GENERAL

Click on the applicable bookmark to selected the required model year.

GENERAL

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HOW TO USE THIS MANUAL

SCOPE OF MAINTENANCE, REPAIR AND SERVICING EXPLANATIONS

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

ON-VEHICLE SERVICE

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

INSPECTION

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

DEFINITION OF TERMS

STANDARD VALUE

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

LIMIT

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

REFERENCE VALUE

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

CAUTION

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

INDICATION OF TIGHTENING TORQUE

Tightening torques (units: N·m) are set to take into account the central value and the allowable tolerance. The central value is the target value, and the allowable tolerance provides the checking range for tightening torques. If bolts and nuts are not provided with tightening torques, refer to P.00-39.

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 models 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 reassemby is possible in reverse order of disassembly steps.

Classifications of Major Maintenance/Service Points

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

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

Symbols for Lubrication, Sealants and Adhesives

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

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

: Sealant or adhesive

: Brake fluid or automatic transmission fluid

: Engine oil, gear oil or air conditioner compressor oil

: Adhesive tape or butyl rubber tape

Indicates the group title.

Indicates the section title.

Indicates the group number.

Indicates the page number.

STEERING – Power Steering Oil Pump 37A-29

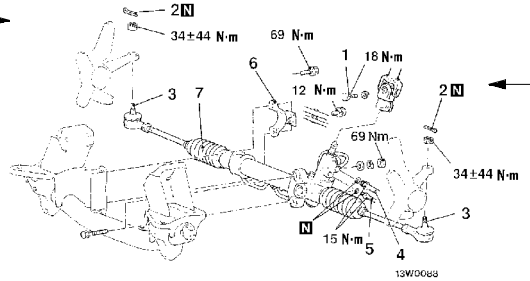
POWER STEERING GEAR BOX

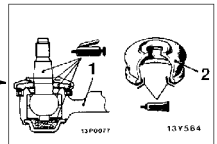
120000039

REMOVAL AND INSTALLATION

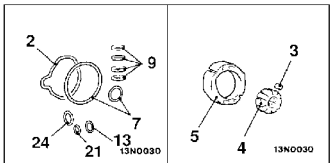
Pre-removal Operation
(1)Power Steering Fluid Draining (Refer to P. 37A-10.)
(2)Air Cleaner Assembly Removal
(3)Under Cover Removal (Refer to GROUP 42 – Under Cover.)

<2WD>





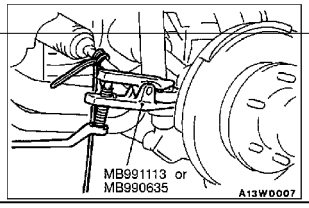
Sealant: 3M ATD Part No. 8661 or equivalent



Oil pump seal kit | Oil pump cartridge kit

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

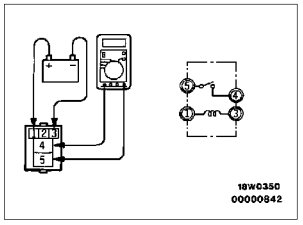
◀A▶ ◀B▶



REMOVAL SERVICE POINTS

◀A▶ TIE-ROD END DISCONNECTION

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

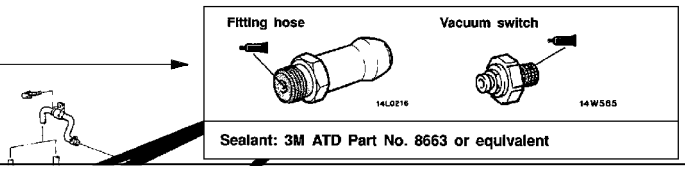


HEADLAMP RELAY CONTINUITY INSPECTION

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

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

Lubrication and sealing points



Sealant: 3M ATD Part No. 8663 or equivalent

00002471

N denotes non-reusable part.

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

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

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

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

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

HOW TO USE TROUBLESHOOTING/INSPECTION SERVICE POINTS

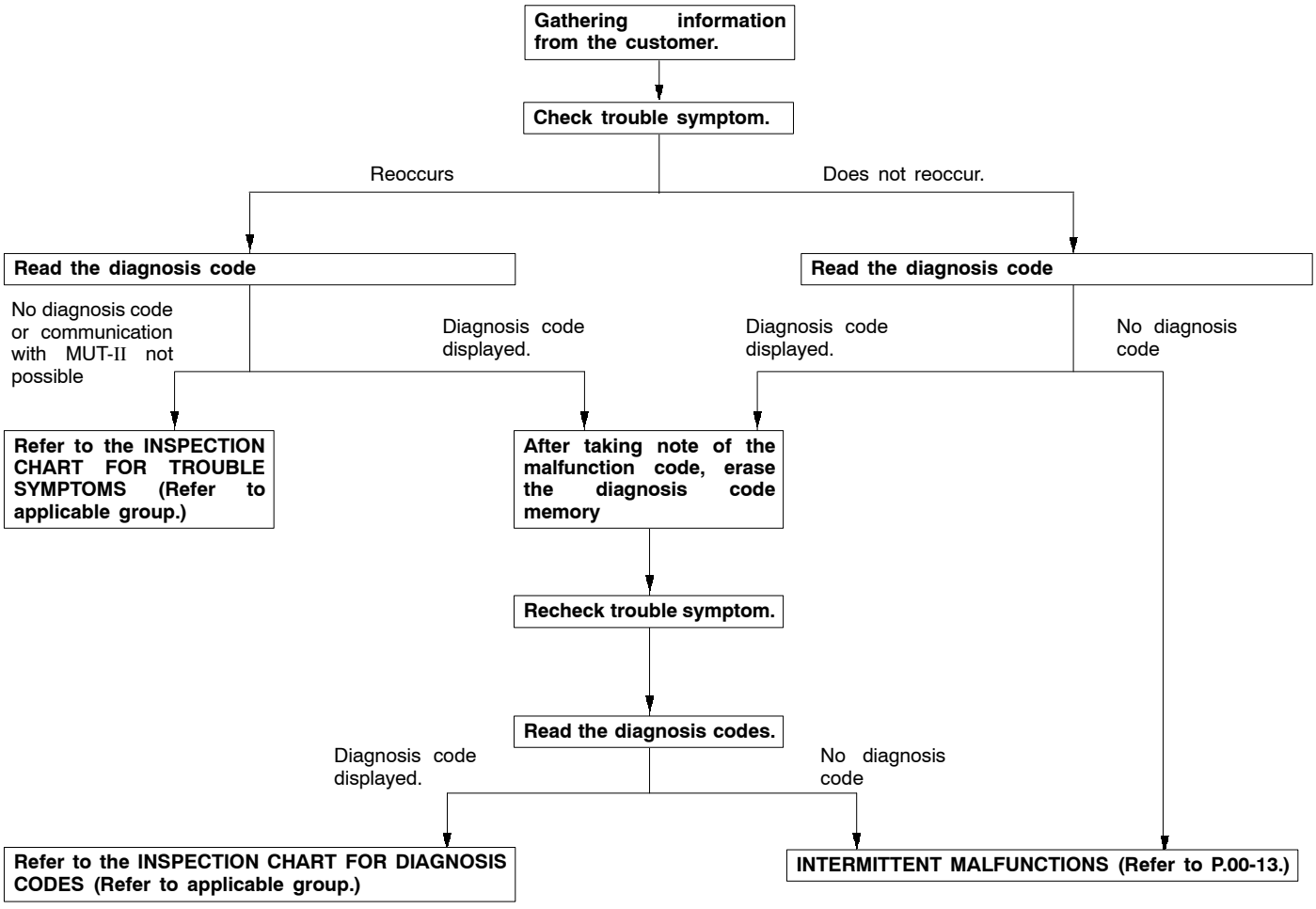
Troubleshooting of electronic control systems for which the MUT-II can be used follows the basic outline described below. Furthermore, even in systems for which the MUT-II cannot be used, part of these systems still follow this outline.

TROUBLESHOOTING CONTENTS

1. STANDARD FLOW OF DIAGNOSIS TROUBLESHOOTING

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

Diagnosis method



2. SYSTEM OPERATION AND SYMPTOM VERIFICATION TESTS

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

3. DIAGNOSIS FUNCTION

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

4. INSPECTION CHART FOR DIAGNOSIS CODES

5. INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Indicates the inspection procedures corresponding to each diagnosis code. (Refer to P.00-10 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.00-10 for how to use the inspection procedures.)

8. SERVICE DATA REFERENCE TABLE

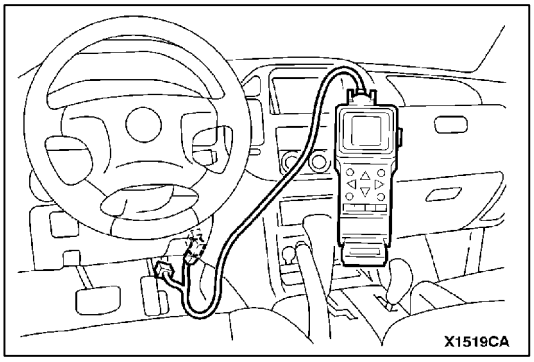
Inspection items and normal judgement values have been provided in this chart as reference information.

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.



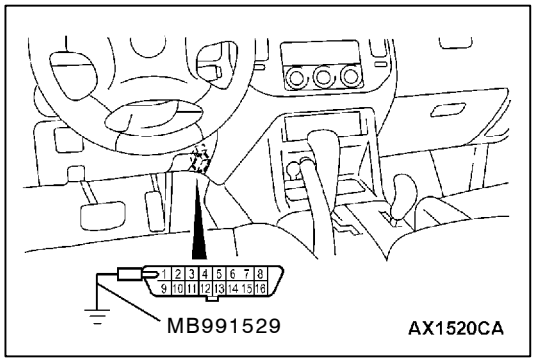
DIAGNOSIS FUNCTION

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 "LOCK(OFF)" position before connecting or disconnecting the MUT-II.



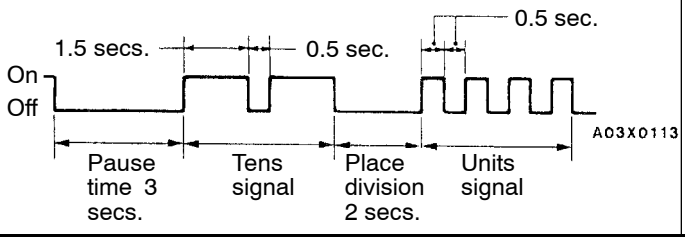
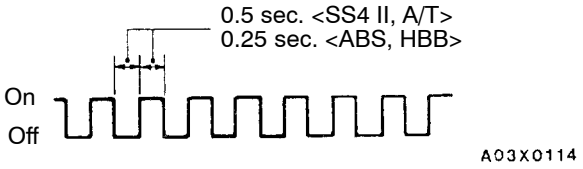
WHEN USING THE WARNING LAMP

1. Use the special tool to earth No.1 terminal (diagnosis control terminal) of the diagnosis connector.
2. Turn on the ignition switch.
3. Read out a diagnosis code by observing how the warning lamp flashes.

Applicable systems

System name	Warning lamp name
A/T	Neutral position indicator lamp
ABS	ABS warning lamp
SS4 II	4WD warning lamp
Hydraulic Brake Booster(HBB)	Brake warning lamp

Indication of diagnosis code by warning lamp

When the diagnosis code No.24 is output	When no diagnosis code is output*
	

NOTE
*: Even if the ABS system is normal, removing the valve relay causes the diagnosis code No.52 to be output.

METHOD OF ERASING DIAGNOSIS CODES

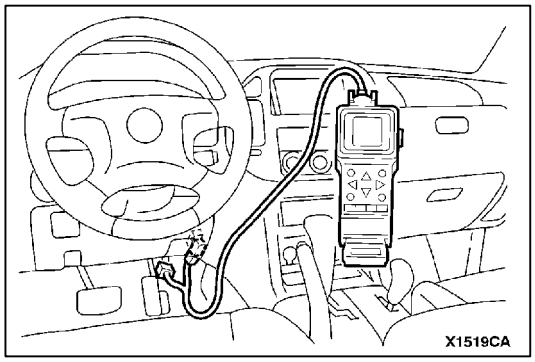
WHEN USING THE MUT-II

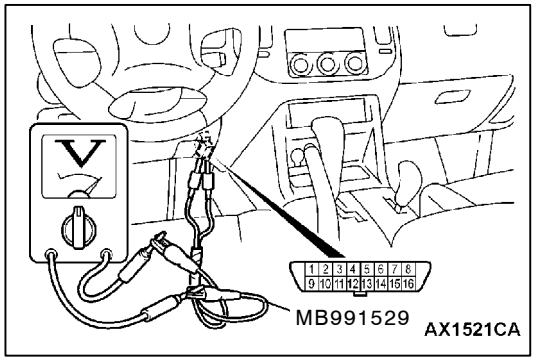
Connect the MUT-II to the diagnosis connector and erase the diagnosis code.

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

WHEN NOT USING THE MUT-II

1. Turn the ignition switch to "LOCK(OFF)" position.
2. After disconnecting the battery cable from the battery (-) terminal for 10 seconds or more, reconnect the cable.
3. After the engine has warmed up, run it at idle for about 15 minutes.





INPUT SIGNAL CHECK <SWS>

WHEN USING THE MUT-II

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

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

(2) If the MUT-II buzzer sounds once when each switch is operated (ON/OFF), the input signal for that switch circuit system is normal.

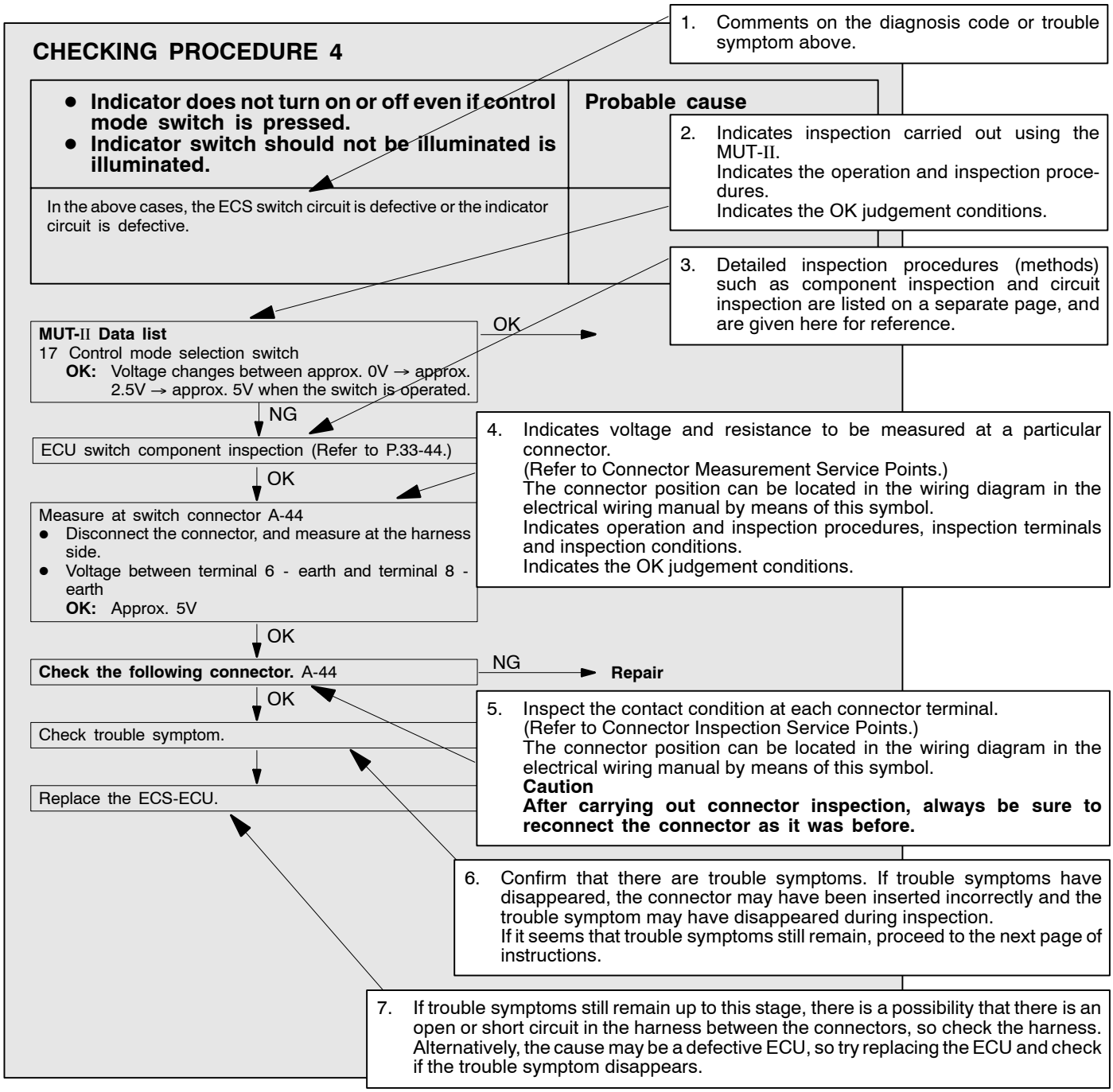
WHEN USING A VOLTMETER

(1) Use the special tool to connect the ETACS terminal (terminal 9) and the earth terminals (terminals 4 and 5) of the diagnosis connector to the voltage meter.

(2) If the needle of the voltage meter flickers once when each switch is operated (ON/OFF), the input signal for that switch circuit system is normal.

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

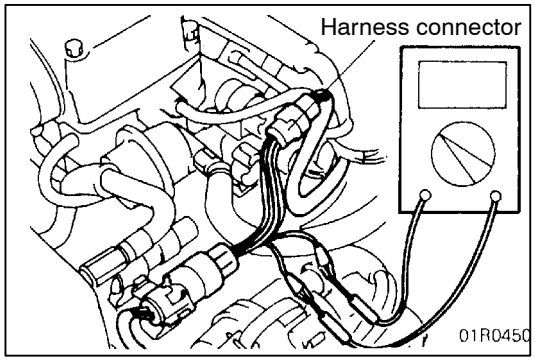
Check for an open or short circuit in the harness between the terminals which were defective according to the connector measurements. Carry out this inspection while referring to the electrical wiring manual. Here, “Check harness between power supply and terminal xx” also includes checking for blown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

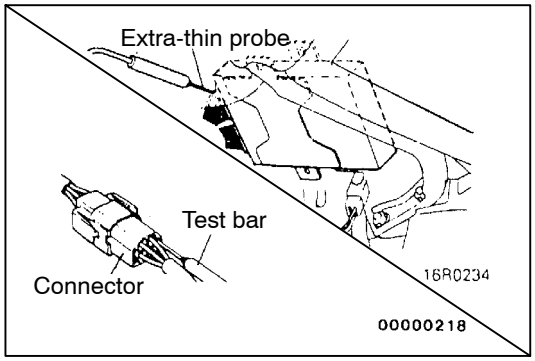
Turn the ignition switch to OFF when connecting disconnecting the connectors, and turn the ignition switch to ON when measuring if there are no instructions to be contrary.



IF INSPECTING WITH THE CONNECTOR CONNECTED (WITH CIRCUIT IN A CONDITION OF CONTINUITY)

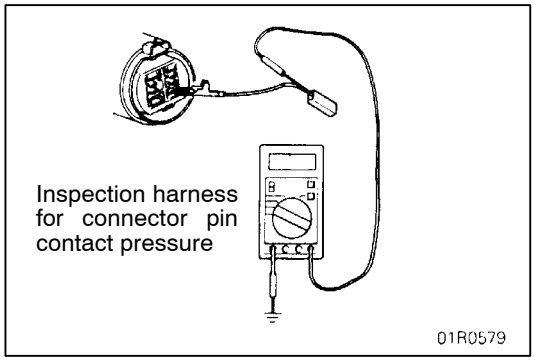
Waterproof Connectors

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

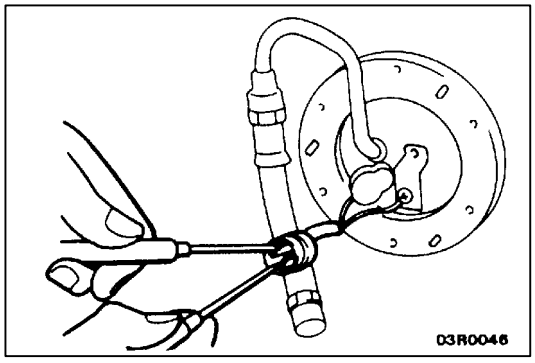
Check by inserting the test bar from the harness side. Note that if the connector (control unit, etc.) is too small to permit insertion of the test bar, it should not be forced; use a special tool (the extra-thin probe in the harness set for checking for this purpose.



IF INSPECTING WITH THE 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.

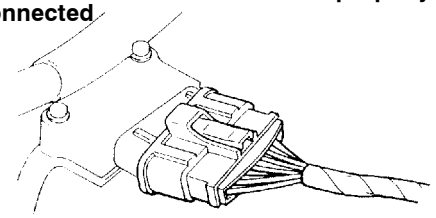


<When Inspecting a Male Pin>

Touch the pin directly with the test bar.

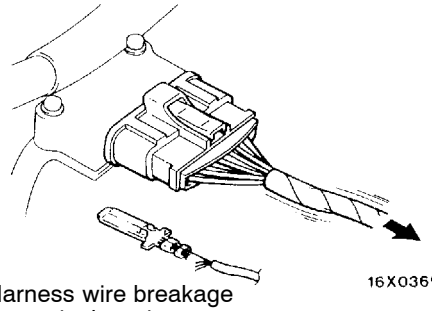
Caution
At this time, be careful not to short the connector pins with the test bars. To do so may damage the circuits inside the ECU.

Connector disconnected or improperly connected



16S0256

Defective connector contact



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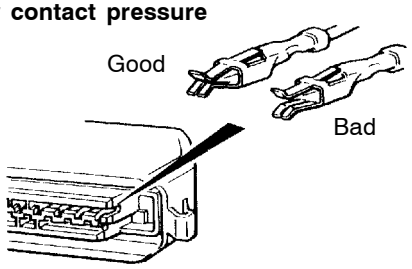
Harness wire breakage at terminal section

Low contact pressure



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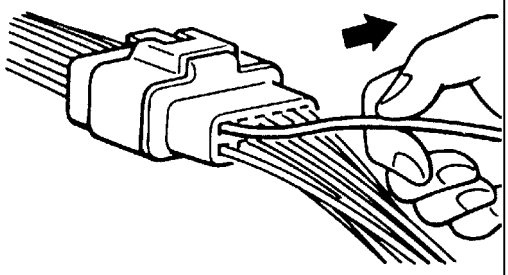
CONNECTOR INSPECTION

VISUAL INSPECTION

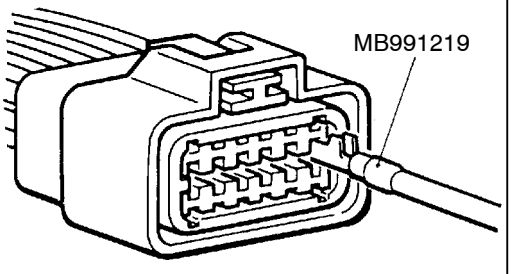
- Connector is disconnected or improperly connected
- Connector pins are pulled out
- Due to harness tension at terminal section
- Low contact pressure between male and female terminals
- Low connection pressure due to rusted terminals or foreign matter lodged in terminals



16R1317

CONNECTOR PIN INSPECTION

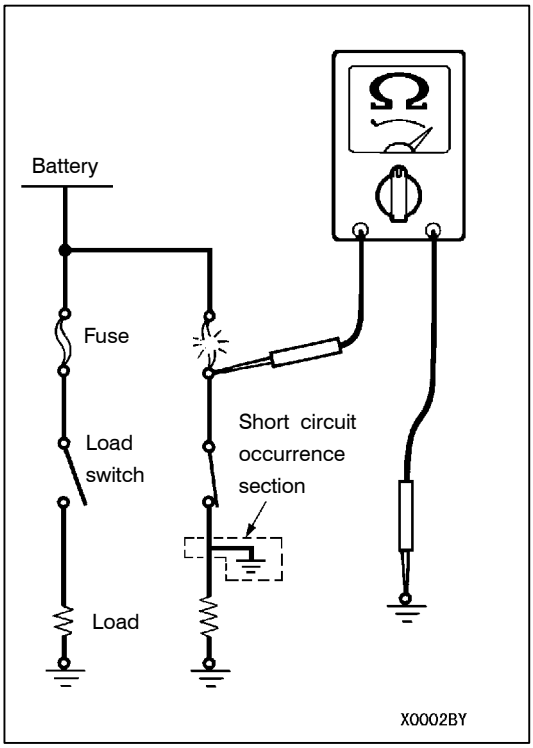
If the connector pin stopper is damaged, the terminal connections (male and female pins) will not be perfect even if the connector body is connected, and the pins may pull out of the reverse side of the connector. Therefore, gently pull the harnesses one by one to make sure that no pins pull out of the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



16R1318

CONNECTOR ENGAGEMENT INSPECTION

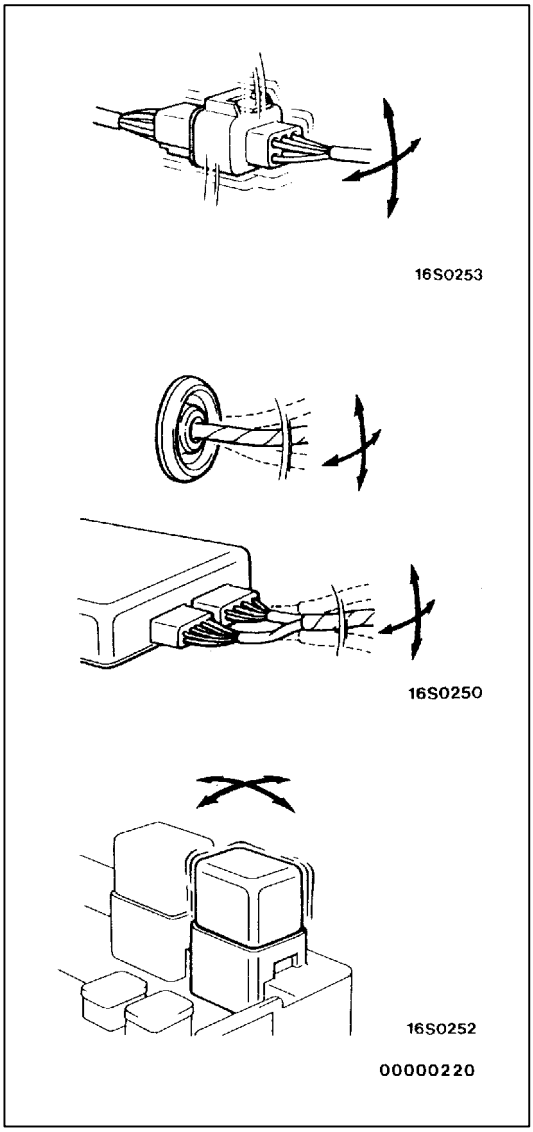
Use the special tool (connector pin connection pressure inspection harness of the inspection harness set) to inspect the engagement of the male pins and females pins. (Pin drawing force : 1 N or more)



INSPECTION SERVICE POINTS FOR A BLOWN FUSE

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

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



POINTS TO NOTE FOR INTERMITTENT MALFUNCTIONS

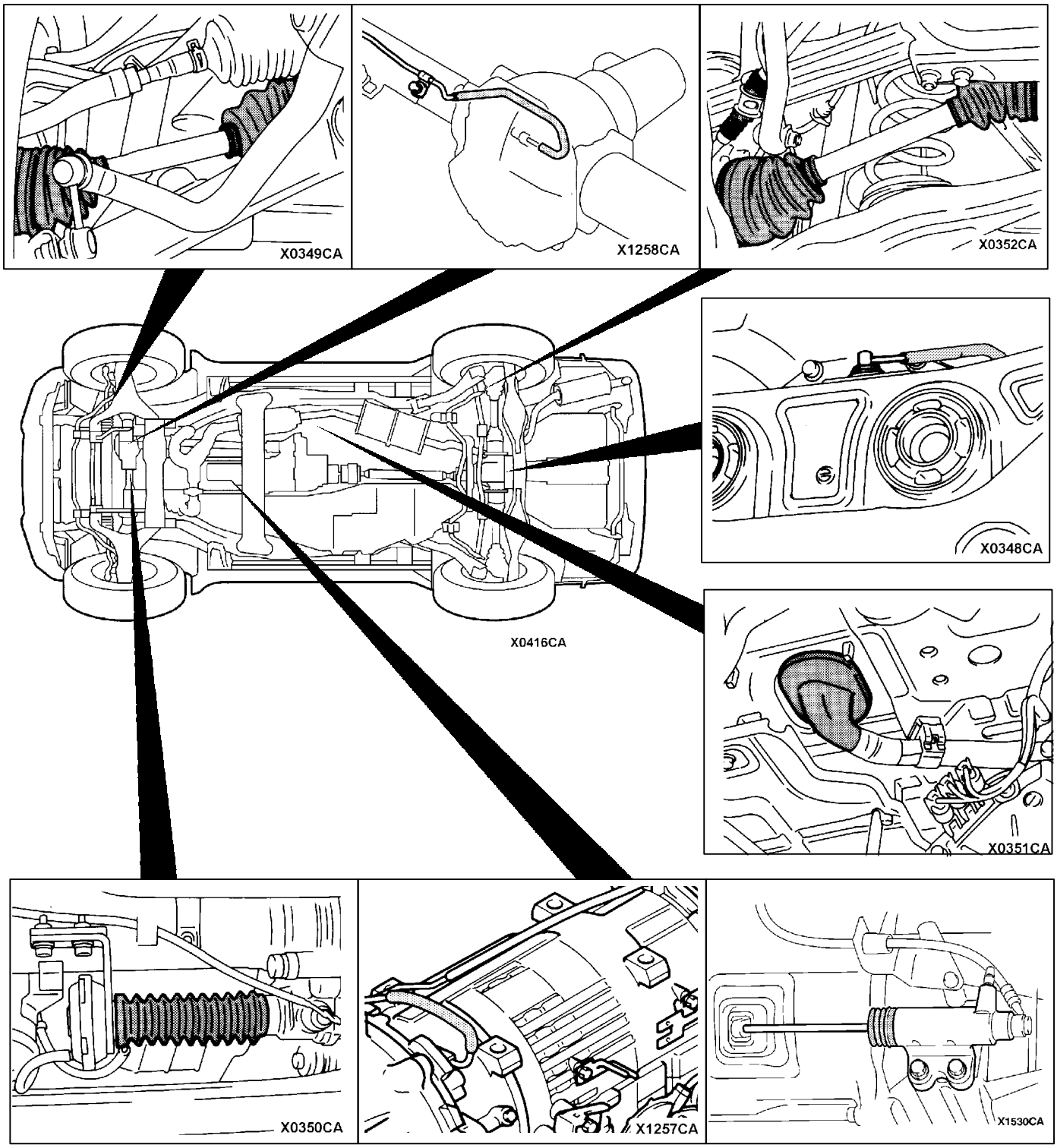
Intermittent malfunctions often occur under certain conditions, and if these conditions can be ascertained, determining the cause becomes simple. In order to ascertain the conditions under which an intermittent malfunction occurs, first ask the customer for details about the driving conditions, weather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

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

TREATMENT BEFORE/AFTER FORDING A STREAM

INSPECTION AND SERVICE BEFORE FORDING A STREAM

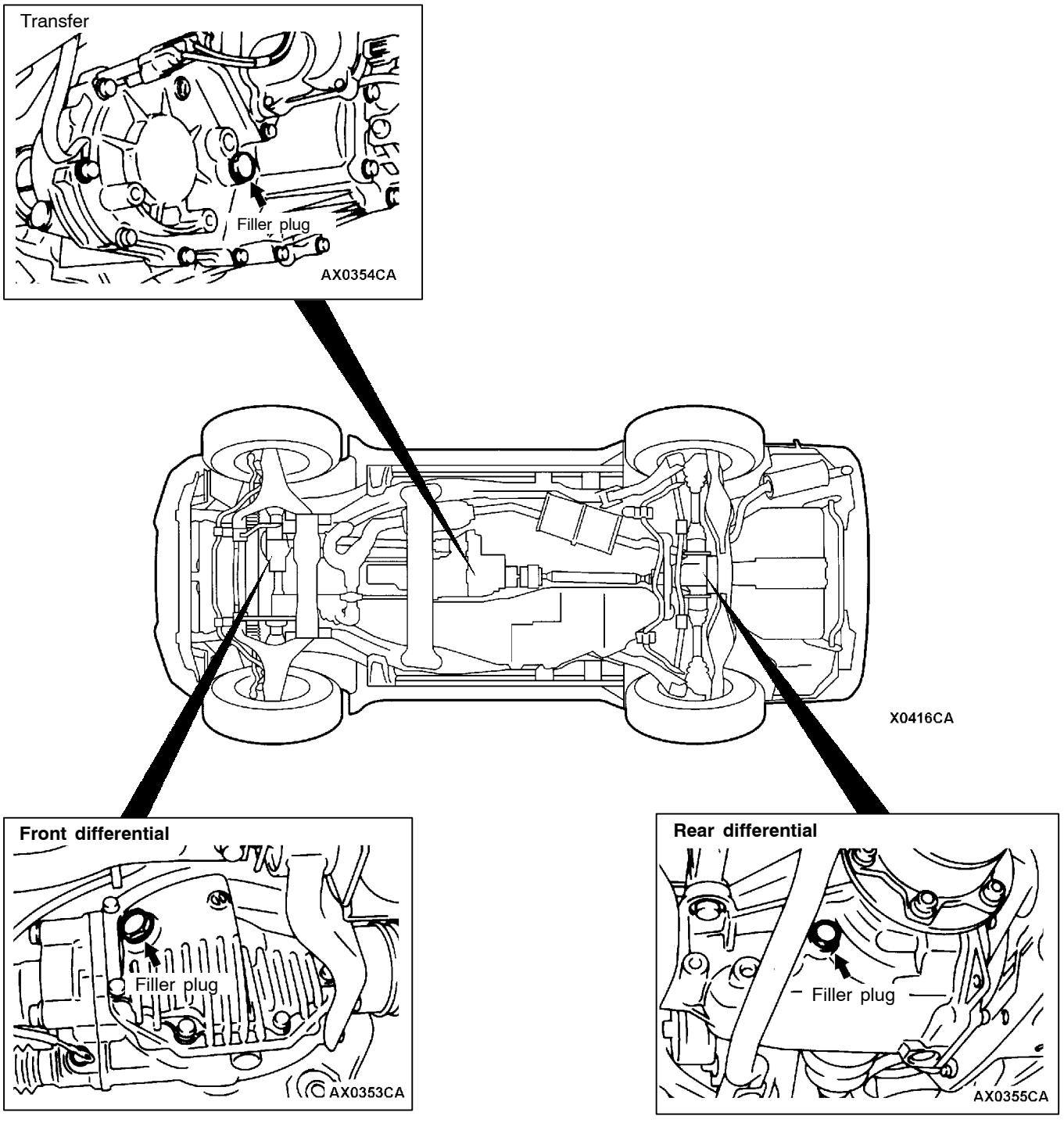
- Vehicles which are driven through water, or which may possibly be driven through water, should be subjected to the following inspections and maintenance procedures in advance.
- Inspect the dust boot and breather hose for cracks or damage, and replace them if cracks or damage are found.

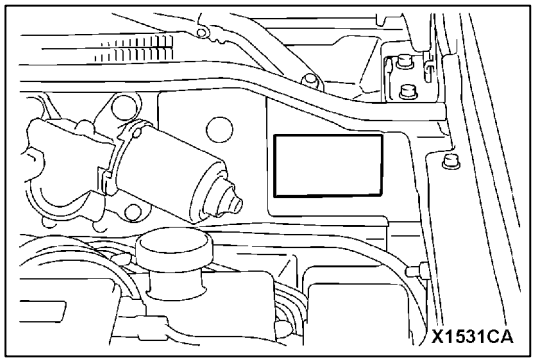


INSPECTION AND SERVICE AFTER FORDING A STREAM

After fording a stream, check the following points. If abnormal condition is evident, clean, replace or lubricate.

- Check for water, mud, sand, etc. in the rear brake drum, clutch housing, starter motor, brake pipe and fuel pipe.
- Check for water in the fluid or oil inside the front differential, rear differential, transmission and transfer.
- Check all boots and breather hoses for cracks and damage.



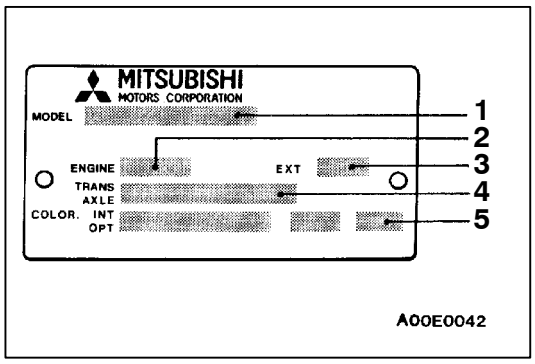


VEHICLE IDENTIFICATION

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	
1	MODEL	V65W MYHCL6	V65W: Vehicle model
			MYHCL6: Model series
2	ENGINE	6G74GDI	Engine model
3	EXT	S74B	Exterior code
4	TRANS AXLE	V5A51	Transmission code
5	COLOR INT OPT	S74 15Q Z06	S74: Body colour code
			15Q: Interior code
			Z06: 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

<Short wheelbase>

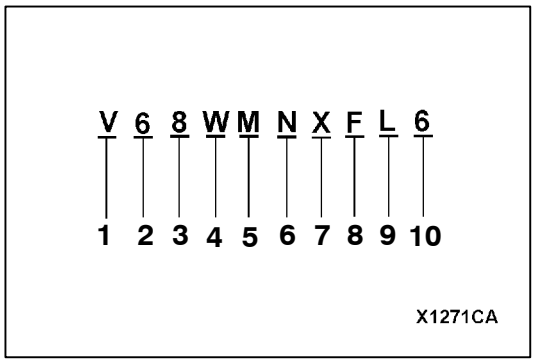
Model code		Engine model	Transmission model	Fuel supply system
V64W	MNDFL6	4D56 Intercooler Turbo (2,477 mL)	V5MT1 <5M/T>	Inyection
	MNHFL6		V5M31 <5M/T>	
	MNHFR6			
	MNXFL6			
	MNXFR6			

Model code		Engine model	Transmission model	Fuel supply system
V68W	MNDFL6	4M41-DOHC Intercooler Turbo (3,200 mL)	V5M31 <5M/T>	Electronically-controlled high pressure fuel distribution
	MNHFL6			
	MYHFL6		V5A51 <5A/T>	
	MNXFL6		V5M31 <5M/T>	
	MNXFR6			
	MYXFL6		V5A51 <5A/T>	
	MYXFR6			
V65W	MNHCL6	6G74GDI (3,496 mL)	V5M31 <5M/T>	GDI
	MNHCR6			
	MYHCL6		V5A51 <5A/T>	
	MYHCR6			
	MNXCL6		V5M31 <5M/T>	
	MNXCR6			
	MYXCL6		V5A51 <5A/T>	
	MYXCR6			

<Long wheelbase>

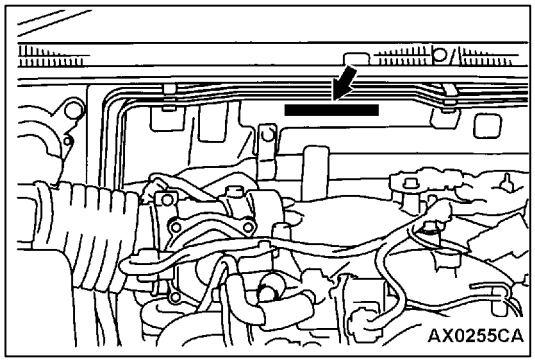
Model code		Engine model	Transmission model	Fuel supply system
V74W	LNDFL6	4D56 Intercooler Turbo (2,477 mL)	V5MT1 <5M/T>	Inyection
	LNHFL6		V5M31 <5M/T>	
	LNXFL6			
V78W	LNDFL6	4M41-DOHC Intercooler Turbo (3,200 mL)	V5M31 <5M/T>	Electronically-controlled high pressure fuel distribution
	LNHFL6			
	LNHFR6			
	LYHFL6		V5A51 <5A/T>	
	LYHFR6			
	LNXFL6		V5M31 <5M/T>	
	LNXFR6			
	LYXFL6		V5A51 <5A/T>	
	LYXFR6			

Model code		Engine model	Transmission model	Fuel supply system
V75W	LNHCL6	6G74GDI (3,496 mL)	V5M31 <5M/T>	GDI
	LNHCR6			
	LYHCL6		V5A51 <5A/T>	
	LYHCR6			
	LNXCL6		V5M31 <5M/T>	
	LNXCR6			
	LYXCL6		V5A51 <5A/T>	
	LYXCR6			



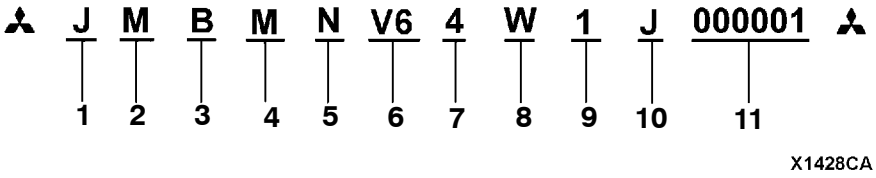
MODEL CODE

No.	Items	Contents
1	Development	V: MITSUBISHI PAJERO
2	wheelbase	6: Short wheelbase 7: Long wheelbase
3	Engine type	4: 2,477 mL diesel engine 5: 3,496 mL petrol engine 8: 3,200 mL diesel engine
4	Sort	W: Wagon
5	Body style	M: 3-door L: 5-door
6	Transmission type	N: 5-speed manual transmission Y: 5-speed automatic transmission
7	Trim level	D: GL H: GLX X: GLS
8	Specification engine feature	C: GDI F: Intercooler Turbocharger
9	Steering wheel location	L: Left hand R: Right hand
10	Destination	6: For Europe

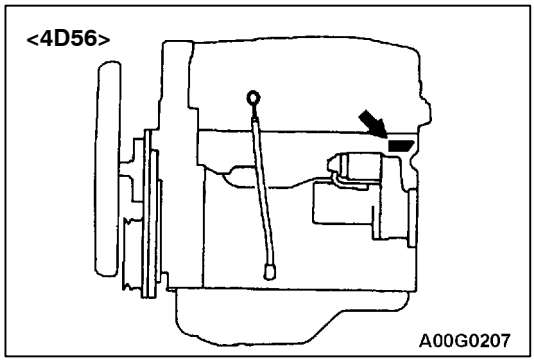


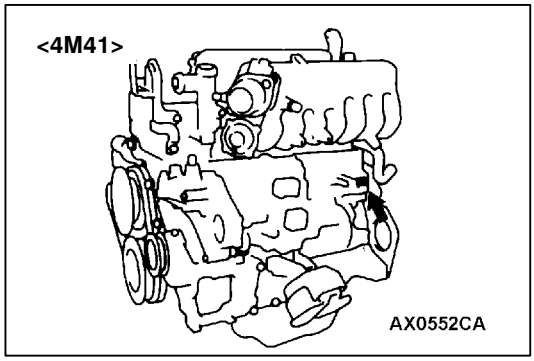
CHASSIS NUMBER

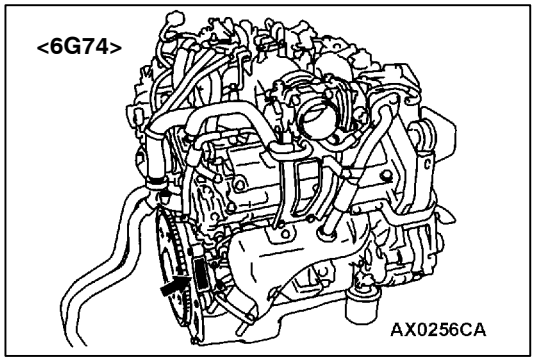
The chassis number is stamped on the toeboard inside the engine compartment.



No.	Items		Contents
1	Fixed figure	J	Asia
2	Distribution channel	M	Japan channel
3	Destination	A	For Europe, right hand drive
		B	For Europe, left hand drive
4	Body style	M	3-door
		L	5-door
5	Transmission type	N	5-speed manual transmission
		Y	5-speed automatic transmission
6	Development order	V6	MITSUBISHI PAJERO short wheelbase
		V7	MITSUBISHI PAJERO long wheelbase
7	Engine	4	4D56: 2,477 mL diesel engine
		5	6G74: 3,496 mL petrol engine
		8	4M41: 3,200 mL diesel engine
8	Sort	W	Station wagon
9	Model year	1	2001
10	Plant	J	Nagoya-3
11	Serial number	-	-







ENGINE MODEL NUMBER

1. The engine model number is stamped at the cylinder block as shown in the following.

Engine model	Engine displacement mL
4D56	2,477
4M41	3,200
6G74	3,496

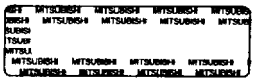
2. The engine serial number is stamped near the engine model number.

Engine serial number	AA0201 to YY9999

THEFT PROTECTION LABEL

FOR MAIN OUTER PANELS

[FOR ORIGINAL PARTS]



[FOR REPLACEMENT PARTS]

X1629CA

THEFT PROTECTION<R.H.D.>

In order to protect against theft, a Vehicle Identification Number (VIN) is attached as a plate or label to the following major parts of the main outer panels:

Fender, Doors, Back door, Quarter panel, Hood, Bumpers

In addition, a theft-protection label is attached to replacement parts for the body outer panel main components.

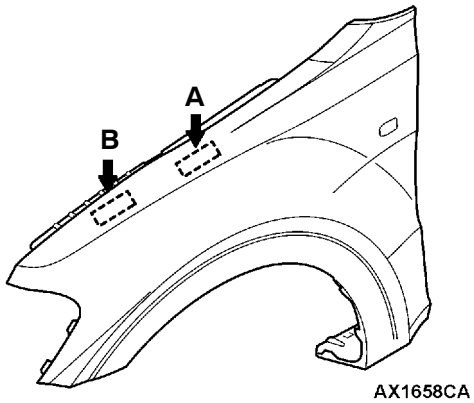
Cautions regarding panel repairs:

1. **When repainting original parts, do so after first masking the theft-protection label, and, after painting, be sure to peel off the masking tape.**
2. **The theft-protection label for replacement parts is covered by masking tape, so such parts can be painted as is. The masking tape should be removed after painting is finished.**
3. **The theft-protection label should not be removed from original parts or replacement parts.**

LOCATIONS

TARGET AREA (A: FOR ORIGINAL EQUIPMENT PARTS, B: FOR REPLACEMENT PARTS)

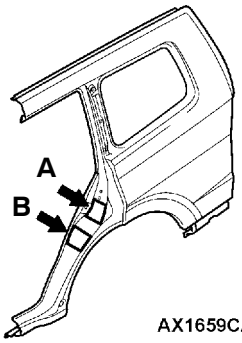
Fender



AX1658CA

The illustration indicates left outer side. Right side is symmetrically opposite.

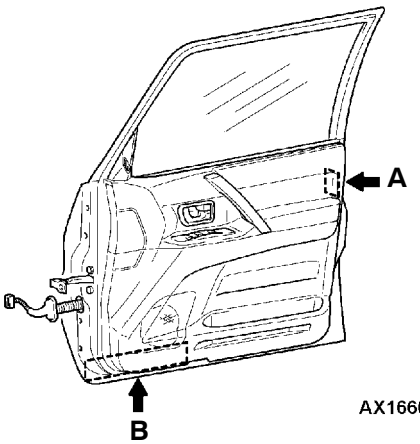
Quarter panel



AX1659CA

The illustration indicates left outer side. Right side is symmetrically opposite.

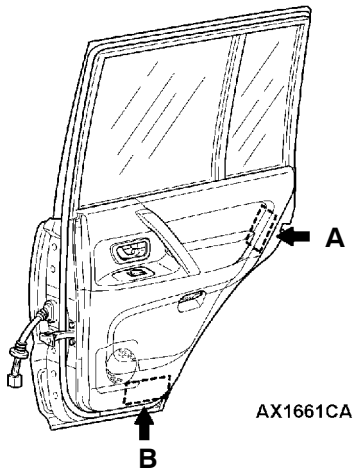
Front door



AX1660CA

The illustration indicates right outer side.
Left side is symmetrically opposite.

Rear door

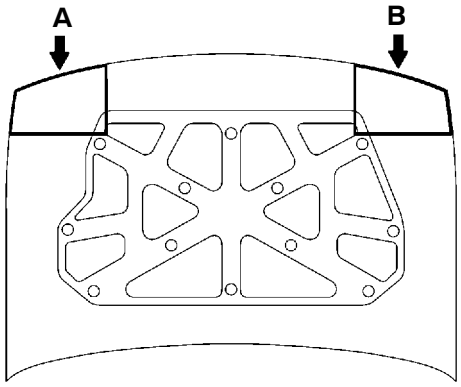


AX1661CA

The illustration indicates right outer side.
Left side is symmetrically opposite.

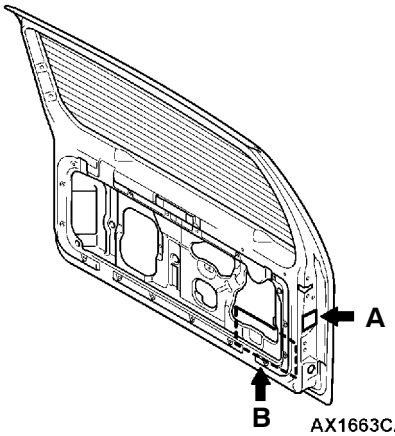
TARGET AREA (A: FOR ORIGINAL EQUIPMENT PARTS, B: FOR REPLACEMENT PARTS)

Hood



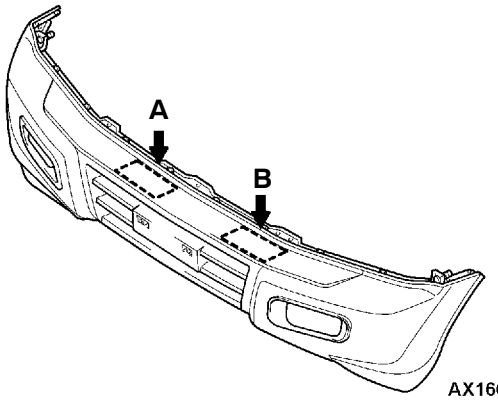
AX1662CA

Back door



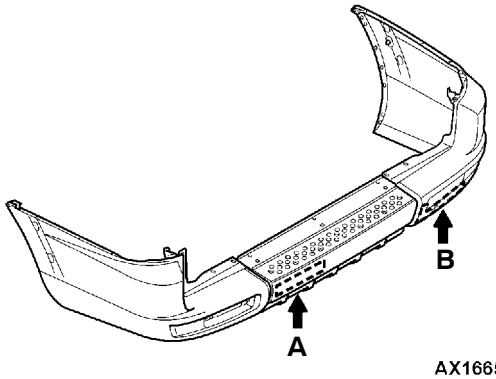
AX1663CA

Front bumper



AX1664CA

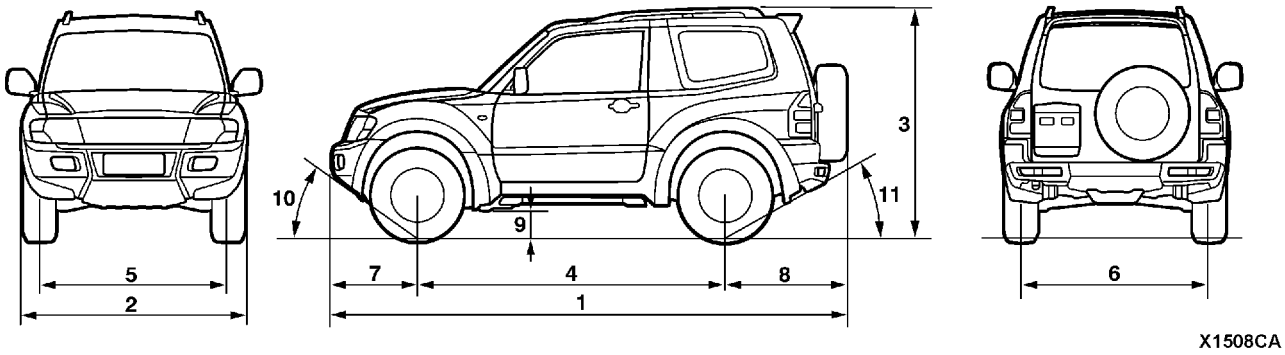
Rear bumper



AX1665CA

MAJOR SPECIFICATIONS

<Short wheelbase>



X1508CA

Items			V64W			V68W	
			MNDFL6	MNHFL6, MNHFR6	MNXFL6, MNXFR6	MNDFL6	MNHFL6
Vehicle dimensions mm	Overall length	1	4,260		4,280	4,260	
	Overall width	2	1,845		1,875	1,845	
	Overall height (unladen)	3	1,845,1,875*1				
	Wheelbase	4	2,545				
	Track-front	5	1,560				
	Track-rear	6	1,560				
	Overhang-front	7	710				
	Overhang-rear	8	1,005*2, 1,025*3				
	Ground clearance (unladen)	9	235			225	
	Angle of approach degrees	10	42*				
	Angle of departure degrees	11	33.5*				
Vehicle weight kg	Kerb weight		1,865	1,900	1,920	1,975	1,980
	Max. gross vehicle weight		2,510				
	Max. axle weight rating-front		1,070	1,090	1,100	1,165	
	Max. axle weight rating-rear		1,440	1,420	1,410	1,345	
Seating capacity			5				
Engine	Model No.		4D56 Intercooler Turbo			4M41-DOHC Intercooler Turbo	
	Total displacement mL		2,477			3,200	
Transmis-sion	Model No.		V5MT1	V5M31			
	Type		5-speed manual				
Fuel system	Fuel supply system		Inyection			Electronically-controlled high pressure fuel distribution	

NOTE:
*1: Vehicles with roof rails
*2: Vehicles with 235/80R16 Tyre
*3: Vehicles with 265/70R16 Tyre

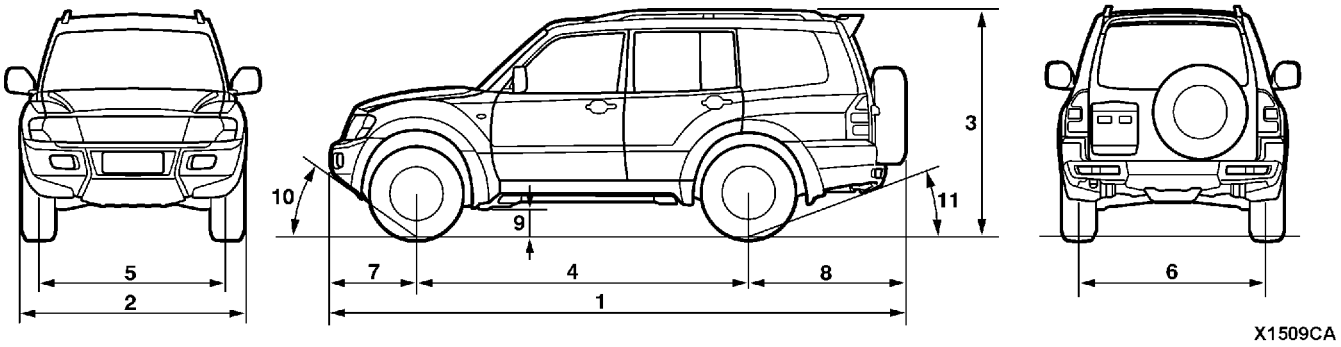
Items			V68W			V65W	
			MYHFL6	MNXFL6, MNXFR6	MYXFL6, MYXFR6	MNHCL6, MNHCR6	MYHCL6, MYHCR6
Vehicle dimensions mm	Overall length	1	4,260	4,280			
	Overall width	2	1,845	1,875		1,845	
	Overall height (unladen)	3	1,845,1,875*1				
	Wheelbase	4	2,545				
	Track-front	5	1,560				
	Track-rear	6	1,560				
	Overhang-front	7	710				
	Overhang-rear	8	1,005*2, 1,025*3				
	Ground clearance (unladen)	9	225			235	
	Angle of approach degrees	10	42*				
	Angle of departure degrees	11	33.5*				
Vehicle weight kg	Kerb weight		1,980	2,000		1,915	
	Max. gross vehicle weight		2,510				
	Max. axle weight rating-front		1,165	1,170		1.075	
	Max. axle weight rating-rear		1,345	1,340		1,435	
Seating capacity			5				
Engine	Model No.		4M41-DOHC Intercooler Turbo			6G74GDI	
	Total displacement mL		3,200			3,496	
Transmis-sion	Model No.		V5A51	V5M31	V5A51	V5M31	V5A51
	Type		5-speed automatic	5-speed manual	5-speed automa-tic	5-speed manual	5-speed automatic
Fuel system	Fuel supply system		Electronically-controlled high pressure fuel distribution			GDI	

NOTE:
*1: Vehicles with roof rails
*2: Vehicles with 235/80R16 Tyre
*3: Vehicles with 265/70R16 Tyre

Items			V65W	
			MNXCL6, MNXCR6	MYXCL6, MYXCR6
Vehicle dimensions mm	Overall length	1	4,280	
	Overall width	2	1,875	
	Overall height (unladen)	3	1,845,1,875*1	
	Wheelbase	4	2,545	
	Track-front	5	1,560	
	Track-rear	6	1,560	
	Overhang-front	7	710	
	Overhang-rear	8	1,005*2, 1,025*3	
	Ground clearance (unladen)	9	235	
	Angle of approach degrees	10	42*	
	Angle of departure degrees	11	33.5*	
Vehicle weight kg	Kerb weight		1,935	
	Max. gross vehicle weight		2,510	
	Max. axle weight rating-front		1,080	
	Max. axle weight rating-rear		1,430	
Seating capacity			5	
Engine	Model No.		6G74GDI	
	Total displacement mL		3,496	
Transmis-sion	Model No.		V5M31	V5A51
	Type		5-speed manual	5-speed automatic
Fuel system	Fuel supply system		GDI	

NOTE:
*1: Vehicles with roof rails
*2: Vehicles with 235/80R16 Tyre
*3: Vehicles with 265/70R16 Tyre

<Long wheelbase>



Items			V74W			V78WL	
			LNDFL6	LNHFL6	LNXFL6	LNDFL6	LNHFL6, LNHFR6
Vehicle dimensions mm	Overall length	1	4,775		4,795	4,775	
	Overall width	2	1,845		1,875	1,845	
	Overall height (unladen)	3	1,855,1,885*1				
	Wheelbase	4	2,780				
	Track-front	5	1,560				
	Track-rear	6	1,560				
	Overhang-front	7	710				
	Overhang-rear	8	1,285*2, 1,305*3				
	Ground clearance (unladen)	9	235			225	
	Angle of approach degrees	10	42*				
	Angle of departure degrees	11	24*				
Vehicle weight kg	Kerb weight		2,015	2,055	2,090	2,120	2,125
	Max. gross vehicle weight		2,760				
	Max. axle weight rating-front		1,110	1,110	1,125	1,160	
	Max. axle weight rating-rear		1,650	1,650	1,635	1,600	
Seating capacity			7				
Engine	Model No.		4D56 Intercooler Turbo			4M41-DOHC Intercooler Turbo	
	Total displacement mL		2,477			3,200	
Transmis-sion	Model No.		V5MT1	V5M31			
	Type		5-speed manual				
Fuel system	Fuel supply system		Inyection			Electronically-controlled high pressure fuel distribution	

NOTE:
*1: Vehicles with roof rails
*2: Vehicles with 235/80R16 Tyre
*3: Vehicles with 265/70R16 Tyre

Items			V78W			V75W	
			LYHFL6, LYHFR6	LNXFL6, LNXFR6	LYXFL6, LYXFR6	LNHCL6, LNHCR6	LYHCL6, LYHCR6
Vehicle dimensions mm	Overall length	1	4,775	4,795			
	Overall width	2	1,845	1,875		1,845	
	Overall height (unladen)	3	1,855,1,885*1				
	Wheelbase	4	2,780				
	Track-front	5	1,560				
	Track-rear	6	1,560				
	Overhang-front	7	710				
	Overhang-rear	8	1,285*2, 1,305*3				
	Ground clearance (unladen)	9	225			235	
	Angle of approach degrees	10	42*				
	Angle of departure degrees	11	24*				
Vehicle weight kg	Kerb weight		2,125	2,155		2,060	
	Max. gross vehicle weight		2,760		2,800	2,760	
	Max. axle weight rating-front		1,160			1,110	
	Max. axle weight rating-rear		1,600			1,650	
Seating capacity			7				
Engine	Model No.		4M41-DOHC Intercooler Turbo			6G74GDI	
	Total displacement mL		3,200			3,496	
Transmis-sion	Model No.		V5A51	V5M31	V5A51	V5M31	V5A51
	Type		5-speed automatic	5-speed manual	5-speed auto-matic	5-speed manual	5-speed automatic
Fuel system	Fuel supply system		Electronically-controlled high pressure fuel distribution			GDI	

NOTE:
*1: Vehicles with roof rails
*2: Vehicles with 235/80R16 Tyre
*3: Vehicles with 265/70R16 Tyre

Items			V75W	
			LNXCL6, LNXCR6	LYXCL6, LYXCR6
Vehicle dimensions mm	Overall length	1	4,795	
	Overall width	2	1,875	
	Overall height (unladen)	3	1,855,1,885*1	
	Wheelbase	4	2,780	
	Track-front	5	1,560	
	Track-rear	6	1,560	
	Overhang-front	7	710	
	Overhang-rear	8	1,285*2, 1,305*3	
	Ground clearance (unladen)	9	235	
	Angle of approach degree	10	42*	
	Angle of departure degree)	11	24*	
Vehicle weight kg	Kerb weight		2,095	
	Max. gross vehicle weight		2,760	
	Max. axle weight rating-front		1,110	
	Max. axle weight rating-rear		1,650	
Seating capacity			7	
Engine	Model No.		6G74GDI	
	Total displacement mL		3,496	
Transmis-sion	Model No.		V5M31	V5A51
	Type		5-speed manual	5-speed automatic
Fuel system	Fuel supply system		GDI	

NOTE:
*1: Vehicles with roof rails
*2: Vehicles with 235/80R16 Tyre
*3: Vehicles with 265/70R16 Tyre

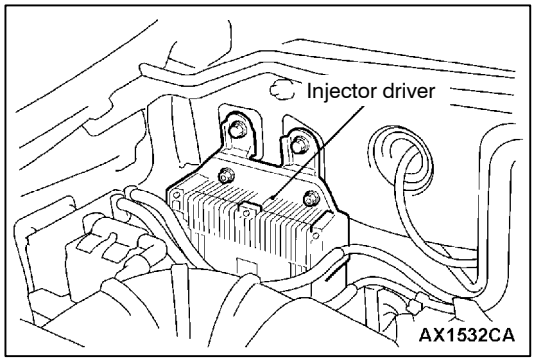
PRECAUTIONS BEFORE SERVICE

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 system is designed to retain enough voltage to deploy the air bag even after the battery has been disconnected. Serious injury may result from unintended air bag deployment if work is done on the SRS system immediately after the battery cable is disconnected.
   (3) Warning labels must be heeded when servicing or handling SRS components. Warning labels are located in the following locations.
   - Hood
   - Sun visor
   - Glove box
   - SRS-ECU
   - Steering wheel
   - Steering gearbox
   - Air bag module (driver's side and front passenger's side)
   - Front impact sensor
   - Clock spring
   - Side air bag module
   - Side impact sensor

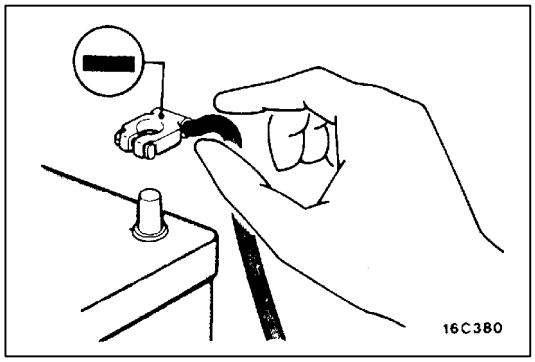
   (4) Always use the designated special tools and test equipment.
   (5) Store components removed from the SRS in a clean and dry place.
   The air bag module should be stored on a flat surface and placed so that the pad surface is facing upward.
   Do not place anything on top of it.
   (6) Never attempt to disassemble or repair the SRS components (SRS-ECU, air bag module, clock spring).
   (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 module or disposing of a vehicle equipped with an 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, so remove the SRS components before drying or baking the vehicle after painting.
   - SRS-ECU, air bag module, clock spring, front and side impact sensors: 93°C or more

   After re-installing them, check the SRS warning lamp operation to make sure that the system functions properly.



SERVICING INJECTOR DRIVER

After driving the vehicle, the injector driver will be hot. In addition, high voltages and high currents are supplied to the injector driver and the injectors while the engine is running, so take sufficient care when handling the injector driver and surrounding components at such times.



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.)

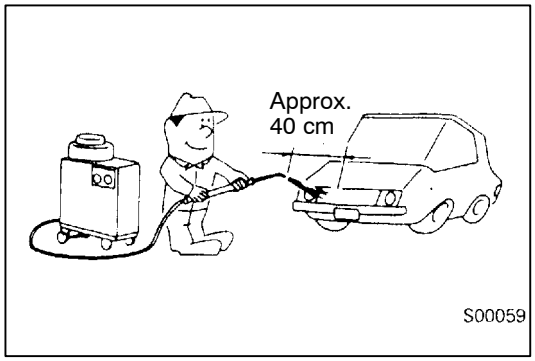
APPLICATION OF ANTI-CORROSION AGENTS AND UNDERCOATS

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.

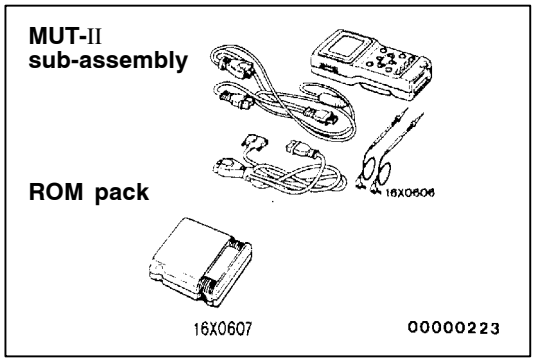
- Engine coolant temperature: 80 - 90°C
- Lamps, electric cooling fan and all accessories: OFF
- M/T: Neutral
- A/T: P range



VEHICLE WASHING

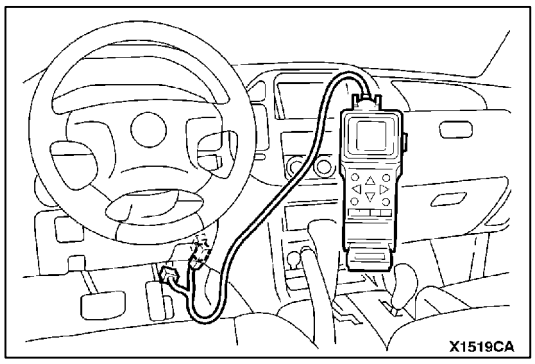
If high-pressure car-washing equipment or steam car-washing equipment is used to wash the vehicle, be sure to note the following information in order to avoid damage to plastic components, etc.

- 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
Connection and disconnection of the MUT-II should always be made with the ignition switch in the "LOCK(OFF)" position.

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:

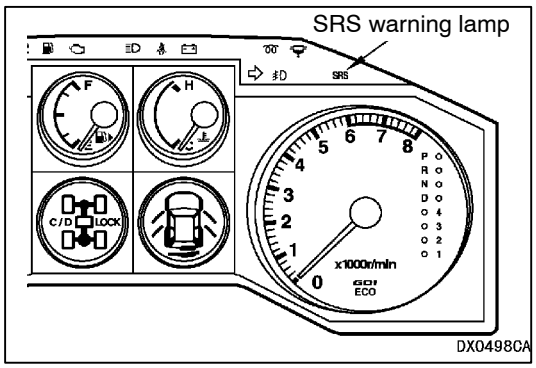
- Avoid prolonged and repeated contact with oils, particularly used engine oils.
- Wear protective clothing, including impervious gloves where practicable.
- Avoid contaminating clothes, particularly underpants, with oil.
- Do not put oily rags in pockets, the use of overalls without pockets will avoid 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.

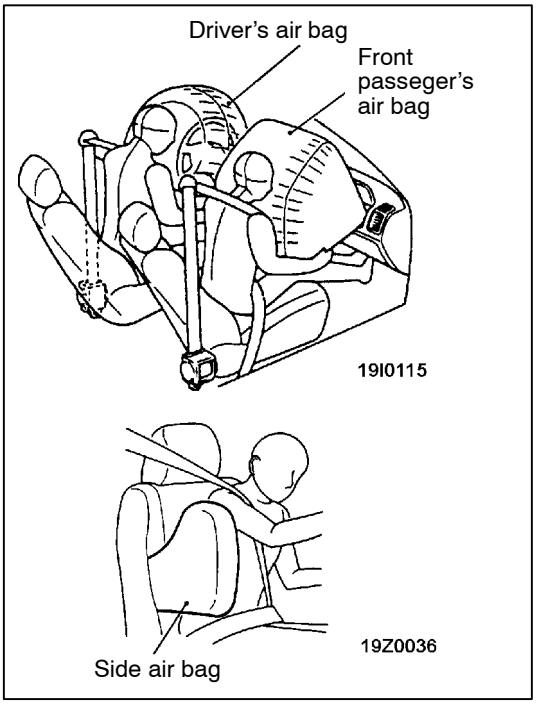
SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

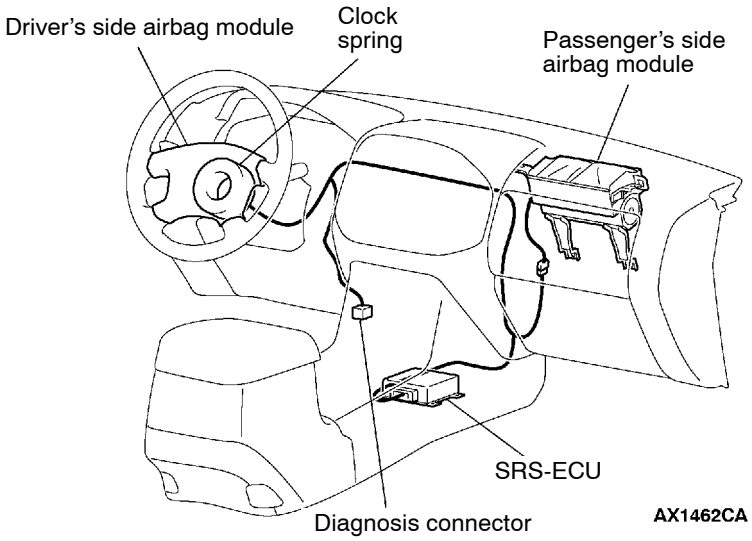
To improve safety, the SRS is available as optional parts. This system enhances collision safety by restraining the front occupants in case of an accident.

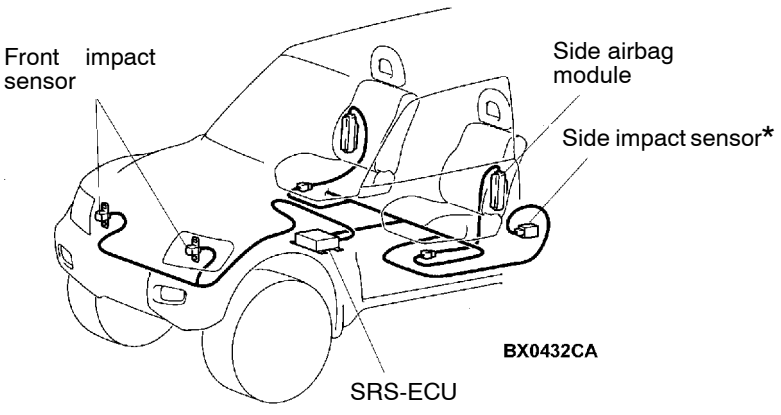
The SRS consists of four air bag modules, SRS air bag control unit (SRS-ECU), front and side impact sensors, SRS warning lamp and clock spring. The air bags are located in the centre of the steering wheel, above the glove box, and built into the front seat back assemblies. Each air bag has a folded air 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 in the headlamp support. The side impact sensors are installed inside the center pillars 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 front or side of the vehicle is stronger than a certain set value, in order to protect the front seat occupant's torso in the event of a collision. Only authorized service personnel should do work on or around the SRS components. Those service personnel should read this manual carefully before starting any such work. Extreme care must be used when servicing the SRS to avoid injury to the service personnel (by inadvertent deployment of the air bags) or the driver (by rendering the SRS inoperative).









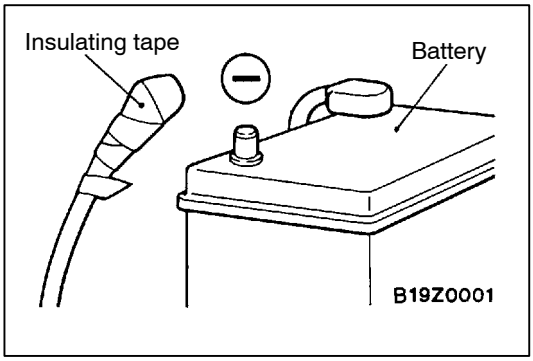
NOTE

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

SRS SERVICE PRECAUTIONS

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

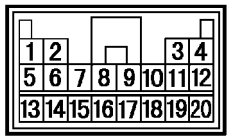
   NOTE
   If any of these components are diagnosed as faulty, they should only be replaced, in accordance with the INDIVIDUAL COMPONENTS SERVICE procedures in this manual. (Refer to GROUP 52B.)



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

<Vehicles without SRS side air bag>



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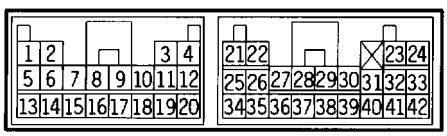
<Vehicles with SRS side air bag>



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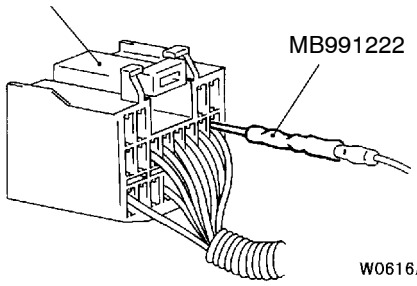
5. Do not attempt to repair the wiring harness connectors of the SRS. If the connector(s) are diagnosed as defective, replace the wiring harness(es). If the harness(es) are diagnosed as faulty, replace or repair the wiring harness(es) according to the table that follows.

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	Repair or replace Instrument panel wiring harness
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 Instrument panel wiring harness. Replace clock spring.
13	Instrument panel wiring harness → Junction block (fuse No.8)	Repair or replace Instrument panel wiring harness.
16	Instrument panel wiring harness → Junction block (fuse No.6)	
20	Instrument panel wiring harness → Diagnosis connector	
21, 22	Side air bag wiring harness → Side air bag module (L.H.)	Repair or replace side air bag wiring harness.
23, 24	Side air bag wiring harness → Side air bag module (R.H.)	
34, 35, 36	Side air bag wiring harness → Floor wiring harness → Side impact sensor (L.H.)	Repair or each wiring harness.
40, 41, 42	Side air bag wiring harness → Floor wiring harness → Side impact sensor (R.H.)	

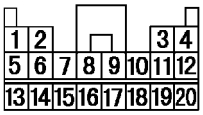
6. Inspection of the SRS-ECU harness connector should be carried out by the following procedure.
   Insert the special tool (probe, MB991222, in the harness set) into the connector from harness side (rear side), and connect the tester to this probe. If any tool than specified is used, damage to the harness 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.

<Vehicles without SRS side air bag>

SRS-ECU harness connector

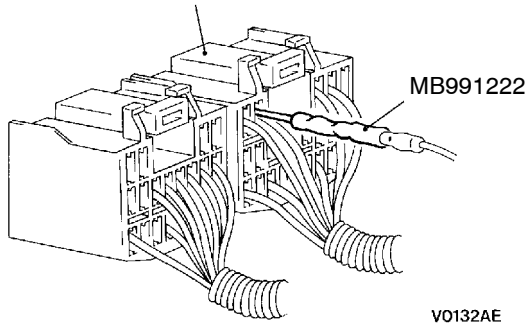


SRS-ECU harness connector (rear view)

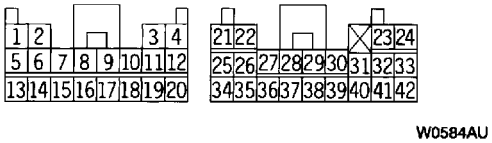


<Vehicles with SRS side air bag>

SRS-ECU harness connector



SRS-ECU harness connector (rear view)



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, 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.

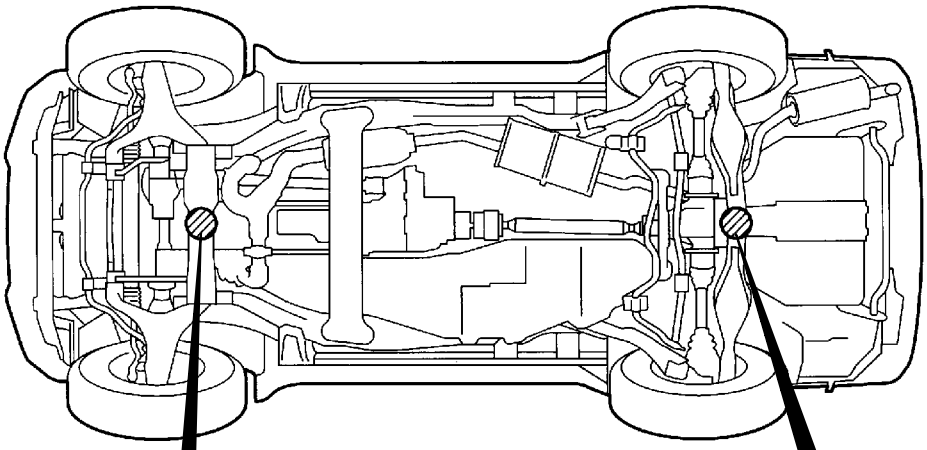
NOTE
SERIOUS INJURY CAN RESULT FROM UNINTENDED AIR BAG DEPLOYMENT, SO USE ONLY THE PROCEDURES AND EQUIPMENT SPECIFIED IN THIS MANUAL.

SUPPORT LOCATIONS FOR LIFTING AND JACKING

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

SUPPORT POSITIONS FOR A GARAGE JACK

Caution
Never support any point other than the specified one, or it will be deformed.



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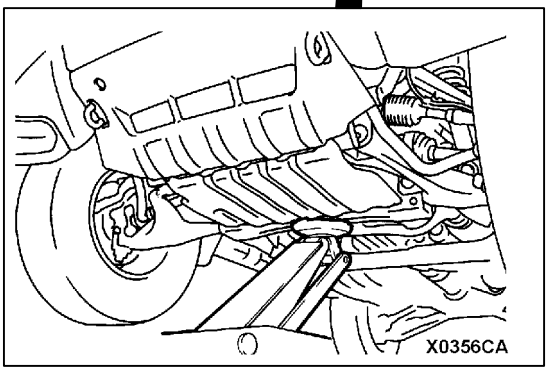

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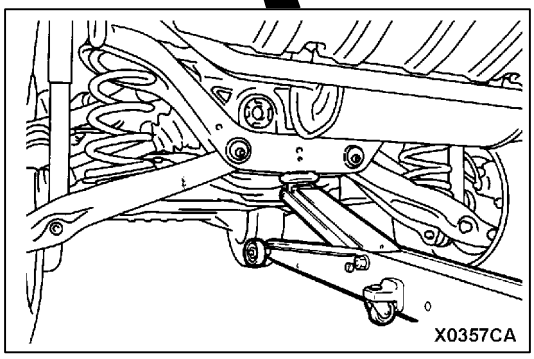

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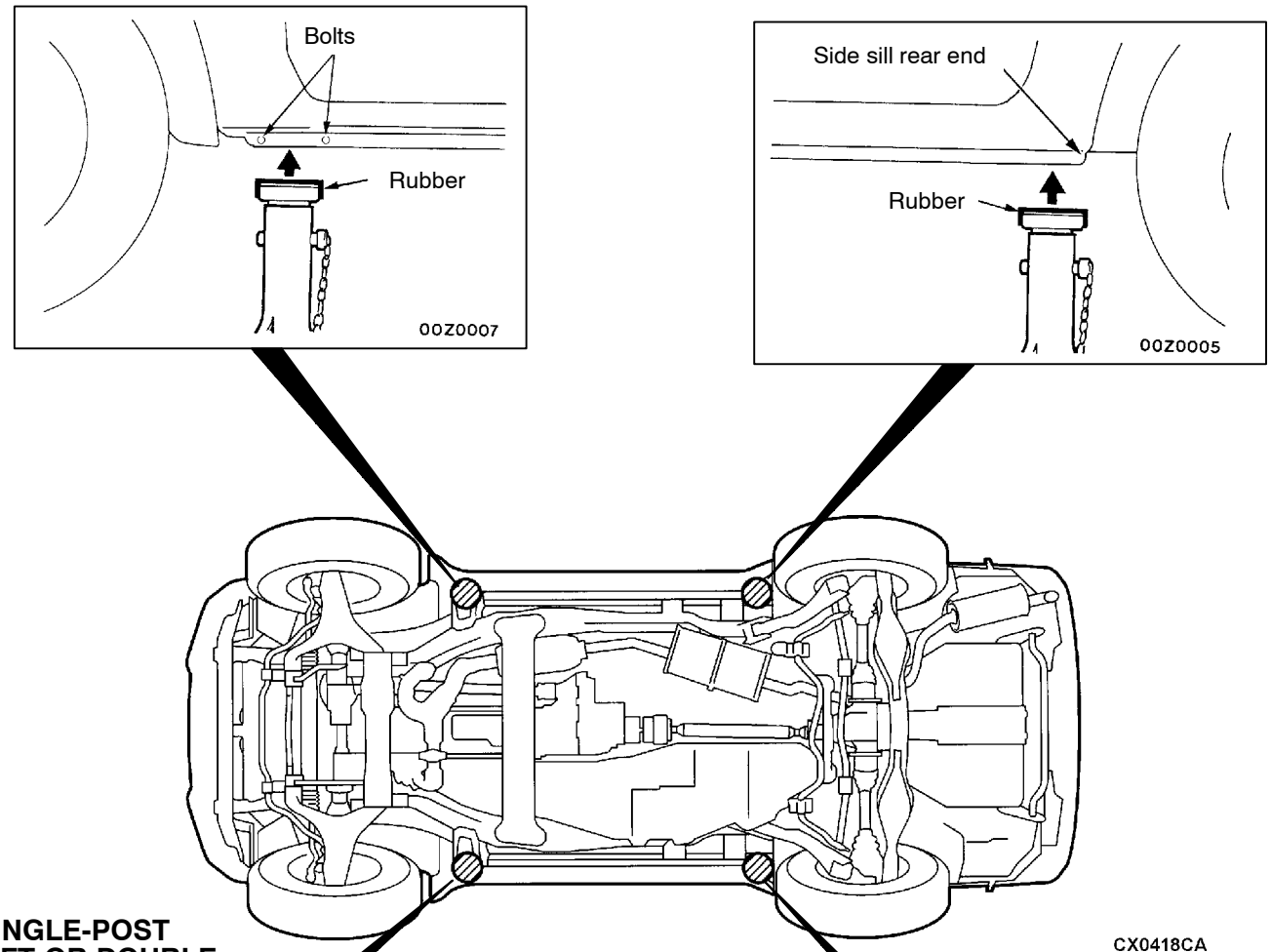
SUPPORT POSITIONS FOR AXLE STANDS AND A SINGLE-POST LIFT OR DOUBLE-POST LIFT

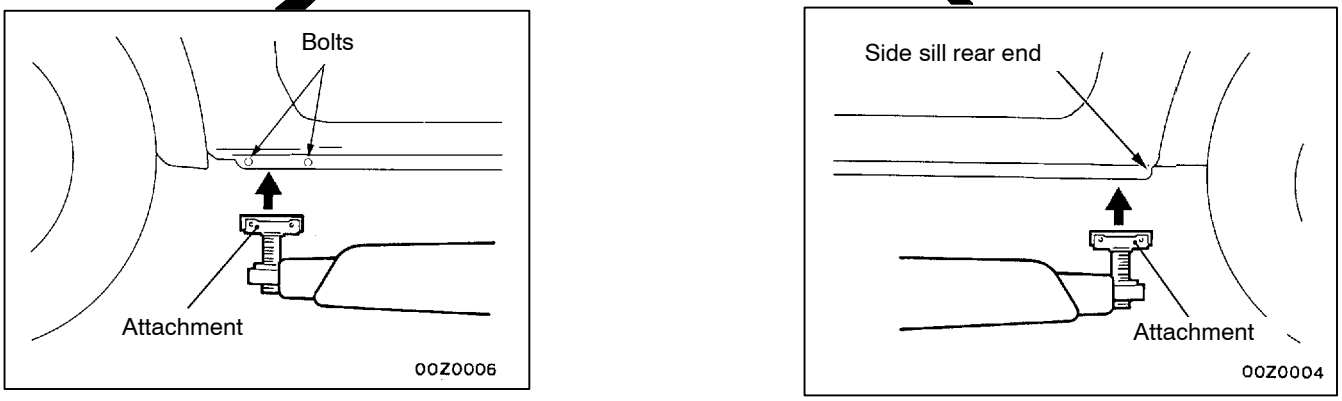
Caution

1. **If rubber attachments with grooves that are too thick are used at the front support positions, the front fender may become bent, so be sure to use rubber attachments with groove thicknesses of 18 mm or less.**
2. **If attachments which are not high enough are used, they may damage areas such as the side step. Be sure to use attachments which are high enough, or remove the side step if not using attachments.**

AXLE STANDS



SINGLE-POST LIFT OR DOUBLE-POST LIFT



STANDARD PART/TIGHTENING-TORQUE TABLE

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

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

Standard bolt and nut tightening torque

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

Flange bolt and nut tightening torque

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

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

Service Bulletins

Click on the applicable bookmark to select the Service Bulletin.

SERVICE BULLETIN

MITSUBISHI MOTORS

TECHNICAL SERVICE PLANNING
INTERNATIONAL CAR ADMINISTRATION OFFICE. MITSUBISHI MOTORS CORPORATION

SERVICE BULLETIN	NO. : MSB-00E00-009	
	DATE : 2000-10-20	<MODEL> (EC)PAJERO/MONTERO(V60,V70) <M/Y> 00-10
SUBJECT : ADDITION OF MODELS OF 2001 PAJERO/MONTERO		
GROUP : GENERAL	DRAFTNO. : 00SY090209	

INFORMATION	INTERNATIONAL CAR ADMINISTRATION OFFICE	T. MASAKI - MANAGER TECHNICAL SERVICE PLANNING

1. Description:

On the 2001 PAJERO/MONTERO, the 4M41 engine equipped models have been added.

2. Applicable Manuals:

Manual	Pub. No.
2001 PAJERO Workshop Manual	PWJE0001 (English) PWJS0002 (Spanish)
2001 PAJERO CD-ROM	PWJF0003 (CD-ROM) (French) PWJG0004 (CD-ROM) (German) PWJT0008R (CD-ROM)

3. Effective Date:

From the 2001 model.

GROUP 00
GENERAL

OUTLINE OF CHANGES

The following models have been added for England that are equipped with the 4M41 engine.

VEHICLE IDENTIFICATION

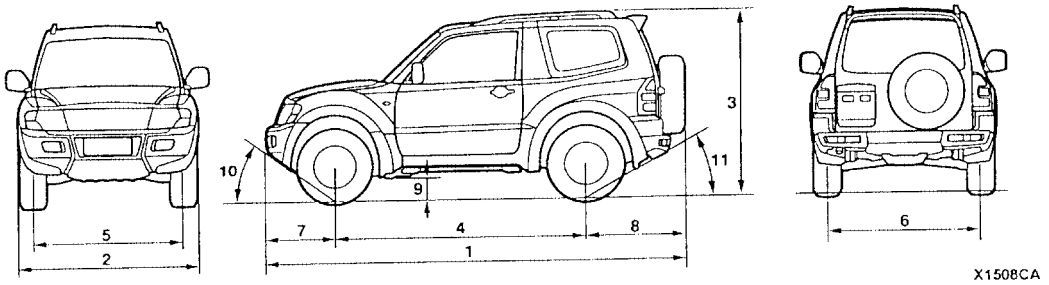
MODELS

<Short wheelbase>

Model code		Engine model	Transmission model	Fuel supply system
V68W	MNHFR6	4M41-DOHC Intercooler Turbo (3,200 mL)	V5M31 <5M/T>	Electronically-controlled high pressure fuel distribution
	MNHFR6		V5A51 <5A/T>	

MAJOR SPECIFICATIONS

<Short wheelbase>



Items			V68W	
			MNHFR6	MYHFR6
Vehicle dimensions mm	Overall length	1	4,260	
	Overall width	2	1,845	
	Overall height (unladen)	3	1,845, 1,875*1	
	Wheelbase	4	2,545	
	Track-front	5	1,560	
	Track-rear	6	1,560	
	Overhang-front	7	710	
	Overhang-rear	8	1,000*2, 1,025*3	
	Ground clearance (unladen)	9	225	
	Angle of approach degrees	10	42°	
	Angle of departure degrees	11	33.5°	
Vehicle weight kg	Kerb weight		1,980	
	Max. gross vehicle weight		2,510	
	Max. axel weight rating-front		1,165	
	Max. axel weight rating-rear		1,345	
Seating capacity			5	
Engine	Model No.		4M41-DOHC Intercooler Turbo	
	Total displacement mL		3,200	
Transmission	Model No.		V5M31	V5A51
	Type		5-speed manual	5-speed automatic
Fuel system	Fuel supply system		Electronically-controlled high pressure fuel distribution	

NOTE
*1: Vehicles with roof rails
*2: Vehicles with 235/80R16 Tyre
*3: Vehicles with 265/70R16 Tyre

SERVICE BULLETIN

MITSUBISHI MOTORS

TECHNICAL SERVICE PLANNING
INTERNATIONAL CAR ADMINISTRATION OFFICE. MITSUBISHI MOTORS CORPORATION

SERVICE BULLETIN	NO. : MSB-00E00-505	
	DATE : 2001-1-20	<MODEL> <M/Y> (EC)PAJERO/MONTERO(V60,70) 01-10 (EC)GALANT(EA0) 99-10 (EC)SPACE RUNNER/SPACE WAGON(N60,80,90) 99-10 (EC)CARISMA 99-10 (EC)SPACE STAR(H60,70) (EC)PAJERO PININ
SUBJECT : ESTABLISHMENT OF GDI ENGINE IDLE LEARNING FUNCTION		
GROUP : GENERAL	DRAFTNO. : 00AL610610	
CORRECTION	INTERNATIONAL CAR ADMINISTRATION OFFICE	T. MASAKI - MANAGER TECHNICAL SERVICE PLANNING

1. Description:

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

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

2. Applicable Manuals:

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

3. Details:

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

PRECAUTIONS BEFORE SERVICE

LEARNING FUNCTION OF GDI ENGINE

1. Purpose

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

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

2. Idle Learning Procedure

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

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

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

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

GROUP 00
GENERAL

OUTLINE OF CHANGES

The following models are equipped with Mitsubishi Stability Control (MITSUBISHI SC) system.

VEHICLE IDENTIFICATION

MODELS

<Short wheelbase>

Model code		Engine model	Transmission model	Fuel supply system
V68W	MNDFL6	4M41-DOHC Intercooler Turbo (3,200 mL)	V5M31 <5M/T>	Electronically-controlled high pressure fuel distribution
	MNHFL6			
	MNHFR6			
	MYHFL6		V5A51 <5A/T>	
	MYHFR6			
	MNXFL6		V5M31 <5M/T>	
	MNXFR6			
	MYXFL6		V5A51 <5A/T>	
	MYXFR6			
V65W	MNHCL6	6G74GDI (3,496 mL)	V5M31 <5M/T>	GDI
	MNHCR6			
	MYHCL6		V5A51 <5A/T>	
	MYHCR6			
	MNXCL6		V5M31 <5M/T>	
	MNXCR6			
	MYXCL6		V5A51 <5A/T>	
	MYXCR6			

<Long wheelbase>

Model code		Engine model	Transmission model	Fuel supply system
V78W	LNDFL6	4M41-DOHC Intercooler Turbo (3,200 mL)	V5M31 <5M/T>	Electronically-controlled high pressure fuel distribution
	LNHFL6			
	LNHFR6			
	LYHFL6		V5A51 <5A/T>	
	LYHFR6			
	LNXFL6		V5M31 <5M/T>	
	LNXFR6			
	LYXFL6		V5A51 <5A/T>	
	LYXFR6			
V75W	LNHCL6	6G74GDI (3,496 mL)	V5M31 <5M/T>	GDI
	LNHCR6			
	LYHCL6		V5A51 <5A/T>	
	LYHCR6			
	LNXCL6		V5M31 <5M/T>	
	LNXCR6			
	LYXCL6		V5A51 <5A/T>	
	LYXCR6			

GROUP 00
GENERAL

INSPECTION SERVICE POINTS

DIAGNOSIS FUNCTION

WHEN USING THE WARNING LAMP

The diagnosis code read-out function, which is available by means of the neutral position indicator lamp, has been discontinued <Vehicles with 6G74 GDI>.

VEHICLE IDENTIFICATION

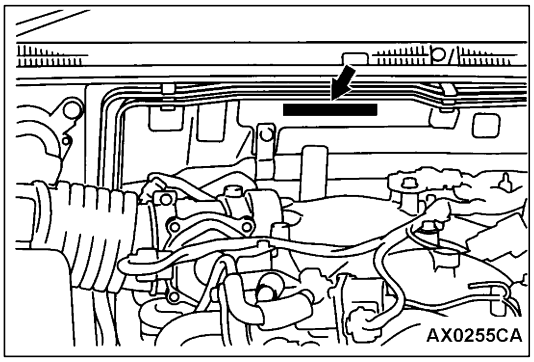
MODELS

<Short wheelbase>

Model code		Engine model	Transmission model	Fuel supply system
V64W	MNDFL6	4D56 Intercooler Turbo (2,477 mL)	V5MT1 <5M/T>	Injection
	MNHFL6		V5M31 <5M/T>	
	MNHFR6			
	MNXFL6			
	MNXFR6			
V68W	MNDFL6	4M41-DOHC Intercooler Turbo (3,200 mL)	V5M31 <5M/T>	Electronically-controlled high pressure fuel distribution
	MNHFL6			
	MNHFR6			
	MYHFL6		V5A51 <5A/T>	
	MYHFR6			
	MNXFL6		V5M31 <5M/T>	
	MNXFR6			
	MYXFL6		V5A51 <5A/T>	
	MYXFR6			
V65W	MYHCL6	6G74 GDI (3,496 mL)	V5A51 <5A/T>	GDI
	MYHCR6			
	MNXCL6		V5M31 <5M/T>	
	MYXCL6		V5A51 <5A/T>	
	MYXCR6			

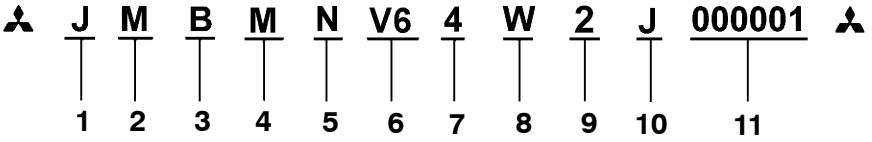
<Long wheelbase>

Model code		Engine model	Transmission model	Fuel supply system
V74W	LNDFL6	4D56 Intercooler Turbo (2,477 mL)	V5MT1 <5M/T>	Injection
	LNHFL6		V5M31 <5M/T>	
	LNXFL6			
V78W	LNDFL6	4M41-DOHC Intercooler Turbo (3,200 mL)	V5M31 <5M/T>	Electronically-controlled high pressure fuel distribution
	LNHFL6			
	LNHFR6			
	LYHFL6		V5A51 <5A/T>	
	LYHFR6			
	LNXFL6		V5M31 <5M/T>	
	LNXFR6			
	LYXFL6		V5A51 <5A/T>	
	LYXFR6			
V75W	LYHCL6	6G74 GDI (3,496 mL)	V5A51 <5A/T>	GDI
	LYHCR6			
	LNXCL6		V5M31 <5M/T>	
	LYXCL6		V5A51 <5A/T>	
	LYXCR6			



CHASSIS NUMBER

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



No.	Items		Contents
1	Fixed figure	J	Asia
2	Distribution channel	M	Japan channel
3	Destination	A	For Europe, right hand drive
		B	For Europe, left hand drive
4	Body style	M	3-door
		L	5-door
5	Transmission type	N	5-speed manual transmission
		Y	5-speed automatic transmission
6	Development order	V6	MITSUBISHI PAJERO short wheelbase
		V7	MITSUBISHI PAJERO long wheelbase
7	Engine	4	4D56: 2,477 mL diesel engine
		5	6G74: 3,496 mL petrol engine
		8	4M41: 3,200 mL diesel engine
8	Sort	W	Station wagon
9	Model year	2*	2002
10	Plant	J	Pajero Manufacturing Co., Ltd. *
11	Serial number	-	-

NOTE
*: Indicates changes.

MAJOR SPECIFICATIONS

The items other than listed below are the same as before.

<Short wheelbase>

Items		V64W		
		MNDFL6	MNHFL6, MNHFR6	MNXFL6, MNXFR6
Vehicle weight kg	Kerb weight	1,875	1,910	1,930
	Max. gross vehicle weight	2,510		
	Max. axle weight rating-front	1,200		
	Max. axle weight rating-rear	1,600		

<Long wheelbase>

Items		V74W		
		LNDFL6	LNHFL6	LNXFL6
Vehicle weight kg	Kerb weight	2,025	2,065	2,100
	Max. gross vehicle weight	2,760		
	Max. axle weight rating-front	1,200		
	Max. axle weight rating-rear	1,650		

Items		V78W				
		LNDFL6	LNHFL6, LNHFR6	LYHFL6, LYHFR6	LNXFL6, LNXFR6	LYXFL6, LYXFR6
Vehicle weight kg	Max. gross vehicle weight	2,810				
	Max. axle weight rating-front	1,200				
	Max. axle weight rating-rear	1,650				

PRECAUTIONS BEFORE SERVICE

SUPPLEMENTAL RESTRAINT SYSTEM (SRS), SEAT BELT WITH PRE-TENSIONER

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 system is designed to retain enough voltage to deploy the air bag even after the battery has been disconnected. Serious injury may result from unintended air bag deployment if work is done on the SRS system immediately after the battery cable is disconnected.
   (3) Warning labels must be heeded when servicing or handling SRS components and seat belt with pre-tensioner. Warning labels are located in the following locations.
   - Hood
   - Sun visor
   - Glove box
   - SRS-ECU
   - Steering wheel
   - Steering gearbox
   - Air bag module (driver's side and front passenger's side)
   - Front impact sensor
   - Clock spring
   - Seat belt with pre-tensioner
   - Side air bag module
   - Side impact sensor

   (4) Always use the designated special tools and test equipment.
   (5) Store components removed from the SRS and seat belt with pre-tensioner in a clean and dry place.
   The air bag module and seat belt with pre-tensioner should be stored on a flat surface and placed so that the pad surface is facing upward.
   Do not place anything on top of it.
   (6) Never attempt to disassemble or repair the SRS components (SRS-ECU, air bag module, clock spring and side impact sensor) and seat belt with pre-tensioner.
   (7) Whenever you finish servicing the SRS and seat belt with pre-tensioner, check the SRS warning lamp operation to make sure that the system functions properly.
   (8) Be sure to deploy the air bag and seat belt with pre-tensioner before disposing of the air bag module and seat belt with pre-tensioner or disposing of a vehicle equipped with an air bag and seat belt with pre-tensioner. (Refer to GROUP 52B - Air Bag Module and Seat Belt with Pre-tensioner Disposal Procedures.)
2. Observe the following when carrying out operations on places where SRS components and seat belt with pre-tensioner are installed, including operations not directly related to the SRS air bag and seat belt with pre-tensioner.
   (1) When removing or installing parts do not allow any impact or shock to the SRS components and seat belt with pre-tensioner.
   (2) SRS components and seat belt with pre-tensioner should not be subjected to heat, so remove the SRS components and seat belt with pre-tensioner before drying or baking the vehicle after painting.
   - SRS-ECU, air bag module, clock spring, front and side impact sensors: 93°C or more
   - Seat belt with pre-tensioner: 90°C or more

   After re-installing them, check the SRS warning lamp operation to make sure that the system functions properly.

NOTES

ENGINE <6G7>

Click on the applicable bookmark to selected the required model year.

ENGINE <6G7>

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CAMSHAFT OIL SEAL 25

CYLINDER HEAD GASKET 27

ENGINE ASSEMBLY 30

GENERAL INFORMATION

Items			6G74-GDI
Total displacement ml			3,497
Bore × Stroke mm			93 × 85.8
Compression ratio			10.4
Combustion chamber			Pentroof + ball-in-piston
Camshaft arrangement			DOHC
Number of valve	Intake		12
	Exhaust		12
Valve timing	Intake	Opening	BTDC 8°
		Closing	ABDC 56°
	Exhaust	Opening	BBDC 48°
		Closing	ATDC 16°
Fuel system			Electronically controlled multipoint fuel injection
Rocker arm			Roller type
Auto-lash adjuster			Equipped

SERVICE SPECIFICATIONS

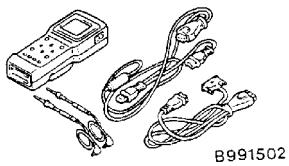
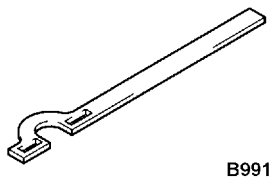
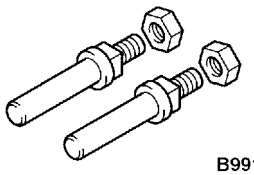
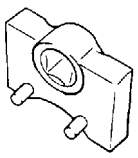
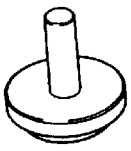
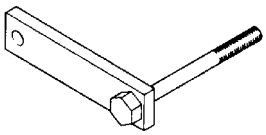
Items	Standard value	Limit
Basic ignition timing	5°BTDC ± 3°	-
Ignition timing	Approx. 20°BTDC*1	-
Idle speed r/min	600 ± 100*1	-
CO contents %	0.5 or less	-
HC contents ppm	100 or less	-
Compression pressure (at engine speed of 280 r/min) kPa	1,275	980
Compression pressure difference of all cylinders kPa	-	Max. 98
Intake manifold vacuum kPa	-	Min. 56*2
Auto tensioner rod depth (mm)	Within 1	-
Timing belt tension torque N·m	4.4	-
Auto-tensioner rod protrusion amount mm	3.8 - 5.0	-

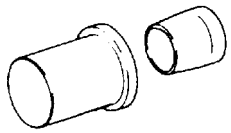
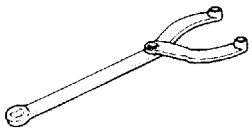
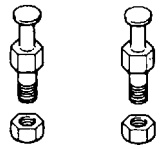
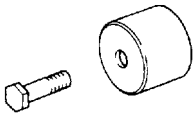
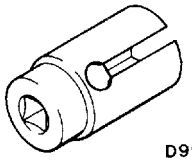
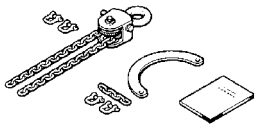
NOTE
*1: Indicates the value measured within 4 minutes since the engine was started.
*2: Indicates the value when more than 4 minutes have passed since the engine was started.

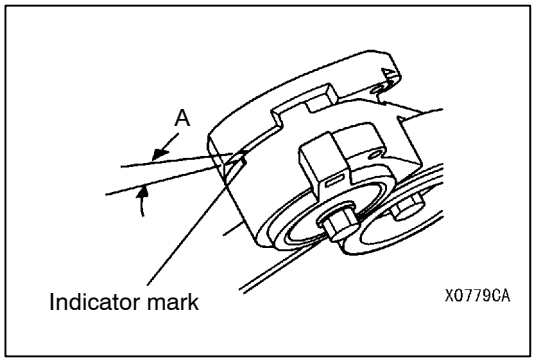
SEALANT

Items	Specified sealants	Remarks
Oil pan	MITSUBISHI GENUINE PART MD970389 or equivalent	Semi-drying sealant

SPECIAL TOOLS

Tool	Number	Name	Use
 B991502	MB991502	MUT-II sub assembly	• Checking the ignition timing • Checking the idle speed • Erasing diagnosis code
 B991800	MB991800	Pulley holder	Supporting of crankshaft pulley
 B991802	MB991802	Pin B	
	MD998769	Crankshaft pulley spacer	Operating the crankshaft when installing the timing belt
	MD998767	Tension pulley socket wrench	Timing belt tension adjustment
	MD998718	Crankshaft rear oil seal installer	Press-fitting the crankshaft rear oil seal
	MD998781	Flywheel stopper	Securing the flywheel

Tool	Number	Name	Use
	MD998717	Crankshaft front oil seal installer	Press-in of the crankshaft front oil seal
	MB990767	End yoke holder	Supporting of camshaft sprocket
	MD998719	Crankshaft pulley holder pin	
	MD998761	Camshaft oil seal installer	Press-in of the camshaft oil seal
 D998773	MD998773	Detonation sensor wrench	Detonation sensor removal and installation
 B991683	MB991683	Sling chain set	Removal and installation of engine assembly



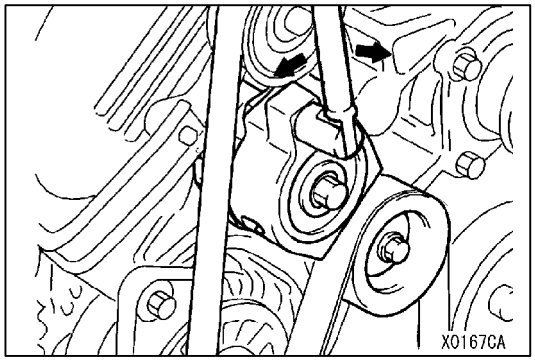
ON-VEHICLE SERVICE

DRIVE BELT TENSION CHECK AND ADJUSTMENT

Caution
Perform the check after rotating the engine to the normal direction (one revolution and over).

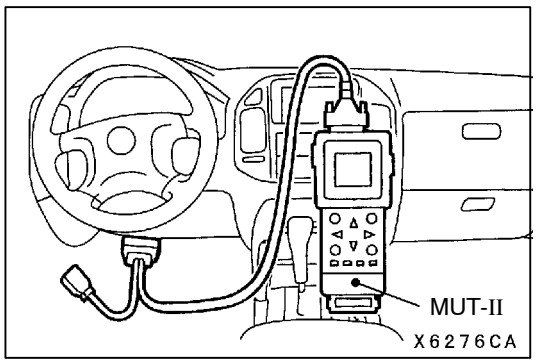
1. Check that the indicator mark of the auto-tensioner is located within the scope shown as ”A” on the tensioner bracket.
2. If the mark is located out of the scope ”A,” replace the drive belt.

NOTE
Since the auto-tensioner is used, it is not necessary to adjust the tension of the belt.



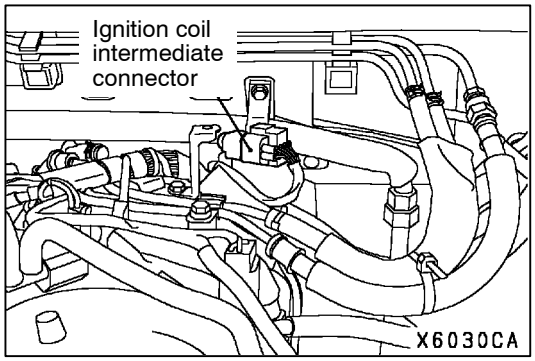
AUTO-TENSIONER CHECK

1. Run the engine at idling speed and then stop it to check whether the drive belt is forced out from the width of the auto-tensioner pulley.
2. Remove the drive belt. (Refer P.11A-17.)
3. Move the auto-tensioner right and left by using a 12.7 mm spinner handle and the like to check whether there is no catch.
4. If some abnormality is found during the above mentioned check (1) and (3), replace the auto-tensioner.
5. Install the drive belt. (Refer P.11A-18.)



IGNITION TIMING CHECK

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Turn the ignition switch to the LOCK (OFF) position, and then connect the MUT-II to the diagnosis connector.



3. Set a timing light to the ignition coil power supply line (intermediate connector No. 7 terminal) of the ignition coil intermediate connector engine-side harness.
4. Start the engine and let it run at idle.
5. Use the MUT-II to measure engine idle speed and check that it is within the standard value.

Standard value: 600 ± 100 (700 ± 100)*

NOTE
*: Indicates the values when more than 4 minutes have passed since the idling condition was started.

6. Select No.17 of the MUT-II Actuator test.

   NOTE
   At this time, the engine speed will become approximately 700 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.

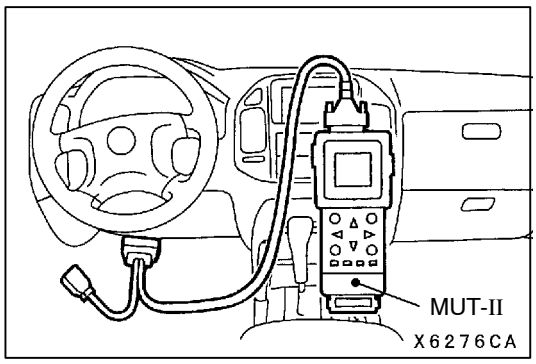
   Caution
   If the test is not cancelled, a forced driving will continue for 27 minutes. Driving under this condition may damage the engine.

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

    Standard value: approx. 20°BTDC (AT)
    approx. 13°BTDC (MT)

    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.

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



IDLE SPEED CHECK

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

   NOTE
   Refer to P.11A-6 concerning the check procedure of the basic ignition timing.

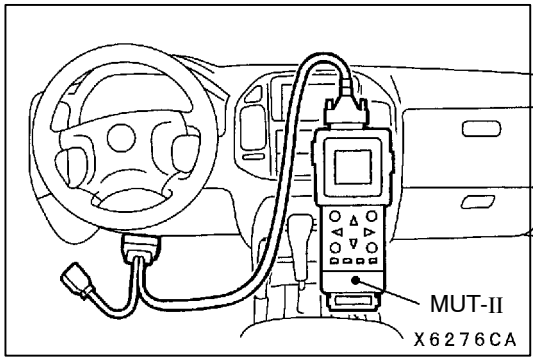
   Standard value: 5°BTDC ± 3°

4. Check the idle speed. Select item No. 22 and take a reading of the idle speed.

   Standard value: 600 ± 100 (700 ± 100)*

   NOTE
   (1) *: Indicates the values when more than 4 minutes have passed since the idling condition was started.
   (2) The idle speed is controlled automatically by the idle speed control system.

5. 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. Turn the ignition switch to the lock (OFF) position, and then connect the MUT-II to the diagnosis connector.
3. Check that the basic ignition timing is within the standard value.

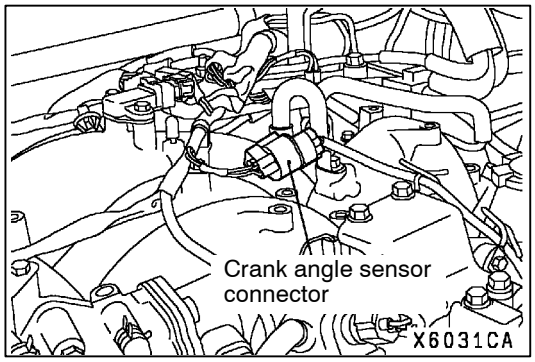
   NOTE
   Refer to P.11A-6 concerning the check procedure of the basic ignition timing.

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

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

   Standard value
   CO contents: 0.5% or less
   HC contents: 100 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-A/T-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.

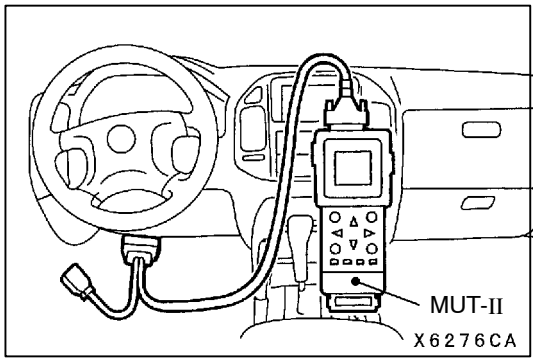
   Caution
   (1) Keep away from the spark plug hole when cranking.
   (2) If compression is measured with water, oil, fuel, etc., that has come from cracks inside the cylinder, these materials will become heated and will gush out from the spark plug hole, which is dangerous.
5. Set compression gauge to one of the spark plug holes.
6. Crank the engine with the throttle valve fully open and measure the compression pressure.

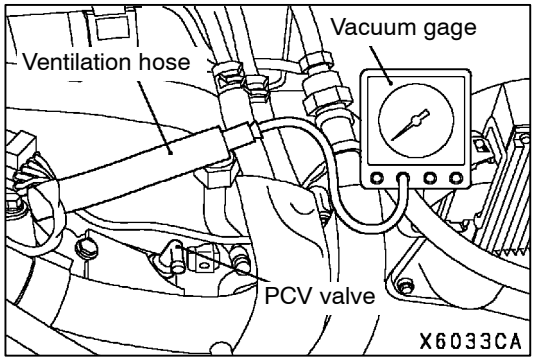
   Standard value (at engine speed of 280 r/min): 1,275 kPa

   Limit (at engine speed of 280 r/min): Min. 980 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. 98 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.





INTAKE MANIFOLD VACUUM CHECK

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Turn the ignition switch to the LOCK (OFF) position.
3. Connect the diagnosis connector to the MUT-II.
4. Remove the ventilation hose from the PCV valve, connect the ventilation hose to a vacuum gauge, and then plug the PCV valve.
5. Start the engine, and let it run at idle.
6. Keep the engine run at idle for at least 4 minutes. The idle speed should be 700 r/min.
7. Check the intake manifold vacuum.

   Limit: Min. 60 kPa
8. Turn the ignition switch to the LOCK (OFF) position.
9. Remove the vacuum gauge, and return the ventilation hose to its normal condition.
10. Remove 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) 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.

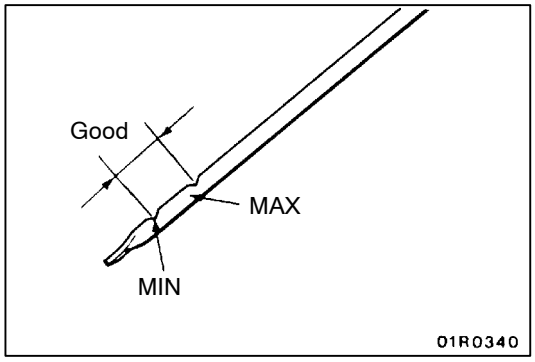
(3) If either of the above situations occur, the abnormal noise can be eliminated by bleeding the air from inside the lash adjusters.

(4) The abnormal noise, which is caused by a defective lash adjuster, occurs immediately after the engine start and changes in accordance with the engine speed, but not the engine load.

(5) 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.

FUNCTIONAL TEST

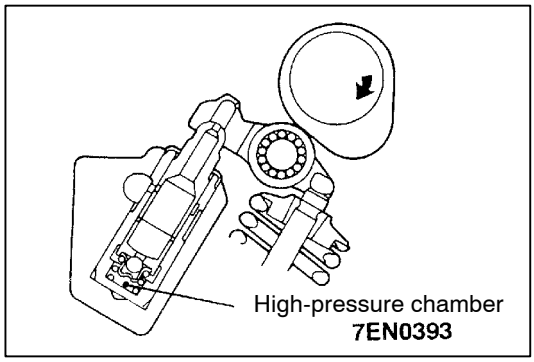
1. Start the engine.
2. Check that the noise occurs immediately after the engine is started, and that the noise changes in accordance with changes in the engine speed.
   If the noise does not occur immediately after the engine is started, or if it does not change in accordance with the engine speed, 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-11.)
6. If the noise has not disappeared even after the air bleeding, clean the lash adjusters. (Refer to the Engine Workshop Manual.)



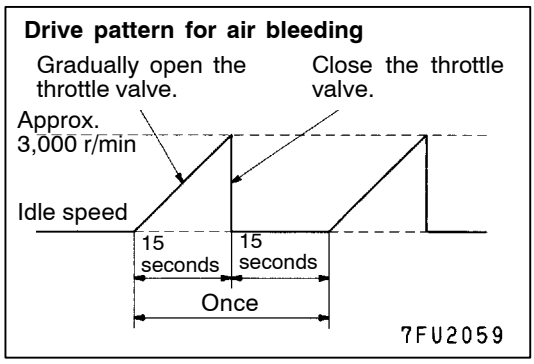
LASH ADJUSTER AIR BLEEDING

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.



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.

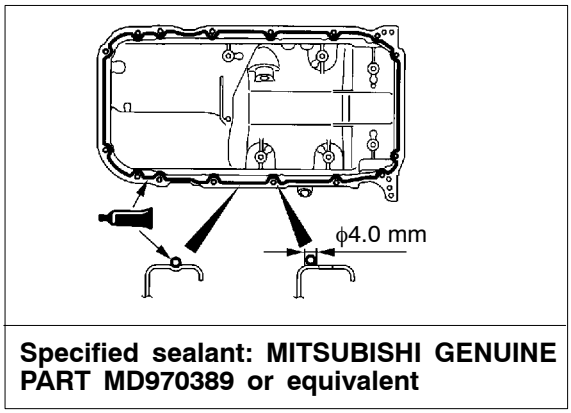


2. Run the engine at idle for 1 - 3 minutes to let it warm up.
3. With no load on the engine, repeat the drive pattern shown in the illustration at left and check if the abnormal noise disappears. (The noise should normally disappear after 10 - 30 repetitions, but if there is no change in the noise level 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.

