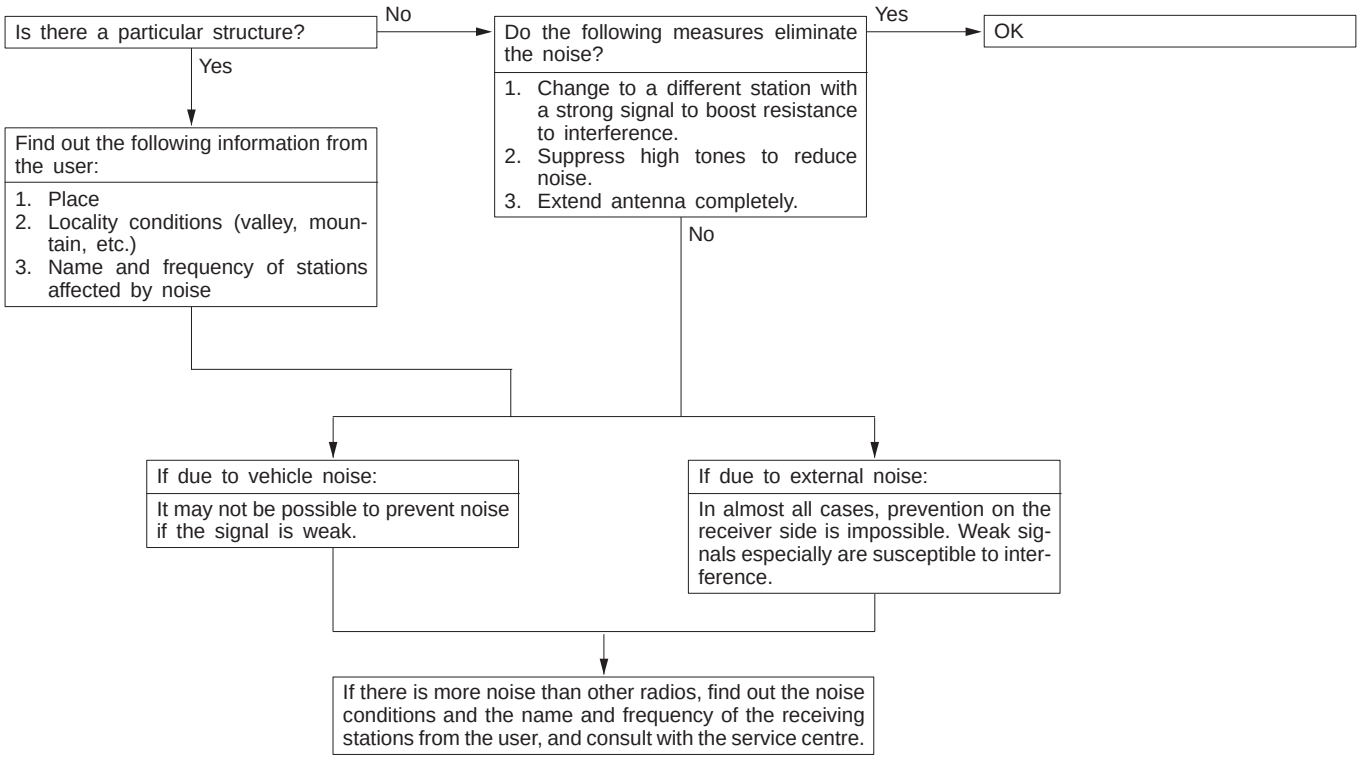
QUICK-REFERENCE TROUBLESHOOTING CHART

Items	Problem symptom	Relevant chart
Noise	Noise appears at certain places when travelling.	A-1
	Mixed with noise, only at night.	A-2
	Broadcasts can be heard but FM/MW/LW has a lot of noise.	A-3
	There is noise when starting the engine.	A-4
	Some noise appears when there is vibration or shocks during travelling.	A-5
	Ever-present noise.	A-6
Radio	When switch is set to ON, no power is available.	B-1
	No sound from one speaker.	B-2
	There is noise but no reception for FM/MW/LW or no sound from FM/MW/LW	B-3
	Insufficient sensitivity.	B-4
	Distortion on FM/MW/LW.	B-5
	Too few automatic select stations.	B-6
	Insufficient memory (preset stations are erased).	B-7
Tape player	Cassette tape will not be inserted.	C-1
	No sound.	C-2
	No sound from one speaker.	C-3
	Sound quality is poor, or sound is weak.	C-4
	Cassette tape will not be ejected.	C-5
	Uneven revolution. Tape speed is fast or slow.	C-6
	Faulty auto reverse.	C-7
	Tape gets caught in mechanism.	C-8

CHART

A. NOISE

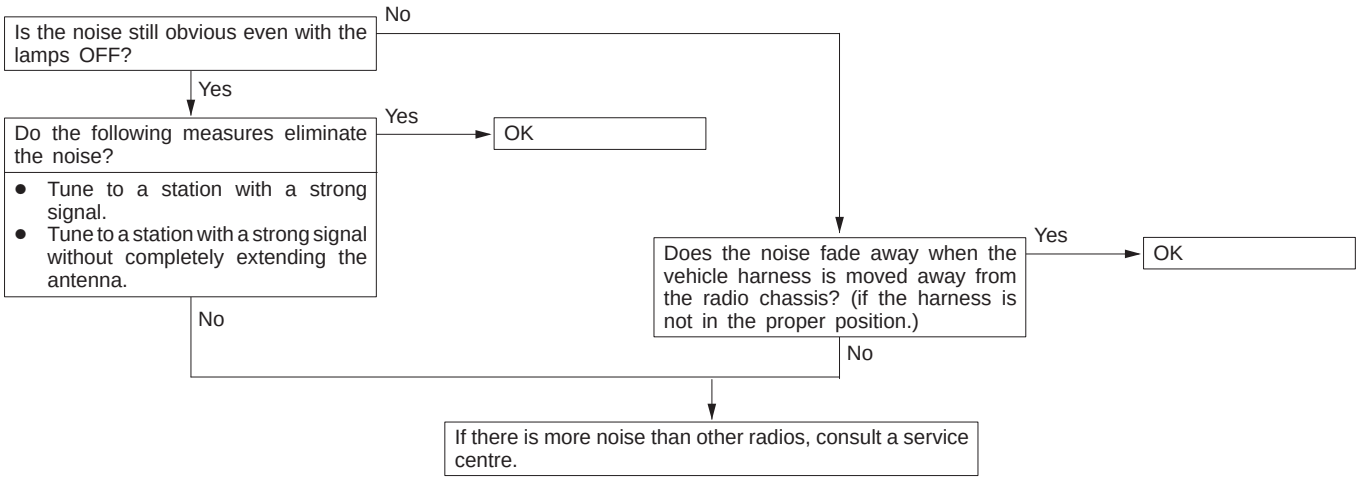
A-1 Noise appears at certain places when travelling.



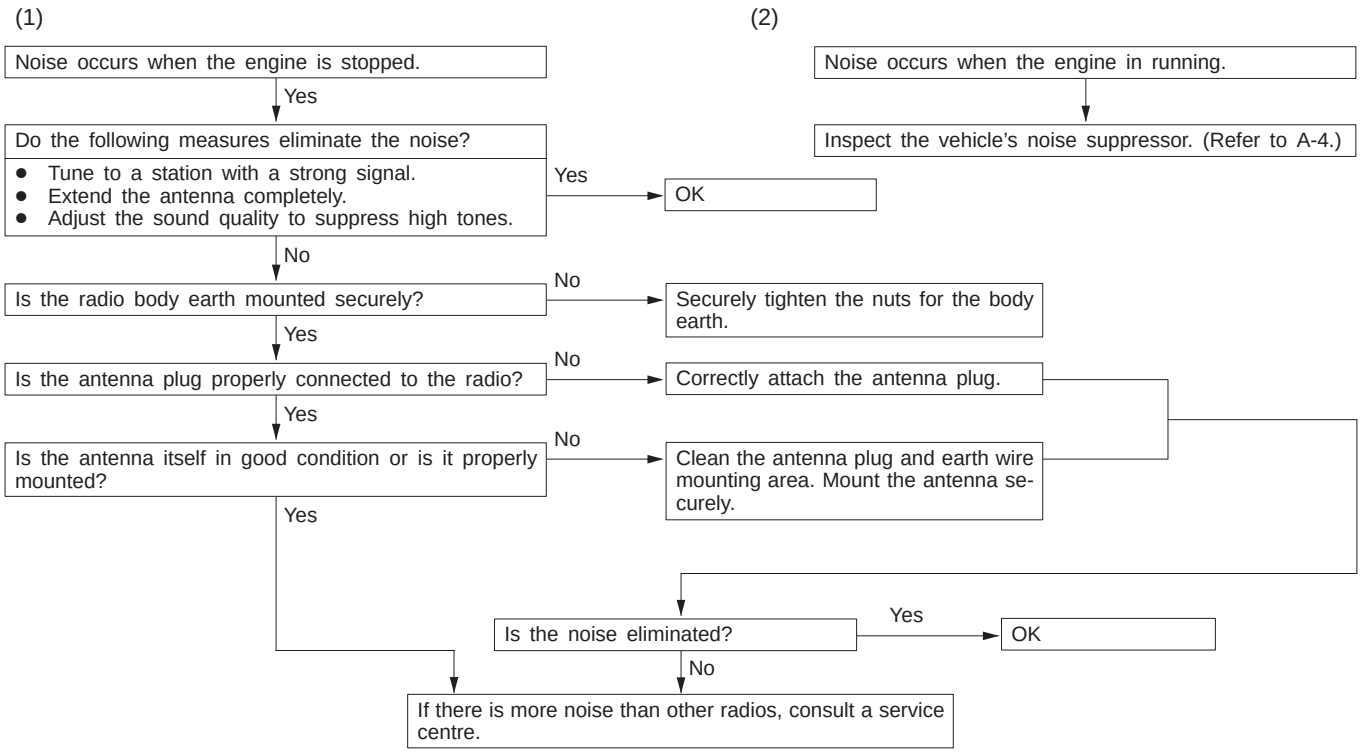
A-2 Mixed with noise, only at night.

The following factors can be considered as possible causes of noise appearing at night.

1. Factors due to signal conditions: Due to the fact that long-distance signals are more easily received at night, even stations that are received without problem during the day may experience interference in a general worsening of reception conditions. The weaker a station is the more susceptible it is to interference, and a change to a different station or the appearance of a beating sound* may occur.
   Beat sound*: Two signals close in frequency interfere with each other, creating a repetitious high-pitched sound. This sound is generated not only by sound signals but by electrical waves as well.
2. Factors due to vehicle noise: Alternator noise may be a cause.



A-3 Broadcasts can be heard but FM/MW/LW has a lot of noise.



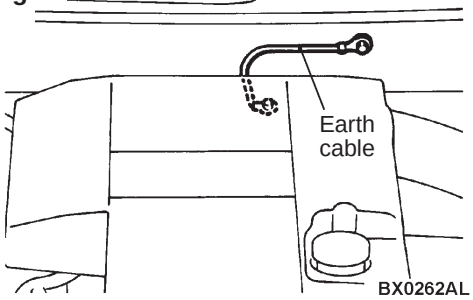
A-4 There is noise when starting the engine.

Noise type Sounds are in parentheses ( ).	Conditions	Cause	Remedy
FM/MW/LW: Ignition noise (Popping, snapping, cracking, buzzing)	● Increasing the engine speed causing the popping sound to speed up, and volume decreases. ● Disappears when the ignition switch is turned to ACC.	● Mainly due to the spark plugs. ● Due to the engine noise.	● Check or replace the earth cable. (Refer to Fig. 1 on P.54A-59.) ● Check or replace the noise capacitor.
Other electrical components	–	Noise may appear as electrical components become older.	Repair or replace electrical components.
Static electricity (Cracking, crinkling)	● Disappears when the vehicle is completely stopped. ● Severe when the clutch is engaged.	Occurs when parts or wiring move for some reason and contact metal parts of the body.	Return parts or wiring to their proper position.
	● Various noises are produced depending on the body part of the vehicle.	Due to detachment from the body of the front hood, bumpers, exhaust pipe and muffler, suspension, etc.	Tighten the mounting bolts securely. Cases where the problem is not eliminated by a single response to one area are common, due to several body parts being imperfectly earthed.

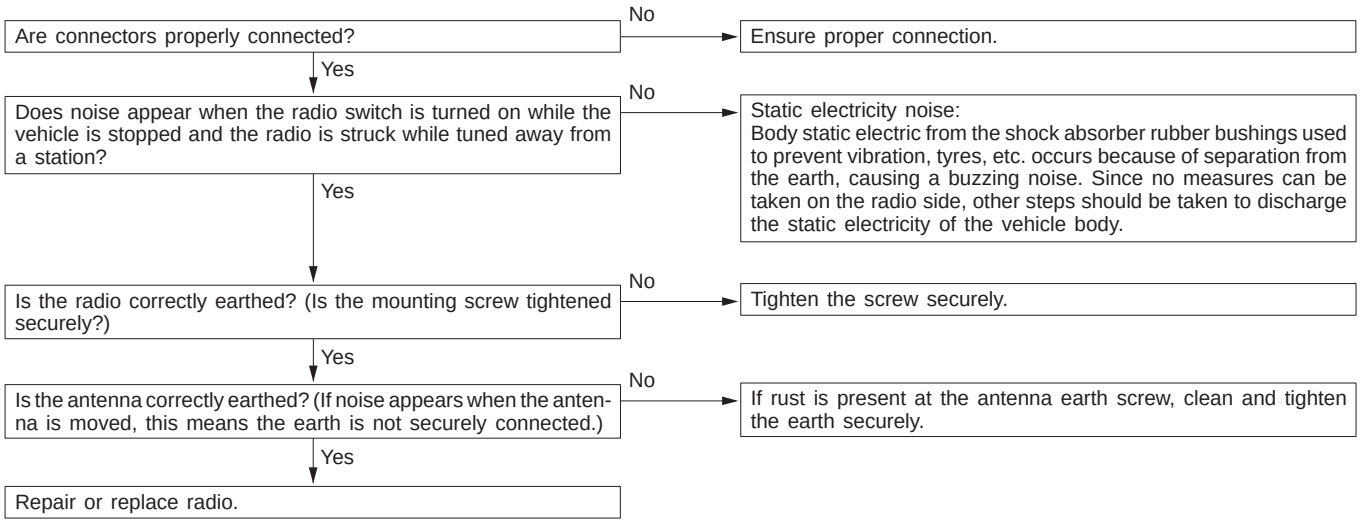
Caution
1. **Connecting a high tension cable to the noise filter may destroy the noise filter and should never be done.**
2. **Check that there is no external noise. Since failure caused by this may result in misdiagnosis due to inability to identify the noise source, this operation must be performed.**
3. **Noise prevention should be performed by suppressing strong sources of noise step by step.**

NOTE
1. Capacitor
   The capacitor does not pass D.C. current, but as the number of waves increases when it passes A.C. current, impedance (resistance against A.C.) decreases, and current flow is facilitated. A noise suppressing condenser which takes advantage of this property is inserted between the power line for the noise source and the earth. This suppresses noise by earthing the noise component (A.C. or pulse signal) to the body of the vehicle.
2. Coil
   The coil passes D.C. current, but impedance rises as the number of waves increases relative to the A.C. current. A noise suppressing coil which takes advantage of this property is inserted into the power line for the noise source, and works by preventing the noise component from flowing or radiating out of the line.

Fig. 1



A-5 Some noise appears when there is vibration or shocks during travelling.



A-6 Ever-present noise.

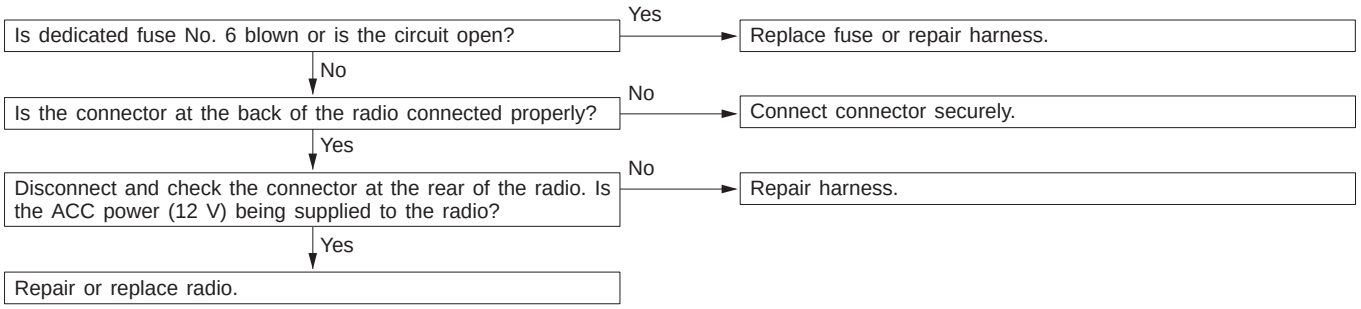
Noise is often created by the following factors, and often the radio is OK when it is checked individually.

- Travelling conditions of the vehicle
- Terrain of area travelled through
- Surrounding buildings
- Signal conditions
- Time period

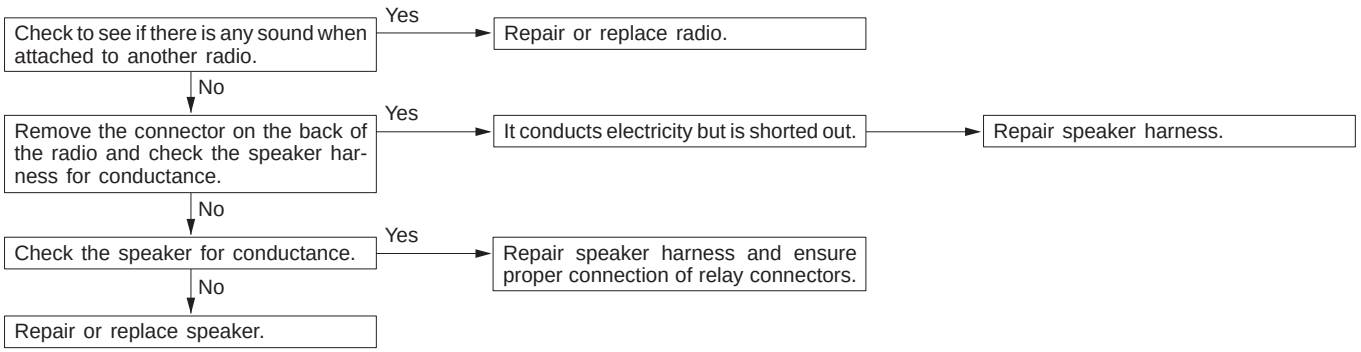
For this reason, if there are still problems with noise even after the measures described in steps A-1 to A-8 have been taken, get information on the factors listed above as well as determining whether the problem occurs with FM/MW/LW, the station names, frequencies, etc., and contact a service centre.

B. RADIO

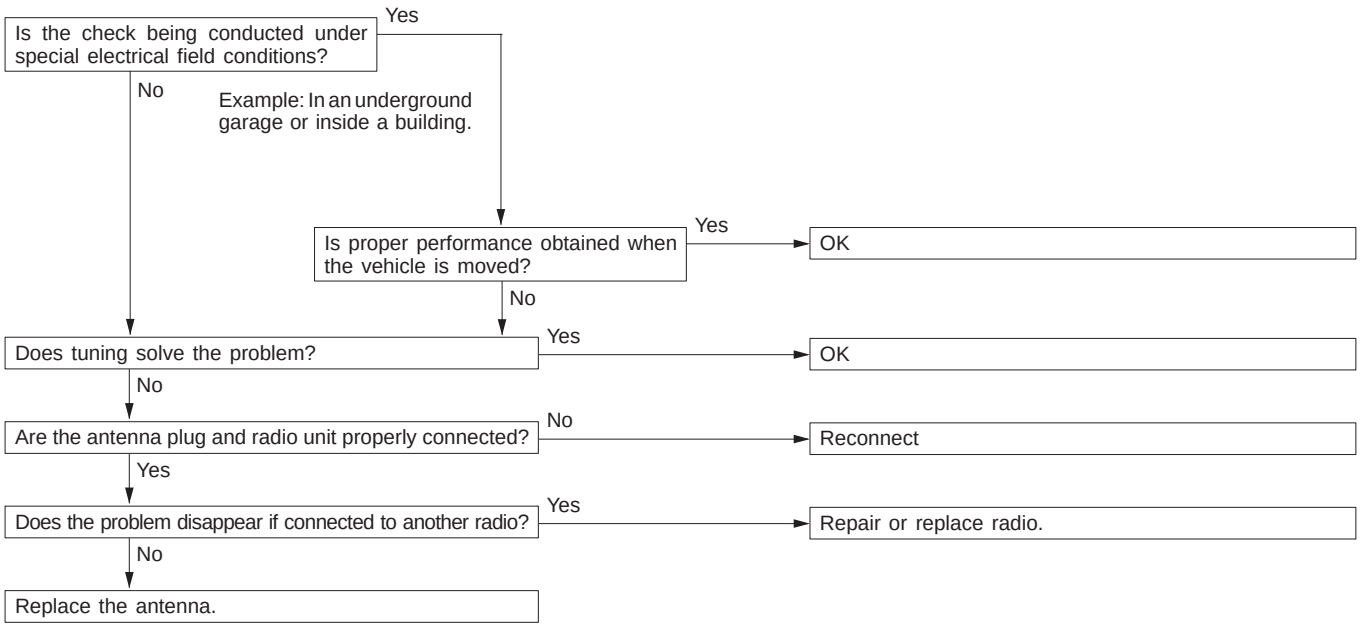
B-1 No power is supplied when the switch is set to ON.



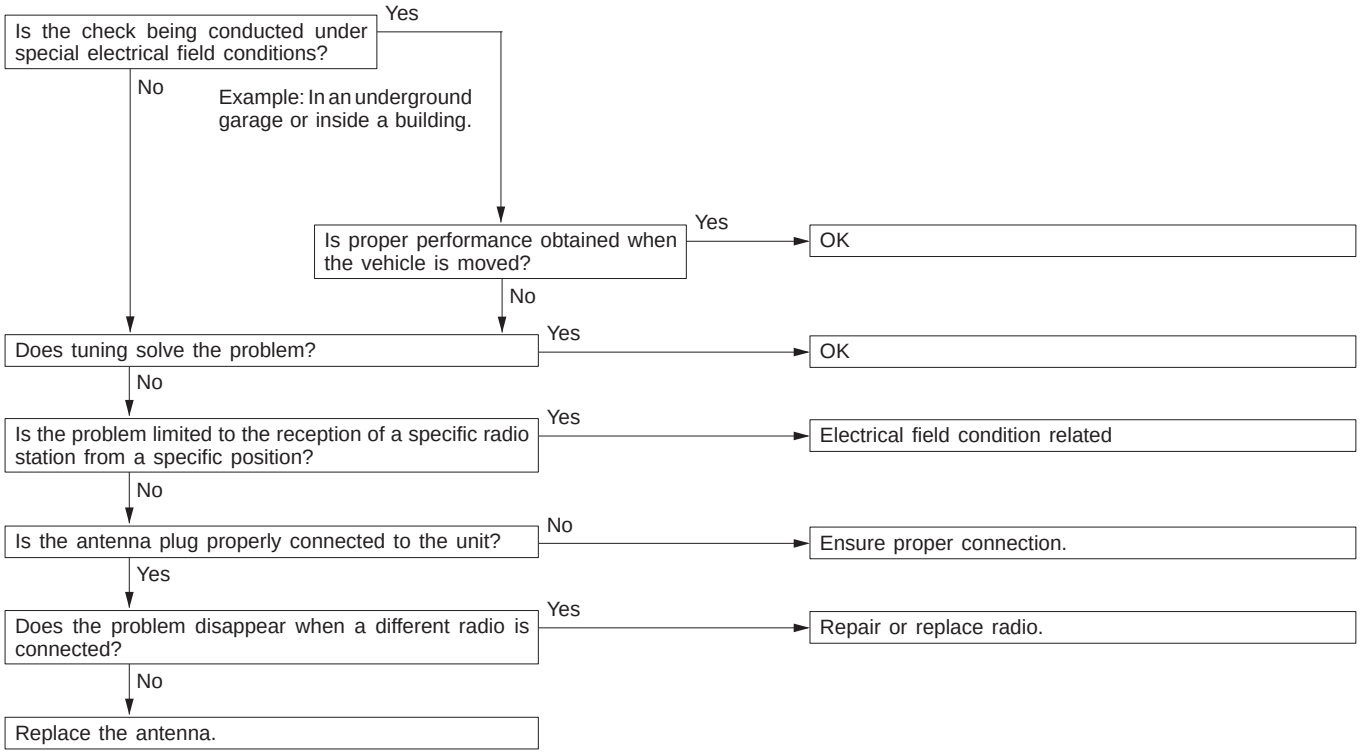
B-2 No sound from one speaker.



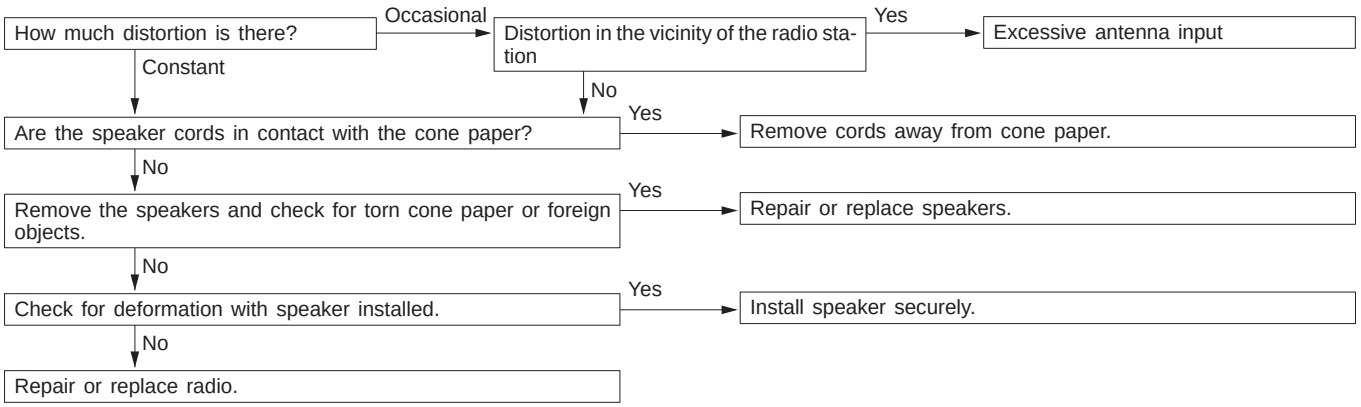
B-3 There is noise but no reception for FM/MW/LW or no sound from FM/MW/LW.



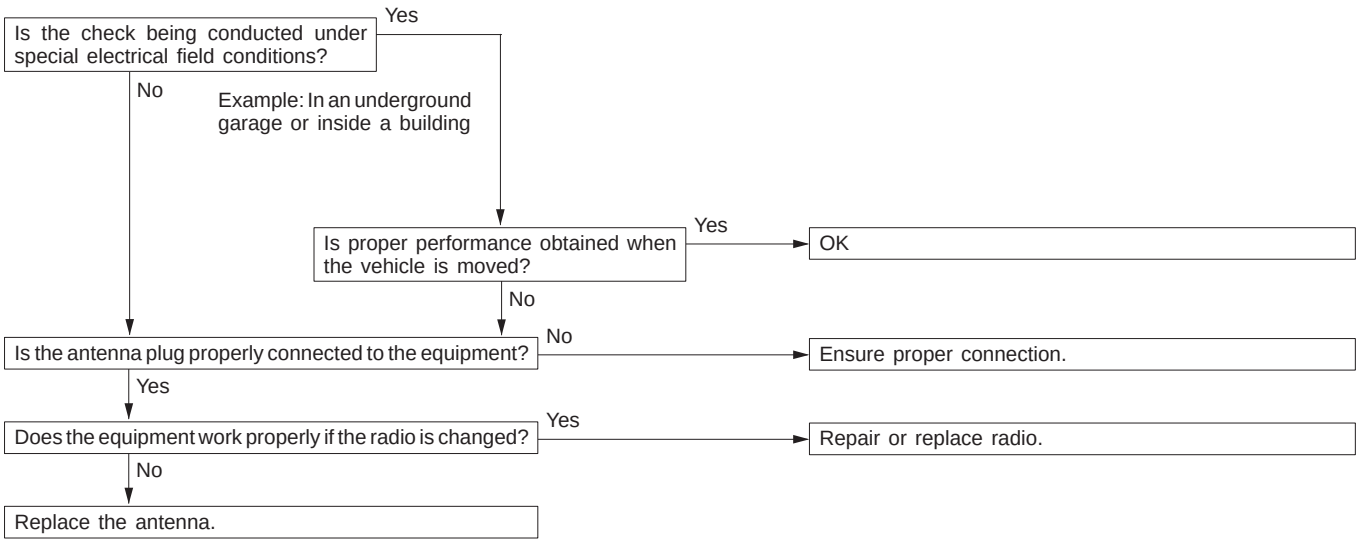
B-4 Insufficient sensitivity.



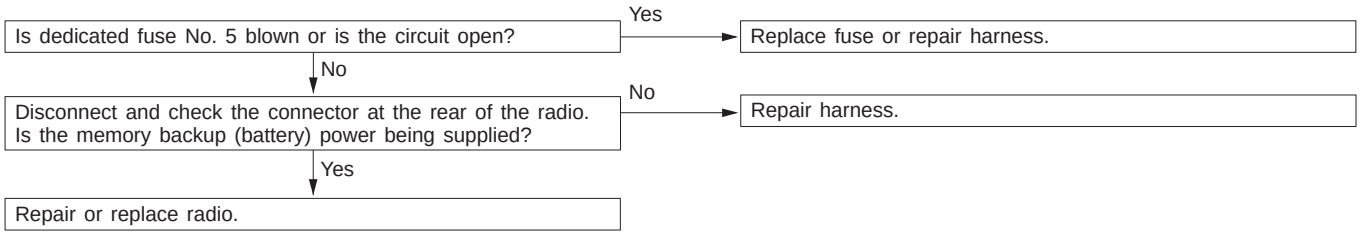
B-5 Distortion on FM/MW/LW.



B-6 Too few automatic select stations.

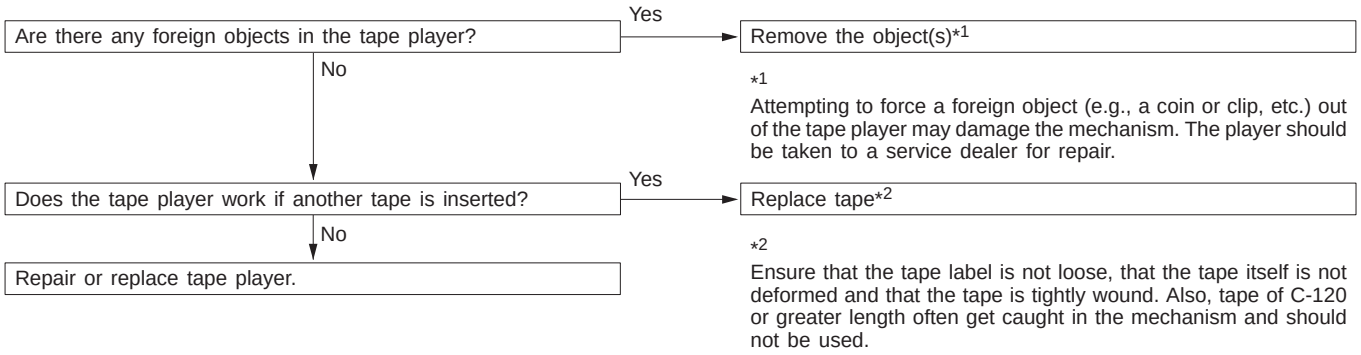


B-7 Insufficient memory (preset stations are erased).



C. TAPE PLAYER

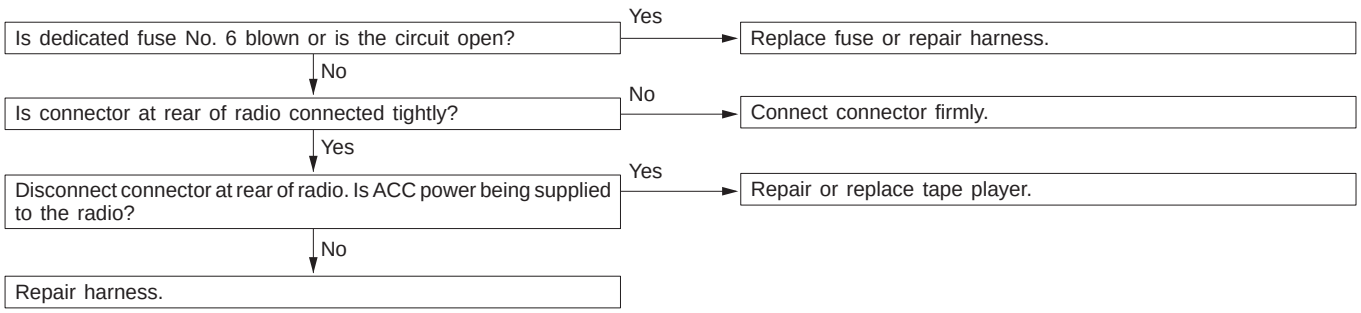
C-1 Cassette tape will not be inserted.



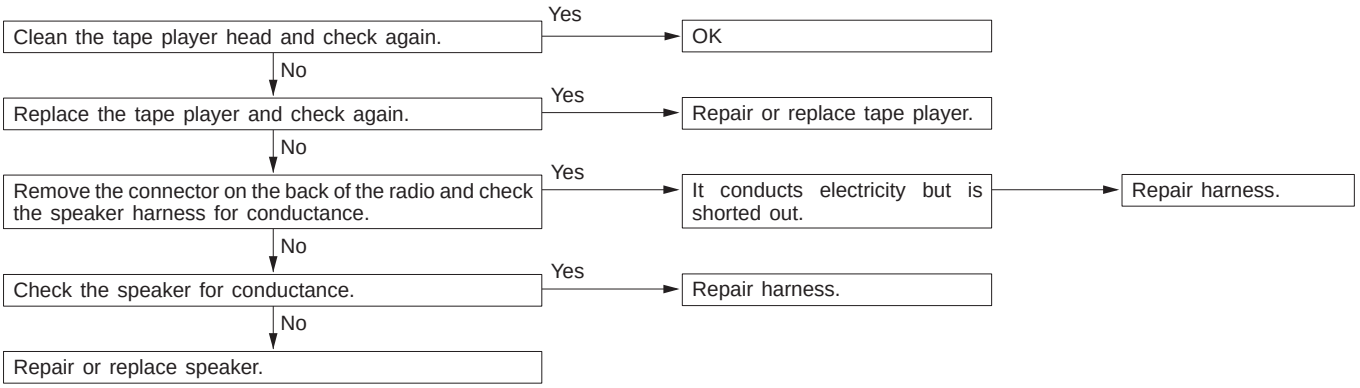
*1
Attempting to force a foreign object (e.g., a coin or clip, etc.) out of the tape player may damage the mechanism. The player should be taken to a service dealer for repair.

*2
Ensure that the tape label is not loose, that the tape itself is not deformed and that the tape is tightly wound. Also, tape of C-120 or greater length often get caught in the mechanism and should not be used.

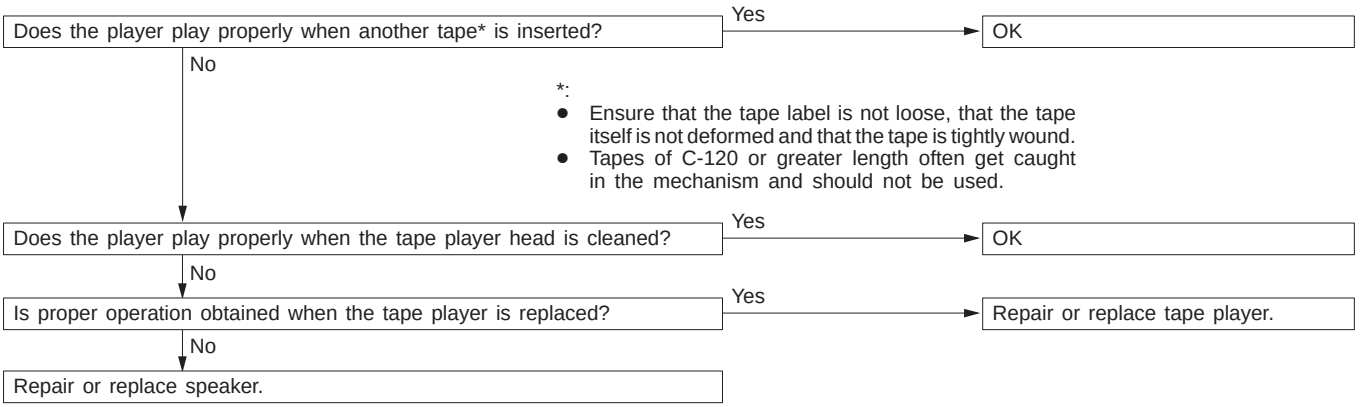
C-2 No sound (even after a tape has been inserted).



C-3 No sound from one speaker.



C-4 Sound quality is poor, or sound is weak.



C-5 Cassette tape will not be ejected.

The problems covered here are all the result of the use of a bad tape (deformed or not properly tightened) or of a malfunction of the tape player itself. Malfunctions involving the tape becoming caught in the mechanism and ruining the case are also possible, and attempting to force the tape out of the player can cause damage to the mechanism. The player should be taken to a service dealer for repair.

C-6 Uneven revolution. Tape speed is fast or slow.

Does the player play OK if the tape*1 is changed?
- Yes → OK
- No

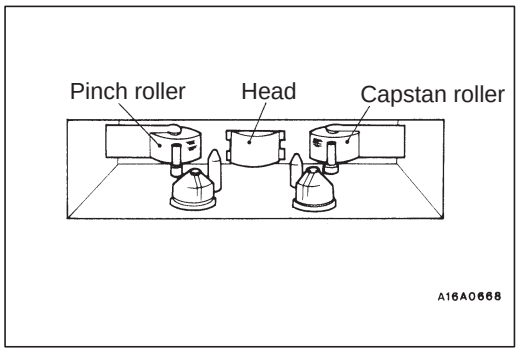
*1
Ensure that the tape label is not loose, that the tape itself is not deformed and that the tape is tightly wound. Also, tape of C-120 or greater length often get caught in the mechanism and should not be used.

Are there any foreign objects *2 inside the tape player?
- Yes → Remove foreign object(s).
- No

*2
Attempting to force a foreign object (e.g., a coin or clip, etc.) out of the tape player may damage the mechanism. The player should be taken to a service dealer for repair.

Is the head or capstan roller dirty? (Refer to the illustration below.)
- Yes → Clean.
- No

Repair or replace tape player.



C-7 Faulty auto reverse.

Does the player play OK if the tape* is changed?
- Yes → OK
- No

*:
- Ensure that the tape label is not loose, that the tape itself is not deformed and that the tape is tightly wound.
- Tapes of C-120 or greater length often get caught in the mechanism and should not be used.

Does the problem only occur while the vehicle is being driven?
- No → Repair or replace tape player.
- Yes

Is the tape player properly installed to the vehicle?
- No → Ensure tape player installation.
- Yes

Repair or replace tape player.

C-8 Tape gets caught in mechanism*1.

*1
When the tape is caught in the mechanism, the case may not eject. When this occurs, do not try to force the tape out as this may damage the tape player mechanism. Take the cassette to a service dealer for repair.

Does the player play OK if the tape*2 is changed?

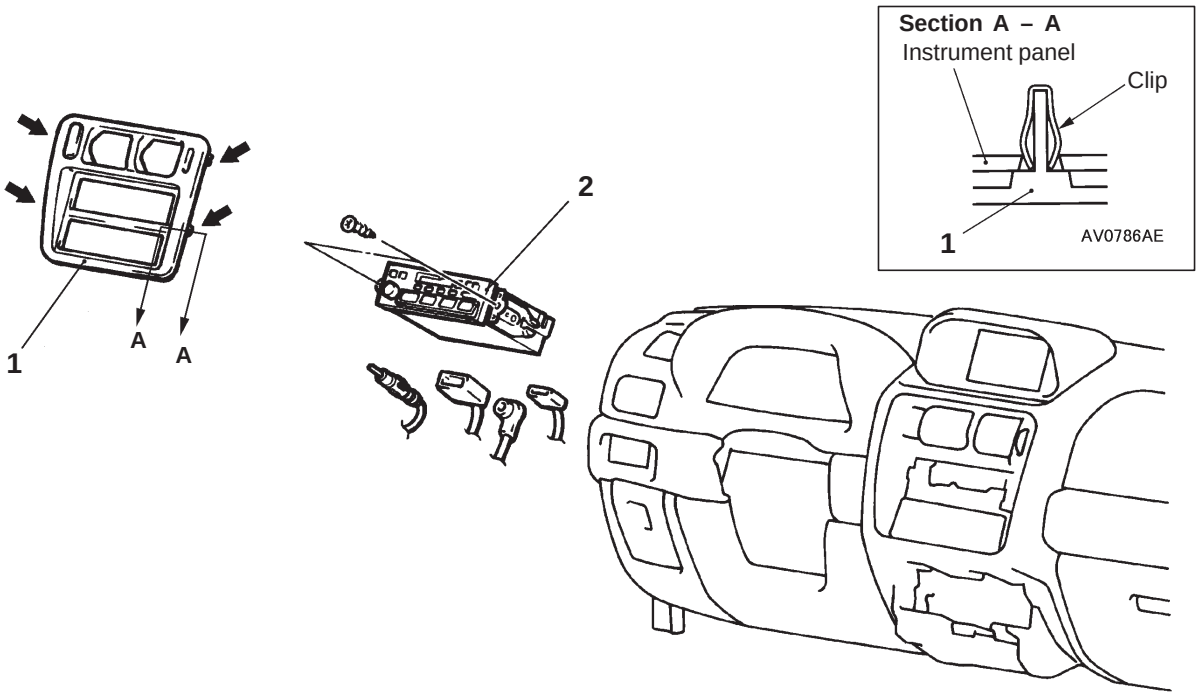
Yes → Tape used is bad.

No → Repair or replace tape player.

*2
Ensure that the tape label is not loose, that the tape itself is not deformed and that the tape is tightly wound. Also, tapes of C-120 or greater length often get caught in the mechanism and should not be used.

RADIO AND TAPE PLAYER

REMOVAL AND INSTALLATION

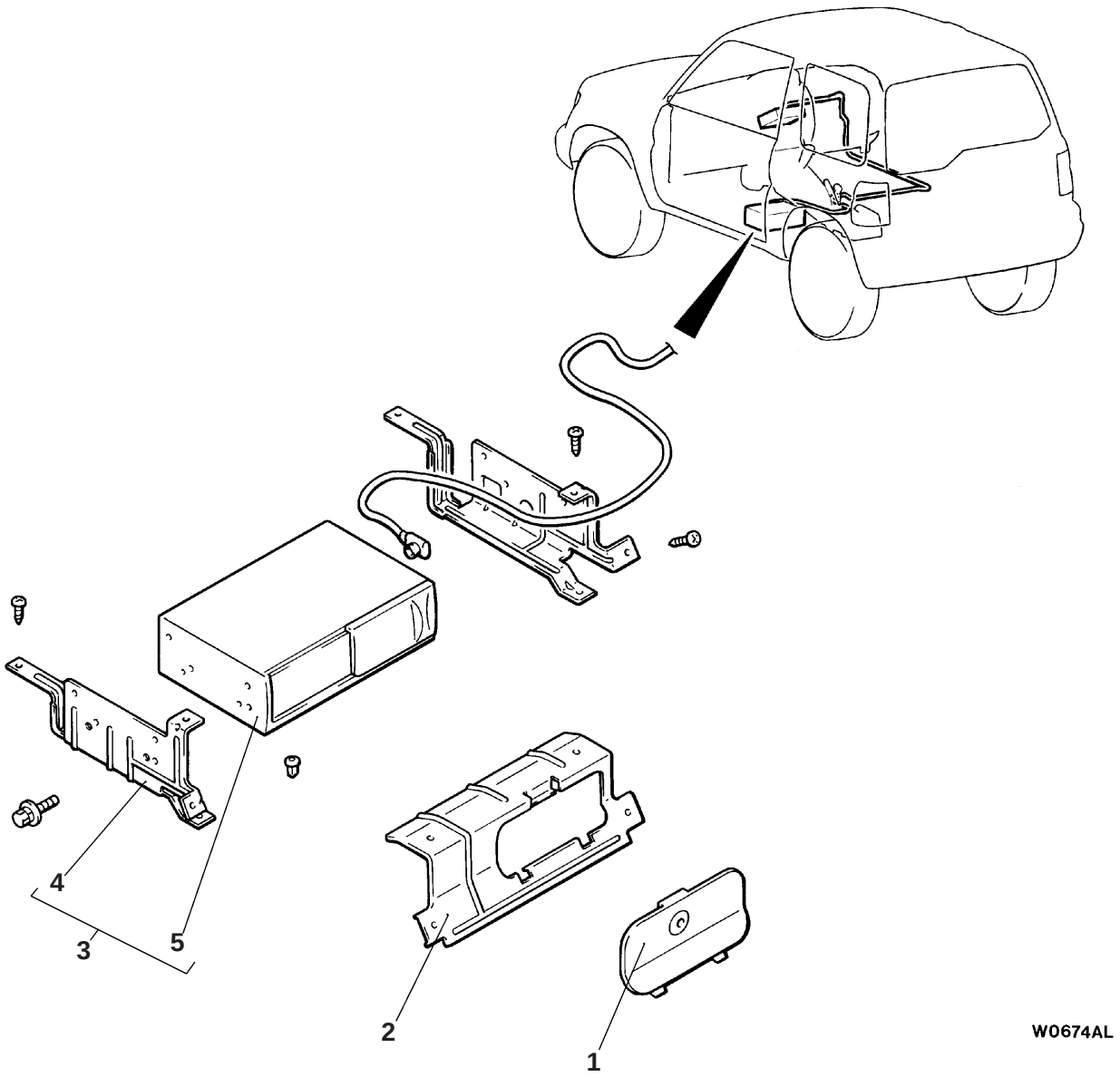


Removal steps

1. Center panel
2. Radio and tape player

CD AUTOCHANGER

REMOVAL AND INSTALLATION



Removal steps

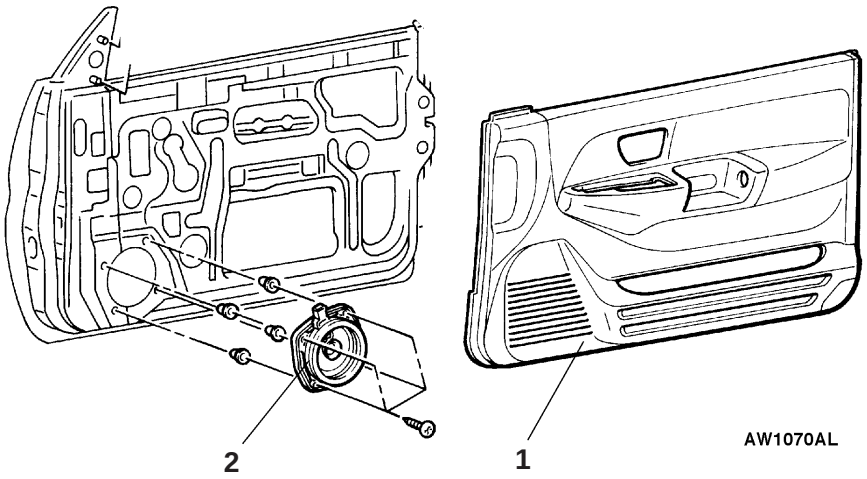
- Front seat (LH)

1. Lid
2. Cover
3. CD autochanger assembly
4. Bracket
5. CD autochanger

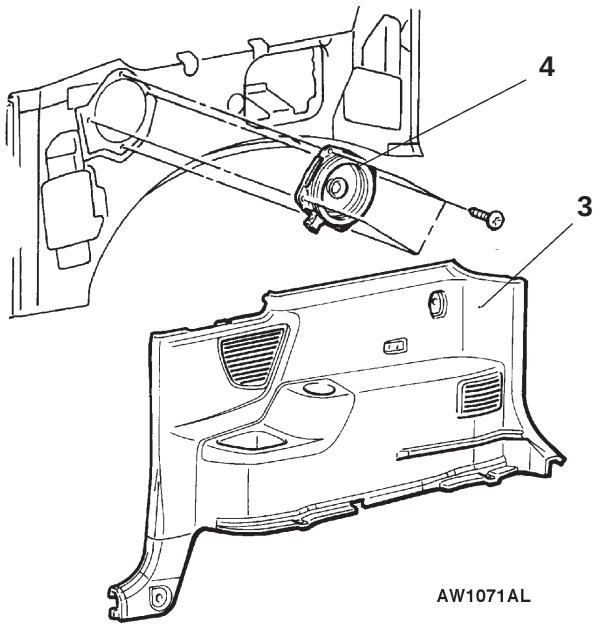
SPEAKER

REMOVAL AND INSTALLATION

<Front speaker>



<Rear speaker>



Front speaker removal steps

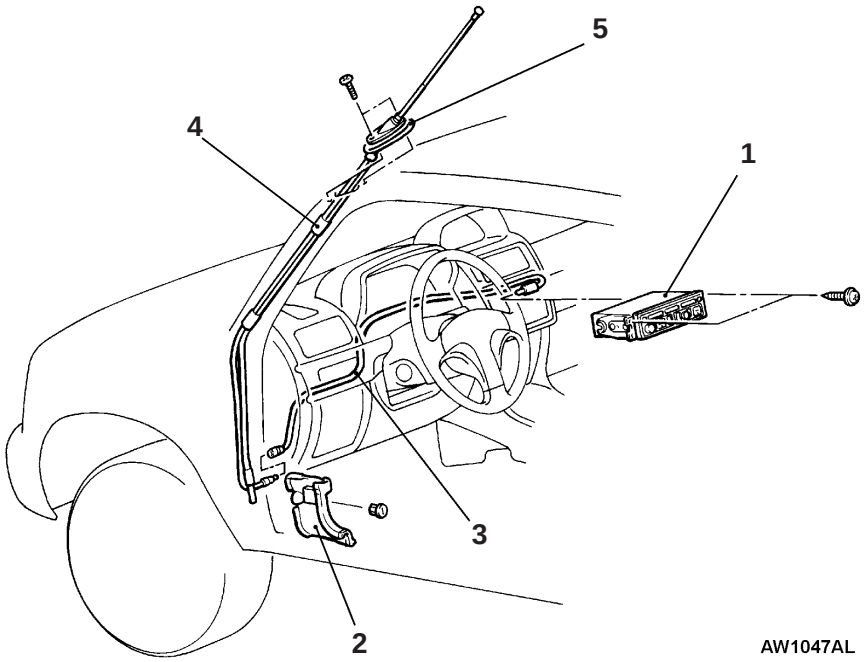
1. Front door trim (Refer to GROUP 42.)
2. Speaker

Rear speaker removal steps

3. Quarter trim (Refer to GROUP 52A.)
4. Speaker

ANTENNA

REMOVAL AND INSTALLATION

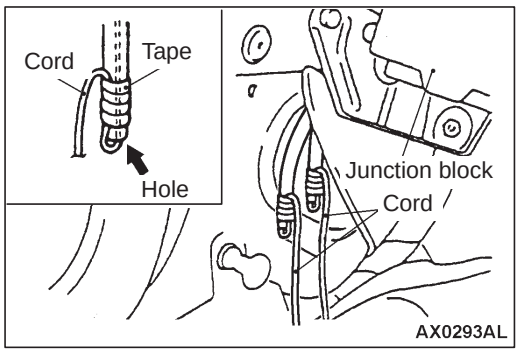


Removal steps

1. Radio and tape player (Refer to P.54-61.)
   - Instrument under cover (Refer to GROUP 52A.)
2. Cowl side trim (Refer to GROUP 52A)

◀A▶

3. Antenna assembly
4. Antenna base
   - Instrument panel (Refer to GROUP 52A)
5. Antenna feeder



REMOVAL SERVICE POINT

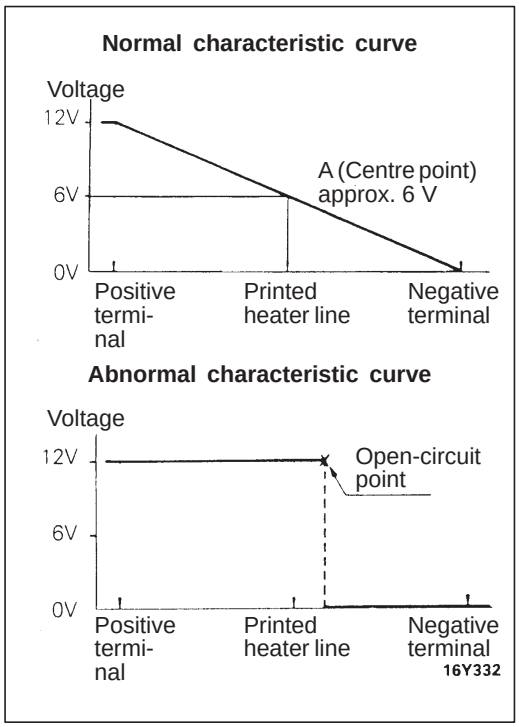
◀A▶ ANTENNA ASSEMBLY REMOVAL

Observe the following steps to make the feeder cable of the antenna to be routed easily during reinstallation.

1. Secure a cord to the end of the feeder cable.
2. Pull out the feeder cable slightly until the tube end of the antenna can been seen.
3. Insert a cord into the tube end, and secure the cord with plastic tape as shown.

   Caution
   Make sure that the cord is not loosened.

4. Remove the antenna assembly by pulling it gradually.

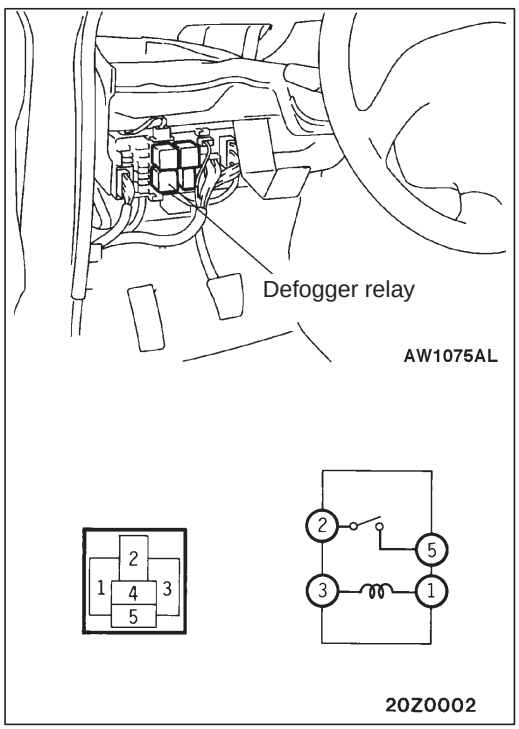


REAR WINDOW DEFOGGER

ON-VEHICLE SERVICE

PRINTED-HEATER LINE CHECK

1. Run engine at 2,000 r/min. Check heater element with battery at full.
2. Turn ON rear window defogger switch. Measure heater element voltage with circuit tester at rear window glass centre A.
   Condition is good if it indicates about 6 V.
3. If 12 V is indicated at A, there is a break in the negative terminals from A.
   Move test bar slowly to negative terminal to detect where voltage changes suddenly (0V).
4. If 0 V is indicated at A, there is a break in the positive terminals from A. Defect where the voltage changes suddenly (12 V) in the same method described above.



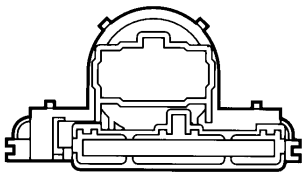
REAR WINDOW DEFOGGER RELAY CONTINUITY CHECK

Battery voltage	Terminal No.			
	1	2	3	5
Power is not supplied	○		○	
Power is supplied	⊕		⊖	
		○		○

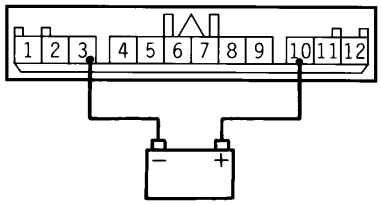
REAR WINDOW DEFOGGER SWITCH

REMOVAL AND INSTALLATION

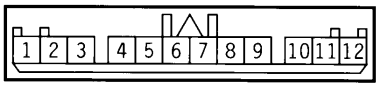
Refer to GROUP 55 – Heater Control.

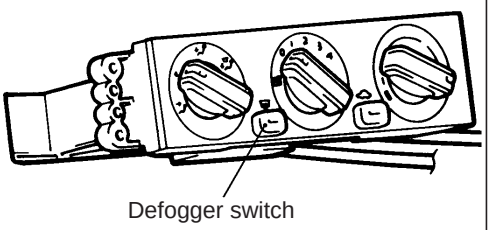


<Vehicles with heated-mirrors>



<Vehicles without heated-mirrors>





AW1079AL

INSPECTION

DEFOGGER SWITCH CONTINUITY CHECK <Vehicles with heated-mirrors>

Switch position	Terminal No.				
	3	10	–	11	12
OFF			IND		
ON			IND		

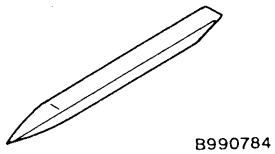
NOTE
Turn on the defogger switch, and then check that there is continuity between the terminals 3 and 12 for 9 to 13 minutes and after it, the defogger switch is turned off.

<Vehicles without heated-mirrors>

Switch position	Terminal No.			
	10	–	11	12
OFF		IND		
ON		IND		

MULTI-CENTER DISPLAY <MIDDLE GRADE>

SPECIAL TOOL

Tool	Number	Name	Use
 B990784	MB990784	Ornament remover	Removal of center display hood

TROUBLESHOOTING

NOTES WITH REGARD TO SERVICE PROCEDURES

1. Before removing the battery

The audio system has a large amount of data stored in memory which the user enters over time. When the terminals are disconnected from the battery, the memory which stores this data is affected as shown in the table below. Accordingly, it is necessary to make sure that you take notes of important information before disconnecting the battery.

Function	Input function/memory	When battery is disconnected
Radio	Channels which are selected during a search	Disappear after a few seconds
	Preset channels	
Tone/Balance	Position set on Bass, Treble, Balance and Fader	
Clock set on display	Current time	Keep a data for approx. one hour
Brightness set for display	Position set on display	
Unit set for trip computer	km or mile, L/100km or mpg or km/L	
Average speed on display	Average speed after reset	
Average fuel consumption on display	Average fuel consumption after reset	
Cruising range on display	Cruising range, fuel economy	
Outside temperature on display	A temperature after the ignition switch is turned to OFF (LOCK).	Keep a data for approx. one hour If the engine is hot, the multi center display might show high temperature when the display unit is reconnected after one hour.

2. Diagnosis Function for Audio System

Audio system has the following diagnosis function.

Function	Contents
Speaker diagnosis function	This function checks if the speakers are all working normally on the audio system or not.
Service functions (1) Check the LCD segments (2) Check the sensors (3) Check units connected into audio system	There are the following 3 diagnosis modes available. The LCD segments for display available to light on or not. Outside temperature, voltage of fuel gauge unit and battery, remaining fuel level, fuel economy calculated after refuelling. Units connected on display Voltage on terminal for MUT-II Engine speed signal, which is sent by ECU Oscillation of internal clock

3. Speaker Connection Diagnosis

Outline

- This diagnosis function checks whether the more than one wired speakers are normally connected to the audio unit and the speaker wiring is pinched in the vehicle.
- The test tone sounds from an applicable speaker according to the display (FL, FR, RL, RR).

Function explanation

To diagnose speaker connections, follow the procedure below to enter the test mode.

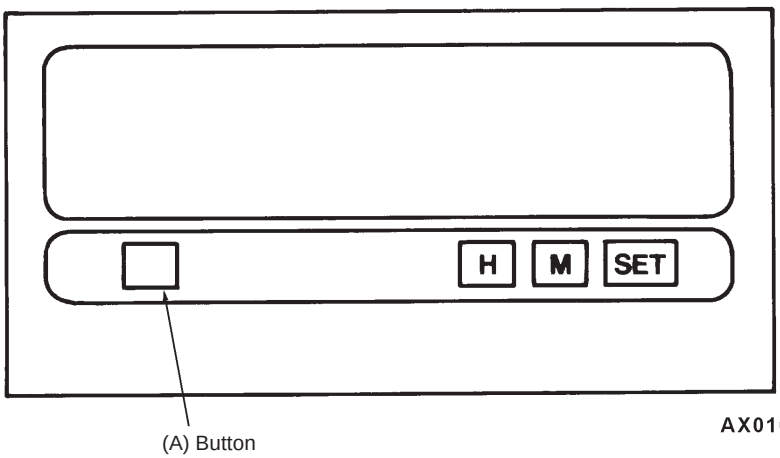
1. Entry to test mode
   (1) Turn the ignition switch to ACC.
   (2) Turn off the power supply switch of the audio unit.
   (3) Press the “CH1” button.
   (4) Press the “Automatic tuning in down button.”
   (5) Press the “Automatic tuning in up button.”
   (6) Press the “CH6” button. Then the audio unit will enter the test mode.

   NOTE
   The above operation must be finished within 60 seconds after the power supply switch is turned off (If 60 seconds have passed, the operation is invalid).
   If you fail in the operation, you must push the power supply switch twice to reset the unit. Then repeat the steps above from step (1).

   (7) The test tone will sound at a constant interval. If you want to change an applicable speaker, you should press the “CH6” button.
2. Cancelling the test mode
   The test mode will be canceled by one of the operations below.
   - Press any button (except the “CH6” button). In addition, if a mode button (LW/MW/LW, CD, TAPE) is pressed, the audio unit will enter an applicable function after cancelling the test mode.
   - Turn the ignition switch to OFF(LOCK).

4. Service Mode For Multi-center Display

1. Enter and terminate the service mode
   (1) To enter the service mode, turn the ignition switch to ACC.
   (2) Press the “H” button twice.
   (3) Press the “SET” button and (A) button at the same time.
   (4) Then the audio unit will enter the service mode.
   First of all, the service mode will show model identification for the multi center display and the vehicle identification. Then the service mode proceeds to three checks; LCD segment check, Sensor check and Unit check. To switch over these checks, press the “SET” button.
   (5) To terminate the service mode, press any button other than the “SET” button.

