

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.

General	00
Engine	11
Engine Lubrication	12
Fuel	13
Engine Cooling	14
Intake and Exhaust	15
Engine Electrical	16
Engine and Emission Control	17
Clutch	21
Manual Transmission	22
Automatic Transmission	23
Propeller Shaft	25
Front Axle	26
Rear Axle	27
Wheel and Tyre	31
Power Plant Mount	32
Front Suspension	33
Rear Suspension	34
Service Brakes	35
Parking Brakes	36
Steering	37
Body	42
Exterior	51
Interior and Supplemental Restraint System (SRS)	52
Chassis Electrical	54
Heater, Air Conditioner and Ventilation	55

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.

GENERAL

CONTENTS

HOW TO USE THIS MANUAL	2	Models	13
Scope of Maintenance, Repair and Servicing		Model Code	13
Explanations	2	Chassis Number	14
Definition of Terms	2	Engine Model Number	15
Indication of Tightening Torque	2		
Model Indications	3	MAJOR SPECIFICATIONS	15
Explanation of Manual Contents	4	PRECAUTIONS BEFORE SERVICE	17
HOW TO USE		SUPPLEMENTAL RESTRAINT SYSTEM	
 TROUBLESHOOTING/INSPECTION SERVICE		(SRS)	21
 POINTS	6	SUPPORT LOCATIONS FOR LIFTING AND	
Troubleshooting Contents	6	 JACKING	25
Diagnosis Function	7	Support Positions for a Garage Jack and Axle	
How to Use the Inspection Procedures	8	Stands	25
Connector Measurement Service Points	9	Support Positions for a Single-Post Lift or	
Connector Inspection	10	Double-Post Lift	26
Inspection Service Points for a Blown Fuse	11	Support Positions and Support Method for an	
Points to Note for Intermittent Malfunctions	11	H-Bar Lift	27
VEHICLE IDENTIFICATION	12	STANDARD PART/TIGHTENING-TORQUE	
Vehicle Information Code Plate	12	 TABLE	29

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 $\pm 10\%$ except the following cases when the upper and lower limits of tightening torque are given.

- (1) The tolerance of the basic value is within $\pm 10\%$.
- (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.



: Indicates that there are essential points for removal or disassembly.



: 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
REMOVAL AND INSTALLATION 120000039

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.)

Sealant: 3M ATD Part No. 8661 or equivalent

Oil pump seal kit

Oil pump cartridge kit

Removal steps

- Lower shaft assembly and gear box connecting bolt
- Split pin
- Connection for tie-rod end and knuckle
- Connection for return tube
- Connection for pressure tube
- Clamp
- Gear box assembly

Removal Service Points

◀A▶ TIE-ROD END DISCONNECTION

Caution

- Using the special tool, loosen the tie rod end mounting nut. Only loosen the nut; do not remove it from the ball joint.
- 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

Fitting hose

Vacuum switch

Sealant: 3M ATD Part No. 8663 or equivalent

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

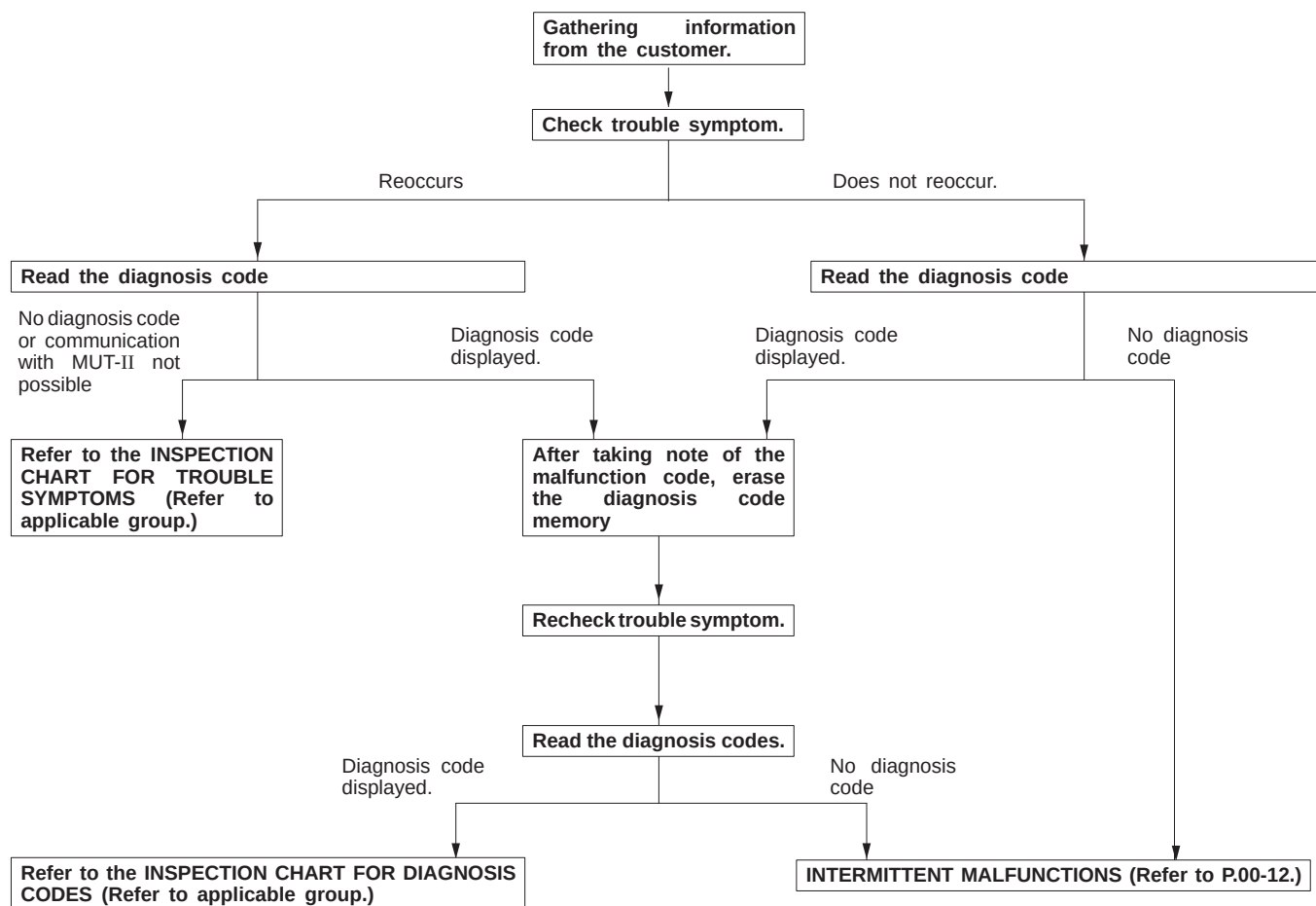
Troubleshooting of electronic control systems for which the MUT-II can be used follows the basic outline described below. Furthermore, even in systems for which the MUT-II cannot be used, part of these systems still follow this outline.

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

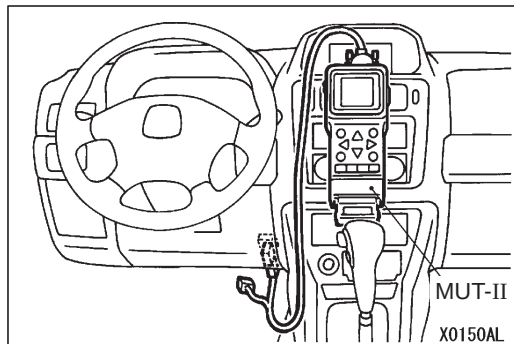
Inspection items and normal judgement values have been provided in this chart as reference information.

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

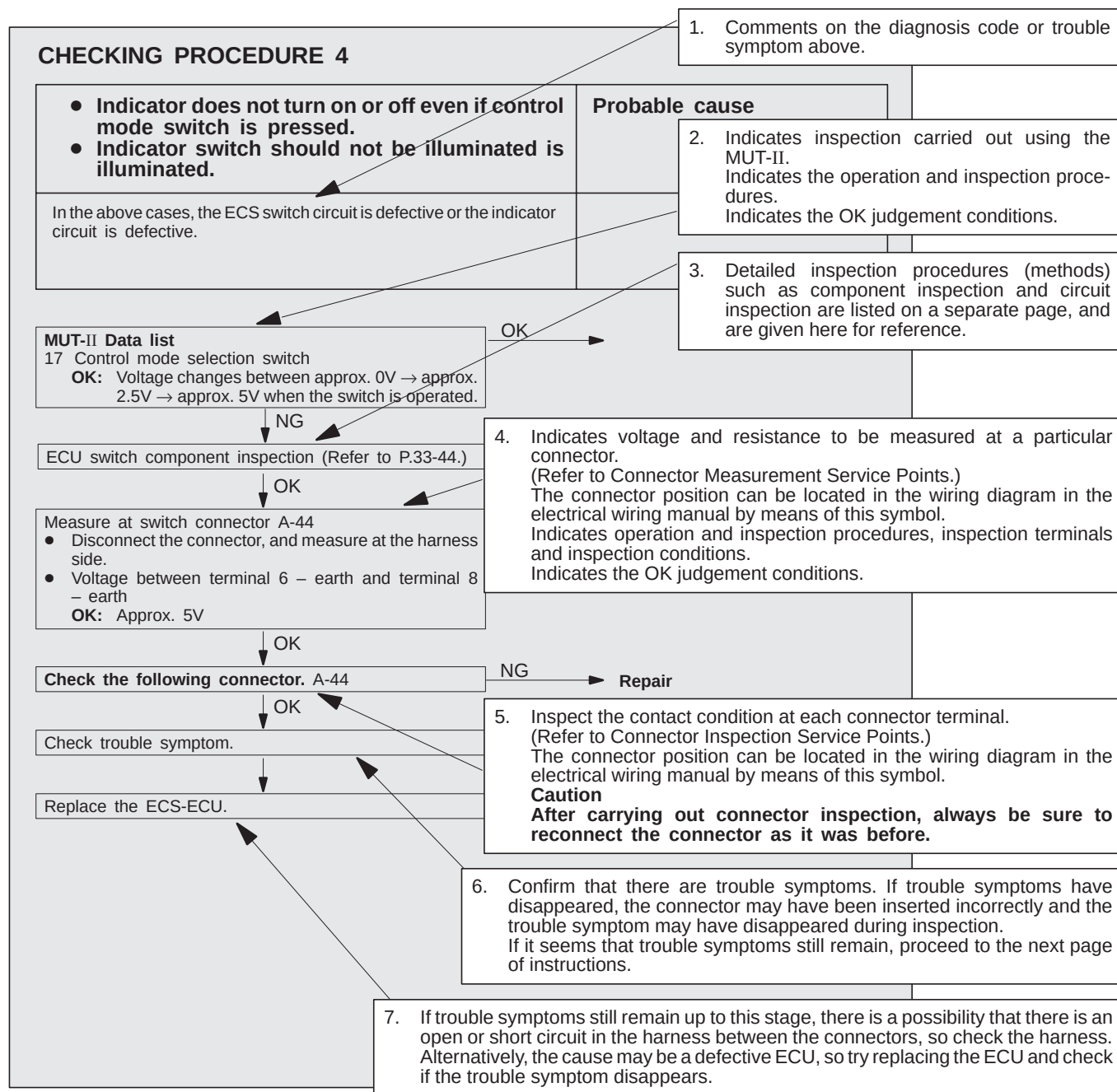
Turn the ignition switch to the LOCK (OFF) position before connecting or disconnecting the MUT-II.

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

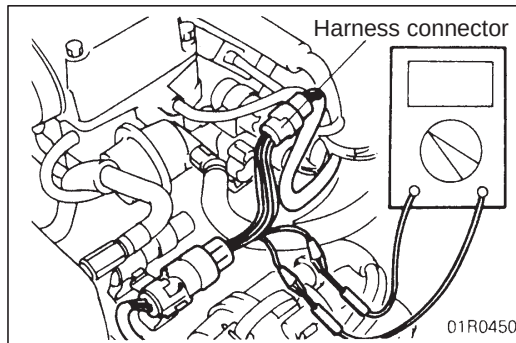
Check for an open or short circuit in the harness between the terminals which were defective according to the connector measurements. Carry out this inspection while referring to the electrical wiring manual. Here, “Check harness between power supply and terminal xx” also includes checking for blown 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

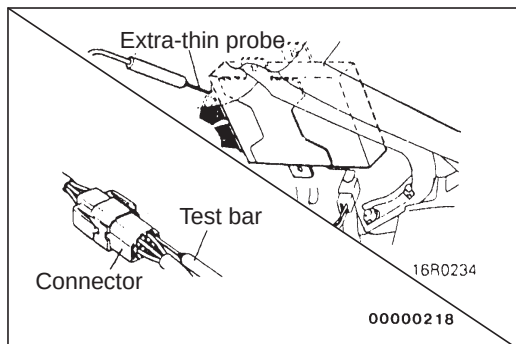
If the trouble symptoms have not disappeared even after replacing the ECU, repeat the inspection procedure from the beginning.

CONNECTOR MEASUREMENT SERVICE POINTS

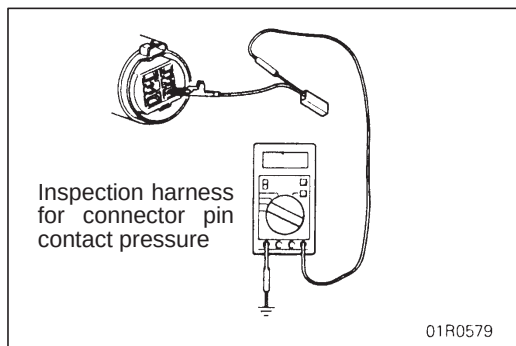
Turn the ignition switch to the LOCK (OFF) position when connecting or disconnecting the connectors and turn the ignition switch ON when measuring, unless otherwise instructed.

**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.

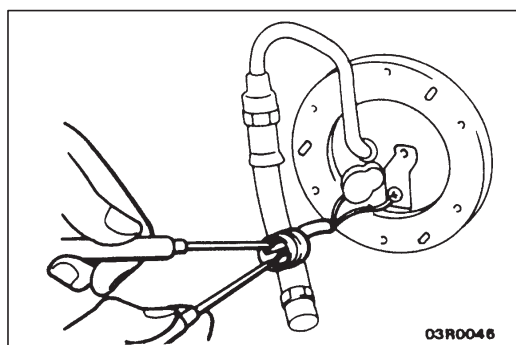
**Ordinary (non-waterproof) Connectors**

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.

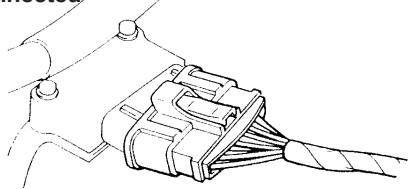
**<When Inspecting a Male Pin>**

Touch the pin directly with the test bar.

Caution

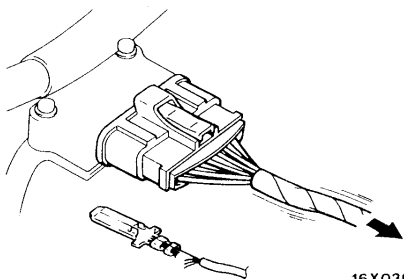
At this time, be careful not to short the connector pins with the test bars. To do so may damage the circuits inside the ECU.

Connector disconnected or improperly connected



16S0256

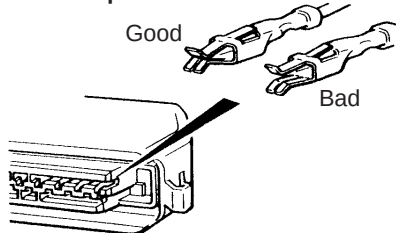
Defective connector contact



Harness wire breakage at terminal section

16X0369

Low contact pressure

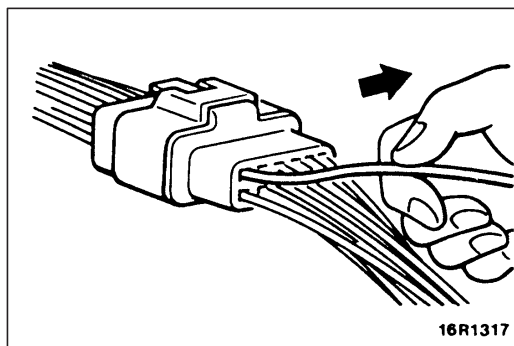


16S0254
00000219

CONNECTOR INSPECTION

VISUAL INSPECTION

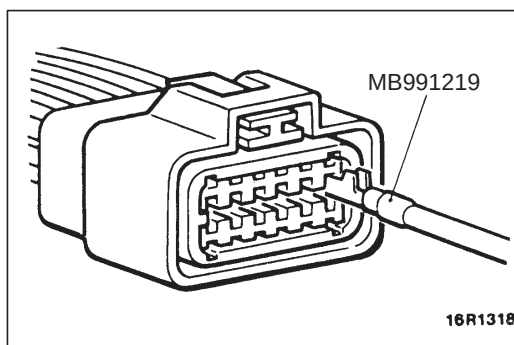
- Connector is disconnected or improperly connected
- Connector pins are pulled out
- Due to harness tension at terminal section
- Low contact pressure between male and female terminals
- Low connection pressure due to rusted terminals or foreign matter lodged in terminals



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.

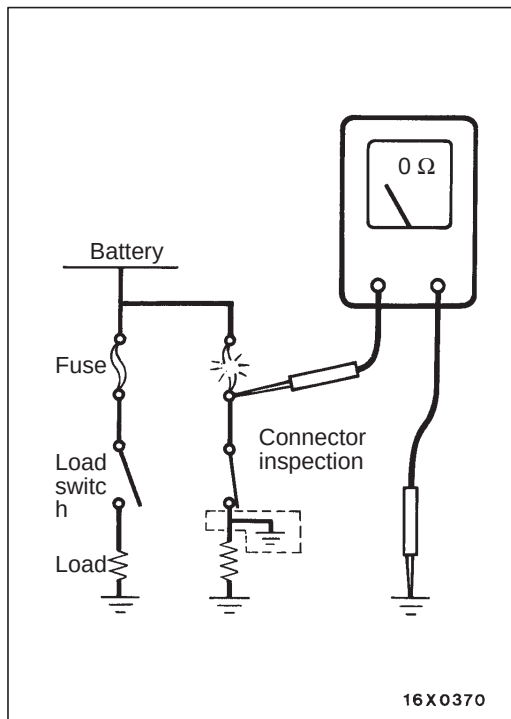


MB991219

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)

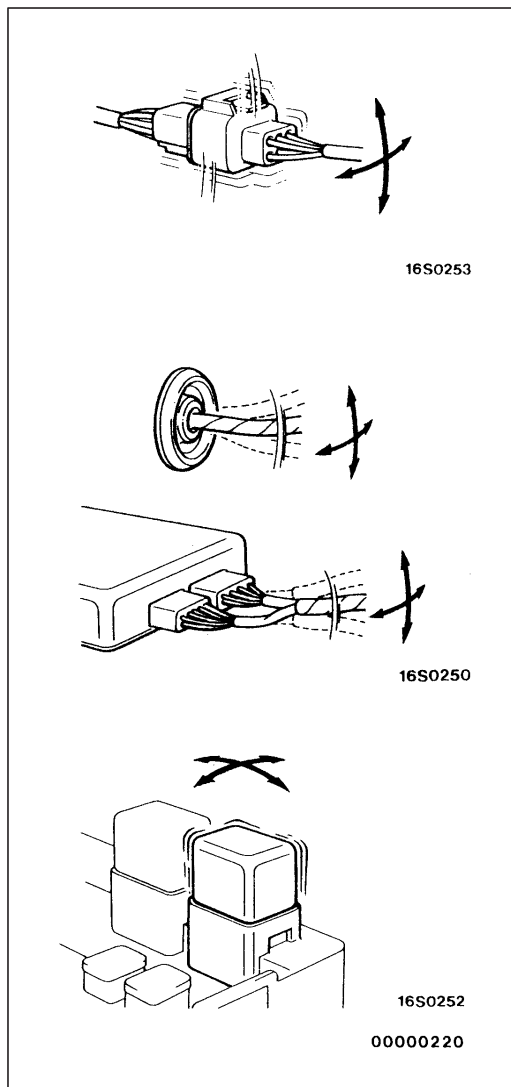


INSPECTION SERVICE POINTS FOR A BLOWN FUSE

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 $0\ \Omega$ at this time, there is a short somewhere between these switches and the load. If the resistance is not $0\ \Omega$, 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

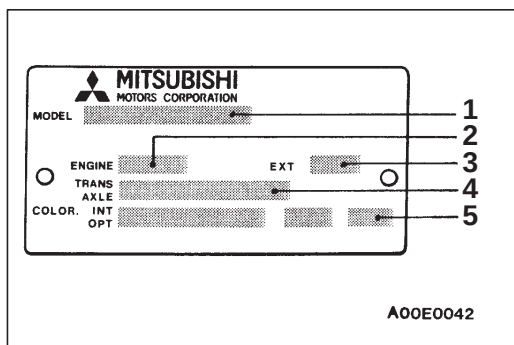
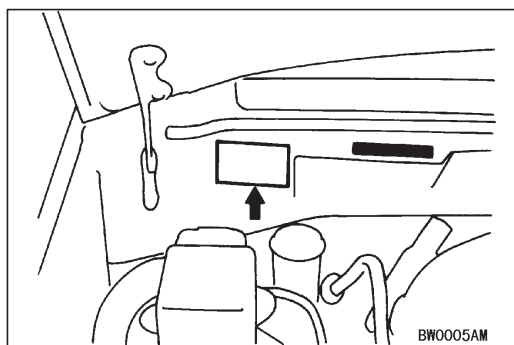
Intermittent malfunctions often occur under certain conditions, and if these conditions can be ascertained, determining the cause becomes simple. In order to ascertain the conditions under which an intermittent malfunction occurs, first ask the customer for details about the driving conditions, weather 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

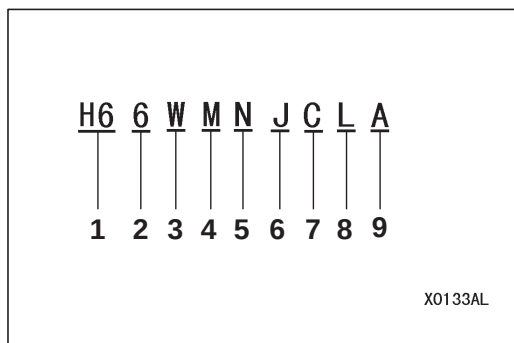
The plate shows model code, engine model, transmission model, and body colour code.

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

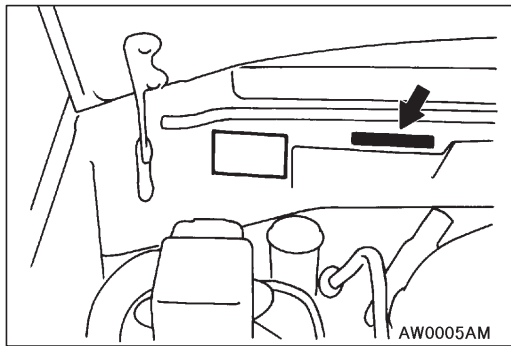
For monotone colour vehicles, the body colour code shall be indicated. For two-tone or three-way two-tone colour vehicles, each colour code only shall be indicated in series.

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**

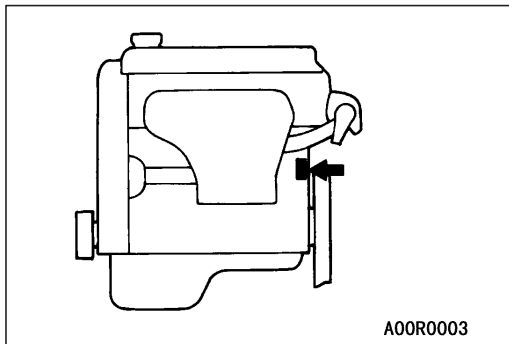
The chassis number is stamped on the toeboard inside the engine compartment.

* J M P 0 N H6 6 W Y X 000001 *

1 2 3 4 5 6 7 8 9

X0152AL

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	—	—

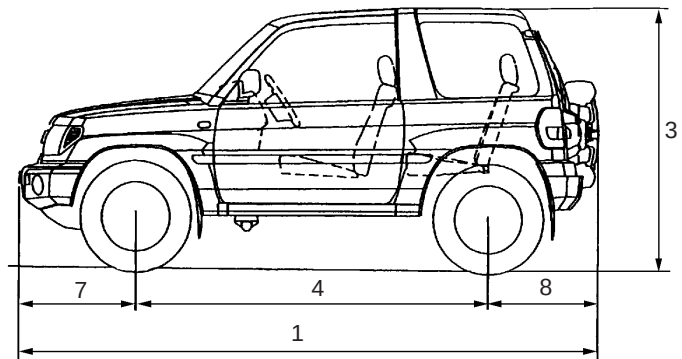
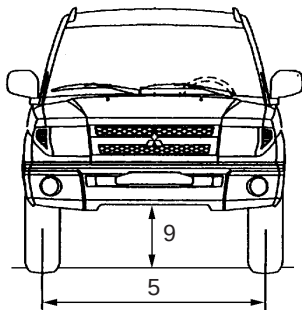
**ENGINE MODEL NUMBER**

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

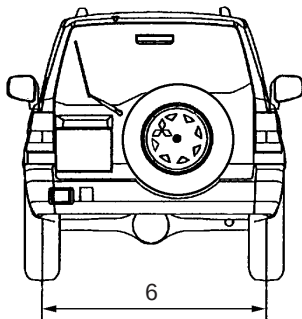
Engine model	Engine displacement ml
4G93	1,834

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

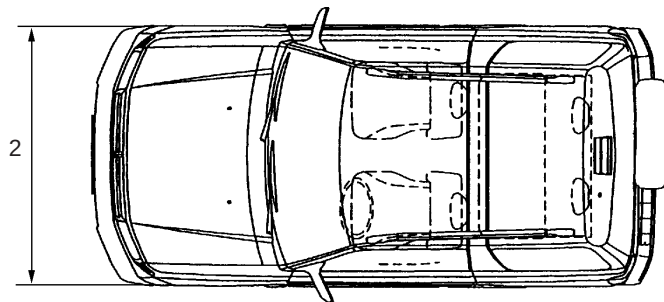
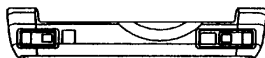
Engine serial number	AA0201 to YY9999

MAJOR SPECIFICATIONS

<L.H. drive vehicles>



<R.H. drive vehicles>



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

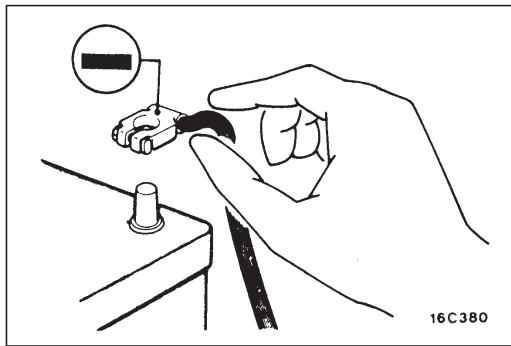
*2: Vehicles with roof rails

*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

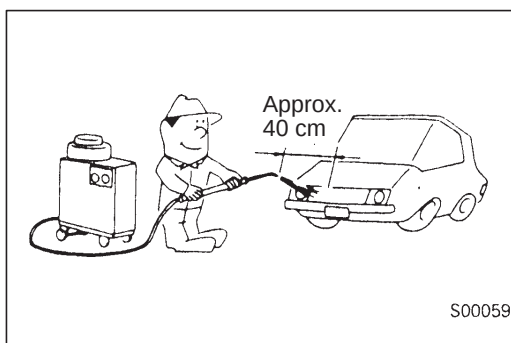
If oil or grease gets onto the oxygen sensor, it will cause a drop in the performance of the sensor.

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.

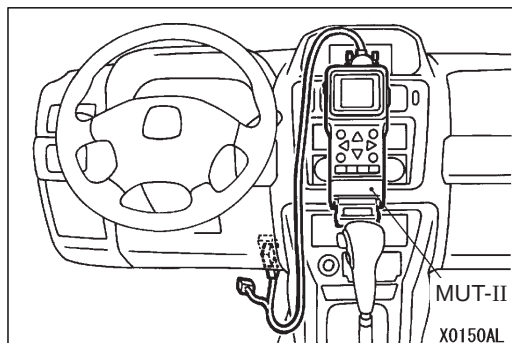
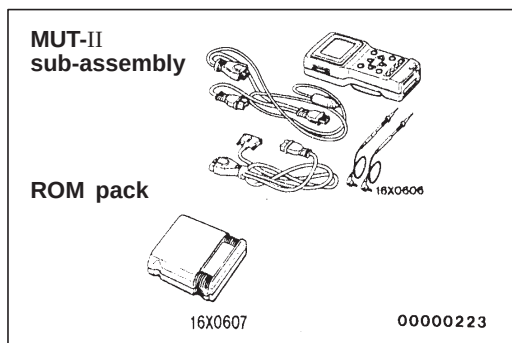
- Engine coolant temperature: 80 to 90°C
- Lamps, electric cooling fan and all accessories: OFF
- M/T: Neutral
- A/T: P range



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.

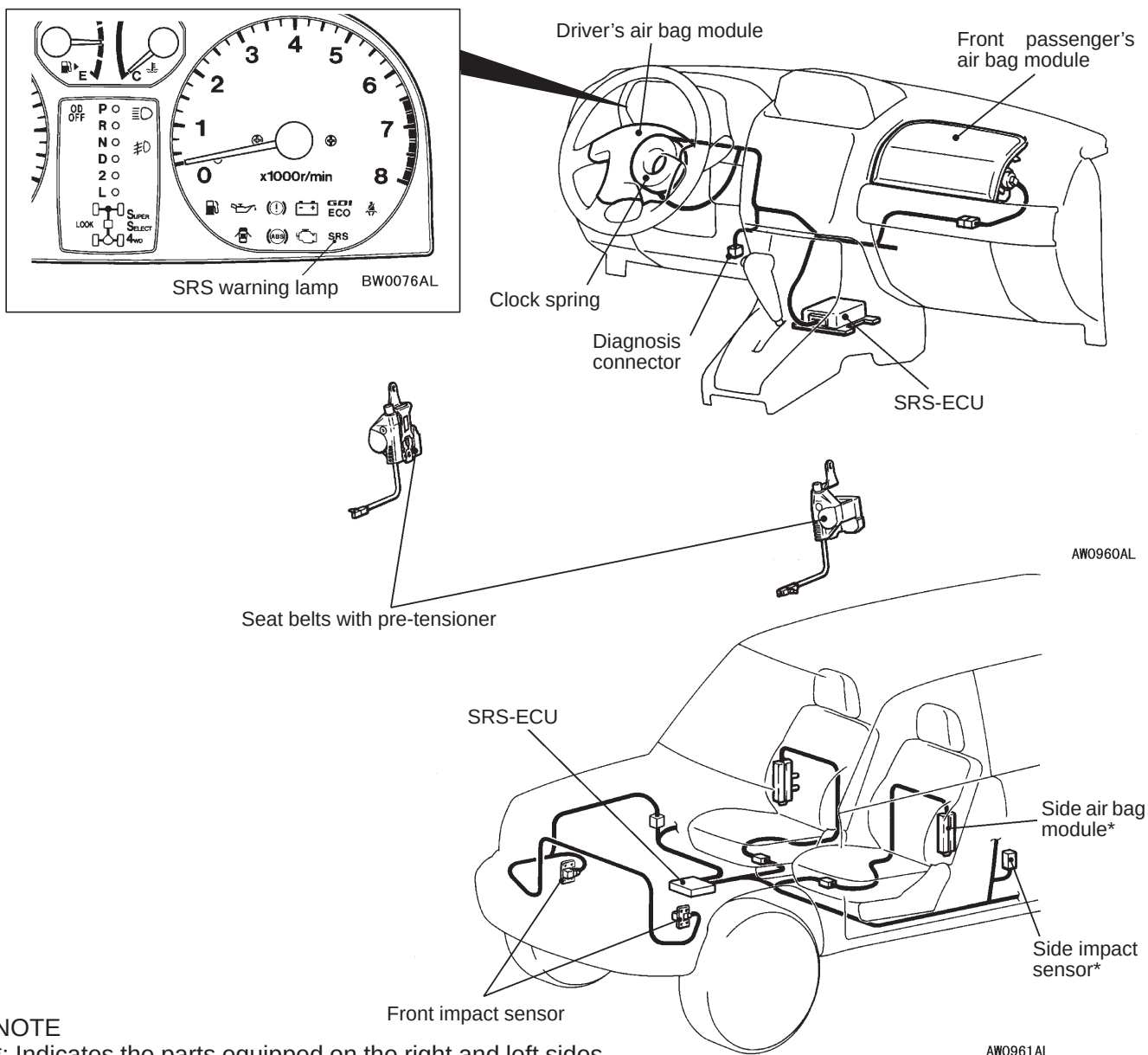
SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

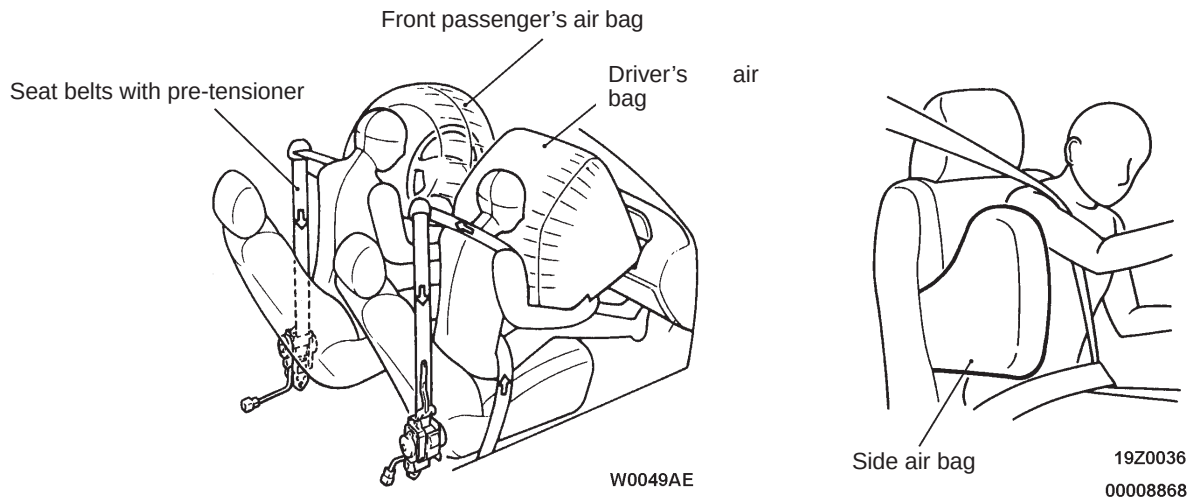
To improve safety, the SRS is available as optional parts. This system enhances collision safety by restraining the front occupants in case of an accident.

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 member. The side impact sensors inside the quarter 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).



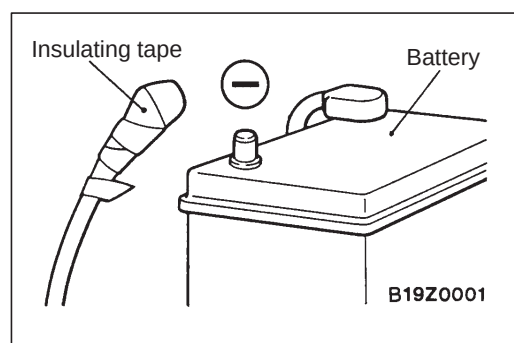


SRS SERVICE PRECAUTIONS

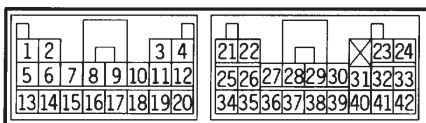
1. In order to avoid injury to yourself or others from accidental deployment of the air bag during servicing, read and carefully follow all the precautions and procedures described in this manual.
2. Do not use any electrical test equipment on or near SRS components, except those specified on GROUP 52B.
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

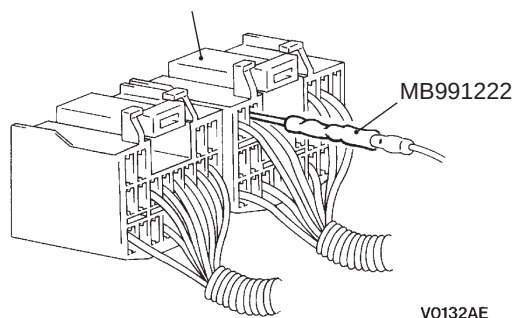
W0582AU

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.

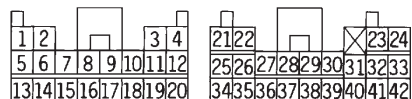
SRS-ECU Terminal No.	Destination of harness	Corrective action
1, 2, 3, 4	Instrument panel wiring harness → Front wiring harness → Front impact sensor	Repair or replace each wiring harness
7	Instrument panel wiring harness → Earth	
8	Instrument panel wiring harness → Combination meter (SRS warning lamp)	
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



SRS-ECU harness connector (rear view)



W0584AU

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

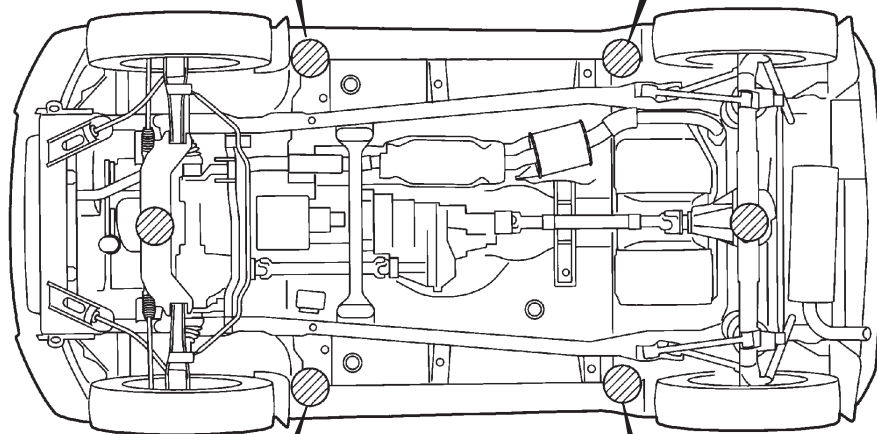
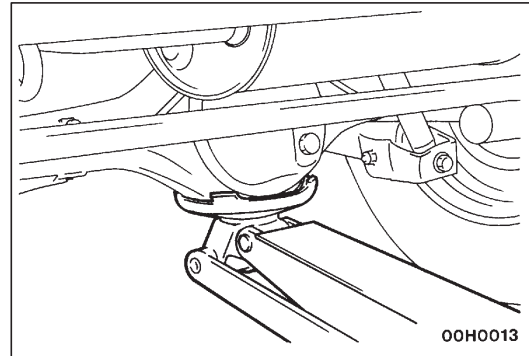
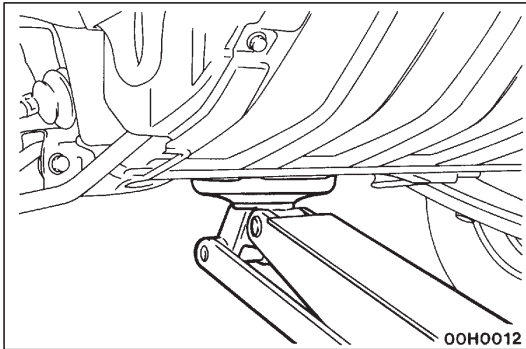
Do not support the vehicles at locations other than specified supporting points. Doing so will cause damage, etc.

SUPPORT POSITIONS FOR A GARAGE JACK AND AXLE STANDS

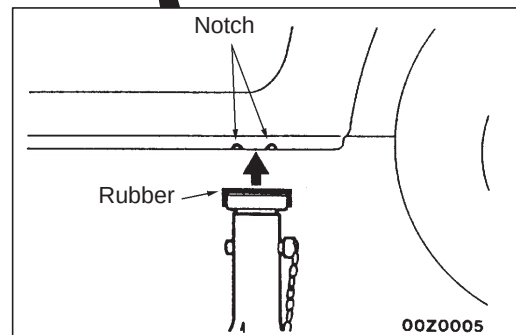
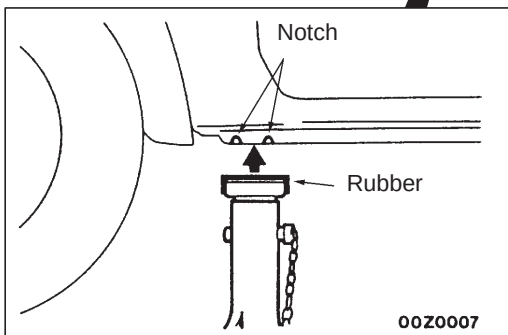
GARAGE JACK

Caution

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

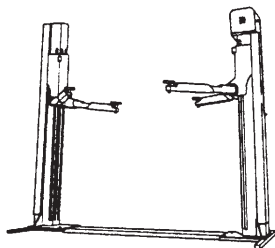


AXLE STANDS

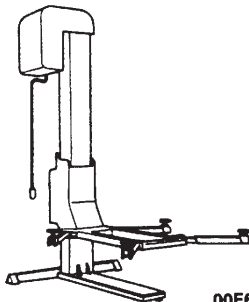


**SUPPORT POSITIONS FOR A
SINGLE-POST LIFT OR DOUBLE-POST
LIFT****Caution**

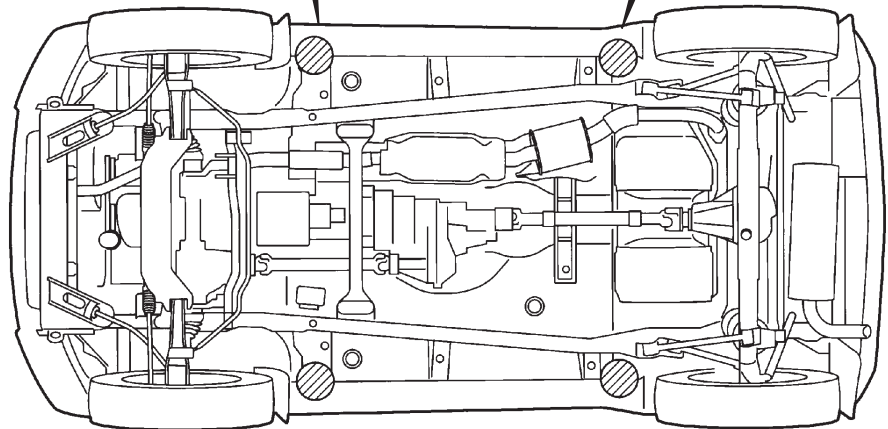
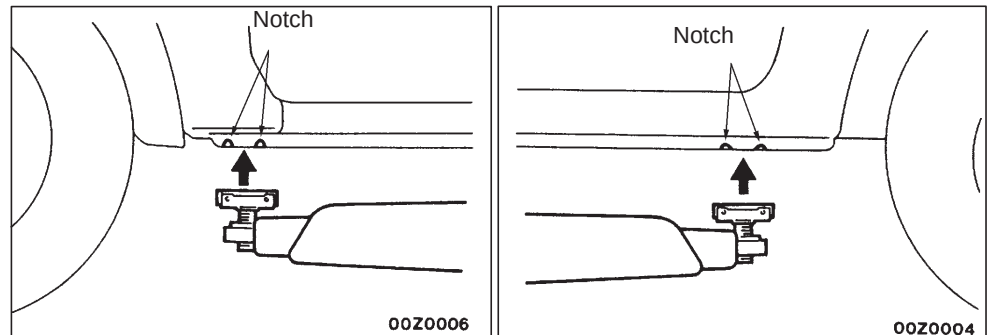
When service procedures require removing the rear suspension, spare tyre and rear bumper, place additional weight on rear end of vehicle or anchor vehicle to hoist to prevent tipping of centre of gravity changes.

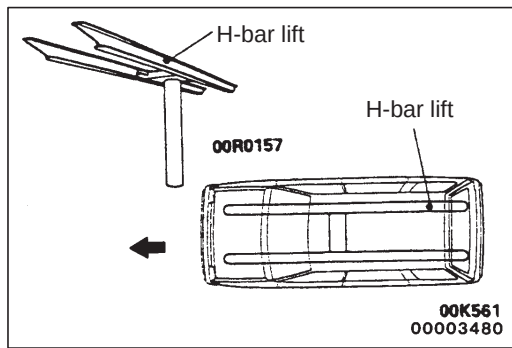
DOUBLE-POST LIFT

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SINGLE-POST LIFT

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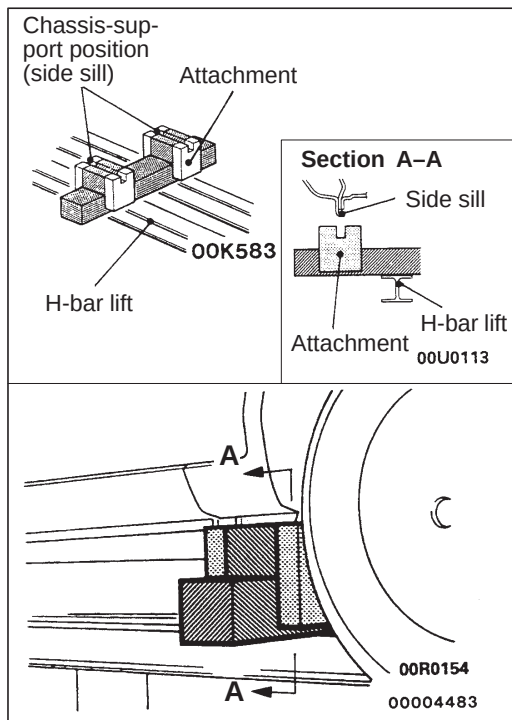


SUPPORT POSITIONS AND SUPPORT METHOD FOR AN H-BAR LIFT

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.

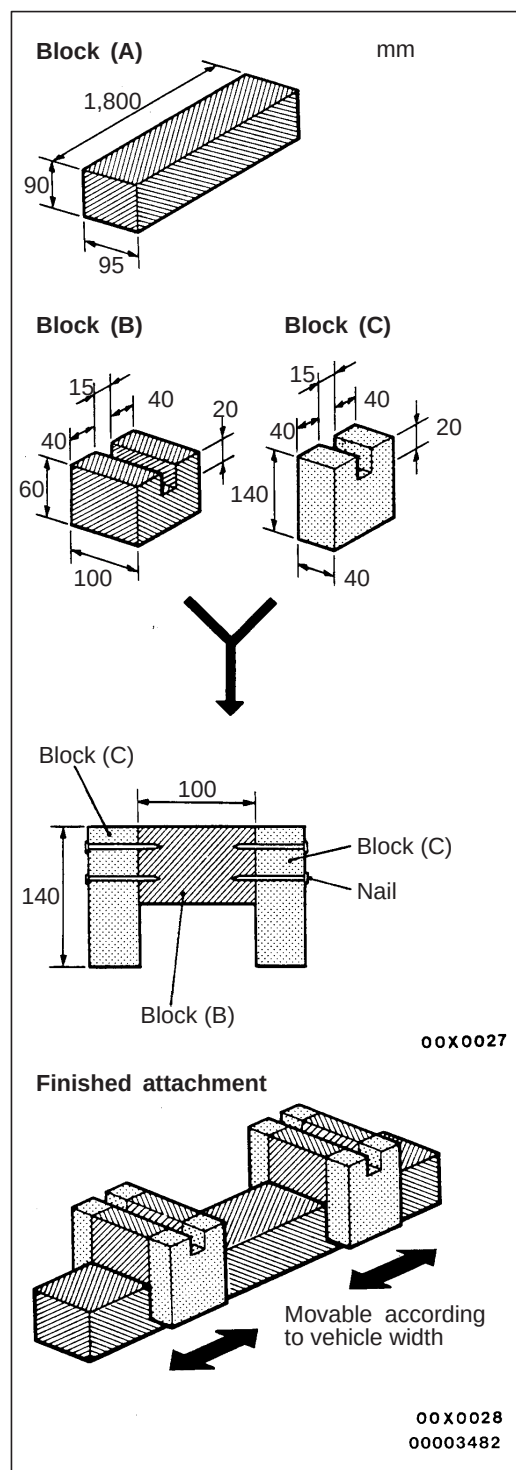


1. Place the vehicle on the H-bar lift (same direction).
2. Place attachments on the H-bar lift at the designated chassis-support positions. When making the attachments, refer to the section concerning making them.

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

ENGINE

<4G9-GDI>

CONTENTS

GENERAL INFORMATION	2	Lash Adjuster Check	13
SERVICE SPECIFICATIONS	2	CRANKSHAFT PULLEY	16
SEALANTS	3	CAMSHAFT AND CAMSHAFT OIL SEAL ...	17
SPECIAL TOOLS	4	OIL PAN	21
ON-VEHICLE SERVICE	6	CRANKSHAFT OIL SEAL	23
Drive Belt Tension Check and Adjustment	6	CYLINDER HEAD GASKET	25
Ignition Timing Check	9	TIMING BELT	28
Idle Speed Check	10	ENGINE ASSEMBLY	33
Idle Mixture Check	10		
Compression Pressure Check	11		
Manifold Vacuum Check	12		

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

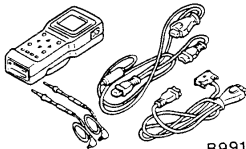
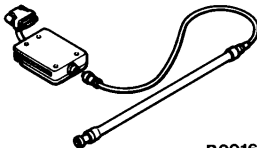
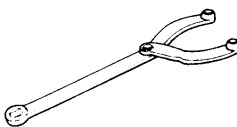
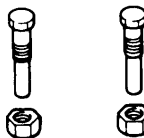
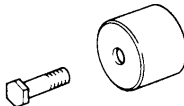
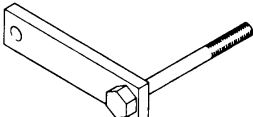
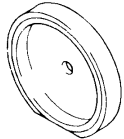
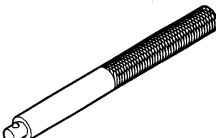
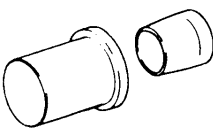
*1: Indicates the value measured within 4 minutes since the engine was started.

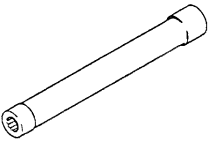
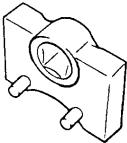
*2: Indicates the value when more than 4 minutes have passed since the engine was started.

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
 B991502	MB991502	MUT-II sub assembly	- Measuring the drive belt tension - Checking the ignition timing - Checking the idle speed - Erasing diagnosis code
 B991668	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

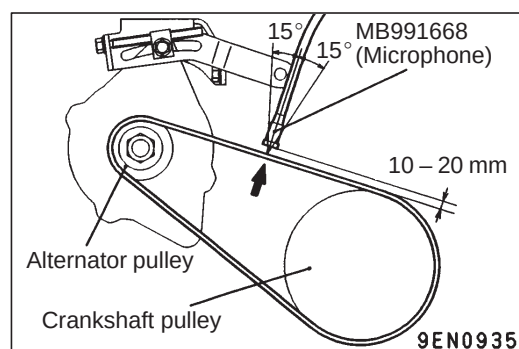
DRIVE BELT TENSION CHECK AND ADJUSTMENT

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

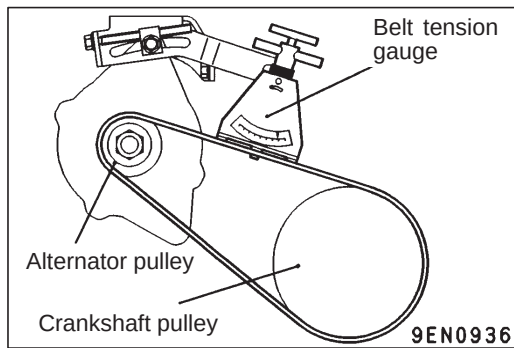


<When using the MUT-II>

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 $\pm 15^\circ$).
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.

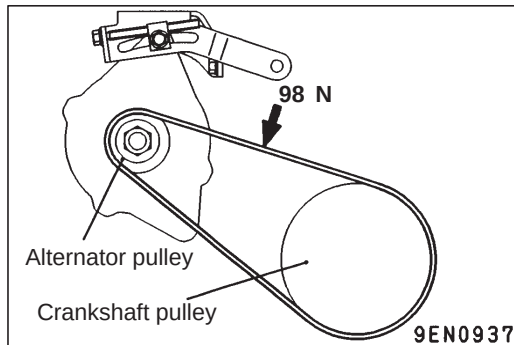
Caution

- (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.



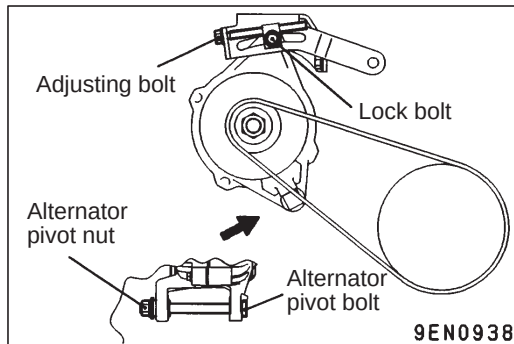
<When using a tension gauge>

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.

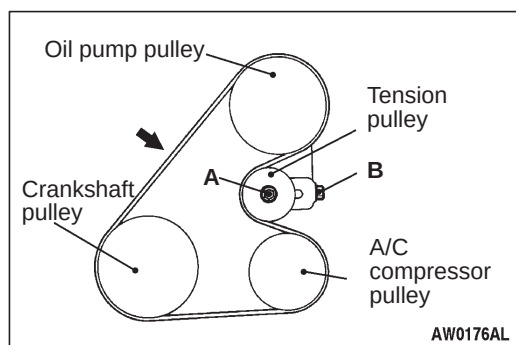
Tightening torque: 44 Nm

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.

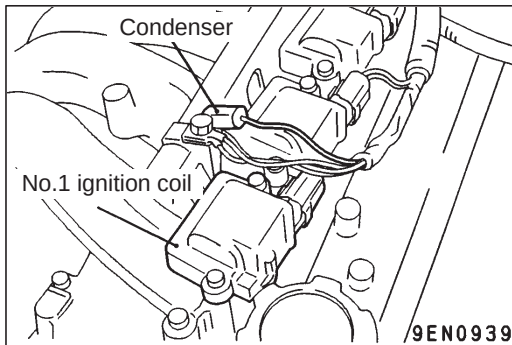
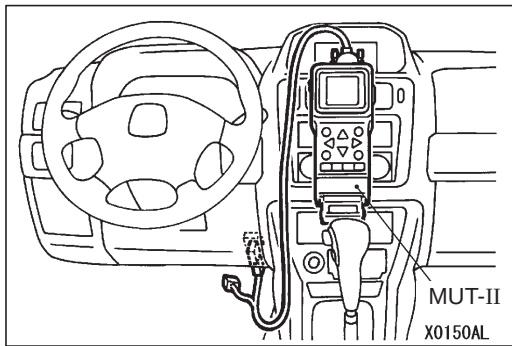
2. If the tension or deflection is outside the standard value, adjust by the following procedure.
 - (1) Loosen tensioner pulley fixing nut A.
 - (2) Adjust the amount of belt deflection using adjusting bolt B.
 - (3) Tighten fixing nut A.

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

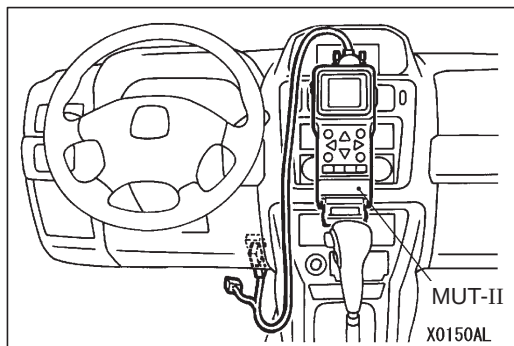
If the test is not cancelled, a forced driving will continue for 27 minutes. Driving under this condition may damage the engine.

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.

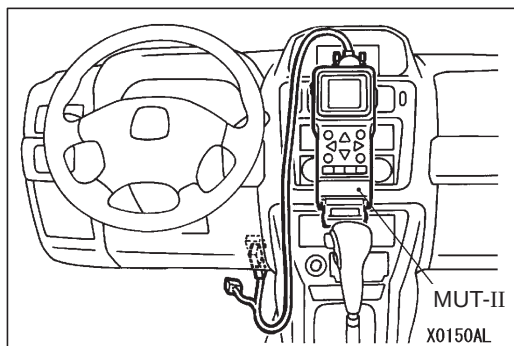
Standard value: 5° BTDC $\pm 3^{\circ}$

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 $\pm$ 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 $\pm 3^{\circ}$

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

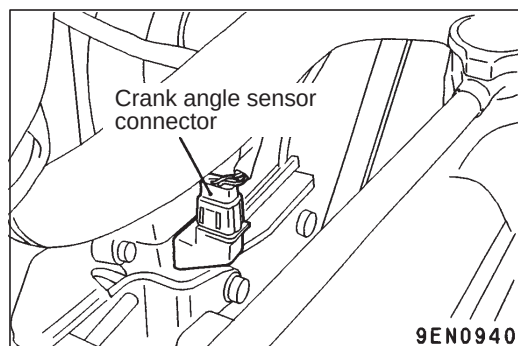
CO contents: 0.6% or less

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

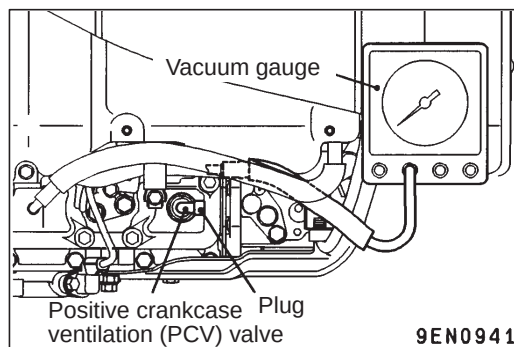
7. Measure the compression pressure for all the cylinders, and check that the pressure differences of the cylinders are below the limit.

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.

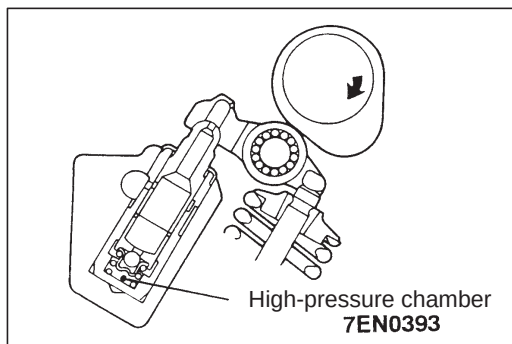
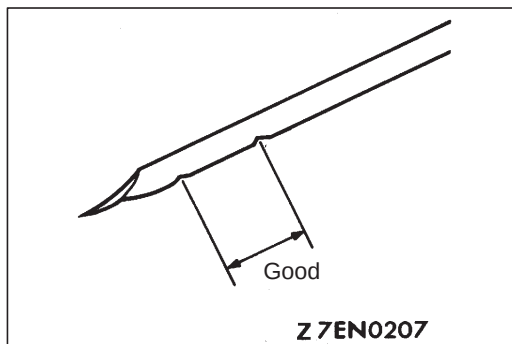
The only case where the noise might disappear is if the oil in the engine has not been looked after properly and oil sludge has caused the lash adjusters to stick.

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

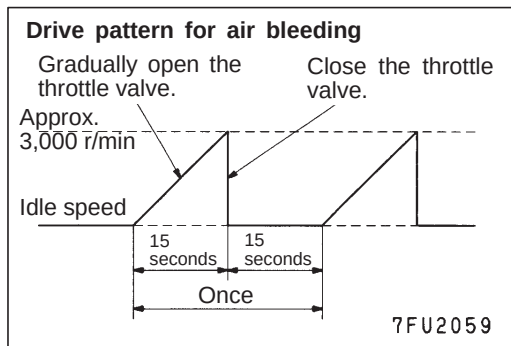
- (1) If the vehicle is parked on a slope for a long period of time, the amount of oil inside the lash adjuster will decrease, and air may get into the high pressure chamber when starting the engine.
- (2) After parking the vehicle for long periods, the oil drains out of the oil passage, and it takes 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.



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

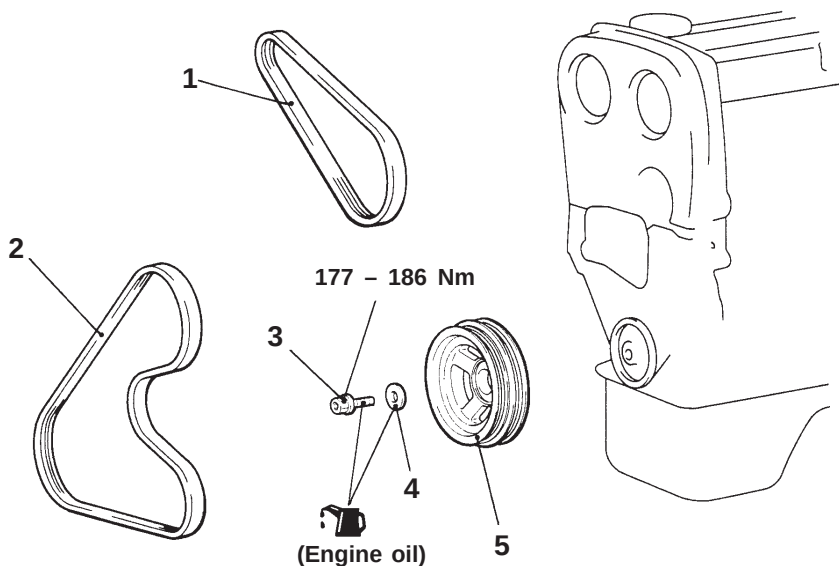
REMOVAL AND INSTALLATION

Pre-removal Operation

Engine Cover and Under Cover Removal

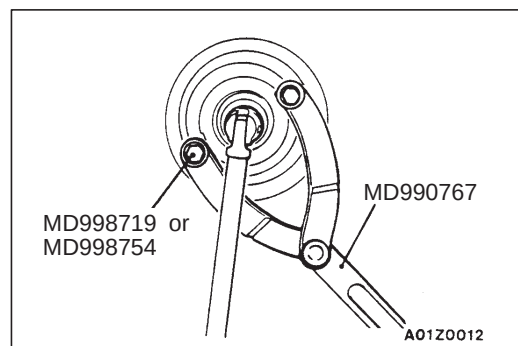
Post-installation Operation

- 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)
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**

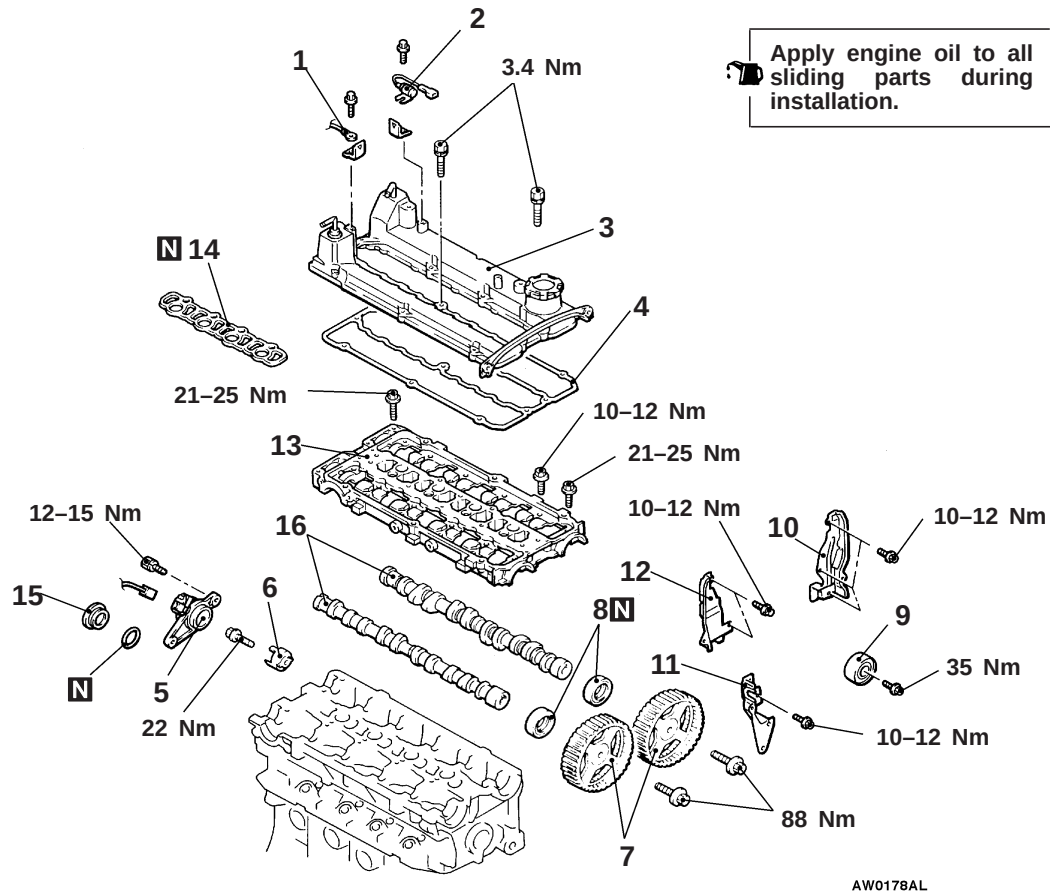
When installing the crankshaft bolt, apply the minimum amount of engine oil to the bearing surface and thread of the bolt.

CAMSHAFT AND CAMSHAFT OIL SEAL

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

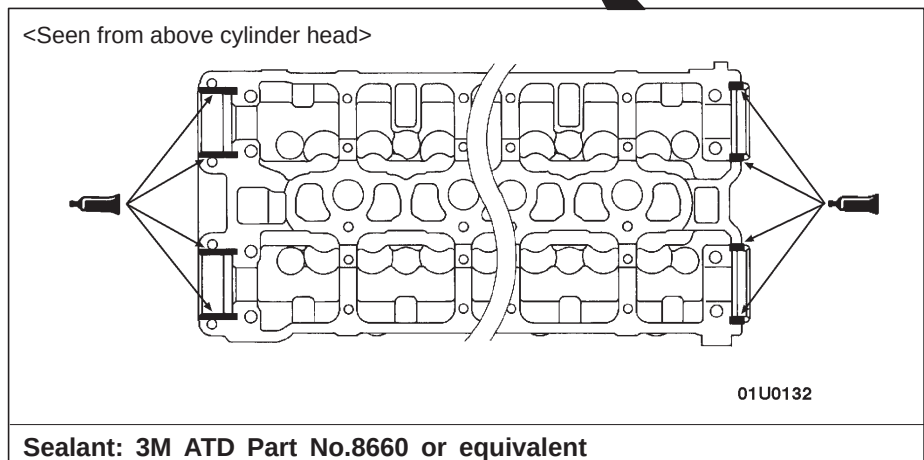
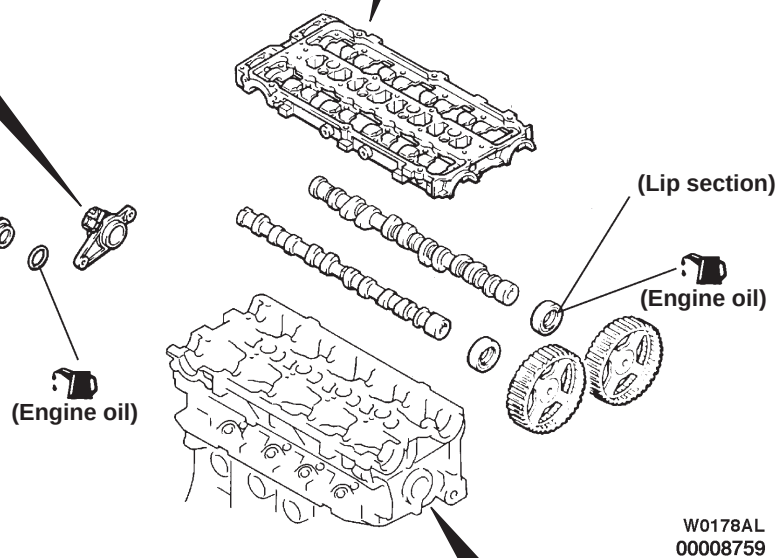
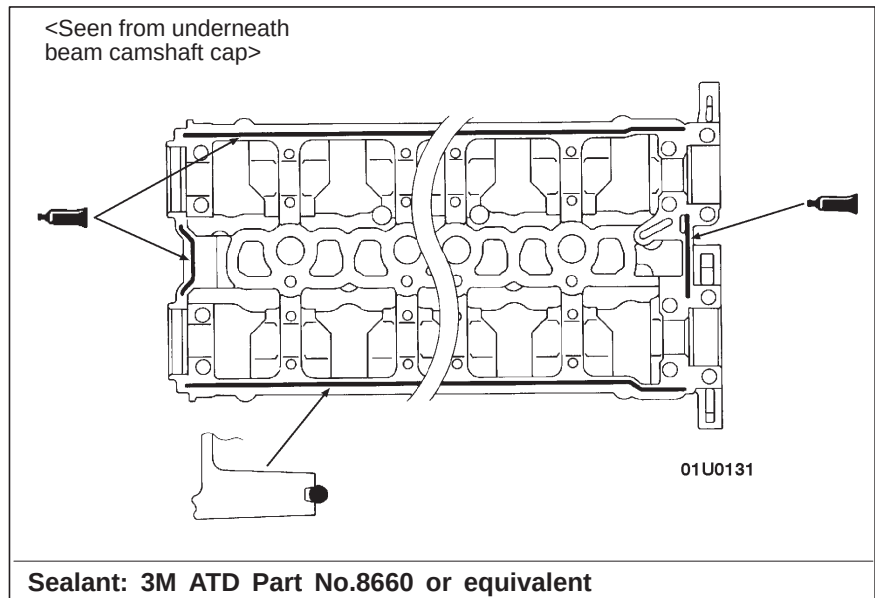
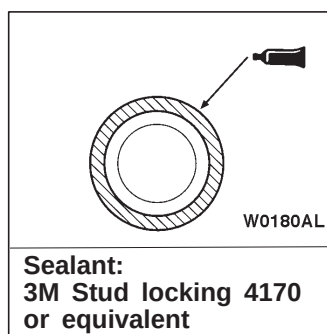
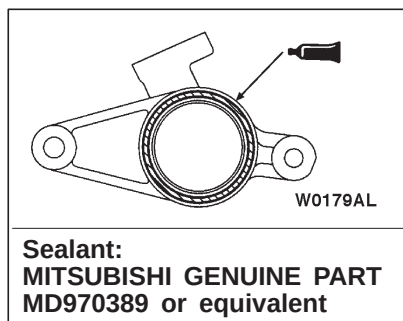
- Air Intake Hose and Resonance Tank Removal and Installation (Refer to GROUP 15 – Air Cleaner and Resonance Tank.)
- Timing Belt Removal and Installation (Refer to P.11A-29.)
- Engine Coolant Draining and Supplying (Refer to GROUP 14 – On-vehicle Service.)
- Intake Manifold Removal and Installation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

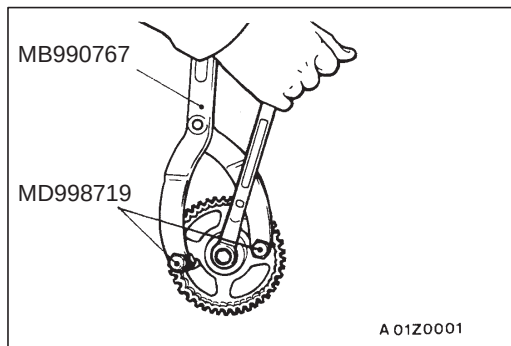
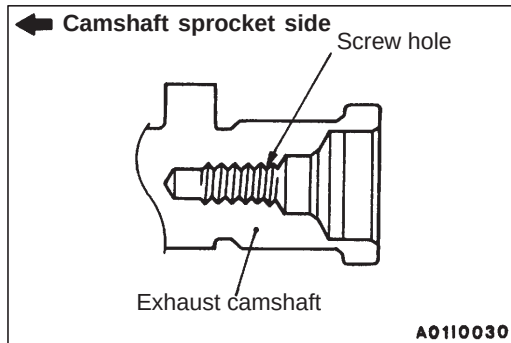
**Removal steps**

1. Earth cable connection
2. Condenser
3. Rocker cover
4. Rocker cover gasket
5. Camshaft position sensor support
6. Camshaft position sensing cylinder
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)
13. Beam camshaft cap
14. Beam camshaft cap gasket
15. Thrust case
16. Camshaft



Lubrication points

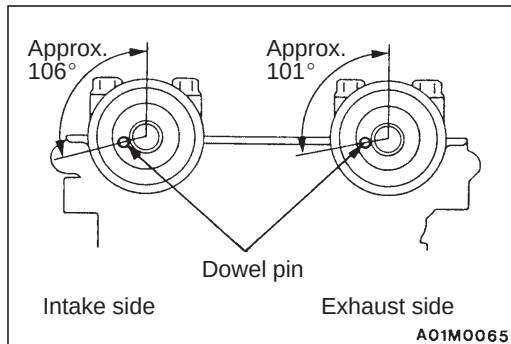


**REMOVAL SERVICE POINT****◀A▶ CAMSHAFT SPROCKET REMOVAL****INSTALLATION SERVICE POINTS****▶A◀ CAMSHAFT INSTALLATION**

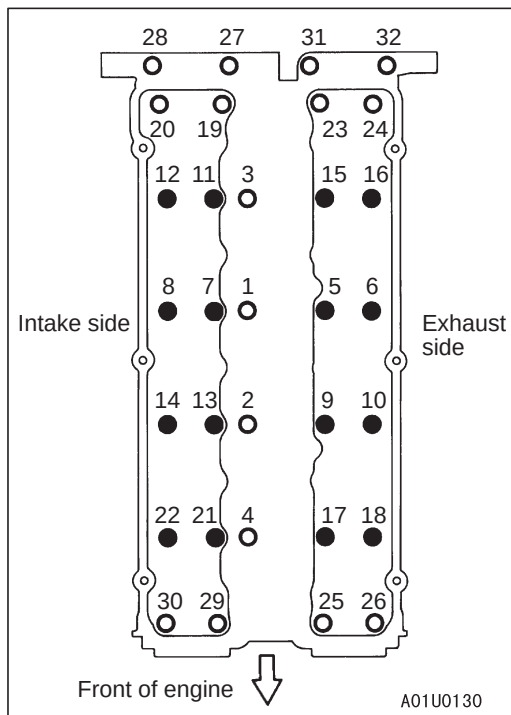
1. Apply engine oil to journals and cams of the camshafts.
2. Install the camshafts on the cylinder head.

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**

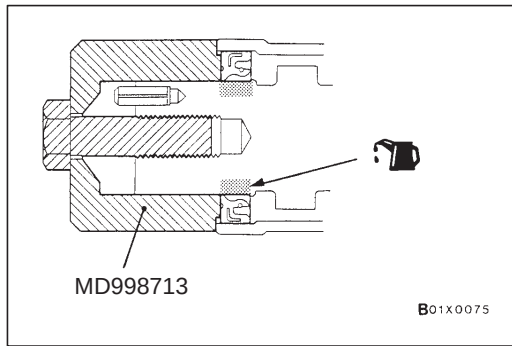
1. Place the camshaft dowel pin as shown in the illustration.



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

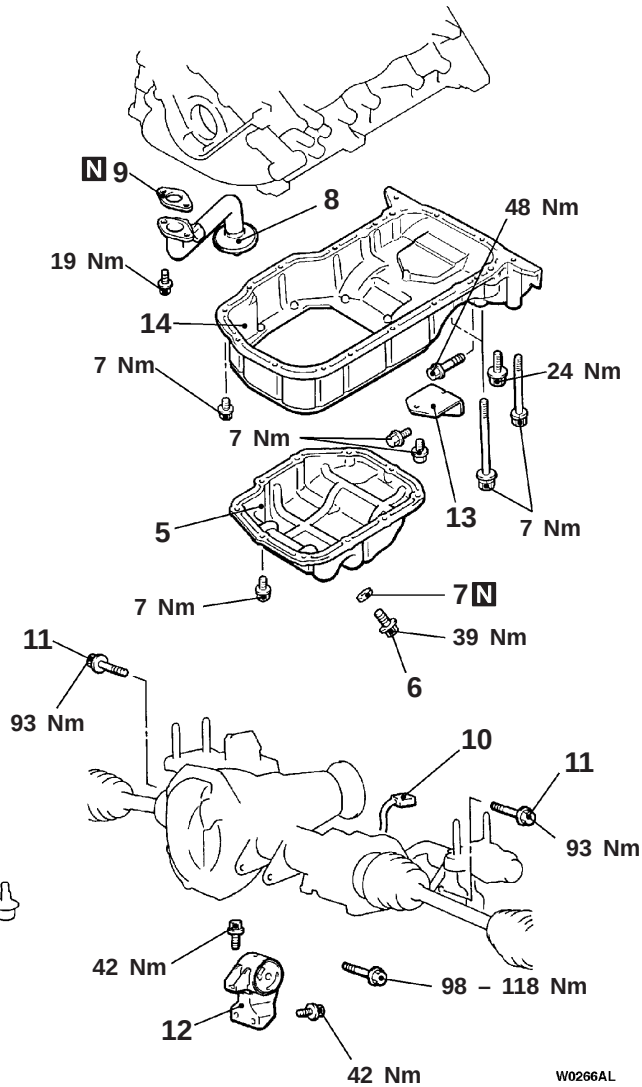
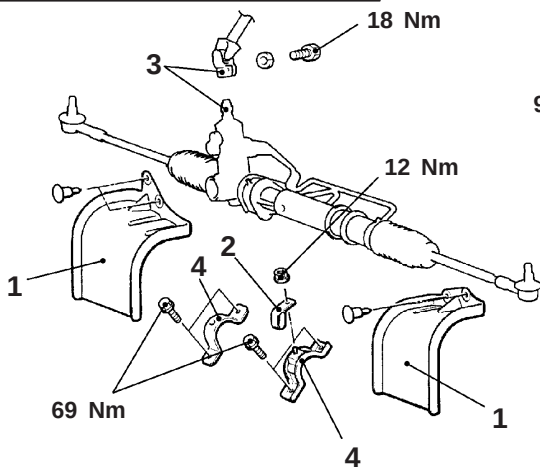
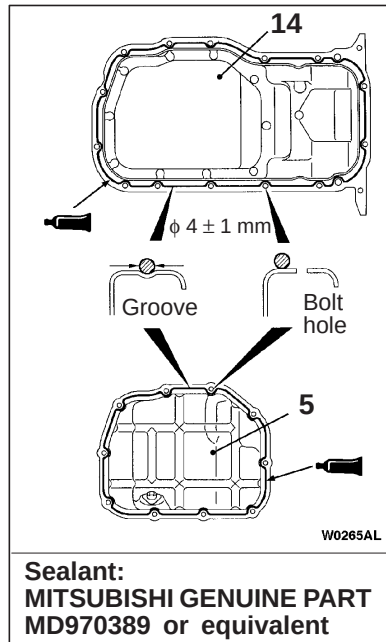
OIL PAN

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.)

**Removal steps**

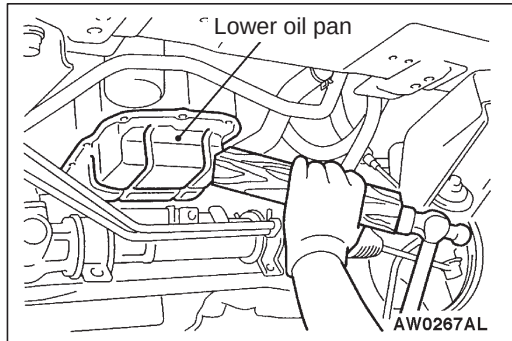
1. Splash shield
2. Power steering pressure hose clamp
3. Steering gear box and shaft connection
4. Steering gear box installation bolt
5. Lower oil pan
6. Drain plug
7. Gasket

8. Oil screen
9. Gasket
10. Free-wheeling clutch engage switch connector connection
11. Front differential mount center bolt
12. Front differential mount
13. Bell housing cover
14. Upper oil pan



REMOVAL SERVICE POINTS**◀A▶ STEERING GEAR BOX INSTALLATION BOLT REMOVAL**

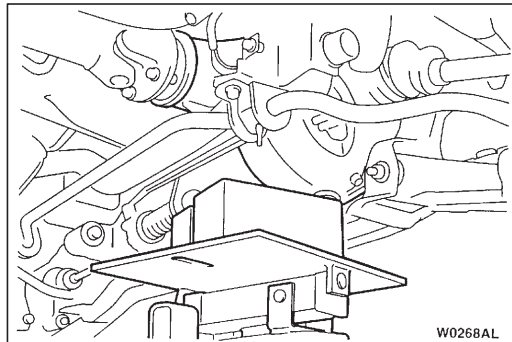
Remove the steering gear box installation bolts and lower the steering gear box.

**◀B▶ LOWER OIL PAN REMOVAL**

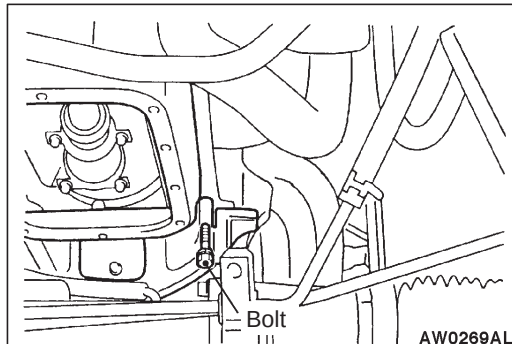
Place a piece of wood against the lower oil pan, and tap the piece of wood with a hammer to remove the lower oil pan.

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**

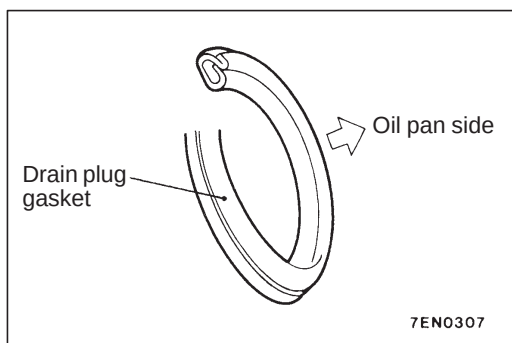
After removing all installation bolts, install 2 bolts (M6 × 85) in the upper oil pan as shown, noting that one located on the left side and one on the right side. Turn the bolts to remove the upper oil pan.

Caution

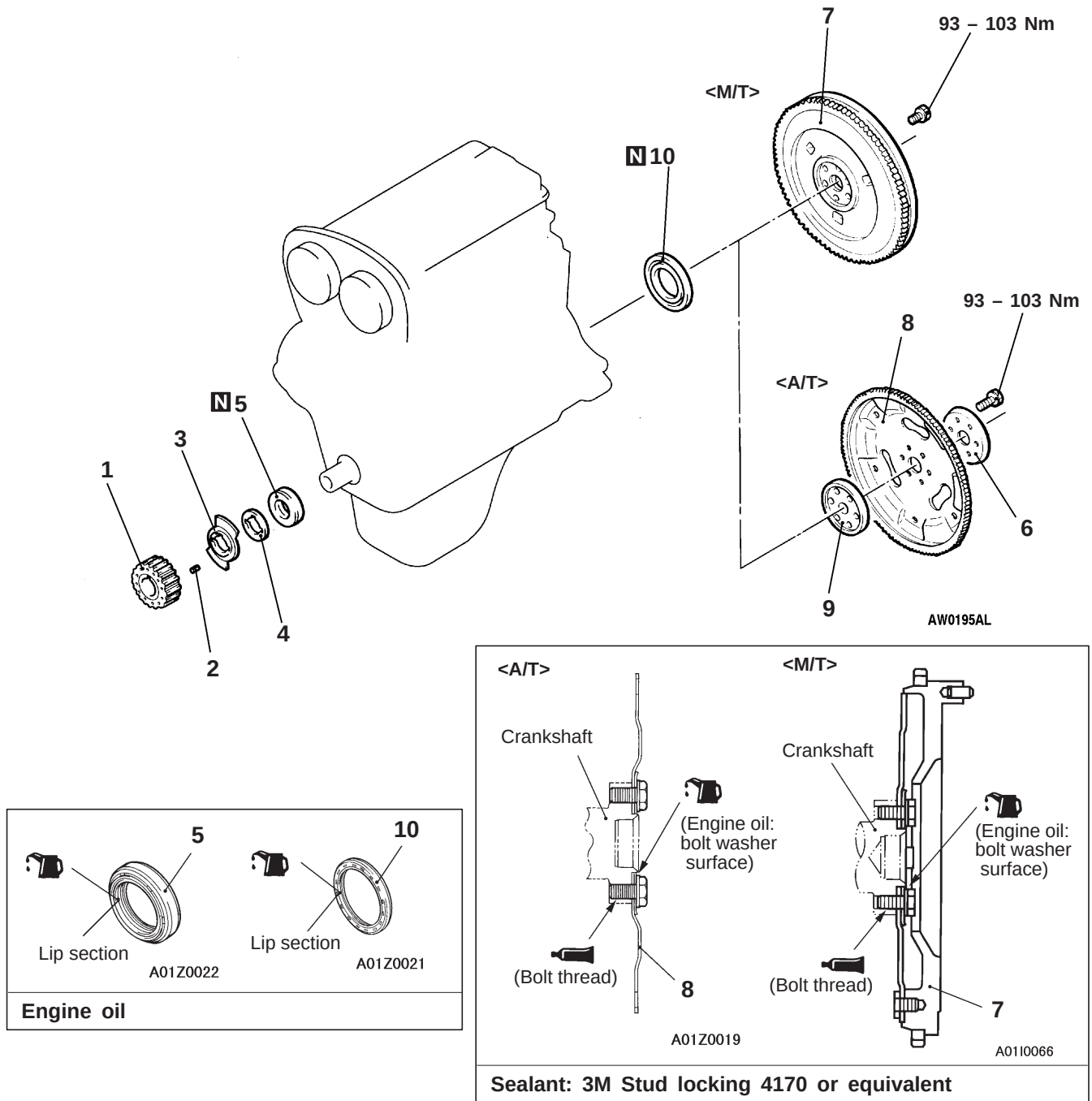
Because the upper oil pan used is made from aluminium, the oil pan remover (MB998727) should not be used.

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



Crankshaft front oil seal removal steps

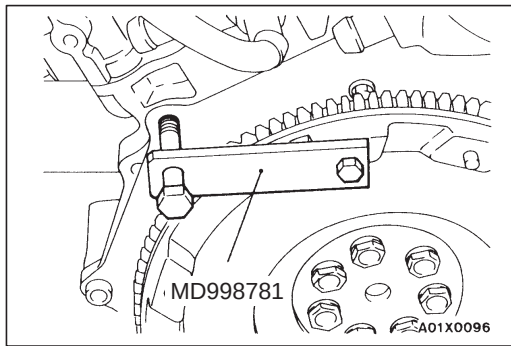
- Timing belt (Refer to P.11A-29.)
 - Crank angle sensor
(Refer to GROUP 16.)
1. Crankshaft sprocket

1. Crankshaft sprocket
2. Key
3. Crankshaft sensing blade
4. Crankshaft spacer
5. Crankshaft front oil seal

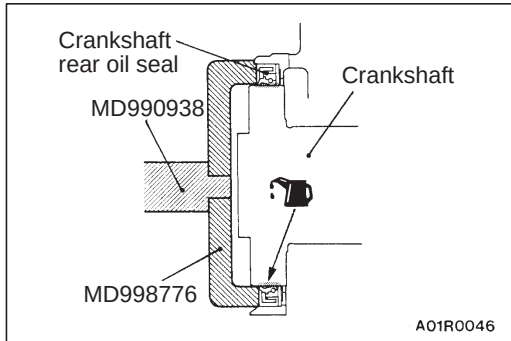
Crankshaft rear oil seal removal steps

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

		6. Adapter plate <A/T>
		7. Flywheel <M/T>
		8. Drive plate <A/T>
		9. Crankshaft adapter <A/T>
		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**

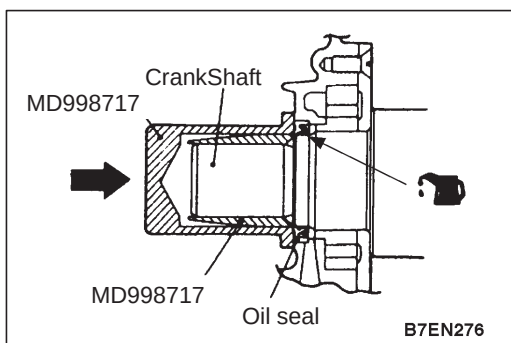
1. Apply a small amount of engine oil to the entire circumference of the oil seal lip.
2. Install the oil seal by tapping it as far as the chamfered position of the oil seal case as shown in the illustration.

▶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**

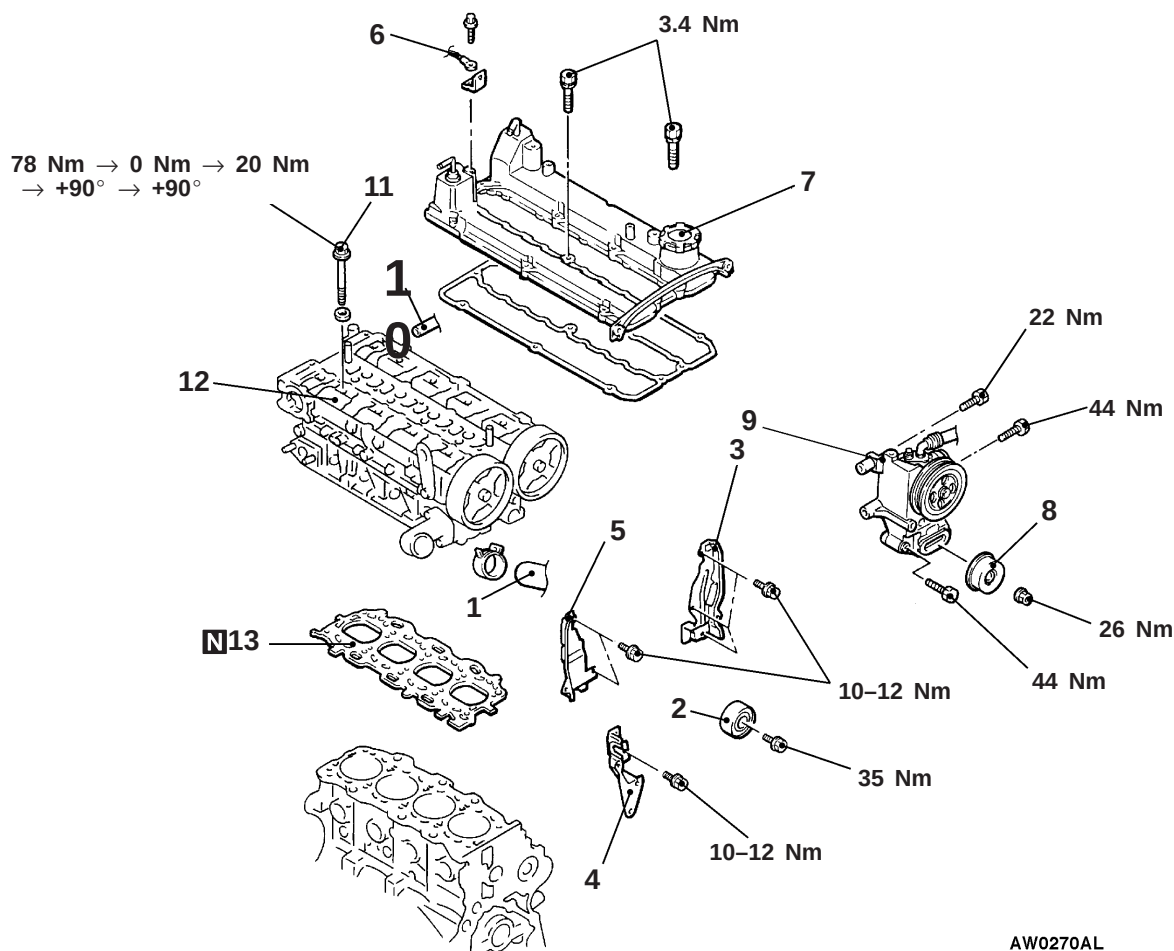
1. Apply a small amount of engine oil to the entire circumference of the oil seal lip.
2. Tap the oil seal unit it is flush with the oil seal case.

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▶

◀B▶

▶B◀

▶A◀

8. Tension Pulley
9. Power steering oil pump and bracket assembly
10. Heater hose connection
11. Cylinder head bolt
12. Cylinder head assembly
13. Cylinder head gasket

REMOVAL SERVICE POINTS**◀A▶ POWER STEERING OIL PUMP AND BRACKET ASSEMBLY REMOVAL**

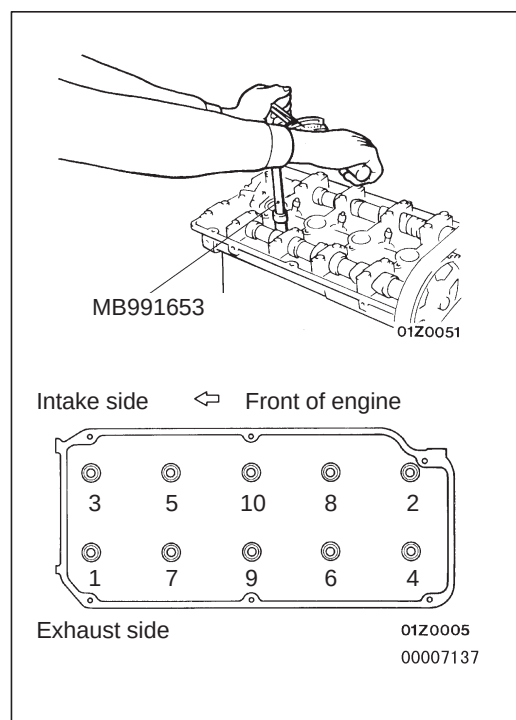
Remove the power steering oil pump and bracket assembly from the engine with the hose attached.

NOTE

Place the removed power steering oil 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.

◀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**

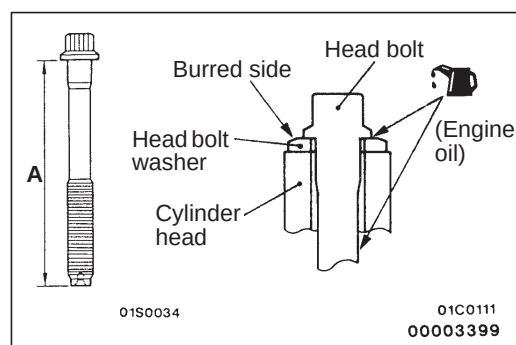
1. Wipe off all oil and grease from the gasket mounting surface.
2. Install so that the shapes of the cylinder head holes match the shapes of the respective cylinder head gasket holes.

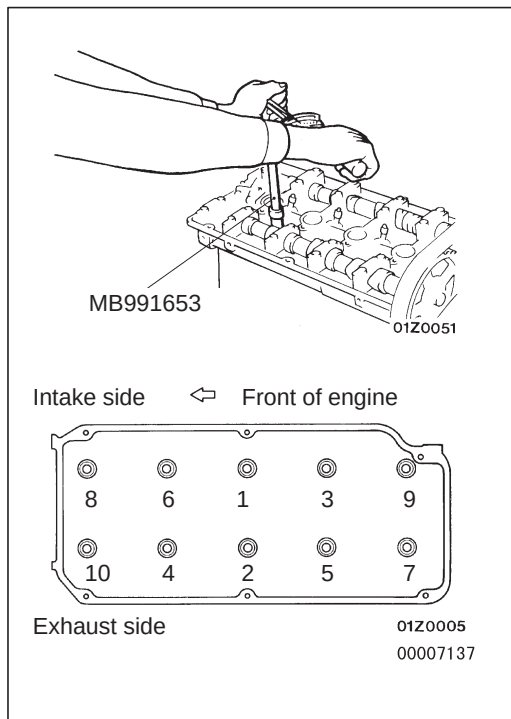
▶B◀ CYLINDER HEAD BOLT INSTALLATION

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.



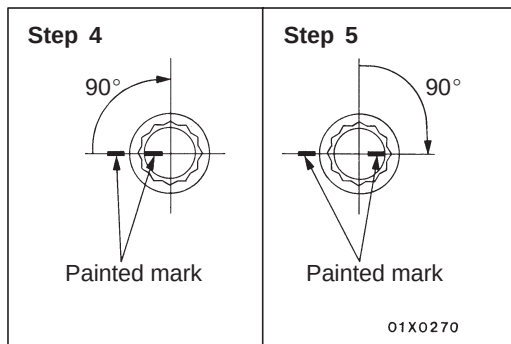


4. Tighten the bolts by the following procedure.

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.

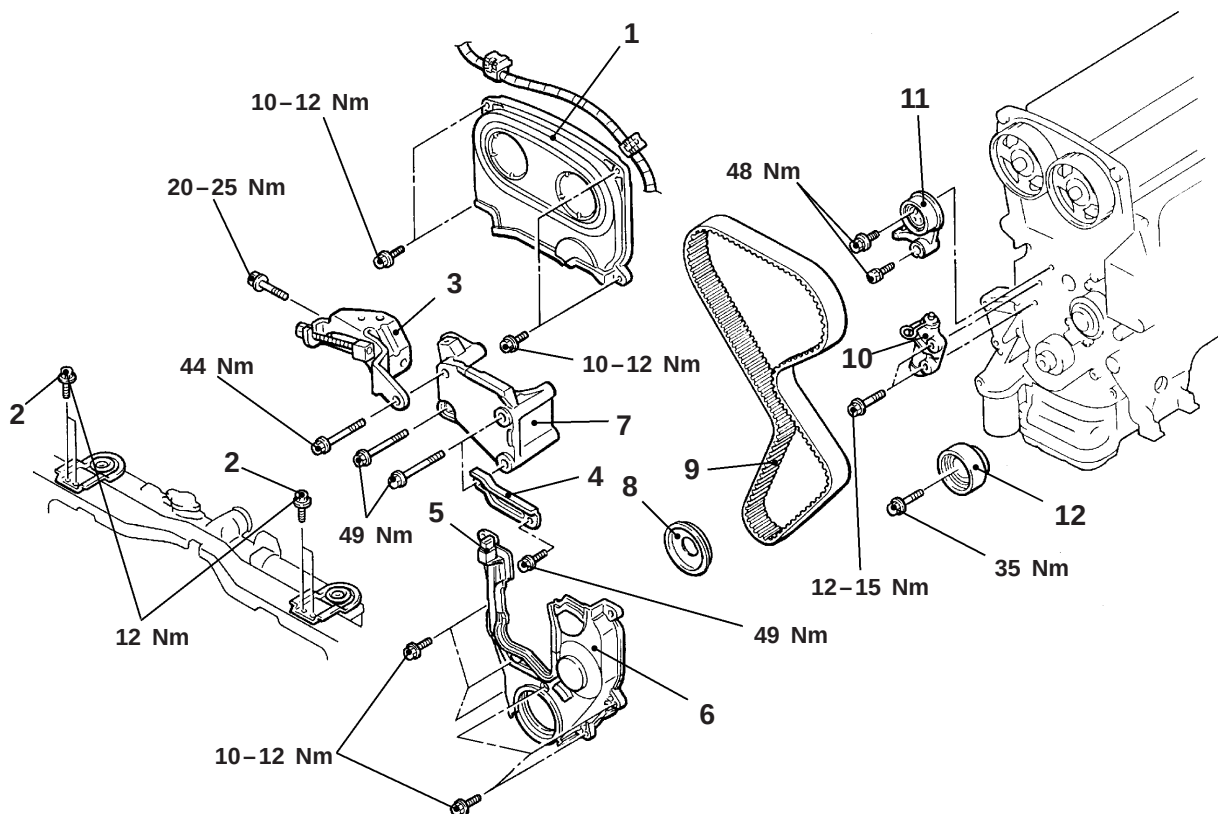


TIMING BELT

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.)



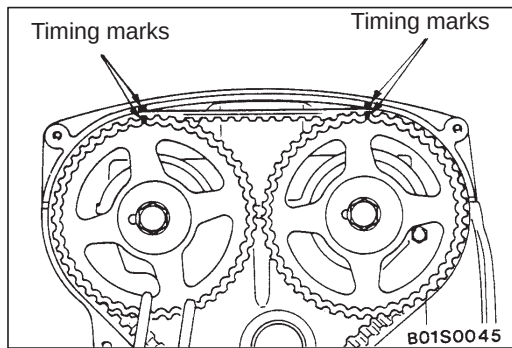
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Removal steps

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
- Timing belt tension adjustment
9. Timing belt
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.

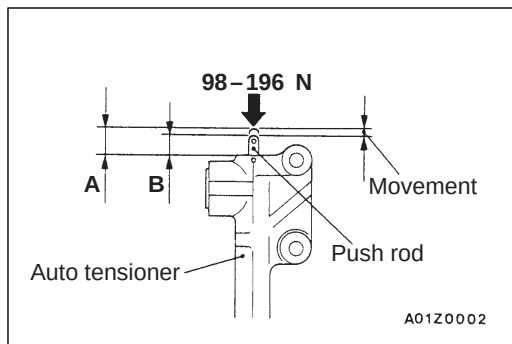
Caution

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)

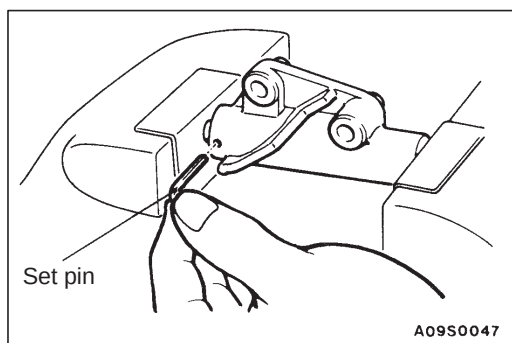
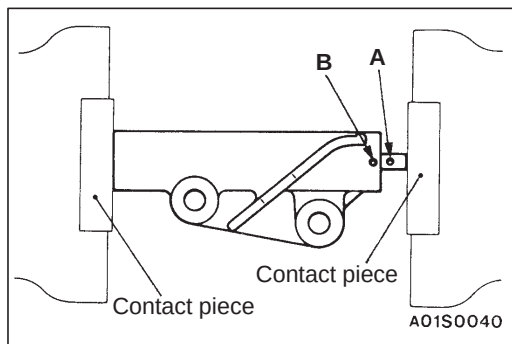
B: Length when it is pressed

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.

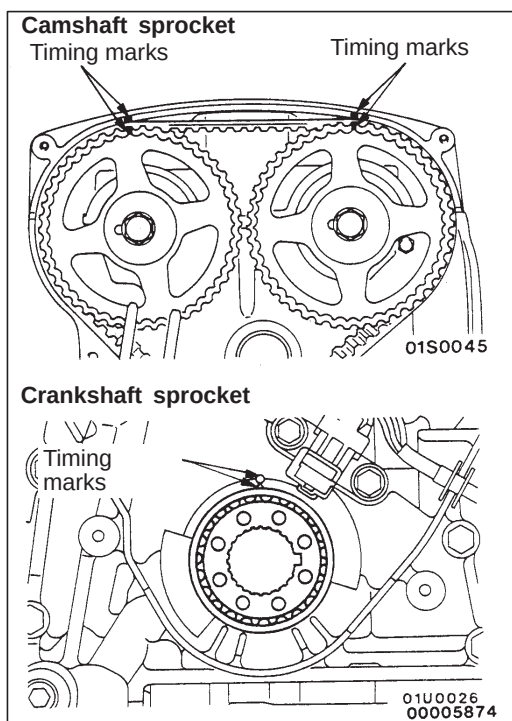


4. Once the holes are aligned, insert the set pin.

NOTE

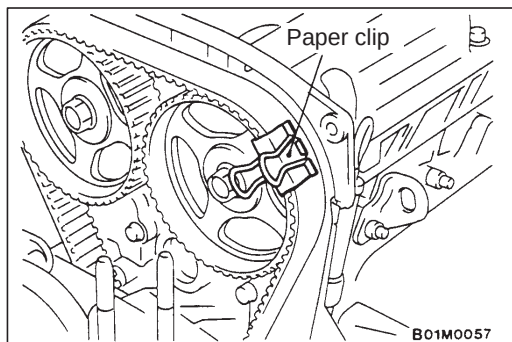
When replacing the auto tensioner with a new part, the pin will be in the auto tensioner.

5. Install the auto tensioner to the engine.

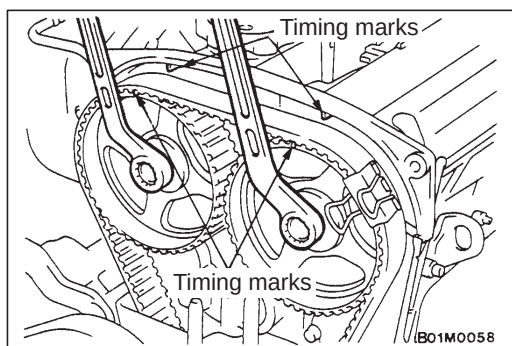


►B◄ TIMING BELT INSTALLATION

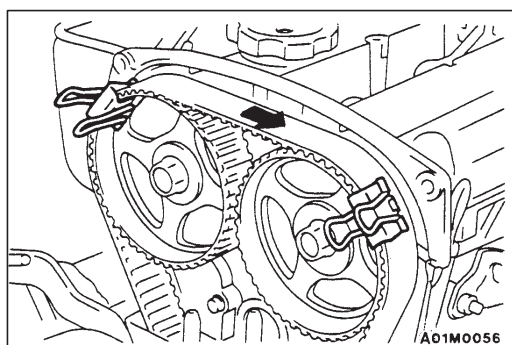
1. Align the timing marks of each camshaft sprocket and the crankshaft sprocket.
2. Loosen the tensioner pulley center bolt.
3. Move the crankshaft sprocket half a tooth width in the anti-clockwise direction.



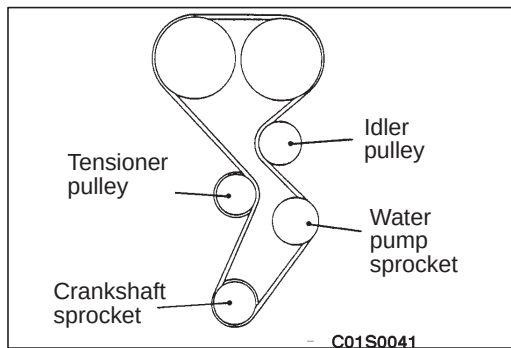
4. Place the timing belt on the exhaust-side camshaft sprocket, and hold it in the position shown in the illustration with a paper clip.



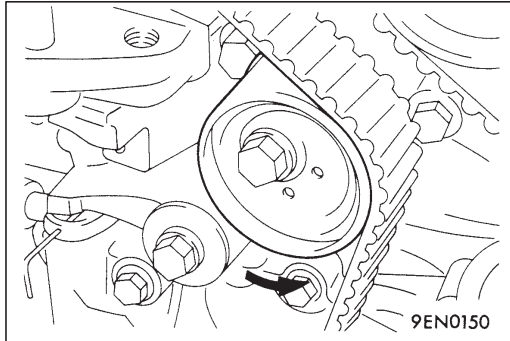
5. Place the timing belt on the intake-side sprocket while using two wrenches to align the timing marks.



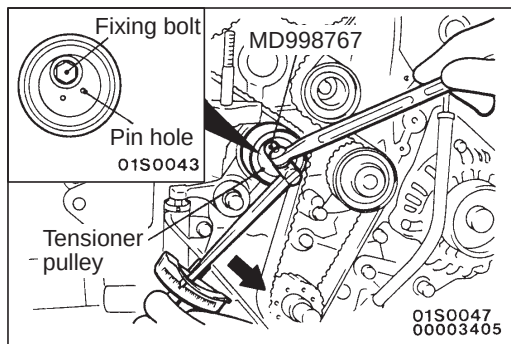
6. Hold the belt in the position shown in the illustration with another paper clip.



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

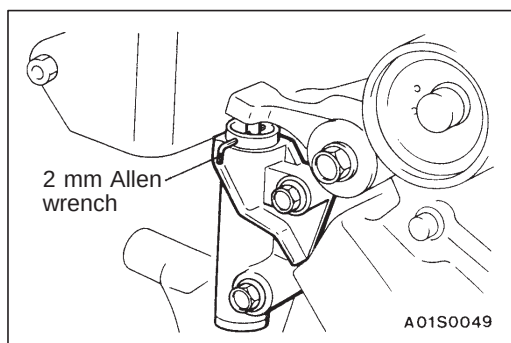
1. After turning the crankshaft a 1/4 turn anti-clockwise, turn it clockwise to the position where the timing marks are aligned.
2. Loosen the fixing bolt of the tensioner pulley and using the special tool and a torque wrench, apply tension to the timing belt; then tighten the fixing bolt at the specified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

Standard Value:

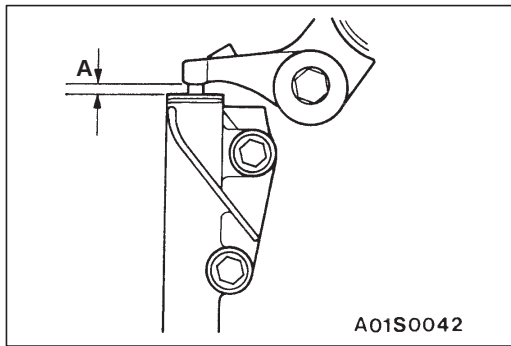
2.5 – 4.0 Nm [timing belt tension torque (reference value)]

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

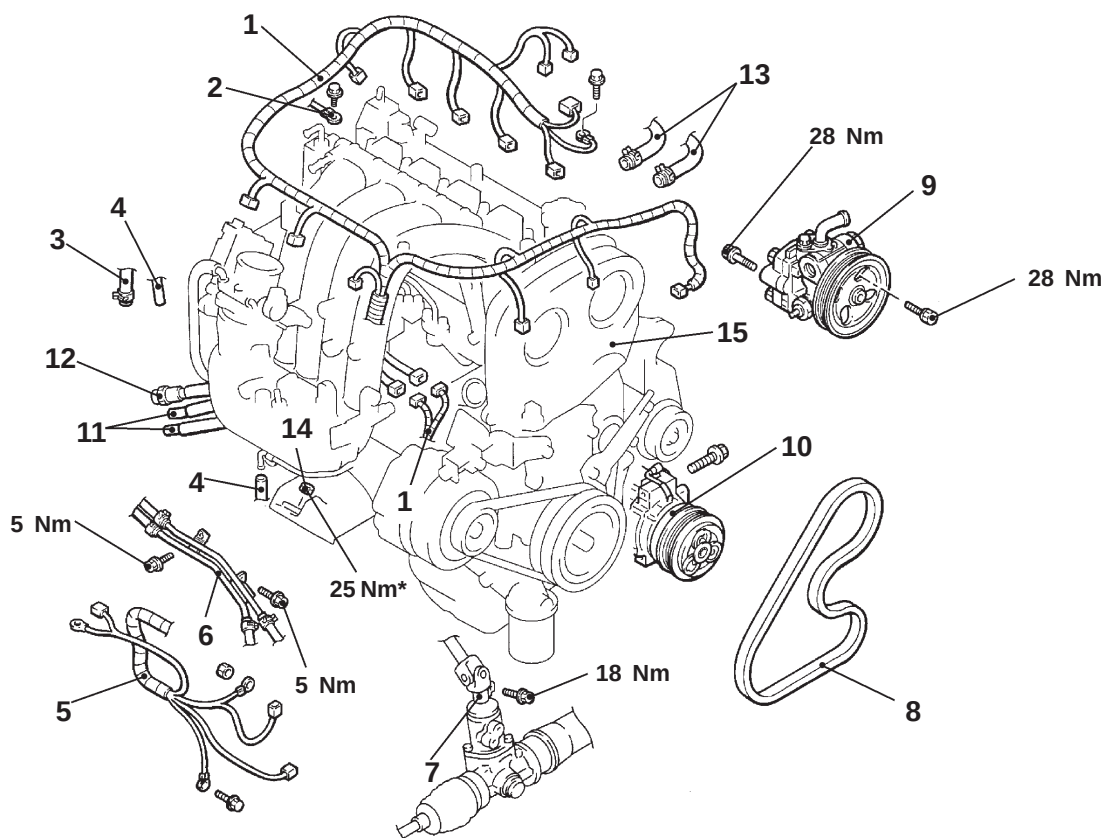
REMOVAL AND INSTALLATION

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>



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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



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
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

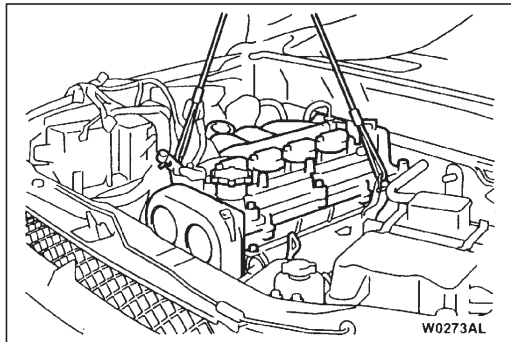
Place the removed power steering oil pump where it will not be a hindrance when removing and installing the engine assembly, and tie it with a cord.

◀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 LUBRICATION

CONTENTS

GENERAL INFORMATION	2	ON-VEHICLE SERVICE	4
SERVICE SPECIFICATIONS	3	Engine Oil Check	4
SEALANT	3	Engine Oil Replacement	4
LUBRICANTS	3	Oil Filter Replacement	5
SPECIAL TOOLS	3	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

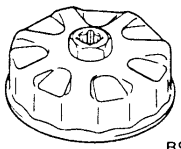
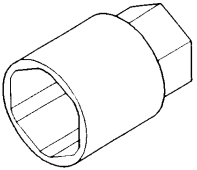
SEALANT

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

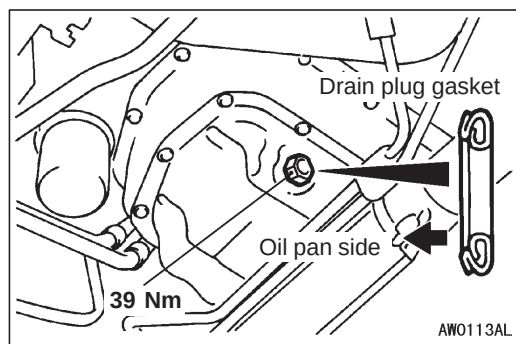
1. Pull out the level gauge slowly and check that the oil level is in the illustrated range.
2. Check that the oil is not excessively dirty, that there is no coolant or gasoline mixed in, and that it has sufficient viscosity.

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

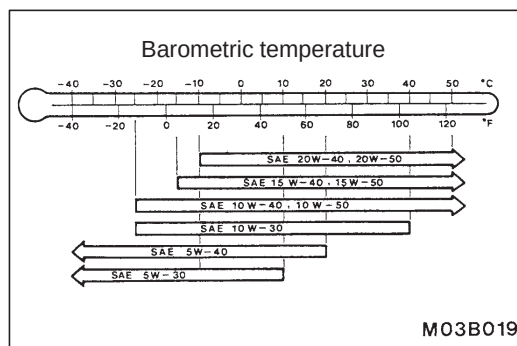
Use care as oil could be hot.



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.

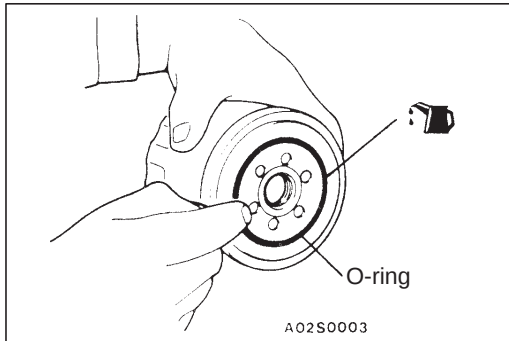
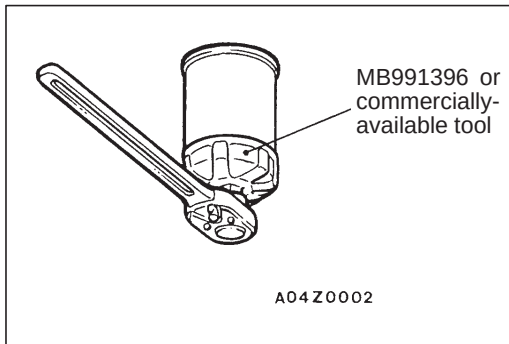


5. Refill with specified quantity of oil.

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

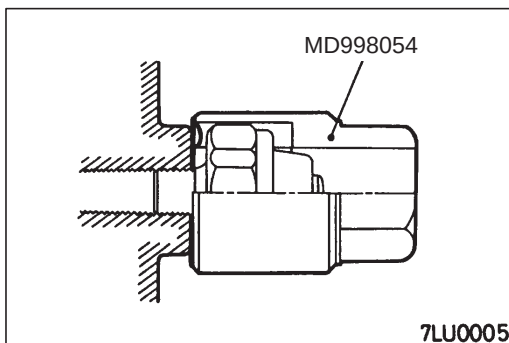
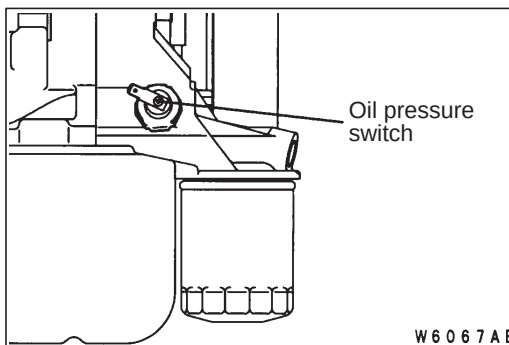
1. Start the engine and allow it to warm up until the temperature of the coolant reaches 80°C to 90°C.
2. Remove the engine oil filler cap.
3. Remove the drain plug to drain oil.

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:

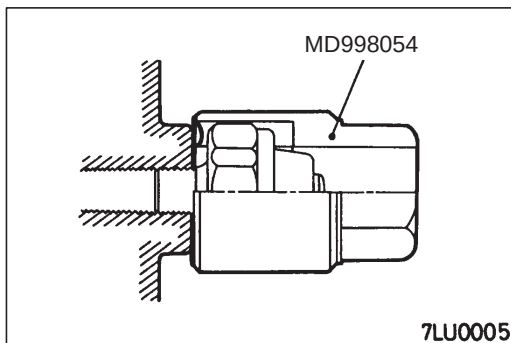
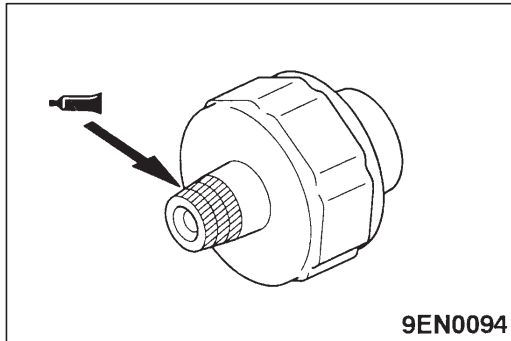
At idle: 29 kPa or more

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.

FUEL

CONTENTS

GASOLINE DIRECT INJECTION (GDI)	13A
FUEL SUPPLY	13B

GASOLINE DIRECT INJECTION (GDI)

CONTENTS

GENERAL INFORMATION	3	Engine Coolant Temperature Sensor Check ..	102
SERVICE SPECIFICATIONS	7	Throttle Position Sensor Check	103
SEALANT	7	Accelerator Pedal Position Sensor (1st channel) Check	104
SPECIAL TOOLS	8	Accelerator Pedal Position Sensor (2nd channel) Check	104
TROUBLESHOOTING	10	Accelerator Pedal Position Switch Check	105
ON-VEHICLE SERVICE	92	Oxygen Sensor Check	105
Throttle Body (Throttle Valve Area) Cleaning ..	92	Injector Check	106
Throttle Position Sensor Adjustment	92	Throttle Valve Control Servo Check	107
Accelerator Pedal Position Sensor Adjustment	94	Purge Control Solenoid Valve Check	107
Fuel Pressure Test	95	EGR Valve Check	107
Fuel Leak Check	99	FUEL PUMP (HIGH PRESSURE) AND FUEL PRESSURE REGULATOR (HIGH PRESSURE)	108
Fuel Pump Connector Disconnection (How to Reduce Fuel Pressure)	99	INJECTOR	111
Fuel Pump Operation Check	100	THROTTLE BODY	114
Component Location	101	INJECTOR DRIVER	116
Engine Control Relay, Fuel Pump Relay, Injector Driver Relay and Throttle Valve Control Servo Relay Continuity Check	102	THROTTLE VALVE CONTROLLER	117
Intake Air Temperature Sensor Check	102		

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

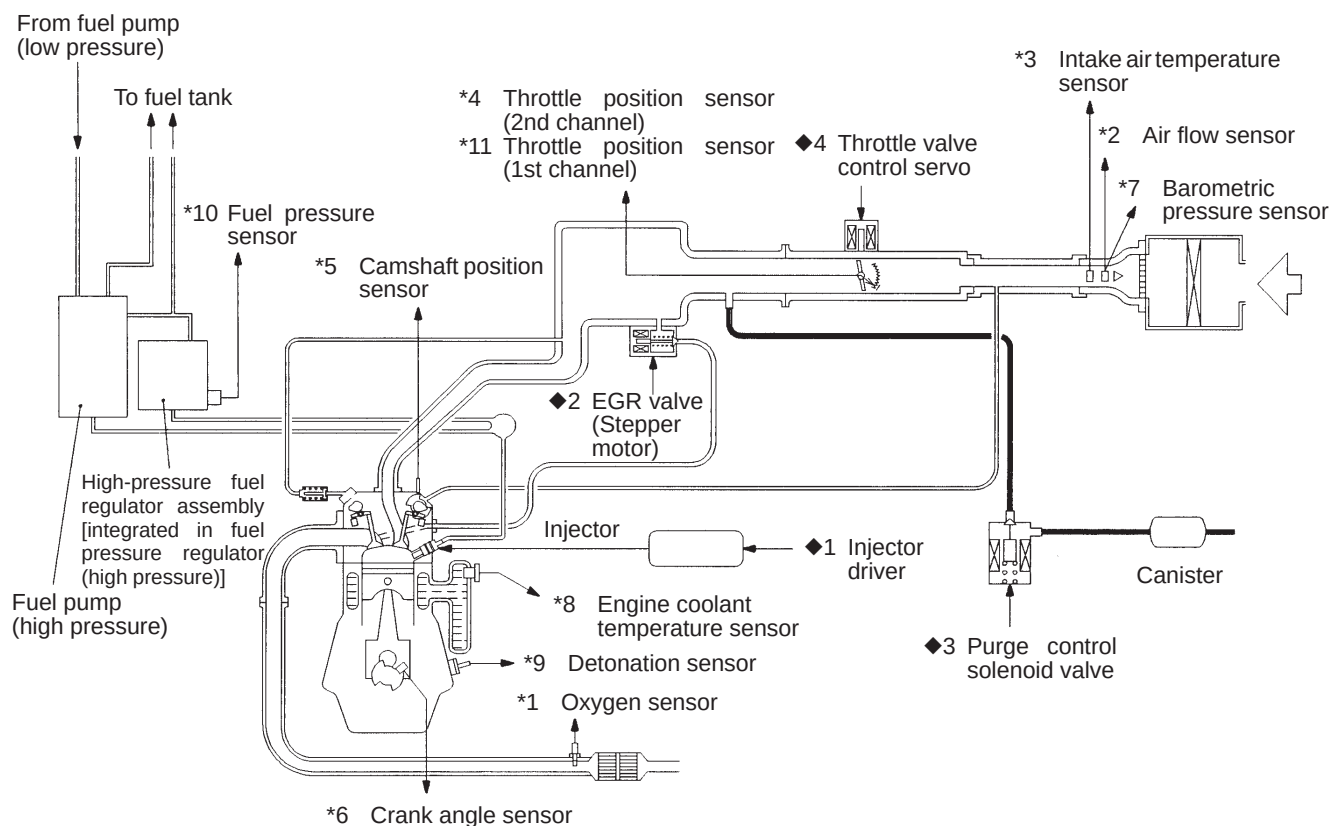
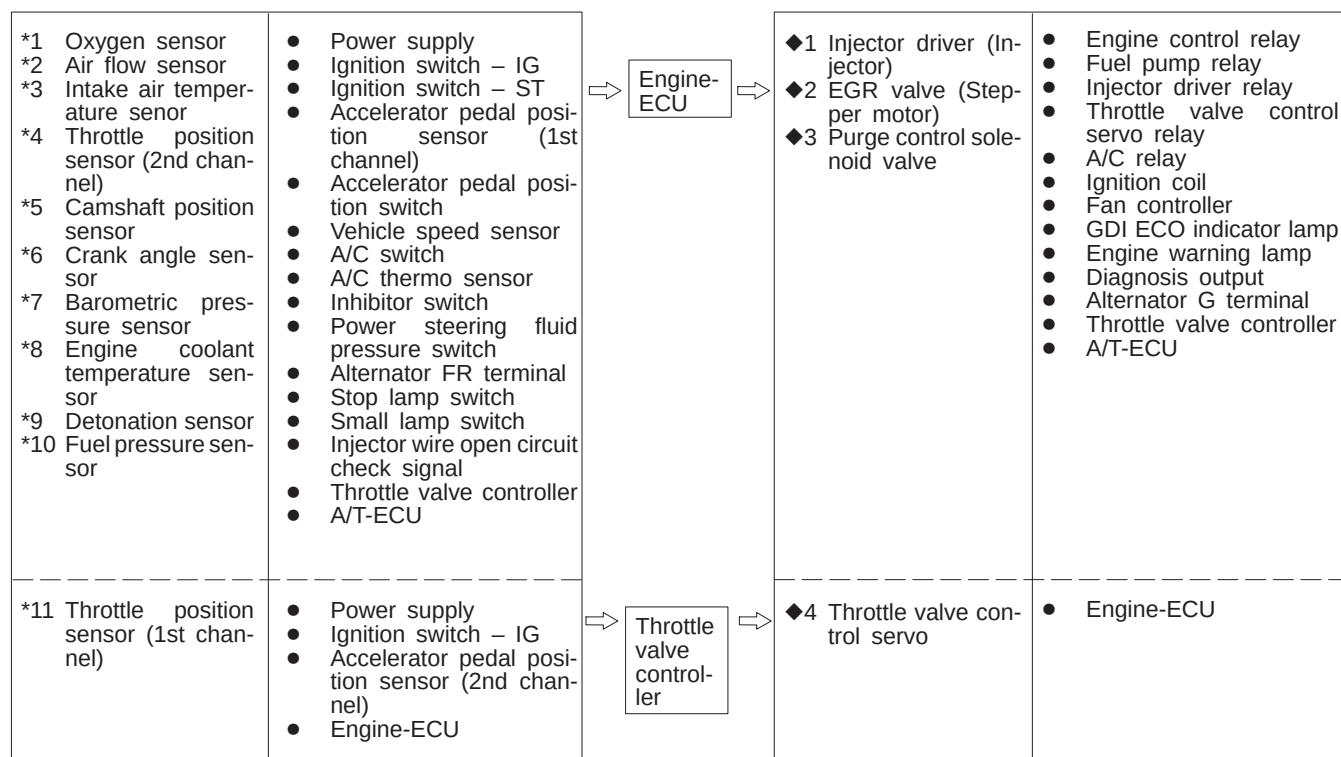
1. Fuel Pump Control
Turns the fuel pump relay ON so that current is supplied to the fuel pump while the engine is cranking or running.
2. A/C Relay Control
Turns the compressor clutch of the A/C ON and OFF.
3. Fan Motor Control
The revolutions of the radiator fan and condenser fan are controlled in 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



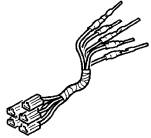
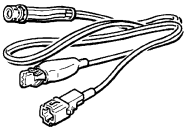
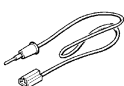
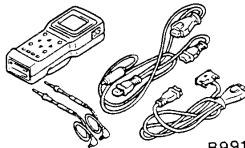
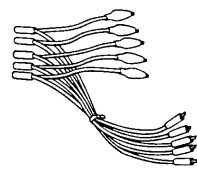
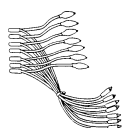
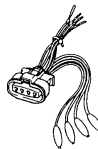
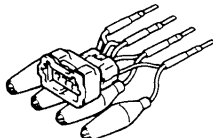
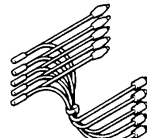
SERVICE SPECIFICATIONS

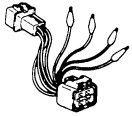
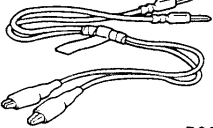
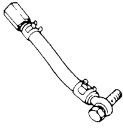
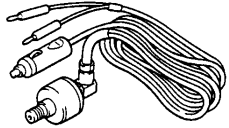
Item		Standard value
Adjustment voltage of throttle position sensor (1st channel) V		0.4 – 0.6
Adjustment voltage of throttle position sensor (2nd channel) V		4.2 – 4.8
Resistance of throttle position sensor k Ω		3.5 – 6.5
Adjustment voltages (1st channel) and (2nd channel) of accelerator pedal position sensor V		0.935 – 1.135
Resistance (1st channel) and (2nd channel) of accelerator pedal position sensor k Ω		3.5 – 6.5
Intake air temperature sensor resistance k Ω	at 20°C	2.3 – 3.0
	at 80°C	0.30 – 0.42
Engine coolant temperature sensor resistance k Ω	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 troubleshooting - 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	

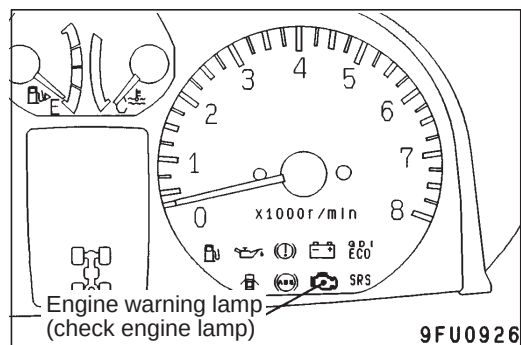
TROUBLESHOOTING

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 be 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

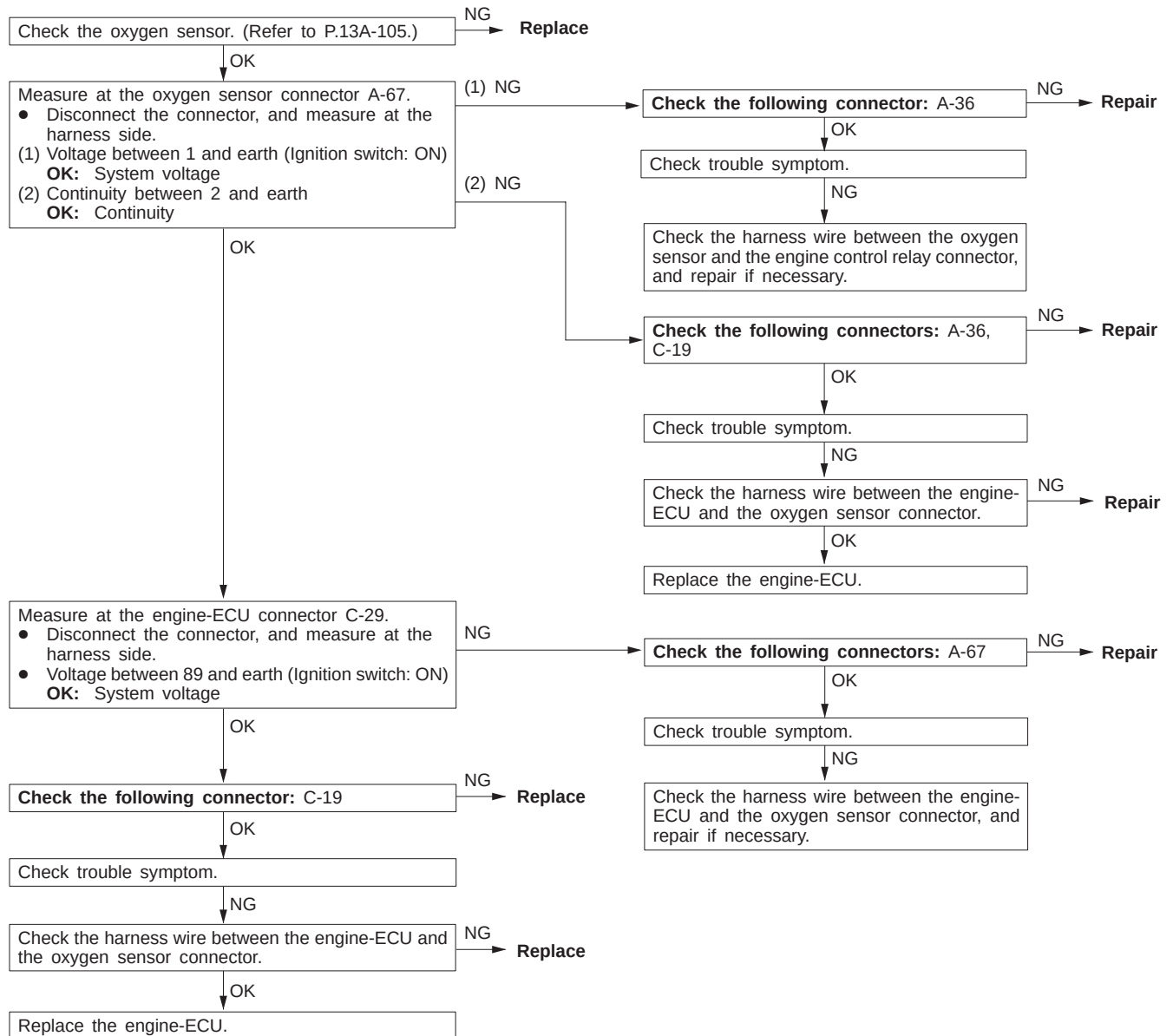
Code No.	Diagnosis item	Reference page
11	Oxygen sensor system	13A-15
12	Air flow sensor system	13A-16
13	Intake air temperature sensor system	13A-17
14	Throttle position sensor (2nd channel) system	13A-18
21	Engine coolant temperature sensor system	13A-19
22	Crank angle sensor system	13A-20
23	Camshaft 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

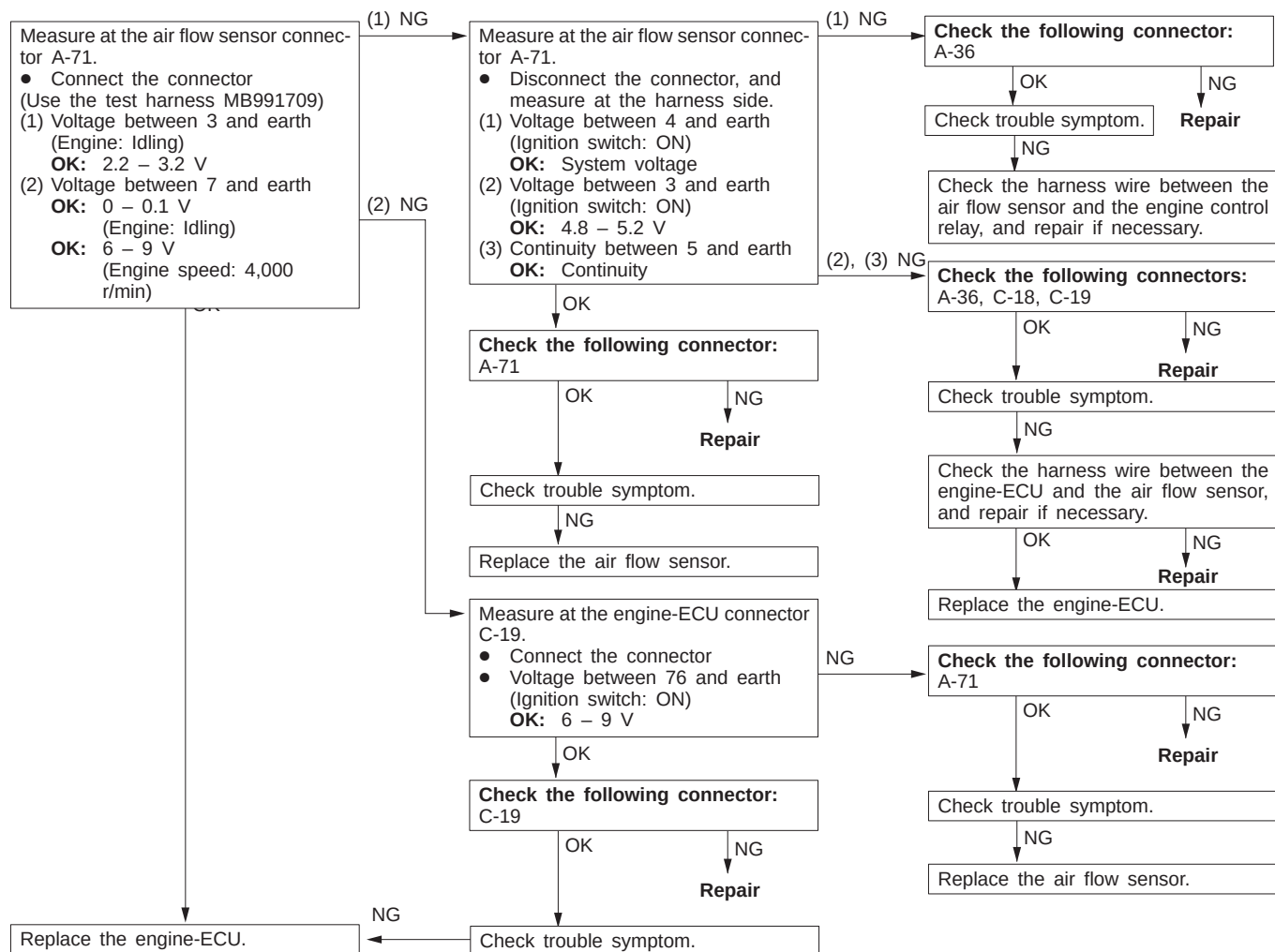
Code No. 56 may be also output when air is sucked in high-pressure fuel line due to no fuel supply.

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

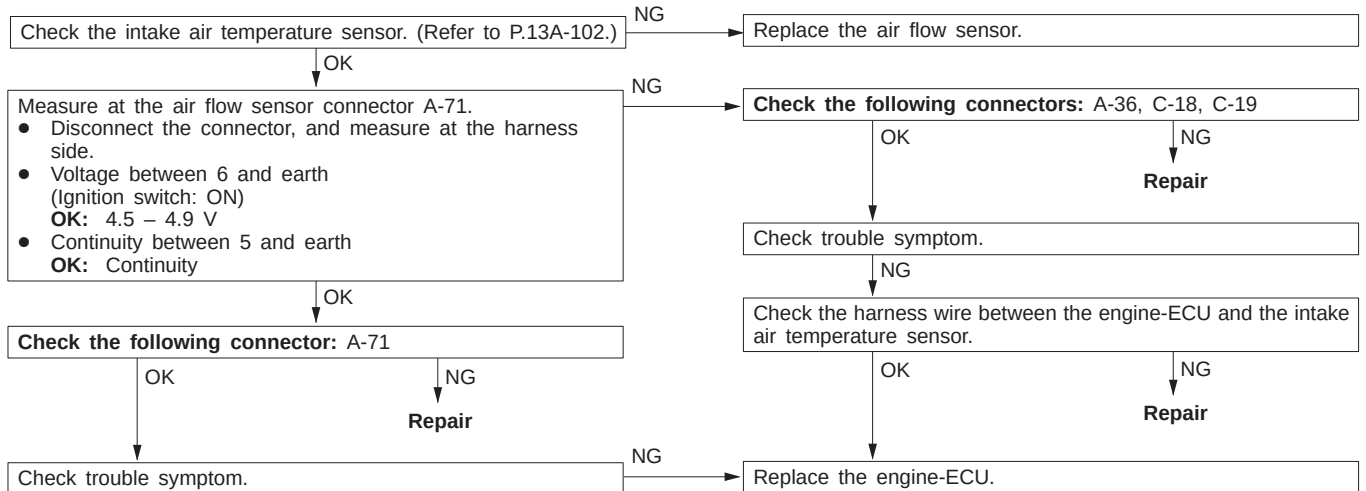
Code No.11 Oxygen sensor system	Probable cause
Range of check 3 minutes have passed after engine was started. - Engine coolant temperature is approx. 80°C or more. - Intake air temperature is 20 – 50°C. - Engine speed is approx. 2,000 – 3,000 r/min. - Vehicle is moving at constant speed on a flat, level 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



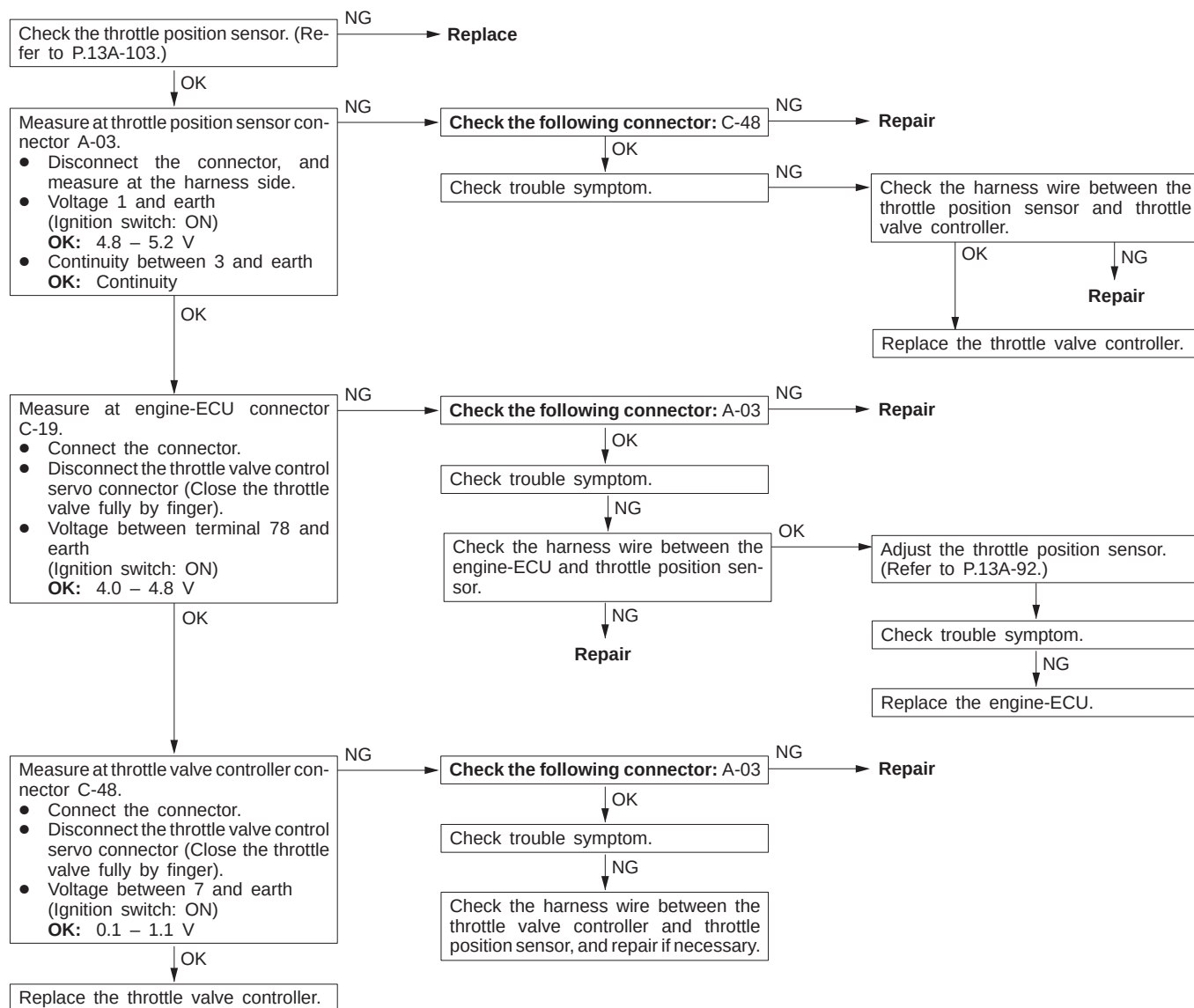
Code No.12 Air flow sensor system	Probable cause
Range of check • Engine speed is 500 r/min or more. Set conditions • Sensor output frequency is 3.3 Hz or less for 4 seconds.	• Malfunction of the air flow sensor • Open circuit or short-circuited harness wire of air flow sensor circuit • Malfunction of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



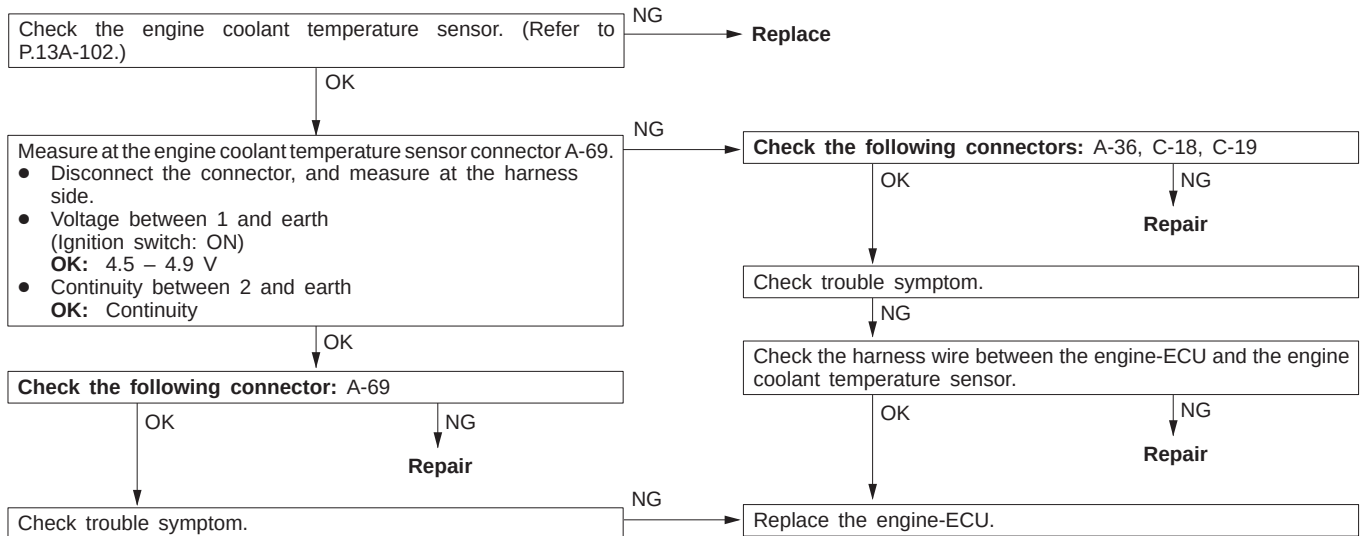
Code No.13 Intake air temperature sensor system	Probable cause
Range of check • After 60 seconds have passed since the engine have started Set conditions • Sensor resistance is 0.14 k Ω or less for 4 seconds. or • Sensor resistance is 50 k Ω or more for 4 seconds.	• Malfunction of the intake air temperature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



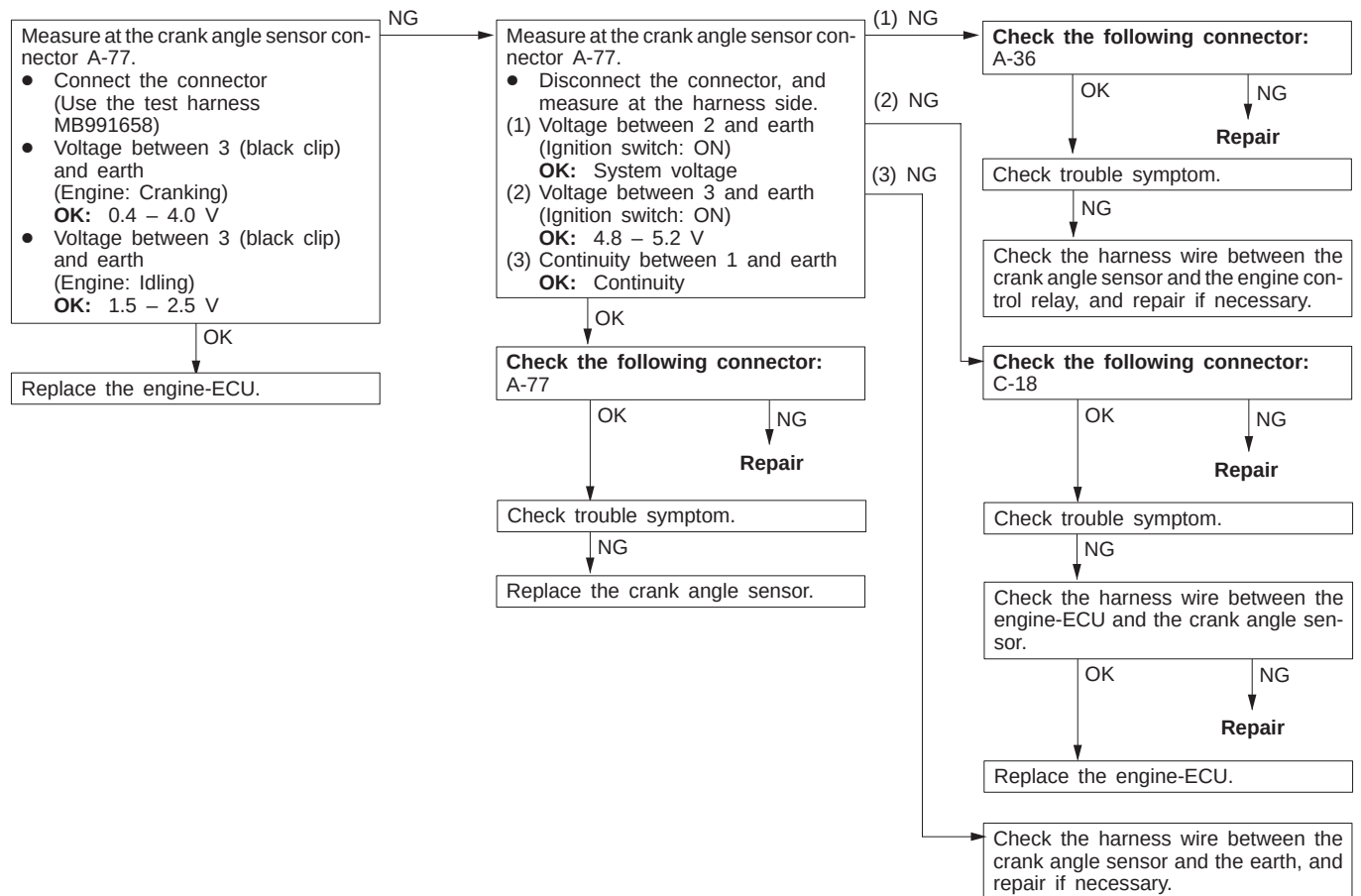
Code No.14 Throttle position sensor system (2nd channel)	Probable cause
The throttle valve controller determines whether a failure is present or not, and sends a signal indicating its result to the engine-ECU. Range of check - Ignition switch: ON - Throttle position sensor (1st channel) is normal Set 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



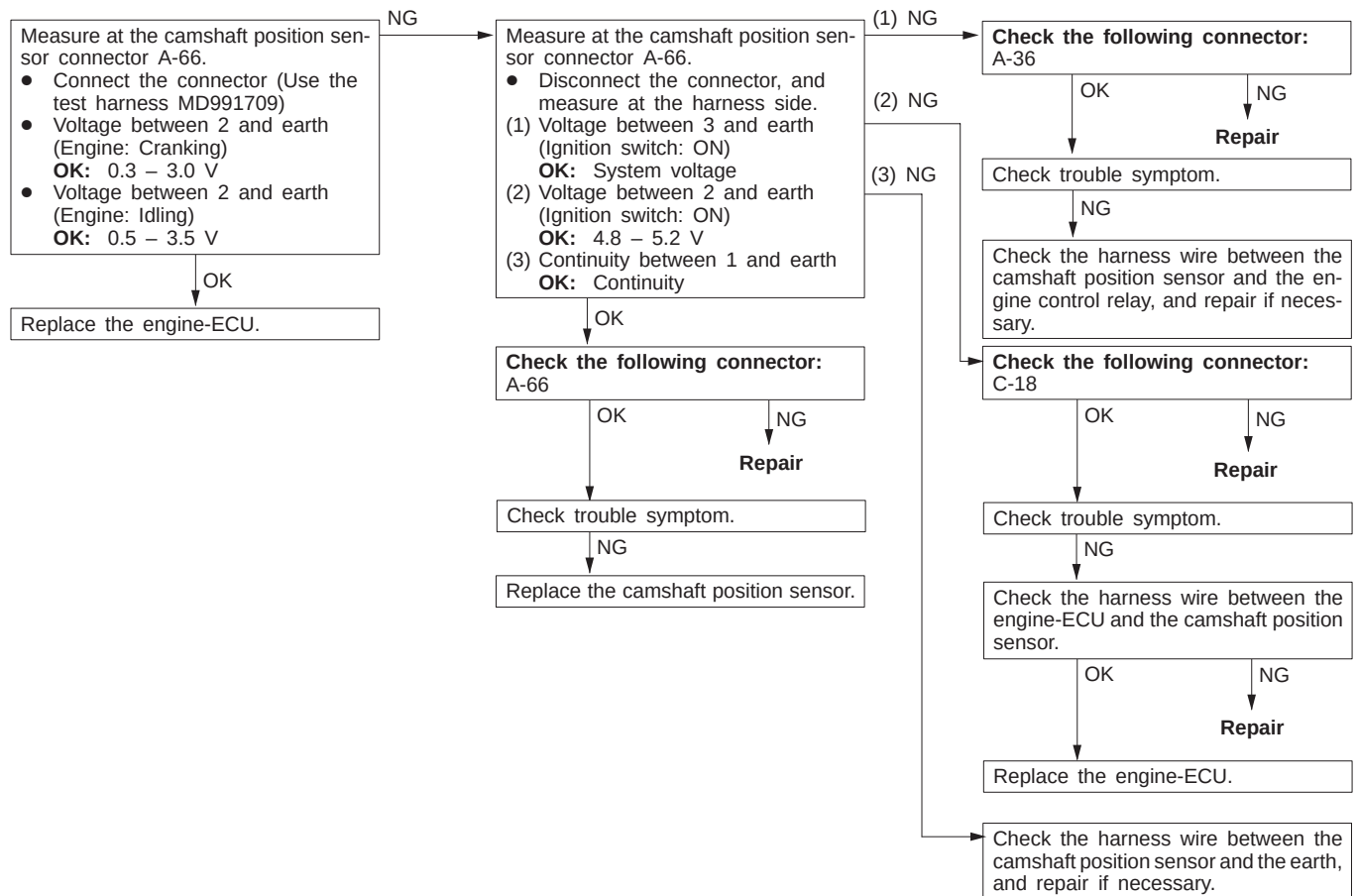
Code No.21 Engine coolant temperature sensor system	Probable cause
Range of check • After 60 seconds have passed since the engine have started Set conditions • Sensor resistance is 50 Ω or less for 4 seconds. or • Sensor resistance is 72 k Ω or more for 4 seconds.	• Malfunction of the engine coolant 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	



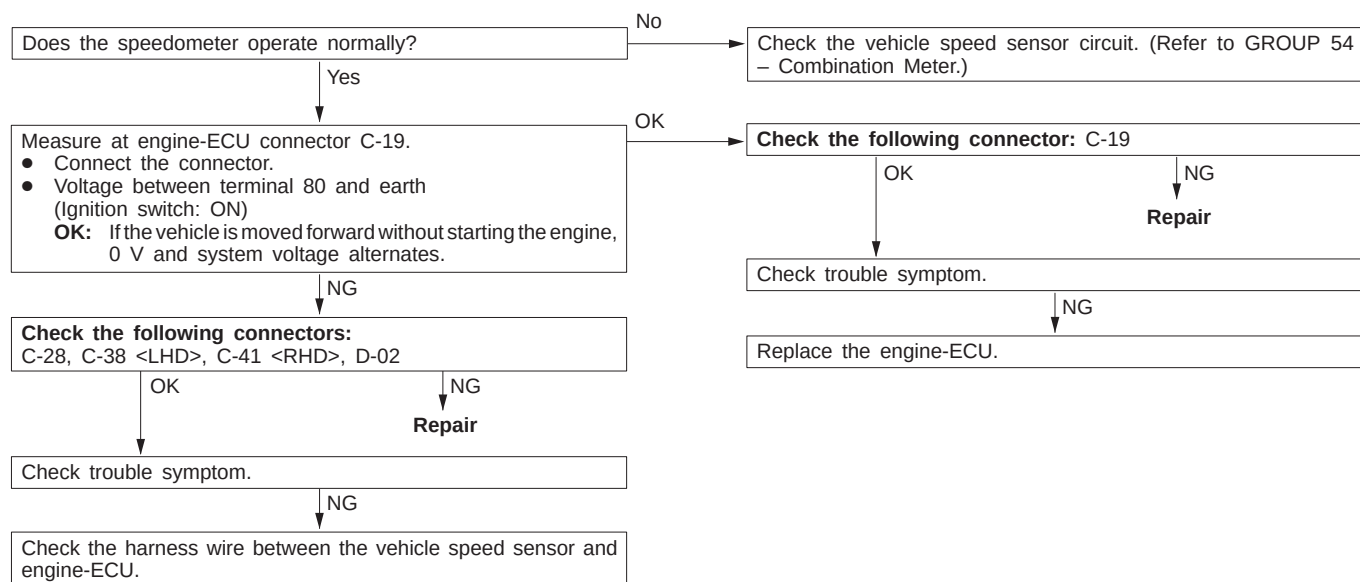
Code No.22 Crank angle sensor system	Probable cause
Range of check • Engine: During cranking Set conditions • Sensor output voltage does not change for 4 seconds (no pulse signal is being input).	• Malfunction of the crank angle sensor • Open circuit or short-circuited harness wire of the crank angle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



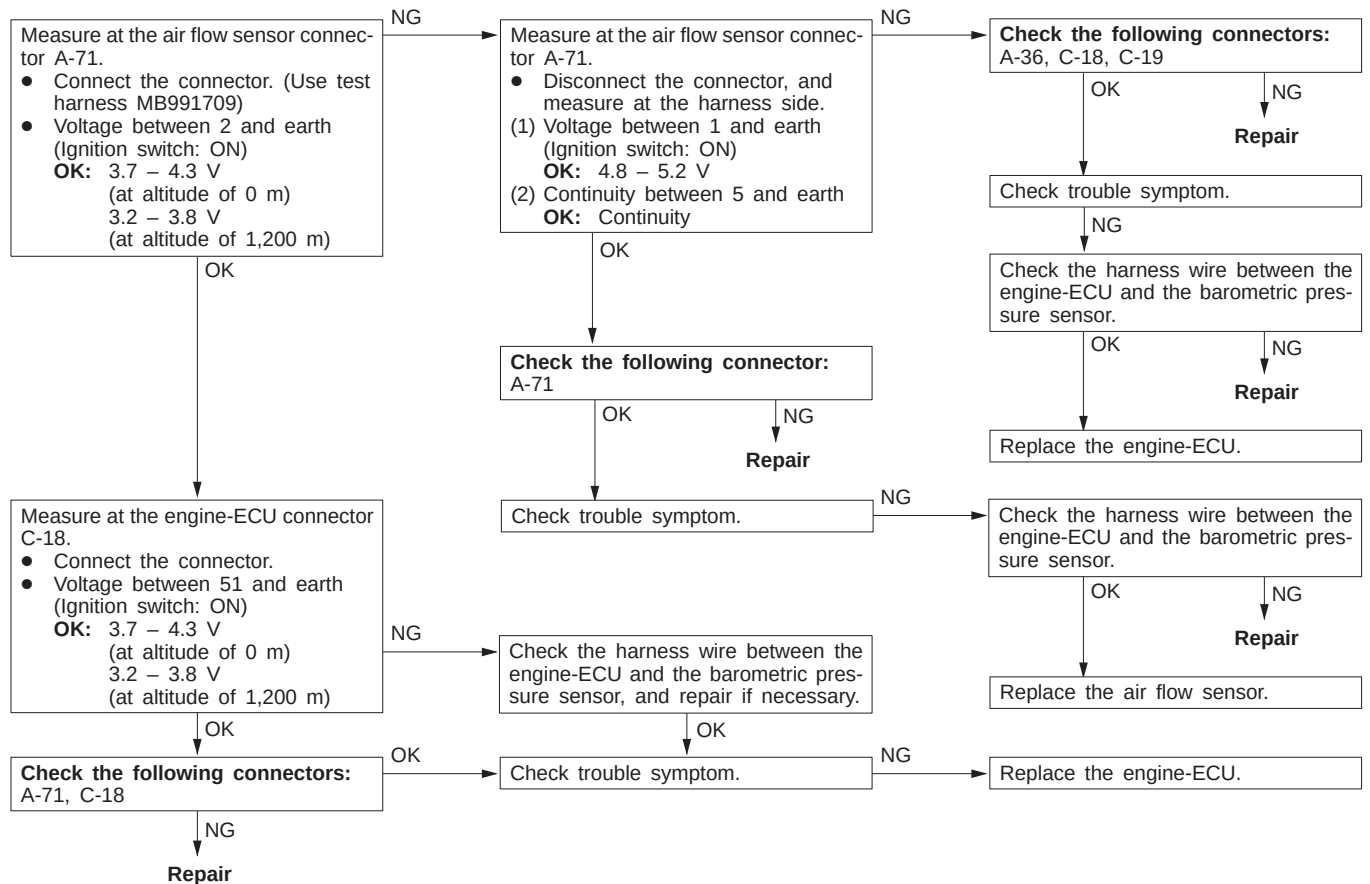
Code No.23 Camshaft position sensor system	Probable cause
Range of check - While engine is cranking or running Set conditions - Sensor output voltage does not change for 4 seconds (no pulse signal is being input).	- Malfunction of the camshaft position sensor - Open circuit or short-circuited harness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



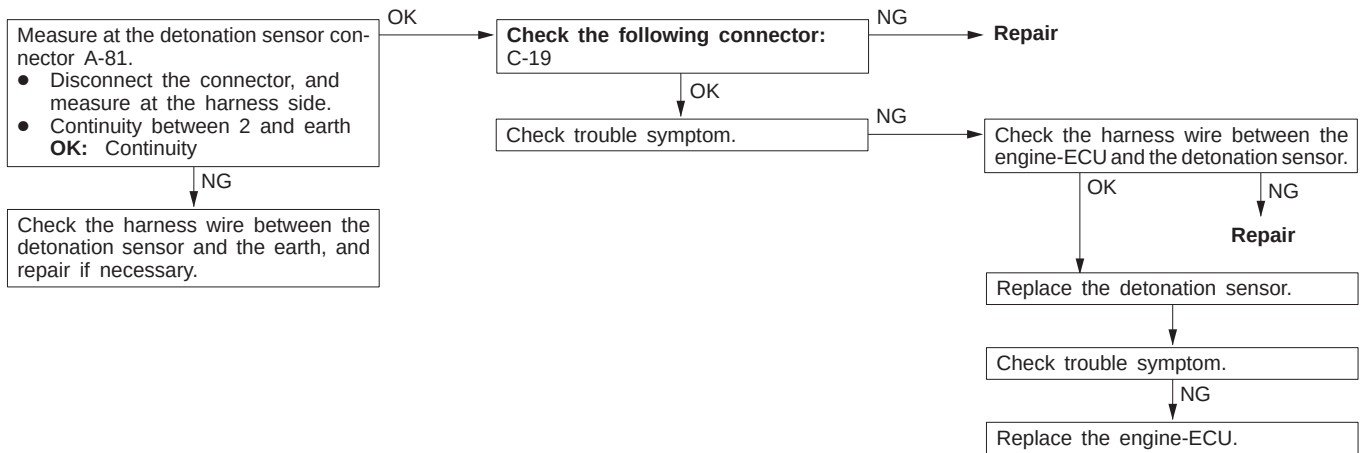
Code No. 24 Vehicles speed sensor system	Probable cause
Range of check - Ignition switch: ON - Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. - Engine speed is 3,000 r/min or more. - Driving under high engine load conditions. Set conditions - Sensor 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



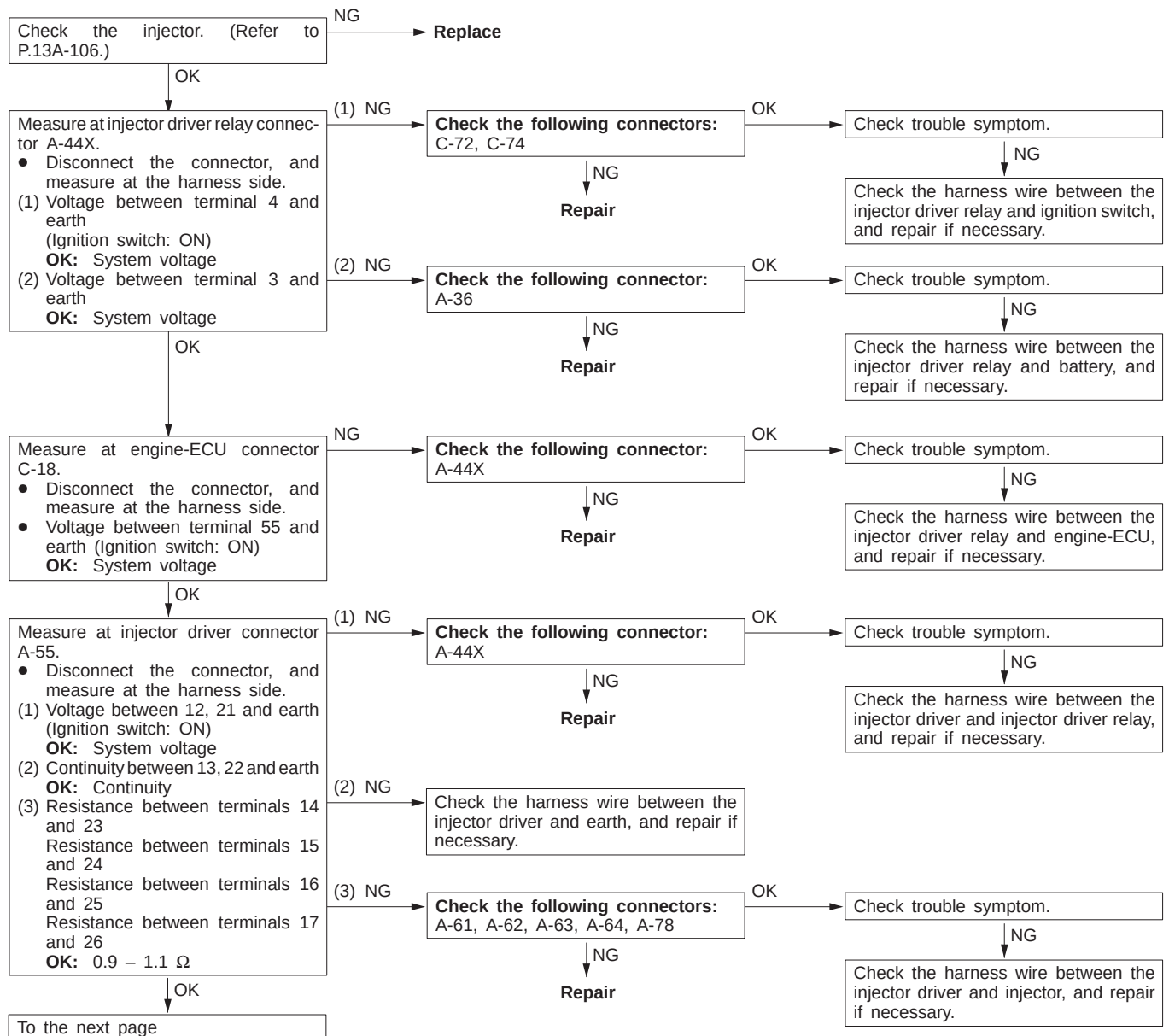
Code No.25 Barometric pressure sensor system	Probable cause
Range of check - After 60 seconds have passed since the engine have started - Battery voltage is 8 V or more. Set conditions - Sensor output voltage is 0.2 V or less for 4 seconds. (This condition corresponds to that the barometric pressure 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

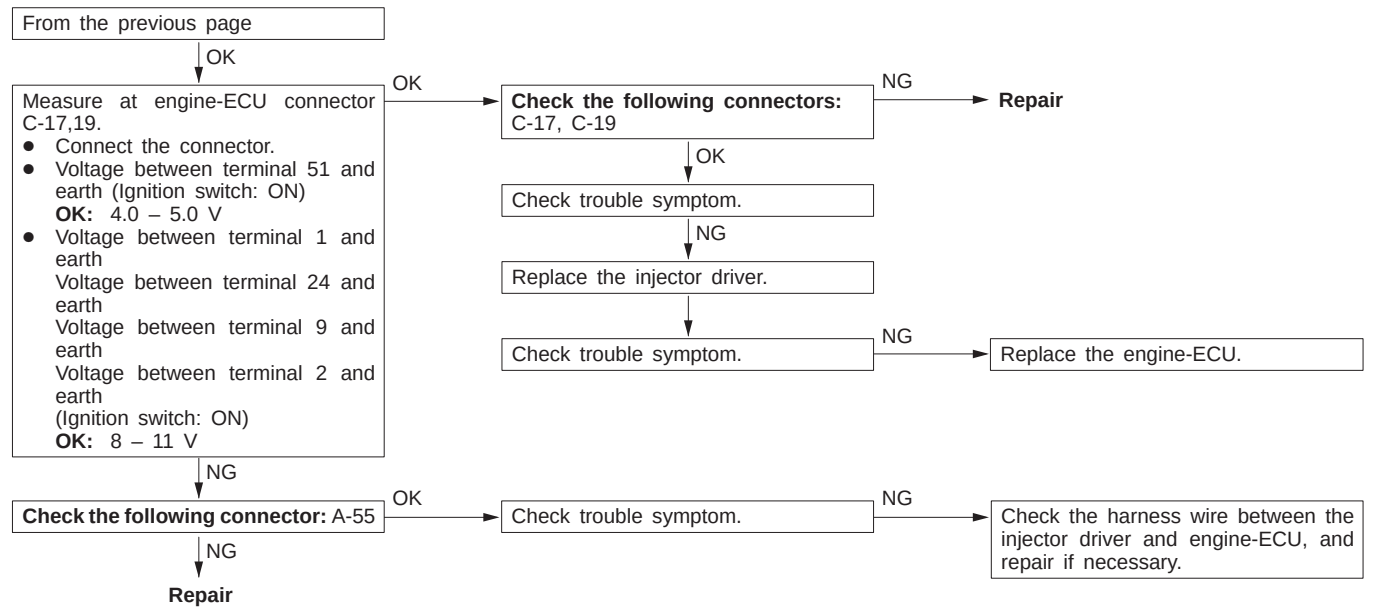


Code No.31 Detonation sensor system	Probable cause
Range of check - After 60 seconds have passed since the engine have started Set conditions - Amount of change in the sensor output voltage (detonation sensor peak voltage for each half rotation of the crankshaft) is 0.06 V or less for 200 continuous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

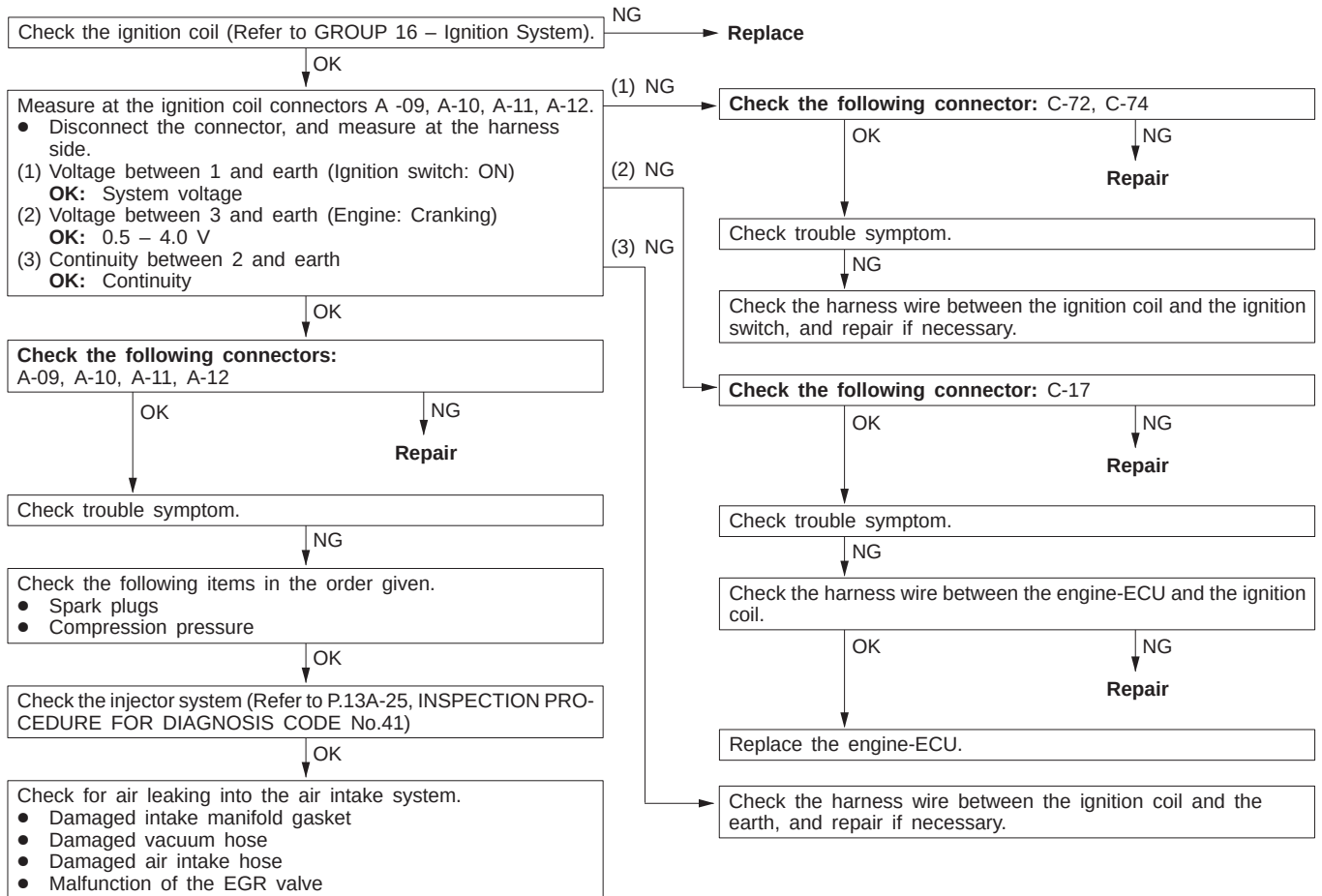


Code No.41 Injector system	Probable cause
Range of check - Engine: while cranking, or running - Engine speed: 4,000 r/min or less - System voltage: 10 V or more - Fuel shut off, or while forcible activating of injector (actuator test) is in operation. Set conditions - Injector open circuit check signal 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





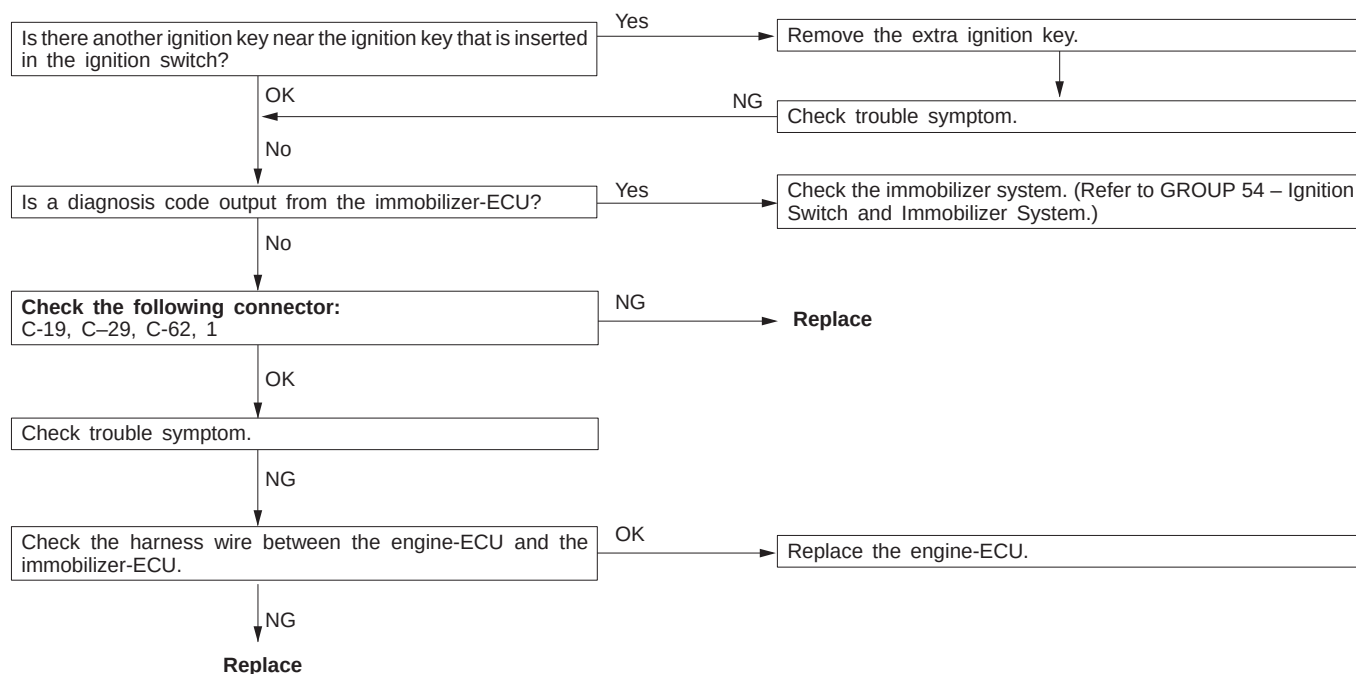
Code No.44 Abnormal combustion	Probable cause
Range of check - While engine is running during lean fuel combustion Set conditions - Abnormal engine speed due to mis-firing is detected by the crank angle sensor	- Malfunction of the ignition coil - Malfunction of the spark plug - Malfunction of the EGR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



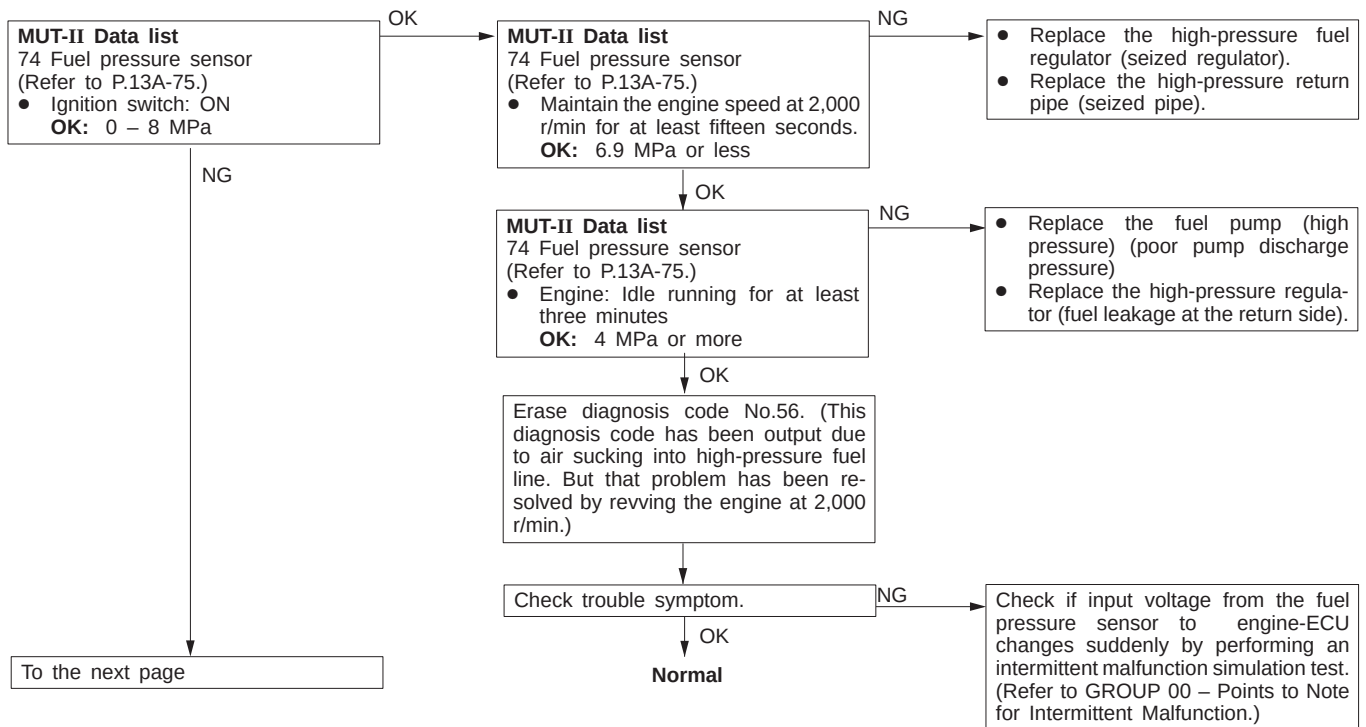
Code No.54 Immobilizer system	Probable cause
Range of check • Ignition switch: ON Set conditions • Improper communication between the engine-ECU and immobilizer-ECU	• Radio interference of ID codes • Incorrect ID code • Malfunction of harness or connector • Malfunction of immobilizer-ECU • Malfunction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

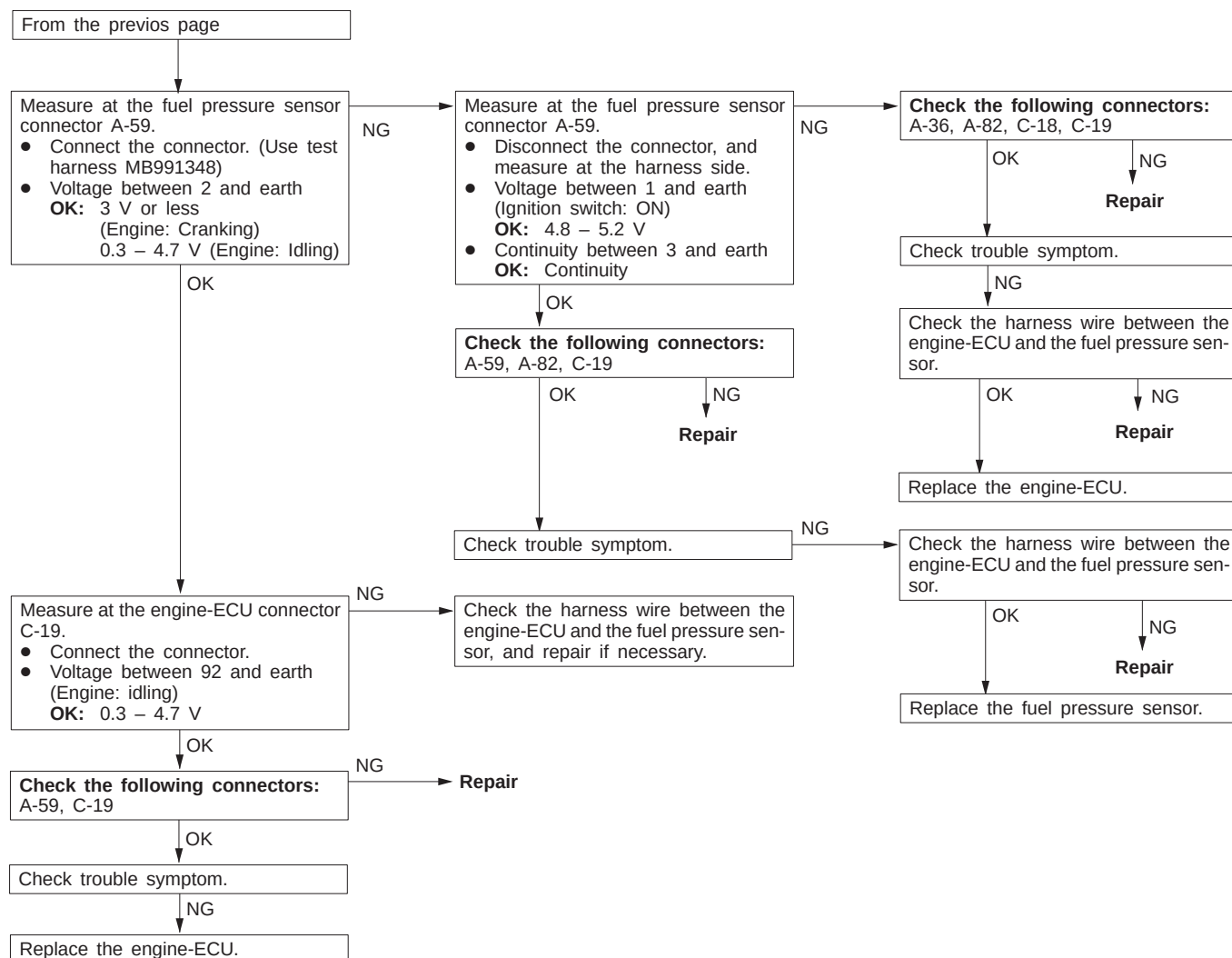
NOTE

- (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.

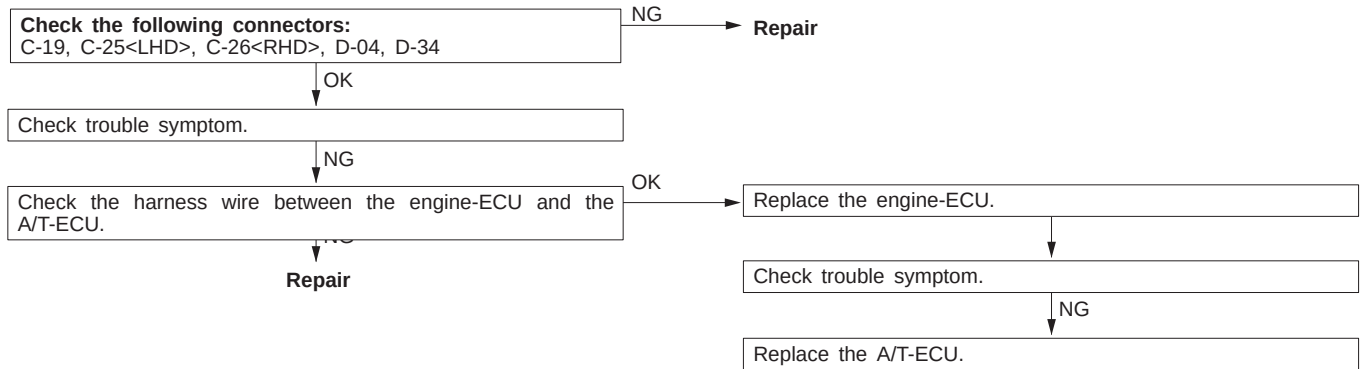


Code No.56 Abnormal fuel pressure	Probable cause
Range of check - Ignition switch: ON Set conditions - Sensor output voltage is 4.8 V or more for four seconds. or - Sensor output voltage is 0.2 V or less for four seconds. Range of check - After the engine is started, the following condition has been 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

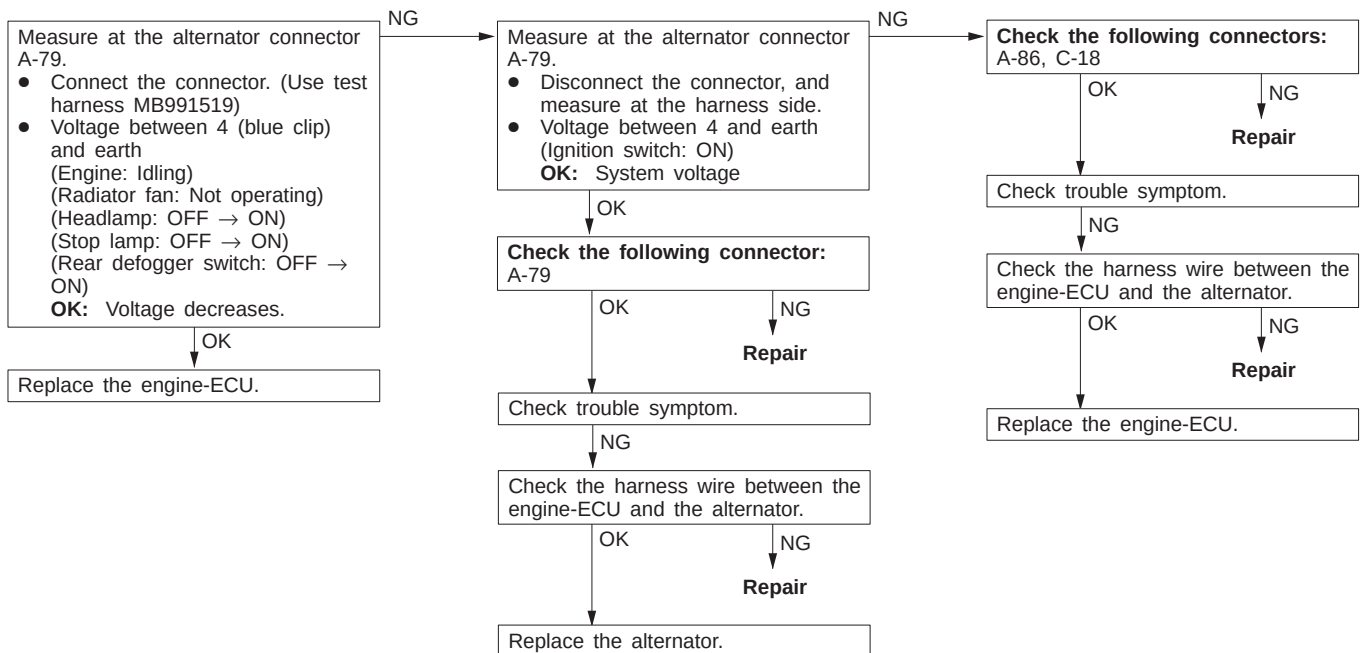




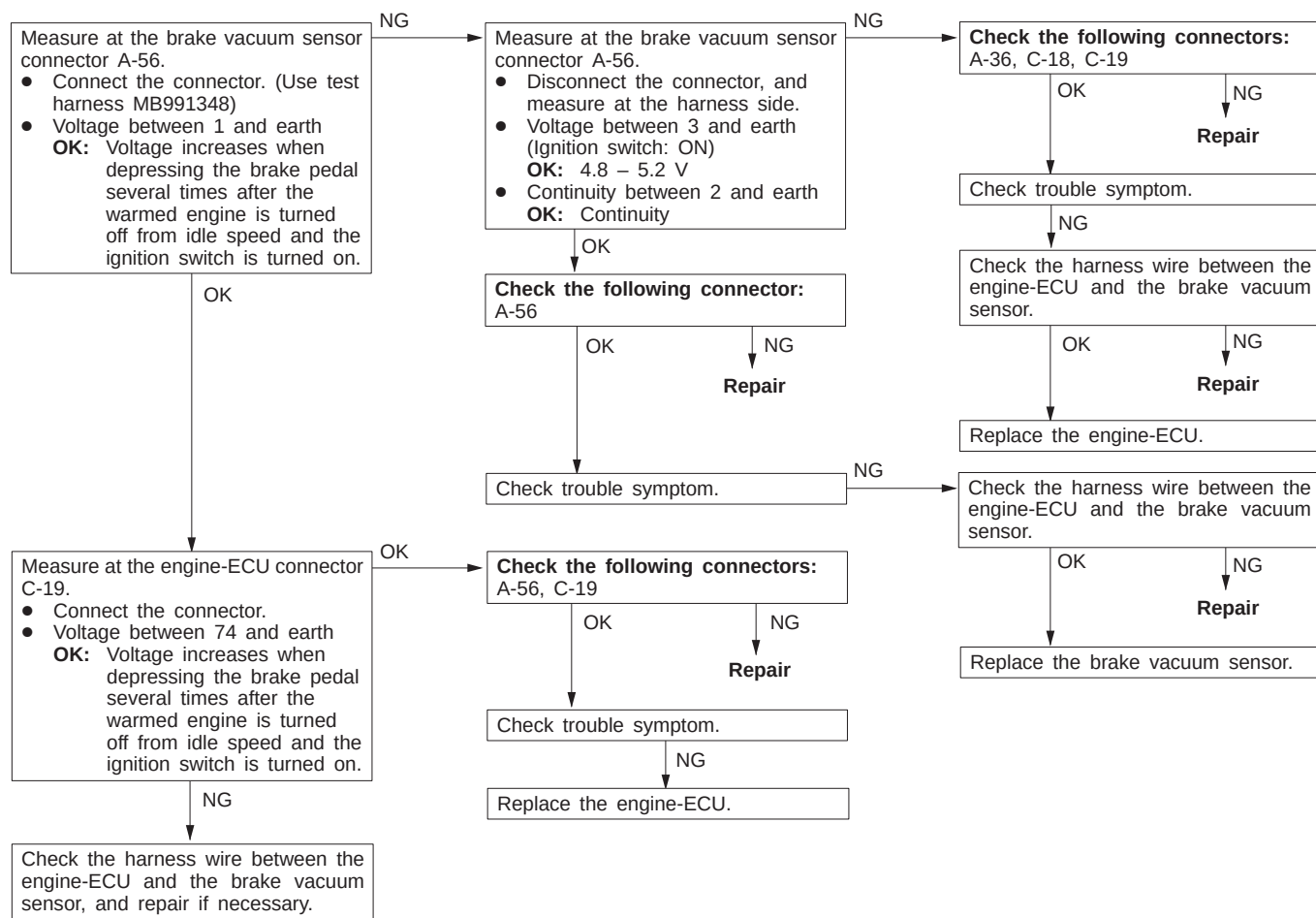
Code No.61 Communication wire with A/T-ECU system	Probable cause
Range of check - After 60 seconds have passed since the engine have started Set conditions - Torque reduction request signal from A/T-ECU is input continuously for 1.5 seconds or more.	- Short circuit in ECU communication circuit - Malfunction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



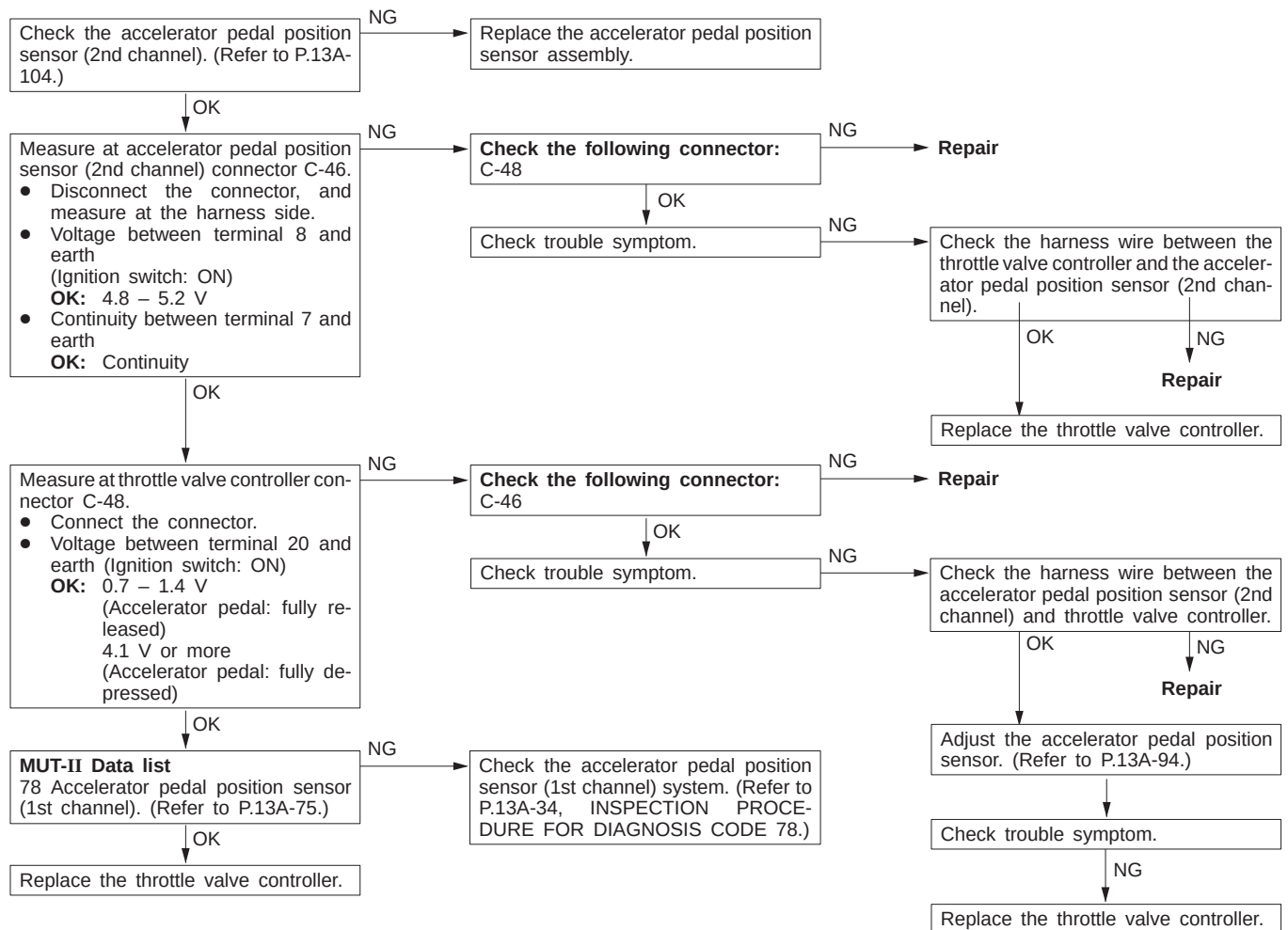
Code No.64 Alternator FR terminal system	Probable cause
Range of check - Engine speed is 50 r/min or more. Set conditions - Input voltage from the alternator FR terminal is system voltage for 20 seconds.	- Open circuit in alternator FR terminal circuit - Malfunction of the engine-ECU



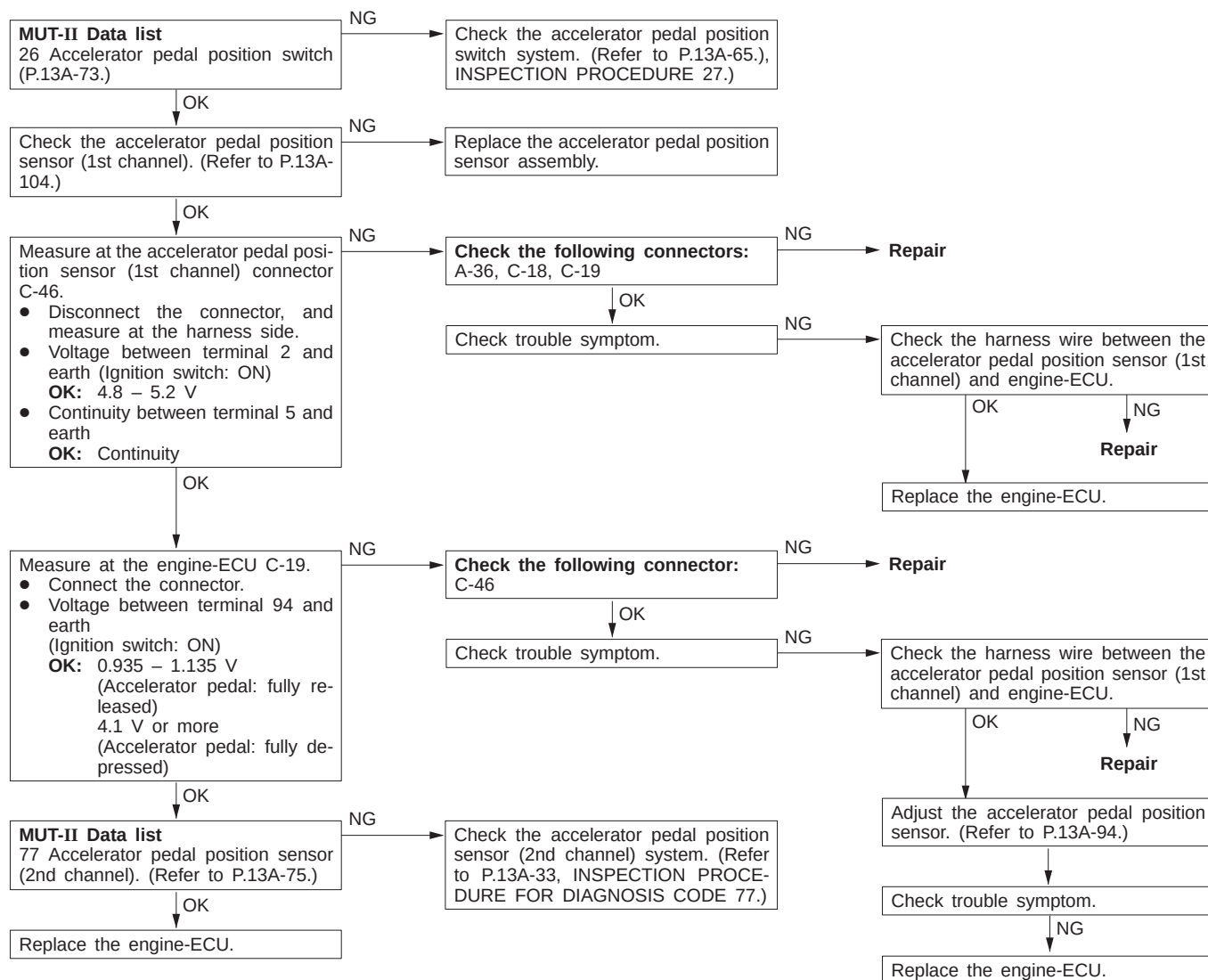
Code No.66 Brake vacuum sensor system	Probable cause
Range of check • Ignition switch: ON Set conditions • Sensor output voltage is 4.8 V or more. or • Sensor output voltage is 0.2 V or less.	• Malfunction of the brake vacuum sensor • Improper connector contact, open circuit or short-circuited harness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



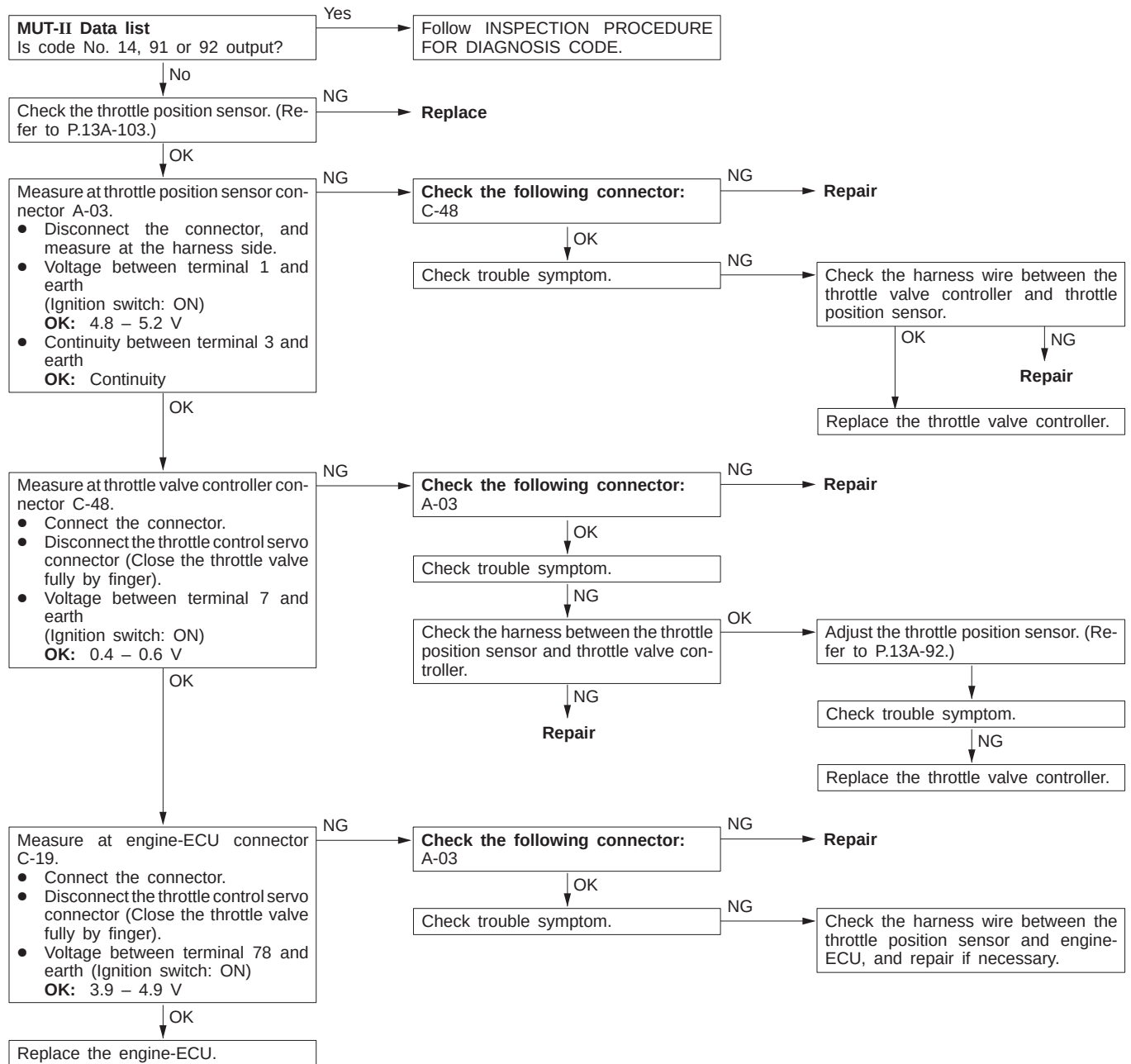
Code No.77 Accelerator pedal position sensor (2nd channel) system	Probable cause
Range of check - Accelerator pedal position sensor (1st channel) system is normal. - Communication between the engine-ECU and throttle valve controller is normal. Set conditions - Output voltage of accelerator pedal position 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



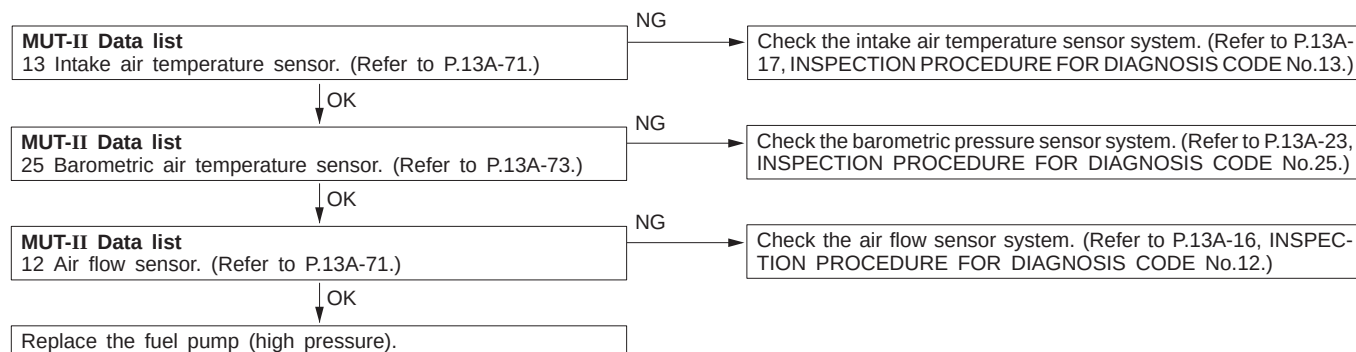
Code No.78 Accelerator pedal position sensor (1st channel) system	Probable cause
Range of check - Accelerator pedal position sensor (2nd channel) system is normal. - Communication between the engine-ECU and throttle valve controller is normal. Set conditions - Output voltage of accelerator position sensor (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



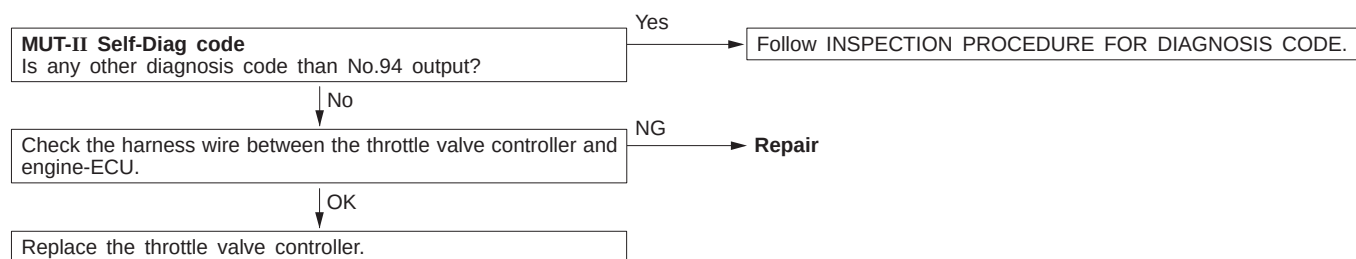
Code No.79 Throttle position sensor (1st channel) system	Probable cause
The throttle valve controller determines a failure, and sends it result to the engine-ECU. Range of check - Ignition switch: ON - System voltage: 8 V or more Set conditions - Output voltage of the sensor remains 0.2 V for one second. 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



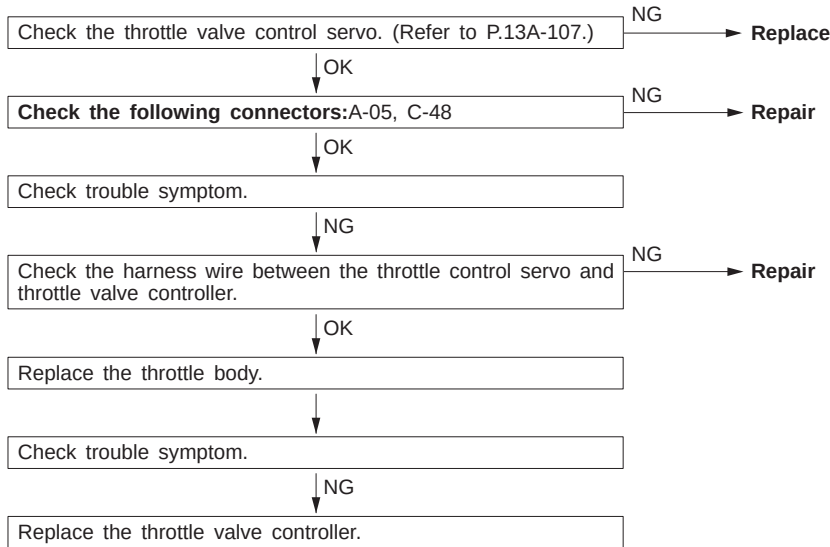
Code No.89 Abnormal fuel pressure system	Probable cause
Range of check - Engine: Idling (during stoichio-feedback operation) Set conditions - Fuel injection correction value remains excessively low for ten seconds or more. or - Fuel injection correction value remains excessively high for ten seconds 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



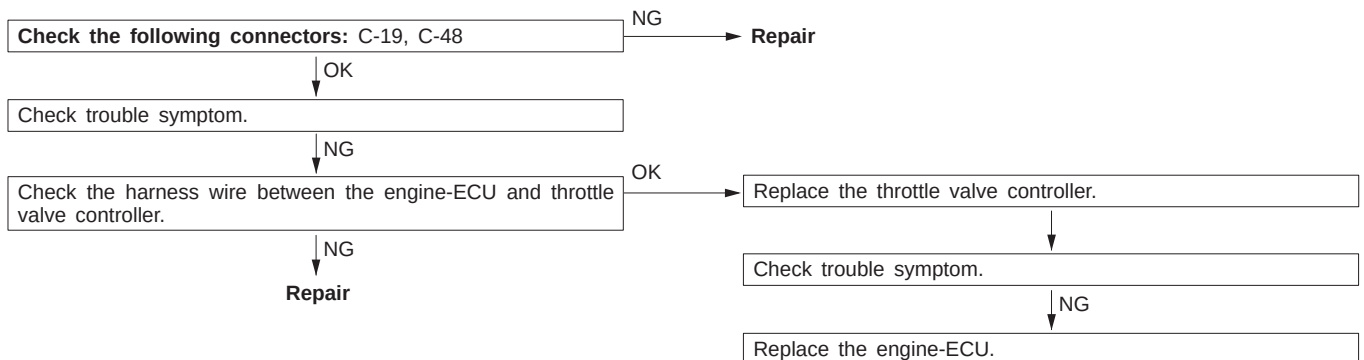
Code No.91 Electronic-controlled throttle valve system	Probable cause
Range of check - Ignition switch: ON - Error in communication from the engine-ECU to throttle valve controller Set conditions - Output voltage of the throttle position sensor (2nd channel) fluctuates significantly (approx. 1 V or more) 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



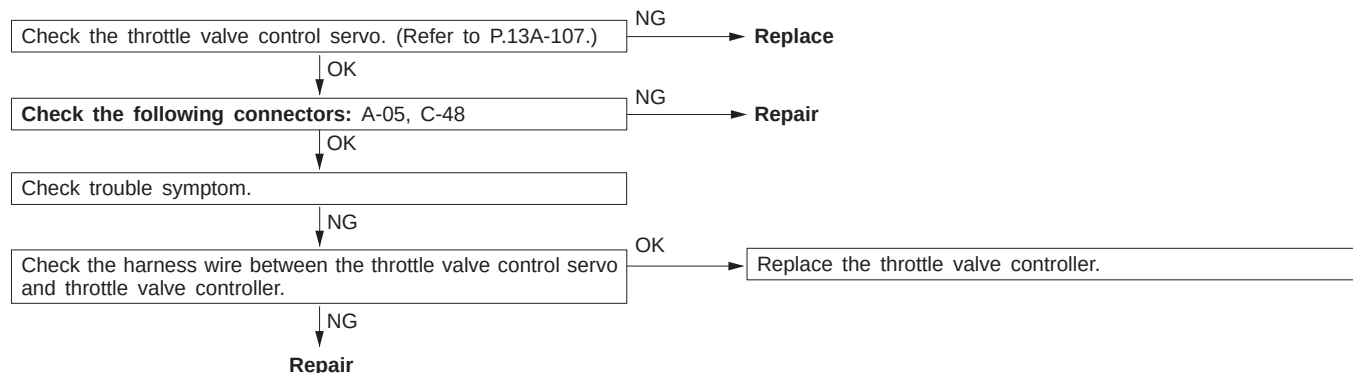
Code No.92 Throttle valve position feedback system	Probable cause
The throttle valve controller determines if a failure is present, and sends its result to the engine-ECU. Range of check - Ignition switch: ON - System voltage: 8 V or more Set condition - Motor position feedback system is defective (System 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



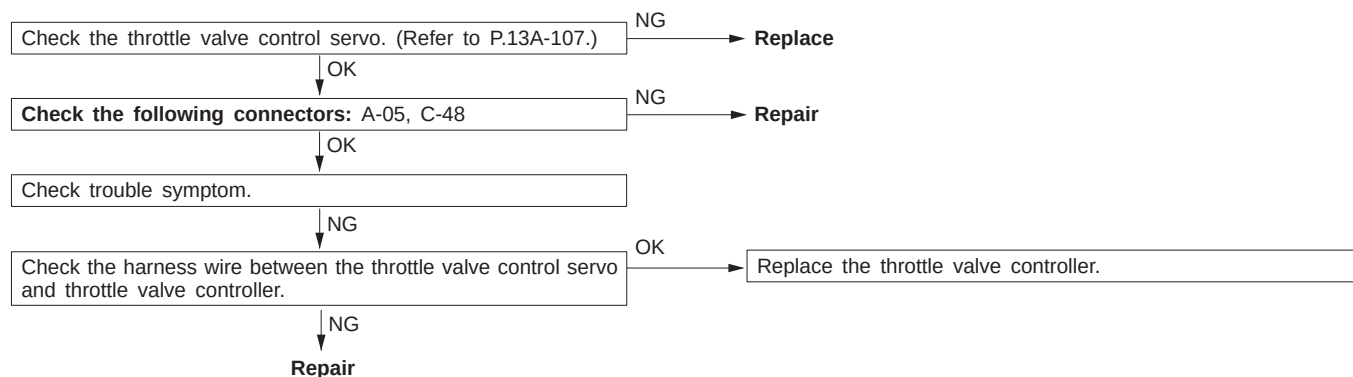
Code No.94 Communication line system with throttle valve controller	Probable cause
Range of check - Ignition switch: ON - System voltage: 8 V or more - Engine: not cranking Set condition - System detects an error in communication line between the engine-ECU and throttle valve controller.	- Short circuit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



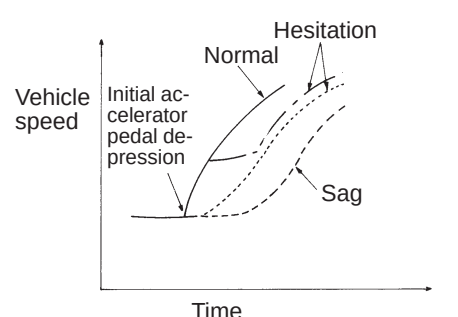
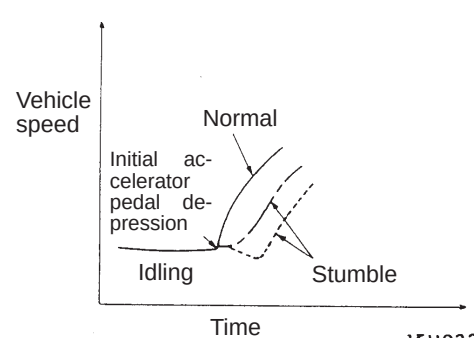
Code No.99 Malfunction in throttle valve control servo motor (2nd motor) system	Probable cause
Range of check - Throttle valve control servo relay: ON - System voltage: 8V or more Set conditions - Throttle valve control servo drive circuit is shorted to earth. - Other power source interferes with throttle 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)

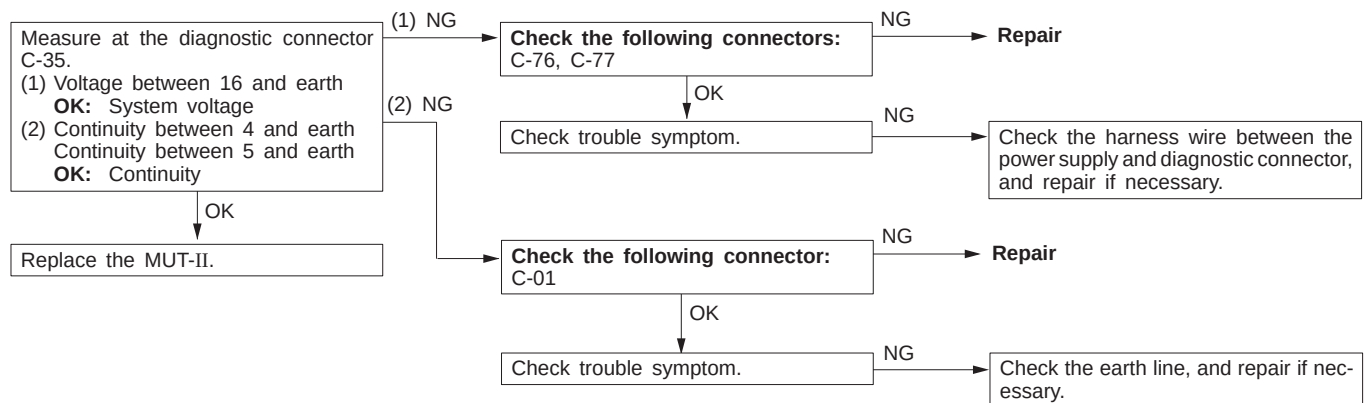
Items		Symptom
Starting	Won't start	The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.
	Fires up and dies	There is combustion within the cylinders, but then the engine soon stalls.
	Hard starting	Engine starts after cranking a while.
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".  1FU0223
	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.  1FU0224

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

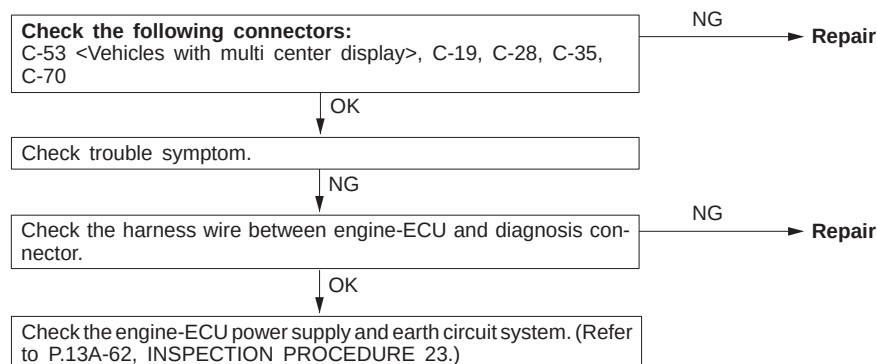
INSPECTION PROCEDURE 1

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

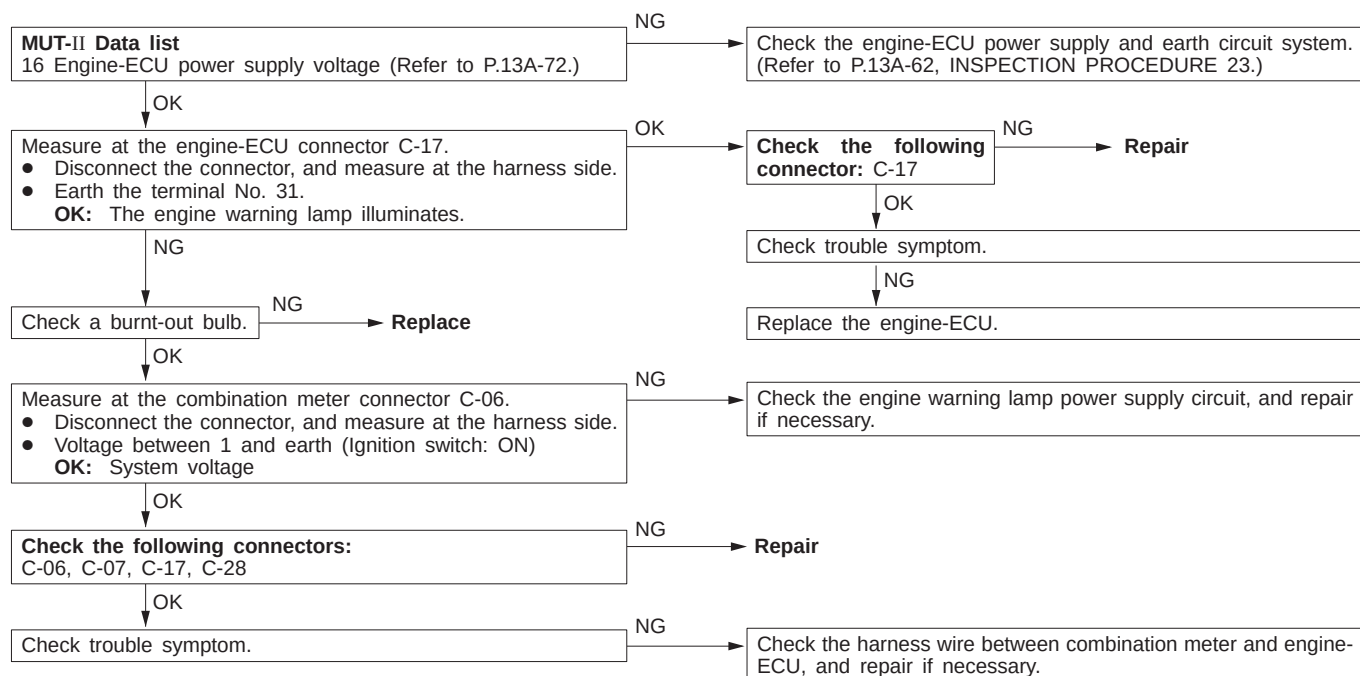


NOTE

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.)