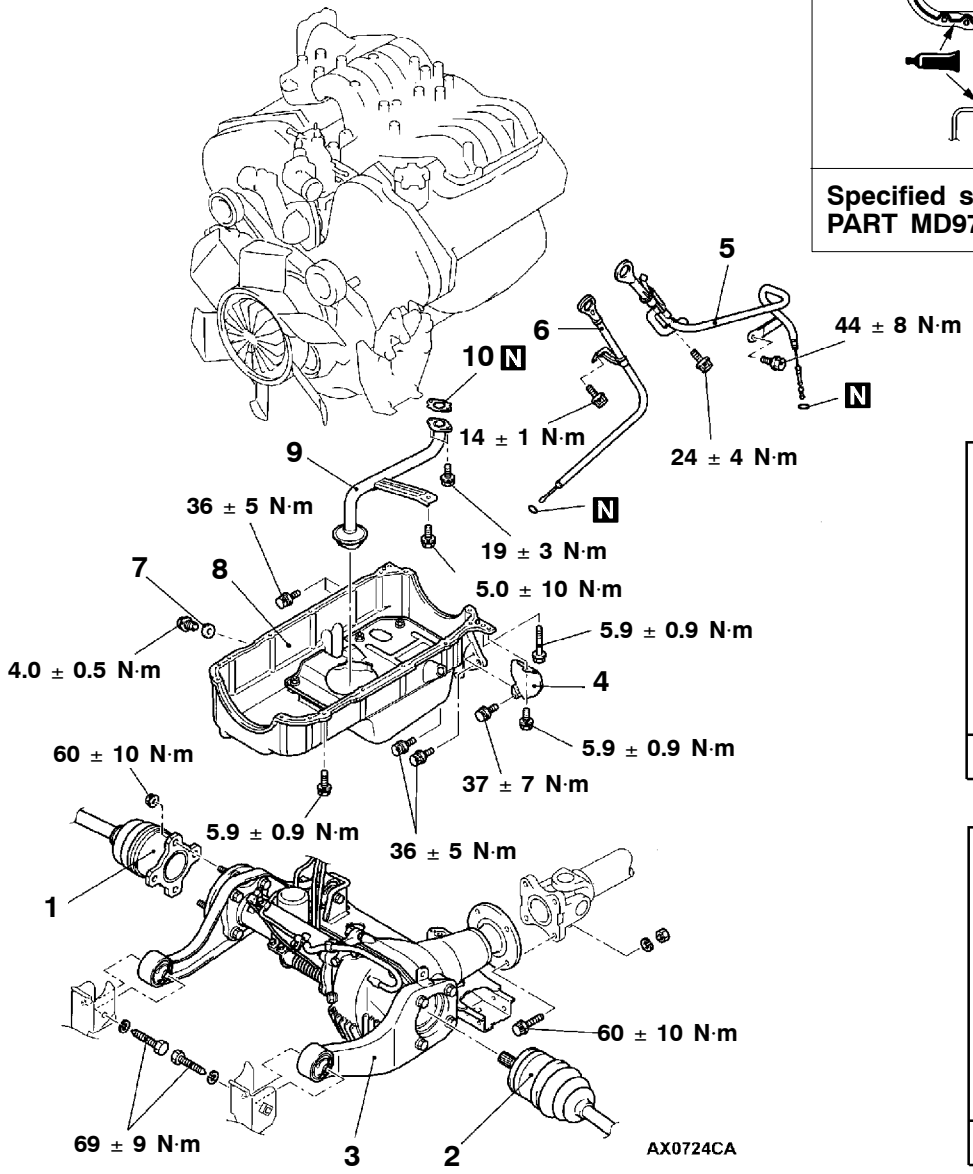
OIL PAN AND OIL SCREEN

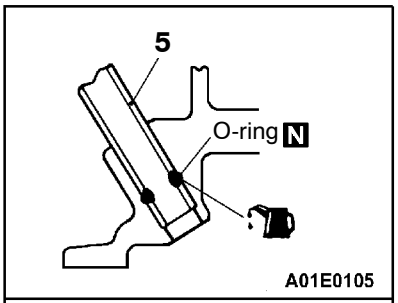
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Skid Plate and Under Cover Removal and Installation
- Engine Oil Draining and Refilling (Refer to GROUP 12 - On-vehicle Service.)
- Starter Assembly Removal and Installation (Refer to GROUP 16 - Starting System.)

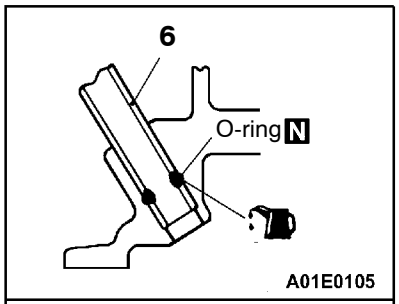


Specified sealant: MITSUBISHI GENUINE PART MD970389 or equivalent





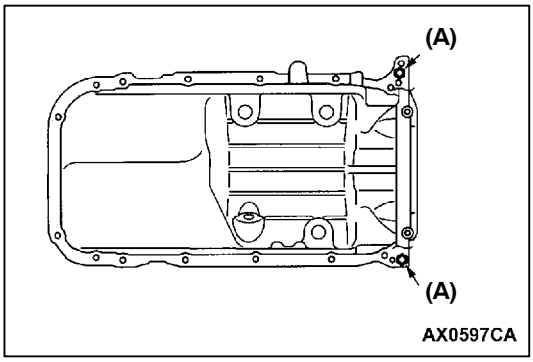
Transmission fluid



Engine oil

Removal steps

1. Drive shaft <R.H.>
2. Drive shaft <L.H.>
3. Front differential, No.2 crossmember
4. Cover
5. A/T oil dipstick assembly
6. Engine dipstick assembly
7. Gasket ▶B◀
8. Oil pan ◀A▶ ▶A◀
9. Oil screen
10. Gasket



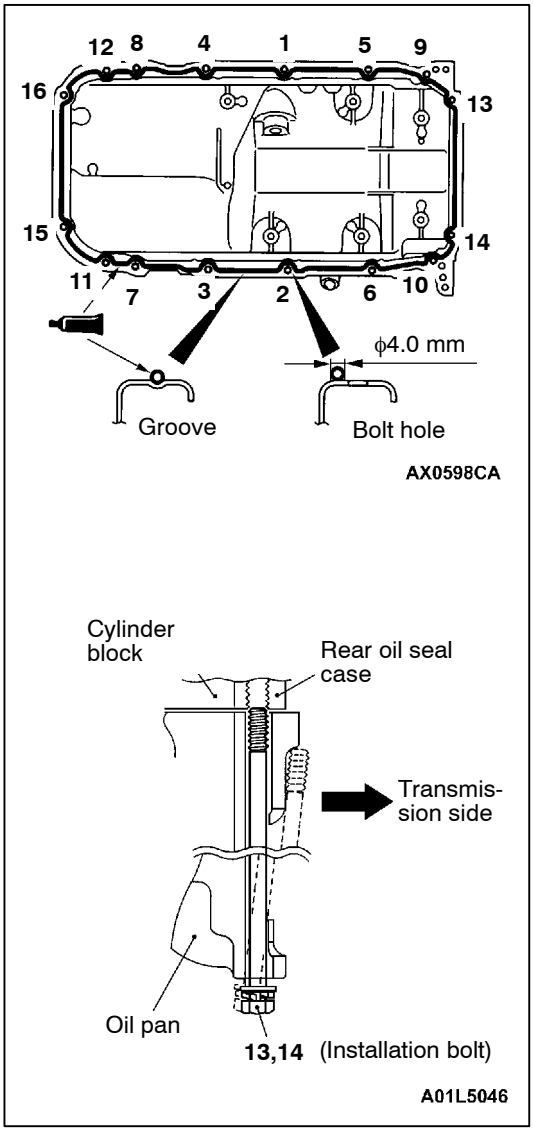
REMOVAL SERVICE POINT

◀A▶ OIL PAN REMOVAL

1. Remove the oil pan installation bolts.

   Caution
   The use of an oil pan remover (MD998727) can damage the oil pan (aluminum made).

2. Screw the bolts (M10) securing the oil pan to the transmission assembly in the illustrated bolt holes, then remove the oil pan.



INSTALLATION SERVICE POINTS

▶A◀ OIL PAN INSTALLATION

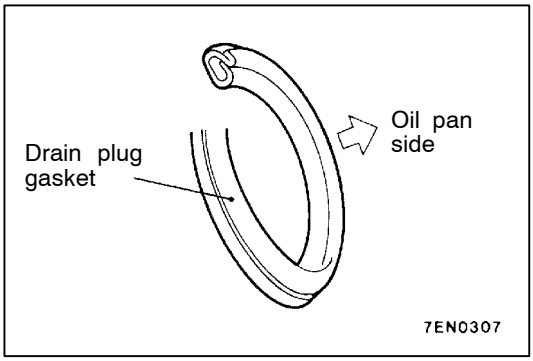
1. Remove sealant from the oil pan and cylinder block mating surfaces.
2. Degrease the sealant-coated surface and the engine mating surface.
3. Apply MITSUBISHI genuine part number MD970389 or equivalent around the gasket surface of oil pan as specified in the illustration.

   NOTE
   The sealant should be applied in a continuous bead approximately 4.0 mm in diameter.

4. Assemble the oil pan to the cylinder block within 30 minutes after applying the sealant.

   Caution
   The bolt holes for bolts 13 and 14 in the illustration are cut away on the transmission side. Be careful not to insert these bolts at an angle.

5. Tighten the bolts in order of the numbers shown in the illustration.



▶B◀ DRAIN PLUG GASKET INSTALLATION

Replace the gasket with a new gasket. Install the new gasket in the direction shown in the illustration.

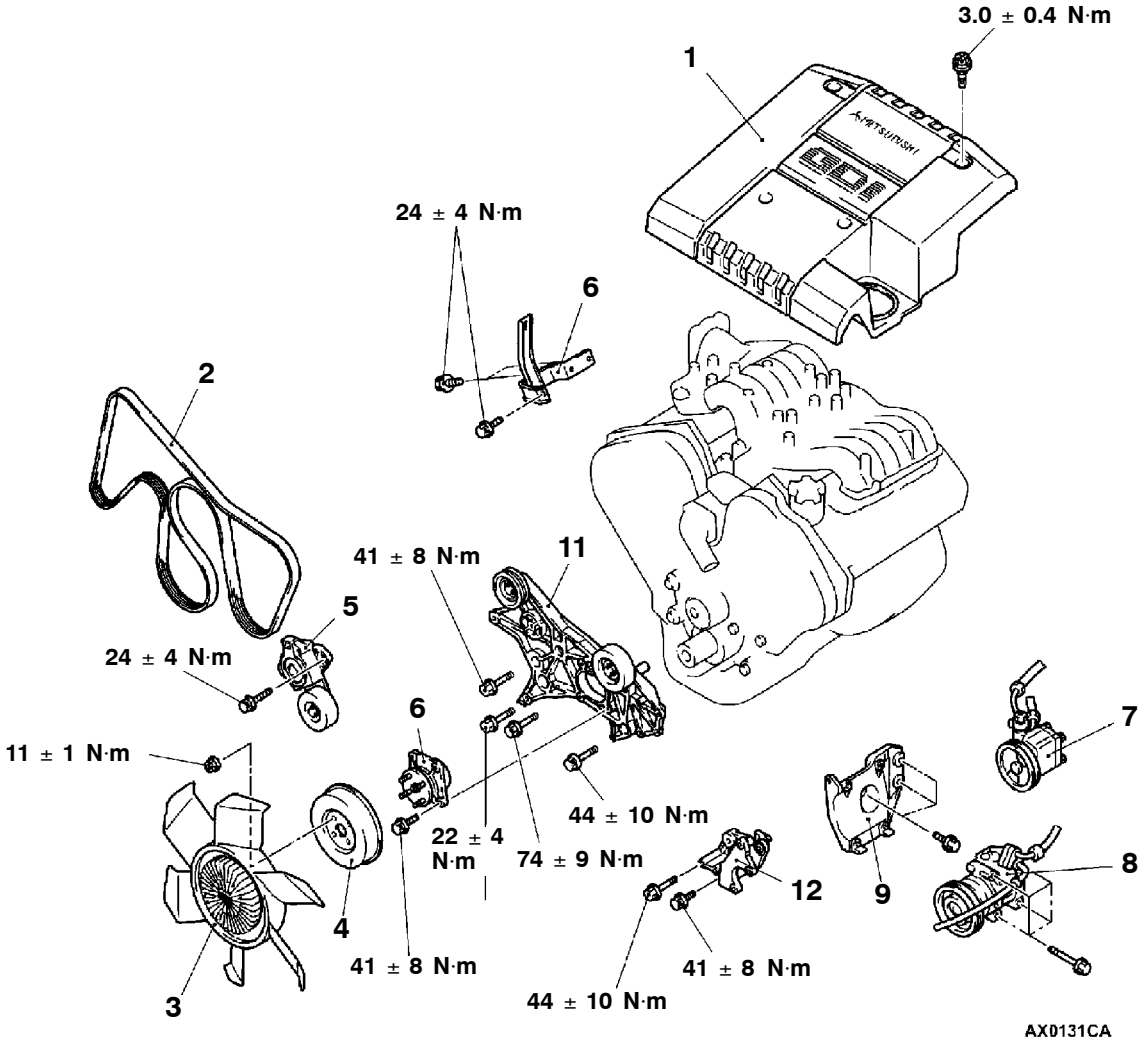
INSPECTION

- Check the oil pan for cracks.
- Check the oil pan sealant-coated surface for damage and deformation.
- Check the oil screen for cracked, clogged or damaged wire net and pipe.

TIMING BELT

REMOVAL AND INSTALLATION

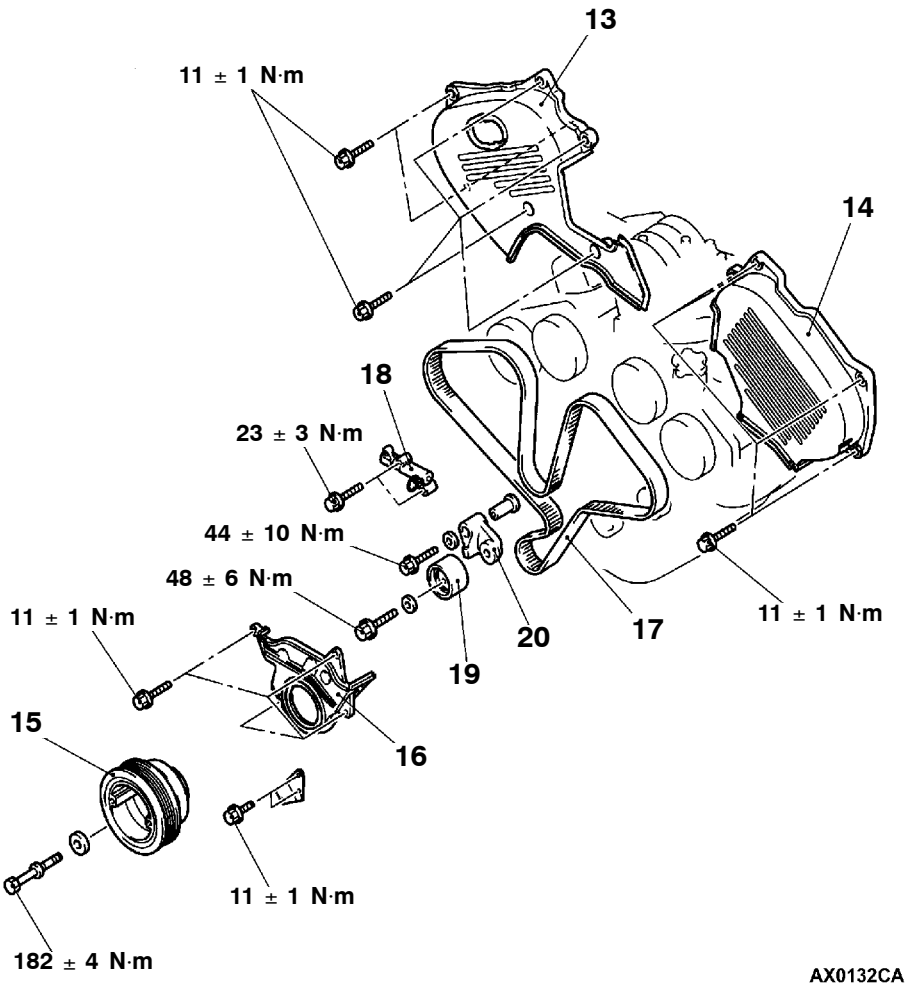
Pre-removal Operation
- Skid Plate and Under Cover Removal and Installation
- Battery abd batterytray Removal and Installation
- Air cleaner assembly Removal and Installation (Refer to GROUP 15)
- Shroud assembly Removal and Installation (Refer to GROUP 14 - Cooling Fan.)
- Engine Coolant Draining and Refilling (Refer to GROUP 14 - On-vehicle Service.)



Removal steps

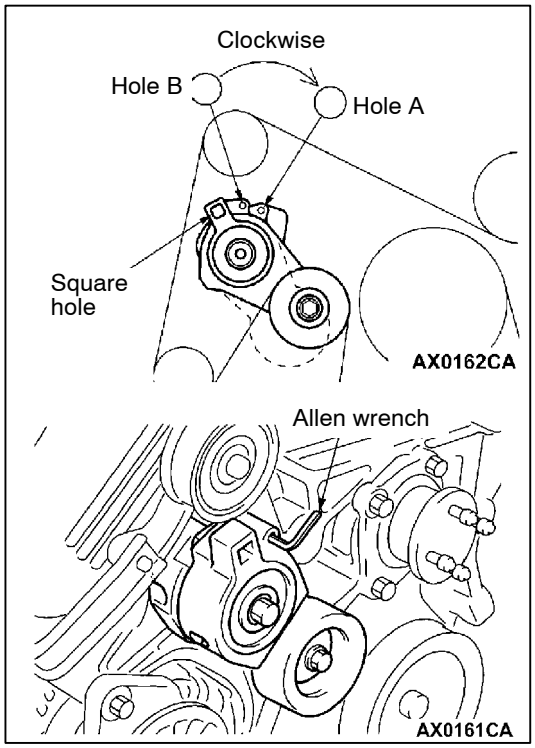
▶F◀ 1. Cover
2. Drive belt
3. Cooling fan and fan clutch assembly
4. Cooling fan pulley
◀A▶ ▶E◀ 5. Drive belt auto-tensioner
6. Engine hanger <R.H.>
   - Alternator (Refer to Group16.)

◀B▶ 7. Power steering oil pump assembly
◀B▶ 8. A/C compressor assembly
9. Compressor bracket
10. Cooling fan bracket
▶D◀ 11. Accessory mount assembly
12. Power steering oil pump bracket



Removal steps

13. Timing belt upper cover assembly <R.H.>
14. Timing belt upper cover assembly <L.H.>
◀C▶ ▶C◀ 15. Crankshaft pulley
16. Timing belt lower cover assembly
◀D▶ ▶B◀ 17. Timing belt
▶A◀ 18. Auto-tensioner
19. Tension pulley
20. Tensioner arm assembly



REMOVAL SERVICE POINTS

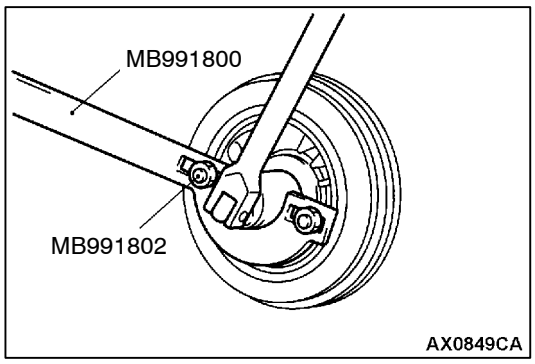
◀A▶ DRIVE BELT AUTO-TENSIONER REMOVAL

The following operations will be needed due to the introduction of the serpentine drive system with the drive belt auto tensioner.

1. Insert a 12.7 mm spinner handle into the square hole on the drive belt auto tensioner, and rotate it clockwise until the tensioner touches the stopper.
2. Align hole B with hole A, and insert a 5.0 mm Allen wrench to hold the tensioner. Then loosen the drive belt, and then remove the drive belt auto tensioner.

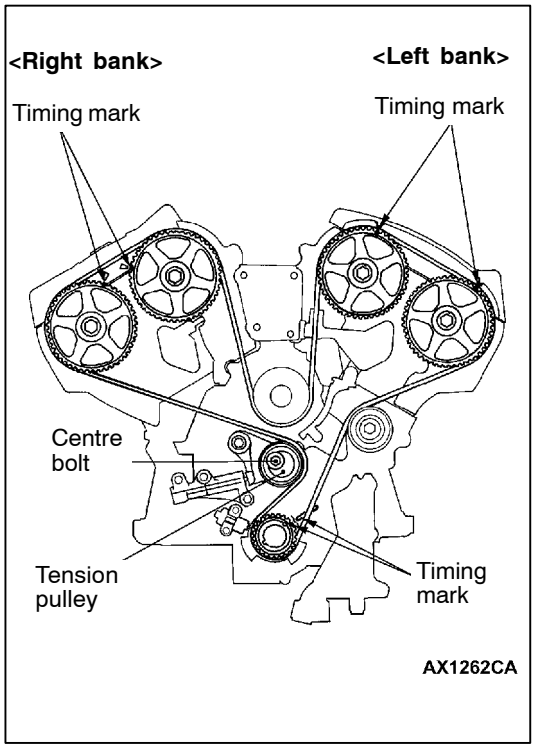
◀B▶ POWER STEERING OIL PUMP ASSEMBLY/A/C COMPRESSOR ASSEMBLY REMOVAL

1. Do not disconnect the hoses to remove the pump and compressor.
2. Support the removed pump and compressor with a wire, etc. so that they will not get in the way while working.



◀C▶ CRANKSHAFT PULLEY REMOVAL

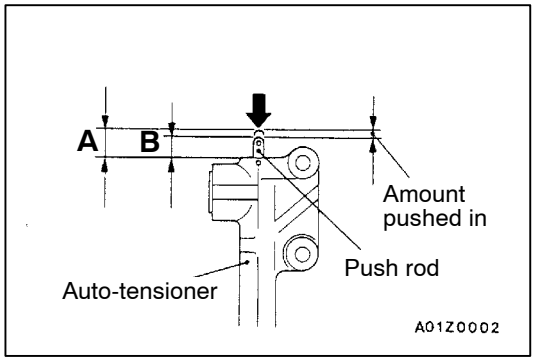
Use special tools to remove the crankshaft pulley from the crankshaft.



◀D▶ TIMING BELT REMOVAL

1. Turn the crankshaft clockwise to align each timing mark and to set the No. 1 cylinder to compression top dead centre.

   Caution
   (1) The camshaft sprocket (right side) can turn easily due to the valve spring force applied, so be careful not to get your fingers caught.
   (2) Never turn the crankshaft anticlockwise.
2. If the timing belt is to be reused, chalk mark the flat side of the belt with an arrow indicating the clockwise direction.
3. Loosen the centre bolt of the tension pulley, and then remove the timing belt.

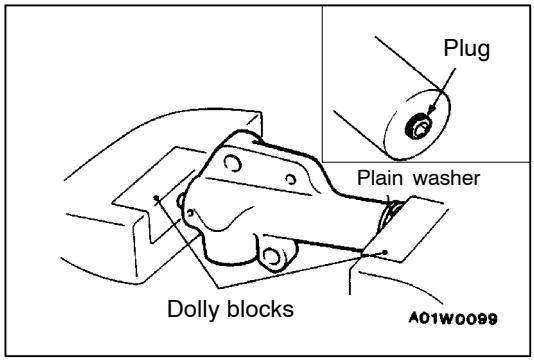


INSTALLATION SERVICE POINTS

▶A◀ AUTO-TENSIONER INSTALLATION

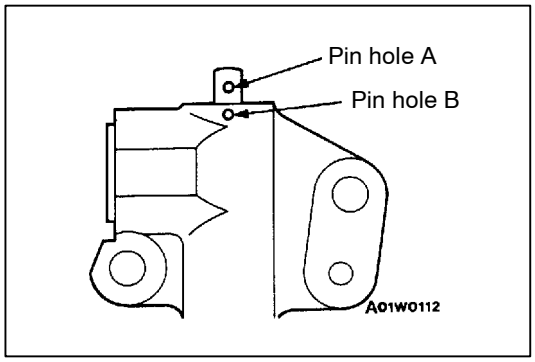
1. While holding the auto-tensioner by hand, press the end of the push rod against a metal surface (such as the cylinder block) with a force of 98 - 196 Nm and measure how far the push rod is pushed in.

   Standard value: Within 1 mm
   A: Length when no force is applied
   B: Length when force is applied
   A - B: Amount pushed in
2. If it is not within the standard value, replace the auto-tensioner.



3. Place two dolly blocks in a vice as shown in the illustration, and then place the auto-tensioner in the vice.

   Caution
   (1) Place the auto-tensioner perpendicular to the jaws of the vice.
   (2) If there is a plug at the base of the auto-tensioner, insert a plain washer onto the end of the auto-tensioner to protect the plug.



4. Slowly compress the push rod of the auto-tensioner until pin hole A in the push rod is aligned with pin hole B in the cylinder.

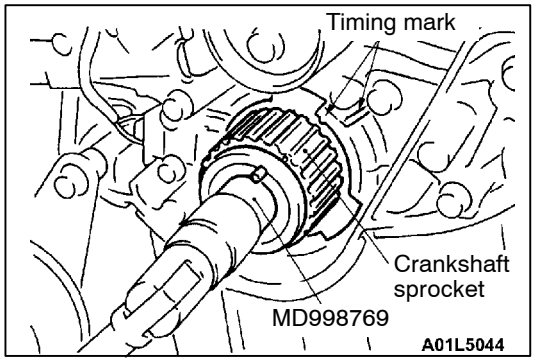
   Caution
   Never compress the push rod too fast, or the push rod may be damaged.

5. Insert the setting pin into the pin holes once they are aligned.

   NOTE
   If replacing the auto-tensioner, the pin will already be inserted into the pin holes of the new part.

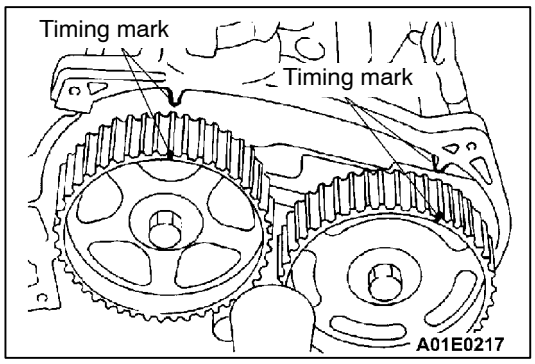
6. Install the auto-tensioner to the engine.

   Caution
   Do not remove the setting pin from the auto-tensioner.

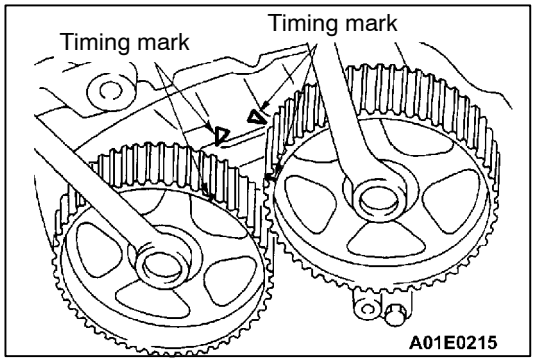


▶B◀ TIMING BELT INSTALLATION

1. Use special tool to align the timing marks on the crankshaft sprocket.



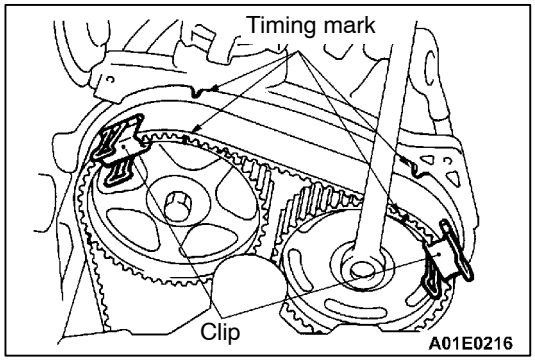
2. Align the timing marks on the right bank side crankshaft sprocket.



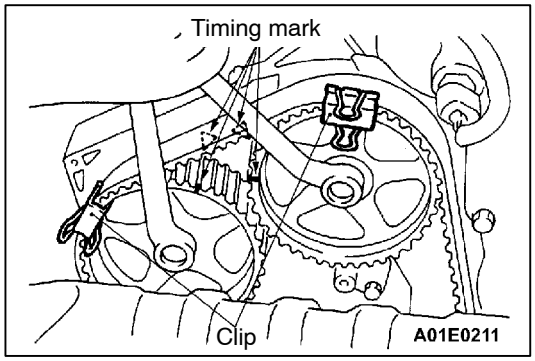
3. Align the timing marks on the left bank side crankshaft sprocket, and then hold the sprocket with a wrench as shown.

   Caution
   (1) The left bank side camshaft sprockets will turn readily because of the spring force being applied, so be careful not to get your fingers caught.

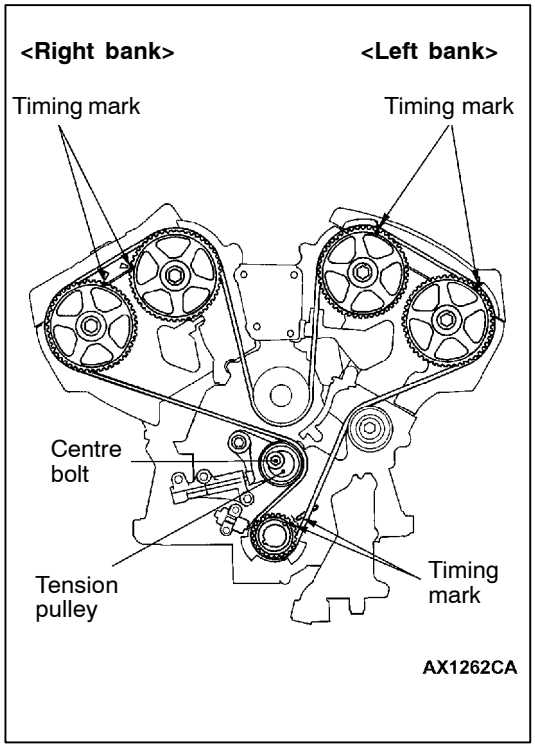
(2) If the sprocket on one side of the left bank is turned one full revolution while the sprocket timing marks on the opposite side of the left bank are aligned, the intake and exhaust valves will interfere.



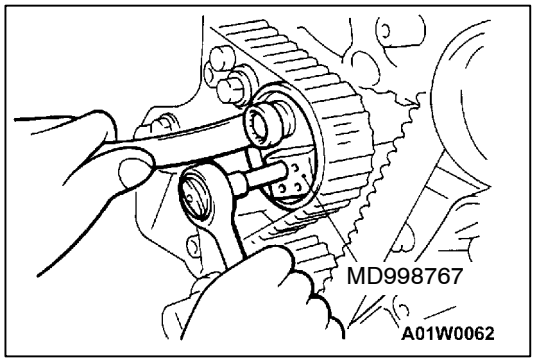
4. Set the timing belt onto the crankshaftsprocket.
5. Set the timing belt onto the idler pulley.
6. Check that the timing marks of the left bank side exhaust camshaft sprocket is aligned, and clamp the timing belt with a clip.
7. Set the timing belt onto the water pump pulley.



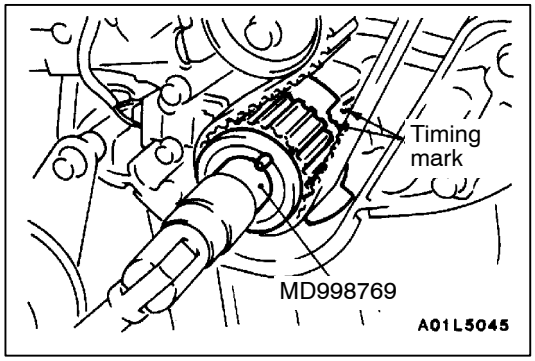
8. Check that the timing marks of the right bank side exhaust camshaft sprocket is aligned, and clamp the timing belt with a clip.
9. Set the timing belt onto the tension pulley.



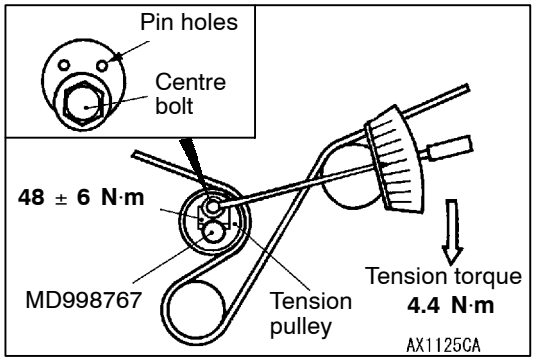
10. Turn the right bank side camsahft sprocket (exhaust side) anticlockwise unitl the tension side of the timing belt is firmaly stretched. Check all timing marks again.



11. Use special tool to push the tensioner pulley into the timing belt, and then temporarily tighten the centre bolt.
12. Loosen all the clips.



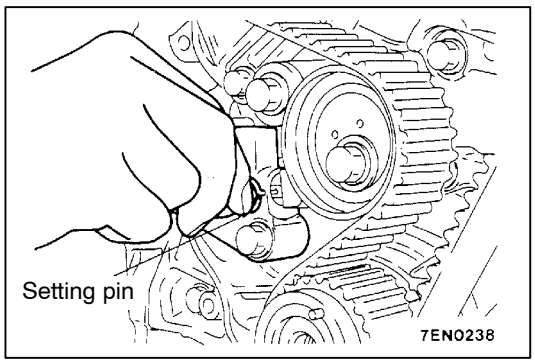
13. Use special tool to turn the crankshaft 1/4 turn anticlockwise and then turn it again clockwise until the timing marks are aligned.



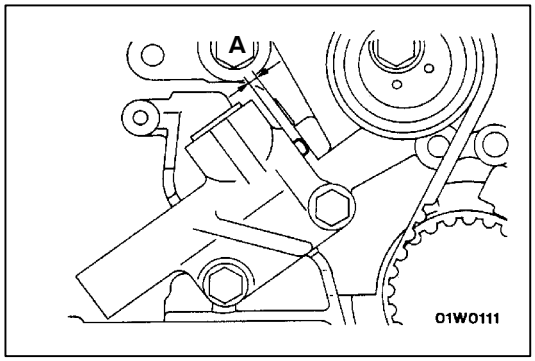
14. Loosen the centre bolt of the tensioner pulley. Use special tool and a torque wrench to apply the standard torque to the timing belt as shown in the illustration. Then tighten the centre bolt to the specified torque.

    Standard value: 4.4 N·m
    <Timing belt tension torque>

    Caution
    When tightening the centre bolt, be careful that the tensioner pulley does not turn with the bolt.



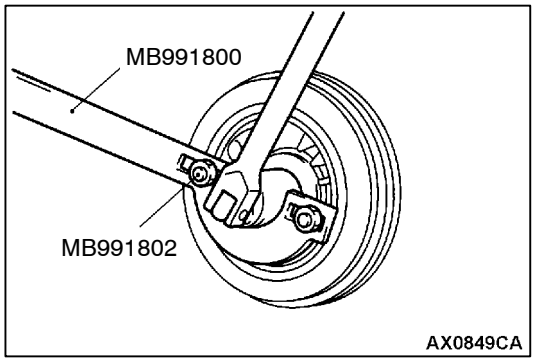
15. Remove the setting pin that has been inserted into the auto-tensioner.
16. Turn the crankshaft two turns clockwise to align the timing marks.



17. Wait for at least five minutes, and then check that the auto-tensioner pushrod extends within the standard value.

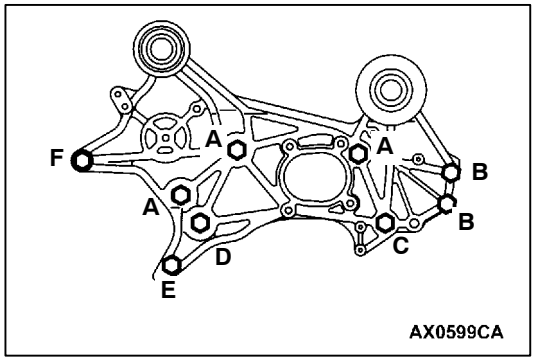
    Standard value (A): 3.8 - 5.0 mm

18. If no, repeat the operation in steps (13) to (17) above.
19. Check again that the timing marks of each sprocket are aligned.



▶C◀ CRANKSHAFT PULLEY INSTALLATION

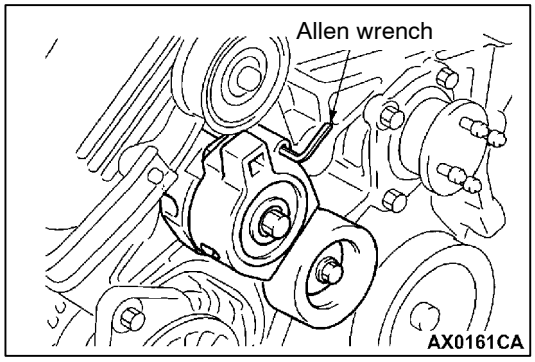
Use special tools MD991800 and MB991802 to install the crankshaft pulley.



▶D◀ ACCESSORY MOUNT ASSEMBLY INSTALLATION

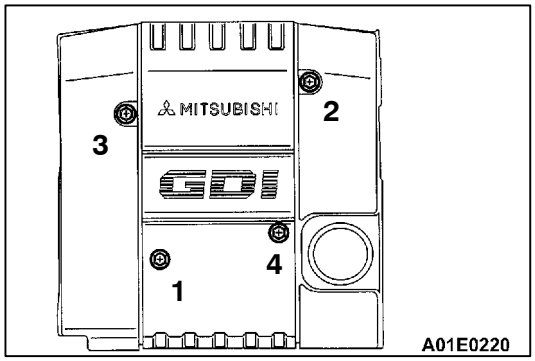
Install the bolts to the shown positions, and tighten them to the specified torque.

Bolt (symbol)	Diameter × length mm	Tightening torque(N·m)
A	10×100	41 ± 8
B	10×30	41 ± 8
C	10×100	44 ± 10
D	12×100	74 ± 9
E	8×30	22 ± 4
F	10×106	44 ± 10



▶E◀ DRIVE BELT AUTO TENSIONER INSTALLATION

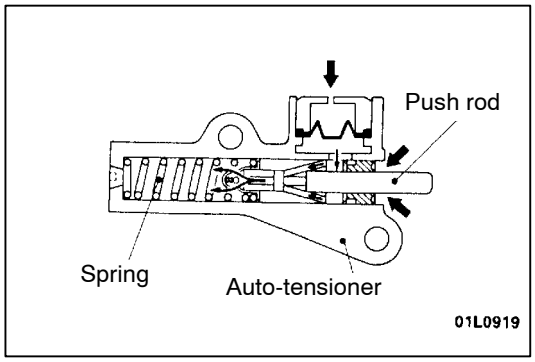
1. Install the drive belt auto tensioner with the Allen wrench inserted.
2. After the drive belt has been installed, remove the Allen wrench while holding the drive belt auto tensioner with a socket wrench drive. Then release the drive belt auto tensioner slowly.



▶F◀ ENGINE COVER INSTALLATION

Install the engine cover bolts finger-tight, and tighten them to the specified torque in the order shown.

Tightening torque: 3.0 ± 0.4 N·m



INSPECTION

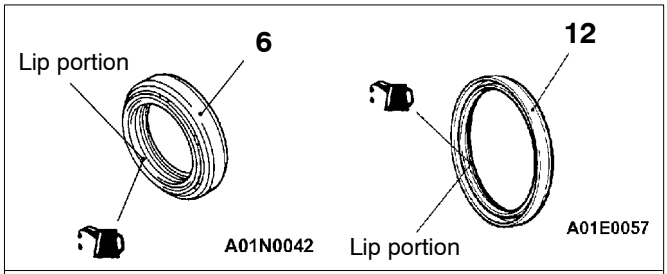
AUTO-TENSIONER

- Check the auto-tensioner for possible leaks.
- Check the push rod for cracks.

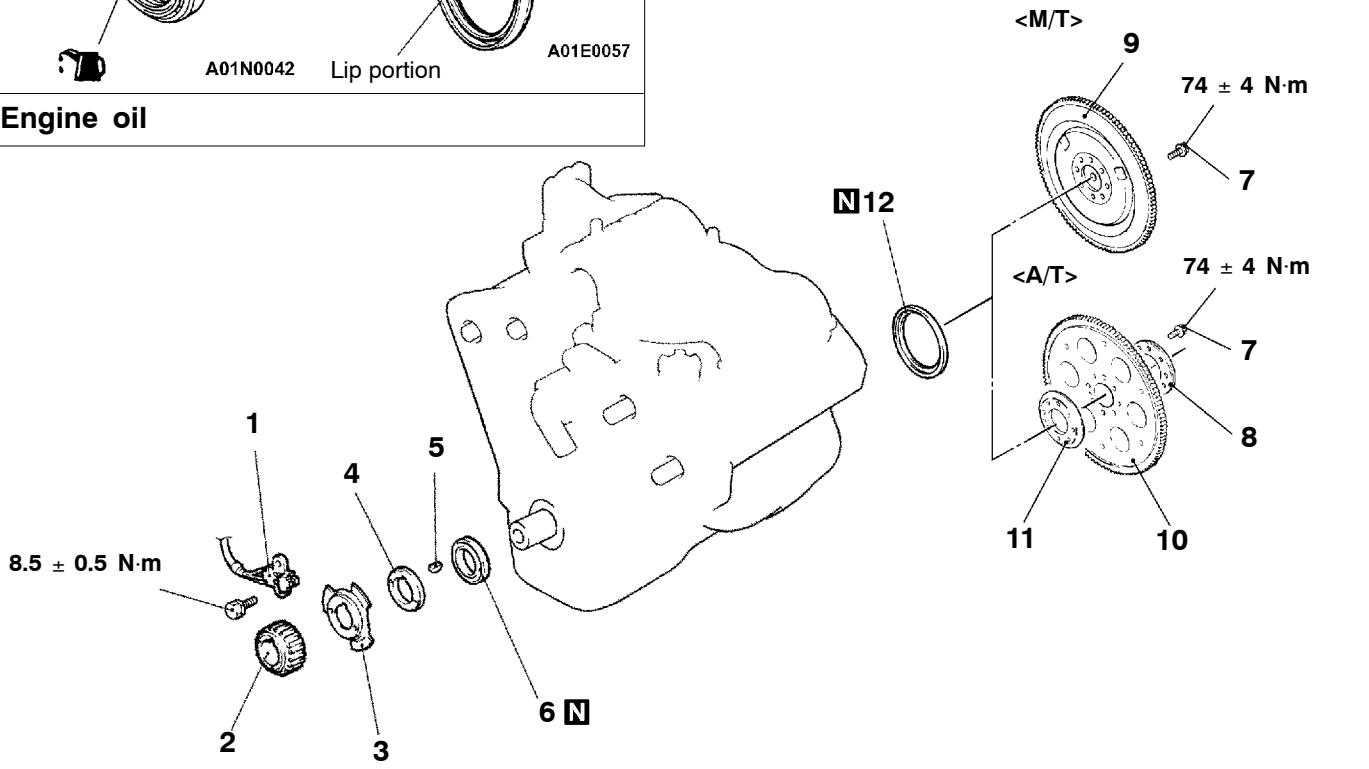
CRANKSHAFT OIL SEAL

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Timing Belt Removal and Installation (Refer to P.11A-15.)



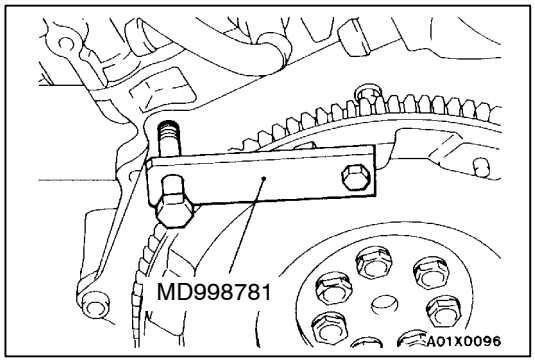
Engine oil



AY0268CA

Removal steps

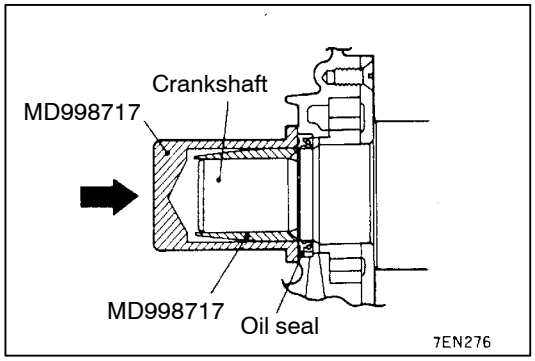
1. Crank angle sensor
▶D◀ 2. Crankshaft sprocket
▶D◀ 3. Crankshaft sensing blade
▶D◀ 4. Crankshaft spacer
5. Key
▶C◀ 6. Crankshaft front oil seal
◀A▶ ▶B◀ 7. Bolt
8. Adaptor plate
9. Flywheel
10. Drive plate
11. Crankshaft adaptor
▶A◀ 12. Crankshaft rear oil seal



REMOVAL SERVICE POINT

◀A▶ BOLT REMOVAL

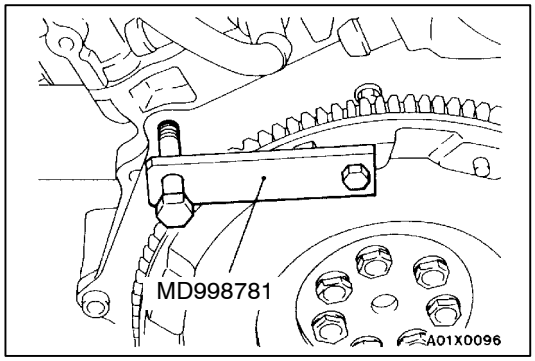
Use special tool to secure the flywheel or drive plate and remove the bolt.



INSTALLATION SERVICE POINTS

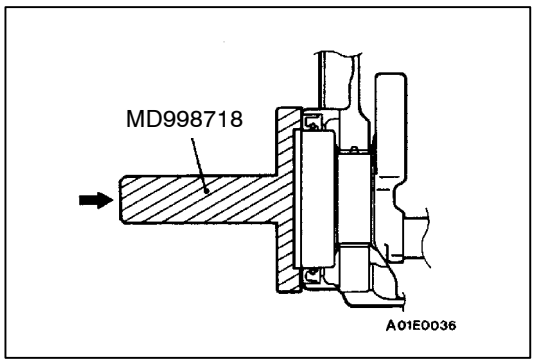
▶A◀ CRANKSHAFT REAR OIL SEAL INSTALLATION

1. Apply a small amount of engine oil to the entire circumference of the oil seal lip.
2. Use special tool to tap in the oil seal as shown in the illustration.



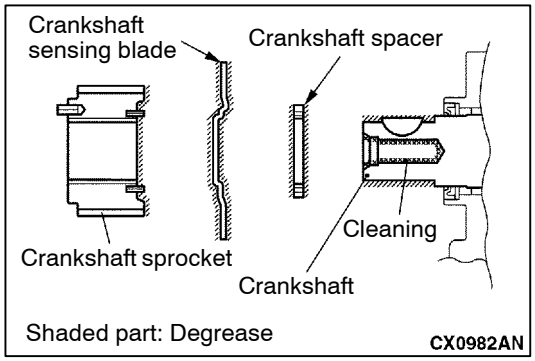
▶B◀ BOLT INSTALLATION

Use special tool in the same way as during removal to install the bolt.



▶C◀ CRANKSHAFT FRONT OIL SEAL INSTALLATION

1. Apply a small amount of engine oil to the oil seal lip and then insert.
2. Using special tool, tap the oil seal into the front case.



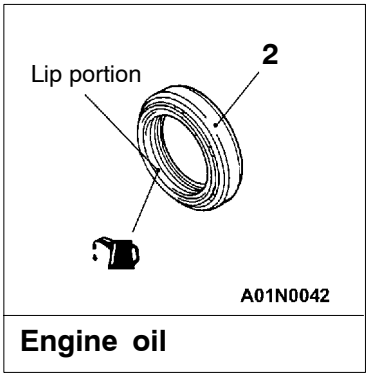
▶D◀ CRANKSHAFT SPACER/CRANKSHAFT SENSING BLADE/CRANKSHAFT SPROCKET

To prevent the crankshaft pulley mounting bolt from loosening, degrease or clean the crankshaft, the crankshaft spacer, the crankshaft sensing blade and the crankshaft at the shown positions.

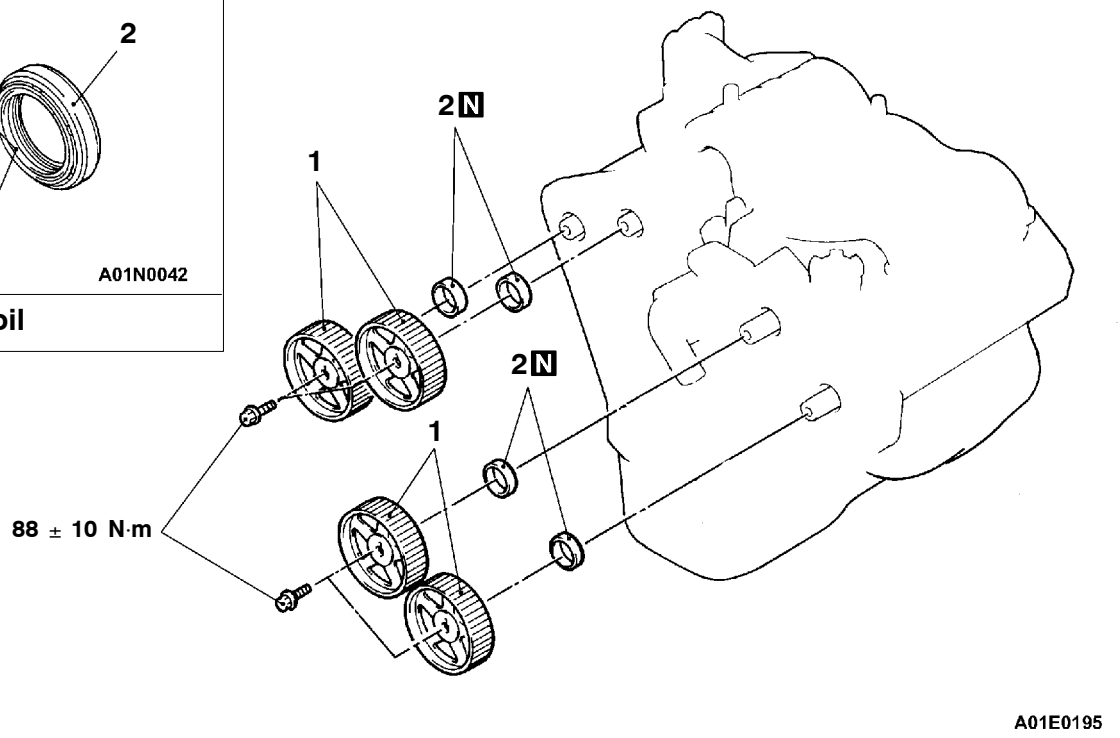
CAMSHAFT OIL SEAL

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Timing Belt Removal and Installation (Refer to P.11A-15.)

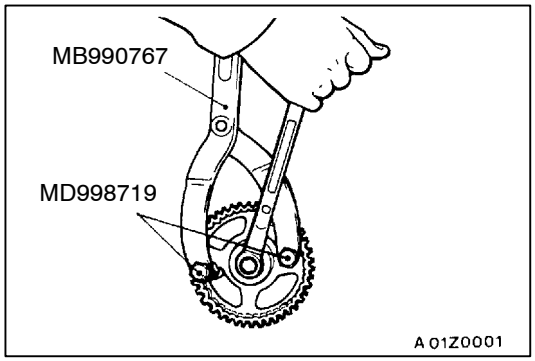


Engine oil



Removal steps

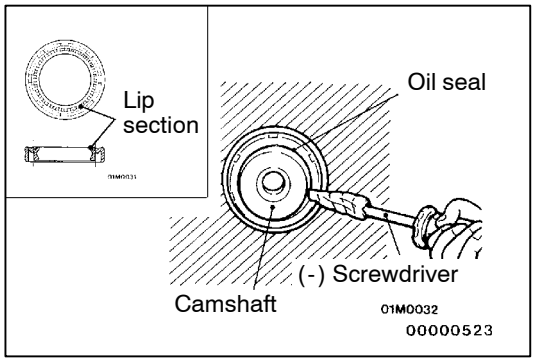
◀A▶ ▶B◀ 1. Camshaft sprocket
◀B▶ ▶A◀ 2. Camshaft oil seal



REMOVAL SERVICE POINTS

◀A▶ CAMSHAFT SPROCKET REMOVAL

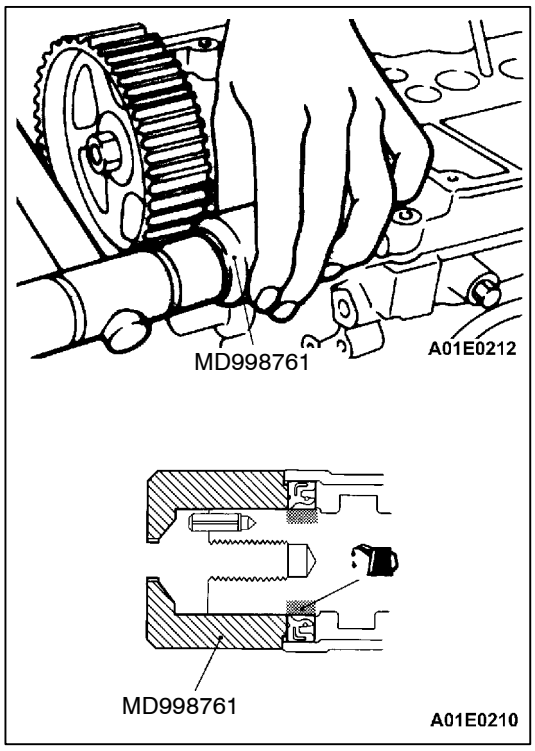
Use special tools to remove the camshaft sprocket.



◀B▶ CAMSHAFT OIL SEAL REMOVAL

1. Make a notch in the oil seal lip section with a knife, etc.
2. Cover the end of a flat-tipped screwdriver with a shop towel and insert into the notched section of the oil seal, and pry out the oil seal to remove it.

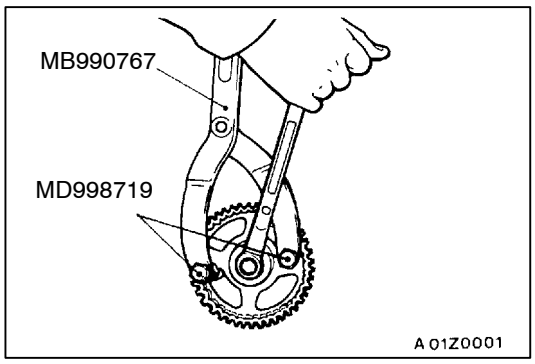
Caution
Be careful not to damage the camshaft and the cylinder head.



INSTALLATION SERVICE POINTS

▶A◀ CAMSHAFT OIL SEAL INSTALLATION

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



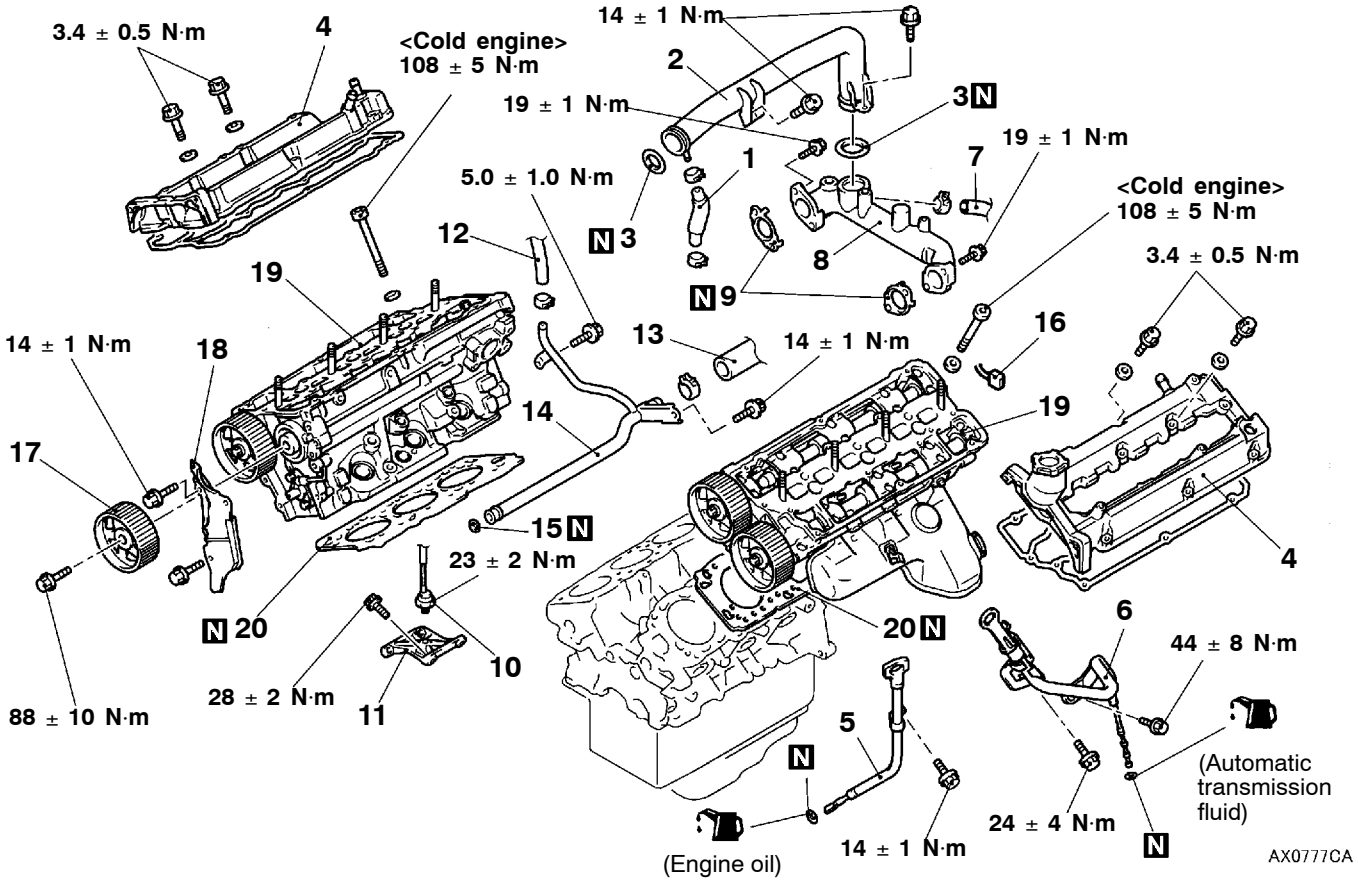
▶B◀ CAMSHAFT SPROCKET INSTALLATION

Use special tools in the same way as during removal to install the camshaft sprocket.

CYLINDER HEAD GASKET

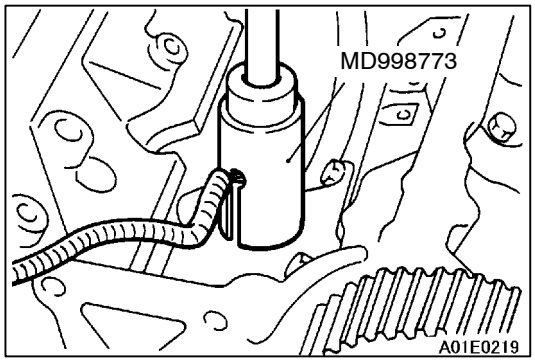
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Fuel Discharge Prevention (Pre-removal operation)
- Engine Coolant Draining and Refilling (Refer to GROUP 14 - On-vehicle Service.)
- Engine Oil Draining and Refilling (Refer to GROUP 12 - On-vehicle Service.)
- Front Exhaust Pipe Removal and Installation (Refer to GROUP 15 - Exhaust Pipe and Main Muffler.)
- Timing Belt Removal and installation (Refer to P.11A-15.)
- Thermostat Case and Water Inlet Fittng Removal and Installation (Refer to GROUP 14 - Water Pump.)
- Intake Manifold Removal and Installation (Refer to GROUP 15 - Intake Manifold.)
- Fuel Pump (High Pressure) Removal and Installation (Refer to GROUP 13.)



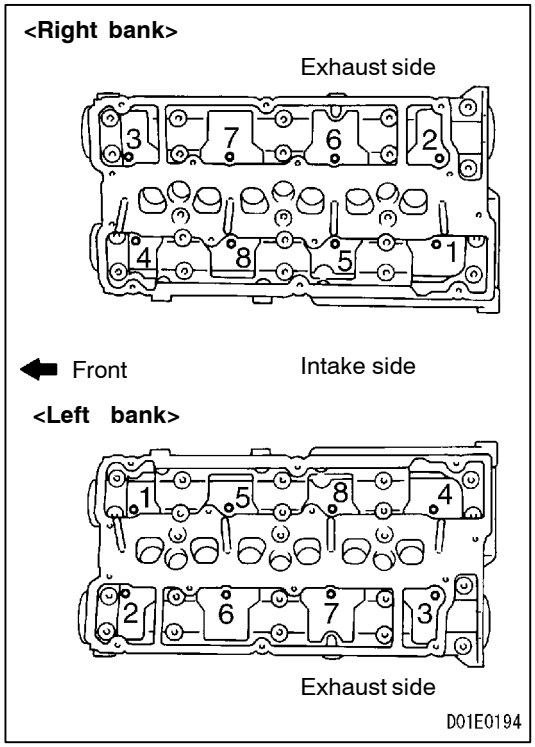
Removal steps

1. Water hose
2. Water outlet pipe assembly
▶C◀ 3. O-ring
4. Rocker cover
5. Oil dipstick assembly <when removing left bank only>
6. A/T Fluid dipstick assembly <when removing left bank only>
7. Heater hose connection
▶E◀ 8. Water passage assembly
▶E◀ 9. Gasket
◀A▶ ▶D◀ 10. Detonation sensor
11. Detonation sensor bracket
12. Water hose connection
13. Heater hose connection
14. Water pipe assembly
▶C◀ 15. O-ring
16. Camshaft position sensor connector <when removing left bank only>
17. Camshaft sprocket (Intake side) <when removing right bank only>
18. Timing belt rear cover <when removing right bank only>
◀B▶ ▶B◀ 19. Cylinder head assembly
▶A◀ 20. Cylinder head gasket



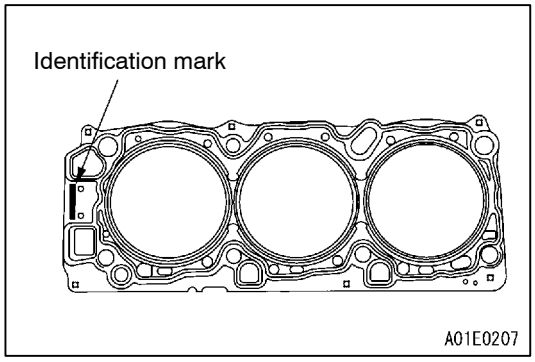
REMOVAL SERVICE POINTS

◀A▶ DETONATION SENSOR REMOVAL



◀B▶ CYLINDER HEAD ASSEMBLY REMOVAL

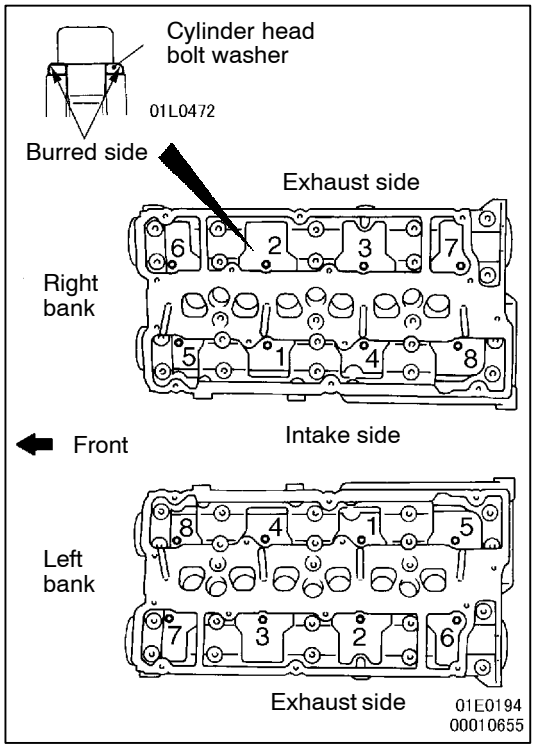
Loosen the bolts in 2 or 3 steps in order of the numbers shown in the illustration, and remove the cylinder head bolt.



IINSTALLATION SERVICE POINTS

▶A◀ CYLINDER HEAD GASKET INSTALLATION

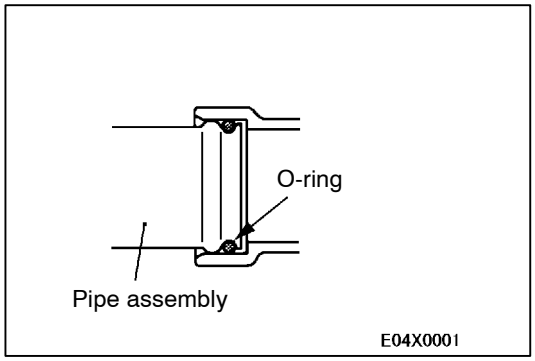
1. Degrease the cylinder head and cylinder block gasket mounting surfaces.
2. Make sure that the gasket has the proper identification mark for the engine.
3. Lay the cylinder head gasket on the cylinder block with the identification mark at the front top.



▶B◀ CYLINDER HEAD ASSEMBLY INSTALLATION

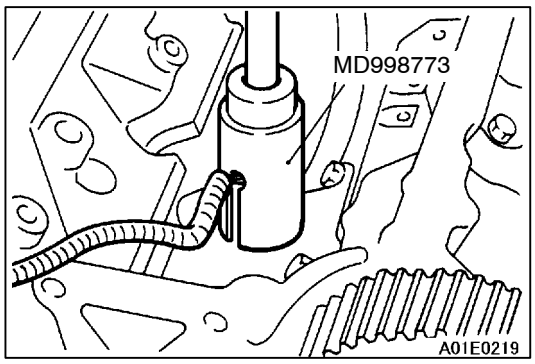
Tighten the bolts in 2 or 3 steps in order of the numbers shown in the illustration, and install the cylinder head bolt.

Caution
Install the head bolt washers with the beveled side facing upwards as shown in the illustration.

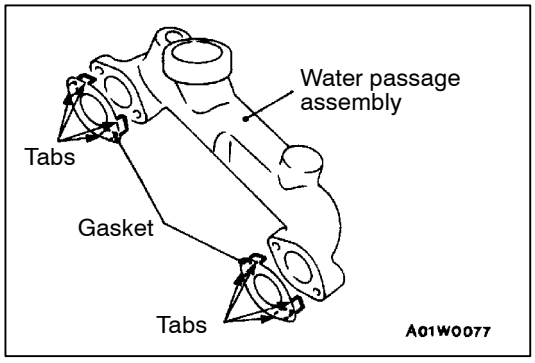


▶C◀ O-RING INSTALLATION

Insert the O-ring to the water inlet pipe assembly and coat the outer circumference of the O-ring with water.



▶D◀ DETONATION SENSOR INSTALLATION



▶E◀ GASKET/WATER PASSAGE ASSEMBLY INSTALLATION

Bend the tabs onto the water passage assembly. Then install the water passage assembly to the cylinder head so that the gasket doesn't slip.

ENGINE ASSEMBLY

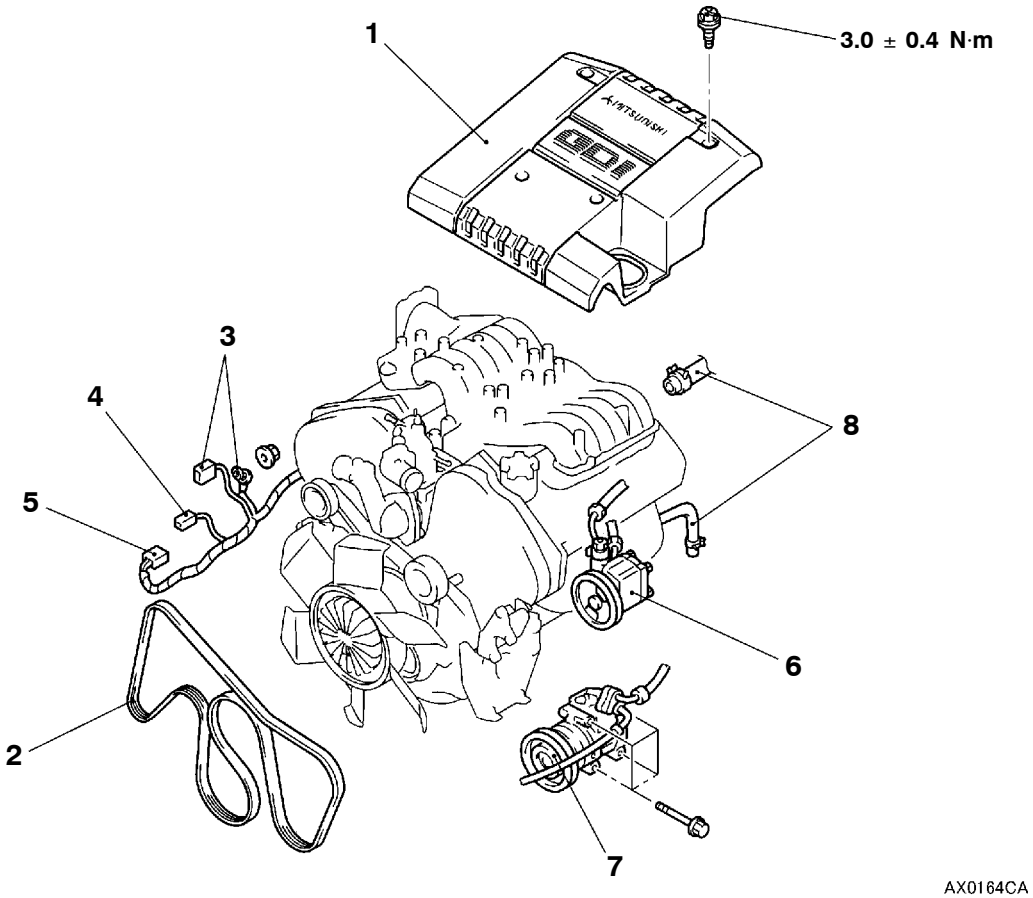
REMOVAL AND INSTALLATION

Caution

***: Indicates parts which should be initially tightened, and then fully tightened after placing the vehicle horizontally and loading the full weight of the engine on the vehicle body.**

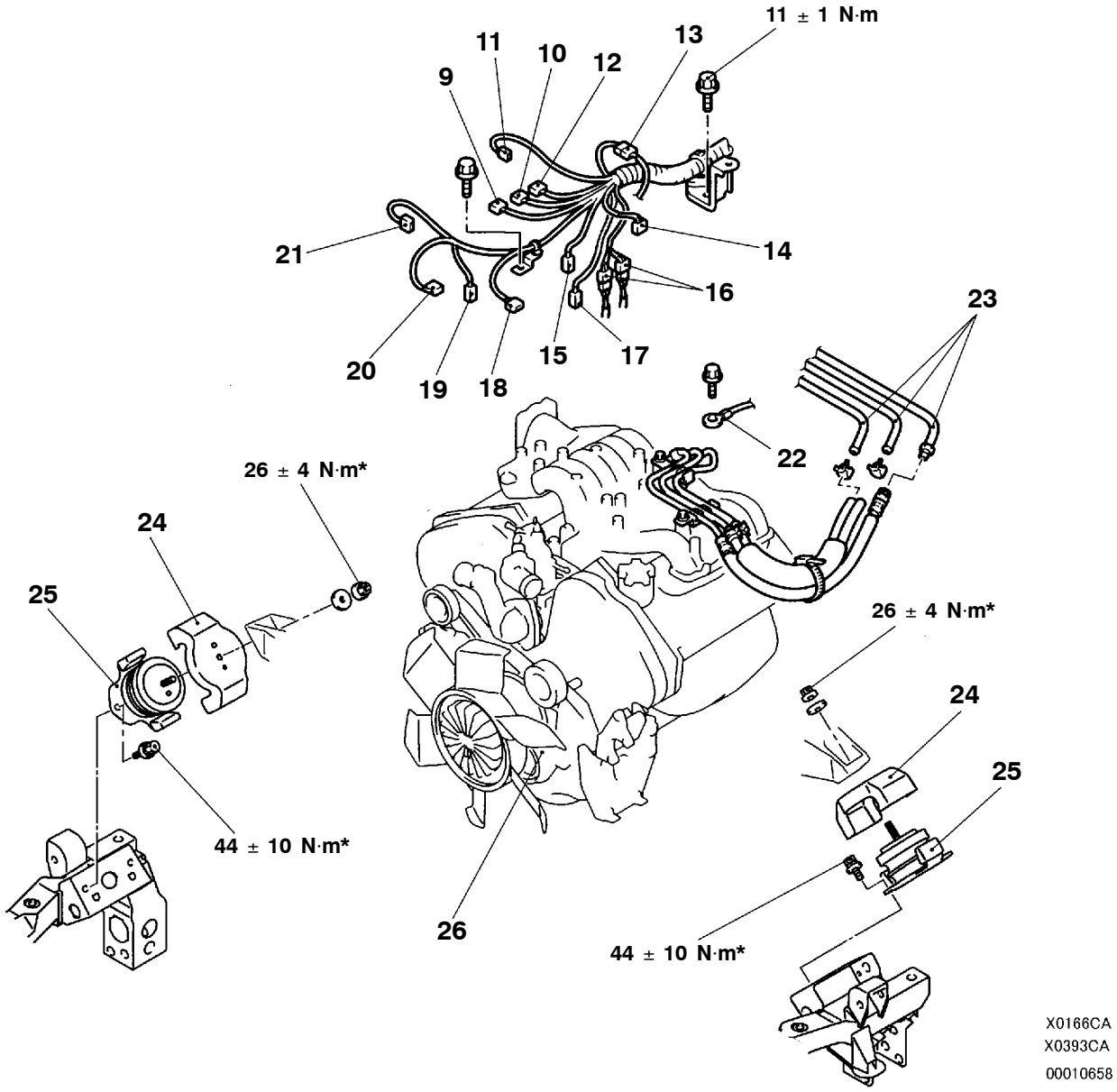
Pre-removal and Post-installation Operation

- Hood Removal and Installation (Refer to GROUP 42 - Hood.)
- Skid Plate and Under Cover Removal and Installation
- Fuel Discharge Prevention (Pre-removal operation)
- Engine Coolant Draining and Refilling (Refer to GROUP 14 - On-vehicle Service.)
- Air Cleaner and Air Intake Hose Removal and Installation (Refer to GROUP 15 - Air Cleaner.)
- Battery, Battery Tray and Bracket Removal and Installation
- Radiator Removal and Installation (Refer to GROUP 14 - Radiator.)
- Engine Oil Draining and Refilling (Refer to GROUP 12 - On-vehicle Service.)
- Front Exhaust Pipe Removal (Refer to GROUP 15 - Exhaust Pipe and Main Muffler.)
- Transmission Assembly Removal and Installation (Refer to GROUP 22,23 - Transmission Assembly.)



Removal steps

▶B◀ 1. Engine cover
2. Drive belt
3. Alternator connector
4. Starter motor connector
◀A▶ 5. Freewheel engage switch connector
◀A▶ 6. Power steering oil pump assembly
7. A/C compressure assembly
8. Heater hose connection



9. Ignition failure sensor connector
10. Detonation sensor connector
11. Throttle position sensor connector
12. Control wiring harness and injector wiring harness connection
13. Control wiring harness and ignition wiring harness connection
14. Fuel pressure sensor harness, camshaft position sensor harness and control wiring harness injector wiring harness connection
15. Purge control solenoid valve connector
16. Control wiring harness and battery cable connection
17. Oxygen sensor connector
18. Crank angle sensor connector
19. Engine coolant temperature gauge unit connector
20. Engine coolant temperature sensor connector
21. Throttle valve control servo connector
22. Battery cable connection
23. Fuel pipe and hose connection
24. Heat protector
25. Engine front mount insulator
- ◀B▶ ▶A◀ 26. Engine assembly

REMOVAL SERVICE POINTS

◀A▶ POWER STEERING OIL PUMP ASSEMBLY AND A/C COMPRESSOR ASSEMBLY REMOVAL

1. Remove the oil pump and A/C compressor (with the hose attached).
2. Suspend the removed oil pump (by using wire or similar material) at a place where no damage will be caused during removal/installation of the engine assembly.

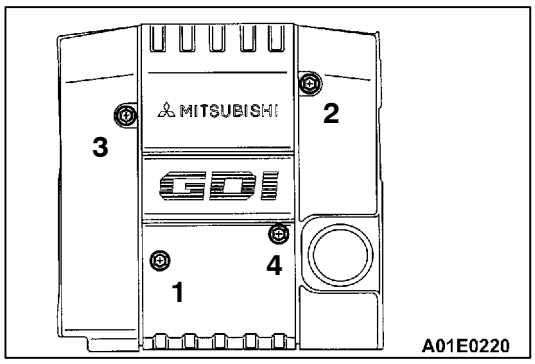
◀B▶ ENGINE ASSEMBLY REMOVAL

1. Check that all cables, hoses, harness connectors, etc. are disconnected from the engine.
2. Lift the special tool (MB991683) and chain block slowly to remove the engine assembly upward from the engine compartment.

INSTALLATION SERVICE POINT

▶A◀ ENGINE ASSEMBLY INSTALLATION

Install the engine assembly. When doing so, check carefully that all pipes and hoses are connected, and that none are twisted, damaged, etc.



▶B◀ ENGINE COVER INSTALLATION

Install the engine cover bolts finger-tight, and tighten them to the specified torque in the order shown.

Tightening torque: 3.0 ± 0.4 N·m

ENGINE <4D5>

Click on the applicable bookmark to selected the required model year.

ENGINE <4D5>

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Auto-tensioner check 7
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CYLINDER HEAD GASKET 30

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GENERAL INFORMATION

Items			4D56
Total displacement mL			2,477
Bore x Stroke mm			91.1 x 95.0
Compression ratio			21
Combustion chamber			Vortex chamber type
Camshaft arrangement			SOHC
Number of valve	Intake		4
	Exhaust		4
Valve timing	Intake	Opening	BTDC 20°
	Exhaust	Closing	ABDC 49°
	Intake	Opening	BBDC 55°
	Exhaust	Closing	ATDC 22°
Fuel system			Distribution type injection pump
Rocker arm			Roller type
Adjusting screw			Elephant foot type

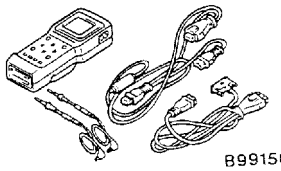
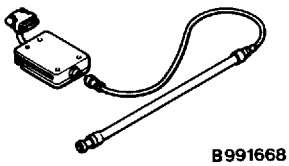
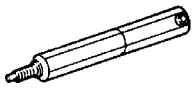
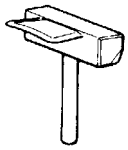
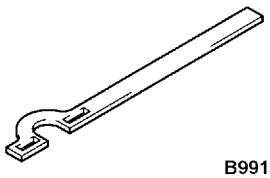
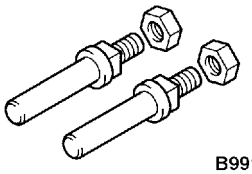
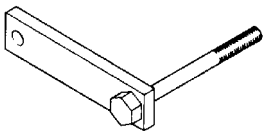
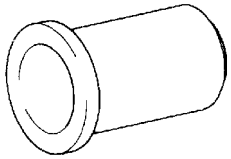
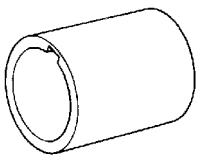
SERVICE SPECIFICATIONS

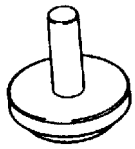
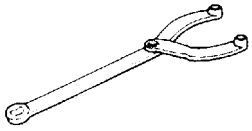
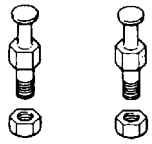
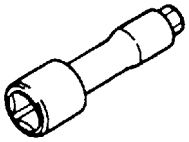
Items		Standard value	Limit
A/C compressor drive belt (When inspection)	Vibration frequency Hz	157 - 176	–
	Tension N	260 - 325	–
	Deflection mm <Reference>	8.0 - 8.5	–
A/C compressor drive belt (When adjustment)	Vibration frequency Hz	157 - 176	–
	Tension N	260 - 325	–
	Deflection mm <Reference>	8.0 - 8.5	–
A/C compressor drive belt (When replacement)	Vibration frequency Hz	192 - 208	–
	Tension N	390 - 450	–
	Deflection mm <Reference>	6.5 - 7.0	–
Valve clearance (at hot) mm		0.25	-
Injection timing (Value indicated on dial gauge mm)		9° ATDC (1 ± 0.03)	-
Idle speed r/min		750 ± 100	-
Compression pressure kPa (at engine speed of 280 r/min)		3,040	Min. 2,256
Compression pressure difference of all cylinder (at engine speed of 280 r/min) kPa		-	Max. 294
Timing belt tension mm		4 - 5	
Timing belt B tension mm		4 - 5	

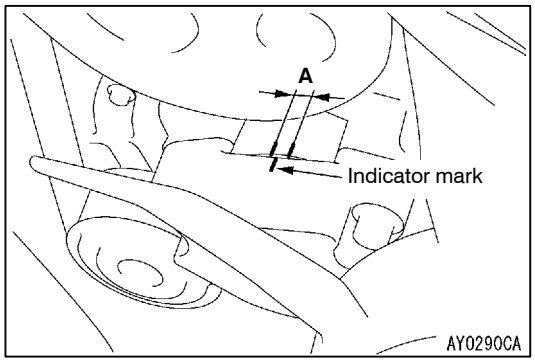
SEALANTS

Items	Specified sealant	Remarks
Oil pan	MITSUBISHI GENUINE PART MD970389 or equivalent	Semi-drying sealant
Semi-circular packing and rocker cover gasket seal, and cylinder head seal	3M ATD Part No. 8660 or equivalent	

SPECIAL TOOLS

Tools	Number	Name	Use
 B991502	MB991502	MUT-II sub-assembly	Drive belt tension measurements
 B991668	MB991668	Belt tension meter set	
	MD998384	Prestroke measuring adapter	Adjustment of the injection timing
	MD998727	Oil pan remover	Removal of oil pan
 B991800	MB991800	Crankshaft pulley holder	Holding the crankshaft pulley
 B991802	MB991802	Pin B	
	MD998781	Flywheel stopper	Securing the flywheel
	MD998382	Crankshaft front oil seal installer	Installing the crankshaft front oil seal
	MD998383	Crankshaft front oil seal guide	

Tools	Number	Name	Use
	MD998376	Crankshaft rear oil seal installer	Press-fitting the crankshaft rear oil seal
	MB990767	End yoke holder	Holding the camshaft sprocket
	MD998719	Crankshaft pulley holder pin	
	MD998381	Camshaft oil seal installer	Installing the camshaft oil seal
	MD998051	Cylinder head bolt wrench	Removal and installation of the cylinder head bolt



ON-VEHICLE SERVICE

DRIVE BELT TENSION CHECK AND ADJUSTMENT

ALTERNATOR AND POWER STEERING OIL PUMP DRIVE BELT TENSION CHECK

Caution
Perform the check after rotating the engine to the normal direction (one revolution and over).

1. Check that the indicator mark of the auto-tensioner is located within the scope shown as “A” on the tensioner bracket.
2. If the mark is located out of the scope “A,” replace the drive belt.

   NOTE
   Since the auto-tensioner is used, it is not necessary to adjust the tension of the belt.

A/C COMPRESSOR DRIVE BELT TENSION CHECK AND ADJUSTMENT <VEHICLES WITH A/C>

1. Check the drive belt tension by the following procedures.

Standard value:

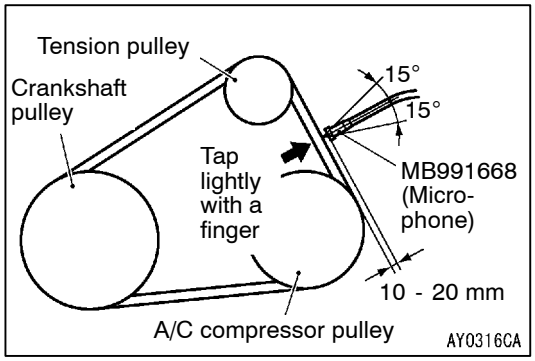
Item	During inspection	During adjustment	During replacement
Vibration frequency Hz	157 - 176	157 - 176	192 - 208
Tension N	260 - 325	260 - 325	390 - 450
Deflection mm <Reference>	8.0 - 8.5	8.0 - 8.5	6.5 - 7.0

<When using MUT-II>

(1) Connect the MUT-II to the special tool (MB991668).
(2) Connect the MUT-II to the diagnosis connector.

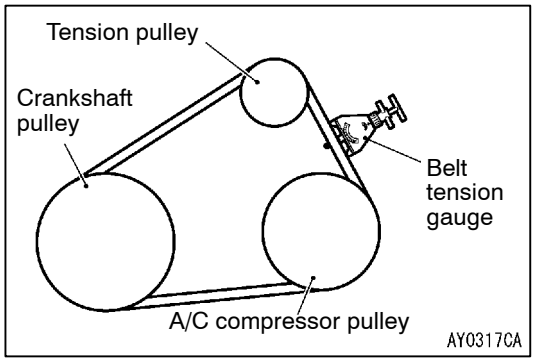
Caution
Always turn the ignition switch to LOCK (OFF) position before disconnecting or connecting the MUT-II.

(3) Turn the ignition switch to ON, and select the "Belt tension measurement" on the menu screen.

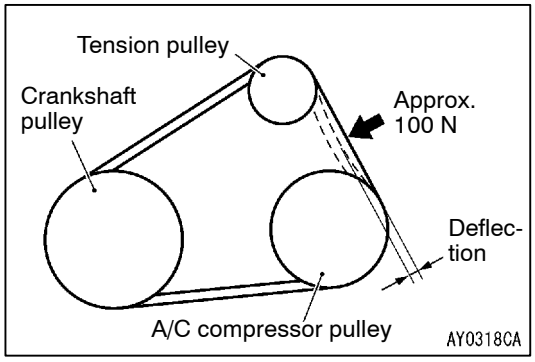


(4) Hold a microphone to the middle of the drive belt between the pulleys (at the place indicated by the arrow), approximately 10 - 20 mm away from the rear surface of the belt and so that it is perpendicular to the belt (within an angle of ±15°).
(5) Gently tap the middle of the belt between the pulleys (the place indicated by the arrow) with your finger as shown in the illustration, and check that the vibration frequency of the belt is within the standard value.

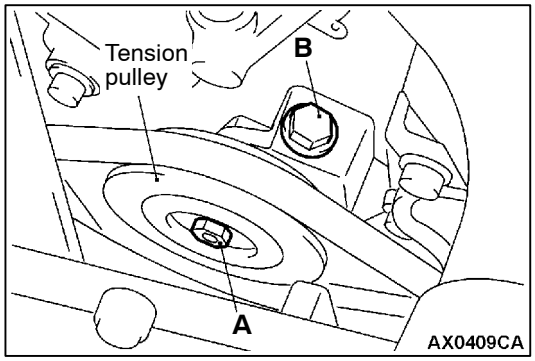
Caution
1) The temperature of the surface of the belt should be as close to normal temperature as possible.
2) Do not allow any contaminants such as water or oil to get onto the microphone.
3) If strong gusts of wind blow against the microphone or if there are any loud sources of noise nearby, the values 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.



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

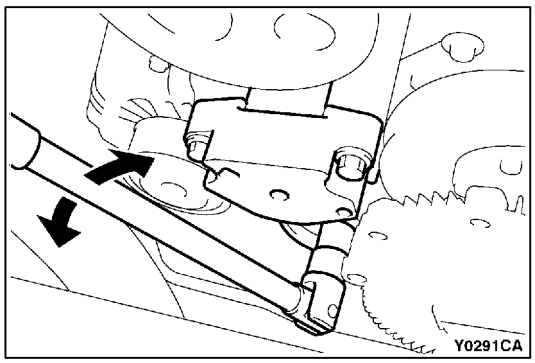


2. If not within the standard value, adjust the belt tension by the following procedure.
   (1) Loosen the tension pulley securing bolt A.
   (2) Use the adjusting bolt B to adjust the belt deflection.
   (3) Tighten the securing bolt A to the specified torque.

   Tightening torque: 44 ± 10 N·m

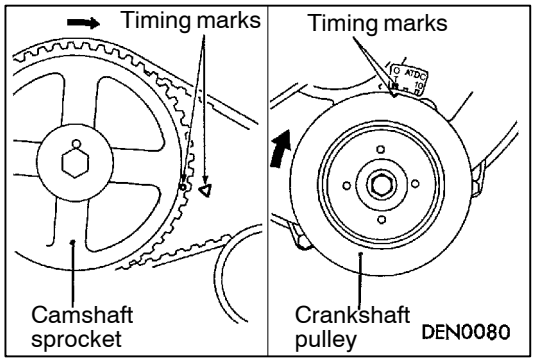
   (4) Check the belt tension, and readjust if necessary.

   Caution
   When checking the belt tension, turn the crankshaft clockwise one turn or more.



AUTO-TENSIONER CHECK

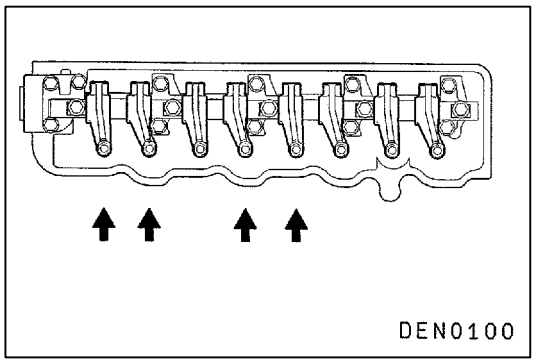
1. Run the engine at idling speed and then stop it to check whether the drive belt is forced out from the width of the auto-tensioner pulley.
2. Remove the alternator and power steering oil pump drive belt. (Refer P.11B-19.)
3. Locate a ring spanner onto the auto-tensioner pulley mounting bolt, and move the tensioner back and forth to confirm there is no stiffness.
4. If some abnormality is found during the above mentioned check (1) and (3), replace the auto-tensioner.
5. Install the alternator and power steering oil pump drive belt. (Refer P.11B-19.)



VALVE CLEARANCE CHECK AND ADJUSTMENT

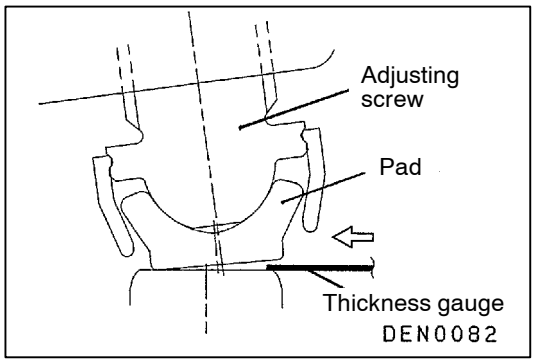
1. Start the engine and allow it to warm up until the engine coolant temperature reaches 80 to 90 °C.
2. Remove the timing belt upper cover.
3. Remove the rocker cover.
4. Align the camshaft sprocket timing marks and set the No. 1 cylinder at top dead centre.

Caution
The crankshaft should always be turned in a clockwise direction.

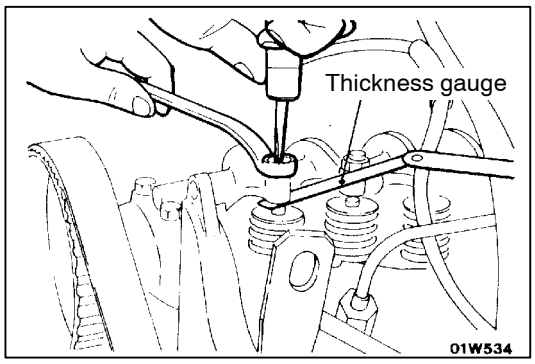


5. Measure the valve clearance at the places indicated by arrows in the illustration.

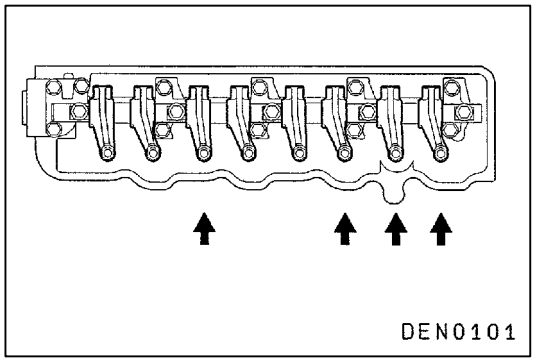
Standard value: 0.25 mm



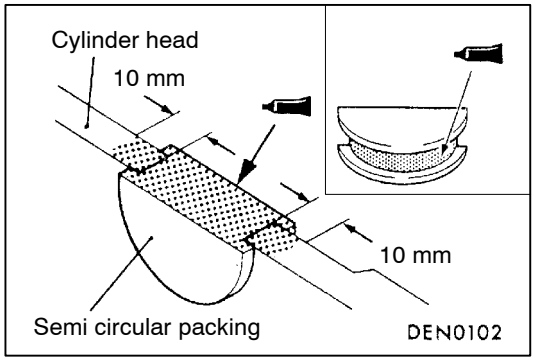
NOTE
Insert the thickness gauge from the centre of the cylinder head towards the outside so that it doesn't touch the pad.



6. If the clearance is outside the standard value, loosen the lock nut of the rocker arm and adjust by turning the adjusting screw while using a thickness gauge to measure the clearance.
7. Tighten the lock nut while holding the adjusting screw with a screwdriver so that it doesn't turn.
8. Turn the crankshaft 360° clockwise to bring No. 4 cylinder to the top dead centre position.



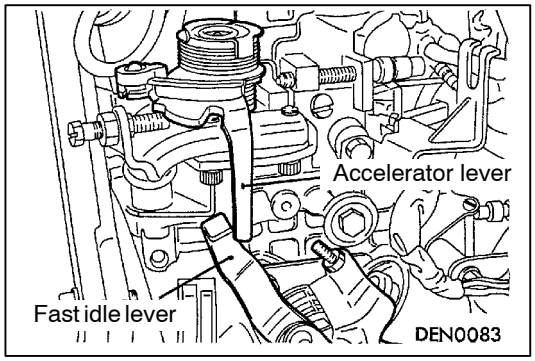
9. Measure the valve clearances at the places indicated by arrows in the illustration. If the clearance is not within the standard value, repeat steps 7 and 8 above.



10. Apply specified sealant to the section of the semi-circular packing shown in the illustration.

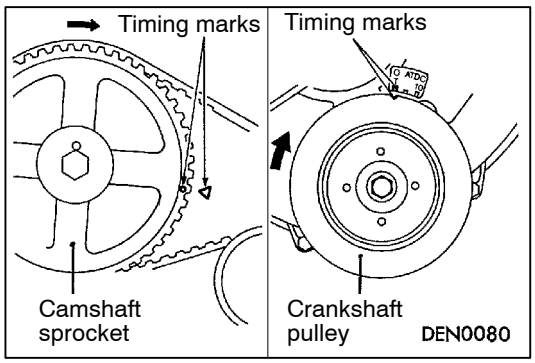
    Specified sealant: 3M ATD Part No. 8660 or equivalent

11. Install the rocker cover.
12. Install the timing belt upper cover.

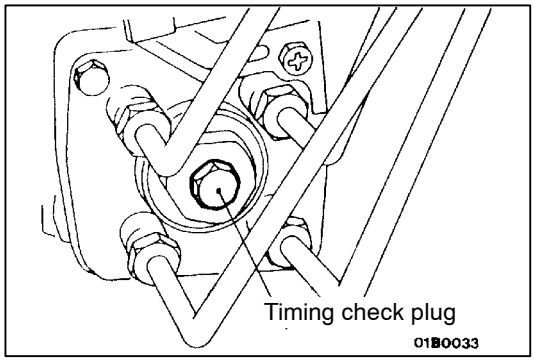


INJECTION TIMING CHECK AND ADJUSTMENT

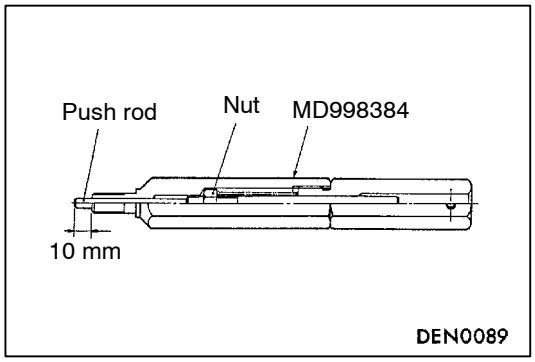
1. Warm up the engine and then check to be sure that the fast idle lever is separated from the accelerator lever.
2. Remove all of the glow plugs.
3. Remove the timing belt upper cover.



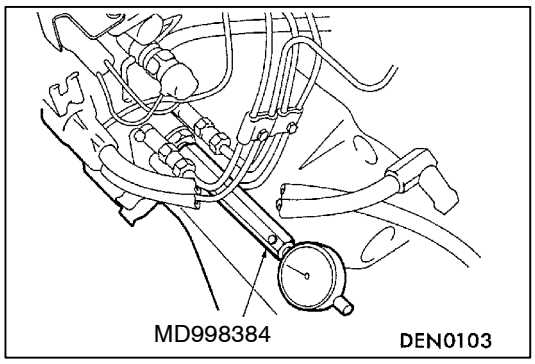
4. Align the timing marks of the camshaft sprocket and set the No. 1 cylinder to the top dead centre position.



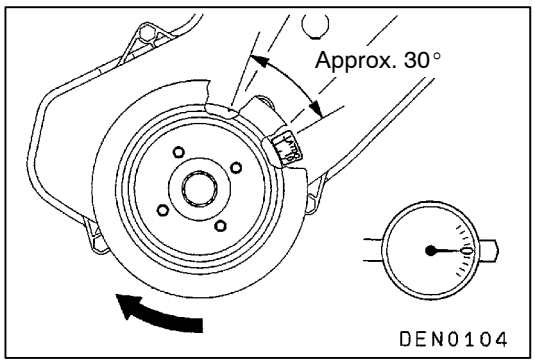
5. Remove the timing check plug at the rear of the injection pump.



6. Before installation of special tool, make sure that push rod is protruding by 10 mm. Protrusion of push rod can be adjusted with an inner nut.
7. Connect the dial gauge to the special tool.

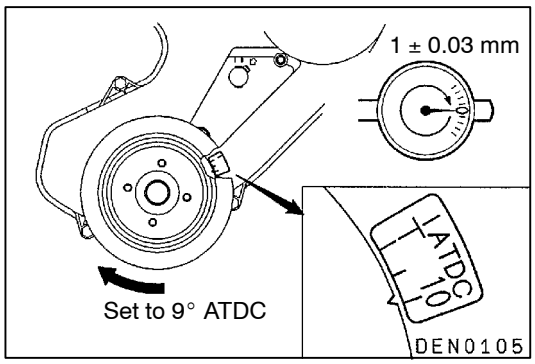


8. Install the special tool to the check plug at the rear of the injection pump.



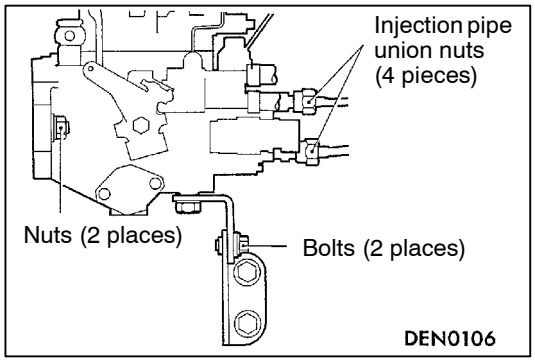
9. Turn the crankshaft clockwise to move the No. 1 cylinder approximately 30° before compression top dead centre.
10. Set the needle of the dial gauge to 0.
11. Check that the needle doesn't move even if the crankshaft is turned slightly (2 - 3°) in both clockwise and counterclockwise direction.

    NOTE
    If the needle moves, the notch is not positioned properly, so once again move the No. 1 cylinder approximately 30° before compression top dead centre.



12. Turn the crankshaft clockwise to align the No. 1 cylinder to 9° ATDC.
13. Check that the value indicated on the dial gauge is at the standard value.

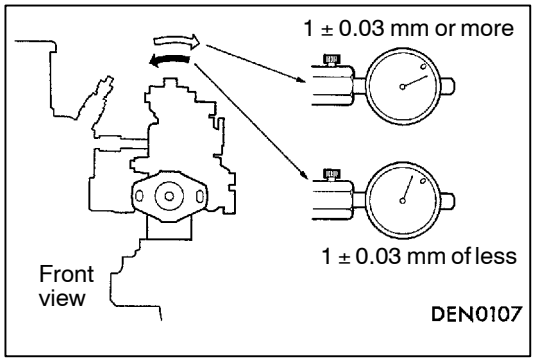
    Standard value: 1 ± 0.03 mm



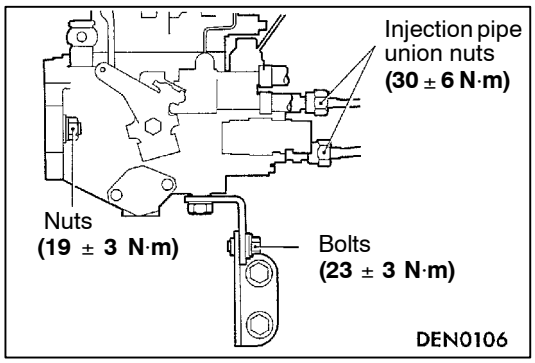
14. If the needle is outside the standard value, adjust the injection timing by the following procedure.
    (1) Loosen the injection pipe union nuts (4 places) on the injection pump. (Do not remove the union nuts.)

    Caution
    When loosening the nuts, hold the delivery valve holders with a spanner so that they don't turn at the same time.

    (2) Loosen the upper mounting nuts and the lower mounting bolts of the injection pump. (Do not remove the nut and bolt.)

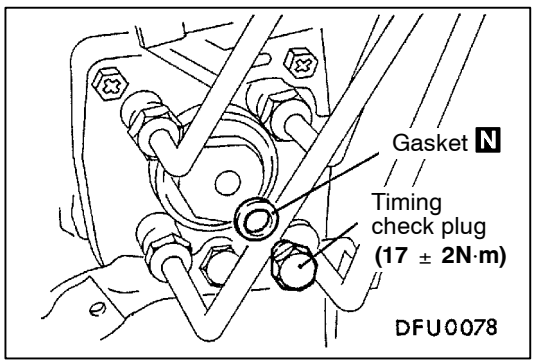


    (3) Tilt the injection pump to the left and right and adjust the needle on the dial gauge so that the display value is uniform.
    (4) Provisionally tighten the mounting nut and bolt of the injection pump.
    (5) Repeat steps 9 - 13 to check if the adjustment has been made correctly.



    (6) Tighten the mounting nuts and bolts to the specified torque.
    (7) Tighten the injection pump union nuts to the specified torque.

    Caution
    When tightening the nuts, hold the delivery valve holders with a spanner so that they don't turn at the same time.

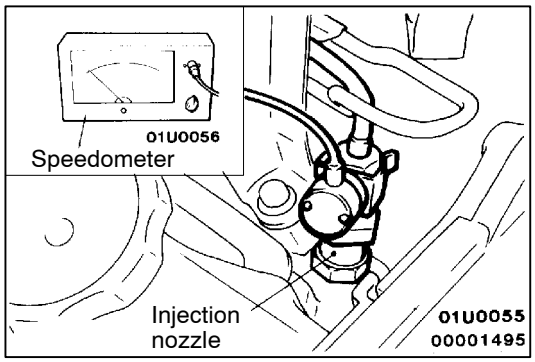


15. Remove the special tool.
16. Install a new gasket to the timing check plug.
17. Tighten the timing check plug to the specified torque.

IDLE SPEED CHECK AND ADJUSTMENT

NOTE
Check that the injection timing is normal

1. Before inspection, set the vehicle to the pre-inspection condition.

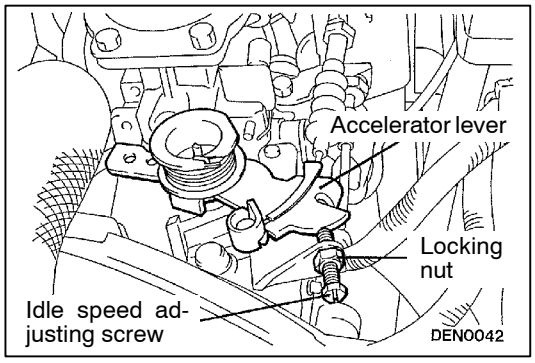


2. Connect the speedometer to the injection nozzle or the injection pipe.

   Caution
   When the speedometer is connected to the injection pipe, the pipe mounting clamps should all be removed.

3. Start the engine and run it at idle.
4. Check the idle speed.

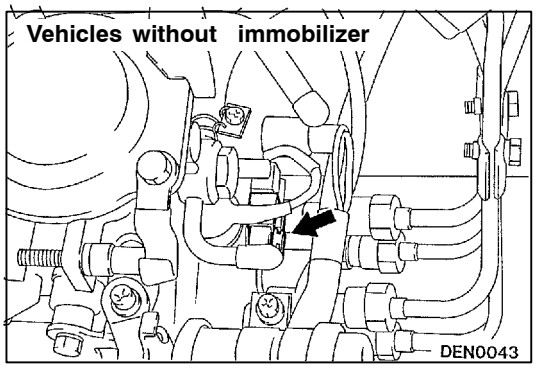
   Standard value: 750 ± 100 r/min



5. If not within the standard value, loosen idle adjusting screw lock nut and adjust the idle speed by rotating adjusting screw. And tighten locking nut.

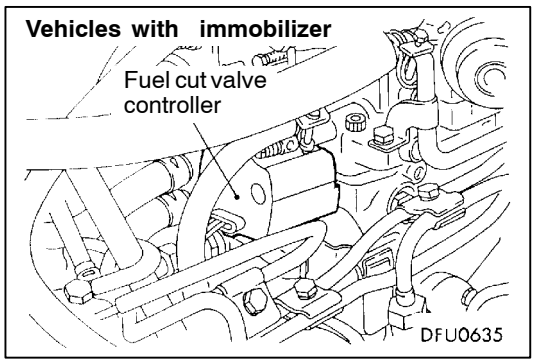
IDLE-UP MECHANISM CHECK AND ADJUSTMENT-FOR A/C

Refer to GROUP 55 - On-vehicle Service.



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 glow plugs.

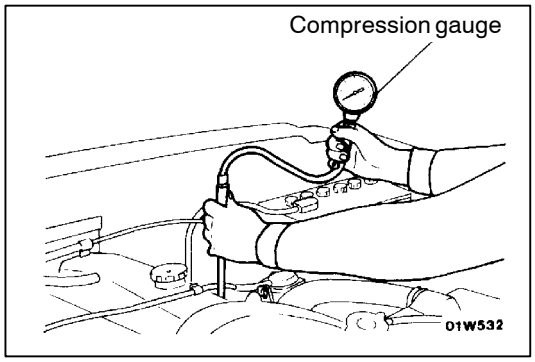


3. Disconnect the fuel cut solenoid valve connector. <Vehicles without immobilizer> Disconnect the fuel cut valve controller connector. <Vehicles with immobilizer>

   NOTE
   Doing this will prevent carrying out fuel injection.

4. Cover the glow 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 glow 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 glow plug hole, which is dangerous.



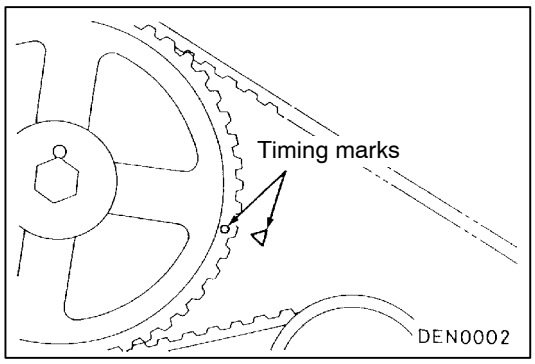
5. Set compression gauge to one of the glow plug holes.
6. Crank the engine and measure the compression pressure.

   Standard value (at engine speed of 280 r/min): 3,040 kPa

   Limit (at engine speed of 280 r/min): min. 2,256 kPa
7. Measure the compression pressure for all the cylinders, and check that the pressure differences of the cylinders are below the limit.

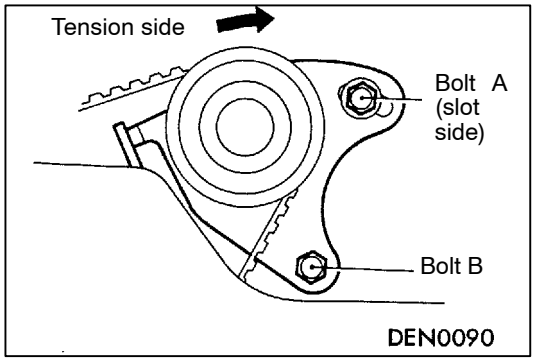
   Limit: max 294 kPa
8. If there is a cylinder with compression or a compression difference that is outside the limit, pour a small amount of engine oil through the glow plug hole, and repeat the operations in steps (6) and (7).
   (1) If the compression increases after oil is added, the cause of the malfunction 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 fuel cut solenoid valve connector or fuel cut valve controller connector.
10. Install the glow plugs.

    Tightening torque: 18 ± 2 N·m



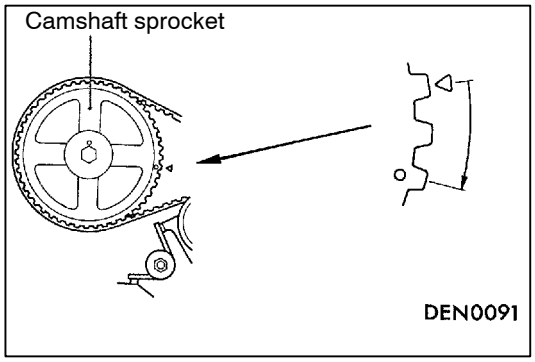
TIMING BELT TENSION ADJUSTMENT

1. Remove the timing belt upper cover.
2. Align the timing mark on the camshaft sprocket with the timing mark on the front upper case to set the No.1 cylinder to top dead centre of its compression stroke.



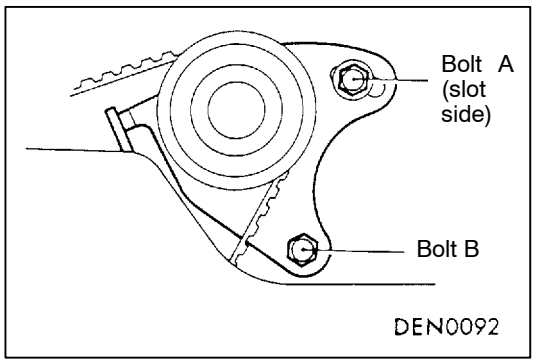
3. Loosen the two tensioner mounting bolts 1 or 2 turns.

   NOTE
   This will allow the tensioner spring to tension the timing belt automatically.



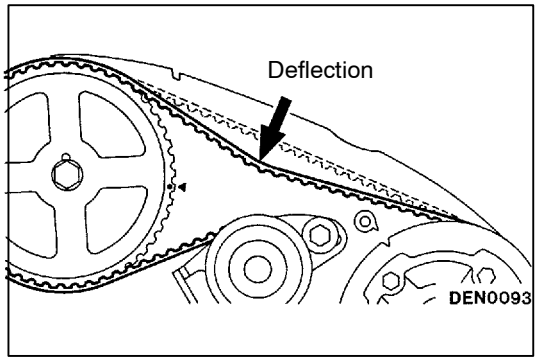
4. Turn the crankshaft clockwise and stop at the second teeth of the camshaft sprocket.

Caution
(1) This will allow the timing belt to be tensioned by a specified amount, so never overturn the crankshaft.
(2) Never turn the crankshaft counterclockwise.



5. To prevent the tensioner bracket from be turned together with the crankshaft, first tighten slot-side bolt A to the specified torque, and then tighten bolt B to the specified torque.

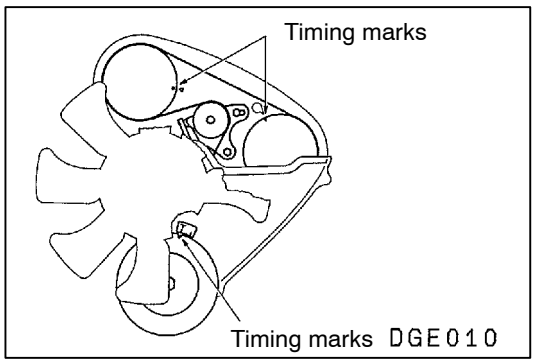
Tightening torque: 26 N·m



6. Turn the crankshaft counterclockwise to align the timing marks. Push down belt at a point halfway with a forefinger to check that defection of belt is up to standard value.

Standard value: 4.0 - 5.0 mm

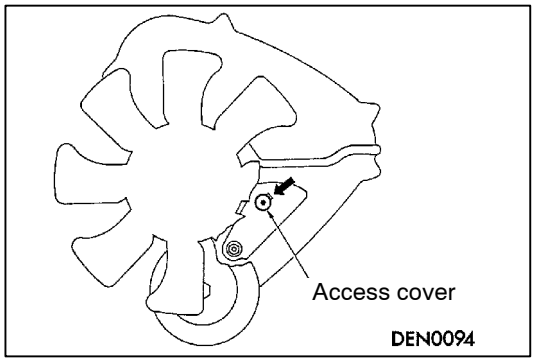
7. Mount the timing belt upper cover.



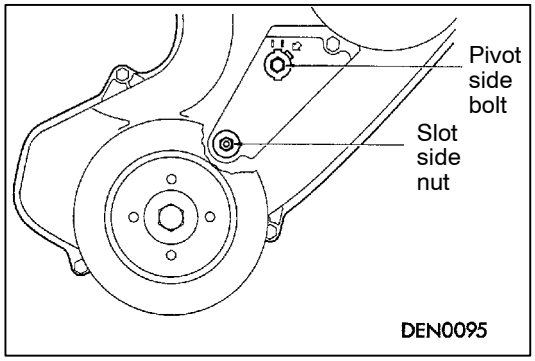
TIMING BELT B TENSION ADJUSTMENT

1. Remove timing belt upper cover.
2. Turn the crankshaft in the clockwise direction and check the timing belt around its entire circumference for abnormalities.
3. Align the timing marks on the sprockets with the timing mark on the front upper case.

Caution
When aligning the timing mark, be sure not to turn the crankshaft in the counterclockwise direction as this can cause improper belt tension.



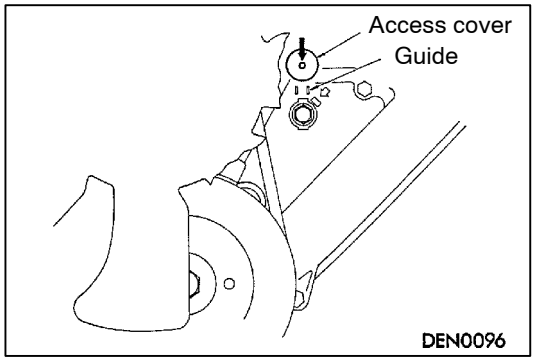
4. Remove the access cover.



5. Loosen the tensioner pivot side bolt 1 mm and slot side nut 1 or 2 turns.

   NOTE
   These works will allow the tensioner spring to tension timing belt B automatically.
6. First tighten tensioner slot side nut, and then tighten pivot side bolt to the specified torque.

   Tightening torque:
   Pivot side bolt 24 ± 4 N·m
   Slot side nut 23 ± 3 N·m

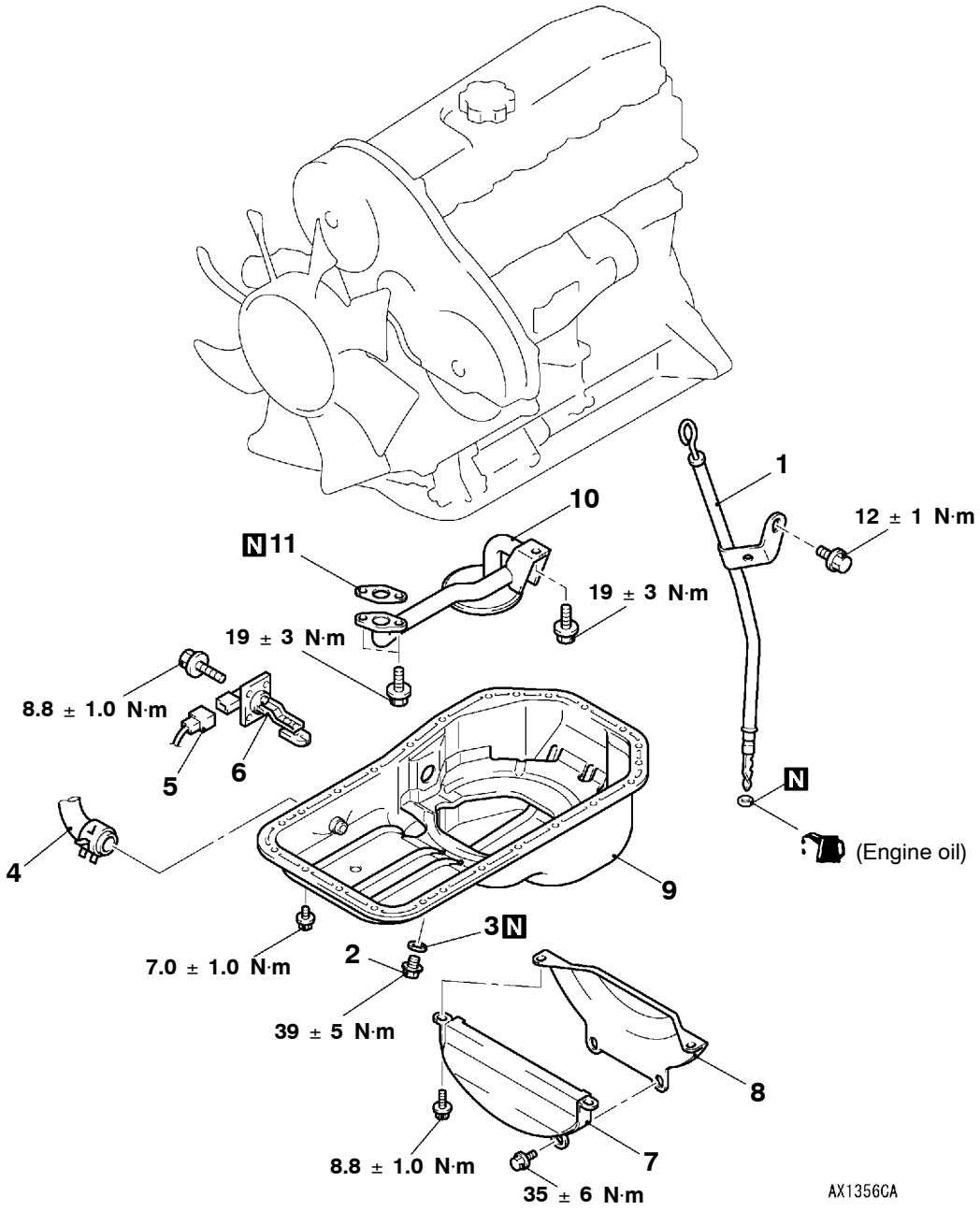


7. Install the access cover while sliding the front lower cover down along the two guides.
8. Install the timing belt upper cover.

OIL PAN AND OIL SCREEN

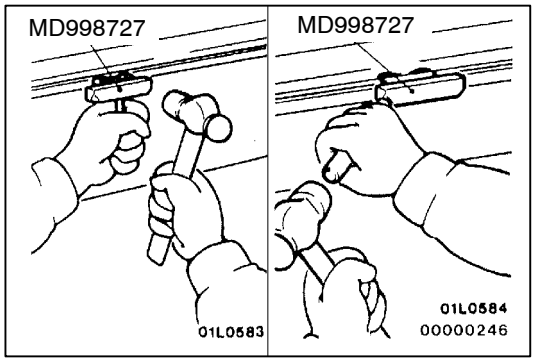
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Skid Plate and Under Cover Removal and Installation
- Engine Oil Draining and Supplying (Refer to GROUP 12 - On-vehicle Service.)
- Differential Gear Oil Draining and Supplying (Refer to GROUP 26 - On-vehicle Service.)
- Front Differential and No.2 Crossmember Assembly Removal and Installation (Refer to GROUP 11A - Oil Pan and Oil Screen.)