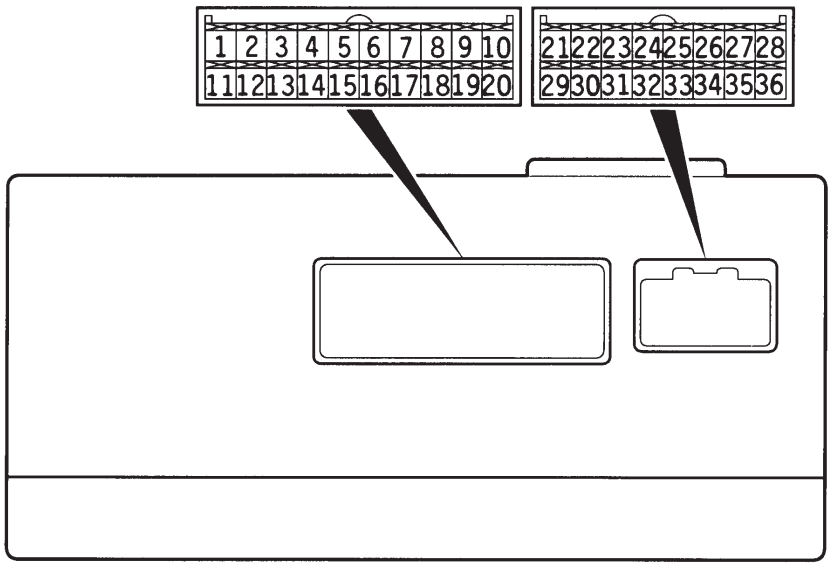


AX0100BN

2. Details of the service mode
   The service mode checks the following in that order:
   (1) LCD segment check
   This screen is divided into four areas. Each area will be active sequentially whenever the “SET” button is pressed.
   When the “SET” button is pressed four times in this screen, the service mode will proceed to the Sensor check.
   (2) Sensor check
   This screen shows voltage signals from the outside temperature sensor, the fuel gauge unit, and the ignition switch as well as fuel economy.
   When the “SET” button is pressed once in this screen, the service mode will proceed to the Unit check.
   (3) Unit check connected into audio system
   This screen shows an audio equipment, air conditioner or MUT-II connected in the system, percentage of system voltage, engine speed sent by the engine-ECU, and oscillation of internal clock.
   When the “SET” button is pressed once in this screen, the service mode will return to the first screen (model identification screen).

MAIN UNIT TERMINAL VOLTAGES

1. MULTI-CENTER DISPLAY UNIT

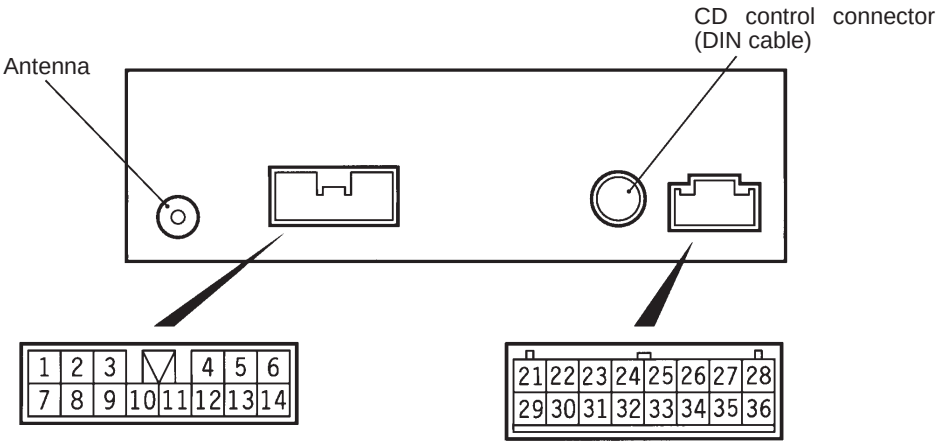


W0278AJ

Terminal No.	Input/ Output	Signal Symbol	Terminal Voltage (V)	Harness Problem		Trouble Symptom Resulting from Harness Problem
				Open Circuit	Short-circuit	
1 – 4	–	–	–	–	–	–
5	Input	ISOK	Hi: System voltage Lo: 0 – 1	○	○	MUT-II cannot be used to check engine-ECU.
6	–	–	–	–	–	–
7	Input/ Output	M–DATA (AUDIO)	Hi: 4 – 5 Lo: 0 – 1	○	○	Audio display dose not appear. Panel switch cannot be operated for audio unit. Nighttime illumination dose not appear for audio unit.
8	Input/ Output	M–CLOCK (AUDIO)	Hi: 4 – 5 Lo: 0 – 1	○	○	Audio display dose not appear. Panel switch cannot be operated for audio unit. Nighttime illumination dose not appear for audio unit.
9 – 14	–	–	–	–	–	–
15	Input/ Output	K	Hi: System voltage Lo: 0 – 1	○	○	Values on Trip information screen (average speed, fuel consumption and cruising distance) are abnormal. Communication is not possible between the engine-ECU and the MUT-II.
16	–	–	–	–	–	–

Terminal No.	Input/ Output	Signal Symbol	Terminal Voltage (V)	Harness Problem		Trouble Symptom Resulting from Harness Problem
				Open Circuit	Short-circuit	
17	Input/ Output	M–BUSY (AUDIO)	Hi: 4 – 5 Lo: 0 – 1	○	○	Audio display dose not appear. Panel switch cannot be operated for audio unit. Nighttime illumination dose not appear for audio unit.
18	–	SHIELD–GND	–	–	–	–
19 – 22	–	–	–	–	–	–
23	Input	EX–TEMP		○	○	Outside air temperature does not appear.
24	Input	ILL+	Hi: System voltage Lo: 0 – 1	○	–	Nighttime illumination does not appear for any navigation system units.
				–	○	Blown multipurpose fuse.
25	Input	ACC (ACC power supply)	System voltage	○	–	Screen display does not appear.
				–	○	Blown multipurpose fuse.
26	Input	+B	System voltage	○	–	Screen display does not appear.
				–	○	Blown multipurpose fuse.
27	Input	VSS		○	–	No effect.
28	–	GND (Ground)	–	○	–	Screen display does not appear.
29, 30	–	–	–	–	–	–
31	–	GND–TEMP	–	○	○	Outside air temperature does not appear.
32	–	ILL–	–	–	–	–
33	Input	FUEL GAUGE	–	○	○	Abnormal cruising distance display.
34, 35	–	–	–	–	–	–
36	Input	IG1	System voltage	○	–	Communication with engine-ECU is not possible. Driving data values displayed are abnormal.
				–	○	Communication with engine-ECU is not possible. Driving data values displayed are abnormal. Blown multipurpose fuse.

2. AUDIO UNIT



BV0846AE

Terminal No.	Input/ Output	Signal Symbol	Terminal Voltage (V)	Harness Problem		Trouble Symptom Resulting from Harness Problem
				Open Circuit	Short-circuit	
1	Output	SPEAKER RR (+)	0 – System voltage (AC)	○	–	No sound is output from rear right speaker.
				–	○	No sound is output from rear left and right speakers.
2	Output	SPEAKER RL (+)	0 – System voltage (AC)	○	–	No sound is output from rear left speaker.
				–	○	No sound is output from rear left and right speakers.
3	–	–	–	–	–	–
4	Input	ILL (+)	Hi: System voltage Lo: 0 – 1	○	–	Nighttime illumination does not appear for audio unit.
				–	○	Blown multipurpose fuse.
5	Output	SPEAKER FL (+)	0 – System voltage (AC)	○	–	No sound is output from front left speaker.
				–	○	No sound is output from front left and right speakers.
6	Output	SPEAKER FR (+)	0 – System voltage (AC)	○	–	No sound is output from front right speaker.
				–	○	No sound is output from front left and right speakers.
7	Output	SPEAKER RR (–)	0 – System voltage (AC)	○	–	No sound is output from rear right speaker.
				–	○	No sound is output from rear left and right speakers.

Terminal No.	Input/ Output	Signal Symbol	Terminal Voltage (V)	Harness Problem		Trouble Symptom Resulting from Harness Problem
				Open Circuit	Short-circuit	
8	Output	SPEAKER RL (–)	0 – System voltage (AC)	○	–	The rear left speaker does not sound.
				–	○	The rear left and right speakers do not sound.
9	–	–	–	–	–	–
10	Input	ACC (ACC power supply) (System voltage)	System voltage	○	–	The audio unit power supply does not turn on.
				–	○	Blown multipurpose fuse.
11	Input	+B (System voltage)	System voltage	○	–	Cassette is not ejected when the ignition switch is at ACC. The memory are cleared.
				–	○	Blown multipurpose fuse.
12	–	ILL (–)	–	–	–	–
13	Output	SPEAKER FL (–)	0 – System voltage (AC)	○	–	The front left speaker does not sound.
				–	○	The front left and right speakers do not sound.
14	Output	SPEAKER FR (–)	0 – System voltage (AC)	○	–	The front right speaker does not sound.
				–	○	The front left and right speakers do not sound.
21	Input/ Output	M–DATA	Hi: 4 or more Lo: 1 or less	○	○	Panel switches cannot be operated.
22	Input/ Output	M–SCK	Hi: 4 or more Lo: 1 or less	○	○	Panel switches cannot be operated.
23 – 28	–	–	–	–	–	–
29	Input/ Output	M–BUSY	Hi: 4 or more Lo: 1 or less	○	○	Panel switches cannot be operated.
30	–	SHIELD EARTH (M–BUS)	–	–	–	–
31– 36	–	–	–	–	–	–

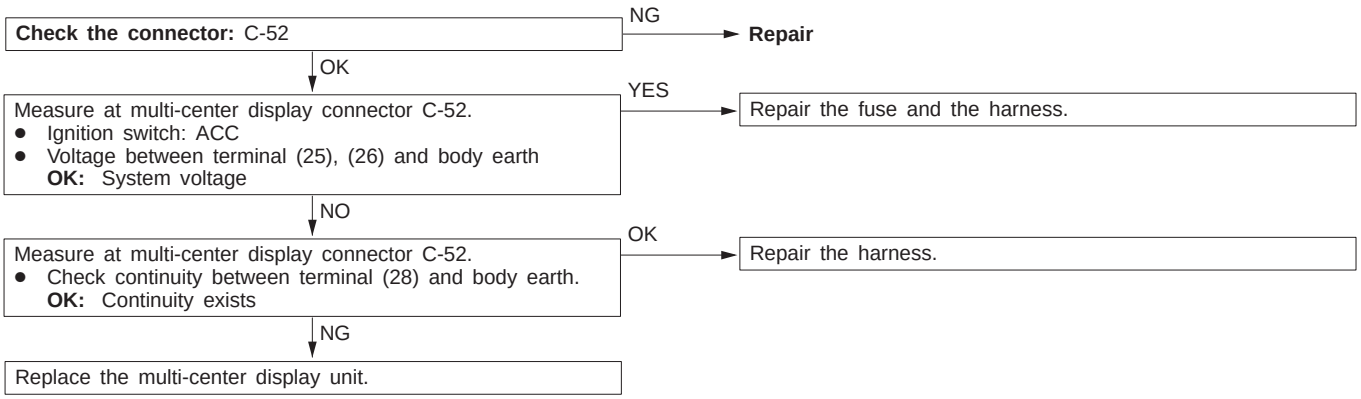
INSPECTION CHART CLASSIFIED BY TROUBLE SYMPTOMS

Related Unit	Trouble Symptom	Inspection Procedure No.	Reference Page
Malfunction of multi-center display	No display appears after the ignition key is turned to ACC.	1	54A-74
	TAPE/CD, UML switches do not work.	2	54A-75
	CD switches do not work.	3	54A-76
	Outside temperature data is not displayed. /Outside temperature data is abnormal.	4	54A-76
	Abnormal driving data display ● Abnormal average fuel consumption and average speed displays. ● Abnormal cruising distance displays	5	54A-77
	No illumination of audio button	6	54A-78
	Dim display	7	54A-78
	Clock runs fast or slow	8	54A-78

INSPECTION PROCEDURES FOR EACH TROUBLE SYMPTOM

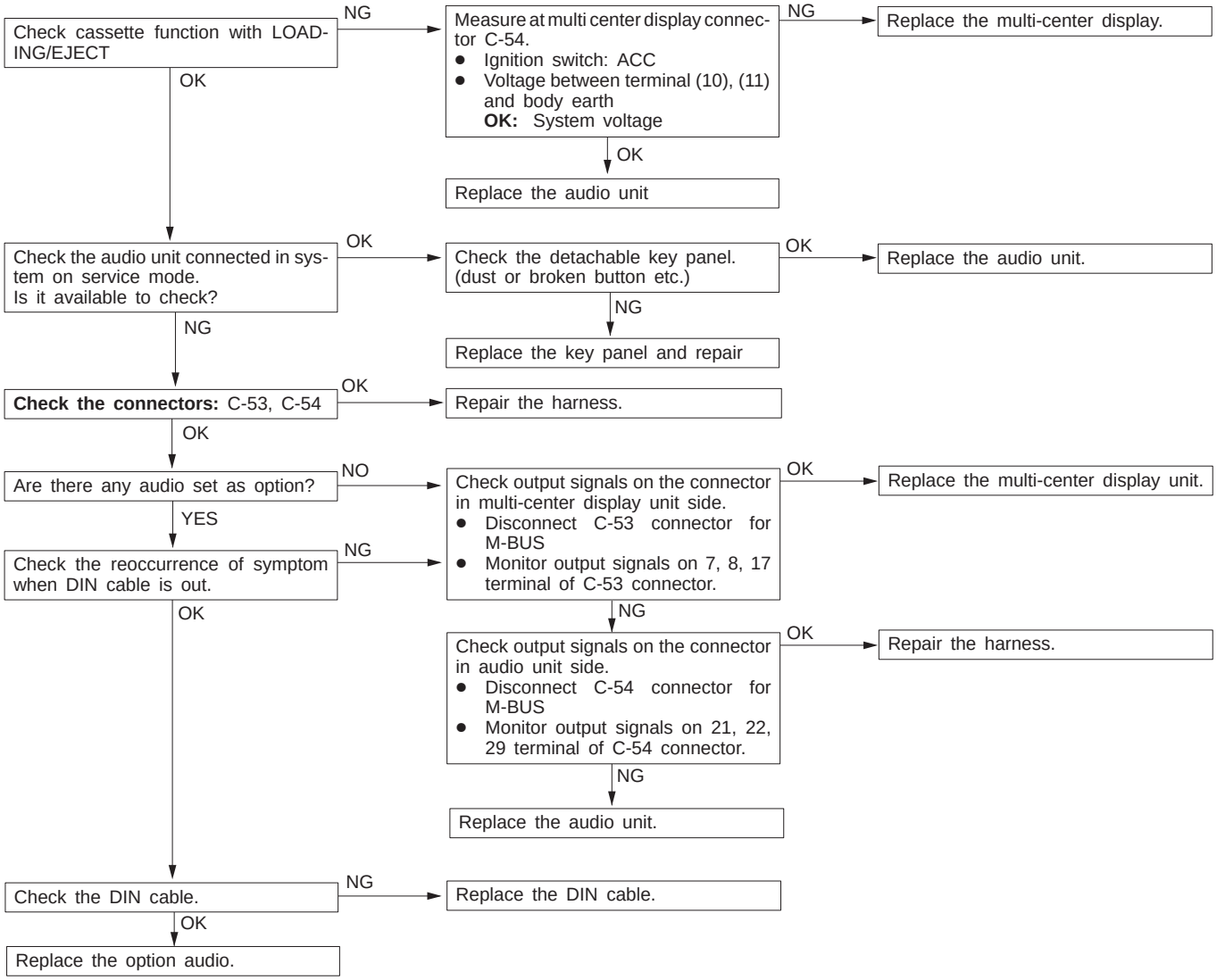
INSPECTION PROCEDURE 1

No display appears after the ignition key is turned to ACC.



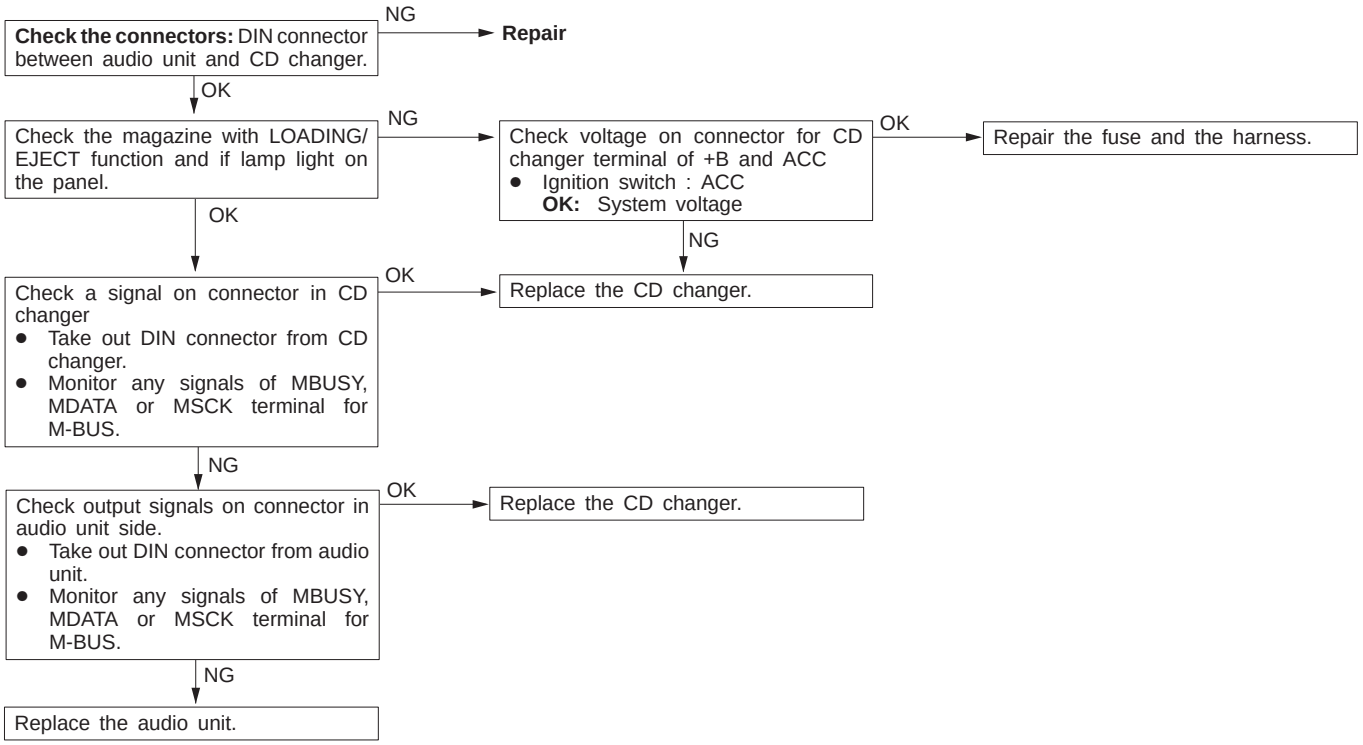
INSPECTION PROCEDURE 2

TAPE/CD, UML switches do not work.



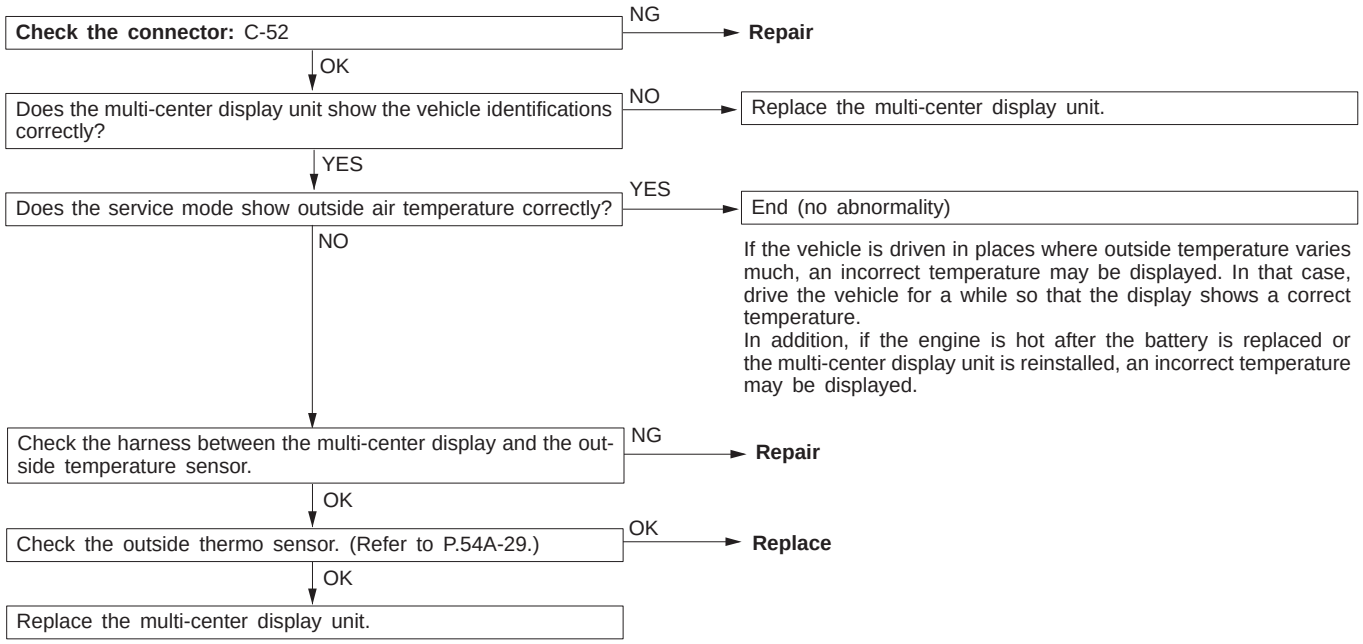
INSPECTION PROCEDURE 3

CD switch do not work.



INSPECTION PROCEDURE 4

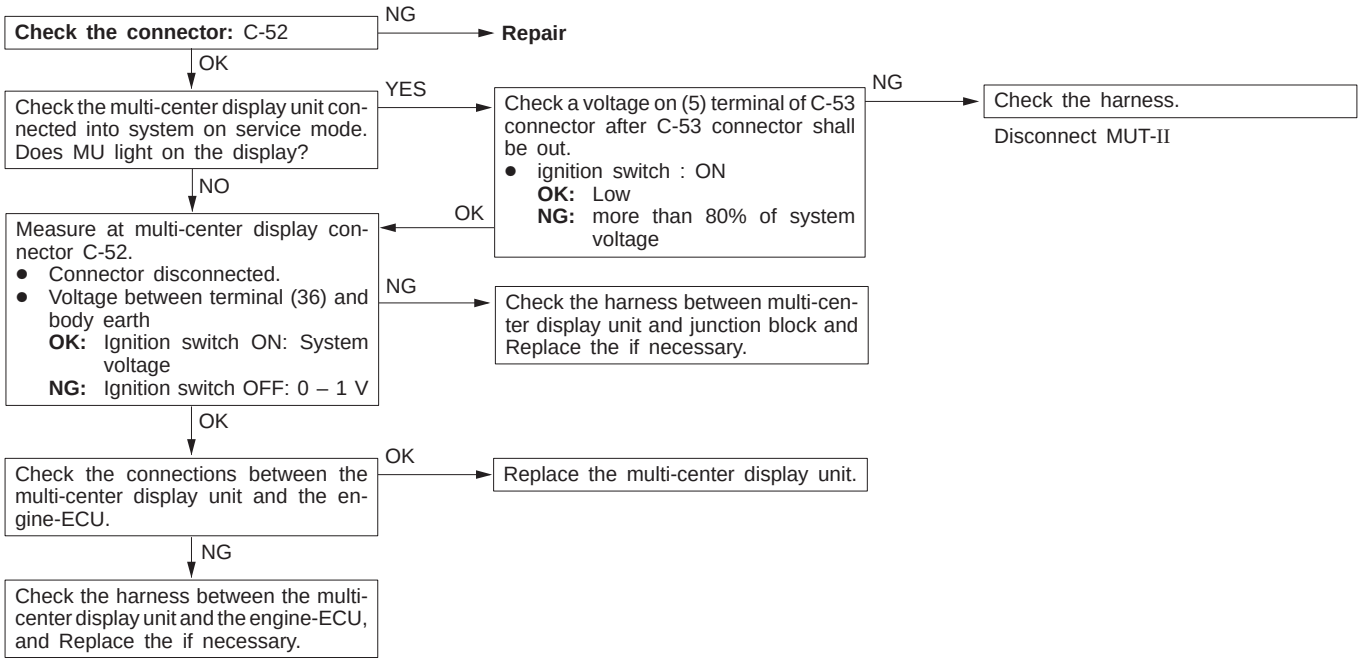
Outside air temperature data is not displayed. /Outside air temperature data is abnormal.



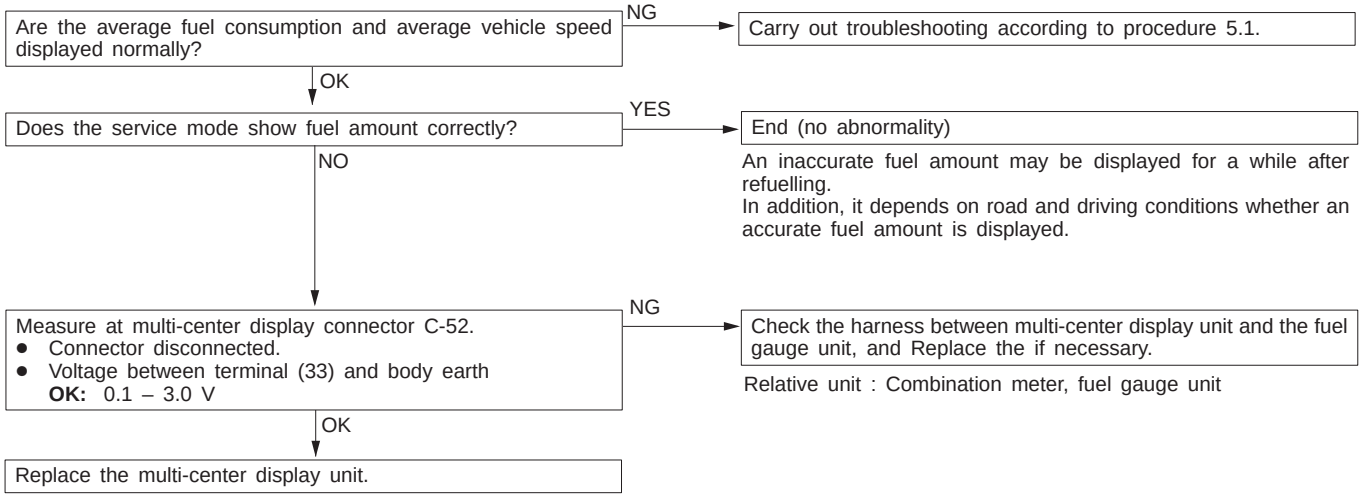
INSPECTION PROCEDURE 5

Abnormal driving data displays.
- Abnormal average fuel consumption and average speed displays.
- Abnormal cruising distance displays.

1. When average fuel consumption and average speed displays are abnormal.

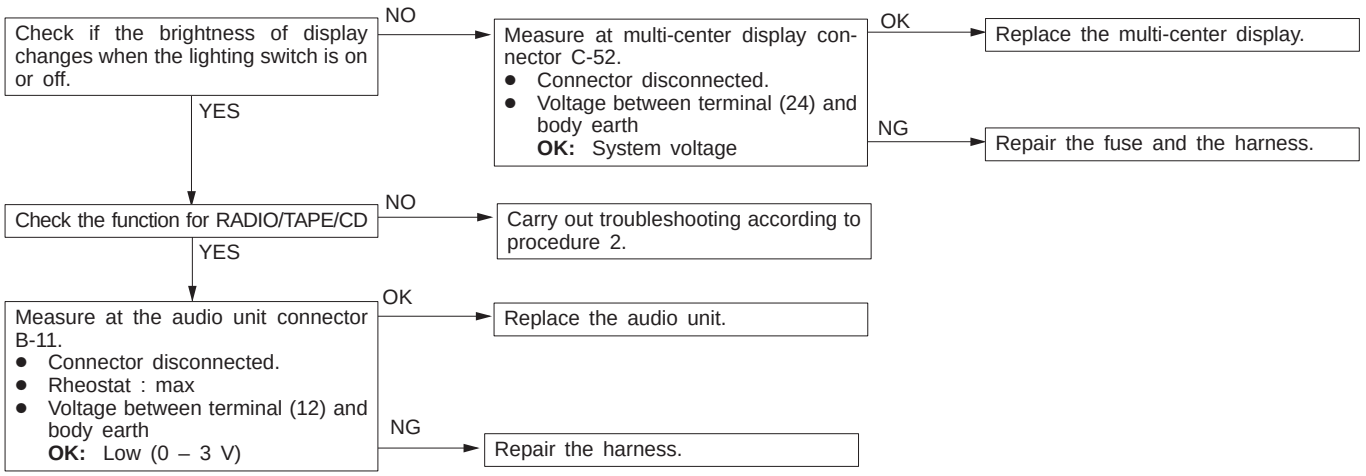


2. When cruising distance display is abnormal.



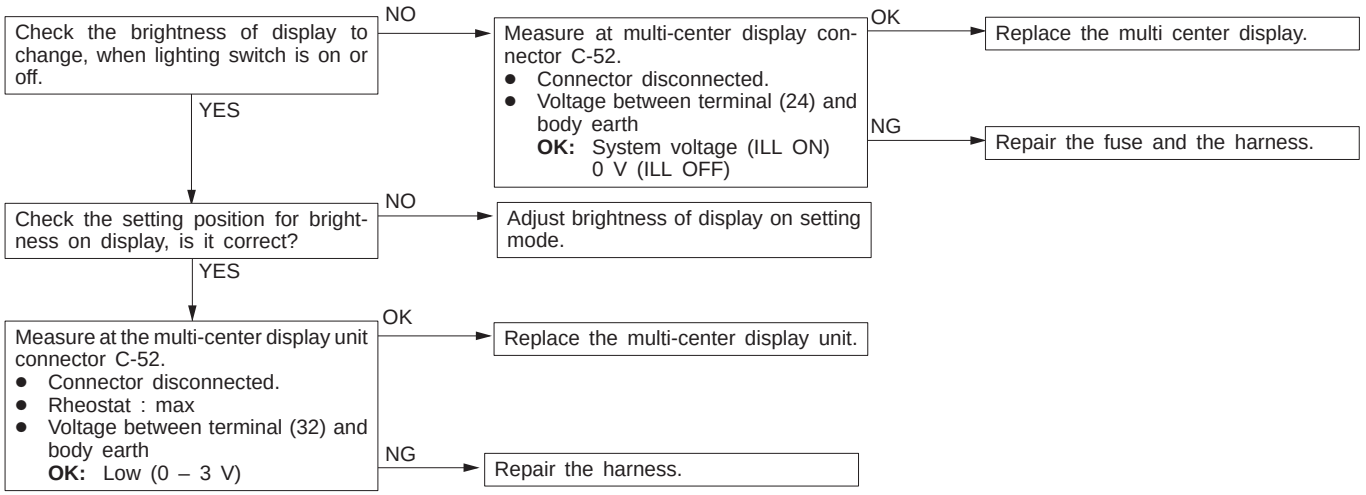
INSPECTION PROCEDURE 6

No illumination for audio buttons light on.



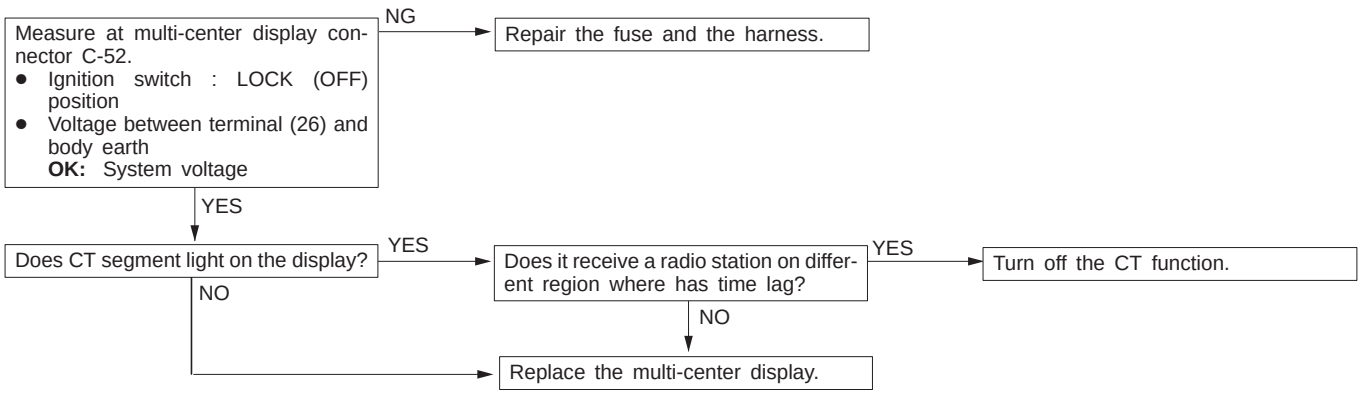
INSPECTION PROCEDURE 7

Dim display



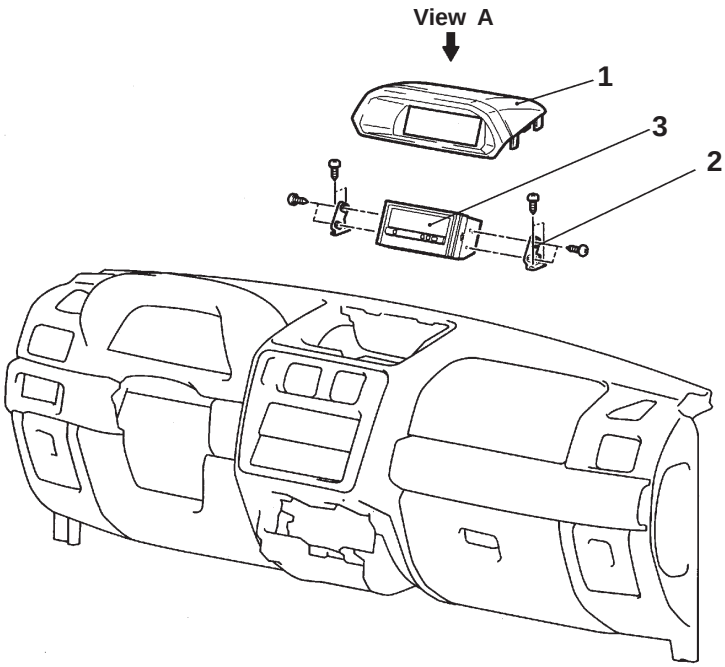
INSPECTION PROCEDURE 8

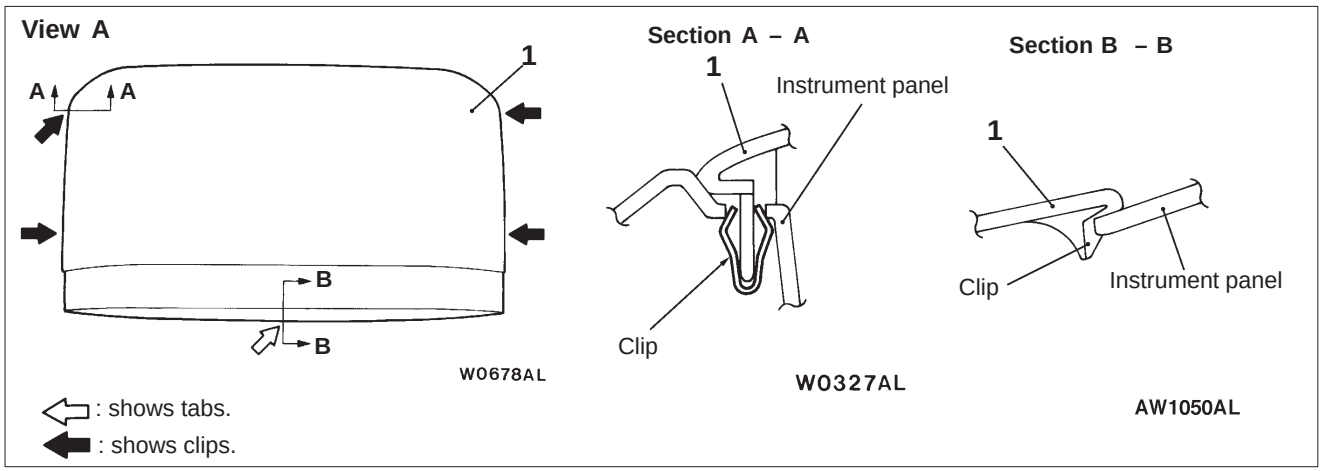
Clock runs fast or slow/indicate different time



MULTI-CENTER DISPLAY

REMOVAL AND INSTALLATION





Removal steps

1. Center display hood
2. Bracket
3. Multi-center display

MULTI-CENTER DISPLAY <HIGH GRADE>

TROUBLESHOOTING

NOTES WITH REGARD TO SERVICE PROCEDURES

1. Before removing the battery

The multi-center display has a large amount of data stored in memory which the user enters over time. When the terminals are disconnected from the battery, the memory which stores this data is affected as shown in the table below. Accordingly, it is necessary to make sure that you take notes of important information before disconnecting the battery.

Function	Input function	When battery is disconnected
Radio function	Channels which are selected during a search	Disappear after a few seconds
	Preset channels	Do not disappear
Navigation function	Current location	
	Recommended route	
	Destination	
	Route search conditions	
	Sensor initialization data	
	Language selection setting	
	Guidance volume setting	
Data search function, data display and input functions	Registered location names	
	Past destinations	
	Average fuel consumption, average speed, cruising range	Disappear after a few seconds
Clock display function	Current time	
Vehicle model settings for travel data	Setting details for vehicle model	
Monitor backlight luminance setting	Luminance setting value	

2. Notes on trouble diagnosis relating to the overall system

(1) If a problem occurs which seems like all of the functions have developed an abnormality simultaneously, the cause is most likely a communication abnormality between the various systems. Thus you should use the communication checking service function in the trouble diagnosis service functions in order to verify the cause.

(2) If the above is not the problem, check the connections of the related harness connectors. If a malfunctioning location is discovered, repair it and then re-check the trouble symptoms.
(3) If there are no abnormalities in the harness connections, check the harnesses themselves. If there are no abnormalities in the harnesses, replace the relevant unit. Make a note of any error codes and service function data generated at this time.

NOTE
If the cause of the problem seems to be related to system communication, carry out troubleshooting.

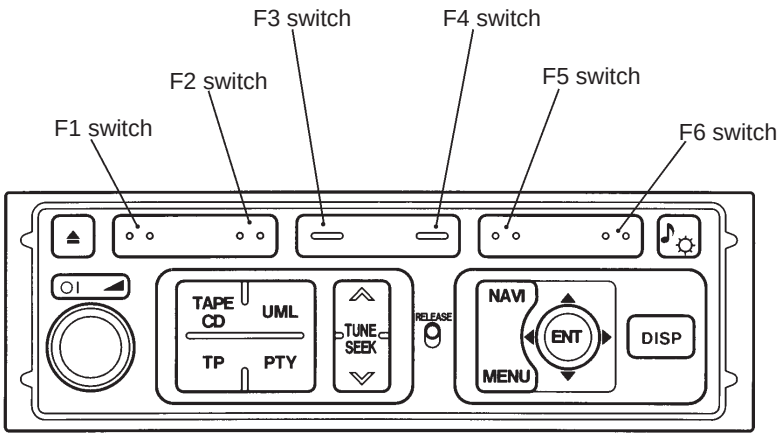
3. Notes on trouble diagnosis when only specific functions are abnormal

(1) If only certain functions are showing an abnormality, use the audio checking function of the service functions to check the hardware switches.
(2) If the switch functions are normal, check the connections of the related harness connectors. If a malfunctioning location is discovered, repair it and then re-check the trouble symptoms.
(3) If there are no abnormalities in the harness connections, check the harnesses themselves. If there are no abnormalities in the harnesses, replace the unit which controls that function.

4. Notes on trouble diagnosis of the navigation function

(1) The vehicle positioning accuracy of the navigation function is limited because of the principle of operation which it uses. Because of this, the system may be operating normally even though customers might be reporting a problem.
Before carrying out troubleshooting, get as much information as possible from the customer regarding things such as usage conditions and driving locations. If it is possible to judge from this that the problem is not caused by a system abnormality, explain the principle of operation used by the navigation function and how to utilize it effectively.
(2) If you find that there is a system abnormality, check according to the Inspection Chart Classified by Trouble Symptoms in the Troubleshooting section.

MITSUBISHI MULTI COMMUNICATION SYSTEM DISPLAY PANEL

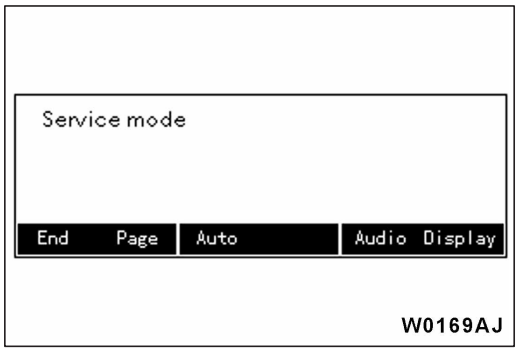


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TROUBLE DIAGNOSIS SERVICE FUNCTIONS

The Multi-center Display is equipped with the following trouble diagnosis service functions.

Function	Contents
Diagnosis function	During normal use, this function constantly monitors the system communication lines, and displays an error if it finds any abnormalities.
CD-ROM checking function	This function displays a message if it cannot read the CD-ROM or if no CD-ROM is inserted.
Service functions	There are five checking modes available: monitor checking, audio checking, automatic checking by mode, self-diagnosis and diagnosis recording.
1. Monitor checking	This mode checks that the image display function is operating normally.
2. Audio checking	This mode checks that the speakers and operating switches of the audio system are all working normally.
3. Automatic diagnosis by mode	In this mode, wiring and communication checking, audio checking, sensor checking and vehicle signal checking are carried out continuously.
4. Self-diagnosis	This mode includes functions such as wiring and communication checking, sensor checking, vehicle signals and version data checking.
● Wiring and communication checking	This checks system communication between all units.
● Sensor checking	This checks all of the sensors that are necessary to the navigation system.
● Vehicle signals	This displays the current vehicle signal condition.
● Version data	This displays the version numbers for each unit in the Multi Center Display.
5. Diagnosis recording	This mode displays error codes from communication checking. (Error codes are erased when the ignition switch is turned to OFF.)

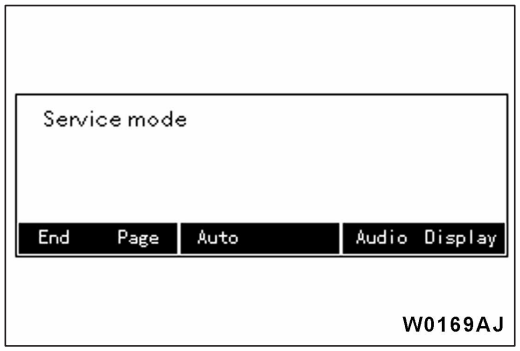


1. ACTIVATING AND ENDING SERVICE MODE

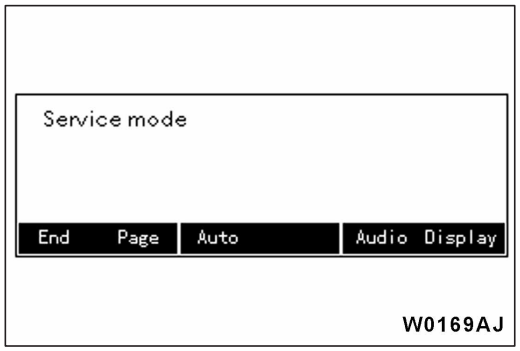
(1) Activating service mode can be carried out by turning the ignition switch to the ON position while pressing the DISP switch on the audio unit and the F6 switch. (Continue pressing each switch for at least 5 seconds after turning the ignition switch to ON.)

(2) If the special CD-ROM has been inserted into the navigation unit but the program has not been set up, the program will then be loaded from the CD-ROM. Service mode can be used once this process is completed.

NOTE
The special CD-ROM is a map CD-ROM which a distributor vends.

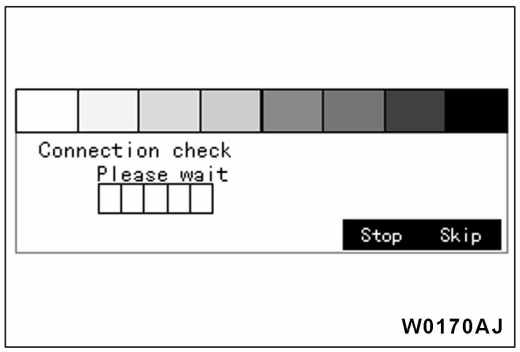


(3) If the F1 switch is pressed at the service mode initial screen, service mode will be ended and the screen will change to navigation mode.

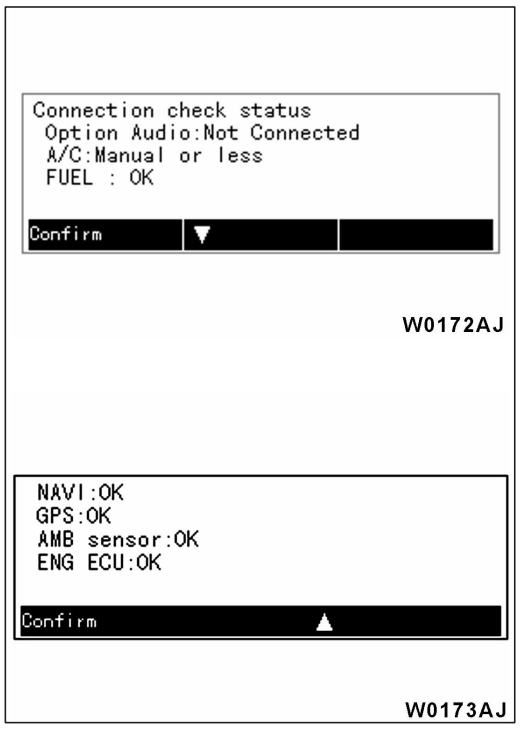


2. AUTOMATIC DIAGNOSIS BY MODE

(1) If the F3 switch is pressed at the service mode screen, automatic diagnosis by mode will start.

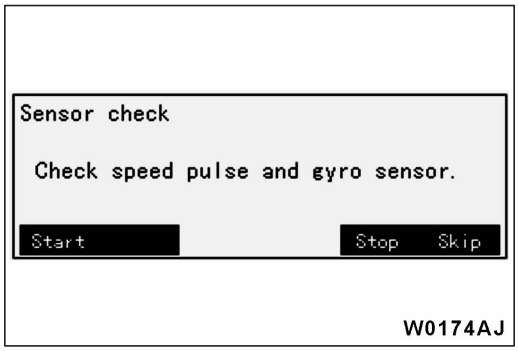


(2) A colored bar will appear on the screen of the Multi-center Display unit, and all units which are connected to the navigation unit will be checked during this time.

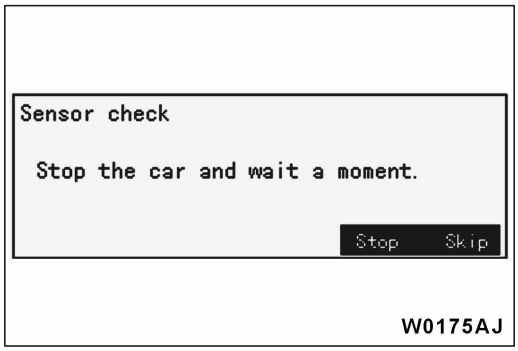


(3) Once the transmission checking is completed, the results of the wiring and transmission checking will appear on the screen.
After checking the results, press the F1 switch to proceed to the next check. The next check will start when the switch is pressed.

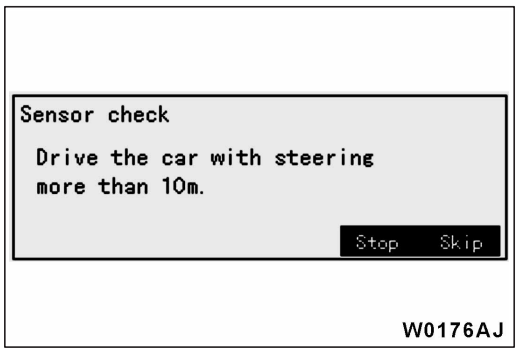
NOTE
1) If the fuel gauge and the engine-ECU are checked while the ignition switch is at ACC, an error will be generated, but this is not a sign of an abnormality.
2) If checking is carried out while the fuel tank is full or the while ignition switch is at ACC, the fuel gauge may be shown to be not connected, but this is not a sign of an abnormality.



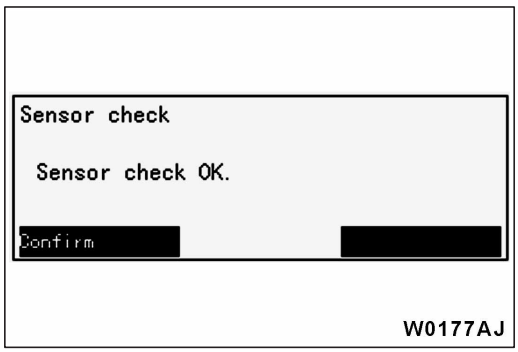
(4) The next mode is the sensor checking mode. Press the F1 switch to start sensor checking.
If you would like to proceed to the next checking operation without carrying out sensor checking, press the F6 switch.



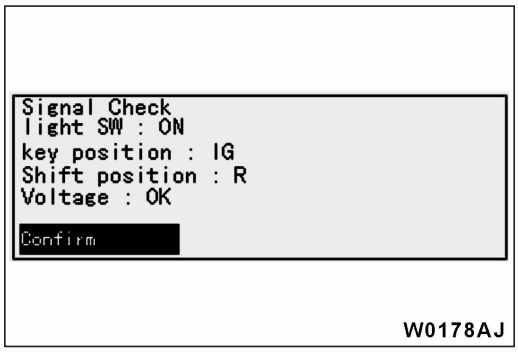
(5) When sensor checking starts, the gyro output will be checked first while the vehicle is stopped, so make sure that the vehicle is stopped for this check.
If the vehicle is moving when the sensor checking starts, the vehicle speed sensor will be shown as defective.
Follow the guidance message on the multi-center display.



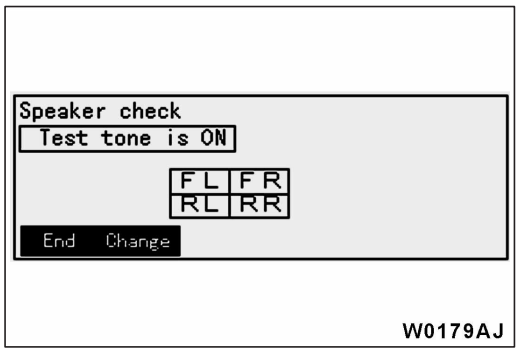
(6) Next, drive the vehicle for approximately 10 meters while changing the running direction in order to check the vehicle speed pulse and the gyro sensor output. The sensor checking will then be completed. If there is an open circuit in the vehicle speed sensor, sensor checking will not complete even after the vehicle has travelled more than 10 meters. In this case, press the F5 switch to stop checking.
If the vehicle does not move or there is an open circuit in vehicle speed sensor, the vehicle speed sensor will be shown as defective.



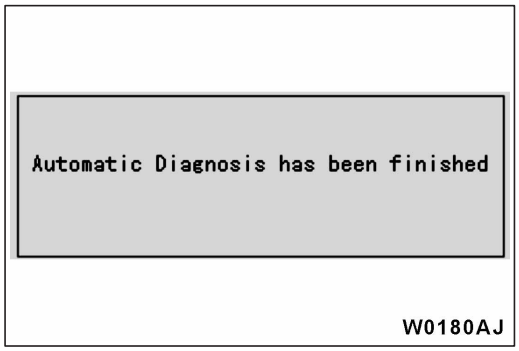
(7) When sensor checking is completed, the check results will appear on the screen. After checking the results, press the F1 switch to proceed to the next check.



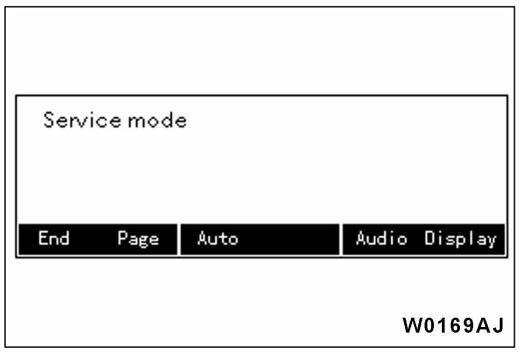
(8) The next mode is the vehicle signal checking mode. The lighting switch condition, ignition key position, shift lever selection (R or a position other than R) and the power supply voltage drop will be appear on the screen. Check that the details displayed match the actual vehicle signals, and then press the F1 switch.
If the vehicles does not move or there is an open circuit in vehicle speed sensor, the vehicle speed sensor will be shown as defective.



(9) The next mode is speaker checking mode. The test sound will be output alternately from each speaker each time the F2 switch is pressed.
At the early mass production, sometimes radio sound will be output. This is not a sign of abnormality.

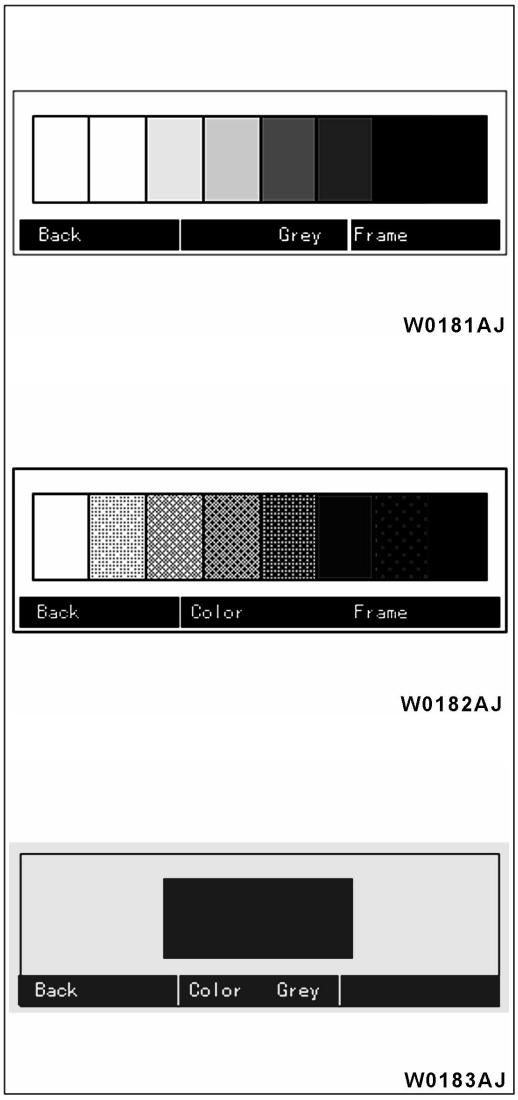


(10) Press the F1 switch to end service mode. The screen will change to navigation mode.

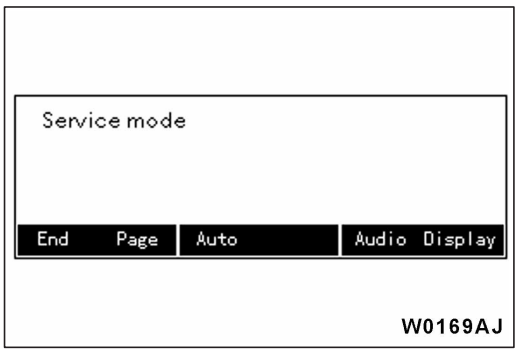


3. MONITOR CHECKING

(1) If the F6 switch is pressed at the service mode initial screen, monitor checking will start.

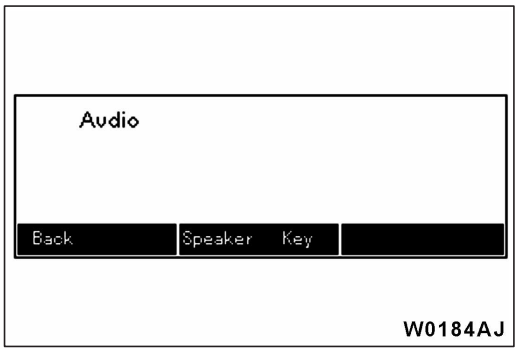


(2) A colored bar will appear on the screen.
Press a function switch to change to another screen. The screen will return to the service mode initial screen if the F1 switch is pressed.

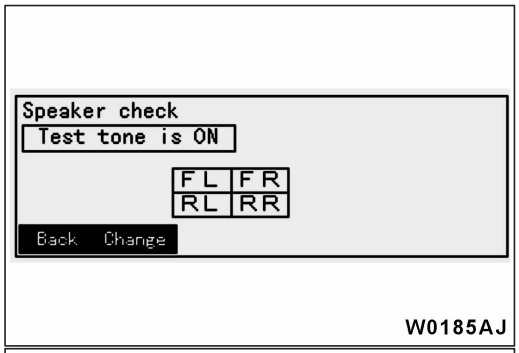


4. AUDIO CHECKING

(1) If the F5 switch is pressed at the service mode initial screen, the audio checking menu screen will appear.

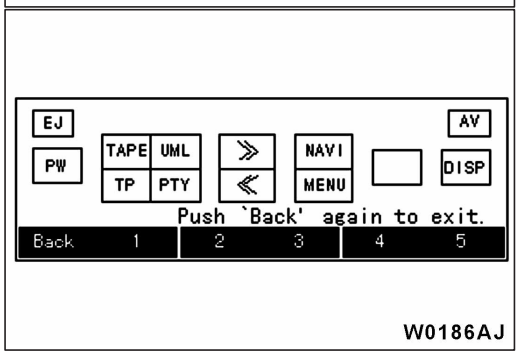


(2) Next, press the function switches to carry out audio checking.



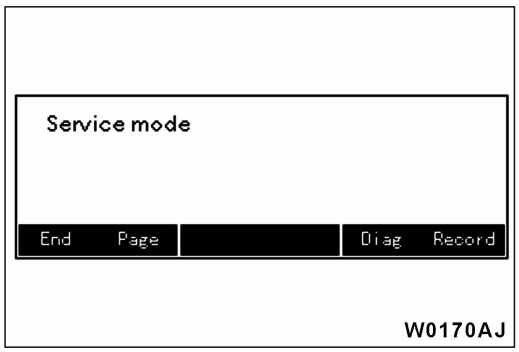
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(3) Press the F3 switch to display the speaker checking screen.
The test sound will be output alternately from each speaker each time the F2 switch is pressed.
Press the F1 switch to end speaker checking and return to the audio checking menu screen.
At the early mass production, sometimes radio sound will be output. This is not a sign of abnormality.



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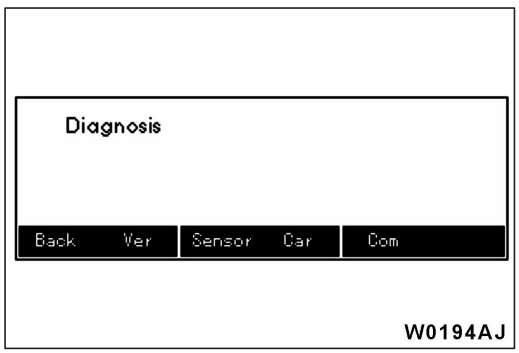
(4) Press F4 to display the audio key checking screen.
When one of the audio switches is pressed, the screen display color for that switch should change. This indicates that this particular switch system is working normally.
Press the F1 switch to check the operation of the F1 switch.
Press the F1 switch once more to return to the audio checking menu screen.



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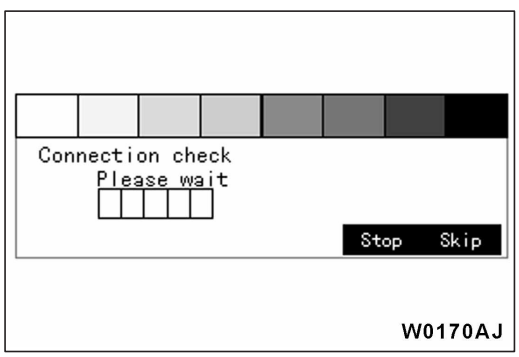
5. SELF-DIAGNOSIS

(1) If the F5 switch is pressed at the service mode initial screen, the self-diagnosis menu screen will appear.



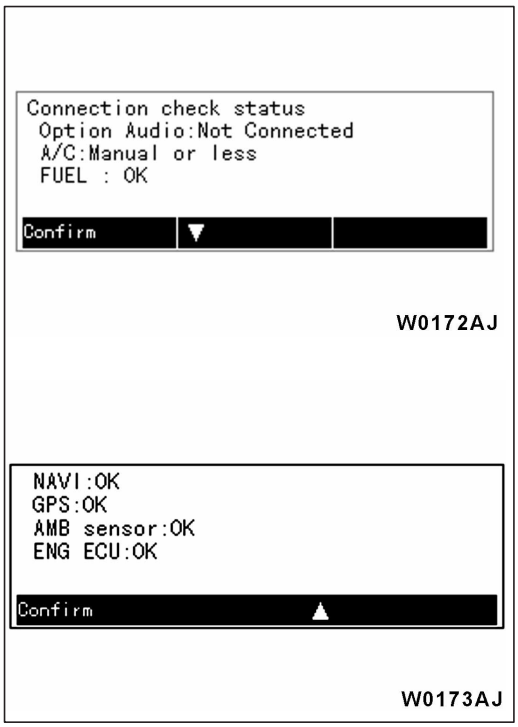
W0194AJ

(2) Next, use the function switches to carry out self-diagnosis.

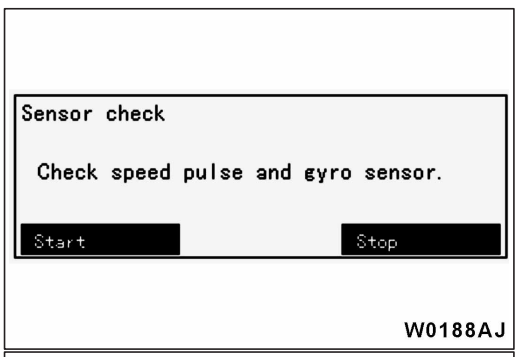


W0170AJ

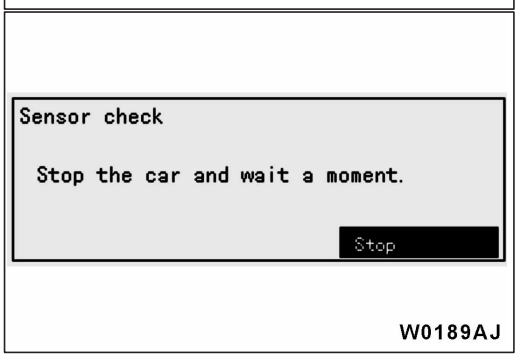
(3) When the F5 switch is pressed, self-diagnosis for the wiring is carried out.
A colored bar will appear on the screen of the Multi-center Display unit, and all units which are connected to the navigation unit will be checked during this time.