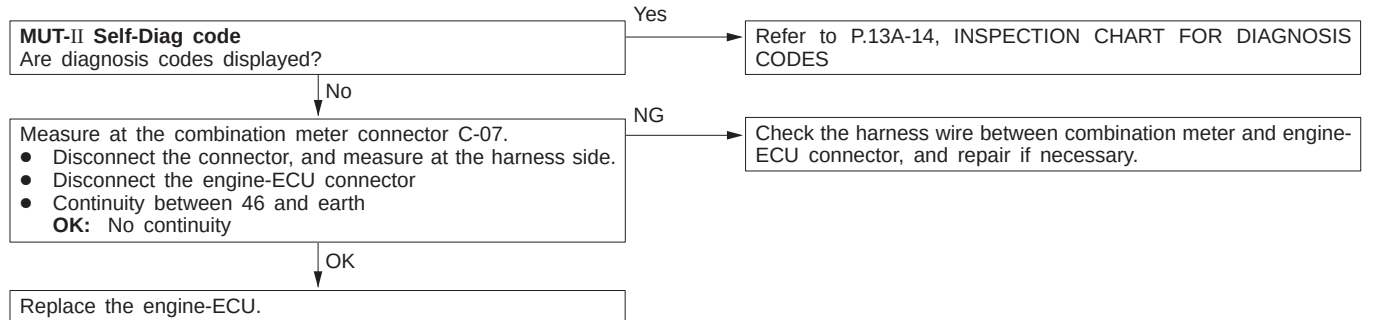
INSPECTION PROCEDURE 3

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



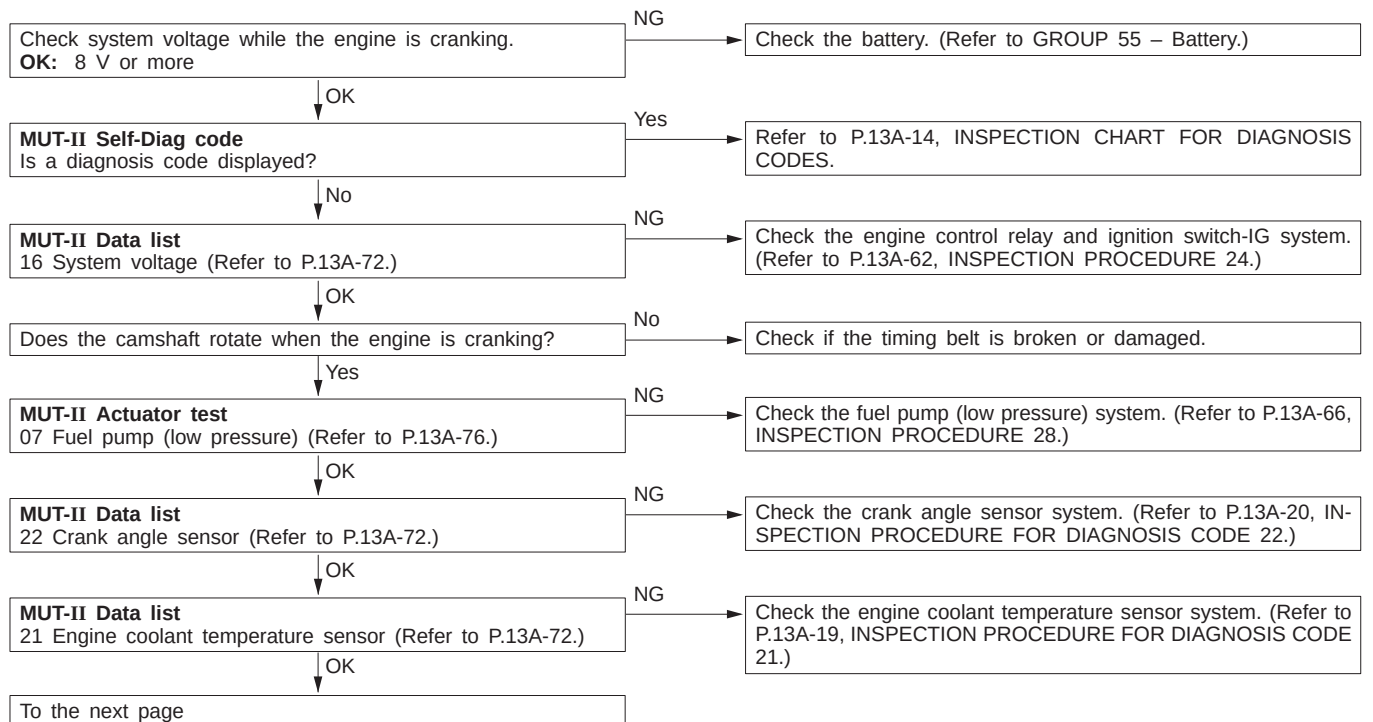
INSPECTION PROCEDURE 4

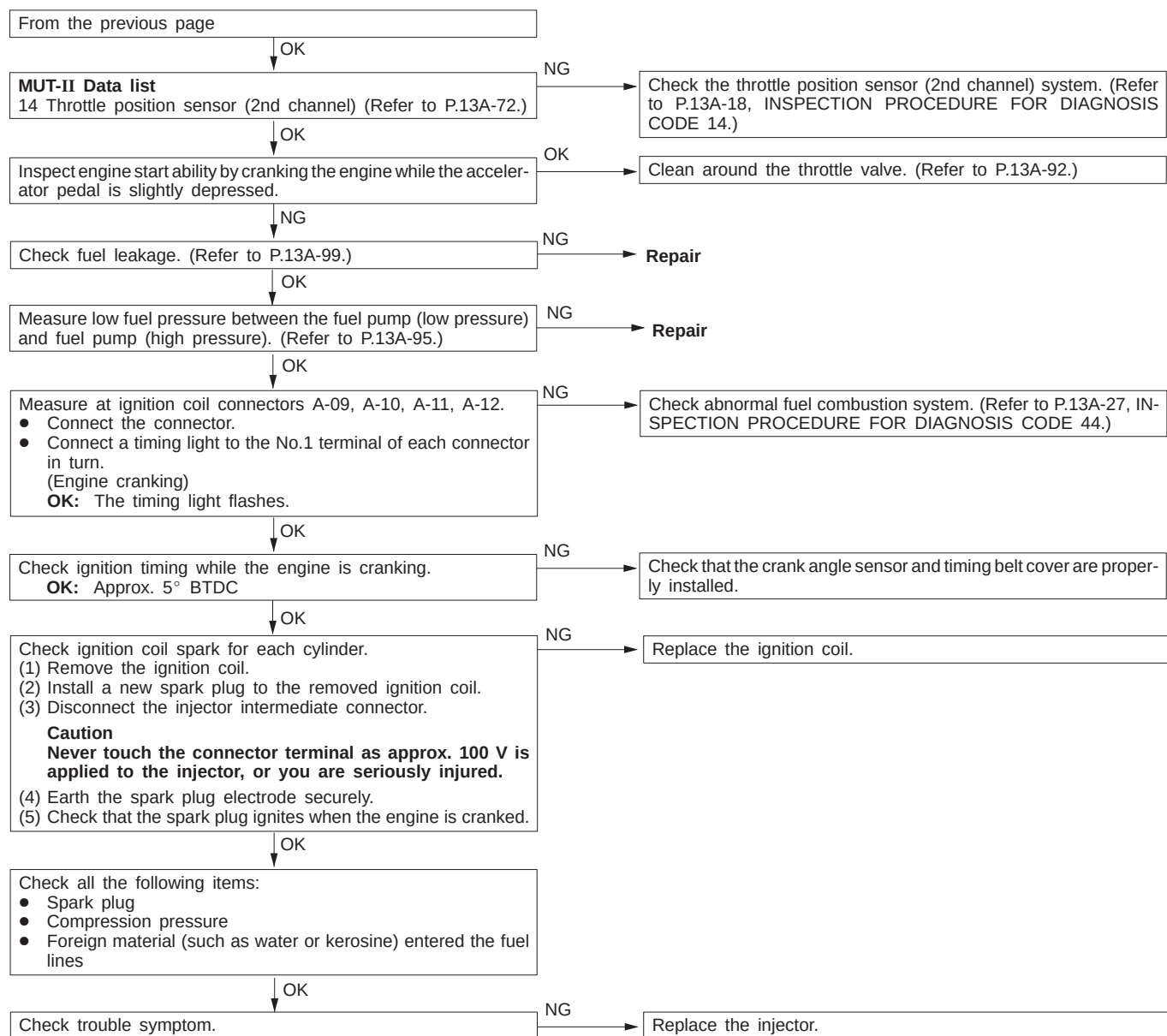
The engine warning lamp remains illuminating and never goes out.	Probable cause
In cases such as the above, the cause is probably that the engine-ECU is detecting a problem in a sensor or actuator, or that one of the malfunctions listed at right has occurred.	• Short-circuit between the engine warning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



INSPECTION PROCEDURE 5

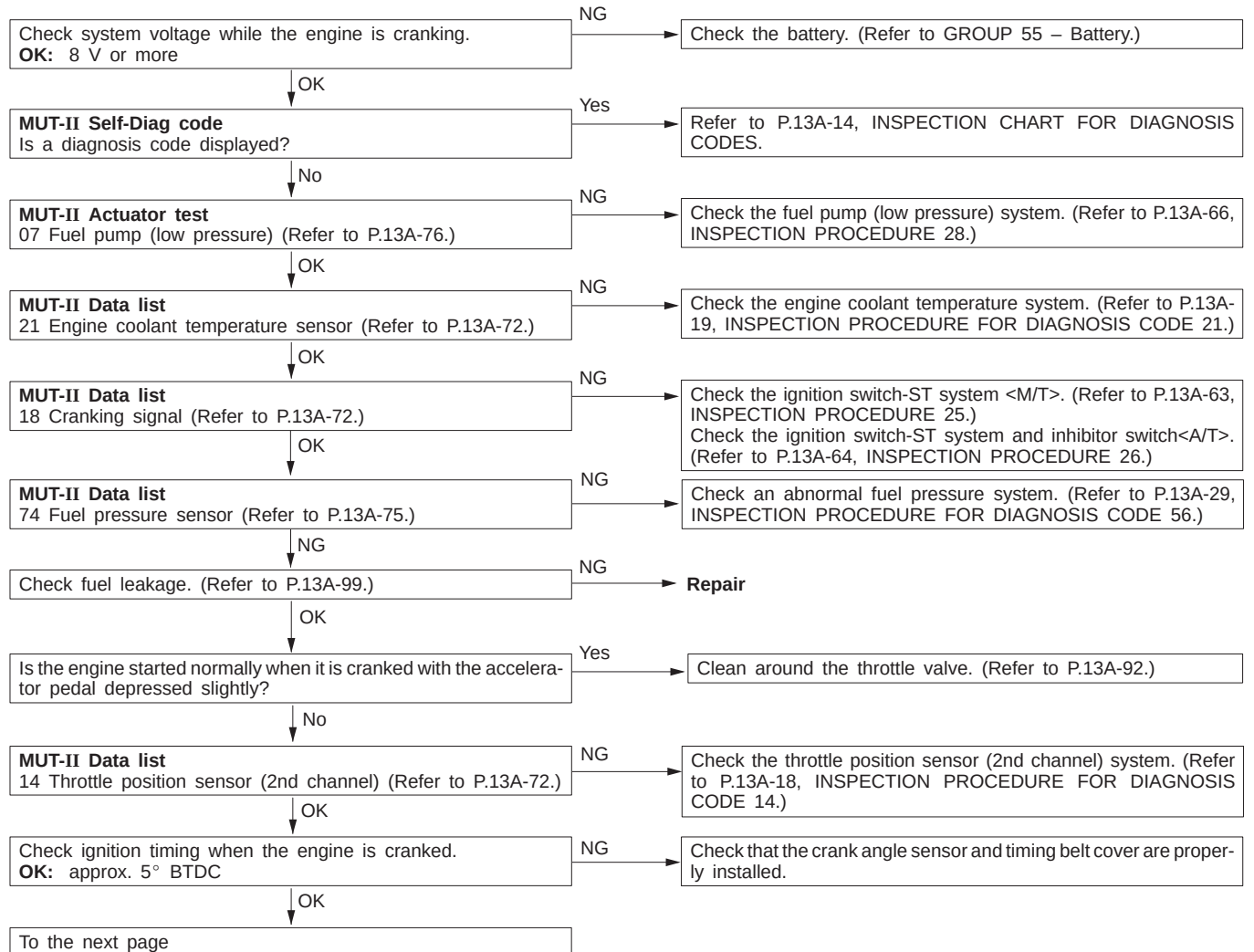
No initial combustion (starting impossible)	Probable cause
This is caused by incorrect fuel supply into the combustion chamber, and improper ignition circuit. Besides that, foreign material may be contaminated in fuel.	• Malfunction of the fuel supply system • Malfunction of the ignition system • Malfunction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

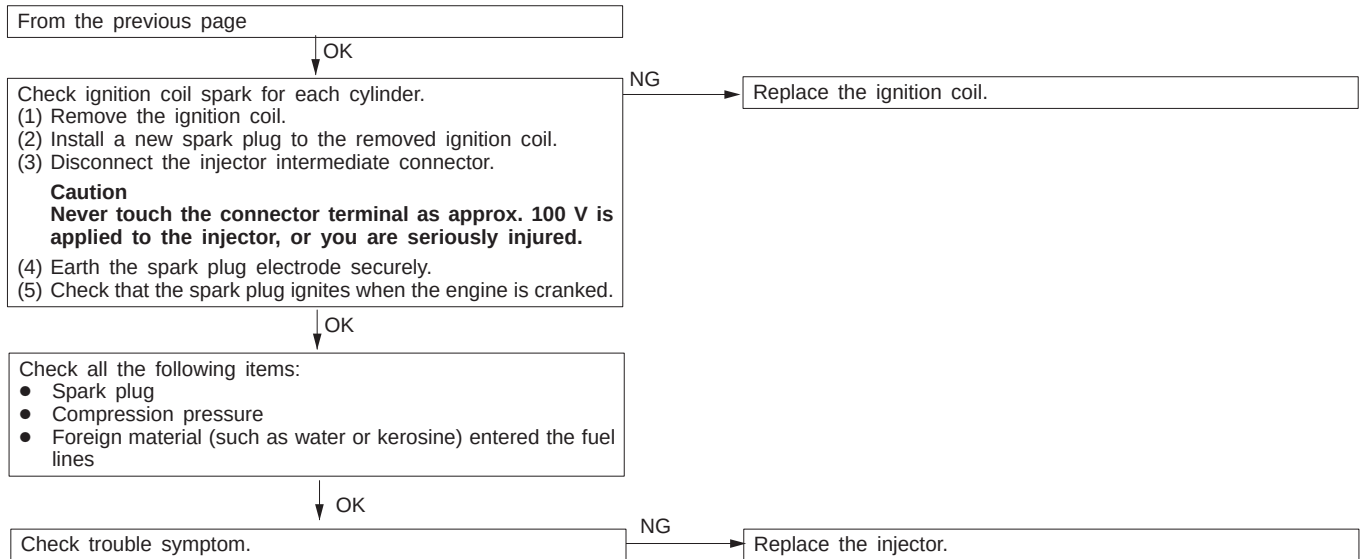




INSPECTION PROCEDURE 6

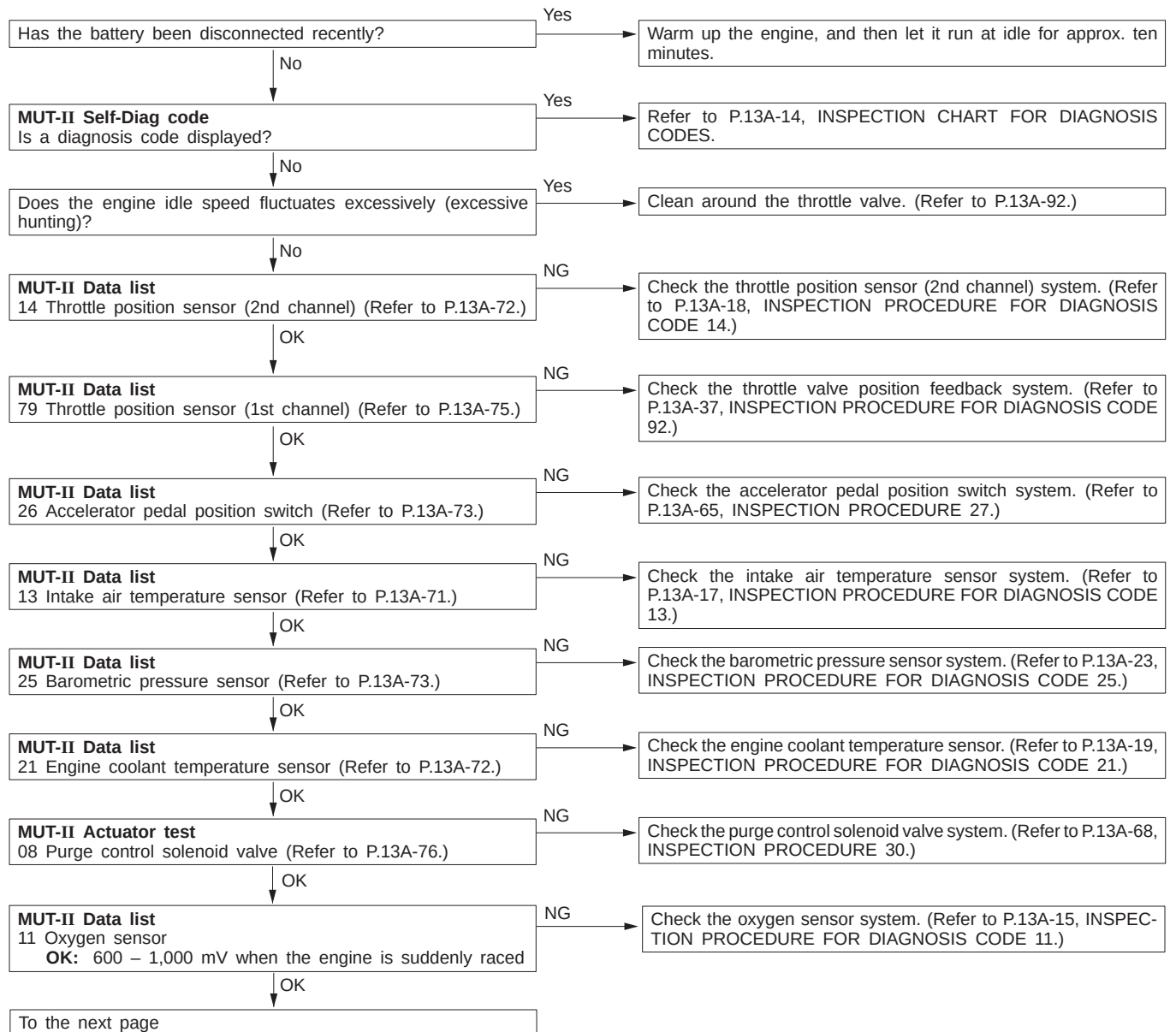
Initial combustion takes place, but does not complete (start impossible), too long time to start (poor start)	Probable cause
This may be caused by improper spark plug ignition (poor spark), improper mixture during engine cranking, improper fuel pressure.	• Malfunction of the fuel supply system • Malfunction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

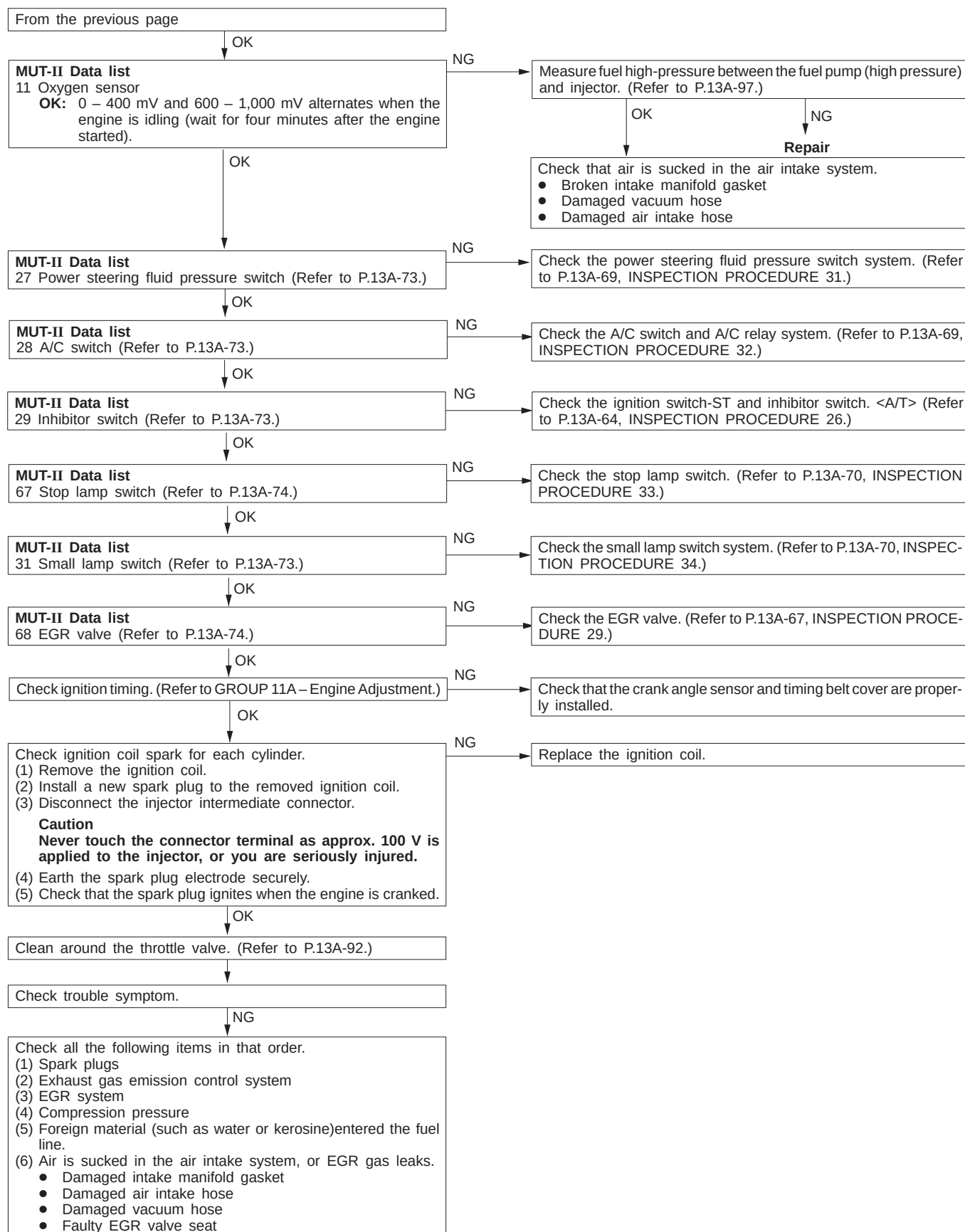




INSPECTION PROCEDURE 7

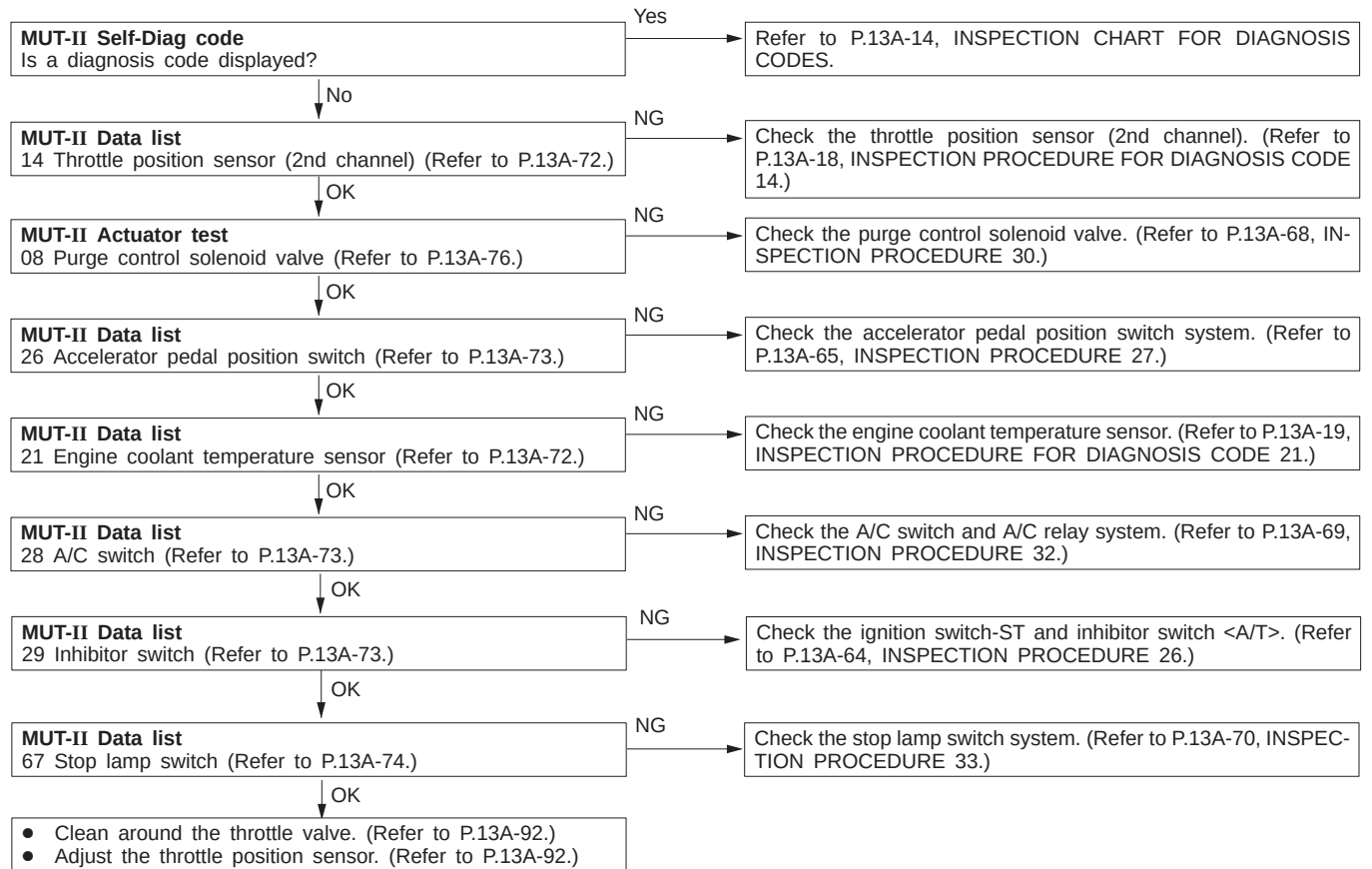
Unstable idling (rough idle, hunting)	Probable cause
This malfunction is probably caused by a faulty ignition system, improper air/fuel ratio, a faulty electronic-controlled throttle valve system, improper compression pressure, etc. As many causes can be suspected, diagnose from easier items.	• Malfunction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





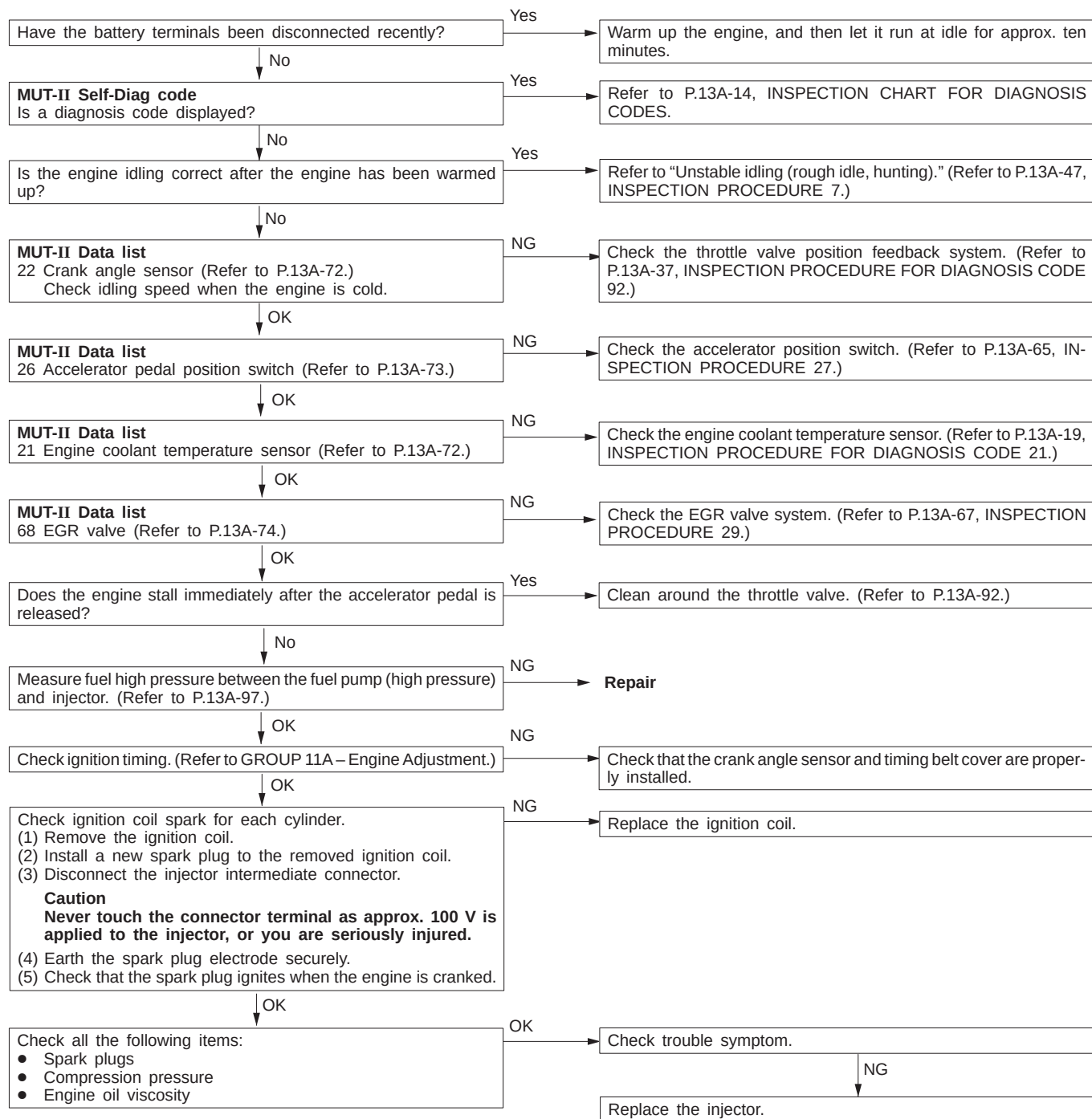
INSPECTION PROCEDURE 8

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



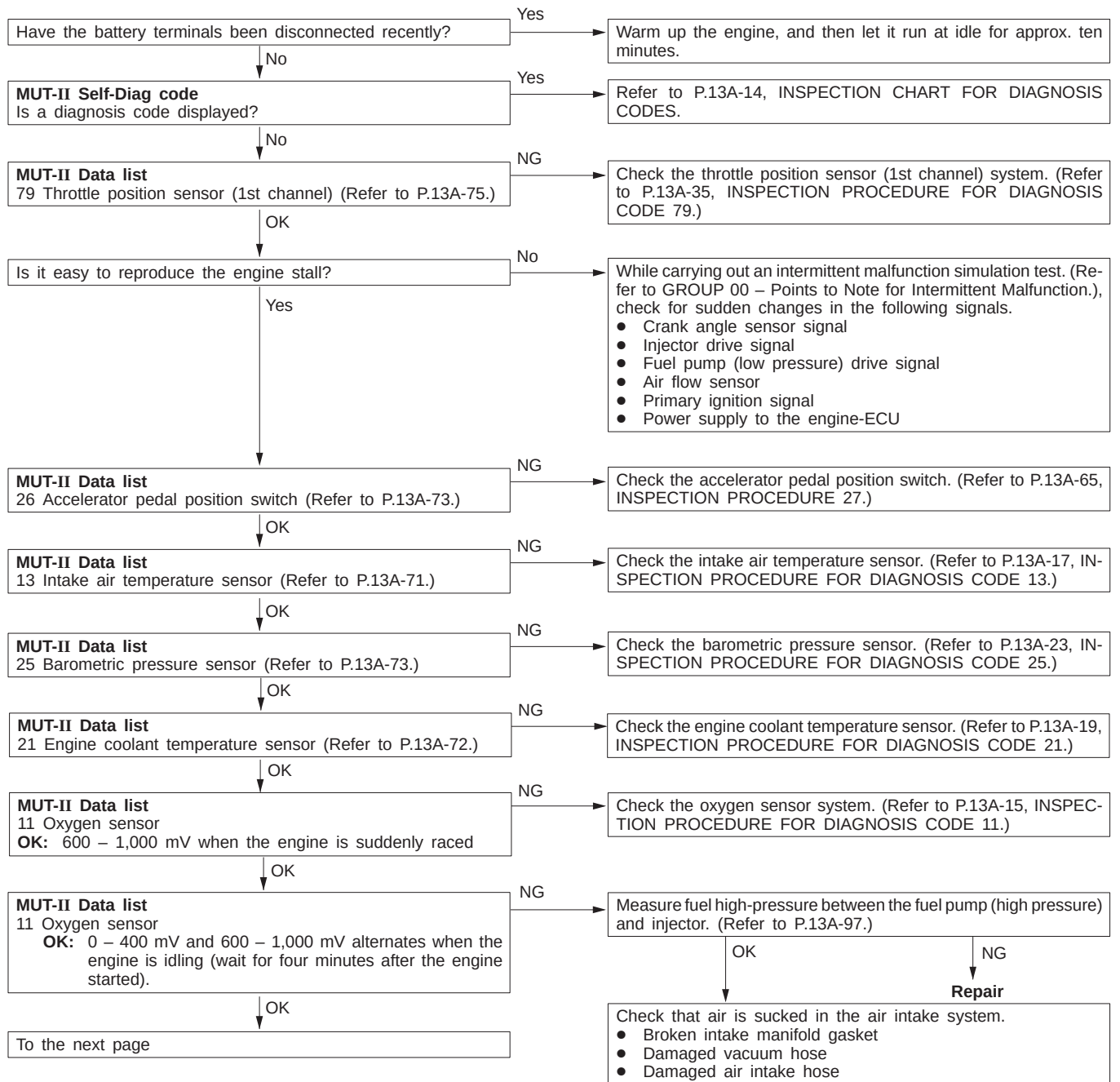
INSPECTION PROCEDURE 9

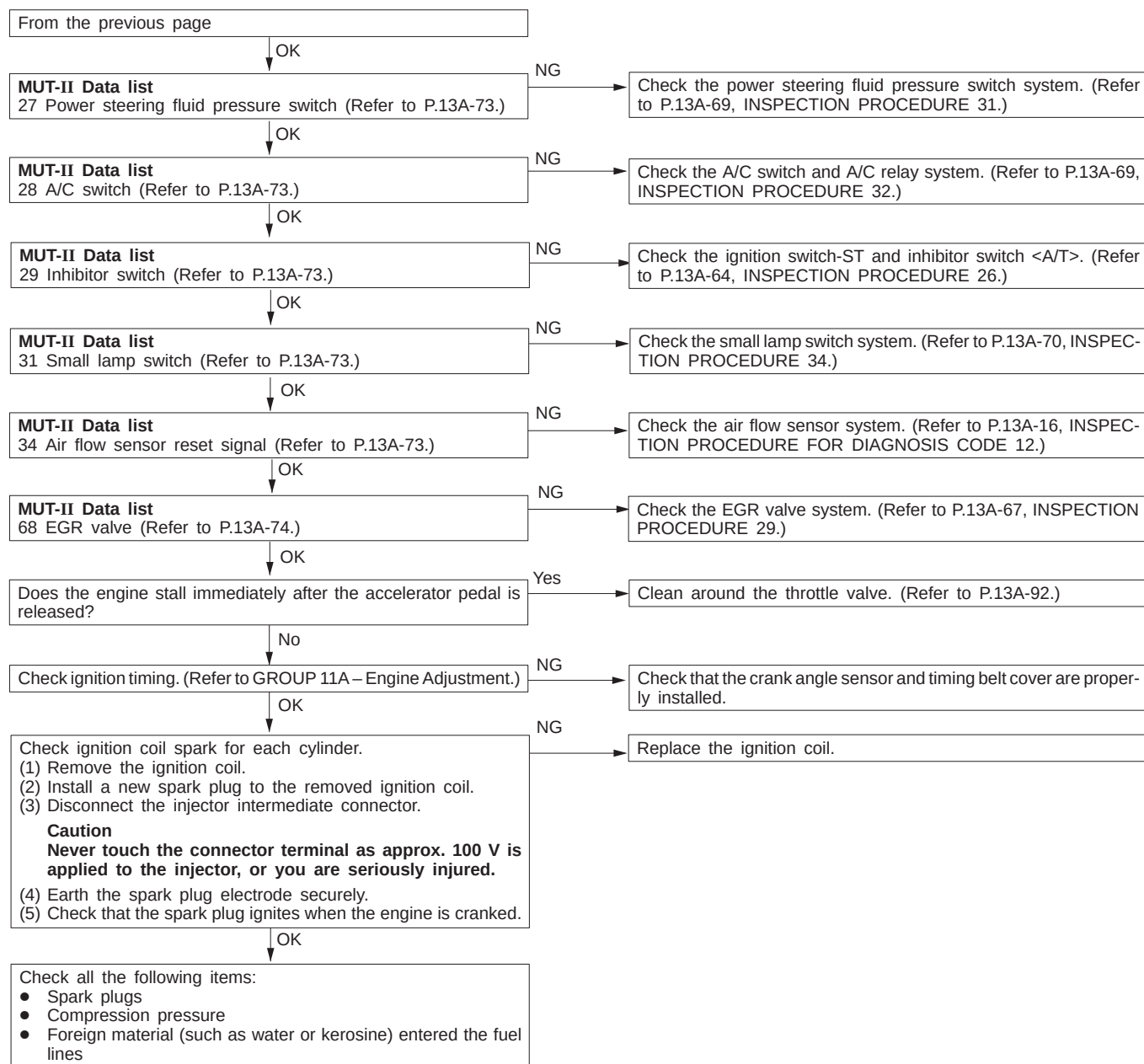
When the engine is cold, it stalls at idling. (Die out)	Probable cause
The cause is probably an incorrect air/fuel ratio or poor intake air amount when the engine is cold.	- Malfunction of the electronic-control throttle valve system - Malfunction of the throttle body



INSPECTION PROCEDURE 10

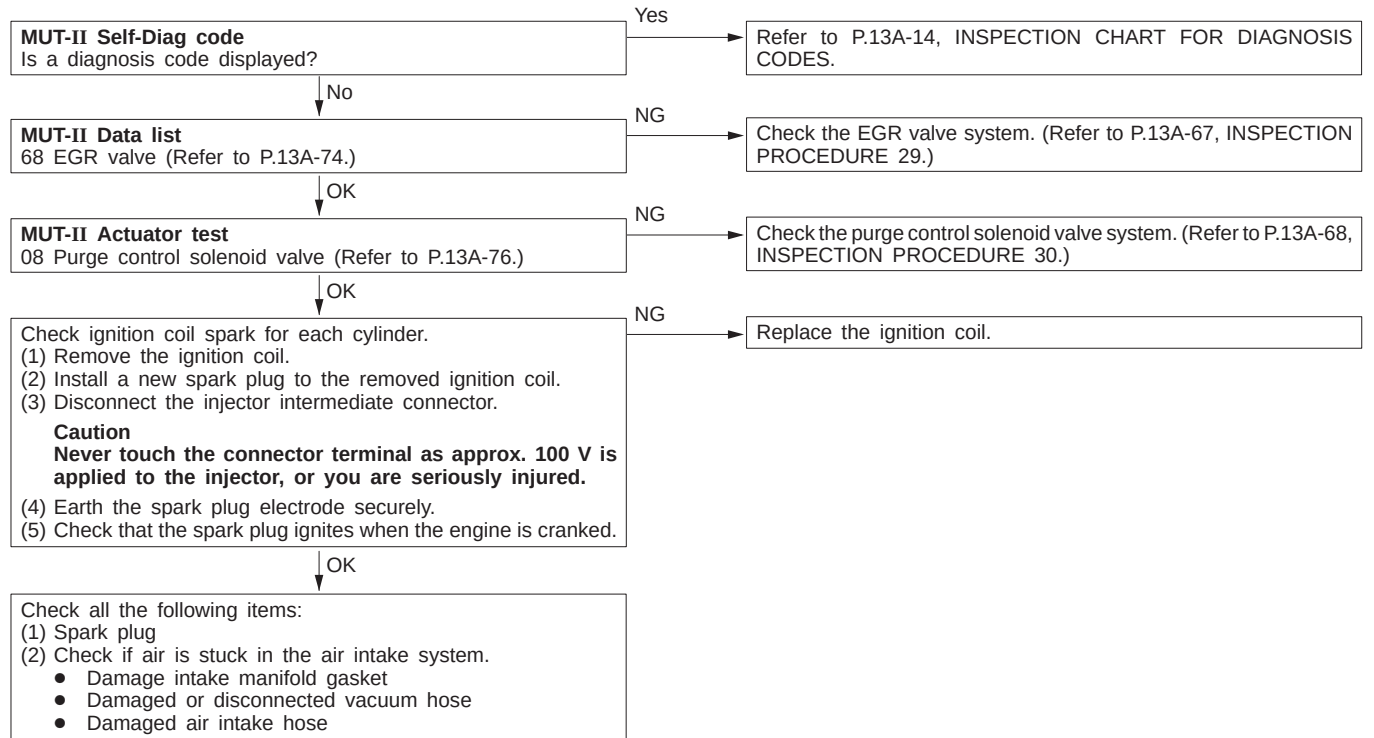
When the engine is hot, it stalls at idling. (Die out)	Probable cause
The cause is probably an improper air/fuel ratio, faulty electronic-controlled throttle valve system, compression pressure. In addition, if the engine stalls suddenly, another possible cause might be a poor connector contact.	• Malfunction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





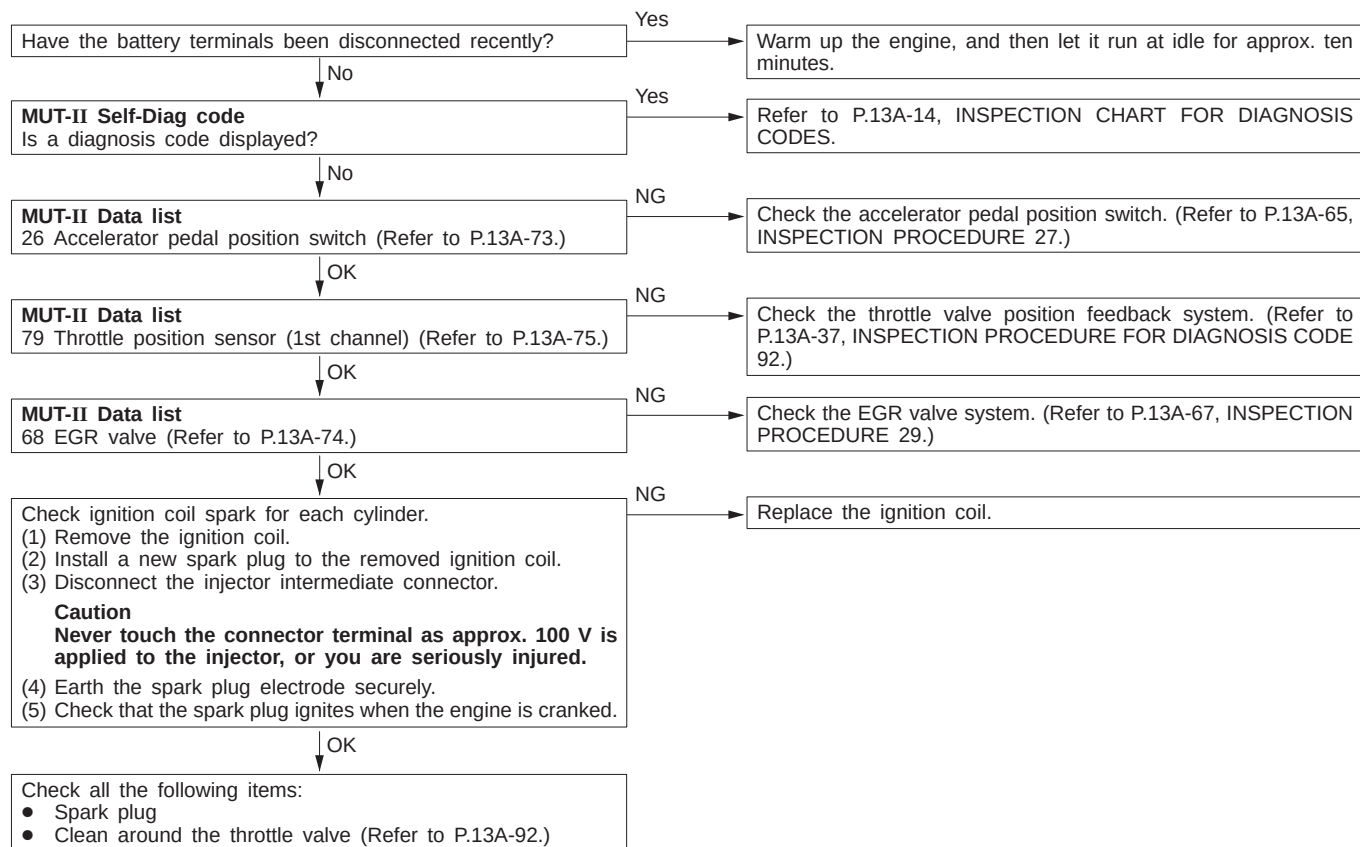
INSPECTION PROCEDURE 11

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



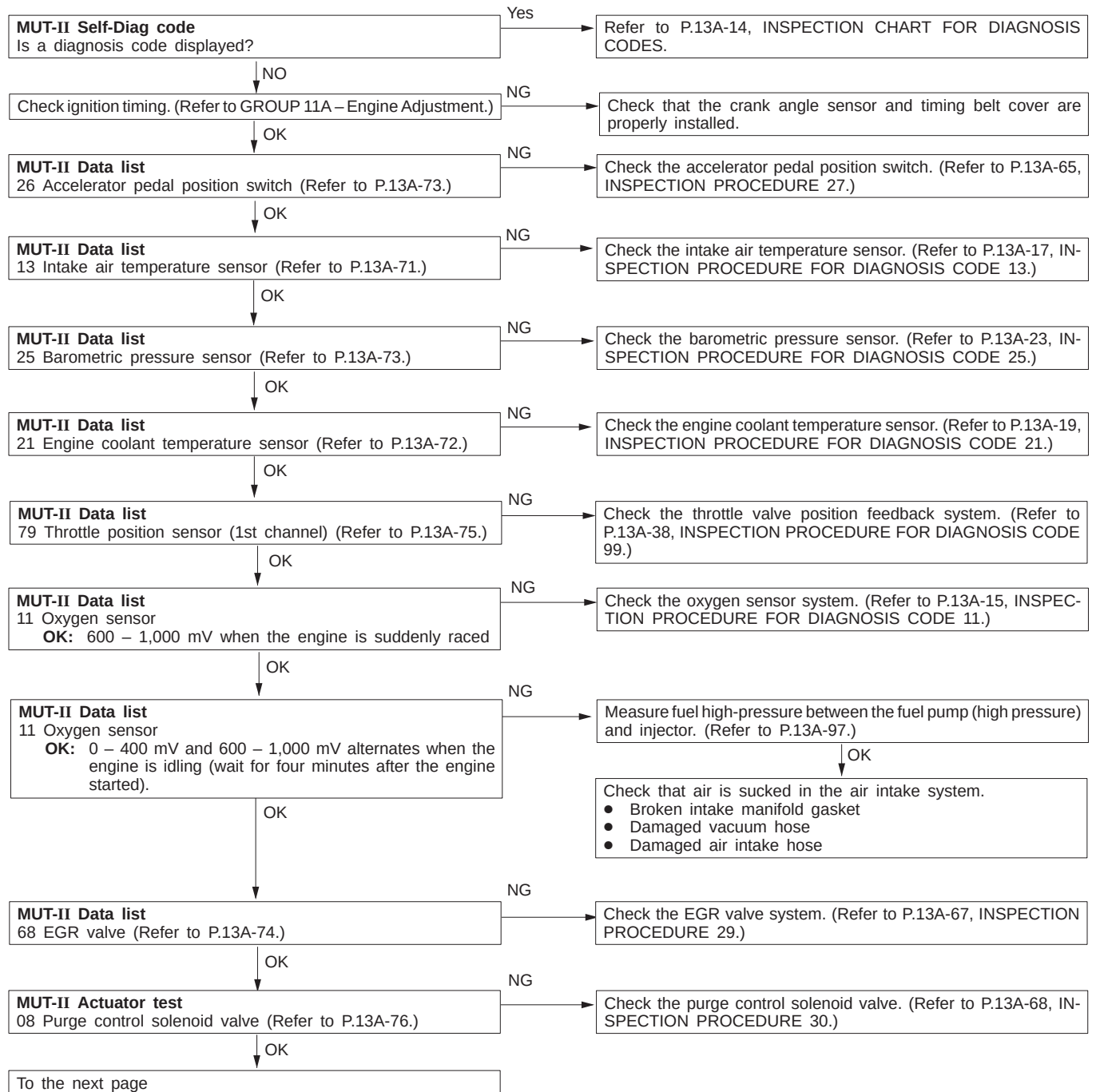
INSPECTION PROCEDURE 12

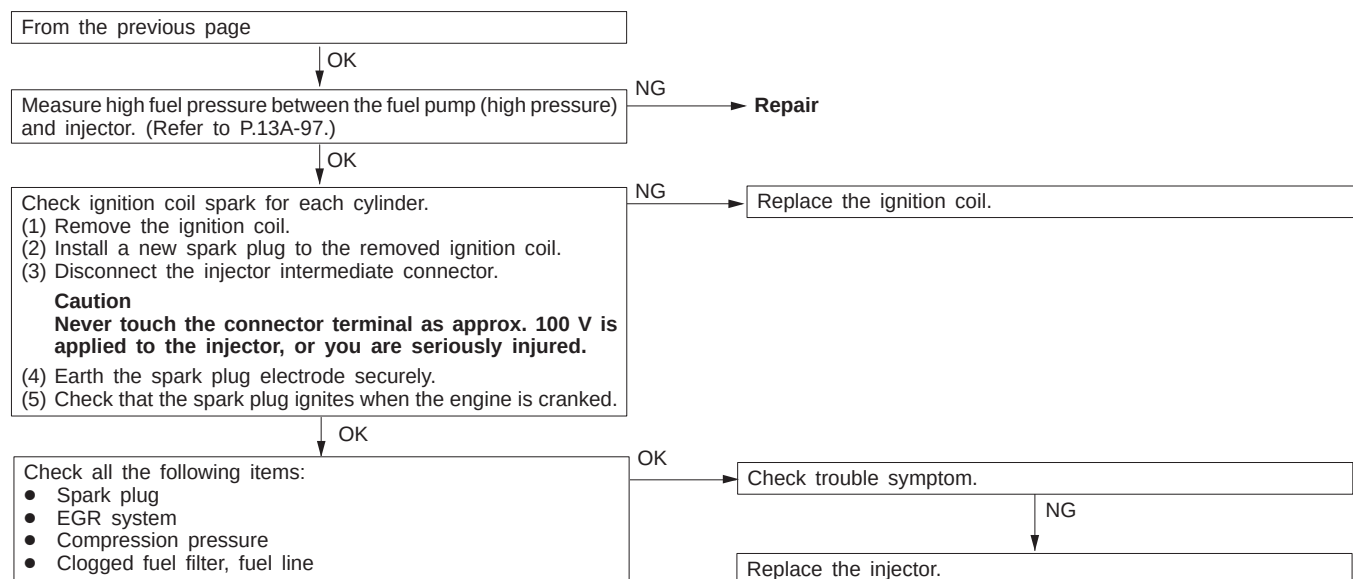
The engine stalls when decelerating.	Probable cause
The cause is probably an improper air/fuel ratio due to a faulty EGR system, or poor intake air volume due to a faulty electronic-controlled throttle valve system.	- Malfunction of the electronic-controlled throttle valve system - Malfunction of the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



INSPECTION PROCEDURE 13

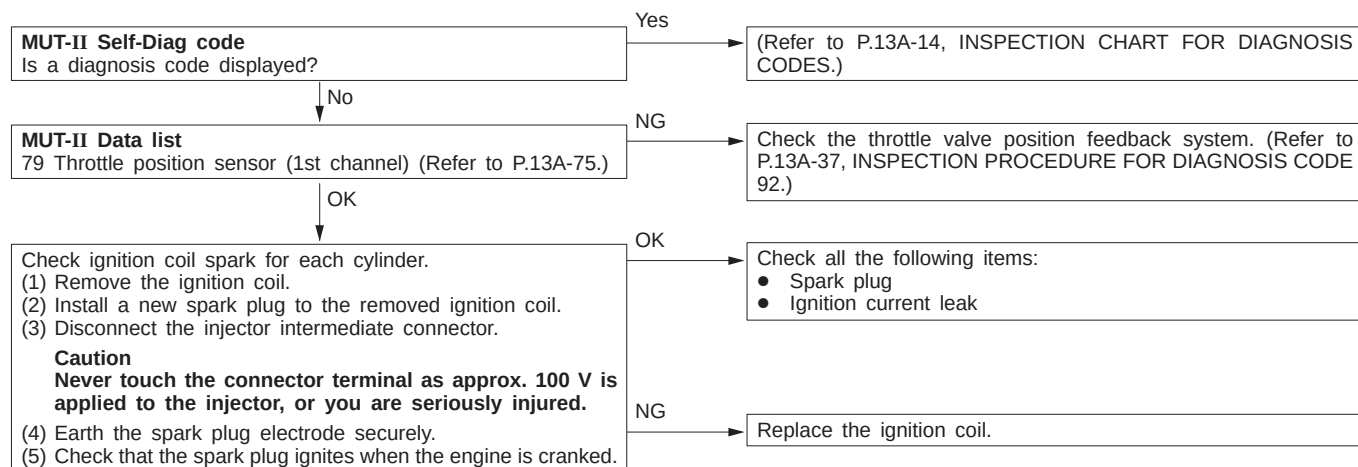
Hesitation, sag, stumble, poor acceleration or surge	Probable cause
The cause is probably a malfunction of the ignition system, electronic-controlled throttle valve system, compression pressure, etc.	• Malfunction of the ignition system • Malfunction of the air/fuel ratio control system • Malfunction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





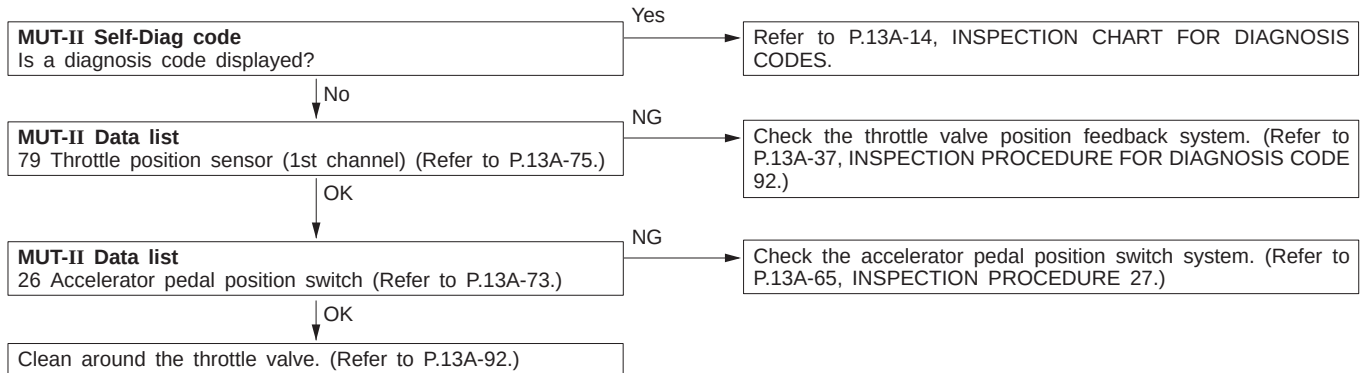
INSPECTION PROCEDURE 14

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



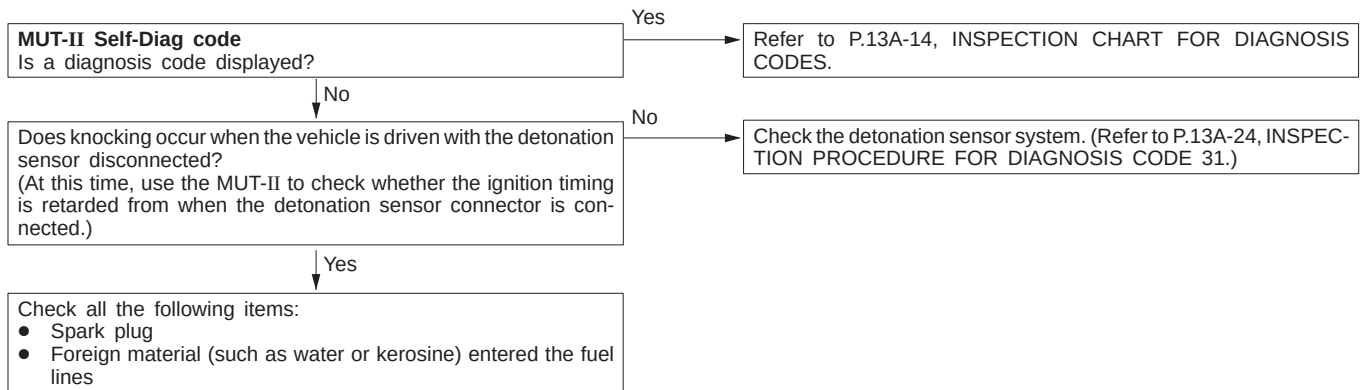
INSPECTION PROCEDURE 15

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



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



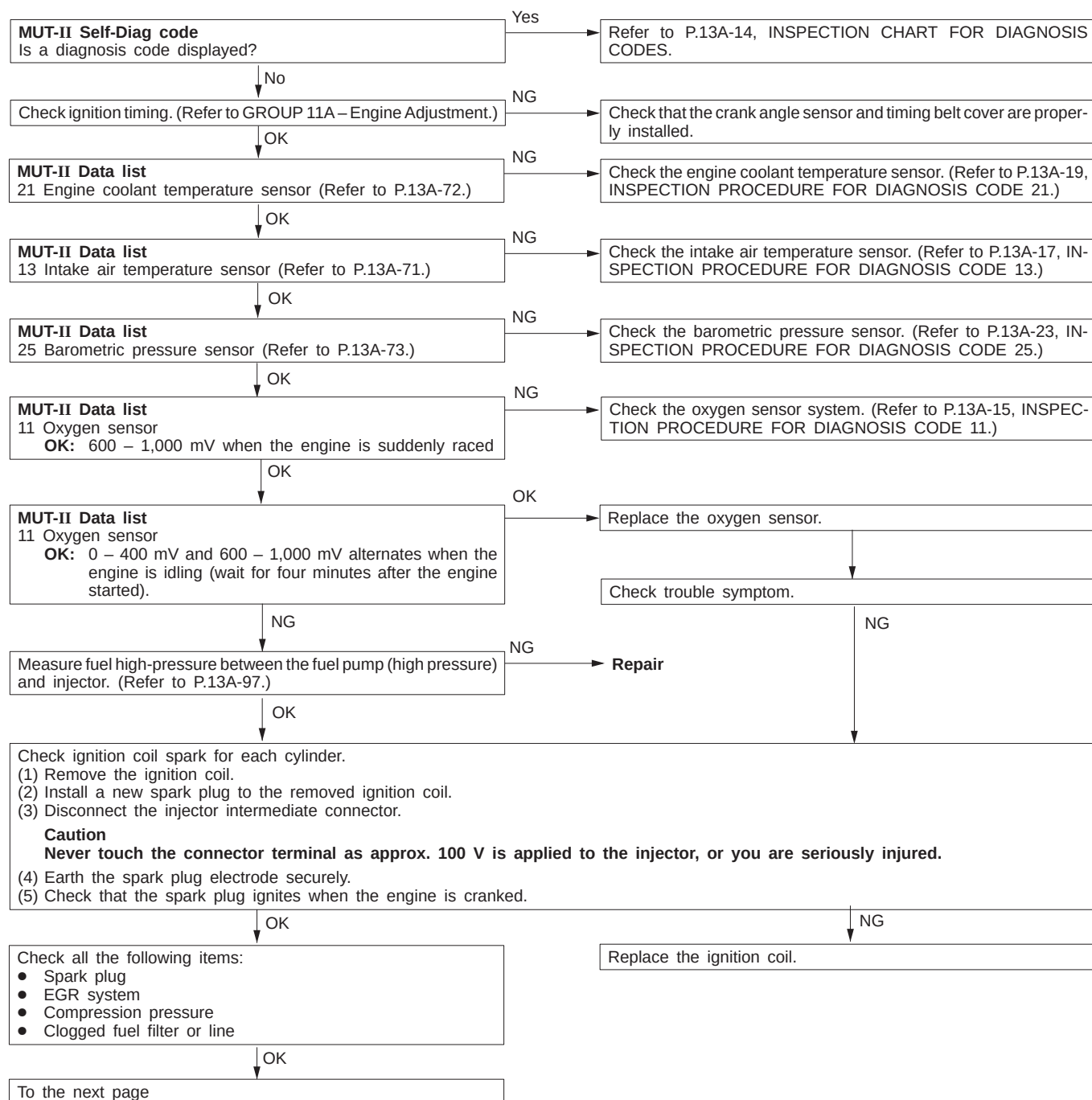
INSPECTION PROCEDURE 17

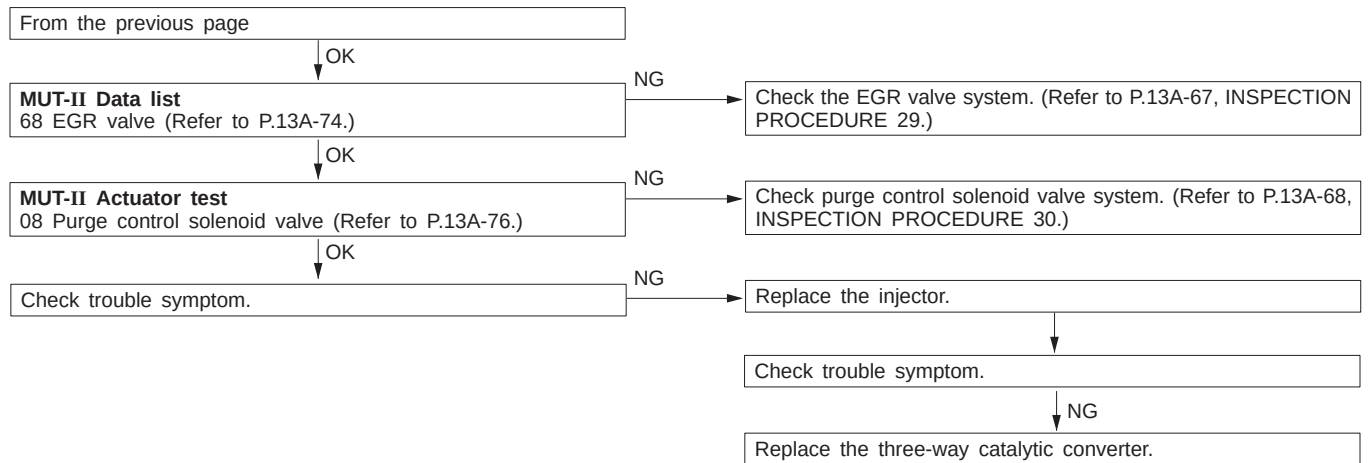
Run-on (dieseling)	Probable cause
The cause is probably fuel leak from injector(s)	Malfunction of the injector

Replace the injector.

INSPECTION PROCEDURE 18

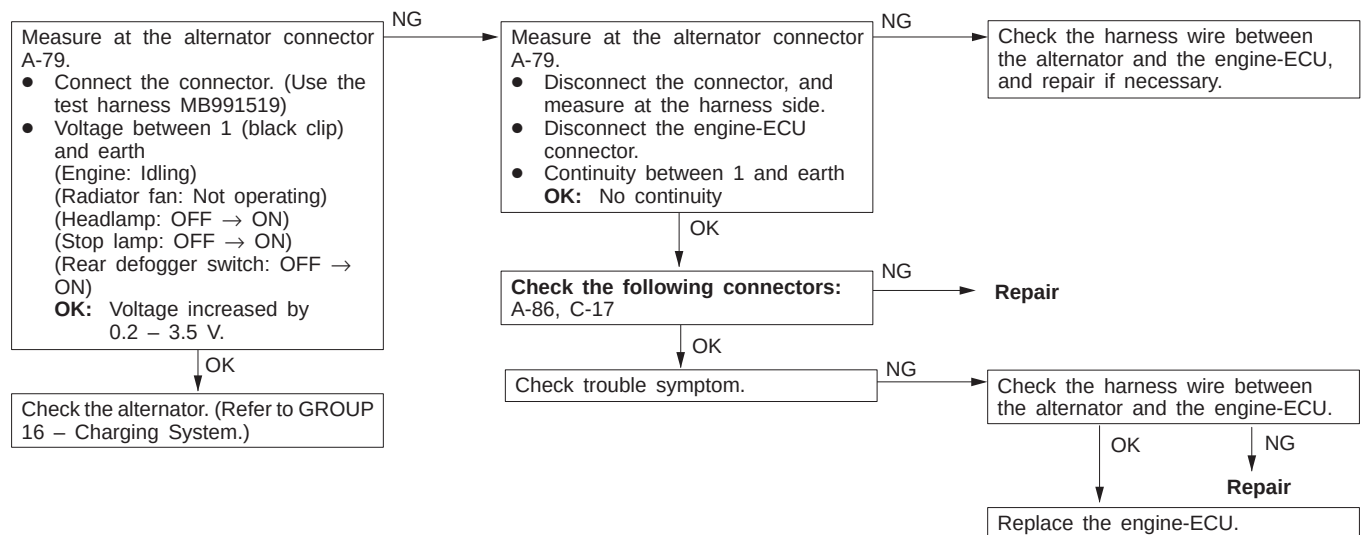
Too high CO and HC concentration when idling	Probable cause
The cause is probably an incorrect air/fuel ratio	- Malfunction of air/fuel ratio control system - Deterioration of the catalyst





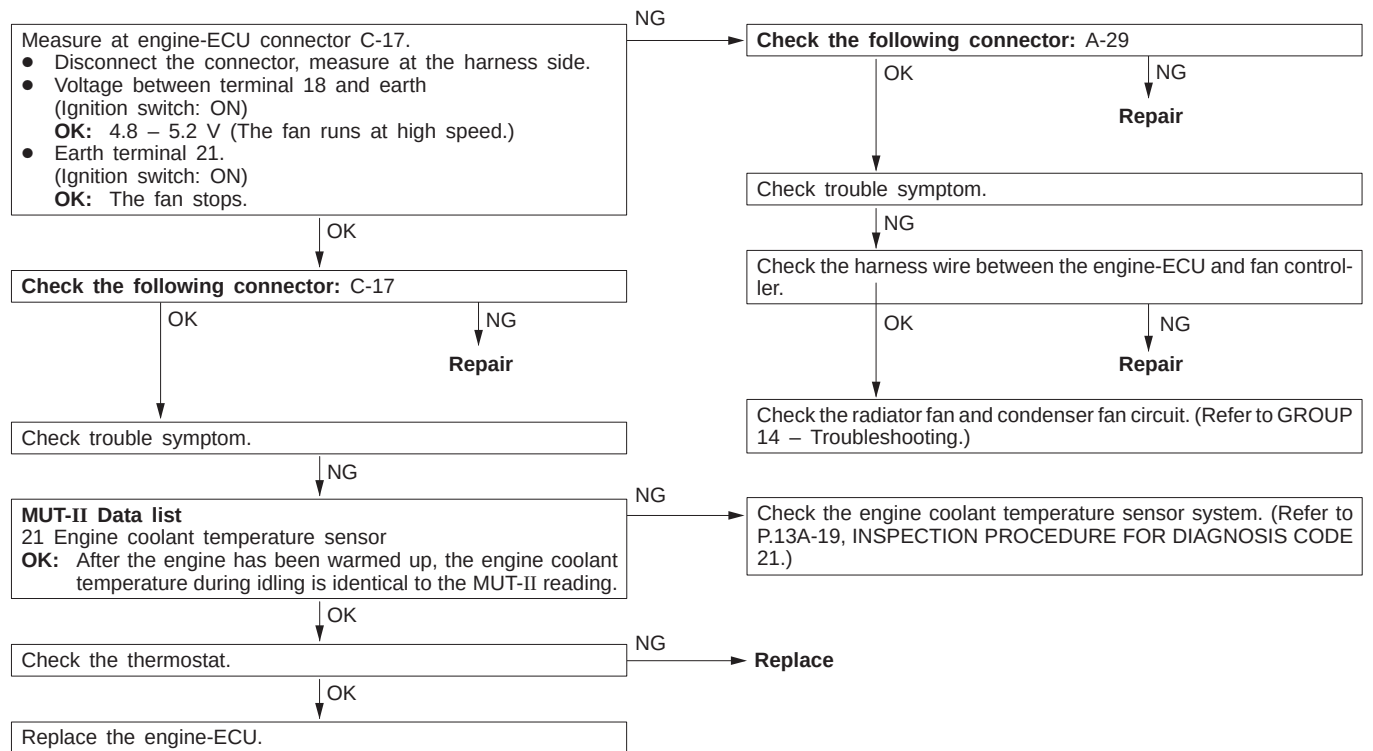
INSPECTION PROCEDURE 19

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

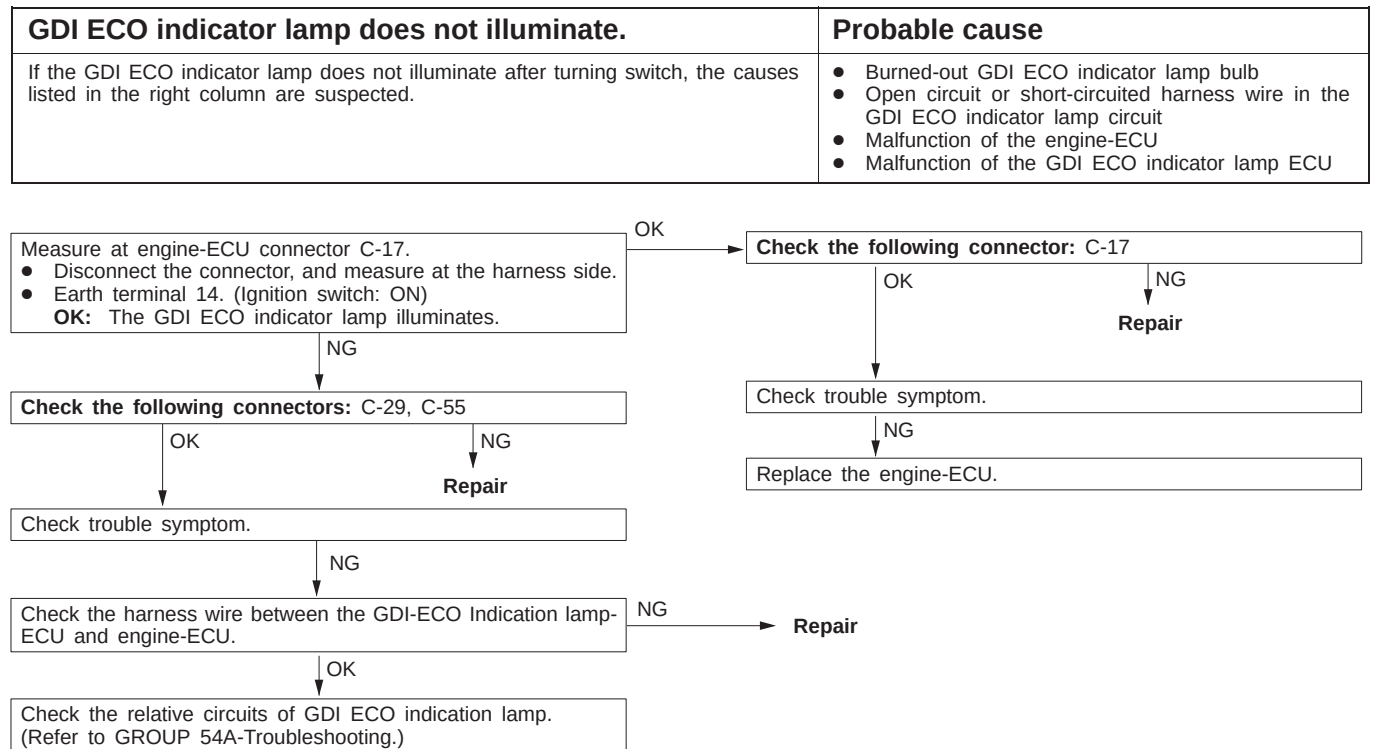


INSPECTION PROCEDURE 20

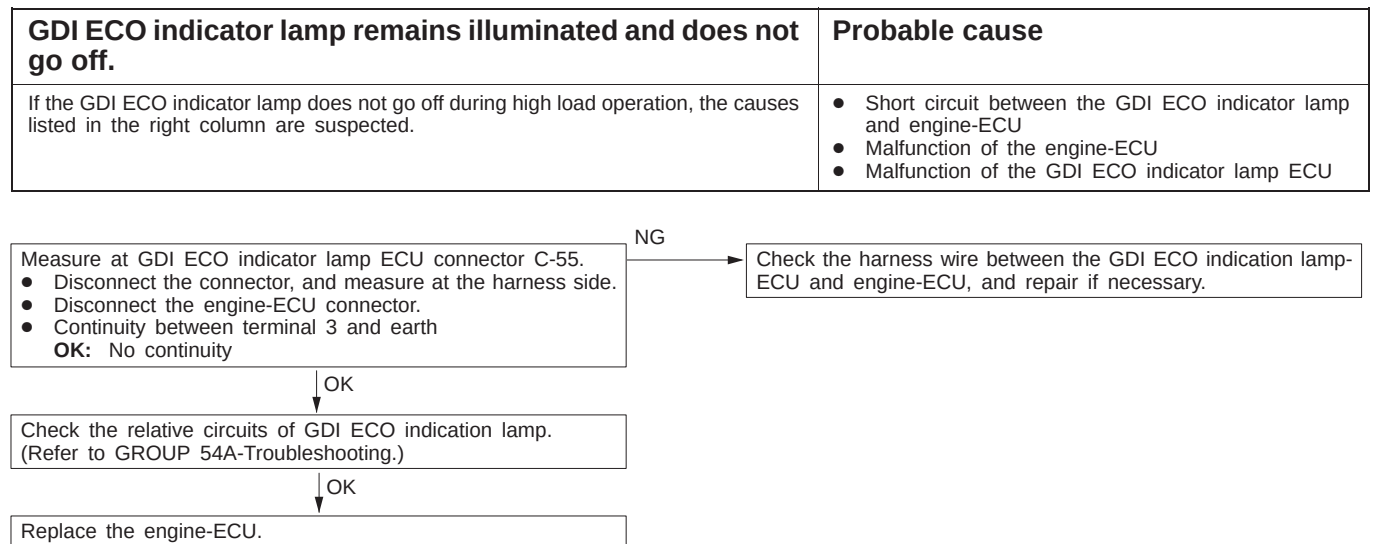
Fans (radiator fan, A/C condenser fan) are inoperative.	Probable cause
The engine-ECU sends a duty signal to the fan controller according to engine coolant temperature, vehicle speed, or A/C switch. The fan controller controls radiator fan and condenser fan speeds, based on this signal. (The closer the 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

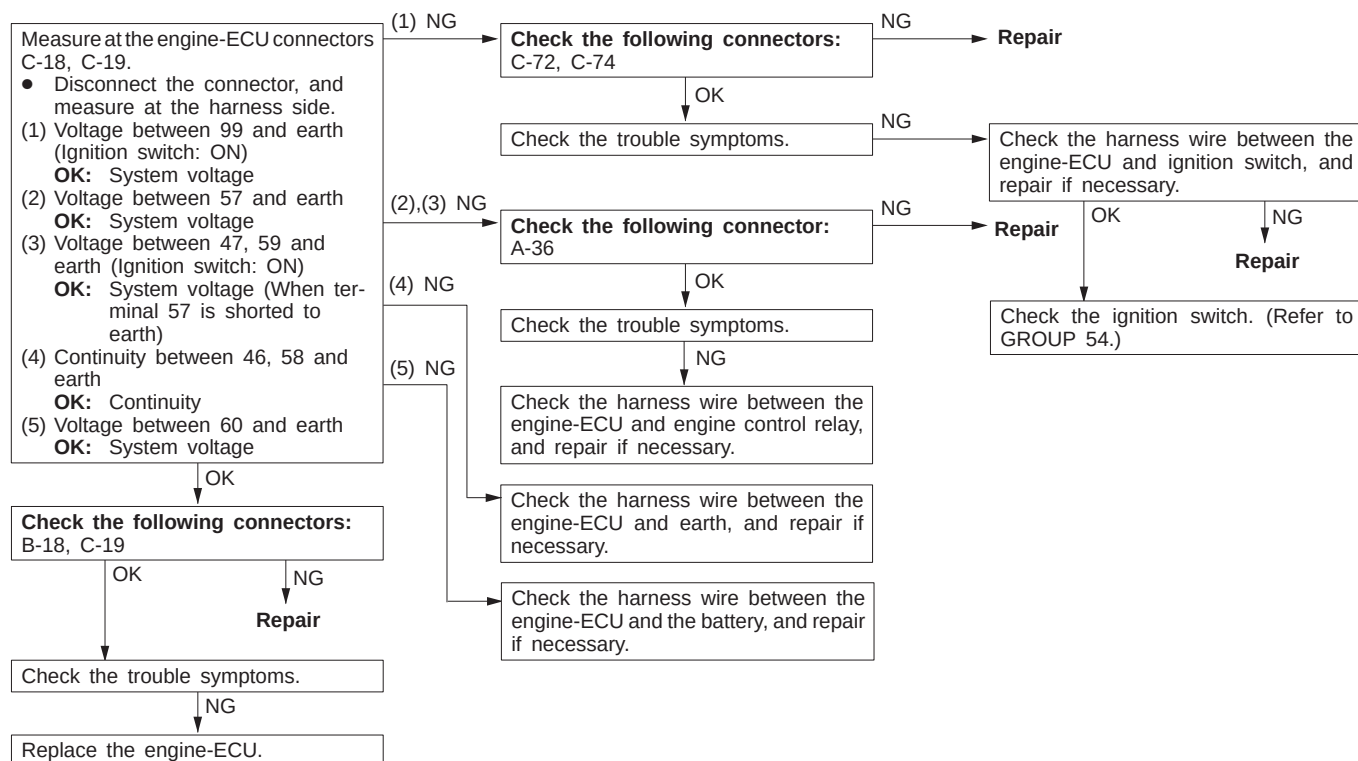


INSPECTION PROCEDURE 22



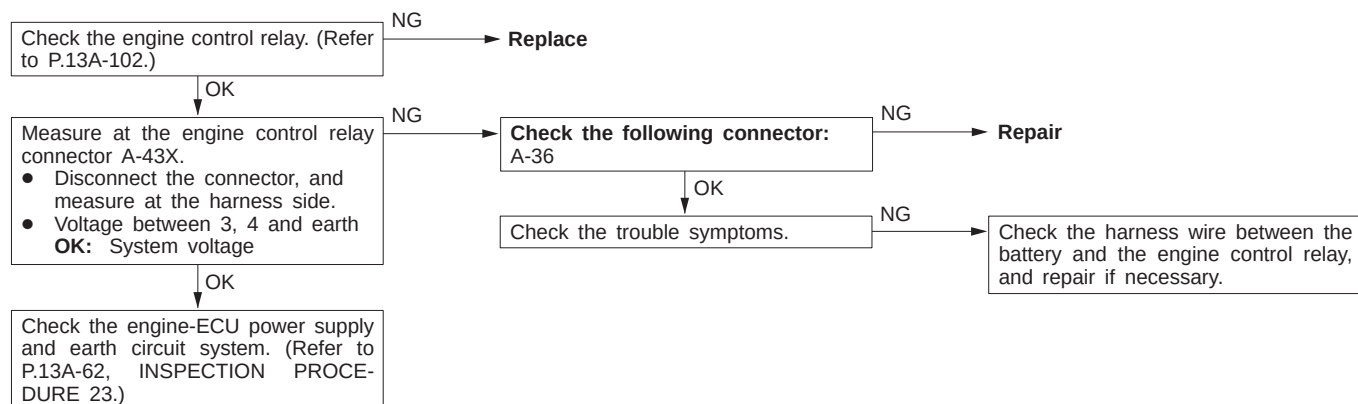
INSPECTION PROCEDURE 23

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



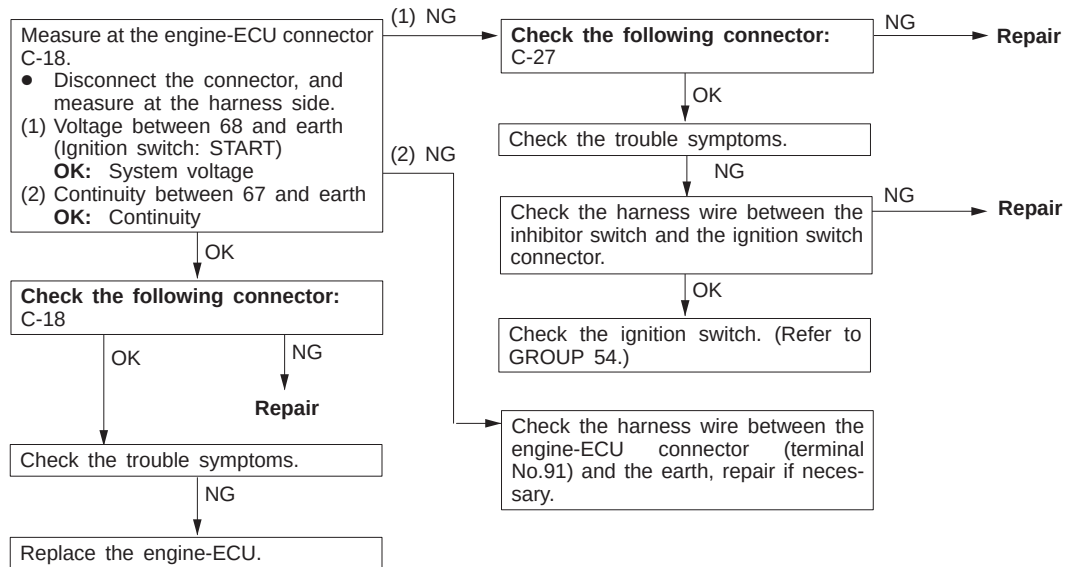
INSPECTION PROCEDURE 24

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



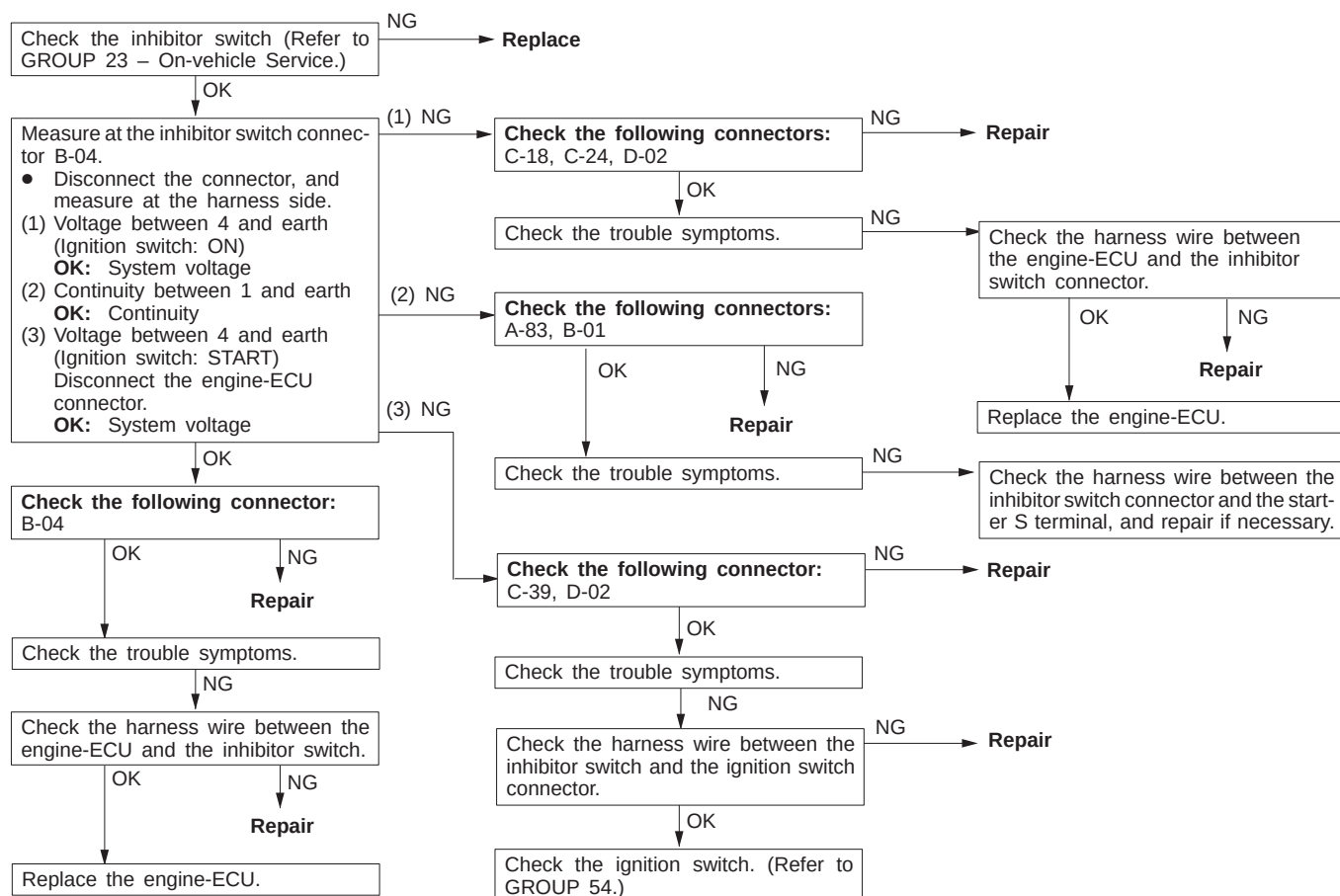
INSPECTION PROCEDURE 25

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



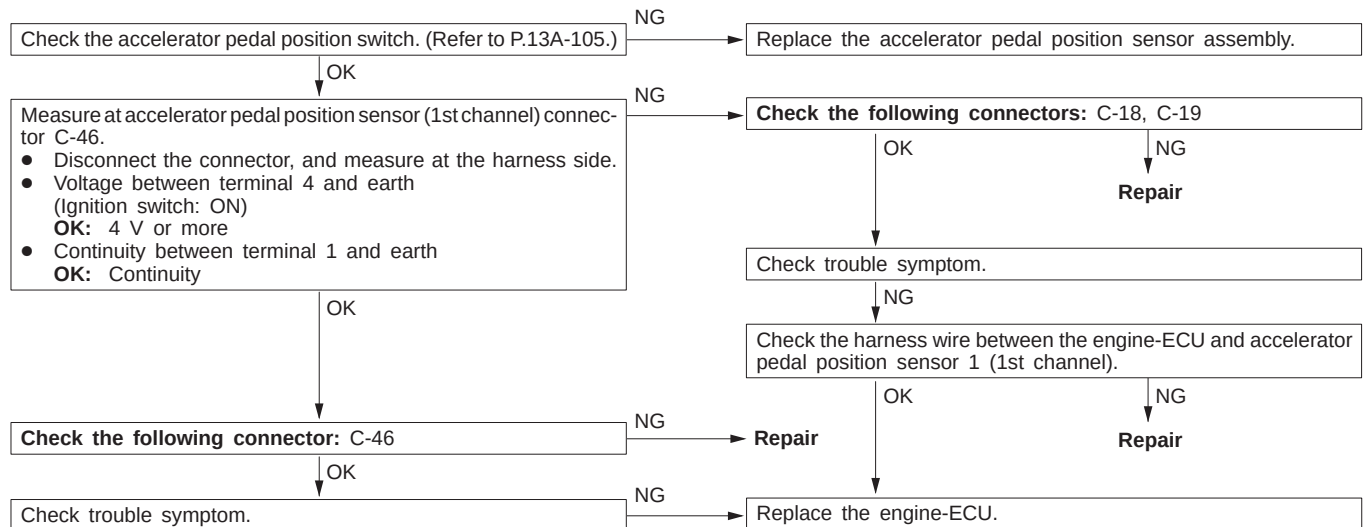
INSPECTION PROCEDURE 26

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



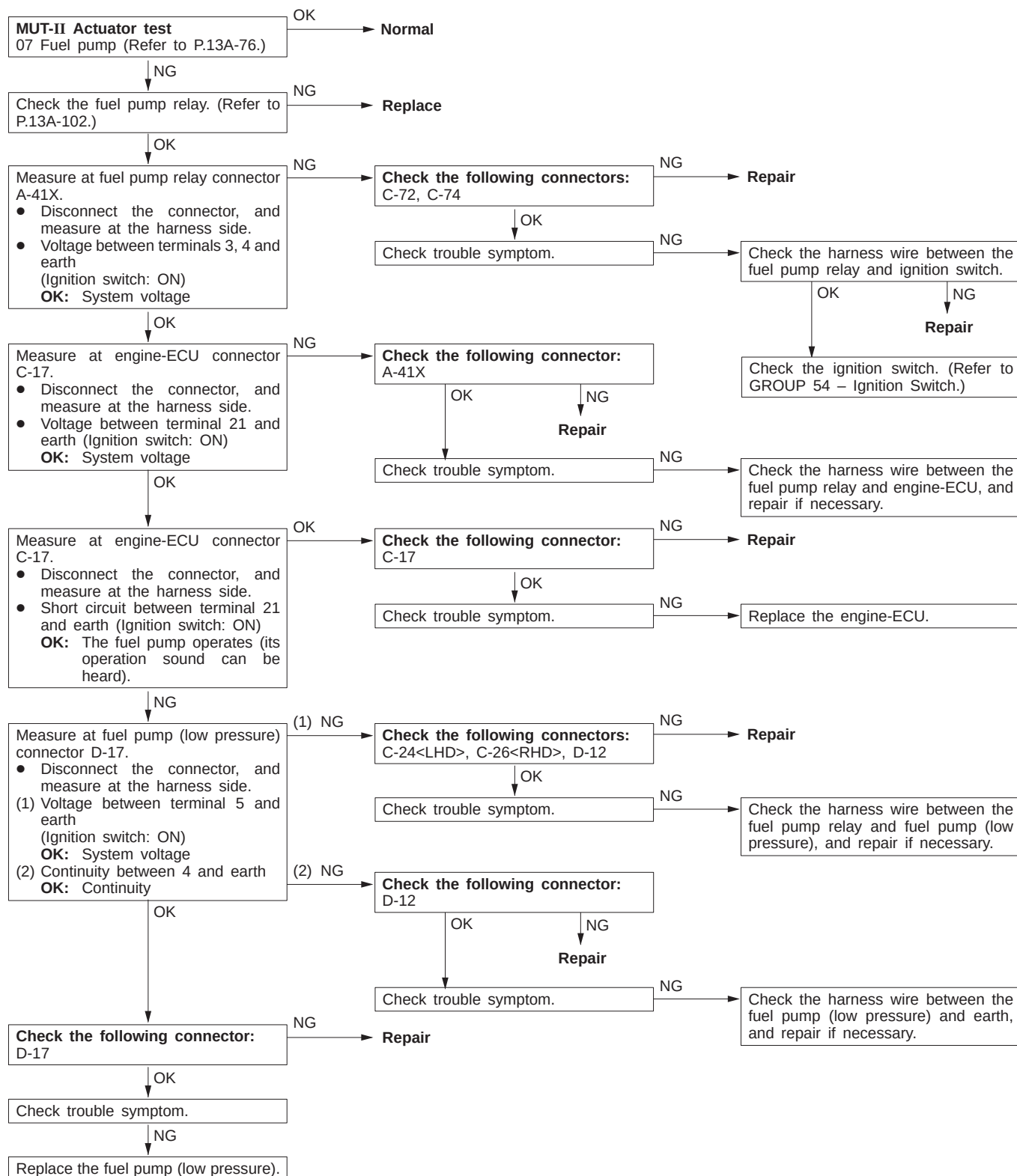
INSPECTION PROCEDURE 27

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



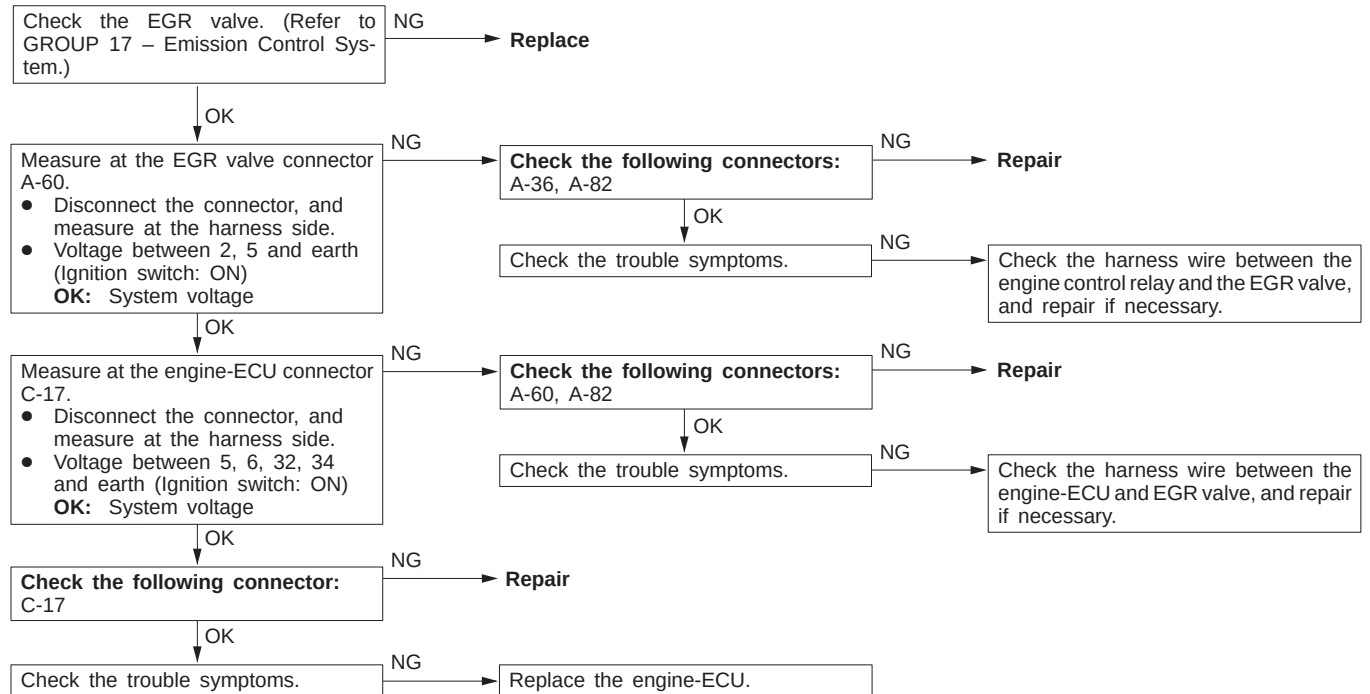
INSPECTION PROCEDURE 28

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



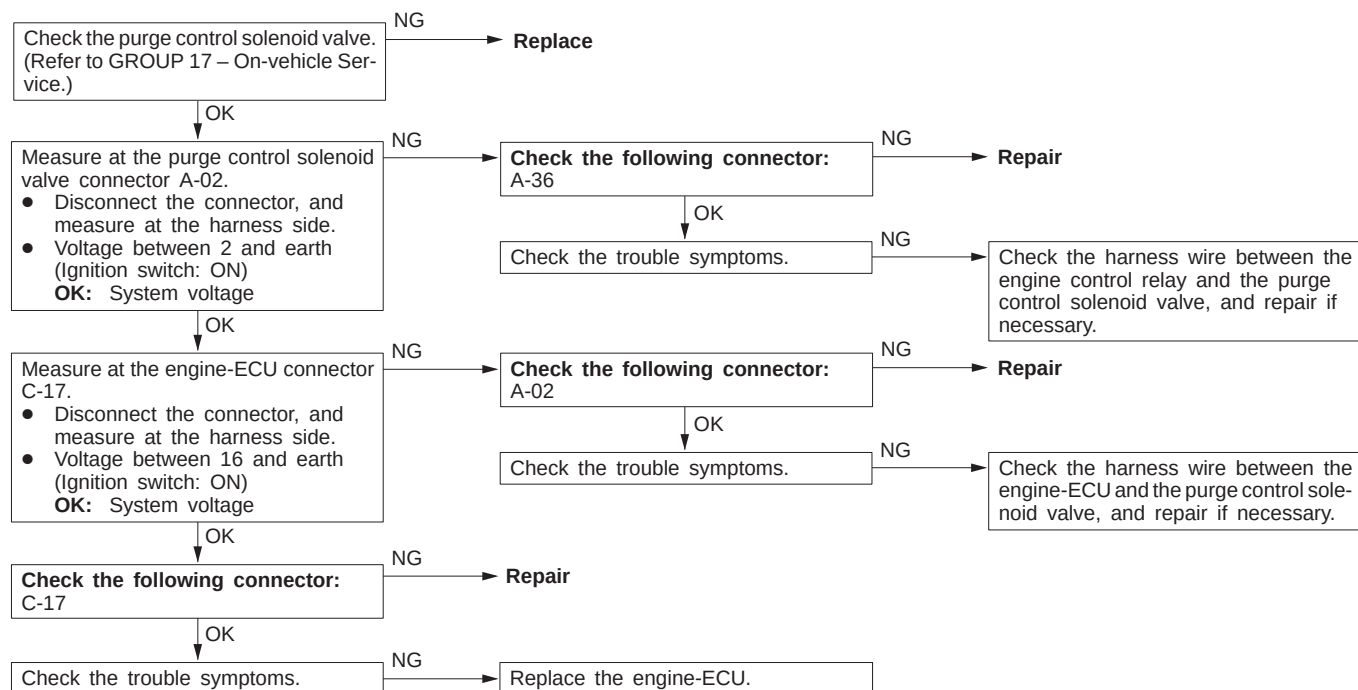
INSPECTION PROCEDURE 29

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



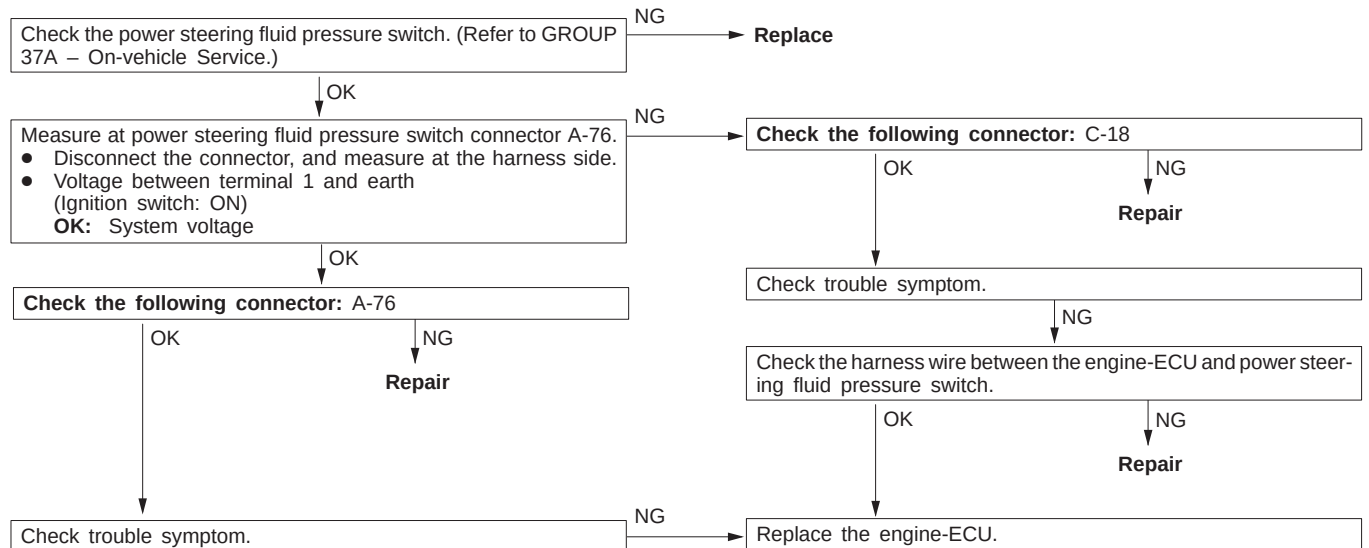
INSPECTION PROCEDURE 30

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



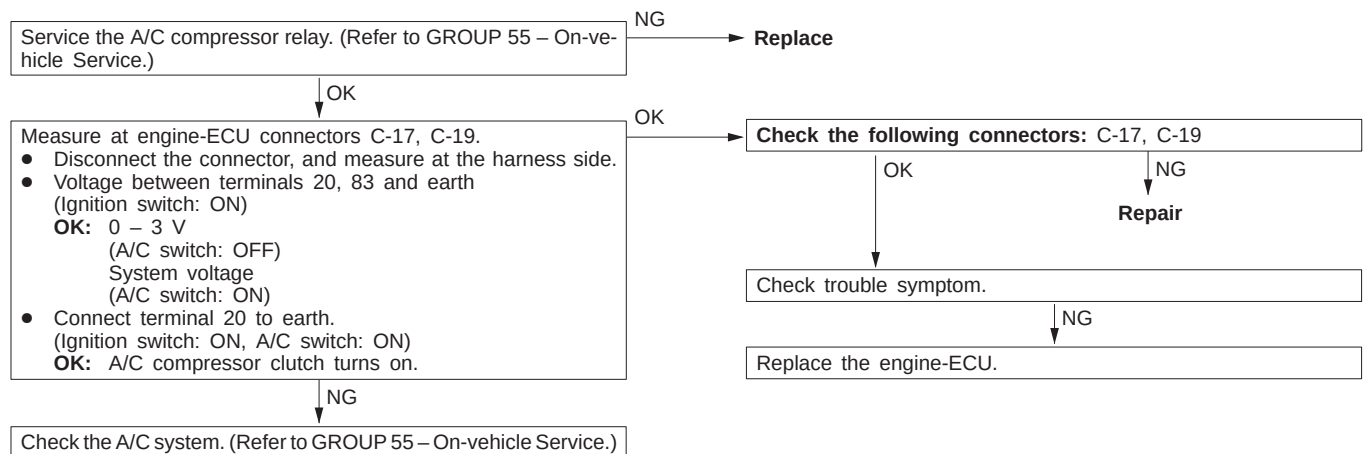
INSPECTION PROCEDURE 31

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



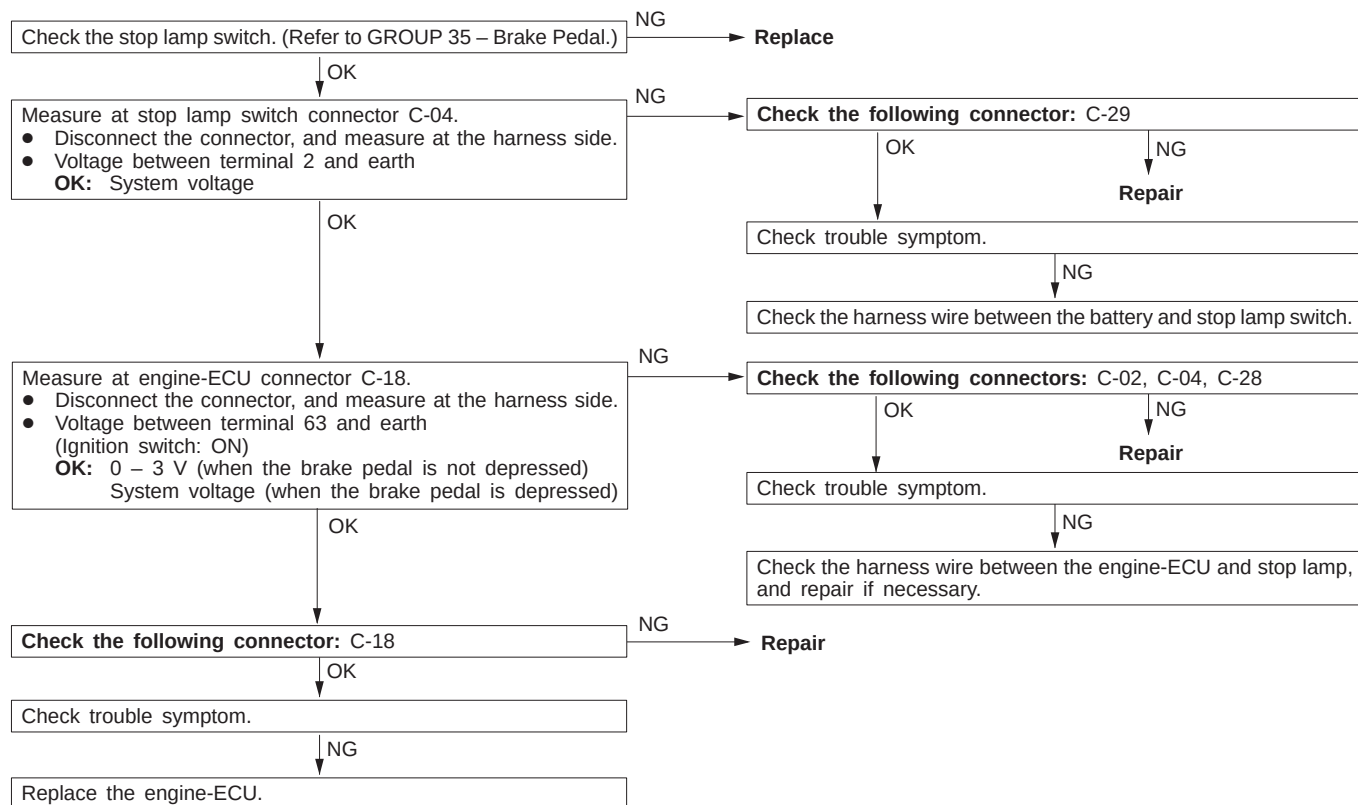
INSPECTION PROCEDURE 32

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



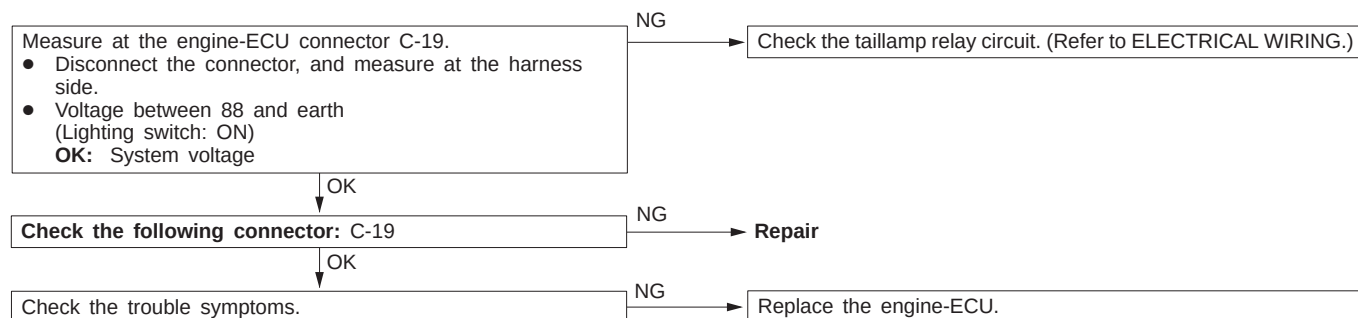
INSPECTION PROCEDURE 33

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>	13A-63 <M/T> 13A-64 <A/T>
			Engine: Cranking	ON	Procedure No.26 <A/T>	
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 coolant temperature: –20°C	1,200 – 1,400 r/min		
		- Engine: Idling - Accelerator pedal position switch: ON - Transmission: Neutral (A/T: P range)	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		

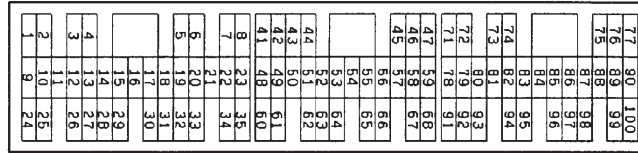
Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
25	Barometric pressure sensor	Ignition switch: ON	Altitude: 0 m	101 kPa	Code No.25	13A-23
			Altitude: 600 m	95 kPa		
			Altitude: 1,200 m	88 kPa		
			Altitude: 1,800 m	81 kPa		
26	Accelerator pedal position switch	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.	Refer-ence 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 switch lamp	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.

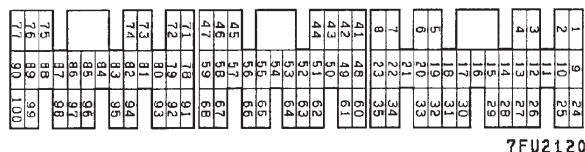
Caution

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.

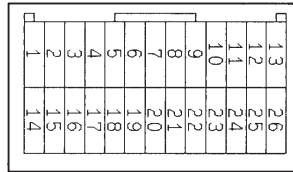
Be careful to prevent this!

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

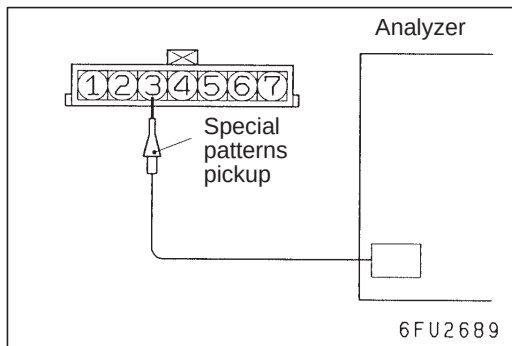


Terminal No.	Check item	Standard value, normal condition (check requirements)
6 – 47	EGR valve (C)	15 – 20 Ω (at 20°C)
5 – 47	EGR valve (D)	
34 – 47	EGR valve (A)	
32 – 47	EGR valve (B)	
16 – 47	Purge control solenoid valve	36 – 44 Ω (at 20°C)
44 – 72	Engine coolant temperature sensor	5.1 – 6.5 k Ω (when engine coolant temperature is 0°C)
		2.1 – 2.7 k Ω (when engine coolant temperature is 20°C)
		0.9 – 1.3 k Ω (when engine coolant temperature is 40°C)
		0.26 – 0.36 k Ω (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 k Ω (when intake air temperature is 0°C)
		2.3 – 3.0 k Ω (when intake air temperature is 20°C)
		1.0 – 1.5 k Ω (when intake air temperature is 40°C)
		0.30 – 0.42 k Ω (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)

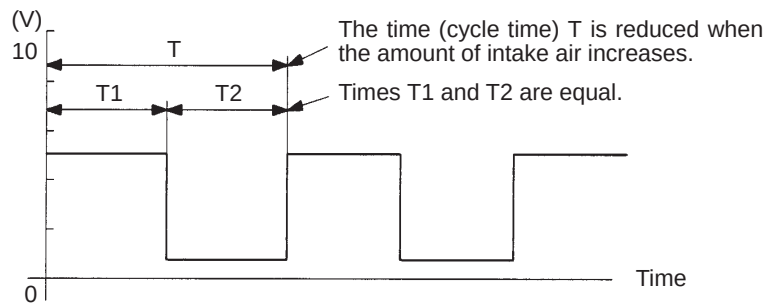
1. Connect the analyzer special patterns pickup to engine-ECU terminal 61.

Standard Wave Pattern

Observation conditions

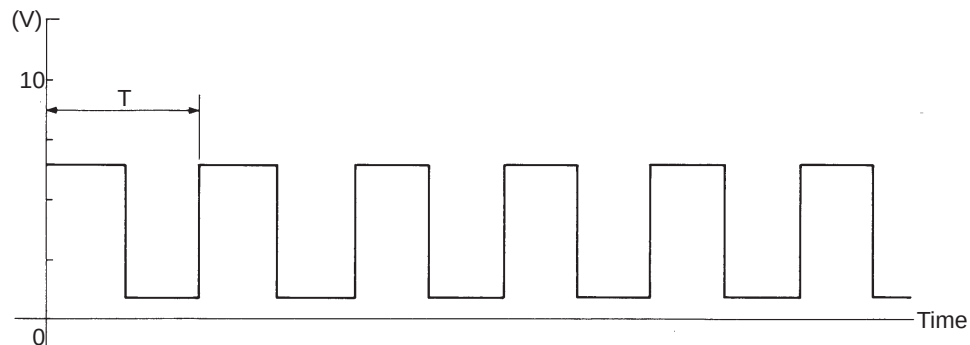
Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Idle speed

Standard wave pattern



7FU1199

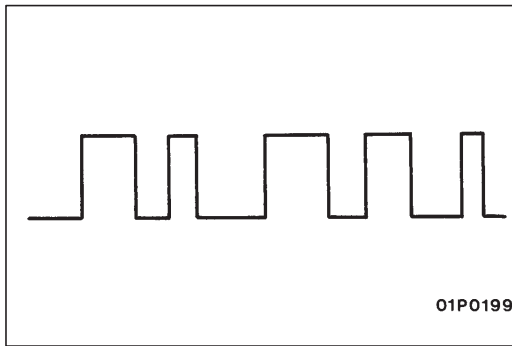
Observation conditions (from conditions above engine speed is increased by racing.)



7FU0880

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.

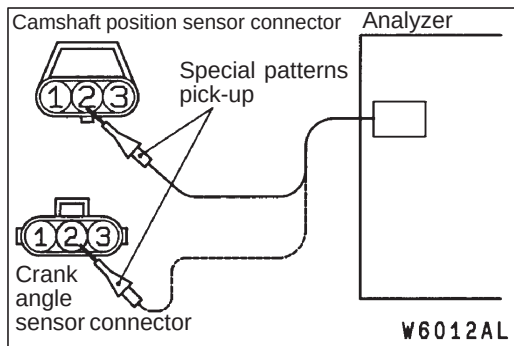
● Example 2

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)

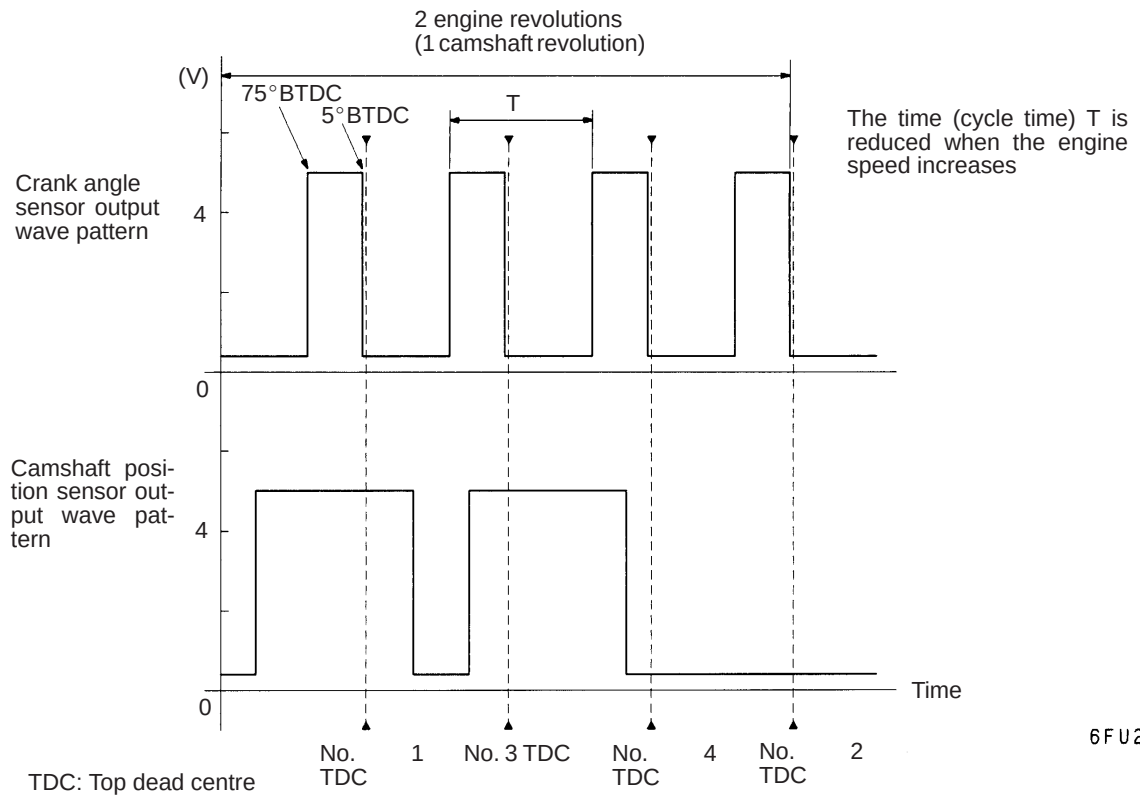
1. Connect the analyzer special patterns pickup to engine-ECU terminal 50. (When checking the camshaft position sensor signal wave pattern.)
2. Connect the analyzer special patterns pickup to engine-ECU terminal 43. (When checking the crank angle sensor signal wave pattern.)

Standard Wave Pattern

Observation conditions

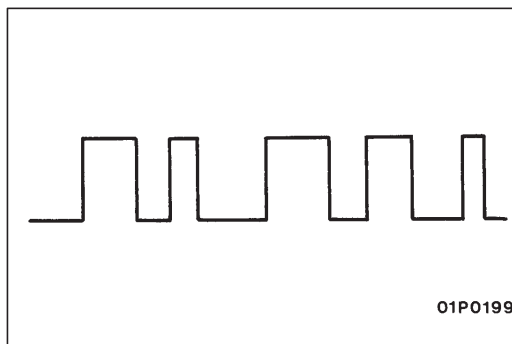
Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Idle speed

Standard wave pattern



Wave Pattern Observation Points

Check that cycle time T becomes shorter when the engine speed increases.



Examples of Abnormal Wave Patterns

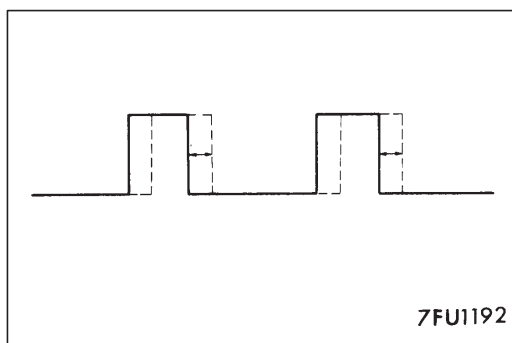
● Example 1

Cause of problem

Sensor interface malfunction

Wave pattern characteristics

Rectangular wave pattern is output even when the engine is not started.



● Example 2

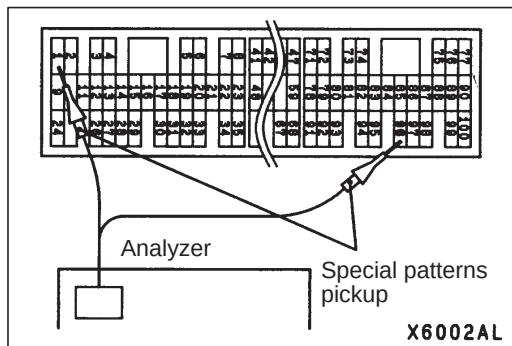
Cause of problem

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

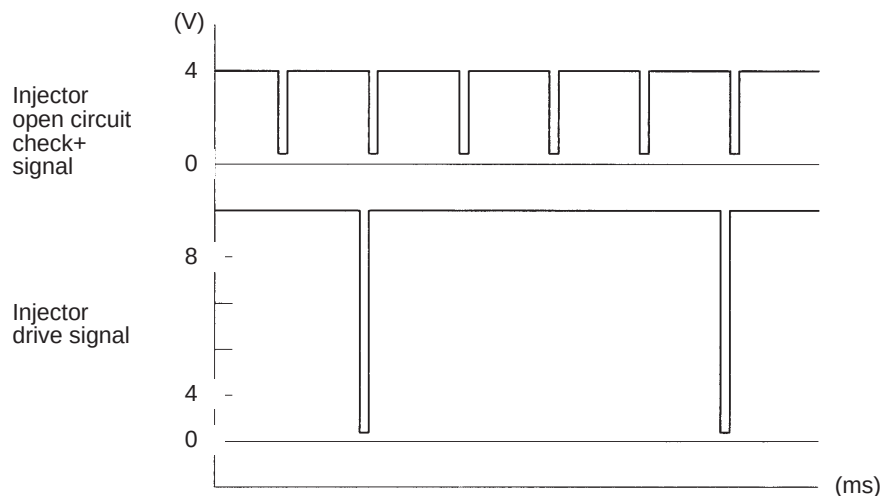
1. Connect the analyzer special patterns pickup to terminal 1 (No.1 injector) of the engine-ECU connector.
2. Connect the analyzer special patterns pickup to terminal 96 (injector open circuit check signal) of the engine-ECU connector.
3. After checking terminal 1, check terminal 9 (No.2 injector), terminal 24 (No.3 injector) and terminal 2 (No.4 injector).

Standard Wave Pattern

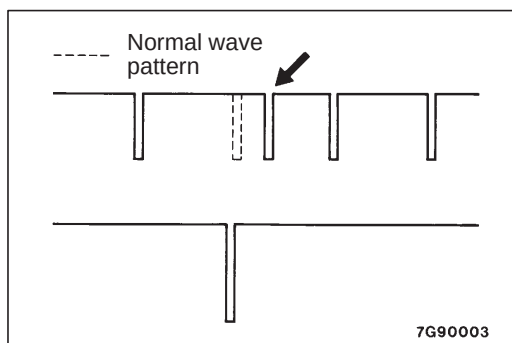
Observation conditions

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

Standard wave pattern

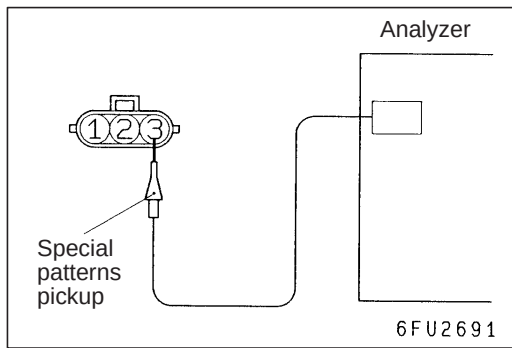


9FU0841



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)

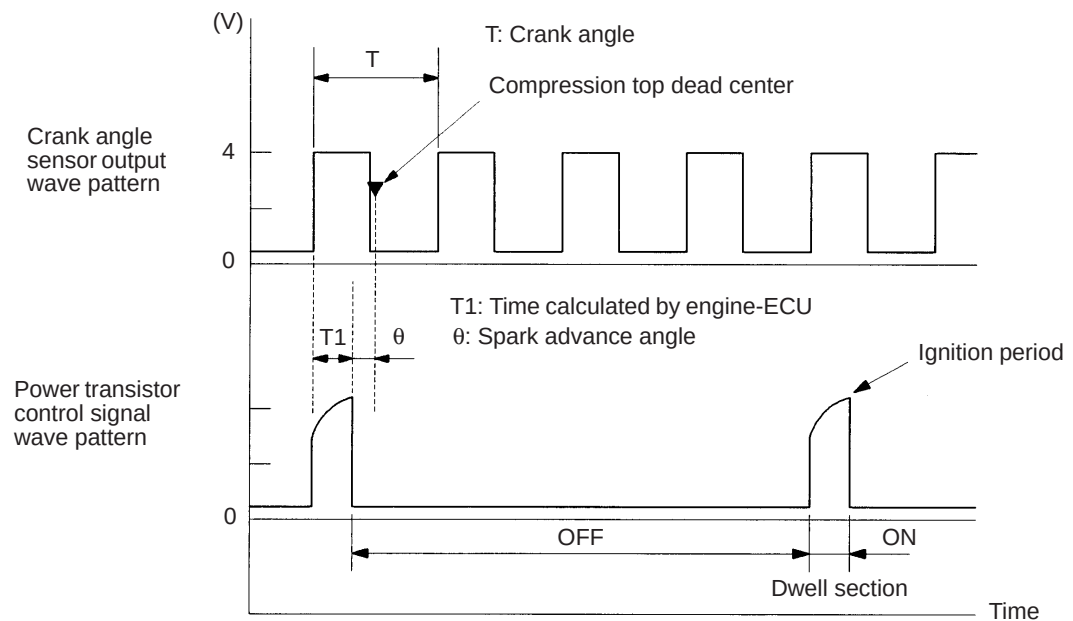
1. Connect the analyzer special patterns pickup to engine-ECU terminal 3 (No. 1 ignition coil), terminal 13 (No. 2 ignition coil), terminal 12 (No. 3 ignition coil), terminal 4 (No. 4 ignition coil) respectively.

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

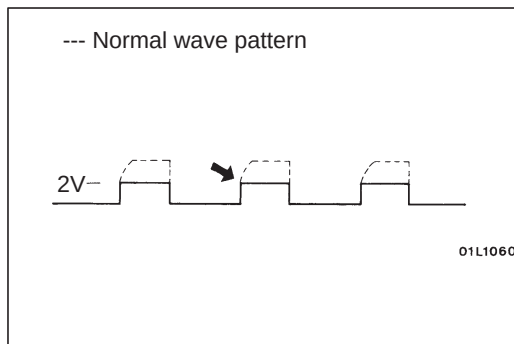


6FU2832

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

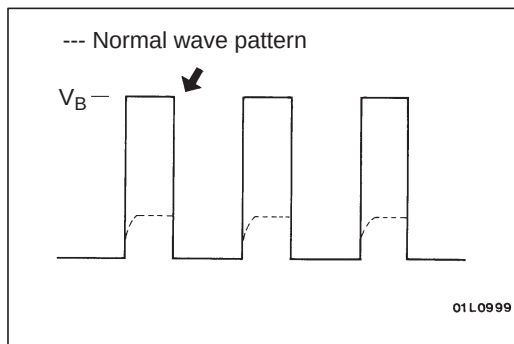
Wave pattern during engine cranking

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

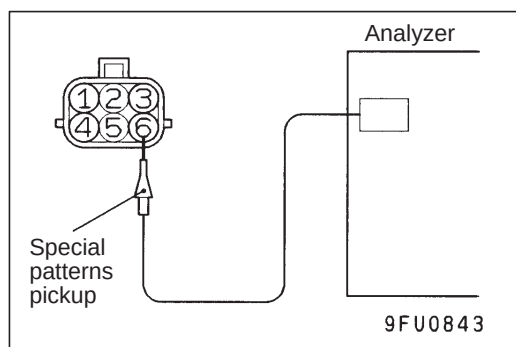
Wave pattern during engine cranking

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)

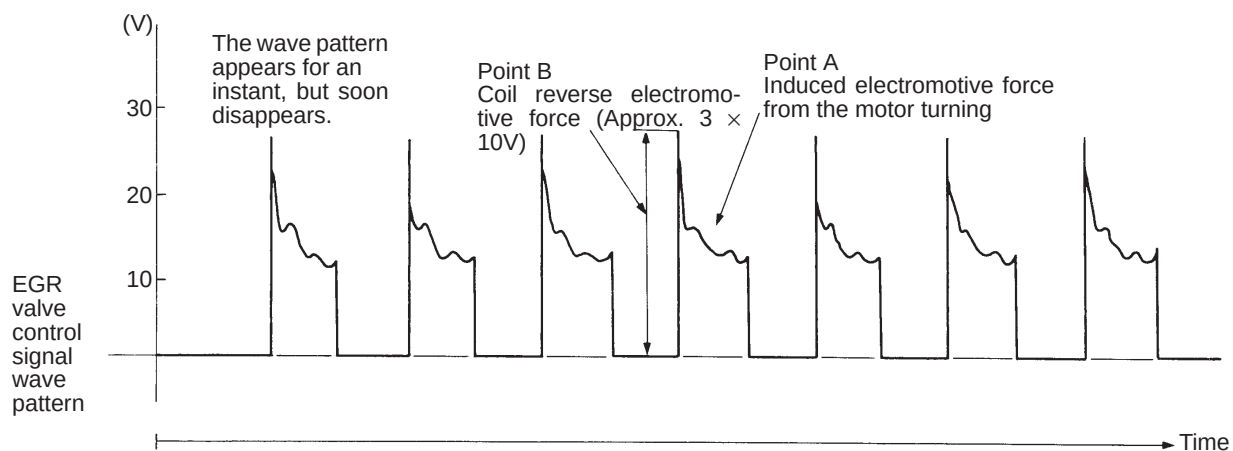
1. Connect the analyzer special patterns pickup to engine-ECU terminal 34, connection terminal 32, connection terminal 6, and connection terminal 5 respectively.

Standard Wave Pattern

Observation conditions

Function	Special patterns
Pattern height	High
Pattern selector	Display
Engine condition	Racing

Standard wave pattern



Wave Pattern Observation Points

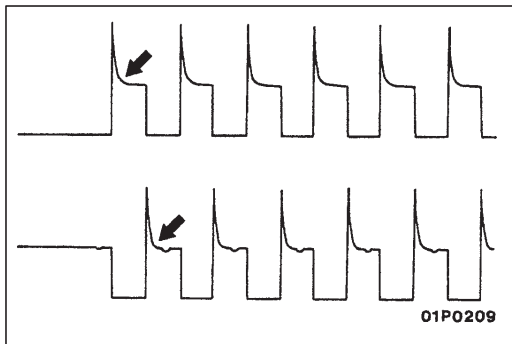
Check that the standard wave pattern appears when the EGR control servo is operating.

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

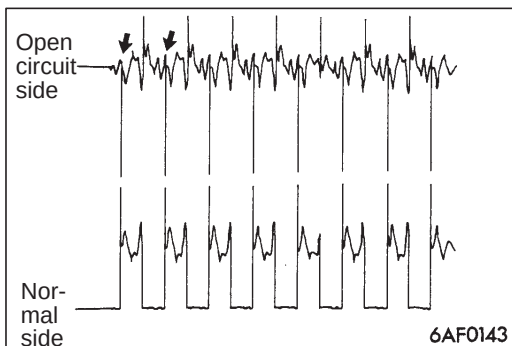
Cause of problem

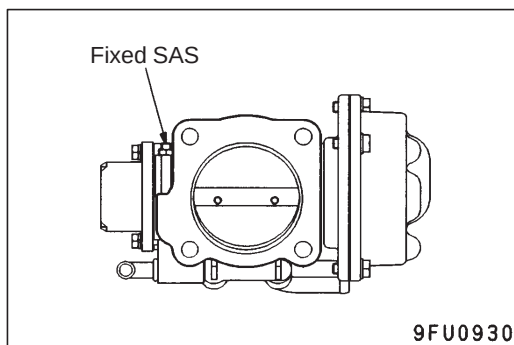
Open circuit in the line between the EGR valve and the engine-ECU

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.





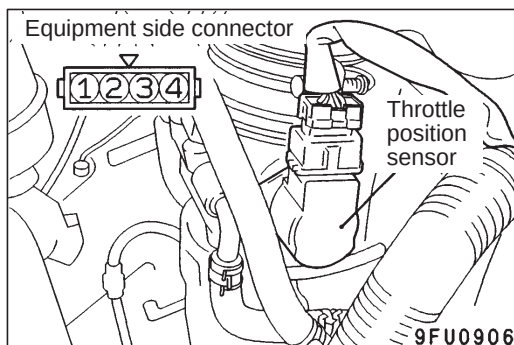
ON-VEHICLE SERVICE

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.

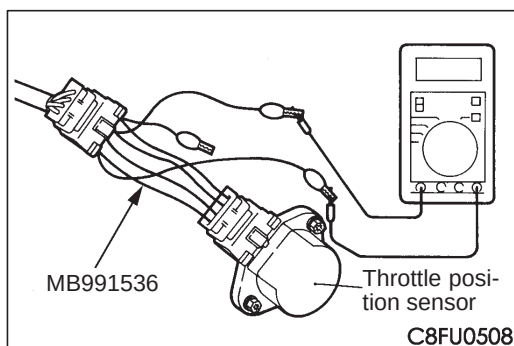
THROTTLE BODY (THROTTLE VALVE ARE) CLEANING

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 valve 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

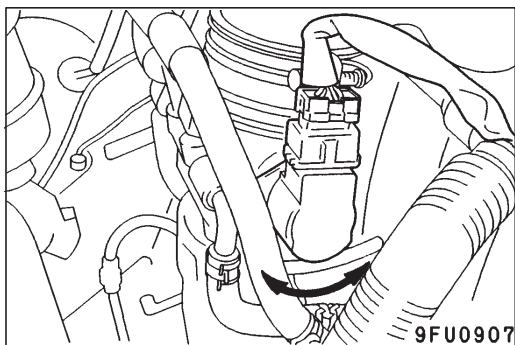
1. Connect the MUT-II to the diagnosis connector. When not using the MUT-II, proceed as follows:



- (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.

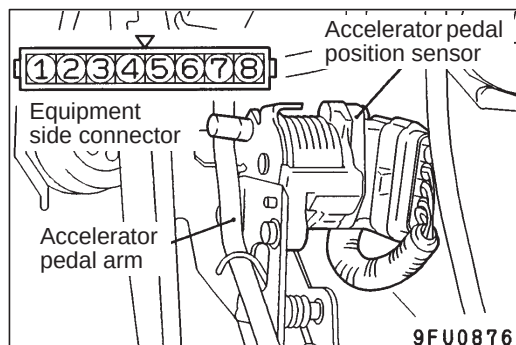
Standard value: 0.4 – 0.6 V



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

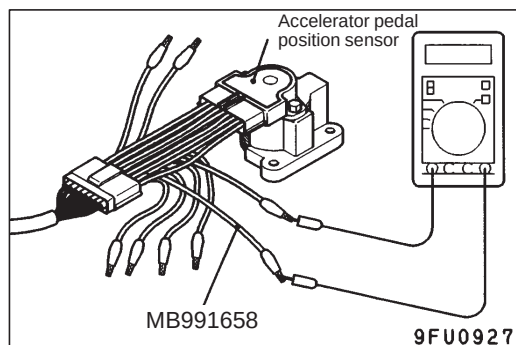
7. If not within the standard value, replace the throttle position sensor.
8. Turn the ignition switch to OFF.
9. Reconnect the throttle valve control servo connector.
10. Remove the MUT-II. If the MUT-II is not used, remove the special tool, and then connect the throttle position sensor connector.
11. 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.



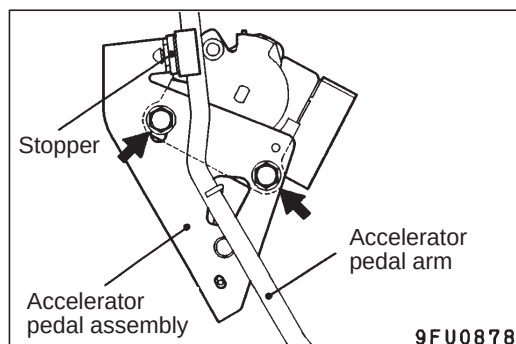
ACCELERATOR PEDAL POSITION SENSOR ADJUSTMENT

Caution

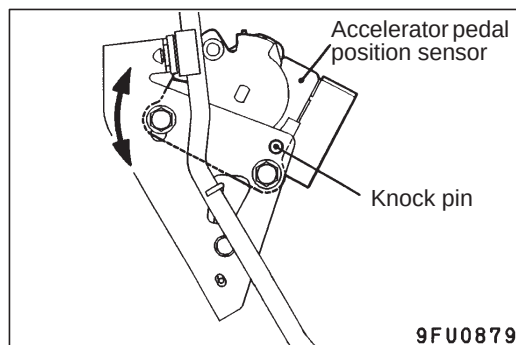
- (1) **Never attempt to tamper the accelerator pedal position sensor. The sensor position is precisely adjusted at factory.**
- (2) **Should it be tampered, follow the procedure below:**



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)].



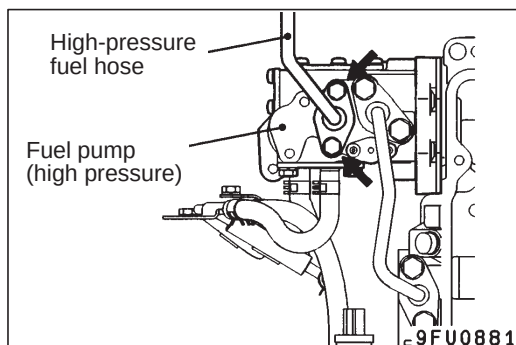
2. Loosen the accelerator pedal position sensor installation bolts.
3. Contact the accelerator pedal arm to the stopper.
4. Turn the ignition switch to the ON position (but do not start the engine).



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.



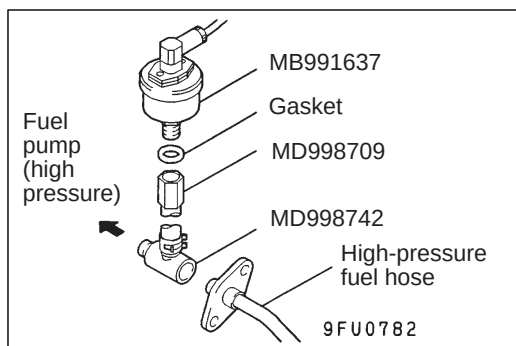
FUEL PRESSURE TEST

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

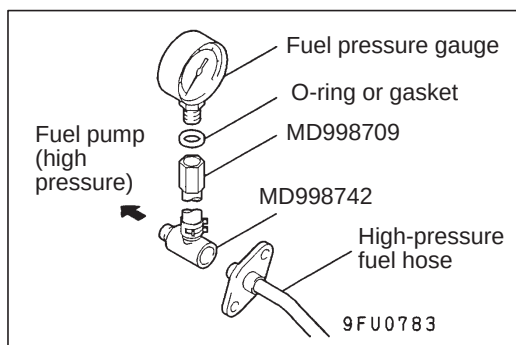
Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.



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.

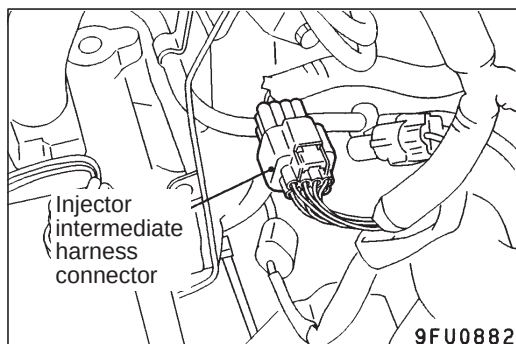
Symptom	Probable cause	Remedy
Fuel pressure drops gradually after engine is stopped	Leaky fuel pressure regulator (low pressure) valve seat	Replace fuel pressure regulator (low pressure)
Fuel pressure drops sharply immediately after engine is stopped	Check valve in fuel pump (low pressure) is held open	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.

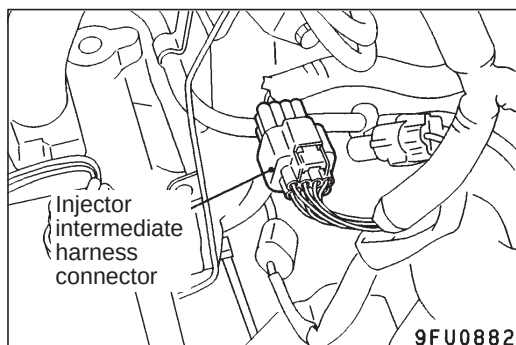
9. Start the engine and run at idle.
10. Measure fuel pressure while the engine is running at idle.

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.

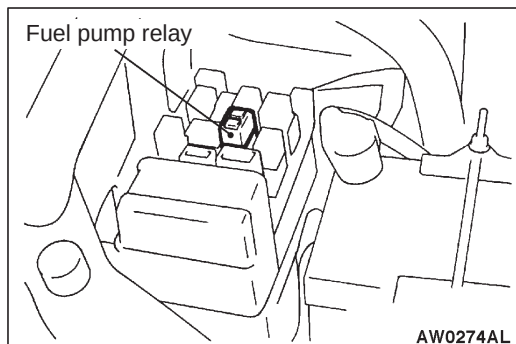
6. Crank the engine, and then measure fuel pressure immediately after 20 seconds.

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.

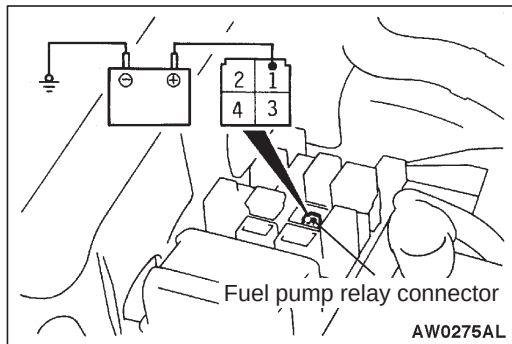
4. Turn off the ignition switch.
5. Select "Item No.74" from the MUT-II Data list.
6. Crank the engine for at least two seconds.
7. If the engine is not be started, use the MUT-II to make sure that the fuel pressure is 0.5 MPa or less. Then turn off the ignition switch.

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.

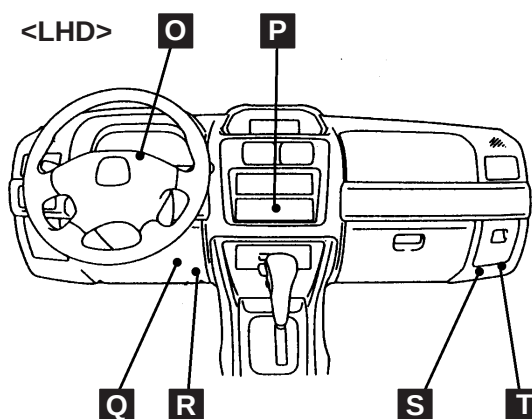
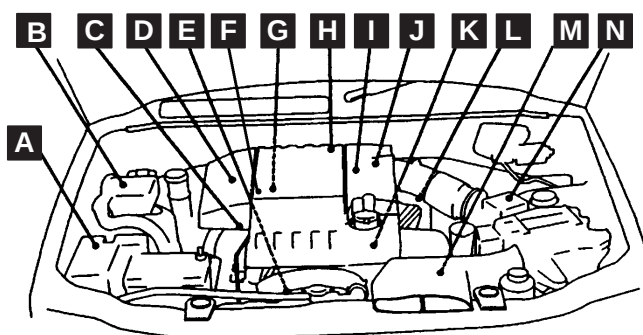
NOTE

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.

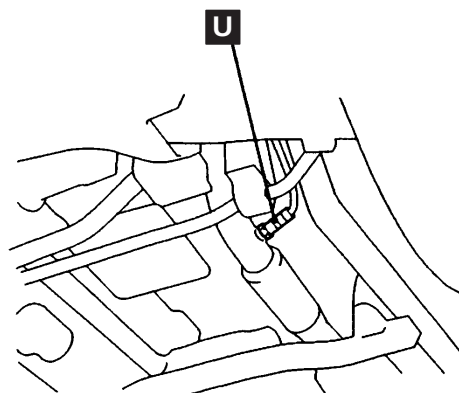
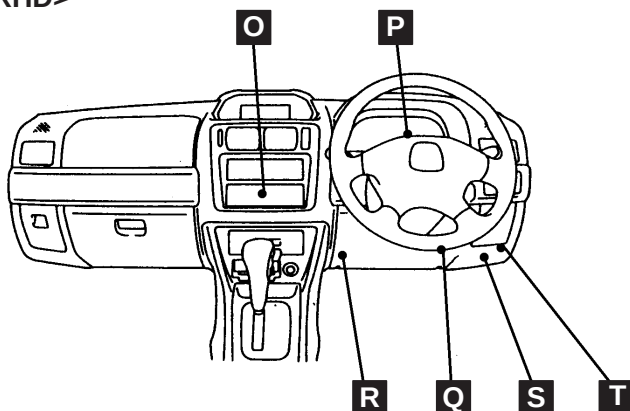
- (3) Check the fuel pressure by pinching the fuel hose with the fingertips.

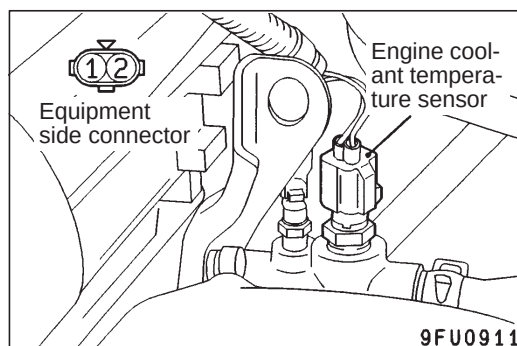
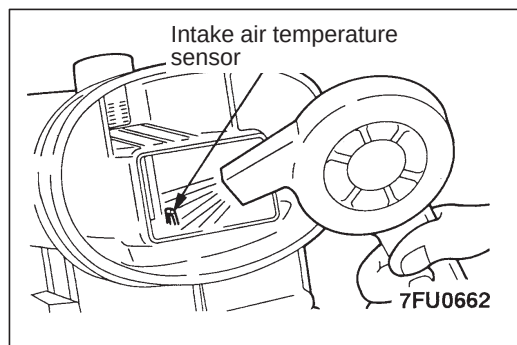
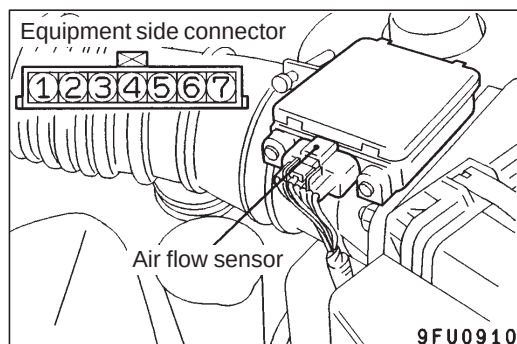
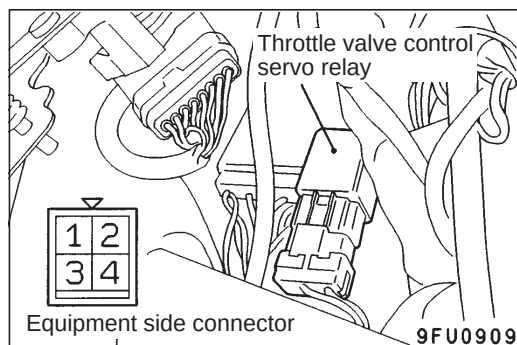
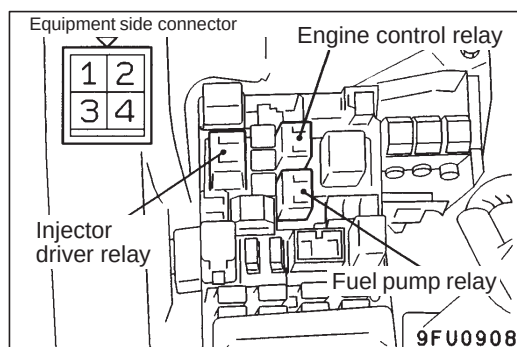
COMPONENT LOCATION

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



<RHD>





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

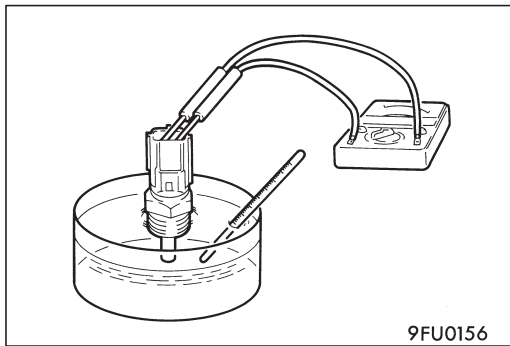
4. If the value deviates from the standard value or the resistance remains unchanged, replace the air flow sensor assembly.

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.



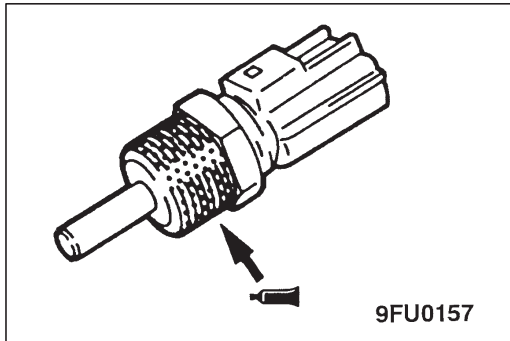
2. With temperature sensing portion of engine coolant temperature sensor immersed in hot water, check resistance.

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.



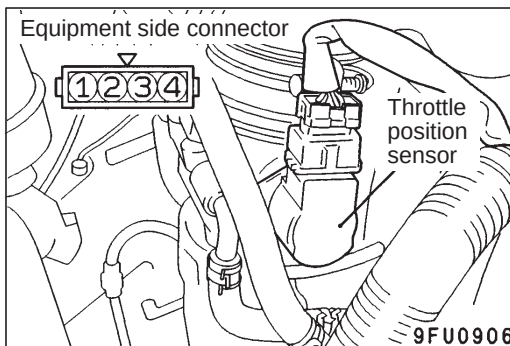
4. Apply sealant to threaded portion.

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:

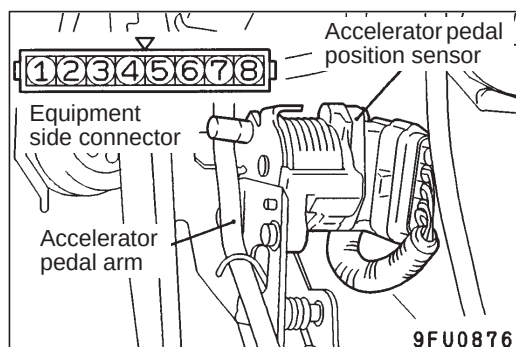
Throttle valve slowly open until fully open from the idle position

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 k Ω

3. Measure resistance between terminal No.2 (sensor power supply) and 3 (sensor output) of the connector.

Normal condition:

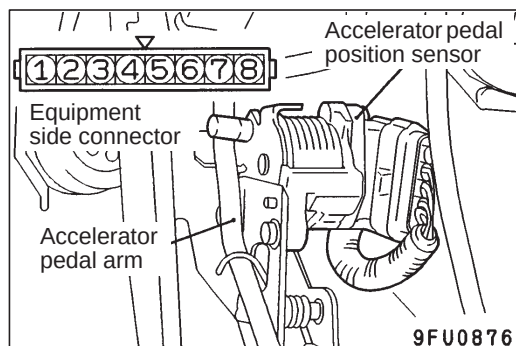
Depress the accelerator pedal slowly.

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 k Ω

3. Measure resistance between terminal No.8 (sensor power supply) and 6 (sensor output) of the connector.

Normal condition:

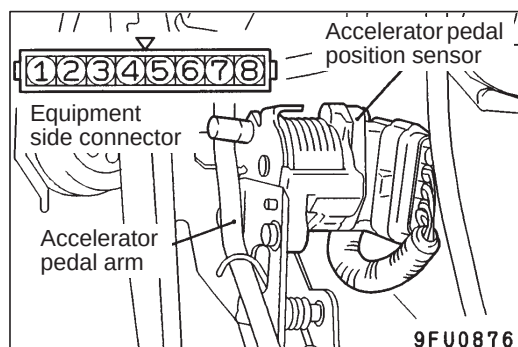
Depress the accelerator pedal slowly.

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.

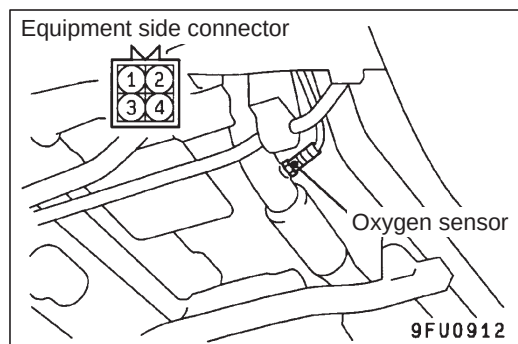
Normal condition

Accelerator pedal	Continuity
Depressed	No continuity
Released	Continuity (0 Ω)

3. If defective, replace the accelerator pedal position sensor assembly.

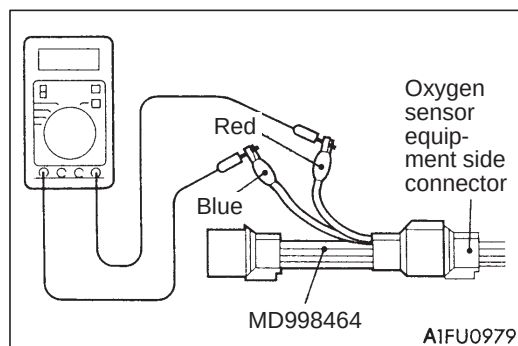
NOTE

After replacement, adjust the accelerator pedal position sensor. (Refer to P.13A-94.)

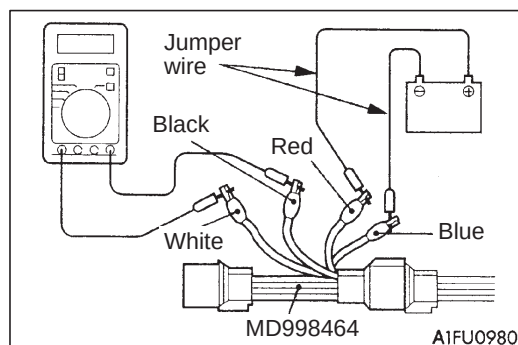


OXYGEN SENSOR CHECK

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 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).

- While repeatedly racing the engine, measure the oxygen sensor output voltage.

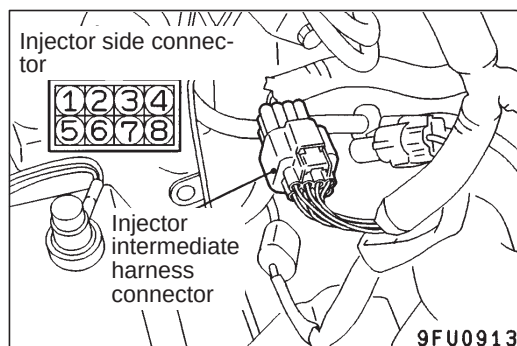
Standard value:

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.

- 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.

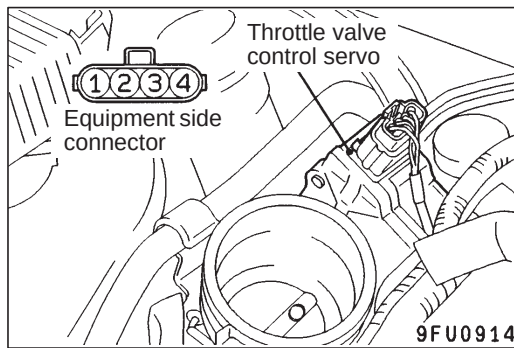
**INJECTOR CHECK**

- Disconnect the injector intermediate harness connector.
- 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

- 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

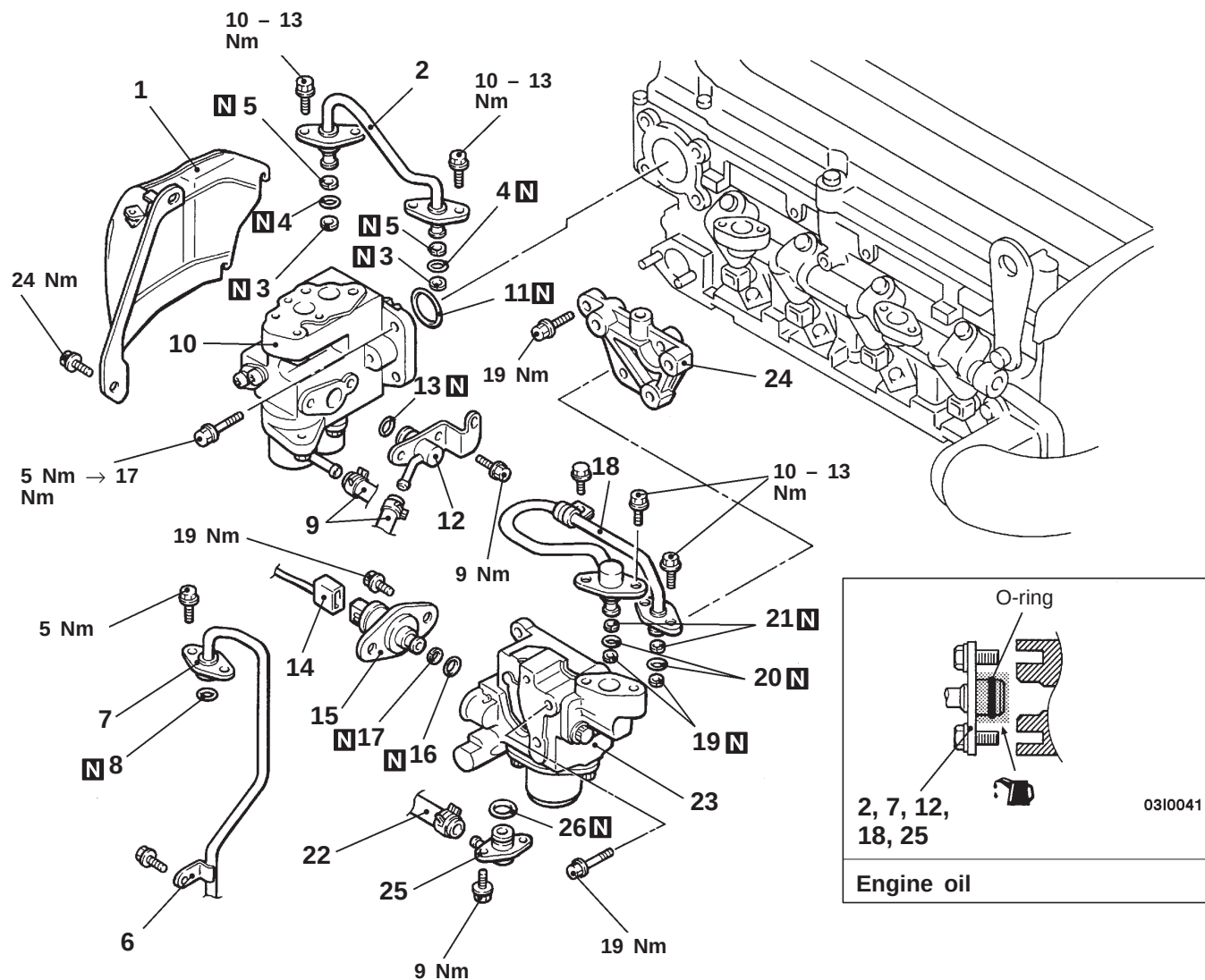
Refer to GROUP 17 – Emission Control System.

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.)



Fuel pump (High pressure) removal steps

- ▶F◀ • Fuel pump (high pressure) air bleeding
- ▶F◀ • 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
- ▶C◀ 6. Fuel pressure hose clamp
- ▶C◀ 7. Fuel pressure hose connection
- ▶C◀ 8. O-ring
- ▶C◀ 9. Fuel return hose connection
- ▶E◀ 10. Fuel pump (high pressure)
- ▶E◀ 11. O-ring
- ▶E◀ 12. Fuel pump return nipple
- ▶E◀ 13. O-ring

Fuel pressure regulator (High pressure) removal steps

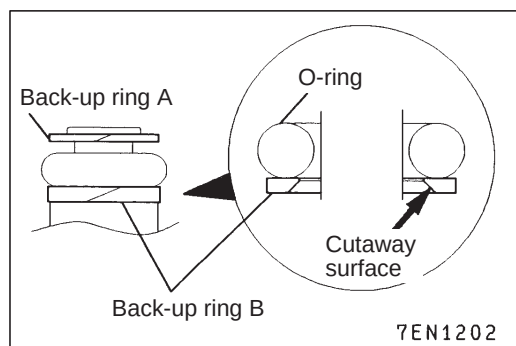
- Intake manifold assembly removal (Refer to GROUP 15.)
- 14. Fuel pressure sensor connector connection
- 15. Fuel pressure sensor
- ▶D◀ 16. O-ring
- ▶D◀ 17. Back-up ring
- ▶C◀ 18. Fuel return pipe
- ▶B◀ 19. Back-up ring A
- ▶B◀ 20. O-ring
- ▶B◀ 21. Back-up ring B
- ▶B◀ 22. Fuel return hose connection
- ▶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

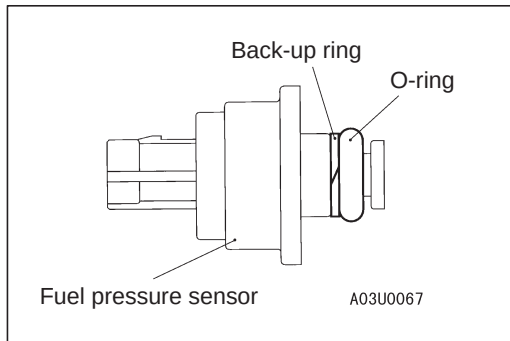
1. Install the back-up ring B facing its cutaway surface toward the opposite side of the O-ring as shown in the illustration.
2. Confirm the outer diameter of the back-up ring A. Take care not to install the back-up ring for the fuel pressure sensor by mistake. (Outer diameter of the back-up ring A: 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.

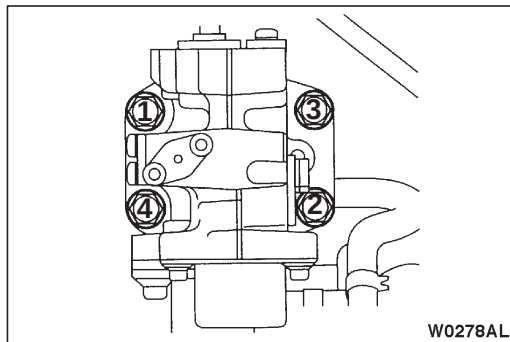


►D◄ BACK-UP RING/O-RING INSTALLATION

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

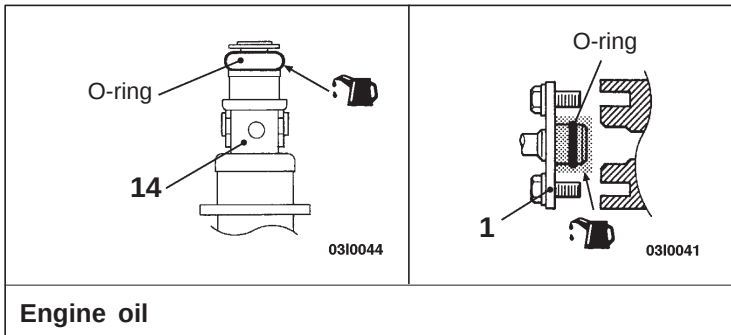
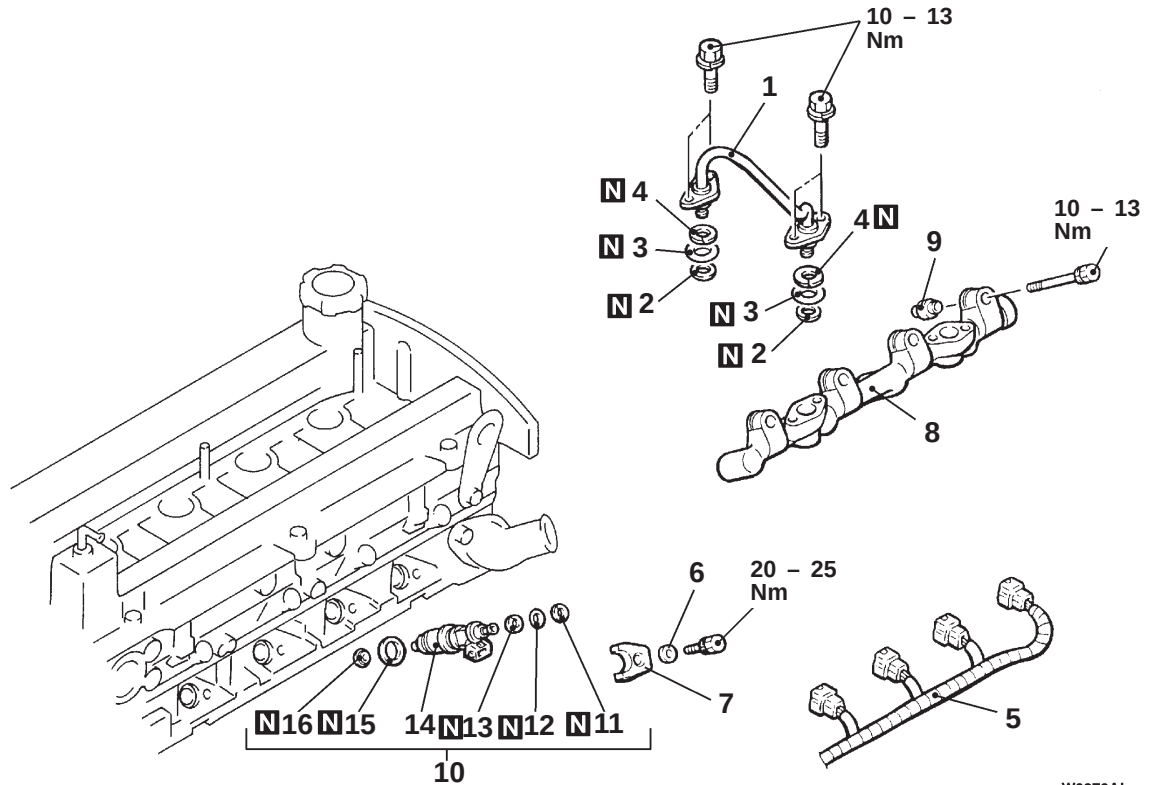
When removing the fuel pump (high pressure), air may get into the fuel pump (high pressure). If air gets into the fuel pump (high pressure), diagnosis code No.56 for abnormal fuel pressure will be output.

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.)



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Removal steps

- ◀A▶ 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
 ▶B▶ 6. Washer
 ▶B▶ 7. Injector holder
 ▶B▶ 8. Delivery pipe assembly

- ▶B▶ 9. Insulator
 ▶B▶ 10. Fuel injector assembly
 ▶B▶ 11. Back-up ring
 ▶B▶ 12. O-ring
 ▶B▶ 13. Back-up ring
 ▶B▶ 14. Fuel injector
 ▶A▶ 15. Gasket
 ▶A▶ 16. Corrugated washer

REMOVAL SERVICE POINTS**◀A▶ INJECTOR HARNESS CONNECTOR
DISCONNECTION****Caution**

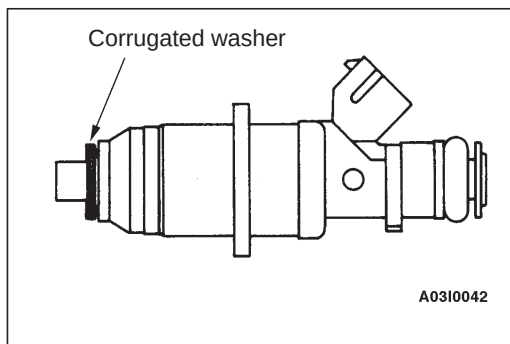
Disconnect the battery (–) cable from its terminal before carrying out this operation.

**◀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.

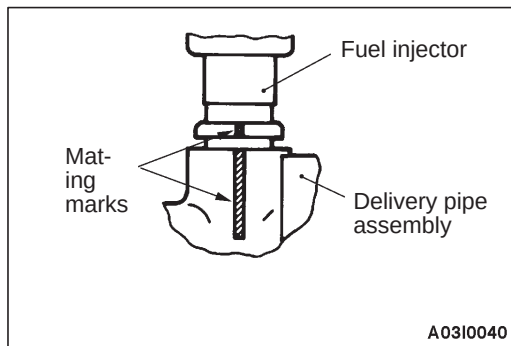
**▶B◀ FUEL INJECTOR ASSEMBLY/DELIVERY PIPE
ASSEMBLY INSTALLATION**

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.

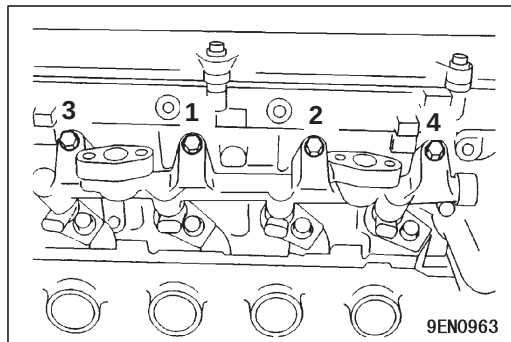


4. Align the mating marks on the delivery pipe assembly and the fuel injector, and then install the delivery pipe assembly with the injector assembly still attached.

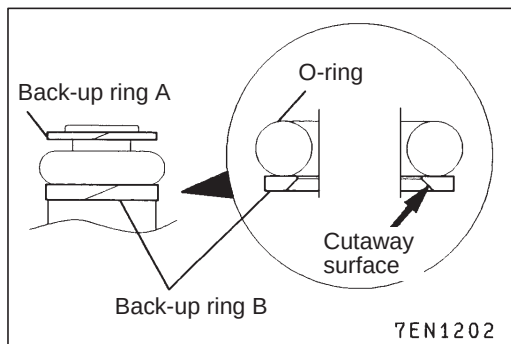
5. Install the delivery pipe and fuel injectors to the cylinder head, and then tighten them provisionally.
6. Install the injector holders and washers, and then tighten them to the specified torque.

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

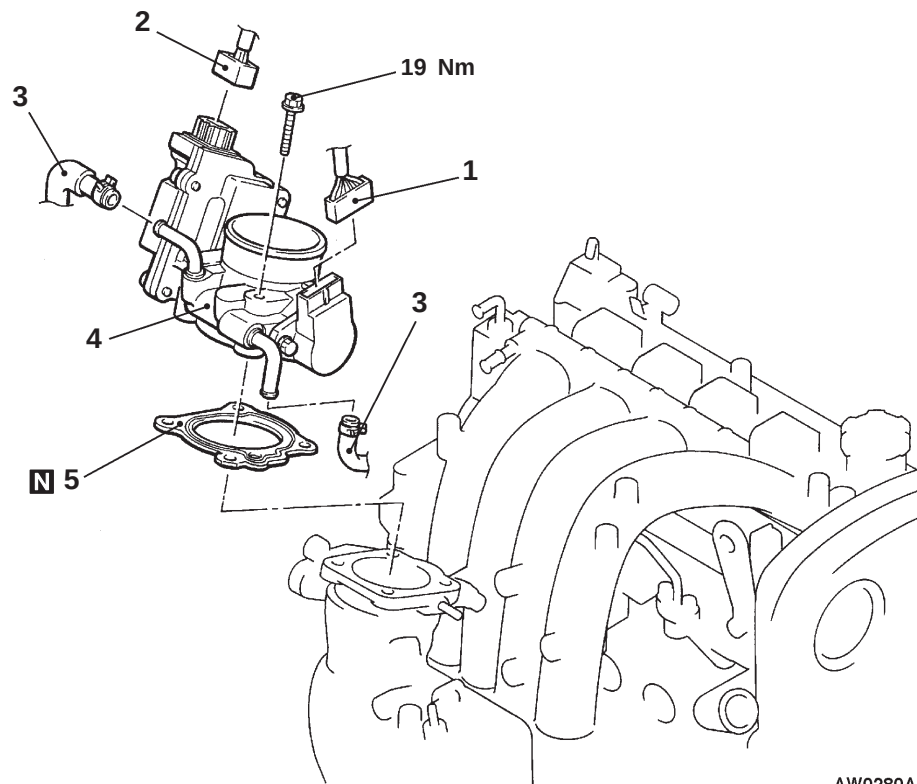
Take care not to let any of the engine oil get inside the fuel pump (high pressure), fuel pressure regulator (high pressure) and delivery pipe.

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.)



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Removal steps

1. Throttle position sensor connector connection
2. Throttle control servo connector connection

- ▶◀ 3. Water hose connection
4. Throttle body assembly
5. Throttle body gasket

INSTALLATION SERVICE POINT

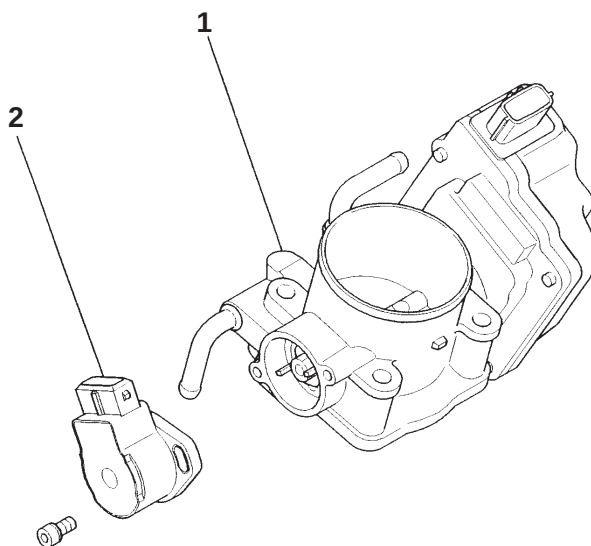
▶◀ THROTTLE BODY INSTALLATION

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.

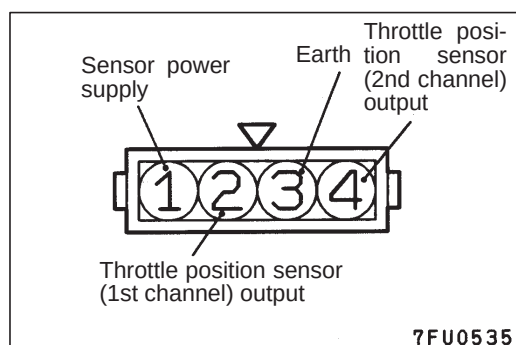
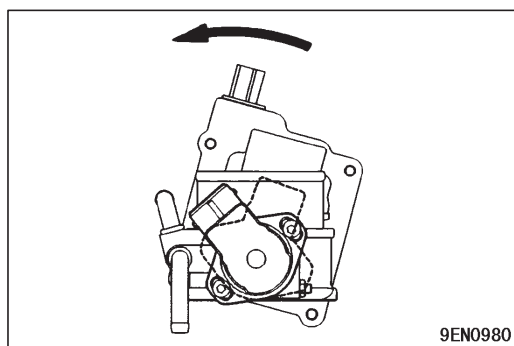
DISASSEMBLY AND REASSEMBLY



9EN0979

Disassembly steps

- A◄
1. Throttle position sensor
 2. Throttle body

**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).

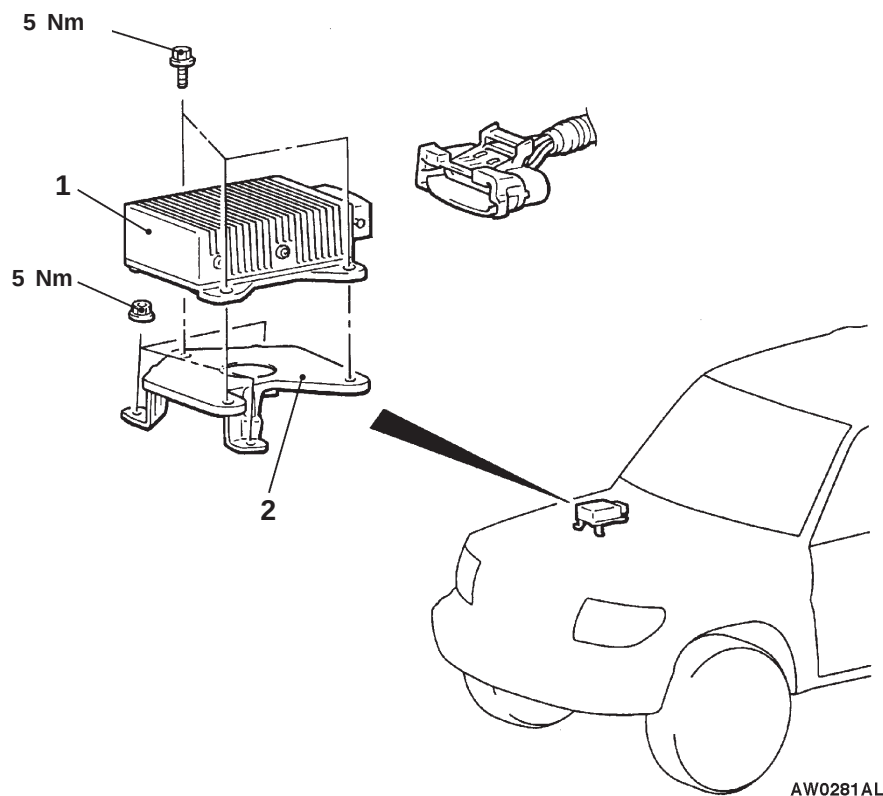
Normal condition

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

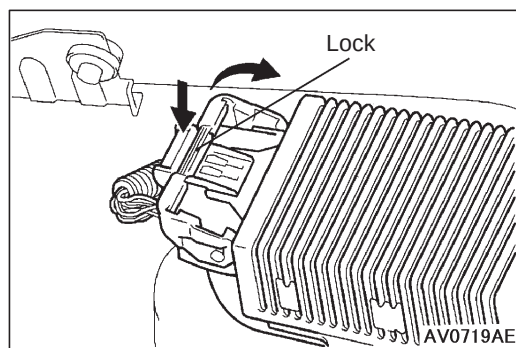
REMOVAL AND INSTALLATION



Removal steps



1. Injector driver
2. Bracket



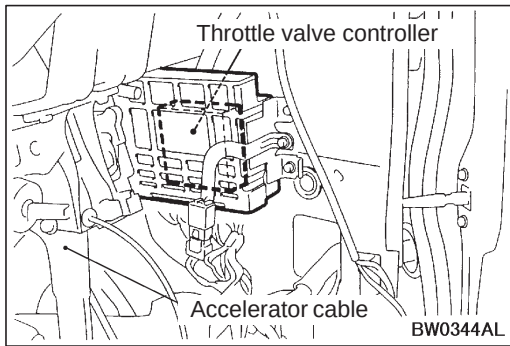
REMOVAL SERVICE POINT

◀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

FUEL SUPPLY

CONTENTS

FUEL TANK	2	Fuel Pump Module	4

FUEL TANK

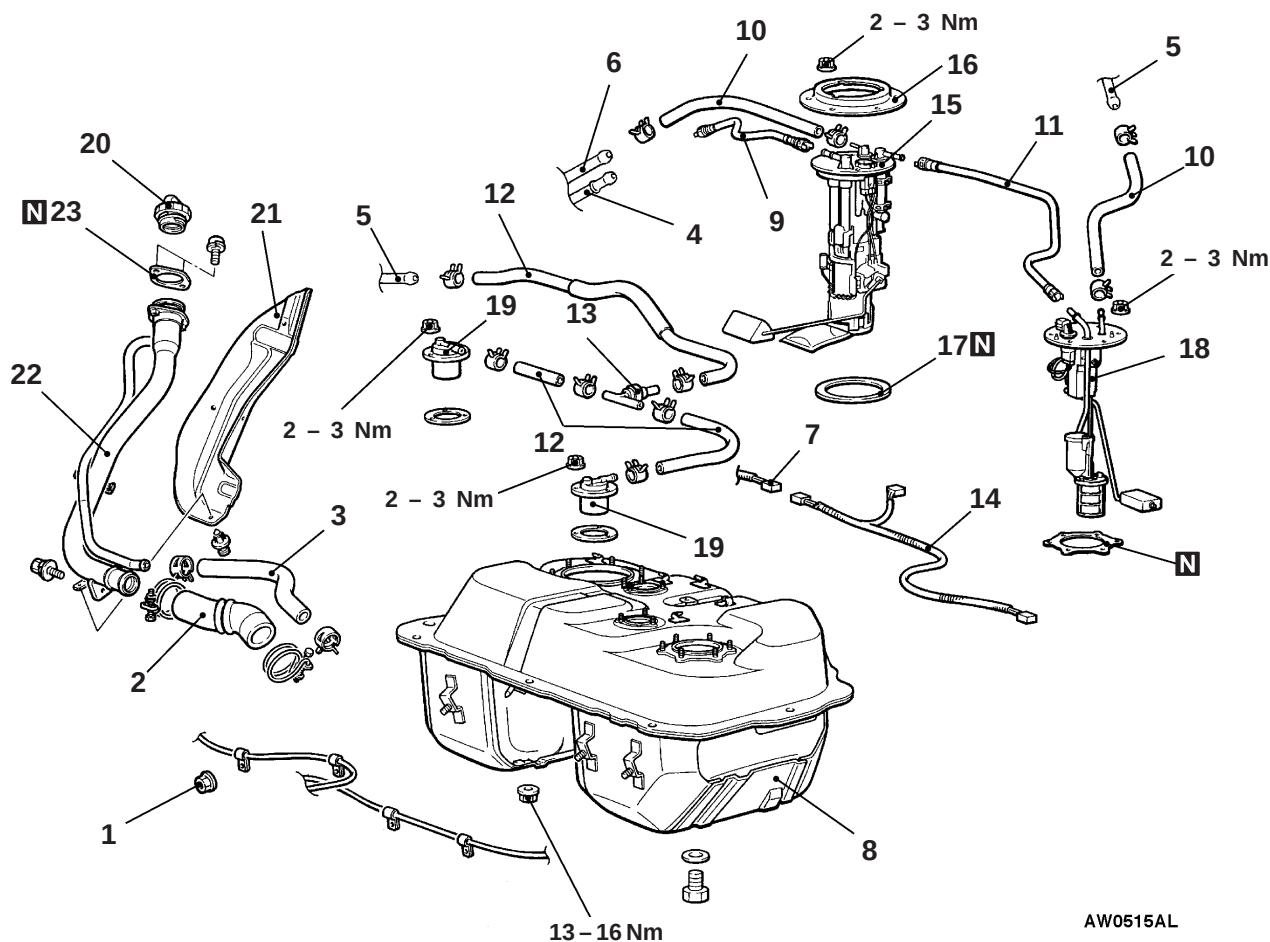
REMOVAL AND INSTALLATION

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.)



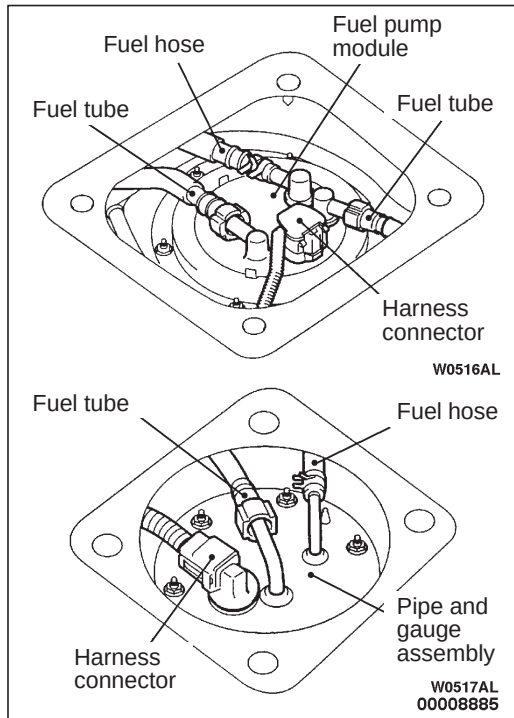
AW0515AL

Removal steps

1. Parking brake cable clamp mounting nut	12. Vapour hose
2. Filler hose	13. Fuel check valve
3. Leveling hose	14. Fuel tank harness
▶A◀ 4. High pressure tube connection	15. Fuel pump module
5. Vapour hose connection	16. Retainer plate
6. Return hose connection	17. Packing
7. Harness connector connection	18. Pipe and gauge assembly
8. Fuel tank assembly	19. Valve assembly
▶A◀ 9. High pressure tube	20. Fuel filler cap
▶A◀ 10. Return hose	21. Filler neck protector
▶A◀ 11. Suction tube	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.

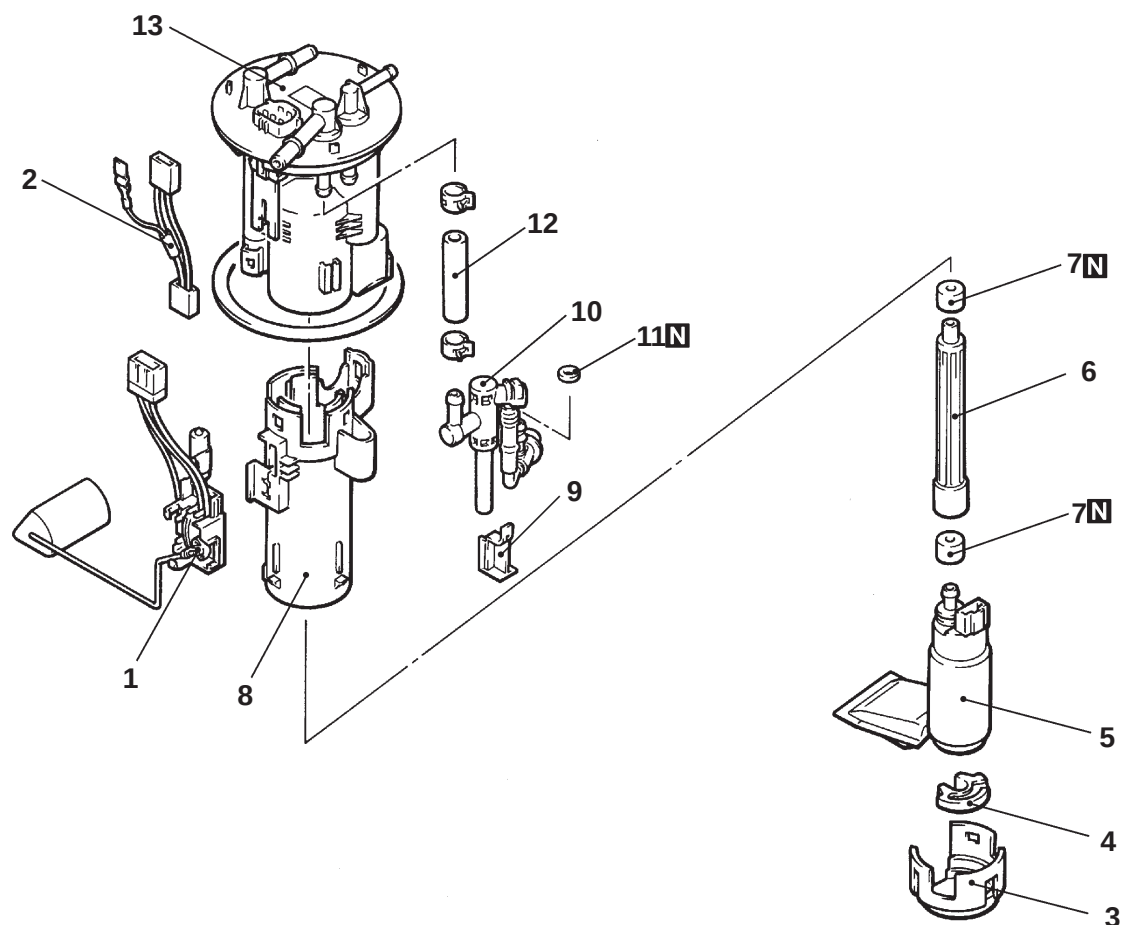
7. Install the service hole cover.
8. Install the rear seat cushion.

FUEL GAUGE UNIT CHECK

Refer to GROUP 54 – Combination Meter.

DISASSEMBLY AND REASSEMBLY

FUEL PUMP MODULE



AW0518AL

Disassembly steps

1. Fuel gauge unit
2. Gauge harness
3. Bracket
4. Cushion
5. Fuel pump (low-pressure)
6. Fuel tube
7. Grommet
8. Housing



9. Stopper
10. Fuel pressure regulator (low-pressure) and assist pump assembly
11. O-ring
12. Fuel hose
13. Fuel filter assembly



REASSEMBLY SERVICE POINT

▶◀ O-RING/GROMMET INSTALLATION

Apply a fuel to O-ring and grommet before installing them, to prevent them from being damaged or twisted.

ENGINE COOLING

CONTENTS

GENERAL INFORMATION	2	Engine Coolant Replacement	9
SERVICE SPECIFICATIONS	2	Concentration Measurement	10
LUBRICANT	2	Fan Controller Check	10
SEALANTS	3	Fan Control Relay Continuity Check	11
SPECIAL TOOL	3	THERMOSTAT	12
TROUBLESHOOTING	3	WATER PUMP	14
ON-VEHICLE SERVICE	8	WATER HOSE AND WATER PIPE	15
Engine Coolant Leak Checking	8	RADIATOR	18
Radiator Cap Valve Opening Pressure Check ...	8		

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	–

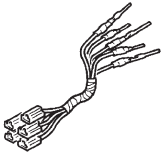
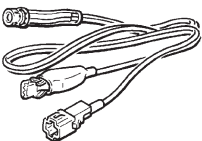
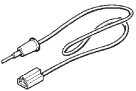
LUBRICANT

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

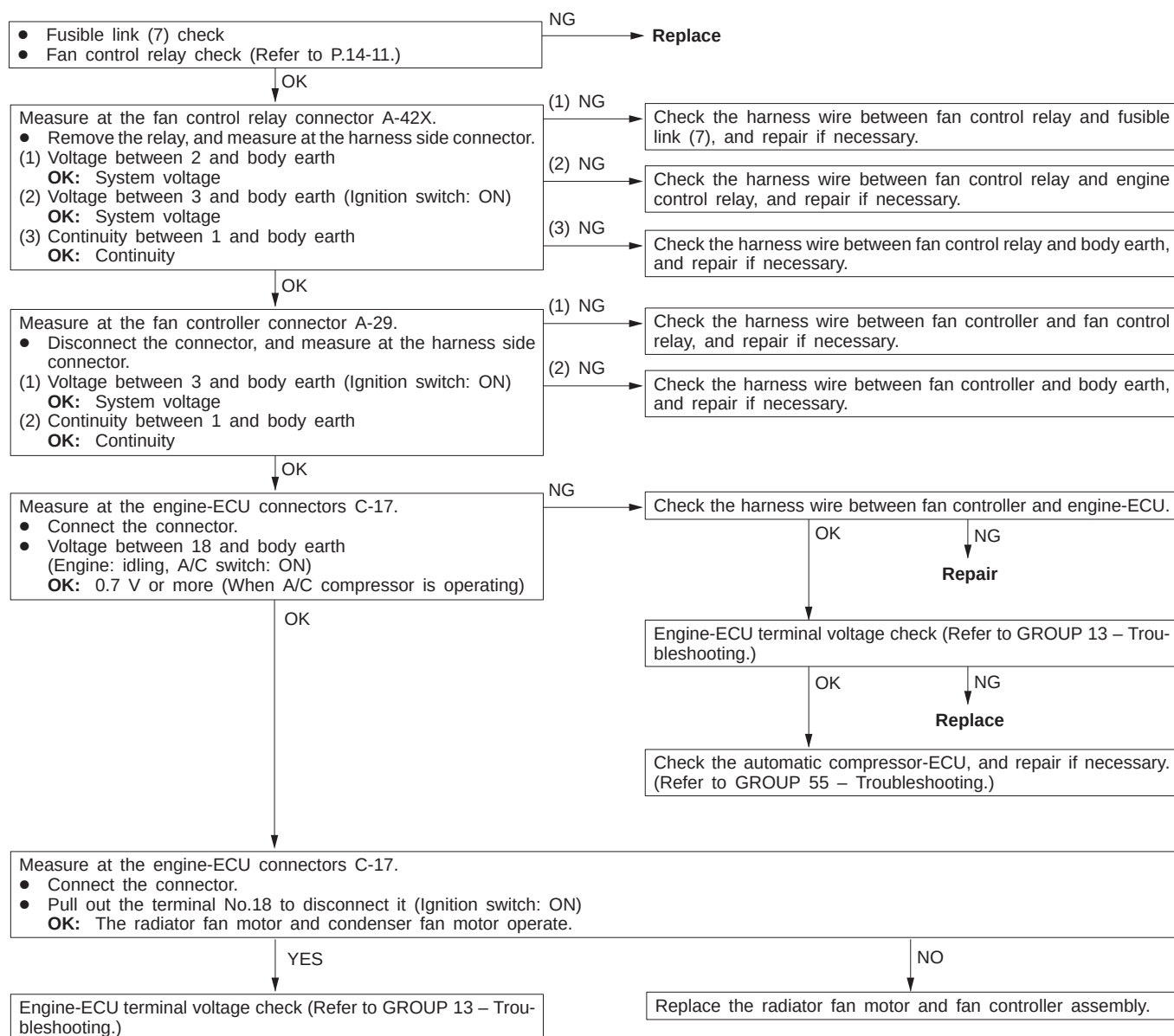
Trouble symptoms	Inspection procedure No.	Reference page
Radiator fan and condenser fan do not operate. <Vehicles with A/C> Radiator fan does not operate. <Vehicles without A/C>	1	14-4
Radiator fan and condenser fan do not change speed or stop. <Vehicles with A/C> Radiator fan does not change speed or 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

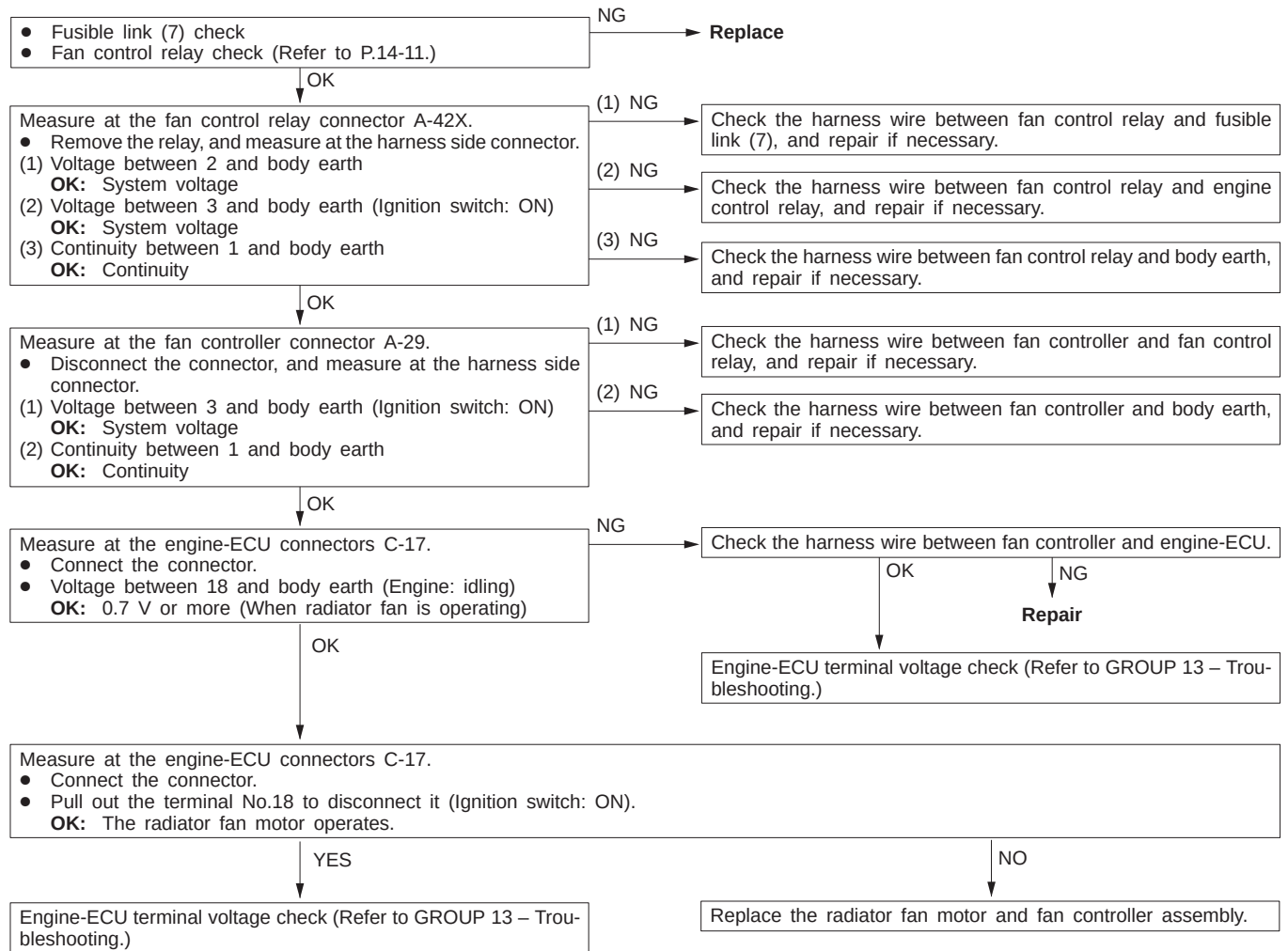
Inspection Procedure 1

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>



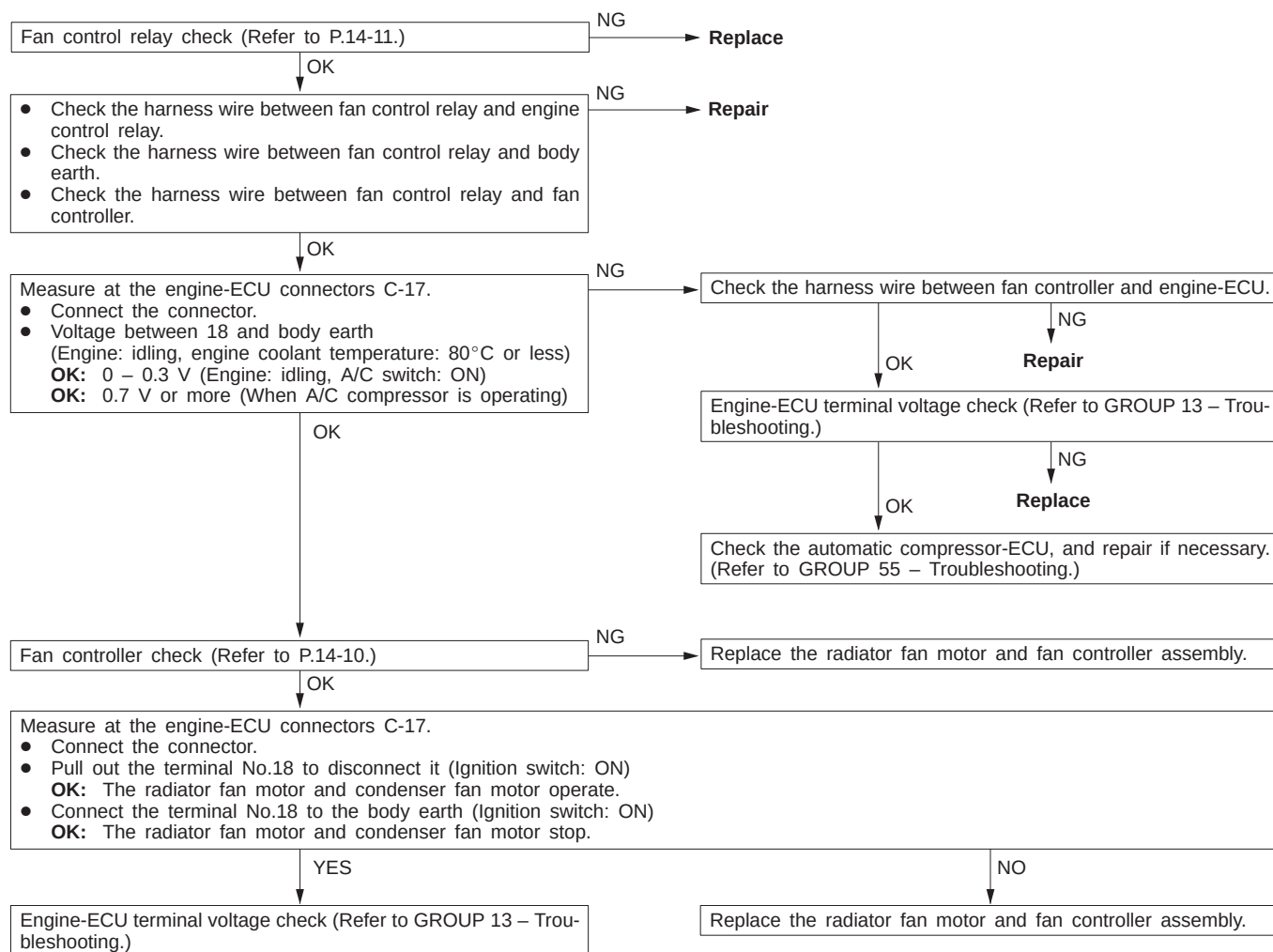
<Vehicles without A/C>



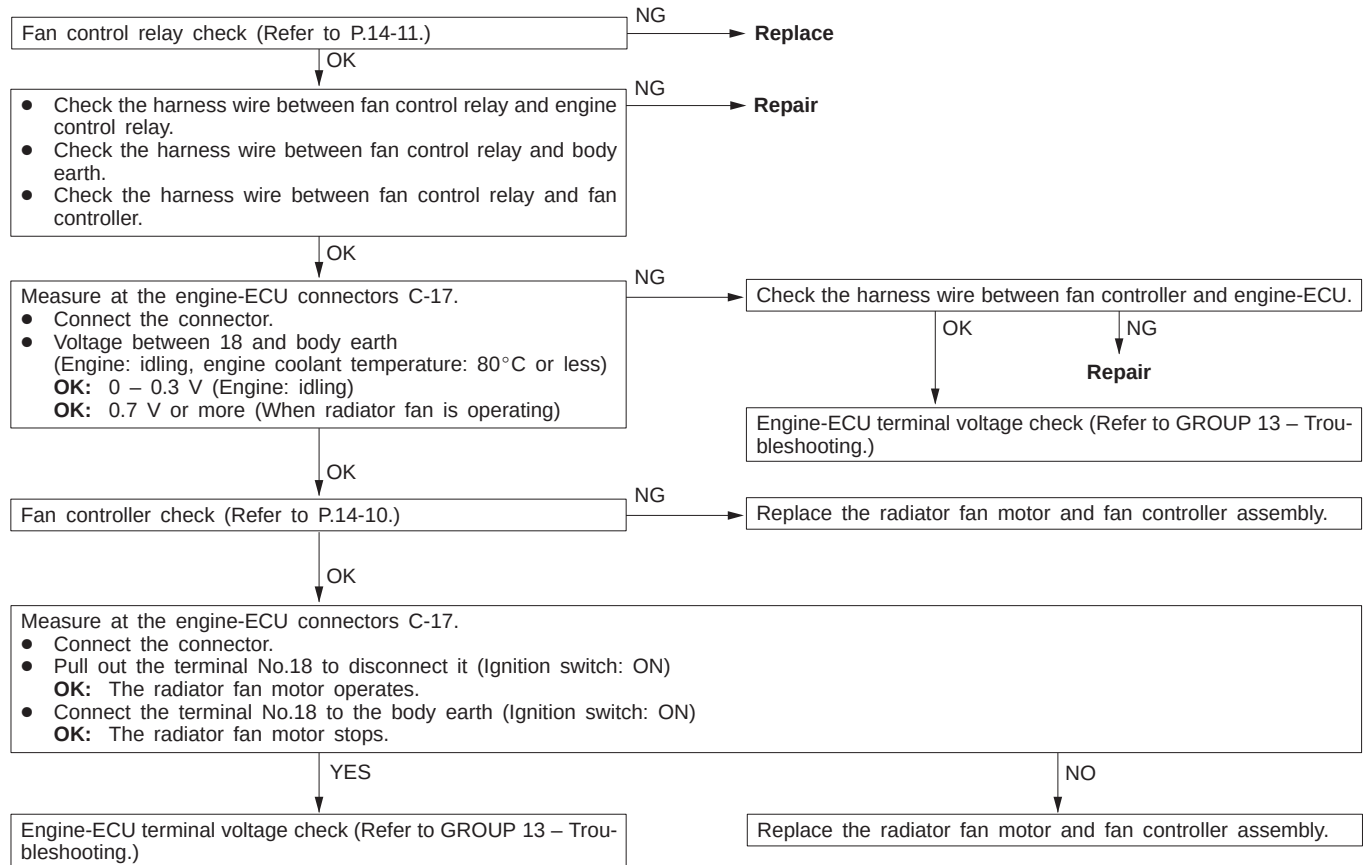
Inspection Procedure 2

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>



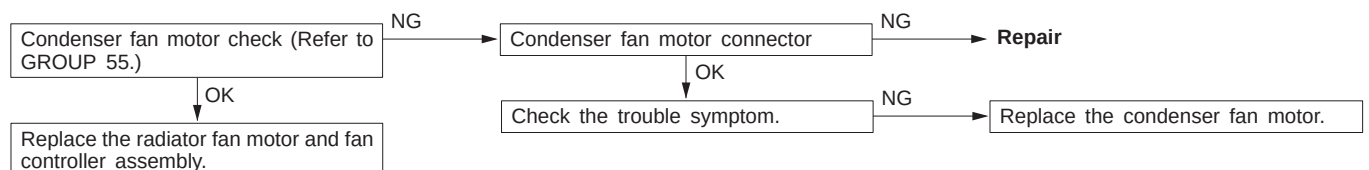
Inspection Procedure 3

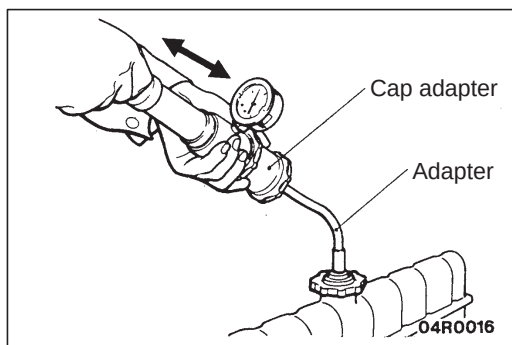
Radiator fan does not operate. <Vehicles with A/C>	Probable cause
The cause could be a malfunction of the radiator fan motor or an open circuit between the fan controller and the radiator fan motor.	- Malfunction of radiator fan motor - Open circuit between fan controller and radiator fan motor

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





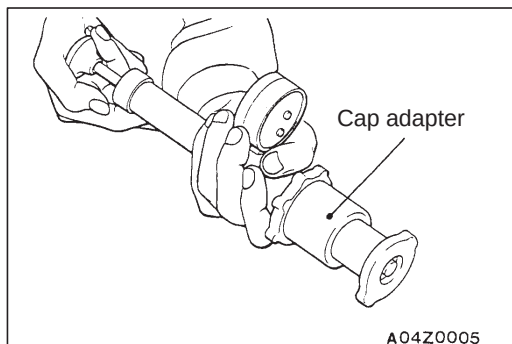
ON-VEHICLE SERVICE

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.

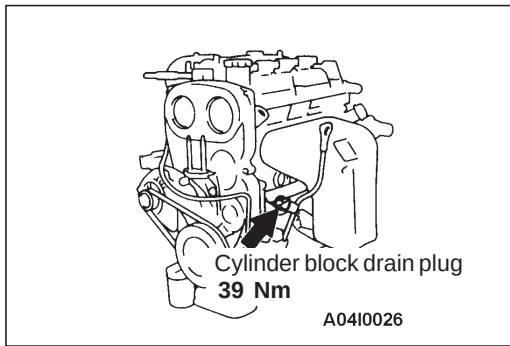
Standard value: 75 – 105 kPa

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:

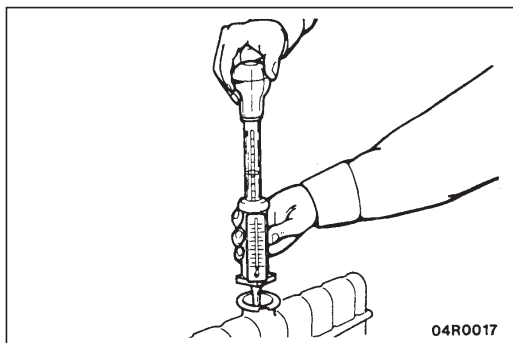
MITSUBISHI GENUINE COOLANT or equivalent

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.

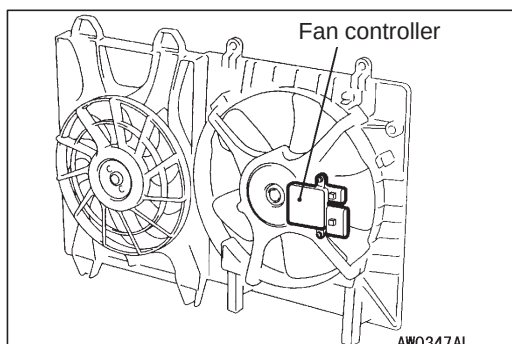
Standard value: 30–60% (allowable concentration range)

RECOMMENDED ANTIFREEZE

Antifreeze	Allowable concentration
MITSUBISHI GENUINE COOLANT or equivalent	30–60%

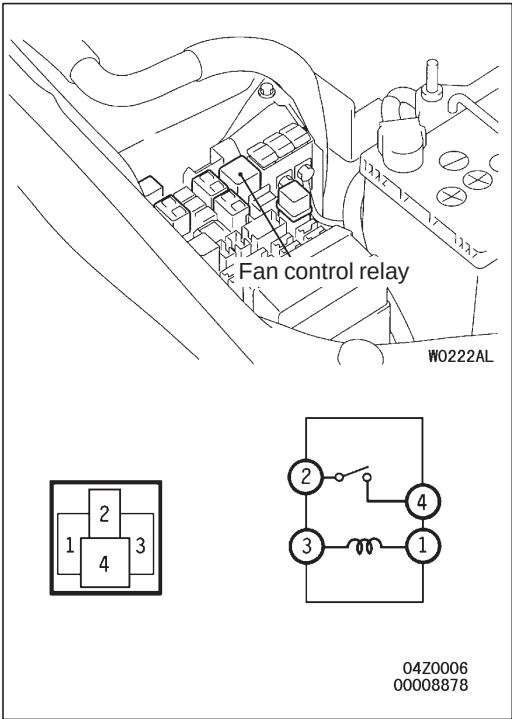
Caution

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

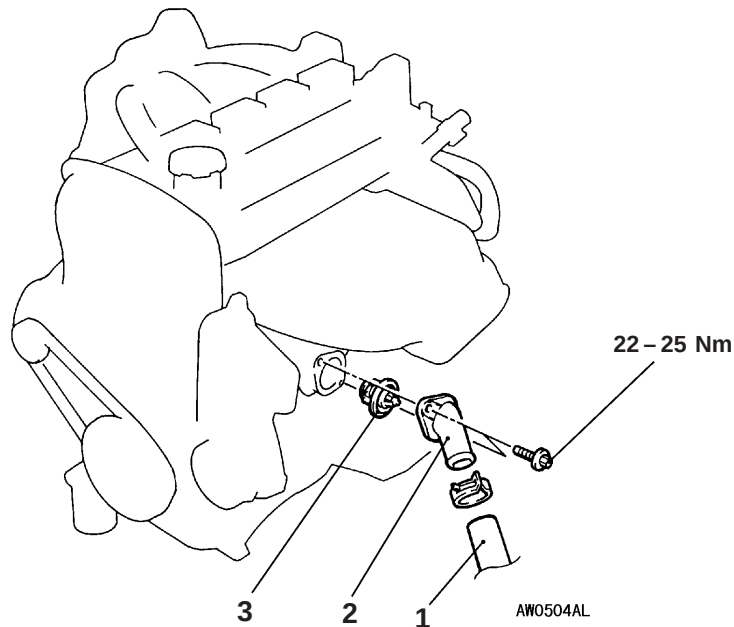
Battery voltage	Terminal No.			
	1	2	3	4
When current is not supplied	○		○	
When current is supplied	⊖	○	⊕	○

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.)



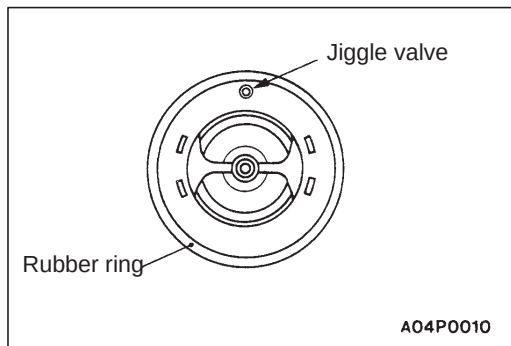
Removal steps

- ◀A▶ ▶B▶ 1. Radiator lower or upper hose connection
- ▶A▶ 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

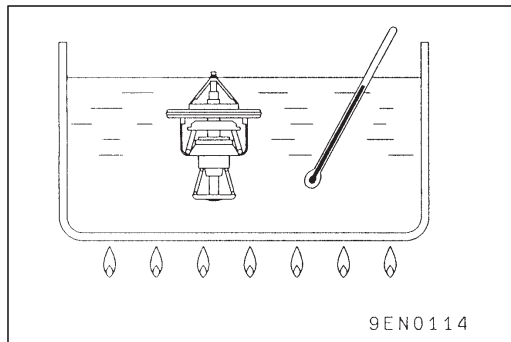
Install the thermostat so that the jiggle valve is facing straight up.

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: $82 \pm 1.5^{\circ}\text{C}$

2. Check that the amount of valve lift is at the standard value when the water is at the full-opening temperature.

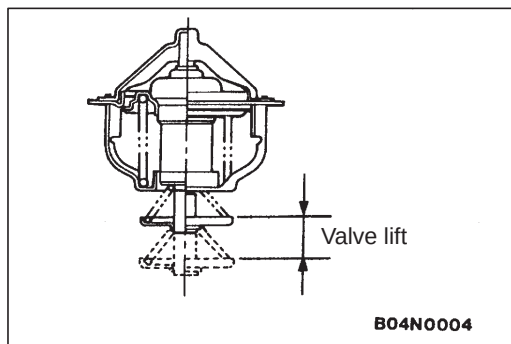
Standard value:

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.

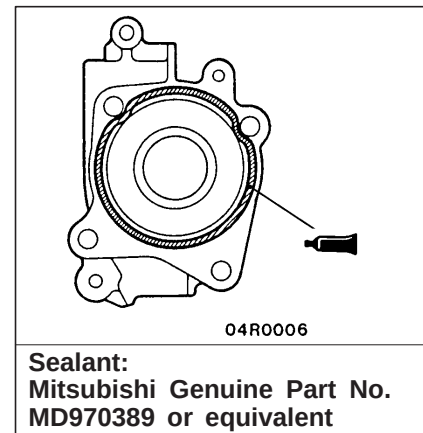
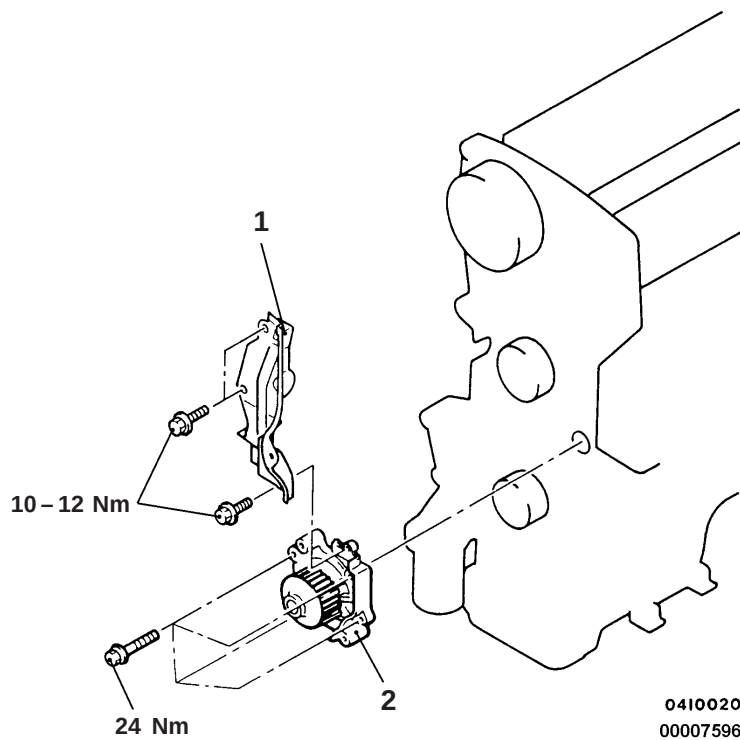


WATER PUMP

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.)



Removal steps

- A◄
1. Timing belt rear cover
 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:

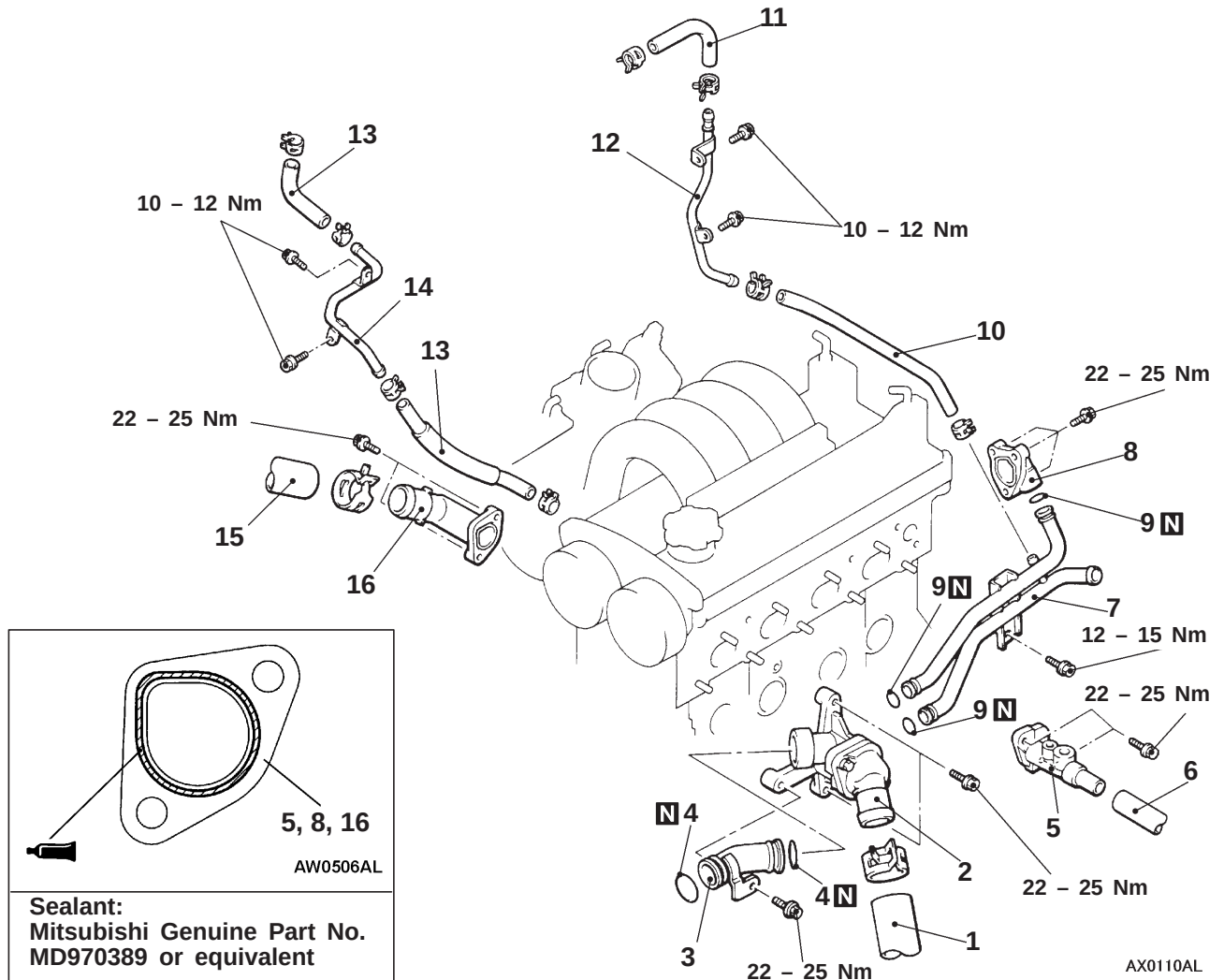
Mitsubishi Genuine Parts No. MD970389 or equivalent

WATER HOSE AND WATER PIPE

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Engine Coolant Draining and Supplying (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.)



Removal steps

- ◀A▶ ▶B▶ 1. Radiator lower hose connection
- ▶C▶ 2. Thermostat case assembly
- ▶C▶ 3. Water pipe
- ▶C▶ 4. O-ring
- ▶C▶ 5. Water fitting
- ▶C▶ 6. Heater hose connection
- ▶A▶ ▶C▶ 7. Water pipe assembly
- ▶A▶ ▶C▶ 8. Water by-pass fitting
- ▶C▶ 9. O-ring

- EGR valve (Refer to GROUP 17.)

- ▶B▶ 10. Water hose
- ▶B▶ 11. Water hose
- ▶B▶ 12. Water pipe
- ▶B▶ 13. Water hose
- ▶B▶ 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

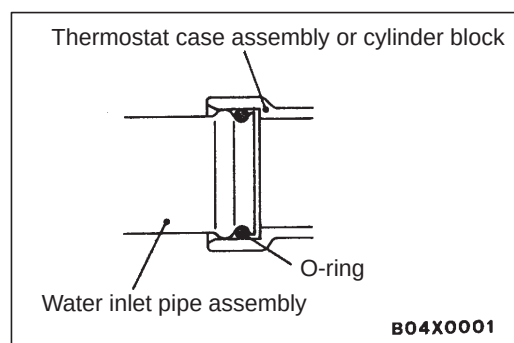
1. Insert each hose as far as the projection of the water inlet fitting.
2. Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.

▶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

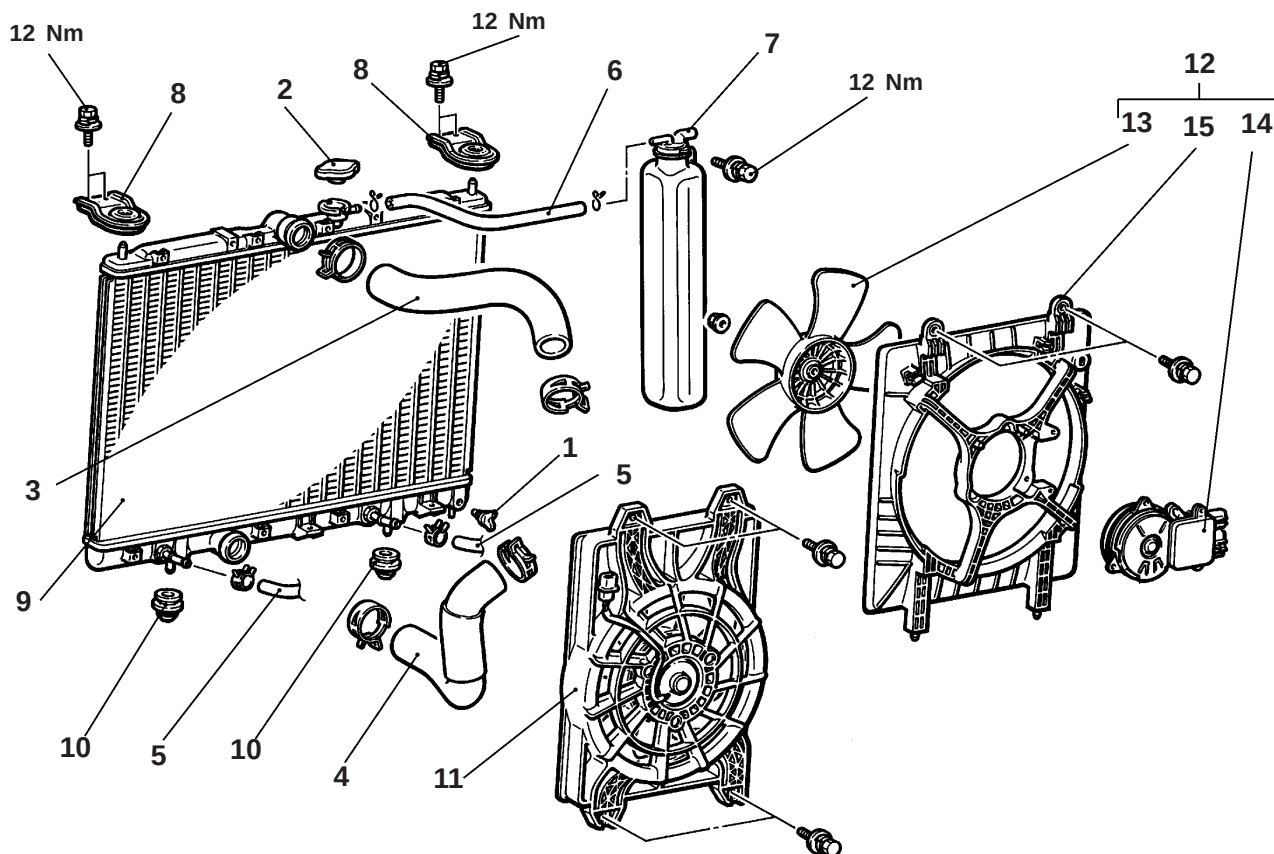
REMOVAL AND INSTALLATION

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.)



AW0261AL

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, 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

INTAKE AND EXHAUST

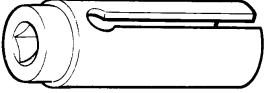
CONTENTS

SERVICE SPECIFICATION	2	EXHAUST MANIFOLD	6
SPECIAL TOOL	2	EXHAUST PIPE AND MAIN MUFFLER	7
AIR CLEANER	3	CATALYTIC CONVERTER	Refer to GROUP 35A
INTAKE MANIFOLD	4		

SERVICE SPECIFICATION

Items	Standard value	Limit
Distortion of the intake manifold installation surface mm	0.15 or less	0.20

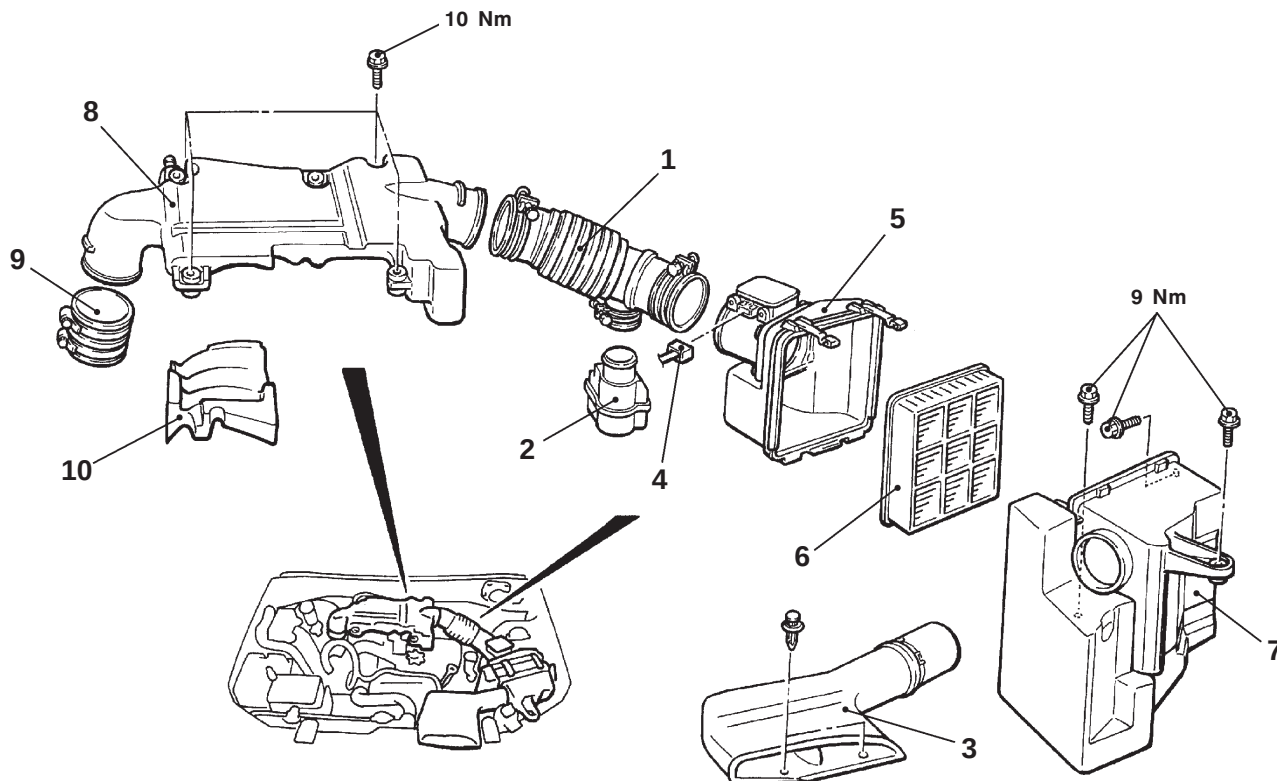
SPECIAL TOOL

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



AW0546AL

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

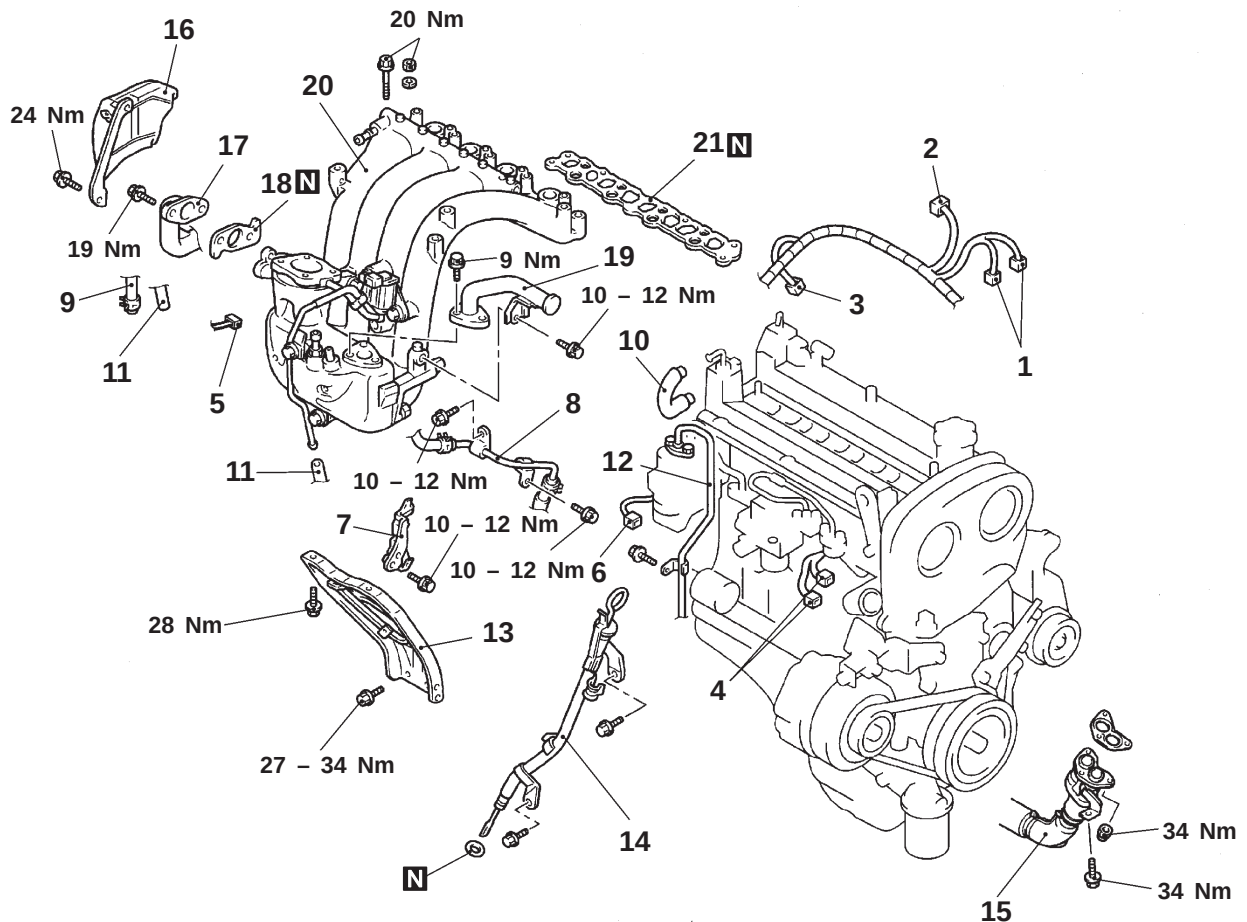
8. Resonance tank
9. Air hose
10. Insulator

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.)



AX0083AL

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
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

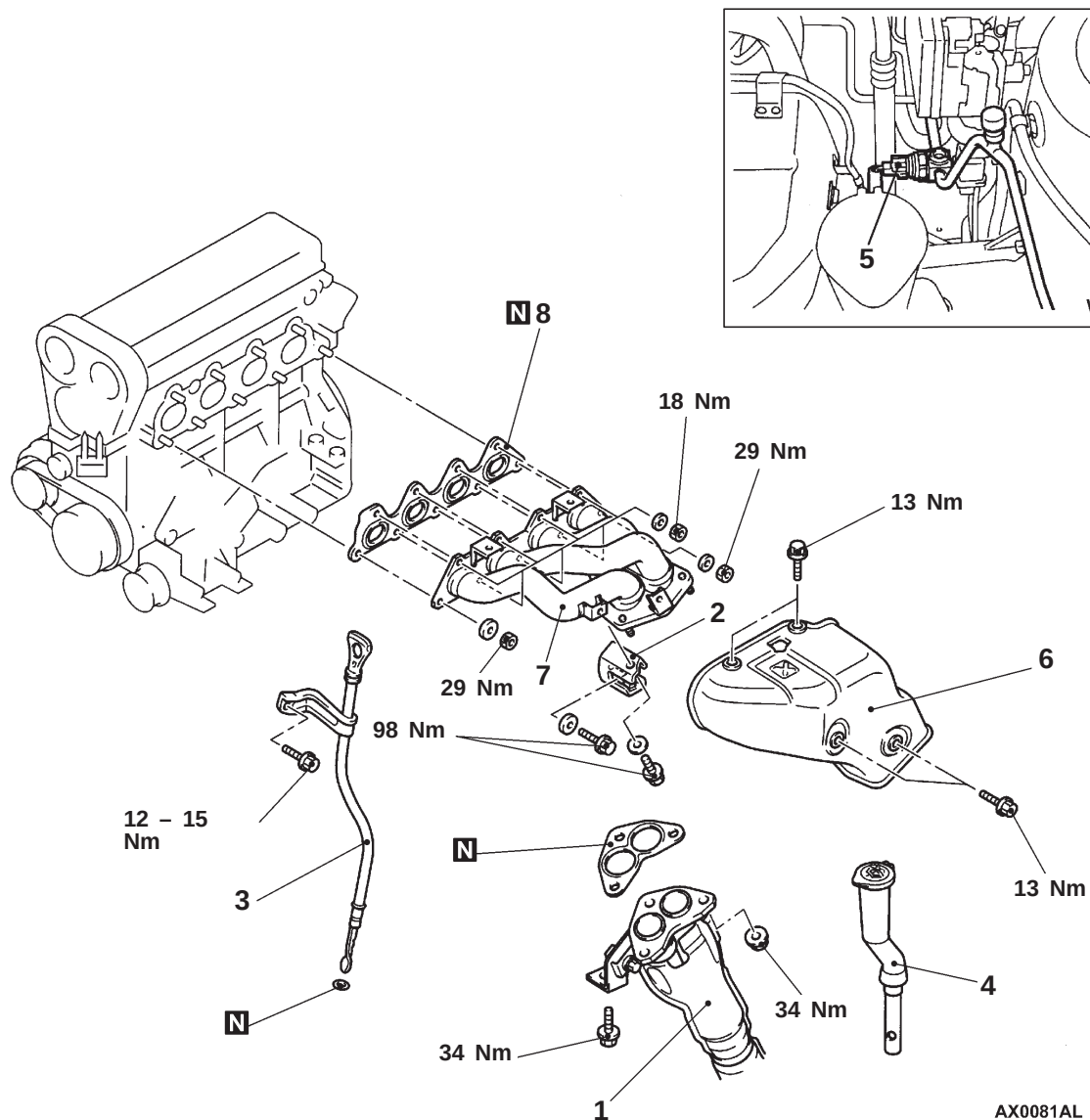
Limit: 0.20 mm

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.)

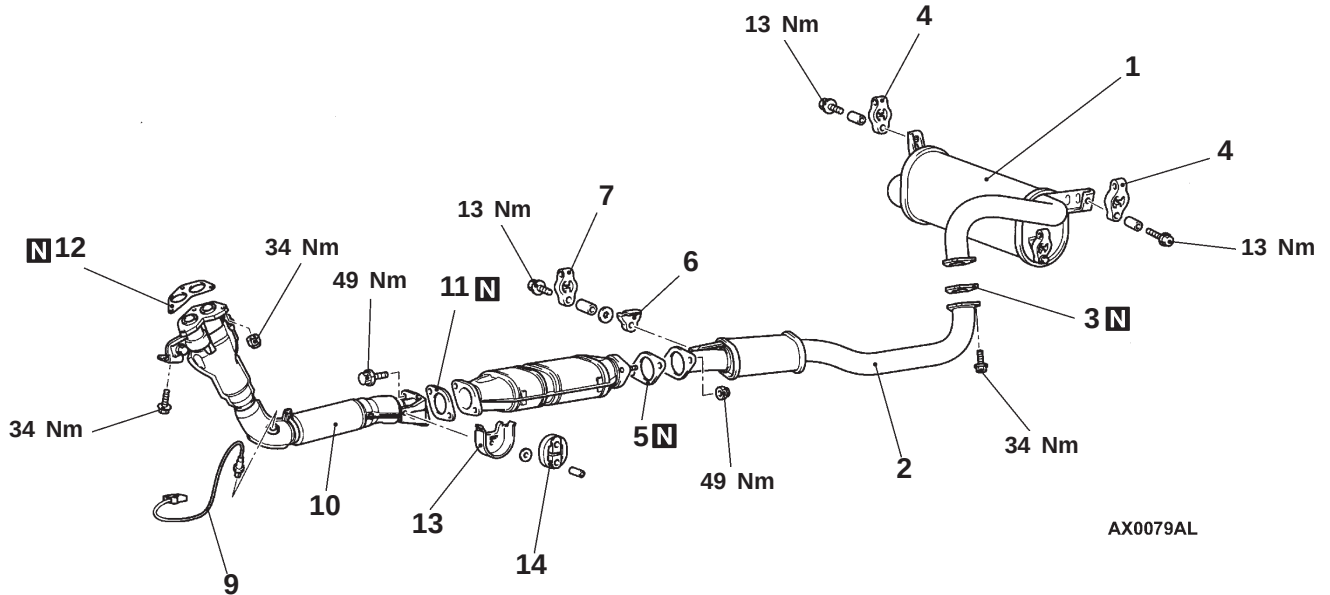
**Removal steps**

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



AX0079AL

Main muffler removal steps

1. Main muffler
3. Gasket
4. Hanger

Center exhaust pipe removal steps

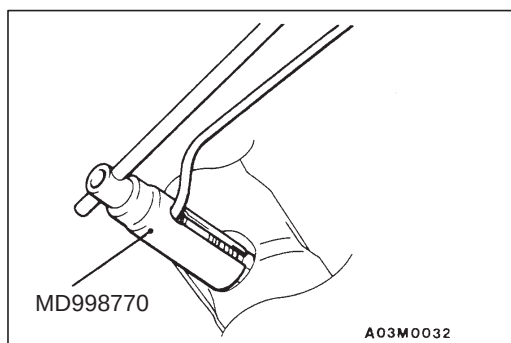
2. Center exhaust pipe
3. Gasket
5. Gasket
6. Protector
7. Hanger

Pre-muffler removal steps

8. Pre-muffler
11. Gasket

Center exhaust pipe removal steps

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

ENGINE ELECTRICAL

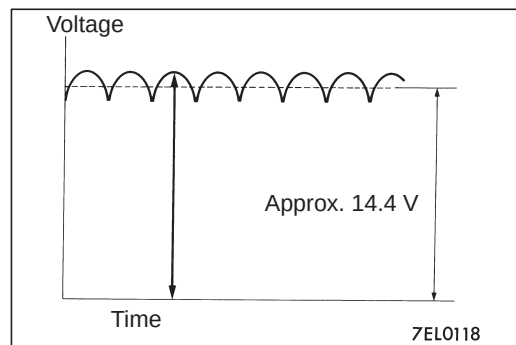
CONTENTS

CHARGING SYSTEM	2	IGNITION SYSTEM	27
GENERAL INFORMATION	2	GENERAL INFORMATION	27
SERVICE SPECIFICATIONS	3	SERVICE SPECIFICATIONS	28
SPECIAL TOOL	3	SPECIAL TOOL	28
ON-VEHICLE SERVICE	4	ON-VEHICLE SERVICE	29
Alternator Output Line Voltage Drop Test	4	Ignition Coil (With Built-in Power Transistor) Check	29
Output Current Test	5	Spark Plug Check and Cleaning	30
Regulated Voltage Test	7	Camshaft Position Sensor Check	30
Waveform Check Using An Analyzer	9	Crank Angle Sensor Check	30
Alternator Relay Continuity Check	10	Detonation Sensor Check	30
ALTERNATOR	11	IGNITION COIL	31
STARTING SYSTEM	17	CRANK ANGLE SENSOR	32
GENERAL INFORMATION	17	CAMSHAFT POSITION SENSOR	32
SERVICE SPECIFICATIONS	17	DETONATION SENSOR	33
STARTER MOTOR	18		

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.

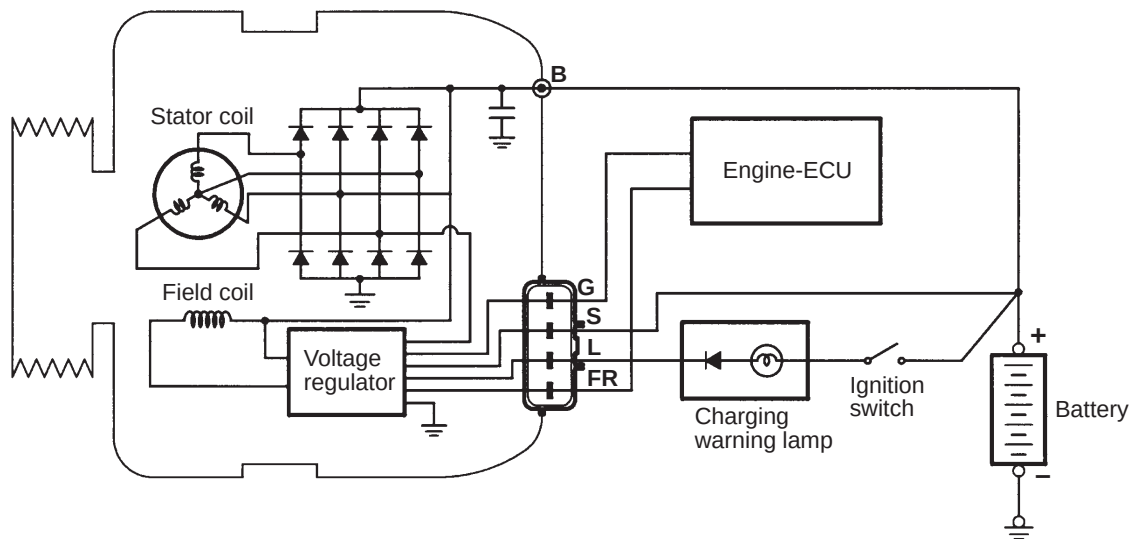
When the stator coil begins to generate power after the engine is started, the field coil is excited by the output current of the stator coil.

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



W6060AE

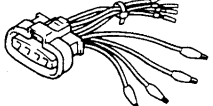
ALTERNATOR SPECIFICATIONS

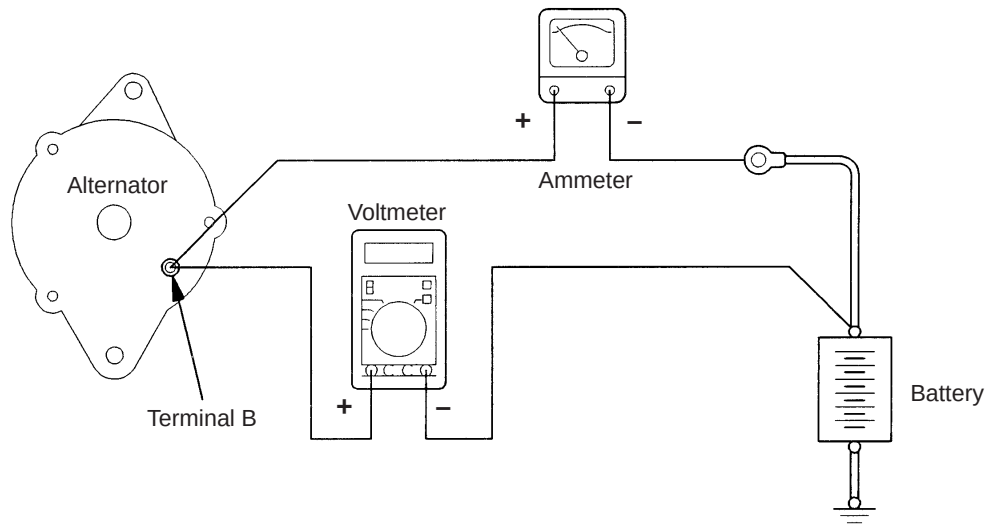
Items	Specifications
Type	Battery voltage sensing
Rated output V/A	12/100
Voltage regulator	Electronic built-in type

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**

9EN0468

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.

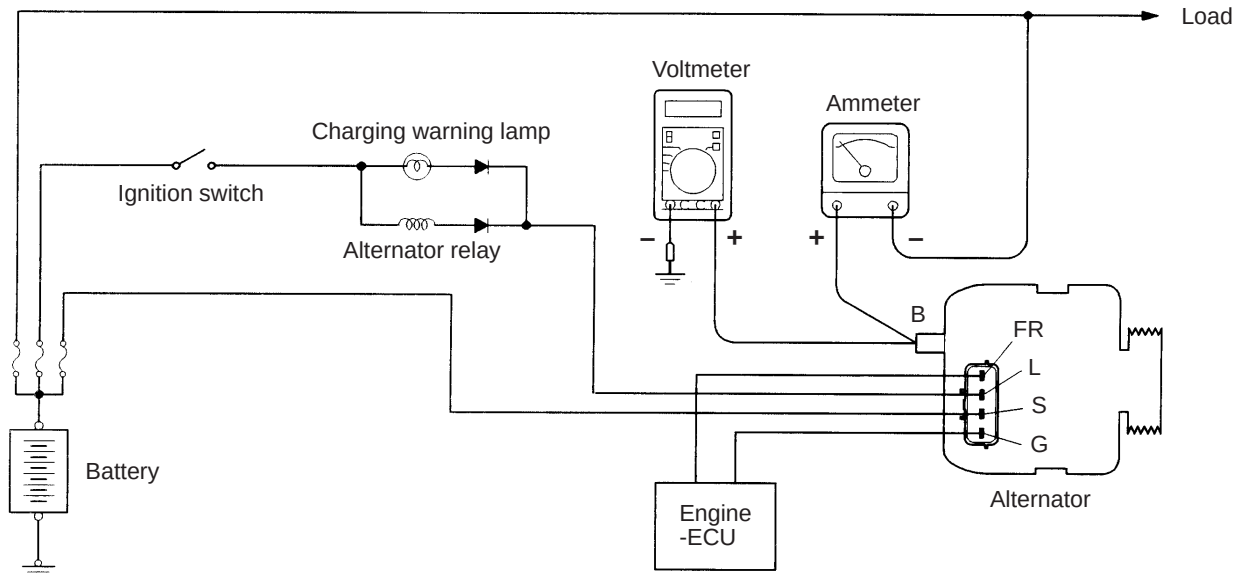
Limit: max. 0.3 V

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.

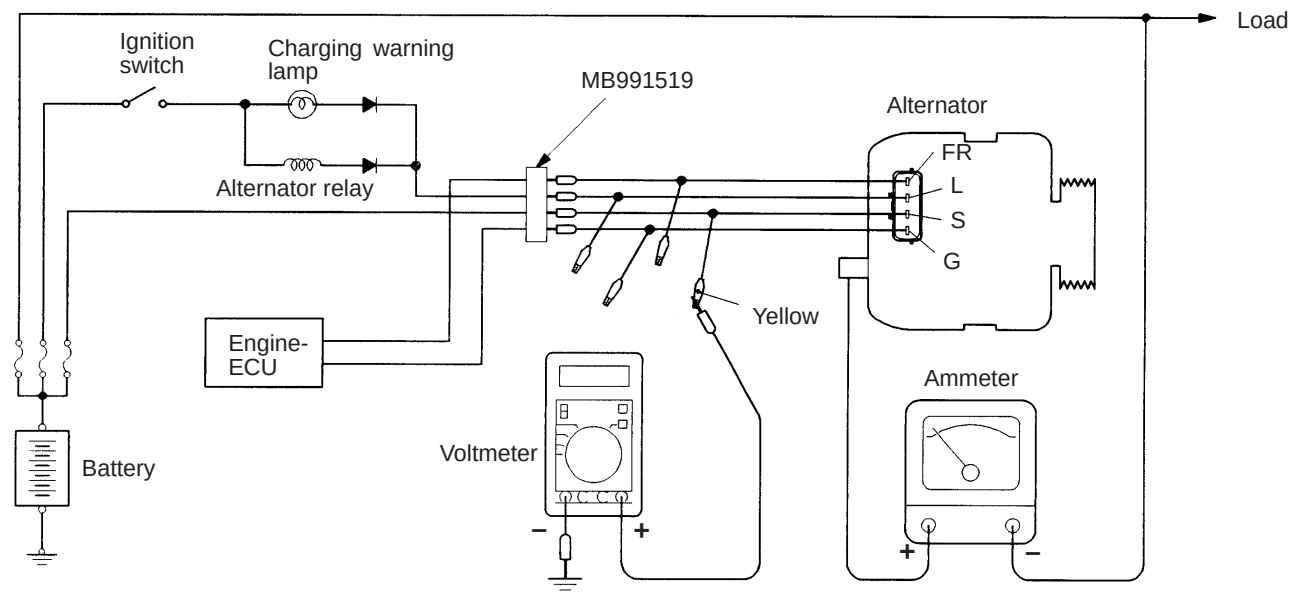
- (16) Disconnect the negative battery cable.

- (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



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

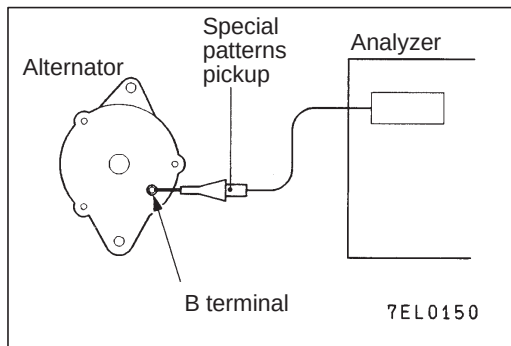
If the voltage is 0 V, the cause is probably an open circuit in the wire or fusible link between the alternator "S" terminal and the battery (+) terminal.

- (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

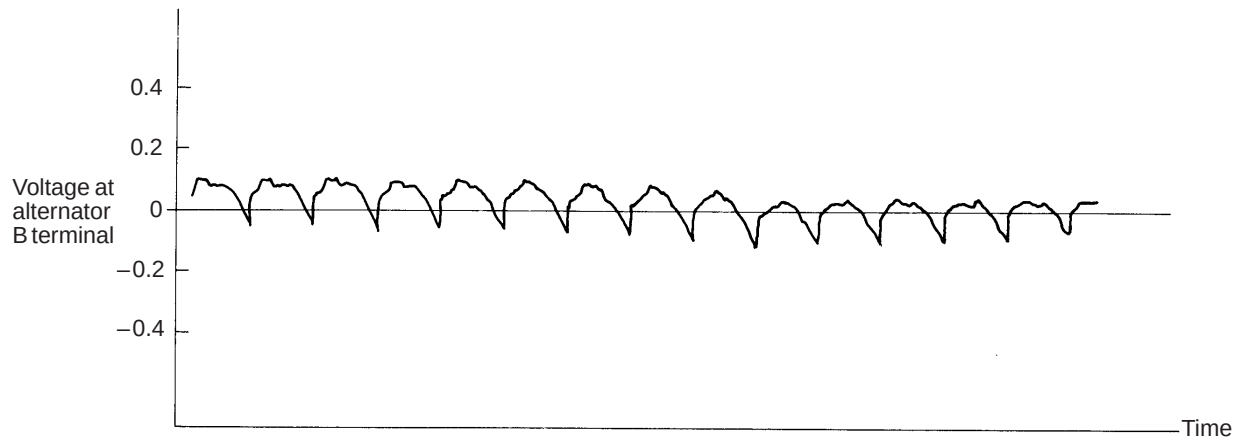
MEASUREMENT METHOD

Connect the analyzer special patterns pick-up to the alternator B terminal.

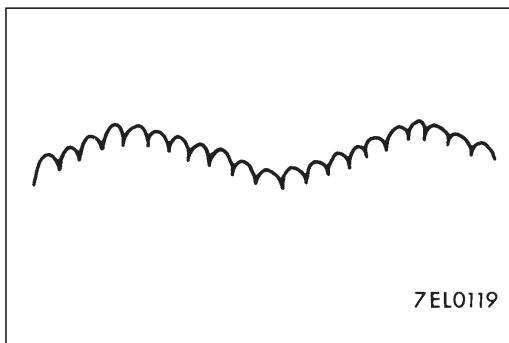
STANDARD WAVEFORM

Observation Conditions

FUNCTION	SPECIAL PATTERNS
PATTERN HEIGHT	VARIABLE
VARIABLE knob	Adjust while viewing the waveform.
PATTERN SELECTOR	RASTER
Engine speed	Curb idle speed



7EL0115



7EL0119

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.

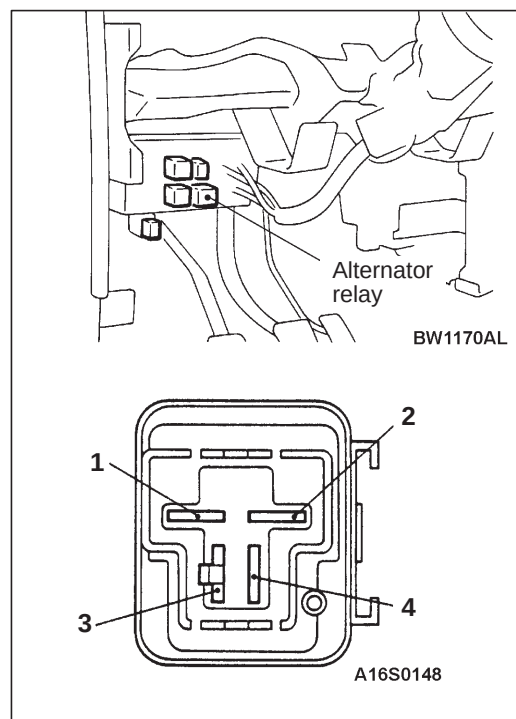
In addition, when the voltage waveform reaches an excessively high value (approx. 2 V or higher at idle), it often indicates an open circuit due to a brown fuse between alternator "B" terminal and battery, but not a defective alternator.

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.

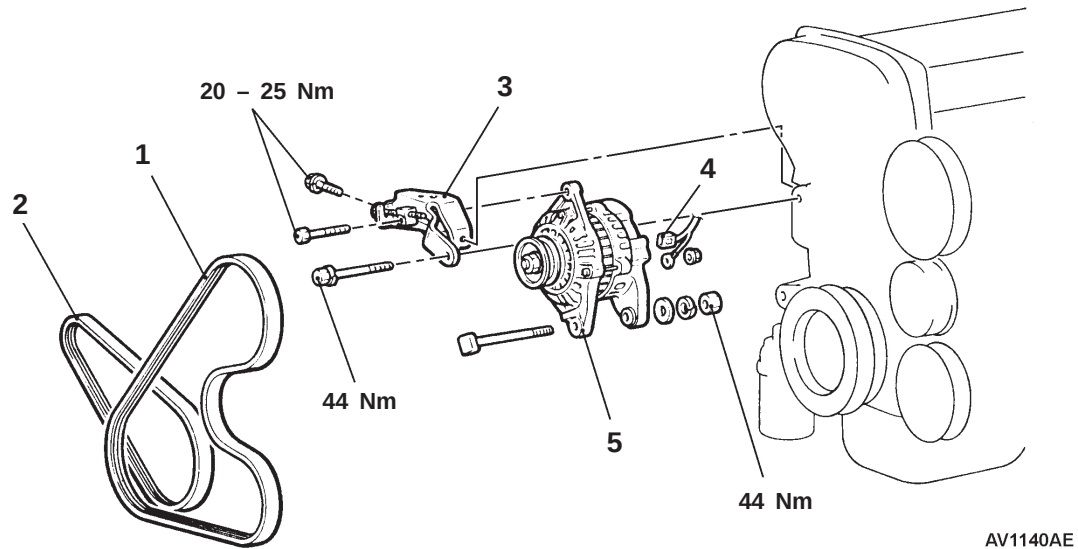
ALTERNATOR

REMOVAL AND INSTALLATION

Pre-removal Operation
Under Cover Removal

Post-installation Operation

- Drive Belt Tension Adjustment
- Under Cover Installation

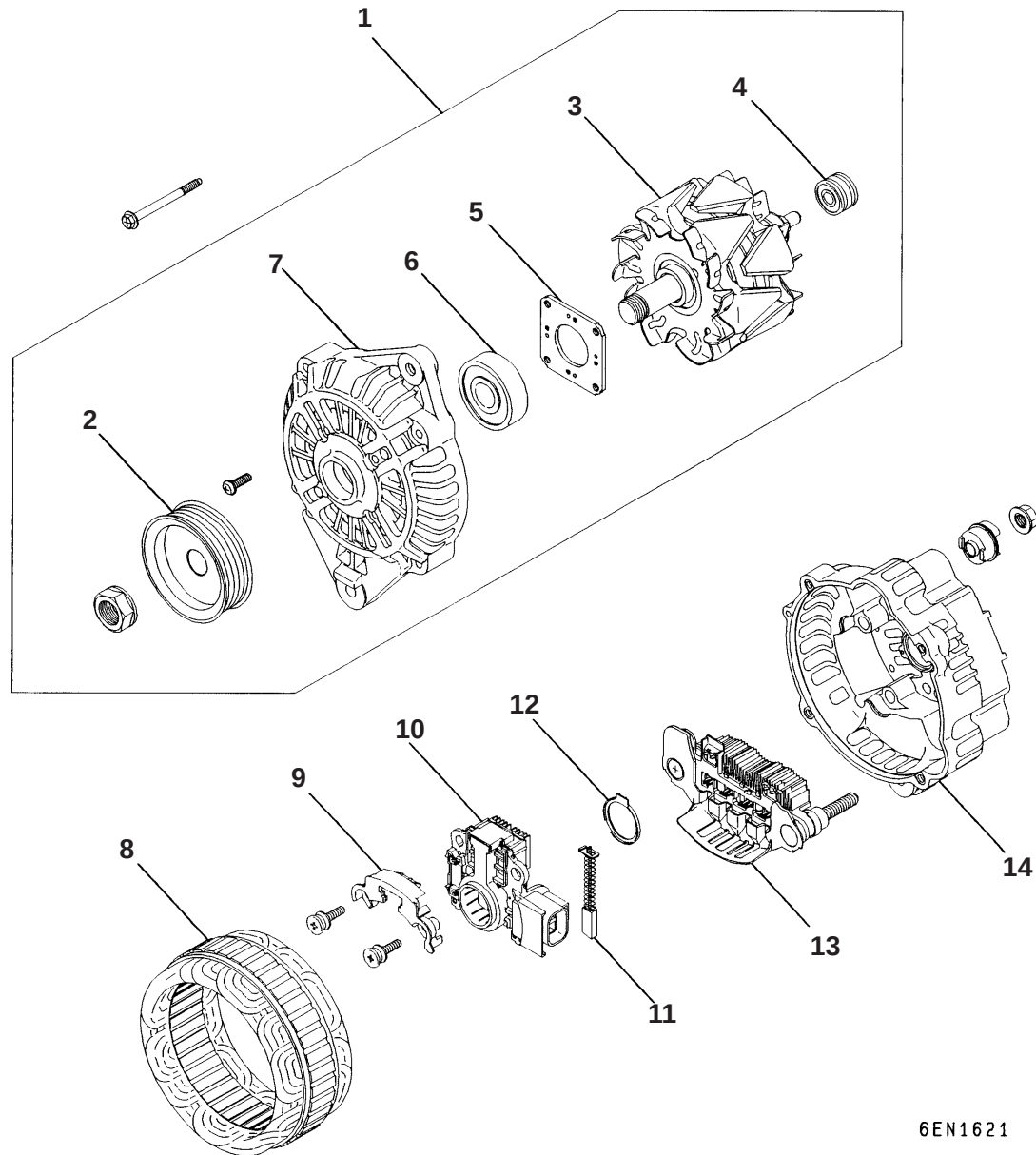


Disassembly steps

1. Drive belt (Power steering, A/C)
2. Drive belt (Alternator)
3. Alternator brace

4. Alternator connector
5. Alternator

DISASSEMBLY AND REASSEMBLY



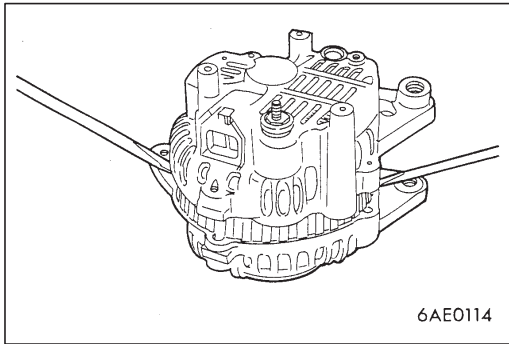
6EN1621

Disassembly steps

1. Front bracket assembly
2. Alternator pulley
3. Rotor
4. Rear bearing
5. Bearing retainer
6. Front bearing
7. Front bracket



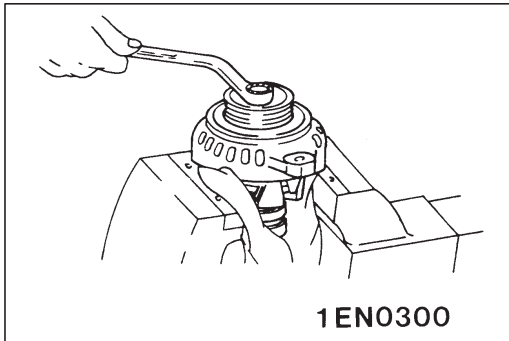
8. Stator
9. Plate
10. Regulator assembly
11. Brush
12. Slinger
13. Rectifier
14. Rear bracket

**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

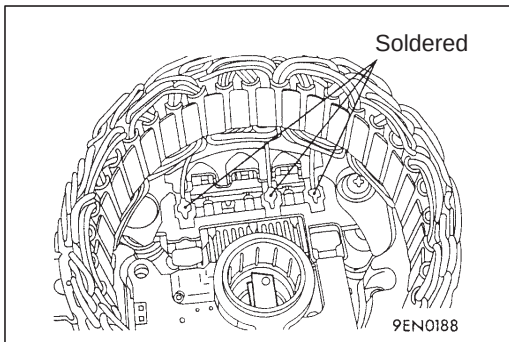
The stator coil could be damaged so do not insert the screwdriver too far.

**◀B▶ ALTERNATOR PULLEY REMOVAL**

Face the pulley side upward, fix the rotor with a work bench and remove the pulley.

Caution

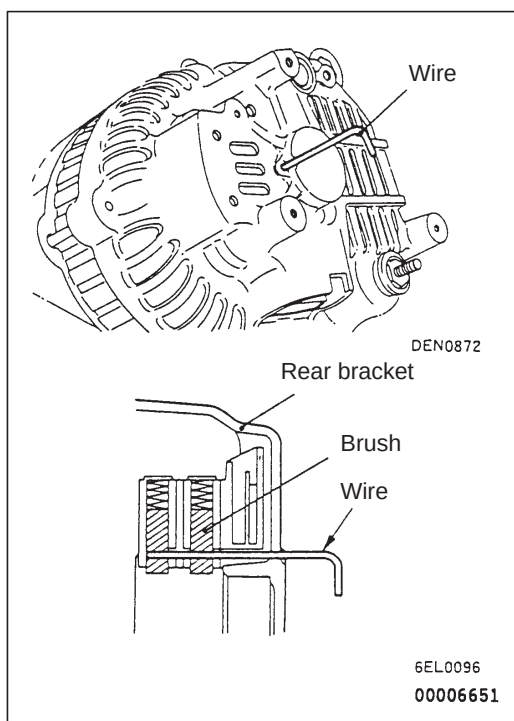
Use care so that the rotor is not damaged.

**◀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.



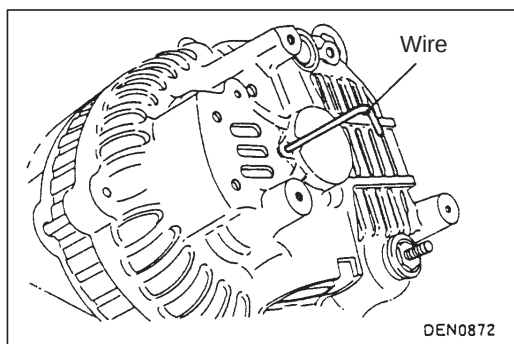
REASSEMBLY SERVICE POINTS

►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.

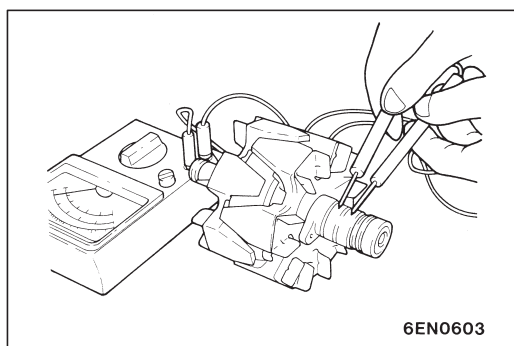
NOTE

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.

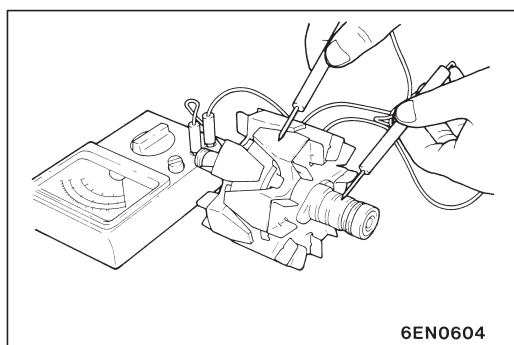


INSPECTION

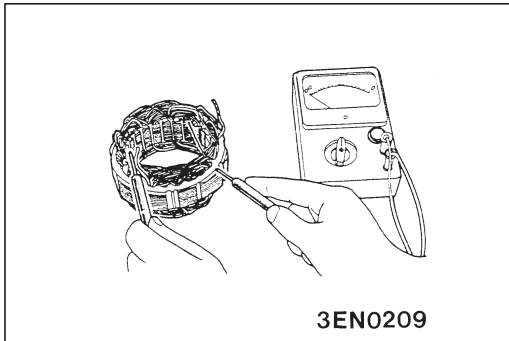
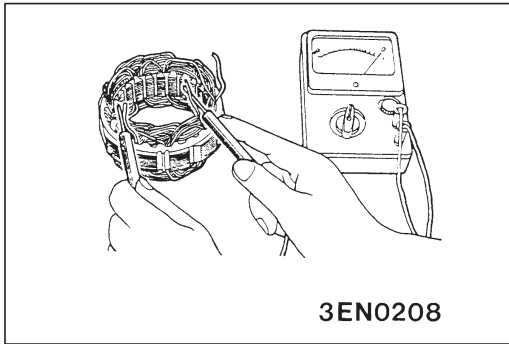
ROTOR CHECK

1. Check the continuity between the rotor coil slip rings, and replace the rotor if the resistance value is not at the standard value.

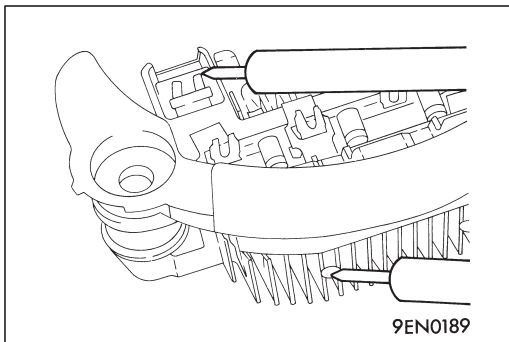
Standard value: 3 – 5 Ω



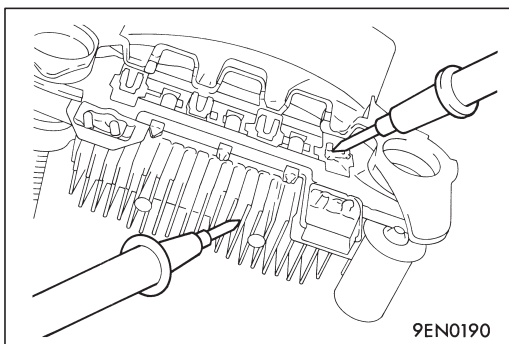
2. Check the continuity between the slip ring and core, and if there is continuity, replace the rotor.

**STATOR CHECK**

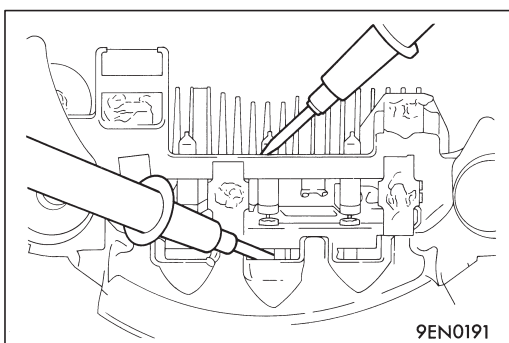
1. Check the continuity between the coil leads, and if there is continuity, replace the stator.
2. Check the continuity between the coil and core, and if there is continuity, replace the stator.

**RECTIFIER CHECK**

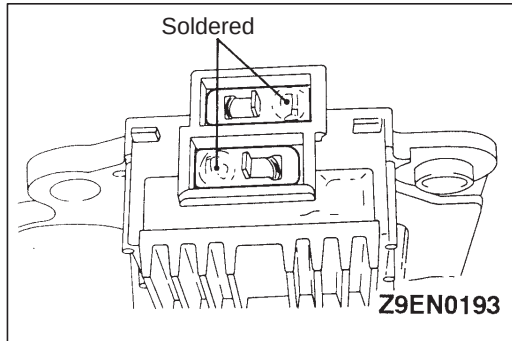
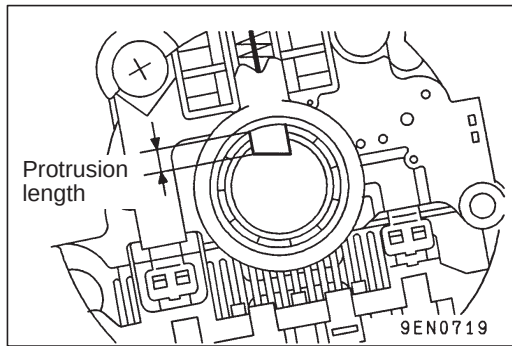
1. Inspect the (+) heat sink by checking the continuity between the (+) heat sink and stator coil lead wire connection terminal using a tester probe. If there is a continuity at both, the diode is short circuited, so replace the rectifier.



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.

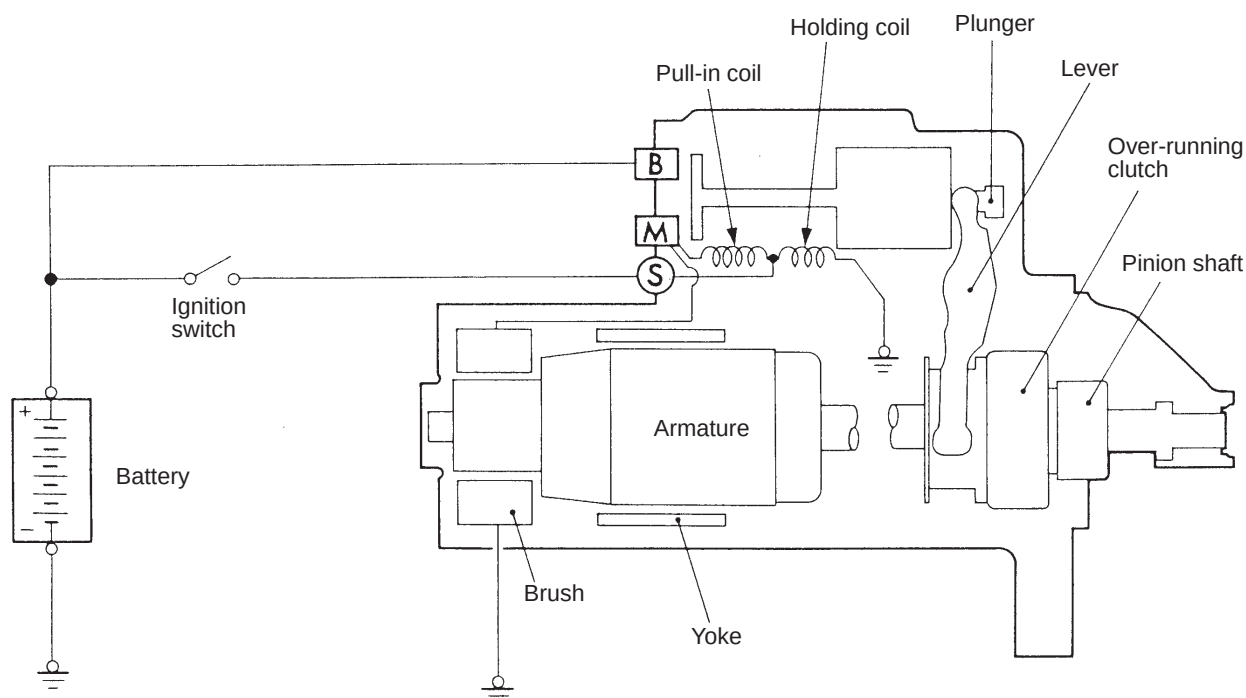
On the other hand, attracting the plunger will turn on the magnetic switch, allowing the B-terminal and

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



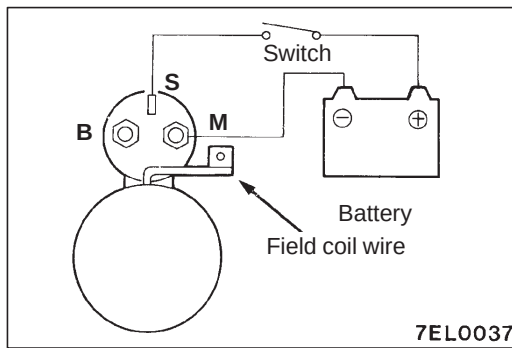
6EN0939

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

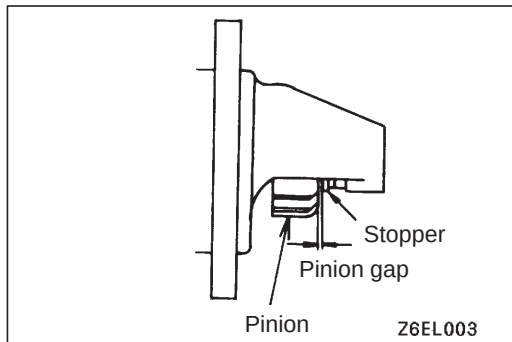
INSPECTION

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.

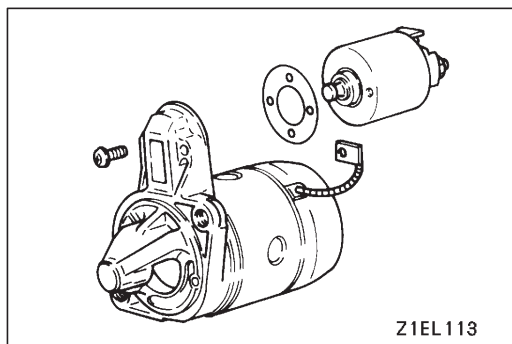
Caution

This test must be performed quickly (in less than 10 seconds) to prevent coil from burning.

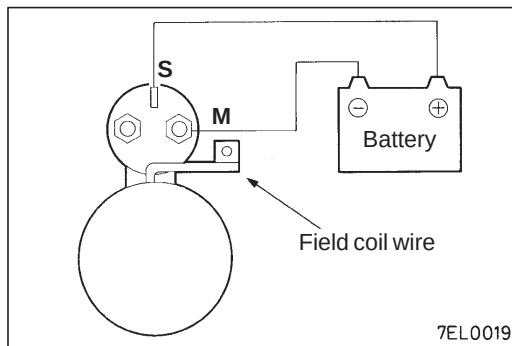


4. Check pinion to stopper clearance (pinion gap) with a thickness gauge.

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.

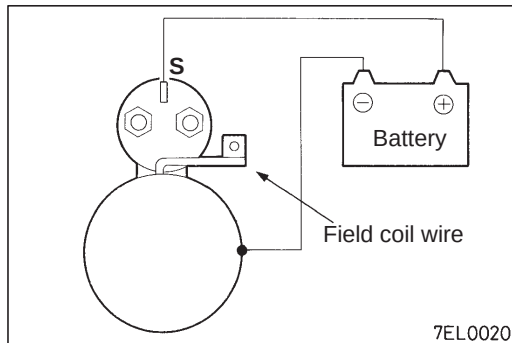
**MAGNETIC SWITCH PULL-IN TEST**

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.

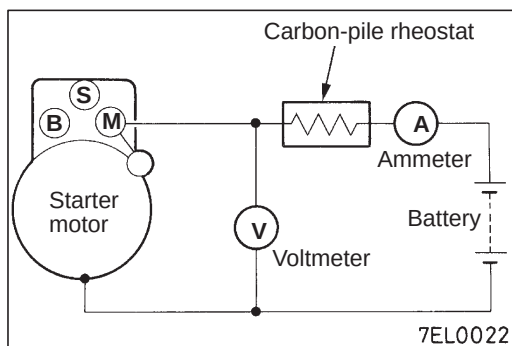
**MAGNETIC SWITCH HOLD-IN TEST**

1. Disconnect field coil wire from M-terminal of magnetic switch.
2. Connect a 12-volt battery between S-terminal and body.

Caution

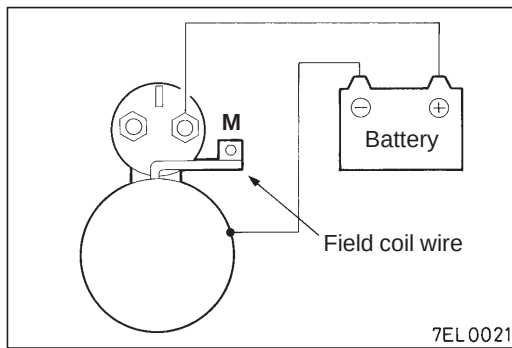
This test must be performed quickly (in less than 10 seconds) to prevent coil from burning.

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.

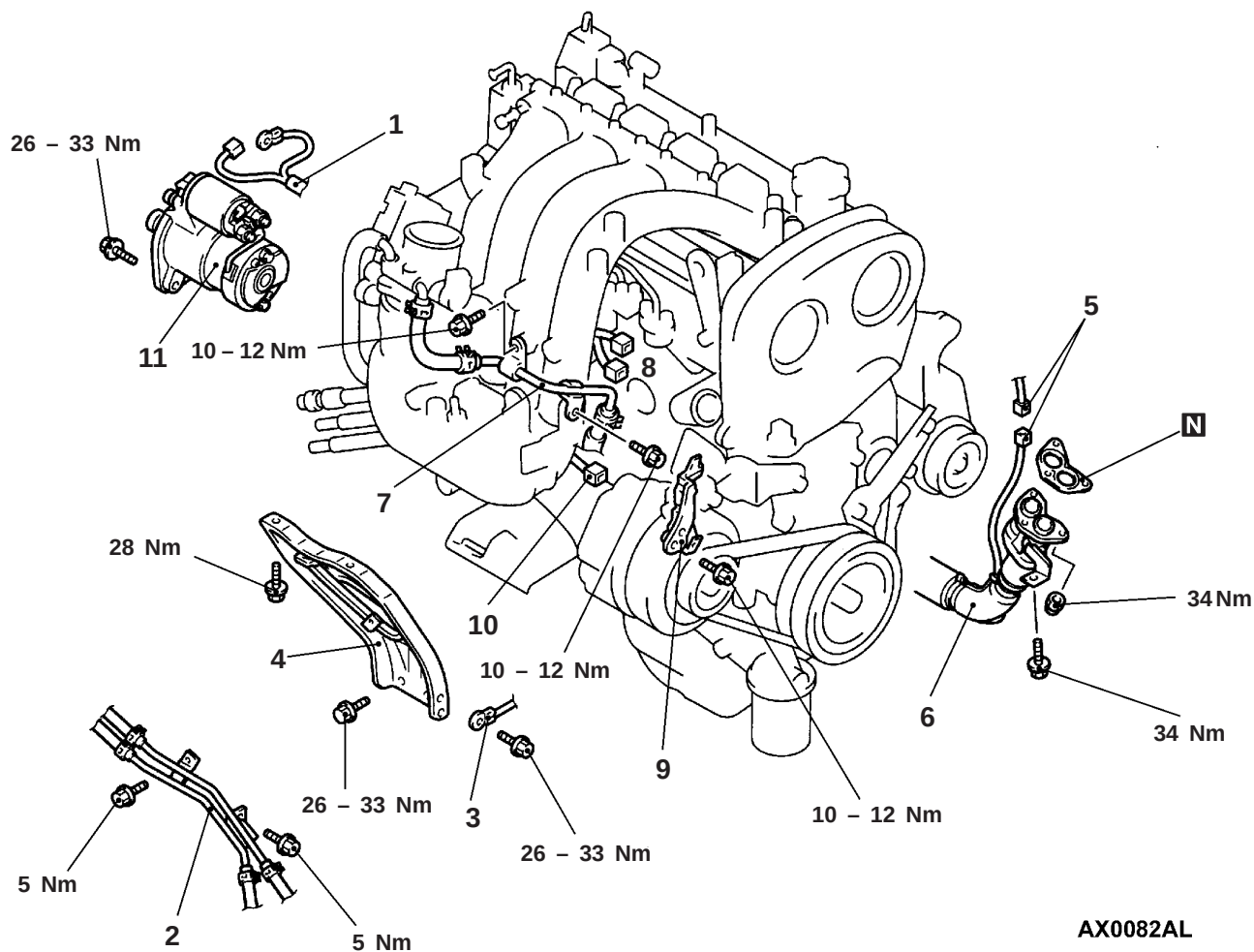
Caution

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
- Transmission mount crossmember

7. Water pipe clamp
8. Injector harness connector connection
9. Harness connector bracket
10. Detonation sensor connector connection
11. Starter motor assembly

◀A▶ ▶A▶

◀B▶

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.

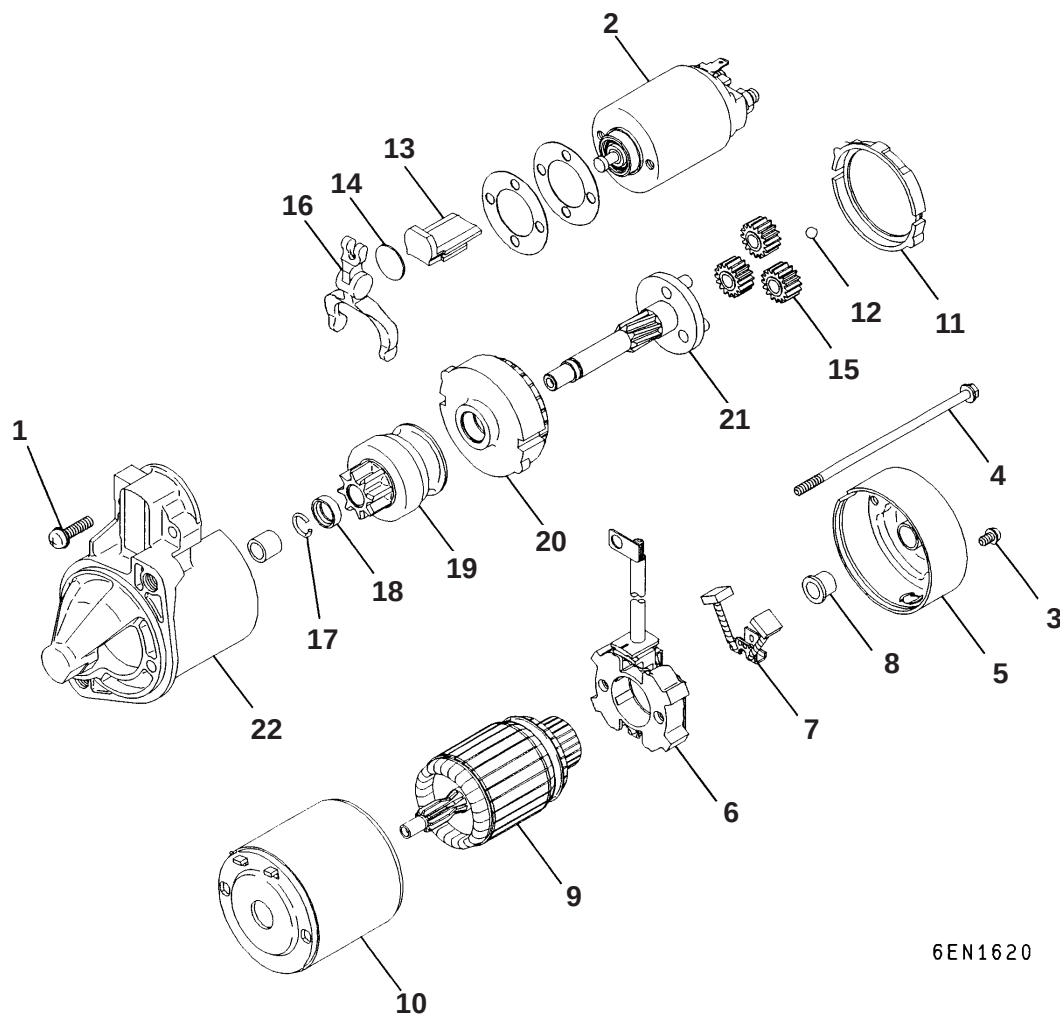
◀B▶ STARTER MOTOR ASSEMBLY REMOVAL

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



6EN1620

Disassembly steps

◀A▶

1. Screw
2. Magnetic switch
3. Screw
4. Through bolt
5. Rear bracket
6. Brush holder
7. Brush
8. Rear bearing
9. Armature
10. Yoke assembly
11. Ball

◀B▶

◀B▶

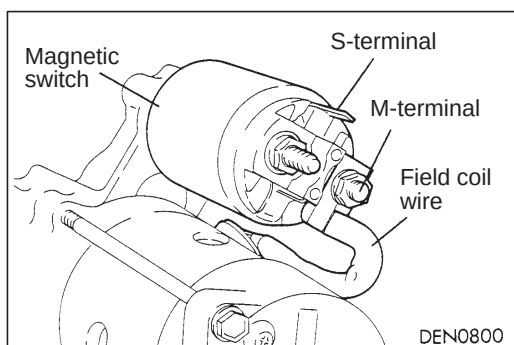
◀C▶

◀C▶

▶A▶

▶A▶

12. Packing A
13. Packing B
14. Plate
15. Planetary gear
16. Lever
17. Snap ring
18. Stop ring
19. Overrunning clutch
20. Internal gear
21. Planetary gear holder
22. Front bracket



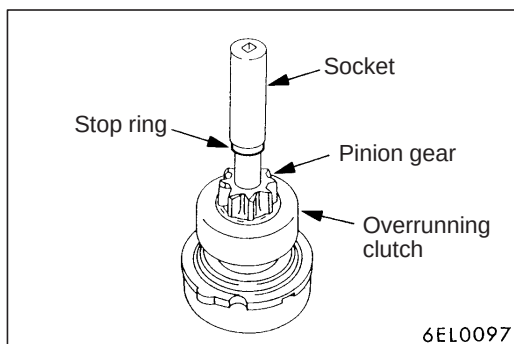
DISASSEMBLY SERVICE POINTS

◀A▶ MAGNETIC SWITCH REMOVAL

Disconnect the field coil wire from M-terminal of the magnetic switch.