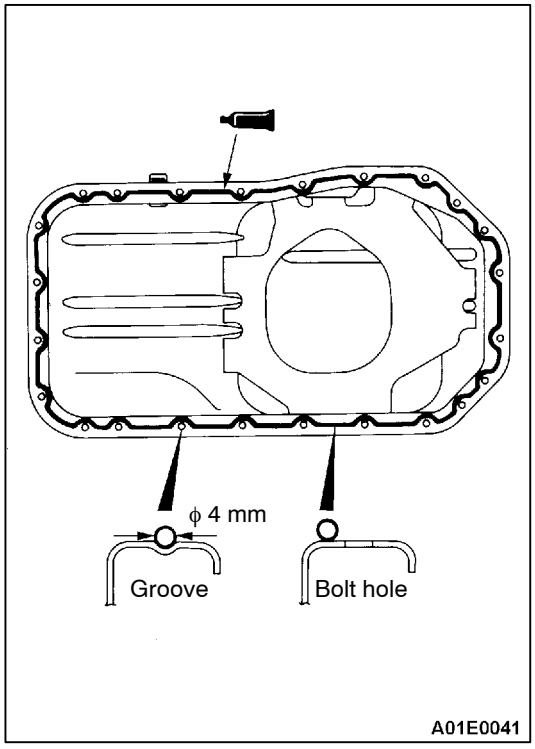
Removal steps

1. Engine oil level gauge and guide assembly
2. Drain plug
▶B◀ 3. Drain plug gasket
4. Alternator vacuum pump oil return hose connection
5. Oil level sensor connector
6. Oil level sensor
7. Space rubber
8. Bell housing cover
◀A▶ ▶A◀ 9. Oil pan
10. Oil screen
11. Oil screen gasket



REMOVAL SERVICE POINT

◀A▶ OIL PAN REMOVAL



INSTALLATION SERVICE POINTS

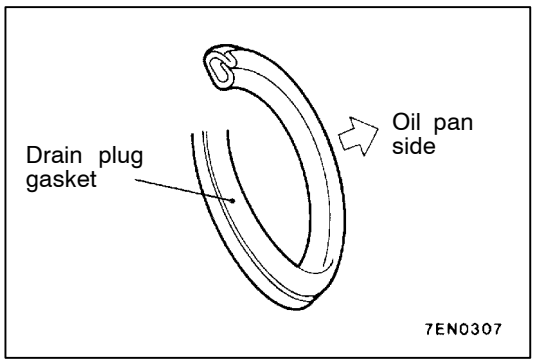
▶A◀ OIL PAN INSTALLATION

1. Remove sealant from oil pan and cylinder block mating surfaces.
2. Degrease the sealant-coated surface and the engine mating surface.
3. Apply a continuous bead of the specified sealant to the oil pan mating surface as shown.

   Specified sealant:
   MITSUBISHI GENUINE PART No. MD970389 or equivalent

   NOTE
   The sealant should be applied in a continuous bead approximately 4 mm in diameter.
4. Assemble oil pan to cylinder block within 15 minutes after applying the sealant.

   Caution
   After installing the oil pan, wait at least 1 hour before starting the engine.



▶B◀ DRAIN PLUG GASKET INSTALLATION

Install a new gasket in the direction so that it faces as shown in the illustration.

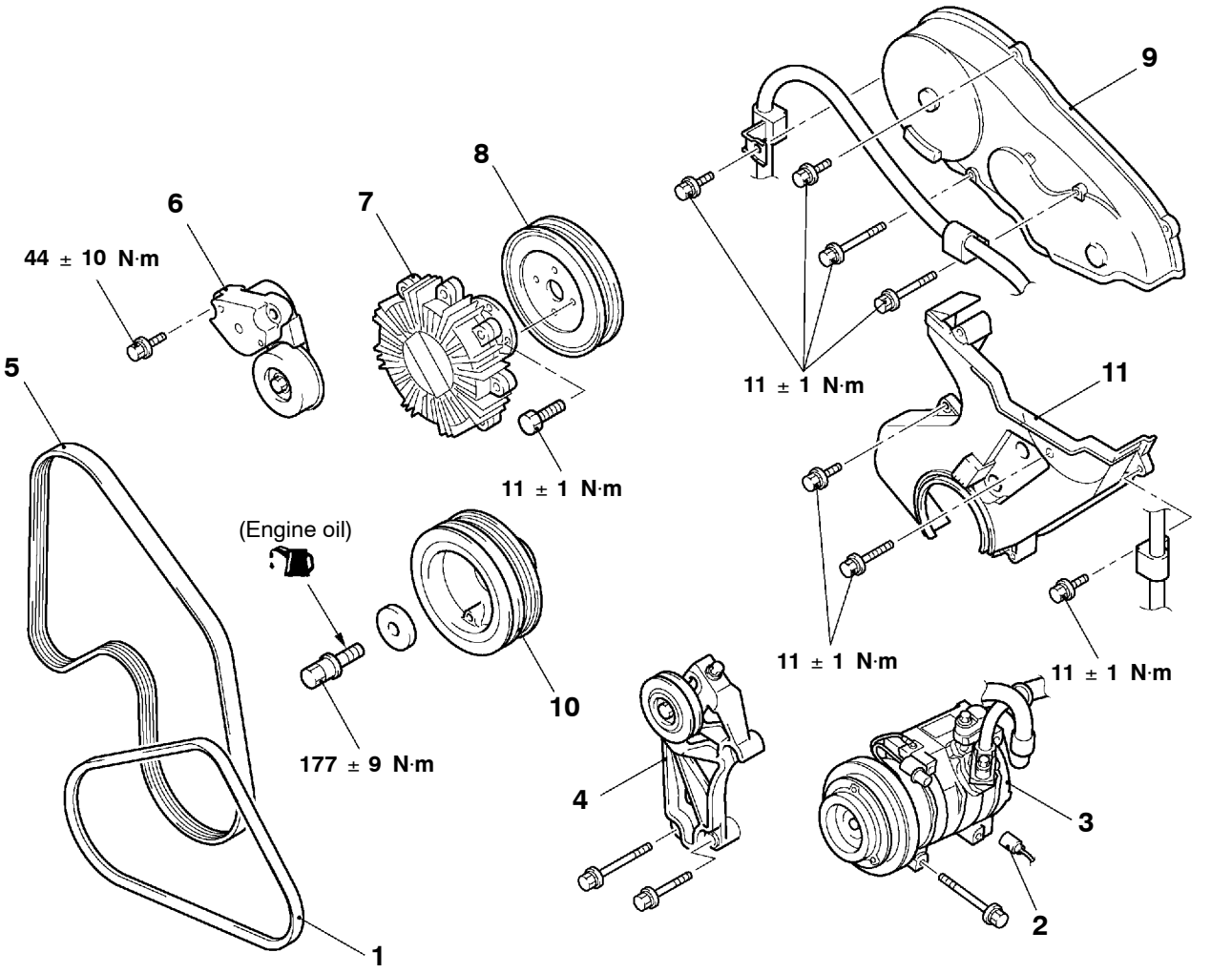
INSPECTION

- Check oil pan for cracks.
- Check oil pan sealant-coated surface for damage and deformation.
- Check oil screen for cracked, clogged or damaged wire net and pipe.

TIMING BELT AND TIMING BELT B

REMOVAL AND INSTALLATION

Post-installation Operation
Drive Belt Tension Check and Adjustment
(Refer to P.11B-5.)



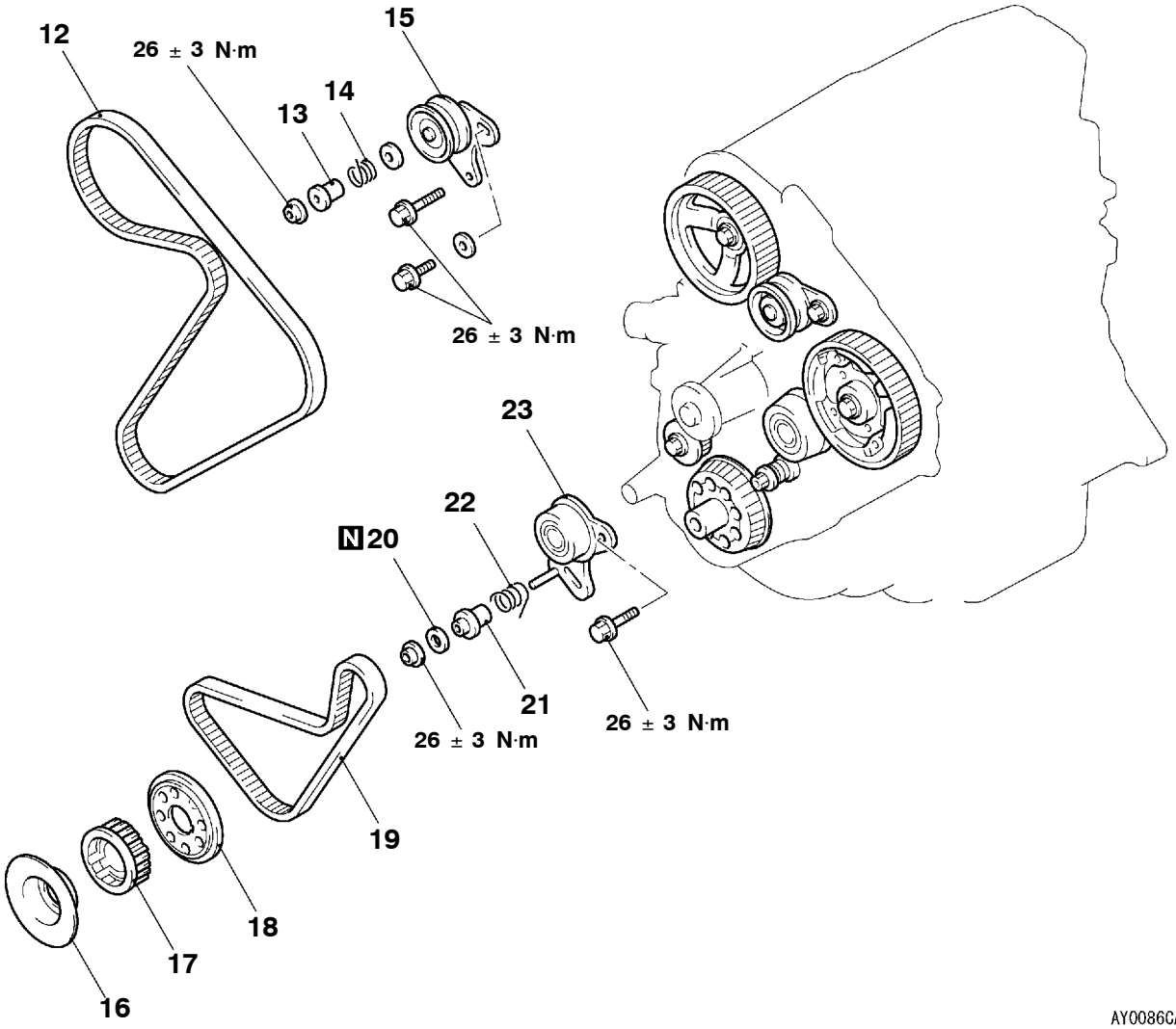
Removal steps

- Radiator upper shroud (Refer to GROUP 14.)

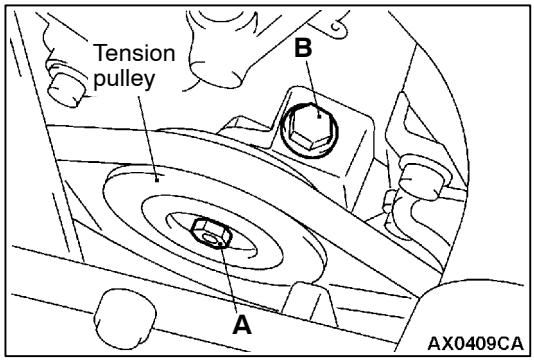
◀A▶ 1. A/C compressor drive belt <Vehicles with A/C>
2. A/C compressor connector <Vehicles with A/C>
◀B▶ 3. A/C compressor <Vehicles with A/C>
4. Tension pulley and tension pulley bracket assembly <Vehicles with A/C>

- Cooling fan (Refer to GROUP 14.)

◀C▶ 5. Alternator and power steering oil pump drive belt
6. Auto-tensioner
7. Fan Clutch
8. Water pump pulley
▶C◀ 9. Timing belt front upper cover
◀D▶ 10. Crankshaft pulley
▶C◀ 11. Timing belt front lower cover



◀E▶ ▶B◀ 12. Timing belt
13. Tensioner spacer
14. Tensioner spring
15. Timing belt tensioner
16. Front flange
17. Crankshaft sprocket
18. Flange
◀F▶ ▶A◀ 19. Timing belt B
20. Gasket
21. Tensioner spacer B
22. Tensioner spring B
23. Timing belt tensioner B



REMOVAL SERVICE POINTS

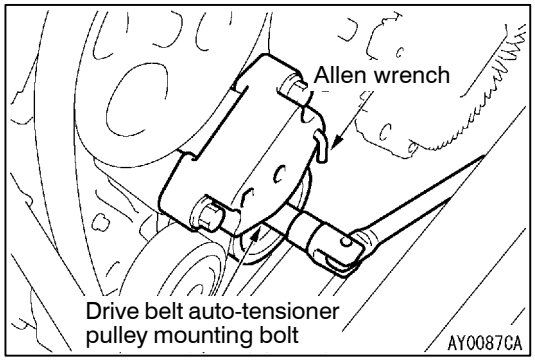
◀A▶ A/C COMPRESSOR DRIVE BELT REMOVAL

1. Loosen the tension pulley securing bolt A.
2. Loose the adjusting bolt B to remove the belt.

Caution
To reuse the drive belt, mark its running direction (clockwise direction) on the belt back side with a chalk.

◀B▶ A/C COMPRESSOR REMOVAL

1. Remove the A/C compressor from the bracket with its refrigerant hoses still attached.
2. Suspend the A/C compressor with a cord out of the way.

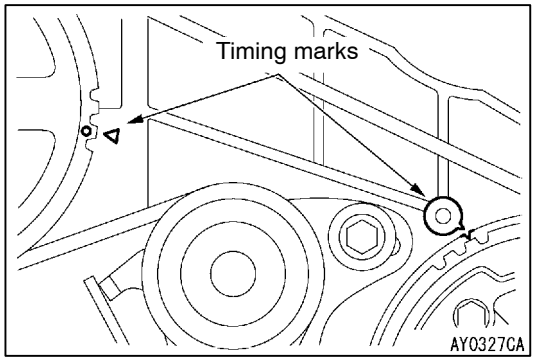


◀C▶ALTERNATOR AND POWER STEERING PUMP DRIVE BELT REMOVAL

The following operations will be needed due to the introduction of the serpentine drive system with the drive belt auto tensioner.

1. Locate a ring spanner onto the drive belt auto-tensioner pulley mounting bolt, and move the tensioner clockwise until it touches the stopper.
2. Hold the tensioner by inserting an Allen wrench as shown, and remove the drive belt.

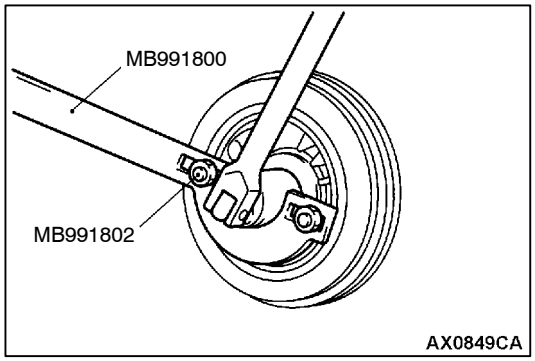
Caution
To reuse the drive belt, mark its running direction (clockwise direction) on the belt back side with a chalk.



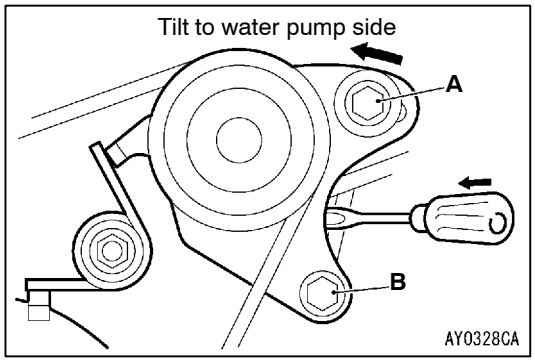
◀D▶ CRANKSHAFT PULLEY REMOVAL

1. Turn the crankshaft clockwise, align the timing marks to set No.1 cylinder to TDC of its compression stroke.

Caution
Never turn the crankshaft anticlockwise.

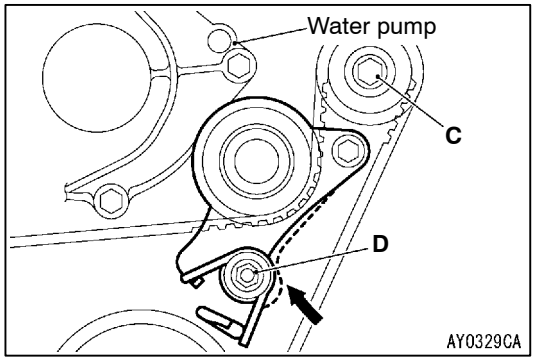


2. Use the special tool to keep crankshaft from turning and remove the bolts.



◀E▶ TIMING BELT REMOVAL

1. When reinstalling timing belt, mark an arrow at the belt to show rotation direction.
2. Loosen the tensioner mounting bolt A and B.
3. Push timing belt tensioner to water pump side and tighten the tensioner mounting bolt A and B. Secure so that tensioner will not move back.

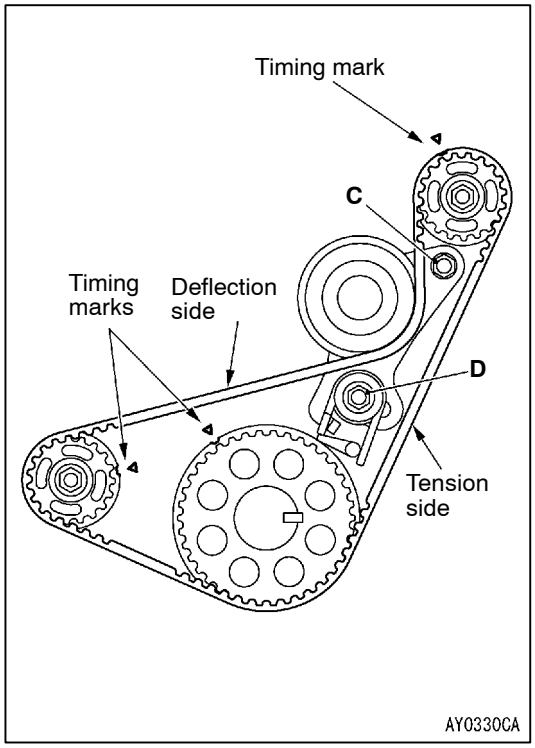


◀F▶ TIMING BELT B REMOVAL

1. When reinstalling timing belt B, mark an arrow at the belt to show rotation direction.
2. Loosen the tensioner mounting bolt C and nut D.
3. Push timing belt tensioner to water pump side and tighten the tensioner mounting bolt C and nut D. Secure so that tensioner will not move back.

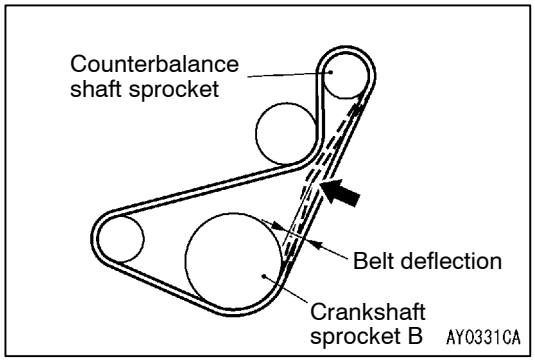
INSTALLATION SERVICE POINTS

▶A◀ TIMING BELT B INSTALLATION



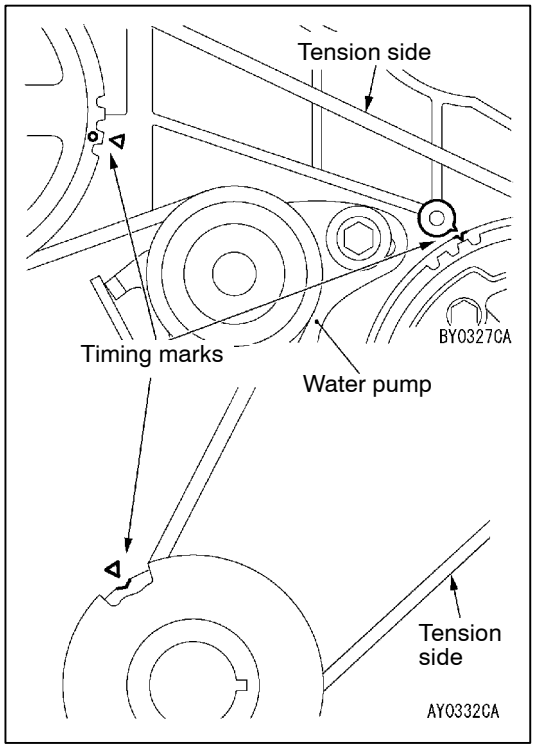
1. Align the timing marks of the 3 sprockets.
2. When reusing timing belt B, make sure the arrow mark is pointing in the same direction as when the belt was removed.
3. Install timing belt B and make sure there is no deflection on the tension side.
4. Press the deflection side of timing belt B with the hand and fully stretch the tensioner side.
5. Make sure that the timing marks are aligned.
6. Loosen the tensioner mounting bolt and nut so that only the pressure of the spring is applied to timing belt B.
7. Tighten the tensioner mounting bolt C and nut D, tightening the nut first. If the bolt is tightened first, the tensioner will move and tension the belt.

   Tightening torque: 26 ± 3 N·m



8. Press in the direction of the arrow in the figure with the index finger to check the amount of deflection.

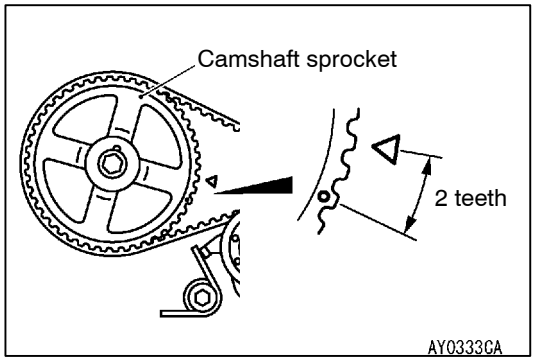
   Standard value: 4 - 5 mm



▶B◀ TIMING BELT INSTALLATION

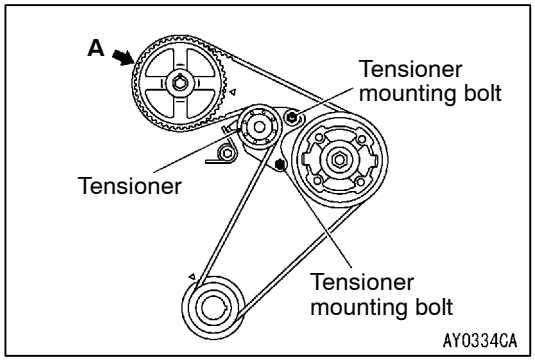
1. Align the timing marks of the 3 sprockets.
2. When reusing timing belt, make sure the arrow mark is pointing in the same direction as when the belt was removed.
3. Install the timing belt to the crankshaft sprocket, to injection pump sprocket, to tensioner and to camshaft sprocket in that order. Being careful not to allow deflection on the tension side of the timing belt.

   Caution
   (1) Engage the belt on the various sprockets while maintaining tension on the belt of tension side.
   (2) Align the injection pump sprocket with the timing mark, hold the sprocket so that is does not turn and engage the belt.
4. Loosen the tensioner mounting bolts and apply tension with the spring.

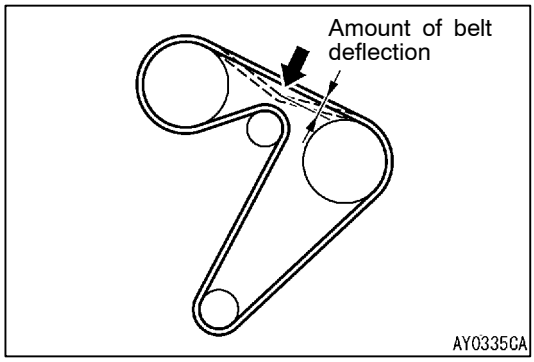


5. Turn the crankshaft clockwise and stop at the second lobe of the camshaft sprocket.

   Caution
   (1) When turning the crankshaft in item (5), strictly observe the specified amount of rotation (2 teeth on the camshaft sprocket) in order to apply a constant force to the tension side of the belt.
   (2) Do not turn the crankshaft counterclockwise.
   (3) Do not touch the belt during adjustment.

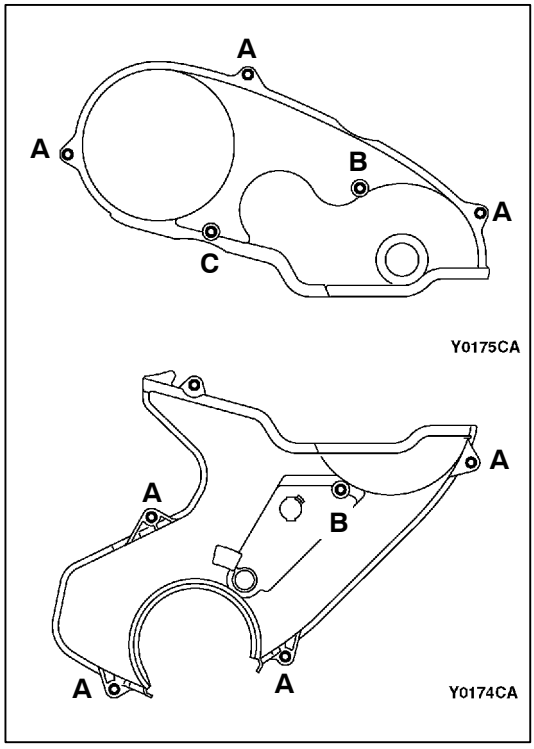


6. Make sure that the part indicated by arrow A does not float upward.
7. Tighten the tensioner mounting bolts, starting with the bolt in the elongated hole. If the lower bolt is tightened first, belt tension will become too tight.
8. Turn the crankshaft anticlockwise and align the timing mark. Next, make sure that the timing marks of all sprockets are aligned.



9. Press on the center of the bolt with an index finger to check the amount of deflection.

   Standard value: 4 - 5 mm



▶C◀ TIMING BELT FRONT LOWER COVER/TIMING BELT FRONT UPPER COVER INSTALLATION

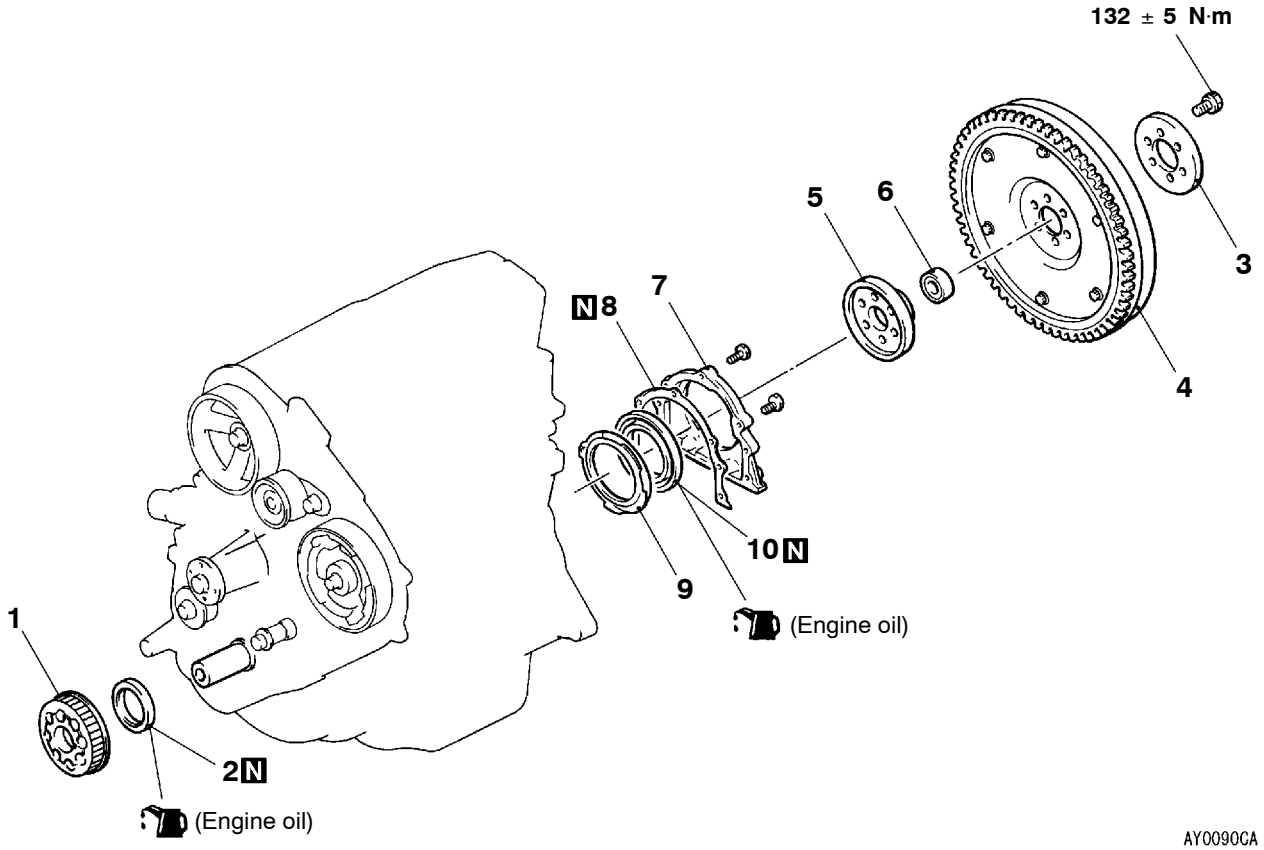
Install the bolts to the timing belt cover at the shown positions.

Name	Symbols	Size mm (d × l)
Flange bolt	A	6 × 22
	B	6 × 50
	C	6 × 60

d=Nominal diameter
l=Nominal length

CRANKSHAFT OIL SEAL

REMOVAL AND INSTALLATION



Crankshaft front oil seal removal steps

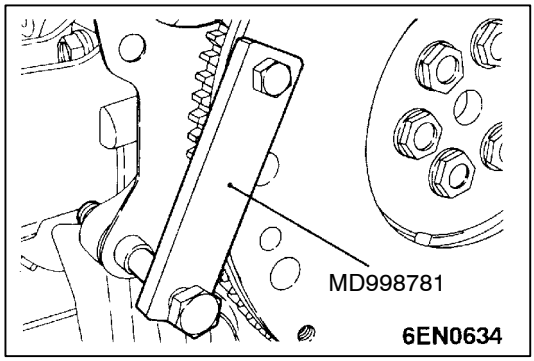
- Timing belt and timing belt B removal and installation (Refer to P.11B-19.)

1. Crankshaft sprocket B
▶D◀ 2. Crankshaft front oil seal

Crankshaft rear oil seal removal steps

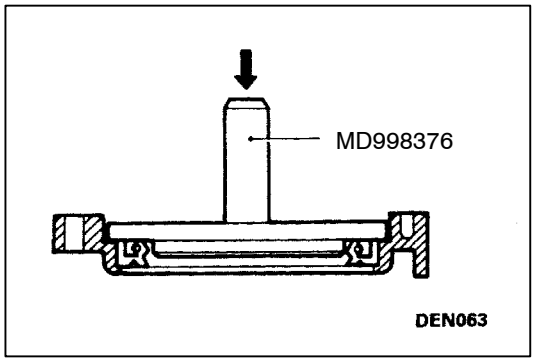
- Transmission assembly (Refer to GROUP 22.)

3. Adapter plate
◀A▶ ▶C◀ 4. Flywheel assembly
5. Crankshaft adaptor
6. Ball bearing
7. Oil seal case
8. Gasket
▶B◀ 9. Oil separator
▶A◀ 10. Crankshaft rear oil seal



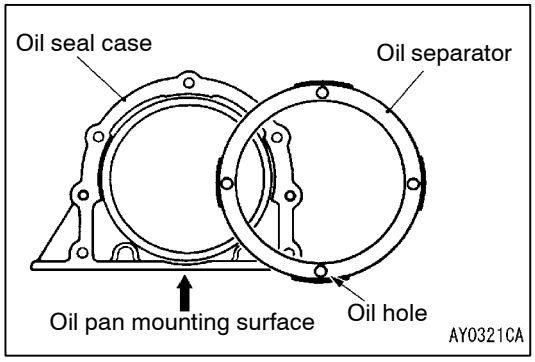
REMOVAL SERVICE POINTS

◀A▶ FLYWHEEL ASSEMBLY REMOVAL



INSTALLATION SERVICE POINTS

▶A◀ CRANKSHAFT REAR OIL SEAL INSTALLATION



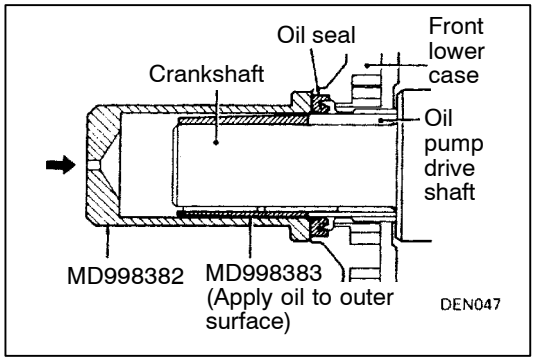
▶B◀ OIL SEPARATOR INSTALLATION

Install the oil separator in such a way that its oil hole come at the case bottom (indicated by an arrow in the illustration).

▶C◀ FLYWHEEL ASSEMBLY INSTALLATION

Use the special tool in the same way as during removal to stop the flywheel assembly from turning, and then tighten the bolt to the specified torque.

Tightening torque: 132 ± 5 N·m



▶D◀ CRANKSHAFT FRONT OIL SEAL INSTALLATION

Apply engine oil to the outside of the special tool (MD998383) and to the oil seal lip, and use the special tool to press-fit the oil seal.

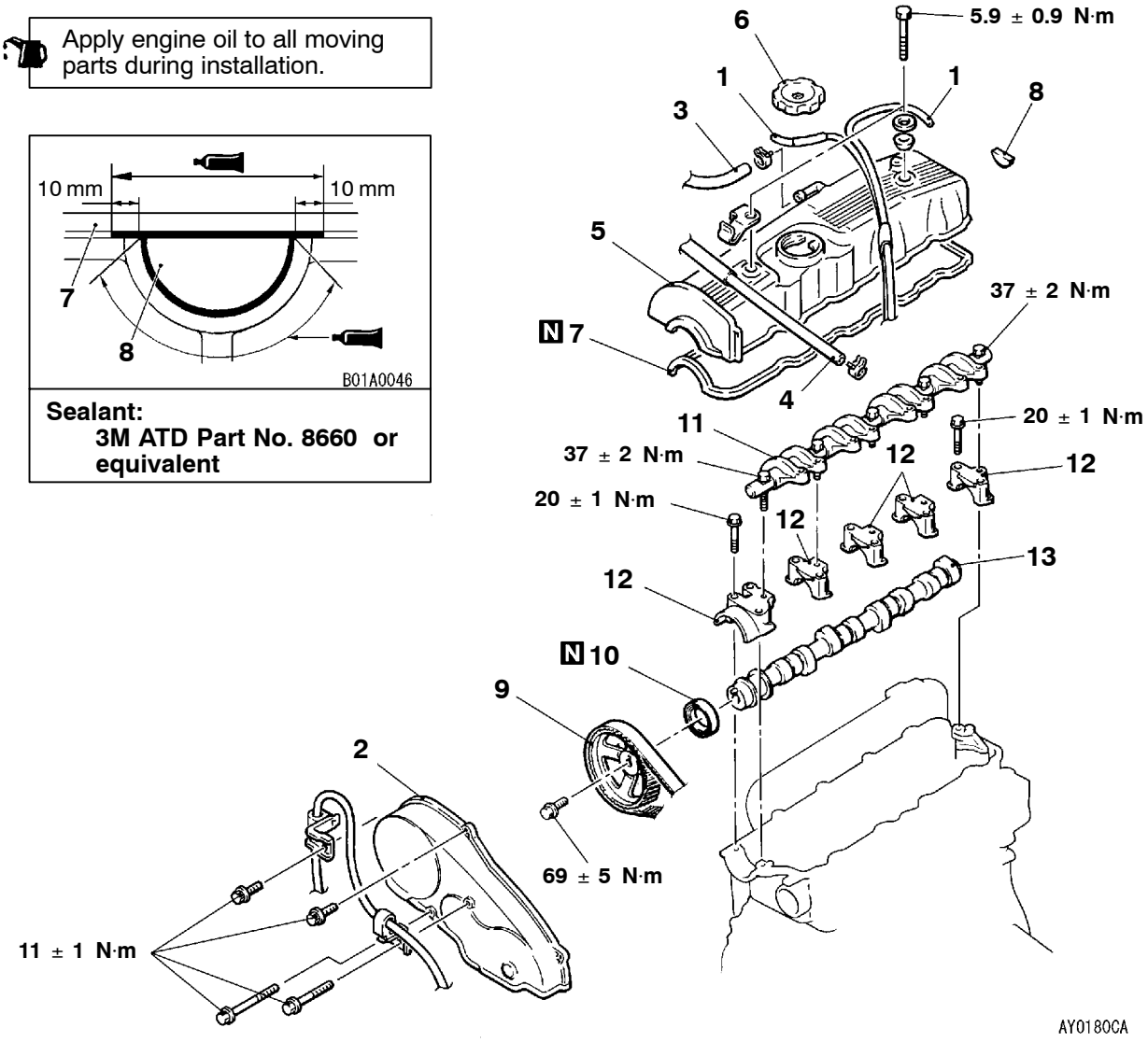
CAMSHAFT AND CAMSHAFT OIL SEAL

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Air Pipe and Air Intake Hose Removal and Installation (Refer to GROUP 15 - Intake Manifold and Exhaust manifold, Turbocharger <4D5>.)

Apply engine oil to all moving parts during installation.

Sealant:
3M ATD Part No. 8660 or equivalent



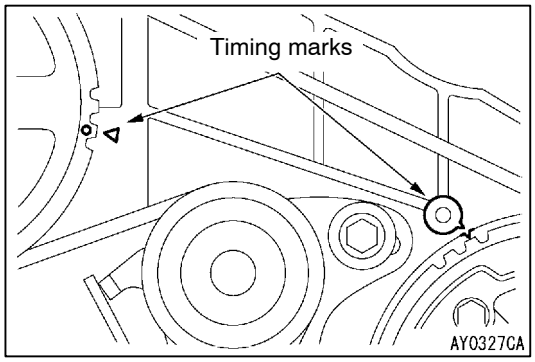
Camshaft removal steps

1. Vacuum hose connection
▶E◀ 2. Timing belt front upper cover
3. Breather hose connection
4. Boost hose connection
5. Rocker cover
6. Oil filler cap
7. Rocker cover gasket
8. Semi-circular packing
   - Valve clearance adjustment (Refer to P.11B-8.)

◀A▶ ▶D◀ 9. Camshaft sprocket
▶C◀ 10. Camshaft oil seal
◀B▶ ▶B◀ 11. Rocker arm and shaft assembly
▶A◀ 12. Camshaft bearing cap
13. Camshaft

Camshaft oil seal removal steps

▶E◀ 2. Timing belt upper cover assembly
◀A▶ ▶D◀ 9. Camshaft sprocket
▶C◀ 10. Camshaft oil seal

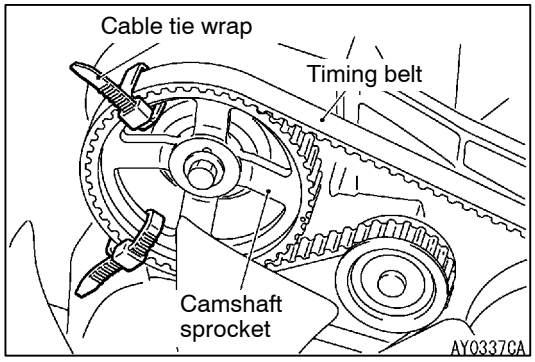


REMOVAL SERVICE POINTS

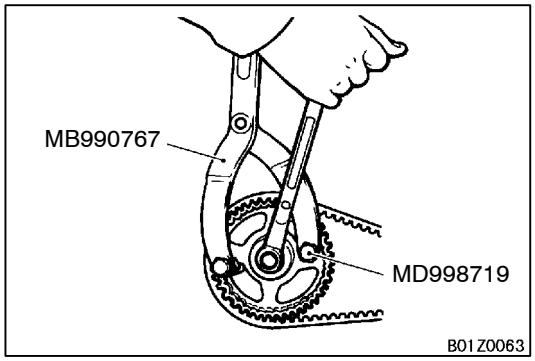
◀A▶ CAMSHAFT SPROCKET REMOVAL

1. Turn the crankshaft clockwise, align the timing marks to set No.1 cylinder to TDC of its compression stroke.

   Caution
   Never turn the crankshaft anticlockwise.



2. Tie the camshaft sprocket and timing belt together with a cable tie wrap so that timing mark is not maladjusted.



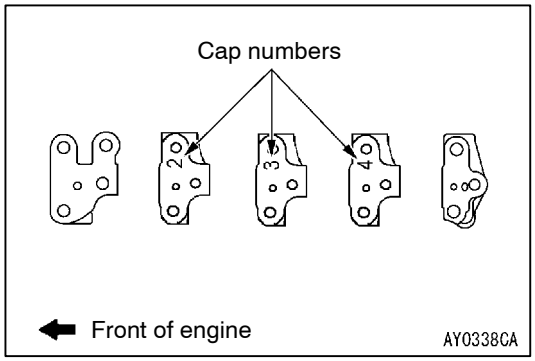
3. Use the special tool to stop the camshaft sprocket from turning, and then remove the camshaft sprocket with the timing belt still attached.

   Caution
   Do not rotate crankshaft after removing camshaft sprocket.

◀B▶ ROCKER ARM AND SHAFT ASSEMBLY REMOVAL

Loosen the rocker arm and shaft assembly mounting bolt, and then remove the rocker arm and shaft assembly with the bolt still attached.

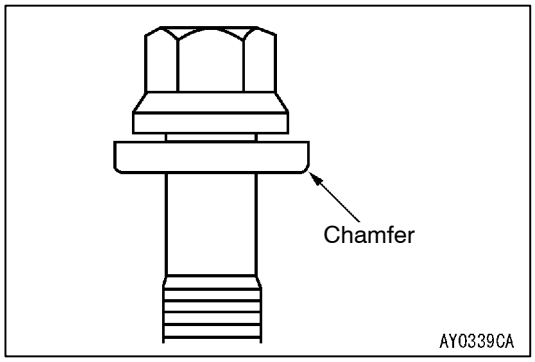
Caution
Never disassemble the rocker arm and shaft assembly.



INSTALLATION SERVICE POINTS

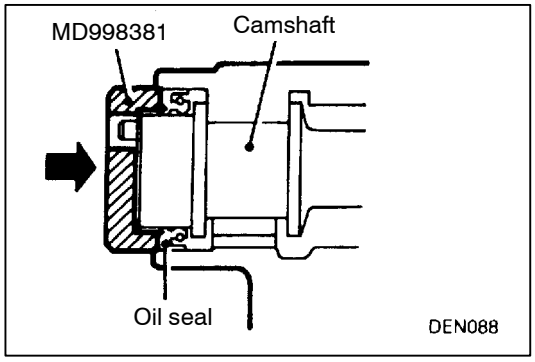
▶A◀ CAMSHAFT BEARING CAP INSTALLATION

The cap numbers are embossed on the top surface of the bearing caps, so install in the order of the numbers. However, no numbers are embossed on bearing caps 1 and 5.



▶B◀ ROCKER ARM AND SHAFT ASSEMBLY INSTALLATION

1. Install the rocker arm and shaft assembly to the bearing caps.
2. Set the washer so that it faces in the direction shown in the illustration, and then install the bolt.



▶C◀ CAMSHAFT OIL SEAL INSTALLATION

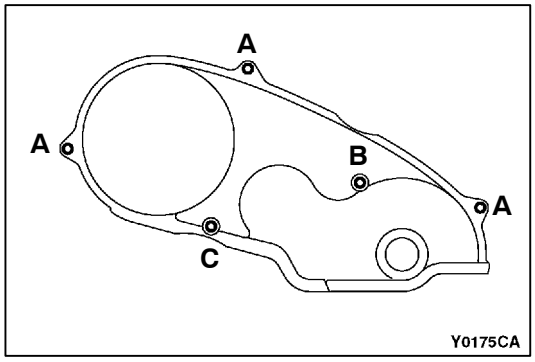
1. Apply a small amount of engine oil to the entire circumference of the oil seal lip and camshaft.
2. Use the special tool to tap in the oil seal.

   NOTE
   The oil seal should be tapped in until the distance from the end of the camshaft to the end of the oil seal is as shown in the illustration.

▶D◀ CAMSHAFT SPROCKET INSTALLATION

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

   Tightening torque: 69 ± 5 N·m
2. Remove the cord which binds the camshaft sprocket and timing belt.



▶E◀ TIMING BELT FRONT UPPER COVER INSTALLATION

Install the bolts to the timing timing belt front upper cover at the shown positions.

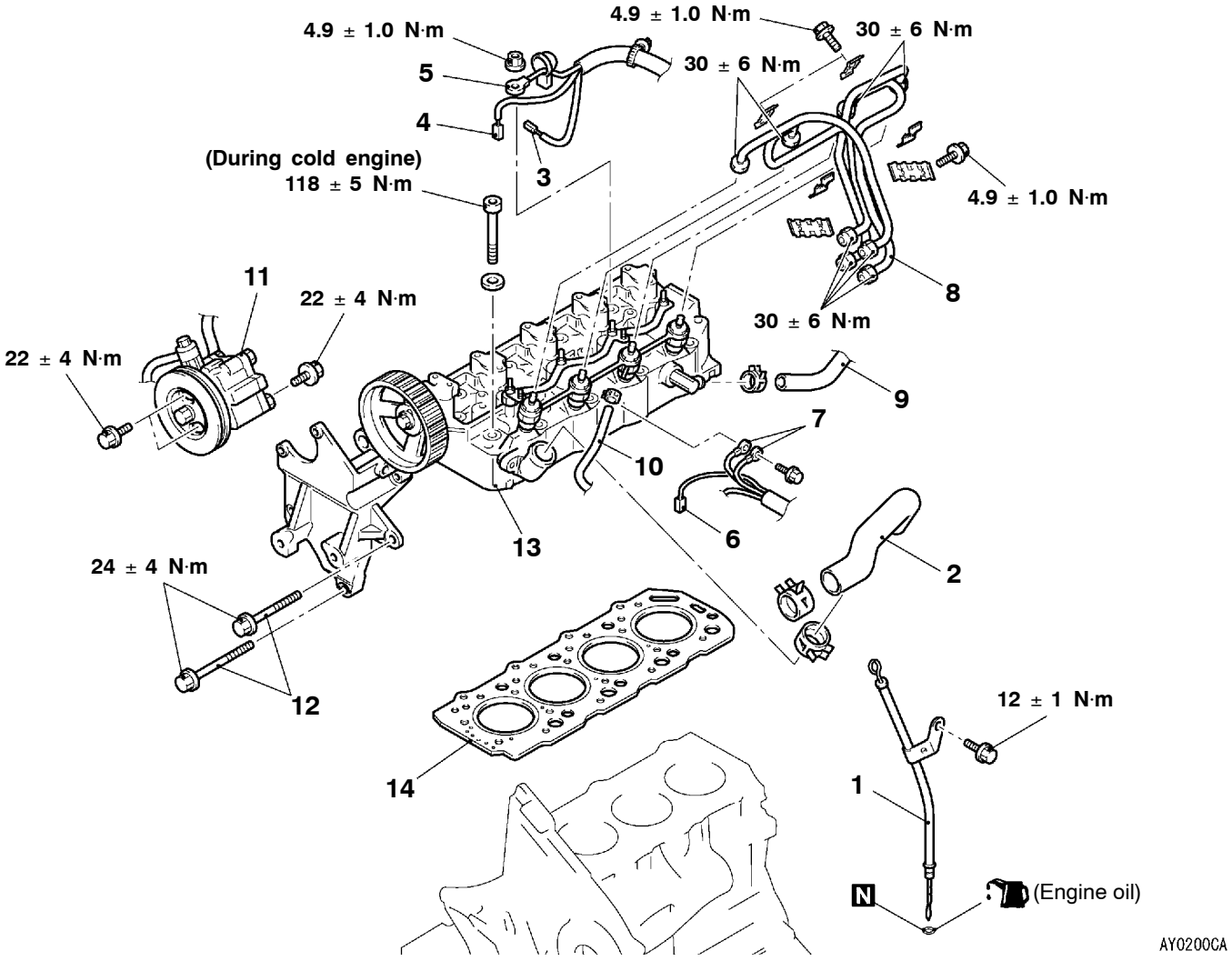
Name	Symbols	Size mm (d × l)
Flange bolt	A	6 × 22
	B	6 × 50
	C	6 × 60

d=Nominal diameter
l=Nominal length

CYLINDER HEAD GASKET

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Cooling Fan and Fan Clutch Assembly Removal and Installation (Refer to GROUP 14.)
- Intake Manifold Removal and Installation (Refer to GROUP15 - Intake Manifold and Exhaust Manifold, Turbocharger <4D5>.)
- Engine Oil Check and Refill (Refer to GROUP 12 - On-vehicle Service.) <Post-installation operation>
- Fuel Line Air-bleeding (Refer to GROUP 13B - On-vehicle Service.) <Post-installation operation>
- Timing Belt Removal and Installation (Refer to P.11B-19.)



Removal steps

1. Oil level gauge guide and oil level gauge assembly
◀A▶ ▶D◀ 2. Radiator upper hose
- Rocker cover (Refer to P.11B-27.)

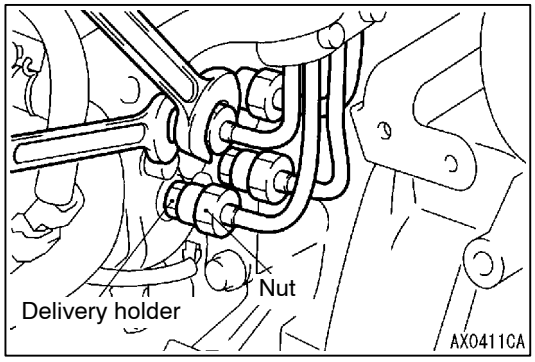
3. Engine coolant temperature switch connector (for A/C compressor control.)
4. Engine coolant temperature switch connector (for condenser fan control.)
5. Glow plug connector
6. Engine coolant temperature gauge unit and sensor connector
7. Earth cable connection
◀B▶ ▶C◀ 8. Fuel injection pipe
9. Heater hose connection
10. Fuel hose connection
- Water pipe assembly C (Refer to GROUP 14.)

◀C▶ 11. Power steering oil pump assembly
12. Power steering oil pump bracket bolt
◀D▶ ▶B◀ 13. Cylinder head assembly
▶A◀ 14. Cylinder head gasket

REMOVAL SERVICE POINTS

◀A▶ RADIATOR UPPER HOSE DISCONNECTION

After making mating marks on the radiator upper hose and the hose clamp, disconnect the radiator upper hose.



◀B▶ FUEL INJECTION PIPE REMOVAL

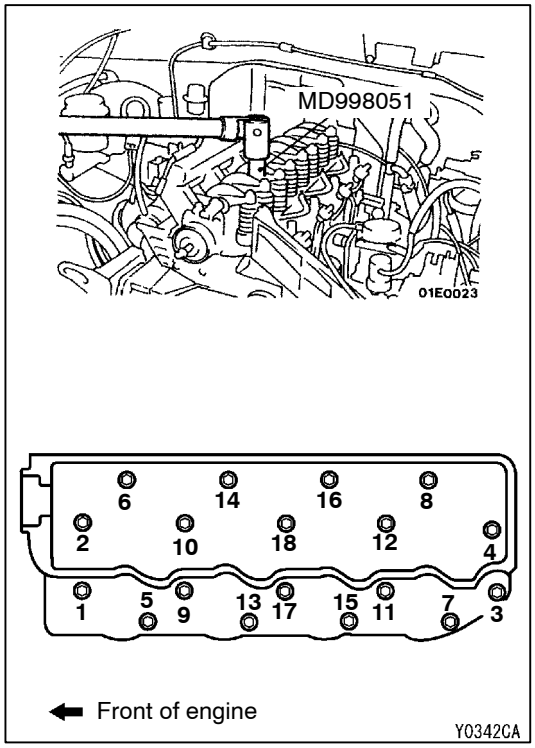
When loosening nuts at both ends of injection pipe, hold the delivery holder (for pump side) and the injection nozzle assembly (for nozzle side) with wrench and loosen nut.

Caution
After disconnecting the injection pipe, plug the opening so that no foreign particles get inside the pump or into the injection nozzle.

◀C▶ POWER STEERING OIL PUMP REMOVAL

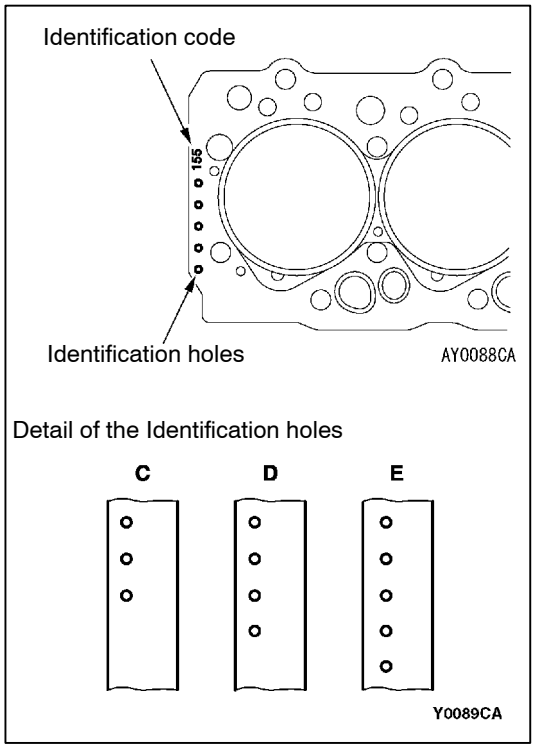
Remove the power steering oil pump from the bracket with the hose attached.

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



◀D▶ CYLINDER HEAD ASSEMBLY REMOVAL

Use the special tool to loosen the cylinder head bolts in the shown sequence progressively, and then remove the cylinder head bolts.



INSTALLATION SERVICE POINTS

▶A◀ CYLINDER HEAD GASKET INSTALLATION

To replace the cylinder head gasket only, select a gasket of correct specification according to the table below.

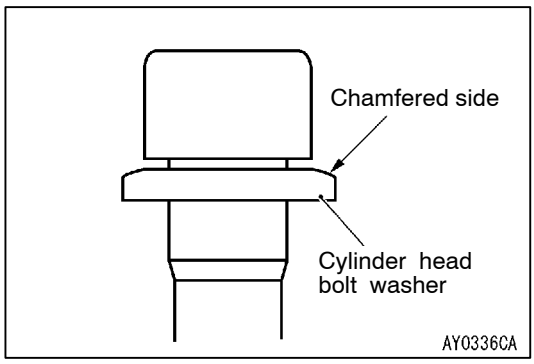
Identification holes specification	Identification code specification	Part number
C (Thickness after tightening the bolts 1.45 mm)	145	MD302891
D (Thickness after tightening the bolts 1.50 mm)	150	MD302892
E (Thickness after tightening the bolts 1.55 mm)	155	MD302893

Caution
The thickness of the original cylinder head gasket is selected according to the protrusion amount of the piston. Therefore, if the piston or the connecting rod is replaced, the protrusion amount may be changed. Always select a correct gasket by measuring the protrusion amount. (For details, refer to the Engine Workshop Manual.)

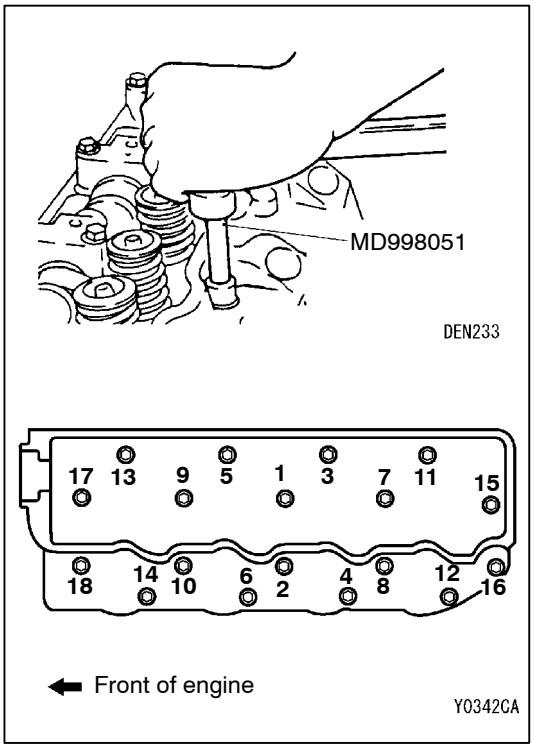
▶B◀ CYLINDER HEAD INSTALLATION

1. Select a cylinder head gasket of correct specification.
2. Clean the cylinder head assembly and the cylinder block mating surfaces with a scraper or a wire brush.

   Caution
   Do not allow foreign material to enter the engine coolant or oil passages and the cylinder.



3. Install the cylinder head bolt washer to the cylinder head bolt so that the washer chamfered side faces as shown.



4. Use the special tool to tighten the cylinder head bolts in the shown sequence progressively, and then install the cylinder head bolts.

   Tightening torque : 132 ± 5 N·m (During cold engine)

▶C◀ RADIATOR UPPER HOSE CONNECTION

To reuse the radiator upper hose, align the mating marks that were made during removal, and then install the hose clamp.

▶D◀ FUEL INJECTION PIPE INSTALLATION

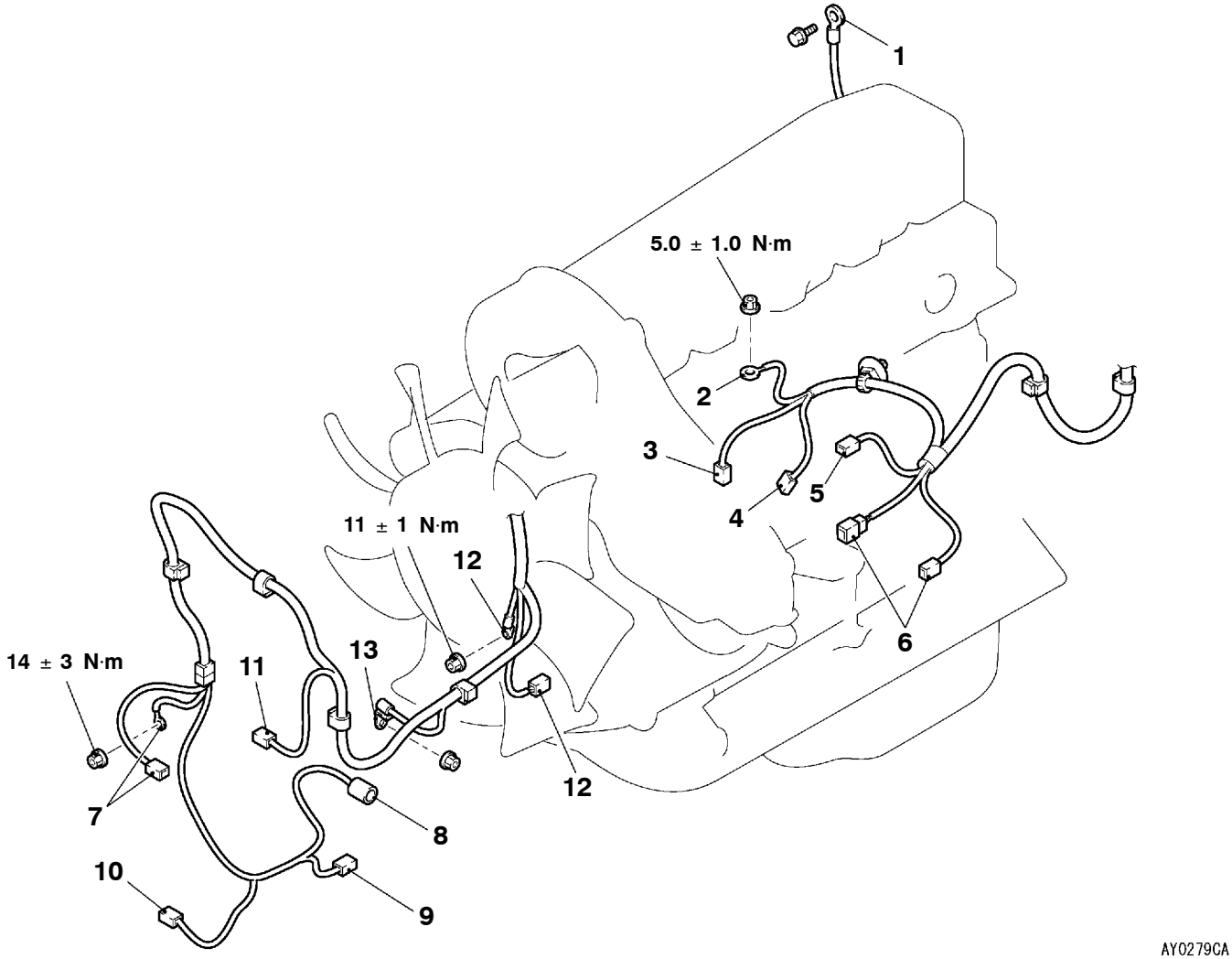
When tightening the nuts at both ends of the fuel injection pipe, hold the delivery holder (for pump side) and the injection nozzle assembly (for nozzle side) with a wrench, and tighten the nuts to the specified torque.

Tightening torque: 30 ± 6 N·m

ENGINE ASSEMBLY

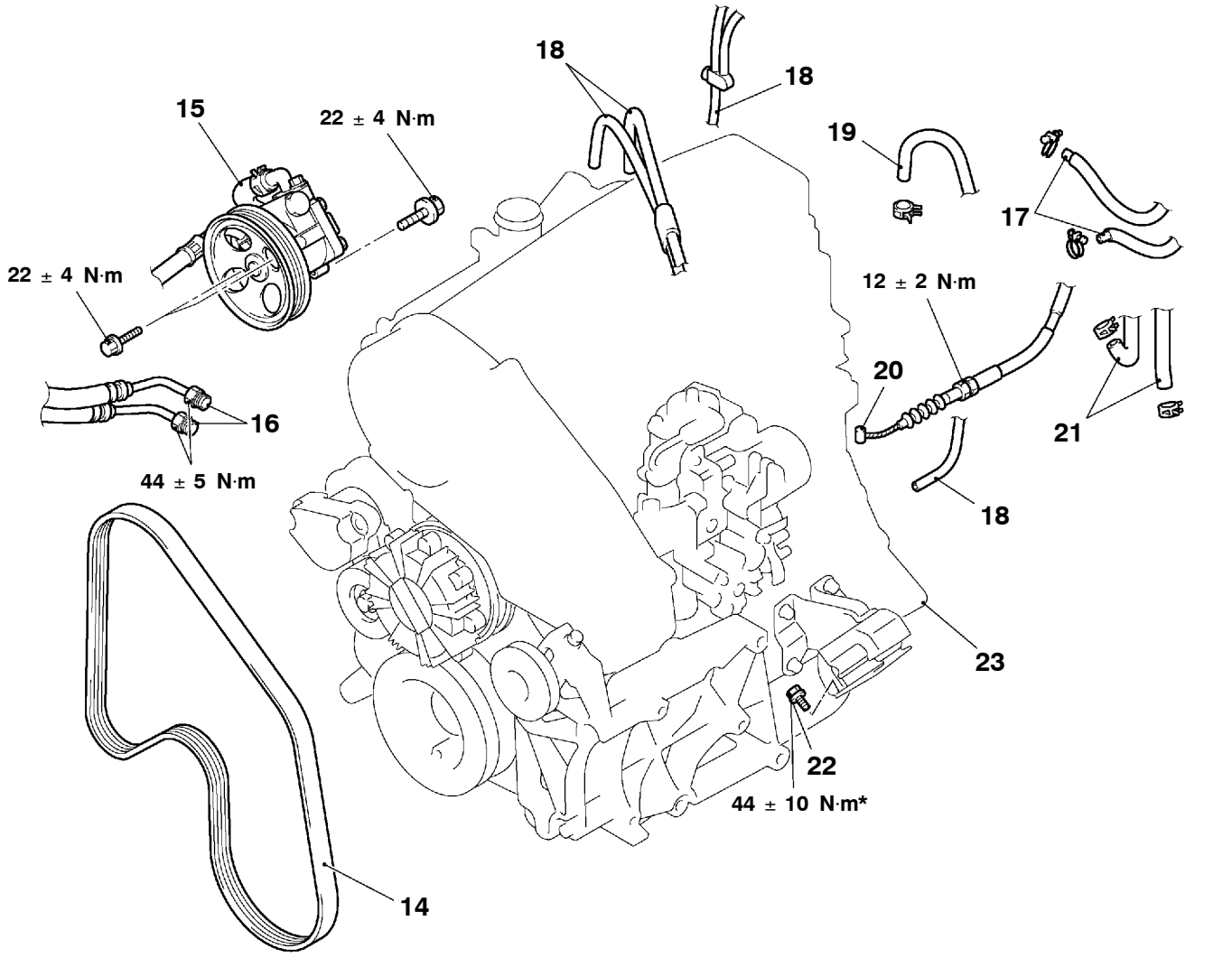
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Hood Removal and Installation (Refer to GROUP 42.)
- Under Cover and Skid Plate Removal and Installation
- Engine Oil Draining and Refilling (Refer to GROUP 12 - On-vehicle Service.)
- Battery and Battery Tray Removal and Installation
- Air Cleaner Removal and Installation (Refer to GROUP 15.)
- Radiator Removal and Installation (Refer to GROUP 14.)
- Accelerator Cable Adjustment (Refer to GROUP 17 - On-vehicle Service.) <Post-installation operation>
- Fuel Line Air-bleeding (Refer to GROUP 13B - On-vehicle Service.) <Post-installation operation>
- Drive Belt Tension Check and Adjustment <Vehicles with A/C> (Refer to P.11B-6.) <Post-installation operation>



Removal steps
1. Earth cable connection
2. Glow plug connector
3. Engine coolant temperature switch connector (for A/C compressor control)
4. Engine coolant temperature switch connector (for condenser fan control)
5. Fuel cut solenoid valve connector
6. Injection pump connector
7. Alternator connector
8. Oil pressure switch connector
9. Engine oil level sensor connector
10. Free-wheeling hub engage switch
11. A/C compressor connector <Vehicles with A/C>
12. Starter connector
    - A/C compressor assembly <Vehicles with A/C> (Refer to P.11B-19.)
13. Earth cable connection

Caution
***: indicates parts which should be temporarily tightened, and then fully tightened with the engine weight applied on the vehicle body.**



AY0280CA

- Cooling fan (Refer to GROUP 14.)

◀A▶ 14. Alternator and power steering oil pump drive belt

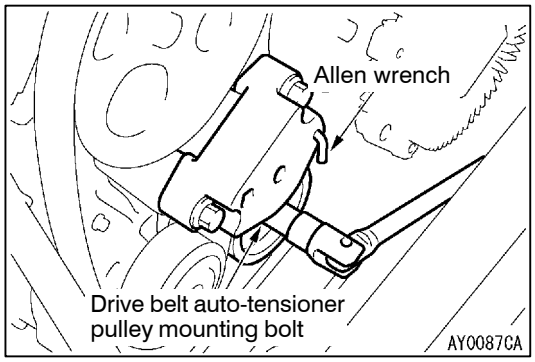
◀B▶ 15. Power steering oil pump assembly

16. Engine oil cooler hoses connection
17. Fuel hoses connections
18. Vacuum hoses connection
19. Brake booster vacuum hose connection <Vehicles with ABS>
20. Accelerator cable connection
21. Heater hoses connection <Vehicles with A/C>

- Transmission assembly (Refer to GROUP 22.)

22. Engine support front insulator attaching bolt

◀C▶ ▶A◀ 23. Engine assembly



REMOVAL SERVICE POINTS

◀A▶ ALTERNATOR AND POWER STEERING PUMP DRIVE BELT REMOVAL

The following operations will be needed due to the introduction of the serpentine drive system with the drive belt auto tensioner.

1. Locate a ring spanner onto the drive belt auto-tensioner pulley mounting bolt, and move the tensioner clockwise until it touches the stopper.
2. Hold the tensioner by inserting an Allen wrench as shown, and remove the drive belt.

Caution
To reuse the drive belt, mark its running direction (clockwise direction) on the belt back side with a chalk.

◀B▶ POWER STEERING OIL PUMP ASSEMBLY REMOVAL

1. Remove the power steering oil pump assembly from the timing gear case with its hoses still attached.
2. Suspend the power steering oil pump with a cord out of the way.

◀C▶ ENGINE ASSEMBLY REMOVAL

1. Check that all cables, hoses, 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. When doing so, check carefully that all pipes and hoses are connected, and that none are twisted, damaged, etc.

ENGINE <4D5>

CONTENTS

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SEALANT 2
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ON-VEHICLE SERVICE 4
Injection Timing Check and Adjustment 4
Idle Speed Check 4
OIL PAN AND OIL SCREEN 5
TIMING BELT AND TIMING BELT B 7
CYLINDER HEAD GASKET 13

GENERAL

OUTLINE OF CHANGES

Some service procedures have been revised as the following changes have been made to comply to the Emission Regulation Step III.

- Injection timing and idle speed check and adjustment have bee changed as the electronic-controlled fuel injection pump has been introduced.
- The oil pan has a cover in order to reduce noise due to an enhanced engine output.
- A crank angle sensor and crankshaft sensing blade have been added due to the introduction of an electronic-controlled fuel injection pump. Due to this change, the timing belt front lower cover has been reshaped.
- The tightening torque of the cylinder head bolts and the cylinder head gasket have been changed.

GENERAL INFORMATION

Items			4D56
Total displacement mL			2,477
Bore x Stroke mm			91.1 x 95.0
Compression ratio			21
Combustion chamber			Vortex chamber type
Camshaft arrangement			SOHC
Number of valve	Intake		4
	Exhaust		4
Valve timing	Intake	Opening	BTDC 20°
	Exhaust	Closing	ABDC 49°
	Intake	Opening	BBDC 55°
	Exhaust	Closing	ATDC 22°
Fuel system			Electronically controlled type injection pump
Rocker arm			Roller type
Adjusting screw			Elephant foot type

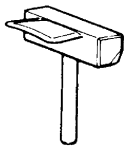
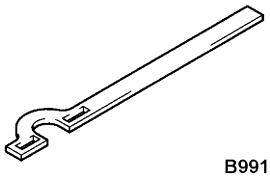
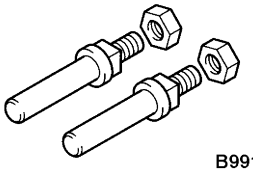
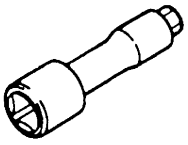
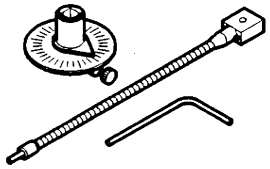
SERVICE SPECIFICATIONS

Items	Standard value
Idle speed r/min	750 ± 30
Timing belt tension mm	4 - 5
Timing belt B tension mm	4 - 5

SEALANT

Items	Specified sealant	Remarks
Oil pan	MITSUBISHI GENUINE PART MD970389 or equivalent	Semi-drying sealant

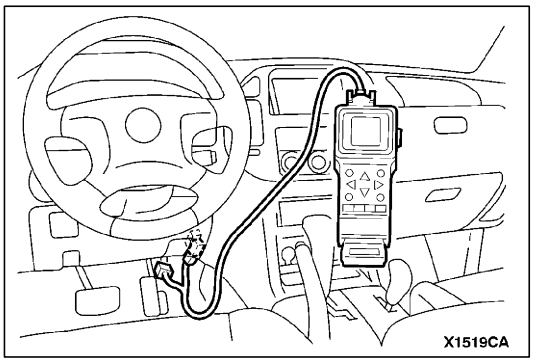
SPECIAL TOOLS

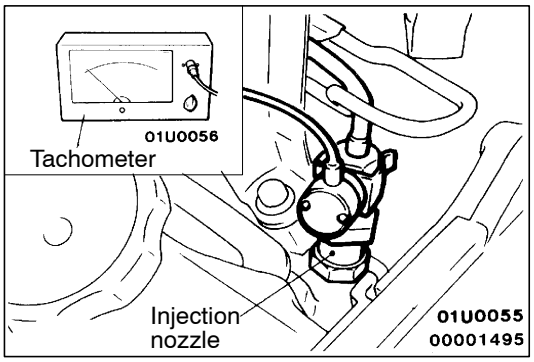
Tools	Number	Name	Use
	MD998727	Oil pan remover	Removal of oil pan
 B991800	MB991800	Crankshaft pulley holder	Holding the crankshaft pulley
 B991802	MB991802	Pin B	
	MD998051	Cylinder head bolt wrench	Removal and installation of the cylinder head bolt
	MB991614	Angle gauge	Tightening of the cylinder head bolts

ON-VEHICLE SERVICE

INJECTION TIMING CHECK AND ADJUSTMENT

The cold start device (wax type) has been discontinued as an electronically controlled injection pump has been used. The other inspection and adjustment procedures are the same as before.





IDLE SPEED CHECK

1. Set the vehicle to the pre-inspection condition.
2. Turn the ignition switch to “LOCK” (OFF) position, and connect the diagnosis connector to the MUT-II.
   If the MUT-II is not used, connect a tachometer to the injection nozzle or the pipe.
3. Start the engine, and let it run at idle.
4. Check the idle speed.

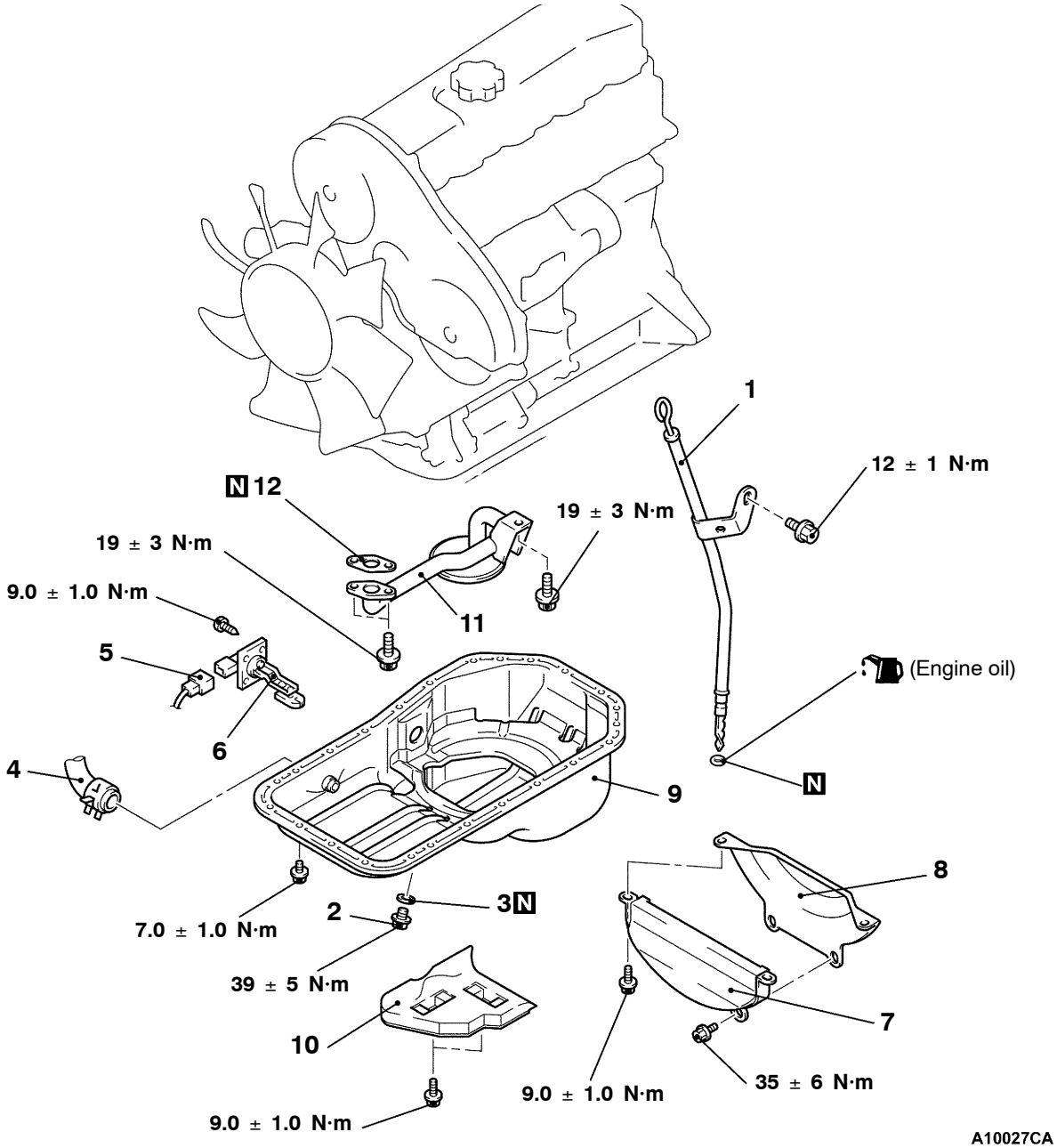
   Standard value: 750 ± 30 r/min
5. If the idle speed is not within the standard value, refer to 13C - Troubleshooting to check the electronic controlled fuel injection system.

   NOTE
   The idle speed is controlled by the engine-ECU.

OIL PAN AND OIL SCREEN

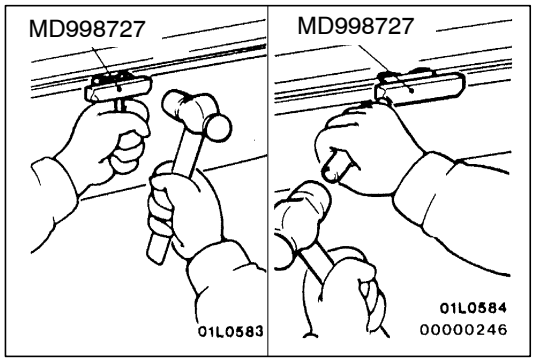
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Skid Plate and Under Cover Removal and Installation.
- Engine Oil Draining and Supplying.
- Differential Gear Oil Draining and Supplying.
- Front Differential and No.2 Crossmember Assembly Removal and Installation.



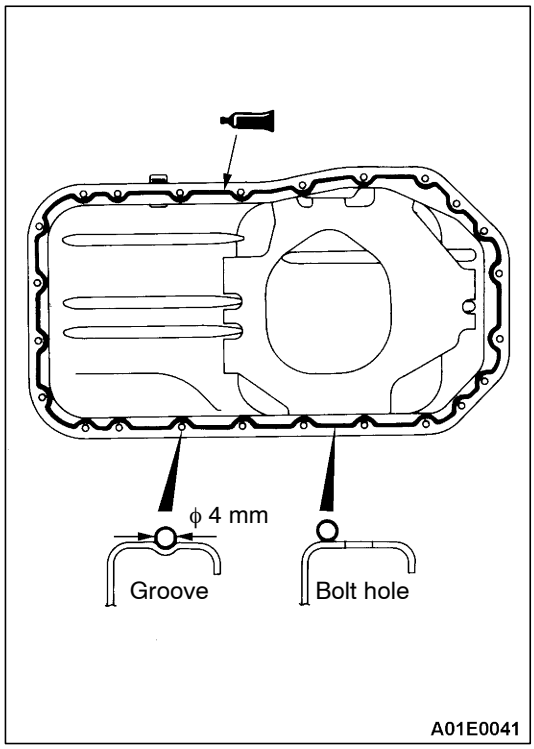
Removal steps

1. Engine oil level gauge and guide assembly
2. Drain plug
▶B◀ 3. Drain plug gasket
4. Alternator vacuum pump oil return hose connection
5. Oil level sensor connector
6. Oil level sensor
7. Space rubber
8. Bell housing cover
◀A▶ ▶A◀ 9. Oil pan
10. Oil pan cover
11. Oil screen
12. Oil screen gasket



REMOVAL SERVICE POINT

◀A▶ OIL PAN REMOVAL



INSTALLATION SERVICE POINTS

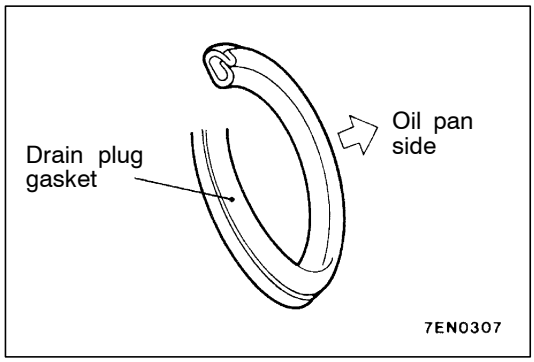
▶A◀ OIL PAN INSTALLATION

1. Remove sealant from oil pan and cylinder block mating surfaces.
2. Degrease the sealant-coated surface and the engine mating surface.
3. Apply a continuous bead of the specified sealant to the oil pan mating surface as shown.

   Specified sealant:
   MITSUBISHI GENUINE PART No. MD970389 or equivalent

   NOTE
   The sealant should be applied in a continuous bead approximately 4 mm in diameter.
4. Assemble oil pan to cylinder block within 15 minutes after applying the sealant.

   Caution
   After installing the oil pan, wait at least 1 hour before starting the engine.



▶B◀ DRAIN PLUG GASKET INSTALLATION

Install a new gasket in the direction so that it faces as shown in the illustration.

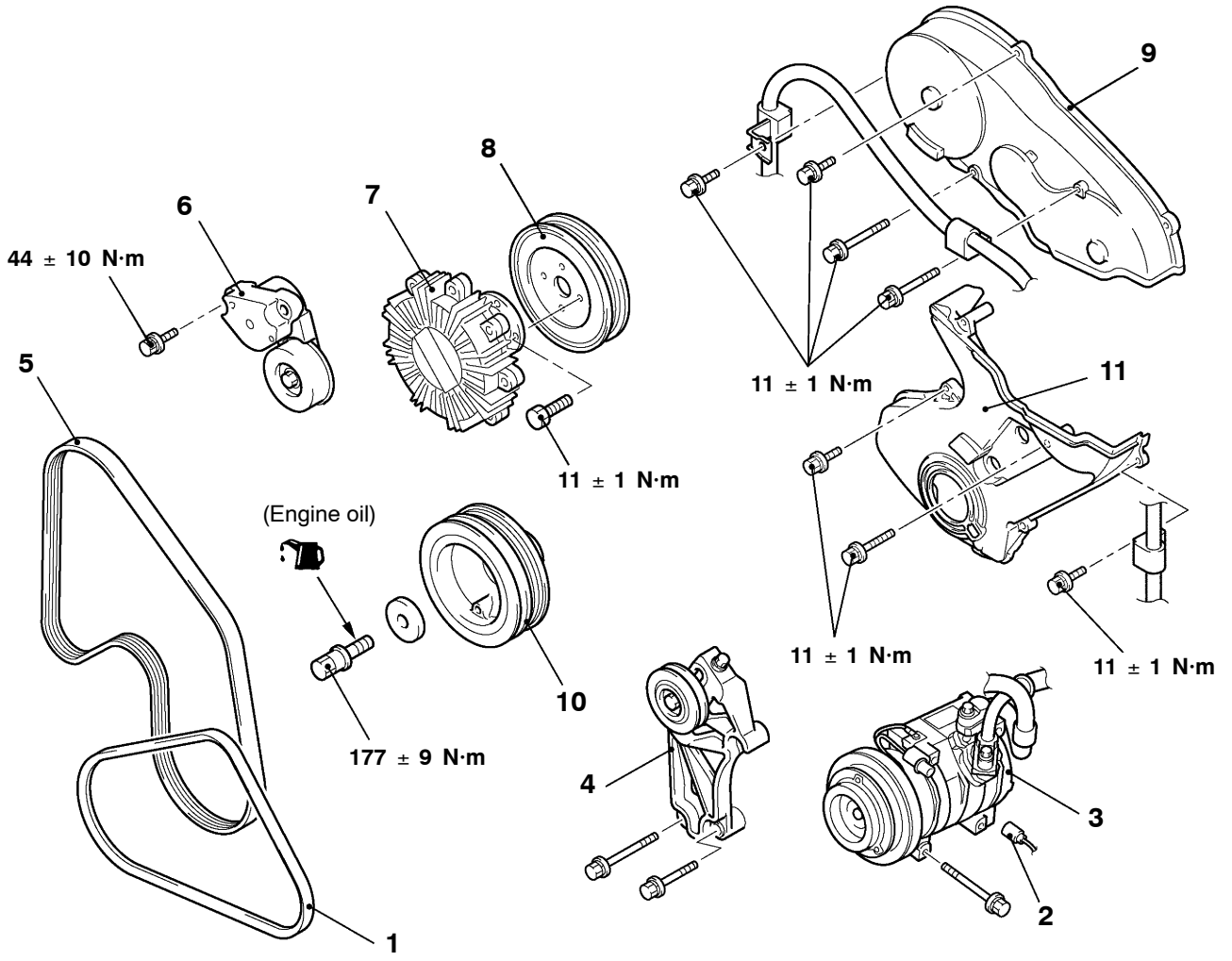
INSPECTION

- Check oil pan for cracks.
- Check oil pan sealant-coated surface for damage and deformation.
- Check oil screen for cracked, clogged or damaged wire net and pipe.

TIMING BELT AND TIMING BELT B

REMOVAL AND INSTALLATION

Post-installation Operation
Drive Belt Tension Check and Adjustment.



Removal steps

- Radiator upper shroud

◀A▶ 1. A/C compressor drive belt <Vehicles with A/C>
2. A/C compressor connector <Vehicles with A/C>

◀B▶ 3. A/C compressor <Vehicles with A/C>
4. Tension pulley and tension pulley bracket assembly <Vehicles with A/C>

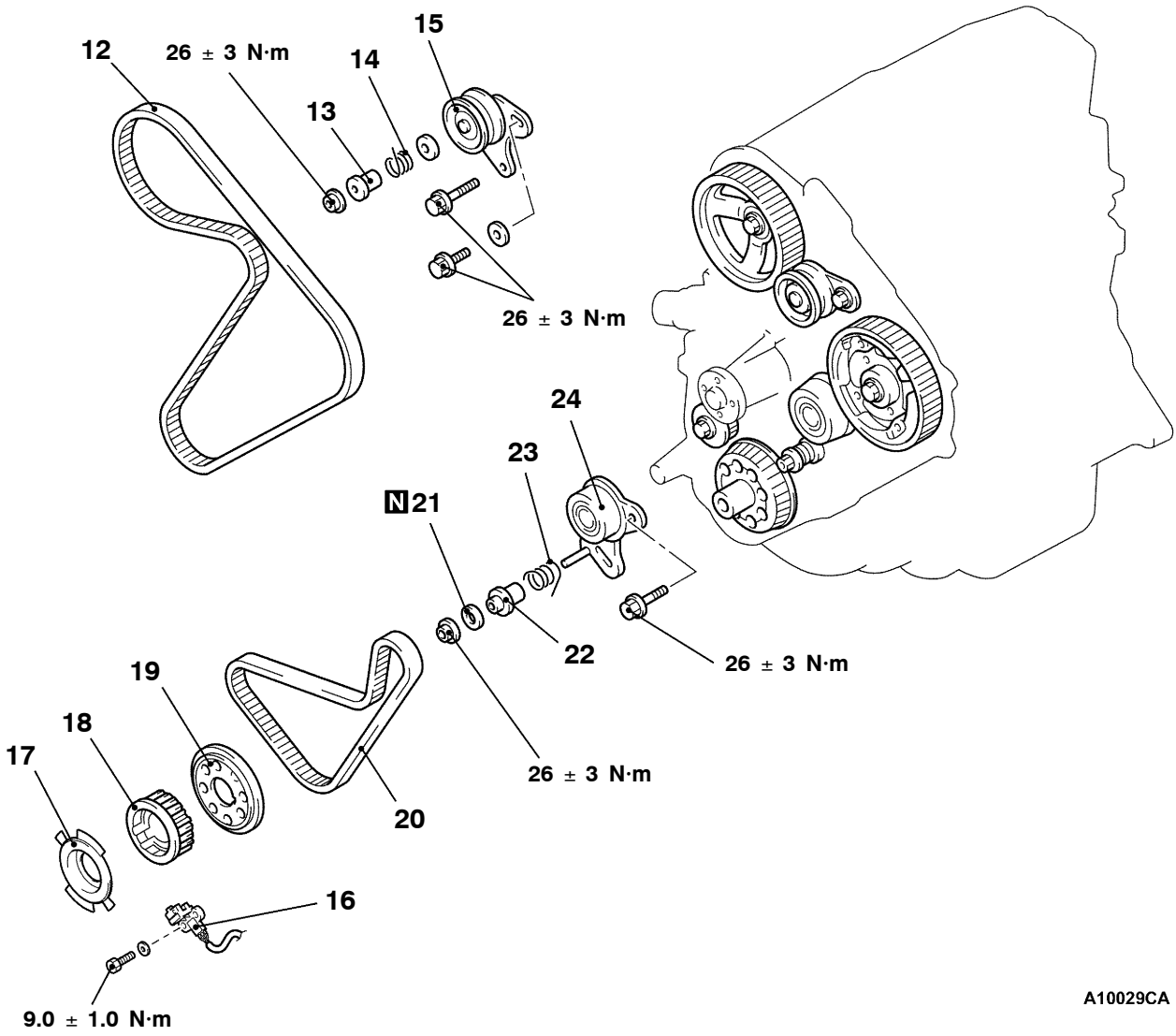
- Cooling fan

◀C▶ 5. Alternator and power steering oil pump drive belt
6. Auto-tensioner
7. Fan Clutch
8. Water pump pulley

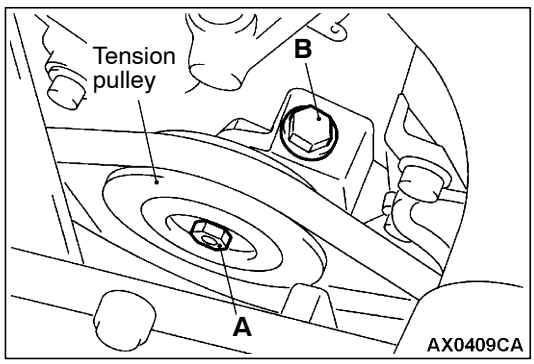
▶C◀ 9. Timing belt front upper cover

◀D▶ 10. Crankshaft pulley

▶C◀ 11. Timing belt front lower cover



◀E▶ ▶B◀ 12. Timing belt
13. Tensioner spacer
14. Tensioner spring
15. Timing belt tensioner
16. Crank angle sensor
17. Crankshaft sensing blade
18. Crankshaft sprocket
19. Flange
◀F▶ ▶A◀ 20. Timing belt B
21. Gasket
22. Tensioner spacer B
23. Tensioner spring B
24. Timing belt tensioner B



REMOVAL SERVICE POINTS

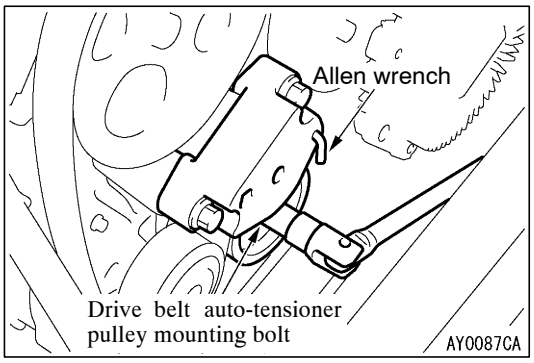
◀A▶ A/C COMPRESSOR DRIVE BELT REMOVAL

1. Loosen the tension pulley securing bolt A.
2. Loose the adjusting bolt B to remove the belt.

Caution
To reuse the drive belt, mark its running direction (clockwise direction) on the belt back side with a chalk.

◀B▶ A/C COMPRESSOR REMOVAL

1. Remove the A/C compressor from the bracket with its refrigerant hoses still attached.
2. Suspend the A/C compressor with a cord out of the way.

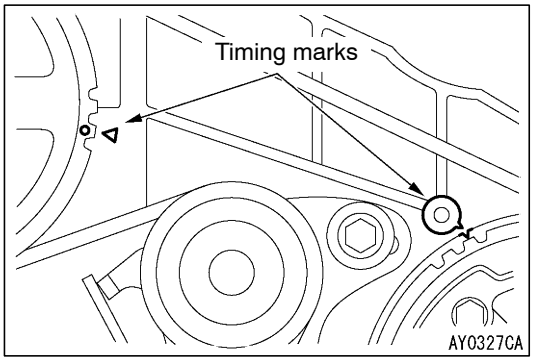


◀C▶ALTERNATOR AND POWER STEERING PUMP DRIVE BELT REMOVAL

The following operations will be needed due to the introduction of the serpentine drive system with the drive belt auto tensioner.

1. Locate a ring spanner onto the drive belt auto-tensioner pulley mounting bolt, and move the tensioner clockwise until it touches the stopper.
2. Hold the tensioner by inserting an Allen wrench as shown, and remove the drive belt.

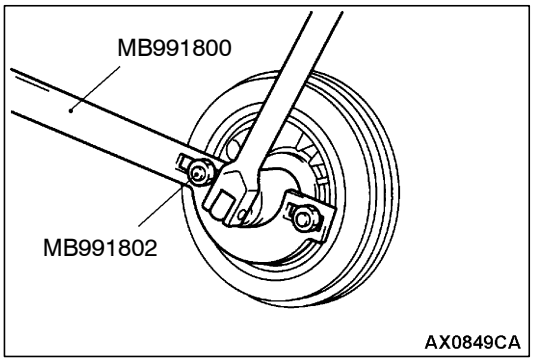
Caution
To reuse the drive belt, mark its running direction (clockwise direction) on the belt back side with a chalk.



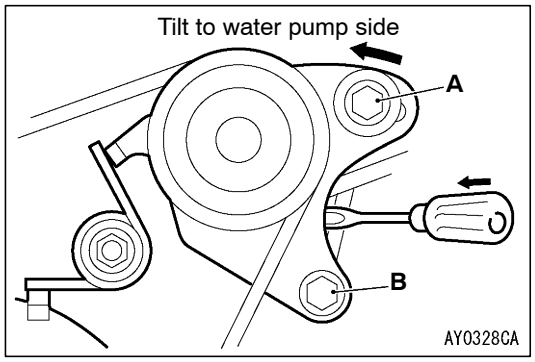
◀D▶ CRANKSHAFT PULLEY REMOVAL

1. Turn the crankshaft clockwise, align the timing marks to set No.1 cylinder to TDC of its compression stroke.

Caution
Never turn the crankshaft anticlockwise.

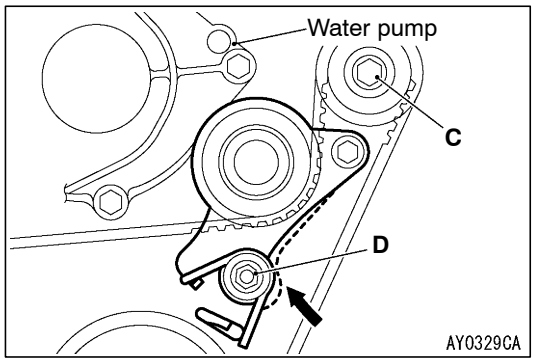


2. Use the special tool to keep crankshaft from turning and remove the bolts.



◀E▶ TIMING BELT REMOVAL

1. When reinstalling timing belt, mark an arrow at the belt to show rotation direction.
2. Loosen the tensioner mounting bolt A and B.
3. Push timing belt tensioner to water pump side and tighten the tensioner mounting bolt A and B. Secure so that tensioner will not move back.

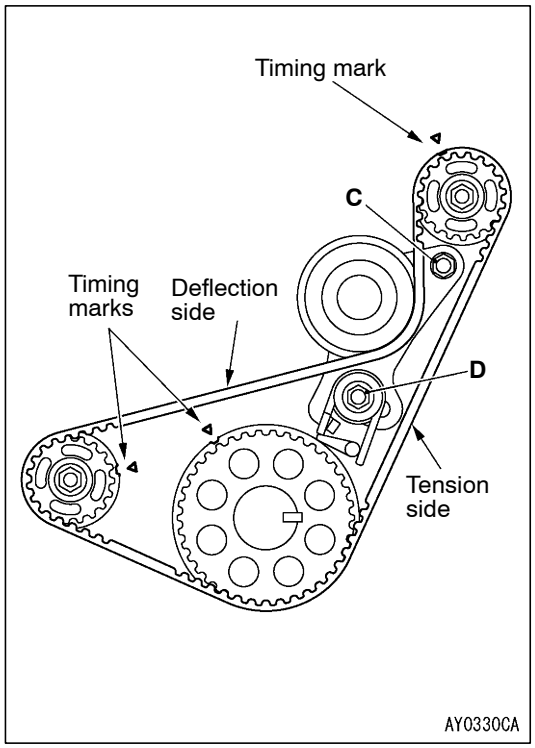


◀F▶ TIMING BELT B REMOVAL

1. When reinstalling timing belt B, mark an arrow at the belt to show rotation direction.
2. Loosen the tensioner mounting bolt C and nut D.
3. Push timing belt tensioner to water pump side and tighten the tensioner mounting bolt C and nut D. Secure so that tensioner will not move back.

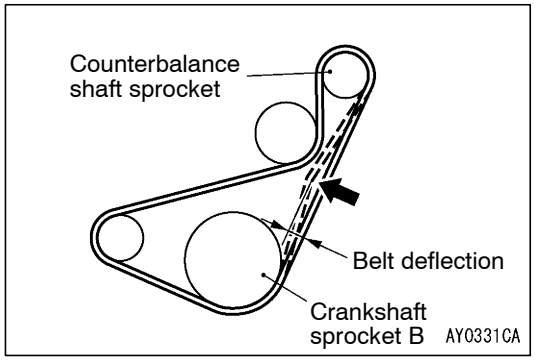
INSTALLATION SERVICE POINTS

▶A◀ TIMING BELT B INSTALLATION



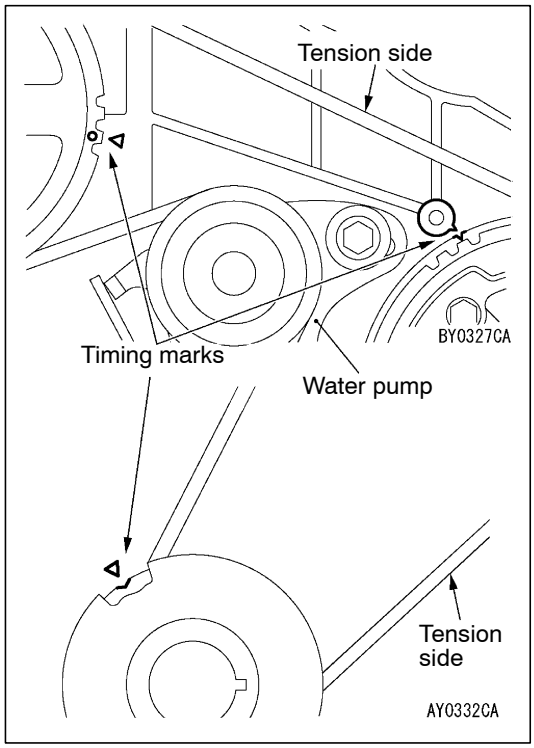
1. Align the timing marks of the 3 sprockets.
2. When reusing timing belt B, make sure the arrow mark is pointing in the same direction as when the belt was removed.
3. Install timing belt B and make sure there is no deflection on the tension side.
4. Press the deflection side of timing belt B with the hand and fully stretch the tensioner side.
5. Make sure that the timing marks are aligned.
6. Loosen the tensioner mounting bolt and nut so that only the pressure of the spring is applied to timing belt B.
7. Tighten the tensioner mounting bolt C and nut D, tightening the nut first. If the bolt is tightened first, the tensioner will move and tension the belt.

   Tightening torque: 26 ± 3 N·m



8. Press in the direction of the arrow in the figure with the index finger to check the amount of deflection.

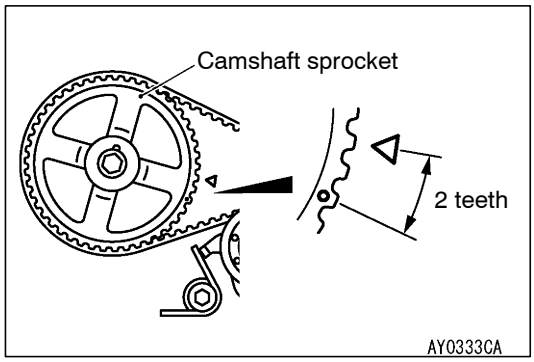
   Standard value: 4 - 5 mm



▶B◀ TIMING BELT INSTALLATION

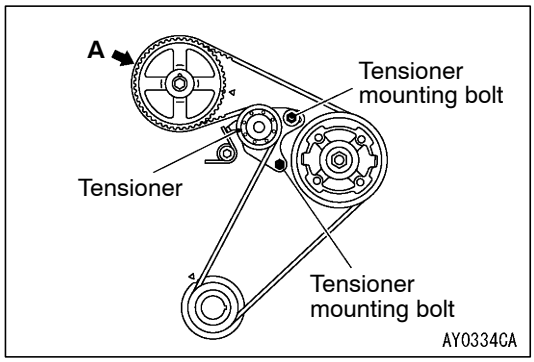
1. Align the timing marks of the 3 sprockets.
2. When reusing timing belt, make sure the arrow mark is pointing in the same direction as when the belt was removed.
3. Install the timing belt to the crankshaft sprocket, to injection pump sprocket, to tensioner and to camshaft sprocket in that order. Being careful not to allow deflection on the tension side of the timing belt.

   Caution
   (1) Engage the belt on the various sprockets while maintaining tension on the belt of tension side.
   (2) Align the injection pump sprocket with the timing mark, hold the sprocket so that is does not turn and engage the belt.
4. Loosen the tensioner mounting bolts and apply tension with the spring.

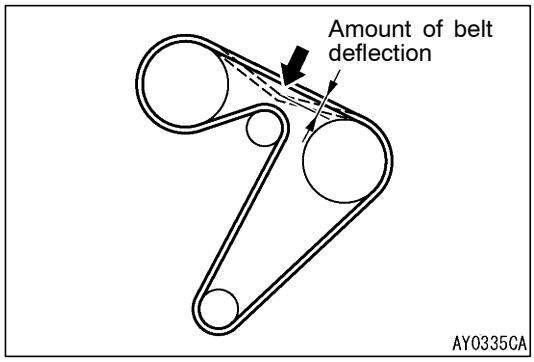


5. Turn the crankshaft clockwise and stop at the second lobe of the camshaft sprocket.

   Caution
   (1) When turning the crankshaft in item (5), strictly observe the specified amount of rotation (2 teeth on the camshaft sprocket) in order to apply a constant force to the tension side of the belt.
   (2) Do not turn the crankshaft counterclockwise.
   (3) Do not touch the belt during adjustment.

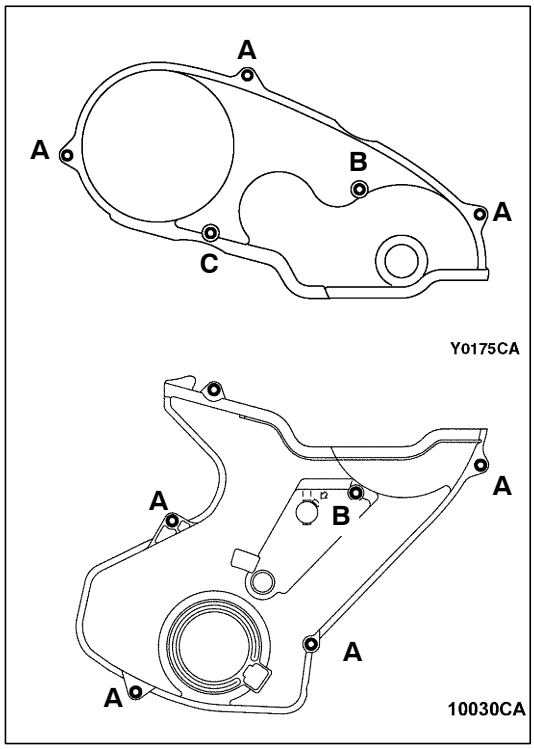


6. Make sure that the part indicated by arrow A does not float upward.
7. Tighten the tensioner mounting bolts, starting with the bolt in the elongated hole. If the lower bolt is tightened first, belt tension will become too tight.
8. Turn the crankshaft anticlockwise and align the timing mark. Next, make sure that the timing marks of all sprockets are aligned.



9. Press on the center of the bolt with an index finger to check the amount of deflection.

   Standard value: 4 - 5 mm



▶C◀ TIMING BELT FRONT LOWER COVER/TIMING BELT FRONT UPPER COVER INSTALLATION

Install the bolts to the timing belt cover at the shown positions.

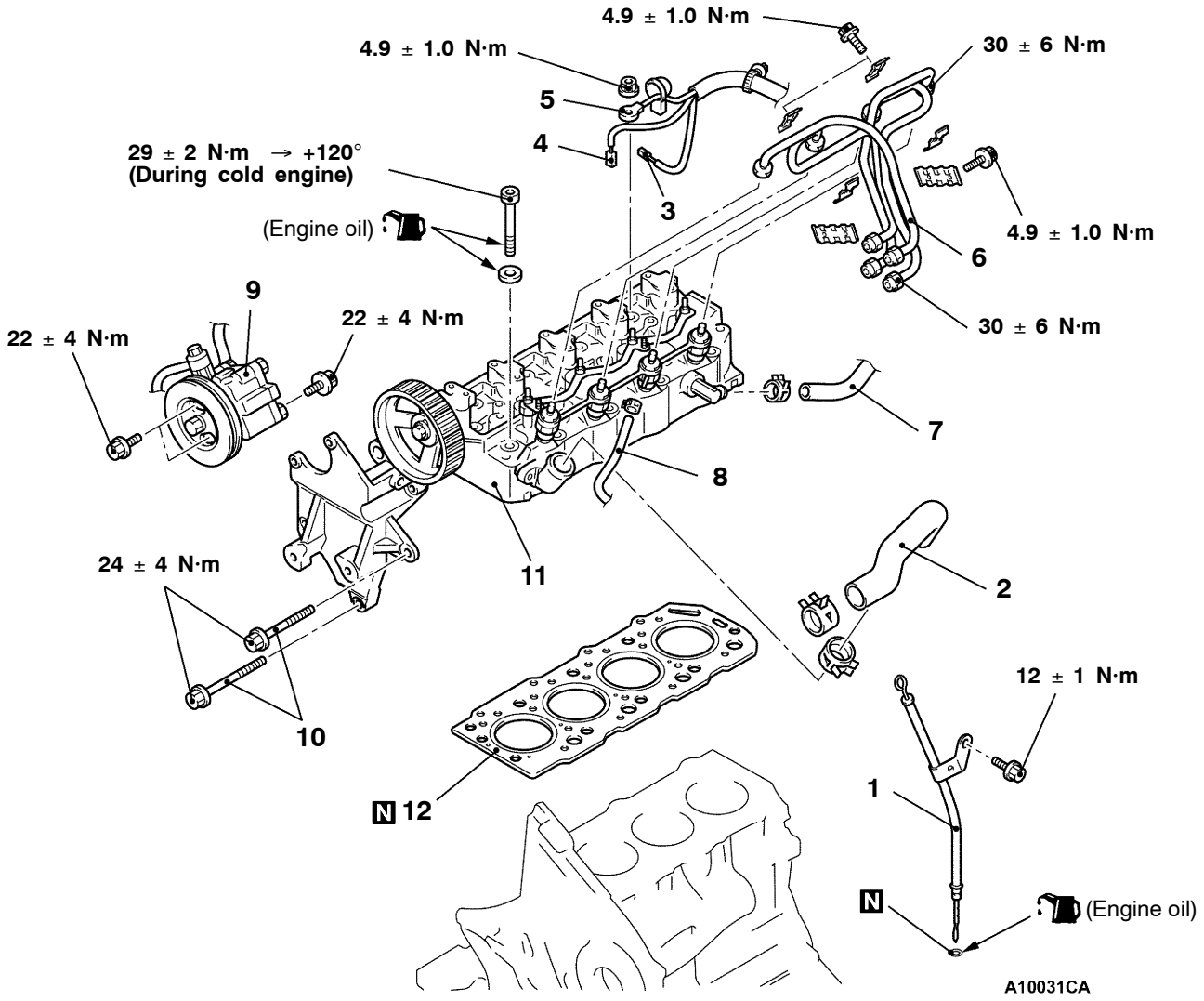
Name	Symbols	Size mm (d × l)
Flange bolt	A	6 × 22
	B	6 × 50
	C	6 × 60

d=Nominal diameter
l=Nominal length

CYLINDER HEAD GASKET

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Cooling Fan and Fan Clutch Assembly Removal and Installation.
- Intake Manifold Removal and Installation (Refer to GROUP15 - Intake Manifold and Exhaust Manifold, Turbocharger <4D5>.)
- Engine Oil Check and Refill.
- Fuel Line Air-bleeding.
- Timing Belt Removal and Installation (Refer to P.11B-6.)



Removal steps

1. Oil level gauge guide and oil level gauge assembly
◀A▶ ▶D◀ 2. Radiator upper hose
- Rocker cover

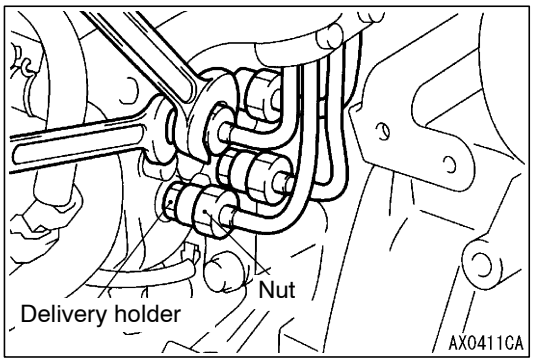
3. Engine coolant temperature switch connector (for A/C compressor control)
4. Engine coolant temperature switch connector (for condenser fan control)
5. Glow plug connector
◀B▶ ▶C◀ 6. Fuel injection pipe
7. Heater hose connection
8. Fuel hose connection
- Water pipe assembly C (Refer to GROUP 14.)

◀C▶ 9. Power steering oil pump assembly
10. Power steering oil pump bracket bolt
◀D▶ ▶B◀ 11. Cylinder head assembly
▶A◀ 12. Cylinder head gasket

REMOVAL SERVICE POINTS

◀A▶ RADIATOR UPPER HOSE DISCONNECTION

After making mating marks on the radiator upper hose and the hose clamp, disconnect the radiator upper hose.



◀B▶ FUEL INJECTION PIPE REMOVAL

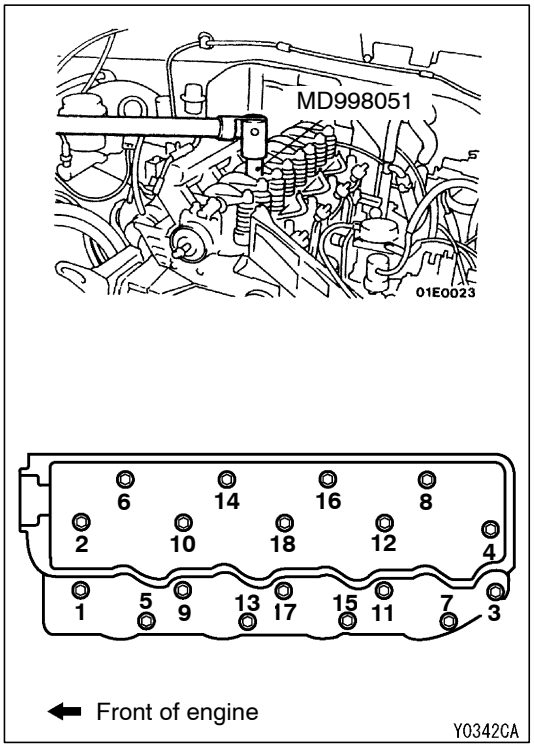
When loosening nuts at both ends of injection pipe, hold the delivery holder (for pump side) and the injection nozzle assembly (for nozzle side) with wrench and loosen nut.

Caution
After disconnecting the injection pipe, plug the opening so that no foreign particles get inside the pump or into the injection nozzle.

◀C▶ POWER STEERING OIL PUMP REMOVAL

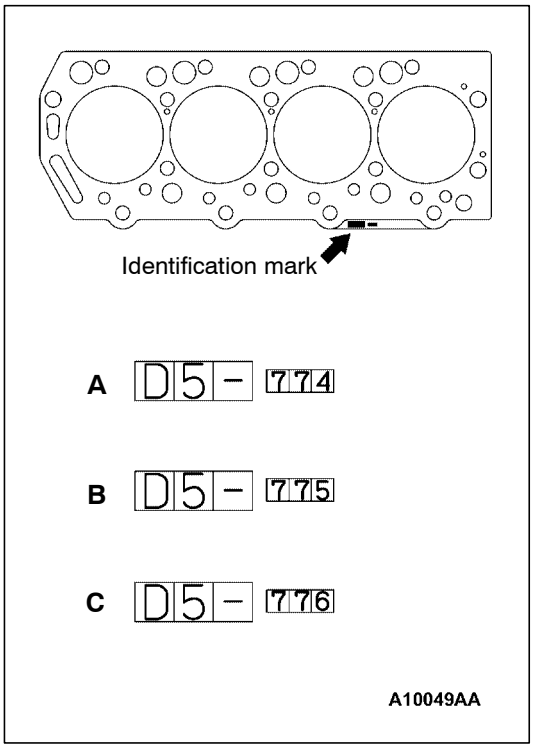
Remove the power steering oil pump from the bracket with the hose attached.

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



◀D▶ CYLINDER HEAD ASSEMBLY REMOVAL

Use the special tool to loosen the cylinder head bolts in the shown sequence progressively, and then remove the cylinder head bolts.



INSTALLATION SERVICE POINTS

▶A◀ CYLINDER HEAD GASKET INSTALLATION

When replacing the cylinder head gasket only, confirm the gasket identification mark, and then select a replacement part according to the table below:

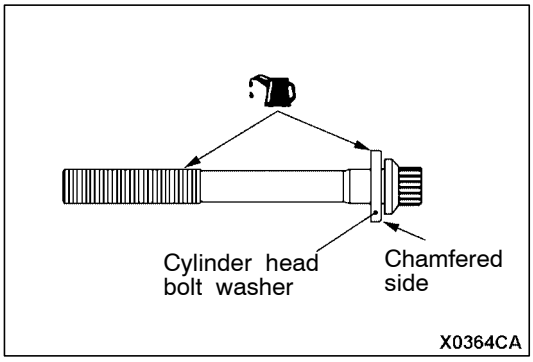
Spec	Identification mark (size)	Parts number
A	D5-774 (fitted thickness 1.45 ± 0.04)	MD377774
B	D5-775 (fitted thickness 1.50 ± 0.04)	MD377775
C	D5-776 (fitted thickness 1.55 ± 0.04)	MD377776

Caution
The thickness of the original cylinder head gasket is selected according to the protrusion amount of the piston. Therefore, if the piston or the connecting rod is replaced, the protrusion amount may be changed. Always select a correct gasket by measuring the protrusion amount. (For details, refer to the Engine Workshop Manual.)

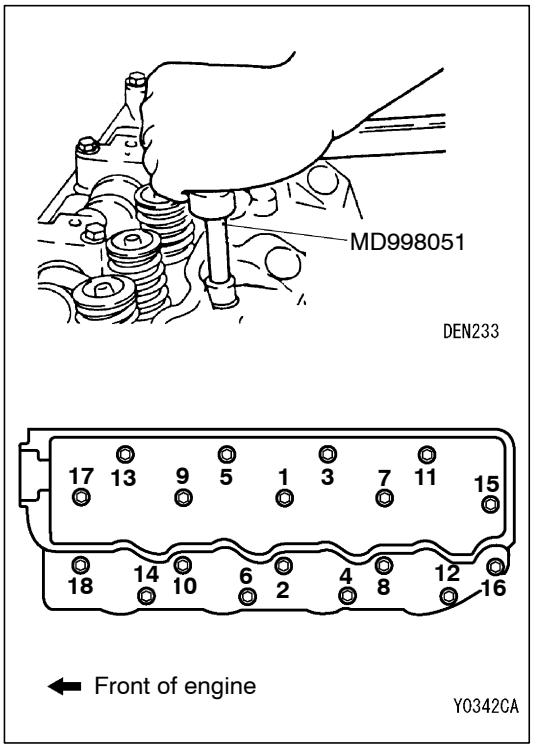
▶B◀ CYLINDER HEAD INSTALLATION

1. Select a cylinder head gasket of correct specification.
2. Clean the cylinder head assembly and the cylinder block mating surfaces with a scraper or a wire brush.

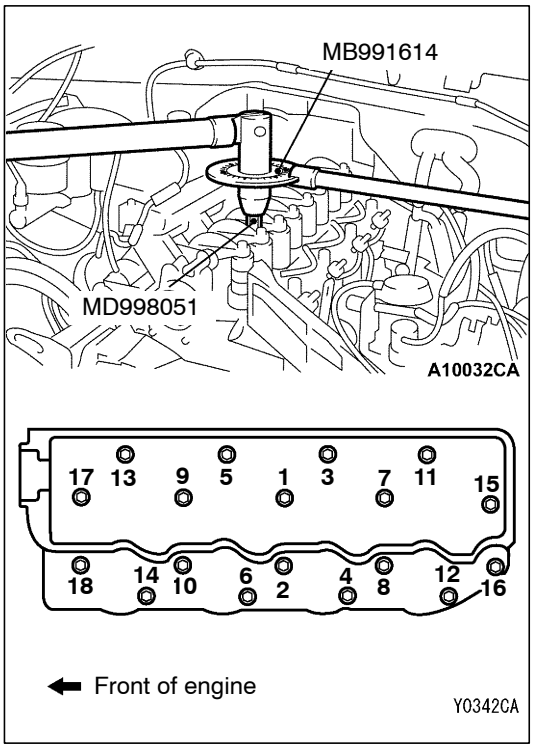
   Caution
   Do not allow foreign material to enter the engine coolant or oil passages and the cylinder.



3. Install the cylinder head bolt washer to the cylinder head bolt so that the washer chamfered side faces as shown.
4. Apply a small amount of engine oil to the cylinder head bolt thread and the washer.



5. Tighten the cylinder head bolts according to the following procedure (angle-tightening procedure.)
   (1) Use the special tool to tighten the cylinder head bolts in the order of the illustrated numbers to 29 ± 2 N·m.



   (2) Place the special tool in a wrench to tighten the cylinder head bolt in the order of the illustrated numbers to 120°.

▶C◀ RADIATOR UPPER HOSE CONNECTION

To reuse the radiator upper hose, align the mating marks that were made during removal, and then install the hose clamp.