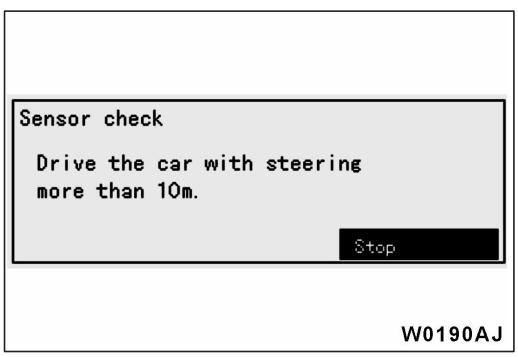
(4) Once the transmission checking is completed, the results of checking will appear on the screen.
After checking the results, press the F1 switch to return to the self-diagnosis menu screen.



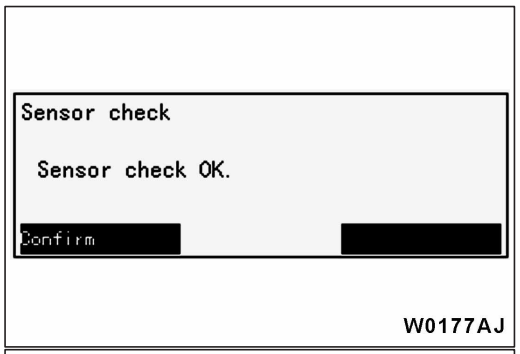
(5) If the F6 switch is pressed at the self-diagnosis menu screen, sensor checking will start.
Press the F1 switch to start sensor checking.
If you would like to return to the self-diagnosis menu screen without carrying out sensor checking, press the F5 switch.



(6) When sensor checking starts, the gyro output will be checked first while the vehicle is stopped, so make sure that the vehicle is stopped for this check.
If the vehicle is moving when the sensor checking starts, the vehicle speed sensor will be shown as defective.
Follow the guidance message on the multi-center display.

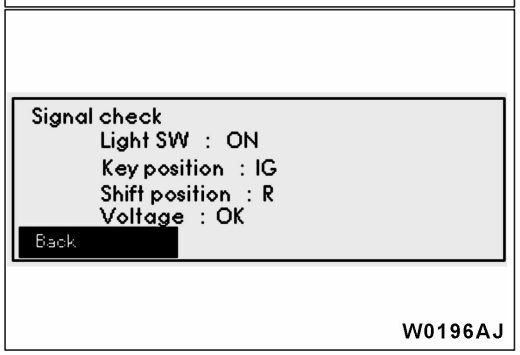


(7) Next, drive the vehicle for approximately 10 meters while changing the running direction in order to check the vehicle speed pulse and the gyro sensor output. The sensor checking will then be completed. If there is an open circuit in the vehicle speed sensor, sensor checking will not complete even after the vehicle has travelled more than 10 meters. In this case, press the F5 switch to stop checking.
If the vehicle does not move or there is an open circuit in vehicle speed sensor, the vehicle speed sensor will be shown as defective.



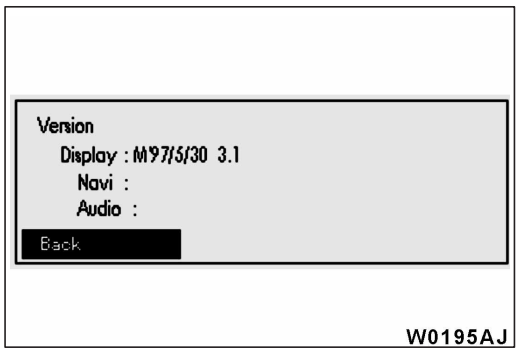
W0177AJ

(8) When sensor checking is completed, the check results will appear on the screen. After checking the results, press the F1 switch to return to the self-diagnosis menu screen.



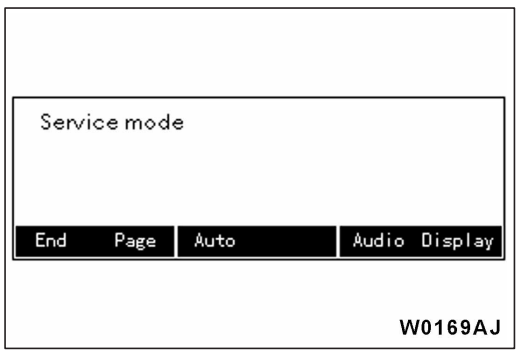
W0196AJ

(9) If the F6 switch is pressed at the self-diagnosis menu screen, vehicle signal checking will start.
The lighting switch condition, ignition key position, shift lever selection (R or a position other than R) and the power supply voltage drop will be appear on the screen.
Press the F1 switch to return to the self-diagnosis menu screen.



W0195AJ

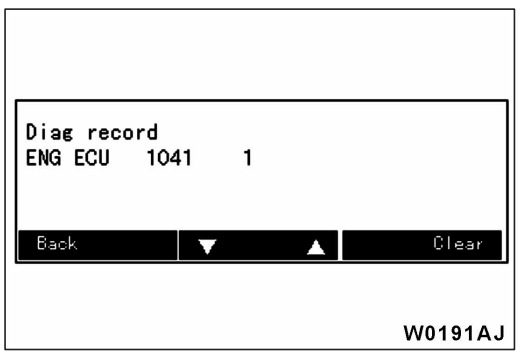
If the F2 switch is pressed at the self-diagnosis menu screen, version data self-diagnosis will be carried out, and the check results will appear on the screen.
Press the F1 switch to return to the self-diagnosis menu screen.



W0169AJ

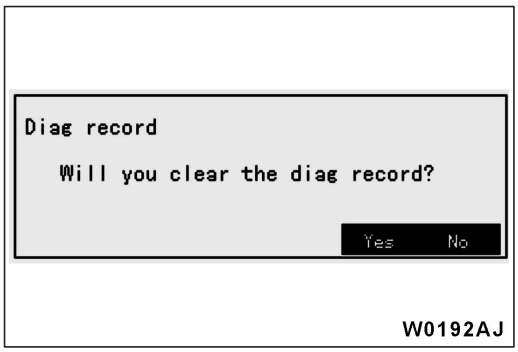
6. DIAGNOSIS RECORDING

(1) If the F6 switch is pressed at the service mode initial screen, the diagnosis recording screen will appear.
(2) Press the F1 switch to return to the service mode initial screen.

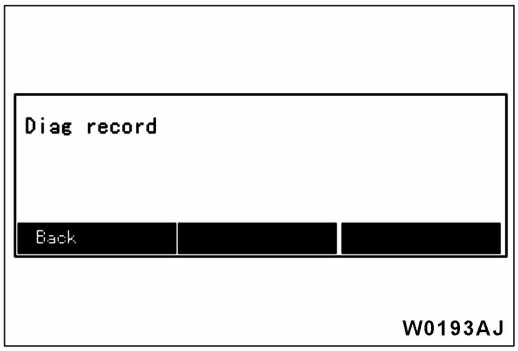


W0191AJ

(3) Press the F6 switch to clear any error codes which may still be remaining from diagnosis recording.
When this is done, the clearing confirmation screen will appear. If it is okay to continue with the clear, press the F5 switch. To cancel clearing, press the F6 switch.
If the F6 switch is pressed, the screen will return to the diagnosis recording screen.



(4) If the F5 switch is pressed, all past error codes will be cleared, and the screen will return to the diagnosis recording screen. The Clear button will not be displayed at this time.



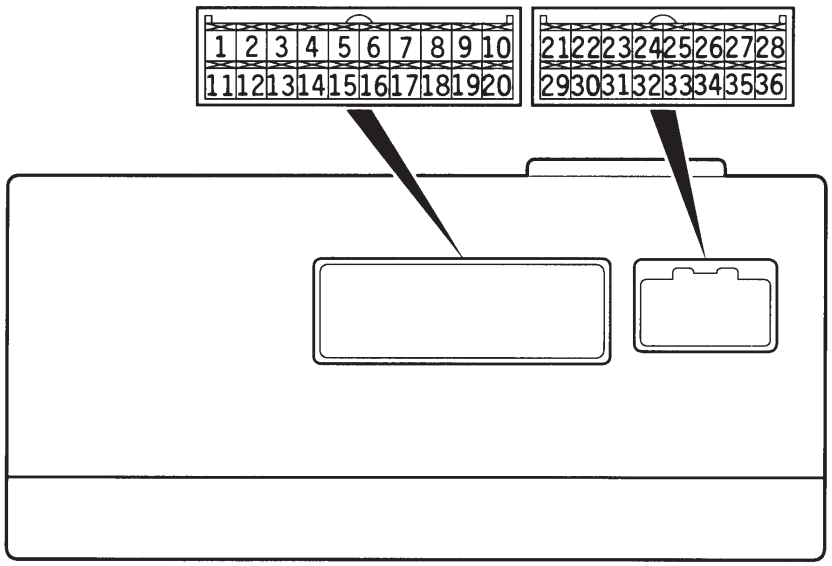
(5) Press the F1 switch to return to the service mode initial screen.

7. ERROR CODE TABLE

Error Code No.	Error Details	Detection Method (Reference)	Reference Page
1011	Ambient temperature sensor not connected during diagnosis	Connection checking	54A-105
1021	Fuel gauge not connected during diagnosis	Connection checking	54A-106
1031	GPS abnormality during diagnosis	Connection checking	54A-106
1041	Engine-ECU not connected during diagnosis	Connection checking	54A-106
1051	SWS not connected during diagnosis (This error does not occur when correct car type is set)	Connection checking	54A-106
1091	CD drive too hot during diagnosis	Connection checking	54A-106
1092 – 1096	CD drive abnormality during diagnosis	Connection checking	54A-107
10A1, 10B1	Memory of navigation unit abnormality during diagnosis	Connection checking	54A-107
20D1, 30D1	Vehicle speed pulse abnormality during diagnosis	Sensor checking	54A-107
20E1, 20E2, 30E1, 30E2	Gyro level abnormality during diagnosis	Sensor checking	54A-107

MAIN UNIT TERMINAL VOLTAGES

1. MULTI-CENTER DISPLAY UNIT



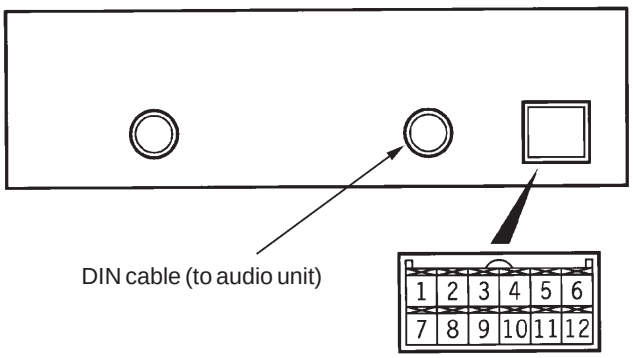
W0278AJ

Terminal No.	Input/ Output	Signal Symbol	Terminal Voltage (V)	Harness Problem		Trouble Symptom Resulting from Harness Problem
				Open Circuit	Short-circuit	
1	Input	G+SYTNC (AUDIO)	–	○	○	Noise display (random dot pattern)
2	Input	B+SYNC (AUDIO)	–	○	○	Blue, white, cyan and magenta do not appear in RGB screen.
3, 4	–	–	–	–	–	–
5	Input	ISOK	Hi: System voltage Lo: 0 – 1	○	○	MUT-II cannot be used to check engine-ECU.
6	Input/ Output	DATA	Hi: System voltage Lo: 0 –1	○	○	Switch operation sound buzzer does not peep.
7	Input/ Output	M–DATA (AUDIO)	Hi: 4 – 5 Lo: 0 – 1	○	○	Buzzer sounds 30 seconds after the power turned to on. Nighttime illumination does not appear for any navigation system.
8	Input/ Output	M–CLOCK (AUDIO)	Hi: 4 – 5 Lo: 0 – 1	○	○	Buzzer sounds 30 seconds after the power turned to on. Nighttime illumination does not appear for any navigation system.
9, 10	–	–	–	–	–	–
11	–	SHIELD–GND	–	–	–	–
12	–	–	–	–	–	–

Terminal No.	Input/ Output	Signal Symbol	Terminal Voltage (V)	Harness Problem		Trouble Symptom Resulting from Harness Problem
				Open Circuit	Short-circuit	
13	Input	R+SYNC (AUDIO)	–	○	○	Red, white, yellow and magenta do not appear in RGB screen.
14	–	–	–	–	–	–
15	Input/ Output	K	Hi: System voltage Lo: 0 – 1	○	○	Values on Trip information screen (average speed, fuel consumption and cruising distance) are abnormal. Wiring and communication error. Communication is not possible between the engine-ECU and the MUT-II.
16	–	–	–	–	–	–
17	Input/ Output	M–BUSY (AUDIO)	Hi: 4 – 5 Lo: 0 – 1	○	–	Screen display does not appear.
				–	○	Buzzer sounds 30 seconds after the power turned to on. Nighttime illumination does not appear for any navigation system.
18	–	SHIELD–GND	–	–	–	–
19 – 21	–	–	–	–	–	–
22	Input	PS–R	Hi: System voltage Lo: 0 – 1	○	○	Current location is not correct when reversing.
23	Input	EX–TEMP	0 – 5	○	○	Outside air temperature does not appear.
24	Input	ILL+	Hi: System voltage Lo: 0 – 1	○	–	Nighttime illumination does not appear for any navigation system units.
				–	○	Blown multipurpose fuse.
25	Input	ACC (ACC power supply)	System voltage	○	–	Screen display does not appear.
				–	○	Blown multipurpose fuse.
26	Input	+B	System voltage	○	–	Screen display does not appear.
				–	○	Blown multipurpose fuse.
27	Input	VSS	Hi: 4 – 5 Lo: 0 – 1	○	–	No effect.
28	–	GND (Ground)	–	○	–	Screen display does not appear.
29, 30	–	–	–	–	–	–
31	–	GND–TEMP	–	○	○	Outside air temperature does not appear.
32	–	ILL –	–	–	–	–
33	Input	FUEL GAUGE	0 – 3	○	○	Abnormal cruising distance display.

Terminal No.	Input/ Output	Signal Symbol	Terminal Voltage (V)	Harness Problem		Trouble Symptom Resulting from Harness Problem
				Open Circuit	Short-circuit	
34, 35	–	–	–	–	–	–
36	Input	IG1	System voltage	○	–	Communication with engine-ECU is not possible. Driving data values displayed are abnormal.
				–	○	Communication with engine-ECU is not possible. Driving data values displayed are abnormal. Blown multipurpose fuse.

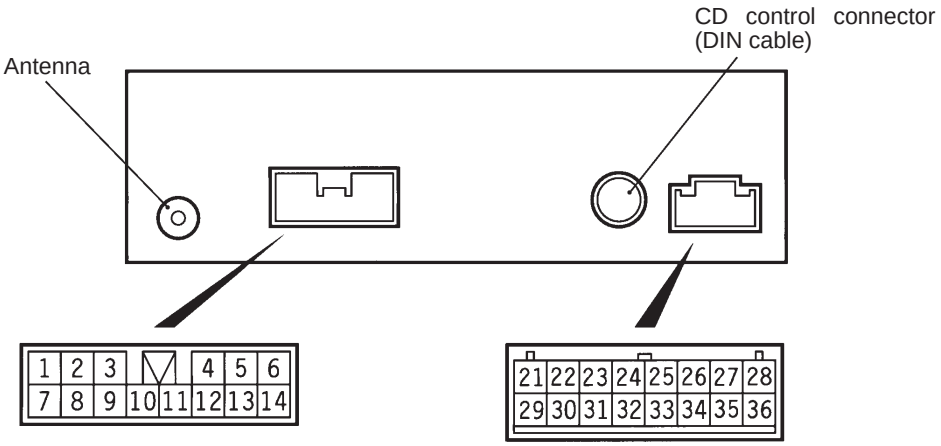
2. NAVIGATION UNIT



AV0845AE

Terminal No.	Input/ Output	Signal Symbol	Terminal Voltage (V)	Harness Problem		Trouble Symptom Resulting from Harness Problem
				Open Circuit	Short-circuit	
1 – 3	–	–	–	–	–	–
4	Input	VEHICLE SPEED PULSE	Voltage should change when wheels are turning. Hi: 4 – 5 Lo: 0 – 1	○	○	Compass display does not change when not following a route. Guide does not appear when following a route.
5	Input	+BATTERY	System voltage	○	–	Navigation does not operate.
				–	○	Blown fuse in +B system.
6	Input	ACCESSORY	System voltage	○	–	Navigation does not operate.
				–	○	Blown fuse in ACC system.
7 – 11	–	–	–	–	–	–
12	–	GND	–	○	–	Navigation sometimes does not operate.

3. AUDIO UNIT



BV0846AE

Terminal No.	Input/ Output	Signal Symbol	Terminal Voltage (V)	Harness Problem		Trouble Symptom Resulting from Harness Problem
				Open Circuit	Short-circuit	
1	Output	SPEAKER RR (+)	0 – System voltage (AC)	○	–	No sound is output from rear right speaker.
				–	○	No sound is output from rear left and right speakers.
2	Output	SPEAKER RL (+)	0 – System voltage (AC)	○	–	No sound is output from rear left speaker.
				–	○	No sound is output from rear left and right speakers.
3	–	–	–	–	–	–
4	Input	ILL (+)	Hi: System voltage Lo: 0 – 1	○	–	Nighttime illumination does not appear for audio unit.
				–	○	Blown multipurpose fuse.
5	Output	SPEAKER FL (+)	0 – System voltage (AC)	○	–	No sound is output from front left speaker.
				–	○	No sound is output from front left and right speakers.
6	Output	SPEAKER FR (+)	0 – System voltage (AC)	○	–	No sound is output from front right speaker.
				–	○	No sound is output from front left and right speakers.
7	Output	SPEAKER RR (–)	0 – System voltage (AC)	○	–	No sound is output from rear right speaker.
				–	○	No sound is output from rear left and right speakers.

Terminal No.	Input/ Output	Signal Symbol	Terminal Voltage (V)	Harness Problem		Trouble Symptom Resulting from Harness Problem
				Open Circuit	Short-circuit	
8	Output	SPEAKER RL (–)	0 – System voltage (AC)	○	–	No sound is output from rear left speaker.
				–	○	No sound is output from rear left and right speakers.
9	–	–	–	–	–	–
10	Input	ACC (ACC power supply) (Battery voltage)	System voltage	○	–	Audio power supply does not turn on.
				–	○	Blown multipurpose fuse.
11	Input	+B (Battery voltage)	System voltage	○	–	Cassette is not ejected when ACC power turned off. Contents of memory are cleared.
				–	○	Blown multipurpose fuse.
12	Input	ILL (–)	–	–	–	–
13	Output	SPEAKER FL (–)	0 – System voltage (AC)	○	–	No sound is output from front left speaker.
				–	○	No sound is output from front left and right speakers.
14	Output	SPEAKER FR (–)	0 – System voltage (AC)	○	–	No sound is output from front right speaker.
				–	○	No sound is output from front left and right speakers.
21	Input/ Output	M–DATA	Hi: 4 or more Lo: 1 or less	○	○	Panel switches cannot be operated.
22	Input/ Output	M–SCK	Hi: 4 or more Lo: 1 or less	○	○	Panel switches cannot be operated.
23	–	–	–	–	–	–
24	Output	G+SYNC	0 – 5	○	○	Abnormal navigation screen color.
25	Output	B+SYNC	0 – 5	○	○	Abnormal navigation screen color.
26 – 28	–	–	–	–	–	–
29	Input/ Output	M–BUSY	Hi: 4 or more Lo: 1 or less	○	○	Panel switches cannot be operated.
30	–	SHIELD EARTH (M–BUS)	–	–	–	–

Terminal No.	Input/ Output	Signal Symbol	Terminal Voltage (V)	Harness Problem		Trouble Symptom Resulting from Harness Problem
				Open Circuit	Short-circuit	
31	–	–	–	–	–	–
32	–	SHIELD EARTH	–	–	–	–
33	–	–	–	–	–	–
34	Output	R+SYNC	0 – 5	○	○	Abnormal navigation screen color.
35, 36	–	–	–	–	–	–

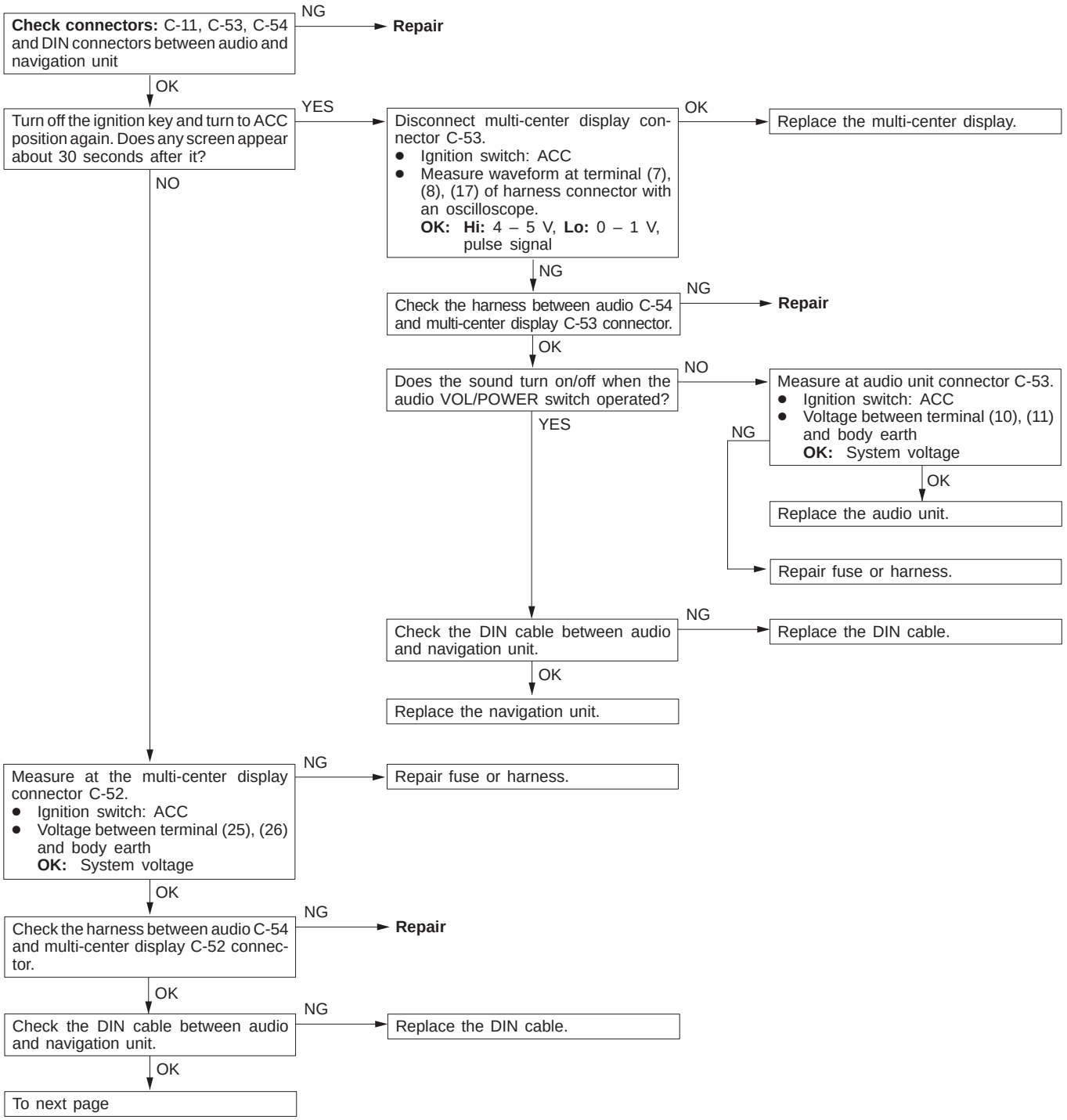
INSPECTION CHART CLASSIFIED BY TROUBLE SYMPTOMS

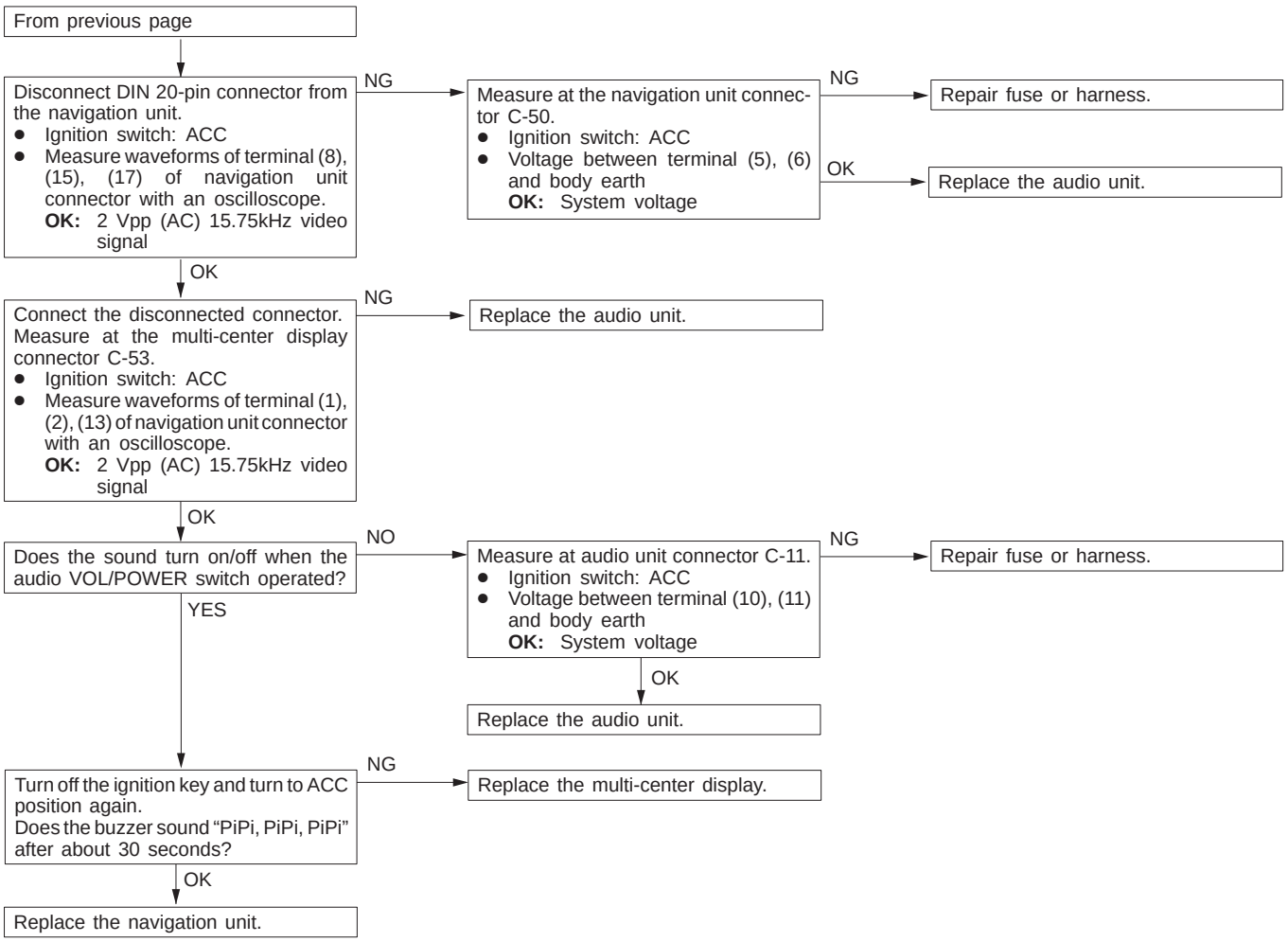
Related Unit	Trouble Symptom	Inspection Procedure No.	Reference Page
Malfunction of navigation unit, multi-center display, audio unit and related sensor, harness	TAPE/CD, UML switches do not work. No display appears after the ignition key is turned to ACC.	1	54A-97
	TAPE/CD, UML switches do not work. (Display appears.)	2	54A-99
	No display appears after the ignition key is turned to ACC, but TAPE/CD, UML switches can be operative.	3	54A-100
	CD changer screen display does not appear when TAPE/CD switch is operated.	4	54A-101
	GPS reception is not possible.	5	54A-101
	Outside air temperature data is not displayed.	6	54A-101
	Abnormal driving data display ● Abnormal average fuel consumption and average speed displays. ● Abnormal cruising distance displays	7	54A-102
	Display moves about. Screen colours do not match correctly.	8	54A-103
	Daytime/nighttime display mode does not change in conjunction with lighting switch operations.	9	54A-103
	Compass display does not rotate , or guidance does not appear when following a route.	10	54A-104
	One of the following messages appears during navigation mode. ● The CD drive has failure condition. Check and reload the disc, please. ● Wrong disc is in the CD drive. Insert a map disc, please. ● No disc is in the CD drive. Insert a map disc please. ● A music disc is in the CD-drive.	11	54A-104

INSPECTION PROCEDURES FOR EACH TROUBLE SYMPTOM

INSPECTION PROCEDURE 1

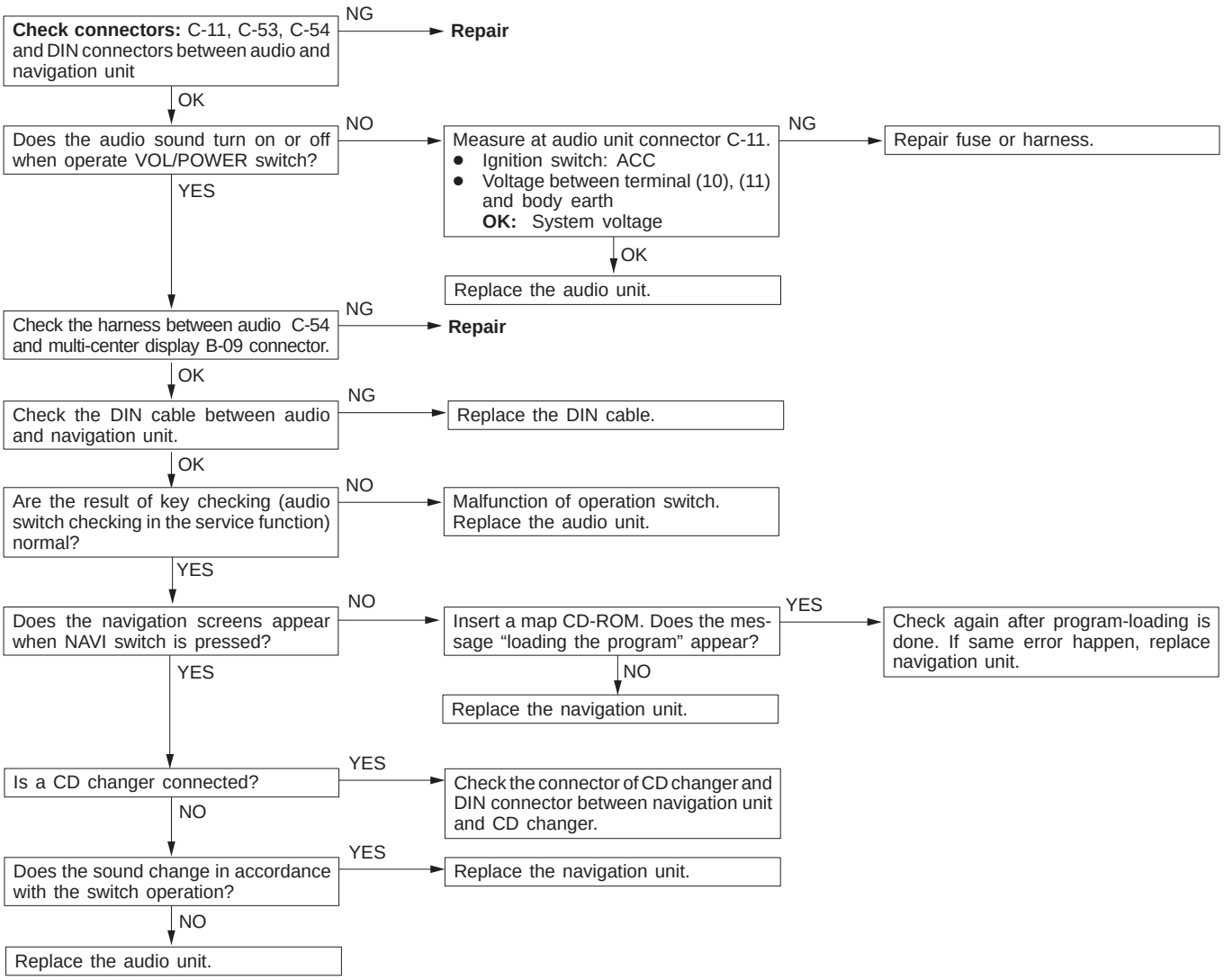
TAPE/CD, UML switches do not work. No display appears after the ignition key is turned to ACC.




From previous page
Disconnect DIN 20-pin connector from the navigation unit.
● Ignition switch: ACC
● Measure waveforms of terminal (8), (15), (17) of navigation unit connector with an oscilloscope.
OK: 2 Vpp (AC) 15.75kHz video signal
NG
Measure at the navigation unit connector C-50.
● Ignition switch: ACC
● Voltage between terminal (5), (6) and body earth
OK: System voltage
NG
Repair fuse or harness.
OK
Replace the audio unit.
OK
Connect the disconnected connector. Measure at the multi-center display connector C-53.
● Ignition switch: ACC
● Measure waveforms of terminal (1), (2), (13) of navigation unit connector with an oscilloscope.
OK: 2 Vpp (AC) 15.75kHz video signal
NG
Replace the audio unit.
OK
Does the sound turn on/off when the audio VOL/POWER switch operated?
NO
Measure at audio unit connector C-11.
● Ignition switch: ACC
● Voltage between terminal (10), (11) and body earth
OK: System voltage
NG
Repair fuse or harness.
OK
Replace the audio unit.
YES
Turn off the ignition key and turn to ACC position again.
Does the buzzer sound “PiPi, PiPi, PiPi” after about 30 seconds?
NG
Replace the multi-center display.
OK
Replace the navigation unit.

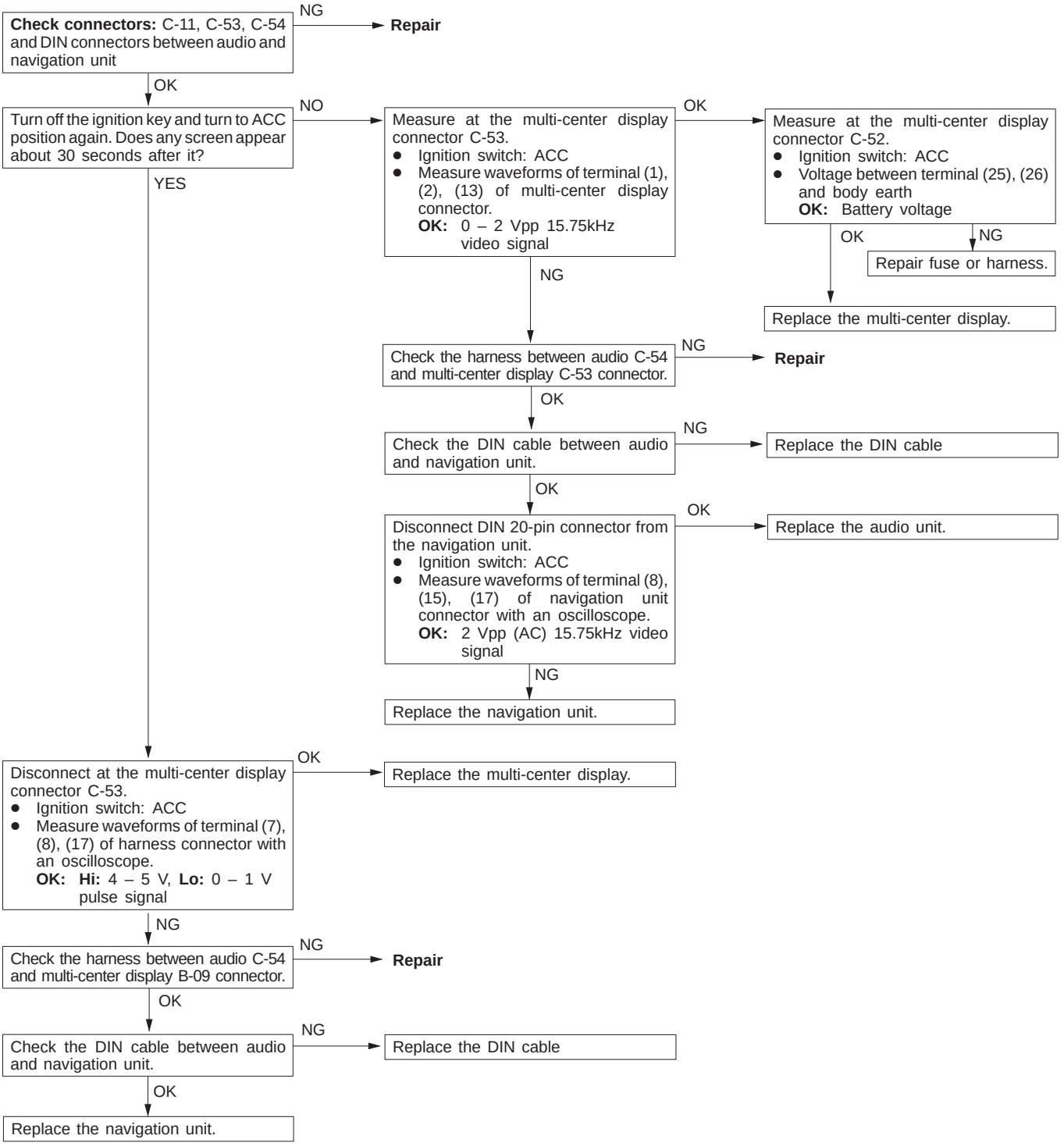
INSPECTION PROCEDURE 2

TAPE/CD, UML switches do not work. (Display appears.)



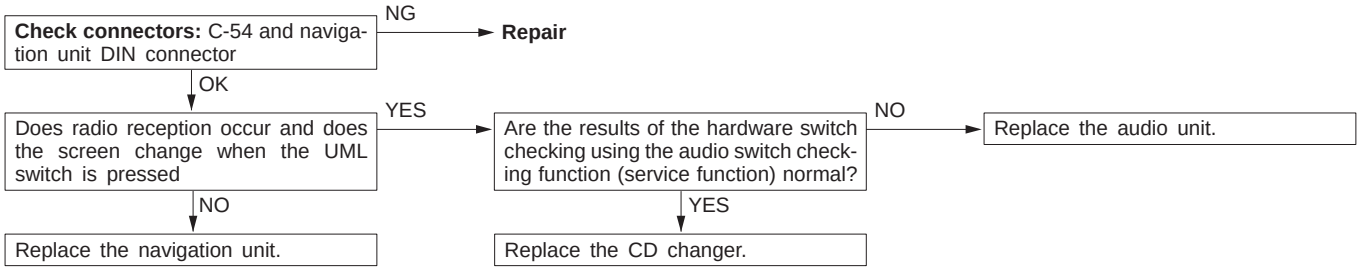
INSPECTION PROCEDURE 3

No display appears after the ignition key is turned to ACC, but TAPE/CD, UML switches can be operative.



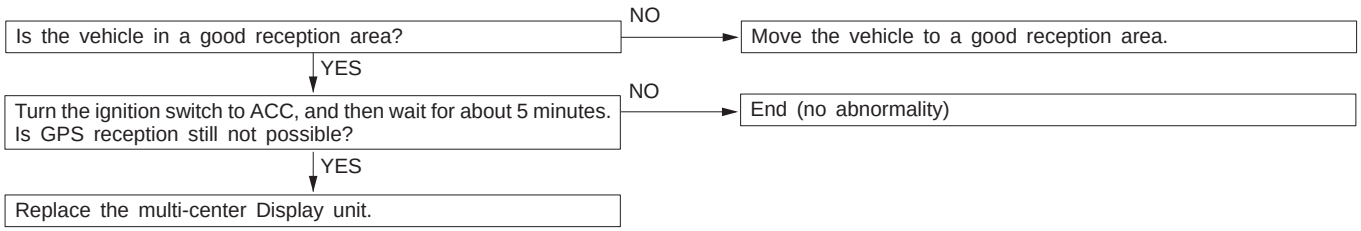
INSPECTION PROCEDURE 4

CD changer screen displays do not appear when TAPE/CD switches are operated.



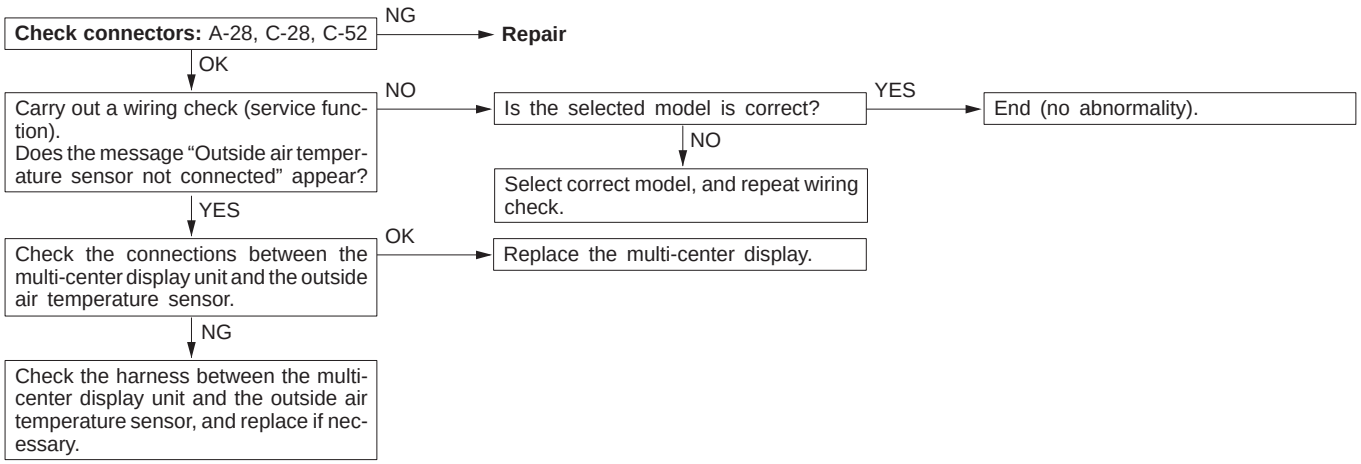
INSPECTION PROCEDURE 5

GPS reception is not possible.



INSPECTION PROCEDURE 6

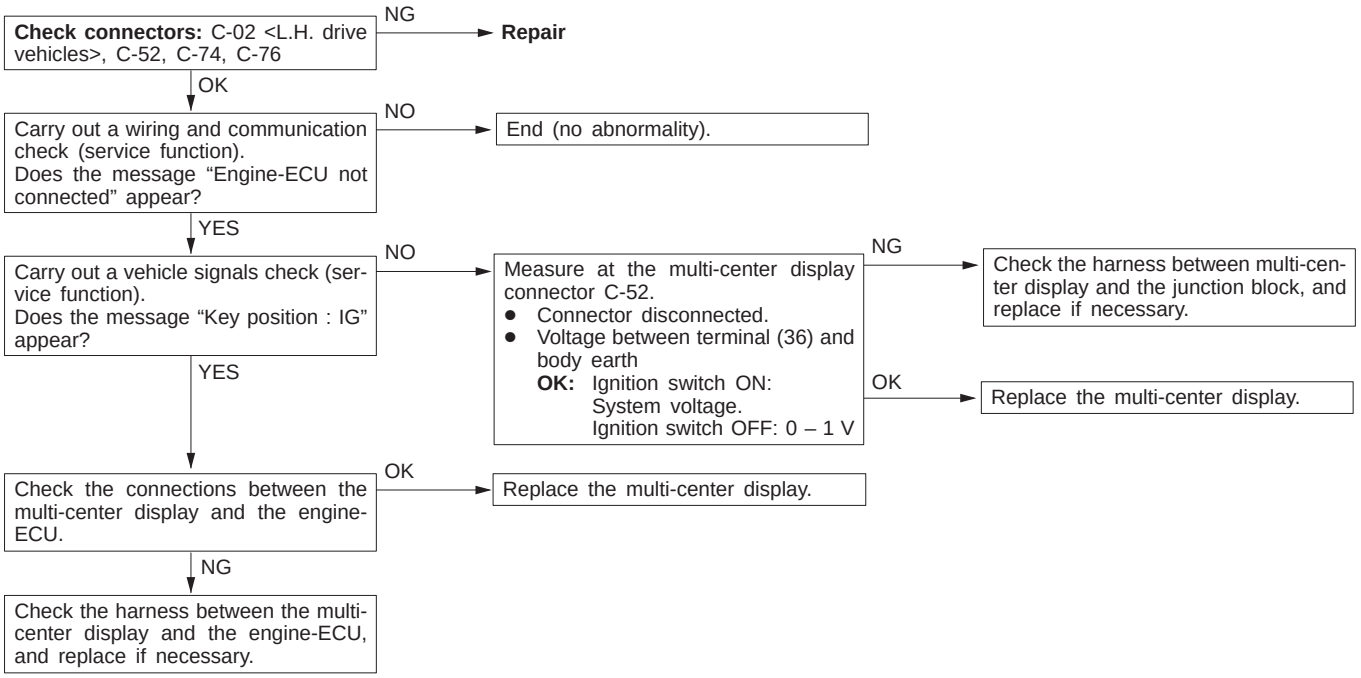
Outside air temperature data is not displayed.



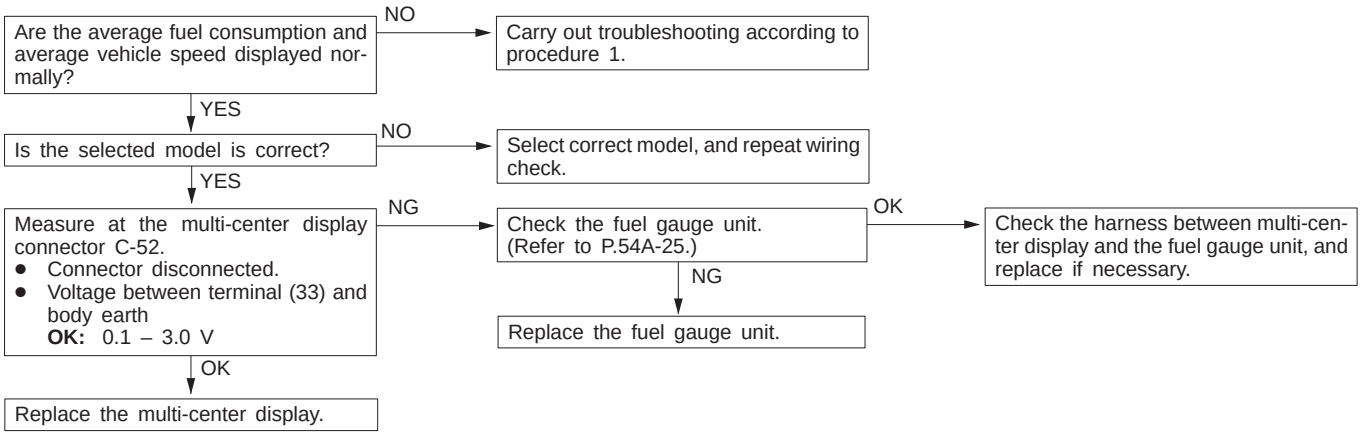
INSPECTION PROCEDURE 7

Abnormal driving data displays.
- Abnormal average fuel consumption (momentary fuel consumption) and average speed displays.
- Abnormal cruising distance displays.

1. When average fuel consumption (momentary fuel consumption) and average speed displays are abnormal.

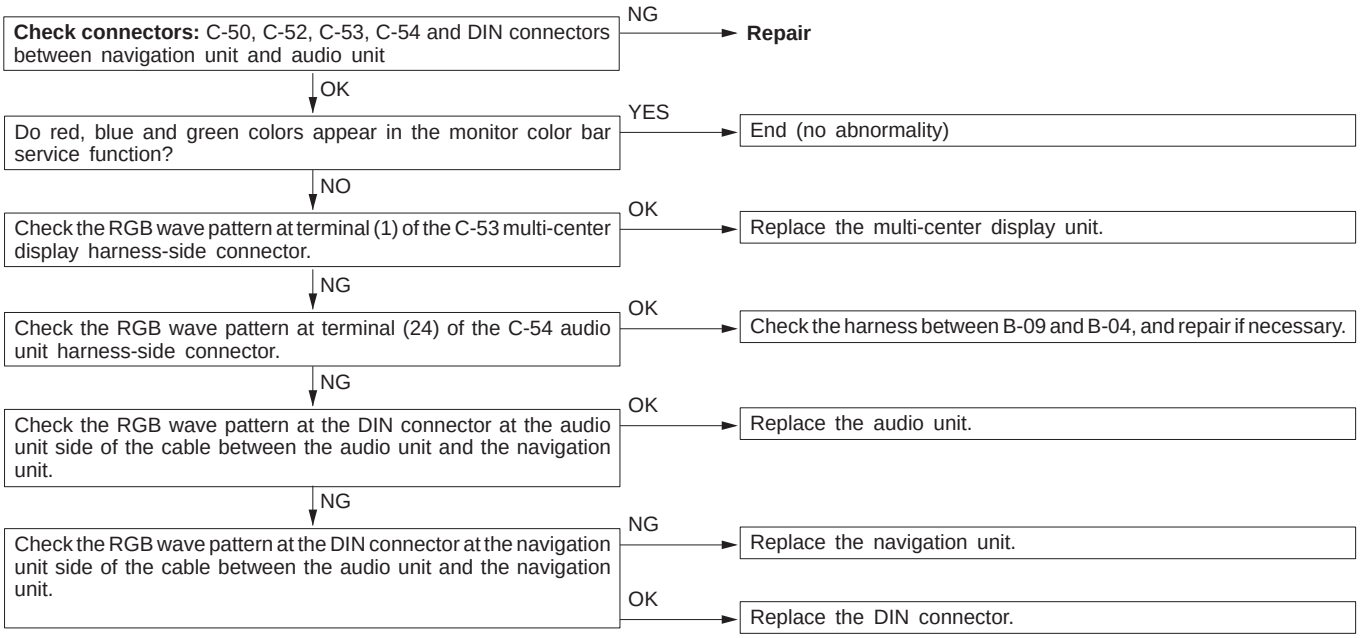


2. When cruising distance display is abnormal.



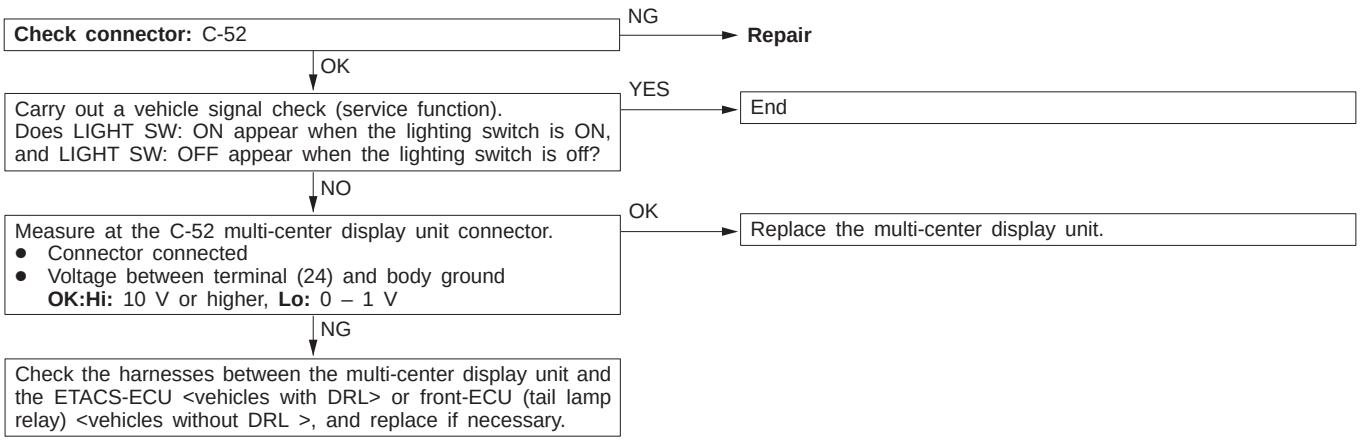
INSPECTION PROCEDURE 8

Display moves about.
Screen colors do not match correctly.



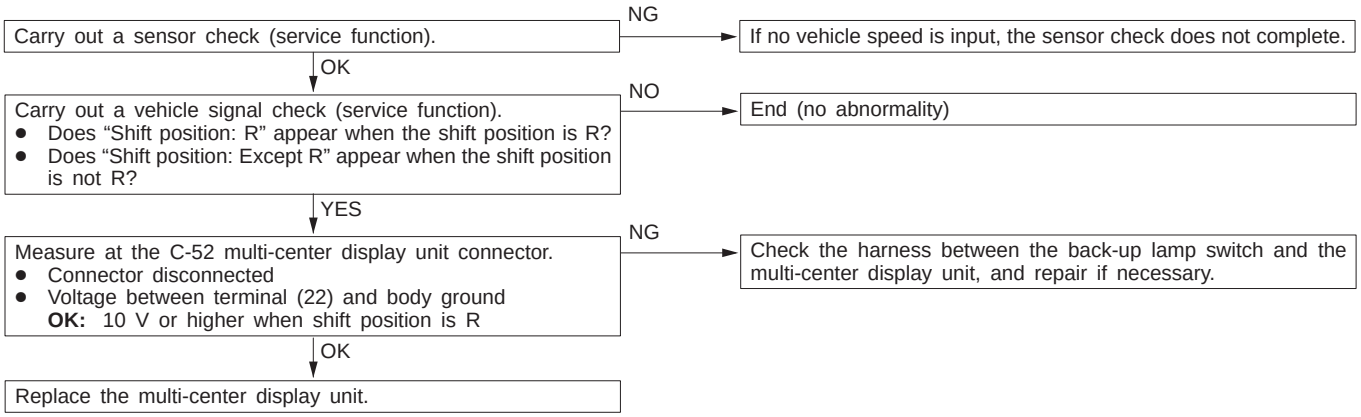
INSPECTION PROCEDURE 9

Daytime/nighttime display mode does not change in conjunction with lighting switch operations.



INSPECTION PROCEDURE 10

Compass display does not change when not following a route, or guide does not appear when searching for and following a route.

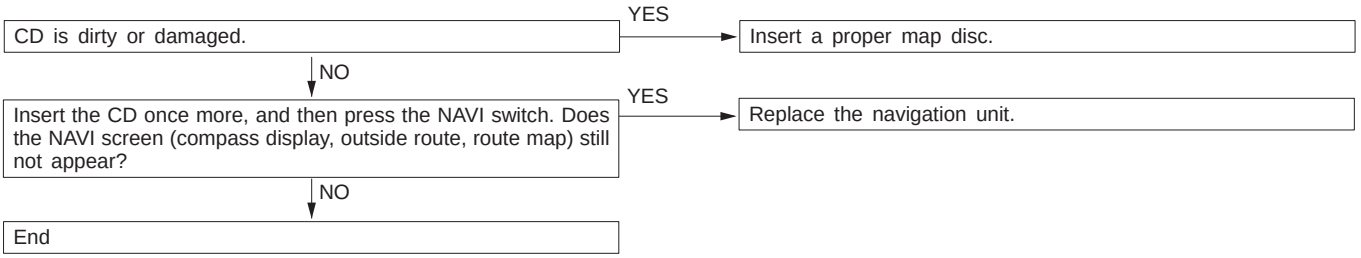


INSPECTION PROCEDURE 11

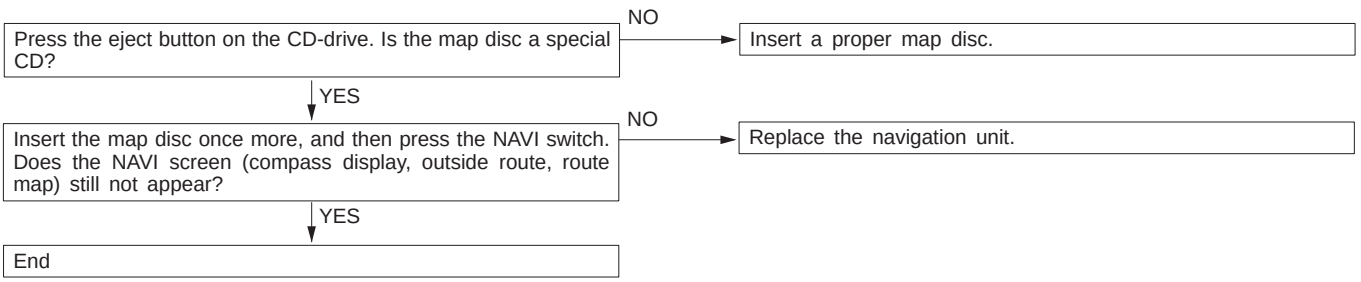
One of the following messages appears during navigation mode.

- The CD-drive has failure condition. Confirm and reload the disc, please.
- Wrong disc is in the CD-drive. Insert a map disc, please.
- No disc is in the CD-drive. Insert a map disc, please.
- A music disc is in the CD-drive.

1. **“The CD-drive has failure condition. Confirm and reload the disc, please.” or “Wrong disc is in the CD-drive. Insert a map disc, please.” appears.**



2. **“No disc is in the CD-drive. Insert a map disc, please.” or “A music disc is in the CD-drive” appears.**

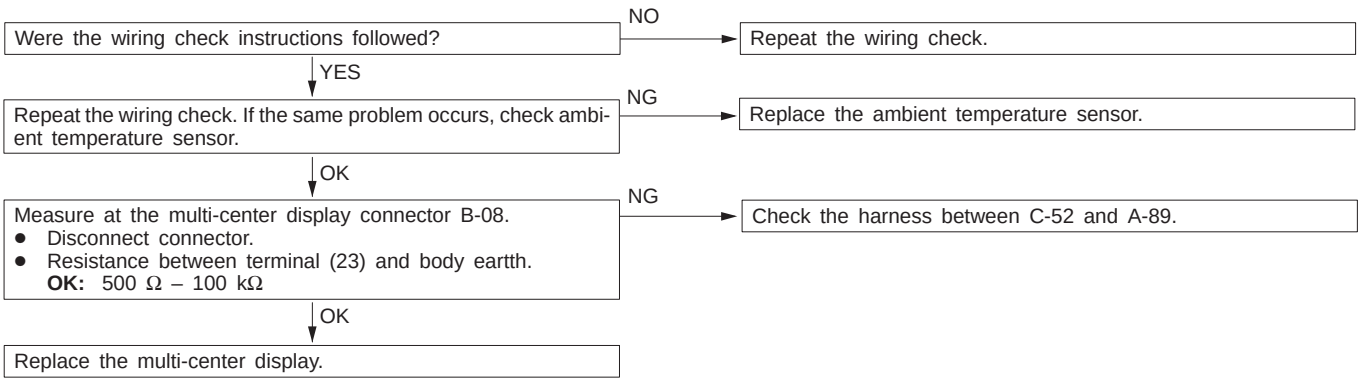


ERROR CODE TABLE <ACCORDING TO SCREEN DISPLAY>

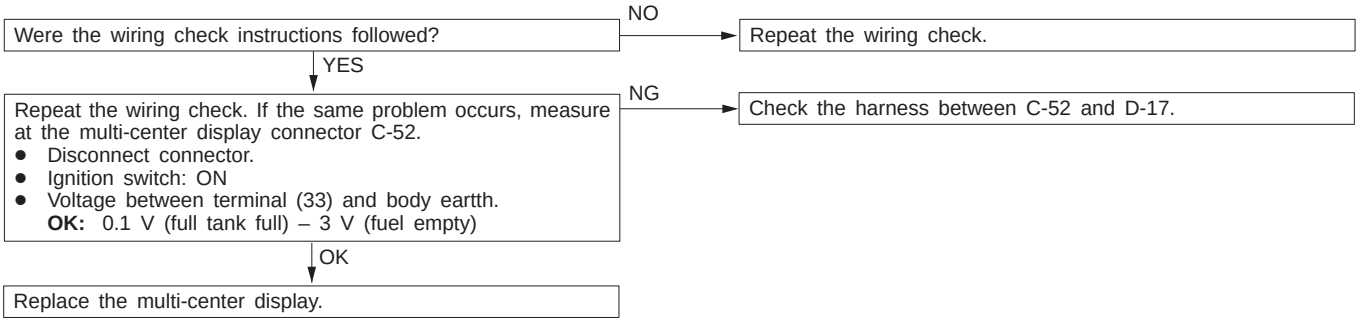
Error Code No.	Error Details	Detection Method (Reference)	Reference Page
1011	Ambient temperature sensor not connected during diagnosis	Connection checking	54A-105
1021	Fuel gauge not connected during diagnosis	Connection checking	54A-106
1031	GPS abnormality during diagnosis	Connection checking	54A-106
1041	Engine-ECU not connected during diagnosis	Connection checking	54A-106
1051	SWS not connected during diagnosis	Connection checking	54A-106
1091	CD drive too hot during diagnosis	Connection checking	54A-106
1092 – 1096	CD drive abnormality during diagnosis	Connection checking	54A-107
10A1, 10B1	Memory of navigation unit abnormality during diagnosis	Connection checking	54A-107
20D1, 30D1	Vehicle speed pulse abnormality during diagnosis	Sensor checking	54A-107
20E1, 20E2, 30E1, 30E2	Gyro level abnormality during diagnosis	Sensor checking	54A-107

INSPECTION PROCEDURES FOR EACH ERROR CODE <ACCORDING TO SCREEN DISPLAY>

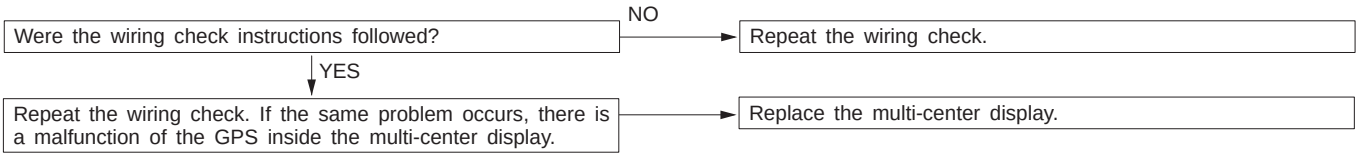
Error Code No. 1011



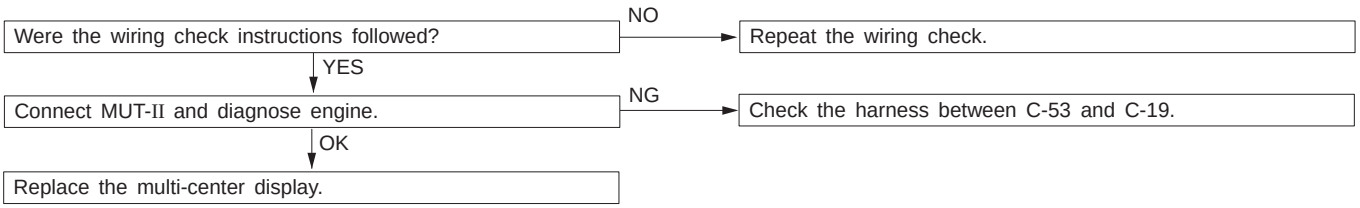
Error Code No. 1021



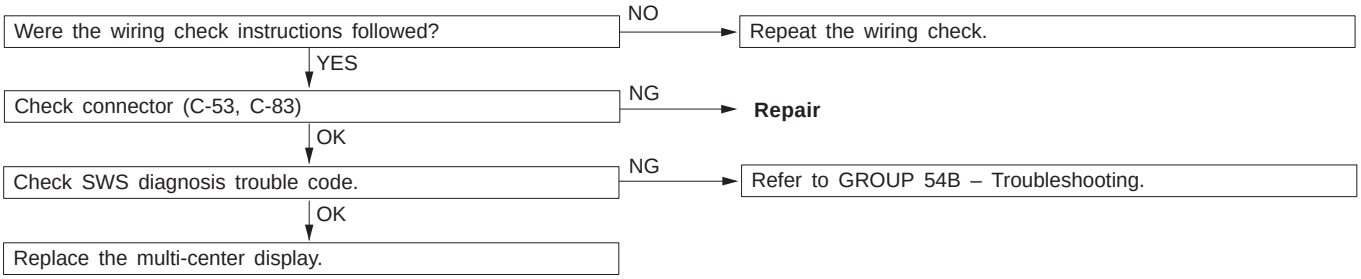
Error Code No. 1031



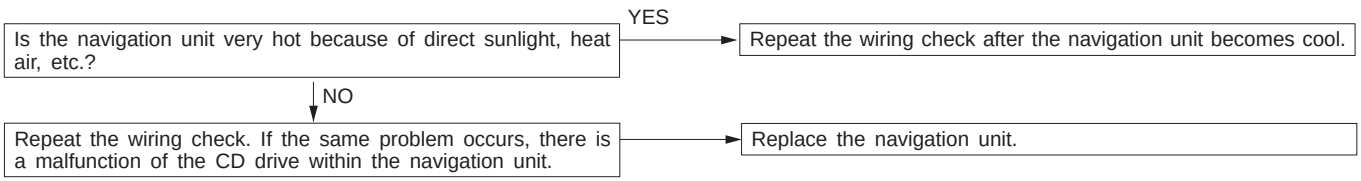
Error Code No. 1041



Error Code No. 1051



Error Code No. 1091



Error Code No. 1092, 1093, 1094, 1095, 1096

- Is a CD-ROM for this navigation system inside?
  - NO → Insert the CD-ROM for this navigation system.
  - YES ↓
- Is the CD-ROM inserted upside down?
  - YES → Insert the CD-ROM correctly.
  - NO ↓
- Is the disc dirty, damaged or iced up?
  - YES → Repair or replace the disc.
  - NO ↓
- Repeat the wiring check. If the same problem occurs, there is a malfunction of the CD drive within the navigation unit.
  - → Replace the navigation unit.