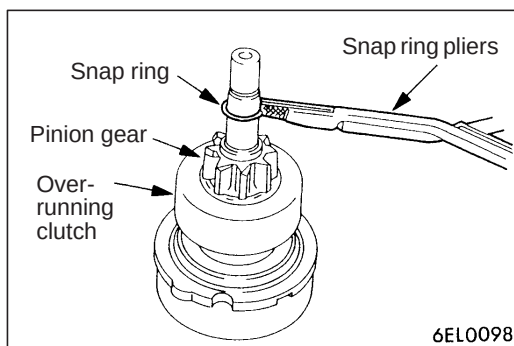
◀B▶ ARMATURE AND BALL REMOVAL

When removing the armature, do not lose the ball placed at the end as a bearing.



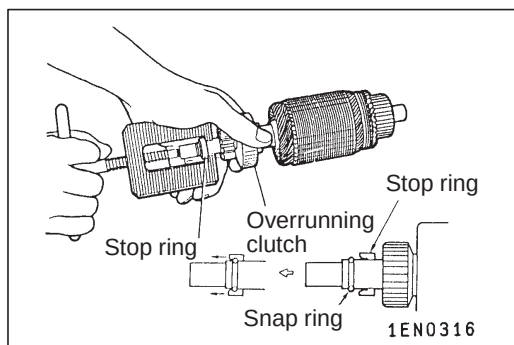
◀C▶ SNAP RING/STOP RING REMOVAL

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.

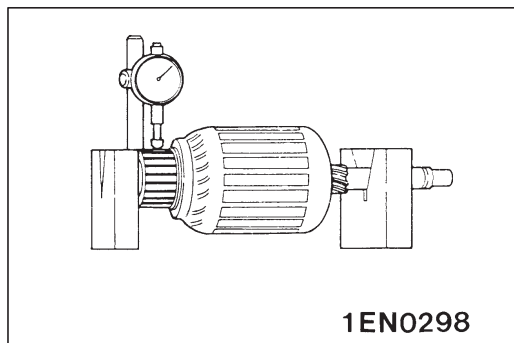


STARTER MOTOR PARTS CLEANING

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**

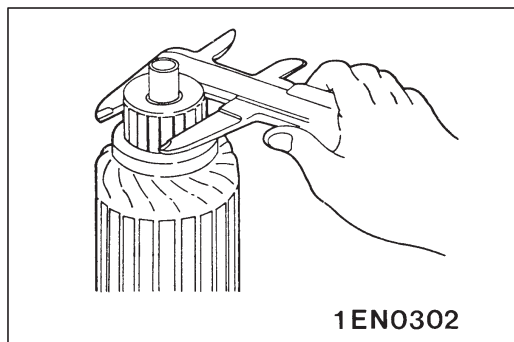
Using an appropriate tool, pull the stop ring over the snap ring.

**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

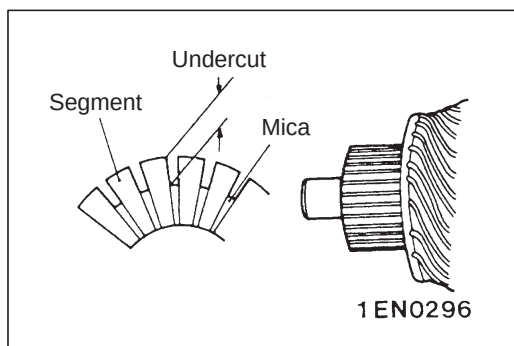
Limit: 0.1 mm



2. Measure the commutator outer diameter.

Standard value: 29.4 mm

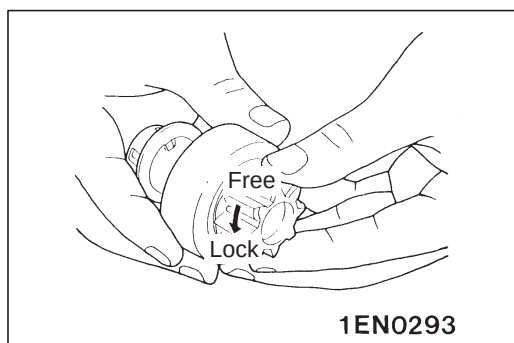
Limit: 28.8 mm



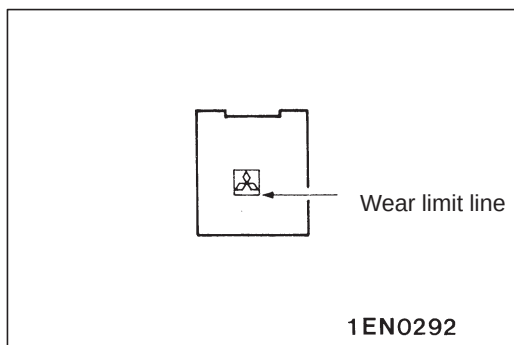
3. Check the undercut depth between segments.

Standard value: 0.5 mm

Limit: 0.2 mm

**OVERRUNNING CLUTCH**

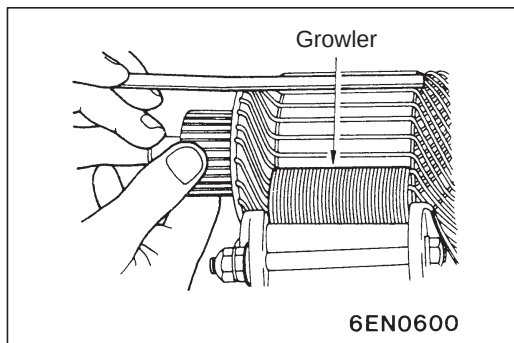
1. Check that the pinion locks when it is turned anti-clockwise and moves smoothly when it is turned clockwise.
2. Check the pinion for wear or damage.

**BRUSH**

1. Check the brush for roughness of the surface that contacts the commutator and check the brush length.

Limit: Wear limit line

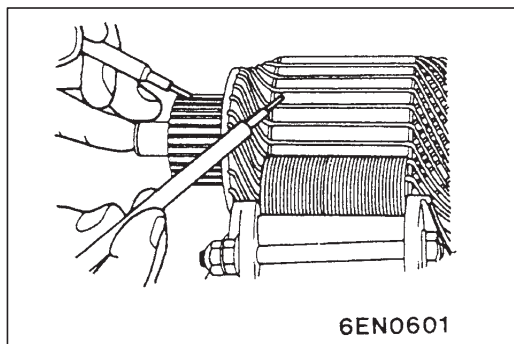
2. In case the contacting surface has been corrected or the brush has been replaced, correct the contacting surface by winding sandpaper around the commutator.

**ARMATURE COIL SHORT-CIRCUIT TEST**

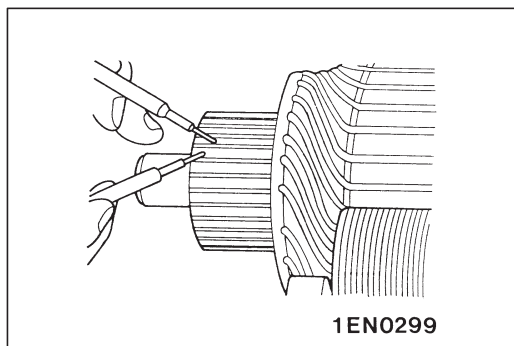
1. Place armature in a growler.
2. Hold a thin steel blade parallel and just above while rotating armature slowly in growler. A shorted armature will cause blade to vibrate and be attracted to the core. Replace shorted armature.

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

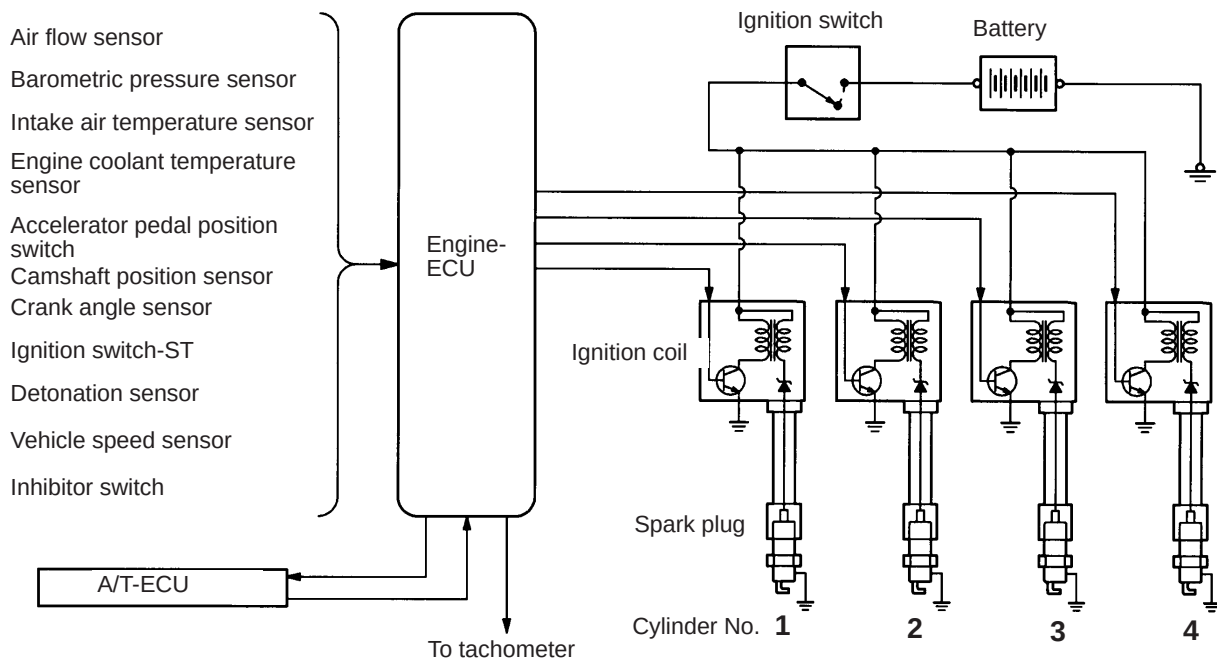
This system is equipped with four ignition coils with built-in power transistors for each of the cylinders. Interruption of the primary current flowing in the primary side of an ignition coil generates a high voltage in the secondary side of the ignition coil. The high voltage thus generated is applied 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

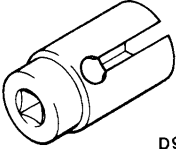
SPARK PLUG SPECIFICATIONS

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

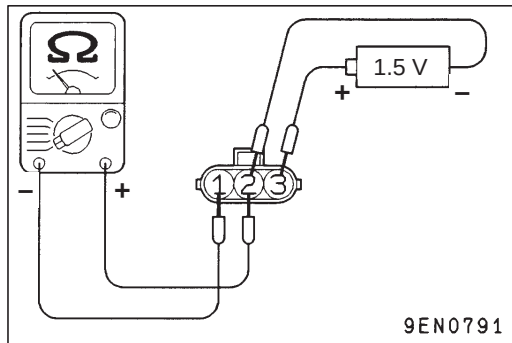
SPECIAL TOOL

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 (–) probe 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.

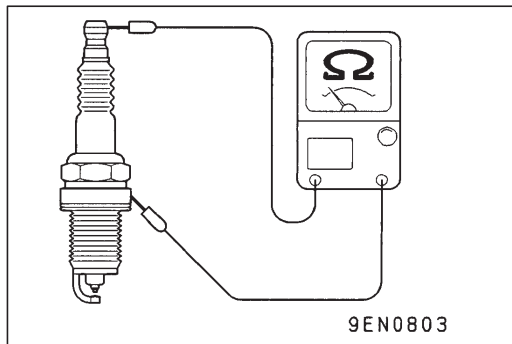
1. Disconnect the ignition coil connector.
2. Remove the ignition coil and install a new spark plug to the ignition coil.
3. Connect the ignition coil connector.
4. Earth the side electrode of the spark plug and crank the engine.
5. Check that spark is produced between the electrodes of the spark plug.
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 M Ω

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

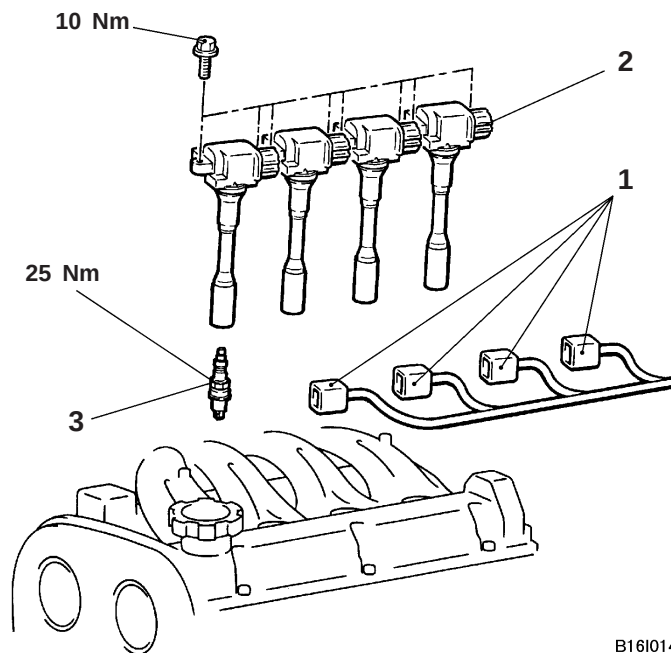
For information concerning the self-diagnosis codes, refer to GROUP 13A – Troubleshooting .

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



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Disassembly steps

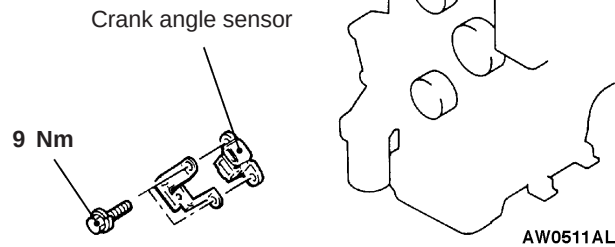
1. Ignition Coil Connector
2. Ignition Coil
3. Spark Plug

CRANK ANGLE SENSOR

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

Timing Belt Front Lower Cover Removal and Installation
(Refer to GROUP 11.)

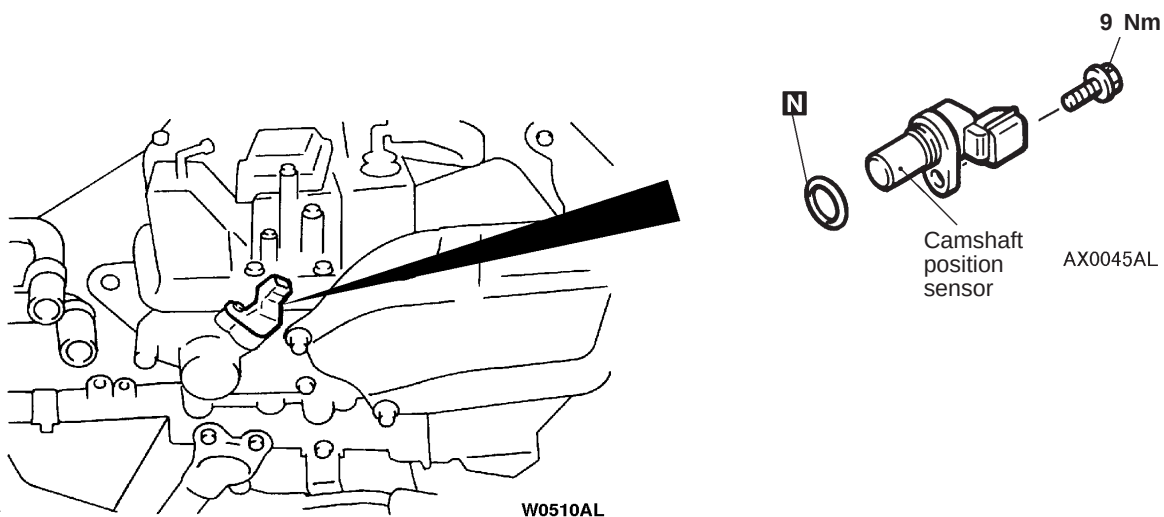


CAMSHAFT POSITION SENSOR

REMOVAL AND INSTALLATION

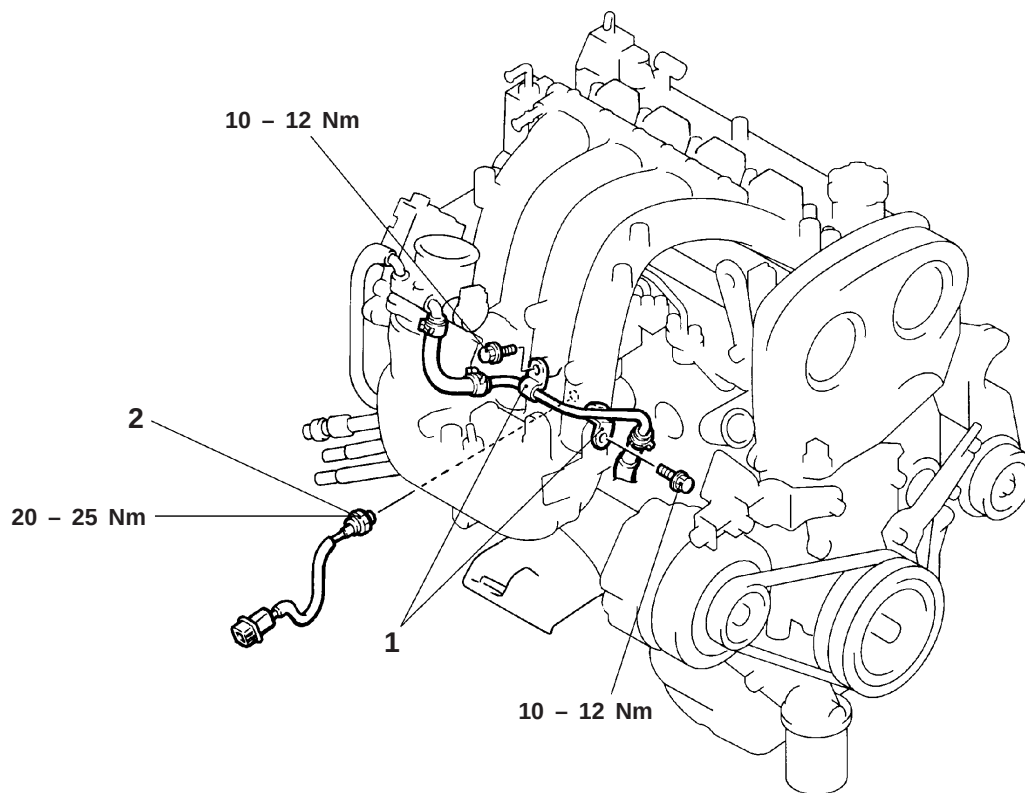
Pre-removal and Post-installation Operation

Engine Cover Removal and Installation



DETONATION SENSOR**REMOVAL AND INSTALLATION****Pre-removal and Post-installation Operation**

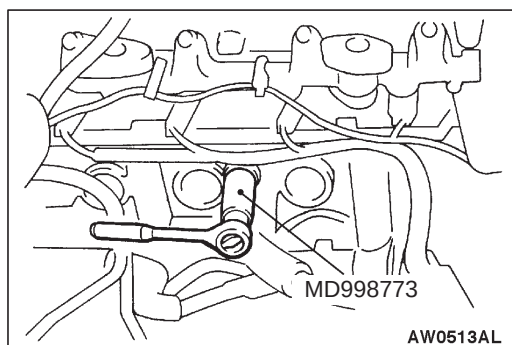
- Engine Cover Removal and Installation



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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

ENGINE AND EMISSION CONTROL

CONTENTS

ENGINE CONTROL SYSTEM	3	Vacuum Hose Installation	7
SERVICE SPECIFICATION	3	CRANKCASE EMISSION CONTROL	
ON-VEHICLE SERVICE	3	SYSTEM	8
Accelerator Cable Check and Adjustment ...	3	General Information	8
ACCELERATOR CABLE AND PEDAL	4	System Diagram	8
EMISSION CONTROL		Component Location	8
SYSTEM	5	Positive Crankcase Ventilation System	
GENERAL INFORMATION	5	Check	9
Emission Control Device Reference		PCV Valve Check	9
Table	5	EVAPORATIVE EMISSION CONTROL	
SERVICE SPECIFICATIONS	6	SYSTEM	10
SPECIAL TOOL	6	General Information	10
VACUUM HOSE	6	System Diagram	10
Vacuum Hose Piping Diagram	6	Component Location	10
Vacuum Circuit Diagram	7	Purge Control System Check	11
Vacuum Hose Check	7	Purge Port Vacuum Check	11
		Purge Control Solenoid Valve Check	12

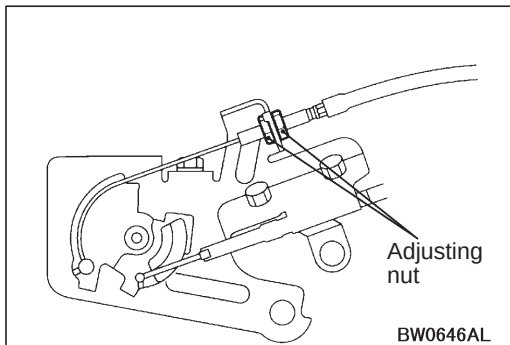
CONTINUED ON NEXT PAGE

EXHAUST GAS RECIRCULATION (EGR) SYSTEM	13	Exhaust Gas Recirculation (EGR) Control System Check	14
General Information	13	EGR Valve (Stepper Motor) Check	14
Operation	13	EGR VALVE	6
System Diagram	13	CATALYTIC CONVERTER	17
Component Location	13		

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

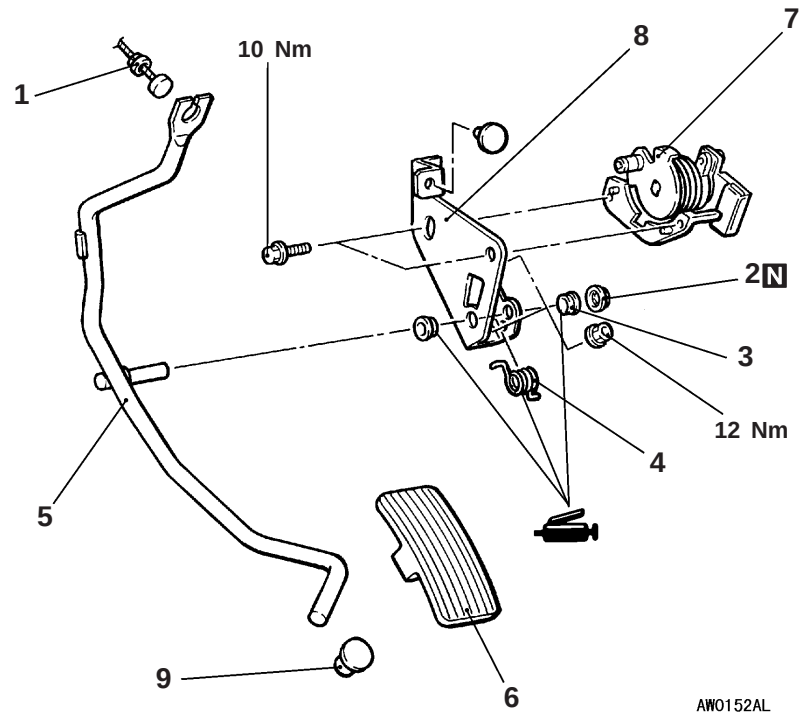
2. If the play is not within the standard value, turn the adjusting nut to adjust the play to the standard value.

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)

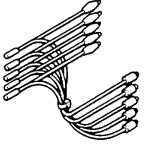
EMISSION CONTROL DEVICE REFERENCE TABLE

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

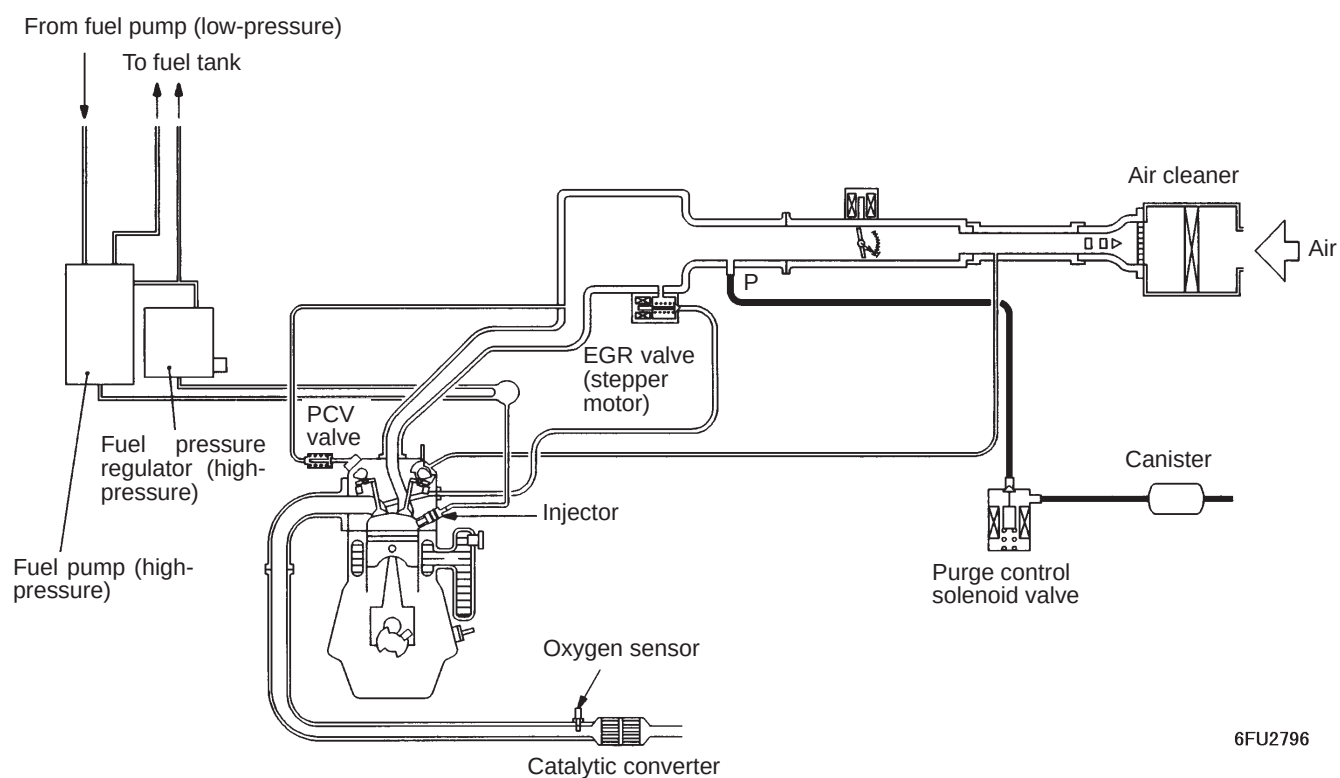
Items	Standard value
Purge control solenoid valve coil resistance (at 20°C) Ω	36 – 44
EGR valve (stepper motor) coil resistance (at 20°C) Ω	10 – 20

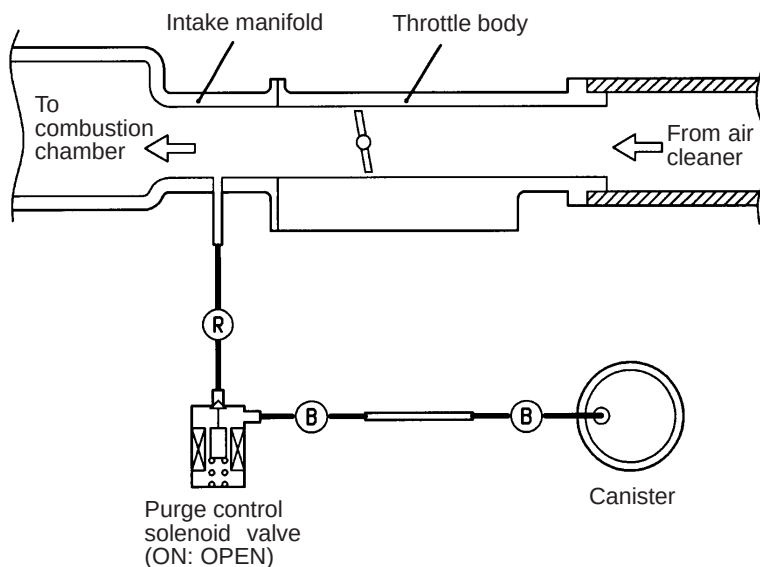
SPECIAL TOOL

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

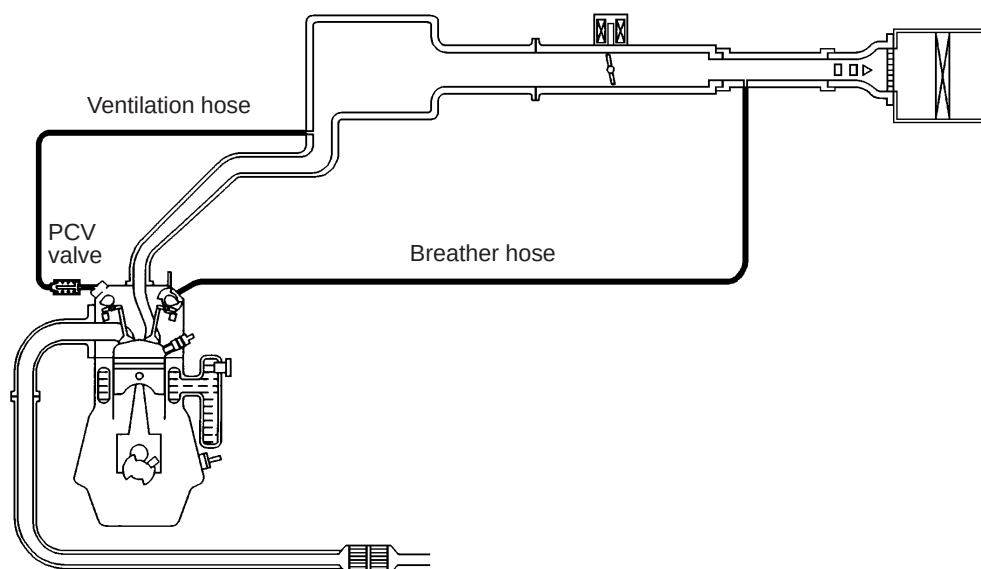
The crankcase emission control system prevents blow-by gases from escaping inside the crankcase into the atmosphere.

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.

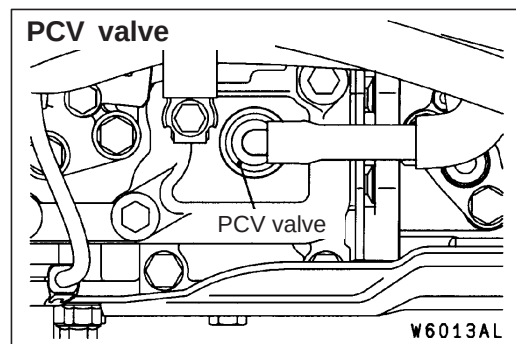
The PCV valve lifts the plunger according to the intake manifold vacuum so as to regulate the flow of blow-by gas properly. In other words, the blow-by gas flow is regulated during low load engine operation to maintain engine stability, while the flow is increased during high load operation to improve the ventilation performance.

SYSTEM DIAGRAM



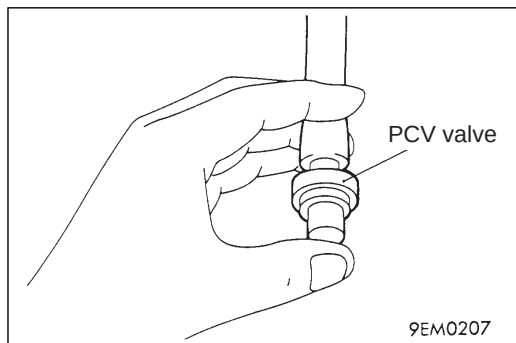
6EM0678

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.

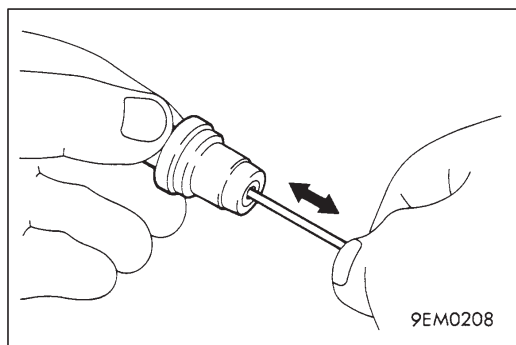


5. Place a finger at the opening of the PCV valve and check that vacuum of the intake manifold is felt.

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.

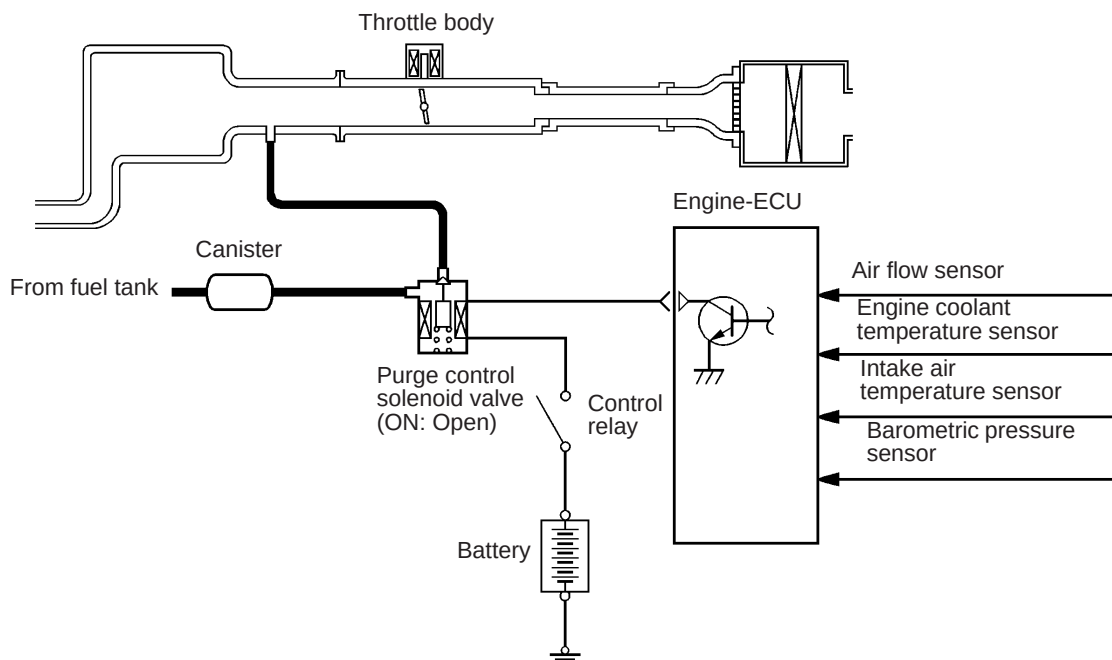
Fuel vapours from the fuel tank flow through the fuel tank pressure control valve and vapour pipe/hose to be stored temporarily in the canister. When driving the vehicle, fuel vapours stored in the canister flow through the purge solenoid and purge port and go into the intake manifold to be

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.

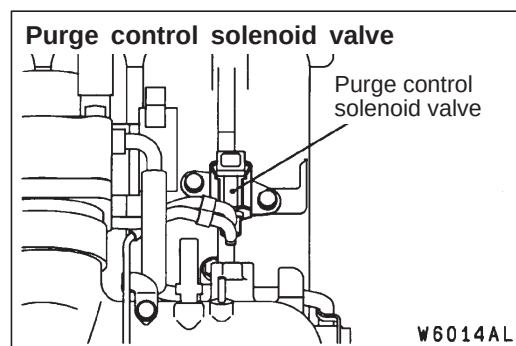
This does not only insure the driveability when the engine is cold or running under low load but also stabilize the emission level.

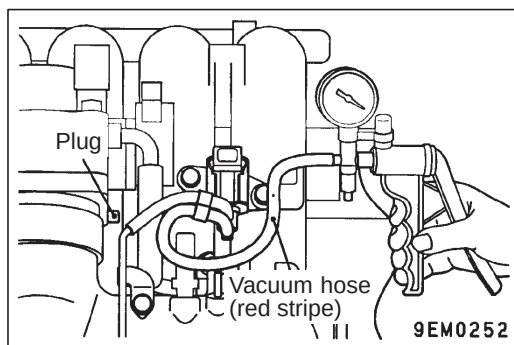
SYSTEM DIAGRAM



6EM0679

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

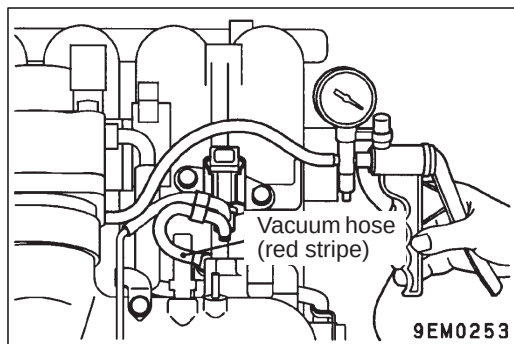
(Engine coolant temperature: 40°C or less)

Engine condition	Normal condition
At idle	Vacuum is maintained
3,000 r/min	

When engine is hot

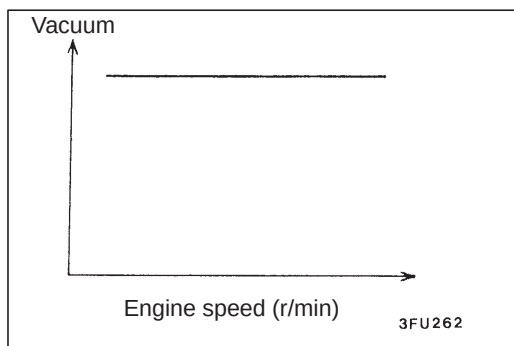
(Engine coolant temperature: 80°C or higher)

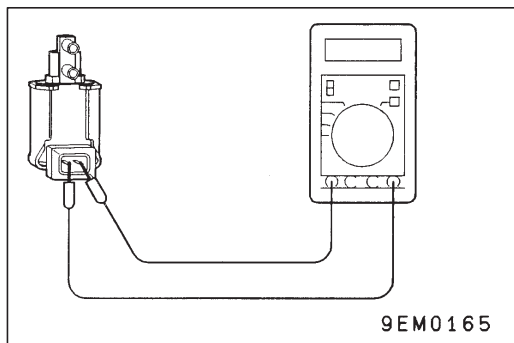
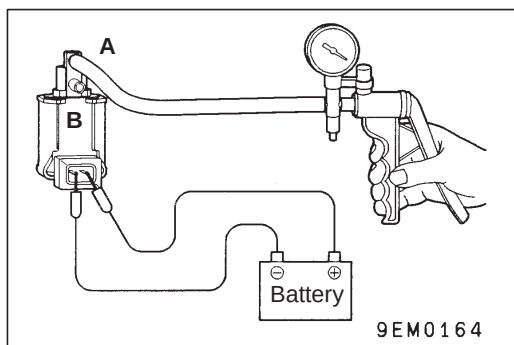
Engine condition	Normal condition
At idle	Vacuum is maintained
3,000 r/min (fore approximately 3 minutes after the engine is started.)	Vacuum will leak.



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.

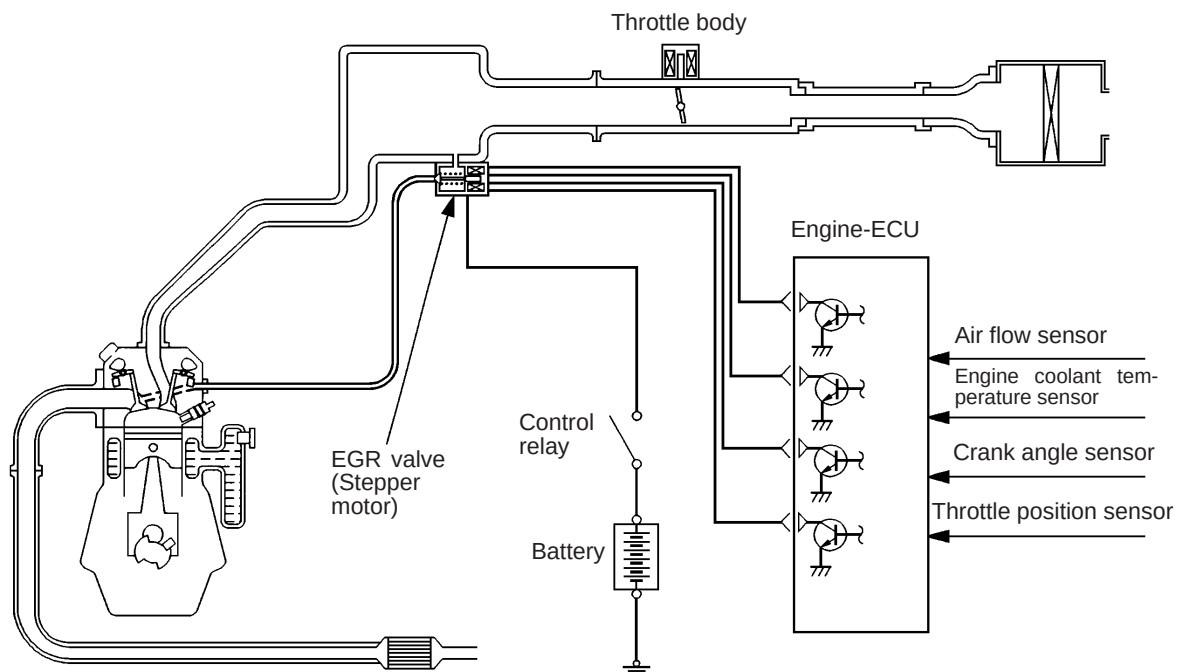
The EGR flow rate is controlled by the EGR valve so as not to decrease the driveability.

OPERATION

The EGR valve is being closed and does not recirculate exhaust gases under one of the following conditions. Otherwise, the EGR valve is opened and recirculates exhaust gases.

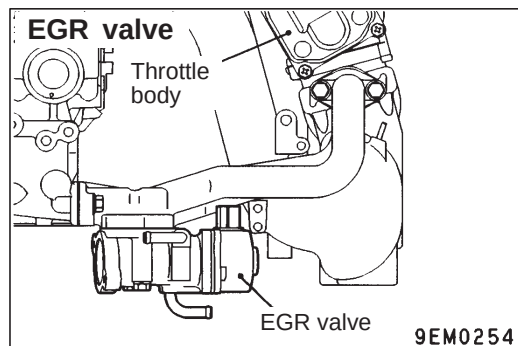
- The engine coolant temperature is low.
- The engine is at idle.
- The throttle valve is widely opened.

SYSTEM DIAGRAM



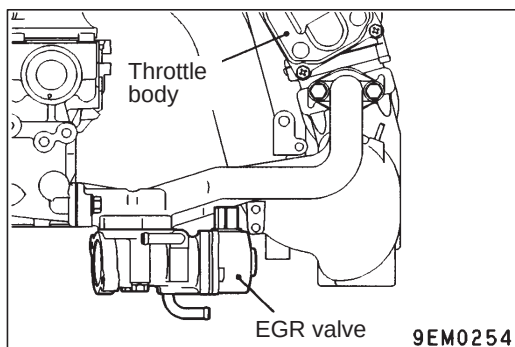
6EM0682

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.

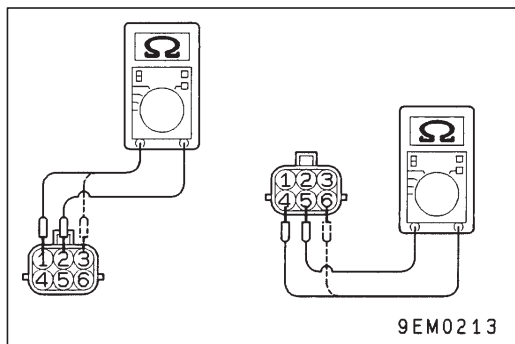
Checking the Coil Resistance

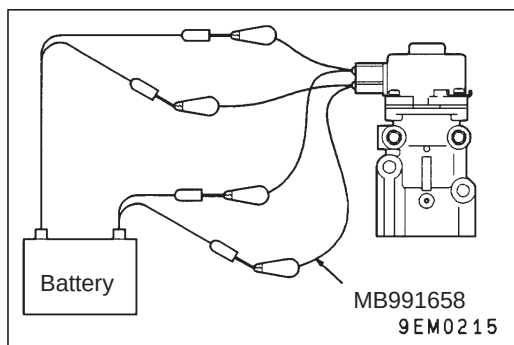
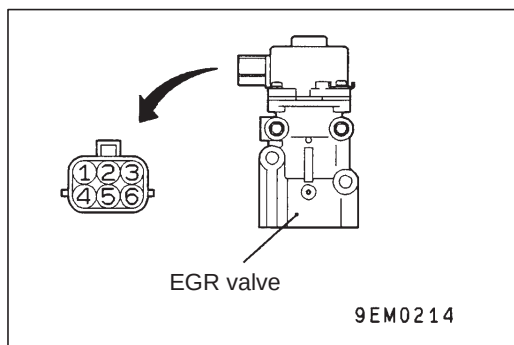
1. Disconnect the EGR valve connector.
2. Measure the resistance between the EGR valve-side connector terminal No.2 and terminal No.1 or terminal No.3.

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

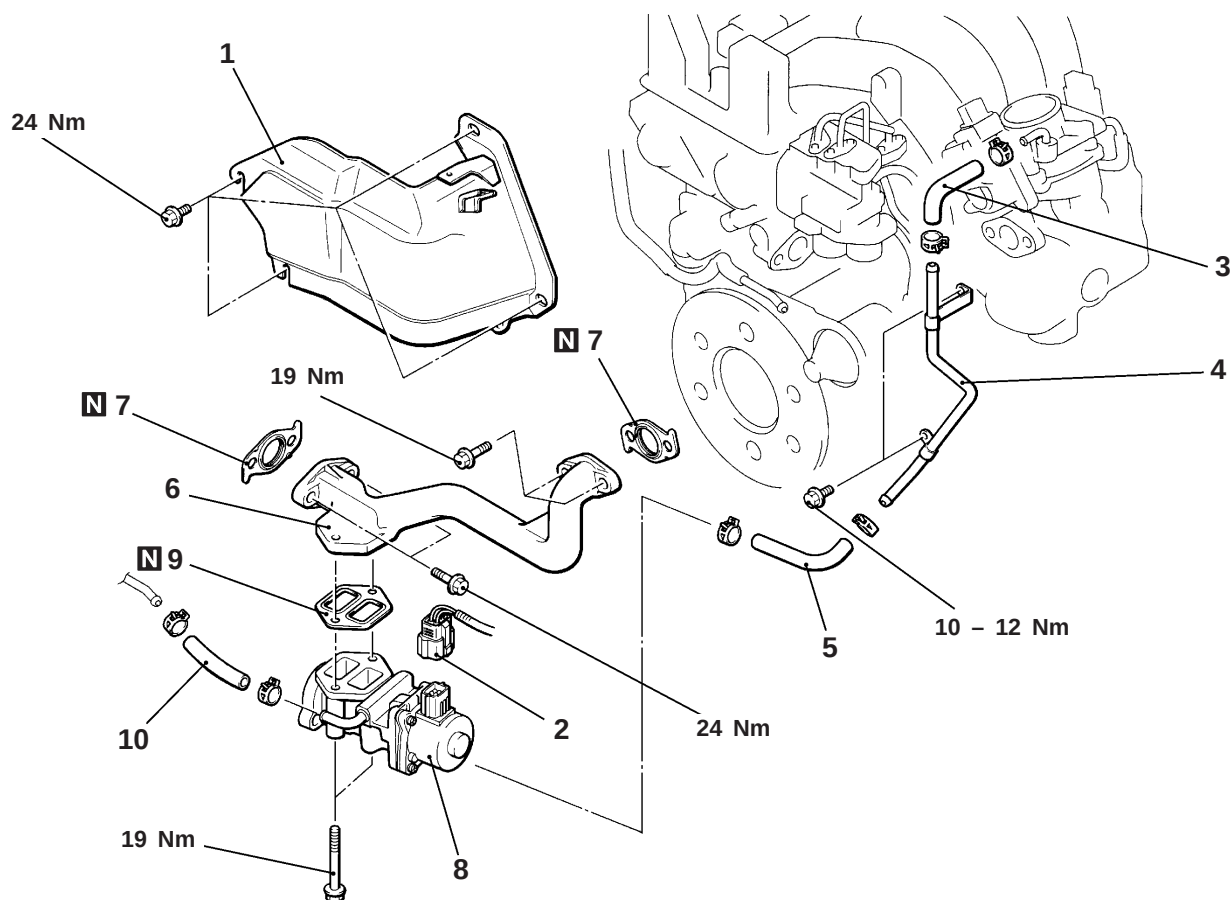
Do not use a cleaning solvent. Solvent will penetrate to the motor and malfunction of EGR valve will result.

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



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Removal steps



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.

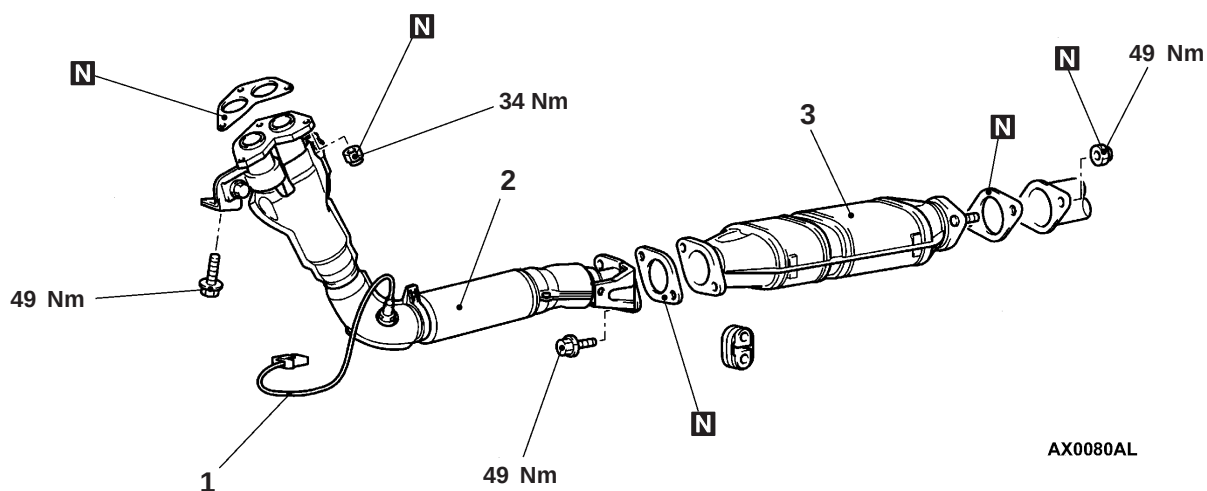
CATALYTIC CONVERTER

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

CLUTCH

CONTENTS

GENERAL INFORMATION	2	CLUTCH PEDAL	4
SERVICE SPECIFICATIONS	2	CLUTCH CONTROL	5
LUBRICANTS	2	Clutch Master Cylinder	7
ON-VEHICLE SERVICE	2		
Clutch Pedal Inspection and Adjustment	2		
Bleeding	3		

GENERAL INFORMATION

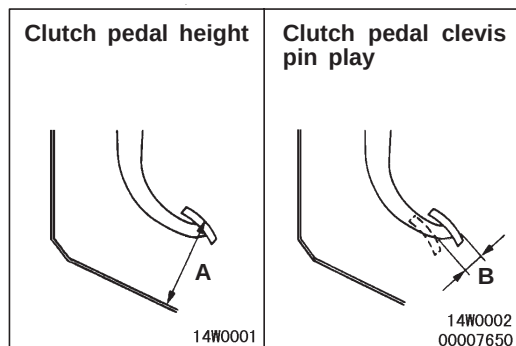
The clutch is a dry single-disc, diaphragm type; hydraulic pressure is used for the clutch control.

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

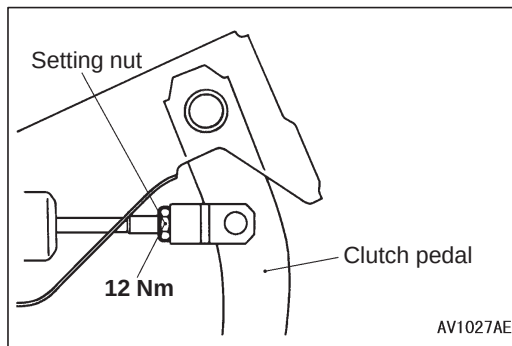
1. Turn up the carpet, etc. under the clutch pedal.
2. Measure the clutch pedal height and the clutch pedal clevis pin play.

Standard value (A):

212 – 215 <L.H. drive vehicles>

202 – 205 <R.H. drive vehicles>

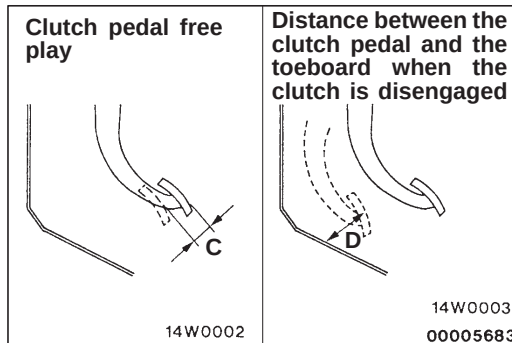
Standard value (B): 1 – 3 mm



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.

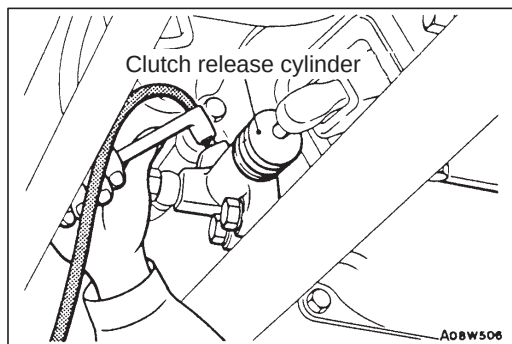


4. After completing the adjustments, confirm that the clutch pedal free play (measured at the face of the pedal pad) and the distance between the clutch pedal (the face of the pedal pad) and the toeboard when the clutch is disengaged are within the standard value ranges.

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

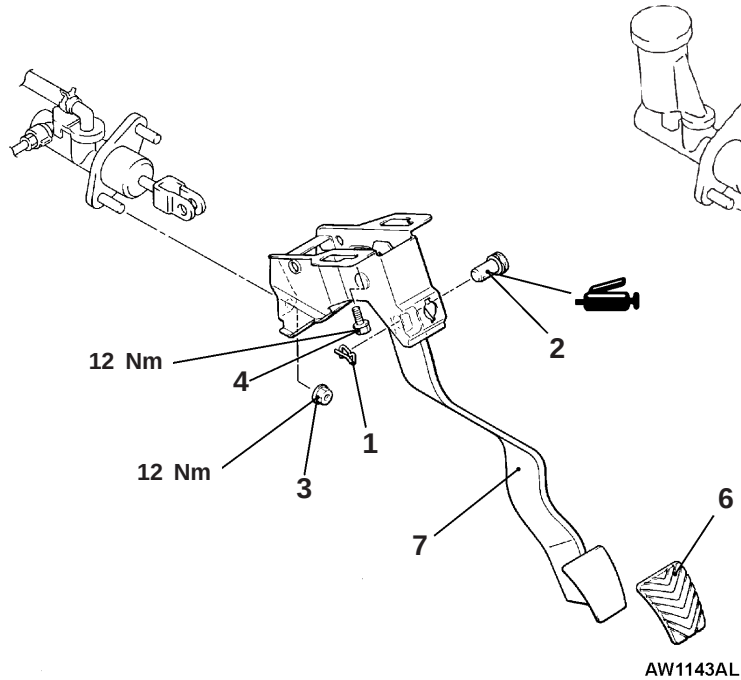
Use the specified brake fluid. Avoid using a mixture of the specified fluid and other fluid.

CLUTCH PEDAL

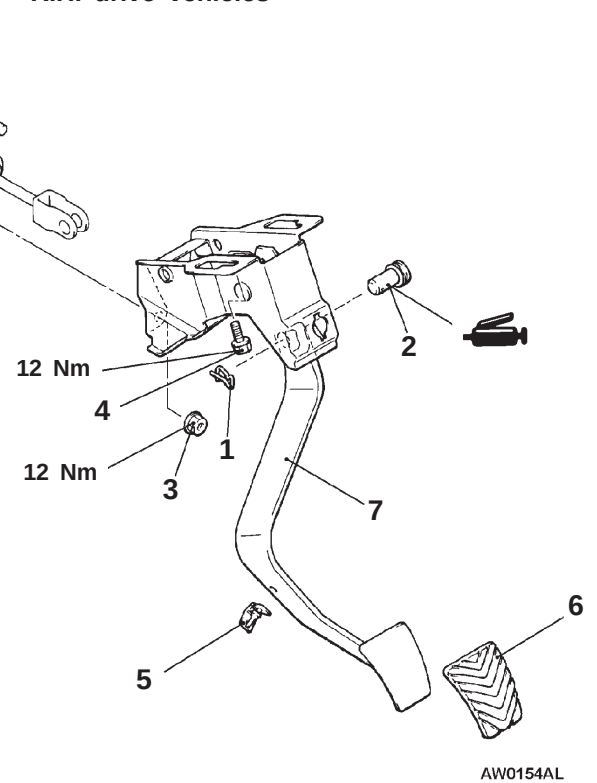
REMOVAL AND INSTALLATION

Post-installation Operation
Clutch Pedal Adjustment (Refer to P.21-2.)

L.H. drive vehicles



R.H. drive vehicles



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

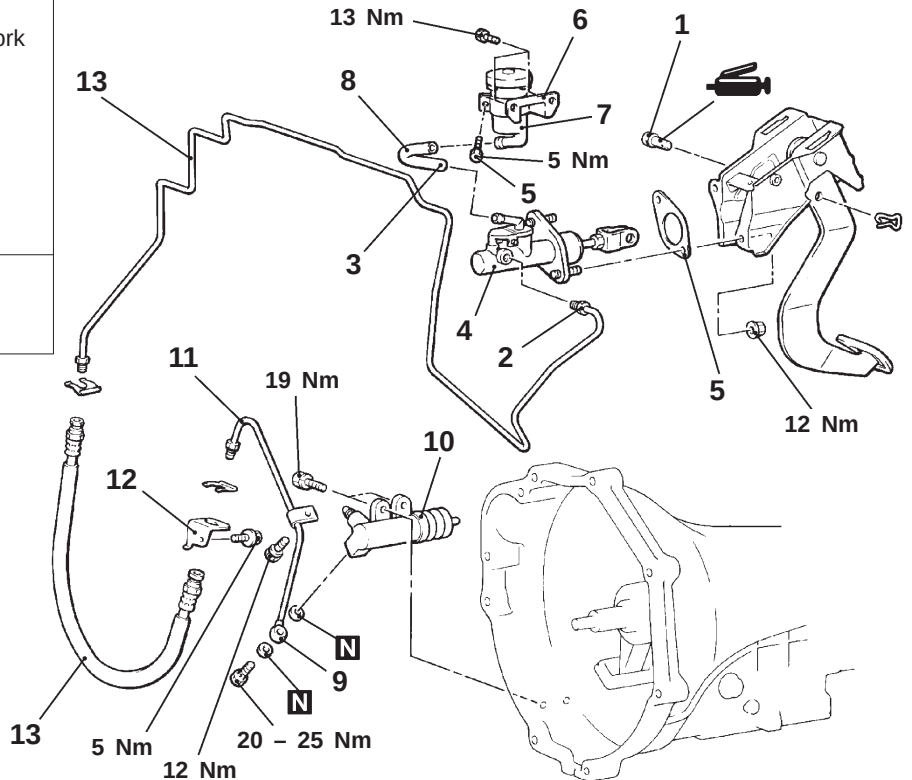
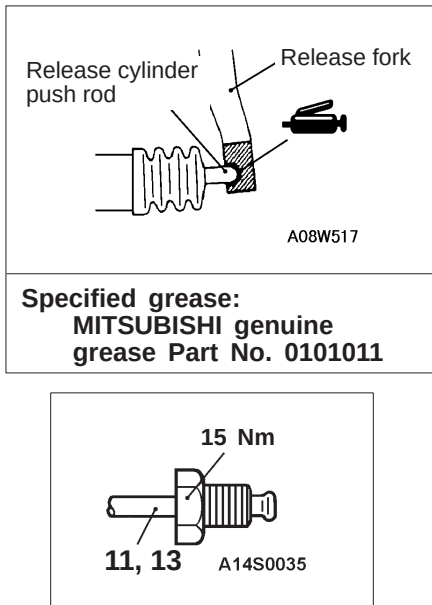
REMOVAL AND INSTALLATION

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>



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

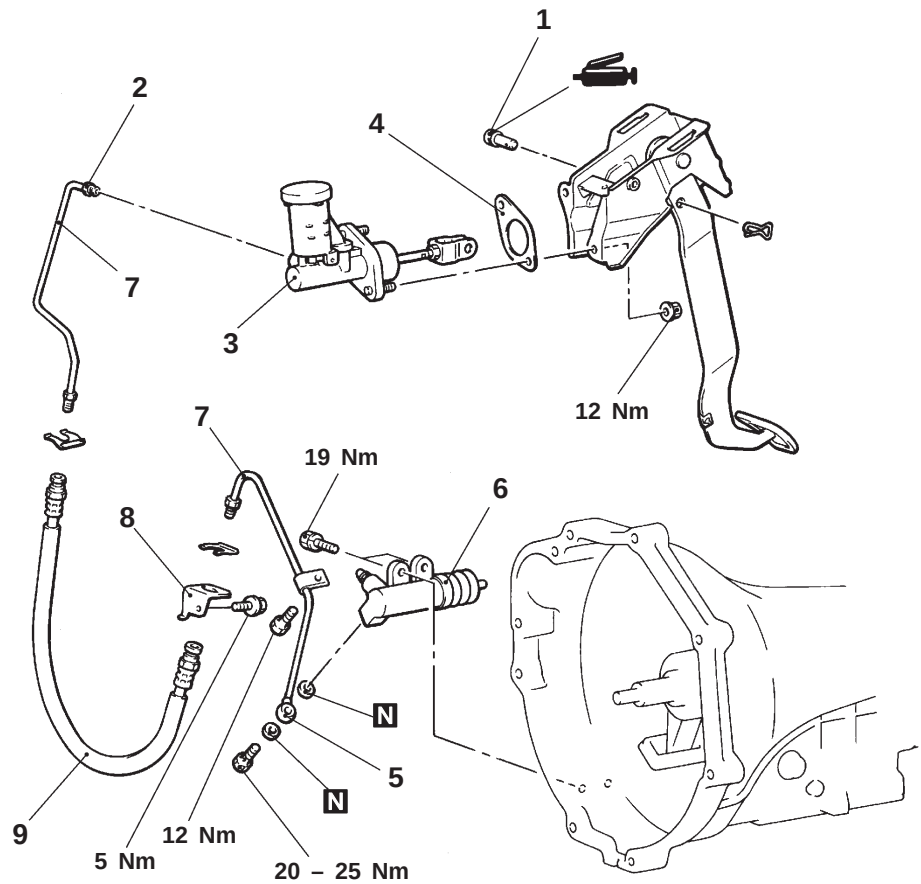
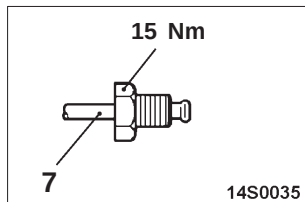
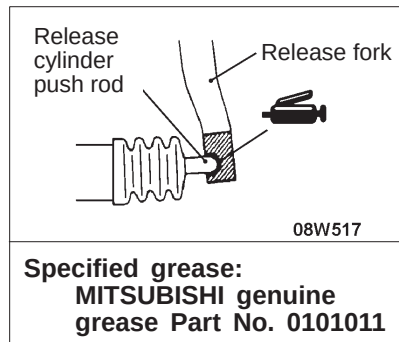
Clutch release cylinder assembly removal steps

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>

W0907AL
00008734**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

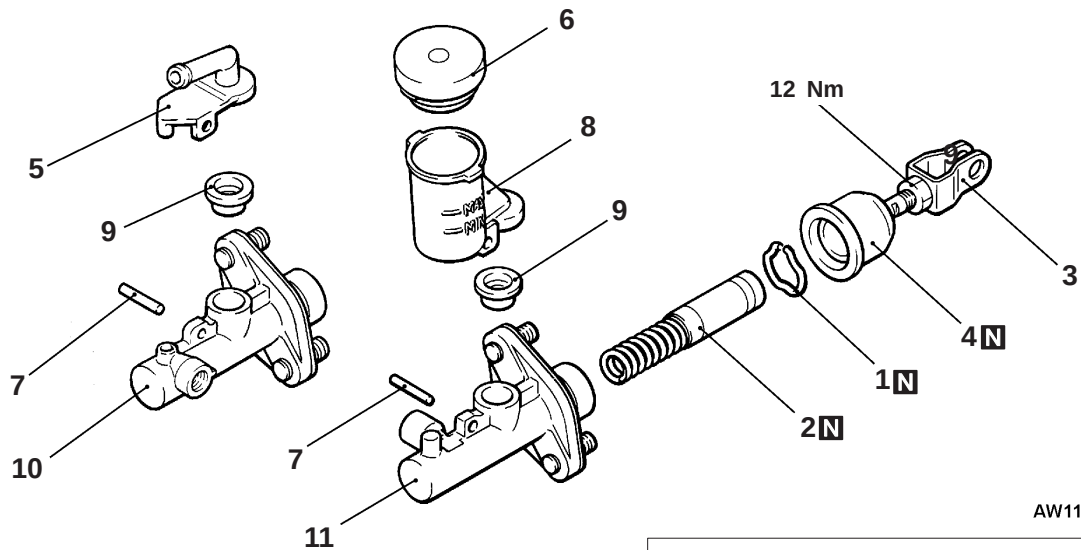
5. Clutch pipe connection
6. Clutch release cylinder assembly

Clutch line removal steps

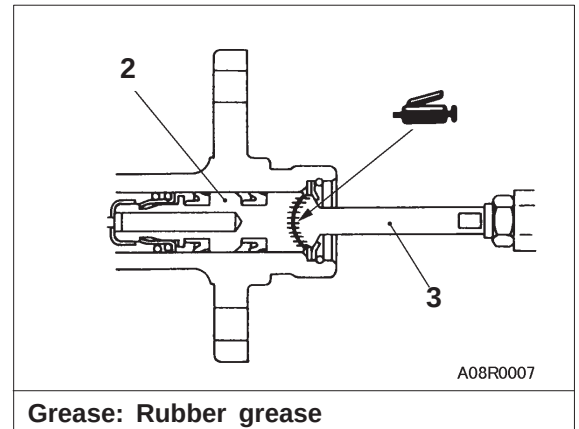
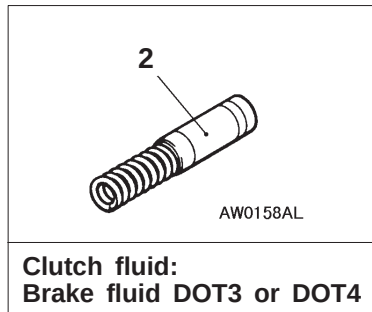
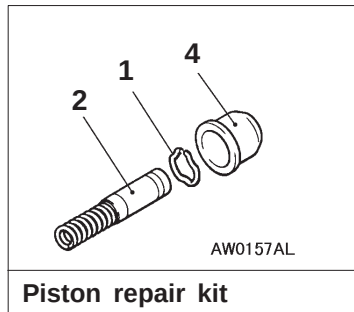
7. Clutch pipe
8. Bracket
9. Clutch hose

DISASSEMBLY AND REASSEMBLY**CLUTCH MASTER CYLINDER****Caution**

Do not disassemble piston assembly.

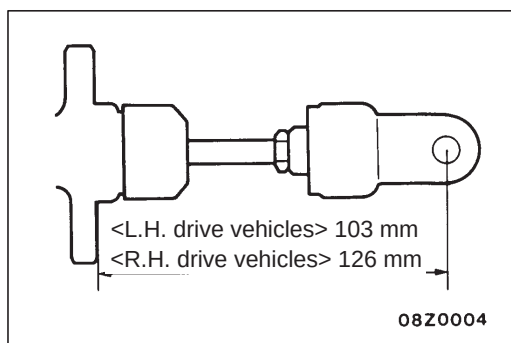


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**Disassembly steps**

1. Piston stopper ring
2. Piston assembly
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

AUTOMATIC TRANSMISSION

CONTENTS

SERVICE SPECIFICATIONS	2	Converter Stall Test	44
LUBRICANTS	2	Hydraulic Pressure Test	45
SEALANTS AND ADHESIVES	2	Hydraulic Circuit	46
SPECIAL TOOLS	3	Selector Lever Operation Check	47
TROUBLESHOOTING <A/T>	4	Transmission Control Cable Adjustment	49
TROUBLESHOOTING <A/T KEY INTERLOCK AND SHIFT LOCK MECHANISMS>	32	TRANSMISSION CONTROL*	50
ON-VEHICLE SERVICE	34	A/T KEY INTERLOCK AND SHIFT LOCK MECHANISMS	54
Essential Service	34	TRANSMISSION ASSEMBLY	56
Transfer Oil Check	39	TRANSMISSION OIL COOLER	59
Transfer Oil Replacement	39	A/T-ECU	60
A/T Control Component Location	40	4WD INDICATOR CONTROL UNIT	60
A/T Control Component Check	41		

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

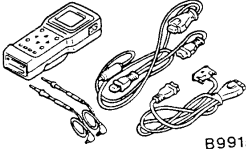
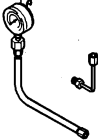
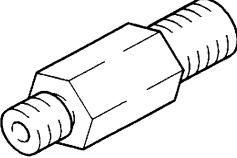
LUBRICANTS

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

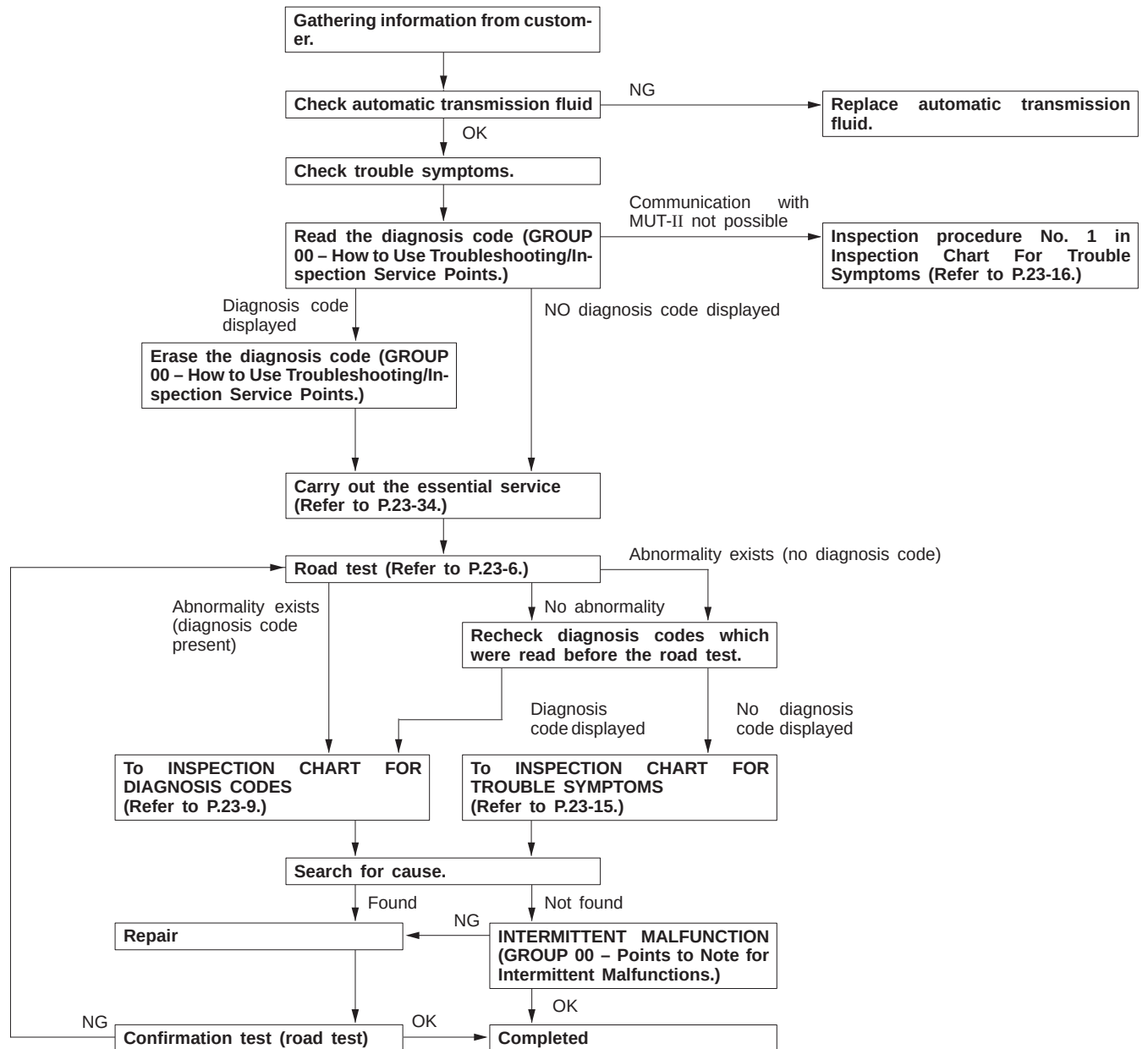
Items	Specified sealant	Remarks
Transfer control lever gasket	3M ATD Part No.8660 or equivalent	Semi-drying sealant
Transfer control lever assembly installation bolt	3M Stud Locking No.4170 or equivalent	Anaerobic sealant

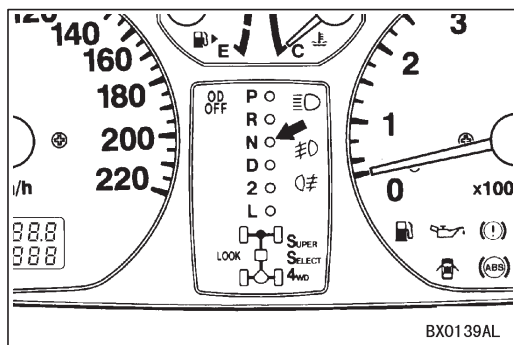
SPECIAL TOOLS

Tool	Number	Name	Use
 B991502	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

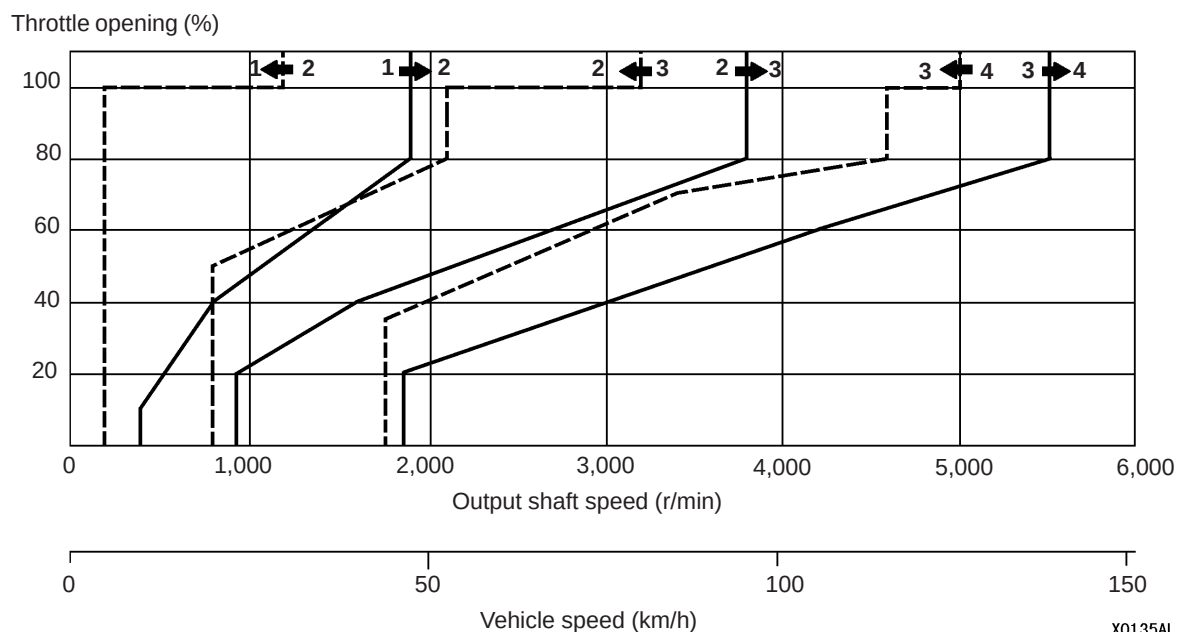
No.	State prior to test and operation	Test and operation	Judgement value	Check item	Inspection item if there is an abnormality
1	Ignition switch: ON Engine: Stopped	Ignition switch (1) ON (2) OFF	Data list No. 14 (1) Approx. 5V (2) 0V	APS (Power supply voltage)	Code No.13, 14 APS system (P.23-10)
		Overdrive 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)
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)
				Malfunction when driving the vehicle	Incorrect drive gear position (P.23-21)
					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)

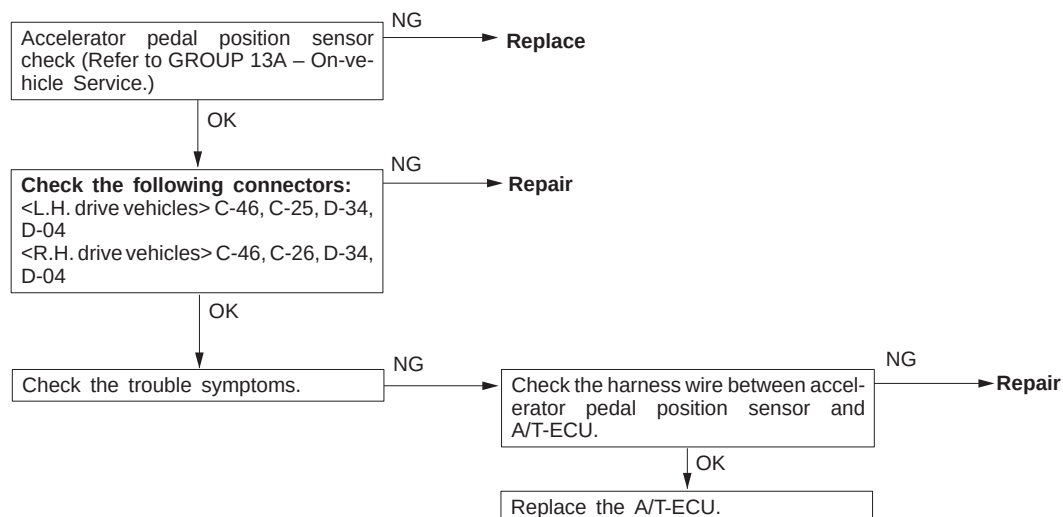


INSPECTION CHART FOR DIAGNOSIS CODE

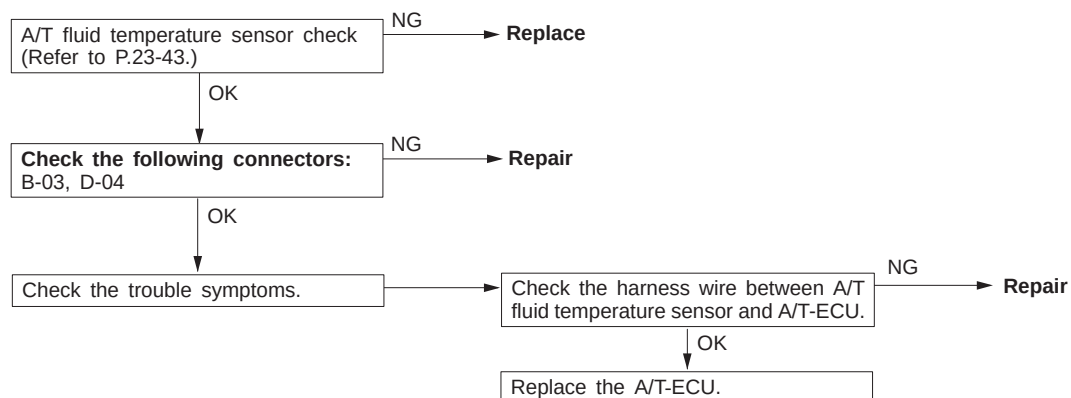
Code	Diagnosis item		Reference page
13	Accelerator pedal position sensor system (Throttle opening voltage)	Sensor malfunction, open circuit, short circuit	23-10
14	Accelerator pedal position sensor system (Throttle power supply voltage)	Open circuit, short circuit	23-10
15	A/T fluid temperature sensor 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

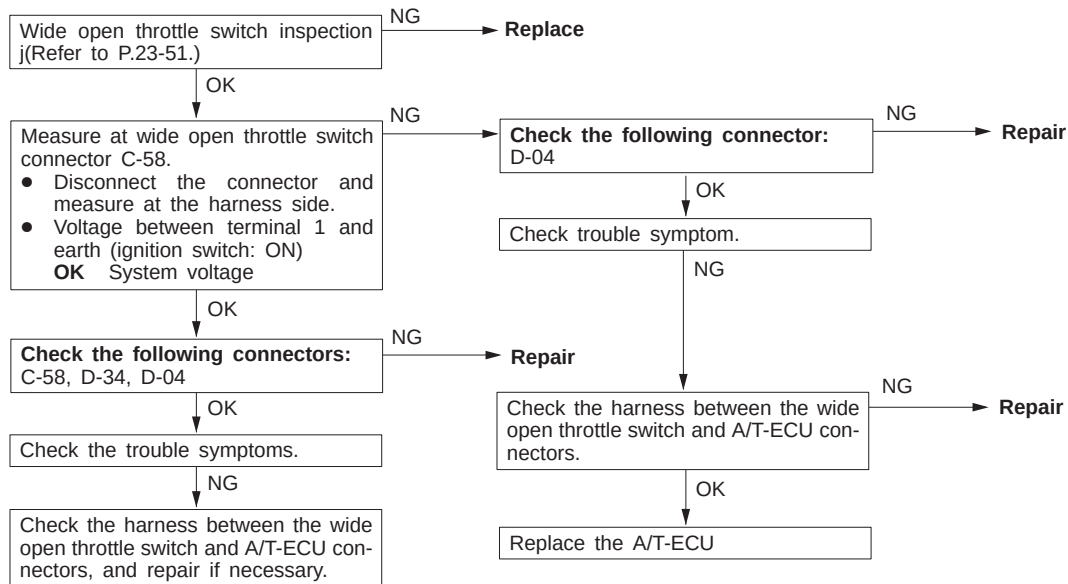
Code No. 13, 14 Accelerator pedal position sensor (APS)	Probable cause
If the APS output voltage (APS opening voltage) is 4.8 V or higher when the engine is idling, the output voltage is judged to be too high and diagnosis code No. 13 is output. If the APS output voltage (APS opening voltage) is 0.335 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

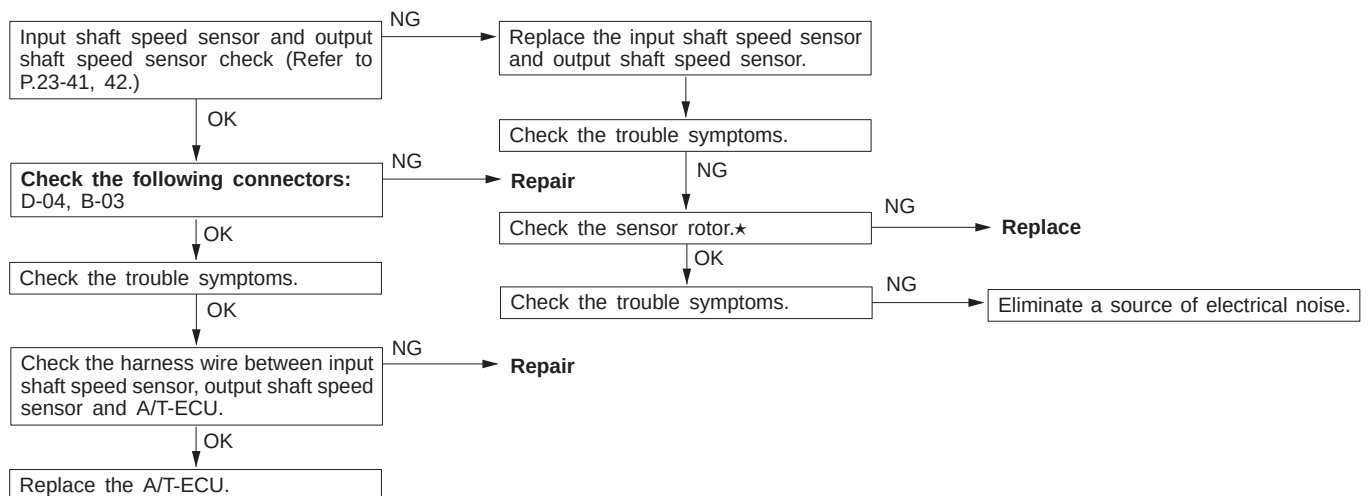


Code No. 22 Wide open throttle switch system	Probable cause
If the wide open throttle switch does not turn OFF when the accelerator pedal is not depressed, there is a short circuit in the wide open throttle switch and diagnosis code No. 25 is output.	• Malfunction of wide open throttle switch • Malfunction of connector • Malfunction of the A/T-ECU

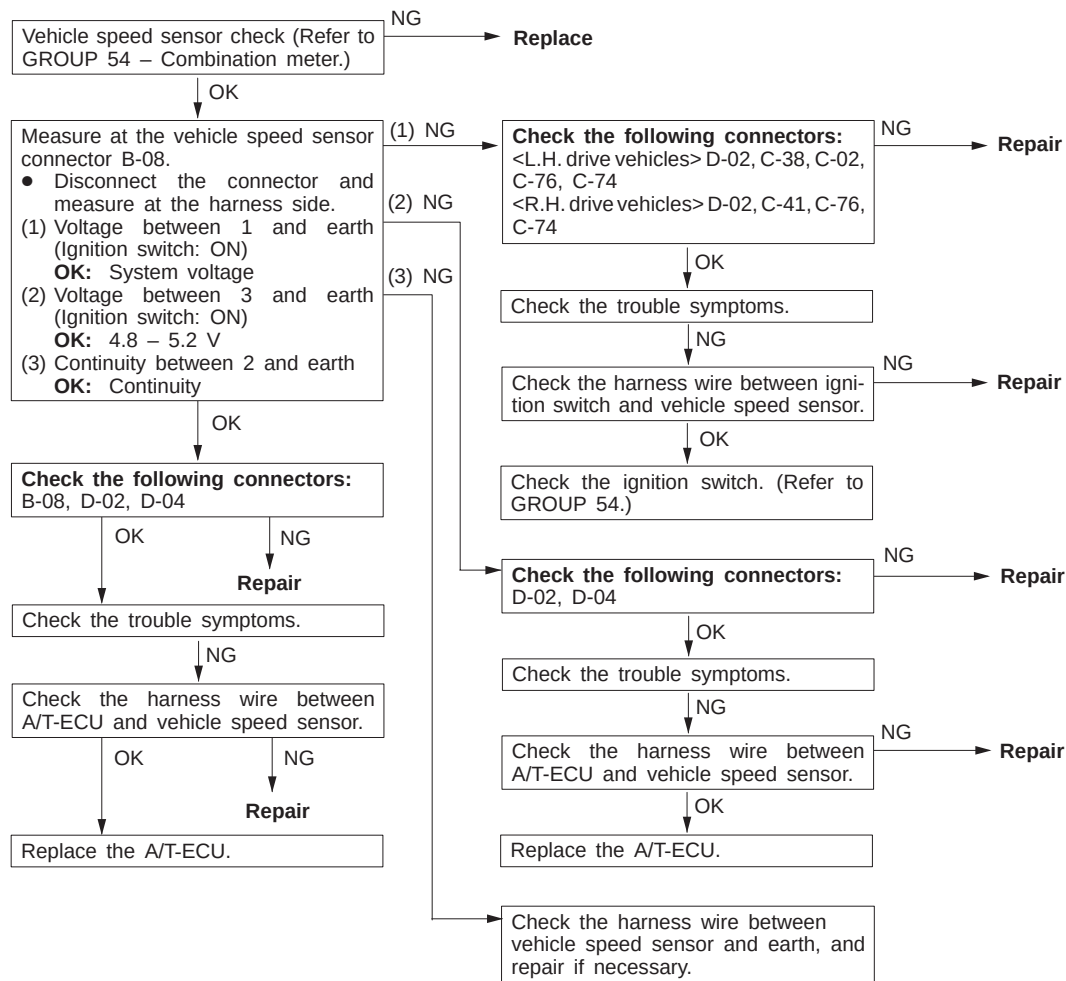


Code No. 31, 32 Input shaft speed sensor system, output shaft speed sensor system	Probable cause
If no output pulse is detected from the input shaft speed sensor for 120 seconds or more while driving in 3rd gear at a speed of 60 km/h or more, there is judged to be an open circuit in the input shaft speed 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

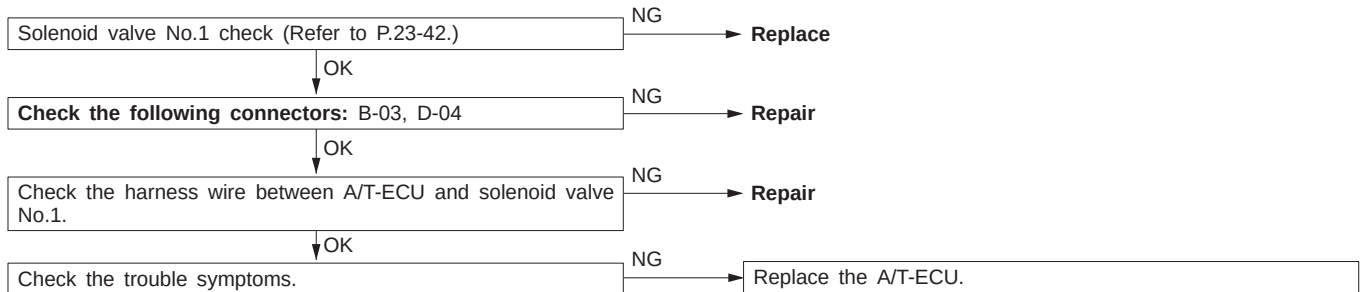
★: Refer to the Transmission Workshop Manual.



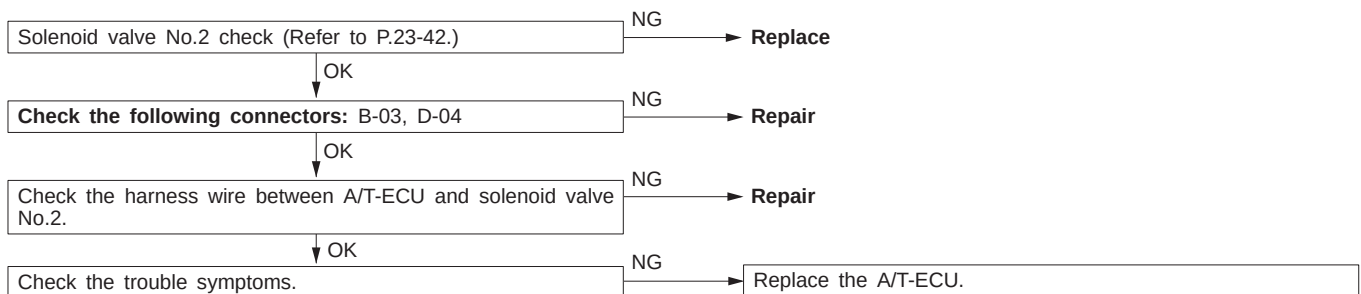
Code No. 38 Vehicle speed sensor system	Probable cause
If no output pulse is detected from the vehicle speed sensor for 120 seconds or more continuously while driving at a speed of 60 km/h or more, there is judged to be an open circuit in the vehicle speed sensor and diagnosis code No. 38 is output.	• Malfunction of the vehicle speed sensor • Malfunction of harness or connector • Malfunction of the A/T-ECU • Malfunction of the ignition switch



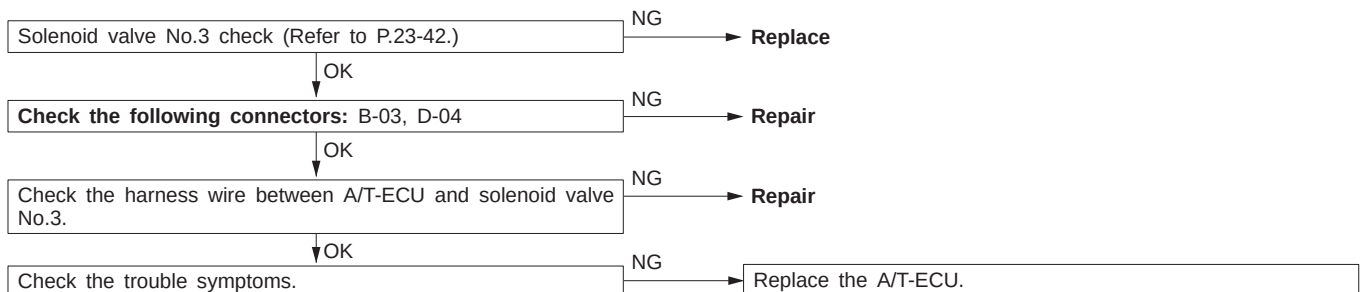
Code No. 41, 42 Solenoid valve No.1 system	Probable cause
If the resistance value for a solenoid valve No.1 is too large, it is judged that there is an open circuit in the solenoid valve No.1 and the diagnosis code No.41 is output. If the resistance value for a solenoid valve No.1 is too small, it is 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



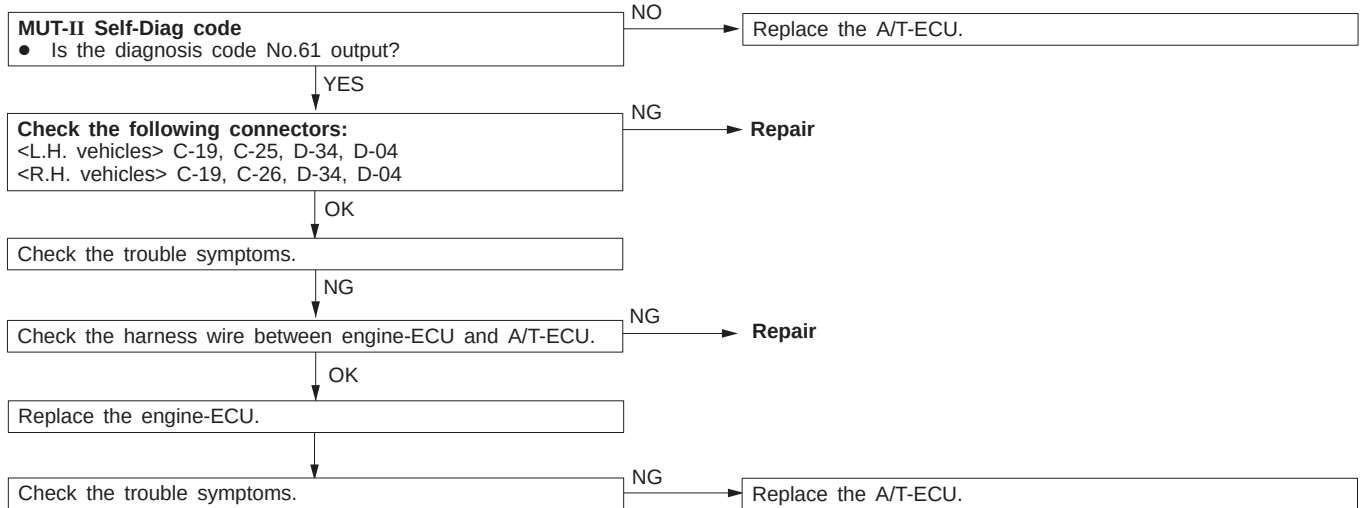
Code No. 43, 44 Solenoid valve No.2 system	Probable cause
If the resistance value for a solenoid valve No.2 is too large, it is judged that there is an open circuit in the solenoid valve No.2 and the diagnosis code No.43 is output. If the resistance value for a solenoid valve No.2 is too small, it is 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



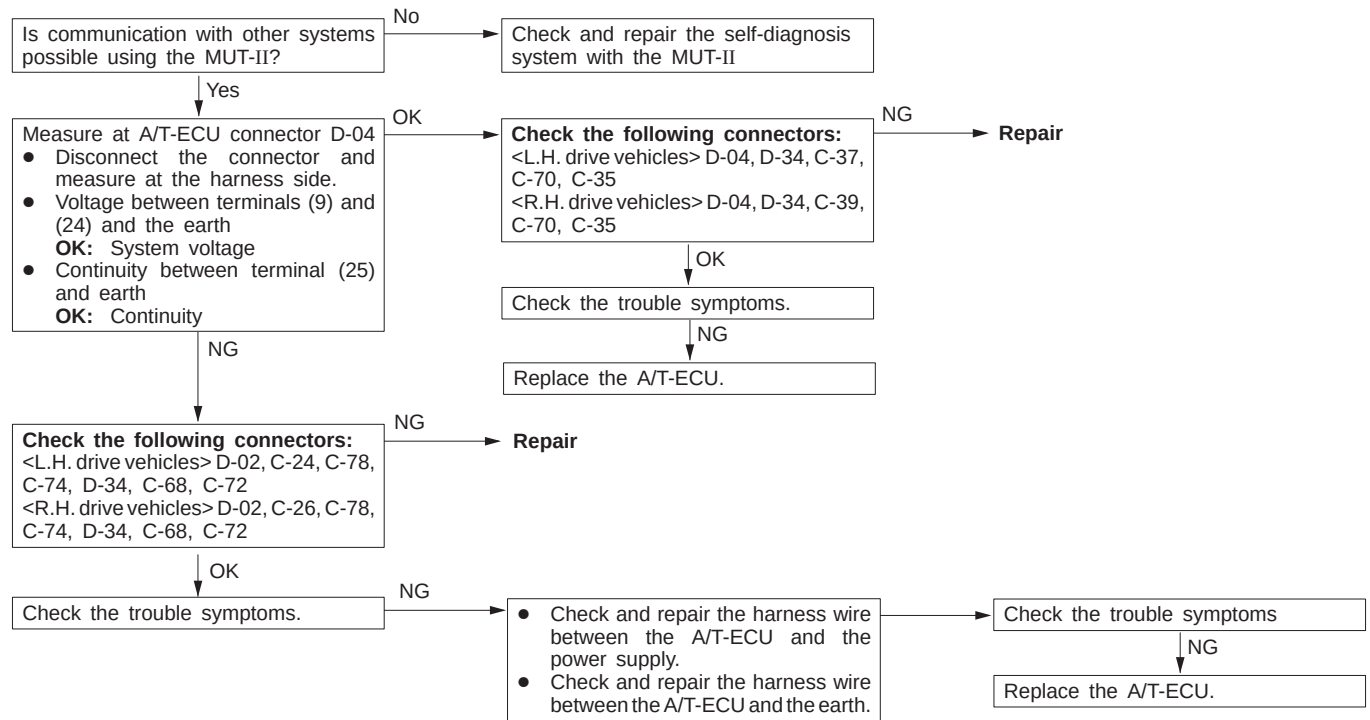
INSPECTION CHART FOR TROUBLE SYMPTOMS

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

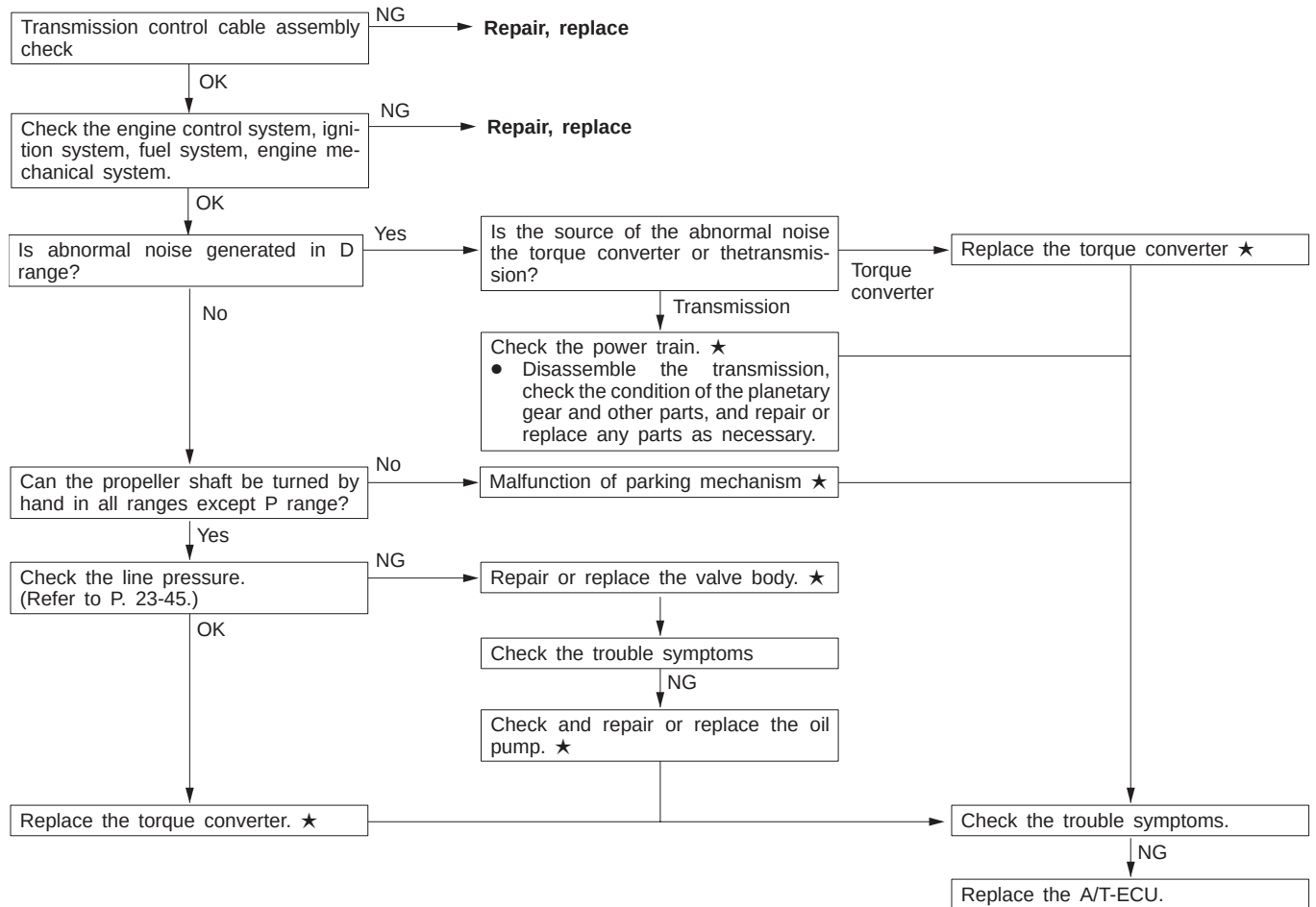
Communication with the MUT-II is not possible	Probable cause
If communication with the MUT-II is not possible, the cause is probably a malfunction in the self-diagnosis system or the A/T-ECU is not functioning.	• Malfunction of self-diagnosis system • Malfunction of A/T-ECU power circuit • Malfunction 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 position. 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

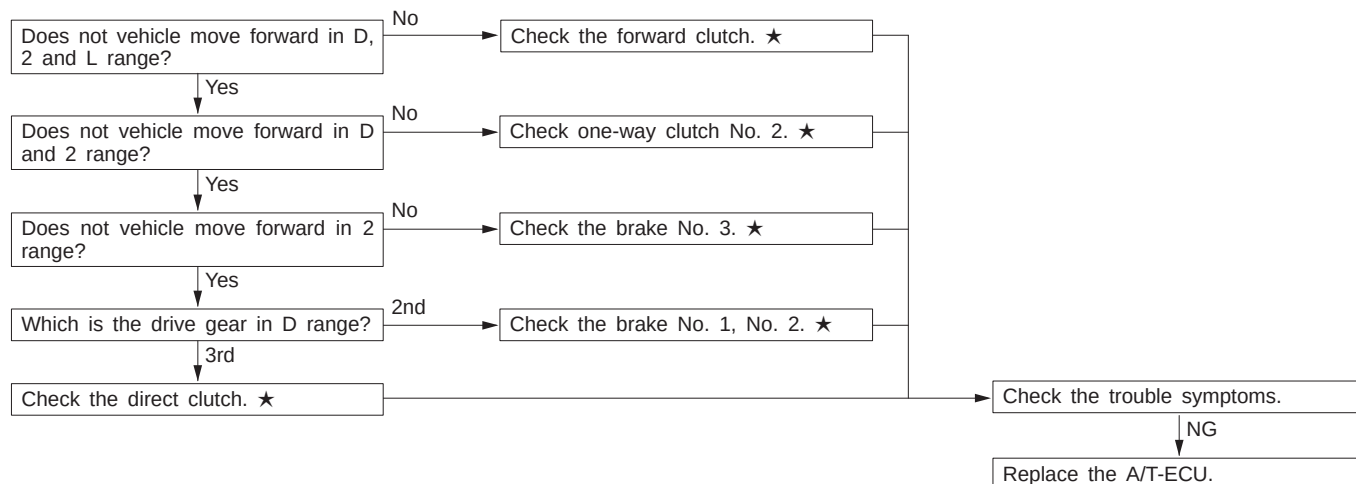
★: Refer to the Transmission Workshop Manual.



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

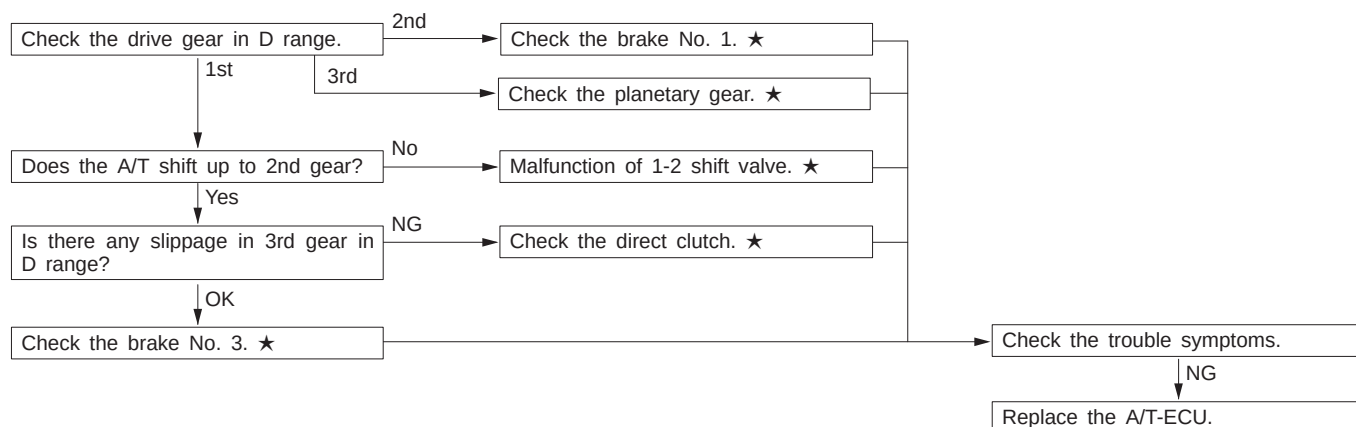
★: Refer to the Transmission Workshop Manual.



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

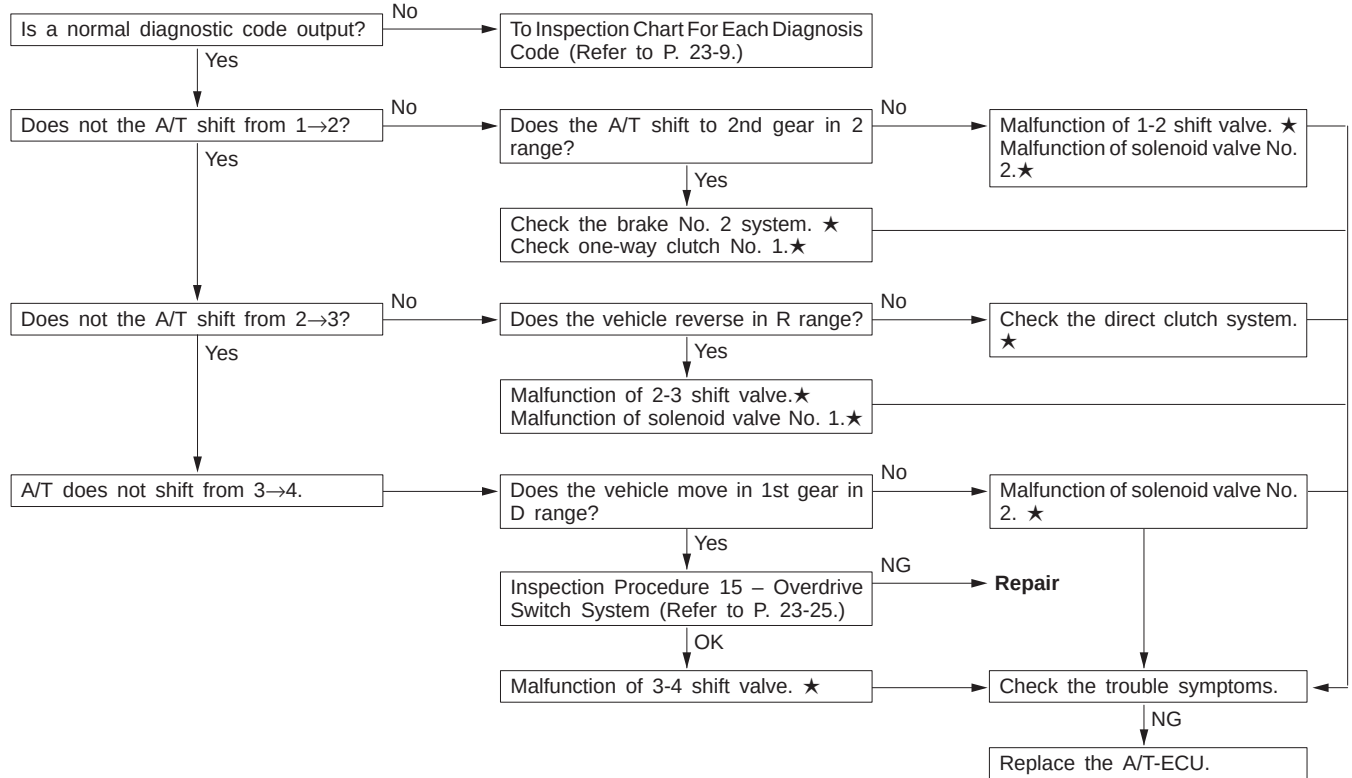
★: Refer to Transmission Workshop Manual.



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

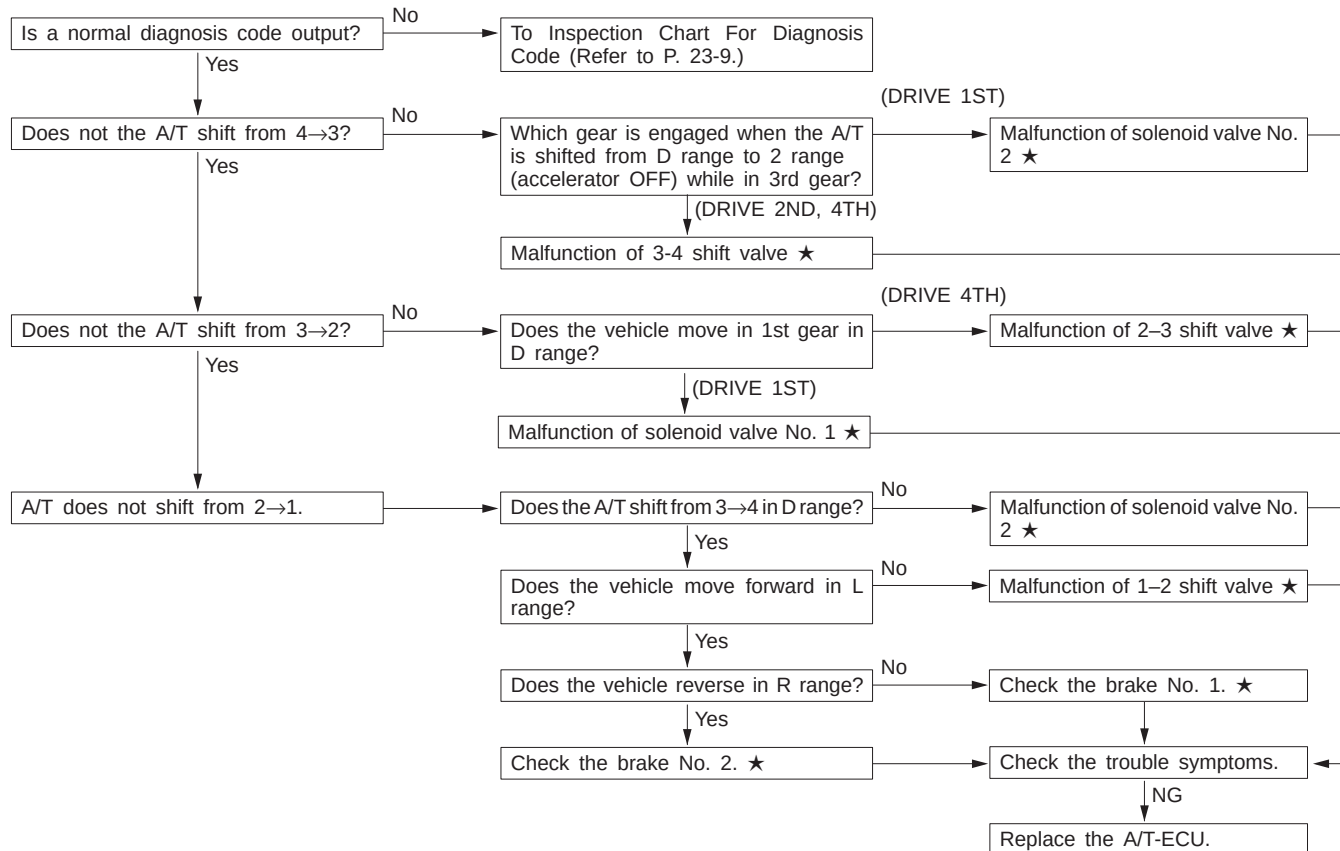
★: Refer to the Transmission Workshop Manual.



INSPECTION PROCEDURE 6

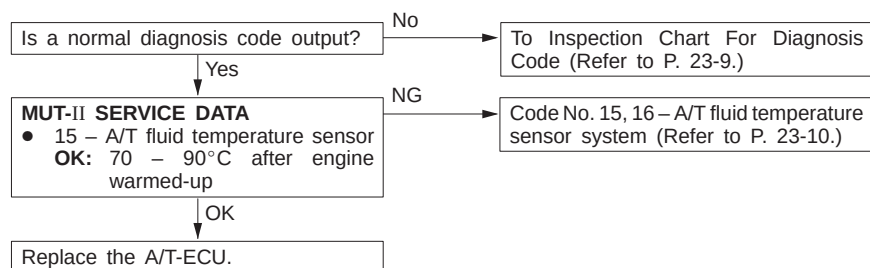
Downshifting does not occur	Probable cause
Downshifting does not occur under conditions when downshifting should occur. Check shifting from 2→1, 3→2 and 4→3 respectively.	• Malfunction of solenoid No. 1, No. 2 • Malfunction of A/T-ECU • Malfunction of power train internal parts

★: Refer to the Transmission Workshop Manual.



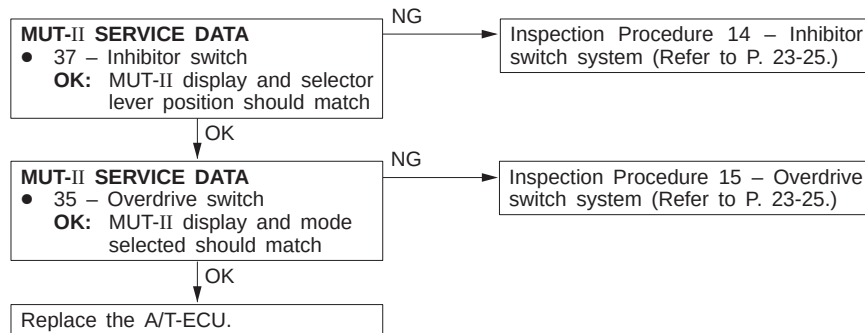
INSPECTION PROCEDURE 7

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

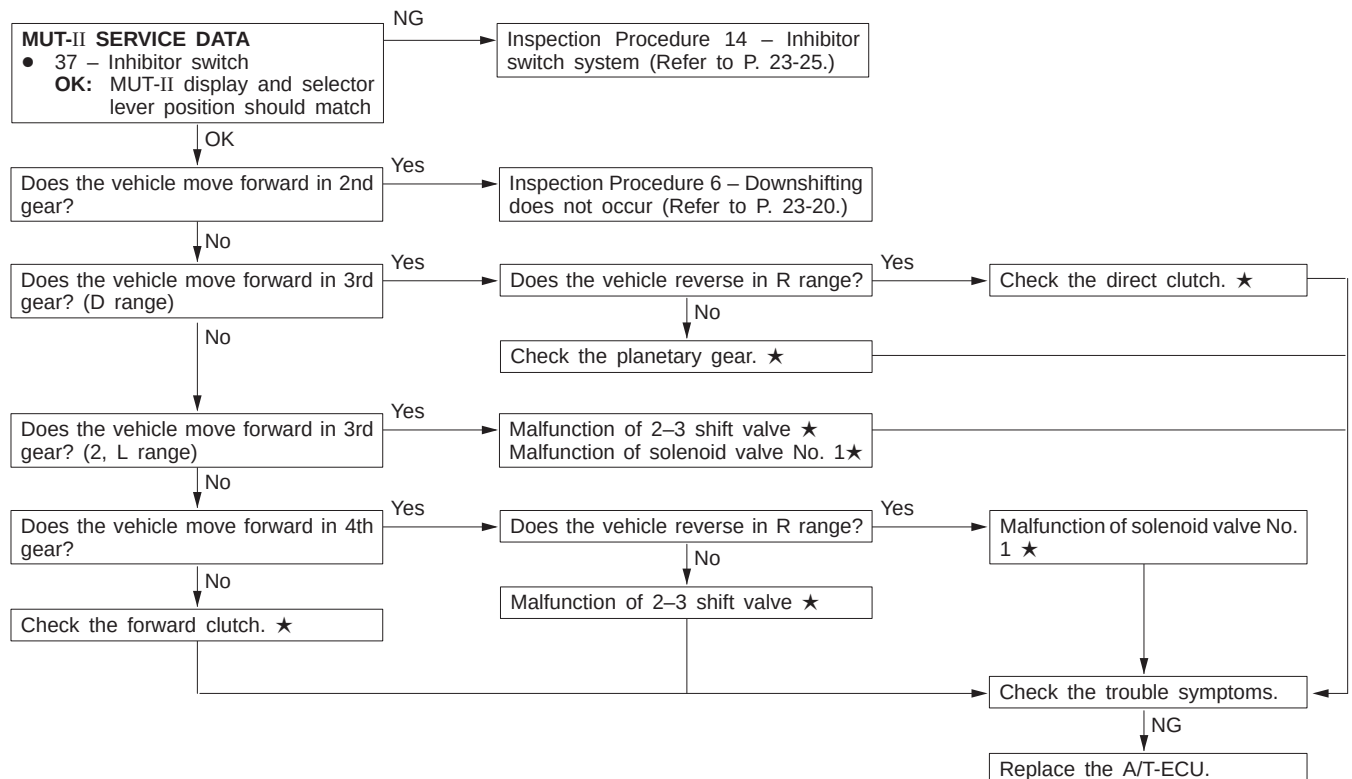
Upshifting occurs spontaneously	Probable cause
Upshifting occurs in ranges where upshifting should not occur, e. g. upshifting to 2nd gear in L range, 3rd gear in 2 range or 4th gear in D range when overdrive is disconnected.	• Malfunction of inhibitor switch • Malfunction of overdrive switch • Malfunction 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

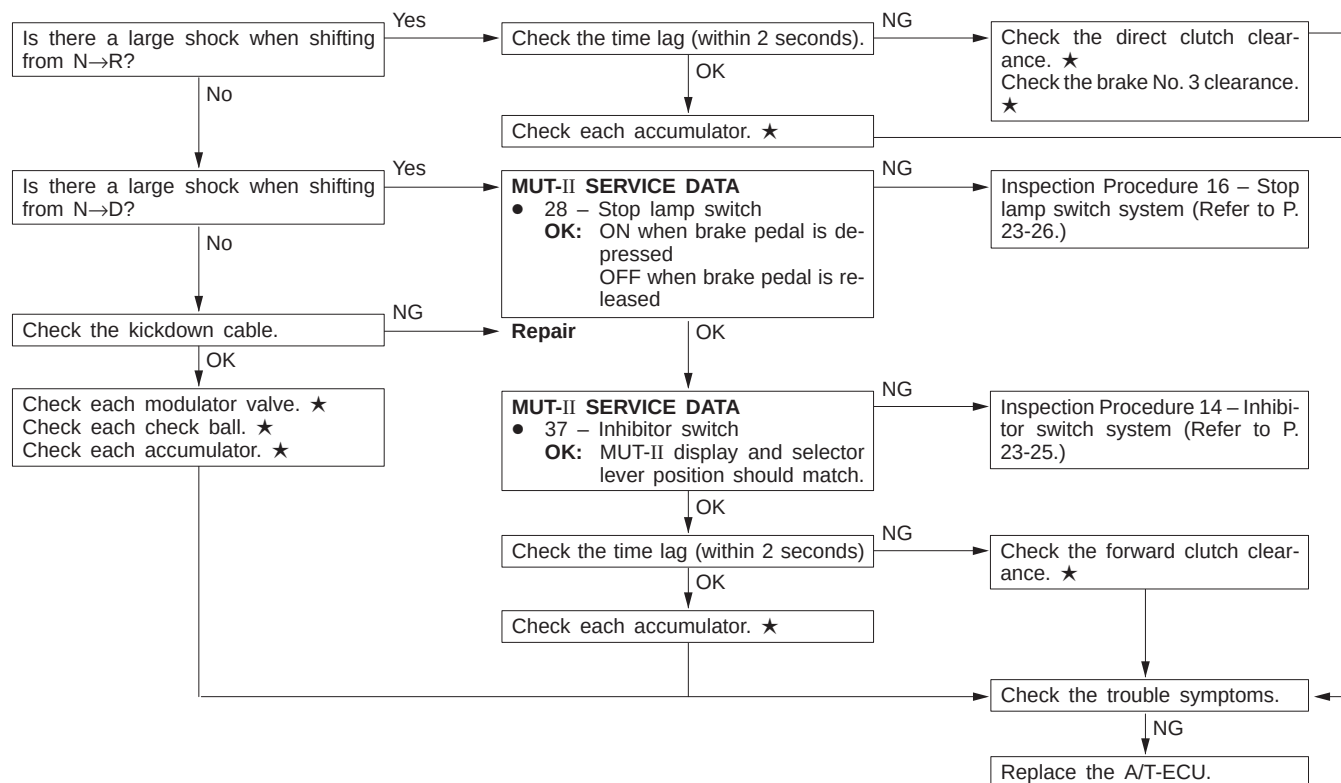
★: Refer to the Transmission Workshop Manual.



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

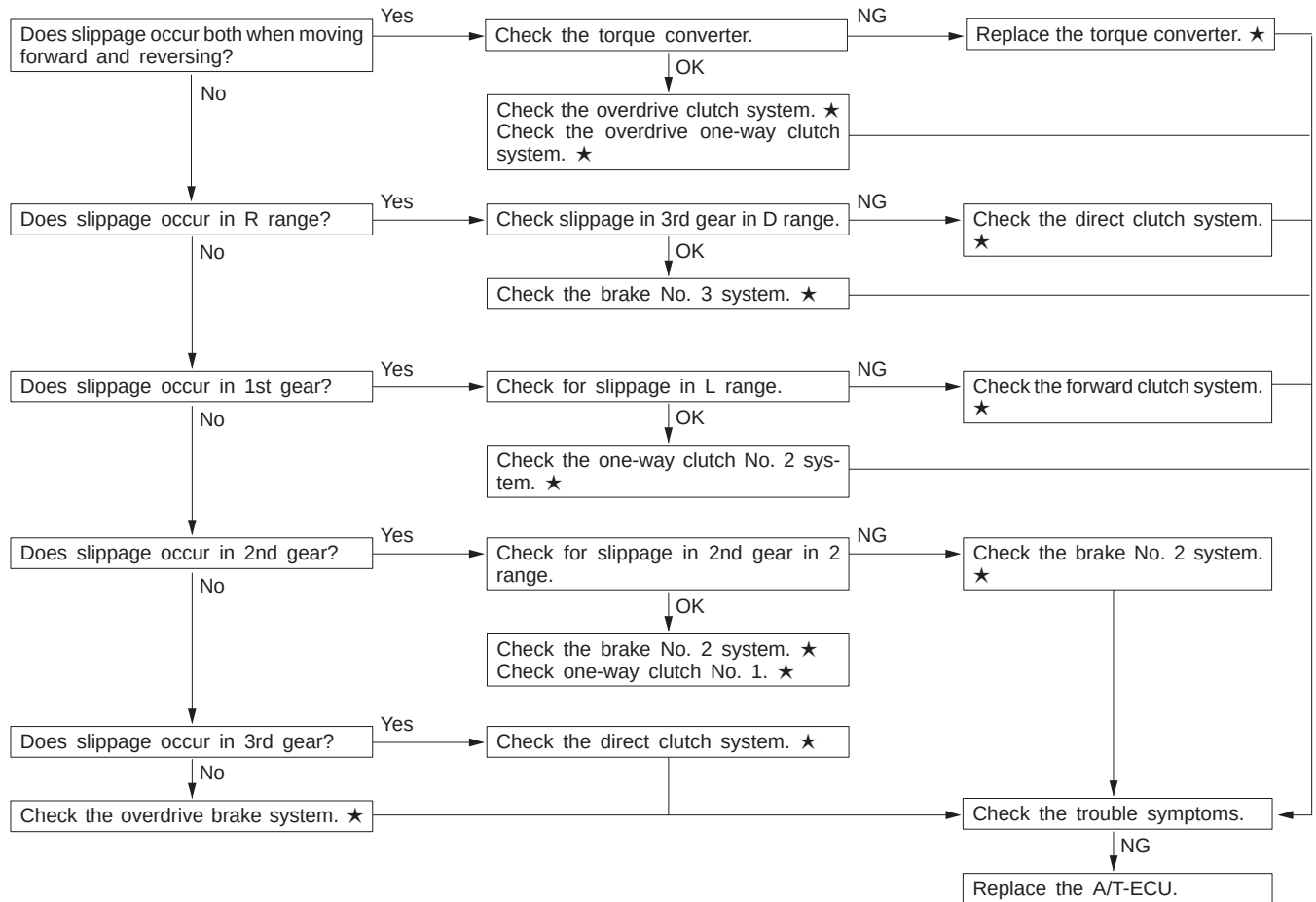
★: Refer to the Transmission Workshop Manual.



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

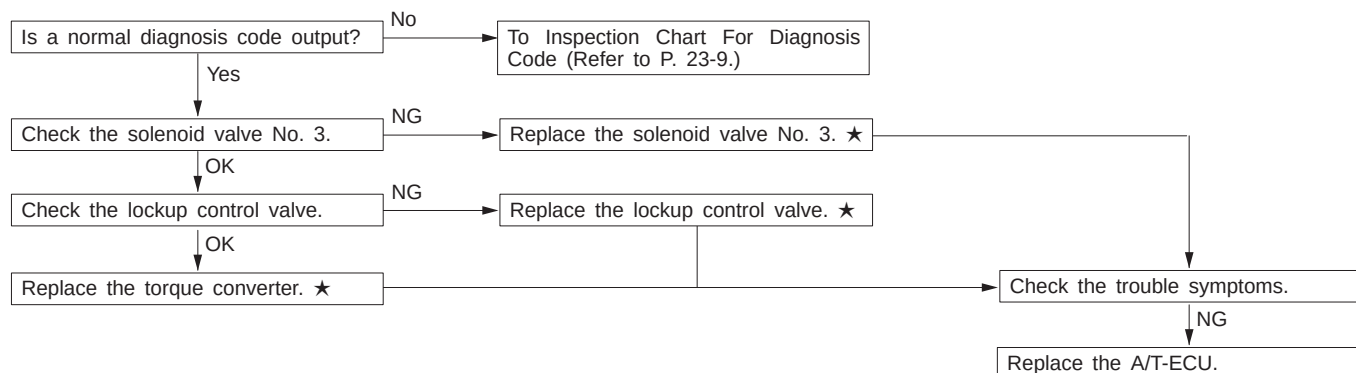
★: Refer to the Transmission Workshop Manual.



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

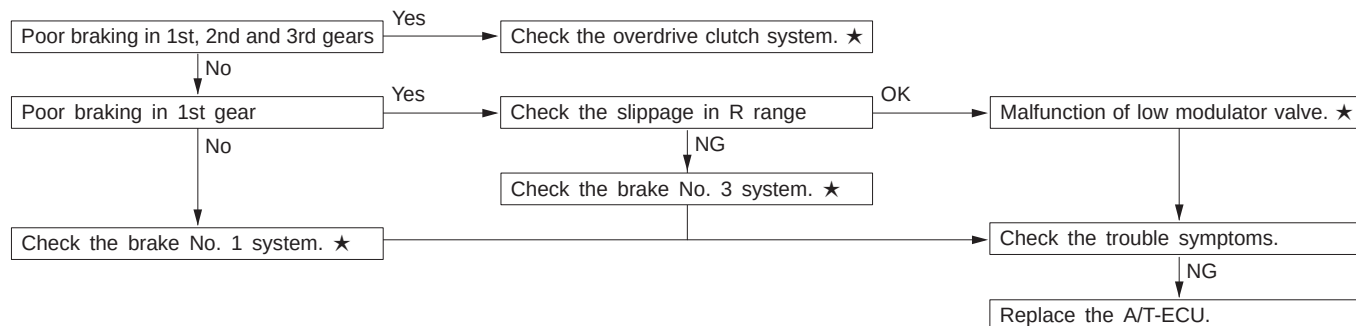
★: Refer to the Transmission Workshop Manual.



INSPECTION PROCEDURE 13

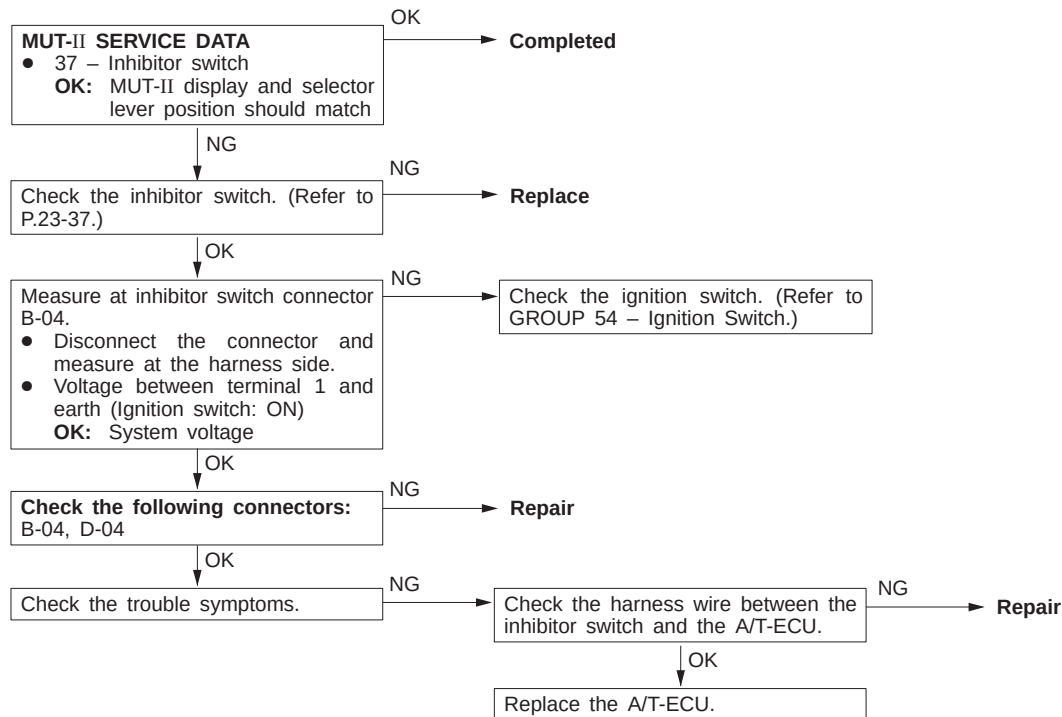
Abnormal engine braking	Probable cause
Engine braking effectiveness is poor after downshifting has occurred.	• Malfunction of overdrive clutch • Malfunction of brake No. 1, No. 3 • Malfunction of valve body • Malfunction of A/T-ECU

★: Refer to the Transmission Workshop Manual.



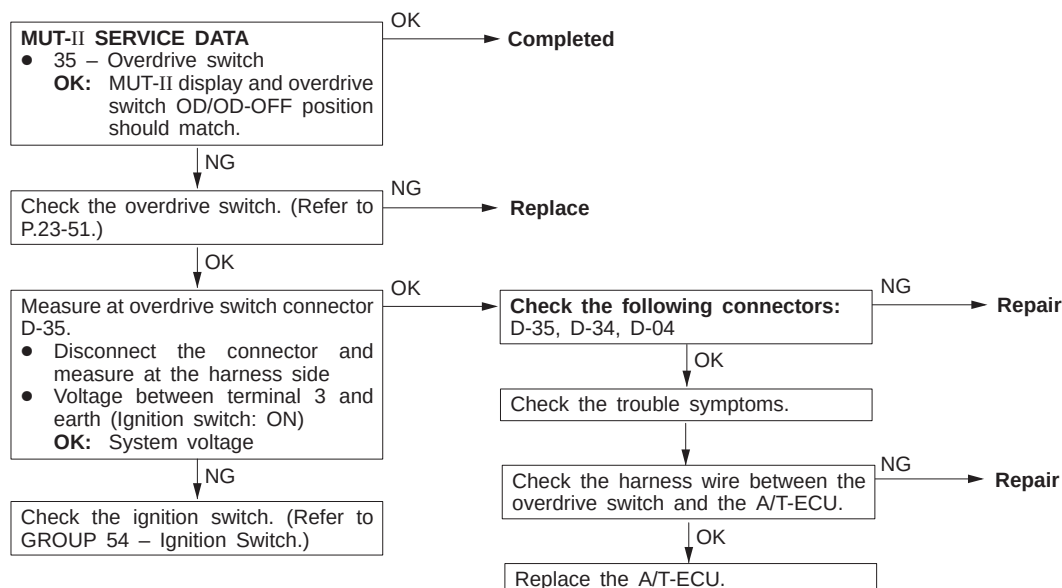
INSPECTION PROCEDURE 14

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



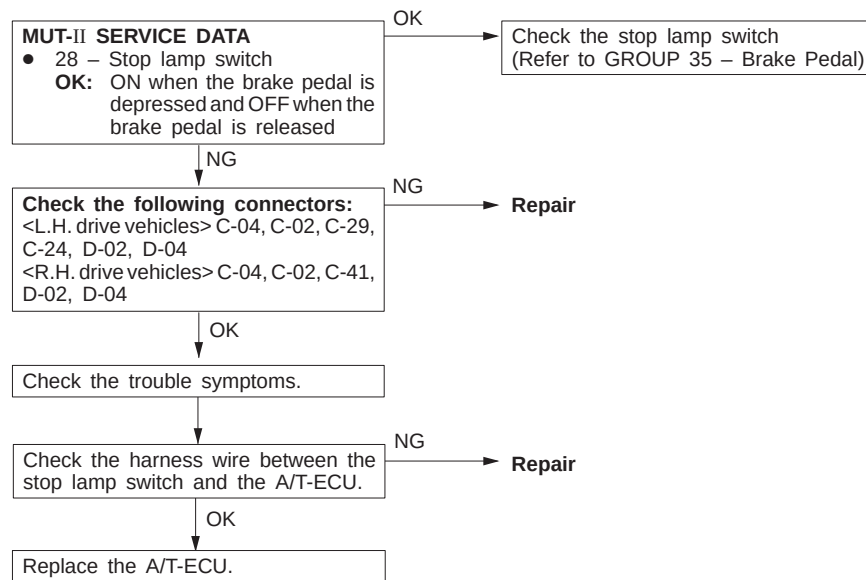
INSPECTION PROCEDURE 15

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

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

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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

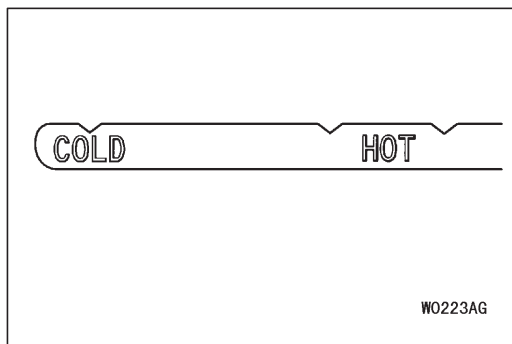
Caution

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**

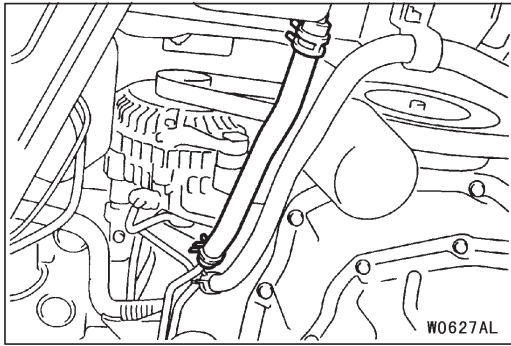
NOTE

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.

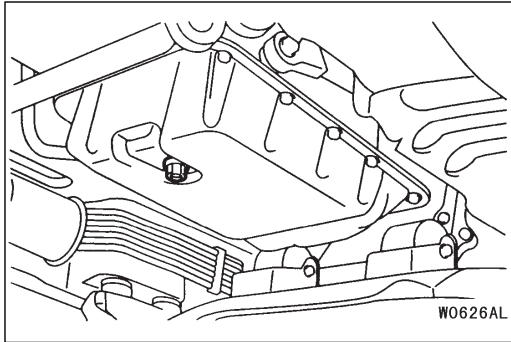
1. Disconnect the hose shown in the illustration which connects the transmission and the A/T fluid cooler (inside the radiator).
2. Start the engine and let the A/T fluid drain out.

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.

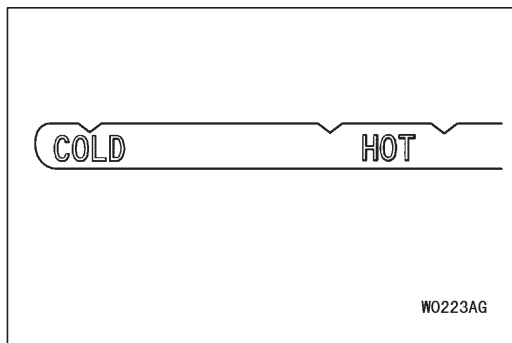
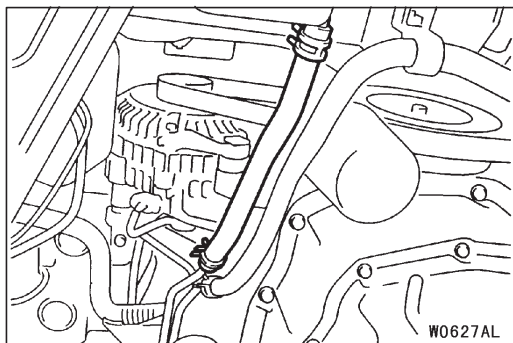
NOTE

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



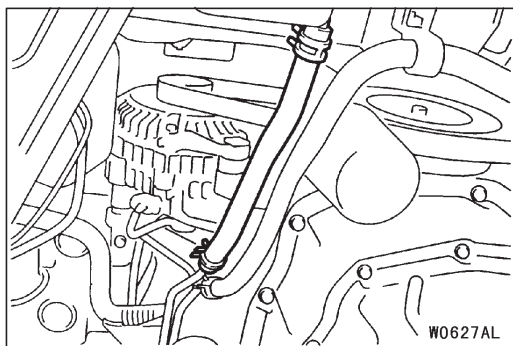
8. Reconnect the hose which was disconnected in step 1 above, and firmly replace the oil level gauge.
9. Start the engine and run it at idle for 1 – 2 minutes.
10. Move the selector lever through all positions, and then move it to the N position.

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.

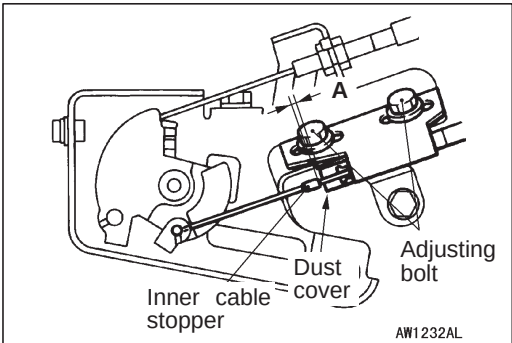
- 4. Repeat the procedure in step 2.

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.



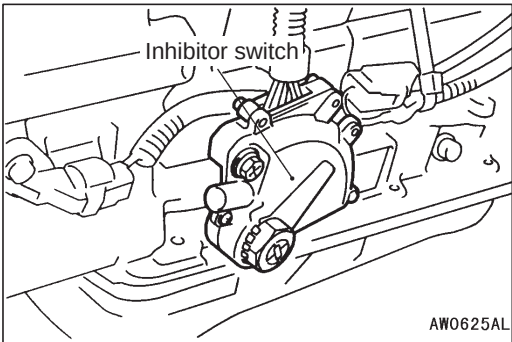
KICKDOWN CABLE CHECK AND ADJUSTMENT

- 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

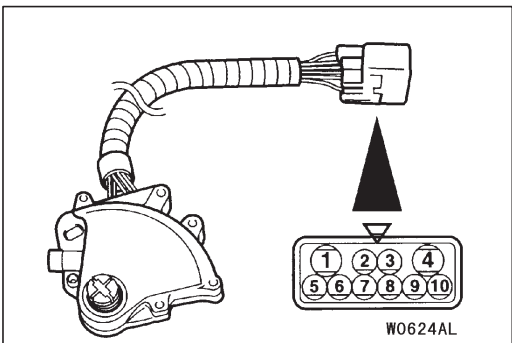
Caution

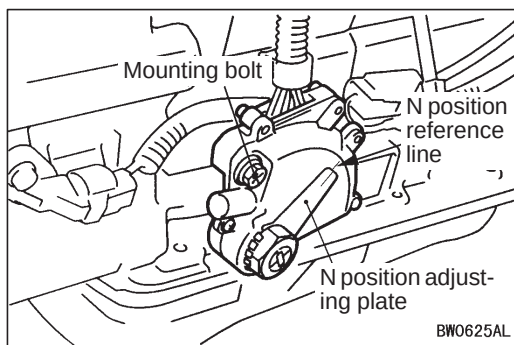
Adjust the accelerator cable assembly after the kickdown cable adjustment.



INHIBITOR SWITCH CONTINUITY CHECK

Position	Terminal No.									
	1	2	3	4	5	6	7	8	9	10
P	○			○		○		○		
R							○	○		
N	○			○	○			○		
D		○						○		
2								○		○
L			○					○		

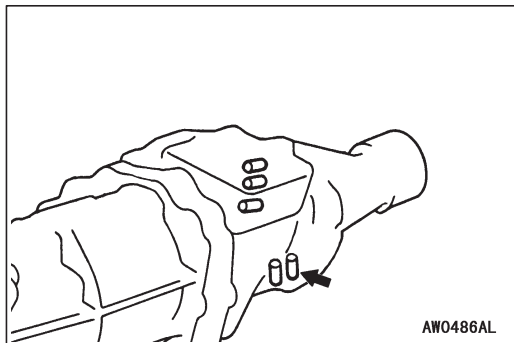




INHIBITOR SWITCH AND CONTROL CABLE ADJUSTMENT

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.

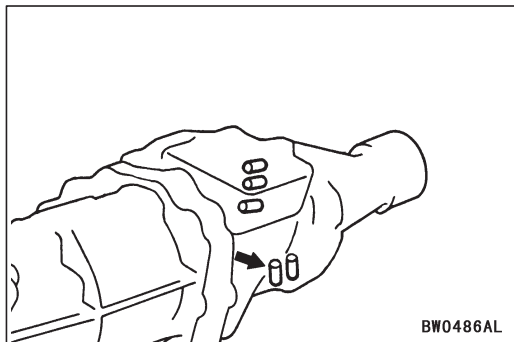
Tightening torque: 5.4 Nm



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.

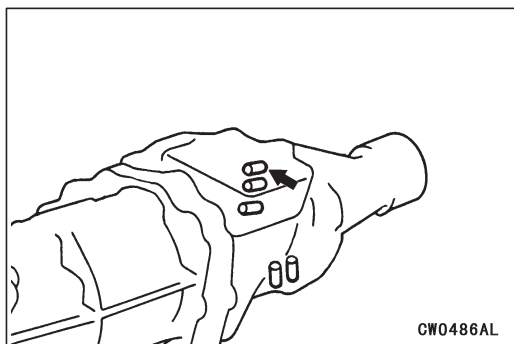
Transfer lever position	Continuity
4H	No continuity
4HLc	Continuity



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.

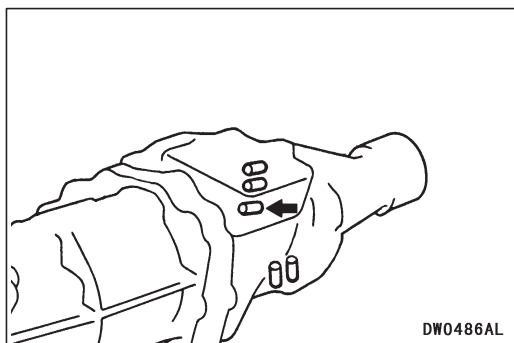
Transfer lever position	Continuity
2H	Continuity
4H	No continuity



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.

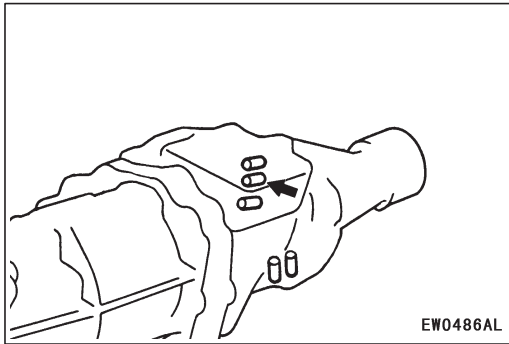
Transfer lever position	Continuity
4H	No continuity
4HLc	Continuity



4WD OPERATION DETECTION SWITCH CONTINUITY CHECK

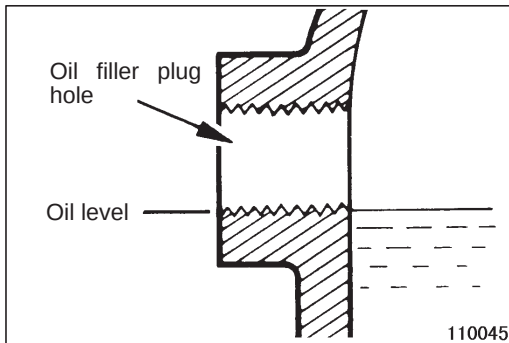
Check the continuity between the terminal of the white connector installed in the top of transfer case (shown in the illustration) and the transfer case.

Transfer lever position	Continuity
2H	No continuity
4H	Continuity

**HIGH/LOW DETECTION SWITCH CONTINUITY CHECK**

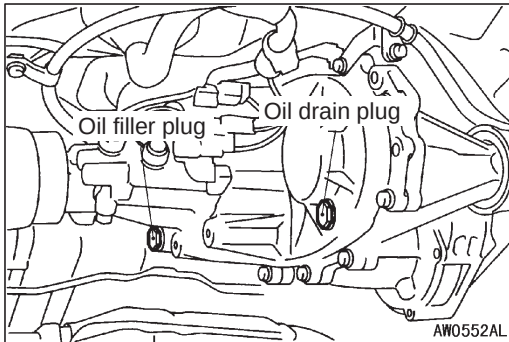
Check the continuity between the terminal of the black connector installed in the top of transfer case (shown in the illustration) and the transfer case.

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**

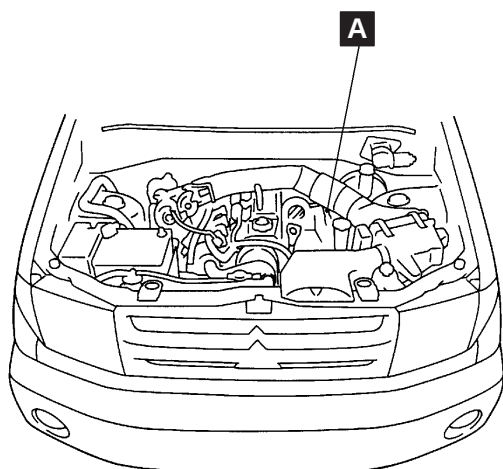
Quantity: 2.2 ℓ

4. Tighten the oil filler plug to the specified torque.

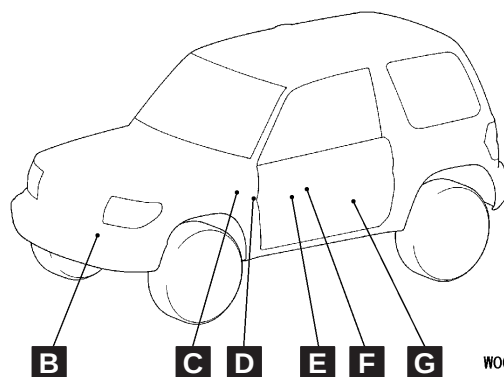
Tightening torque: 29 – 34 Nm

A/T CONTROL COMPONENT LOCATION

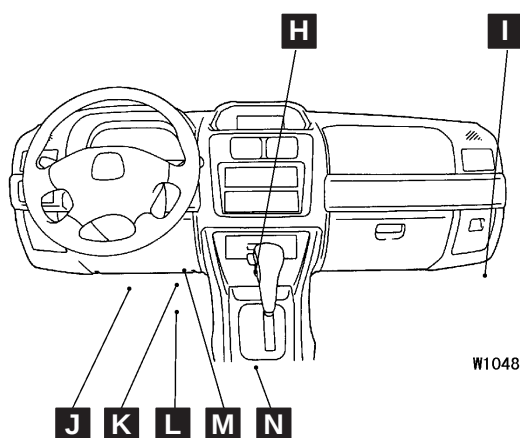
Name	Symbol	Name	Symbol
Accelerator pedal position sensor (APS)	K	Inhibitor switch	D
		Input shaft speed sensor	C
A/T-ECU	N	Output shaft speed sensor	F
A/T fluid temperature sensor	E	Overdrive switch	H
Diagnosis connector	M	Solenoid valves	E
Dual-pressure switch	A	Stop lamp switch	J
Engine-ECU	I	Vehicle speed sensor	G
Free wheeling engage switch	B	Wide open throttle position switch	L



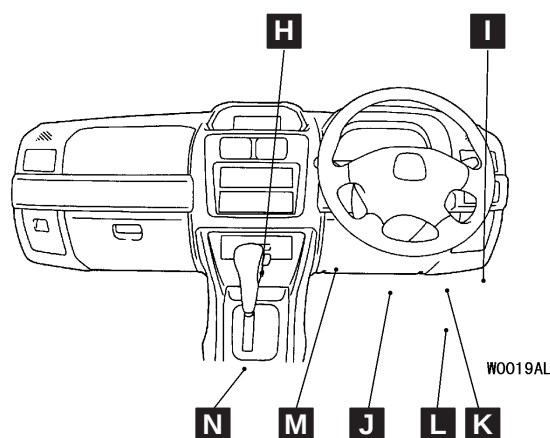
W1044AL



W0011AL



W1048AL



W0019AL

A/T CONTROL COMPONENT CHECK**OVERDRIVE SWITCH CHECK**

Refer to P.23-51.

WIDE OPEN THROTTLE SWITCH CHECK

Refer to P.23-51.

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

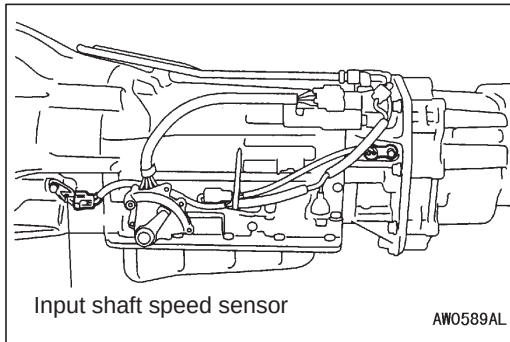
Refer to GROUP 54 – On-vehicle Service.

DUAL-PRESSURE SWITCH CHECK

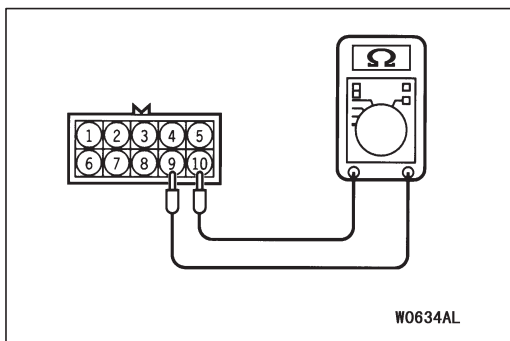
Refer to GROUP 55 – On-vehicle Service.

FREE WHEELING ENGAGE SWITCH CHECK

Refer to GROUP 26 – On-vehicle Service.

**INPUT SHAFT SPEED SENSOR CHECK**

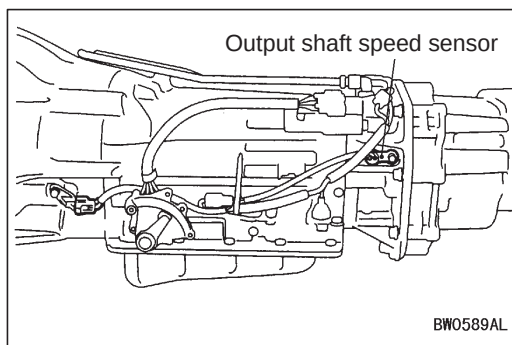
1. Disconnect the input shaft speed sensor connector.



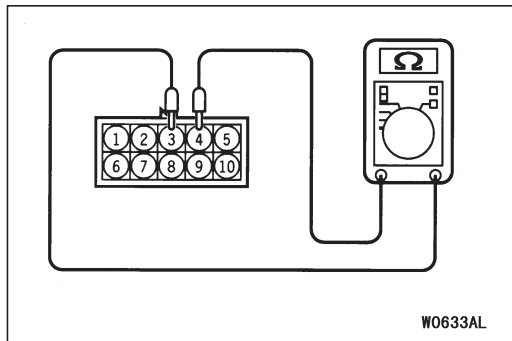
2. Measure the resistance between terminals 9 and 10 of the input shaft speed sensor connector.

Standard value: $620 \pm 60 \Omega$ (at 20°C)

3. If the resistance is not within the standard value, replace the input shaft speed sensor.

**OUTPUT SHAFT SPEED SENSOR CHECK**

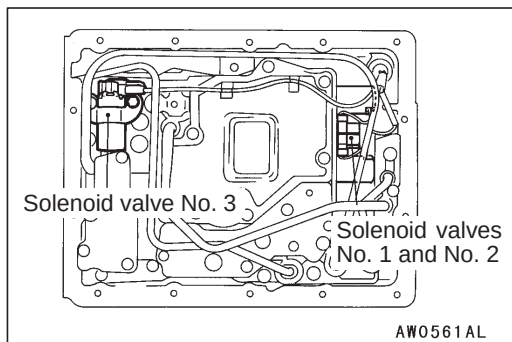
1. Disconnect the output shaft speed sensor connector.



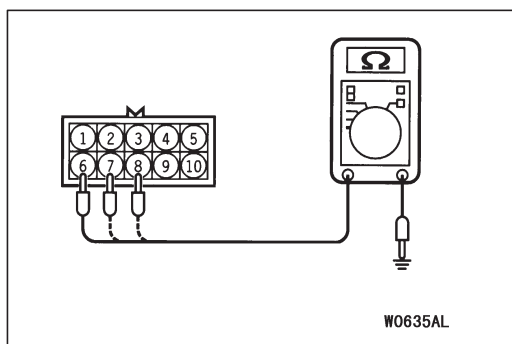
2. Measure the resistance between terminals 3 and 4 of the output shaft speed sensor connector.

Standard value: $430 \pm 43 \Omega$ (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.

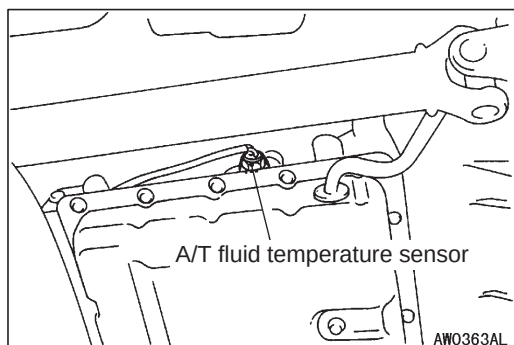


2. Measure the solenoid valve resistance.

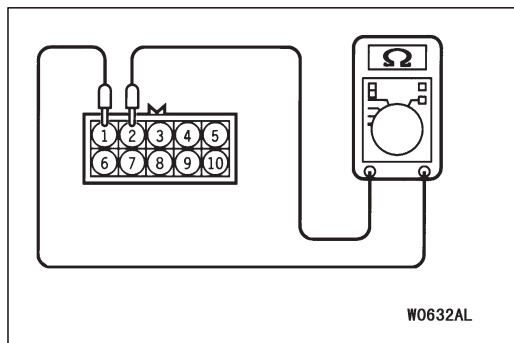
Standard value:

Item	Measurement terminal	Resistance
Solenoid valve No. 1	Between terminal 6 and earth	$13 \pm 2 \Omega$ (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.

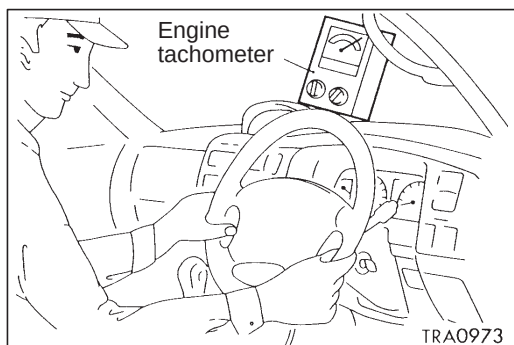


2. Measure the resistance between terminals 1 and 2 of the A/T fluid temperature sensor connector.

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

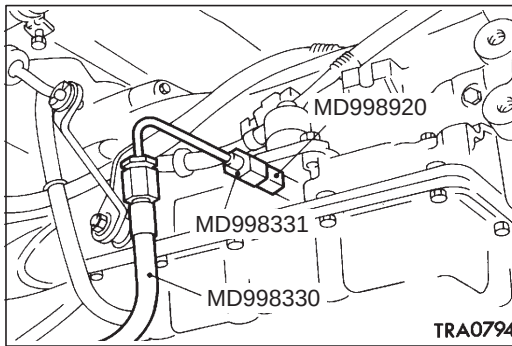
When doing so, do not keep the engine running with throttle full open for more than 5 seconds. If two or more stall tests are needed, place the selector lever in the “N” position and run the engine at about 1,000 r/min to allow the transmission fluid to cool before another stall test.

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.

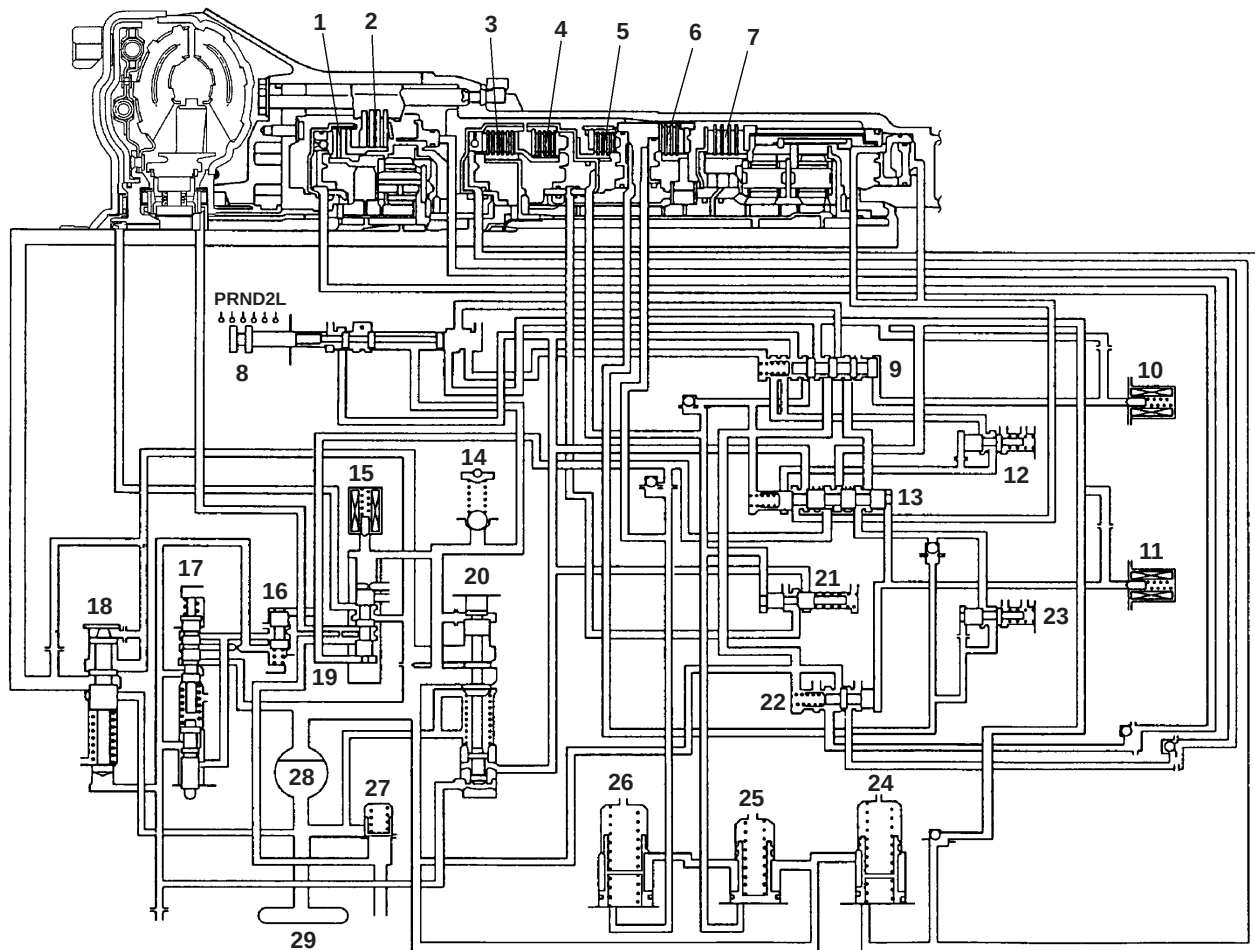
Standard value:

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

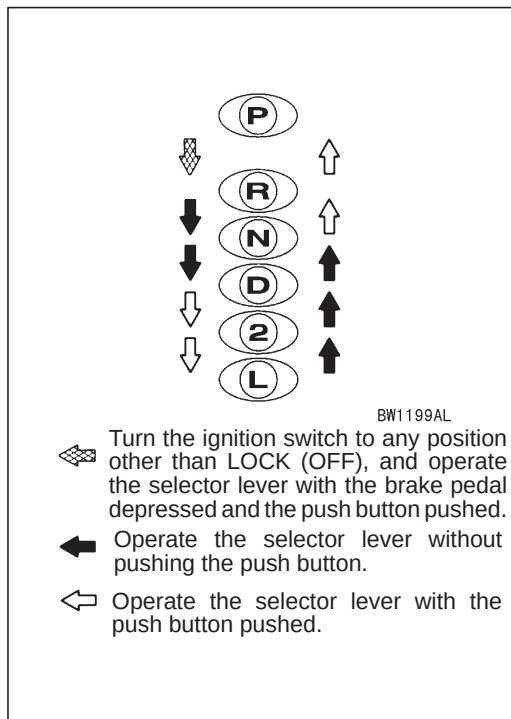
Hydraulic pressure higher than nominal in all ranges	(1) Regulator valve faulty (2) Throttle valve faulty (3) Throttle cable incorrectly adjusted
Hydraulic pressure lower than nominal in all ranges	(1) Oil pump faulty (2) Regulator valve faulty (3) Throttle valve faulty (4) Throttle cable incorrectly 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



AW0179AG

1. Overdrive clutch	16. Cut-back valve
2. Overdrive brake	17. Throttle valve
3. Forward clutch	18. Secondary regulator valve
4. Direct clutch	19. Lockup control valve
5. Brake No. 1	20. Primary regulator valve
6. Brake No. 2	21. Reverse clutch sequence valve
7. Brake No. 3	22. 3-4 shift valve
8. Manual valve	23. Intermediate modulator valve
9. 2-3 shift valve	24. Accumulator C1
10. Solenoid valve No. 1	25. Accumulator C2
11. Solenoid valve No. 2	26. Accumulator B2
12. Low coast modulator valve	27. Oil cooler bypass valve
13. 1-2 shift valve	28. Oil pump
14. Pressure relief valve	29. Oil strainer
15. Solenoid valve No. 3	



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.

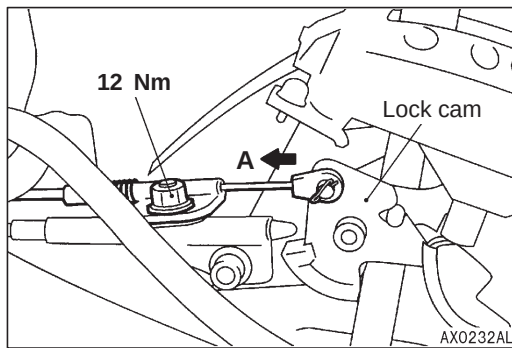
NOTE

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).

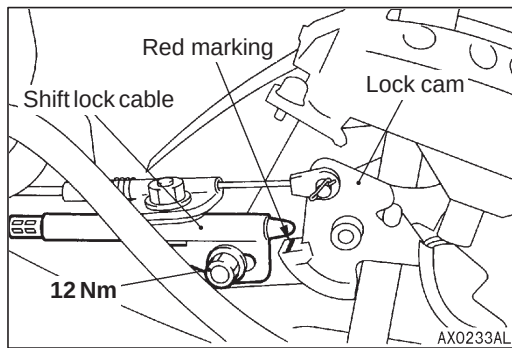
Tightening torque: 12 Nm

- (6) Install the rear floor console. (Refer to GROUP 52A.)

SHIFT LOCK MECHANISM CHECK

1. Carry out the following inspection:

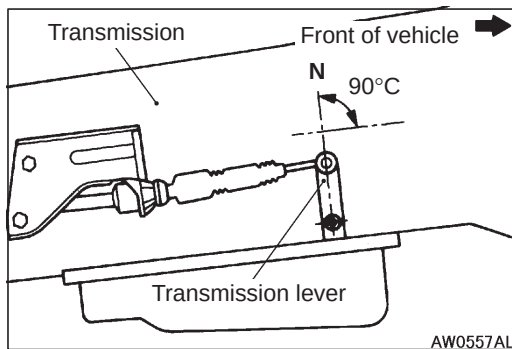
Inspection procedure	Requirements		Normal condition
1	Brake pedal: Depressed	Ignition key: ACC	If the selector lever push button is not pushed, the selector lever can not be moved from P position.
2			If the selector lever push button is pushed, the selector lever can be moved from P position.
3	Brake 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.

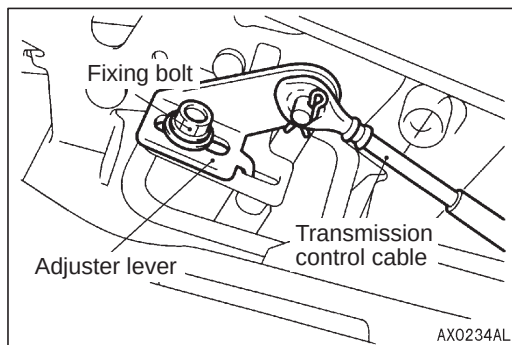
Tightening torque: 12 Nm

- (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.

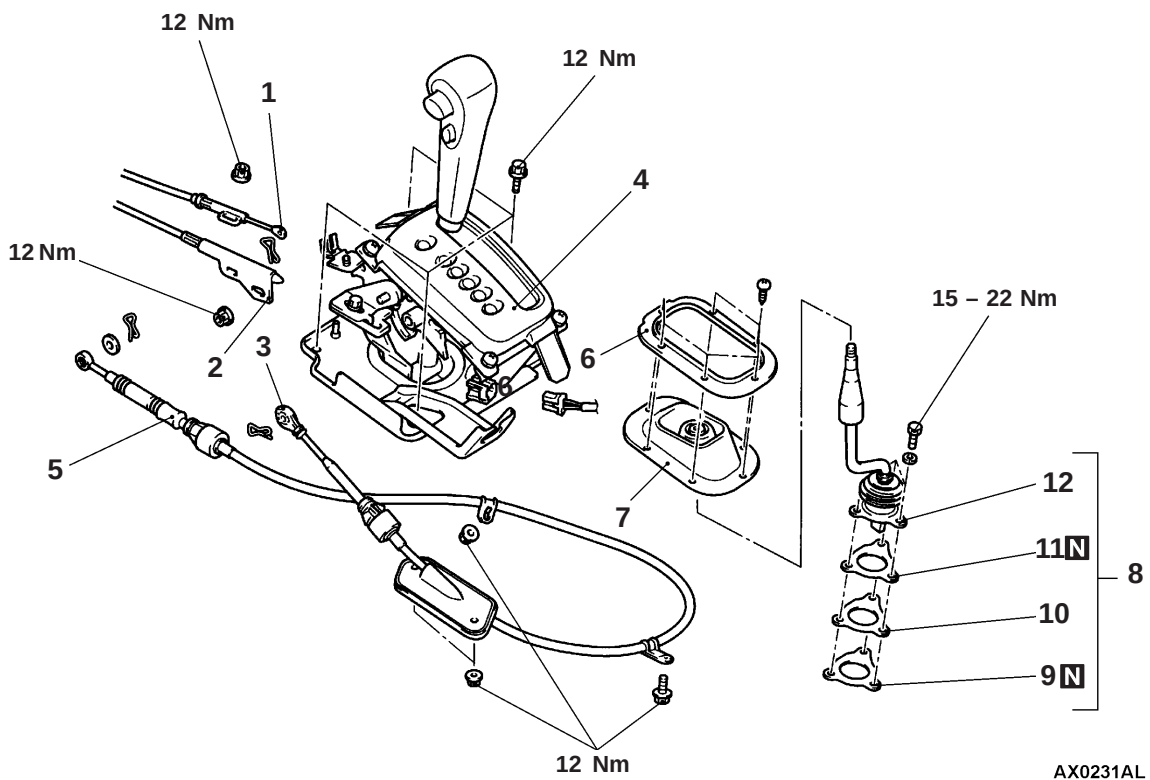
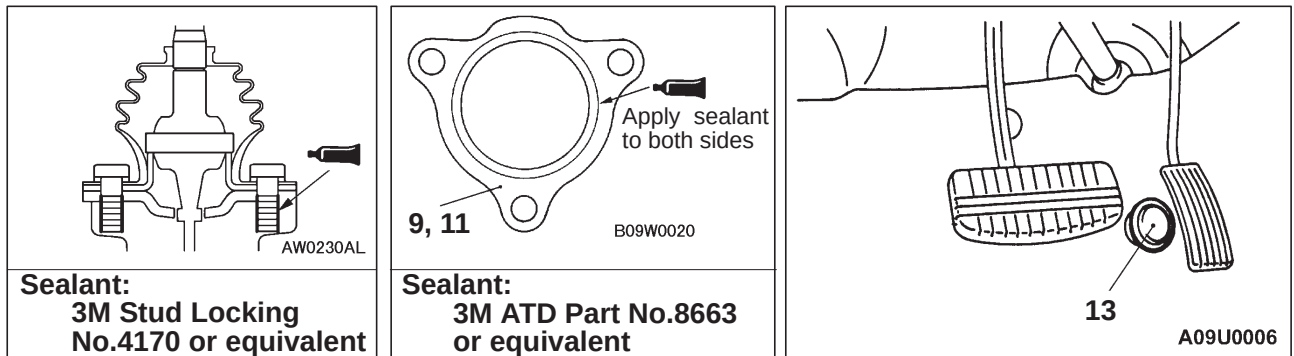


TRANSMISSION CONTROL

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.



Selector lever assembly and transmission control cable assembly removal steps

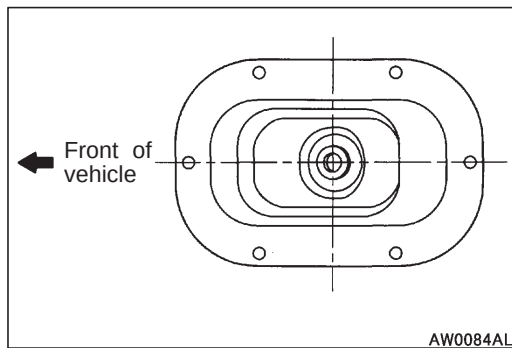
- Rear floor console assembly (Refer to GROUP 52A.)
- 1. Key interlock cable connection
- 2. Shift lock cable connection
- 3. Transmission control cable connection (selector lever side)
- 4. Selector lever assembly
- 5. Transmission control cable connection (transmission side)

Transfer control lever assembly removal steps

- Front floor console assembly (Refer to GROUP 52A.)
- 6. Retainer plate
- 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

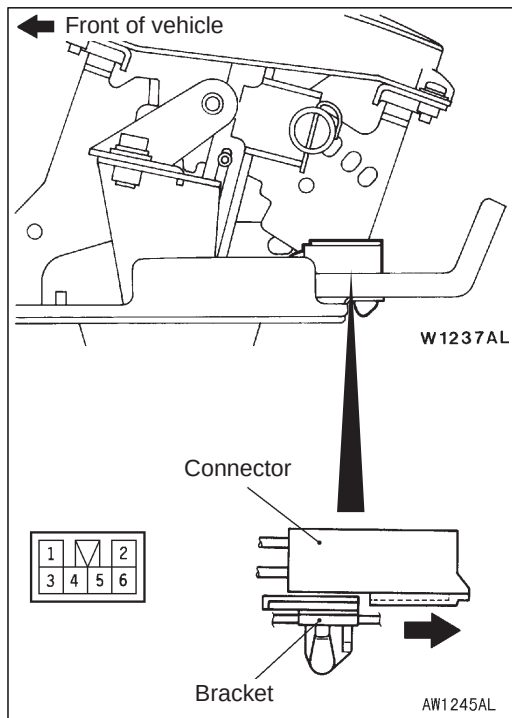
- 13. Wide open throttle switch



INSTALLATION SERVICE POINT

▶◀ TRANSFER LEVER INNER BOOT INSTALLATION

Install the transfer lever inner boot as shown in the illustration.



INSPECTION

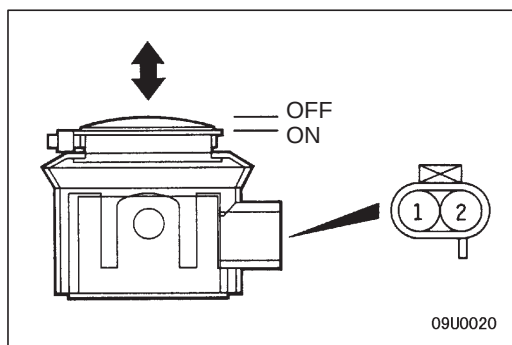
Slide the connector in the direction of arrow shown in the illustration to remove it from the bracket.

POSITION INDICATOR LAMP CHECK

Check requirement	Terminal No.	
	1	2
Always		

OVERDRIVE SWITCH CHECK

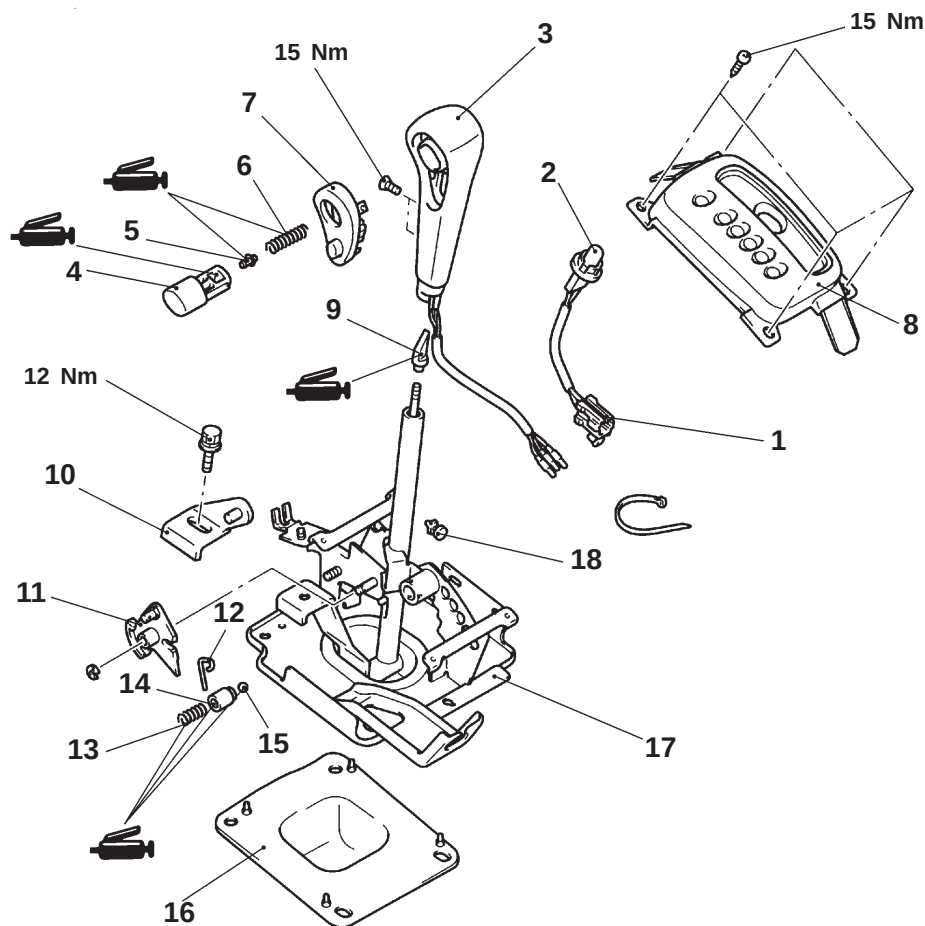
Switch position	Terminal No.		
	3	4	5
ON			
OFF			



WIDE OPEN THROTTLE SWITCH CHECK

Switch position	Terminal No.	
	1	2
OFF		
ON		

SELECTOR LEVER ASSEMBLY DISASSEMBLY AND REASSEMBLY



AX0235AL

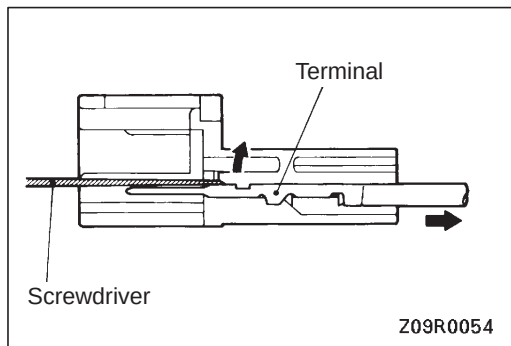
Disassembly steps



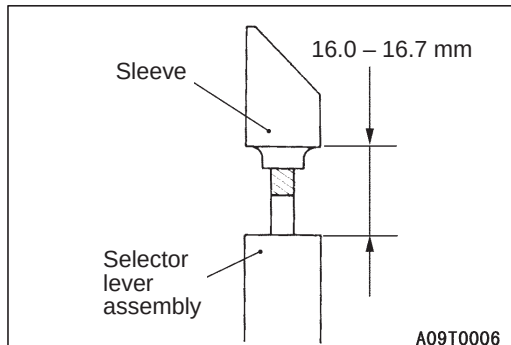
1. Position indicator socket assembly
2. Bulb
3. Shift knob
4. Push button
5. Stopper
6. Spring
7. Overdrive switch
8. Indicator panel assembly
9. Sleeve



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**

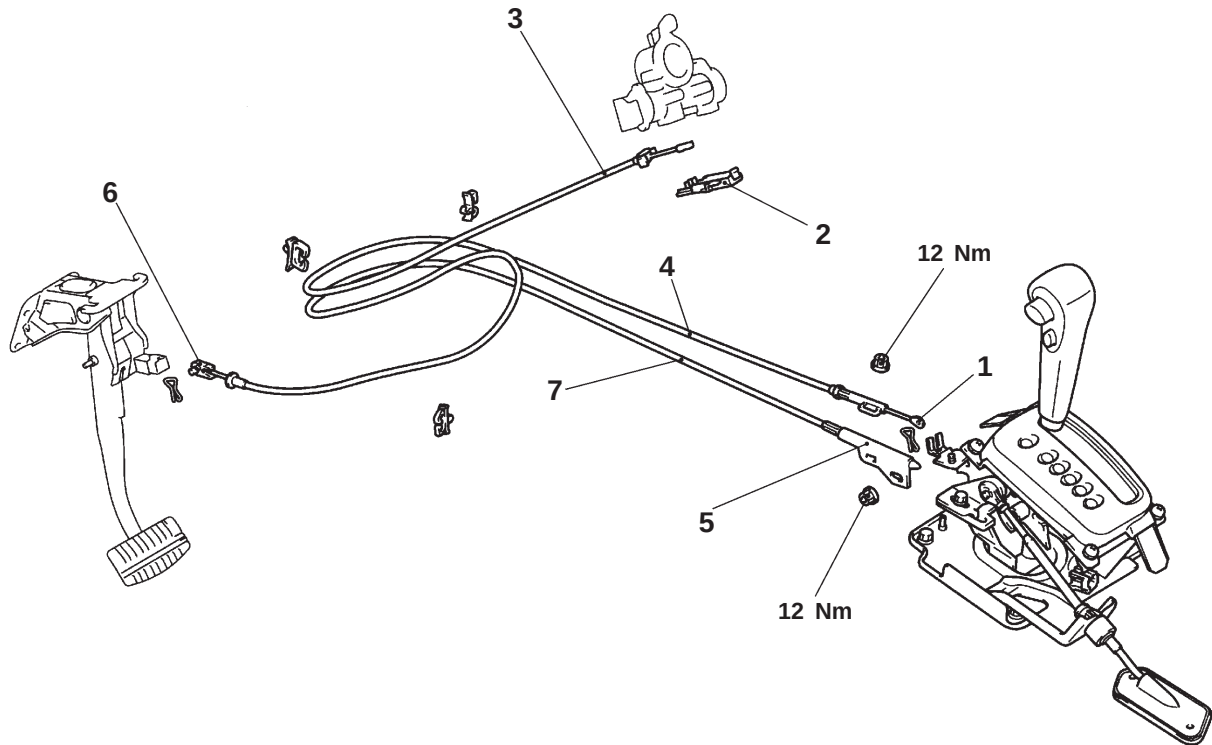
Use a flat-tipped screwdriver, etc. to remove the terminal of shift knob side from the position indicator socket assembly connector.

**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



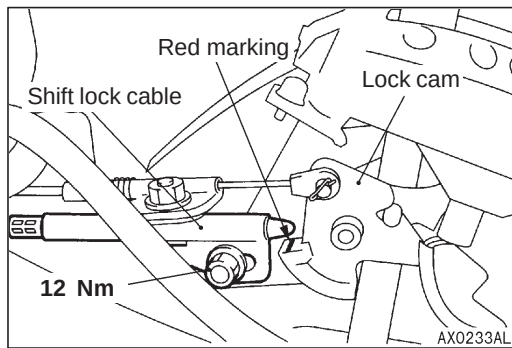
AX0230AL

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**

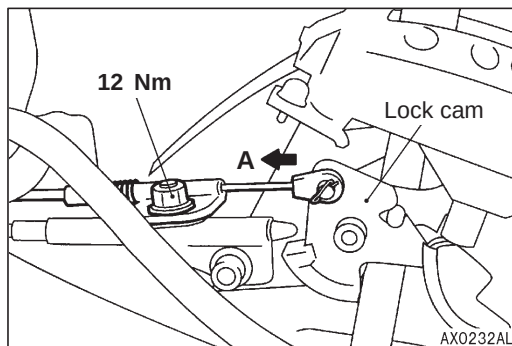
1. Move the selector lever to P position.
2. Move the shift lock cable to position the shift lock cable end above the red marking painted on the lock cam, and then tighten the shift lock cable fixing nut to the specified torque.

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

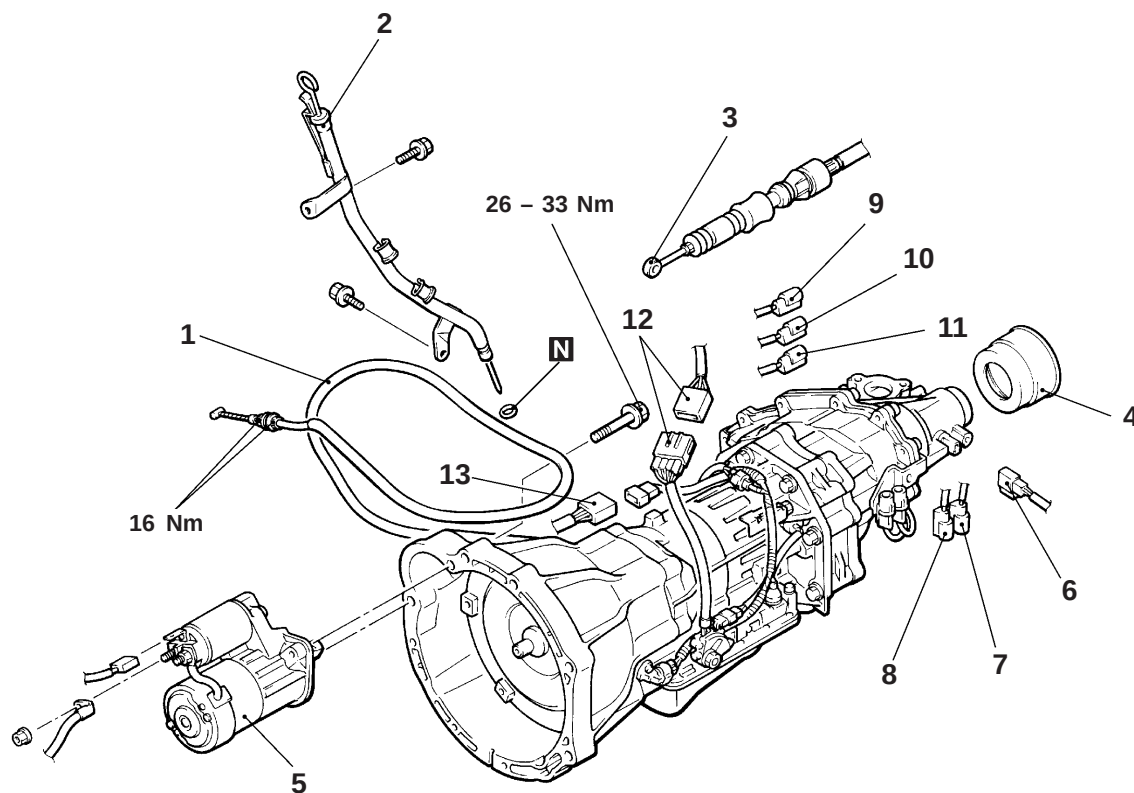
REMOVAL AND INSTALLATION

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.)

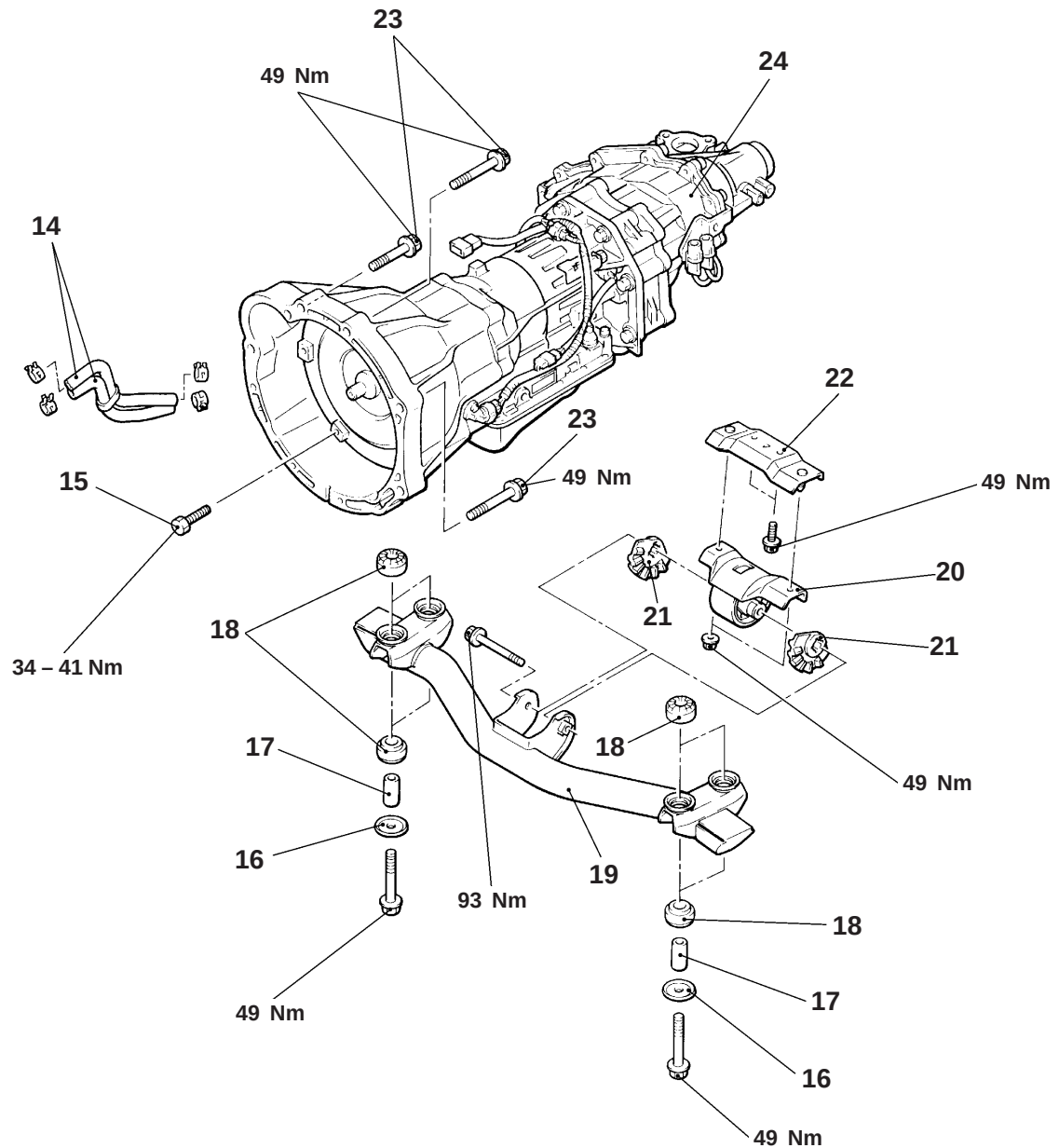


AW1238AL

Removal steps

1. Kick-down cable connection
2. Oil level gauge assembly
3. Transmission control cable connection
4. Dust shield guard
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





BW0699AL

◀B▶

- 14. Oil cooler hose
 - Oil pan removal (Refer to GROUP 11A.)
- 15. Drive plate connection bolt
 - Support the transmission with a transmission jack
- 16. Washer
- 17. Spacer

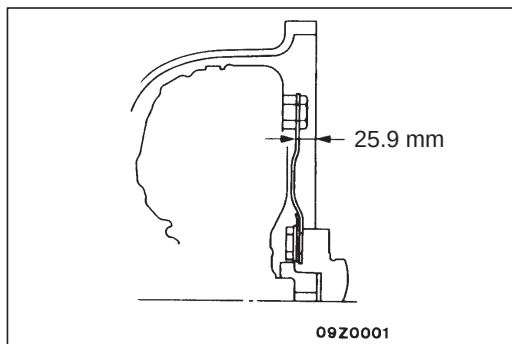
- 18. Transmission mount bushing
- 19. Transmission mount crossmember
- 20. Transmission mount insulator assembly
- ▶B◀ 21. Transmission mount stopper
- 22. Adapter
- ▶A◀ 23. Transmission upper part coupling bolts
- 24. Transmission assembly

REMOVAL SERVICE POINTS**◀A▶ STARTER MOTOR REMOVAL**

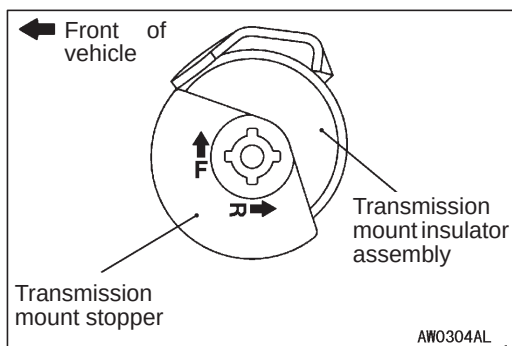
Remove the starter motor with the starter motor harnesses still connected, and secure it inside the engine compartment.

◀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**

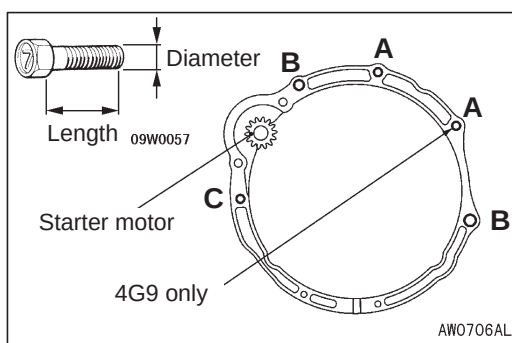
Press in the torque converter to the transmission side completely, and then install the transmission assembly to the engine.

**▶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.

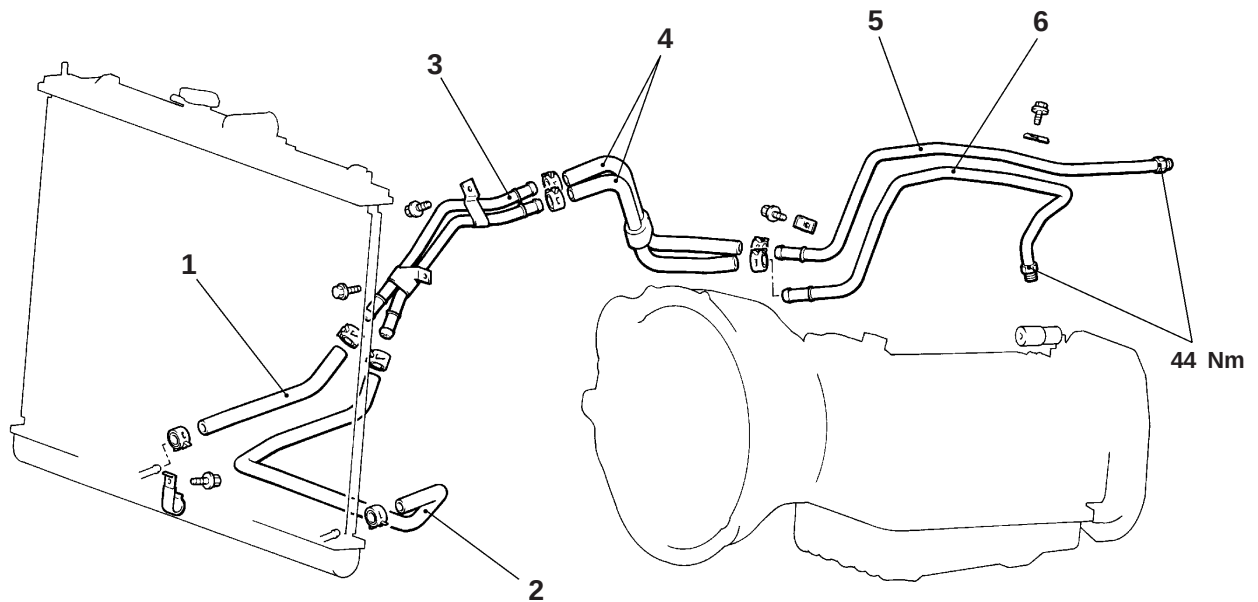
Bolt	Diameter x Length mm
A	10 x 50
B	10 x 60
C	10 x 40

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



AW0086AL

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

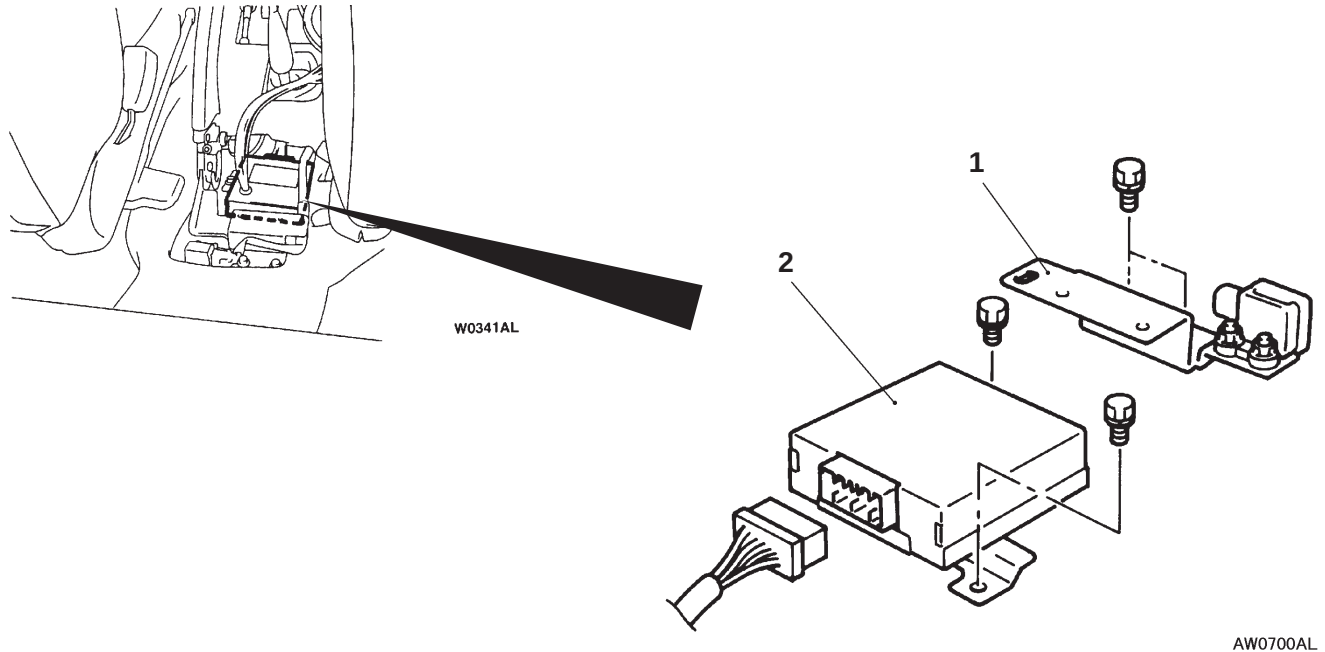
A/T-ECU

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.

PROPELLER SHAFT

CONTENTS

GENERAL INFORMATION	2	SPECIAL TOOL	2
SERVICE SPECIFICATIONS	2	PROPELLER SHAFT	3
LUBRICANT	2		



GENERAL INFORMATION

A two-joint propeller shaft was used for both the front and rear.

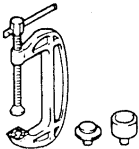
SERVICE SPECIFICATIONS

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

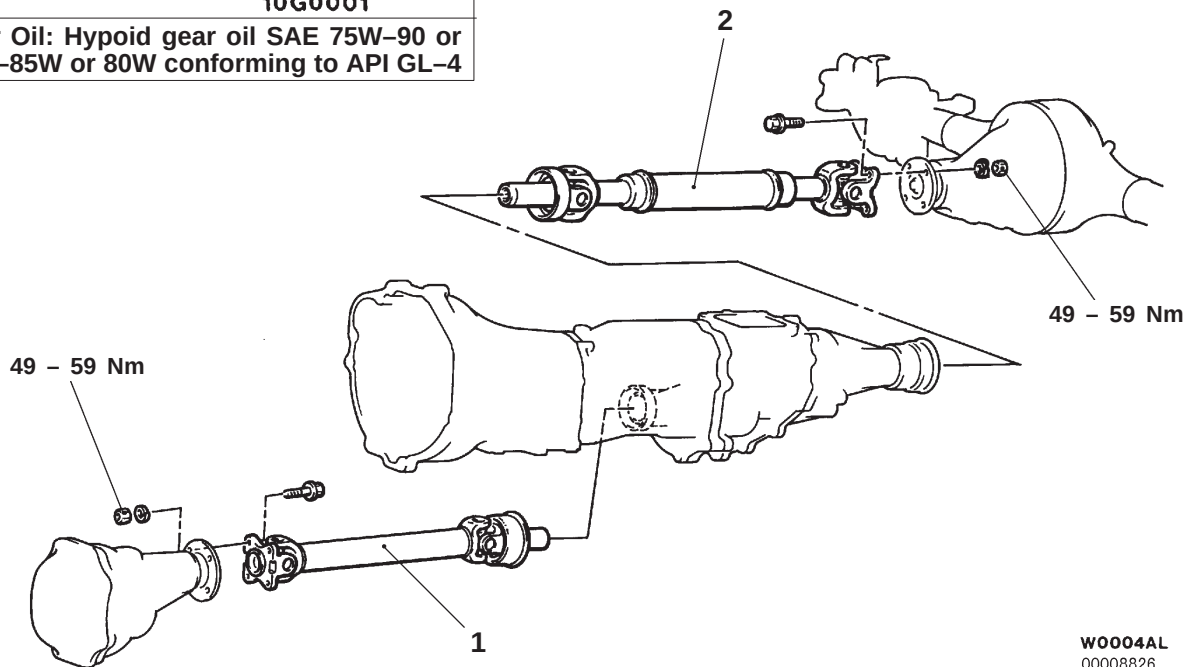
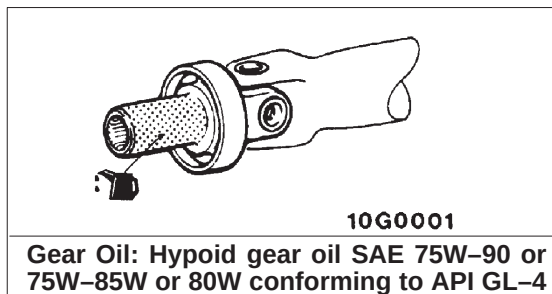
Do not reuse the rear propeller shaft already shrunk due to a big impact. The rear propeller shaft has impact-absorption mechanism (shrinkage).

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.)



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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.

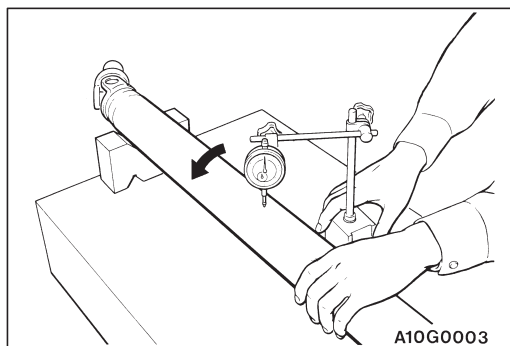
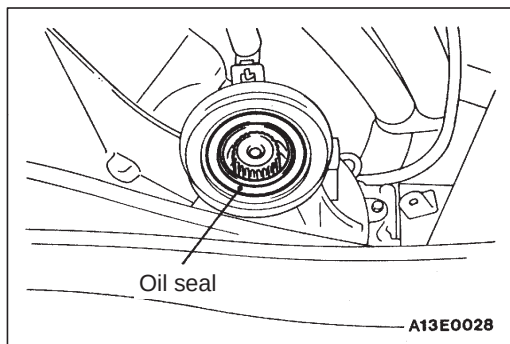
INSTALLATION SERVICE POINT

▶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.



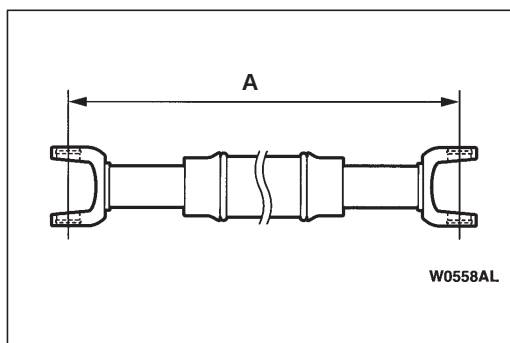
INSPECTION

PROPELLER SHAFT RUNOUT

Limit:

Front propeller shaft: 0.5 mm

Rear propeller shaft: 0.4 mm



REAR PROPELLER SHAFT

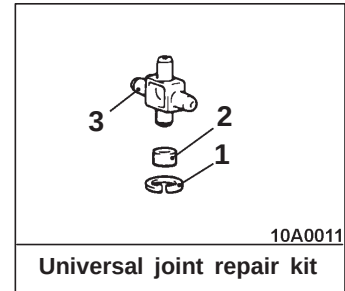
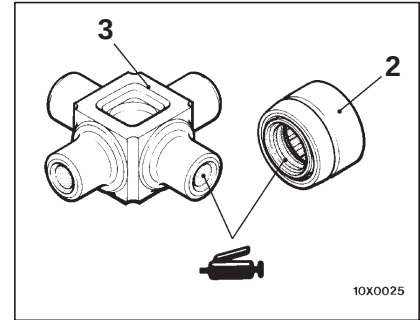
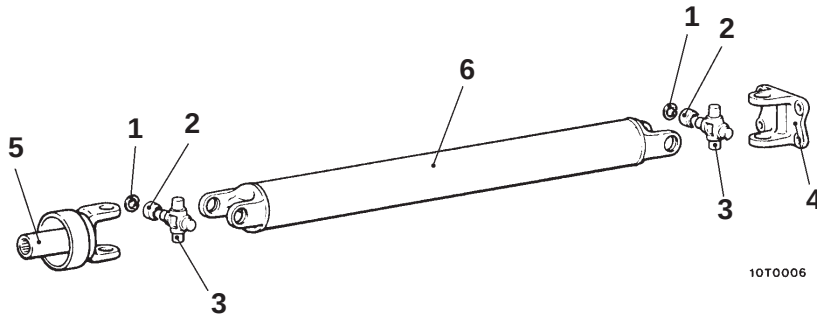
1. Measure length A.

Standard value:

630 ± 1.5 mm

2. If the standard value is not met, replace the rear propeller shaft.

DISASSEMBLY AND REASSEMBLY



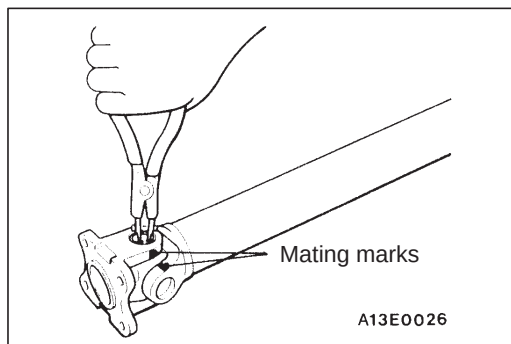
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Disassembly steps



1. Snap ring
2. Journal bearing
3. Journal

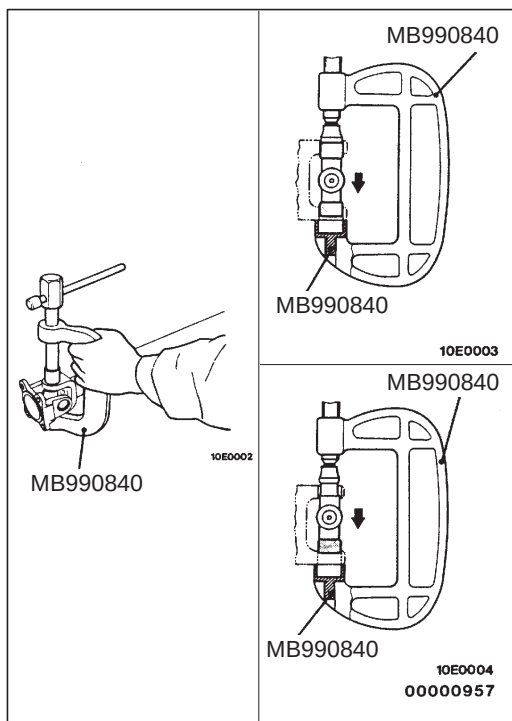
4. Flange yoke
5. Sleeve yoke
6. Propeller shaft



DISASSEMBLY SERVICE POINTS

◀A▶ SNAP RING REMOVAL

Make mating marks on the flange yoke, sleeve yoke and propeller shaft. Then, remove the snap rings.

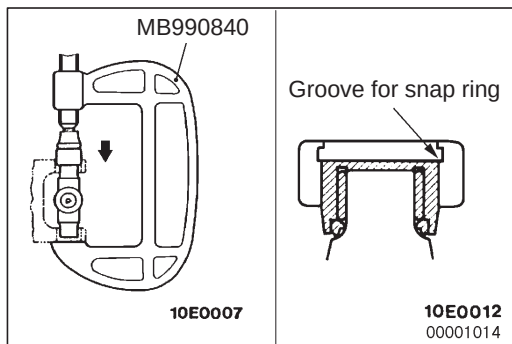


◀B▶ JOURNAL BEARING REMOVAL

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

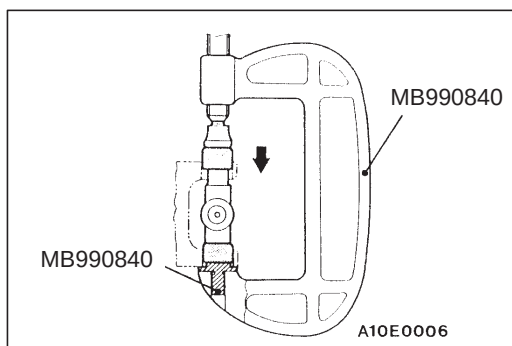
Do not tap the journal bearing to remove. Tapping the journal bearing will upset the balance of the propeller shaft.



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.

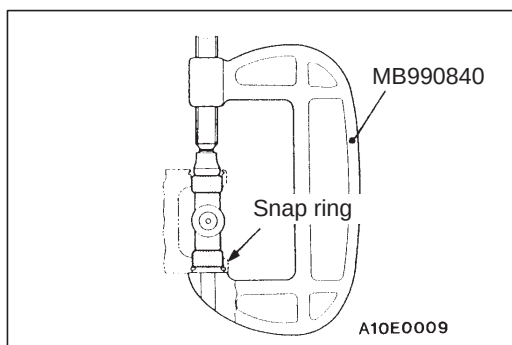


2. Using the special tools, press in the journal bearing on the opposite side to the yoke.

Caution

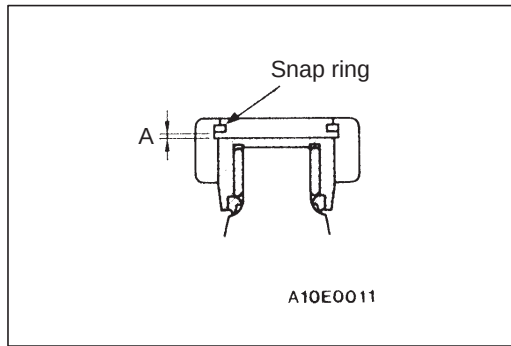
Press in the journal bearing straight, or the journal could damage the inside of the journal bearing.

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

FRONT AXLE

CONTENTS

GENERAL INFORMATION	2	Solenoid Valve Operation Check	12
SERVICE SPECIFICATIONS	4	HUB AND KNUCKLE ASSEMBLY	14
LUBRICANTS	4	DRIVE SHAFT	19
SEALANTS AND ADHESIVES	5	MAIN SHAFT	26
SPECIAL TOOLS	5	DIFFERENTIAL CARRIER	28
ON-VEHICLE SERVICE	10	FREE-WHEELING CLUTCH ASSEMBLY	45
Wheel Bearing Axial Play Check	10	SOLENOID VALVE, VACUUM PIPES AND	
Front Axle Total Backlash Check	10	VACUUM TANK	48
Front Axle Gear Oil Level Check	11	FRONT DIFFERENTIAL MOUNT	50
Hub Bolt Replacement	11		
Differential Carrier Oil Seal Replacement	11		

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

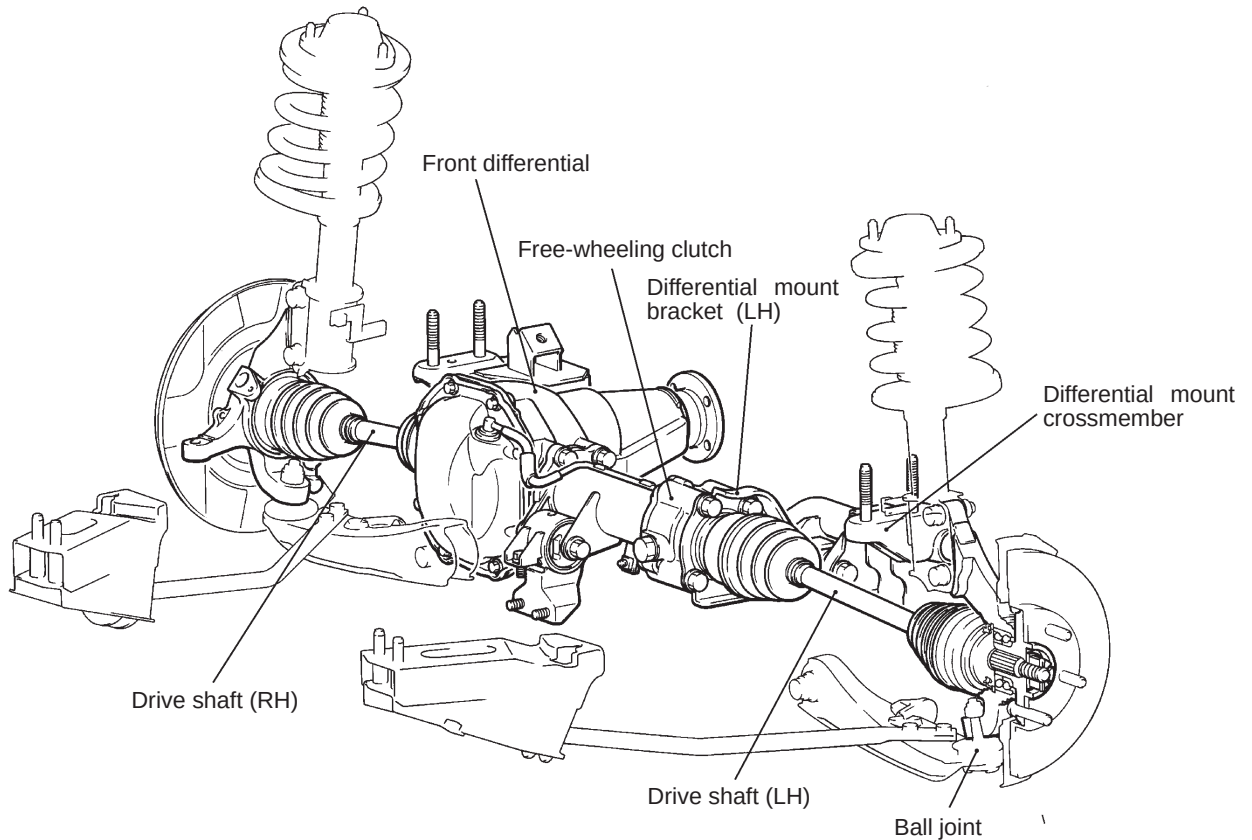
Item			Specifications
Drive gear type			Hypoid gear
Reduction ratio			4.875
Differential gear type			Straight bevel gear
Number of teeth	Drive gear		39
	Drive pinion		8
	Side gear		14
	Pinion gear		10
Bearing (O.D. × I.D.) mm		Side	72.0 × 35.0*1, 80.0 × 45.0*2
		Front	62.0 × 25.0*1, 64.0 × 30.0*2
		Rear	72.0 × 35.0*1, 76.0 × 36.5*2

NOTE

*1: A/T

*2: M/T

CONSTRUCTION DIAGRAM

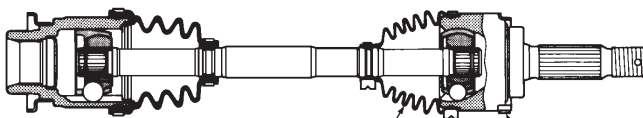


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**Drive shaft
(LH)**

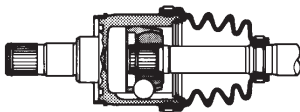
Differential side D.O.J.

B.J.



(RH)

Differential side



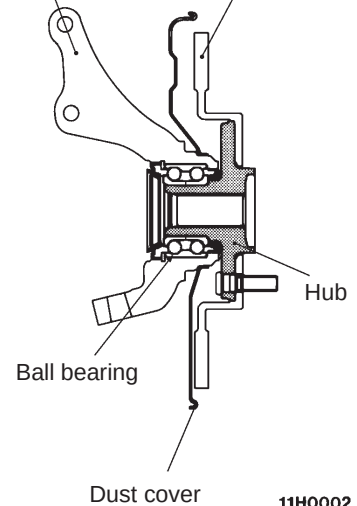
Plastic BJ boot

ABS rotor

11H0001

Knuckle

Brake disc



11H0002
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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

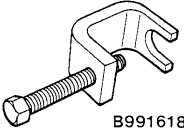
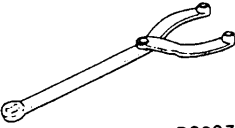
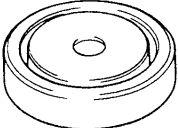
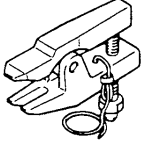
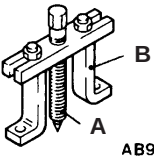
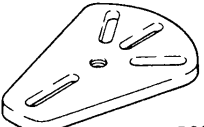
LUBRICANTS

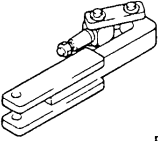
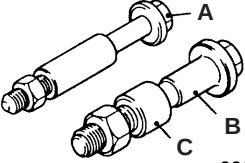
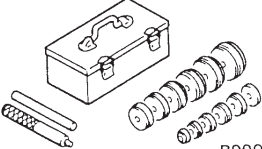
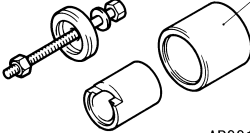
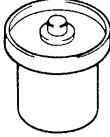
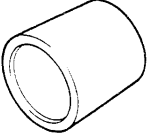
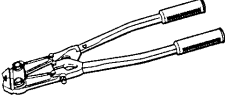
Items		Specified lubricants	Quantity
Gear oil	Front differential	Hypoid gear oil API classification GL-5 or higher SAE viscosity No.90, 80W	0.83 ℓ
	Free-wheeling clutch		0.12 ℓ
D.O.J.		Repair kit grease	<A/T> 85 g <M/T> 100 g
B.J.		Repair kit grease	<A/T> 85 g <M/T> 110 g

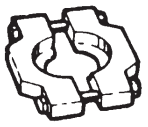
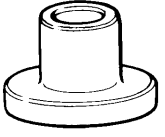
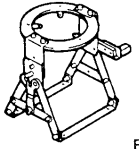
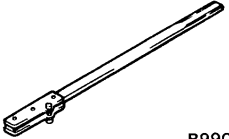
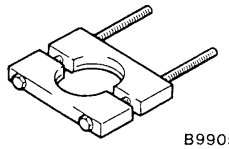
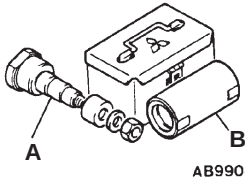
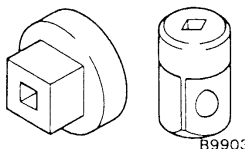
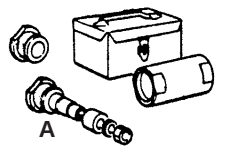
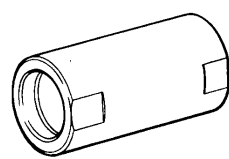
SEALANTS AND ADHESIVES

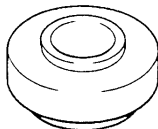
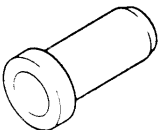
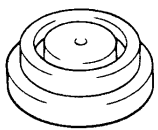
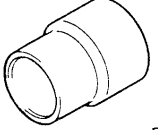
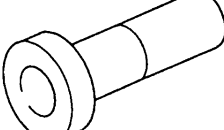
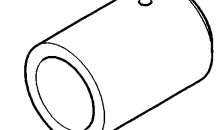
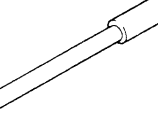
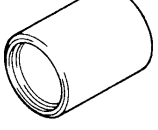
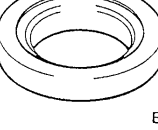
Items	Specified sealants and adhesives	Remarks
Front housing assembly and free-wheeling hosing assembly	3M ATD Part No.8661 or equivalent	Semi-drying sealant
Front housing assembly and differential carrier		
Vent plug		
Differential cover		
Drive gear and differential case mating surface	3M Stud Locking 4170 or equivalent	Anaerobic sealant

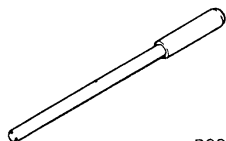
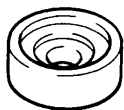
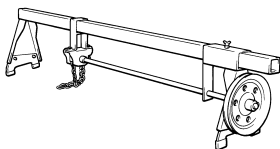
SPECIAL TOOLS

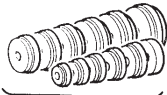
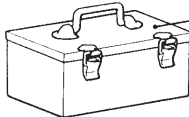
Tool	Number	Name	Use
 B991618	MB991618	Hub bolt remover	Hub bolt removal
 B990767	MB990767	Front hub and flange yoke holder	Hub fixing
 B990955	MB991115	Oil seal installer	- Front axle hub oil seal press-fitting (Used together with MB990938) - Housing tube dust seal press-fitting
 B991113	MB991406 or 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 base remover	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	

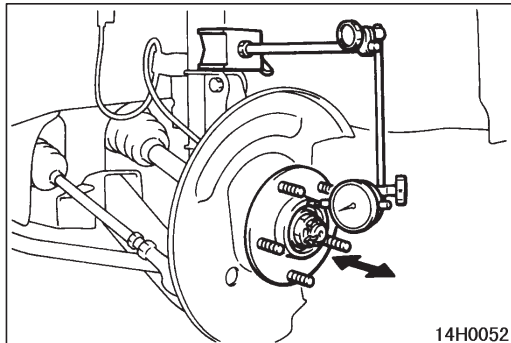
Tool	Number	Name	Use
 B991318	MB991318	Lower arm bushing arbour	Front differential mount insulator <rear> pressing-in
	MB991183	Bushings arbour	
	MB990843	Drag link bushing remover and installer	
	GENERAL SERVICE TOOL MZ203827	Engine lifter	Supporting the engine assembly when the differential carrier is removed and installed

MB990925  A Installer adapter  C Brass bar B Bar (snap-in type)  Tool box 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

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.



14H0052

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

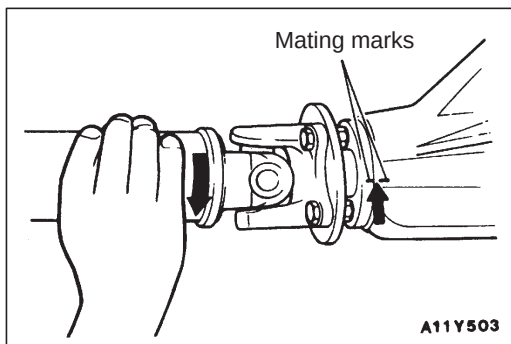
If the propeller shaft is rotated by hand while the ignition switch is OFF, the front wheel actuator will lock the front wheels. To prevent this, follow the procedures below:

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.

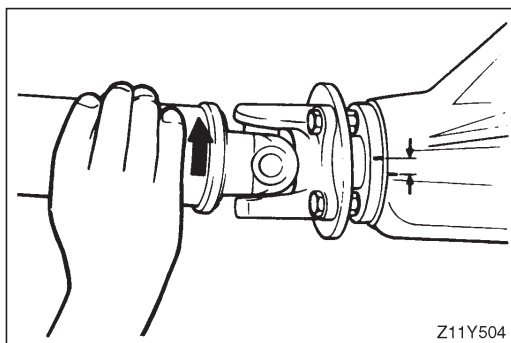
Caution

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.



A11Y503



Z11Y504

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

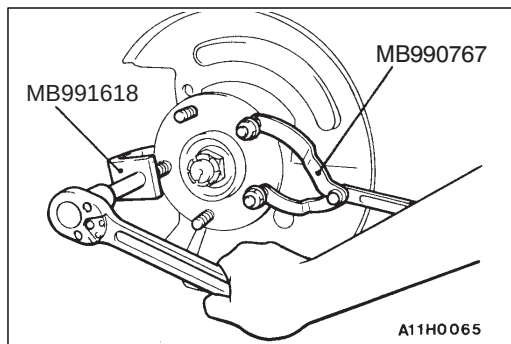
NOTE

SAE 90 for 10 °C or higher, SAE80 for 10 °C or lower

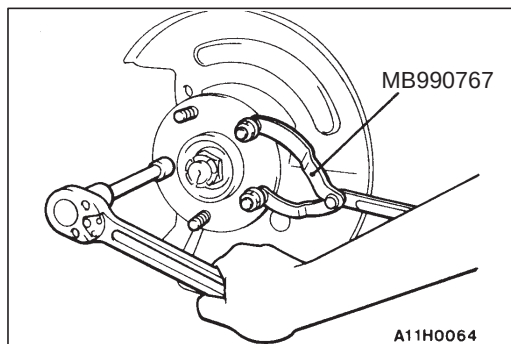
Capacity:

Front differential: Approx. 0.83 ℓ

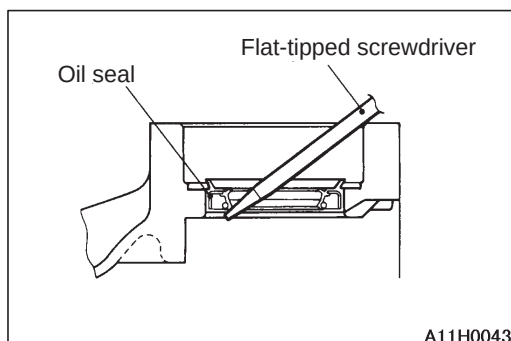
Free-wheeling clutch: 0.12 ℓ

**HUB BOLT REPLACEMENT**

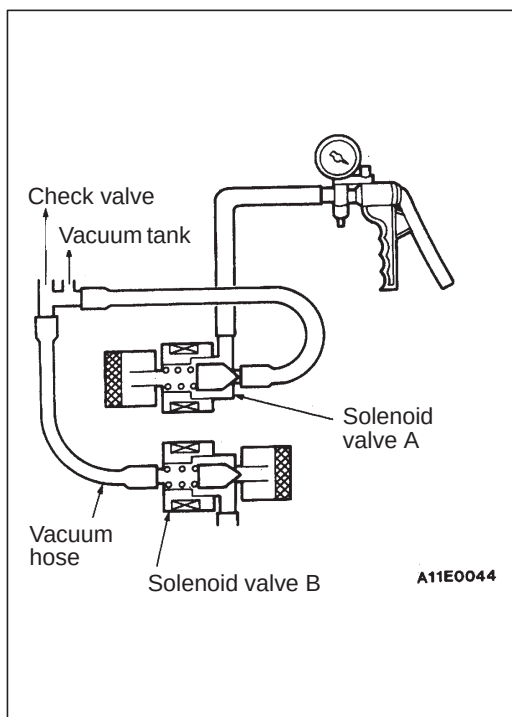
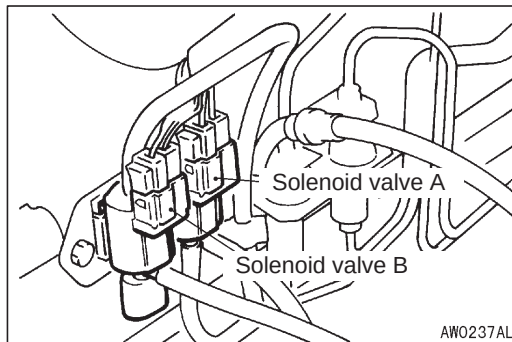
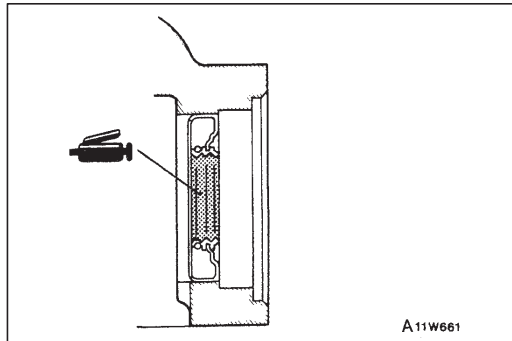
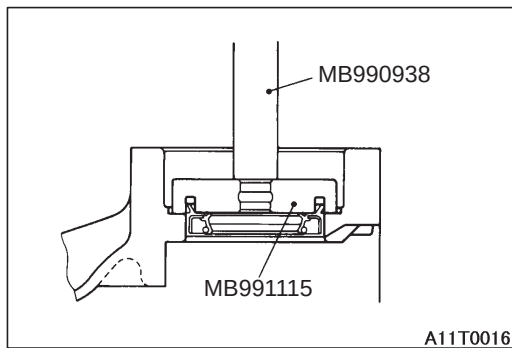
1. Rotate the hub to align each hub bolt with the cutout section of the dust cover, and push out each hub bolt while locking the hub with the special tool.



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.

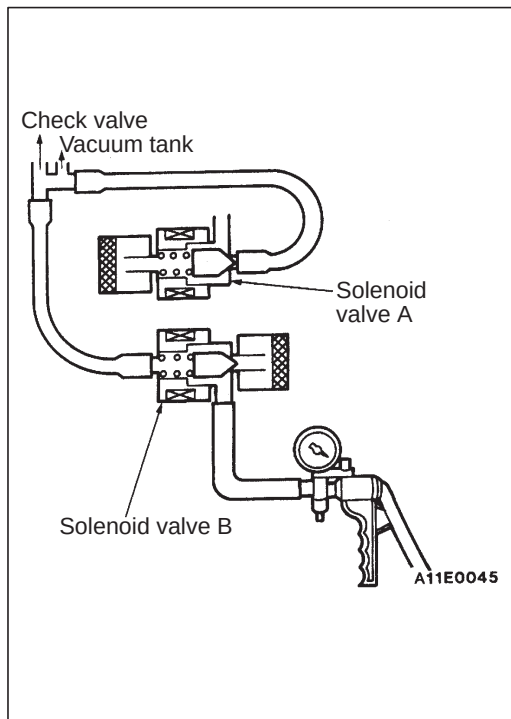
5. Apply multi-purpose grease to the oil seal lip, and then install the right drive shaft (Refer to P.26-19) and the front housing assembly (Refer to P.26-26).

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 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.

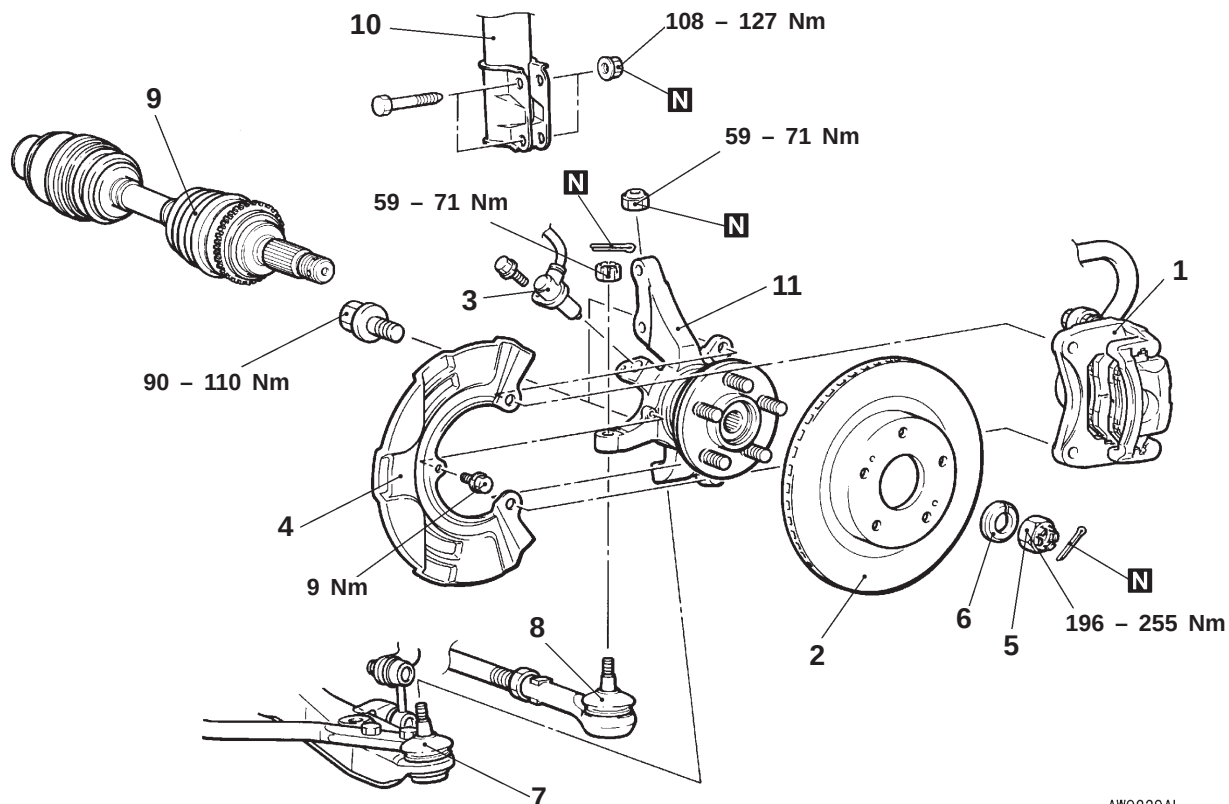
Standard value: 36 – 46 Ω

HUB AND KNUCKLE ASSEMBLY

REMOVAL AND INSTALLATION

Post-installation Operation

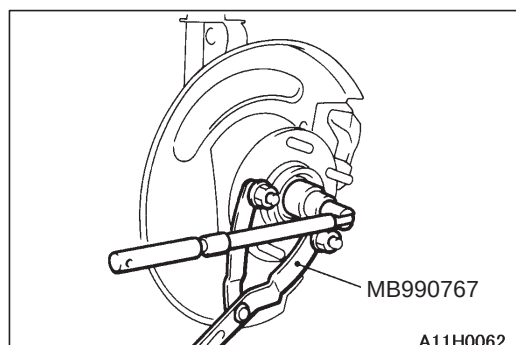
Press the Dust Cover with a Finger to Check Whether the Dust Cover is Cracked or Damaged.



AW0239AL

Removal steps

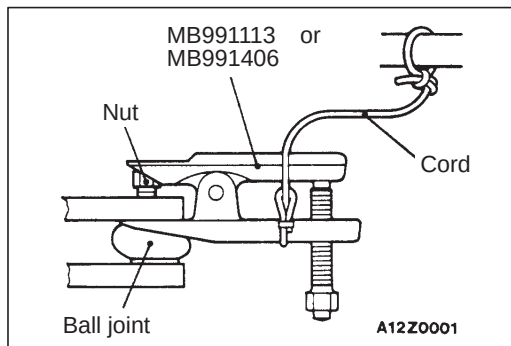
	1. Disc brake assembly	◀B▶	8. Tie rod end and hub/knuckle assembly connection
	2. Brake disc		9. Drive shaft and hub/knuckle assembly connection
	3. Wheel speed sensor <Vehicles with ABS>	◀C▶	10. Strut assembly and hub/knuckle assembly connection
◀A▶	4. Dust cover		11. Hub/knuckle assembly
◀A▶	5. Castle nut		
◀B▶	6. Washer		
	7. Lower arm and hub/knuckle assembly connection		



A11H0062

REMOVAL SERVICE POINTS**◀A▶ CASTLE NUT REMOVAL****Caution**

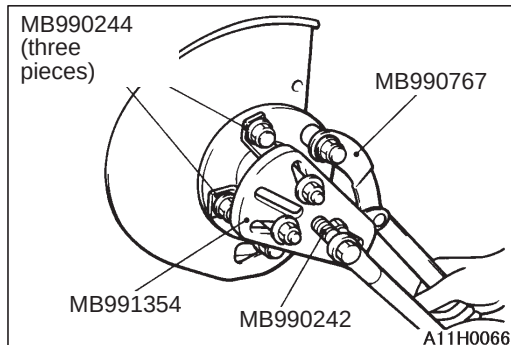
Never apply the vehicle weight to the wheel bearing while the castle nut is loosened. If the vehicle weight is applied, the wheel bearing will be damaged.



◀B▶ TIE ROD END/LOWER ARM REMOVAL

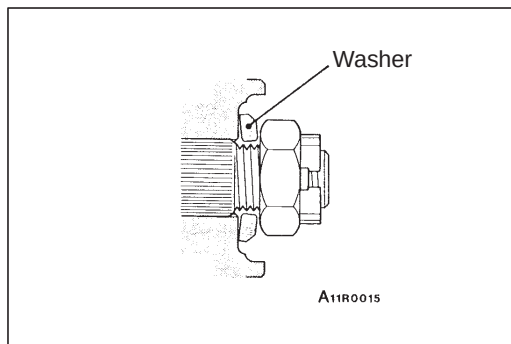
Caution

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

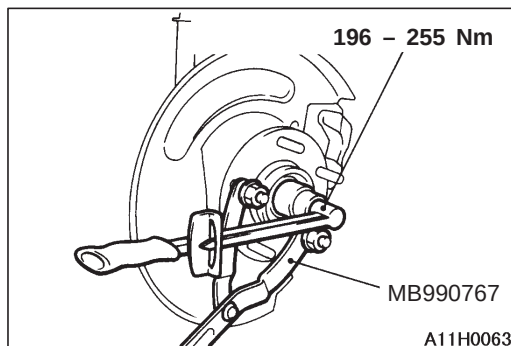
▶A◀ WASHER/CASTLE NUT INSTALLATION

1. Face the chamfered side of the washer against the castle nut.
2. Use the special tool to tighten the castle nut securely.

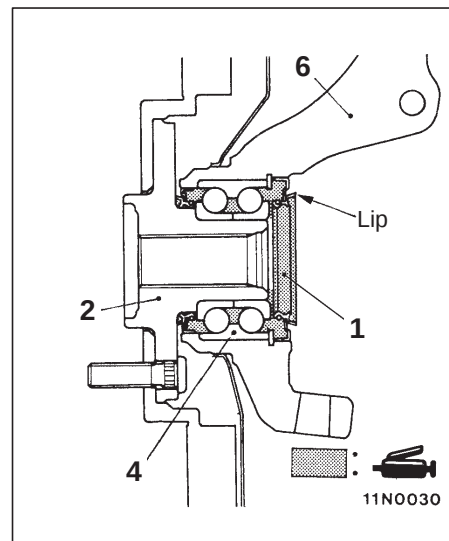
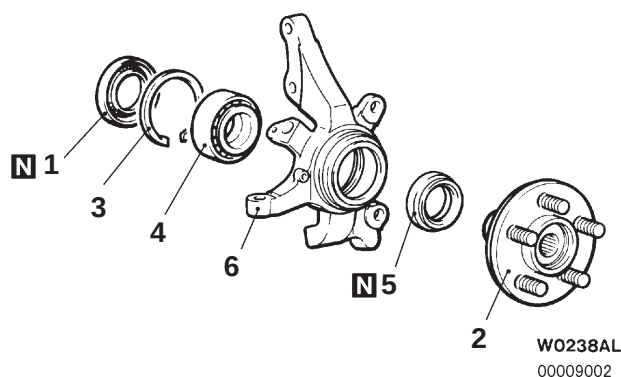
Caution

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

◀A▶

◀B▶

1. Inner oil seal
2. Hub
3. Snap ring
4. Wheel bearing
5. Outer oil seal
6. Knuckle

Reassembly steps

▶A▶

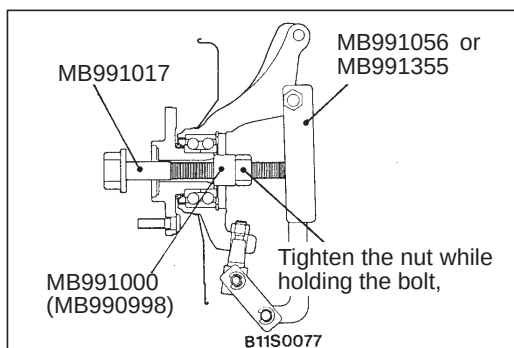
▶B▶

▶C▶

▶D▶

▶E▶

6. Knuckle
4. Wheel bearing
3. Snap ring
5. Outer oil seal
2. Hub
 - Hub rotation starting torque check
- Wheel bearing axial play check
1. Inner oil seal



DISASSEMBLY SERVICE POINTS

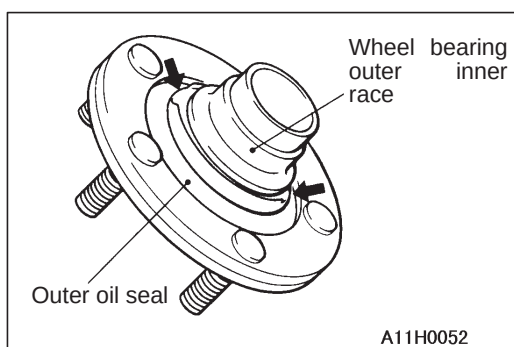
◀A▶ HUB REMOVAL

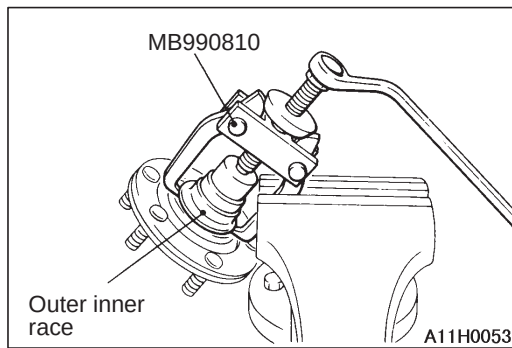
Caution

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.

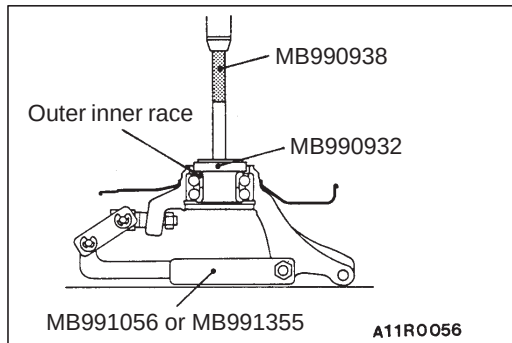




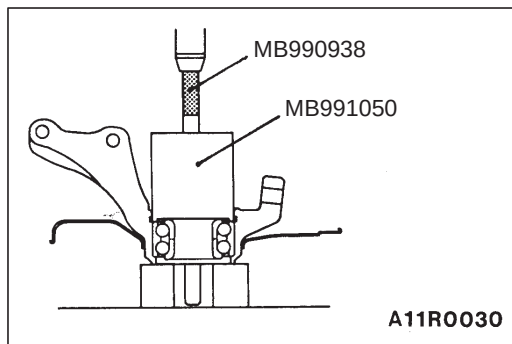
2. Use the special tool to remove the wheel bearing outer inner race from the hub.

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.

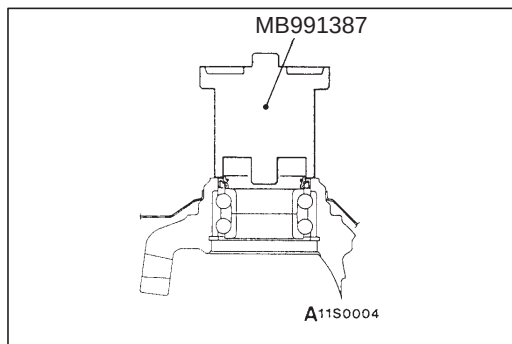


REASSEMBLY SERVICE POINTS

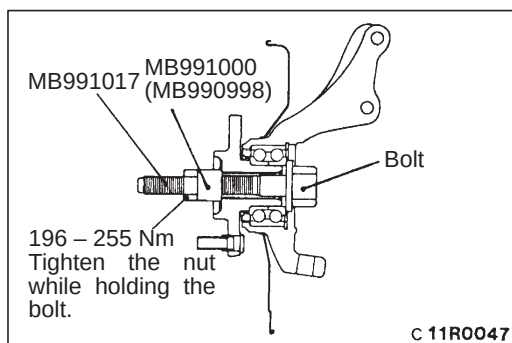
►A◄ WHEEL BEARING INSTALLATION

Caution

When the wheel bearing is pressed in, its outer race should be pushed in.

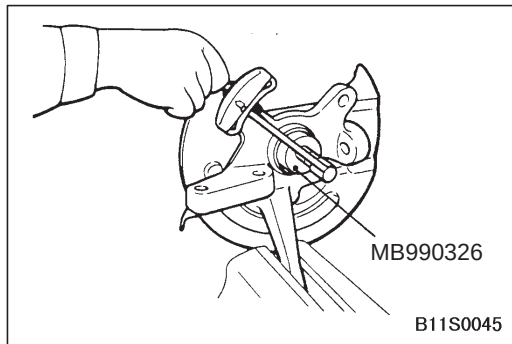


►B◄ OUTER OIL SEAL INSTALLATION



►C◄ HUB ROTATION STARTING TORQUE CHECK

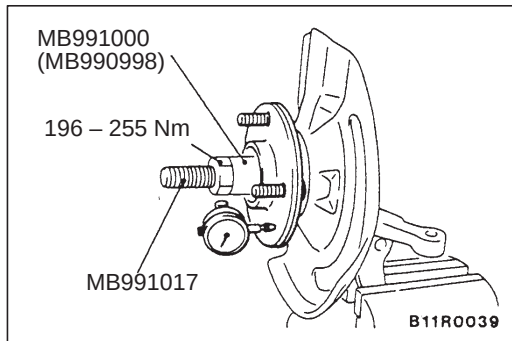
1. Tighten the special tools to the specified torque to press the hub into the knuckle.
2. Rotate the hub so that the hub is lubricated sufficiently.



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.

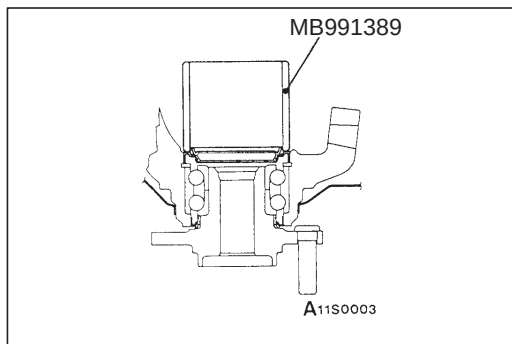


►D◄ WHEEL BEARING AXIAL PLAY CHECK

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

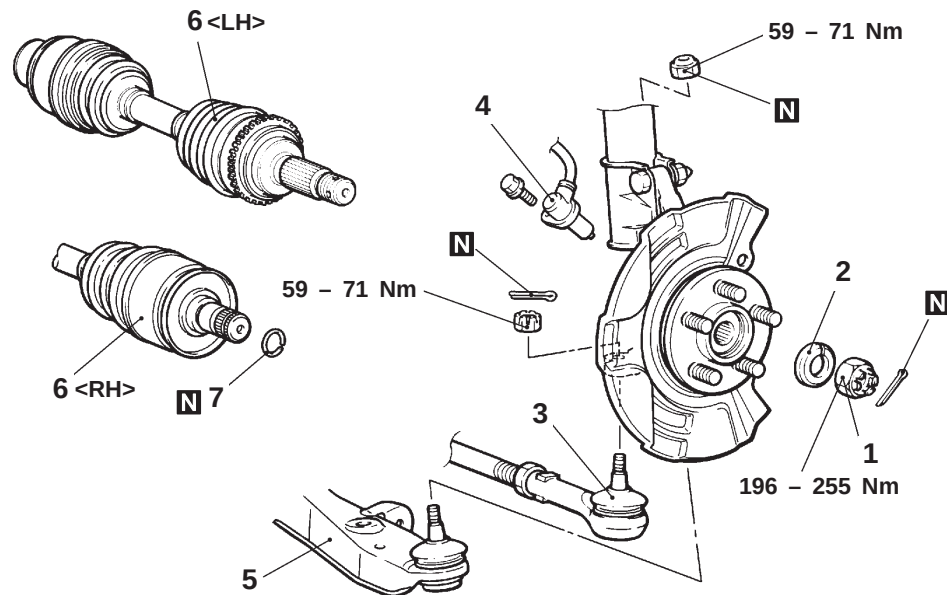
On the vehicles with ABS, when the drive shaft is removed or installed, be careful not to interfere with the ABS rotor installed to the B.J. outer race to prevent the rotor from damage.

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

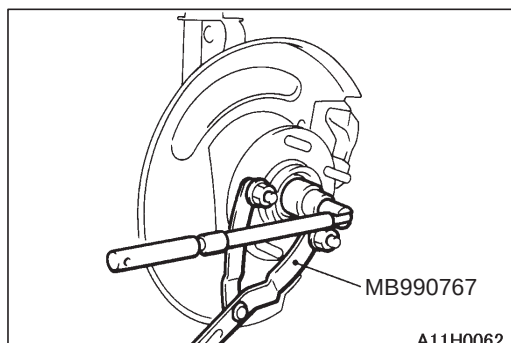
- Press the Dust Cover with a Finger to Check Whether the Dust Cover is Cracked or Damaged.
- Engage the Stabilizer Link with the Strut Bar (Refer to GROUP 33 – Strut Bar and Lower Arm.)
- Brake Disc Installation (Refer to P.26-14.)



Removal steps

- ◀A▶ ▶A▶ 1. Castle nut
 ▶A▶ ▶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

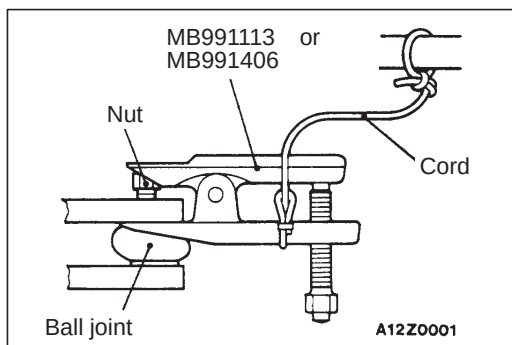


REMOVAL SERVICE POINTS

◀A▶ CASTLE NUT REMOVAL

Caution

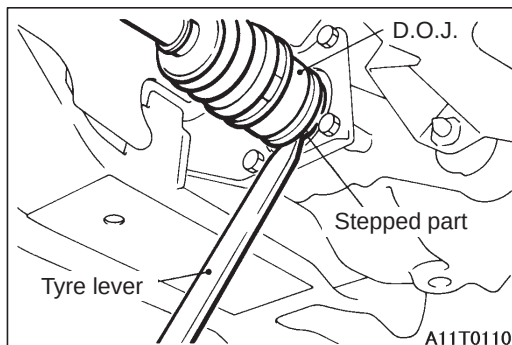
Never apply the vehicle weight to the wheel bearing while the castle nut is loosened. If the vehicle weight is applied, the wheel bearing will be damaged.



◀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

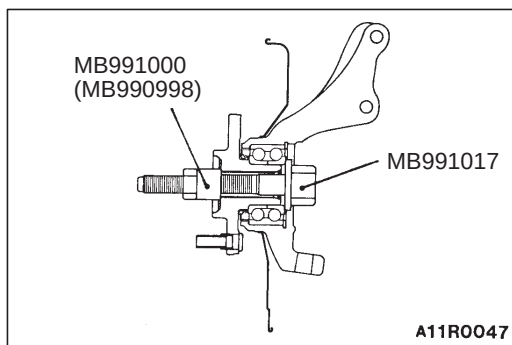
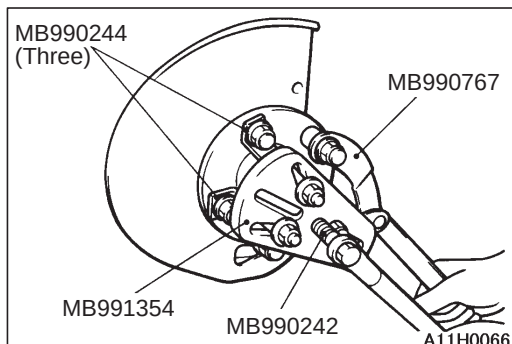
Always use a tyre lever. When the drive shaft is withdrawn from the B.J. assembly, the D.O.J. may be damaged.

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

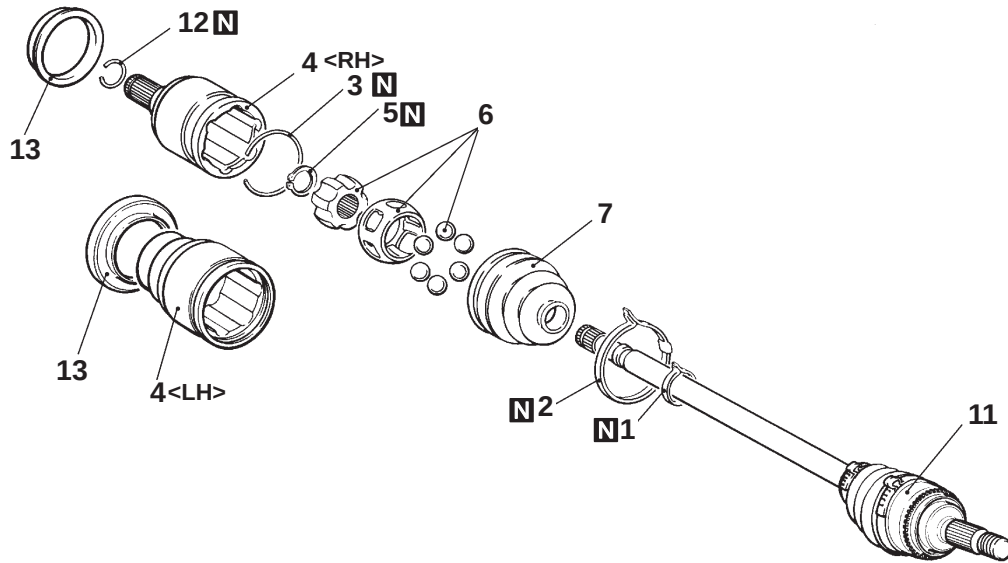
▶A◀ WASHER/CASTLE NUT INSTALLATION

Refer to P. 26-15.