▶D◀ FUEL INJECTION PIPE INSTALLATION

When tightening the nuts at both ends of the fuel injection pipe, hold the delivery holder (for pump side) and the injection nozzle assembly (for nozzle side) with a wrench, and tighten the nuts to the specified torque.

Tightening torque: 30 ± 6 N·m

NOTES

ENGINE <4M4>

Click on the applicable bookmark to selected the required model year.

ENGINE <4M4>

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TIMING CHAIN 17

CRANKSHAFT OIL SEAL 21

CAMSHAFT 23

CYLINDER HEAD GASKET 27

ENGINE ASSEMBLY 33

GENERAL INFORMATION

Items			4M41
Total displacement mL			3,200
Bore × Stroke mm			98.5 × 105.0
Compression ratio			17.0
Camshaft arrangement			DOHC
Number of valve	Intake		8
	Exhaust		8
Valve timing	Intake	Opening	BTDC 13°
		Closing	ABDC 31°
	Exhaust	Opening	BBDC 55°
		Closing	ATDC 17°
Fuel system			Distribution type injection pump
Rocker arm			Roller type

SERVICE SPECIFICATIONS

Items			Standard value	Limit
Alternator drive belt (When inspection)	Vibration frequency Hz		122 - 161	–
	Tension N		207 - 363	–
	Deflection mm <Reference>		8 - 11	–
Alternator drive belt (When adjustment)	Vibration frequency Hz		122 - 136	–
	Tension N		207 - 259	–
	Deflection mm <Reference>		10 - 11	–
Alternator drive belt (When replacement)	Vibration frequency Hz		149 - 161	–
	Tension N		311 - 363	–
	Deflection mm <Reference>		8 - 9	–
A/C compressor drive belt (When inspection)	Vibration frequency Hz	A	177 - 191	–
		B	145 - 156	–
	Tension N	C	343 - 392	–
	Deflection mm <Reference>	C	7.5 - 8.5	–
A/C compressor drive belt (When adjustment)	Vibration frequency Hz	A	177 - 191	–
		B	145 - 156	–
	Tension N	C	343 - 392	–
	Deflection mm <Reference>	C	7.5 - 8.5	–
A/C compressor drive belt (When replacement)	Vibration frequency Hz	A	177 - 191	–
		B	145 - 156	–
	Tension N	C	490 - 539	–
	Deflection mm <Reference>	C	6.0 - 6.5	–

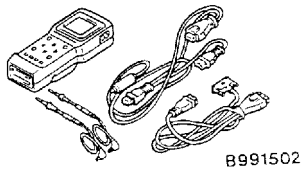
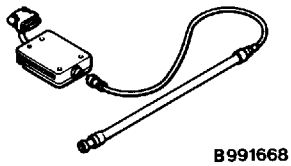
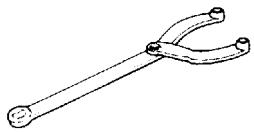
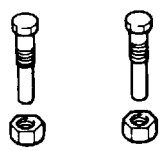
Items		Standard value	Limit
Valve clearance(at cold engine) mm	Intake valve	0.1	–
	Exhaust valve	0.15	–
Injection timing		4°BTDC	–
Idle speed r/min		750 ± 20	–
Compression pressure kPa-r/min		2,844-240	2,256-240
Compression pressure difference of all cylinder kPa		–	Maximum 294

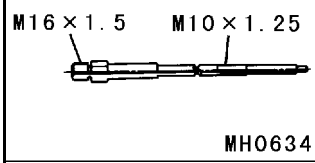
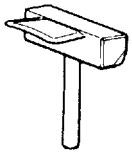
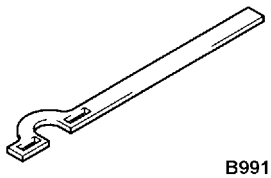
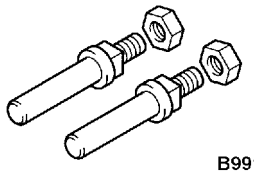
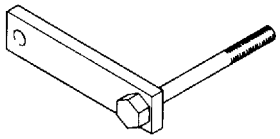
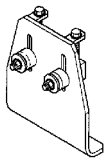
NOTE
A: Between crankshaft pulley and tension pulley
B: Between crankshaft pulley and A/C compressor pulley
C: Between A/C compressor pulley and tension pulley

SEALANTS AND ADHESIVES

Items	Specified Sealants	Remarks
Oil pan cover rubber	3M ATD Part No. 8121 or equivalent	Quick fix adhesive
Engine cover insulator		
Contact surface between timing gear case and crankcase assembly	3M ATD Part No. 8660 or equivalent	Semi-drying sealant
Oil pan	MITSUBISHI GENUINE PART MD970389 or equivalent	
Timing gear case		

SPECIAL TOOLS

Tool	Number	Name	Use
 B991502	MB991502	MUT-II sub-assembly	• Drive belt tension measurement • Fuel injection timing check and adjustment • Idle speed check
 B991668	MB991668	Belt tension meter set	Drive belt tension measurements (Use with MUT-II)
	MB990767	Endyoke holder	Crankshaft pulley holding
	MD998754	Pulley holder pin	

Tool	Number	Name	Use
	MH063494	Compression gauge adapter	Compression pressure check
	MD998727	Oil pan remover	Oil pan removal
	MB991800	Pulley holder	Crankshaft pulley holding
	MB991802	Pin B	
	MD998781	Flywheel stopper	Flywheel<M/T> or drive plate<A/T> holding
	MH063490	Cam sprocket holder kit	Camshaft sprocket holding

ON-VEHICLE SERVICE

DRIVE BELT TENSION CHECK AND ADJUSTMENT

ALTERNATOR DRIVE BELT TENSION CHECK AND ADJUSTMENT

1. Check the drive belt tension by the following procedures.

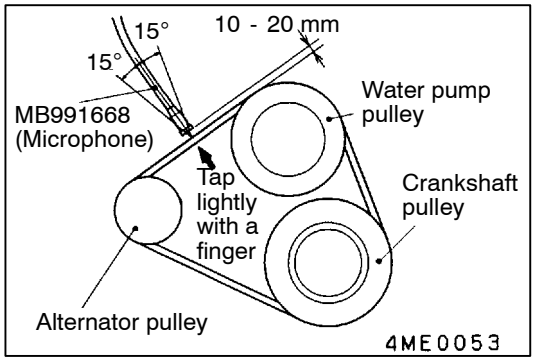
Standard value:

Item	During inspection	During adjustment	During replacement
Vibration frequency Hz	122 - 161	122 - 136	149 - 161
Tension N	207 - 363	207 - 259	311 - 363
Deflection mm <Reference>	8.0 - 11.0	10.0 - 11.0	8.0 - 9.0

<When using MUT-II>

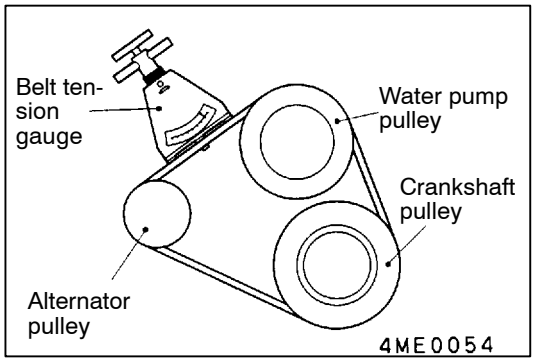
(1) Connect the MUT-II to the special tool (MB991668).
(2) Connect the MUT-II to the diagnosis connector.

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

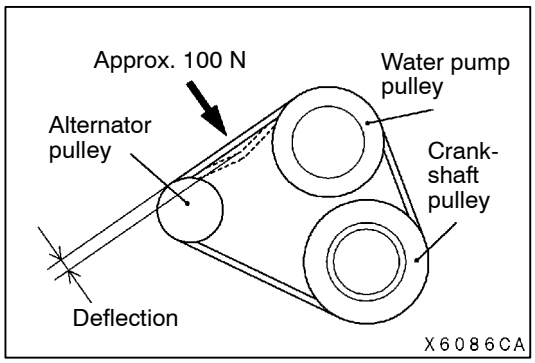


(3) Turn the ignition switch to ON, and select the “Belt tension measurement” on the menu screen.
(4) Hold a microphone to the middle of the drive belt between the pulleys(at the place indicated by the arrow), approximately 10 - 20 mm away from the rear surface of the belt and so that it is perpendicular to the belt (within an angle of ±15°).
(5) Gently tap the middle of the belt between the pulleys (the place indicated by the arrow) with your finger as shown in the illustration, and check that the vibration frequency of the belt is within the standard value.

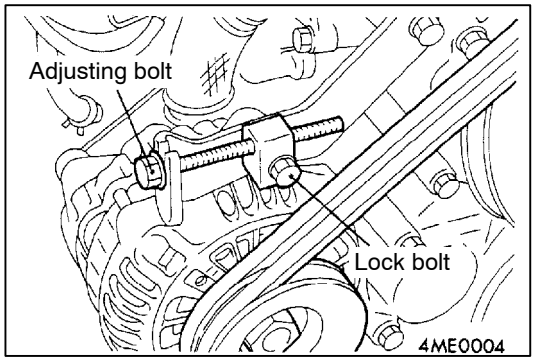
Caution
1) The temperature of the surface of the belt should be as close to normal temperature as possible.
2) Do not allow any contaminants such as water or oil to get onto the microphone.
3) If strong gusts of wind blow against the microphone or if there are any loud sources of noise nearby, the values 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.

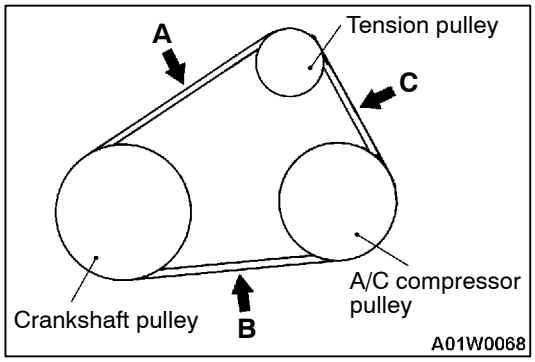


<When checking the deflection>
Apply approx. 100 N of force to the middle of the drive belt between the pulleys (at the place indicated by the arrow) and check that the amount of deflection is within the standard value.



2. If not within the standard value, adjust the belt tension by the following procedure.
   (1) Loosen the pivot nut.
   (2) Loosen the lock bolt.
   (3) Turn the adjusting bolt to adjust the belt deflection.
   (4) Tighten the lock bolt and pivot nut to the specified torque.
   (5) Crank the engine clockwise one turn or more, and then check the belt tension.

   Caution
   These V belts must always be replaced as a set, being careful to keep them clear of oil or grease.



A/C compressor drive belt tension check and adjustment<Vehicles with A/C>

1. Check the drive belt tension by the following procedures.

Standard value:

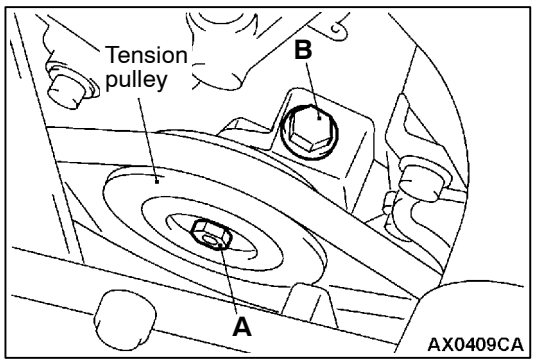
Item		During inspection	During adjustment	During replacement
Vibration frequency Hz	A	177 - 191	177 - 191	177 - 191
	B	145 - 156	145 - 156	145 - 156
Tension N	C	343 - 392	343 - 392	490 - 539
Deflection mm <Reference>	C	7.5 - 8.5	7.5 - 8.5	6.0 - 6.5

<When using MUT-II>
Gently tap the center of the belt between the pulleys (arrows A and B), and check that the belt vibration frequency is within the standard value.

NOTE
For the vibration frequency measurement using the MUT-II, refer to P.11C-5.

<When using a tension gauge>
Place a belt tension gauge at the center between the pulleys (arrow C) to check the belt tension is within the standard value.

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

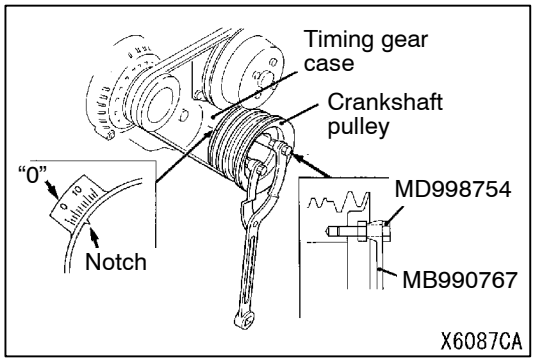


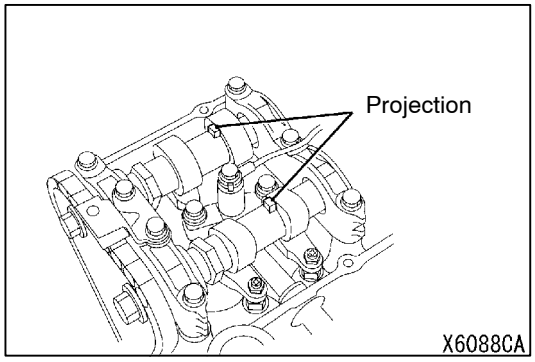
2. If not within the standard value, adjust the belt tension by the following procedure.
   (1) Loosen the tension pulley securing bolt A.
   (2) Use the adjusting bolt B to adjust the belt deflection.
   (3) Tighten the securing bolt A to the specified torque.

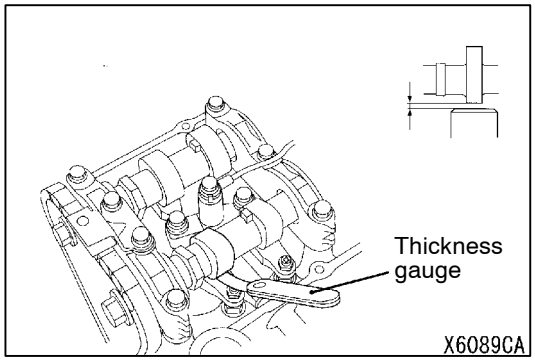
   Tightening torque: 44 ± 10 N·m

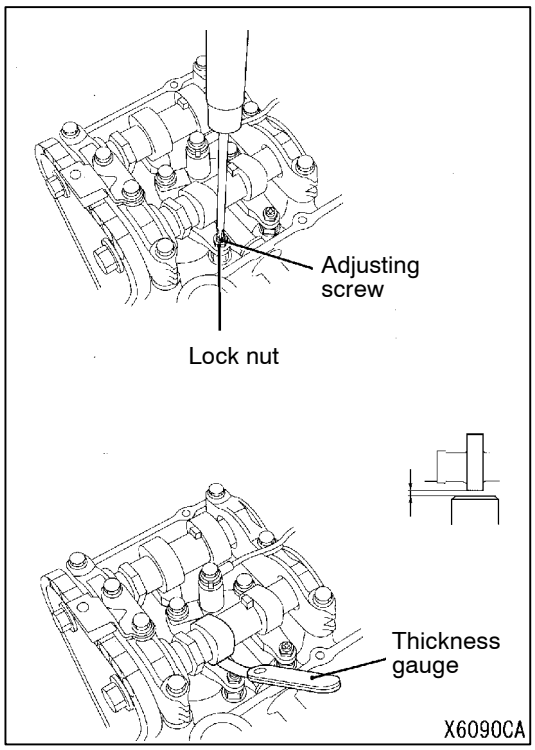
   (4) Check the belt tension, and readjust if necessary.

   Caution
   When checking the belt tension, turn the crankshaft clockwise one turn or more.









VALVE CLEARANCE CHECK AND ADJUSTMENT

NOTE
The valve clearance check and adjustment should be done when the engine is cold.

1. Remove the rocker cover.
2. Remove all the glow plugs.
3. Use the special tool to turn the crankshaft clockwise, and align the notch on the crankshaft pulley with timing mark "0" to set the No.1 cylinder or No.4 cylinder to the top dead centre of its compression stroke.

Caution
Never turn the crankshaft anticlockwise, or the tensioner for adjusting the timing chain tension at the timing gear can be damaged.
If it is turned anticlockwise, once remove the tensioner and reinstall.

NOTE
If the projection on the camshaft faces up, the No.1 cylinder is on the top dead centre of its compression stroke .When the crankshaft is turned just one more turn, the No.4 cylinder is at top dead centre.

4. When the No.1 or No.4 piston is on the top dead centre of its compression stroke, use a thickness gauge to measure the valve clearance indicated by the circle in the table below.

When the No.1 cylinder is at compression top dead centre:

Cylinder No.	1	2	3	4
Intake	○	○	-	-
Exhaust	○	–	○	–

When the No.4 cylinder is at compression top dead centre:

Cylinder No.	1	2	3	4
Intake	–	–	○	○
Exhaust	–	○	–	○

Standard value:
Intake side 0.1 mm
Exhaust side 0.15 mm

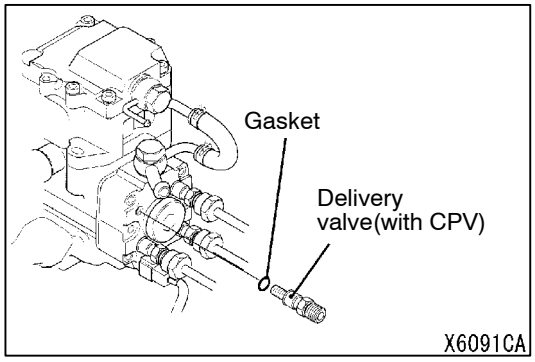
NOTE
If the thickness gauge is inserted and pulled out with resistance, its reading will be accurate.
If the thickness gauge can be inserted and pulled out smoothly without resistance, its reading will be inaccurate.

5. If not at the standard value, adjust by the following procedure.
   (1) Loosen the lock nut, and tighten the adjusting screw so that the thickness gauge can be passed with a slight drag.

(2) After adjustment, tighten the lock nut to the specified torque while preventing the adjusting screw from turning with a screwdriver.

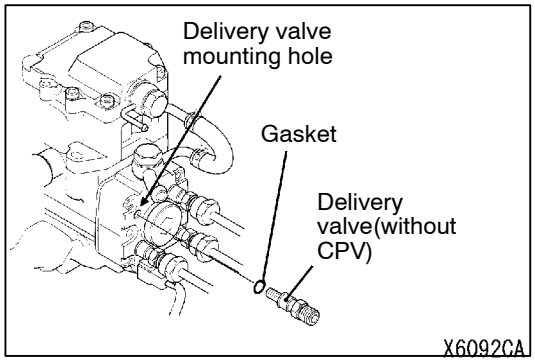
Tightening torque: 9.5 ± 0.5 N·m

(3) Measure the valve clearance again, and check that it is at the standard value.



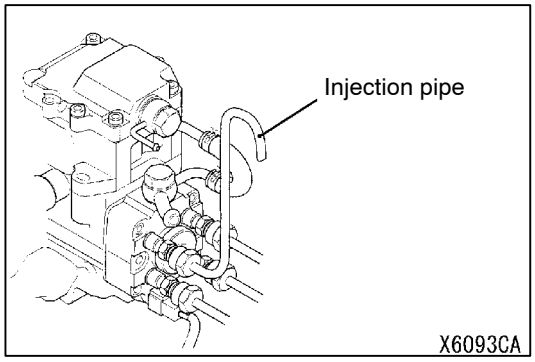
INJECTION TIMING CHECK AND ADJUSTMENT

1. Warm up the engine.
2. Remove all the glow plugs.
3. Remove the No.1 cylinder delivery valve (with CPV) and gasket of the injection pump.

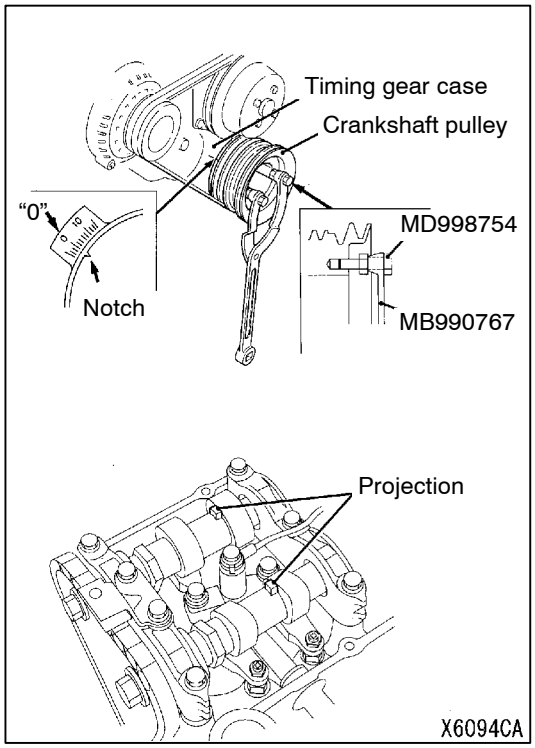


4. Install the gasket (ME741133) and delivery valve(without: MH063483) to the injection pump delivery valve mounting hole, and tighten them to the specified torque.

Tightening torque: 49 ± 5 N·m



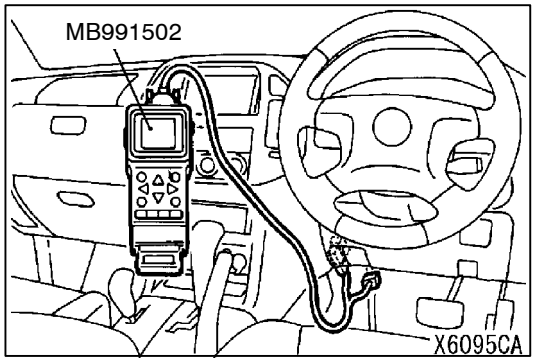
5. Install an old the auxiliary injection pipe to the delivery valve. Cut out the open end of the injection pipe, and bend it down so as to observe the fuel flow.



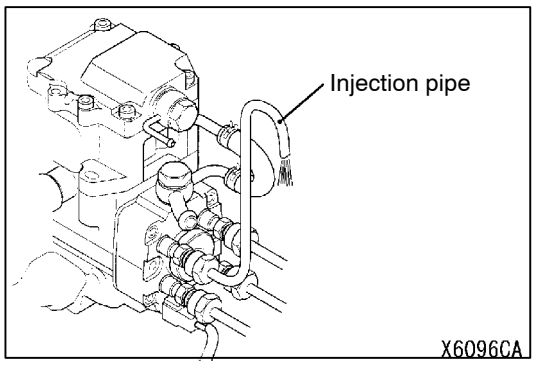
6. Use the special tool to turn the crankshaft clockwise, align the notch on the crankshaft pulley with the "0" timing mark to set the No.1 cylinder to the top dead centre of its compression stroke.

   Caution
   Never turn the crankshaft anticlockwise, or the tensioner for adjusting the timing chain tension at the timing gear can be damaged. If it is turned anticlockwise, once remove it and reinstall.

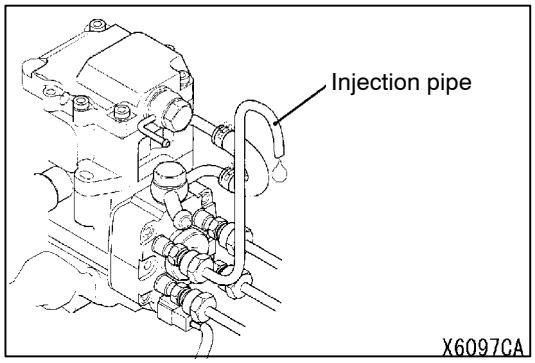
   NOTE
   Remove the filler cap, and check the camshaft condition. If the camshaft projection faces up, the No.1 cylinder is on top dead centre of its compression stroke.
7. Turn the crankshaft pulley clockwise, and set the No.1 cylinder to before top dead centre 30° of its compression stroke.

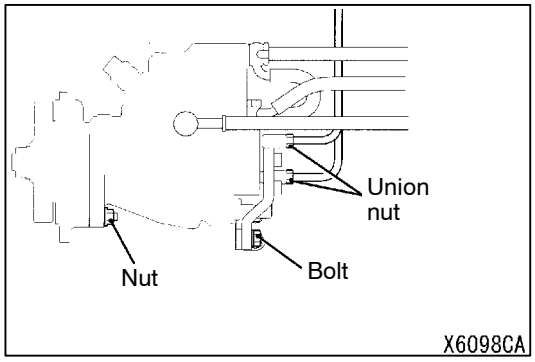


8. Turn the ignition switch to "LOCK"(OFF), and connect the diagnosis connector to the MUT-II.
9. Turn the ignition switch ON.
10. Carry out the actuator test (No.34) on MUT-II.



11. Supply the fuel by operating the fuel filer hand pump,and turn the engine clockwise while allowing the fuel to flow through the injection pipe.



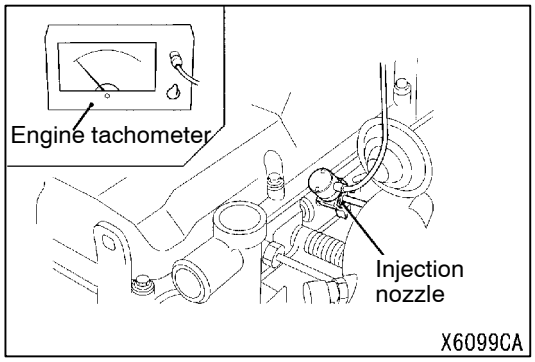


12. If the fuel flow through the injection pipe decreases, turn the engine more slowly. Then stop turning the engine when the fuel flow stops completely. Check the fuel injection timing during this condition.

    Standard value: 4° BTDC
13. If not at the standard value, adjust by the following procedure.
    (1) Loose the fuel injection pipe union nut, the injection pump securing bolt and nut in that order.

    Caution
    a. When the union nut is loosened, use a open end wrench to prevent the delivery valve holder from rotating with it.
    b. Do not remove the bolt and nut at this time.
    (2) Tile the injection pump housing to the left or the right to adjust.
    (3) Tile the injection pump mounting nut and bolt temporarily.
    (4) Repeat steps 9 - 12 to check that the injection timing is correct.
    (5) Tile the injection pump mounting nut and bolt securely.
    (6) Loose the fuel injection pipe union nut securely.

    Caution
    Hold the delivery pipe holder with a open end wrench when tightening the union nut.
14. Remove the special tool.
15. Install the delivery valve (with CPV) and the new gasket.
16. Install the glow plugs.

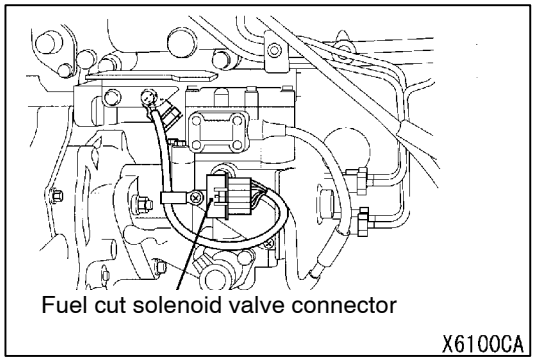


IDLE SPEED CHECK

1. Set the vehicle to the pre-inspection condition.
2. Turn the ignition switch to LOCK (OFF) position, and connect the diagnosis connector to the MUT-II.
   If the MUT-II is not used, connect an engine tachometer to the injection nozzle or the pipe.
3. Start the engine, and let it run at idle.
4. Check the idle speed.

   Standard value: 750 ± 20 r/min
5. If the idle speed is not within the standard value, refer to 13C - Troubleshooting to check the electronic controlled fuel injection system.

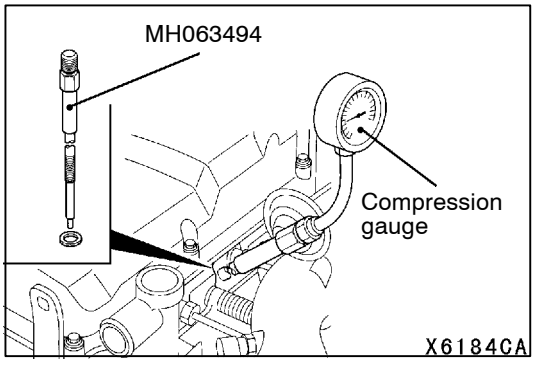
   NOTE
   The idle speed is controlled by the engine-ECU.



COMPRESSION PRESSURE CHECK

1. Check that the engine oil,the starter motor and the battery is in good condition. In addition,set the vehicle to the pre-inspection condition.
2. Remove all the glow plugs.
3. Disconnect the fuel cut solenoid valve connector.

   NOTE
   Doing this will prevent carrying out fuel injection.
4. Plug the glow plug mounting holes with a shop towel, crank the engine, and then check that the shop towel is not contaminated with foreign material.
   Caution
   1) Keep away from the glow plug mounting holes when cranking the engine.
   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 glow plug holes, which is dangerous.



5. Install the special tool to the glow plug mounting holes, and install the compression gauge.
6. Measure the compression pressure while cranking the engine.

   Standard value: 2844 kPa – 240 r/min
   Limit value: 2256 kPa – 240 r/min
7. Measure the compression pressure for all the cylinders and check that the pressure differences of the cylinders are below the limit.

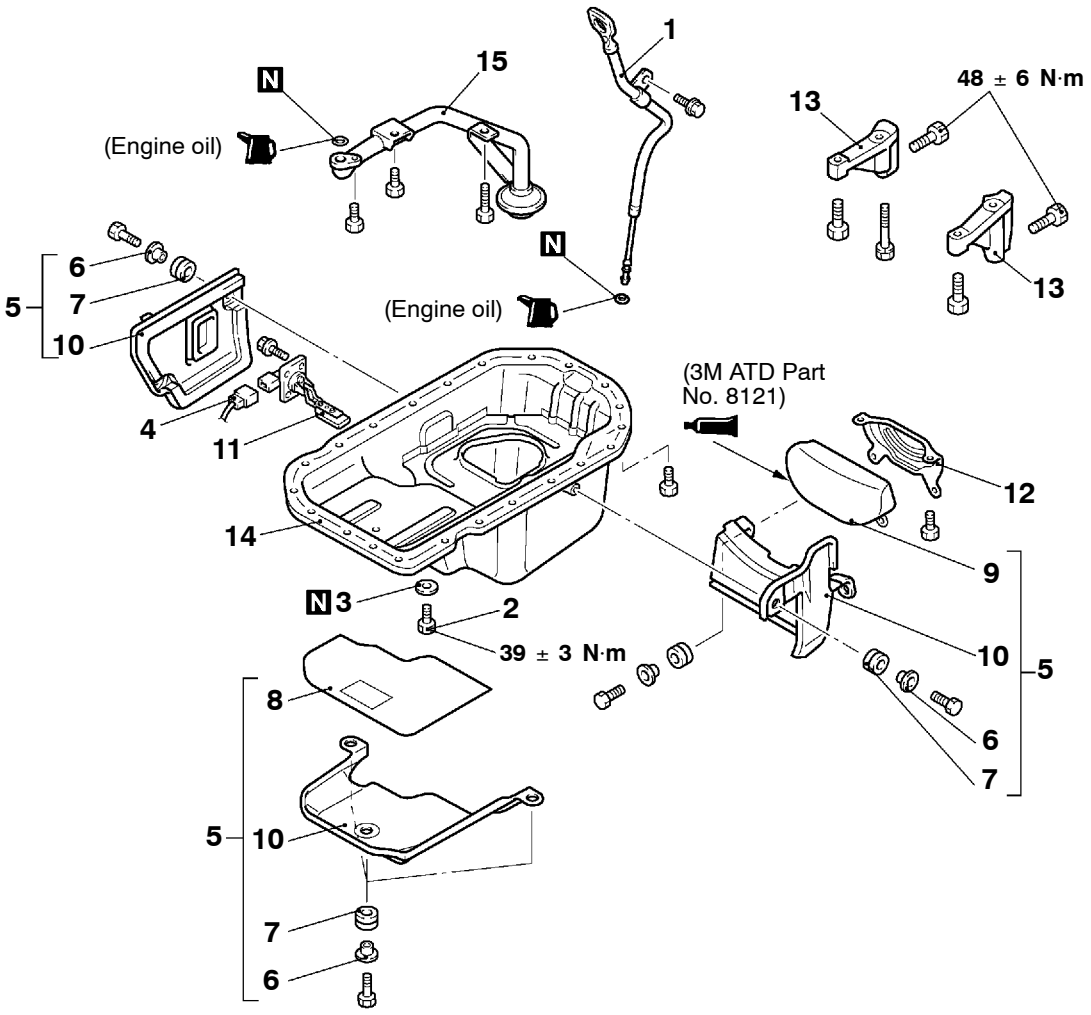
   Limit: 294 kPa in maximum

8. If there is a cylinder which compression or compression difference is outside the limit, pour a small amount of engine oil through the glow plug hole, and repeat the operations in steps 6 - 7.
   (1) If the compression increases after the 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 the oil is added, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket.
9. Connect the fuel cut solenoid valve connector.
10. Install the glow plugs.

OIL PAN

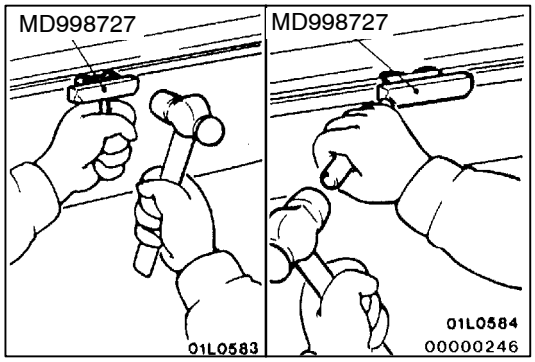
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Skid Plate and Under Cover Removal and Installation
- Engine Oil Draining and Refilling (Refer to GROUP 12 - On-vehicle Service.)
- Differential Gear Oil Draining and Refilling (Refer to GROUP 26 - On-vehicle Service.)
- Front Differential and No.2 Crossmember Assembly Removal and Installation (Refer to GROUP 11A - Oil Pan.)



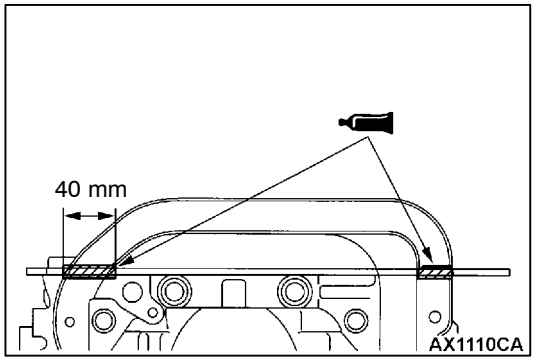
Removal steps

1. Engine oil level gauge and guide assembly
2. Drain plug
▶B◀ 3. Drain plug gasket
4. Engine oil level sensor connector
5. Oil pan cover assembly
6. Insulator collar
7. Insulator
8. Oil pan rubber
9. Rubber
10. Oil pan cover
11. Engine oil level sensor
12. Dust cover
13. Stiffener
◀A▶ ▶A◀ 14. Oil pan
15. Oil screen



REMOVAL SERVICE POINT

◀A▶ OIL PAN REMOVAL

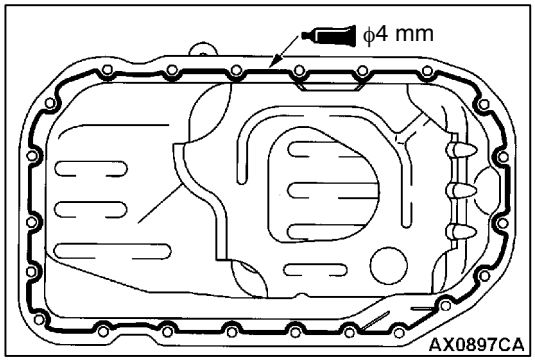


INSTALLATION SERVICE POINTS

▶A◀ OIL PAN INSTALLATION

1. Clean the gasket mating surfaces of the oil pan, the timing gear case and the crankcase assembly with a scraper or a wire brush.
2. Apply the specified sealant to the mating surface of the timing gear case and crankcase.

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

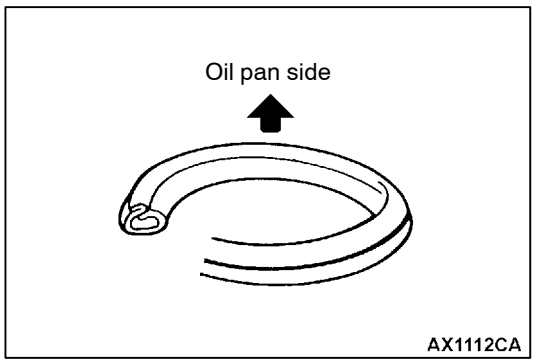


3. Apply a continuous bead of the specified sealant to the the oil pan mating surface as shown.

   Specified sealant:
   MITSUBISHI GENUINE PART MD970389 or equivalent

4. After applying the sealant, install the oil pan within 15 minutes.

   Caution
   (1) When installing the oil pan, be careful not to disturb the sealant.
   (2) Whenever the oil pan mounting bolts are loosened or tightened again after the oil pan installation, always apply the sealant again.
   (3) After the oil pan is installed, wait for at least one hour, and then start the engine.



▶B◀ DRAIN PLUG GASKET INSTALLATION

Always replace the gasket with a new one so that it faces the direction shown.

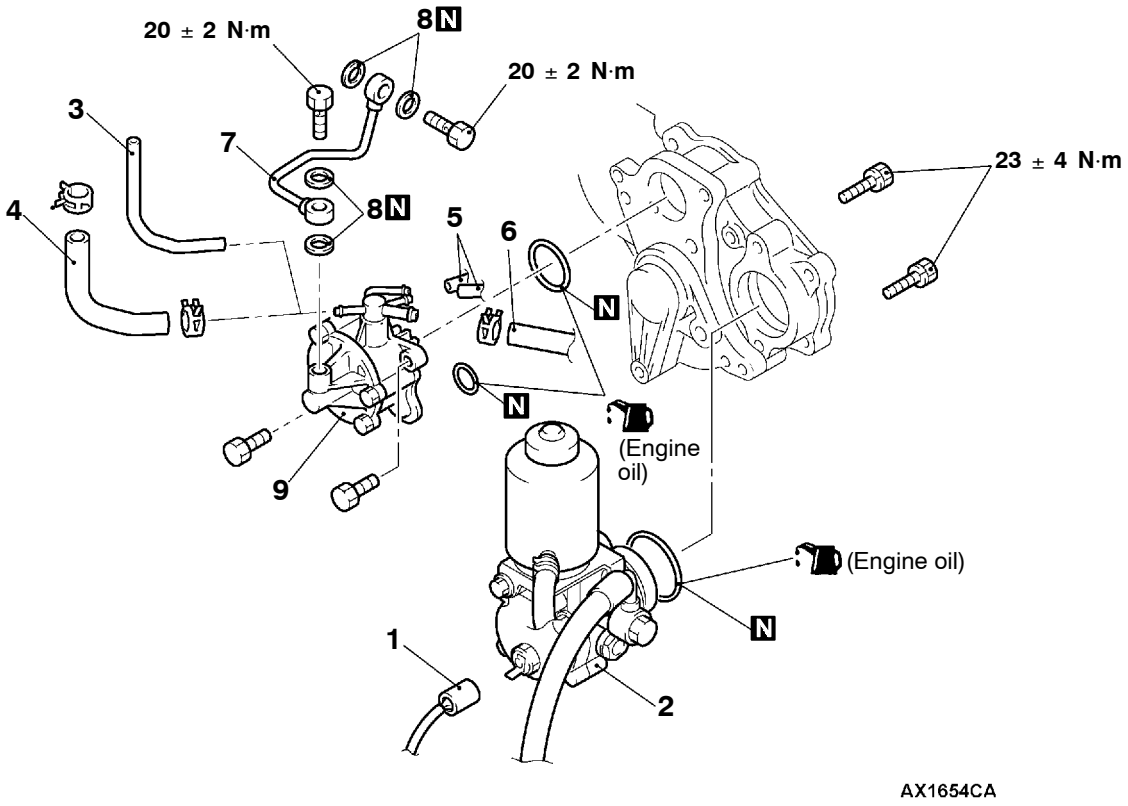
INSPECTION

- Check oil pan for cracks.
- Check oil pan sealant-coated surface for damage and deformation.
- Check oil screen for cracked, clogged or damaged wire net and pipe.

VACUUM PUMP

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Cover Removal and Installation (Refer to P.11C-23.)
- Battery and Battery Tray Removal and Installation
- Engine Oil Check and Refill (Refer to GROUP 12 - On-vehicle Service.) <Post-installation operation>



Removal steps

1. Power steering oil pressure switch connector
◀A▶ 2. Power steering oil pump assembly
3. Vacuum hose <Except R.H. drive vehicles without ABS>
4. Vacuum hose <R.H. drive vehicles without ABS>
5. Vacuum hose connection
6. Brake booster vacuum hose connection <L.H. drive vehicles without ABS>
7. Vacuum pump oil pipe
8. Vacuum pump oil pipe gasket
9. Vacuum pump assembly

REMOVAL SERVICE POINT

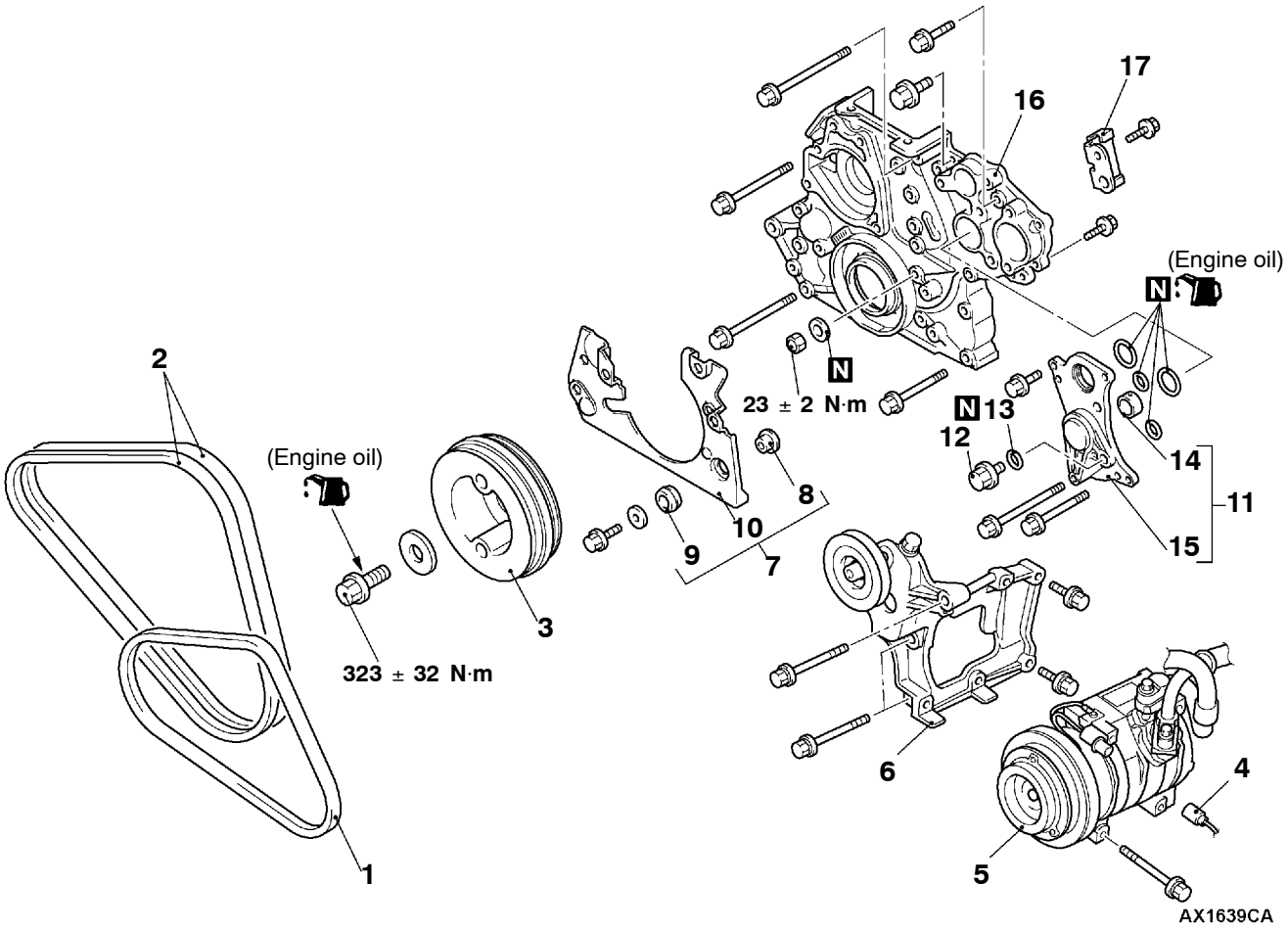
◀A▶ POWER STEERING OIL PUMP ASSEMBLY REMOVAL

1. Remove the power steering oil pump assembly from the timing gear case with its hoses still attached.
2. Support the oil pump aside with a cord.

TIMING CHAIN

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Drain and Refill (Refer to GROUP 14 - On-vehicle Service.)
- Under Cover and Skid Plate Removal and Installation
- Engine Oil Draining and Refilling (Refer to GROUP 12 - On-vehicle Service.)
- Fuel Line Air-bleeding (Refer to GROUP 13C - On-vehicle Service.) <Post-installation operation>
- Drive Belt Tension Check and Adjustment (Refer to P.11C-5.)<Post-installation operation>
- Camshaft Removal and Installation (Refer to P.11C-23.)
- Cooling Fan and Fan Clutch Assembly Removal and Installation (Refer to GROUP 14.)
- Vacuum Pump Removal and Installation (Refer to P.11C-16.)
- Oil Pan Removal and Installation(Refer to P.11C-14.)



Removal steps

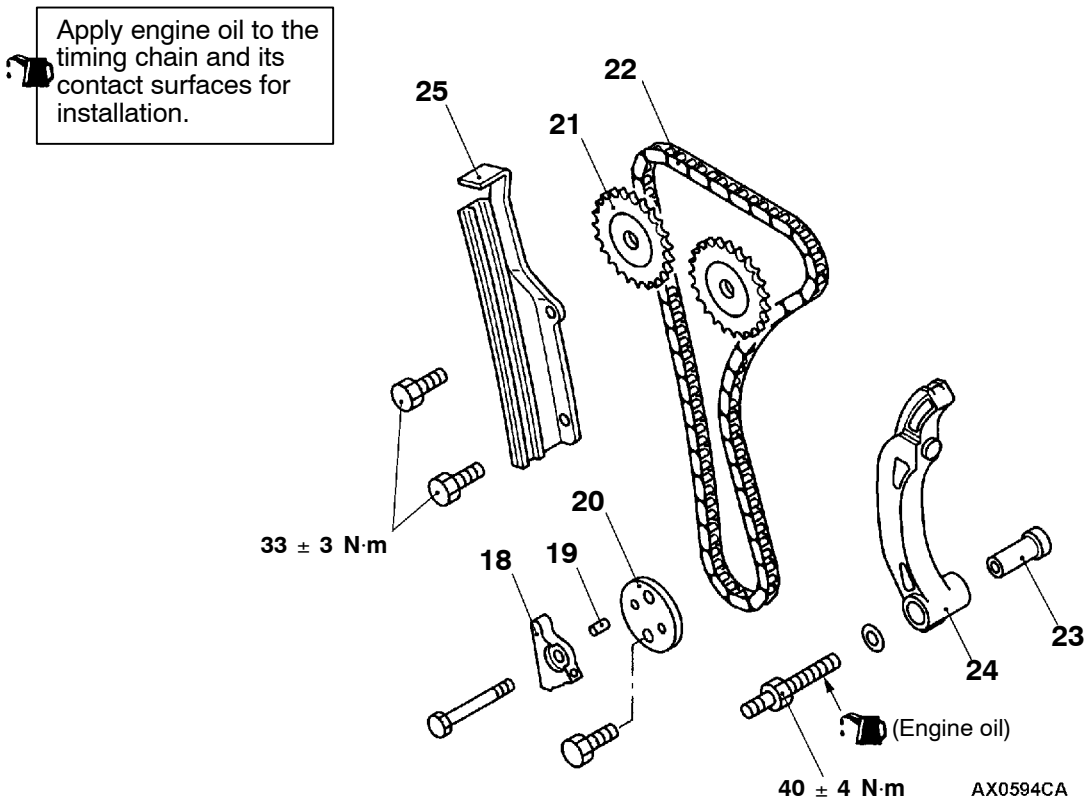
◀A▶ 1. A/C compressor drive belt <Vehicles with A/C>
◀B▶ 2. Alternator drive belt
◀C▶ 3. Crankshaft pulley
- Alternator(Refer to GROUP 16.)
- Water pump(Refer to GROUP 14.)
- Cylinder Head Assembly (Refer to P.11C-27.)

4. A/C compressor connector <Vehicles with A/C>
5. A/C compressor <Vehicles with A/C>
6. A/C compressor bracket and tension pulley assembly<Vehicles with A/C>
7. Timing gear case cover assembly
8. Insulator collar
9. Insulator
10. Timing gear case cover

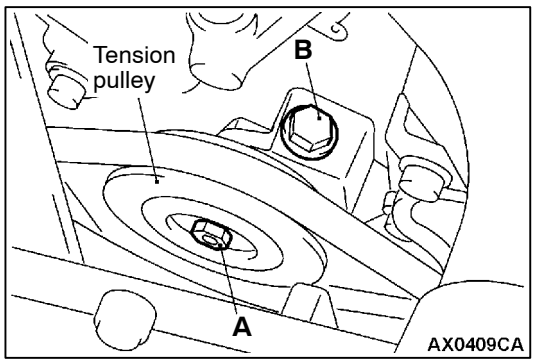
▶B◀ 11. Bearing block assembly

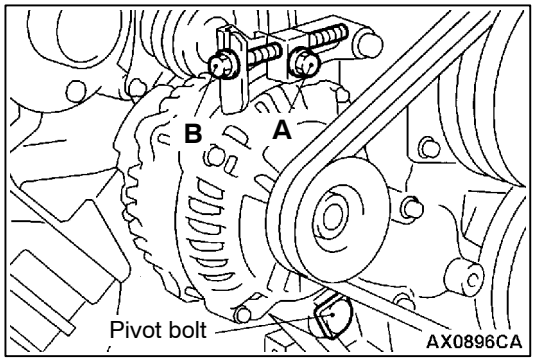
12. Drain plug
13. Drain plug gasket
14. Bearing block bushing
15. Bearing block

▶B◀ 16. Timing gear case
17. Lower guide plate



▶A◀ 18. Oil jet
▶A◀ 19. Spring pin
▶A◀ 20. Idler washer
▶A◀ 21. Camshaft sprocket
▶A◀ 22. Timing chain
23. Tension lever shaft
24. Tension lever
25. Guide plate





REMOVAL SERVICE POINTS

◀A▶ A/C COMPRESSOR DRIVE BELT REMOVAL

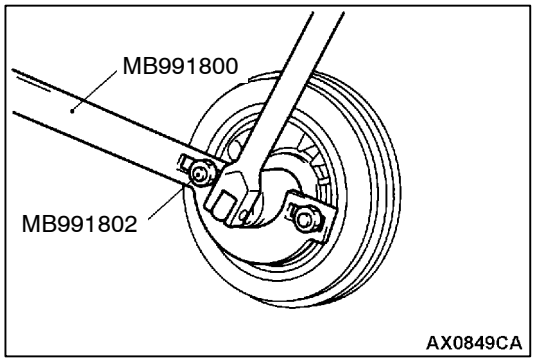
1. Loosen the tension pulley securing bolt A.
2. Loose the adjusting bolt B to remove the belt.

Caution
To reuse the drive belt, mark its running direction (clockwise direction) on the belt back side with a chalk.

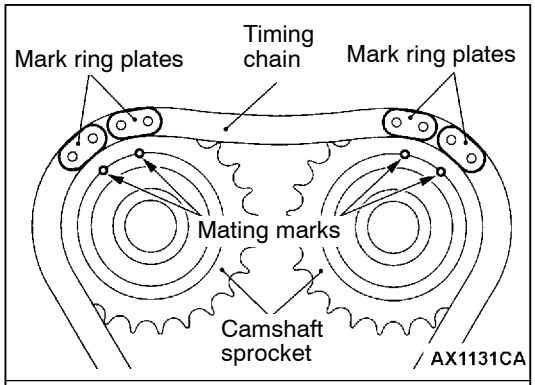
◀B▶ ALTERNATOR DRIVE BELT REMOVAL

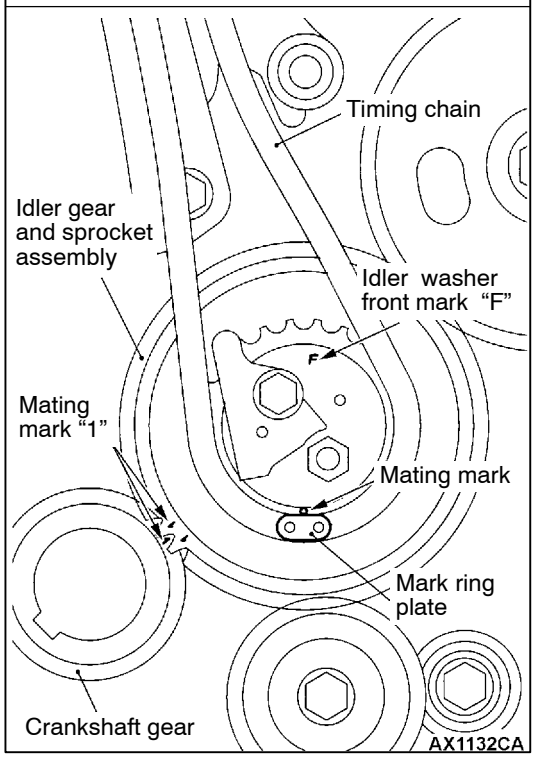
1. Loosen the alternator pivot bolt, nut and the securing bolt A.
2. Loose the adjusting bolt B to remove the belts.

Caution
(1) To reuse the drive belts,mark its running direction (clockwise direction) on the belt backside with a chalk.
(2) To replace the drive belts, always replace them as a set.



◀C▶ CRANKSHAFT PULLEY REMOVAL



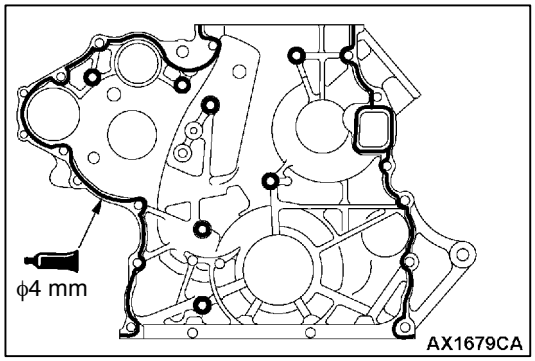


INSTALLATION SERVICE POINTS

▶A◀ TIMING CHAIN/CAMSHAFT SPROCKET/IDLER WASHER/SPRING PIN/OIL JET INSTALLATION

1. Check that the mating mark on the idler gear and sprocket assembly is aligned with mating mark "1"on the crankshaft gear.
2. Align the mating mark on the idler gear and sprocket assembly with the dark blue mark ring plate on the timing chain.

   Caution
   Note that the timing chain has one mark ring plate for the idler gear and sprocket assembly side, and two mark ring plates for each camshaft sprocket.
3. Align the mark ring plates with the camshaft sprocket mating marks.
4. Tie up the timing chain and the camshaft sprocket with a cord to prevent the mating mark misalignment.
5. Install the idler washer, the spring pin and the oil jet. The idler washer front mark "F" must face toward the the front of the engine.



▶B◀ TIMING GEAR CASE/BEARING BLOCK ASSEMBLY INSTALLATION

1. Clean the timing gear case and the front plate mating surfaces with a scraper or a wire brush.
2. Apply a continuous bead of the specified sealant to the timing gear case mating surface as shown.

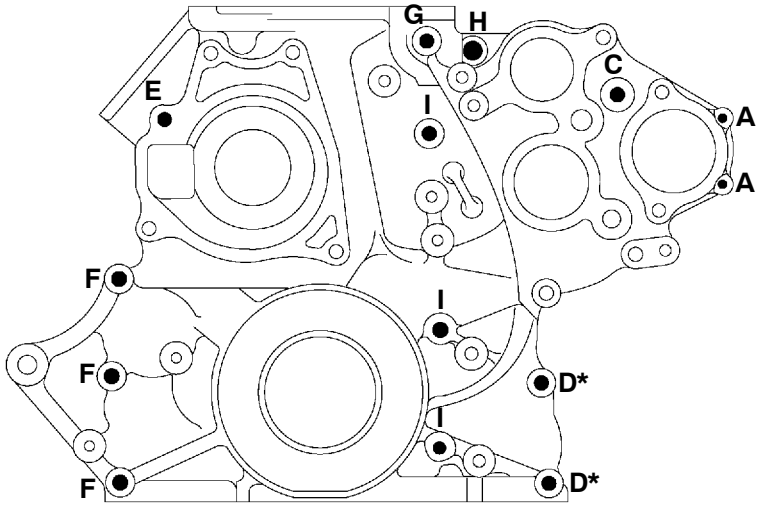
   Specified sealant:
   MITSUBISHI GENUINE PART MD970389 or equivalent

3. After applying the sealant, install the gear case within 15 minutes.

Caution
(1) When installing the timing gear case, be careful not to disturb the sealant.
(2) Whenever the timing gear case mounting bolts are loosened or tightened again after the timing gear case installation, always apply the sealant again.
(3) After the timing gear case is installed, wait for at least one hour, and then start the engine.

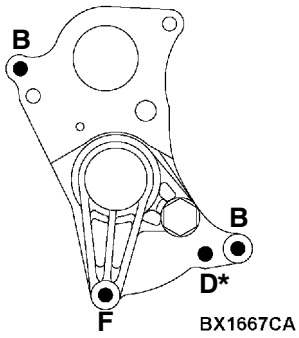
4. Install the mounting nuts and bolts to the timing gear case and the bearing block assembly at the shown positions.

Timing gear case



BX1666CA

Bearing block assembly



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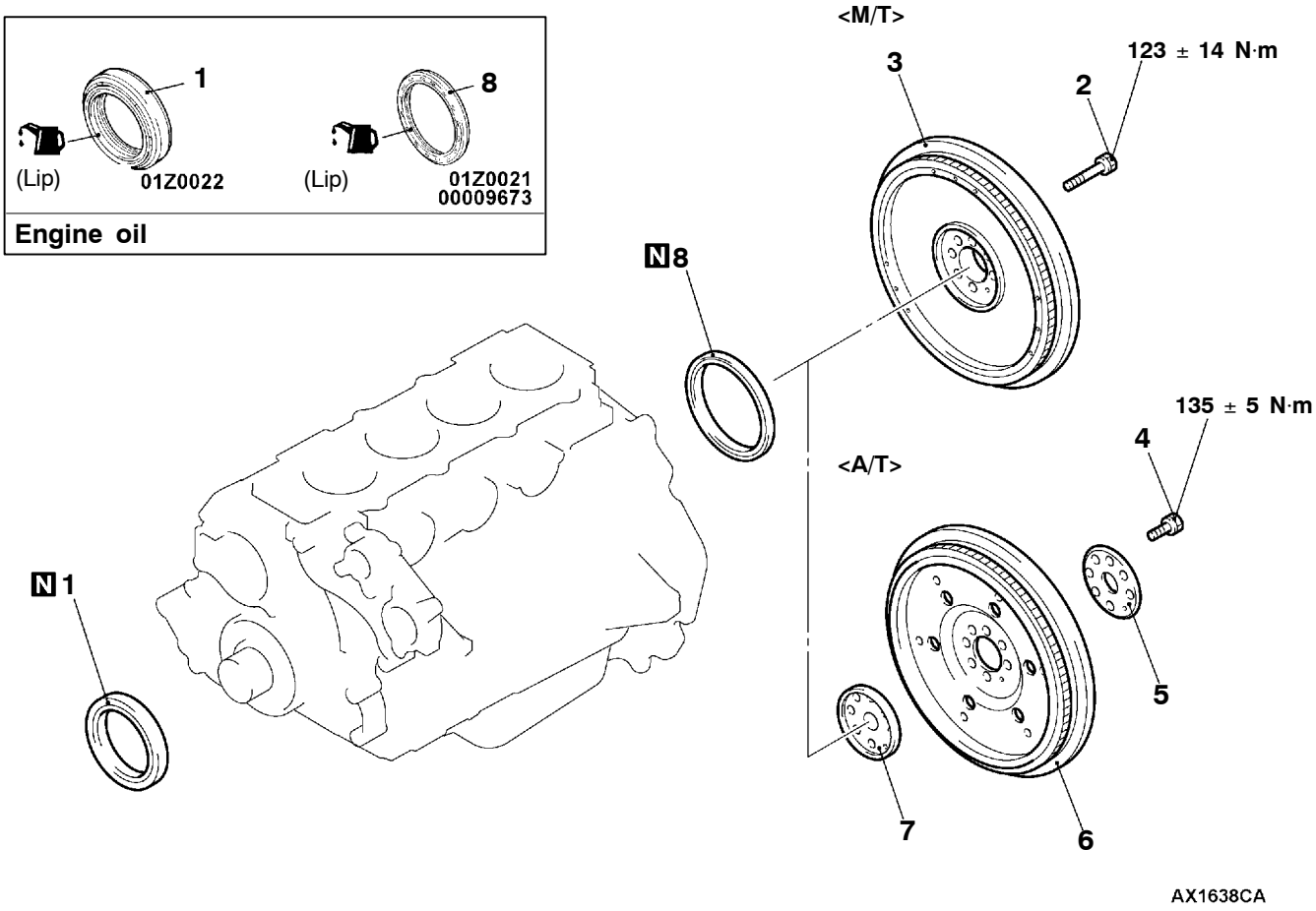
Name	Symbol	SIze mm (D × L)	Name	Symbol	SIze mm (D × L)
Flange bolt	A	6 × 20	Flange bolt	F	8 × 85
	B	8 × 30		G	8 × 90
	C	8 × 50		H	10 × 35
	D*	8 × 60	Cap nut	I	-
	E	8 × 75			

D=Nominal diameter
L=Nominal length
*: Vehicles without A/C

CRANKSHAFT OIL SEAL

REMOVAL AND INSTALLATION



Crankshaft front oil seal removal steps

- Crankshaft pulley (Refer to P.11C-17.)

1. Crankshaft front oil seal

◀A▶

Crankshaft rear oil seal removal steps

<M/T>

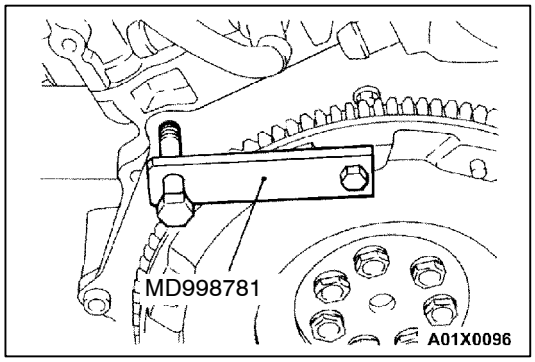
- Transmission assembly (Refer to GROUP 22.)

2. Flywheel bolt
3. Flywheel
8. Crankshaft rear oil seal

<A/T>

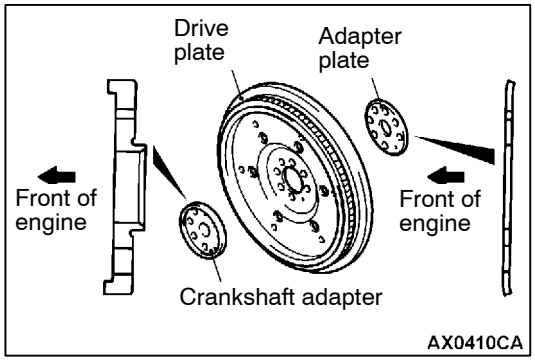
- Transmission assembly (Refer to GROUP 23.)

◀A▶ 4. Drive plate bolt
▶A◀ 5. Adapter plate
▶A◀ 6. Drive plate
▶A◀ 7. Crankshaft adapter
8. Crankshaft rear oil seal



REMOVAL SERVICE POINT

◀A▶ FLYWHEEL BOLT/DRIVE PLATE BOLT REMOVAL



INSTALLATION SERVICE POINT

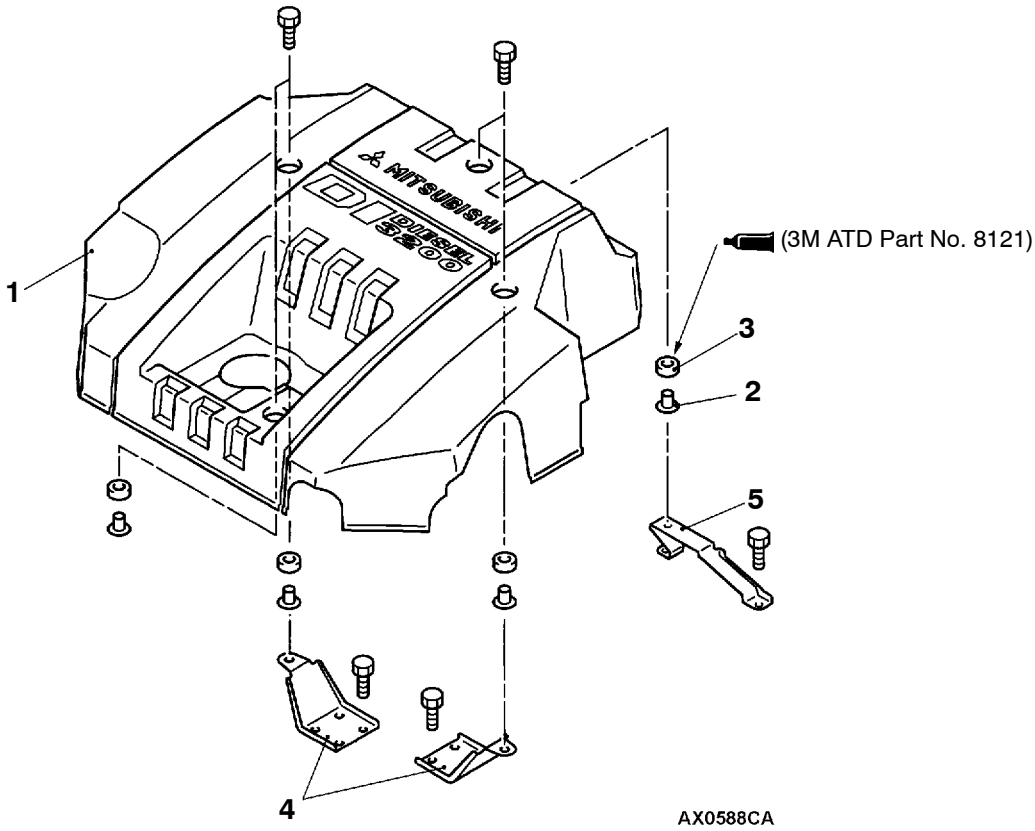
▶A◀ CRANKSHAFT ADAPTER/DRIVE PLATE/ADAPTER PLATE INSTALLATION

Assemble the crankshaft adapter and the adapter plate to the drive plate as shown, and then install the drive plate assembly into the crankshaft.

CAMSHAFT

REMOVAL AND INSTALLATION

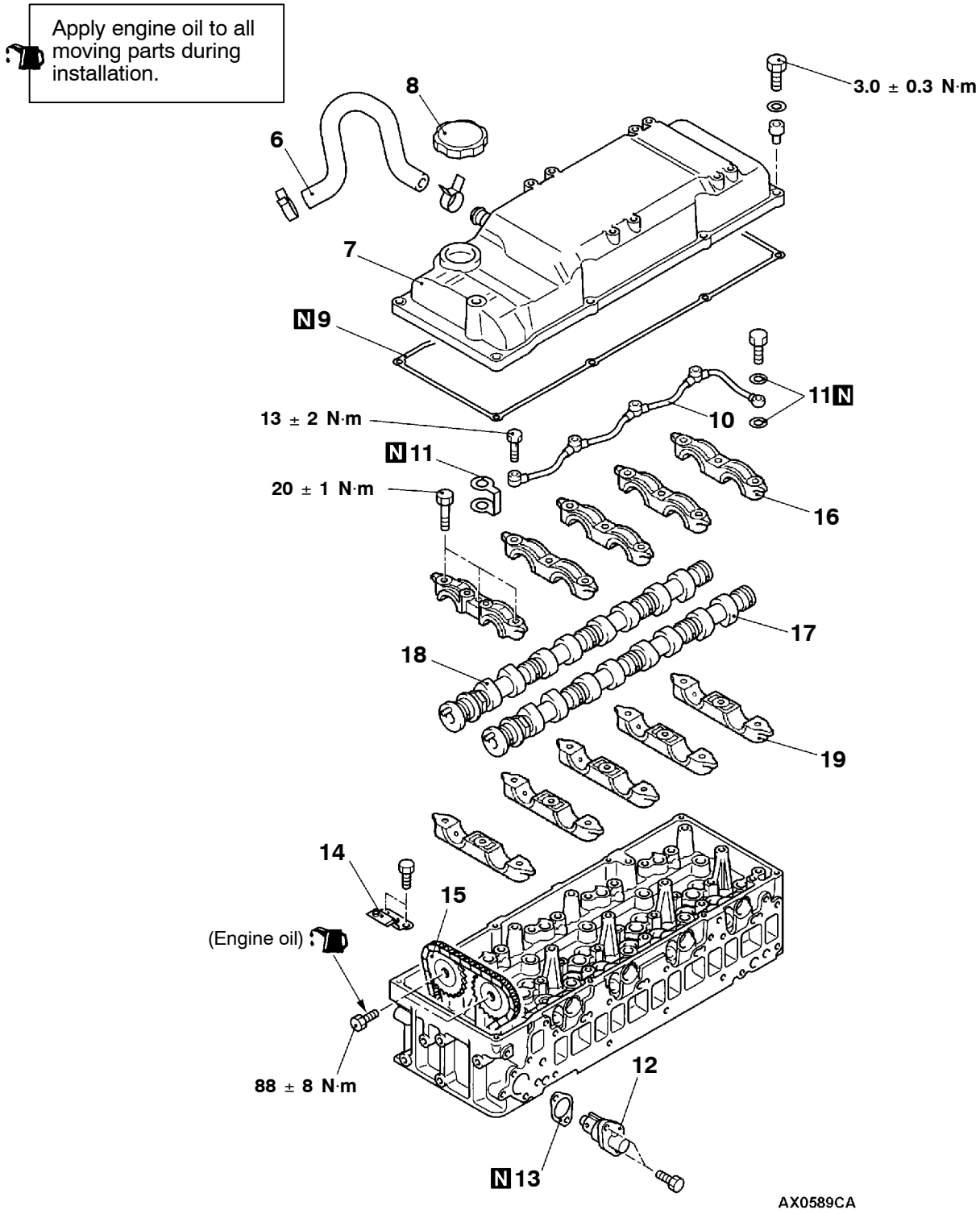
Post-installation Operation
Fuel Line Air-bleeding
(Refer to GROUP 13C - On-vehicle Service.)



Removal steps

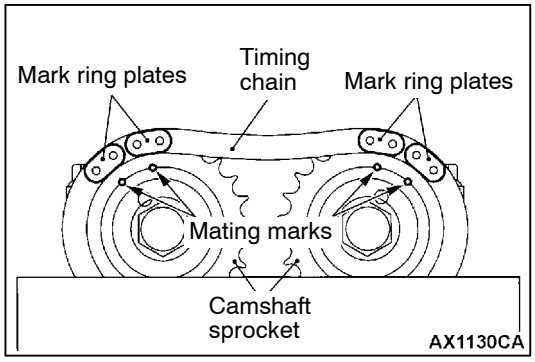
1. Engine cover assembly
2. Insulator collar
3. Insulator
4. Engine cover bracket
5. Engine cover bracket

- Air cleaner (Refer to GROUP 15.)
- EGR valve and EGR pipe assembly (Refer to GROUP 17 - EGR Valve.)



6. Breather hose
7. Rocker cover
8. Oil filler cap
9. Rocker cover gasket
10. Fuel leak-off pipe
11. Fuel leak-off pipe gasket
- Valve clearance adjustment (Refer to P.11C-8.)

▶D◀ 12. Chain tensioner
▶C◀ 13. Chain tensioner gasket
14. Upper guide plate
◀A▶ ▶B◀ 15. Camshaft sprocket
▶A◀ 16. Camshaft cap
17. Intake camshaft
18. Exhaust camshaft
▶A◀ 19. Camshaft holder

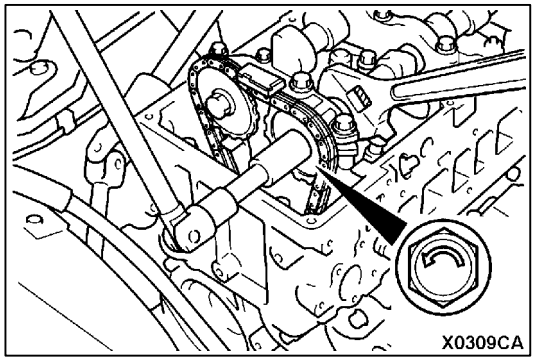


REMOVAL SERVICE POINT

◀A▶ CAMSHAFT SPROCKET REMOVAL

1. Turn the crankshaft clockwise, align the mating marks on the camshaft sprocket with the dark blue mark ring plates on the timing chain to set No.1 cylinder to TDC of its compression stroke.

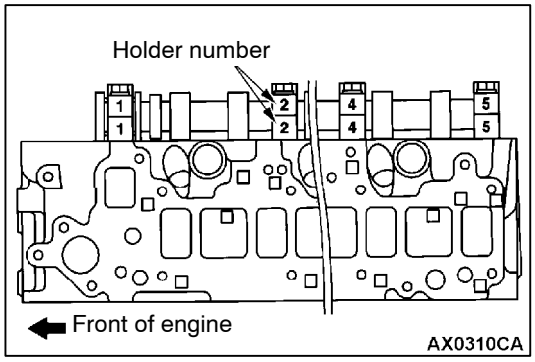
   Caution
   Never turn the crankshaft anticlockwise.



2. Hold the hexagonal part of the camshaft with an open end wrench, loosen the camshaft sprocket bolts, and then remove the camshaft sprockets with the timing chain still attached.

   Caution
   (1) Use the timing chain to prevent the camshaft from turning.
   (2) The camshaft sprocket bolt is left threaded, so the arrow indicating its tightening direction is marked on the bolt head. To loosen this bolt, turn the bolt to the opposite direction of the arrow.
   (3) The timing chain must be attached to the camshaft sprockets.

3. Tie up the timing chain and the camshaft sprocket with a cord to prevent the mating mark misalignment.



INSTALLATION SERVICE POINTS

▶A◀ CAMSHAFT HOLDER/CAMSHAFT CAP INSTALLATION

The holder numbers are stamped on the camshaft holders and the camshaft caps, so install them in that order and tighten to the specified torque.

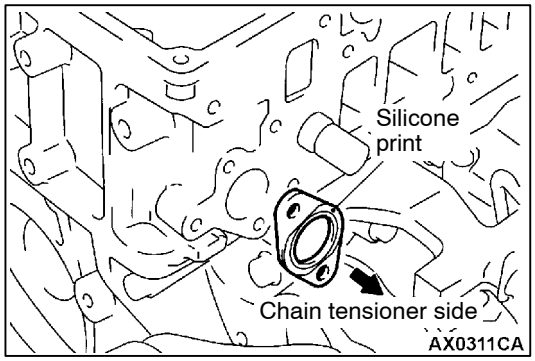
Tightening torque: 20 ± 1 N·m

▶B◀ CAMSHAFT SPROCKET INSTALLATION

1. Install the camshaft sprockets to the camshafts with the timing chain still attached.
2. Hold the hexagonal part of the camshaft with an open end wrench in the same manner as removal.
3. Apply a small amount of engine oil to the camshaft sprocket bolt thread and the flange, and then tighten to the specified torque.

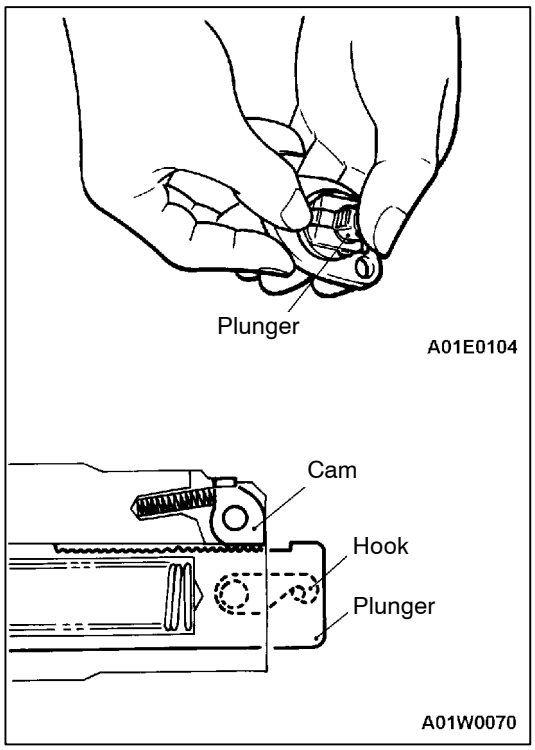
   Tightening torque: 88 ± 8 N·m

   Caution
   (1) Use the timing chain to prevent the camshaft from turning.
   (2) The camshaft sprocket bolt is left threaded, so the arrow indicating its tightening direction is marked on the bolt head.



▶C◀ CHAIN TENSIONER GASKET INSTALLATION

Place the chain tensioner gasket with its silicone print facing toward the chain tensioner side.



▶D◀ CHAIN TENSIONER INSTALLATION

1. Bend up the tab as shown to push in the plunger, and lock it with the hook.
2. Install the chain tensioner to the cylinder head.

   Caution
   To install the chain tensioner, always push in the plunger. If you fail to do this, the timing chain will be excessively tensioned, causing damage.

3. Turn the crankshaft clockwise.

   Caution
   If the crankshaft is turned anticlockwise after the chain tensioner is installed, the plunger will be excessively tensioned, causing the plunger to go beyond the cam inside the chain tensioner.

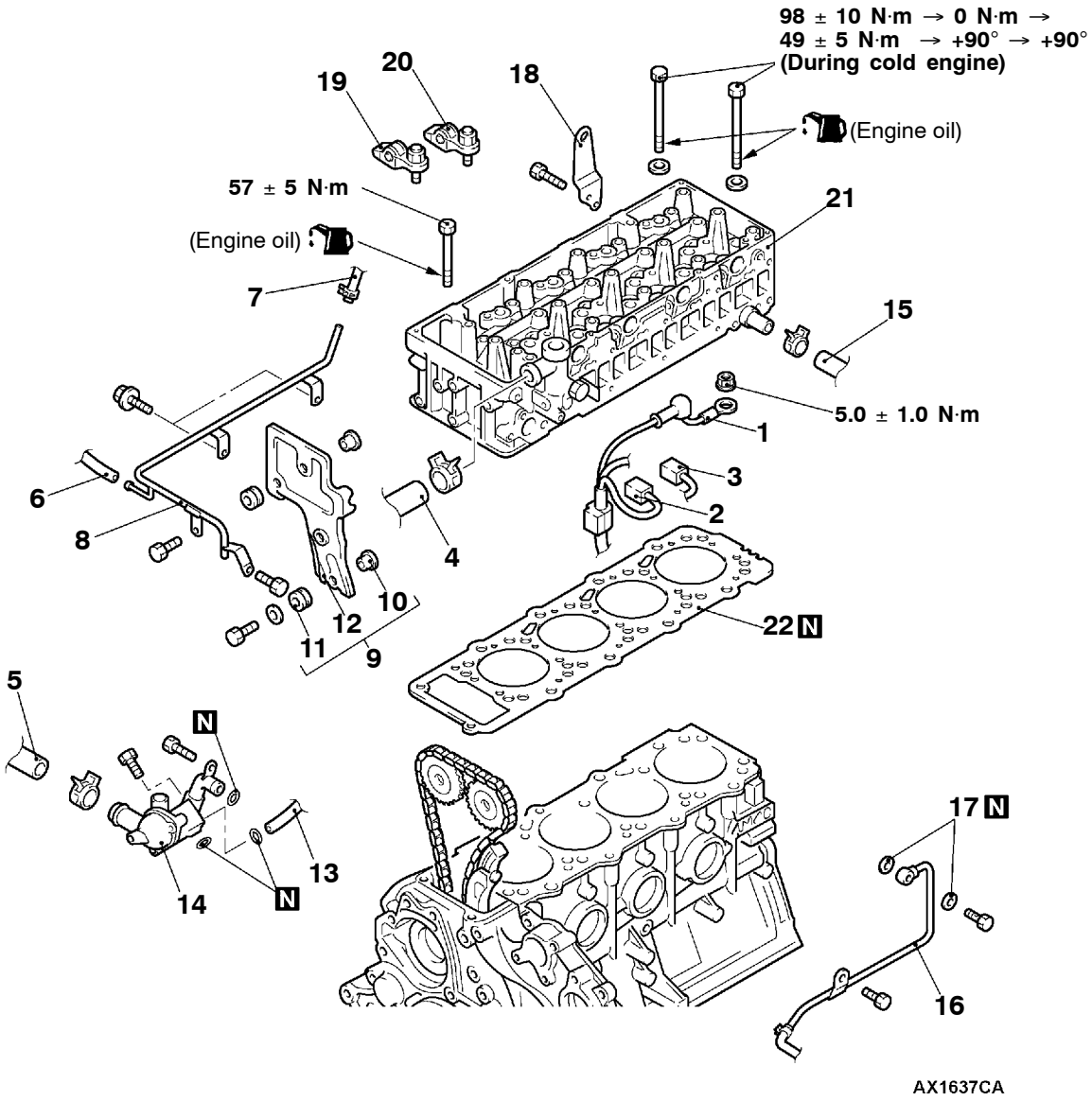
   NOTE
   If the crankshaft is turned clockwise after the chain tensioner is installed, the plunger is automatically unhooked. Then its internal ratchet mechanism adjusts the timing chain tension.

CYLINDER HEAD GASKET

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Engine Coolant Drain and Refill (Refer to GROUP 14 - On-vehicle Service.)
- Engine Oil Check and Refill (Refer to GROUP 12 - On-vehicle Service.) <Post-installation operation>
- Fuel Line Air-bleeding (Refer to GROUP 13C - On-vehicle Service.) <Post-installation operation>
- Drive Belt Tension Check and Adjustment (Refer to P.11C-5.)<Post-installation operation>
- Camshaft Removal and Installation (Refer to P.11C-20.)
- Cooling Fan and Fan Clutch Assembly Removal and Installation (Refer to GROUP 14.)
- Intake Manifold Removal and Installation (Refer to GROUP15.)
- Turbocharger Removal and Installation (Refer to GROUP15.)
- Exhaust Manifold Removal and Installation (Refer to GROUP15.)



Removal steps

1. Glow plug connector
2. Engine coolant temperature gauge unit connector
3. Engine coolant temperature sensor connector
- Drive belt (Refer to P.11C-17.)

◀A▶ ▶D◀ 4. Radiator upper hose connection
◀A▶ ▶D◀ 5. Radiator lower hose connection

6. Free-wheeling hub solenoid valve vacuum hose connection
7. Brake booster vacuum hose connection
<R.H. drive vehicles without ABS>
8. Vacuum pipe
9. Timing gear case cover assembly
10. Insulator collar
11. Insulator
12. Timing gear case cover
- Alternator brace
(Refer to GROUP 16.)

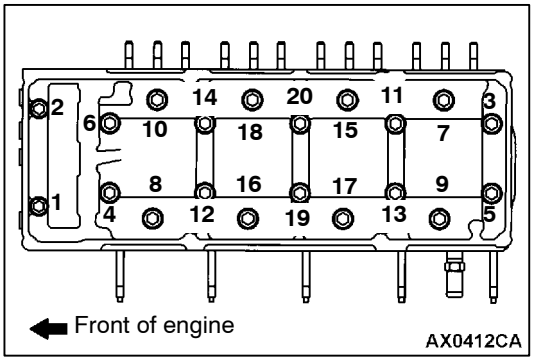
▶C◀ 13. Heater return pipe connection
▶C◀ 14. Bypass pipe, thermostat case and cover assembly
15. Heater hose connection
16. Fuel return pipe connection
17. Fuel return pipe gasket
18. Engine hanger
19. Short rocker, adjusting screw and lock nut assembly
20. Long rocker, adjusting screw and lock nut assembly

◀B▶ ▶B◀ 21. Cylinder head assembly
▶A◀ 22. Cylinder head gasket

REMOVAL SERVICE POINTS

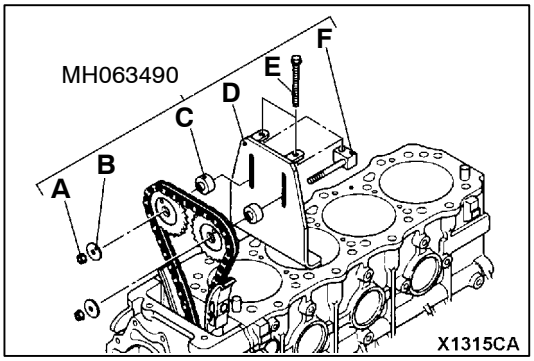
◀A▶ RADIATOR UPPER HOSE /RADIATOR LOWER HOSE DISCONNECTION

Align the mating marks on the radiator hose and the hose clamp, and then disconnect the hose.



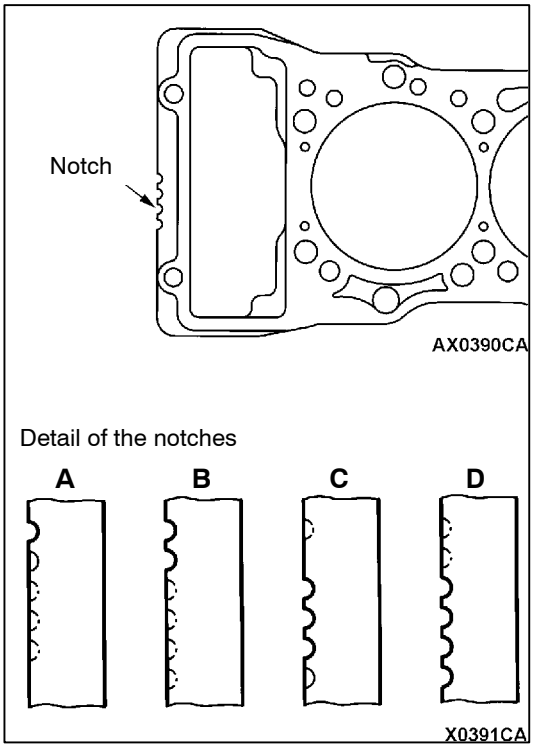
◀B▶ CYLINDER HEAD ASSEMBLY REMOVAL

1. Loosen the cylinder head bolts in the shown sequence progressively, and then remove the cylinder head bolts.
2. Lift the cylinder head assembly straight without removing the timing chain from the camshaft sprocket.



3. After the cylinder head assembly has been removed, use the special tool to hold the camshaft sprocket to prevent the timing chain from sliding off.

   Special tool MH063490: Camshaft sprocket holder kit components
   - A: Two nuts
   - B: Two washers
   - C: Two spacers
   - D: One adjust plate
   - E: Two bolts
   - F: Two nuts



INSTALLATION SERVICE POINTS

▶A◀ CYLINDER HEAD GASKET INSTALLATION

To replace the cylinder head gasket only, select a gasket of correct specification according to the table below.

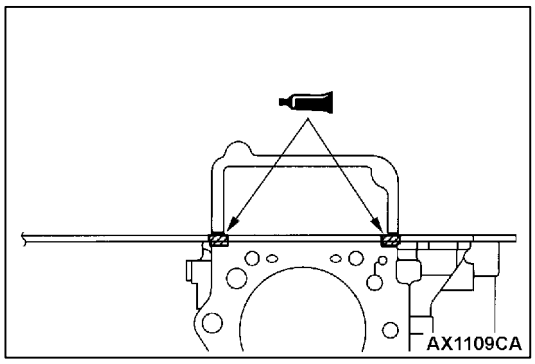
Notch specification	Part number
A(Thickness after tightening the bolts 0.70 mm)	ME204037
B(Thickness after tightening the bolts 0.75 mm)	ME204038
C(Thickness after tightening the bolts 0.80 mm)	ME204039
D(Thickness after tightening the bolts 0.85 mm)	ME204040

Caution
The thickness of the original cylinder head gasket is selected according to the protrusion amount of the piston. Therefore, if the piston or the connecting rod is replaced, the protrusion amount may be changed. Always select a correct gasket by measuring the protrusion amount. (For details, refer to the Engine Workshop Manual.)

▶B◀ CYLINDER HEAD ASSEMBLY INSTALLATION

1. Select a cylinder head gasket of correct specification.
2. Clean the cylinder head assembly, the timing gear case, and the crankcase assembly mating surfaces with a scraper or a wire brush.

Caution
Do not allow foreign material to enter the engine coolant or oil passages and the cylinder.



3. Apply the specified sealant to the upper side of the mating surface between the timing gear case and the crankcase assembly.

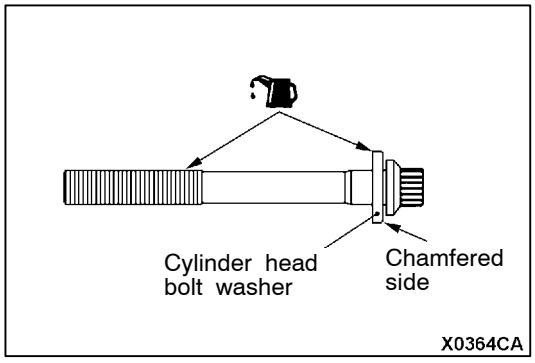
Specified sealant: 3M ATD Part No.8660 or equivalent

4. Immediately after applying the sealant, use the cylinder head gasket to install the cylinder head assembly to the crankcase.

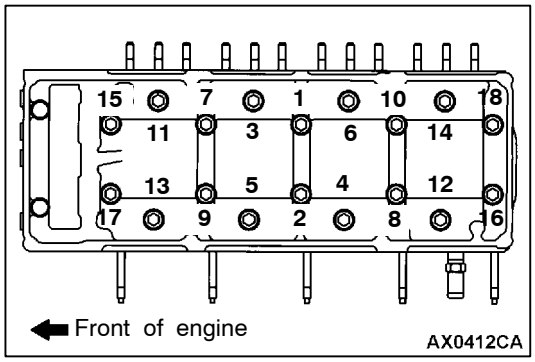
Caution
(1) When installing the cylinder head, be careful not to disturb the sealant.
(2) Whenever the cylinder head bolts are loosened after the cylinder head is installed, always apply the sealant again.
(3) After the cylinder head is installed, wait for at least one hour, and then start the engine.

5. The cylinder head bolt can be reused three times. Before installing the bolt, mark the bolt head by a punch to indicate how many times the bolt is used.

Caution
If three marks have been already stamped, the bolt can't be reused and must be replaced with a new one.

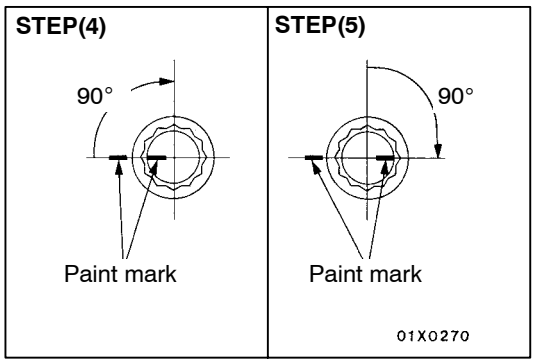


6. Install the cylinder head bolt washer to the cylinder head bolt so that the washer chamfered side faces as shown.
7. Apply a small amount of engine oil to the cylinder head bolt thread and the washer.



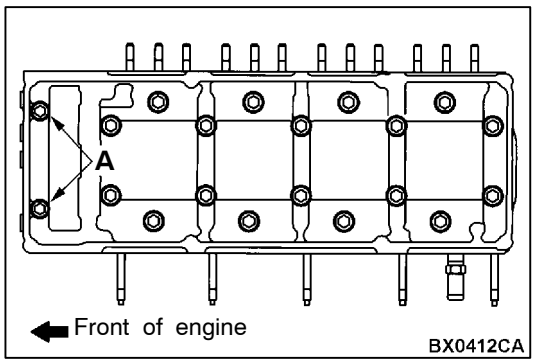
8. Tighten the cylinder head bolts according to the following procedure (angle-tightening procedure).
   (1) Tighten the cylinder head bolts in the shown sequence to 98 ± 10 N·m.

   Bolt size: Nominal diameter×length mm
   Except 3, 6, 11, 14: 12×118
   3, 6, 11, 14: 12×133
   (2) Loosen the cylinder head bolts completely in the reverse of the shown sequence.
   (3) Tighten the cylinder head bolts in the shown order to 49 ± 5N·m.



   (4) Mark the cylinder head bolts and the cylinder head with paint, and then tighten the bolts in the shown sequence to 90°.
   (5) Tighten the bolts in the shown sequence to additional 90°, and check that the paint marks on the cylinder head bolts are flush with the paint marks on the cylinder head.

   Caution
   1) If the tightening angle is less than 90°, the bolt is loose.
   2) If the tightening angle is more than 90°, loosen the bolt and repeat the procedure from step 2.



   (6) Apply a small amount of engine oil to the thread and the flange of bolts A , and tighten them to A to 57 ± 5 N·m.

▶C◀ BYPASS PIPE, THERMOSTAT CASE AND COVER ASSEMBLY/HEATER RETURN PIPE INSTALLATION

Install the O-rings into the pipes and the thermostat case grooves, apply water to the outer circumference of the O-ring and the inside surface of the pipe, and then press in the O-rings.

Caution
Never get engine oil or grease on the O-rings.

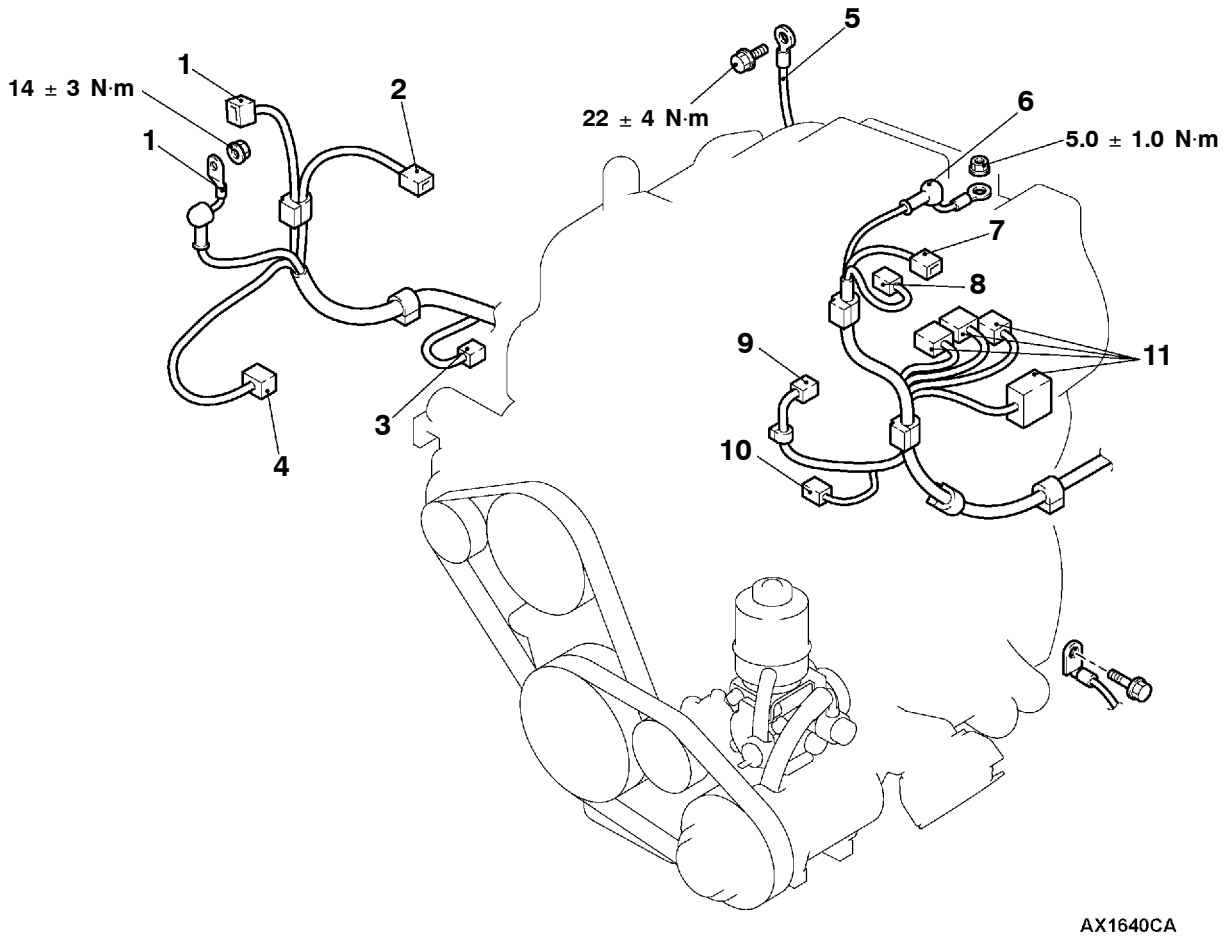
▶D◀ RADIATOR LOWER HOSE/RADIATOR UPPER HOSE CONNECTION

1. Insert the hose up to the convex part of the thermostat cover and water outlet pipe.
2. Align the mating marks on the radiator hose and the hose clamp, and then install the hose.

ENGINE ASSEMBLY

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Drain and Refill (Refer to GROUP 14 - On-vehicle Service.)
- Under Cover and Skid Plate Removal and Installation
- Engine Oil Draining and Refilling (Refer to GROUP 12 - On-vehicle Service.)
- Fuel Line Air-bleeding (Refer to GROUP 13C - On-vehicle Service.) <Post-installation operation>
- A/C Compressor Drive Belt Tension Check and Adjustment<Vehicles with A/C> (Refer to P.11C-7.)<Post-installation operation>
- Hood Removal and Installation(Refer to GROUP 42.)
- Engine Cover Removal and Installation (Refer to P.11C-23.)
- Fuel Filter Removal and Installation (Refer to GROUP 13D.)
- Air Cleaner Removal and Installation (Refer to GROUP 15.)
- Cooling Fan and Fan Clutch Assembly Removal and Installation (Refer to GROUP 14.)
- Radiator Removal and Installation (Refer to GROUP 14.)

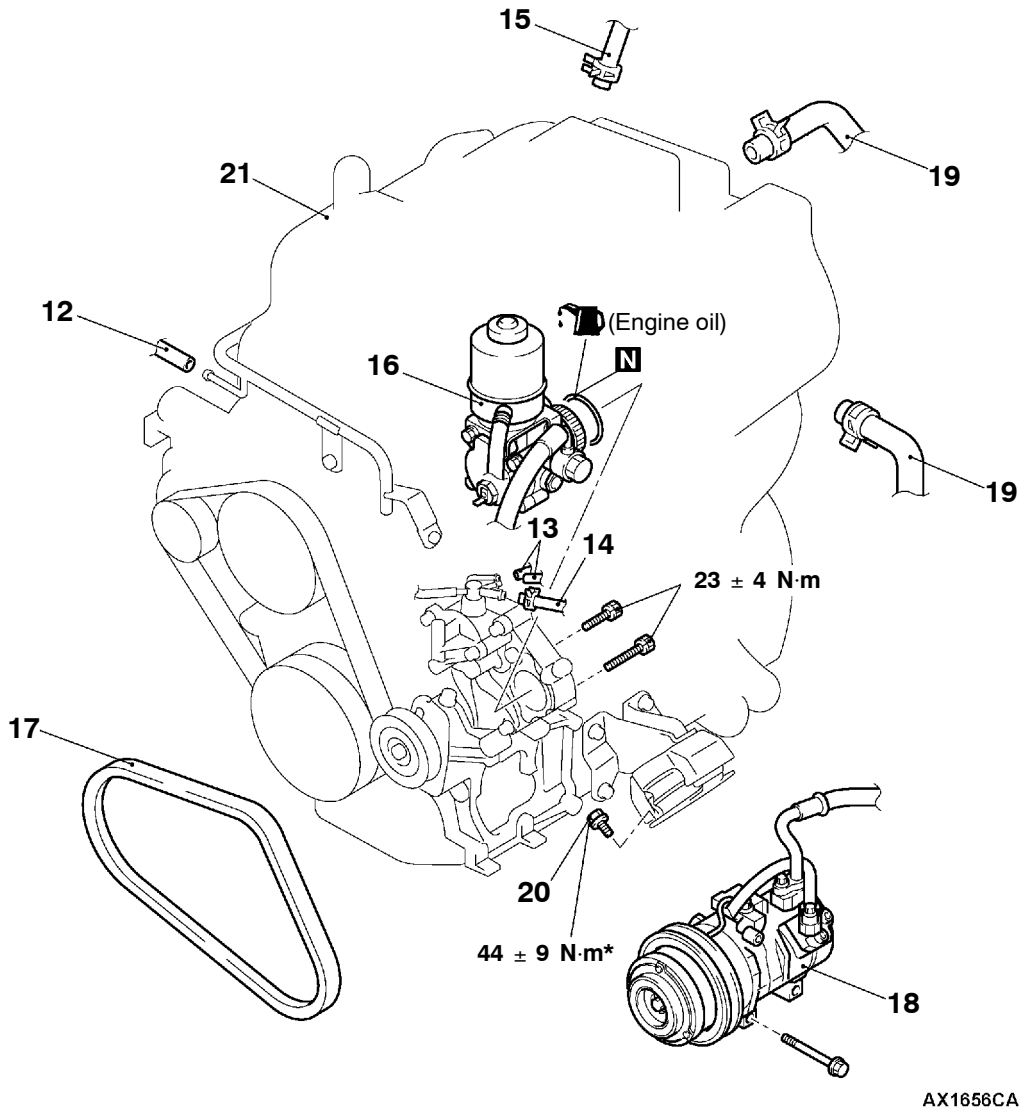


Removal steps
- Intercooler air pipe (Refer to GROUP 15 - Intercooler.)

1. Alternator connector
2. Oil pressure switch connector
3. Engine oil level sensor connector
4. Free-wheeling hub engage switch connector
5. Earth cable connection
- EGR valve and EGR pipe assembly (Refer to GROUP 17 - EGR Valve.)

6. Glow plug connector
7. Boost air temperature sensor connector
8. Engine coolant temperature gauge unit connector
9. Power steering oil pressure switch connector
10. A/C compressor connector <Vehicles with A/C>
11. Injection pump connector

Caution
***: indicates parts which should be temporarily tightened, and then fully tightened with the engine weight applied on the vehicle body.**



12. Free-wheeling hub solenoid valve vacuum hose connection
13. Vacuum hose connection
14. Brake booster vacuum hose connection
    <L.H. drive vehicles without ABS>
15. Brake booster vacuum hose connection
    <R.H. drive vehicles without ABS>

◀A▶ ◀B▶ 16. Power steering oil pump assembly
17. A/C compressor drive belt
    <Vehicles with A/C>

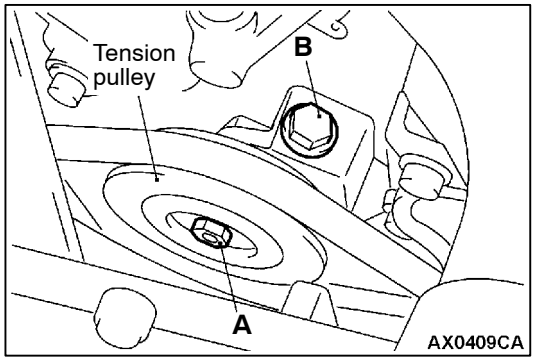
◀C▶ 18. A/C compressor
    <Vehicles with A/C>
19. Heater hose connection
    - Glow plug relay and solenoid valve assembly
    - Transmission assembly
      (M/T: Refer to GROUP 22.)
      (A/T: Refer to GROUP 23.)
20. Engine mount insulator mounting bolt

◀D▶ ▶A◀ 21. Engine assembly

REMOVAL SERVICE POINTS

◀A▶ POWER STEERING OIL PUMP ASSEMBLY REMOVAL

1. Remove the power steering oil pump assembly from the timing gear case with its hoses still attached.
2. Suspend the power steering oil pump with a cord out of the way.



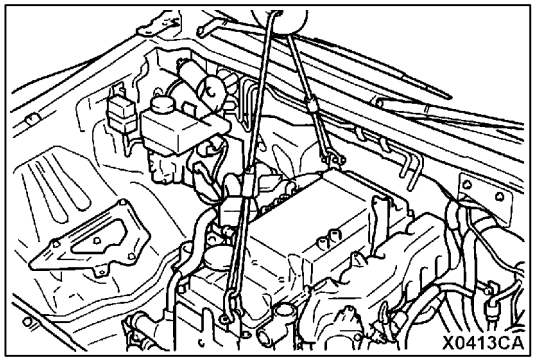
◀B▶ A/C COMPRESSOR DRIVE BELT REMOVAL

1. Loosen the tension pulley securing bolt A.
2. Loose the adjusting bolt B to remove the belt.

Caution
To reuse the drive belt, mark its running direction (clockwise direction) on the belt back side with a chalk.

◀C▶A/C COMPRESSOR REMOVAL

1. Remove the A/C compressor from the bracket with its refrigerant hoses still attached.
2. Suspend the A/C compressor with a cord out of the way.



◀D▶ENGINE ASSEMBLY REMOVAL

1. Make sure that all the cables, hoses and harness connectors are disconnected.
2. Use a chain block to support and lift the engine assembly carefully.

INSTALLATION SERVICE POINT

▶A◀ ENGINE ASSEMBLY INSTALLATION

Lower the engine assembly into the engine compartment, being careful not to pinch the cables, hoses or harness connectors.

NOTES

Service Bulletins

Click on the applicable bookmark to select the Service Bulletin.

SERVICE BULLETIN

MITSUBISHI MOTORS

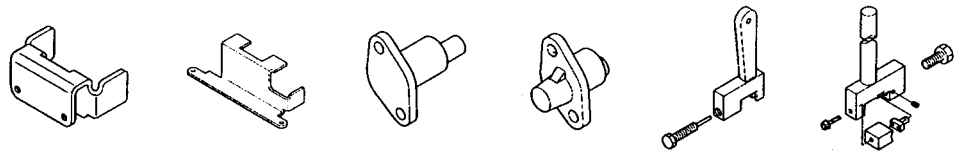
TECHNICAL SERVICE PLANNING
INTERNATIONAL CAR ADMINISTRATION OFFICE. MITSUBISHI MOTORS CORPORATION

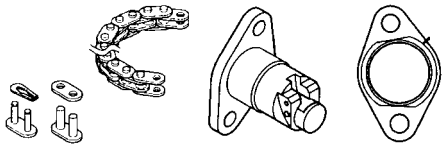
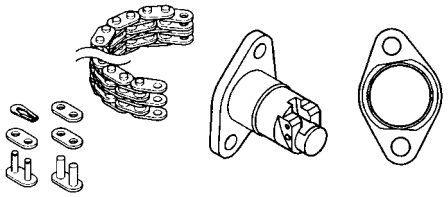
SERVICE BULLETIN	NO. : MSB-00E11-002	
	DATE : 2000-10-20	<MODEL> (EC)PAJERO/ MONTERO(V10 to V40, V60, V70) <M/Y> 95-10
SUBJECT : TIMING CHAIN REPLACEMENT PROCEDURE FOR 4M40, 41 ENGINES		
GROUP : ENGINE	DRAFTNO. : 00SY070311	
INFORMATION	INTERNATIONAL CAR ADMINISTRATION OFFICE	T. MASAKI - MANAGER TECHNICAL SERVICE PLANNING

1. Description:

This Service Bulletin informs you of the timing chain replacement procedures for 4M40 and 4M41 engines, the relevant special tools and the timing chain replacement kits available.

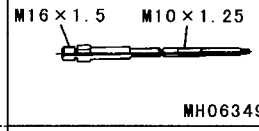
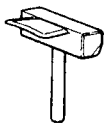
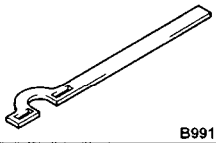
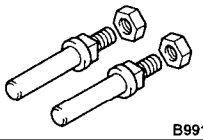
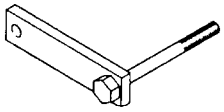
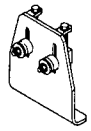
MH063566: Timing chain tool set



ME190551: Timing chain kit (for 4M40 single chain) ME190552: Timing chain kit (for 4M41)	ME190549: Timing chain kit (for 4M40 double chain)
	

2. Applicable Manuals:

Manual	Pub. No.
PAJERO Workshop Manual Chassis	PWJE9086-F (English)
MONTERO Workshop Manual Chassis	PWJS9087-F (Spanish)
PAJERO Workshop Manual Chassis	PWJF9088-F (French)
	PWJG9089-F (German)
	PWJD9090-F (Dutch)
	PWJW9091-F (Swedish)
2001 PAJERO Workshop Manual Chassis Volume 1	PWJE0001 (1/2) (English)
2001 MONTERO Workshop Manual Chassis Volume 1	PWJS0002 (1/2) (Spanish)

Tool	Number	Name	Use
	MH063494	Compression gauge adapter	Compression pressure check
	MD998727	Oil pan remover	Oil pan removal
	MB991800	Pulley holder	Crankshaft pulley holding
	MB991802	Pin B	
	MD998781	Flywheel stopper	Flywheel<M/T> or drive plate<A/T> holding
	MH063490	Cam sprocket holder kit	Camshaft sprocket holding

The following two pages to be added here.

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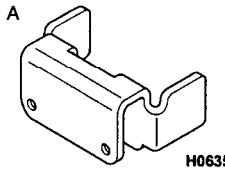
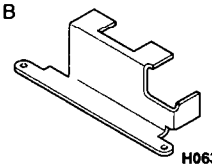
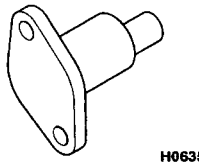
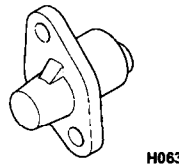
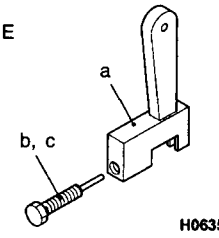
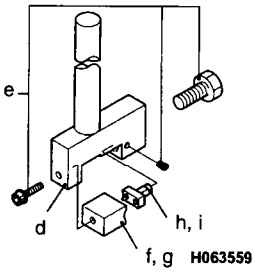
Tool	Number	Name	Use
A  H063502	MH063566 A: MH063502	Timing chain tool set A: Fixture tool (for 4M40)	Replacement of timing chain (Since the 4M41 engine has a single timing chain, use only special tools for single chain.)
B  H063552	B: MH063552	B: Fixture tool (for 4M41)	
C  H063553	C: MH063553	C: Dummy tensioner (for 4M40)	
D  H063554	D: MH063554	D: Dummy tensioner (for 4M41)	
E  H063555	E: MH063555 a: MH063556 b: MH063558 c: MH063557	E: Chain disassembly tool a: Body b: Slider (for single chain) c: Slider (for double chain)	
F  H063559	F: MH063559 d: MH063560 e: MH063563 f: MH063564 g: MH063561 h: MH063565 i: MH063562	F: Riveting tool d: Holder e: Set bolt f: Die (for single chain) g: Die (for double chain) h: Punch (for single chain) i: Punch (for double chain)	

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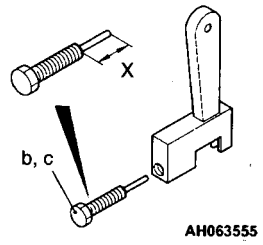
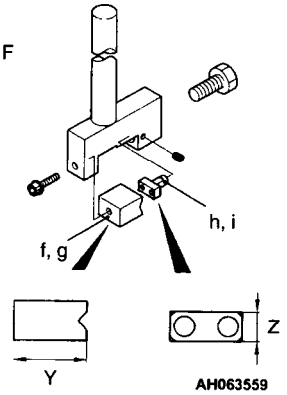
Caution
Use individual special tools in the timing chain tool set (MH063566) appropriately according to the engine model and the type of timing chain.

E



F



E: Chain disassembly tool (MH063555)

Symbol	Size X mm	Tool No.	Tool Name
b	13.5	MH063558	Slider (for single chain)
c	22.5	MH063557	Slider (for double chain)

F: Riveting tool (MH063559)

Symbol	Size Y mm	Size Z mm	Tool No.	Tool Name
f	18.0	–	MH063564	Die (for single chain)
g	10.0	–	MH063561	Die (for double chain)
h	–	9.6	MH063565	Punch (for single chain)
i	–	9.0	MH063562	Punch (for double chain)

8. If there is a cylinder which compression or compression difference is outside the limit, pour a small amount of engine oil through the glow plug hole, and repeat the operations in steps 6 – 7.
   (1) If the compression increases after the 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 the oil is added, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket.
9. Connect the fuel cut solenoid valve connector.
10. Install the glow plugs.

To be followed by the subsequent pages.

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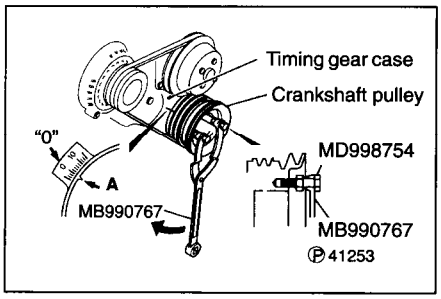
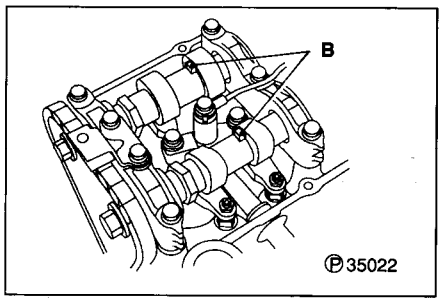


TIMING CHAIN REPLACEMENT

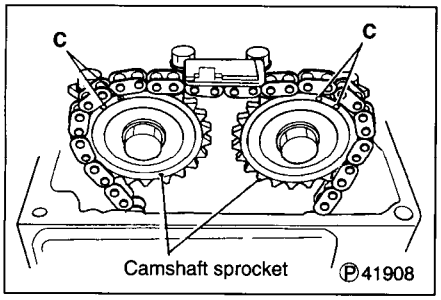
If there is an abnormal noise caused by the interference of piston with valve when the engine is running, replace the timing chain by the following procedure.

1. Remove the fan coupling, front engine hanger, rocker cover, etc.
2. To check for timing mark positions, bring No. 1 piston to the top dead center of its compression stroke by turning the crankshaft pulley clockwise with the special tool until its notch A is aligned with the timing mark "0" on the timing gear case.

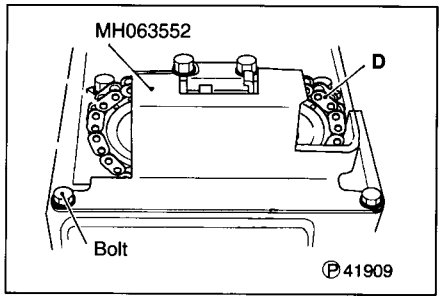
   NOTE
   No. 1 piston is at the top dead center if the projections B on the camshafts are on the upside.



3. With No. 1 piston at the top dead center, make sure that each camshaft sprocket has its timing marks C in the illustrated position.

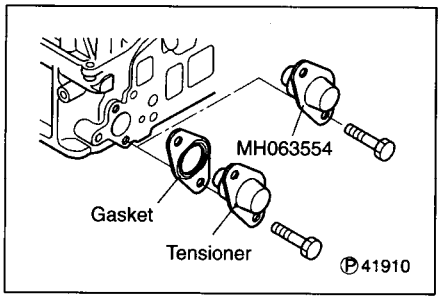


4. Secure the special tool to the cylinder head with bolts (M6 × 12mm).
5. Cranking by hand, move the timing chain until its blue mark plate D (1-piece mark) reaches the illustrated point and hold it in that position.



6. Remove the tensioner and gasket from the cylinder head.
7. Attach the special tool to the cylinder head.

   Caution
   Stuff open spaces around the timing chain with shop rags to prevent parts from dropping in the timing gear case.



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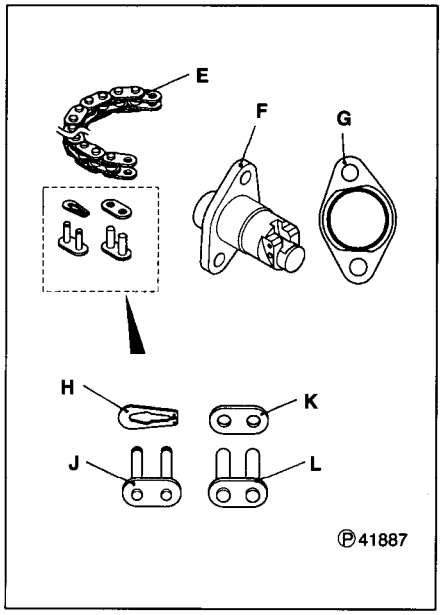
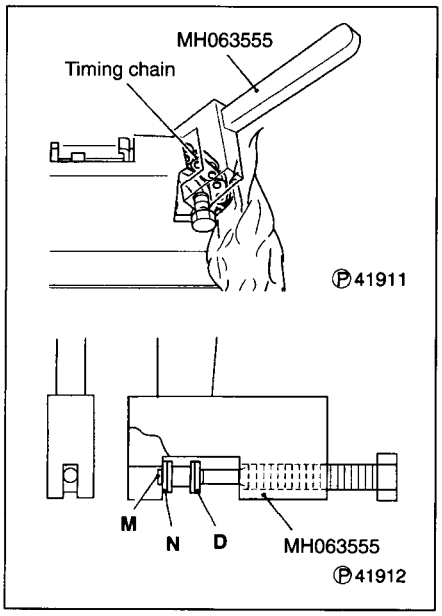
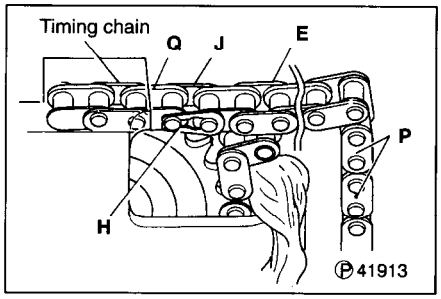


Component parts of timing chain kit (MH190552)
E: Timing chain
F: Tensioner
G: Gasket
H: Clip
J: Temporary link
K: Blue mark plate
L: Permanent link



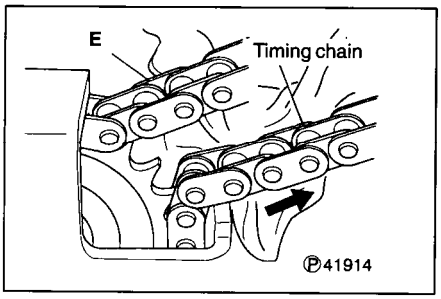
8. Extract the pins M from the blue mark plate D (1-piece mark) of the new timing chain with the special tool, then remove the blue mark plate and the plate N.