Error Code No. 10A1, 10B1

- Were the wiring check instructions followed?
  - NO → Repeat the wiring check.
  - YES ↓
- Repeat the wiring check. If the same problem occurs, there is a malfunction of the memory within the navigation unit..
  - → Replace the navigation unit.

Error Code No. 20D1, 30D1

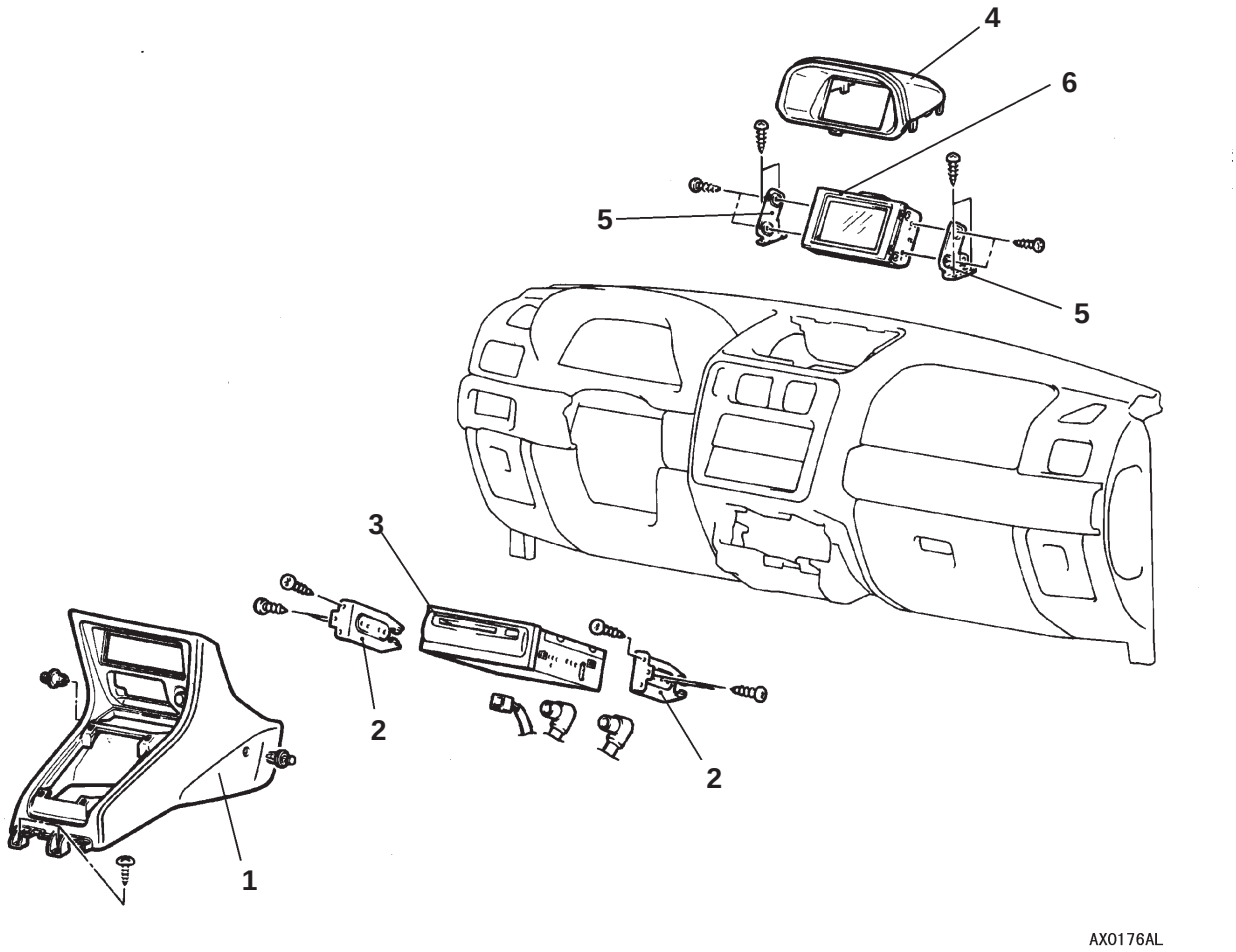
- Were the sensor check instructions followed?
  - NO → Repeat the sensor check.
  - YES ↓
- Check connector (B-08, C-50).
  - NG → **Repair**
  - OK ↓
- Measure at the navigation unit connector B-08.
  - Disconnect connector.
  - Turn on the Ignition switch and then move the vehicle slowly.
  - Voltage between terminal (4) and body eartth.
    OK: HI: 4 – 5 V, Lo: 0 – 1 V, pulse signal
  - NG → Check the vehicle speed sensor. (Refer to P.54A-27.)
  - OK ↓
- Replace the navigation unit.

Error Code No. 20E1, 20E2, 30E1, 30E2

- Were the sensor check instructions followed?
  - NO → Repeat the sensor check.
  - YES ↓
- Repeat the sensor check. If the same problem occurs, there is a malfunction of Gyro sensor within the navigation unit.
  - → Replace the navigation unit.

MULTI-CENTER DISPLAY

REMOVAL AND INSTALLATION



Navigation unit removal steps

1. Floor console (Refer to GROUP 52A – Floor console)
2. Radio bracket
3. Navigation unit

Multi-center display removal steps

4. Multi-center display hood (Refer to P.54A-79.)
5. Multi-center display bracket
6. Multi-center display

GROUP 54A
CHASSIS ELECTRICAL

GENERAL

OUTLINE OF CHANGE

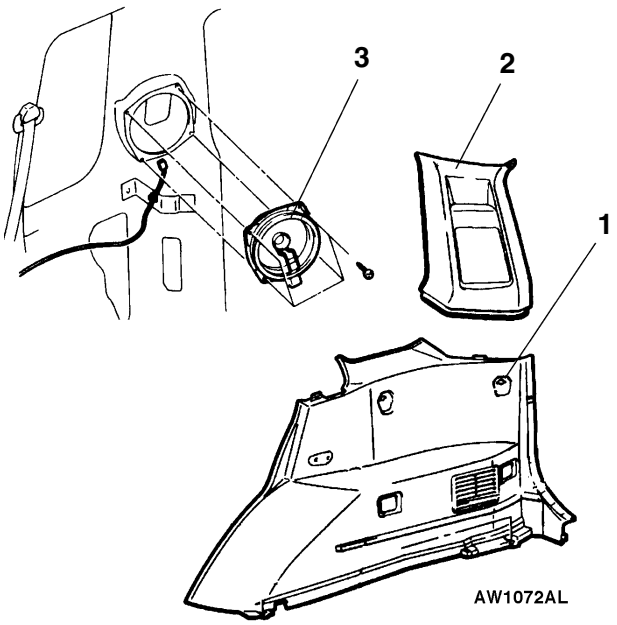
- Due to the introduction of 5-door models, the rear speaker service procedure has been changed.

SPEAKER

REMOVAL AND INSTALLATION

<Rear speaker>

5-door models



Rear speaker removal steps

1. Quarter trim, lower (Refer to GROUP 52A.)
2. Rear pillar trim (Refer to GROUP 52A.)
3. Speaker

SERVICE BULLETIN

PUBLICATION GROUP, AFTER SALES SERVICE DEP.
MITSUBISHI MOTOR SALES EUROPE BV

SERVICE BULLETIN	**No.:** ESB-00E54-502	
	Date:2000-07-30	**<Model>** (EC)PAJERO PININ/MONTERO io (H60,H70) **<M/Y>** 00-10
Subject: CORRECTION TO SERVICE MODE FOR MULTI-CENTER DISPLAY		
Group: CHASSIS ELECTRICAL	**Draftno.:**99SY111917	
INFORMATION/CORRECTION	O. Kai - E.V.P. & G.M. After Sales Service Dept.	

1. Description:

This Service Bulletin ingorms you thet correction has been made to the service mode for the multi-center display (middle grade)

2. Applicable Manuals:

Manual	Pub. No.	Language	Page(s)
'00PAJERO PININ Workshop Manual chassis	CKRE00E1	(English)	54a-69
	CKRF00E1	(French)	
	CKRG00E1	(German)	
	CKRD00E1	(Dutch)	
	CKRI00E1	(Italian)	
'00 MONTERO Workshop Manual chassis	CKRS00E1	(Spanish)	

3. Details:

CHASSIS ELECTRICAL –Multi-center Display <Middle Grade> (page 2,3 and 4)

4. Service Mode For Multi-center Display

1. Enter and terminate the service mode
   (1) To enter the service mode, turn the ignition switch to ACC

<Incorrect>

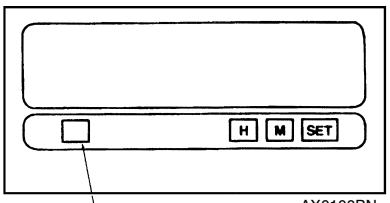
<Correct>

LOCK (OFF)

~~(2) Press the "H" button twice.~~
~~(3) Press the "SET" button and (A) button at the same time.~~
~~(4) Then the audio unit will enter the service mode.~~
~~First of all, the service mode will show model identification for th multi center display and the vehicle identification. Then the service mode proceeds to three checks. LCD segment check, Sensor check and Unit check. To switch over these checks, press the "SET" button.~~

(5) To terminate the service mode, press any button other than the "SET" button.

<Incorrect>



~~2. Details of the service mode~~
~~The service mode checks the following in that order:~~
~~(1) LCD segment check~~
~~This screen is divided into four areas. Each area will be active sequentially whenever the "SET" button is pressed.~~
~~When the "SET" button is pressed four times in this screen, the service mode will proceed to the Sensor check.~~
~~(2) Sensor check~~
~~This screen shows voltage signals from the outside temperature sensor, the fuel gauge unit, and th ignition switch as well as fuel economy.~~
~~When the "SET" button is pressed once in this screen, the service mode will proceed to the Unit check.~~
~~(3) Unit check connected into audio system~~
~~This screen shows an audio equipment, air conditioner or MUT-II connected in the system, percentage of system voltage engine speed sent by the engine-ECU, and oscillation of internal clock.~~
~~When the "SET" button is pressed once in this screen, the service mode will return to the first scree (model identification screen).~~

<Incorrect>

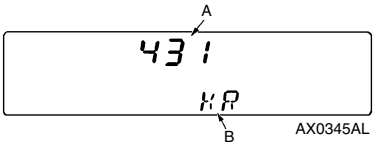
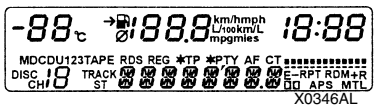
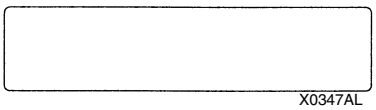
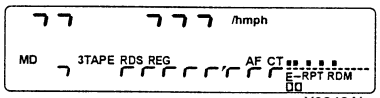
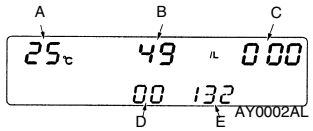
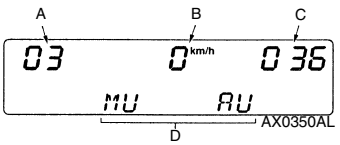
<Correct>

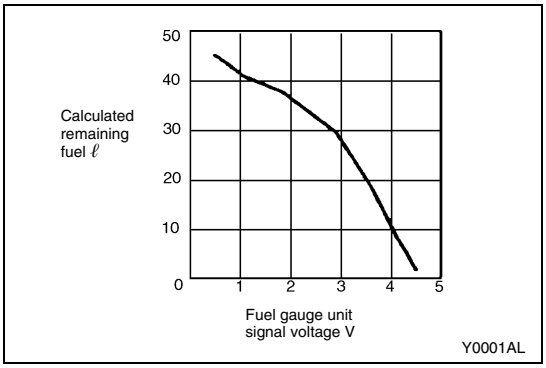
(2) While pressing (A) button, turn the ignition switch to ON. With (A) button depressed, press "H" button twice.
(3) Press "SET" button.
(4) Then th multi-center display will enter th service mode. Each mode will change eac time "SET" button is pressed.

Add pages 3-4 of this bulletin here.

<Added>

2. Service mode menu and check procedure.
   The service mode display changes by pressing “SET” button by following order. (Next to No.9, th function returns to No.1 and repeats the sequence from No.1.)

No.	Mode and display	Displayed contents	Unit	Checking item
1	Model name and vehicle type.  AX0345AL	A. Display model.	Code	Confirm the display model code. (“431” is displayed for this vehicle
		B. Vehicle type.	Code	Confirm the vehicle type. (“KR” is displayed for this vehicle.)
2	Segment check.(illuminate)  X0346AL	All segment illuminated.	_	Check defect segments.
3	Segment check. (only back-lamp)  X0347AL	Back-lamp only. (all segment off)	_	Check damage, dust etc.
4 - 7	¼ segment check.  X0348AL	Each ¼ segment illuminate. (4 different displays appear. The left figure shows the first display.)	_	Check short circuit.
8	Temperature sensor and fue gauge unit signal check  AY0002AL	A. Calculated outside temperate.	℃	Check the displayed value.
		B. Calculated remaining fuel.	ℓ	Check the displayed value.*2
		C. Consumed fuel quantity since.	ℓ	Check the displayed value.
		D. Fuel gauge unit signal voltage.	V*1	Check th displayed value. *2
		E. IG voltage.	V*1	Check the displayed value. (Battery positive voltage)
9	Clock and connected components check.  AX0350AL	A. Voltage of MUT-II detection input.	%	Connect: more than 80, Disconnect: less than 50.
		B. Calculated vehicle speed.	Km/h	Check the displayed value.
		C. Clock.	Sec	Confirm operating.
		D. Connecting components.	Name	Conform connecte components (“MU”: MUT-II< “AU”: audio)



NOTE
*1: Display is made in 0.1 volts.
*2: The relationship between the calculated remaining fuel and the fuel gauge unit signal voltage is as sown in the left figure

SMART WIRING SYSTEM (SWS)

SMART WIRING SYSTEM (SWS)

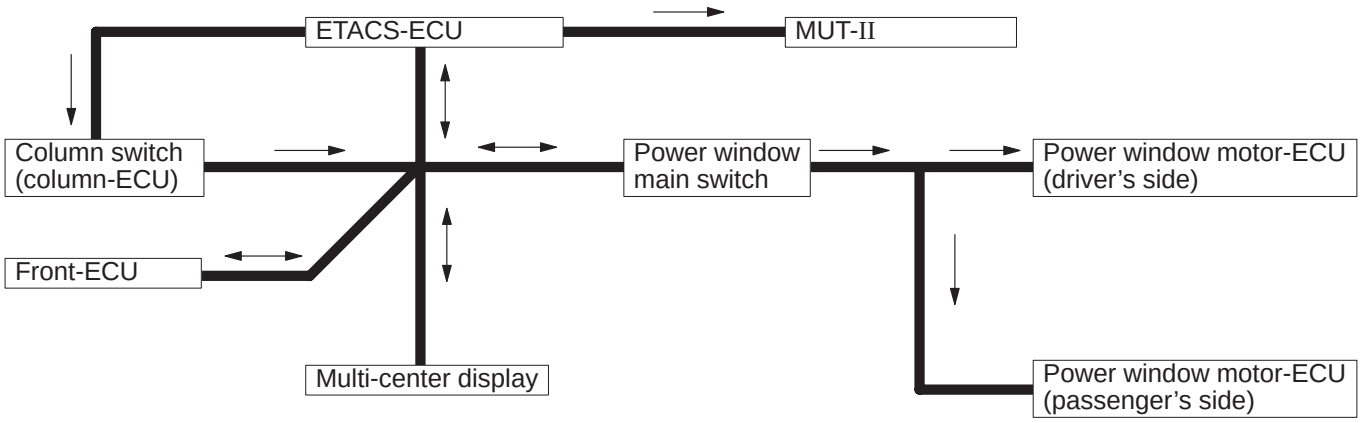
CONTENTS

GENERAL INFOMATION 54B-2
SPECIAL TOOLS 54B-5
TROUBLESHOOTING 54B-6

GENERAL INFORMATION

COMMUNICATION LINE

Data lines for multiplex communication are connected between the front-ECU, ETACS-ECU, column switch assembly, multi-center display, power window main switch, and power window motors as illustrated below.



→ : Uni-directional communication line
↔ : Bi-directional communication line

OPERATION

BUZZER

Light Reminder Warning Function

When the driver's door is opened (driver's door switch ON) with light switch in the TAIL or HEAD position, the buzzer will sound continuously to remind the driver that the lights (taillights or headlights) are ON.

Multi-center Display Buzzer Function

If there is a request from the multi-center display to make the buzzer sound, the ETACS-ECU causes the buzzer to sound.

CENTRAL DOOR LOCKING SYSTEM

Central Door Locking System Operation

If a door is locked or unlocked by using any one of the key cylinders (driver's door, passenger's door or back door), all of the doors are locked or unlocked. In addition, all doors can be locked and unlocked by using the driver's door lock knob.

Forgotten Key Prevention Function

This function automatically release the door lock if the inside door lock knob is placed in the lock position with the door opened while the key is still in the ignition switch, thereby preventing the key from being left behind locked door.

POWER WINDOWS

Power Windows Operation

A signal line dedicated for transmission of multiplex communication data is connected between the power window main switches and the power window motor-ECU.
Communication is uni-directional. The power window main switches have a transmitting circuit only, whereas the power window sub switches have a receiving circuit only.

Power Window Timer Function

With the ignition switch in the ON position, the power window relay and power window switch receipt permission are turned ON [the power window switch receipt permission signal remains ON for 30 seconds after the ignition switch is turned LOCK (OFF)], enabling opening and closing of the windows. The power window relay goes ON for additional 30 seconds. If the driver's door is subsequently closed during this period, the receipt permission signal goes OFF. The power window relay goes OFF 10 seconds after the receipt permission signal goes OFF.

KEYLESS ENTRY SYSTEM

If the transmitter LOCK or UNLOCK switch is pressed while the ignition key is removed and all of the doors are closed, the doors can be locked or unlocked. If the doors are closed, the hazard warning lamps, the room lamp and the horn will operate due to answerback function. Because of the answerback function, the hazard warning lamps flash twice, and the room lamp flashes twice when the doors are locked. Meanwhile, when the doors are unlocked, the hazard warning lamps flash and the room lamp illuminate for 15 seconds. The hazard answerback functions can be cancelled by using the MUT-II.

WINDSHIELD WIPER AND WASHER

Windshield Low-speed (and High-speed) Wiper Operation

- If the windshield low-speed wiper switch is turned to the ON position with the ignition switch at the ACC or ON position, the column switch sends a low-speed wiper ON and high-speed wiper OFF signals to the front-ECU.
  This turns the wiper signal on and the wiper speed switching relay off (low-speed), causing the wipers to operate at low-speed.
- If the windshield high-speed wiper switch is turned to the ON position, the column switch sends a low-speed wiper OFF and high-speed wiper ON signals to the front-ECU.
  This turns both the wiper signal and the wiper speed switching relay on (high-speed), causing the wipers to operate at high-speed.

Windshield Intermittent Wiper Operation

The ETACS-ECU calculates the wiper operation interval according to the voltage signal sent from the column switch. (For vehicles without variable intermittent wiper, the intermittent interval is fixed at 4 seconds.) Then the ETACS-ECU sends a signal to the front-ECU. The front-ECU determines the wiper operation interval and turns on the wiper signal relay. This causes the wiper auto stop relay to turn on. Then the wiper auto stop relay will turn off after the wipers reach the park position. This causes the wiper signal relay and then the wipers to turn off.
If the wiper signal relay remains off for the wiper operation interval, the relay turns on again, causing the wipers to operate in intermittent mode.

Windshield Mist Wiper Operation

- If the windshield mist wiper switch of the column switch is turned to the ON position with the ignition switch at ACC or ON position, the mist wiper high-speed operation signal is sent to the front-ECU. This signal turns on the wiper speed switching relay, causing the wipers to work at high-speed while the mist switch is on.
- While the windshield mist wiper switch remains turned on when the intermittent mode is still working, the wipers work as the mist wiper. However, the wipers return to the intermittent mode again when the wiper auto stop signal turns on after the mist wiper switch is turned off.

Windshield Washer Operation

If the windshield washer switch of the column switch is turned to the ON position with the ignition switch at ACC or ON position, the windshield washer ON signal is sent to the front-ECU, causing the windshield wiper signal to turn on after 0.3 seconds. After the windshield washer switch signal turns off, the windshield wiper signal turns off in three seconds.
If the windshield wiper switch is turned to the ON position while the windshield wiper is at intermittent mode, the windshield washer works for that period when the windshield washer switch remains on. Then the wipers return to the intermittent mode.

REAR WIPER AND WASHER

Rear Wiper Operation

If the rear wiper switch is turned to the ON position with the ignition switch at ACC or ON position, the ETACS-ECU cause the rear wiper to operate continuously two times then intermittently at eight-second intervals.
If the shift lever <M/T> selector lever <A/T> is moved to the R position when the rear wiper switch is turned to the ON position and the ignition switch at ACC or ON position, back-up lamp switch <M/T> or inhibitor switch R <A/T> turns ON. One second later, the ETACS-ECU causes the rear wiper to operate two times continuously to ensure good rearward visibility. The ETACS-ECU then causes the rear wiper to again operate intermittently at eight-second intervals.

Rear Washer Operation

If the rear washer switch is turned to the ON position with the ignition switch at ACC or ON position, the rear washer ON signal is sent to the ETACS-ECU, causing the rear wiper signal to turn on after 0.3 seconds. After the rear washer switch signal turns off, the rear wiper signal turns off in three seconds. If the rear wiper switch is turned to the ON position while the rear wiper is at intermittent mode, the rear washer works for that period when the washer switch remains on. Then the rear wipers return to the intermittent mode.

HEADLAMP WASHER

If the headlamp washer switch of the column switch assembly is turned to the ON position with the ignition switch in the ACC or ON position, the front-ECU turns on the headlamp washer relay.

HEADLAMP

Headlamp Auto-cut Function

If the ignition switch is turned to LOCK (OFF) or ACC position, when the headlamps are on, the headlamps will be switched off in three minutes. If the driver's door is opened within that three-minute period, the headlamps will be switched off automatically. This prevents the battery from discharged.
In addition, if the headlamps are turned on when the ignition switch is at LOCK (OFF) or ACC position, the headlamps will not be switched off.

Headlamp Dimmer Switch Auto-reset Function

This function allows the dimmer switch to be reset to the low-beam position whenever the headlamp switch is turned ON.

Daytime Running Lamp (DRL) Function

If the ignition switch is turned to ON when the headlamps and tail lamps are off, the headlamps (low-beam) and tail lamps turn on.

FLASHER TIMER

Turn-signal Lamp

When the ignition switch is turned to ON position and turn-signal lamp switch is placed in the ON position for right or left turn signaling, the system generates turn-signal lamp drive signals (flashing signals).
The system also notifies of a blown turn-signal lamp bulb by shortening the flashing intervals of the corresponding indicator lamp.

Hazard Warning Lamp

The system detects a change from ON to OFF of the hazard lamp input signal and activates the hazard lamps if they are not in operation or deactivates the lamps if they are operating (reversal of state between activation and deactivation).

FRONT FOG LAMP

The front fog lamp switch becomes active only when the tail lamps are on. Therefore, if the tail lamps are turned off, the fog lamps will also be switched off. Whenever the tail lamps are turned on at the next time, the front fog lamps will always be off regardless of the switch positions.

REAR FOG LAMP

The rear fog lamp switch becomes active only when the headlamps or front fog lamps* are on. Therefore, if the headlamps and front fog lamps* are turned off, the rear fog lamps will also be switched off. Whenever the headlamps or front fog lamps* are turned on at the next time, the rear fog lamps will always be off regardless of the switch positions.

NOTE
*: In vehicles without front fog lamps, these conditions apply to the headlamps only.

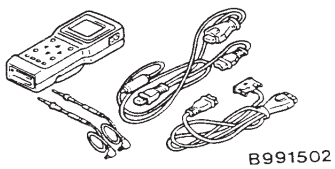
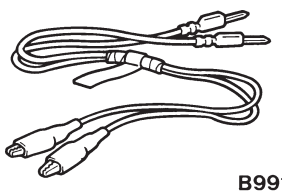
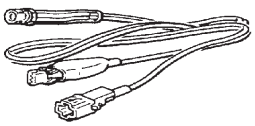
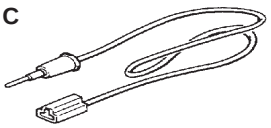
ROOM LAMP

With the room lamp switch in the DOOR position, the ETACS-ECU controls the room lamp operation as follows:

- When a door is opened from outside or inside [with the ignition switch turned to LOCK (OFF) position]:
  When a door is opened, the ETACS-ECU causes the room lamp to be illuminated at the 100% intensity. When the door is closed, it dims out the room lamp to 65% intensity and approx. 30 seconds later, turns out the lamp completely. During this period (timer controlled period), the room lamp does out if the ignition switch is turned to ON position or the doors are locked.
- When a door is opened or closed with the ignition switch in the ON position:
  The room lamp illuminates at 100% intensity when a door is opened and turned out when it is closed.
- When no door is opened and the ignition key is removed:
  When the ignition key is removed with all the doors closed, the room lamp is illuminated at an intensity of 65% and turned out approx. 30 seconds later. During that time (timer-controlled period), the room lamp does out if the ignition key is inserted and turned to ON position or the door locking system is activated.
- Room lamp's answerback operation in response to door lock control by keyless entry system:

  To allow the driver to ascertain the result of the door locking/unlocking control action by the use of the keyless entry system, the ETACS-ECU causes the room lamp to blink twice when the doors are locked through the system and to illuminate for approx. 15 seconds when the doors are locked.
  The room lamp's answerback operation in response to a keyless entry system control action is accompanied by operation of the hazard warning lamps.

SPECIAL TOOLS

Tool	Number	Name	Use
 B991502	MB991502	MUT-II sub assembly	Checking of the SWS (Diagnosis code display and input check with the MUT-II)
 B991529	MB991529	Diagnosis code check harness	Simple diagnosis
A  B  C  D  C991223	MB991223 A: MB991219 B: MB991220 C: MB991221 D: MB991222	Harness set A: Test harness B: LED harness C: LED harness adapter D: Probe	Measurement of terminal voltage at ECUs A: Connector pin contact pressure inspection B: Power circuit inspection C: Power circuit inspection D: Commercial tester connection

TROUBLESHOOTING

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING

Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.

DIAGNOSTIC FUNCTION

DIAGNOSIS CODES CHECK

Use the MUT-II to check a diagnosis code.
(Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.)

NOTE
Connect the MUT-II to the 16-pin diagnosis connector (black).

INPUT SIGNAL CHECK

1. Use the MUT-II to check a input signal.
   (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.)
2. In this condition, the following input switches can be checked.
3. If an abnormality is found during the input signal check, carry out troubleshooting while referring to the Trouble Symptom Check page.

Input Signal Check Function

Input signal	Buzzer operation condition
Ignition switch (ACC)	Turned from LOCK (OFF) to ACC
Ignition switch (IG1)	Turned from ACC to ON
Key reminder switch	Ignition key removed from ignition key cylinder (from inserted position)
Hazard warning lamp switch	Turned from OFF to ON
Front fog lamp switch <vehicles with front fog lamp>	
Rear fog lamp switch	
Back-up lamp switch <M/T>	Shift lever moved to R position
Inhibitor switch (reverse) <A/T>	Selector lever moved to R position
Rear wiper motor auto-stop signal	Rear wiper begins to operate (The input signal is sent before the rear wiper begins to operate)
Driver's door switch	Driver's door opened from closed condition
Door switches	All doors closed to any door opened
Passenger's door key cylinder switch <vehicles with central door locking system>	Passenger's door locked or unlocked using ignition key
Back door key cylinder switch <vehicles with central door locking system>	Back door locked or unlocked using ignition key
Driver's door lock actuator switch <vehicles with central door locking system>	Driver's door lock knob moved from lock position to unlock position or vice versa

Input signal		Buzzer operation condition
Column switch	Tail lamp switch	Turned the lighting switch from OFF to tail lamp position
	Headlamp switch	Turn the lighting switch from tail lamp position to headlamp position
	Dimmer switch	Turned from OFF to ON
	Passing switch	
	Turn-signal lamp switch	
	Windshield mist wiper switch	
	Windshield intermittent wiper switch	
	Windshield low-speed wiper switch	
	Windshield high-speed wiper switch	
	Windshield intermittent wiper interval adjusting knob <vehicles with variable windshield intermittent wiper>	Rotate the windshield intermittent wiper interval adjusting knob from FAST to SLOW when the ignition switch is at ON position (The ETACS-ECU sends a signal around the medium knob position)
	Windshield washer switch	Turned from OFF to ON
	Rear wiper switch	
	Rear washer switch	
	Headlamp washer switch <vehicles with headlamp washer>	
Power window main switch	Any switch <vehicles with power window>	
Transmitter	Any switch <vehicles with keyless entry system>	
Multi-center display	Any switch <vehicles with multi-center display>	

DIAGNOSIS CODE CHART

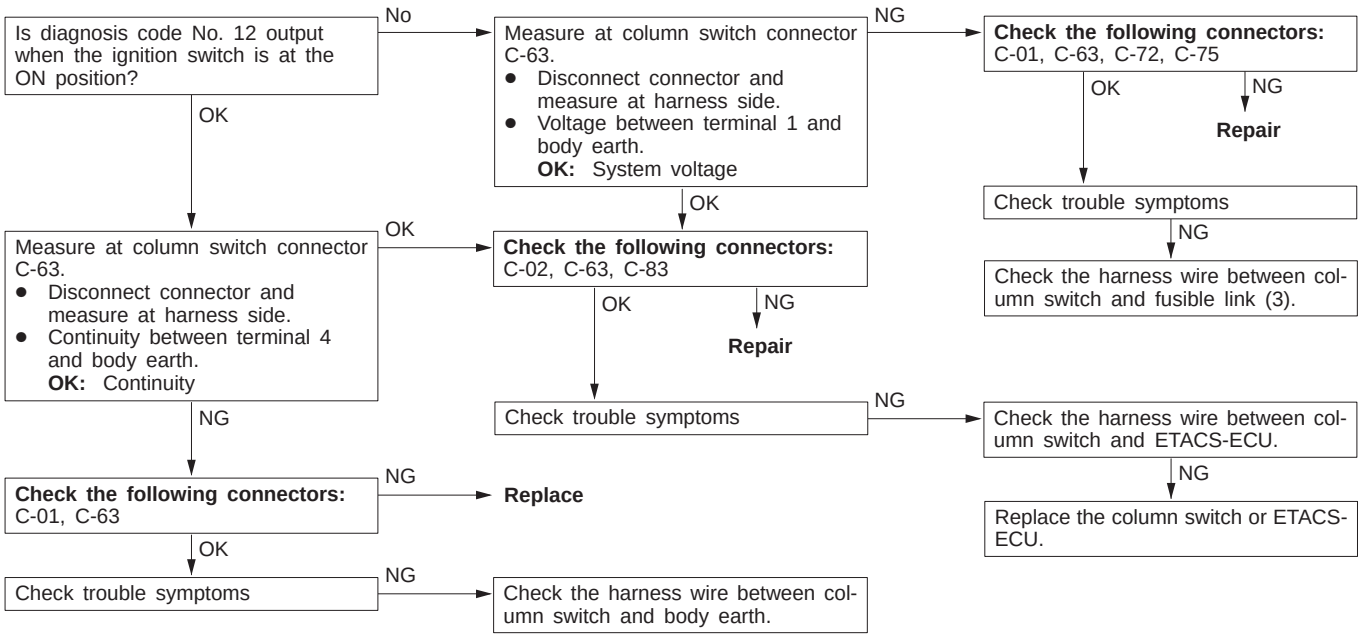
Code No.	Diagnosis item	Reference page
11	Failure concerning the ETACS-ECU	54B-8
12	Failure concerning the column switch or improper connecting with the ETACS-ECU	54B-8
13	Failure concerning the front-ECU	54B-9
21	Short circuit in communication line	54B-10

DIAGNOSIS CODE INSPECTION PROCEDURES

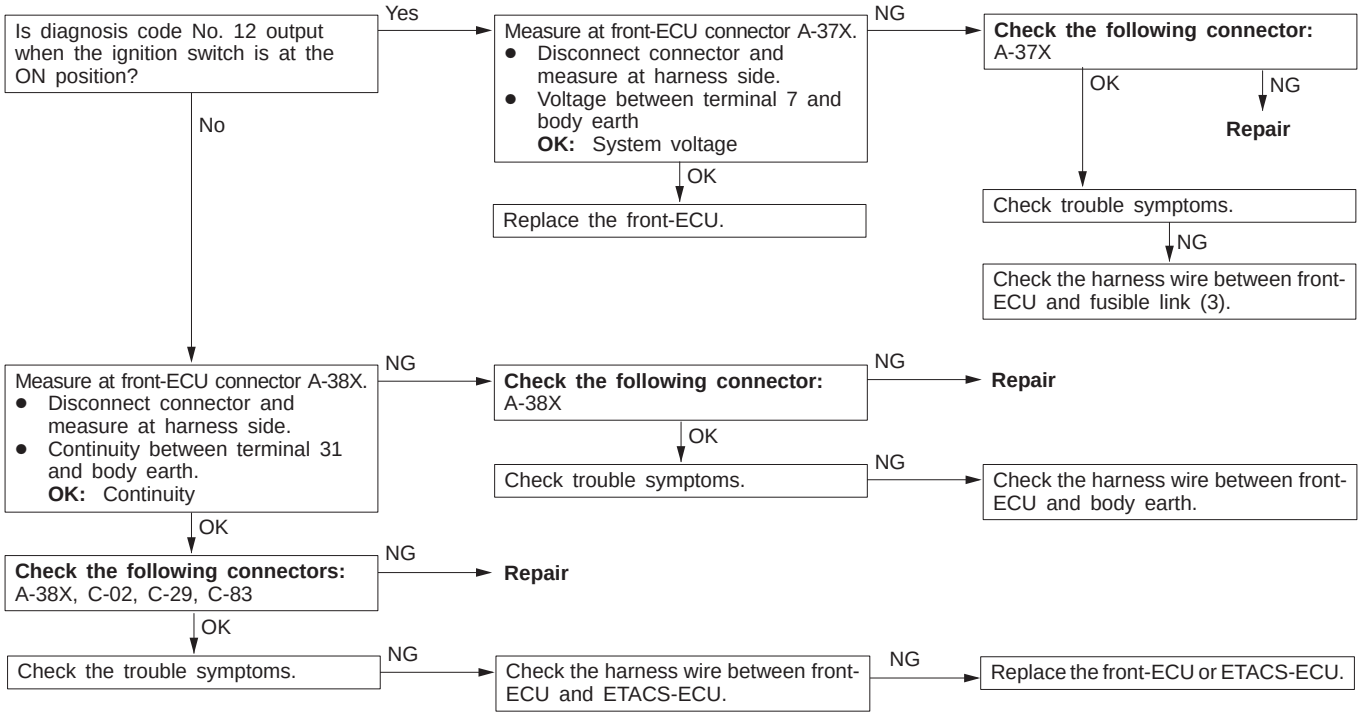
Code No.11 Failure concerning the ETACS-ECU	Probable cause
The ETACS-ECU monitors its own communication data, and sends a diagnosis code when an error takes place consecutive fifteen times in 0.6 second. The diagnosis code will be erased when the ETACS-ECU determines that its own communication data is sent consecutive 15 times in 0.6 second.	• Malfunction of ETACS-ECU

Replace the ETACS-ECU.

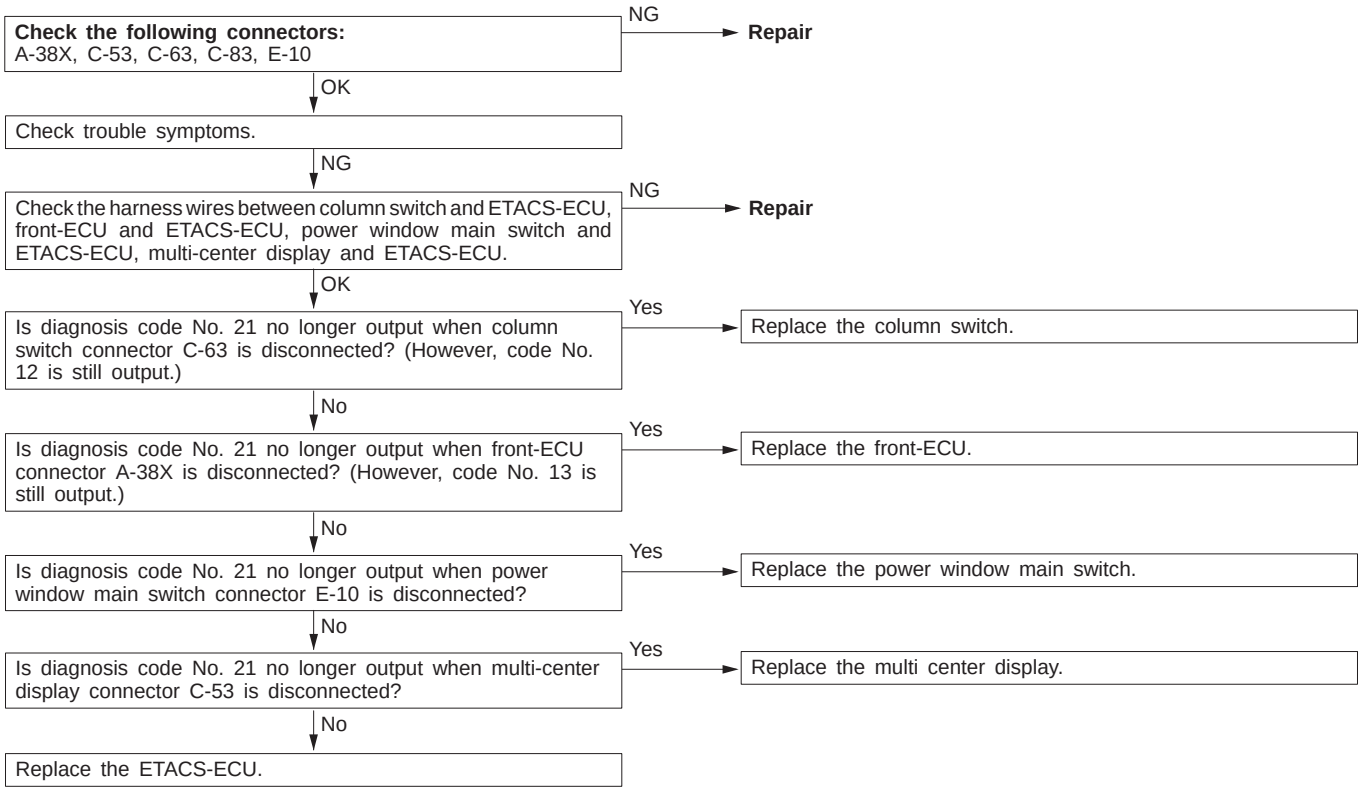
Code No.12 Failure concerning the column switch or improper connection with the ETACS-ECU	Probable cause
This diagnosis code is displayed when the column switch sends a signal regardless of the transmission request signal from the ETACS-ECU (three times or more in one second). The diagnosis code is erased when the column switch continues to send a signal according to the transmission request signal from the ETACS-ECU for one second.	• Malfunction of column switch • Malfunction of ETACS-ECU • Malfunction of wiring harness or connector



Code No.13 Failure concerning the front-ECU	Probable cause
This diagnosis code is displayed when the signals that the front-ECU sends to the ETACS-ECU are errors consecutive fifteen times in 0.6 second. The diagnosis code will be erased when the front-ECU sends normal signals to the ETACS-ECU consecutive 15 times in 0.6 second.	• Malfunction of front-ECU • Malfunction of ETACS-ECU • Malfunction of wiring harness or connector



Code No.21 Short circuit in communication lines	Probable cause
This diagnosis code is displayed when the SWS communication line voltage reaches the LO level for 0.3 second. The diagnosis code is erased when voltage in the ETACS-ECU data line reaches the HI level for 0.3 second, or the ETACS-ECU receives a normal signal from other ECUs or switches. While this code is displayed, other codes are not displayed.	● Malfunction of column switch ● Malfunction of front-ECU ● Malfunction of power window main switch <vehicles with front power window> ● Malfunction of multi center display <vehicles with multi center display> ● Malfunction of ETACS-ECU ● Malfunction of wiring harness or connector



TROUBLE SYMPTOM CHART

Trouble symptom		Inspection procedure	Reference page
Communication with the MUT-II is impossible.		A-1	54B-14
Buzzer	Light reminder warning function does not work normally.	B-1	54B-15
	Multi-center display alarm function does not work normally.	B-2	54B-15
Central door locking system	Central door locking system does not work normally.	C-1	54B-16
	Some doors do not lock or unlock.	C-2	54B-16
	All the doors do not lock or unlock with just the driver's door lock key cylinder key operation or driver's inside lock knob operation.	C-3	54B-17
	All the doors do not lock or unlock with just the passenger's or back door lock key cylinder key operation.	C-4	54B-17
	Forgotten key prevention function does not work.	C-5	54B-17
Power window	Power window do not work at all.	D-1	54B-18
	Power window main switch can not operate driver's window.	D-2	54B-18
	Power window sub switch can not operate passenger's window.	D-3	54B-19
	Power window main switch can not operate passenger's window.	D-4	54B-20
	Power window timer function does not work normally.	D-5	54B-20
	When the glass is raised, it then lowers automatically.	D-6	54B-21
	The glass is not lowered when something is jammed in the window.	D-7	54B-21
	When the glass is fully raised, it then lowers automatically.	D-8	54B-21
Keyless entry system	Keyless entry system does not operate.	E-1	54B-22
	The room lamp and hazard warning lamps do not operate through the answerback function.	E-2	54B-22
	The encrypted code cannot be registered.	E-3	54B-22
Windshield wiper and washer	Windshield wiper does not operate.	F-1	54B-23
	Any of the windshield wiper switch positions is defective.	F-2	54B-24
	Windshield wiper does not stop at the predetermined park position.	F-3	54B-24
	Windshield intermittent wiper interval cannot be adjusted.	F-4	54B-25
	Windshield washer does not work.	F-5	54B-25

Trouble symptom		Inspection procedure	Reference page
Rear wiper and washer	Rear wiper does not work at all.	G-1	54B-26
	Rear wiper does not stop at the predetermined park position.	G-2	54B-26
	When the shift lever <M/T> or selector lever <A/T> is moved to R position during the rear wiper operation, the rear wiper does not operate at the continuous mode.	G-3	54B-27
	Rear washer does not work.	G-4	54B-27
Headlamp washer	Headlamp washer does not work.	H-1	54B-28
Headlamp, tail lamp	Tail lamp do not illuminate.	I-1	54B-29
	Headlamps (low-beam) do no illuminate.	I-2	54B-29
	Headlamps (high-beam) do no illuminate.	I-3	54B-30
	Headlamps do not illuminate when the passing switch is operated.	I-4	54B-30
	The headlamp auto-cut function does not work normally.	I-5	54B-31
	Headlamp dimmer switch auto-reset function does not work normally.	I-6	54B-31
	Daytime running lamp (DRL) function does not work.	I-7	54B-31
Flasher timer	Turn-signal lamp do not flash when the turn-signal lamp switch is turned on.	J-1	54B-32
	Hazard warning lamps do not flash when the hazard warning lamp switch is turned on.	J-2	54B-33
Front fog lamp	Front fog lamps do not illuminate when the front fog lamp switch is turned on.	K-1	54B-34
	Front fog lamp do not go out when the tail lamps are turned off while the fog lamps are on.	K-2	54B-34
Rear fog lamp	Rear fog lamp do not illuminate when the rear fog lamp switch is turned on.	L-1	54B-35
	Rear fog lamp do not out when the headlamps and front fog lamps <vehicles with front fog lamp> are turned off while the fog lamp is on.	L-2	54B-36
Room lamp	The room lamp does not illuminate.	M-1	54B-36
	The doom lamp dimming function does not work normally.	M-2	54B-37
Multi-center display	The multi-center display does not work normally.	–	GROUP 54A – Multi-center Display.

DEFECTS FOUND BY INPUT SIGNAL CHECK

If the input signal check finds a defect, follow the table below to check.

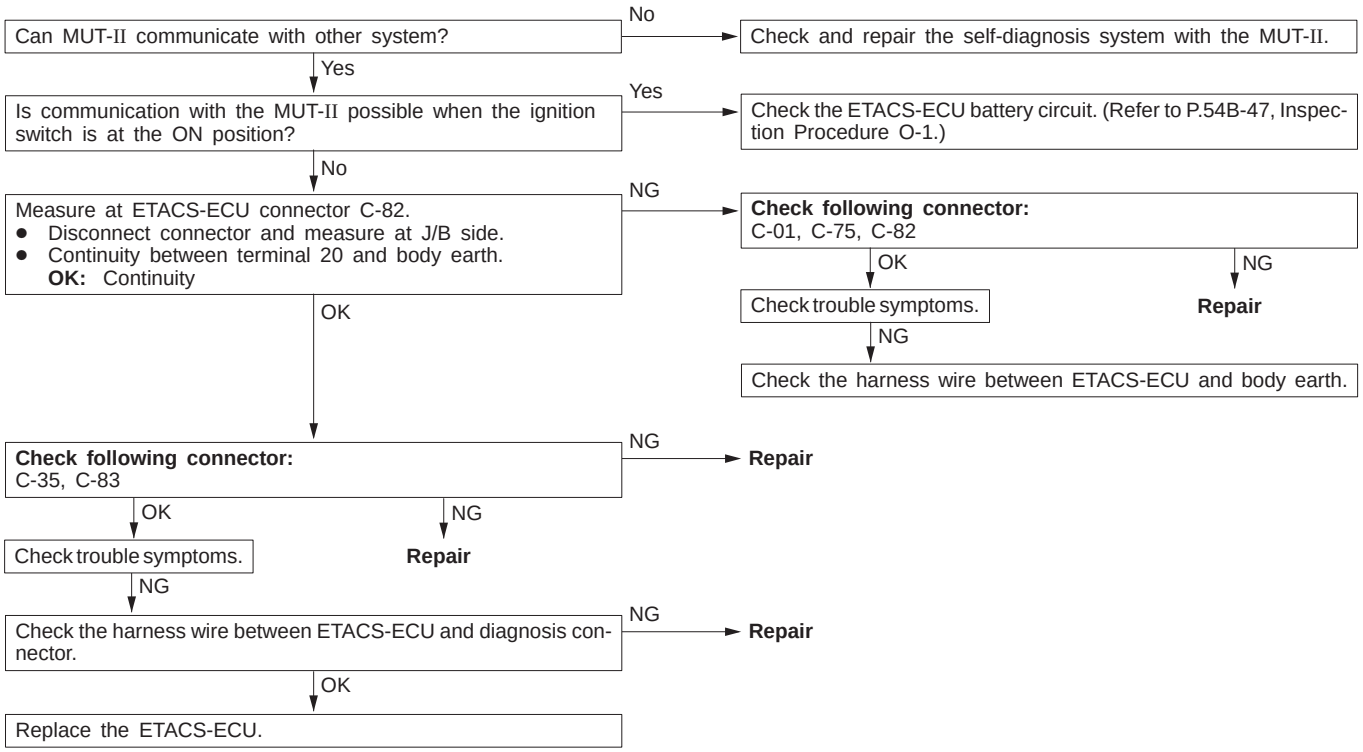
Trouble symptom		Inspection procedure	Reference page
Ignition switch (ACC) signal is not sent to the ETACS-ECU.		N-1	54B-37
Ignition switch (IG1) signal is not sent to the ETACS-ECU.		N-2	54B-38
Key reminder switch signal is not sent to the ETACS-ECU.		N-3	54B-38
Hazard warning lamp switch signal is not sent to the ETACS-ECU.		N-4	54B-39
Front fog lamp switch signal is not sent to the ETACS-ECU.		N-5	54B-39
Rear fog lamp switch signal is not sent to the ETACS-ECU.		N-6	54B-40
Back-up lamp switch signal is not sent to the ETACS-ECU. <M/T>		N-7	54B-40
Inhibitor switch (reverse) signal is not sent to the ETACS-ECU. <A/T>		N-8	54B-41
Rear wiper motor auto-stop signal is not sent to the ETACS-ECU.		N-9	54B-41
Driver's door switch signal is not sent to the ETACS-ECU.		N-10	54B-42
Door switches signal is not sent to the ETACS-ECU.			
Passenger's door lock key cylinder switch signal is not sent to the ETACS-ECU.		N-11	54B-43
Back door lock key cylinder switch signal is not sent to the ETACS-ECU.		N-12	54B-43
Driver's door lock actuator switch signal is not sent to the ETACS-ECU.		N-13	54B-44
Column switch	Tail lamp switch signal is not sent to the ETACS-ECU.	N-14	54B-45
	Headlamp switch signal is not sent to the ETACS-ECU.		
	Dimmer switch signal is not sent to the ETACS-ECU.		
	Passing switch signal is not sent to the ETACS-ECU.		
	Turn-signal lamp switch signal is not sent to the ETACS-ECU.		
	Windshield mist wiper switch signal is not sent to the ETACS-ECU.		
	Windshield intermittent wiper switch signal is not sent to the ETACS-ECU.		
	Windshield low-speed wiper switch signal is not sent to the ETACS-ECU.		
	Windshield high-speed wiper switch signal is not sent to the ETACS-ECU.		
	Windshield intermittent wiper interval adjusting knob signal is not sent to the ETACS-ECU.	N-15	54B-45
	Windshield wiper switch signal is not sent to the ETACS-ECU.	N-14	54B-45
	Rear wiper switch signal is not sent to the ETACS-ECU.		
	Rear washer switch signal is not sent to the ETACS-ECU.		
	Headlamp washer switch signal is not sent to the ETACS-ECU.		

Trouble symptom		Inspection procedure	Reference page
Power window main switch	Any switch signal is not sent to the ETACS-ECU.	N-16	54B-46
Transmitter	Any switch signal is not sent to the ETACS-ECU.	N-17	54B-46
Multi-center display	Any switch signal is not sent to the ETACS-ECU.	N-18	54B-47

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

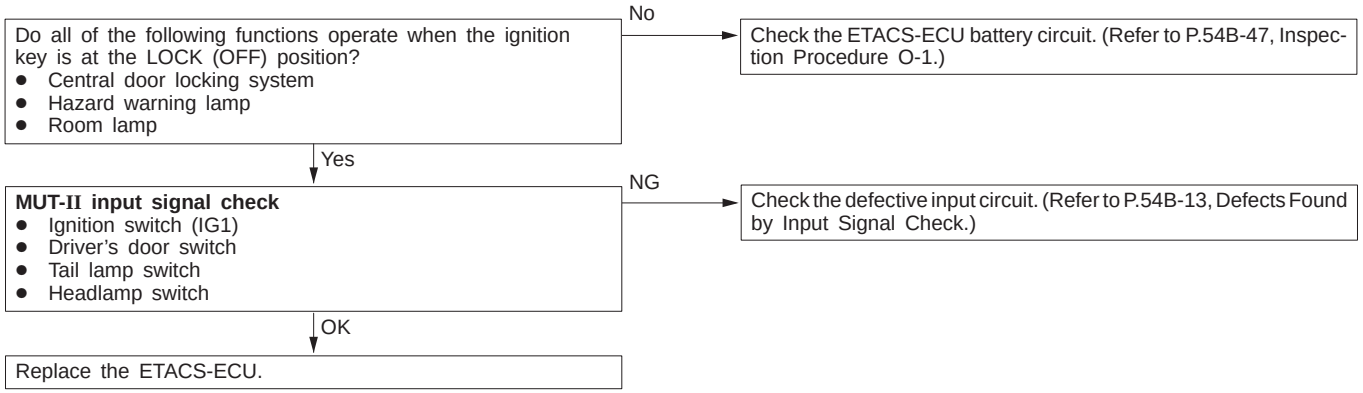
Inspection Procedure A-1

Communication with the MUT-II is impossible.	Probable cause
The harness wires between the ETACS-ECU power supply line or the ETACS-ECU and the diagnosis connector may be defective.	• Malfunction of ETACS-ECU • Malfunction of harness wire or connector



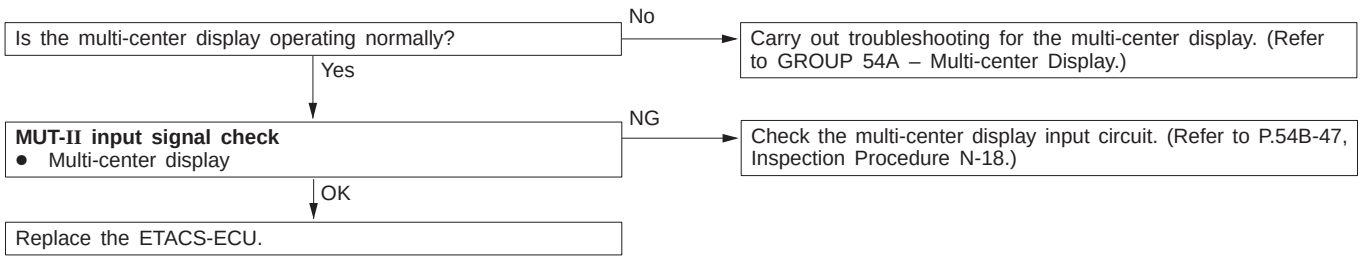
Inspection Procedure B-1

Buzzer: Light reminder warning function does not work normally.	Probable cause
The ETACS-ECU operates the light reminder warning function, based on input signals from the following switched: ● Ignition switch (IG1) ● Driver's door switch ● Tail lamp switch ● headlamp switch If the function does not work normally, a defect on the relevant circuit or the ETACS-ECU may be suspected.	● Malfunction of driver's door switch ● Malfunction of column switch ● Malfunction of ETACS-ECU ● Malfunction of harness wire or connector



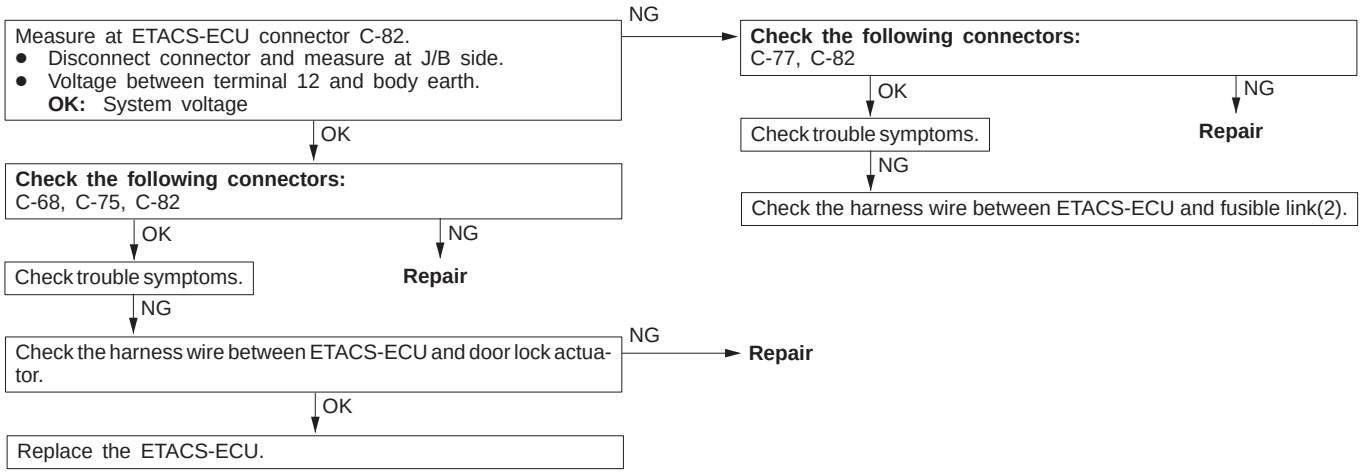
Inspection Procedure B-2

Buzzer: Multi-center display buzzer function does not work normally.	Probable cause
If the multi-center display is operating normally, the cause is probably a malfunction in the harness between the multi-center display and the ETACS-ECU or in the ETACS-ECU itself.	● Malfunction of multi-center display ● Malfunction of ETACS-ECU ● Malfunction of harness wire or connector



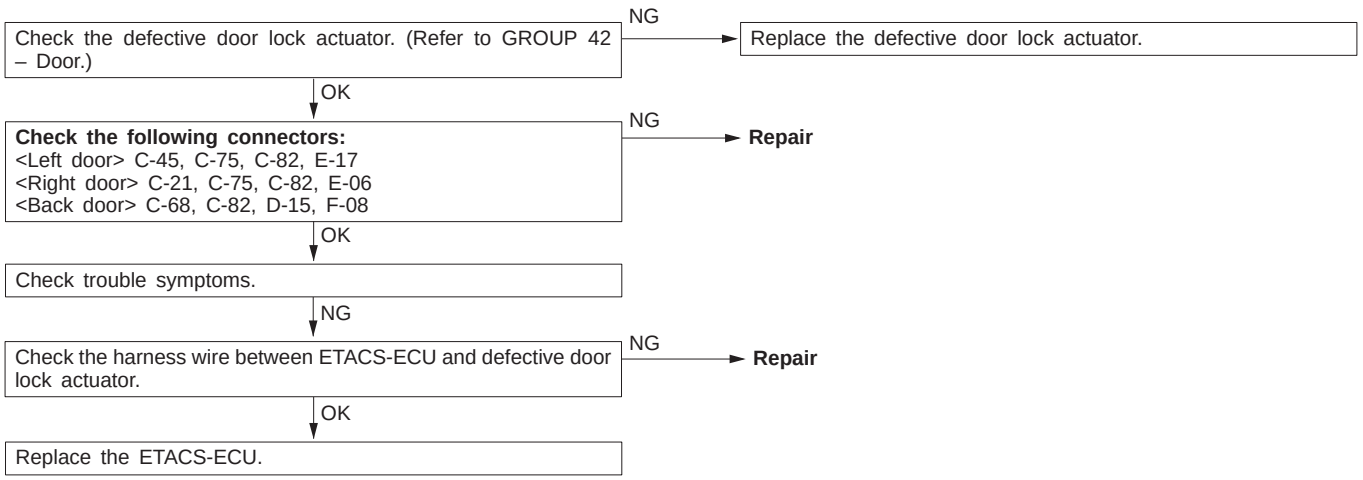
Inspection Procedure C-1

Central door locking system: Central door locking system does not work normally.	Probable cause
The power supply circuit, the circuit shared by door lock actuators, or the ETACS-ECU may be defective.	• Malfunction of ETACS-ECU • Malfunction of harness wire or connector



Inspection Procedure C-2

Central door locking system: Some doors do not lock or unlock.	Probable cause
The door lock actuator, or the harness wire between ETACS-ECU and the door lock actuator may be defective.	• Malfunction of driver's, passenger's or back door lock actuator • Malfunction of ETACS-ECU • Malfunction of harness wire or connector



Inspection Procedure C-3

Central door locking system: All the doors do not lock or unlock with just the driver's door lock key cylinder key operation or driver's inside lock knob operation.	Probable cause
The driver's door lock actuator switch or the ETACS-ECU may be defective.	• Malfunction of driver's door lock actuator • Malfunction of ETACS-ECU • Malfunction of harness wire or connector

MUT-II input signal check
- Driver's door lock actuator switch

NG → Check the driver's door lock actuator switch input circuit. (Refer to P.54B-44, Inspection Procedure N-13.)