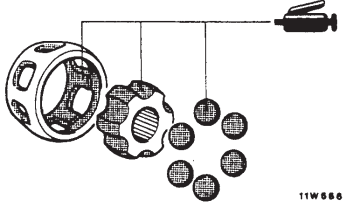
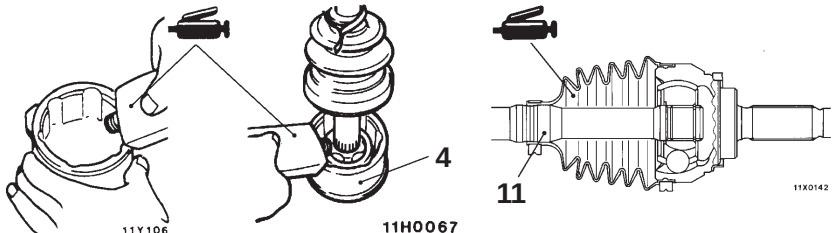
DISASSEMBLY AND REASSEMBLY

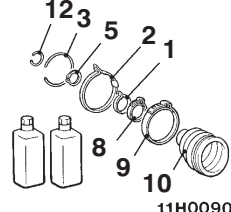
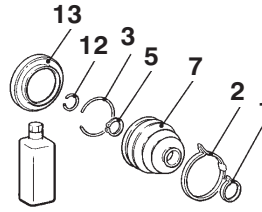
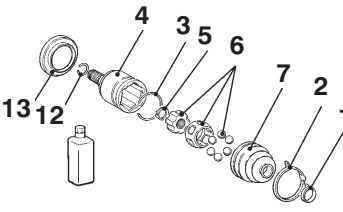
Caution

The B.J. assembly is non-serviceable and requires replacement if defective. B.J. boot can be replaced.



W0033AL

 11W666	 11Y106 11H0067 11X0142
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.	

 11H0090	 11H0077	 11H0076
B.J. boot repair kit	D.O.J. boot repair kit	D.O.J. repair kit

00009003

Disassembly steps

1. D.O.J. boot band (small)
2. D.O.J. boot band (large)
3. Circlip
4. D.O.J. outer race
5. Snap ring
6. Inner race, cage, ball assembly



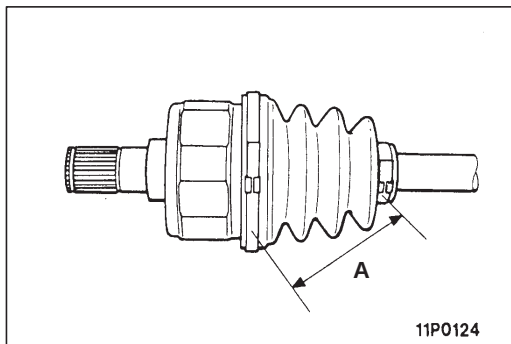
7. D.O.J. boot
8. B.J. boot band (small)
9. B.J. boot band (large)
10. B.J. boot
11. B.J. assembly
12. Circlip
13. Dust cover

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**

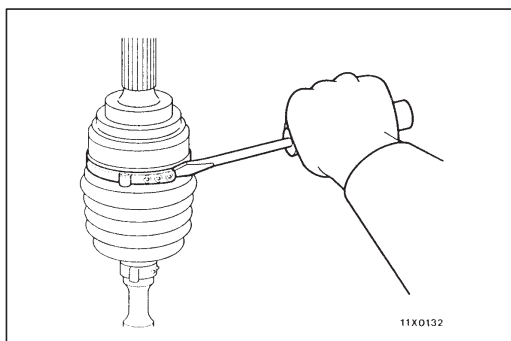
Wrap a plastic tape around the B.J. assembly spline to prevent damage, and then install the boot.

**▶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.

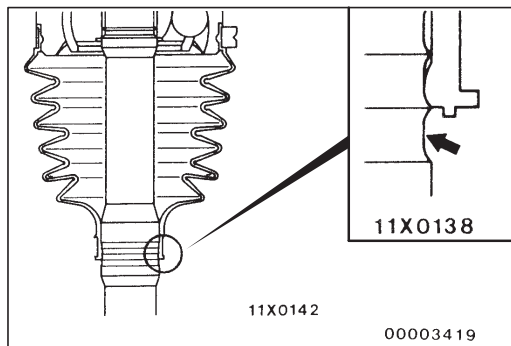
**B.J. BOOT (PLASTIC BOOT) REPLACEMENT**

1. Remove the boot bands (small and large).

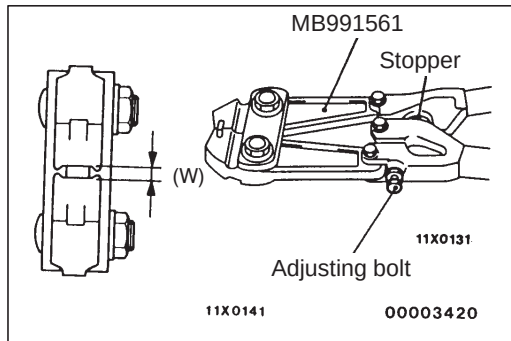
NOTE

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>

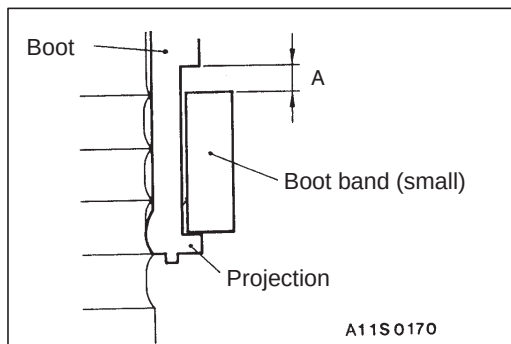
Tighten the adjusting bolt.

<Less than 2.9 mm>

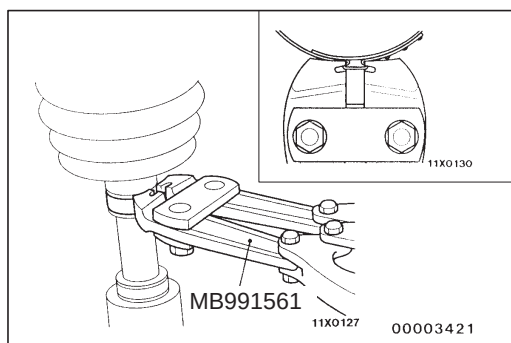
Loosen the adjusting bolt

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.



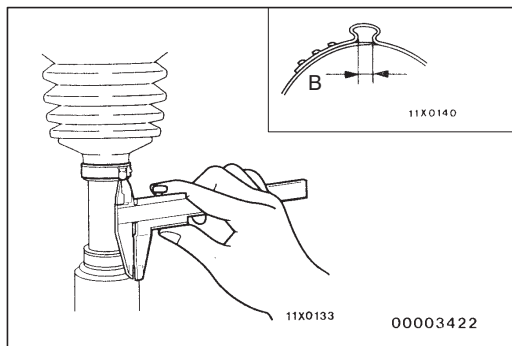
5. Butt the boot band (small) against the boot end projection so that a certain clearance (A) is obtained.



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.

$$W = 5.5 \text{ mm} - B$$

Example: If $B = 2.9 \text{ mm}$, then $W = 2.6 \text{ mm}$.

<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.

$$W = 5.5 \text{ mm} - B$$

Example: If $B = 2.3 \text{ mm}$, then $W = 3.2 \text{ mm}$.

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.

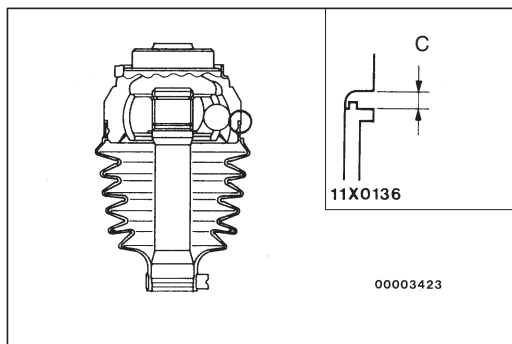
9. Fill the inside of the B.J. boot with the specified amount of the specified grease.

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)

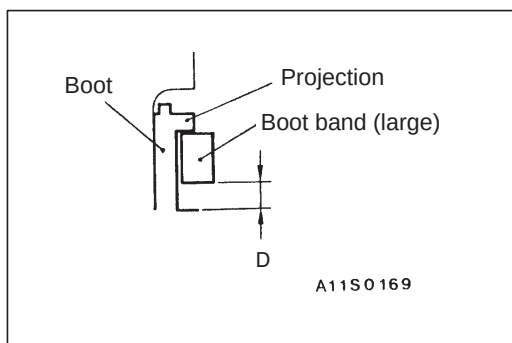


10. Position the boot so that the difference between the boot big end and the housing stepped part (C) meets the standard value.

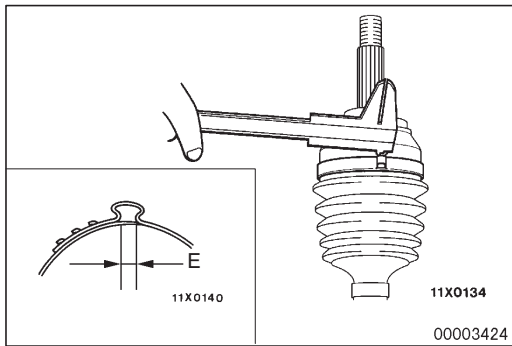
Standard value (C): 0.1 – 1.55 mm

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.

$$W = 5.8 \text{ mm} - E$$

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.

$$W = 5.8 \text{ mm} - E$$

Example: If E = 2.3 mm, then W = 3.5 mm.

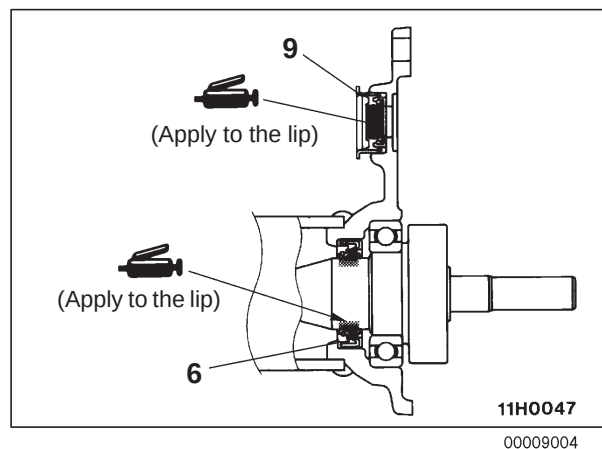
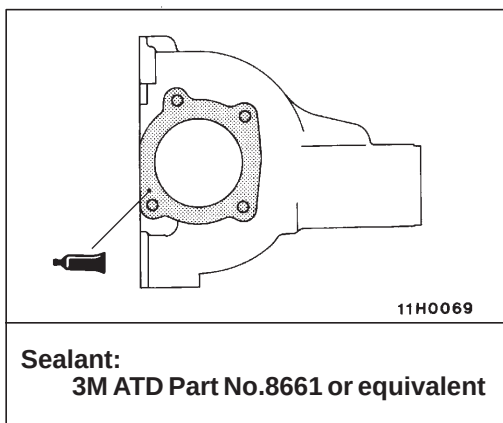
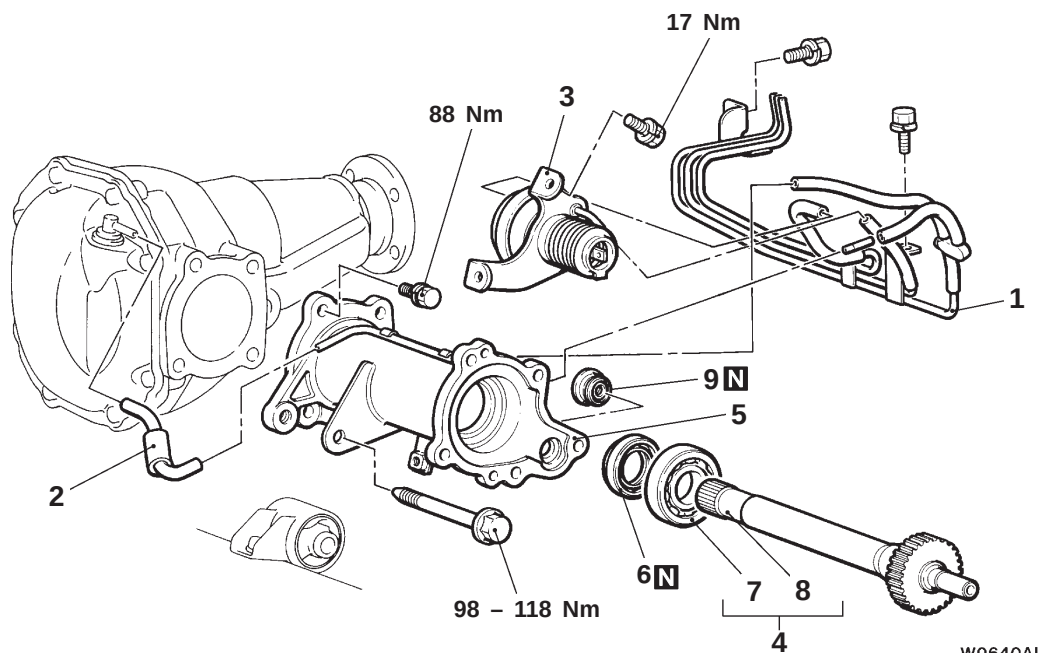
15. Check that the B.J. boot band is not sticking out past the place where it has been installed.
If the B.J. boot band is sticking out, remove it and then repeat the operations in steps 12 to 14 using a new B.J. boot band.

MAIN SHAFT

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

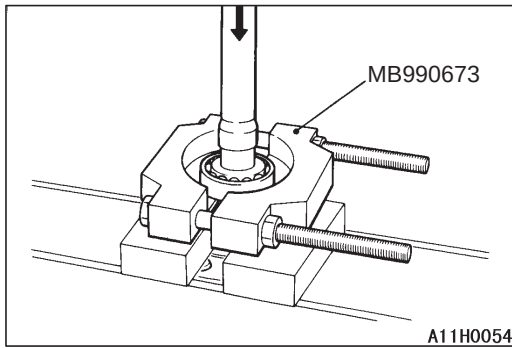
- Drive Shaft Removal and Installation (Refer to P.26-19.)
- Free-wheeling Clutch Housing Assembly Removal and Installation (Refer to P.26-45.)
- Gear Oil Draining and Refilling (Refer to P.26-11.)


Removal steps

1. Vacuum pipe assembly
2. Vacuum hose assembly
3. Vacuum actuator assembly
4. Inner shaft assembly
5. Front housing assembly



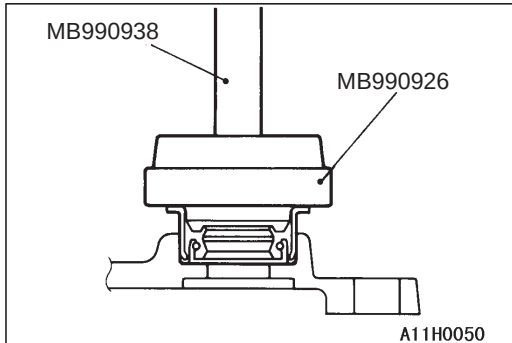
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REMOVAL SERVICE POINT

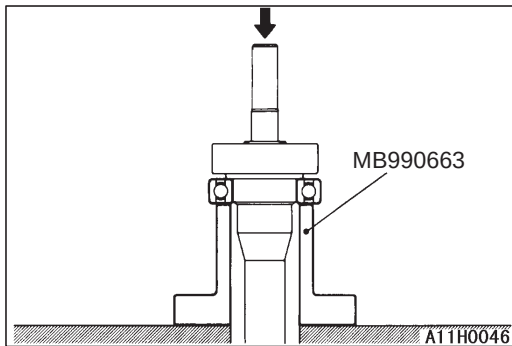
◀A▶ BEARING REMOVAL

Install the special tool as shown in the illustration, and use a press to drive out the bearing from the main shaft.

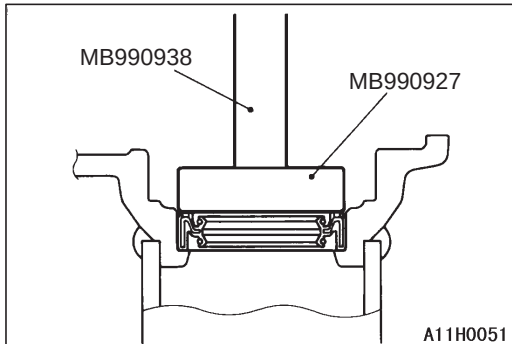


INSTALLATION SERVICE POINTS

▶A◀ OIL SEAL INSTALLATION



▶B◀ BEARING INSTALLATION



▶C◀ OIL SEAL INSTALLATION

DIFFERENTIAL CARRIER

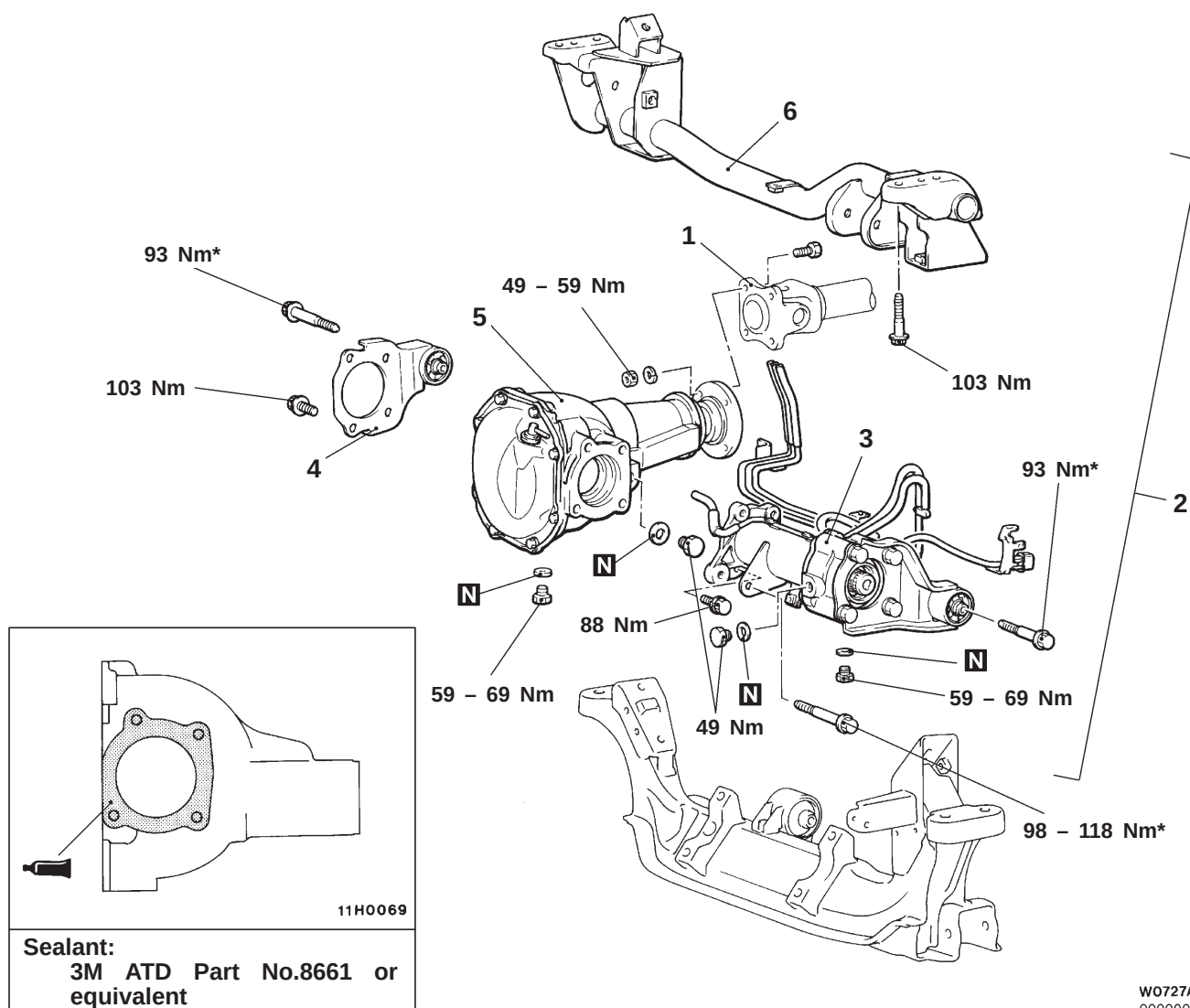
REMOVAL AND INSTALLATION

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.)
- Gear Oil Draining and Refilling (Refer to P.26-11.)
- Stabilizer Bar Removal and Installation (Refer to GROUP 33A.)

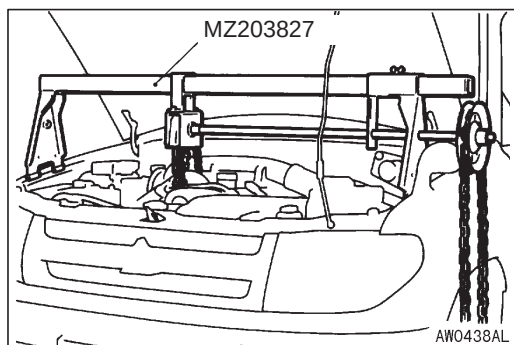


Removal steps

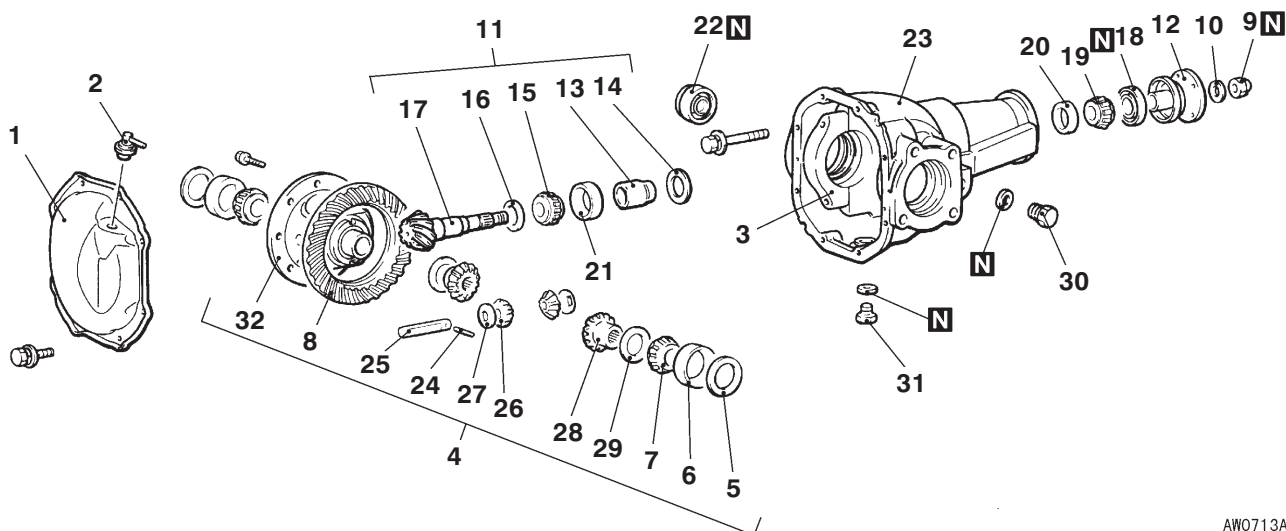


1. Support the Engine Assembly
1. Front propeller shaft connection
2. Front differential assembly and differential mount crossmember assembly
3. Free-wheeling clutch assembly

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

AWO713AL

Disassembly steps

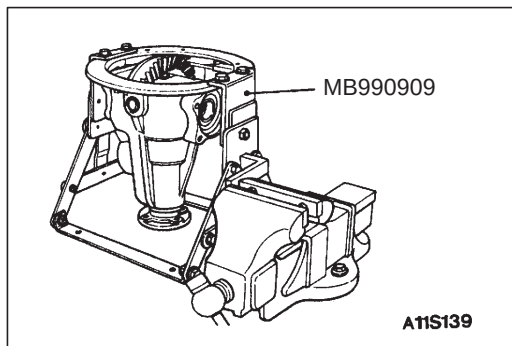
- Inspection before disassembly

◀A▶

1. Cover
2. Vent plug
3. Bearing cap
4. Differential case assembly
5. Side bearing spacer
6. Side bearing outer race
7. Side bearing inner race
8. Drive gear
9. Self-locking nut
10. Washer
11. Drive pinion assembly
12. Companion flange
13. Drive pinion spacer
14. Drive pinion rear shim
(For drive pinion rotation torque adjustment)
15. Drive pinion front bearing inner race

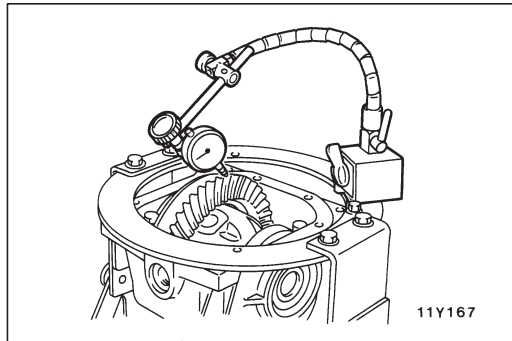
◀B▶**◀C▶****◀D▶****◀E▶****◀F▶****◀G▶****◀G▶****◀G▶****◀H▶****◀I▶****◀J▶****◀K▶****◀L▶****◀M▶****◀N▶****◀O▶****◀P▶****◀Q▶****◀R▶****◀S▶****◀T▶****◀U▶****◀V▶****◀W▶****◀X▶****◀Y▶****◀Z▶**

16. Drive pinion front shim
(For drive pinion height adjustment)
17. Drive pinion
18. Oil seal
19. Drive pinion rear bearing inner race
20. Drive pinion rear bearing outer race
21. Drive pinion front bearing outer race
22. Oil seal
23. Differential carrier
24. Lock pin
25. Pinion shaft
26. Pinion gear
27. Pinion 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.

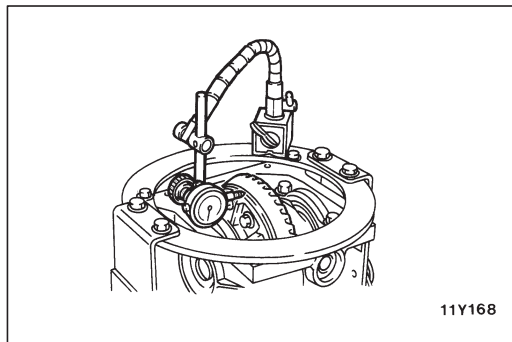


DRIVE GEAR BACKLASH

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.

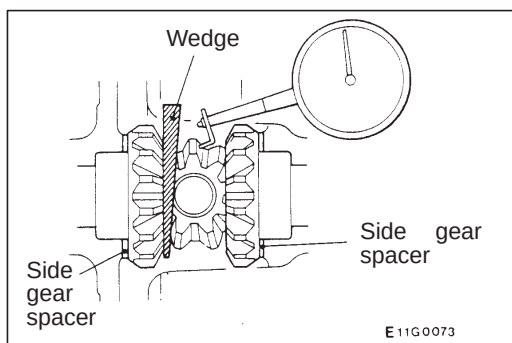


DRIVE GEAR RUNOUT

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

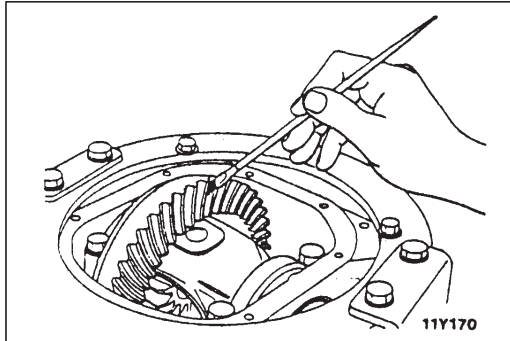
1. While locking the side gear with the wedge, measure the differential gear backlash with a dial indicator on the pinion gear.

Standard value: 0 – 0.076 mm

Limit: 0.2 mm

Repeat the same procedure for other pinion gear.

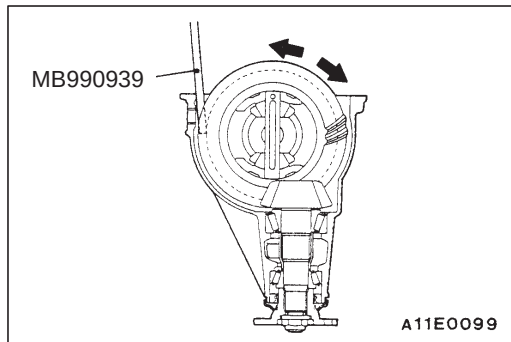
2. If the backlash exceeds the limit, adjust the differential gear backlash (Refer to P.26-41).
3. If adjustment is impossible, replace the side gear and pinion gear as a set.



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.

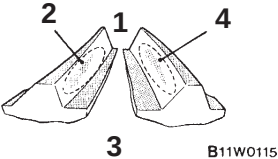
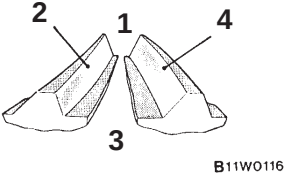
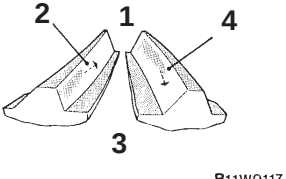
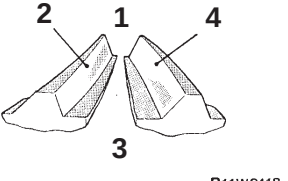
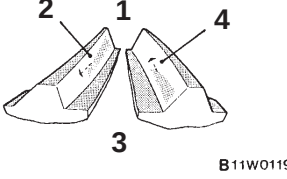


2. Insert the special tool between the differential carrier and the differential case, and then rotate the companion flange by hand (once in the normal direction, and then once in the reverse direction) while applying a load to the drive gear so that the revolution torque (approximately 2.5 – 2.9 Nm) 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.

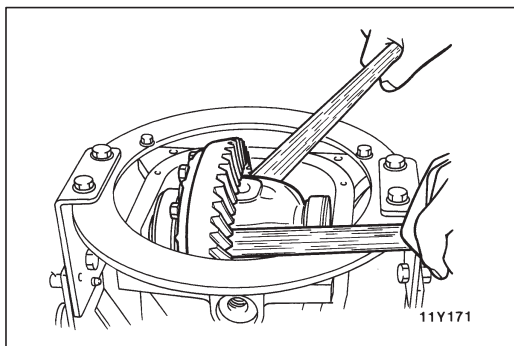
3. Check the tooth contact condition of the drive gear and drive pinion.

Standard tooth contact pattern	Problem	Solution
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	Tooth contact pattern resulting from excessive pinion height  B11W0116 The drive pinion is positioned too far from the centre of the drive gear. Tooth contact pattern resulting from insufficient pinion height.  B11W0117 The drive pinion is positioned too close to the centre of the drive gear.	 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.  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.

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

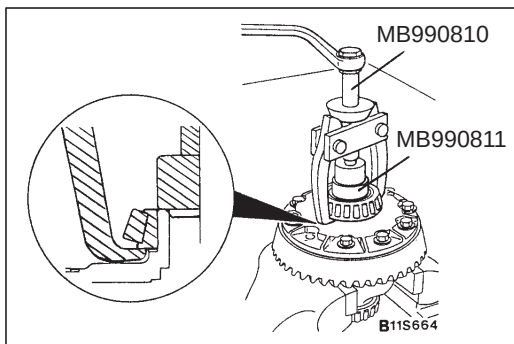
Remove the differential case assembly with a hammer handle or the like.

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.

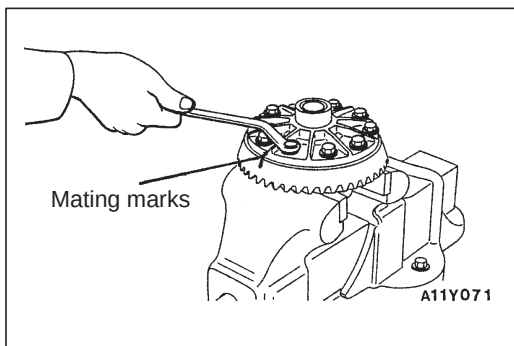


◀B▶ SIDE BEARING INNER RACE REMOVAL

NOTE

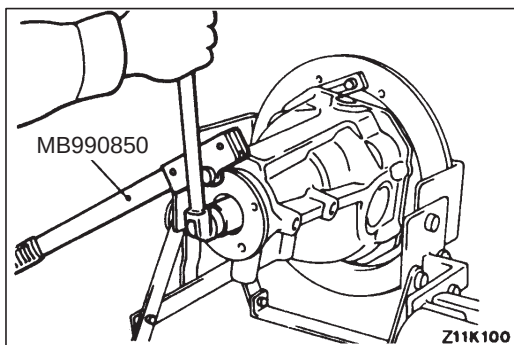
There are two notches provided (at the differential case side) for the jaws of the special tool; use the special tool at that position.

If the special tool jaws cannot be inserted between the differential case and the bearing inner race, file the jaw tips as necessary.

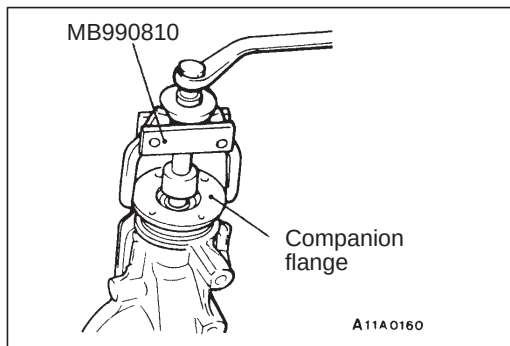


◀C▶ DRIVE GEAR REMOVAL

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



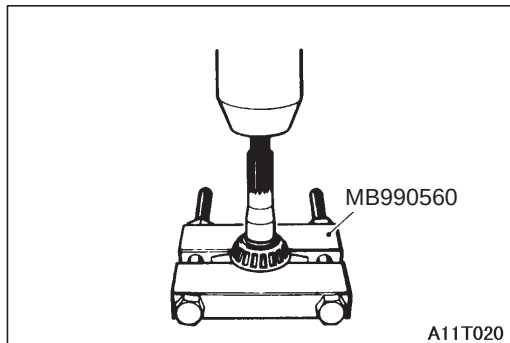
◀E▶ DRIVE PINION ASSEMBLY REMOVAL

1. Make mating marks on the drive pinion and the companion flange.

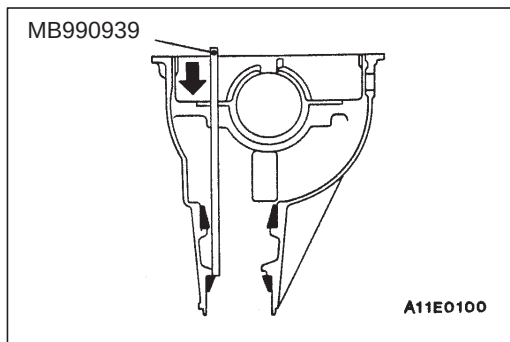
Caution

The mating mark must not be on the coupling surface of the companion flange and the front propeller shaft.

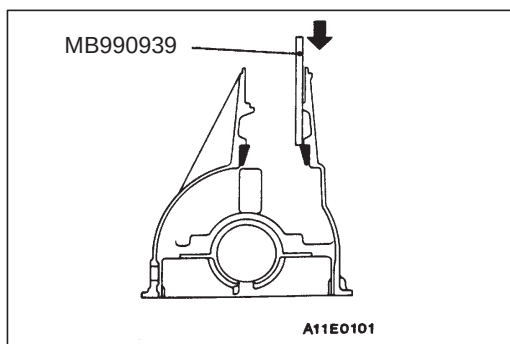
2. Use the special tool to drive out the drive pinion.



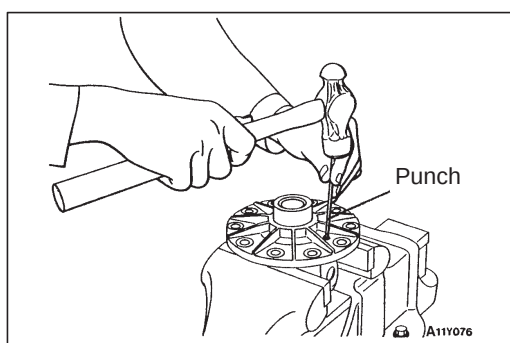
◀F▶ DRIVE PINION FRONT BEARING INNER RACE REMOVAL



◀G▶ OIL SEAL/DRIVE PINION REAR BEARING INNER RACE/DRIVE PINION REAR BEARING OUTER RACE REMOVAL

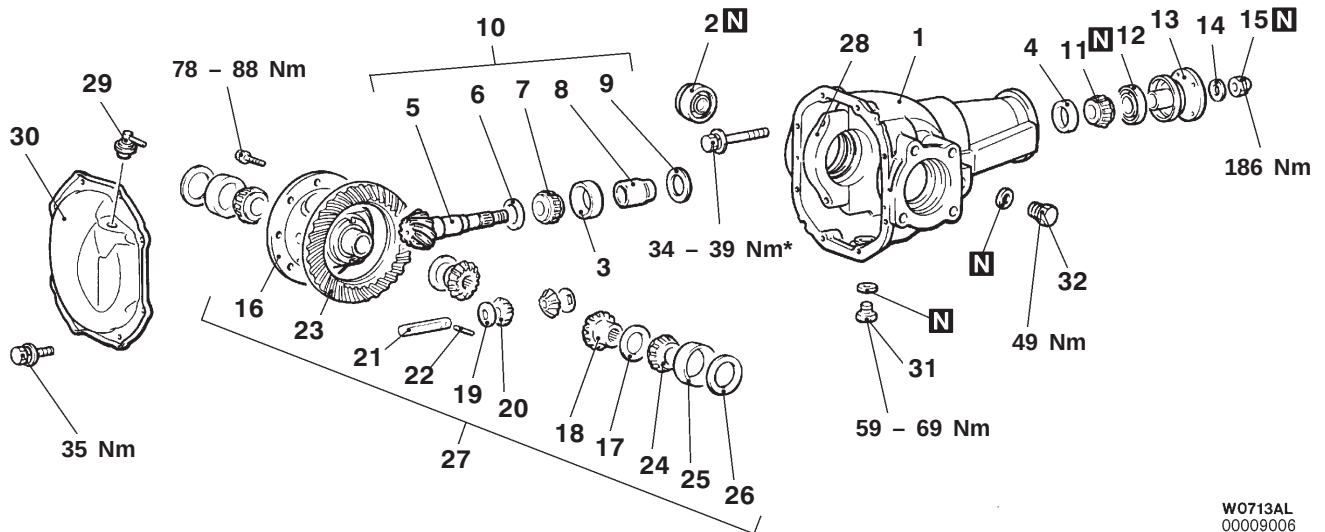
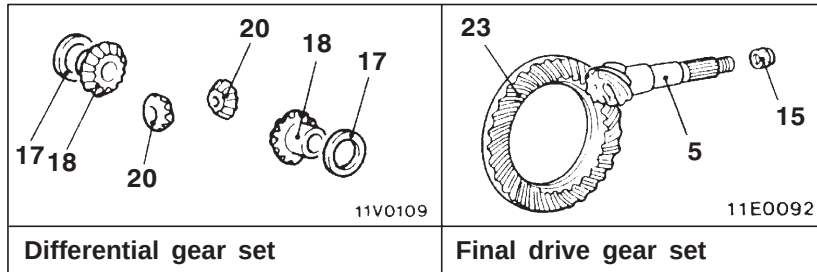


◀H▶ DRIVE PINION FRONT BEARING OUTER RACE REMOVAL



◀I▶ LOCK PIN DRIVE OUT

REASSEMBLY



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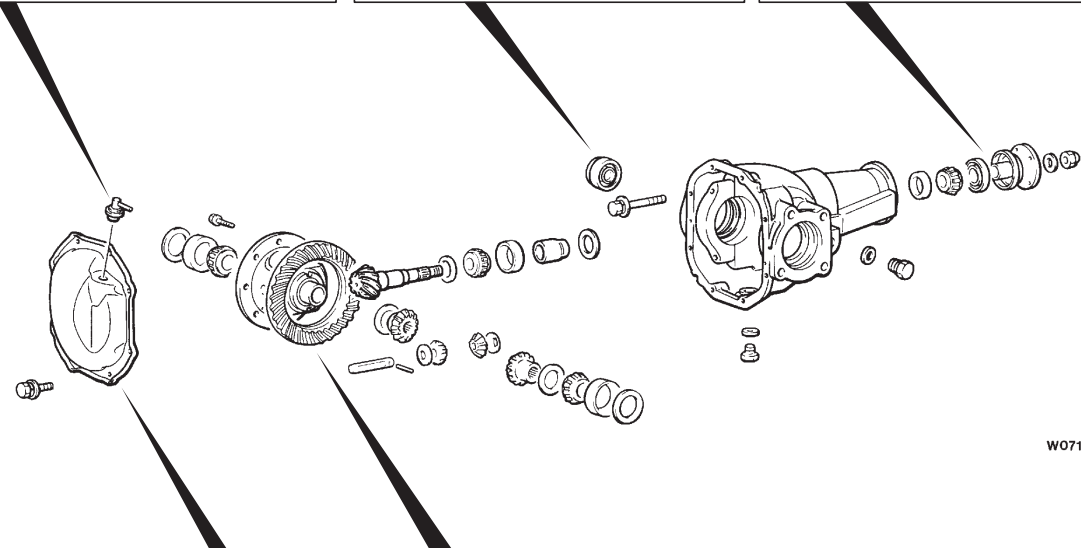
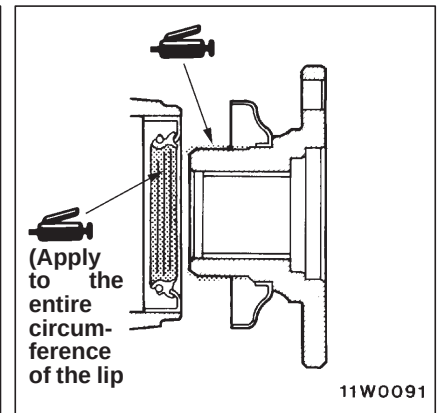
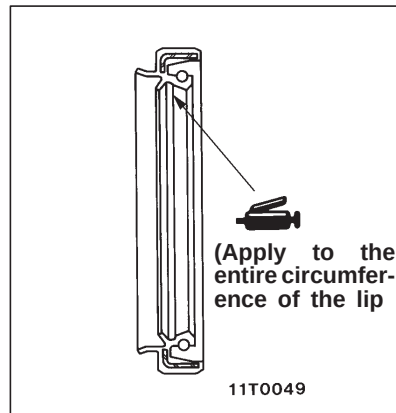
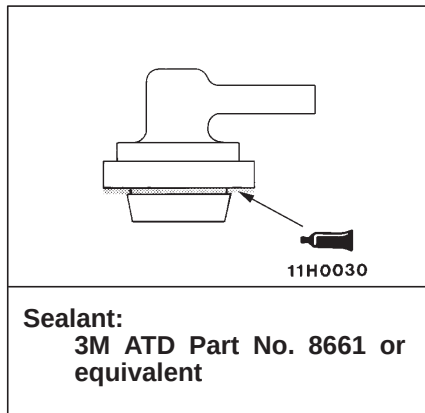
Reassembly steps

►A◄ 1. Differential carrier ►B◄ 2. Oil seal ►C◄ 3. Drive pinion front bearing outer race ►D◄ 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

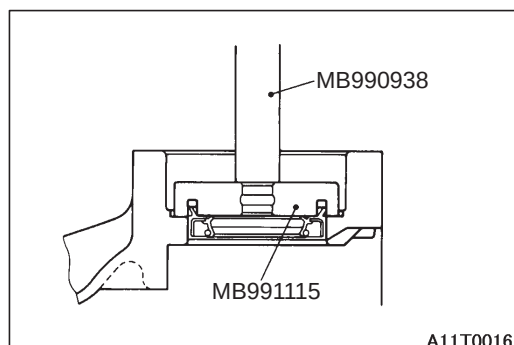
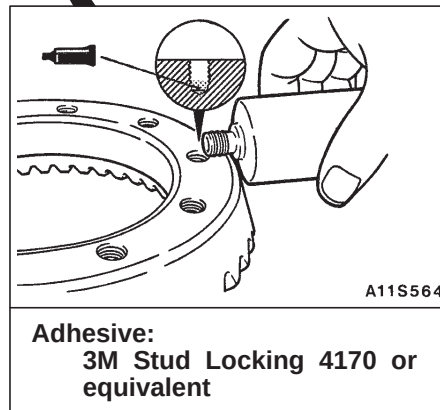
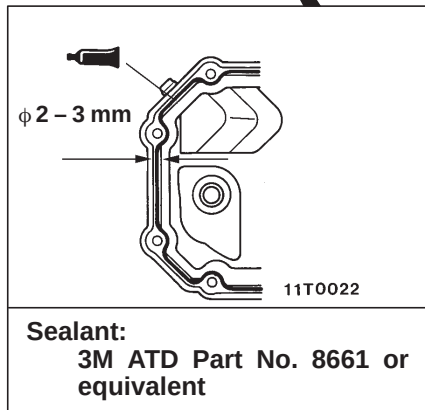
NOTE

The fasteners marked by * should be tightened when the differential gear oil is applied.

LUBRICATION, SEALANT AND ADHESIVE POINTS

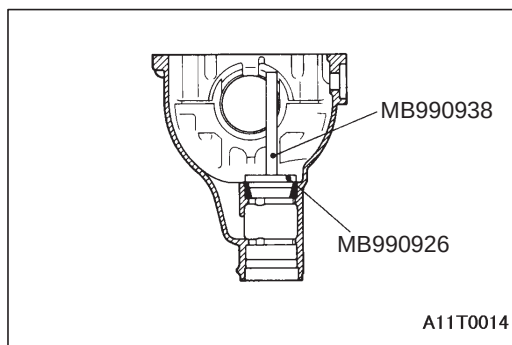


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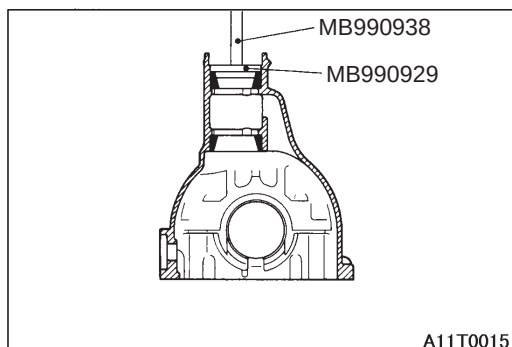


REASSEMBLY SERVICE POINTS

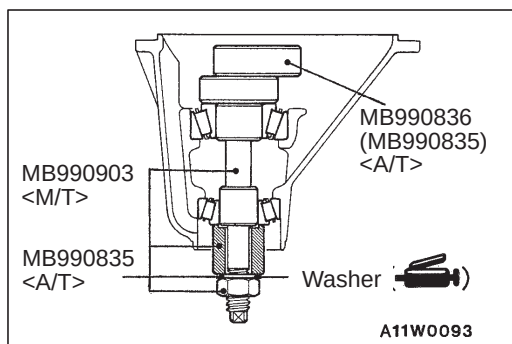
►A◄ OIL SEAL INSTALLATION



►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.

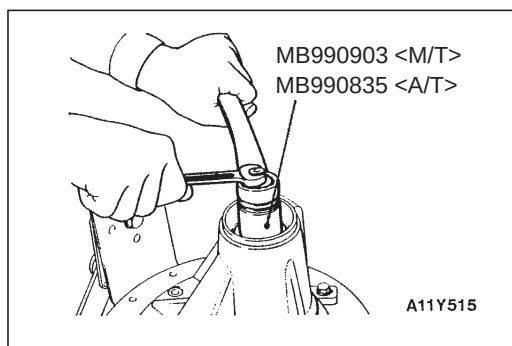
Standard value:

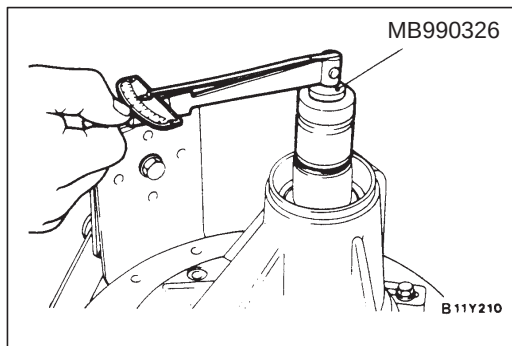
Bearing division	Bearing lubrication	Rotation torque Nm
New	None (With anti-rust agent)	0.88 – 1.17*1 0.29 – 0.49*2
New or reused	Gear oil applied	0.39 – 0.49*1 0.147 – 0.245*2

NOTE

*1: A/T

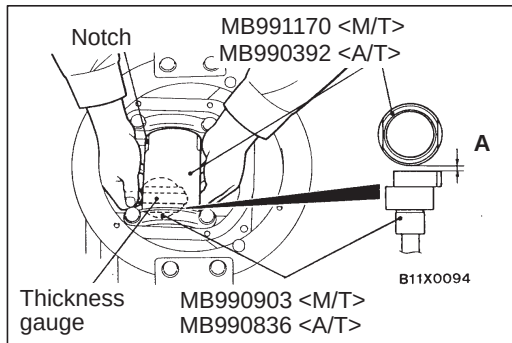
*2: M/T





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.

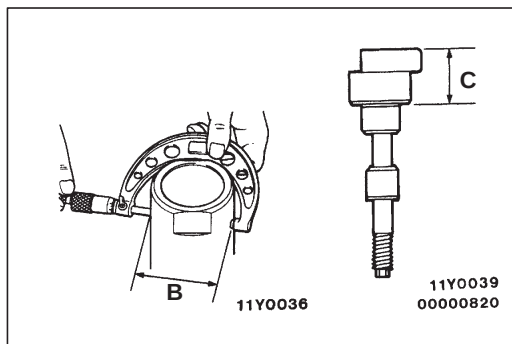


4. Clean the side bearing hub.
5. Install the special tools to the side bearing hub of the gear carrier, and then install the bearing cap.

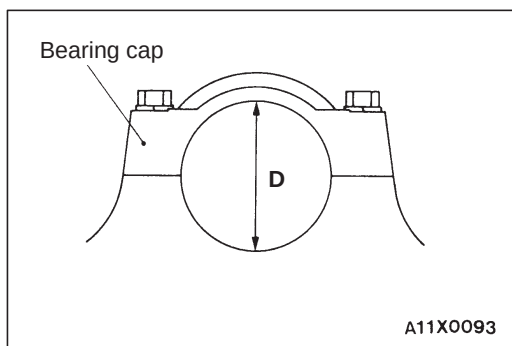
NOTE

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.



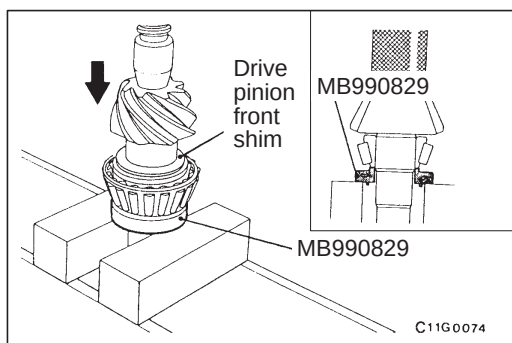
7. Remove the special tools.
8. Use a micrometer to measure the special tool in the places (B, C) shown in the illustration.



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

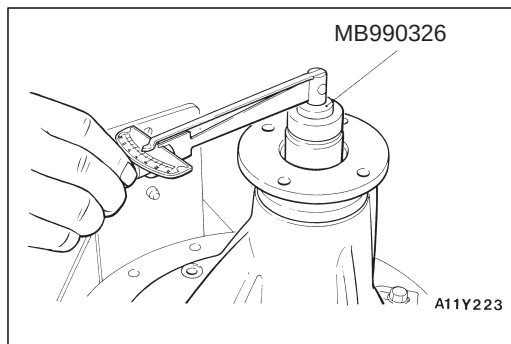
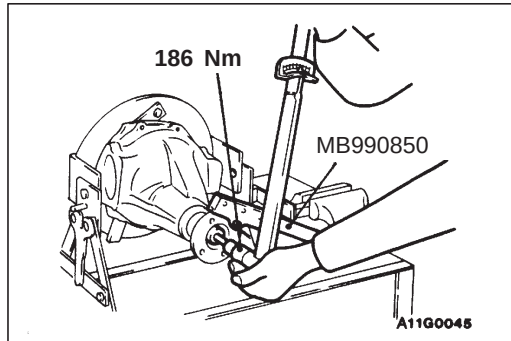
Adjust the drive pinion rotation torque by using the following procedure:

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

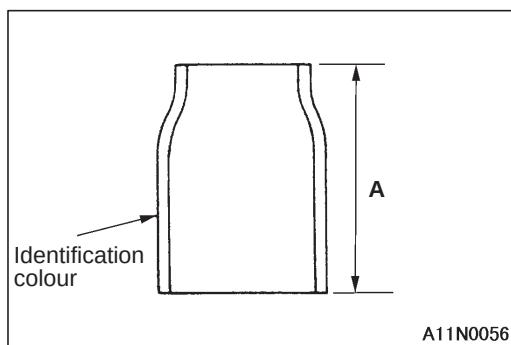
*1: A/T

*2: M/T

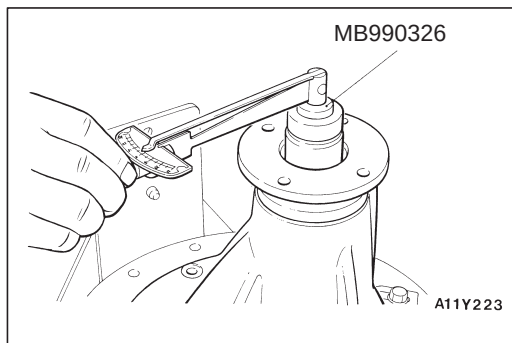
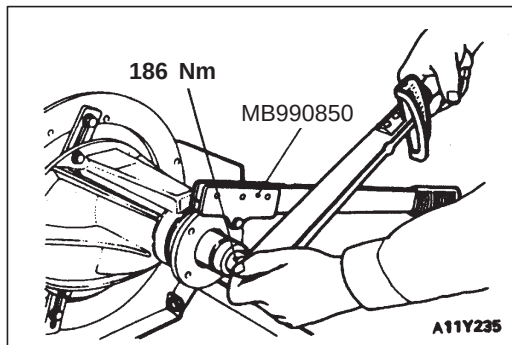
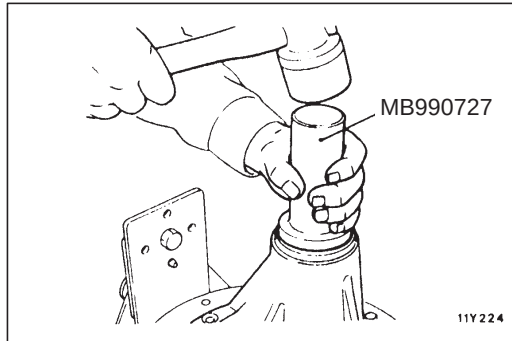
4. If the drive pinion rotation torque is not within the range of the standard value, adjust it by replacing the drive pinion rear shim(s) or the drive pinion spacer.

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.

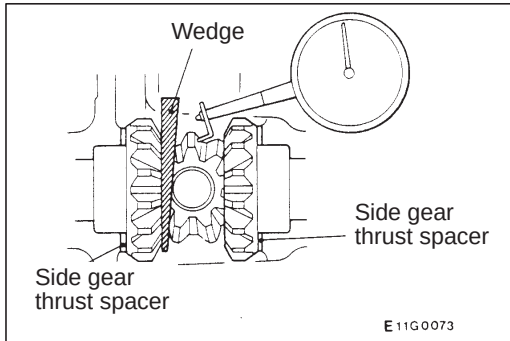
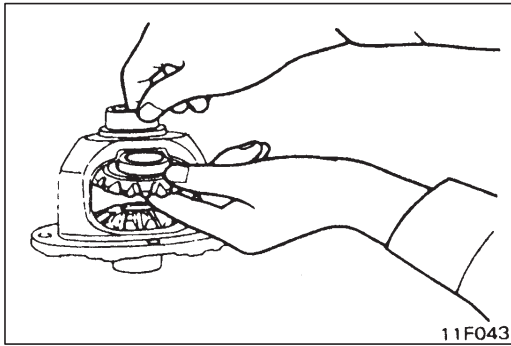
7. Measure the drive pinion rotation torque (with the oil seal) by using the special tool.

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.

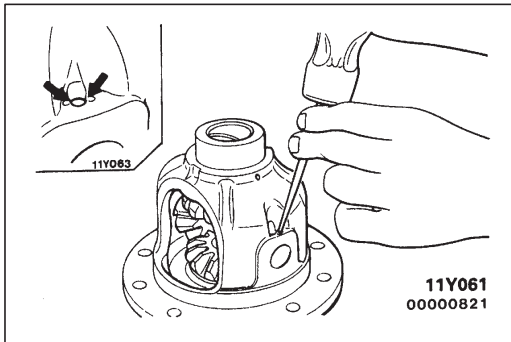
3. Insert a wedge between the side gear and the pinion shaft to lock the side gear.
4. Measure the differential gear backlash with a dial indicator on the pinion gear.

Standard value: 0 – 0.076 mm

Limit: 0.2 mm

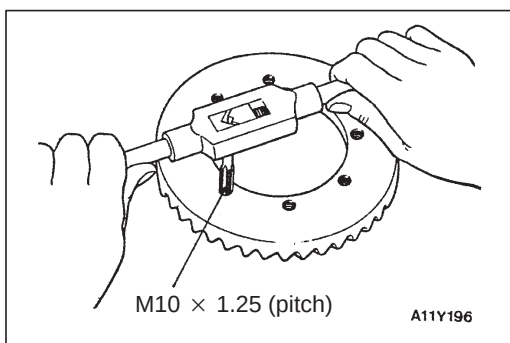
Repeat the steps above for the other pinion gear.

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.



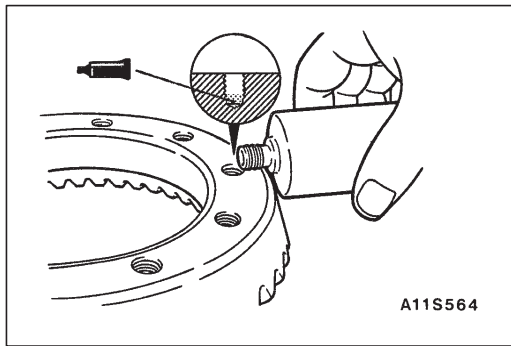
►G◄ LOCK PIN INSTALLATION

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.



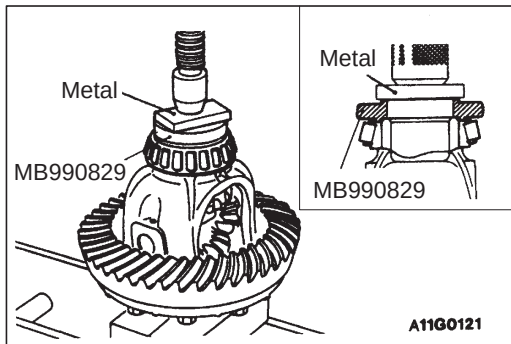
3. Clean the drive gear attaching surface, and then apply the specified adhesive to the threaded holes of the drive gear.

Specified sealant:

3M Stud Locking 4170 or equivalent

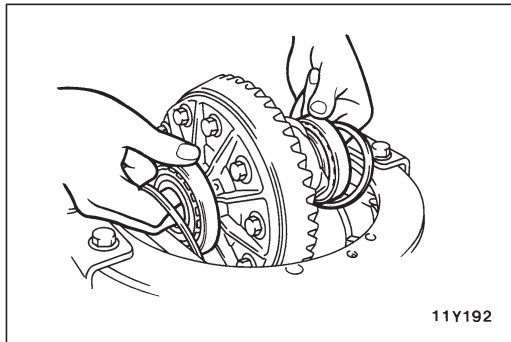
4. Install the drive gear onto the differential case with the mating marks properly aligned.
5. Tighten the drive gear attaching bolts provisionally, and then tighten them to the specified torque in a diagonal sequence.

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.



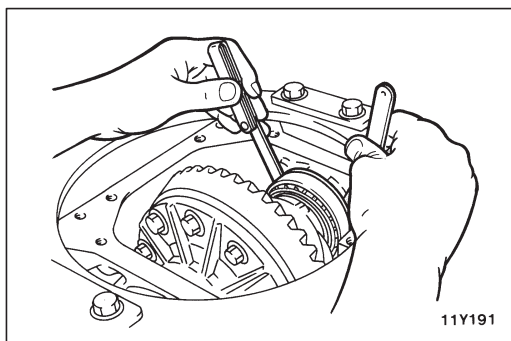
►J◄ DRIVE GEAR BACKLASH ADJUSTMENT

Adjust the drive gear backlash by the following procedures:

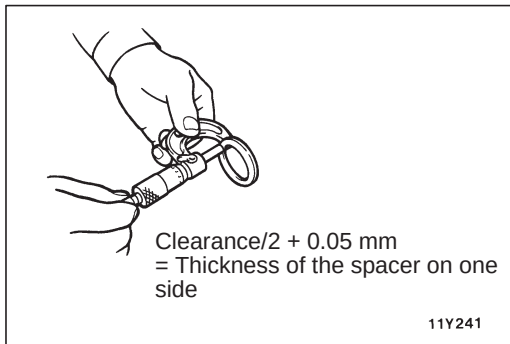
1. Install the side bearing spacers, which are thinner than those removed, to the side bearing outer races, and then mount the differential case assembly into the gear carrier.

NOTE

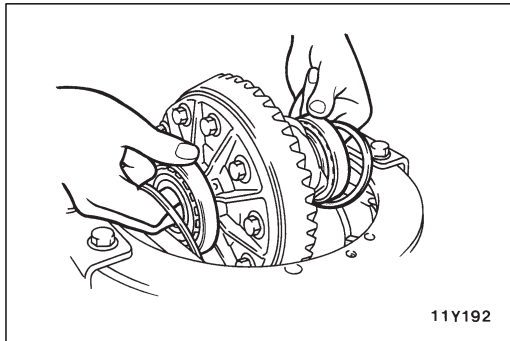
Select side bearing spacers with the same thickness for both the drive gear sides.



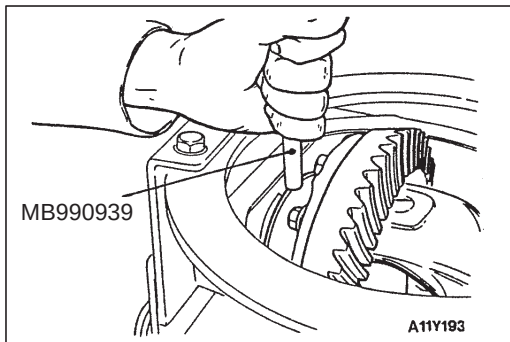
2. Push the differential case assembly to one side, and measure the clearance between the gear carrier and the side bearing spacer with a thickness gauge.



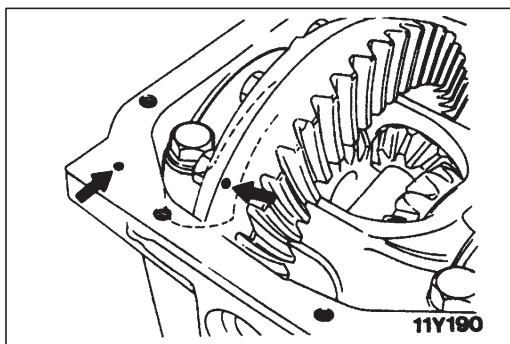
3. Measure the thickness of the side bearing spacers on one side, select two pairs of spacers which correspond to that thickness plus one half of the clearance plus 0.05 mm, and then install one pair each to the drive pinion side and the drive gear side.



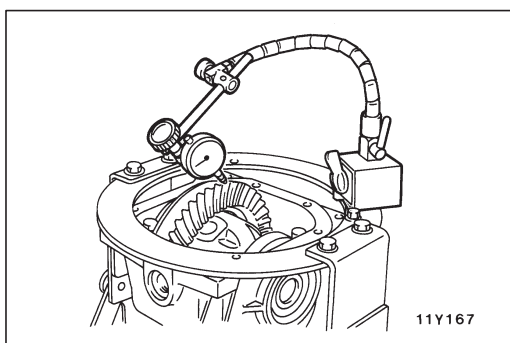
4. Install the selected side bearing spacers and differential case assembly, as shown in the illustration, to the gear carrier.



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.

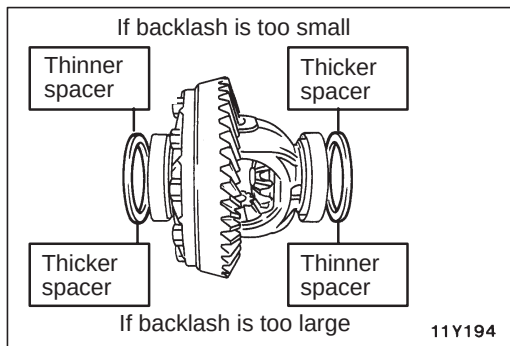


7. With the drive pinion locked in place, measure the drive gear backlash with a dial indicator on the drive gear.

NOTE

Measure at four points or more on the circumference of the drive gear.

Standard value: 0.11 – 0.16 mm

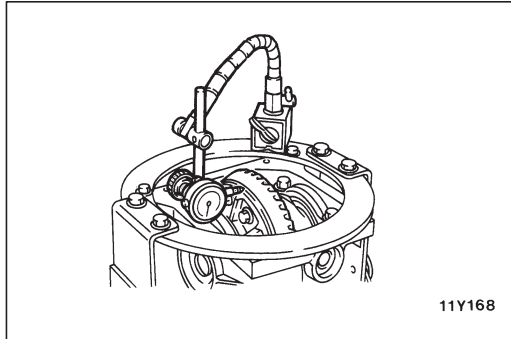


8. Change the side bearing spacers as illustrated, and then adjust the drive gear backlash.

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

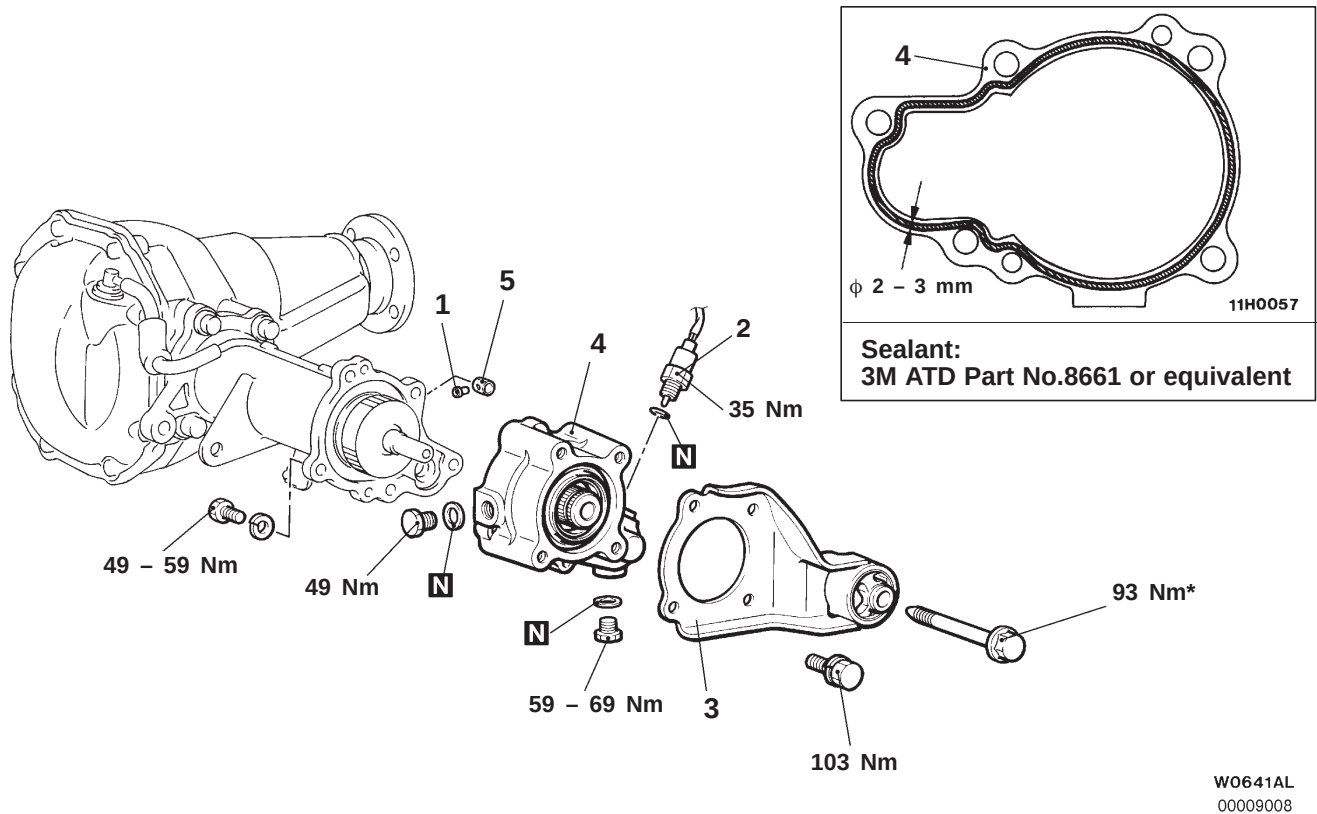
REMOVAL AND INSTALLATION

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.)

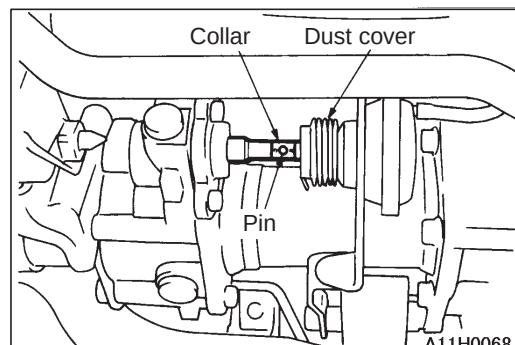


Removal steps



1. Pin
2. Free-wheeling engage switch assembly
3. Differential mount bracket assembly <LH>

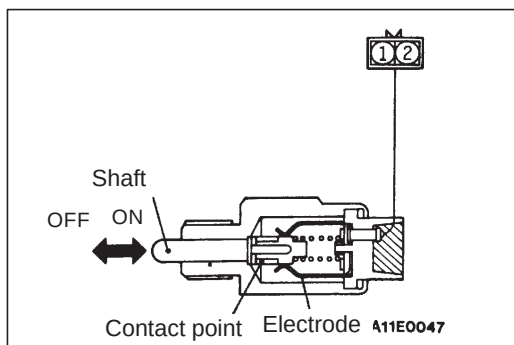
4. Free-wheeling clutch housing assembly
5. Collar



REMOVAL SERVICE POINT

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.

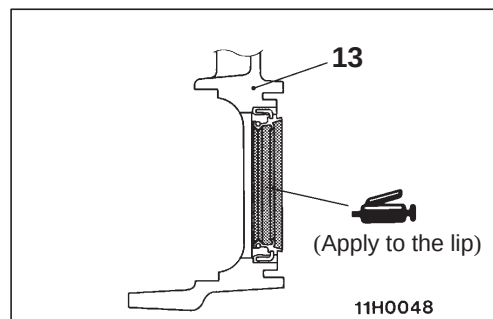
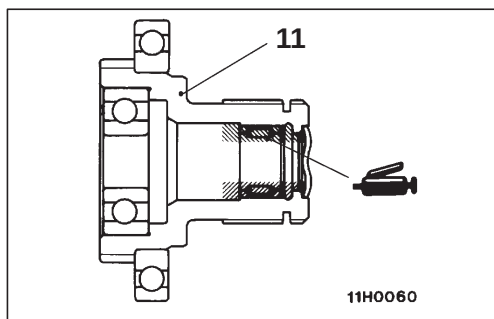
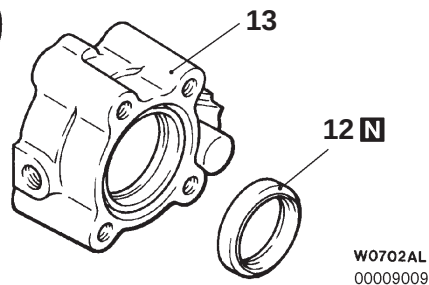
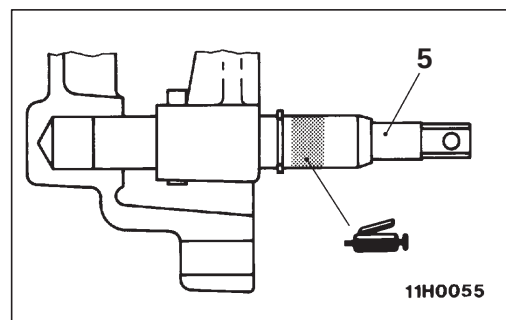
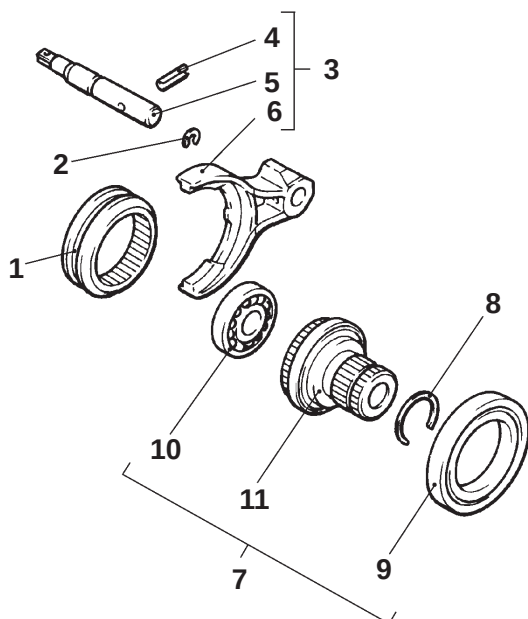


INSPECTION

FREE-WHEELING ENGAGE SWITCH CONTINUITY CHECK

Shaft (switch) position	Terminal number	
	1	2
Pushed (ON)		
Released (OFF)		

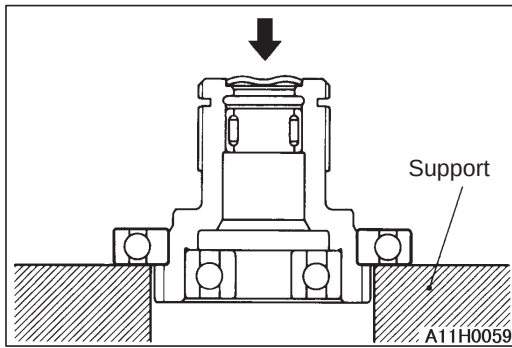
DISASSEMBLY AND REASSEMBLY



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

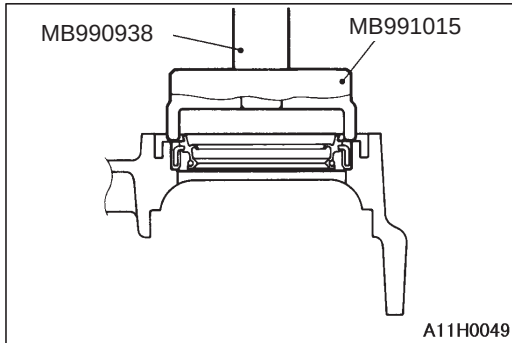
- ◄A► ►B◄ 8. Circlip
9. Bearing
10. Bearing
11. Clutch gear
►A◄ 12. Oil seal
13. Free-wheeling clutch housing



DISASSEMBLY SERVICE POINT

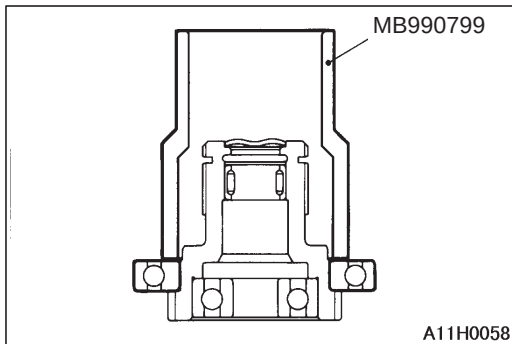
◀A▶ BEARING REMOVAL

Position the bearing inner race on a support. Then use a press to separate the clutch gear from the bearing.



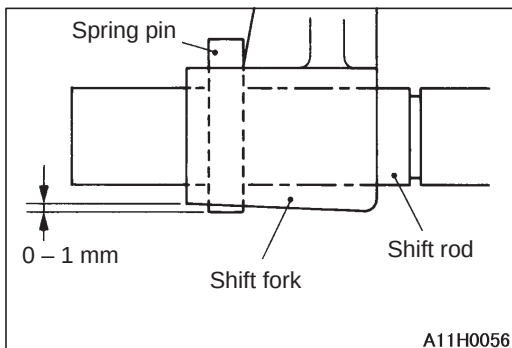
REASSEMBLY SERVICE POINTS

▶A◀ OIL SEAL INSTALLATION



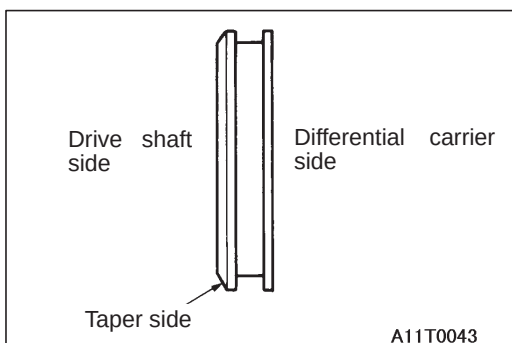
▶B◀ BEARING INSTALLATION

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.

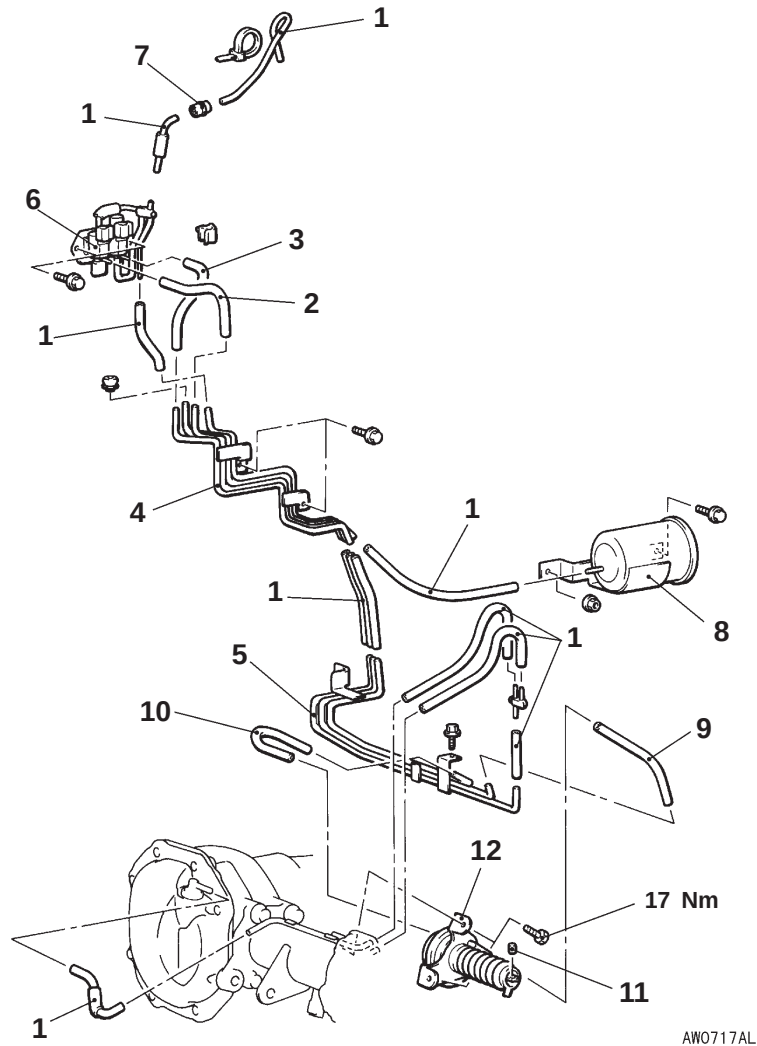


▶D◀ CLUTCH SLEEVE INSTALLATION

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

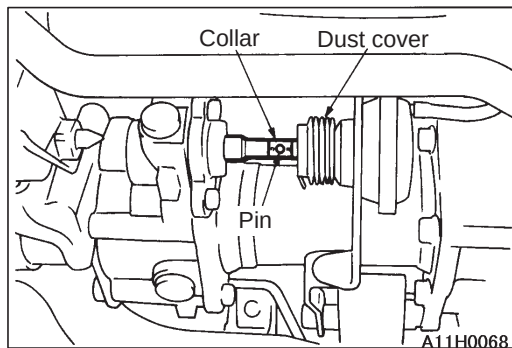


AW0717AL

- ▶A◀ 1. Vacuum hose
▶A◀ 2. Vacuum hose <blue stripe>
▶A◀ 3. Vacuum hose <yellow stripe>
4. Vacuum pipe assembly
5. Vacuum pipe assembly
▶B◀ 6. Solenoid valve assembly
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

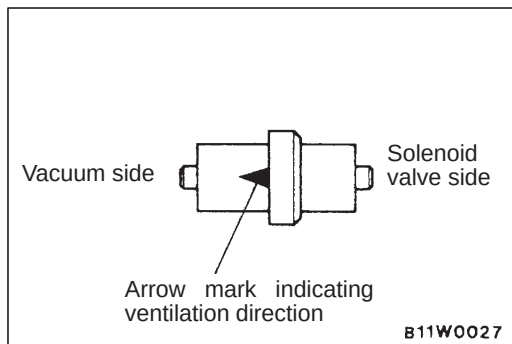
◀A▶ PIN REMOVAL

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

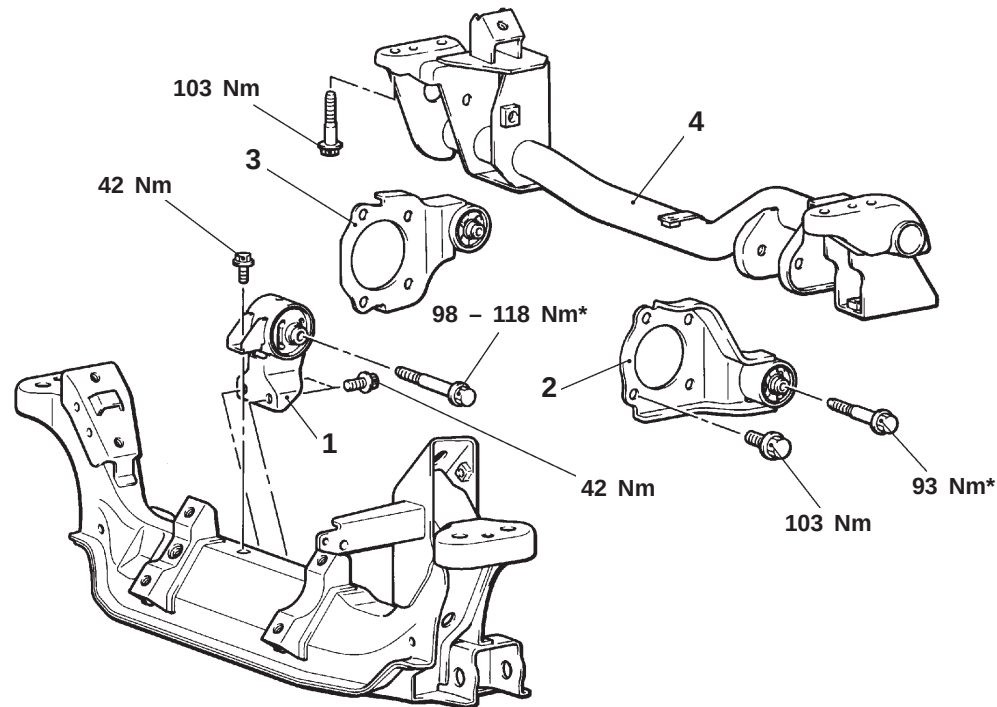
Face the arrow mark to the vacuum side.

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.



AW0701AL

Differential mount bracket assembly (front) removal steps

- Free-wheeling clutch assembly removal (Refer to P. 26-45.)
1. Differential mount bracket assembly <front>

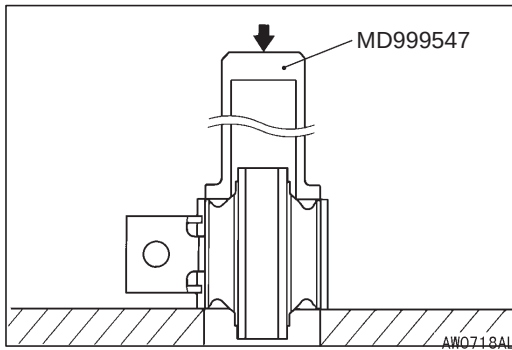
Differential mount bracket assembly (LH, RH) removal steps

- 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

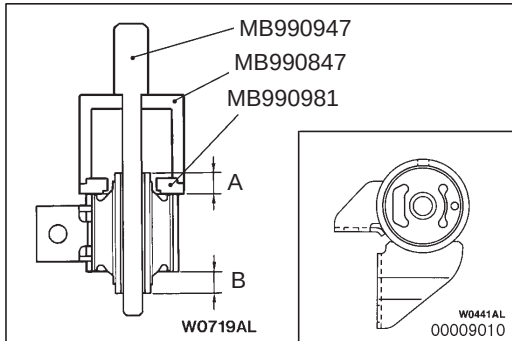
- Front propeller shaft removal (Refer to GROUP 25.)
4. Differential mount crossmember assembly



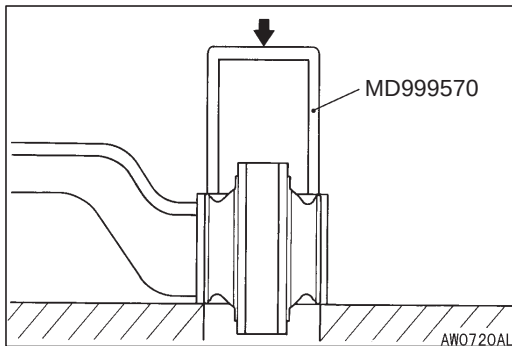
DIFFERENTIAL MOUNT INSULATOR REPLACEMENT

FRONT

1. Use the special tool to drive out the insulator.

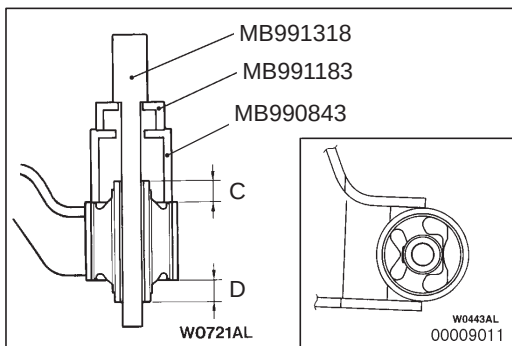


2. Use the special tools and a press to press-fit the insulators so that their hollow portion points to the shown direction and the insulator protrudes evenly (Distance A is equal to distance B).



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

REAR AXLE

CONTENTS

GENERAL INFORMATION	2	Rear Axle Total Backlash Check	6
SERVICE SPECIFICATIONS	3	Gear Oil Level Check	7
LUBRICANTS	3	Wheel Bearing Axial Play Check	7
SEALANTS AND ADHESIVES	4	Axle Housing Oil Seal Replacement	7
SPECIAL TOOLS	4	AXLE ASSEMBLY	9
ON-VEHICLE SERVICE	6	AXLE SHAFT	11
		DIFFERENTIAL CARRIER	15

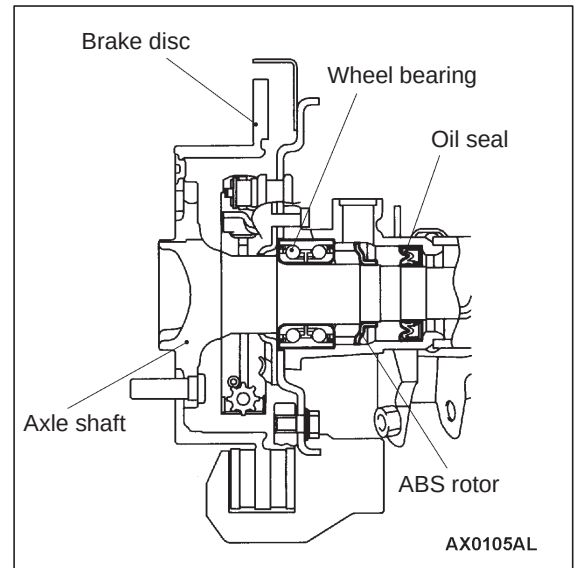
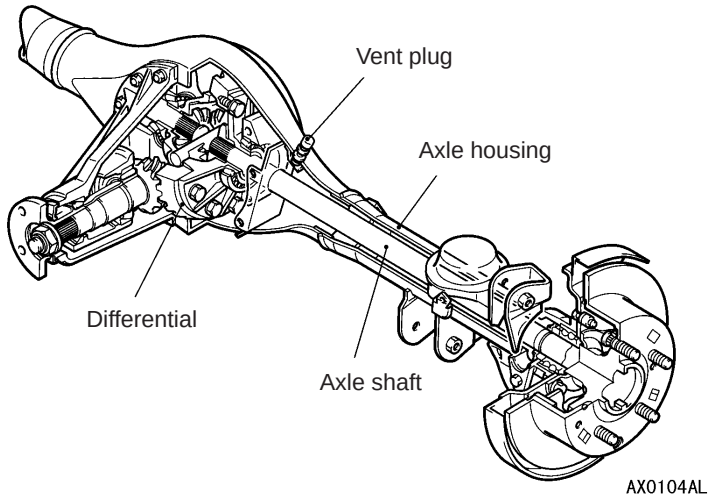
GENERAL INFORMATION

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	–

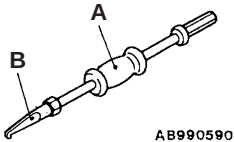
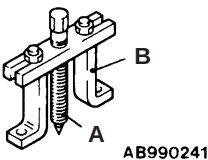
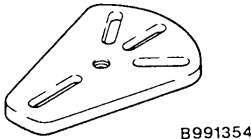
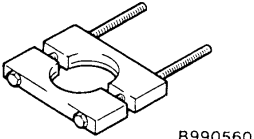
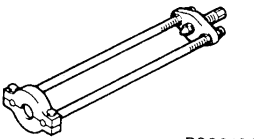
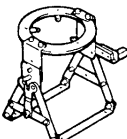
LUBRICANTS

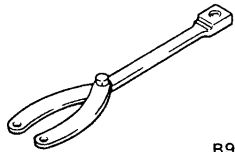
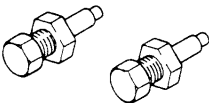
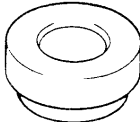
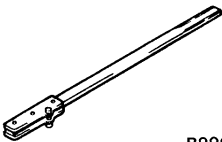
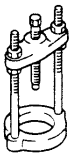
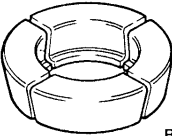
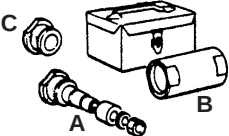
Items	Specified lubricant	Quantity
Gear oil	Hypoid gear oil API classification GL-5 or higher SAE viscosity No. 90, 80W	Approx. 1.7 ℓ

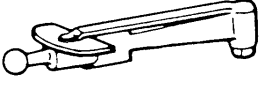
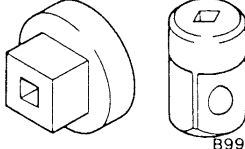
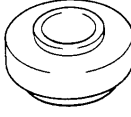
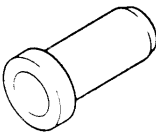
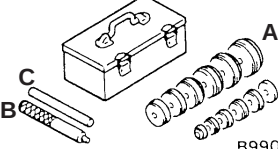
SEALANTS AND ADHESIVES

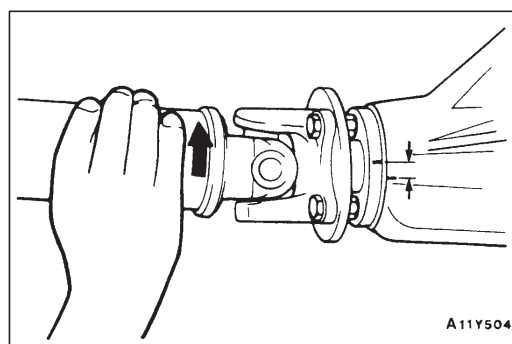
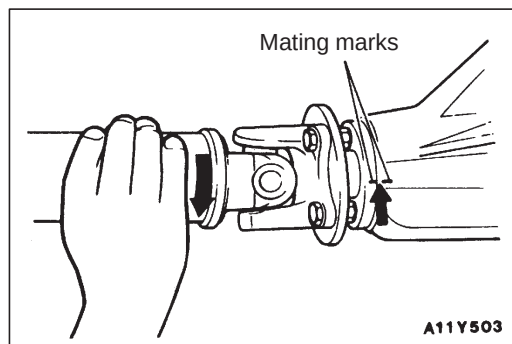
Items	Specified sealants and adhesives	Specified sealants and adhesives
Bearing case	3M ATD Part No. 8661 or equivalent	Semi-drying sealant
Axle housing (Differential carrier installation surface)		
Drive gear threaded holes	3M Stud Locking 4170 or equivalent	Anaerobic sealant

SPECIAL TOOLS

Tool	Number	Name	Use
 AB990590	MB990590 A: MB990211 B: MB990212	Rear axle shaft oil seal remover A: Slide hammer B: Adapter	• Axle shaft removal • Axle housing oil seal removal
 AB990241	MB990241 A: MB990242 B: MB990244	Axle shaft puller A: Puller shaft B: Puller bar	Axle shaft removal
 B991354	MB991354	Puller body	
 B990560	MB990560	Rear axle shaft bearing remover	Rotor removal
 B990104	MB991284	Axle shaft bearing puller set	Axle shaft wheel bearing removal
 B990909	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	
 A: MB990819 B: MB991170 C: MB991169	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

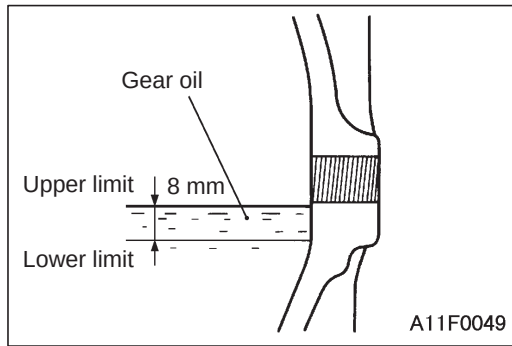
REAR AXLE TOTAL BACKLASH CHECK

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

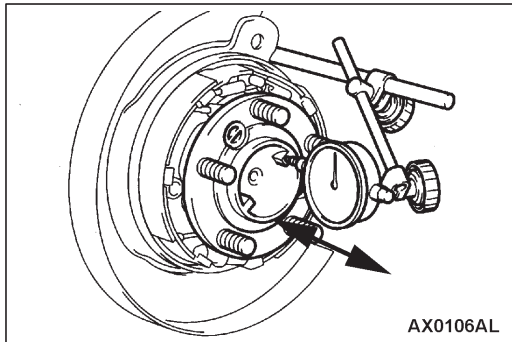
1. Remove the filler plug.
2. Check that the gear oil level is between the upper limit (the bottom of a filler plug) and the lower limit.
3. If the gear oil level is not between the upper limit and the lower limit, add the specified gear oil until the gear oil level reaches the bottom of the filler plug.

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

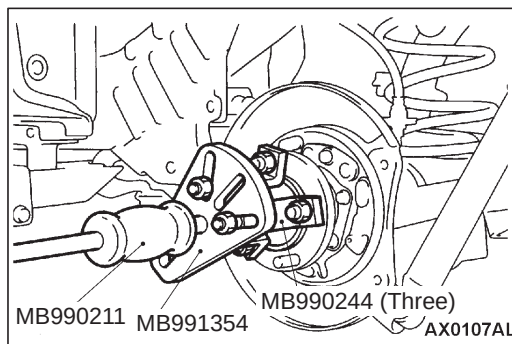


WHEEL BEARING AXIAL PLAY CHECK

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.

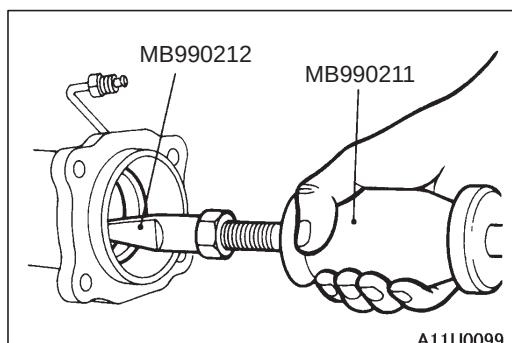
Limit: 0.025 mm

2. If the axial play exceeds the limit, check the backing plate to axle housing tightening torque. If it is correct, replace the bearing.

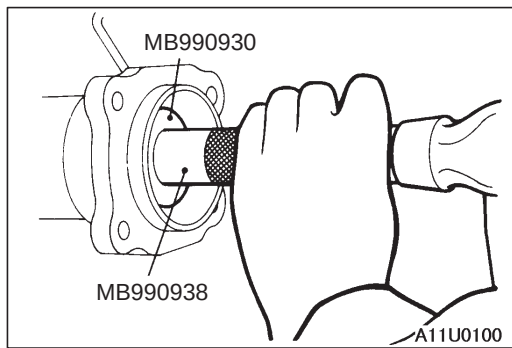


AXLE HOUSING OIL SEAL REPLACEMENT

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

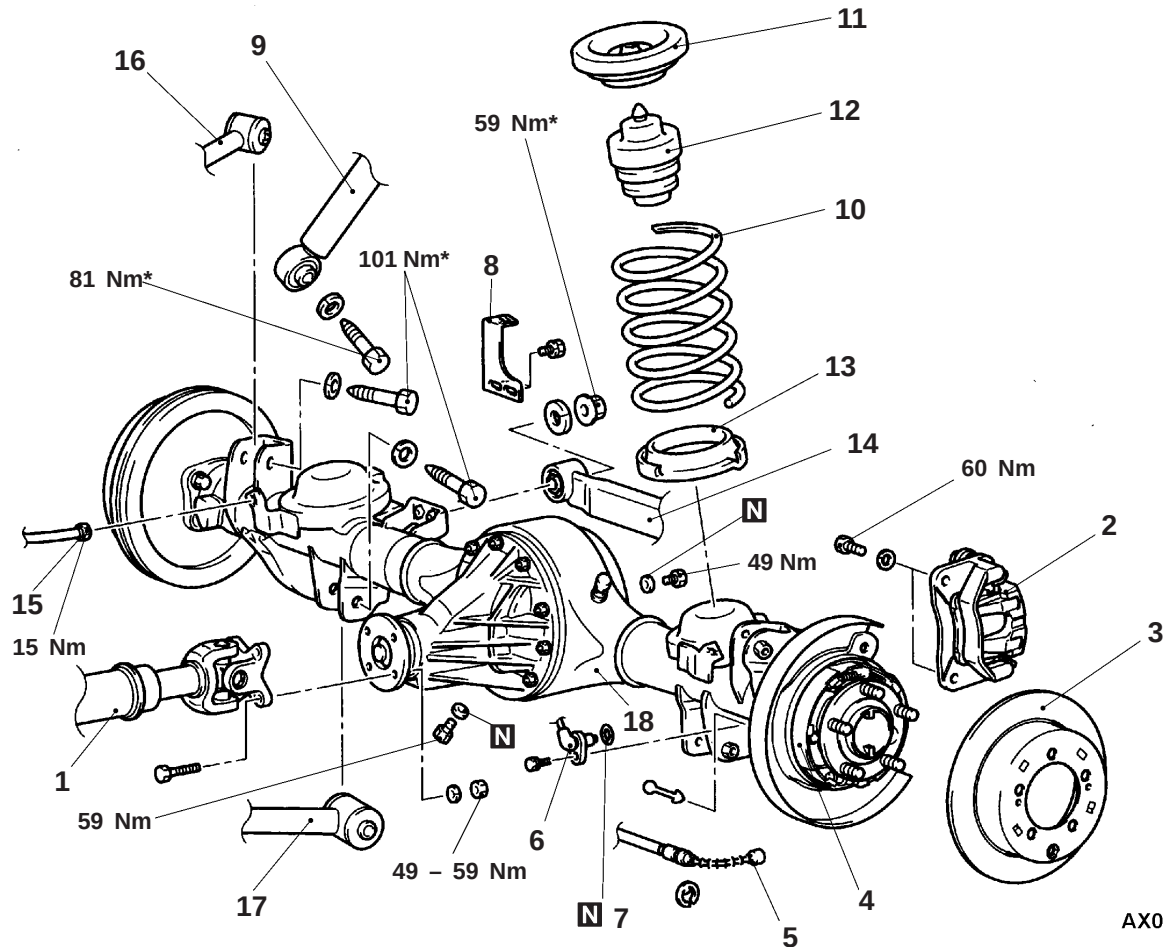
1. To prevent bushings from breakage, the parts indicated by * should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.
2. Be careful not to strike the pole piece at the tip of the wheel speed sensor against the other parts when removing and installing 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.)



AX0108AL

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 9. Shock absorber connection ◀B▶	◀C▶ 10. Coil spring (Refer to GROUP 34 – Rear Suspension Assembly.) 11. Silencer sheet 12. Bump stopper 13. Lower spring pad 14. Lateral rod connection 15. Rear brake pipe and hose connection 16. Upper arm connection 17. Lower arm connection 18. Axle assembly ◀D▶

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

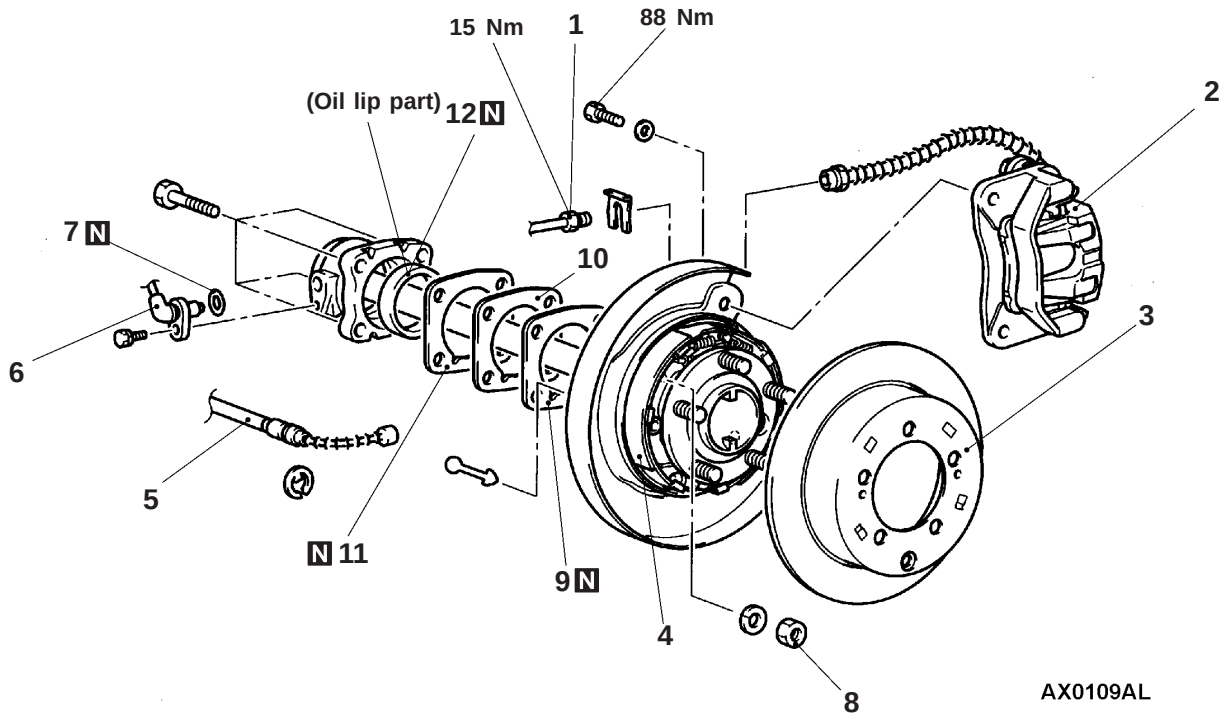
REMOVAL AND INSTALLATION

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.)

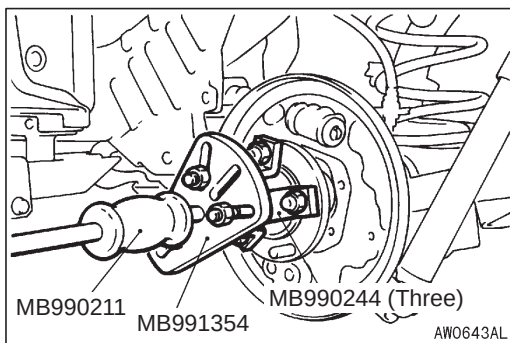


AX0109AL

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>

◀A▶	7. O-ring <Vehicles with ABS>
▶B▶	8. Axle shaft assembly
▶B▶	9. Packing(s)
▶B▶	10. Shim(s)
▶B▶	11. Packing(s)
◀B▶	▶A▶ 12. Oil seal



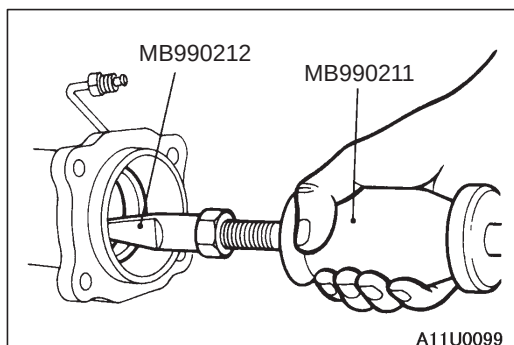
REMOVAL SERVICE POINTS

◀A▶ AXLE SHAFT ASSEMBLY REMOVAL

Use the special tools to remove the axle shaft assembly.

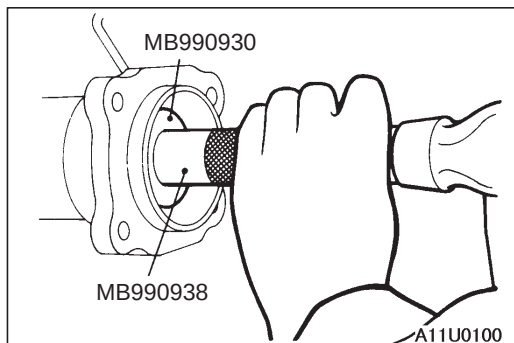
Caution

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.

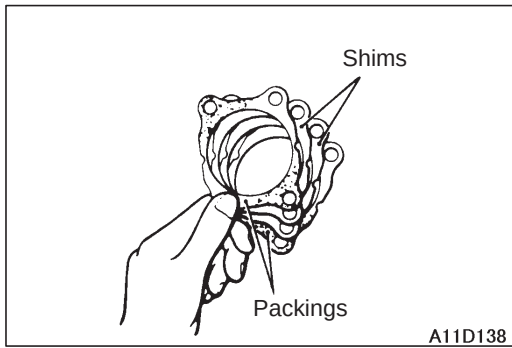
▶B◀ PACKING/SHIM INSTALLATION

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.

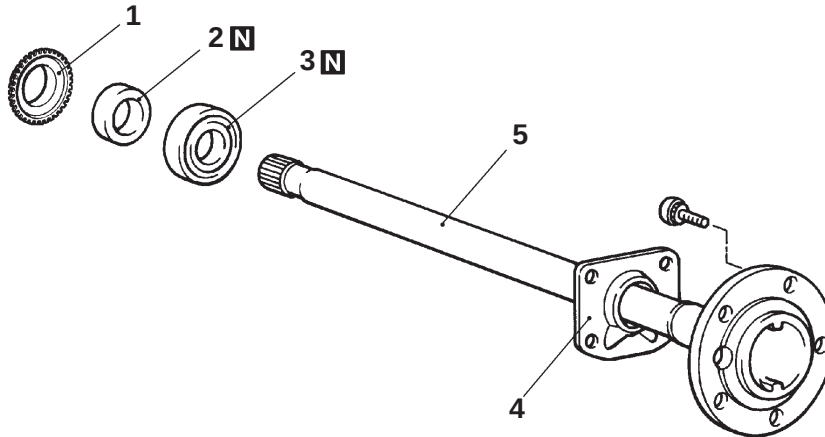
Clearance mm	Number of packing	Number of shim
0.2	0	0
0.2 – 0.5	1	0
0.5 – 0.75	2	0
0.75 – 1.0	2	1
1.0 – 1.25	2	2



- (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

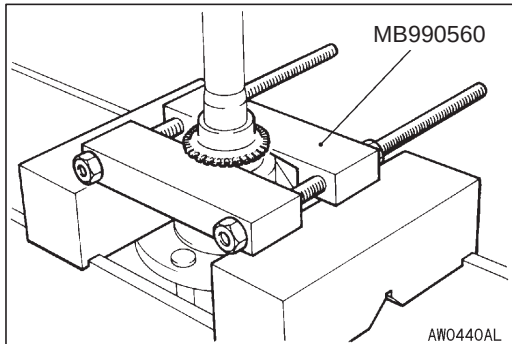
DISASSEMBLY AND REASSEMBLY



Disassembly steps

1. ABS rotor <Vehicles with ABS>
2. Bearing inner retainer
3. Wheel bearing

4. Bearing outer retainer
5. Axle shaft



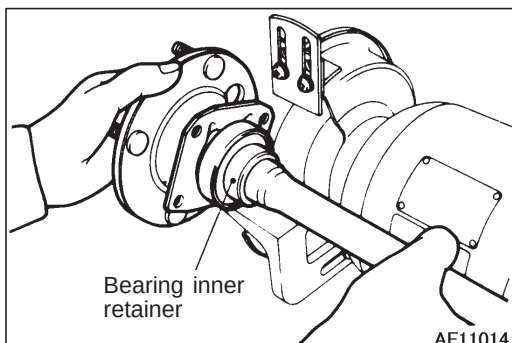
DISASSEMBLY SERVICE POINTS

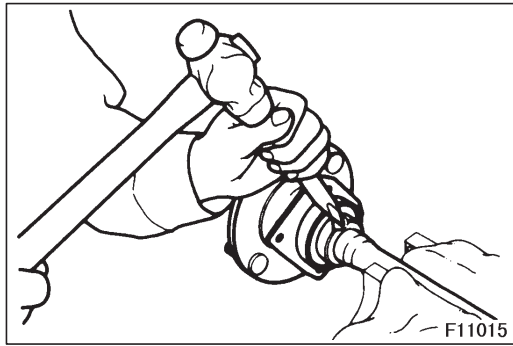
◀A▶ ABS ROTOR REMOVAL

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.

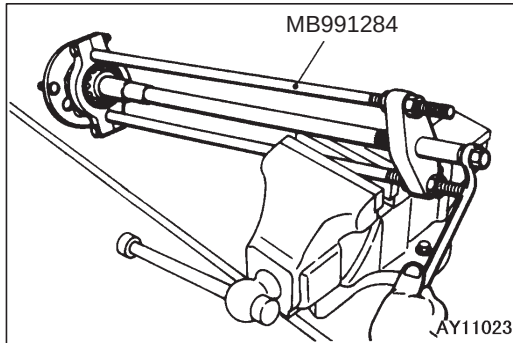




2. Use a chisel to cut the shaven part of the bearing inner retainer, and then remove the bearing inner retainer.

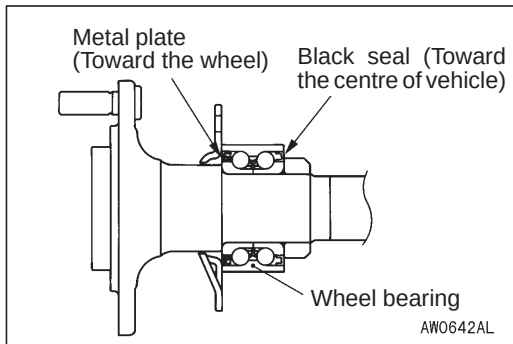
Caution

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

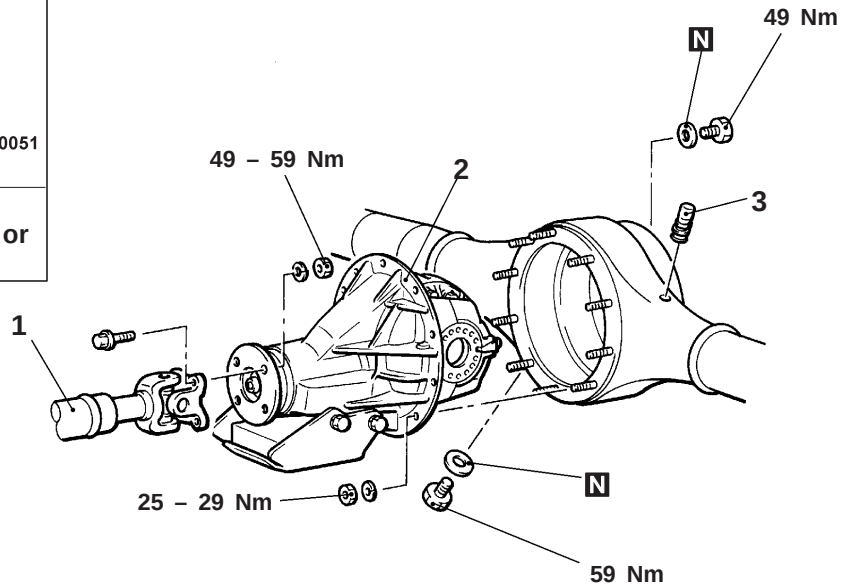
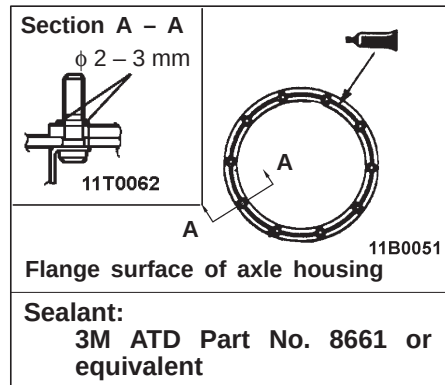
REMOVAL AND INSTALLATION

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.)



AW0714AL

Removal steps



1. Rear propeller shaft connection
2. Differential carrier assembly
3. Vent plug

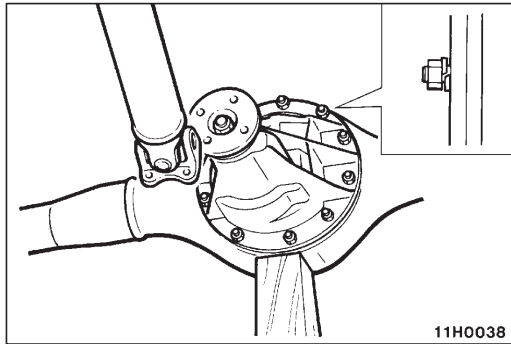
REMOVAL SERVICE POINTS

◀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

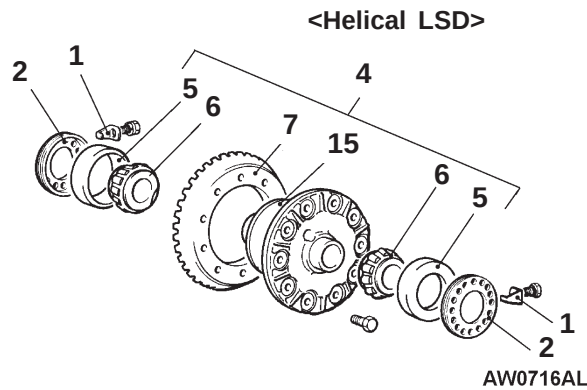
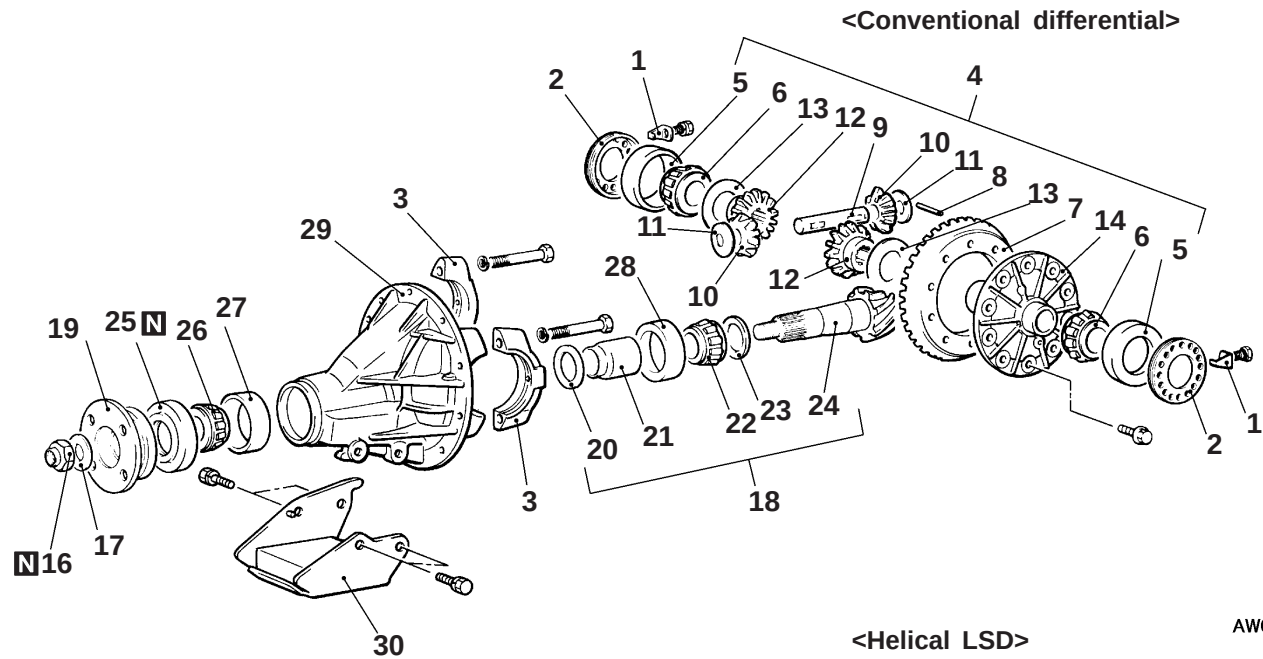
DIFFERENTIAL GEAR BACKLASH

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.



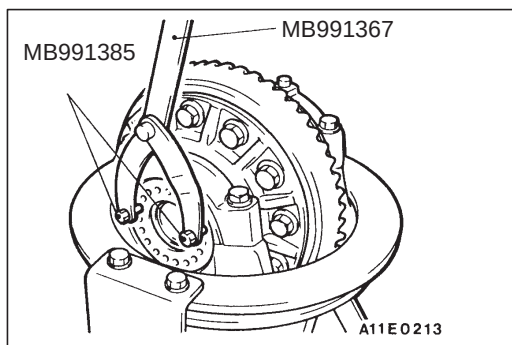
AW0715AL

AW0716AL

Disassembly steps

- Inspection before disassembly (Refer to P.27-17.)

◀A▶	1. Locking plate	◀F▶	17. Washer
◀B▶	2. Side bearing nut	◀F▶	18. Drive pinion assembly
◀C▶	3. Bearing cap		19. Companion flange
◀D▶	4. Differential case assembly		20. Drive pinion front shim (for drive pinion turning torque adjustment)
	5. Side bearing outer race	◀G▶	21. Drive pinion spacer
	6. Side bearing inner race		22. Drive pinion rear bearing inner race
	7. Drive gear		23. Drive pinion rear shim (for drive pinion height adjustment)
	8. Lock pin	◀H▶	24. Drive pinion
	9. Pinion shaft	◀H▶	25. Oil seal
	10. Pinion gear		26. Drive pinion front bearing inner race
	11. Pinion washer	◀H▶	27. Drive pinion front bearing outer race
	12. Side gear		28. Drive pinion rear bearing outer race
	13. Side gear spacer	◀I▶	29. Differential carrier
	14. Differential case		30. Dynamic damper
◀E▶	15. Limited slip differential case assembly		
	16. Self-locking nut		



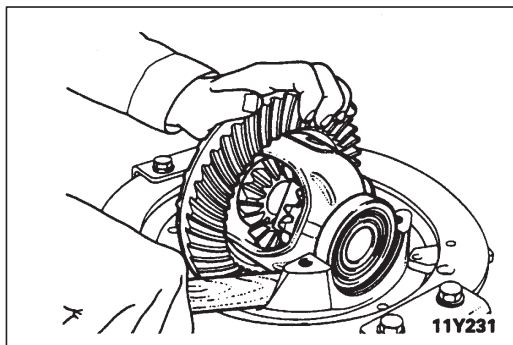
DISASSEMBLY SERVICE POINTS

◀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

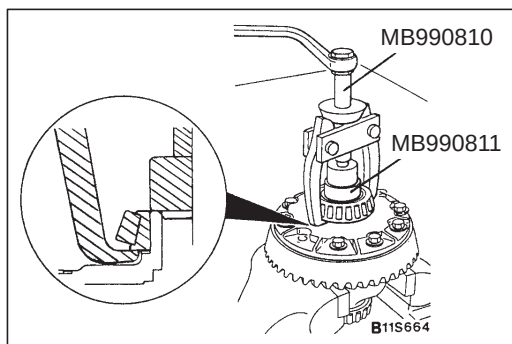
Use the handle of hammer to pry up the differential case assembly.

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.

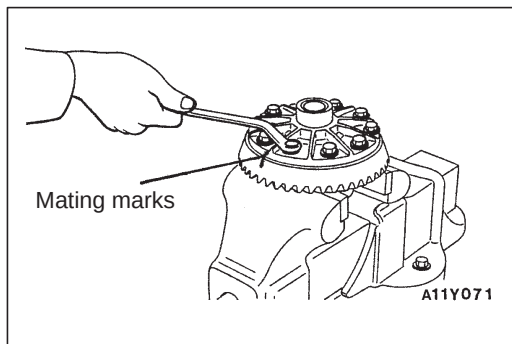


◀C▶ SIDE BEARING INNER RACE REMOVAL

Use the special tools to pull out the side bearing inner race.

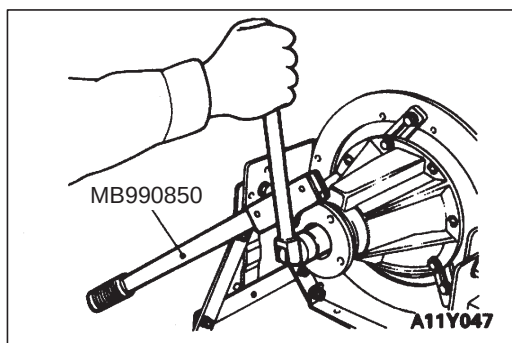
NOTE

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.



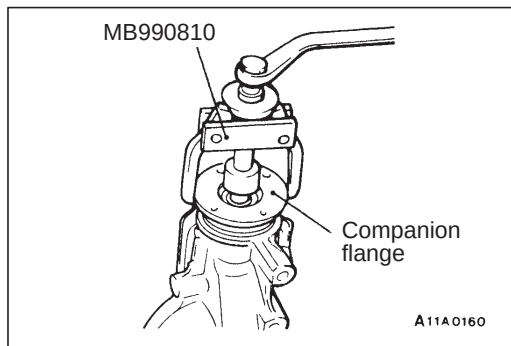
◀D▶ DRIVE GEAR REMOVAL

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.



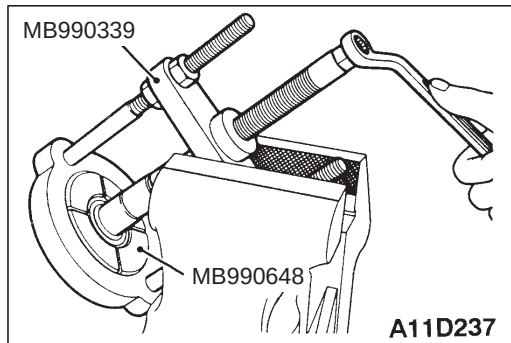
◀F▶ DRIVE PINION ASSEMBLY/COMPANION FLANGE REMOVAL

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

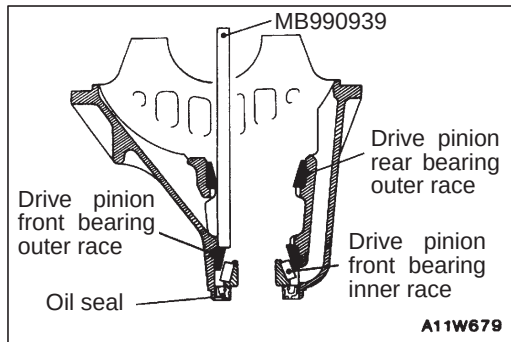
Do not make mating mark on the surface that contacts with the propeller shaft.

2. Use the special tool to remove the companion flange.



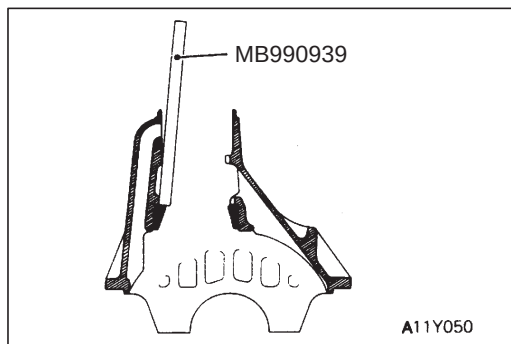
◀G▶ DRIVE PINION REAR BEARING INNER RACE REMOVAL

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

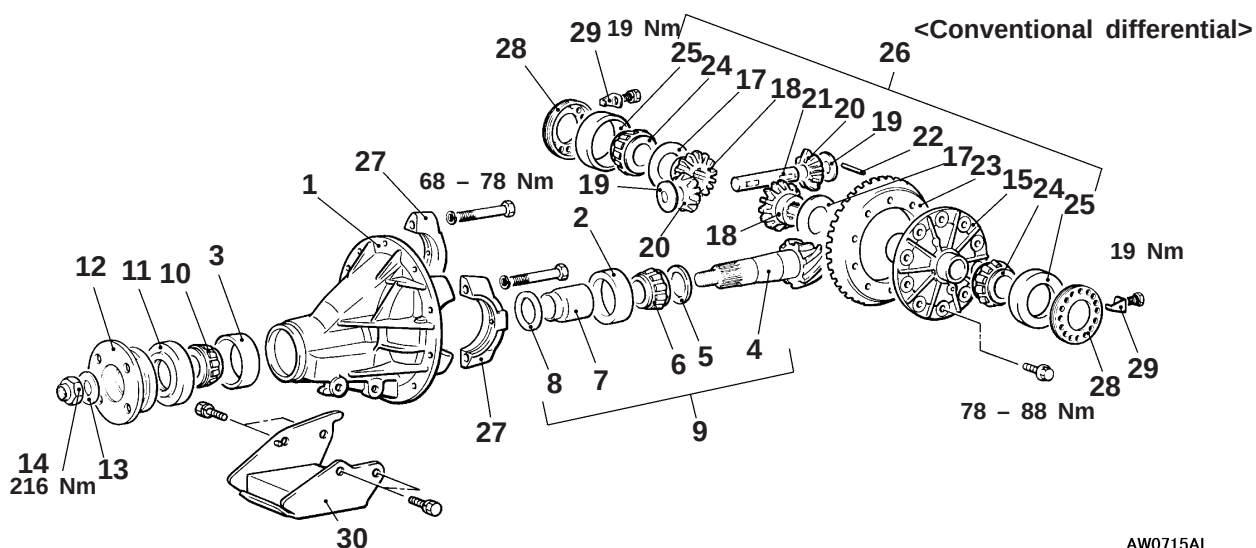
Use the special tool to remove the drive pinion front bearing outer race, drive pinion front bearing inner race and oil seal.



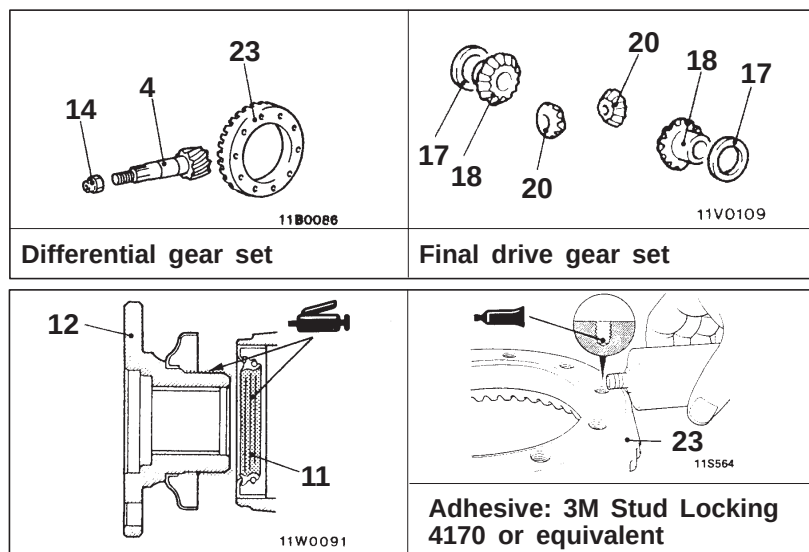
◀I▶ DRIVE PINION REAR BEARING OUTER RACE REMOVAL

Use the special tool to remove the drive pinion rear bearing outer race.

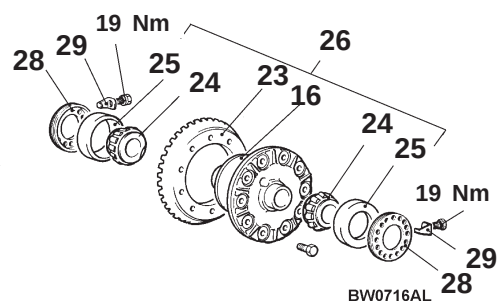
REASSEMBLY



AW0715AL



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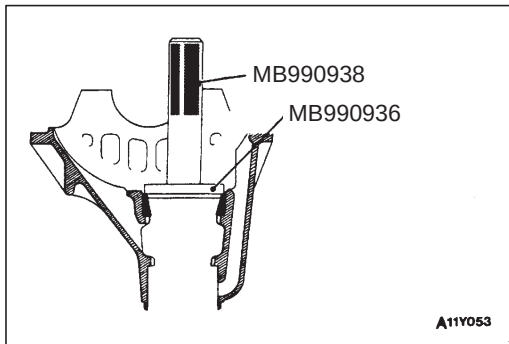


BW0716AL

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

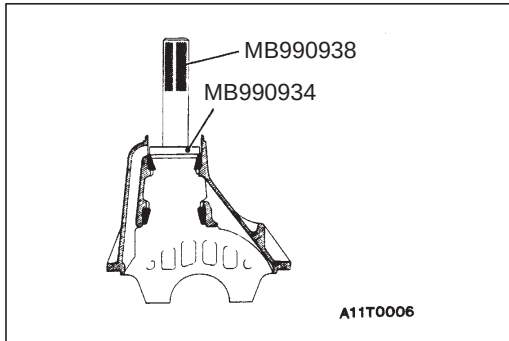
- 14. Self-locking nut
- 15. Differential case
- 16. Limited slip differential case assembly
- ▶E◀
 - Differential gear backlash adjustment
- 17. Side gear spacer
- 18. Side gear
- 19. Pinion washer
- 20. Pinion gear
- 21. Pinion shaft
- 22. Lock pin
- ▶F◀ 23. Drive gear
- ▶G◀ 24. Side bearing inner race
- 25. Side bearing outer race
- 26. Differential case assembly
- 27. Bearing cap
- ▶H◀
 - Drive gear backlash adjustment
- ▶I◀ 28. Side bearing nut
- 29. Locking plate
- 30. Dynamic damper



REASSEMBLY SERVICE POINTS

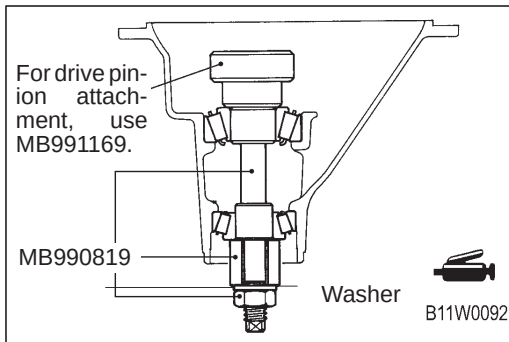
►A◄ DRIVE PINION REAR BEARING OUTER RACE PRESS-FITTING

Use the special tools to tap in the drive pinion rear bearing outer race.



►B◄ DRIVE PINION FRONT BEARING OUTER RACE PRESS-FITTING

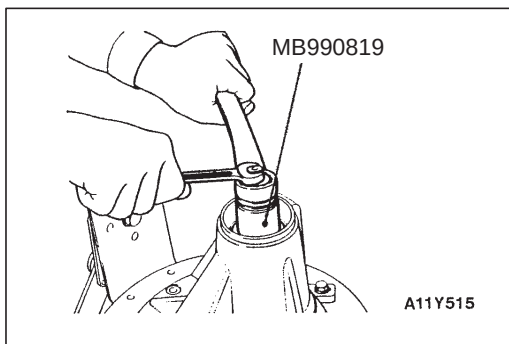
Use the special tools to tap in the drive pinion front bearing outer race.



►C◄ DRIVE PINION HEIGHT ADJUSTMENT

Adjust the drive pinion height by the following procedures:

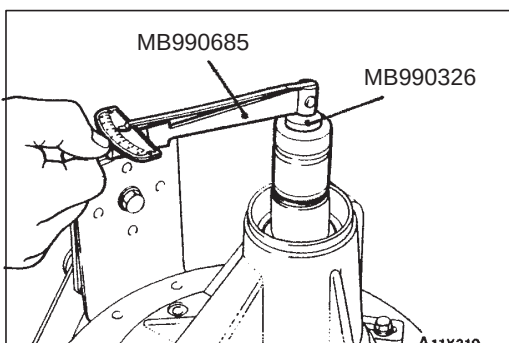
1. Apply multipurpose grease to the washer of special tool.
2. Install the special tools and drive pinion front and rear bearing inner races to the differential carrier in the sequence shown in the illustration.

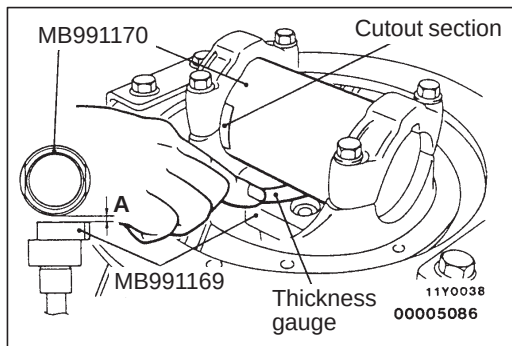


3. Gradually tighten the nut of the special tool while checking the drive pinion turning torque until the standard value of drive pinion turning torque (without oil seal) is obtained.

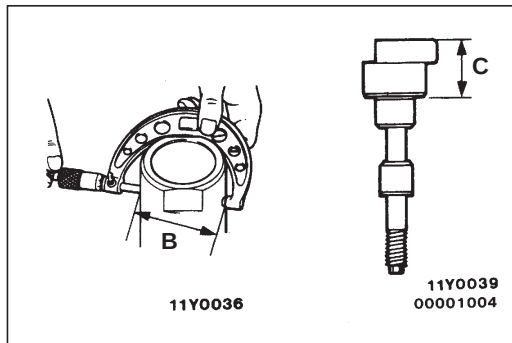
Standard value:

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

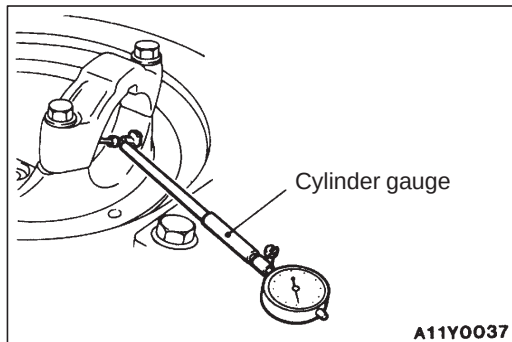




4. Clean the side bearing seat thoroughly.
5. Set the special tool on the side bearing seats, and position the cutout section as shown in the illustration. Then confirm that the special tool contacts with the side bearing seats completely.
6. Use a thickness gauge to measure the clearance (A) between the special tools.

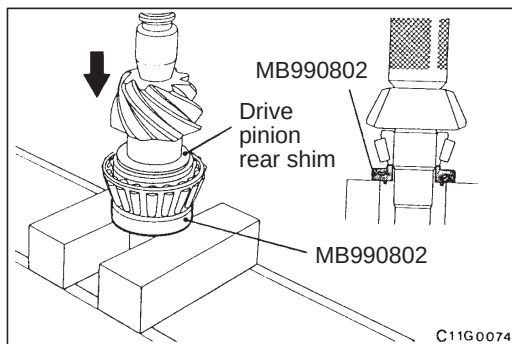


7. Remove special tools MB990720, MB990858, MB991169 and MB991170.
8. Use a micrometer to measure dimensions (B) and (C) of the special tools.



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.

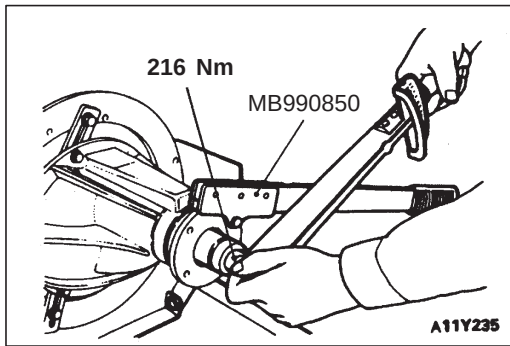
►◄ DRIVE PINION TURNING TORQUE ADJUSTMENT

Adjust the drive pinion turning torque by using the following procedure:

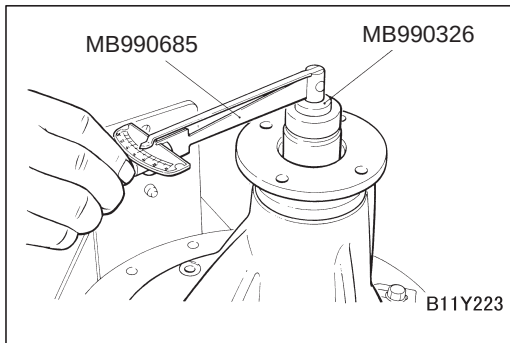
1. Insert the drive pinion into the differential carrier, and then install the drive pinion spacer, the drive pinion front shim, the drive pinion front bearing inner race, and the companion flange in that order.

NOTE

Do not install the oil seal.



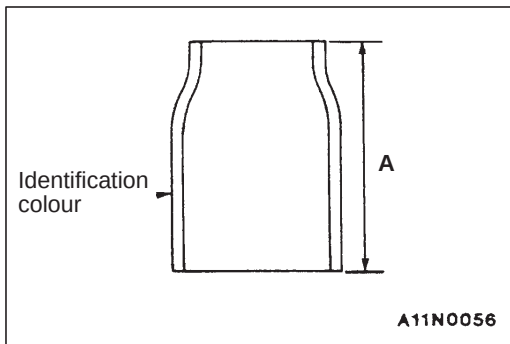
- Use the special tool to hold the companion flange, and then tighten the companion flange self-locking nut to the specified torque.



- 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



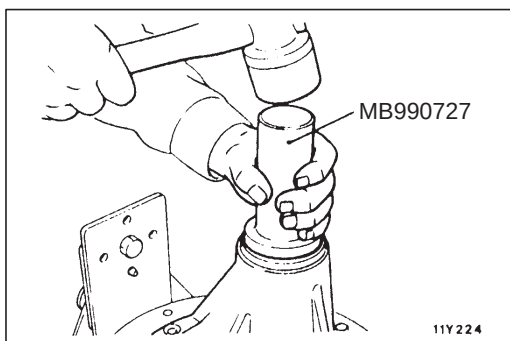
- If the drive pinion turning torque is not within the standard value, adjust the turning torque by replacing the drive pinion front shim(s) or the drive pinion spacer.

NOTE

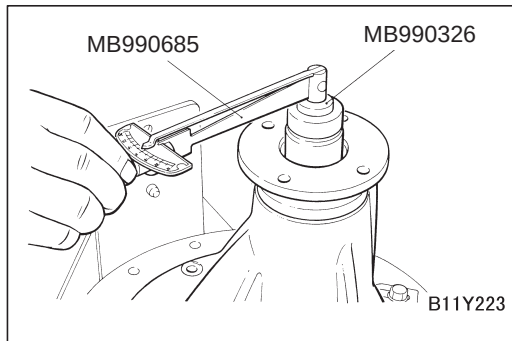
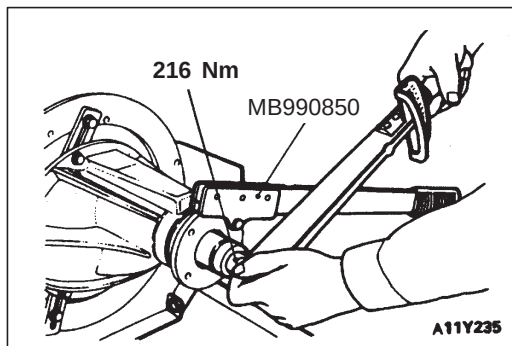
When selecting the drive pinion front shims, if the number of shims is large, reduce the number of shims to a minimum by selecting the drive pinion spacer.

Select either of the following drive pinion spacers.

Height (A) of drive pinion spacer mm	Identification colour
56.67	–
57.01	White



- 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.



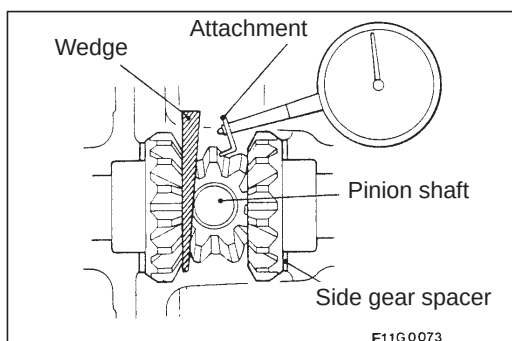
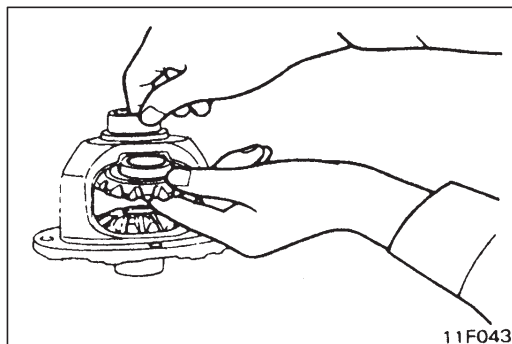
6. Install the drive pinion assembly and the companion flange with mating marks properly aligned. Install the new self-locking nut, then use the special tool to hold the companion flange, and tighten the self-locking nut to the specified torque.

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.



DIFFERENTIAL GEAR BACKSLASH ADJUSTMENT

Adjust the differential gear backslash 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.

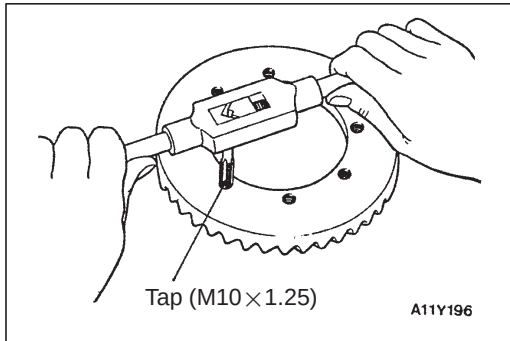
NOTE

The measurement should be made for both pinion gears individually.

Standard value: 0.01 – 0.25 mm

Limit: 0.2 mm

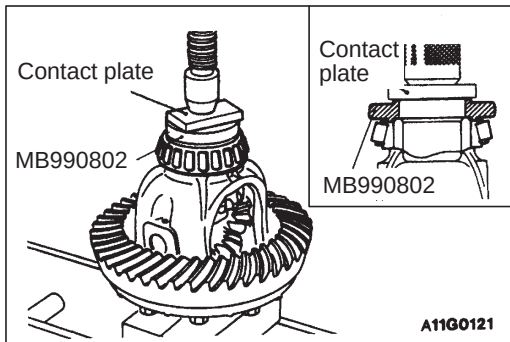
5. If the differential gear backlash exceeds the limit, adjust the backlash by replacing the side gear spacers.
6. If adjustment is not possible, replace the side gears and pinion gears as a set.
7. After adjustment, check that the backlash does not exceed the limit and the differential gear turns smoothly.



►F◄ DRIVE GEAR INSTALLATION

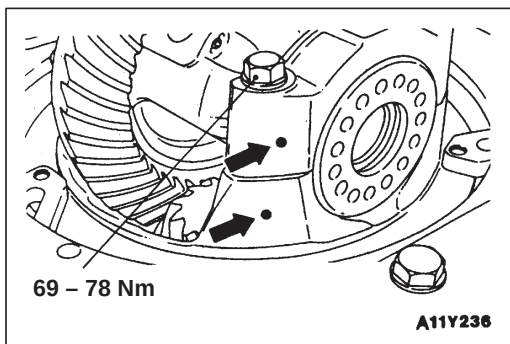
1. Clean the drive gear attaching bolts.
2. Remove the adhesive adhered to the threaded holes of the drive gear by using a tap, and then clean the threaded holes by applying compressed air.
3. Install the drive gear onto the differential case with the mating marks properly aligned.

Tightening torque: 78 – 88 Nm



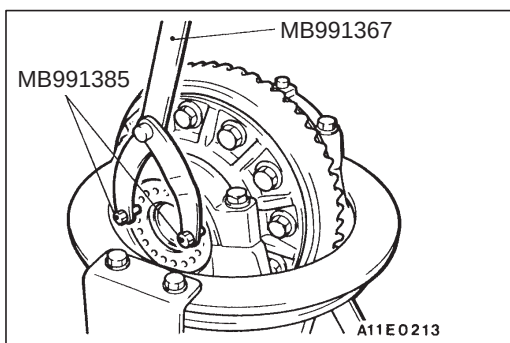
►G◄ SIDE BEARING INNER RACE INSTALLATION

Use the special tool to press-fit the side bearing inner races into the differential case.



►H◄ BEARING CAP INSTALLATION

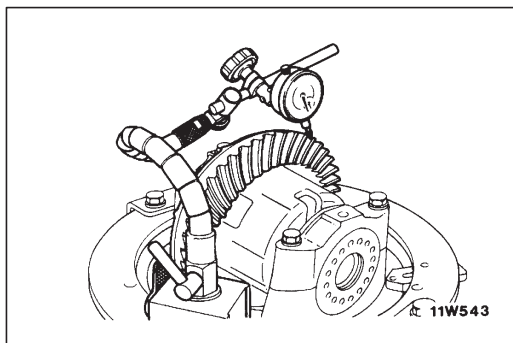
Install the bearing caps with the mating marks properly aligned, and then tighten the bearing caps installation bolts to the specified torque.



►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.

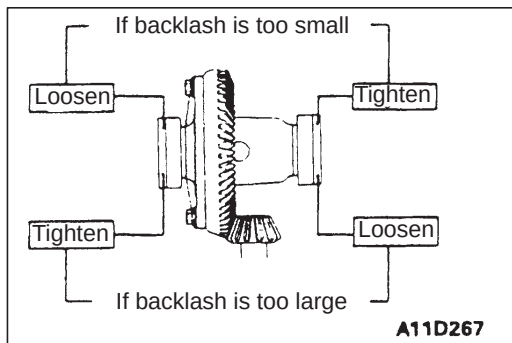


2. With the drive pinion locked in place, measure the drive gear backlash with a dial indicator on the drive gear.

NOTE

Measure at four points or more on the circumference of the drive gear.

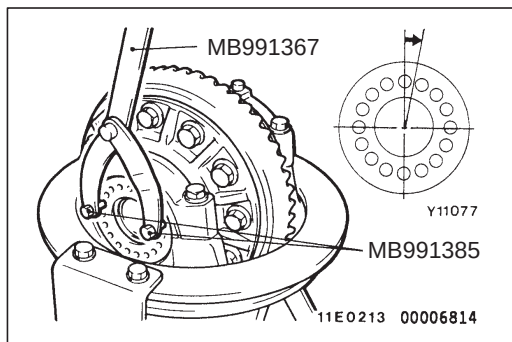
Standard value: 0.08 – 0.13 mm



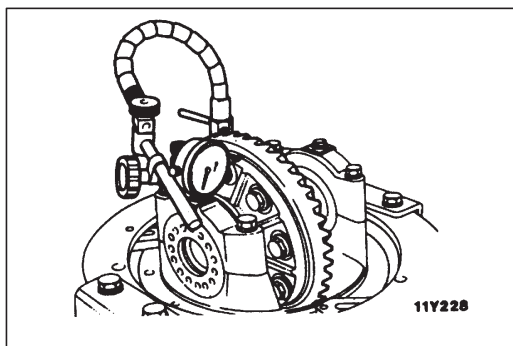
3. If the drive gear backlash is not within the standard value, use the special tools (MB991367 and MB991385) to tighten or loosen the side bearing nuts as shown in the illustration, in order to adjust the backlash.

NOTE

First loosen the side bearing nut, then tighten the side bearing nut the same amount as when it was loosened.



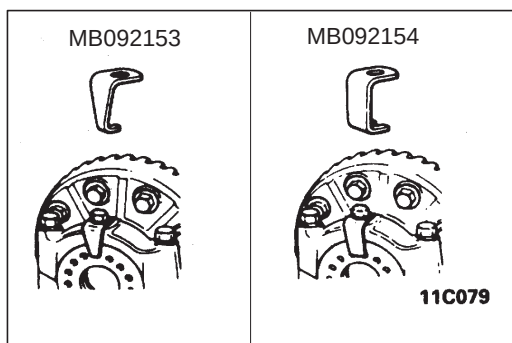
4. Use the special tools to turn down both right and left side bearing nuts on half the distance between centres of two neighboring holes, in order to apply the preload to the side bearing.



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.)

WHEEL AND TYRE

CONTENTS

GENERAL INFORMATION	2	ON-VEHICLE SERVICE	4
SERVICE SPECIFICATIONS	2	Tyre Inflation Pressure Check	4
TROUBLESHOOTING	3	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

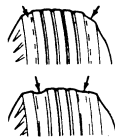
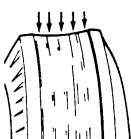
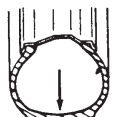
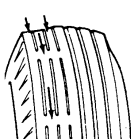
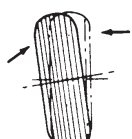
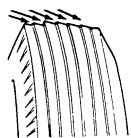
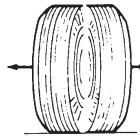
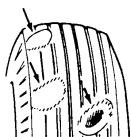
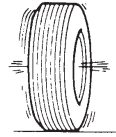
NOTE

*: 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

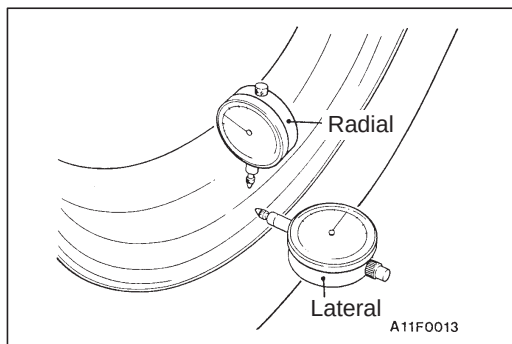
Measure the tread depth of tyres.

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.



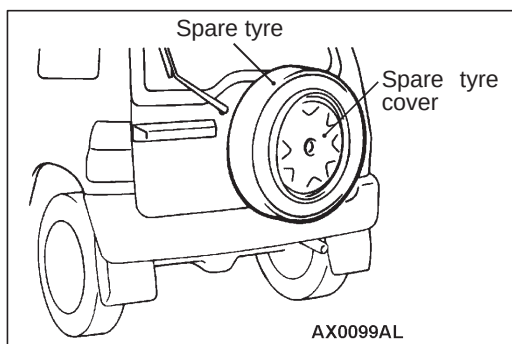
WHEEL RUNOUT CHECK

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

POWER PLANT MOUNT

CONTENTS

ENGINE MOUNTING	2	TRANSMISSION MOUNTING	3

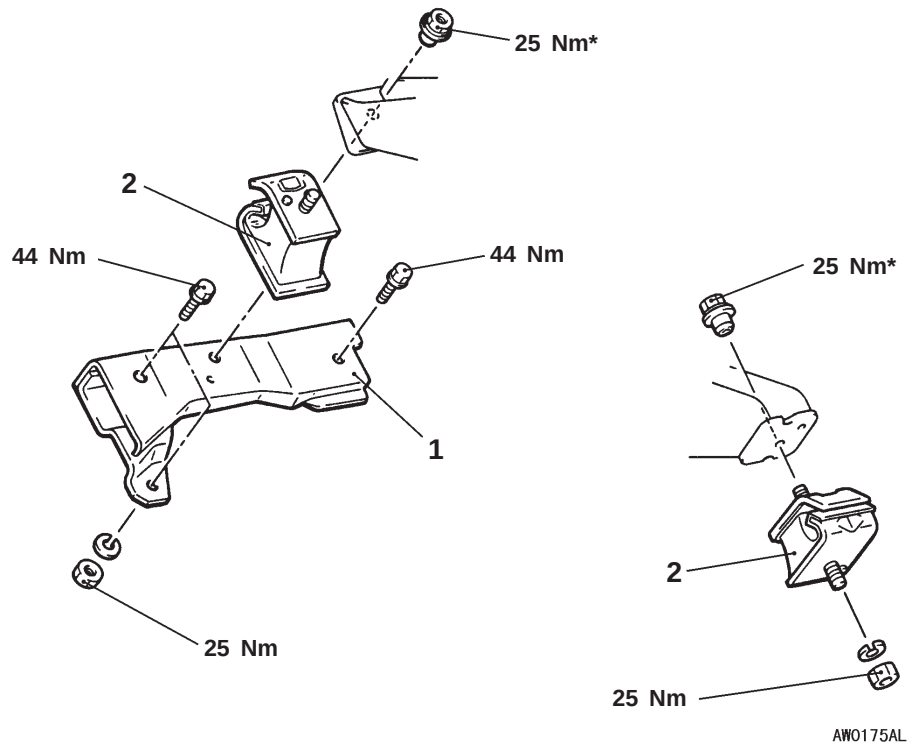
ENGINE MOUNTING

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

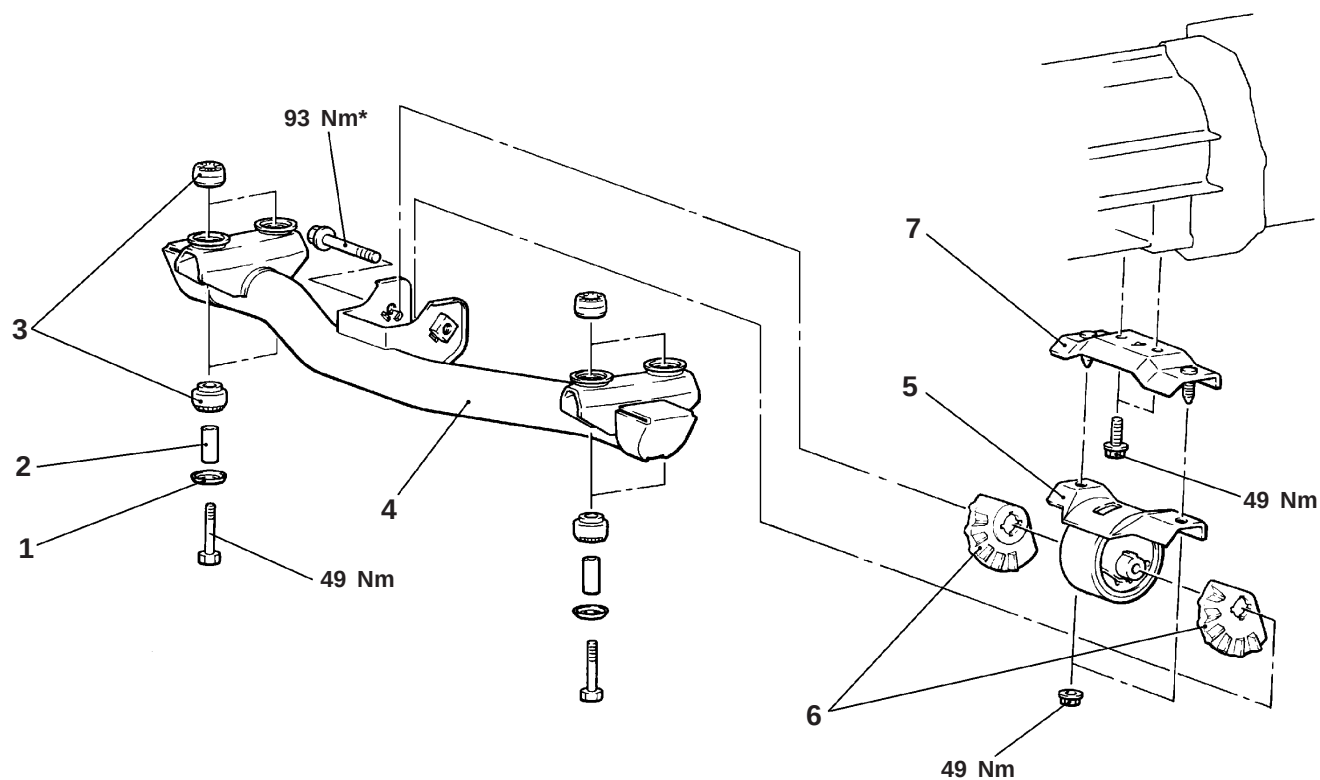
REMOVAL AND INSTALLATION

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

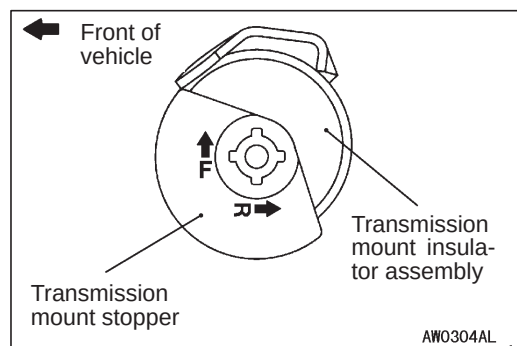
Jack up the Engine and Transmission Assembly until there is no weight on the Engine Mount Bracket Insulator.



Removal steps

1. Washer
2. Spacer
3. Transmission mount bushing
4. Transmission mount crossmember assembly

- A◄ 5. Transmission mount insulator assembly
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

FRONT SUSPENSION

CONTENTS

GENERAL INFORMATION	2	Ball Joint Dust Cover Check	6
SERVICE SPECIFICATIONS	3	STRUT ASSEMBLY	7
SPECIAL TOOLS	3	STRUT BAR AND LOWER ARM	10
ON-VEHICLE SERVICE	4	STABILIZER BAR	13
Wheel Alignment Check and Adjustment	4	CROSSMEMBER	15

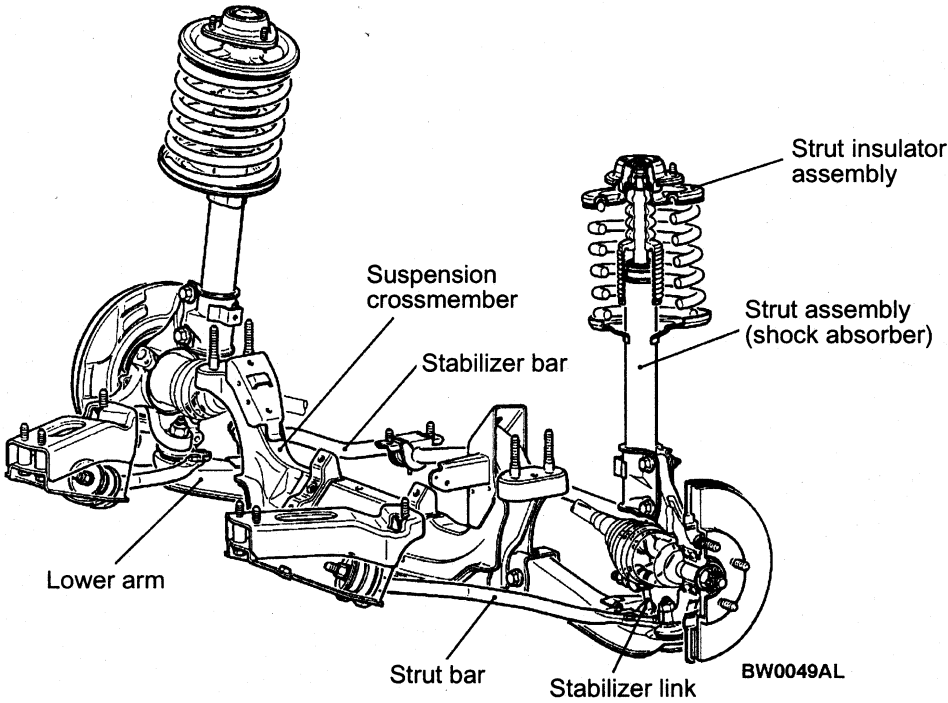
GENERAL INFORMATION

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

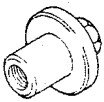
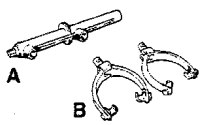
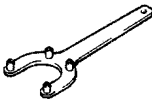
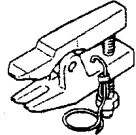
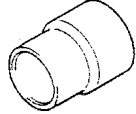
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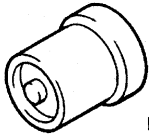
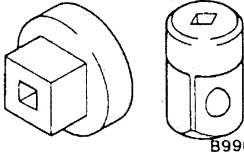
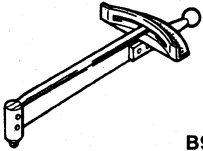
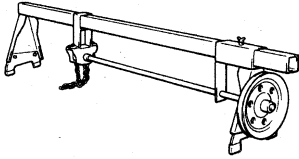
Items		Standard value
Toe-in	At the centre of tyre tread mm	3 ± 2
	Toe-angle (per wheel)	$0^{\circ}07' \pm 05'$
Toe-out angle on turns (inner wheel when outer wheel at 20°)		$21^{\circ}04'$  $-0^{\circ}30' \pm 30'^*$ <ПРАВИЛЬНО>
Camber		~~$0^{\circ}30' \pm 30'^*$~~ <НЕ ПРАВИЛЬНО>
Caster		$3^{\circ}00' \pm 30'^*$
Side slip mm (per 1 m)		0 ± 3
Kingpin inclination		$11^{\circ}04'$
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

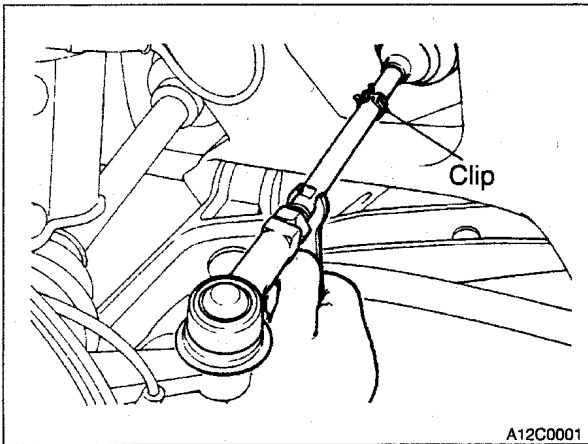
Tools	Number	Name	Use
 B990996	MB990996	Lower arm bushing arbor	Lower arm bushing press-in and press-out
 B99099	MB990997	Lower arm bushing installer support	
 B990326	MB990326	Preload socket	• Lower arm ball joint rotation starting torque measurement • Stabilizer link ball joint rotation torque measurement
 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) $0^{\circ}07' \pm 05'$

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.

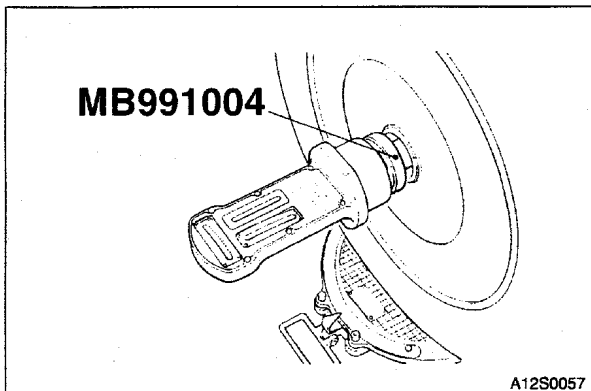
(Refer to GROUP 37A – On-vehicle Service.)

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°): $21^{\circ}04'$



Исправлено согласно ESB-99E33-503 от 2000-04-15

CAMBER, CASTER AND KINGPIN INCLINATION**Standard value:**

$-0^{\circ}30' \pm 30'$

<Правильно>

Item	Specification
Camber (difference between right and left wheel: less than $30'$)	$0^{\circ}30' \pm 30'$ <Не правильно>
Caster (difference between right and left wheel: less than $30'$)	$3^{\circ}00' \pm 30'$
Kingpin inclination	$11^{\circ}04'$

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

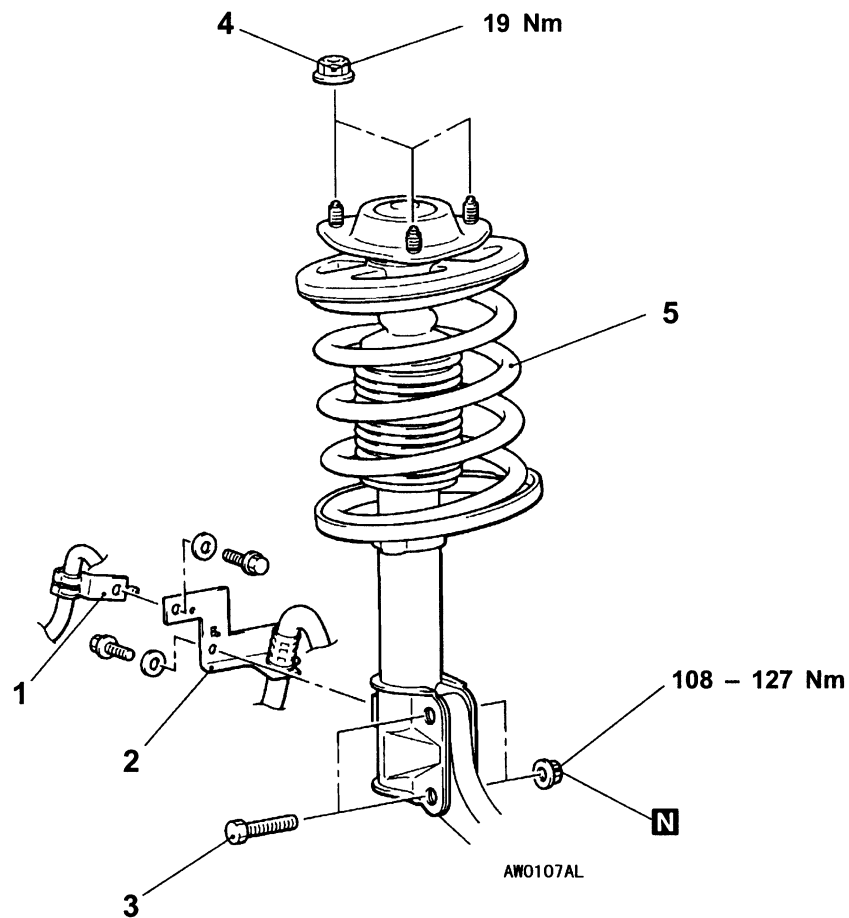
Cracks or damage of the dust cover may cause damage of the ball joint.

STRUT ASSEMBLY**REMOVAL AND INSTALLATION****Pre-removal Operation**

Injector Driver Removal <right side>
(Refer to GROUP 13A.)

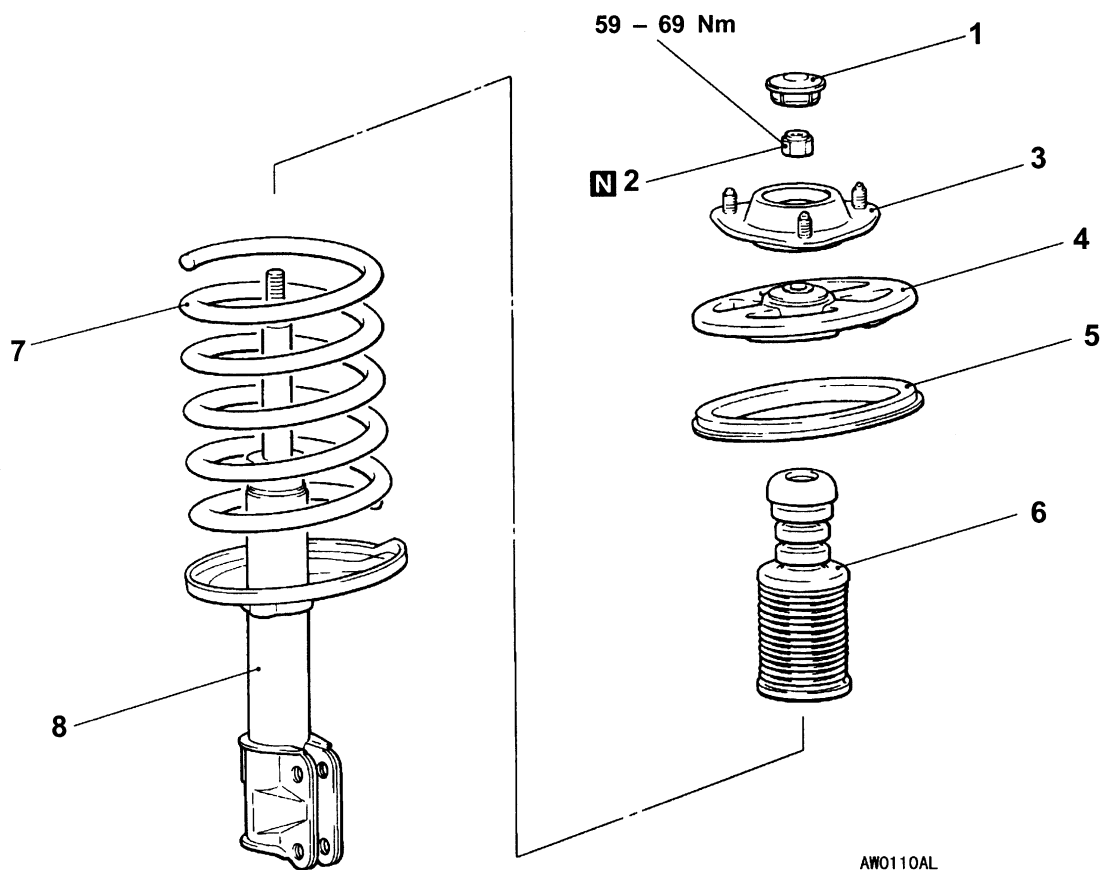
Post-installation Operation

- 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

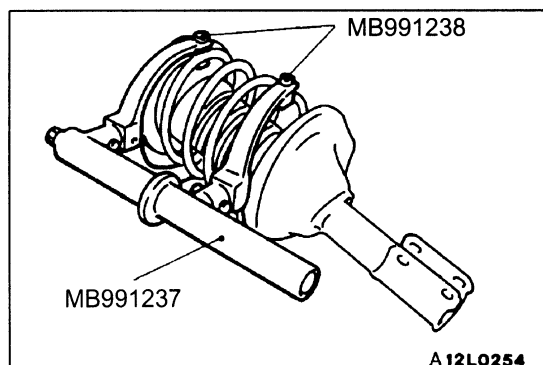
**Disassembly steps**

◀A▶ ▶A▶

1. Dust cover
2. Self-locking nut
3. Strut insulator assembly
4. Upper spring seat assembly

◀B▶

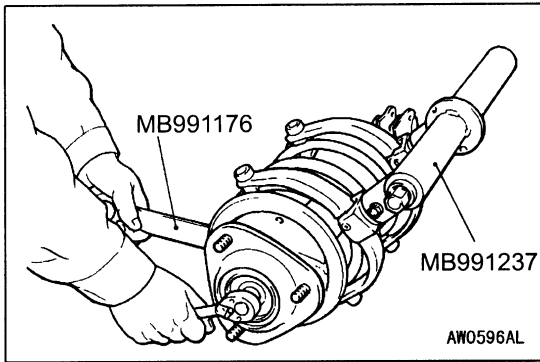
5. Upper spring pad
6. Bump rubber
7. Coil spring
8. Strut assembly

**DISASSEMBLY SERVICE POINT****◀A▶ SELF-LOCKING NUT REMOVAL**

1. Use the special tools to compress the coil spring.

Caution

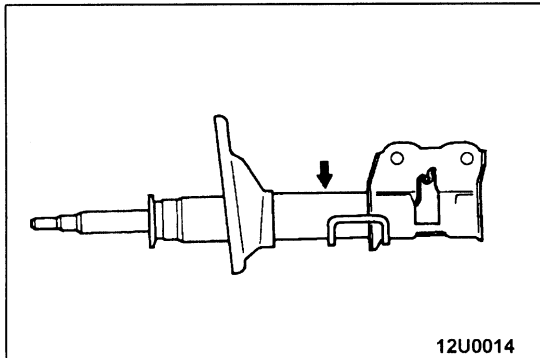
Install the special tools evenly, and so that the maximum length will be attained within the installation range.



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.

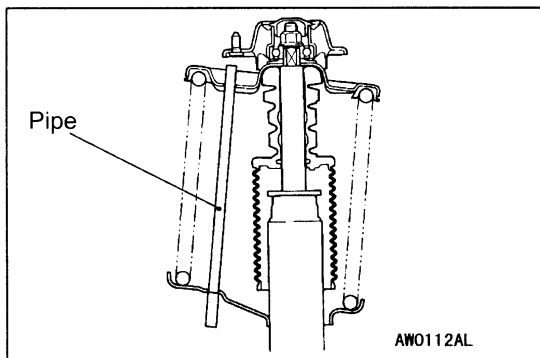


◀B▶ STRUT ASSEMBLY REMOVAL

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.



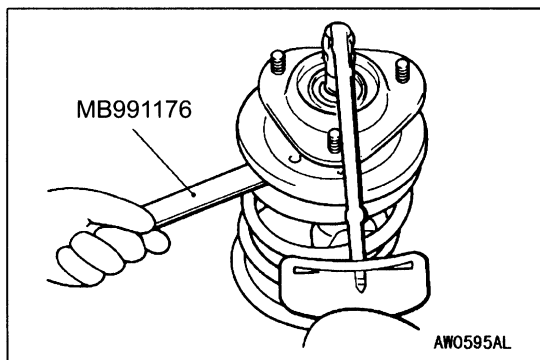
REASSEMBLY SERVICE POINT

▶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.

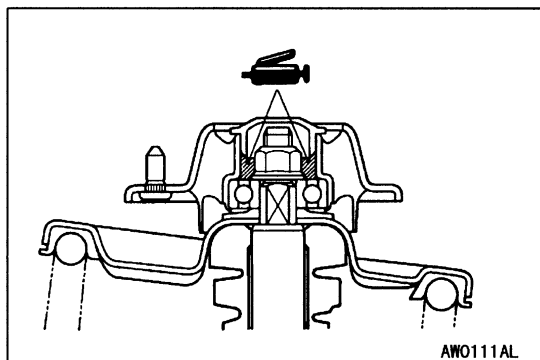
NOTE

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

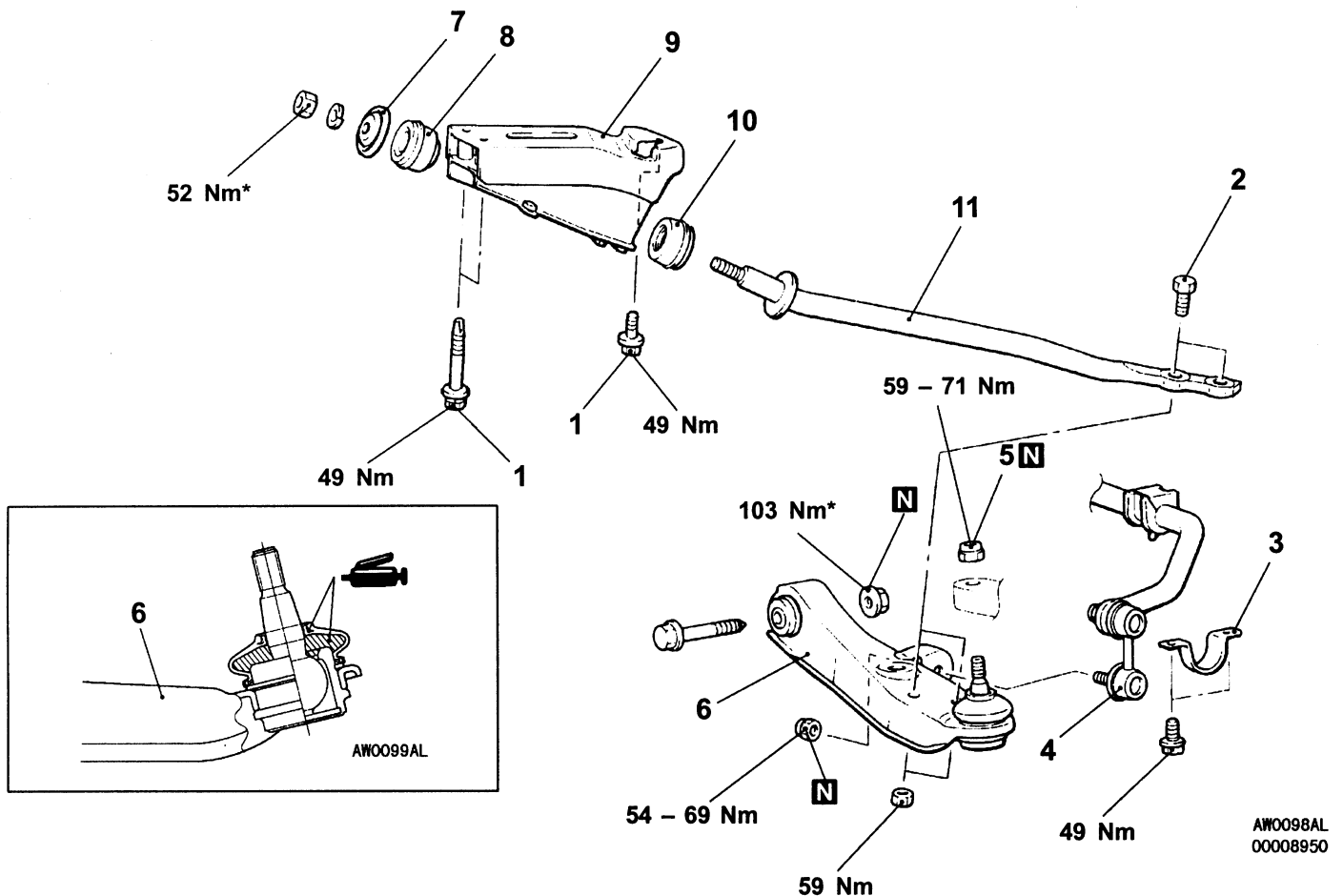
Caution

*: 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

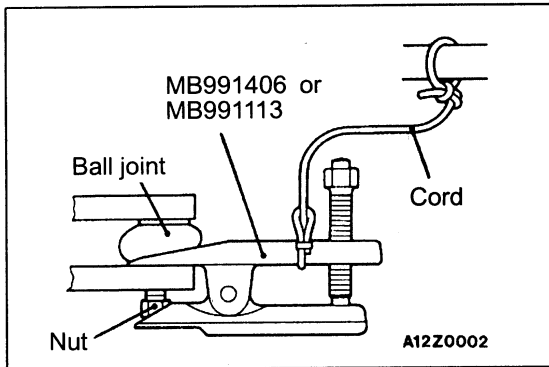


Lower arm removal steps

1. Strut bar bracket installation bolt
2. Strut bar installation bolt
3. Fixture
4. Stabilizer link connection
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
8. Strut bar bushing A
9. Strut bar bracket
10. Strut bar bushing B
11. Strut bar

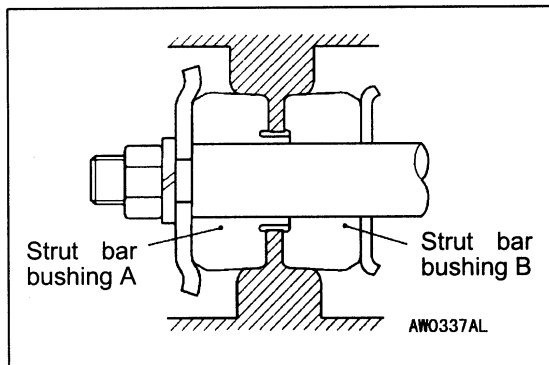


REMOVAL SERVICE POINT

◀A▶ LOWER ARM ASSEMBLY AND KNUCKLE DISCONNECTION

Caution

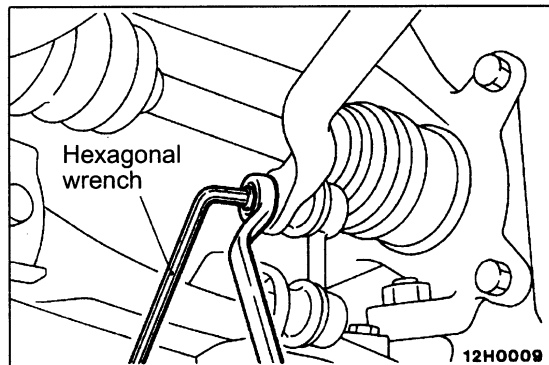
1. Loosen the nut but do not remove it.
2. Support the special tool with a cord to prevent it from coming off.



INSTALLATION SERVICE POINTS

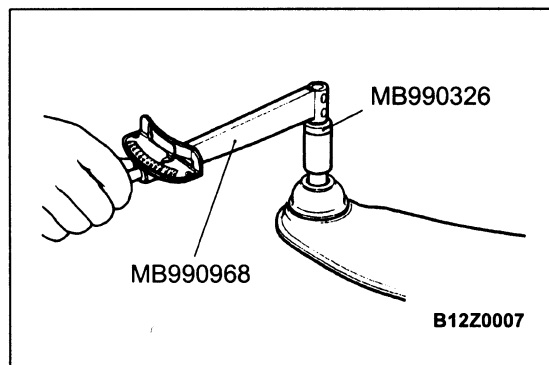
▶A▶ STRUT BAR BUSHING B AND STRUT BAR BUSHING A INSTALLATION

Install the bushings A and B as shown in the illustration confirming their 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

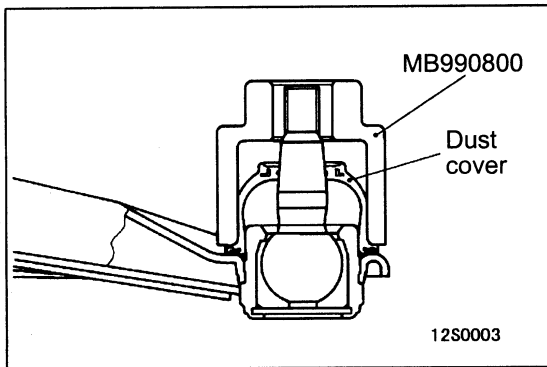
2. When the measured value exceeds the standard value, replace the lower arm assembly.
3. When the measured value is lower than the standard value, check that the ball joint turns smoothly without excessive play. If so, it is possible to reuse that ball joint.

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.

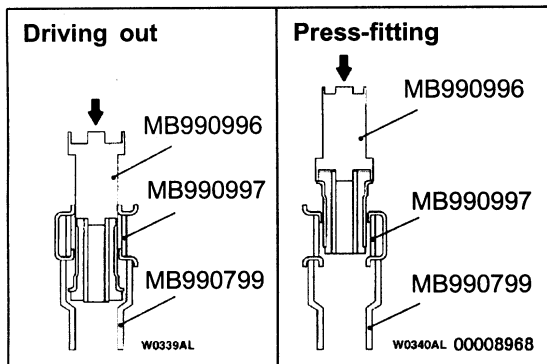
**LOWER ARM BALL JOINT DUST COVER REPLACEMENT**

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.



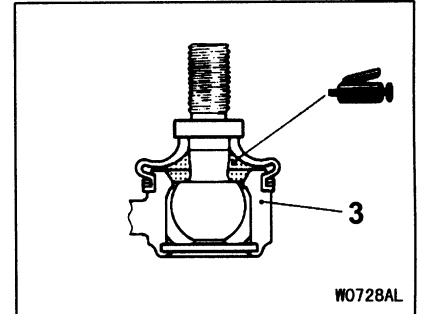
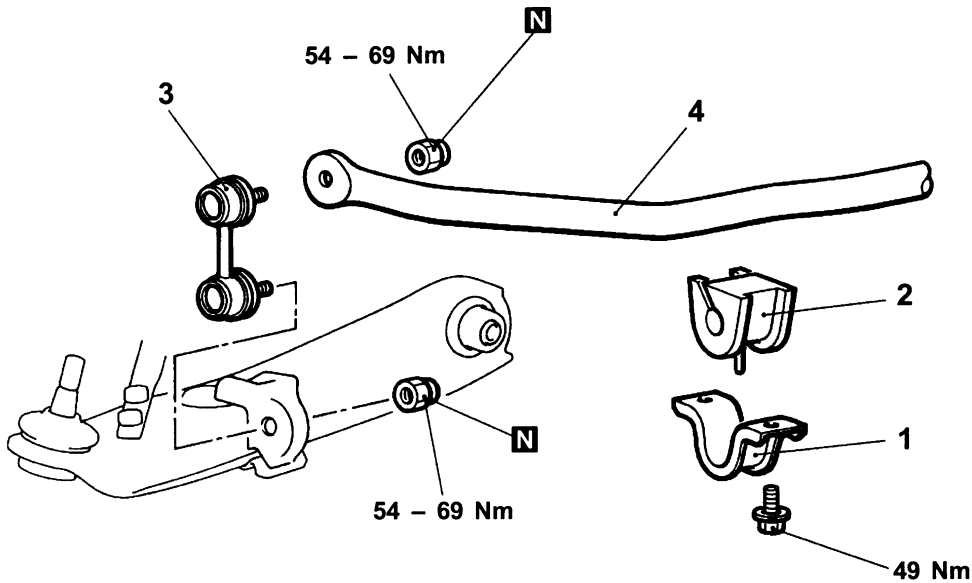
STABILIZER BAR

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



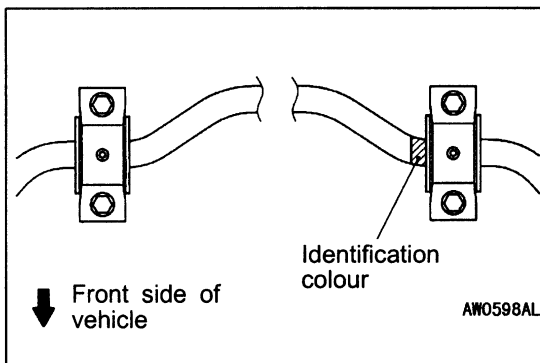
Removal steps



1. Fixture
2. Bushing



3. Stabilizer link
4. Stabilizer bar



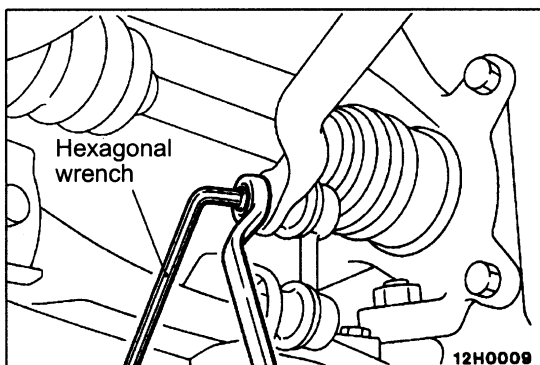
INSTALLATION SERVICE POINTS

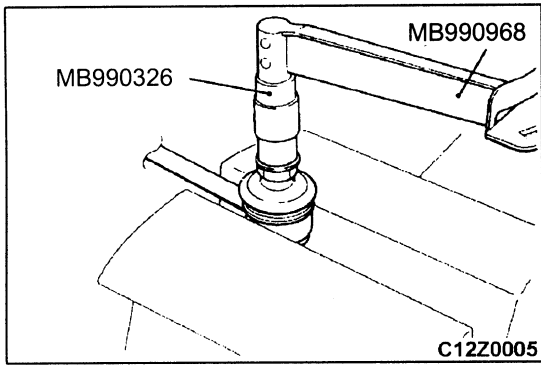
►A◄ STABILIZER BAR/BUSHING/FIXTURE INSTALLATION

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.

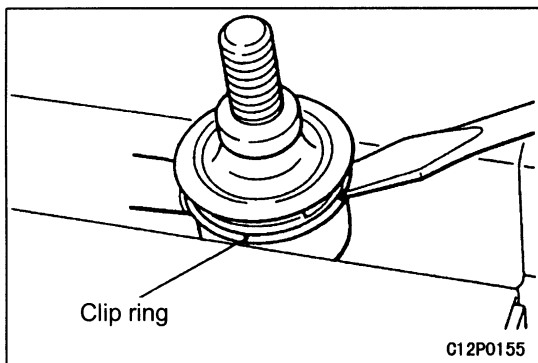
NOTE

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

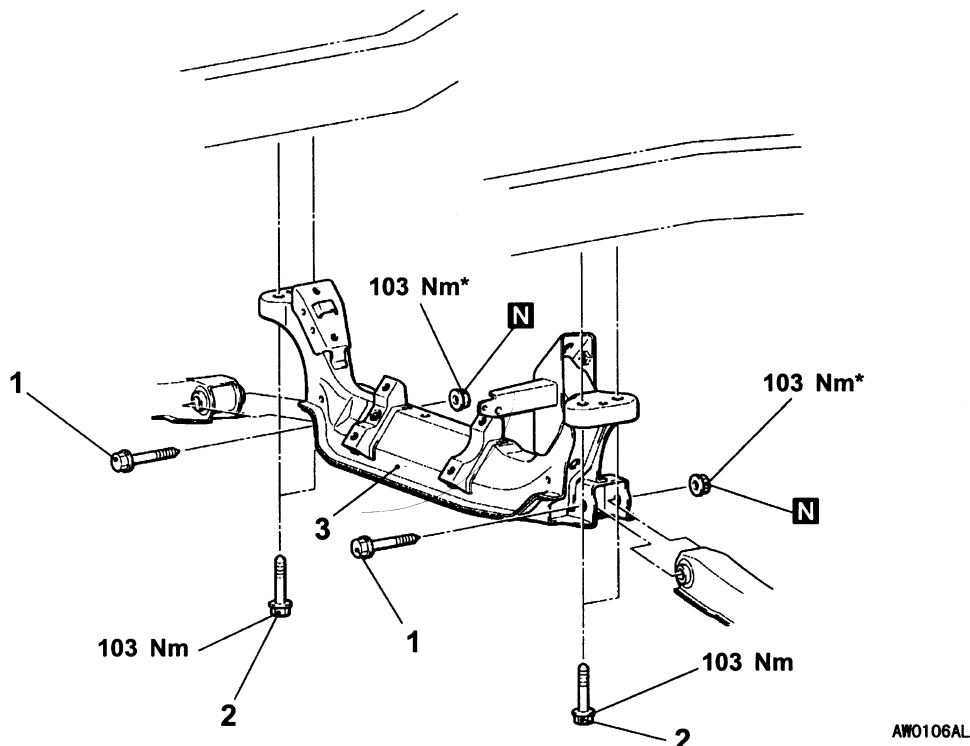
REMOVAL AND INSTALLATION

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.)

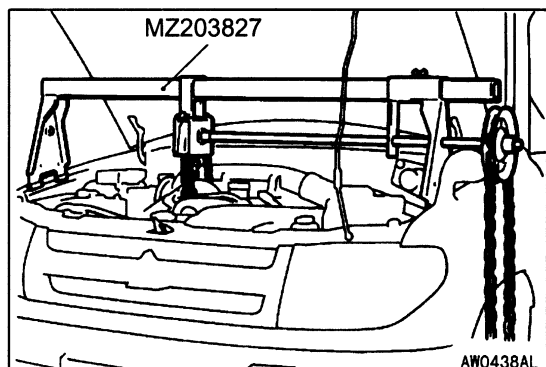


Removal steps



- 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.

REAR SUSPENSION

CONTENTS

GENERAL INFORMATION	2	REAR SUSPENSION ASSEMBLY	4
SPECIAL TOOLS	3		



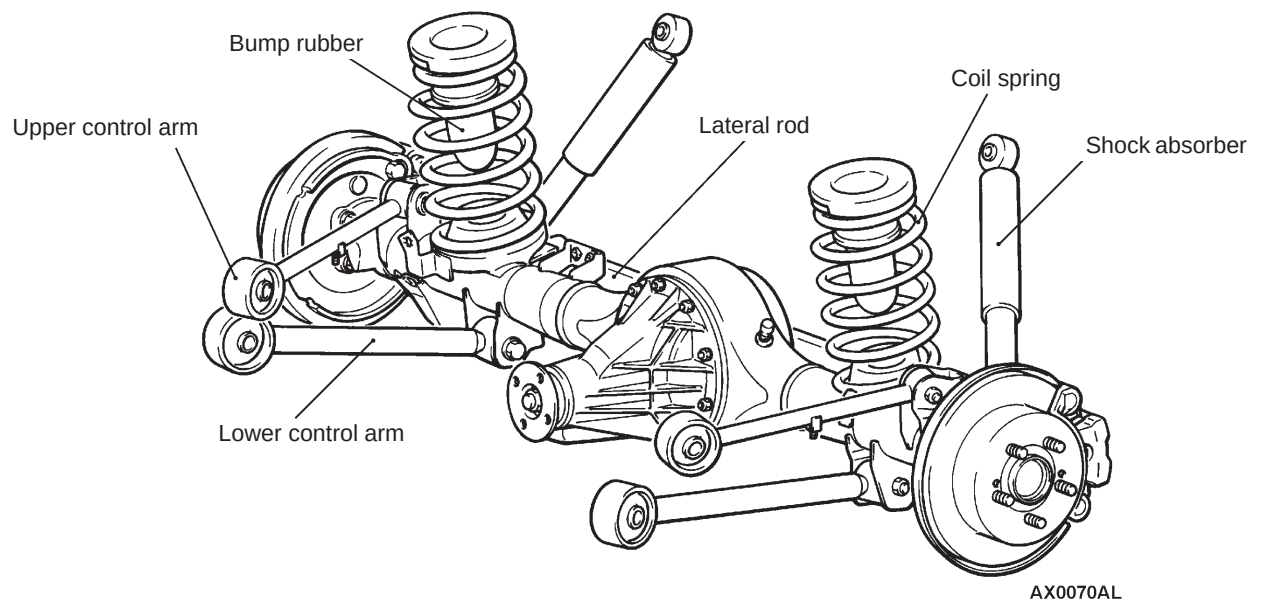
GENERAL INFORMATION

The rear suspension is a 5-link coil spring type axle suspension, which assures comfortable ride and outstanding steering stability.

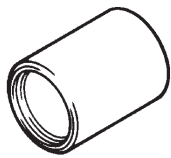
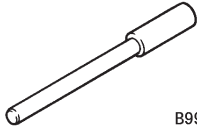
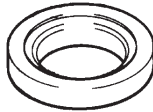
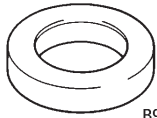
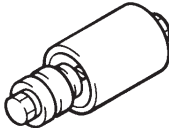
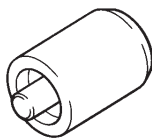
COIL SPRING

Items	Specification
Wire diameter × outer diameter × free length mm	11 × 131 × 306

CONSTRUCTION DIAGRAM



SPECIAL TOOLS

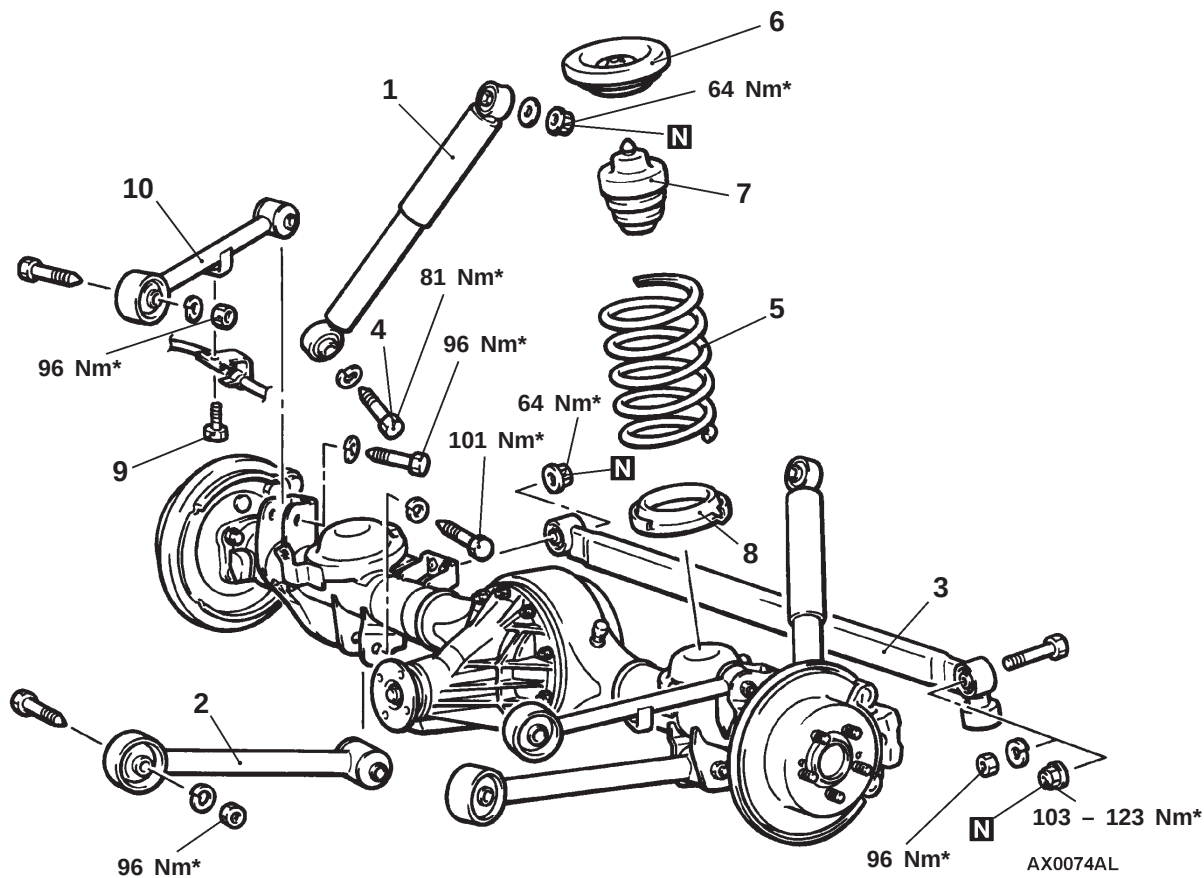
Tool	Number	Name	Use
 B990847	MB990847	Rear suspension bushing remover and installer base	- Upper arm rear bushing driving out and press-fitting - Lower arm rear bushing driving out and press-fitting
 B990947	MB990947	Lower arm bushing arbor	
 B990831	MB990832	Lower arm rear bushing remover and installer 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
5. Coil spring
6. Silencer sheet

7. Bump stopper
8. Lower spring pad

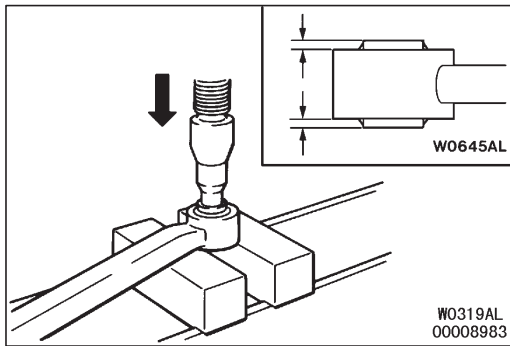
Upper arm removal steps

5. Coil spring
9. Rear wheel speed sensor installation bolt <Vehicles with ABS>
10. Upper arm

INSTALLATION SERVICE POINT

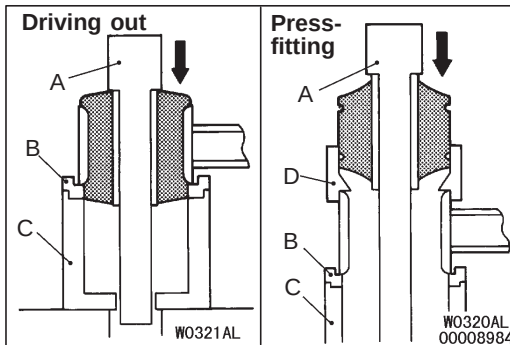
►A◄ COIL SPRING INSTALLATION

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

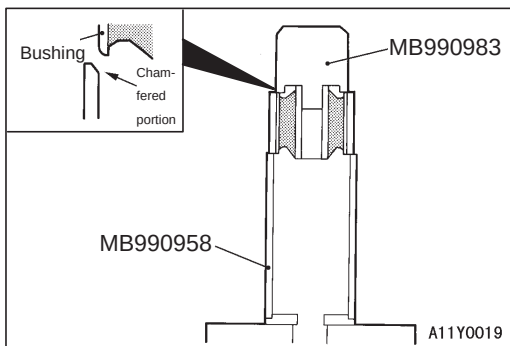
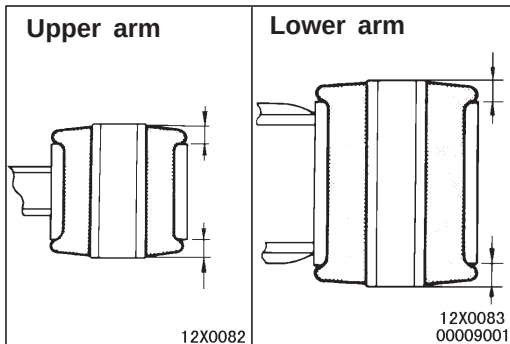
UPPER ARM REAR BUSHING, LOWER ARM REAR BUSHING

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.



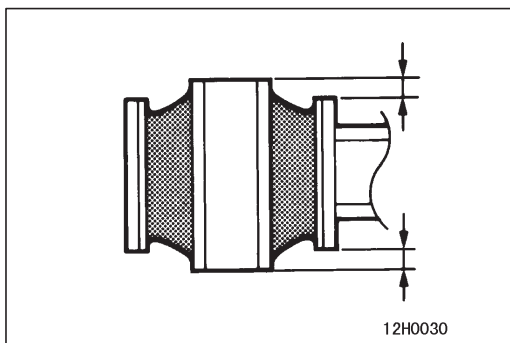
UPPER ARM FRONT BUSHING, LOWER ARM FRONT BUSHING

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

SERVICE BRAKES

CONTENTS

BASIC BRAKE SYSTEM	35A
ANTI-SKID BRAKING SYSTEM (ABS) <4WD>	35B



BASIC BRAKE SYSTEM

CONTENTS

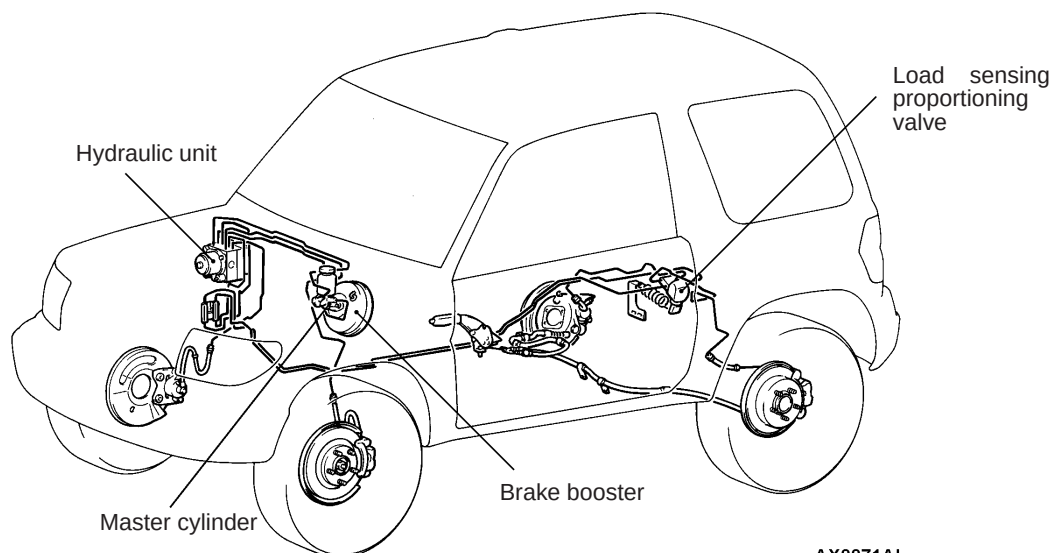
GENERAL INFORMATION	3	Brake Fluid Level Sensor Check	10
SERVICE SPECIFICATIONS	4	Disc Brake Pad Check and Replacement	11
LUBRICANTS	5	Disc Brake Rotor Check	12
SEALANT	5	Brake Disc Thickness Check	12
SPECIAL TOOLS	5	Brake Disc Run-out Check and Correction	13
ON-VEHICLE SERVICE	6	BRAKE PEDAL	14
Brake Pedal Check and Adjustment	6	MASTER CYLINDER AND BRAKE	
Brake Booster Operating Test	7	BOOSTER	15
Check Valve Operation Check	8	Master Cylinder	19
Load Sensing Spring Length Check and		FRONT DISC BRAKE	20
Adjustment	8	REAR DISC BRAKE	25
Load Sensing Proportioning Valve Function		LOAD SENSING PROPORTIONING	
Test	9	VALVE	31
Bleeding	10		

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



AX0071AL

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

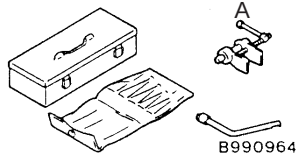
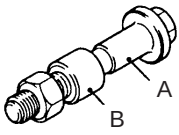
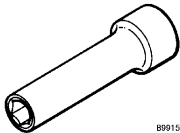
LUBRICANTS

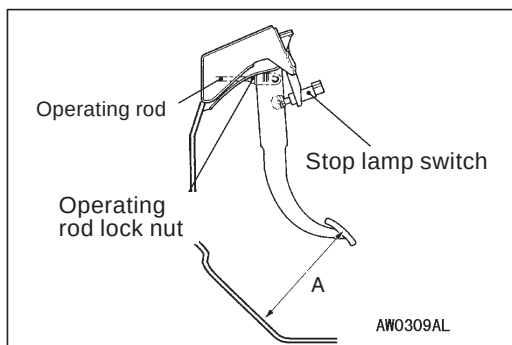
Items	Specified Lubricant	Quantity
Brake fluid	DOT3 or DOT4	As required
Vacuum sensor grommet	Silicone grease	
Brake booster seal		
Piston boot, piston seal	Repair kit grease	
Guide pin, lock pin		
Piston, wheel cylinder body	DOT3 or DOT4	

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 re-mover 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):

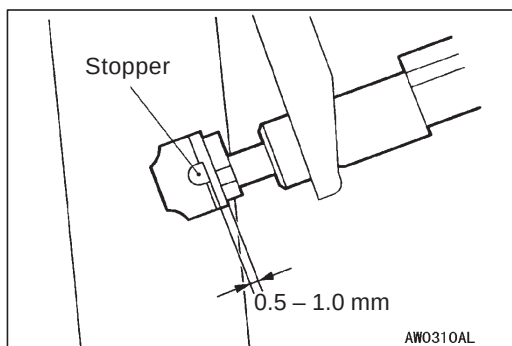
<L.H. drive vehicles> 201 – 204 mm

<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.

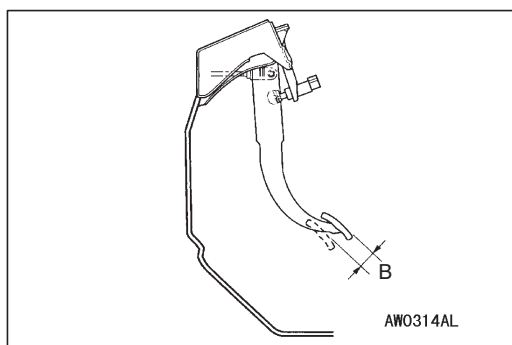


- (4) Screw in the stop lamp switch until it touches the stopper. At this time, support the brake pedal to the highest position by hand.
- (5) Lock the stop lamp switch by turning it approx. 1/4 turns clockwise, and confirm that the clearance between the switch plunger and the stopper is as shown.
- (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.

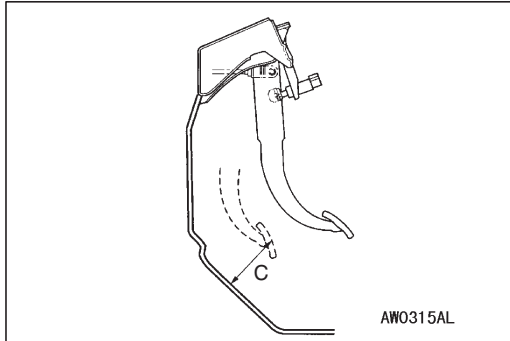


BRAKE PEDAL FREE PLAY

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.

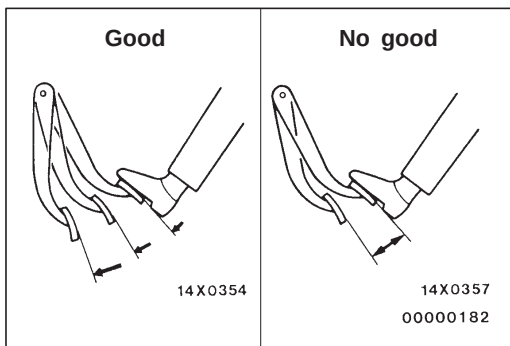


CLEARANCE BETWEEN BRAKE PEDAL AND FLOOR BOARD

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

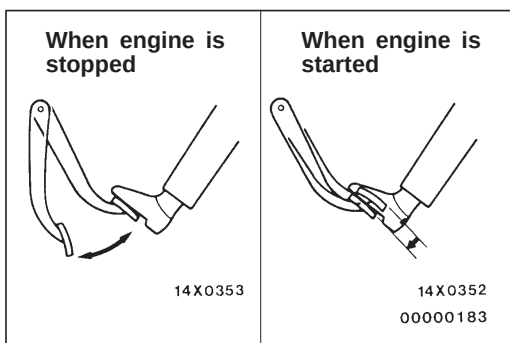
3. If the clearance is outside the standard value, check for air trapped in the brake line, thickness of the disc brake pad or the drum brake lining and dragging in the parking brake.
Adjust and replace defective parts as required.
4. Return the carpet, etc.

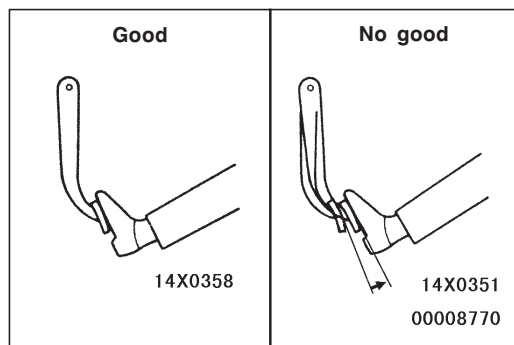


BRAKE BOOSTER OPERATING TEST

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.





- 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.

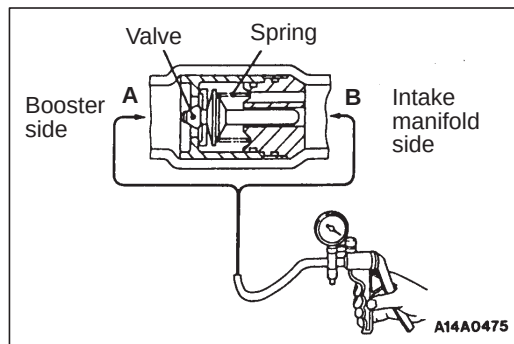
CHECK VALVE OPERATION CHECK

- 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.

- 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

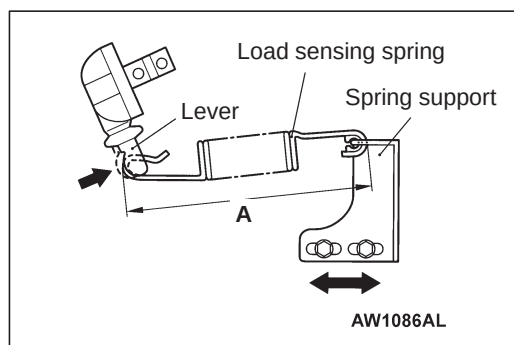
If the check valve is defective, always replace it as an assembly unit together with the vacuum hose.

LOAD SENSING SPRING LENGTH CHECK AND ADJUSTMENT

- Park the vehicle on a level ground. The vehicle should be unloaded and supported only by wheels.

Caution

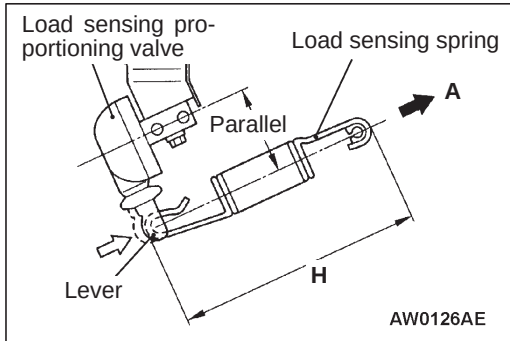
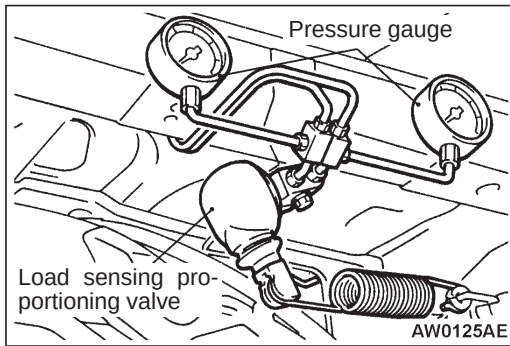
Never support the vehicle with jacks or other similar means.



- 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

- 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.

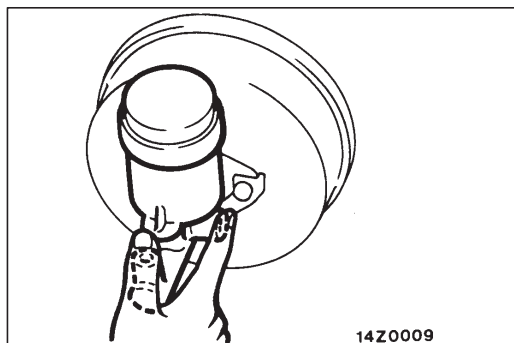
Limit: 0.39 MPa

7. After making the check, install the spring. Disconnect the pressure gauges from the load sensing proportioning valve and bleed air.

BLEEDING**Caution**

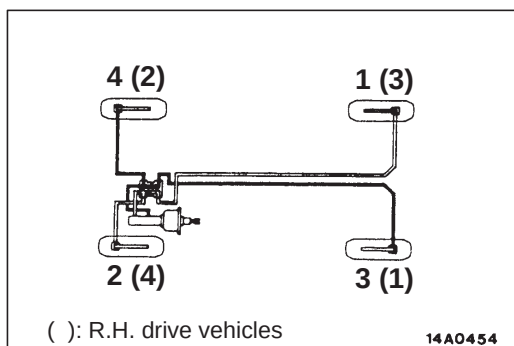
Specified brake fluid: DOT3 or DOT4

Always use the specified brake fluid. Avoid using a mixture of the specified brake fluid and other fluid.

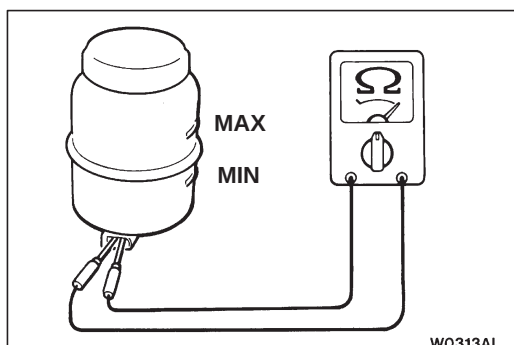
**MASTER CYLINDER BLEEDING**

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.

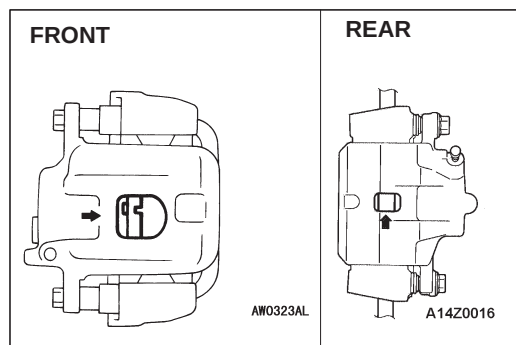
**BRAKE FLUID LEVEL SENSOR CHECK**

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.

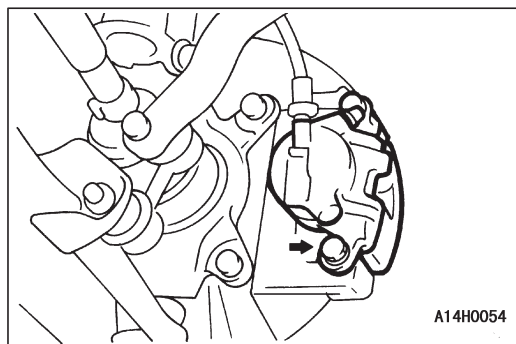


1. Check the brake pad thickness through the caliper body check port.

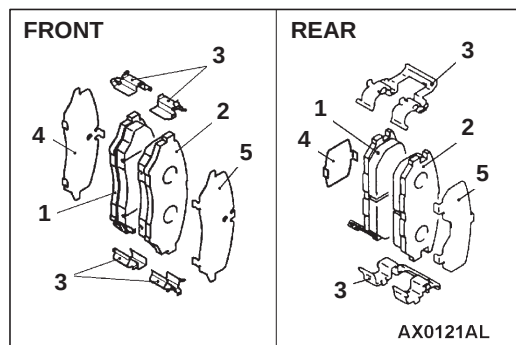
Standard value: 10.0 mm

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.)

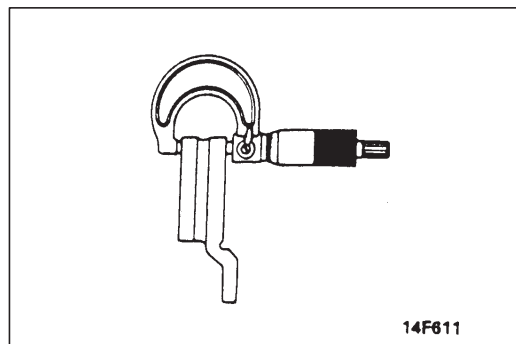
DISC BRAKE ROTOR CHECK

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

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

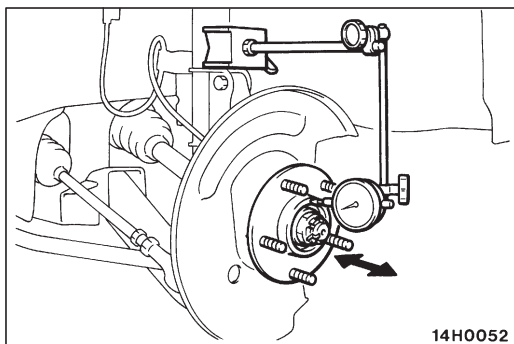
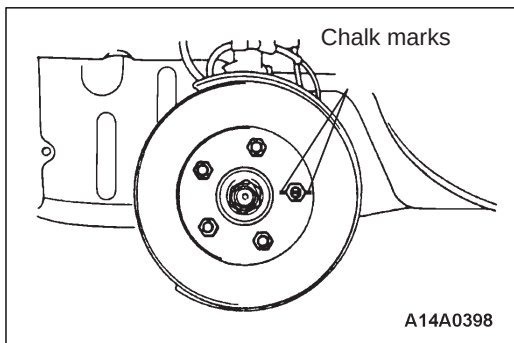
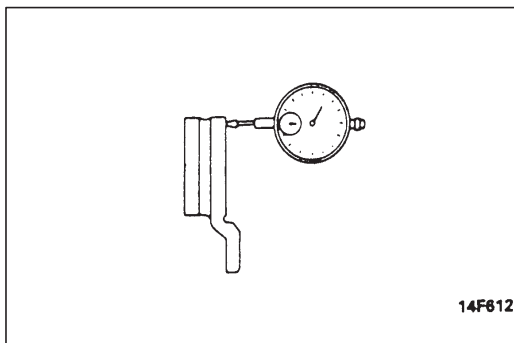
Brake disc thickness

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.

- 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.

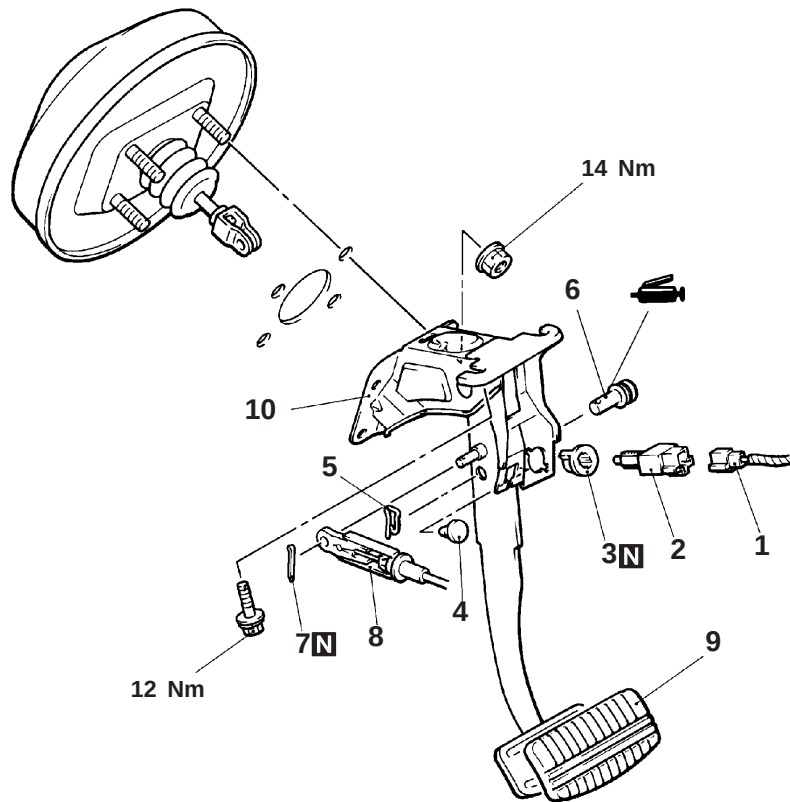
Limit: <Front> 0.2 mm, <Rear> 0.025 mm

- (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

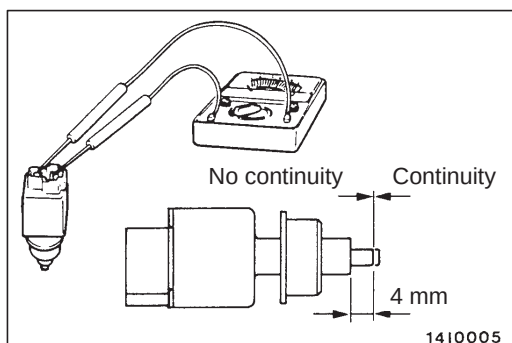
Post-installation Operation
Brake Pedal Adjustment (Refer to P.35A-6.)



AW0151AL

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



1410005

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

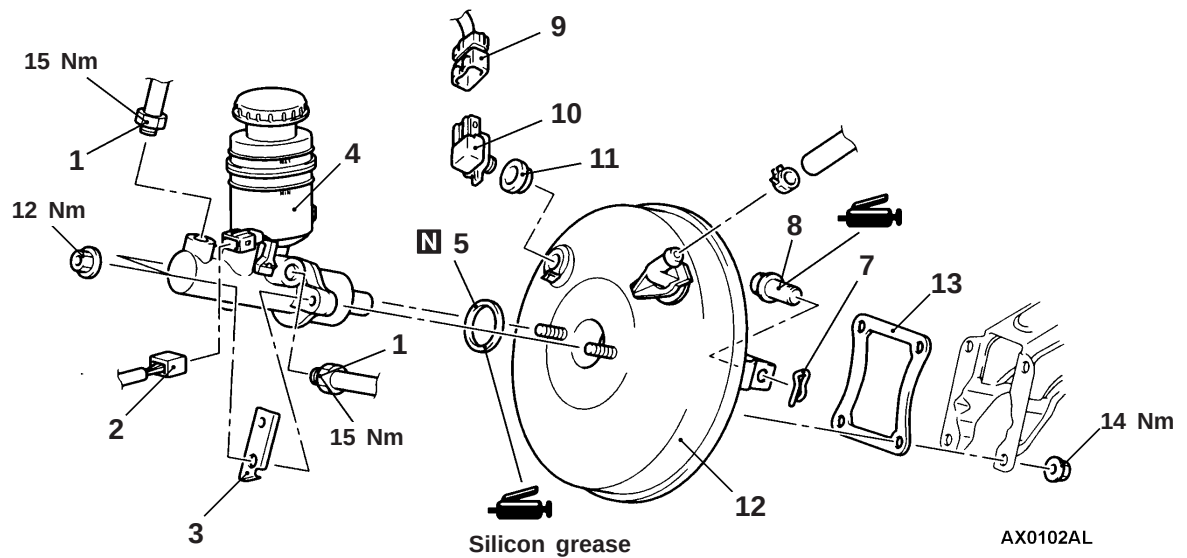
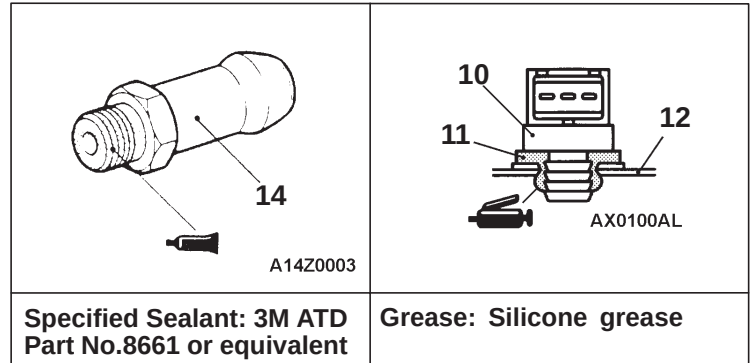
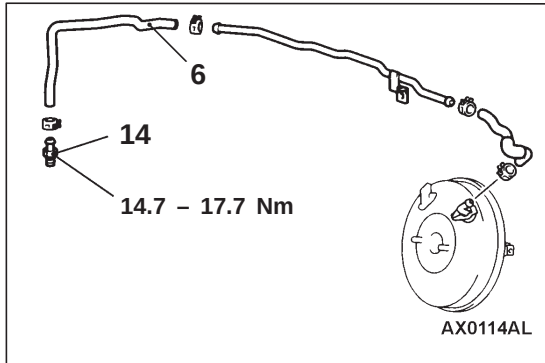
REMOVAL AND INSTALLATION

<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.)



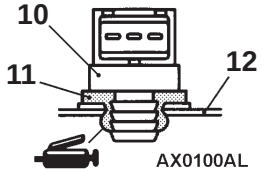
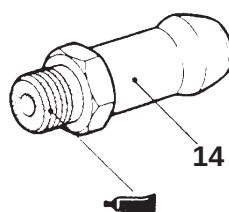
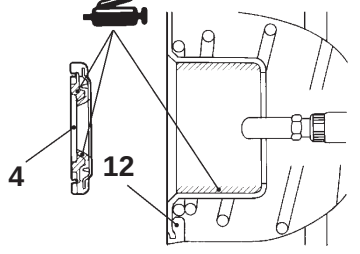
35A-16 BASIC BRAKE SYSTEM – Master Cylinder and Brake Booster

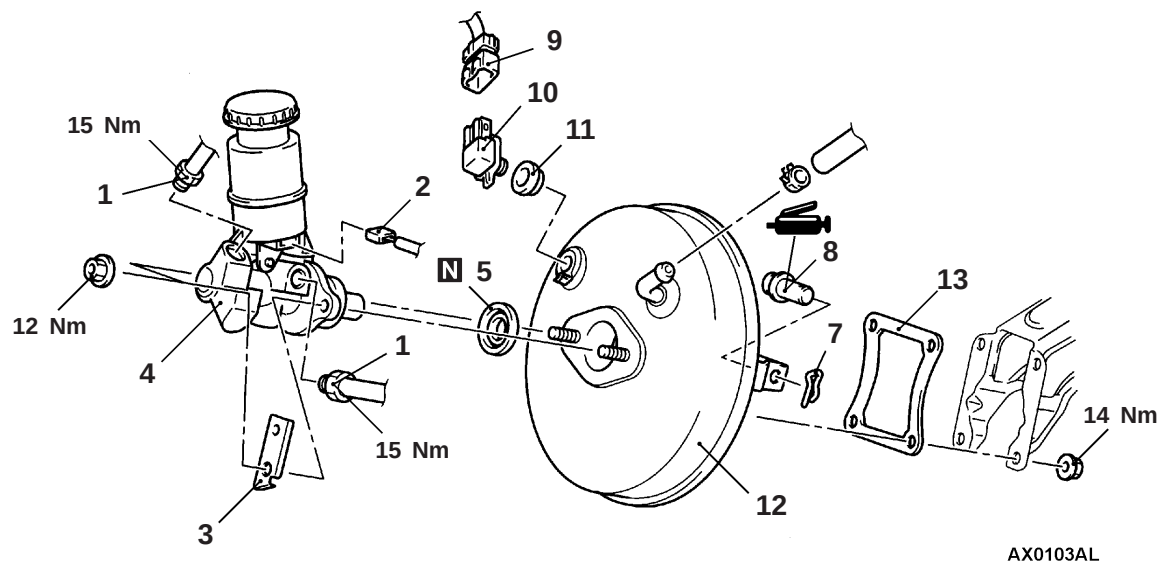
<L.H. drive vehicles without ABS and R.H. drive vehicles>

Pre-removal Operation
Brake Fluid Draining

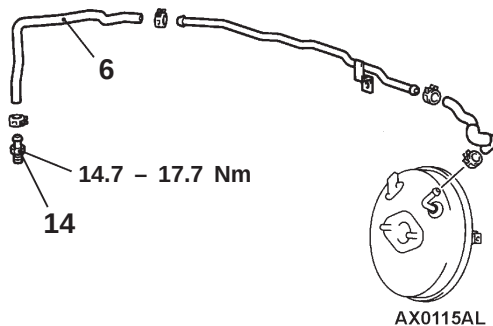
Post-installation Operation

- Brake Fluid Supplying and Air Bleeding (Refer to P.35A-10.)
- Brake Pedal Adjustment (Refer to P.35A-6.)

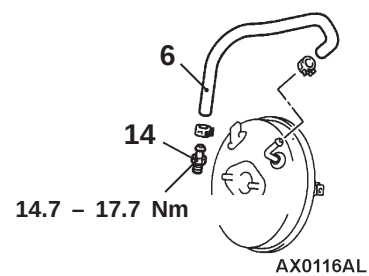
 AX0100AL	 A14Z0003	 AW0747AL
Grease: Silicone grease	Specified Sealant: 3M ATD Part No.8661 or equivalent	Grease: Silicone grease



<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
5. Seal

►C◄

Brake booster removal steps

1. Brake pipe connection
 2. Brake fluid level sensor connector
 3. Bracket <L.H. drive vehicles>
 4. Master cylinder
 5. Seal
- B◄
- Push rod protrusion amount check and adjustment

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.

►B◄ PUSH ROD PROTRUSION AMOUNT CHECK AND ADJUSTMENT

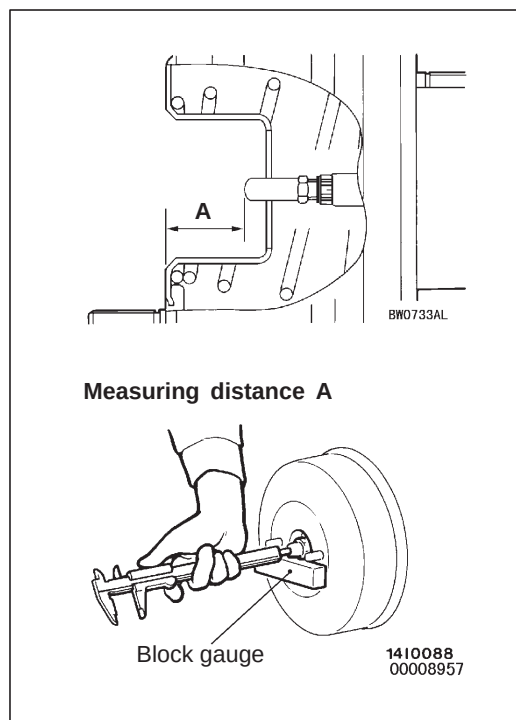
1. Measure dimension (A).

Standard value (A) :

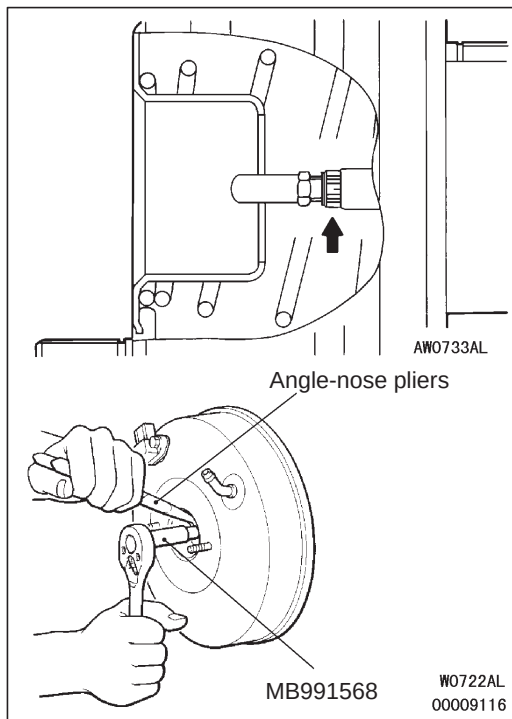
<L.H. drive vehicles with ABS> 22.7 – 22.9 mm
 <L.H. drive vehicles without ABS and R.H. drive vehicles> 23.93 – 24.18 mm

NOTE

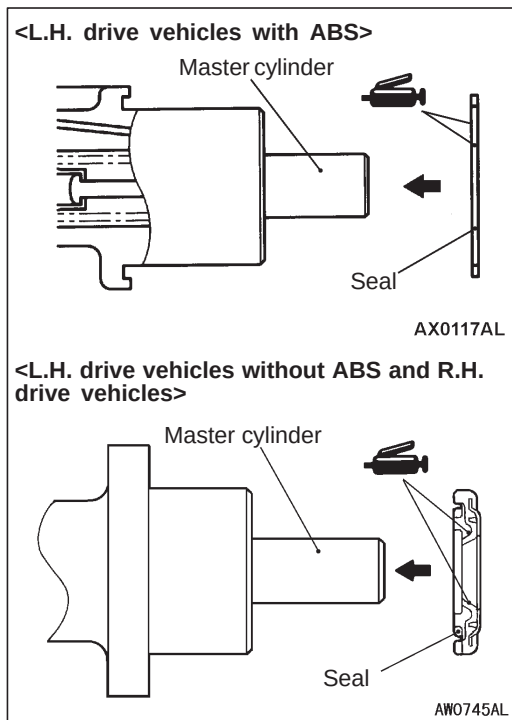
When a negative pressure of 66.7 kPa is applied to the brake booster, the push rod should protrude 22.2 – 22.4 mm <L.H. drive vehicles with ABS>/23.48 – 23.73 mm <L.H. drive vehicles without ABS and R.H. drive vehicles>.



35A-18 BASIC BRAKE SYSTEM – Master Cylinder and Brake Booster



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

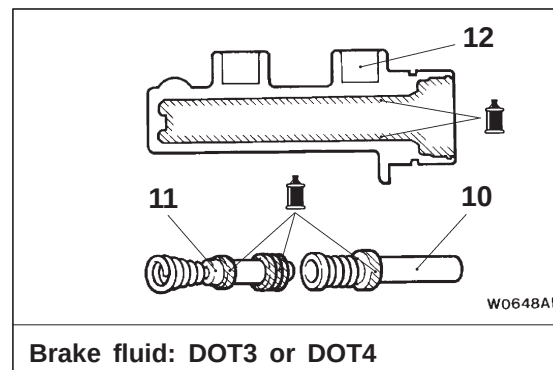
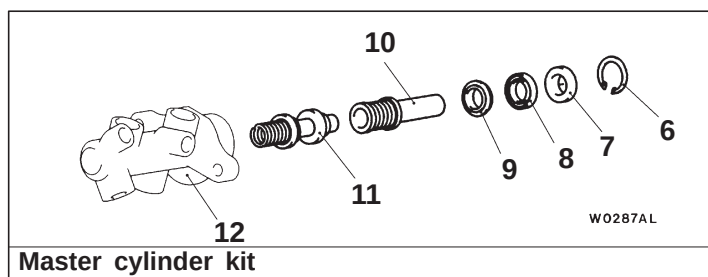
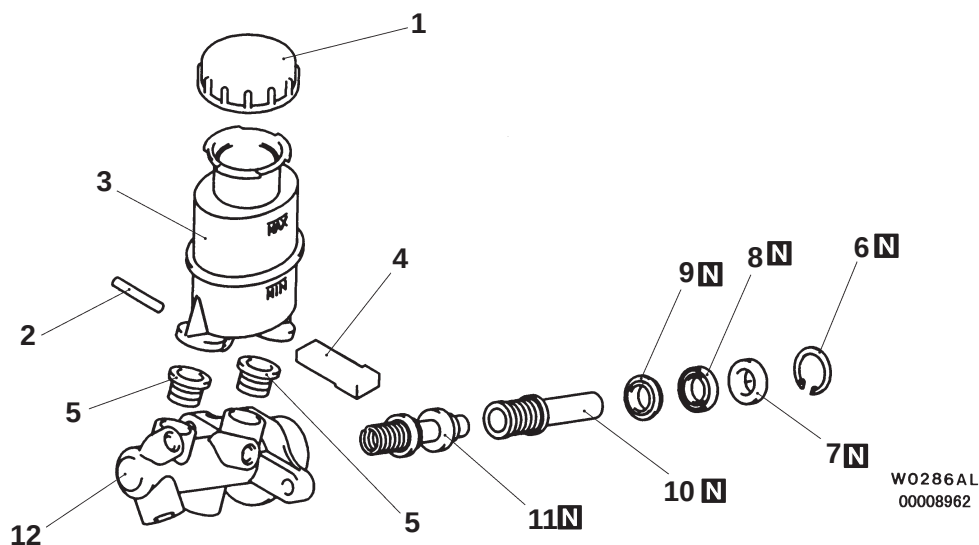
VACUUM SENSOR CHECK

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.

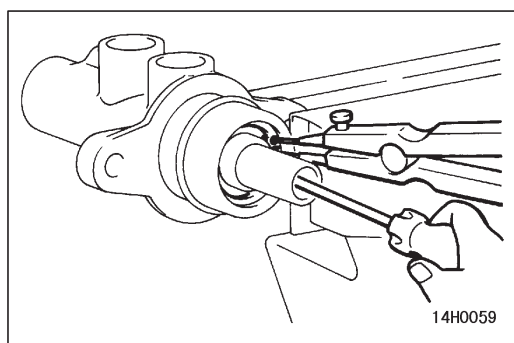
MASTER CYLINDER <L.H. drive vehicles without ABS and R.H. drive vehicles> DISASSEMBLY AND REASSEMBLY



Disassembly steps

1. Reservoir cap
2. Pin
3. Reservoir tank
4. Brake fluid level sensor
5. Reservoir seal
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

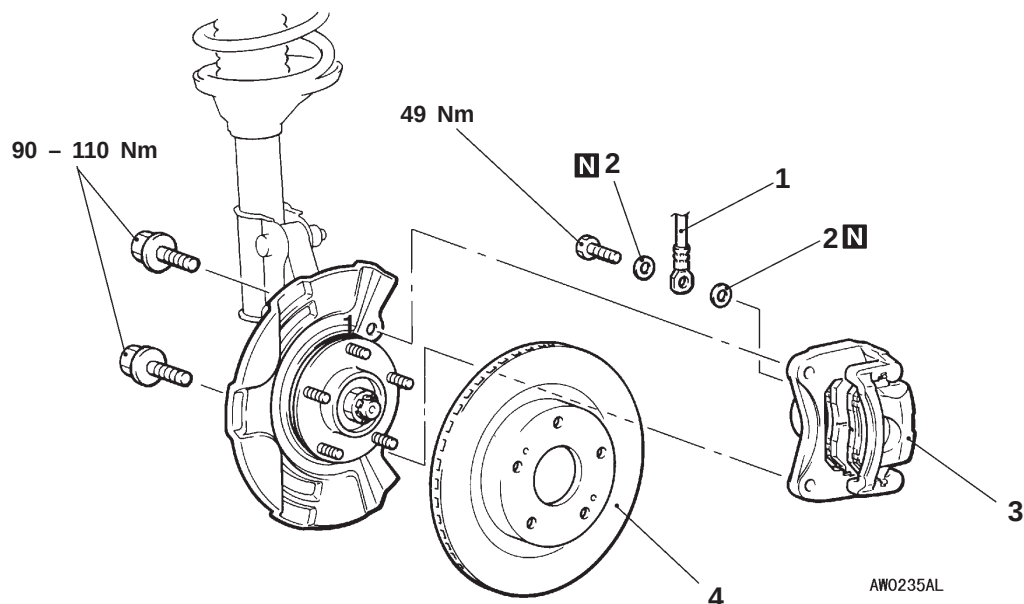
Push the primary piston assembly and remove the stopper ring.

FRONT DISC BRAKE

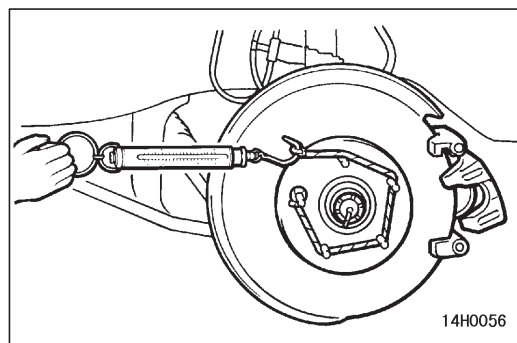
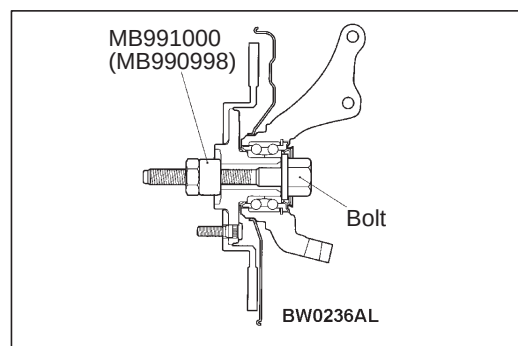
REMOVAL AND INSTALLATION

Pre-removal Operation
Brake Fluid Draining

Post-installation Operation
Brake Fluid Supplying and Air Bleeding
(Refer to P.35A-10.)

**Removal steps**

- A◄
1. Brake hose connection
 2. Gasket
 3. Disc brake assembly
 4. Brake disc

**INSTALLATION SERVICE POINT****►A◄ DISC BRAKE ASSEMBLY INSTALLATION**

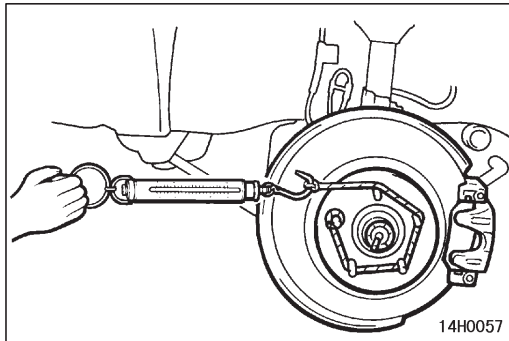
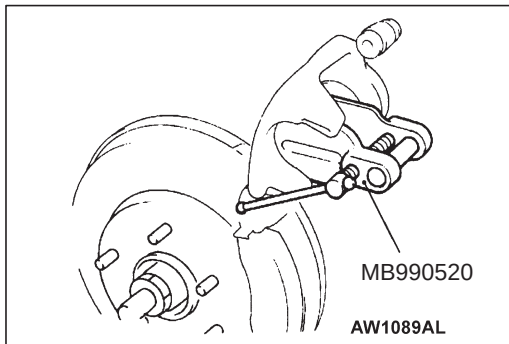
1. In order to measure the brake drag force after pad installation, measure the rotary-sliding resistance of the hub by the following procedure with the pads removed.
 - (1) Withdraw the drive shaft. (Refer to GROUP 26 – Front Axle.)
 - (2) Attach the special tool to the front hub assembly as shown in 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.



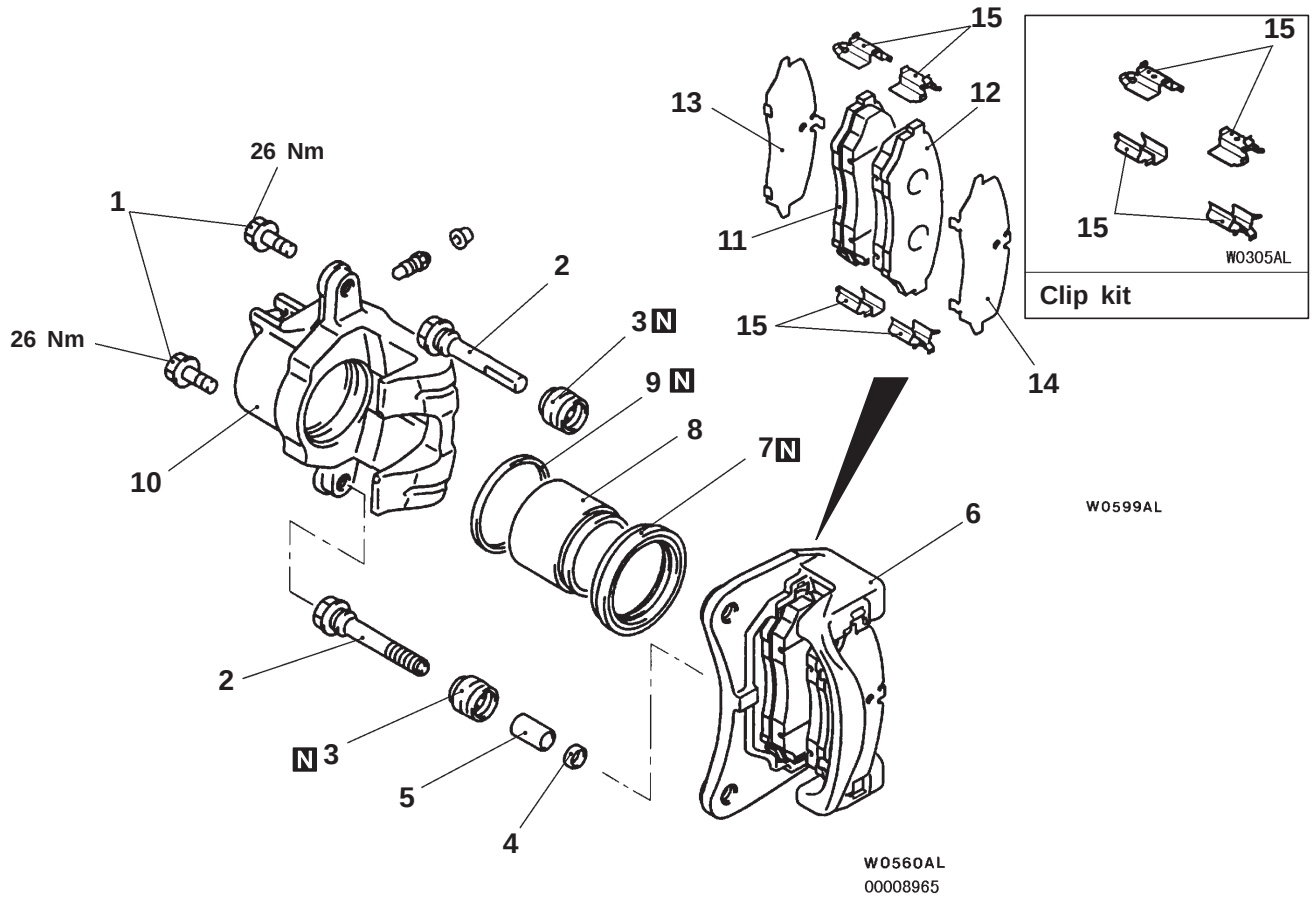
3. Clean the piston and insert it into the cylinder with the special tool.
4. Be careful that the piston boot does not become caught, when lowering the caliper assembly and install the guide pin to the caliper.
5. Start the engine, and then depress the brake pedal two or three times strongly. Then stop 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



W0300AL	W0302AL	W0306AL	W0301AL
Brake caliper kit	Pad set	Shim kit	Seal and boot kit

Disassembly steps

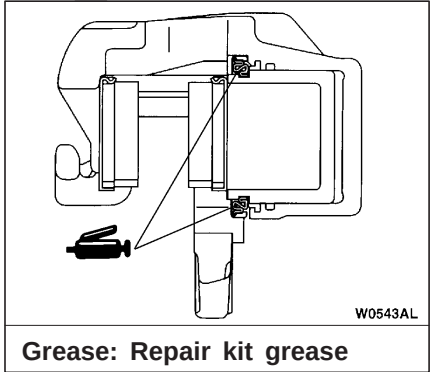
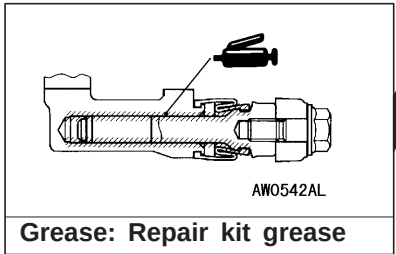
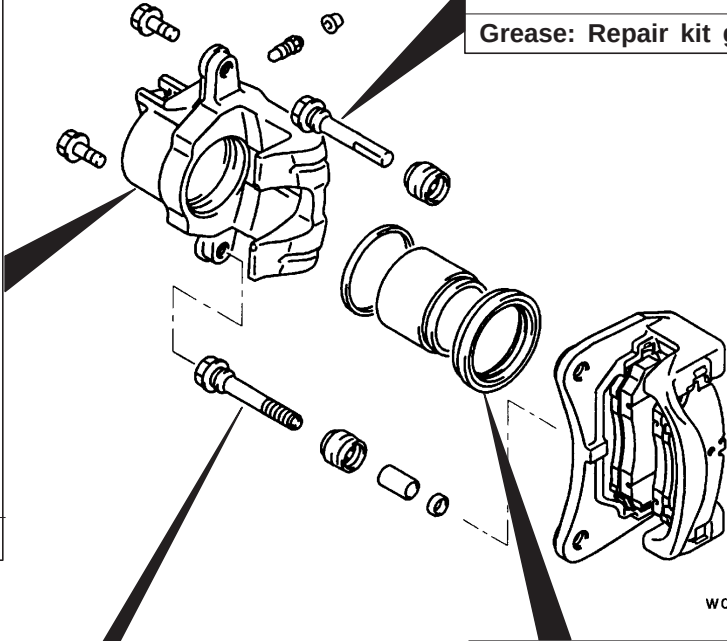
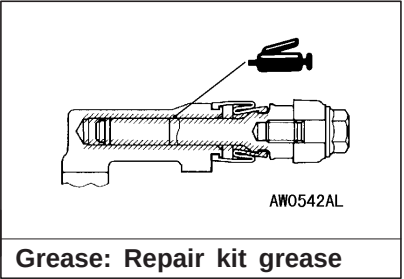
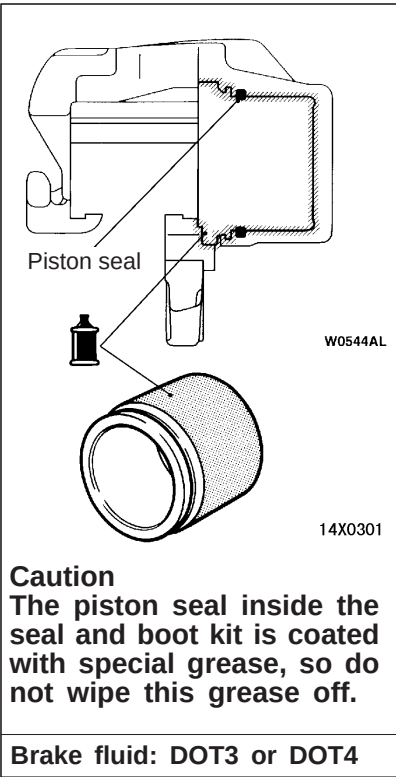
1. Guide pin lock bolt
2. Guide pin
3. Boot
4. Bushing
5. Bushing retainer
6. Caliper support (including pad, clip, and shim)
7. Piston boot

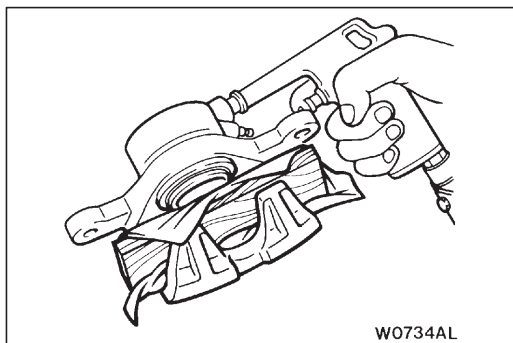


8. Piston
9. Piston seal
10. Caliper body
11. Pad and wear indicator assembly
12. Pad assembly
13. Inner shim
14. Outer shim
15. Clip



LUBRICATION POINTS





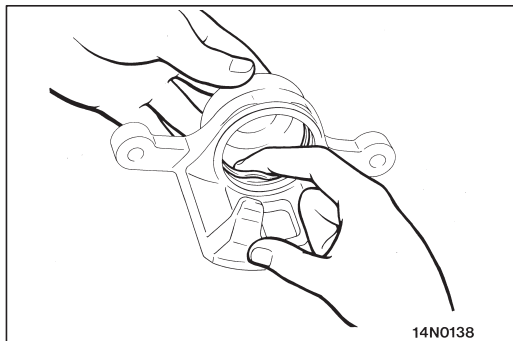
DISASSEMBLY SERVICE POINTS

◀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

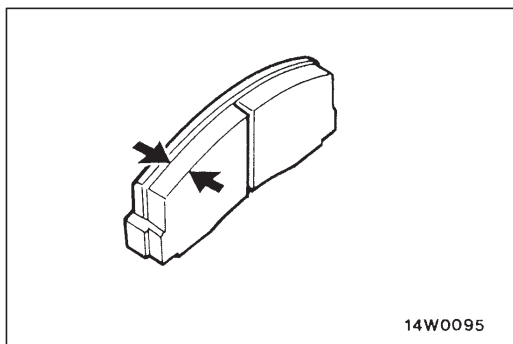
Do not use a flat-tipped screwdriver or other tool to prevent damage to inner cylinder.