Caution
(1) If the pins M are difficult to remove, thrust them out using the temporary link J of the timing chain kit from the front of the engine.
(2) Do not mix up the blue mark plate D, pins M and plate N removed with the parts in the timing chain kit.

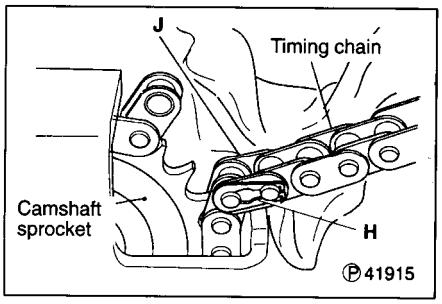


9. Hold the new timing chain E with its blue mark plates P (2-piece mark) facing toward the front and connect it to the separated timing chain end Q using the temporary link J and clip H.
10. Remove all shop rags from around the timing chain.

<Added>

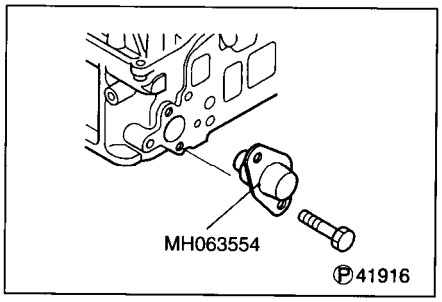


11. Slowly turn the engine clockwise by hand to feed the existing timing chain forward so that it is replaced with the new timing chain E.

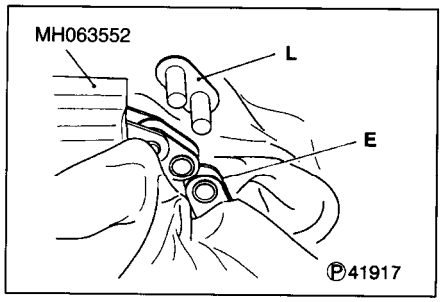


12. Stop feeding the timing chains when the temporary link J reaches the illustrated point of the camshaft sprocket, and hold it in that position.
13. Stuff open spaces around the timing chain with shop rags again. Remove the temporary link J to separate the superseded timing chain.

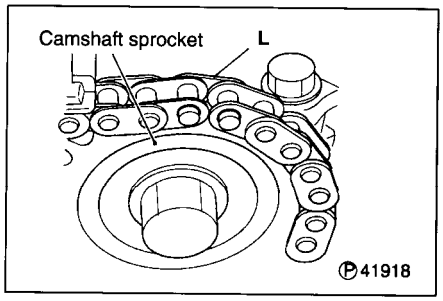
Caution
Do not mix up the removed temporary link J and clip H with the other parts in the timing chain kit.



14. Remove the special tool from the cylinder head.

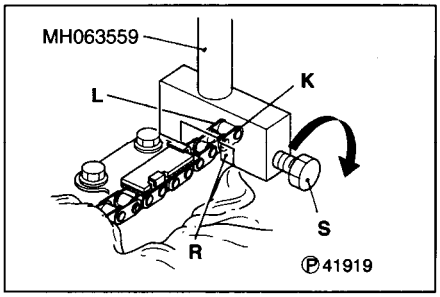


15. Connect both ends of the new timing chain E by fitting the permanent link L from the rear side.
16. Remove the special tool.

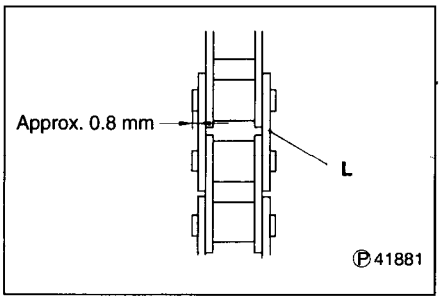


17. Cranking by hand, move the new timing chain until the permanent link L reaches the illustrated point of the intake camshaft sprocket, and hold it in that position.

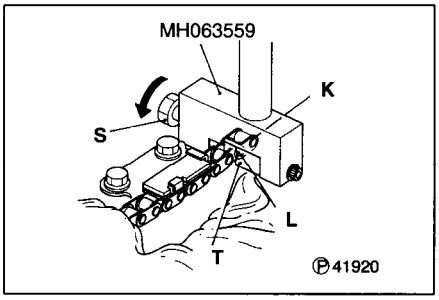
<Added>



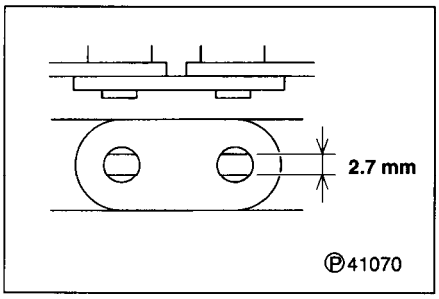
18. Attach the blue mark plate K to the punch R of the special tool.
19. Set the special tool such that the pins of the permanent link L are aligned with the mating holes in the blue mark plate K.
20. Fully tighten the bolt S of the special tool.



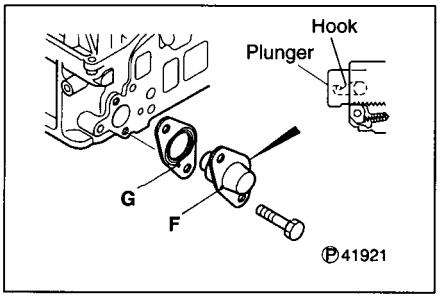
21. Make sure that the pins of the permanent link L protrude approximately 0.8 mm.



22. Reverse the special tool, and set its die T opposite to the blue mark plate K.
23. Tighten the bolt S of the special tool to a torque of approximately 64 Nm to head the pins of the permanent link L.



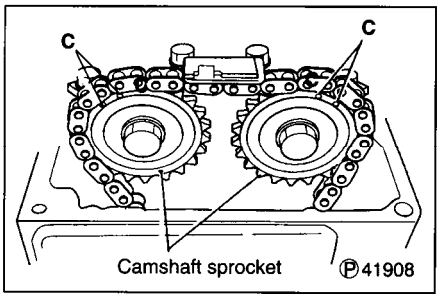
24. Make sure that the head width of each pin is 2.7 mm.
25. Remove shop rags from around the timing chain.



26. After ascertaining that the plunger of the new tensioner F is locked by the hook, fit the tensioner to the cylinder head together with the new gasket G.
27. Crank the engine clockwise.

    NOTE
    Cranking the engine clockwise disengages the hook of the tensioner F.

<Added>



28. Make sure that the timing marks C on the camshaft sprockets, with No. 1 piston at the top dead center of its compression stroke, are in the same position as they were at the start of the work.
29. Install the rocker cover, front cover, fan coupling, etc. back in place.

SERVICE BULLETIN

MITSUBISHI MOTORS

QUALITY INFORMATION ANALYSIS
OVERSEAS SERVICE DEPT. MITSUBISHI MOTORS CORPORATION

SERVICE BULLETIN	**No.:** MSB-00E11-501		
	Date: 2000-11-30	**<Model>**	**<M/Y>**
Subject: CORRECTION TO A/C COMPRESSOR DRIVE BELT TENSION CHECK AND ADJUSTMENT		(EC)PAJERO/MONTERO(V60,70)	01-10
Group: ENGINE	**Draft No.:** 00SY050819		
CORRECTION	**INTERNATIONAL CAR ADMINISTRATION OFFICE**	Tomoaki Nitta T.NITTA - PROJECT LEADER AFTER SALES SERVICE & CS PROMOTION	

1. Description:

On the 4M40 or 4M41 engine equipped vehicles, correction has been made to A/C compressor drive belt tension check and adjustment.

2. Applicable Manuals:

Manual	Pub. No.	Language	Page(s)
2001 PAJERO Workshop Manual Chassis VOL.1	PWJE0001 (1/2)	(English)	11C-2, 3, 7
2001 MONTERO Workshop Manual Chassis VOL.1	PWJE0001 (1/2)	(Spanish)	

GENERAL INFORMATION

Items			4M41
Total displacement mℓ			3,200
Bore x Stroke mm			98.5 x 105.0
Compression ratio			17.0
Camshaft arrangement			DOHC
Number of valve	Intake		8
	Exhaust		8
Valve timing	Intake	Opening	BTDC 13°
		Closing	ABDC 31°
	Exhaust	Opening	BBDC 55°
		Closing	ATDC 17°
Fuel system			Distribution type injection pump
Rocker arm			Roller type

SERVICE SPECIFICATIONS

Items			Standard value	Limit
Alternator drive belt (When inspection)	Vibration frequentcy Hz		122 – 161	-
	Tension N		207 – 363	-
	Deflection mm <Reference>		8 – 11	-
Alternator drive belt (When adjustment)	Vibration frequentcy Hz		122 – 136	-
	Tension N		207 – 259	-
	Deflection mm <Reference>		10 – 11	-
Alternator drive belt (When replacement)	Vibration frequentcy Hz		149 – 161	-
	Tension N		311 – 363	-
	Deflection mm <Reference>		8 – 9	-
A/C compressor drive belt (When inspection)	Vibration frequentcy Hz	A	177 – 191	-
		B	145 – 156	-
	Tension N	C	343 – 392	-
	Deflection mm <Reference>	C	7.5 – 8.5	-
A/C compressor drive belt (When adjustment)	Vibration frequentcy Hz	A	177 – 191	-
		B	145 – 156	-
	Tension N	C	343 – 392	-
	Deflection mm <Reference>	C	7.5 – 8.5	-
A/C compressor drive belt (When replacement)	Vibration frequentcy Hz	A	177 – 191	-
		B	145 – 156	-
	Tension N	C	490 – 539	-
	Deflection mm <Reference>	C	6.0 – 6.5	-

A	169 – 189
B	111 – 124
A	285 – 355
A	7.0 – 8.0
A	169 – 189
B	111 – 124
A	285 – 355
A	7.0 – 8.0
A	207 – 223
B	135 – 146
A	425 – 500
A	6.0 – 6.5

<Incorrect> **<Correct>**

Items		Standard value	Limit
Valve clearance (at cold engine) mm	Intake valve	0.1	-
	Exhaust valve	0.15	-
Injection timing		4°BTDC	-
Idle speed r/min		750 ± 20	-
Compression pressure kPa-r/min		2,844-240	2,256-240
Compression pressure difference of all cylinder kPa		-	Maximum 294

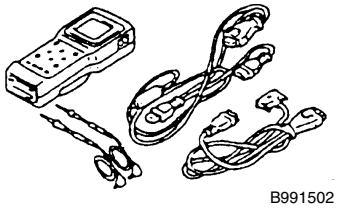
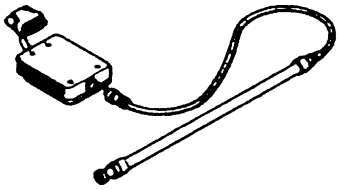
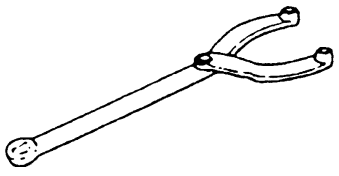
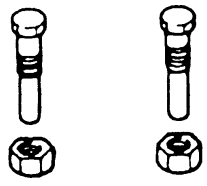
NOTE

~~A: Between crankshaft pulley and tension pulley~~
~~B: Between crankshaft pulley and A/C compressor pulley~~ **<Incorrect>**
~~C: Between A/C compressor pulley and tension pulley~~

SEALANTS AND ADHESIVES

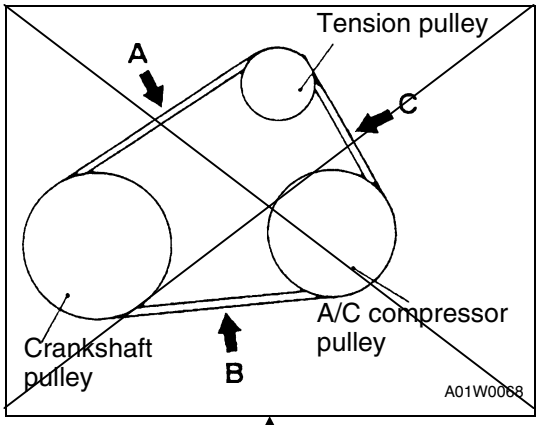
Items	Specified Sealants	Remark
Oil pan cover rubber	3M ATD Part No. 8121 or equivalent	Quick fix adhesive
Engine cover insulator		
Contact surface between timing gear case and crankcase assembly	3M ATD Part No. 8660 or equivalent	Semi-drying sealant
Oil pan	MITSUBISHI GENUINE PART MD970389 or equivalent	
Timing gear case		

SPECIAL TOOLS

Tool	Number	Name	Use
 B991502	MB991502	MUT-II Sub-assembly	• Drive belt tension measurement • Fuel infection timing check and adjustment • Idle speed check
 B991668	MB991668	Belt tension meter set	Drive belt tension measurements (Use with MUT-II)
	MB990767	Endyoke holder	Crankshaft pulley holding
	MD998754	Pulley holder pin	

A: Between A/C compressor pulley and tension pulley
B: Between A/C compressor pulley and crankshaft pulley **<Correct>**

<Incorrect>



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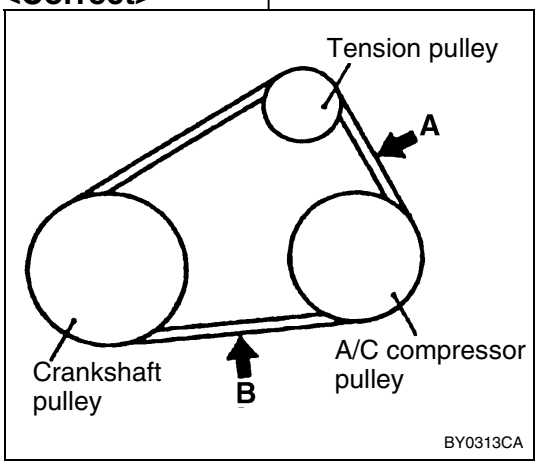
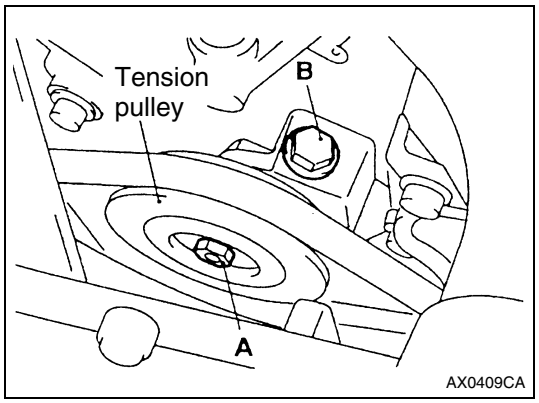




A/C compressor drive belt tension check and adjustment<Vehicles with A/C>

1. Check the drive belt tension by the following procedures.

Standard value:

Item		During inspection	During adjustment	During replacement
Vibration frequency Hz	A	177 - 191	177 - 191	177 - 191
	B	145 - 156	145 - 156	145 - 156
Tension N	C	343 - 392	343 - 392	490 - 539
Deflection mm <Reference>	C	7.5 - 8.5	7.5 - 8.5	6.0 - 6.5

<Incorrect>

<When using MUT-II>

Gently tap the centre of the belt between the pulleys (arrows A and B), and check that the belt vibration frequency is within the standard value.

NOTE

For the vibration frequency measurement using the MUT-II, refer to P.11C-5.

<When using a tension Gauge>

Place a belt tension gauge at the centre between the pulleys (arrow C) to check the belt tension is within the standard value.

<Incorrect>

<When checking the deflection>

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

<Incorrect>

<Correct> **A**

2. If not within the standard value, adjust the belt tension by the following procedure.
   (1) Loosen the tension ;pulley securing bolt A.
   (2) Use the adjusting bolt B to adjust the belt deflection.
   (3) Tighten the securing bolt A to the specified torque.

   Tightening torque: 44 ± 10 N·m

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

   Caution
   When checking the belt tension, turn the crankshaft clockwise one turn or more.

A	169 - 189	169 - 189	207 - 223
B	111 - 124	111 - 124	135 - 146
A	285 - 355	285 - 355	425 - 500
A	7.0 - 8.0	7.0 - 8.0	6.0 - 6.5

<Correct>

SERVICE BULLETIN

MITSUBISHI MOTORS

QUALITY INFORMATION ANALYSIS
OVERSEAS SERVICE DEPT. MITSUBISHI MOTORS CORPORATION

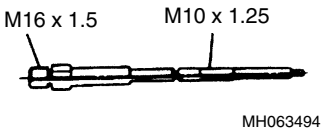
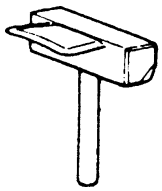
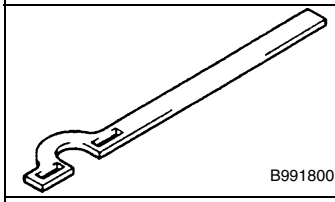
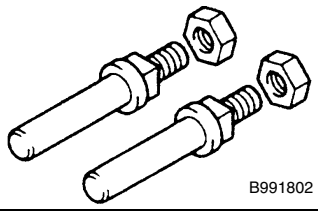
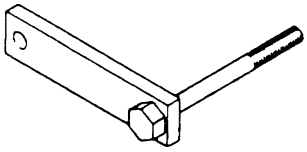
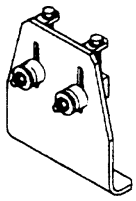
SERVICE BULLETIN	**No.:** MSB-00E11-505		
	Date: 2001-07-05	**<Model>**	**<M/Y>**
Subject: CORRECTION TO REMOVAL/INSTALLATION PROCEDURE FOR BEARING BLOCK		(EC)PAJERO/MONTERO(V60,V70)	01-10
Group: ENGINE	**Draft No.:** 00SY083009		
CORRECTION	**INTERNATIONAL CAR ADMINISTRATION OFFICE**	T.MASAKI-MANAGER TECHNICAL SERVICE PLANNING	

1. Description:

On the vehicle equipped with the 4M41 engine, corrections have been made to the REMOVAL/INSTALLATION procedure for the bearing block.

2. Applicable Manuals:

Manual	Pub. No.	Language	Page(s)
2001 PAJERO Workshop Manual VOL.1	PWJE0001 (1/2)	(English)	11C-4, 17, 19, 20
2001 MONTERO Workshop Manual VOL.1	PWJS0002 (1/2)	(Spanish)	
2001 PAJERO/MONTERO Workshop Manual CD-ROM	PWJT0008R	(English)	
	PWJT0008R	(Spanish)	
	PWJT0008R	(French)	
	PWJT0008R	(German)	

Tool	Number	Name	Use
	MH063494	Compression gauge adapter	Compression pressure check
	MD998727	Oil pan remover	Oil pan removal
	MB991800	Pulley holder	Crankshaft pulley holding
	MB991802	Pin B	
	MD998781	Flywheel stopper	Flywheel<M/T> or drive plate<A/T> holding
	MH063490	Cam sprocket holder kit	Camshaft sprocket holding

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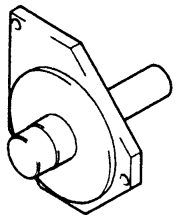	MH063497	Bearing installer	Bearing block installation

TIMING CHAIN

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Drain and Refill (Refer to GROUP 14 – On-vehicle Service.)
- Under Cover and Skid Plate Removal and Installation
- Engine Oil Draining and Refilling. (Refer to GROUP 12 – On-vehicle Service.)
- Fuel Line Air-bleeding (Refer to GROUP 13C – On-vehicle Service.) <Post-installation operation>
- Drive Belt Tension Check and Adjustment (Refer to P.11C-5.) <Post-installation operation>
- Camshaft Removal and Installation (Refer to P.11C-23.)
- Cooling Fan and Fan Clutch Assembly Removal and Installation (Refer to GROUP 14.)
- Vacuum Pump Removal and Installation (Refer to P.11C-16.)
- Oil Pan Removal and Installation (Refer to P.11C-14.)

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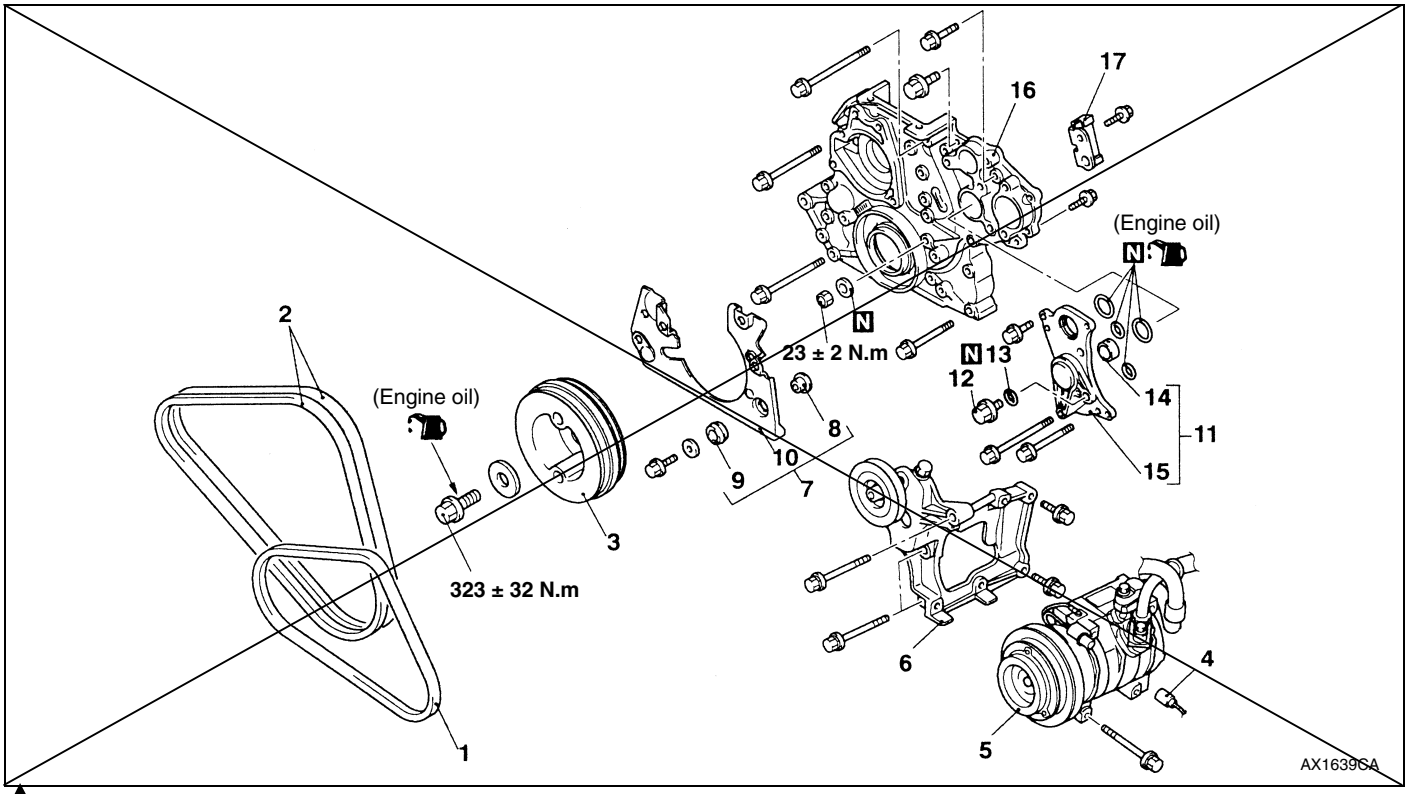


Removal steps

◄A► 1. A/C compressor drive belt <Vehicles with A/C>
◄B► 2. Alternator drive belt
3. Crankshaft pulley
◄C► • Alternator (Refer to GROUP 16.)
• Water pump (Refer to GROUP 14.)
• Cylinder Head Assembly (Refer to P.11C-27.)
4. A/C compressor connector <Vehicles with A/C>
5. A/C compressor <Vehicles with A/C>
6. A/C compressor bracket and tension pulley assembly<Vehicles with A/C>
7. Timing gear case cover assembly
8. Insulator collar
9. Insulator
10. Timing gear case cover

<Incorrect>

►B◄ 11. Bearing block assembly
12. Drain plug
13. Drain plug gasket
14. Bearing block bushing
15. Bearing block

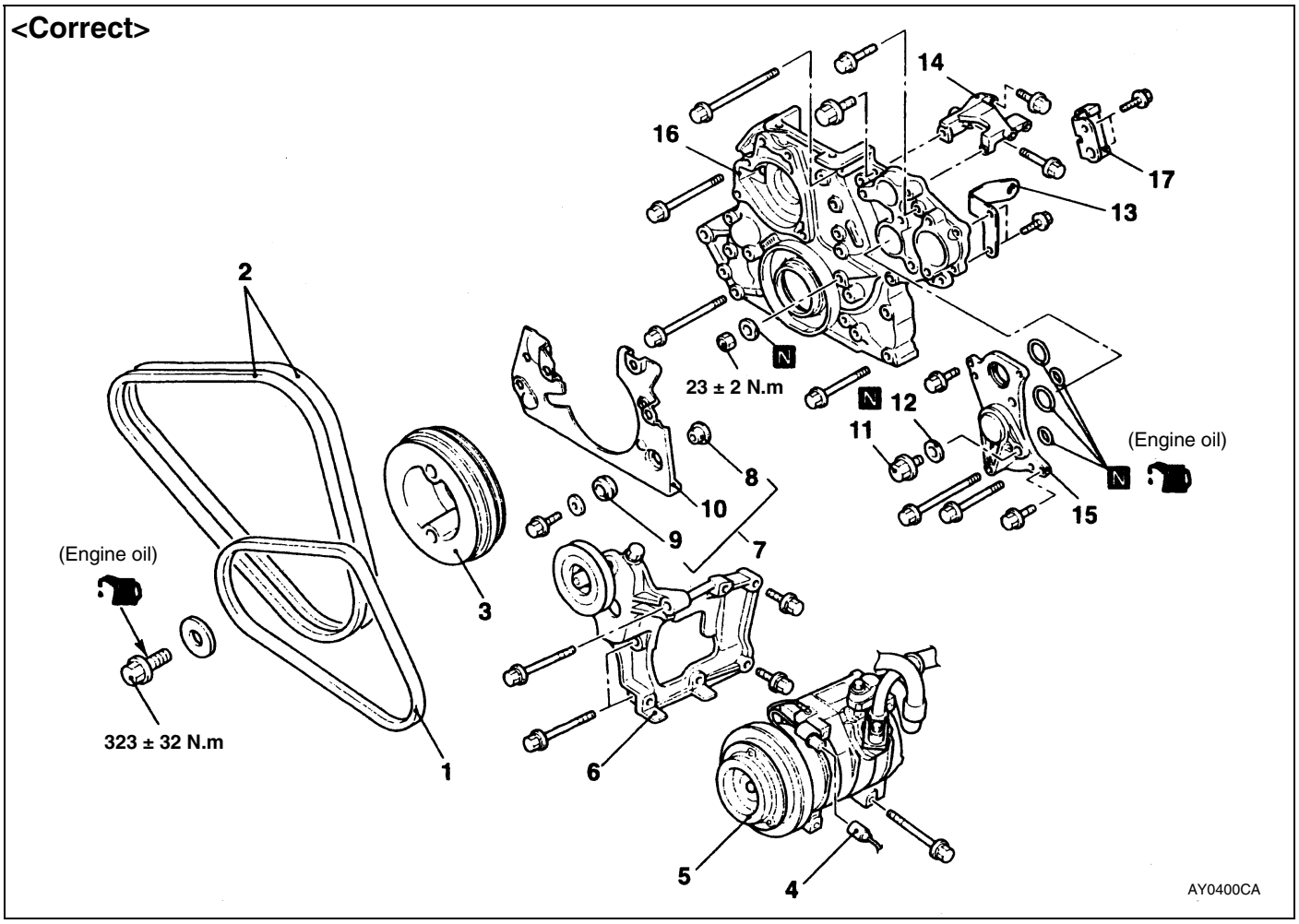
►B◄ 16. Timing gear case
17. Lower guide plate

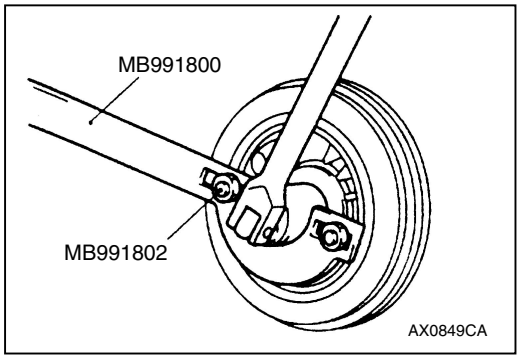
<Correct>

11. Drain plug
12. Drain plug gasket
13. Timing gear case stay
• Injection pump (Refer to GROUP 13C.)
14. Timing gear case stiffener
►C◄ 15. Bearing block

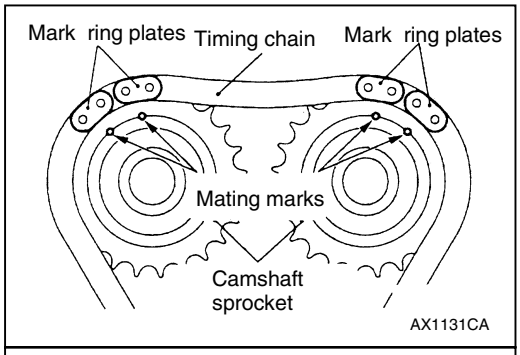
See next page.

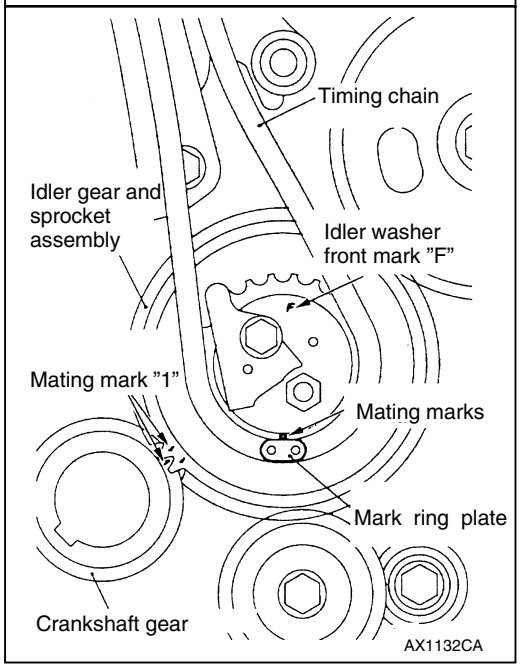
<Correct>


14
16
17
13
2
23 ± 2 N.m
12
11
(Engine oil)
8
10
9
7
15
(Engine oil)
3
323 ± 32 N.m
1
6
5
4
AY0400CA



◄C► CRANKSCHAFT PULLEY REMOVAL





INSTALLATION SERVICE POINTS

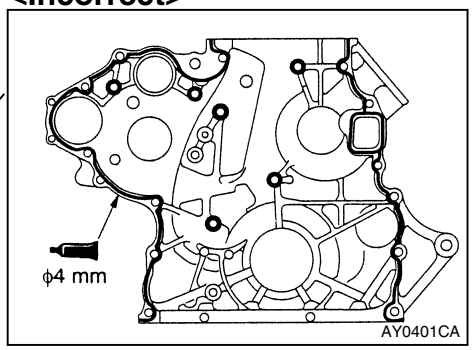
►A◄ TIMING CHAIN/CAMSHAFT SPROCKET/IDLER WASHER/SPRING PIN/OIL JET INSTALLATION

1. Check that the mating mark on the idler gear and sprocket assembly is aligned with mating mark "1" on the crankshaft gear.
2. Align the mating mark on the idler gear and sprocket assembly with the dark blue mark ring plate on the timing chain.

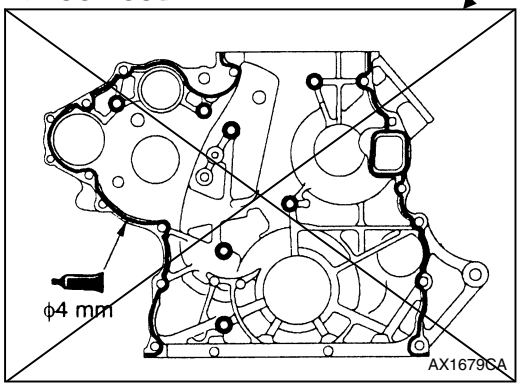
Caution
Note that the timing chain has one mark ring plate for the idler gear and sprocket assembly side, and two mark ring plates for each camshaft sprocket.

3. Align the mark ring plates with the camshaft sprocket mating marks.
4. Tie up the timing chain and the camshaft sprocket with a cord to prevent the mating mark misalignment.
5. Install the idler washer front mark "F" must face toward the front of the engine.

<Incorrect>



<Incorrect>



►B◄ TIMING GEAR CASE/BEARING BLOCK ASSEMBLY INSTALLATION

1. Clean the timing gear case and the front plate mating surfaces with a scraper or a wire brush.
2. Apply a continuous bead of the specified sealant to the timing gear case-mating surface as shown.

Specified sealant:
MITSUBISHI GENUINE PART MD970389 or equivalent

3. After applying the sealant, install the gear case within 15 minutes.

Timing <Added>

Caution

(1) When installing the timing gear case, be careful not to disturb the sealant.

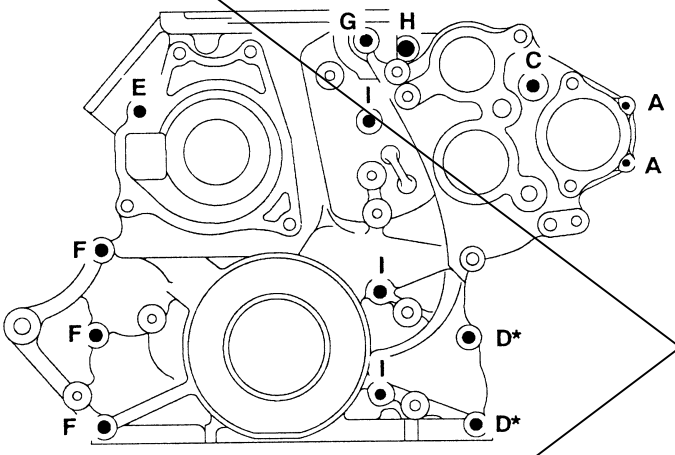
(2) Whenever the timing gear case mounting bolts are loosened or tightened again after the timing gear case installation, always apply the sealant again.

(3) After the timing gear case is installed, wait for at least one hour, and then start the engine.

<Incorrect>

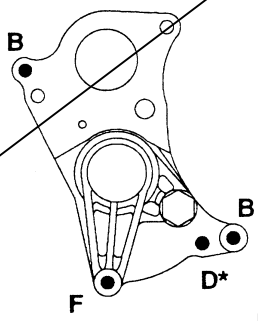
4. Install the mounting nuts and bolts to the timing gear case and the bearing block assembly at the shown positions.

Timing gear case



BX1666CA

Bearing block assembly

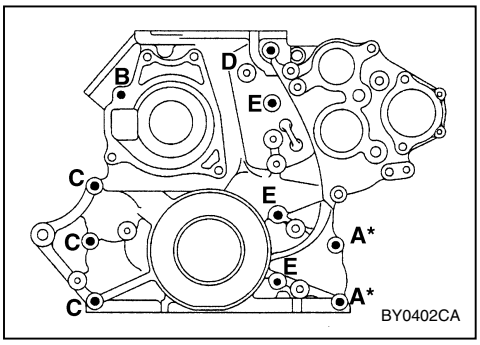


BX1667CA

Name	Symbol	Size mm (D x L)	Name	Symbol	Size mm (D x L)
Flange bolt	A	6 x 20	Flange bolt	F	8 x 85
	B	8 x 30		G	8 x 90
	C	8 x 50		H	10 x 35
	D*	8 x 60	Cap nut	I	-
	E	8 x 75			

D= Nominal diameter
L= Nominal length
*: Vehicles without A/C

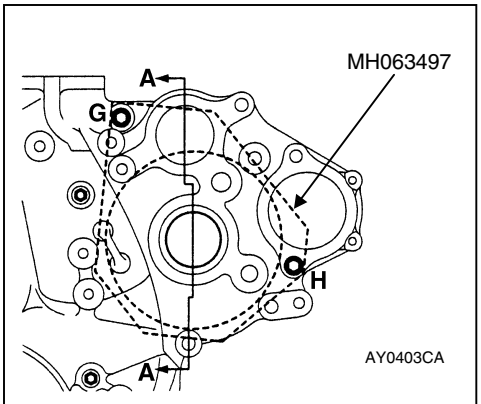
See next page.



4. Install the mounting nuts and bolts to the timing gear case at the shown positions.

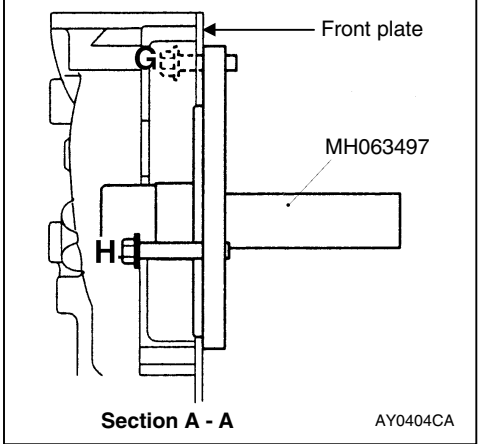
Name	Symbol	Quantity	Size mm (D x L)
Flange bolt	A*	2	8 x 60
	B	1	8 x 75
	C	3	8 x 85
	D	1	8 x 90
Cap nut	E	3	-

D= Nominal diameter
L= Nominal length
*: Vehicles without A/C



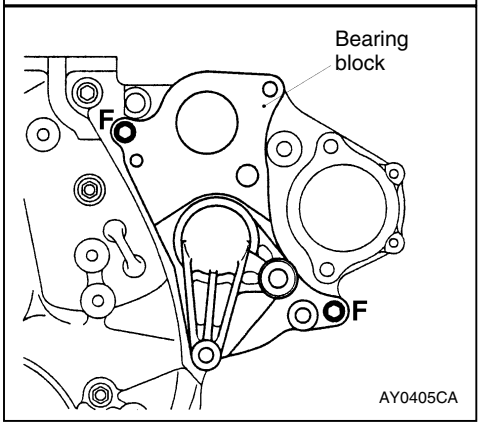
►C◄ BEARING BLOCK INSTALLATION

1. Install the special tool on the front plate with flange bolts G and H.
2. Install the bearing block over the special tool.
3. Using flange bolts F. install the bearing block to the timing gear case.
4. Remove the special tool.



Name	Symbol	Quantity	Size mm (D × L)
Flange bolt	F	2	8 x 30
	G	1	8 x 35
	H	1	8 x 50

D= Nominal diameter
L= Nominal length



SERVICE BULLETIN

MITSUBISHI MOTORS

TECHNICAL SERVICE PLANNING
INTERNATIONAL CAR ADMINISTRATION OFFICE. MITSUBISHI MOTORS CORPORATION

SERVICE BULLETIN	NO. : MSB-00E11-506	
	DATE : 2000-11-20	<MODEL> (EC)PAJERO/ MONTERO(V60,70) <M/Y> 01-10
SUBJECT : ESTABLISHMENT OF STANDARD VALUES OF VALVE CLEARANCE WHEN ENGINE IS HOT		
GROUP : ENGINE	DRAFTNO. : 00SY590610	
CORRECTION	INTERNATIONAL CAR ADMINISTRATION OFFICE	T. MASAKI - MANAGER TECHNICAL SERVICE PLANNING

1. Description:

For the valve clearance inspection and adjustment of the 4M41 engine, the standard values of valve clearance when the engine is hot (cooling water temperature at 80 to 95°C) have been established.

2. Applicable Manuals:

Manual	Pub. No.	Page
2001 PAJERO Workshop Manual Chassis Vol. 1	PWJE0001 (1/2) (English)	11C-8
2001 MONTERO Workshop Manual Chassis Vol. 1	PWJS0002 (1/2) (Spanish)	
2001 PAJERO/MONTERO Workshop Manual CD-ROM	PWJT0008R (English/ Spanish/French/German)	

3. Details:

Standard values of valve clearance when the engine is hot (cooling water temperature at 80 to 95°C):

Intake valve: 0.15 mm
Exhaust valve: 0.20 mm

* The valve clearance inspection and adjustment procedures are the same as the conventional ones except those procedures to be followed when the engine is hot (cooling water temperature at 80 to 95°C).

ENGINE LUBRICATION

Click on the applicable bookmark to selected the required model year.

ENGINE LUBRICATION

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SERVICE SPECIFICATIONS 3

SEALANT 3

LUBRICANTS 3

SPECIAL TOOLS 3

ON-VEHICLE SERVICE 4

Engine Oil Check 4

Engine Oil Replacement 4

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ENGINE OIL COOLER 9

GENERAL INFORMATION

The lubrication method is a fully force-fed, full-flow filtration type.

An oil cooler with high cooling performance and which is built into the crankcase has been adopted. <4M4>

Items	6G7	4D5	4M4
Oil pump type	Trochoid type	External gear type	External gear type
Drive method	Crankshaft	Crankshaft gear	Crankshaft gear

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 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	Limit
Oil pressure kPa	6G7, 4D5	at idle	29 or more	-
		at 3,500 r/min	294 - 686	-
	4M4	During minimum engine speed with no load	145 or more	49 or more
		During maximum engine speed with no load	295 - 490	195

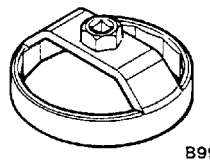
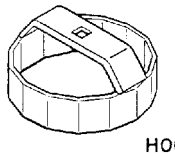
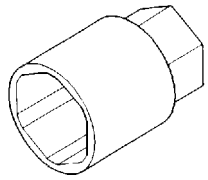
SEALANT

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

LUBRICANTS

Items		6G7	4D5	4M4
Engine oil API classification		SG or higher	CD or higher	CD or higher
Engine oil quantity litre	Oil filter	0.3	0.8	1.0
	Oil cooler	-	0.4	1.3
	Total	4.6	6.5	9.8

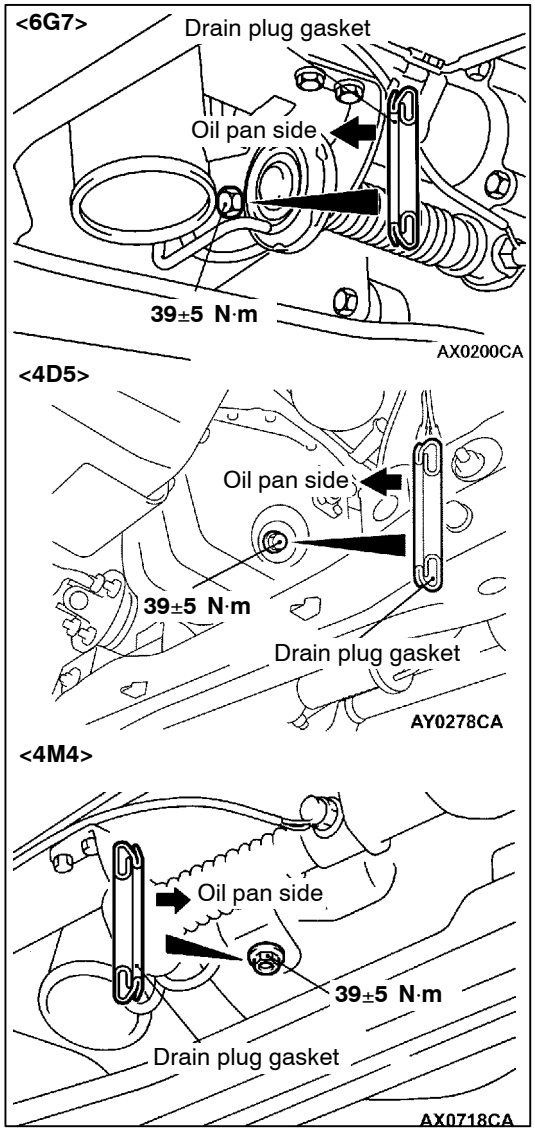
SPECIAL TOOLS

Tool	Number	Name	Use
 B991610	MB991610	Oil filter wrench	Removal and installation of engine oil filter (When using the oil filter of MD352626)
 H061590	MH061590	Oil filter wrench	Removal and installation of engine oil filter (When using the oil filter of MD069782 or MD326489 or ME013307)
	MD998054 <6G7, 4D5> MD998012 <4M4>	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 petrol mixed in, and that it has sufficient viscosity.



ENGINE OIL REPLACEMENT

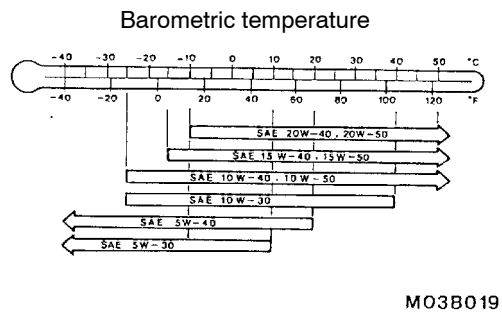
1. Start the engine and allow it to warm up until the temperature of the coolant reaches 80°C to 90°C.
2. Remove the engine oil filler cap.
3. Remove the drain plug to drain oil.

   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.

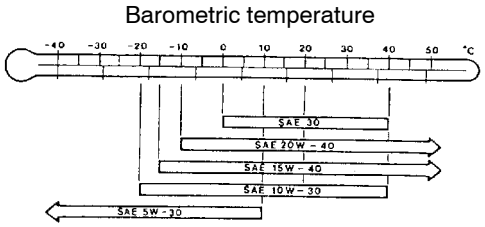
   NOTE
   Install the drain plug gasket so it faces in the direction shown in the illustration.

<6G7>



M03B019

<4D5, 4M4>



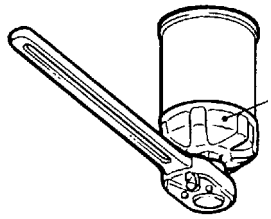
M03B017
00004957

5. Refill with specified quantity of oil.

Specified Engine Oil (API classification):
<6G7> SG or higher
<4D5, 4M4> CD or higher

Total quantity (Includes volume inside oil filter and oil cooler):
<6G7> 4.6 litre
<4D5> 6.5 litre
<4M4> 9.8 litre

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



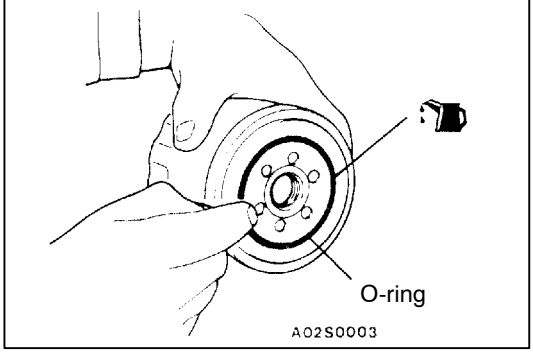
A04Z0002

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.

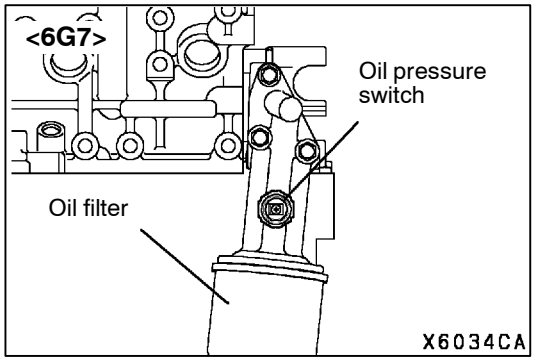


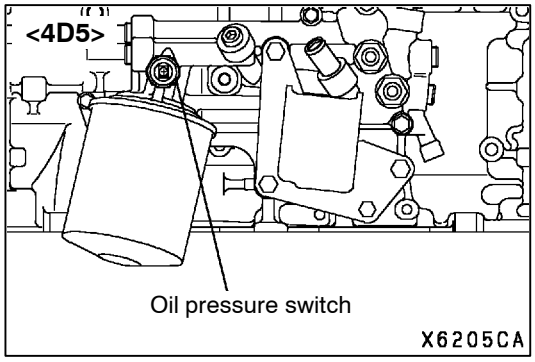
A02S0003

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 the engine oil. (Refer to Engine Oil Replacement 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
MD352626	MB991610 or equivalent tool	Approx. 3/4 turn (14±2 N·m)
ME013307	MH061590 or equivalent tool	Approx. 3/4 turn (20±2 N·m)
MD069782	MH061590 or equivalent tool	Approx. 5/8 turn (20±2 N·m)

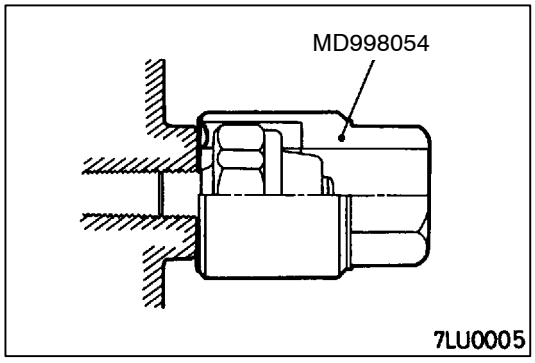




OIL PRESSURE CHECK

<6G7, 4D5>

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.

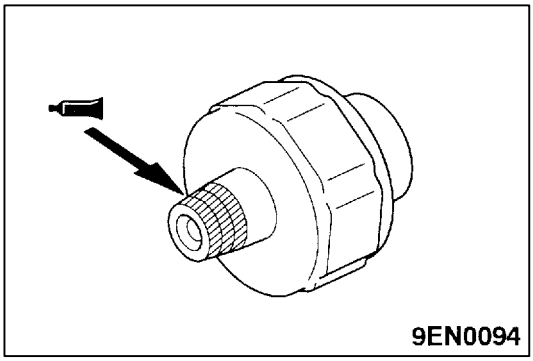
5. Run the engine to warm it.
6. After the engine has been warmed up, check that oil pressure is within the standard value.

   Standard value:

   At idle: 29 kPa or more

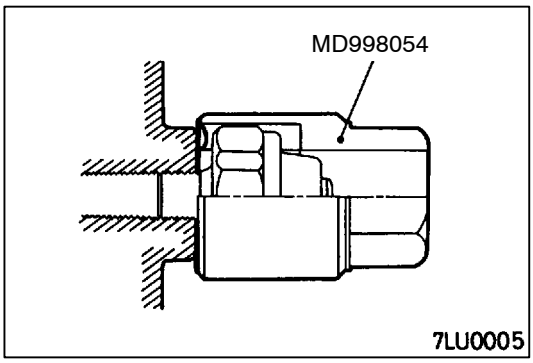
   At 3,500 r/min: 294 - 686 kPa

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

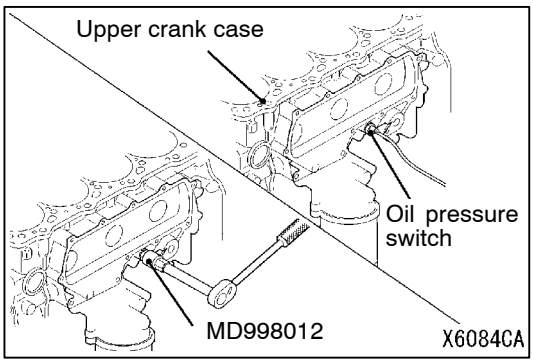


9. Use the special tool to tighten the oil pressure switch to the specified torque.

   Tightening torque: 10 N·m

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

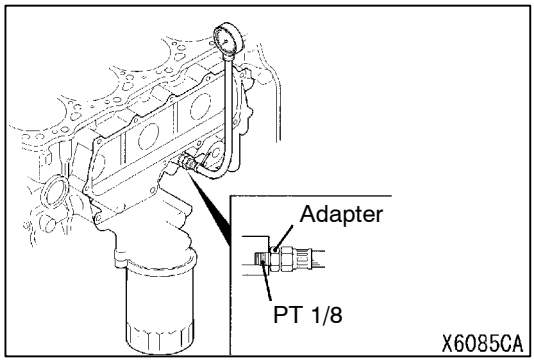
10. Install the oil pressure switch terminal.

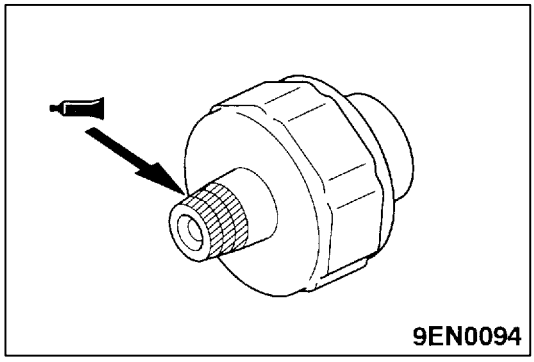


<4M4>

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:
   During minimum engine speed with no load: 145 kPa or more
   During maximum engine speed with no load: 295 - 490 kPa

   Limit:
   During minimum engine speed with no load: 49 kPa or more
   During maximum engine speed with no load: 195 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: 12 N·m

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

10. Install the oil pressure switch terminal.

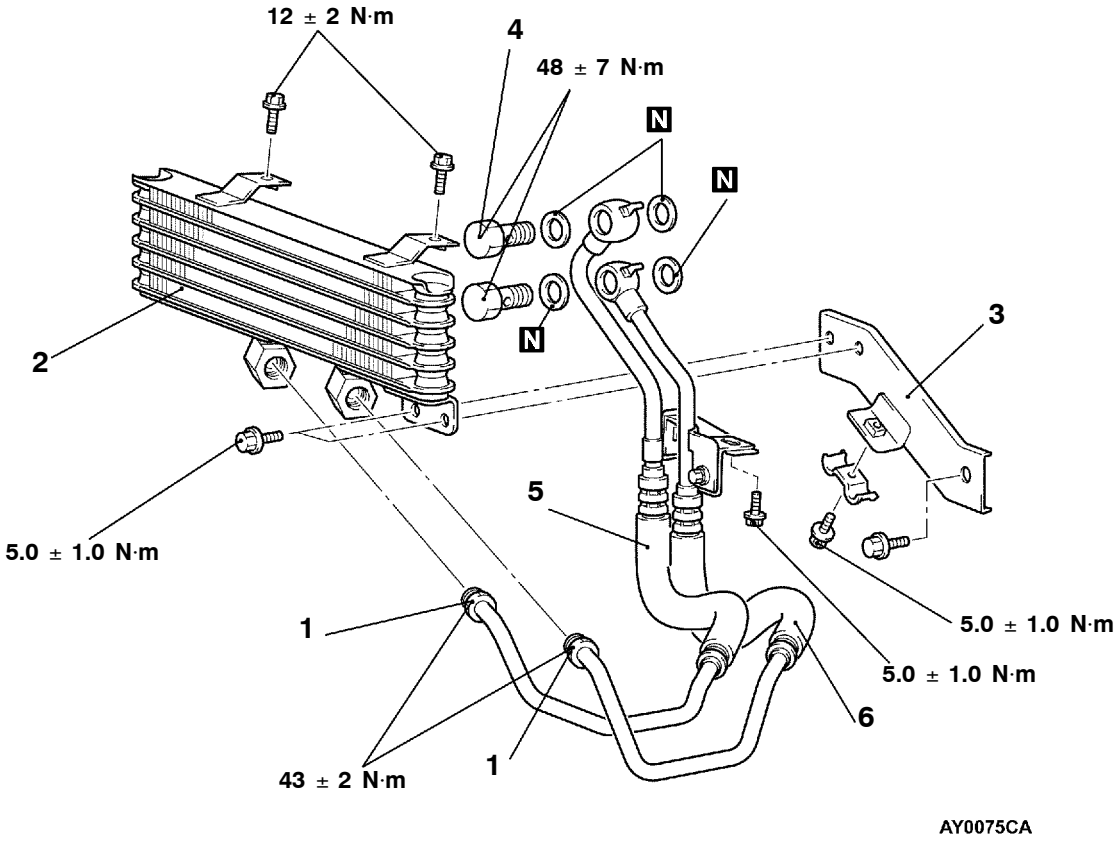
ENGINE OIL COOLER

REMOVAL AND INSTALLATION

<6G7>

Pre-removal Operation
- Skid Plate and Under Cover Removal
- Radiator Shroud Lower Cover Removal (Refer to GROUP 14 - Radiator.)

Post-installation Operation
- Skid Plate and Under Cover Installation
- Radiator Shroud Lower Cover Installation (Refer to GROUP 14 - Radiator.)
- Engine Oil Refilling and Level Check (Refer to P.12-4.)



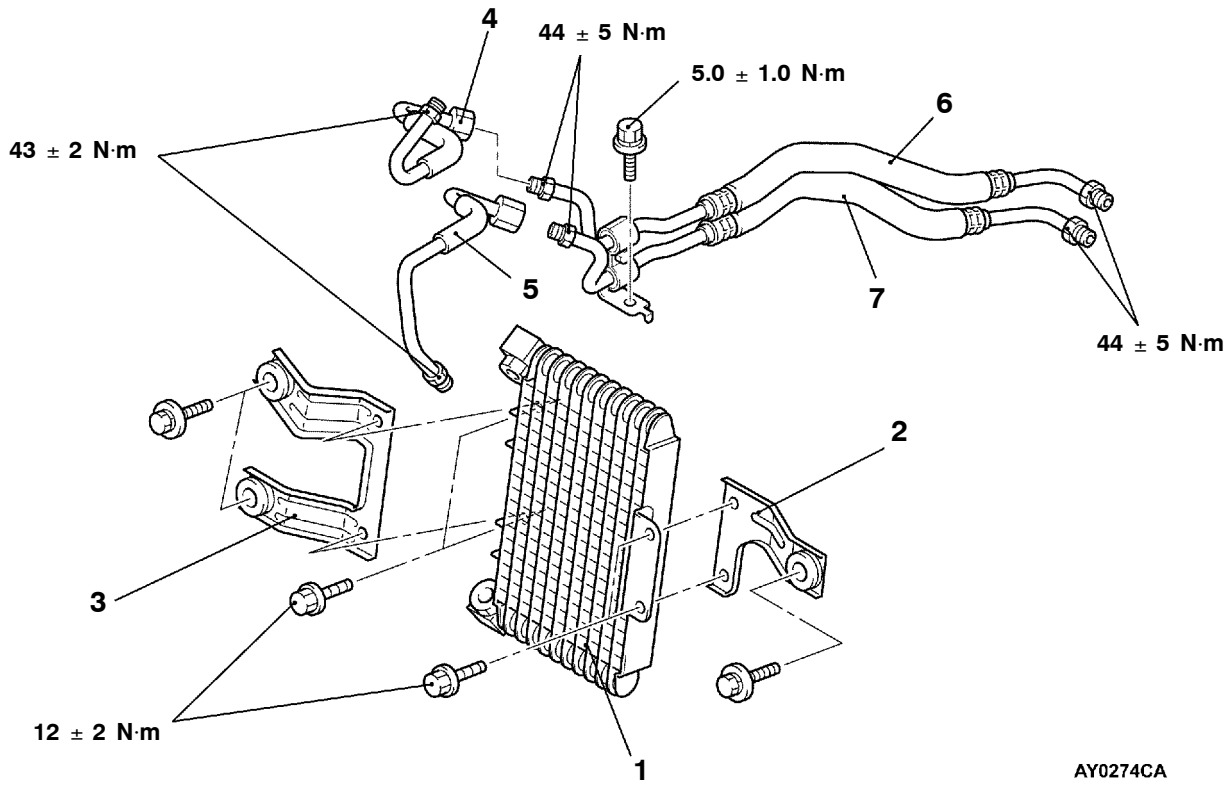
Removal steps

1. Oil cooler hose connection at cooler side
2. Oil cooler assembly
3. Bracket
4. Eye bolts
5. Oil cooler return hose
6. Oil cooler feed hose

<4D5>

Pre-removal Operation
- Oil Reservoir Removal
- Air Cleaner Removal (Refer to GROUP 15 - Air Cleaner.)

Post-installation Operation
- Oil Reservoir Installation
- Air Cleaner Installation (Refer to GROUP 15 - Air Cleaner.)
- Engine Oil Refilling and Level Check (Refer to P.12-4.)



Removal steps
- Radiator grille (Refer to GROUP 51.)

1. Oil cooler assembly
2. Bracket
- Headlamp (Refer to GROUP 54A.)

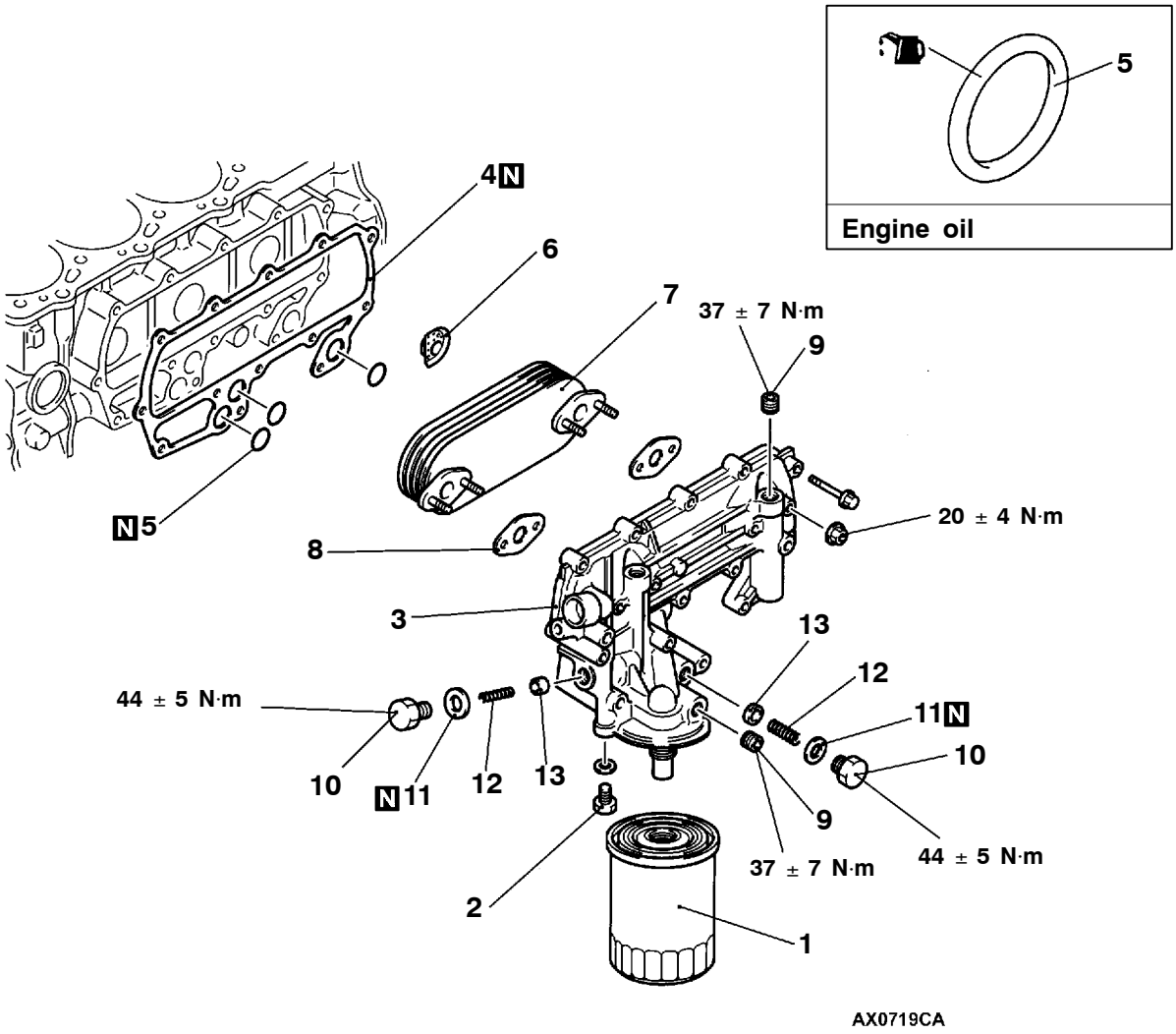
3. Bracket
- Intercooler air pipe (Refer to GROUP 15.)

4. Oil cooler return tube
5. Oil cooler feed tube
6. Oil cooler return hose
7. Oil cooler feed hose

<4M4>

Pre-removal Operation
- Coolant Draining (Refer to GROUP 14 - On-vehicle Service.)
- Turbocharger Removal (Refer to GROUP 33A.)

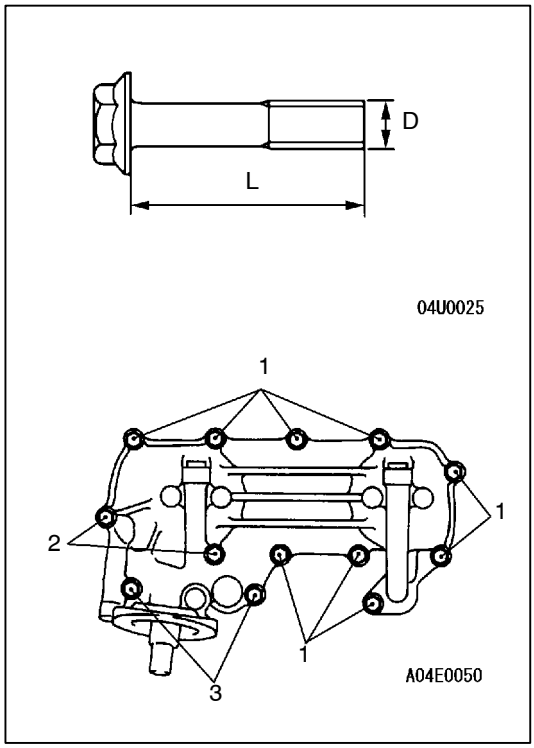
Post-installation Operation
- Turbocharger Installation (Refer to GROUP 15.)
- Coolant Refilling (Refer to GROUP 14 - On-vehicle Service.)
- Engine Oil Refilling and Level Check (Refer to P.12-4.)



Removal steps

1. Oil filter (Refer to P.12-5.)
2. Water drain plug
▶A◀ 3. Oil cooler assembly
4. Gasket
5. O ring
6. Water separator
- Engine oil draining (Refer to P.12-4.)

7. Oil cooler element
8. Gasket
9. Plug
10. Plug
11. Gasket
12. Spring
13. Valve



INSTALLATION SERVICE POINT

▶A◀ OIL COOLER ASSEMBLY INSTALLATION

Symbol	Head mark	D×L mm
1	7T	8×32
2		8×75
3		10×80

GROUP 12
ENGINE LUBRICATION

GENERAL

OUTLINE OF CHANGE

- The engine oil quantity has been changed as variable geometry (VG) turbocharger has been used.

LUBRICANT

Items		4D5
Engine oil quantity L	Oil filter	0.8
	Oil cooler	0.4
	Total	7.5

GASOLINE DIRECT INJECTION (GDI)

Click on the applicable bookmark to selected the required model year.

GASOLINE DIRECT INJECTION (GDI)

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GENERAL INFORMATION

The Gasoline Direct Injection System consists of sensors which detect the engine conditions, the engine-ECU <M/T> or engine-A/T-ECU <A/T> which controls the system based on signals from these sensors, and actuators which operate under the control of the engine-ECU <M/T> or engine-A/T-ECU <A/T>.

The engine-ECU <M/T> or engine-A/T-ECU <A/T> carries out activities such as fuel injection control, idle speed control and ignition timing control. In addition, the engine-ECU <M/T> or engine-A/T-ECU <A/T> 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 1-2-3-4-5-6. 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 <M/T> or engine-A/T-ECU <A/T> determines how deeply the accelerator pedal is depressed by means of the accelerator position sensor (APS). Then the engine-ECU <M/T> or engine-A/T-ECU <A/T> 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 <M/T> or engine-A/T-ECU <A/T> 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.

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 <M/T> or engine-A/T-ECU <A/T> 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 or flashes 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 engine-ECU records the engine operating condition when the diagnosis code is set. This data is called “freeze frame” data.
  This data can be read by using the MUT-II, and can then be used in simulation tests for troubleshooting. <Only vehicles with M/T>
- The RAM data inside the engine-ECU <M/T> or engine-A/T-ECU <A/T> 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. Purge Control Solenoid Valve Control
   Refer to GROUP 17.
4. EGR Control Servo Control
   Refer to GROUP 17.

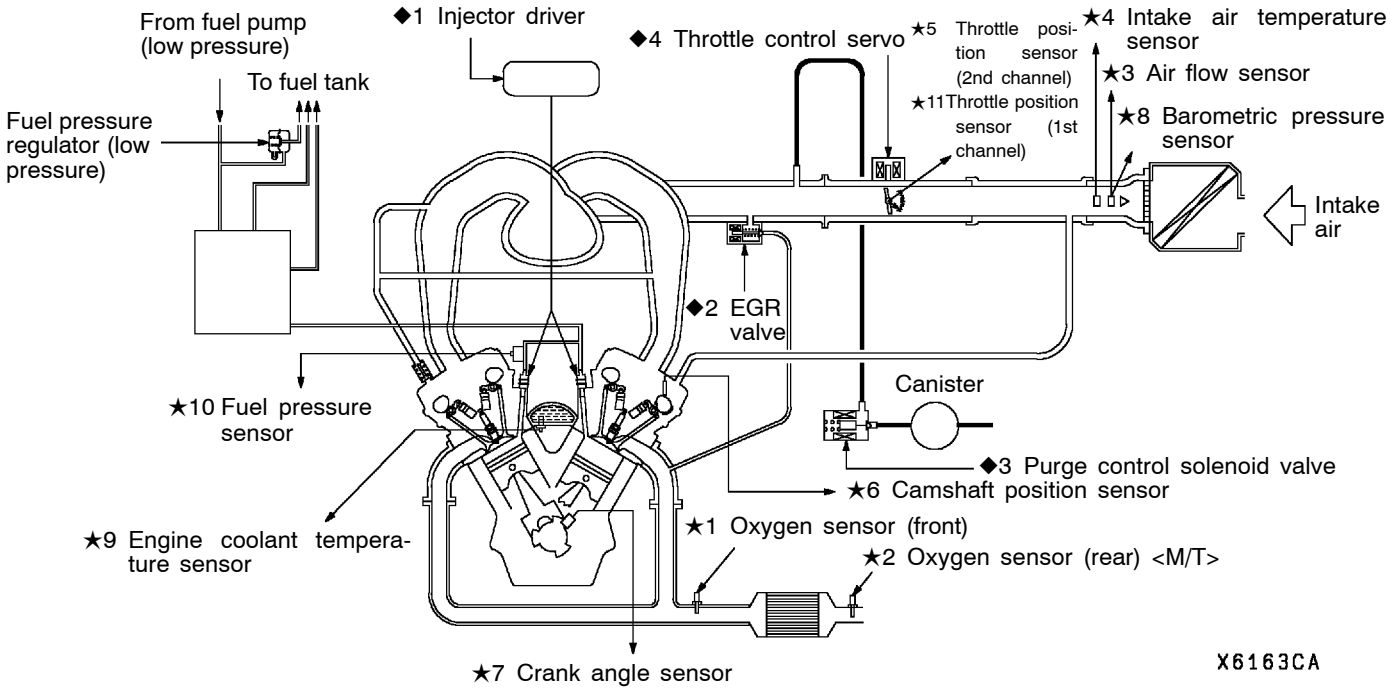
GENERAL SPECIFICATIONS

Items		Specifications
Throttle body	Throttle bore mm	65
	Throttle position sensor	Variable resistor type
	Throttle valve control servo	Brushless DC-motor type
Engine-ECU <M/T>	Identification model No.	E2T79271 <RHD> E2T79272 <LHD>
Engine-A/T-ECU <A/T>	Identification model No.	E2T76277 <RHD> E2T76278 <LHD>

Items		Specifications
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 (1st and 2nd channels)	Variable resistor type
	Accelerator pedal position switch	Rotary contact type, within accelerator pedal position sensor (1st channel)
	Vehicle speed sensor	Magnetic resistive element type
	Inhibitor switch	Contact switch type
	Camshaft position sensor	Hall 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
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, 6
	Injector identification mark	DIM 1070
	Throttle valve control servo relay	Contact switch type
	Throttle valve control servo	Brushless DC-motor type
	EGR valve	Stepper motor type
	Purge control solenoid valve	Duty cycle type solenoid valve
Fuel pressure regulator (low pressure)	Regulator pressure kPa	329
Fuel pressure regulator (high pressure)	Regulator pressure MPa	5.0

GASOLINE DIRECT INJECTION SYSTEM DIAGRAM

★1 Oxygen sensor (front) ★2 Oxygen sensor (rear) <M/T> ★3 Air flow sensor ★4 Intake air temperature sensor ★5 Throttle position sensor (2nd channel) ★6 Camshaft position sensor ★7 Crank angle sensor ★8 Barometric pressure sensor ★9 Engine coolant temperature sensor ★10 Fuel pressure sensor	• Power supply • Ignition switch-IG • Ignition switch-ST • Accelerator pedal position sensor (1st channel) • Accelerator pedal position switch • Detonation sensor • Vehicle speed sensor • A/C switch 1 • A/C switch 2 • Inhibitor switch • Power steering fluid pressure switch • Alternator FR terminal • Stop lamp switch • Clutch switch <M/T> • Small lamp switch • Injector wire open circuit check signal • Throttle valve controller	⇨ Engine-ECU <M/T> or engine-A/T-ECU <A/T> ⇨	◆1 Injector driver (injector) ◆2 EGR valve (stepper motor) ◆3 Purge control solenoid valve	• Engine control relay • Fuel pump relay • Injector driver relay • Throttle control servo relay • A/C relay • Condenser fan relay • Ignition coil • Engine warning lamp • GDI ECO indicator lamp • Diagnosis output • Alternator G terminal • Throttle valve controller • Oxygen sensor heater
★11 Throttle position sensor (1st channel)	• Power supply • Ignition switch-IG • Accelerator pedal position sensor (2nd channel) • Engine-ECU <M/T> or engine-A/T-ECU <A/T>	⇨ Throttle valve controller ⇨	◆4 Throttle valve control servo	• Engine-ECU <M/T> or engine-A/T-ECU <A/T>	



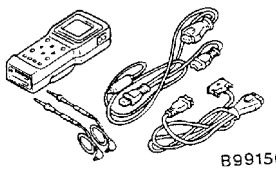
SERVICE SPECIFICATIONS

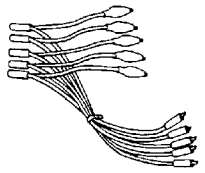
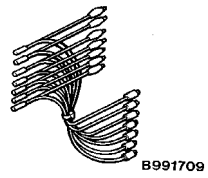
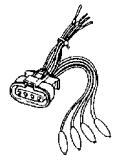
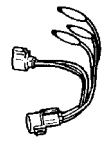
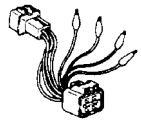
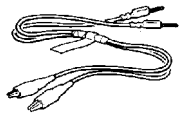
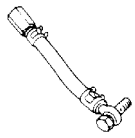
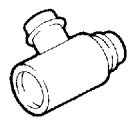
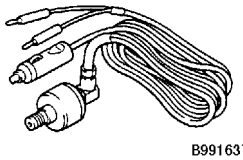
Item		Standard value
Adjustment voltage of throttle position sensor (1st channel) V		0.4 - 0.6
Adjustment voltage of throttle position sensor (2nd channel) V		4.2 - 4.8
Throttle position sensor resistance kΩ		0.9 - 2.5
Adjustment voltage of accelerator pedal position sensors 1 and 2 V		0.985 - 1.085
Resistance of accelerator pedal position sensors 1 and 2 kΩ		3.5 - 6.5
Intake air temperature sensor resistance kΩ	at 20°C	2.3 - 3.0
	at 80°C	0.30 - 0.42
Engine coolant temperature sensor resistance kΩ	at 20°C	2.1 - 2.7
	at 80°C	0.26 - 0.36
Fuel pressure	High-pressure side MPa	4 - 6.9
	Low-pressure side kPa	Approximately 329
Injector coil resistance (at 20°C) Ω		0.9 - 1.1
Oxygen sensor output voltage V (during revving)		0.6 - 1.0
Oxygen sensor heater resistance (at 20°C) Ω		4.5 - 8.0
Throttle control servo coil resistance (at 20°C) Ω		0.6 - 1.0

SEALANT

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

SPECIAL TOOLS

Tools	Number	Name	Use
 B991502	MB991502	MUT-II sub assembly	● GDI system check ● Take a reading of the diagnosis codes

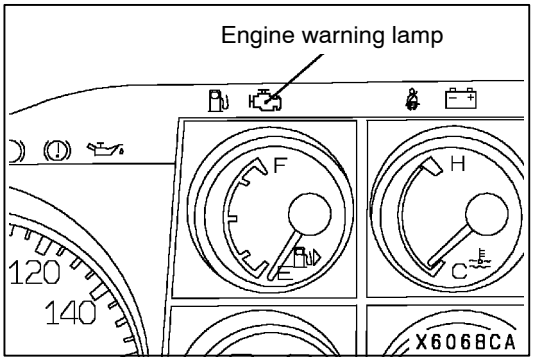
Tools	Number	Name	Use
	MB991348, MB991658	Test harness set	• Troubleshooting - voltage measurement • Inspection using an analyzer
	MB991709		
	MB991519	Alternator harness connector	Troubleshooting - voltage measurement
	MD998478	Test harness (3-pin, square)	• Troubleshooting - voltage measurement • Inspection using an analyzer
	MD998464	Test harness (4-pin, square)	Oxygen sensor check
	MB991529	Diagnosis code checking harness	Take a reading of the diagnosis codes <A/T>
	MD998709	Adaptor hose	Fuel pressure measurement
	MD998742	Hose adaptor	
	MB991637	Fuel pressure gauge set	

TROUBLESHOOTING <M/T>

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING

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

NOTE
When replacing the engine-ECU, replace immobilizer-ECU and ignition key as well at the same time.



DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

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

Engine warning lamp inspection items

Code No.	Diagnosis item
-	Engine-ECU
P0100	Air flow sensor system
P0105	Barometric pressure sensor system
P0110	Intake air temperature sensor system
P0115	Engine coolant temperature sensor system
P0120★	Throttle position sensor (1st channel) system
P0125	Feedback system
P0130	Oxygen sensor (front) system <sensor 1>
P0135	Oxygen sensor heater (front) system <sensor 1>
P0136	Oxygen sensor (rear) system <sensor 2>
P0141	Oxygen sensor heater (rear) system <sensor 2>
P0170	Abnormal fuel system
P0190★	Abnormal fuel pressure
P0201	No.1 injector system
P0202	No.2 injector system
P0203	No.3 injector system
P0204	No.4 injector system
P0205	No.5 injector system

Code No.	Diagnosis item
P0206	No.6 injector system
P0220★	Accelerator pedal position sensor (1st channel) system
P0225★	Throttle position sensor (2nd channel) system
P0300★	Ignition coil (power transistor) system
P0301	No.1 cylinder misfire detected.
P0302	No.2 cylinder misfire detected.
P0303	No.3 cylinder misfire detected.
P0304	No.4 cylinder misfire detected.
P0305	No.5 cylinder misfire detected.
P0306	No.6 cylinder misfire detected.
P0335	Crank angle sensor system
P0340	Camshaft position sensor system
P0403	EGR valve system
P0420	Catalyst malfunction
P0443	Purge control solenoid valve system
P1200	Injector driver system
P1220★	Electronic-controlled throttle valve system
P1221★	Throttle valve position feedback system
P1222★	Throttle control servo system
P1223★	Communication line system with throttle valve controller
P1225★	Accelerator pedal position sensor (2nd channel) system
P1226★	Throttle valve controller system

NOTE
1. If the engine warning lamp illuminates because of a malfunction of the engine-ECU, communication between MUT-II and the engine-ECU is impossible. In this case, the diagnosis code cannot be read.
2. After the engine-ECU has detected a malfunction, the engine warning lamp illuminates when the engine is next turned on and the same malfunction is re-detected. However, for items marked with a "★" in the diagnosis code number column, the engine warning lamp illuminates only on the first detection of the malfunction.
   If diagnosis code P0120, P0220, P0225 or P1225 is set, the engine warning lamp will flash. If the 1st and 2nd channels of the throttle postion sensor or the acccelerator pedal position sensor fail at the same time, the engine warning lamp will also flash.
3. After the engine warning lamp illuminates, it will be switched off under the following conditions.
   (1) When the engine-ECU monitored the power train malfunction three times* and met set condition requirements, it detected no malfunction.
      *: In this case, "one time" indicates from engine start to stop.
   (2) For misfiring malfunction, when driving conditions (engine speed, engine coolant temperature, etc.) are similar to those when the malfunction was first recorded.

4. Sensor 1 indicates the sensor mounted at a position closest to the engine, and sensor 2 indicates the sensor mounted at the position second closest to the engine.

METHOD OF READING AND ERASING DIAGNOSIS CODES

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

DIAGNOSIS USING DIAGNOSIS 2 MODE

1. Switch the diagnosis mode of the engine control unit to DIAGNOSIS 2 mode using the MUT-II.
2. Carry out a road test.
3. Take a reading of the diagnosis code and repair the problem location.
4. Turn the ignition switch to OFF and then back to ON again.

NOTE
By turning the ignition switch to OFF, the ENGINE-ECU will switch the diagnosis mode from DIAGNOSIS 2 mode to DIAGNOSIS 1 mode.

5. Erase the diagnosis codes.

INSPECTION USING MUT-II DATA LIST AND ACTUATOR TESTING

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

FREEZE FRAME DATA

When the engine-ECU detects a malfunction and stores a diagnosis code, it also stores a current status of the engine. This function is called "Freeze frame data." By analyzing this "freeze frame" data with the MUT-II, an effective troubleshooting can be performed.

Data item		Unit
Engine coolant temperature sensor		°C
Engine speed		r/min
Vehicle speed		km/h
Long-term fuel compensation (long-term fuel trim)		%
Short-term fuel compensation (short-term fuel trim)		%
Fuel control condition	Open loop	OL
	Closed loop	CL
	Open loop owing to drive condition	OL-DRV.
	Open loop owing to system malfunction	OL-SYS.
	Closed loop based on one oxygen sensor	CL-H02S
Calculation load value		%
Diagnosis code during data recording		-

NOTE
If malfunctions have been detected in multiple systems, store one malfunction only, which has been detected first.

READINESS TEST STATUS

The engine-ECU monitors the following main diagnosis items, judges if these items are in good condition or not, and the stores its history. This history can be read out by using MUT-II. (If the ECU has judged a item before, the MUT-II displays "Complete.")
In addition, if diagnosis codes are erased or the battery cable is disconnected, this history will also be erased (the memory will be reset).

- Catalyst: P0420
- Oxygen sensor: P0130
- Oxygen sensor heater: P0135, P0141

FAIL-SAFE FUNCTION REFERENCE TABLE

When the main sensor malfunctions are detected by the diagnosis function, the vehicle is controlled by means of the pre-set control logic to maintain safe conditions for driving.

Malfunctioning item	Control contents during malfunction
Air flow sensor	1. Suspends lean burn operation. 2. Uses the throttle position sensor signal and engine speed signal (crank angle sensor signal) to take reading of the basic injector drive time and basic ignition timing from the pre-set mapping.
Intake air temperature sensor	Controls as if the intake air temperature is 25°C.
Throttle position sensor (2nd channel)	1. Suspends lean burn operation. 2. Controls the throttle opening angle feedback (half as much as the opening rate in the normal condition) by using signals from the throttle position sensor (1st channel). However, this controlling system is not applied if the throttle position sensor (1st channel) and throttle position sensor (2nd channel) combination output voltage is outside 4 - 6 V. 3. Refrains from controlling the throttle opening angle feedback if the throttle position sensor (1st channel) is also defective.
Engine coolant temperature sensor	Controls as if the engine coolant temperature is 80°C. (Moreover, the control system is working until the ignition switch is turned OFF if the sensor signal returns to normal.)
Camshaft position sensor	Cuts the fuel supply once a malfunction is detected. (Only when there has been no occasion of detecting No.1 cylinder top dead centre after the ignition switch is turned ON.)
Vehicle speed sensor	1. Suspends lean burn operation. However, the control is cancelled as a certain time passes by with the engine speed of 1,500 r/min or more. 2. Suspends lean burn operation during the engine idling.
Barometric pressure sensor	Controls as if the barometric pressure is 101 kPa.
Detonation sensor	Fixes the ignition timing as that for standard petrol.
Injector	1. Suspends lean burn operation. 2. Suspends the exhaust gas recirculation.
Ignition coil (incorporating power transistor)	1. Suspends lean burn operation. 2. Cuts off the fuel supply to cylinders with an abnormal ignition signal.
Fuel pressure sensor	1. Controls as if the fuel pressure is 5MPa. 2. Suspends fuel injection. (when the low pressure is detected and the engine speed is more than 3,000r/min)
Alternator FR terminal	Refrains from controlling to suppress the alternator output to electrical load. (Operated as a normal alternator)
Accelerator pedal position sensor (2nd channel)	1. Suspends lean burn operation. 2. Controls the throttle valve position by using signals from the accelerator pedal position sensor (1st channel). (However, the control system is not applicable if the difference from the accelerator pedal position sensor (1st channel) output voltage is 1.0 V or higher.) 3. Suspends the electronic controlled throttle valve system if accelerator pedal position sensor (1st channel) is also defective.

Malfunctioning item	Control contents during malfunction
Accelerator pedal position sensor (1st channel)	1. Suspends lean burn operation. 2. Controls the throttle valve position by using signals from the accelerator pedal position sensor (2nd channel). (However, this control is not applicable if the voltage difference between the accelerator pedal position sensor (1st channel) and accelerator pedal position sensor (2nd channel) is 1.0 V or higher.) 3. Also suspends the electronic-controlled throttle valve system when the accelerator pedal position sensor (2nd channel) is defective.
Throttle position sensor (1st channel)	1. Suspends lean burn operation. 2. Controls throttle opening angle feedback by using signals from throttle position sensor (2nd channel). (However, the controlling system is not applied when the throttle position sensor (1st channel) and throttle position sensor (2nd channel) combination output voltage is outside 4 - 6 V.) 3. Refrains from controlling the throttle opening angle feedback when throttle position sensor (2nd channel) is also defective.
Electronic-controlled throttle valve system	1. Suspends the electronic controlled throttle valve system. 2. Suspends lean burn operation. 3. Suspends the idle speed feedback control.
Throttle valve position feedback	1. Suspends the electronic controlled throttle valve system. 2. Suspends lean burn operation. 3. Suspends the engine speed feedback control. However, if the throttle valve opening angle is significantly wide, this system carries out the following controls. 1. Always cuts the fuel supply to three cylinders. 2. Cuts the fuel supply when the engine speed reaches 3,000 r/min or more.
Throttle control servo	1. Suspends the electronic-controlled throttle valve system. 2. Suspends lean burn operation. 3. Suspends the engine speed feedback control.
Communication line between the throttle valve controller and the ECU	1. Communication error between the throttle valve controller and the engine-ECU: ● Suspends lean burn operation. ● Cuts the fuel supply when the engine speed reaches 3,000 r/min or more. ● Suspends the cruise-control. 2. Communication error between the throttle valve controller and the engine-ECU: ● Suspends lean burn operation. ● Cuts the fuel supply when the engine speed reaches 3,000 r/min or more. ● Suspends the cruise-control. ● The throttle valve controller controls the throttle valve opening angle by using signals from accelerator pedal position sensor (2nd channel).
Throttle valve controller	1. Suspends the electronic-controlled throttle valve system. 2. Suspends lean burn operation. 3. Suspends the engine speed feedback control.

NOTE
If the electronic-controlled throttle valve system is suspended, the engine warning lamp will illuminate.

INSPECTION CHART FOR DIAGNOSIS CODES

Code No.	Diagnosis item	Reference page
P0100	Air flow sensor system	13A-17
P0105	Barometric pressure sensor system	13A-19
P0110	Intake air temperature sensor system	13A-21
P0115	Engine coolant temperature sensor system	13A-22
P0120★	Throttle position sensor (1st channel) system	13A-25
P0125	Feedback system	13A-27
P0130	Oxygen sensor (front) system <sensor 1>	13A-28
P0135	Oxygen sensor heater (front) system <sensor 1>	13A-30
P0136	Oxygen sensor (rear) system <sensor 2>	13A-31
P0141	Oxygen sensor heater (rear) system <sensor 2>	13A-33
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P0302	No.2 cylinder misfire detected.	13A-55
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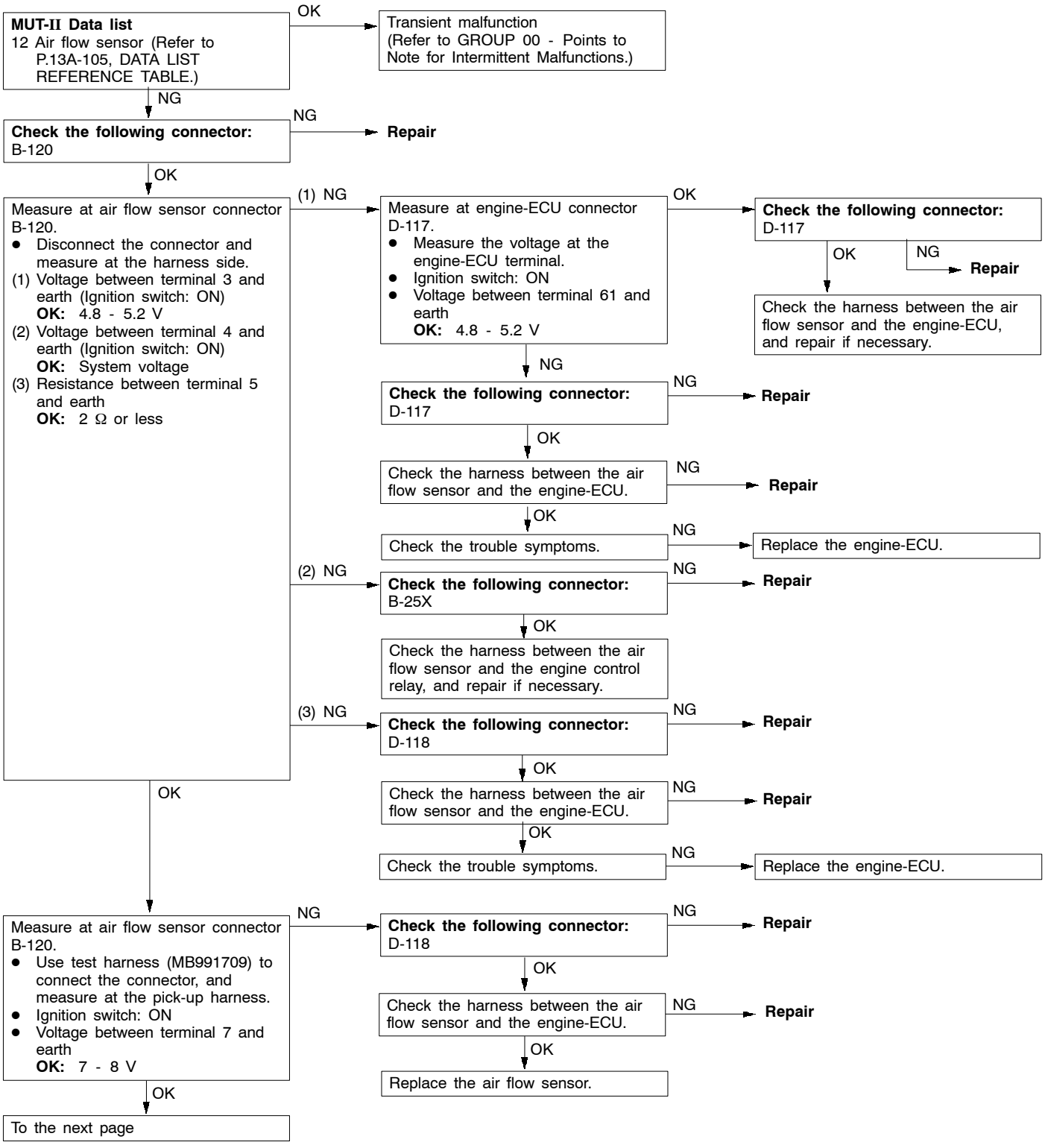
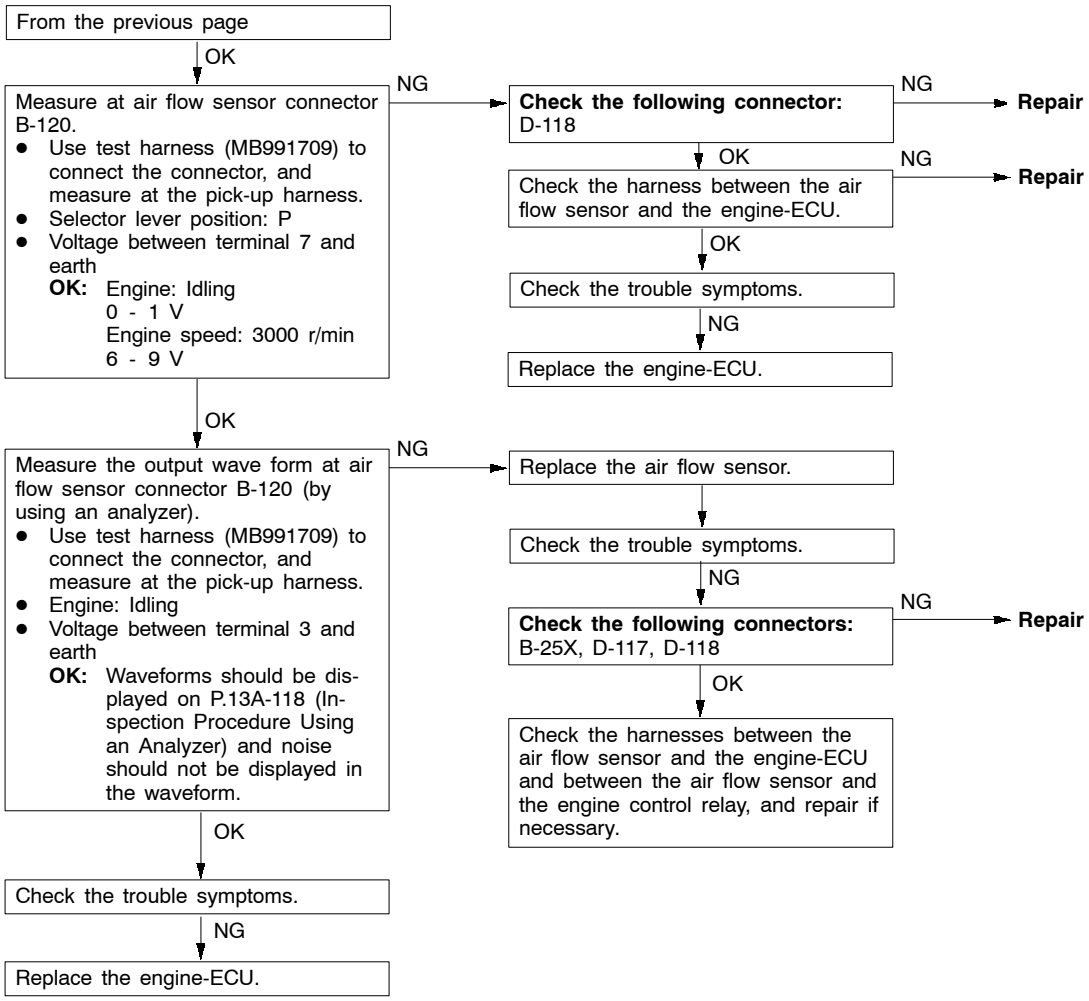
P1610	Immobilizer system	13A-71

NOTE
1. Do not replace the engine-ECU until a through terminal check reveals there are no short/open circuit.
2. Check that the engine-ECU earth circuit is normal before checking for the cause of the problem.
3. After the engine-ECU has detected a malfunction, a diagnosis code is recorded the next time the engine is started and the same malfunction is re-detected. However, for items marked with a "★", the diagnosis code is recorded on the first detection of the malfunction.
4. Sensor 1 indicates the sensor mounted at a position closest to the engine, and sensor 2 indicates the sensor mounted at the position second closest to the engine.

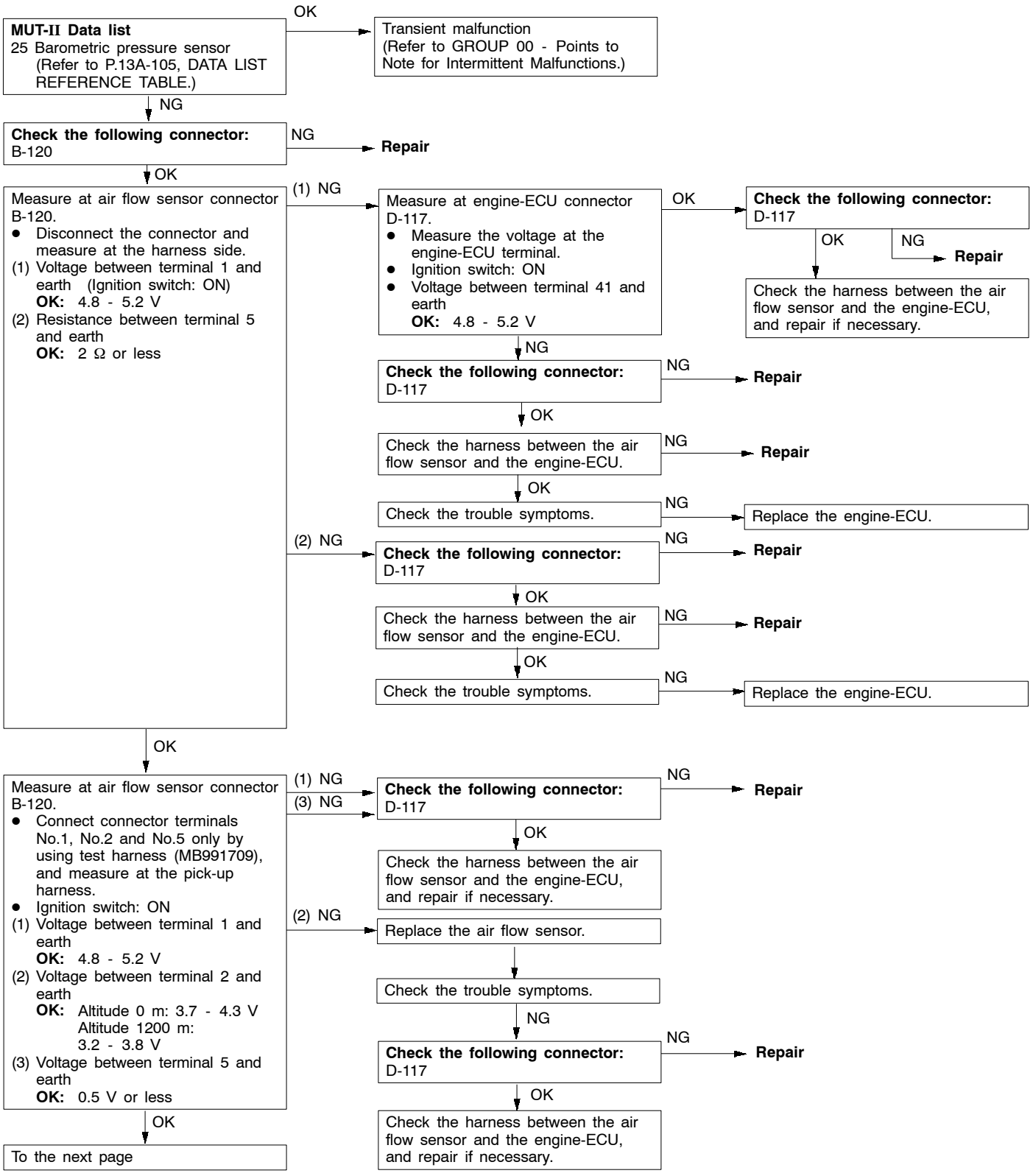
INSPECTION PROCEDURE CLASSIFIED BY DIAGNOSIS CODE

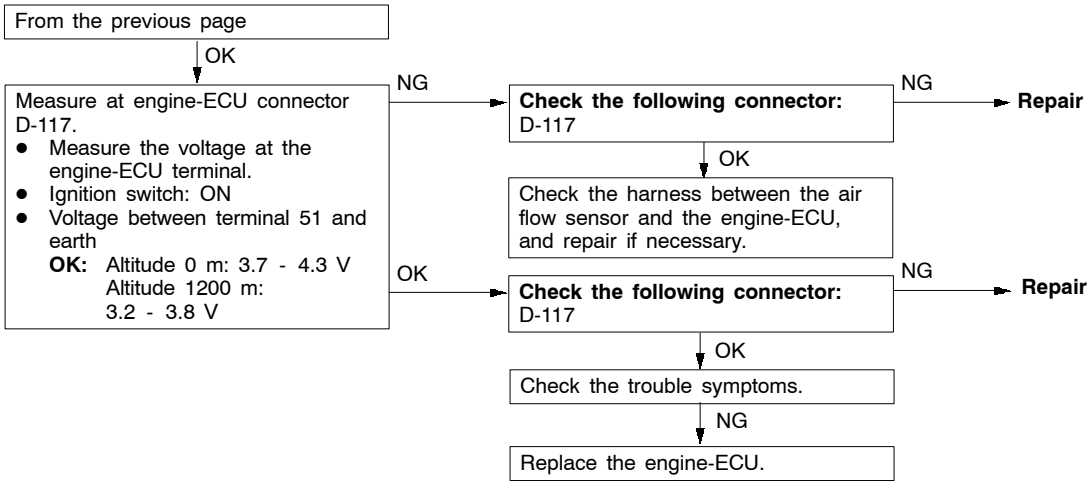
Code No.P0100 Air flow sensor system	Probable cause
Range of Check ● Engine speed: 500 r/min or more Set Conditions ● The sensor output frequency is 3.3 Hz or less for four seconds.	● Malfunction of air flow sensor ● Open or short circuit in air flow sensor circuit or loose connector contact ● Malfunction of engine-ECU



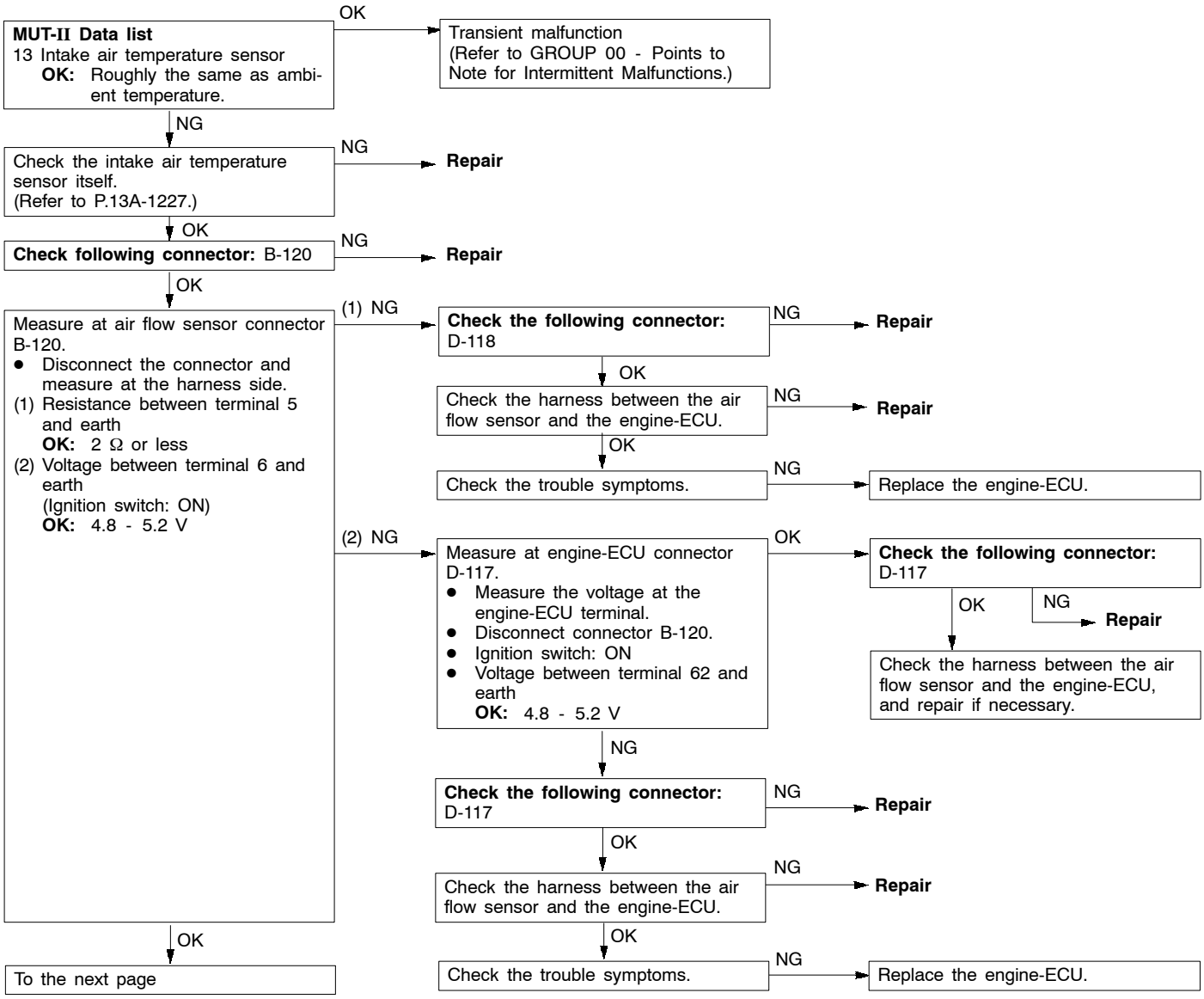

From the previous page
OK
Measure at air flow sensor connector B-120.
● Use test harness (MB991709) to connect the connector, and measure at the pick-up harness.
● Selector lever position: P
● Voltage between terminal 7 and earth
OK: Engine: Idling
0 - 1 V
Engine speed: 3000 r/min
6 - 9 V
NG
Check the following connector: D-118
NG
Repair
OK
Check the harness between the air flow sensor and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
OK
Measure the output wave form at air flow sensor connector B-120 (by using an analyzer).
● Use test harness (MB991709) to connect the connector, and measure at the pick-up harness.
● Engine: Idling
● Voltage between terminal 3 and earth
OK: Waveforms should be displayed on P.13A-118 (Inspection Procedure Using an Analyzer) and noise should not be displayed in the waveform.
NG
Replace the air flow sensor.
Check the trouble symptoms.
NG
Check the following connectors: B-25X, D-117, D-118
NG
Repair
OK
Check the harnesses between the air flow sensor and the engine-ECU and between the air flow sensor and the engine control relay, and repair if necessary.
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.

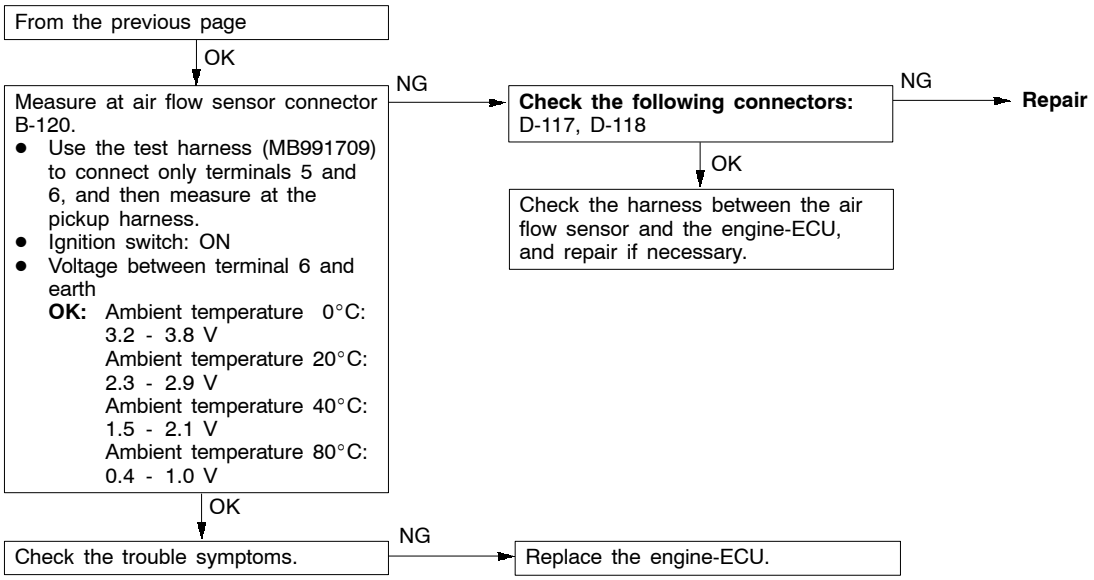
Code No.P0105 Barometric pressure sensor system	Probable cause
Range of Check ● Two seconds have passed since the ignition switch is turned ON or the engine starting process is completed. ● Battery voltage: 8 V or more Set Conditions ● The sensor output voltage is 4.5 V or more for four seconds (equivalent to 114 kPa of barometric pressure) or ● The sensor output voltage is 0.2 V or less (equivalent to 53 kPa of barometric pressure)	● Malfunction of barometric pressure sensor ● Open or short circuit in barometric pressure sensor circuit or loose connector contact ● Malfunction of engine-ECU



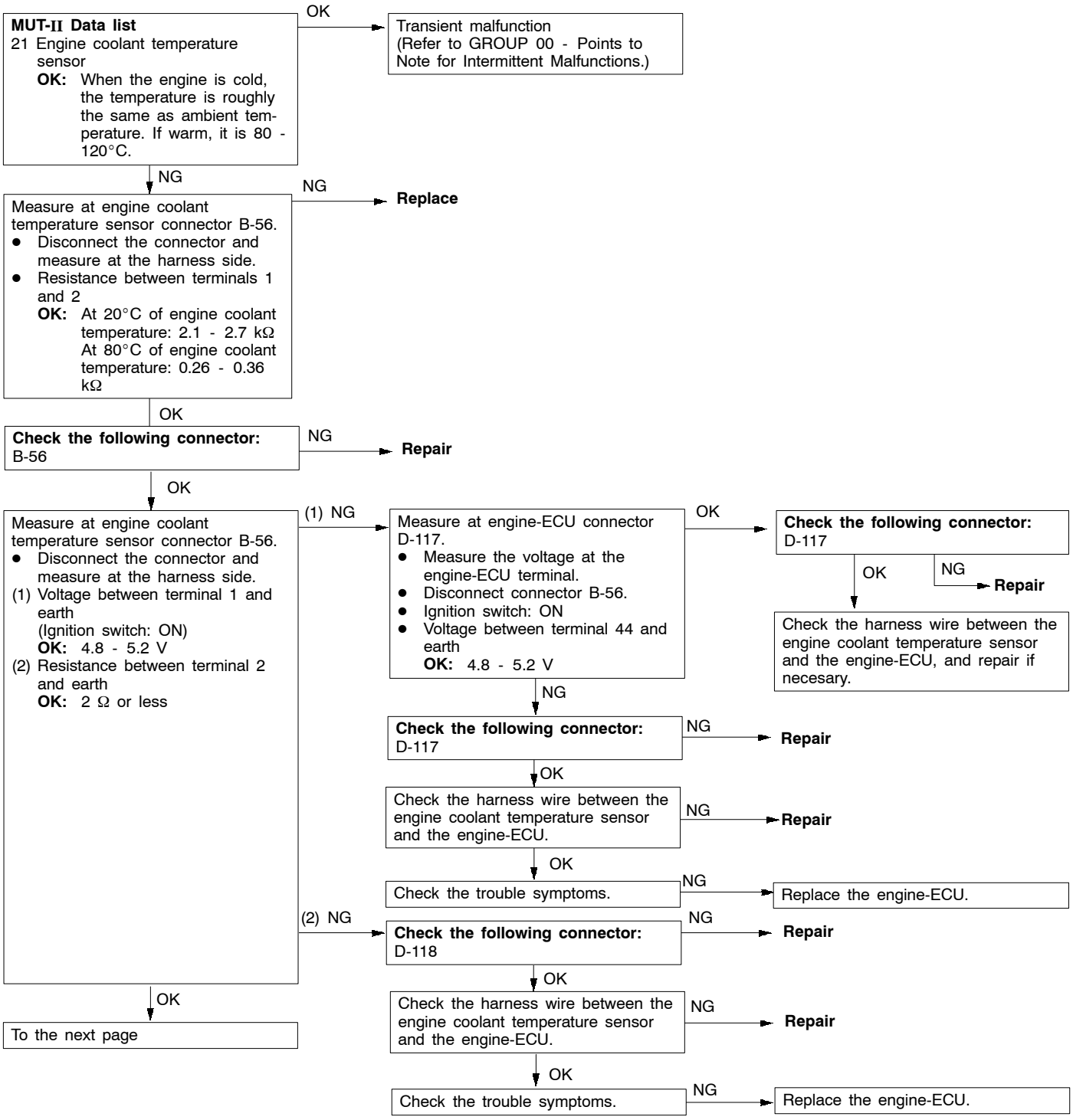

From the previous page
OK
Measure at engine-ECU connector D-117.
● Measure the voltage at the engine-ECU terminal.
● Ignition switch: ON
● Voltage between terminal 51 and earth
OK: Altitude 0 m: 3.7 - 4.3 V
Altitude 1200 m: 3.2 - 3.8 V
NG
Check the following connector: D-117
NG
Repair
OK
Check the harness between the air flow sensor and the engine-ECU, and repair if necessary.
OK
Check the following connector: D-117
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.

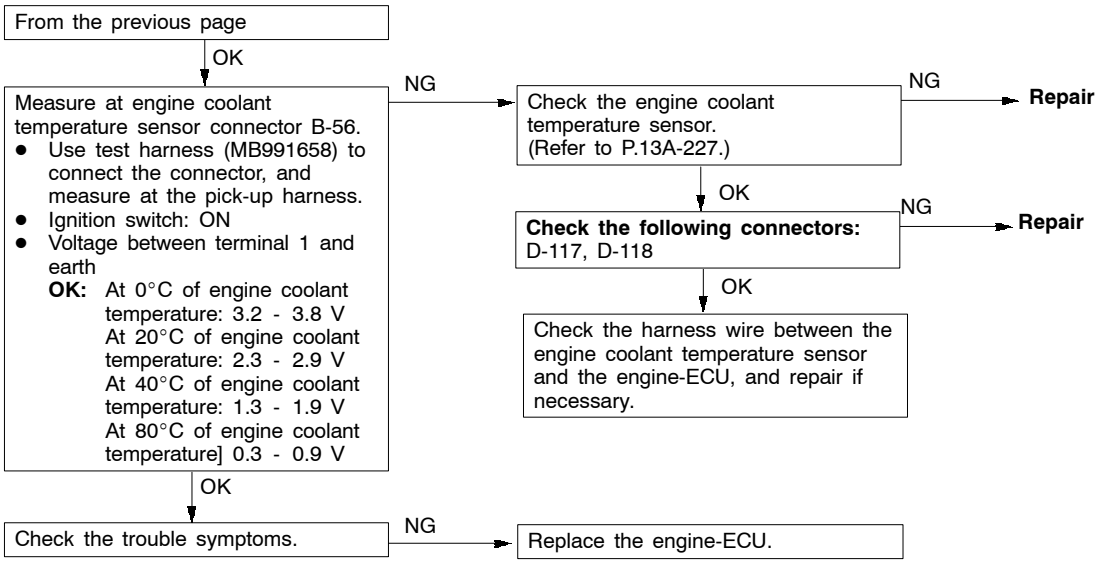
Code No.P0110 Intake air temperature sensor system	Probable cause
Range of Check ● Two seconds have passed since the ignition switch is turned ON or the engine starting process is completed. Set Conditions ● The sensor output voltage is 4.6 V or more for four seconds (equivalent to -45°C of intake air temperature) or ● The sensor output voltage is 0.2 V or more for four seconds (equivalent to 125°C of intake air temperature)	● Malfunction of intake air temperature sensor ● Open or short circuit in intake air temperature sensor or loose connector contact ● Malfunction of engine-ECU





Code No.P0115 Engine coolant temperature sensor system	Probable cause
Range of Check ● Engine: Two seconds after the engine has been started Set Conditions ● The sensor output voltage is 4.6 V or more for four seconds (equivalent to -45°C of engine coolant temperature) or ● The sensor output voltage is 0.1 V or less for four seconds (equivalent to 140°C of engine coolant temperature)	● Malfunction of engine coolant temperature sensor ● Open or short circuit in the engine coolant temperature sensor circuit or loose connector contact ● Malfunction of engine-ECU
Range of Check ● Engine: After starting Set Conditions ● The engine coolant temperature has reduced from over 40°C to less than 40°C, and that condition has lasted for five minutes or more.	