OK ↓

Replace the ETACS-ECU.

Inspection Procedure C-4

Central door locking system: All the doors do not lock or unlock with just the passenger's or back door lock key cylinder key operation.	Probable cause
The passenger's or back door lock key cylinder or the ETACS-ECU may be defective.	• Malfunction of passenger's or back door lock key cylinder switch • Malfunction of ETACS-ECU • Malfunction of harness wire or connector

MUT-II input signal check
- Passenger's door lock key cylinder switch
- Back door lock key cylinder switch

NG → Check the defective input circuit. (Refer to P.54B-13, Defects Found by Input Signal Check.)

OK ↓

Replace the ETACS-ECU.

Inspection Procedure C-5

Central door locking system: Forgotten key prevention function does not work.	Probable cause
The ETACS-ECU operates the forgotten key prevention function, based on the input signals from the following switches: • Key reminder switch • Driver's door switch • Driver's door lock actuator switch If the function does not work normally, a defect on the relevant circuit or the ETACS-ECU may be suspected.	• Malfunction of key reminder switch • Malfunction of driver's door switch • Malfunction of driver's door lock actuator • Malfunction of ETACS-ECU • Malfunction of harness wire or connector

MUT-II input signal check
- Key reminder switch
- Driver's door switch
- Driver's door lock actuator switch

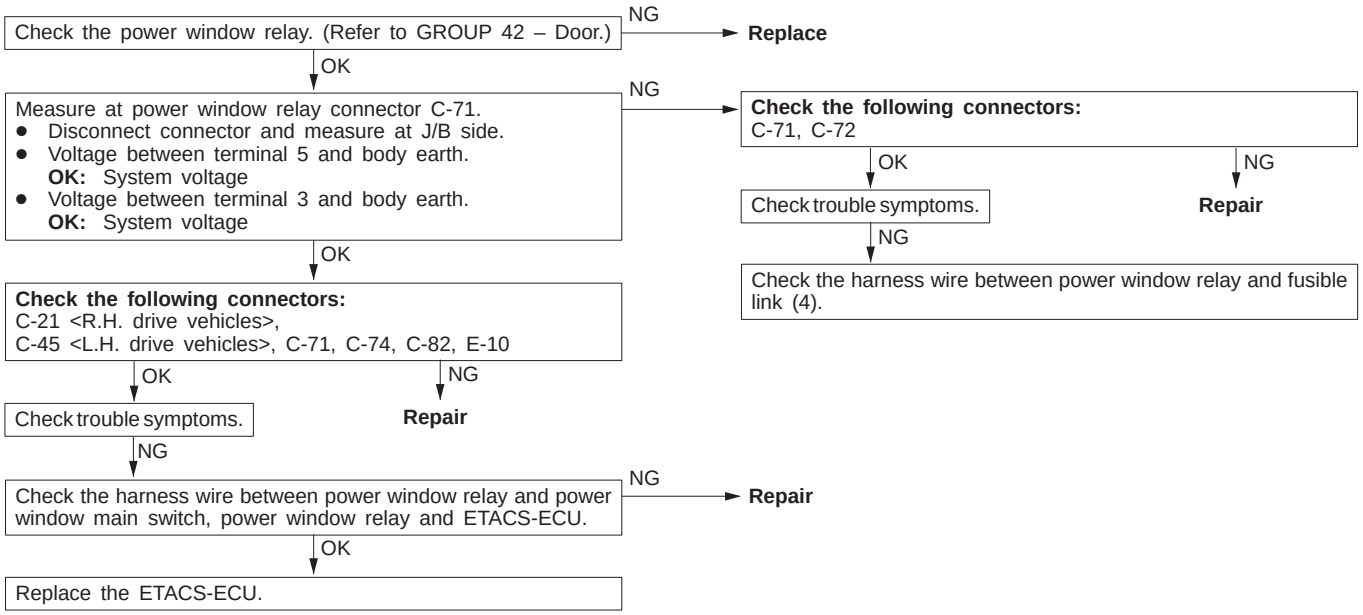
NG → Check the defective input circuit. (Refer to P.54B-13, Defects Found by Input Signal Check.)

OK ↓

Replace the ETACS-ECU.

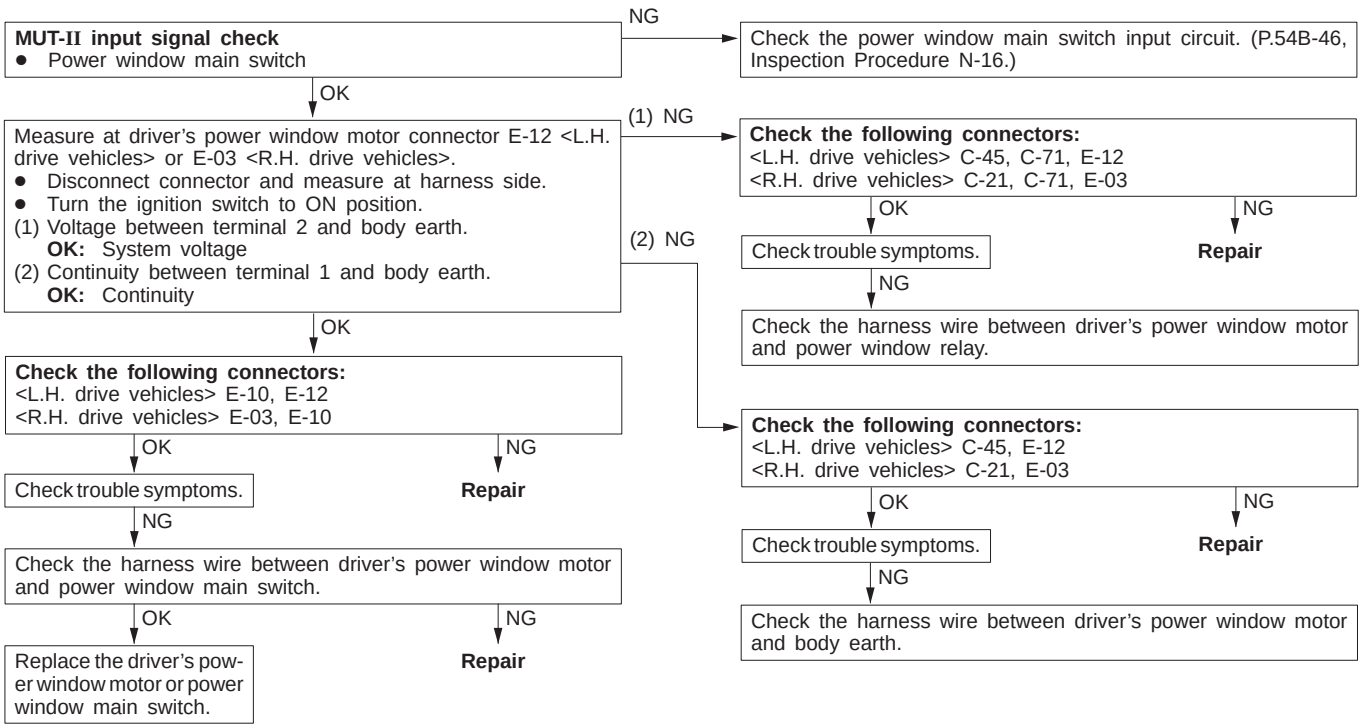
Inspection Procedure D-1

Power window: Power window do not work at all.	Probable cause
The power window relay or the ETACS-ECU may be defective.	• Malfunction of power window relay • Malfunction of ETACS-ECU • Malfunction of harness wire or connector



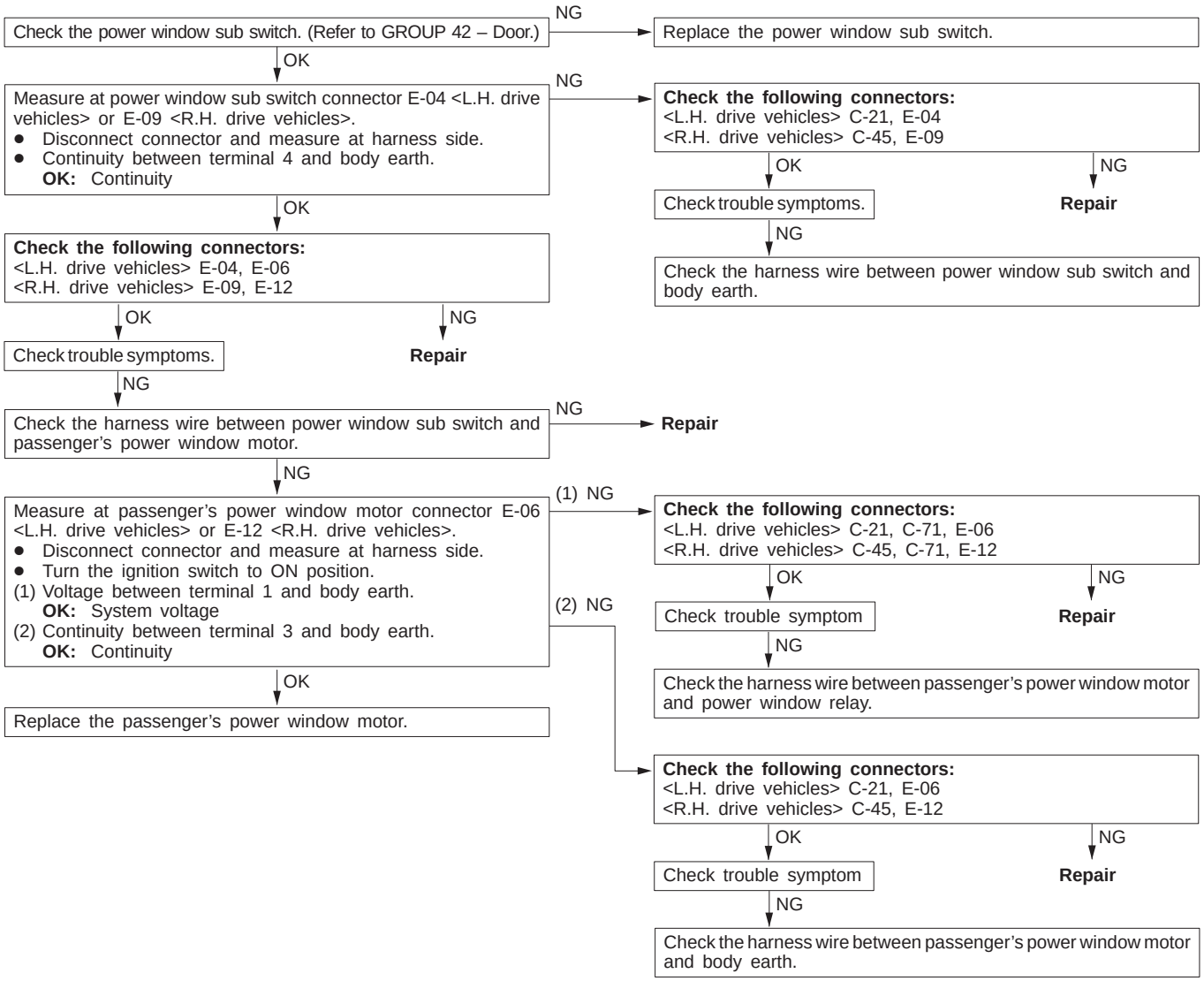
Inspection Procedure D-2

Power window: Power window main switch can not operate drive's window.	Probable cause
The cause is probably a malfunction of the power window main switch or driver's side power window motor, or an abnormality in the power supply circuit.	• Malfunction of power window main switch • Malfunction of driver's power window motor • Malfunction of harness wire or connector



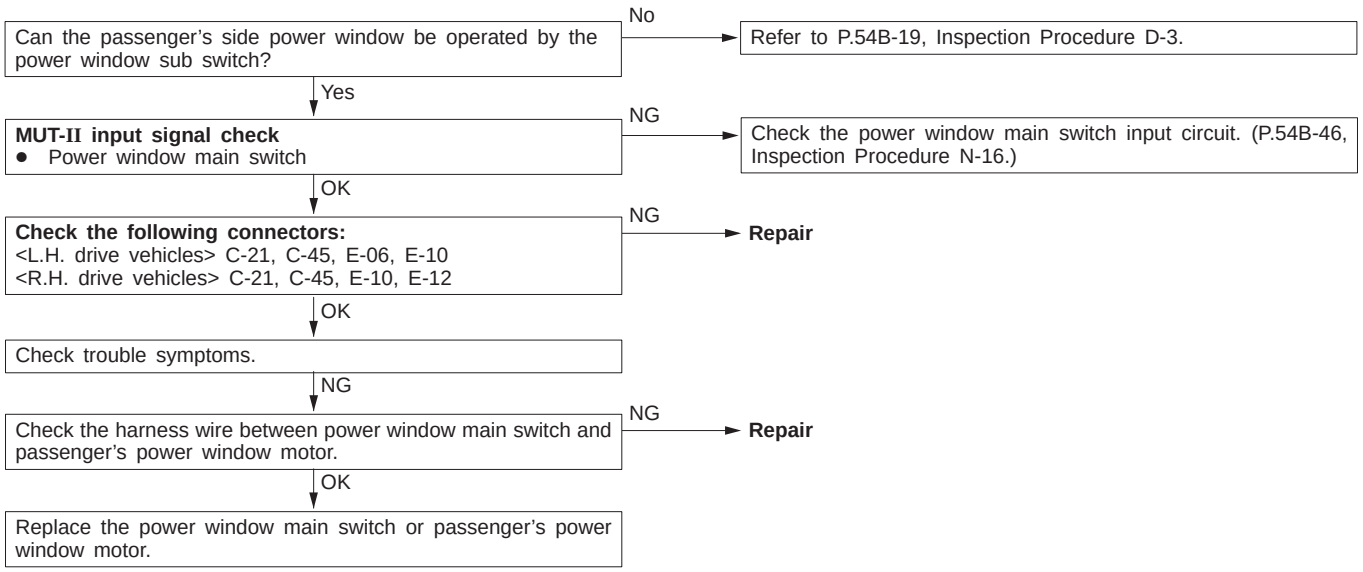
Inspection Procedure D-3

Power window: Power window sub switch can not operate passenger's window.	Probable cause
The cause is probably a malfunction of the power window main switch or driver's side power window motor, or an abnormality in the power supply circuit.	• Malfunction of power window sub switch • Malfunction of passenger's power window motor • Malfunction of harness wire or connector



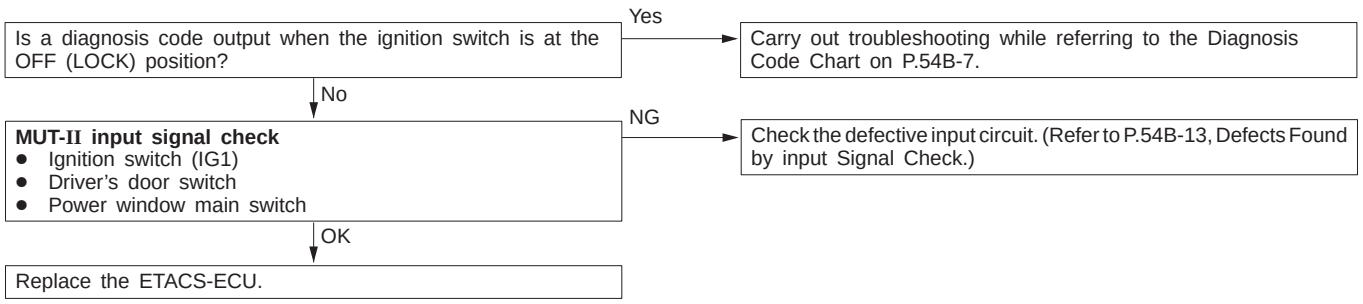
Inspection Procedure D-4

Power window: Power window main switch can not operate passenger's window.	Probable cause
The cause is probably a malfunction of the power window main switch or driver's side power window motor, or an abnormality in the power supply circuit.	• Malfunction of power window main switch • Malfunction of passenger's power window motor • Malfunction of harness wire or connector



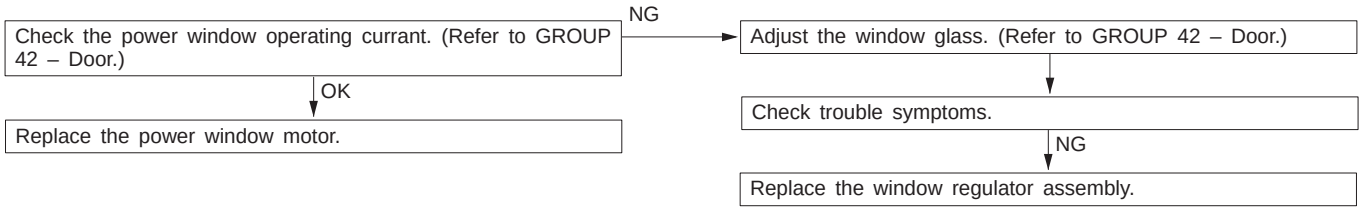
Inspection Procedure D-5

Power window: Power window timer function does not work normally.	Probable cause
The ETACS-ECU operates the power window timer function, based on the input signals from the following switches: • Ignition switch (IG1) • Driver's door switch If the function does not work normally, a defect on the relevant circuit or the ETACS-ECU may be suspected.	• Malfunction of driver's door switch • Malfunction of ETACS-ECU • Malfunction of harness wire or connector



Inspection Procedure D-6

Power window: When the glass is raised, it then lowers automatically.	Probable cause
If the sliding resistance is too large when the glass is being raised, it is judged that something is jammed in the window, and the window is lowered by approximately 150 mm.	• Incorrect window glass adjustment • Glass slider is incorrectly installed or warped • Malfunction of power window motor



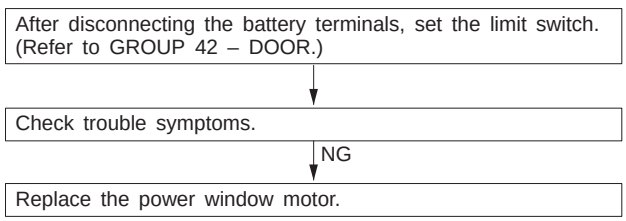
Inspection Procedure D-7

Power window: The glass is jammed in the window.	Probable cause
The cause may be a malfunction of the revolution detection sensor in the power window motor.	• Malfunction of power window motor

Replace the power window motor.

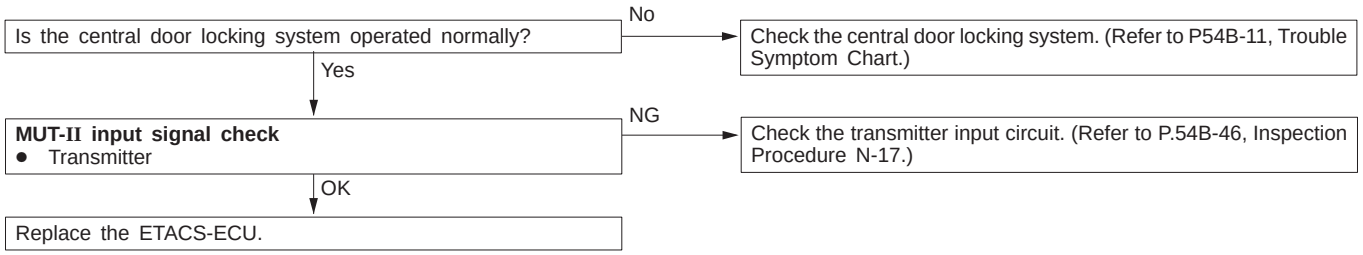
Inspection Procedure D-8

Power window: When the glass is fully raised, it then lowers automatically.	Probable cause
The cause may be a malfunction of the revolution detection sensor in the power window motor.	• Malfunction of power window motor



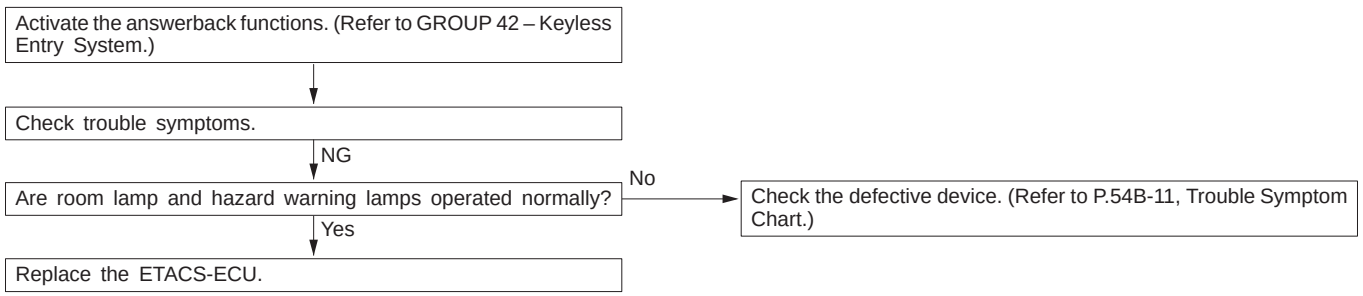
Inspection Procedure E-1

Keyless entry system: Keyless entry system does not operate.	Probable cause
The cause may be a malfunction of the receiver and transmitter communication system	• Malfunction of transmitter • Malfunction of ETACS-ECU



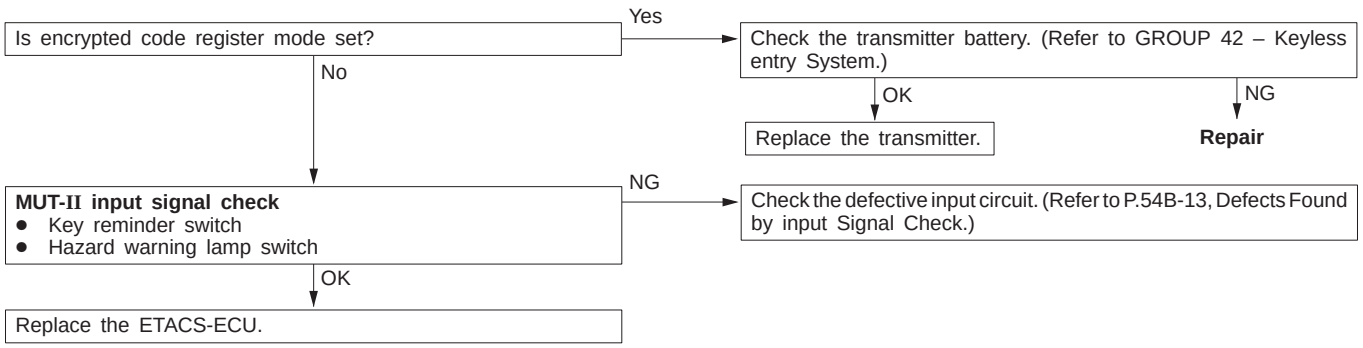
Inspection Procedure E-2

Keyless entry system: The room lamp and hazard warning lamps do not operate through the answerback function.	Probable cause
The hazard warning lamp answerback function can be selected by the driver's desire (can be deactivated). However, the room lamp answerback function can not be deactivated. if all of these device do not operate through the answerback function, the ETACS-ECU may be defective.	• Malfunction of turn-signal lamp • Malfunction of room lamp • Malfunction of ETACS-ECU • Malfunction of harness wire or connector



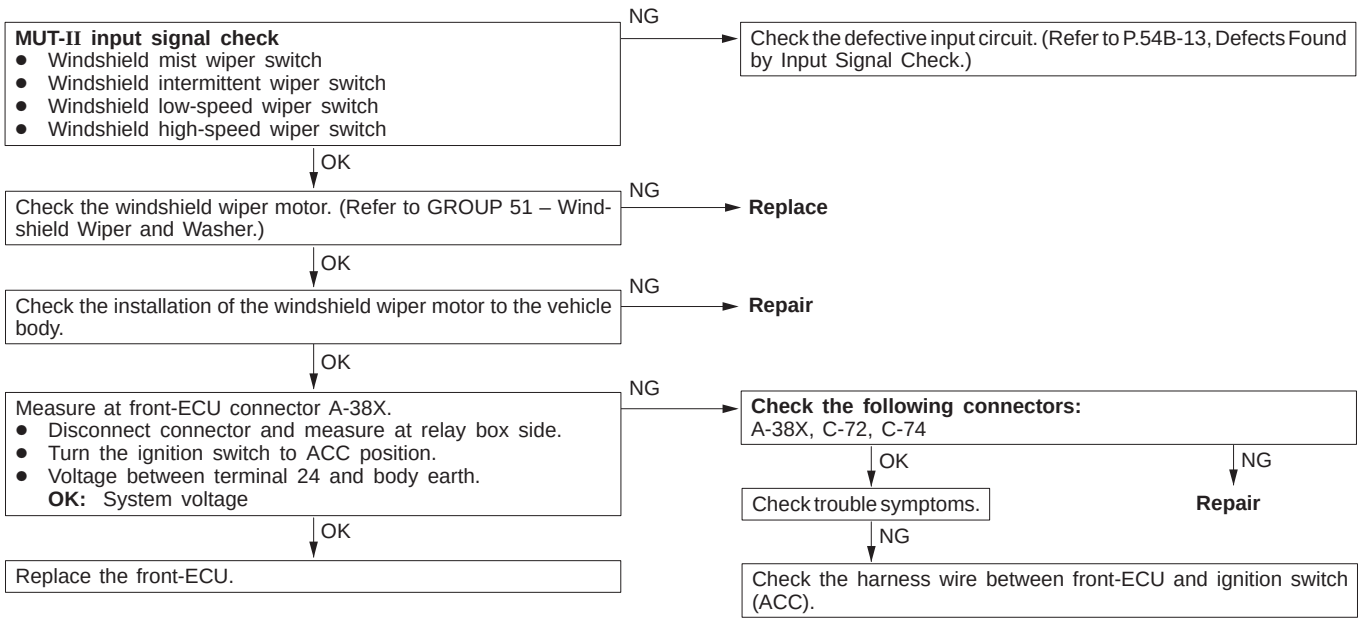
Inspection Procedure E-3

Keyless entry system: The encrypted code cannot be registered.	Probable cause
The ETACS-ECU actives the encrypted code register mode according to the following switch signals. • Key reminder switch • Hazard warning lamp switch If the encrypted code register mode is not set, the relevant input signal circuit or the ETACS-ECU may be defective. If a transmitter can not be registered although the encrypted code register mode is set, the transmitter or the ETACS-ECU may be defective.	• Malfunction of key reminder switch • Malfunction of hazard warning lamp switch • Malfunction of transmitter • Malfunction of ETACS-ECU • Malfunction of harness wire or connector



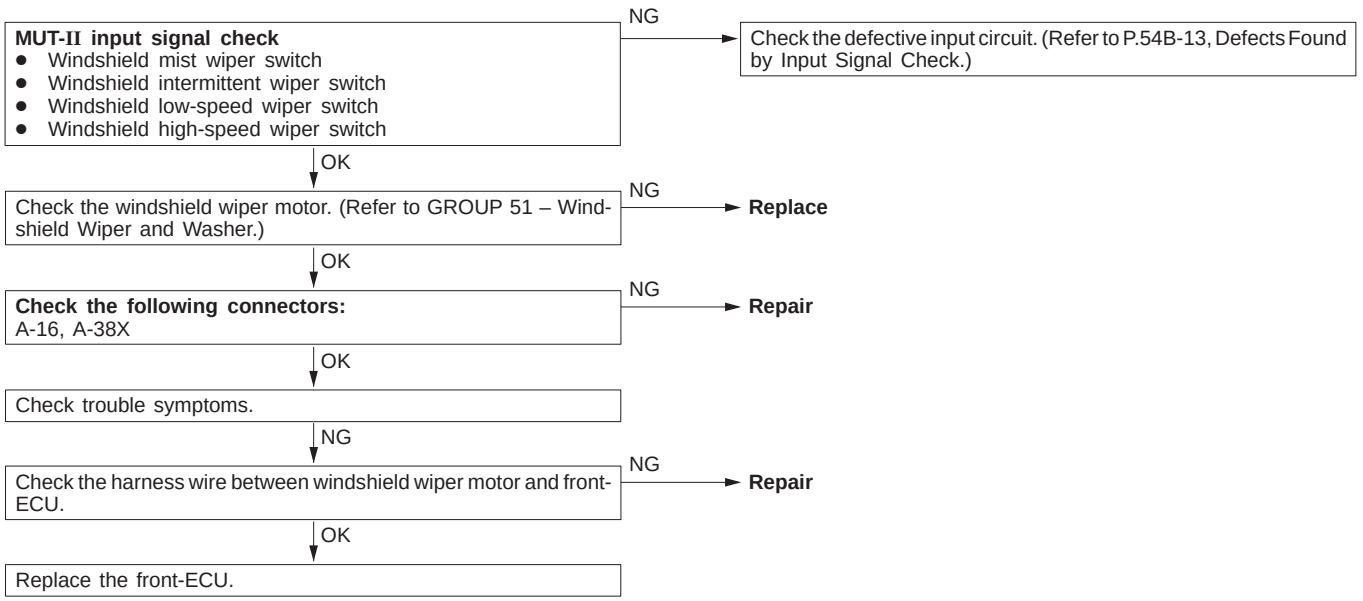
Inspection Procedure F-1

Windshield wiper and washer: Windshield wiper does not operate.	Probable cause
If the windshield wiper does not work at all, the windshield wiper motor, column switch or the front-ECU may be defective.	• Malfunction of windshield wiper motor • Malfunction of column switch • Malfunction of front-ECU • Malfunction of harness wire or connector



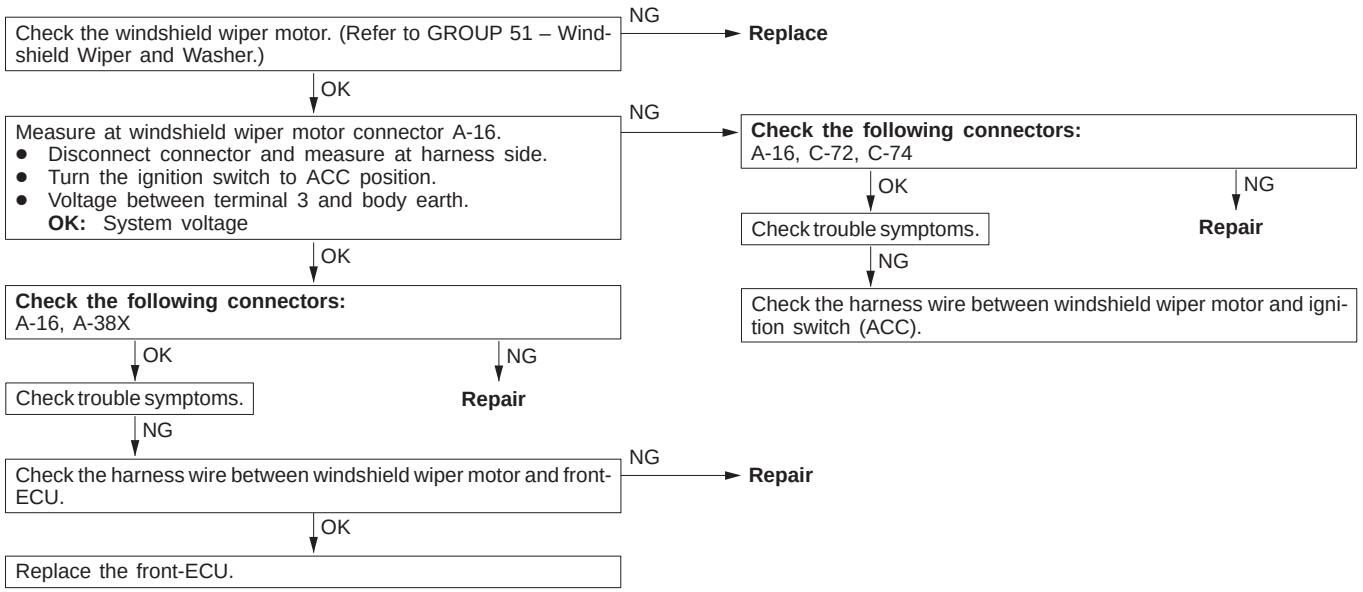
Inspection Procedure F-2

Windshield wiper and washer: Any of the windshield wiper switch positions is defective.	Probable cause
The windshield wiper motor, column switch or the front-ECU may be defective.	• Malfunction of windshield wiper motor • Malfunction of column switch • Malfunction of front-ECU • Malfunction of harness wire or connector



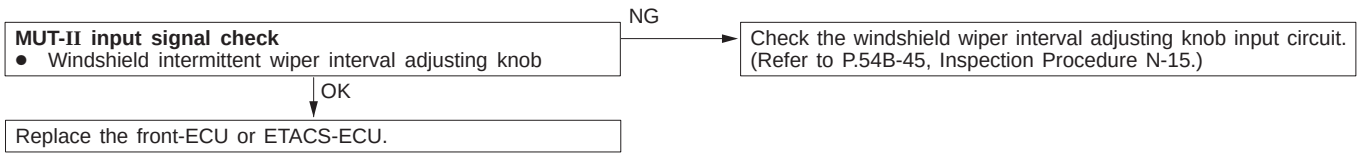
Inspection Procedure F-3

Windshield wiper and washer: Windshield wiper does not stop at the predetermined park position.	Probable cause
The windshield wiper motor or the front-ECU may be defective.	• Malfunction of windshield wiper motor • Malfunction of front-ECU • Malfunction of harness wire or connector



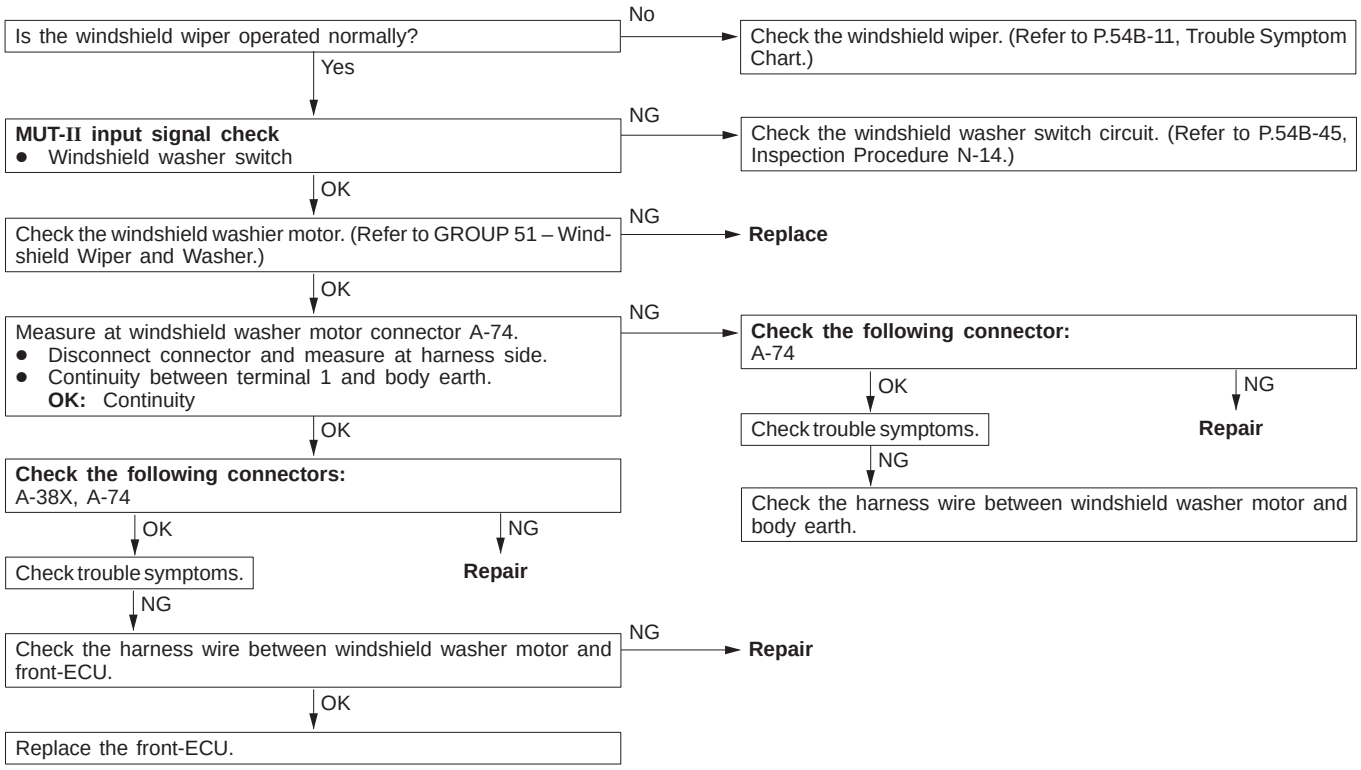
Inspection Procedure F-4

Windshield wiper and washer: Windshield intermittent wiper interval cannot be adjusted.	Probable cause
The ETACS-ECU calculates the intermittent wiper interval, and sends a signal to the front-ECU through the SWS communication line. If the signal is defective, the front-ECU will ignore the signal and set the intermittent wiper interval to 4 seconds.	• Malfunction of column switch • Malfunction of front-ECU • Malfunction of ETACS-ECU • Malfunction of harness wire or connector



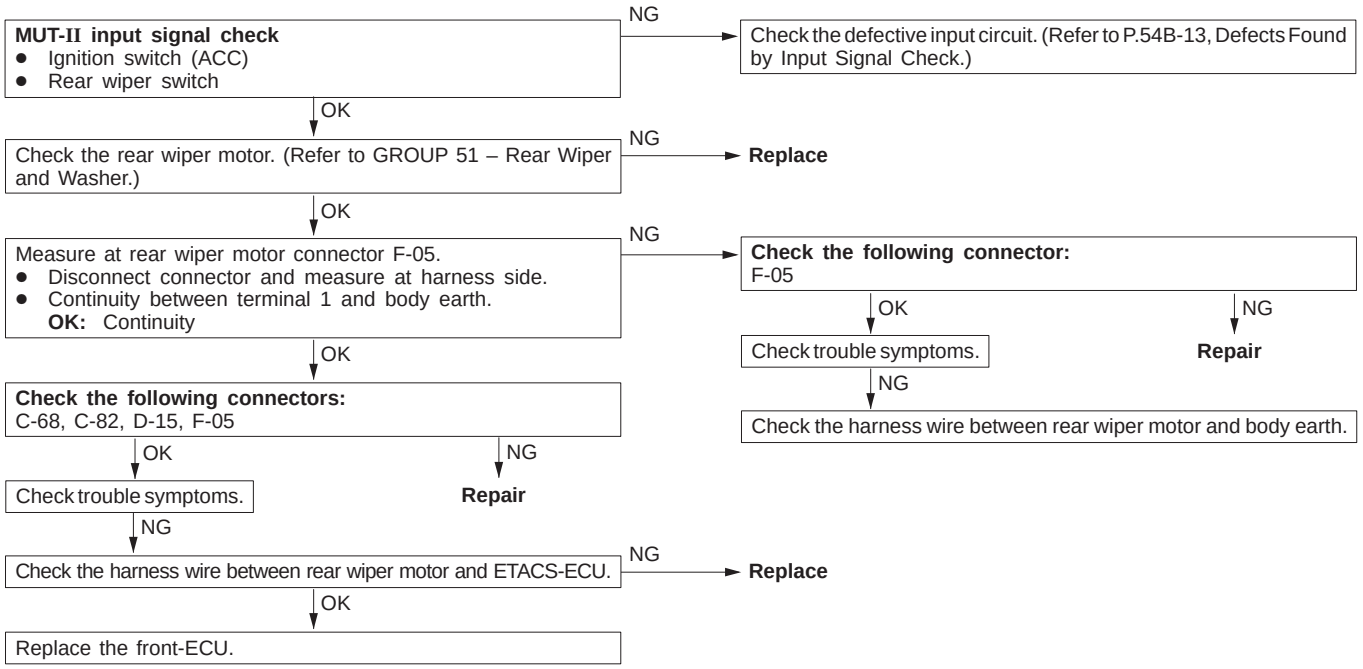
Inspection Procedure F-5

Windshield wiper and washer: Windshield washer does not work.	Probable cause
The windshield washer motor, the column switch or the front-ECU may be defective.	• Malfunction of windshield washer motor • Malfunction of column switch • Malfunction of front-ECU • Malfunction of harness wire or connector



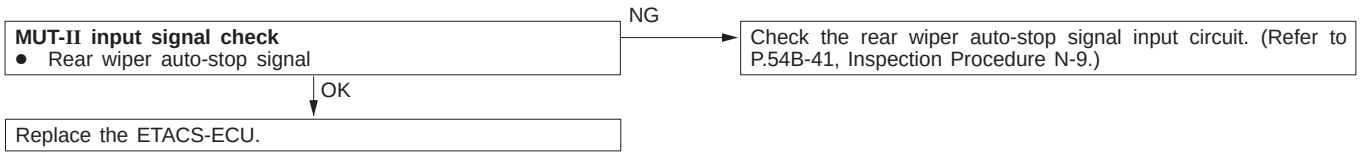
Inspection Procedure G-1

Rear wiper and washer: Rear wiper does not work normally.	Probable cause
The ETACS-ECU operates the rear wiper according to the input signals from the following switches: ● Ignition switch (ACC) ● Rear wiper switch If the rear wiper does not work normally, the relevant input signal circuit, the rear wiper motor, the column switch or the ETACS-ECU may be defective.	● Malfunction of rear wiper motor ● Malfunction of column switch ● Malfunction of front-ECU ● Malfunction of harness wire or connector



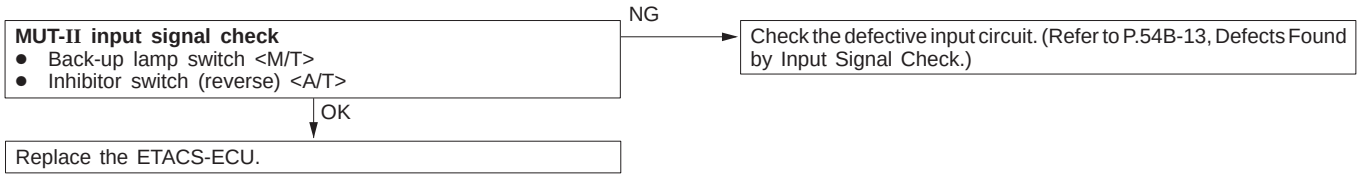
Inspection Procedure G-2

Rear wiper and washer: Rear wiper does not stop at the predetermined park position.	Probable cause
The rear wiper motor or the ETACS-ECU may be defective.	● Malfunction of rear wiper motor ● Malfunction of front-ECU ● Malfunction of harness wire or connector



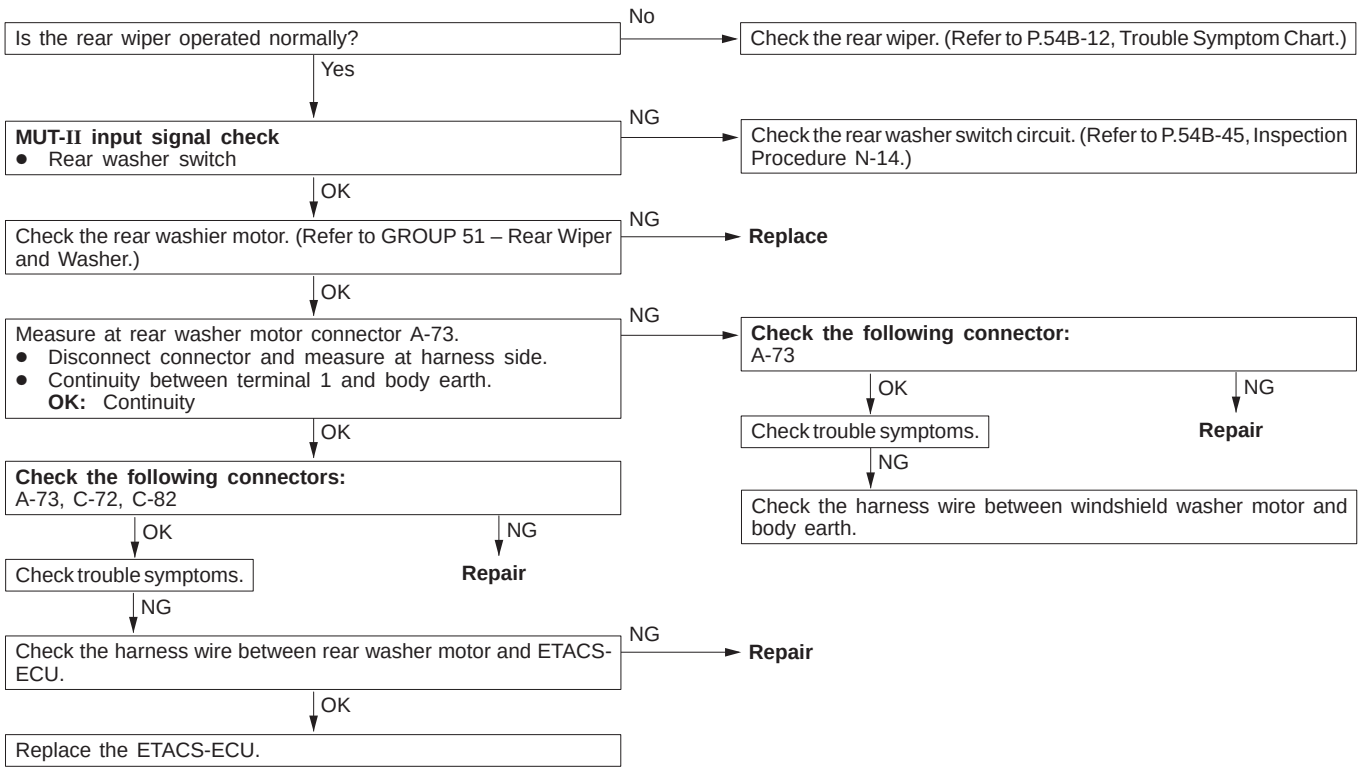
Inspection Procedure G-3

Rear wiper and washer: When the shift lever <M/T> or selector lever <A/T> is moved to R position during the rear wiper operation, the rear wiper does not operate at the continuous mode.	Probable cause
The ETACS-ECU operates the rear wiper consecutively twice when the shift lever <M/T> or selector lever <A/T> is moved to R position while the rear wiper is turned on. If the rear wiper does not work consecutively twice, the back-up lamp switch <M/T> or the inhibitor switch (reverse) <A/T> may be defective.	• Malfunction of back-up lamp switch • Malfunction of inhibitor switch • Malfunction of ETACS-ECU • Malfunction of harness wire or connector



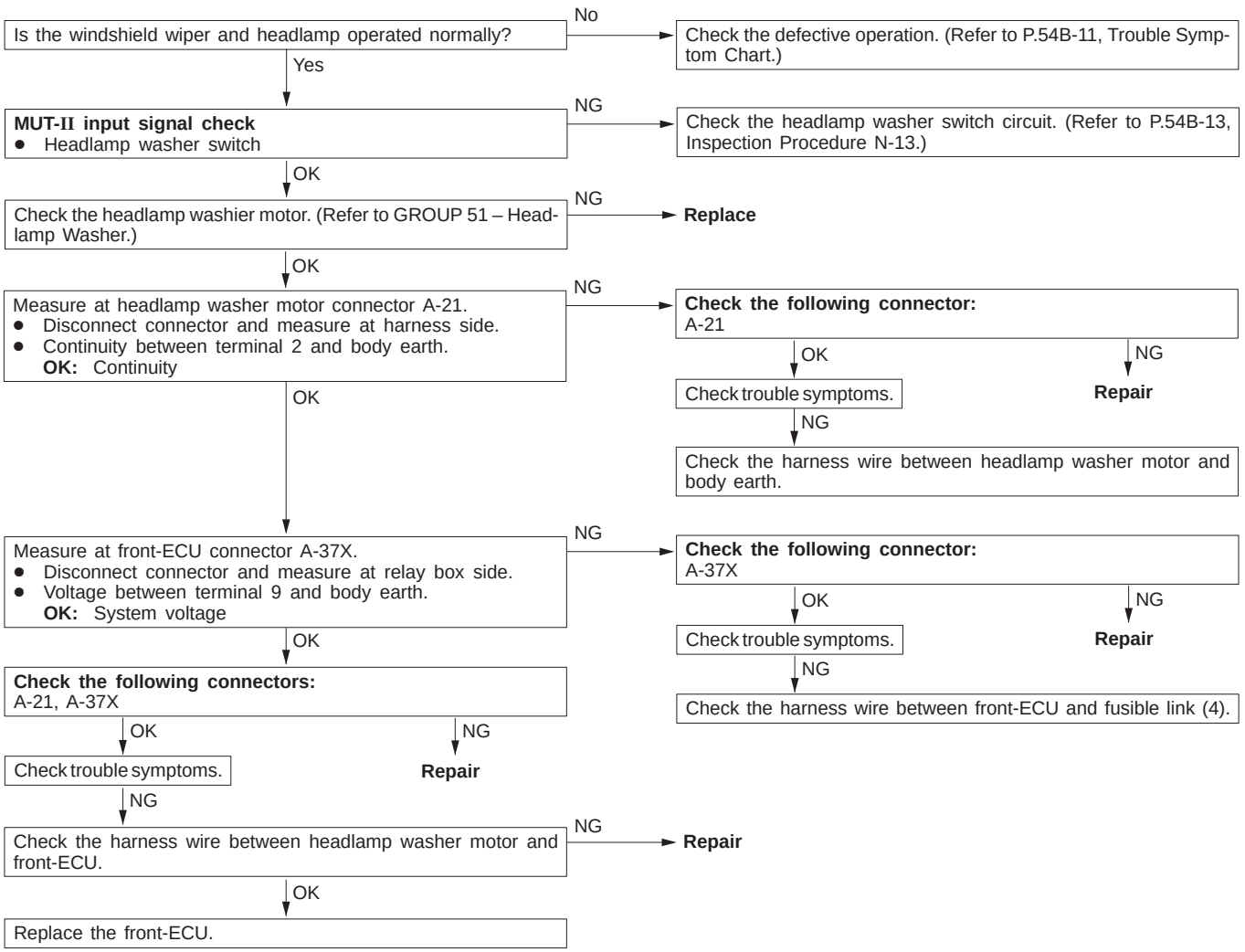
Inspection Procedure G-4

Rear wiper and washer: Rear washer does not work.	Probable cause
The rear washer motor, the column switch or the ETACS-ECU may be defective.	• Malfunction of rear washer motor • Malfunction of column switch • Malfunction of ETACS-ECU • Malfunction of harness wire or connector



Inspection Procedure H-1

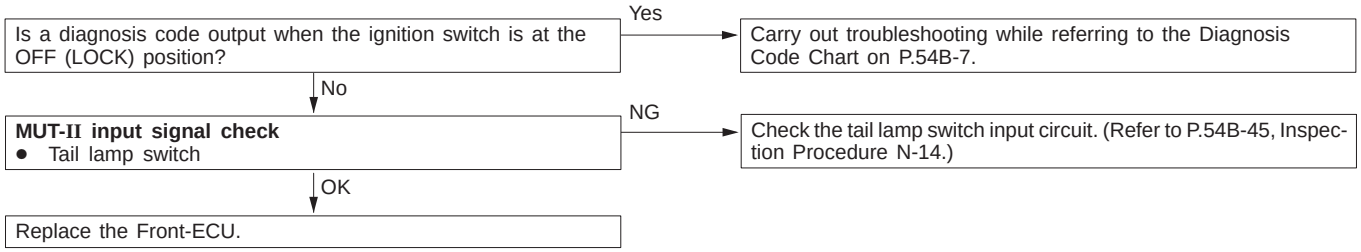
Headlamp washer: Headlamp washer does not work.	Probable cause
The front-ECU operates the headlamp washers if the headlamp washer switch is turned to ON while the headlamp relays (low and high) are ON and the ignition switch is at the ACC or ON position. If the headlamp washer does not work normally, the headlamp washer motor, the column switch or the front-ECU may be defective.	• Malfunction of headlamp washer motor • Malfunction of column switch • Malfunction of front-ECU • Malfunction of harness wire or connector



Inspection Procedure I-1

Headlamp, tail lamp: Tail lamp do not illuminate.	Probable cause
The column switch or the front-ECU may be defective.	• Malfunction of column switch • Malfunction of front-ECU • Malfunction of harness wire or connector

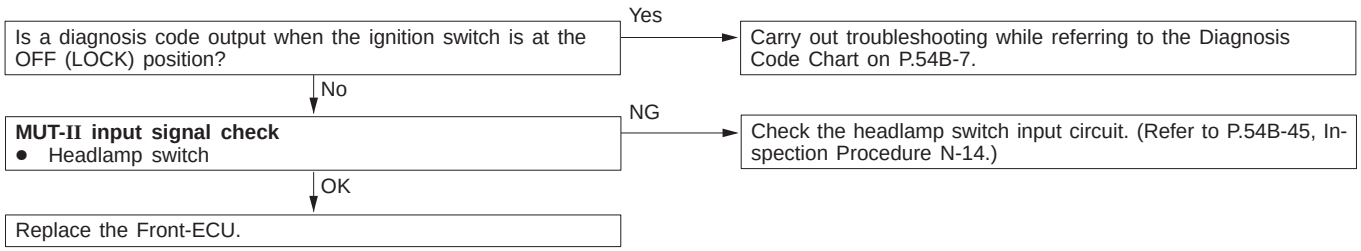
NOTE
If only one lamp does not illuminate, the harness wire between the lamp and front-ECU may be defective or the light bulb may be burned out. In this case, check the tail lamp circuit.



Inspection Procedure I-2

Headlamp, tail lamp: Headlamps (low-beam) do not illuminate.	Probable cause
The column switch or the front-ECU may be defective.	• Malfunction of column switch • Malfunction of front-ECU • Malfunction of harness wire or connector

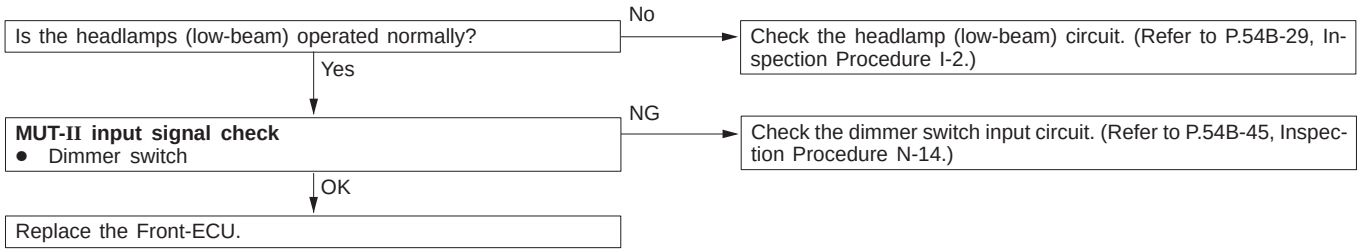
NOTE
If only one of the headlamps (low-beam) does not illuminate, the harness wire between the headlamp and front-ECU may be defective or the headlamp bulb may be burned out. In this case, check the headlamp circuit.



Inspection Procedure I-3

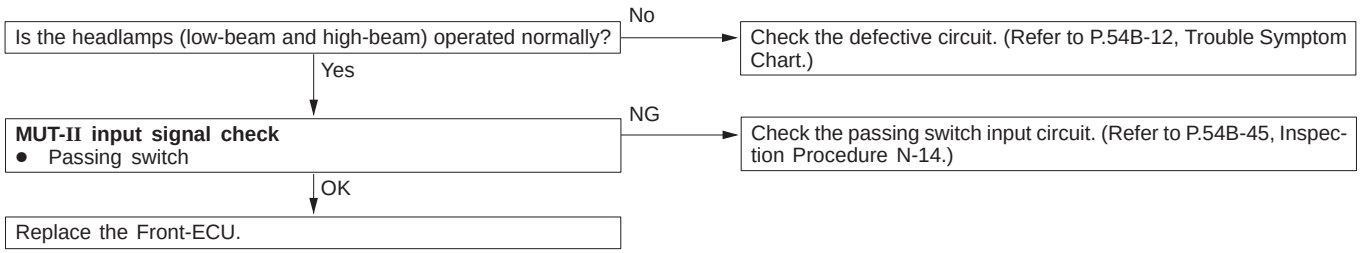
Headlamp, tail lamp: Headlamps (high-beam) do not illuminate.	Probable cause
The column switch or the front-ECU is suspected to be defective.	● Malfunction of column switch ● Malfunction of front-ECU ● Malfunction of harness wire or connector

NOTE
If only one of the headlamps (high-beam) does not illuminate, the harness wire between the headlamp and front-ECU may be defective or the headlamp bulb may be burned out. In this case, check the headlamp circuit.



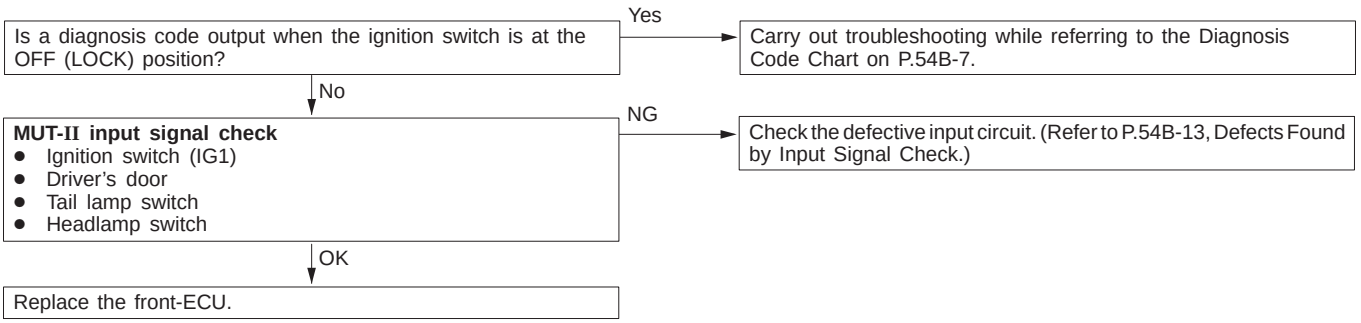
Inspection Procedure I-4

Headlamp, tail lamp: Headlamps do not illuminate when the passing switch is operated.	Probable cause
If the headlamps (low-beam and high-beam) are defective, the column switch or the front-ECU is suspected to be defective.	● Malfunction of column switch ● Malfunction of front-ECU ● Malfunction of harness wire or connector



Inspection Procedure I-5

Headlamp, tail lamp: The headlamp auto-cut function does not work normally.	Probable cause
The ETACS-ECU operates the headlamp auto-cut function, based on the signals from the following switch: ● Ignition switch (IG1) ● Driver's door switch ● Tail lamp switch ● Headlamp switch If the function does work normally, a defect on relevant input circuits, the ETACS-ECU or the front-ECU is suspected.	● Malfunction of driver's door switch ● Malfunction of column switch. ● Malfunction of front-ECU ● Malfunction of harness wire or connector



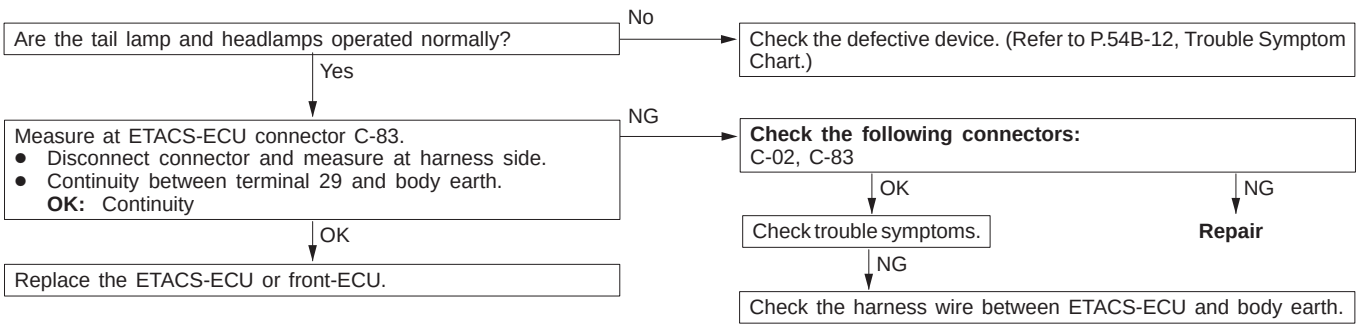
Inspection Procedure I-6

Headlamp, tail lamp: Headlamps dimmer switch auto-reset function does not work normally.	Probable cause
The headlamp dimmer switch auto-reset function is controlled by the front-ECU. If a defect appears, the front-ECU may be defective.	● Malfunction of front-ECU



Inspection Procedure I-7

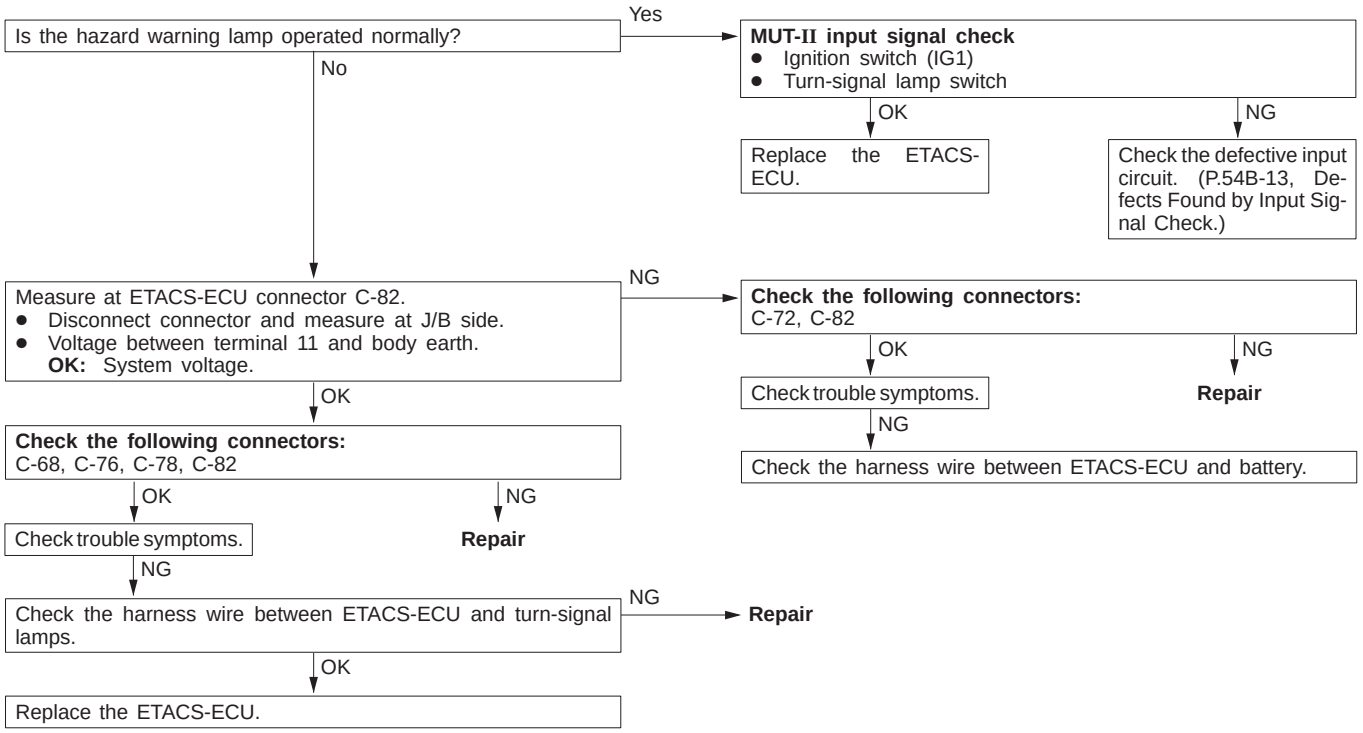
Headlamp, tail lamp: Daytime running lamp (DRL) function does not work.	Probable cause
The headlamp dimmer switch auto-reset function is controlled by the front-ECU. If a defect appears, the front-ECU may be defective.	● Malfunction of ETACS-ECU ● Malfunction of front-ECU ● Malfunction of harness wire or connector.