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

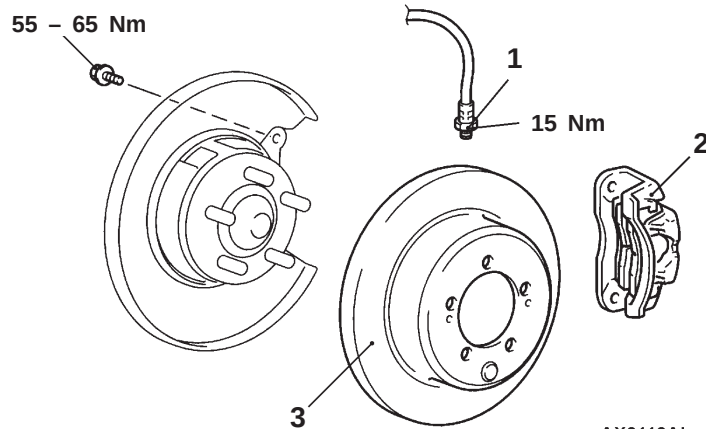
REMOVAL AND INSTALLATION

Pre-removal Operation

- Brake Fluid Draining

Post-installation Operation

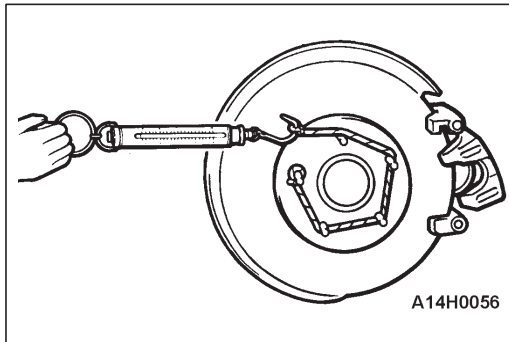
- Brake Fluid Supplying and Air Bleeding (Refer to P.35A-10.)



Removal steps



1. Brake hose connection
2. Disc brake assembly
3. Brake disc



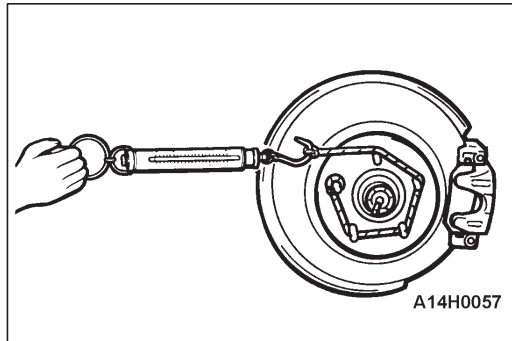
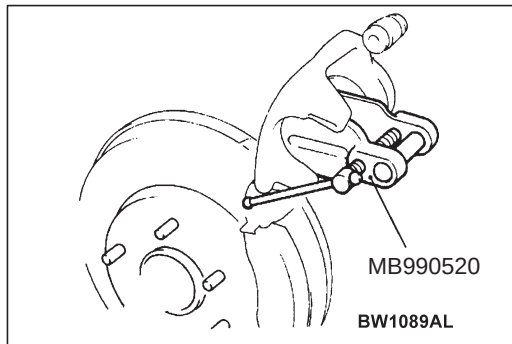
INSTALLATION SERVICE POINT

►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.



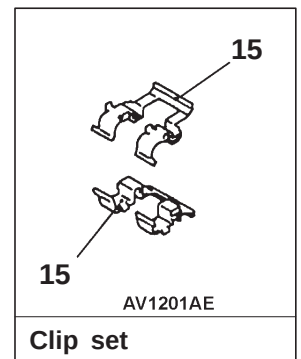
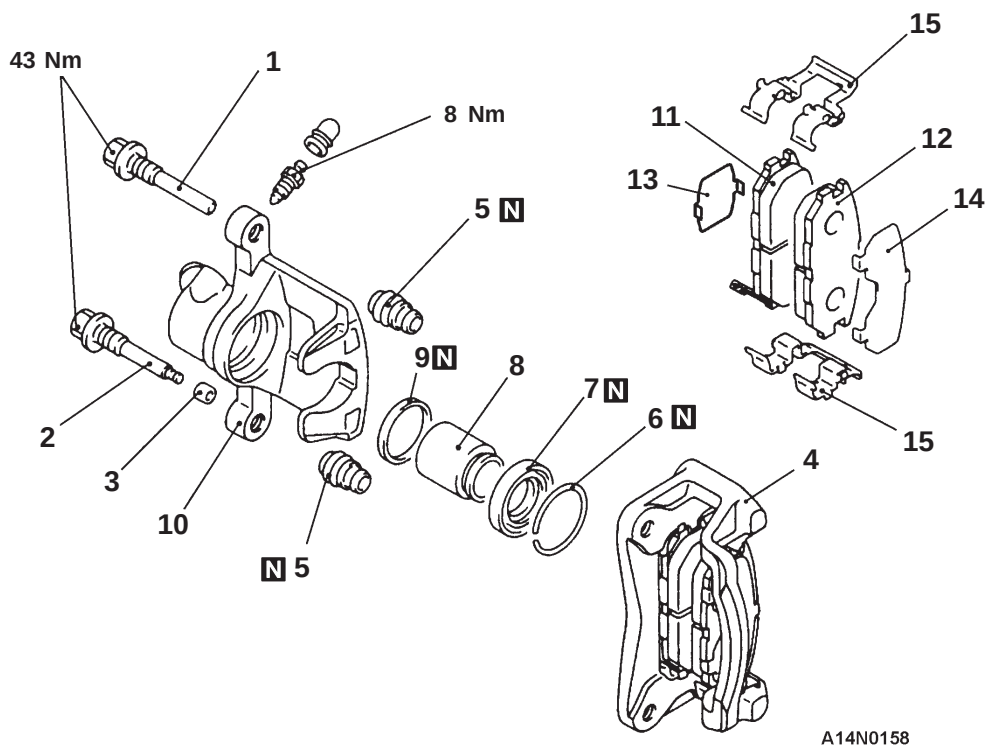
3. Clean the piston and insert it into the cylinder with the special tool.
4. Be careful that the piston boot does not become caught, when lowering the caliper assembly and install the guide pin to the caliper.
5. Start the engine, and then depress the brake pedal two or three times strongly. Then stop 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



B14N0159	AW0133AE	AX0120AL	A14N0161
Brake caliper kit	Pad set	Shim set	Seal and boots kit

Disassembly steps



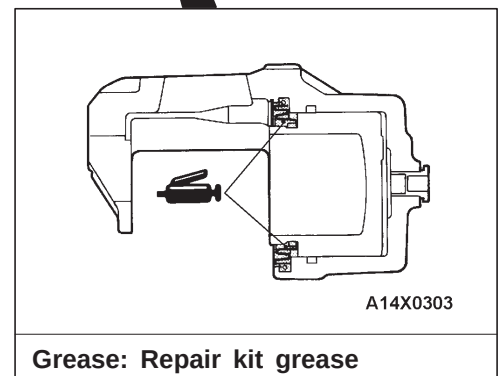
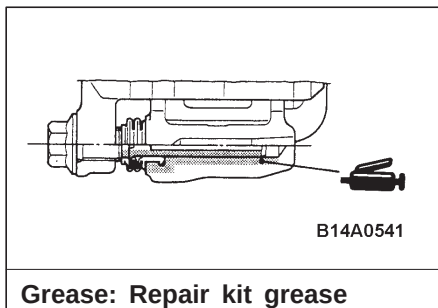
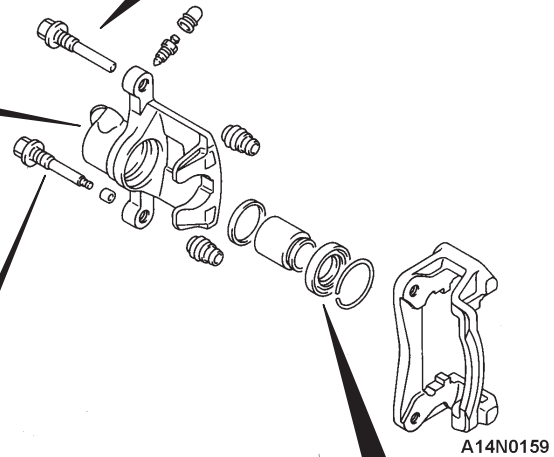
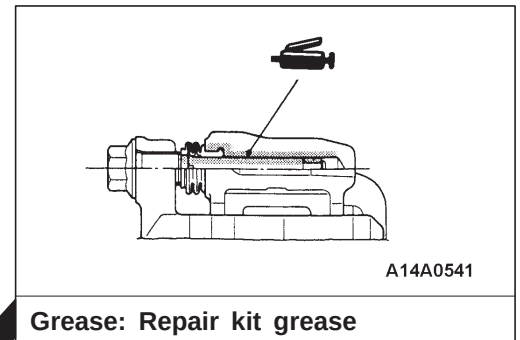
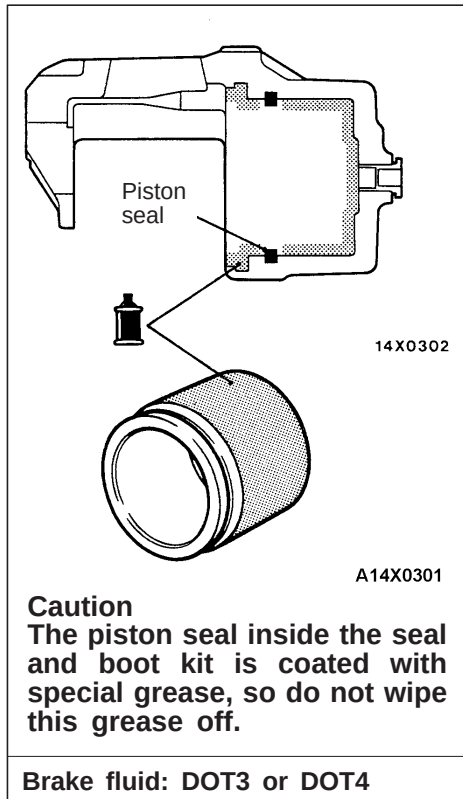
1. Guide pin
2. Lock pin
3. Bushing
4. Caliper support (pad, clip, shim)
5. Pin boot
6. Boot ring
7. Piston boot
8. Piston

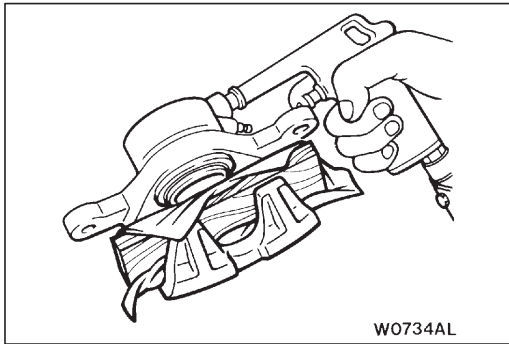


9. Piston seal
10. Caliper body
11. Pad and wear indicator assembly
12. Pad assembly
13. Inner shim
14. Outer shim
15. Clip



LUBRICATION POINTS





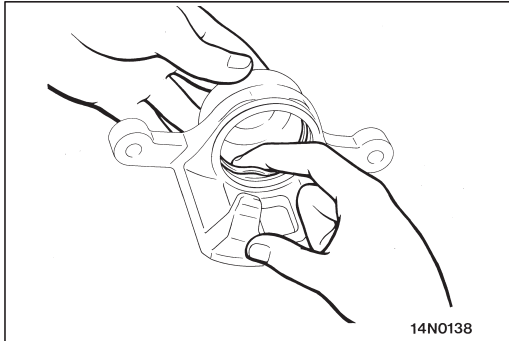
DISASSEMBLY SERVICE POINTS

◀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

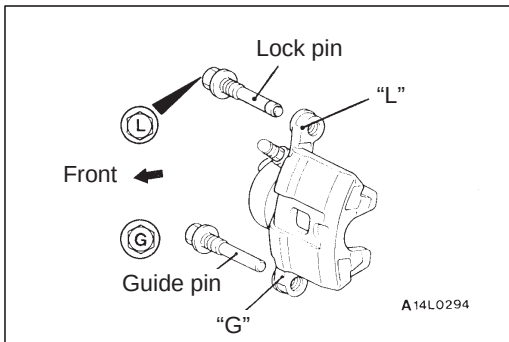
1. Remove the piston seal with finger tip.

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



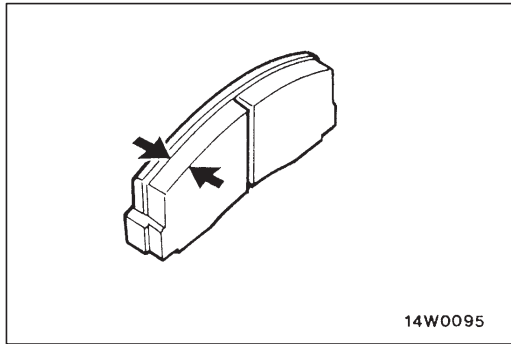
REASSEMBLY SERVICE POINT

▶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

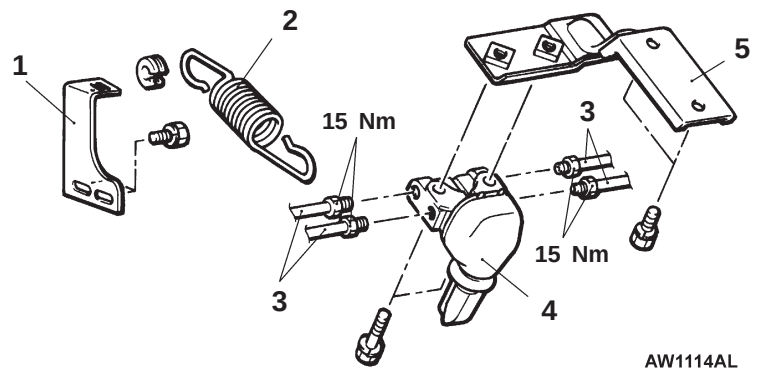
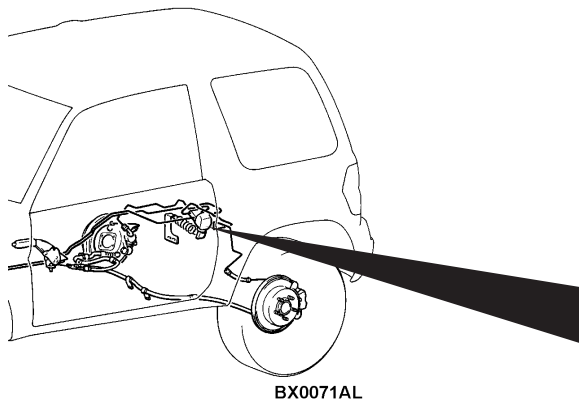
Caution

Do not disassemble the load sensing proportioning valve.

Pre-removal Operation
Brake Fluid Draining

Post-installation Operation

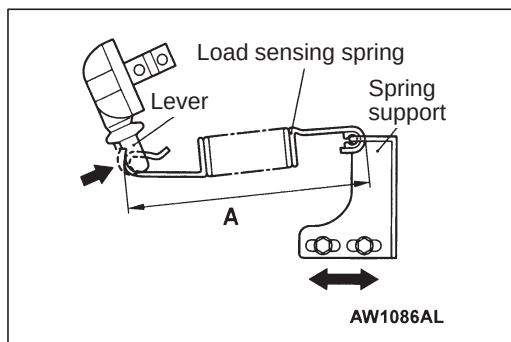
- Brake Fluid Supplying
- Brake Line Bleeding (Refer to P.35A-10.)



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

ANTI-SKID BRAKING SYSTEM (ABS) <4WD>

CONTENTS

GENERAL INFORMATION	3	Brake Fluid Level Sensor Check	Refer to GROUP 35A
SERVICE SPECIFICATIONS	3	Bleeding	Refer to GROUP 35A
LUBRICANTS	Refer to GROUP 35A	Disc Brake Pad Check and Replacement	Refer to GROUP 35A
SEALANTS	Refer to GROUP 35A	Disc Brake Rotor Check ...	Refer to GROUP 35A
SPECIAL TOOLS	4	Brake Disc Thickness Check	Refer to GROUP 35A
TROUBLESHOOTING	5	Brake Disc Run-out Check and Correction	Refer to GROUP 35A
ON-VEHICLE SERVICE	22	Wheel Speed Sensor Output Voltage Check	22
Brake Pedal Check and Adjustment	Refer to GROUP 35A	ABS Warning Lamp Relay Continuity Check	23
Brake Booster Operating Test	Refer to GROUP 35A	Hydraulic Unit Check	24
Check Valve Operation Check	Refer to GROUP 35A	Remedy for a Flat Battery	25
Load Sensing Spring Length Check and Adjustment	Refer to GROUP 35A	BRAKE PEDAL	Refer to GROUP 35A
Load Sensing Proportioning Valve Function Test	Refer to GROUP 35A	MASTER CYLINDER AND BRAKE BOOSTER	Refer to GROUP 35A

CONTINUED ON NEXT PAGE

35B-2

FRONT DISC BRAKE .. Refer to GROUP 35A	HYDRAULIC UNIT AND ABS-ECU 26
REAR DISC BRAKE Refer to GROUP 35A	WHEEL SPEED SENSOR 29
LOAD SENSING PROPORTIONING VALVE Refer to GROUP 35A	G SENSOR 31

GENERAL INFORMATION

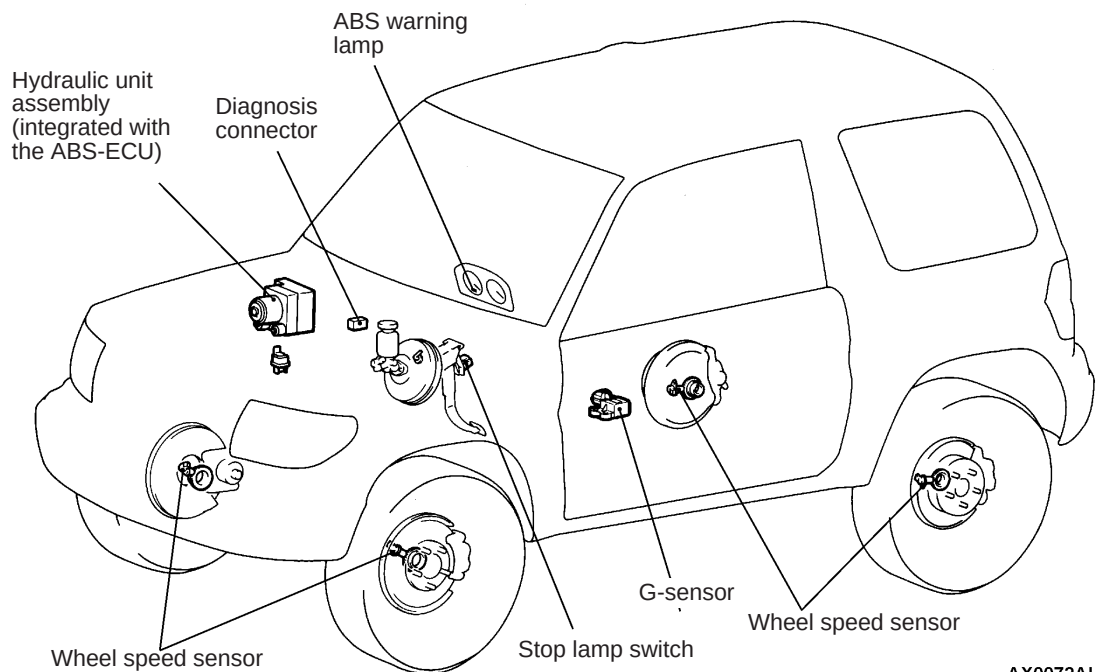
The ABS consists of components such as the wheel speed sensors, stop lamp switch, hydraulic unit assembly (integrated with the ABS-ECU) and the ABS warning lamp. If a problem occurs in the system, the malfunctioning components can be

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

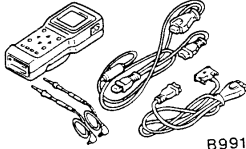
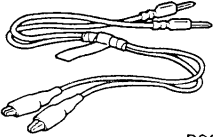
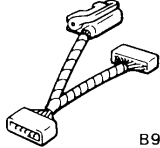
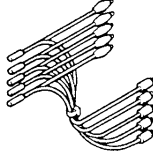
CONSTRUCTION DIAGRAM



SERVICE SPECIFICATIONS

Items		Standard value
Wheel speed sensor internal resistance $k\Omega$		1.30 – 1.58
Wheel speed sensor insulation resistance $k\Omega$		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

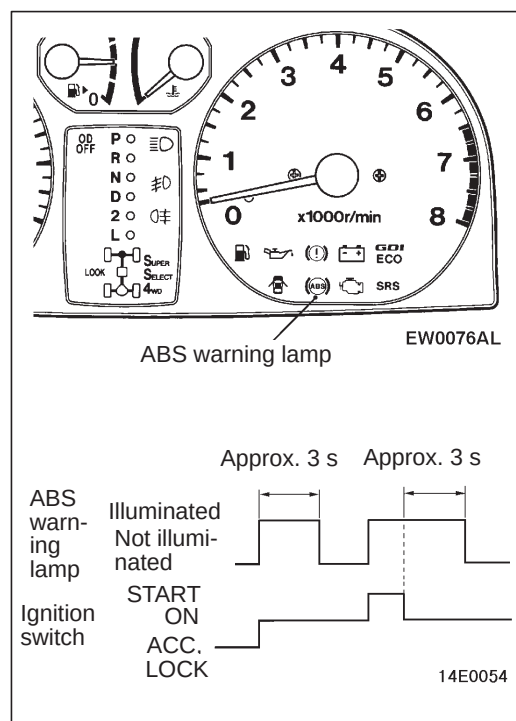
1. The phenomena listed in the following table are not abnormal.

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).

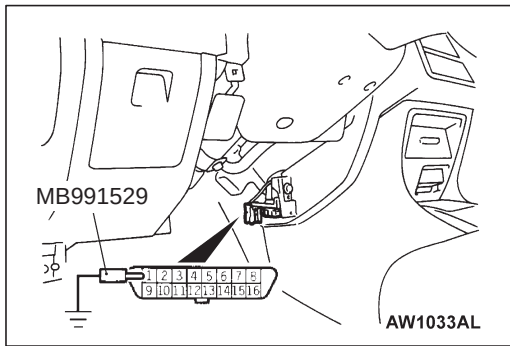
ERASING DIAGNOSIS CODES

When using the MUT-II

Connect the MUT-II to the diagnosis connector (16-pin) and erase the diagnosis code.

Caution

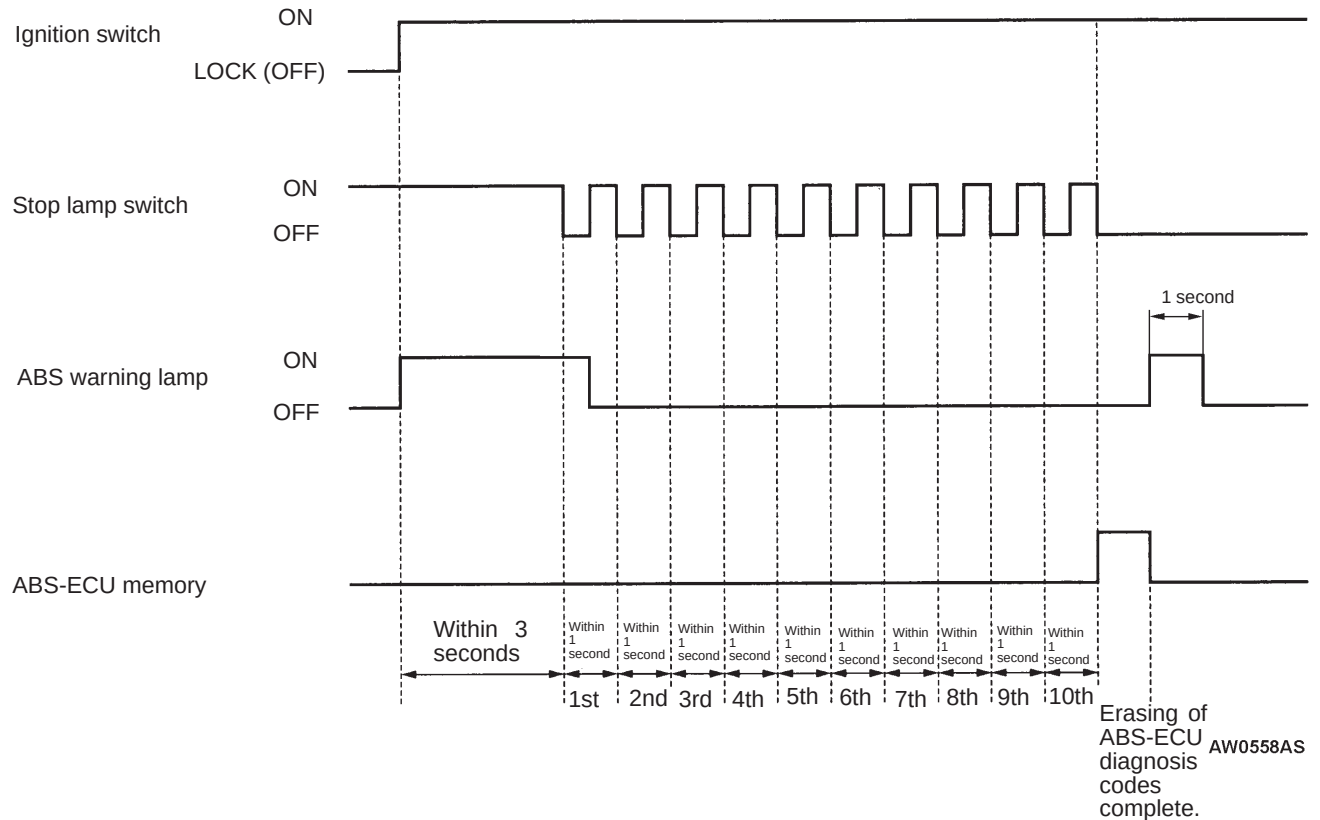
Turn the ignition key to the LOCK (OFF) position before connecting or disconnecting the MUT-II.

**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

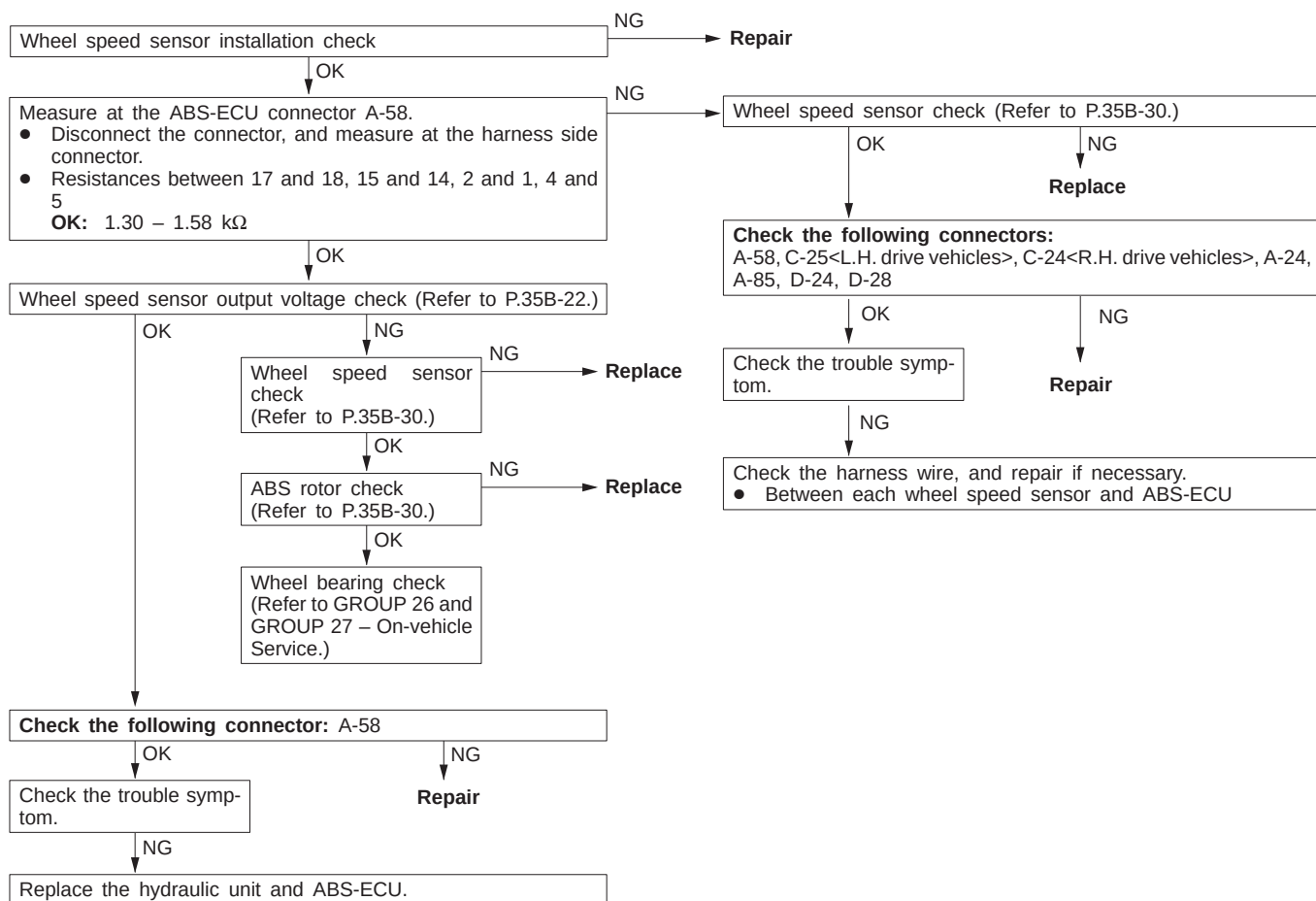
Diagnosis code No.	Inspection item		Reference page
11	Front right wheel speed sensor (Open circuit or short circuit)		35B-9
12	Front left wheel speed sensor (Open circuit or short circuit)		35B-9
13	Rear right wheel speed sensor (Open circuit or short circuit)		35B-9
14	Rear left wheel speed sensor (Open 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

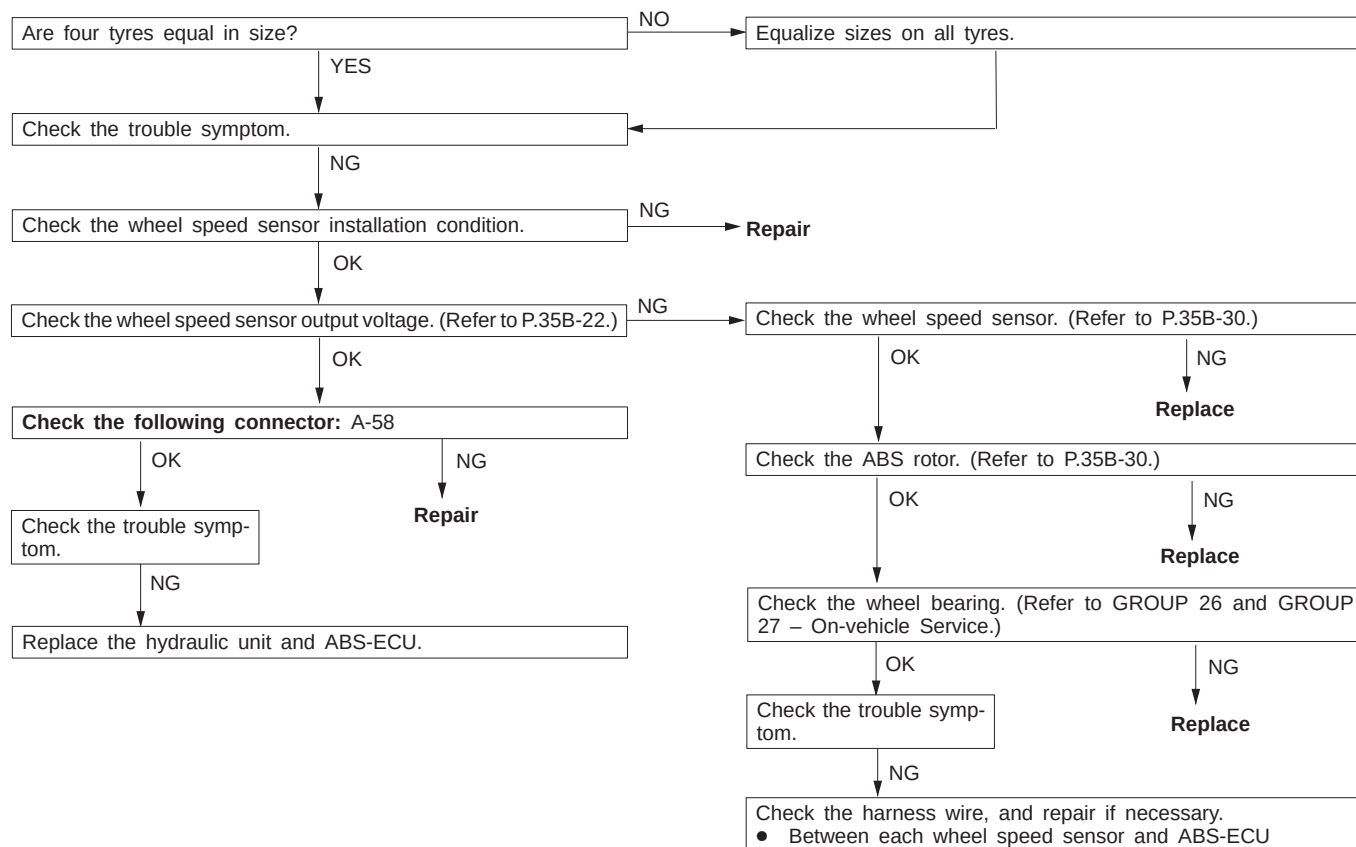
*: Turning the ignition switch to ACC will erase the diagnosis code No.16.

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code Nos.11, 12, 13 and 14 Wheel speed sensor (open circuit or short circuit)	Probable cause
Code Nos.21, 22, 23 and 24 Wheel speed sensor	
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

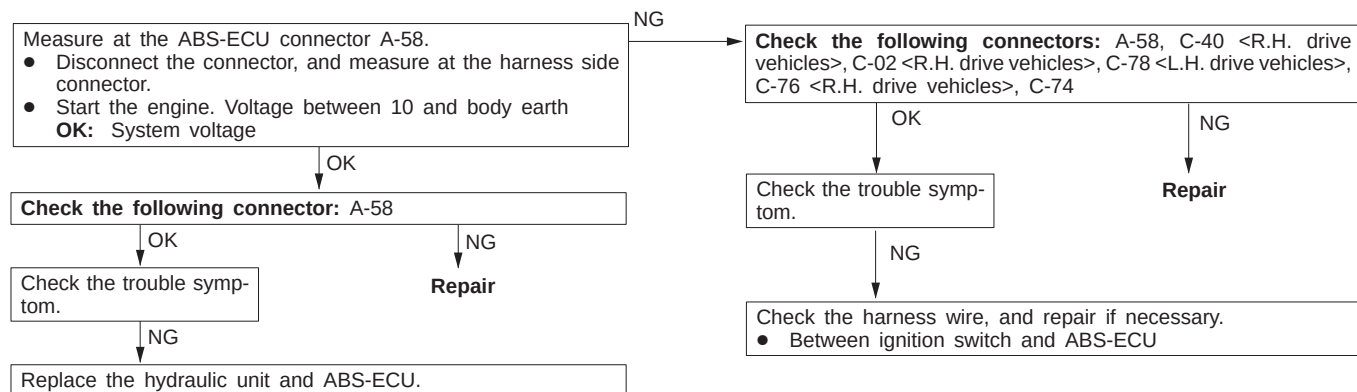


Code No.16 ABS-ECU power supply system (abnormal voltage drop or rise)	Probable cause
This code is output if the ABS-ECU power supply voltage drops below or rises above the rated values. Furthermore, turning the ignition switch to ACC will erase this code.	• Malfunction of battery • Malfunction of wiring harness or connector • Malfunction of hydraulic unit and ABS-ECU

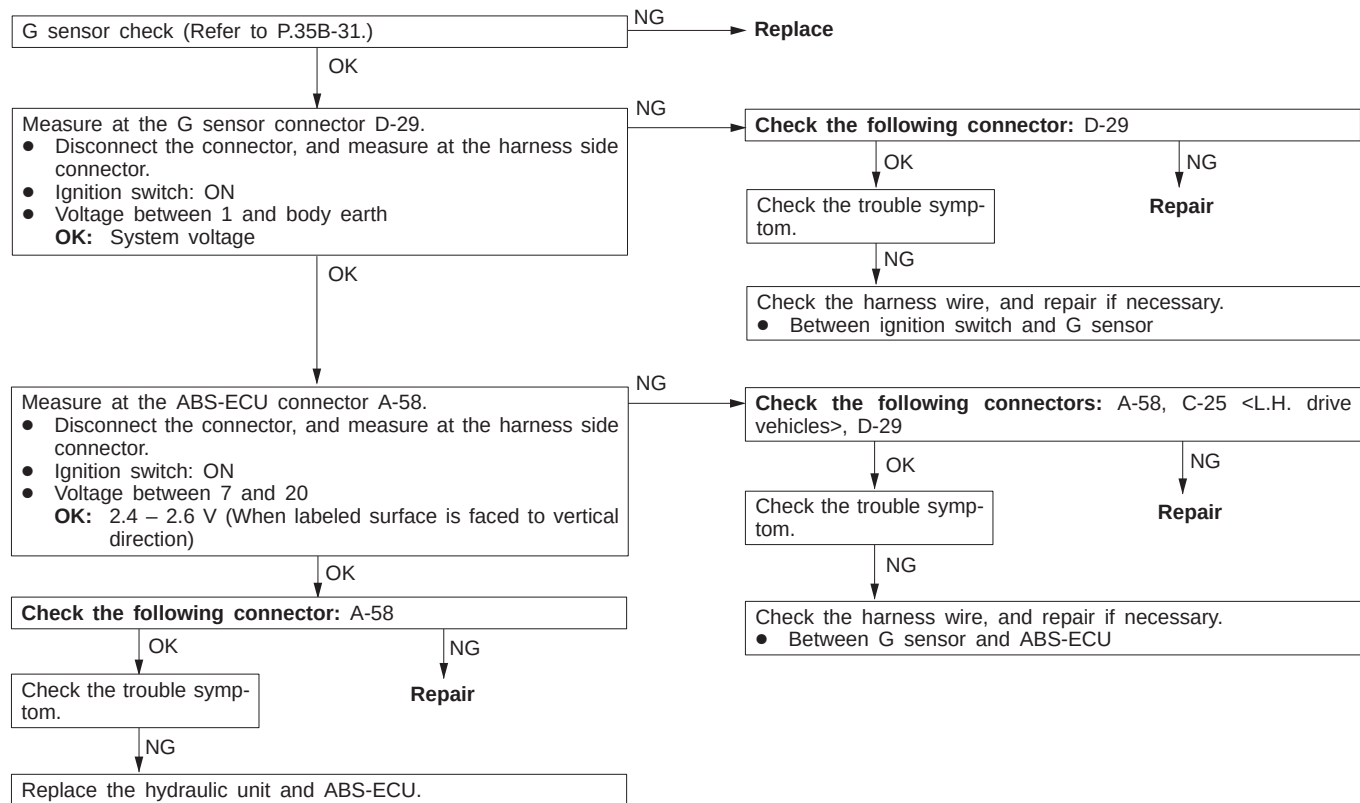
Caution

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.

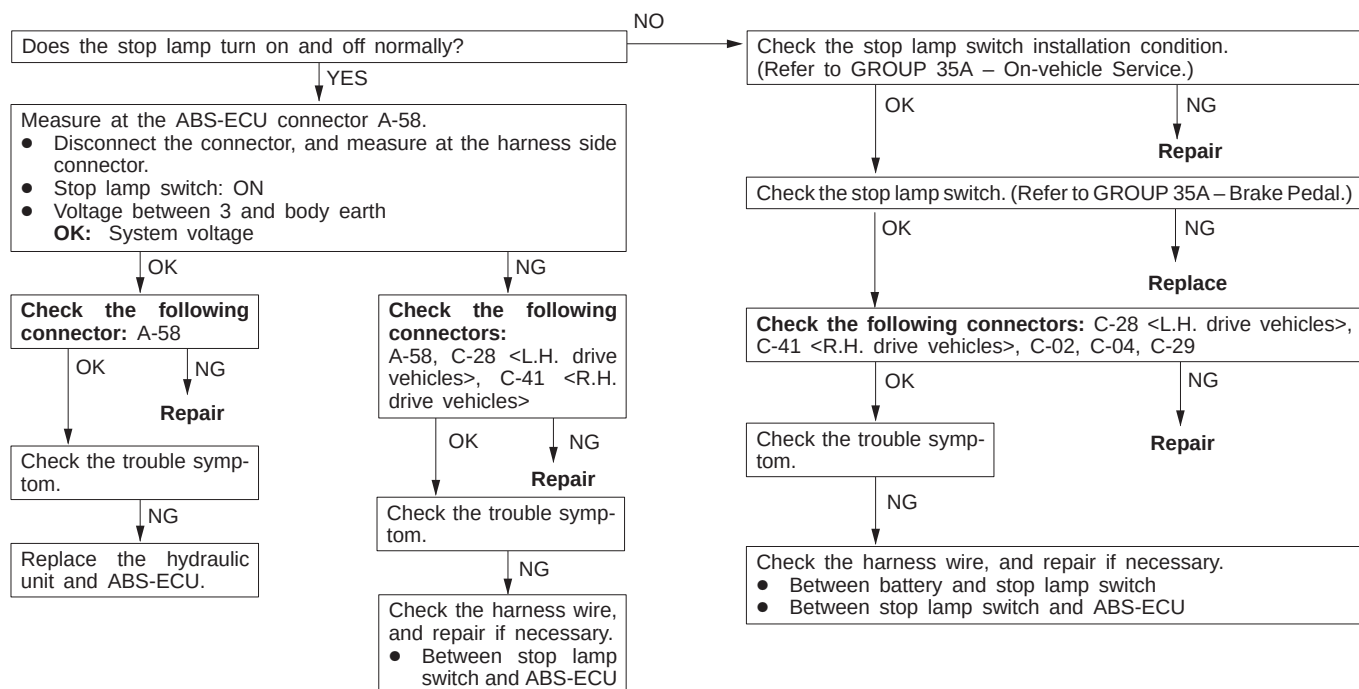
Before carrying out the following inspection, check the battery level, and refill it if necessary.



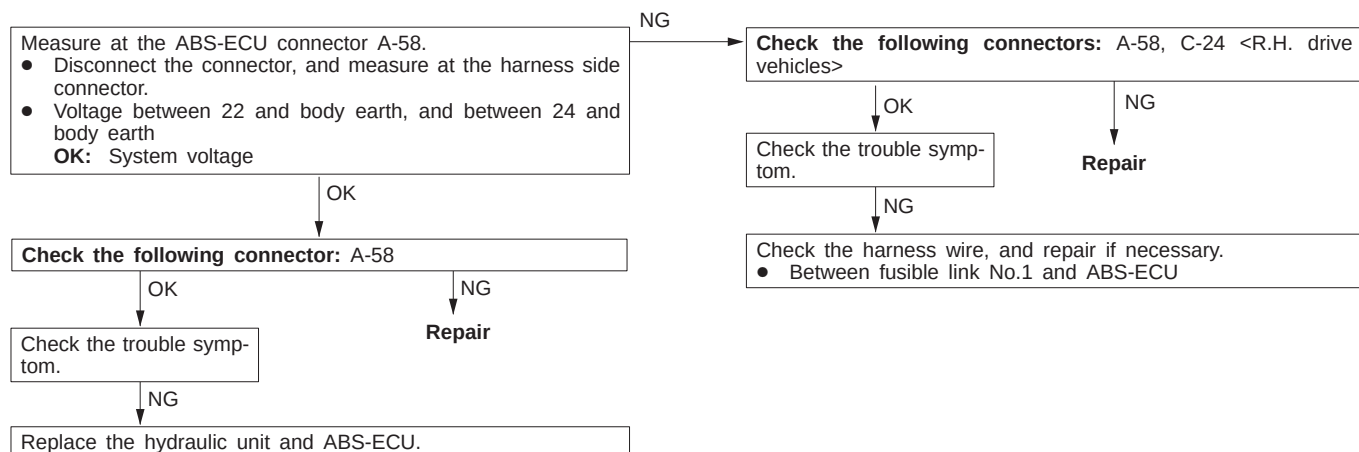
Code No.32 G sensor system	Probable cause
This code is output in the following cases. • G sensor output voltage is less than 0.5 V or more than 4.5 V. (An open or short circuit is present in the G sensor circuit.) • G sensor output voltage does not change. (G sensor output voltage is abnormal.)	• Malfunction 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	Probable cause
Code No.52 Valve relay problem (stays off)	
Code No.53 Motor relay problem (stays off)	
Code No.55 Motor system (seized pump motor)	
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

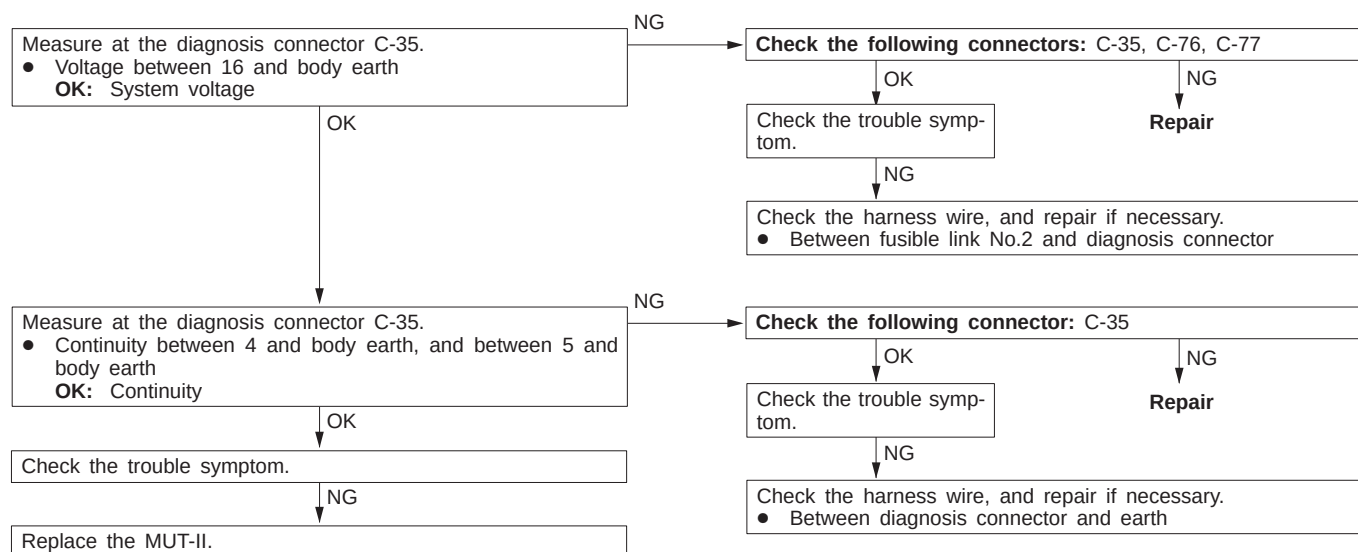


Trouble symptoms	Inspection procedure No.	Reference page
Communication between the MUT-II and the whole system is not possible.	1	35B-14
Communication between the MUT-II and the ABS-ECU is not possible.	2	35B-15
When the ignition key is turned to “ON” (engine stopped), the ABS warning lamp does not illuminate.	3	35B-16
Even after the engine is started, the ABS warning lamp remains illuminated.	4	35B-17
Faulty ABS operation	5	35B-18

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.

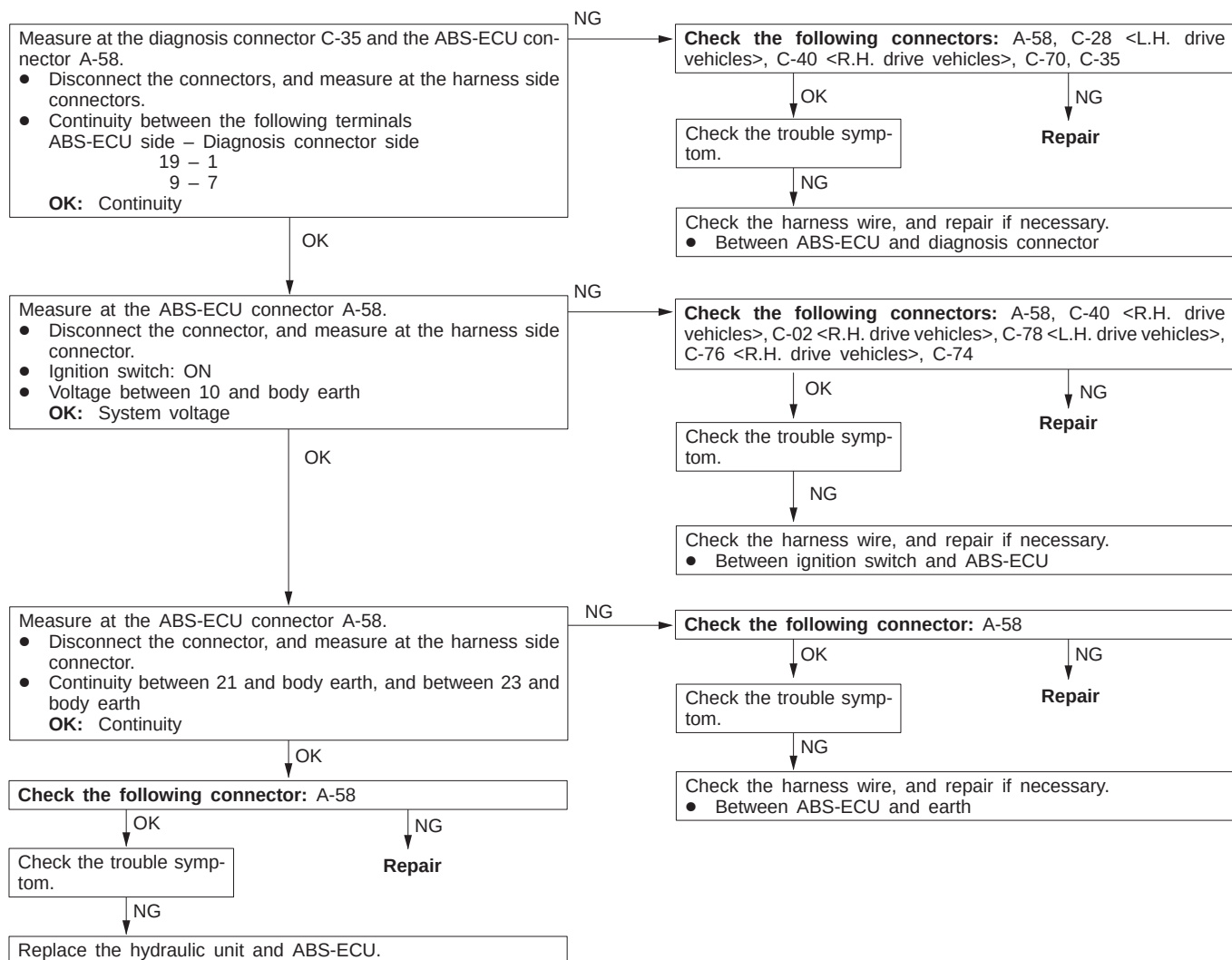
Inspection Procedure 1

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



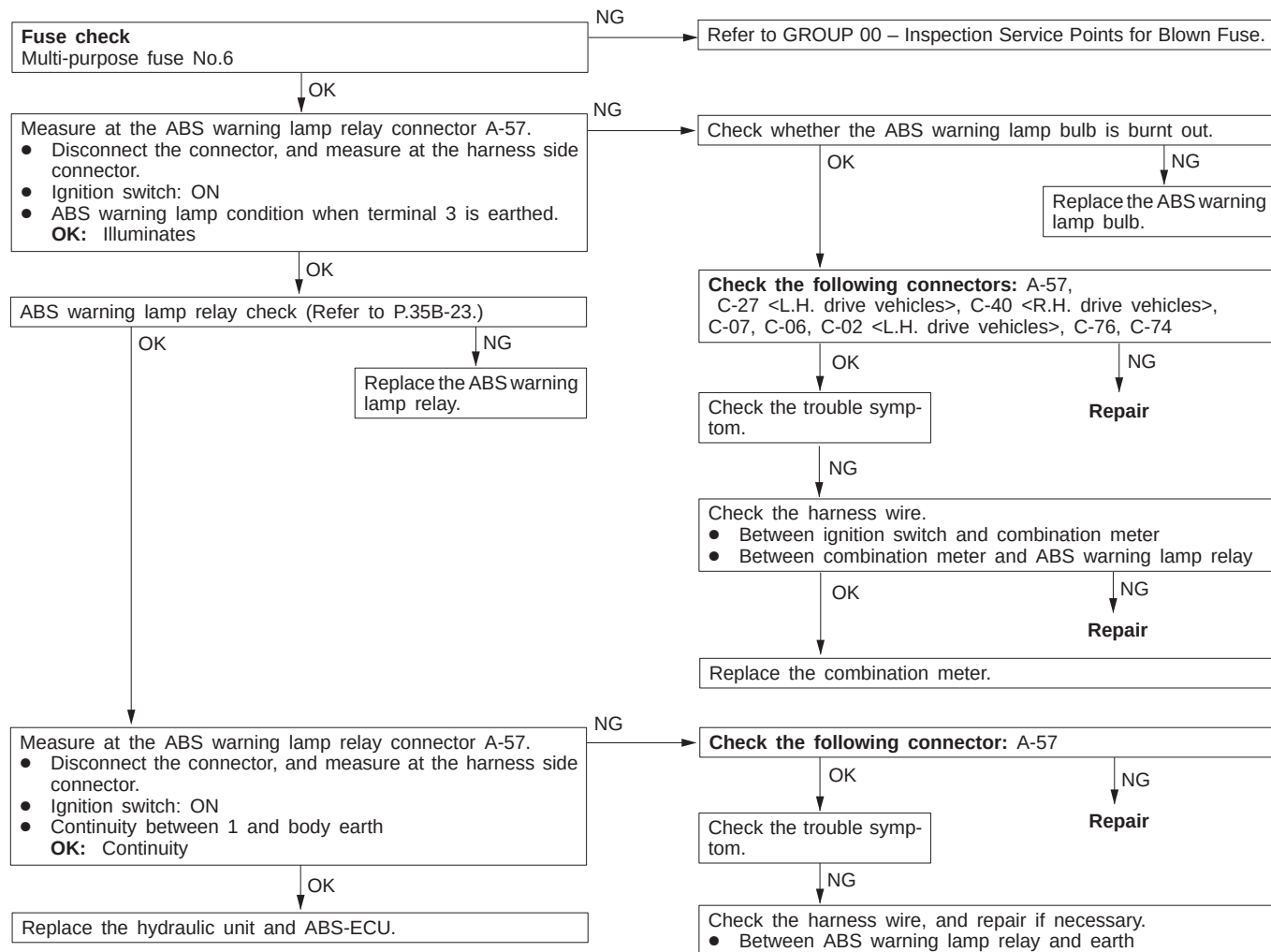
Inspection Procedure 2

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

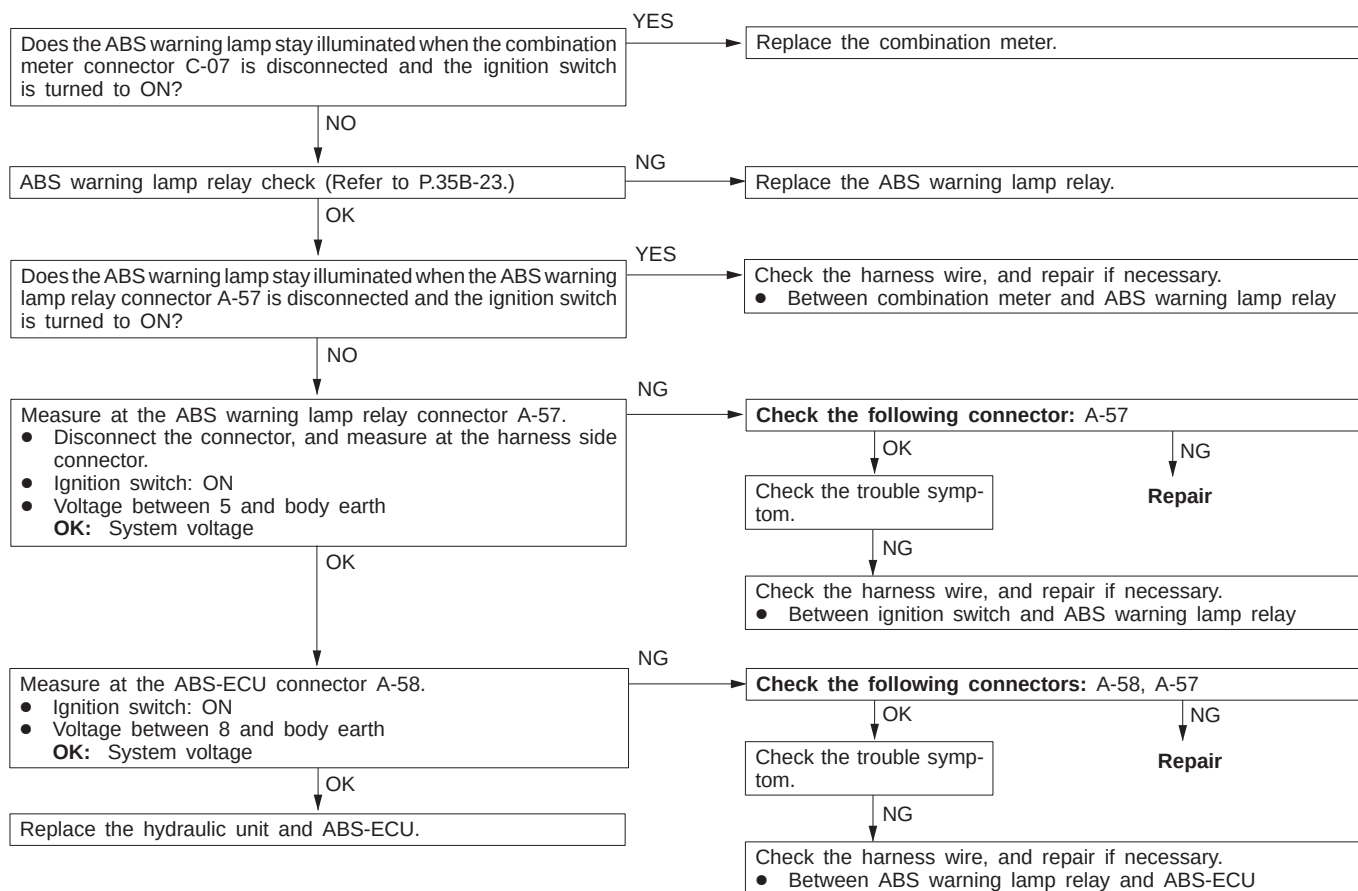


Inspection Procedure 4

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

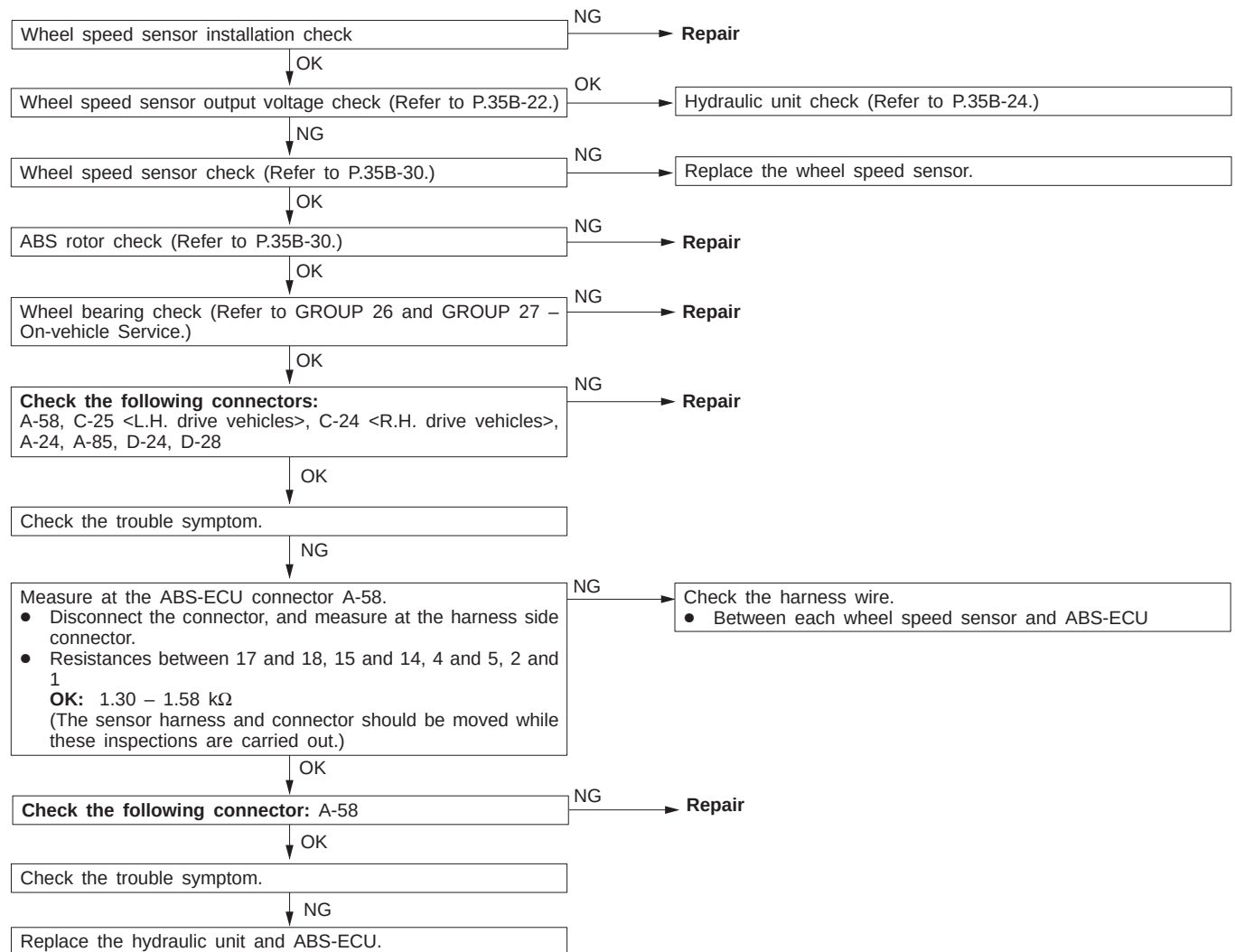
NOTE

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.

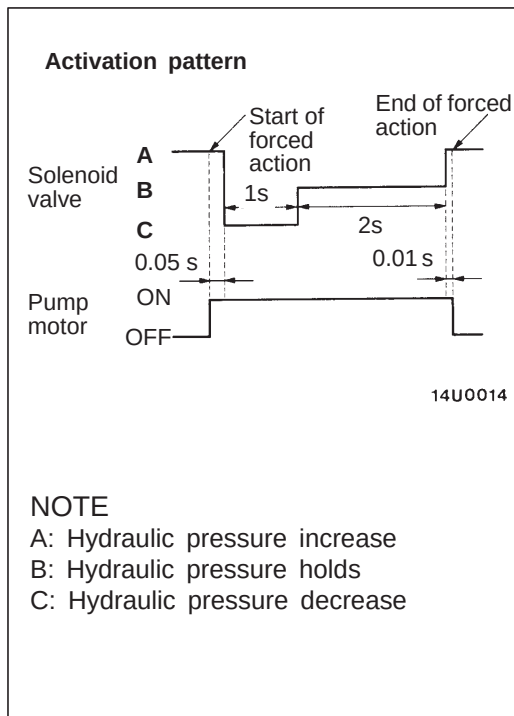
When the diagnosis system stops the ABS-ECU, the MUT-II display data will be unreliable.

ACTUATOR TEST REFERENCE TABLE

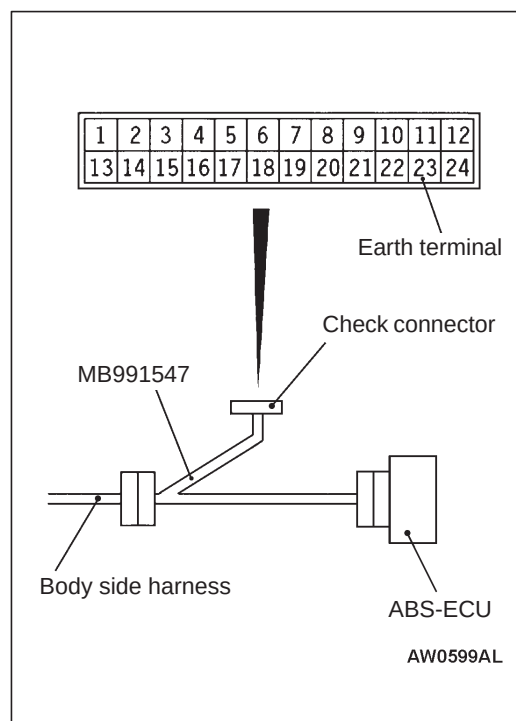
The MUT-II activates the following actuators for testing.

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.

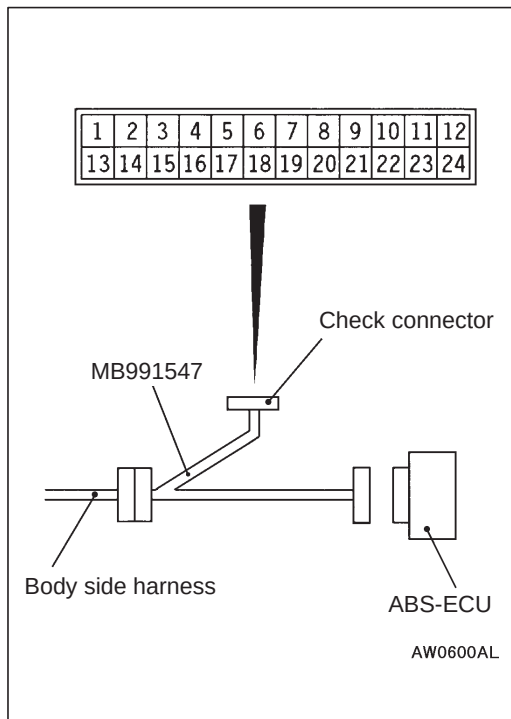
**ACTUATOR TEST SPECIFICATIONS**

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.

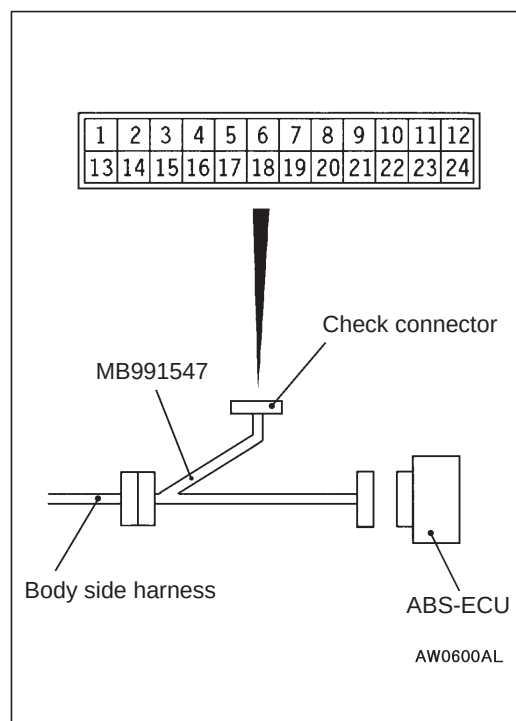
Terminal No.	Check item	Checking requirements		Normal condition
3	Stop lamp switch input	Ignition switch: ON	Stop lamp switch: ON	System voltage
			Stop lamp switch: OFF	1 V or less
7	Input from G sensor	Ignition switch: ON Vehicle is horizontal		2.4 – 2.6 V
8	ABS warning lamp relay transistor output	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.

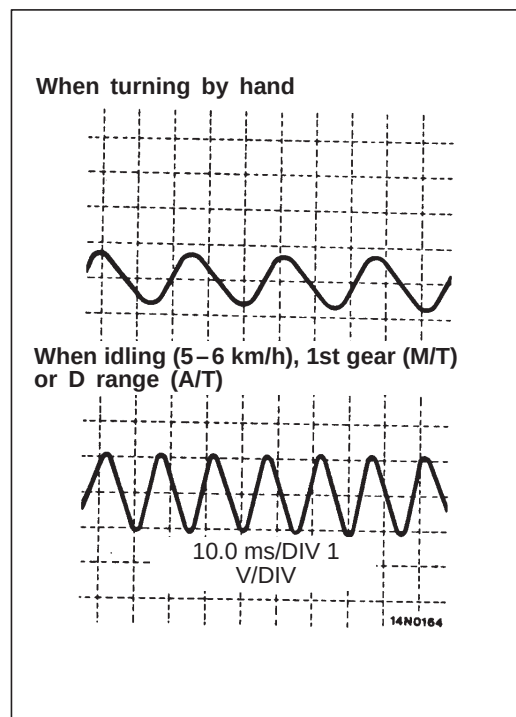
Wheel speed sensor	Front left	Front right	Rear left	Rear right
Terminal No.	15	17	2	4
	14	18	1	5

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

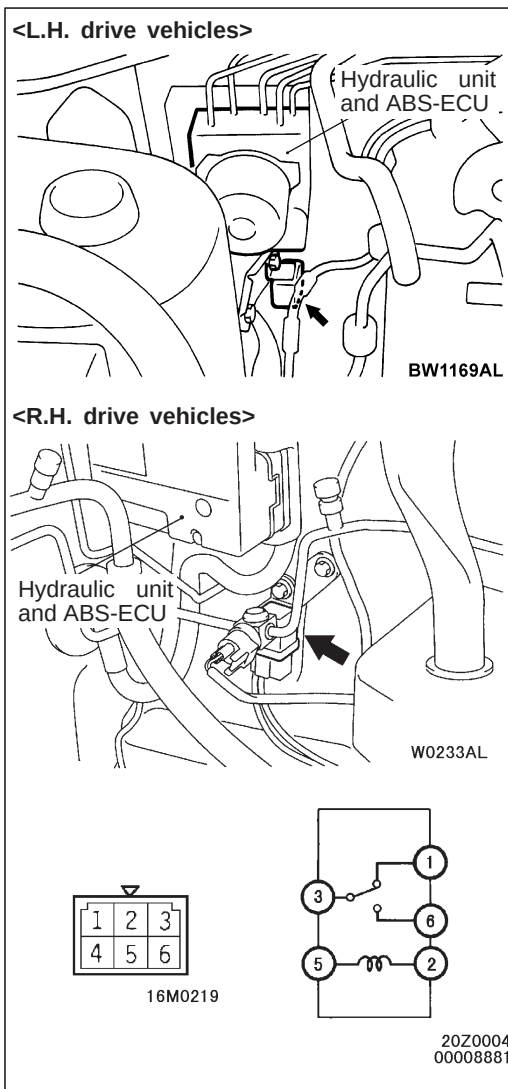
1. The waveform measurements can also be taken while the vehicle is actually moving.
2. The output voltage will be small when the wheel speed is low, and similarly it will be large when the wheel speed is high.

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.



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.

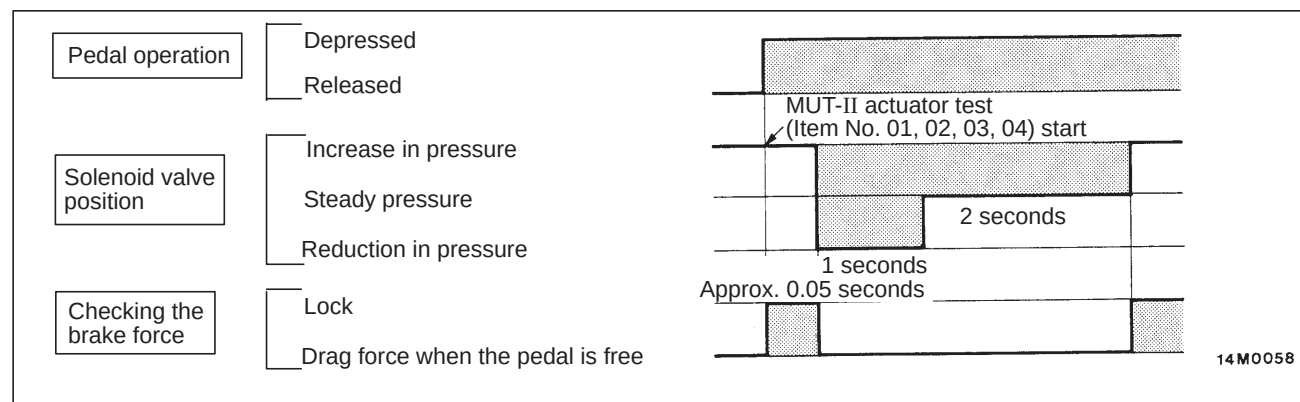
3. After checking that the shift lever <M/T> or the selector lever <A/T> is in neutral, start the engine.
4. Use the MUT-II to force-drive the actuator.

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

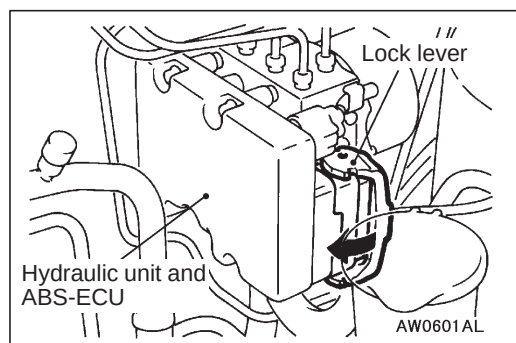
7. After inspection, disconnect the MUT-II immediately after turning the ignition switch to OFF.

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

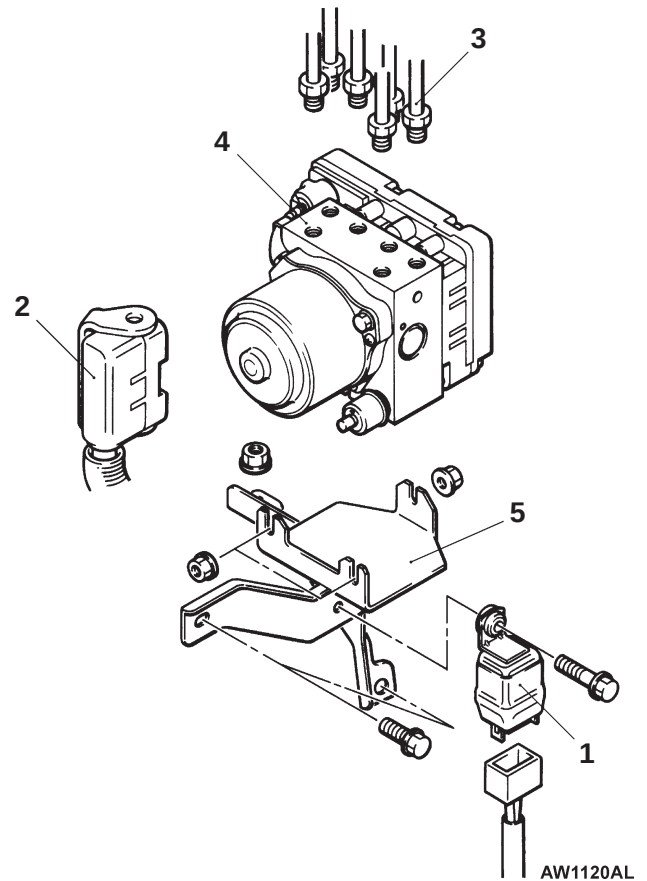
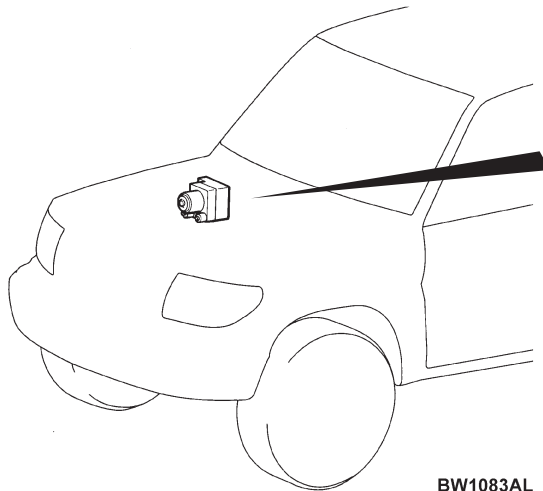
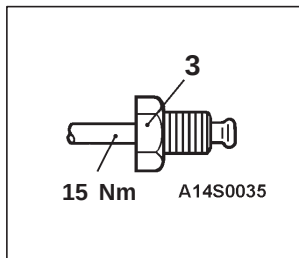
REMOVAL AND INSTALLATION

Pre-removal Operation

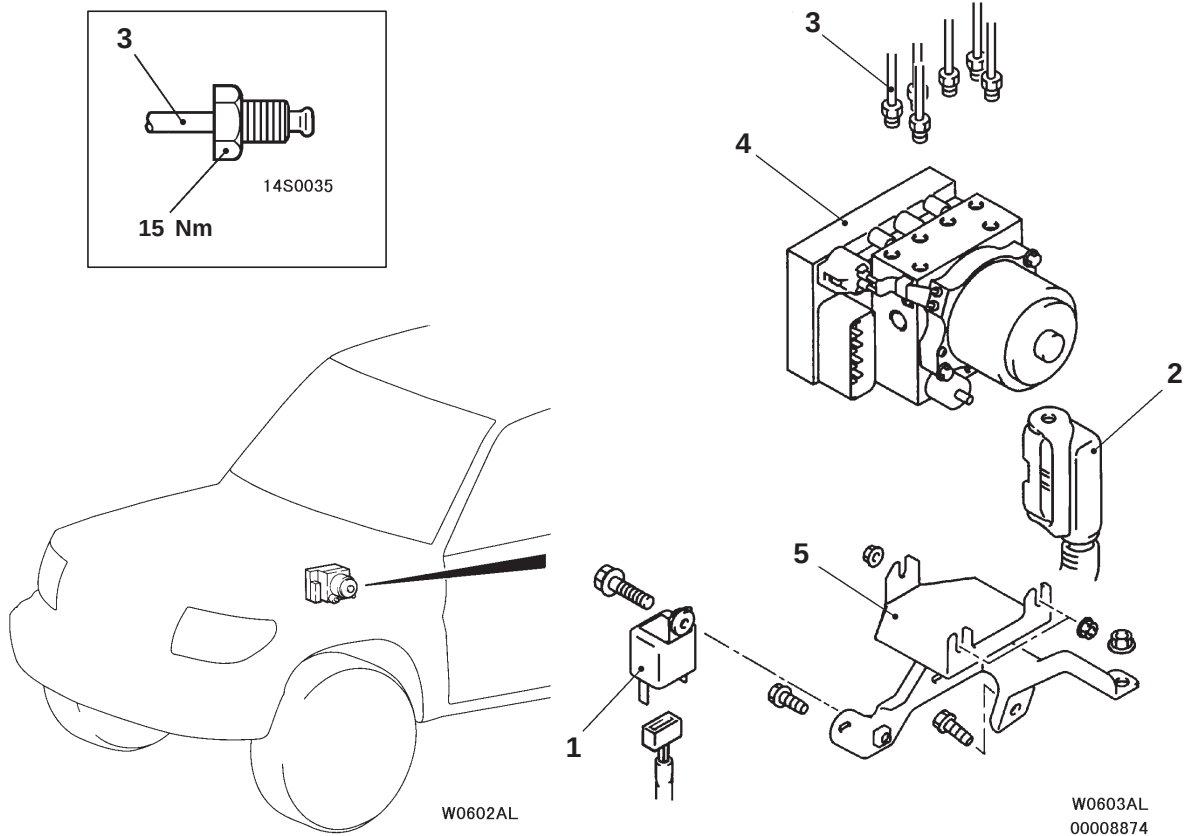
- Brake Fluid Draining
- Air Cleaner Removal (Refer to GROUP 15.)

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.)

<L.H. drive vehicles>

<R.H. drive vehicles>

**Removal steps**

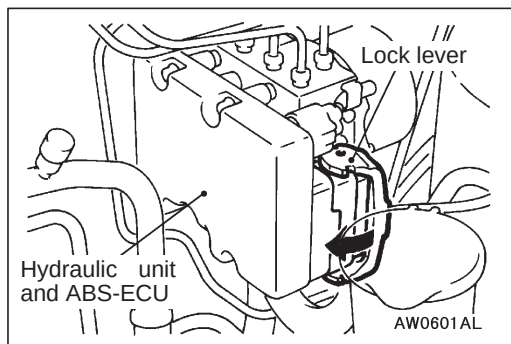
◀A▶

▶A▶

1. ABS warning lamp relay
2. Harness connector
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.

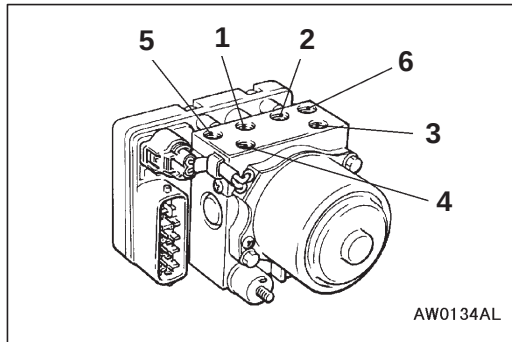
◀B▶ HYDRAULIC UNIT AND ABS-ECU REMOVAL**Caution**

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)



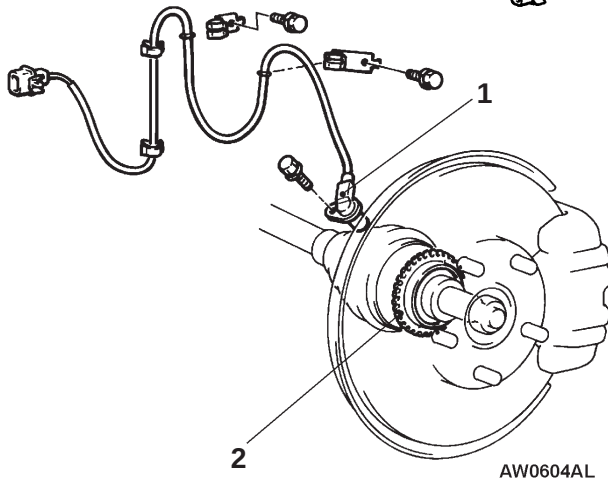
WHEEL SPEED SENSOR

REMOVAL AND INSTALLATION

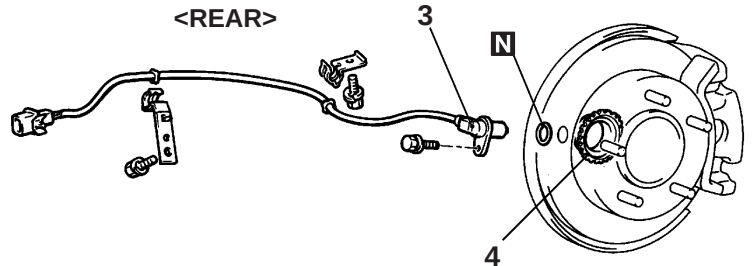
Post-installation Operation

Wheel Speed Sensor Output Voltage Check
(Refer to P.35B-22.)

<FRONT>



<REAR>



AX0096AL



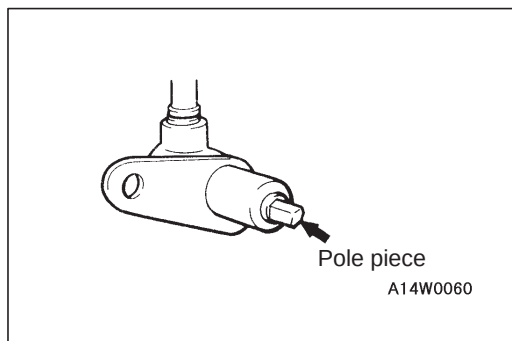
1. Front wheel speed sensor
2. Front ABS rotor (Refer to GROUP 26 – Drive Shaft.)



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

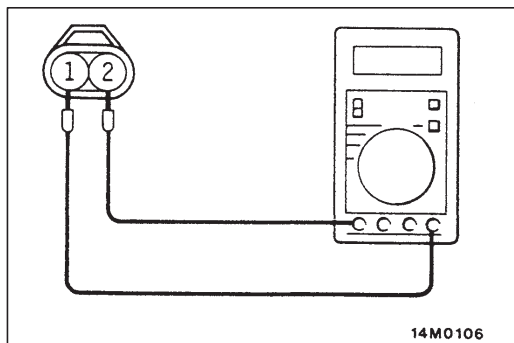
◀A▶ FRONT WHEEL SPEED SENSOR/REAR WHEEL SPEED SENSOR REMOVAL

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.

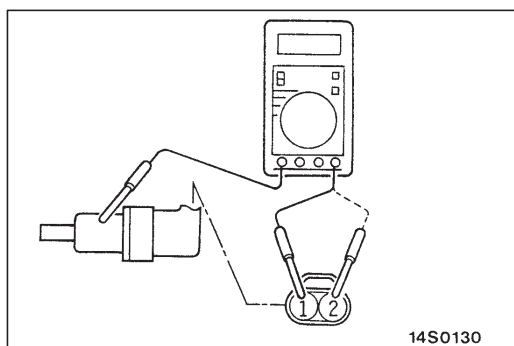
Standard value: 1.30 – 1.58 k Ω

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 k Ω 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.

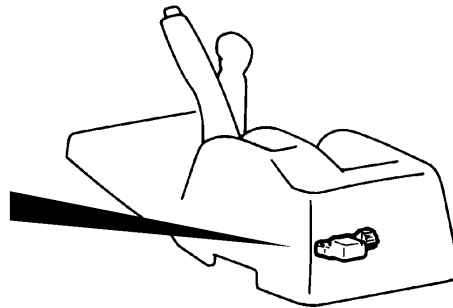
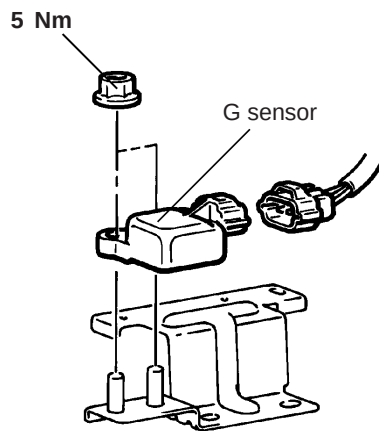
G SENSOR

REMOVAL AND INSTALLATION

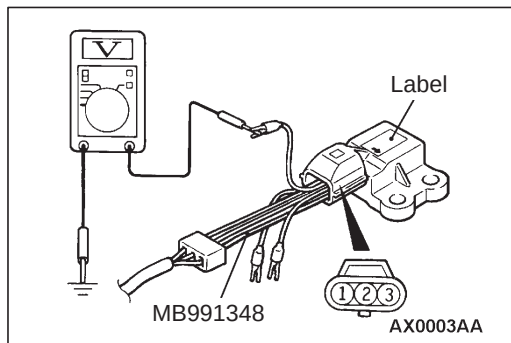
Caution

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.)



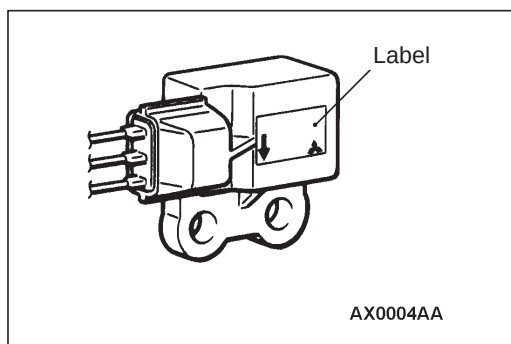
AX0095AL



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

PARKING BRAKES

CONTENTS

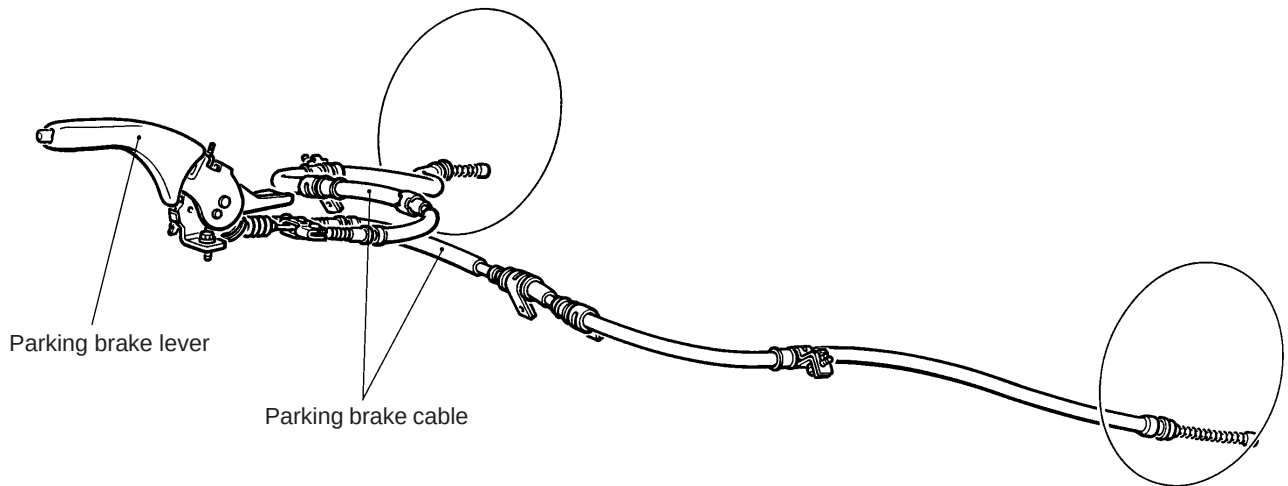
GENERAL INFORMATION	2	Parking Brake Switch Check	4
SERVICE SPECIFICATIONS	2	Lining Runing-In	4
LUBRICANTS	2	PARKING BRAKE LEVER	5
ON-VEHICLE SERVICE	3	PARKING BRAKE CABLE	6
Parking Brake Lever Stroke Check and Adjustment	3	PARKING BRAKE DRUM	8



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



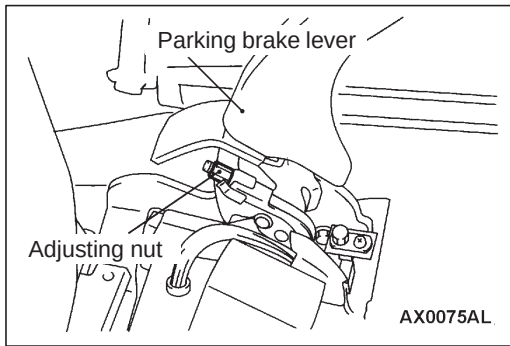
AW0051AL

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	



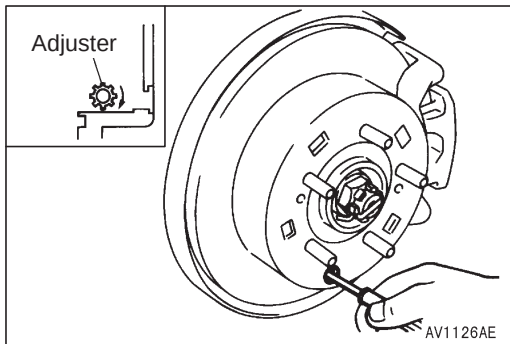
ON-VEHICLE SERVICE

PARKING BRAKE LEVER STROKE CHECK AND ADJUSTMENT

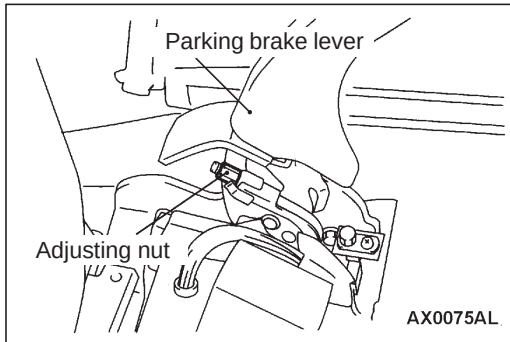
1. Pull the parking brake lever with a force of approx. 196 N and count the number of notches.

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.

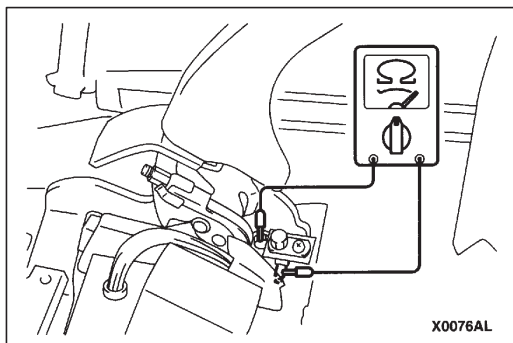


- (4) Turn the adjusting nut to adjust the parking brake lever stroke to the standard value. After adjusting, check that there is no space between the adjusting nut and the parking brake lever.

Caution

If the parking brake lever stroke is below the standard value and the braking is too firm, the rear brakes may drag.

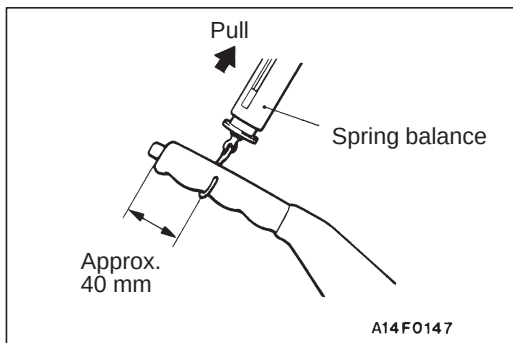
- (5) Release the parking brake and turn the rear wheels to check that the rear brakes are not dragging.



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

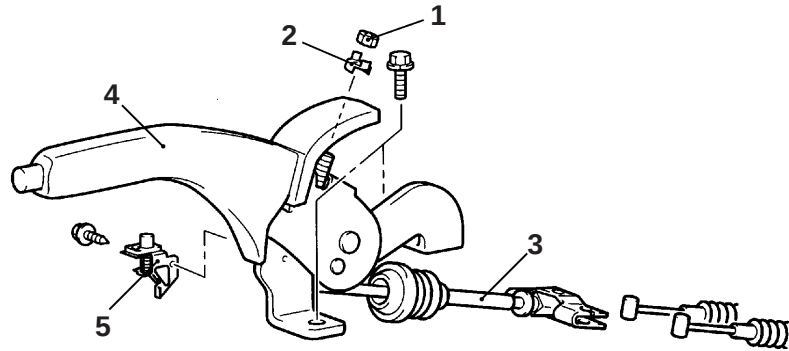
REMOVAL AND INSTALLATION

Pre-removal Operation

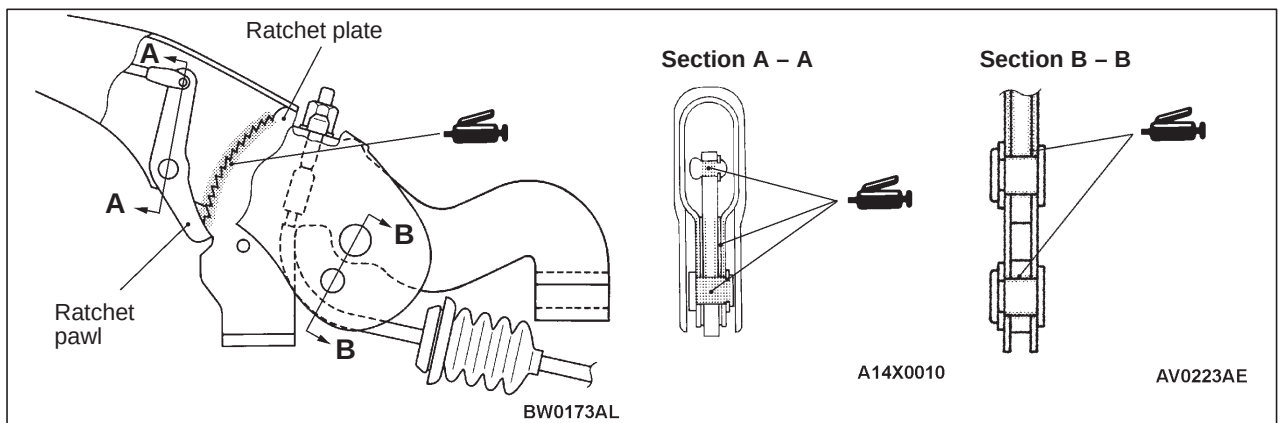
Rear Floor Console Removal
(Refer to GROUP 52A.)

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

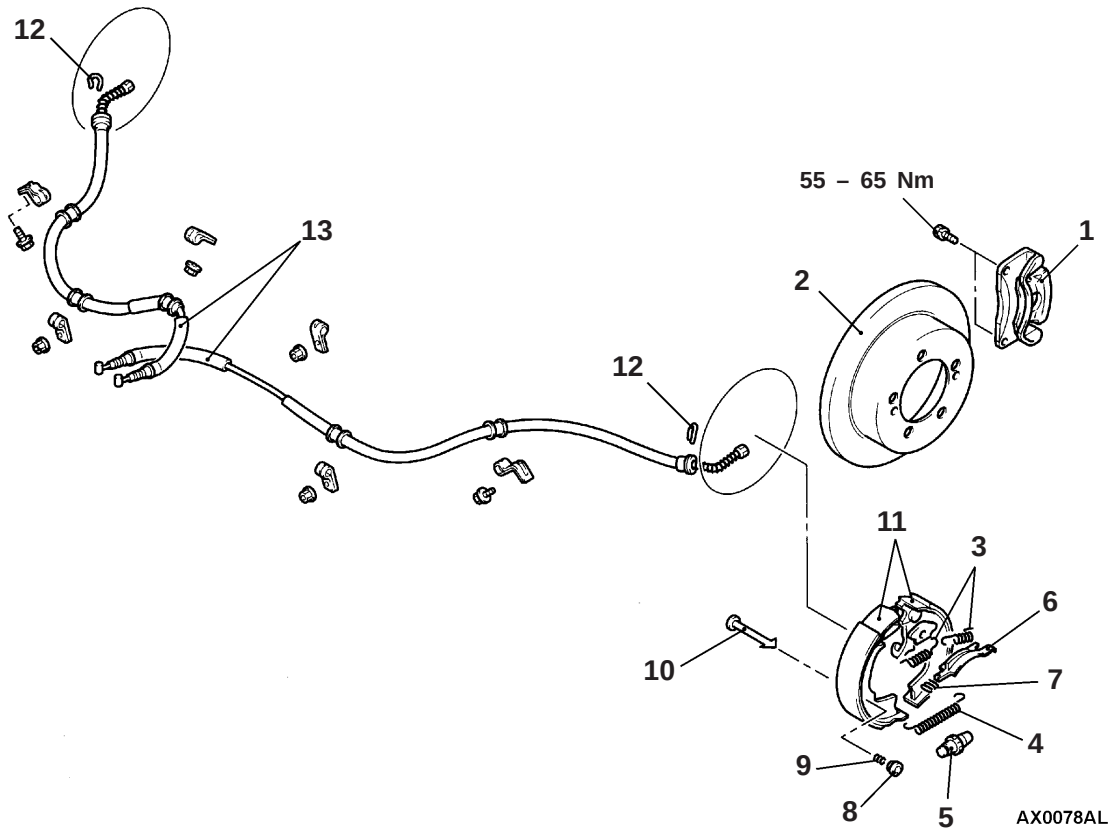
REMOVAL AND INSTALLATION

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
3. Shoe-to-anchor spring
4. Adjusting screw spring
5. Adjuster
6. Strut
7. Strut return spring

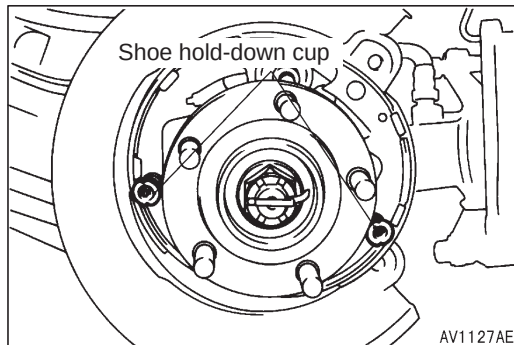
▶B◀

▶A◀

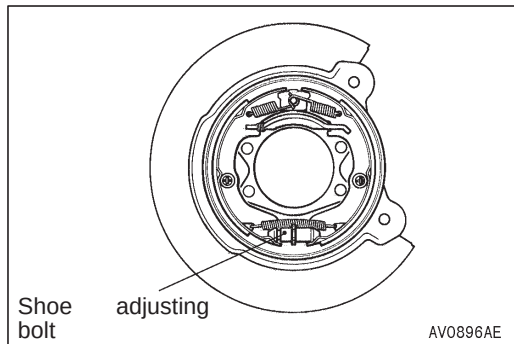
8. Shoe hold-down cup
9. Shoe hold-down spring
10. Shoe hold-down pin
11. Shoe and lining assembly
12. Clip
13. Parking brake cable

REMOVAL SERVICE POINTS**◀A▶ REAR BRAKE CALIPER ASSEMBLY REMOVAL**

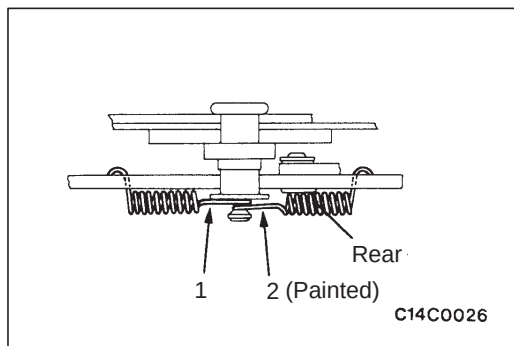
Remove the rear brake caliper assembly and support it with wire or similar.

**◀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

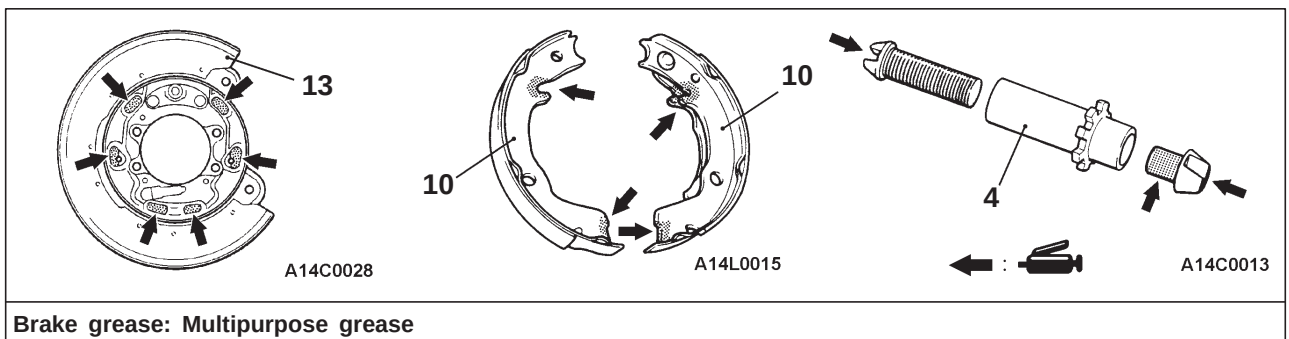
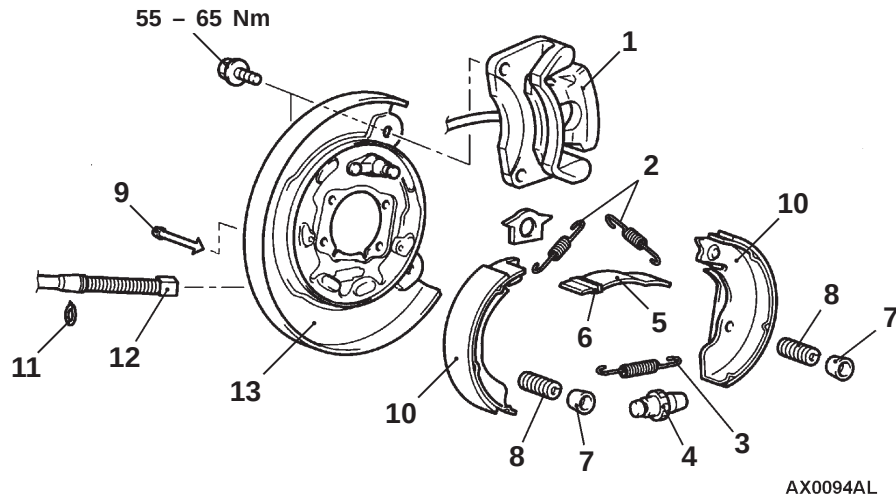
REMOVAL AND INSTALLATION

Pre-removal Operation

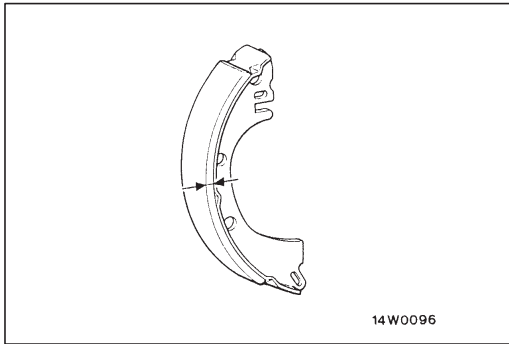
Drive Shaft Removal (Refer to GROUP 27B.)

Post-installation Operation

- Drive Shaft Installation (Refer to GROUP 27B.)
- Parking Brake Lever Stroke Check and Adjustment (Refer to P.36-3.)

**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

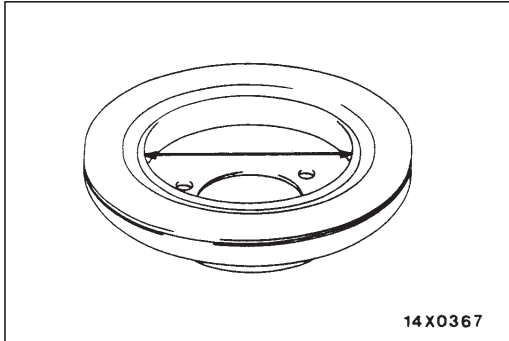
BRAKE LINING AND BRAKE DRUM CHECK

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

STEERING

CONTENTS

GENERAL INFORMATION	2	Oil Pump Belt Tension Check	8
SERVICE SPECIFICATIONS	4	Power Steering Fluid Level Check	9
LUBRICANTS	4	Power Steering Fluid Replacement	9
SEALANT AND ADHESIVE	4	Power Steering System Bleeding	9
SPECIAL TOOLS	5	Oil Pressure Test	10
ON-VEHICLE SERVICE	7	Power Steering Oil Pressure Switch Check	11
Steering Wheel Free Play Check	7	Ball Joint Dust Cover Check	11
Steering Angle Check	7	STEERING WHEEL AND SHAFT*	12
Tie Rod End Ball Joint Starting Torque Check	7	POWER STEERING GEAR BOX AND LINKAGE	15
Stationary Steering Effort Check	8	POWER STEERING OIL PUMP	29
Steering Wheel Returnability Check	8	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

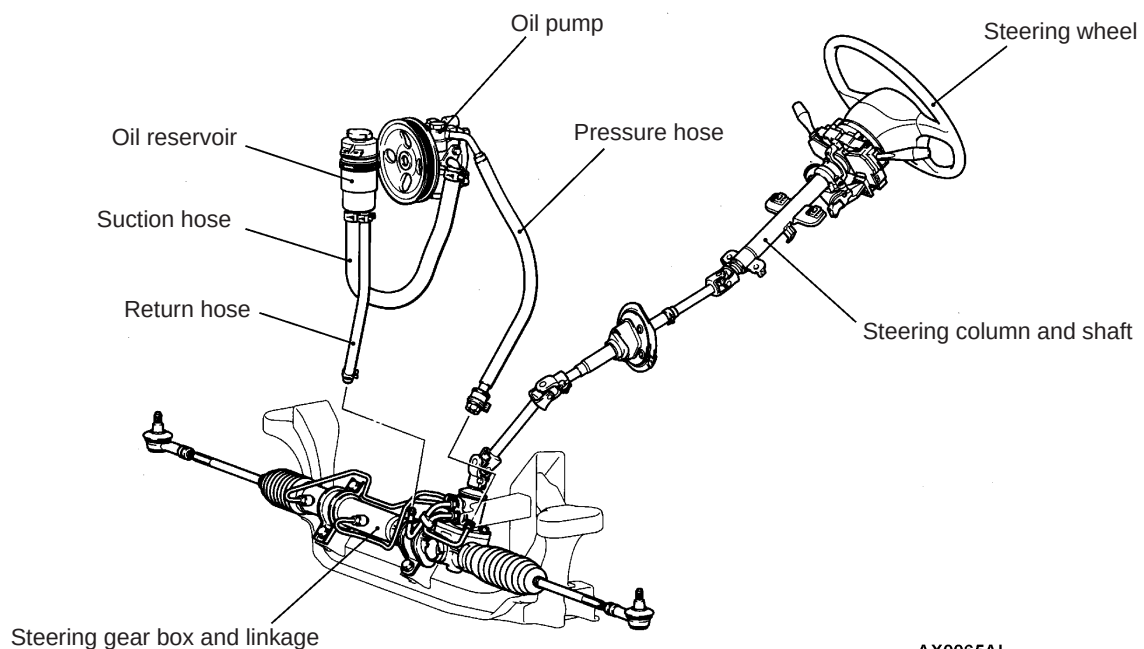
A 4-spoke type steering wheel has been mounted. The power steering is an integral rack and pinion type that combines the steering gear and linkage into one light-weight and compact assembly.

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

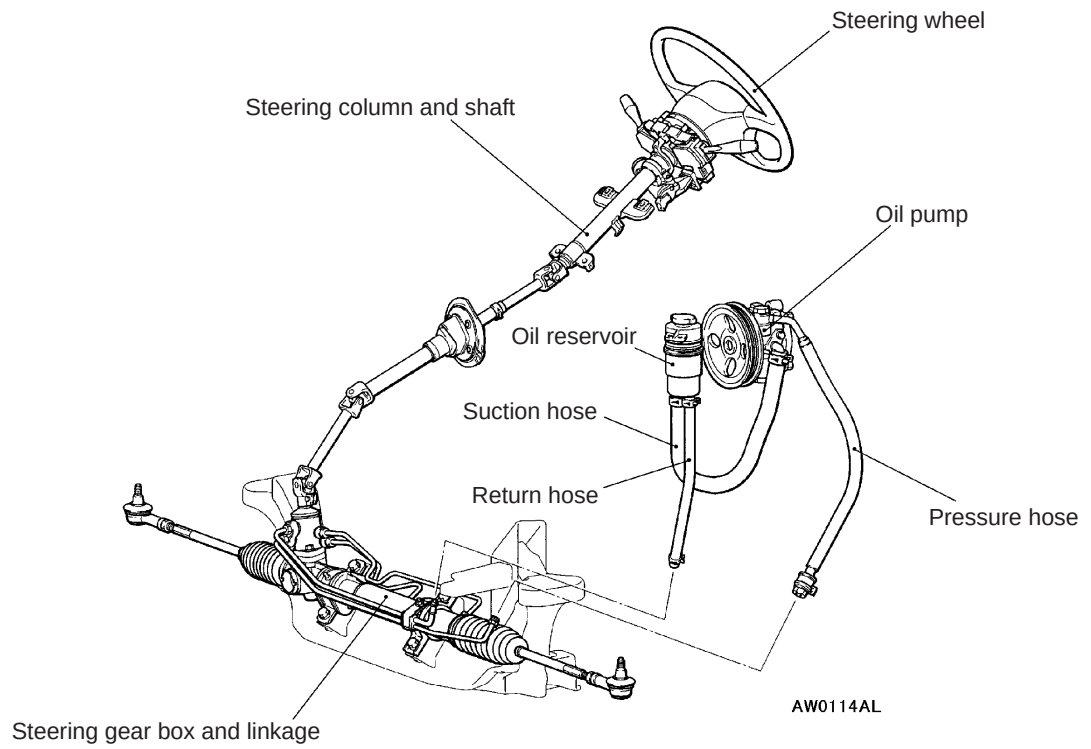
CONSTRUCTION DIAGRAM

<L.H. drive vehicles>



AX0065AL

<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	–

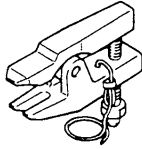
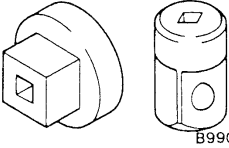
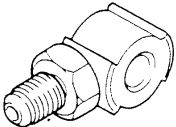
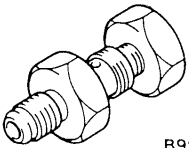
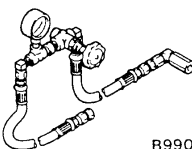
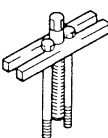
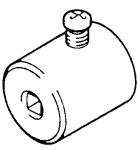
LUBRICANTS

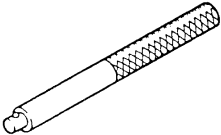
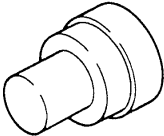
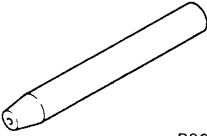
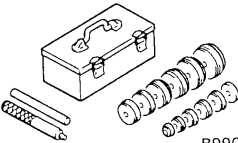
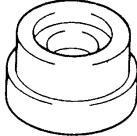
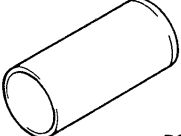
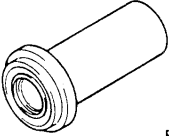
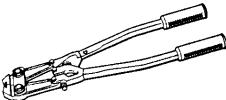
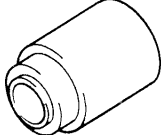
Item	Specified lubricant	Quantity
Power steering	Automatic transmission fluid DEXRON or DEXRON II	Approx. 0.6 ℓ
Tie rod bellows	Silicone grease	As required
Pinion and valve assembly	Repair kit grease	As required
Rack assembly	Repair kit grease	As required

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

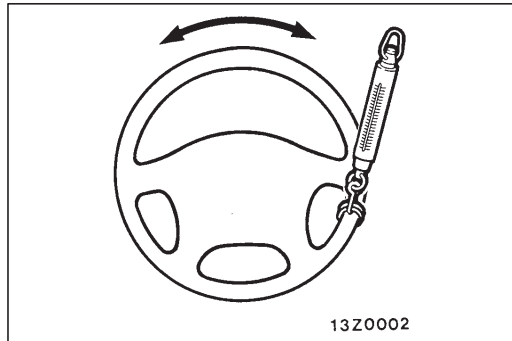
Tool	Number	Name	Use
 B991197	MB991197	Bar (long type)	Gear housing oil seal press fitting
 B991198	MB991199	Oil seal installer	
 B991212	MB991213	Oil seal protector	Rack assembly installation
 B990925	MB990925	Bearing and oil seal installer set	Oil seal and bearing press fitting (Refer to GROUP 26 – 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.)

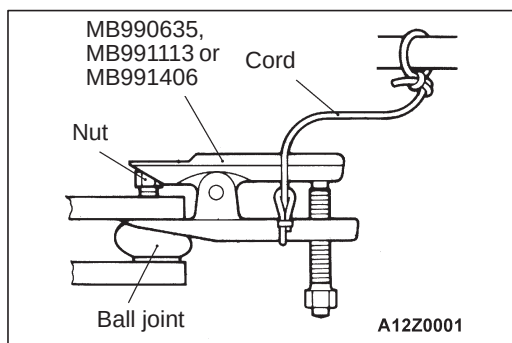
STEERING ANGLE CHECK

1. Put the front wheels on a turning radius gauge and measure steering angle.

Standard value:

Inner wheels	$34^{\circ}40' \pm 2^{\circ}$
Outer wheels <For reference>	$32^{\circ}10'$

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.

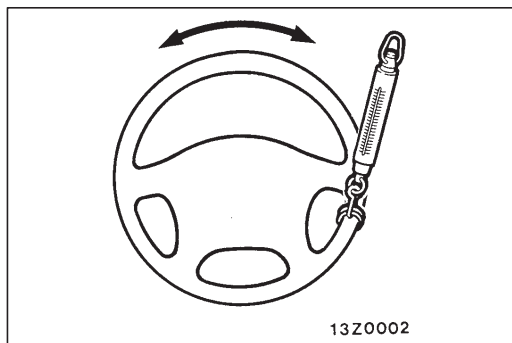
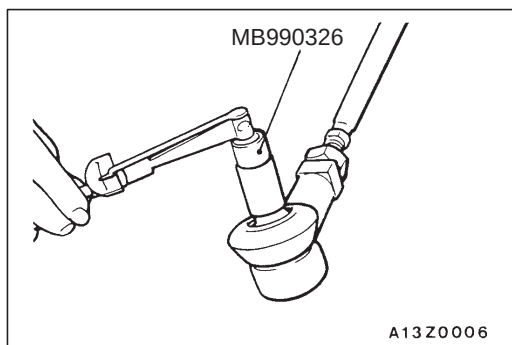


TIE ROD END BALL JOINT STARTING TORQUE CHECK

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.

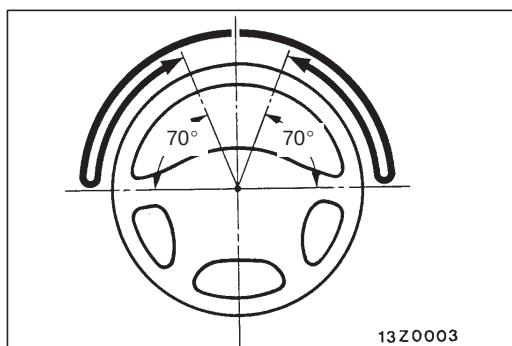
STATIONARY STEERING EFFORT CHECK

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 $1,000 \pm 100$ 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:

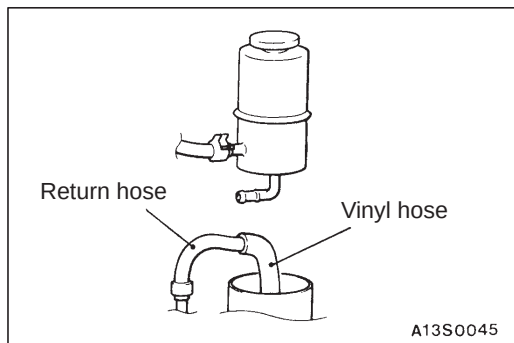
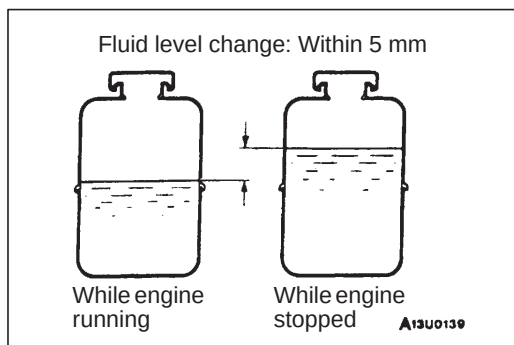
1. Make both gradual and sudden turns and see by your own feeling that the steering effort and returnability have no difference between the left and right turns.
2. At a speed of about 35 km/h, turn the steering wheel 90° , keep it there for 1 to 2 seconds and release. When the steering wheel returns 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.

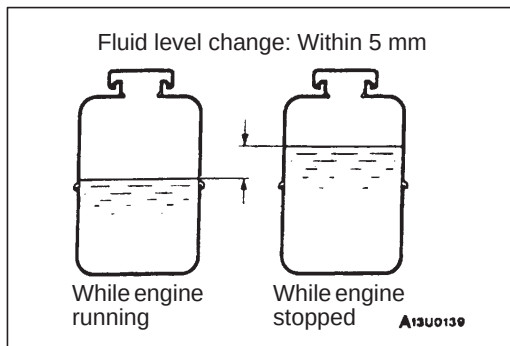
POWER STEERING SYSTEM BLEEDING

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.

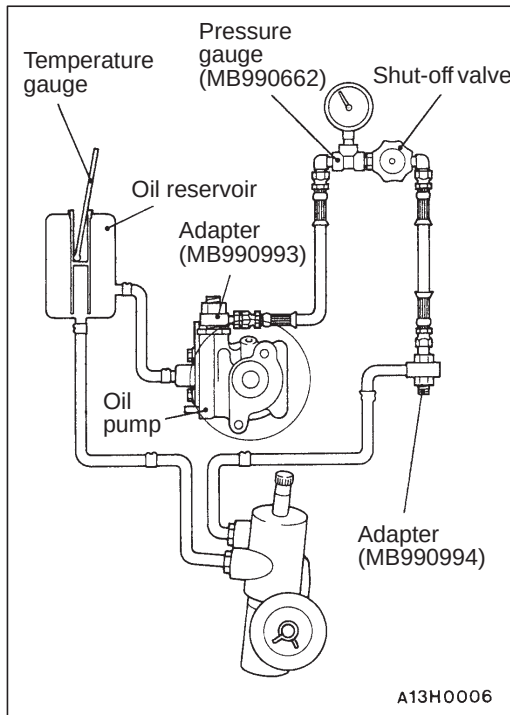
3. Connect the ignition coil connectors and idle the engine.
4. Turn the steering wheel left and right fully until no bubbles comes out in the oil reservoir.
5. See that the fluid is not milky and that the fluid level is between "MAX" and "MIN" marks.
6. See that the fluid level changes little when the 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

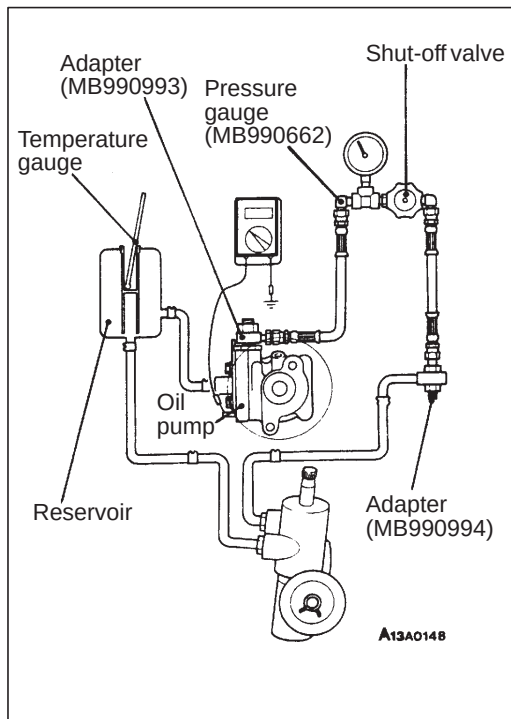
7. If the standard value is not met, the oil line or steering gear is probably defective. So, repair and measure oil pressure again.
8. Turn the steering wheel fully either left or right and check the retention hydraulic pressure.

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.

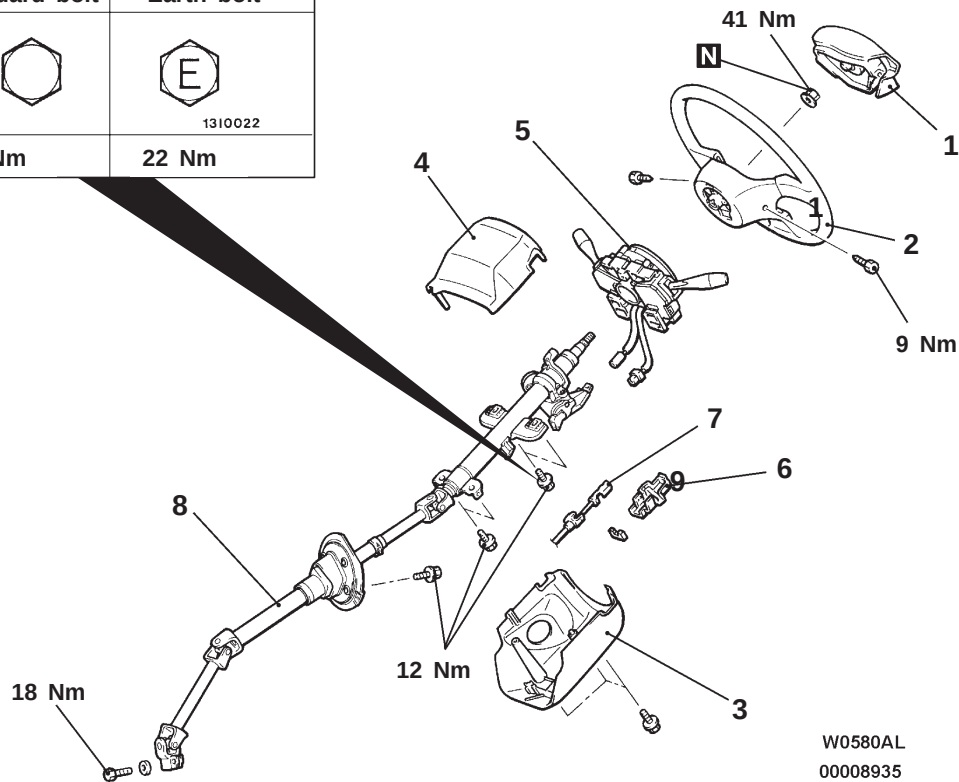
Pre-removal Operation

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

Standard bolt	Earth bolt
	
12 Nm	22 Nm



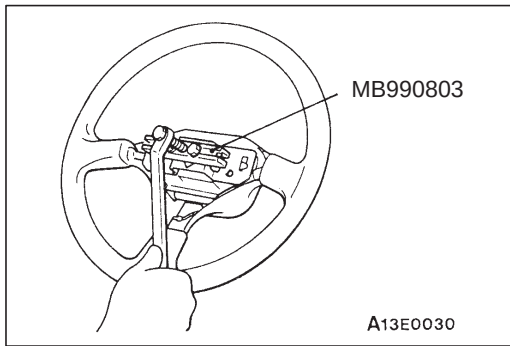
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Removal steps

1. Air bag module <Refer to GROUP 52B>	7. Key interlock cable <A/T>
2. Steering wheel	8. Steering column shaft assembly
3. Lower column cover	
4. Upper column cover	
5. Clock spring and column switch assembly <Refer to GROUP 52B>	
6. Cover <A/T>	
- NOTE
- When the air bag module assembly must be removed, refer to GROUP 52B – Air Bag Module and Clock Spring.

NOTE

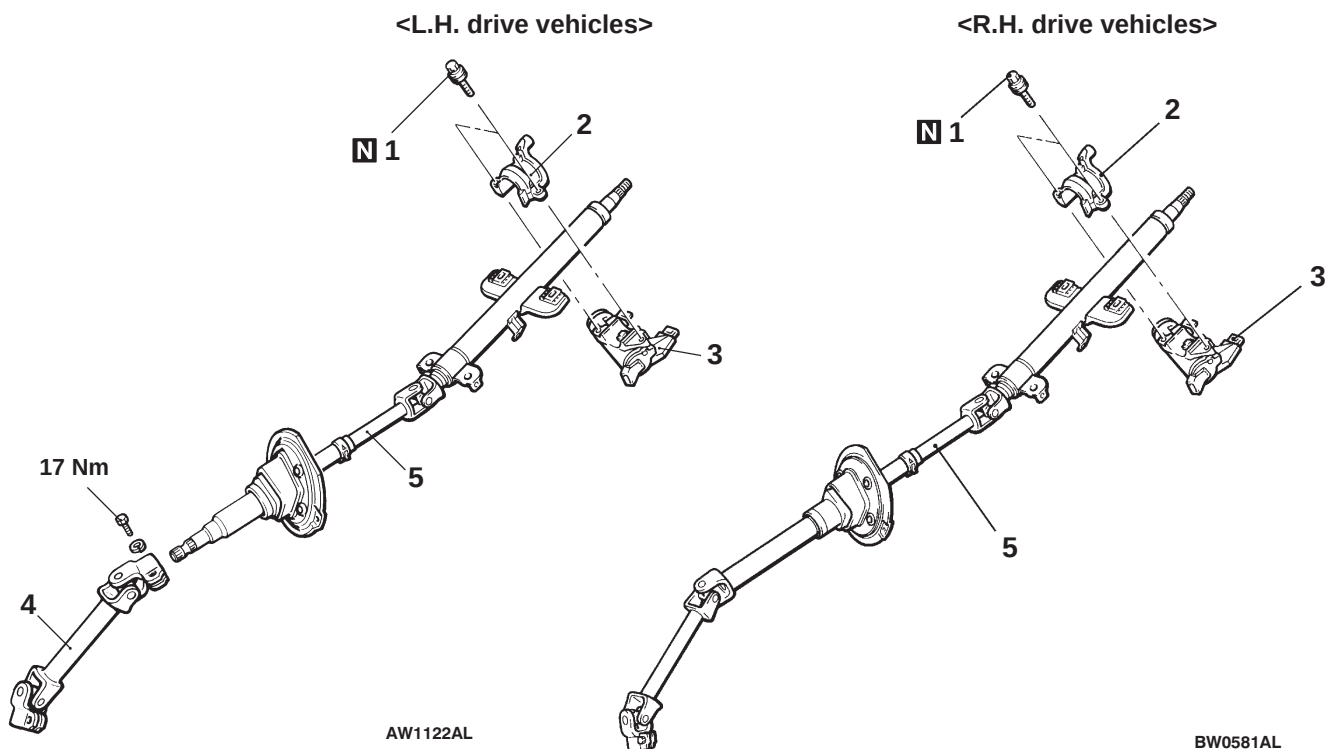
When the air bag module assembly must be removed, refer to GROUP 52B – Air Bag Modules and Clock Spring.



REMOVAL SERVICE POINTS

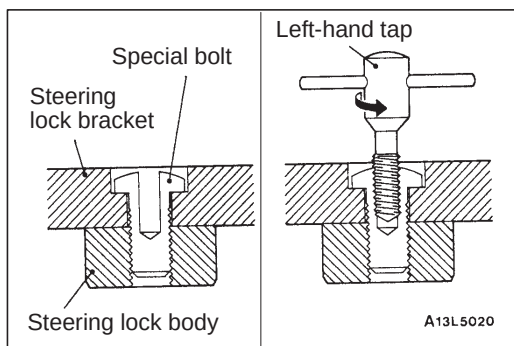
◀A▶ STEERING WHEEL REMOVAL

DISASSEMBLY AND REASSEMBLY



Disassembly steps

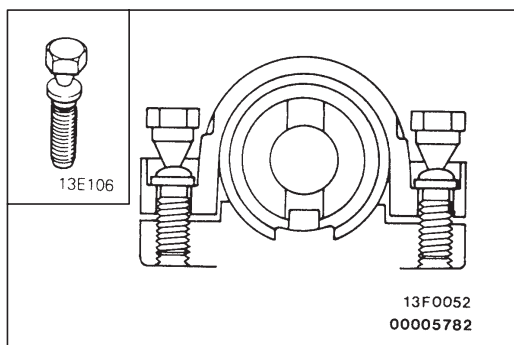
◀A▶ ▶A▶ ▶A▶ ▶A▶	1. Special bolt 2. Steering lock bracket 3. Steering lock cylinder assembly	4. Shaft assembly <L.H. drive vehicles> 5. Steering column shaft assembly



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.

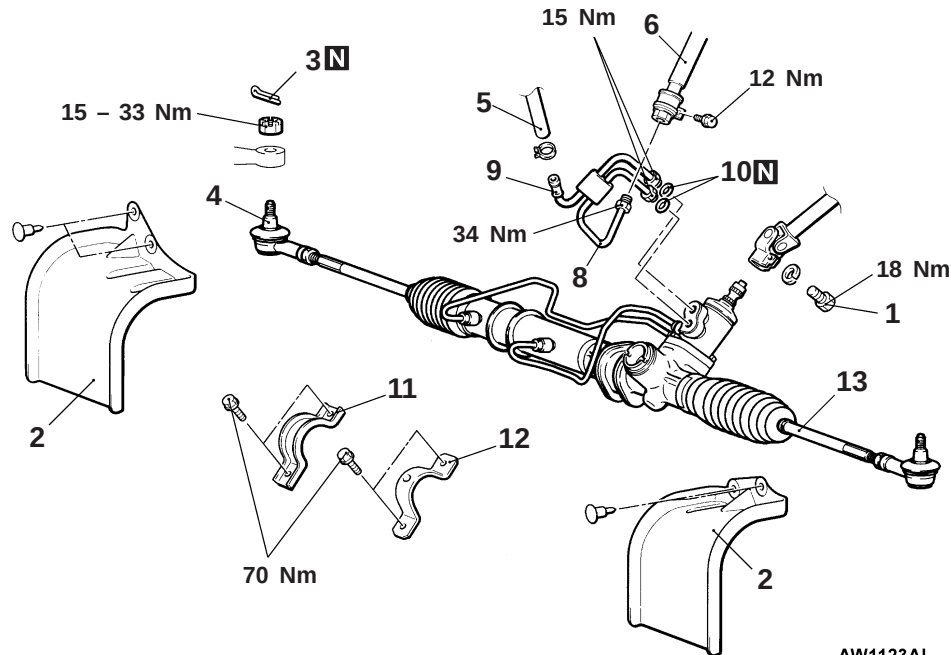
Pre-removal Operation

- Power Steering Fluid Draining (Refer to P.37A-9.)
- Under Cover Removal

Post-installation Operation

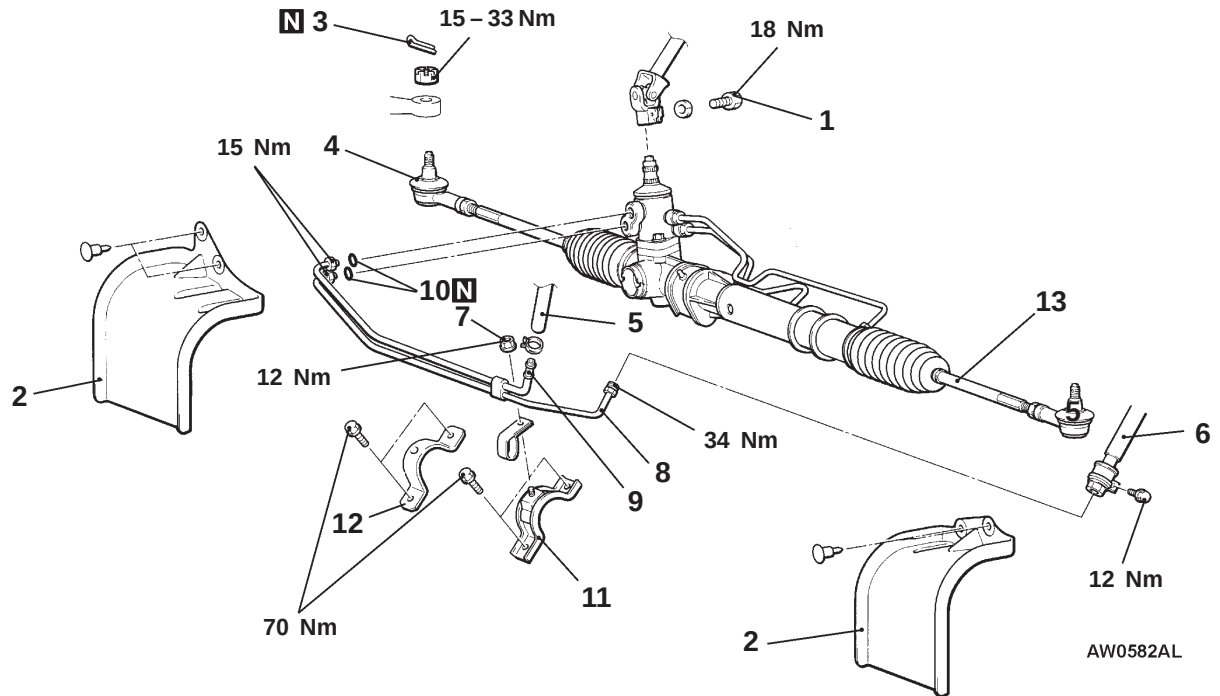
- Check the Dust Cover for Cracks or Damage by Pushing it with Finger.
- Under Cover Installation
- Power Steering Fluid Supplying and bleeding (Refer to P.37A-9.)
- Checking Steering Wheel Position with Wheels Straight Ahead
- Front Wheel Alignment Check and Adjustment (Refer to GROUP 33A – On-vehicle Service.)

<L.H. drive vehicles>

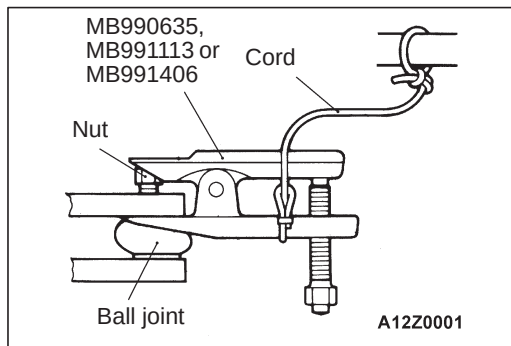


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<R.H. drive vehicles>

**Removal steps**

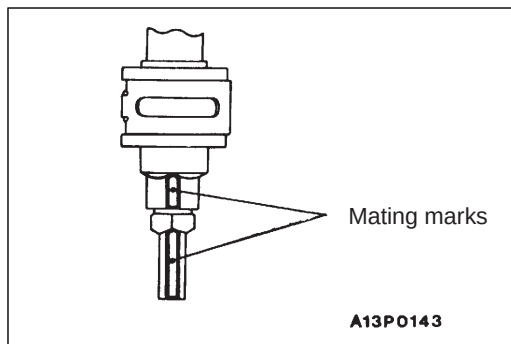
◀A▶ ▶B▶ ▶A▶	1. Steering gear and joint connecting bolt 2. Splash shield 3. Split pin 4. Tie rod end and knuckle connection 5. Return hose 6. Pressure hose	▶B▶ 7. Nut <R.H. drive vehicles> 8. Pressure tube 9. Return tube 10. O-ring 11. Cylinder clamp 12. Gear housing clamp 13. Steering and gear linkage

**REMOVAL SERVICE POINTS****◀A▶ TIE ROD END AND KNUCKLE DISCONNECTION****Caution**

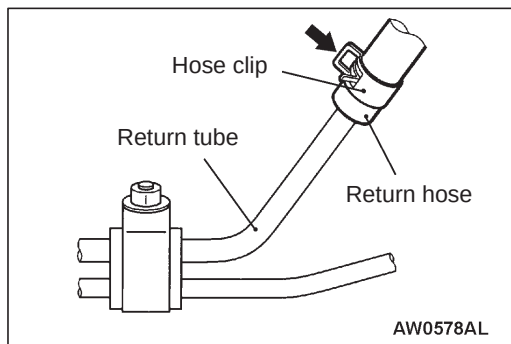
- (1) In order not to damage the ball joint thread, the tie rod end mounting nut must be only loosened but not removed from the ball joint. Be sure to use the special tool.
- (2) Tie the special tool with a cord so as not to fall off.

◀B▶ STEERING GEAR BOX AND LINKAGE REMOVAL**Caution**

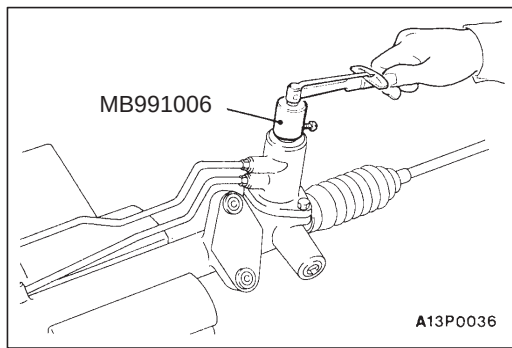
Do not damage the boots when removing the steering gear box and linkage.

**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

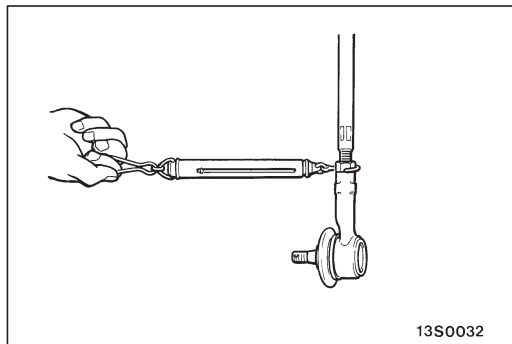
Torque fluctuation: 0.5 Nm or less

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

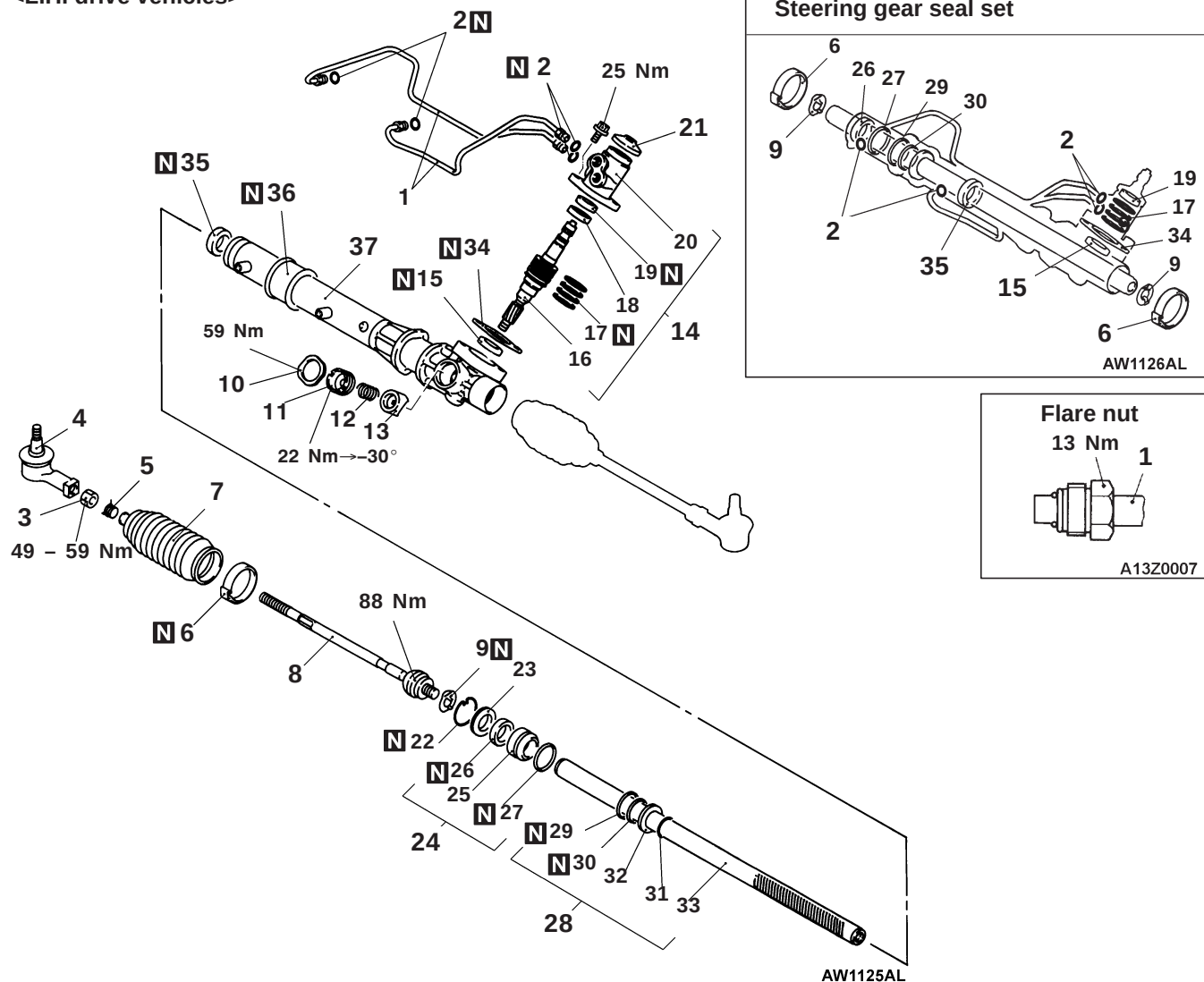
1. Check the dust cover for cracks or damage by pushing it with finger.
2. If the dust cover is cracked or damaged, replace the tie rod end. (Refer to P.37A-19, 20.)

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

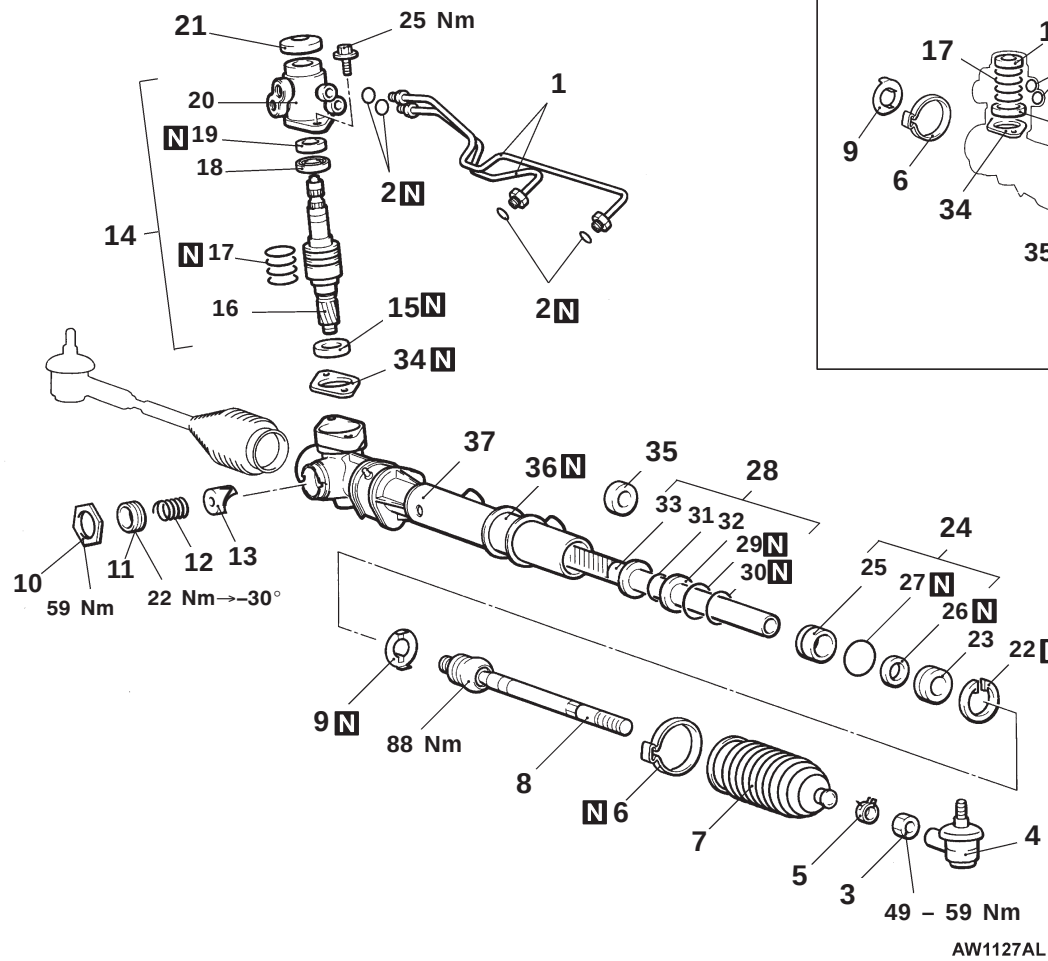
<L.H. drive vehicles>



Disassembly steps

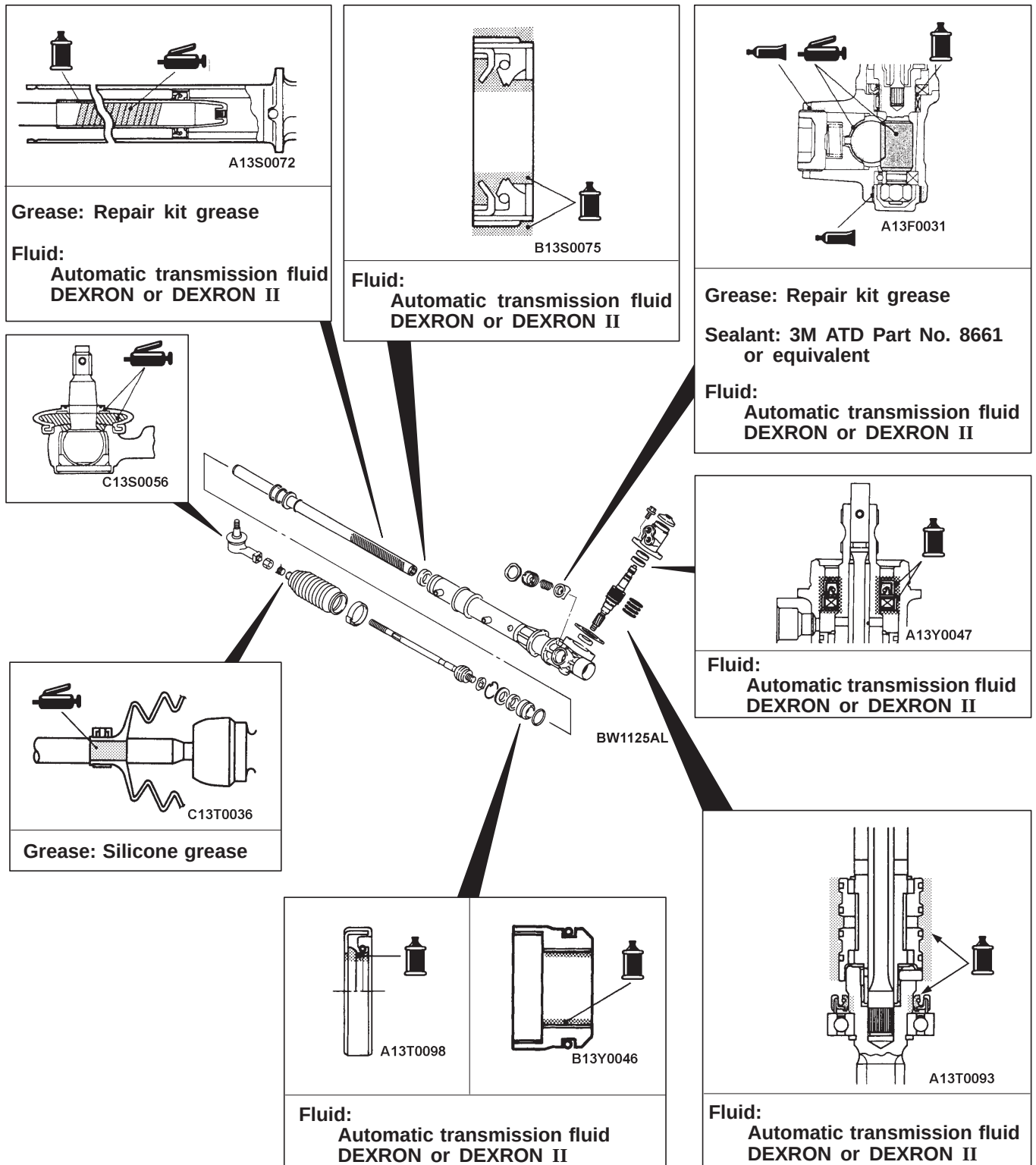
	1. Feed pipe	◀D▶ ▶F▶	19. Upper oil seal
	2. O-ring		20. Valve housing
▶M▶ ▶M▶	3. Locking nut	◀E▶ ▶E▶	21. Dust cover
▶L▶	4. Tie rod end	◀F▶ ▶D▶	22. Circlip
	5. Clip	◀F▶ ▶D▶	23. Rack stopper
	6. Band	◀F▶ ▶D▶	24. Rack bushing assembly
▶K▶ ▶K▶	7. Bellows	◀F▶ ▶C▶	25. Rack bushing
▶K▶ ▶J▶	8. Tie rod		26. Oil seal
▶J▶ ▶I▶	9. Tab washer		27. O-ring
▶I▶ ▶I▶	• Total pinion torque adjustment		28. Rack assembly
◀A▶ ▶I▶	10. Locking nut		29. Piston ring
	11. Rack support cover		30. O-ring
	12. Rack support spring		31. Circlip
	13. Rack support		32. Piston
◀B▶ ▶H▶	14. Valve assembly		33. Rack
◀B▶ ▶G▶	15. Lower oil seal	◀G▶ ▶B▶	34. Gasket
◀C▶ ▶F▶	16. Pinion and valve assembly	▶A▶	35. Oil seal
	17. Seal ring		36. Gear housing mounting rubber
	18. Upper bearing		37. Gear Housing

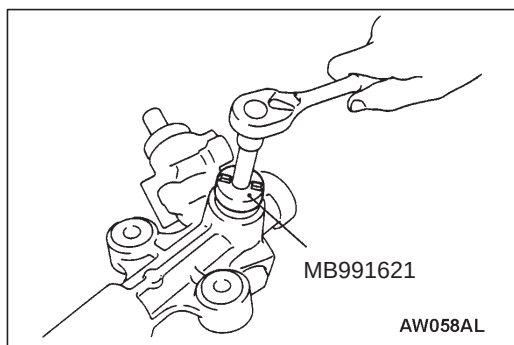
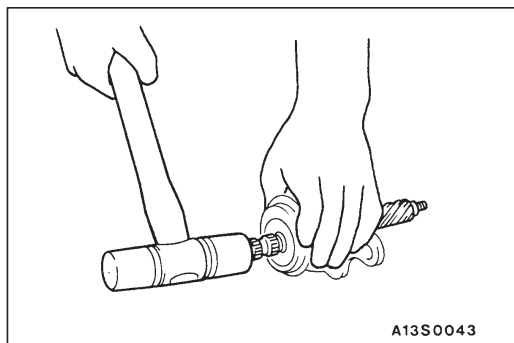
<R.H. drive vehicles>

**Disassembly steps**

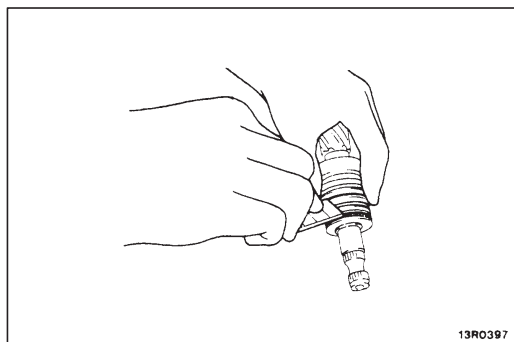
	1. Feed pipe	◀D▶ ▶F▶	19. Upper oil seal
	2. O-ring		20. Valve housing
▶M▶	3. Locking nut	◀E▶ ▶E▶	21. Dust cover
▶M▶	4. Tie rod end	◀F▶ ▶E▶	22. Circlip
	5. Clip	◀F▶ ▶D▶	23. Rack stopper
▶L▶	6. Band	◀F▶ ▶D▶	24. Rack bushing assembly
	7. Bellows	◀F▶ ▶D▶	25. Rack bushing
▶K▶	8. Tie rod	◀F▶ ▶D▶	26. Oil seal
▶K▶	9. Tab washer	◀F▶ ▶C▶	27. O-ring
▶J▶	• Total pinion torque adjustment		28. Rack assembly
▶I▶	10. Locking nut		29. Piston ring
◀A▶ ▶I▶	11. Rack support cover		30. O-ring
	12. Rack support spring		31. Circlip
	13. Rack support		32. Piston
	14. Valve assembly		33. Rack
◀B▶ ▶H▶	15. Lower oil seal	◀G▶ ▶B▶	34. Gasket
◀B▶ ▶G▶	16. Pinion and valve assembly	▶A▶	35. Oil seal
◀C▶ ▶G▶	17. Seal ring		36. Gear housing mounting rubber
◀D▶ ▶F▶	18. Upper bearing		37. Gear Housing

Lubrication and Sealing Points



**DISASSEMBLY SERVICE POINTS****◀A▶ RACK SUPPORT COVER REMOVAL****◀B▶ OIL SEAL/PINION AND VALVE ASSEMBLY REMOVAL**

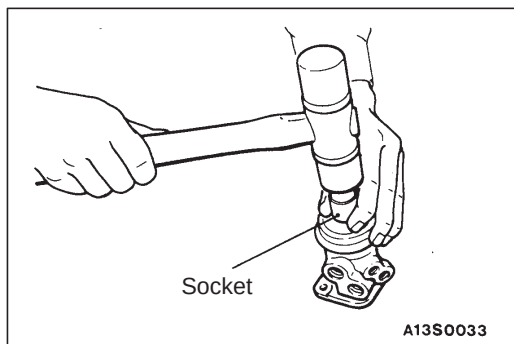
With a plastic hammer, lightly tap the pinion and valve assembly in its spline to remove the lower oil seal and pinion and valve assembly from the valve housing.

**◀C▶ SEAL RING REMOVAL**

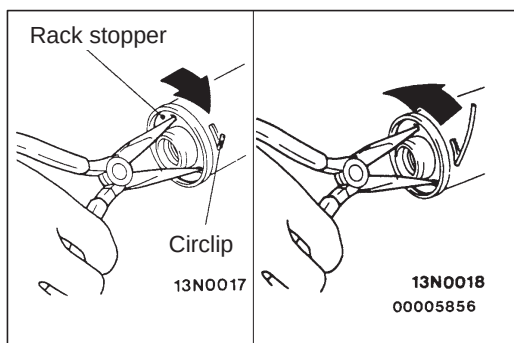
Cut the seal ring to remove from the pinion and valve assembly.

Caution

When cutting the seal ring, be careful not to damage the pinion and valve assembly.

**◀D▶ UPPER BEARING/UPPER OIL SEAL REMOVAL**

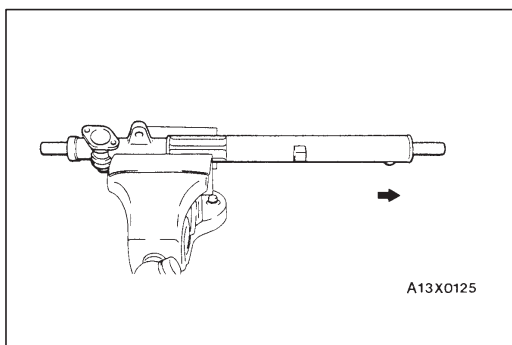
Using a socket, pull out the upper oil seal and bearing from the valve housing.

**◀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.

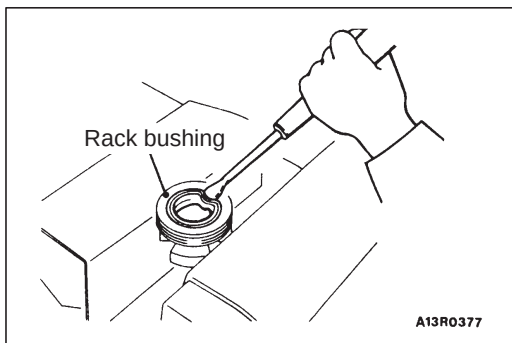
Caution

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

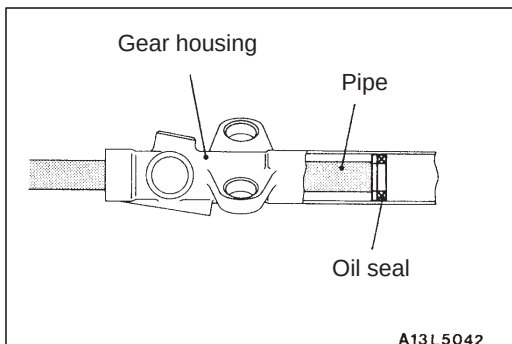
1. Remove the rack stopper, rack bushing, oil seal and O-ring together by pulling out the rack gently.



2. Partially bend the oil seal to remove from the rack bushing.

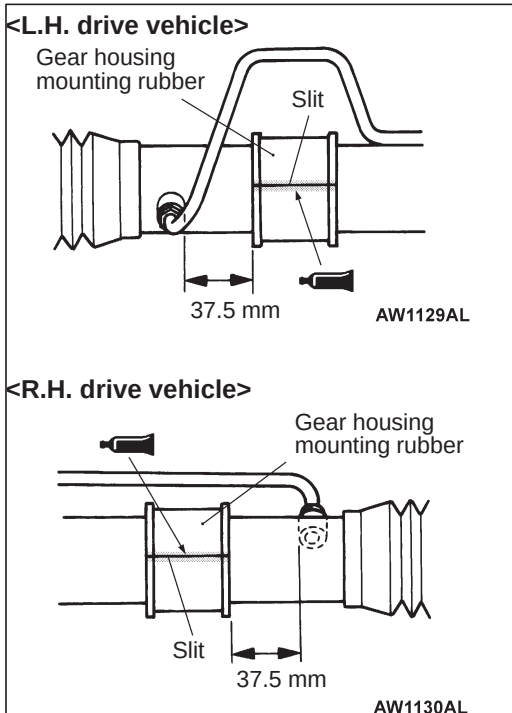
Caution

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.

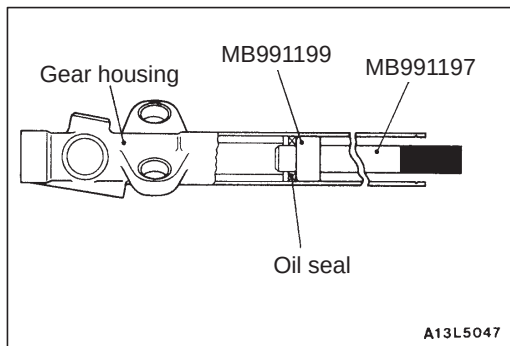
NOTE

The gear housing mounting rubber can be installed regardless of the installation direction of the slit.

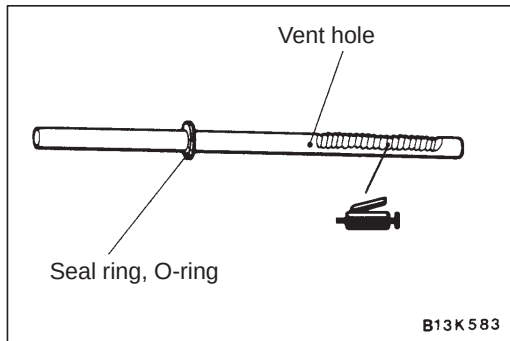
2. Apply specified adhesive to the slit of the gear housing mounting rubber.

Specified adhesive:

3M ATD Part No.8155 or equivalent



►B◄ OIL SEAL INSTALLATION

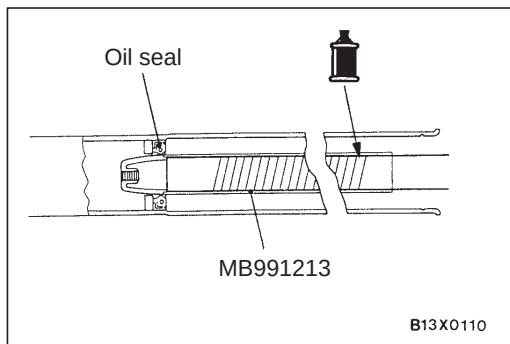


►C◄ RACK ASSEMBLY INSTALLATION

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.

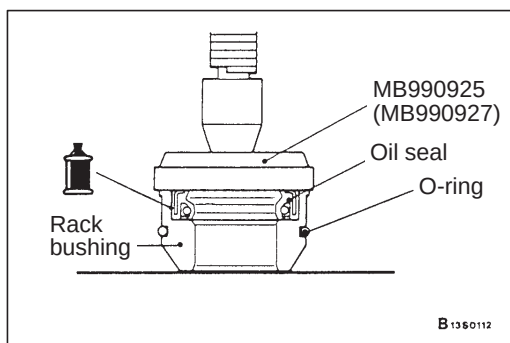
Specified fluid:

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

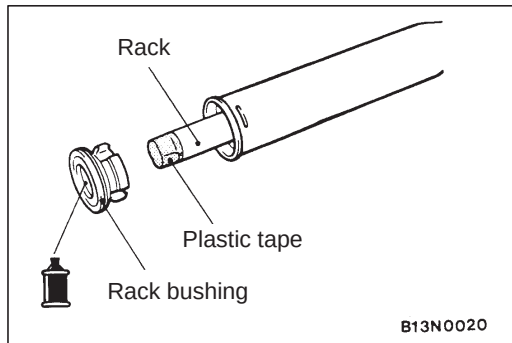
1. Apply specified fluid to the outer surface of the oil seal. Using the special tool, press in the oil seal until it is flush with the bushing end face.

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.

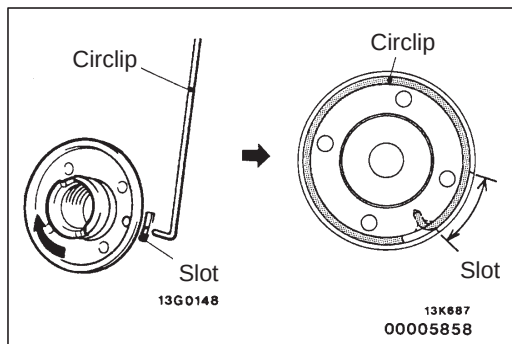
Specified fluid:

Automatic transmission fluid
DEXRON or DEXRON II

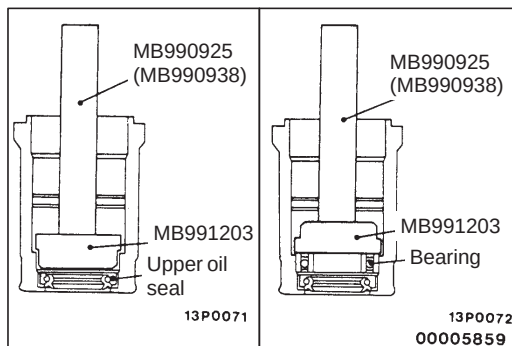
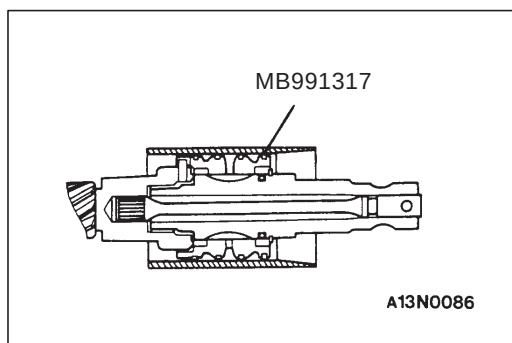
Caution

Do not use Dia Queen ATF SPII and ATF SPII M as they damage the components of the power steering.

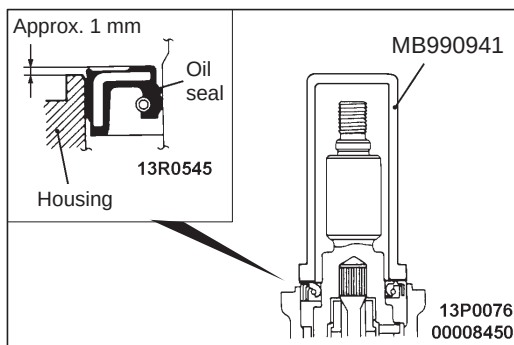
3. Wrap the rack end with plastic tape, and push the rack bushing onto the rack.

**►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.

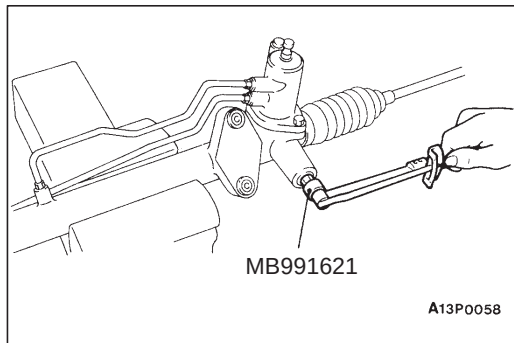


►H◄ LOWER OIL SEAL INSTALLATION

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.



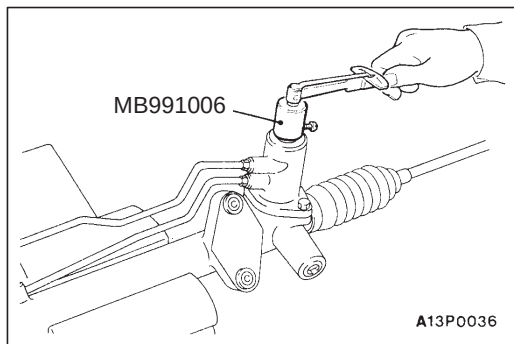
►I◄ RACK SUPPORT COVER/LOCKING NUT INSTALLATION

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:

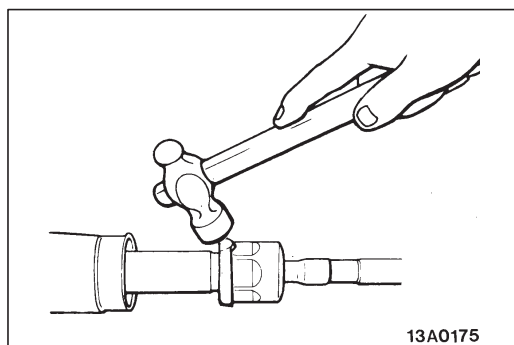
Total rotation torque: 0.6 – 1.5 Nm

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°.

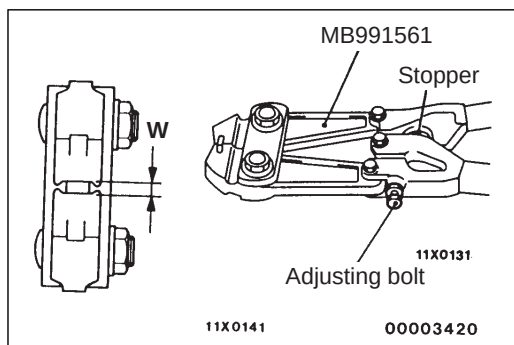
Caution

- (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>

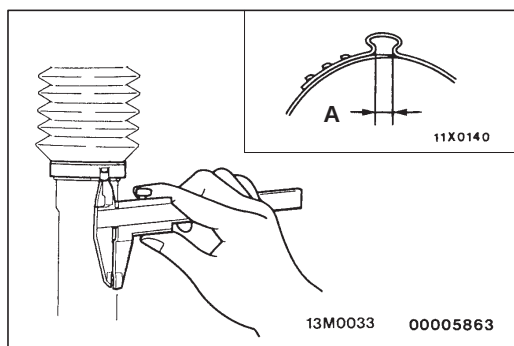
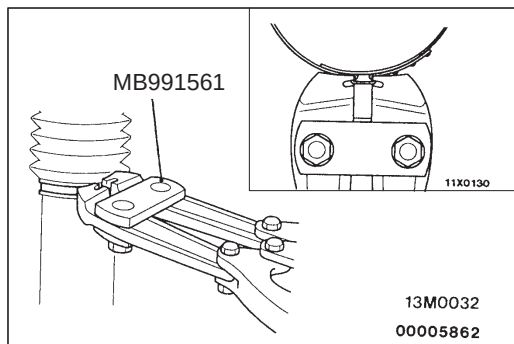
Loosen the adjusting bolt.

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>

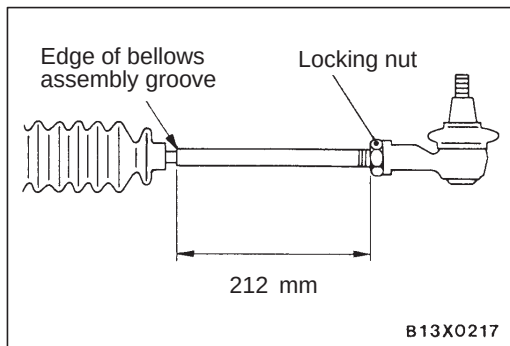
Readjust the dimension (W) of step (1) to the value calculated by the following equation, and repeat step (2).

$W = 5.5 \text{ mm} - A$ [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).

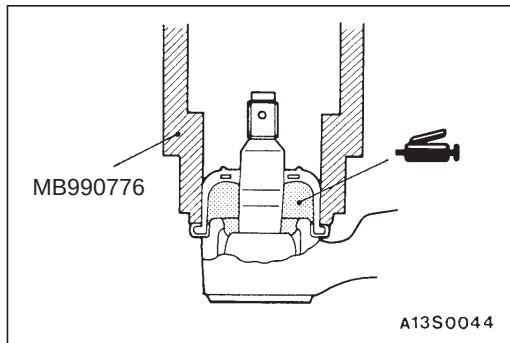
$W = 5.5 \text{ mm} - A$ [Example: If (A) is 2.3 mm, (W) is 3.2 mm.]

**►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

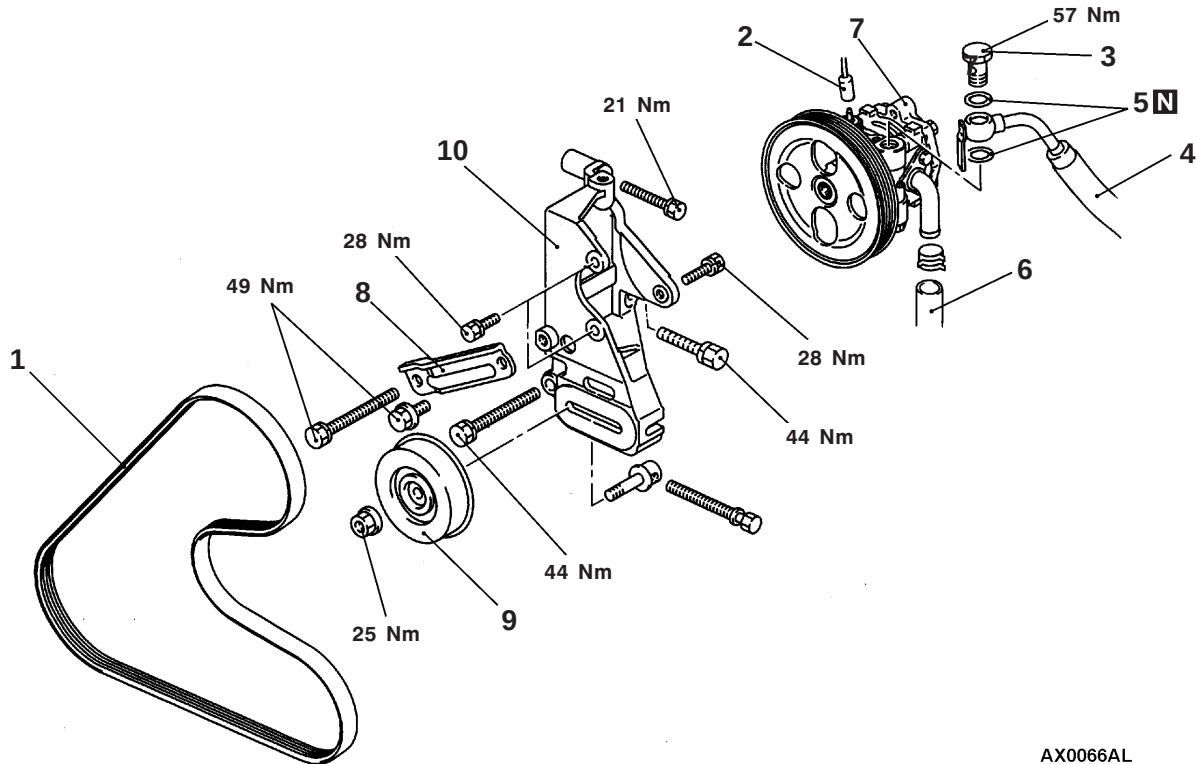
REMOVAL AND INSTALLATION

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.)

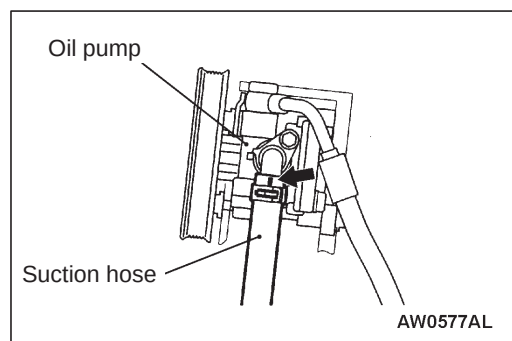


AX0066AL

Removal steps

- Air intake duct
- 1. Drive belt
- 2. Pressure switch connector
- 3. Eye bolt
- 4. Pressure hose
- 5. Gasket

- ▶◀ 6. Suction hose
- 7. Oil pump assembly
- 8. Oil pump stay
- 9. Tensioner pulley
- 10. Oil pump bracket



AW0577AL

INSTALLATION SERVICE POINT

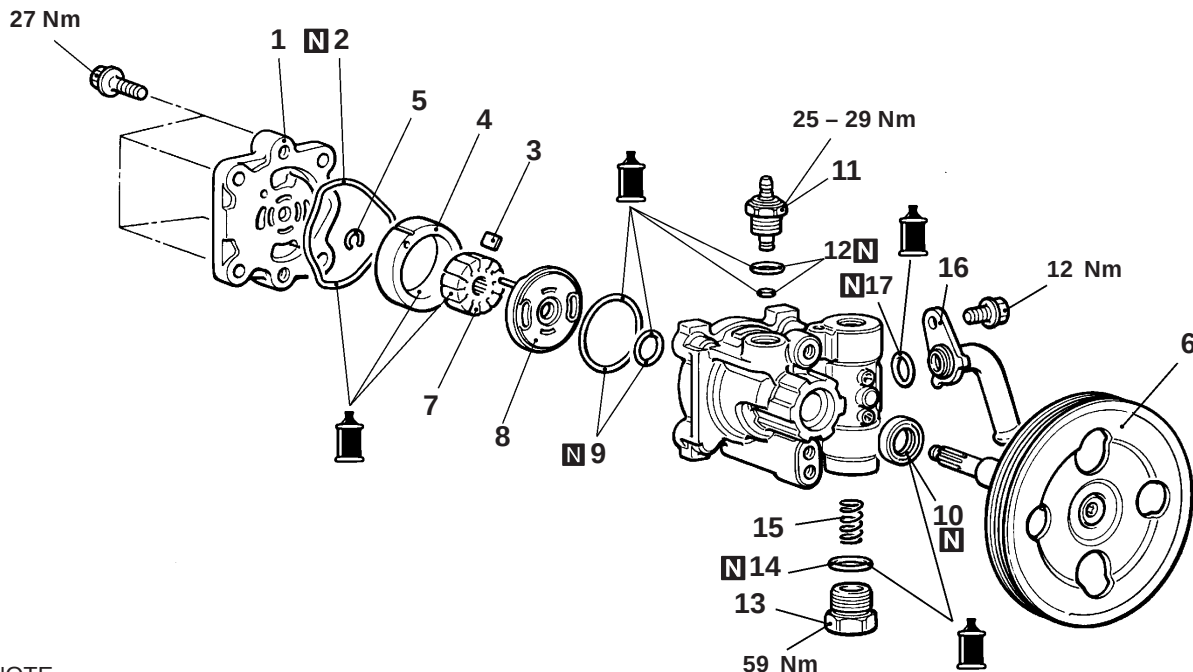
▶◀ SUCTION HOSE INSTALLATION

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

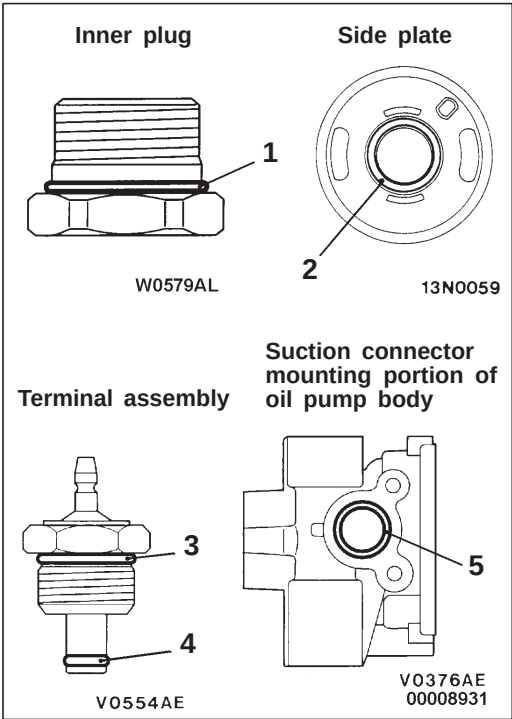
W0574AL
00008929

V0558AE	W0575AL	V0556AE
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
- ▶C◀ 6. Pulley and shaft
- 7. Rotor
- ▶A◀ 8. Side plate
- ▶A◀ 9. O-ring

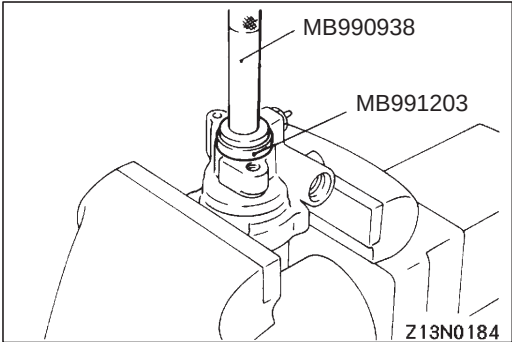
- ▶B◀ 10. Oil seal
- 11. Terminal assembly
- ▶A◀ 12. O-ring
- 13. Inner plug
- ▶A◀ 14. O-ring
- 15. Flow control spring
- 16. Suction connector
- ▶A◀ 17. O-ring



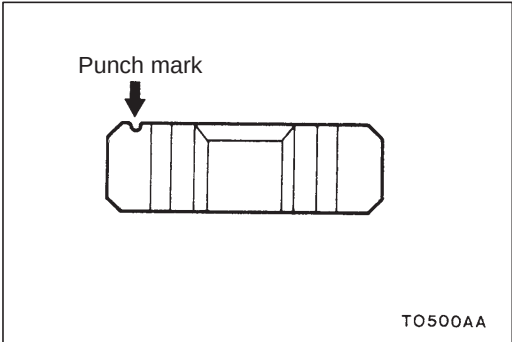
REASSEMBLY SERVICE POINTS

►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

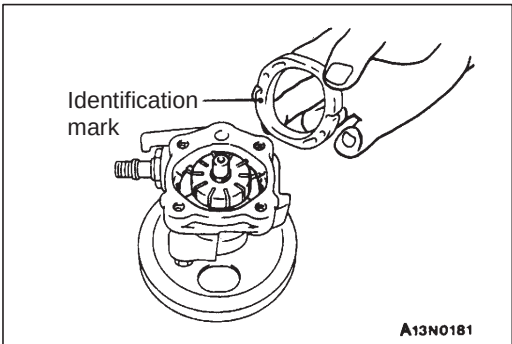


►B◄ OIL SEAL INSTALLATION



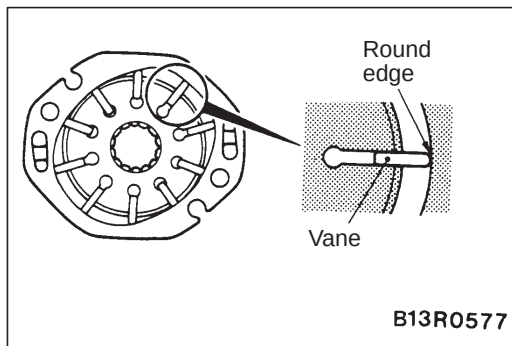
►C◄ ROTOR INSTALLATION

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).

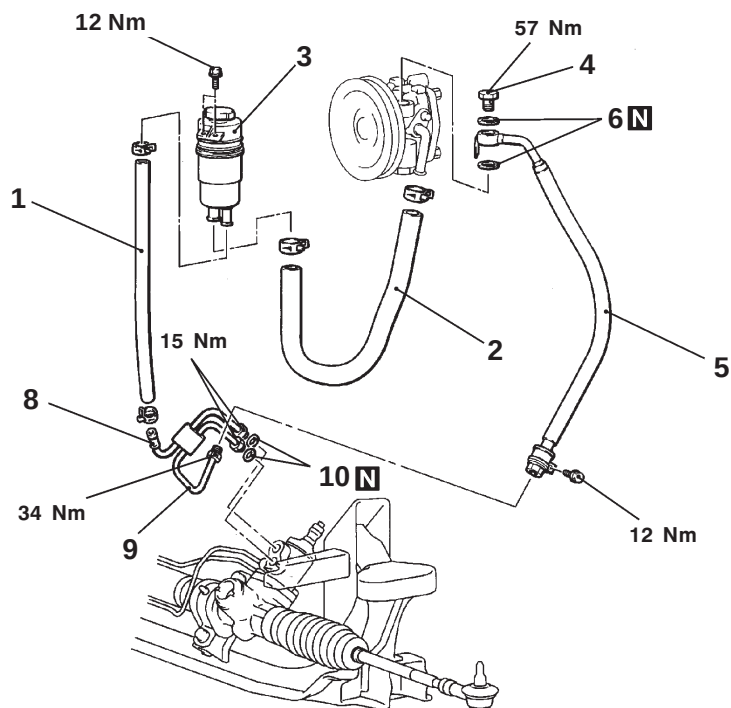
POWER STEERING OIL HOSES

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations

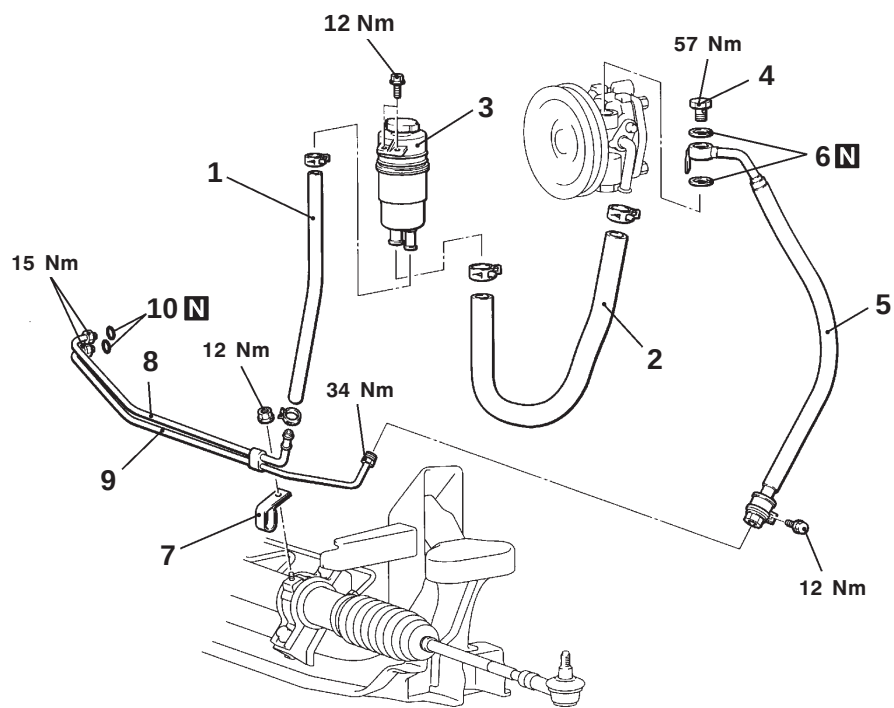
- Power Steering Fluid Draining and Supplying, and Bleeding (Refer to P.37A-9.)
- Under Cover Removal and Installation
- Air Intake Hose, Resonator, Air Duct, Air Cleaner Cover Removal and Installation (Refer to GROUP 15.)

<L.H. drive vehicles>



AX0067AL

<R.H. drive vehicles>



AW0120AL

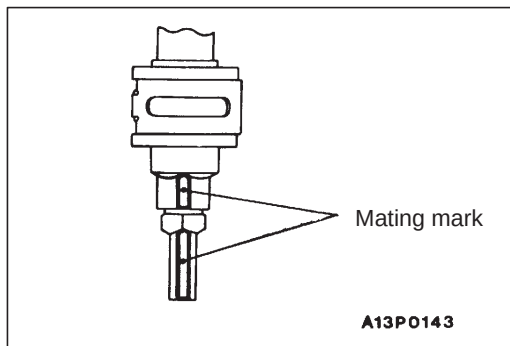
Removal steps

1. Return hose
2. Suction hose
3. Oil reservoir
 - Splash shield (Refer to P.37A-15, 16.)
4. Eye bolt

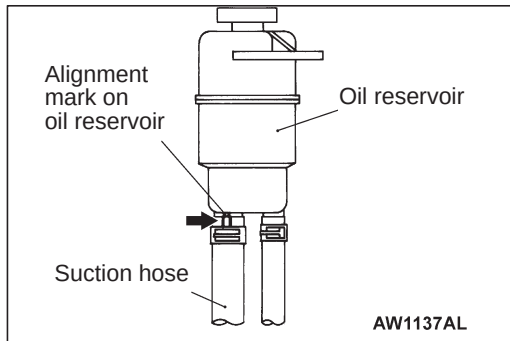


5. Pressure hose

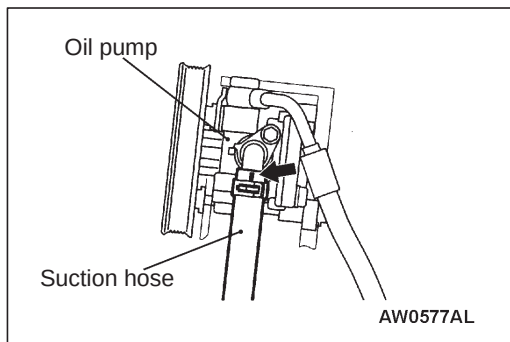
6. Gasket
7. Clip
8. Return tube
9. Pressure tube
10. O-ring

**INSTALLATION SERVICE POINTS****►A◄ PRESSURE HOSE INSTALLATION**

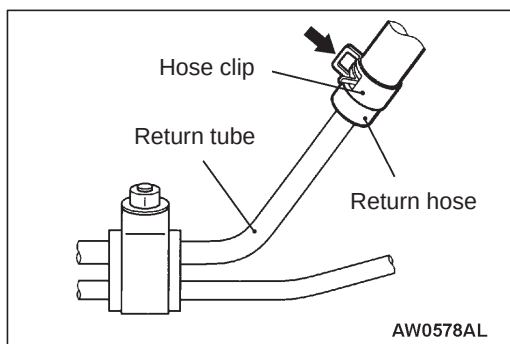
Install with the marks on the pressure hose and pressure tube aligned.

**►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

CONTENTS

HOOD	3	SEALANT	18
FENDER*	4	SPECIAL TOOLS	18
SEALANT	4	TROUBLESHOOTING	18
FENDER	5	ON-VEHICLE SERVICE	19
FUEL FILLER DOOR	6	Door Fit Adjustment	19
WINDOW GLASS	8	Door Window Glass Adjustment	19
ADHESIVE	8	Defective Power Window Adjustment and Replacement	20
SPECIAL TOOLS	8	Power Window Safety Mechanism Check	20
WINDOW REPAIR	8	Door Outside Handle Play Check	20
WINDSHIELD	10	Power Window Operation Current Check ...	21
QUARTER WINDOW GLASS	14	Circuit Breaker (Incorporated in the Power Window Motor) Check	21
BACK DOOR GLASS	16	Door Inside Handle Play Check and Adjustment	21
DOOR	18		
SERVICE SPECIFICATIONS	18		

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.

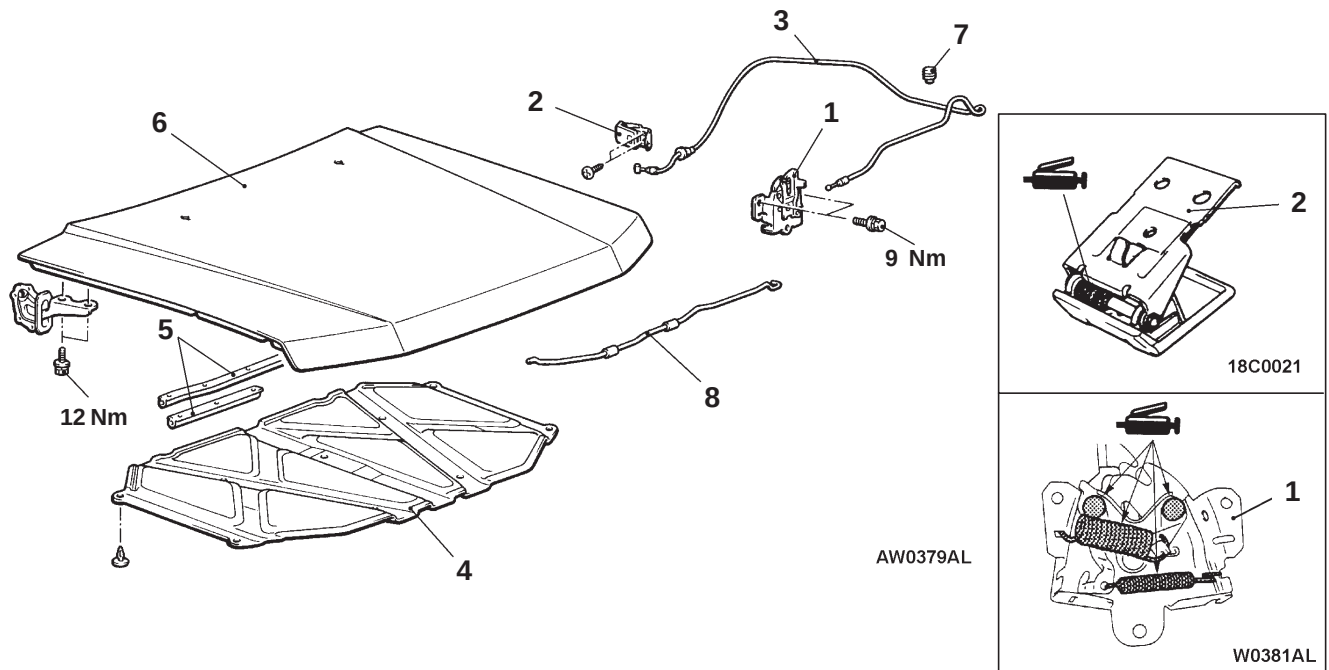
NOTE

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	BACK DOOR HANDLE AND LATCH	37
DOOR TRIM AND WATERPROOF FILM	23	KEYLESS ENTRY SYSTEM	38
DOOR GLASS AND REGULATOR	26	TROUBLESHOOTING	38
DOOR HANDLE AND LATCH	30	ON-VEHICLE SERVICE	38
WINDOW GLASS RUNCHANNEL AND DOOR OPENING WEATHERSTRIP	32	How to Replace a Battery of the Transmitter	38
BACK DOOR	33	Encrypted Code Registration Method	39
SERVICE SPECIFICATION	33	Hazard Lamp Answerback Adjustment	40
SEALANT	33	KEYLESS ENTRY SYSTEM	41
SPECIAL TOOL	33	SUNROOF	42
TROUBLESHOOTING	33	SERVICE SPECIFICATION	42
ON-VEHICLE SERVICE	33	TROUBLESHOOTING	42
Back Door Fit Adjustment	33	ON-VEHICLE SERVICE	46
Back Door Handle Play Check	33	Water Test	46
BACK DOOR ASSEMBLY	34	Sunroof Fit Adjustment	46
BACK DOOR TRIM AND WATERPROOF FILM	36	SUNROOF	47

HOOD

REMOVAL AND INSTALLATION



AW0382AL	18H0050	18H0049
Adjustment of hood step and hood striker linkage	Adjustment of clearance around hood	Adjustment of hood height

Hood latch removal steps

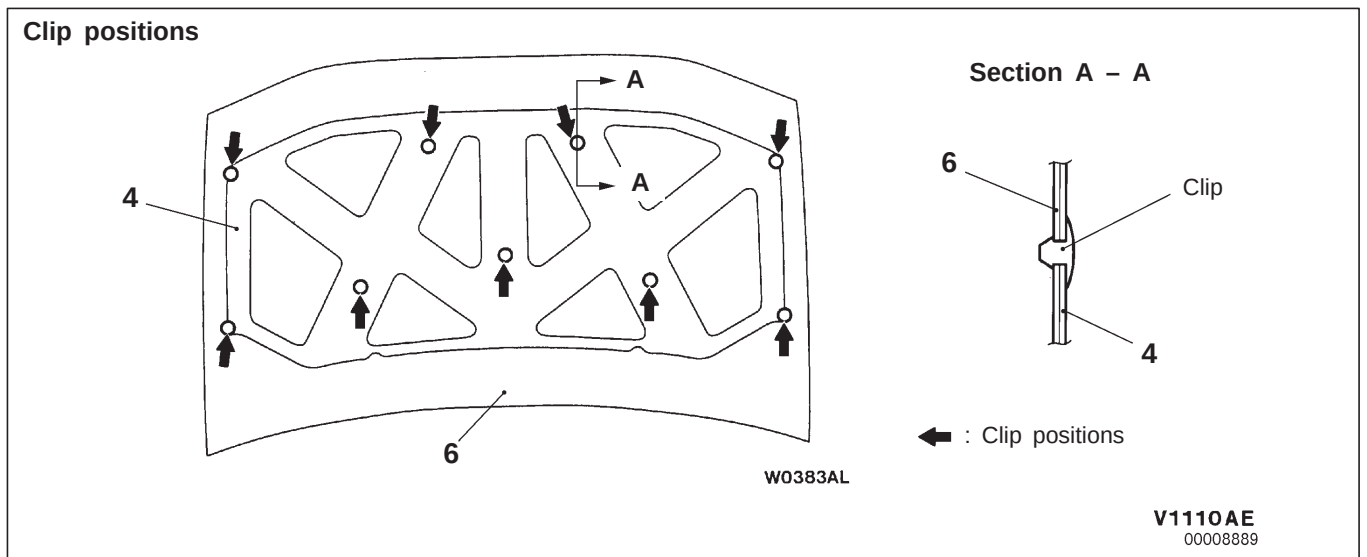
- Front grille (Refer to GROUP 51.)
- 1. Hood latch

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



FENDER

SEALANT

Item	Specified sealant	Remark
Splash shield	3M ATD Part No. 8625 or equivalent	Ribbon sealer

FENDER

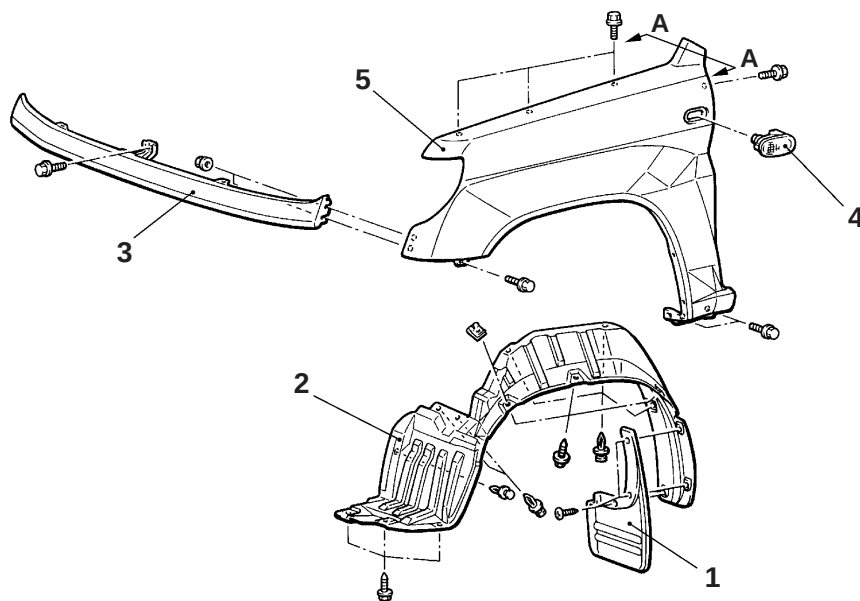
REMOVAL AND INSTALLATION

Caution: SRS

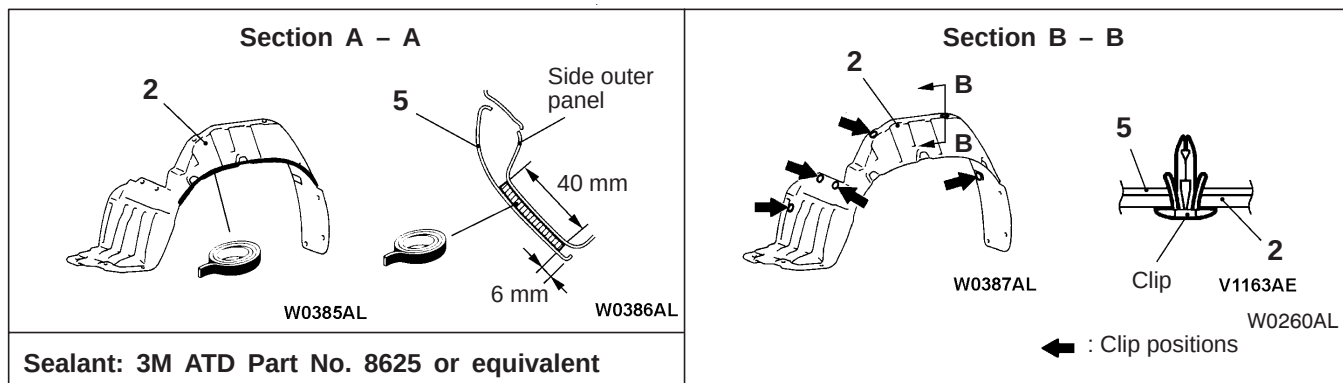
Do not strike the front impact sensor when removing or installing the fender.

Pre-removal and Post-installation Operation

- Front Bumper Removal and Installation
(Refer to GROUP 51.)



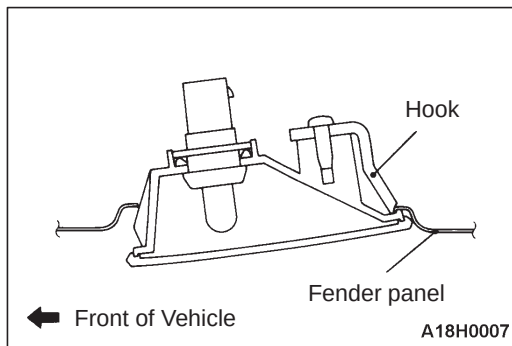
W0537AL
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Removal steps

1. Mud guard
2. Splash shield
3. Grille filler panel

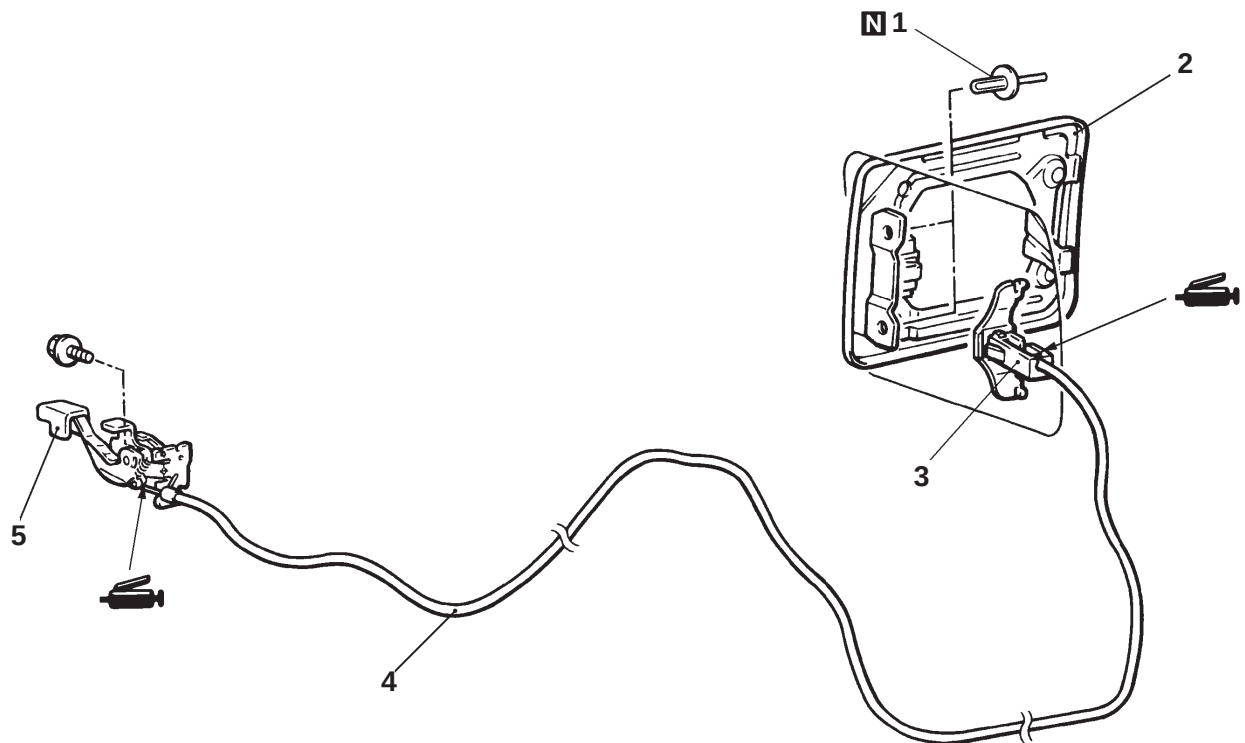
- A◄
4. Side turn signal lamp
(Refer to GROUP 54.)
 5. Fender

**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.)

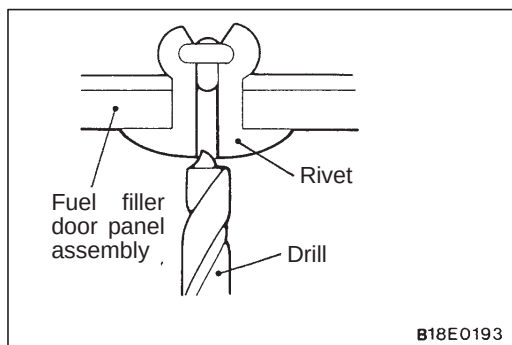


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Removal steps

1. Rivet
2. Fuel filler door panel assembly
3. Fuel filler door lock assembly

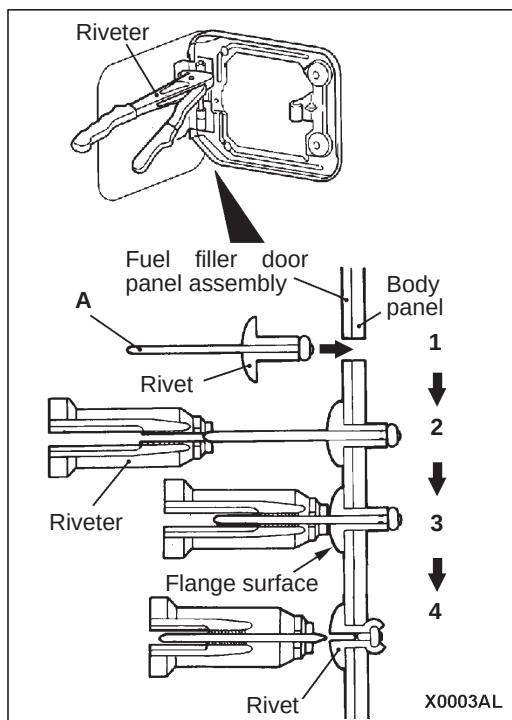
4. Fuel filler door lock release cable
5. Lid lock release handle



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:

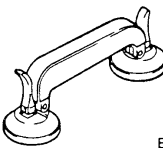
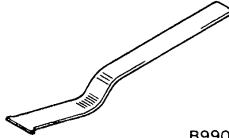
1. Insert a rivet in the body panel and fuel filler door panel assembly.
2. Insert the riveter to the rod (A shown) of a rivet.
3. Pressing the flange surface of the rivet with the riveter, handle the riveter.
4. The rod is cut at its thinnest point and the rivet is held in position.

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

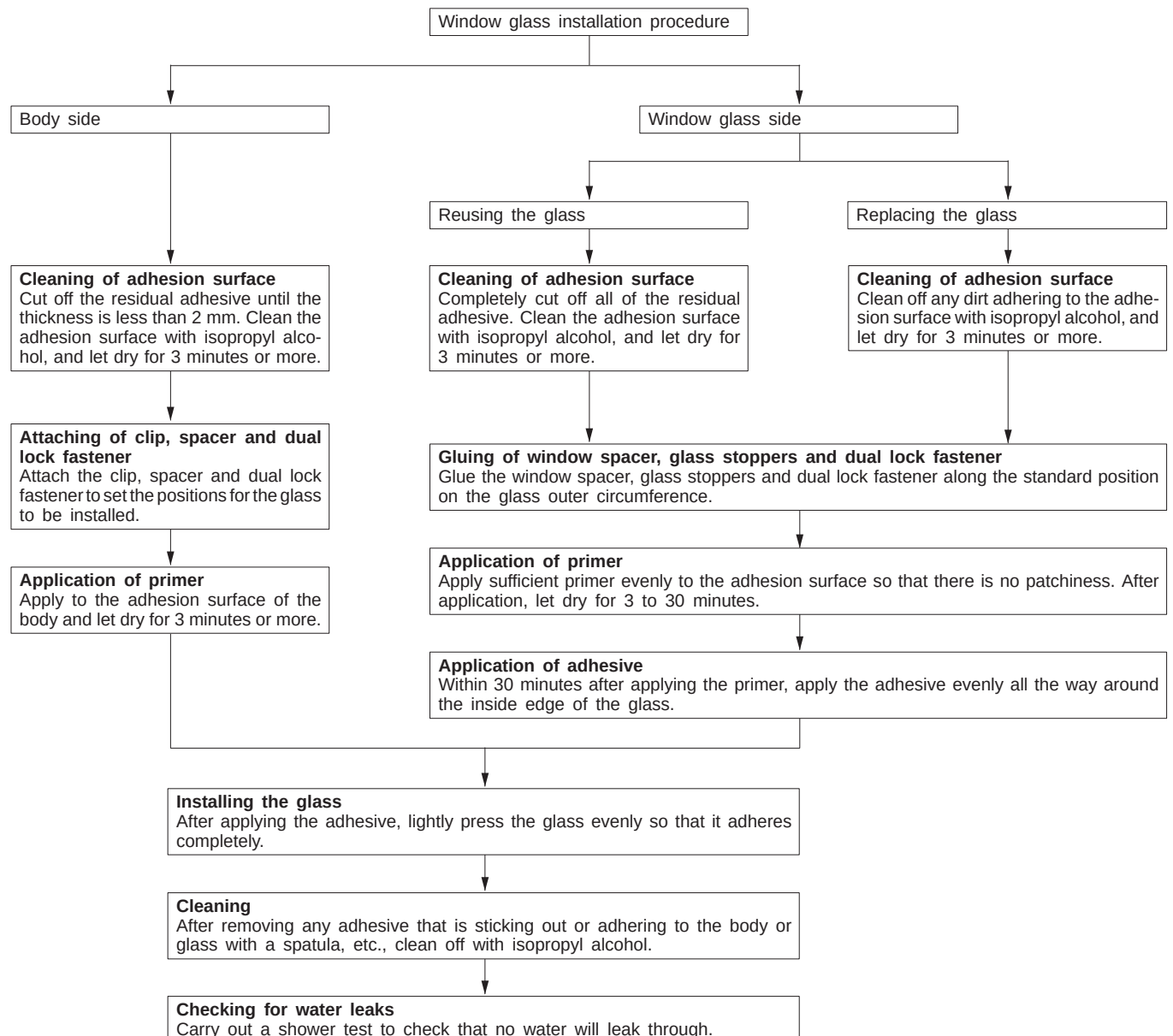
Name	Remarks
Adhesive	3M ATD Part No. 8609 Super Fast Urethane Auto Glass Sealant or equivalent
Primer	3M ATD Part No. 8608 Super Fast Urethane Primer or equivalent
Spacers	Available as service part
Dam	Available as service part
Anti-rust solvent (or Tectyl 506T...Valvoline Oil Company)	For rust prevention
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.

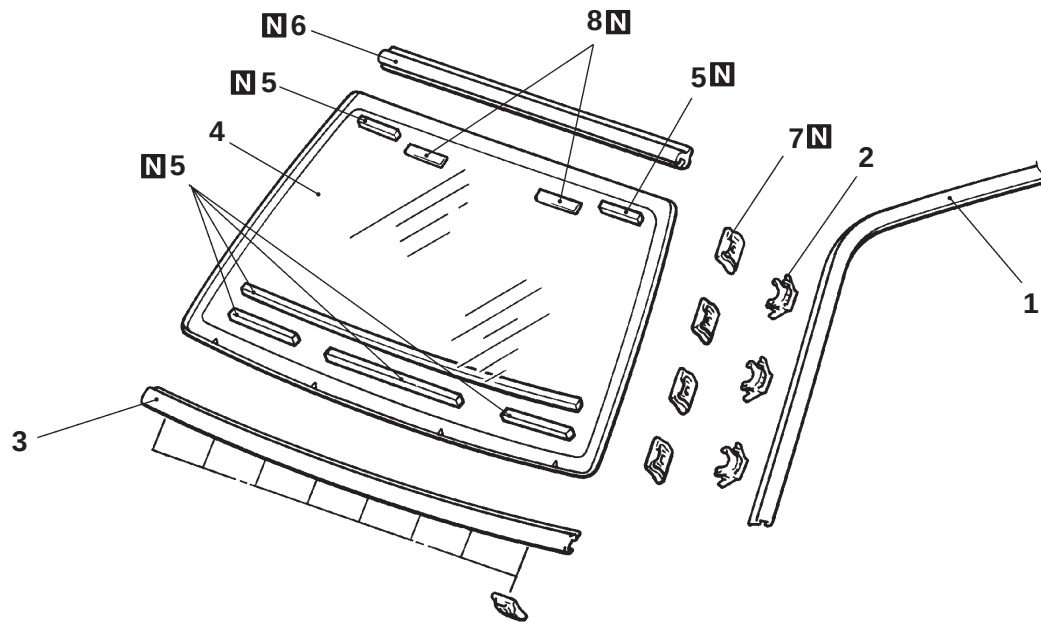
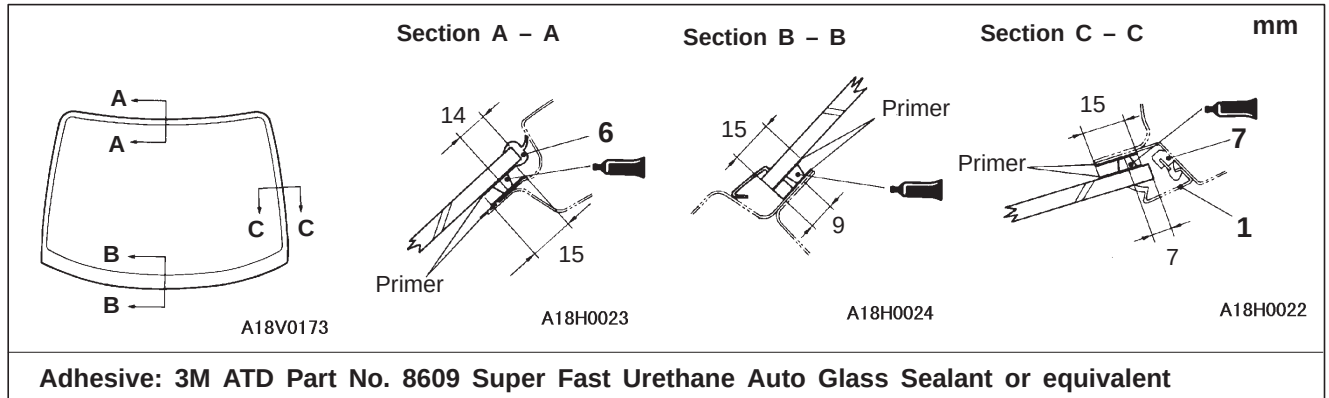
WORKING PROCESS

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.)



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Removal steps

◀A▶

1. Roof drip moulding (Refer to GROUP 51.)
2. Roof drip moulding clip
3. Windshield lower moulding
4. Windshield

◀B▶ ▶A▶

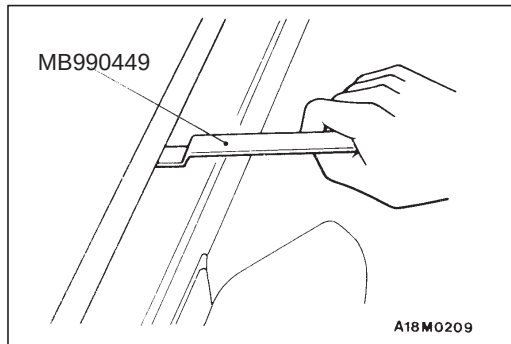
▶A▶

▶A▶

▶A▶

▶A▶

5. Windshield spacer
6. Windshield upper moulding
7. Clip
8. Glass stopper



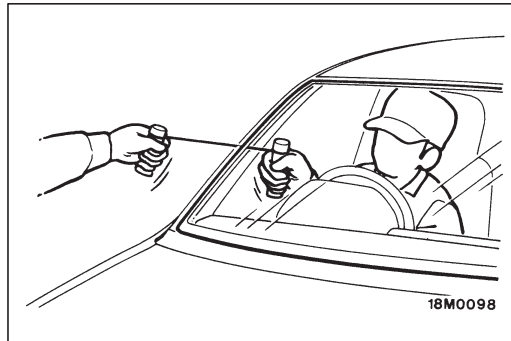
REMOVAL SERVICE POINTS

◀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.

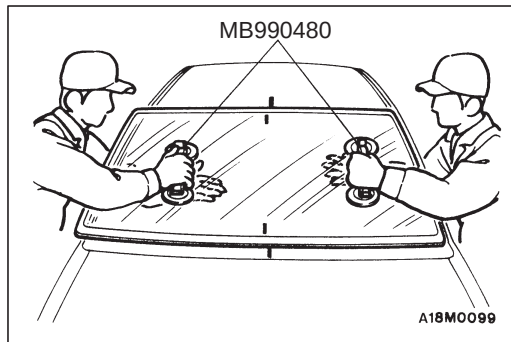


◀B▶ WINDSHIELD REMOVAL

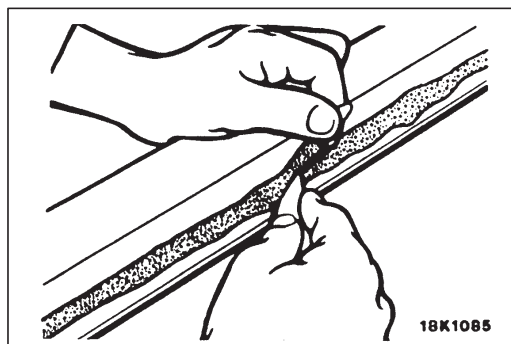
1. In order to protect the body (paint surface), apply cloth tape to all body areas around the installed windshield.
2. Using a sharp-point drill, make hole in the windshield adhesive.
3. Pass the piano wire from the inside of the vehicle through the hole.
4. Pull the piano wire alternately from the 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

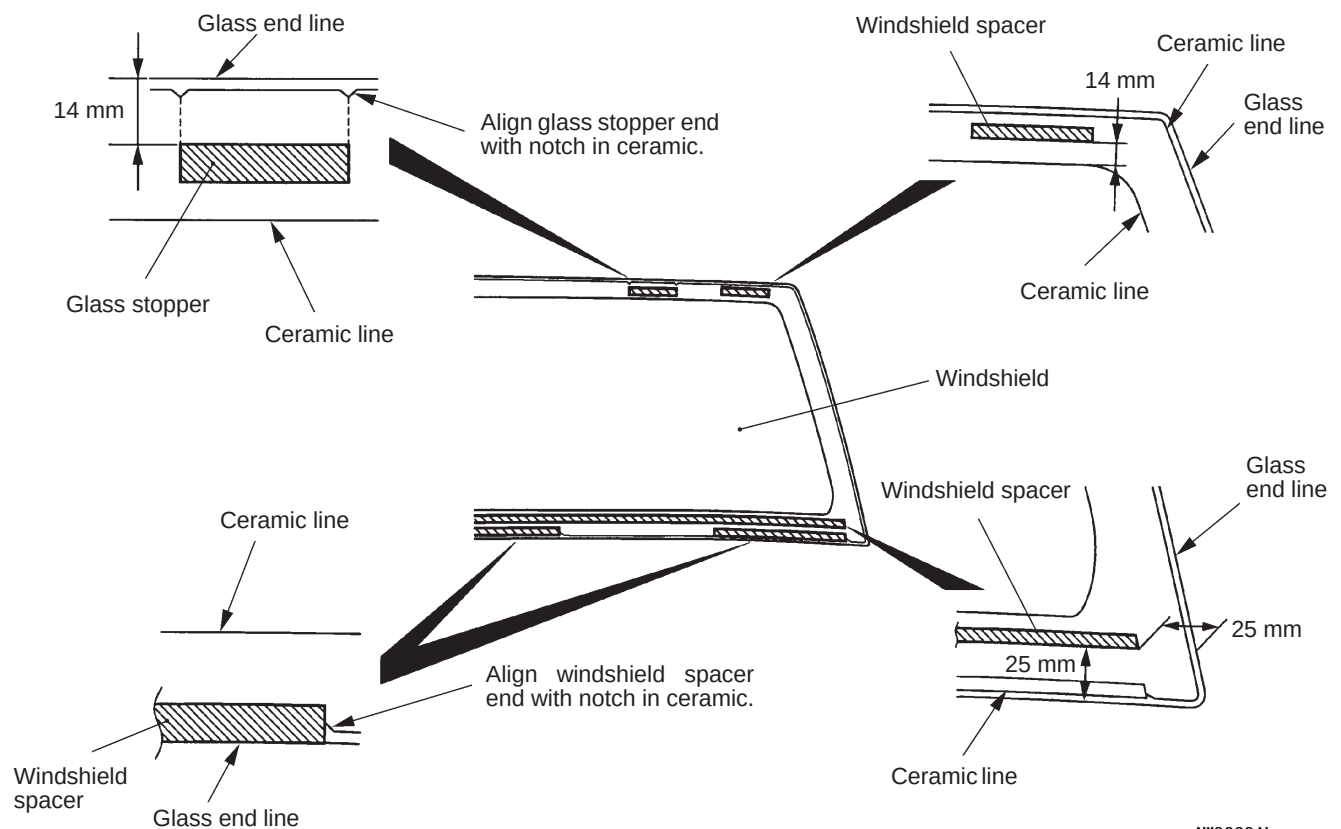
Before the next job, leave the decreased parts for 3 minutes or more to dry. Also, do not touch any cleaned surface.

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.

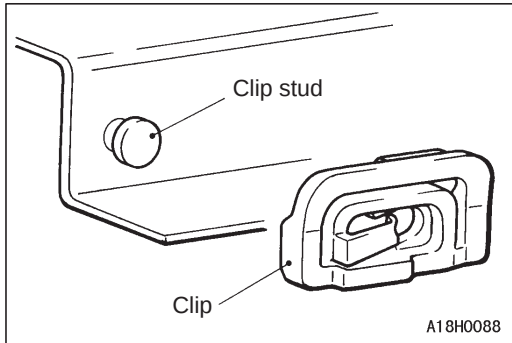
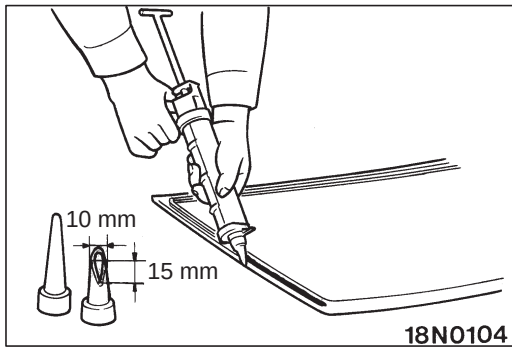
Glass stopper and windshield spacer installation position



AW0389AL

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

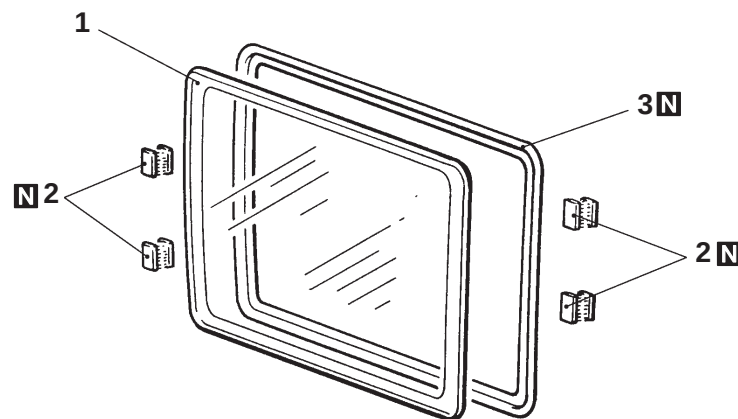
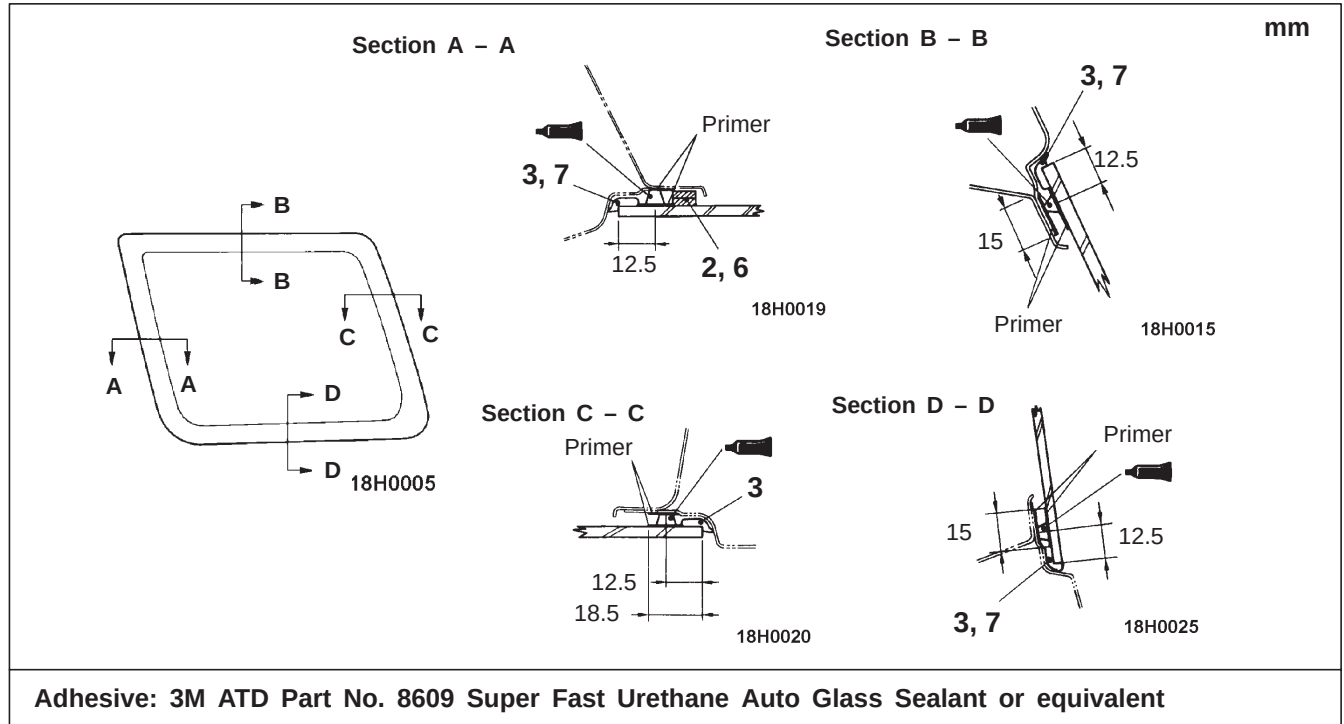
- (1) **Do not move the vehicle unless necessary. If doing so, move it very gently.**
- (2) **When testing for water leakage, do not pinch the end of the hose to spray the water.**

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.)



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Removal steps

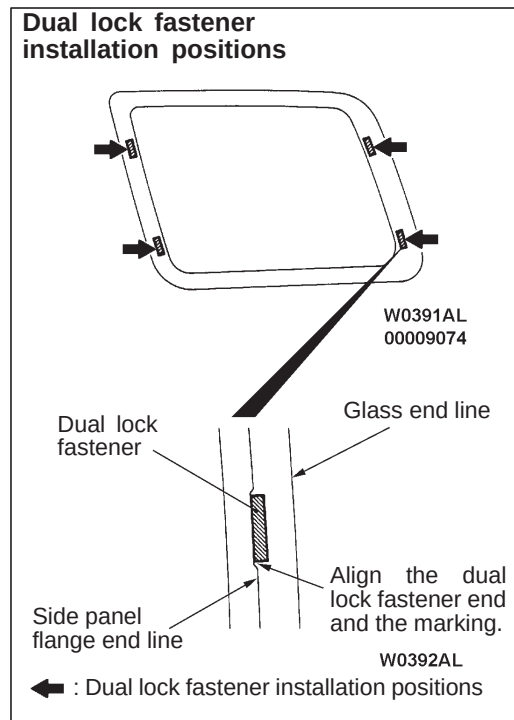
- ◀A▶
- ▶A▶ 1. Quarter window glass
 - ▶A▶ 2. Dual lock fastener
 - ▶A▶ 3. Window dam

REMOVAL SERVICE POINT**◀A▶ QUARTER WINDOW GLASS REMOVAL**

Remove the quarter window glass in the same manner as for the windshield. (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.



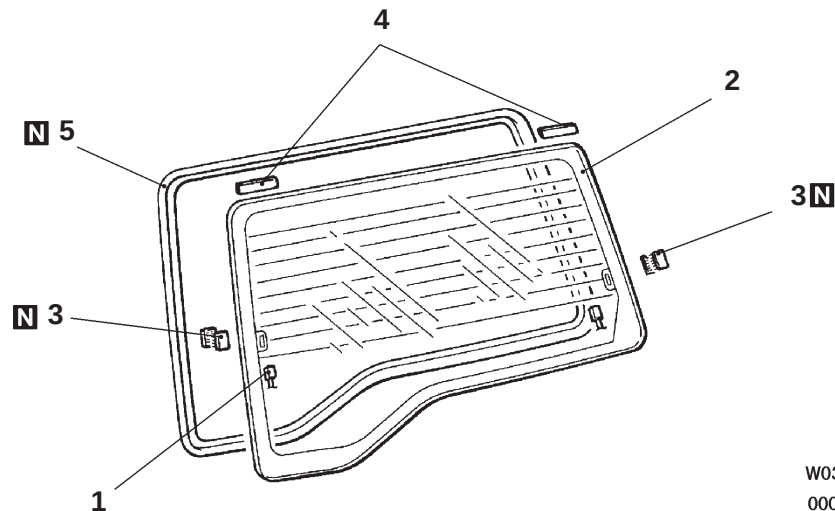
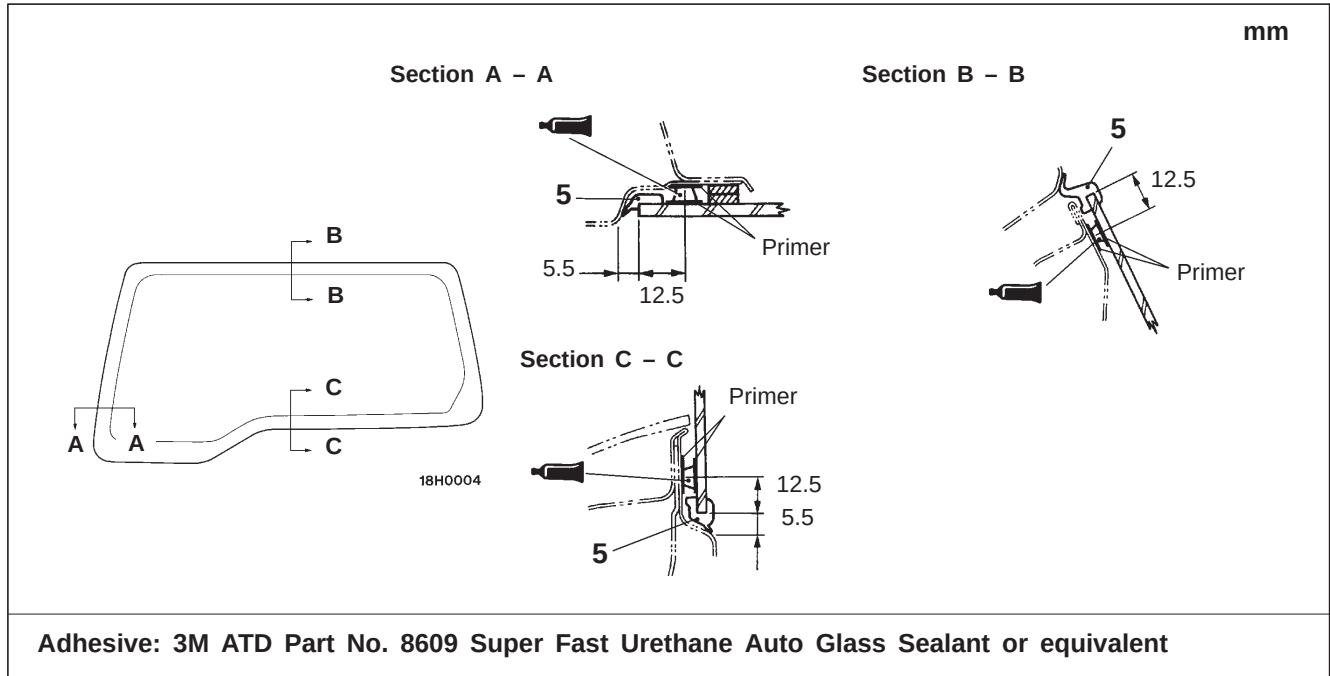
3. Install the dual lock fasteners to the body flange in the specified positions.
4. Install the dual lock fasteners to the windshield in the positions corresponding to the ones on the body flange where the dual lock fasteners have been installed.
5. Apply the primer and adhesive.
6. Install the glass 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.)



Removal steps

1. Harness connector
2. Back door glass
3. Dual lock fastener

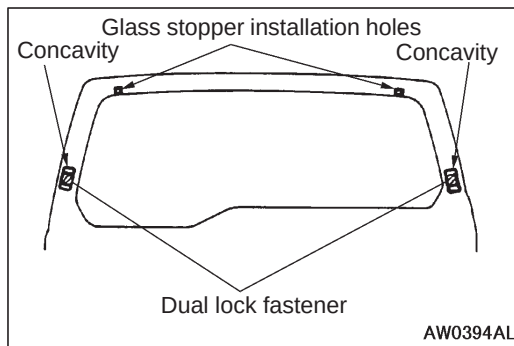
4. Glass stopper
5. Window dam

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

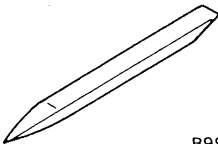
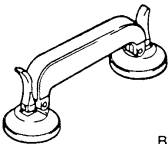
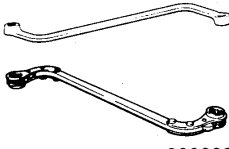
SERVICE SPECIFICATIONS

Items		Standard value
Door outside handle play mm		3.7 or more
Power window operating current A		5.3 ± 2 (power supply $14.5 \text{ V} \pm 0.3 \text{ V}$ 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

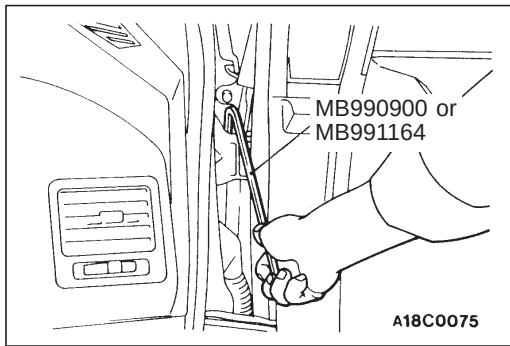
Items	Specified sealant	Remark
Waterproof film	3M ATD Part No. 8625 or equivalent	Ribbon sealer

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 troubleshooting, refer to GROUP 54B – Troubleshooting.



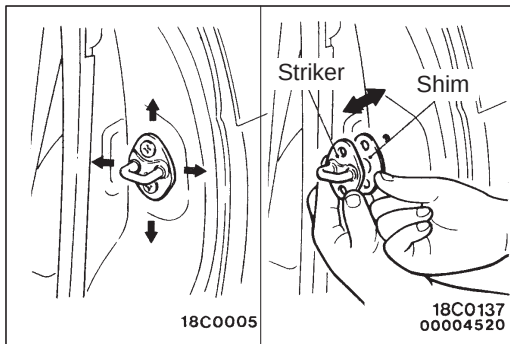
ON-VEHICLE SERVICE

DOOR FIT ADJUSTMENT

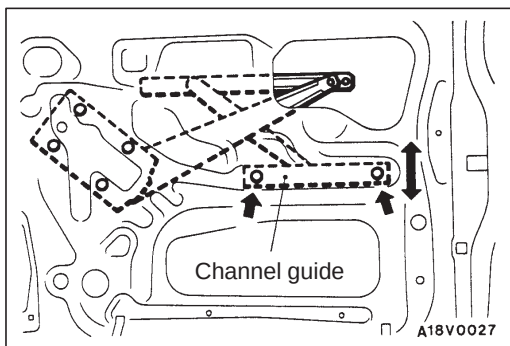
1. If clearance between the door and body is uneven, affix protective tape to the fender around the hinge and to the edge of the door. Then use the special tool to loosen the door hinge mounting bolts on the body, and adjust the clearance around the door so that it becomes even.
2. If the door and body 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.



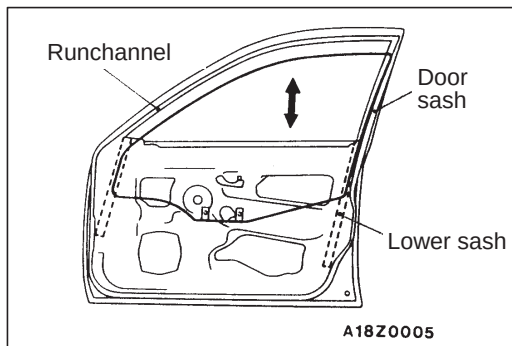
3. If the door opening and closing is heavy, adjust the meshing of the striker and the door latch (forward and backward) by adding shims to the striker and by moving the striker up and down or to the left and right.



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

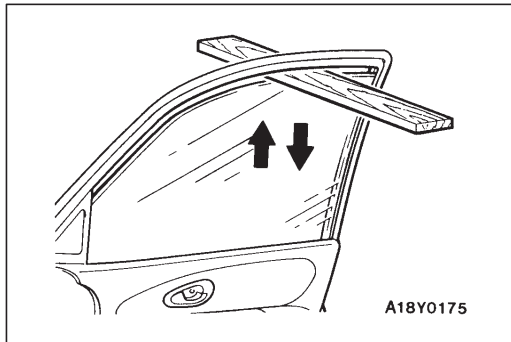
Insert soft stuff like cushion to prevent damage to the glass if it falls down.

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

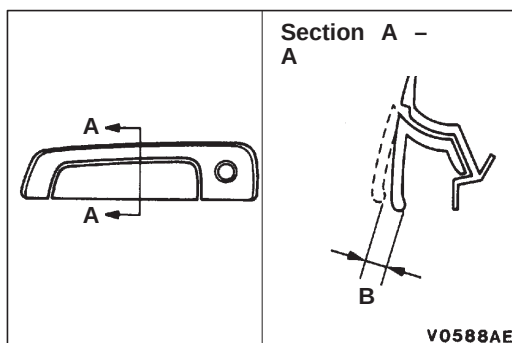
The lower sash cannot normally be adjusted, but it may be possible to adjust the sash span slightly within the range allowed by manufacturing tolerances by pushing the lower sash outwards while re-installing it.

4. If repair or adjustment is impossible, replace the door assembly.



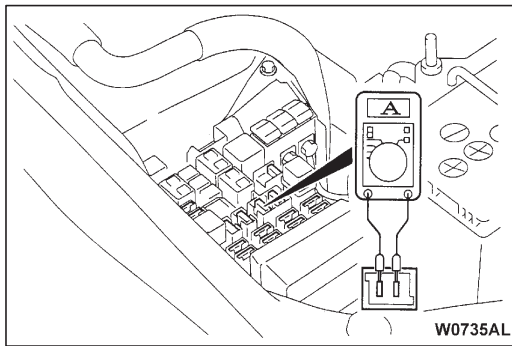
POWER WINDOW SAFETY MECHANISM CHECK

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.

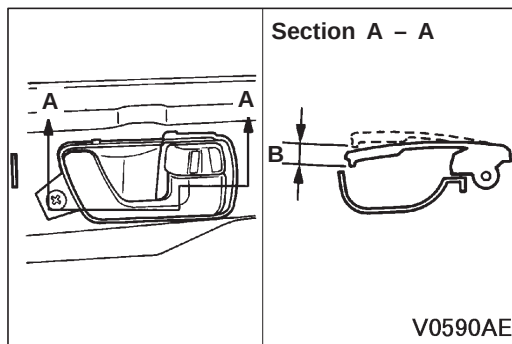
Standard value:

$5.3 \pm 2 \text{ A}$ (power supply voltage $14.5 \pm 0.3 \text{ V}$ 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

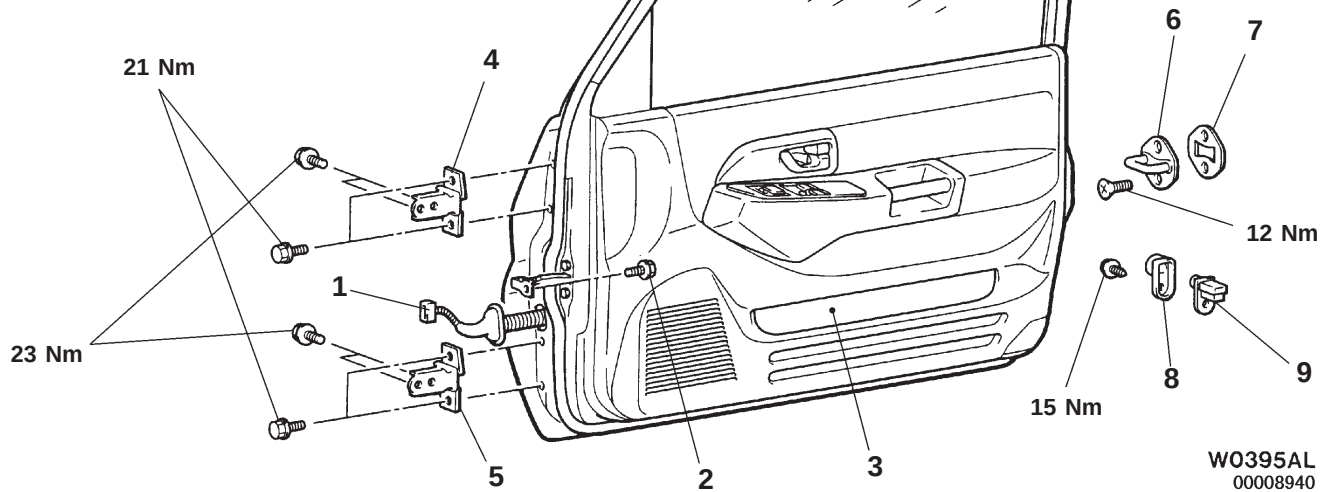
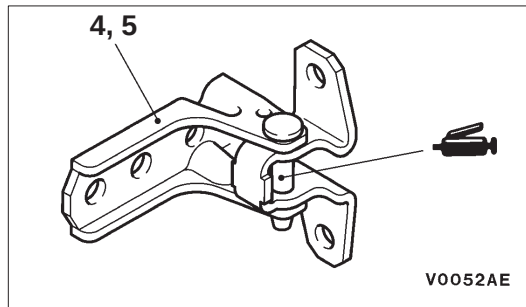
2. If the play is not within the standard value, remove the door trim. (Refer to P.42-23.)
3. Adjust the door inside handle play with the clip connecting the inside handle and the rod.

DOOR ASSEMBLY

REMOVAL AND INSTALLATION

Post-installation Operation

Door Fit Adjustment (Refer to P.42-19.)

**Door assembly removal steps**

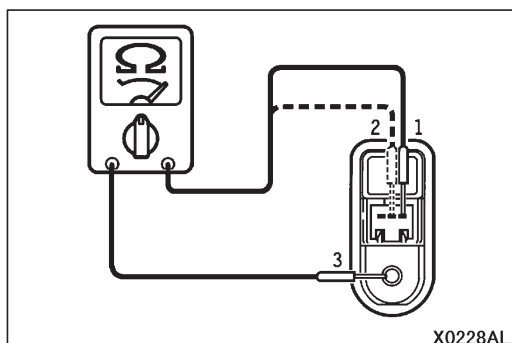
1. Harness connector
2. Door check connecting bolt
3. Door assembly
4. Door upper hinge
5. Door lower hinge

Striker removal steps

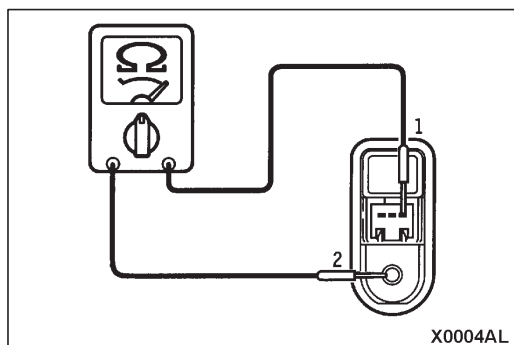
6. Striker
7. Striker shim

Door switch removal steps

8. Door switch cap
9. Door switch

**INSPECTION****DOOR SWITCH CONTINUITY CHECK****Driver's side**

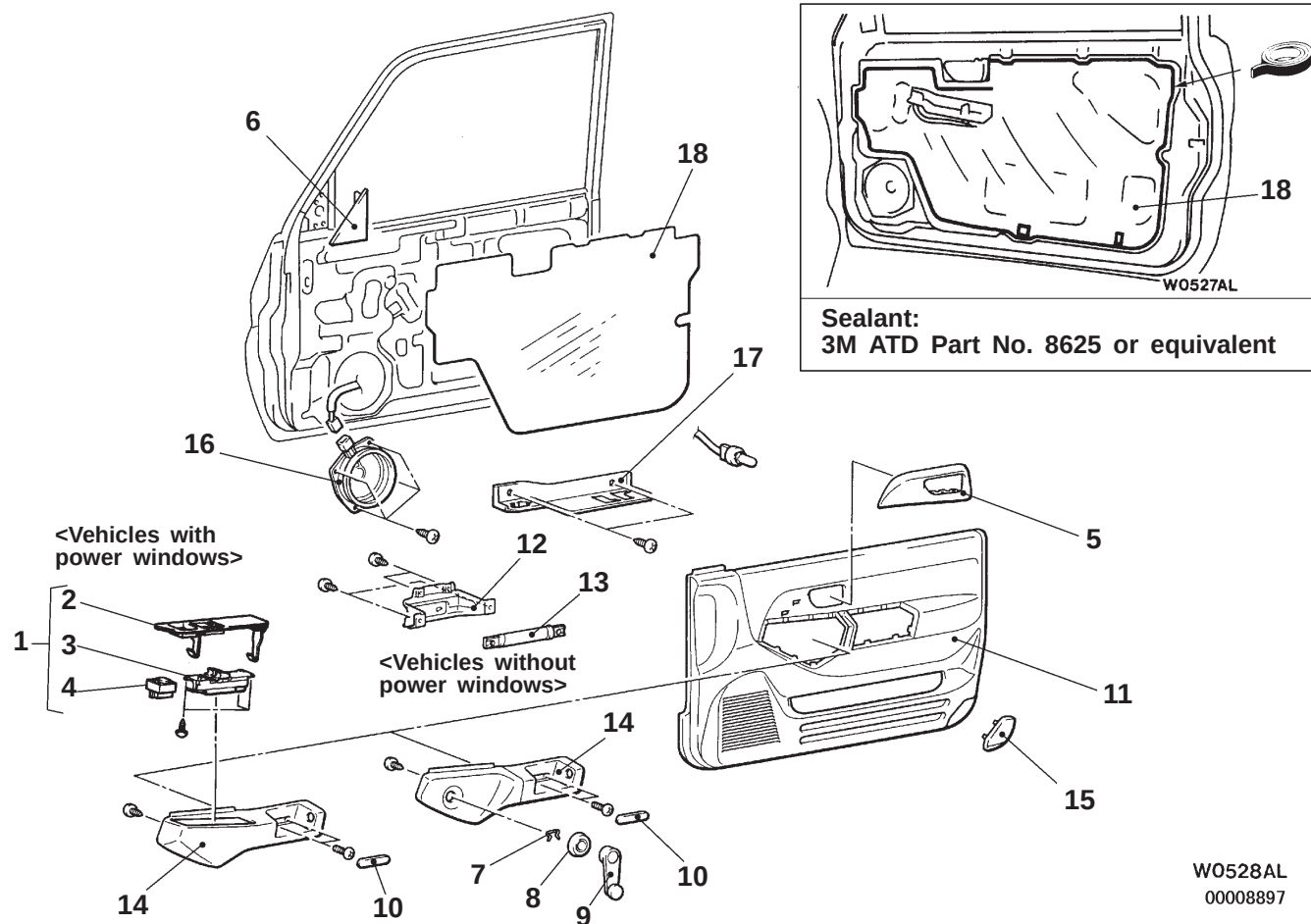
Switch position	Terminal number		
	1	2	3 (Earth)
Released (ON)	○	○	○
Depressed (OFF)			



Passenger's side

Switch position	Terminal number	
	1	2 (Earth)
Released (ON)		
Depressed (OFF)		

DOOR TRIM AND WATERPROOF FILM REMOVAL AND INSTALLATION



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
5. Door inside handle cover
6. Delta cover, inner
7. Clip
8. Escutcheon

◀B▶

◀C▶

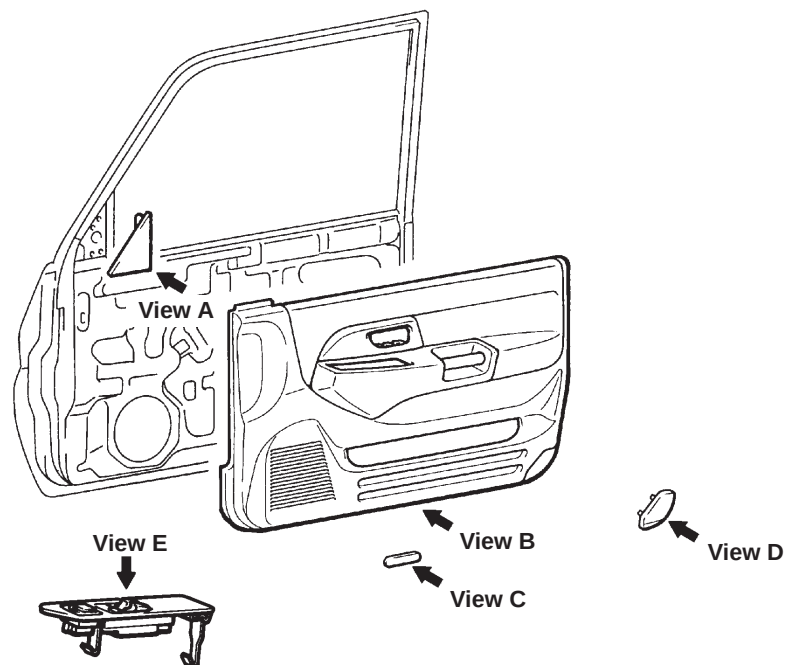
▶B▶
▶B▶

▶B▶

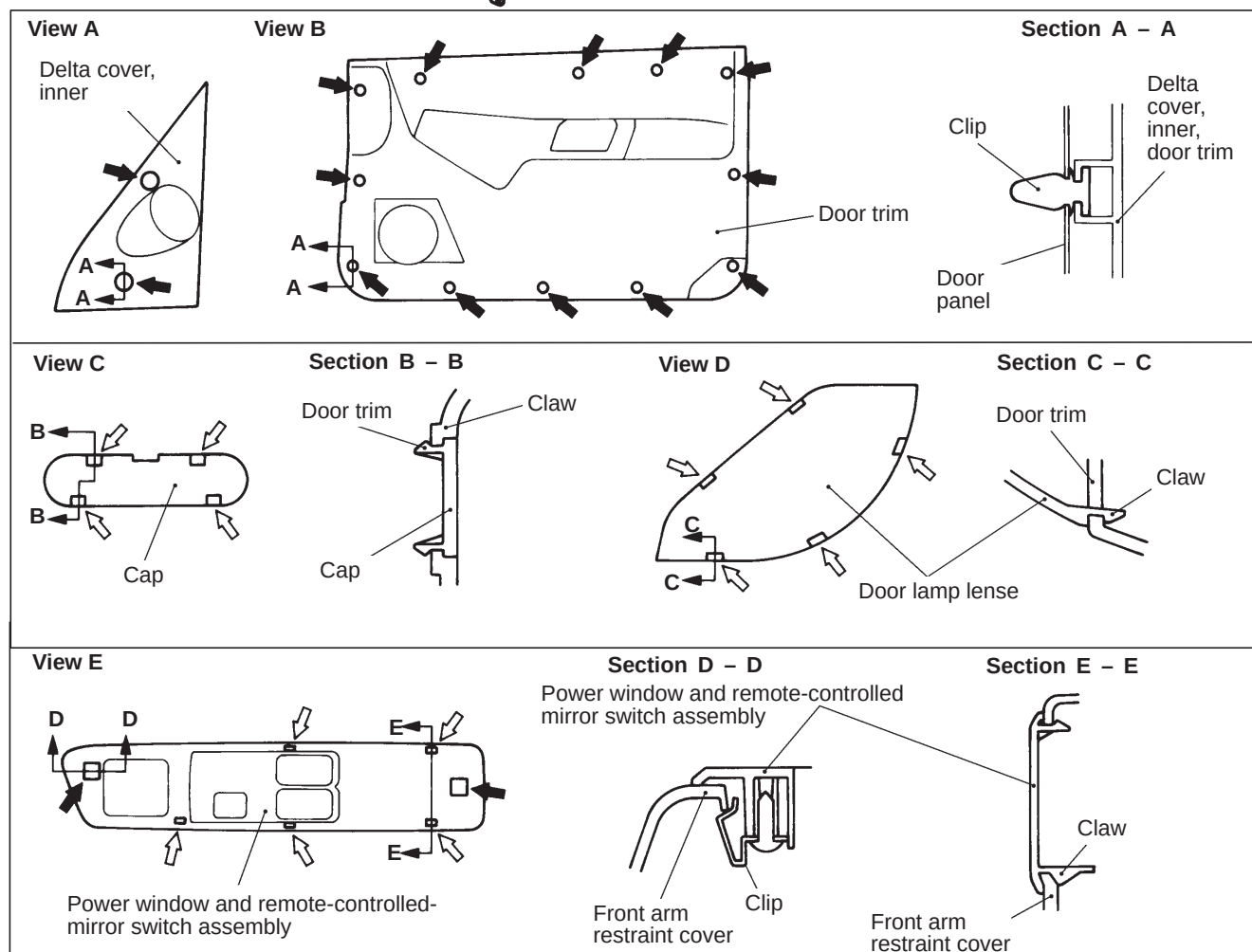
9. Regulator handle
10. Cap
11. Door trim
12. Grip bracket
13. Door grip
14. Front arm restraint cover
15. Door lamp lense
16. Speaker
17. Power window switch bracket
18. Waterproof film

▶A▶

CLIP AND CLAW POSITIONS



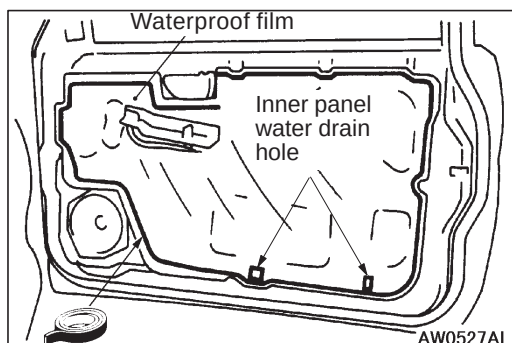
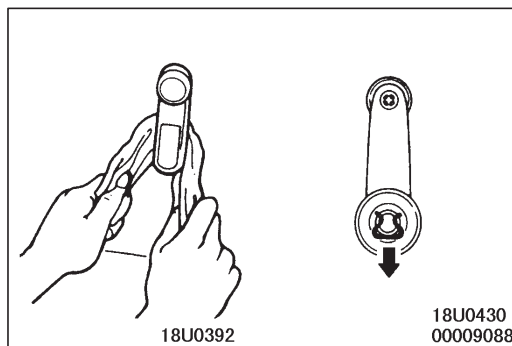
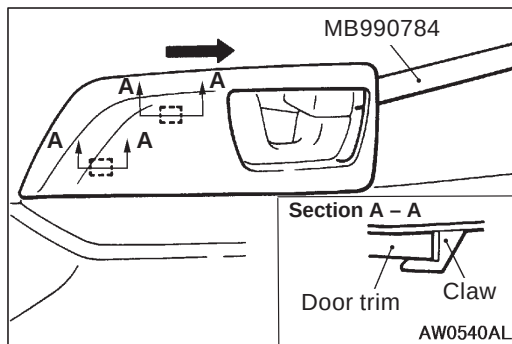
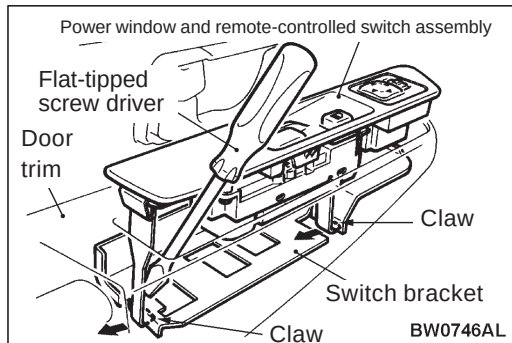
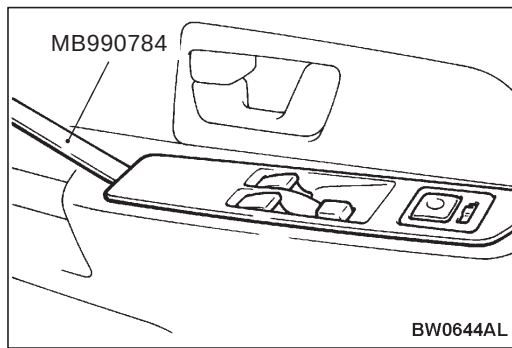
W0529AL
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NOTE

- ◄ : Clips positions
 ⇨ : Claws positions

W0530AL



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

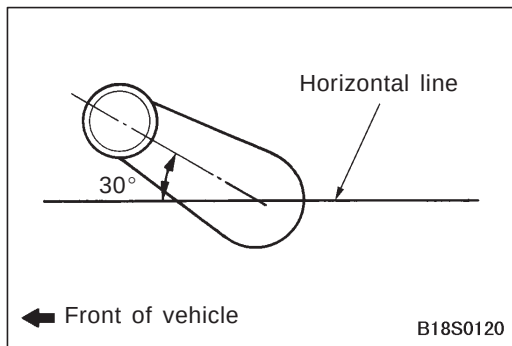
▶A◀ WATERPROOF FILM INSTALLATION

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

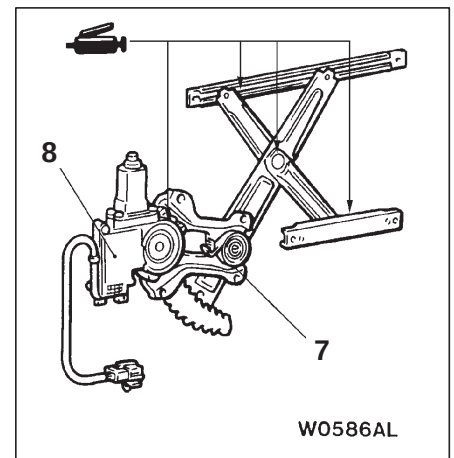
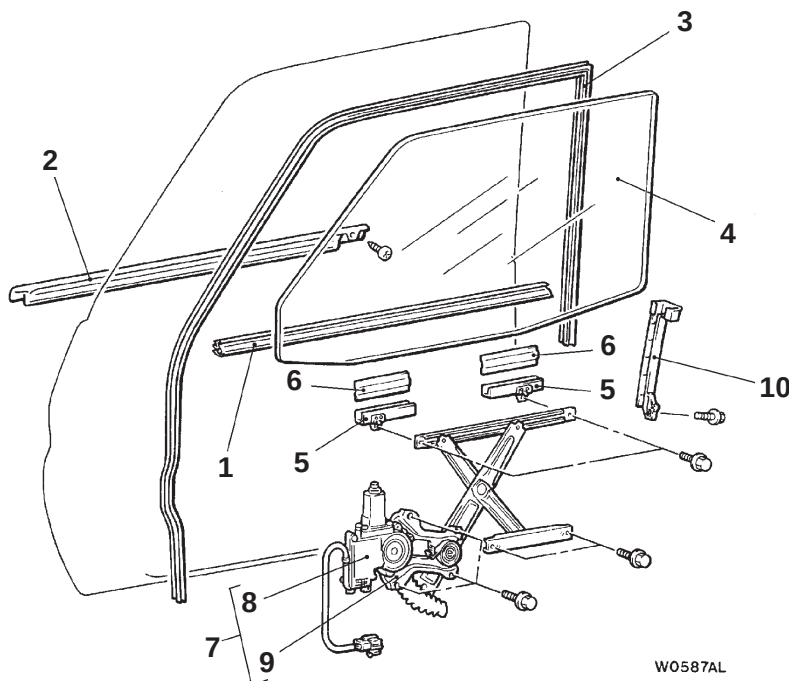
REMOVAL AND INSTALLATION

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.)