MUT-II Data list
21 Engine coolant temperature sensor
OK: When the engine is cold, the temperature is roughly the same as ambient temperature. If warm, it is 80 - 120°C.
OK
Transient malfunction (Refer to GROUP 00 - Points to Note for Intermittent Malfunctions.)
NG
Measure at engine coolant temperature sensor connector B-56.
Disconnect the connector and measure at the harness side.
Resistance between terminals 1 and 2
OK: At 20°C of engine coolant temperature: 2.1 - 2.7 kΩ
At 80°C of engine coolant temperature: 0.26 - 0.36 kΩ
NG
Replace
OK
Check the following connector: B-56
NG
Repair
OK
Measure at engine coolant temperature sensor connector B-56.
Disconnect the connector and measure at the harness side.
(1) Voltage between terminal 1 and earth (Ignition switch: ON)
OK: 4.8 - 5.2 V
(2) Resistance between terminal 2 and earth
OK: 2 Ω or less
(1) NG
Measure at engine-ECU connector D-117.
Measure the voltage at the engine-ECU terminal.
Disconnect connector B-56.
Ignition switch: ON
Voltage between terminal 44 and earth
OK: 4.8 - 5.2 V
OK
Check the following connector: D-117
OK
NG
Repair
Check the harness wire between the engine coolant temperature sensor and the engine-ECU, and repair if necesary.
NG
Check the following connector: D-117
NG
Repair
OK
Check the harness wire between the engine coolant temperature sensor and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
(2) NG
Check the following connector: D-118
NG
Repair
OK
Check the harness wire between the engine coolant temperature sensor and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
OK
To the next page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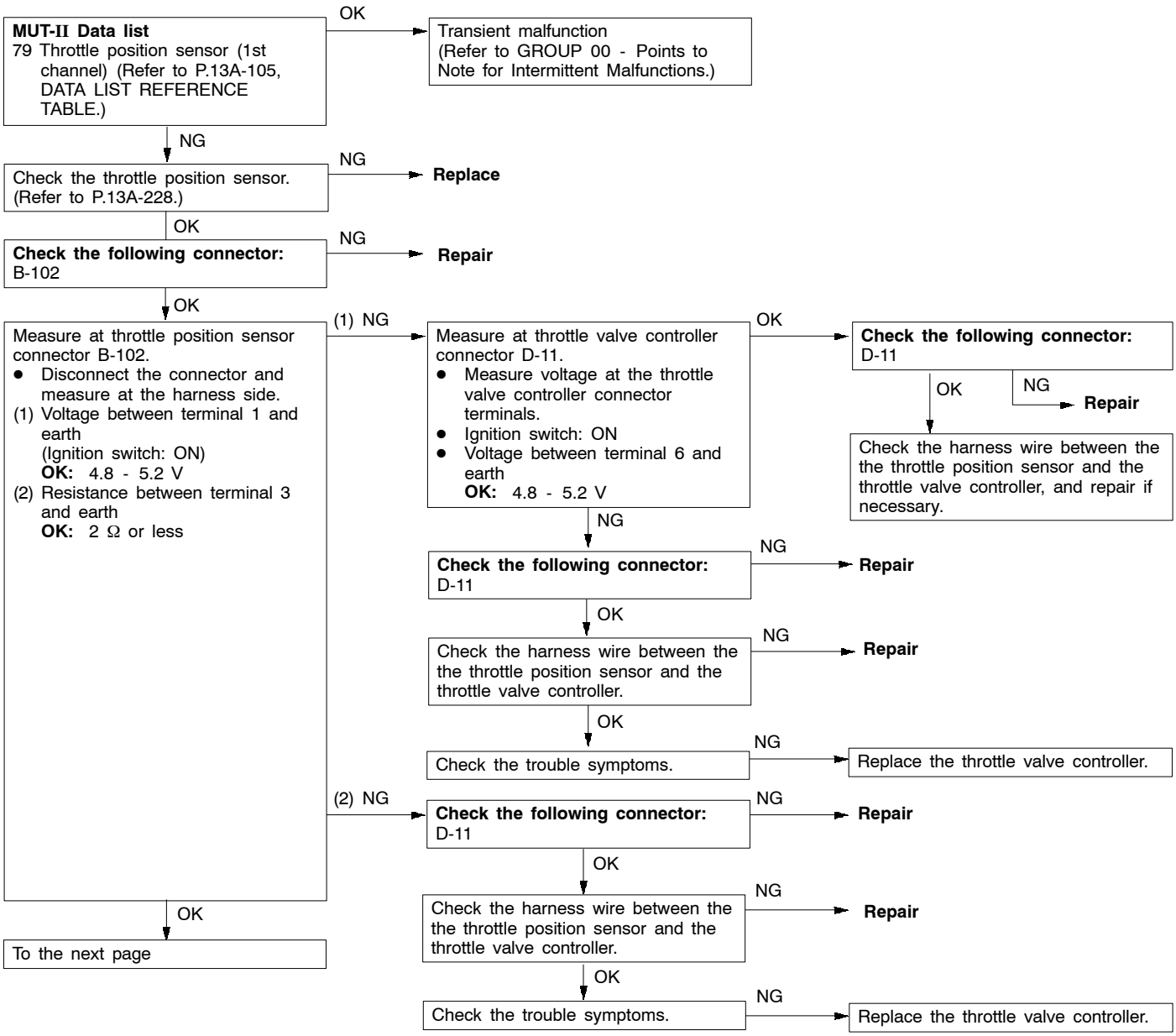
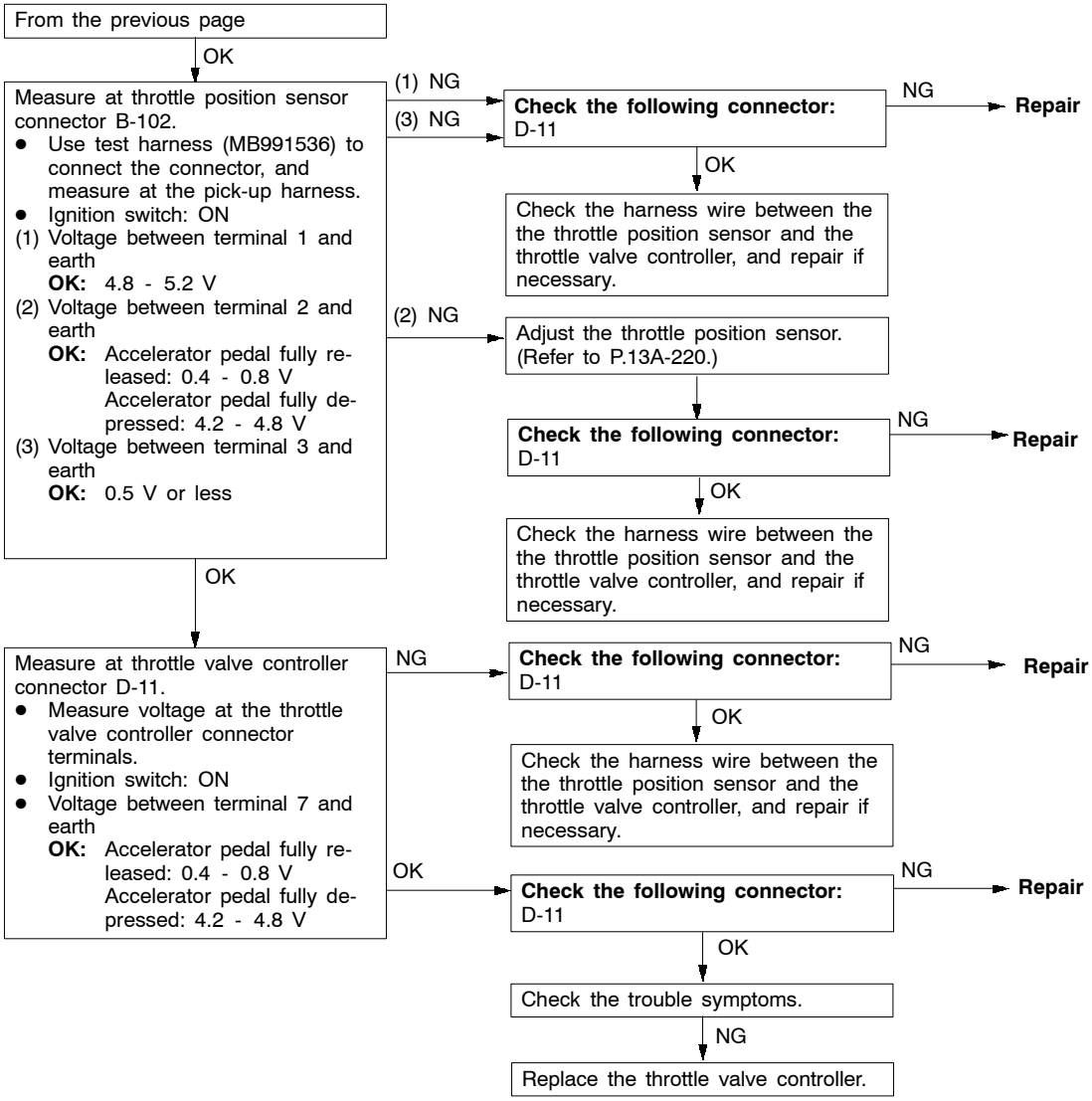
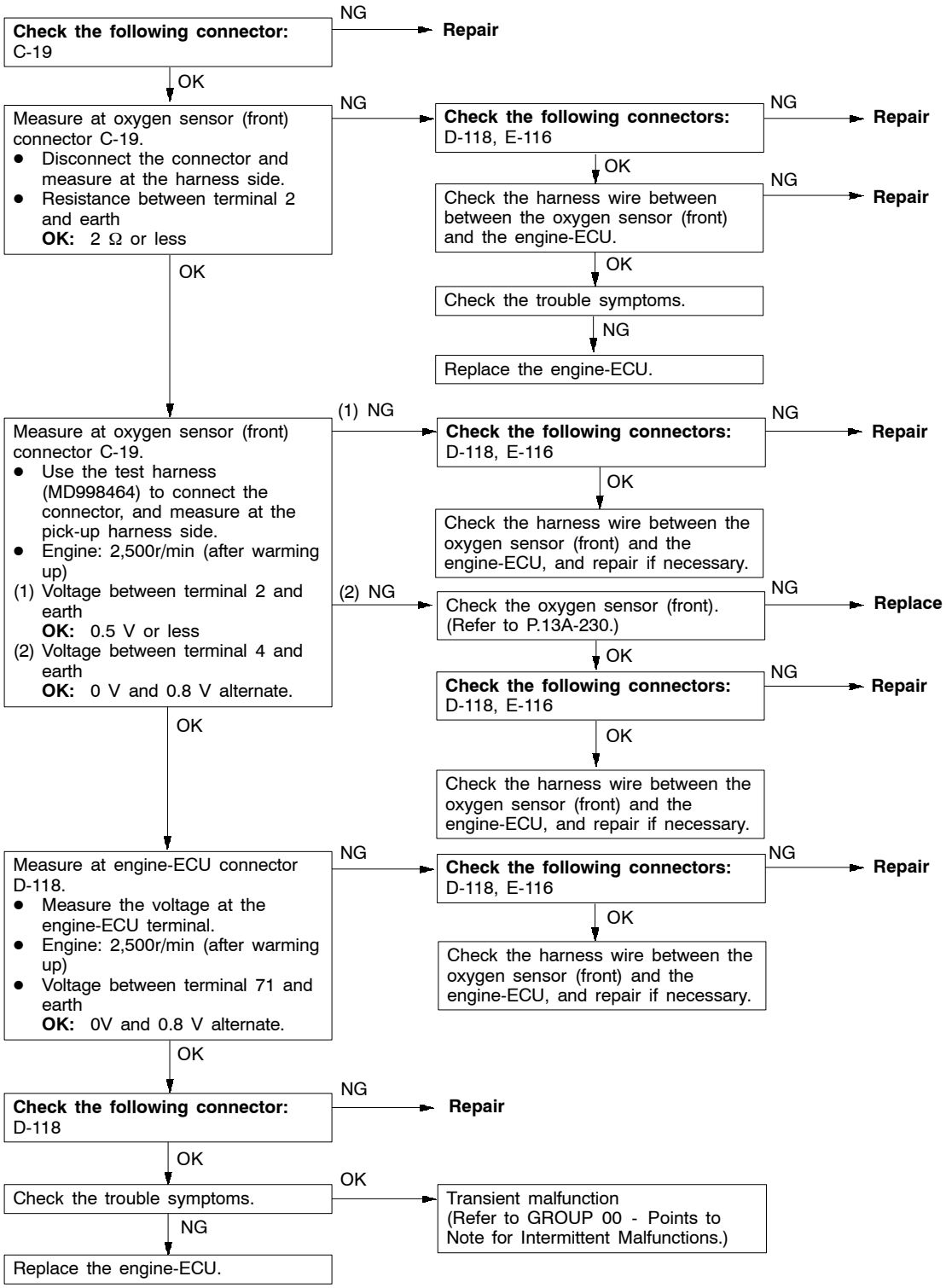
OK
Measure at engine coolant temperature sensor connector B-56.
● Use test harness (MB991658) to connect the connector, and measure at the pick-up harness.
● Ignition switch: ON
● Voltage between terminal 1 and earth
OK: At 0°C of engine coolant temperature: 3.2 - 3.8 V
At 20°C of engine coolant temperature: 2.3 - 2.9 V
At 40°C of engine coolant temperature: 1.3 - 1.9 V
At 80°C of engine coolant temperature] 0.3 - 0.9 V
NG
Check the engine coolant temperature sensor. (Refer to P.13A-227.)
NG
Repair
OK
Check the following connectors: D-117, D-118
NG
Repair
OK
Check the harness wire between the engine coolant temperature sensor and the engine-ECU, and repair if necessary.
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.

Code No.P0120 Throttle position sensor (1st channel) system	Probable cause
The throttle valve controller judges a malfunction, and then transmit the result to the engine-ECU. Range of Check ● Ignition switch: ON Set Conditions ● The sensor output voltage is 0.2 V or less. or ● The sensor output voltage is 4.85 V or more and the throttle position sensor (2nd channel) output voltage is 2.5V or more. or ● The throttle position sensor (1st channel) and throttle position sensor (2nd channel) combination output voltage is outside 4 - 6 V. or ● The opening angle of throttle position sensor (1st channel) is different from its target by 1 V or more. or ● The throttle position sensor (1st channel) output changes within 25 mV when the throttle control servo moves one step.	● Malfunction of throttle position sensor ● Open or short circuit in the throttle position sensor (1st channel) circuit or loose connector contact ● Malfunction of throttle valve controller ● Malfunction of engine-ECU

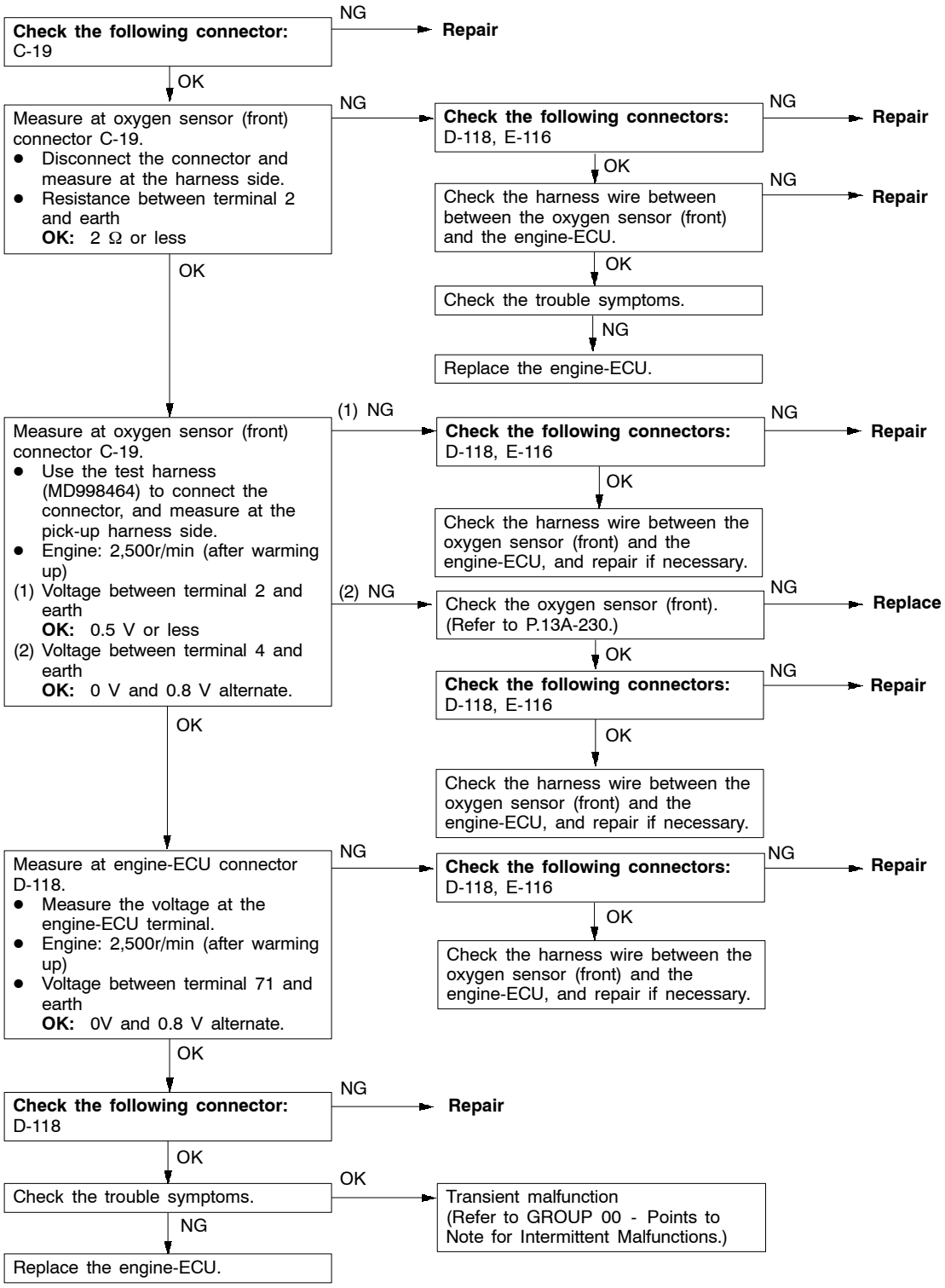



From the previous page
OK
Measure at throttle position sensor connector B-102.
● Use test harness (MB991536) to connect the connector, and measure at the pick-up harness.
● Ignition switch: ON
(1) Voltage between terminal 1 and earth
OK: 4.8 - 5.2 V
(2) Voltage between terminal 2 and earth
OK: Accelerator pedal fully released: 0.4 - 0.8 V
Accelerator pedal fully depressed: 4.2 - 4.8 V
(3) Voltage between terminal 3 and earth
OK: 0.5 V or less
(1) NG
(3) NG
Check the following connector: D-11
NG
Repair
OK
Check the harness wire between the the throttle position sensor and the throttle valve controller, and repair if necessary.
(2) NG
Adjust the throttle position sensor. (Refer to P.13A-220.)
Check the following connector: D-11
NG
Repair
OK
Check the harness wire between the the throttle position sensor and the throttle valve controller, and repair if necessary.
OK
Measure at throttle valve controller connector D-11.
● Measure voltage at the throttle valve controller connector terminals.
● Ignition switch: ON
● Voltage between terminal 7 and earth
OK: Accelerator pedal fully released: 0.4 - 0.8 V
Accelerator pedal fully depressed: 4.2 - 4.8 V
NG
Check the following connector: D-11
NG
Repair
OK
Check the harness wire between the the throttle position sensor and the throttle valve controller, and repair if necessary.
OK
Check the following connector: D-11
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the throttle valve controller.

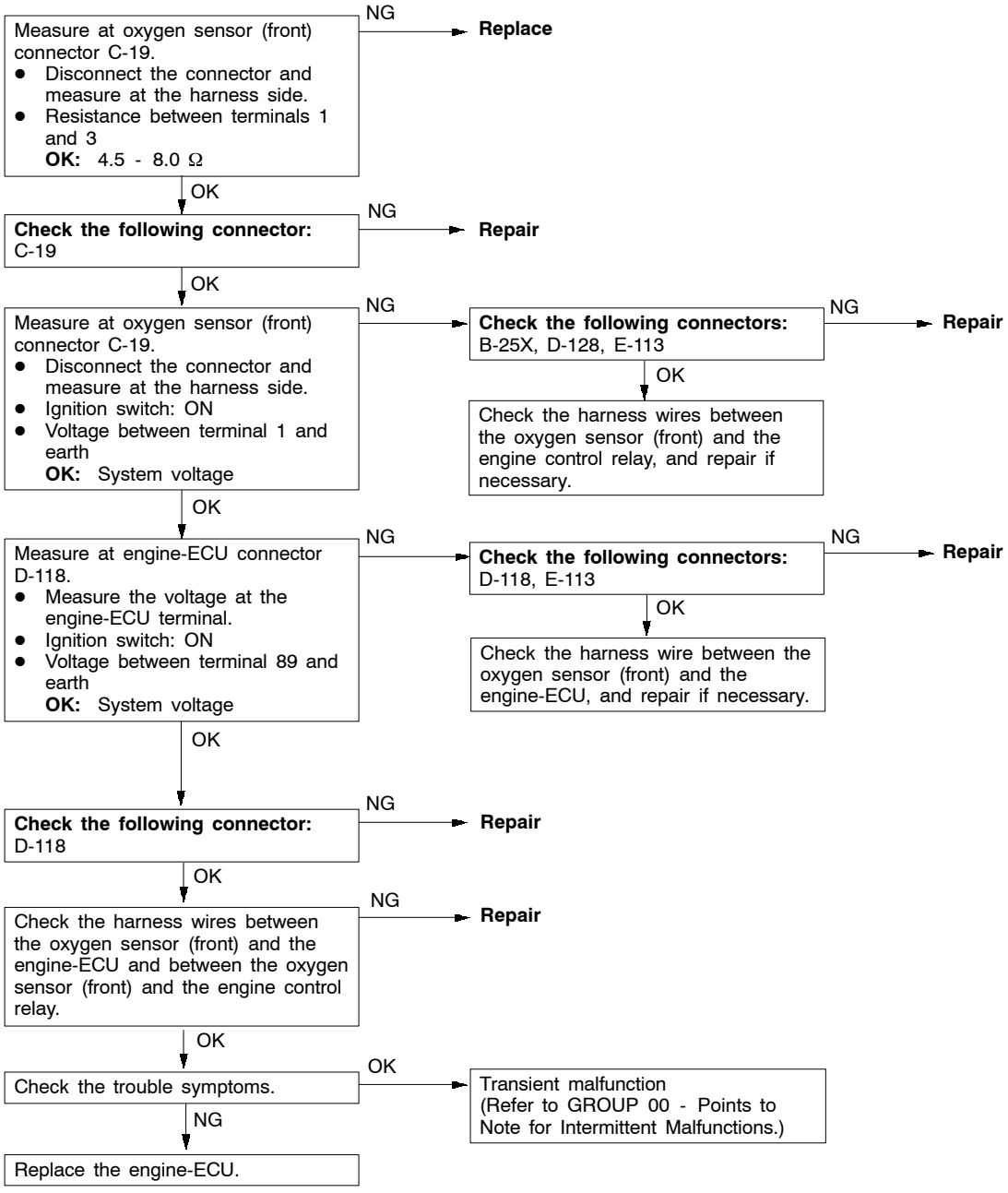
Code No.P0125 Feedback system	Probable cause
Range of Check ● The engine coolant temperature is approx. 80°C or more. ● During stoichiometric feedback control ● The vechile is not being deccelerated. Set Conditions ● Oxygen sensor (front) output voltage has been higher or lower than 0.5 V for at least thirty seconds.	● Malfunction of oxygen sensor (front) ● Open or short circuit in the oxygen sensor (front) circuit or loose connector contact ● Malfunction of engine-ECU



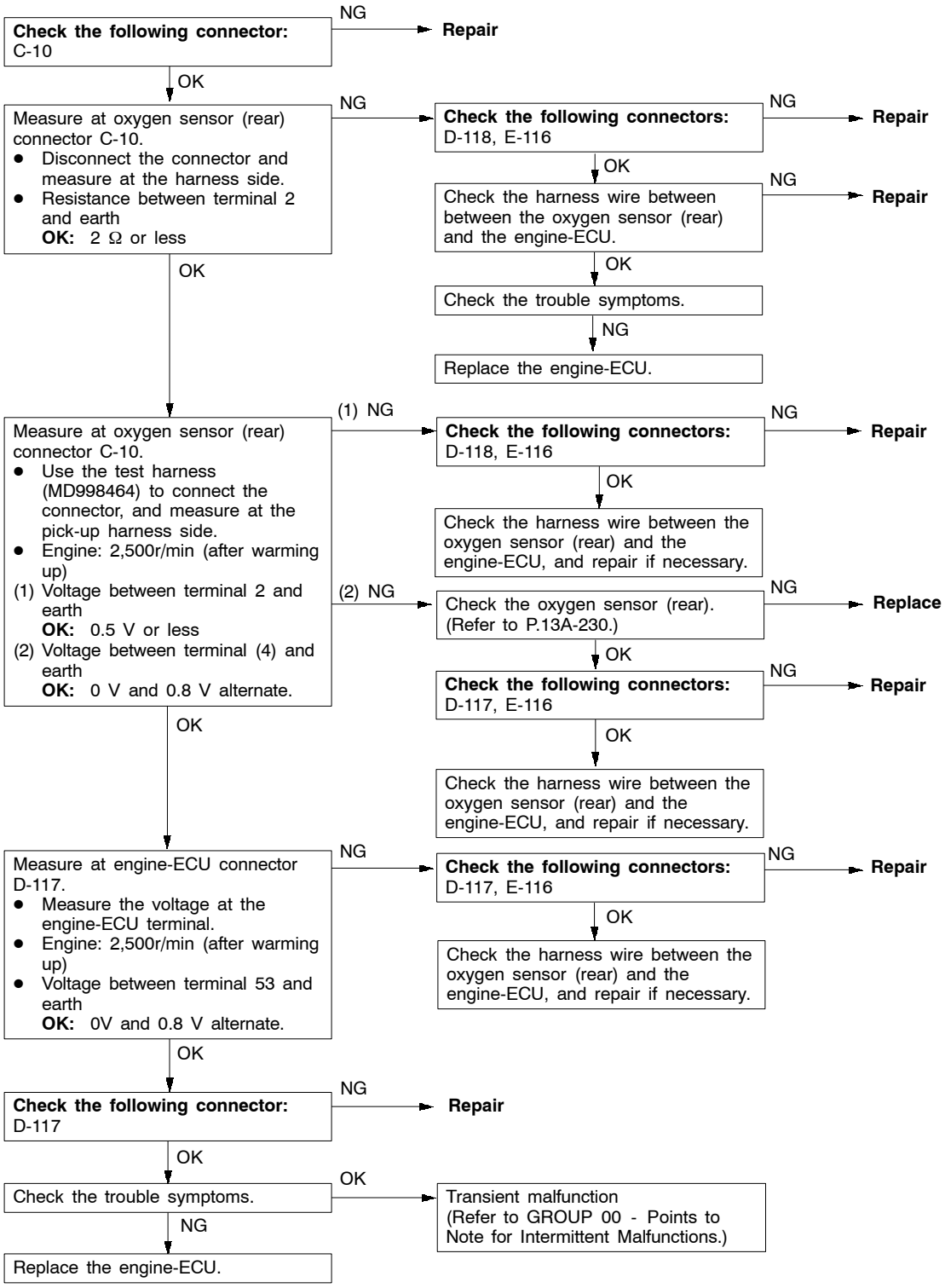
Code No.P0130 Oxygen sensor (front) system <sensor 1>	Probable cause
Range of Check ● Three minutes have been passed since the engine has been started. ● The engine coolant temperature is approx. 80°C or more. ● Intake air temperature is 20 - 50°C ● Engine speed is 1,200 r/min or more ● Driving on a level surface at constant speed. Set Conditions ● The oxygen sensor (front) output voltage is 4.5 V or more when the sensor output voltage is 0.2 V or less and a voltage of 5 V is applied to the oxygen sensor (front) inside the engine-ECU.	● Malfunction of oxygen sensor (front) ● Open or short circuit in the oxygen sensor (front) circuit or loose connector contact ● Malfunction of engine-ECU
Range of Check ● Engine speed is 3,000 r/min or less ● During driving ● During air/fuel ratio feedback control Set Conditions ● The oxygen sensor (front) output frequency is five or less per 12 seconds on average.	


Check the following connector: C-19
NG
Repair
OK
Measure at oxygen sensor (front) connector C-19.
● Disconnect the connector and measure at the harness side.
● Resistance between terminal 2 and earth
OK: 2 Ω or less
NG
Check the following connectors: D-118, E-116
NG
Repair
OK
Check the harness wire between between the oxygen sensor (front) and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
OK
Measure at oxygen sensor (front) connector C-19.
● Use the test harness (MD998464) to connect the connector, and measure at the pick-up harness side.
● Engine: 2,500r/min (after warming up)
(1) Voltage between terminal 2 and earth
OK: 0.5 V or less
(2) Voltage between terminal 4 and earth
OK: 0 V and 0.8 V alternate.
(1) NG
Check the following connectors: D-118, E-116
NG
Repair
OK
Check the harness wire between the oxygen sensor (front) and the engine-ECU, and repair if necessary.
(2) NG
Check the oxygen sensor (front). (Refer to P.13A-230.)
NG
Replace
OK
Check the following connectors: D-118, E-116
NG
Repair
OK
Check the harness wire between the oxygen sensor (front) and the engine-ECU, and repair if necessary.
OK
Measure at engine-ECU connector D-118.
● Measure the voltage at the engine-ECU terminal.
● Engine: 2,500r/min (after warming up)
● Voltage between terminal 71 and earth
OK: 0V and 0.8 V alternate.
NG
Check the following connectors: D-118, E-116
NG
Repair
OK
Check the harness wire between the oxygen sensor (front) and the engine-ECU, and repair if necessary.
OK
Check the following connector: D-118
NG
Repair
OK
Check the trouble symptoms.
OK
Transient malfunction (Refer to GROUP 00 - Points to Note for Intermittent Malfunctions.)
NG
Replace the engine-ECU.

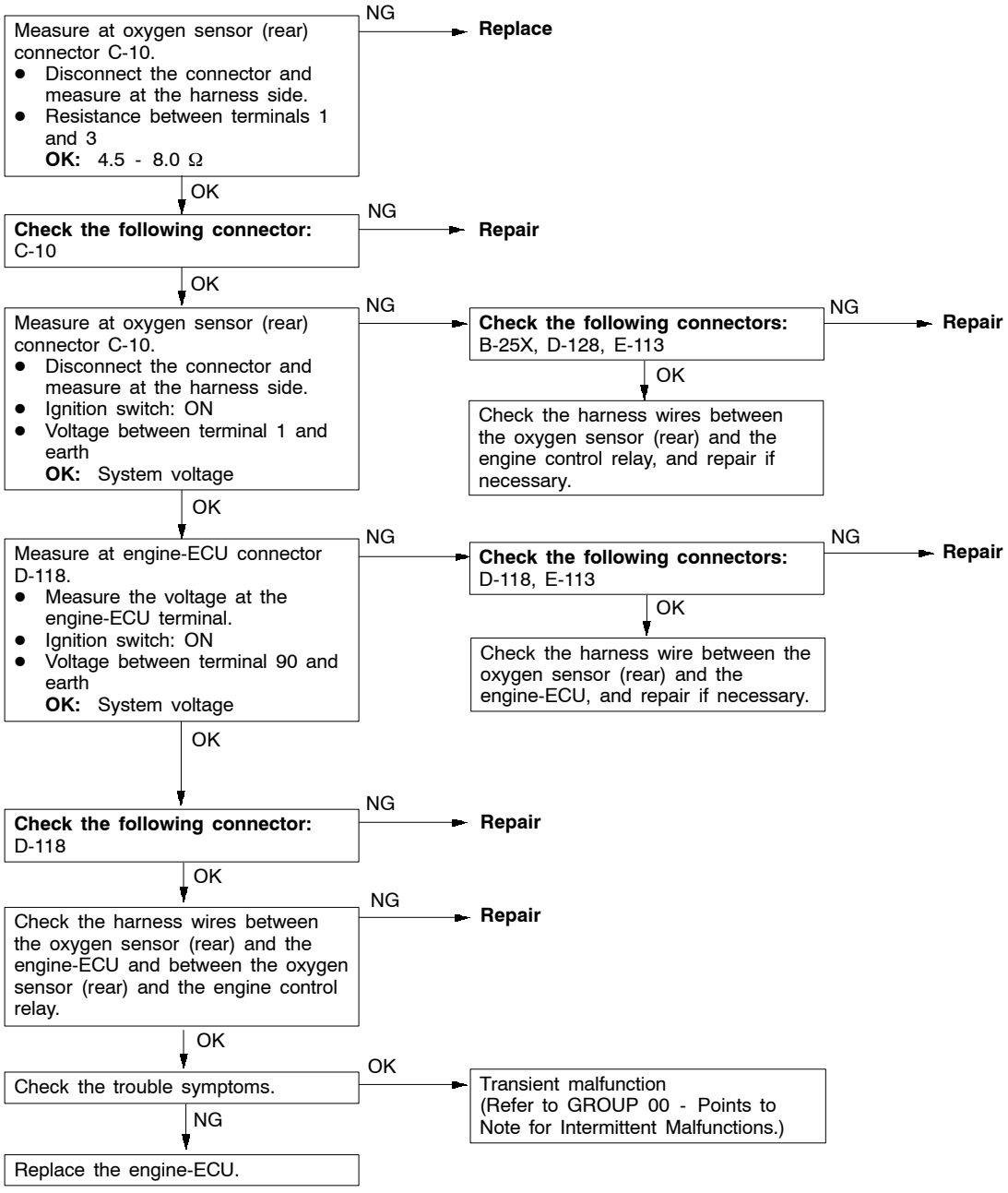
Code No.P0135 Oxygen sensor heater (front) system <sensor 1>	Probable cause
Range of Check ● The engine coolant temperature is approx. 20°C or more. ● The oxygen sensor heater (front) remains on. ● The engine speed is 50 r/min or more. ● Battery voltage is 11 - 16 V. Set Conditions ● The current, which flows through the oxygen sensor heater (front), is 0.2 A or less or 3.5 A or more for six seconds.	● Malfunction of oxygen sensor heater (front) ● Open or short circuit in the oxygen sensor heater (front) circuit or loose connector contact ● Malfunction of engine-ECU



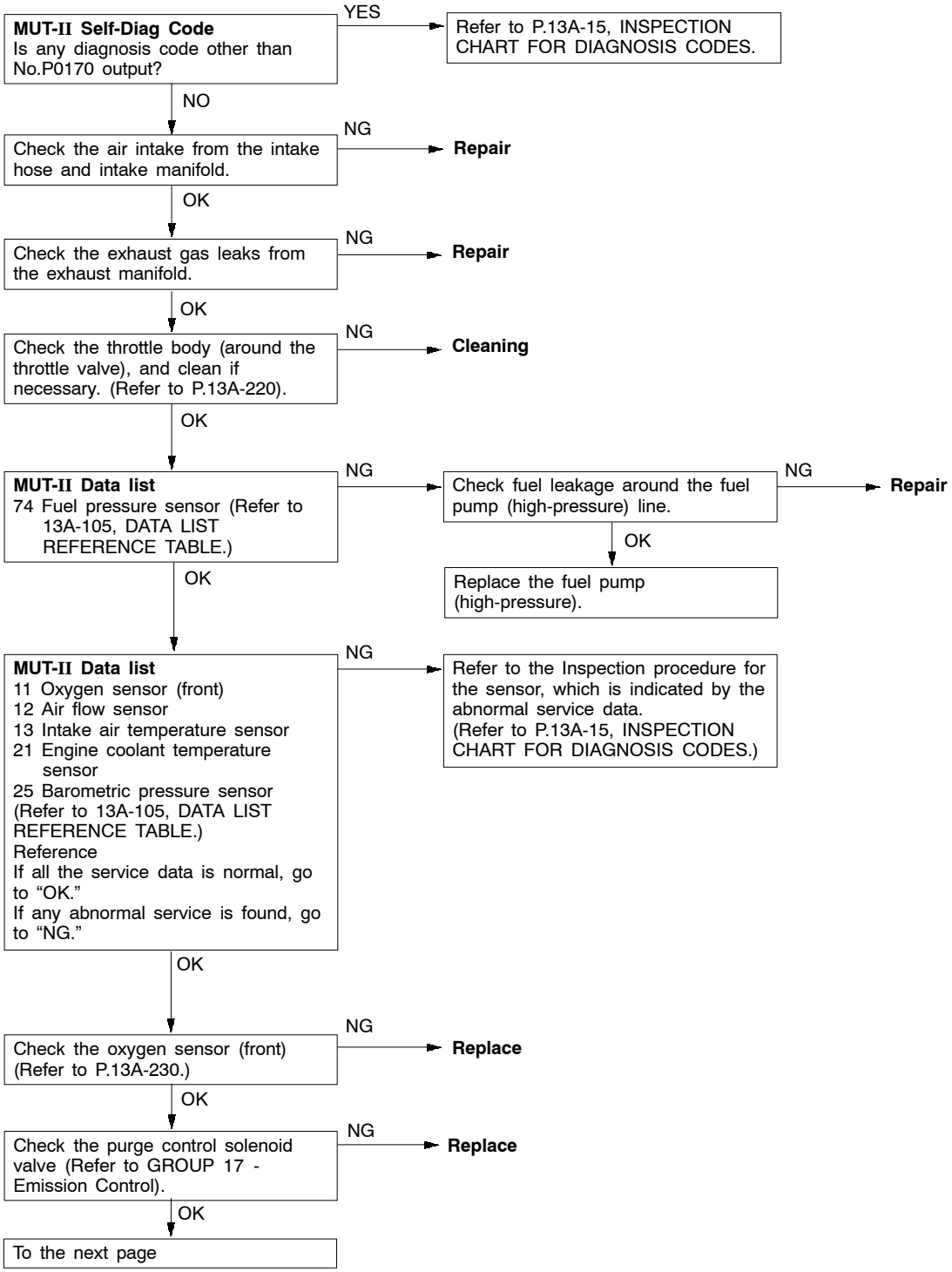
Code No.P0136 Oxygen sensor (rear) system <sensor 2>	Probable cause
Range of Check ● Three minutes have been passed since the engine has been started. ● The engine coolant temperature is approx. 80°C or more. ● Intake air temperature is 20 - 50°C ● Engine speed is 1,200 r/min or more ● Driving on a level surface at constant speed. Set Conditions ● The oxygen sensor (rear) output voltage is 4.5 V or more when the sensor output voltage is 0.2 V or less and a voltage of 5 V is applied to the oxygen sensor (rear) inside the engine-ECU.	● Malfunction of oxygen sensor (rear) ● Open or short circuit in the oxygen sensor (rear) circuit or loose connector contact ● Malfunction of engine-ECU
Range of Check ● Two seconds have passed after the ECU detected an open circuit. ● When the oxygen sensor (front) is in good condition. Set Conditions ● When the air/fuel ratio is rich, the oxygen sensor (front) output voltage is 0.5 V or more, the oxygen sensor (rear) output voltage is less than 0.1 V, and the oxygen sensor (rear) output voltage fluctuates within 0.078 V.	

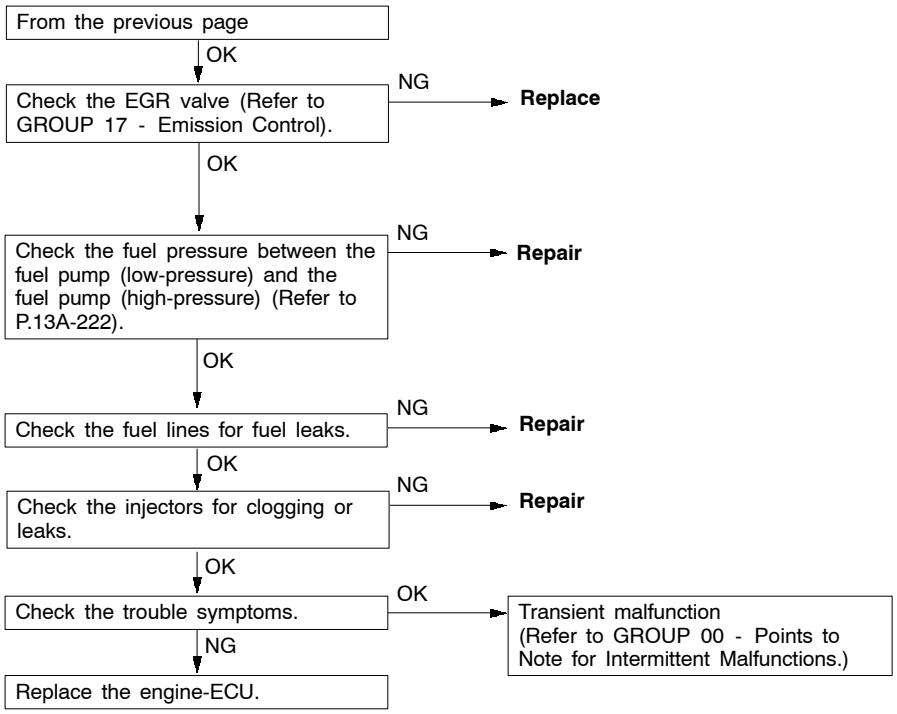

Check the following connector: C-10
NG
Repair
OK
Measure at oxygen sensor (rear) connector C-10.
● Disconnect the connector and measure at the harness side.
● Resistance between terminal 2 and earth
OK: 2 Ω or less
NG
Check the following connectors: D-118, E-116
NG
Repair
OK
Check the harness wire between between the oxygen sensor (rear) and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
OK
Measure at oxygen sensor (rear) connector C-10.
● Use the test harness (MD998464) to connect the connector, and measure at the pick-up harness side.
● Engine: 2,500r/min (after warming up)
(1) Voltage between terminal 2 and earth
OK: 0.5 V or less
(2) Voltage between terminal (4) and earth
OK: 0 V and 0.8 V alternate.
(1) NG
Check the following connectors: D-118, E-116
NG
Repair
OK
Check the harness wire between the oxygen sensor (rear) and the engine-ECU, and repair if necessary.
(2) NG
Check the oxygen sensor (rear). (Refer to P.13A-230.)
NG
Replace
OK
Check the following connectors: D-117, E-116
NG
Repair
OK
Check the harness wire between the oxygen sensor (rear) and the engine-ECU, and repair if necessary.
OK
Measure at engine-ECU connector D-117.
● Measure the voltage at the engine-ECU terminal.
● Engine: 2,500r/min (after warming up)
● Voltage between terminal 53 and earth
OK: 0V and 0.8 V alternate.
NG
Check the following connectors: D-117, E-116
NG
Repair
OK
Check the harness wire between the oxygen sensor (rear) and the engine-ECU, and repair if necessary.
OK
Check the following connector: D-117
NG
Repair
OK
Check the trouble symptoms.
OK
Transient malfunction (Refer to GROUP 00 - Points to Note for Intermittent Malfunctions.)
NG
Replace the engine-ECU.

Code No.P0141 Oxygen sensor heater (rear) system <sensor 2>	Probable cause
Range of Check ● The engine coolant temperature is approx. 20°C or more. ● The oxygen sensor heater (rear) remains on. ● The engine speed is 50 r/min or more. ● Battery voltage is 11 - 16 V. Set Conditions ● The current, which flows through the oxygen sensor heater (rear), is 0.2 A or less or 3.5 A or more for six seconds.	● Malfunction of oxygen sensor heater (rear) ● Open or short circuit in the oxygen sensor heater (rear) circuit or loose connector contact ● Malfunction of engine-ECU



Code No.P0170 Abnormal fuel system	Probable cause
Range of Check • Engine: Being learning the air-fuel ratio Set Conditions • Ten seconds or more have been passed while the fuel injection amount compensation value is too low. or • Ten seconds or more have been passed while the fuel injection amount compensation value is too high.	• Malfunction of fuel supply system • Malfunction of oxygen sensor (front) • Malfunction of intake air temperature sensor • Malfunction of barometric pressure sensor • Malfunction of air flow sensor • Malfunction of engine-ECU

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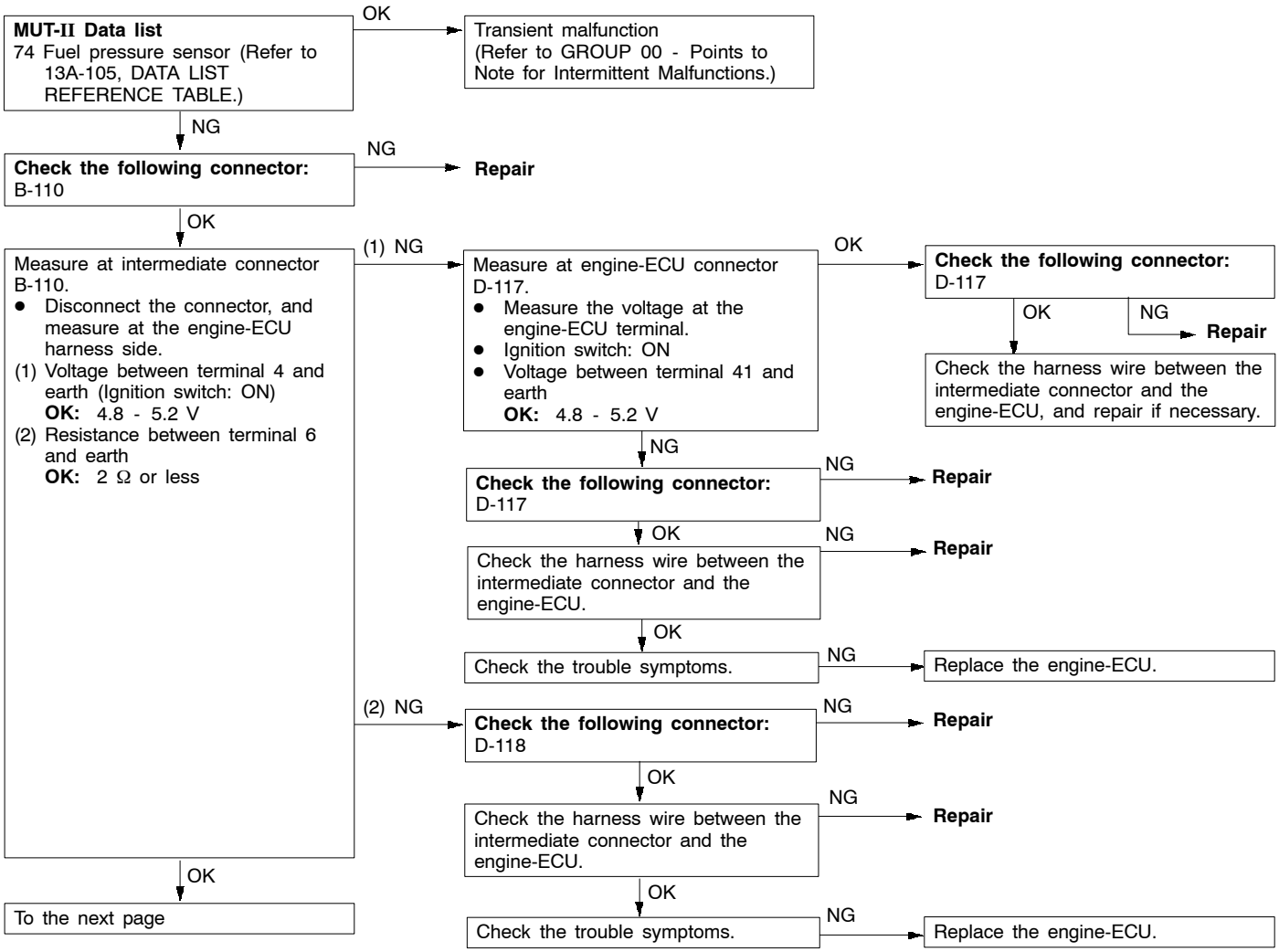
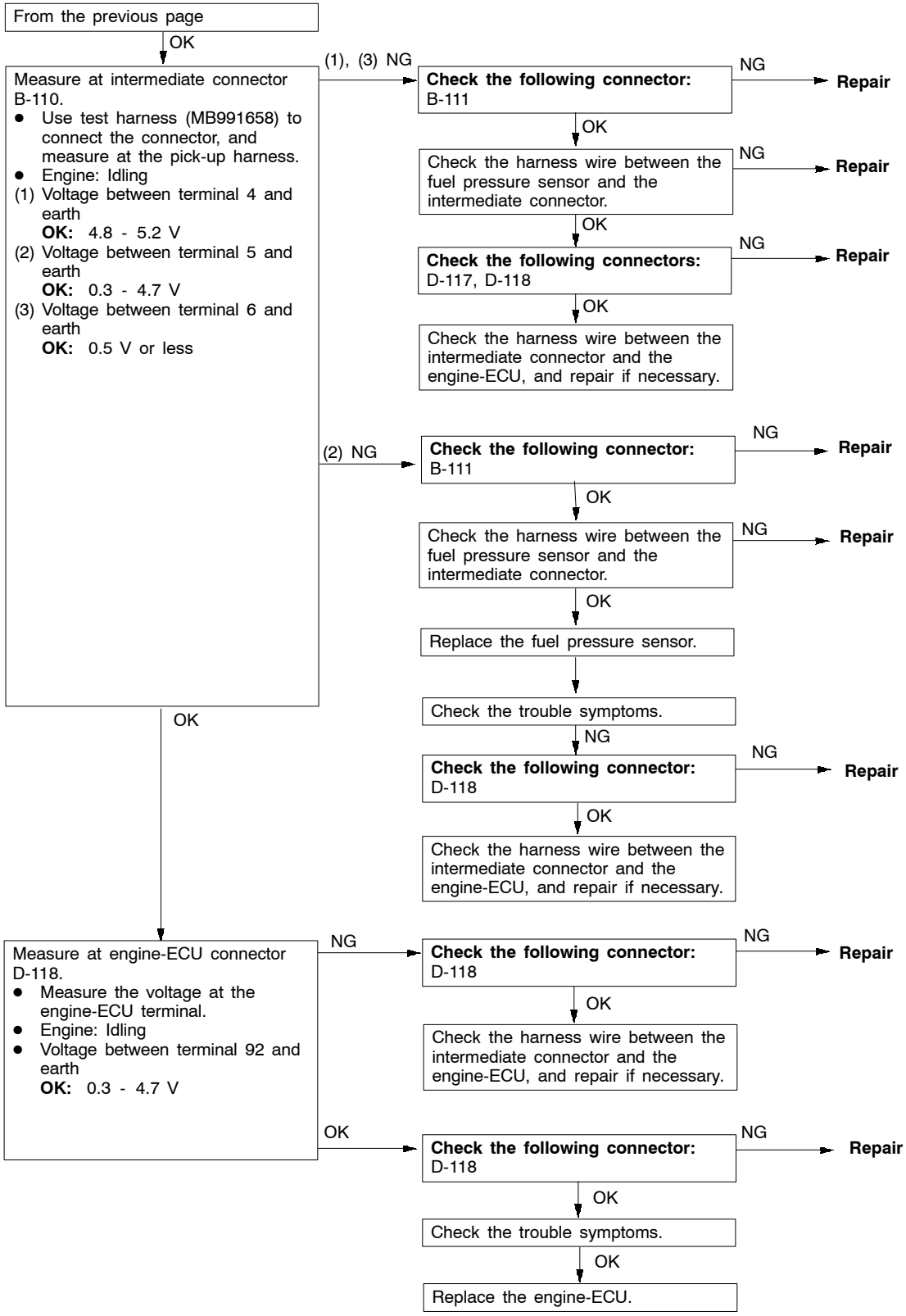
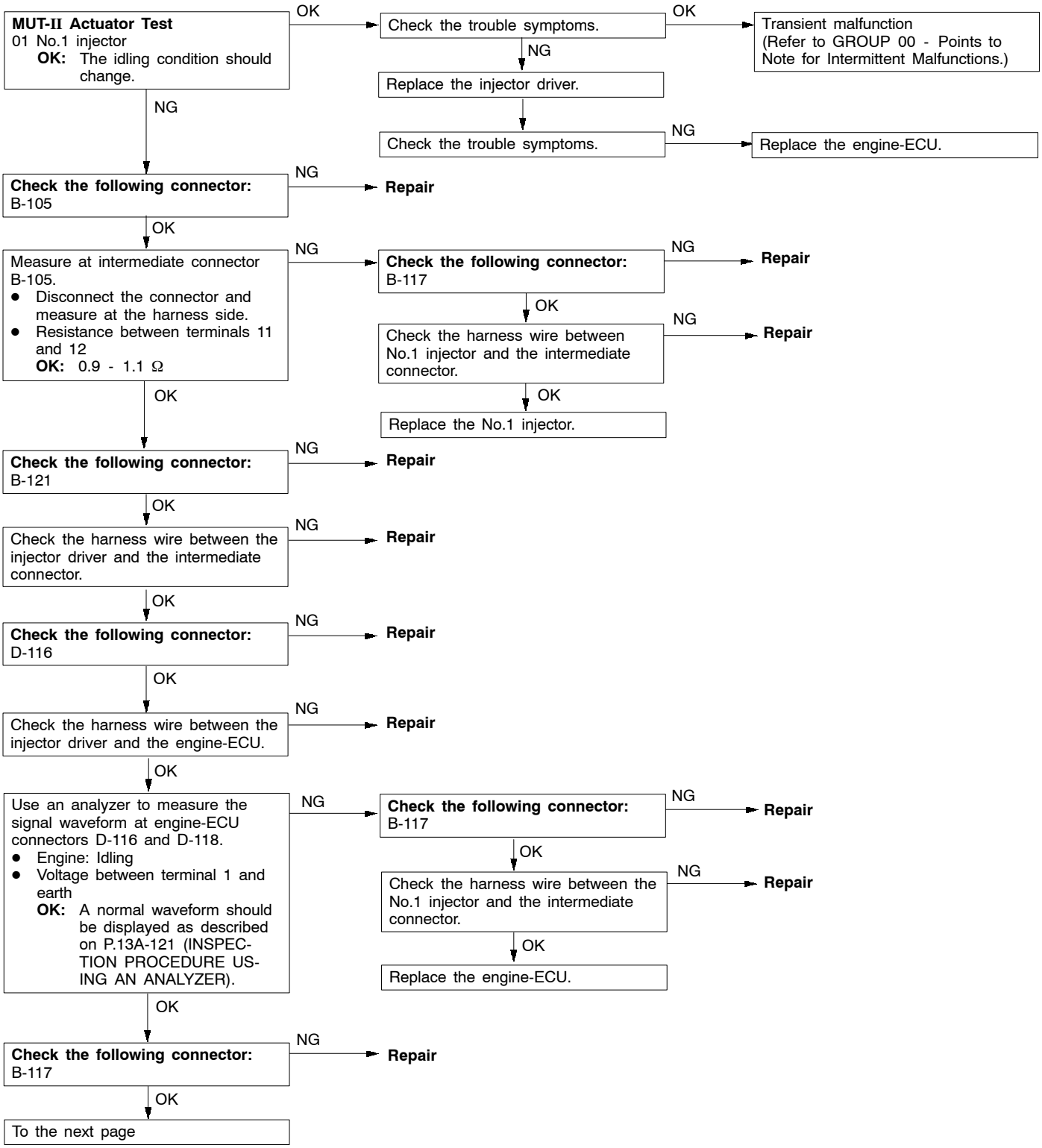
OK
Check the EGR valve (Refer to GROUP 17 - Emission Control).
NG
Replace
OK
Check the fuel pressure between the fuel pump (low-pressure) and the fuel pump (high-pressure) (Refer to P.13A-222).
NG
Repair
OK
Check the fuel lines for fuel leaks.
NG
Repair
OK
Check the injectors for clogging or leaks.
NG
Repair
OK
Check the trouble symptoms.
OK
Transient malfunction (Refer to GROUP 00 - Points to Note for Intermittent Malfunctions.)
NG
Replace the engine-ECU.

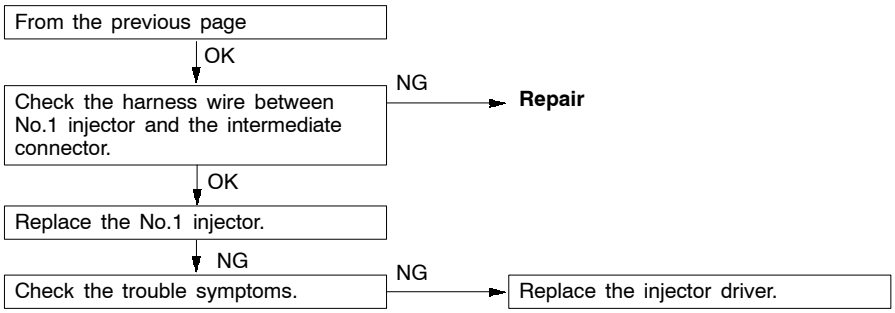
Code No.P0190 Abnormal fuel pressure	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● The sensor output voltage is 4.8V or more, or 0.2 V or less for four seconds.	● Malfunction of of fuel pressure sensor ● Open or short circuit in the fuel pressure sensor circuit or loose connector contact ● Malfunction of engine-ECU
Range of Check ● The following conditions are detected temporarily after the engine has been started. (1) Engine speed: 1,000 r/min or more (2) Fuel pressure: 2 MPa or more ● Engine running Set Conditions ● The fuel pressure is 6.9 MPa or more, or 2 MPa or less for four seconds.	● Malfunction of high-pressure fuel pump ● Clogging of high-pressure fuel lines
This diagnosis code will also be output when air is trapped into the high-pressure fuel lines (such as poor fuel level). In that case, the air can be evacuated by operating the engine for at least 15 seconds at 2,000 r/min. After the repair, use the MUT-II to erase the diagnosis code.	● Air trapped due to poor fuel level




From the previous page
OK
Measure at intermediate connector B-110.
● Use test harness (MB991658) to connect the connector, and measure at the pick-up harness.
● Engine: Idling
(1) Voltage between terminal 4 and earth
OK: 4.8 - 5.2 V
(2) Voltage between terminal 5 and earth
OK: 0.3 - 4.7 V
(3) Voltage between terminal 6 and earth
OK: 0.5 V or less
(1), (3) NG
Check the following connector: B-111
NG
Repair
OK
Check the harness wire between the fuel pressure sensor and the intermediate connector.
NG
Repair
OK
Check the following connectors: D-117, D-118
NG
Repair
OK
Check the harness wire between the intermediate connector and the engine-ECU, and repair if necessary.
(2) NG
Check the following connector: B-111
NG
Repair
OK
Check the harness wire between the fuel pressure sensor and the intermediate connector.
NG
Repair
OK
Replace the fuel pressure sensor.
Check the trouble symptoms.
NG
Check the following connector: D-118
NG
Repair
OK
Check the harness wire between the intermediate connector and the engine-ECU, and repair if necessary.
OK
Measure at engine-ECU connector D-118.
● Measure the voltage at the engine-ECU terminal.
● Engine: Idling
● Voltage between terminal 92 and earth
OK: 0.3 - 4.7 V
NG
Check the following connector: D-118
NG
Repair
OK
Check the harness wire between the intermediate connector and the engine-ECU, and repair if necessary.
OK
Check the following connector: D-118
NG
Repair
OK
Check the trouble symptoms.
OK
Replace the engine-ECU.

Code No.P0201 No.1 injector system	Probable cause
Range of Check ● The engine speed is 4,000 r/min or less. ● The battery voltage is 10 V or more. ● The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. Set Conditions ● The injector driver is not transmitting a injector open circuit check signal for four seconds.	● Malfunction of No.1 injector ● Open or short circuit in the No.1 injector circuit or loose connector contact ● Malfunction of engine-ECU

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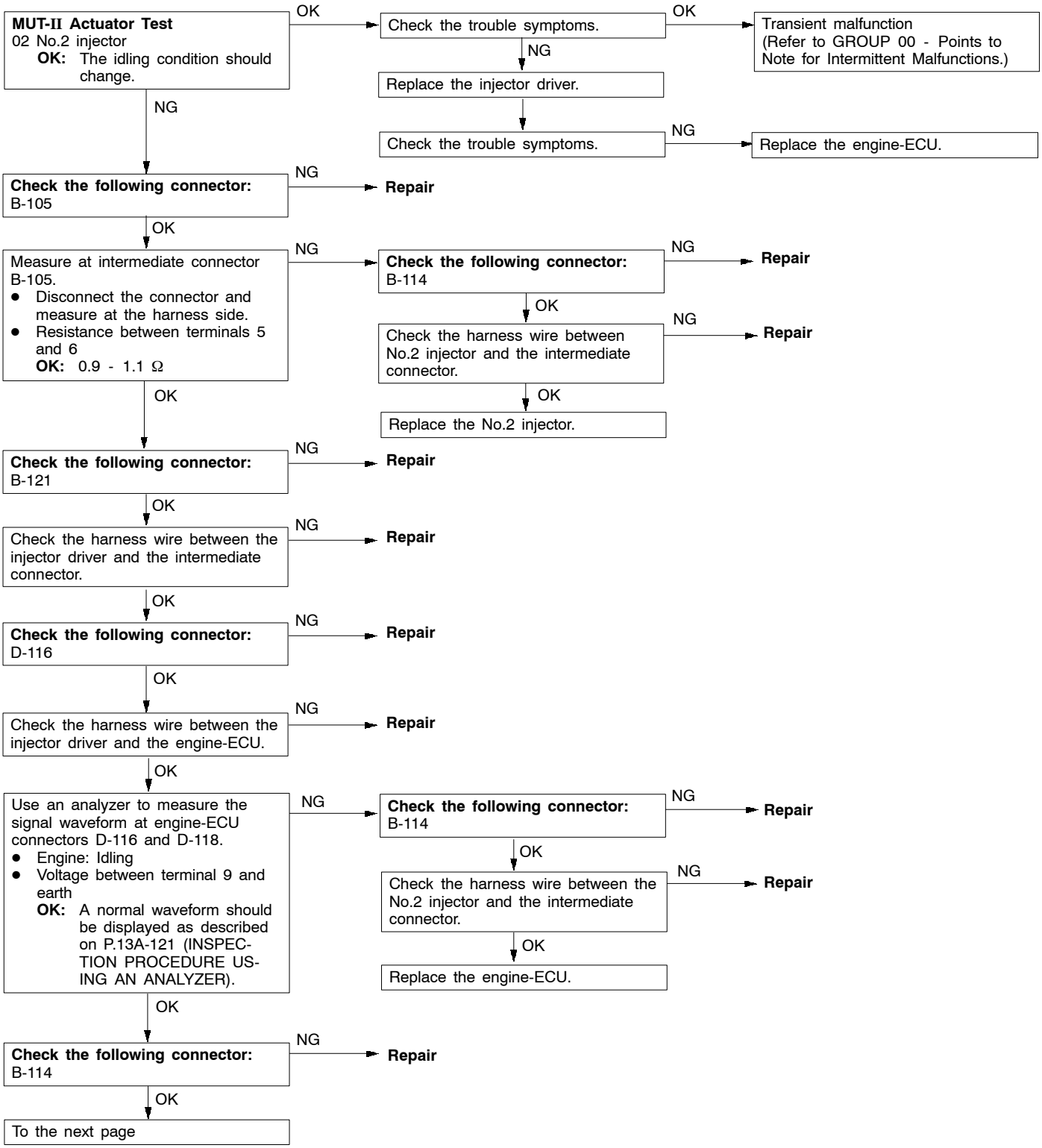
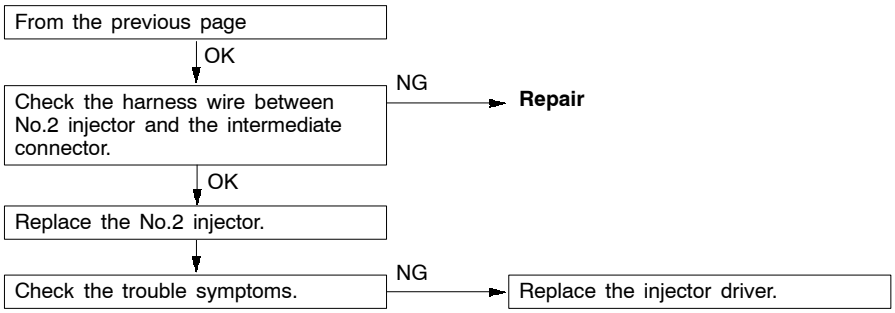
OK
Check the harness wire between No.1 injector and the intermediate connector.
NG
Repair
OK
Replace the No.1 injector.
NG
Check the trouble symptoms.
NG
Replace the injector driver.

Code No.P0202 No.2 injector system	Probable cause
Range of Check ● The engine speed is 4,000 r/min or less. ● The battery voltage is 10 V or more. ● The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. Set Conditions ● The injector driver is not transmitting a injector open circuit check signal for four seconds.	● Malfunction of No.2 injector ● Open or short circuit in the No.2 injector circuit or loose connector contact ● Malfunction of engine-ECU

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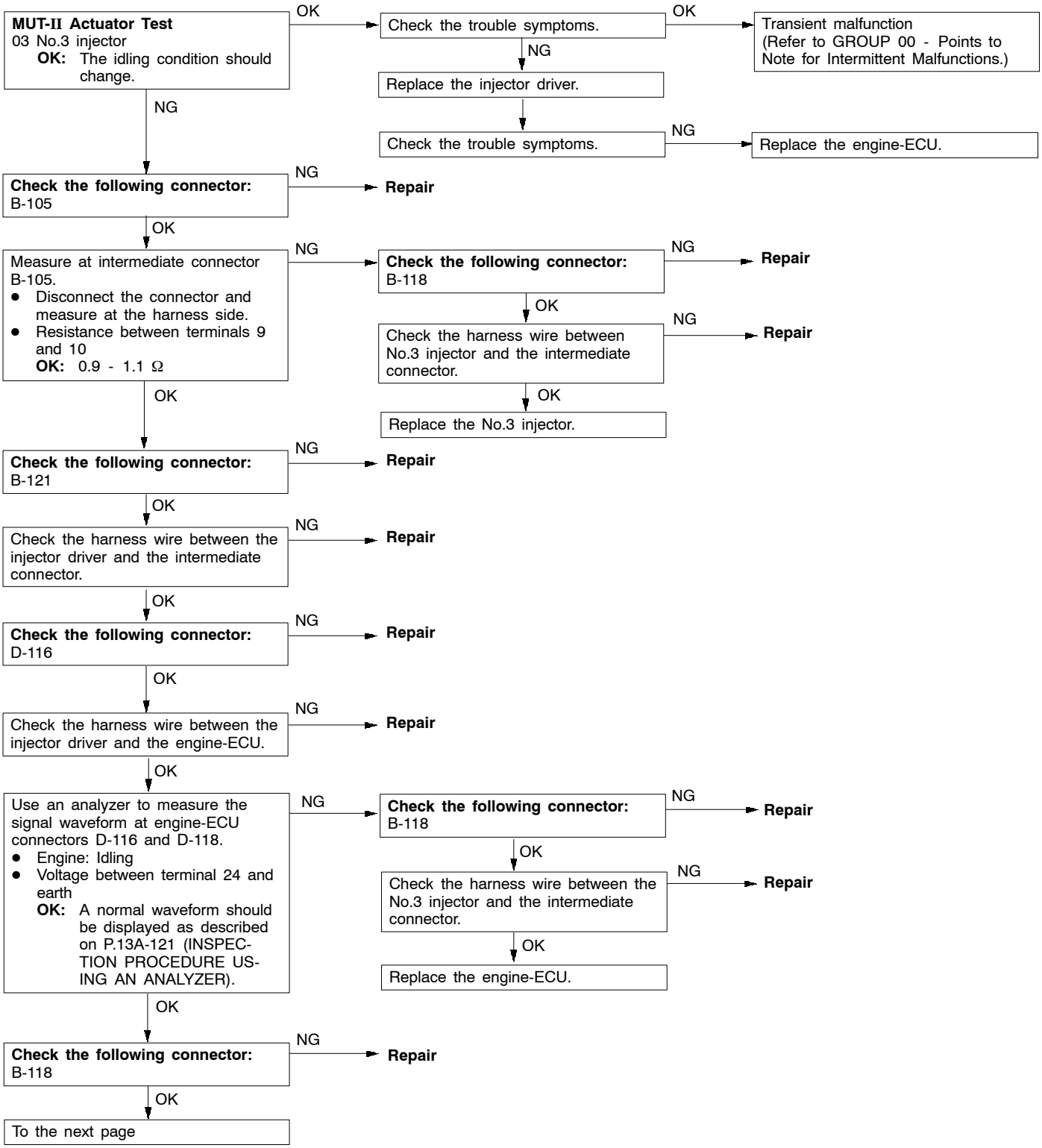
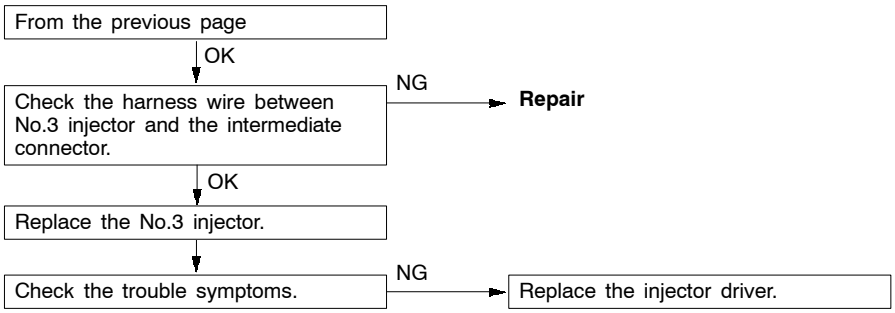
OK
Check the harness wire between No.2 injector and the intermediate connector.
NG
Repair
OK
Replace the No.2 injector.
Check the trouble symptoms.
NG
Replace the injector driver.

Code No.P0203 No.3 injector system	Probable cause
Range of Check ● The engine speed is 4,000 r/min or less. ● The battery voltage is 10 V or more. ● The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. Set Conditions ● The injector driver is not transmitting a injector open circuit check signal for four seconds.	● Malfunction of No.3 injector ● Open or short circuit in the No.3 injector circuit or loose connector contact ● Malfunction of engine-ECU

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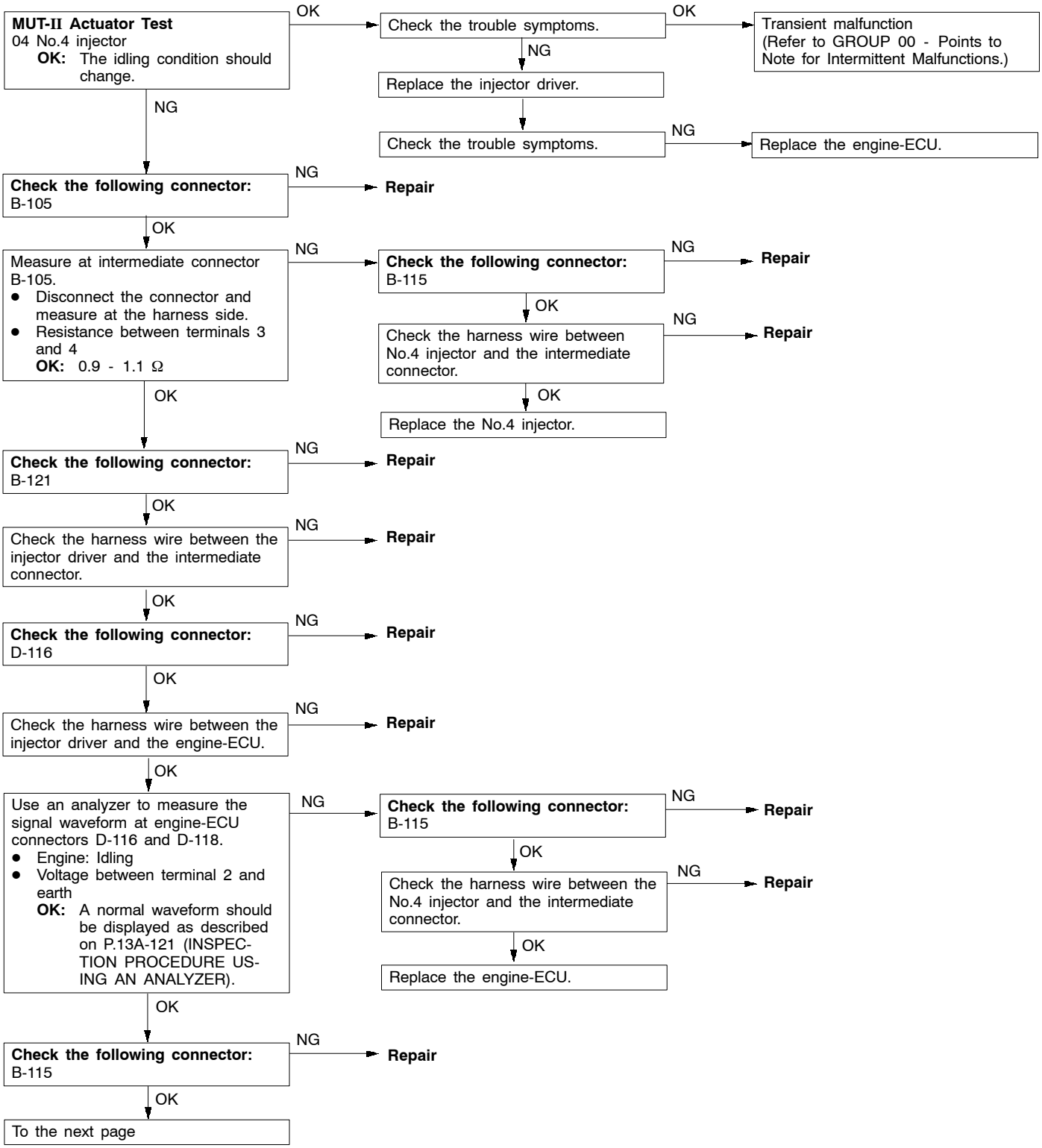
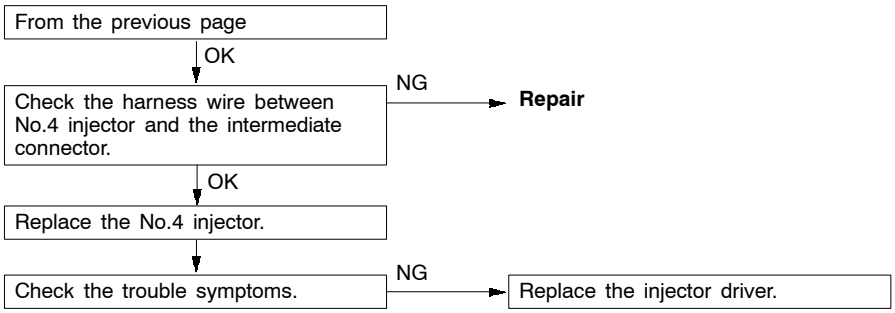
OK
Check the harness wire between No.3 injector and the intermediate connector.
NG
Repair
OK
Replace the No.3 injector.
Check the trouble symptoms.
NG
Replace the injector driver.

Code No.P0204 No.4 injector system	Probable cause
Range of Check ● The engine speed is 4,000 r/min or less. ● The battery voltage is 10 V or more. ● The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. Set Conditions ● The injector driver is not transmitting a injector open circuit check signal for four seconds.	● Malfunction of No.4 injector ● Open or short circuit in the No.4 injector circuit or loose connector contact ● Malfunction of engine-ECU

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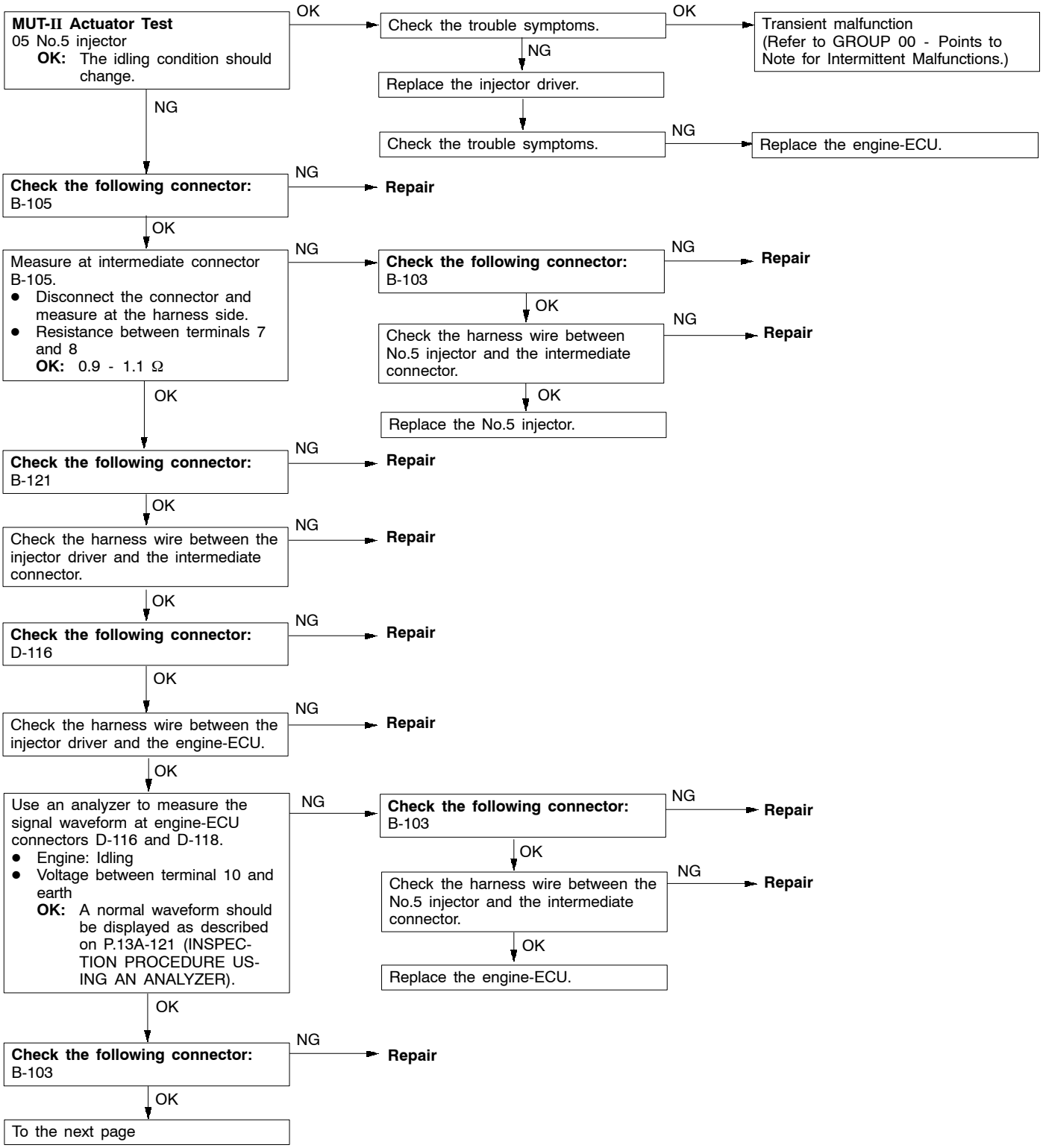
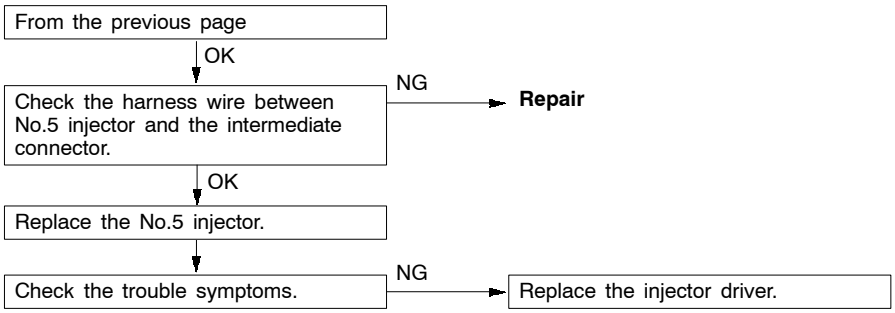
OK
Check the harness wire between No.4 injector and the intermediate connector.
NG
Repair
OK
Replace the No.4 injector.
Check the trouble symptoms.
NG
Replace the injector driver.

Code No.P0205 No.5 injector system	Probable cause
Range of Check ● The engine speed is 4,000 r/min or less. ● The battery voltage is 10 V or more. ● The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. Set Conditions ● The injector driver is not transmitting a injector open circuit check signal for four seconds.	● Malfunction of No.5 injector ● Open or short circuit in the No.5 injector circuit or loose connector contact ● Malfunction of engine-ECU

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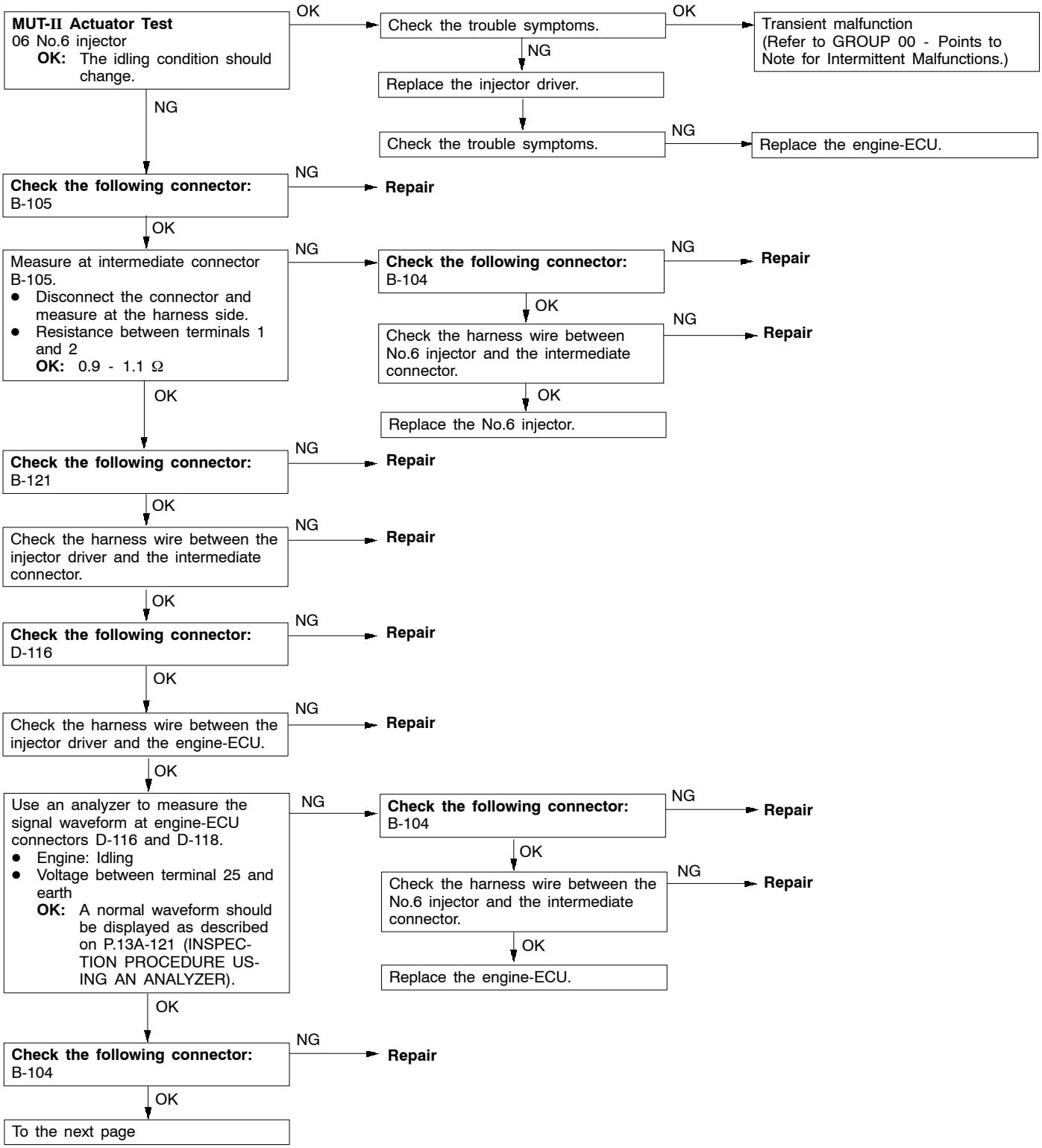
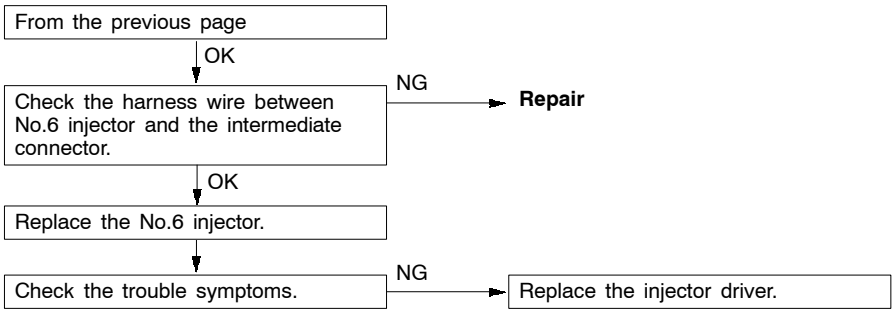
OK
Check the harness wire between No.5 injector and the intermediate connector.
NG
Repair
OK
Replace the No.5 injector.
Check the trouble symptoms.
NG
Replace the injector driver.

Code No.P0206 No.6 injector system	Probable cause
Range of Check ● The engine speed is 4,000 r/min or less. ● The battery voltage is 10 V or more. ● The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. Set Conditions ● The injector driver is not transmitting a injector open circuit check signal for four seconds.	● Malfunction of No.6 injector ● Open or short circuit in the No.6 injector circuit or loose connector contact ● Malfunction of engine-ECU

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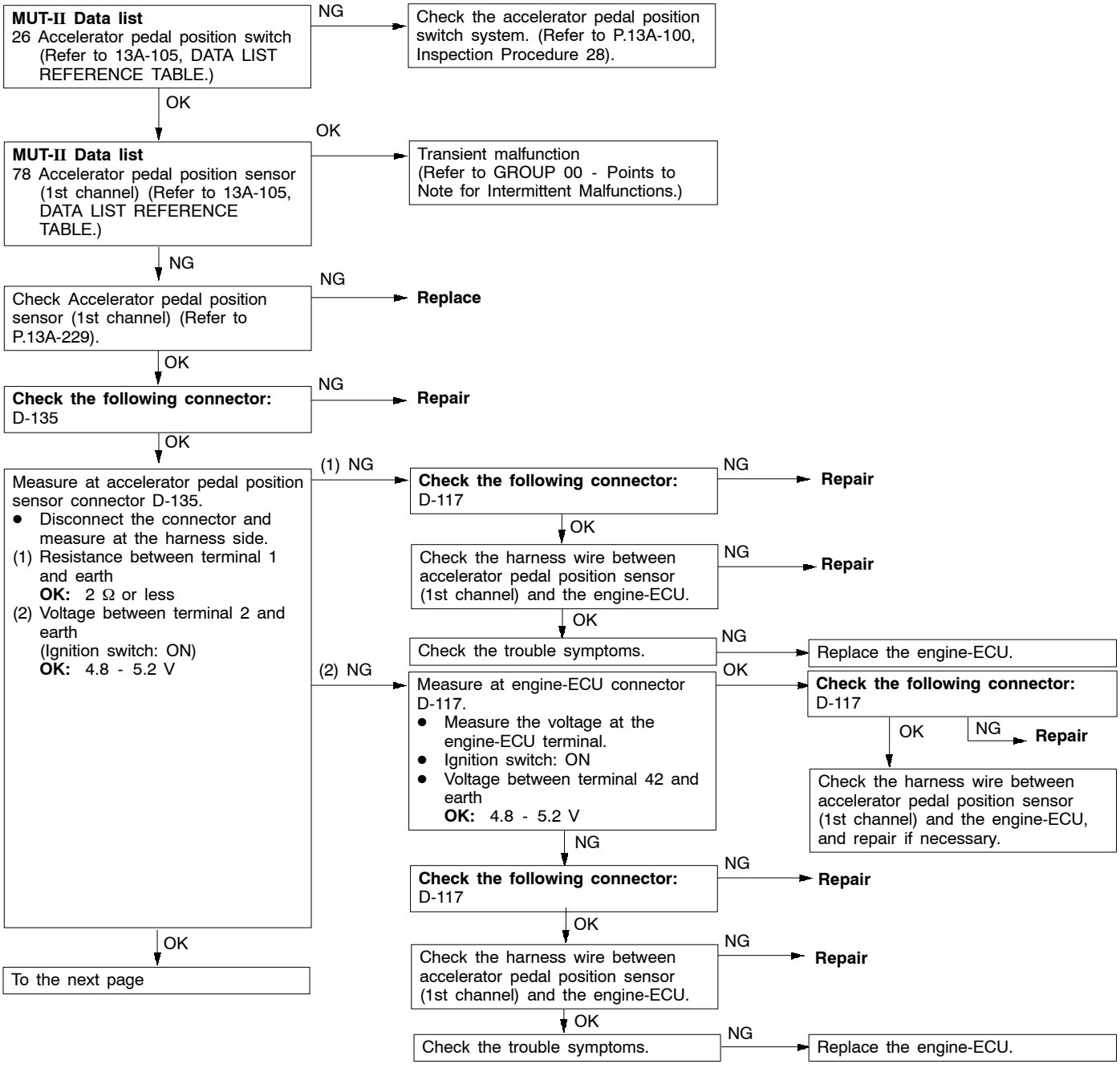
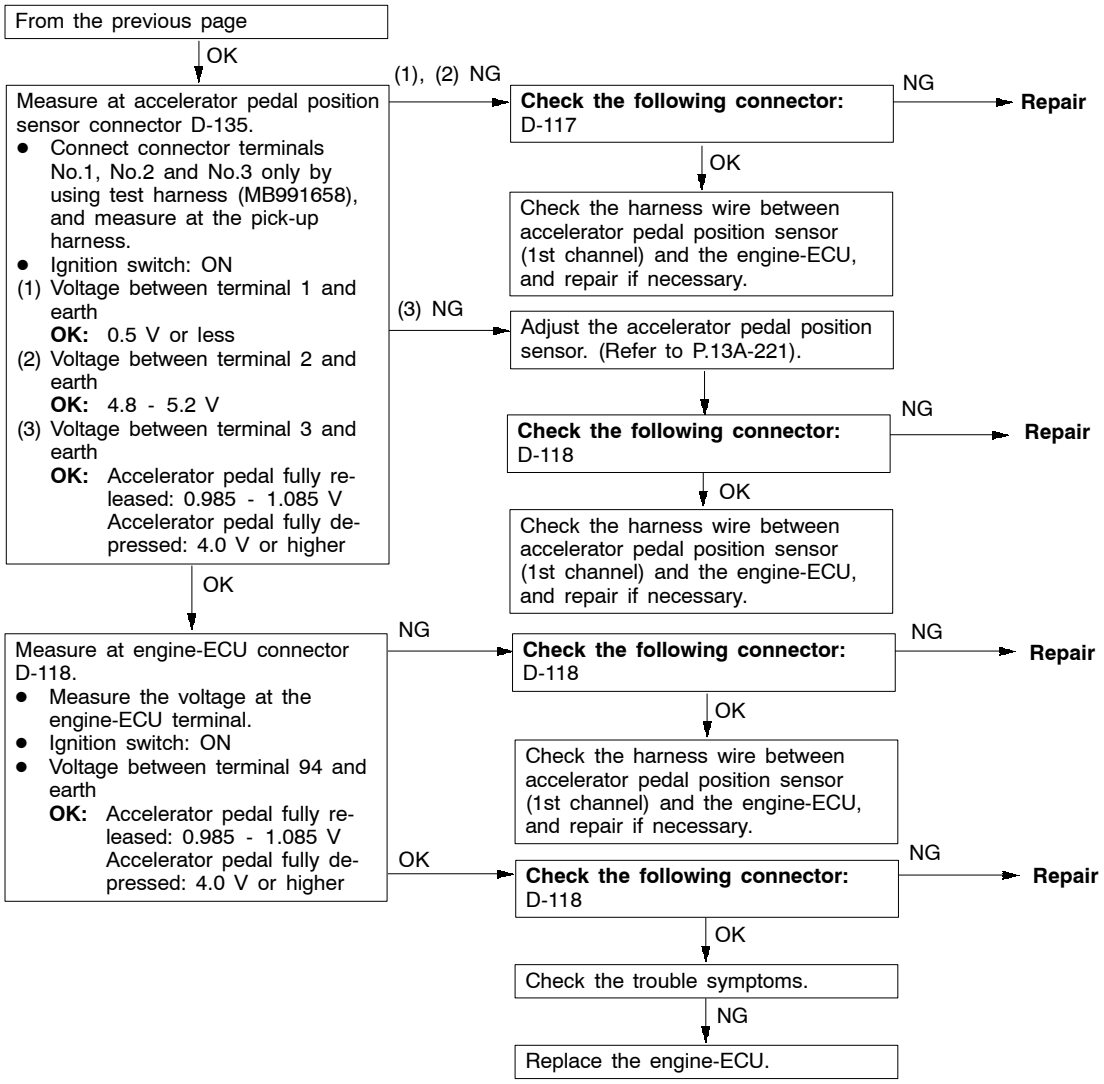
OK
Check the harness wire between No.6 injector and the intermediate connector.
NG
Repair
OK
Replace the No.6 injector.
Check the trouble symptoms.
NG
Replace the injector driver.

Code No.P0220 Accelerator pedal position sensor (1st channel) system	Probable cause
Range of Check ● Accelerator pedal position sensor (2nd channel) is normal. ● Communication between the engine-ECU and the throttle valve controller is normal. Set Conditions ● The output voltage of accelerator pedal position sensor (1st channel) is 0.2 V or less for one second. or ● The output voltage of accelerator pedal position sensor (2nd channel) is 2.5 V or less, and that of accelerator pedal position sensor (1st channel) is 4.5 V or more for one second or ● The difference between accelerator pedal position sensor (1st channel) and accelerator pedal position sensor (2nd channel) output voltages is 1.0 V or more (i.e. the throttle opening angle changes slightly). or ● The output voltage of accelerator pedal position sensor (1st channel) is 1.1 V or more for one second when the accelerator pedal position switch is turned on.	● Malfunction of accelerator pedal position sensor (1st channel) ● Open or short circuit in the accelerator pedal position sensor (1st channel) circuit or loose connector contact ● Accelerator pedal position switch seized ON ● Malfunction of throttle valve controller ● Malfunction of engine-ECU

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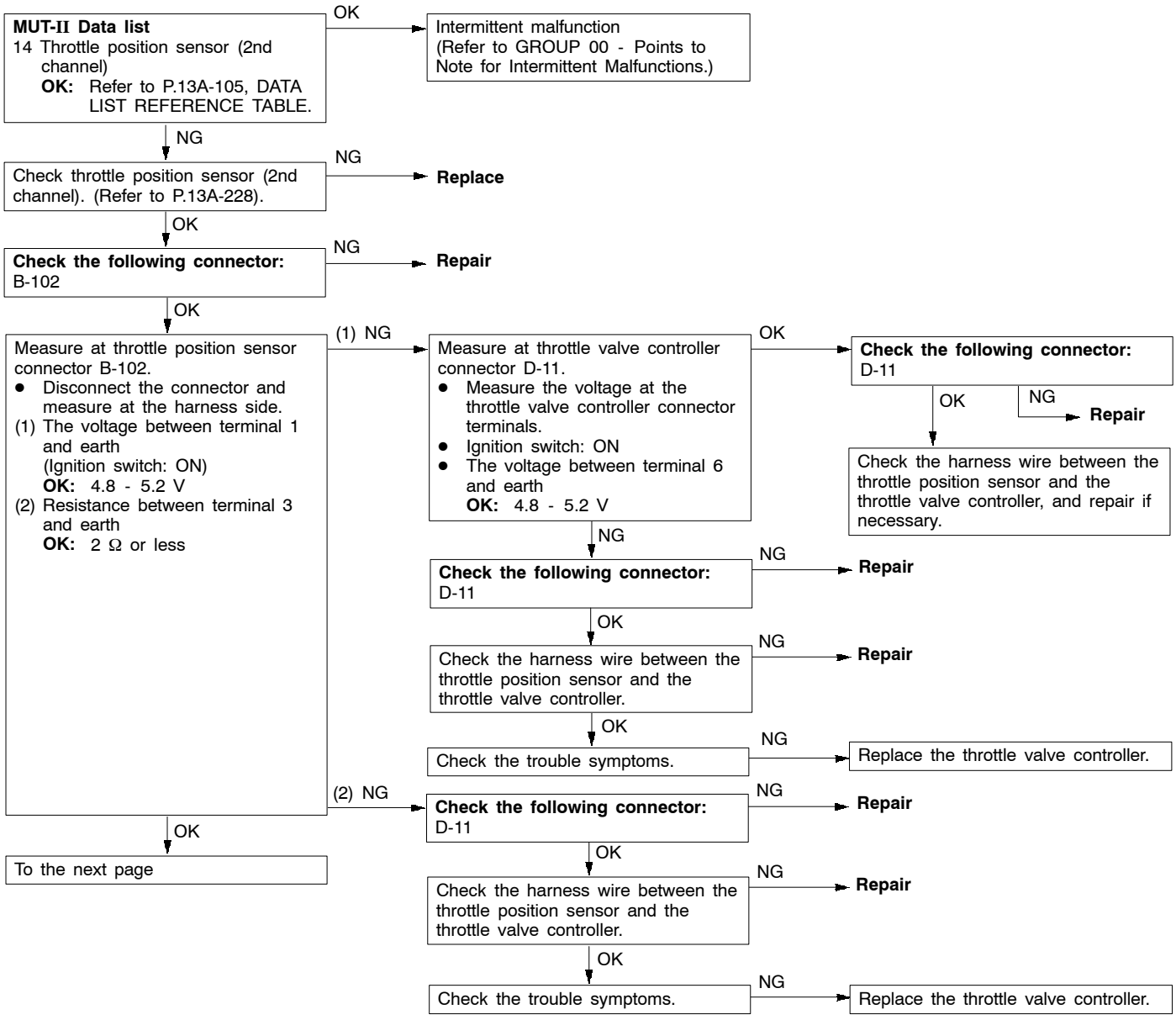
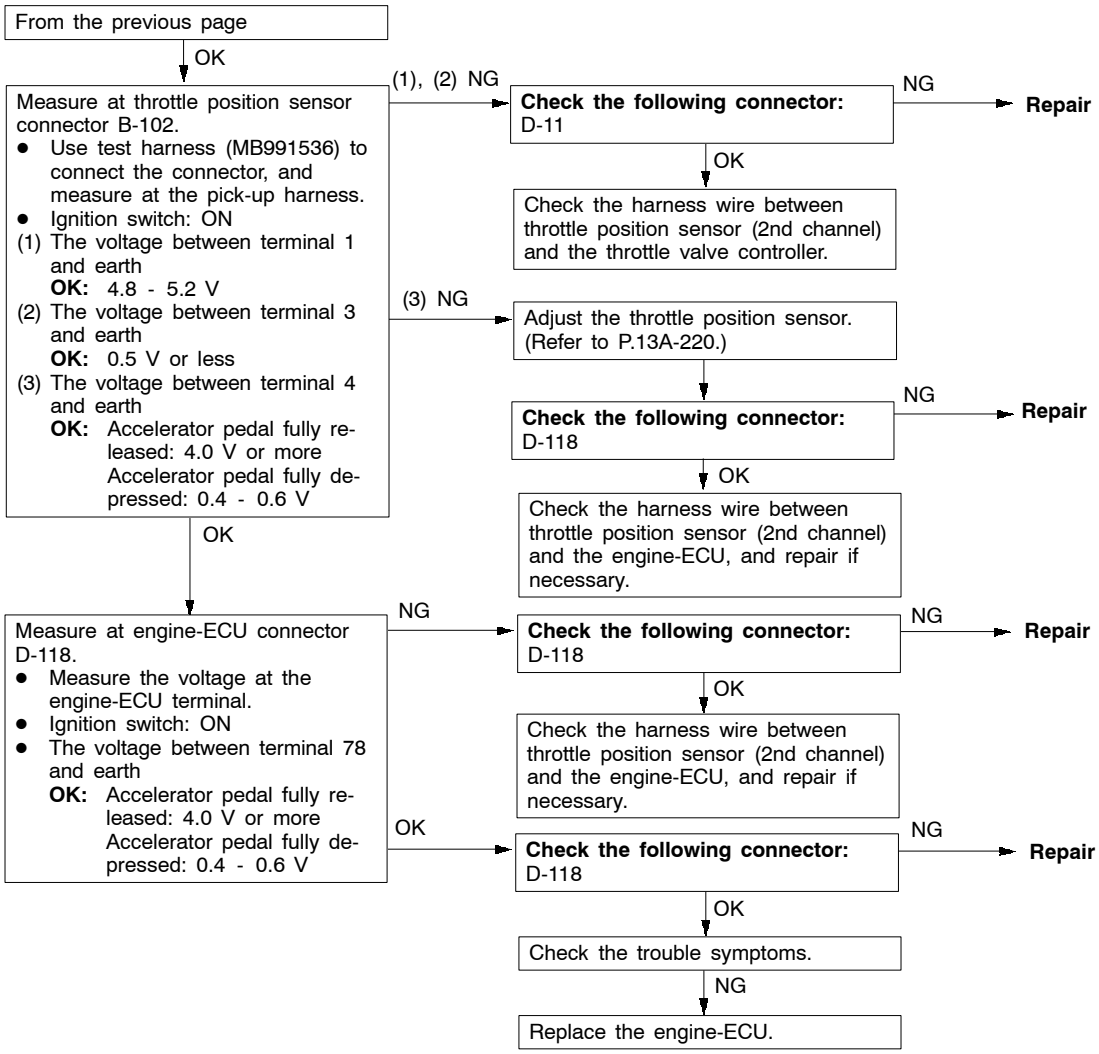
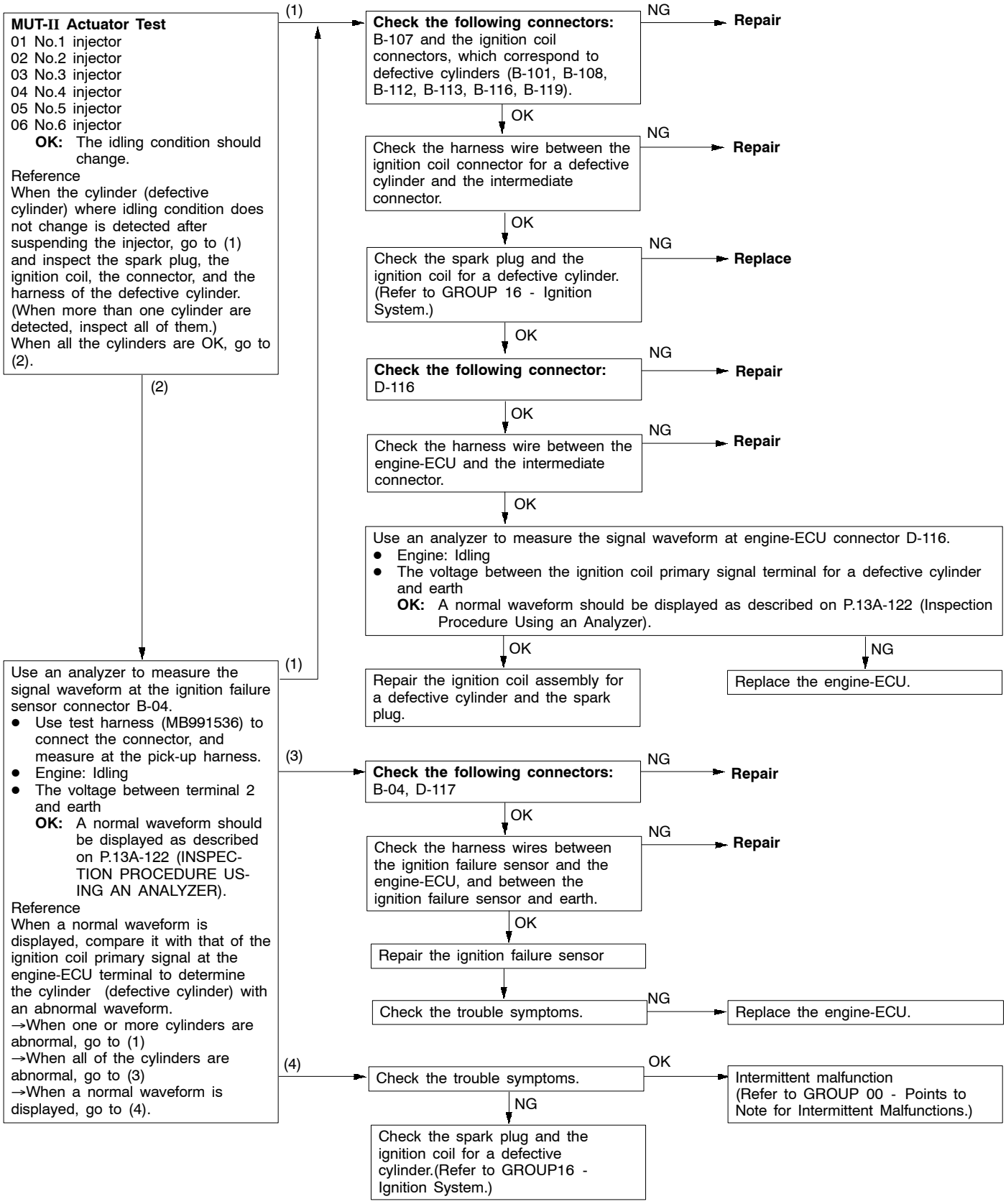
OK
Measure at accelerator pedal position sensor connector D-135.
● Connect connector terminals No.1, No.2 and No.3 only by using test harness (MB991658), and measure at the pick-up harness.
● Ignition switch: ON
(1) Voltage between terminal 1 and earth
OK: 0.5 V or less
(2) Voltage between terminal 2 and earth
OK: 4.8 - 5.2 V
(3) Voltage between terminal 3 and earth
OK: Accelerator pedal fully released: 0.985 - 1.085 V
Accelerator pedal fully depressed: 4.0 V or higher
(1), (2) NG
Check the following connector: D-117
NG
Repair
OK
Check the harness wire between accelerator pedal position sensor (1st channel) and the engine-ECU, and repair if necessary.
(3) NG
Adjust the accelerator pedal position sensor. (Refer to P.13A-221).
Check the following connector: D-118
NG
Repair
OK
Check the harness wire between accelerator pedal position sensor (1st channel) and the engine-ECU, and repair if necessary.
OK
Measure at engine-ECU connector D-118.
● Measure the voltage at the engine-ECU terminal.
● Ignition switch: ON
● Voltage between terminal 94 and earth
OK: Accelerator pedal fully released: 0.985 - 1.085 V
Accelerator pedal fully depressed: 4.0 V or higher
NG
Check the following connector: D-118
NG
Repair
OK
Check the harness wire between accelerator pedal position sensor (1st channel) and the engine-ECU, and repair if necessary.
OK
Check the following connector: D-118
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.

Code No.0225 Throttle position sensor (2nd channel) system	Probable cause
The throttle valve controller judges a malfunction, and then transmit the result to the engine-ECU. Range of Check ● Ignition switch: ON ● The throttle position sensor (1st channel) is normal. Set Conditions ● The sensor output voltage is 0.2 V or less for four seconds. or ● The sensor output voltage is 4.85 V or more for four seconds, and the output voltage of the throttle position sensor (1st channel) is 1.2 V or more. or ● The throttle position sensor (1st channel) and throttle position sensor (2nd channel) combination output voltage is outside 4 - 6 V.	● Malfunction of throttle position sensor (2nd channel) ● Open or short circuit in the throttle position sensor (2nd channel) circuit or loose connector contact ● Malfunction of the throttle valve controller ● Malfunction of the engine-ECU

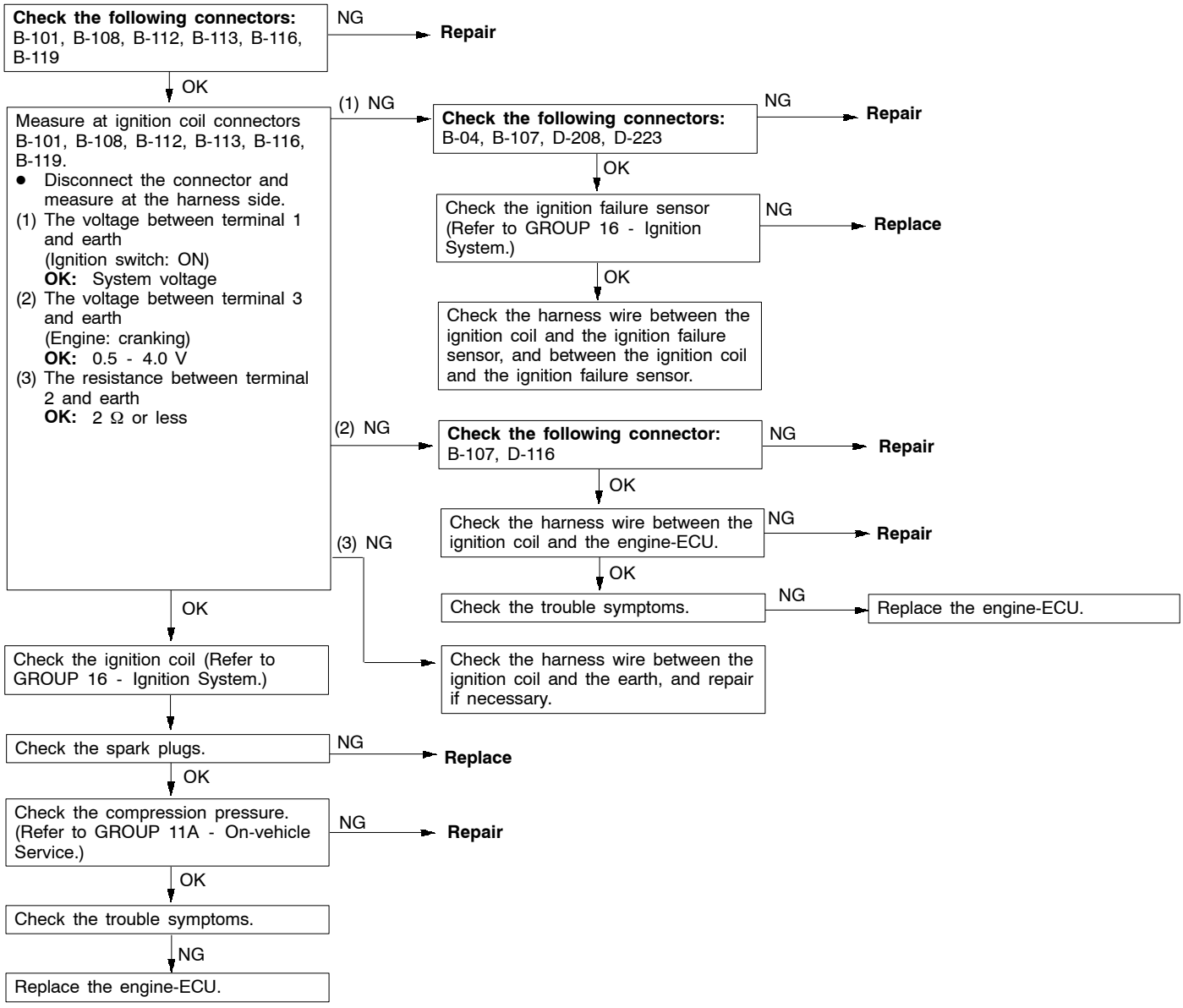




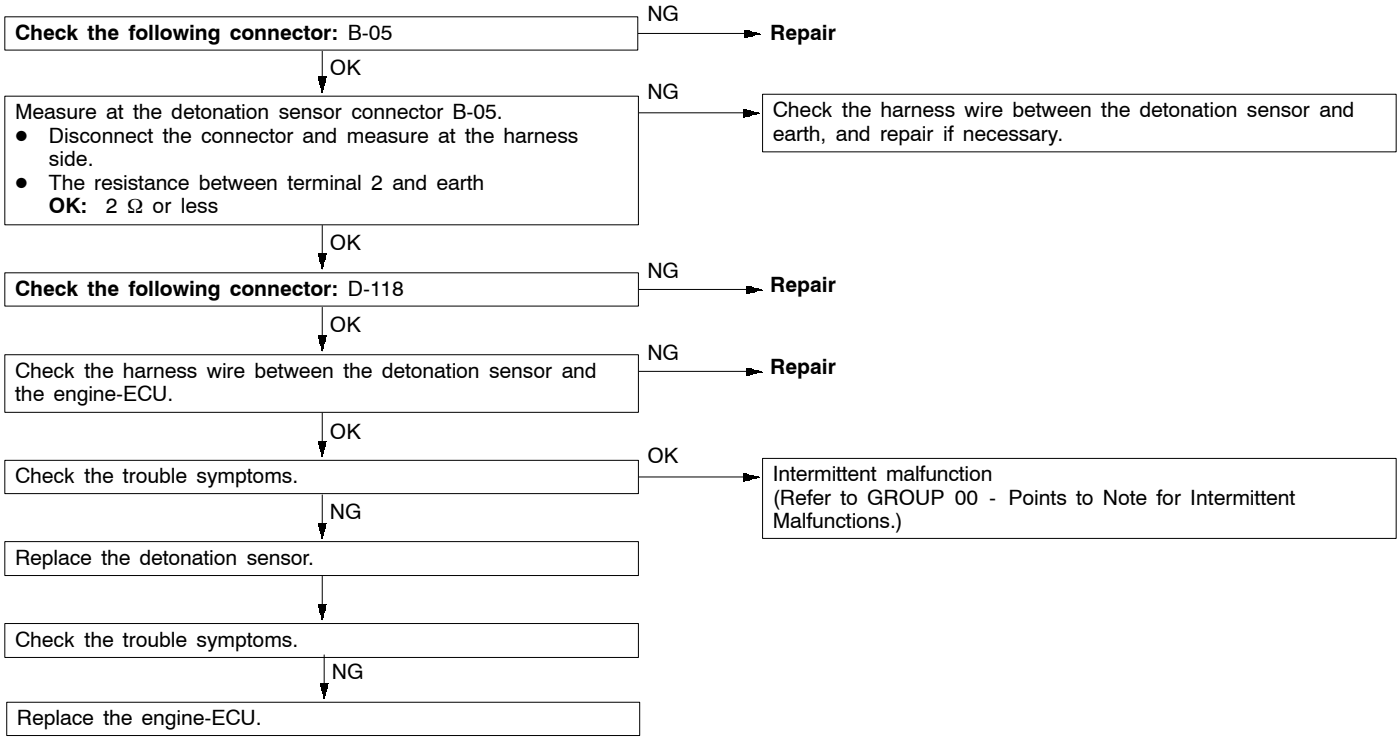
Code No.P0300 Ignition coil (power transistor) system	Probable cause
Range of Check ● Engine speed is approx. 50 - 4,000 r/min. ● Engine is not cranking. Set Conditions ● The ignition failure sensor does not send a signal about a certain cylinder for four seconds.	● Malfunction of the ignition coil ● Malfunction of the ignition failure sensor ● Malfunction of spark plug ● Open or short circuit in the primary ignition circuit or loose connector contact ● Malfunction of engine-ECU


MUT-II Actuator Test
01 No.1 injector
02 No.2 injector
03 No.3 injector
04 No.4 injector
05 No.5 injector
06 No.6 injector
OK: The idling condition should change.
Reference
When the cylinder (defective cylinder) where idling condition does not change is detected after suspending the injector, go to (1) and inspect the spark plug, the ignition coil, the connector, and the harness of the defective cylinder. (When more than one cylinder are detected, inspect all of them.)
When all the cylinders are OK, go to (2).
(1)
Check the following connectors: B-107 and the ignition coil connectors, which correspond to defective cylinders (B-101, B-108, B-112, B-113, B-116, B-119).
NG
Repair
OK
Check the harness wire between the ignition coil connector for a defective cylinder and the intermediate connector.
NG
Repair
OK
Check the spark plug and the ignition coil for a defective cylinder. (Refer to GROUP 16 - Ignition System.)
NG
Replace
OK
Check the following connector: D-116
NG
Repair
OK
Check the harness wire between the engine-ECU and the intermediate connector.
NG
Repair
OK
Use an analyzer to measure the signal waveform at engine-ECU connector D-116.
Engine: Idling
The voltage between the ignition coil primary signal terminal for a defective cylinder and earth
OK: A normal waveform should be displayed as described on P.13A-122 (Inspection Procedure Using an Analyzer).
OK
NG
Repair the ignition coil assembly for a defective cylinder and the spark plug.
Replace the engine-ECU.
(2)
Use an analyzer to measure the signal waveform at the ignition failure sensor connector B-04.
Use test harness (MB991536) to connect the connector, and measure at the pick-up harness.
Engine: Idling
The voltage between terminal 2 and earth
OK: A normal waveform should be displayed as described on P.13A-122 (INSPECTION PROCEDURE USING AN ANALYZER).
Reference
When a normal waveform is displayed, compare it with that of the ignition coil primary signal at the engine-ECU terminal to determine the cylinder (defective cylinder) with an abnormal waveform.
→When one or more cylinders are abnormal, go to (1)
→When all of the cylinders are abnormal, go to (3)
→When a normal waveform is displayed, go to (4).
(1)
(3)
Check the following connectors: B-04, D-117
NG
Repair
OK
Check the harness wires between the ignition failure sensor and the engine-ECU, and between the ignition failure sensor and earth.
NG
Repair
OK
Repair the ignition failure sensor
Check the trouble symptoms.
NG
Replace the engine-ECU.
(4)
Check the trouble symptoms.
OK
Intermittent malfunction (Refer to GROUP 00 - Points to Note for Intermittent Malfunctions.)
NG
Check the spark plug and the ignition coil for a defective cylinder.(Refer to GROUP16 - Ignition System.)