Inspection Procedure J-1

Flasher timer: Turn-signal lamp do not flash when the turn-signal lamp switch is turned on.	Probable cause
The ETACS-ECU makes the turn-signal lamps flash, based on the input signals from the following switched: ● Ignition switch (IG1) ● Turn-signal lamp switch If the turn-signal lamps do not flash normally, a defect on the relevant circuits or the ETACS-ECU may be suspected. If the hazard warning lamps also do not flash, a defect in the ETACS-ECU power supply line specific to the turn-signal lamps is suspected.	● Malfunction of column switch ● Malfunction of ETACS-ECU ● Malfunction of harness wire or connector.

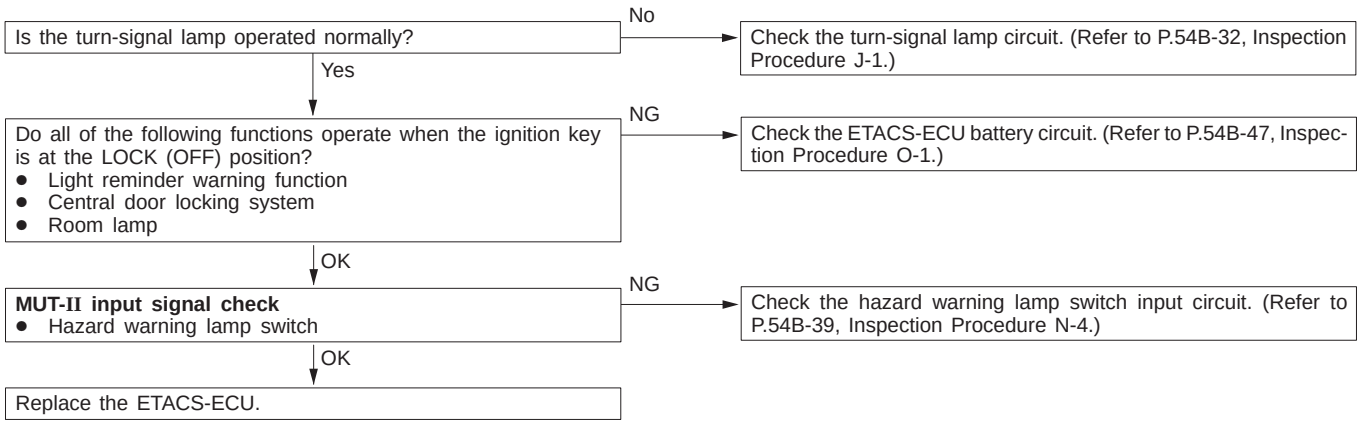
NOTE
If only one of the turn-signal lamp does not flash, the harness wire between the lamp and ETACS-ECU may be defective or the lamp bulb may be burned out. In this case, check the turn-signal lamp and hazard warning lamp circuit.



Inspection Procedure J-2

Flasher timer: Hazard warning lamp do not flash when the hazard warning lamp switch is turned on.	Probable cause
The ETACS-ECU makes the turn-signal lamps flash, base on the input signals from the hazard warning lamp switch. If the turn-signal lamps do not flash normally, the hazard warning lamp switch input circuit or the ETACS-ECU may be defective.	● Malfunction of hazard warning lamp switch ● Malfunction of ETACS-ECU ● Malfunction of harness wire or connector.

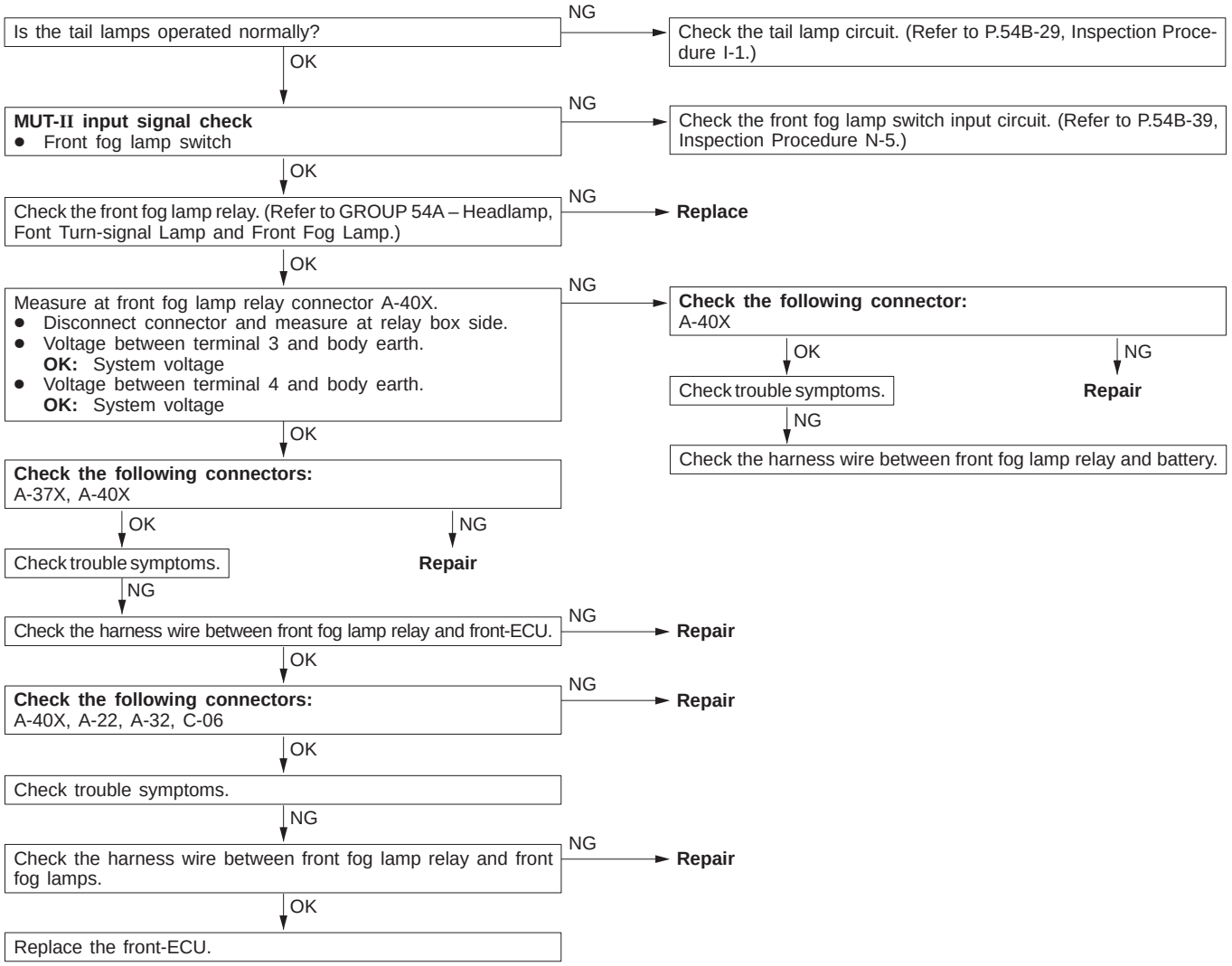
NOTE
If only one of the turn-signal lamp does not flash, the harness wire between the lamp and ETACS-ECU may be defective or the lamp bulb may be burned out. In this case, check the turn-signal lamp and hazard warning lamp circuit.



Inspection Procedure K-1

Front fog lamp: Front fog lamps do not illuminate when the front fog lamp switch is turned on.	Probable cause
If the tail lamps illuminate normally, the front fog lamp switch, the front fog lamp relay, the front-ECU or the ETACS-ECU may be defective.	• Malfunction of front fog lamp switch • Malfunction of front fog lamp relay • Malfunction of front-ECU • Malfunction of ETACS-ECU • Malfunction of harness wire or connector.

NOTE
If only one of the front fog lamp or fog lamp indicator lamp does not illuminate, the harness wire between the lamp and front fog lamp relay may be defective or the lamp bulb may be burned out. In this case, check the front fog lamp circuit.



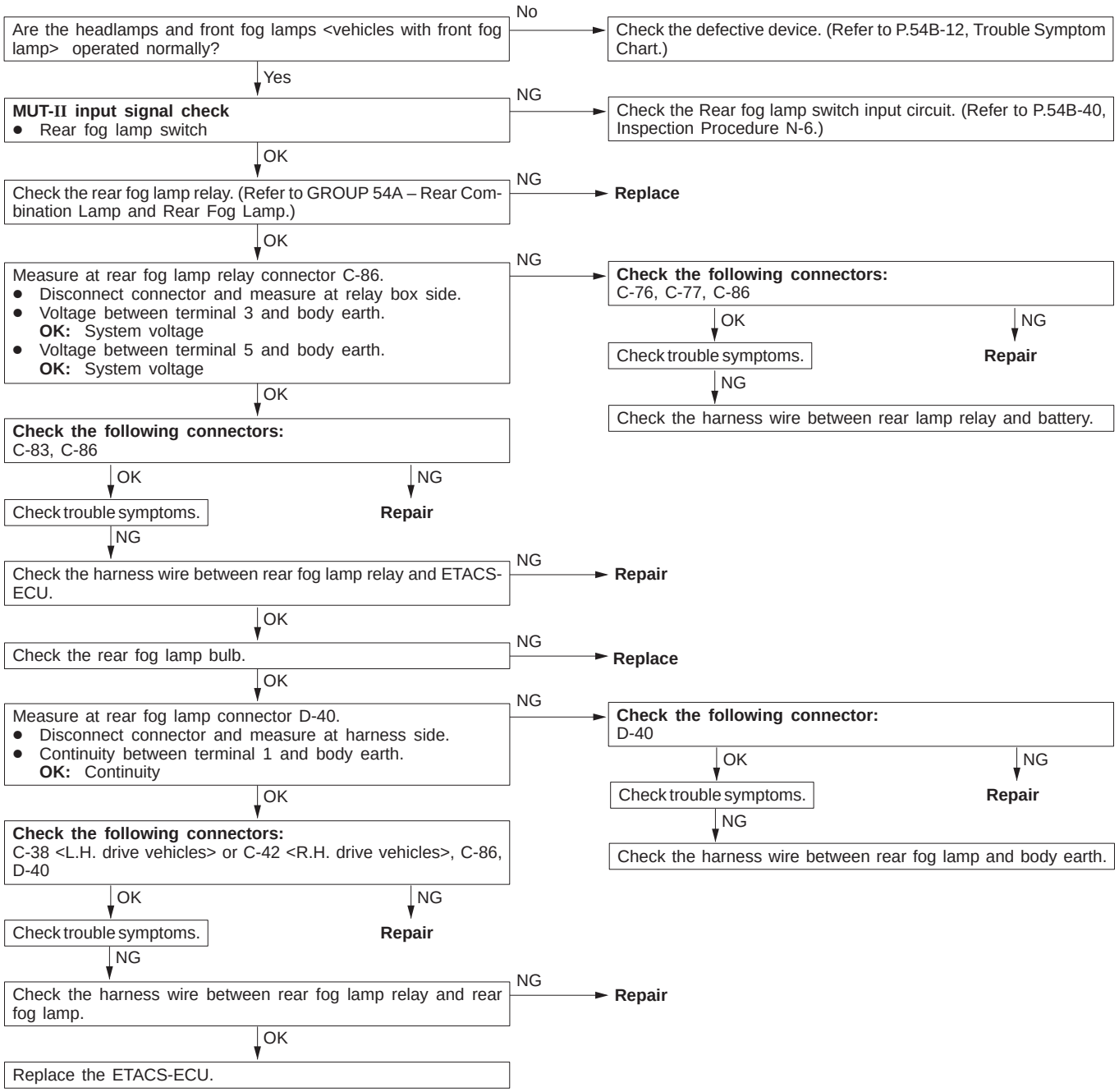
Inspection Procedure K-2

Front fog lamp: Front fog lamp do not go out when the tail lamps are turned off while the fog lamps are on.	Probable cause
If the malfunction above occurs, the ETACS-ECU may be defective.	• Malfunction of ETACS-ECU

Replace the ETACS-ECU.

Inspection Procedure L-1

Rear fog lamp: Rear fog lamps do not illuminate when the rear fog lamp switch is turned on.	Probable cause
If the headlamps and front fog lamp <vehicles with front fog lamp> illuminate normally, the rear fog lamp switch, the rear fog lamp relay or the ETACS-ECU may be defective.	• Malfunction of rear fog lamp switch • Malfunction of rear fog lamp relay • Malfunction of ETACS-ECU • Malfunction of harness wire or connector.



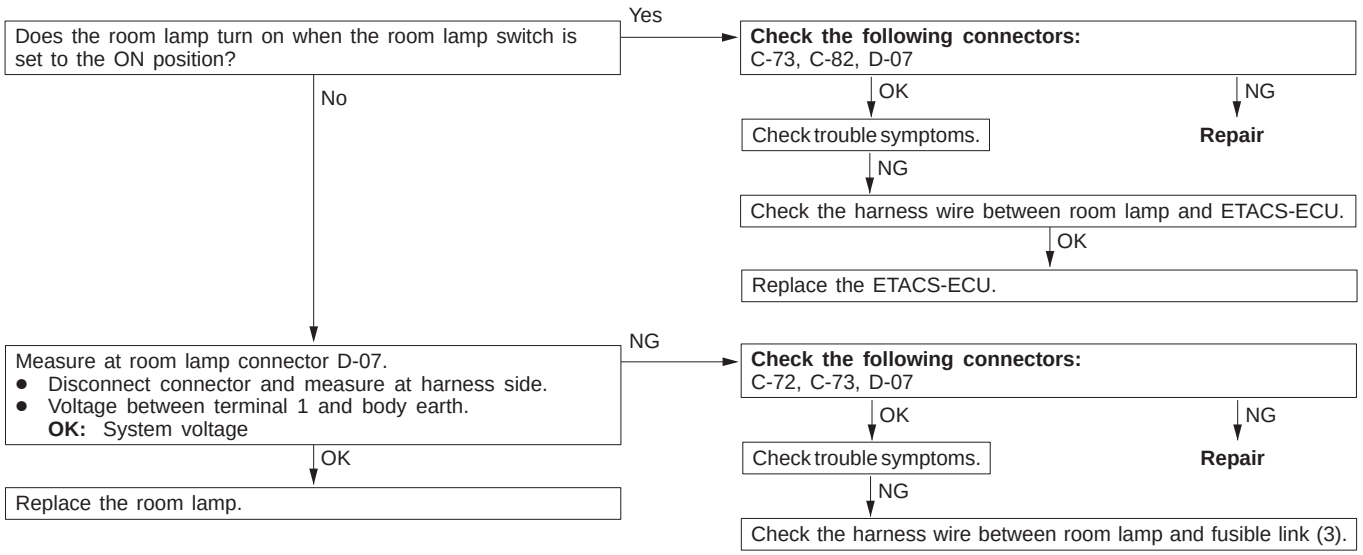
Inspection Procedure L-2

Rear fog lamp: Rear fog lamp do not go out when the headlamps and front fog lamps <vehicles with front fog lamp> are turned off while the fog lamps are on.	Probable cause
If the malfunction above occurs, the ETACS-ECU may be defective.	• Malfunction of ETACS-ECU

Replace the ETACS-ECU.

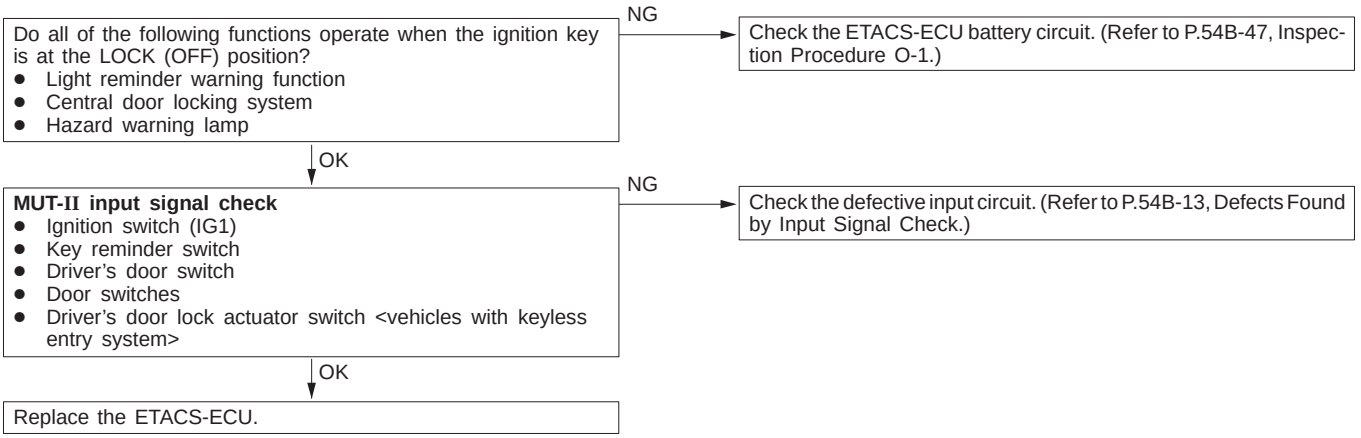
Inspection Procedure M-1

Room lamp: The room lamp does not illuminate.	Probable cause
If the room lamp does not illuminate at all, the room lamp bulb may be burned out, or the power supply circuit or the ETACS-ECU may be defective.	• Malfunction of room lamp • Malfunction of ETACS-ECU • Malfunction of harness wire or connector



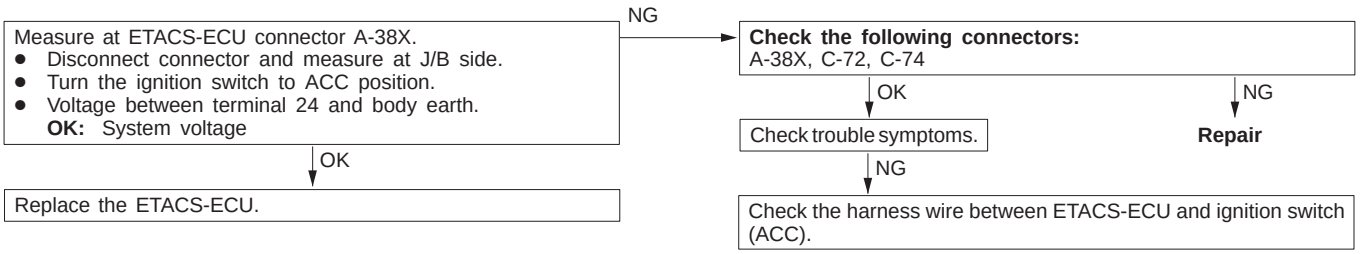
Inspection Procedure M-2

Room lamp: The room lamp dimming function does not work normally.	Probable cause
The ETACS-ECU dims the room lamp according to the input signals from the following switches: ● Ignition switch (IG1) ● Key reminder switch ● Driver's door switch ● Door switches ● Driver's door lock actuator switch <vehicles with keyless entry system> If the Room lamp does not be dimmed normally, the relevant input signal circuit or the ETACS-ECU may be defective.	● Malfunction of key reminder switch ● Malfunction of driver's door switch ● Malfunction of door switches ● Malfunction of driver's door lock actuator switch ● Malfunction of ETACS-ECU ● Malfunction of harness wire or connector



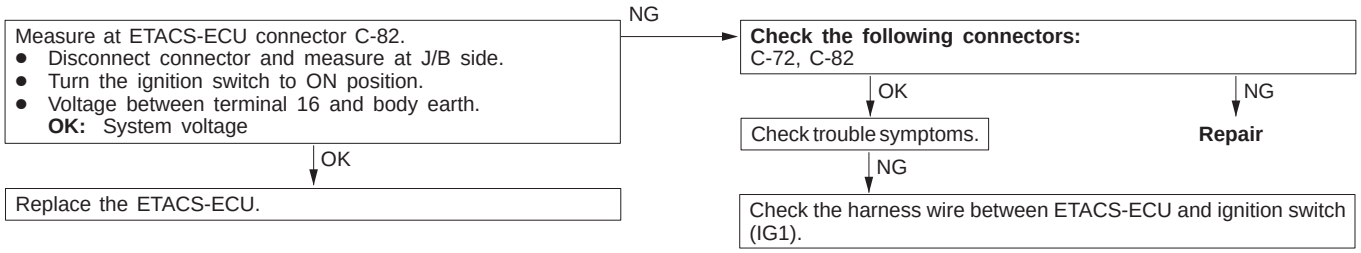
Inspection Procedure N-1

Ignition switch (ACC) signal is not sent to the ETACS-ECU.	Probable cause
The ignition switch (ACC) input signal is used to operate the following devices. If the signal fails, these devices will not work normally. ● Windshield wiper and washer ● Rear wiper and washer ● Headlamp washer <vehicles with headlamp washer>	● Malfunction of ETACS-ECU ● Malfunction of harness wire or connector



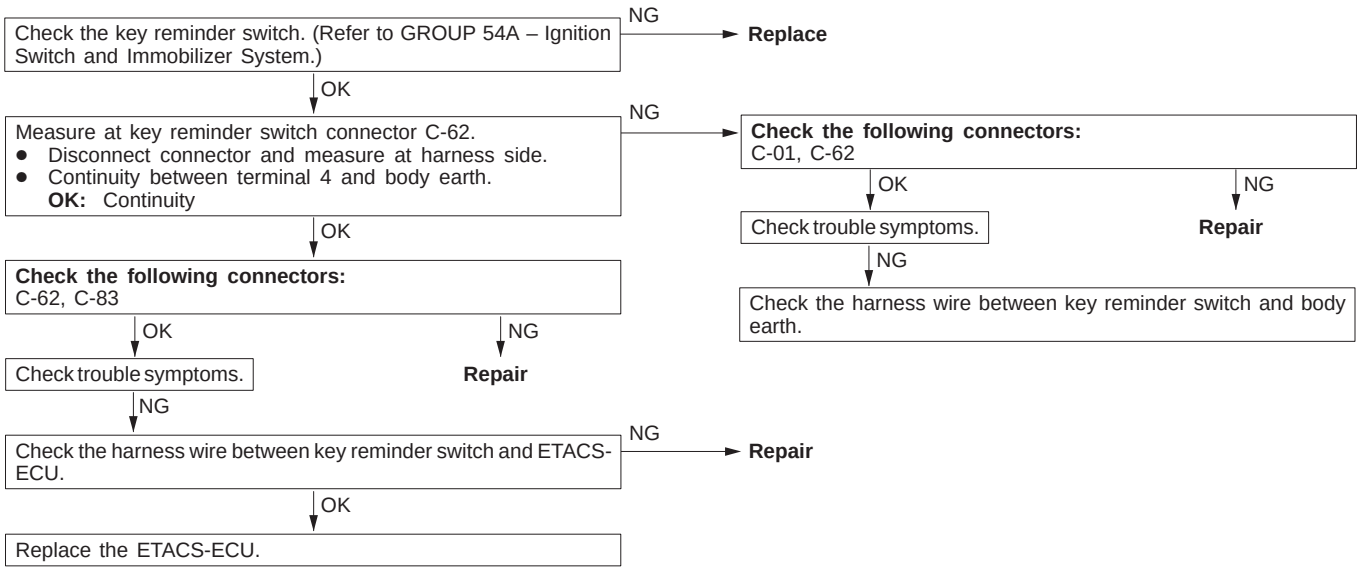
Inspection Procedure N-2

Ignition switch (IG1) signal is not sent to the ETACS-ECU.	Probable cause
The ignition switch (IG1) input signal is used to operate the following devices. If the signal fails, these devices will not work normally. ● Light reminder alarm function ● Power window timer function <vehicles with power window> ● Headlamp auto-cut function ● Turn-signal lamp ● Room lamp dimming function	● Malfunction of ETACS-ECU ● Malfunction of harness wire or connector



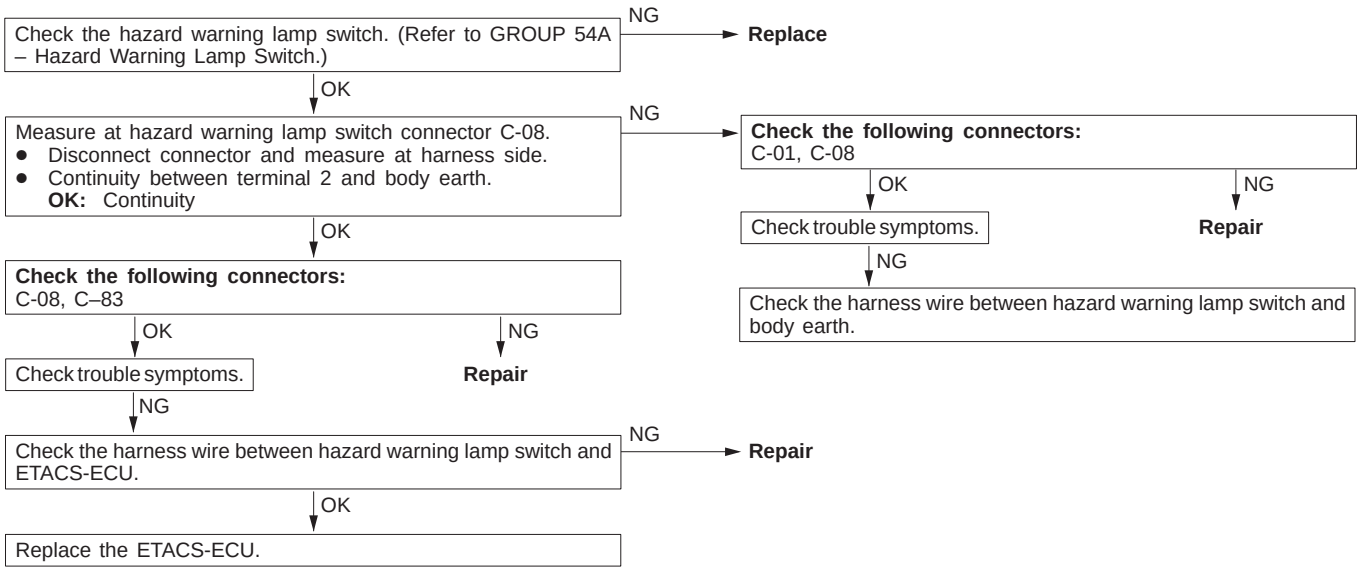
Inspection Procedure N-3

Key reminder switch signal is not sent to the ETACS-ECU.	Probable cause
The key reminder switch input signal is used to operate the following devices. If the signal fails, these devices will not work normally. ● Forgotten key prevention function <Vehicles with keyless entry system> ● Keyless entry system <Vehicles with keyless entry system> ● Room lamp dimming function	● Malfunction of key reminder switch ● Malfunction of ETACS-ECU ● Malfunction of harness wire or connector



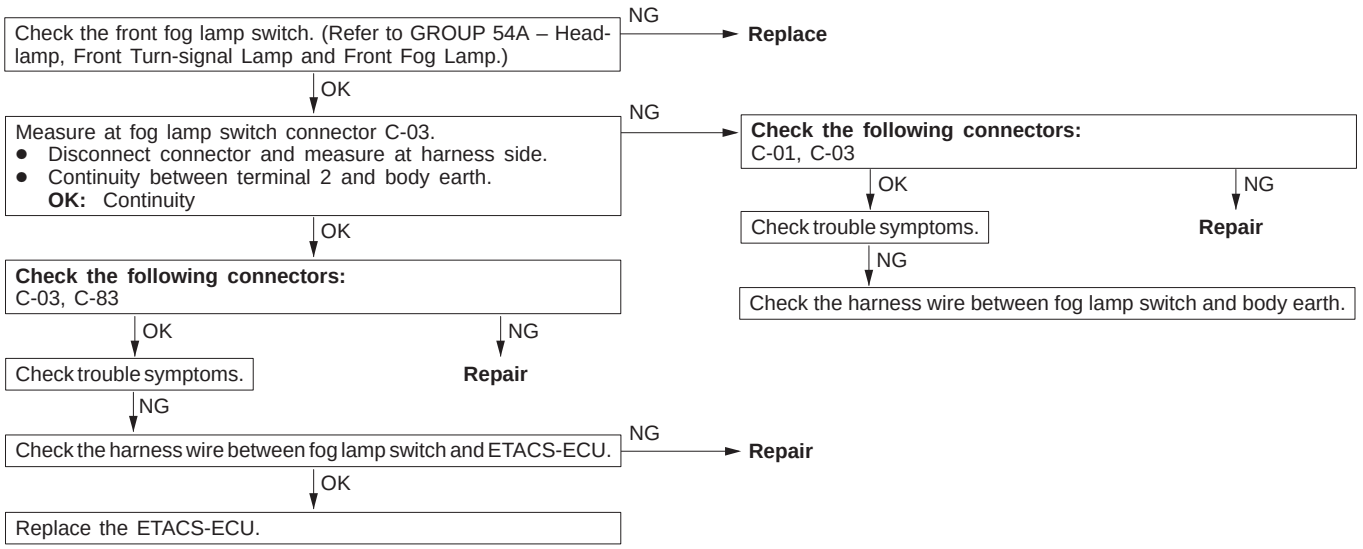
Inspection Procedure N-4

Hazard warning lamp switch signal is not sent to the ETACS-ECU.	Probable cause
The hazard warning lamp switch input signal is used to operate the following devices. If the signal fails, these devices will not work normally. ● Hazard warning lamp ● Keyless entry system (Registering the encrypted code) <vehicles with keyless entry system>	● Malfunction of hazard warning lamp switch ● Malfunction of ETACS-ECU ● Malfunction of harness wire or connector



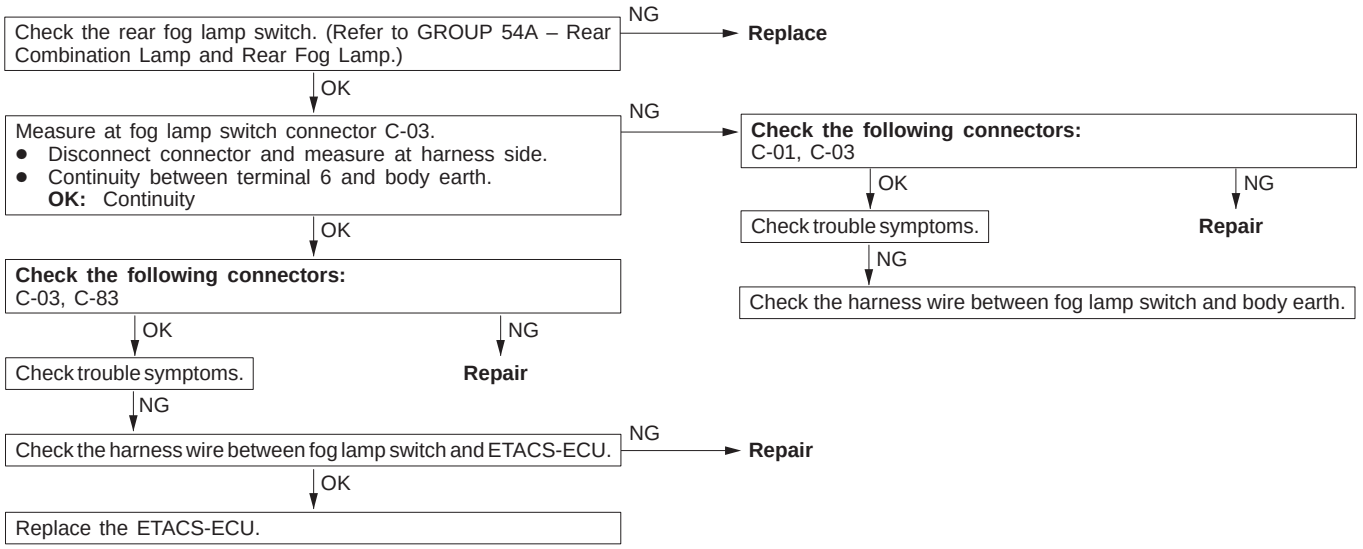
Inspection Procedure N-5

Front fog lamp switch signal is not sent to the ETACS-ECU.	Probable cause
The front fog lamp switch input signal is used to operate the front fog lamp. If the signal fails, front fog lamp will not work normally.	● Malfunction of fog lamp switch ● Malfunction of ETACS-ECU ● Malfunction of harness wire or connector



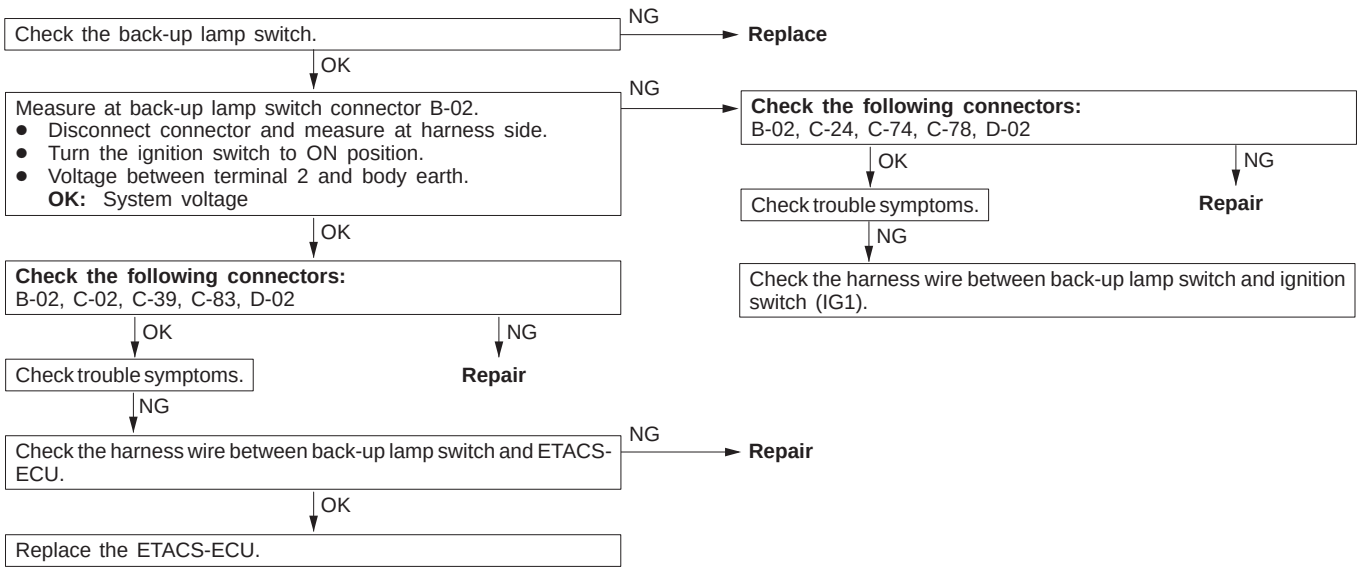
Inspection Procedure N-6

Rear fog lamp switch signal is not sent to the ETACS-ECU.	Probable cause
The rear fog lamp switch input signal is used to operate the rear fog lamp. If the signal fails, rear fog lamp will not work normally.	• Malfunction of fog lamp switch • Malfunction of ETACS-ECU • Malfunction of harness wire or connector



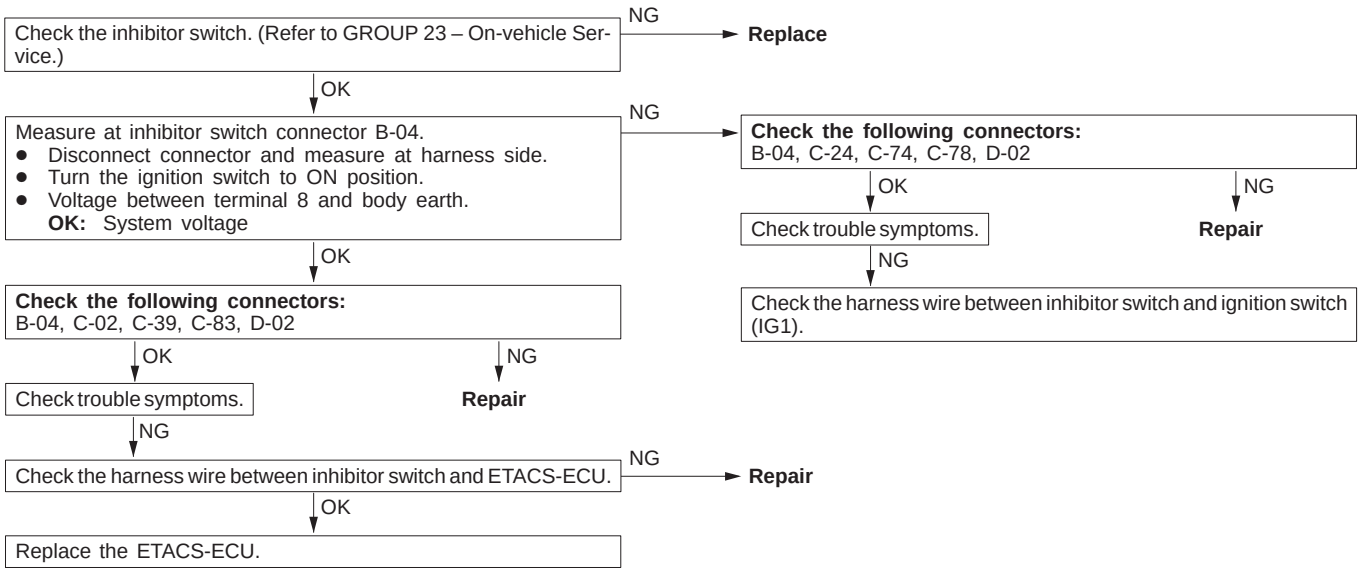
Inspection Procedure N-7

Back-up lamp switch signal is not sent to the ETACS-ECU. <M/T>	Probable cause
The back-up lamp switch input signal is used to operate the rear wiper. If the signal is an error, the rear wiper will not operate consecutively twice when the rear wiper is on and the shift lever is moved to R position.	• Malfunction of back-up lamp switch • Malfunction of ETACS-ECU • Malfunction of harness wire or connector



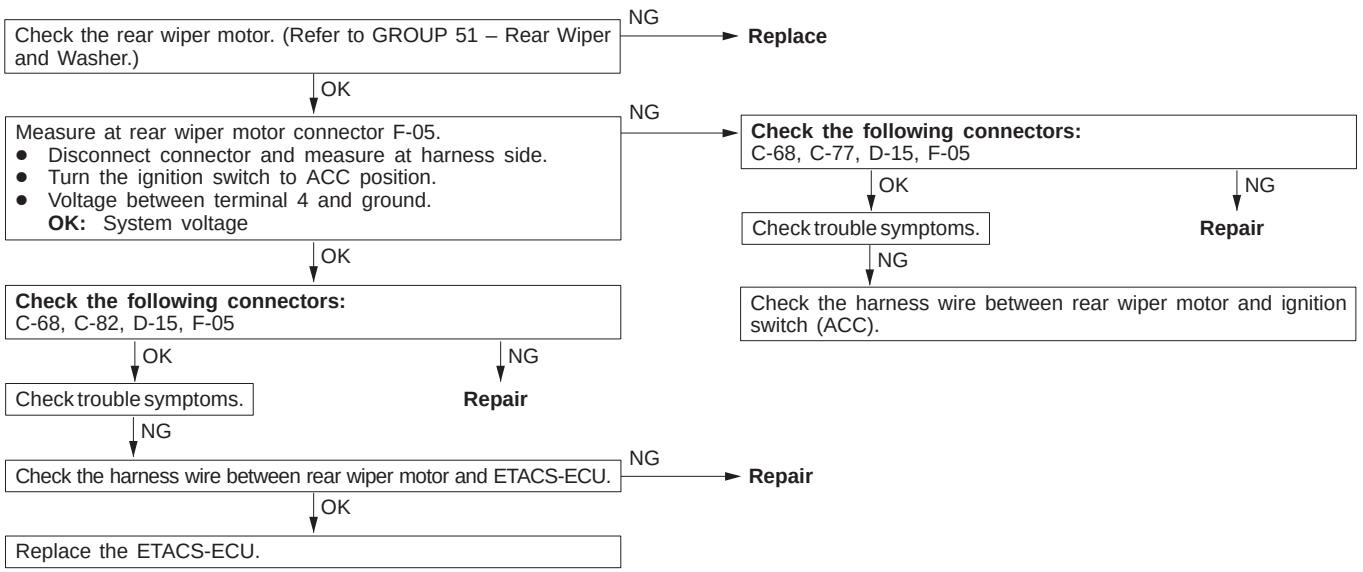
Inspection Procedure N-8

Inhibitor switch (reverse) signal is not sent to the ETACS-ECU. <A/T>	Probable cause
The inhibitor switch (reverse) input signal is used to operate the rear wiper. If the signal is an error, the rear wiper will not operate consecutively twice when the rear wiper is on and the selector lever is moved to R position.	• Malfunction of inhibitor switch • Malfunction of ETACS-ECU • Malfunction of harness wire or connector



Inspection Procedure N-9

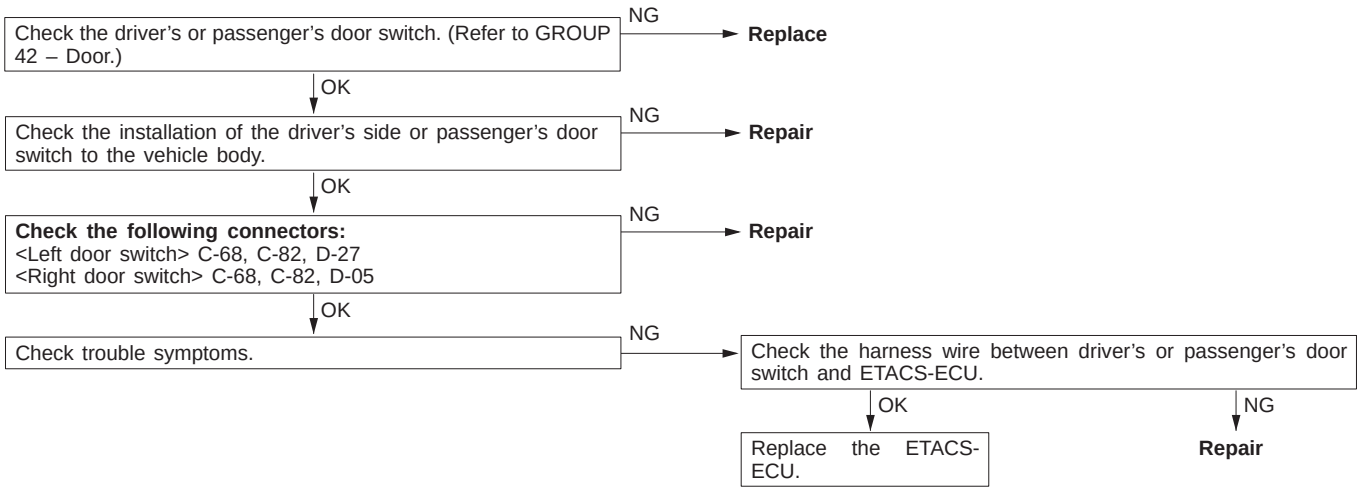
Rear wiper motor auto-stop signal is not sent to the ETACS-ECU.	Probable cause
Rear wiper motor auto-stop signal is used to operate the rear wiper. If the signal is an error, the rear wiper will not stop at the predetermined park position.	• Malfunction of rear wiper motor • Malfunction of ETACS-ECU • Malfunction of harness wire or connector



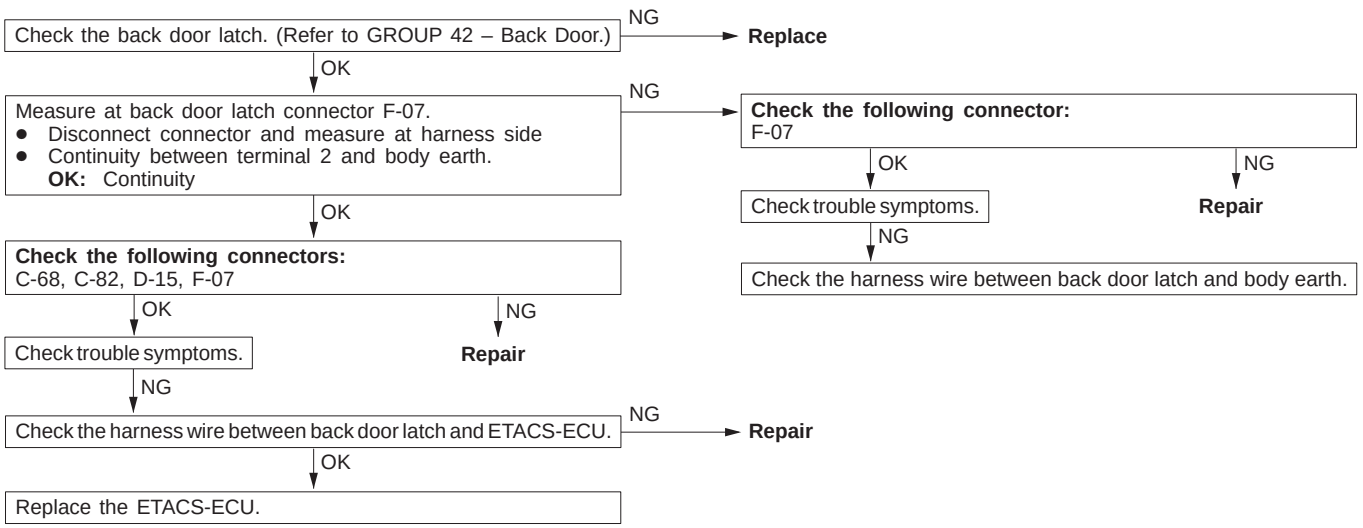
Inspection Procedure N-10

Driver's door switch signal is not sent to the ETACS-ECU. Door switches signal is not sent to the ETACS-ECU.	Probable cause
<Driver's door switch> The driver's door switch is used to operate the following functions. If the signal fails, these devices will not work normally. ● Light reminder warning function ● Forgotten key prevention function <vehicles with keyless entry system> ● Power window timer function <vehicles with power window> ● Headlamp auto-cut function **<Door switches>** The door switches is used to operate the following devices. If the signal fails, these devices will not work normally. ● Keyless entry system <vehicles keyless entry system> ● Room lamp dimming function	● Malfunction of driver's or passenger's door switch ● Malfunction of back door latch ● Malfunction of ETACS-ECU ● Malfunction of harness wire or connector

<Driver's and passenger's door switch>

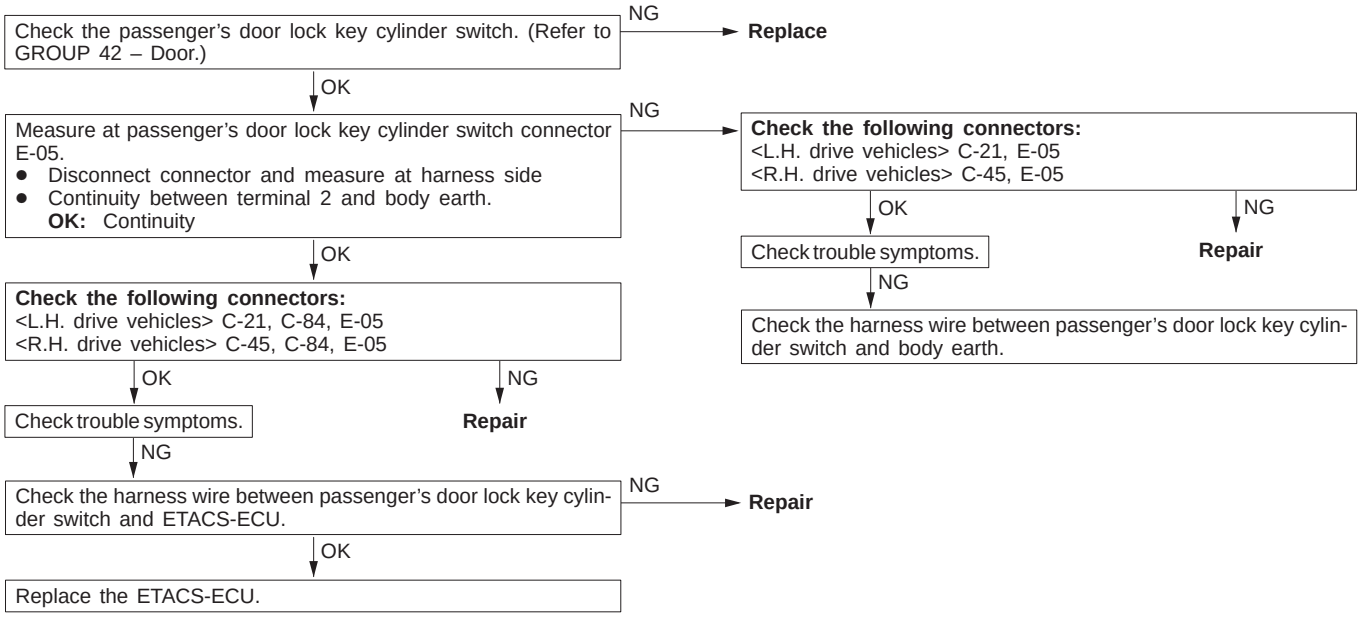


<Back door switch>



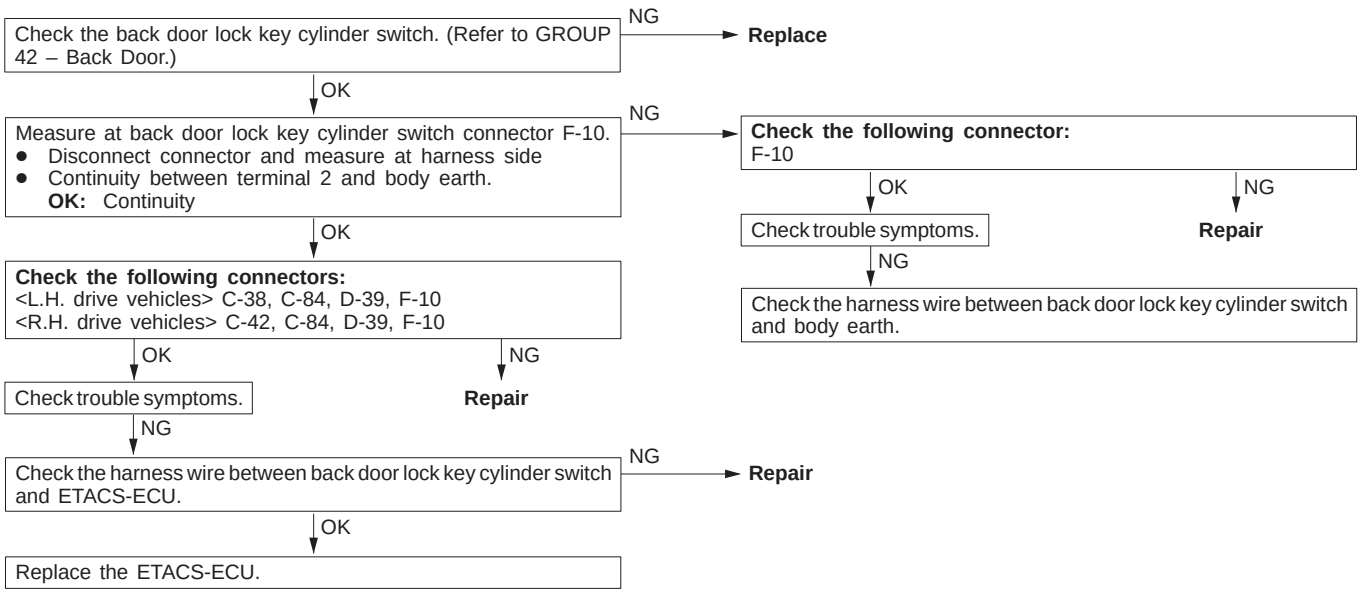
Inspection Procedure N-11

Passenger's door lock key cylinder switch signal is not sent to the ETACS-ECU.	Probable cause
The passenger's door lock key cylinder switch is used to operate the central door locking system. If the signal fails, central door locking system will not work normally.	• Malfunction of passenger's door lock key cylinder switch • Malfunction of ETACS-ECU • Malfunction of harness wire or connector



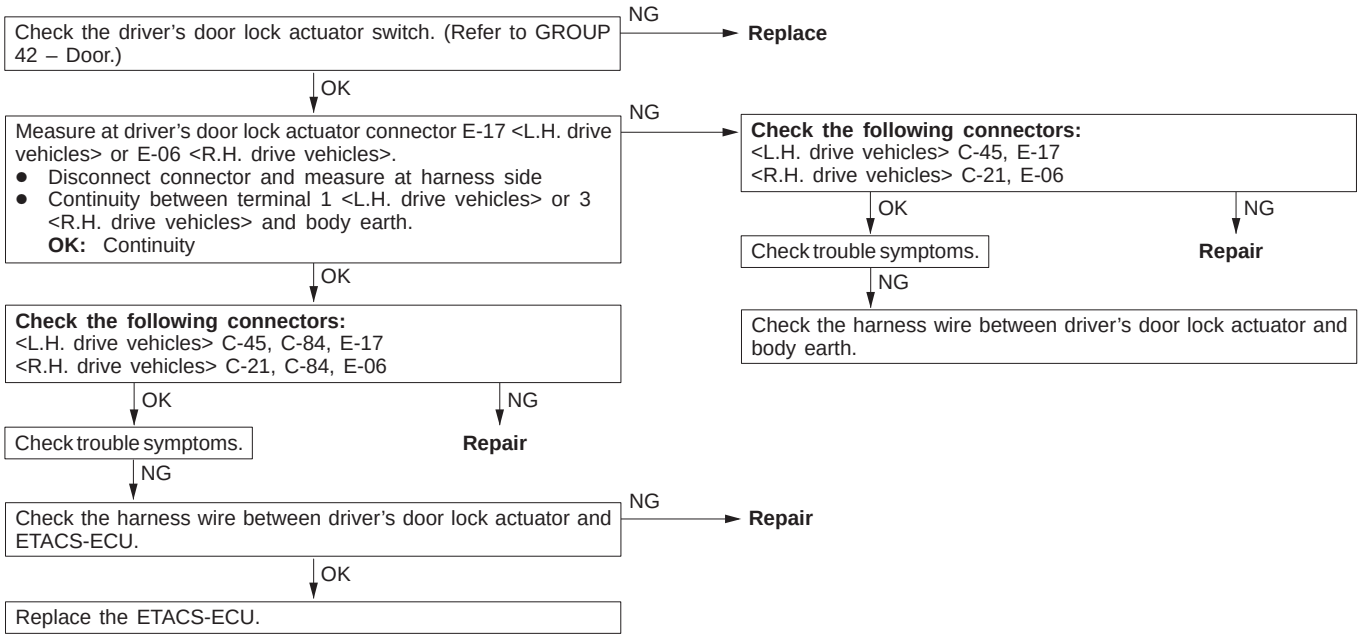
Inspection Procedure N-12

Back door lock key cylinder switch signal is not sent to the ETACS-ECU.	Probable cause
The back door lock key cylinder switch is used to operate the central door locking system. If the signal fails, central door locking system will not work normally.	• Malfunction of back door lock key cylinder switch • Malfunction of ETACS-ECU • Malfunction of harness wire or connector



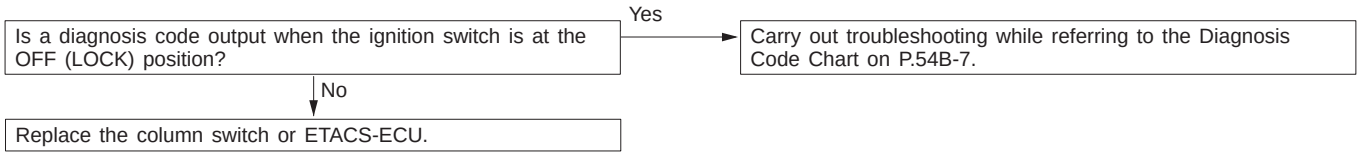
Inspection Procedure N-13

Driver's door lock actuator switch signal is not sent to the ETACS-ECU.	Probable cause
The driver's door lock actuator switch is used to operate the following systems or functions. If the signal fails, these systems or function will not work normally. ● Central door locking system ● Forgotten key prevention function <vehicles with keyless entry system> ● Keyless entry system <vehicles with keyless entry system>	● Malfunction of driver's door lock actuator ● Malfunction of ETACS-ECU ● Malfunction of harness wire or connector



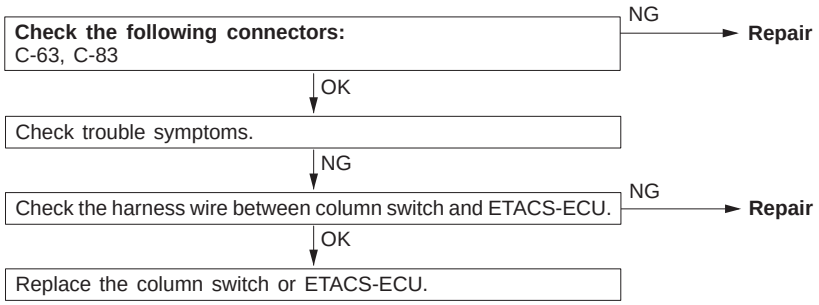
Inspection Procedure N-14

Column switch: ● **Tail lamp switch signal is not sent to the ETACS-ECU.** ● **Headlamp switch signal is not sent to the ETACS-ECU.** ● **Dimmer switch signal is not sent to the ETACS-ECU.** ● **Passing switch signal is not sent to the ETACS-ECU.** ● **Turn-signal lamp switch signal is not sent to the ETACS-ECU.** ● **Windshield mist wiper switch signal is not sent to the ETACS-ECU.** ● **Windshield intermittent wiper switch signal is not sent to the ETACS-ECU.** ● **Windshield low-speed wiper switch signal is not sent to the ETACS-ECU.** ● **Windshield high-speed wiper switch signal is not sent to the ETACS-ECU.** ● **Windshield washer switch is not sent to the ETACS-ECU.** ● **Rear wiper switch is not sent to the ETACS-ECU.** ● **Rear washer is not sent to the ETACS-ECU.** ● **Headlamp washer switch is not sent to the ETACS-ECU.**	**Probable cause**
The column switch is used to operate the following systems or functions. If the signal fails, these systems or function will not work normally. ● Light reminder warning function ● Windshield wiper and washer ● Rear wiper and washer ● Headlamp washer <vehicles with headlamp washer> ● Headlamp, tail lamp ● Turn-signal lamp ● Front fog lamp <vehicles with front fog lamp> ● Rear fog lamp	● Malfunction of column switch ● Malfunction of ETACS-ECU



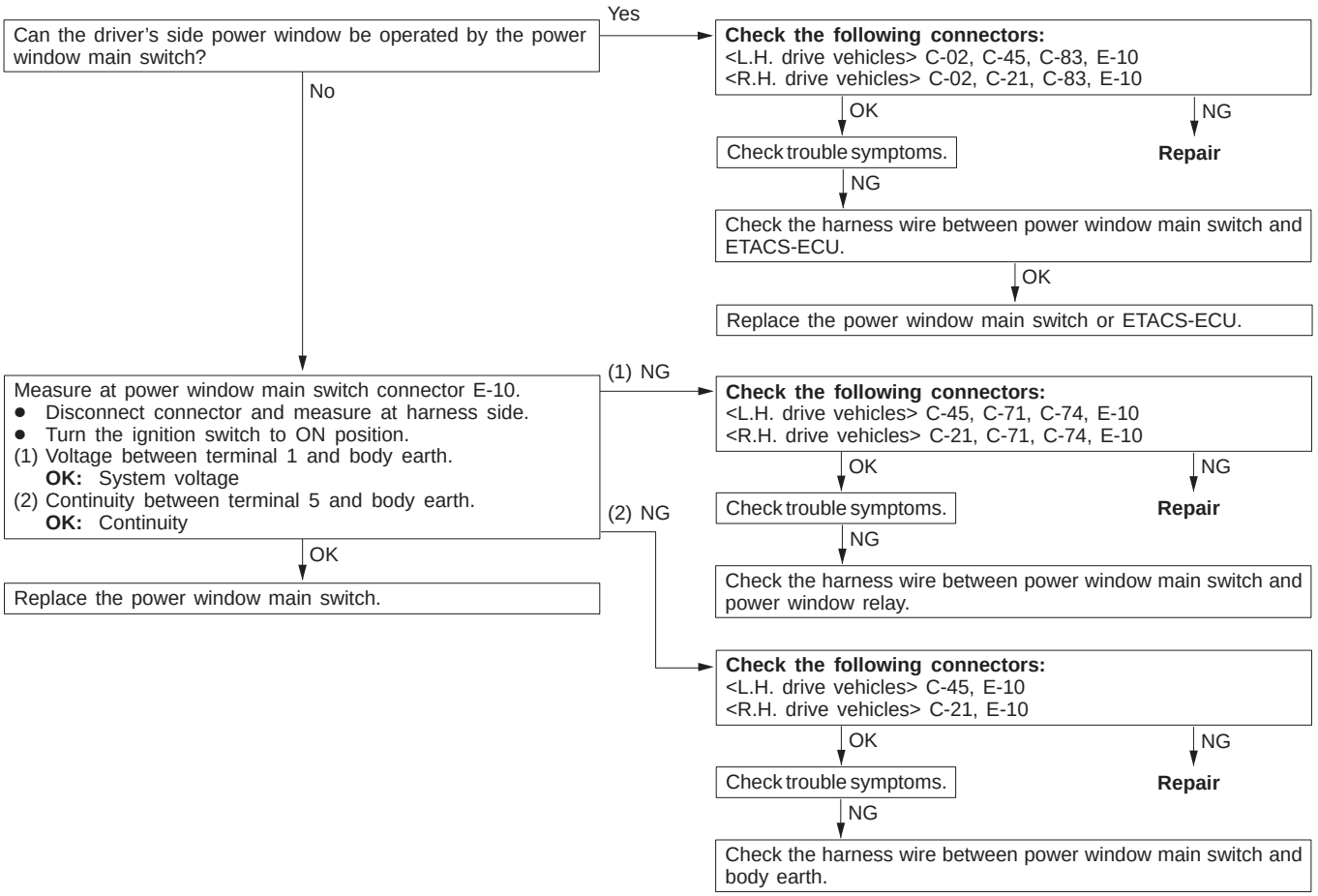
Inspection Procedure N-15

Column switch: Windshield intermittent wiper interval adjusting knob signal is not sent to the ETACS-ECU.	**Probable cause**
If the windshield intermittent wiper interval adjusting knob is defective the windshield intermittent wiper interval can not be adjusted.	● Malfunction of column switch ● Malfunction of ETACS-ECU ● Malfunction of harness wire or connector



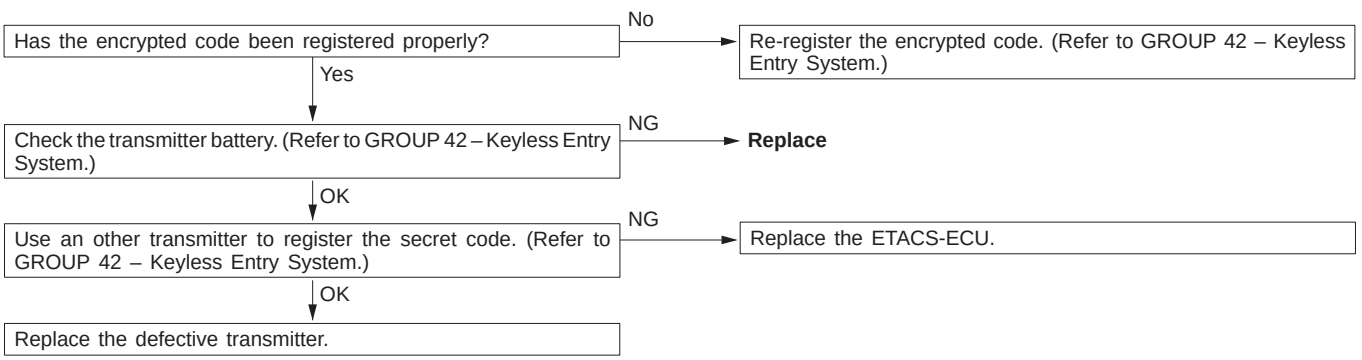
Inspection Procedure N-16

Power window main switch: Any switch signal is not sent to the ETACS-ECU.	Probable cause
If there is a problem with communication between the power window main switch and the ETACS-ECU, the input signal check for the power window main switch can no longer be carried out. In addition, the power window timer function will also stop working.	• Malfunction of power window main switch • Malfunction of ETACS-ECU • Malfunction of harness wire or connector



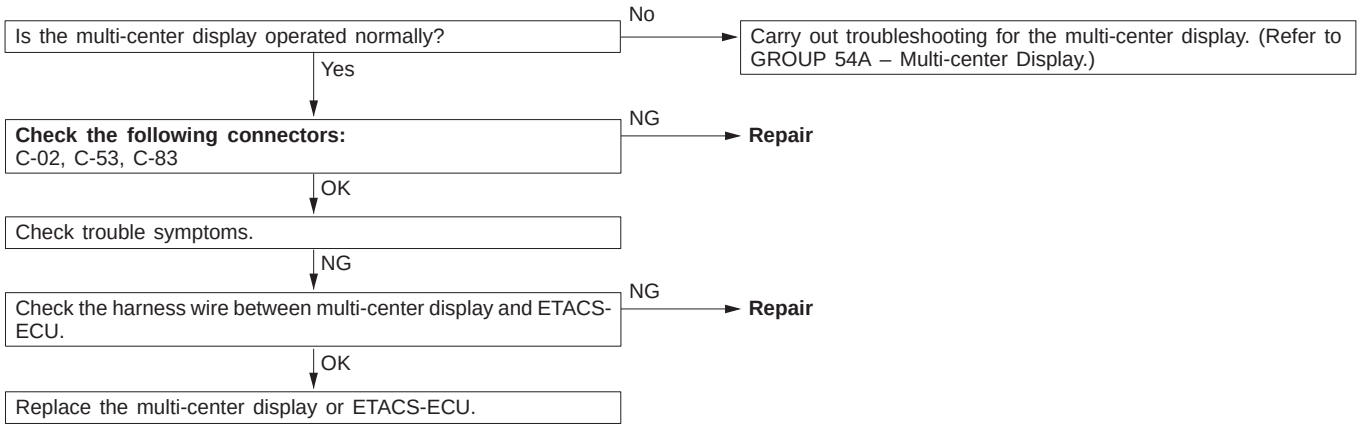
Inspection Procedure N-17

Transmitter: Any switch signal is not sent to the ETACS-ECU.	Probable cause
The transmitter input signal is used to operate the keyless entry system. If the signal fails, keyless entry will not work normally.	• Malfunction of transmitter • Malfunction of ETACS-ECU



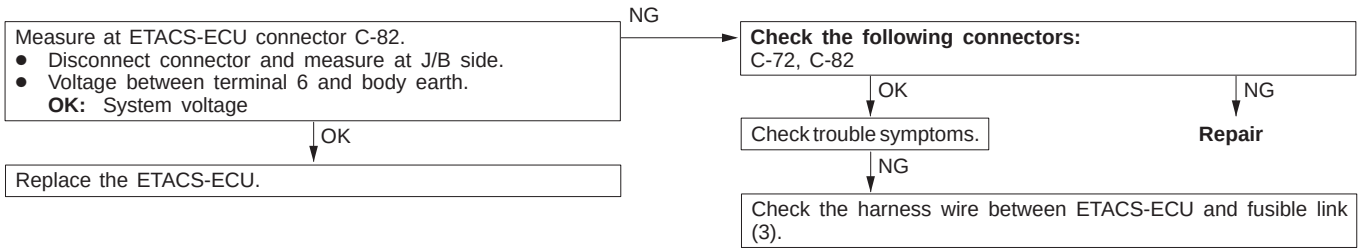
Inspection Procedure N-18

Multi-center display: Any switch signal is not sent to the ETACS-ECU.	Probable cause
The cause is probably a malfunction of the multi-center display or the ETACS-ECU.	• Malfunction of multi-center display • Malfunction of ETACS-ECU • Malfunction of harness wire or connector.