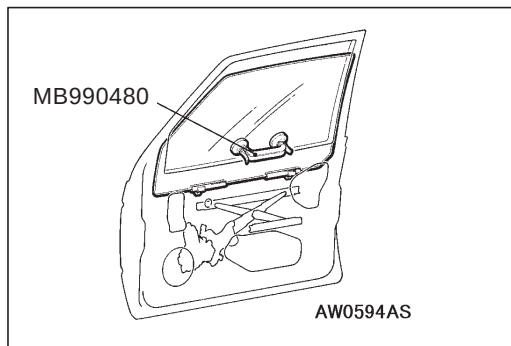
Door window glass removal steps

- 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
 5. Glass holder
 6. Door glass pad

◄A►

Power window regulator and motor assembly removal steps

7. Power window regulator and motor assembly
 8. Power window motor assembly
 9. Power window regulator assembly
 10. Rear lower sash
- B◄
- B◄
- A◄



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

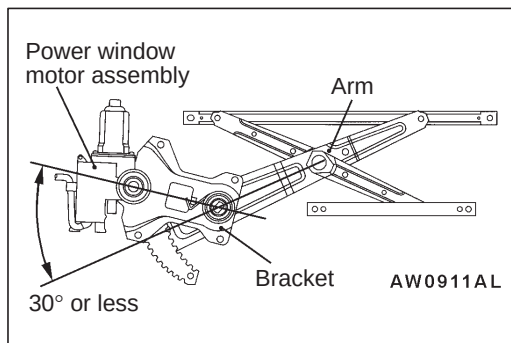
If a film, etc. is attached to the door window glass, install the special tool to the outside of window glass in order to prevent the film peeling.

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.



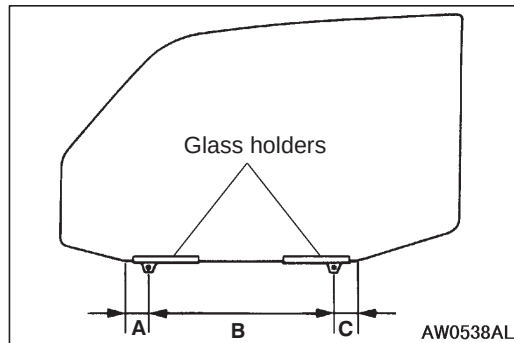
▶B◀ POWER WINDOW MOTOR ASSEMBLY/POWER WINDOW REGULATOR ASSEMBLY INSTALLATION

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 function 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.

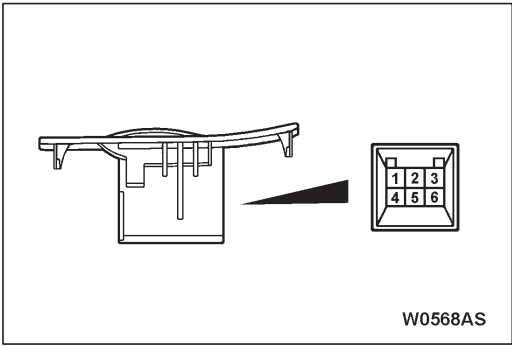
2. Check that the limit switch operates normally.
(Refer to P.42-20.)

INSPECTION

POWER WINDOW MAIN SWITCH CONTINUITY CHECK

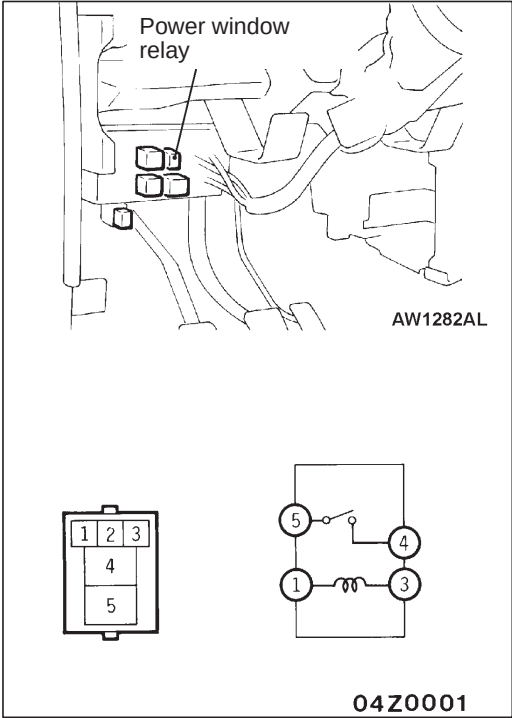
NOTE

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

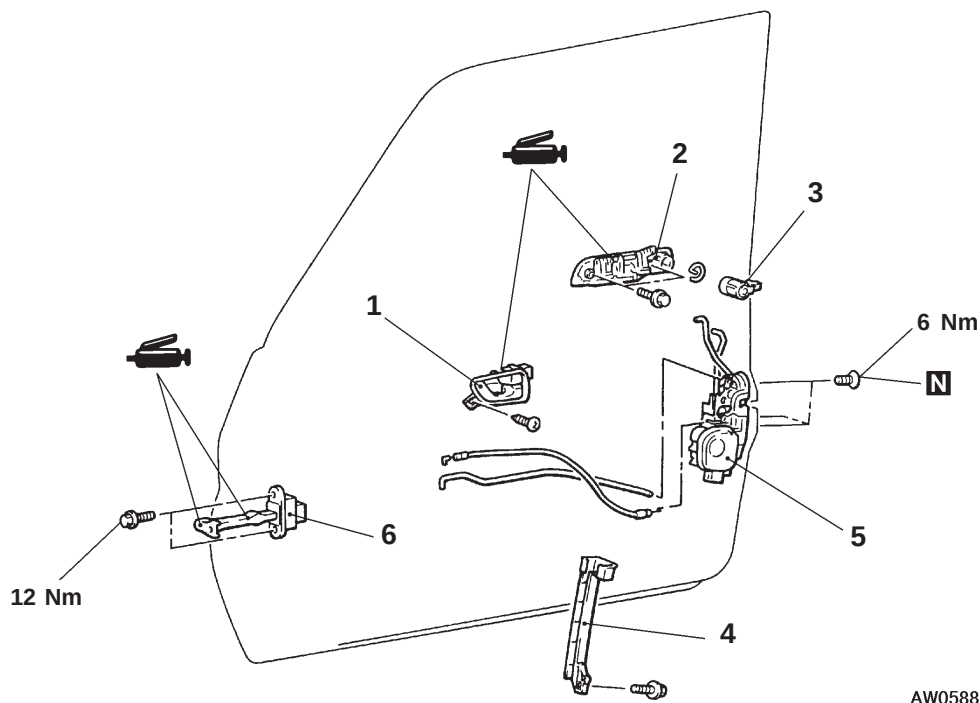
REMOVAL AND INSTALLATION

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.)

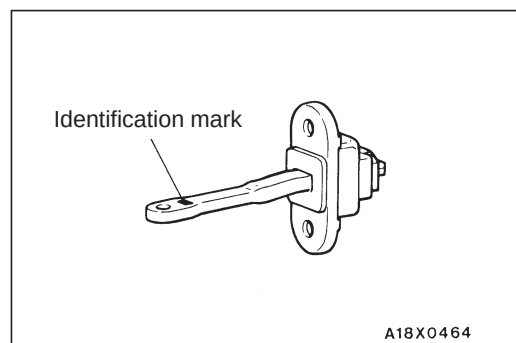


Door handle and door latch assembly removal steps

- C◄ 1. Door inside handle
 • Waterproof film (Refer to P.42-23.)
- B◄ 2. Door outside handle
 3. Door lock key cylinder
 4. Rear lower sash
 5. Door latch assembly

Door check removal steps

- A◄ • Waterproof film (Refer to P.42-23.)
 6. Door check



INSTALLATION SERVICE POINTS

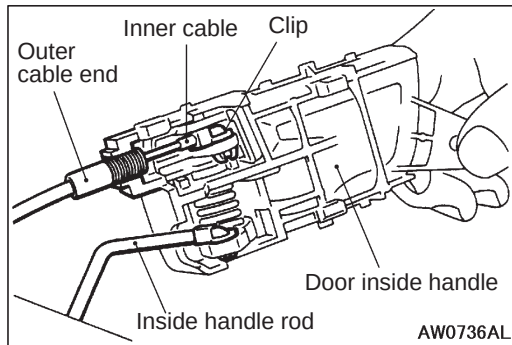
►A◄ DOOR CHECK INSTALLATION

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**

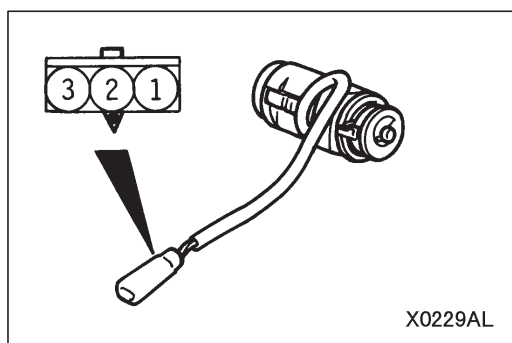
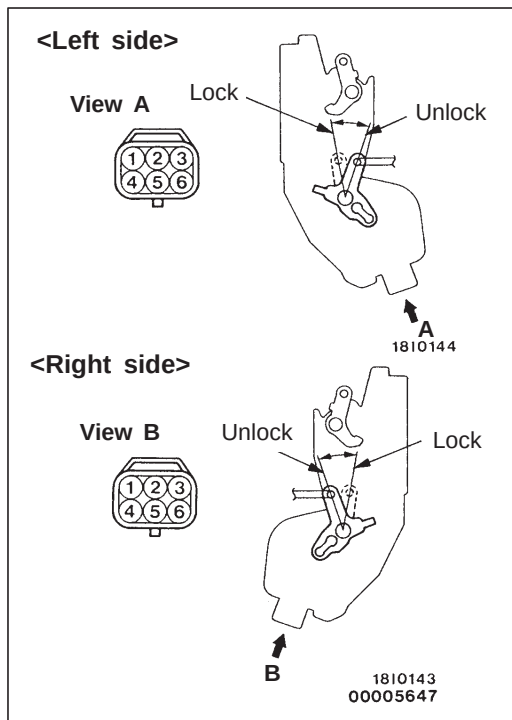
1. Install the inside lock cable to the door inside handle as follows:
 - (1) Install the inner cable end in the inside lock cable to the clip in the door inside handle.
 - (2) Turn the inside lock knob to the door lock position.
 - (3) Install the outer cable end to the door inside handle securely.
 - (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>

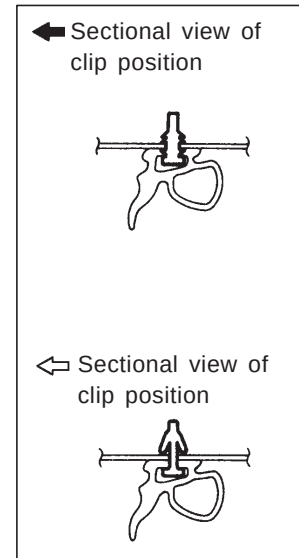
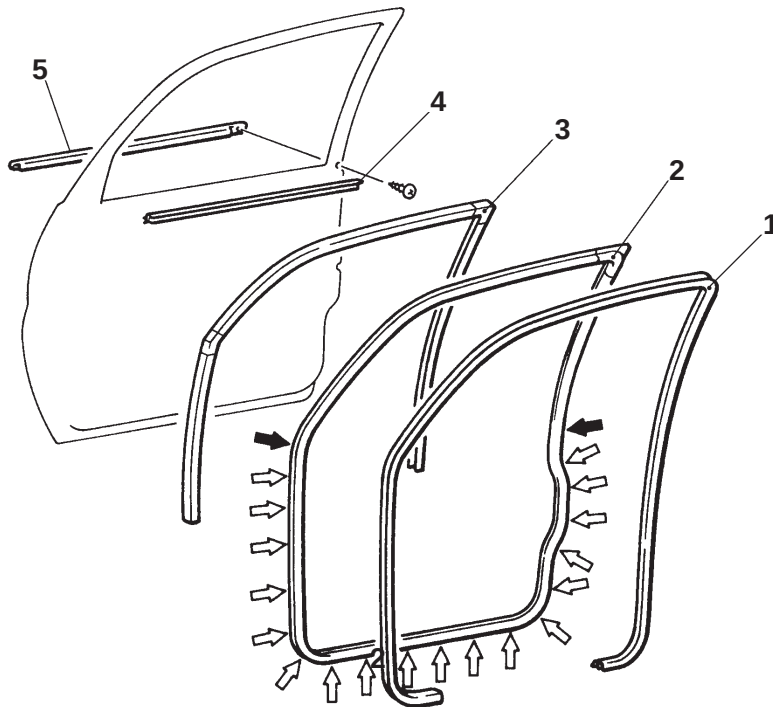
Rod position	Terminal No.					Rod operation
	1	2	3	4	6	
LOCK				⊖	⊕	LOCK to UNLOCK
UNLOCK				⊕	⊖	UNLOCK to LOCK
LOCK	○		○			
UNLOCK		○	○			

**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



AW0594AL

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

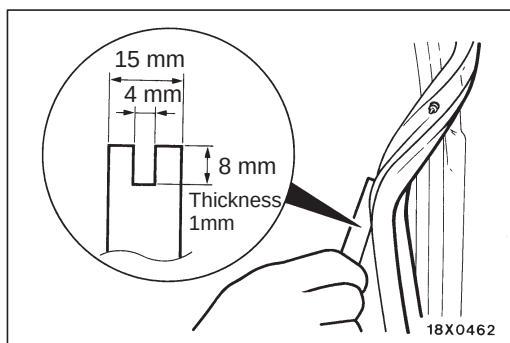
2. Door outer opening weatherstrip

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

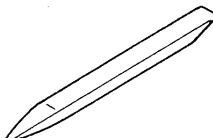
SERVICE SPECIFICATION

Item	Standard value
Back door handle play mm	2.0 – 8.0

SEALANT

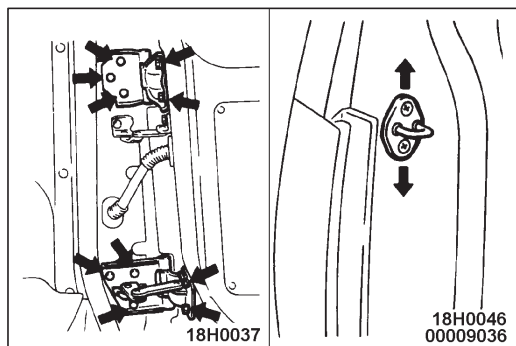
Item	Specified sealant	Remark
Waterproof film	3M ATD Part No. 8625 or equivalent	Ribbon sealer

SPECIAL TOOL

Tool	Number	Name	Use
 8990784	MB990784	Ornament remover	Back door trim removal

TROUBLESHOOTING

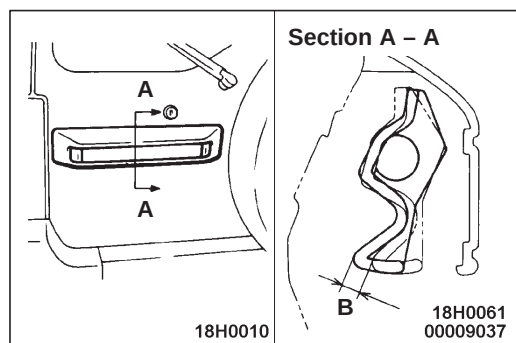
The central door locking (back door) is controlled by the Smart Wiring System (SWS). For troubleshooting, refer to GROUP 54B – Troubleshooting.



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

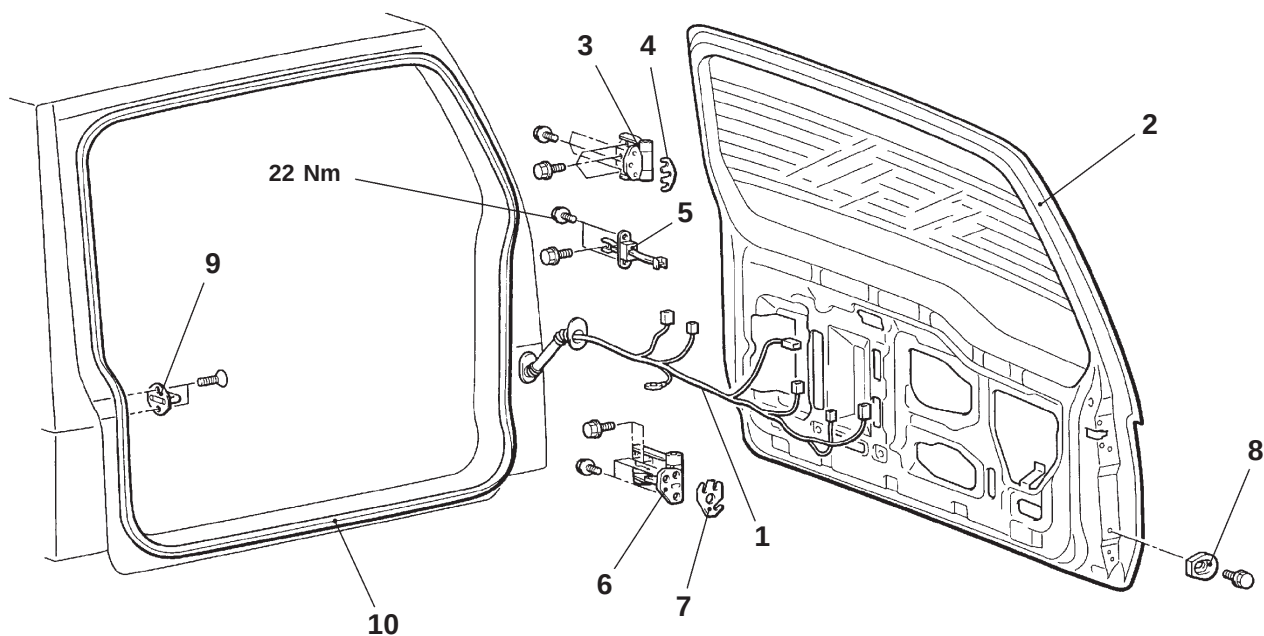
REMOVAL AND INSTALLATION

Pre-removal Operation

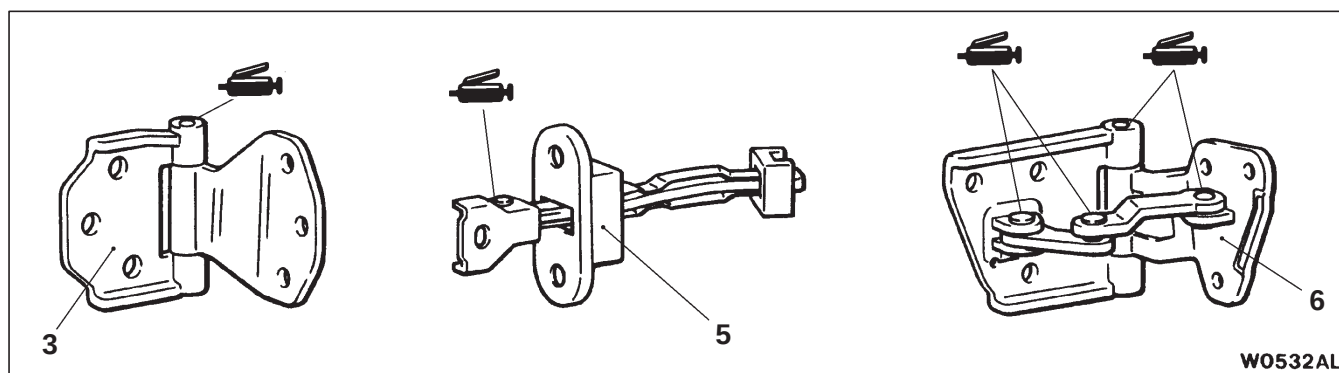
- High-mounted Stop Lamp Removal (Refer to GROUP 54A.)
- Spare Tyre Carrier Removal (Refer to GROUP 51.)

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.)



W0531AL
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W0532AL

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

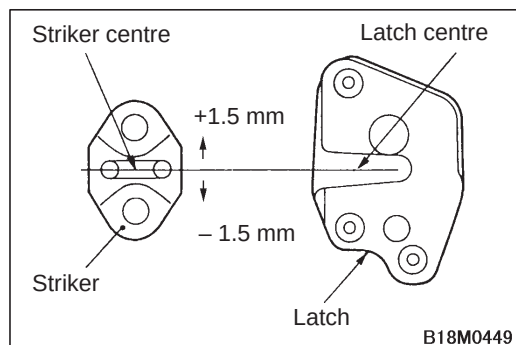
- 5. Door check
- 6. Back door lower hinge
- 7. Shim
- 8. Damper mail



- 9. Striker
- 10. Back door opening weatherstrip

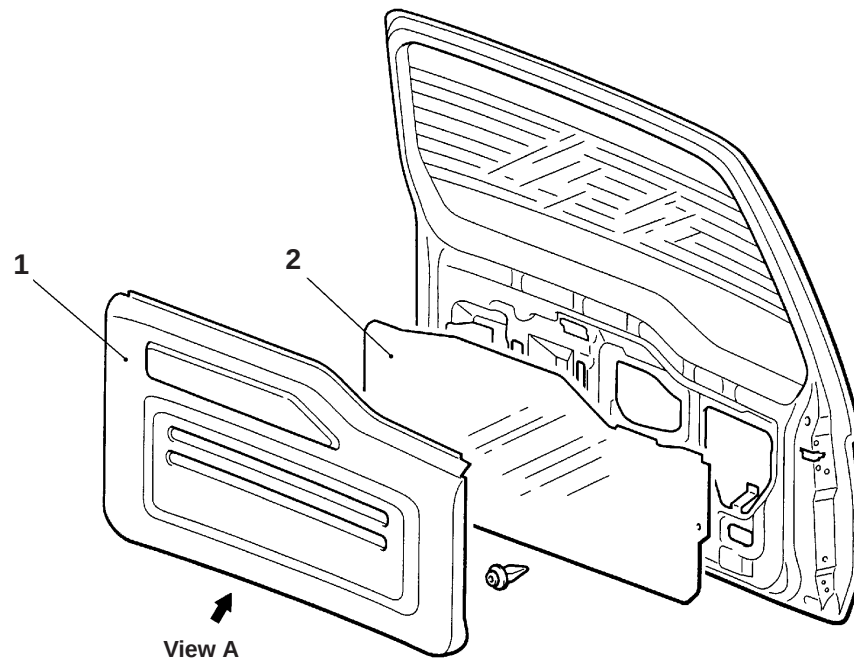
INSTALLATION SERVICE POINT**►A◄ BACK DOOR OPENING WEATHERSTRIP
INSTALLATION**

Align the marking section on the back door opening weatherstrip with the centre of the body.

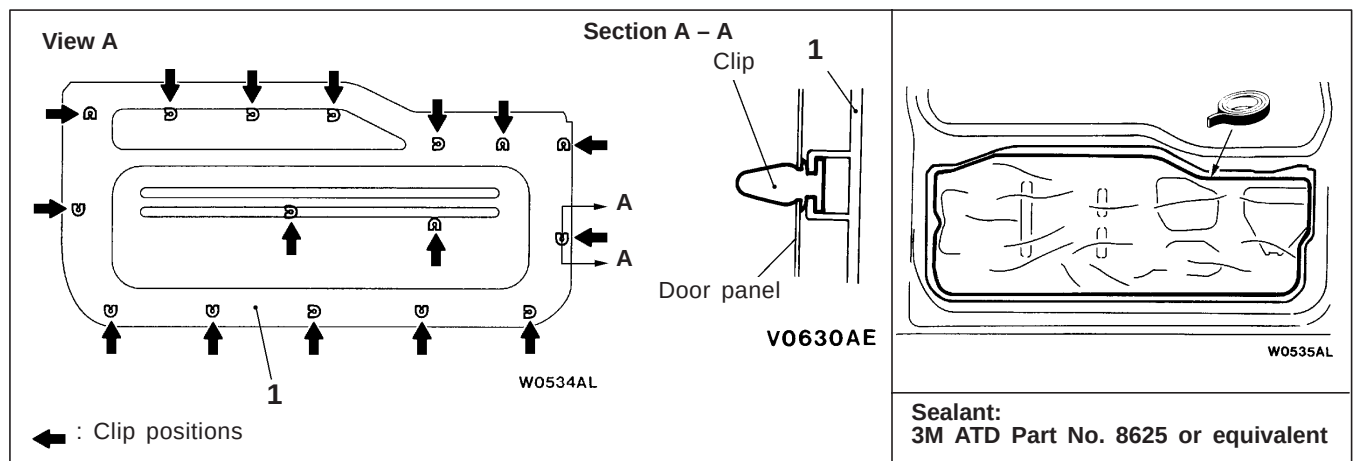
**►B◄ STRIKER INSTALLATION**

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



W0533AL
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Removal steps

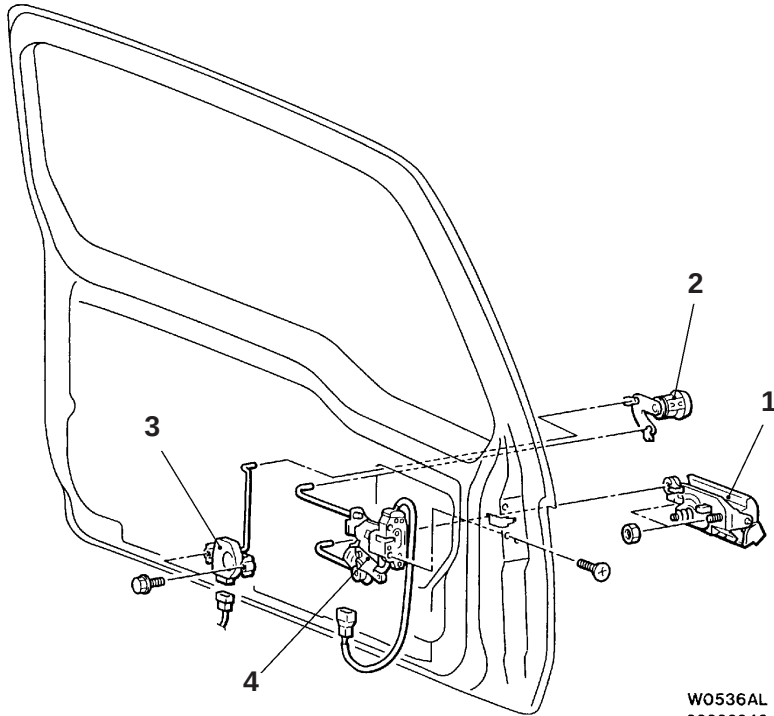
1. Back door trim
2. Waterproof film

BACK DOOR HANDLE AND LATCH

REMOVAL AND INSTALLATION

Post-installation Operation

Back Door Handle Play Check (Refer to P.42-33.)

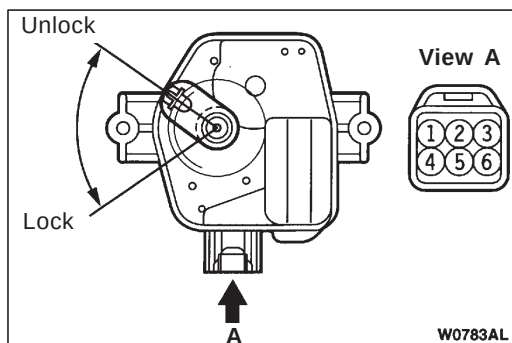


Back door handle and lock key cylinder removal steps

- 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

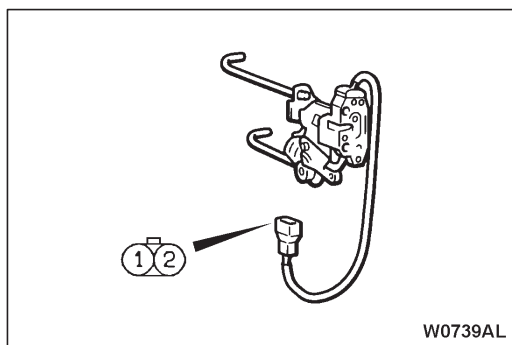
- Back door trim and waterproof film (Refer to P.42-36.)
- 3. Back door lock actuator
- 4. Back door latch assembly



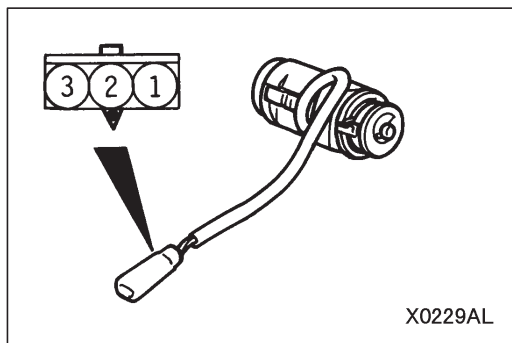
INSPECTION

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**

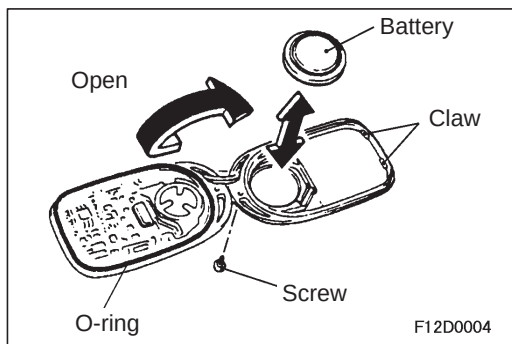
Switch position	Terminal No.	
	4	6
Back door open		
Back door closed	○	○

**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 troubleshooting, 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.

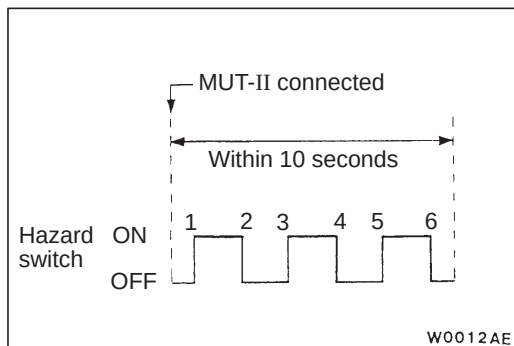
1. Check that the doors lock normally when the ignition key is inserted into the door key cylinder and turned.
2. Insert the ignition key in the ignition switch.
3. Connect the MUT-II to the diagnosis connector.

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 deactivation, or viceversa)
 - Initialization of all the ETACS functions (From deactivation 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

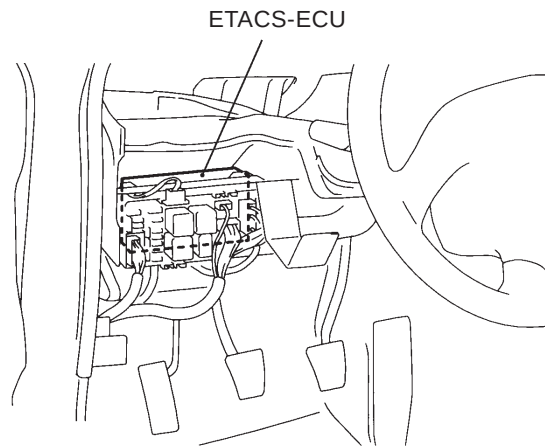
3. Adjustment of functions

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 remain on 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.)



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SUNROOF

SERVICE SPECIFICATION

Items	Standard value
Roof lid glass operating current A (at 20°C)	7 or less

TROUBLESHOOTING

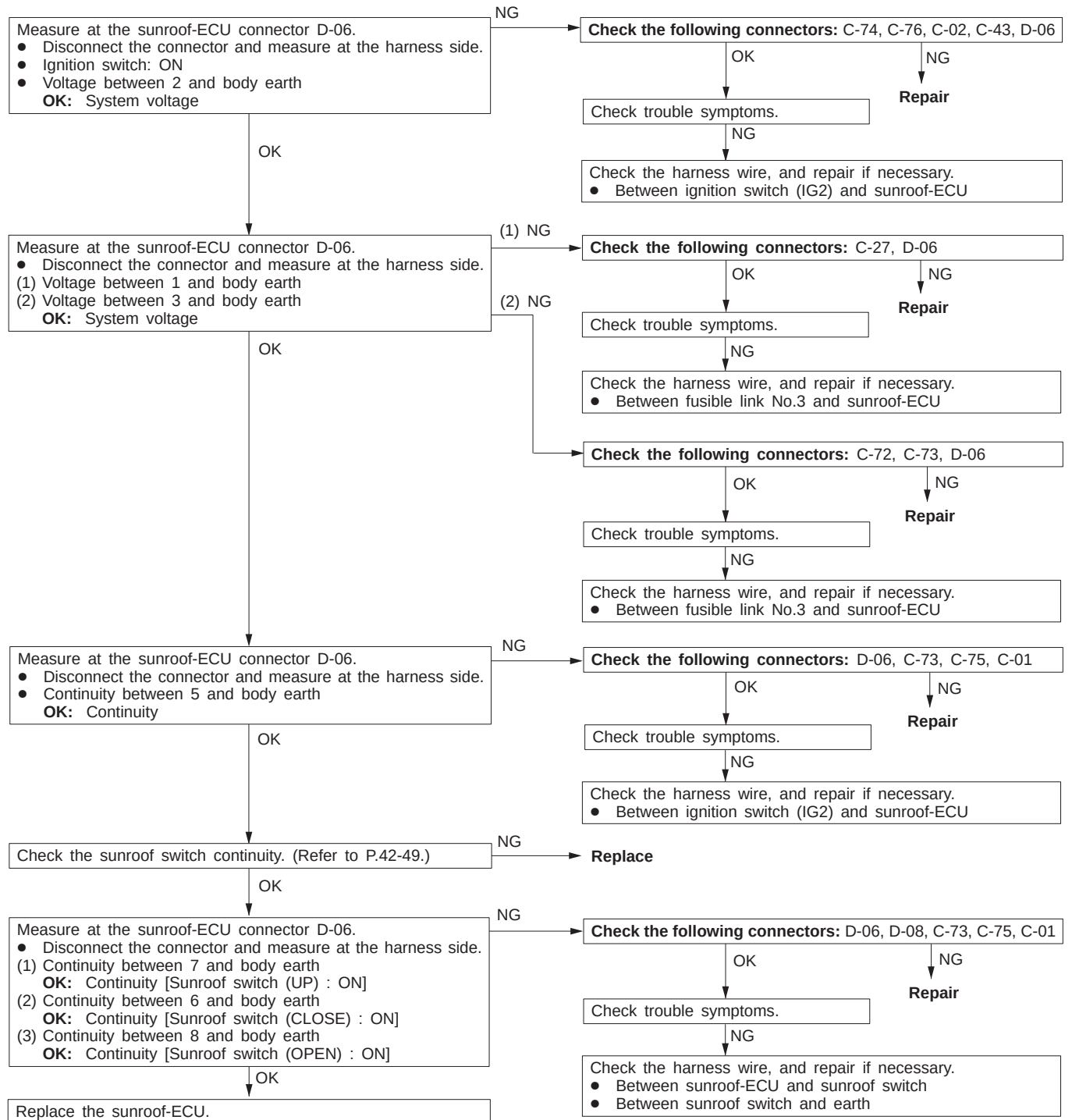
INSPECTION CHART FOR TROUBLE SYMPTOMS

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



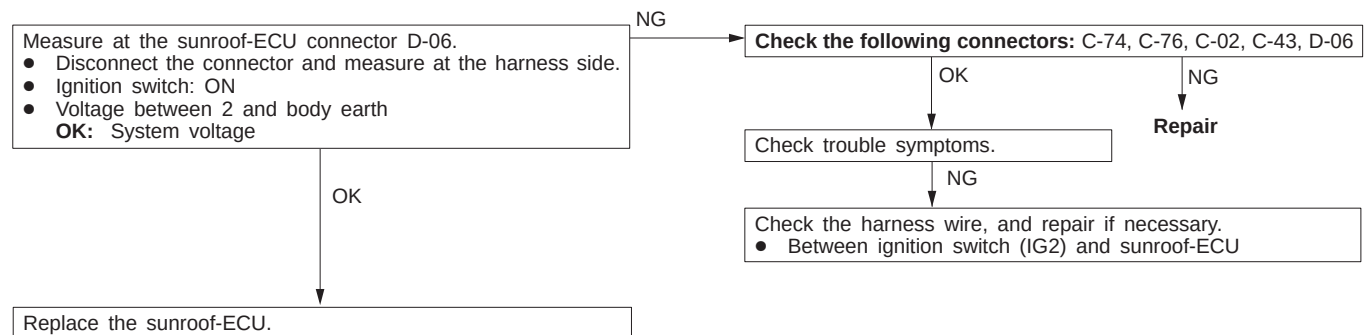
INSPECTION PROCEDURE 2

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.

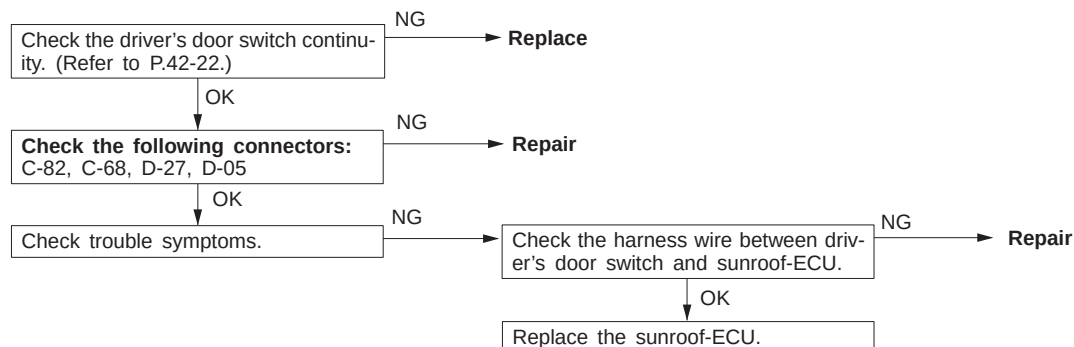
INSPECTION PROCEDURE 3

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

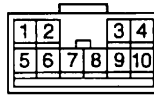


INSPECTION PROCEDURE 4

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

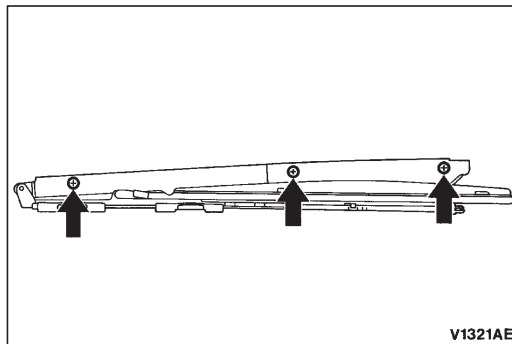
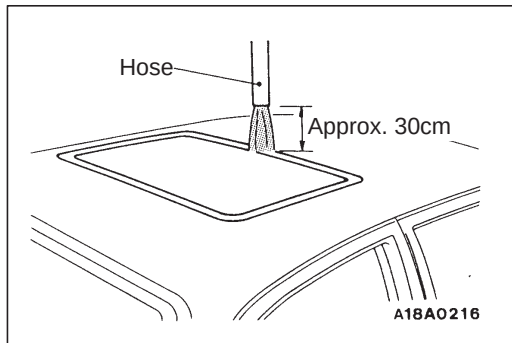
Terminal No.	Check Item	Check Condition		Normal Condition
1	ECU power supply	Always		System voltage
2	Sensor power supply	Ignition switch: ON		System voltage
5	Earth	Always		0 V
6	Sunroof switch (CLOSE, DOWN input)	Sunroof switch (close position or down position)	ON	0 V
			OFF	System voltage
7	Sunroof 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

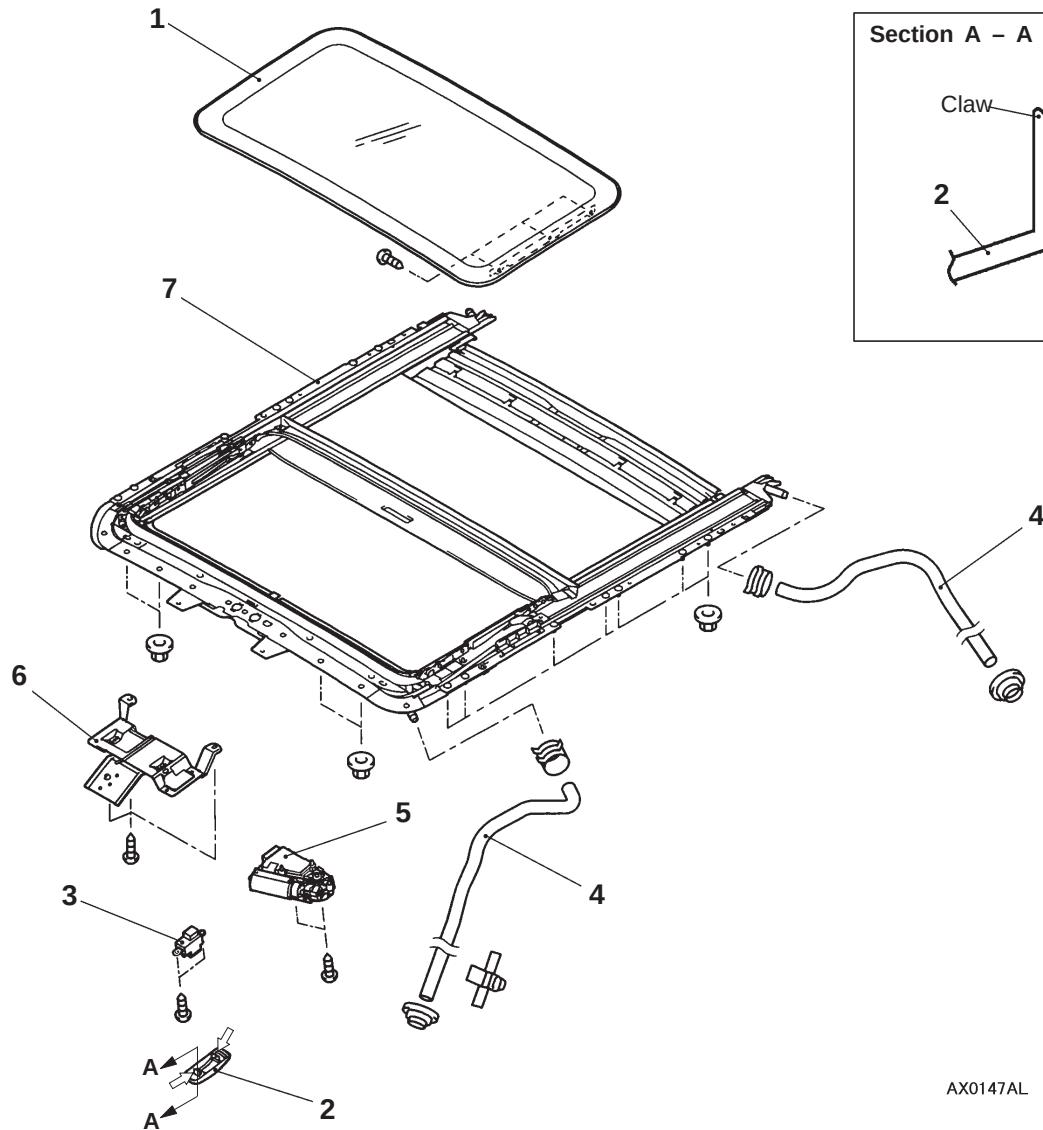
1. Fully close the roof lid glass.
2. Fully open the sunshade.
3. Loosen the roof lid glass assembly mounting screws, and then slide the roof lid glass assembly along the slot in the mechanism assembly to adjust the height of the roof lid glass.
4. After adjustment, check to be sure that the sunroof 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.)
- 5. Sunroof motor assembly

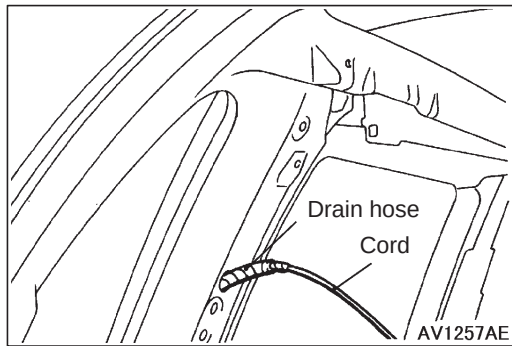
Sunroof assembly removal steps

- Headlining (Refer to GROUP 52A.)
- 4. Drain hose
- 6. Room lamp bracket
- 7. Sunroof assembly

◀B▶ ▶B▶

◀A▶ ▶A▶

AX0147AL



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.

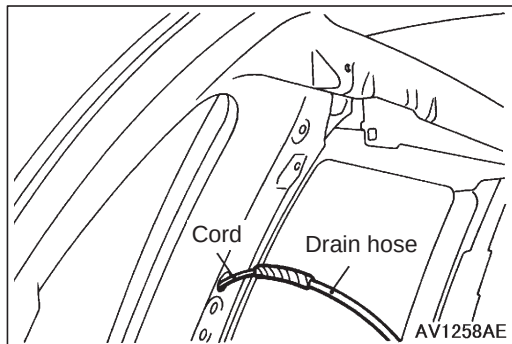
◀B▶ SUNROOF MOTOR ASSEMBLY REMOVAL

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

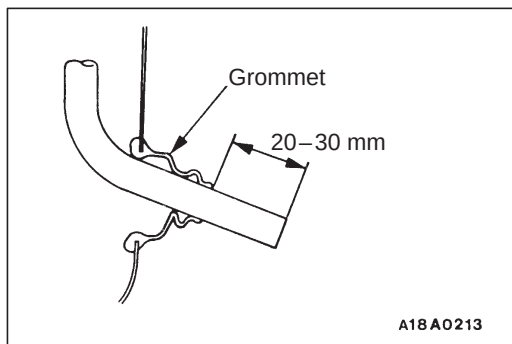
If there is a problem with the sunroof motor so that the roof lid glass cannot close fully, use an Allen key to turn the gear section of the sunroof motor to fully close the roof lid glass.



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.



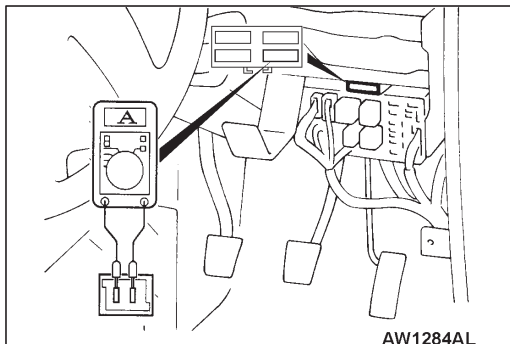
►B◄ SUNROOF MOTOR ASSEMBLY INSTALLATION

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 position. Do not release the switch at hard stop position before initialization is completed.
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.



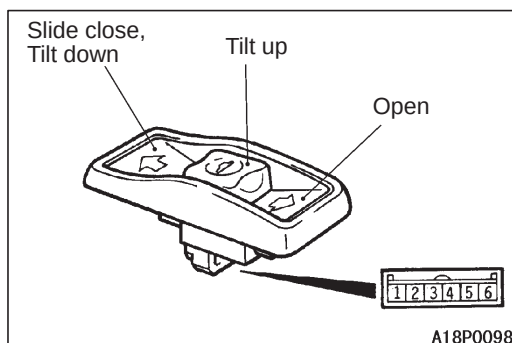
INSPECTION

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)

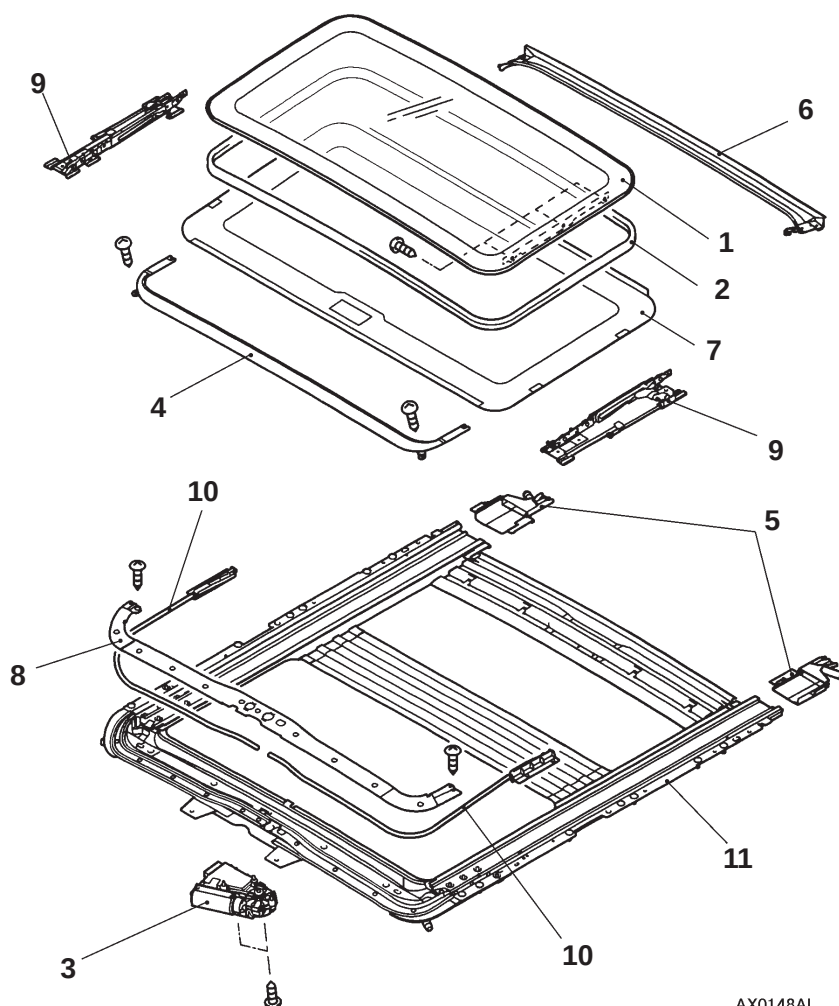
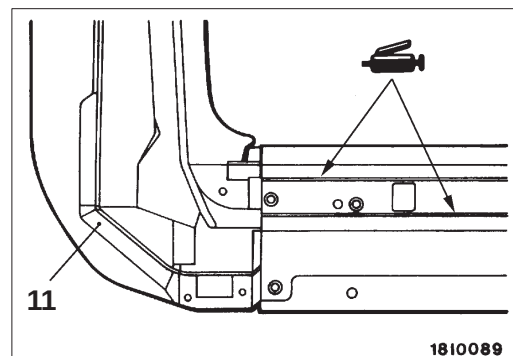
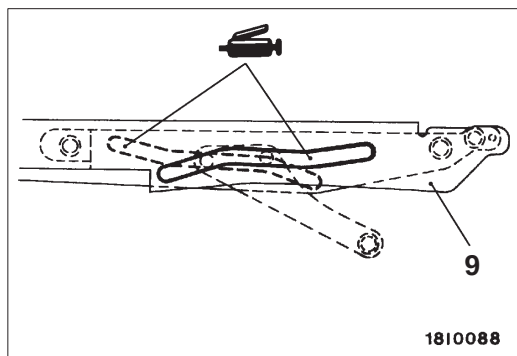
3. If the operation current is not within the standard value, check the following points.
 - Installation condition, warping or jamming of sunroof assembly
 - Sticking of drive cable
 - Tilt of roof lid glass



SUNROOF SWITCH CONTINUITY CHECK

Switch position	Terminal No.			
	3	4	5	6
Open		○	○	
Off				
Tilt up	○	○		
Slide close, Tilt down		○		○

DISASSEMBLY AND REASSEMBLY



AX0148AL

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

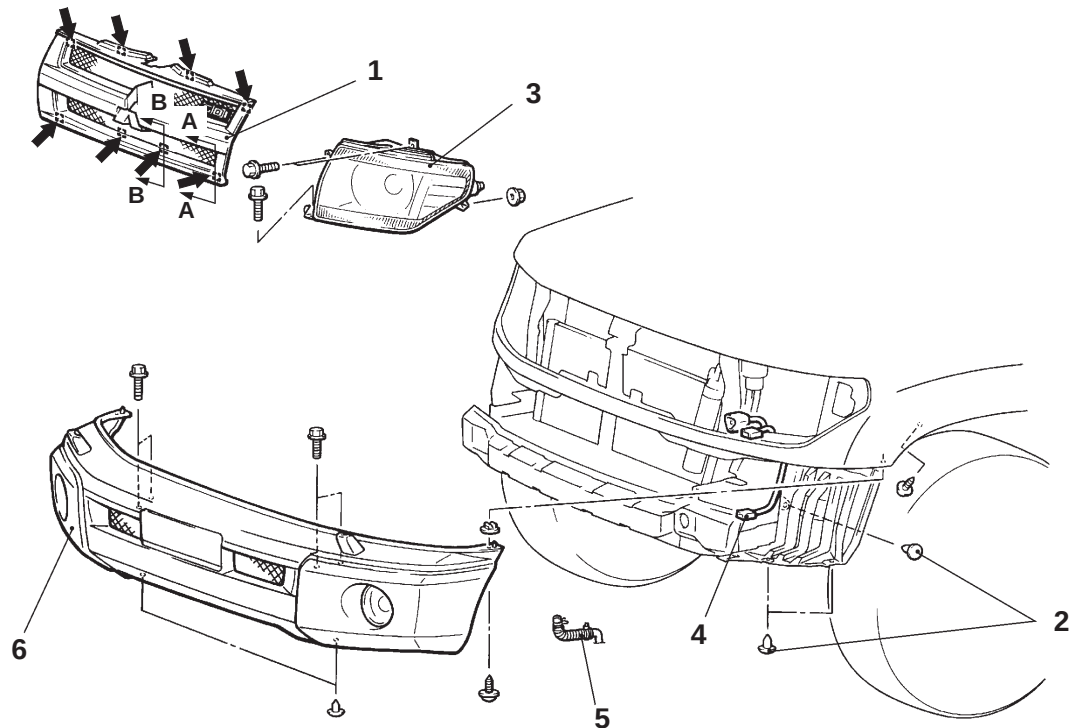
EXTERIOR

CONTENTS

FRONT BUMPER	2	REAR WIPER AND WASHER	14
REAR BUMPER	4	SERVICE SPECIFICATION	14
EXTERIOR PARTS	5	TROUBLESHOOTING	14
SPECIAL TOOL	5	REAR WIPER AND WASHER	15
EXTERIOR PARTS	6	HEADLAMP WASHER	17
MOULDING AND GARNISH	7	TROUBLESHOOTING	17
SPECIAL TOOL	7	HEADLAMP WASHER	17
MOULDING AND GARNISH	8	MARKS	19
WINDSHIELD WIPER AND WASHER	10	OUTSIDE DOOR MIRROR	21
SERVICE SPECIFICATIONS	10		
TROUBLESHOOTING	10		
WINDSHIELD WIPER AND WASHER	11		

FRONT BUMPER

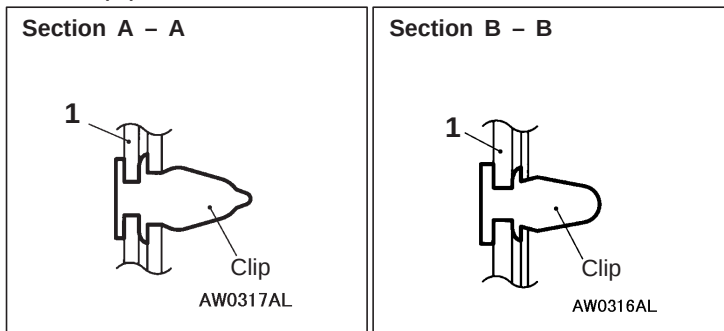
REMOVAL AND INSTALLATION



AX0087AL

NOTE

← : Clip positions

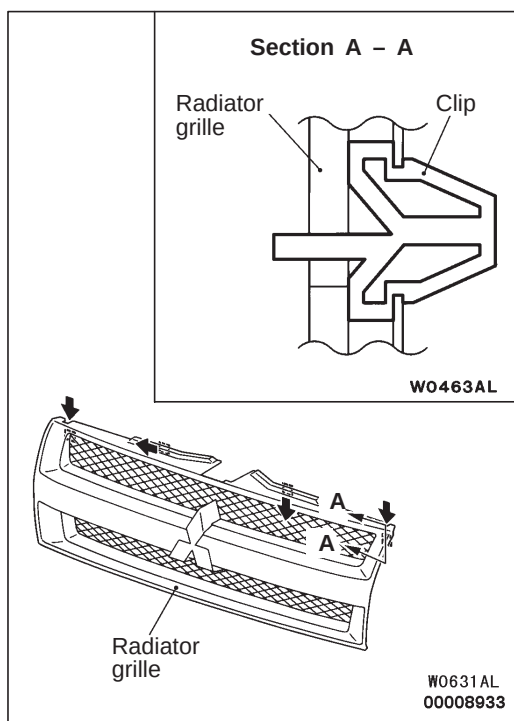


Removal steps

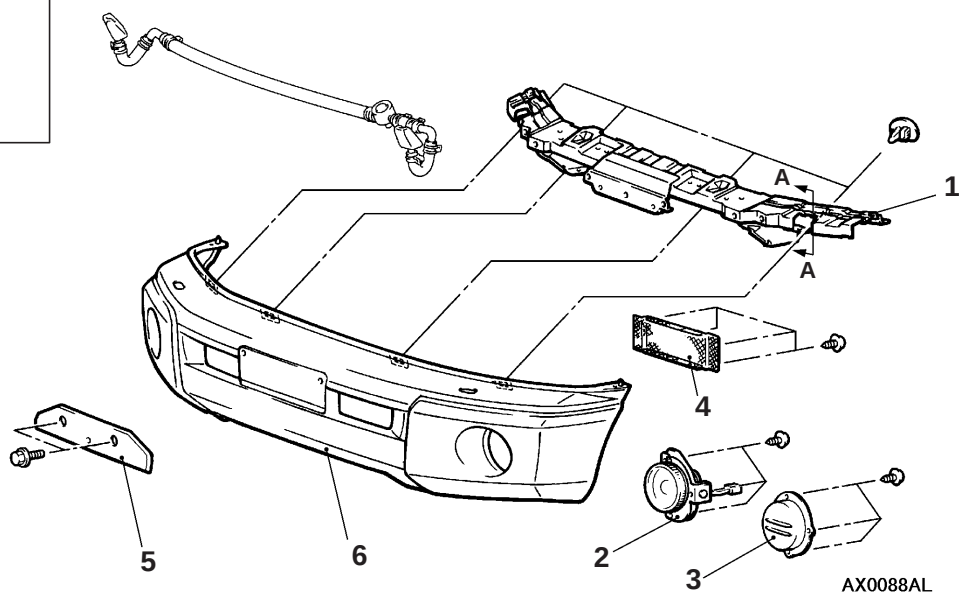
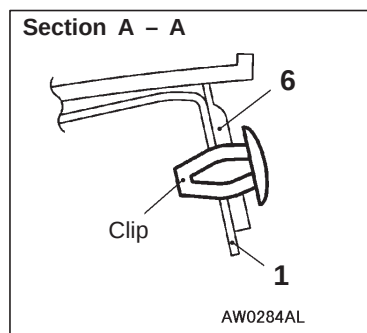


1. Radiator grille
2. Splash shield installation clips
3. Headlamp
4. Fog lamp connector

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.

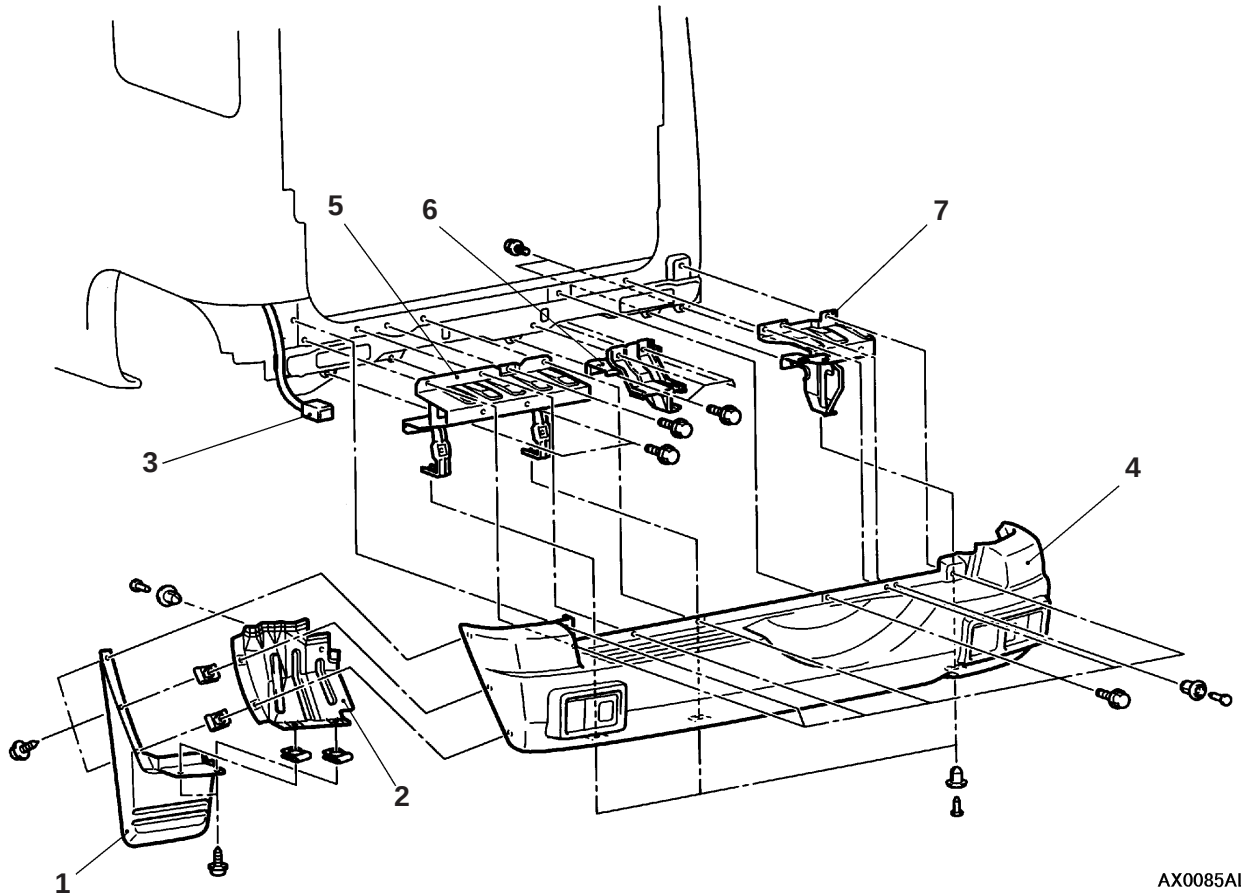
DISASSEMBLY AND REASSEMBLY**Disassembly steps**

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

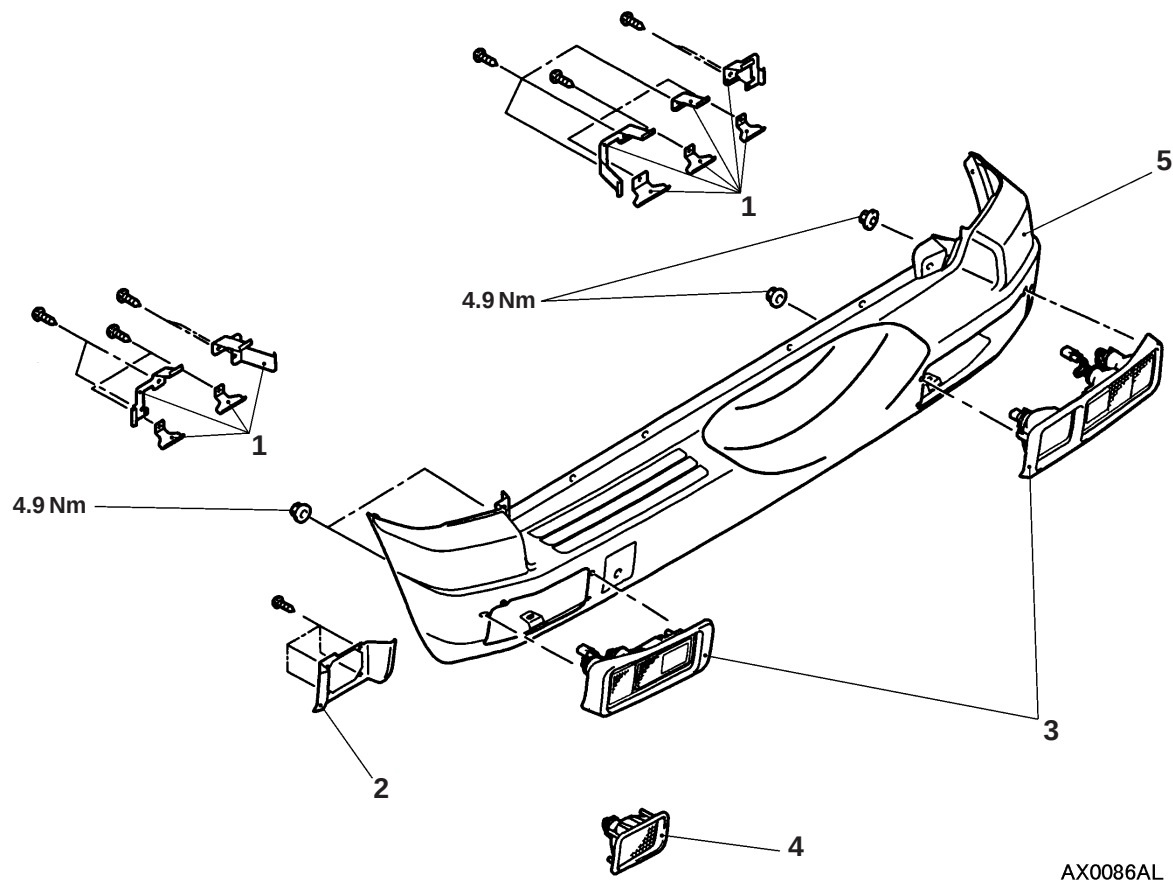


AX0085AL

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



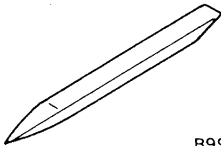
AX0086AL

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

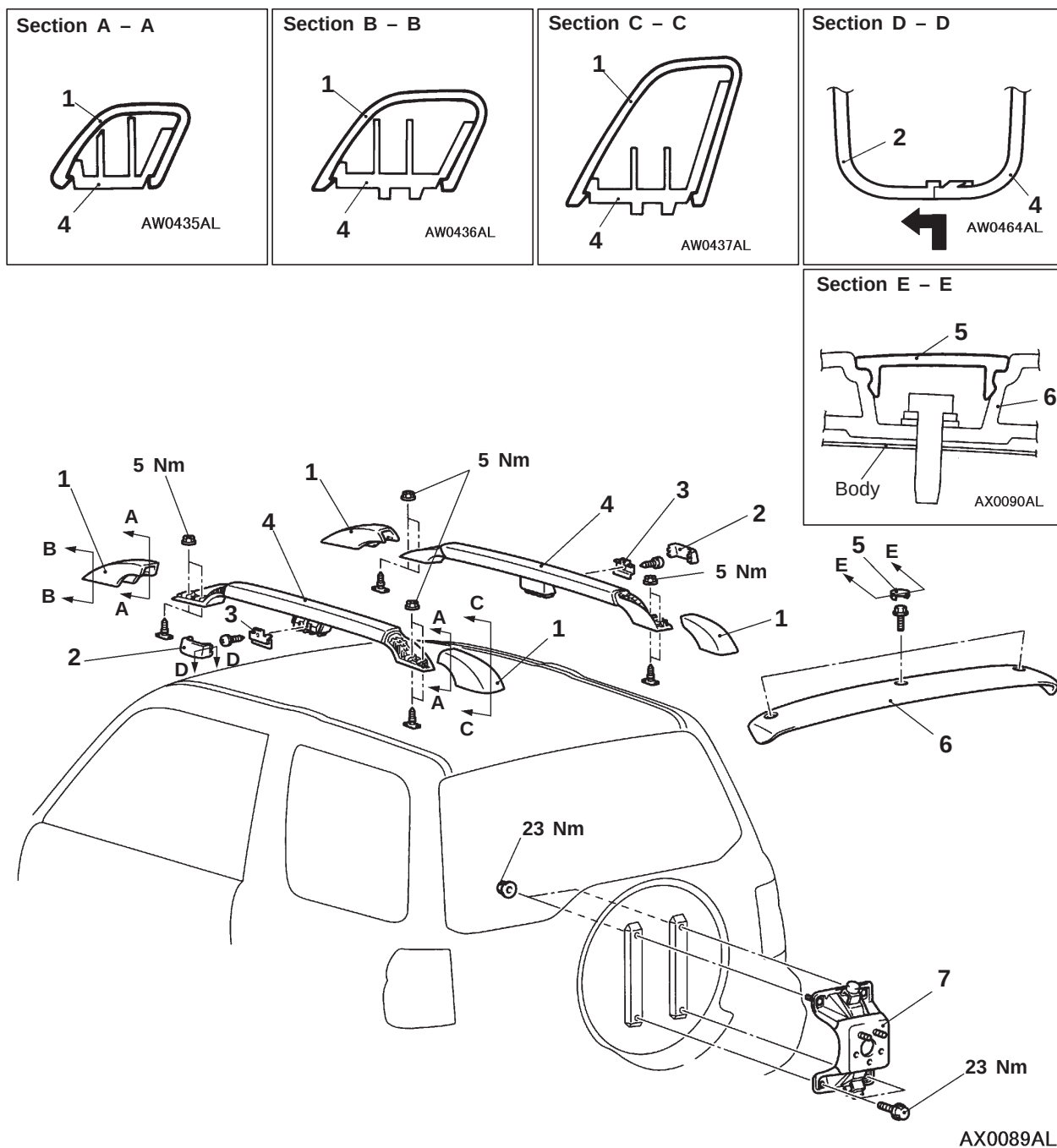
EXTERIOR PARTS

SPECIAL TOOL

Tool	Number	Name	Use
 8990784	MB990784	Ornament remover	Removal of roof rack cover.

EXTERIOR PARTS

REMOVAL AND INSTALLATION



Roof rail removal steps

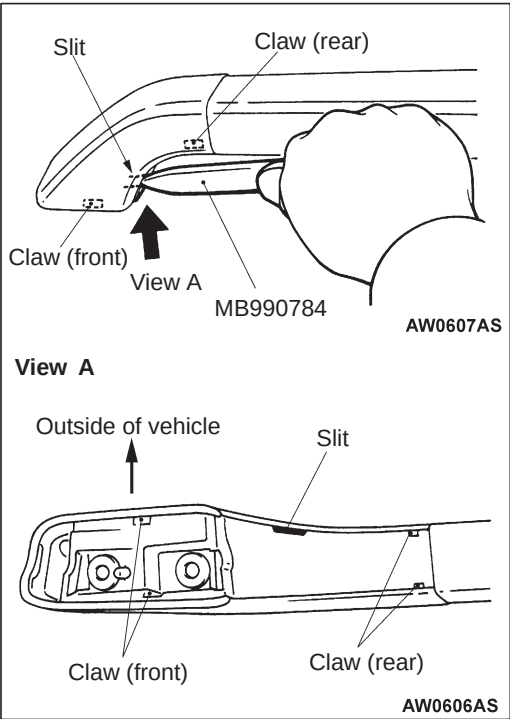
- ◀A▶
1. Roof rack cover (front, rear)
 2. Roof rack cover (side)
 3. Center bracket
 4. Roof bar

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

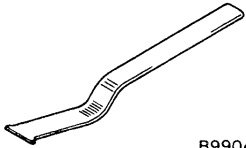
◀A▶ ROOF RACK COVER (FRONT, REAR) REMOVAL

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.

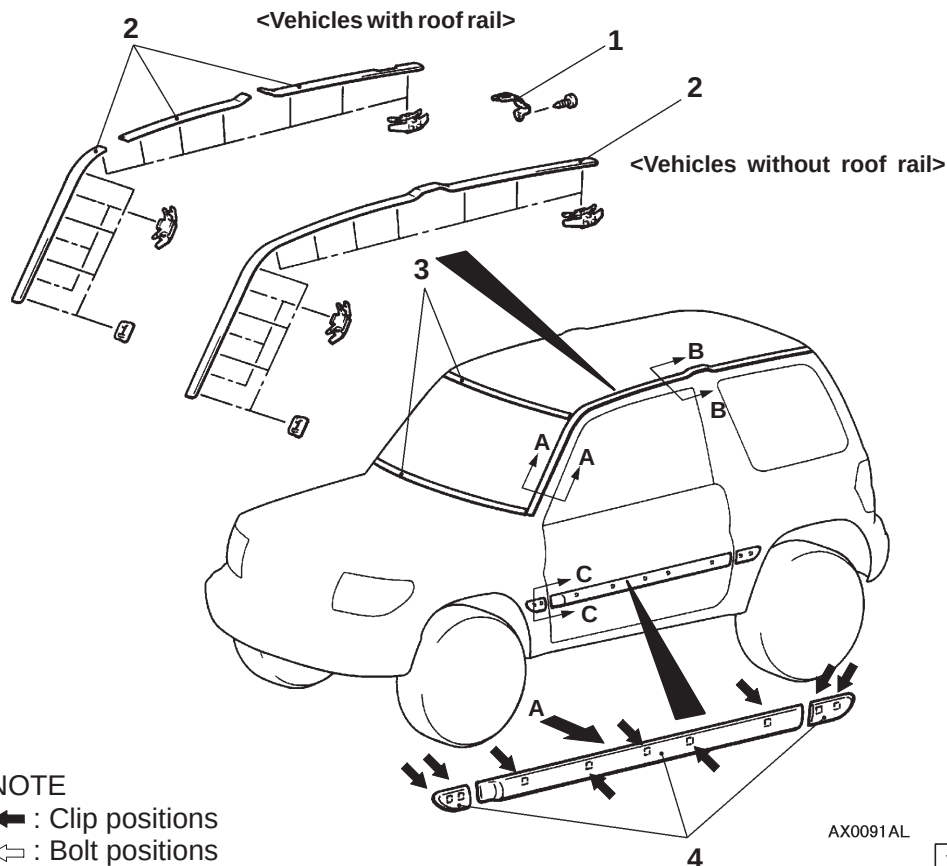
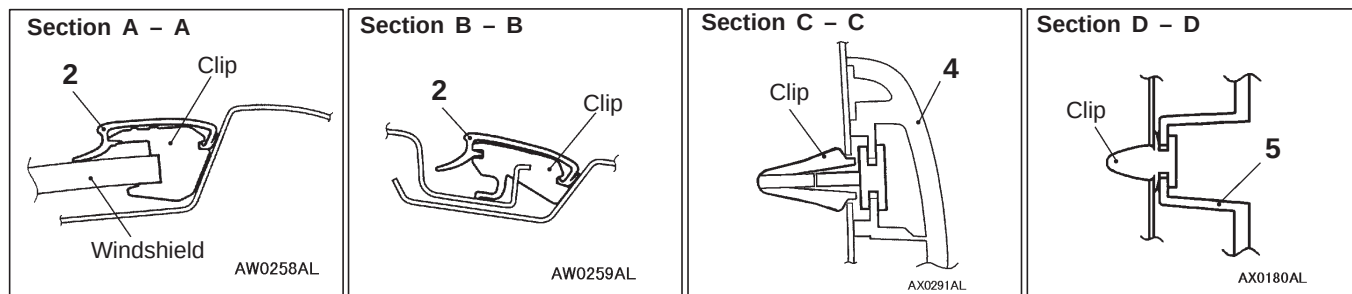
MOULDING AND GARNISH

SPECIAL TOOL

Tool	Number	Name	Use
 B990449	MB990449	Window moulding remover	Removal of roof drip moulding.

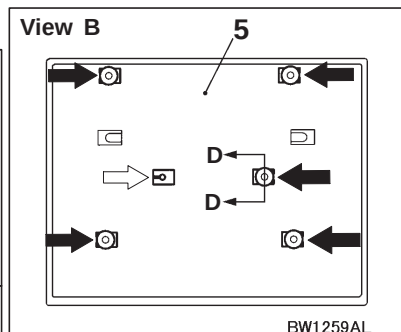
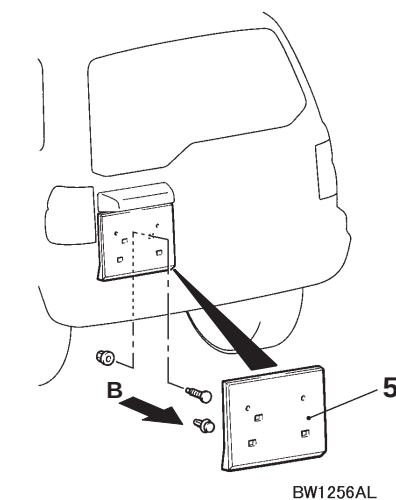
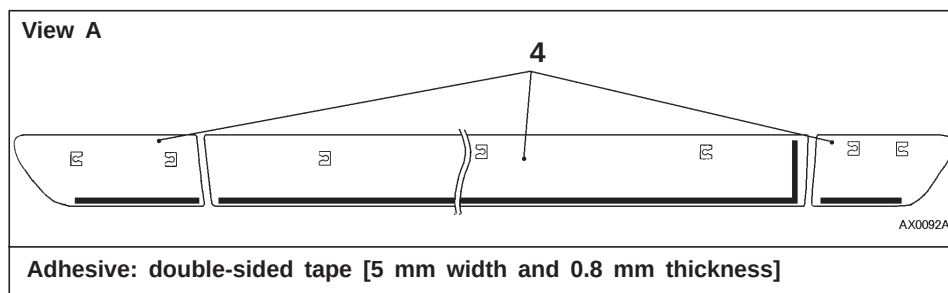
MOULDING AND GARNISH

REMOVAL AND INSTALLATION



NOTE

- ◀▶ : Clip positions
 ◀▶ : Bolt positions



Roof drip moulding removal steps

- Roof rail assembly <Vehicles with roof rail> (Refer to P.51-6)
- 1. Roof drip cover
- 2. Roof drip moulding
- 3. Windshield moulding (Refer to GROUP 42 – Windshield.)



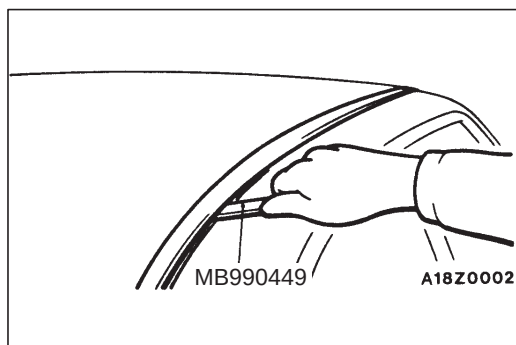
Side protector moulding removal



- 4. Side protector moulding

Rear licence plate garnish removal steps

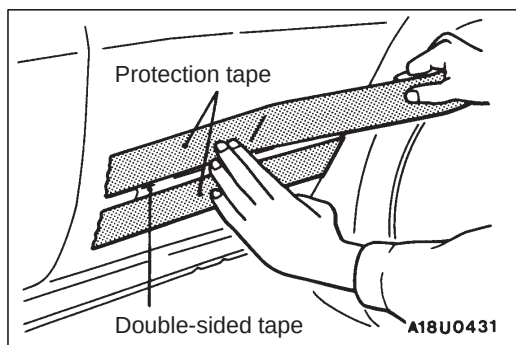
- Back door trim (Refer to GROUP 42 – Back door.)
- 5. Rear licence plate garnish

**REMOVAL SERVICE POINT****◀A▶ ROOF DRIP MOULDING REMOVAL**

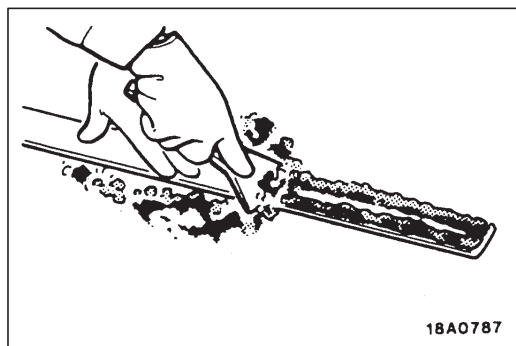
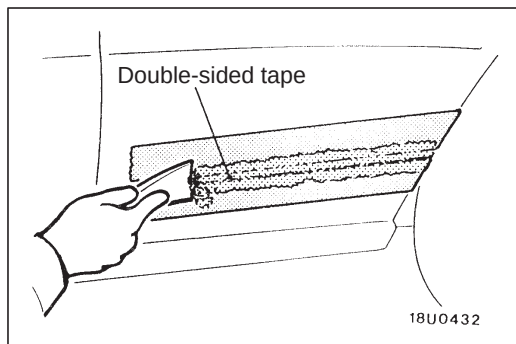
Use the special tool to lever out the moulding.

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**

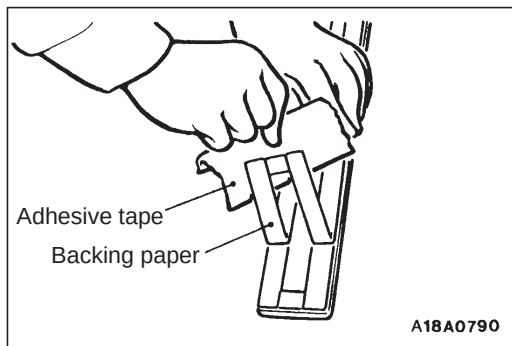
Double-sided tape affixing to the side protect moulding (when reusing)

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

51-10 EXTERIOR – Moulding and Garnish/Windshield Wiper and Washer



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

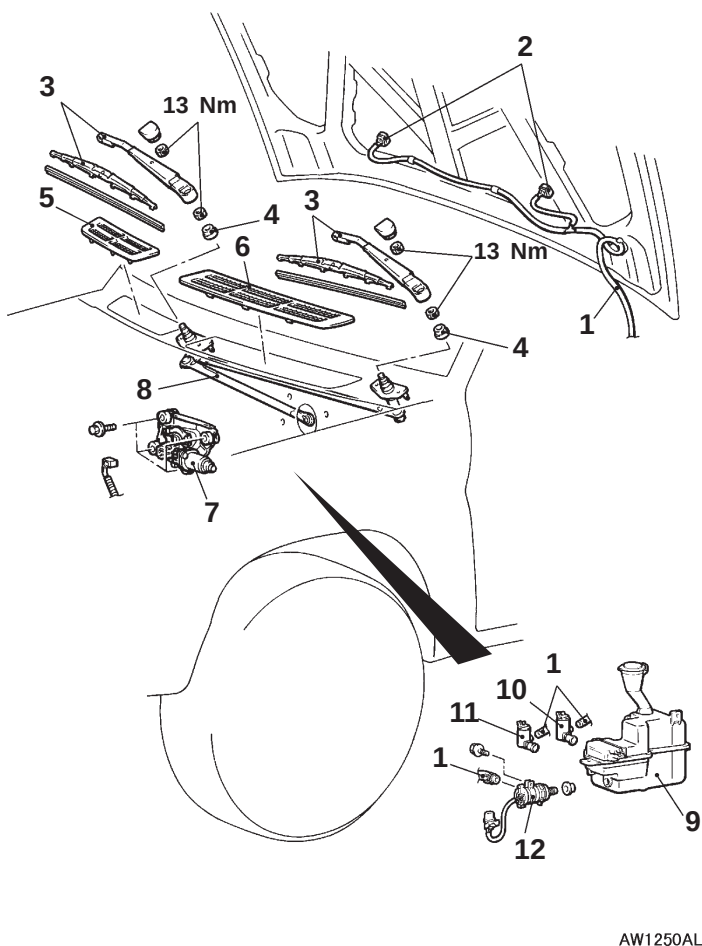
SERVICE SPECIFICATIONS

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 troubleshooting, refer to GROUP 54B – Troubleshooting.

WINDSHIELD WIPER AND WASHER REMOVAL AND INSTALLATION



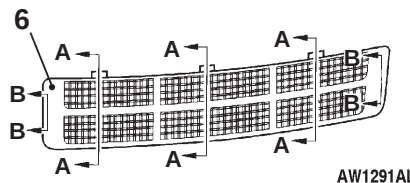
AW1250AL

1. Washer hose connection
2. Washer nozzle

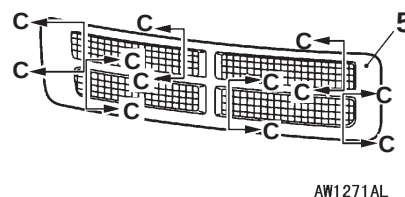
Wiper motor and linkage removal steps

- ▶ 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>
 7. Wiper motor
 8. Linkage assembly

◀ A ▶

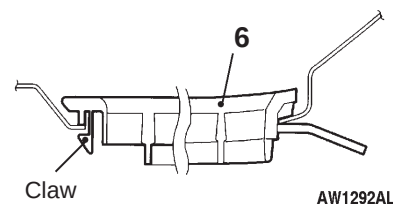


AW1291AL



AW1271AL

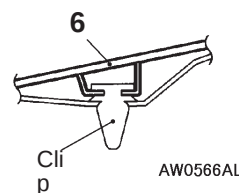
Section A – A



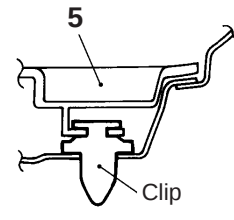
AW1292AL

Section B – B

Section C – C



AW0566AL



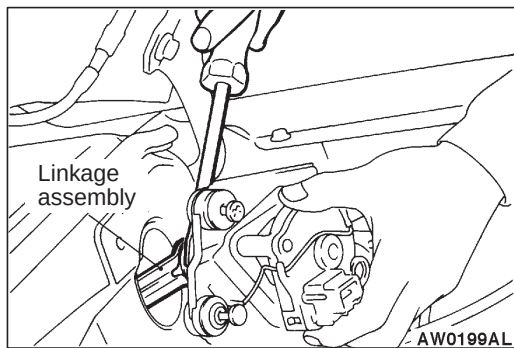
AW1272AL

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.



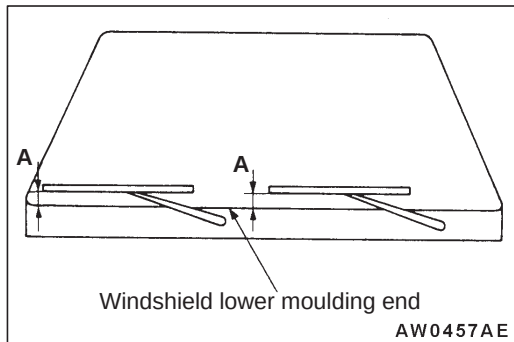
REMOVAL SERVICE POINT

◀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

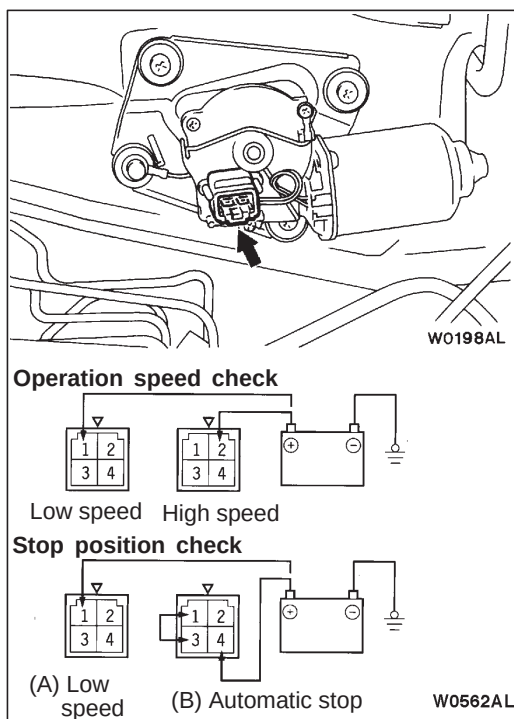
Disconnect the wiring harness connector, and then check the wiper motor operation with the wiper motor remaining installed to the body.

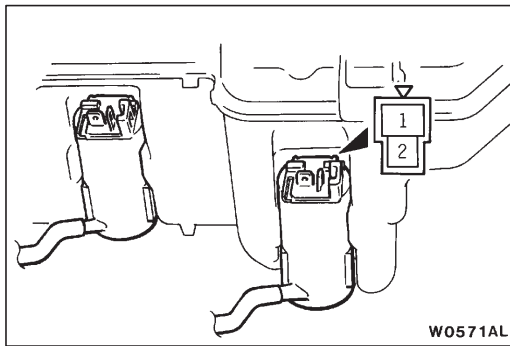
Wiper Motor Operation Speed

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.

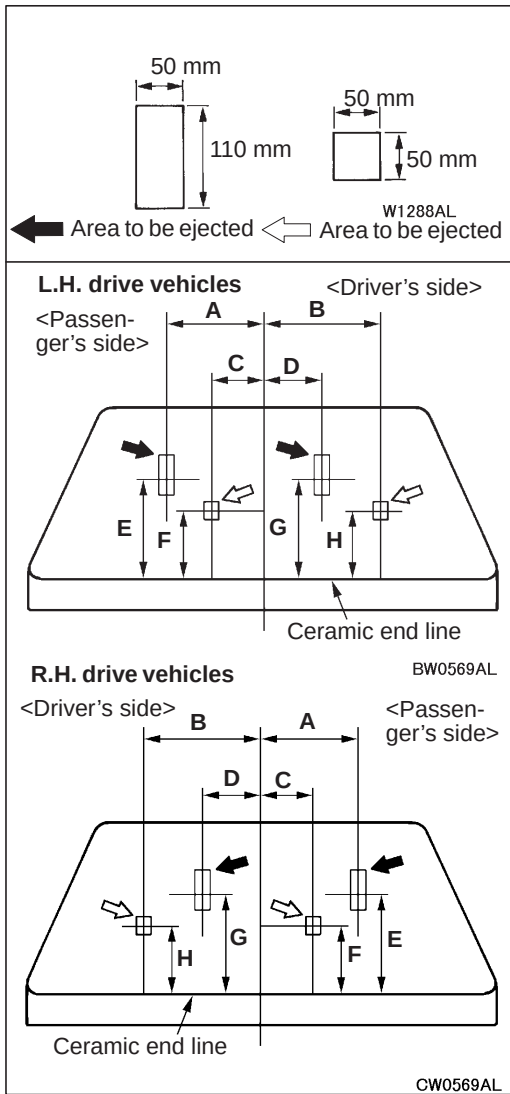


**WASHER MOTOR CHECK**

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

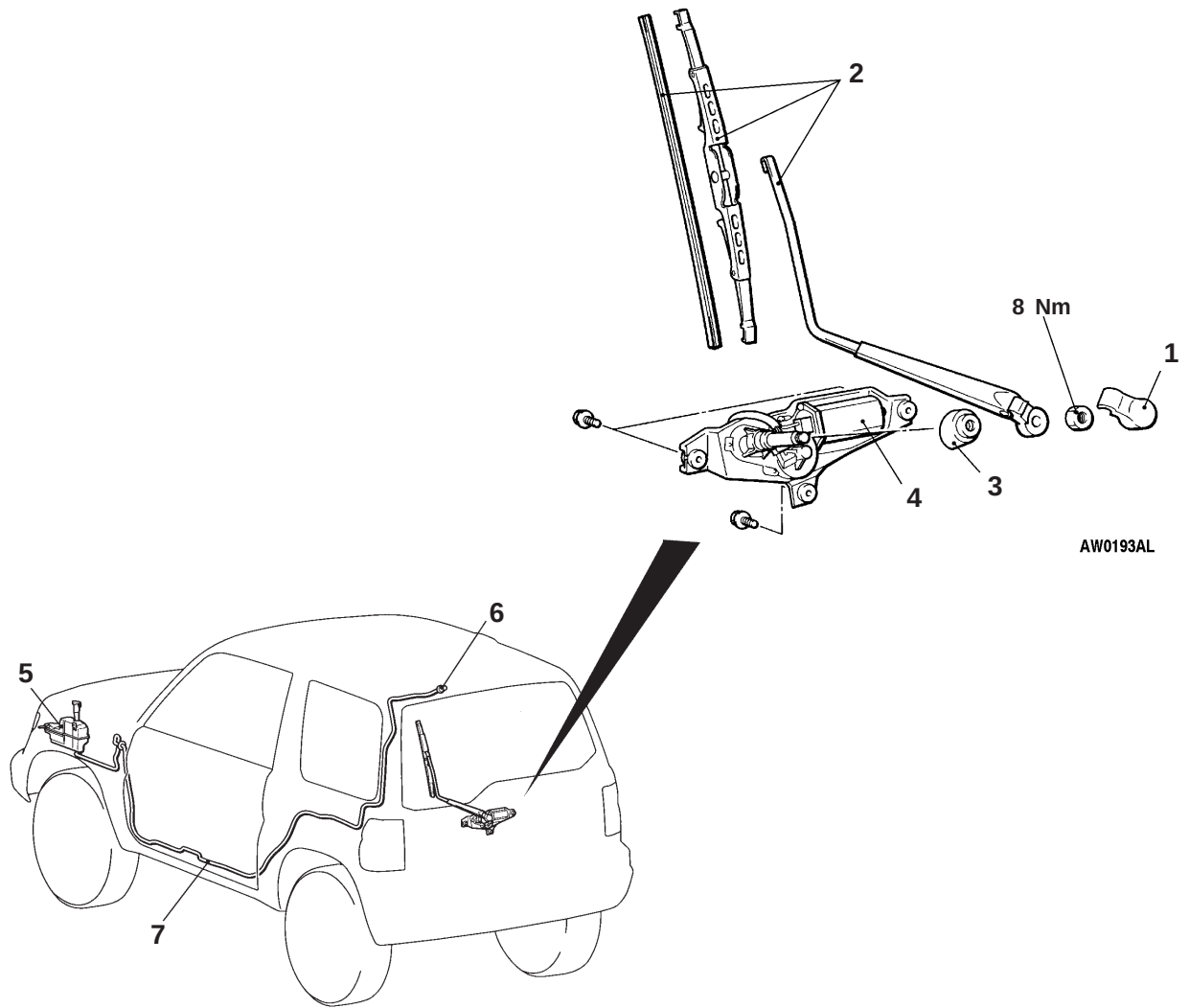
Items	Standard value
Park position of rear wiper arm and blade assembly (Distance between wiper blade and back door glass ceramic end line) mm	33 ± 5

TROUBLESHOOTING

The rear wiper and washer is controlled by the Smart Wiring System (SWS). For troubleshooting, refer to GROUP 54B – Troubleshooting.

REAR WIPER AND WASHER

REMOVAL AND INSTALLATION



Wiper motor assembly removal steps

- Back door trim (Refer to GROUP 42.)
- 1. Cover
- 2. Wiper arm and blade assembly
- 3. Grommet
- 4. Wiper motor assembly



Washer tank and washer motor removal

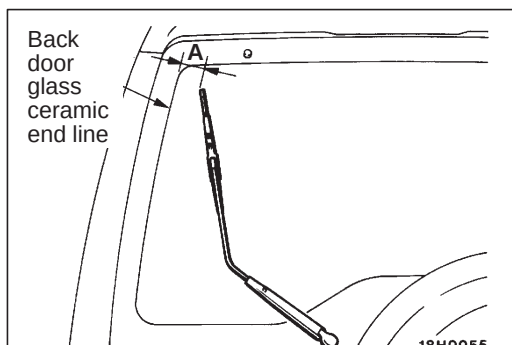
- 5. Washer tank and washer motor (Refer to P.51-11.)

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

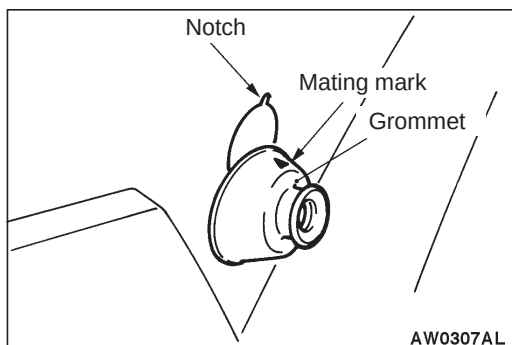
NOTE

For removal and installation of the column switch assembly (wiper and washer switch), refer to GROUP 37A – Steering Wheel and Shaft.

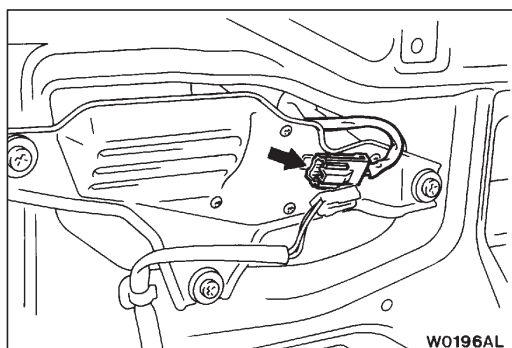
**INSTALLATION SERVICE POINT****►A◄ WIPER ARM AND BLADE ASSEMBLY INSTALLATION**

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**

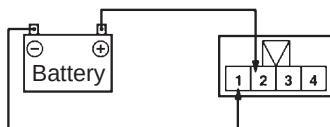
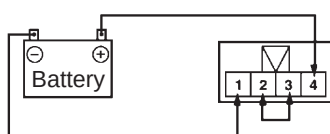
Disconnect the wiring harness connector, and check the wiper motor operation with the wiper motor remaining installed to the body.

Wiper Motor Operation

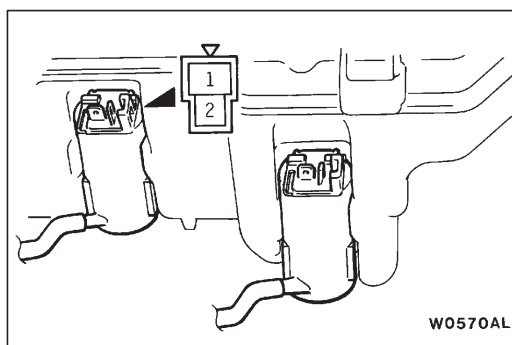
Connect a battery to the wiper motor as shown in the illustration and check the motor operation.

Wiper Motor Stop Position

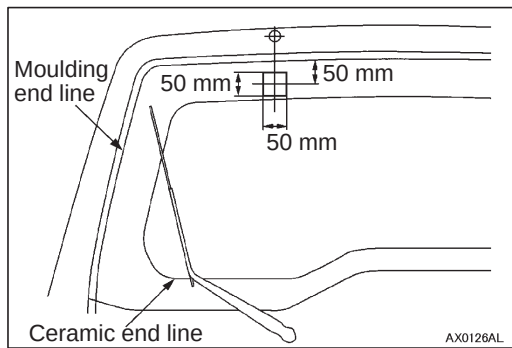
1. Operate the wiper motor, and then disconnect the battery to stop the wiper motor while the wiper motor is operating.
2. Reconnect the battery as shown in the illustration, and confirm that after the motor starts turning, it stops at the automatic stop position.

Operation check**Stop position check**

W0729AL
00008917

**WASHER MOTOR CHECK**

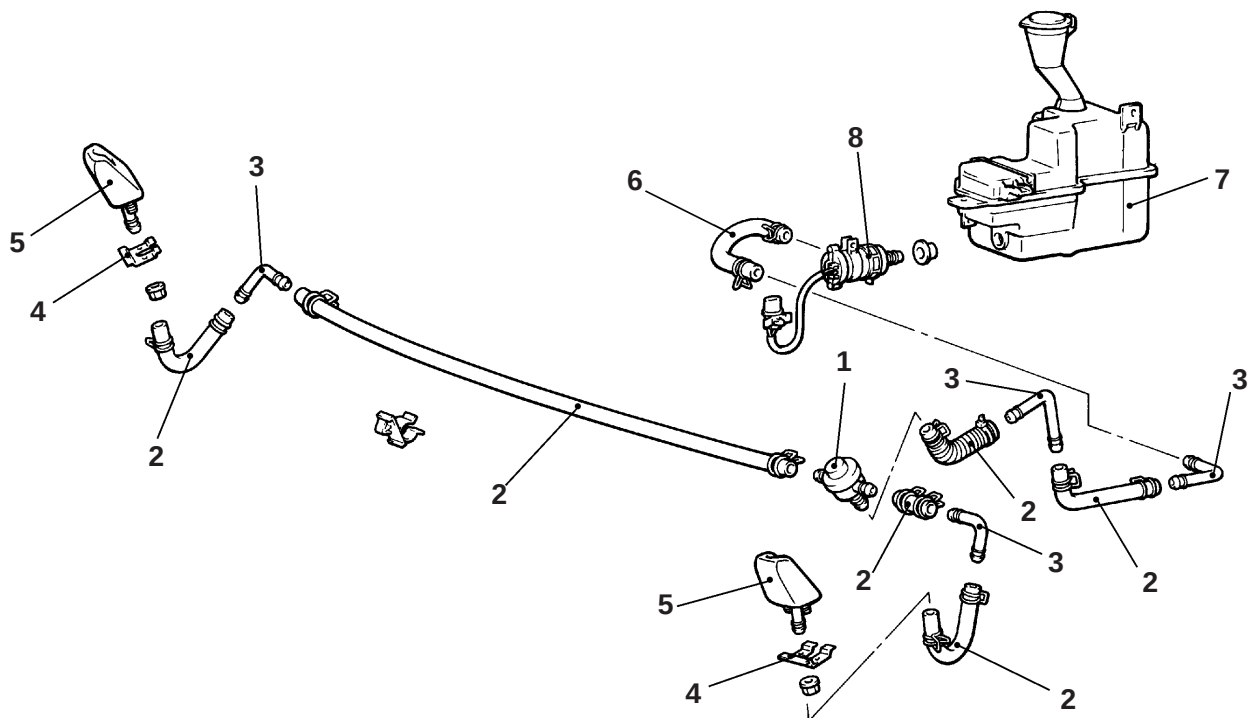
1. With the washer motor installed to the washer tank, fill the washer tank with water.
2. Check that the water squirts out strongly when system voltage is applied to terminal 2 and terminal 1 is earthed.

**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 troubleshooting, refer to GROUP 54B – Troubleshooting.

HEADLAMP WASHER**REMOVAL AND INSTALLATION**

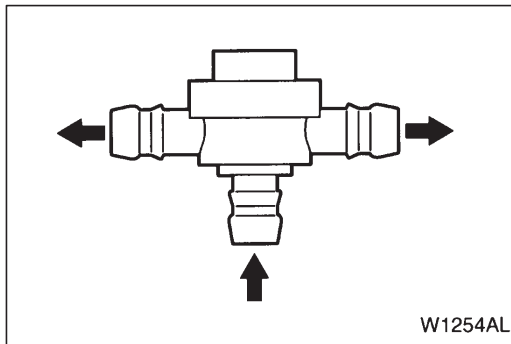
AW1249AL

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

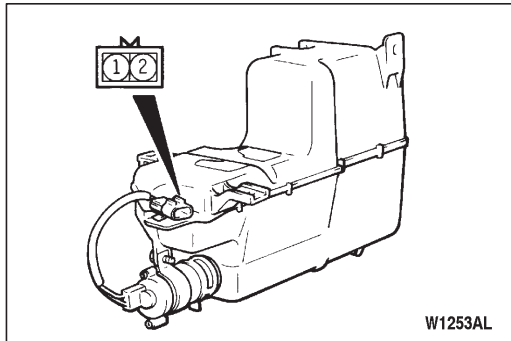
Washer tank removal steps

- 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.

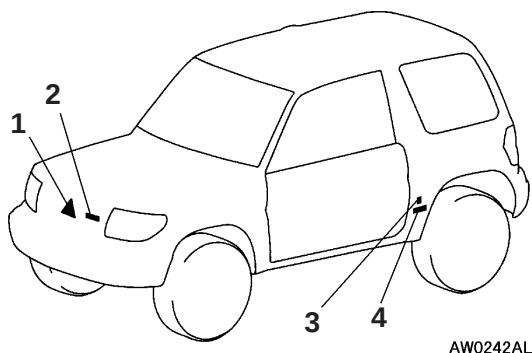
Opening pressure: 78 kPa

**HEADLAMP WASHER MOTOR CHECK**

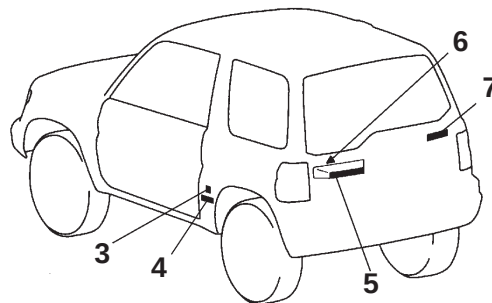
1. With the washer motor installed to the washer tank, fill the washer tank with water.
2. Connect battery (+) and (–) cables to terminals (1) and (2) respectively to see that the washer motor runs and water is injected.

MARKS

REMOVAL AND INSTALLATION



AW0242AL



AW0243AL

1. Three diamonds mark
2. "GDI" mark
3. Pininfarina mark
4. Pininfarina logo mark

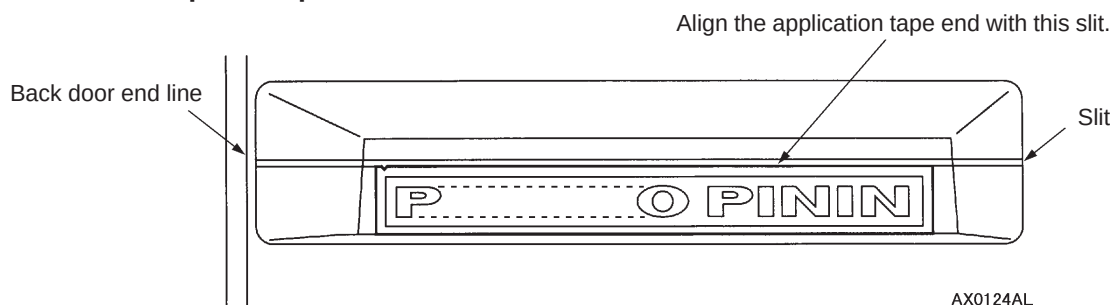
5. Vehicle name decal
6. Three diamonds mark
7. "GDI" mark

INSTALLATION SERVICE POINT

▶A◀ INSTALLATION OF MARKS

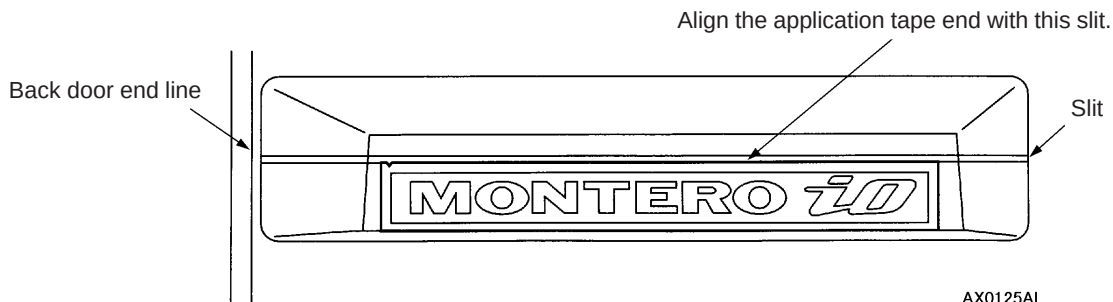
1. APPLICATION POSITION

(5) Vehicle name decal <Vehicles except for Spain>



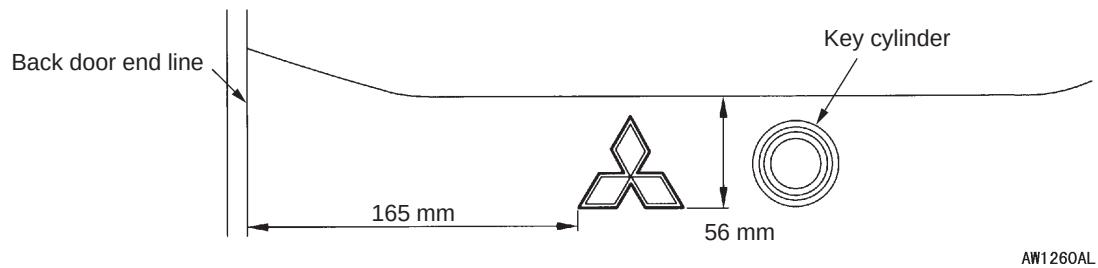
AX0124AL

<Vehicles for Spain>

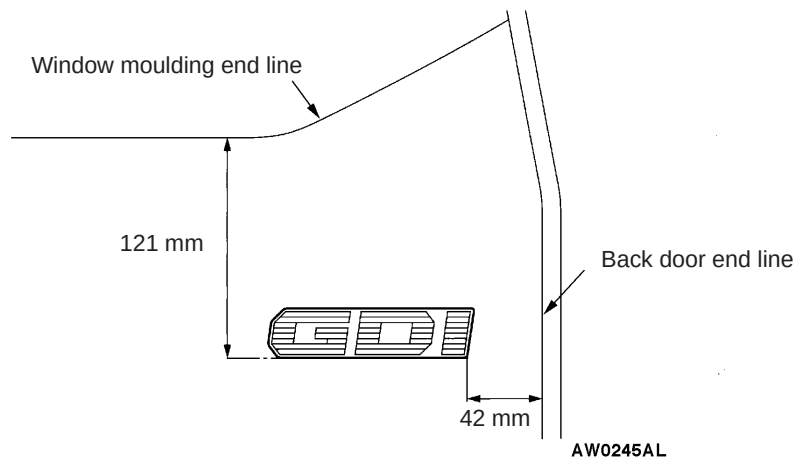


AX0125AL

(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.

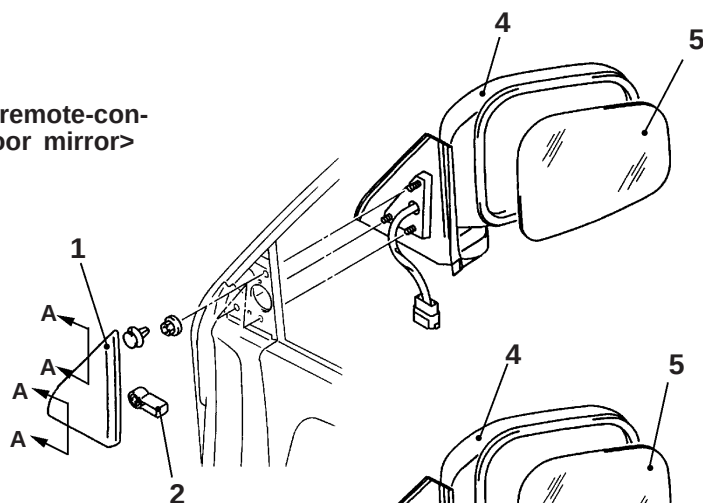
If the surrounding temperature is lower than 20°C, the marks and the places on the body where the marks are to be attached should be heated to 20–38°C.

When the marks are attached, care should be used not to allow bubble to enter between tape and the body.

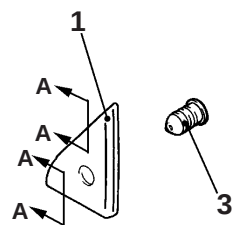
OUTSIDE DOOR MIRROR

REMOVAL AND INSTALLATION

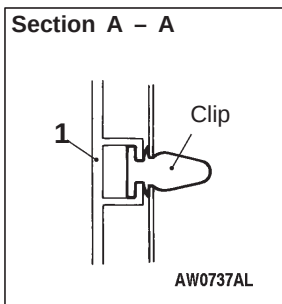
<Electric remote-controlled door mirror>



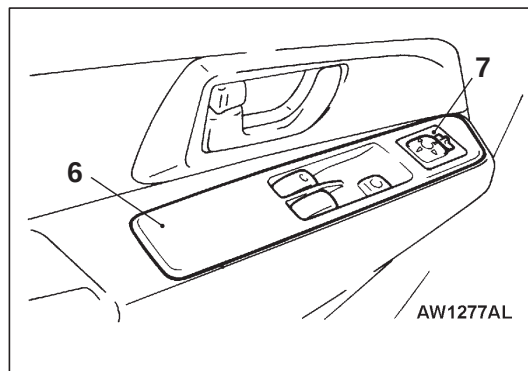
<Manual-controlled door mirror >



AW0216AL



AW0737AL



AW1277AL

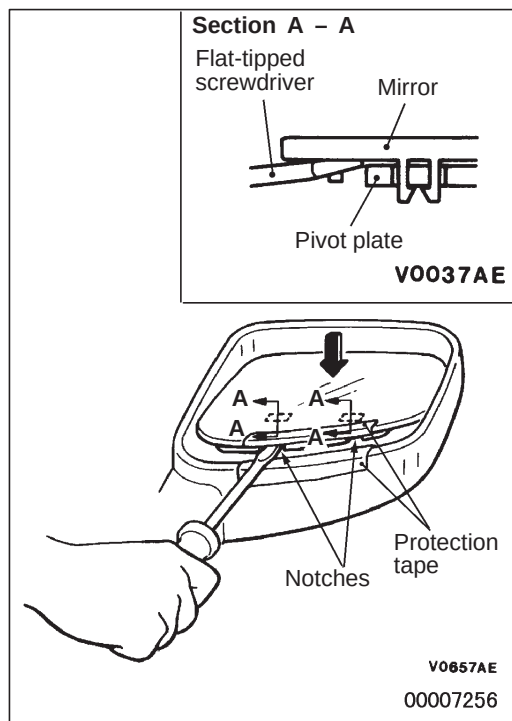
Door mirror removal steps

1. Delta inner cover
2. Clip
3. Boot
4. Mirror assembly
5. Mirror

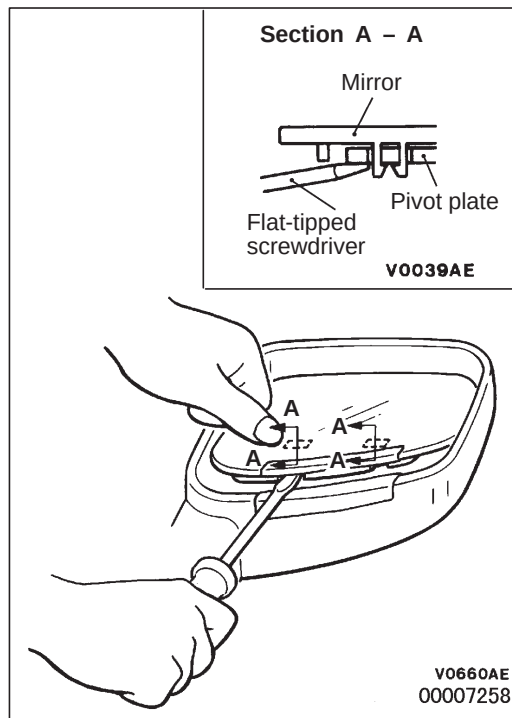


Electric remote-controlled mirror switch removal steps

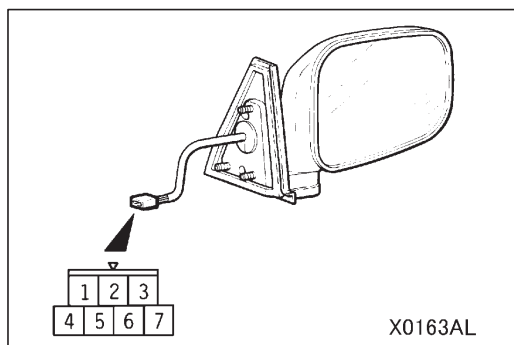
6. Power window and remote-controlled mirror switch assembly (Refer to GROUP 42 – Door trim and water proof film.)
7. Electric remote-controlled mirror switch

**REMOVAL SERVICE POINT****◀A▶ MIRROR REMOVAL**

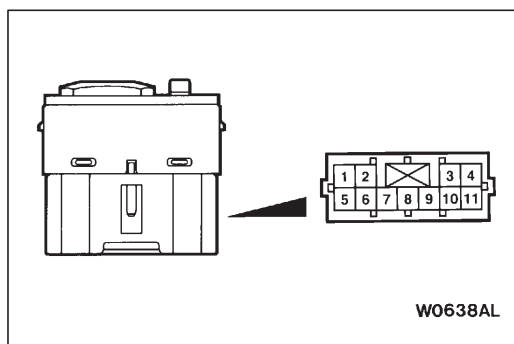
Using a hand, push the upper part of mirror to tilt it. Apply a protection tape as shown in the illustration. Insert a flat-tipped screwdriver between a notch behind the mirror and the pivot plate, and then pry off the lower part of mirror from the pivot plate.

**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

INTERIOR AND SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

CONTENTS

INTERIOR	52A
SUPPLEMENTAL RESTRAINT SYSTEM (SRS)	52B

INTERIOR

CONTENTS

SPECIAL TOOL	3	SEAT	12
INSTRUMENT PANEL*	3	Front Seat*	12
FLOOR CONSOLE	7	Rear Seat	15
TRIMS	9	SEAT BELT	17
INSIDE REAR VIEW MIRROR	11	Front Seat Belt	17
HEADLINING	11	Rear Seat Belt	18

WARNINGS REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLES

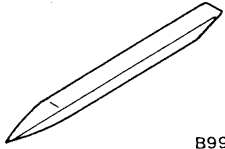
WARNING!

- (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

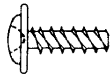
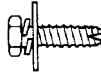
The SRS includes the following components: SRS-ECU, SRS warning lamp, air bag module, clock spring, side impact sensors and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents 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

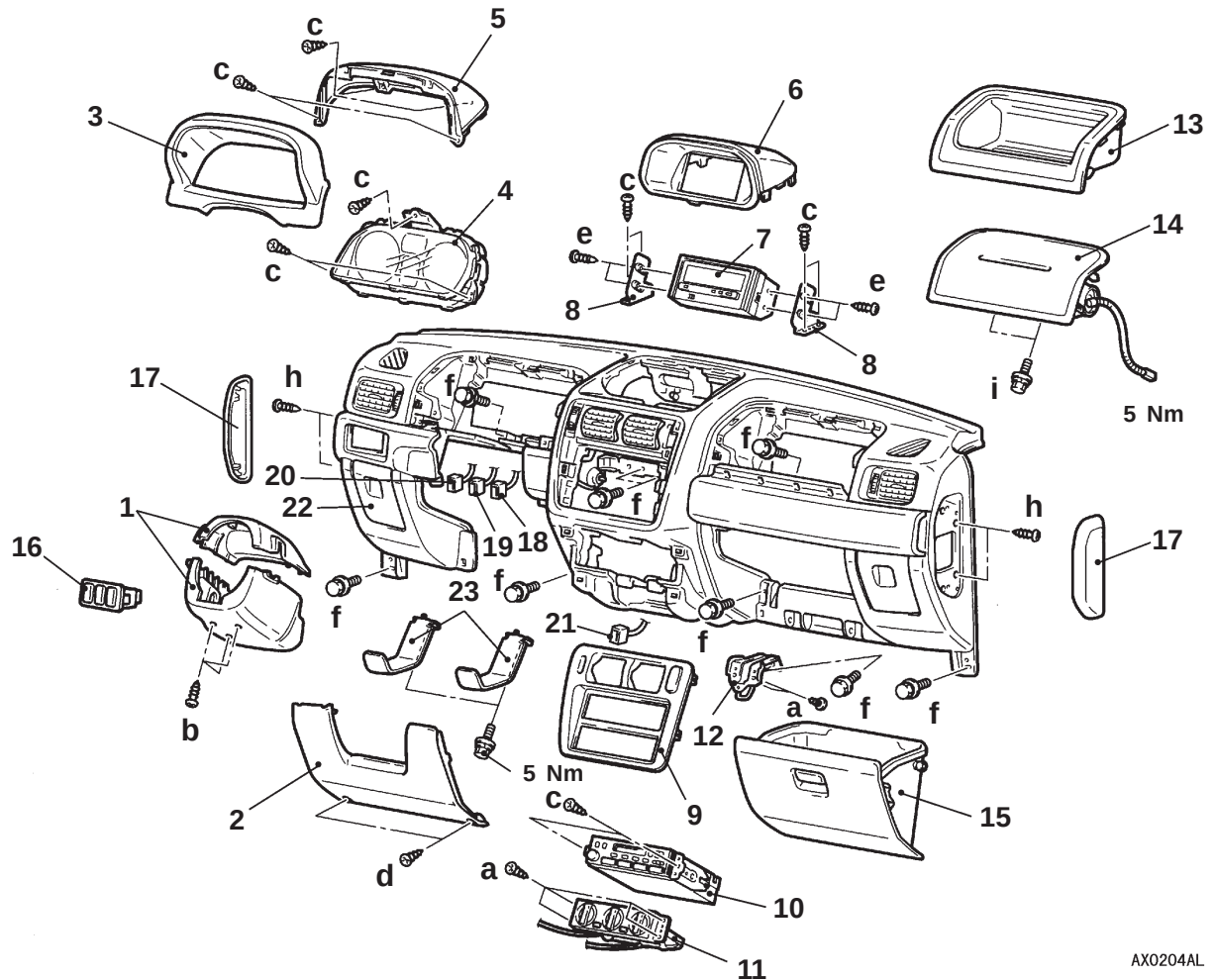
L = Effective thread length

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



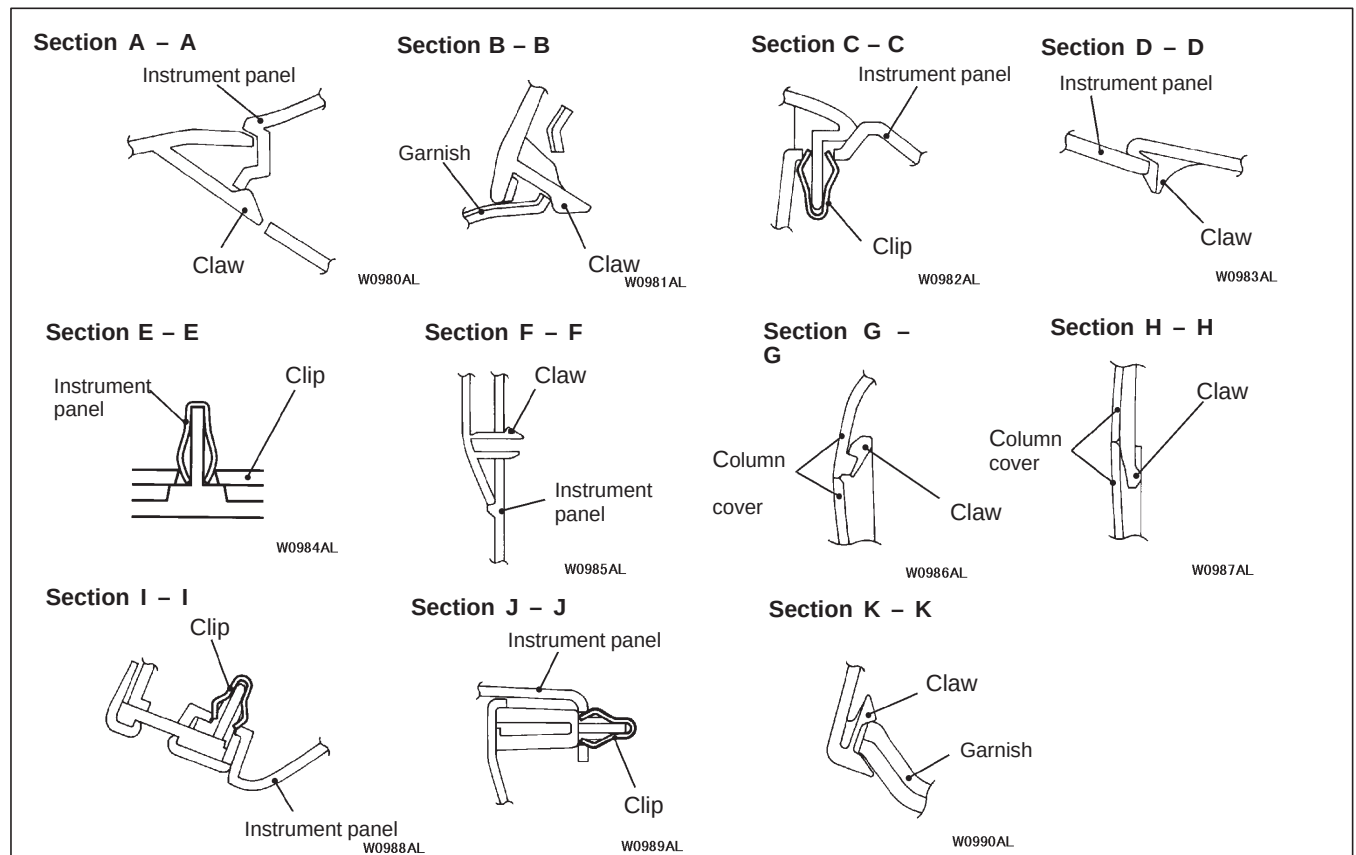
AX0204AL

Removal steps

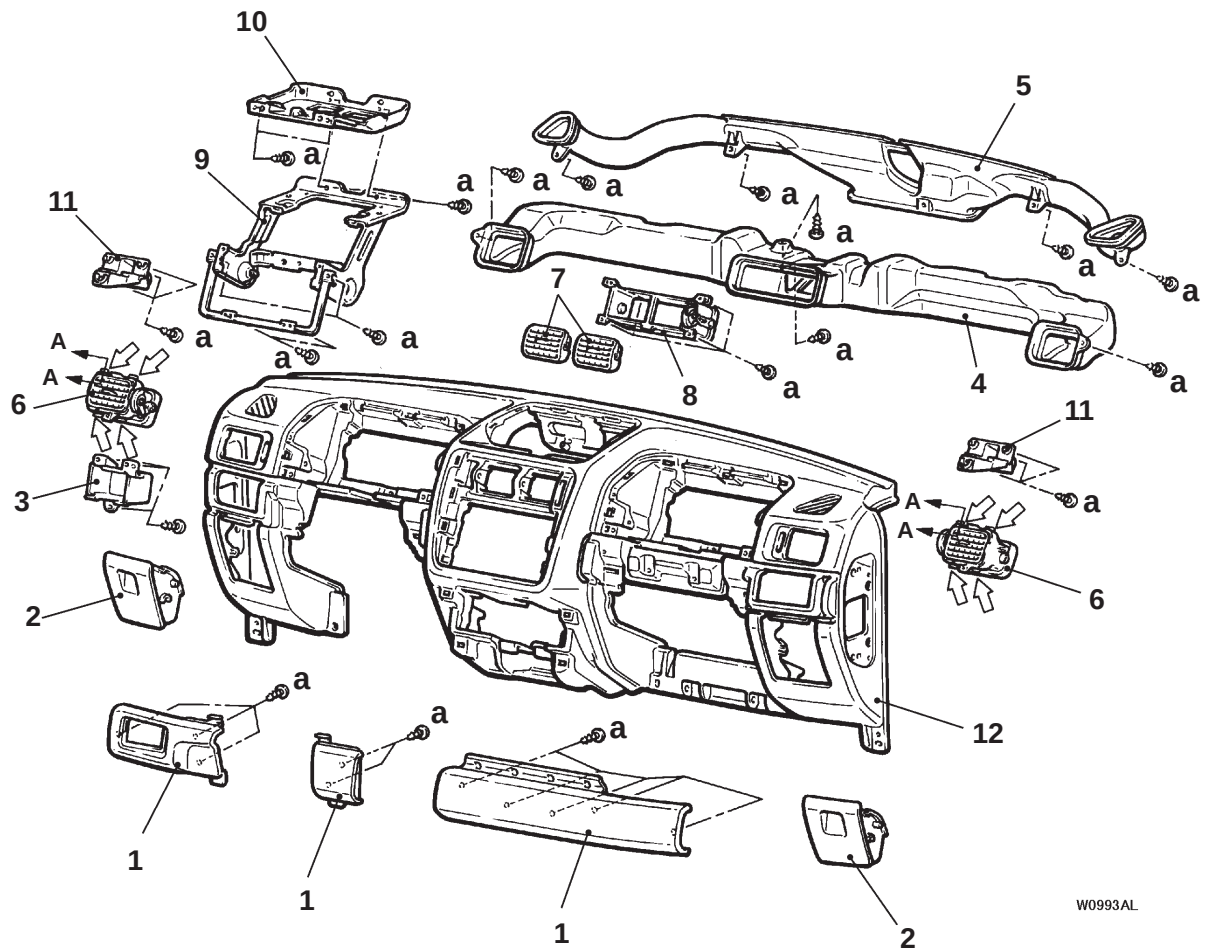
1. Column cover
2. Under cover
3. Meter hood B
4. Combination meter
5. Meter hood A
6. Multi-center display hood
7. Multi-center display
8. Multi-display bracket
9. Center panel
10. Radio and tape player
11. Heater control assembly or automatic A/C control panel assembly
12. Glove box striker
13. Instrument 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 positions
 : Claw positions

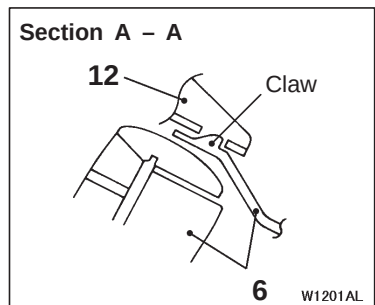
AX0205AL



DISASSEMBLY AND REASSEMBLY



W0993AL



W1201AL

NOTE

↔ : Claw positions

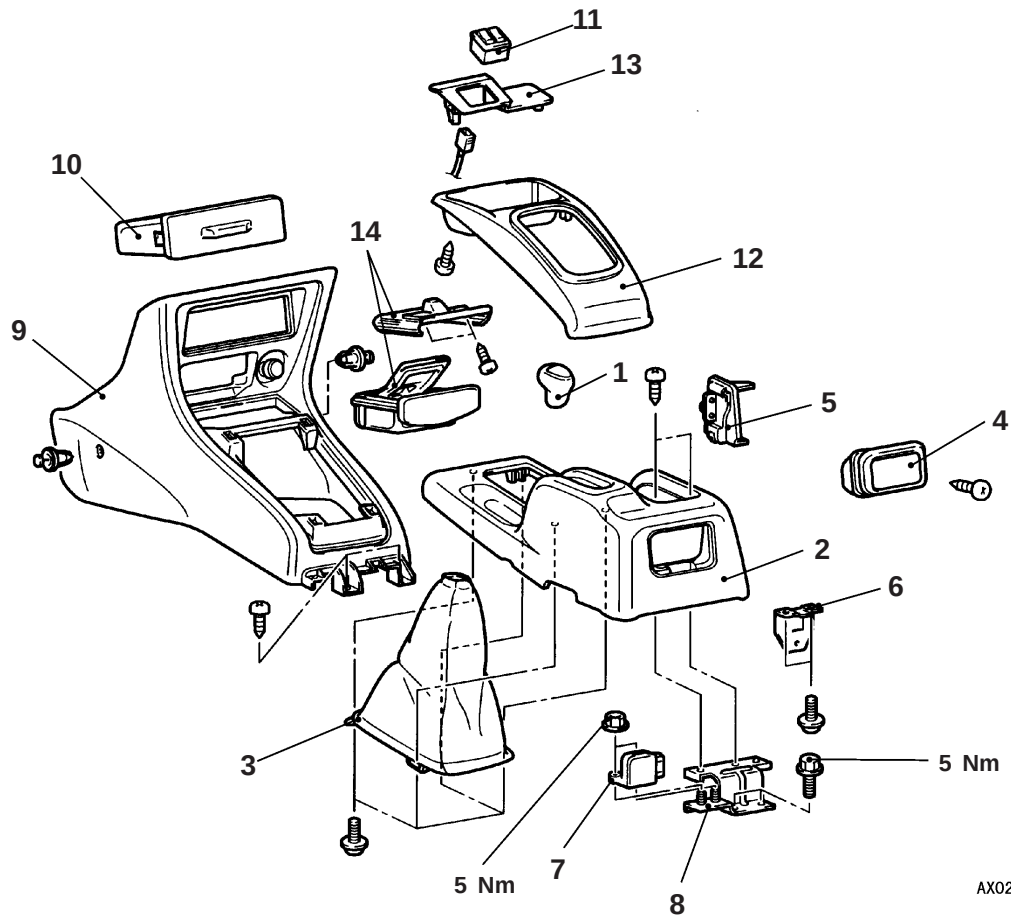
Disassembly steps

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

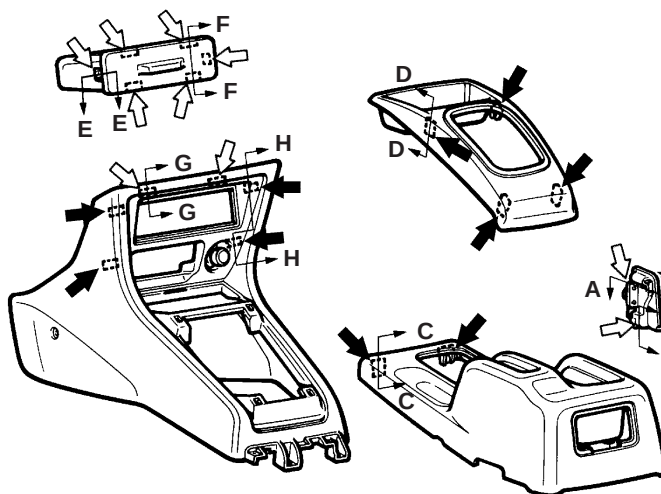
REMOVAL AND INSTALLATION



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



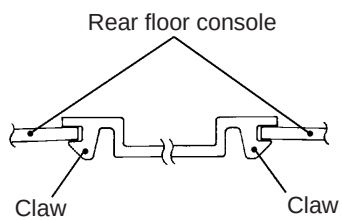
W0250AL

NOTE

➡ : Clip positions

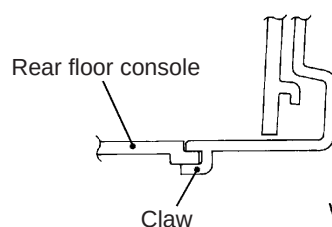
↔ : Claw positions

Section A – A



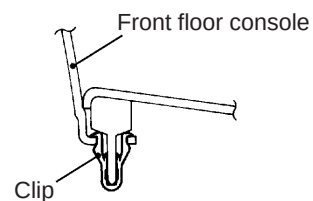
W0251AL

Section B – B



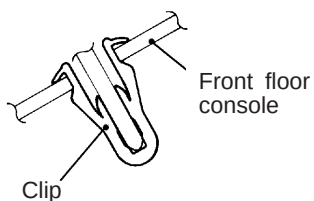
W0256AL

Section C – C



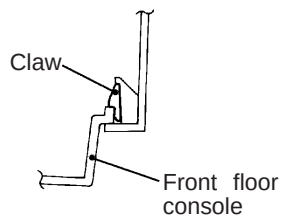
W0255AL

Section D – D



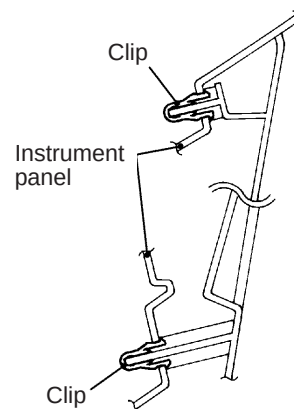
W0254AL

Section E – E



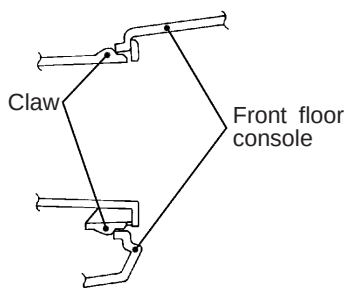
W0252AL

Section H – H



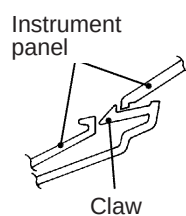
W0257AL

Section F – F



W0253AL

Section G – G

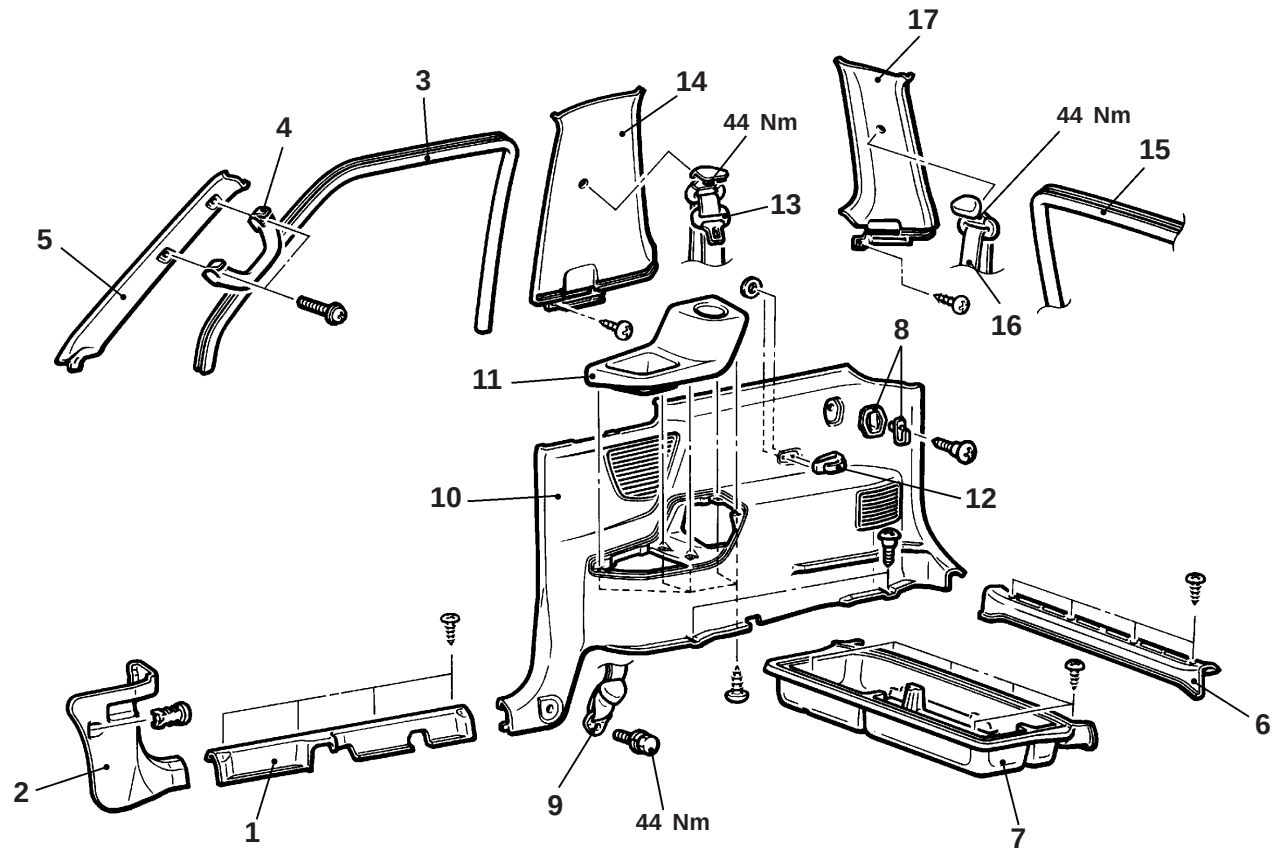


W0262AL

00008903

TRIMS

REMOVAL AND INSTALLATION

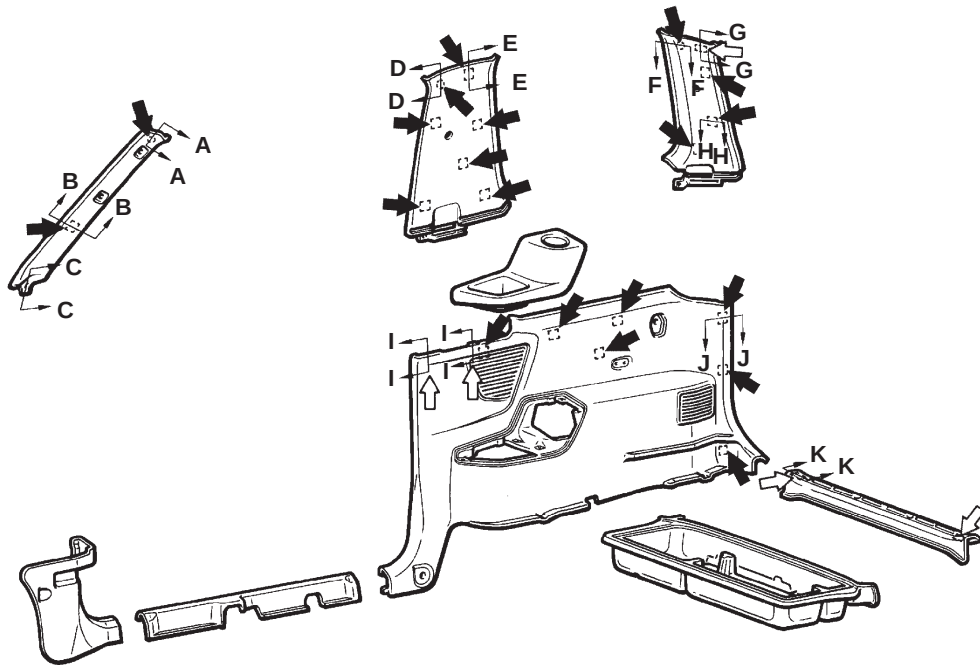


AW0137AL

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



W0288AL

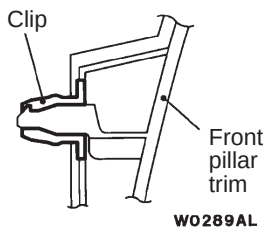
NOTE

: Clip positions

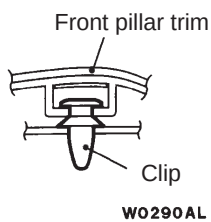
: Claw positions

For door trim, refer to GROUP 42.

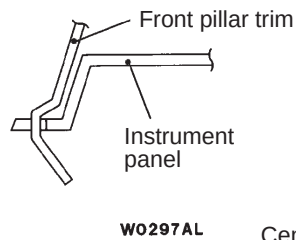
Section A – A



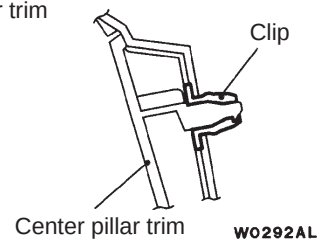
Section B – B



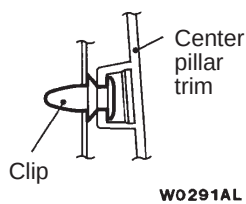
Section C – C



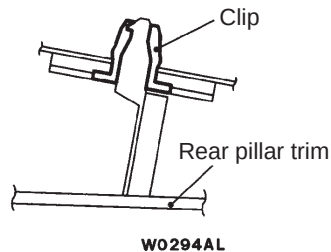
Section D – D



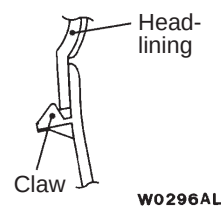
Section E – E



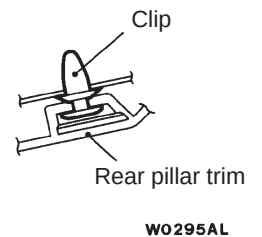
Section F – F



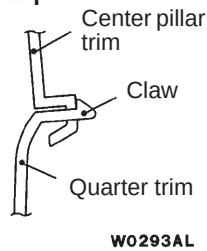
Section G – G



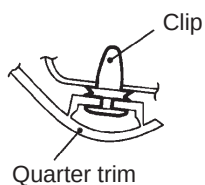
Section H – H



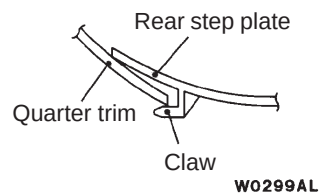
Section I – I



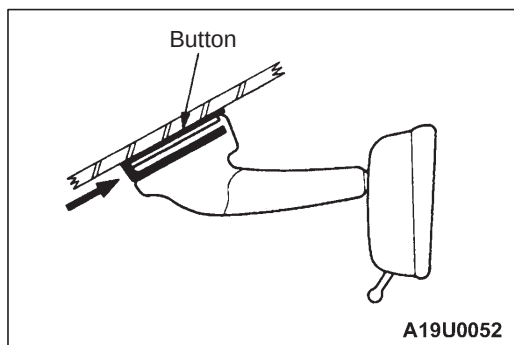
Section J – J



Section K – K



00008904



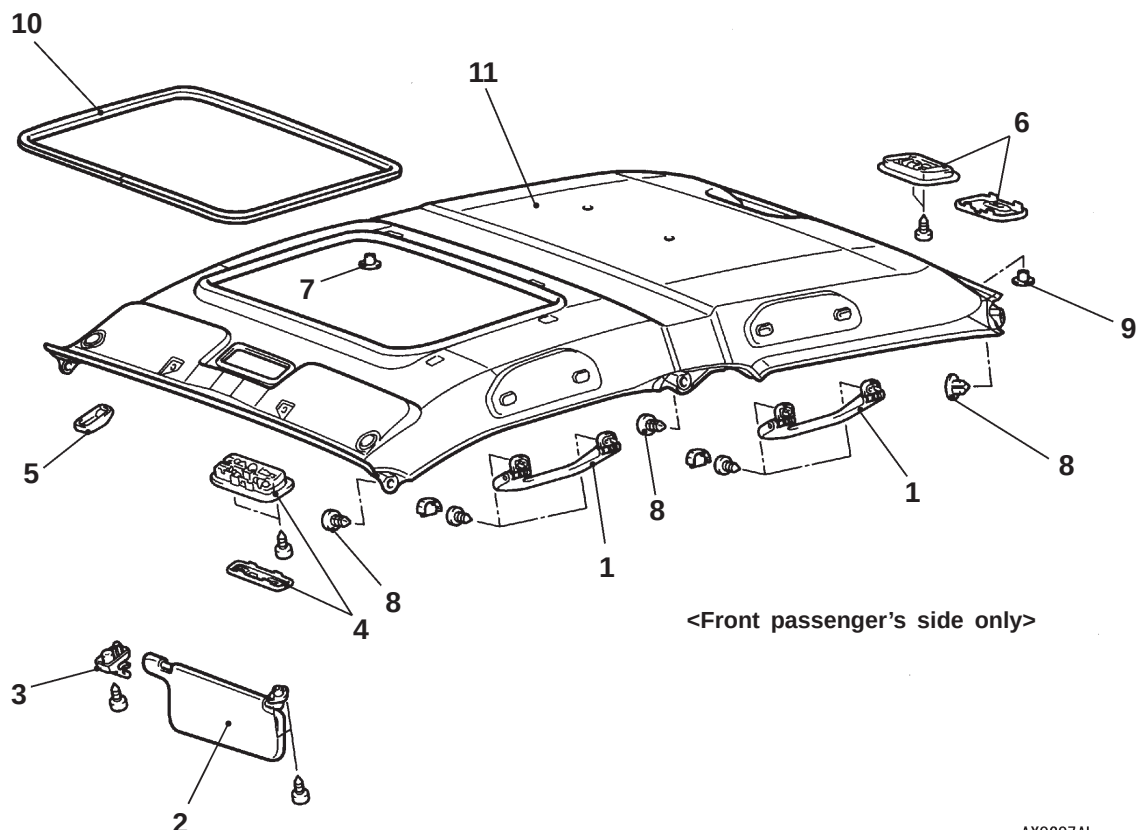
INSIDE REAR VIEW MIRROR

REMOVAL SERVICE POINT

Remove by pushing in the direction of the arrow in the illustration.

HEADLINING

REMOVAL AND INSTALLATION



AX0207AL

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

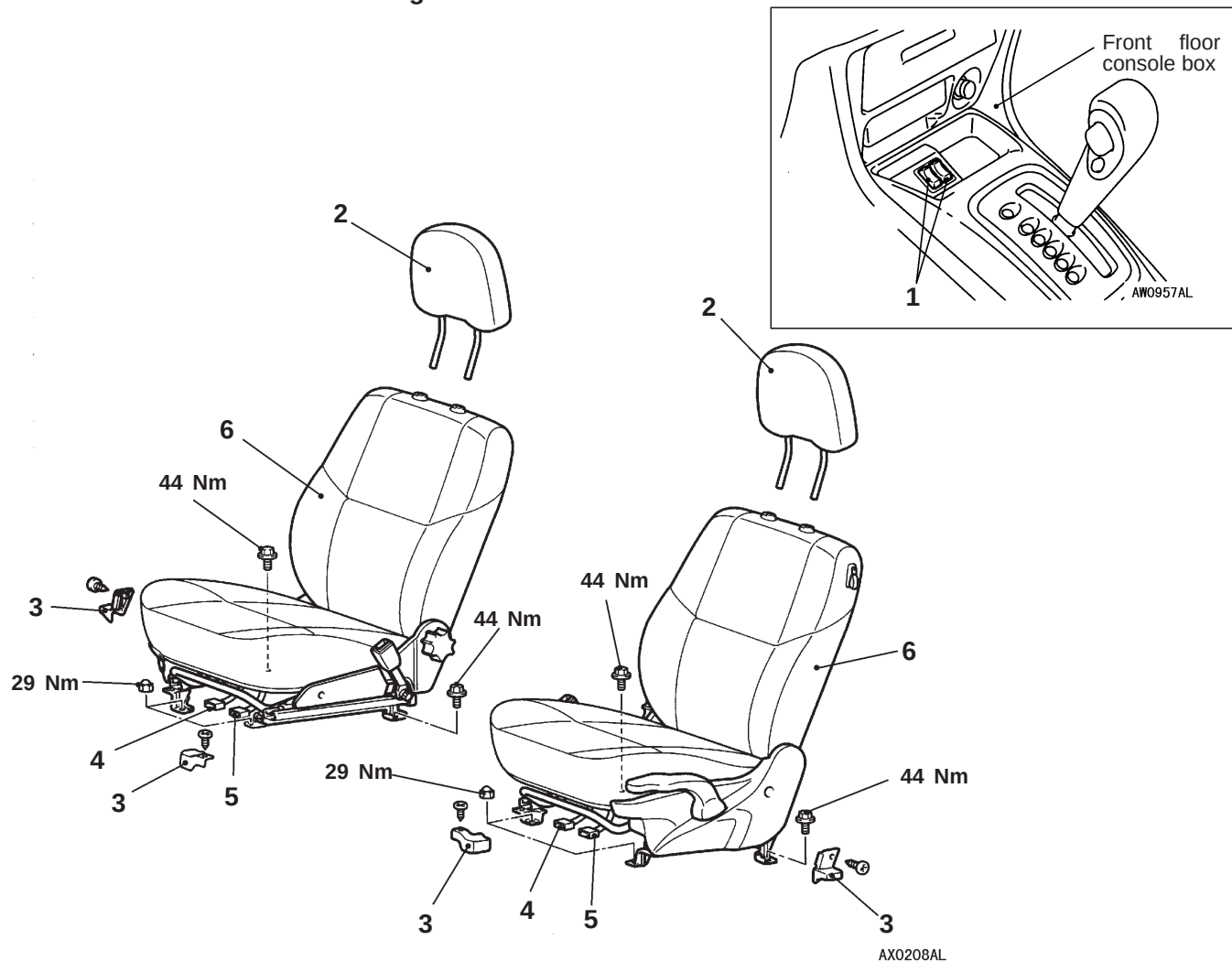
SEAT

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**.

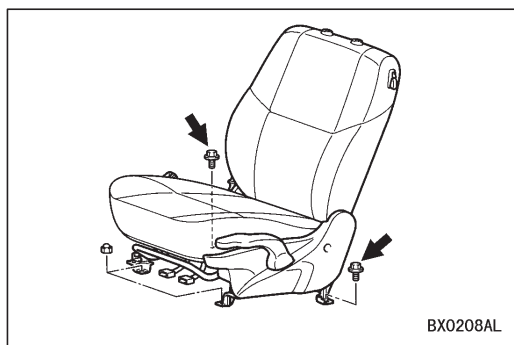


1. Heated seat switch
<Vehicles with heated seat>
2. Headrest

Front seat assembly removal steps

3. Front seat anchor cover

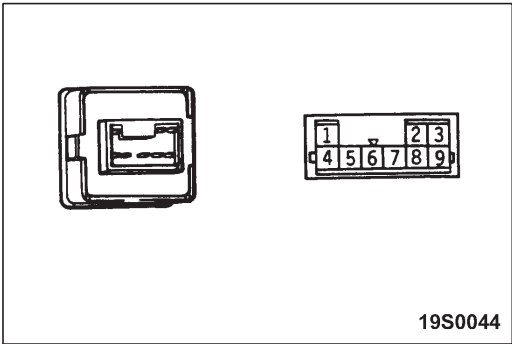
4. Heated seat harness connector
<Vehicles with heated seat>
5. Side air bag module harness connector <Vehicles with SRS side air bag>
6. Front seat assembly



INSTALLATION SERVICE POINT

►◄ 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.



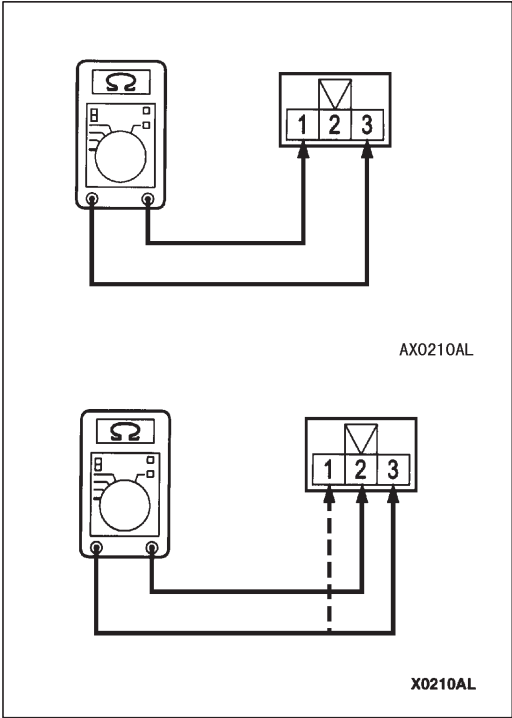
INSPECTION
HEATED SEAT SWITCH CONTINUITY CHECK

Switch position		Terminal No.									
		1	3	4	5	-	8	9	2	-	6
Driver's seat switch	HI	○	○		○		○				
	LO		○		○		○				
Passenger's seat switch	HI			○	○		○	○			
	LO				○			○			

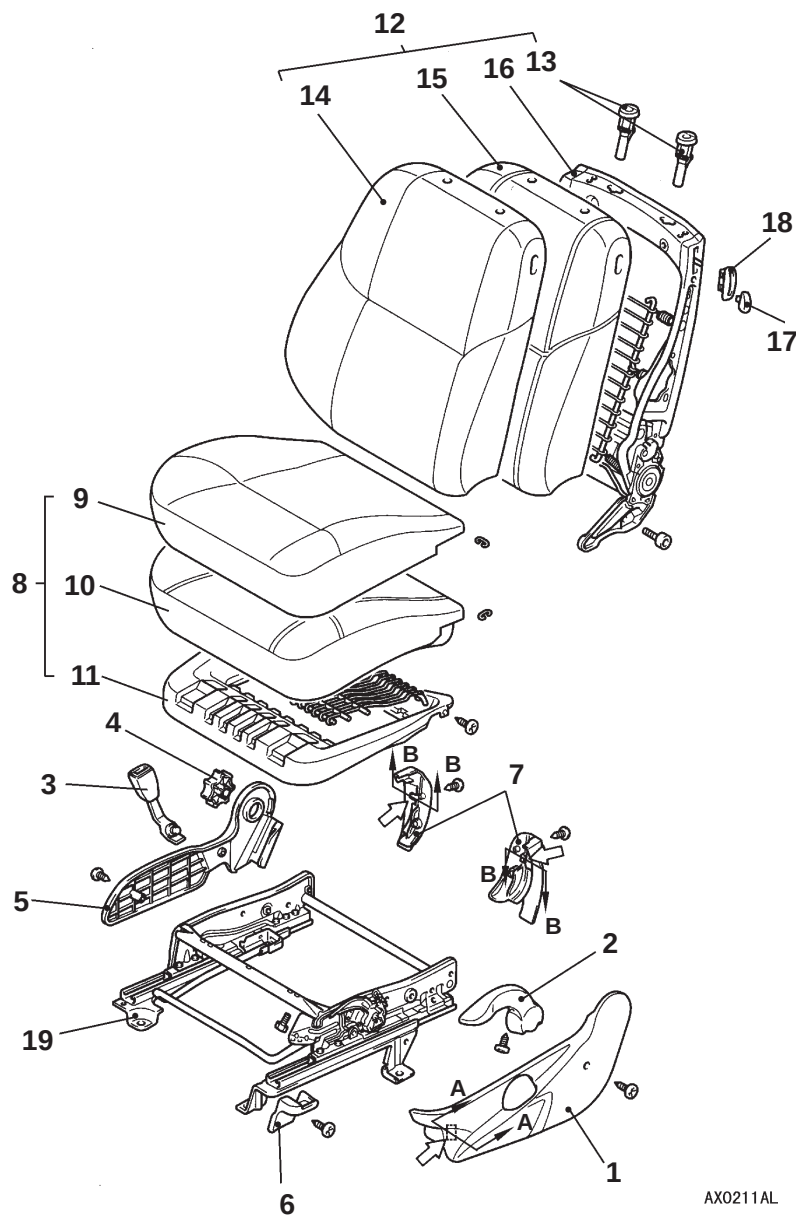
NOTE
To inspect the diode, match the polarity of the circuit tester with the (+) (–) polarities in the table.

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



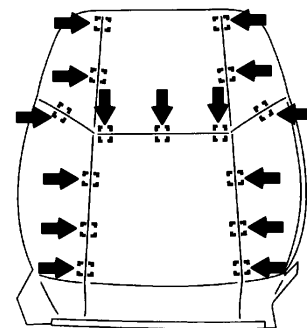
DISASSEMBLY AND REASSEMBLY

**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

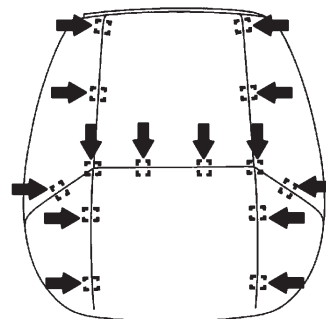


<Front view of front seat back>



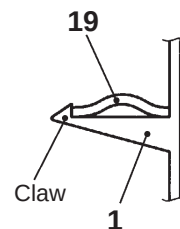
<Front view of front seat cushion>

AX0212AL

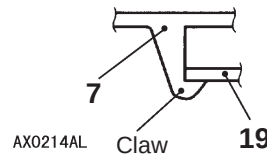


AX0213AL

Section A-A



Section B-B

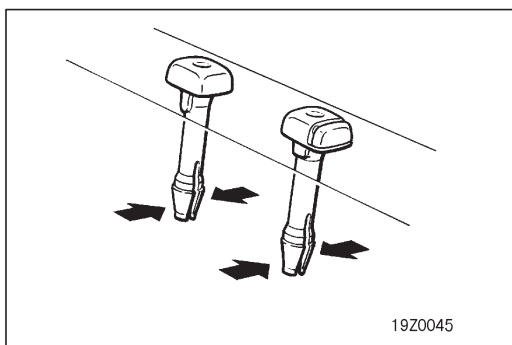


AX0215AL

NOTE

- : Hog ring positions
 : Claw positions

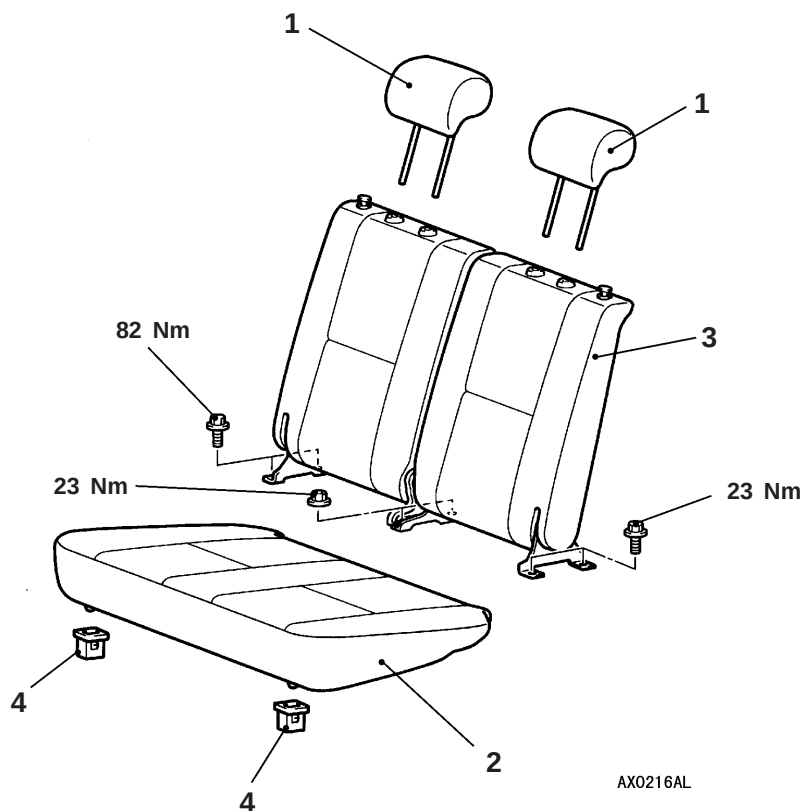
10. Front seat cushion pad
11. Front seat cushion frame
12. Front seat back assembly
13. Headrest guide
14. Front seat back cover
15. Front seat back pad
16. Front seat back frame
17. Release lever knob
18. Release lever trim
19. Seat slide adjuster



REMOVAL SERVICE POINT

◀A▶ HEADRESTRAINT GUIDE REMOVAL

REAR SEAT REMOVAL AND INSTALLATION



1. Headrest

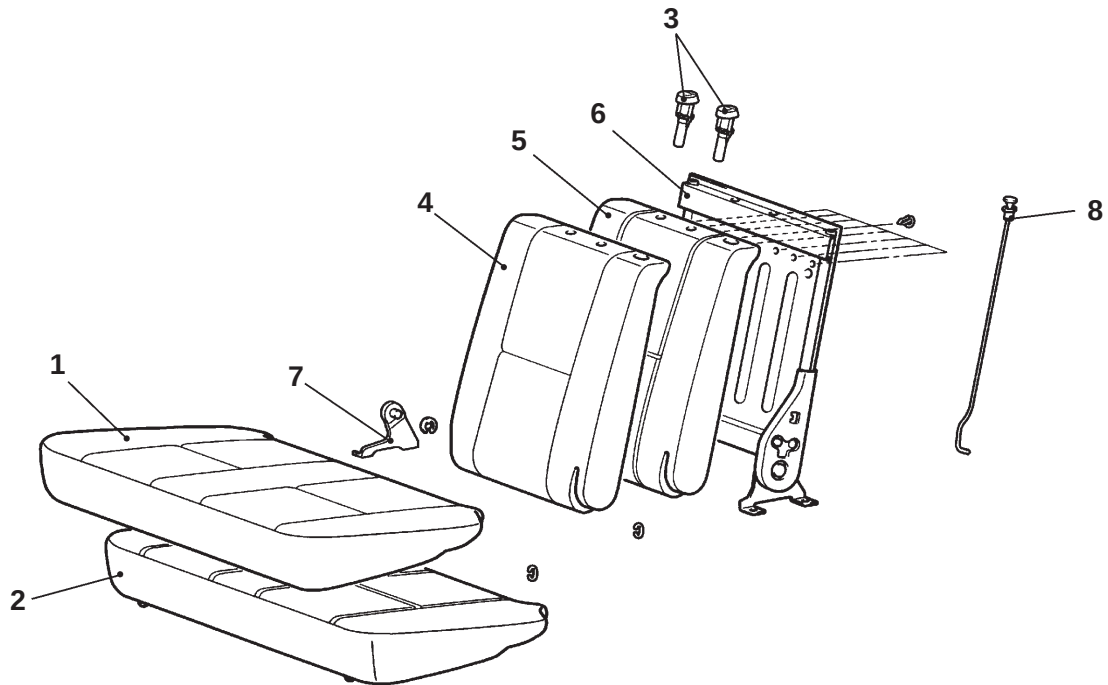
Rear seat assembly removal steps

2. Rear seat cushion assembly

3. Rear seat back assembly

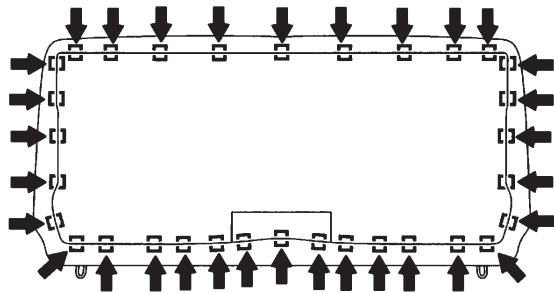
4. Rear seat stopper

DISASSEMBLY AND REASSEMBLY



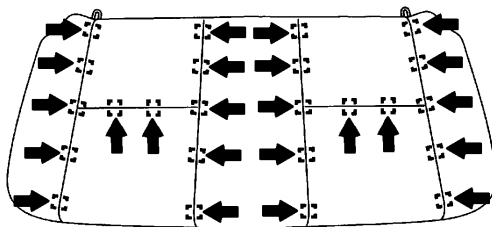
AX0217AL

<Back view of rear seat cushion>



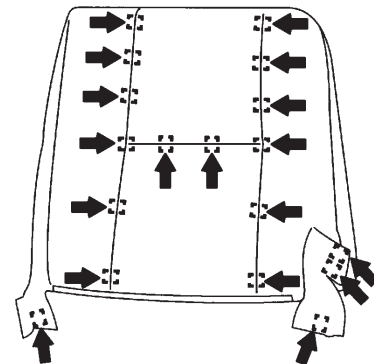
AX0218AL

<Front view of rear seat cushion>



AX0219AL

<Front view of rear seat back>



AX0220AL

NOTE

← : Hog ring positions

Disassembly steps

1. Rear seat cushion cover
2. Rear seat cushion pad
3. Headrest 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



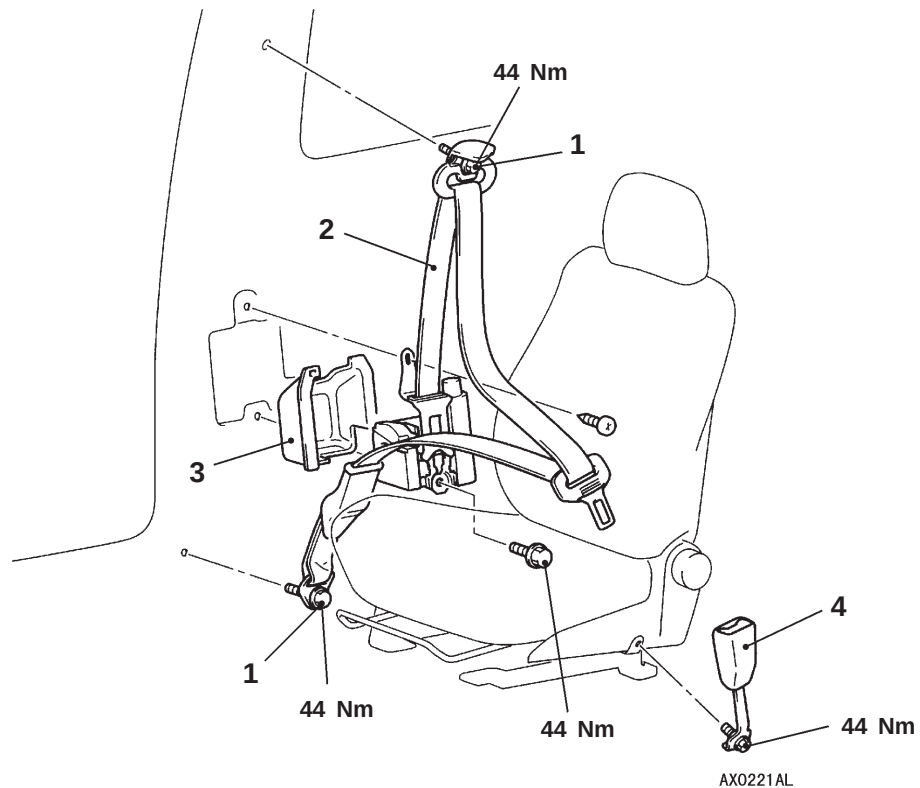
SEAT BELT

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.



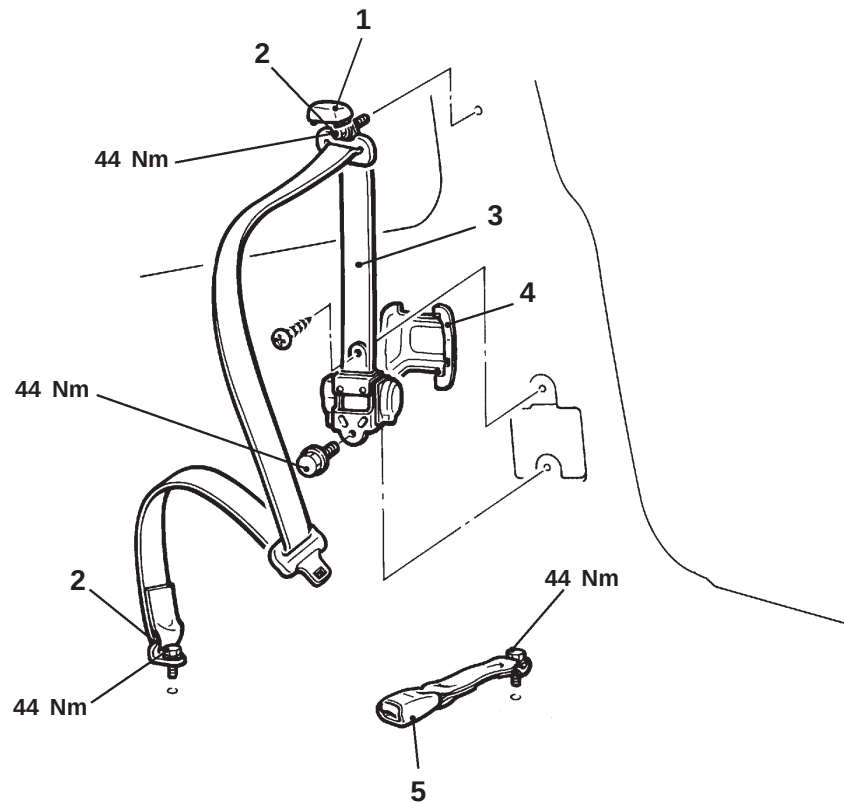
Outer seat belt removal steps

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



AW0171AL

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

SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

CONTENTS

GENERAL INFORMATION	2	SRS AIR BAG CONTROL UNIT (SRS-ECU)	34
SRS SERVICE PRECAUTIONS	4	AIR BAG MODULES AND CLOCK SPRING	36
SPECIAL TOOLS	6	SEAT BELT WITH PRE-TENSIONER	44
TEST EQUIPMENT	7	SIDE IMPACT SENSOR	46
TROUBLESHOOTING	8	AIR BAG MODULE AND SEAT BELT PRE-TENSIONER DISPOSAL PROCEDURES	48
SRS MAINTENANCE	23	Undeployed Air Bag Module and Seat Belt Pre-tensioner Disposal	48
POST-COLLISION DIAGNOSIS	27	Deployed Air Bag Module or Operated Seat Belt Pre-tensioner Disposal Procedures	60
INDIVIDUAL COMPONENT SERVICE	30		
WARNING/CAUTION LABELS	31		
FRONT IMPACT SENSORS	32		

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.

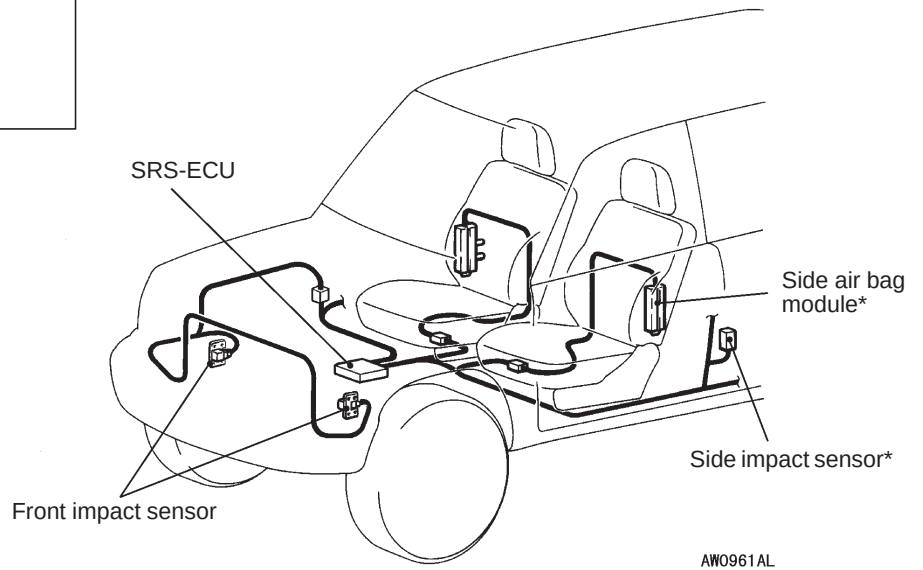
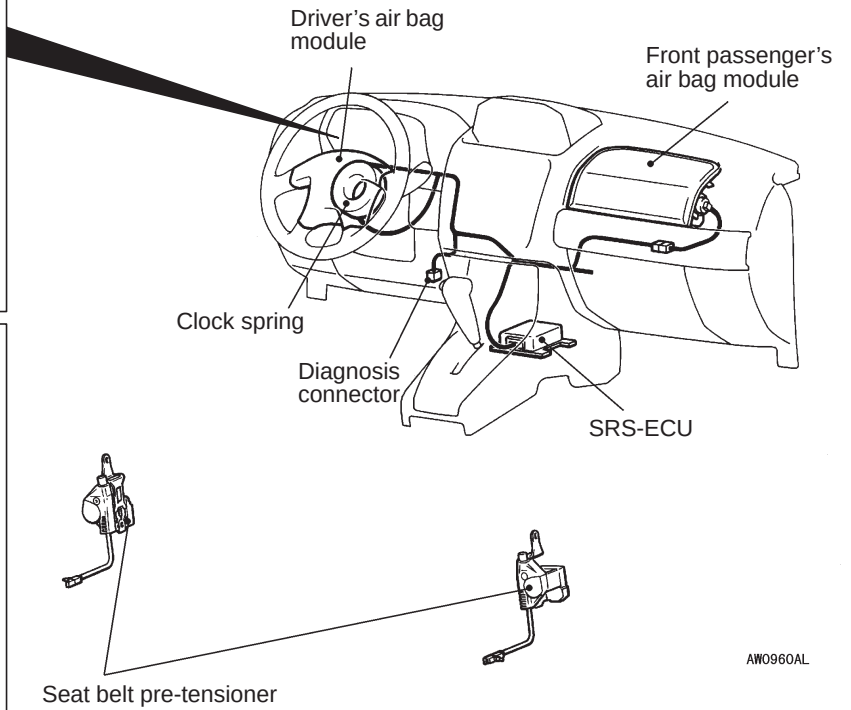
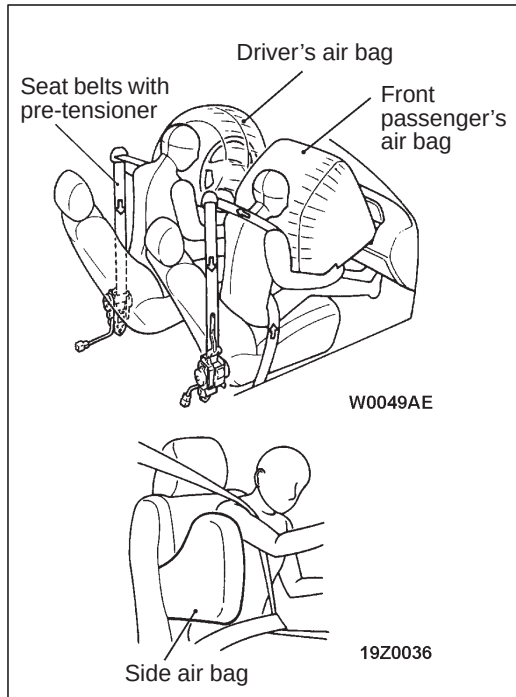
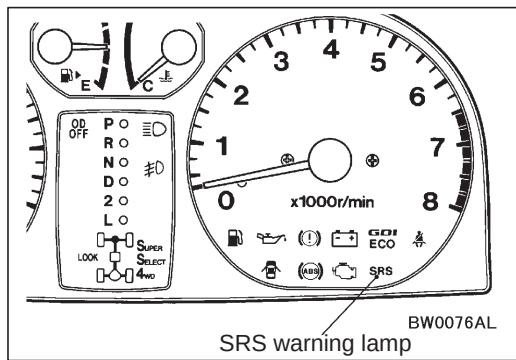
GENERAL INFORMATION

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

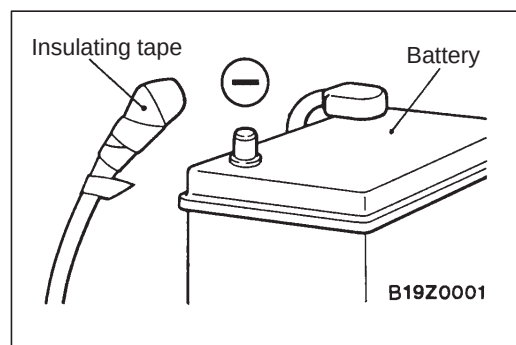
*: Indicates the parts equipped on the right and left sides.

SRS SERVICE PRECAUTIONS

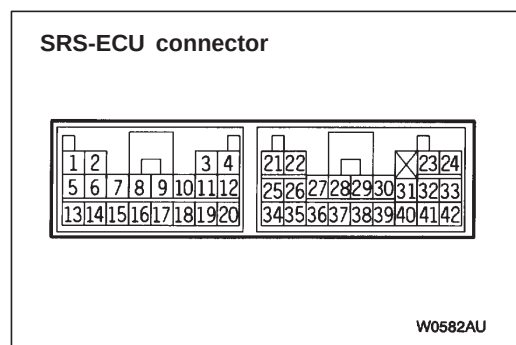
1. In order to avoid injury to yourself or others from accidental deployment of the air bag during servicing, read and carefully follow all the precautions and procedures described in this manual.
2. Do not use any electrical test equipment on or near SRS components, except those specified on P.52B-7.
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.

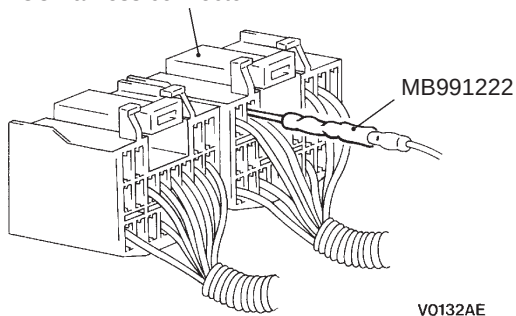


5. Do not attempt to repair the wiring harness connectors of the SRS. If the connector(s) are diagnosed as defective, replace the wiring harness(es). If the harness(es) are diagnosed as faulty, replace or repair the wiring harness(es) according to the following table.

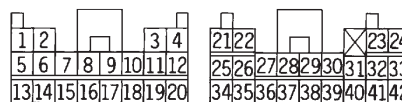
SRS-ECU Terminal No.	Destination of harness	Corrective action
1, 2, 3, 4	Instrument panel wiring harness → Front wiring harness → Front impact sensor	Repair or replace each wiring harness.
7	Instrument panel wiring harness → Earth	
8	Instrument panel wiring harness → Combination meter (SRS warning lamp)	
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



SRS-ECU harness connector (rear view)



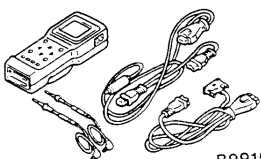
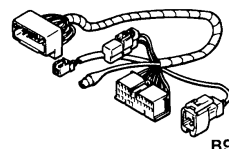
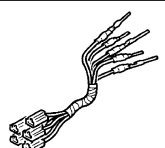
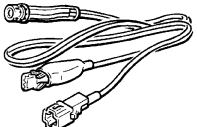
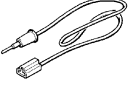
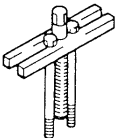
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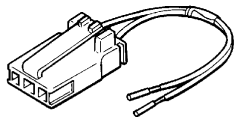
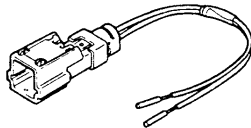
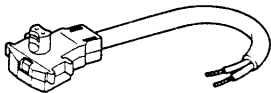
7. SRS components and seat belt with pre-tensioner should not be subjected to heat, so remove the front impact sensor, SRS-ECU, air bag module (driver's side and front passenger's side), clock spring, side impact sensors, front seat assemblies (side air bag module), and seat belts with pre-tensioner 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.

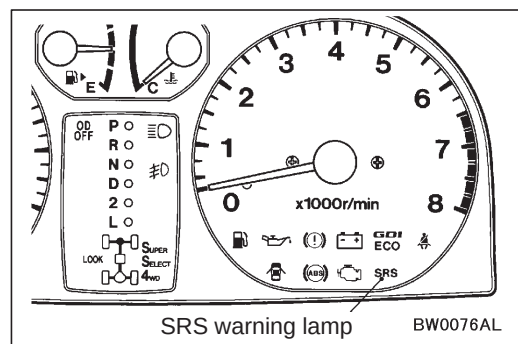
(Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.)

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.
		Lamp does not switch off.
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

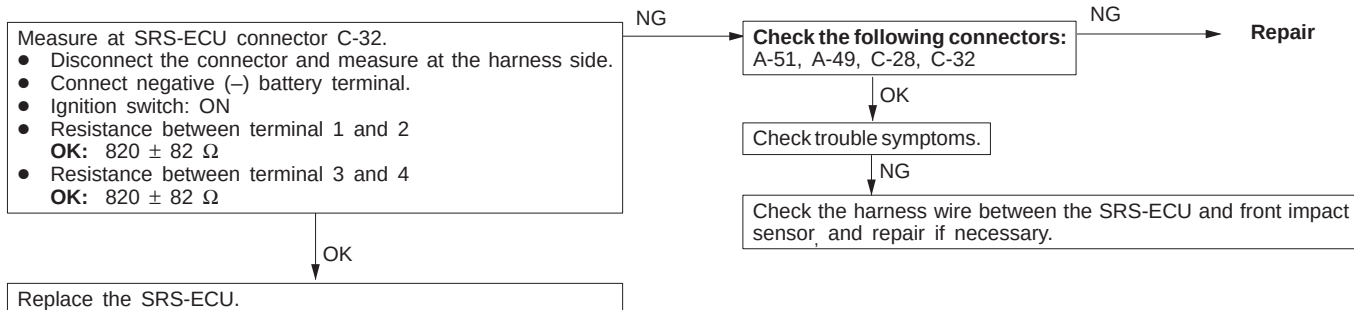
- (1) *1: If the vehicle condition returns to normal, the diagnosis code will be automatically erased, and the SRS warning lamp will return to normal.
- (2) *2: If the trouble(s) are extinguished, the SRS warning lamp go out with diagnosis code history stored.
- (3) If the vehicle has a discharged battery 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

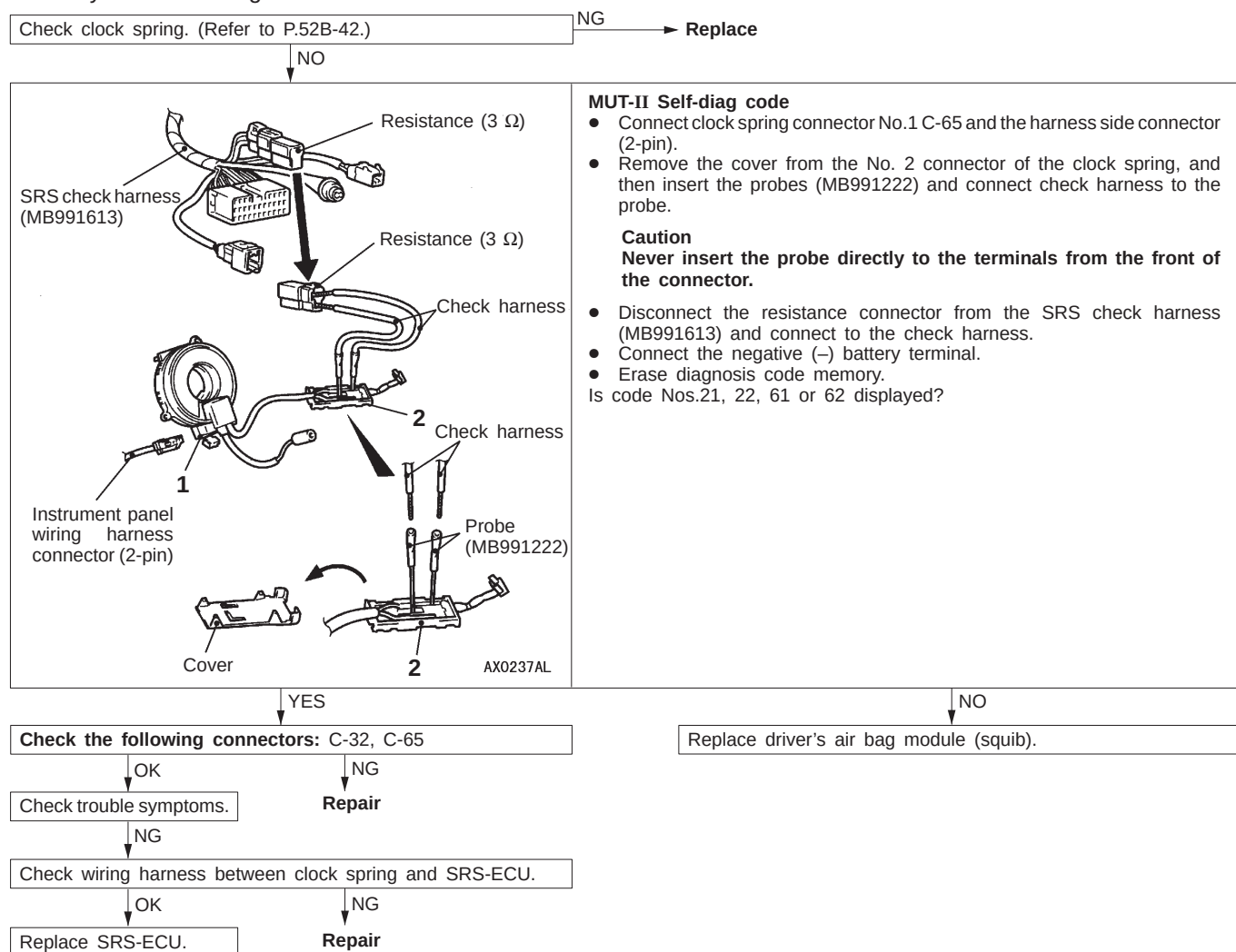
Code No.	Defective parts	Trouble causes
14	Analog G-sensor	- Analog G-sensor is not operating - Analog G-sensor characteristics are abnormal - Analog G-sensor output is abnormal
15	Front impact safing G-sensor	Short circuit in the safing G-sensor
16		Open circuit in the safing G-sensor
17	Side impact 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.

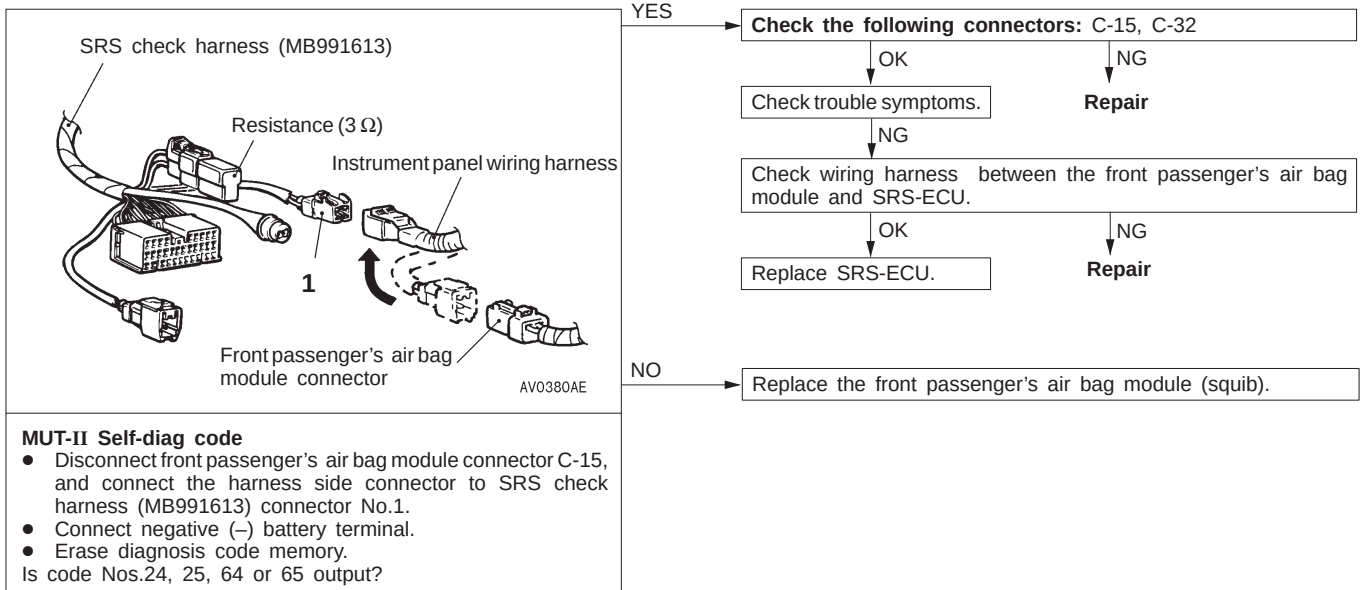


Code No.24, 25, 64, 65 Front passenger's air bag module (squib) system	Probable cause
Abnormal resistance is present between input terminals of front passenger's air bag module (squib). See table below for what each code tells. However, once trouble is extinguished, SRS-warning lamp will go out. (Diagnosis 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.



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

SRS check harness (MB991613)

Resistance (3 Ω)

Resistance (3 Ω)

Check harness

Body wiring harness

Probe (MB991222)

Check harness AX0238AL

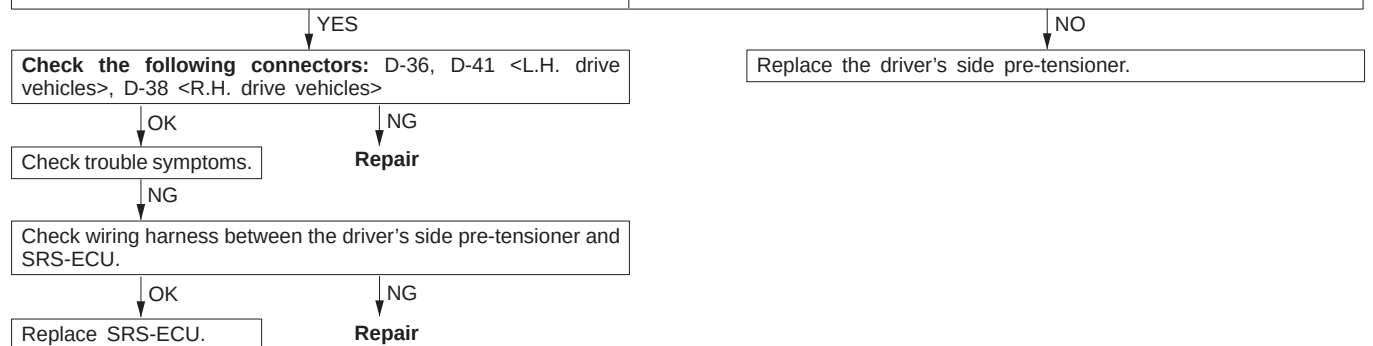
MUT-II Self-diag code

- 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?



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

The diagram illustrates the setup for testing the front passenger's side pre-tensioner (squib) system. It shows the SRS check harness (MB991613) connected to the resistance (3 Ω) and the check harness. The body wiring harness is also shown, connected to the probe (MB991222) and the check harness (AX0238AL).

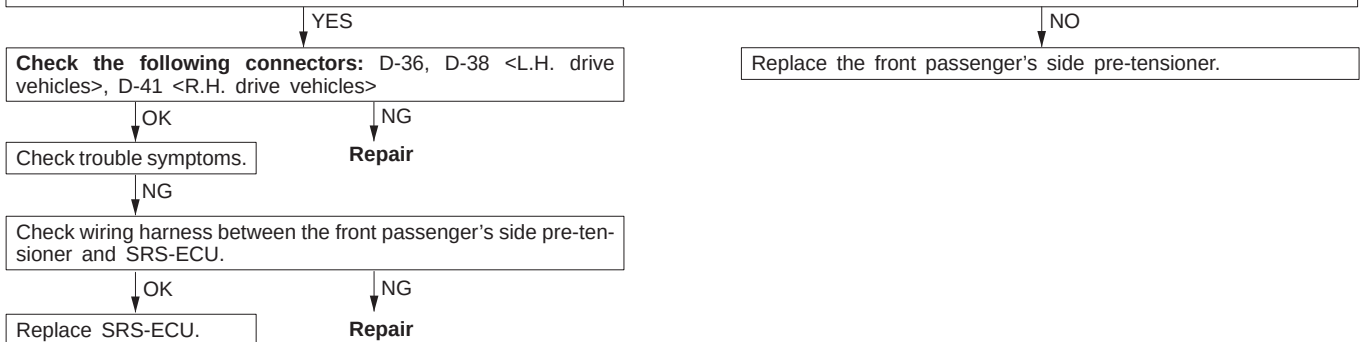
MUT-II Self-diag code

- 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.

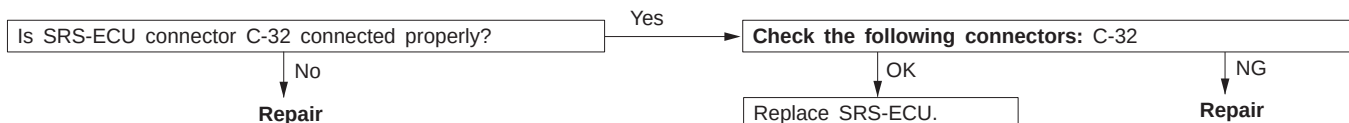
Caution
Never insert the probe directly to the terminals from the front of the connector.

- 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?



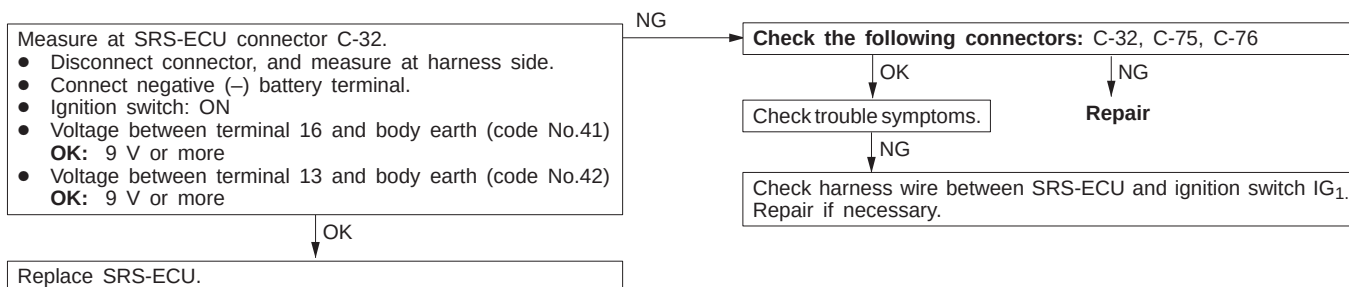
Code No.34 Connector lock system	Probable cause
SRS-ECU is poorly connected. However, when vehicle condition returns to normal, this code will be automatically erased, and the SRS warning lamp will go out.	- Defective connectors - Malfunction of SRS-ECU



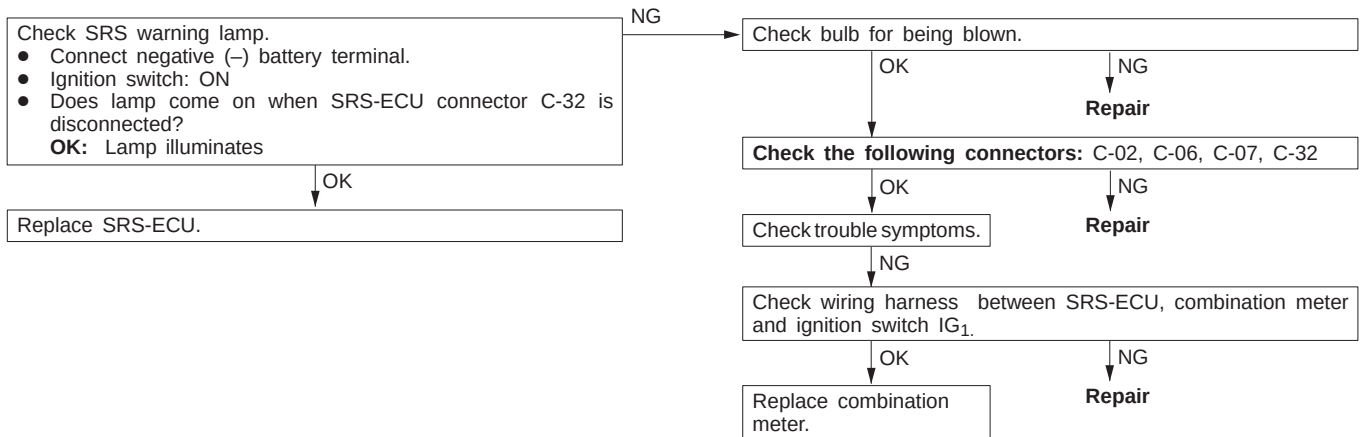
Code No.35 SRS-ECU (deployed air bag) system	Probable cause
This code is displayed after deployment of air bags. If displayed before deployment, the code indicates malfunction probably present in SRS-ECU.	Malfunction of SRS-ECU

Replace the SRS-ECU.

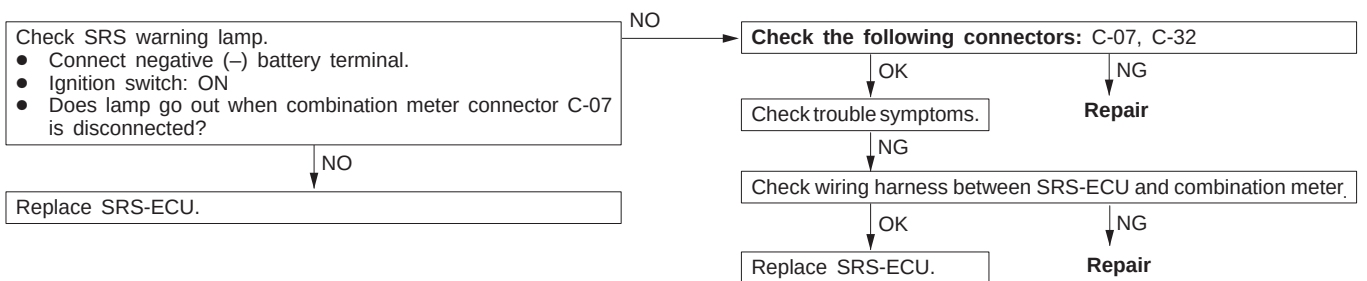
Code No.41 Power circuit system (fuse No.6 circuit)	Probable cause
Code No.42 Power circuit system (fuse No.8 circuit)	
Code No.41 is displayed if voltage between IG₁ terminal (SRS-ECU, terminal 12) and earth is lower than specified for five successive seconds or more. Code No.42 is displayed if voltage between IG₁ 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



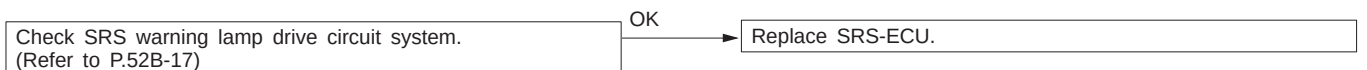
Code No.43 SRS warning lamp drive circuit system (Lamp does not come on)	Probable cause
Open circuit is present for 5 successive seconds or more in SRS warning lamp drive circuit. However, once trouble is extinguished, this code, if displayed due to open circuit, will be automatically erased.	- Defective 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

SRS check harness (MB991613)

Resistance (3 Ω)

Resistance (3 Ω)

Check harness

Body wiring harness

Probe (MB991222)

Check harness AX0238AL

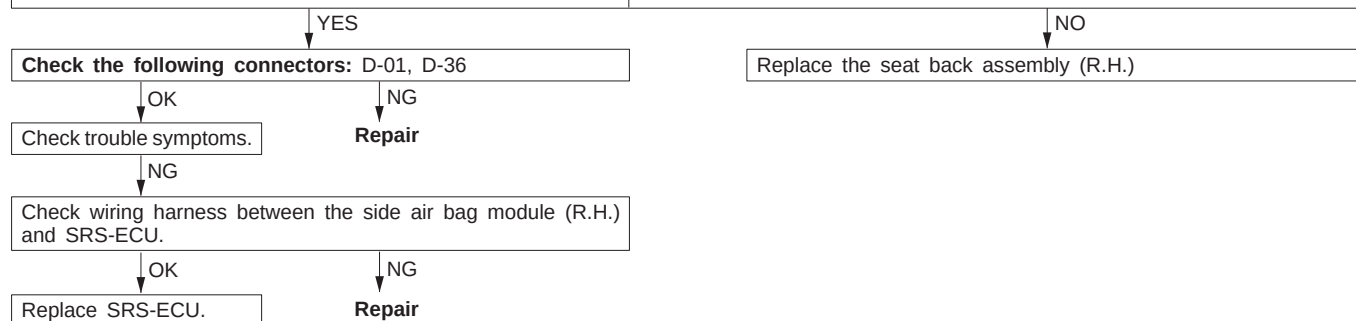
MUT-II Self-diag code

- 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.

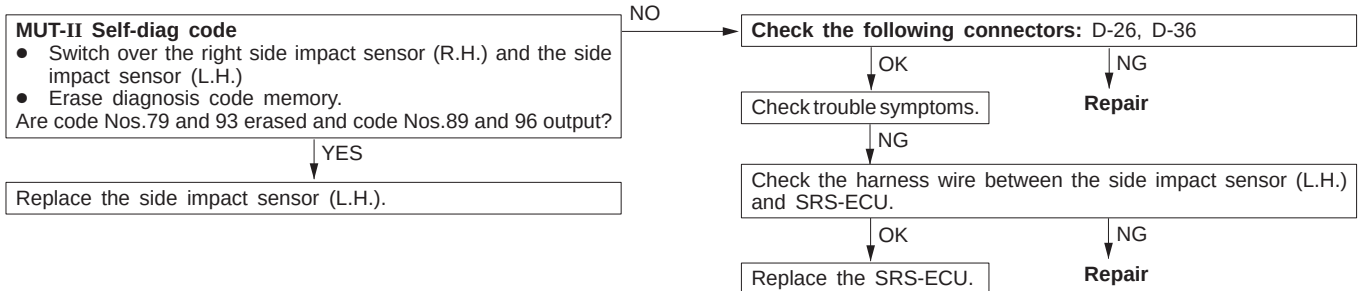
Caution
Never insert the probe directly to the terminals from the front of the connector.

- 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?

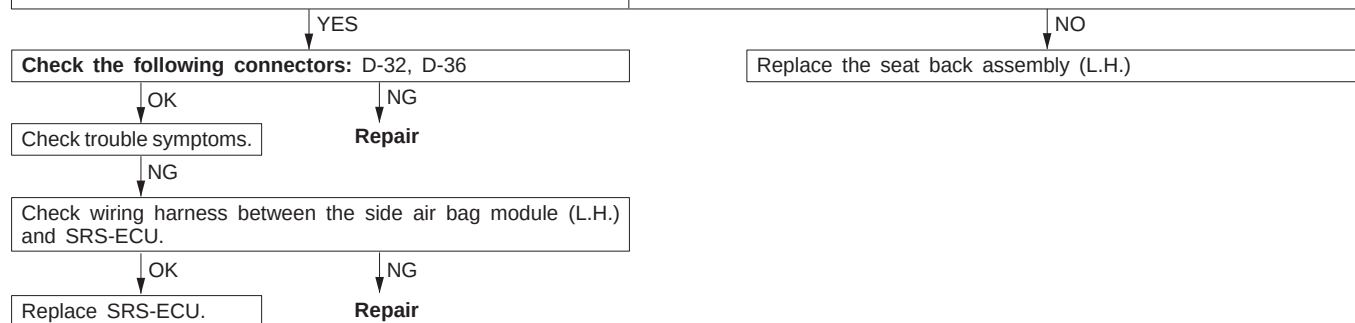
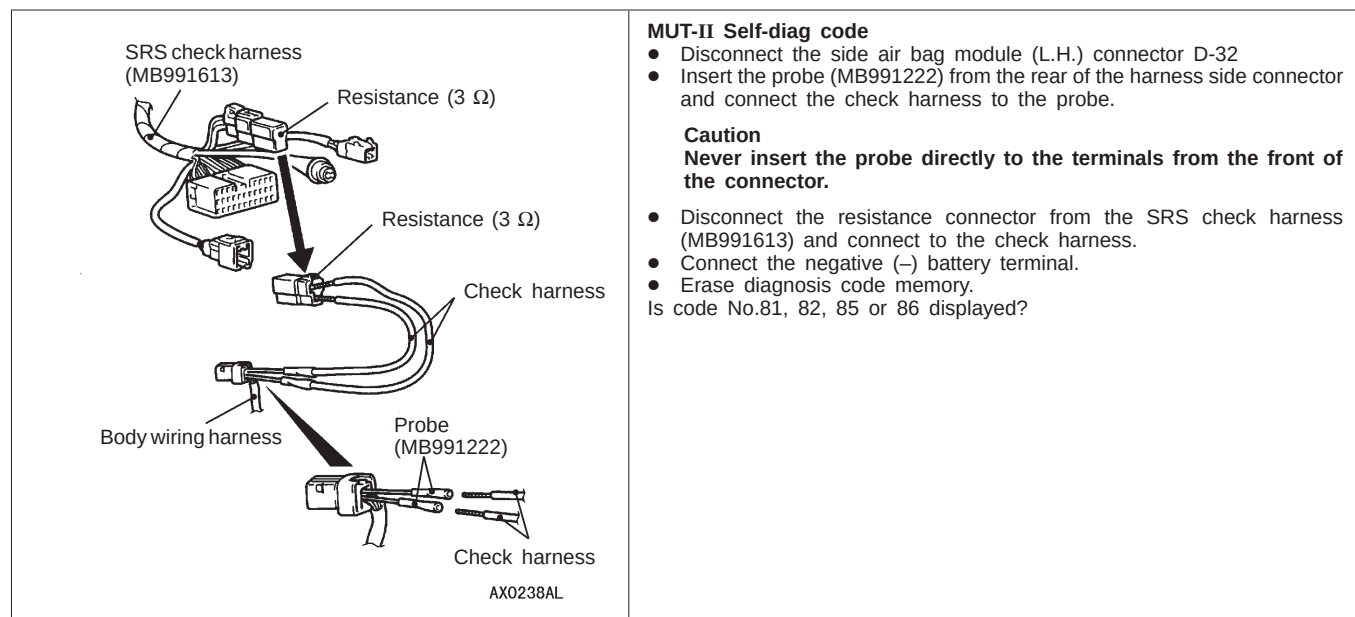


Code No.79 or No.93 Side impact sensor (L.H.) communication system	Probable cause
These diagnosis code are output if communication between the side impact sensor (L.H.) and the SRS-ECU is not possible (code No.79) or abnormal (code No.93).	• Malfunction of wiring harnesses or connectors • Malfunction of side impact sensor (L.H.) • Malfunction of SRS-ECU

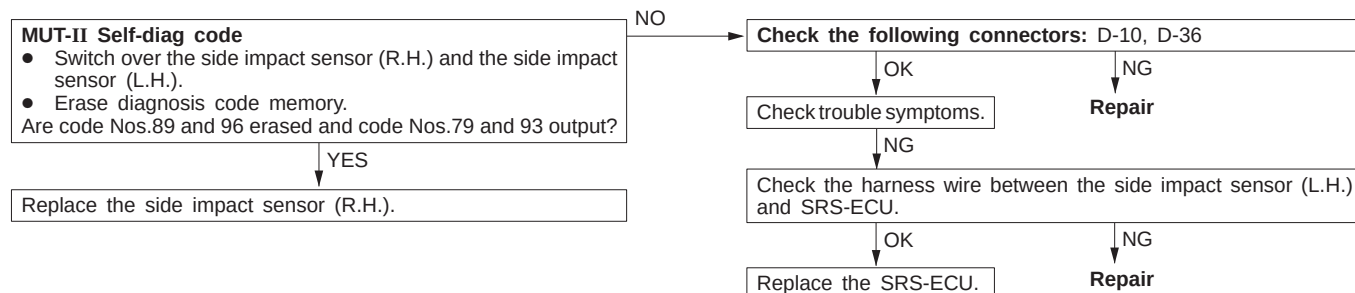


Code No.81, 82, 85, 86 Side air bag module (L.H.) (squib) system	Probable cause
Abnormal resistance is present between input terminals of SRS-ECU for side air bag module (L.H.) (squib). See table below for what each code tells. However, as for code Nos. 81 and 82, once trouble is extinguished, SRS warning 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

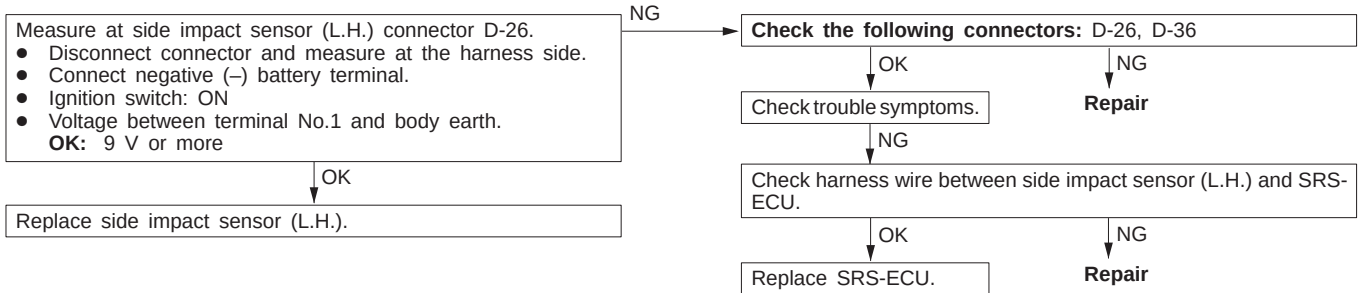
Code No.	Trouble causes
81	• Short in side air bag module (L.H.) (squib) or harness short
82	• Open circuit in side air bag module (L.H.) (squib) or open harness • Poor connector contact
85	• Side air bag module (L.H.) (squib) harness short to power supply
86	• Side air bag module (L.H.) (squib) harness short to earth



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



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

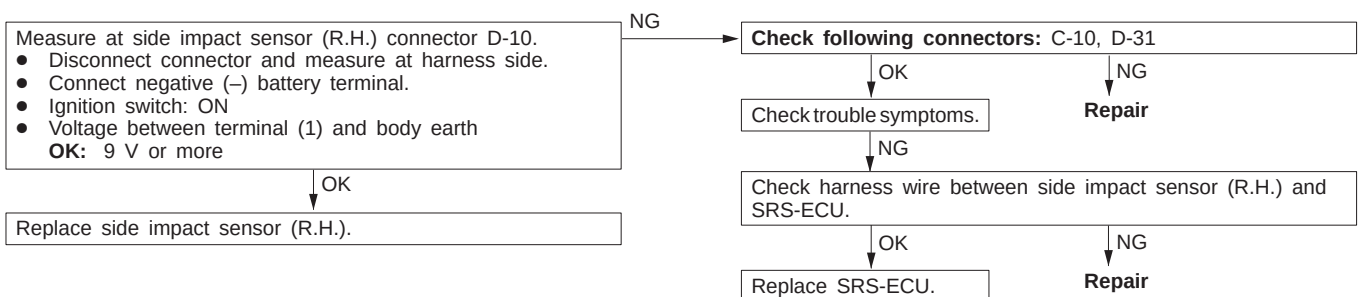


Code No.92, 95 Side impact sensor system	Probable cause
Code No.92 is displayed when malfunction is present inside side impact sensor (L.H.). Code No.95 is displayed when malfunction is present inside side impact sensor (R.H.). See INSPECTION CHART 6, below, for what each code tells.	- Malfunction of 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

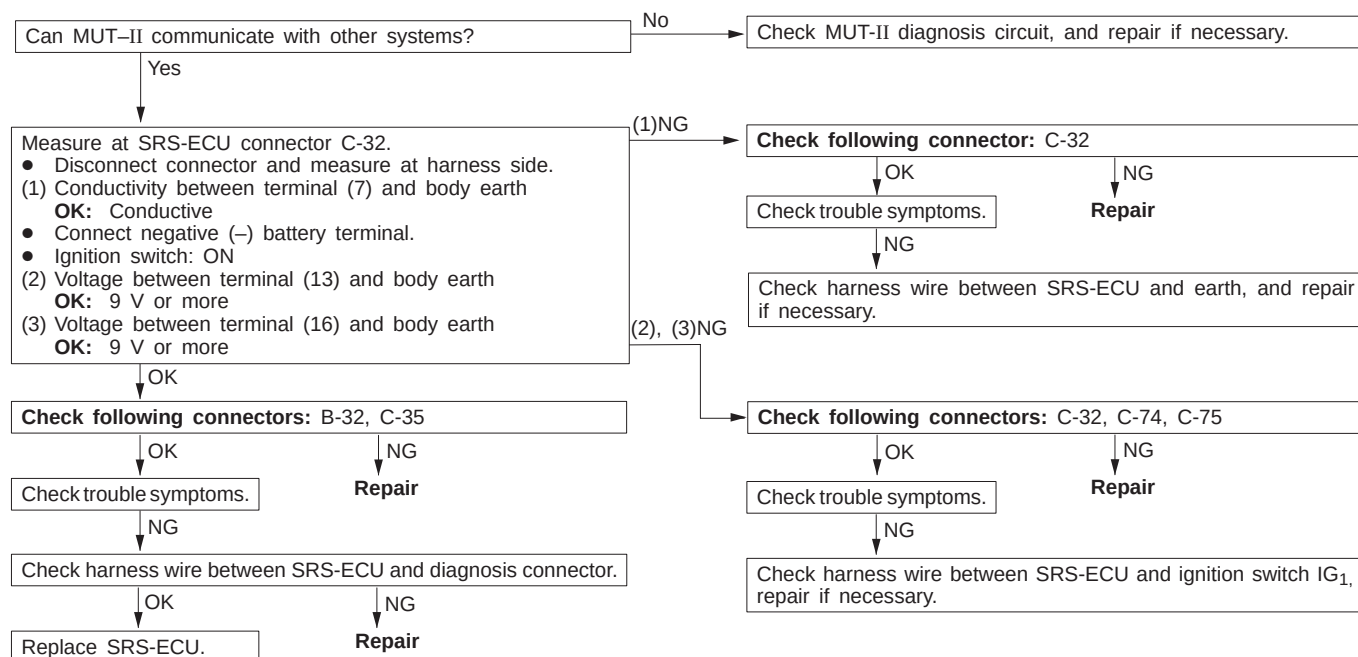
Get an understanding of the trouble symptoms and check according to the inspection procedure chart.

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

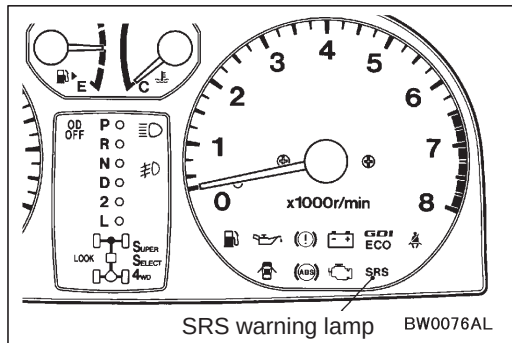
Inspection Procedure 1

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



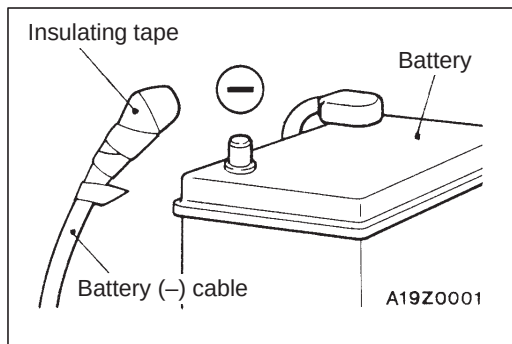
SRS MAINTENANCE

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.

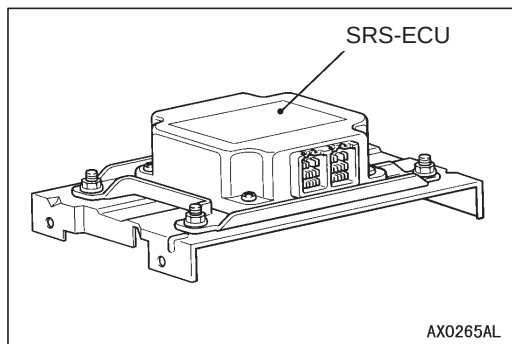


SRS COMPONENT VISUAL CHECK

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.)



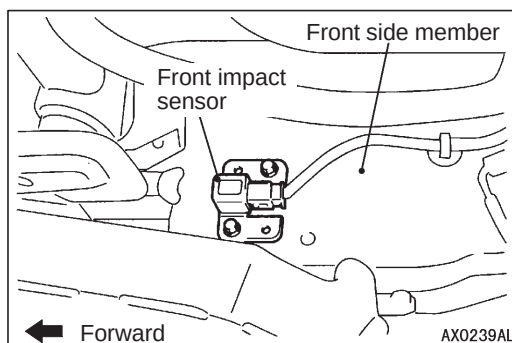
SRS CONTROL UNIT (SRS-ECU)

1. Check SRS-ECU case and brackets for dents, cracks, deformation or rust.

Caution

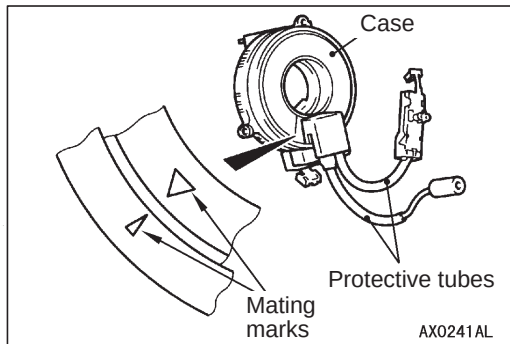
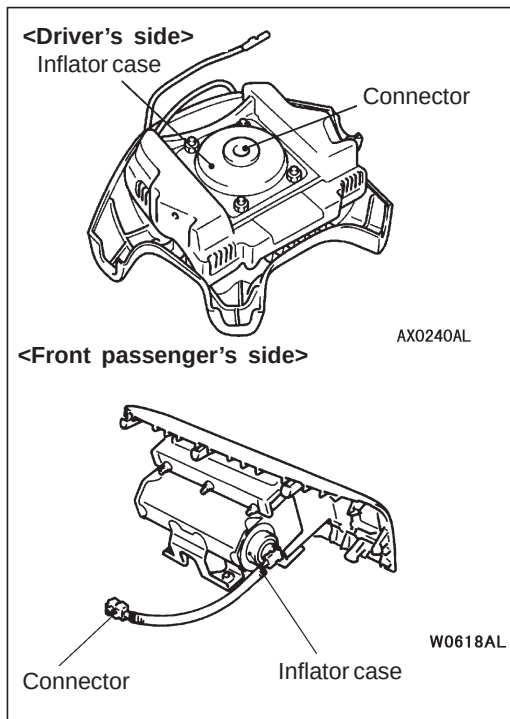
The SRS may not activate if the SRS-ECU is not installed properly, which could result in serious injury or death to the vehicle's driver or front passenger.

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

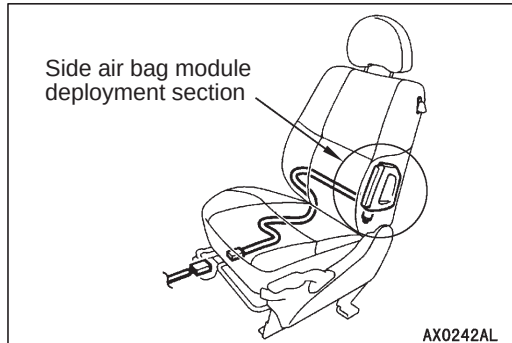
If the clock spring's mating mark is not properly aligned, the steering wheel may not be completely rotational during a turn, or the flat cable within the clock spring may be severed, obstructing normal operation of the SRS and possibly leading to serious injury to the vehicle's driver or front passenger.

9. Install the steering column covers, steering wheel and the air bag module.
10. Check steering wheel for noise, binds or difficult operation.

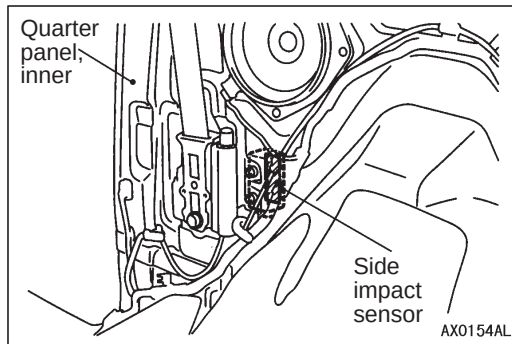
11. Check steering wheel for excessive free play.
REPLACE ANY VISUALLY INSPECTED PART IF IT FAILS THAT INSPECTION. (Refer to P.52B-41.)

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.

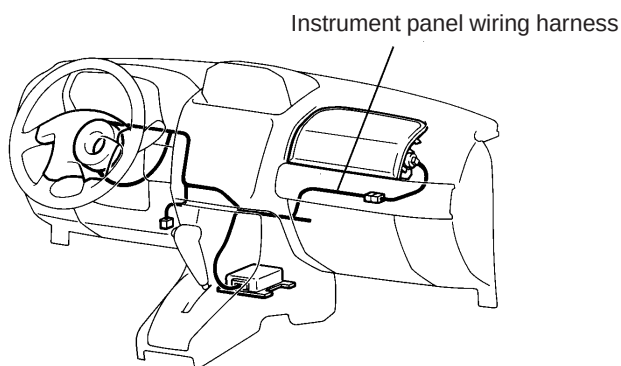
NOTE

The illustration at left shows the side impact sensor (R.H.). The position of the side impact sensor (L.H.) is symmetrical to this.

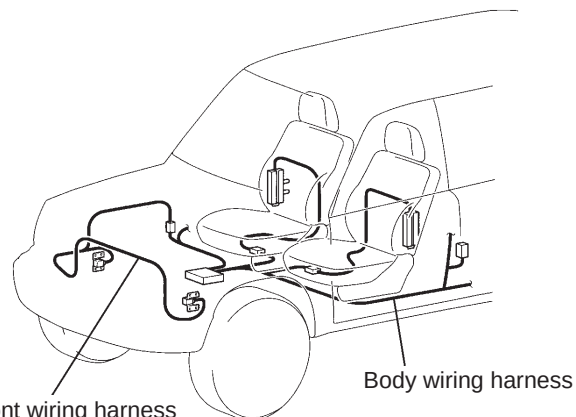
Caution

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



BW0960AL

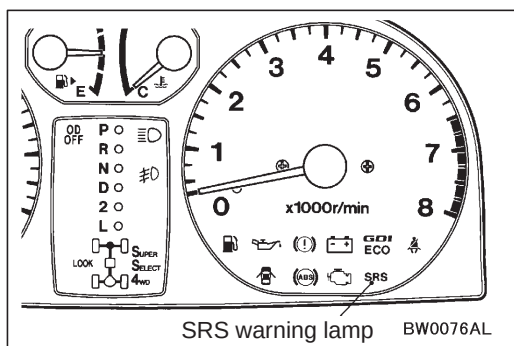


BW0961AL

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.



SRS warning lamp BW0076AL

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.)

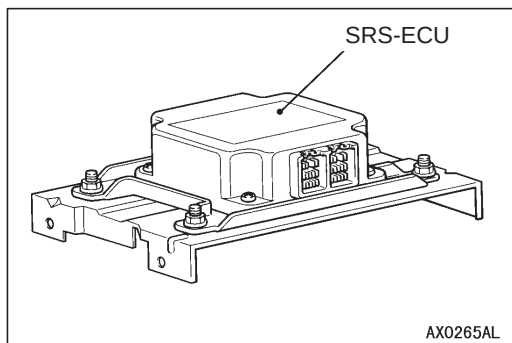
2. Check the following parts and replace if there are any malfunctions.
 - Clock spring (Refer to P.52B-36.)
 - Steering wheel, steering column and intermediate joint
 - (1) Check wiring harness (built into steering wheel) and connectors for damage, and terminals for deformation.
 - (2) Install air bag 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.)

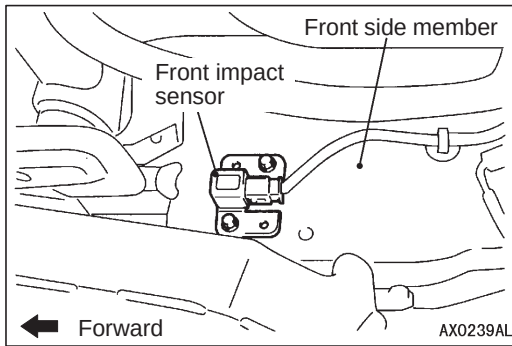
UNDEPLOYED AIR BAGS IN LOW-SPEED COLLISION

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.



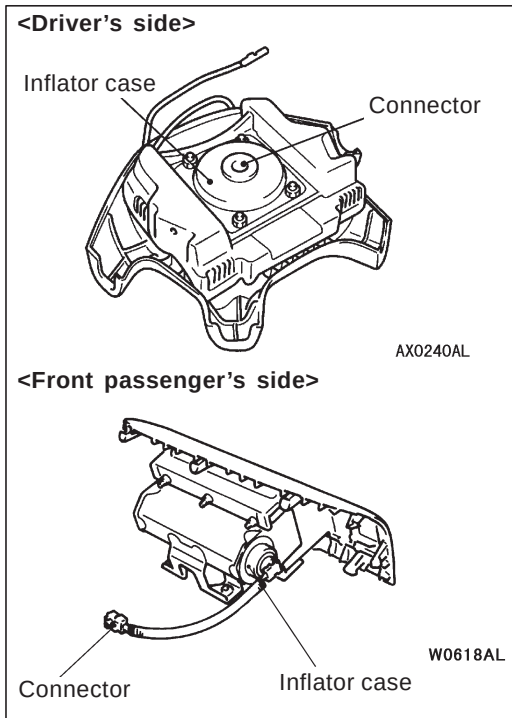
SRS-ECU

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.



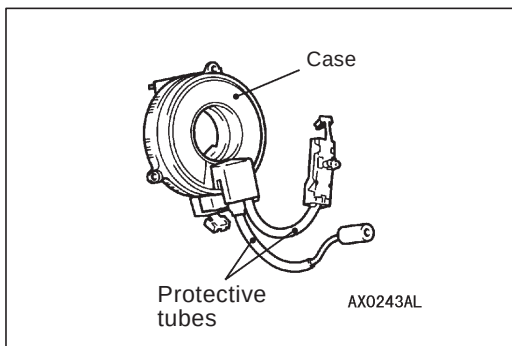
FRONT IMPACT SENSORS

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.

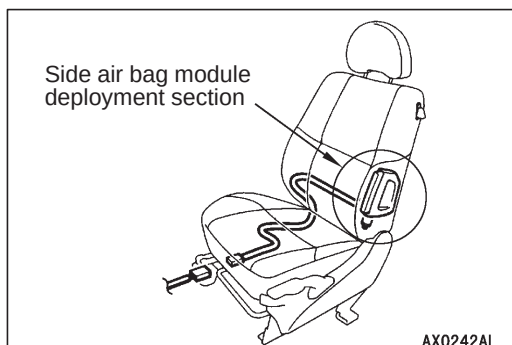
Steering wheel, steering column and intermediate joint

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.

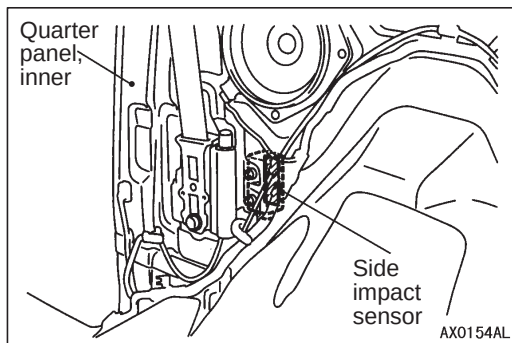
Harness connector (Instrument panel wiring harness)

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

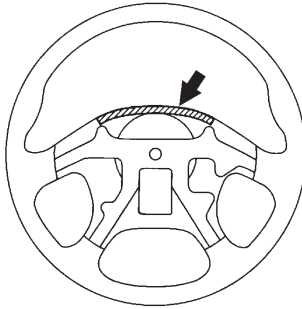
Recheck SRS system operability after re-installing them.
2. If the SRS components and seat belts with pre-tensioner are removed for the purpose of check, sheet metal repair, painting, etc., they should be stored in a clean, dry place until they are reinstalled.

WARNING/CAUTION LABELS

Caution labels on the SRS are attached in the vehicle as shown. Follow label instructions when servicing

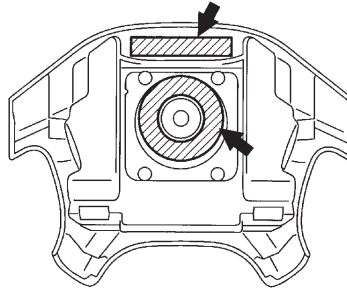
the SRS. If the label(s) are dirty or damaged, replace with new one(s).

Steering wheel



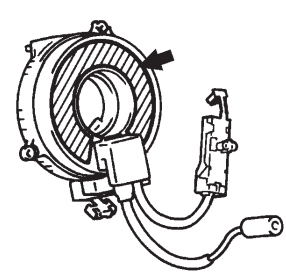
BW0968AL

Driver's air bag module



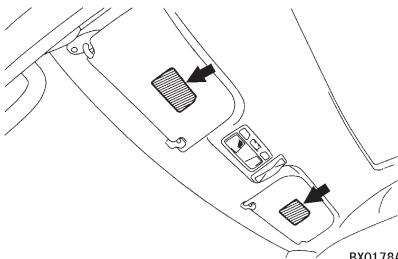
BW0969AL

Clock spring



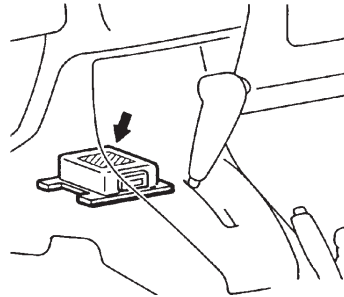
BW0965AL

Sun visor



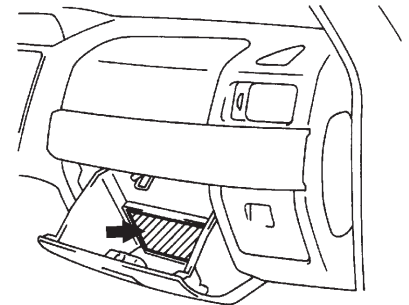
BX0178AL

SRS-ECU



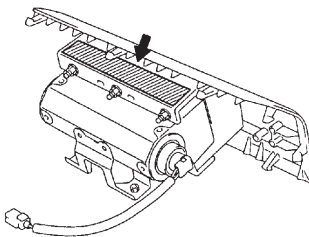
W0202AL

Glove box



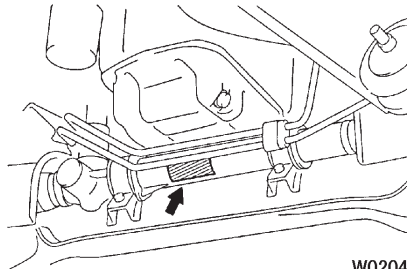
BW0964AL

**Front passenger's
air bag module**



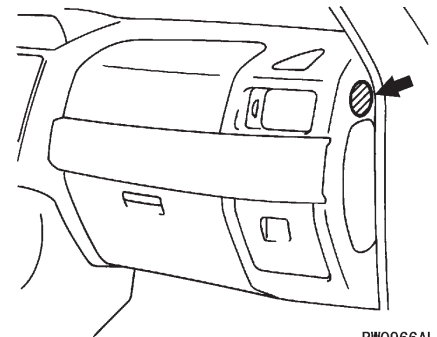
W0201AL

Steering gear box



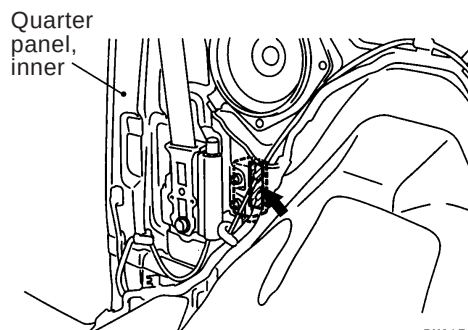
W0204AL

Instrument panel



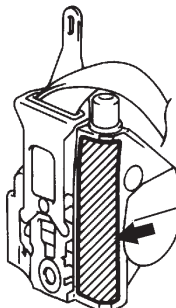
BW0966AL

Side impact sensor



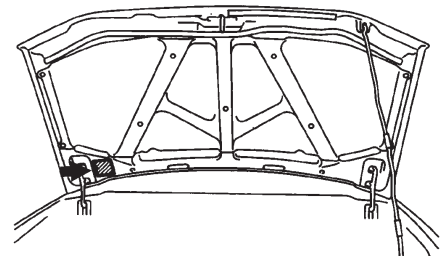
BX0154AL

Seat belt with pre-tensioner



BW0967AL

Hood



BX0155AL

FRONT IMPACT SENSORS

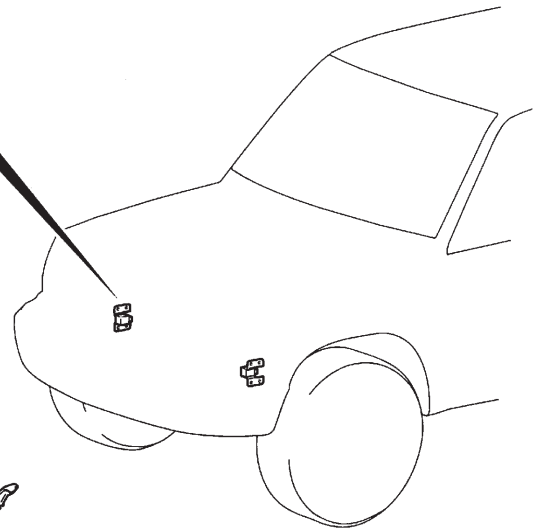
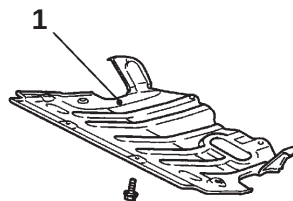
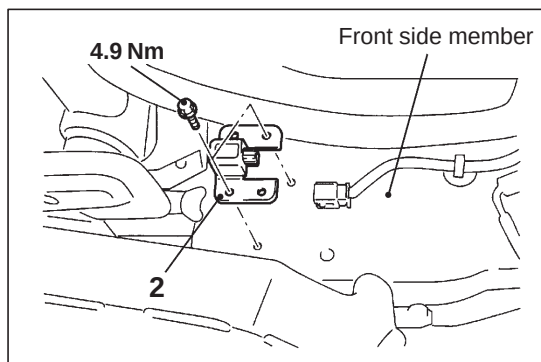
Caution

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.



AX0244AL

Removal steps

1. Under cover
2. Front impact sensor

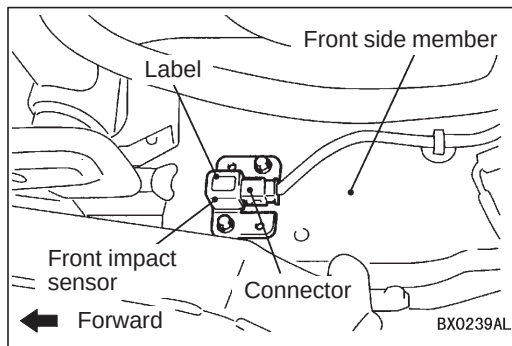
Installation steps

- A◄ • Pre-installation inspection
- B◄ 2. Front impact sensor
1. Under cover
- C◄ • Negative (–) battery cable connection
- 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")

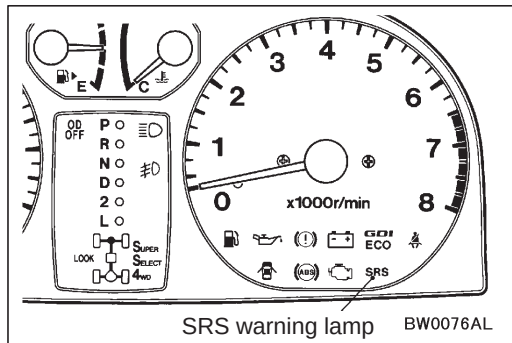


►B◄ FRONT IMPACT SENSOR INSTALLATION

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 is 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.

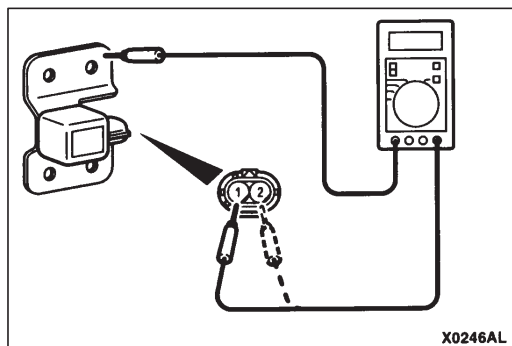
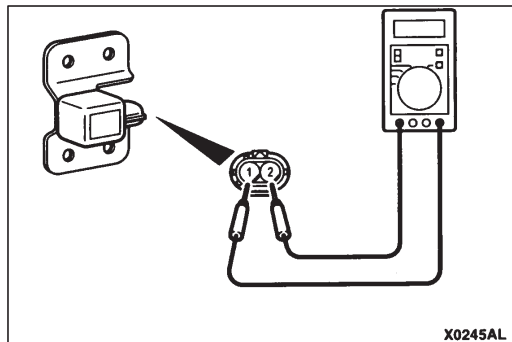
2. Measure the resistance between terminals and check whether it is within the standard value.

Standard value: $820 \pm 82 \Omega$

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)

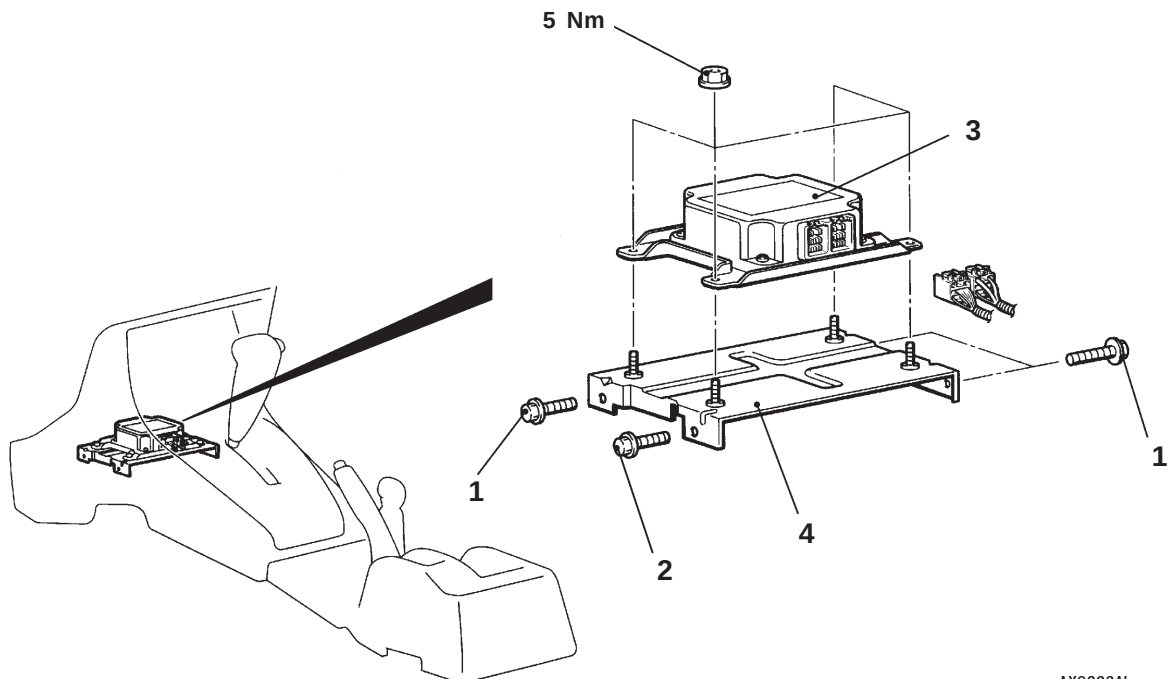
Caution

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.



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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

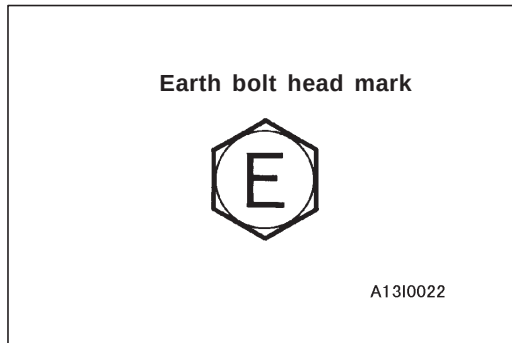
- 4. SRS-ECU bracket
- 3. SRS-ECU
- 2. Bracket mounting bolt (Earth bolt)
- 1. Bracket mounting bolt
- Floor console (Refer to GROUP 52A.)
- Negative (–) battery cable connection
- Post-installation inspection

INSTALLATION SERVICE POINTS

►A◄ SRS-ECU INSTALLATION

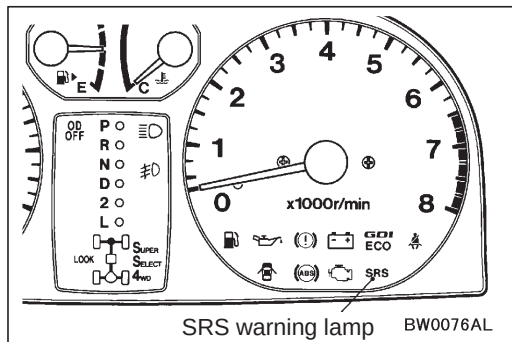
Caution

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.)

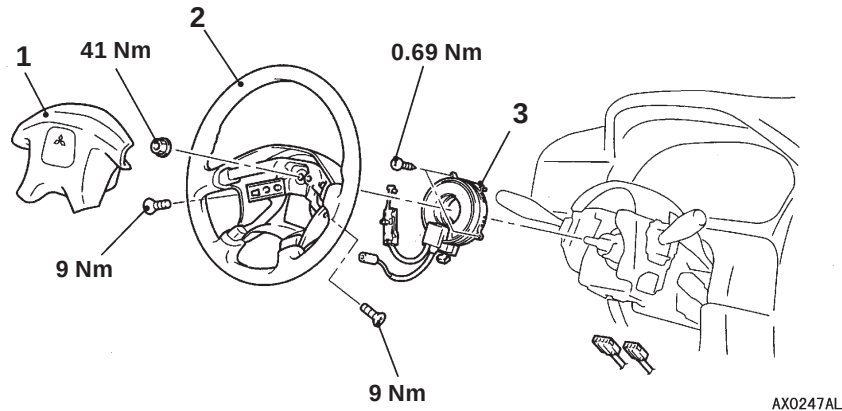
AIR BAG MODULES AND CLOCK SPRING

Caution

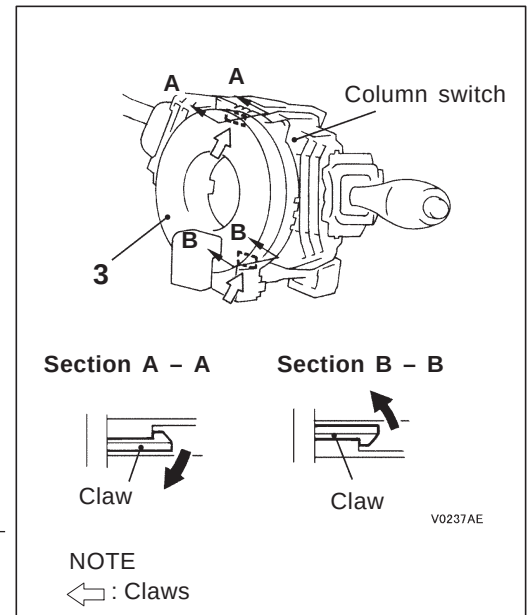
1. Disconnect the negative (–) battery terminal and wait for 60 seconds or more before starting work. Also, the disconnected battery terminal should be insulated with tape. (Refer to P.52B-4.)
2. Never attempt to disassemble or repair the air bag modules and clock spring. If faulty, just replace with 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.



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**Driver's air bag module removal steps**

1. Driver's air bag module
2. Steering wheel

Clock spring removal steps

1. Driver's air bag module
2. Steering wheel
3. Clock spring

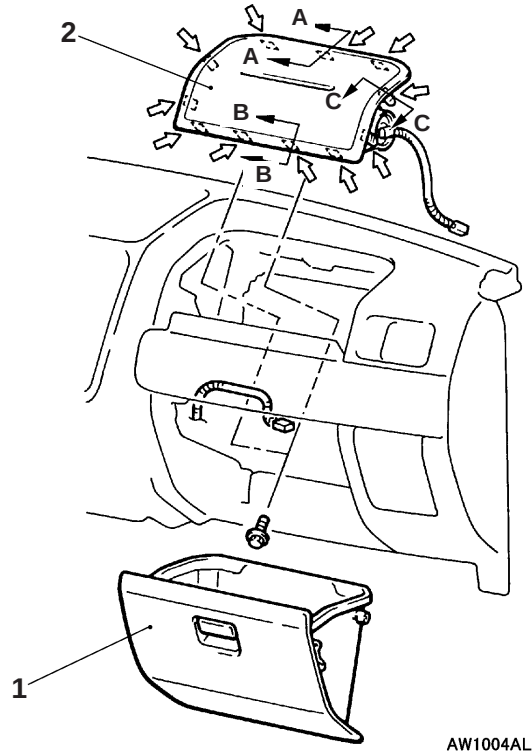
Driver's air bag module installation steps

- Pre-installation inspection
- 2. Steering wheel
- 1. Driver's air bag module
- Negative (-) battery cable connection
- Post-installation check

Clock spring installation steps

- Pre-installation check
- 3. Clock spring
- Lower column cover
- 2. Steering wheel
- 1. Driver's air bag module
- Negative (-) battery cable connection
- Post-installation inspection

<Front passenger's air bag module>

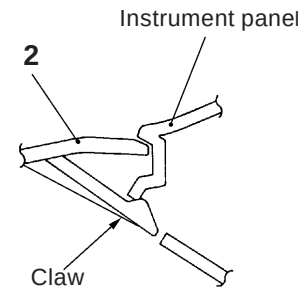


NOTE

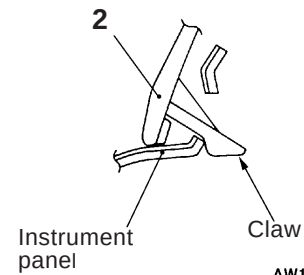
↔ : Claws

Removal steps

1. Glove box
2. Passenger's air bag module

**Sections A – A and C – C**

AW1005AL

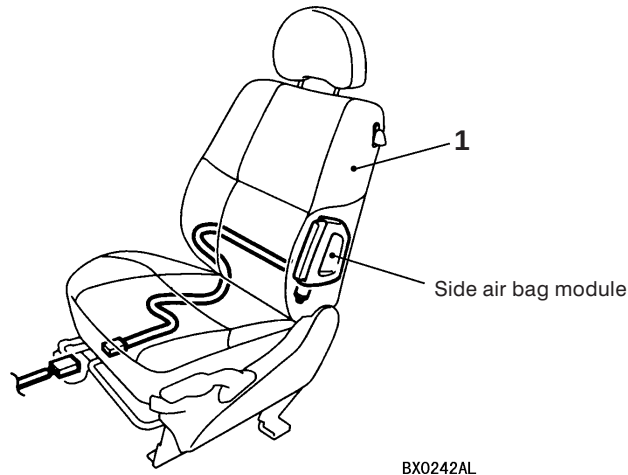
Section B – B

AW1006AL

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**

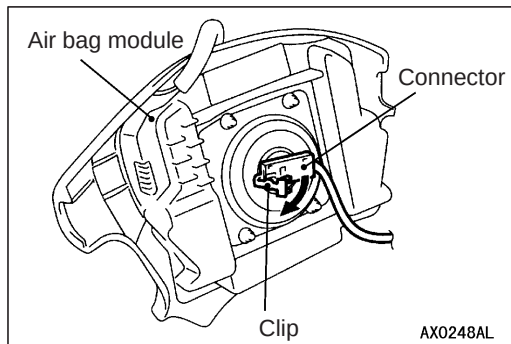
1. Front seat back assembly

Installation steps

- Pre-installation inspection
- 1. Front seat back assembly
- Negative (-) battery cable connection



- Post-installation inspection

**REMOVAL SERVICE POINTS****◀A▶ DRIVER'S AIR BAG MODULE REMOVAL**

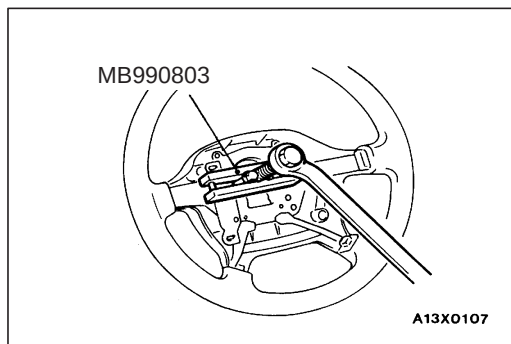
After removing the clip shown in the illustration, disconnect the connector.

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.

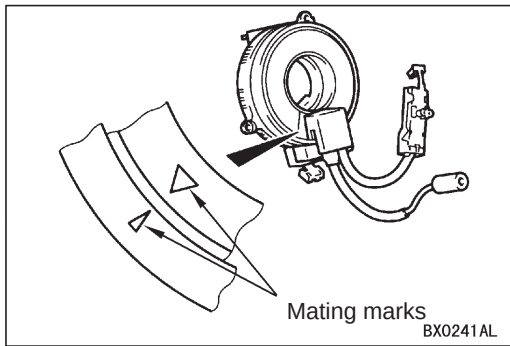
4. Turn the ignition switch to ON.
5. Read a diagnostic code to Refer to that the SRS is operating properly except an open in the air bag module circuit.
6. Turn the ignition switch to LOCK (OFF) position. Disconnect the negative (–) battery cable and insulate with tape.