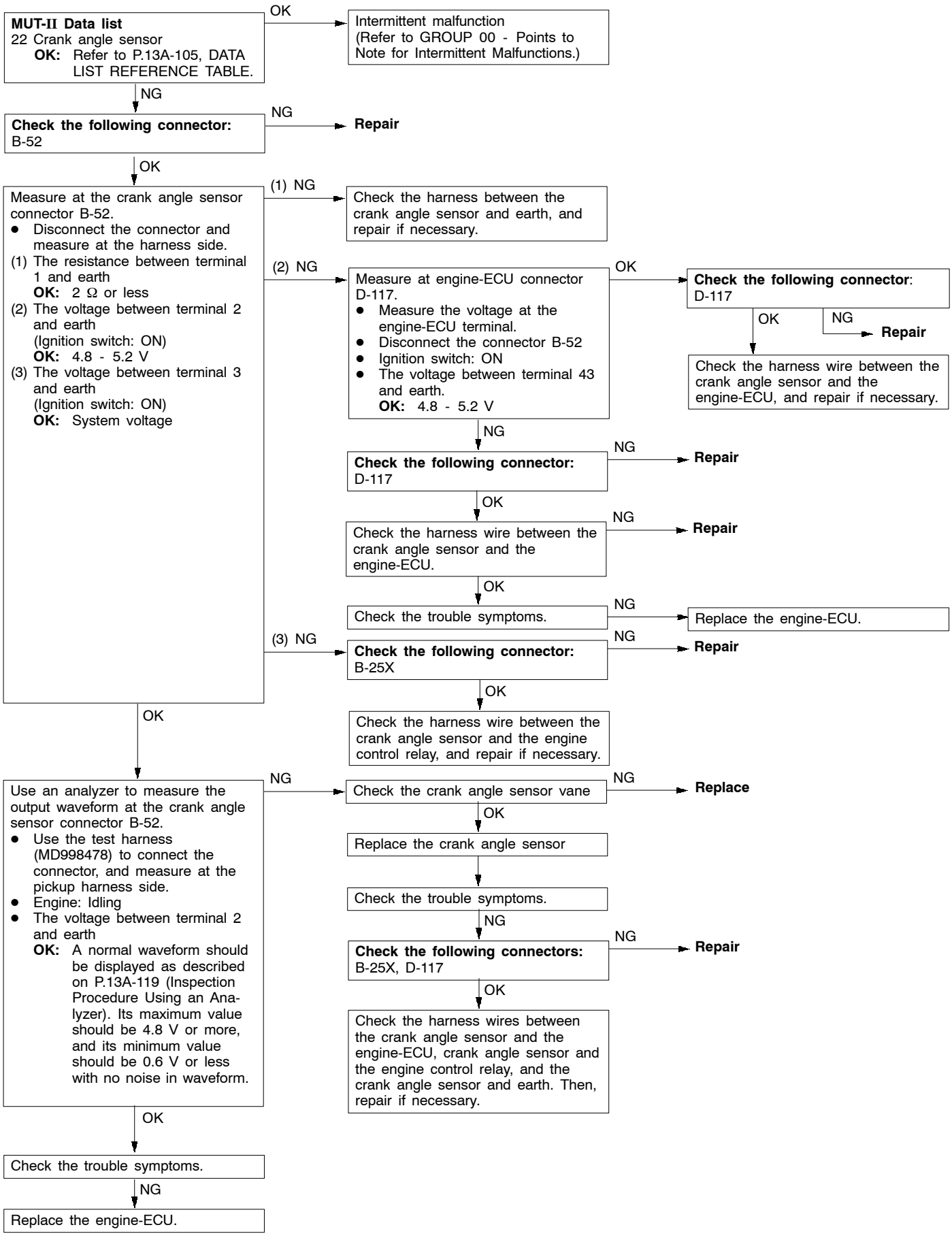
Code No.P0301 No.1 cylinder misfire detected. **Code No.P0302 No.2 cylinder misfire detected.** **Code No.P0303 No.3 cylinder misfire detected.** **Code No.P0304 No.4 cylinder misfire detected.** **Code No.P0305 No.5 cylinder misfire detected.**	**Probable cause**
Range of Check ● The engine speed is 500 - 4,500 r/min. ● While the engine is running except deceleration and sudden acceleration. Set Conditions ● The number of misfires exceeds a predetermined number per 200 engine revolutions (Misfire has occurred in only one cylinder). or ● The number of misfires exceeds a predetermined number per 100 engine revolutions (Misfire has occurred in only one cylinder).	● Malfunction of the ignition system ● Abnormal compression ● Malfunction of injector ● Malfunction of engine-ECU



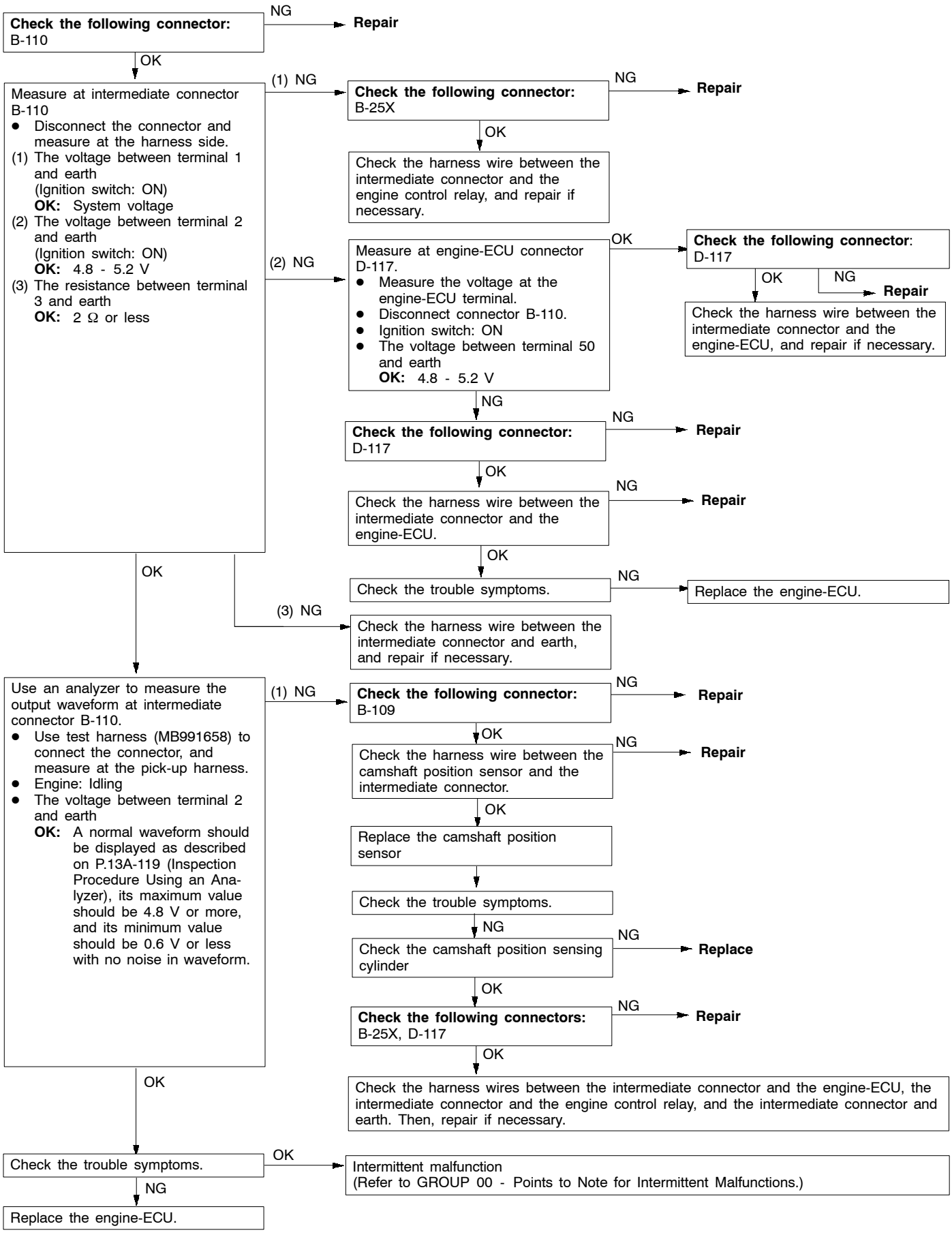
Code No.P0325 Detonation sensor system	Probable cause
Range of Check ● Engine: Two seconds after the engine has been started Set Conditions ● Changes in sensor output voltage (detonation sensor peak voltage per 1/3 crankshaft rotation) in 200 consecutive cycles are 0.08 V or less.	● Malfunction of the detonation sensor ● Open or short circuit in the detonation sensor circuit or loose connector contact ● Malfunction of engine-ECU



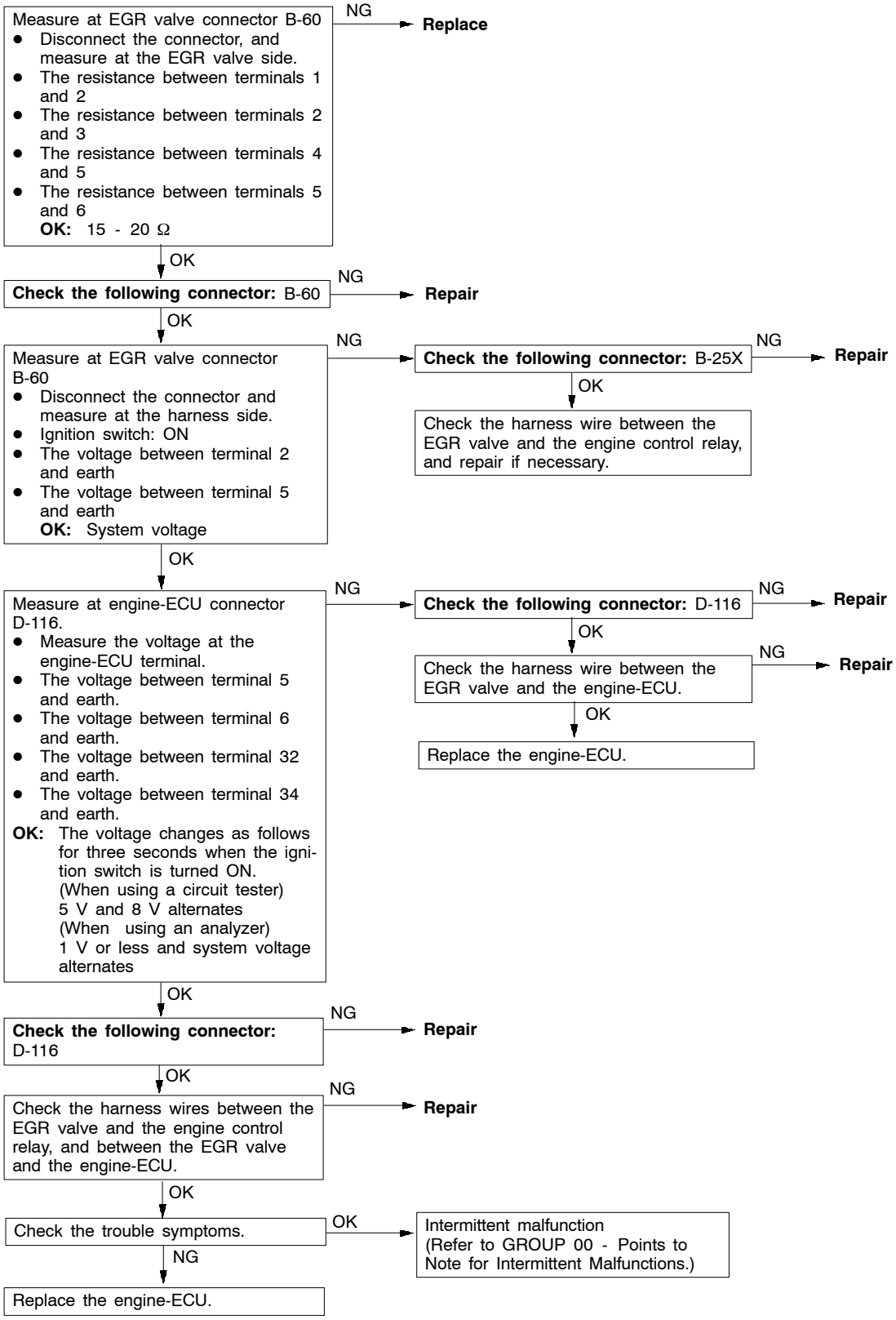
Code No.P0335 Crank angle sensor system	Probable cause
Range of Check ● Engine is cranking Set Conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the crank angle sensor. ● Open or short circuit in the crank angle sensor circuit or loose connector contact. ● Malfunction of engine-ECU


MUT-II Data list
22 Crank angle sensor
OK: Refer to P.13A-105, DATA LIST REFERENCE TABLE.
OK
Intermittent malfunction
(Refer to GROUP 00 - Points to Note for Intermittent Malfunctions.)
NG
Check the following connector:
B-52
NG
Repair
OK
Measure at the crank angle sensor connector B-52.
Disconnect the connector and measure at the harness side.
(1) The resistance between terminal 1 and earth
OK: 2 Ω or less
(2) The voltage between terminal 2 and earth
(Ignition switch: ON)
OK: 4.8 - 5.2 V
(3) The voltage between terminal 3 and earth
(Ignition switch: ON)
OK: System voltage
(1) NG
Check the harness between the crank angle sensor and earth, and repair if necessary.
(2) NG
Measure at engine-ECU connector D-117.
Measure the voltage at the engine-ECU terminal.
Disconnect the connector B-52
Ignition switch: ON
The voltage between terminal 43 and earth.
OK: 4.8 - 5.2 V
OK
Check the following connector: D-117
OK
NG
Repair
Check the harness wire between the crank angle sensor and the engine-ECU, and repair if necessary.
NG
Check the following connector:
D-117
NG
Repair
OK
Check the harness wire between the crank angle sensor and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
(3) NG
Check the following connector:
B-25X
NG
Repair
OK
Check the harness wire between the crank angle sensor and the engine control relay, and repair if necessary.
OK
Use an analyzer to measure the output waveform at the crank angle sensor connector B-52.
Use the test harness (MD998478) to connect the connector, and measure at the pickup harness side.
Engine: Idling
The voltage between terminal 2 and earth
OK: A normal waveform should be displayed as described on P.13A-119 (Inspection Procedure Using an Analyzer). Its maximum value should be 4.8 V or more, and its minimum value should be 0.6 V or less with no noise in waveform.
NG
Check the crank angle sensor vane
NG
Replace
OK
Replace the crank angle sensor
Check the trouble symptoms.
NG
Check the following connectors:
B-25X, D-117
NG
Repair
OK
Check the harness wires between the crank angle sensor and the engine-ECU, crank angle sensor and the engine control relay, and the crank angle sensor and earth. Then, repair if necessary.
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.

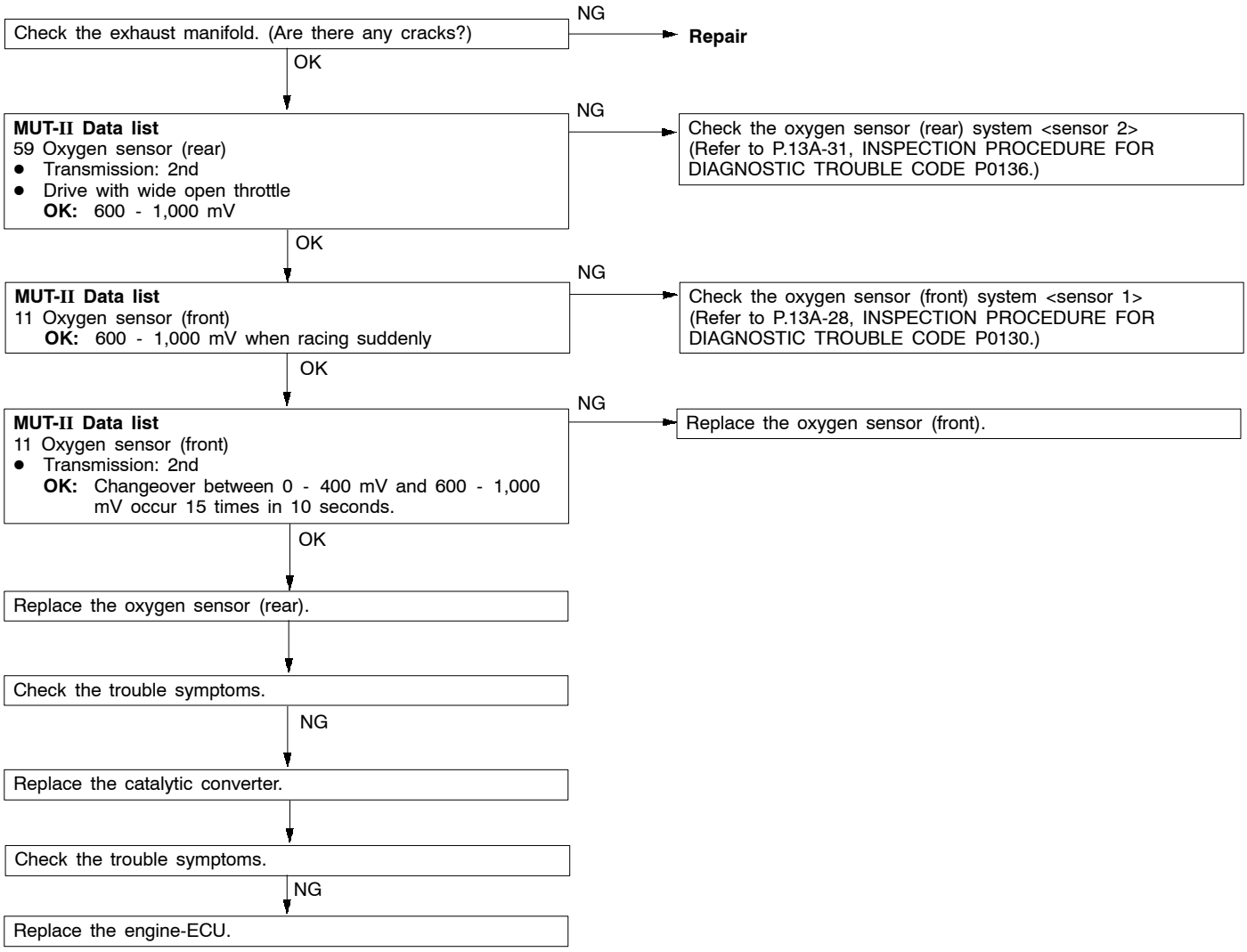
Code No.P0340 Camshaft position sensor system	Probable cause
Range of Check ● After the engine was started Set Conditions ● The sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the camshaft position sensor ● Open or short circuit in the camshaft position sensor circuit or loose connector contact. ● Malfunction of engine-ECU


Check the following connector: B-110
NG
Repair
OK
Measure at intermediate connector B-110
● Disconnect the connector and measure at the harness side.
(1) The voltage between terminal 1 and earth (Ignition switch: ON)
OK: System voltage
(2) The voltage between terminal 2 and earth (Ignition switch: ON)
OK: 4.8 - 5.2 V
(3) The resistance between terminal 3 and earth
OK: 2 Ω or less
(1) NG
Check the following connector: B-25X
NG
Repair
OK
Check the harness wire between the intermediate connector and the engine control relay, and repair if necessary.
(2) NG
Measure at engine-ECU connector D-117.
● Measure the voltage at the engine-ECU terminal.
● Disconnect connector B-110.
● Ignition switch: ON
● The voltage between terminal 50 and earth
OK: 4.8 - 5.2 V
OK
Check the following connector: D-117
OK
NG
Repair
Check the harness wire between the intermediate connector and the engine-ECU, and repair if necessary.
NG
Check the following connector: D-117
NG
Repair
OK
Check the harness wire between the intermediate connector and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
OK
(3) NG
Check the harness wire between the intermediate connector and earth, and repair if necessary.
Use an analyzer to measure the output waveform at intermediate connector B-110.
● Use test harness (MB991658) to connect the connector, and measure at the pick-up harness.
● Engine: Idling
● The voltage between terminal 2 and earth
OK: A normal waveform should be displayed as described on P.13A-119 (Inspection Procedure Using an Analyzer), its maximum value should be 4.8 V or more, and its minimum value should be 0.6 V or less with no noise in waveform.
(1) NG
Check the following connector: B-109
NG
Repair
OK
Check the harness wire between the camshaft position sensor and the intermediate connector.
NG
Repair
OK
Replace the camshaft position sensor
Check the trouble symptoms.
NG
Check the camshaft position sensing cylinder
NG
Replace
OK
Check the following connectors: B-25X, D-117
NG
Repair
OK
Check the harness wires between the intermediate connector and the engine-ECU, the intermediate connector and the engine control relay, and the intermediate connector and earth. Then, repair if necessary.
OK
Check the trouble symptoms.
OK
Intermittent malfunction
(Refer to GROUP 00 - Points to Note for Intermittent Malfunctions.)
NG
Replace the engine-ECU.

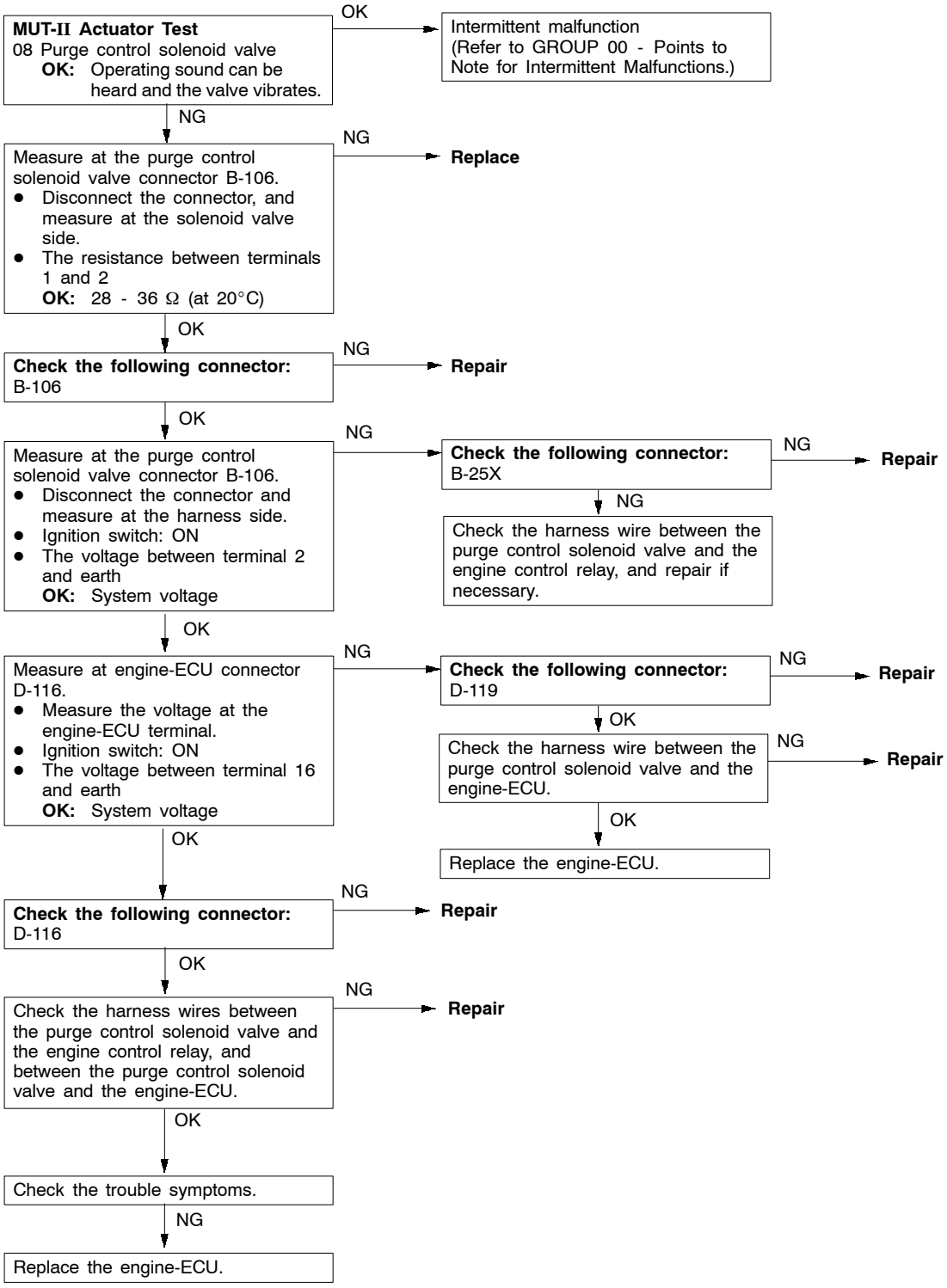
Code No.P0403 EGR valve system	Probable cause
Range of Check ● Ignition switch: OFF to ON ● EGR valve is in operation after the engine starting process is complete. Set Conditions ● Off-surge voltage is not generated from the motor coil while the EGR valve control motor is running.	● Malfunction of the EGR valve ● Open or short circuit in the EGR valve circuit or loose connector contact ● Malfunction of engine-ECU



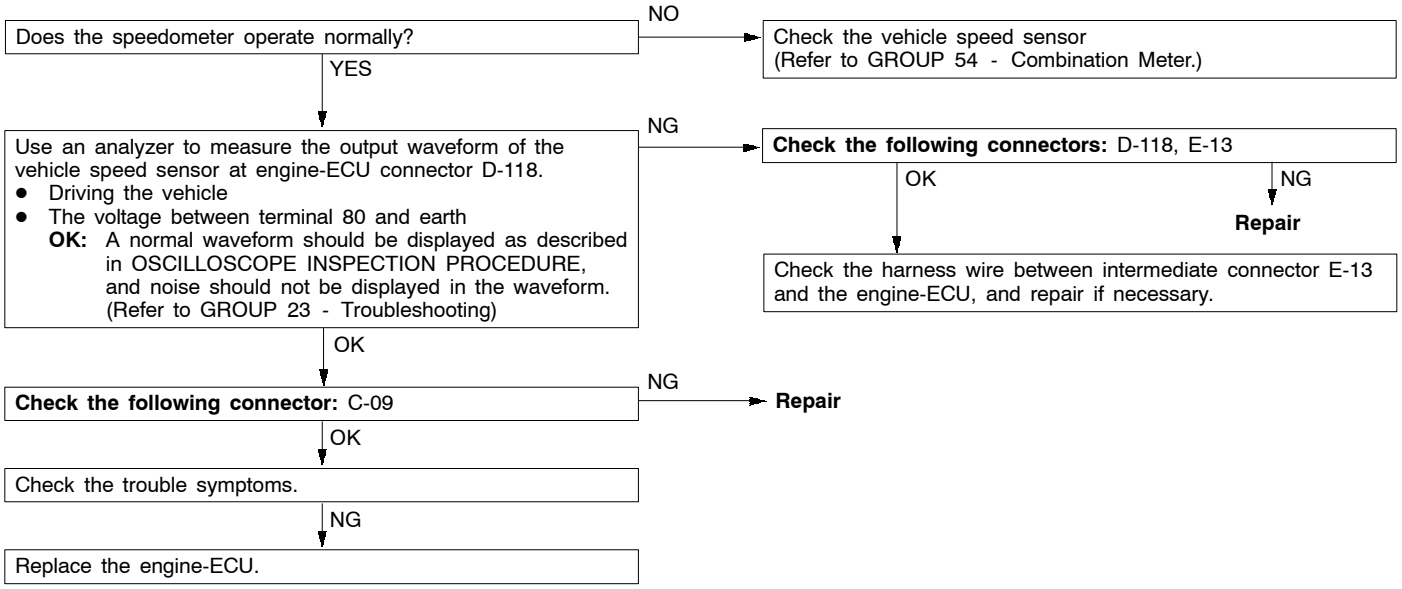
Code No.P0420 Catalyst malfunction	Probable cause
Range of Check ● The engine speed is 3,000 r/min or less. ● During driving ● During air/fuel ratio feedback control Set Conditions ● The ratio between the oxygen sensor (rear) and the oxygen sensor (front) output frequencies reaches 0.8 per 12 seconds on average.	● Malfunction of catalyst ● Malfunction of the oxygen sensor (front) ● Malfunction of the oxygen sensor (rear) ● Malfunction of engine-ECU



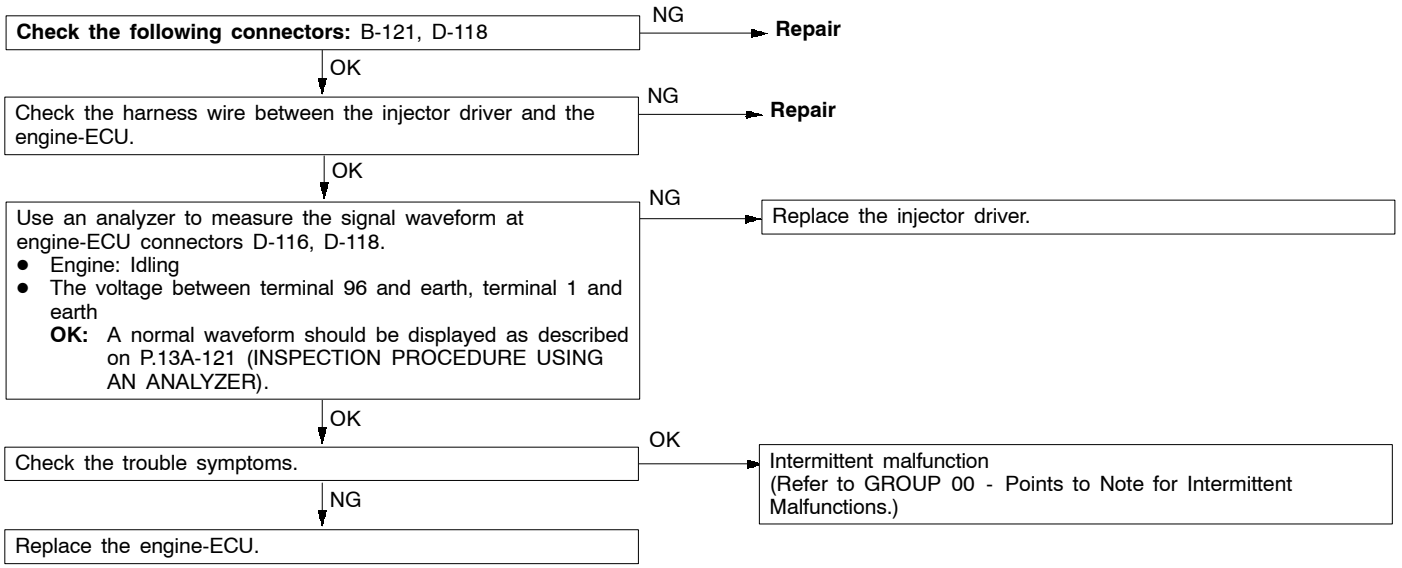
Code No.P0443 Purge control solenoid valve system	Probable cause
Range of Check ● Ignition switch: ON ● Battery voltage is 10 V or more. Set Conditions ● The solenoid coil surge voltage (battery voltage + 2 V) is not detected when the purge control solenoid valve is turned from on to off.	● Malfunction of the purge control solenoid valve ● Open or short circuit in the purge control solenoid valve circuit or loose connector contact ● Malfunction of engine-ECU



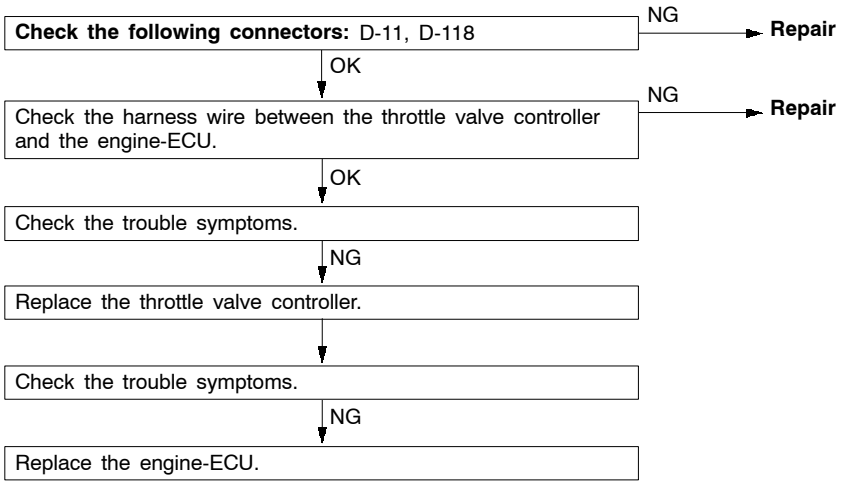
Code No.P0500 Vehicle speed sensor system	Probable cause
Range of Check ● Engine: Two seconds after the engine was started ● Idle switch: OFF ● Engine speed: 2,500 r/min or more ● During high engine load Set Conditions ● The sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the vehicle speed sensor ● Open or short circuit in the vehicle speed sensor circuit or loose connector contact ● Malfunction of engine-ECU



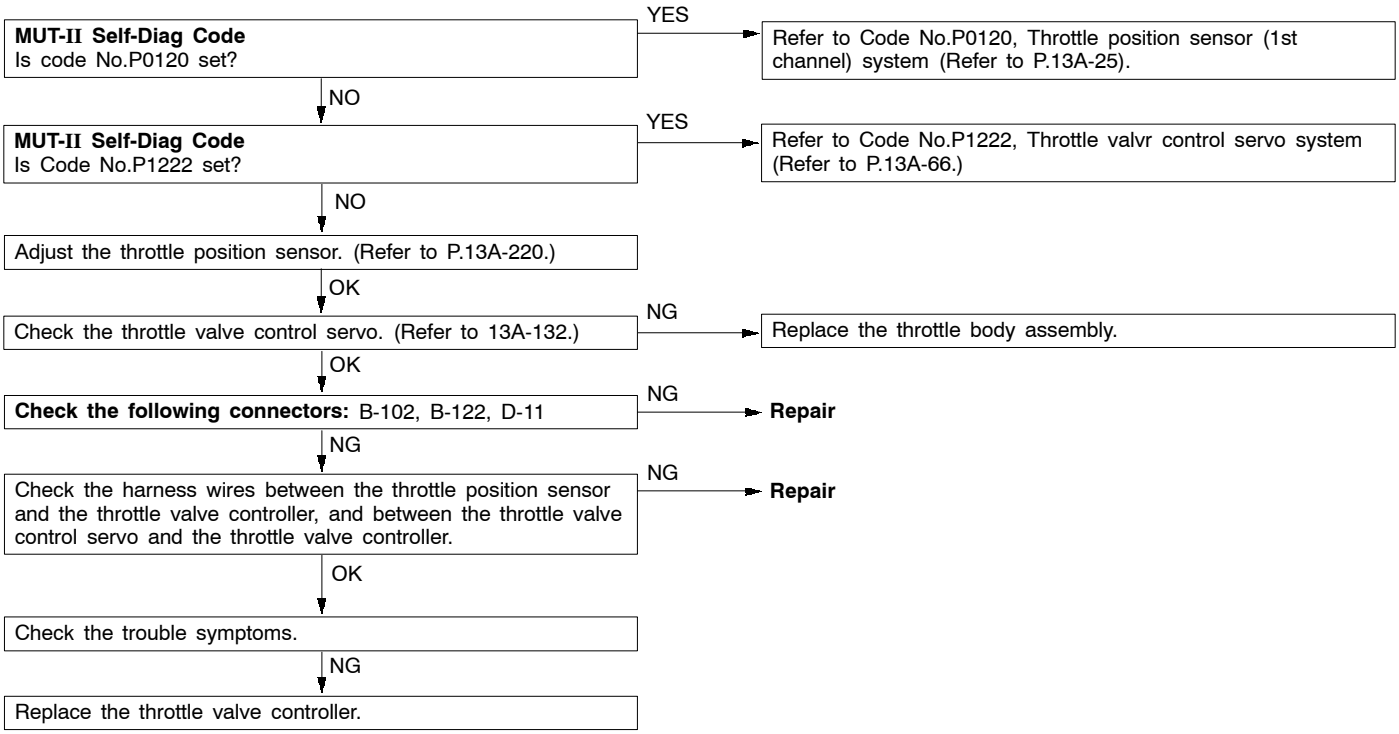
Code No.P1200 Injector driver system	Probable cause
Range of Check ● Engine speed: 4,000 r/m or less ● Battery voltage: 10 V or more ● The fuel cut operation and the injector operation (by carrying out the Actuator test) are not in progress. ● During high engine load Set Conditions ● Injector open circuit check signal is not output from the injector driver.	● Malfunction of the injector driver ● Open or short circuit, or loose connector contact ● Malfunction of engine-ECU



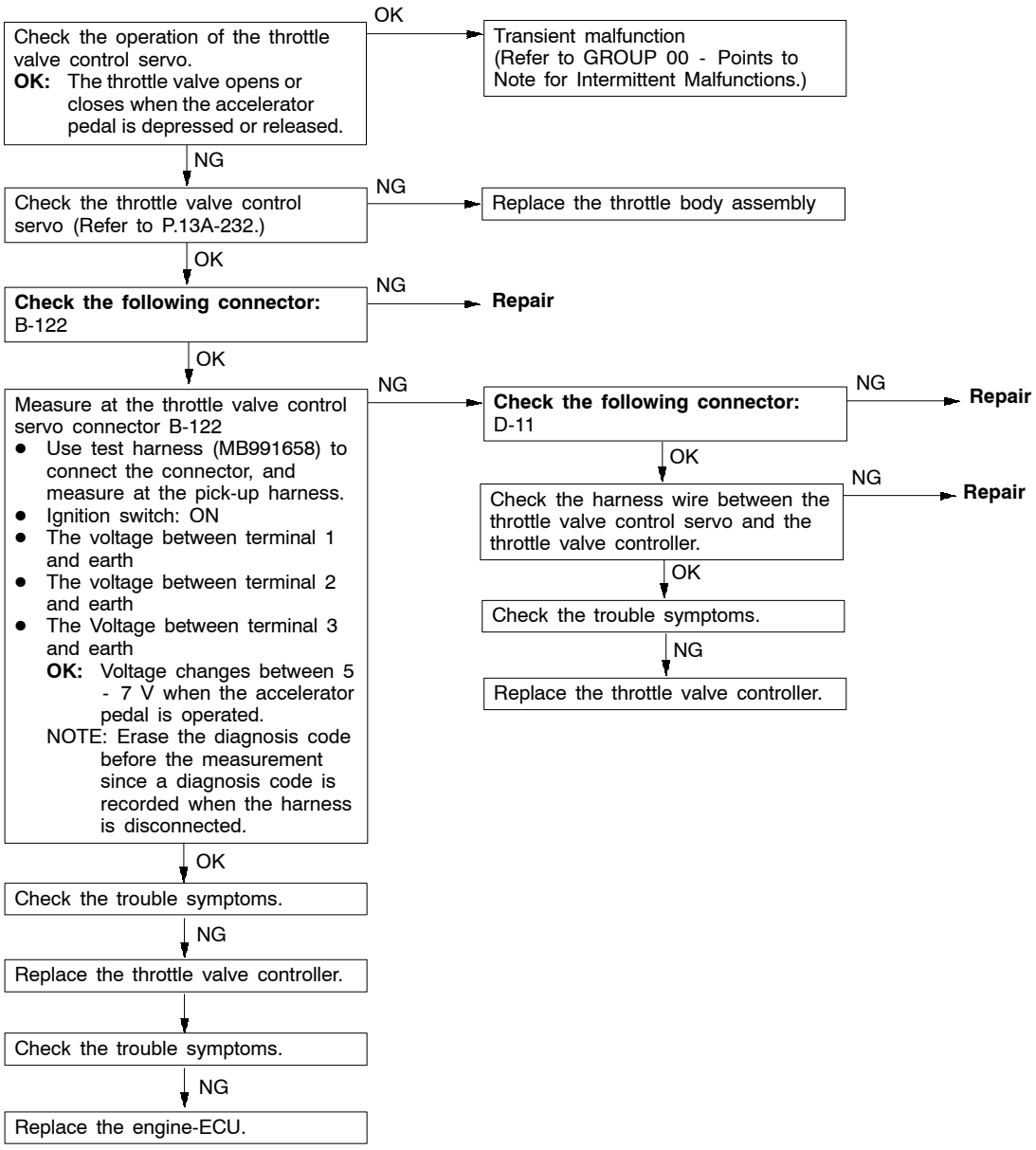
Code No.P1220 Electronic-controlled throttle valve system	Probable cause
Range of Check ● Ignition switch: ON ● Error in communication between the engine-ECU and the throttle valve controller Set Conditions ● Output voltage of throttle position sensor (2nd channel) fluctuates significantly (approx. 1 V or more) from an expected value, based on that of the accelerator pedal position sensor (2nd channel). Range of Check ● Ignition switch: ON ● Error in communication between the throttle valve controller and the engine-ECU Set Conditions ● The output voltage of the throttle position sensor (2nd channel) is significantly different (approx. 1 V) from the the throttle valve opening angle (voltage), which the engine-ECU request the throttle valve controller.	● Short in communication line ● Malfunction of the engine-ECU ● Malfunction of the throttle valve controller



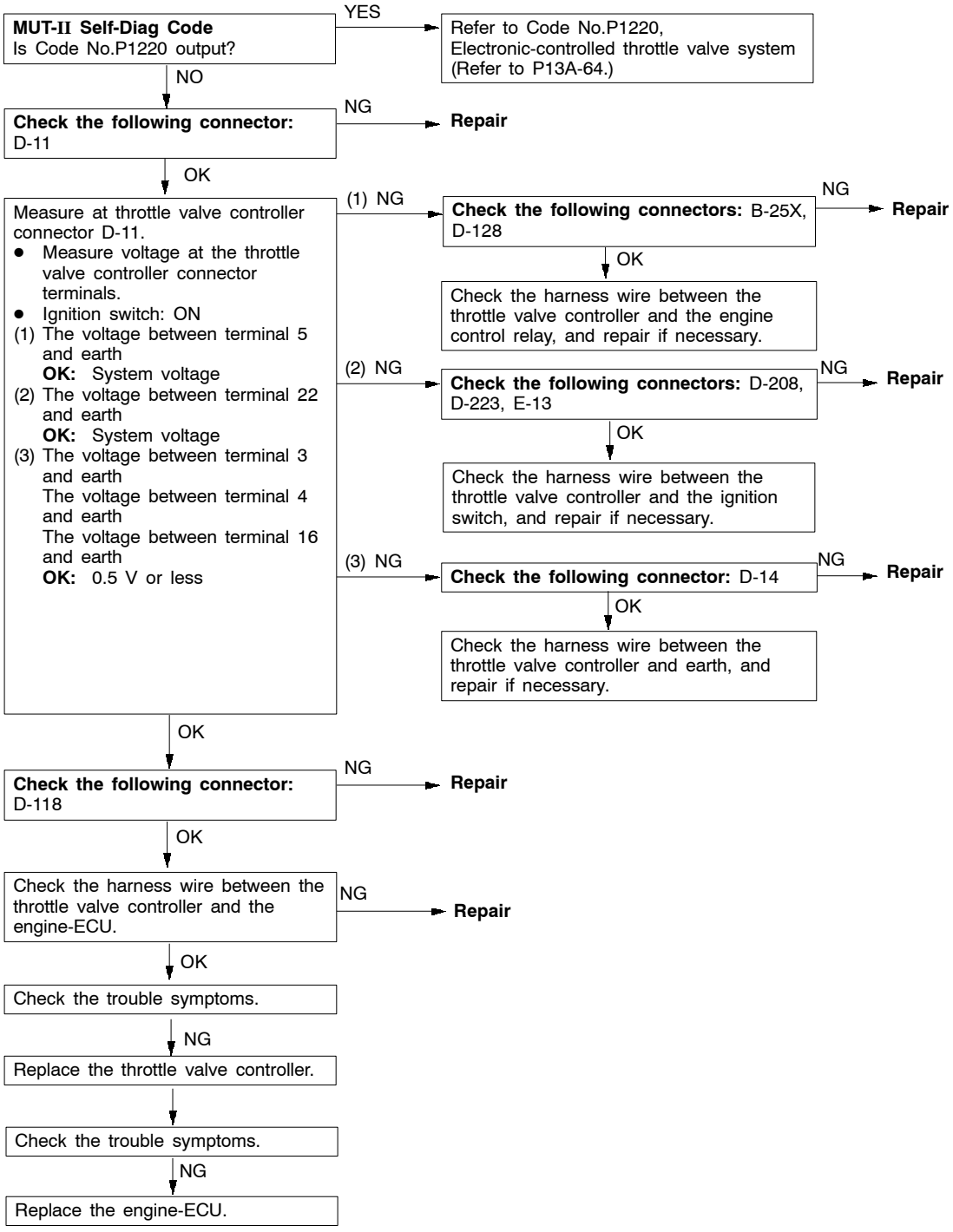
Code No.P1221 Throttle valve position feedback system	Probable cause
The throttle valve controller judges a malfunction, and then transmit the result to the engine-ECU. Range of Check ● Ignition switch: ON ● Battery voltage: 10 V or more Set Conditions ● Failure in the position feedback (The engine-ECU detects that the current in the motor is excessive and the opening angle difference between the target value of throttle position sensor (1st channel) and the actual value of throttle position sensor (1st channel) is 2.0 V or more)	● Malfunction of throttle position sensor (1st channel) ● Open or short circuit in the throttle position sensor (1st channel) circuit or loose connector contact ● Malfunction of the throttle valve controller



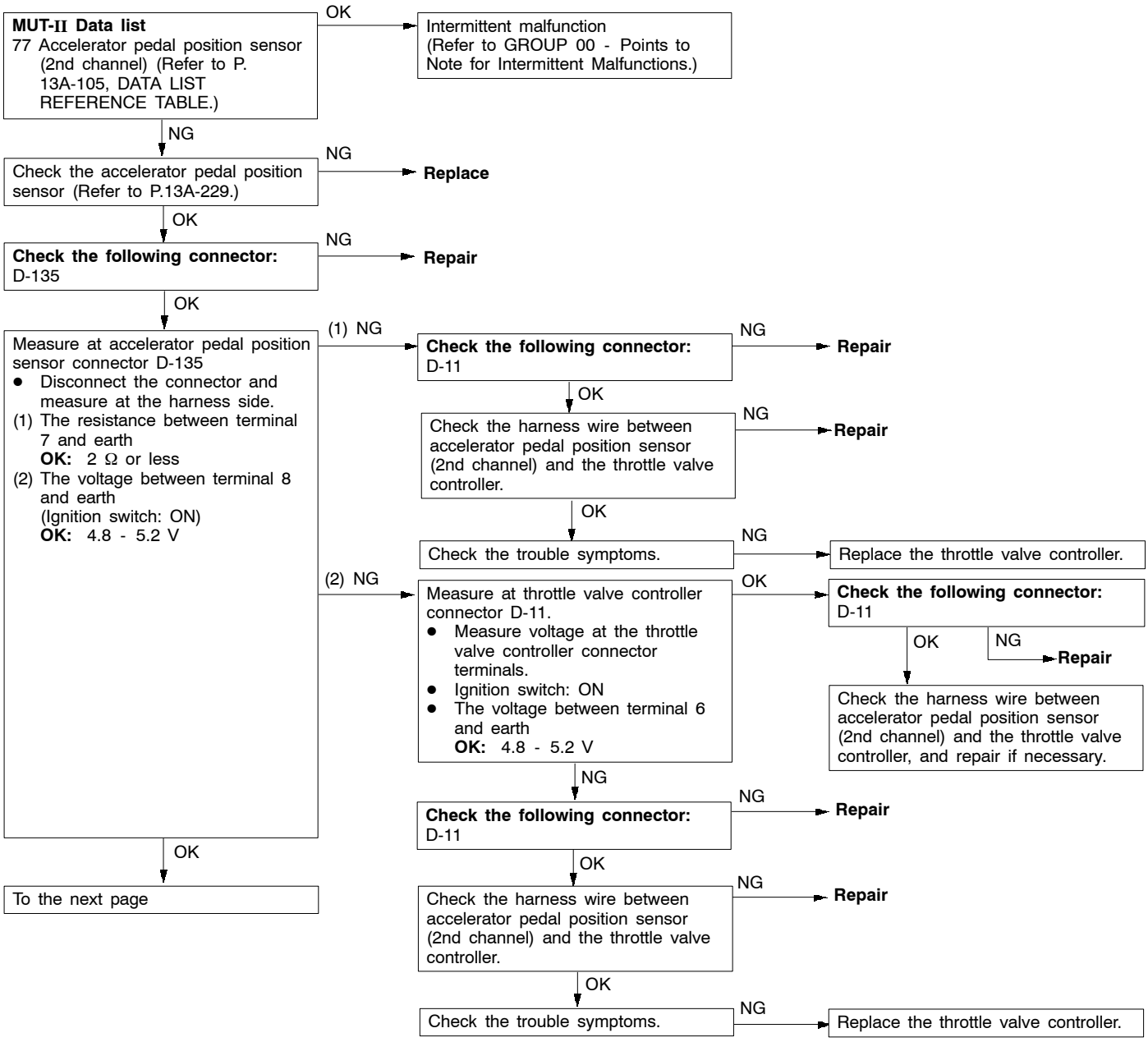
Code No.P1222 throttle valve control servo system	Probable cause
The throttle valve controller judges a malfunction, and then transmit the result to the engine-ECU. Range of Check ● throttle valve control servo relay: ON Set Conditions ● Short circuit of the throttle valve control servo drive circuit to earth ● Power is supplied to the throttle valve control servo circuit from other sources. ● Open circuit in the throttle valve control servo power supply circuit	● Malfunction of the throttle valve control servo ● Open circuit in the throttle valve control servo power supply circuit ● Open or short circuit in the throttle valve control servo circuit or loose connector contact ● Malfunction of throttle valve controller

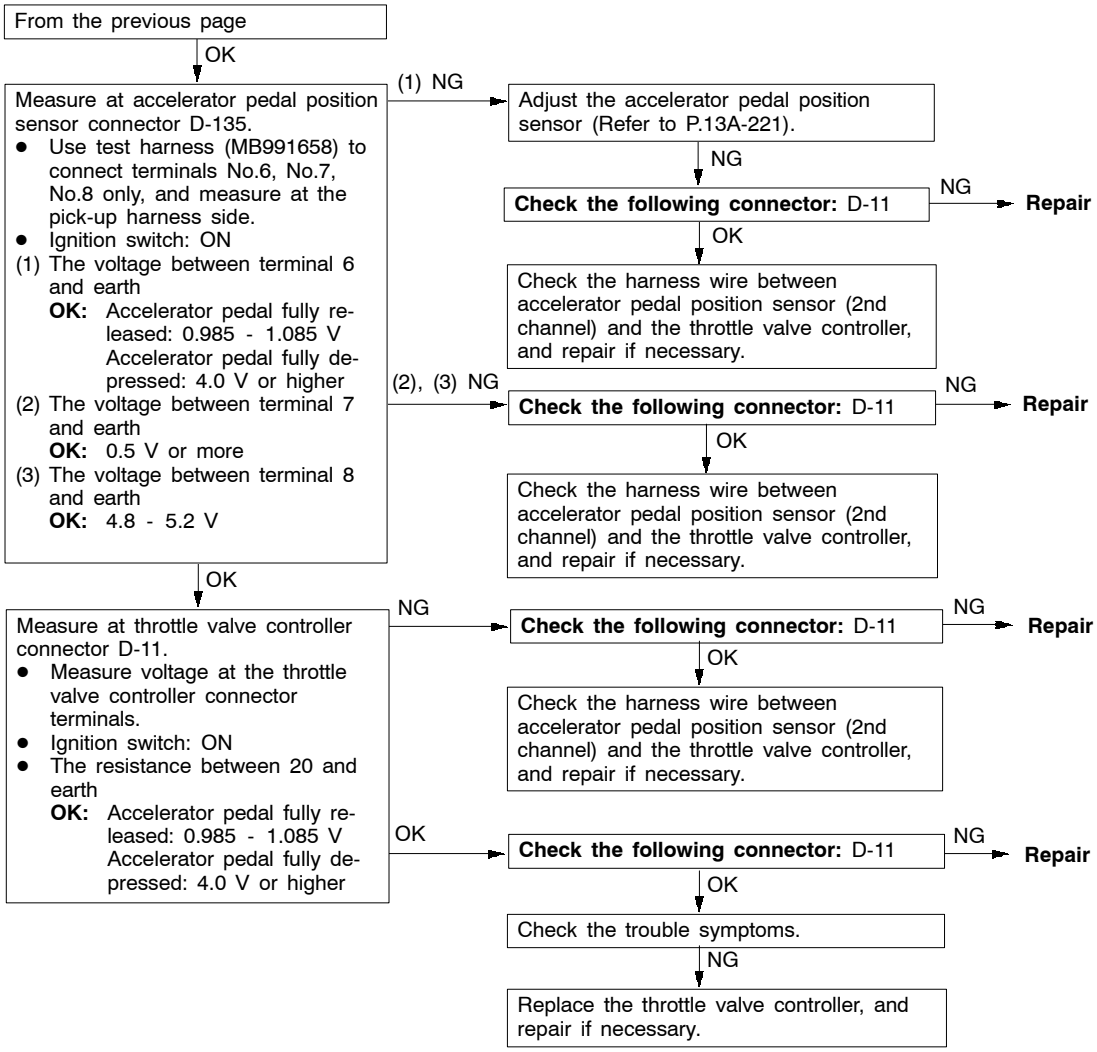


Code No.P1223 Communication line system with the throttle valve controller	Probable cause
Range of Check ● Ignition switch: ON ● Battery voltage: 8 V or more. ● Engine: not cranking Set Conditions ● System detects an error in communication line between the engine-ECU and the throttle valve controller, and between the throttle valve controller and the engine-ECU.	● Short in communication line ● Malfunction of engine-ECU ● Malfunction of throttle valve controller



Code No.P1225 Accelerator pedal position sensor (2nd channel) system	Probable cause
Range of Check ● Accelerator pedal position sensor (2nd channel) is normal. ● Communication between the engine-ECU and the throttle valve controller is normal. Set Conditions ● Output voltage of the accelerator pedal position sensor (2nd channel) is 0.2 V or less for one second or ● Output voltage of the accelerator pedal position sensor (1st channel) is 2.5 V or less, and output voltage of the accelerator pedal position sensor (2nd channel) is 4.5 V or more for one second. or ● Difference between the accelerator pedal position sensor (1st and 2nd channels) output voltages exceeds 1.0 V (i.e. when the throttle valve opening angle changes slightly).	● Malfunction of accelerator pedal position sensor (2nd channel) ● Open or short circuit in accelerator pedal position sensor (2nd channel) circuit or loose connector contact ● Malfunction of the throttle valve controller ● Malfunction of engine-ECU

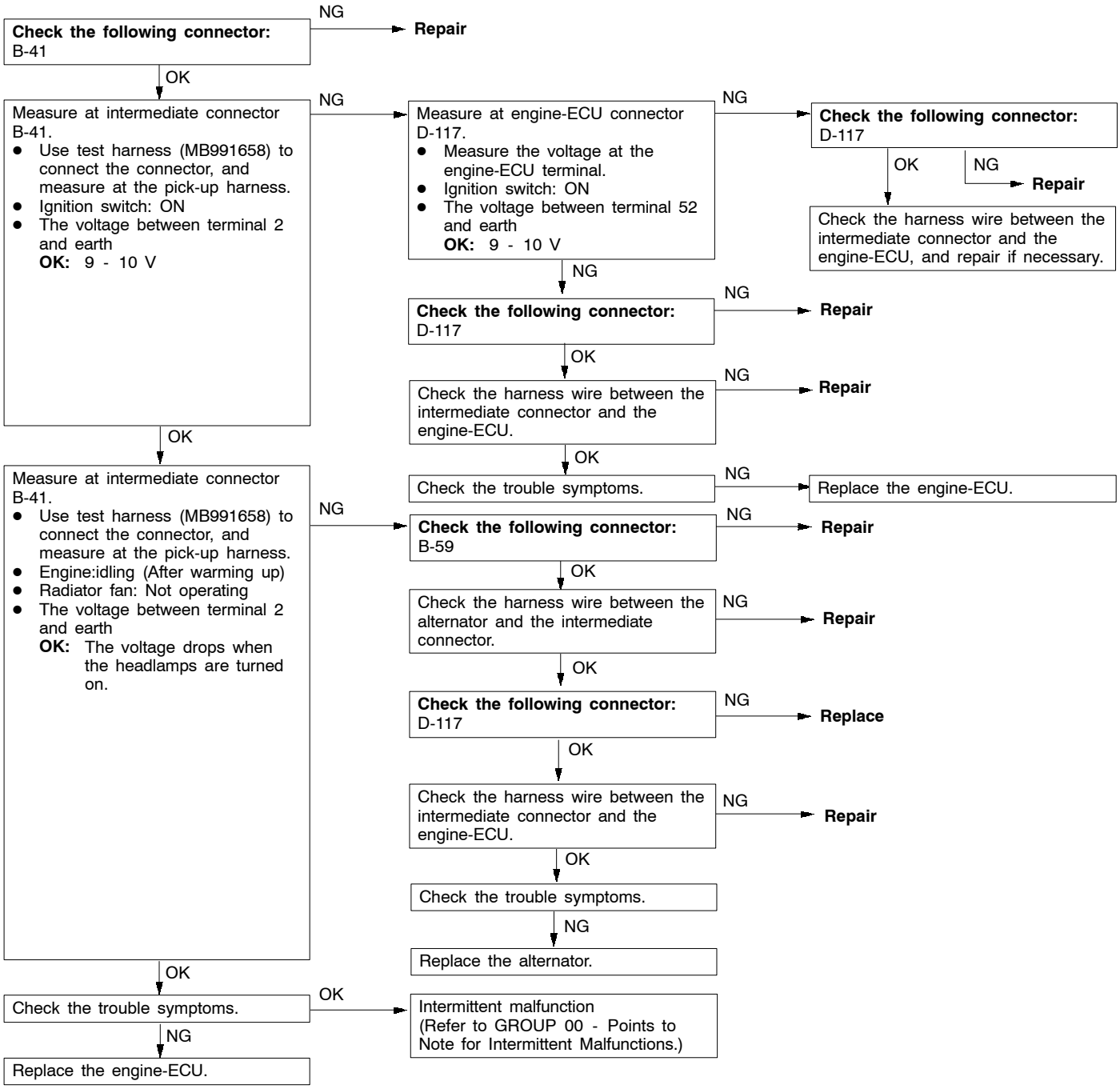




Code No.P1226 Throttle valve controller system	Probable cause
Set Conditions ● Errors in reading or writing to the throttle valve controller ROM.	● Malfunction of the throttle valve controller

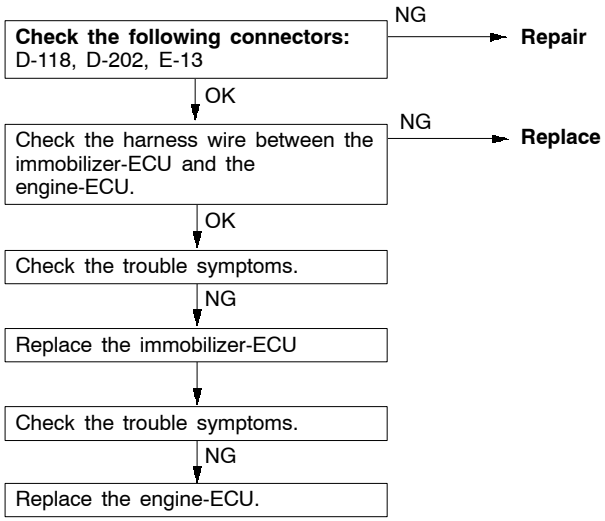
Replace the throttle valve controller.

Code No.P1500 Alternator FR terminal system	Probable cause
Range of Check ● Engine speed: 50 r/min or more Set Conditions ● Input voltage from the alternator FR terminal is system voltage for 20 seconds.	● Open circuit in alternator FR terminal circuit ● Malfunction of engine-ECU



Cord No.P1610 Immobilizer system	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● Improper communication between the engine-ECU and the immobilizer-ECU	● Open or short circuit, or loose connector contact ● Malfunction of the immobilizer-ECU ● Malfunction of the engine-ECU

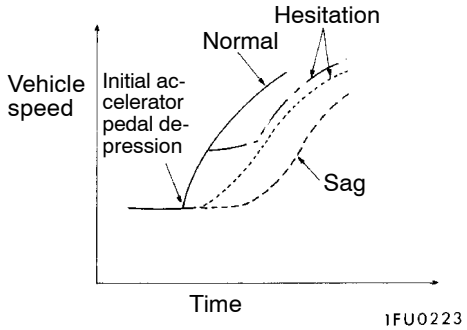
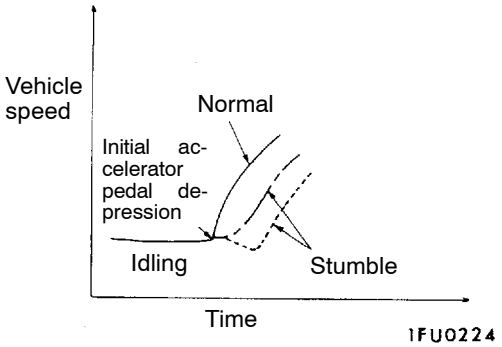
NOTE
(1) If the registered ignition keys are close each other when starting the engine, radio interference may cause this code to be displayed.
(2) This code may be displayed when registering the key encrypted code.



INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is impossible.	Communication with all systems is not possible.	1	13A-74
	Communication with engine-ECU only is not possible.	2	13A-75
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-76
	The engine warning lamp remains illuminating and never goes out.	4	13A-76
Starting	No initial combustion (starting impossible)	5	13A-77
	Initial combustion but no complete combustion (starting impossible)	6	13A-79
	Long time to start (improper starting)		
Idling stability (Improper idling)	Unstable idling (Rough idling, hunting)	7	13A-81
	Idling speed is high. (Improper idling speed)	8	13A-83
	Idling speed is low. (Improper idling speed)		
Idling stability (Engine stalls)	When the engine is cold, it stalls at idling. (Die out)	9	13A-84
	When the engine is hot, it stalls at idling. (Die out)	10	13A-85
	The engine stalls when starting the car. (Pass out)	11	13A-87
	The engine stalls when decelerating.	12	13A-88
Driving	Hesitation, sag or stumble	13	13A-89
	Poor acceleration		
	Surge		
	The feeling of impact or vibration when accelerating	14	13A-90
	The feeling of impact or vibration when decelerating	15	13A-91
	Knocking	16	13A-91
Dieseling		17	13A-91
Too high CO and HC concentration when idling		18	13A-92
Low alternator output voltage (approx. 12.3 V)		19	13A-94
Engine idle speed is incorrect while the A/C is on.		20	13A-94
A/C condenser fan is inoperative		21	13A-95
Clutch switch system malfunction		22	13A-96
GDI ECO indicator lamp system	GDI ECO indicator lamp does not illuminate.	23	13A-96
	GDI ECO indicator lamp remains illuminated and does not go off.	24	13A-97

PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

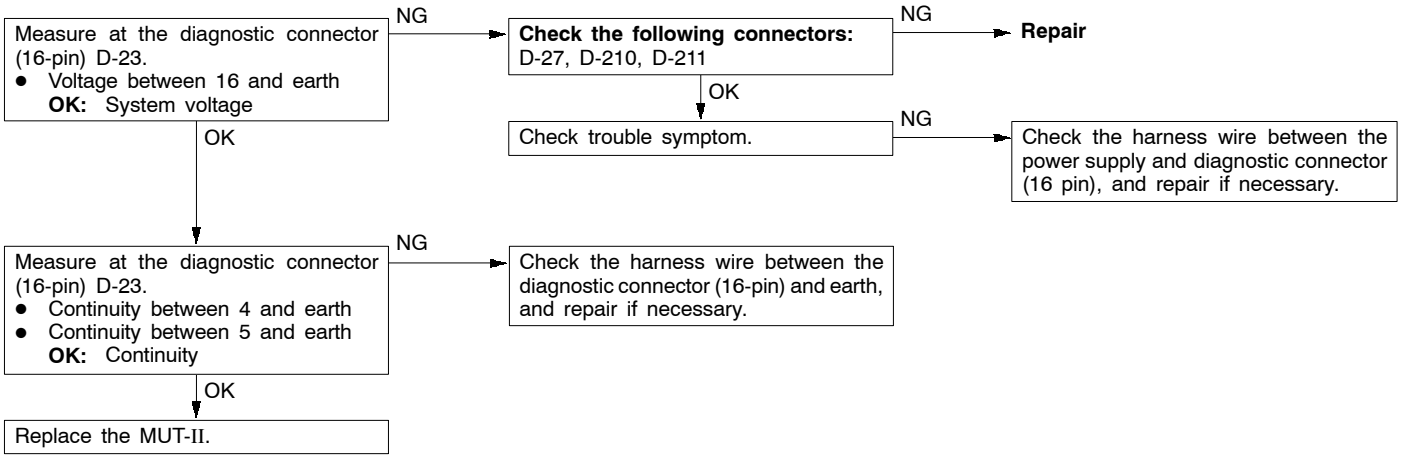
Items		Symptom
Starting	Won't start	The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.
	Fires up and dies	There is combustion within the cylinders, but then the engine soon stalls.
	Hard starting	Engine starts after cranking a while.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

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

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

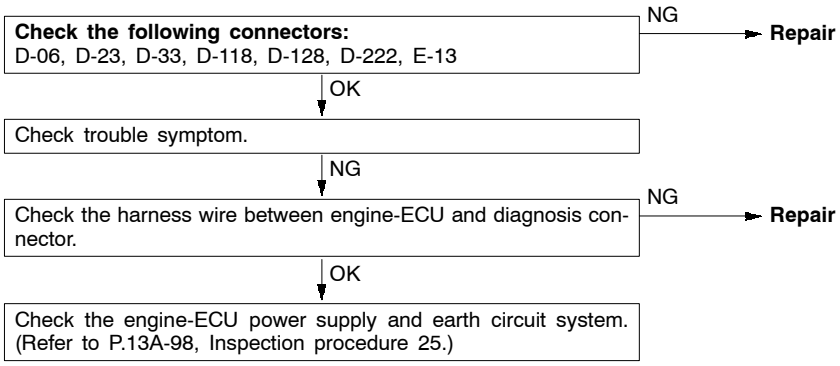
INSPECTION PROCEDURE 1

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



Inspection procedure 2

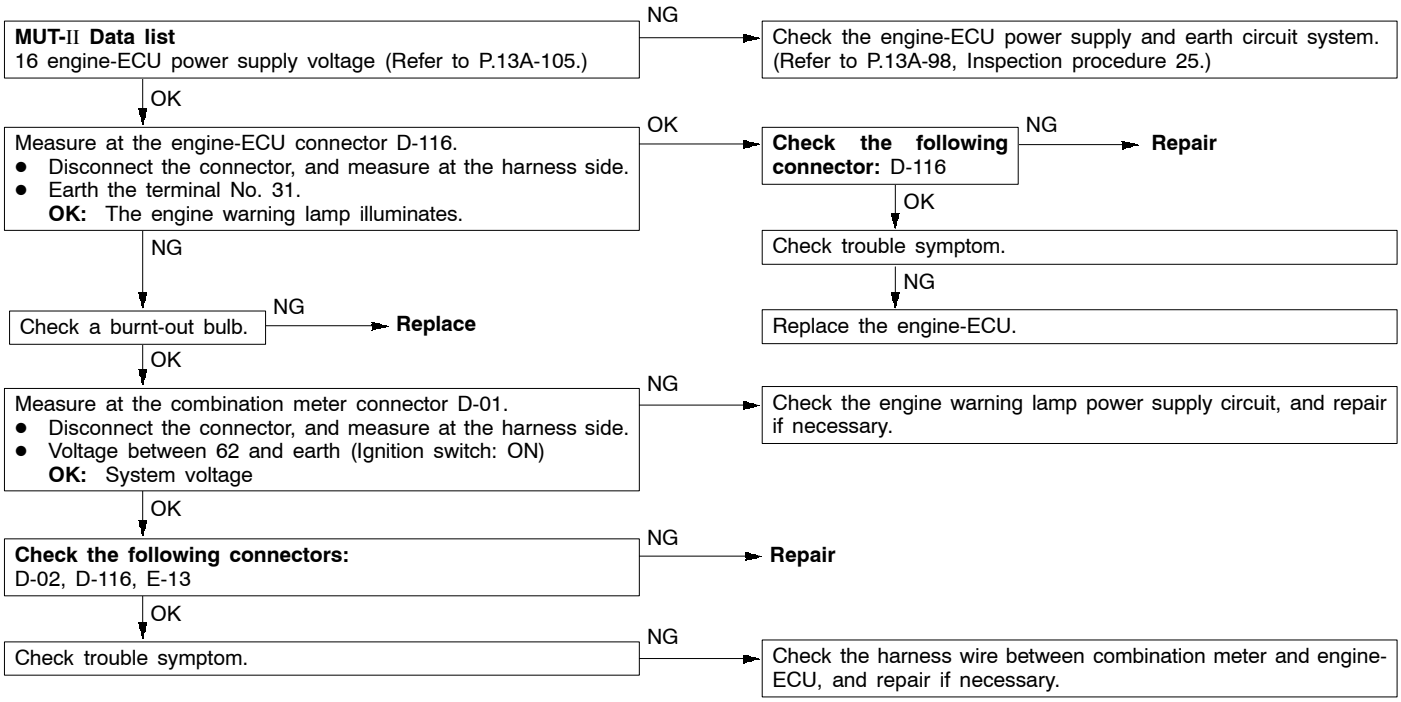
MUT-II communication with engine-ECU is impossible.	Probable cause
One of the following causes may be suspected. ● No power supply to engine-ECU. ● Defective earth circuit of engine-ECU. ● Defective engine-ECU. ● Improper communication line between engine-ECU and MUT-II	● Malfunction of engine-ECU power supply circuit ● Malfunction of engine-ECU ● Open circuit between the engine-ECU and diagnosis connector



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

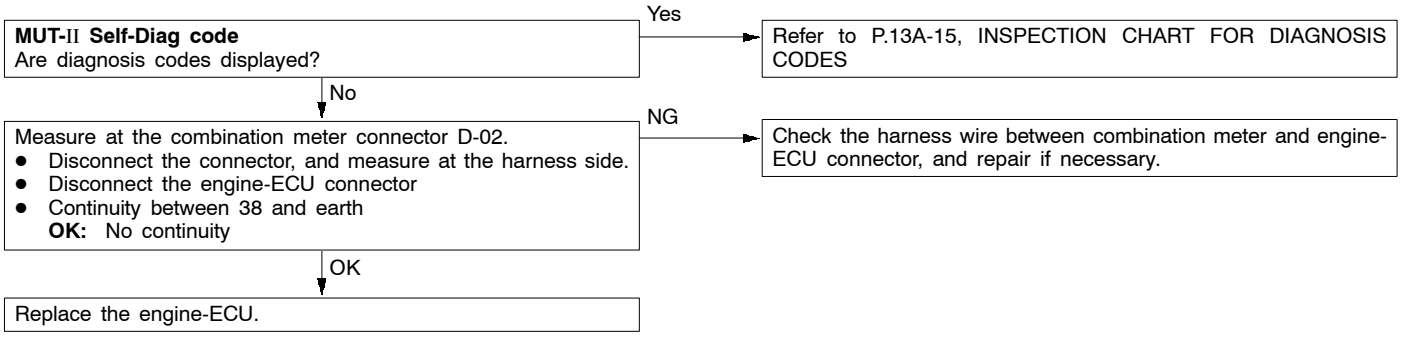
Inspection procedure 3

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

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

MUT-II Self-Diag code
Is a diagnosis code displayed?
Yes → Refer to P.13A-15, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

MUT-II Data list
16 System voltage (Refer to P.13A-105.)
NG → Check the engine control relay and ignition switch-IG system. (Refer to P.13A-99, Inspection procedure 26.)
OK ↓

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

MUT-II Actuator test
07 Fuel pump (low pressure) (Refer to P.13A-110.)
NG → Check the fuel pump (low pressure) system. (Refer to P.13A-101, Inspection procedure 29.)
OK ↓

MUT-II Data list
22 Crank angle sensor (Refer to P.13A-105.)
NG → Check the crank angle sensor system. (Refer to P.13A-56, code No. P0335.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-105.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13A-22, code No. P0115.)
OK ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-105.)
NG → Check the throttle position sensor (1st channel) system. (Refer to P.13A-25, code No. P0120.)
OK ↓

Inspect engine start ability by cranking the engine while the accelerator pedal is slightly depressed.
OK → Clean around the throttle valve. (Refer to P.13A-220.)
NG ↓

Measure at injector driver connector B-121.
- Disconnect the connector, and measure at the connector side.
- Voltage between each of terminals 4, 12, 21 and earth (Ignition switch: ON)
  OK: System voltage

NG → Check the injector driver system. (Refer to P.13A-104, Inspection procedure 34.)
OK ↓

Check fuel leakage. (Refer to P.13A-225.)
NG → **Repair**
OK ↓

Measure low fuel pressure between the fuel pump (low pressure) and fuel pump (high pressure). (Refer to P.13A-222.)
NG → **Repair**
OK ↓

Measure at ignition coil connectors B-101, B-108, B-112, B-113, B-116, B-119.
- Connect the connector.
- Connect a timing light to the No.1 terminal of each connector in turn.
  (Engine cranking)
  OK: The timing light flashes.

NG → Check the ignition coil (incorporating power transitor) system. (Refer to P.13A-53, code No. P0300.)
OK ↓

Check ignition timing while the engine is cranking.
OK: Approx. 5° BTDC
NG → Check that the crank angle sensor and timing belt cover are properly installed.
OK ↓

To the next page

From the previous page

↓ OK

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

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

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

NG → Replace the ignition coil.

↓ OK

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

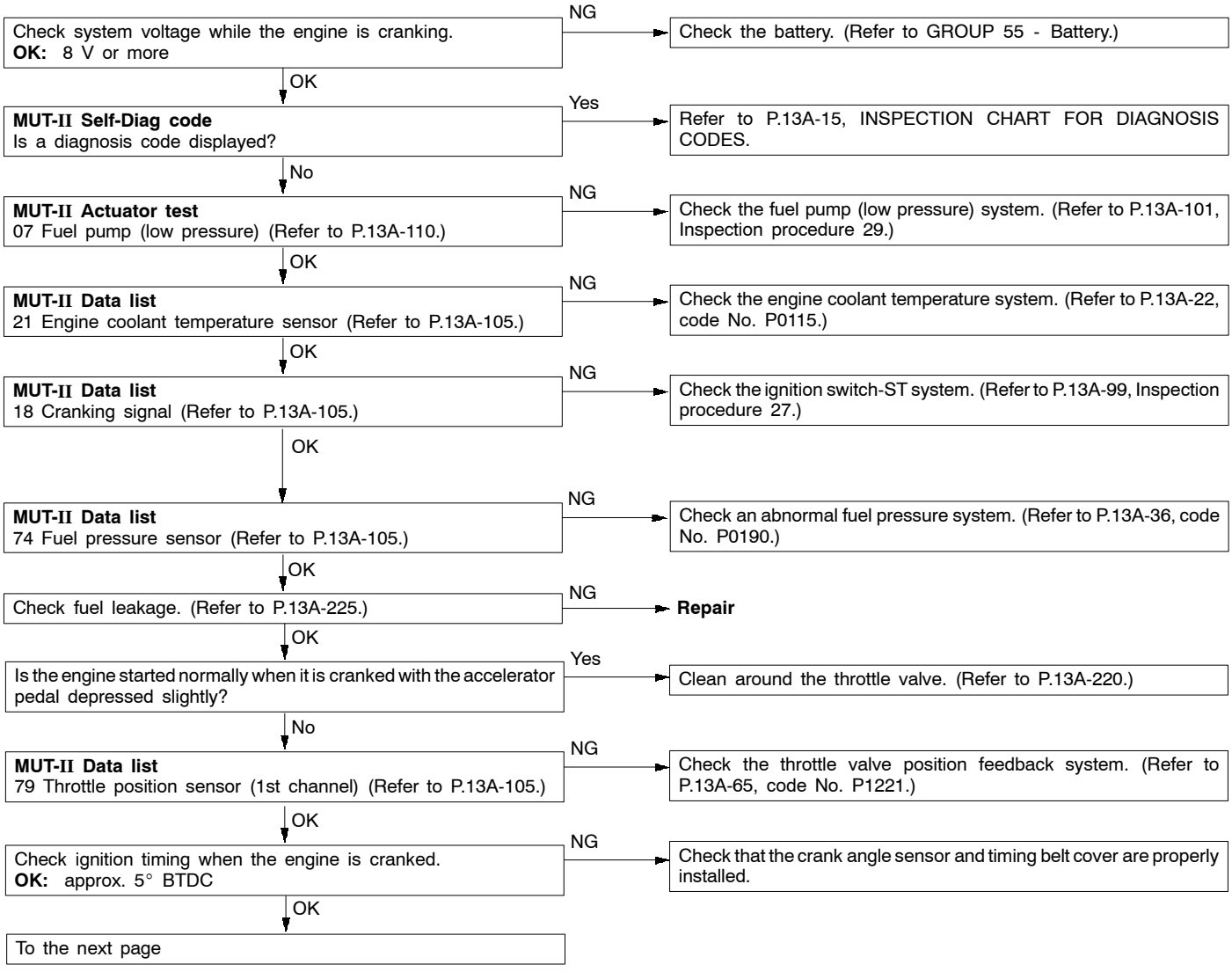
↓ OK

Check trouble symptom.

NG → Replace the injector.

Inspection procedure 6

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



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OK

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

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

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

NG → Replace the ignition coil.

OK

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

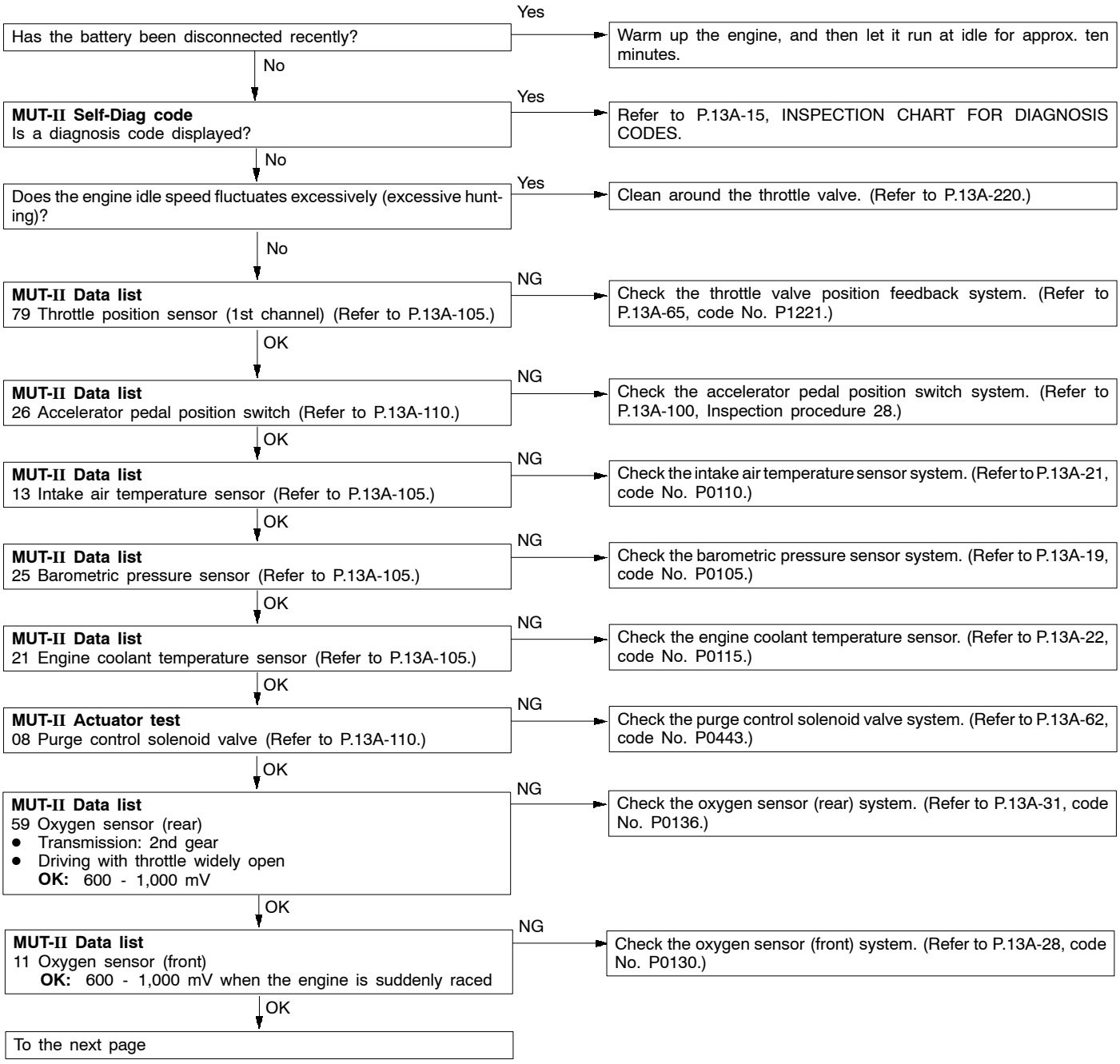
OK

Check trouble symptom.

NG → Replace the injector.

Inspection procedure 7

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



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OK

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

NG → Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-224.)

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

NG → **Repair**

OK

MUT-II Data list
27 Power steering fluid pressure switch (Refer to P.13A-105.)

NG → Check the power steering fluid pressure switch system. (Refer to P.13A-102, Inspection procedure 30.)

OK

MUT-II Data list
28 A/C switch (Refer to P.13A-105.)

NG → Check the A/C switch and A/C relay system. (Refer to P.13A-102, Inspection procedure 31.)

OK

MUT-II Data list
67 Stop lamp switch (Refer to P.13A-105.)

NG → Check the stop lamp switch. (Refer to P.13A-103, Inspection procedure 32.)

OK

MUT-II Data list
31 Small lamp switch (Refer to P.13A-105.)

NG → Check the small lamp switch system. (Refer to P.13A-104, Inspection procedure 33.)

OK

MUT-II Data list
68 EGR valve (Refer to P.13A-105.)

NG → Check the EGR valve. (Refer to P.13A-60, code No. P0403.)

OK

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

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

OK

Clean around the throttle valve. (Refer to P.13A-220.)

Check trouble symptom.

NG

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

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

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

NG → Replace the ignition coil.

OK

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

Inspection procedure 8

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

MUT-II Self-Diag code
Is a diagnosis code displayed?
- Yes → (Refer to P.13A-15, INSPECTION CHART FOR DIAGNOSIS CODES.)
- No ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-105.)
- NG → Check the throttle valve position feedback system. (Refer to P.13A-65, code No.S P1221.)
- OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13A-110.)
- NG → Check the purge control solenoid valve. (Refer to P.13A-62, code No. P0443.)
- OK ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-105.)
- NG → Check the accelerator pedal position switch system. (Refer to P.13A-100, Inspection procedure 28.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-105.)
- NG → Check the engine coolant temperature sensor. (Refer to P.13A-22, code No. P0115.)
- OK ↓

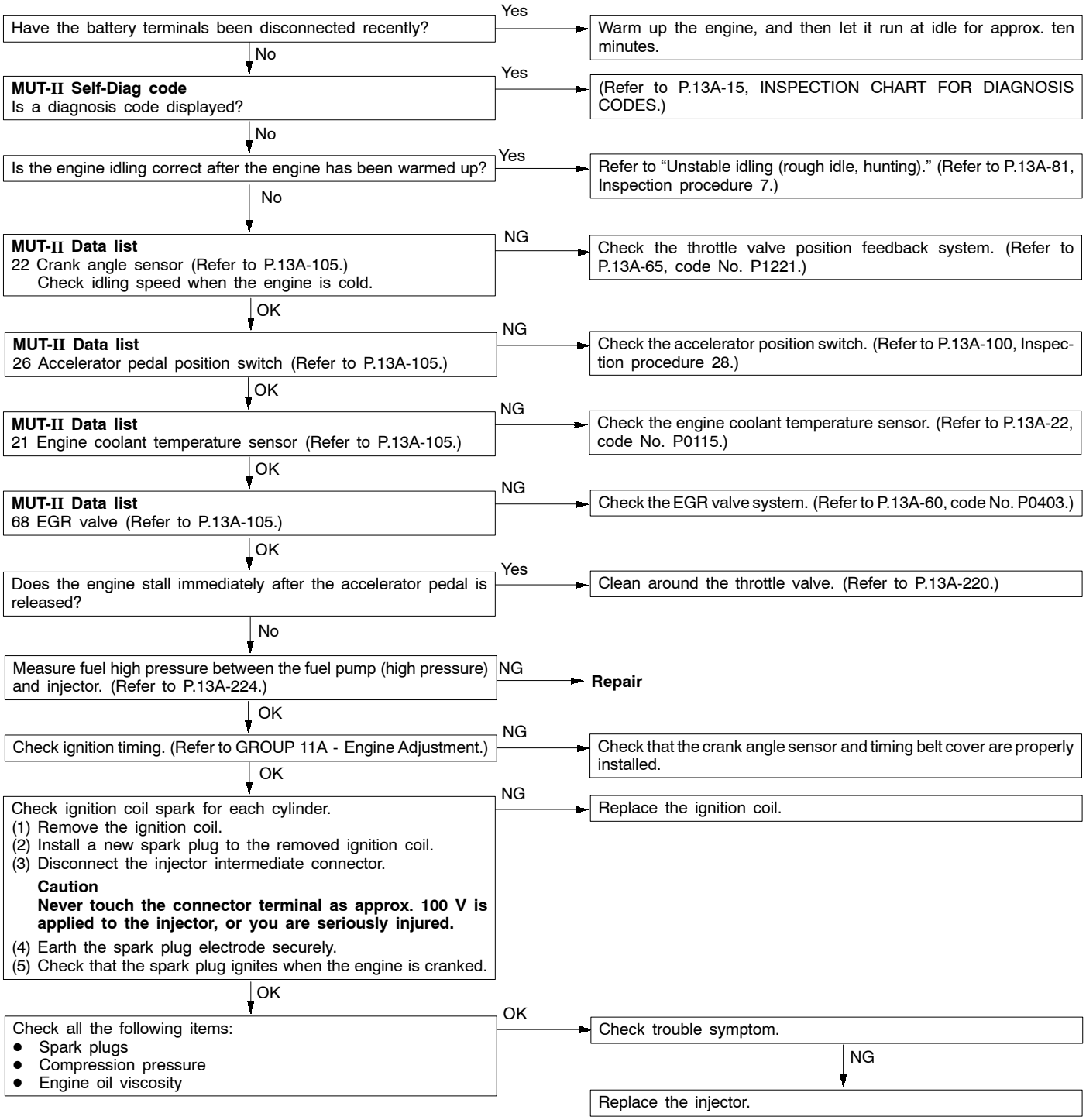
MUT-II Data list
28 A/C switch (Refer to P.13A-105.)
- NG → Check the A/C switch and A/C relay system. (Refer to P.13A-102, Inspection procedure 31.)
- OK ↓

MUT-II Data list
67 Stop lamp switch (Refer to P.13A-105.)
- NG → Check the stop lamp switch system. (Refer to P.13A-103, Inspection procedure 32.)
- OK ↓

- Clean around the throttle valve. (Refer to P.13A-220.)
- Adjust the throttle position sensor. (Refer to P.13A-220.)

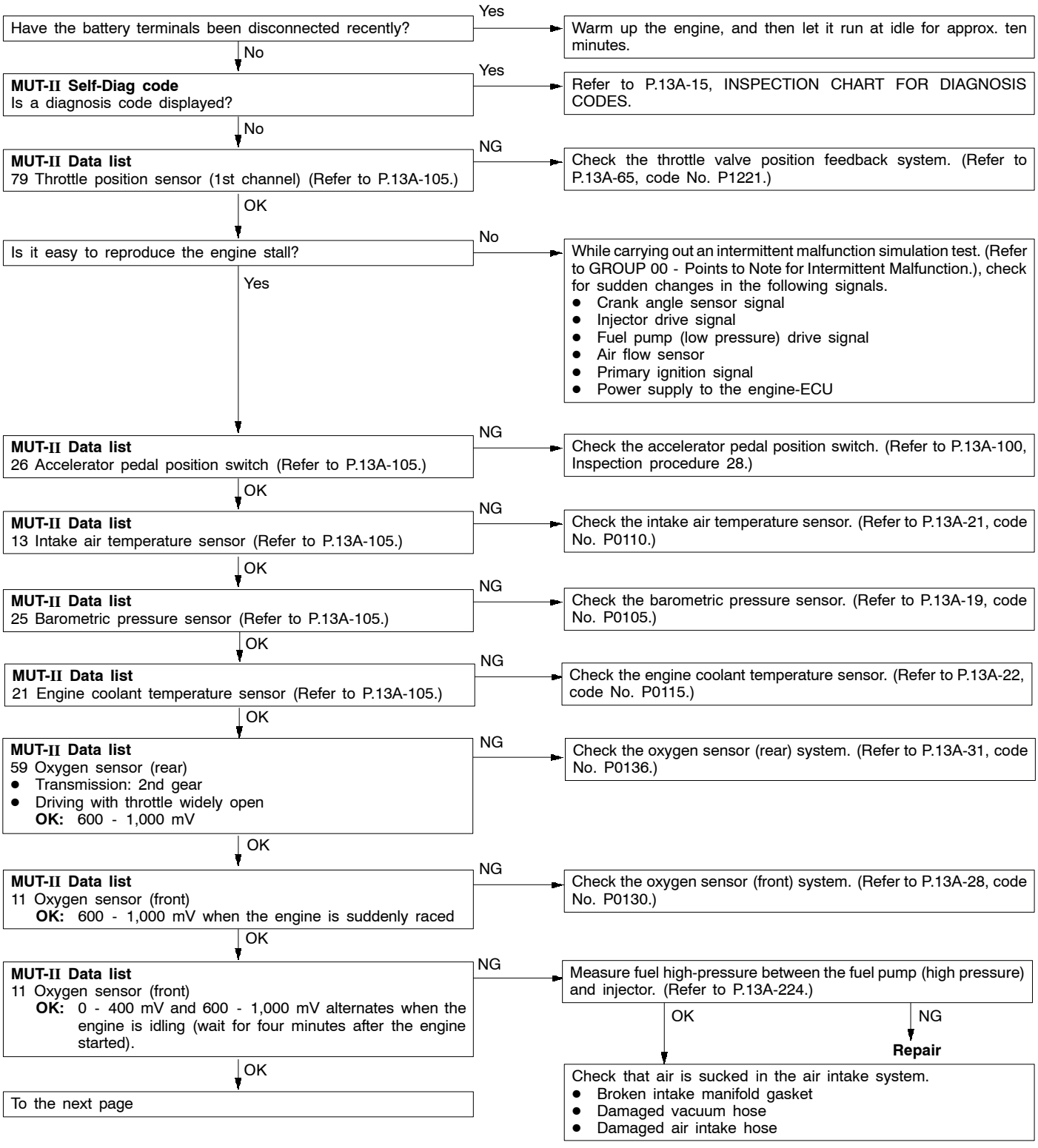
Inspection procedure 9

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



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OK

MUT-II Data list
27 Power steering fluid pressure switch (Refer to P.13A-105.)

NG → Check the power steering fluid pressure switch system. (Refer to P.13A-102, Inspection procedure 30.)

OK

MUT-II Data list
28 A/C switch (Refer to P.13A-105.)

NG → Check the A/C switch and A/C relay system. (Refer to P.13A-102, Inspection procedure 31.)

OK

MUT-II Data list
31 Small lamp switch (Refer to P.13A-105.)

NG → Check the small lamp switch system. (Refer to P.13A-104, Inspection procedure 33.)

OK

MUT-II Data list
34 Air flow sensor reset signal (Refer to P.13A-105.)

NG → Check the air flow sensor system. (Refer to P.13A-17, code No. P0100.)

OK

MUT-II Data list
68 EGR valve (Refer to P.13A-105.)

NG → Check the EGR valve. (Refer to P.13A-60, code No. P0403.)

OK

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

Yes → Clean around the throttle valve. (Refer to P.13A-220.)

No

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

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

OK

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

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

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

NG → Replace the ignition coil.

OK

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

Inspection procedure 11

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

MUT-II Self-Diag code
Is a diagnosis code displayed?

Yes → (Refer to P.13A-15, INSPECTION CHART FOR DIAGNOSIS CODES.)

No ↓

MUT-II Data list
68 EGR valve (Refer to P.13A-105.)

NG → Check the EGR valve. (Refer to P.13A-60, code No. P0403.)

OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13A-110.)

NG → Check the purge control solenoid valve system. (Refer to P.13A-62, code No. P0443.)

OK ↓

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

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

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

NG → Replace the ignition coil.

OK ↓

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

Inspection procedure 12

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

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

MUT-II Self-Diag code
Is a diagnosis code displayed?
- Yes → (Refer to P.13A-15, INSPECTION CHART FOR DIAGNOSIS CODES.)
- No ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-105.)
- NG → Check the accelerator pedal position switch. (Refer to P.13A-100, Inspection procedure 28.)
- OK ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-105.)
- NG → Check the throttle valve position feedback system. (Refer to P.13A-65, code No. P1221.)
- OK ↓

MUT-II Data list
68 EGR valve (Refer to P.13A-105.)
- NG → Check the EGR valve system. (Refer to P.13A-69, code No. P0403.)
- OK ↓

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

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

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

Check all the following items:
- Spark plug
- Clean around the throttle valve (Refer to P.13A-220.)

Inspection procedure 13

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

MUT-II Self-Diag code
Is a diagnosis code displayed?
Yes → (Refer to P.13A-15, INSPECTION CHART FOR DIAGNOSIS CODES.)
OK ↓

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

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-105.)
NG → Check the accelerator pedal position switch. (Refer to P.13A-100, Inspection procedure 28.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-105.)
NG → Check the intake air temperature sensor. (Refer to P.13A-21, code No. P0110.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-105.)
NG → Check the barometric pressure sensor. (Refer to P.13A-19, code No. P0105.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-105.)
NG → Check the engine coolant temperature sensor. (Refer to P.13A-22, code No. P0115.)
OK ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-105.)
NG → Check the throttle valve position feedback system. (Refer to P.13A-65, code No. P1221.)
OK ↓

MUT-II Data list
59 Oxygen sensor (rear) (Refer to P.13A-78.)
- Transmission: 2nd gear
- Driving with throttle widely open
  OK: 600 - 1,000 mV

NG → Check the oxygen sensor (rear) system. (Refer to P.13A-31, code No. P0136.)
OK ↓

MUT-II Data list
11 Oxygen sensor (front)
OK: 600 - 1,000 mV when the engine is suddenly raced
NG → Check the oxygen sensor (front) system. (Refer to P.13A-28, code No. P0130.)
OK ↓

MUT-II Data list
11 Oxygen sensor (front)
OK: 0 - 400 mV and 600 - 1,000 mV alternates when the engine is idling (wait for four minutes after the engine started).
NG → Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-224.)
OK ↓

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

OK ↓

MUT-II Data list
68 EGR valve (Refer to P.13A-105.)
NG → Check the EGR valve. (Refer to P.13A-60, code No. P0403.)
OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13A-110.)
NG → Check the purge control solenoid valve. (Refer to P.13A-62, code No. P0443.)
OK ↓

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OK

Measure high fuel pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-224.)

NG → **Repair**

OK

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

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

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

NG → Replace the ignition coil.

OK

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

OK → Check trouble symptom.

NG → Replace the injector.

Inspection procedure 14

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

MUT-II Self-Diag code
Is a diagnosis code displayed?

Yes → (Refer to P.13A-15, INSPECTION CHART FOR DIAGNOSIS CODES.)

No

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-105.)

NG → Check the throttle valve position feedback system. (Refer to P.13A-65, code No. P1221.)

OK

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

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

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

OK → Check all the following items:
- Spark plug
- Ignition current leak

NG → Replace the ignition coil.

Inspection procedure 15

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

MUT-II Self-Diag code
Is a diagnosis code displayed?
Yes → (Refer to P.13A-15, INSPECTION CHART FOR DIAGNOSIS CODES.)
No ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-105.)
NG → Check the throttle valve position feedback system. (Refer to P.13A-65, code No. P1221.)
OK ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-105.)
NG → Check the accelerator pedal position switch system. (Refer to P.13A-100, Inspection procedure 28.)
OK ↓

Clean around the throttle valve. (Refer to P.13A-220.)

Inspection procedure 16

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

MUT-II Self-Diag code
Is a diagnosis code displayed?
Yes → (Refer to P.13A-15, INSPECTION CHART FOR DIAGNOSIS CODES.)
No ↓

Does knocking occur when the vehicle is driven with the detonation sensor disconnected?
(At this time, use the MUT-II to check whether the ignition timing is retarded from when the detonation sensor connector is connected.)
No → Check the detonation sensor system. (Refer to P.13A-56, code No. P0325.)
Yes ↓

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

Inspection procedure 17

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

Replace the injector.

Inspection procedure 18

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

MUT-II Self-Diag code
Is a diagnosis code displayed?
Yes → (Refer to P.13A-15, INSPECTION CHART FOR DIAGNOSIS CODES.)
No ↓

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

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-105.)
NG → Check the engine coolant temperature sensor. (Refer to P.13A-22, code No. P0115.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-105.)
NG → Check the intake air temperature sensor. (Refer to P.13A-21, code No. P0110.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-105.)
NG → Check the barometric pressure sensor. (Refer to P.13A-19, code No. P0105.)
OK ↓

MUT-II Data list
59 Oxygen sensor (rear) (Refer to P.13A-78.)
- Transmission: 2nd gear
- Driving with throttle widely open

OK: 600 - 1,000 mV
NG → Check the oxygen sensor (rear) system. (Refer to P.13A-31, code No. P0136.)
OK ↓

MUT-II Data list
11 Oxygen sensor (front)
OK: 600 - 1,000 mV when the engine is suddenly raced
NG → Check the oxygen sensor (front) system. (Refer to P.13A-31, code No. P0130.)
OK ↓

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

NG ↓

Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-224.)
NG → **Repair**
OK ↓

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

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

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

OK ↓
NG → Replace the ignition coil.

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

OK ↓

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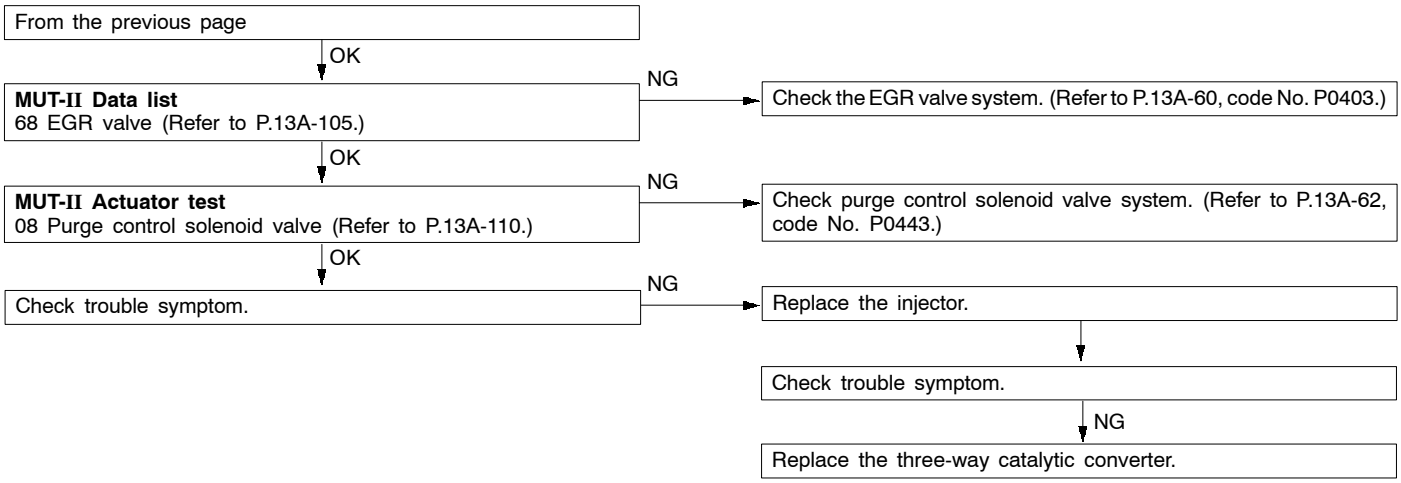
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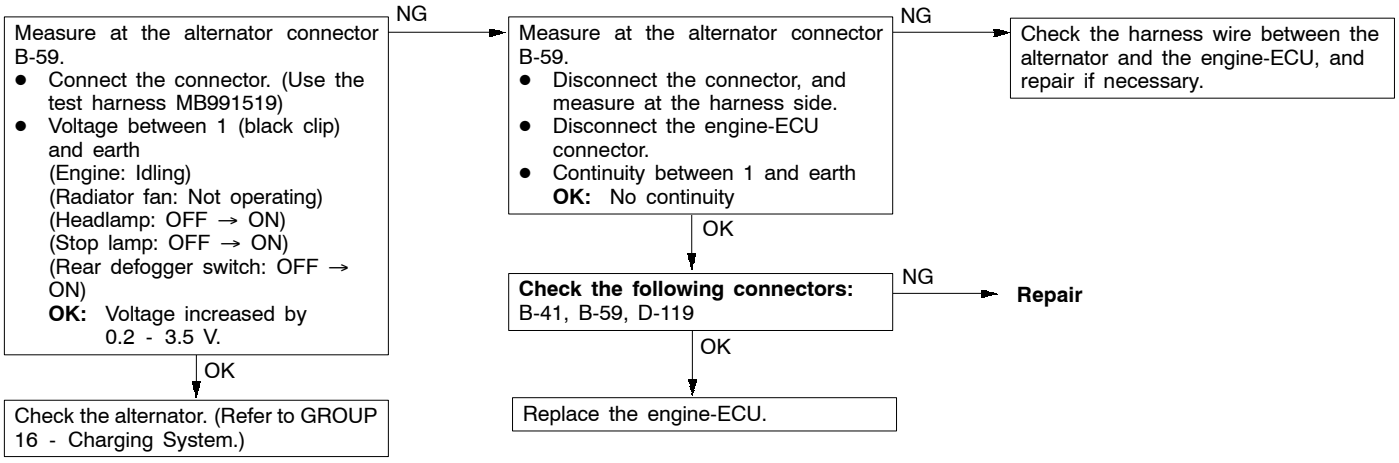
OK
MUT-II Data list
68 EGR valve (Refer to P.13A-105.)
NG
Check the EGR valve system. (Refer to P.13A-60, code No. P0403.)
OK
MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13A-110.)
NG
Check purge control solenoid valve system. (Refer to P.13A-62, code No. P0443.)
OK
Check trouble symptom.
NG
Replace the injector.
Check trouble symptom.
NG
Replace the three-way catalytic converter.

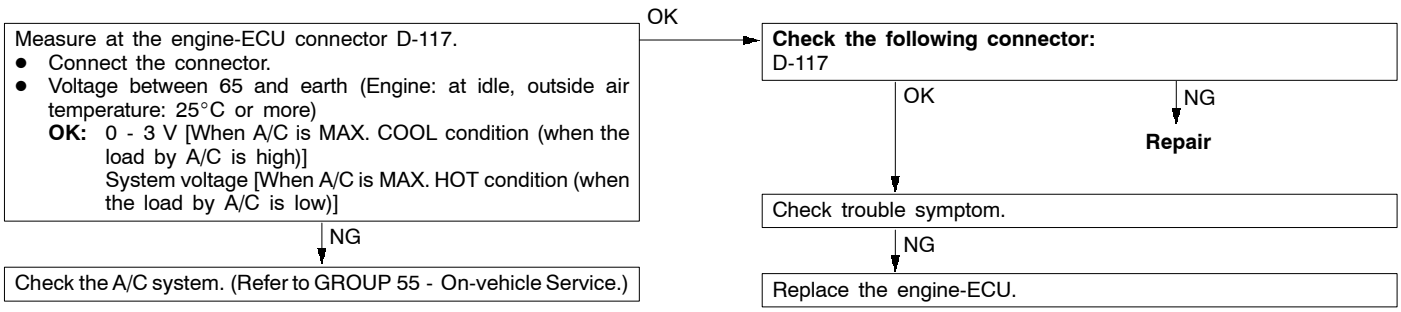
Inspection procedure 19

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



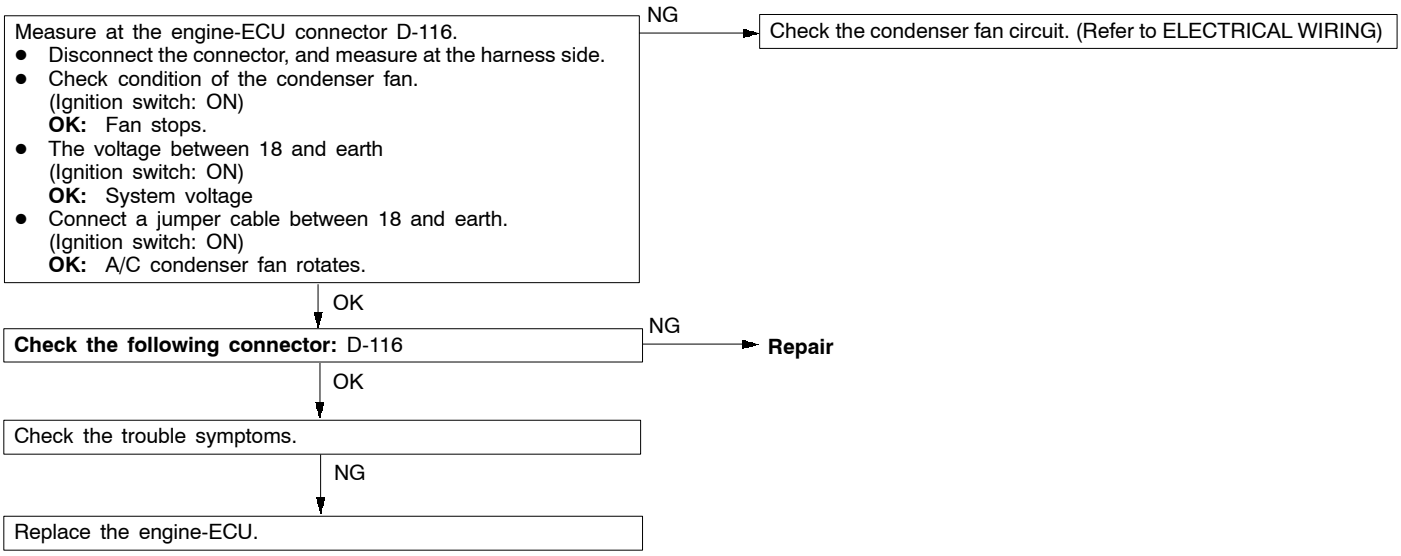
Inspection procedure 20

Idling speed is improper when A/C is operating	Probable cause
If the engine-ECU detects that the air conditioner is on, it activates the throttle control servo to control idle-up operation. The A/C-ECU judges if the load caused by air conditioner operation is high or low, and converts it to voltage signal (high or low voltage) and inputs the signal to the engine-ECU. Based on this voltage signal, the engine-ECU controls the idle-up speed (for high or low load).	• Malfunction of the A/C control system • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU



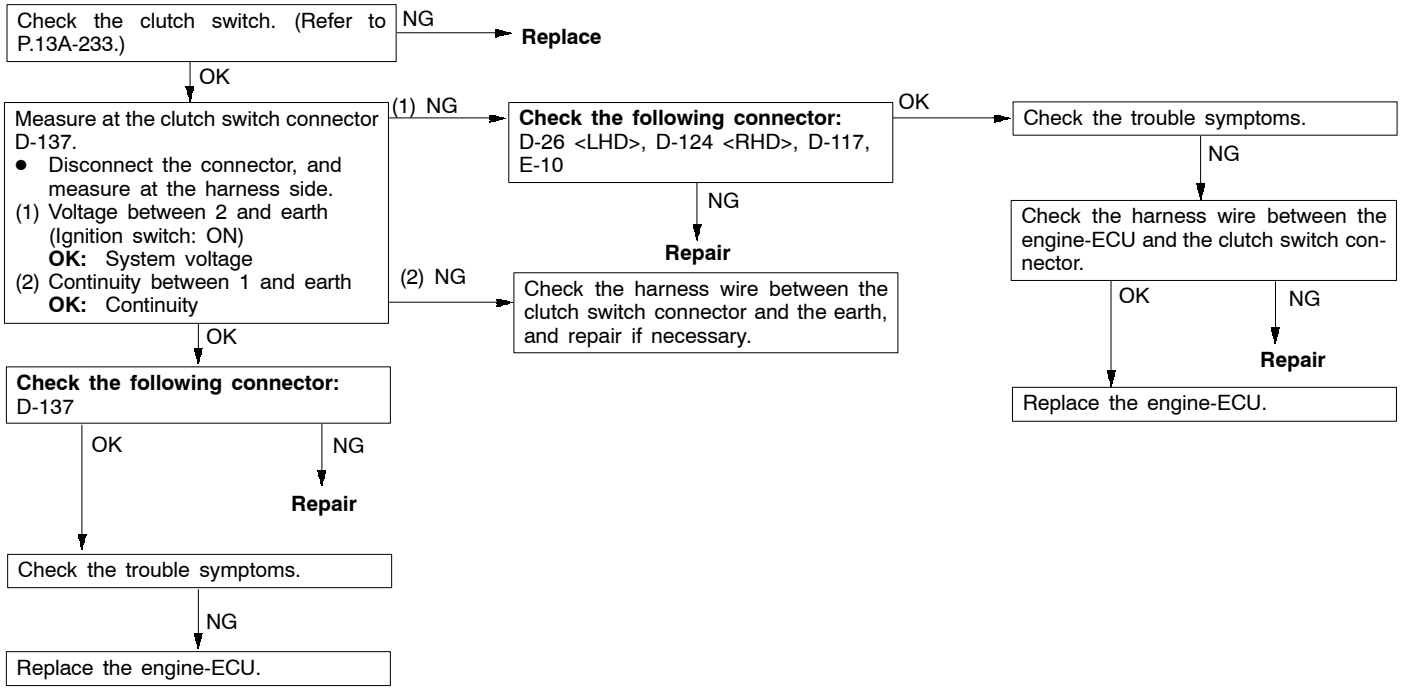
Inspection procedure 21

A/C condenser fan is inoperative	Probable cause
The fan motor relay is controlled by turning on and off the power transistor in the engine-ECU.	• Malfunction of the A/C condenser fan relay. • Malfunction of the condenser fan motor. • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU



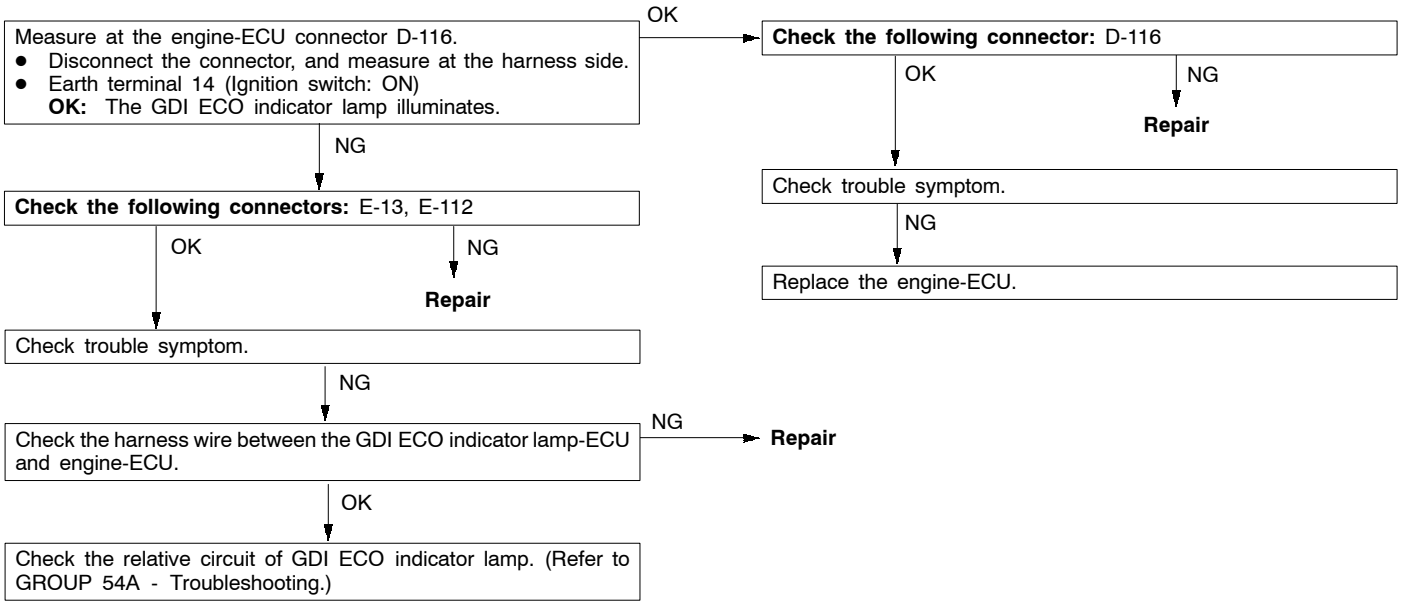
Inspection procedure 22

Clutch switch system malfunction	Probable cause
The clutch pedal switch sends a signal indicating clutch pedal depression to the engine-ECU. The engine-ECU controls the fuel injection properly according to this signal, thus prevents the fluctuation of the engine speed during shift change.	• Malfunction of the clutch switch • Open circuit or short-circuited harness wire in the clutch switch circuit • Malfunction of the engine-ECU