Inspection Procedure O-1

Check the circuit (power supply line) from the battery to the ETACS-ECU.	Probable cause
If that power supply circuit is defective, the circuit flowing trough the ignition switch (IG1) will function as a back-up circuit. In this case, the following functions will not work when the ignition switch is at LOCK (OFF) position. • Light reminder alarm function • Central door lock ing system • Hazard warning lamp • Room lamp	• Malfunction of ETACS-ECU • Malfunction of harness wire or connector.



NOTES

GROUP 54B
SMART WIRING SYSTEM(SWS)

GENERAL

OUTLINE OF CHANGES

- Due to the introduction of 5-door models, the troubleshooting for the rear power windows have been added.

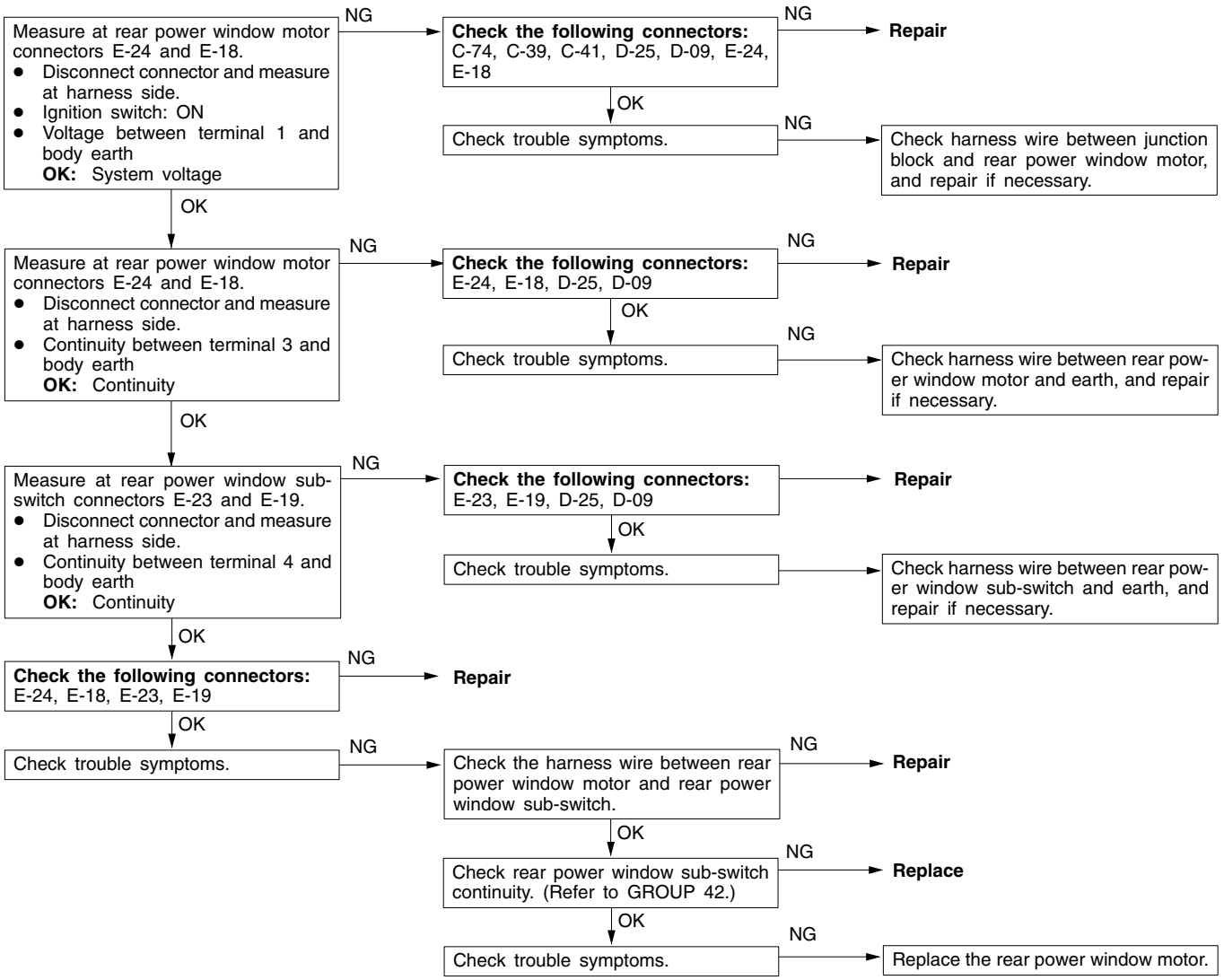
TROUBLESHOOTING

TROUBLE SYMPTOM CHART

Trouble symptom		Inspection procedure	Reference page
Power window	Rear power window sub-switches can not operate rear door windows. (However, power window main switch can operate rear door windows.)	D-9	54B-2

Inspection Procedure D-9

Power windows: Rear power window sub-switches can not operate rear door windows. (However, power window main switch can operate rear door windows.)	Probable cause
Power supply circuit or earth circuit of the rear power window motor, rear power window motor or rear power window sub-switches may be defective.	• Malfunction of rear power window sub-switches • Malfunction of rear power window motors • Malfunction of wiring harness or connector



HEATER, AIR CONDITIONER AND VENTILATION

HEATER, AIR CONDITIONER AND VENTILATION

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Magnetic Clutch Test 9
Receiver Drier Test 9
Compressor Drive Belt Adjustment 9
Dual Pressure Switch Check 9

CONTINUED ON NEXT PAGE

WARNINGS REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLES

WARNING!

(1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver and passenger (from rendering the SRS inoperative).
(2) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.
(3) MITSUBISHI dealer personnel must thoroughly review this manual, and especially its GROUP 52B – Supplemental Restraint System (SRS) before beginning any service or maintenance of any component of the SRS or any SRS-related component.

NOTE
The SRS includes the following components: SRS-ECU, SRS warning lamp, air bag module, clock spring, side impact sensors and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents by an asterisk (*).

Charging 10
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Refrigerant Leak Repair 16
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Power Relay Check 17
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HEATER CONTROL ASSEMBLY AND A/C SWITCH 19

HEATER UNIT*, BLOWER UNIT*, RESISTER* AND EVAPORATOR* 22

BLOWER MOTOR ASSEMBLY AND INSIDE/OUTSIDE AIR CHANGEOVER DAMPER MOTOR 25

COMPRESSOR AND TENSION PULLEY 26

CONDENSER AND CONDENSER FAN MOTOR 30

REFRIGERANT LINE 32

VENTILATORS* 34

GENERAL INFORMATION

The heater system uses a two-way-flow full-air-mix system that features high performance and low operating noise, and includes an independent face air blowing function. The A/C system is basically the same as the conventional system, but a new refrigerant system has been adopted as a response to restrictions on the use of chlorofluorocarbons. In addition, an air purifier which carries out fine A/C control has been included.

Items		Specifications
Heater unit	Type	Two-way-flow full-air-mix system
Heater control assembly		Dial type
Compressor	Model	Scroll type <KC 50AG or KC 50G>
Dual pressure switch kPa	High-pressure switch	ON → OFF: 2,650, OFF → ON: 2,050
	Low-pressure switch	ON → OFF: 176, OFF → ON: 186
Refrigerant and quantity g		R-134a (HFC-134a) Approx. 550 – 590 (R.H.D.) Approx. 600 – 640 (L.H.D.)

SAFETY PRECAUTIONS

Because R-134a refrigerant is a hydrofluorocarbon (HFC) which contains hydrogen atoms in place of chlorine atoms, it will not cause damage to the ozone layer.

Refrigerant R-134a is transparent and colourless in both the liquid and vapour state. Since it has a boiling point of –29.8°C, at atmospheric pressure, it will be a vapour at all normal temperatures and pressures. The vapour is heavier than air, non-flammable, and nonexplosive. The following precautions must be observed when handling R-134a.

Caution
Wear safety goggles when servicing the refrigeration system.

R-134a evaporates so rapidly at normal atmospheric pressures and temperatures that it tends to freeze anything it contacts. For this reason, extreme care must be taken to prevent any liquid refrigerant from contacting the skin and especially the eyes. Always wear safety goggles when servicing the refrigeration part of the A/C system. Keep a bottle of sterile mineral oil handy when working on the refrigeration system. Should any liquid refrigerant get into the eyes, use a few drops of mineral oil to wash them out. R-134a is rapidly absorbed by the oil. Next splash the eyes with plenty of cold water. Call your doctor immediately even though irritation has ceased after treatment.

Caution
Do not heat R-134a above 40°C

In most instances, moderate heat is required to bring the pressure of the refrigerant in its container above the pressure of the system when charging or adding refrigerant.

A bucket or large pan of hot water not over 40°C is all the heat required for this purpose. Do not heat the refrigerant container with a blow torch or any other means that would raise temperature and pressure above this temperature. Do not weld or steam clean on or near the system components or refrigerant lines.

Caution
Keep R-134a containers upright when charging the system.

When metering R-134a into the refrigeration system keep the supply tank or cans in an upright position. If the refrigerant container is on its side or upside down, liquid refrigerant will enter the system and damage the compressor.

Caution
1. **The leak detector for R-134a should be used to check for refrigerant gas leaks.**
2. **Do not allow liquid refrigerant to touch bright metal.**

Refrigerant will tarnish bright metal and chrome surfaces, and in combination with moisture can severely corrode all metal surfaces.

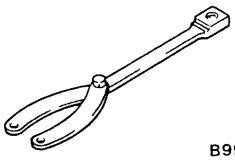
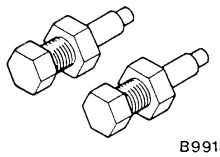
SERVICE SPECIFICATIONS

Items	Standard value
Idle speed r/min	600 ± 50
Idle up speed r/min	A/C at low load 700 ± 50 A/C at high load 800 ± 50
Resistor (for blower motor) Ω	LO: 2.3, ML:1.0, MH: 0.3
Air gap (Magnetic clutch)	0.25 – 0.55

LUBRICANTS

Items	Specified lubricants	Quantity
Each connection of refrigerant line	ZXL 200PG	As required
Compressor refrigerant unit lubricant mℓ	ZXL 200PG	130 – 170 <KC 50AG> 160 – 200 <KC 50G>

SPECIAL TOOLS

Tool	Number	Name	Use
	MB991367	Special spanner	Removal and installation of armature mounting nut of compressor
	MB991386	Pin	

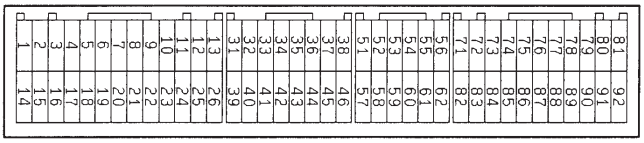
TROUBLESHOOTING

TROUBLESHOOTING PROCEDURES

Trouble symptom	Problem cause	Remedy	Reference page
When the ignition switch is "ON", the A/C does not operate	Fuse is defective	Replace the fuse	–
	Harness or connector is defective	Repair the harness or connector	–
	A/C compressor relay is defective	Replace the A/C compressor relay	55-17
	A/C compressor magnetic clutch is defective	Replace the armature plate, rotor or clutch coil	55-28
	Refrigerant leak or overfilling of refrigerant	Replenish the refrigerant, repair the leak or take out some of the refrigerant	55-16
	Dual pressure switch is defective	Replace the dual pressure switch	55-32
	A/C switch is defective	Replace the blower switch assembly	55-21
	Blower switch is defective	Replace the blower switch assembly	55-21
	Air thermosensor is defective	Replace the air thermosensor	55-22
	Engine-ECU is defective	Replace the engine-ECU	–
When the A/C is operating, temperature inside the passenger compartment doesn't decrease (cool air is not emitted)	Refrigerant leak	Replenish the refrigerant and repair the leak	55-16
	Dual pressure switch is defective	Replace the dual pressure switch	55-32
	Fan controller is defective	Replace the fan controller	GROUP14 – Radiator
	Air thermosensor is defective	Replace the air thermosensor	55-22
	Engine-ECU is defective	Replace the engine-ECU	–
Blower fan and motor do not turn	Fuse is defective	Replace the fuse	–
	Harness or connector is defective	Repair the harness or connector	–
	Blower relay is defective	Replace the blower relay	55-17
	Blower fan and motor are defective	Replace the blower fan and motor	55-23
	Resistor (for blower motor) is defective	Replace the resistor	55-22
	Blower switch is defective	Replace the blower switch assembly	55-26

Trouble symptom	Problem cause	Remedy	Reference page
Blower fan and motor do not stop turning	Harness or connector is defective	Repair the harness or connector	–
	Blower switch is defective	Replace the blower switch assembly	55-21
	Blower relay is defective	Replace the blower relay	55-17
When the A/C is operating condenser fan or radiator fan does not turn	Fuse is defective	Replace the fuse	–
	Harness or connector is defective	Repair the harness or connector	–
	Condenser fan motor is defective	Replace the condenser fan motor	55-30
	Radiator fan motor is defective	Replace the radiator fan motor	GROUP14 – Radiator
	Engine-ECU is defective	Replace the engine-ECU	–
Inside and outside changeover does not operate	Harness or connector is defective	Repair the harness or connector	–
	Inside and outside changeover switch is defective	Replace the blower switch assembly	55-21
	Inside and outside changeover damper motor is defective	Replace the inside and outside changeover damper motor	55-25

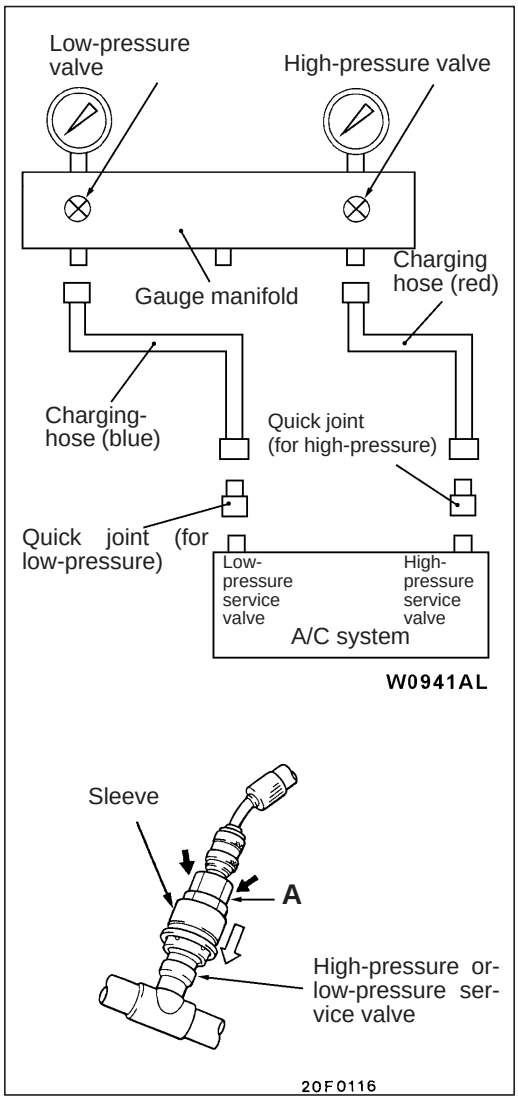
INSPECTION AT THE ENGINE-ECU TERMINAL



9FU0393

Terminal No.	Check item	Checking requirements	Normal condition
21	Fan controller output	A/C switch: OFF	5 V
		A/C switch: ON	0 V
8*1 22*2	A/C compressor output	A/C compressor relay: OFF	0 V
		A/C compressor relay: ON	System voltage
45	A/C switch input	A/C switch: OFF	0 V
		A/C switch: ON	System voltage
73*1 77*2	Air thermosensor earth	Air thermosensor detection temperature: 25°C	2.0 – 2.9 V
92	Air thermosensor input	Always	0 V

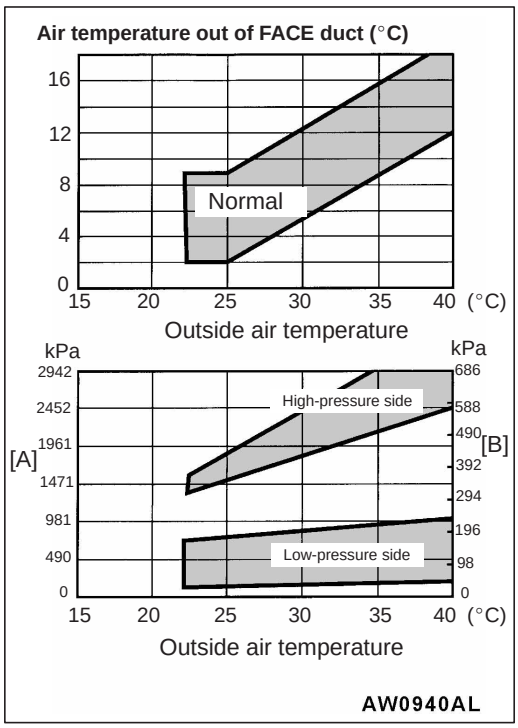
NOTE
*1: Vehicles with immobilizer
*2: Vehicles without immobilizer
*3: Vehicles for Hong Kong
*4: Except vehicles for Hong Kong



ON-VEHICLE SERVICE

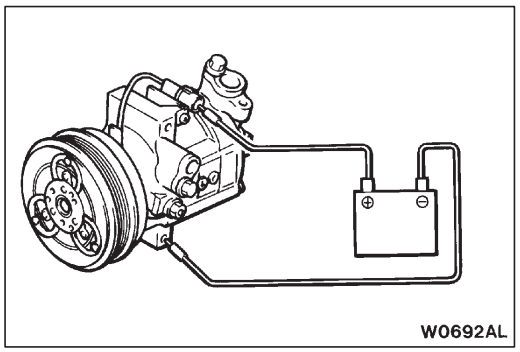
REFRIGERANT LEVEL TEST THROUGH PERFORMANCE TEST

1. Park the vehicle to be tested in a place that is not in direct sunlight.
2. Set conditions for outside air temperature as follows:
   Dry-bulb temperature: 22°C or more
   Relative humidity: 60 to 100%
3. Close all of the doors with the windows fully closed.
4. Close the valves of the gauge manifold.
5. Connect the charging hose (red) to the gauge manifold (high-pressure side) and the quick joint (for high-pressure) to the end of the hose.
6. Connect the charging hose (blue) to the gauge manifold (low-pressure side) and the quick joint (for low-pressure) to the end of the hose.
7. Connect the quick joints to the appropriate service valves of the vehicle.
   Caution
   To connect the quick joint, press section "A" firmly against the service valve until a click is heard.
   When connecting, run your hand along the hose while pressing the section "A" to ensure that there are no bends in the hose.
8. Start the engine.
9. Turn the blower switch to HI position.
10. Turn on the A/C switch, and set the A/C control to MAX. COOL.
11. Set the air outlet changeover to FACE mode and the inside air/outside air changeover to the inside air recirculation mode.
12. Adjust the engine speed to 1,500 r/min.



13. Check if the outside air temperature and air temperature blown out of FACE duct, and the outside air temperature and refrigerant pressure (high-pressure and low-pressure sides) are within the normal value range shown in the graphs.
14. If the temperature and pressure are below the given range, replenish the refrigerant. If above, drain the refrigerant. (For charging, refer to P.55-10.)

    NOTE
    In the graph below, see the following:
    [A]: Refrigerant pressure (high-pressure side)
    [B]: Refrigerant pressure (low-pressure side)



MAGNETIC CLUTCH TEST

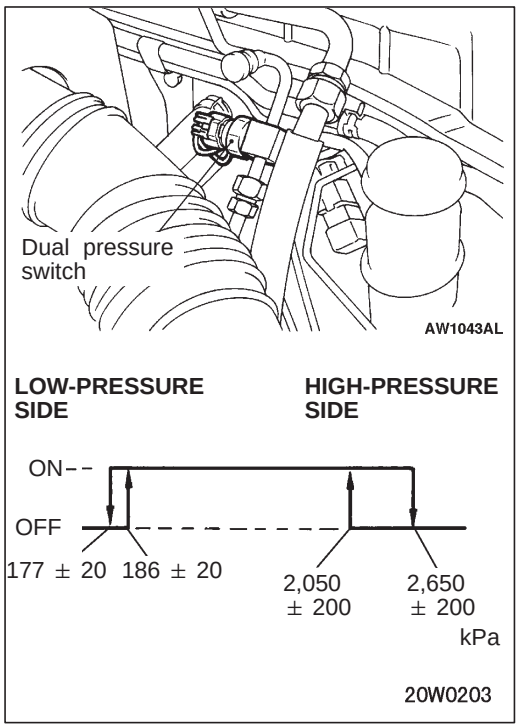
1. Disconnect the connector (1-pin) to the magnetic clutch.
2. Connect battery (+) voltage directly to the connector for the magnetic clutch.
3. If the magnetic clutch is normal, there will be “click”. If the pulley and armature do not make contact (‘click’), there is a malfunction.

RECEIVER DRIER TEST

Operate the unit and check the piping temperature by touching the receiver drier outlet and inlet.
If there is a difference in the temperatures, the receiver drier is restricted.
Replace the receiver drier.

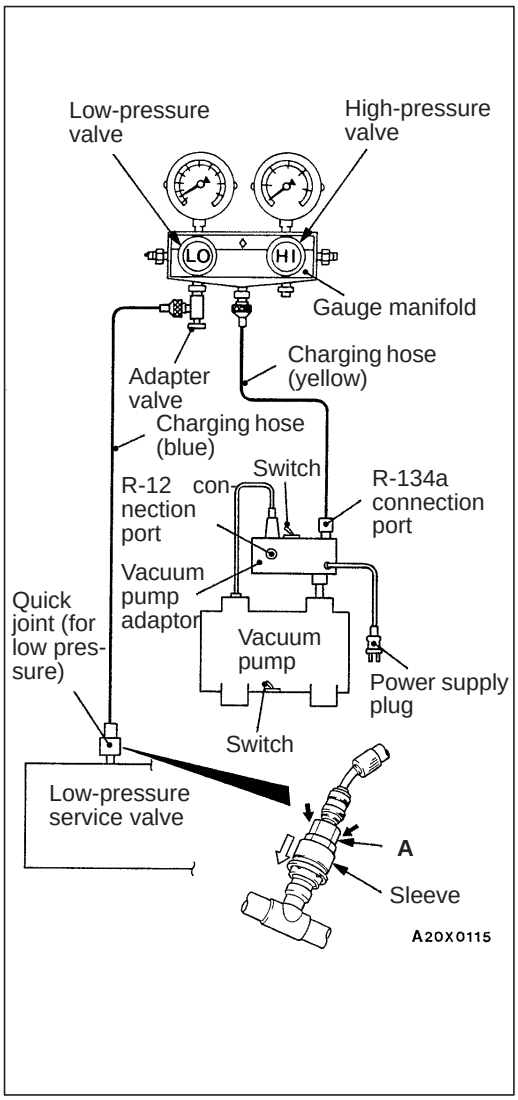
COMPRESSOR DRIVE BELT ADJUSTMENT

Refer to GROUP 11 – On-vehicle Service.



DUAL PRESSURE SWITCH CHECK

1. Remove the dual pressure switch connector and connect the high/low pressure side terminals located on the harness side as shown in the illustration.
2. Install a gauge manifold to the high-pressure side service valve of the refrigerant line. (Refer to Performance Test.)
3. When the high/low pressure sides of the dual pressure switch are at operation pressure (ON) and there is continuity between the respective terminals, then the condition is normal. If there is no continuity, replace the switch.



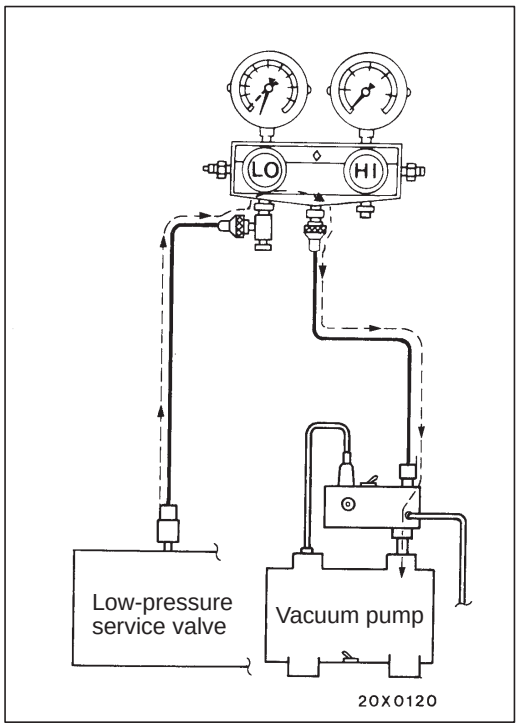
CHARGING

1. With the handles turned back all the way (valve closed), install the adaptor valve to the low-pressure side of the gauge manifold.
2. Connect the charging hose (blue) to the adaptor valve.
3. Connect the quick joint (for low-pressure) to the charging hose (blue).
4. Connect the quick joint (for low-pressure) to the low-pressure service valve.

   NOTE
   The low-pressure service valve should be connected to the suction hose.

   Caution
   (1) Use tools that are suited to R-134a.
   (2) To install the quick joint, press section "A" firmly against the service valve until a click is heard. When connecting, run your hand along the hose while pressing to ensure that there are no bends in the hose.
5. Close the high and low-pressure valves of the gauge manifold.
6. Install the vacuum pump adaptor to the vacuum pump.
7. Connect the vacuum pump plug to the vacuum pump adaptor.
8. Connect the charging hose (yellow) to the R-134a connection port of the vacuum pump adaptor.
9. Tighten the adaptor valve handle (valve open).
10. Open the low-pressure valve of the gauge manifold.
11. Turn the power switch of the vacuum pump to the ON position.

    NOTE
    Even if the vacuum pump power switch is turned ON, the vacuum pump will not operate because of the power supply connection in step (7).



12. Turn the vacuum pump adaptor switch to the R-134a side to start the vacuum pump.

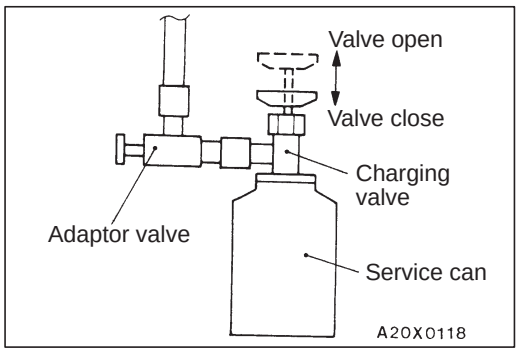
    Caution
    Do not operate the compressor for evacuation.

13. Evacuate to a vacuum reading of 100 kPa or higher (takes approx. 10 minutes).
14. Turn the vacuum pump adaptor switch OFF and allow to stand it for 5 minutes.

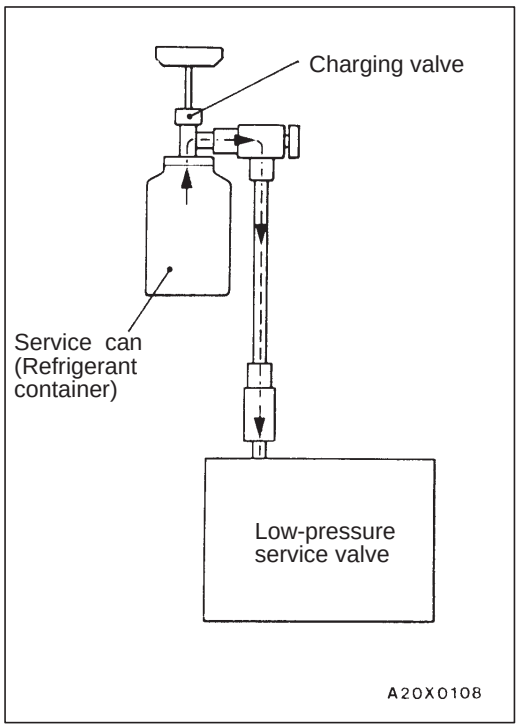
    Caution
    Do not operate the compressor in the vacuum condition; damage may occur.

15. Carry out a leak test. (Good if the negative pressure does not drop.)

    Caution
    If the negative pressure drops, increase the tightness of the connections, and then repeat the evacuation procedure from step (12).



16. With the handle turned back all the way (valve open), install the charging valve to the service can.
17. Turn the handle of the adaptor valve back all the way (valve closed), remove it from the gauge manifold and install the service can.
18. Tighten the handle of the charging valve (valve closed) to puncture the service can.



19. Turn the handle of the charging valve back (valve open) and tighten the handle of the adaptor valve (valve open) to charge the system with refrigerant.

    Caution
    If the service can is inverted, liquid refrigerant may be drawn into the compressor damaging it by liquid compression. Keep the service can upright to ensure that refrigerant is charged in gas state.

20. If the refrigerant is not drawn in, turn the handle of the adaptor valve back all the way (valve closed).
21. Check for gas leaks using a leak detector.
    If a gas leak is detected, re-tighten the connections, and then repeat the charging procedure from evacuation in step (12).

    Caution
    The leak detector for R-134a should be used.

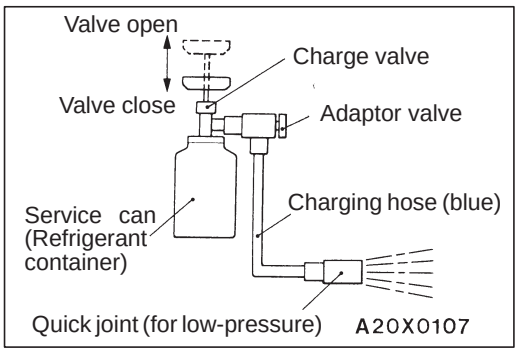
22. Start the engine.
23. Operate the A/C and set to the lowest temperature (MAX. COOL).

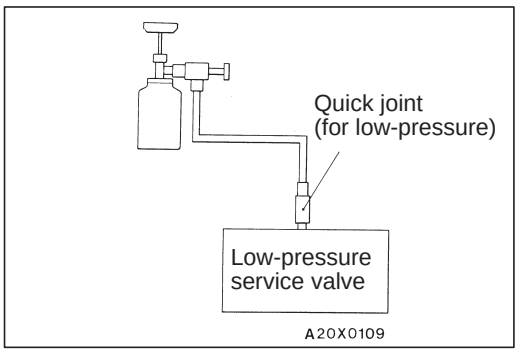
24. Fix the engine speed at 1,500 r/min.
25. Tighten the handle of the adaptor valve (valve open) to charge the required volume of refrigerant.

    Caution
    If the service can is inverted, liquid refrigerant may be drawn into the compressor damaging it by liquid compression. Keep the service can upright to ensure that refrigerant is charged in gas state.

26. After charging with refrigerant, turn the handle of the adaptor valve back all the way (valve closed).
27. Tighten the charging valve handle (valve closed). Remove the quick joint (for low-pressure) from the low-pressure service valve.

    NOTE
    If the service can is not emptied completely, keep the handles of the charging valve and adaptor valve closed for the next charging.

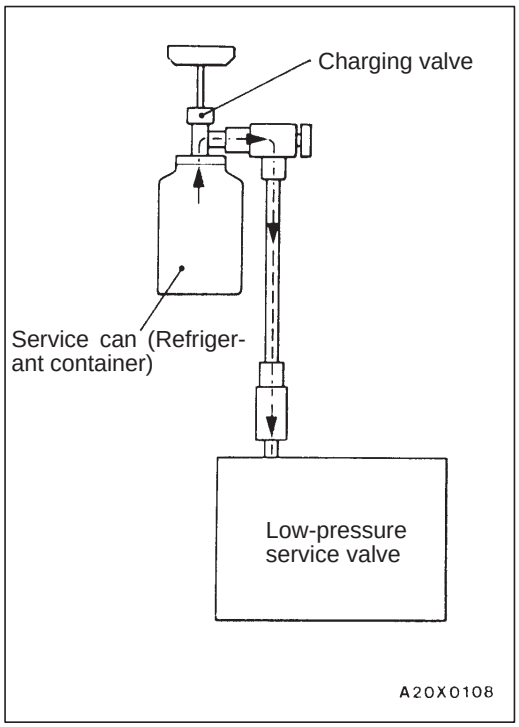




CORRECTING LOW REFRIGERANT LEVEL IN CASE THE SERVICE CAN IS USED.

1. Install the charge valve with the handle turned all the way back (valve open) to the service can.
2. Install the adaptor valve with the handle turned all the way back (valve close) to the charging valve.
3. Connect the charging hose (blue) to the adaptor valve.
4. Connect the charging hose (blue) to the quick joint (for low-pressure).
5. Tighten the handle of the charge valve (valve close), and pierce the service can.
6. Turn the handle of the adaptor valve to bleed the air.
7. Install the quick joint (for low-pressure) to the low-pressure service valve.

   NOTE
   The low-pressure service valve should be connected to the suction hose.

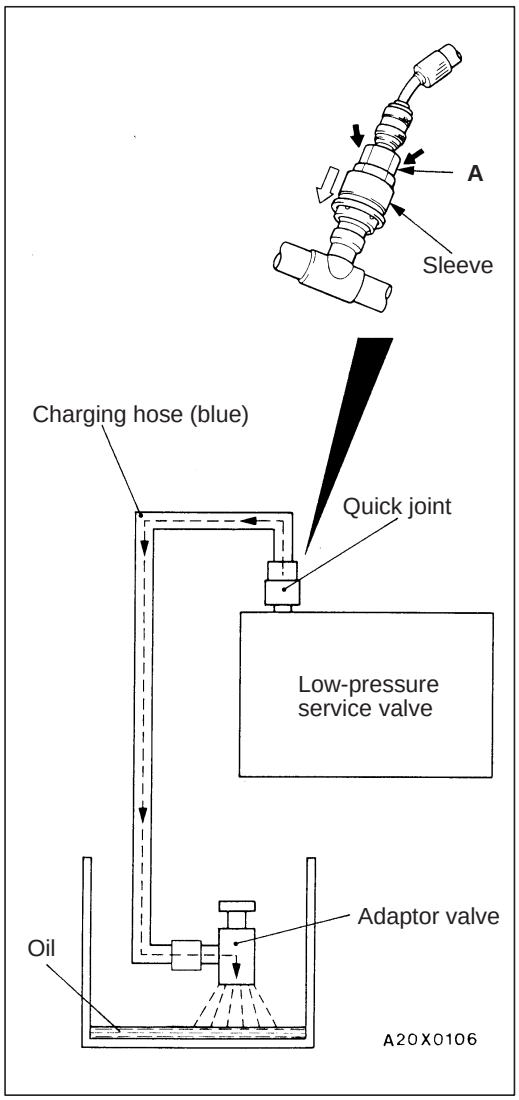


8. Start the engine.
9. Operate the air conditioner and set at the lowest temperature (MAX. COOL).
10. Fix the engine speed at 1,500 r/min.
11. Tighten the handle of the adaptor valve (valve open), and replenish refrigerant while checking the quantity through the sight glass.

    Caution
    If the service can is inverted, liquid refrigerant may be draw into the compressor damaging it by liquid compression. Keep the service can upright to ensure that refrigerant is changed in gas state.

12. After replenishing is completed, turn the handle of the adaptor valve all the way back (valve close), and remove the quick joint.

    NOTE
    When there is remainder of refrigerant in the service can, keep it for next use with the charge value and the valve of the adaptor valve being closed.



DISCHARGING SYSTEM

1. Run the engine at an engine speed of 1,200–1,500 r/min for approximately 5 minutes with the A/C operating to return to the oil.

   NOTE
   Returning the oil will be more effective if it is done while driving.

2. Stop the engine.
3. Connect the charging hose (blue) to the adaptor valve with its handle turned back all the way (valve closed).
4. Connect the quick joint to the charging hose (blue).
5. Install the quick joint to the low-pressure service valve.

   NOTE
   The low-pressure service valve should be connected to the suction hose.

   Caution
   To connect the quick joint, press section "A" firmly against the service valve until a click is heard.
   When connecting, run your hand along the hose while pressing to ensure that there are no bends in the hose.

6. Place the adaptor valve inside the container and discharge the refrigerant by opening the handle gradually so that oil does not gush out.

   NOTE
   Any oil remaining in the container should be returned to the A/C system.

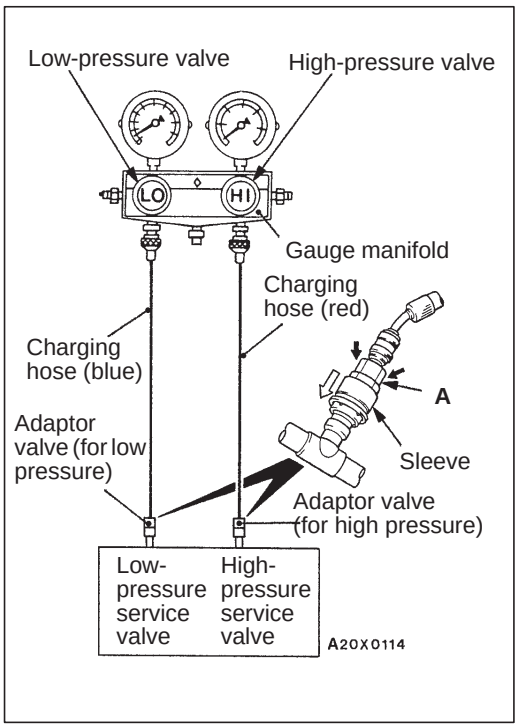
REFILLING OF OIL IN THE A/C SYSTEM

Too little oil will provide inadequate compressor lubrication and cause a compressor failure. Too much oil will increase discharge air temperature.
When a compressor is installed at the factory, it contains 120 mℓ of refrigerant oil. While the A/C system is in operation, the oil is carried through the entire system by the refrigerant. Some of this oil will be trapped and retained in various parts of the system.
When the following system components are changed, it is necessary to add oil to the system to replace the oil being removed with the component.

Compressor oil: ZXL 200PG

Quantity

Condenser: 10 mℓ
Evaporator: 40 mℓ
Suction hose: 6.5 mℓ



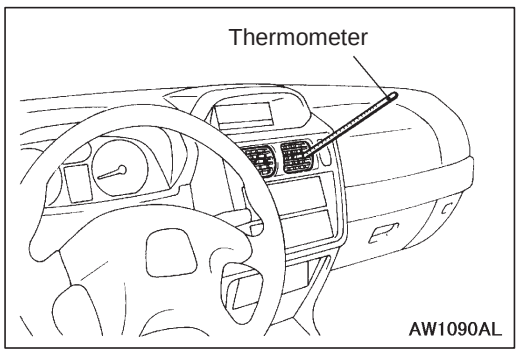
PERFORMANCE TEST

1. The vehicles to be tested should be in a place that is not in direct sunlight.
2. Close the high and low-pressure valve of the gauge manifold.
3. Connect the charging hose (blue) to the low-pressure valve and connect the charging hose (red) to the high-pressure valve of the gauge manifold.
4. Install the quick joint (for low-pressure) to the charging hose (blue), and connect the quick joint (for high-pressure) to the charging hose (red).
5. Connect the quick joint (for low-pressure) to the low-pressure service valve and connect the quick joint (for high-pressure) to the high-pressure service valve.

   NOTE
   The high-pressure service valve is on liquid pipe A and the low-pressure service valve is on the suction hose.

   Caution
   To connect the quick joint, press section "A" firmly against the service valve until a click is heard.
   When connecting, run your hand along the hose while pressing to ensure that there are no bends in the hose.
6. Start the engine.

7. Set the controls to the A/C as follows:
   A/C switch: A/C – ON position
   Mode selection: Face position
   Temperature control: Max. cooling position
   Air selection: Recirculation position
   Blower switch: HI (Fast) position
8. Adjust engine speed to 1,000 r/min with A/C clutch engaged.
9. Engine should be warmed up with doors and windows closed.



10. Insert a thermometer in the center A/C outlet and operate the engine for 20 minutes.
11. Note the discharge air temperature.

    NOTE
    If the clutch cycles, take the reading before the clutch disengages.

Performance Temperature Chart

Garage ambient temperature °C	20	25	35	40
Discharge air temperature °C	2.5 – 4.5	2.5 – 4.5	4.0 – 6.5	6.5 – 9.0
Compressor high-pressure kPa	765 – 960	765 – 960	1,325 – 1,420	1,570 – 1,765
Compressor low-pressure kPa	40 – 135	40 – 135	80 – 175	155 – 255

REFRIGERANT LEAK REPAIR

LOST CHARGE

If the system has lost all charge due to a leak:
1. Evacuate the system. (See procedure.)
2. Charge the system with approximately one pound of refrigerant.
3. Check for leaks.
4. Discharge the system.
5. Repair leaks.
6. Replace receiver drier.

Caution
Replacement filter-drier units must be sealed while in storage. The drier used in these units will saturate water quickly upon exposure to the atmosphere. When installing a drier, have all tools and supplies ready for quick reassembly to avoid keeping the system open any longer than necessary.

7. Evacuate and charge system.

LOW CHARGE

If the system has not lost all of its refrigerant charge; locate and repair all leaks. If it is necessary to increase the system pressure to find the leak (because of an especially low charge) add refrigerant. If it is possible to repair the leak without discharging the refrigerant system, use the procedure for correcting low refrigerant level.

HANDLING TUBING AND FITTINGS

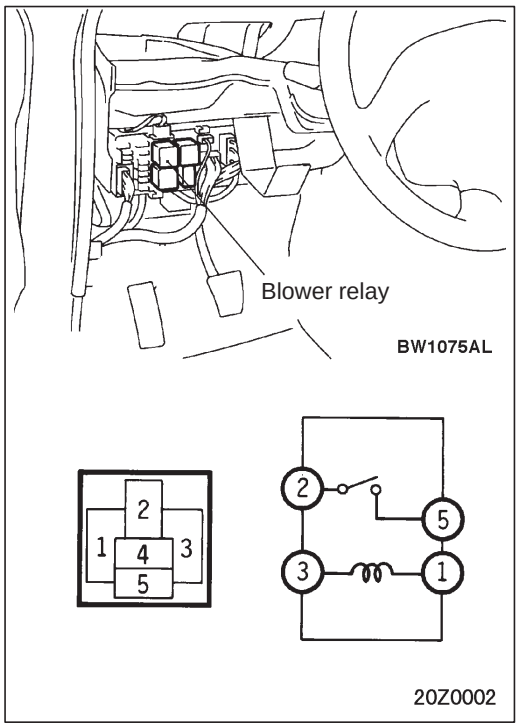
Kinks in the refrigerant tubing or sharp bends in the refrigerant hose lines will greatly reduce the capacity of the entire system. High pressures are produced in the system when it is operating. Extreme care must be exercised to make sure that all connections are pressure tight. Dirt and moisture can enter the system when it is opened for repair or replacement of lines or components. The following precautions must be observed. The system must be completely discharged before opening any fitting of connection in the refrigeration system. Open fittings with caution even after the system has been discharged. If any pressure is noticed as a fitting is loosened, allow trapped pressure to bleed off very slowly.
Never attempt to rebend formed lines to fit. Use the correct line for the installation you are servicing. A good rule for the flexible hose lines is keep the radius of all bends at least 10 times the diameter of the hose.
Sharper bends will reduce the flow of refrigerant. The flexible hose lines should be routed so that they are at least 80 mm from the exhaust manifold. It is good practice to inspect all flexible hose lines at least once a year to make sure they are in good condition and properly routed.
Unified plumbing connections with O-rings, these O-rings are not reusable.

COMPRESSOR NOISE

You must first know the conditions when the noise occurs. These conditions are: weather, vehicle speed, in gear or neutral, engine temperature or any other special conditions.
Noises that develop during A/C operation can often be misleading. For example: what sounds like a failed front bearing or connecting rod, may be caused by loose bolts, nuts, mounting brackets, or a loose clutch assembly. Verify accessory drive belt tension (power steering or alternator).
Improper accessory drive belt tension can cause a misleading noise when the compressor is engaged and little or no noise when the compressor is disengaged.
Drive belts are speed-sensitive. That is, at different engine speeds, and depending upon belt tension, belts can develop unusual noises that are often mistaken for mechanical problems within the compressor.

ADJUSTMENT

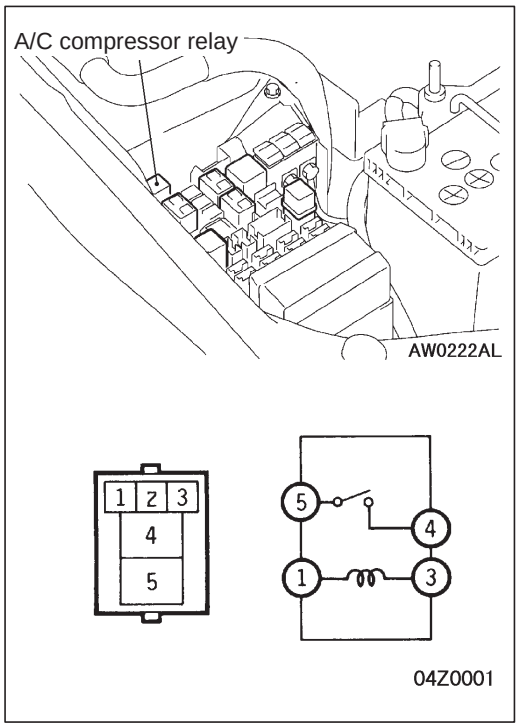
1. Select a quiet area for testing. Duplicate conditions as much as possible. Switch compressor on and off several times to clearly identify compressor noise. To duplicate high ambient conditions (high head pressure), restrict air flow through condenser. Install manifold gauge set to make sure discharge pressure doesn't exceed 2,070 kPa.
2. Tighten all compressor mounting bolts, clutch mounting bolt, and compressor drive belt. Check to assure clutch coil is tight (no rotation or wobble).
3. Check refrigerant hoses for rubbing or interference that can cause unusual noises.
4. Check refrigerant charge. (See "Charging System".)
5. Recheck compressor noise as in Step 1.
6. If noise still exists, loosen compressor mounting bolts and retorque. Repeat Step 1.
7. If noise continues, replace compressor and repeat Step 1.



POWER RELAY CHECK

BLOWER RELAY

Battery voltage	Terminal No.			
	1	3	2	5
Power is not supplied	○	○		
Power is supplied	⊕	⊖	○	○



A/C COMPRESSOR RELAY

Battery voltage	Terminal No.			
	1	3	4	5
Power is not supplied	○	○		
Power is supplied	⊕	⊖	○	○

FAN CONTROL RELAY

Refer to GROUP 14 – Radiator.

IDLE-UP OPERATION CHECK

1. Before inspection and adjustment, set vehicle in the following condition:
   - Engine coolant temperature: 80 – 90°C
   - Lights, electric cooling fan and accessories: Set to OFF
   - Transmission: Neutral (N or P for vehicles with A/T)
   - Steering wheel: Straightforward
2. Check whether or not the idling speed is the standard value.

   Standard value: 600 ± 50 r/min
3. When the A/C is running after turning the A/C switch to ON, and the blower switch to the MH or HI position, check to be sure that the idle speed is at the standard value.

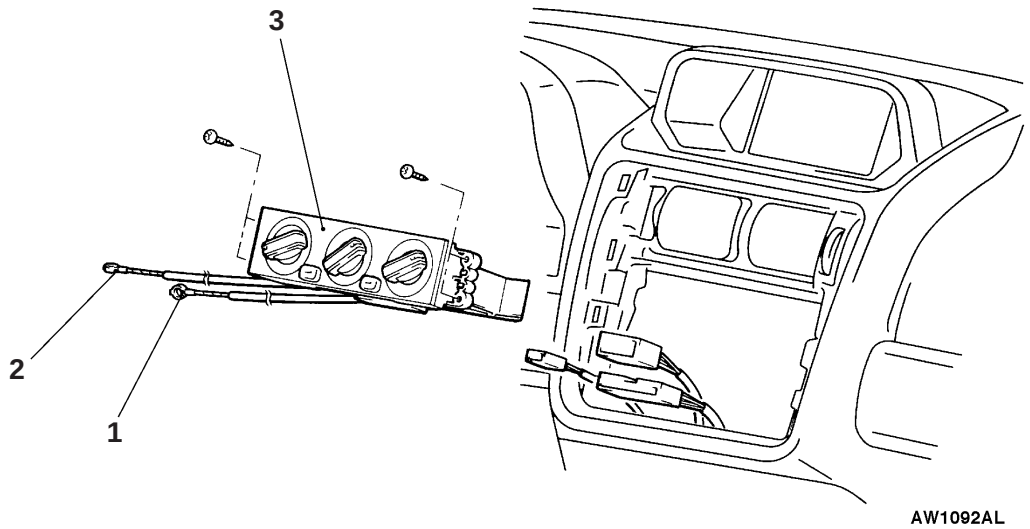
   Standard value: A/C at low load 700 ± 50 r/min
   A/C at high load 800 ± 50 r/min

   NOTE
   There is no necessity to make an adjustment, because the idling speed is automatically adjusted by the ISC system. If, however, there occurs a deviation from the standard value for some reason, check the ISC system. (Refer to GROUP 13A – On-vehicle Service.)

HEATER CONTROL ASSEMBLY AND A/C SWITCH

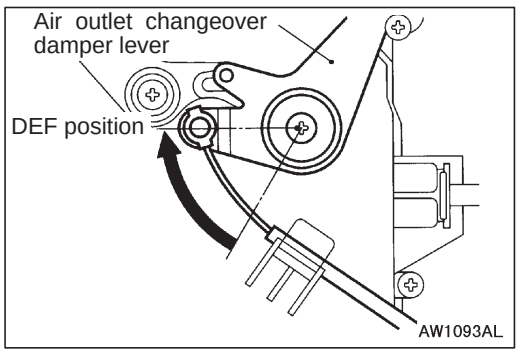
REMOVAL AND INSTALLATION

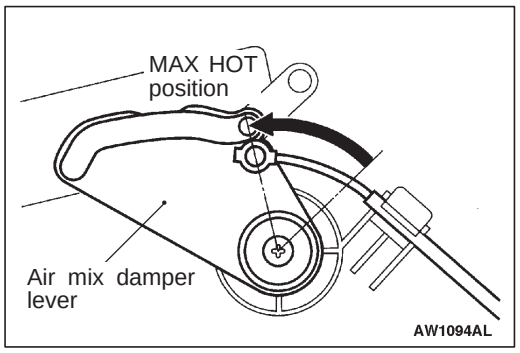
Pre-removal and Post-installation Operation
- Center Air Outlet Assembly, Instrument Under Cover Removal and Installation (Refer to GROUP 52A – Instrument Panel.)
- Radio, Tape Player Removal and Installation (Refer to GROUP 54.)



Removal steps

▶B◀ 1. Air mix damper cable connection
▶A◀ 2. Air outlet changeover damper cable connection
3. Heater control assembly





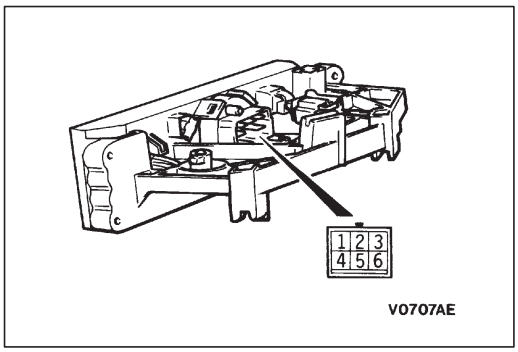
INSTALLATION SERVICE POINTS

▶A◀ AIR OUTLET CHANGEOVER DAMPER CABLE CONNECTION

1. Set the air outlet changeover control knob on the heater control assembly to the DEF position.
2. Set the air outlet changeover damper lever of the heater unit to the DEF position (turn clockwise the damper lever unit it stops), and then connect the cable to the lever.

▶B◀ AIR MIX DAMPER CABLE CONNECTION

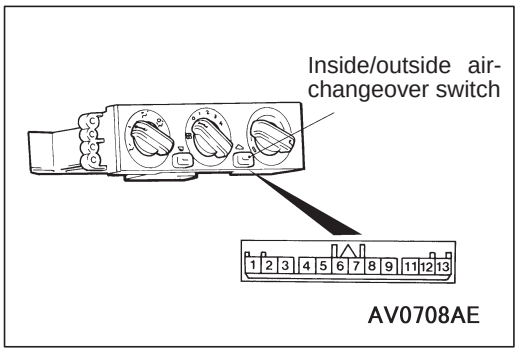
1. Set the temperature control knob on the heater control assembly to the MAX HOT position.
2. Set the air mix damper lever of the heater unit to the MAX HOT position (turn clockwise the damper lever until it stops), and then connect the cable to the lever.