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.

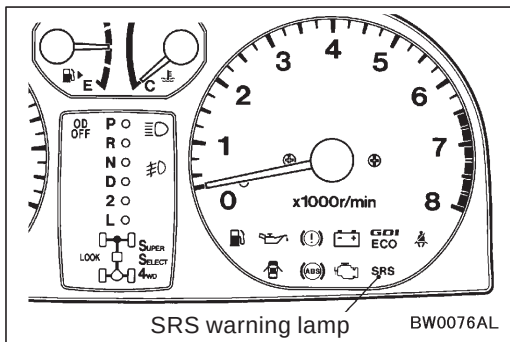
►C◄ STEERING WHEEL INSTALLATION

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

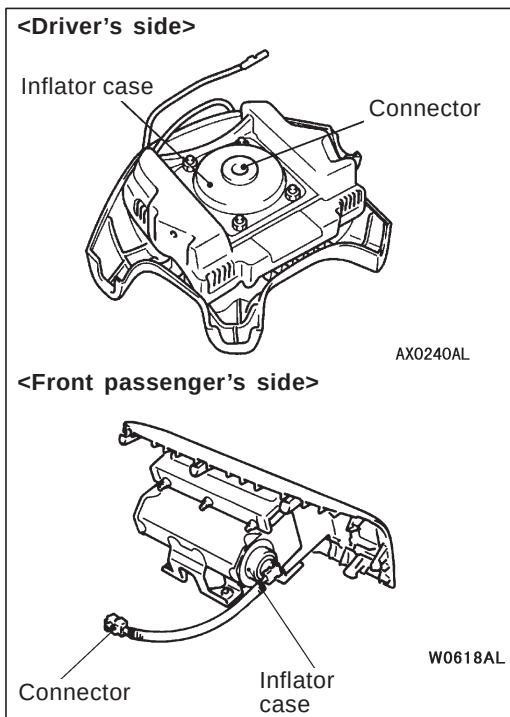
If any malfunction is found in the following inspection, replace the air bag module(s) with new one(s).

Discard the old one(s) after deployment as specified in the service procedure. (Refer to P.52B-48.)

Caution

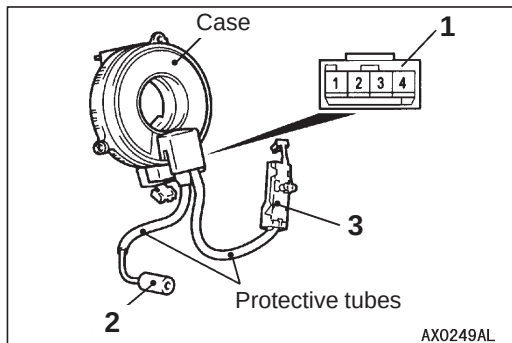
Never measure circuit resistance in the air bag modules (squib) even with the specified tester. Measuring the circuit resistance with a tester causes accidental air bag deployment due to current that flows or static, resulting in serious personal injury.

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.



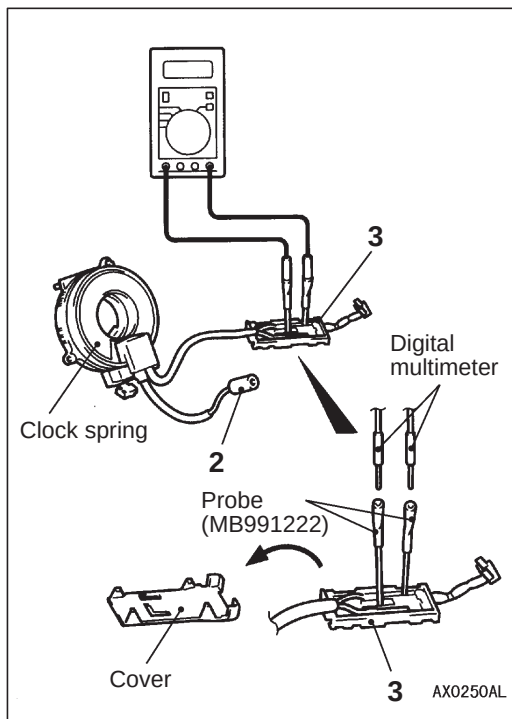
Caution

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.



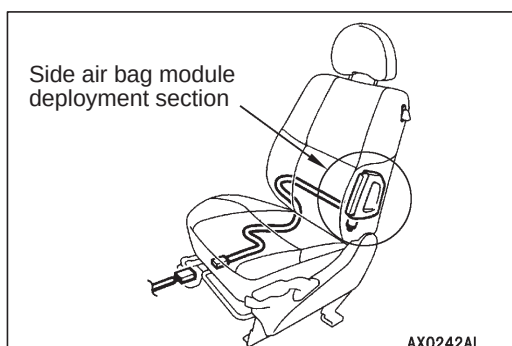
4. Remove the cover from the No. 3 connector of the clock spring, and then insert the probes (MB991222).

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: $0.62 \pm 0.12 \Omega$

**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

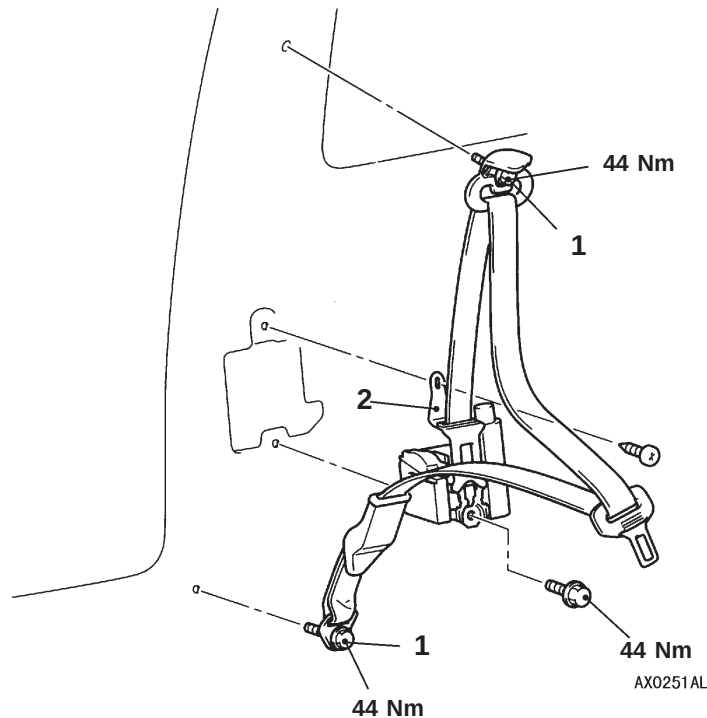
Caution

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

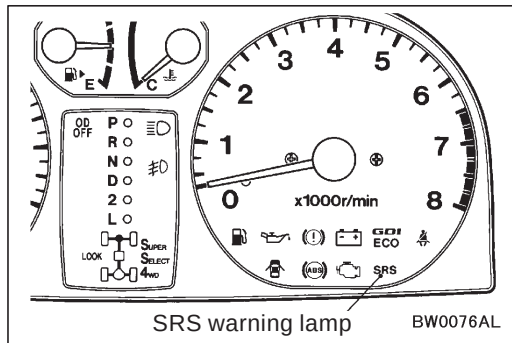
The figure shows the seat belt with pre-tensioner (R.H.)

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.)

**►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

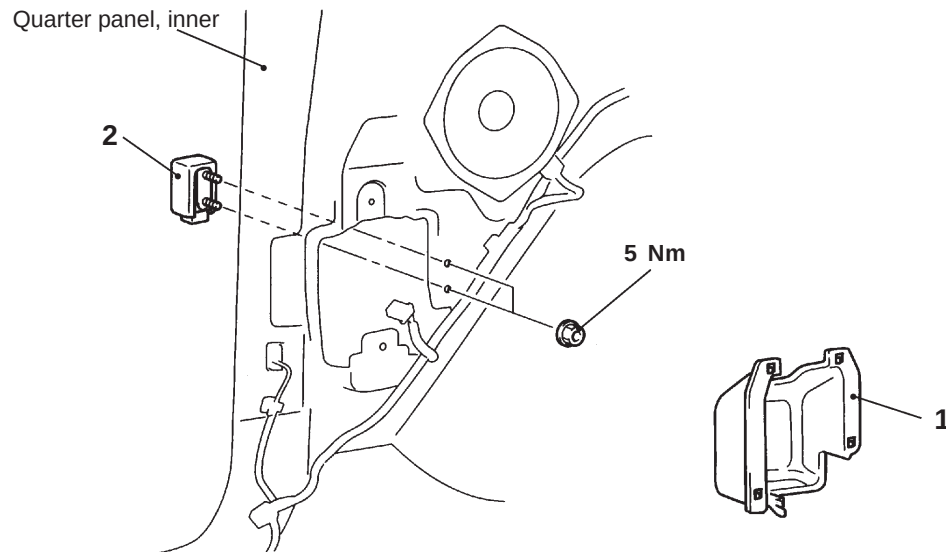
Caution

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.



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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.).

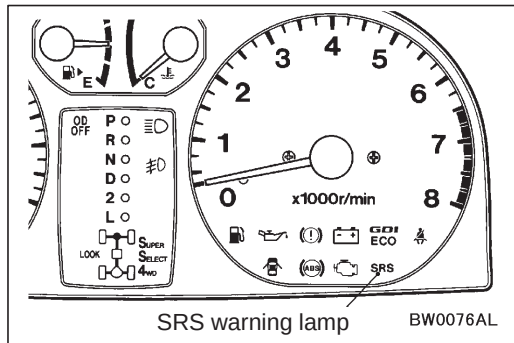
▶A◀ PRE-INSTALLATION INSPECTION

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

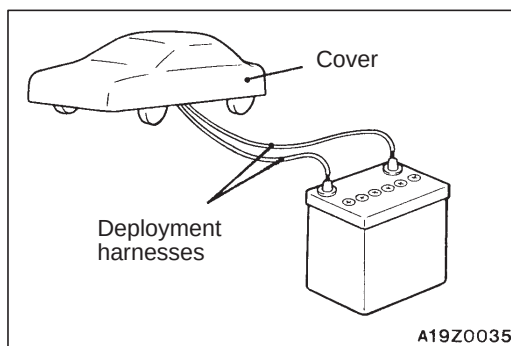
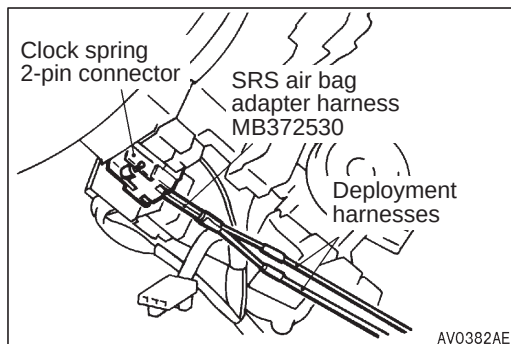
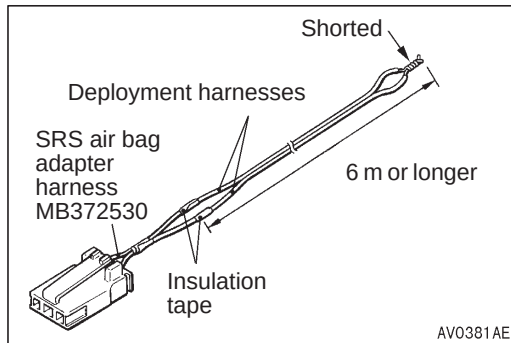
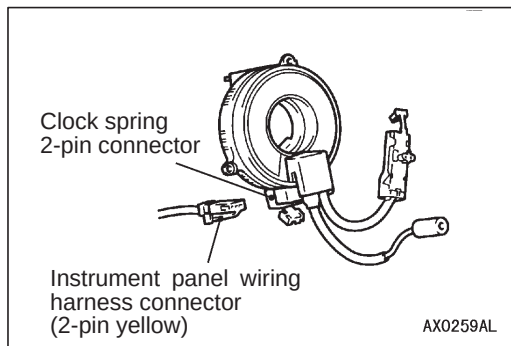
1. Move the vehicle to an isolated spot.
2. Disconnect the negative (–) and positive (+) battery cables from the battery terminals, and then remove the battery from the vehicle.

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

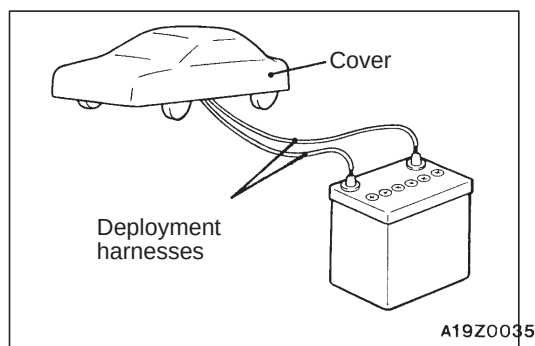
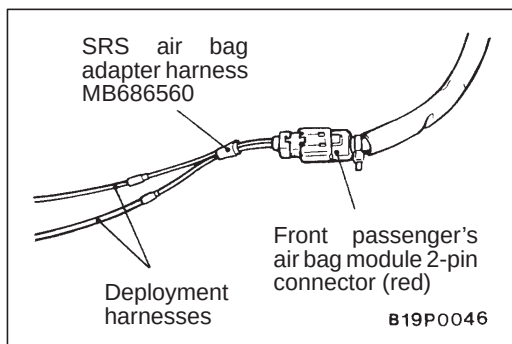
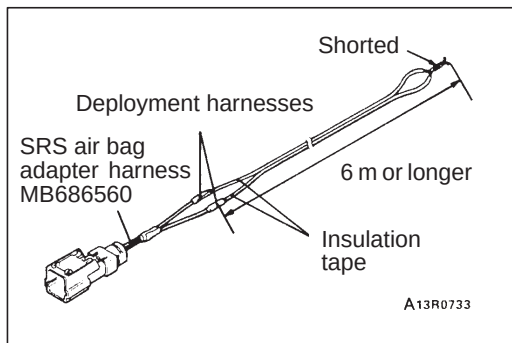
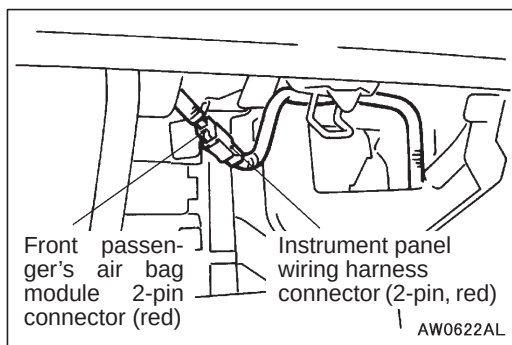
The cover is required as the glass, if already damaged, may break.

- (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

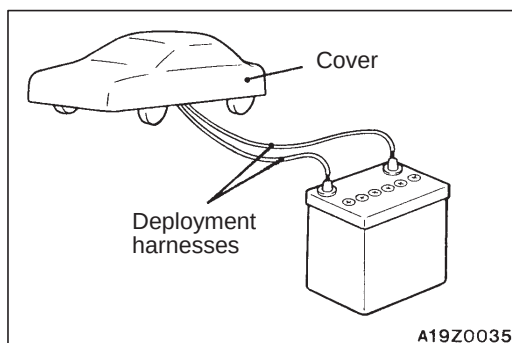
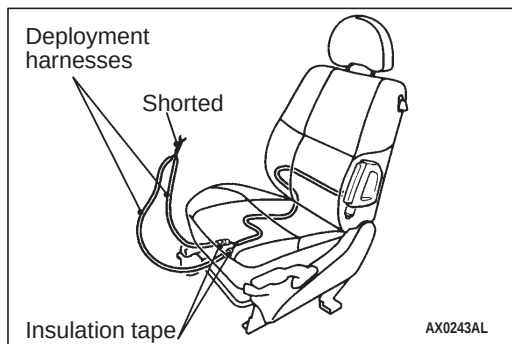
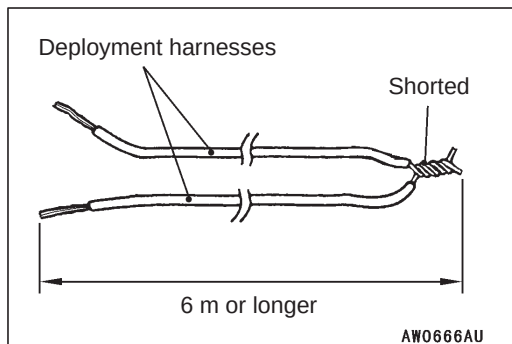
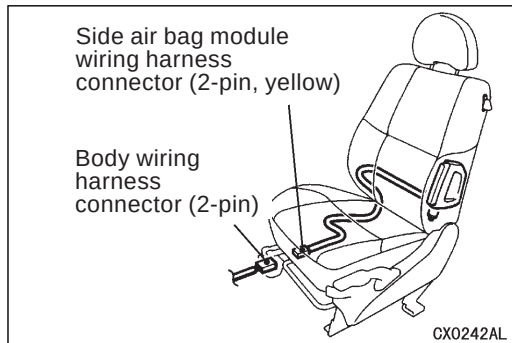
The cover is required as the glass, if already damaged, may break.

- (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.

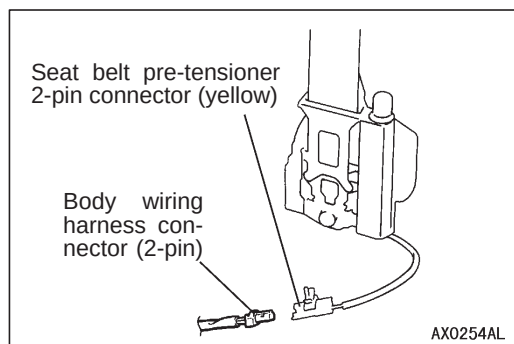
Caution

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).

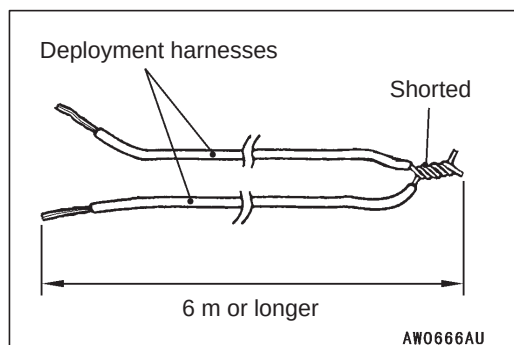


Seat belt pre-tensioner

- (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

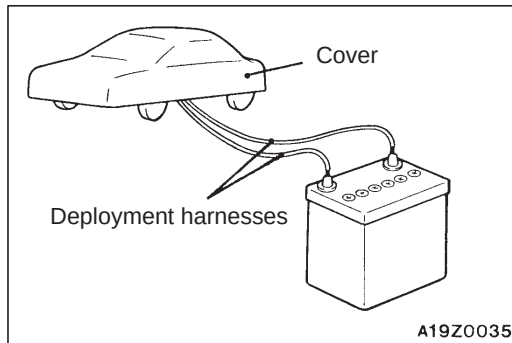
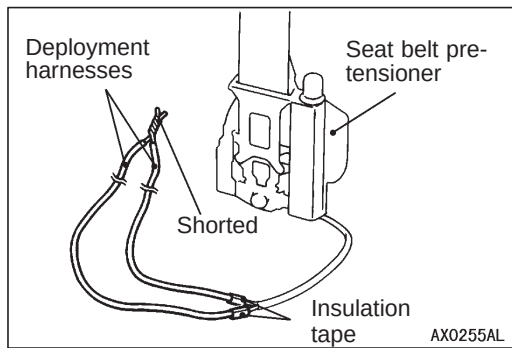
If the seat belt pre-tensioner connector is disconnected from the body wiring harness, both electrodes of the seat belt pre-tensioner connector will be automatically shorted to prevent unintended operation of the seat belt pre-tensioner due to static electricity, etc.



- (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.)

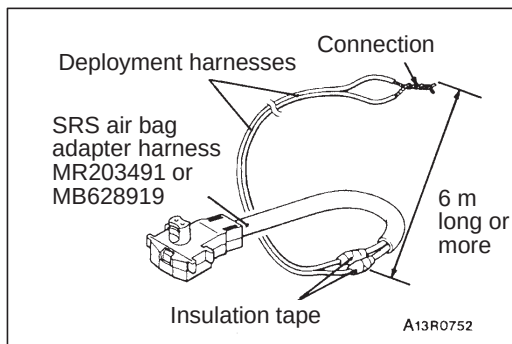
2. Deploy each air bag module, seat belt pre-tensioner in the following procedures.

Driver's air bag module

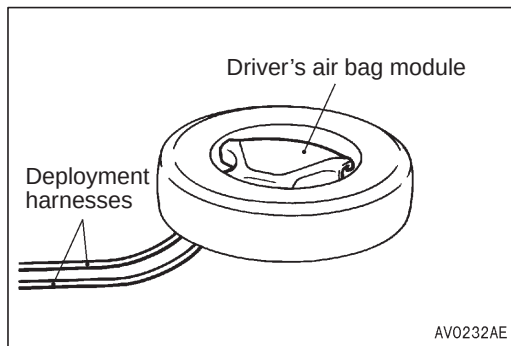
- (1) Remove the driver's air bag module from the vehicle. (Refer to P.52B-36.)

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.



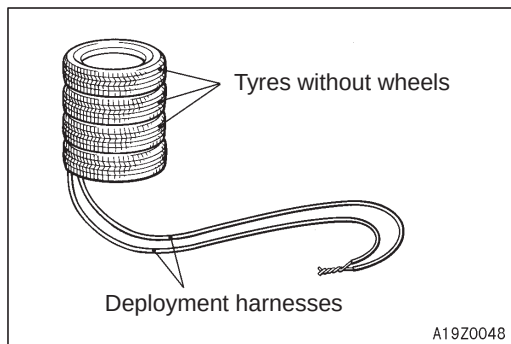
- (2) Connect two wires, each six meters or longer, to the two leads of SRS air bag adapter harness and cover the connections with insulation tape. The other ends of the two wires should be connected to each other (short-circuited), to prevent sudden unexpected deployment of the driver's air bag.
- (3) Install a nut to the bolt behind the driver's air bag module and tie thick wire for securing to the wheel.



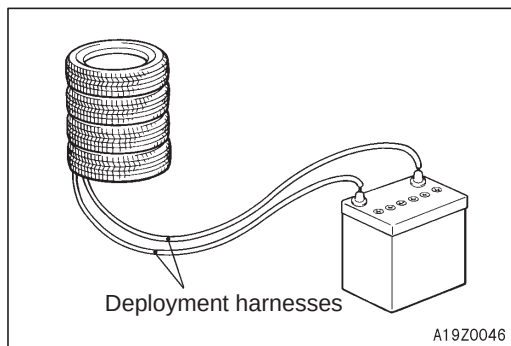
- (4) Take the SRS air bag adapter harness that is connected to the wires, pass it beneath the old tyre wheel assembly, and connect it to the driver's air bag module.
- (5) With the driver's air bag module upwards, place it in the wheel of old tyre and secure with the wire tied to the bolt.

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

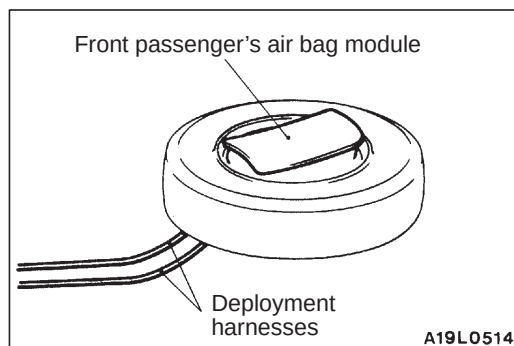
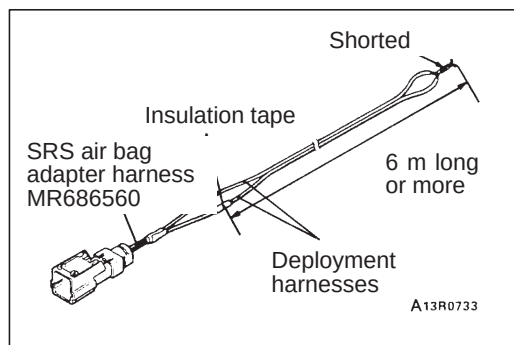
- 1) Before the deployment, be sure that no one is near the driver's air bag module.
 - 2) The deployment of the driver's air bag makes the inflator very hot. Before handling the inflator, wait more than 30 minutes for cooling.
 - 3) If the driver's air bag module fails to deploy when the procedures 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.

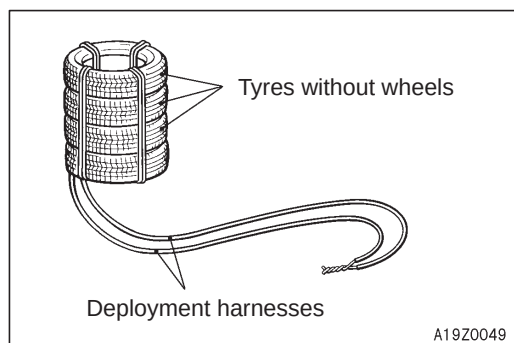


- (2) Connect deployment wires 6 m or longer with the SRS air bag adapter harness respectively. Insulate the connection with tape. Also, connect the other ends of the deployment harness each other to short, thereby preventing the front passenger's air bag from accidental deployment caused by static etc.

- (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

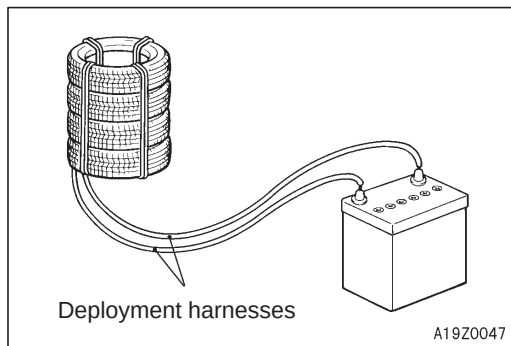
- 1) The deployment harnesses must not be tight below the wheel. Otherwise, the adapter harness could get damaged at deployment.
- 2) Place the connector of the SRS air bag adapter harness so that it is not clamped by the tyre at deployment.



- (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.

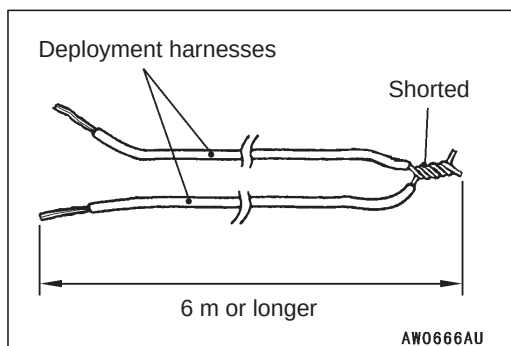
- (7) After deployment of the front passenger's air bag module, discard as specified in the procedure (Refer to P.52B-60).

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

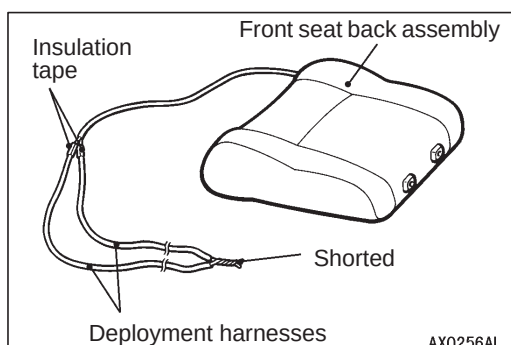
Once disconnected, both electrodes of the side air bag module connector short automatically to prevent accidental deployment caused by static etc. Still, in consideration of the accidental deployment, store the air bag module on flat place with deployment surface facing up. Also, do not put anything on it.



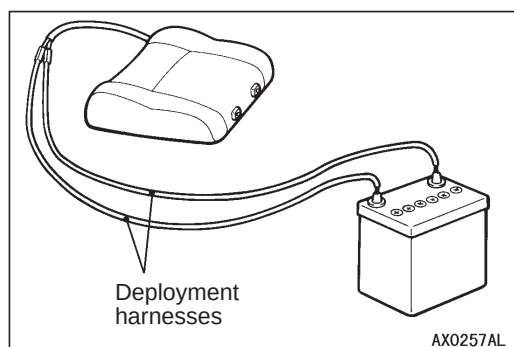
- (2) Prepare two wires longer than 6 m for deployment and connect the terminals in one end to short-circuit. This is to prevent accidental deployment caused by static etc.
- (3) Touch the vehicle's body with bare hands to discharge static in you.

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

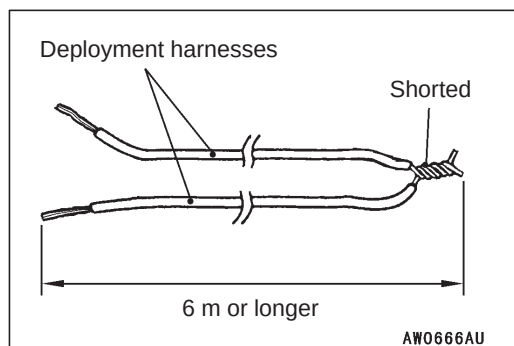
- 1) Before the deployment, see that no one is near the front seat back assembly.
 - 2) The deployment makes the inflator of the side air bag very hot. Before handling the inflator, wait more than 30 minutes for cooling.
 - 3) If the side air bag module fails to deploy although the procedure is respected, 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

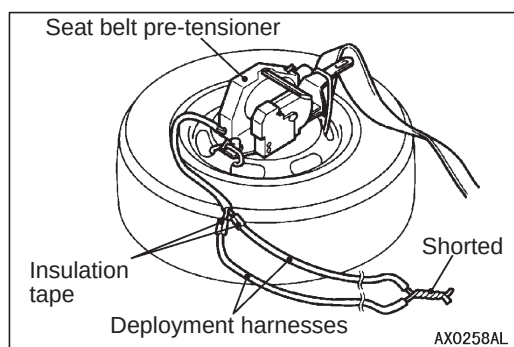
The seat belt pre-tensioner should be stored on a flat surface and placed so that the air bag operation surfaces are facing upward. Do not place anything on top of them.



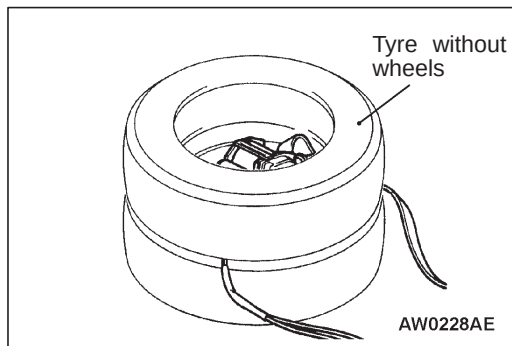
- (2) Prepare two wires longer than 6 m for deployment and connect the terminals in one end to short-circuit. This is to prevent accidental operation caused by static etc.
- (3) Touch the vehicle's body with bare hands to discharge static in you.

Caution

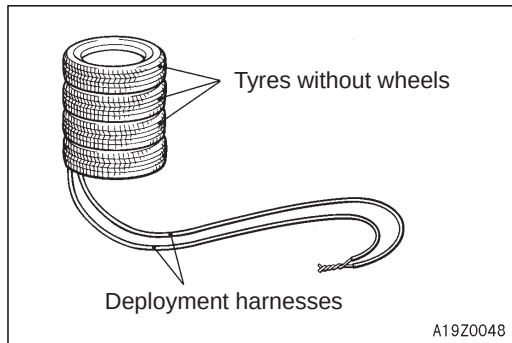
Never fail to do Step (3) in order to prevent accidental operation caused by static.



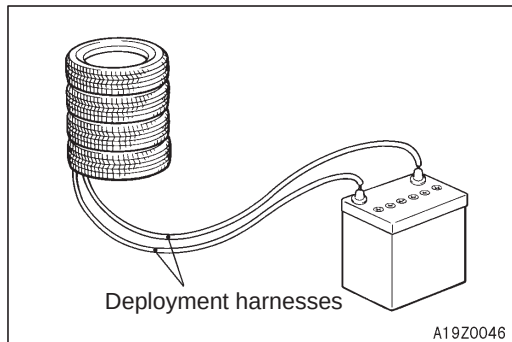
- (4) Using pliers, cut the seat belt pre-tensioner connector from the harnesses. Connect the deployment harnesses to each harness that has been cut and insulate the connections with plastic tape.
- (5) Pass the wires through the hole on the seat belt retractor bracket and secure them to the front (raised 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).

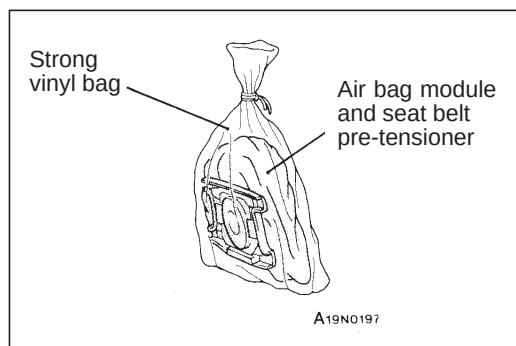
DEPLOYED AIR BAG MODULE OR OPERATED SEAT BELT PRE-TENSIONER DISPOSAL PROCEDURES

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.

CHASSIS ELECTRICAL

CONTENTS

CHASSIS ELECTRICAL	54A
SMART WIRING SYSTEM (SWS)	54B



CHASSIS ELECTRICAL

CONTENTS

BATTERY	5	TROUBLESHOOTING	8
SERVICE SPECIFICATION	5	IGNITION SWITCH AND IMMOBILIZER SYSTEM	13
ON-VEHICLE SERVICE	5	COMBINATION METERS	17
Fluid Level and Specific Gravity Check	5	SERVICE SPECIFICATIONS	17
Charging	6	SEALANT	18
Battery Testing Procedure	7	SPECIAL TOOLS	18
IGNITION SWITCH AND IMMOBILIZER SYSTEM*	8	TROUBLESHOOTING	19
SPECIAL TOOL	8		

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 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 (*).

MULTI-CENTER DISPLAY <MIDDLE
GRADE> 67

SPECIAL TOOL 67

TROUBLESHOOTING 67

MULTI-CENTER DISPLAY 79

MULTI-CENTER DISPLAY <HIGH
GRADE> 80

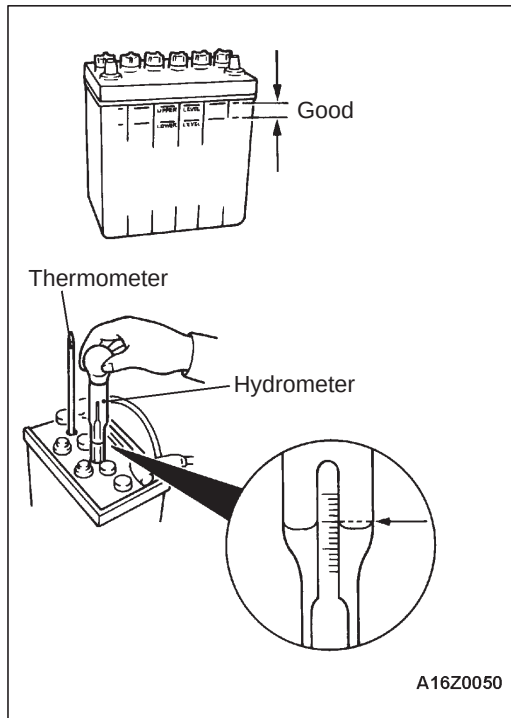
TROUBLESHOOTING 80

MULTI-CENTER DISPLAY 108

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.

$$D20 = (t - 20) \times 0.0007 + Dt$$

D20: Specific gravity of the battery fluid calculated for 20°C.

Dt: Actually measured specific gravity

t: Actually measured temperature

CHARGING

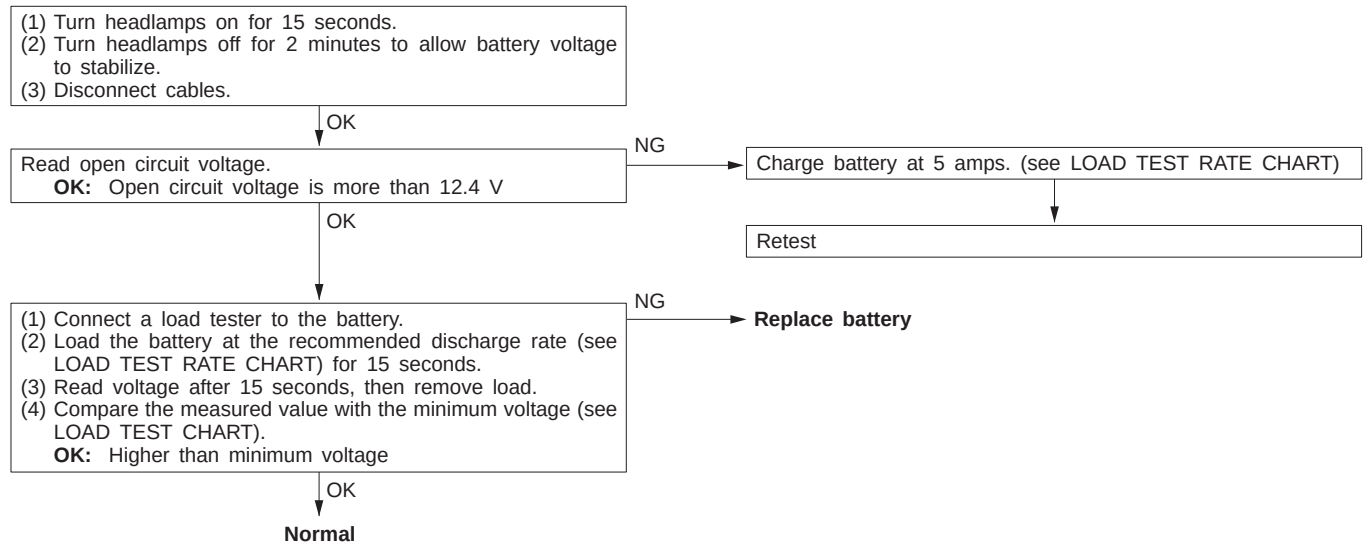
1. When charging a battery while still installed in the vehicle, disconnect the battery cables to prevent damage to electrical parts.
2. The current normally used for charging a battery should be approximately 1/10th of the battery capacity. When performing a quick-charging due to lack of time, etc., 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**

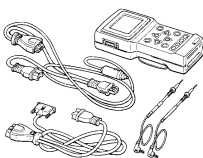
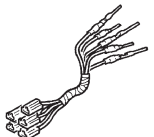
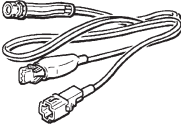
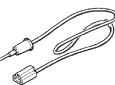
Battery type	65D23L
Charging time when fully discharged h [5-amp rated current charging]	11
Load test (Amps)	300

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

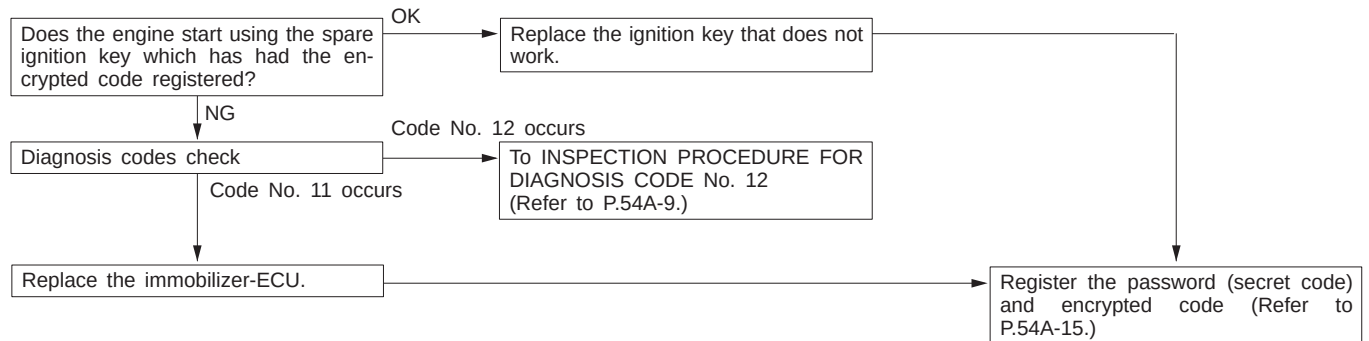
The diagnosis codes which result from disconnecting the battery cables cannot be erased.

INSPECTION CHART FOR DIAGNOSIS CODES

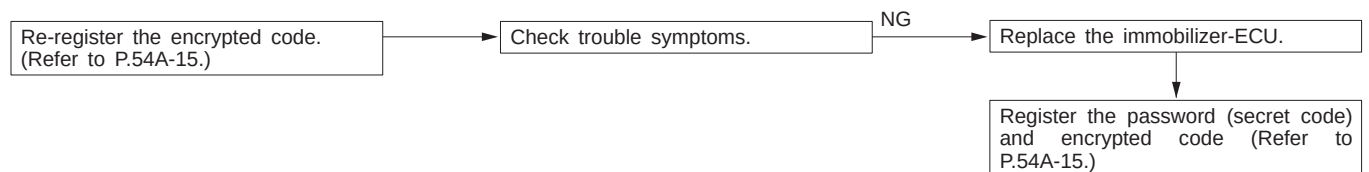
Diagnosis code No.	Inspection items	Reference page
11	Transponder communication system	54A-9
12	Encrypted code are not the same or are not registered	54A-9

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



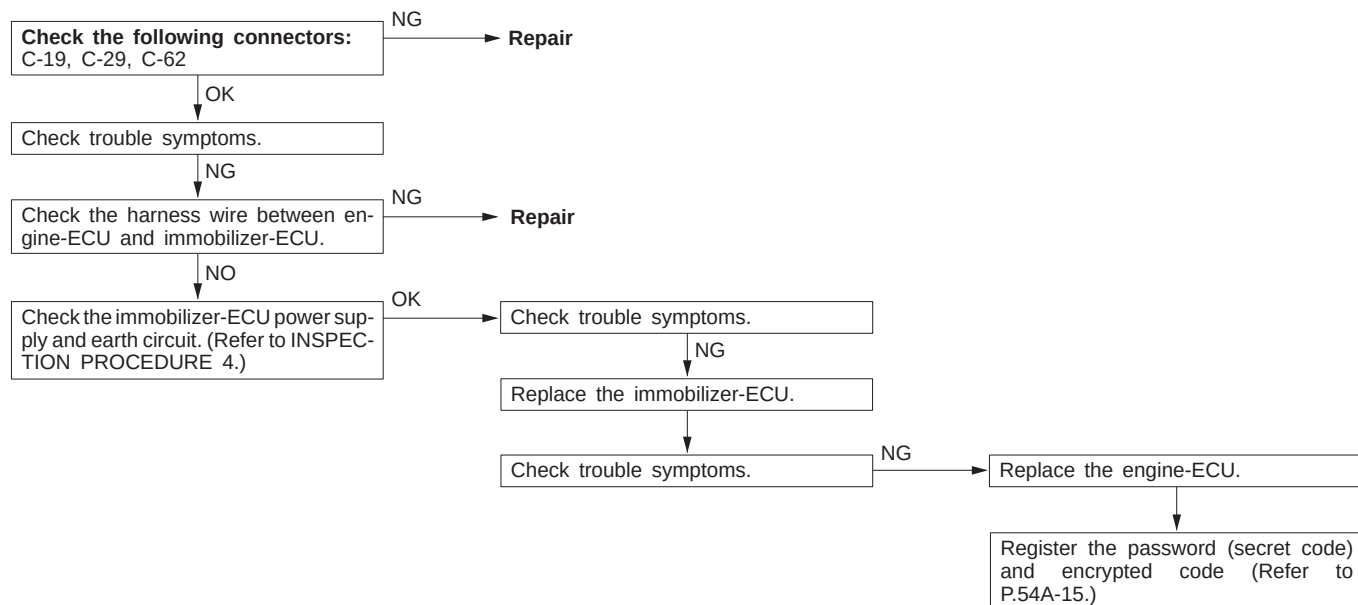
INSPECTION CHART FOR TROUBLE SYMPTOMS

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

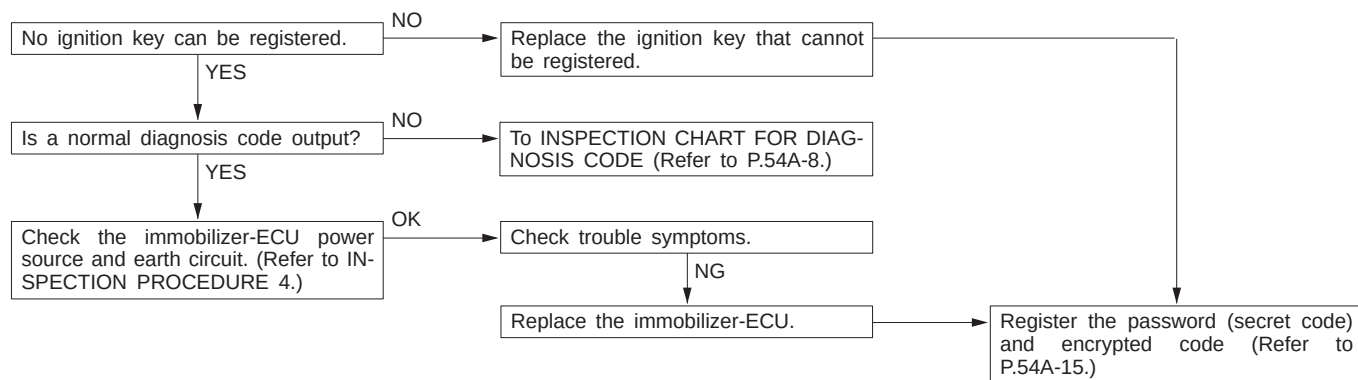
Inspection Procedure 1

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



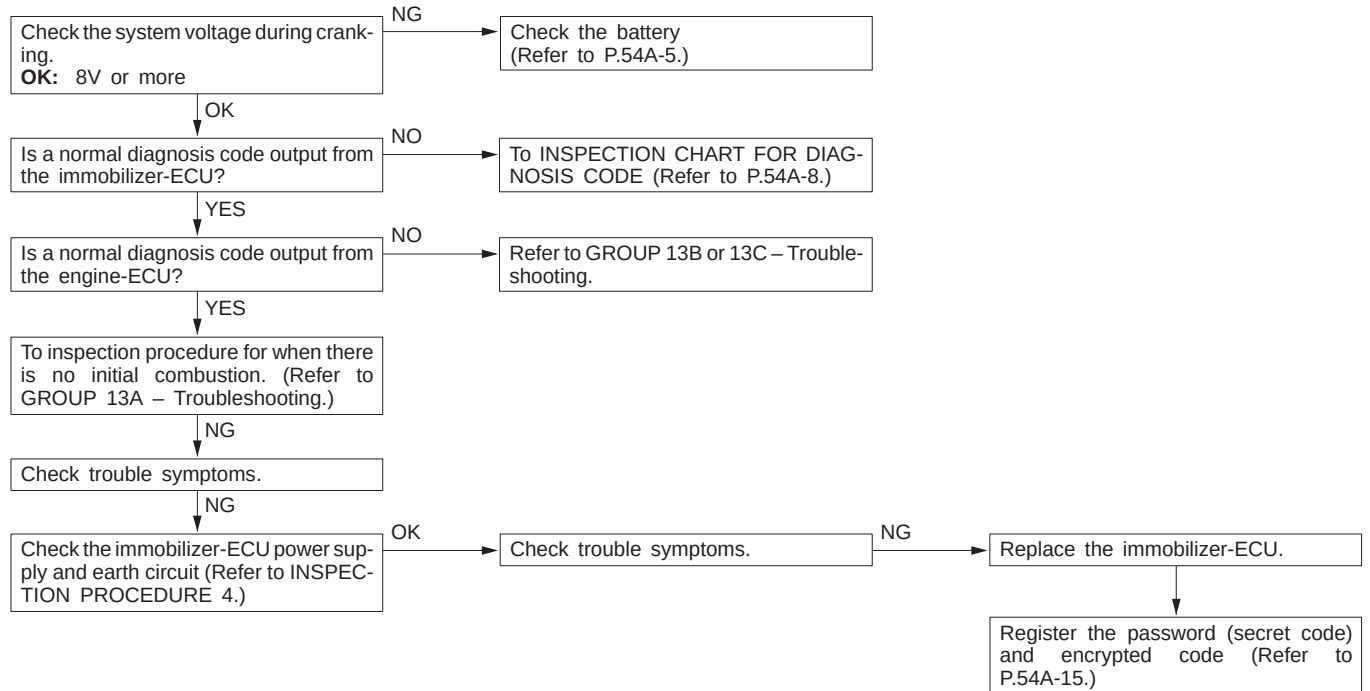
Inspection Procedure 2

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



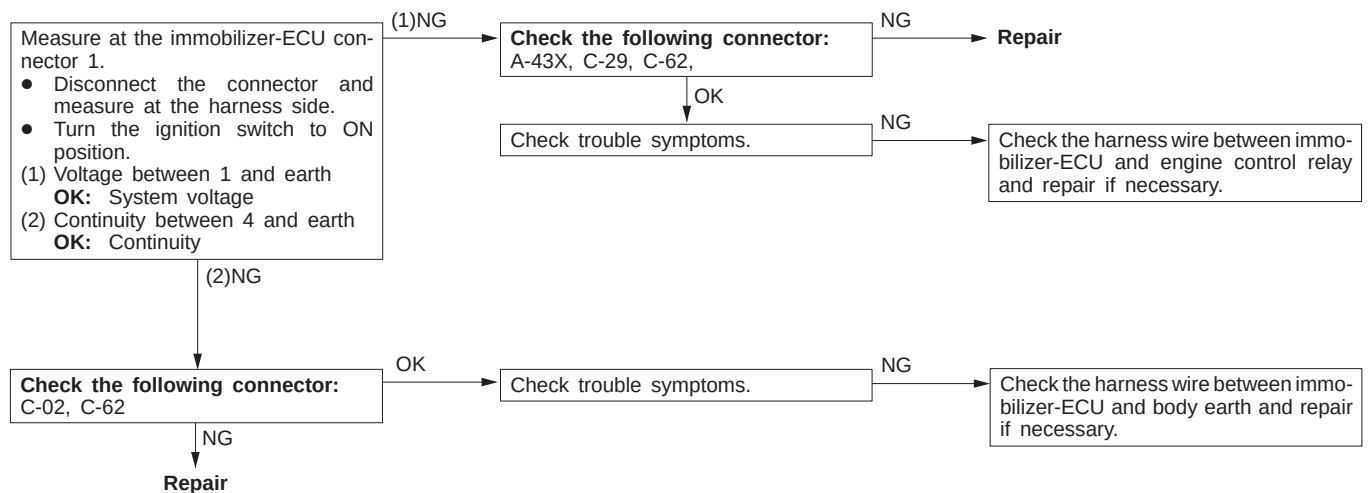
Inspection Procedure 3

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



54A-12 CHASSIS ELECTRICAL – Ignition Switch and Immobilizer System

CHECK AT IMMOBILIZER-ECU

TERMINAL VOLTAGE CHECK CHART



W0599AE

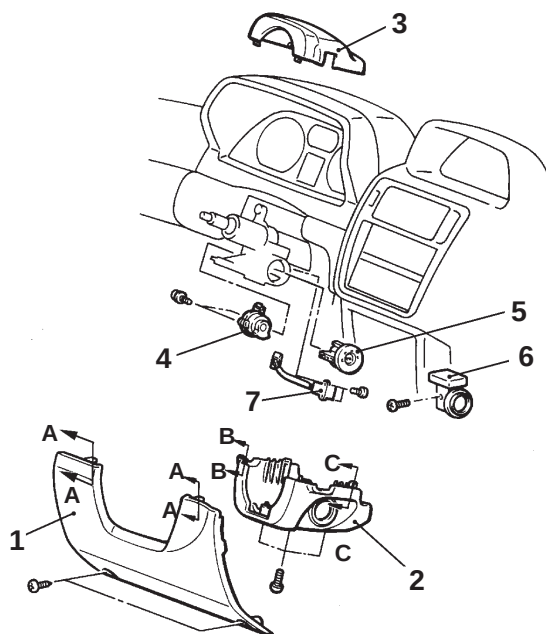
Terminal No.	Signal	Checking requirements	Terminal voltage
1	Immobilizer-ECU power supply	Ignition switch: ON	System voltage
2	–	–	–
3	Engine-ECU	–	–
4	Immobilizer-ECU earth	Always	0 V

IGNITION SWITCH AND IMMOBILIZER SYSTEM**REMOVAL AND INSTALLATION****Caution: SRS**

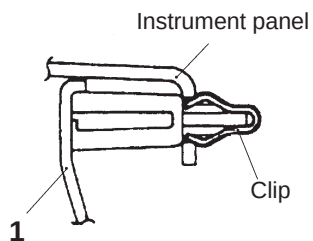
Before removal of air bag module and clock spring, refer to GROUP 52B – Service Precautions and Air Bag Module and Clock Spring.

Pre-removal and Post-installation Operation

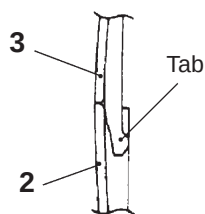
Clock Spring and Column Switch Removal and Installation (Refer to GROUP 52B – Air Bag Modules and Clock Spring.)



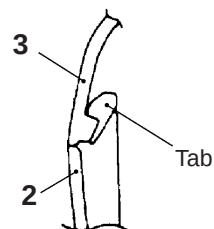
AX0131AL

Section A – A

AW0989AL

Section B – B

W1109AL

Section C – C

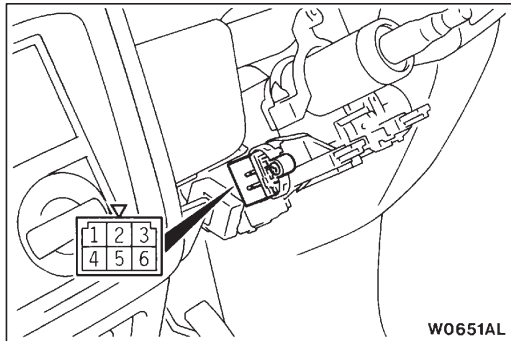
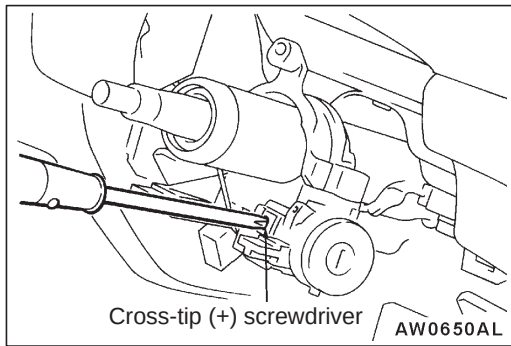
W1110AL

Removal steps

1. Instrument under cover
2. Column cover, lower
3. Column cover, upper
4. Ignition switch



5. Steering lock cylinder
6. Immobilizer-ECU
7. Key reminder switch



REMOVAL SERVICE POINTS

◀A▶ STEERING LOCK CYLINDER REMOVAL

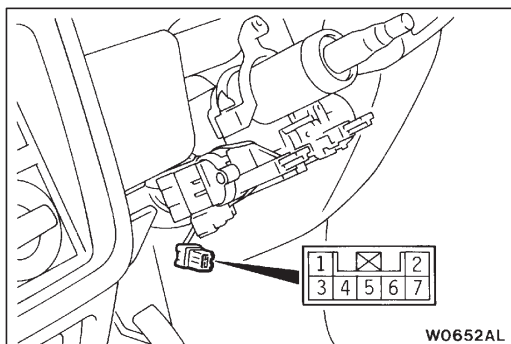
1. Insert the key in the steering lock cylinder and turn it to the “ACC” position.
2. Using a cross-tip (+) screwdriver (small) or a similar tool, push the lock pin of the steering lock cylinder inward and then pull the steering lock cylinder toward you.

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.

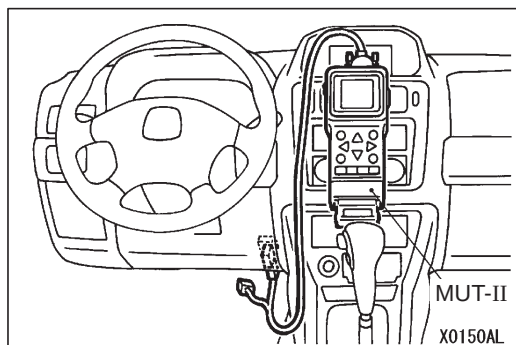
ENCRYPTED CODE REGISTRATION METHOD

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

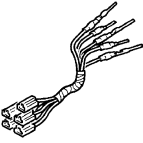
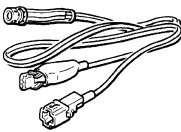
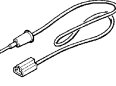
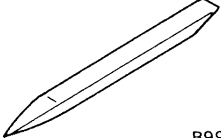
SERVICE SPECIFICATIONS

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 tempera- ture 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

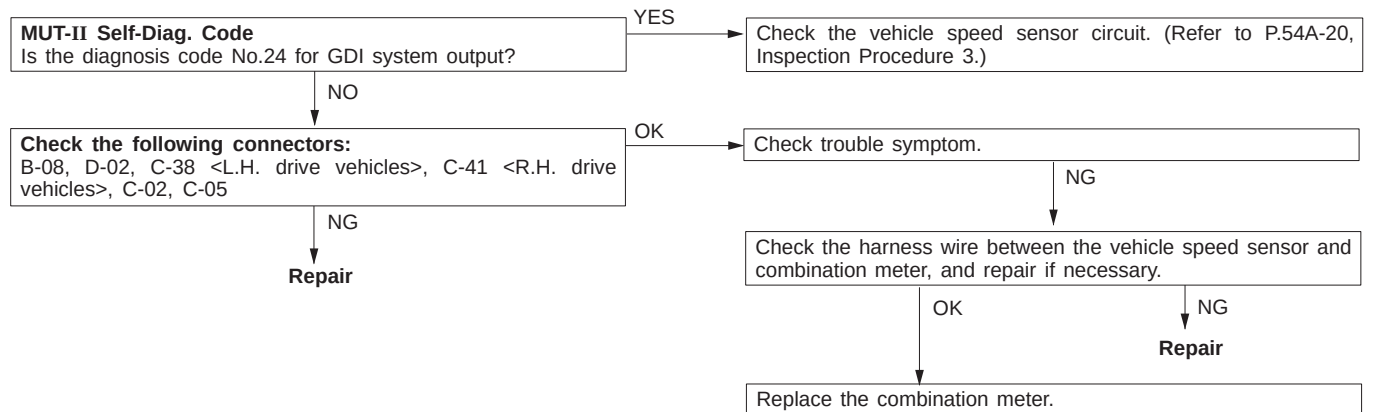
INSPECTION CHART FOR TROUBLE SYMPTOMS

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

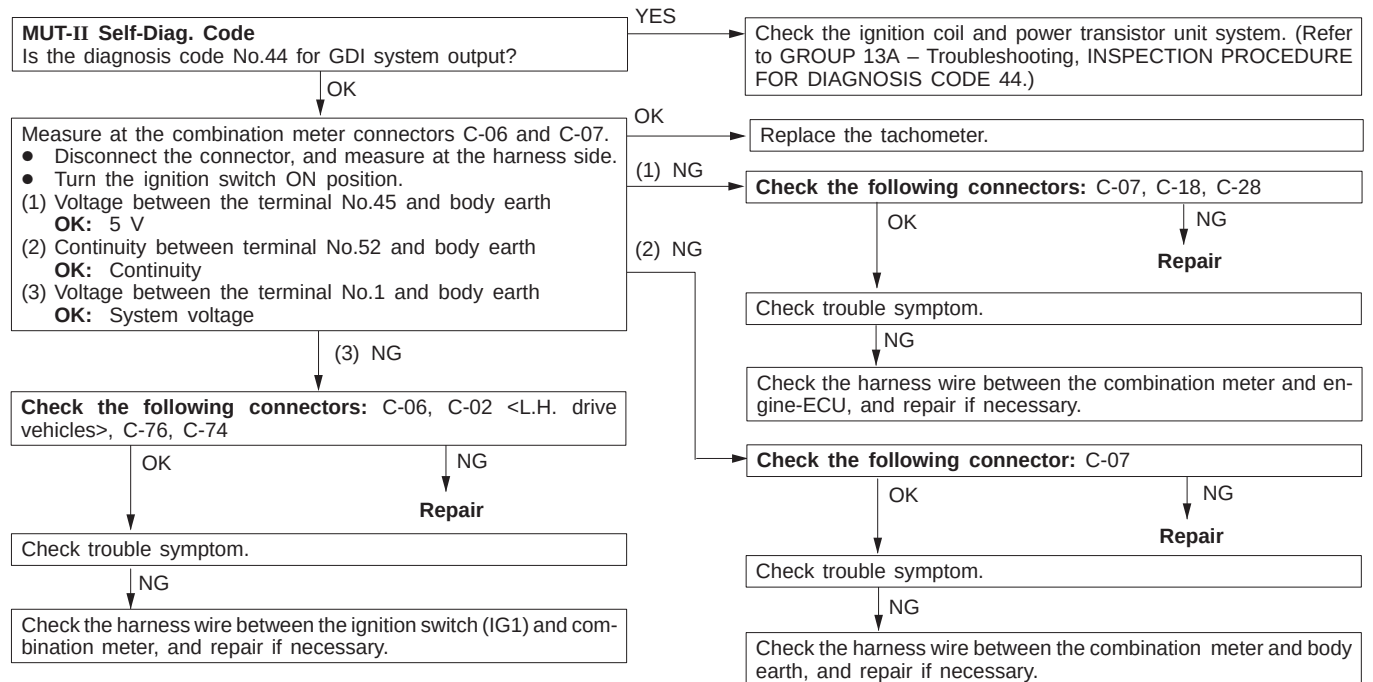
Inspection Procedure 1

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



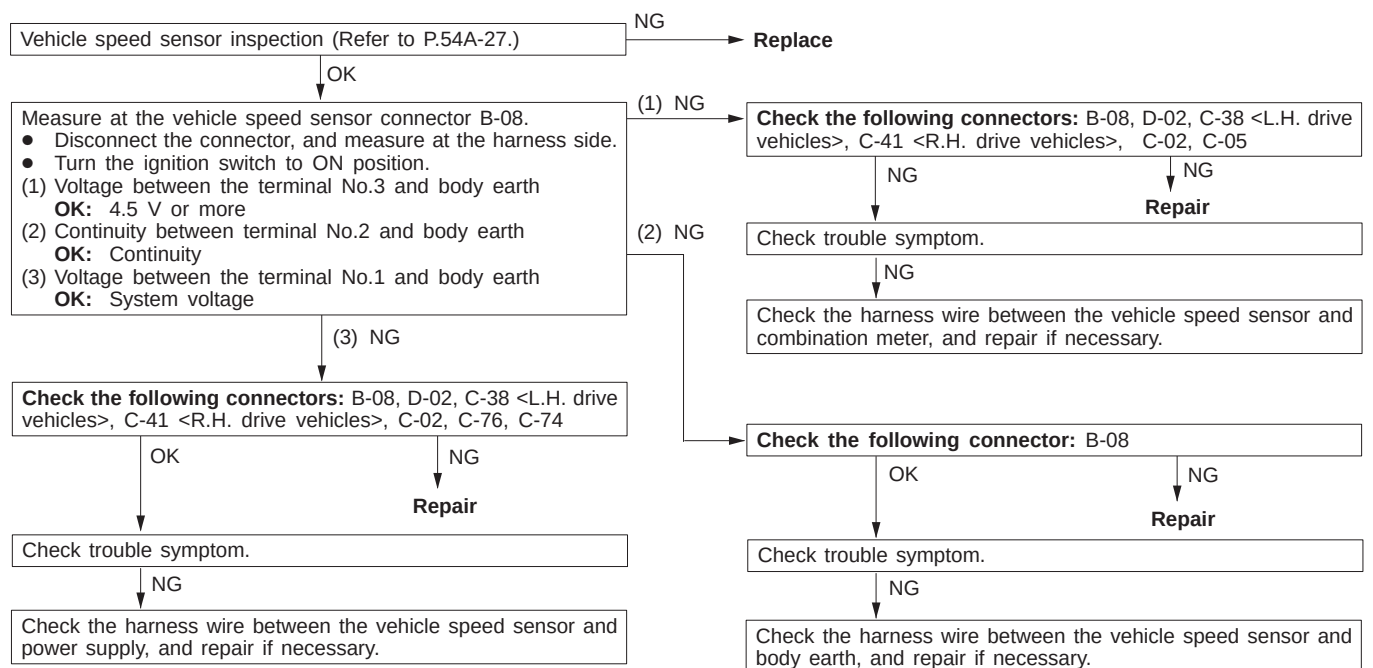
Inspection Procedure 2

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



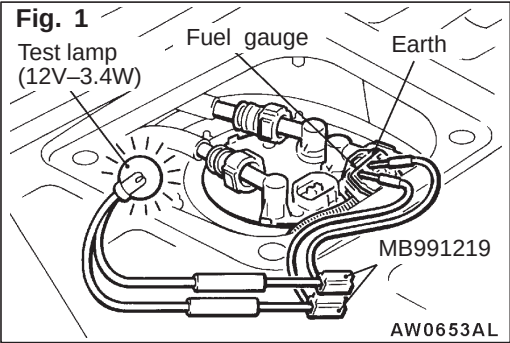
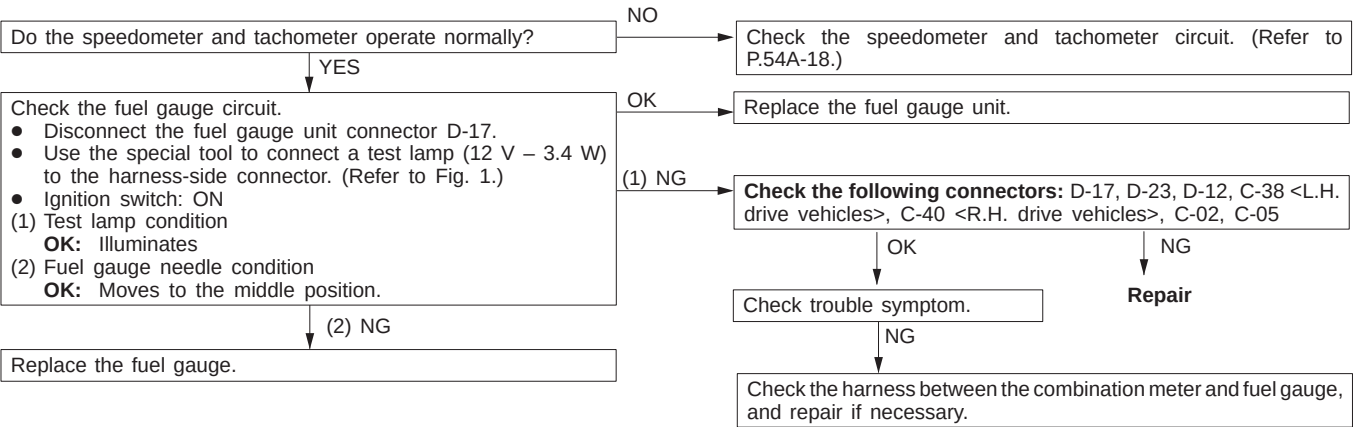
Inspection Procedure 3

Vehicle speed sensor circuit system inspection



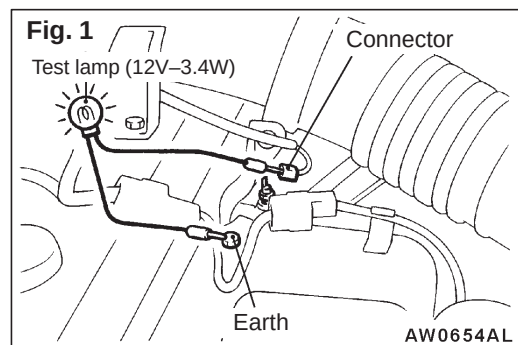
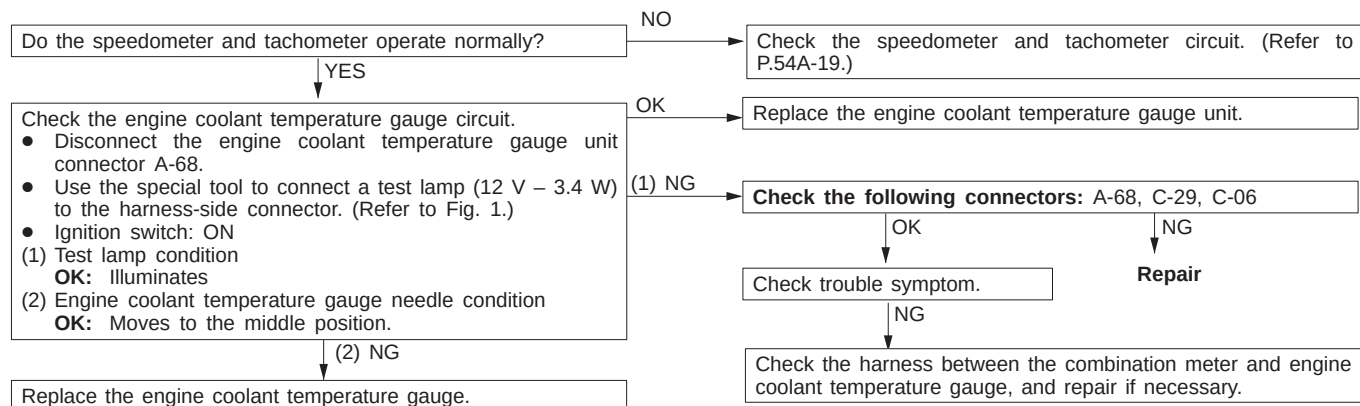
Inspection Procedure 4

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



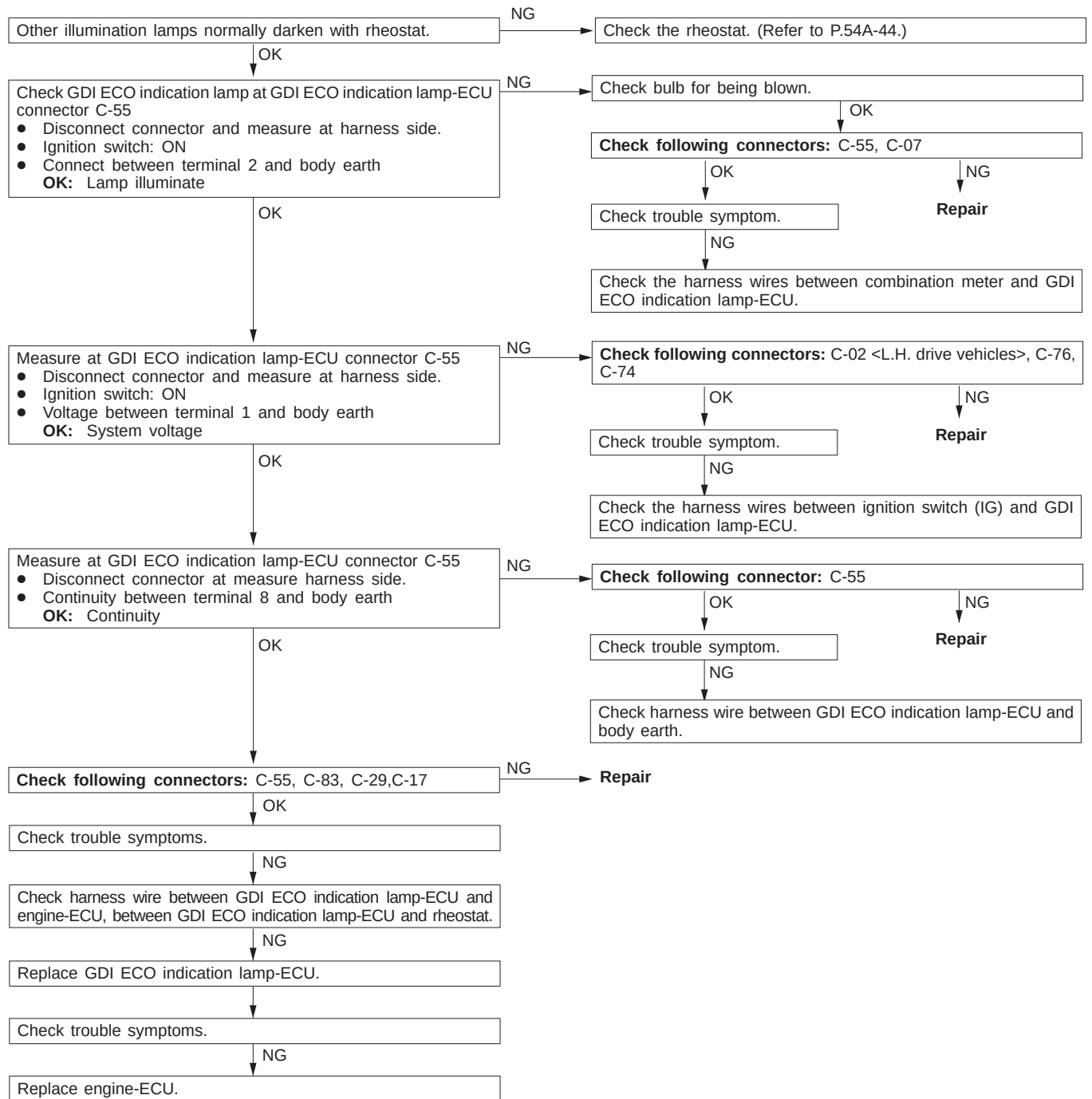
Inspection Procedure 5

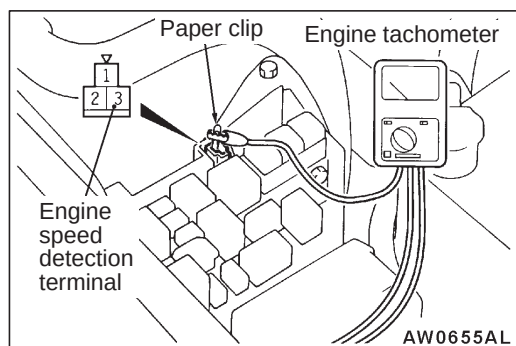
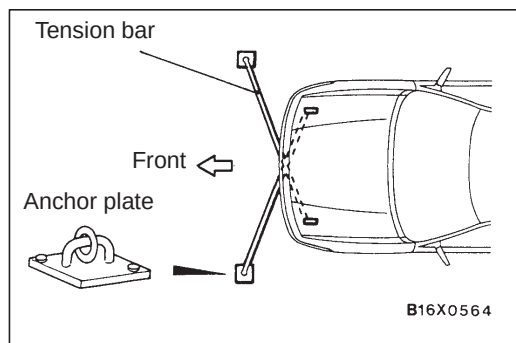
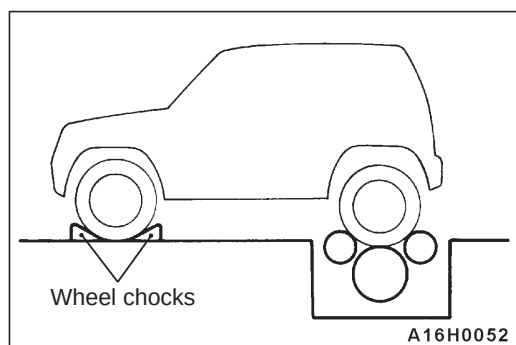
Engine coolant temperature gauge does not operate.	Probable cause
If speedometer and tachometer operate normally, the harness from power supply to combination meter is normal.	• Malfunction of engine coolant temperature gauge unit • Malfunction of engine coolant temperature gauge • Malfunction of harness or connector



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.

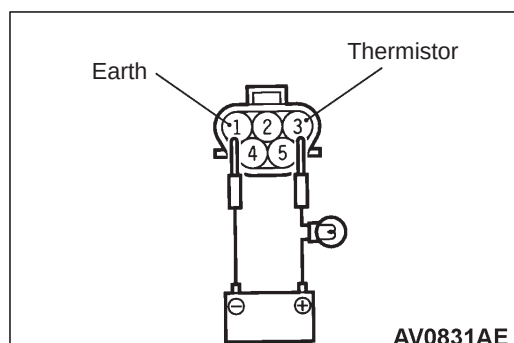
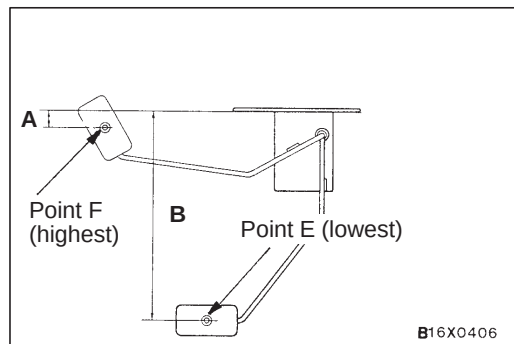
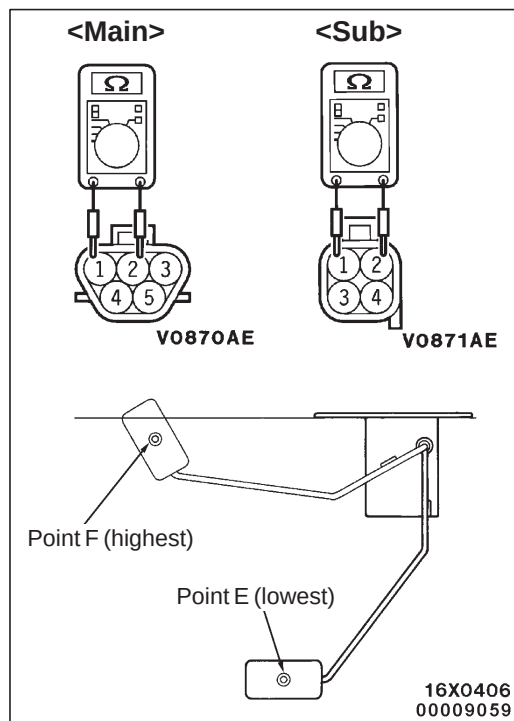
NOTE

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.

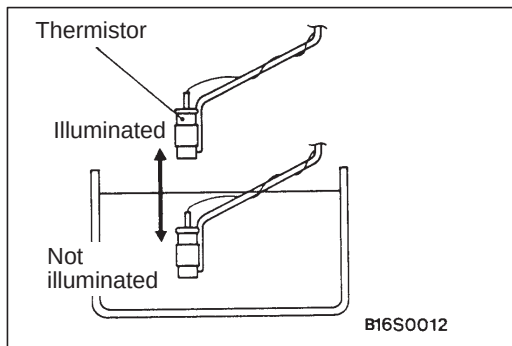
Standard value:

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)

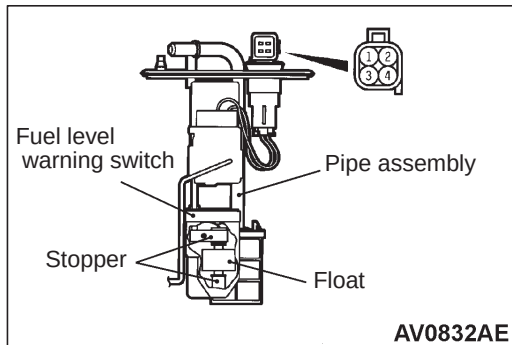
1. Connect the battery to the main fuel gauge unit connector via test lamp (12 V – 3.4 W) as shown in the illustration.



- 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**

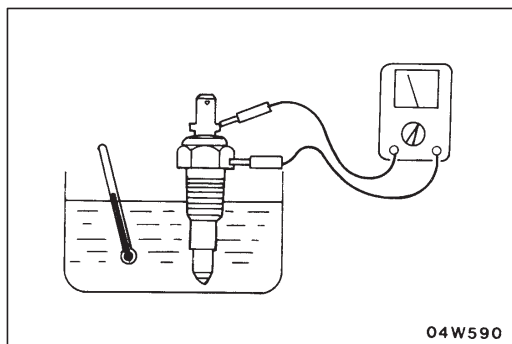
- Remove the sub fuel gauge unit pipe assembly. (Refer to GROUP 13B – Fuel Tank.)

NOTE

Moving up and down of the float makes the reed switch of fuel level warning switch turned on and off.

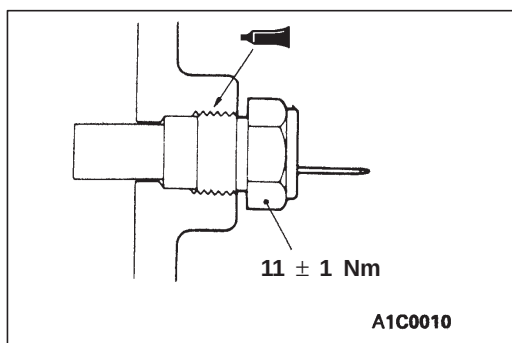
- Check the continuity between the terminals.

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**

- Bleed the engine coolant. (Refer to GROUP 14 – On-vehicle Service.)
- Remove the engine coolant temperature gauge unit.
- Immerse the unit in 70°C water to measure the resistance.

Standard value: $104 \pm 13.5 \Omega$



- After checking, apply the specified adhesive around the thread of engine coolant temperature gauge unit.

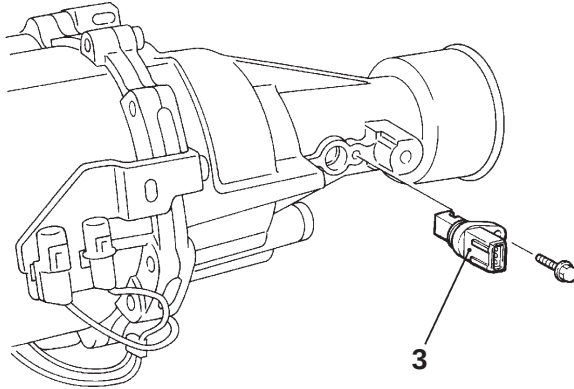
Specified sealant:

3M Adhesive Nut Locking No. 4171 or equivalent

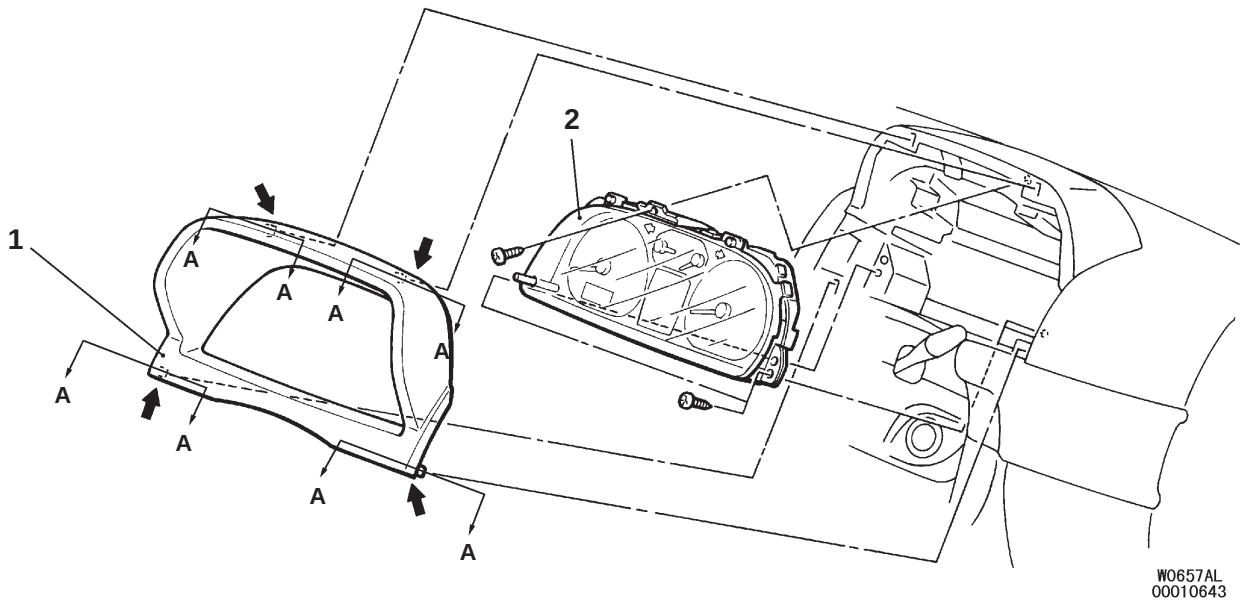
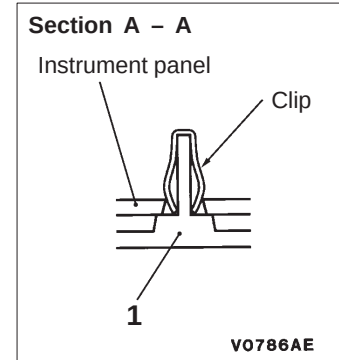
- Add engine coolant. (Refer to GROUP 14 – On-vehicle Service.)

COMBINATION METERS

REMOVAL AND INSTALLATION



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W0657AL
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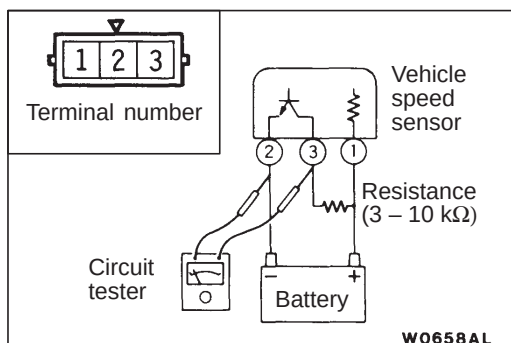
← Clip position

Combination meter removal steps

1. Meter hood
2. Combination meter

Vehicle speed sensor removal

3. Vehicle speed sensor

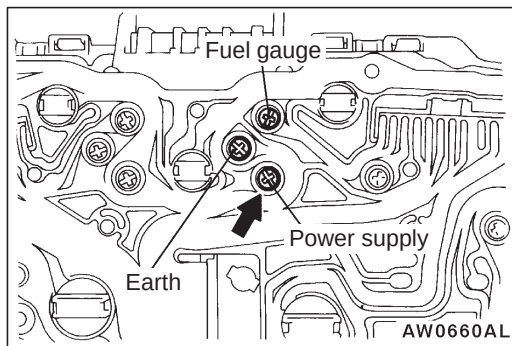


W0658AL

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:

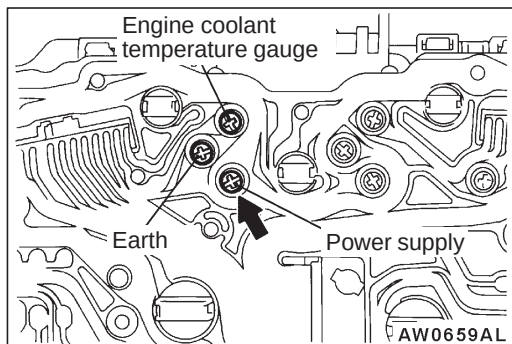
Power supply – Earth: 233.3 Ω

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.

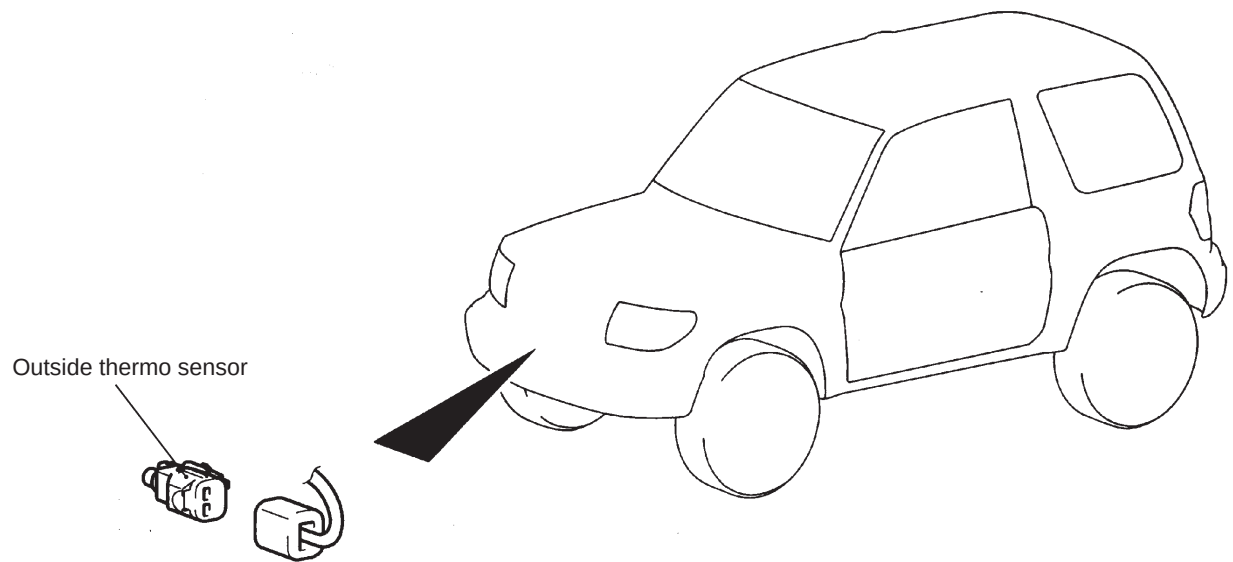
OUTSIDE THERMO SENSOR

SERVICE SPECIFICATIONS

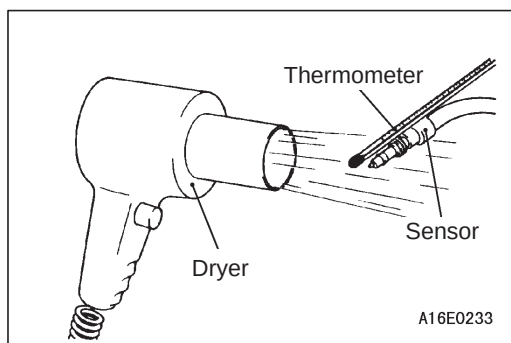
Items		Standard value
Internal resistance of outside thermo sensor Ω	At 25 °	Approx. 1,700

OUTSIDE THERMO SENSOR

REMOVAL AND INSTALLATION



AX0222AL



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:

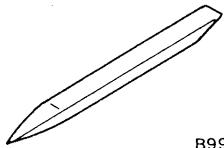
Approx. 1,700 Ω (at 25 °C)

HEADLAMP, FRONT TURN-SIGNAL LAMP AND FRONT FOG LAMP

SERVICE SPECIFICATIONS

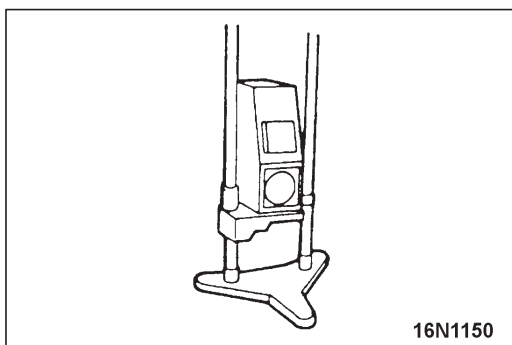
Items		Standard value	Limit
Headlamp aiming for low beam	Vertical direction	60 mm below horizontal (H)	–
	Horizontal direction	Position where the 15° sloping section intersects the vertical line (V)	–
Headlamp intensity cd		–	30,000 or more
Front fog lamp aiming	Vertical direction	100 mm below horizontal (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

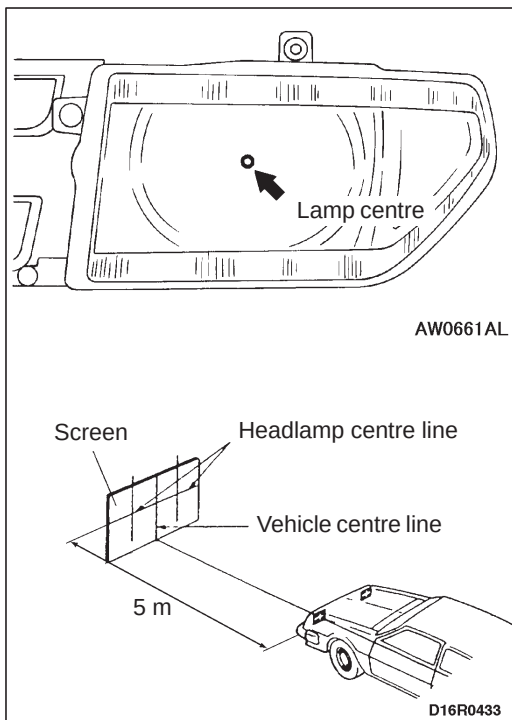
<USING A BEAM SETTING EQUIPMENT>

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

NOTE

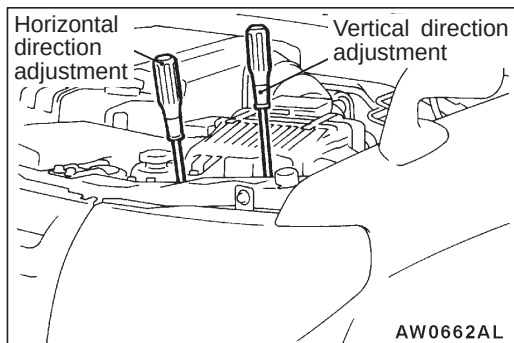
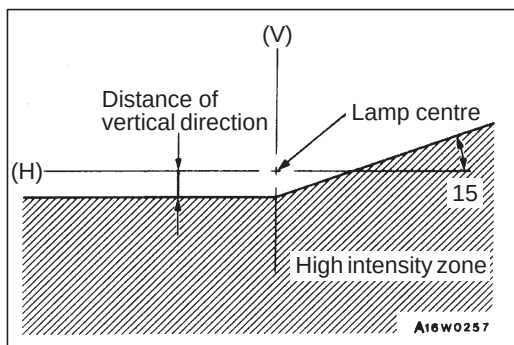
If there are any regulations pertinent to the aiming of headlamps in the area where the vehicle is to be used, adjust so as to meet those requirements.

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

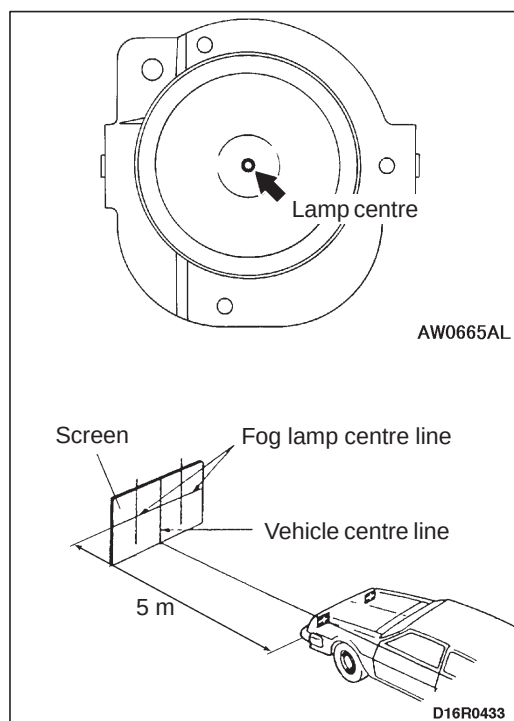
1. When measuring the intensity, maintain an engine speed of 2,000 r/min, with the battery in the charging condition.
2. There may be special local regulations pertaining to headlamp intensity, be sure to make any adjustments necessary to satisfy such regulations.
3. If an illuminometer is used to make the measurements, convert its values to photometer values by using the following formula.

$I = Er^2$ Where:

I=intensity (cd)

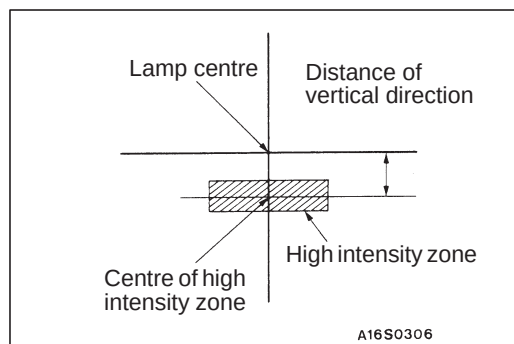
E=illumination (lux)

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.

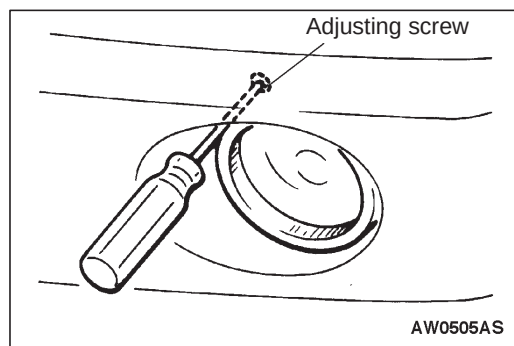
Standard value:

(Vertical direction)

100 mm below horizontal (H)

(Horizontal direction)

Parallel to direction of vehicle travel

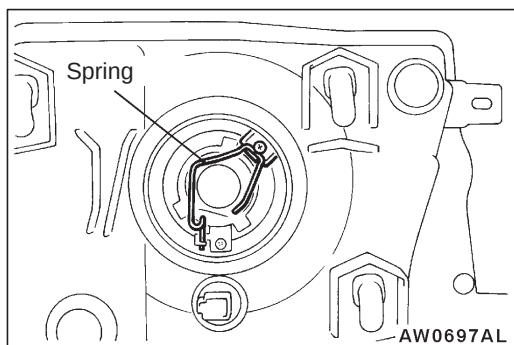


NOTE

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.



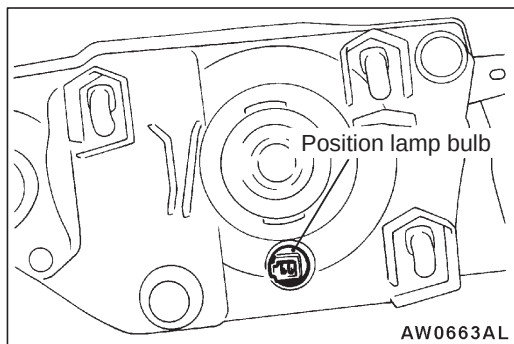
BULB REPLACEMENT

<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.

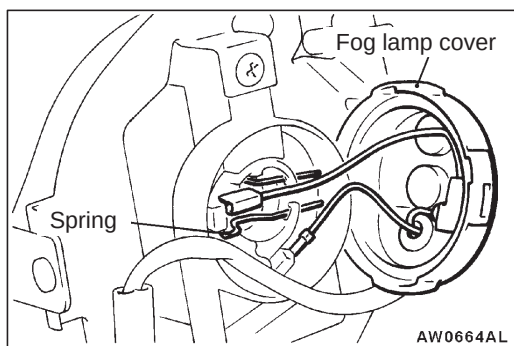
Caution

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>

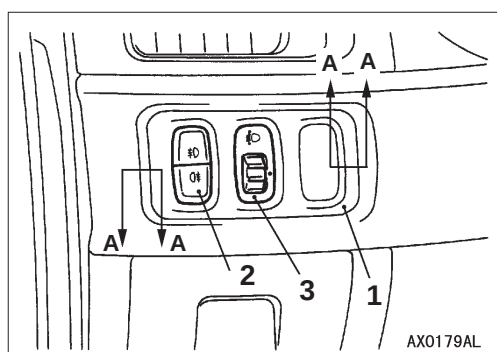
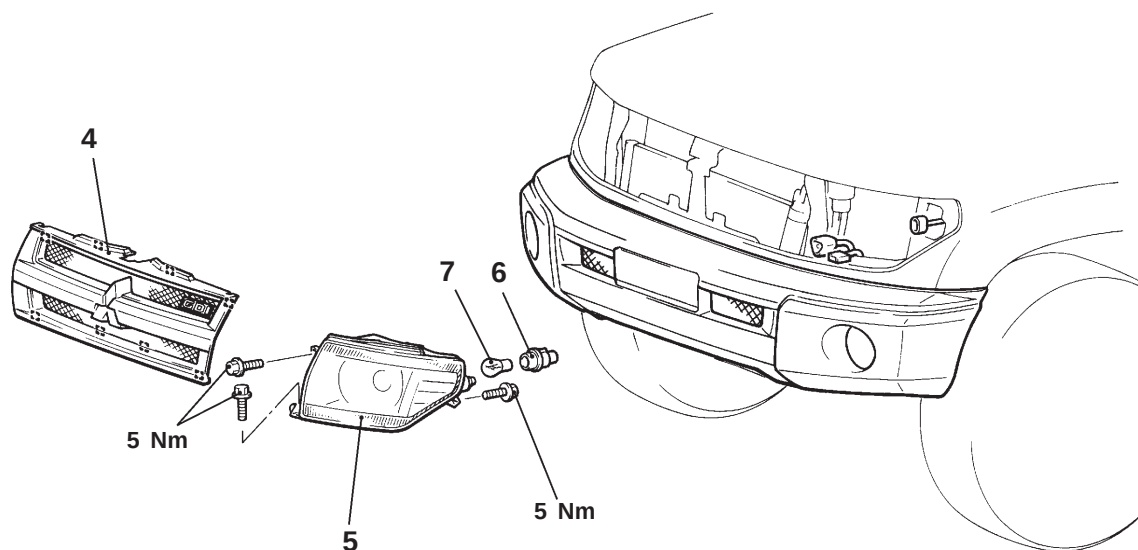
1. Remove the front fog lamp.
2. Remove the front fog lamp cover.
3. Remove the front bulb mounting spring, and then withdraw the bulb.
4. Disconnect the connector, and then replace the bulb.

Caution

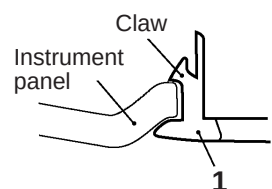
- (1) Always use the genuine part for replacement.
- (2) Do not touch the surface of the bulb with hands or dirty gloves. If the surface does become dirty, clean it with alcohol or thinner, and let it dry thoroughly before installing.
- (3) Be sure to install the socket cap. If the socket cap is improperly 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



Section A - A

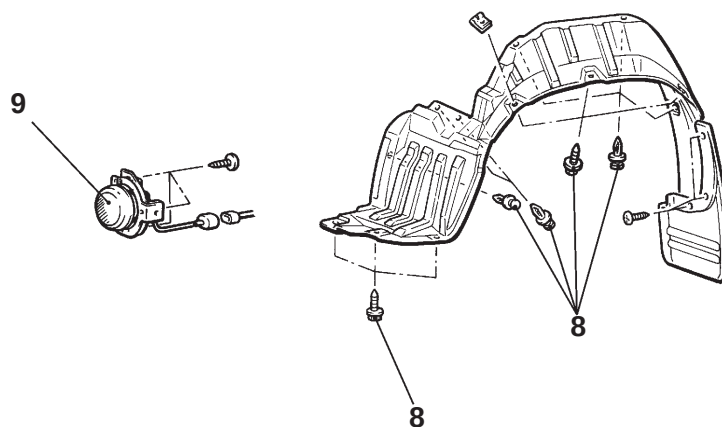


Fog lamp switch and headlamp leveling switch removal steps

1. Switch panel
2. Fog lamp switch
3. Headlamp leveling switch

Headlamp removal steps

4. Radiator grille
5. Headlamp
6. Front turn-signal lamp socket
7. Front turn-signal lamp bulb



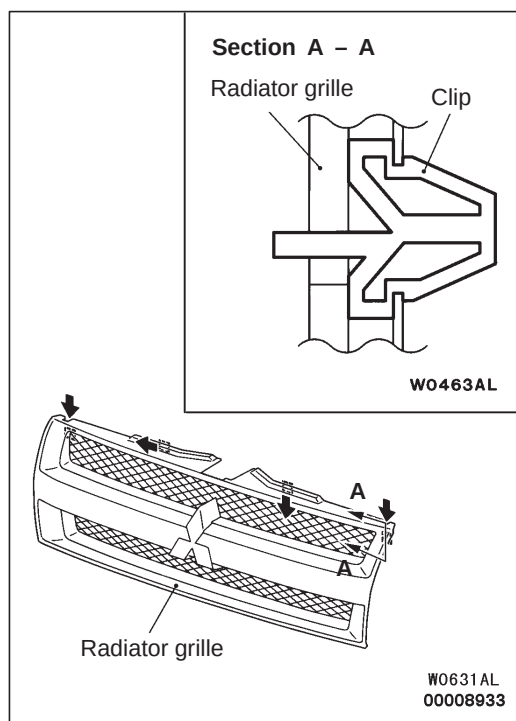
Front fog lamp removal steps

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.

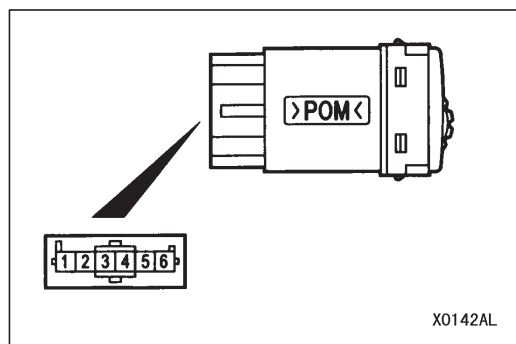




REMOVAL SERVICE POINT

◀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.

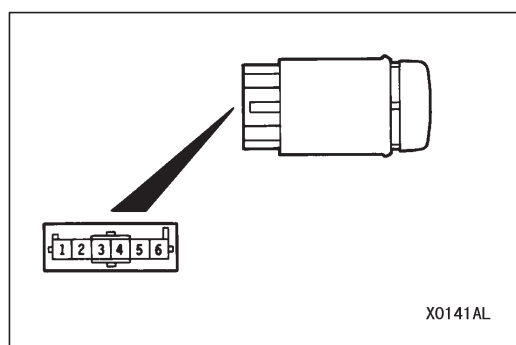


INSPECTION

HEADLAMP LEVELING SWITCH CONTINUITY CHECK

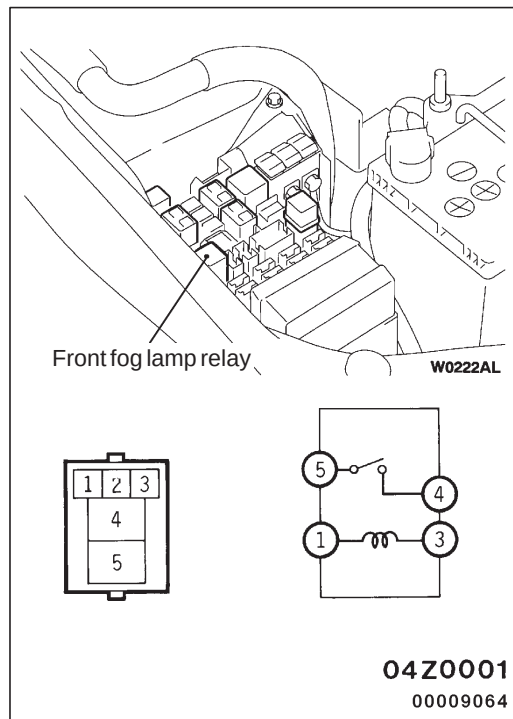
1. Check the continuity between terminals 4 and 5 (illumination circuit).
2. Operating the headlamp leveling switch, check that the resistance between terminals 4 and 5 meets the condition below.

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	○	○	○	○	○

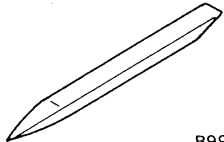


FRONT FOG LAMP RELAY CONTINUITY CHECK

Battery voltage	Terminal No.			
	1	3	4	5
Not supplied	○	○		
Supplied	⊕	⊖	○	○

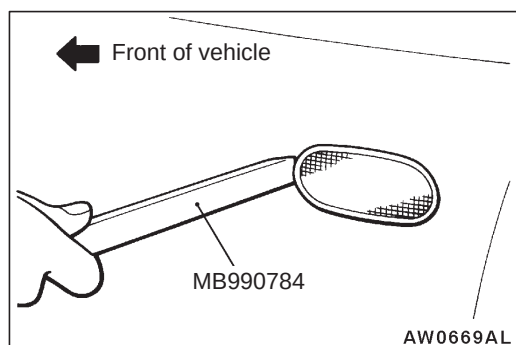
SIDE TURN-SIGNAL LAMP

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

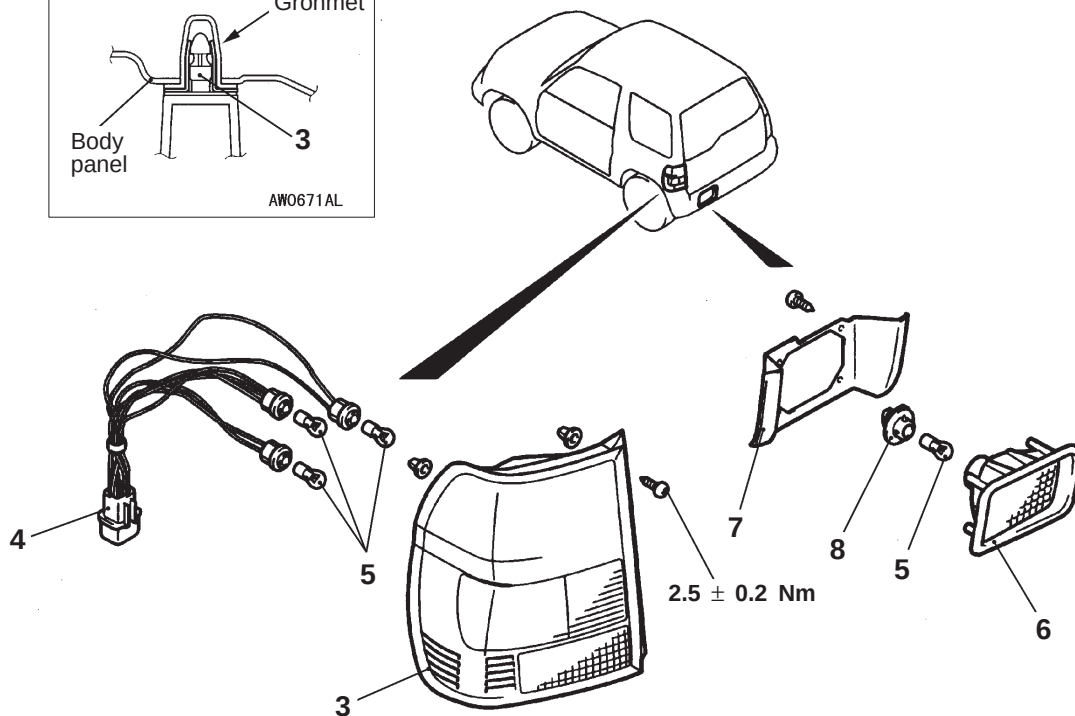
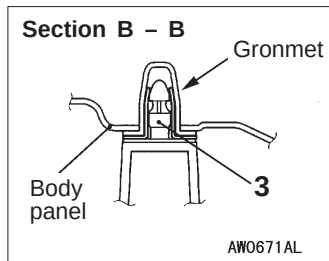
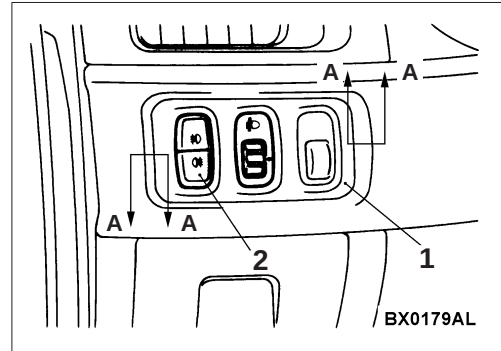
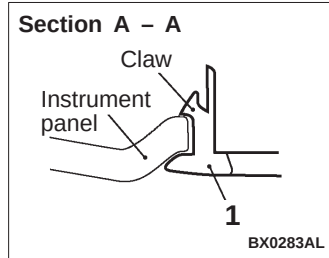
Tool	Number	Name	Use
	MB990784	Ornament remover	Removal of side turn-signal lamp

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>



AX0127AL

Fog lamp switch removal steps

1. Switch panel
2. Fog lamp switch

Rear combination lamp removal steps

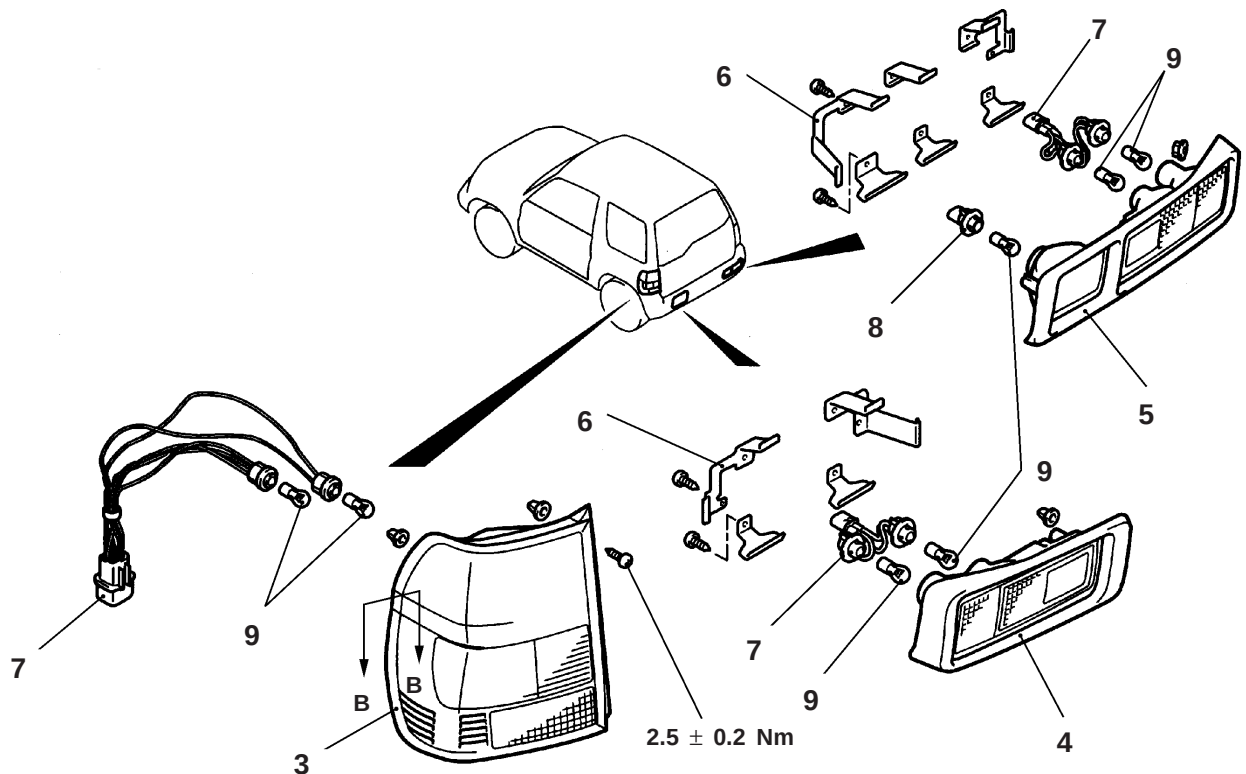
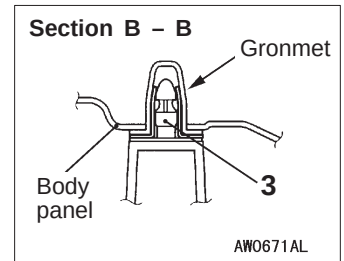
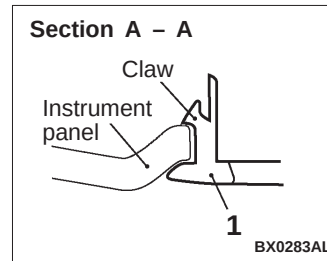
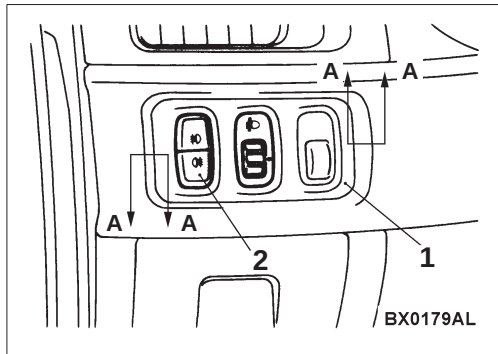
- Quarter Trim Removal and Installation (Refer to GROUP 52A)
- 3. Rear combination lamp
- 4. Socket assembly
- 5. Bulb

Rear fog lamp removal steps

- Rear mud guard (Refer to GROUP 51)
- Rear splash shield
- 6. Rear fog lamp
- 7. Bracket
- 8. Socket

54A-40 CHASSIS ELECTRICAL – Rear Combination Lamp, Rear Fog Lamp

REMOVAL AND INSTALLATION <R.H. drive vehicles>



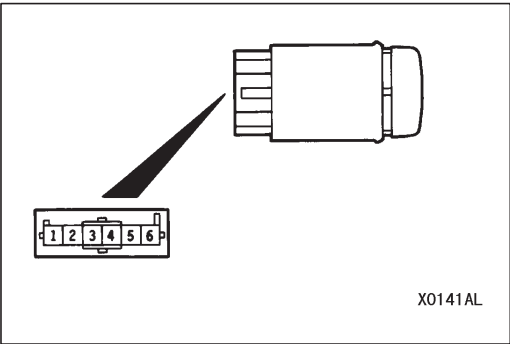
Fog lamp switch removal steps

1. Switch panel
2. Fog lamp switch

Rear combination lamp removal steps

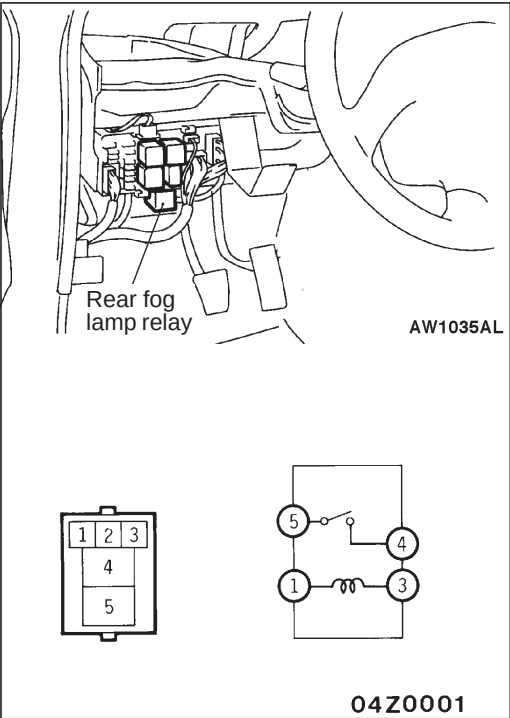
- Quarter trim removal and installation (Refer to GROUP 52A)
3. Rear combination lamp (Stop and back up lamp)

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
Released	○	○	○		
Pressed	○	○	○	○	○

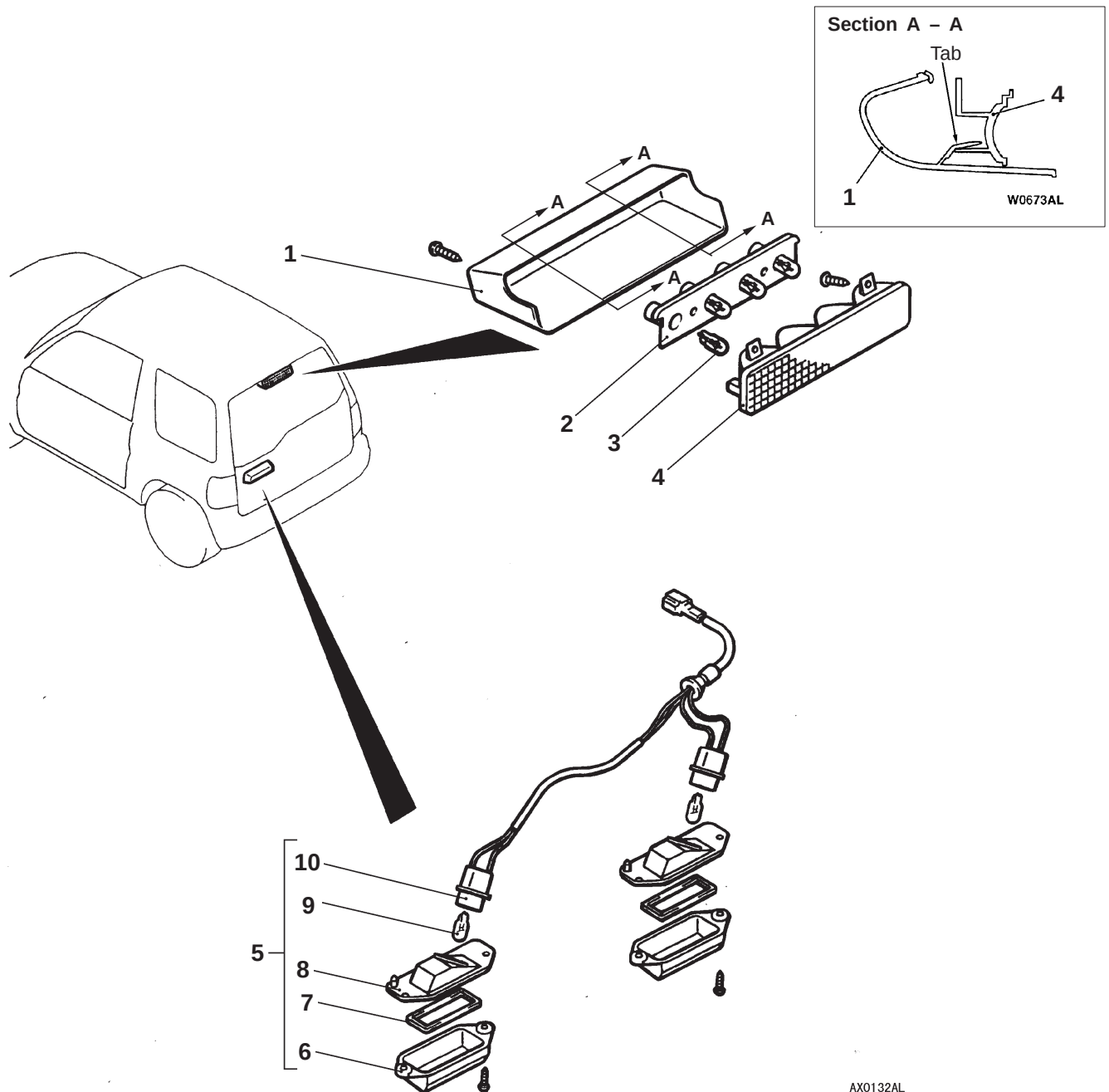


INSPECTION
REAR FOG LAMP RELAY CONTINUITY CHECK

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

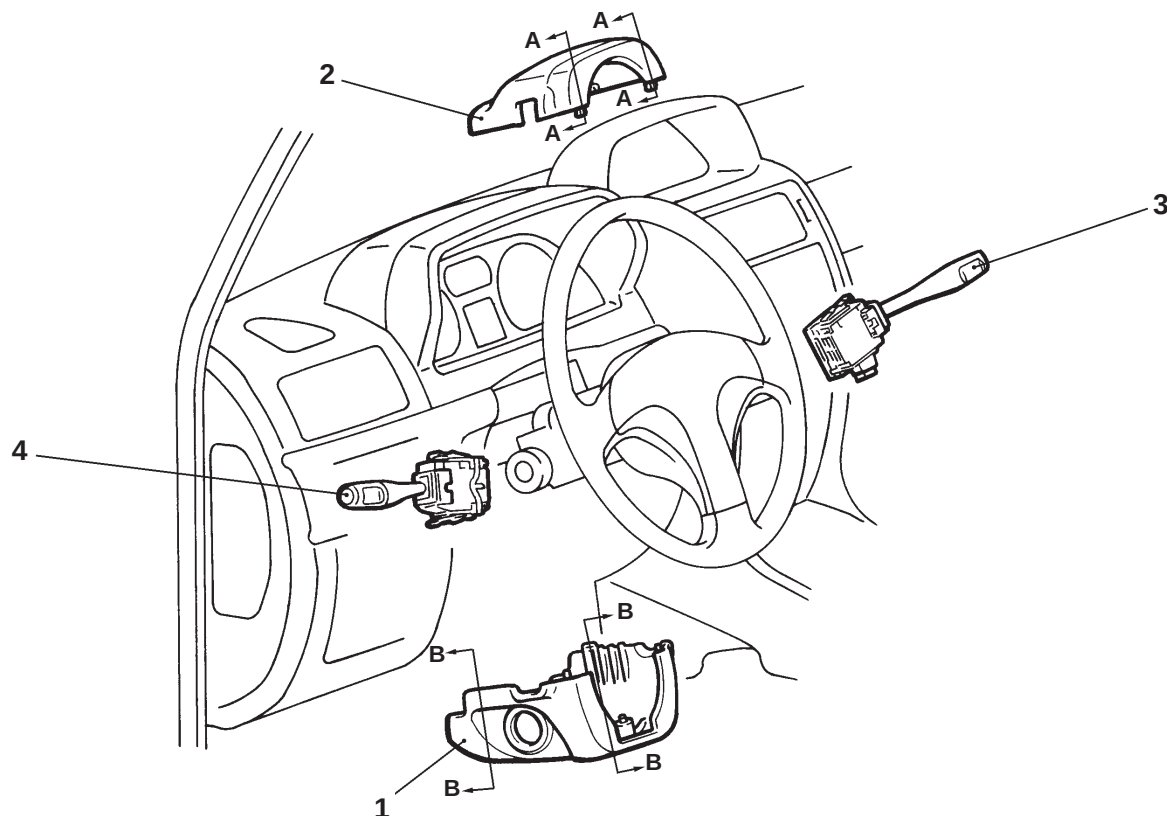
- Back door trim and waterproof film (Refer to GROUP 42.)

- 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

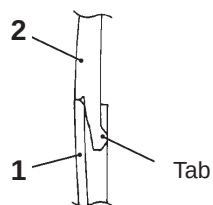
AX0132AL

COLUMN SWITCH

REMOVAL AND INSTALLATION

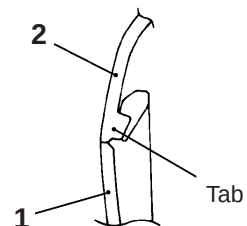


Section A – A



AW0329AL

Section B – B



AW0330AL

AW1051AL

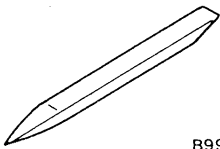
Removal steps

1. Column cover, lower
2. Column cover, upper

3. Wiper and washer switch
4. Lighting switch

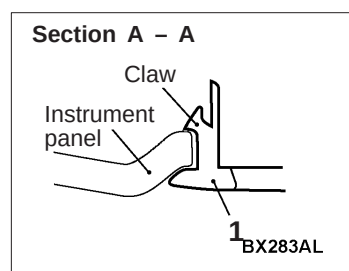
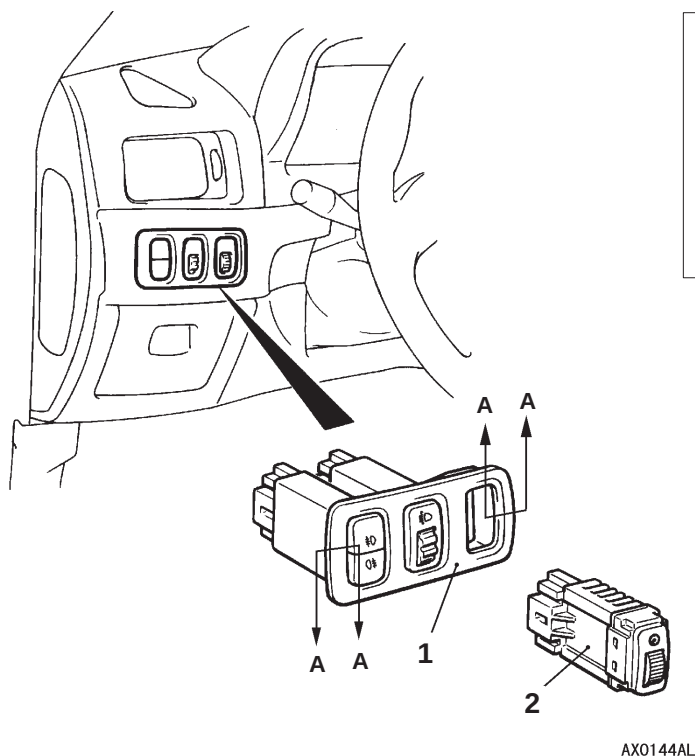
RHEOSTAT

SPECIAL TOOL

Tool	Number	Name	Use
 B990784	MB990784	Ornament remover	Removal of switch garnish

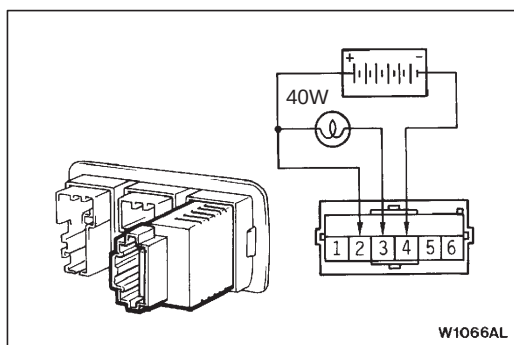
RHEOSTAT

REMOVAL AND INSTALLATION



Removal steps

1. Switch panel
2. Rheostat

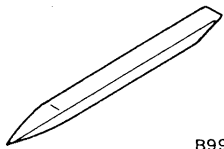


INSPECTION

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.

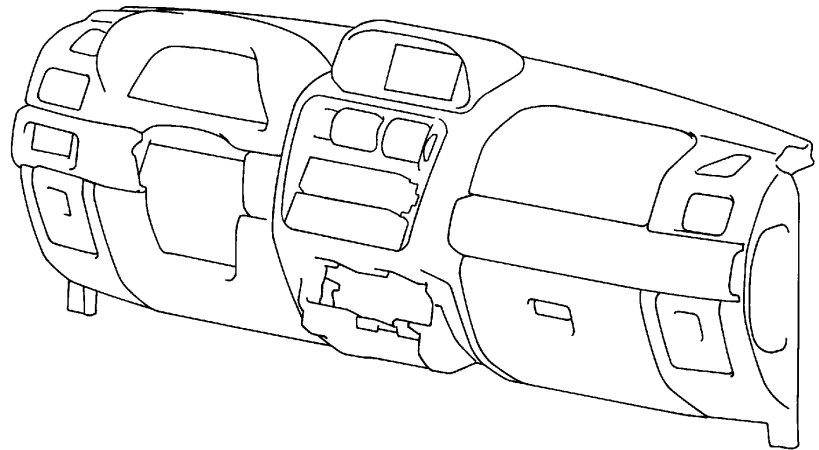
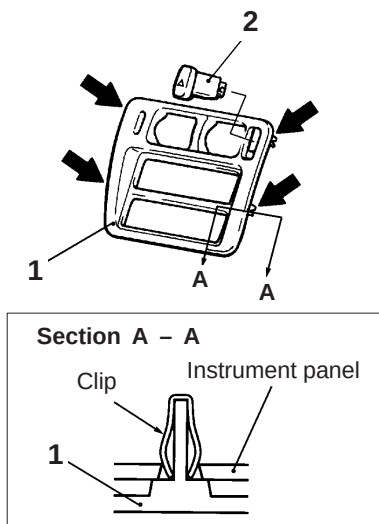
HAZARD WARNING LAMP SWITCH

SPECIAL TOOL

Tool	Number	Name	Use
 B990784	MB990784	Ornament remover	Removal of center panel

HAZARD WARNING LAMP SWITCH

REMOVAL AND INSTALLATION

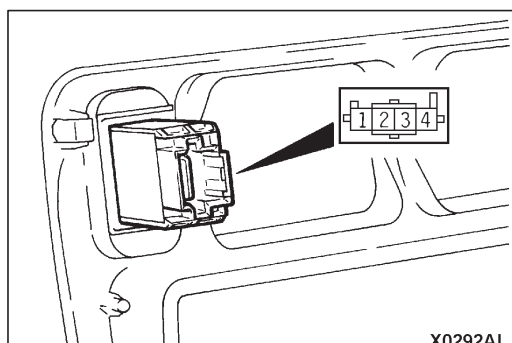


← : shows clips.

AW1049AL

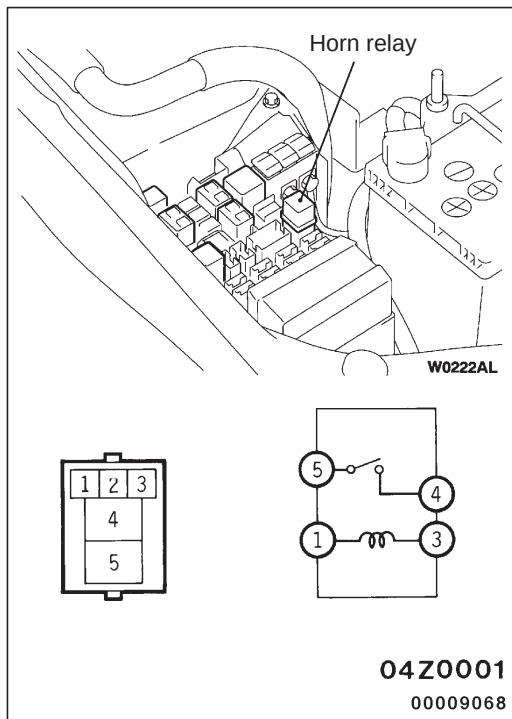
Removal steps

1. Center panel
2. Hazard warning lamp switch



INSPECTION

Switch position	Terminal No.			
	1	2	3	4
OFF			○	ILL
ON	○	○	○	ILL



HORN

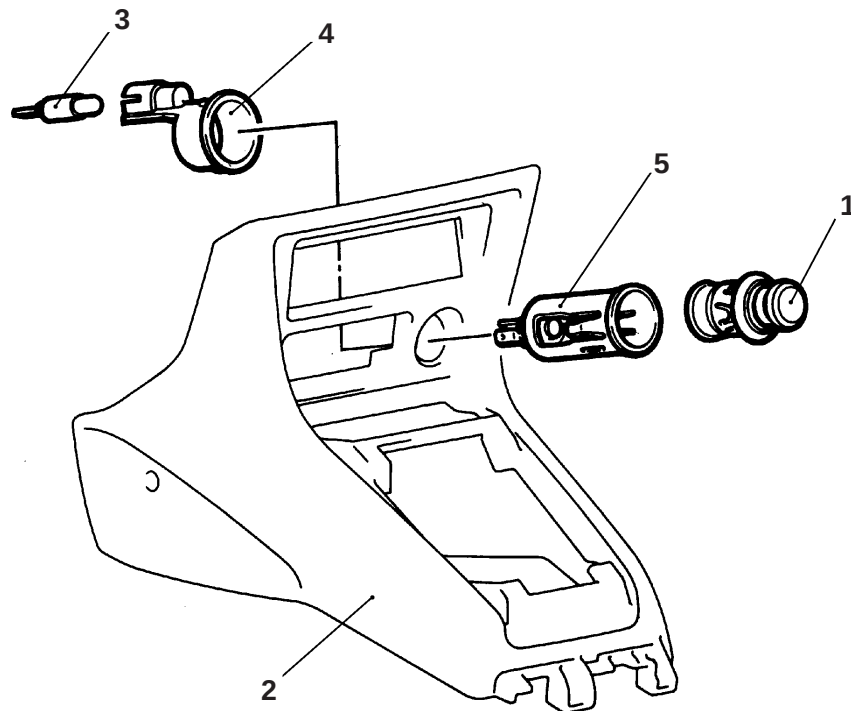
INSPECTION

HORN RELAY CONTINUITY CHECK

Battery voltage	Terminal No.			
	1	3	4	5
Not supplied	○	○		
Supplied	⊕	⊖	○	○

CIGARETTE LIGHTER

REMOVAL AND INSTALLATION

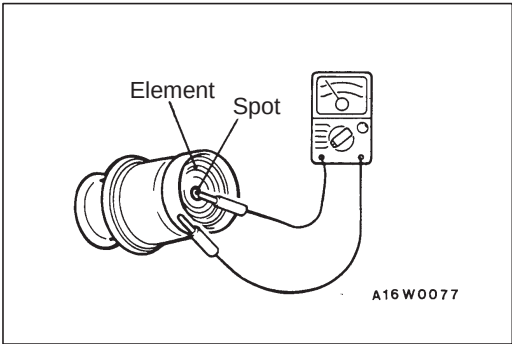


AX0149AL

Removal steps

1. Plug
2. Floor console (Refer to GROUP 52A)

3. Bulb
4. Socket case
5. Socket



INSPECTION

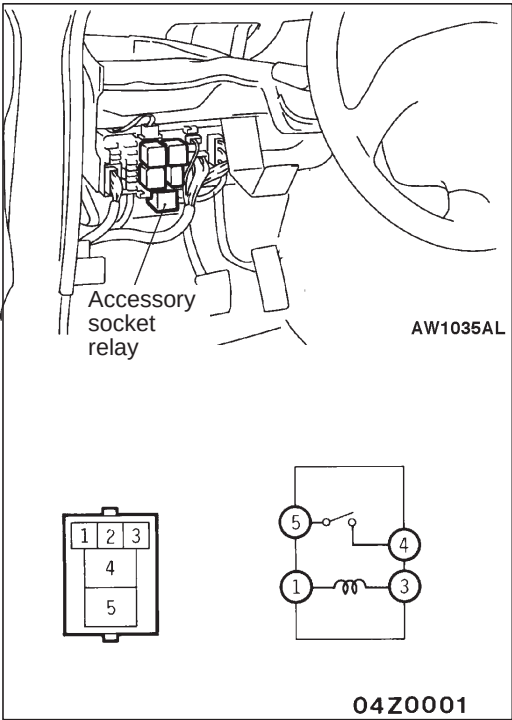
- Take out the plug, and check for a worn edge on the element spot connection, and for shreds of tobacco or other material on the element.
- Using a circuit tester, check the continuity of the element.

ACCESSORY SOCKET

INSPECTION

ACCESSORY SOCKET RELAY CONTINUITY CHECK

Battery voltage	Terminal No.			
	1	3	4	5
Not supplied	○	○		
Supplied	⊕	⊖	○	○

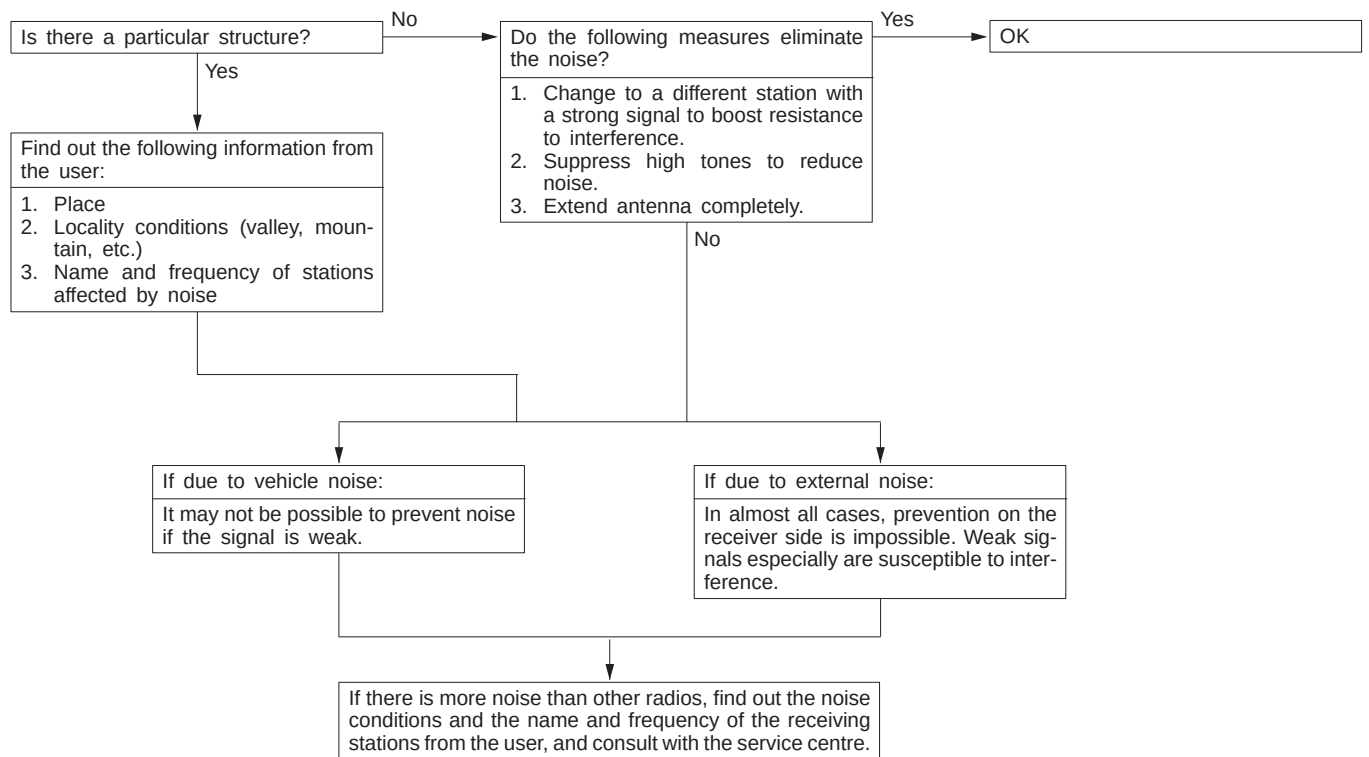


RADIO AND TAPE PLAYER

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.

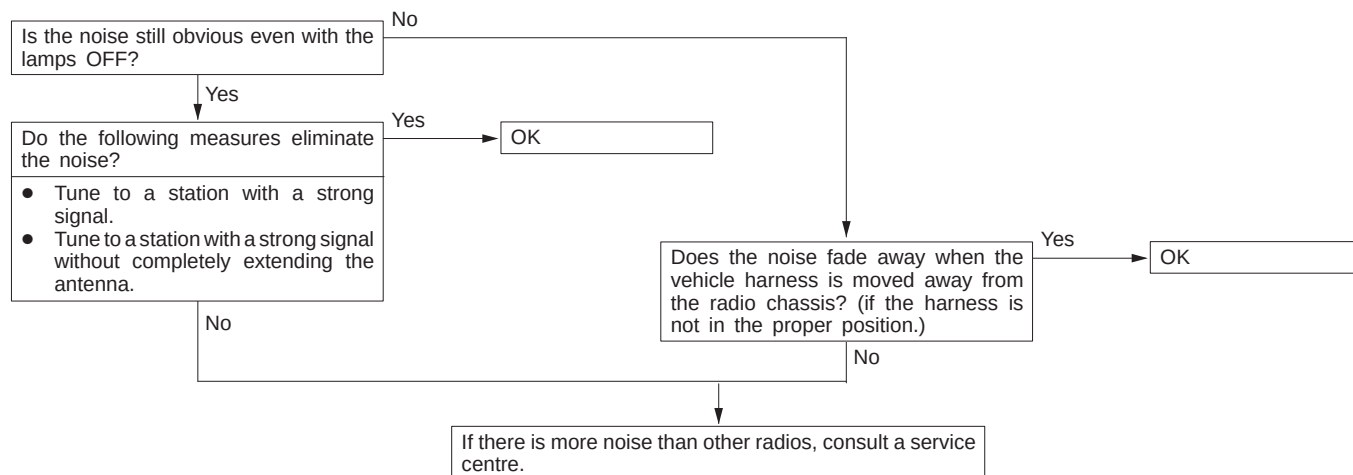
The following factors can be considered as possible causes of noise appearing at night.

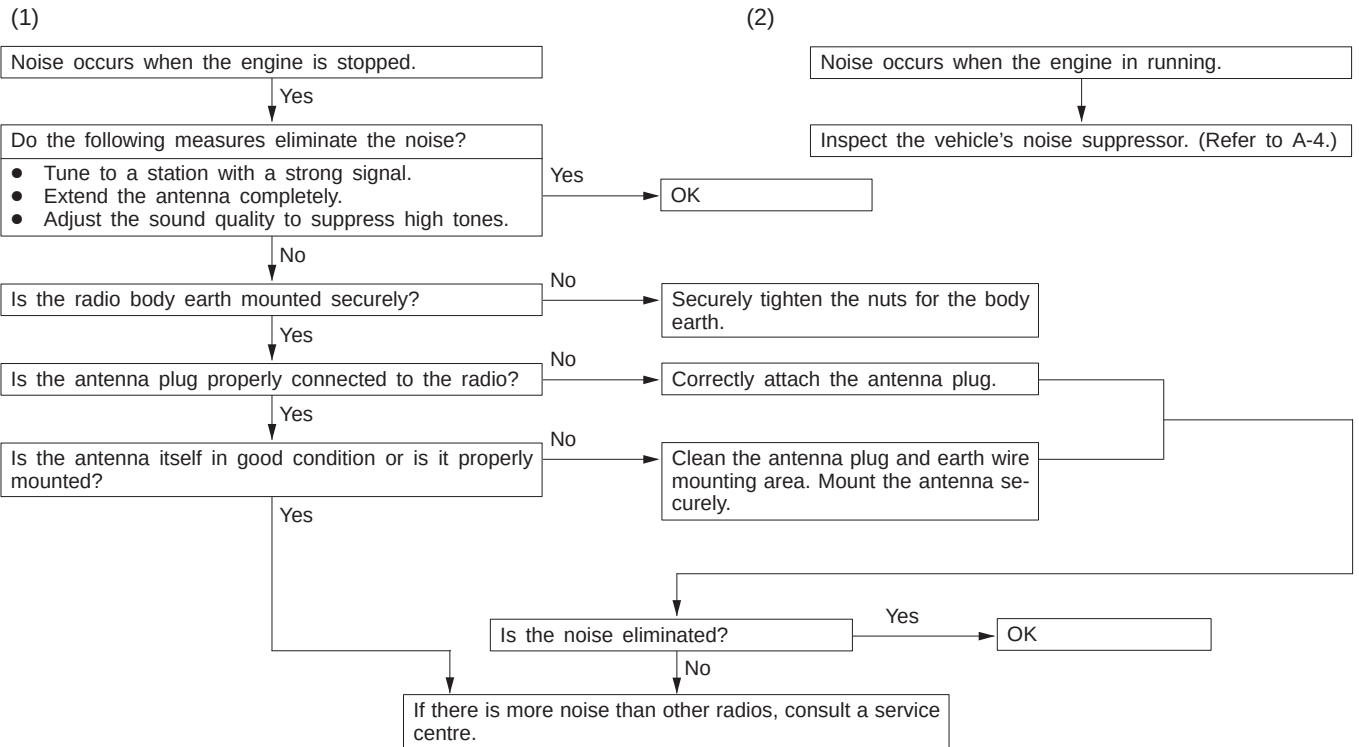
1. Factors due to signal conditions: Due to the fact that long-distance signals are more easily received at night, even stations that are received without problem during the day may experience interference in a general worsening of reception conditions. The weaker a station is the more susceptible it 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.

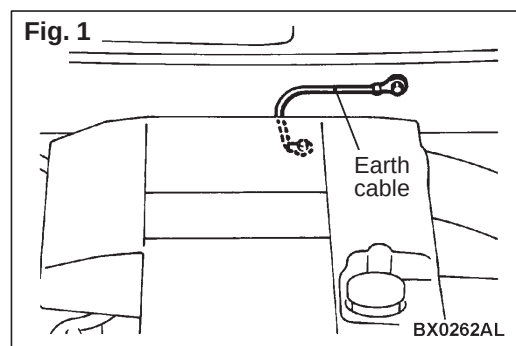
NOTE

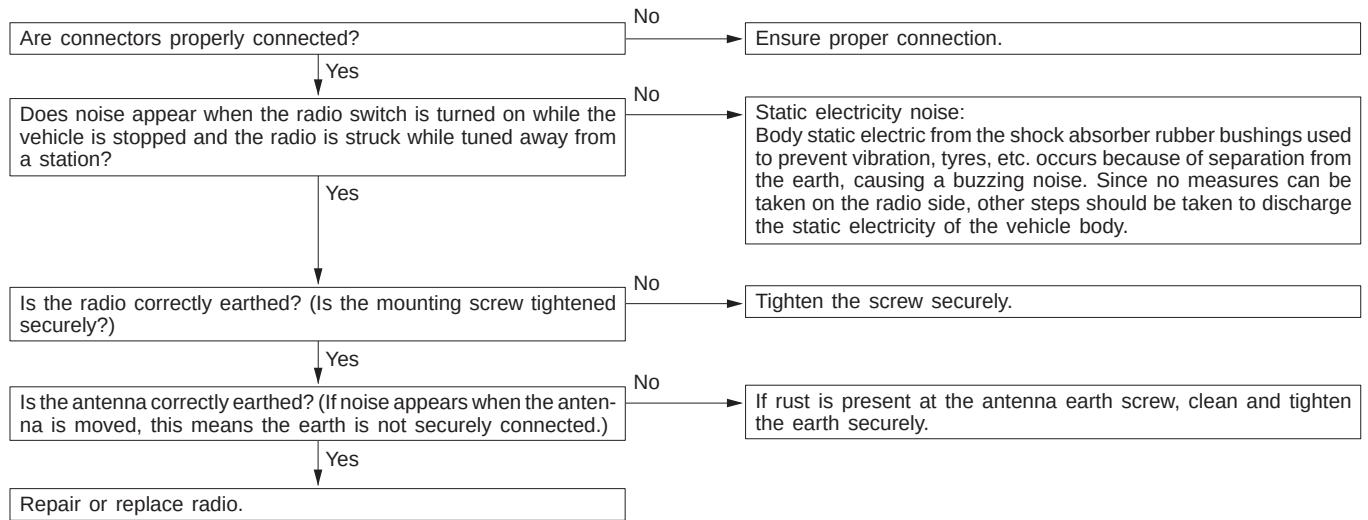
1. Capacitor
The capacitor does not pass D.C. current, but as the number of waves increases when it

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.

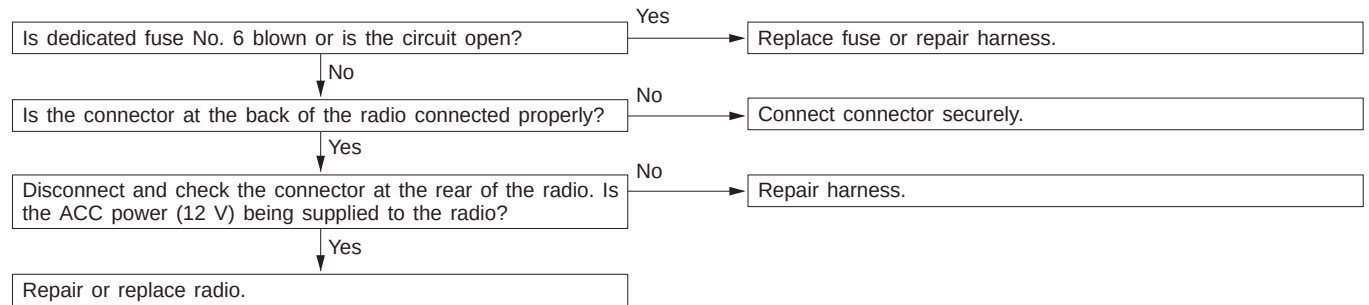
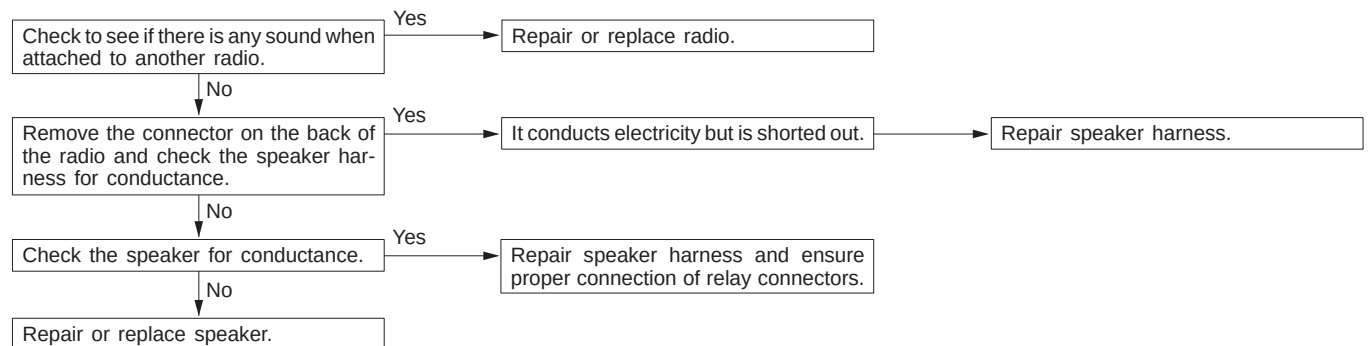


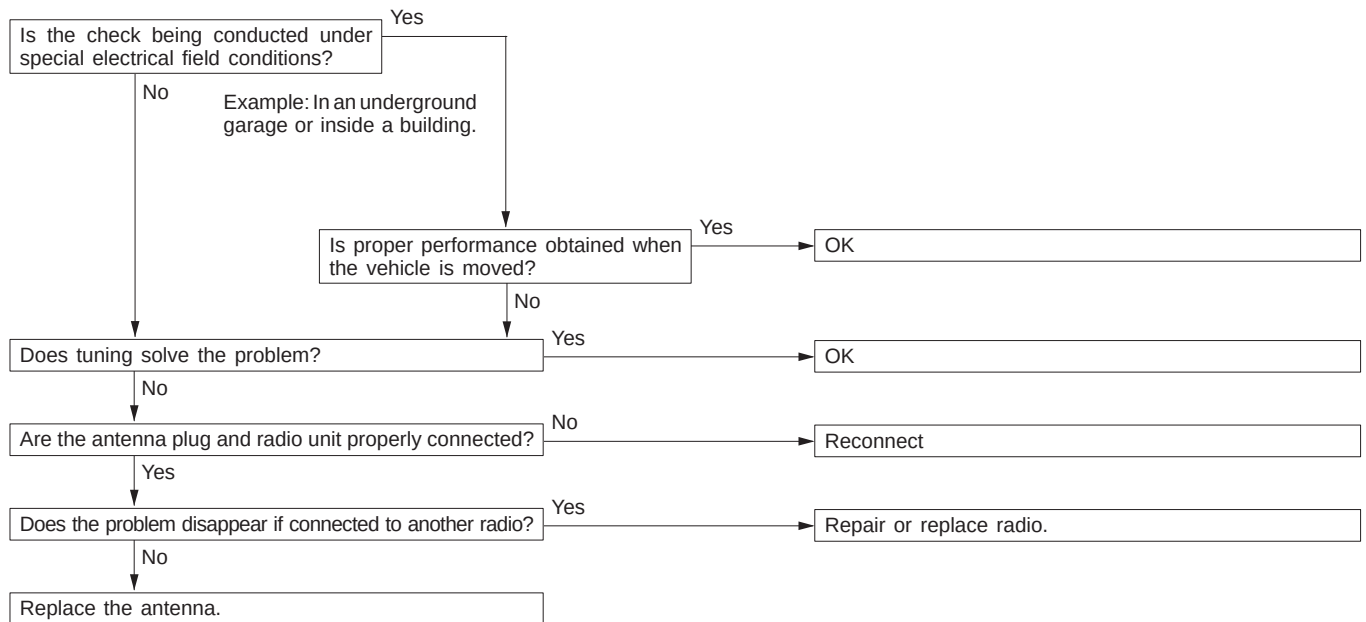
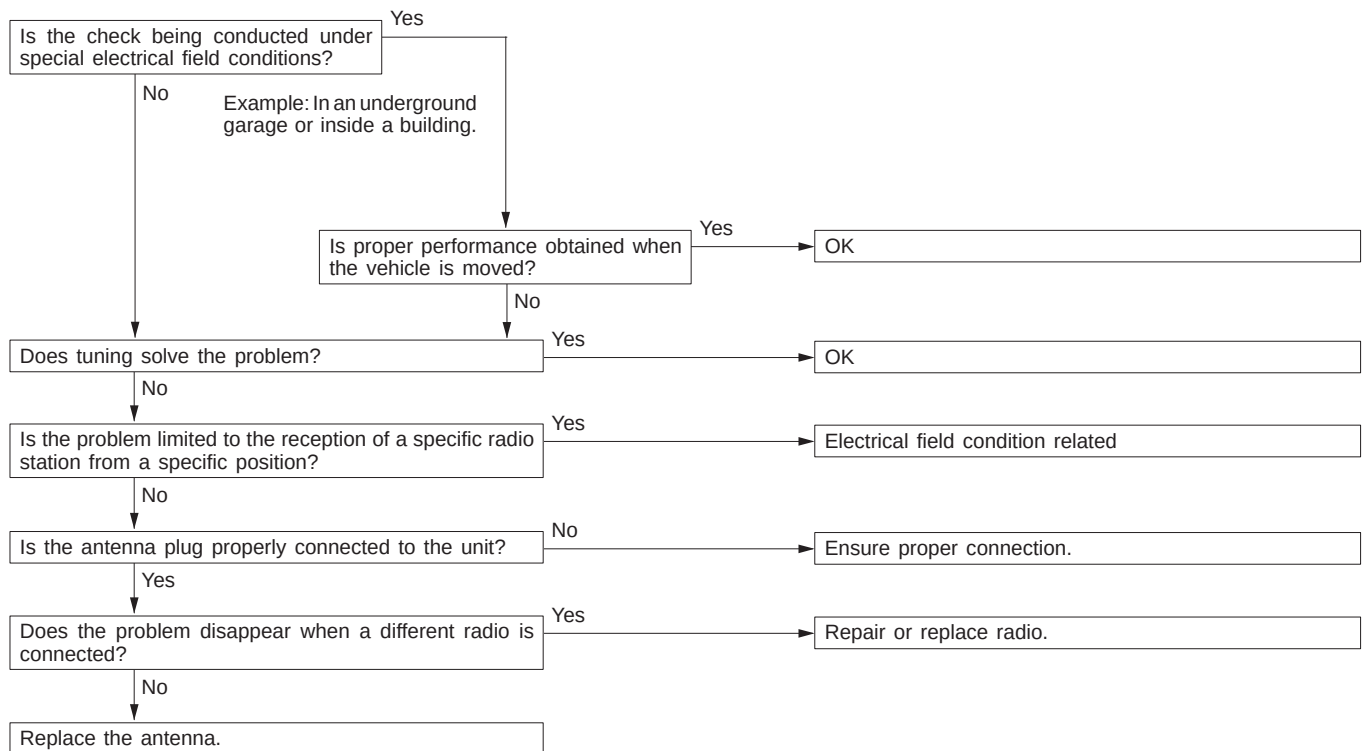
A-5 Some noise appears when there is vibration or shocks during travelling.**A-6 Ever-present noise.**

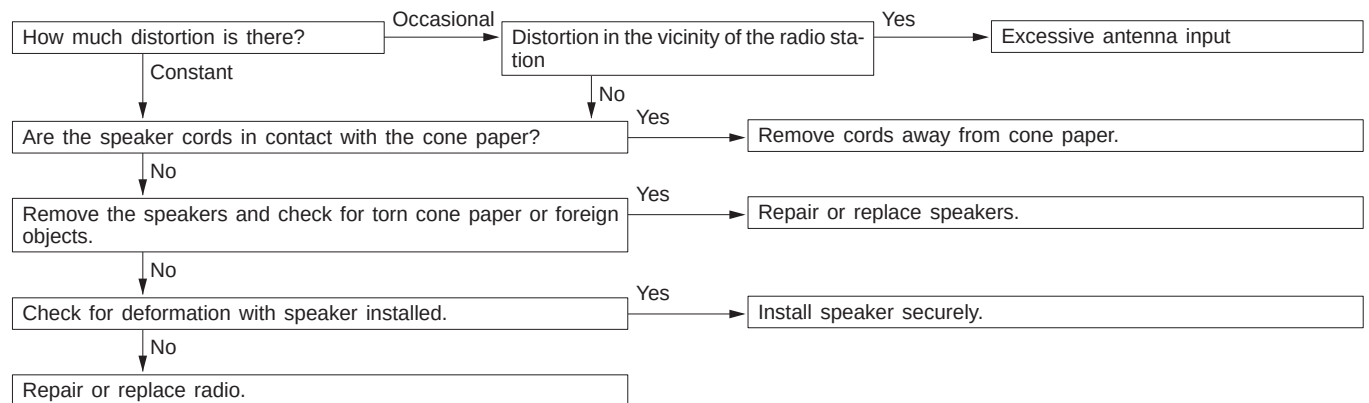
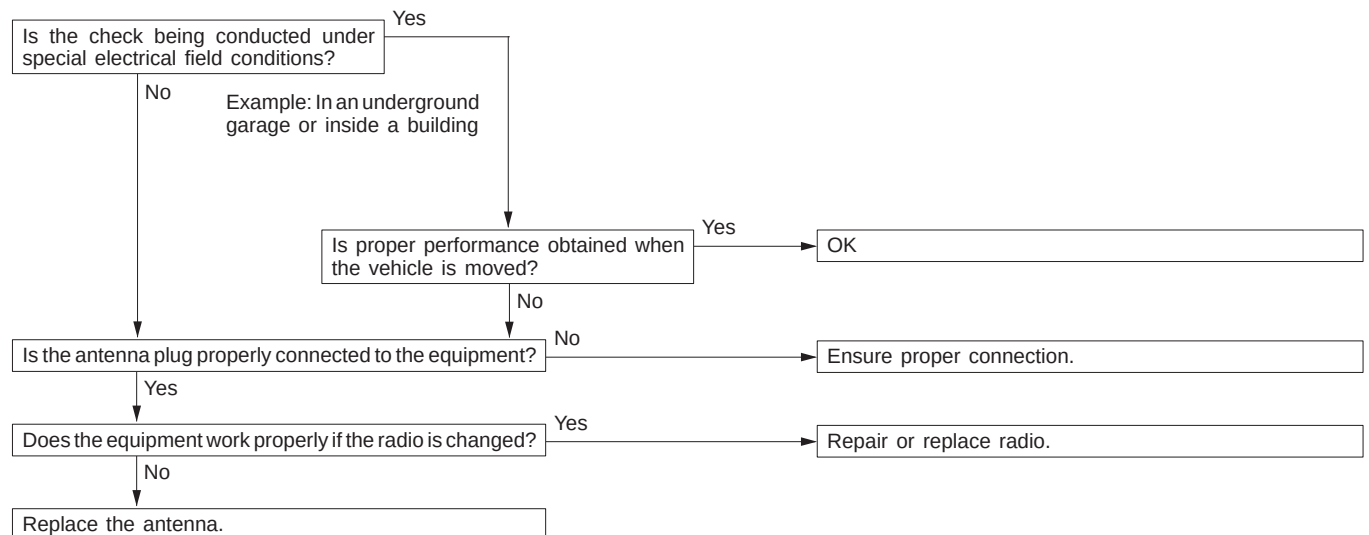
Noise is often created by the following factors, and often the radio is OK when it is checked individually.

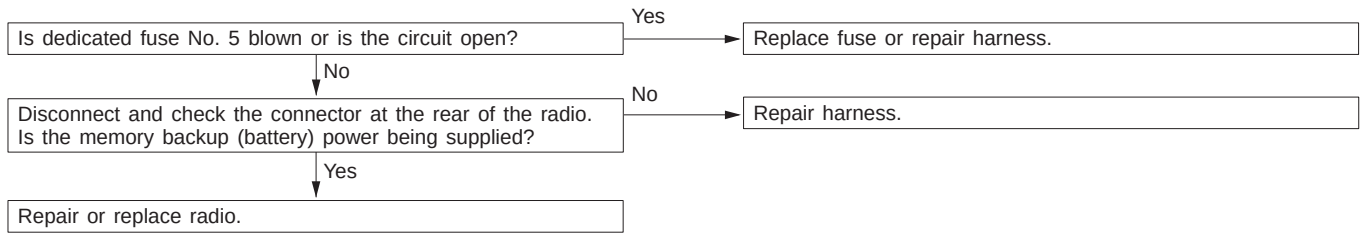
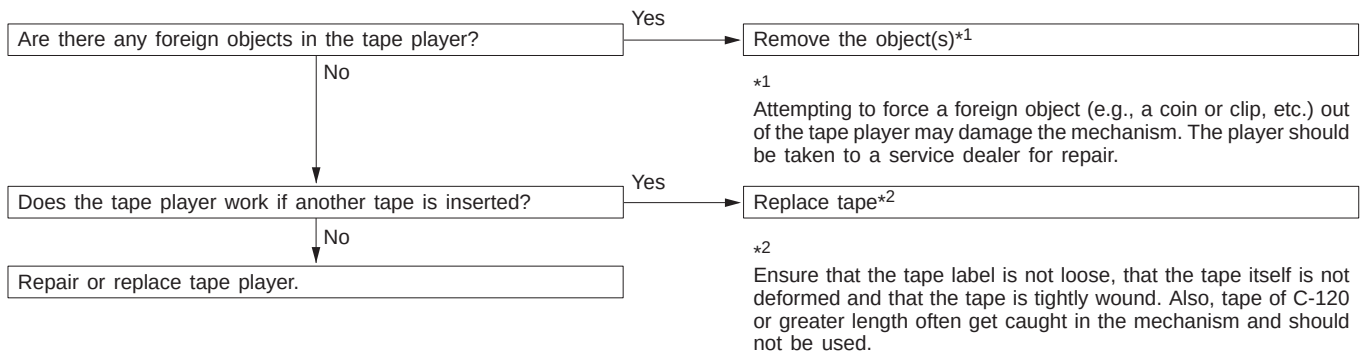
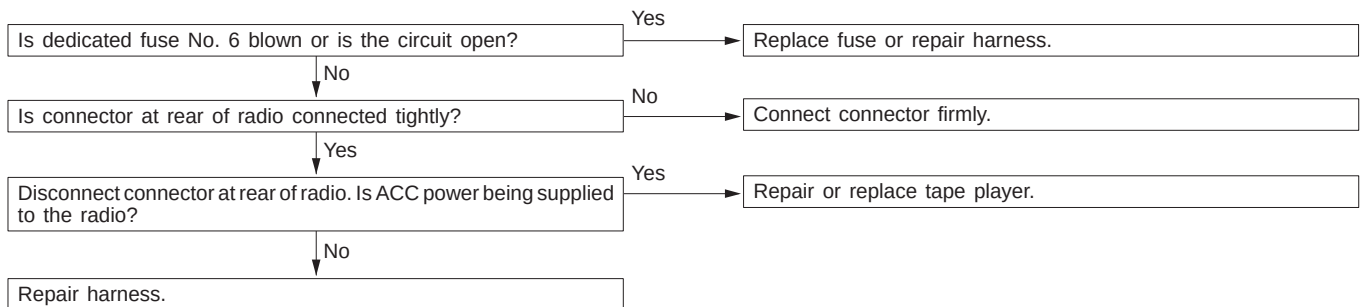
- Travelling conditions of the vehicle
- Terrain of area travelled through
- Surrounding buildings
- Signal conditions
- Time period

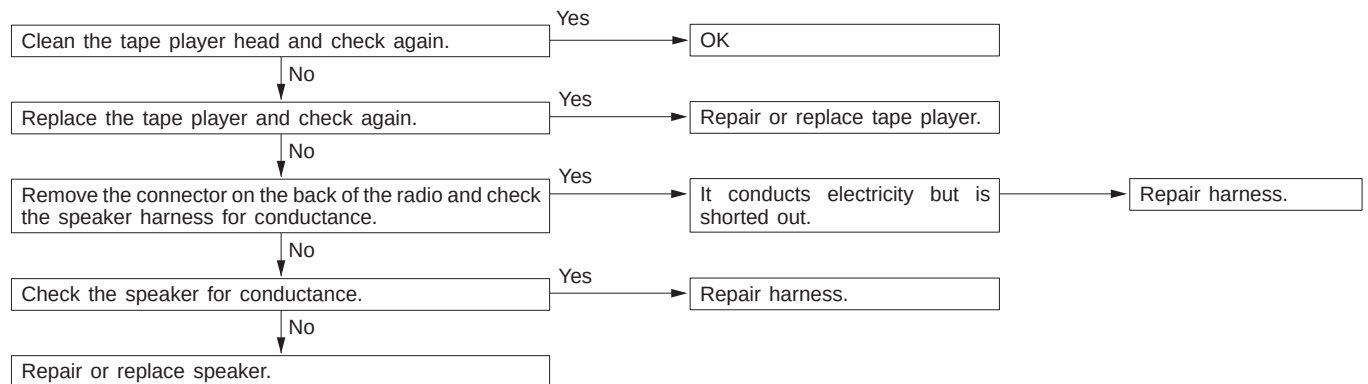
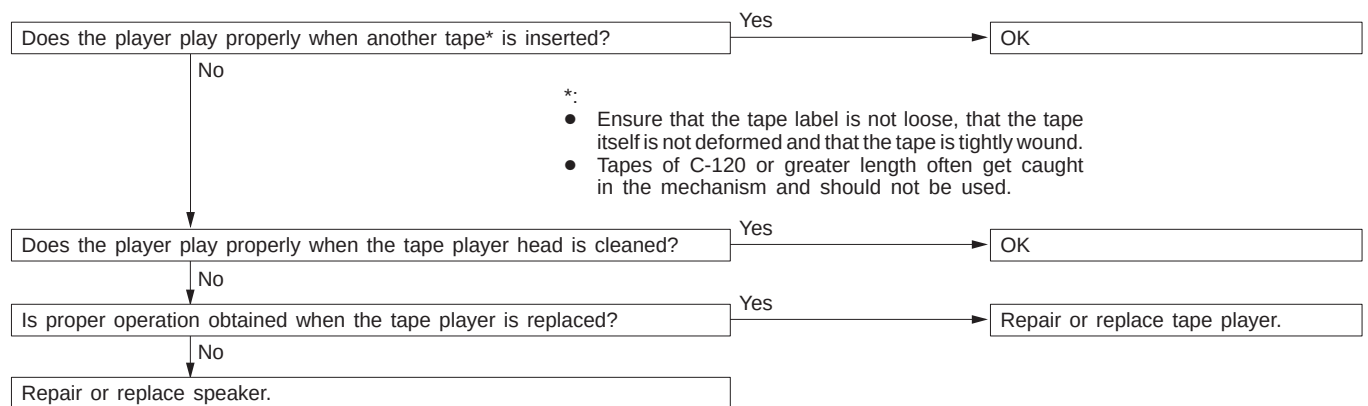
For this reason, if there are still problems with noise even after the measures described in steps A-1 to A-8 have been taken, get information on the factors listed above as well as determining whether the problem occurs with FM/MW/LW, the station names, frequencies, etc., and contact a service centre.

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.**

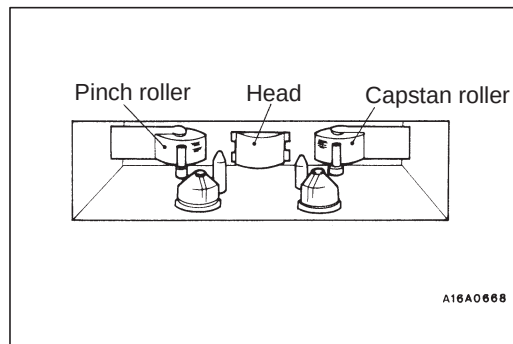
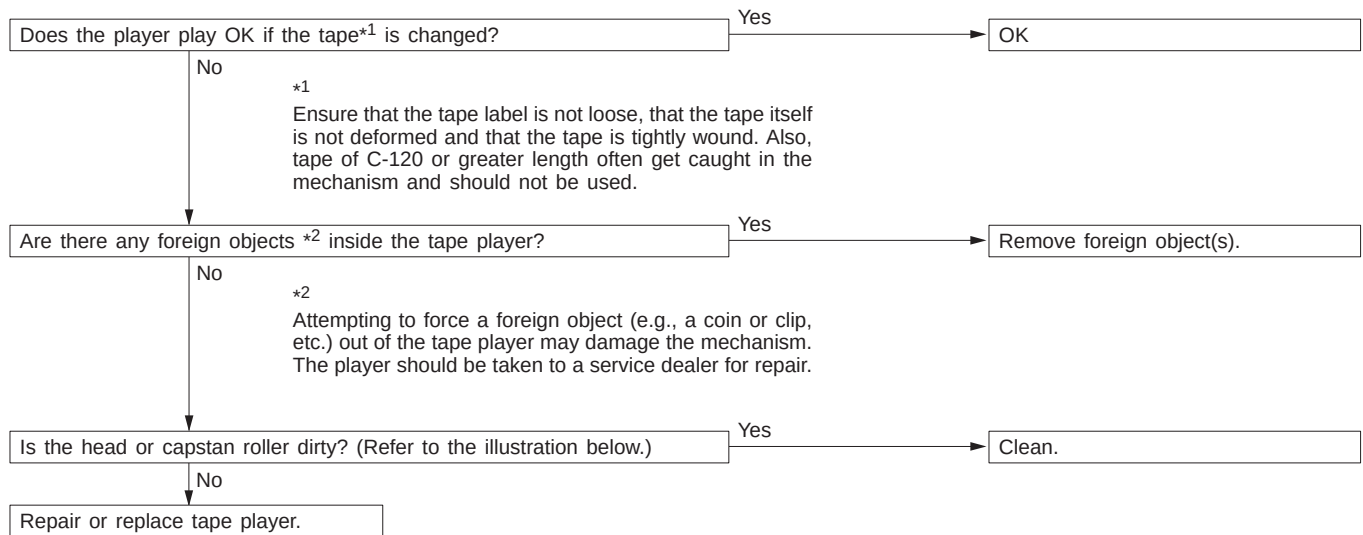
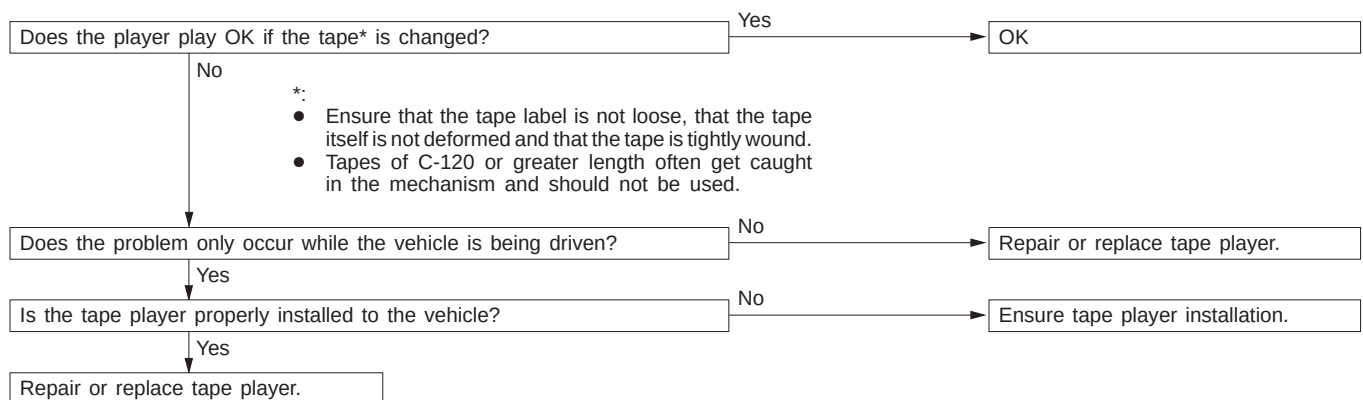
B-5 Distortion on FM/MW/LW.**B-6 Too few automatic select stations.**

B-7 Insufficient memory (preset stations are erased).**C. TAPE PLAYER****C-1 Cassette tape will not be inserted.****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

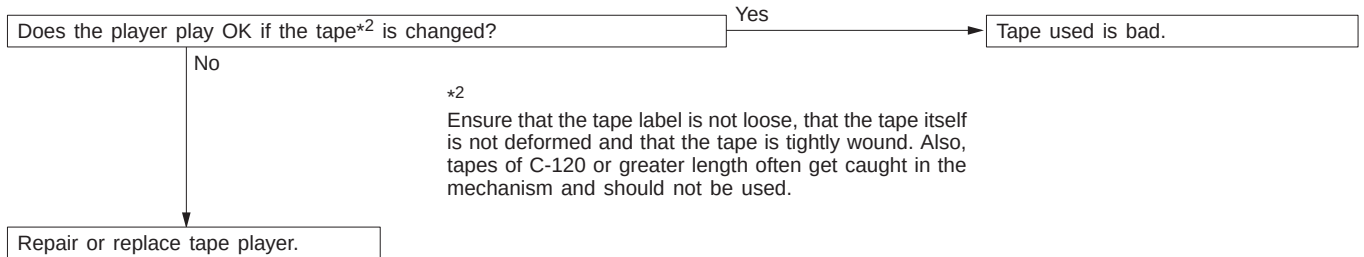
also possible, and attempting to force the tape out of the player can cause damage to the mechanism. The player should be taken to a service dealer for repair.

C-6 Uneven revolution. Tape speed is fast or slow.**C-7 Faulty auto reverse.**

C-8 Tape gets caught in mechanism*1.

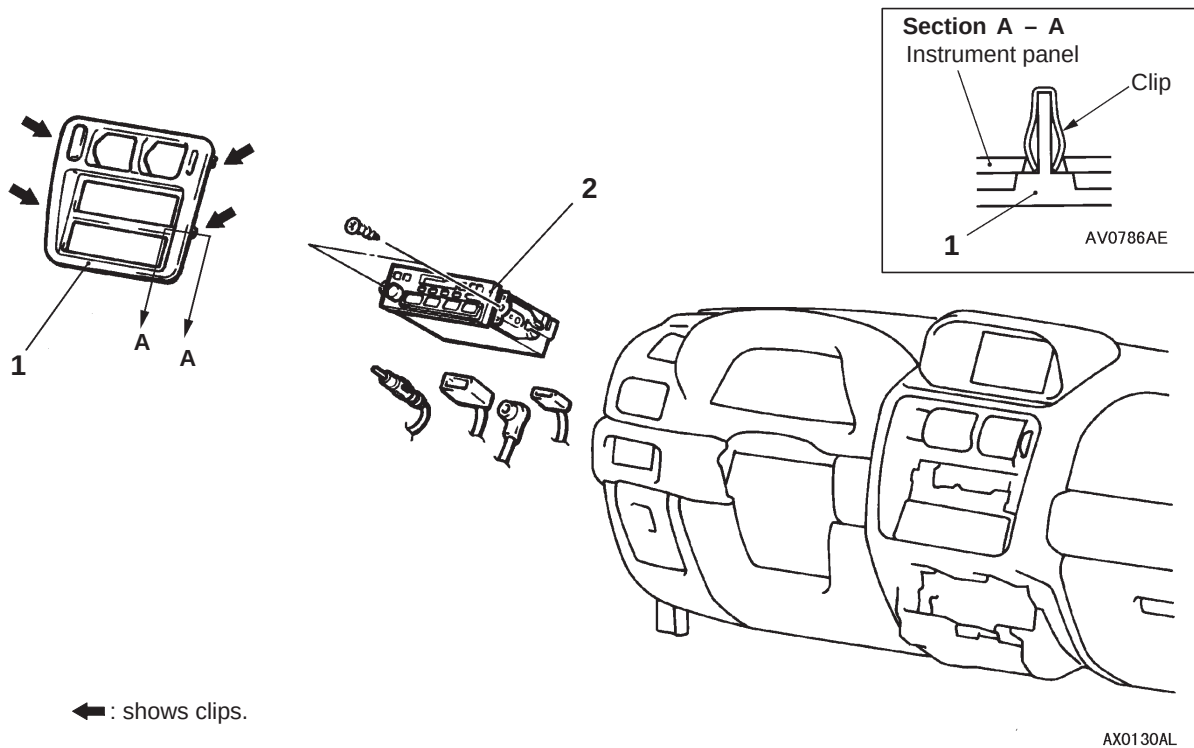
*1

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.



RADIO AND TAPE PLAYER

REMOVAL AND INSTALLATION

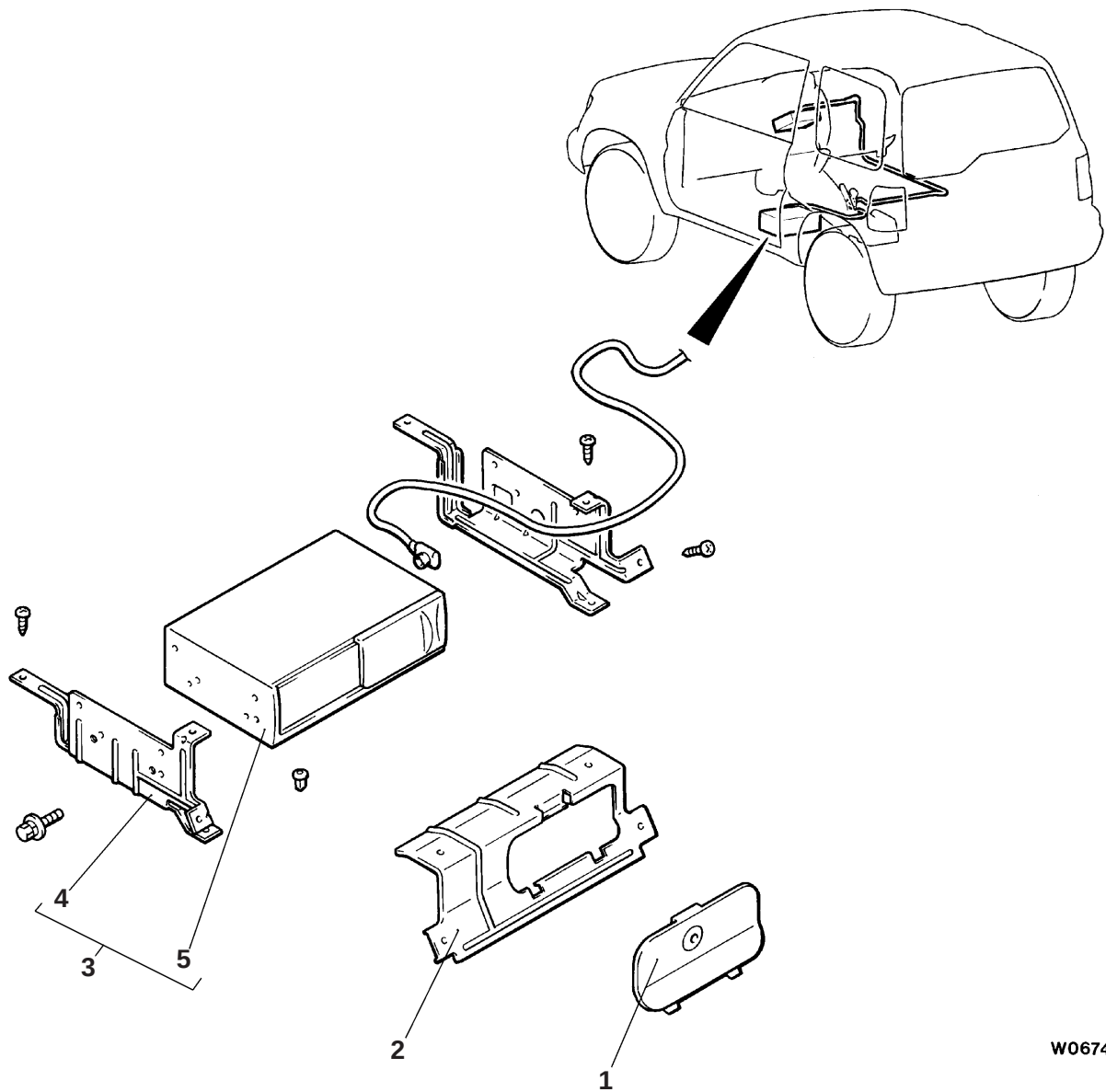


Removal steps

1. Center panel
2. Radio and tape player

CD AUTOCHANGER

REMOVAL AND INSTALLATION



W0674AL

Removal steps

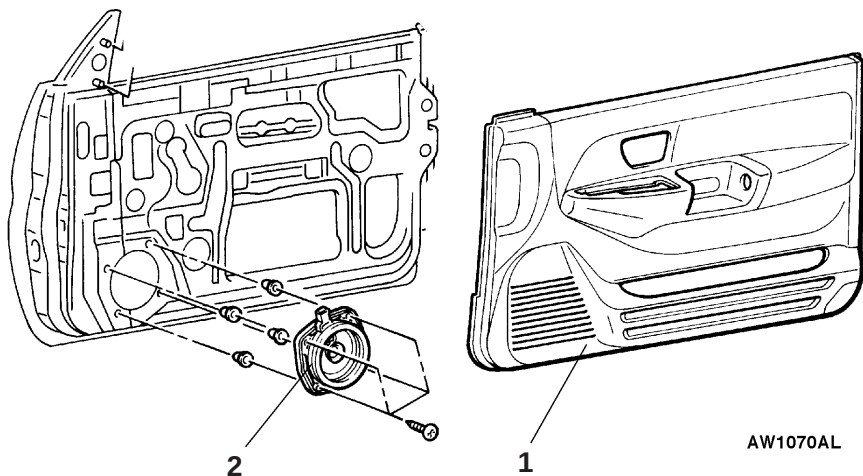
- Front seat (LH)
- 1. Lid
- 2. Cover

- 3. CD autochanger assembly
- 4. Bracket
- 5. CD autochanger

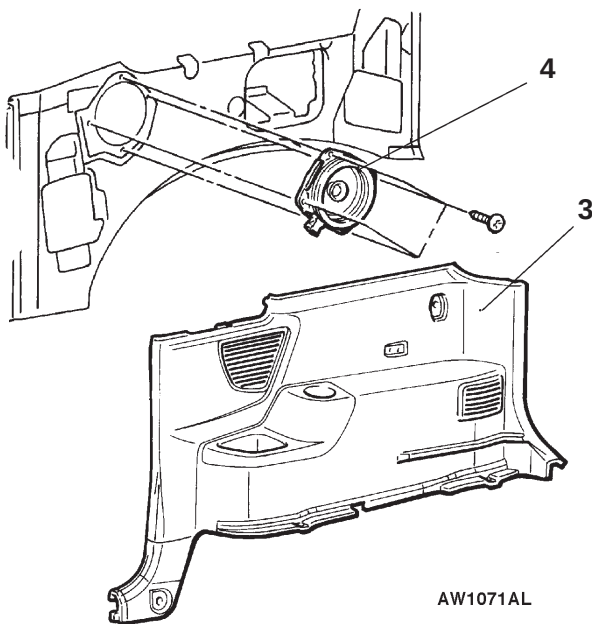
SPEAKER

REMOVAL AND INSTALLATION

<Front speaker>



<Rear speaker>



Front speaker removal steps

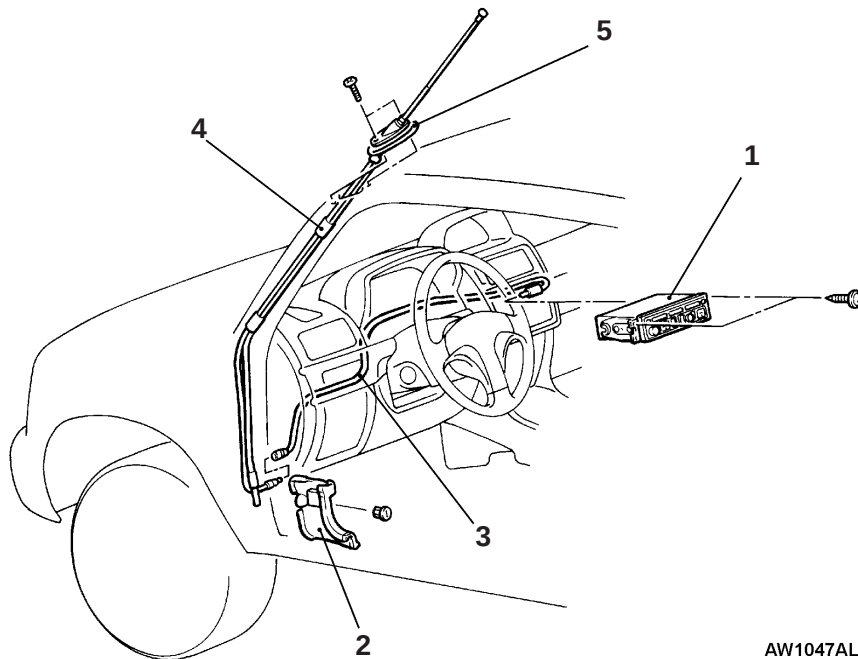
1. Front door trim (Refer to GROUP 42.)
2. Speaker

Rear speaker removal steps

3. Quarter trim (Refer to GROUP 52A.)
4. Speaker

ANTENNA

REMOVAL AND INSTALLATION



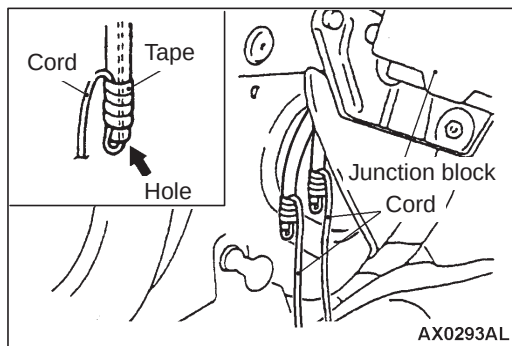
AW1047AL

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)



3. Antenna assembly
4. Antenna base
 - Instrument panel (Refer to GROUP 52A)
5. Antenna feeder



REMOVAL SERVICE POINT

◀A▶ ANTENNA ASSEMBLY REMOVAL

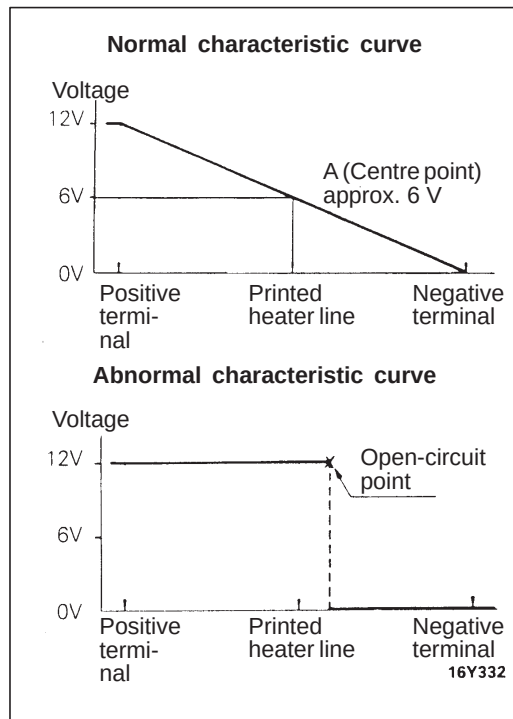
Observe the following steps to make the feeder cable of the antenna to be routed easily during reinstallation.

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 be 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.

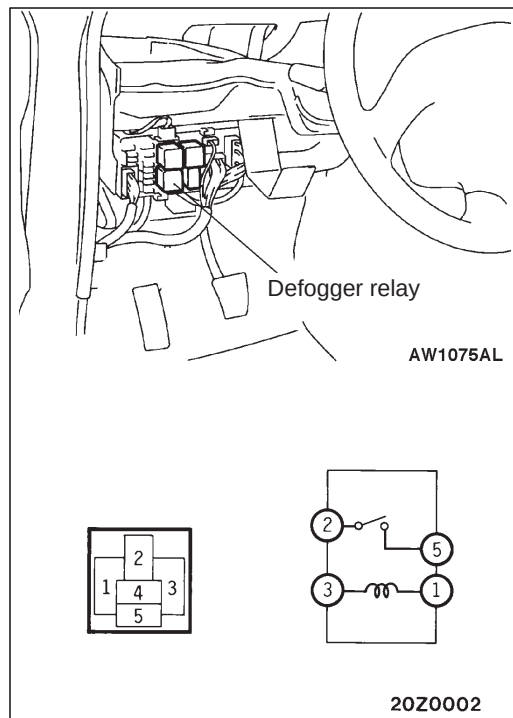


REAR WINDOW DEFOGGER

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.



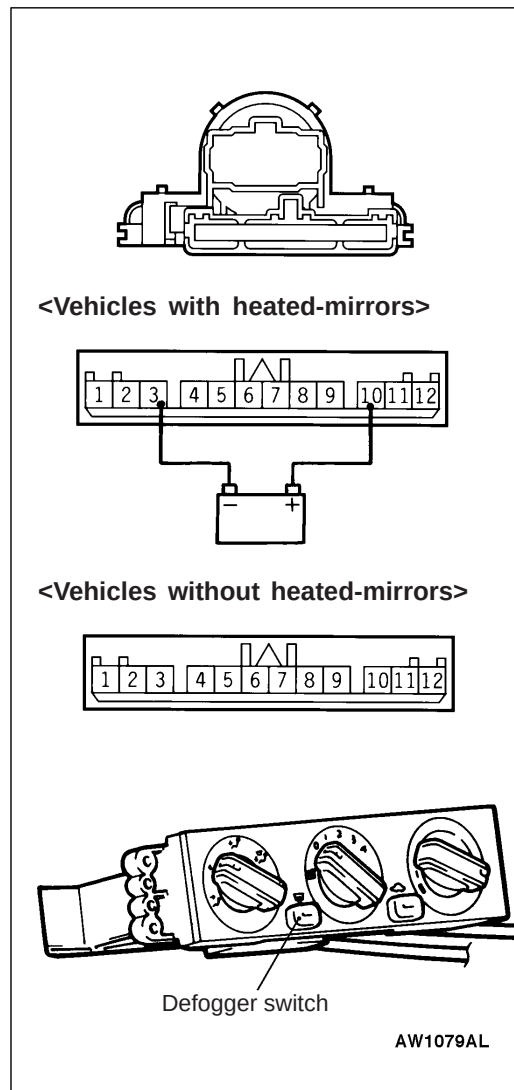
REAR WINDOW DEFOGGER RELAY CONTINUITY CHECK

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.



INSPECTION

DEFOGGER SWITCH CONTINUITY CHECK

<Vehicles with heated-mirrors>

Switch position	Terminal No.				
	3	10	–	11	12
OFF	○ ○	+	IND ○	○	
ON	○ ○ ○	+	IND ○	○	○

NOTE

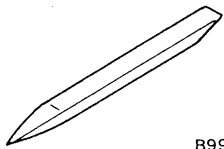
Turn on the defogger switch, and then check that there is continuity between the terminals 3 and 12 for 9 to 13 minutes and after it, the defogger switch is turned off.

<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).

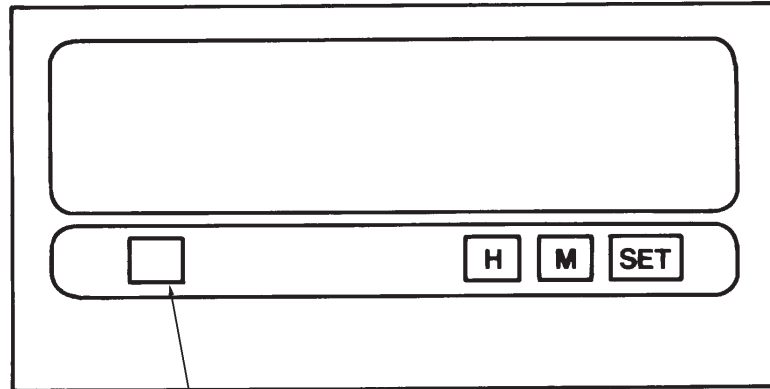
4. Service Mode For Multi-center Display

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

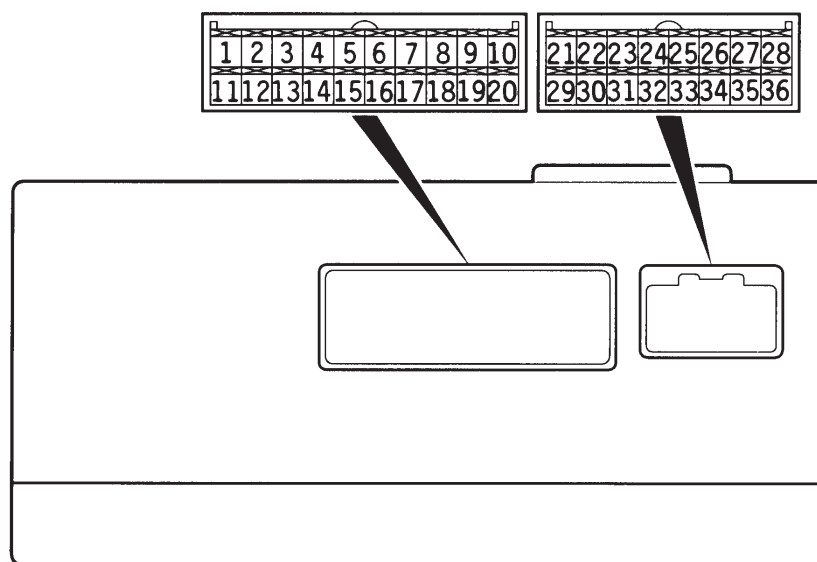
This screen shows voltage signals from the outside temperature sensor, the fuel gauge unit, and the ignition switch as well as fuel economy.

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.

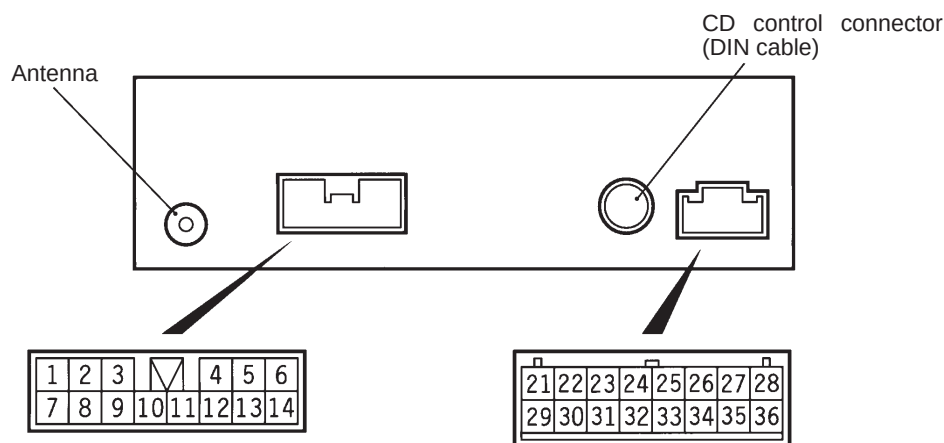
When the "SET" button is pressed once in this screen, the service mode will return to the first screen (model identification screen).

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 does not appear. Panel switch cannot be operated for audio unit. Nighttime illumination does 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	–	–	–	–	–	–

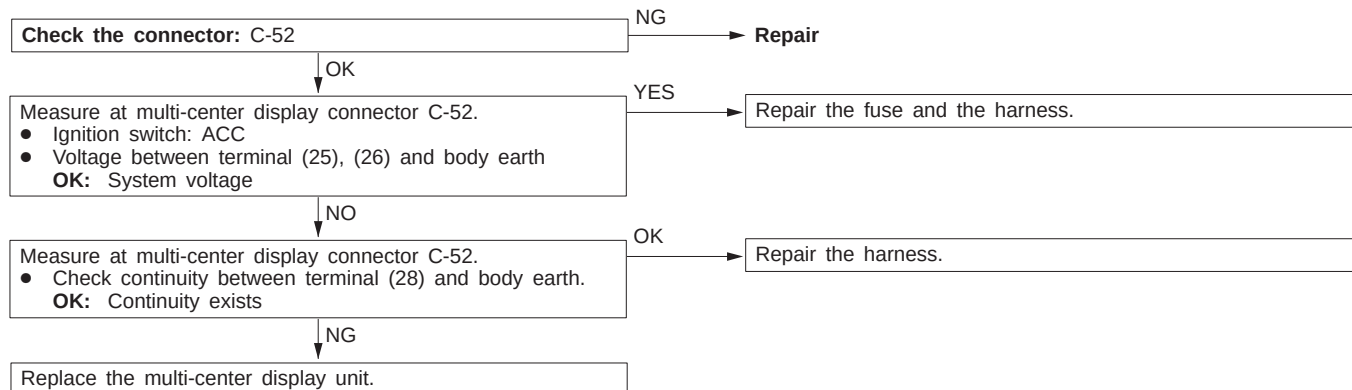
INSPECTION CHART CLASSIFIED BY TROUBLE SYMPTOMS

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

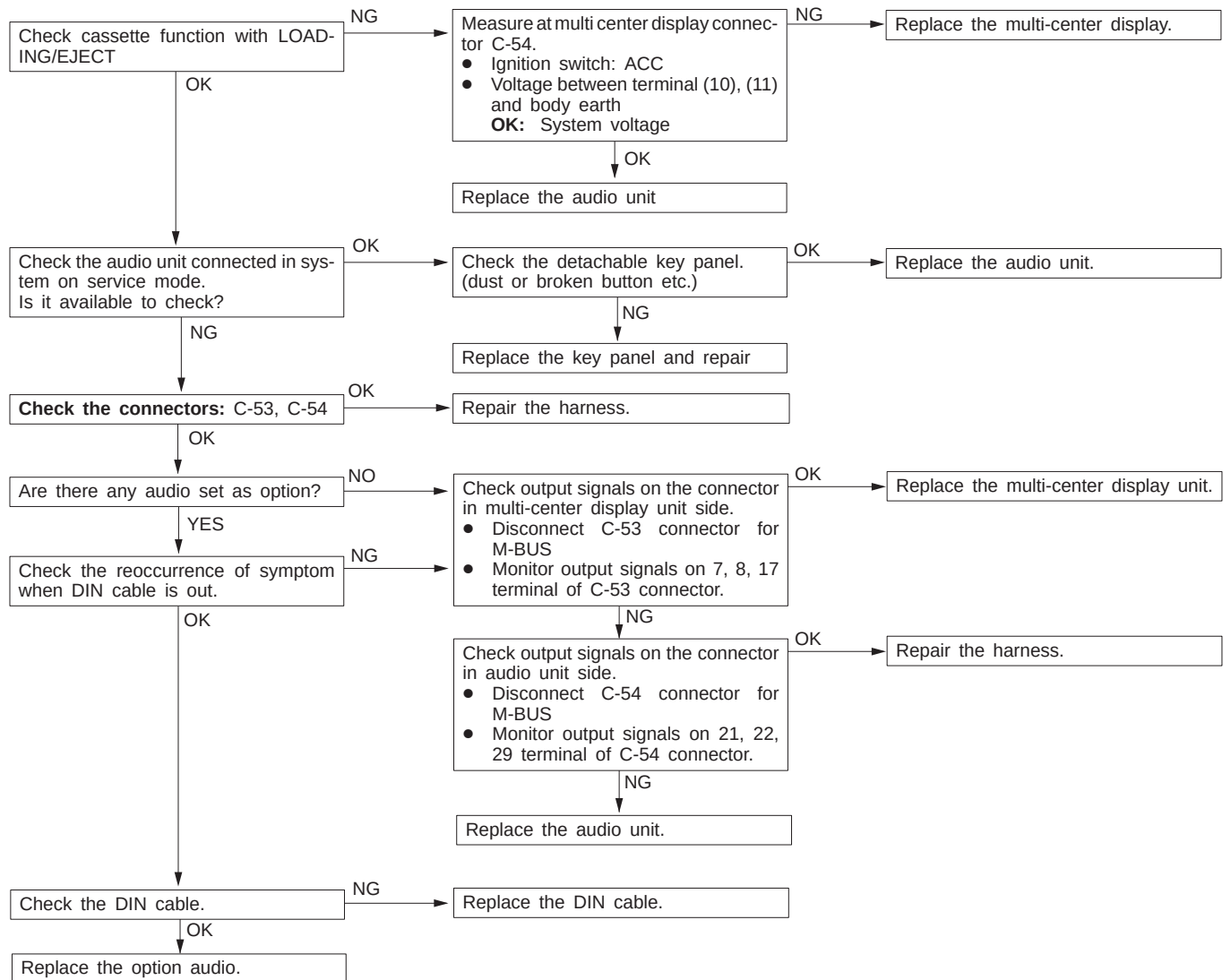
INSPECTION PROCEDURE 1

No display appears after the ignition key is turned to ACC.



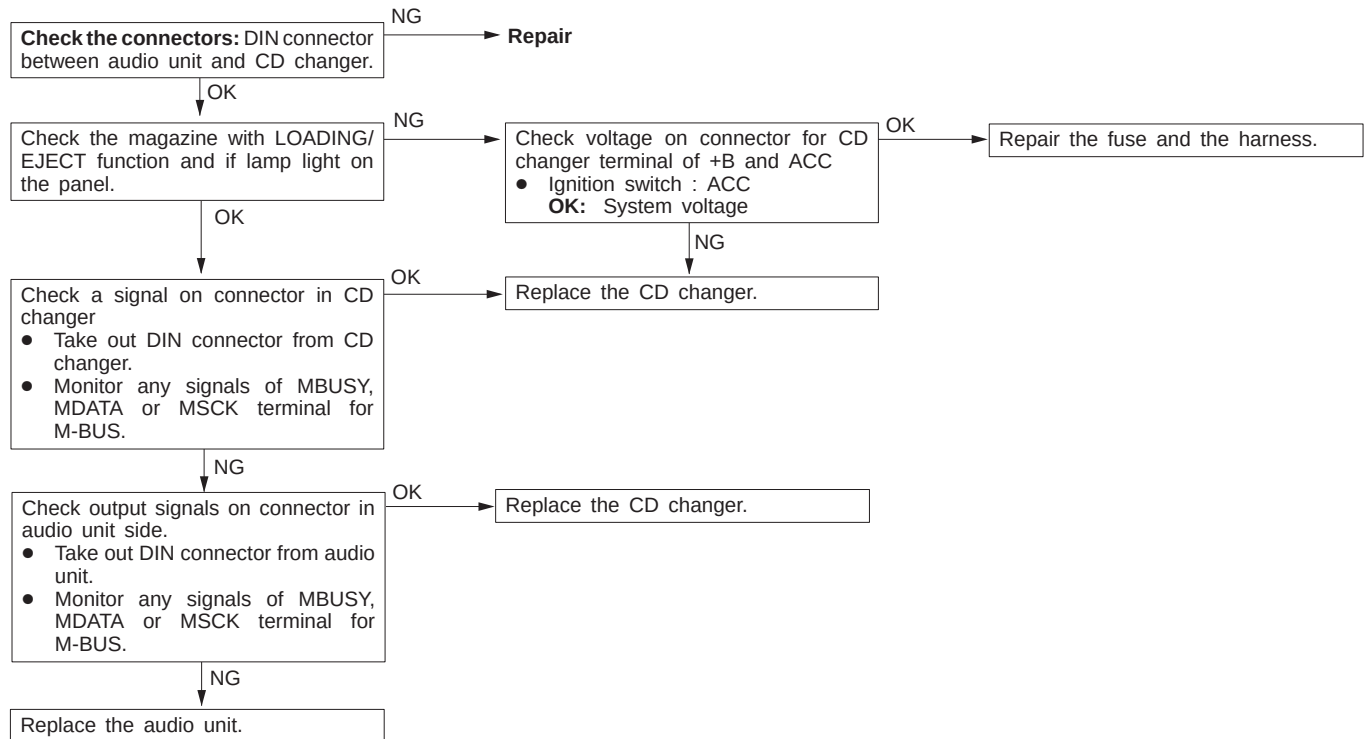
INSPECTION PROCEDURE 2

TAPE/CD, UML switches do not work.



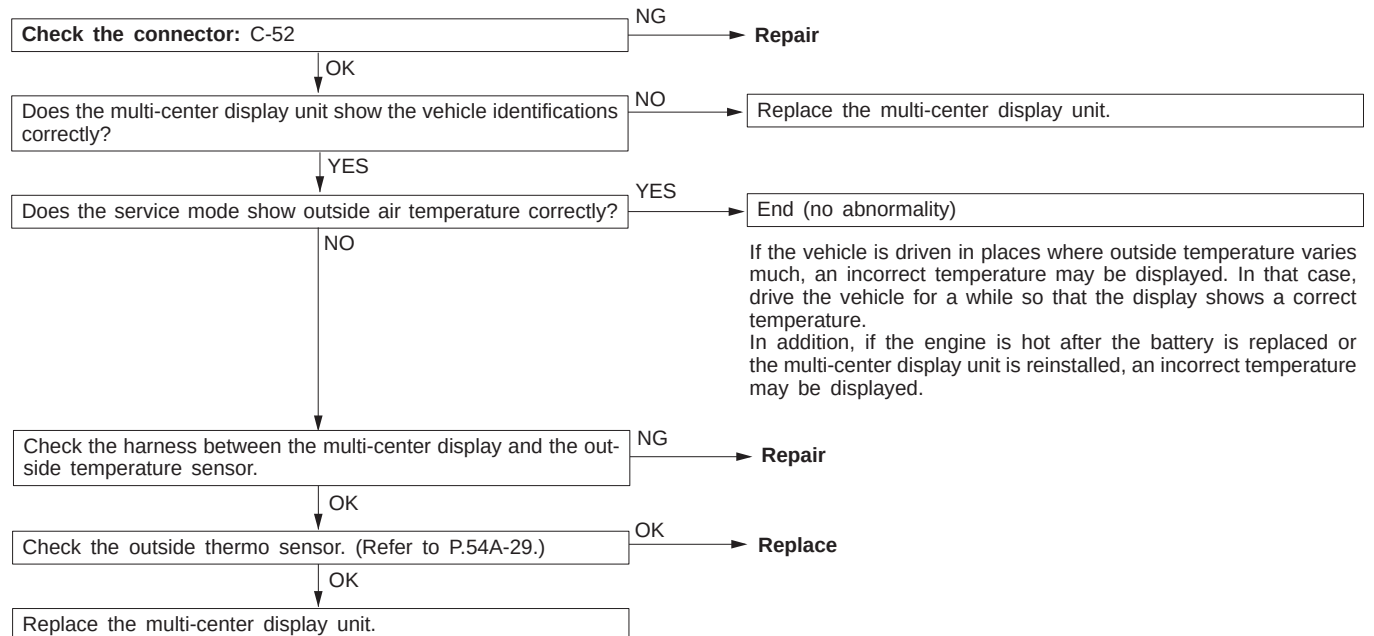
INSPECTION PROCEDURE 3

CD switch do not work.



INSPECTION PROCEDURE 4

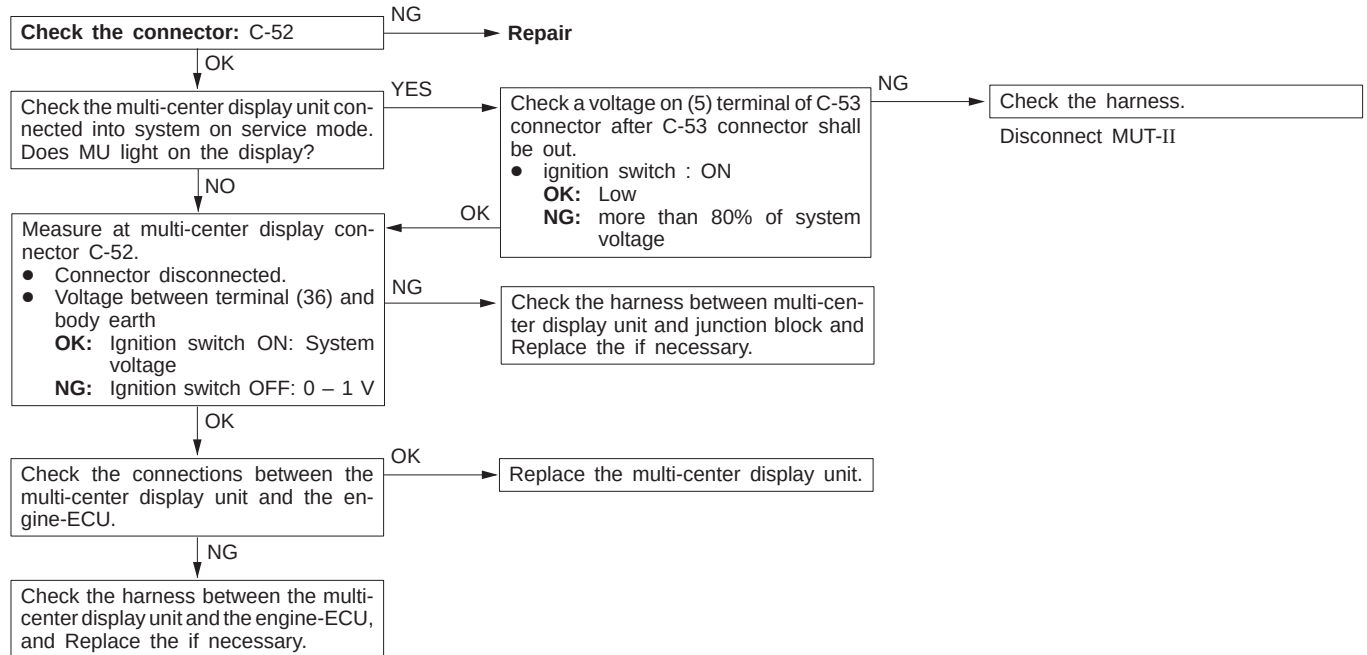
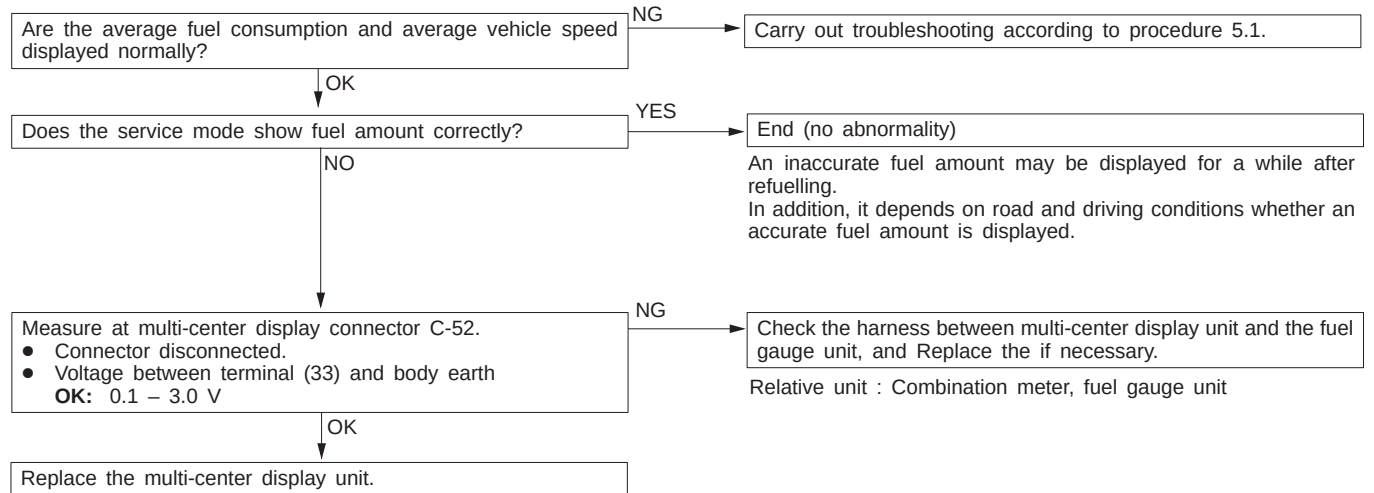
Outside air temperature data is not displayed. /Outside air temperature data is abnormal.



INSPECTION PROCEDURE 5

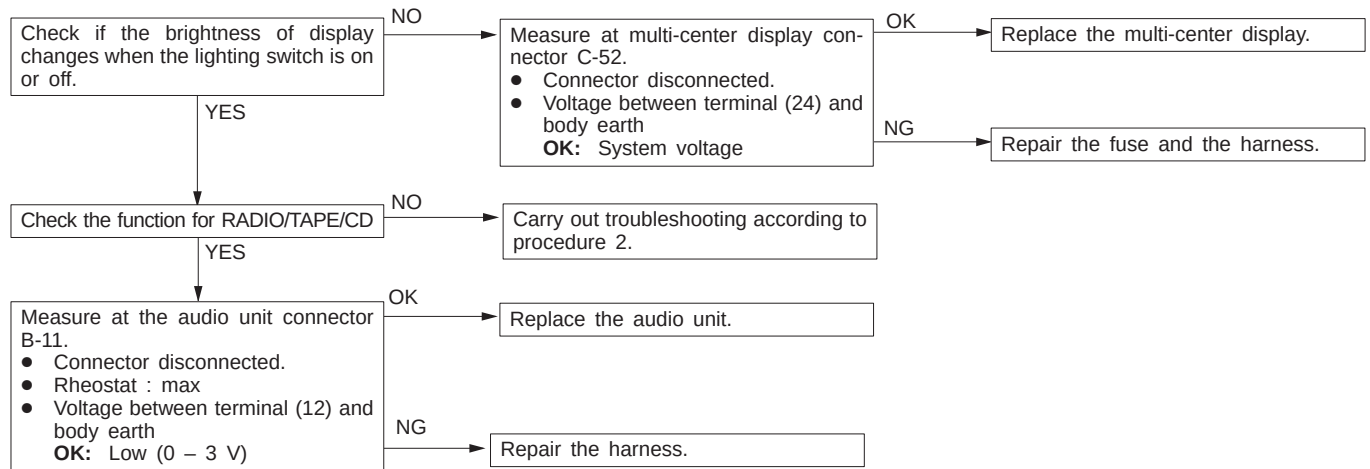
Abnormal driving data displays.

- 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.**

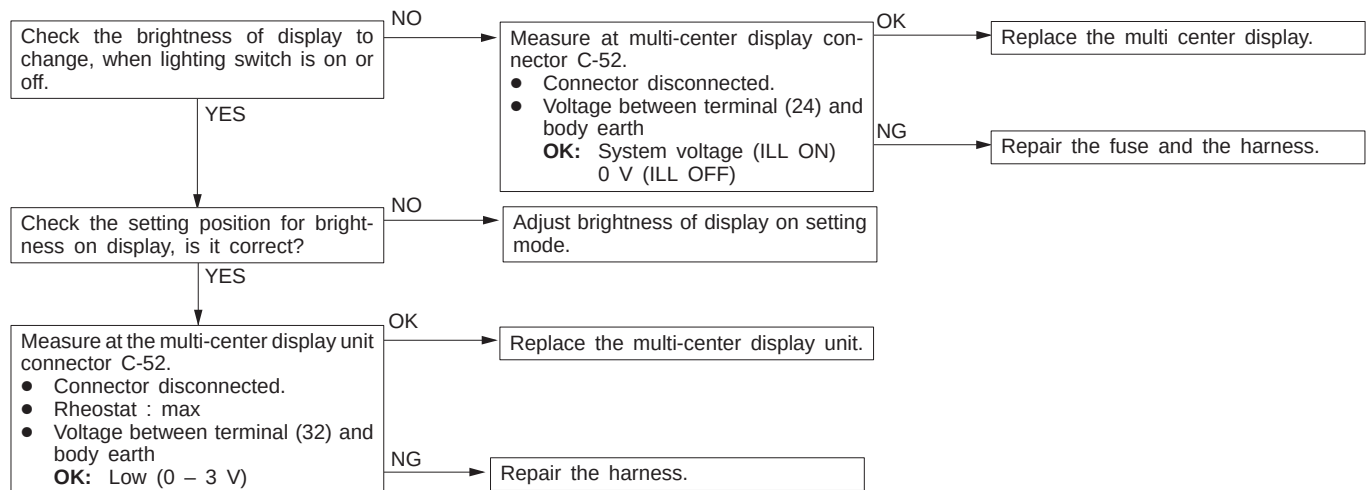
INSPECTION PROCEDURE 6

No illumination for audio buttons light on.



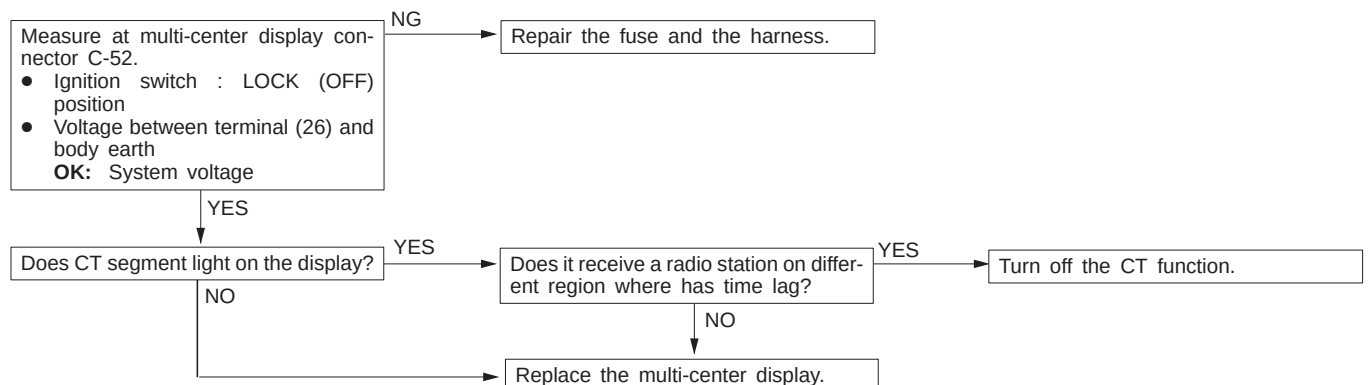
INSPECTION PROCEDURE 7

Dim display

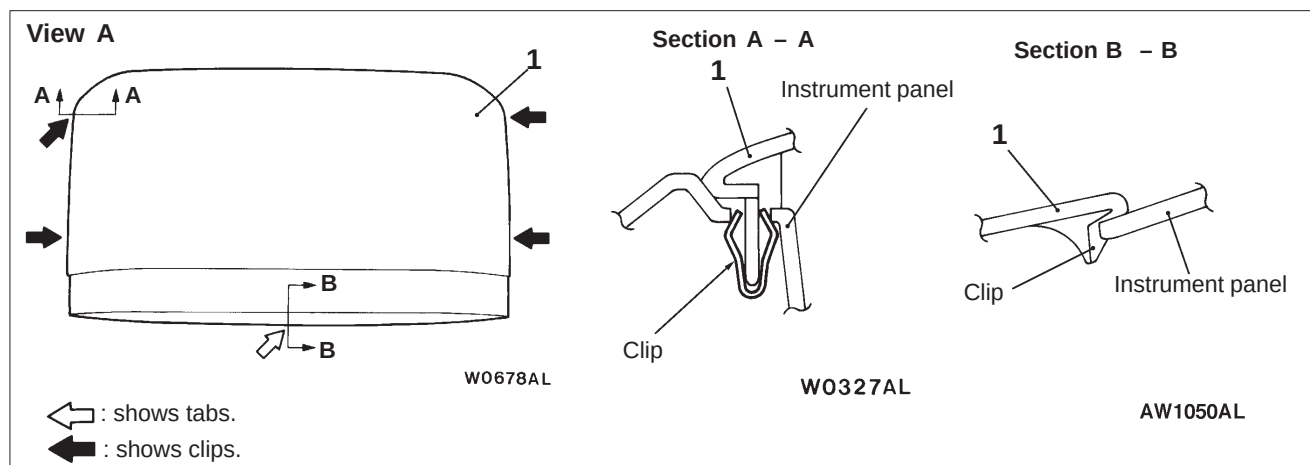
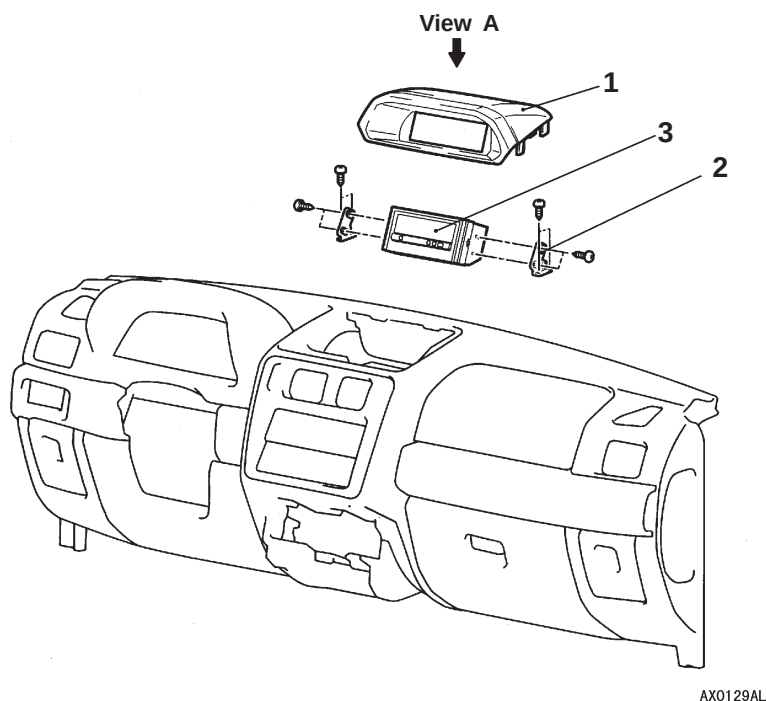


INSPECTION PROCEDURE 8

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	Disappear after a few seconds
	Past destinations	
	Average fuel consumption, average speed, cruising range	
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

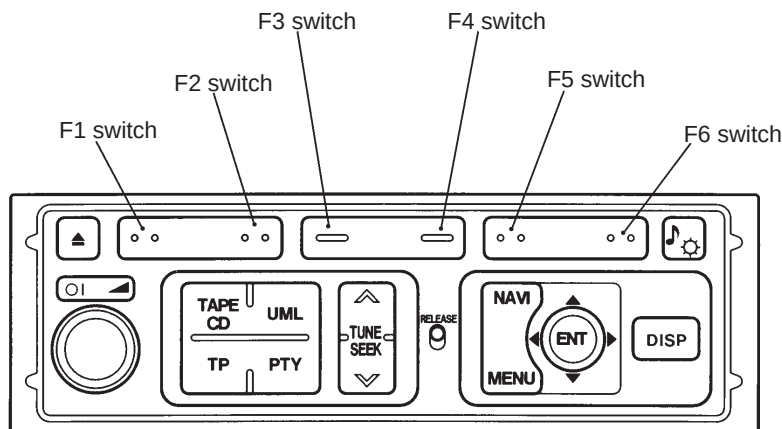
- (1) If only certain functions are showing an abnormality, use the audio checking function of the service functions to check the hardware switches.
- (2) If the switch functions are normal, check the connections of the related harness connectors. If a malfunctioning location is discovered, repair it 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.

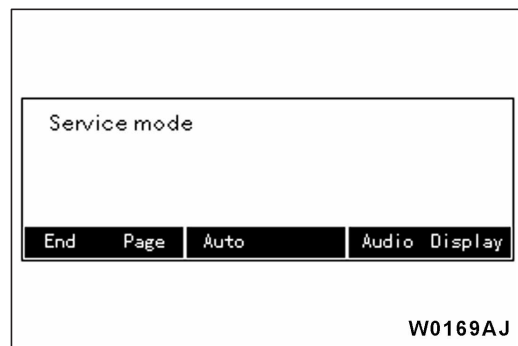
MITSUBISHI MULTI COMMUNICATION SYSTEM DISPLAY PANEL

AV0273AJ

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 1. Monitor checking 2. Audio checking 3. Automatic diagnosis by mode 4. Self-diagnosis • Wiring and communication checking • Sensor checking • Vehicle signals • Version data 5. Diagnosis recording	There are five checking modes available: monitor checking, audio checking, automatic checking by mode, self-diagnosis and diagnosis recording. This mode checks that the image display function is operating normally. This mode checks that the speakers and operating switches of the audio system are all working normally. In this mode, wiring and communication checking, audio checking, sensor checking and vehicle signal checking are carried out continuously. This mode includes functions such as wiring and communication checking, sensor checking, vehicle signals and version data checking. This checks system communication between all units. This checks all of the sensors that are necessary to the navigation system. This displays the current vehicle signal condition. This displays the version numbers for each unit in the Multi Center Display. This mode displays error codes from communication checking. (Error codes are erased when the ignition switch is turned to OFF.)

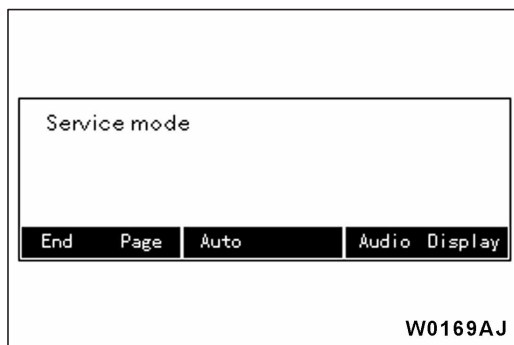


1. ACTIVATING AND ENDING SERVICE MODE

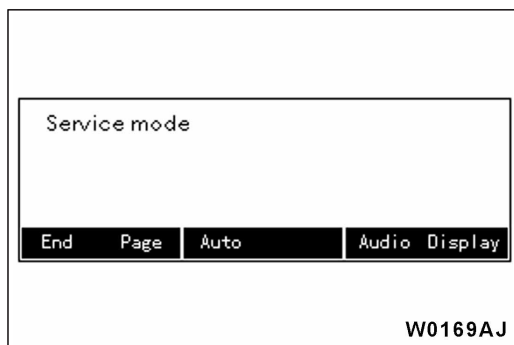
- (1) Activating service mode can be carried out by turning the ignition switch to the ON position while pressing the DISP switch on the audio unit and the F6 switch. (Continue pressing each switch for at least 5 seconds after turning the ignition switch to ON.)
- (2) If the special CD-ROM has been inserted 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.

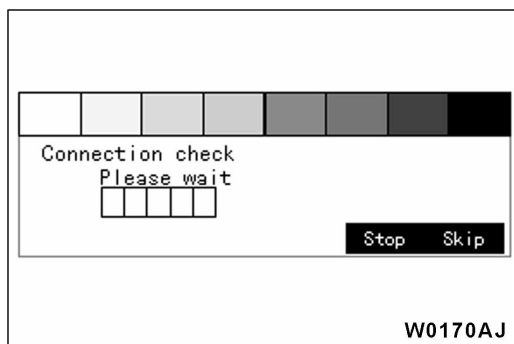


- (3) If the F1 switch is pressed at the service mode initial screen, service mode will be ended and the screen will change to navigation mode.

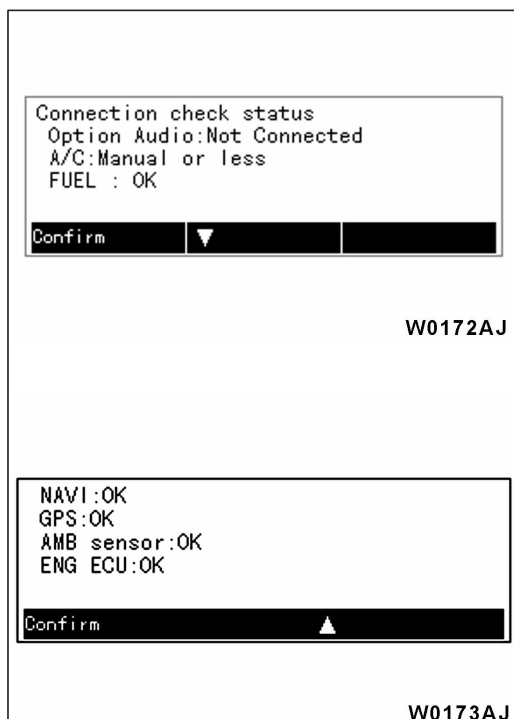


2. AUTOMATIC DIAGNOSIS BY MODE

- (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.

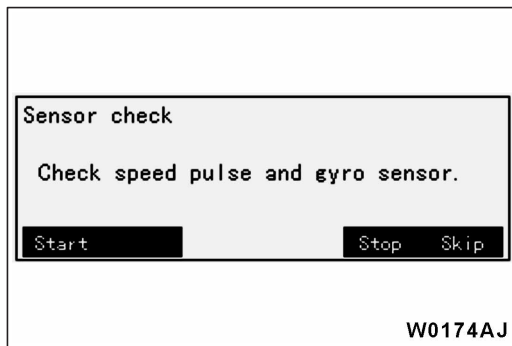


- (3) Once the transmission checking is completed, the results of the wiring and transmission checking will appear on the screen.

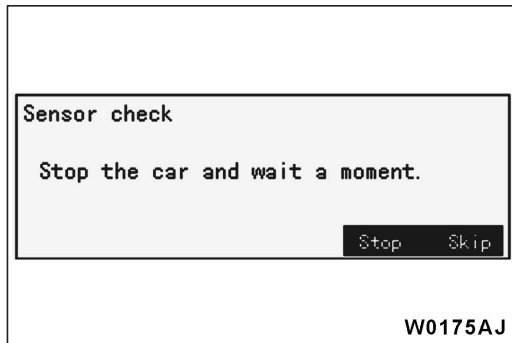
After checking the results, press the F1 switch to proceed to the next check. The next check will start when the switch is pressed.

NOTE

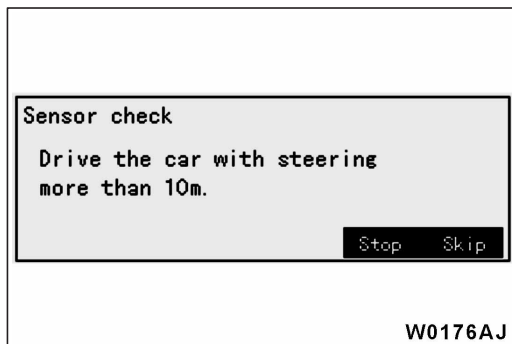
- 1) If the fuel gauge and the engine-ECU are checked while the ignition switch is at ACC, an error will be generated, but this is not a sign of an abnormality.
- 2) If checking is carried out while the fuel tank is full or the while ignition switch is at ACC, the fuel gauge may be shown to be not connected, but this is not a sign of an abnormality.



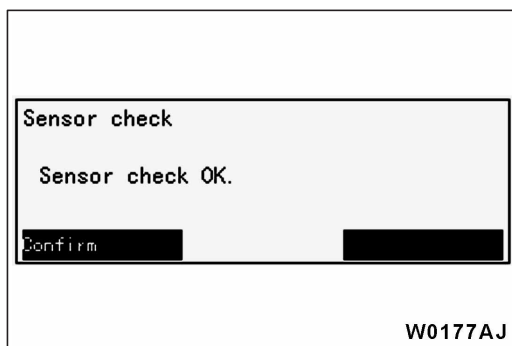
- (4) The next mode is the sensor checking mode. Press the F1 switch to start sensor checking.
If you would like to proceed to the next checking operation without carrying out sensor checking, press the F6 switch.



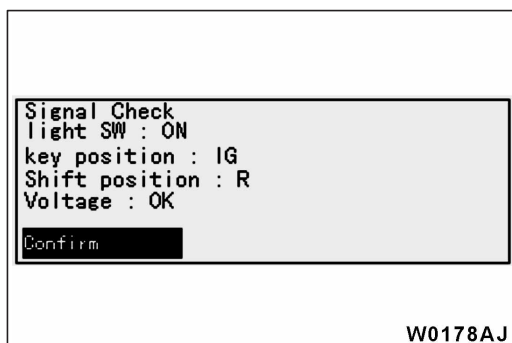
- (5) When sensor checking starts, the gyro output will be checked first while the vehicle is stopped, so make sure that the vehicle is stopped for this check.
If the vehicle is moving when the sensor checking starts, the vehicle speed sensor will be shown as defective.
Follow the guidance message on the multi-center display.



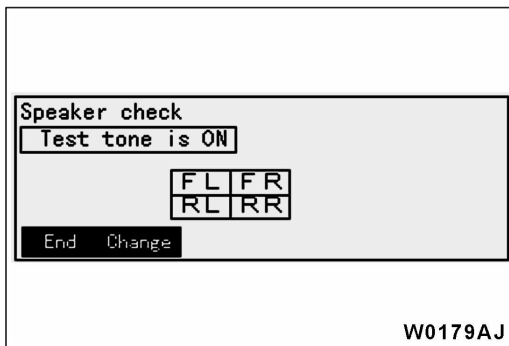
- (6) Next, drive the vehicle for approximately 10 meters while changing the running direction in order to check the vehicle speed pulse and the gyro sensor output. The sensor checking will then be completed. If there is an open circuit in the vehicle speed sensor, sensor checking will not complete even 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.



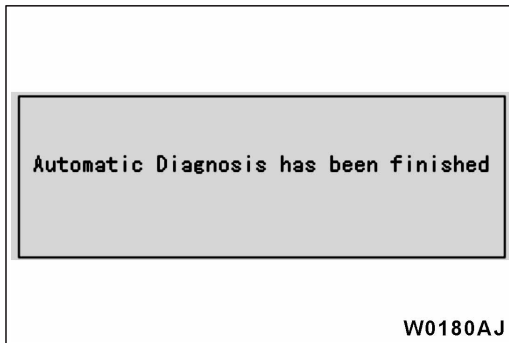
- (7) When sensor checking is completed, the check results will appear on the screen. After checking the results, press the F1 switch to proceed to the next check.



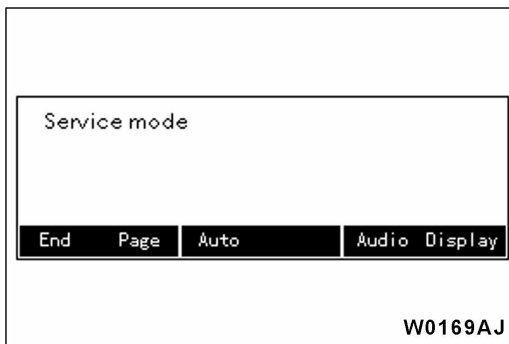
- (8) The next mode is the vehicle signal checking mode. The lighting switch condition, ignition key position, shift lever selection (R or a position other than R) and the power supply voltage drop will be appear on the screen. Check that the details displayed match the actual vehicle signals, and then 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.

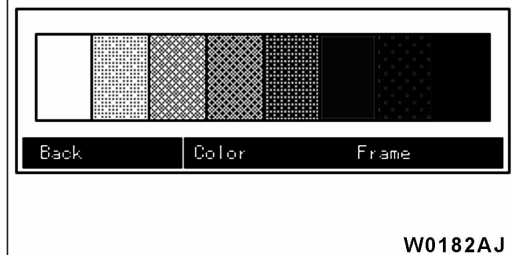
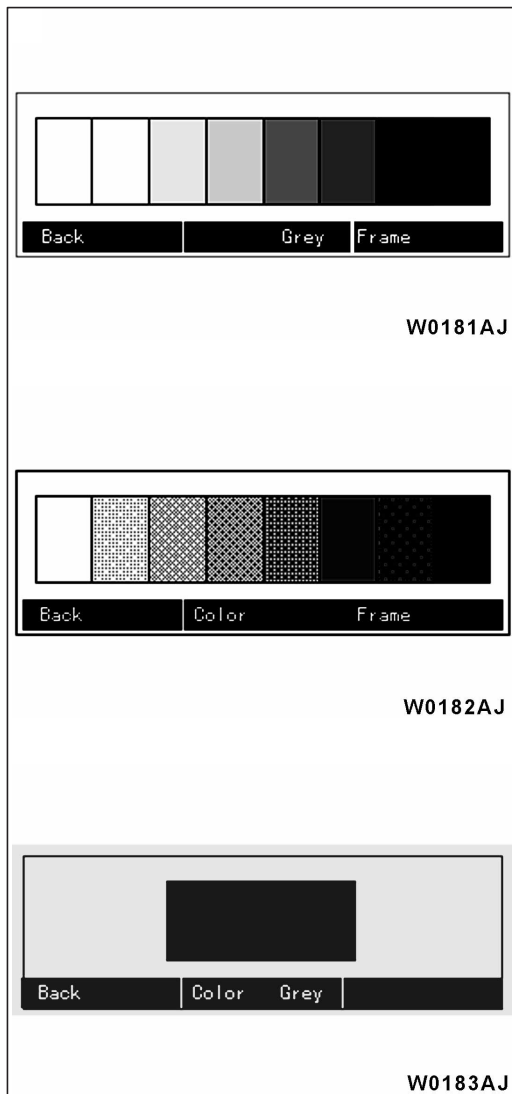


- (10) Press the F1 switch to end service mode. The screen will change to navigation mode.

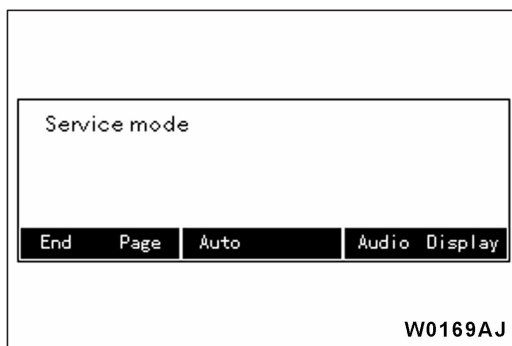


3. MONITOR CHECKING

- (1) If the F6 switch is pressed at the service mode initial screen, monitor checking will start.

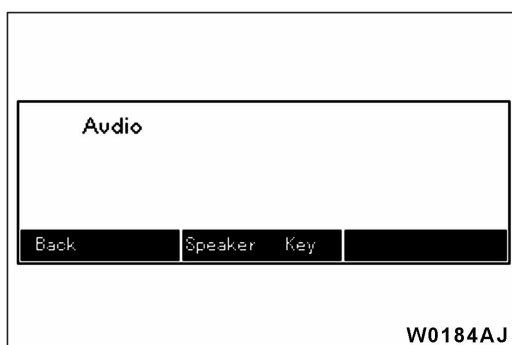


- (2) A colored bar will appear on the screen. Press a function switch to change to another screen. The screen will return to the service mode initial screen if the F1 switch is pressed.

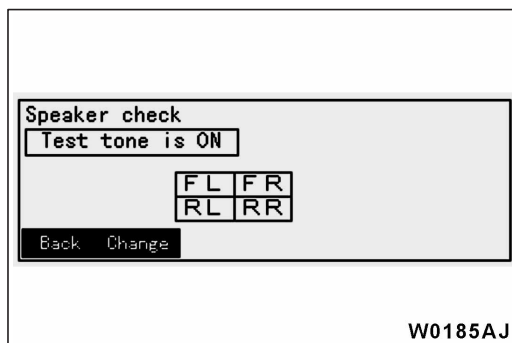


4. AUDIO CHECKING

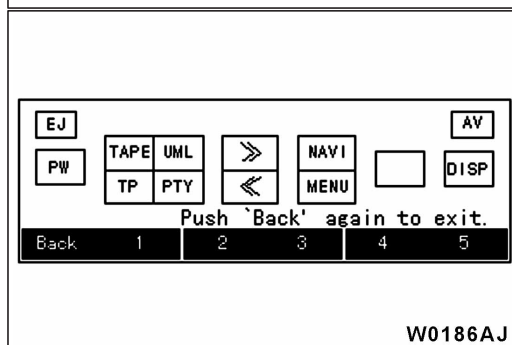
- (1) If the F5 switch is pressed at the service mode initial screen, the audio checking menu screen will appear.



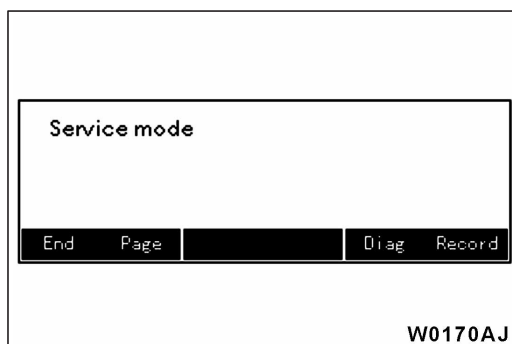
- (2) Next, press the function switches to carry out audio checking.



- (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.

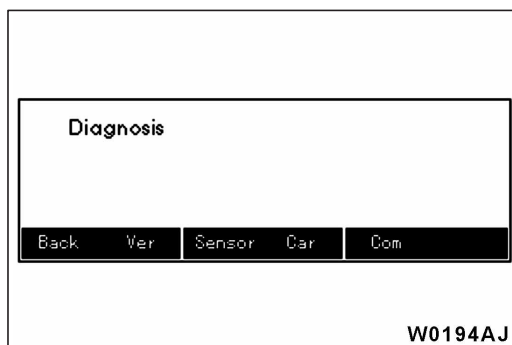


- (4) Press F4 to display the audio key checking screen. When one of the audio switches is pressed, the screen display color for that switch should change. This indicates that this particular switch system is working normally. Press the F1 switch to check the operation of the F1 switch. Press the F1 switch once more to return to the audio checking menu screen.

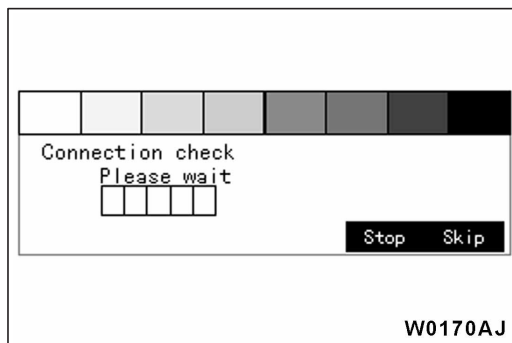


5. SELF-DIAGNOSIS

- (1) If the F5 switch is pressed at the service mode initial screen, the self-diagnosis menu screen will appear.



- (2) Next, use the function switches to carry out self-diagnosis.



- (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.

Connection check status

Option Audio:Not Connected

A/C:Manual or less

FUEL : OK

Confirm ▼

W0172AJ

NAVI:OK

GPS:OK

AMB sensor:OK

ENG ECU:OK

Confirm ▲

W0173AJ

Sensor check

Check speed pulse and gyro sensor.

Start Stop

W0188AJ

Sensor check

Stop the car and wait a moment.

Stop

W0189AJ

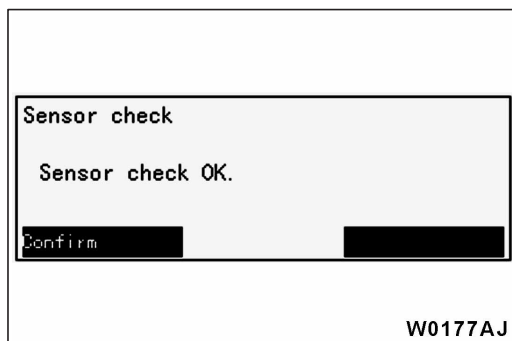
Sensor check

Drive the car with steering more than 10m.

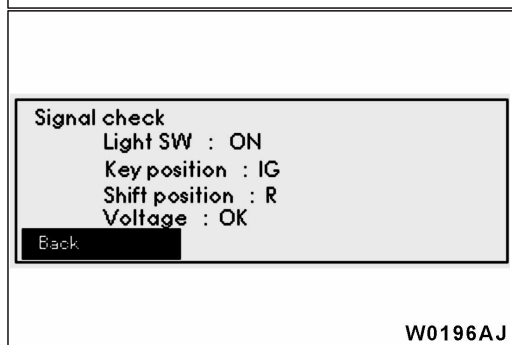
Stop

W0190AJ

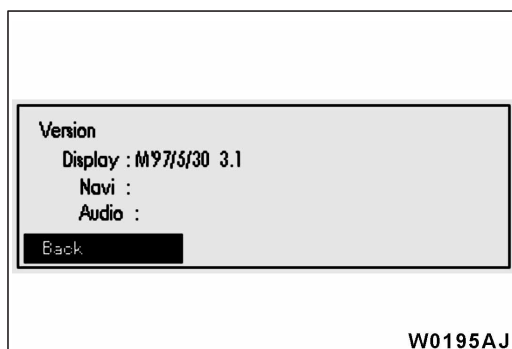
- (4) Once the transmission checking is completed, the results of checking will appear on the screen. After checking the results, press the F1 switch to return to the self-diagnosis menu screen.
- (5) If the F6 switch is pressed at the self-diagnosis menu screen, sensor checking will start. Press the 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.



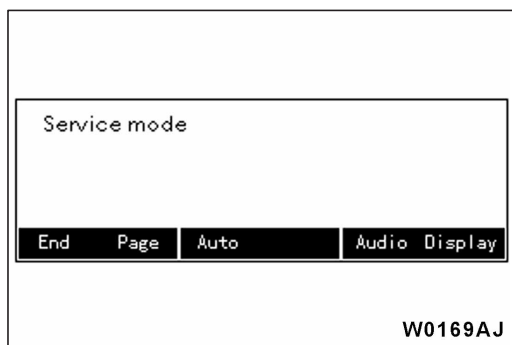
- (8) When sensor checking is completed, the check results will appear on the screen. After checking the results, press the F1 switch to return to the self-diagnosis menu screen.



- (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.

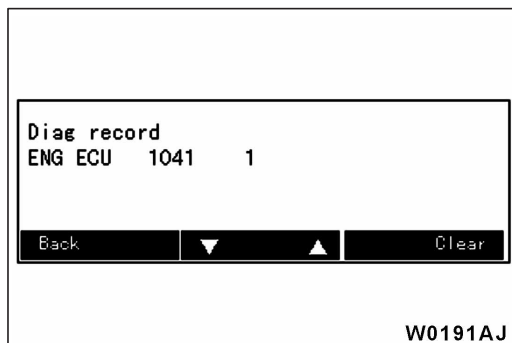


If the F2 switch is pressed at the self-diagnosis menu screen, version data self-diagnosis will be carried out, and the check results will appear on the screen. Press the F1 switch to return to the self-diagnosis menu screen.

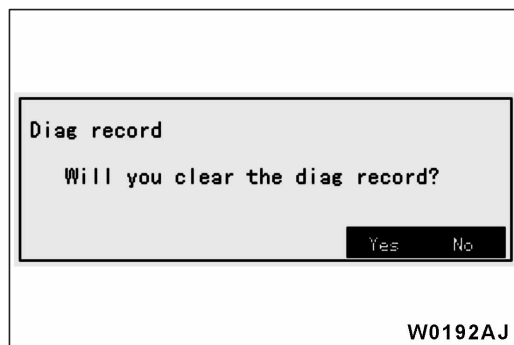


6. DIAGNOSIS RECORDING

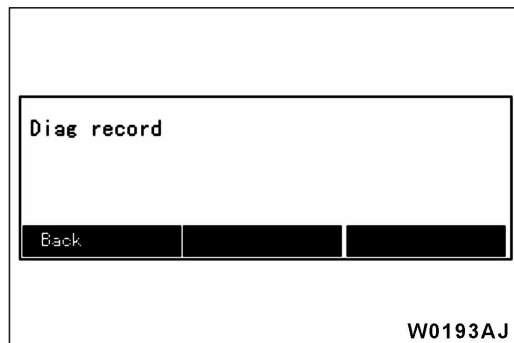
- (1) If the F6 switch is pressed at the service mode initial screen, the diagnosis recording screen will appear.
 (2) Press the F1 switch to return to the service mode initial screen.



- (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.



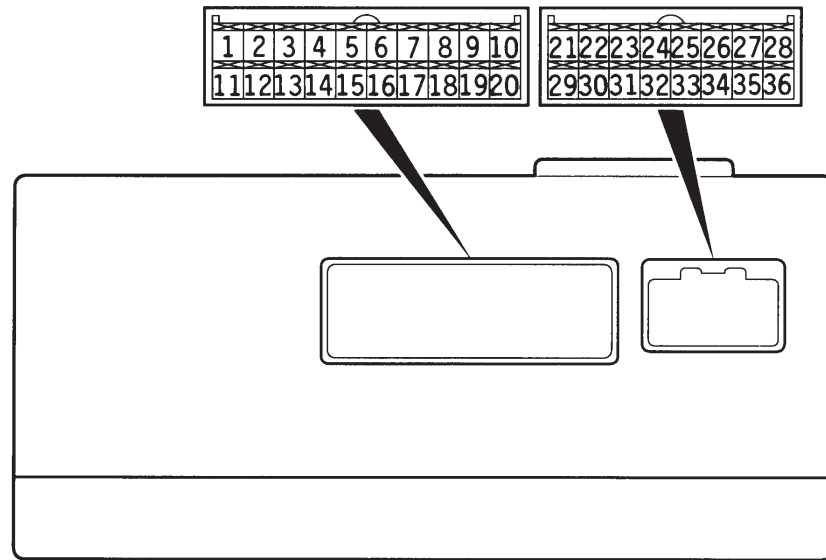
- (5) Press the F1 switch to return to the service mode initial screen.

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

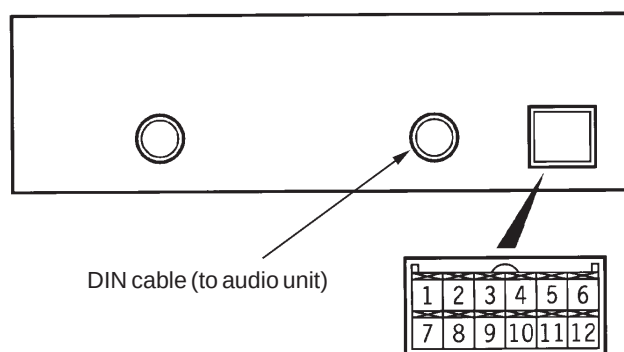
Terminal No.	Input/Output	Signal Symbol	Terminal Voltage (V)	Harness Problem		Trouble Symptom Resulting from Harness Problem
				Open Circuit	Short-circuit	
1	Input	G+SYTNC (AUDIO)	–	○	○	Noise display (random dot pattern)
2	Input	B+SYNC (AUDIO)	–	○	○	Blue, white, cyan and magenta do not appear in RGB 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	–	–	–	–	–	–

54A-92 CHASSIS ELECTRICAL – Multi-Center Display <High Grade>

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.