INSPECTION

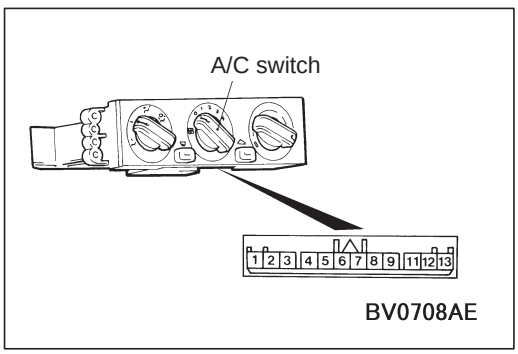
BLOWER SWITCH CONTINUITY CHECK

Switch position	Terminal No.					
	1	2	3	4	5	6
OFF						
• (LO)			○		○	
• (ML)	○		○			
• (MH)			○			○
• (HI)			○	○		



INSIDE/OUTSIDE AIR CHANGEOVER SWITCH CONTINUITY CHECK

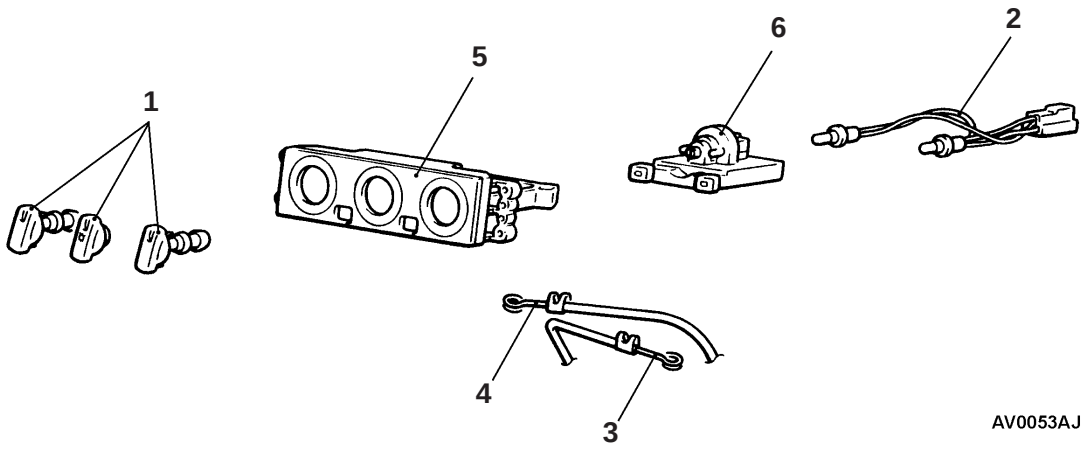
Switch position	Terminal No.						
	1	2	3	IND	4	8	9
RECIRC		○	○	⌒	○		
FRESH	○		○			ILL	



A/C SWITCH CONTINUITY CHECK

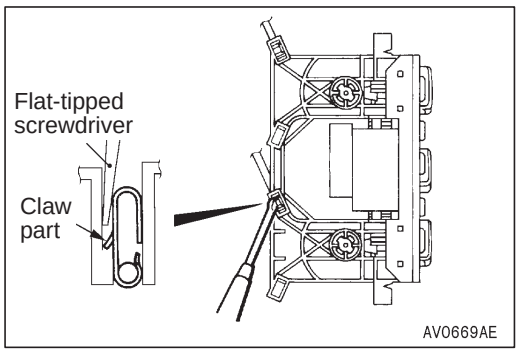
Switch position	Terminal No.					
	5	IND	6	7	8	9
OFF						
ON	○	⌒	○	○	ILL	

DISASSEMBLY AND REASSEMBLY



Disassembly steps

1. Knob assembly
2. Bulb harness
◀A▶ 3. Air outlet changeover damper cable
◀A▶ 4. Air mix damper cable
5. Heater control panel
6. Blower switch assembly



DISASSEMBLY SERVICE POINT

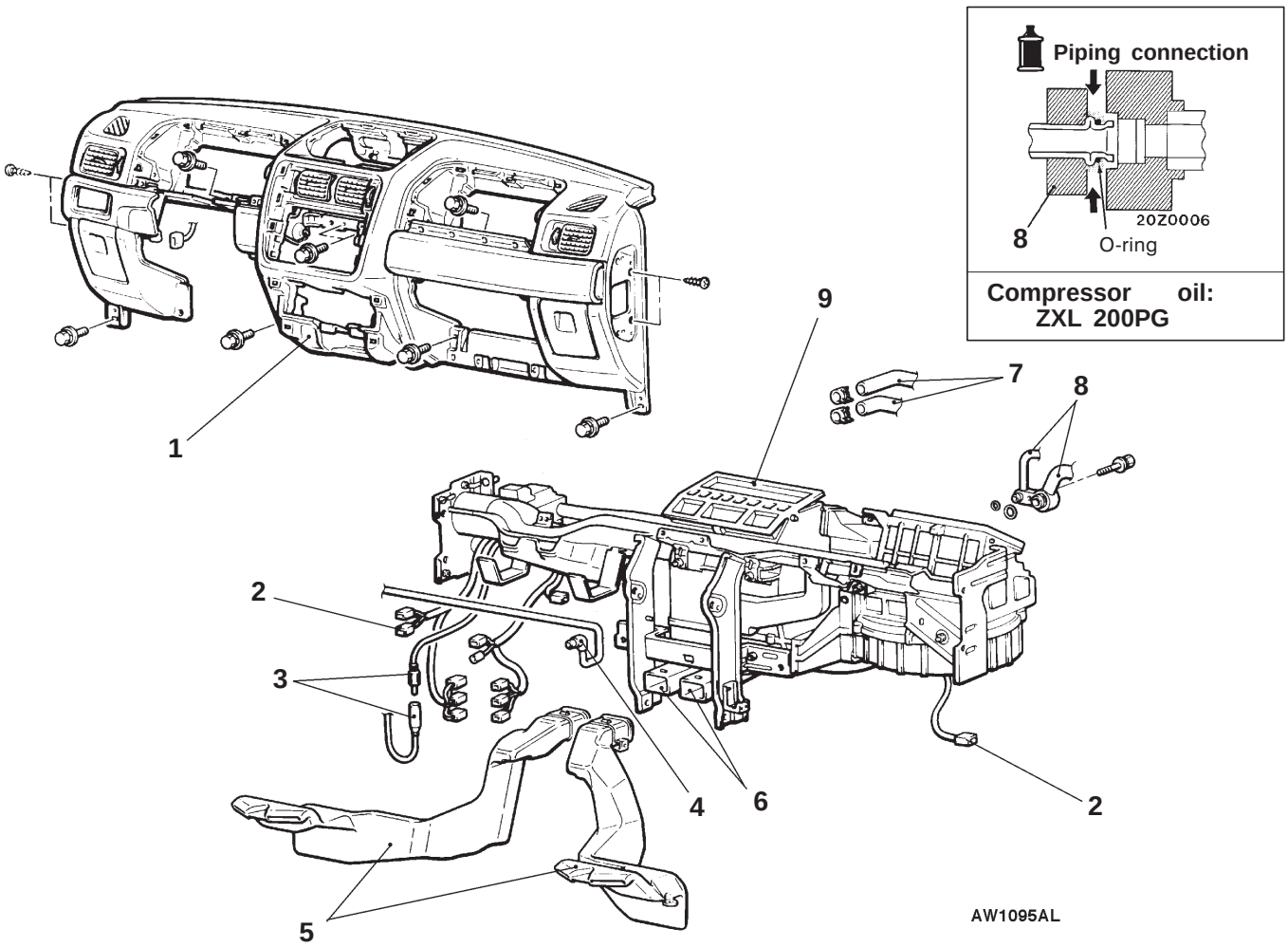
◀A▶ AIR OUTLET CHANGEOVER DAMPER CABLE/AIR MIX DAMPER CABLE REMOVAL

Insert a flat-tipped screwdriver into the control base clip from inner side, and then remove the cable by lifting the claw part of the clip.

HEATER UNIT, BLOWER UNIT, RESISTER AND EVAPORATOR

REMOVAL AND INSTALLATION

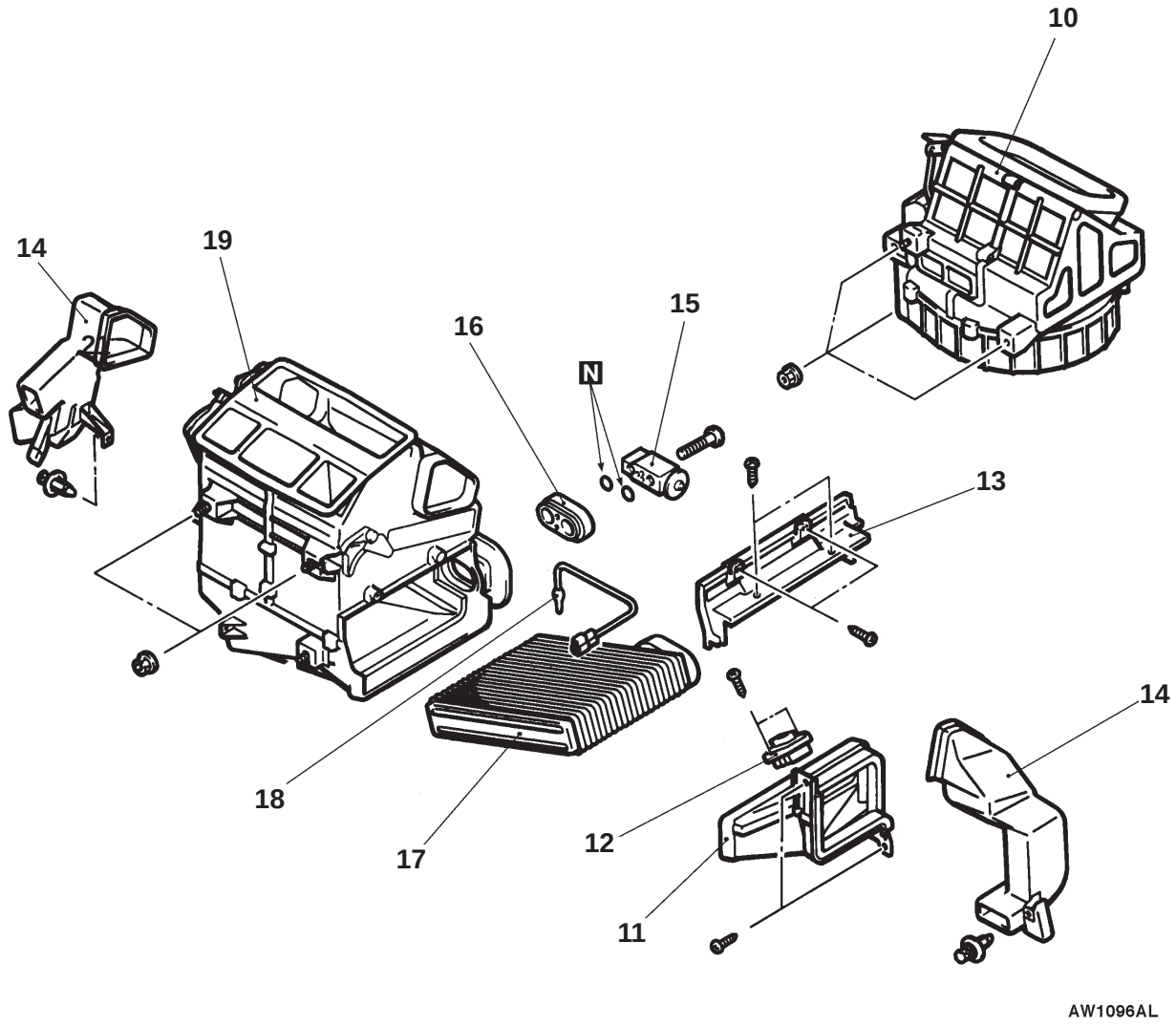
Caution: SRS
When removing and installing the floor console assembly from vehicles equipped with SRS, do not let it bump against the SRS-ECU or the components.



Heater unit and blower unit removal steps

- Discharging and Charging of Refrigerant (Refer to P.55-10.)
- Discharging and Charging of Engine Coolant (Refer to GROUP 14 – On-vehicle Service.)
- Engine Cover Removal and Installation (Refer to GROUP 11 – Engine Assembly.)
- Air Cleaner Assembly Removal and Installation.
- Front Scuff Plate, Rear Scuff Plate, Cowl Side Trim and Glove Box Removal and Installation (Refer to GROUP 52A – Trims.)
- Front Seat Assembly (Driver's side) Removal and Installation (Refer to GROUP 52A – Seat.)
- Shift Lever Assembly Removal and Installation (Refer to GROUP 22 – Transmission Control.) <M/T>
- Selector Lever Assembly Removal and Installation (Refer to GROUP 23 – Transmission Control.) <A/T>
- SRS–ECU (Refer to GROUP 52B.)
- Floor Carpet Removal and Installation.

1. Instrument panel assembly (Refer to GROUP 52A.)
2. Intermediate connector connections
3. Antenna feeder cable connection
4. DIN cable
5. Rear heater duct B
6. Rear heater duct A
7. Heater hoses connection
8. Refrigerant line connection
9. Blower unit, heater unit and deck crossmember assembly

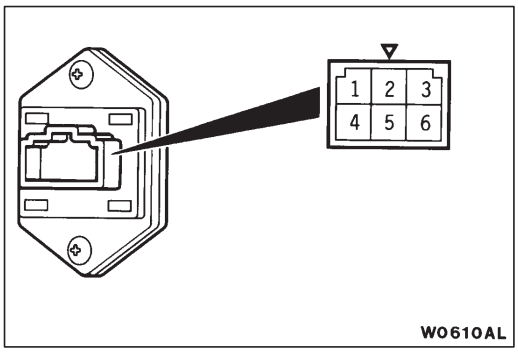


10. Blower unit
14. Foot duct
19. Heater unit assembly

Evaporator and Resister removal steps

- Discharging and Charging of Refrigerant (Refer to P.55-10.)
- Engine Cover (Refer to GROUP 11 – Engine Assembly.)
- Air Cleaner
- Glove Box (Refer to GROUP 52A – Instrument Panel.)

11. Joint duct
12. Resistor
13. Cover
14. Foot duct
8. Refrigerant line connection
15. Expansion valve
16. Joint
17. Evaporator
18. Air thermosensor



INSPECTION

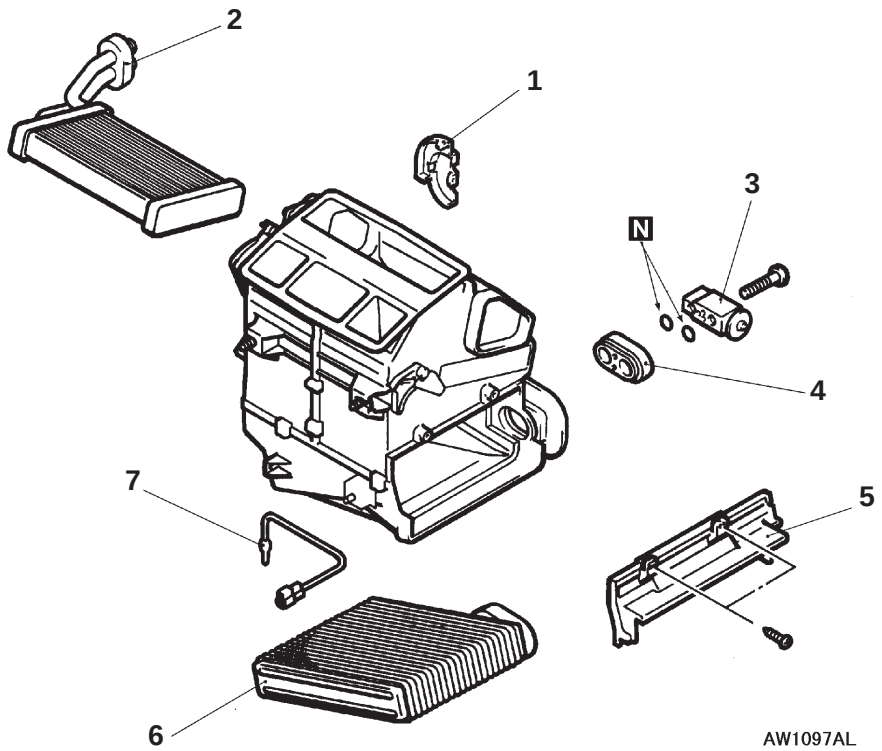
RESISTOR CHECK

Use a circuit tester to measure the resistance between the terminals as indicated below. Check that the measured value is at the standard value.

Standard value:

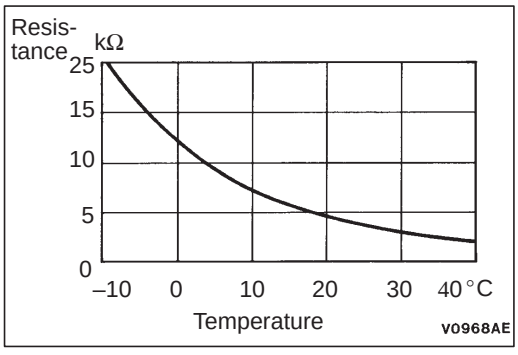
Measurement terminal	Standard value Ω
Between terminals 1 and 3 (LO)	2.3
Between terminals 1 and 6 (ML)	1.0
Between terminals 1 and 4 (MH)	0.3

DISASSEMBLY AND REASSEMBLY



Disassembly steps

1. Cover
2. Heater core
3. Expansion valve
4. Joint
5. Cover
6. Evaporator
7. Air thermosensor



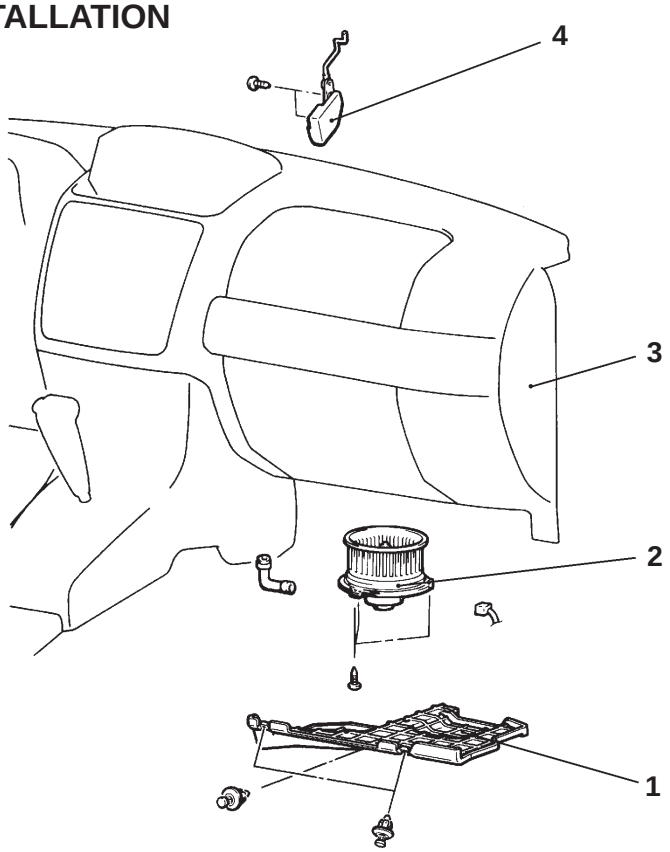
INSPECTION

AIR THERMOSENSOR CHECK

Measure the resistance between terminals under two or more temperature conditions. The resistance should be close to the values shown in the graph.

BLOWER MOTOR ASSEMBLY AND INSIDE/OUTSIDE AIR CHANGEOVER DAMPER MOTOR

REMOVAL AND INSTALLATION

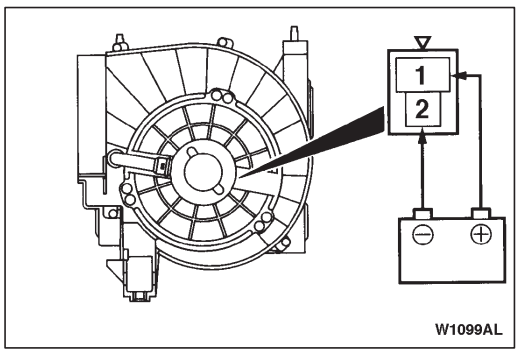


Blower motor assembly removal steps

1. Under cover
2. Blower motor assembly

Inside/outside air changeover damper motor removal steps

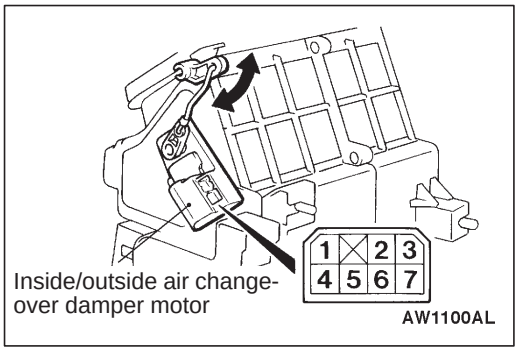
3. Instrument panel (Refer to GROUP 52A)
4. Inside/outside air changeover damper motor



INSPECTION

BLOWER MOTOR CHECK

When battery voltage is applied between the terminals, check that the motor operates. Also, check that there is no abnormal noise.



INSIDE/OUTSIDE CHANGEOVER DAMPER MOTOR CHECK

Battery connection terminal			Lever operation
4	6	7	
⊖		⊕	Moves to the inside air position
	⊖	⊕	Moves to the outside air position

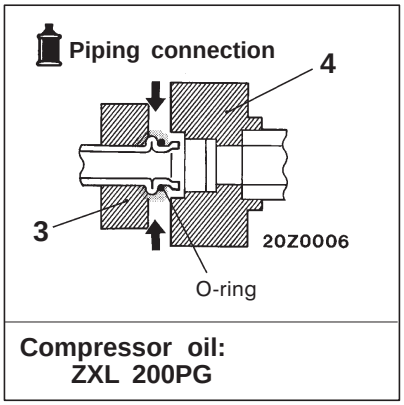
Caution
Cut off the battery voltage when the damper is in the inside air position or outside air position.

COMPRESSOR AND TENSION PULLEY

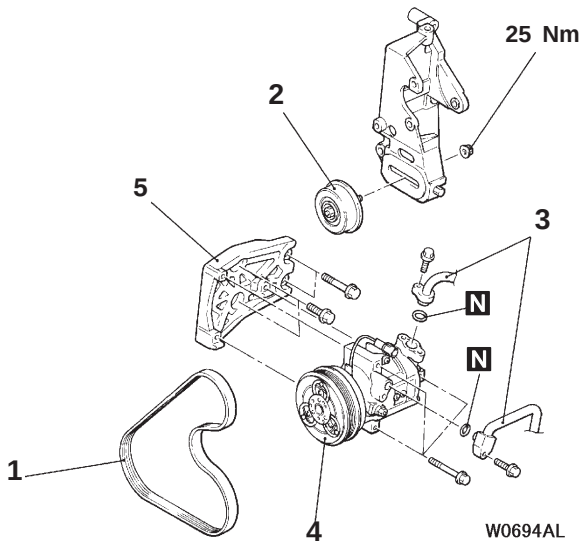
REMOVAL AND INSTALLATION

Pre-removal Operation
Discharging of Refrigerant (Refer to P.55-13.)

Post-installation Operation
- Charging of Refrigerant (Refer to P.55-10.)
- Drive Belt Tension Adjustment (Refer to GROUP 11 – On-vehicle Service.)



Compressor oil:
ZXL 200PG



Removal steps
- Washer tank (Refer to GROUP 51.)

1. Drive belt (Refer to GROUP 11.)
2. Tension pulley

◀A▶ 3. Suction hose and discharge hose connection

- Under cover

◀B▶ ▶A◀ 4. Compressor
5. Compressor bracket

REMOVAL SERVICE POINTS

◀A▶ SUCTION HOSE, DISCHARGE HOSE DISCONNECTION

Plug the nipples of the disconnected hose and compressor to prevent from foreign materials from entering.

Caution
Plug the nipples with material that is not permeable to air as compressor oil and receiver absorb water vapour easily.

◀B▶ COMPRESSOR REMOVAL

When doing this work, be careful not to spill the compressor oil.

INSTALLATION SERVICE POINT

▶A◀ COMPRESSOR INSTALLATION

If a new compressor is installed, first adjust the amount of oil according to the procedures described below, and then install the compressor.

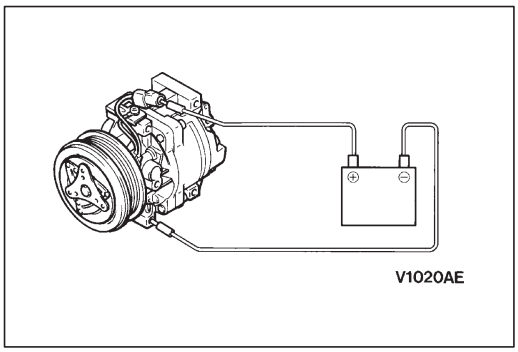
1. Measure the amount (X mℓ) of oil within the removed compressor.
2. Drain (from the new compressor) the amount of oil calculated according to the following formula, and then install the new compressor.
   New compressor oil amount

   <KC 50AG>
   150 mℓ – X mℓ = Y mℓ

   <KC 50G>
   180 mℓ – X mℓ = Y mℓ

   NOTE
   (1) Y mℓ indicates the amount of oil in the refrigerant line, the condenser, the evaporator etc.
   (2) When replacing the following parts at the same time as the compressor, subtract the rated oil amount of the each part from Y mℓ and discharge from the new compressor.

   Quantity
   Evaporator: 40 mℓ
   Condenser: 10 mℓ
   Suction hose: 6.5 mℓ



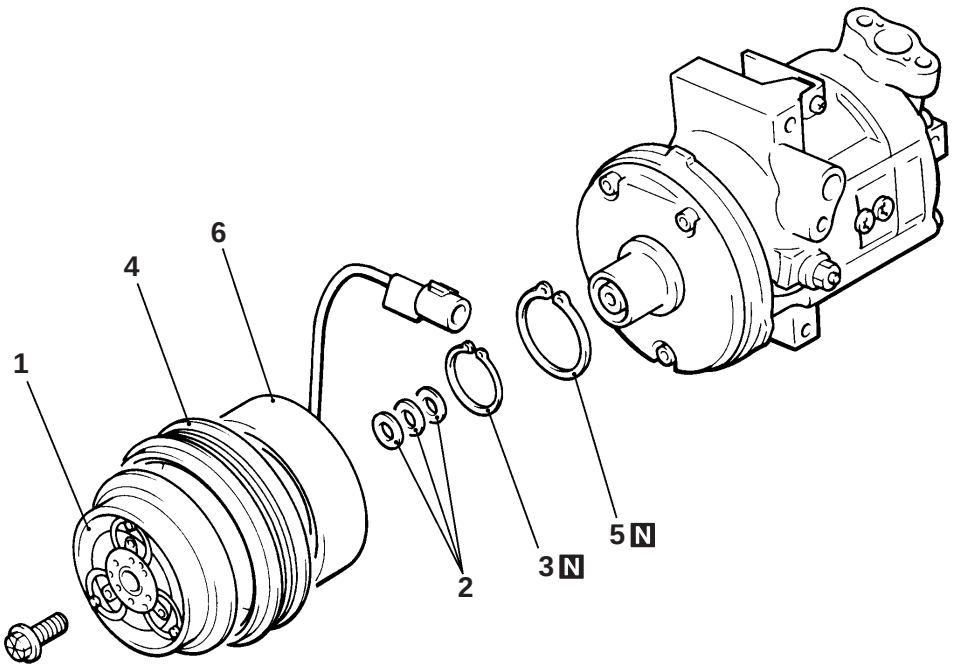
INSPECTION

COMPRESSOR MAGNETIC CLUTCH OPERATION INSPECTION

Connect the battery (+) terminal to the compressor side terminal, and earth the battery (–) terminal to the body of the compressor. The condition is normal if the sound of the magnetic clutch (click) can be heard.

MAGNETIC CLUTCH

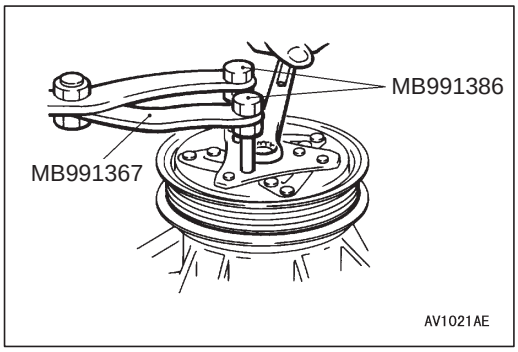
DISASSEMBLY AND REASSEMBLY



Magnetic clutch disassembly steps

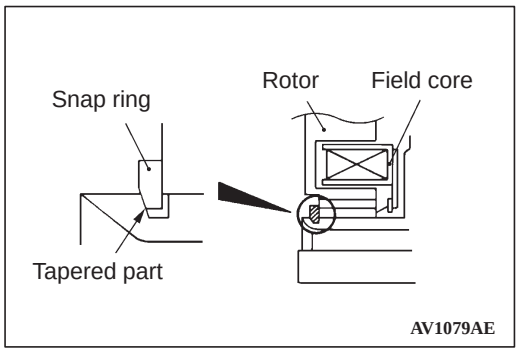
◀A▶ ▶B◀ ● Air gap adjustment
1. Armature plate
2. Shims

▶A◀ 3. Snap ring
4. Rotor
5. Snap ring
6. Clutch coil



DISASSEMBLY SERVICE POINT

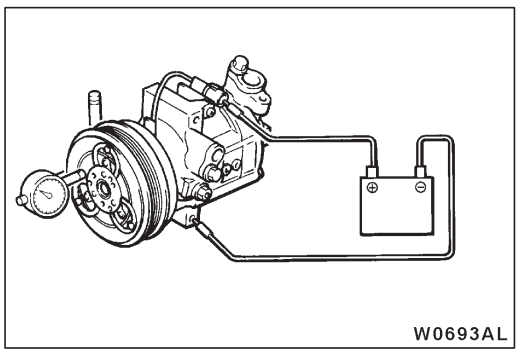
◀A▶ ARMATURE PLATE REMOVAL



REASSEMBLY SERVICE POINTS

▶A◀ SNAP RING INSTALLATION

Install the snap ring so that the tapered surface is at the outer side.



▶B◀ AIR GAP ADJUSTMENT

Check whether or not the air gap of the clutch is within the standard value.

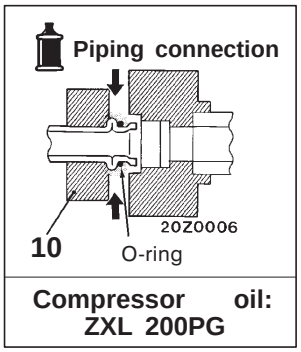
Standard value: 0.25 – 0.55 mm

NOTE
If there is a deviation of the air gap from the standard value, make the necessary adjustment by adjusting the number of shims.

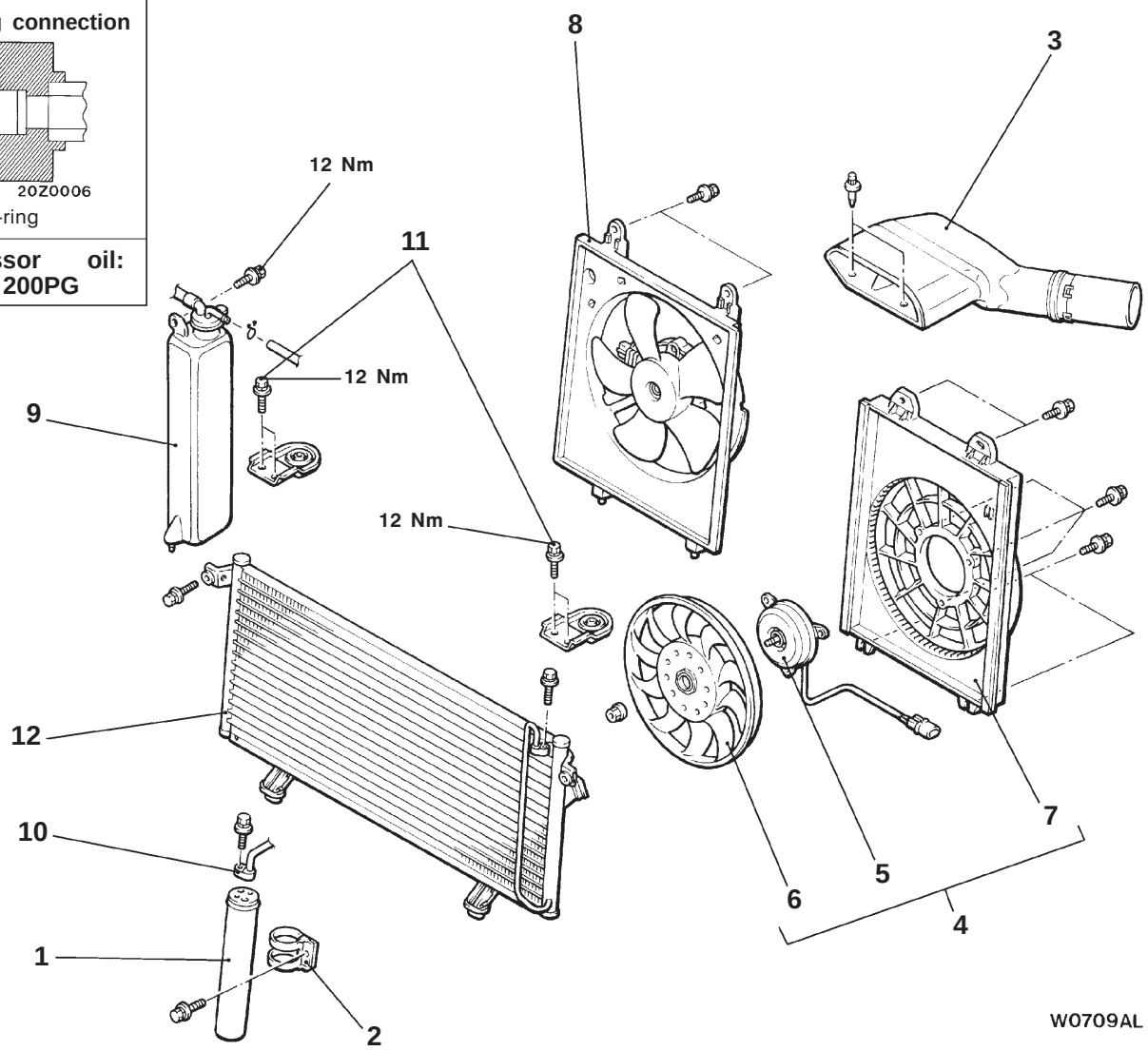
CONDENSER AND CONDENSER FAN MOTOR

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Under Cover Removal and Installation



Compressor oil: ZXL 200PG



Condenser assembly removal steps
- Discharging and charging of refrigerant (Refer to P.55-10.)
- Radiator grille (Refer to GROUP 51.)

▶A◀ 1. Receiver
2. Receiver bracket
3. Air intake duct
4. Fan motor and shroud assembly
8. Radiator fan motor and shroud assembly (Refer to GROUP 14)
9. Condense tank
◀A▶ 10. Discharge hose connection
◀B▶ 11. Radiator mounting bolt
- Engine cover (Refer to GROUP 11A.)

12. Condenser assembly

Condenser fan and motor assembly removal steps

4. Condenser fan motor and shroud assembly
5. Condenser motor and fan controller assembly
6. Condenser fan
7. Condenser fan shroud

REMOVAL SERVICE POINTS

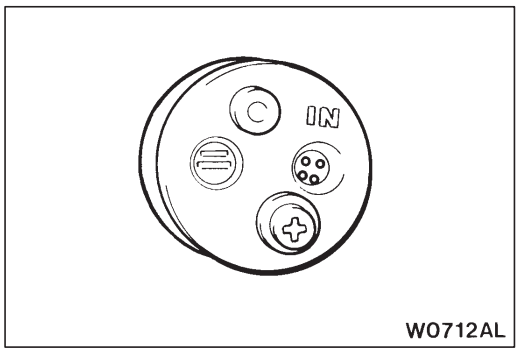
◀A▶ DISCHARGE HOSE DISCONNECTION

Plug the nipples of the disconnected pipe, hose and condenser assembly to prevent foreign materials from entering.

Caution
Plug the nipples with material that is not permeable to air as compressor oil and the receiver absorb water vapour easily.

◀B▶ CONDENSER ASSEMBLY REMOVAL

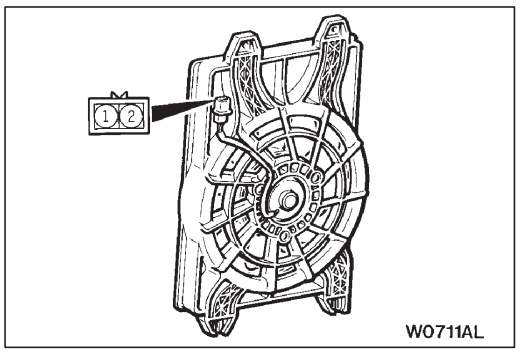
1. Remove the mounting bolts from the front side of the headlamp support member.
2. Disengage the lower part of the radiator, and then move the radiator slightly toward the engine.
3. Raise the condenser assembly to remove from the engine compartment.



INSTALLATION SERVICE POINT

▶A◀ RECEIVER INSTALLATION

Install the pipe coming from the condenser to the side stamped “IN”.



INSPECTION

CONDENSER FAN CHECK

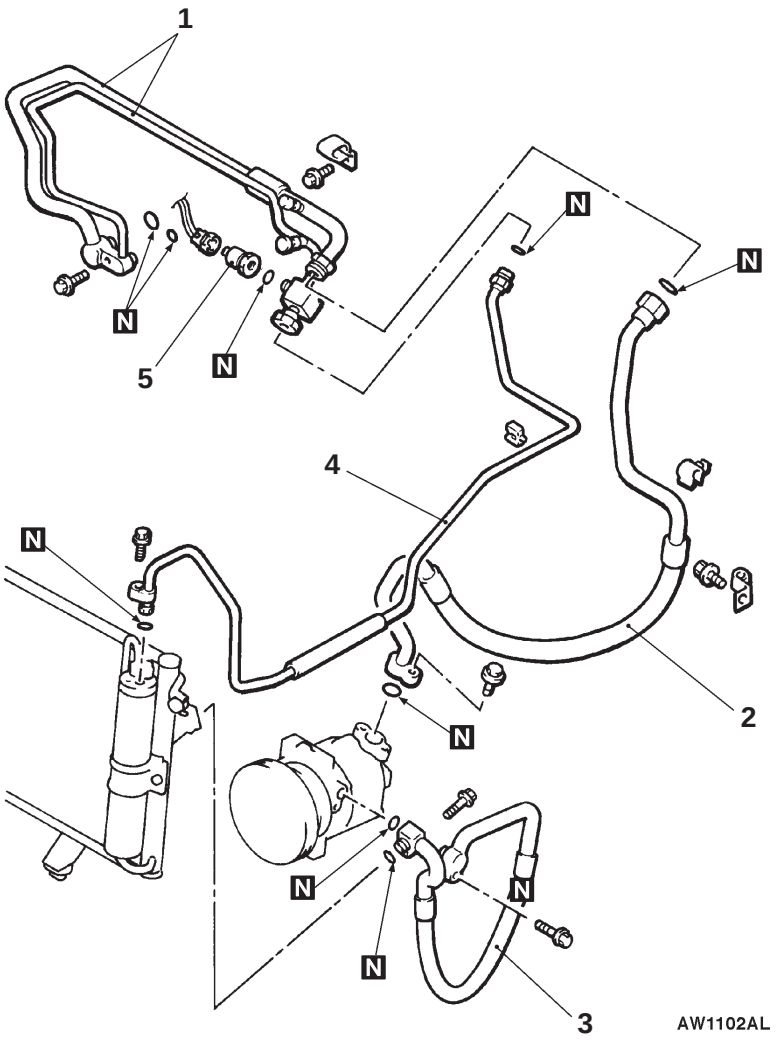
Terminals connected to battery		Condenser fan condition
1	2	
⊕	⊖	Operates

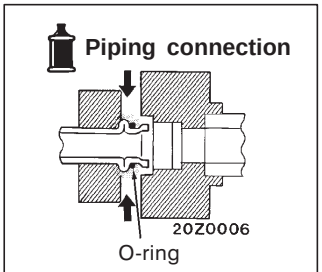
REFRIGERANT LINE

REMOVAL AND INSTALLATION

<L.H. DRIVE VEHICLES>

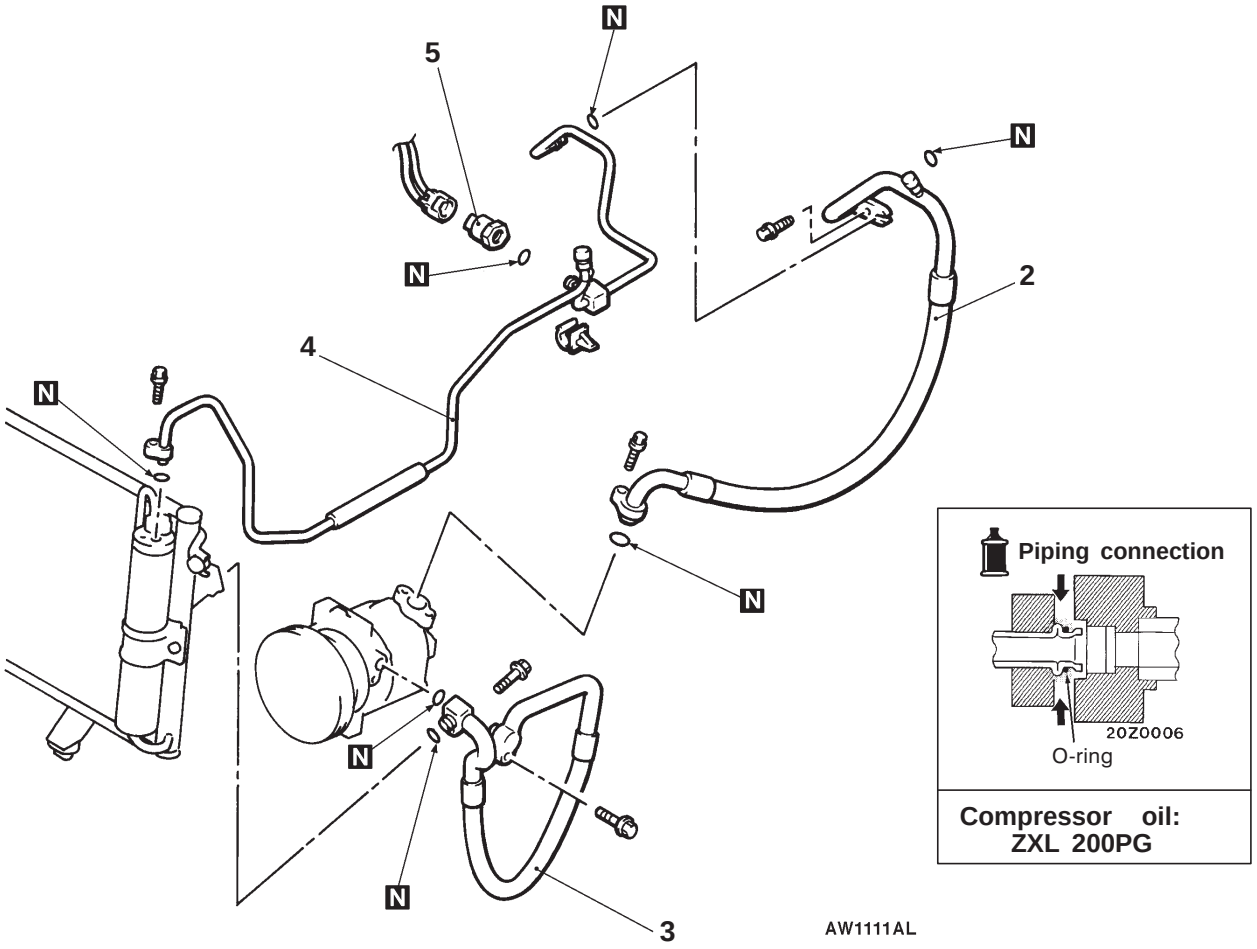
Pre-removal and Post-installation Operation
- Discharging and Charging of Refrigerant (Refer to P.55-10.)
- Engine Cover Removal and Installation (Refer to GROUP 11 – Engine Assembly.)
- Air Cleaner Assembly Removal and Installation.





Compressor oil: ZXL 200PG

<R.H. DRIVE VEHICLES>



Removal steps

◀A▶ 1. Pipe assembly
◀A▶ 2. Suction hose
◀A▶ 3. Discharge hose
4. Liquid pipe
◀A▶ 5. Dual pressure switch

REMOVAL SERVICE POINT

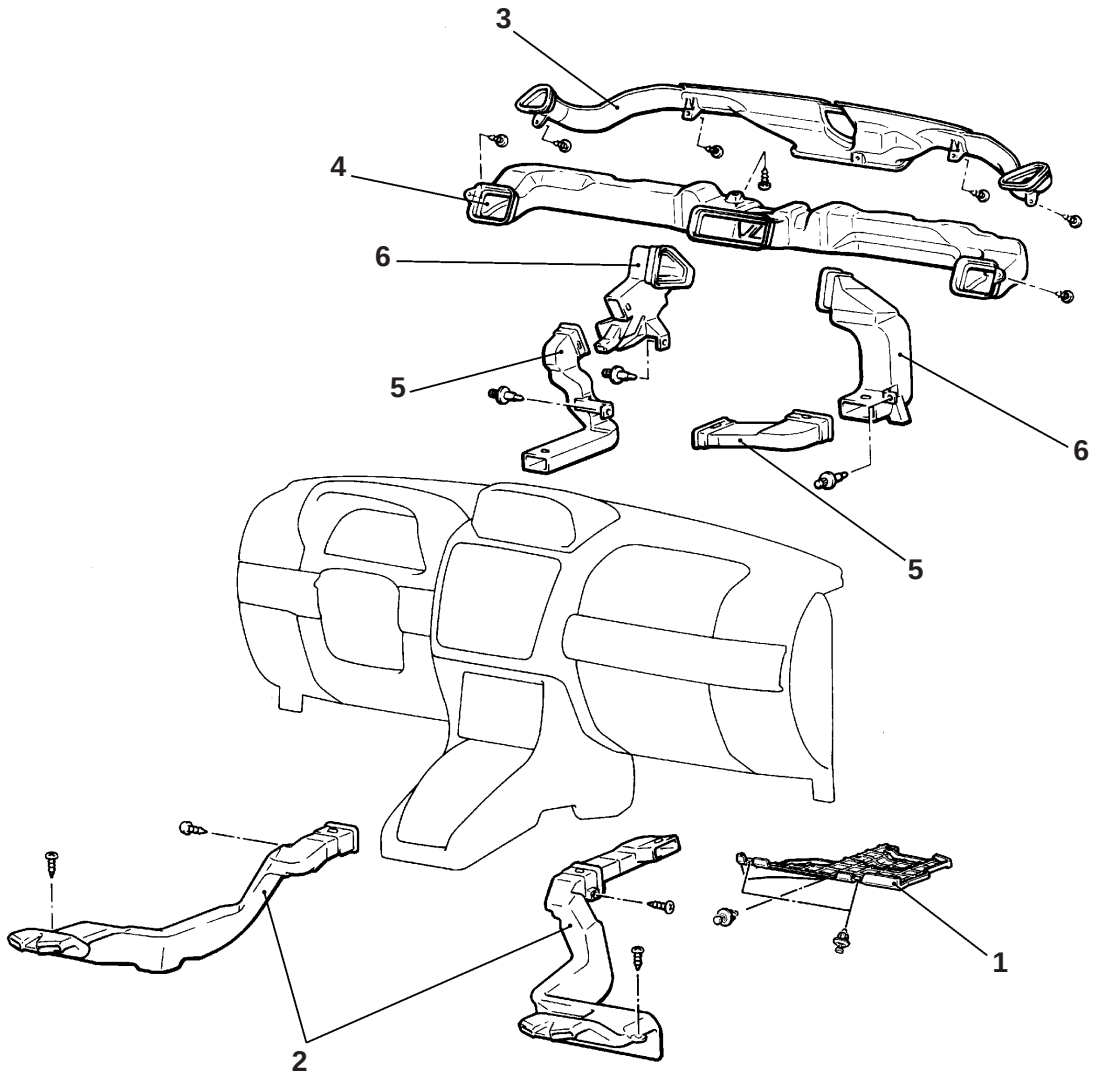
◀A▶ HOSE/PIPE DISCONNECTION

Plug the nipples of the disconnected hose, receiver, evaporator and compressor to prevent foreign materials from entering.

Caution
Plug the nipples with material that is not permeable to air as compressor oil and the receiver absorb water vapour easily.

VENTILATORS

Caution: SRS
When removing and installing the floor console assembly from vehicles equipped with SRS, do not let it bump against the SRS-ECU or the components.



AX0165AL

Rear heater duct B removal steps

- Front scuff plate, cowl side trim and center console assembly (Refer to GROUP 52A – Instrument Panel.)
- Floor console assembly (Refer to GROUP 52A.)
- Front seat (Refer to GROUP 52A.)
- Floor carpet

1. Under cover
2. Rear heater duct B

Defroster nozzle and distribution duct removal steps

- Instrument panel (Refer to GROUP 52A.)

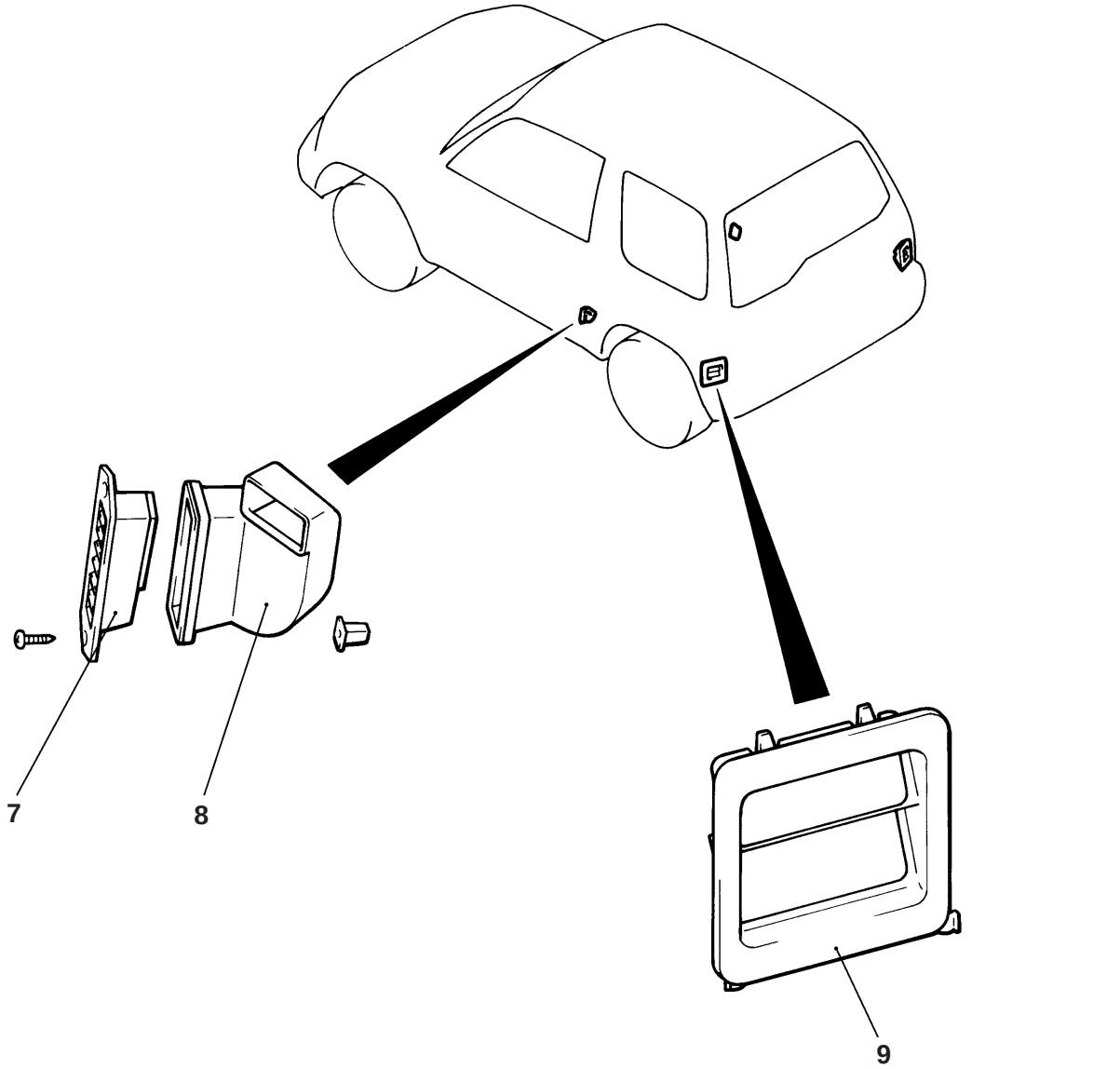
3. Defroster nozzle assembly
4. Distribution duct assembly

Foot distribution duct and rear heater duct A removal steps

- Floor console assembly (Refer to GROUP 52A.)
- Instrument panel assembly (Refer to GROUP 52A.)
- Blower motor (Refer to P.55-25.)

5. Rear heater duct A
6. Foot distribution duct

NOTE
For the center air outlet assembly and the side air outlet assembly, refer to GROUP 52A – Instrument panel.



AW0708AL

7. Rear ventilation garnish
8. Rear ventilation duct A

Rear vent duct removal steps

- Rear bumper (Refer to GROUP 51.)

9. Rear ventilation duct

NOTE
For the front deck garnish, refer to GROUP 51 – Windshield Wiper and Washer.

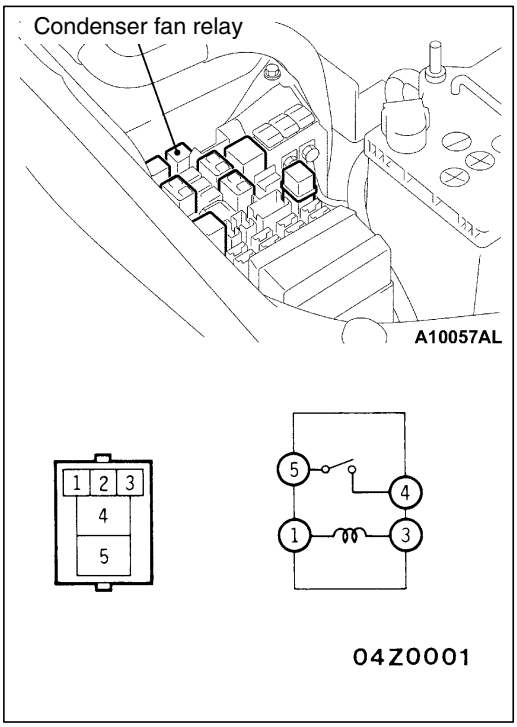
NOTES

GROUP 55
HEATER, AIR CONDITIONER AND VENTILATION

GENERAL

OUTLINE OF CHANGES

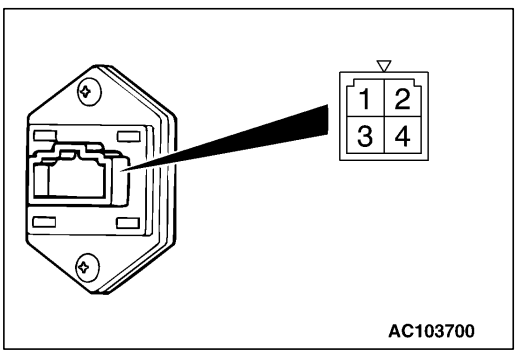
The following service procedure has been established due to the addition of condenser fan relay and the changes on the resister. The other service procedures are the same as before.



ON-VEHICLE SERVICE

CONDENSER FAN RELAY CONTINUITY CHECK

System voltage	Terminal No.			
	1	3	4	5
When current is not supplied	○	○		
When current is supplied	⊖	⊕	○	○



RESISTER

INSPECTION

Resister Check

Standard values:

Test terminals	Standard value (Ω)
HI – LO (between terminals 2 and 4)	2.3
HI – ML (between terminals 2 and 1)	1.0
HI – MH (between terminals 2 and 3)	0.3

NOTES

SERVICE BULLETIN

MITSUBISHI MOTORS

QUALITY INFORMATION ANALYSIS
OVERSEAS SERVICE DEPT. MITSUBISHI MOTORS CORPORATION

SERVICE BULLETIN	**No.:** MSB-01E55-502	
	Date: 2001-09-20	

Subject: AIR CONDITIONING REFRIGERANT PROCEDURE

Group: HEATER, A/C & VENTILATION

Draft No.: 00AL112911

CORRECTION

INTERNATIONAL CAR ADMINISTRATION OFFICE

T.MASAKI-MANAGER
TECHNICAL SERVICE PLANNING

<Model>	<M/Y>
(EC)PAJERO PININ (H60,H70)	00-10
(EC)PAJERO (V60,70)	01-10
(EC)SPACE RUNNER/SPACE WAGON(N60,80,90)	99-10
(EC)COLT/LANCER (CK01,CJ0A)	93-10
(EC)L200(K00T,K30T)	97-10
(EC)L300(P00)	95-10
(EC)L400(PA0-PD0)	95-10
(EC)PAJERO SPORT (K80W,K90W)	99-10
(EC)SPACE STAR	97-10
(EC)CARISMA	
(EC)GALANT(EA0A)	

1. Description:

The air conditioning refrigerant discharging procedure has been changed as described below.

2. Applicable Manuals:

Manual	Pub. No.	Language	Page(s)
'00 PAJERO PININ/MONTERO iO Workshop Manual	CKRE00E1	(English)	55-13
	CKRS00E1	(Spanish)	
	CKRF00E1	(French)	
	CKRG00E1	(German)	
	CKRD00E1	(Dutch)	
'99 SPACE RUNNER/SPACE WAGON Workshop Manual	PWDE9803	(English)	55-13
	PWDS9804	(Spanish)	
	PWDF9805	(French)	
	PWDG9806	(German)	
	PWDD9807	(Dutch)	
	PWDW9808	(Swedish)	
'96 COLT/LANCER Workshop Manual	PWME9511	(English)	55-13
	PWMS9512	(Spanish)	
	PWMF9513	(French)	
	PWMG9514	(German)	
	PWMD9515	(Dutch)	
	PWMW9516	(Swedish)	

Manual	Pub. No.	Language	Page(s)
'99 SPACE STAR Workshop Manual	CMXE99E1	(English)	55-13
	CMXS99E1	(Spanish)	
	CMXF99E1	(French)	
	CMXG99E1	(German)	
	CMXD99E1	(Dutch)	
	CMXW99E1	(Swedish)	
	CMXI99E1	(Italian)	
'97 L200 Workshop Manual	PWTE96E1	(English)	55-12
	PWTS96E1	(Spanish)	
	PWTF96E1	(French)	
	PWTG96E1	(German)	
'99 PAJERO SPORT/MONTERO SPORT Workshop Manual	PWJE9812	(English)	55-14
	PWJS9813	(Spanish)	
	PWJF9814	(French)	
	PWJG9815	(German)	
'96 CARISMA Workshop Manual	PWDE9502	(English)	55-12
	PWDS9503	(Spanish)	
	PWDF9504	(French)	
	PWDG9505	(German)	
	PWDD9506	(Dutch)	
	PWDW9507	(Swedish)	
'95 L400 Workshop Manual	PWWE9410	(English)	55-20
	PWWS9411	(Spanish)	
	PWWF9412	(French)	
	PWWG9413	(German)	
	PWWD9414	(Dutch)	
	PWWW9415	(Swedish)	
'97 GALANT Workshop Manual	PWDE9611	(English)	55-13
	PWDS9612	(Spanish)	
	PWDF9613	(French)	
	PWDG9614	(German)	
	PWDD9615	(Dutch)	
	PWDW9616	(Swedish)	
'93 COLT/LANCER	PWME9117-D	(English)	55-18-4
	PWMS9118-D	(Spanish)	
	PWMF9119-D	(French)	
	PWMG9120-D	(German)	
	PWMD9121-D	(Dutch)	
	PWMW9122-D	(Swedish)	

Manual	Pub. No.	Language	Page(s)
'01 PAJERO/MONTERO Workshop Manual VOL.2	PWJE00001	(English)	55A-14
	PWJS00002	(Spanish)	
'95 L300 Workshop Manual	PWWE9409	(English)	55-67-4

CD-ROM

Manual	Pub. No.	Language	Page(s)
1992-1995 COLT/LANCER Workshop Manual	PWMM0009R	(English)	55-18-4
	PWMM0009R	(French)	
	PWMM0009R	(German)	
	PWMM0009R	(Dutch)	
1996-2001 COLT/LANCER Workshop Manual	PWMH0018R	(English)	55-13
	PWMH0018R	(Spanish)	
	PWMH0018R	(Swedish)	
	PWMK0019R	(French)	
	PWMK0019R	(German)	
	PWMK0019R	(Dutch)	
2001 PAJERO/MONTERO Workshop Manual	PWJT0008R	(English)	55A-14
	PWJT0008R	(Spanish)	
	PWJT0008R	(French)	
	PWJT0008R	(German)	
1999 SPACE RUNNER/SPACE WAGON Workshop Manual	PWDH1816R	(English)	55-13
	PWDH1816R	(Spanish)	
	PWDH1816R	(Swedish)	
	PWDK9817R	(French)	
	PWDK9817R	(German)	
	PWDK9817R	(Dutch)	
2000 PAJERO PININ/MONTERO iO Workshop Manual	CKRX00E1CD	(English)	55-13
	CKRX00E1CD	(Spanish)	
	CKRZ00E1CD	(French)	
	CKRZ00E1CD	(German)	
	CKRZ00E1CD	(Dutch)	
	CKRZ00E1CD	(Italian)	
1999 PAJERO SPORT/MONTERO SPORT Workshop Manual	PWJT9818R	(English)	55-14
	PWJT9818R	(Spanish)	
	PWJT9818R	(French)	
	PWJT9818R	(German)	
1999 SPACE STAR Workshop Manual	CMXX99E1CD	(English)	55-13
	CMXX99E1CD	(Spanish)	
	CMXX99E1CD	(Swedish)	
	CMXZ99E1CD	(French)	
	CMXZ99E1CD	(German)	
	CMXZ99E1CD	(Dutch)	
	CMXZ99E1CD	(Italian)	

3. Details:

<Correct>

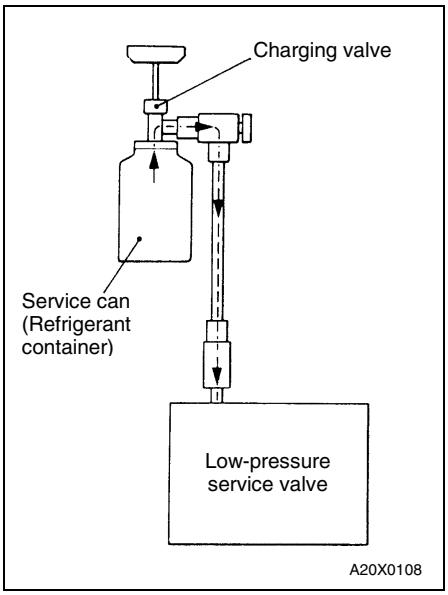
DISCHARGING SYSTEM

Use the refrigerant recovery unit to discharge refrigerant gas from the system.

NOTE

Refer to the Refrigerant Recovery and Recycling Unit Instruction Manual for operation of the unit.

HEATER, AIR CONDITIONER AND VENTILATION –On-vehicle Service



8. Start the engine.
9. Operate the air conditioner and set at the lowest temperature (MAX. COOL).
10. Fix the engine speed at 1,500 r/min.
11. Tighten the handle of the adaptor valve (valve open), and replenish refrigerant while checking the quantity through the sight glass.

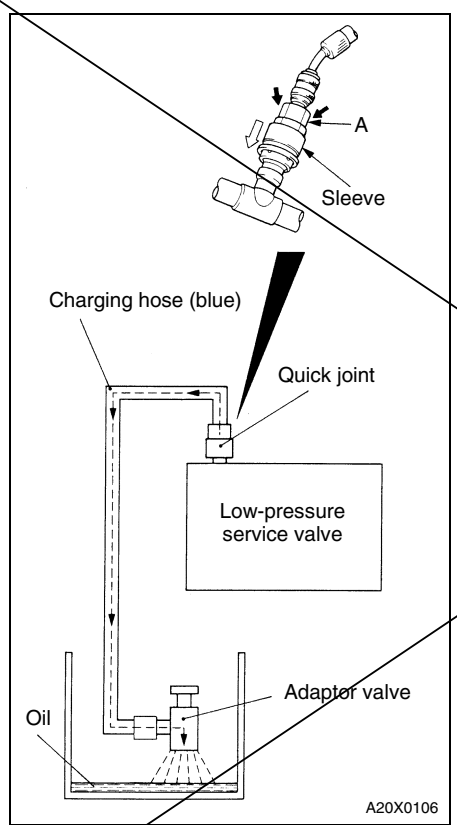
    Caution

    If the service can is inverted, liquid refrigerant may be draw into the compressor damaging it by liquid compression. Keep the service can upright to ensure the refrigerant is changed in gas state.
12. After replenishing is completed, turn the handle of the adaptor valve all the way back (valve close), and remove the quick joint.

    NOTE

    When there is remainder of refrigerant in the service can, keep it for next use with the charge value and the valve of the adaptor valve being closed.

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DISCHARGING SYSTEM

1. Run the engine at an engine speed of 1,200-1,500 r/min for approximately 5 minutes with the A/C operating to return to the oil.

   NOTE

   Returning the oil will be more effective if it is done while driving.
2. Stop the engine
3. Connect the charging hose (blue) to the adaptor valve with its handle turned back all the way (valve closed).
4. Connect the quick joint to the charging hose (blue).
5. Install the quick joint to the low-pressure service valve.

   NOTE

   The low-pressure service valve should be connected to the suction hose.

   Caution

   To connect the quick joint, press section "A" firmly against the service valve until a click is heard. When connecting, run your hand along the horse while pressing to ensure that there are no bends in the hose.
6. Place the adaptor valve inside the container and discharge the refrigerant by opening the handle gradually so that oil does not gush out.

   NOTE

   Any oil remaining in the container should be returned to the A/C system.