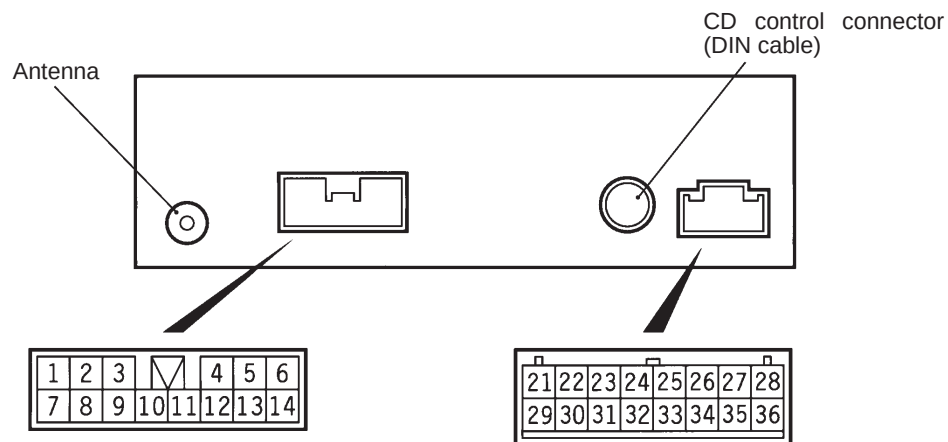
Terminal No.	Input/Output	Signal Symbol	Terminal Voltage (V)	Harness Problem		Trouble Symptom Resulting from Harness Problem
				Open Circuit	Short-circuit	
34, 35	–	–	–	–	–	–
36	Input	IG1	System voltage	○	–	Communication with engine-ECU is not possible. Driving data values displayed are abnormal.
				–	○	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)	–	–	–	–

54A-96 CHASSIS ELECTRICAL – Multi-Center Display <High Grade>

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	–	–	–	–	–	–

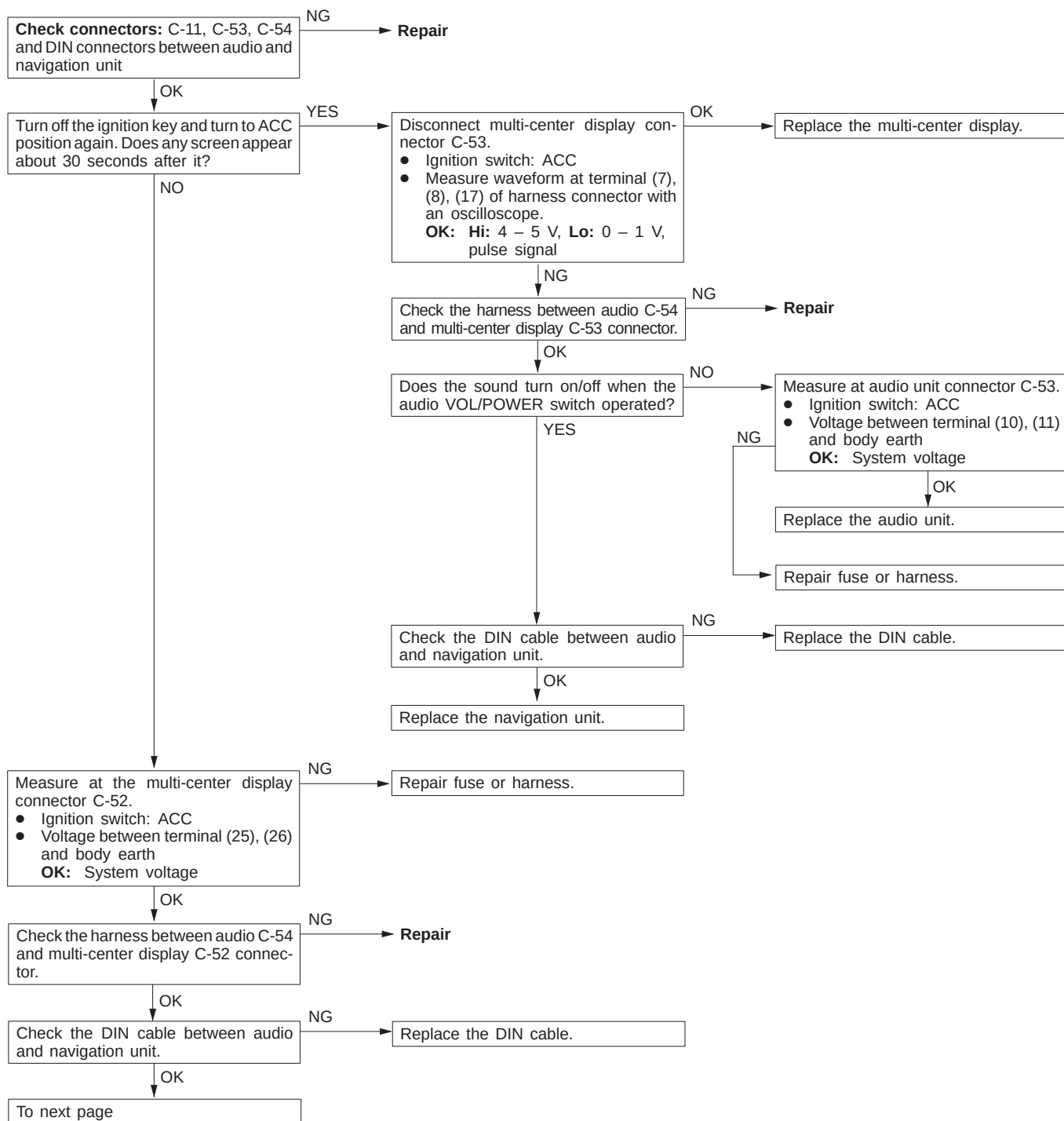
INSPECTION CHART CLASSIFIED BY TROUBLE SYMPTOMS

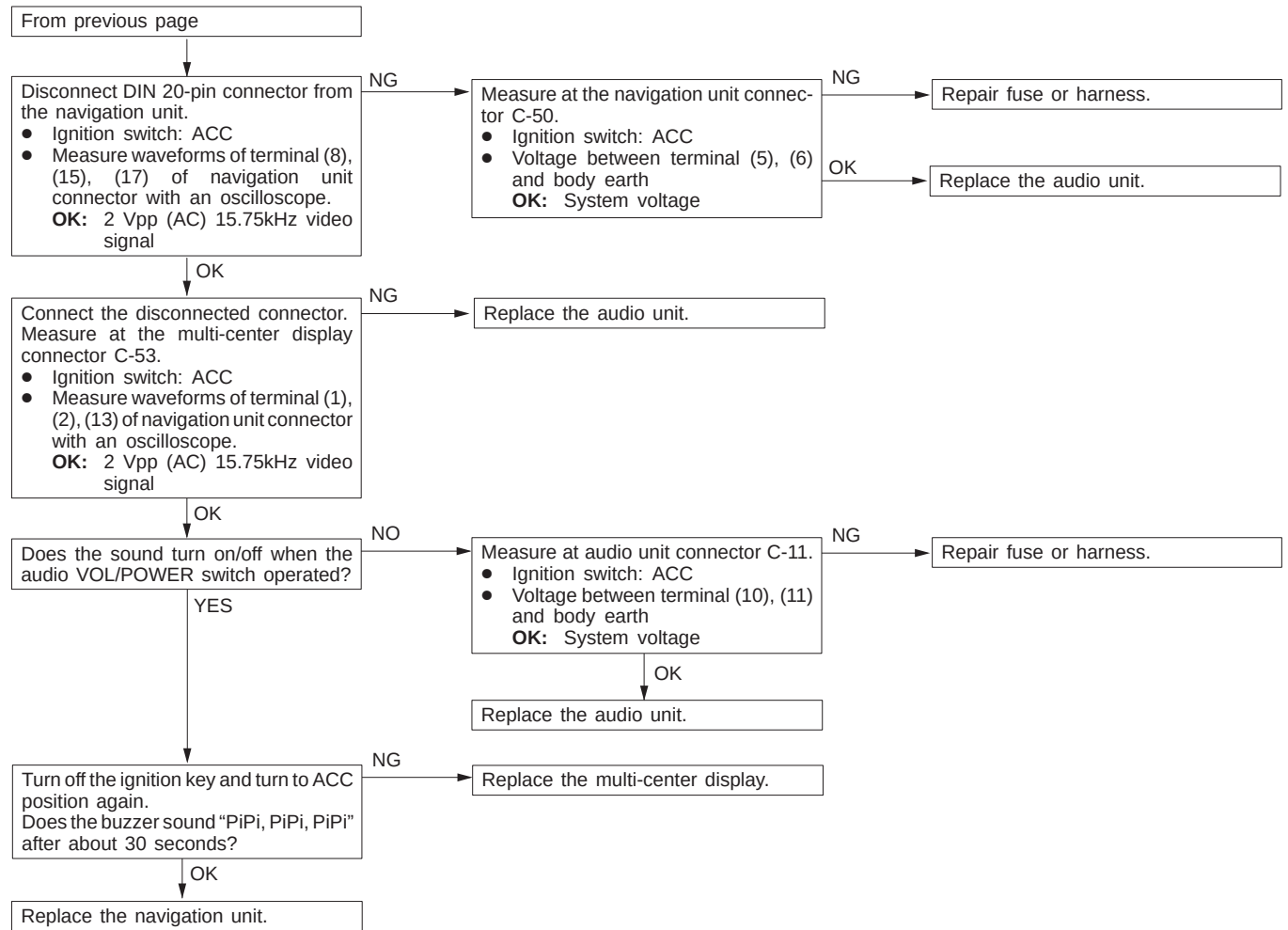
Related Unit	Trouble Symptom	Inspection Procedure No.	Reference Page
Malfunction of navigation unit, multi-center display, audio unit and related sensor, harness	TAPE/CD, UML switches do not work. No display appears after the ignition key is turned to ACC.	1	54A-97
	TAPE/CD, UML switches do not work. (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

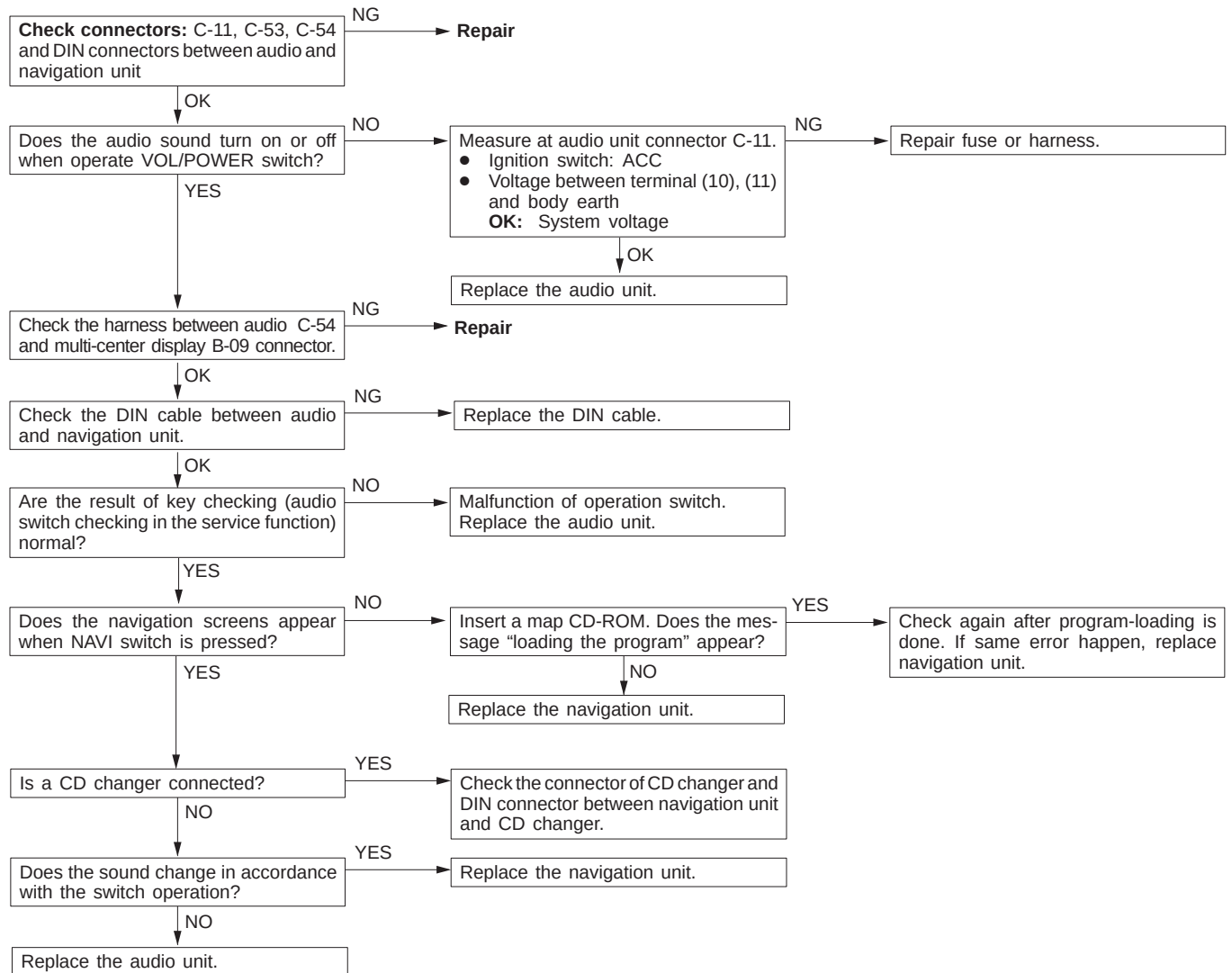
TAPE/CD, UML switches do not work. No display appears after the ignition key is turned to ACC.





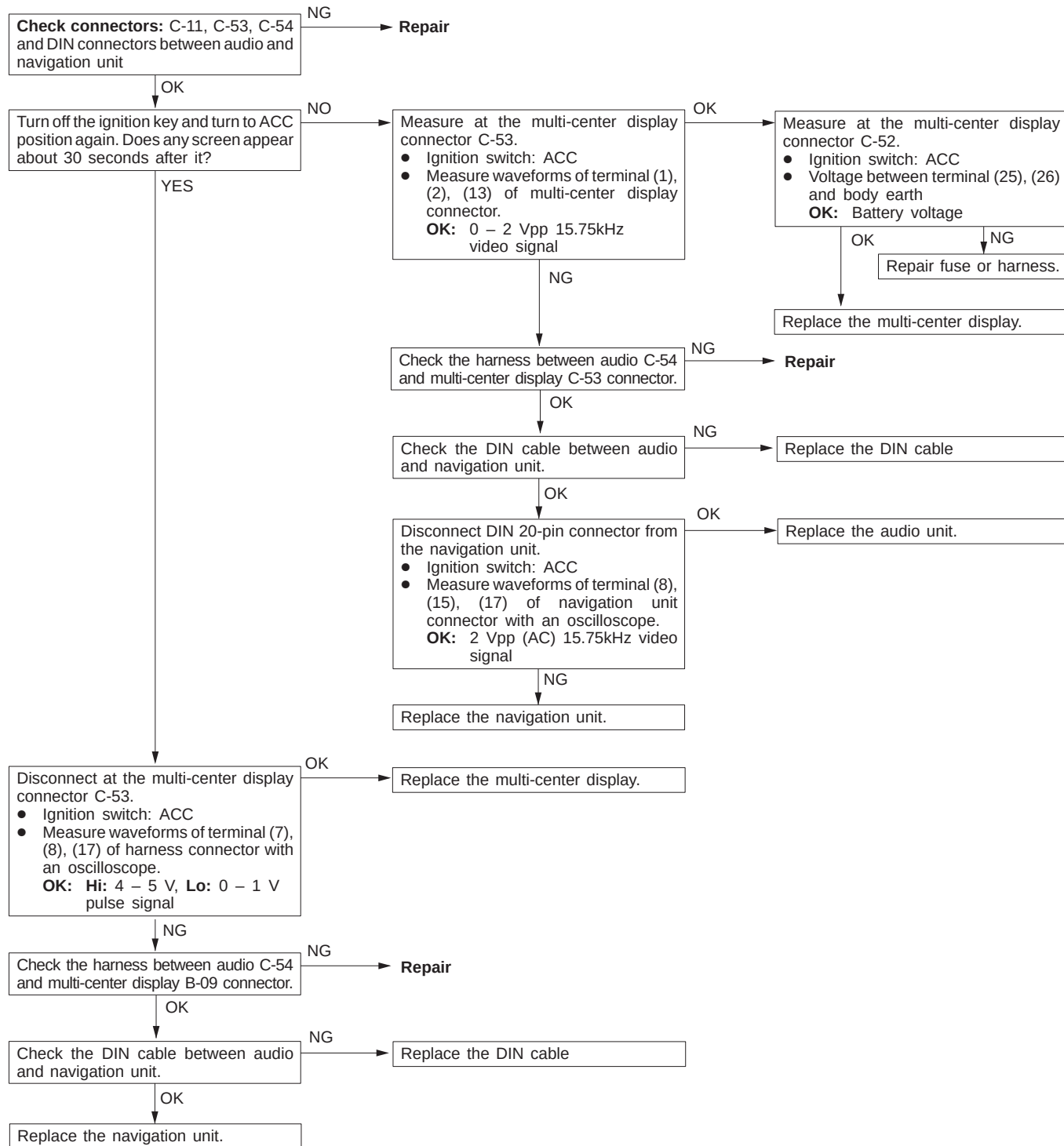
INSPECTION PROCEDURE 2

TAPE/CD, UML switches do not work. (Display appears.)



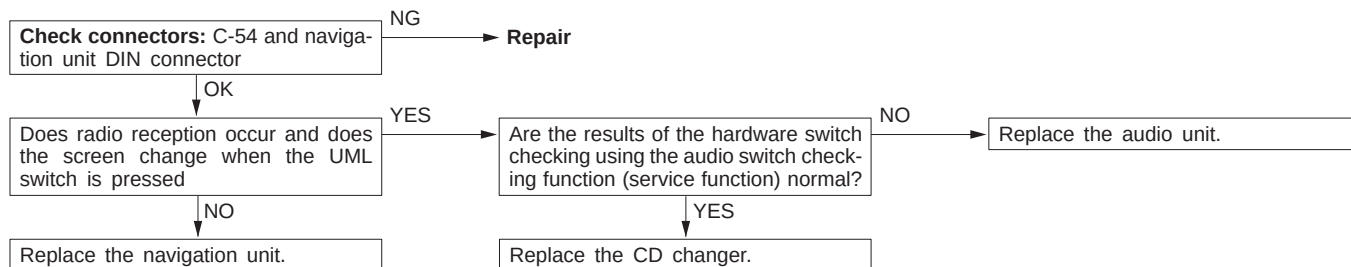
INSPECTION PROCEDURE 3

No display appears after the ignition key is turned to ACC, but TAPE/CD, UML switches can be operative.



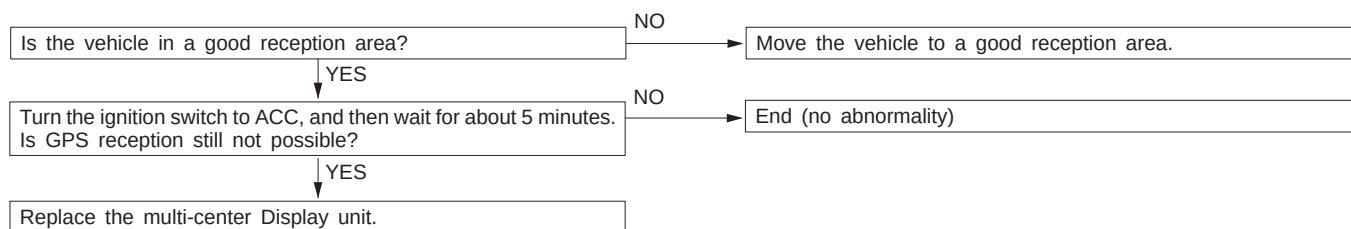
INSPECTION PROCEDURE 4

CD changer screen displays do not appear when TAPE/CD switches are operated.



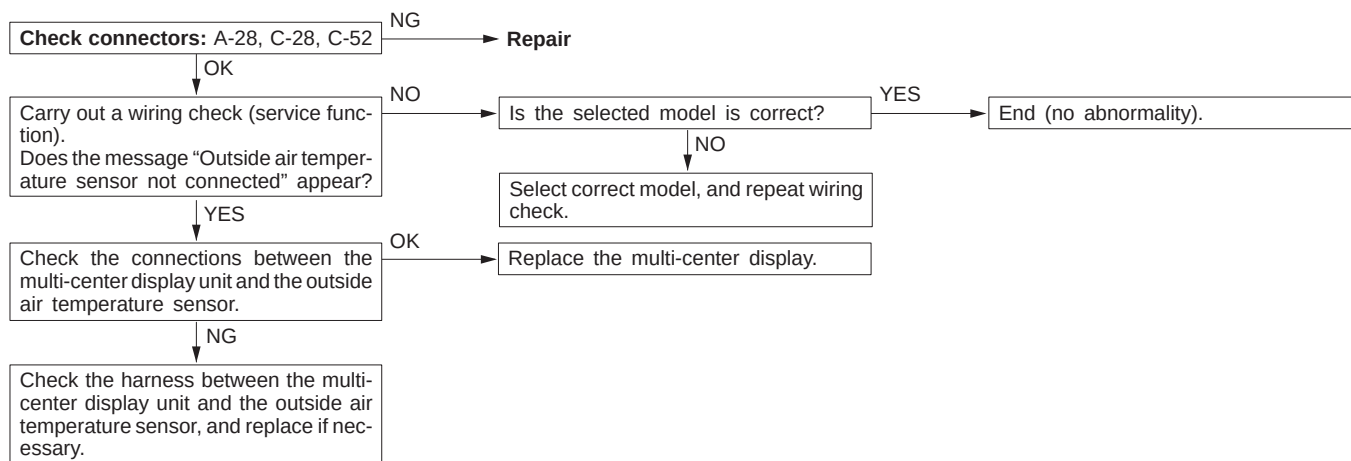
INSPECTION PROCEDURE 5

GPS reception is not possible.



INSPECTION PROCEDURE 6

Outside air temperature data is not displayed.

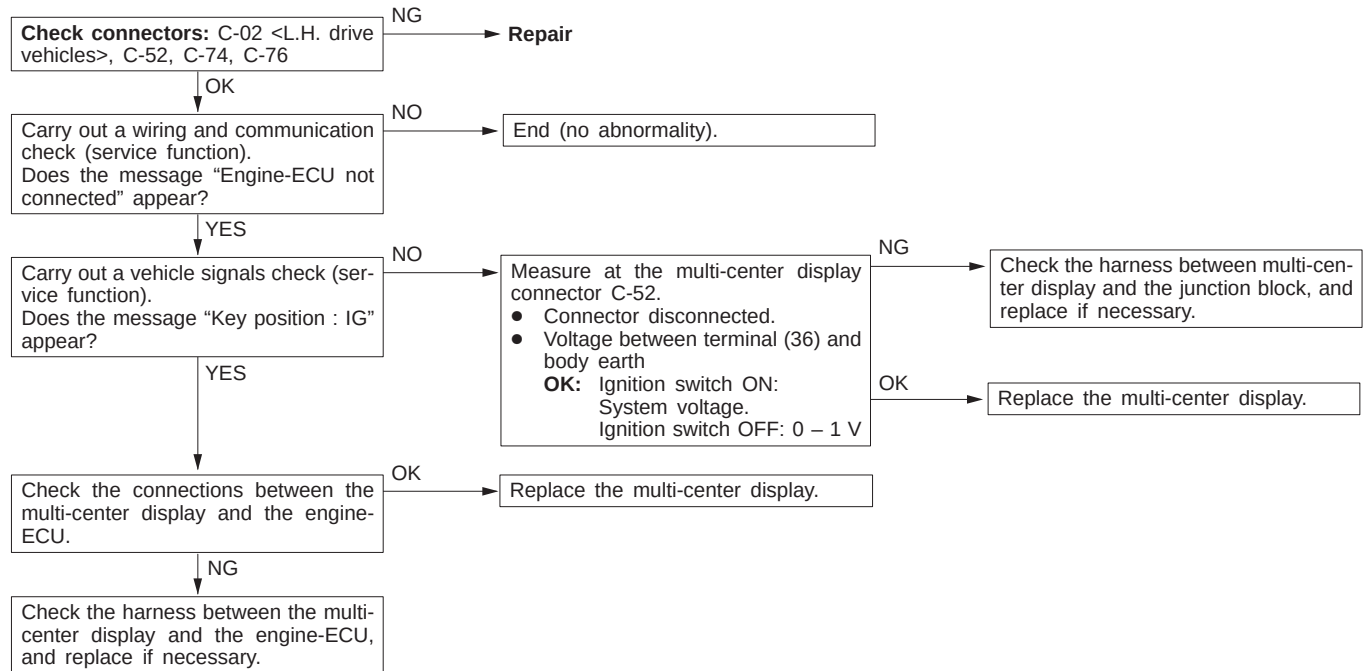


INSPECTION PROCEDURE 7

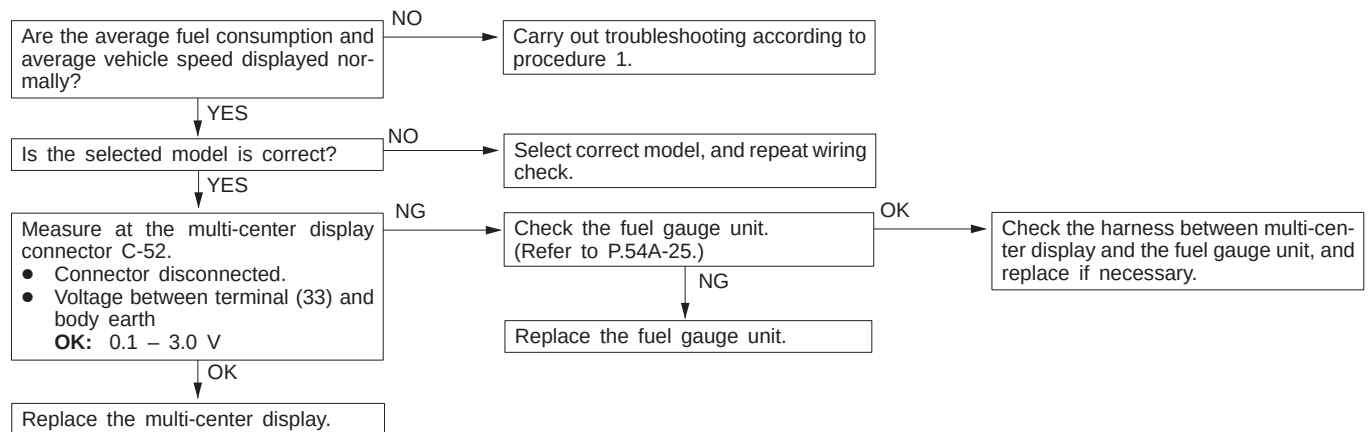
Abnormal driving data displays.

- 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.

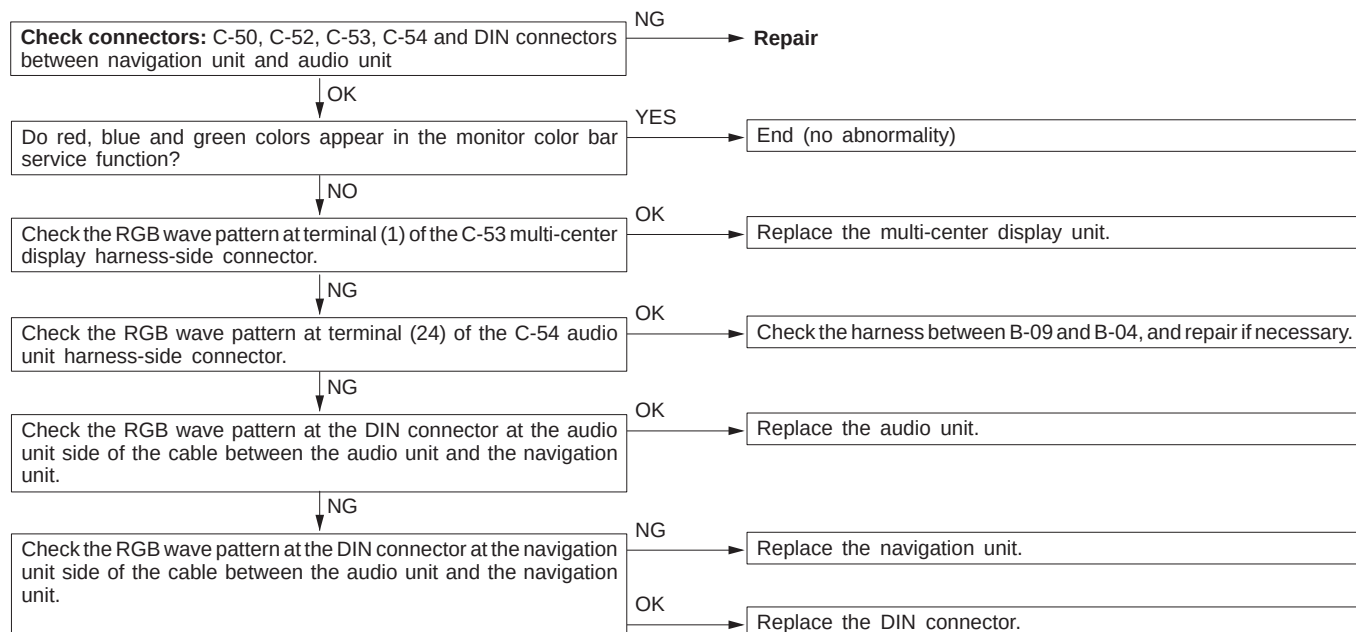


2. When cruising distance display is abnormal.



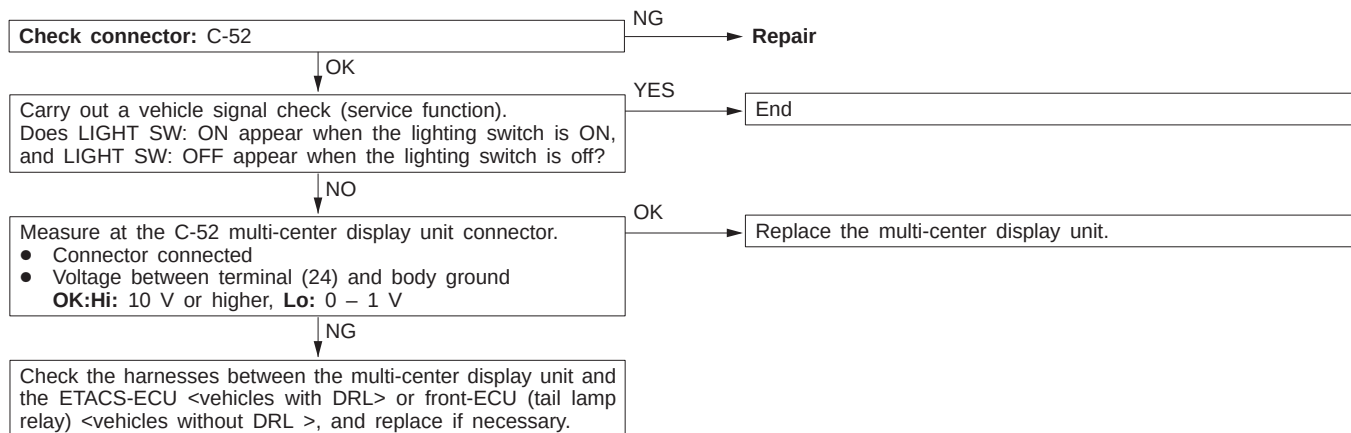
INSPECTION PROCEDURE 8

**Display moves about.
Screen colors do not match correctly.**



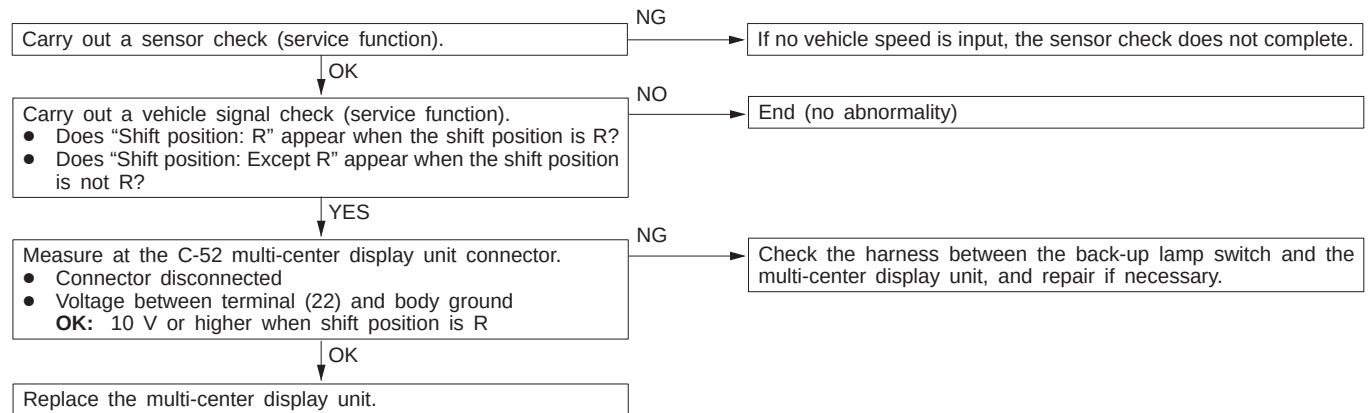
INSPECTION PROCEDURE 9

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.

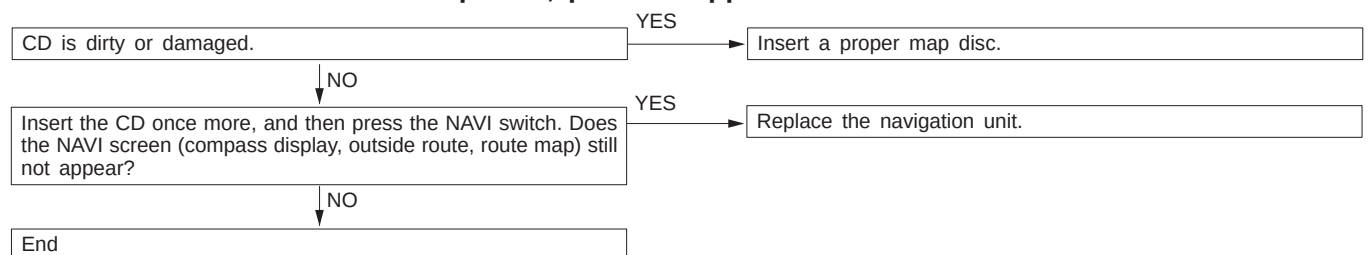


INSPECTION PROCEDURE 11

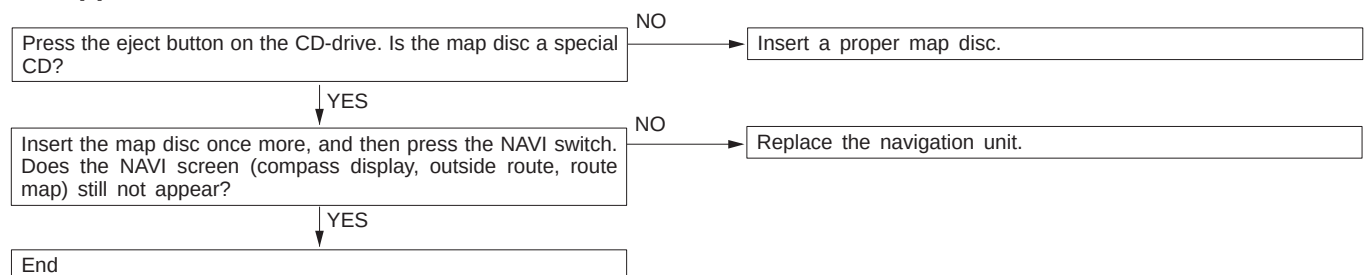
One of the following messages appears during navigation mode.

- 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.

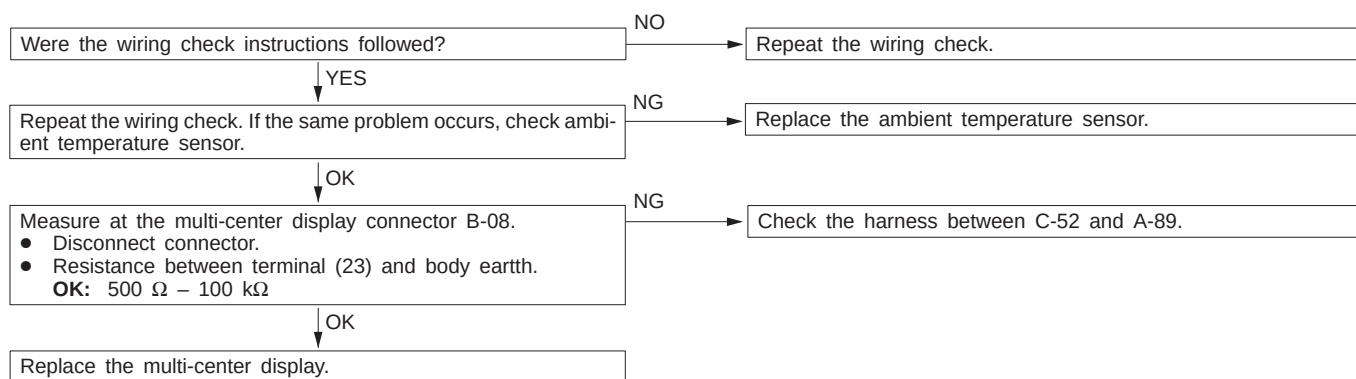


2. "No disc is in the CD-drive. Insert a map disc, please." or "A music disc is in the CD-drive" appears.

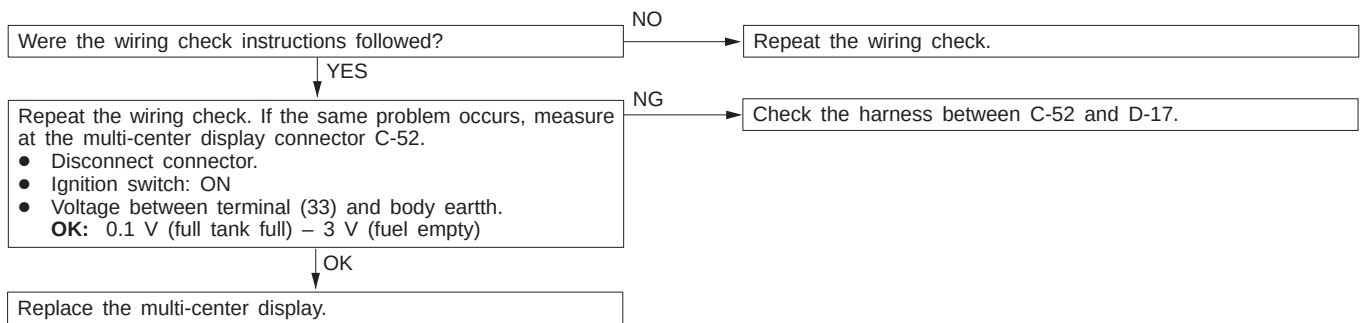


ERROR CODE TABLE <ACCORDING TO SCREEN DISPLAY>

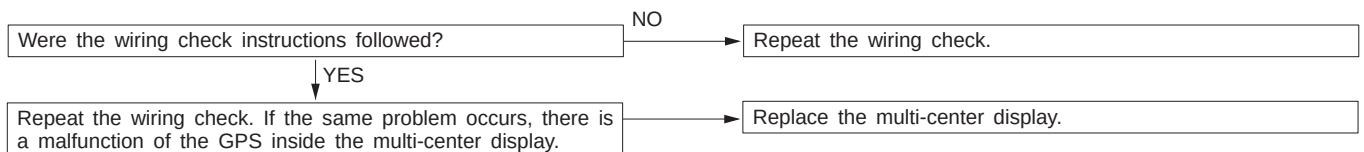
Error Code No.	Error Details	Detection Method (Reference)	Reference Page
1011	Ambient temperature sensor not connected during diagnosis	Connection checking	54A-105
1021	Fuel gauge not connected during diagnosis	Connection checking	54A-106
1031	GPS abnormality during diagnosis	Connection checking	54A-106
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**

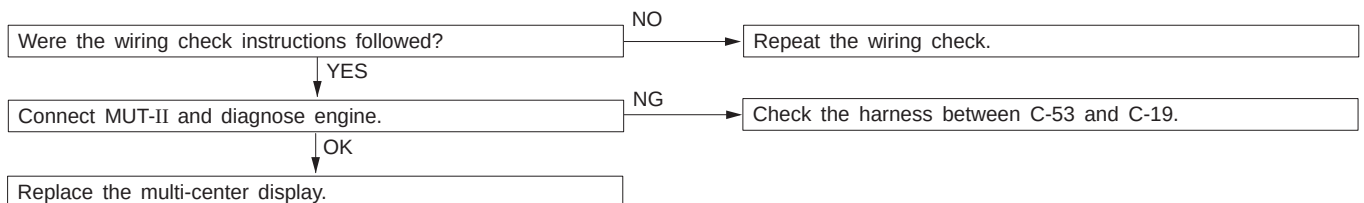
Error Code No. 1021



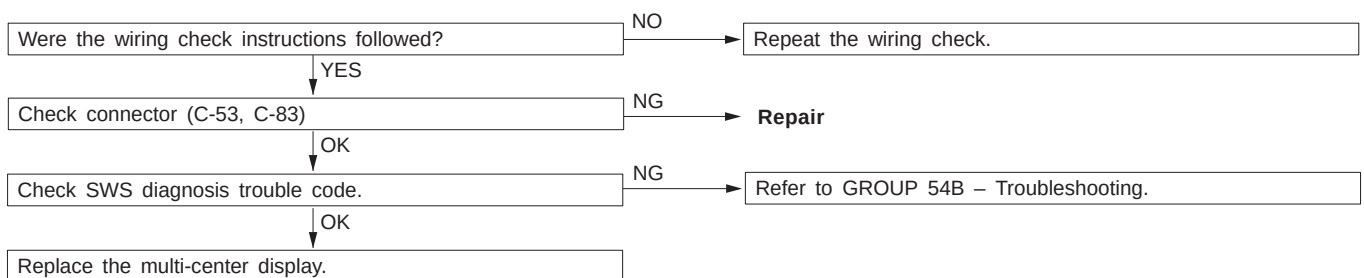
Error Code No. 1031



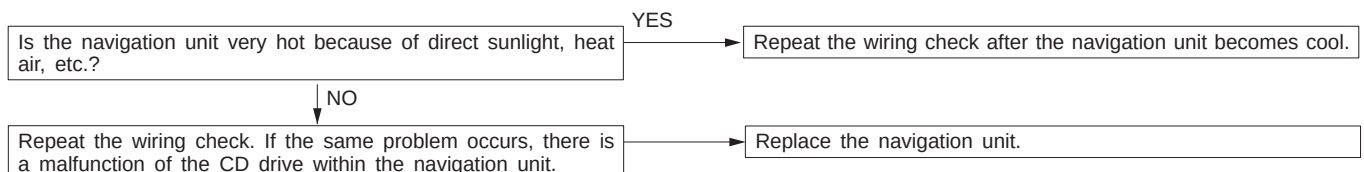
Error Code No. 1041

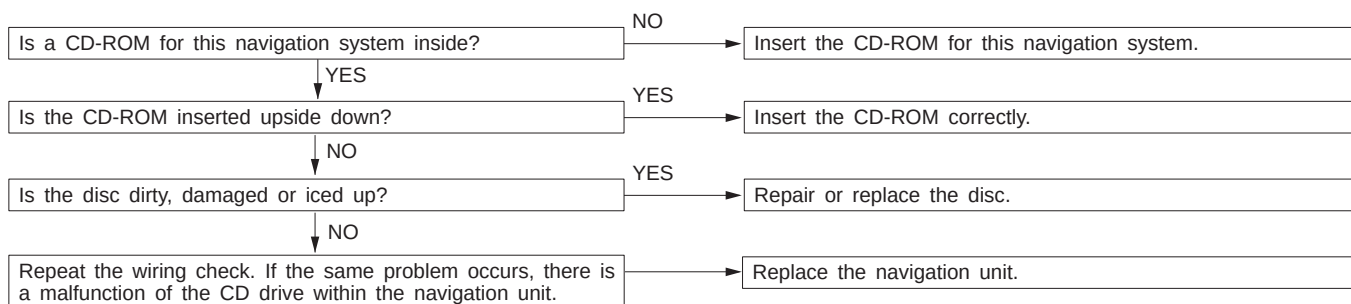
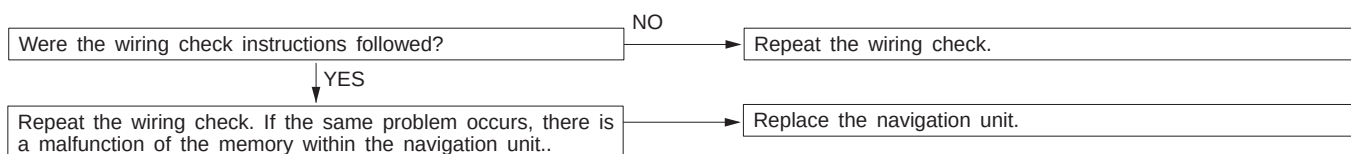
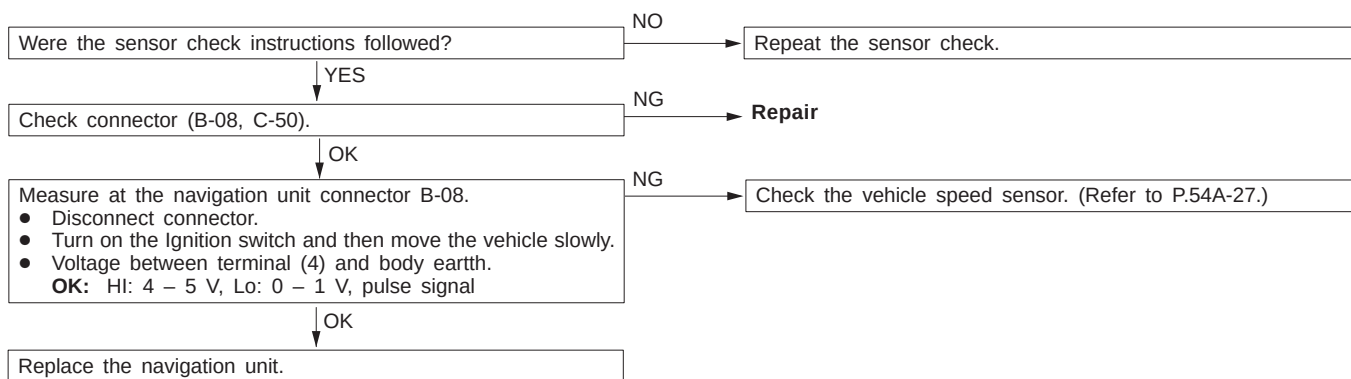
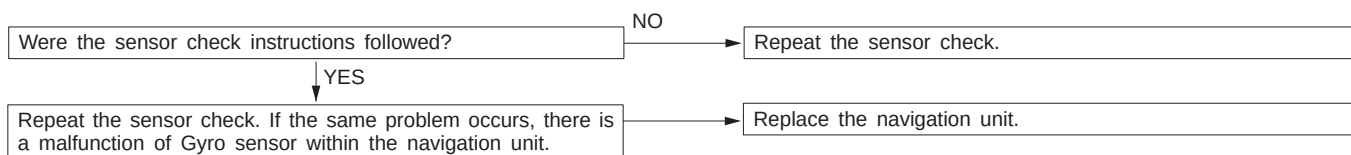


Error Code No. 1051

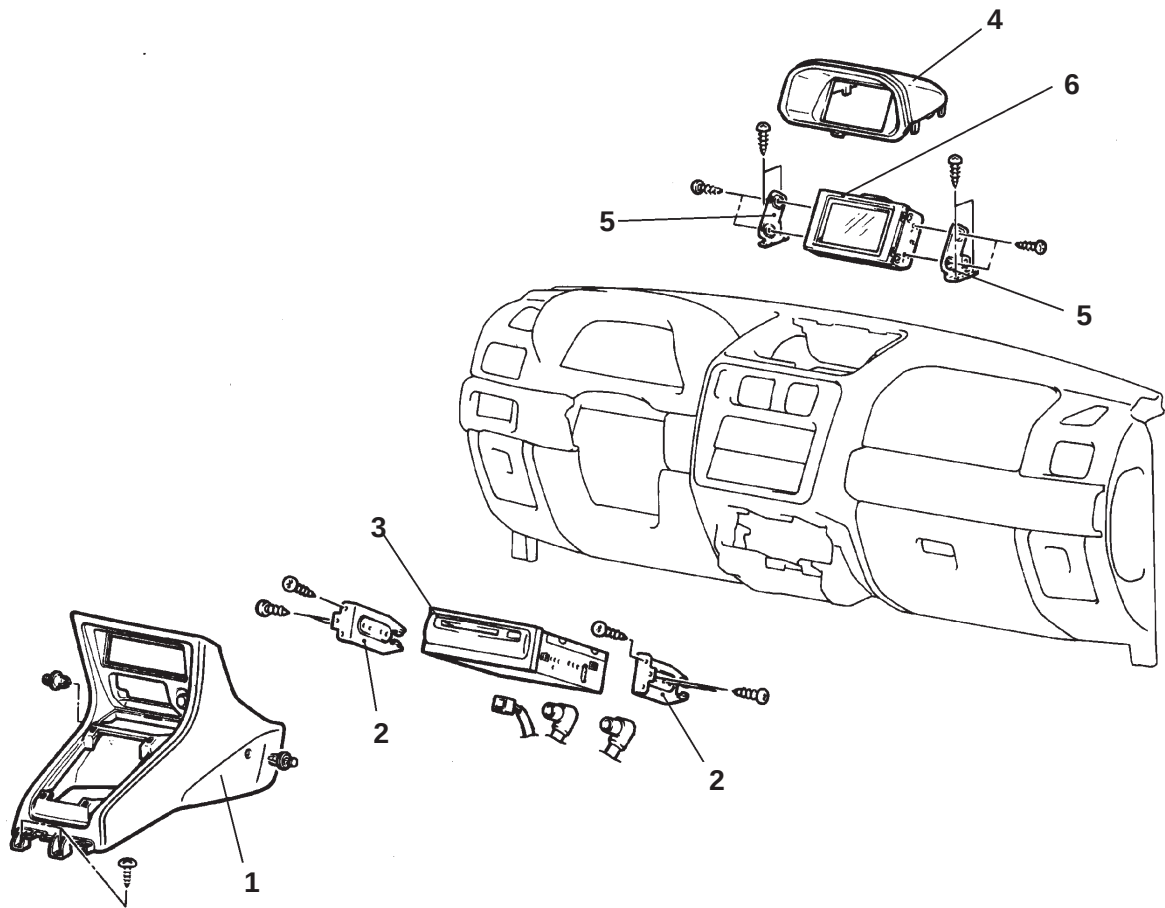


Error Code No. 1091



Error Code No. 1092, 1093, 1094, 1095, 1096**Error Code No. 10A1, 10B1****Error Code No. 20D1, 30D1****Error Code No. 20E1, 20E2, 30E1, 30E2**

MULTI-CENTER DISPLAY REMOVAL AND INSTALLATION



AX0176AL

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

SMART WIRING SYSTEM (SWS)

CONTENTS

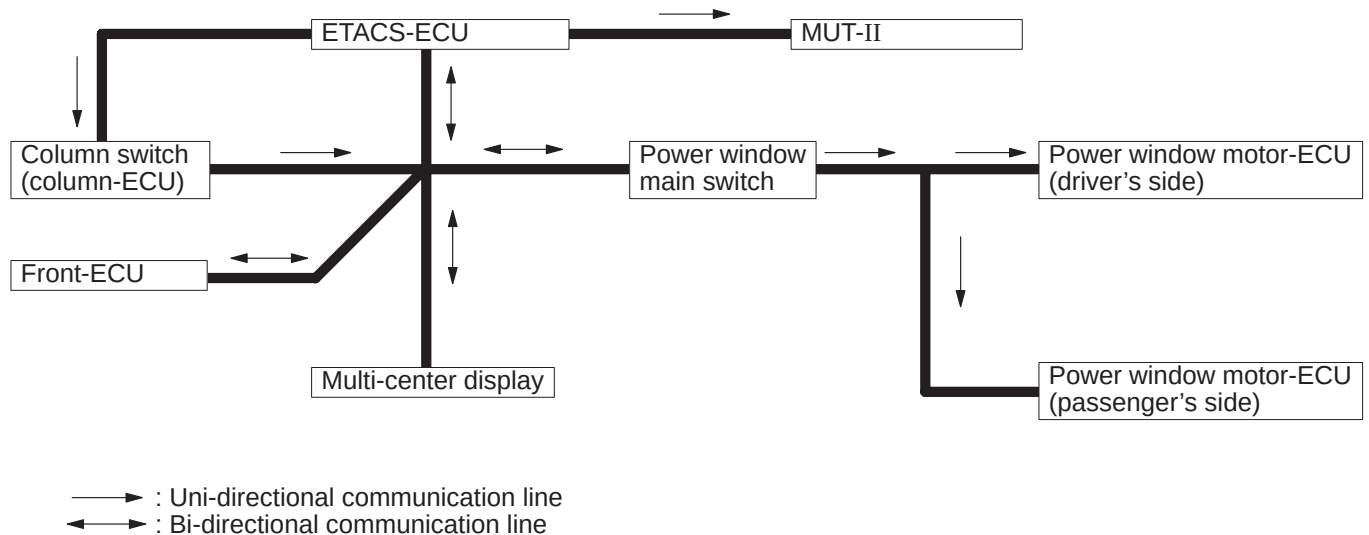
GENERAL INFORMATION	54B-1	TROUBLESHOOTING	54B-6
SPECIAL TOOLS	54B-5		



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.



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.

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

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.

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.

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 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.

HEADLAMP WASHER

If the headlamp washer switch of the column switch assembly is turned to the ON position with the

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.

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.

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

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

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.

ignition switch in the ACC or ON position, the front-ECU turns on the headlamp washer relay.

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.

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).

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.

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:

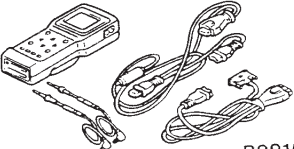
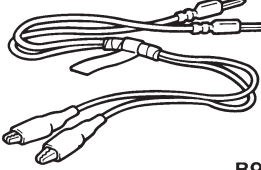
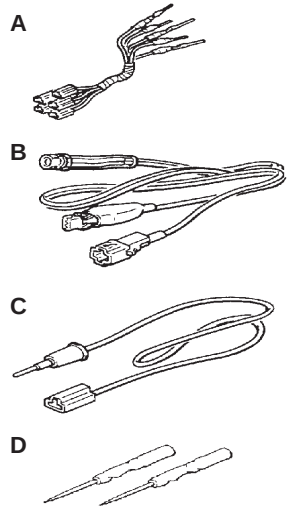
When the ignition key is removed with all the doors closed, the room lamp is illuminated at an intensity of 65% and turned out approx. 30 seconds later. During that time (timer-controlled period), the room lamp does out if the ignition key is inserted and turned to ON position or the door locking system 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

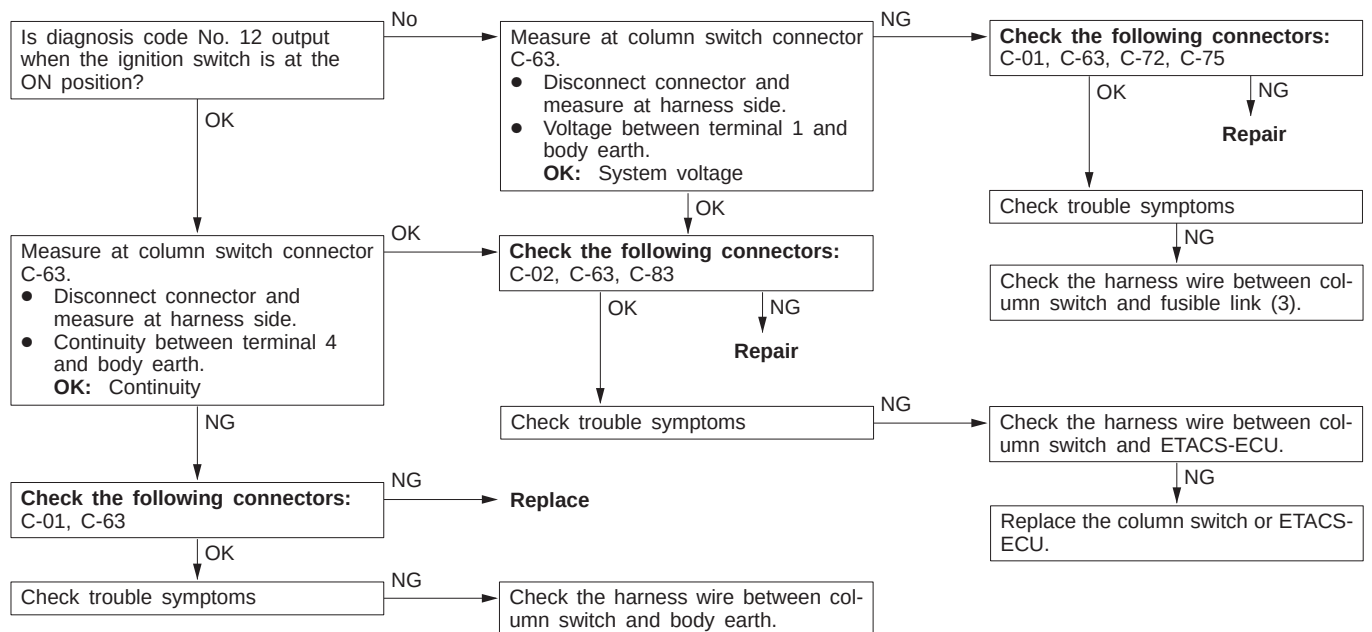
Code No.	Diagnosis item	Reference page
11	Failure concerning the ETACS-ECU	54B-8
12	Failure concerning the column switch or improper connecting with the ETACS-ECU	54B-8
13	Failure concerning the front-ECU	54B-9
21	Short circuit in communication line	54B-10

DIAGNOSIS CODE INSPECTION PROCEDURES

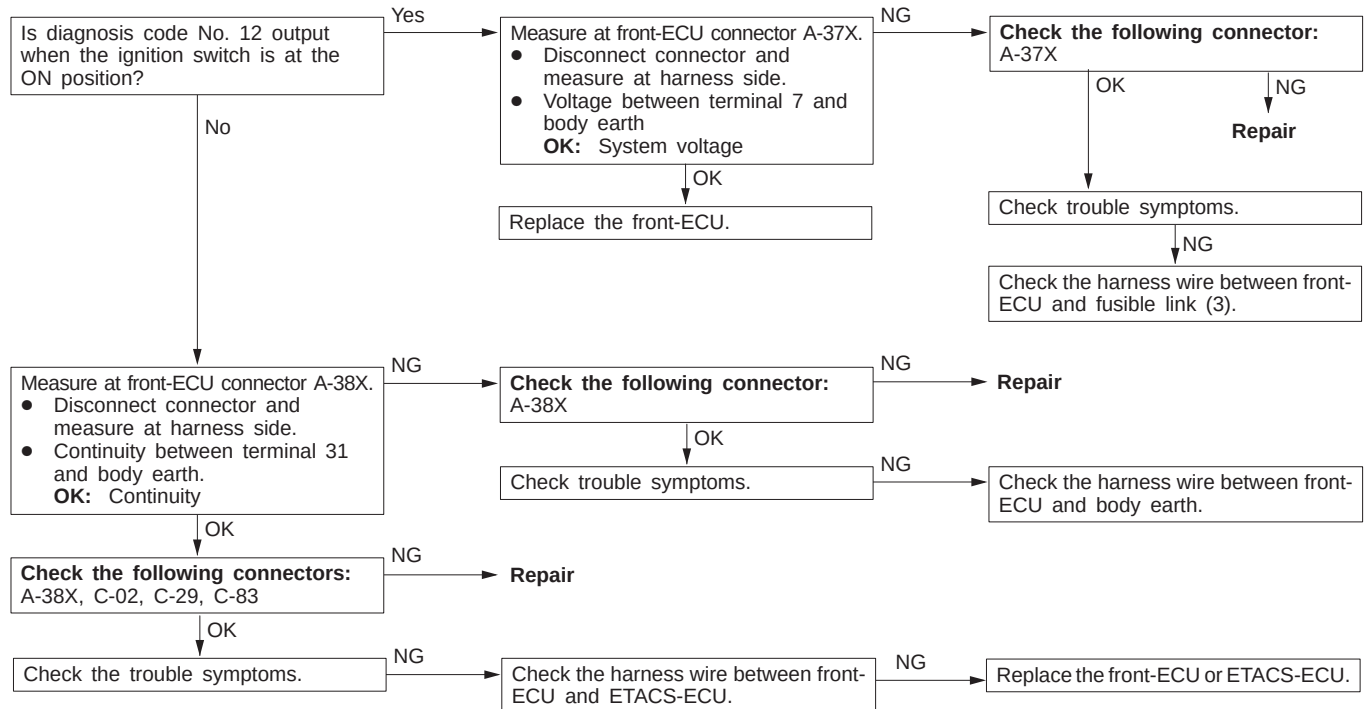
Code No.11 Failure concerning the ETACS-ECU	Probable cause
The ETACS-ECU monitors its own communication data, and sends a diagnosis code when an error takes place consecutive fifteen times in 0.6 second. The diagnosis code will be erased when the ETACS-ECU determines that its own communication data is sent consecutive 15 times in 0.6 second.	Malfunction of ETACS-ECU

Replace the ETACS-ECU.

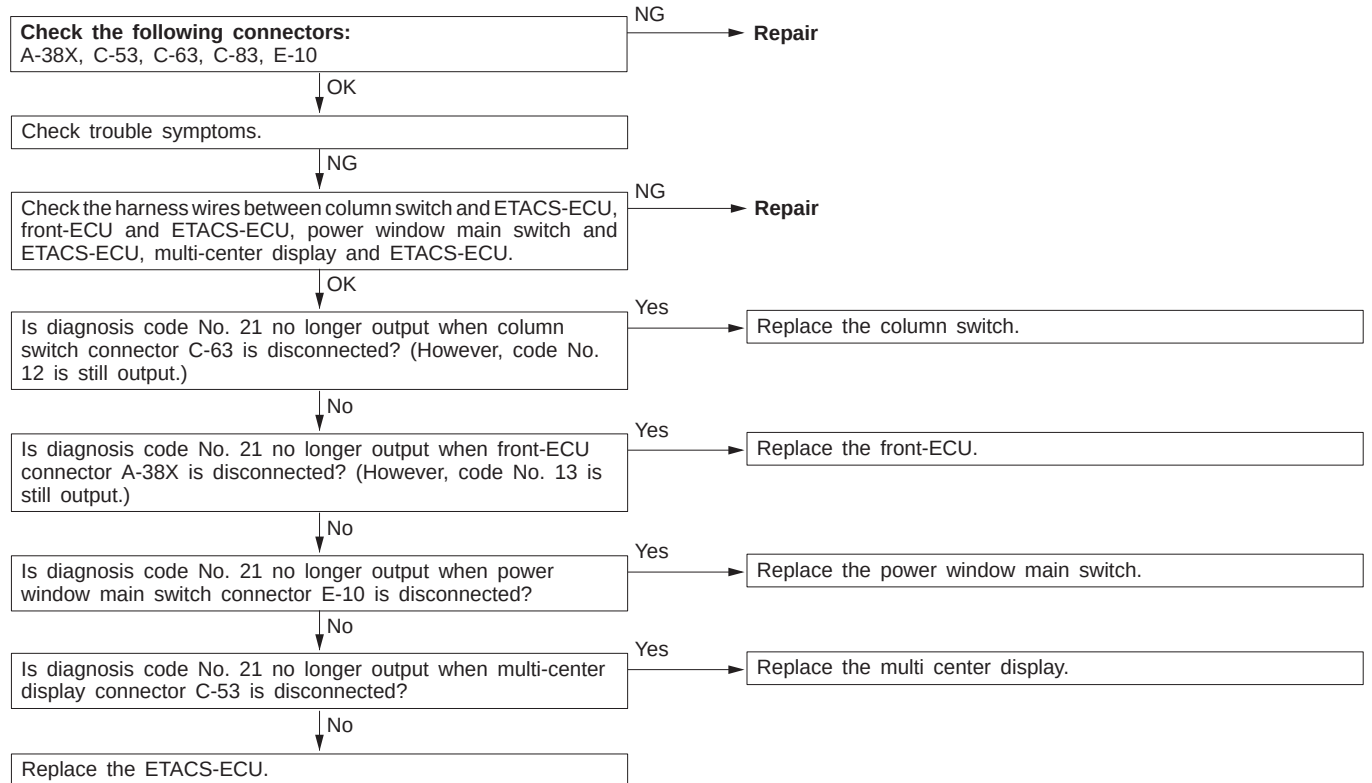
Code No.12 Failure concerning the column switch or improper connection with the ETACS-ECU	Probable cause
This diagnosis code is displayed when the column switch sends a signal regardless of the transmission request signal from the ETACS-ECU (three times or more in one second). The diagnosis code is erased 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.

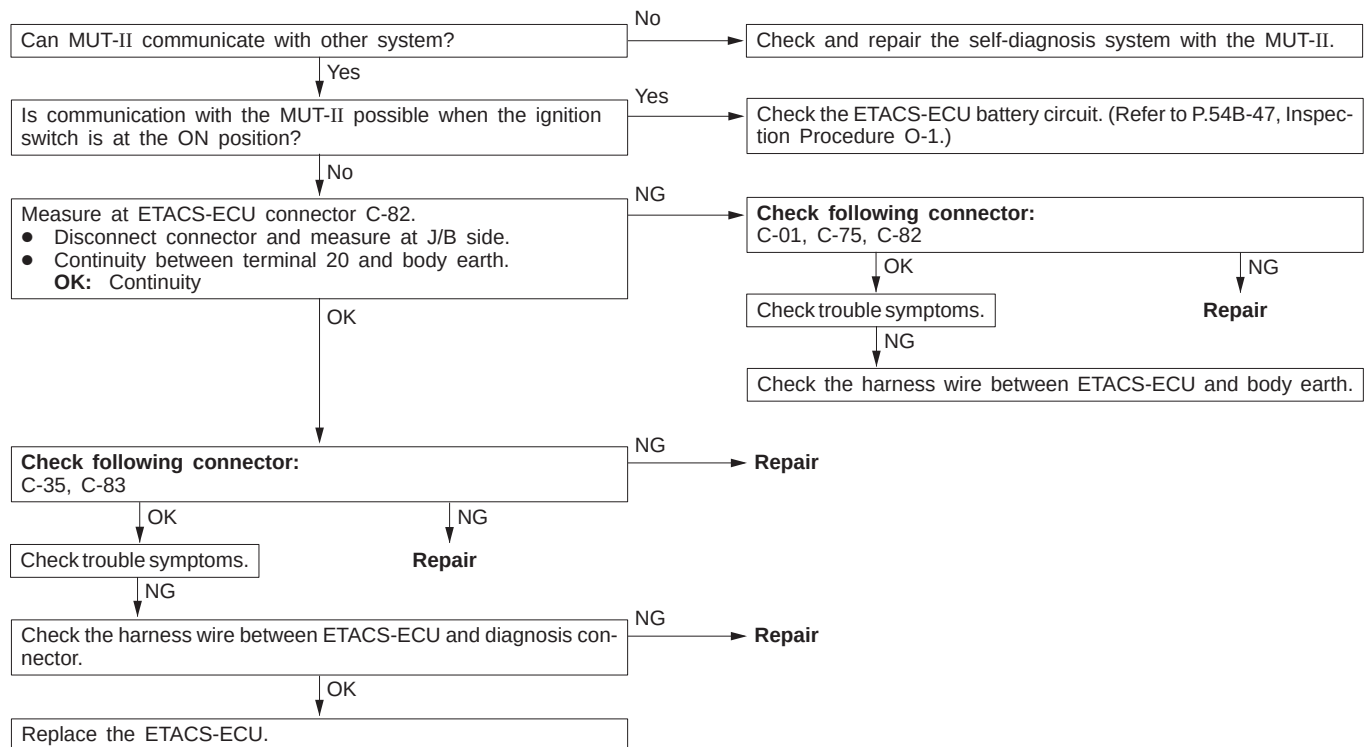
Trouble symptom		Inspection procedure	Reference page
Ignition switch (ACC) signal is not sent to the ETACS-ECU.		N-1	54B-37
Ignition switch (IG1) signal is not sent to the ETACS-ECU.		N-2	54B-38
Key reminder switch signal is not sent to the ETACS-ECU.		N-3	54B-38
Hazard warning lamp switch signal is 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

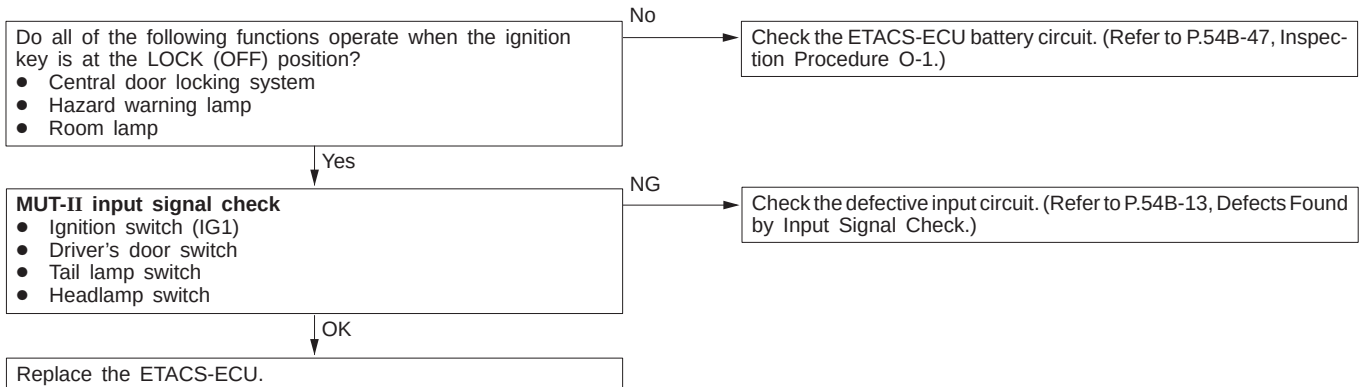
Inspection Procedure A-1

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



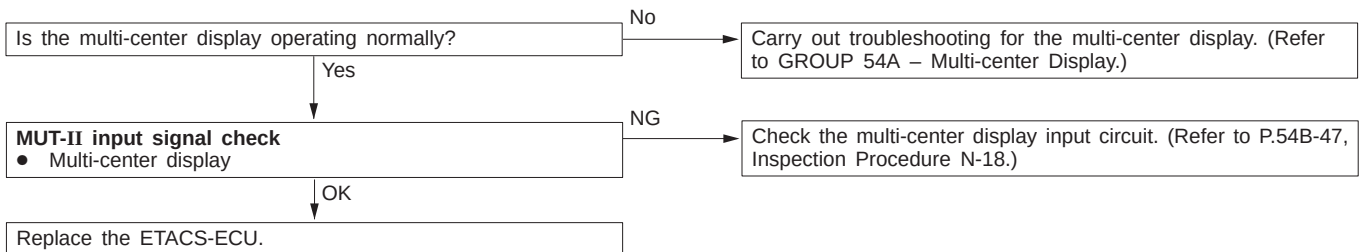
Inspection Procedure B-1

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



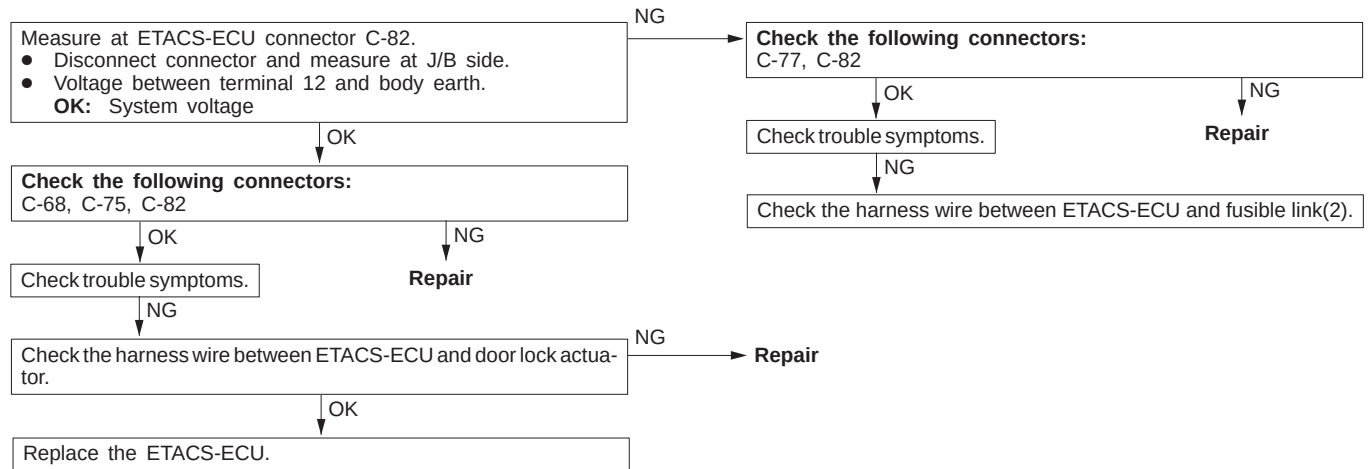
Inspection Procedure B-2

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



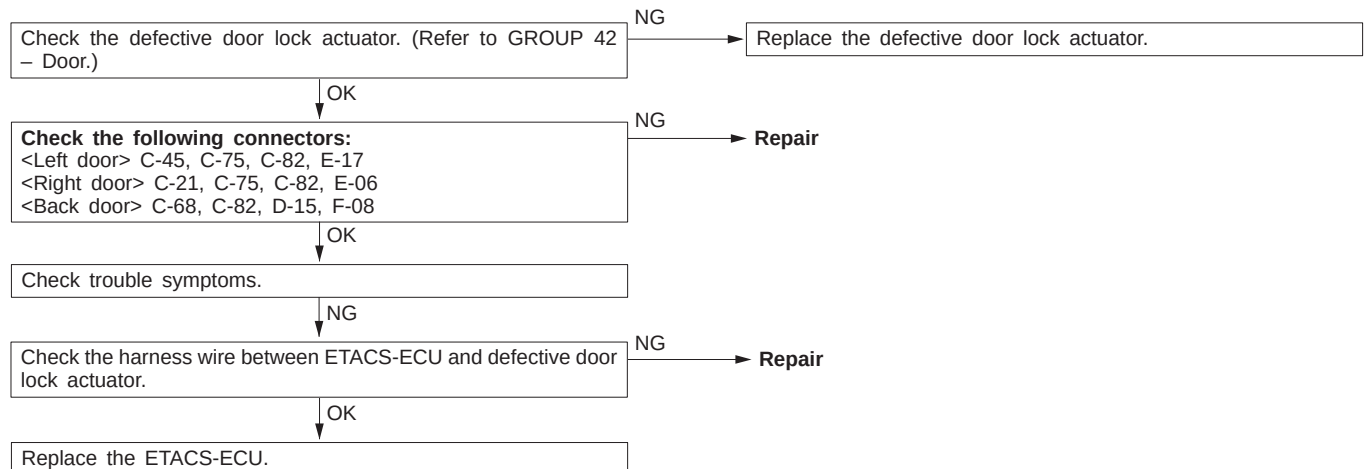
Inspection Procedure C-1

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



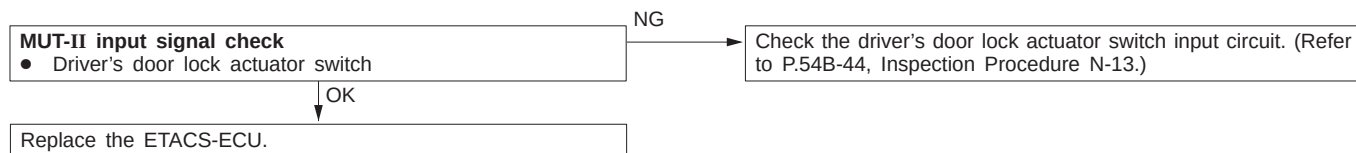
Inspection Procedure C-2

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



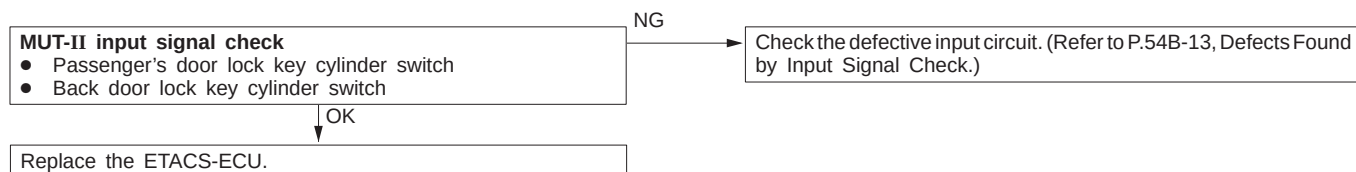
Inspection Procedure C-3

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



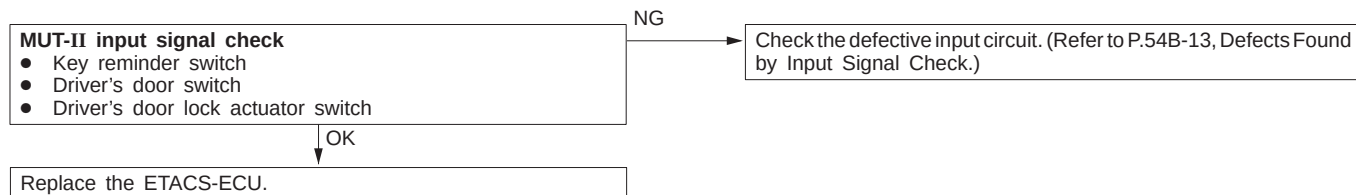
Inspection Procedure C-4

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



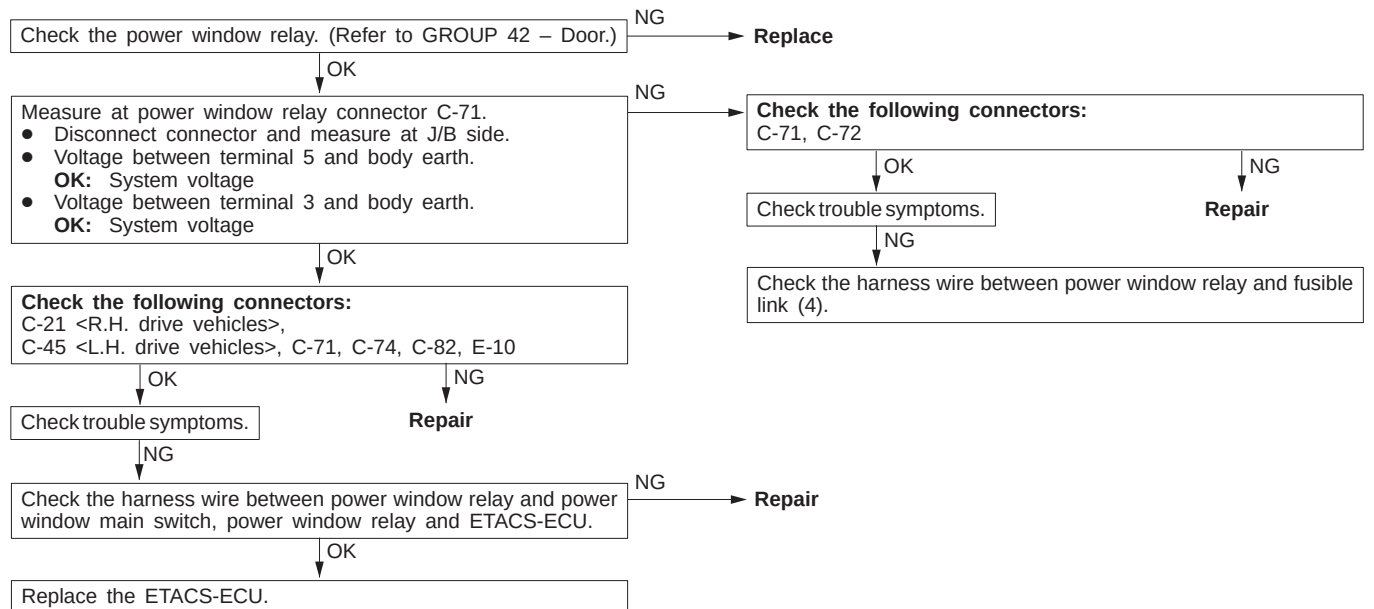
Inspection Procedure C-5

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



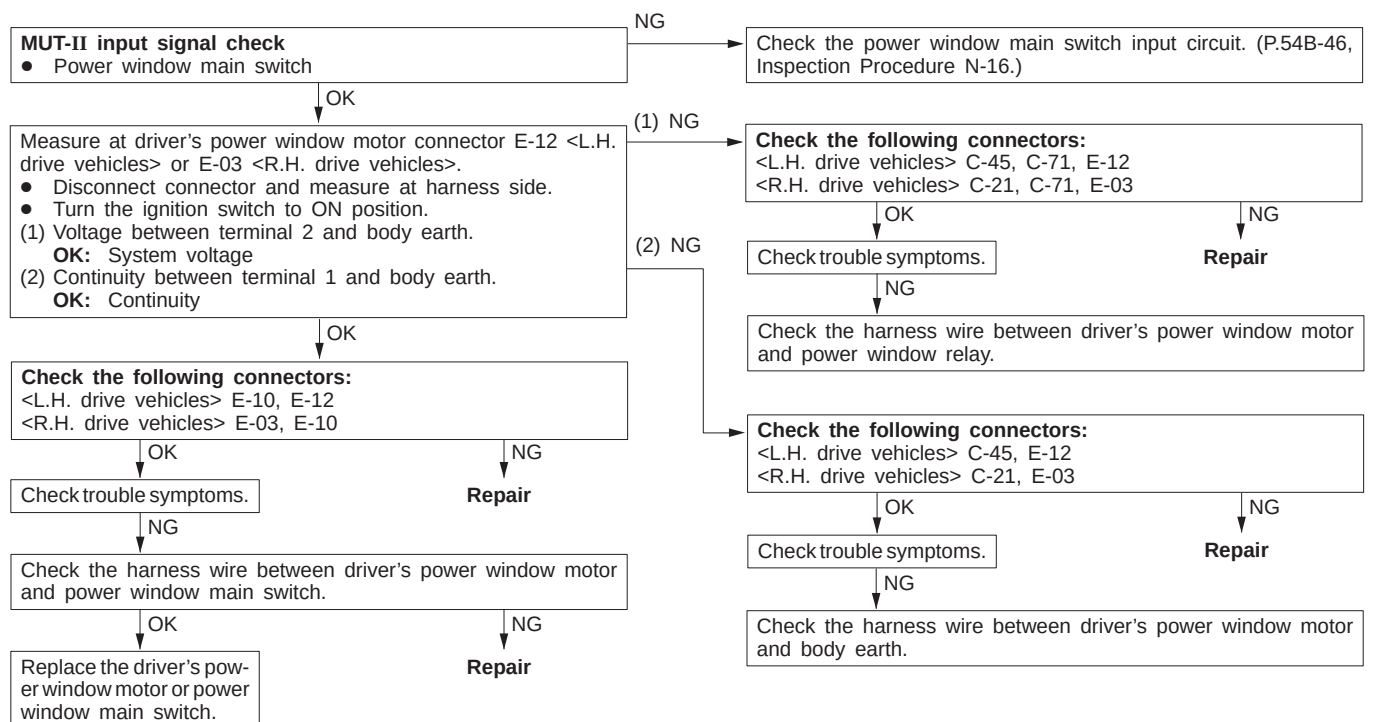
Inspection Procedure D-1

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



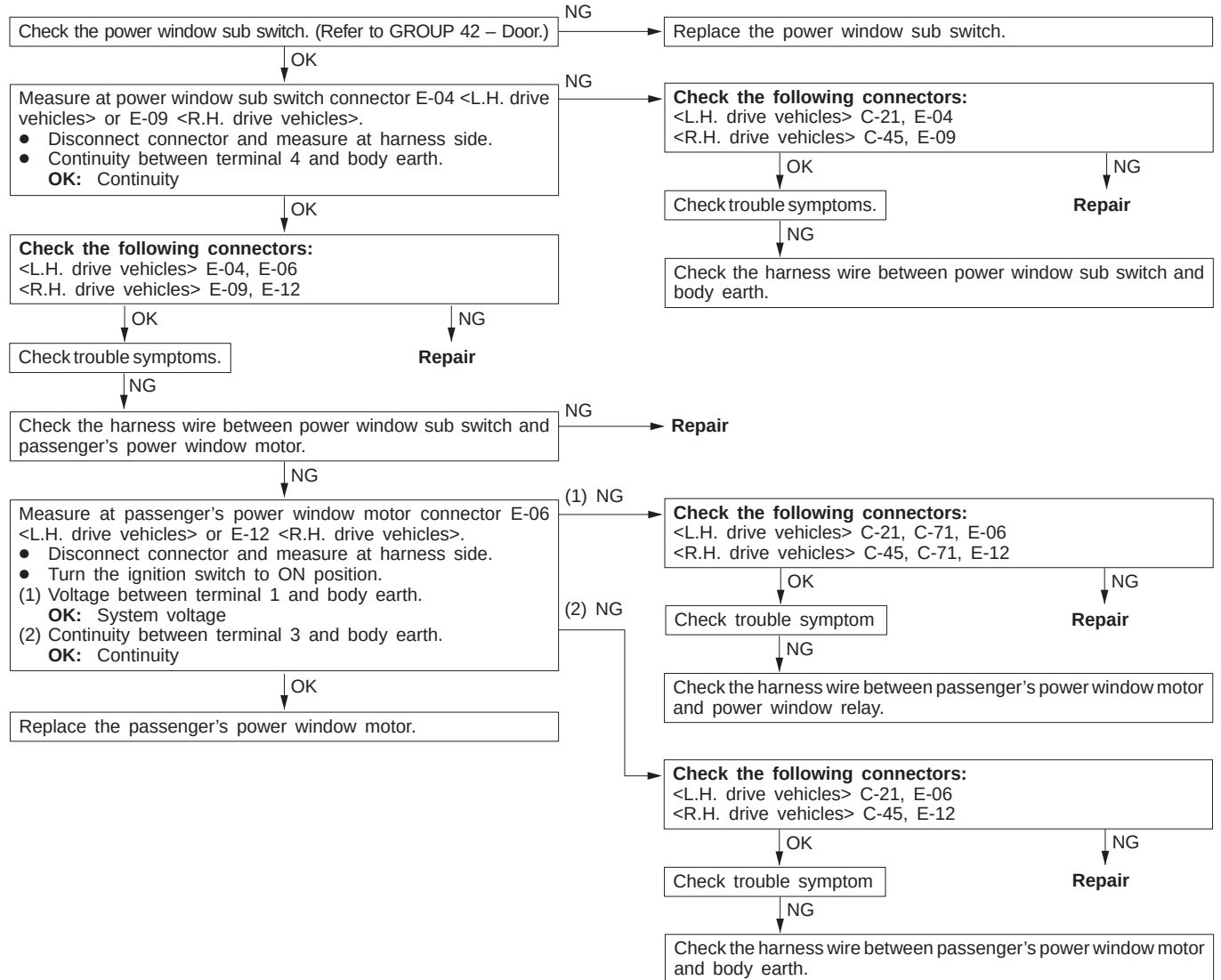
Inspection Procedure D-2

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



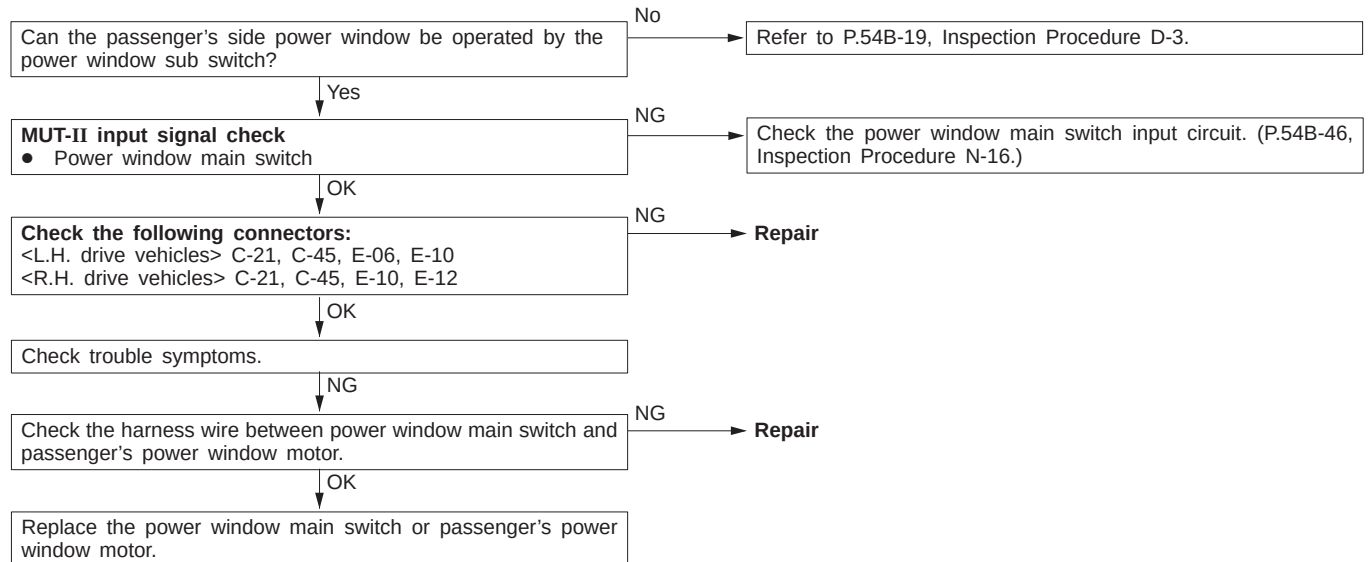
Inspection Procedure D-3

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



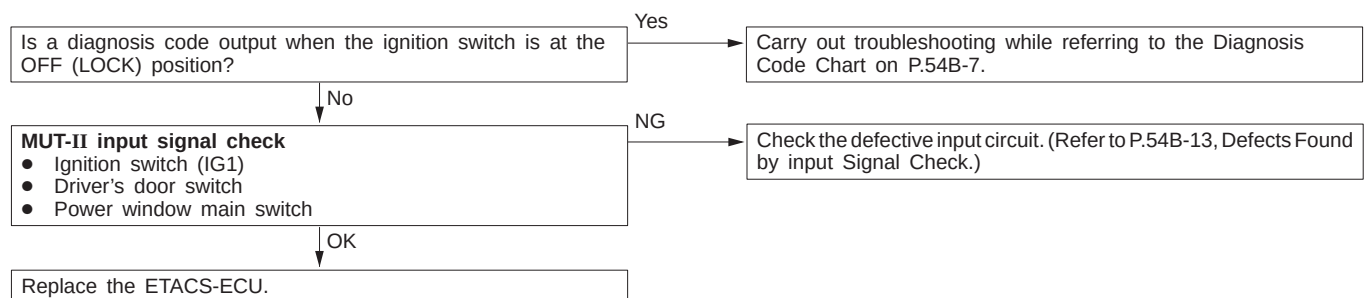
Inspection Procedure D-4

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



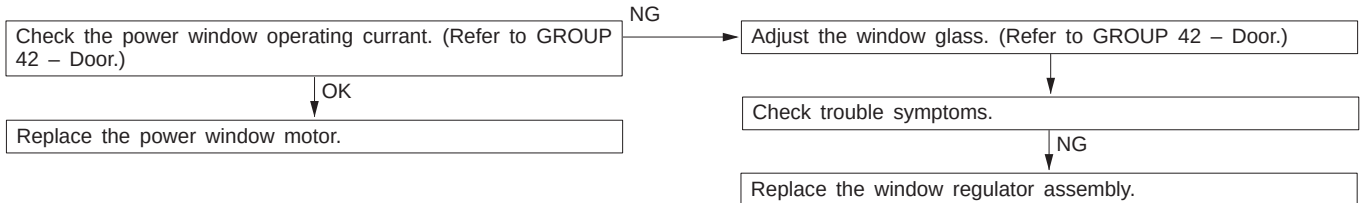
Inspection Procedure D-5

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



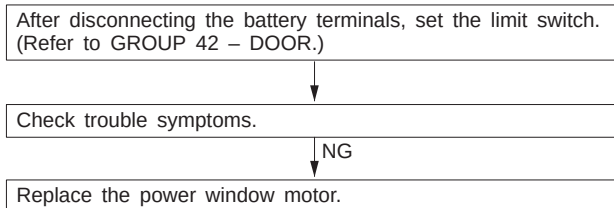
Inspection Procedure D-7

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.

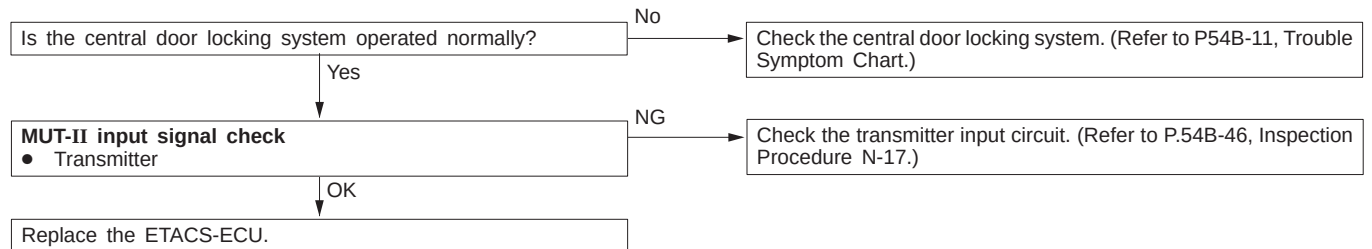
Inspection Procedure D-8

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



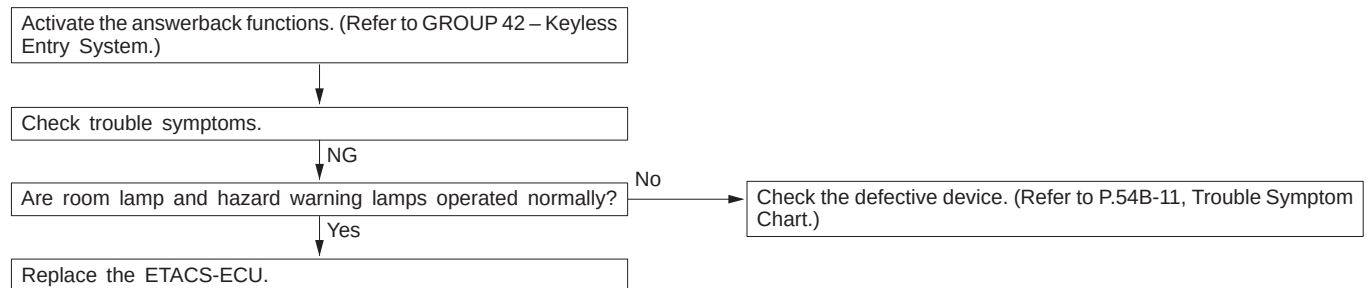
Inspection Procedure E-1

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



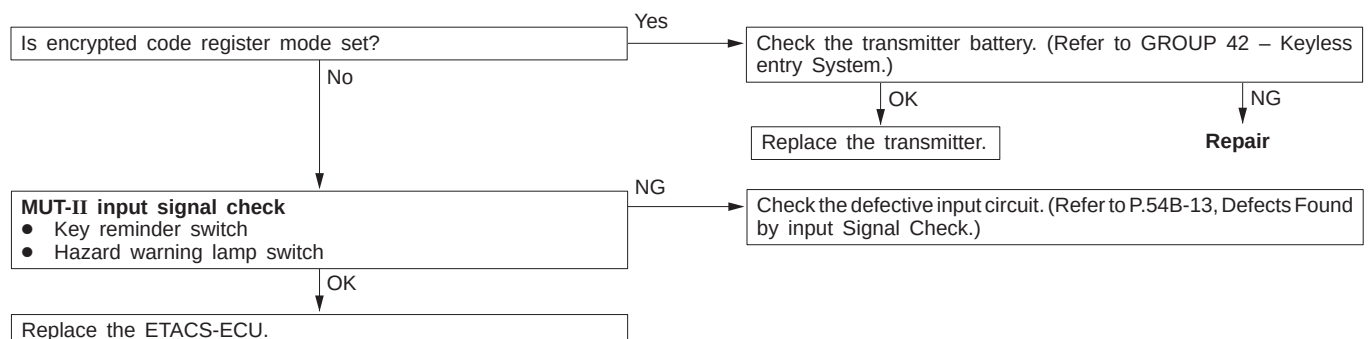
Inspection Procedure E-2

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



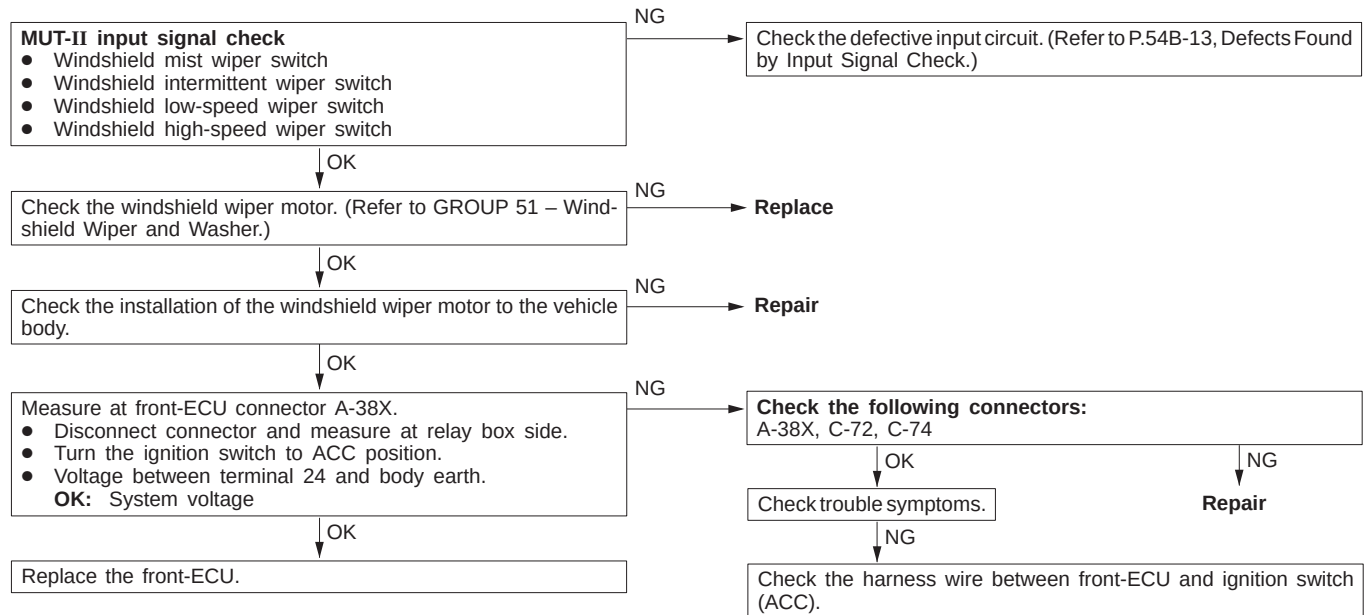
Inspection Procedure E-3

Keyless entry system: The encrypted code cannot be registered.	Probable cause
The ETACS-ECU activates 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



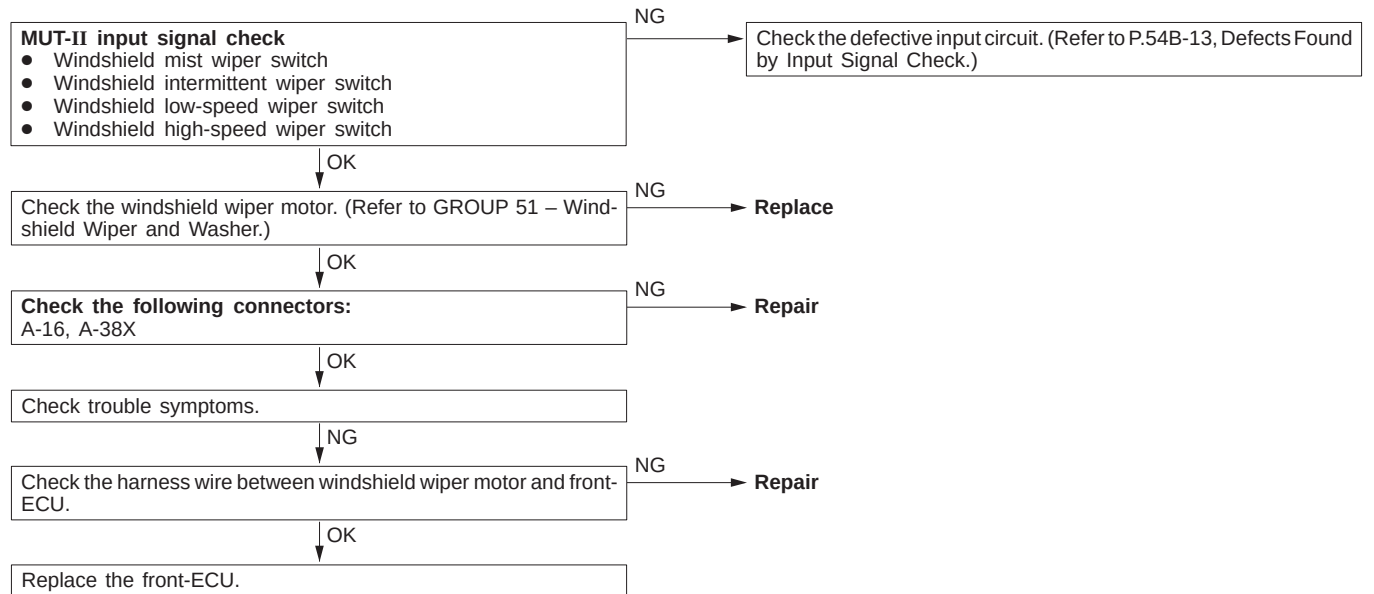
Inspection Procedure F-1

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



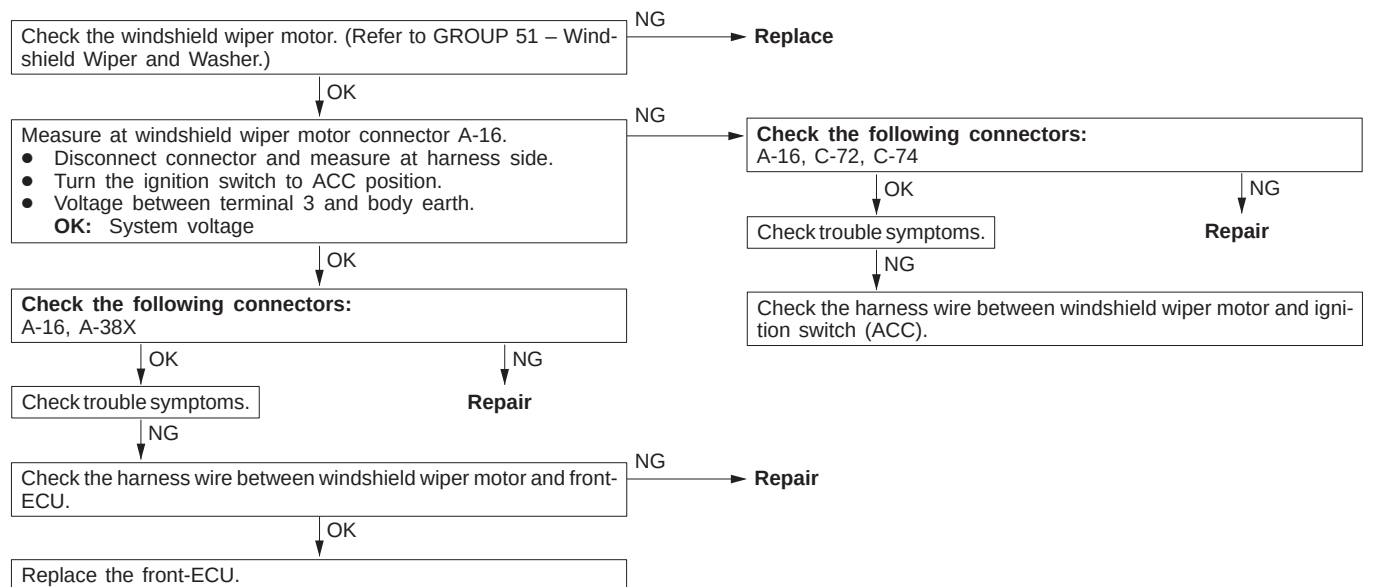
Inspection Procedure F-2

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



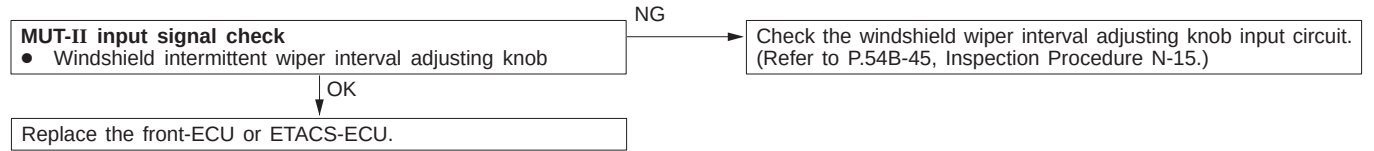
Inspection Procedure F-3

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



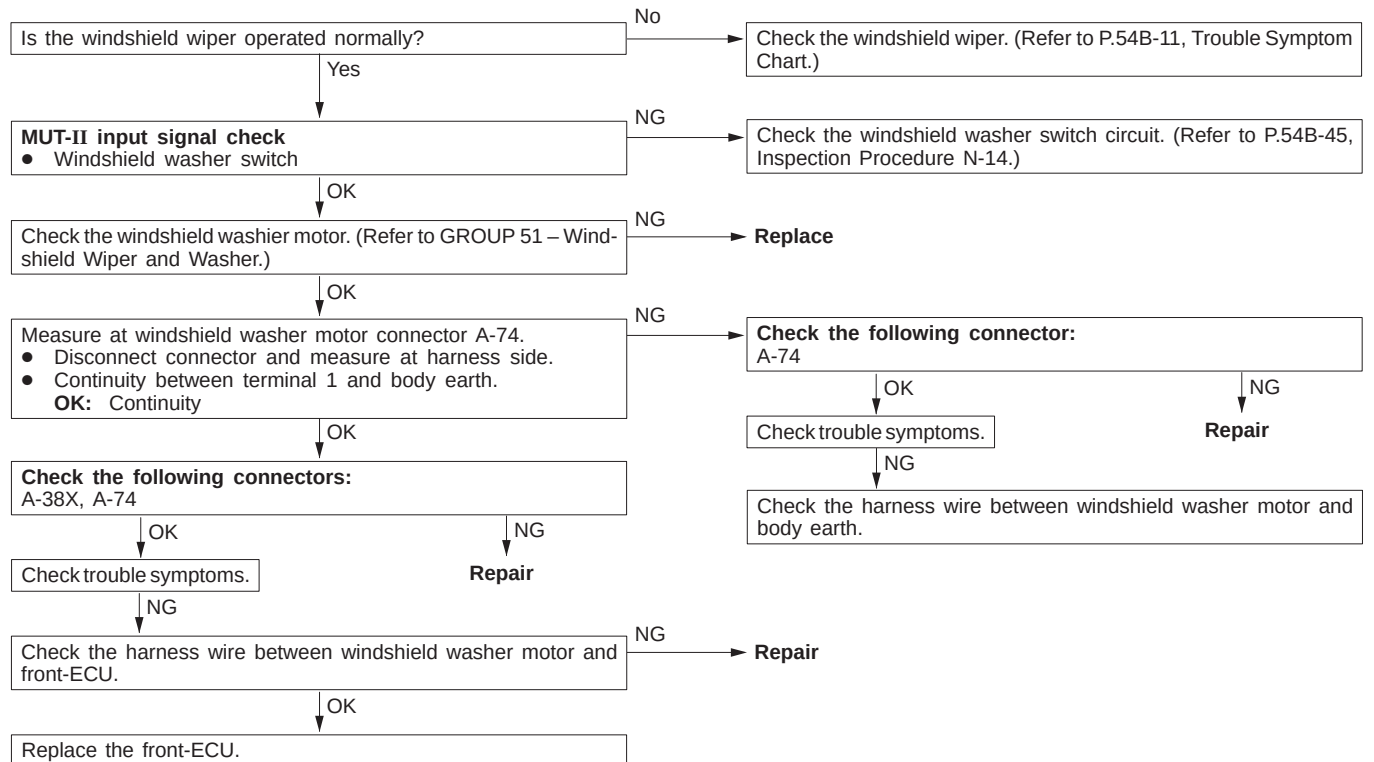
Inspection Procedure F-4

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



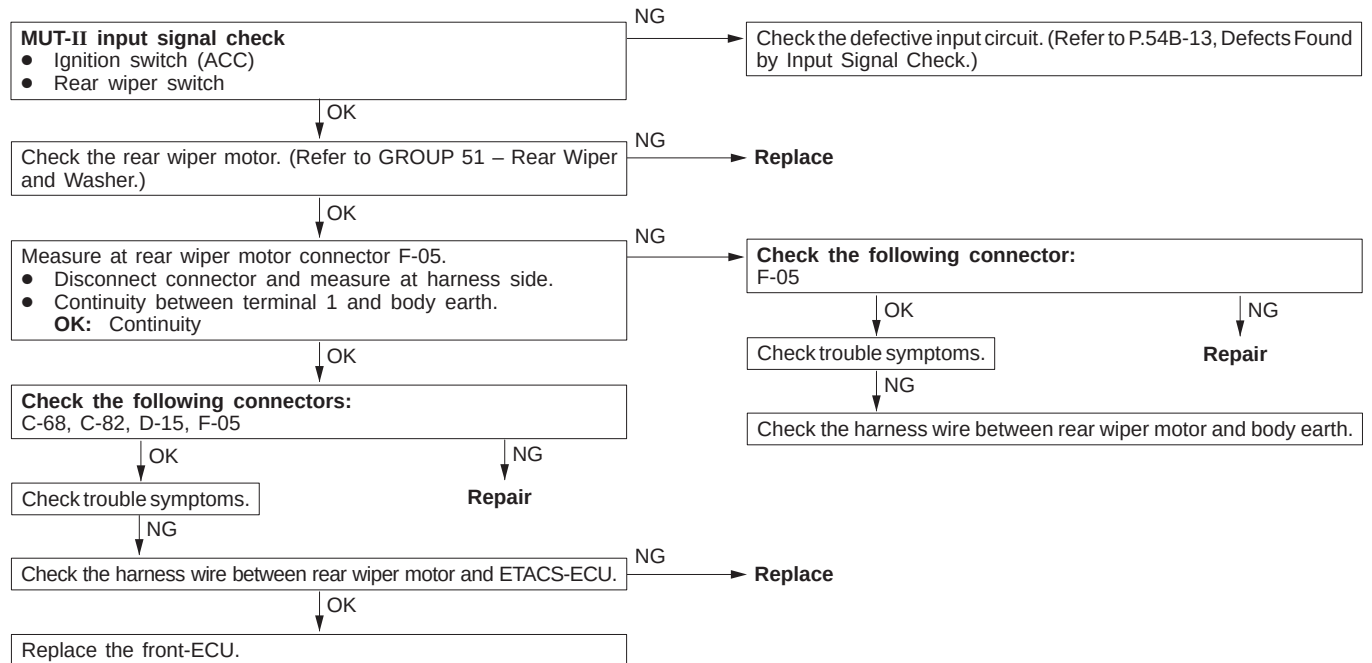
Inspection Procedure F-5

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



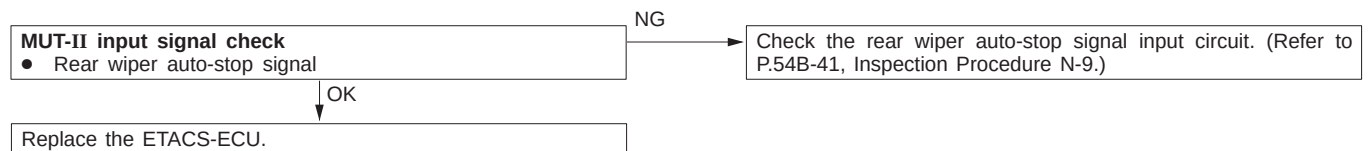
Inspection Procedure G-1

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



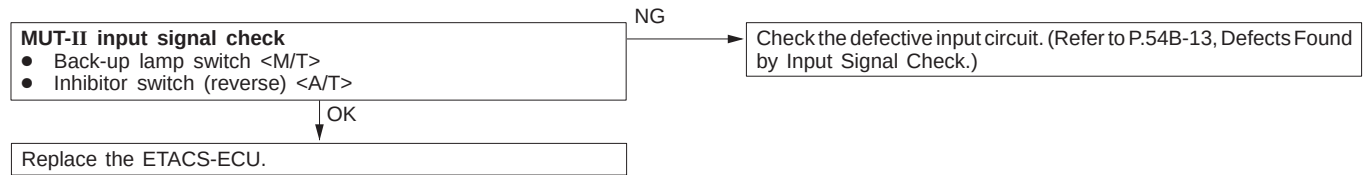
Inspection Procedure G-2

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



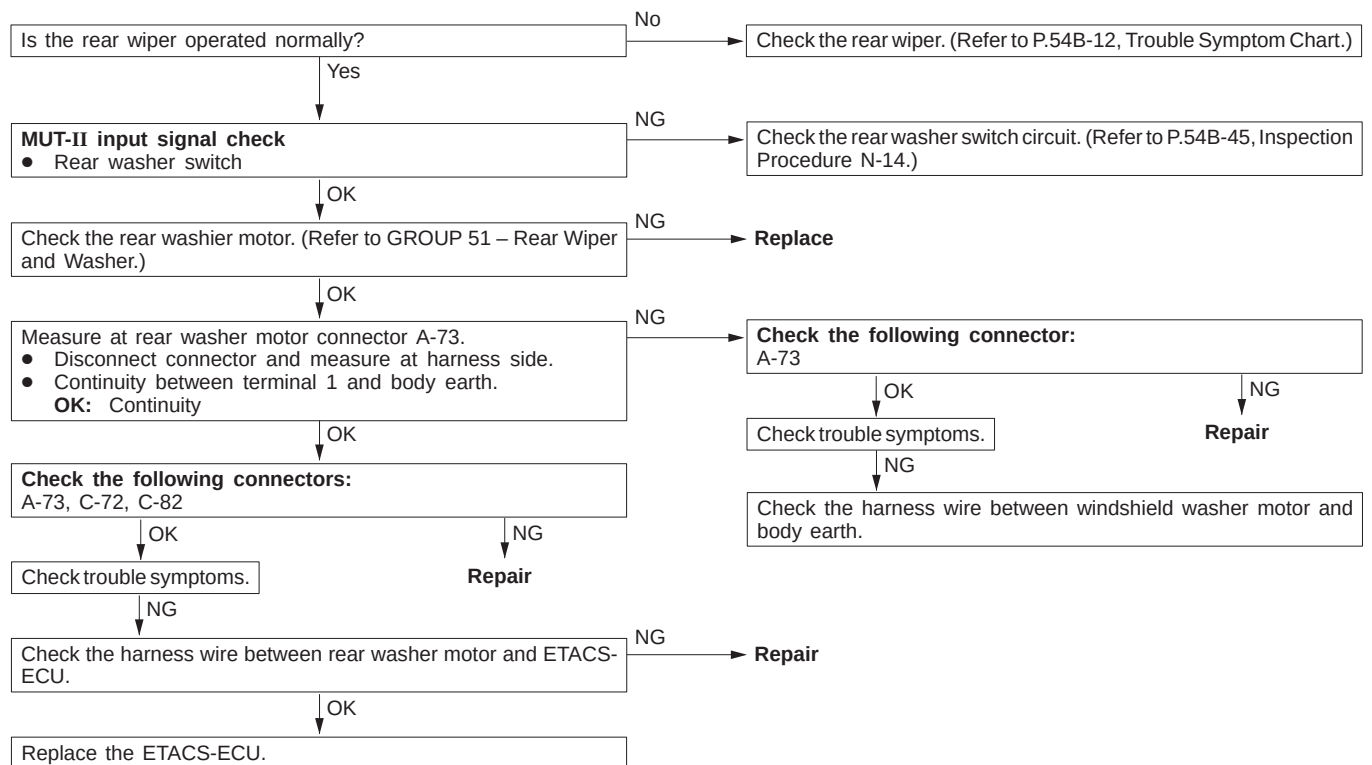
Inspection Procedure G-3

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



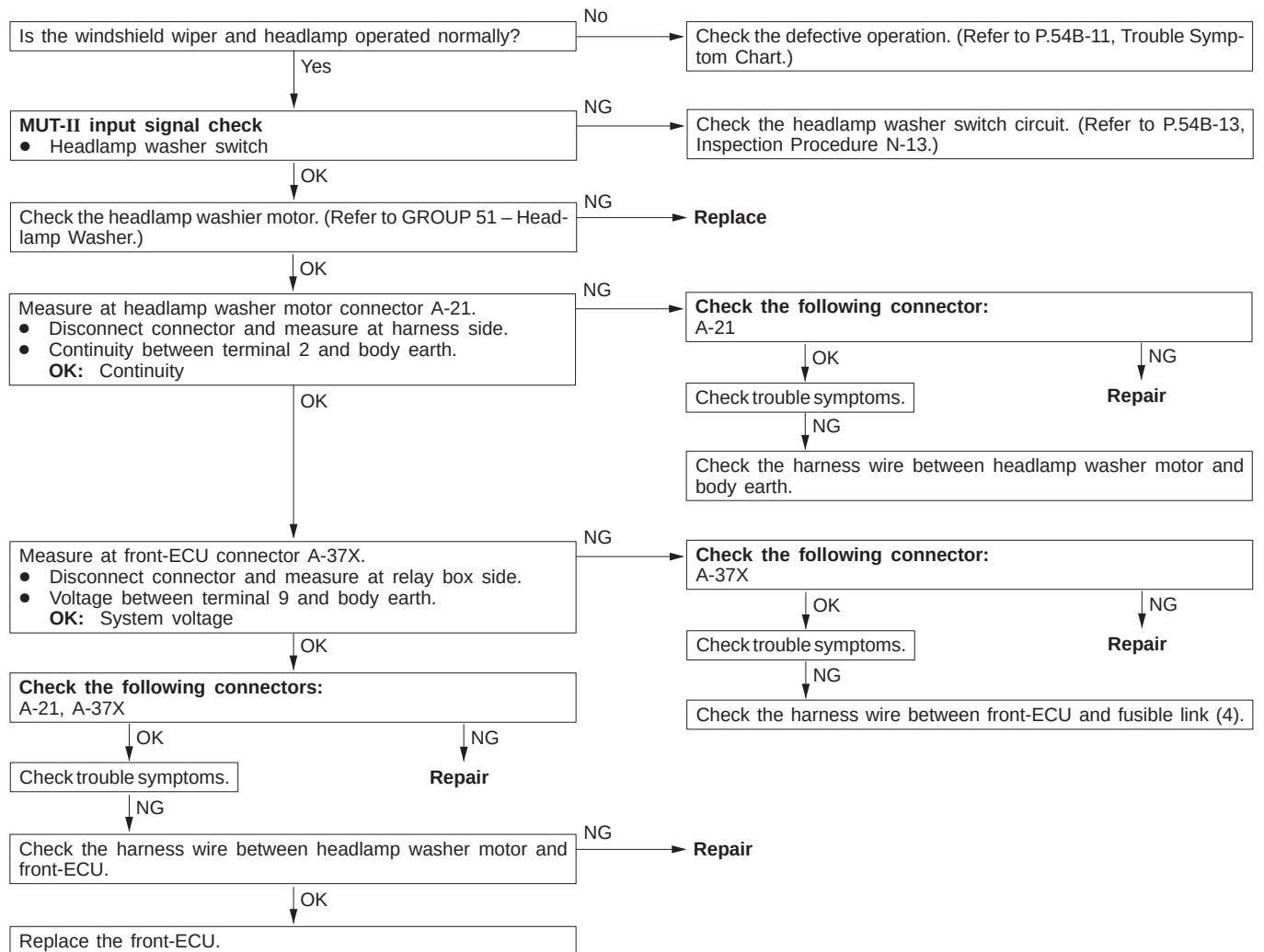
Inspection Procedure G-4

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

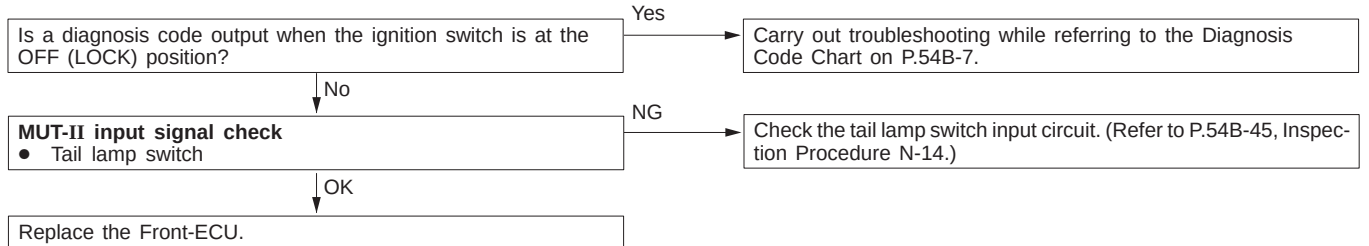


Inspection Procedure I-1

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.

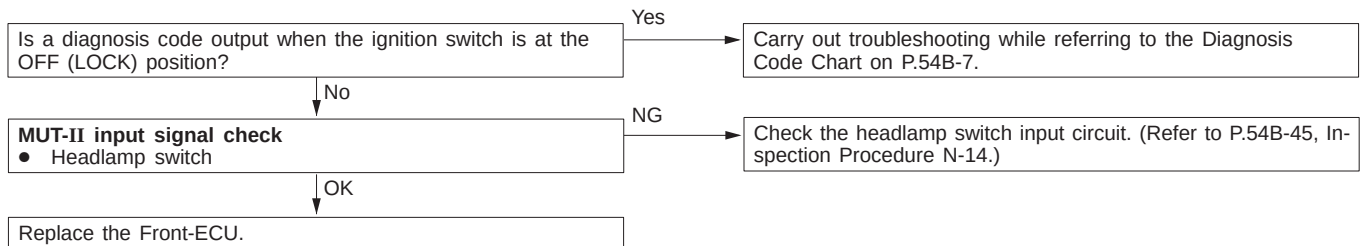


Inspection Procedure I-2

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.

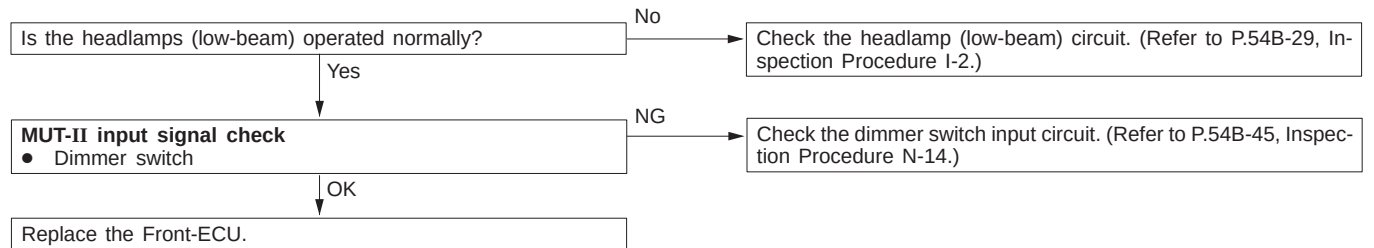


Inspection Procedure I-3

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

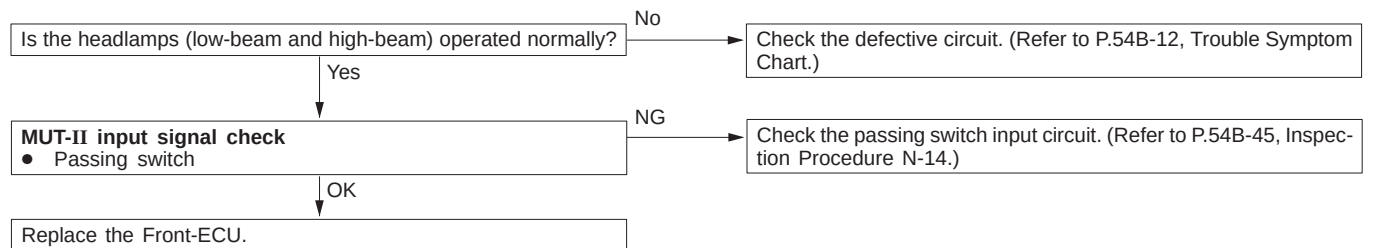
NOTE

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.



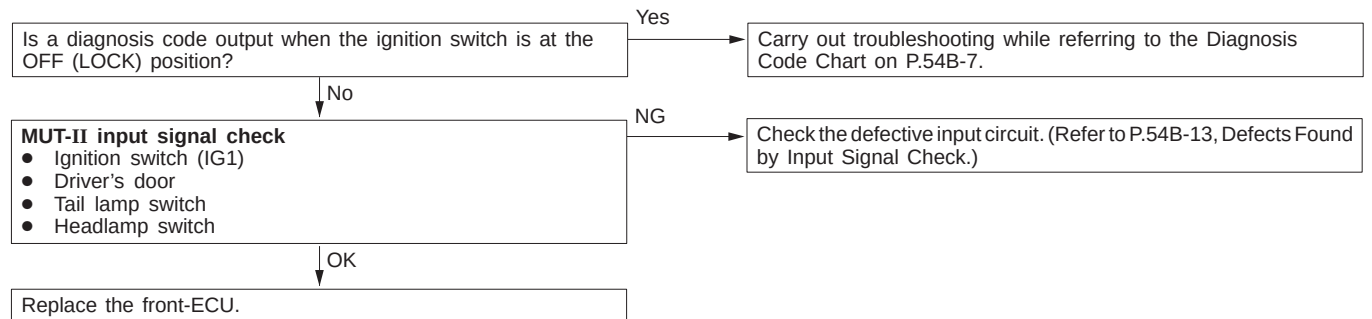
Inspection Procedure I-4

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



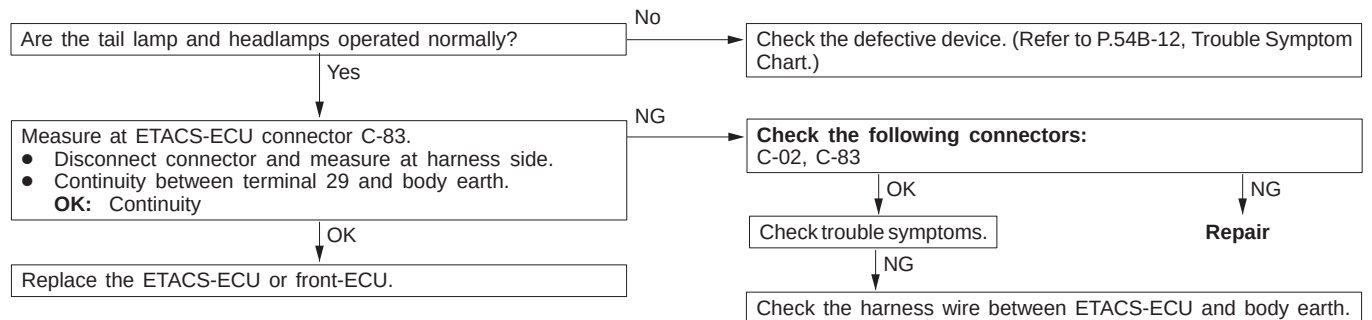
Inspection Procedure I-6

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

Replace the 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.

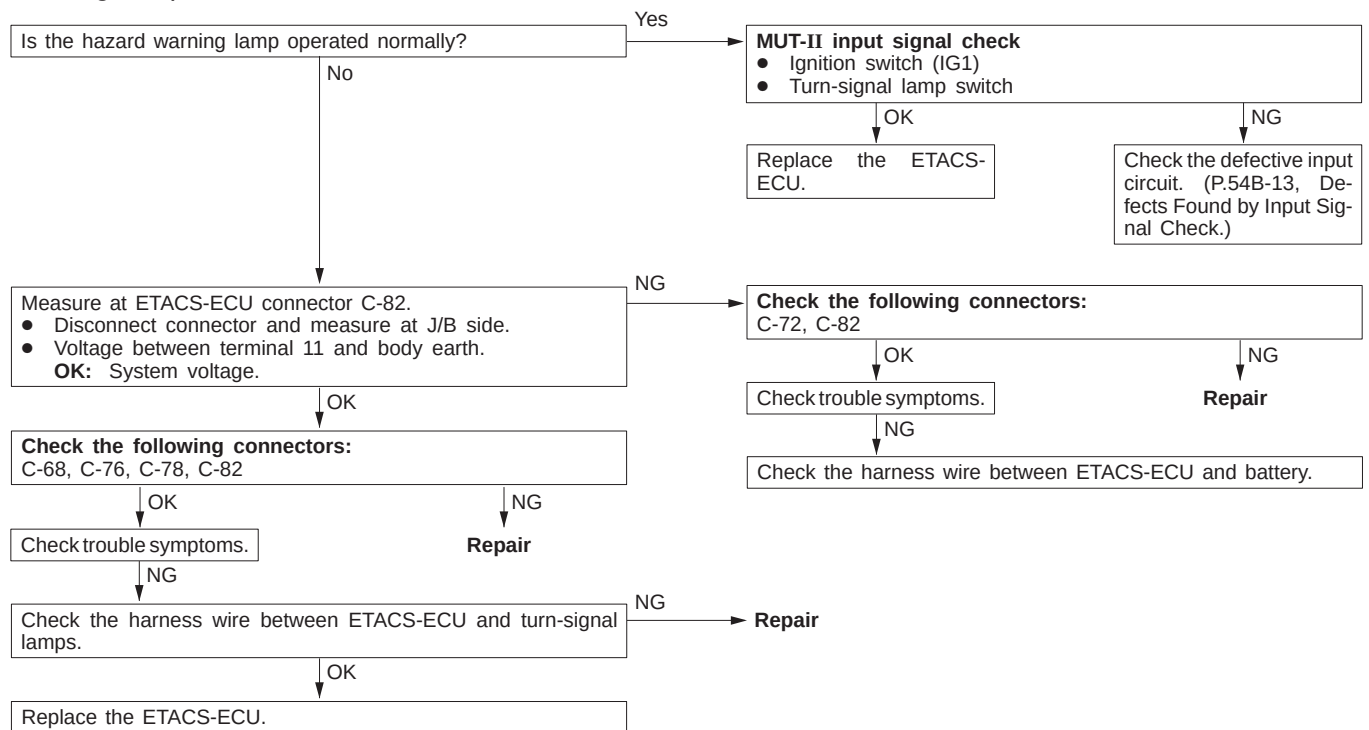


Inspection Procedure J-1

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.

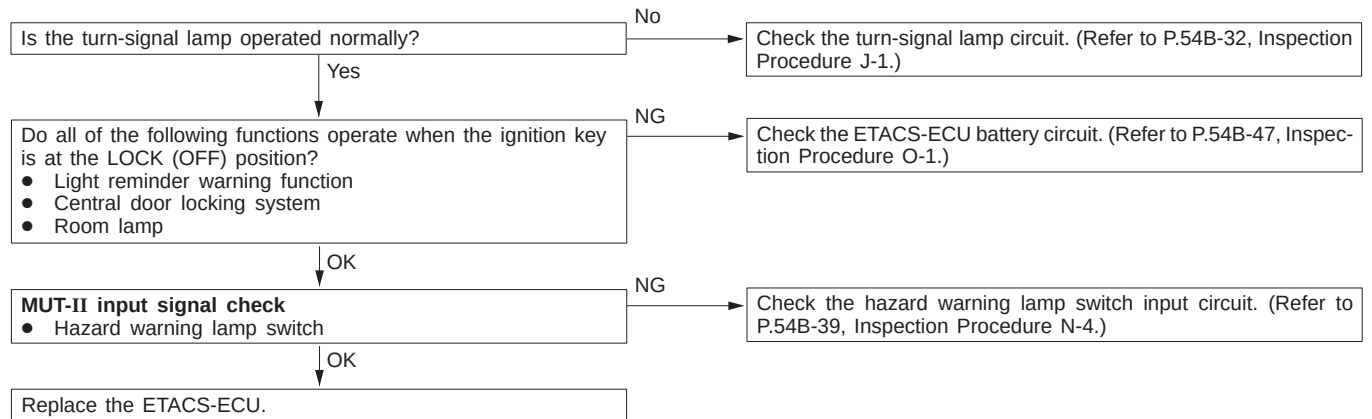


Inspection Procedure J-2

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.

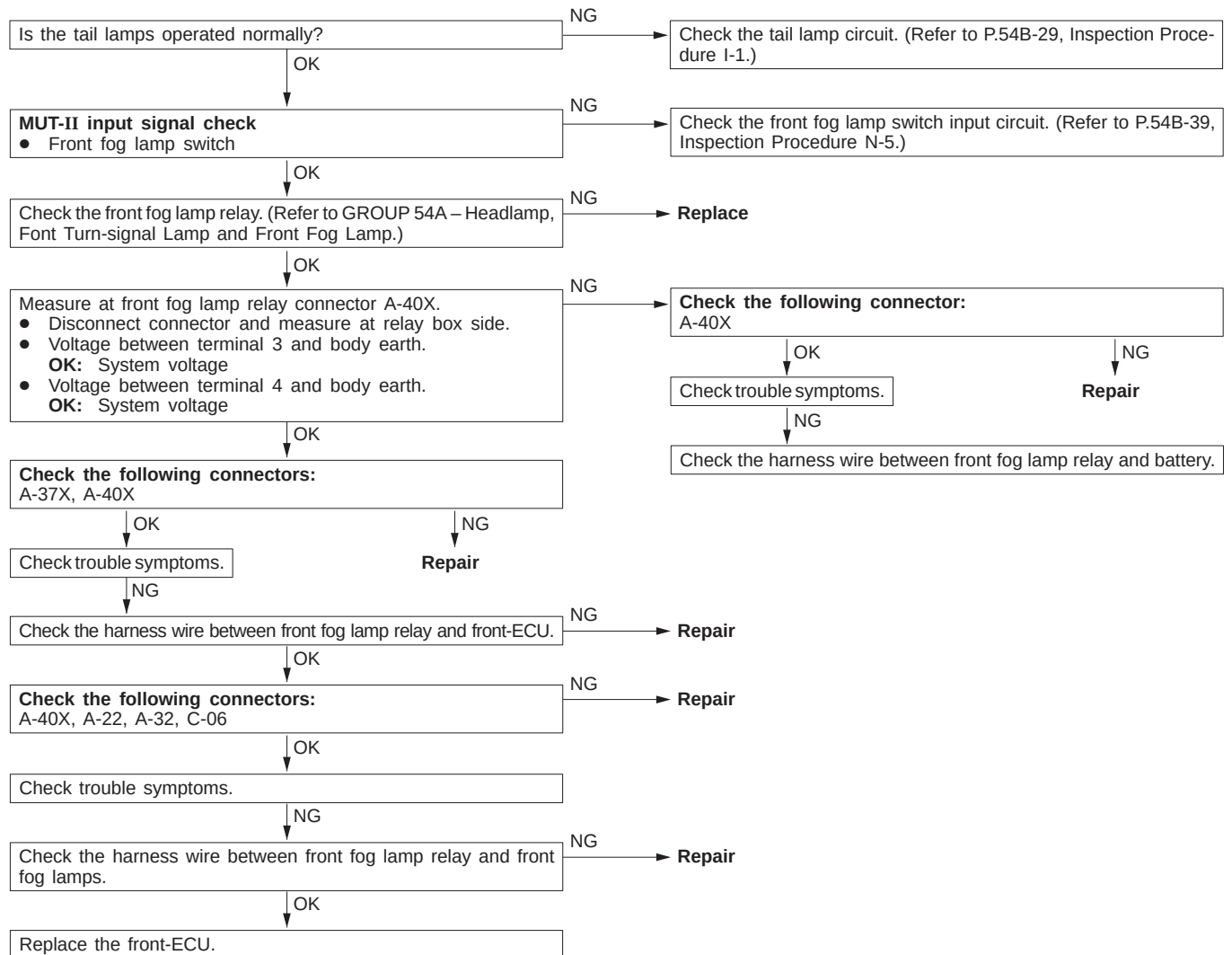


Inspection Procedure K-1

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.



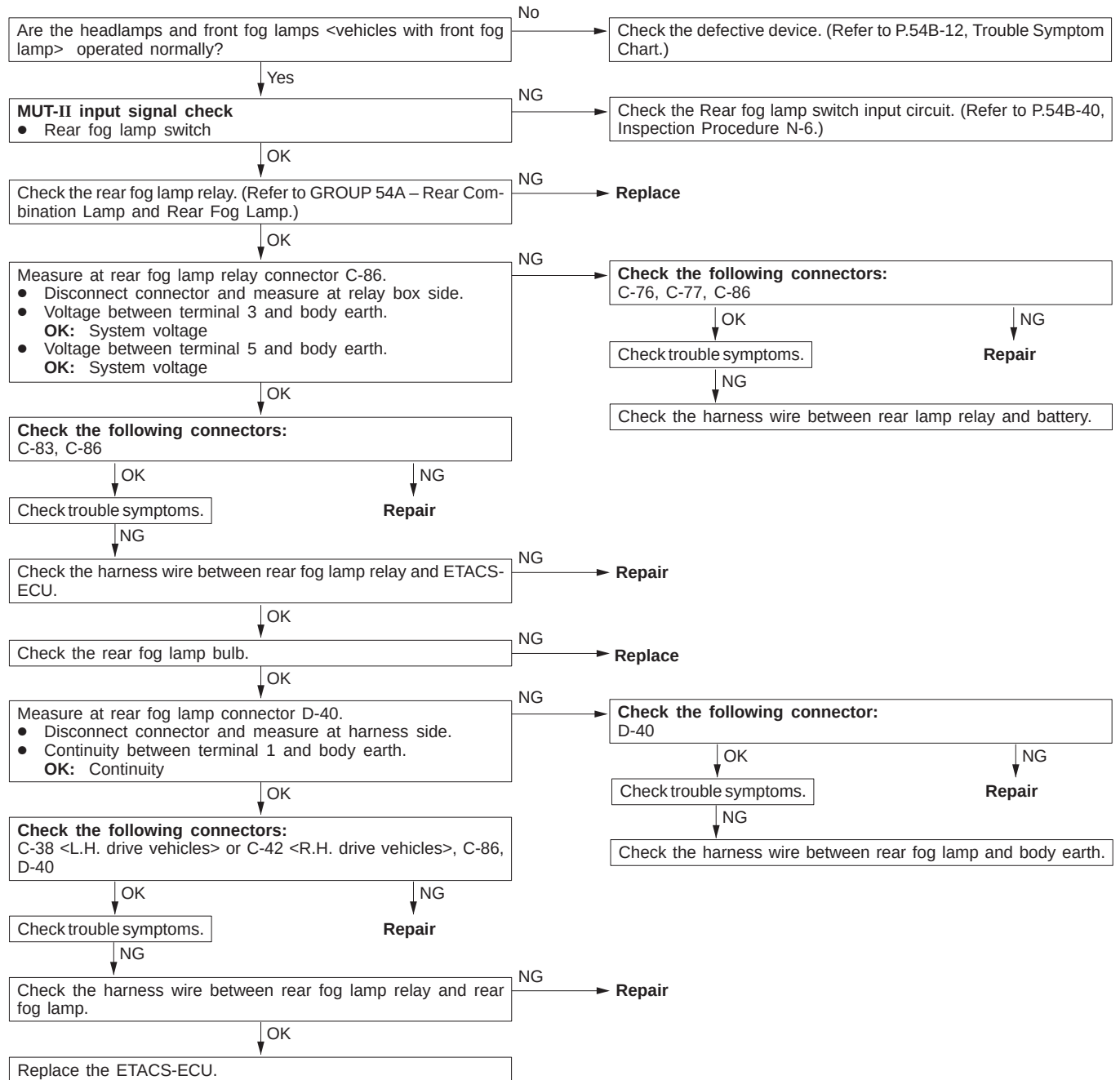
Inspection Procedure K-2

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.



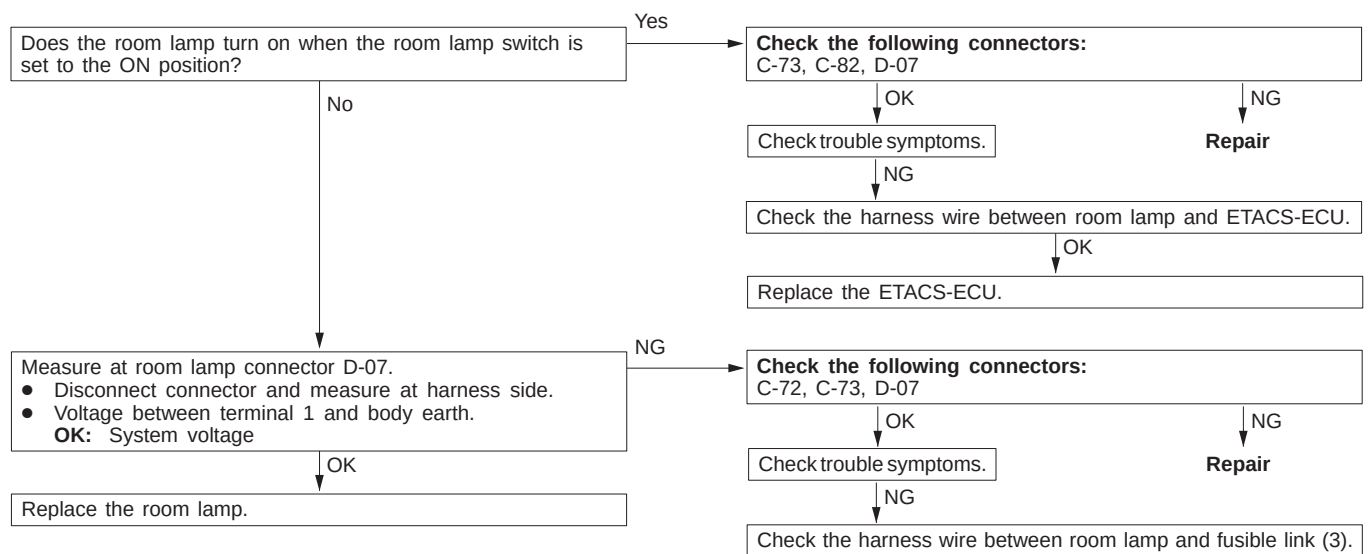
Inspection Procedure L-2

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.

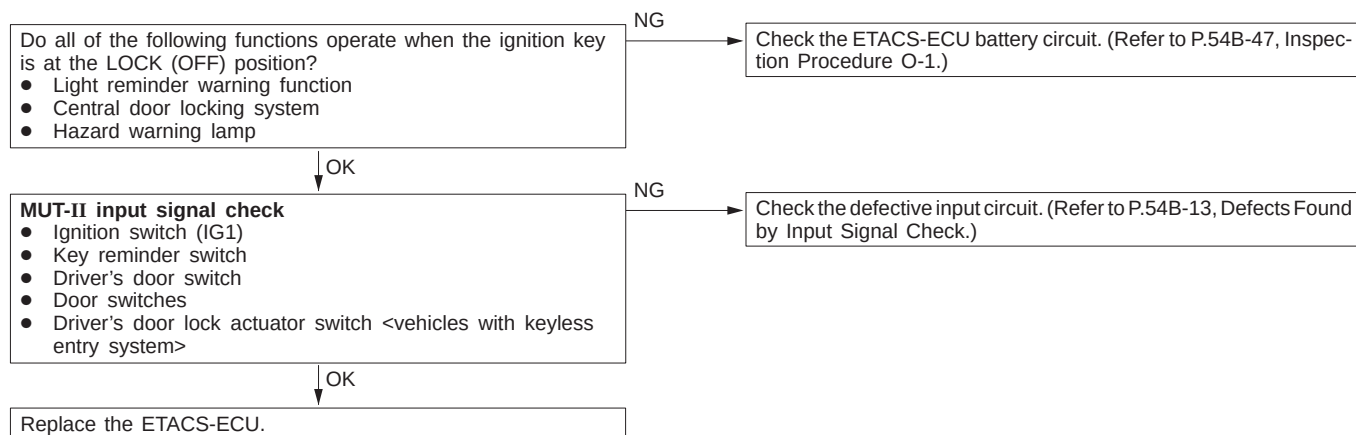
Inspection Procedure M-1

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



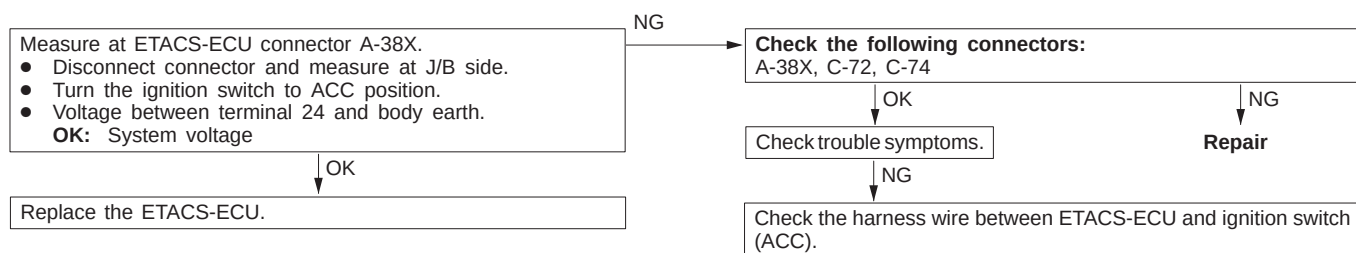
Inspection Procedure M-2

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



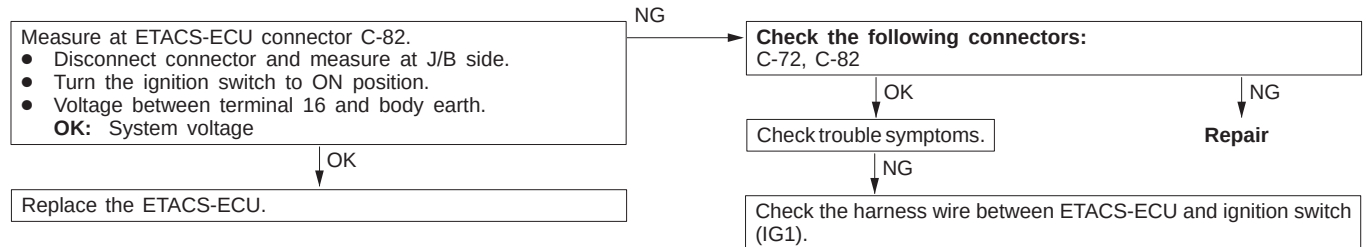
Inspection Procedure N-1

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



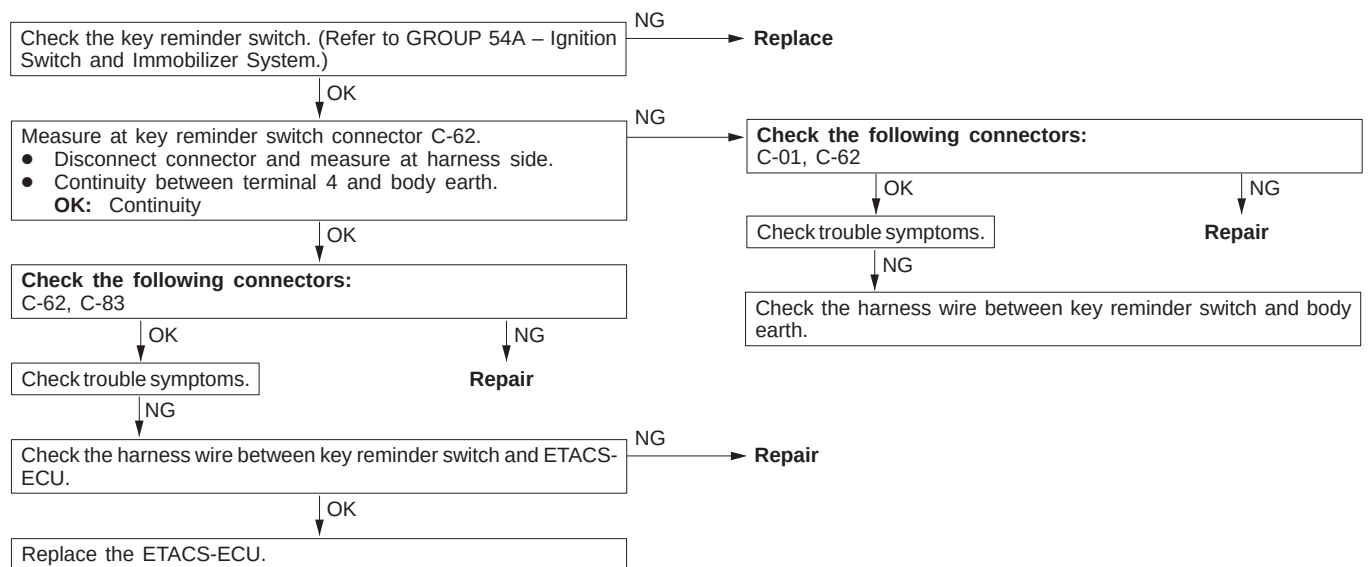
Inspection Procedure N-2

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



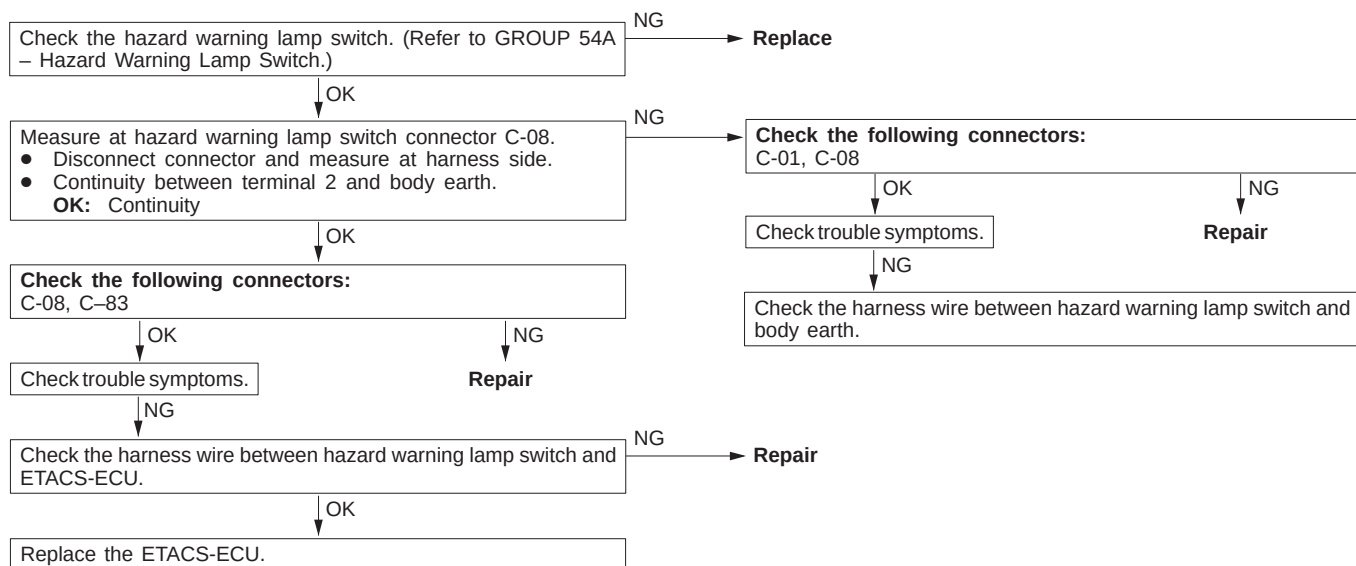
Inspection Procedure N-3

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



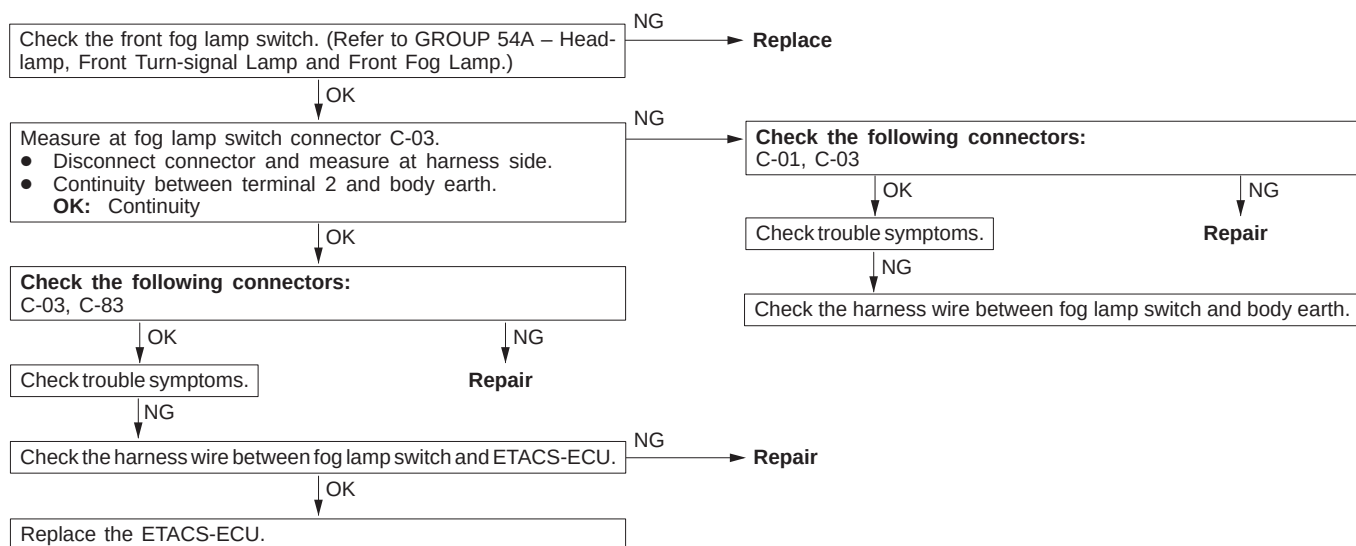
Inspection Procedure N-4

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



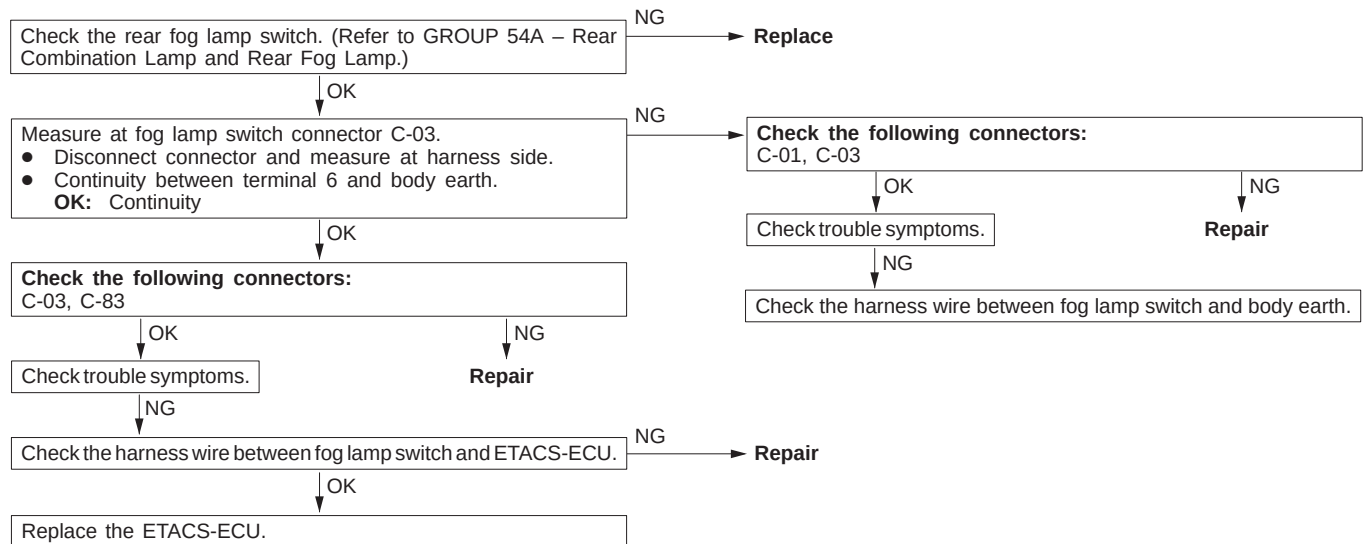
Inspection Procedure N-5

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



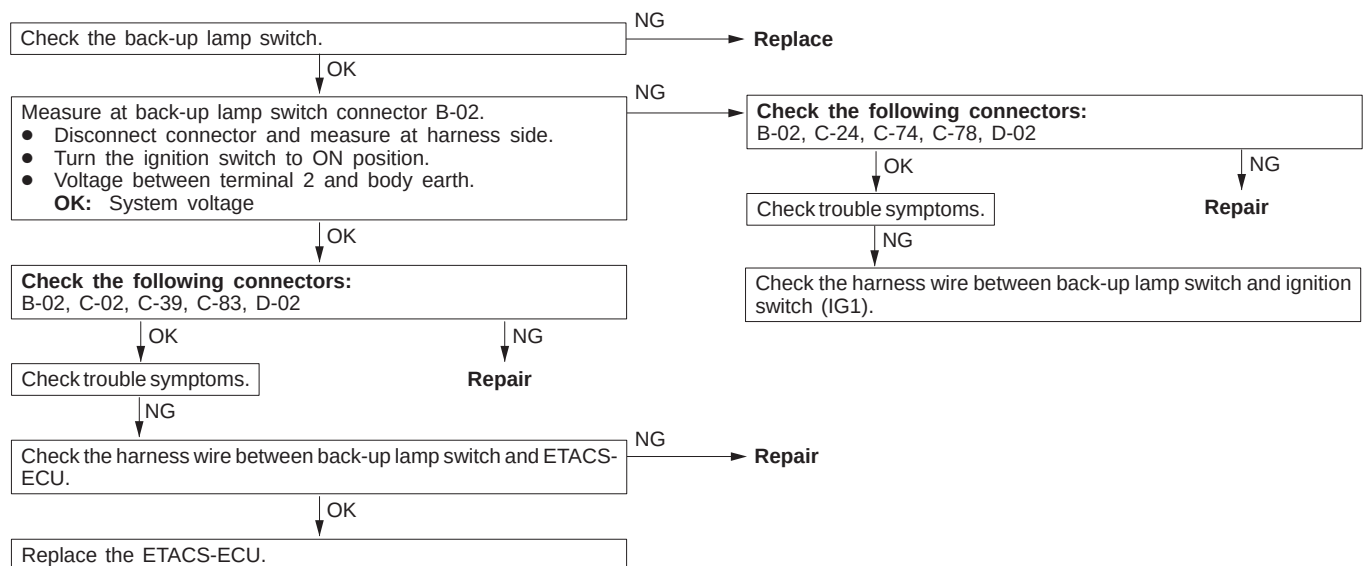
Inspection Procedure N-6

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



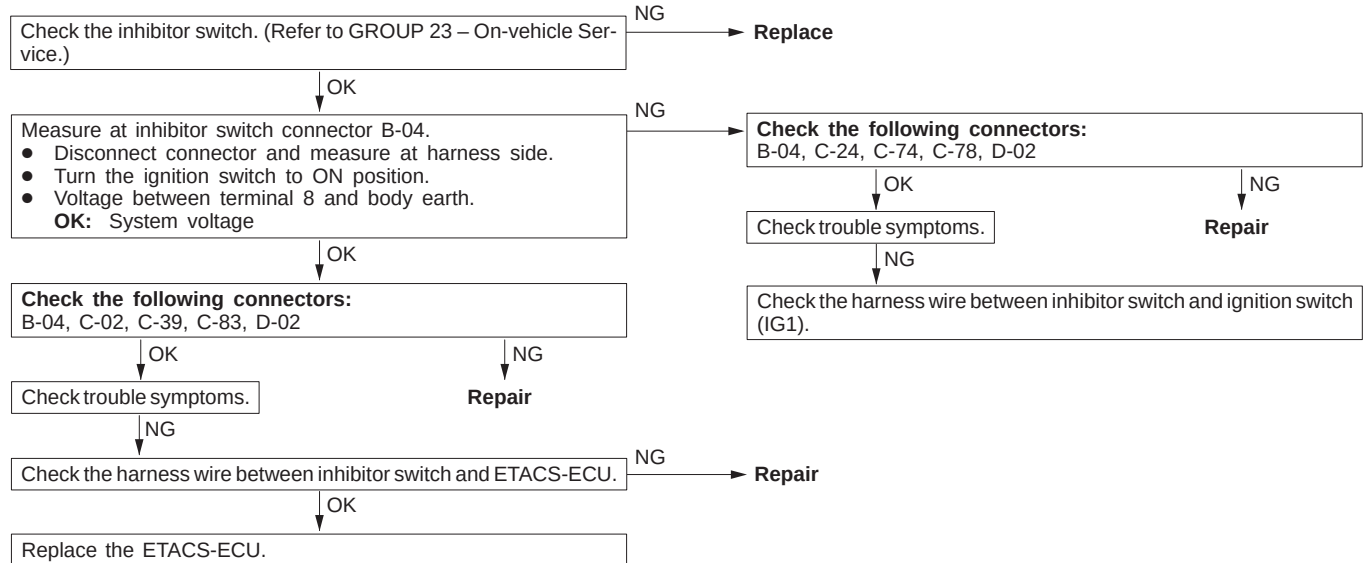
Inspection Procedure N-7

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



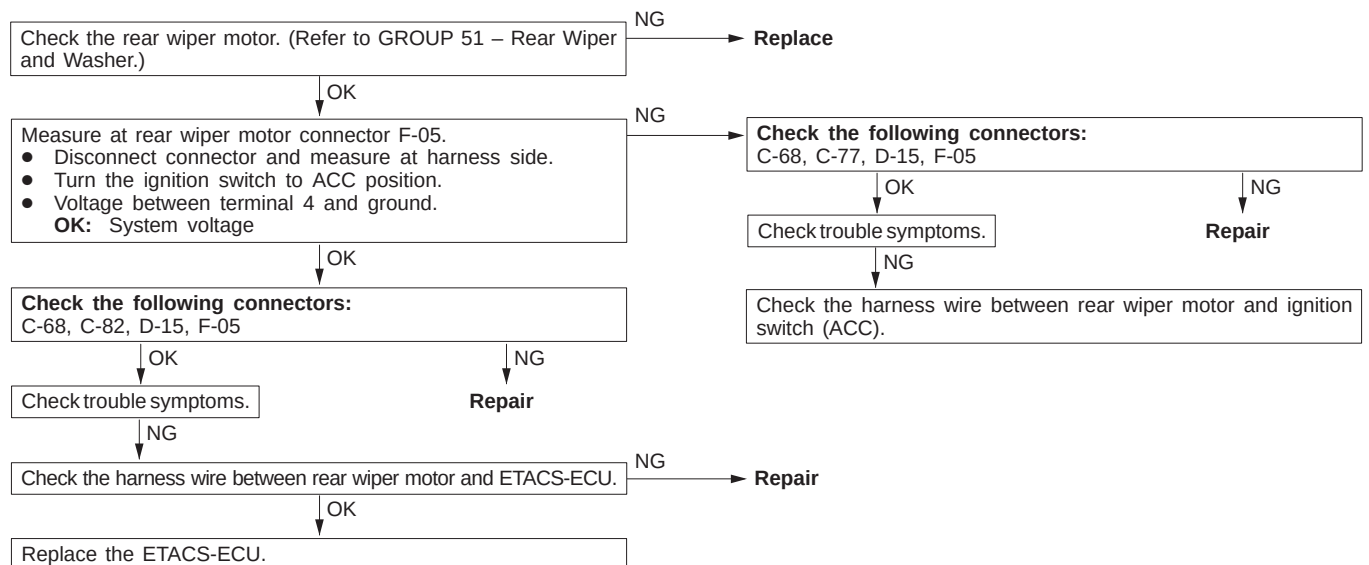
Inspection Procedure N-8

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



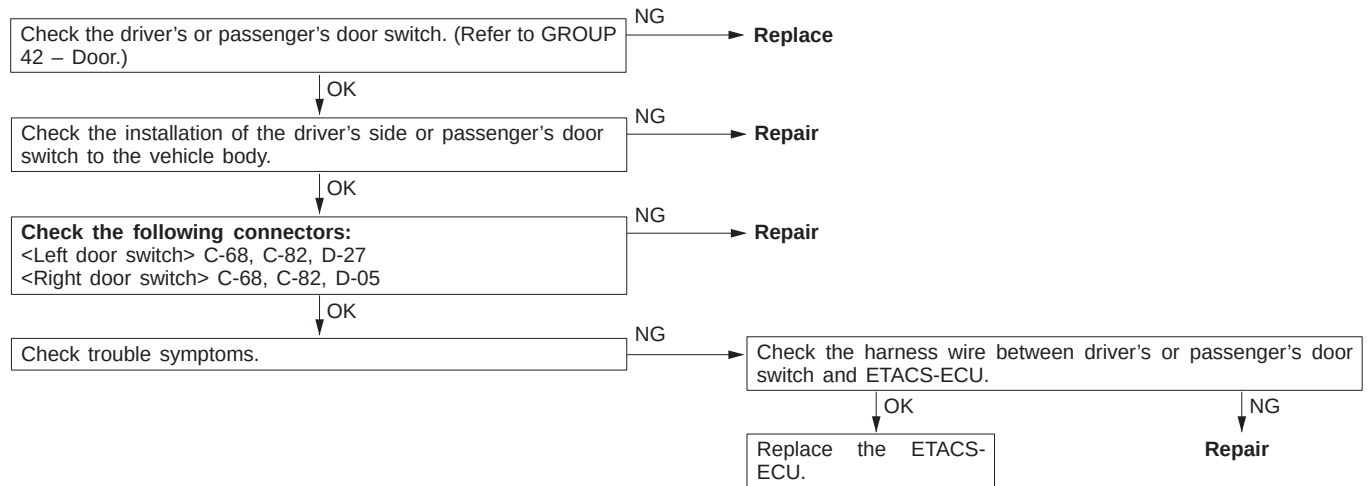
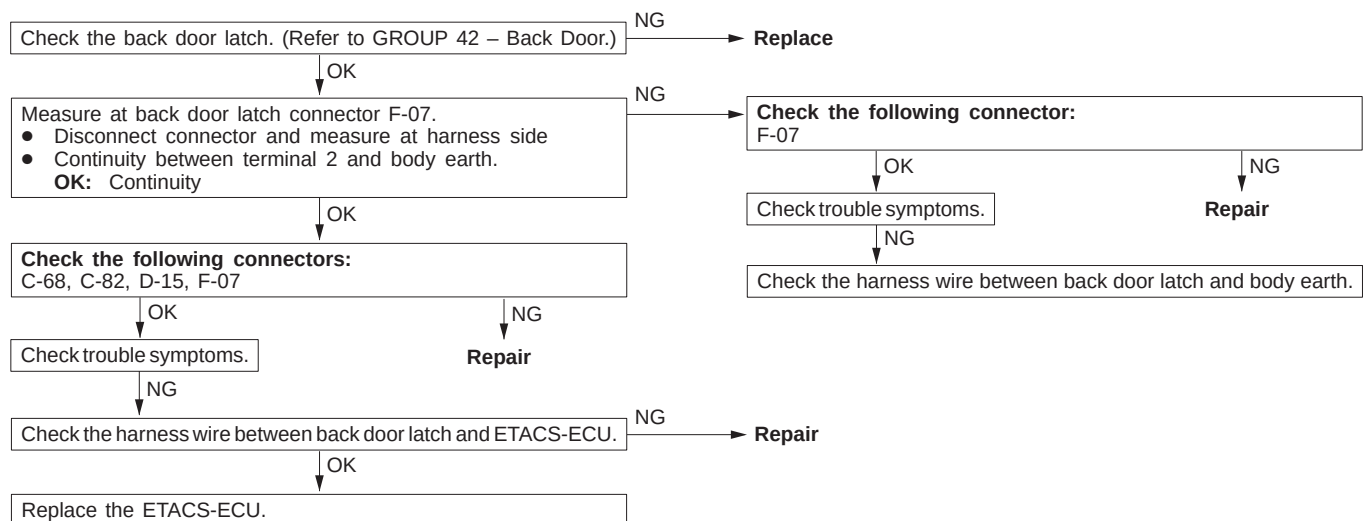
Inspection Procedure N-9

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



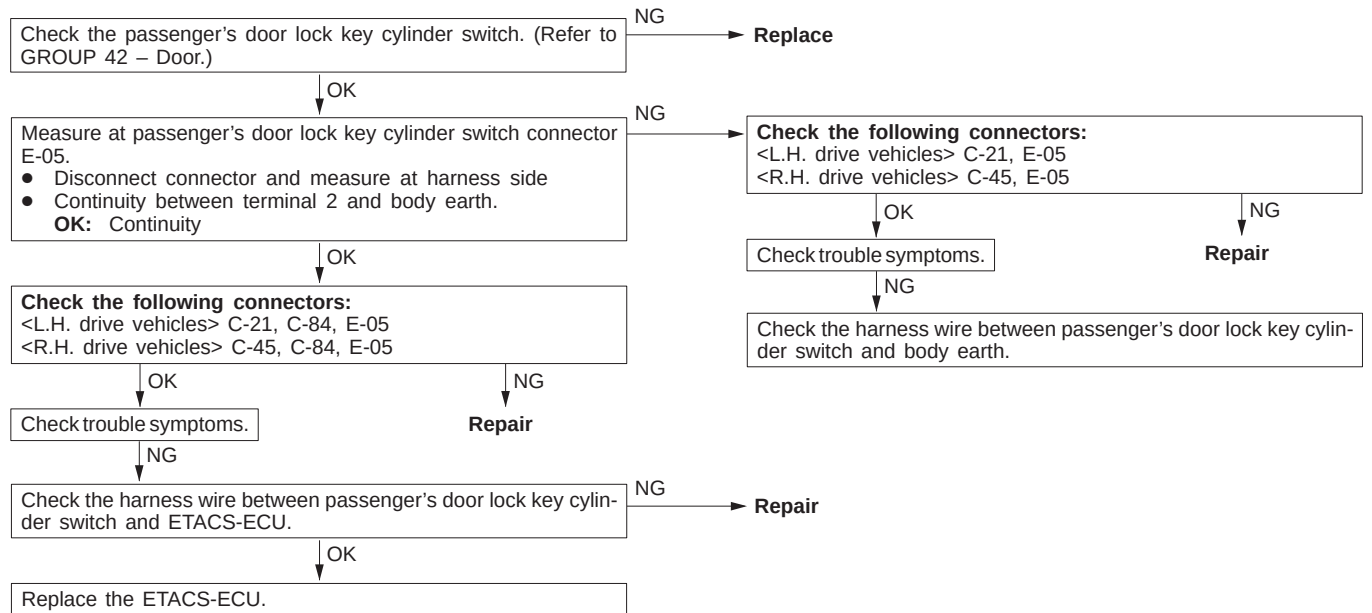
Inspection Procedure N-10

Driver's door switch signal is not sent to the ETACS-ECU.	Probable cause
Door switches signal is not sent to the ETACS-ECU.	
<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>**

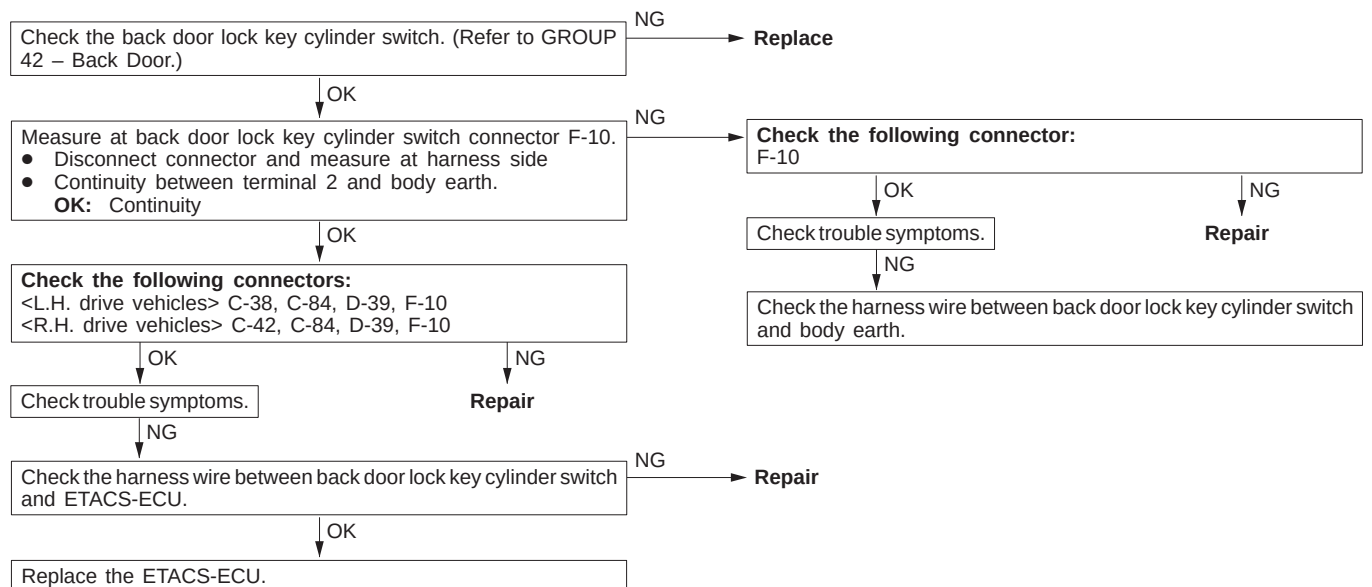
Inspection Procedure N-11

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



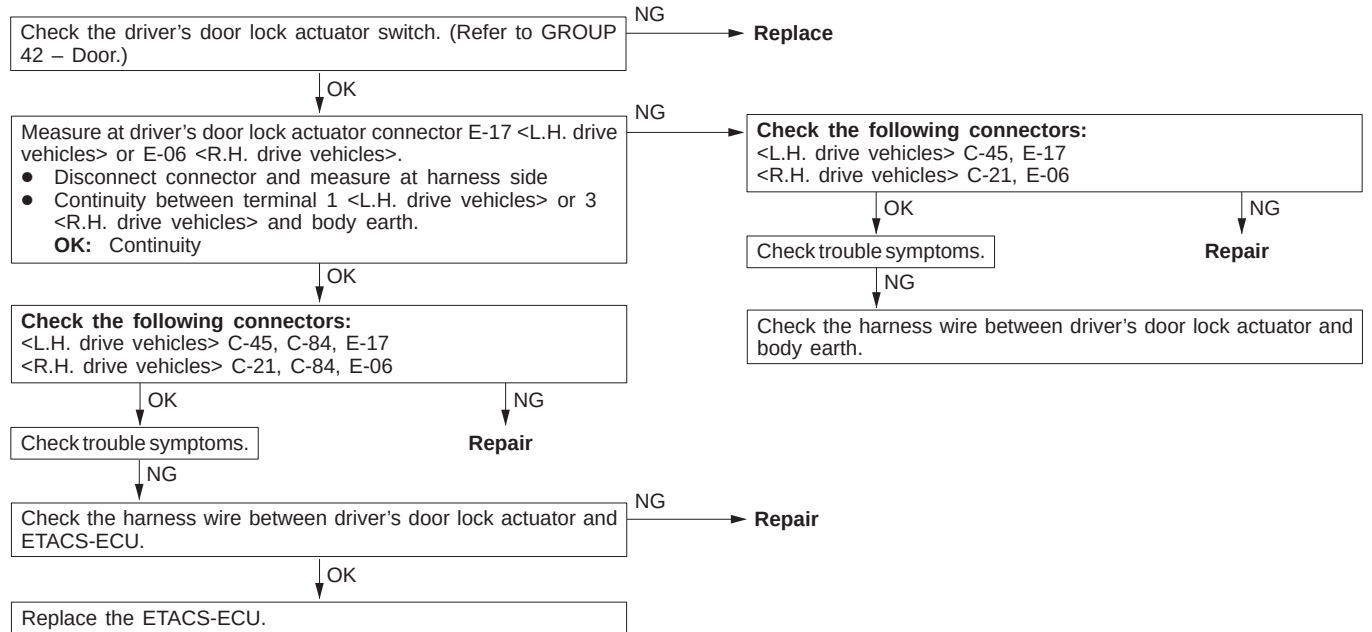
Inspection Procedure N-12

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



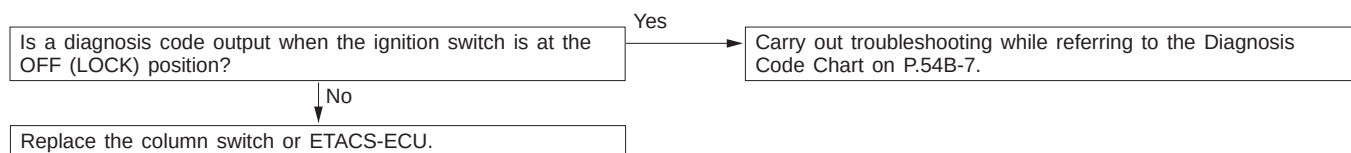
Inspection Procedure N-13

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



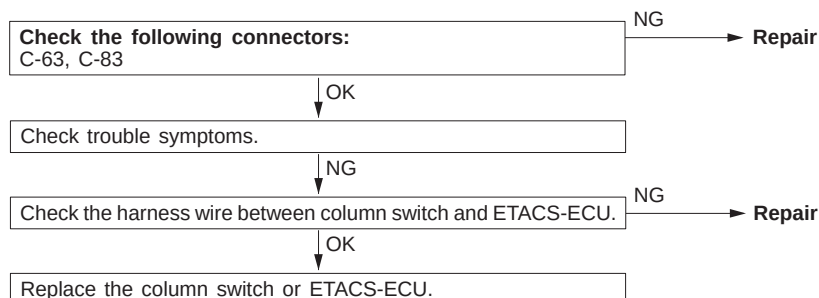
Inspection Procedure N-14

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



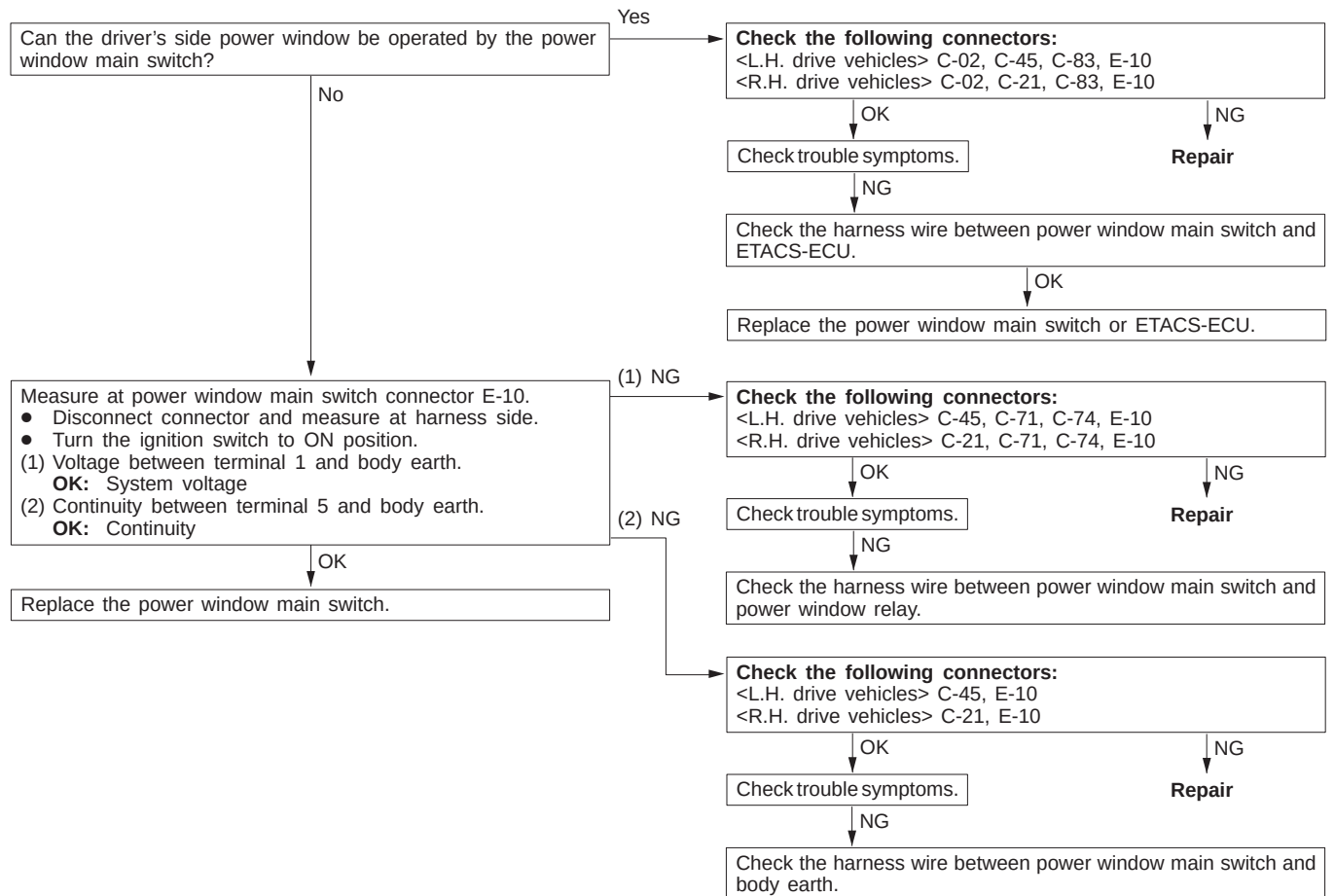
Inspection Procedure N-15

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



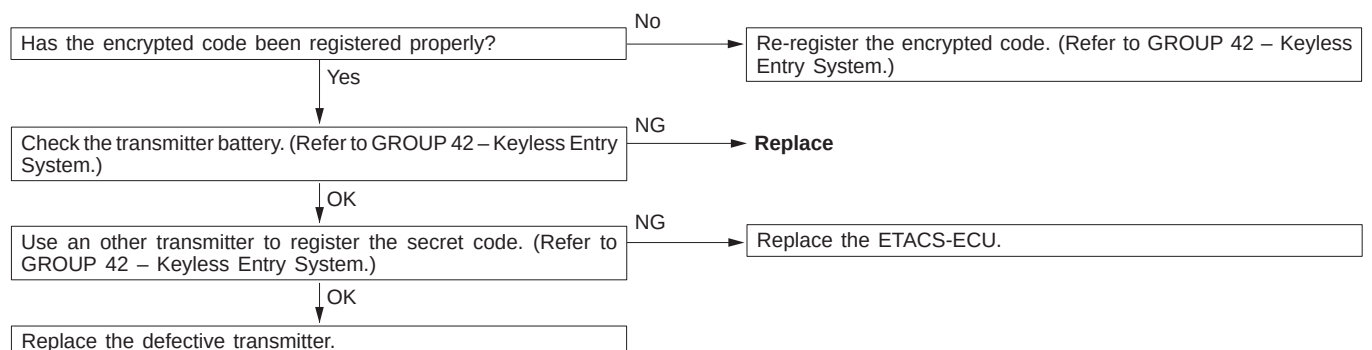
Inspection Procedure N-16

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



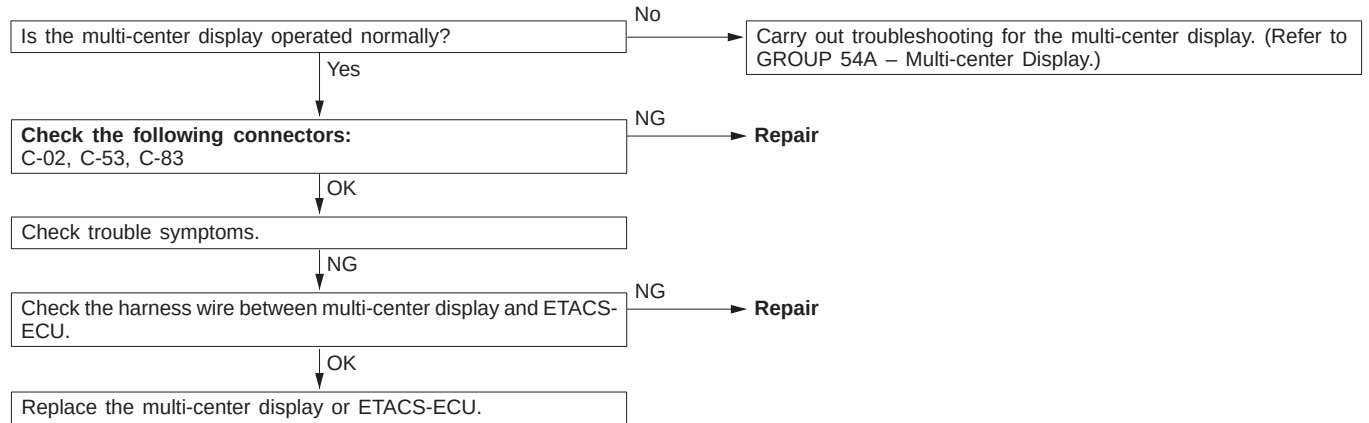
Inspection Procedure N-17

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



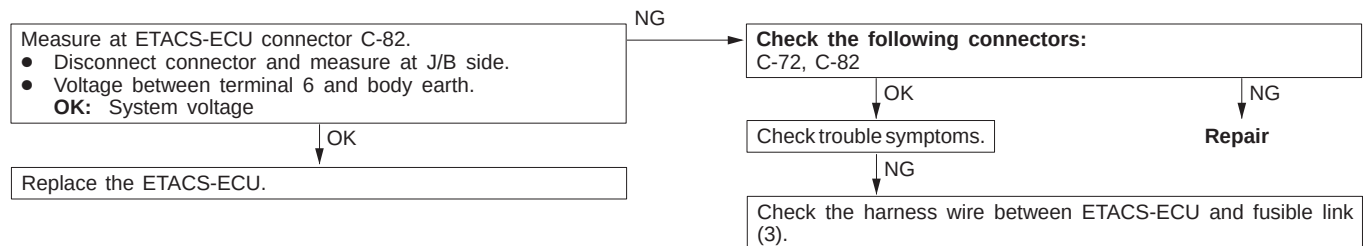
Inspection Procedure N-18

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 through 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

HEATER, AIR CONDITIONER AND VENTILATION

CONTENTS

GENERAL INFORMATION	3	ON-VEHICLE SERVICE	8
Safety Precautions	3	Refrigerant Level Test Through Performance Test	8
SERVICE SPECIFICATIONS	4	Magnetic Clutch Test	9
LUBRICANTS	4	Receiver Drier Test	9
SPECIAL TOOLS	4	Compressor Drive Belt Adjustment	9
TROUBLESHOOTING	5	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	BLOWER MOTOR ASSEMBLY AND INSIDE/OUTSIDE AIR CHANGEOVER DAMPER MOTOR	25
Performance Test	14	COMPRESSOR AND TENSION PULLEY	26
Refrigerant Leak Repair	16	CONDENSER AND CONDENSER FAN MOTOR	30
Compressor Noise	16	REFRIGERANT LINE	32
Power Relay Check	17	VENTILATORS*	34
Idle-up Operation Check	18		
HEATER CONTROL ASSEMBLY AND A/C SWITCH	19		
HEATER UNIT*, BLOWER UNIT*, RESISTER* AND EVAPORATOR*	22		

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.

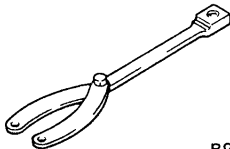
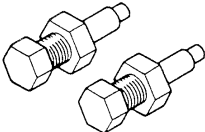
SERVICE SPECIFICATIONS

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

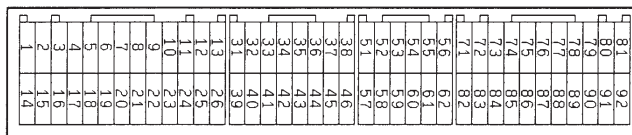
Tool	Number	Name	Use
 B991367	MB991367	Special spanner	Removal and installation of armature mounting nut of compressor
 B991386	MB991386	Pin	

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

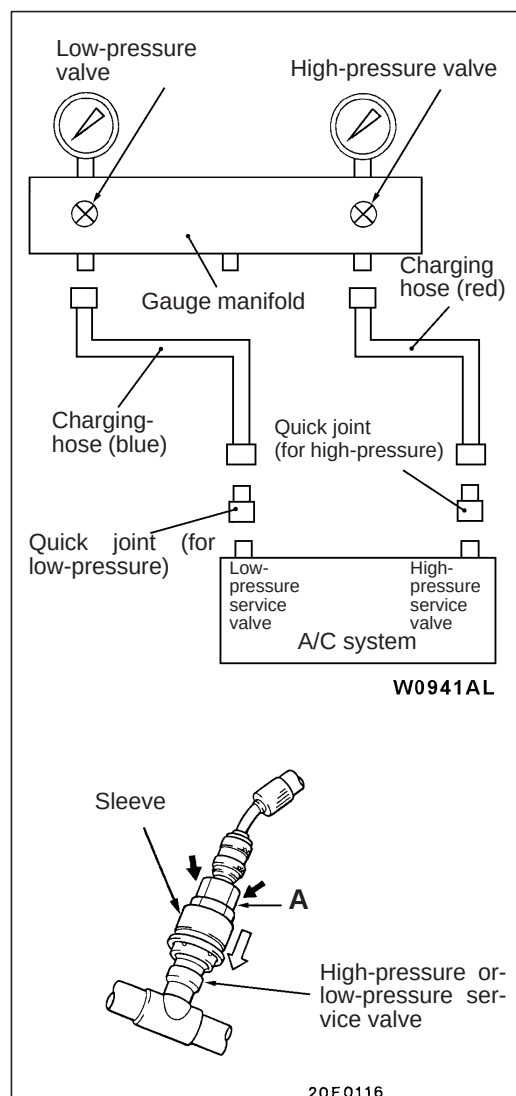
NOTE

*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.

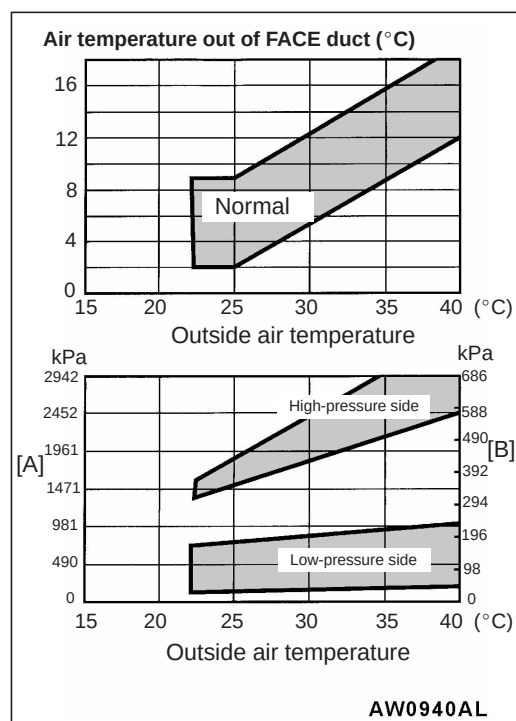
13. Check if the outside air temperature and air temperature blown out of FACE duct, and the outside air temperature and refrigerant pressure (high-pressure and low-pressure sides) are within the normal value range shown in the graphs.
14. If the temperature and pressure are below the given range, replenish the refrigerant. If above, drain the refrigerant. (For charging, refer to P.55-10.)

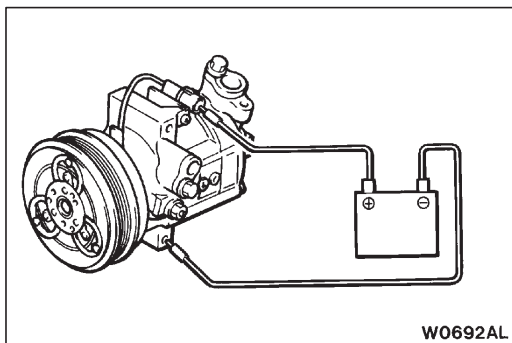
NOTE

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

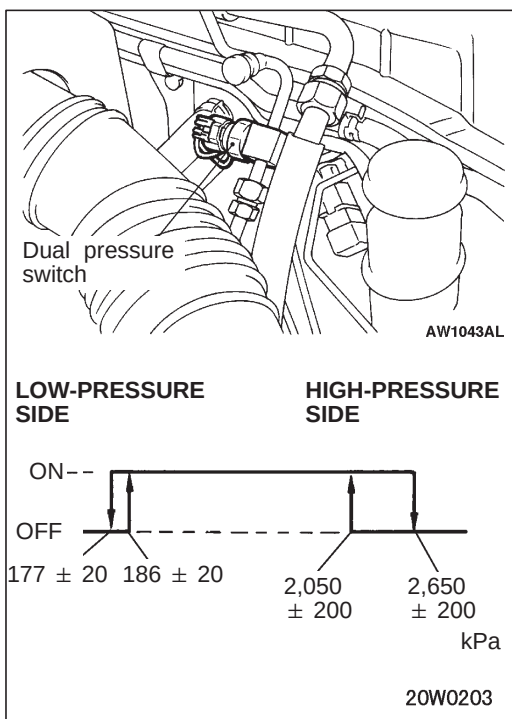
Operate the unit and check the piping temperature by touching the receiver drier outlet and inlet.

If there is a difference in the temperatures, the receiver drier is restricted.

Replace the receiver drier.

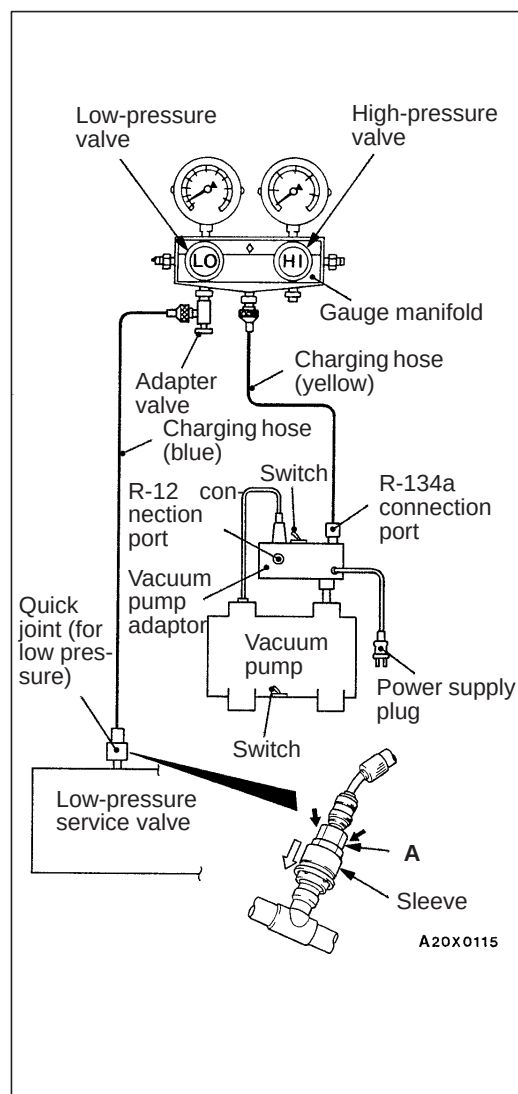
COMPRESSOR DRIVE BELT ADJUSTMENT

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

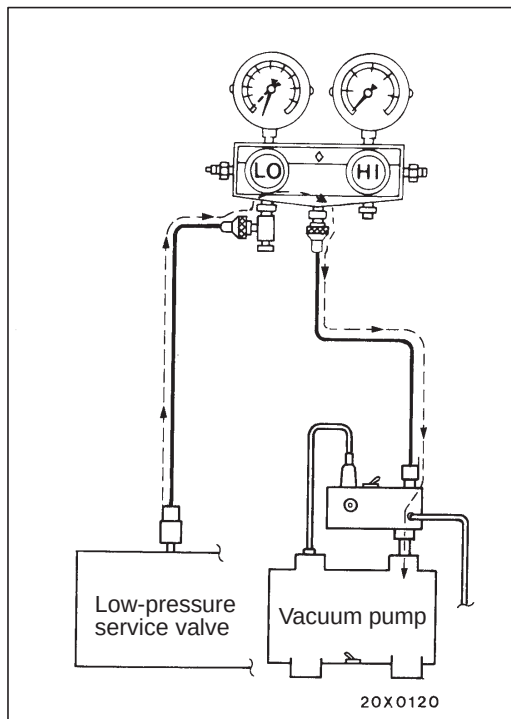
The low-pressure service valve should be connected to the suction hose.

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.

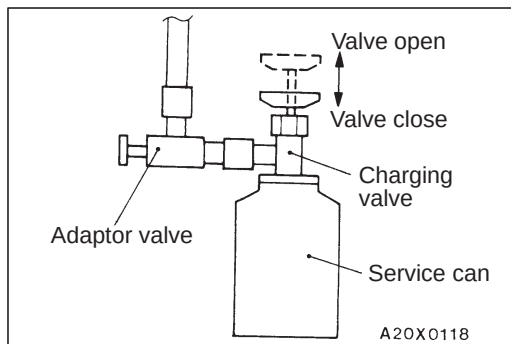
Caution

Do not operate the compressor in the vacuum condition; damage may occur.

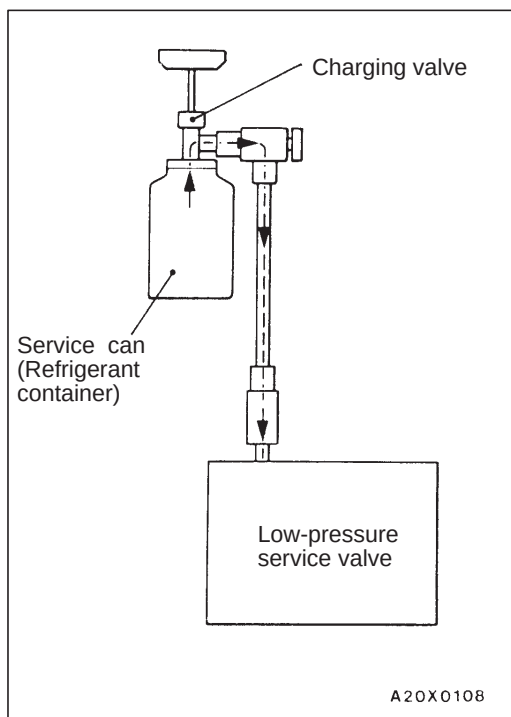
15. Carry out a leak test. (Good if the negative pressure does not drop.)

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.

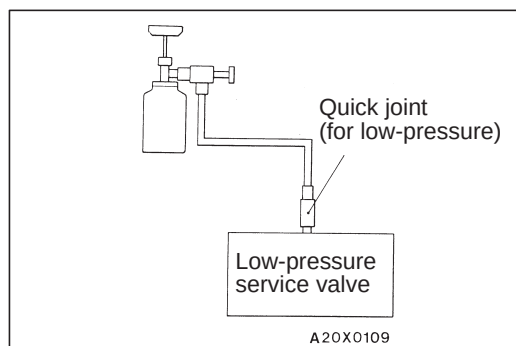
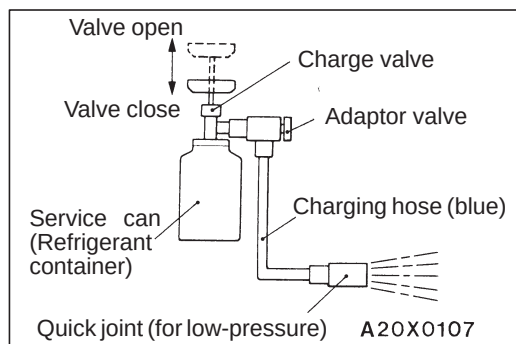
Caution

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

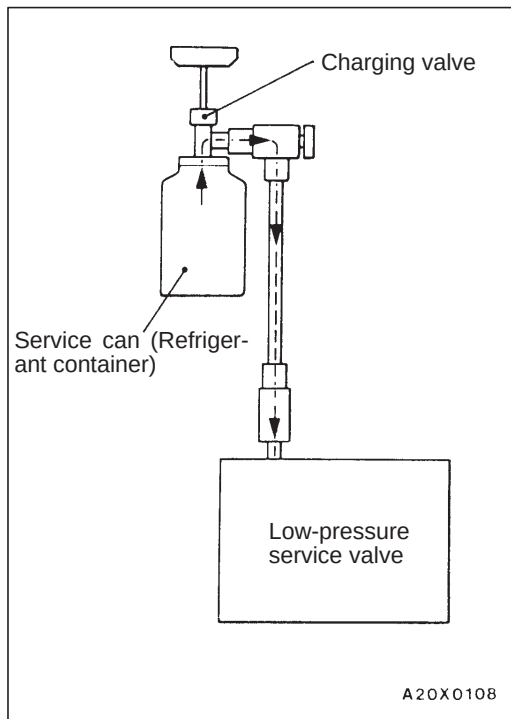
If the service can is not emptied completely, keep the handles of the charging valve and adaptor valve closed for the next charging.

**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.

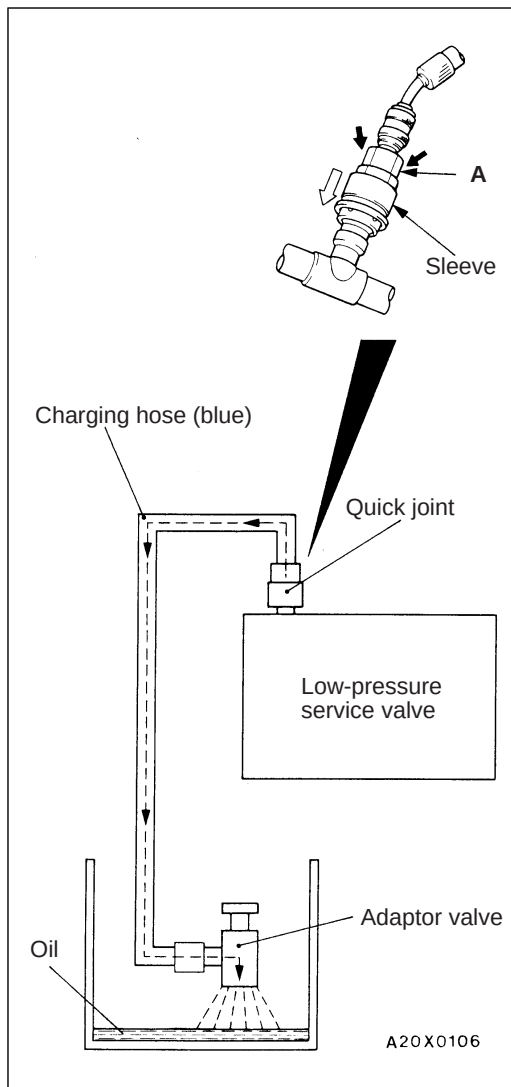
Caution

If the service can is inverted, liquid refrigerant may be drawn 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 valve 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.

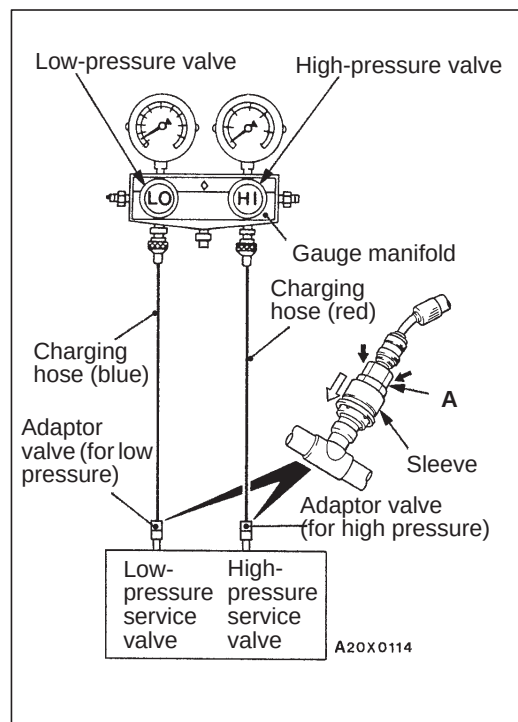
Compressor oil: ZXL 200PG

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.

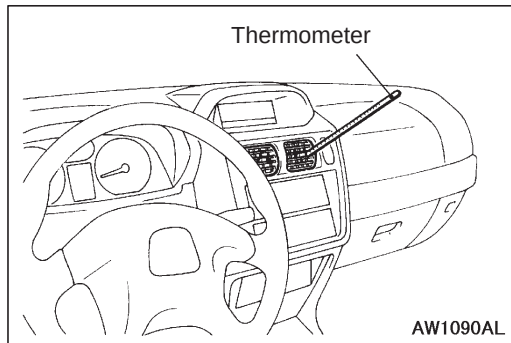
Caution

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.

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.

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.

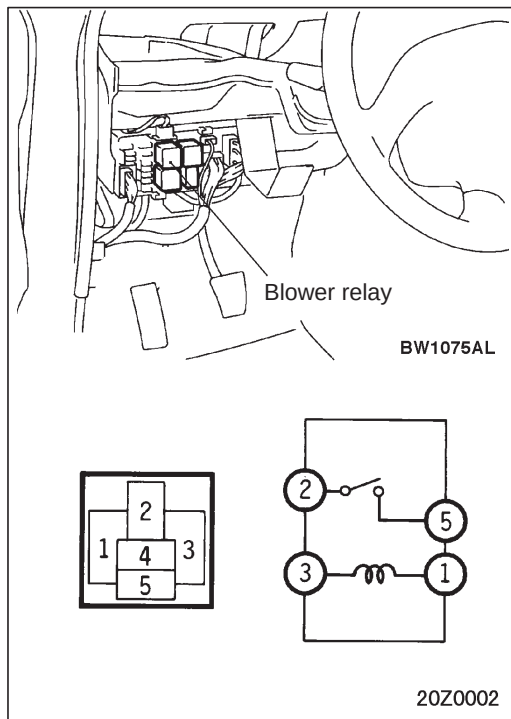
Never attempt to rebend formed lines to fit. Use the correct line for the installation you are servicing. A good rule for the flexible hose lines is keep the radius of all bends at least 10 times the diameter of the hose.

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.

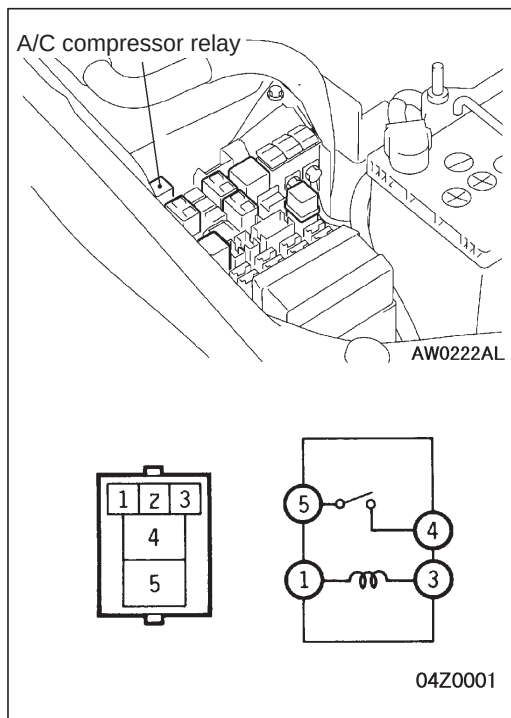
Unified plumbing connections with O-rings, these O-rings are not reusable.

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

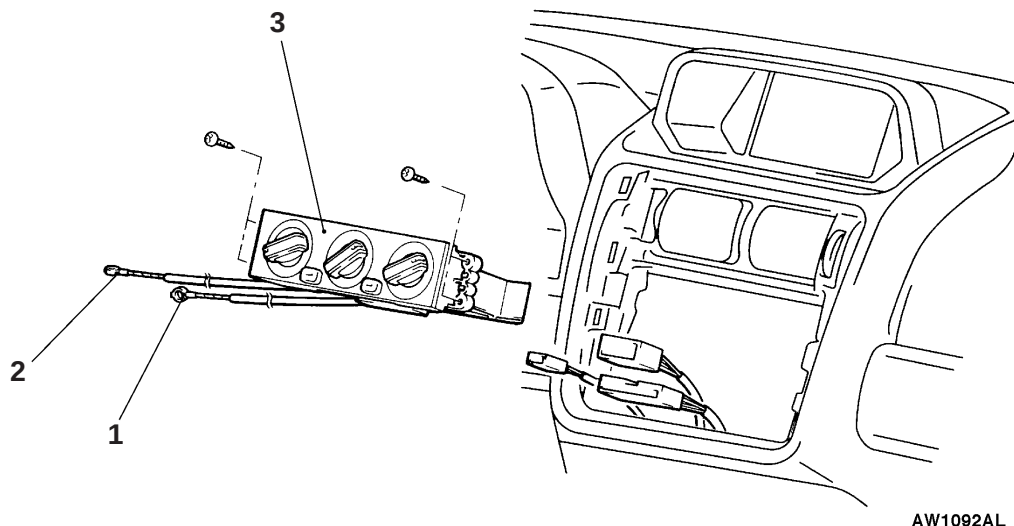
There is no necessity to make an adjustment, because the idling speed is automatically adjusted by the ISC system. If, however, there occurs a deviation from the standard value for some reason, check the ISC system. (Refer to GROUP 13A – On-vehicle Service.)

HEATER CONTROL ASSEMBLY AND A/C SWITCH

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

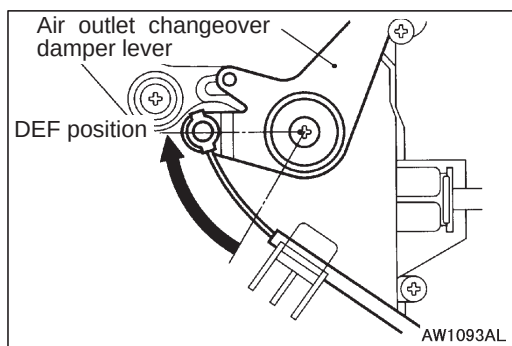
- Center Air Outlet Assembly, Instrument Under Cover Removal and Installation (Refer to GROUP 52A – Instrument Panel.)
- Radio, Tape Player Removal and Installation (Refer to GROUP 54.)



AW1092AL

Removal steps

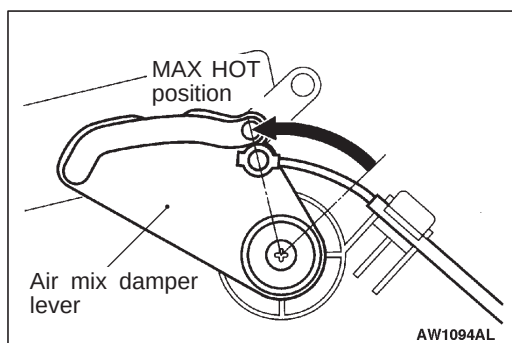
- ▶B◀ 1. Air mix damper cable connection
- ▶A◀ 2. Air outlet changeover damper cable connection
- 3. Heater control assembly



INSTALLATION SERVICE POINTS

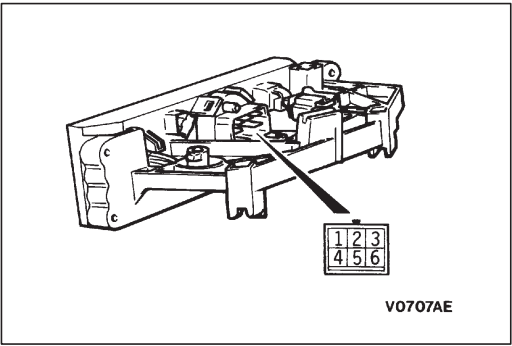
▶A◀ AIR OUTLET CHANGEOVER DAMPER CABLE CONNECTION

- Set the air outlet changeover control knob on the heater control assembly to the DEF position.
- Set the air outlet changeover damper lever of the heater unit to the DEF position (turn clockwise the damper lever until it stops), and then connect the cable to the lever.



▶B◀ AIR MIX DAMPER CABLE CONNECTION

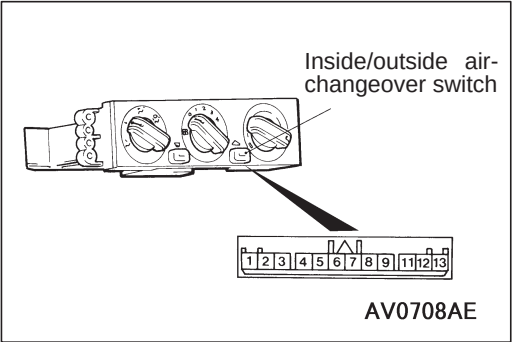
- Set the temperature control knob on the heater control assembly to the MAX HOT position.
- Set the air mix damper lever of the heater unit to the MAX HOT position (turn clockwise the damper lever until it stops), and then connect the cable to the lever.



INSPECTION

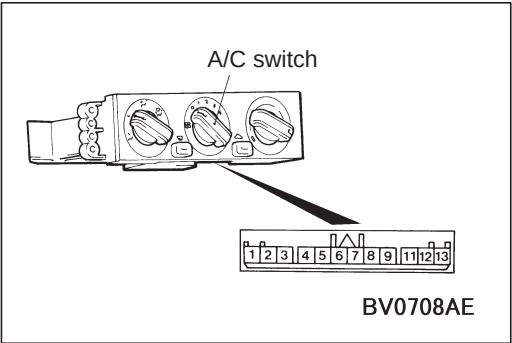
BLOWER SWITCH CONTINUITY CHECK

Switch position	Terminal No.					
	1	2	3	4	5	6
OFF						
● (LO)			○		○	
● (ML)	○		○			
● (MH)			○			○
● (HI)			○	○		



INSIDE/OUTSIDE AIR CHANGEOVER SWITCH CONTINUITY CHECK

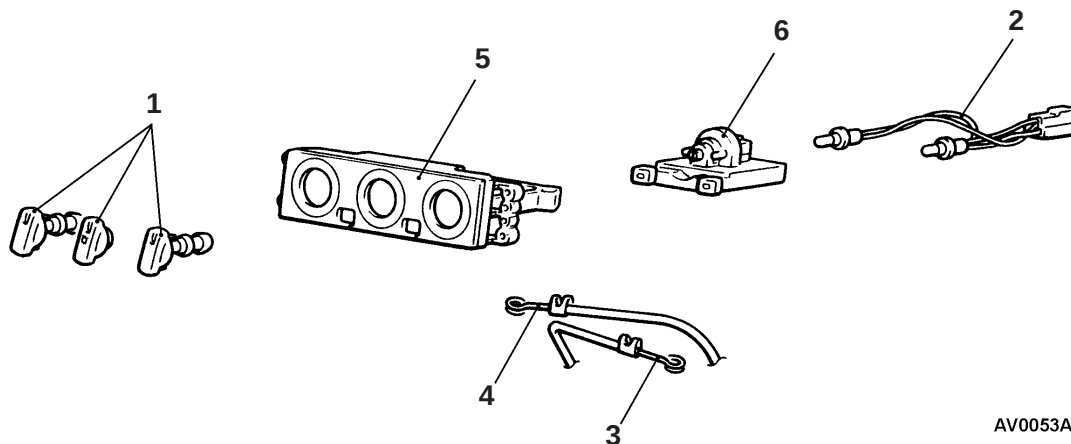
Switch position	Terminal No.						
	1	2	3	IND	4	8	9
RECIRC			○	○	○	ILL	
FRESH	○		○				



A/C SWITCH CONTINUITY CHECK

Switch position	Terminal No.					
	5	IND	6	7	8	9
OFF					ILL	
ON	○	○	○	○		

DISASSEMBLY AND REASSEMBLY



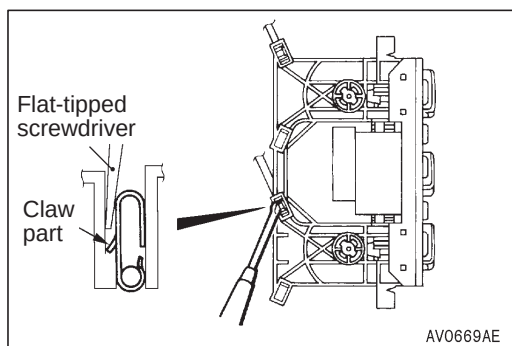
AV0053AJ

Disassembly steps

- ◀A▶
1. Knob assembly
 2. Bulb harness
 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

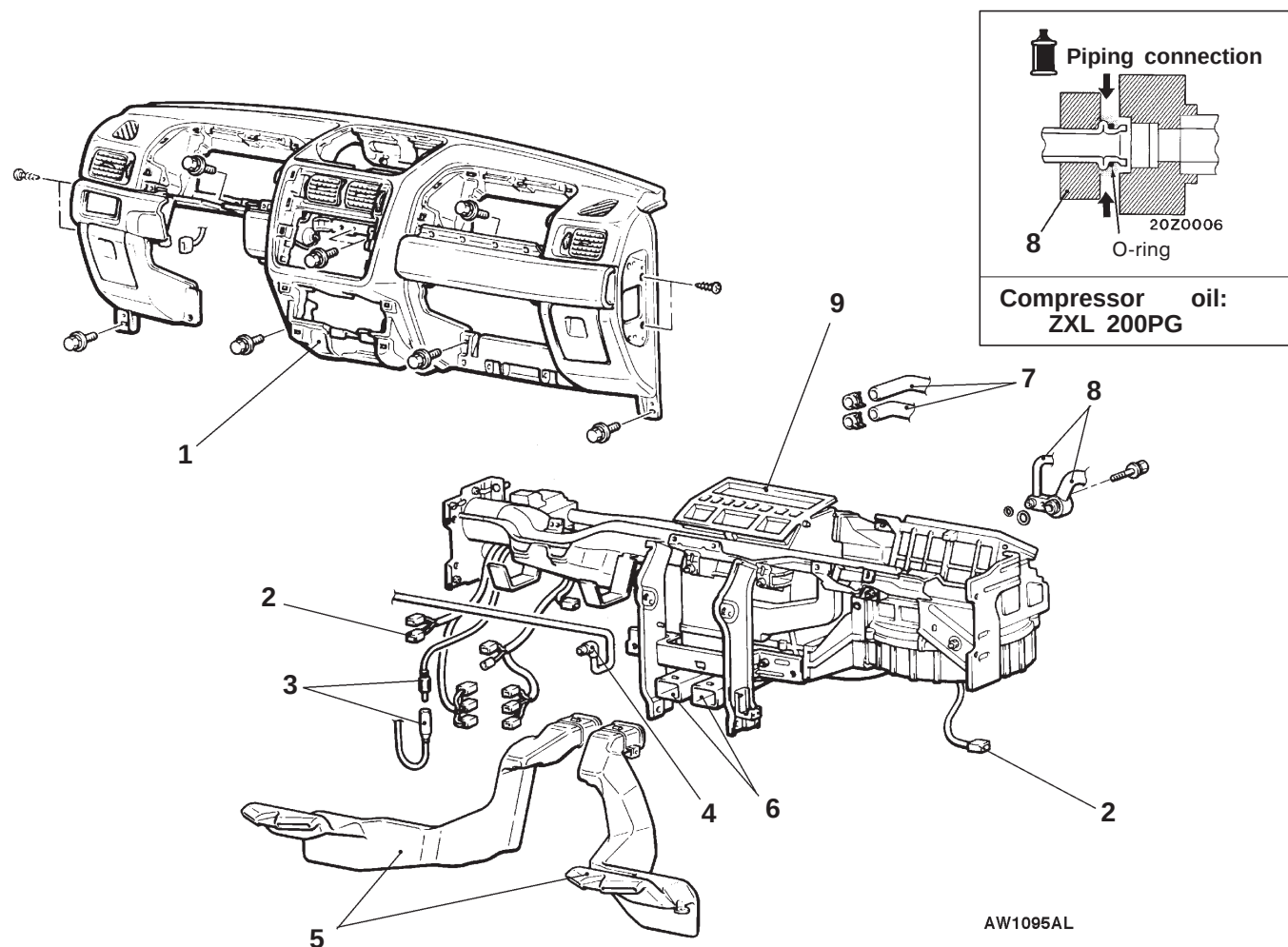
Insert a flat-tipped screwdriver into the control base clip from inner side, and then remove the cable by lifting the claw part of the clip.

HEATER UNIT, BLOWER UNIT, RESISTER AND EVAPORATOR

REMOVAL AND INSTALLATION

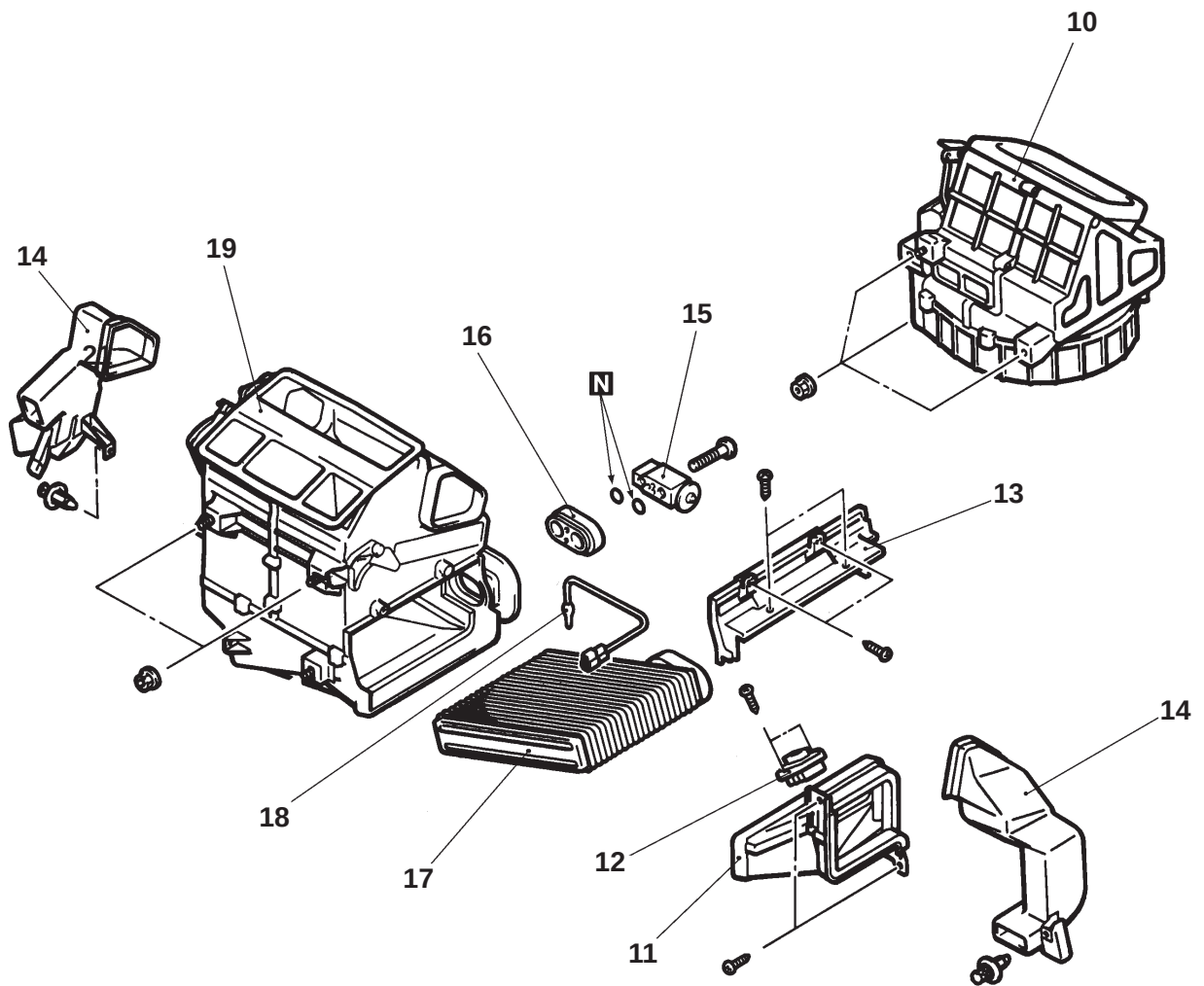
Caution: SRS

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



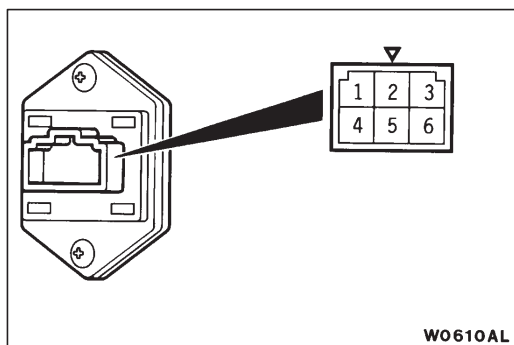
AW1096AL

- 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



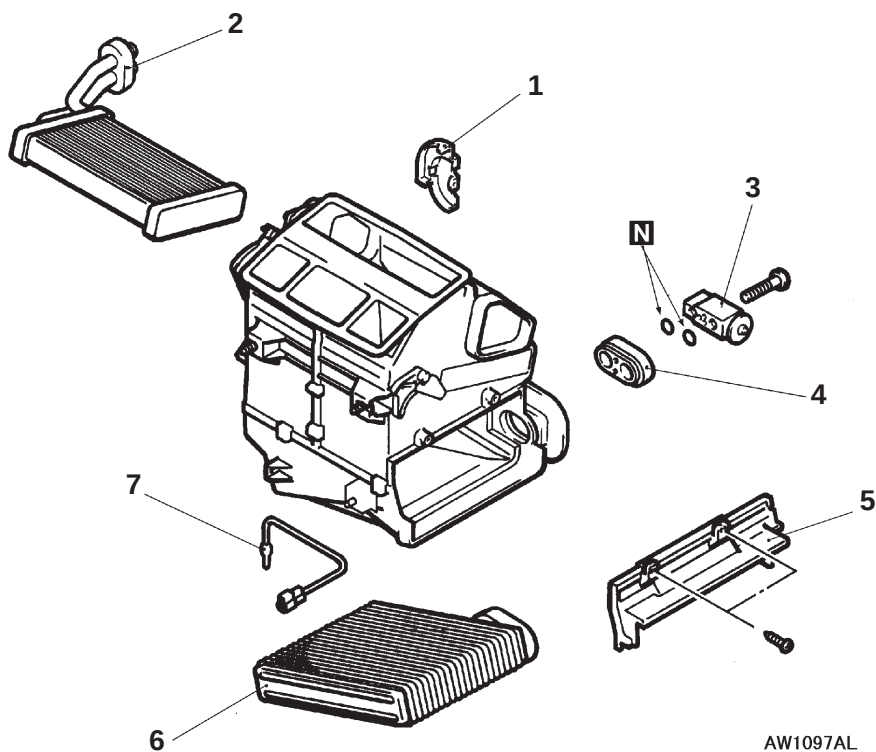
INSPECTION RESISTOR CHECK

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

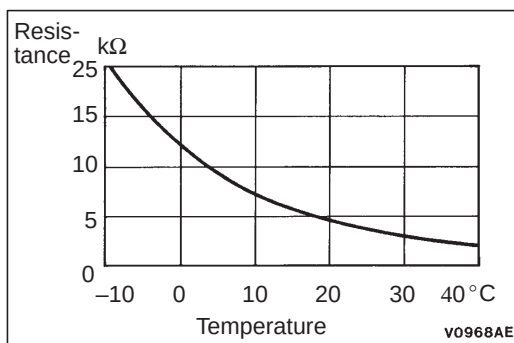
DISASSEMBLY AND REASSEMBLY



Disassembly steps

1. Cover
2. Heater core
3. Expansion valve

4. Joint
5. Cover
6. Evaporator
7. Air thermosensor

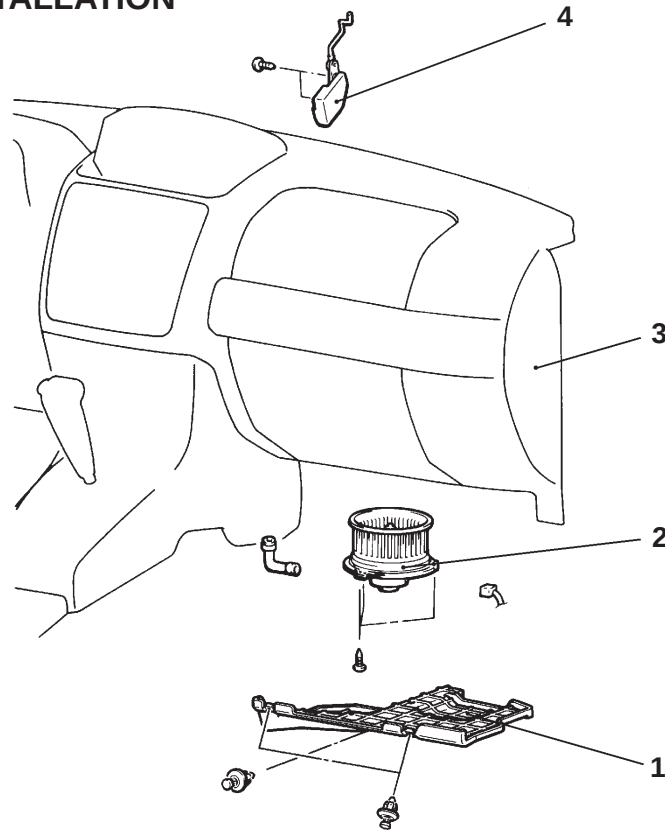


INSPECTION AIR THERMOSENSOR CHECK

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



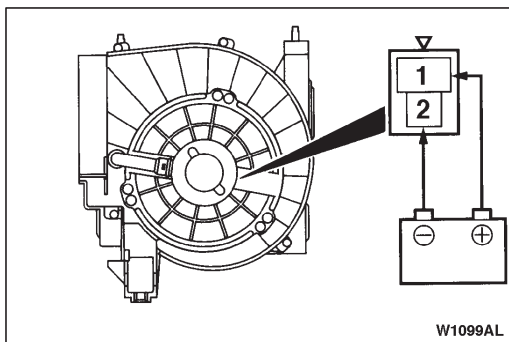
AX0164AL

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

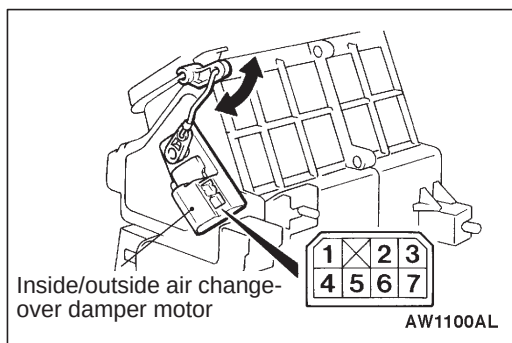


W1099AL

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

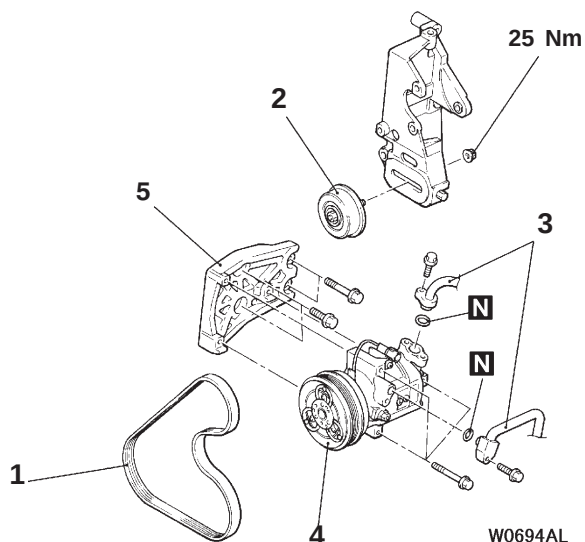
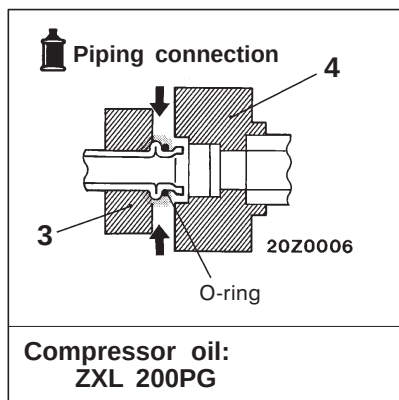
REMOVAL AND INSTALLATION

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.)



Removal steps

- Washer tank (Refer to GROUP 51.)
1. Drive belt (Refer to GROUP 11.)
 2. Tension pulley
 3. Suction hose and discharge hose connection



- Under cover
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>

$$150 \text{ mℓ} - X \text{ mℓ} = Y \text{ mℓ}$$

<KC 50G>

$$180 \text{ mℓ} - X \text{ mℓ} = Y \text{ mℓ}$$

NOTE

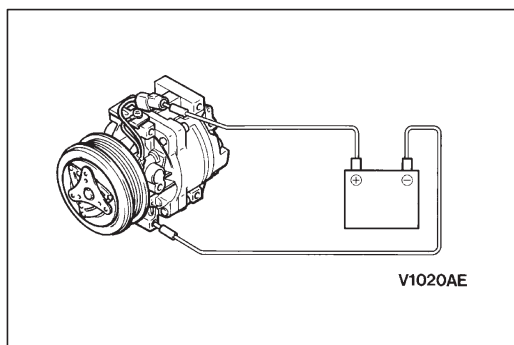
- (1) Y mℓ indicates the amount of oil in the refrigerant line, the condenser, the evaporator etc.
- (2) When replacing the following parts at the same time as the compressor, subtract the rated oil amount of the each part from Y mℓ and discharge from the new compressor.

Quantity

Evaporator: 40 mℓ

Condenser: 10 mℓ

Suction hose: 6.5 mℓ



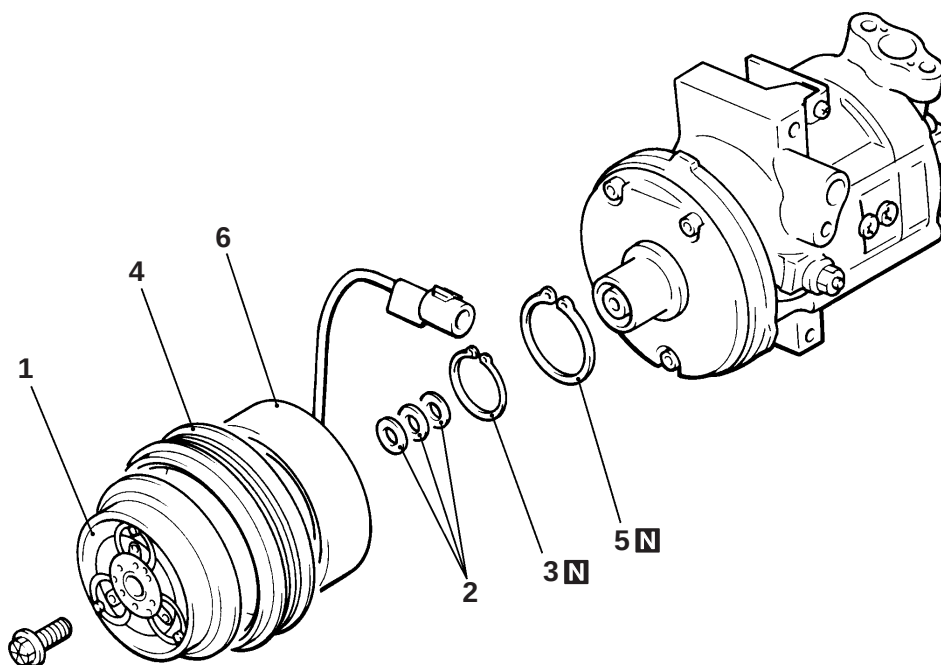
INSPECTION

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



AW0611AL

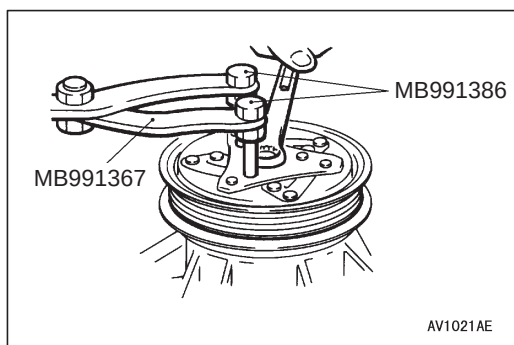
Magnetic clutch disassembly steps



- Air gap adjustment
- 1. Armature plate
- 2. Shims

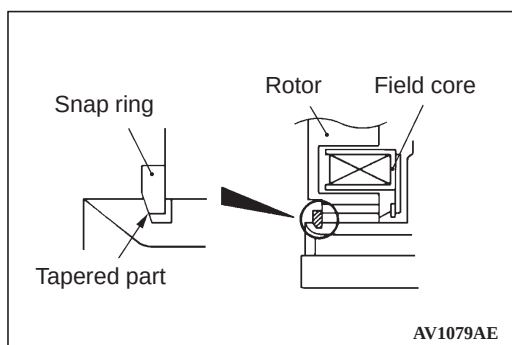


- 3. Snap ring
- 4. Rotor
- 5. Snap ring
- 6. Clutch coil



DISASSEMBLY SERVICE POINT

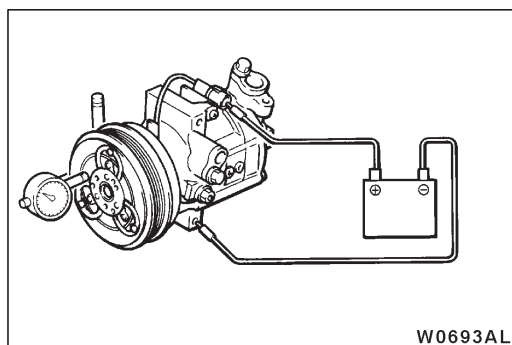
ARMATURE PLATE REMOVAL



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

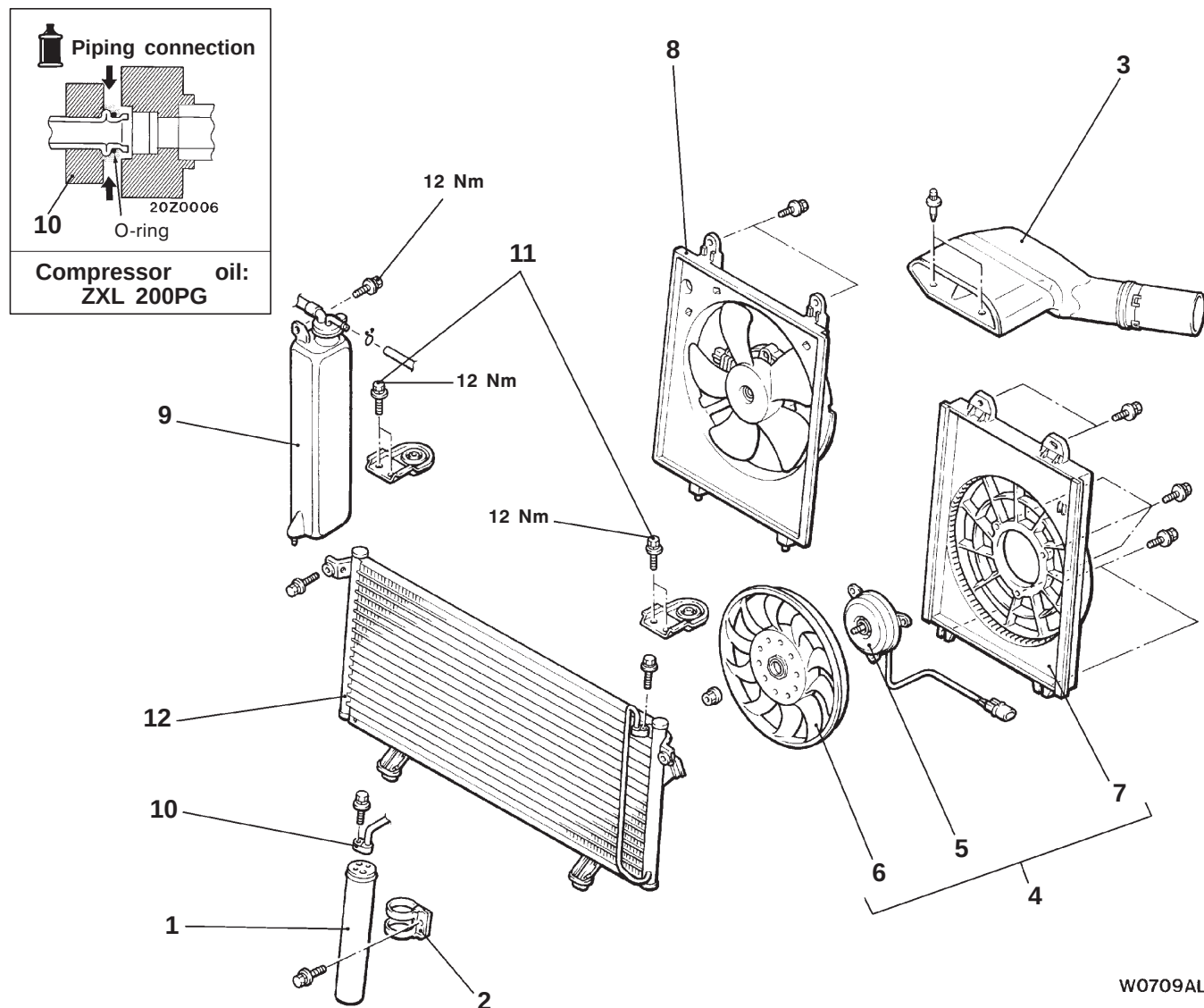
If there is a deviation of the air gap from the standard value, make the necessary adjustment by adjusting the number of shims.

CONDENSER AND CONDENSER FAN MOTOR

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Under Cover Removal and Installation



W0709AL

Condenser assembly removal steps

- Discharging and charging of refrigerant (Refer to P.55-10.)
- Radiator grille (Refer to GROUP 51.)

▶A◀

- Receiver
- Receiver bracket
- Air intake duct
- Fan motor and shroud assembly
8. Radiator fan motor and shroud assembly (Refer to GROUP 14)
9. Condense tank
10. Discharge hose connection

◀A▶

◀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

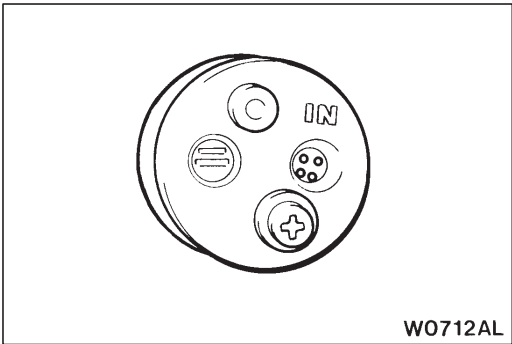
Plug the nipples of the disconnected pipe, hose and condenser assembly to prevent foreign materials from entering.

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

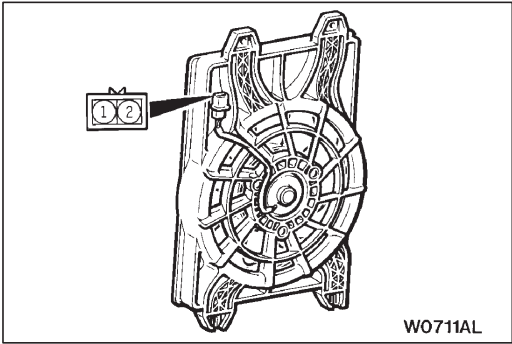
1. Remove the mounting bolts from the front side of the headlamp support member.
2. Disengage the lower part of the radiator, and then move the radiator slightly toward the engine.
3. Raise the condenser assembly to remove from the engine compartment.



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

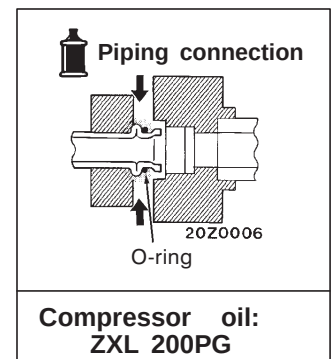
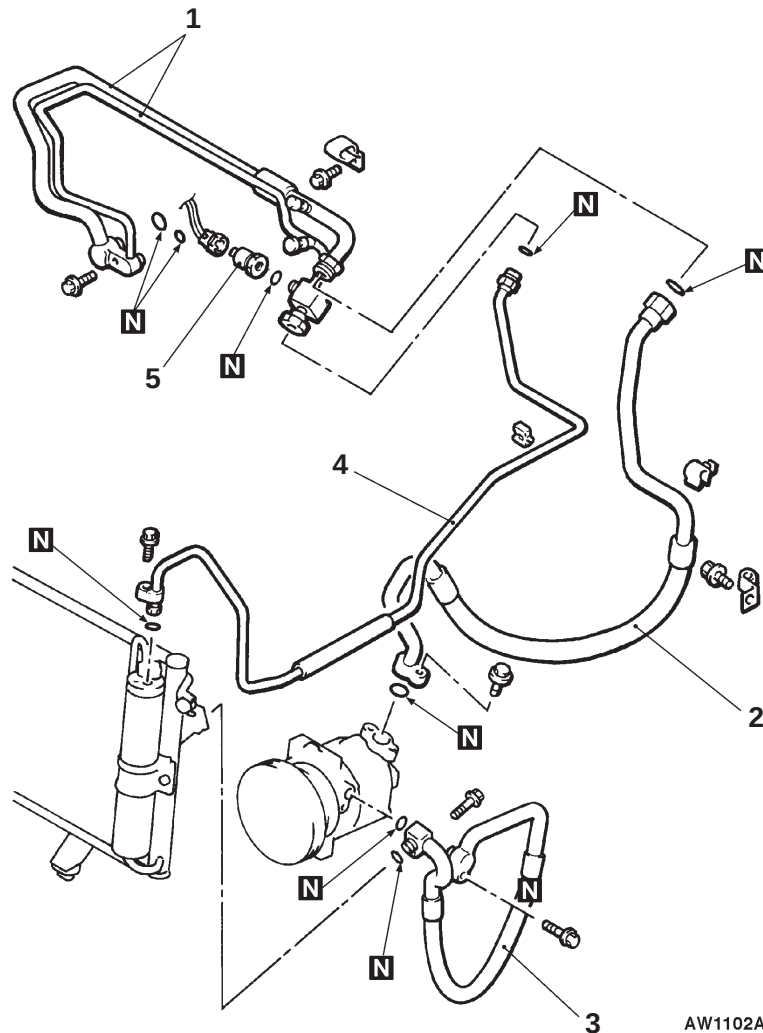
REFRIGERANT LINE

REMOVAL AND INSTALLATION

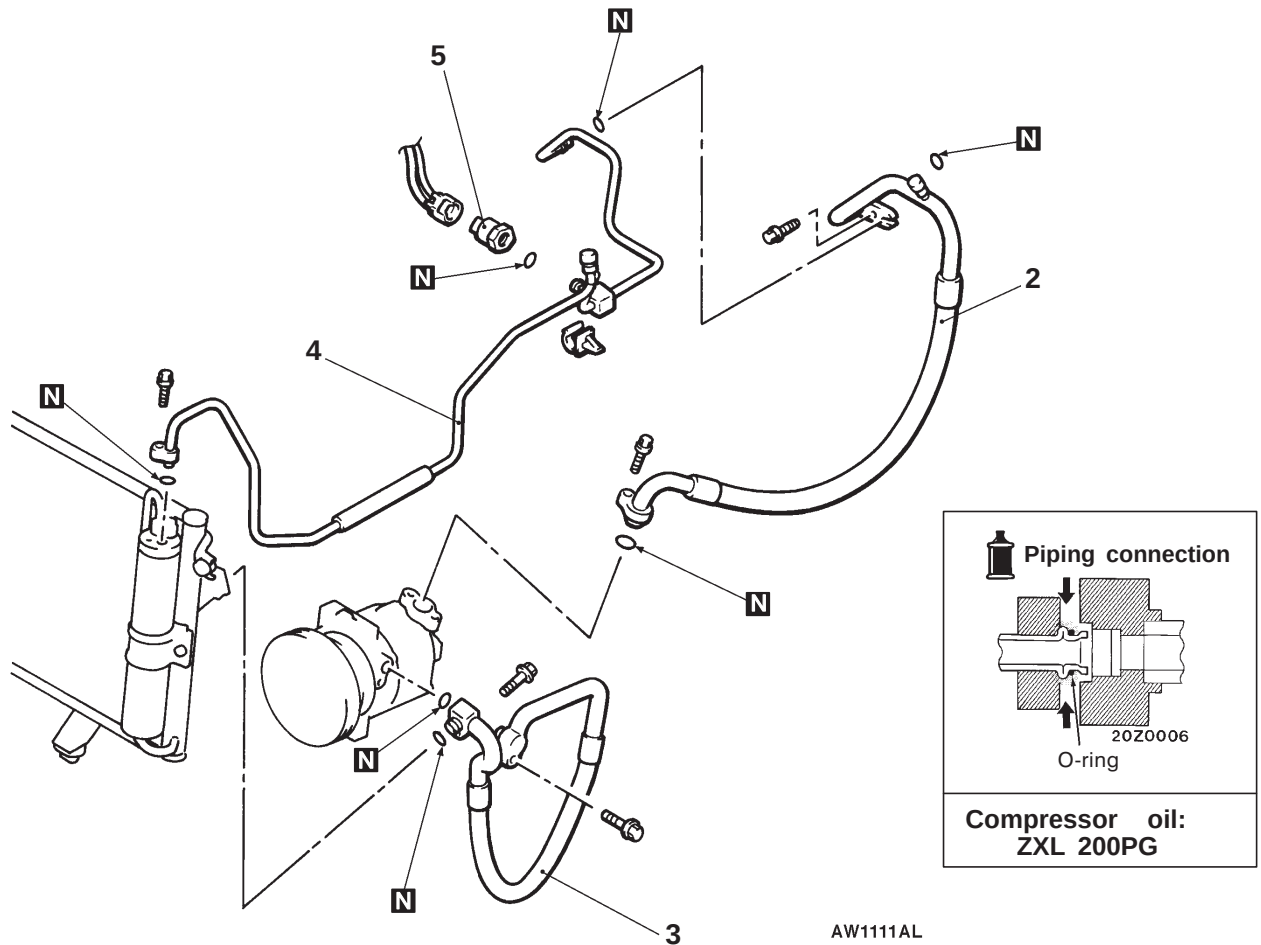
<L.H. DRIVE VEHICLES>

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.



<R.H. DRIVE VEHICLES>

**Removal steps**

1. Pipe assembly
2. Suction hose
3. Discharge hose



4. Liquid pipe
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.

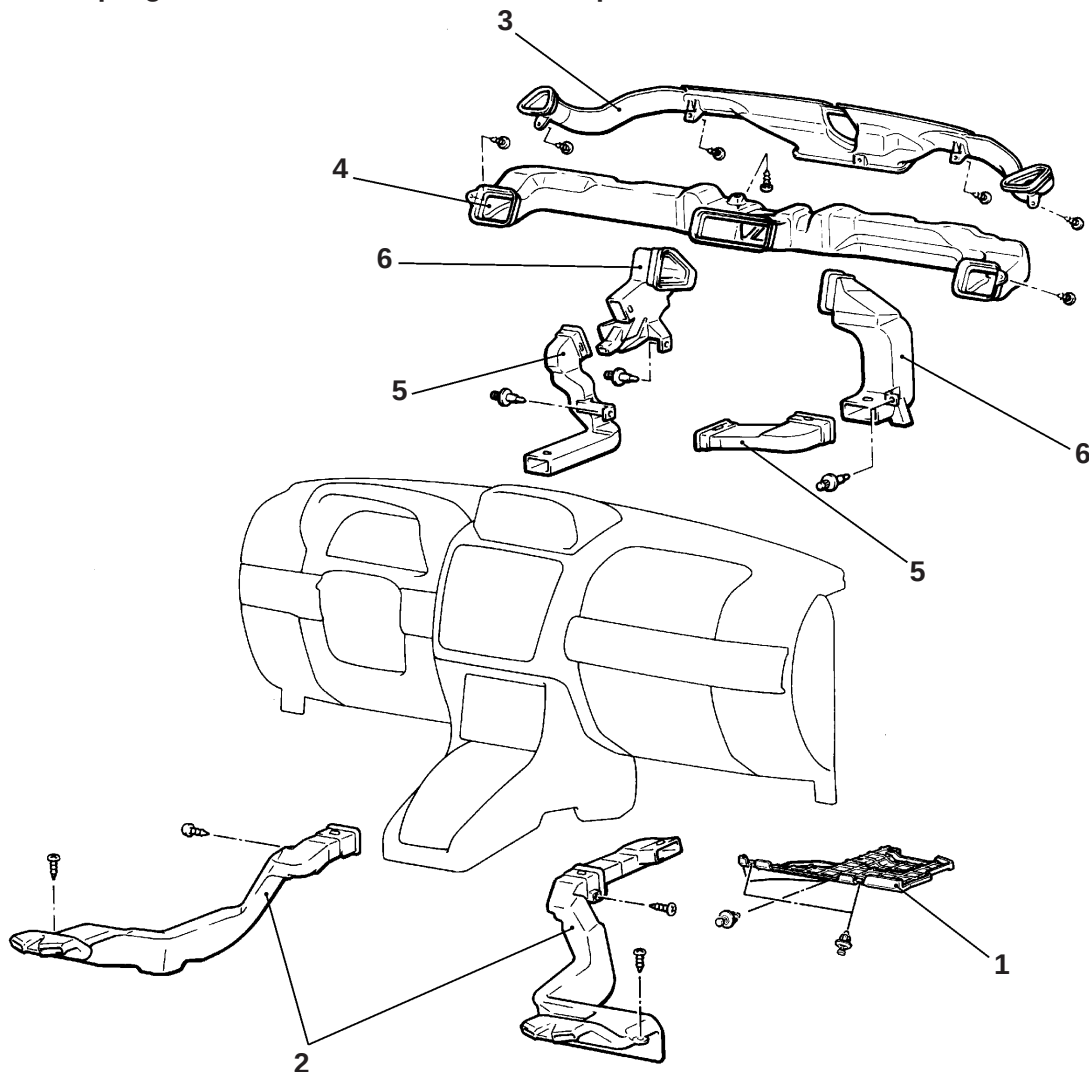
Caution

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

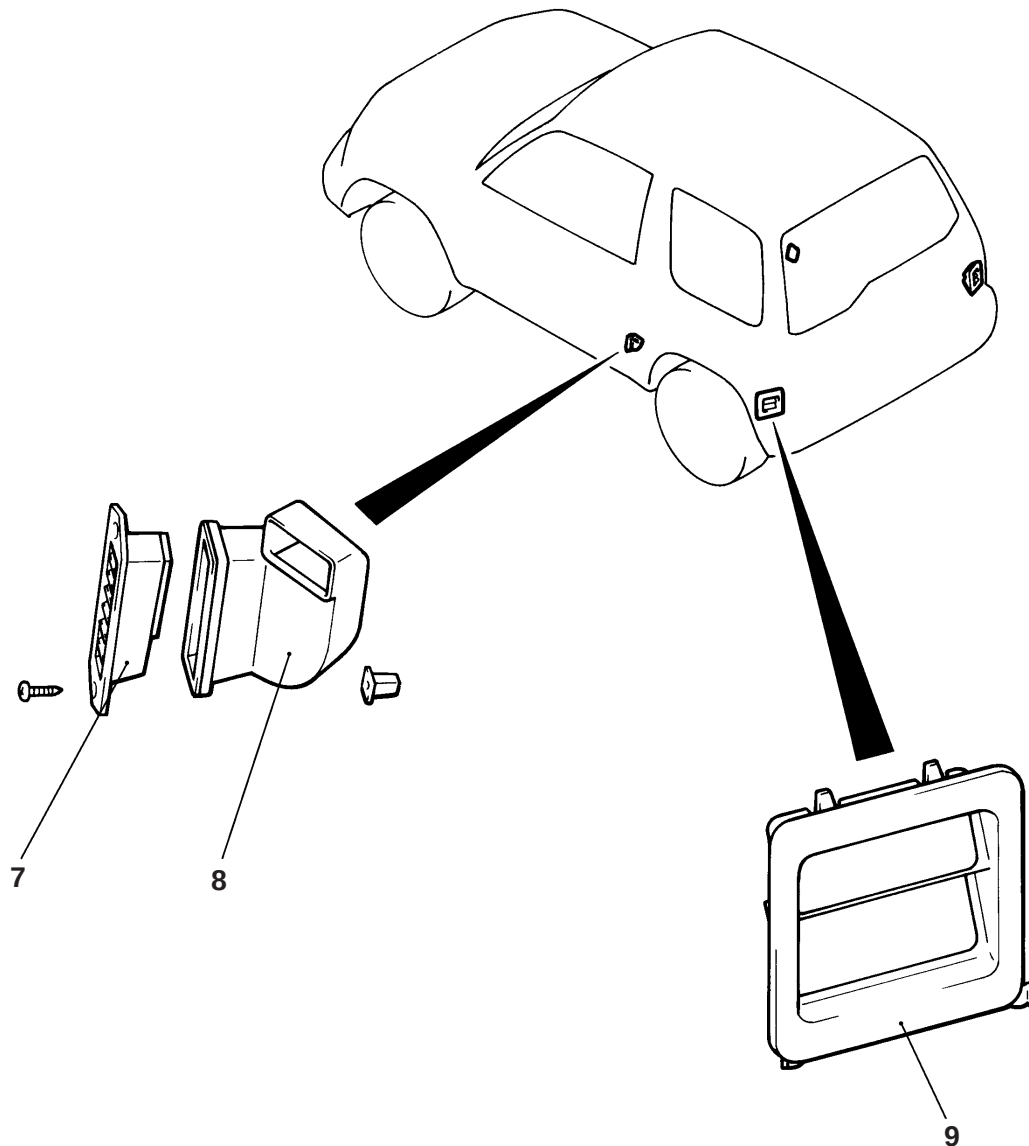
- Instrument panel (Refer to GROUP 52A.)
3. Defroster nozzle assembly
 4. Distribution duct assembly

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