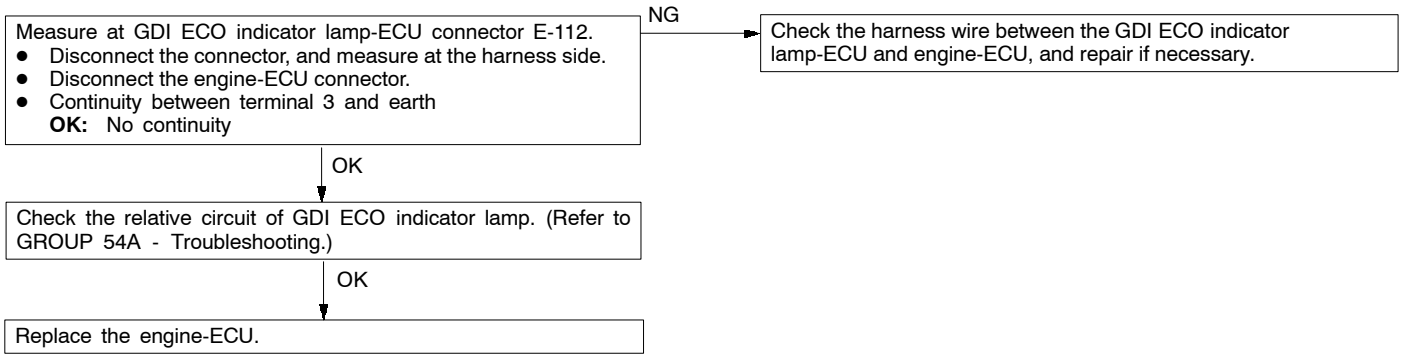
Inspection procedure 23

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



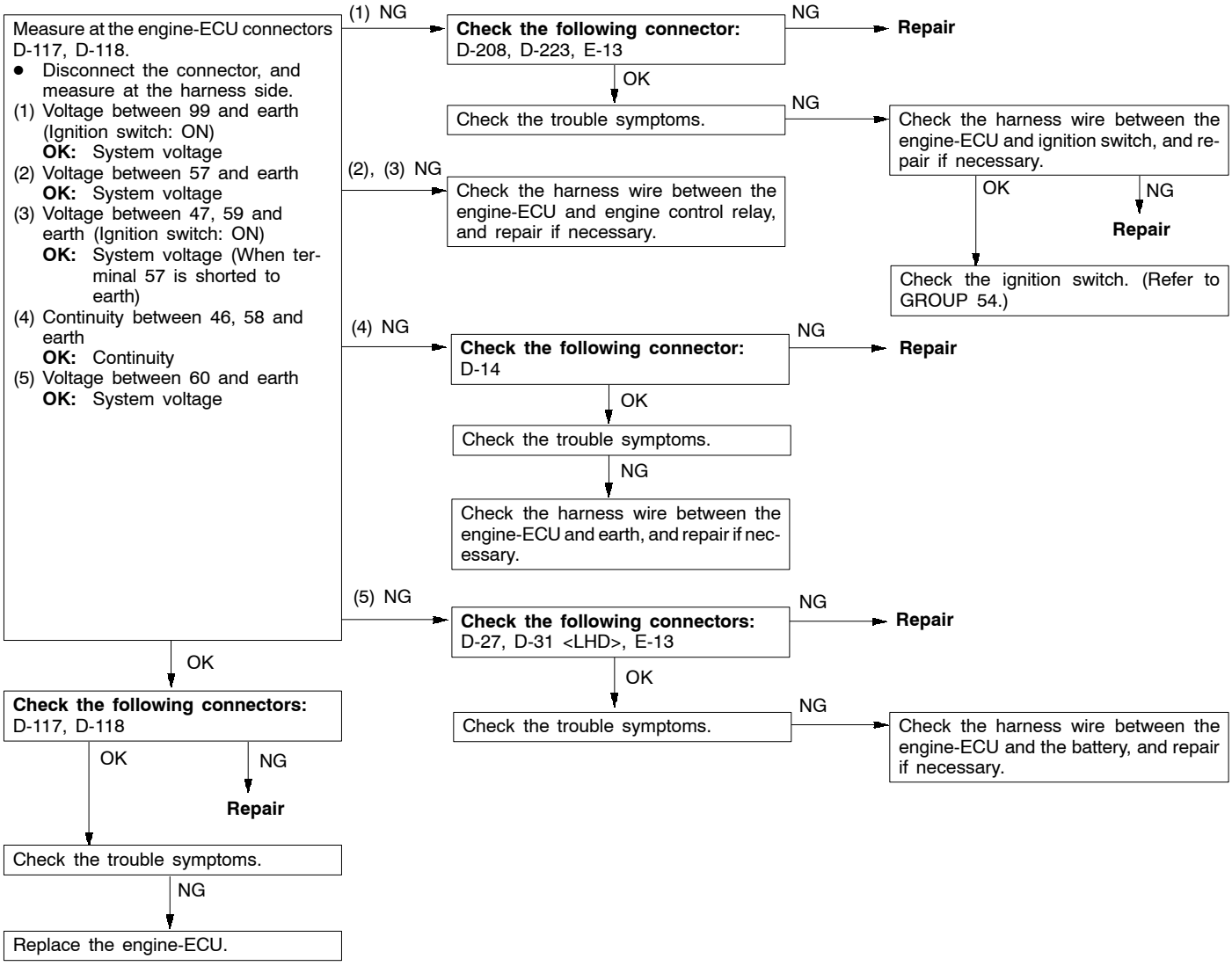
Inspection procedure 24

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



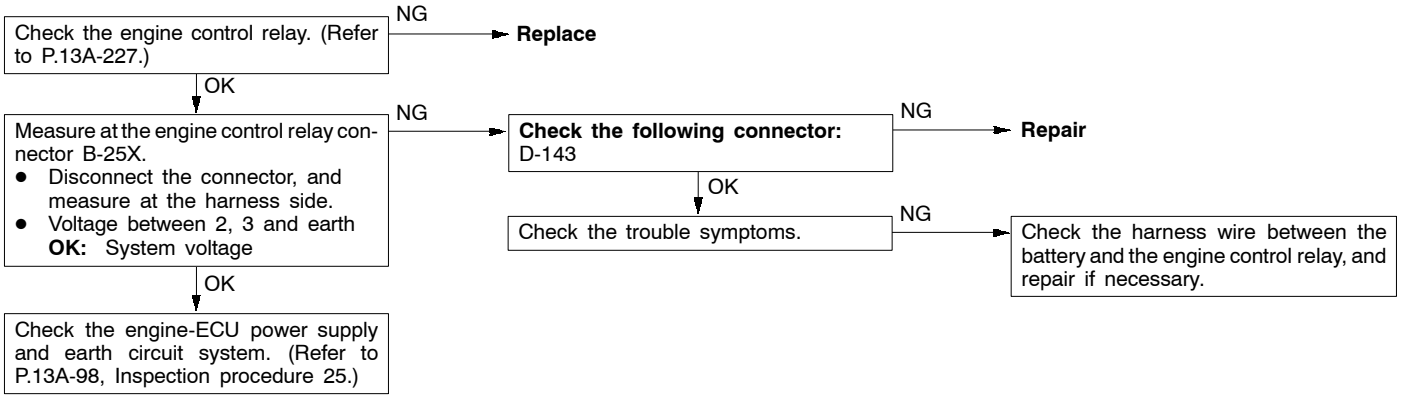
Inspection procedure 25

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



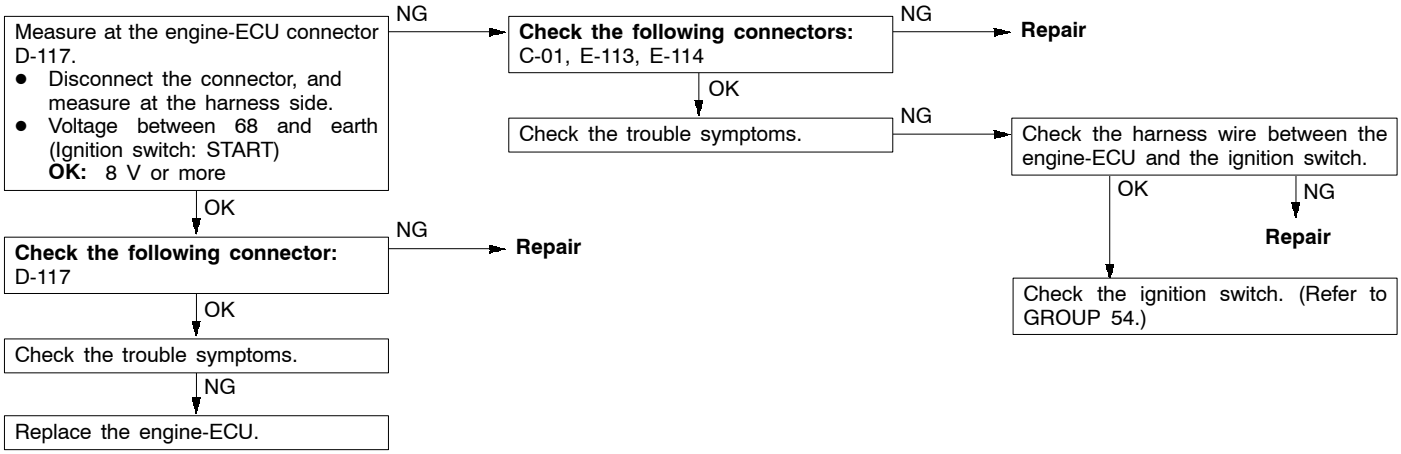
Inspection procedure 26

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



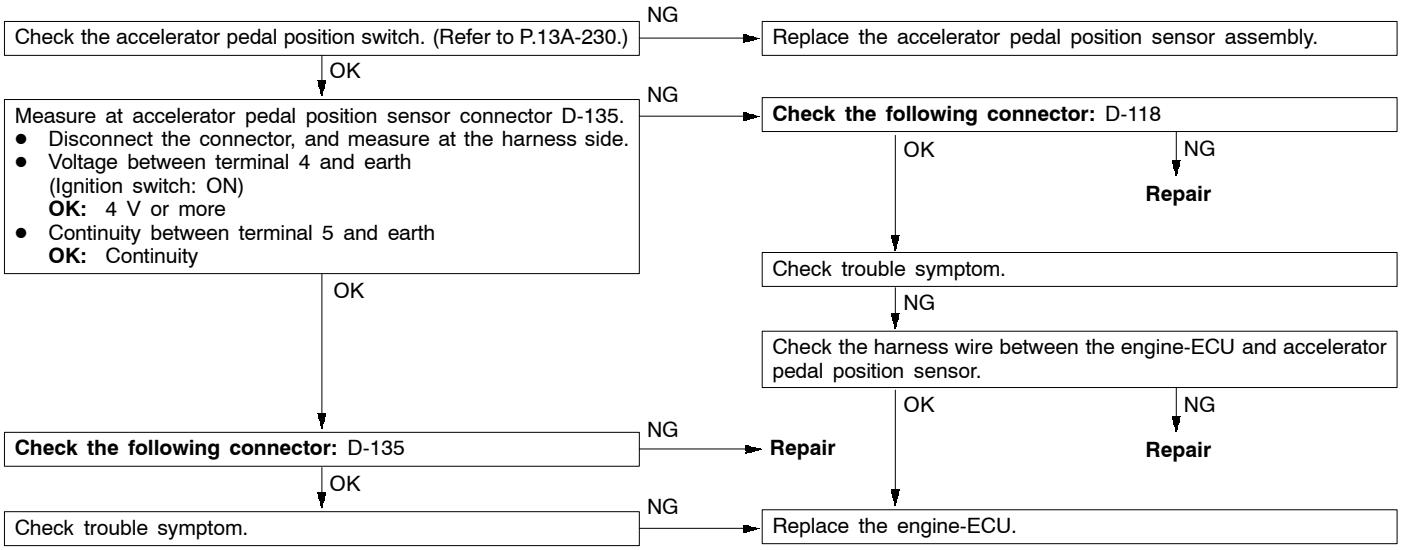
Inspection procedure 27

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



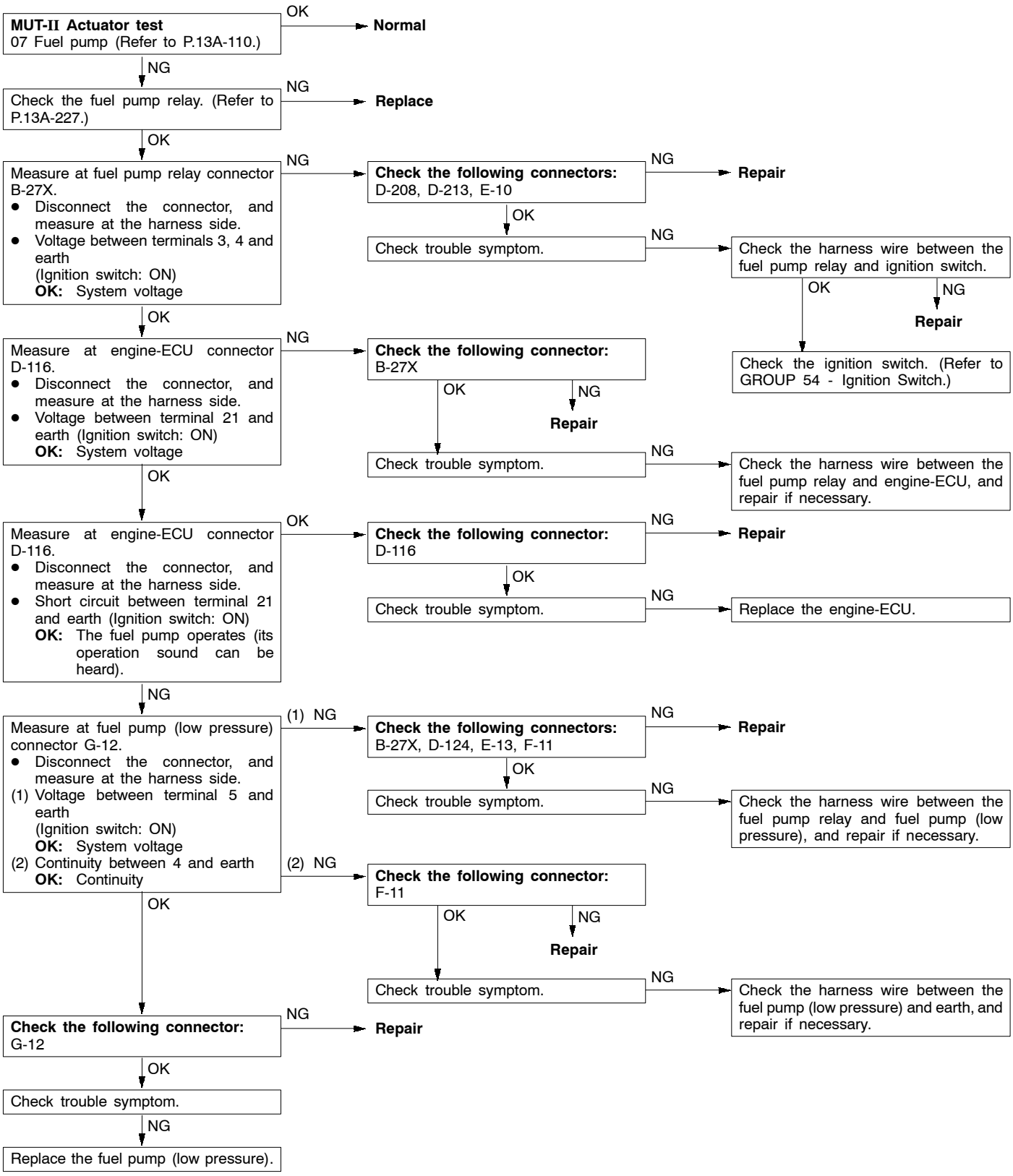
Inspection procedure 28

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



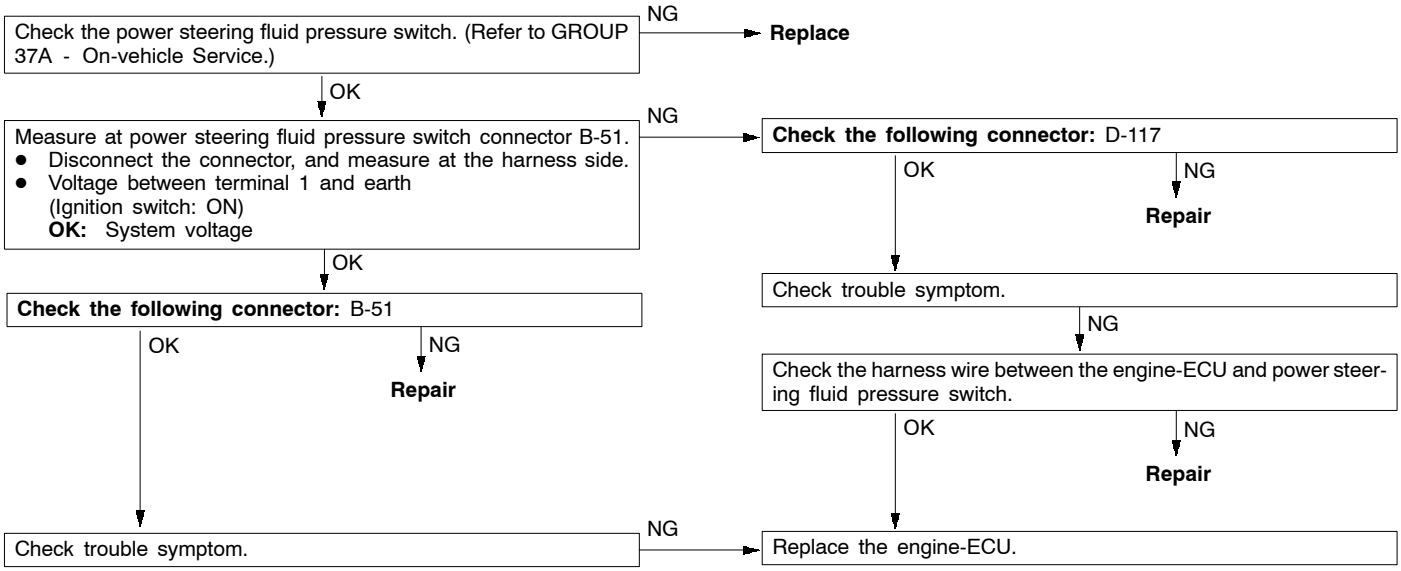
Inspection procedure 29

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



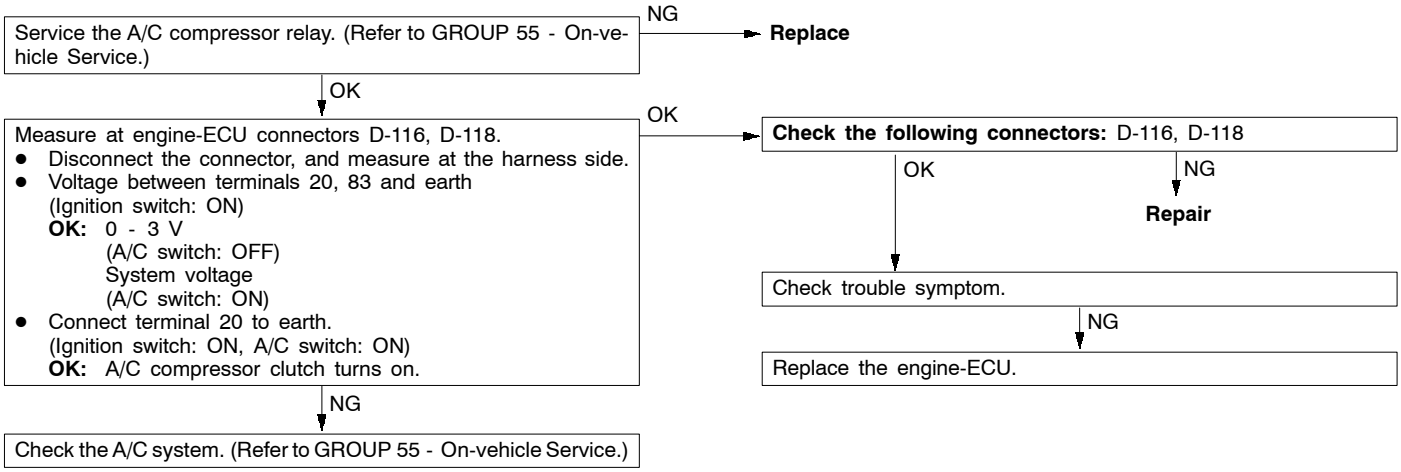
Inspection procedure 30

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



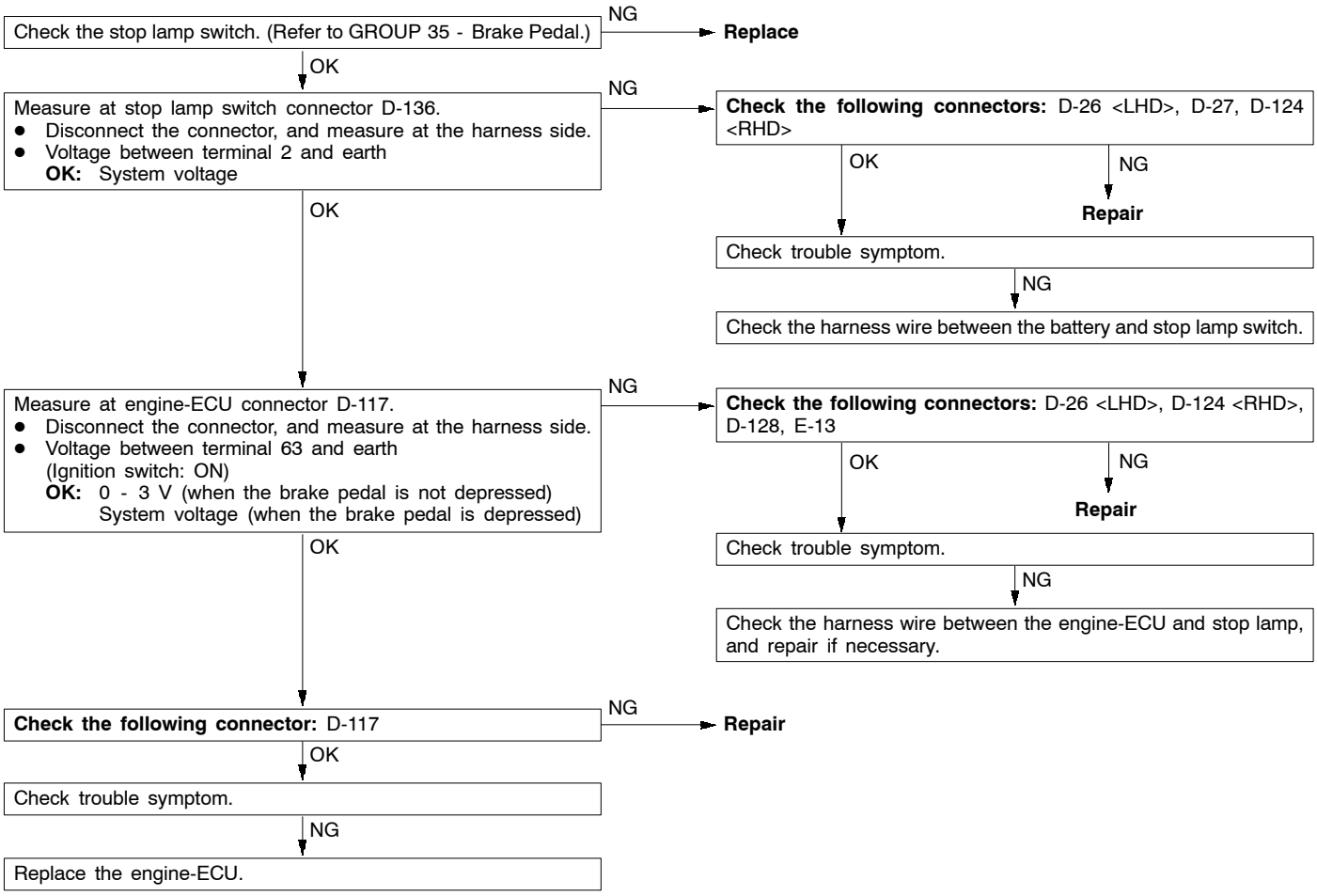
Inspection procedure 31

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



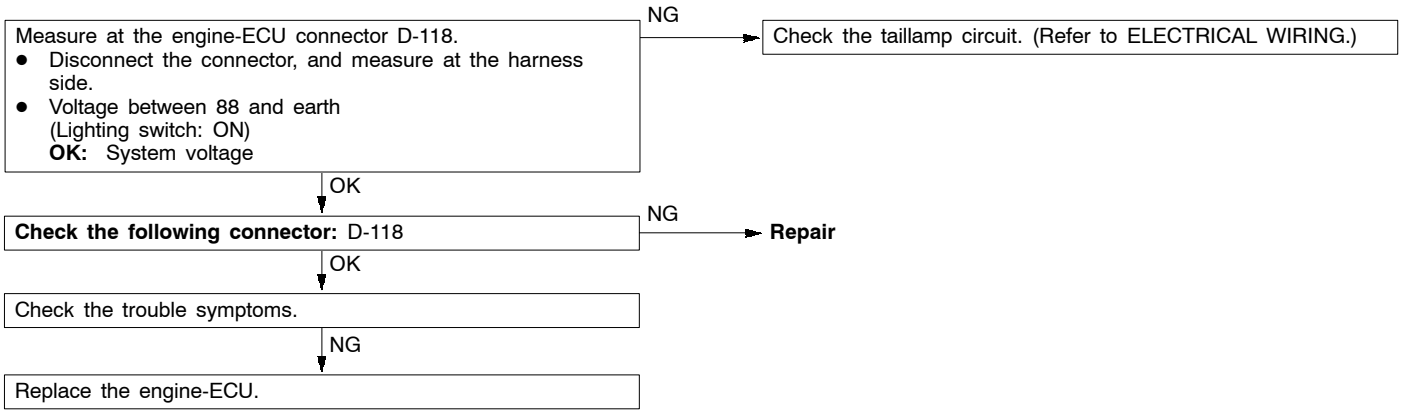
Inspection procedure 32

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



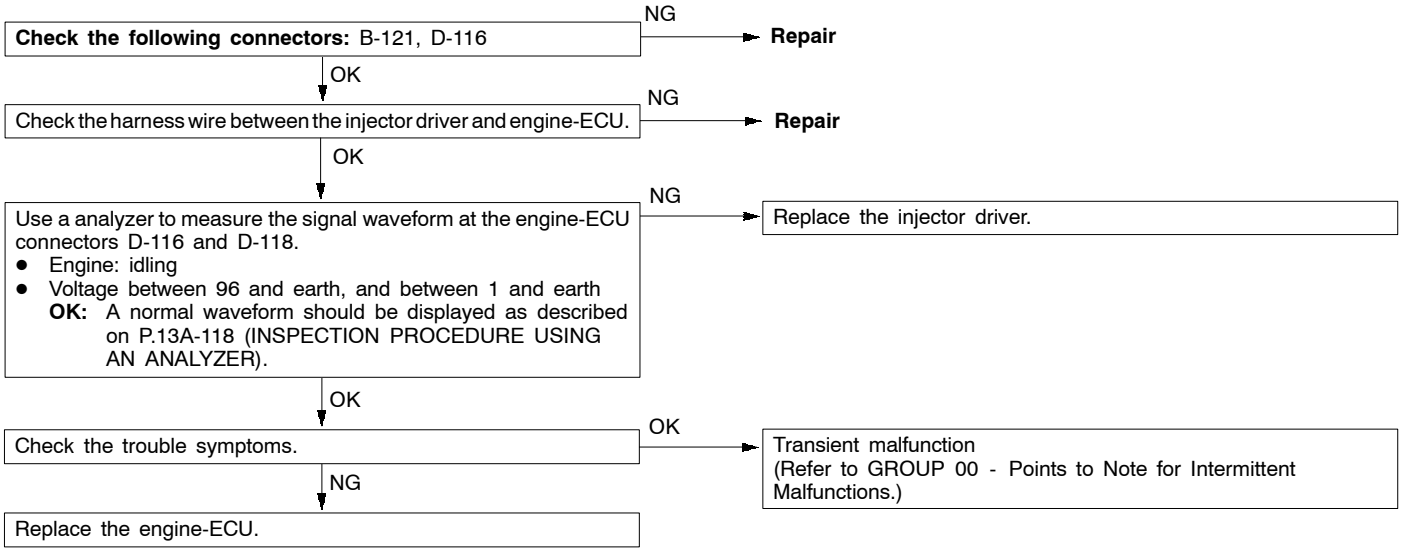
Inspection procedure 33

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



Inspection procedure 34

Injector driver system	Probable cause
The engine-ECU drives the injector by the drive signal.	• Malfunction of the injector driver • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU



DATA LIST REFERENCE TABLE

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

NOTE
*1: Within four minutes after starting the engine
*2: In a new vehicle [driven approximately 500 km or less], the injector drive time is sometimes 10% longer than the standard time.
*3: The accelerator pedal position switch normally turns off when the voltage of the accelerator pedal position sensor (1st channel) is 200 - 600 mV higher than the voltage at the idle position. If the accelerator pedal position switch turns back on after the accelerator pedal position sensor voltage has risen by 100 mV and the throttle valve has opened, the accelerator pedal position switch and the accelerator pedal position sensor (1st channel) need to be adjusted.

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
11	Oxygen sensor (front)	Engine: After warm-up	Idling	200 mV or less*1	Code No. P0130	13A-28
			Sudden racing	600 - 1,000 mV		
			2,500 r/min	400 mV or less and 600 - 1,000 mV alternates.		
12	Air flow sensor	● Engine coolant temperature: 80 - 95°C ● Lamps, electric cooling fan and all accessories: OFF ● Transmission: Neutral	Idling	22 - 48 Hz	Code No. P0100	13A-17
			2,500 r/min	60 - 100 Hz		
			Racing	Frequency increases in response to racing.		
13	Intake air temperature sensor	Ignition switch: ON	Intake air temperature: -20°C	-20°C	Code No. P0110	13A-21
			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 mV or more	Code No. P0225	13A-52
			Depress the accelerator pedal gradually.	Voltage decreases in response to the pedal depression.		
			Depress the accelerator pedal fully.	400 - 600 mV		
16	Power supply voltage	Ignition switch: ON		System voltage	Procedure No.25	13A-98
18	Cranking signal (Ignition switch - ST)	Transmission: Neutral	Engine: Stopped	OFF	Procedure No.27	13A-99
			Engine: Cranking	ON		
21	Engine coolant temperature sensor	Ignition switch: ON	Engine coolant temperature: -20°C	-20°C	Code No. P0115	13A-22
			Engine coolant temperature: 0°C	0°C		
			Engine coolant temperature: 20°C	20°C		
			Engine coolant temperature: 40°C	40°C		
			Engine coolant temperature: 80°C	80°C		
22	Crank angle sensor	● Engine: cranking ● Tachometer: Connected	Compare the engine speed readings on the tachometer and the MUT-II.	Accord	Code No. P0335	13A-56
		● Engine: Idling ● Accelerator pedal position switch: ON	Engine coolant temperature: -20°C	1,250 - 1,450 r/min		
			Engine coolant temperature: 0°C	1,100 - 1,300 r/min		
			Engine coolant temperature: 20°C	1,000 - 1,200 r/min		
			Engine coolant temperature: 40°C	900 - 1,100 r/min		
			Engine coolant temperature: 80°C	550 - 650 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. P0105	13A-19
			Altitude: 600 m	95 kPa		
			Altitude: 1,200 m	88 kPa		
			Altitude: 1,800 m	81 kPa		
26	Accelerator pedal position switch	Ignition switch: ON (Depress and release the accelerator pedal several times)	Release the accelerator pedal.	ON	Procedure No.28	13A-100
			Depress the accelerator pedal slightly.	OFF		
27	Power steering fluid pressure switch	Engine: Idling	Steering wheel stationary	OFF	Procedure No.30	13A-102
			Steering wheel turning	ON		
28	A/C switch	Engine: Idling (The A/C compressor is running when the A/C switch is on.)	A/C switch: OFF	OFF	Procedure No.31	13A-100
			A/C switch: ON	ON		
31	Small lamp switch	Engine: Idling	Lighting switch: OFF	OFF	Procedure No.33	13A-104
			Lighting switch: ON	ON		
34	Air flow sensor reset signal	Engine: After having warmed up	Engine is idling	ON	Code No. P0100	13A-17
			3,000 r/min	OFF		
37	Volumetric efficiency	• Engine coolant temperature: 80 - 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral	Engine is idling	20 - 40%	-	-
			2,500 r/min	10 - 30%		
			Engine is suddenly raced	Volumetric efficiency increases in response to racing		
38	Crank angle sensor	• Engine: Cranking [reading is possible at 2,000 r/min or less] • Tachometer: Connected		Engine speeds displayed on the MUT-II and tachometer are identical.	-	-

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
41	Injector drive time *2	• Engine coolant temperature: 80 - 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral	Idling	0.3 - 0.8 ms*1	-	-
			2,500 r/min	0.4 - 1.0 ms		
			Sudden racing	Increases		
44	Ignition advance	• Engine: After warm-up • Set a timing light.	Idling	5 - 20°BTDC *1	Code No. P0300	13A-53
			2,500 r/min	15 - 35°BTDC		
49	A/C relay	Engine: After warm-up, idling	A/C switch: OFF	OFF (compressor clutch is not operating)	Procedure No.31	13A-102
			A/C switch: ON	ON (compressor clutch is operating)		
59	Oxygen sensor (rear)	• Transmission: 2nd gear • Drive with throttle widely open	3,500 r/min	600 - 1,000 mV	Code No. P0136	13A-31
67	Stop lamp switch	Ignition switch: ON	Brake pedal: Depressed	OFF	Procedure No.32	13A-103
			Brake pedal: Released	ON		
68	EGR valve	• Engine coolant temperature: 80 - 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral	Idling	2 - 20 STEP	Code No. P0403	13A-60
			2,500 r/min	0 - 10 STEP		
74	Fuel pressure sensor	• Engine coolant temperature: 80 - 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral	Engine: Idling	4 - 6.9 MPa	Code No. P0190	13A-36

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
77	Accelerator pedal position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	985 - 1085 mV	Code No.P1225	13A-68
			Depress the accelerator pedal gradually.	Increases in response to the pedal depression stroke.		
			Depress the accelerator pedal fully.	4,000 mV or more		
78	Accelerator pedal position sensor (1st channel) *3	Ignition switch: ON	Release the accelerator pedal.	985 - 1085 mV	Code No.P0220	13A-50
			Depress the accelerator pedal gradually.	Increases in response to pedal depression stroke.		
			Depress the accelerator pedal fully.	4,200 - 4,800 mV		
79	Throttle position sensor (1st channel)	• Engine coolant temperature: 80 - 95°C • Ignition switch: ON (Engine stopped)	Release the accelerator pedal.	400 - 800 mV	Code No.0120	13A-25
			Depress the accelerator pedal gradually.	Increases in response to pedal depression stroke.		
			4,600 - 5,200 mV	4,200 - 4,800 mV		
		Engine: After warm-up, idling	No load	450 - 1,000 mV		
			A/C switch: OFF → ON	Increases by 100 - 600 mV.		
99	Fuel injection mode	Engine: After warm up	Idling (after four minutes or more have passed since engine start)	Lean compression	-	-
			2,500 r/min	Stoichiometric metric feedback		
			Sudden racing after idle position	Open loop		

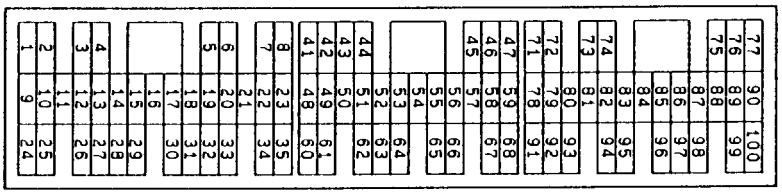
ACTUATOR TEST REFERENCE TABLE

Item No.	Inspection item	Drive contents	Inspection contents	Normal condition	Inspection procedure No.	Reference page
01	Injectors	Cut fuel to No. 1 injector	Engine: After having warmed up/Engine is idling (Cut the fuel supply to each injector in turn and check cylinders which don't affect idling.)	Idling condition becomes different (becomes unstable).	Code No. P0201	13A-38
02		Cut fuel to No. 2 injector			Code No. P0202	13A-40
03		Cut fuel to No. 3 injector			Code No. P0203	13A-42
04		Cut fuel to No. 4 injector			Code No. P0204	13A-44
05		Cut fuel to No. 5 injector			Code No. P0205	13A-46
06		Cut fuel to No. 6 injector			Code No. P0206	13A-48
07	Fuel pump (low pressure)	Fuel pump operates and fuel is recirculated.	Ignition switch: ON	Sound of operation is heard.	Procedure No. 29	13A-101
08	Purge control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch: ON	Sound of operation can be heard when solenoid valve is driven.	Code No. P0443	13A-62
17	Basic ignition timing	Set the engine-ECU to ignition timing adjustment mode	Idling after engine warm up	5°BTDC	-	-
21	Condenser fan	Drive the fan motor	Ignition switch: ON	The fan motor operates	Procedure No.21	13A-95
34	Electronic-controlled throttle valve system	Stop the throttle control servo.	Ignition switch: ON	Throttle valve is opened slightly.	Code No. P1220	13A-64

CHECK AT THE ENGINE-ECU TERMINALS

TERMINAL VOLTAGE CHECK CHART

Engine-ECU Connector Terminal Arrangement



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		
10	No.5 injector		
25	No.6 injector		
3	No.1 ignition coil	Engine: 3,000 r/min	0.3 - 3.0 V.
12	No.2 ignition coil		
26	No.3 ignition coil		
4	No.4 ignition coil		
13	No.5 ignition coil		
27	No.6 ignition coil		
5	EGR valve (D)	Ignition switch: Immediately after turning ON	5 - 8 V (fluctuates for approx. three seconds)
6	EGR valve (C)		
32	EGR valve (B)		
34	EGR valve (A)		
8	Alternator G terminal	• Engine: Warm up, and then idling • Radiator fan: not operating • Headlamp: OFF → ON • Stop lamp: OFF → ON • Rear defogger switch: OFF → ON	Voltage increases by 0.2 - 3.5 V
14	GDI ECO indication lamp	Ignition switch: OFF → ON	0 - 3 V (system voltage after five seconds)
		Engine: When the accelerator pedal is suddenly depressed while the engine is idling	System voltage

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
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	Condenser fan relay	Condenser fan is not operating.		System voltage
		Condenser fan is operating.		0 - 3 V
20	Fuel pump relay	Ignition switch: ON	Engine: stopped	System voltage
			Engine: idling	0 - 3 V
21	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
31	Engine warning lamp	Ignition switch: OFF → ON		0 - 3 V → System voltage (after several seconds)
41	Sensor power supply	Ignition switch: ON		4.5 - 5.5 V
42	Power supply to accelerator pedal position sensor (1st channel)	Ignition switch: ON		4.5 - 5.5 V
43	Crank angle sensor	Engine: Cranking		0.4 - 4.0 V
		Engine: Idling		1.5 - 2.5 V
44	Engine coolant temperature sensor	Ignition switch: ON	Engine coolant temperature: 0 °C	3.2 - 3.5 V
			Engine coolant temperature: 20 °C	2.3 - 2.9 V
			Engine coolant temperature: 40 °C	1.5 - 2.1 V
			Engine coolant temperature: 80 °C	0.4 - 1.0 V
45	Engine ignition signal	Engine: 3,000 r/min		0.3 - 3.0 V

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
47	Power supply	Ignition switch: ON		System voltage
59				
50	Camshaft position sensor	Engine: Cranking		0.4 - 3.0 V
		Engine: Idling		0.5 - 2.0 V
51	Barometric pressure sensor	Ignition switch: ON	Altitude: 0 m	3.7 - 4.3 V
			Altitude: 1,200 m	3.2 - 3.8 V
52	Alternator FR terminal	● Engine: Warm up, and then idling ● Radiator fan: not operating ● Headlamp: OFF → ON ● Stop lamp: OFF → ON ● Rear defogger: OFF → ON		Voltage decreases
53	Oxygen sensor (rear)	● Transmission: 2nd gear ● Engine speed: 3,500 r/min or more ● Driving with the throttle valve widely open		0.6 - 1.0 V
54	Power steering fluid pressure switch	Engine: Warm up, and then idling	Steering wheel stationary	System voltage
			Steering wheel turning	0 - 3 V
55	Injector driver relay	Ignition switch: OFF		0 - 0.1 V
		Ignition switch: ON		0.5 - 1.0 V
56	Throttle valve control servo relay	Ignition switch: OFF		0 - 0.3 V
		Ignition switch: ON		0.5 - 1.0 V
57	Engine control relay	Ignition switch: OFF		0 - 3 V
		Ignition switch: ON		System voltage
60	Back-up power source	Ignition switch: OFF		System voltage
61	Air flow sensor	Engine: Idling		2.2 - 3.2 V
		Engine: 2,500 r/min		
62	Intake air temperature sensor	Ignition switch: ON	Intake air temperature: 0°C	3.2 - 3.8 V
			Intake air temperature: 20°C	2.3 - 2.9 V
			Intake air temperature: 40°C	1.5 - 2.1 V
			Intake air temperature: 80°C	0.4 - 1.0 V

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
63	Stop lamp switch	Depress the brake pedal.		System voltage
		Release the brake pedal.		0 - 3 V
65	A/C switch (2nd channel)	Refer to GROUP 55 - Troubleshooting “Check at the A/C-ECU terminal, engine-ECU output terminals.”		
66	Clutch switch	Depress the clutch pedal.		0 - 3 V
		Release the clutch pedal.		System voltage
68	Ignition switch-ST	Engine: Cranking		8V or more
71	Oxygen sensor (front)	Engine: Warm up, and then hold the engine speed at 2,500r/min (Use a digital voltmeter).		0 ↔ 0.8 V alternates.
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.	4.5 - 5.5 V
			Depress the accelerator pedal fully.	0.4 - 0.6 V
79	Accelerator pedal position switch	Ignition switch: ON	Release the accelerator pedal.	0 - 1 V
			Depress the accelerator pedal fully.	4V or more
80	Vehicle speed sensor	• Ignition switch: ON • Move the vehicle forward.		0 ↔ system voltage alternates.
83	A/C switch (1st channel)	Engine: Idling	A/C switch: OFF	0 - 3 V
			A/C switch: ON (Compressor is operating)	System voltage
88	Small lamp switch	Lighting switch: OFF		0 - 3 V
		Lighting switch: ON (Taillamp: ON)		System voltage
89	Oxygen sensor heater (front)	Engine: Idling		0 - 3 V
		Engine: 3,500 r/min		System voltage
90	Oxygen sensor heater (rear)	Engine: Idling		0 - 3 V
		Engine: 3,500 r/min		System voltage
92	Fuel pressure sensor	Engine: Idling		0.3 - 4.7 V

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
94	Accelerator pedal position sensor (1st channel)	Ignition switch: ON	Release the accelerator pedal.	0.3 - 1.0 V*1
			Depress the accelerator pedal fully.	4.2 - 5.5 V*2
96	Injector open circuit check signal	Engine: Increase engine speed from idle speed to 4,000 r/min.		Decreases slightly (approx. 0.7V) from 4.5 V - 5.0 V.
99	Ignition switch - IG	Ignition switch: ON		System voltage

NOTE
Check if the difference in output between *1 and *2 is 4 V or more.

CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

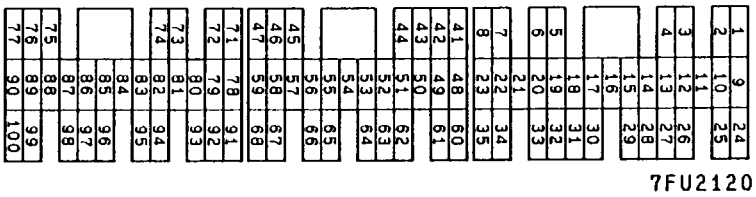
1. Turn the ignition switch to OFF.
2. Disconnect the engine-ECU connector.
3. Measure the resistance and check for continuity between the terminals of the engine-ECU harness-side connector while referring to the check chart.

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

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

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

Engine-ECU Harness Side Connector Terminal Arrangement

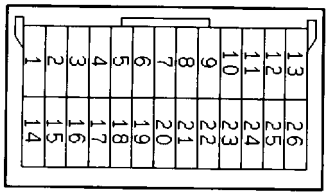


Terminal No.	Check item	Standard value, normal condition (check requirements)
5 - 47	EGR valve (D)	15 - 20 Ω (at 20°C)
6 - 47	EGR valve (C)	
32 - 47	EGR valve (B)	
34 - 47	EGR valve (A)	
16 - 47	Purge control solenoid valve	36 - 44 Ω (at 20°C)
44 - 72	Engine coolant temperature sensor	5.1 - 6.5 kΩ (when engine coolant temperature is 0°C)
		2.1 - 2.7 kΩ (when engine coolant temperature is 20°C)
		0.9 - 1.3 kΩ (when engine coolant temperature is 40°C)
		0.26 - 0.36 kΩ (when engine coolant temperature is 80°C)
46 - Body earth	Earth	Continuity (0 Ω)
58 - Body earth		
62 - 72	Intake air temperature sensor	5.3 - 6.7 kΩ (when intake air temperature is 0°C)
		2.3 - 3.0 kΩ (when intake air temperature is 20°C)
		1.0 - 1.5 kΩ (when intake air temperature is 40°C)
		0.30 - 0.42 kΩ (when intake air temperature is 80°C)
79 - 49	Accelerator pedal position switch	Continuity (when the accelerator pedal is released)
		No continuity (when the accelerator pedal is slightly depressed)
89 - 47	Oxygen sensor heater control (front)	4.5 - 8.0 Ω (at 20°C)
90 - 47	Oxygen sensor heater (rear)	4.5 - 8.0 Ω (at 20°C)

CHECK AT THE THROTTLE VALVE CONTROLLER TERMINALS

TERMINAL VOLTAGE CHECK CHART

Throttle Valve Controller Terminal Arrangement



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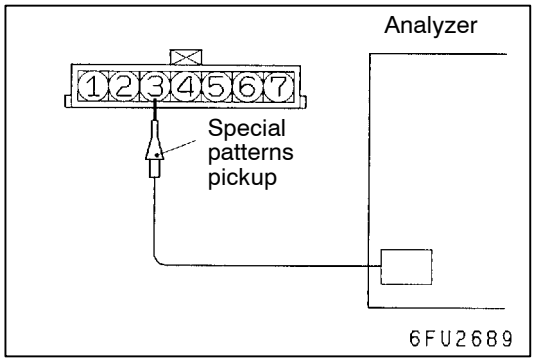
Terminal No.	Check item	Check condition (Engine condition)		Normal condition
1	Throttle control servo (U)	● Ignition switch: ON ● Accelerator pedal: From released position to fully depressed position		Changes
14	Throttle control servo (V)			
15	Throttle control servo (W)			
2	Throttle control servo power supply	Ignition switch: ON		System voltage
5	Power supply	Ignition switch: ON		System voltage
6	Sensor applied voltage	Ignition switch: ON		4.5 - 5.5 V
7	Throttle position sensor (1st channel)	Ignition switch: ON	Release the accelerator pedal.	0.4 - 0.8 V
			Depress the accelerator pedal fully.	4.2 - 4.8 V
18	Backup power supply	Ignition switch: OFF		System voltage
20	Accelerator pedal position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	0.985 - 1.085 V
			Depress the accelerator pedal fully.	4.0 V or higher
22	Ignition switch-IG	Ignition switch: ON		System voltage



INSPECTION PROCEDURE USING AN ANALYZER

AIR FLOW SENSOR (AFS)

Measurement Method

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

Alternate Method (Test harness not available)

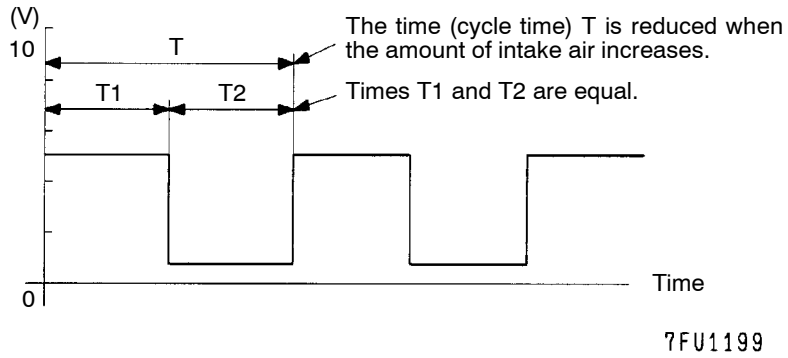
1. Connect the analyzer special patterns pickup to engine-ECU terminal 61.

Standard Wave Pattern

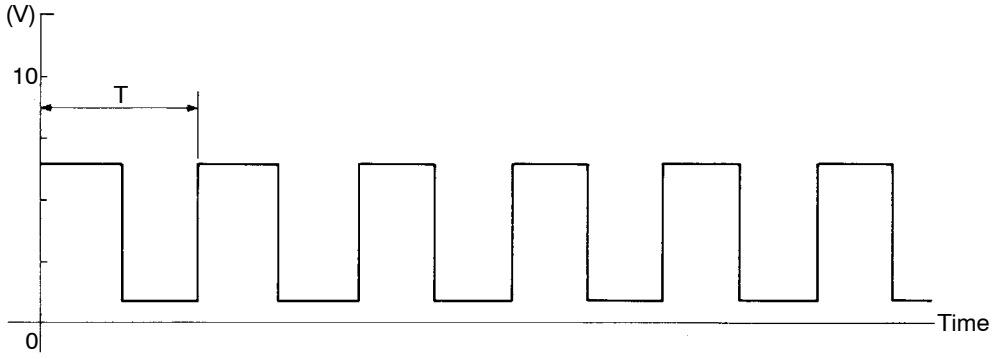
Observation conditions

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

Standard wave pattern

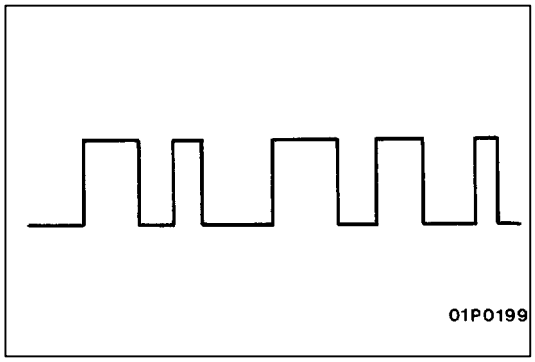


Observation conditions (from conditions above engine speed is increased by racing.)



Wave Pattern Observation Points

Check that cycle time T becomes shorter and the frequency increases when the engine speed is increased.



Examples of Abnormal Wave Patterns

- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

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

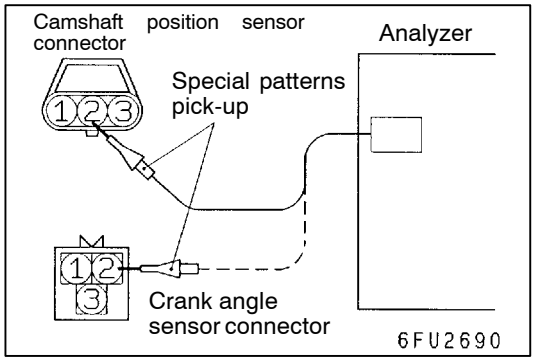
- Example 2

  Cause of problem

  Damaged rectifier or vortex generation column

  Wave pattern characteristics

  Unstable wave pattern with non-uniform frequency. However, when an ignition leak occurs during acceleration, the wave pattern will be distorted temporarily, even if the air flow sensor is normal.



CAMSHAFT POSITION SENSOR AND CRANK ANGLE SENSOR

Measurement Method

1. Disconnect the camshaft position sensor connector and connect the special tool (test harness: MB991709) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to camshaft position sensor terminal 2.
3. Disconnect the crank angle sensor connector and connect the special tool (test harness: MD998478) in between.
4. Connect the analyzer special patterns pickup to crank angle sensor terminal 2.

Alternate Method (Test harness not available)

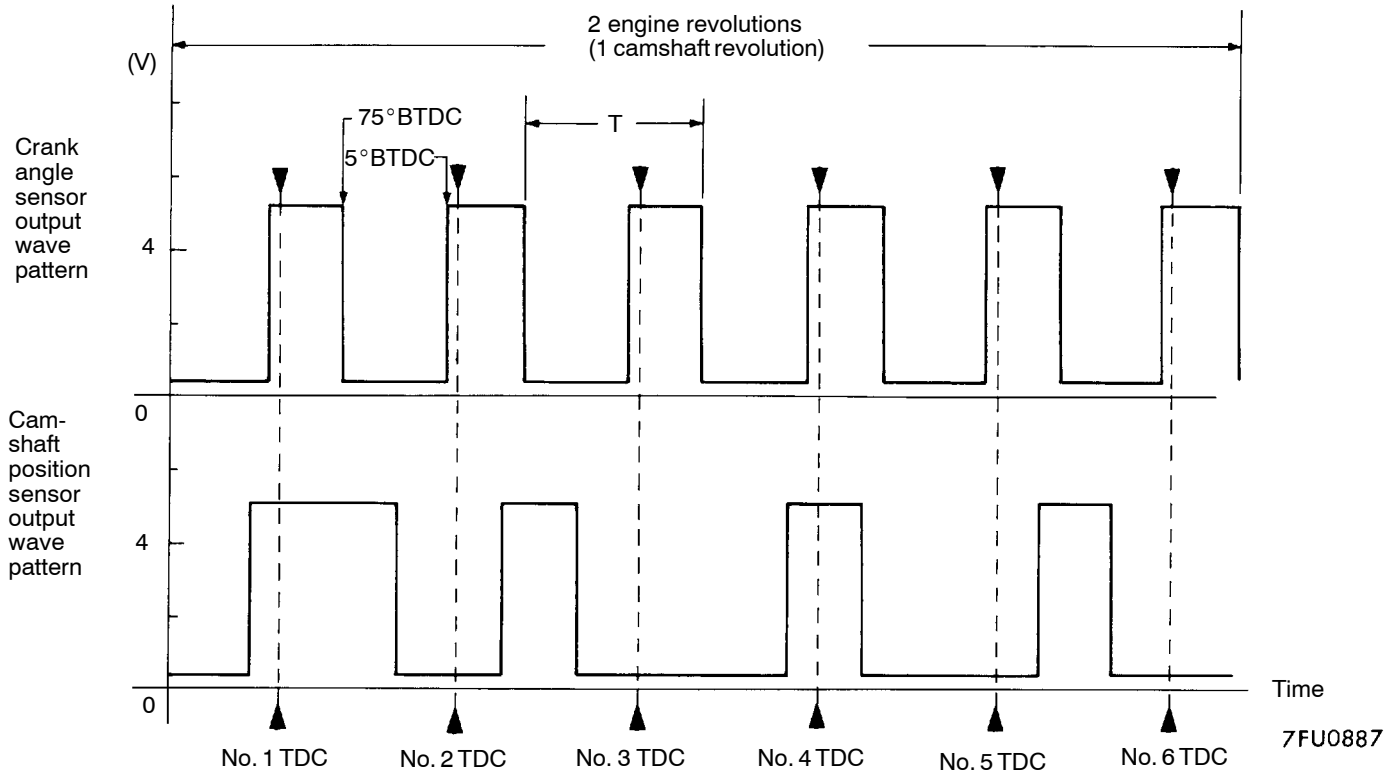
1. Connect the analyzer special patterns pickup to engine-ECU terminal 50. (When checking the camshaft position sensor signal wave pattern.)
2. Connect the analyzer special patterns pickup to engine-ECU terminal 43. (When checking the crank angle sensor signal wave pattern.)

Standard Wave Pattern

Observation conditions

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

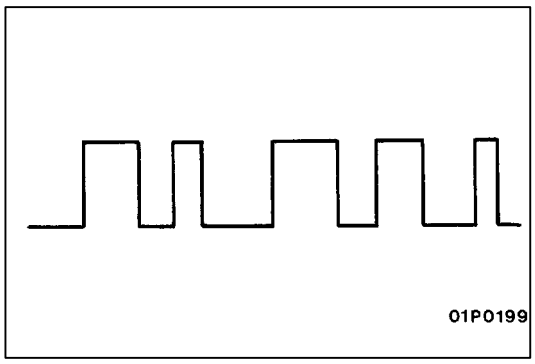
Standard wave pattern



NOTE
1. TDC: Top dead centre
2. The time (cycle time) T is reduced when the engine speed increases

Wave Pattern Observation Points

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



Examples of Abnormal Wave Patterns

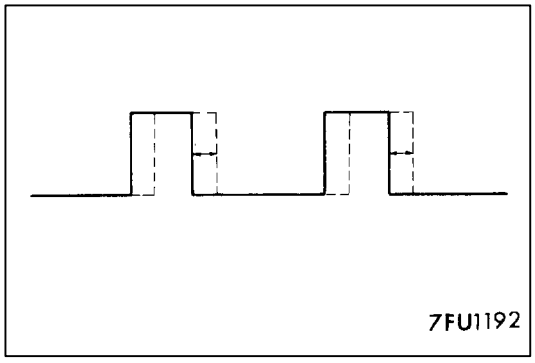
- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

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



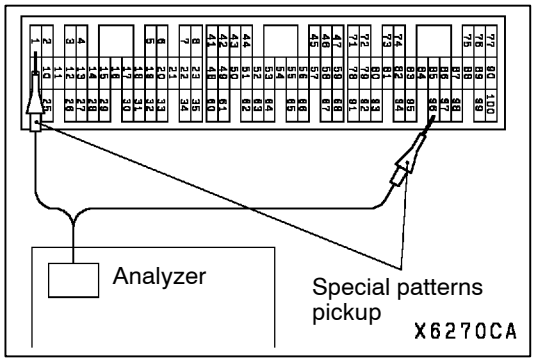
- Example 2

  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

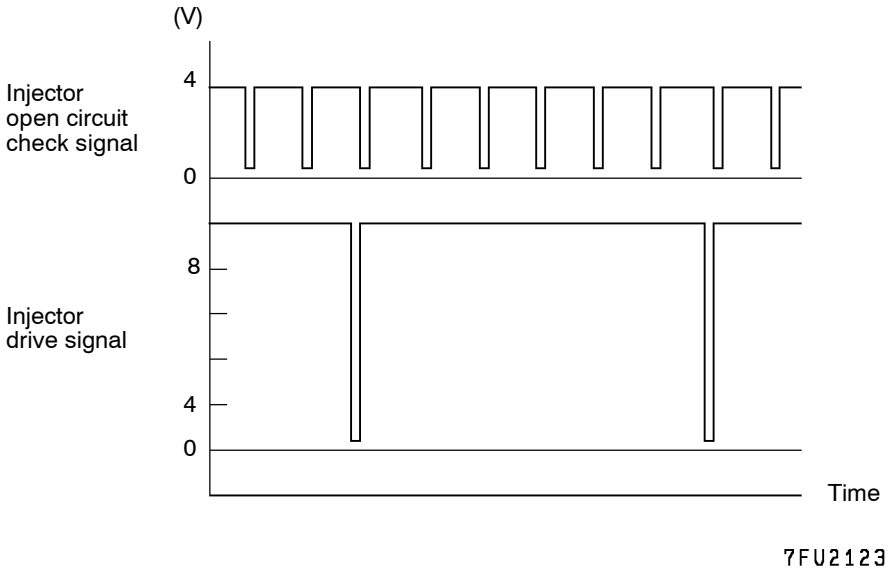
1. Connect the analyzer special patterns pickup to terminal 1 (No.1 injector) of the engine-ECU connector.
2. Connect the analyzer special patterns pickup to terminal 96 (injector open circuit check signal) of the engine-ECU connector.
3. After checking terminal 1, check terminal 9 (No.2 injector), terminal 24 (No.3 injector) and terminal 2 (No.4 injector), terminal 10 (No.5 injector), terminal 25 (No.6 injector).

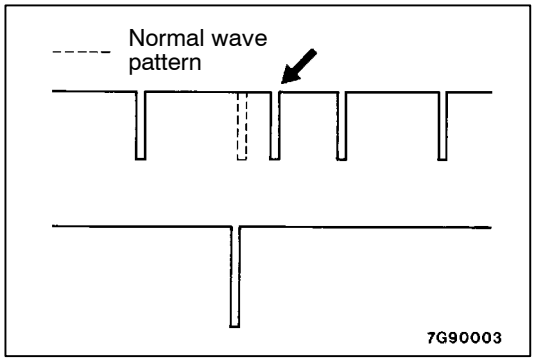
Standard Wave Pattern

Observation conditions

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

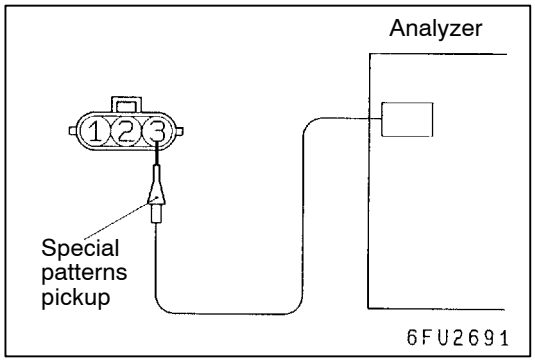
Standard wave pattern





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)

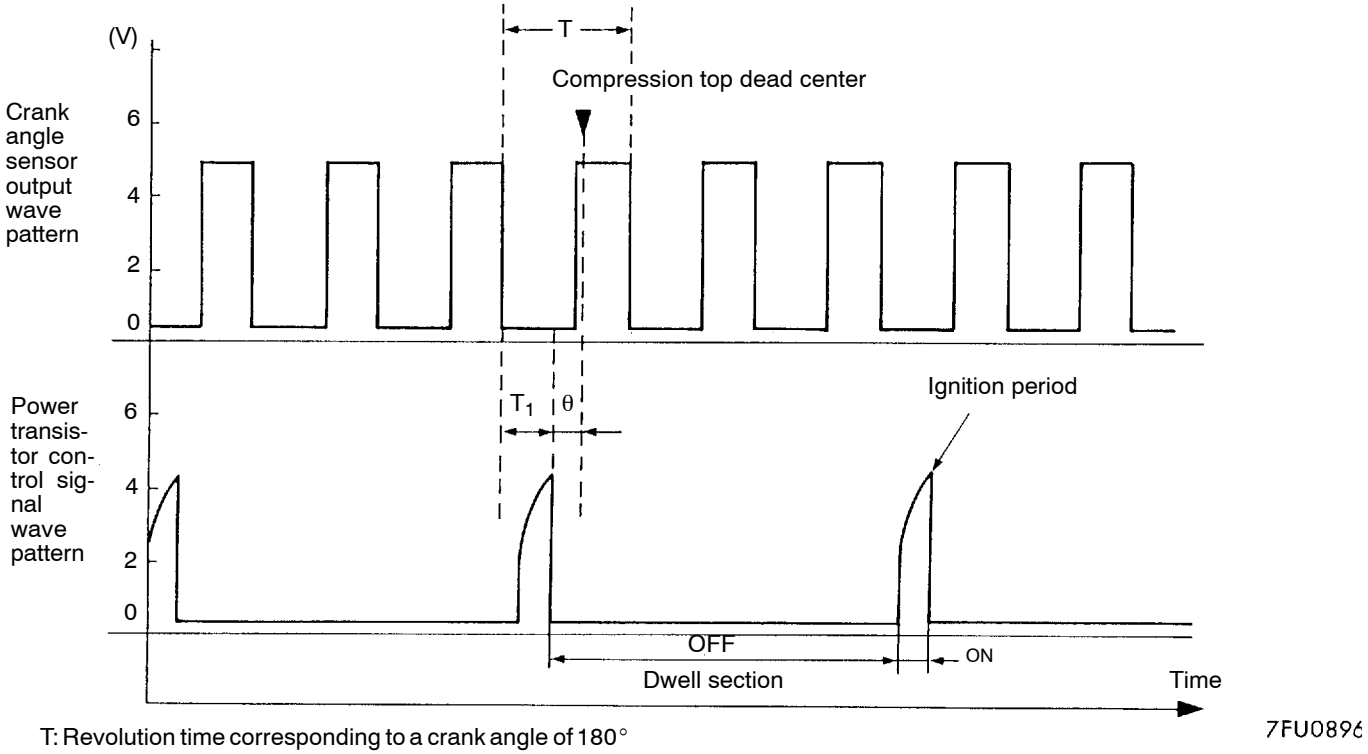
1. Connect the analyzer special patterns pickup to engine-ECU terminal 3 (No. 1 ignition coil), terminal 12 (No. 2 ignition coil), terminal 26 (No. 3 ignition coil), terminal 4 (No. 4 ignition coil), terminal 13 (No.5 ignition coil), terminal 27 (No.6 ignition coil) respectively.

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



T: Revolution time corresponding to a crank angle of 180°

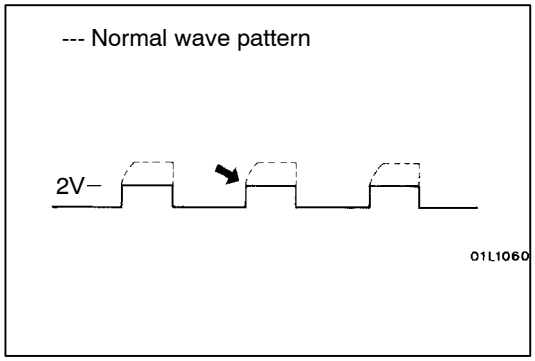
T_1: Time calculated by the engine-ECU

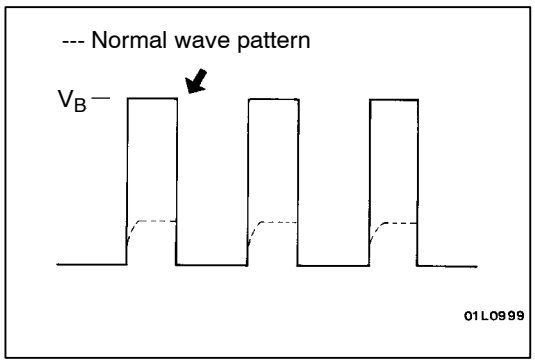
θ: Spark advance angle

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

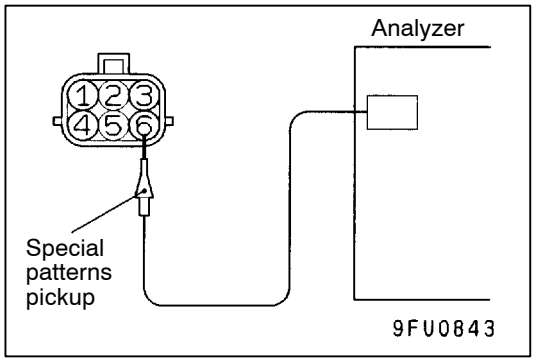
  Wave pattern during engine cranking

  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)

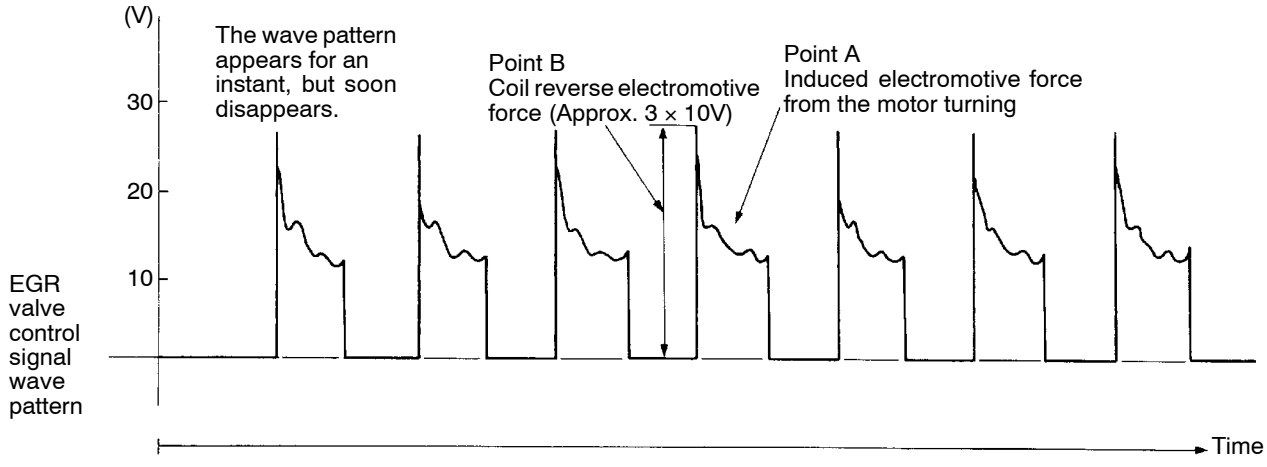
1. Connect the analyzer special patterns pickup to engine-ECU terminal 32, connection terminal 34, connection terminal 5, and connection terminal 6 respectively.

Standard Wave Pattern

Observation conditions

Function	Special patterns
Pattern height	High
Pattern selector	Display
Engine condition	When the engine coolant temperature is 20°C or below, turn the ignition switch from OFF to ON (without starting the engine).
	While the engine is idling, turn the A/C switch to ON.
	Immediately after starting the warm engine

Standard wave pattern



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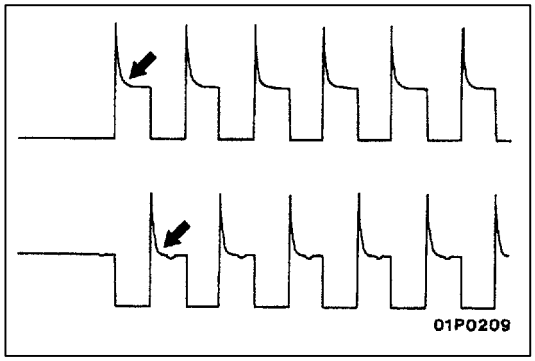
Wave Pattern Observation Points

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

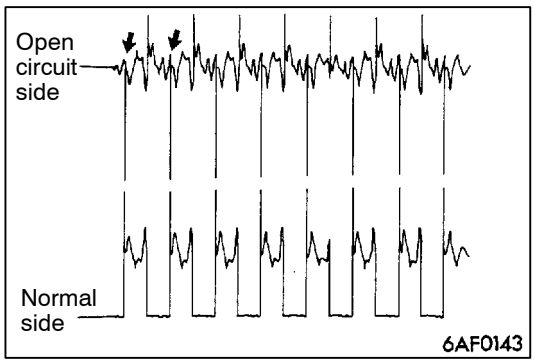
- Example 1

  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

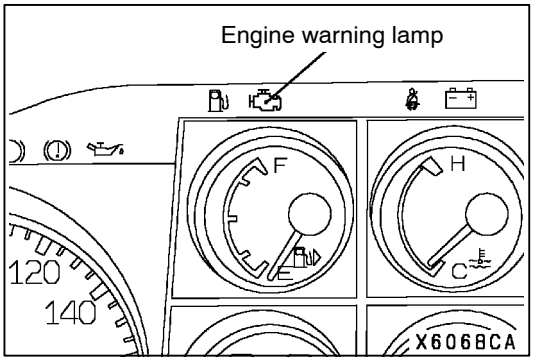
  Current is not supplied to the motor coil on the open circuit side. (Voltage does not drop to 0 V.)
  Furthermore, the induced electromotive force waveform at the normal side is slightly different from the normal waveform.

TROUBLESHOOTING <A/T>

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING

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

NOTE
When replacing the engine-A/T-ECU, replace immobilizer-ECU as well at the same time.



DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

If an abnormality occurs in any of the following items related to the GDI system, the engine warning lamp will illuminate. If the lamp remains illuminated or if the lamp illuminates while the engine is running, check the diagnosis code output. However, the warning lamp will illuminate as bulb check for five seconds whenever the ignition switch is turned to the ON position.

Engine warning lamp inspection items

Air flow sensor	Ignition coil (power transistor)
Barometric pressure sensor	Detonation sensor
Intake air temperature sensor	Crank angle sensor
Engine coolant temperature sensor	Camshaft position sensor
Oxygen sensor	EGR valve
Oxygen sensor heater	Purge control solenoid valve
Fuel system malfunction	Injector driver
Abnormal fuel pressure	Electronic-controlled throttle valve system
Injector	Throttle control servo
Throttle position sensor (1st channel)	Throttle valve controller
Throttle position sensor (2nd channel)	Immobilizer system
Accelerator pedal position sensor (1st channel)	Engine-A/T-ECU
Accelerator pedal position sensor (2nd channel)	-

Caution
If a malfunction occurred inside the engine-A/T-ECU, the engine warning lamp will remain illuminated.

NOTE
The engine warning lamp will flash when the electronic-controlled throttle valve system is suspended by the fail-safe function.

METHOD OF READING AND ERASING DIAGNOSIS CODES

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

DIAGNOSIS USING DIAGNOSIS 2 MODE

1. Switch the diagnosis mode of the engine-A/T-ECU to DIAGNOSIS 2 mode using the MUT-II, and then carry out a road test.
2. Take a reading of the diagnosis code and repair the problem location.
3. Turn the ignition switch to the LOCK (OFF) position, and then back to ON again.

   NOTE
   By turning the ignition switch to the LOCK (OFF) position, the engine-A/T-ECU will switch the DIAGNOSIS 2 mode to DIAGNOSIS 1 mode.
4. Erase the diagnosis codes.

INSPECTION USING MUT-II DATA LIST AND ACTUATOR TESTING

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

FAIL-SAFE FUNCTION REFERENCE TABLE

When the main sensor malfunctions are detected by the diagnosis function, the vehicle is controlled by means of the pre-set control logic to maintain safe conditions for driving.

Malfunctioning item	Control contents during malfunction
Air flow sensor	1. Suspends lean burn operation. 2. Uses the throttle position sensor signal and engine speed signal (crank angle sensor signal) to take reading of the basic injector drive time and basic ignition timing from the pre-set mapping.
Intake air temperature sensor	Controls as if the intake air temperature is 25°C.
Throttle position sensor (2nd channel)	1. Suspends lean burn operation. 2. Controls the throttle opening angle feedback (half as much as the opening rate in the normal condition) by using signals from the throttle position sensor (1st channel). However, this controlling system is not applied if the throttle position sensor (1st channel) and throttle position sensor (2nd channel) combination output voltage is outside 4 - 6 V. 3. Refrains from controlling the throttle opening angle feedback if the throttle position sensor (1st channel) is also defective.
Engine coolant temperature sensor	Controls as if the engine coolant temperature is 80°C. (Moreover, the control system is working until the ignition switch is turned OFF if the sensor signal returns to normal.)
Camshaft position sensor	Cuts the fuel supply once a malfunction is detected. (Only when there has been no occasion of detecting No.1 cylinder top dead centre after the ignition switch is turned ON.)
Vehicle speed sensor	1. Suspends lean burn operation. However, the control is cancelled as a certain time passes by with the engine speed of 1,500 r/min or more. 2. Suspends lean burn operation during the engine idling.
Barometric pressure sensor	Controls as if the barometric pressure is 101 kPa.
Detonation sensor	Fixes the ignition timing as that for regular gasoline.
Injector	1. Suspends lean burn operation. 2. Suspends the exhaust gas recirculation.
Ignition coil (incorporating power transistor)	1. Suspends lean burn operation. 2. Cuts off the fuel supply to cylinders with an abnormal ignition signal.
Fuel pressure sensor	1. Controls as if the fuel pressure is 5MPa. 2. Suspends fuel injection. (when the low pressure is detected and the engine speed is more than 3,000r/min)
Alternator FR terminal	Refrains from controlling to suppress the alternator output to electrical load. (Operated as a normal alternator)
Accelerator pedal position sensor (2nd channel)	1. Suspends lean burn operation. 2. Controls the throttle valve position by using signals from the accelerator pedal position sensor (1st channel). (However, the control system is not applicable if the difference from the accelerator pedal position sensor (1st channel) output voltage is 1.0V or higher.) 3. Suspends the electronic controlled throttle valve system if accelerator pedal position sensor (1st channel) is also defective.

Malfunctioning item	Control contents during malfunction
Accelerator pedal position sensor (1st channel)	1. Suspends lean burn operation. 2. Controls the throttle valve position by using signals from the accelerator pedal position sensor (2nd channel). (However, this control is not applicable if the voltage difference between the accelerator pedal position sensor (1st channel) and accelerator pedal position sensor (2nd channel) is 1.0 V or higher.) 3. Also suspends the electronic-controlled throttle valve system when the accelerator pedal position sensor (2nd channel) is defective.
Throttle position sensor (1st channel)	1. Suspends lean burn operation. 2. Controls throttle opening angle feedback by using signals from throttle position sensor (2nd channel). (However, the controlling system is not applied when the throttle position sensor (1st channel) and throttle position sensor (2nd channel) combination output voltage is outside 4 - 6 V.) 3. Refrains from controlling the throttle opening angle feedback when throttle position sensor (2nd channel) is also defective.
Electronic-controlled throttle valve system	1. Suspends the electronic controlled throttle valve system. 2. Suspends lean burn operation. 3. Suspends the idle speed feedback control.
Throttle valve position feedback	1. Suspends the electronic controlled throttle valve system. 2. Suspends lean burn operation. 3. Suspends the engine speed feedback control. However, if the throttle valve opening angle is significantly wide, this system carries out the following controls. 1. Always cuts the fuel supply to three cylinders. 2. Cuts the fuel supply when the engine speed reaches 3,000 r/min or more.
Throttle control servo	1. Suspends the electronic-controlled throttle valve system. 2. Suspends lean burn operation. 3. Suspends the engine speed feedback control.
Communication line between the throttle valve controller and the ECU	1. Communication error between the throttle valve controller and the engine-A/T-ECU: ● Suspends lean burn operation. ● Cuts the fuel supply when the engine speed reaches 3,000 r/min or more. ● Suspends the cruise-control. 2. Communication error between the throttle valve controller and the engine-A/T-ECU: ● Suspends lean burn operation. ● Cuts the fuel supply when the engine speed reaches 3,000 r/min or more. ● Suspends the cruise-control. ● The throttle valve controller controls the throttle valve opening angle by using signals from accelerator pedal position sensor (2nd channel).
Throttle valve controller	1. Suspends the electronic-controlled throttle valve system. 2. Suspends lean burn operation. 3. Suspends the engine speed feedback control.

NOTE
If the electronic-controlled throttle valve system is suspended, the engine warning lamp will illuminate.

INSPECTION CHART FOR DIAGNOSIS CODES

Code No.	Diagnosis item	Reference page
11	Oxygen sensor system	13A-131
12	Air flow sensor system	13A-133
13	Intake air temperature sensor system	13A-135
14	Throttle position sensor (2nd channel) system	13A-137
21	Engine coolant temperature sensor system	13A-138
22	Crank angle sensor system	13A-140
23	Camshaft position sensor system	13A-142
24	Vehicle speed sensor system	13A-144
25	Barometric pressure sensor system	13A-145
31	Detonation sensor system	13A-146
41	Injector system	13A-147
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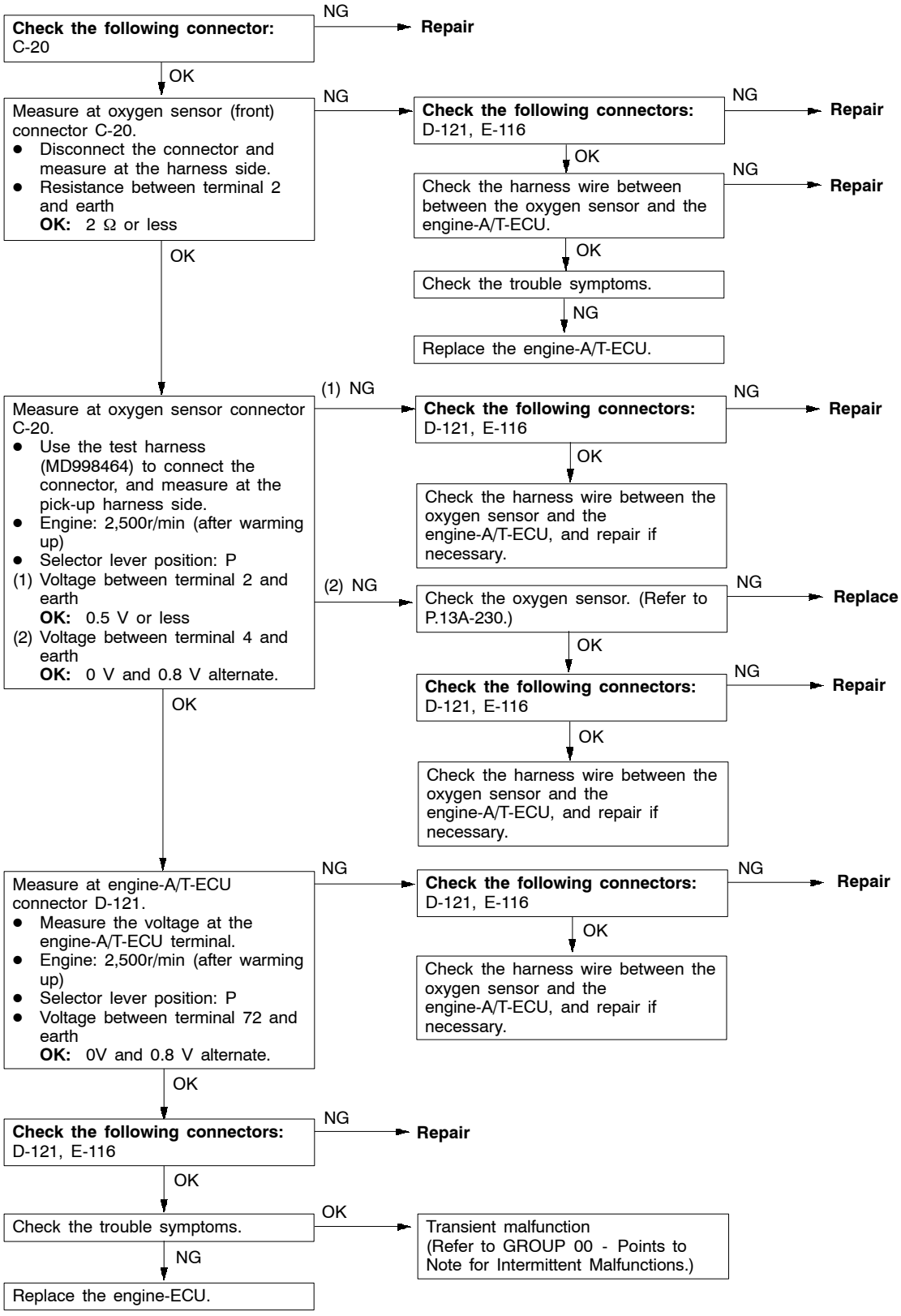
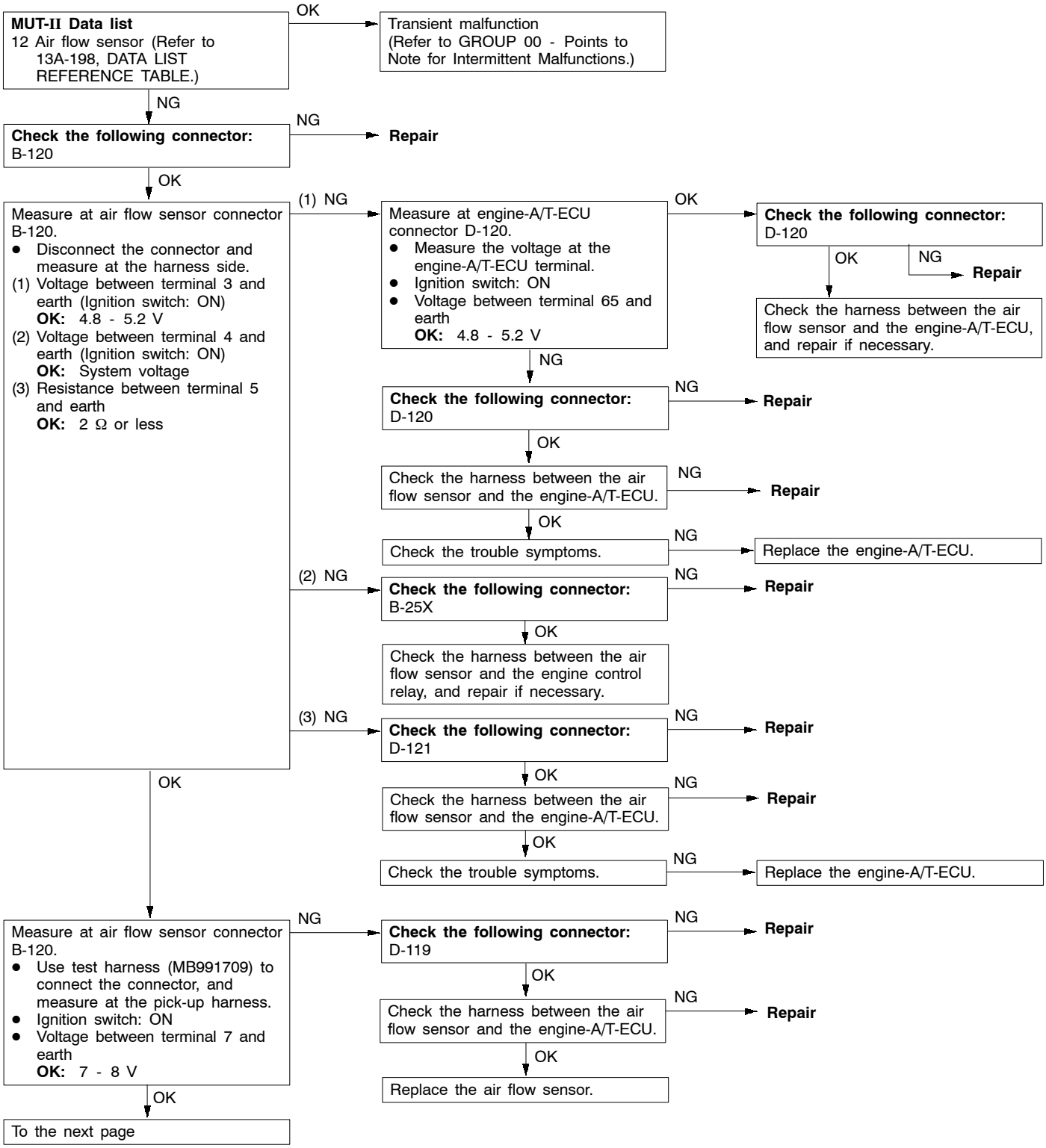
NOTE
Code No. 56 may be also output when air is sucked in high-pressure fuel line due to no fuel supply.

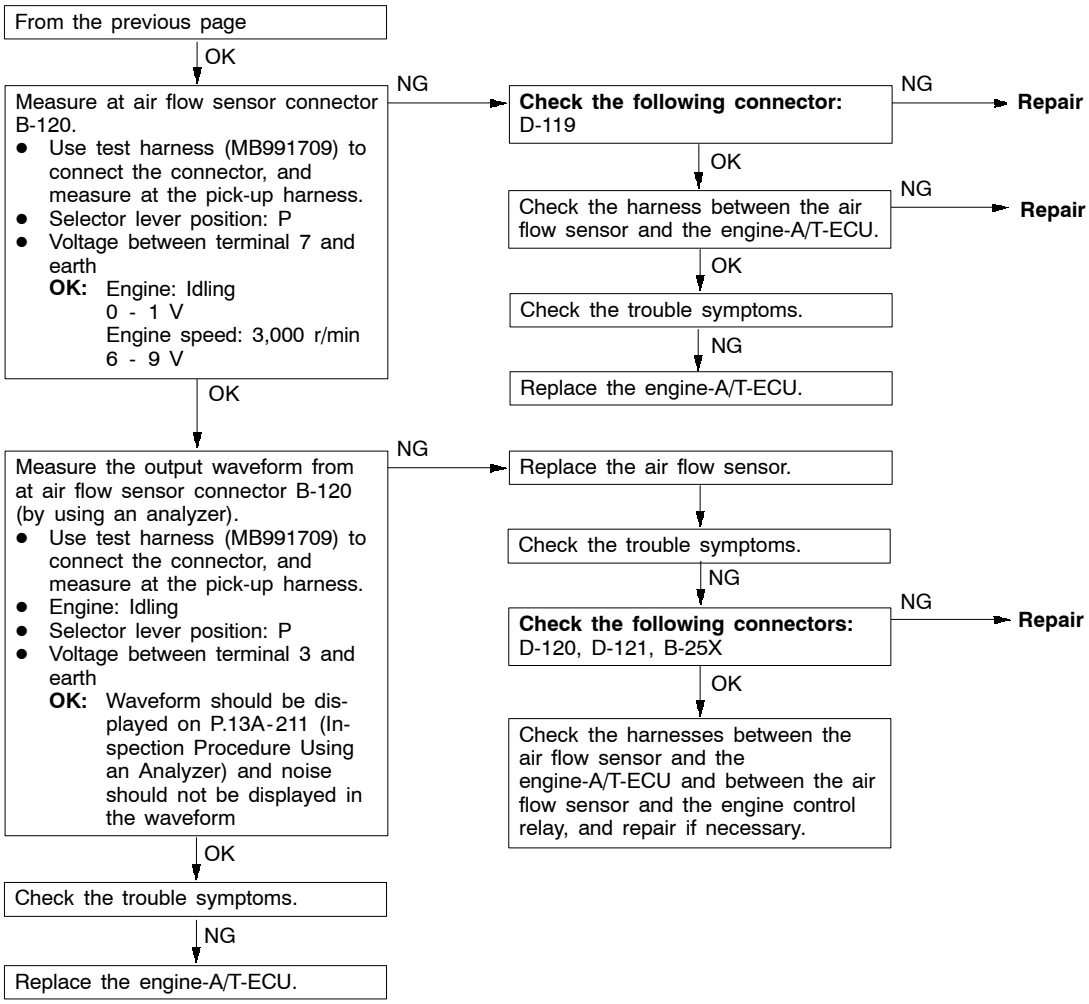
INSPECTION PROCEDURE CLASSIFIED BY DIAGNOSIS CODE

Code No.11 Oxygen sensor system	Probable cause
Range of Check ● Three minutes have been passed since the engine has been started. ● The engine coolant temperature is approx. 80°C or more. ● Intake air temperature is 20 - 30°C ● Engine speed is 1,200 r/min or more ● Driving on a level surface at constant speed. Set Conditions ● The oxygen sensor output voltage is 4.5 V or more when the sensor output voltage is 0.2 V or less and a voltage of 5 V is applied to the oxygen sensor inside the engine-A/T-ECU.	● Malfunction of oxygen sensor ● Open or short circuit in the oxygen sensor circuit or loose connector contact ● Malfunction of engine-A/T-ECU


Check the following connector: C-20
NG
Repair
OK
Measure at oxygen sensor (front) connector C-20.
● Disconnect the connector and measure at the harness side.
● Resistance between terminal 2 and earth
OK: 2 Ω or less
NG
Check the following connectors: D-121, E-116
NG
Repair
OK
Check the harness wire between between the oxygen sensor and the engine-A/T-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-A/T-ECU.
OK
Measure at oxygen sensor connector C-20.
● Use the test harness (MD998464) to connect the connector, and measure at the pick-up harness side.
● Engine: 2,500r/min (after warming up)
● Selector lever position: P
(1) Voltage between terminal 2 and earth
OK: 0.5 V or less
(2) Voltage between terminal 4 and earth
OK: 0 V and 0.8 V alternate.
(1) NG
Check the following connectors: D-121, E-116
NG
Repair
OK
Check the harness wire between the oxygen sensor and the engine-A/T-ECU, and repair if necessary.
(2) NG
Check the oxygen sensor. (Refer to P.13A-230.)
NG
Replace
OK
Check the following connectors: D-121, E-116
NG
Repair
OK
Check the harness wire between the oxygen sensor and the engine-A/T-ECU, and repair if necessary.
OK
Measure at engine-A/T-ECU connector D-121.
● Measure the voltage at the engine-A/T-ECU terminal.
● Engine: 2,500r/min (after warming up)
● Selector lever position: P
● Voltage between terminal 72 and earth
OK: 0V and 0.8 V alternate.
NG
Check the following connectors: D-121, E-116
NG
Repair
OK
Check the harness wire between the oxygen sensor and the engine-A/T-ECU, and repair if necessary.
OK
Check the following connectors: D-121, E-116
NG
Repair
OK
Check the trouble symptoms.
OK
Transient malfunction (Refer to GROUP 00 - Points to Note for Intermittent Malfunctions.)
NG
Replace the engine-ECU.

Code No.12 Air flow sensor system	Probable cause
Range of Check ● Engine speed: 500 r/min or more Set Conditions ● The sensor output frequency is 3.3 Hz or less for four seconds.	● Malfunction of air flow sensor ● Open or short circuit in air flow sensor circuit or loose connector contact ● Malfunction of engine-A/T-ECU

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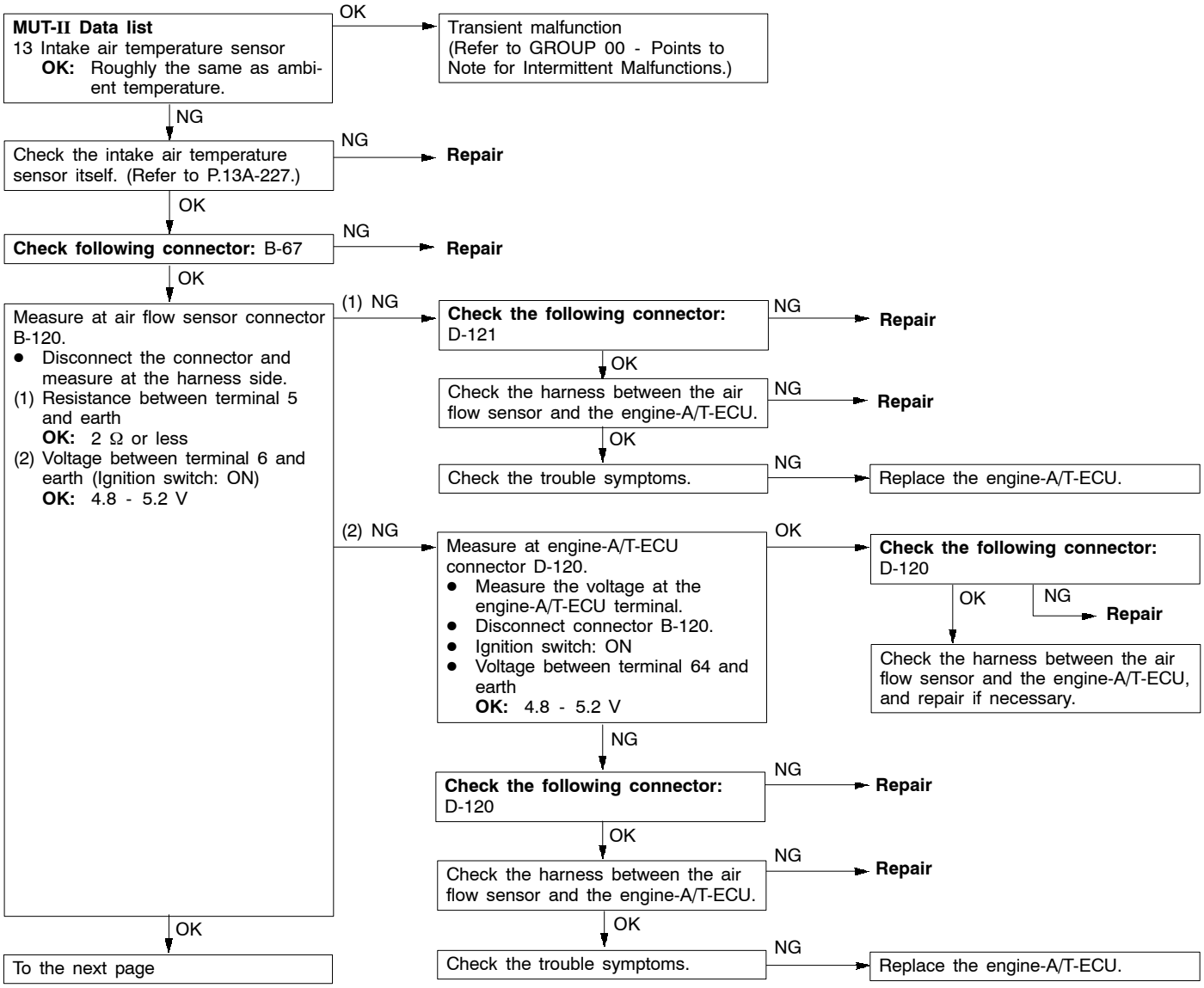
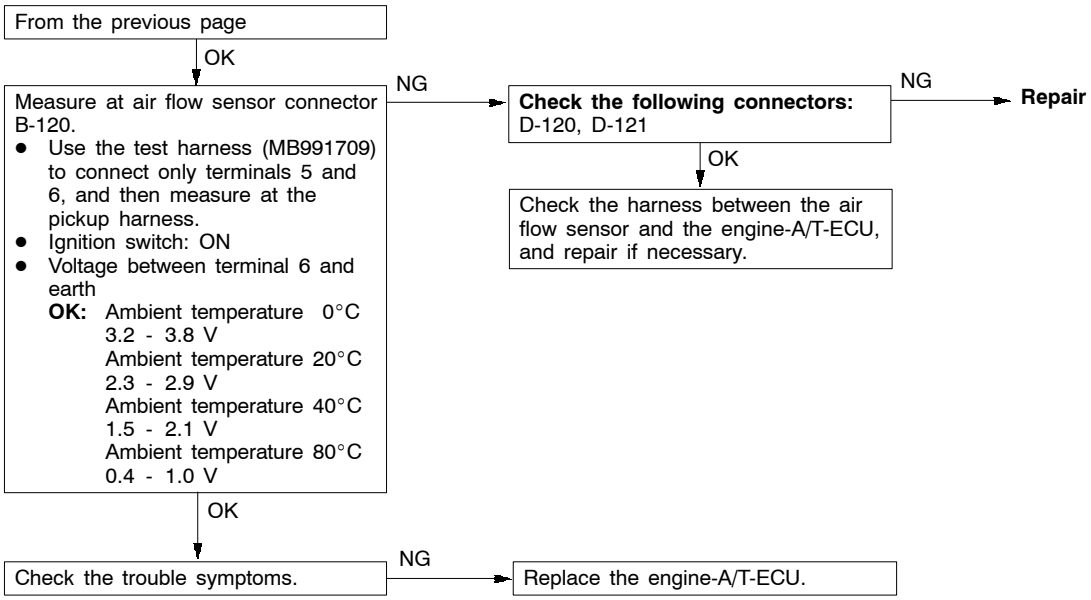
OK
Measure at air flow sensor connector B-120.
● Use test harness (MB991709) to connect the connector, and measure at the pick-up harness.
● Selector lever position: P
● Voltage between terminal 7 and earth
OK: Engine: Idling
0 - 1 V
Engine speed: 3,000 r/min
6 - 9 V
NG
Check the following connector: D-119
NG
Repair
OK
Check the harness between the air flow sensor and the engine-A/T-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-A/T-ECU.
OK
Measure the output waveform from at air flow sensor connector B-120 (by using an analyzer).
● Use test harness (MB991709) to connect the connector, and measure at the pick-up harness.
● Engine: Idling
● Selector lever position: P
● Voltage between terminal 3 and earth
OK: Waveform should be displayed on P.13A-211 (Inspection Procedure Using an Analyzer) and noise should not be displayed in the waveform
NG
Replace the air flow sensor.
Check the trouble symptoms.
NG
Check the following connectors: D-120, D-121, B-25X
NG
Repair
OK
Check the harnesses between the air flow sensor and the engine-A/T-ECU and between the air flow sensor and the engine control relay, and repair if necessary.
OK
Check the trouble symptoms.
NG
Replace the engine-A/T-ECU.

Code No.13 Intake air temperature sensor system	Probable cause
Range of Check • Two seconds have passed since the ignition switch is turned ON or the engine starting process is completed. Set Conditions • The sensor output voltage is 4.6 V or more for four seconds (equivalent to -45°C of intake air temperature) or • The sensor output voltage is 0.2 V or more for four seconds (equivalent to 125°C of intake air temperature)	• Malfunction of intake air temperature sensor • Open or short circuit in intake air temperature sensor or loose connector contact • Malfunction of engine-A/T-ECU

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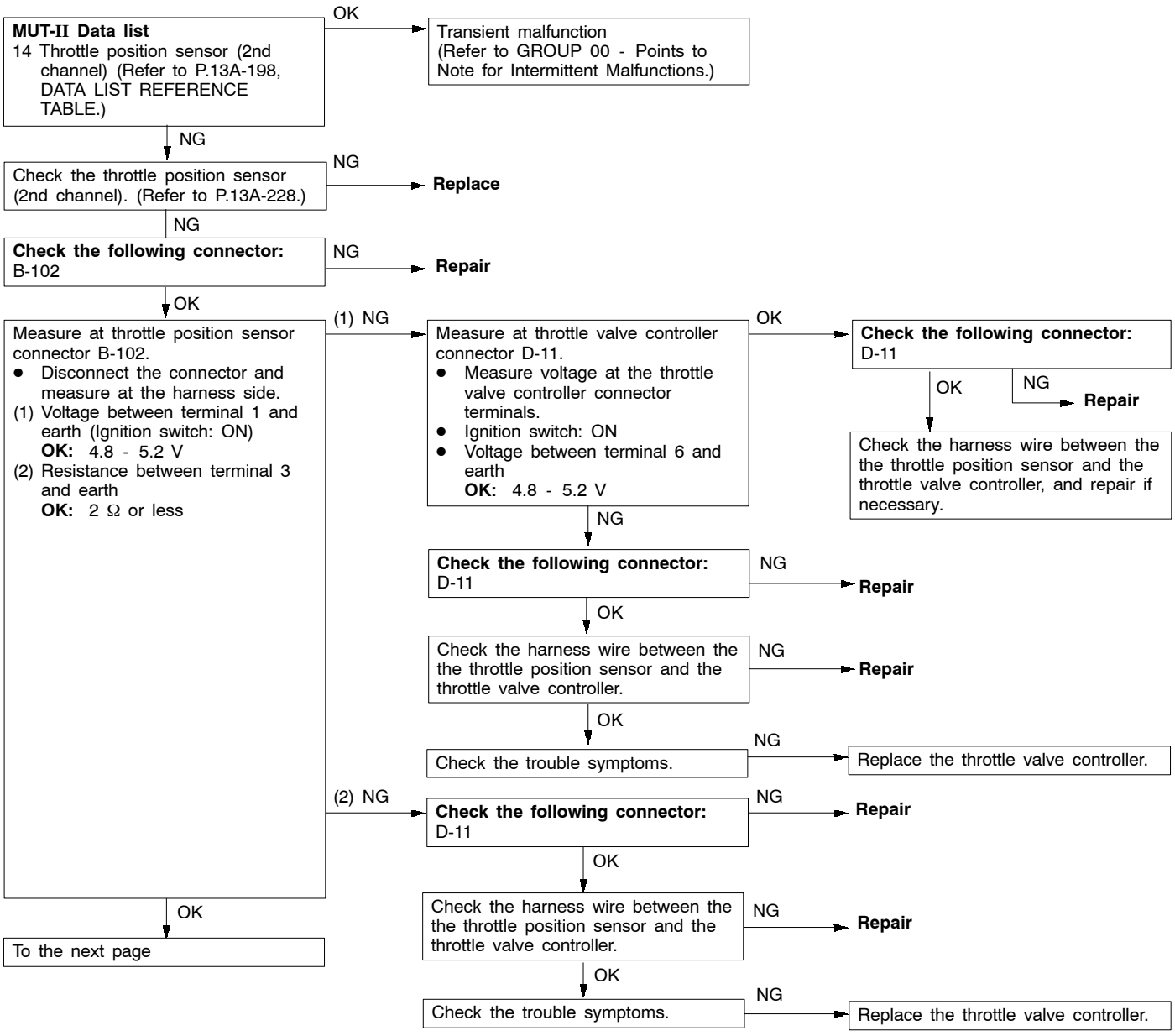
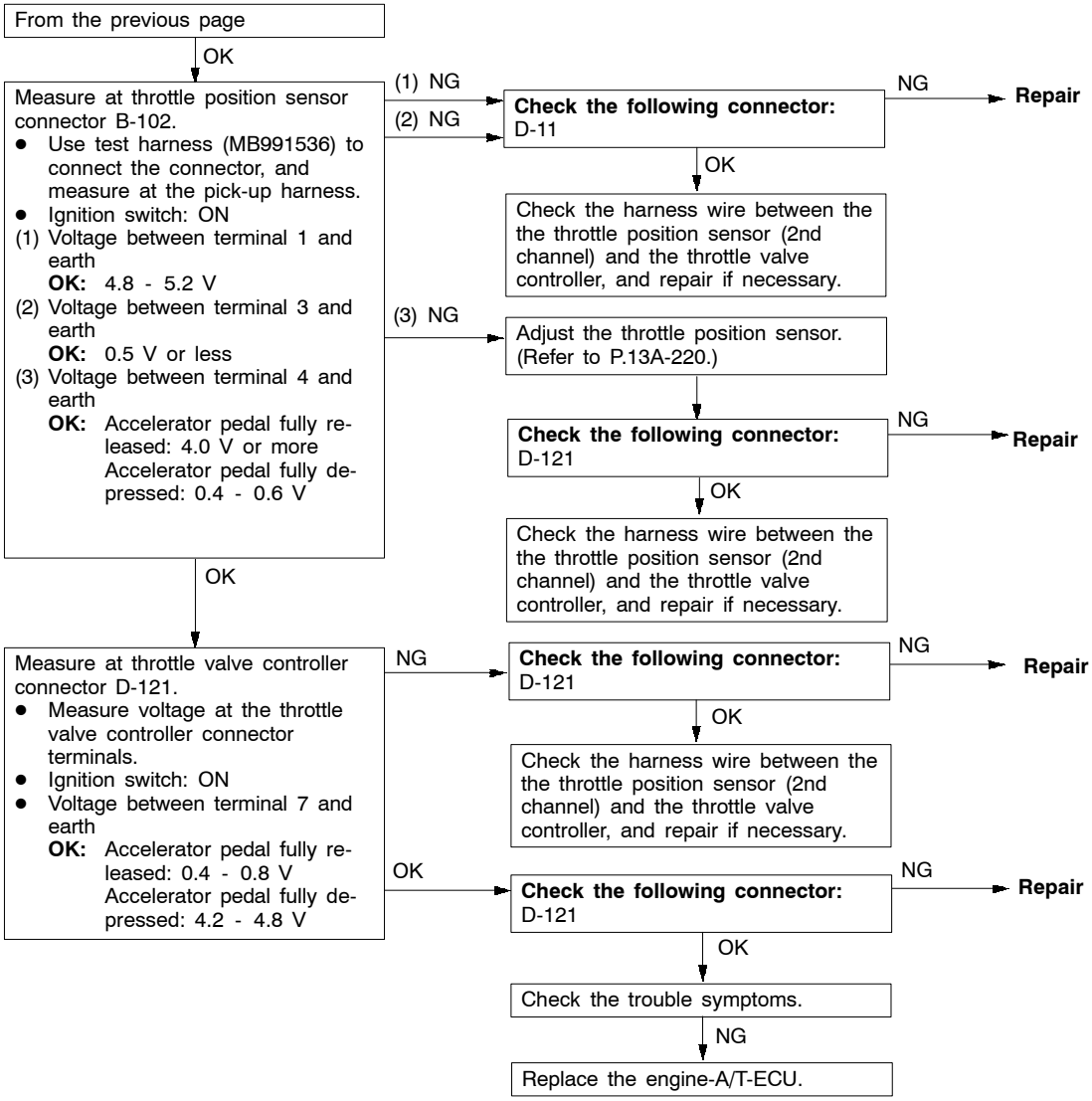
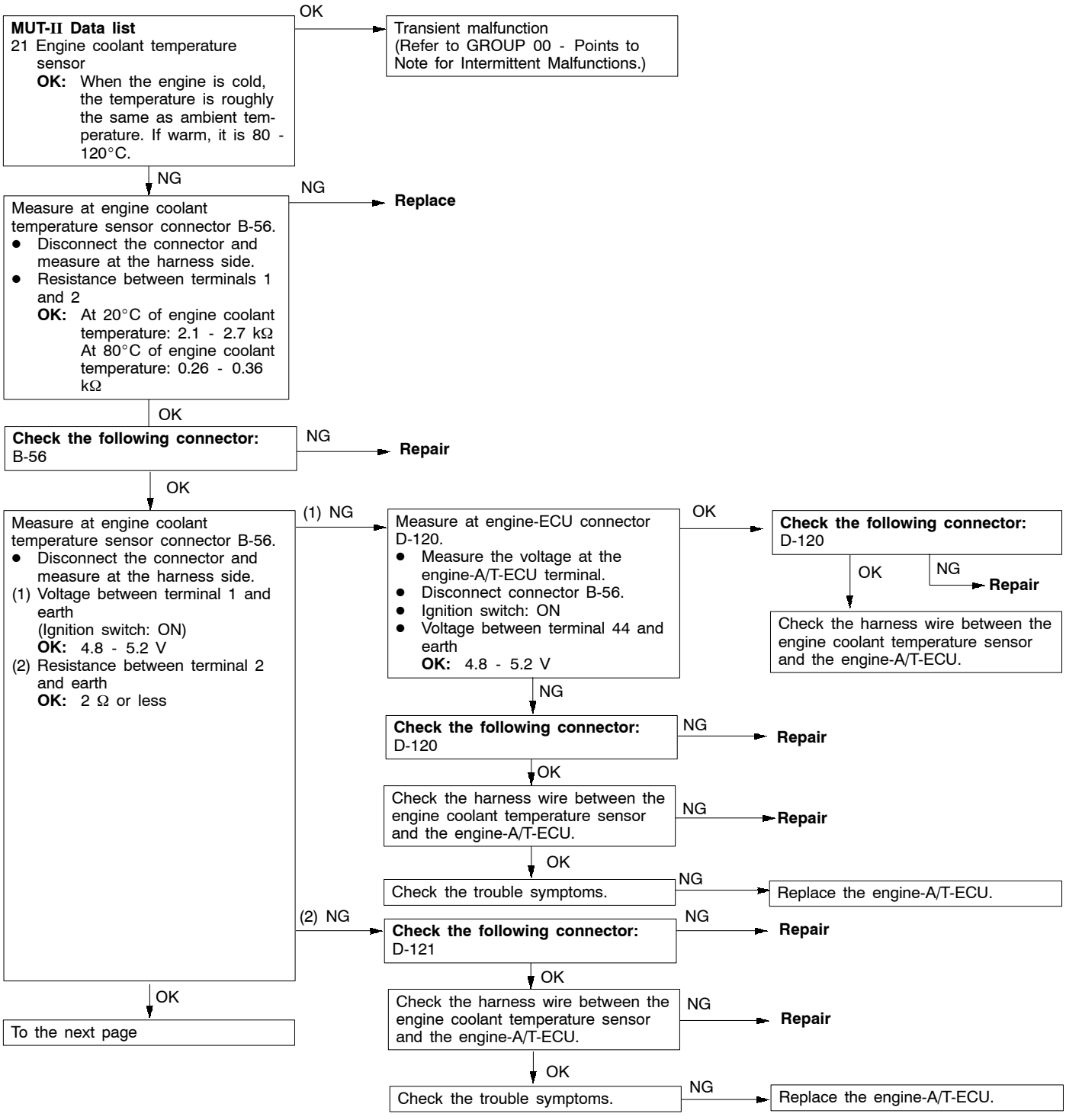
OK
Measure at air flow sensor connector B-120.
● Use the test harness (MB991709) to connect only terminals 5 and 6, and then measure at the pickup harness.
● Ignition switch: ON
● Voltage between terminal 6 and earth
OK: Ambient temperature 0°C 3.2 - 3.8 V
Ambient temperature 20°C 2.3 - 2.9 V
Ambient temperature 40°C 1.5 - 2.1 V
Ambient temperature 80°C 0.4 - 1.0 V
NG
Check the following connectors: D-120, D-121
NG
Repair
OK
Check the harness between the air flow sensor and the engine-A/T-ECU, and repair if necessary.
OK
Check the trouble symptoms.
NG
Replace the engine-A/T-ECU.

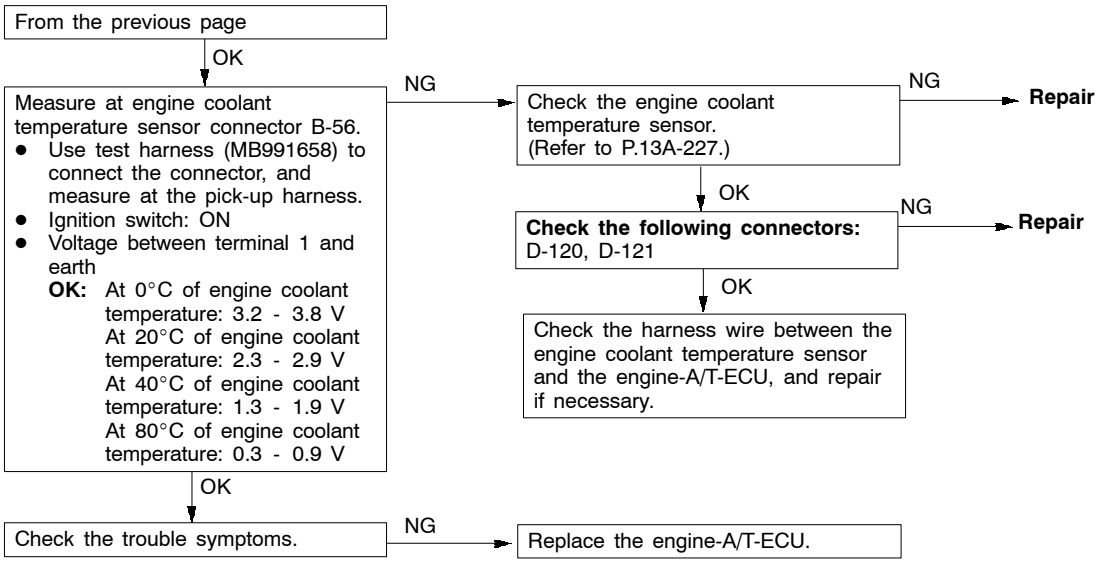
Code No.14 Throttle position sensor (2nd channel) system	Probable cause
The throttle valve controller judges a malfunction, and then transmit the result to the engine-A/T-ECU. Range of Check ● Ignition switch: ON ● The throttle position sensor (1st channel) is normal. Set Conditions ● The sensor output voltage is 0.2 V or less for four seconds. or ● The sensor output voltage is 4.85 V or more and the throttle position sensor (1st channel) output voltage is 1.2 V or more for four seconds. or ● The throttle position sensor (1st channel) and throttle position sensor (2nd channel) combination output voltage is outside 4 - 6 V.	● Malfunction of throttle position sensor (2nd channel) ● Open or short circuit in the throttle position sensor (2nd channel) circuit or loose connector contact ● Malfunction of throttle valve controller ● Malfunction of engine-A/T-ECU



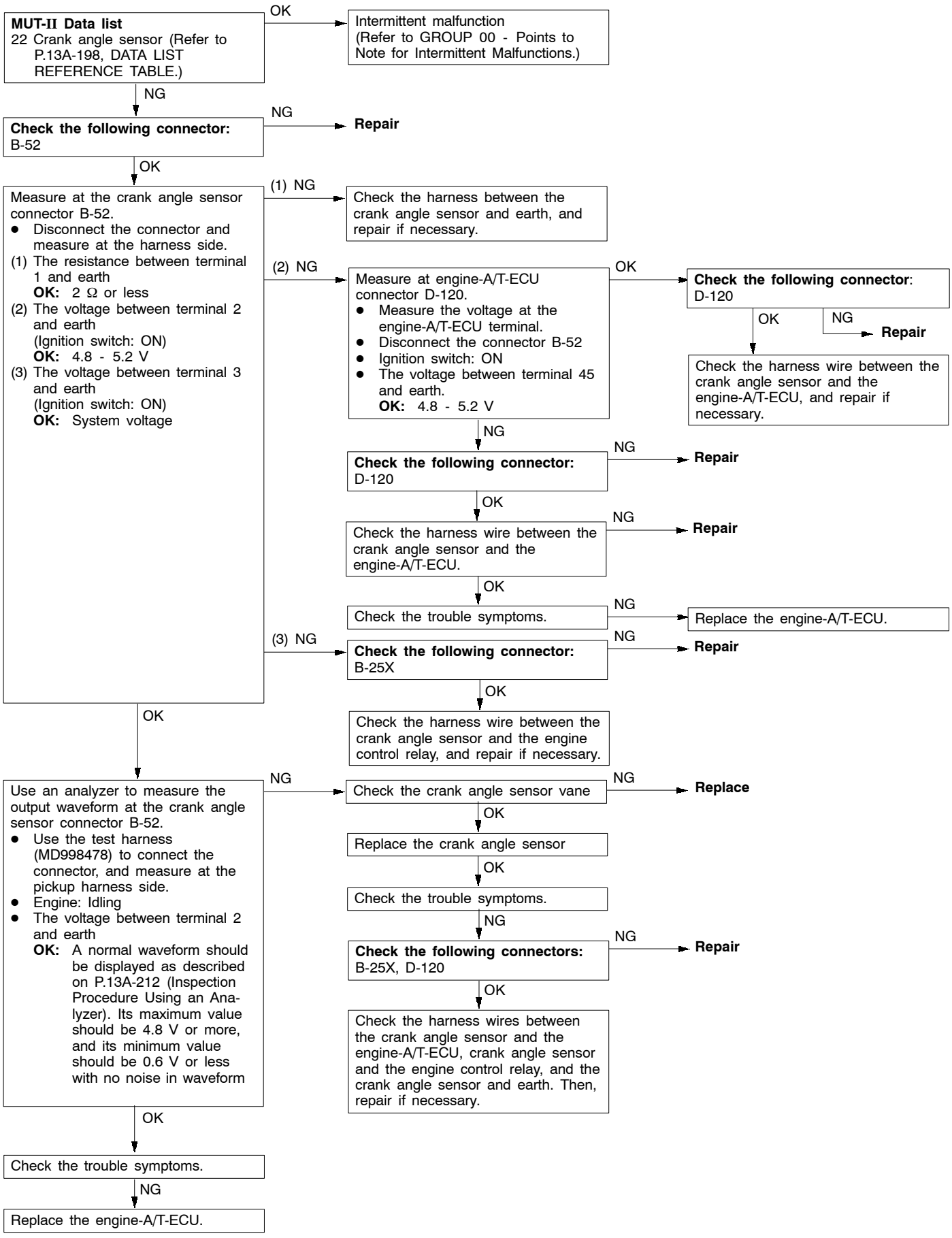


Code No.21 Engine coolant temperature sensor system	Probable cause
Range of Check ● Engine: Two seconds after the engine has been started Set Conditions ● The sensor output voltage is 4.6 V or more for four seconds (equivalent to -45°C of engine coolant temperature) or ● The sensor output voltage is 0.1 V or less for four seconds (equivalent to 140°C of engine coolant temperature)	● Malfunction of engine coolant temperature sensor ● Open or short circuit in the engine coolant temperature sensor circuit or loose connector contact ● Malfunction of engine-A/T-ECU
Range of Check ● Engine: After starting Set Conditions ● The engine coolant temperature has reduced from over 40°C to less than 40°C, and that condition has lasted for five minutes or more.	

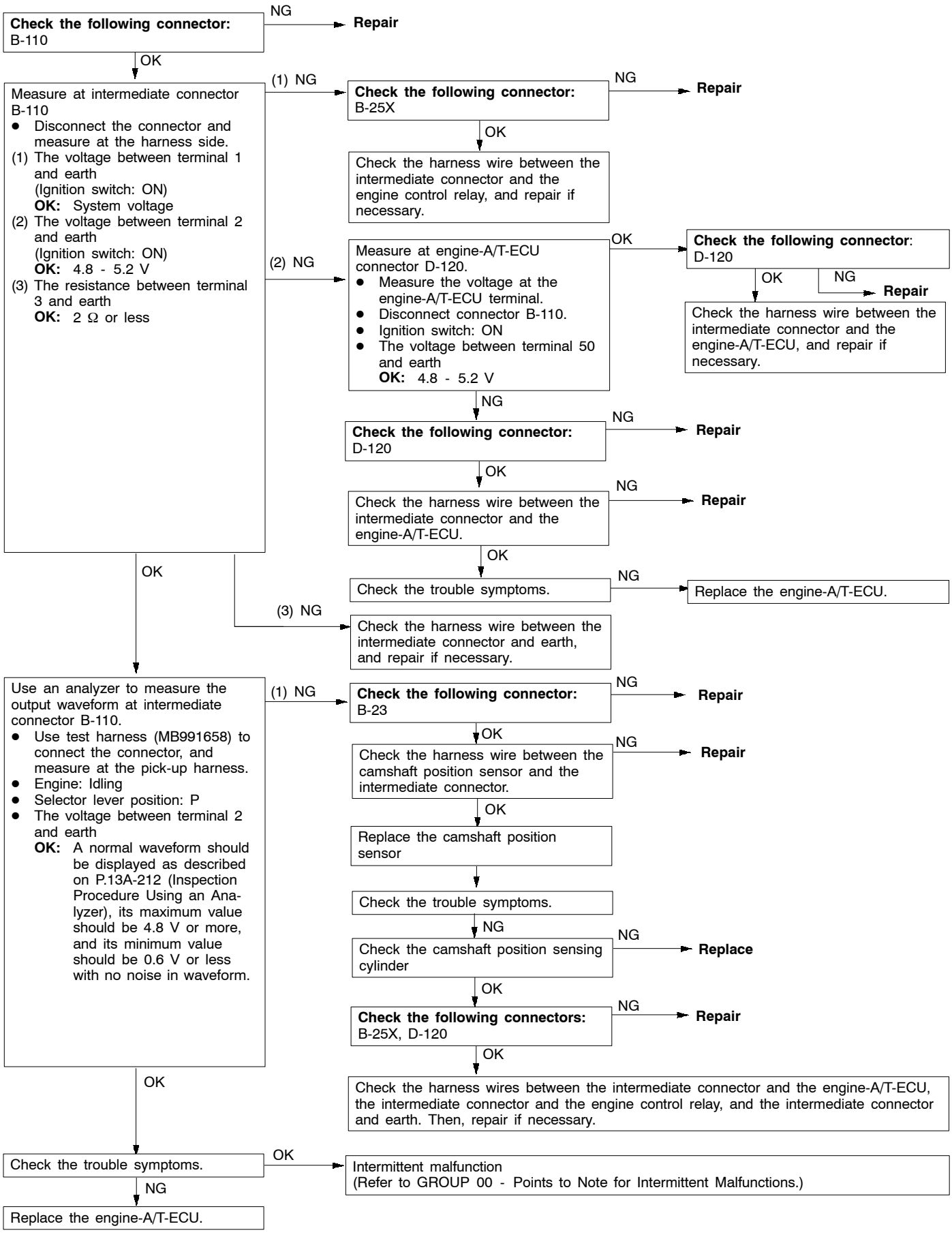

MUT-II Data list
21 Engine coolant temperature sensor
OK: When the engine is cold, the temperature is roughly the same as ambient temperature. If warm, it is 80 - 120°C.
OK
Transient malfunction (Refer to GROUP 00 - Points to Note for Intermittent Malfunctions.)
NG
Measure at engine coolant temperature sensor connector B-56.
Disconnect the connector and measure at the harness side.
Resistance between terminals 1 and 2
OK: At 20°C of engine coolant temperature: 2.1 - 2.7 kΩ
At 80°C of engine coolant temperature: 0.26 - 0.36 kΩ
NG
Replace
OK
Check the following connector: B-56
NG
Repair
OK
Measure at engine coolant temperature sensor connector B-56.
Disconnect the connector and measure at the harness side.
(1) Voltage between terminal 1 and earth
(Ignition switch: ON)
OK: 4.8 - 5.2 V
(2) Resistance between terminal 2 and earth
OK: 2 Ω or less
(1) NG
Measure at engine-ECU connector D-120.
Measure the voltage at the engine-A/T-ECU terminal.
Disconnect connector B-56.
Ignition switch: ON
Voltage between terminal 44 and earth
OK: 4.8 - 5.2 V
OK
Check the following connector: D-120
OK
NG
Repair
Check the harness wire between the engine coolant temperature sensor and the engine-A/T-ECU.
NG
Check the following connector: D-120
NG
Repair
OK
Check the harness wire between the engine coolant temperature sensor and the engine-A/T-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-A/T-ECU.
(2) NG
Check the following connector: D-121
NG
Repair
OK
Check the harness wire between the engine coolant temperature sensor and the engine-A/T-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-A/T-ECU.
OK
To the next page



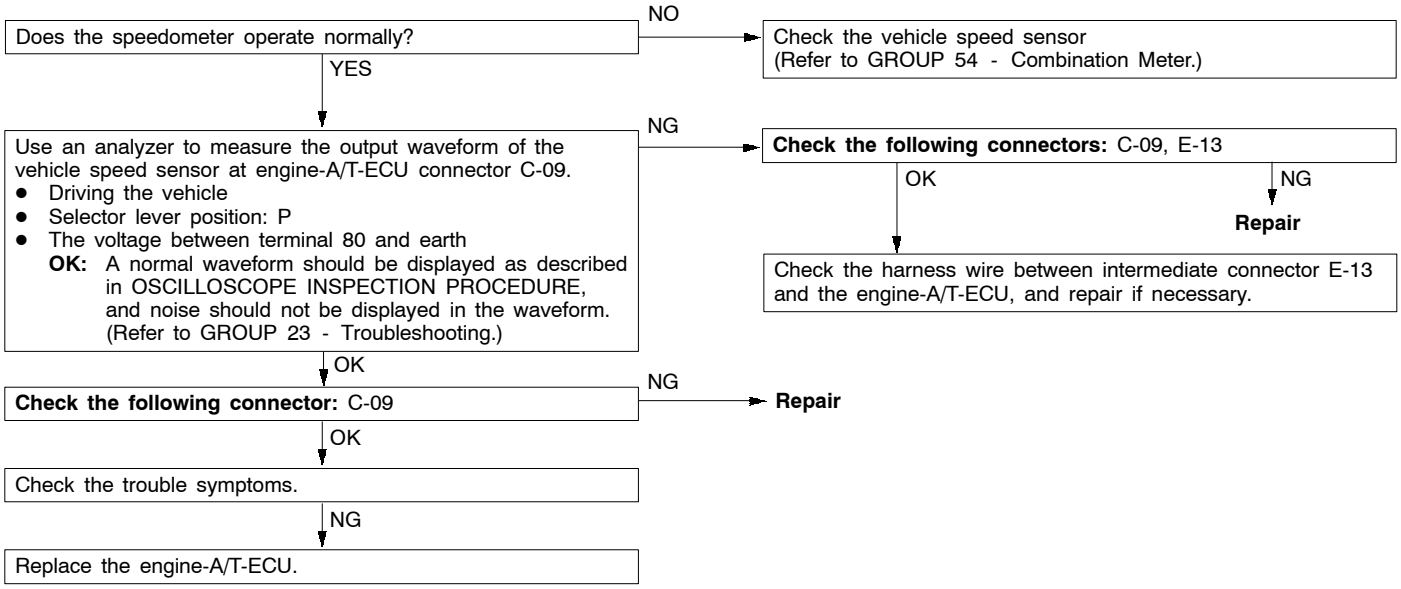
Code No.22 Crank angle sensor system	Probable cause
Range of Check ● Engine is cranking Set Conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the crank angle sensor. ● Open or short circuit in the crank angle sensor circuit or loose connector contact. ● Malfunction of engine-A/T-ECU


MUT-II Data list
22 Crank angle sensor (Refer to P.13A-198, DATA LIST REFERENCE TABLE.)
OK
Intermittent malfunction (Refer to GROUP 00 - Points to Note for Intermittent Malfunctions.)
NG
Check the following connector: B-52
NG
Repair
OK
Measure at the crank angle sensor connector B-52.
● Disconnect the connector and measure at the harness side.
(1) The resistance between terminal 1 and earth
OK: 2 Ω or less
(2) The voltage between terminal 2 and earth
(Ignition switch: ON)
OK: 4.8 - 5.2 V
(3) The voltage between terminal 3 and earth
(Ignition switch: ON)
OK: System voltage
(1) NG
Check the harness between the crank angle sensor and earth, and repair if necessary.
(2) NG
Measure at engine-A/T-ECU connector D-120.
● Measure the voltage at the engine-A/T-ECU terminal.
● Disconnect the connector B-52
● Ignition switch: ON
● The voltage between terminal 45 and earth.
OK: 4.8 - 5.2 V
OK
Check the following connector: D-120
OK
NG
Repair
Check the harness wire between the crank angle sensor and the engine-A/T-ECU, and repair if necessary.
NG
Check the following connector: D-120
NG
Repair
OK
Check the harness wire between the crank angle sensor and the engine-A/T-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-A/T-ECU.
(3) NG
Check the following connector: B-25X
NG
Repair
OK
Check the harness wire between the crank angle sensor and the engine control relay, and repair if necessary.
OK
Use an analyzer to measure the output waveform at the crank angle sensor connector B-52.
● Use the test harness (MD998478) to connect the connector, and measure at the pickup harness side.
● Engine: Idling
● The voltage between terminal 2 and earth
OK: A normal waveform should be displayed as described on P.13A-212 (Inspection Procedure Using an Analyzer). Its maximum value should be 4.8 V or more, and its minimum value should be 0.6 V or less with no noise in waveform
NG
Check the crank angle sensor vane
NG
Replace
OK
Replace the crank angle sensor
OK
Check the trouble symptoms.
NG
Check the following connectors: B-25X, D-120
NG
Repair
OK
Check the harness wires between the crank angle sensor and the engine-A/T-ECU, crank angle sensor and the engine control relay, and the crank angle sensor and earth. Then, repair if necessary.
OK
Check the trouble symptoms.
NG
Replace the engine-A/T-ECU.

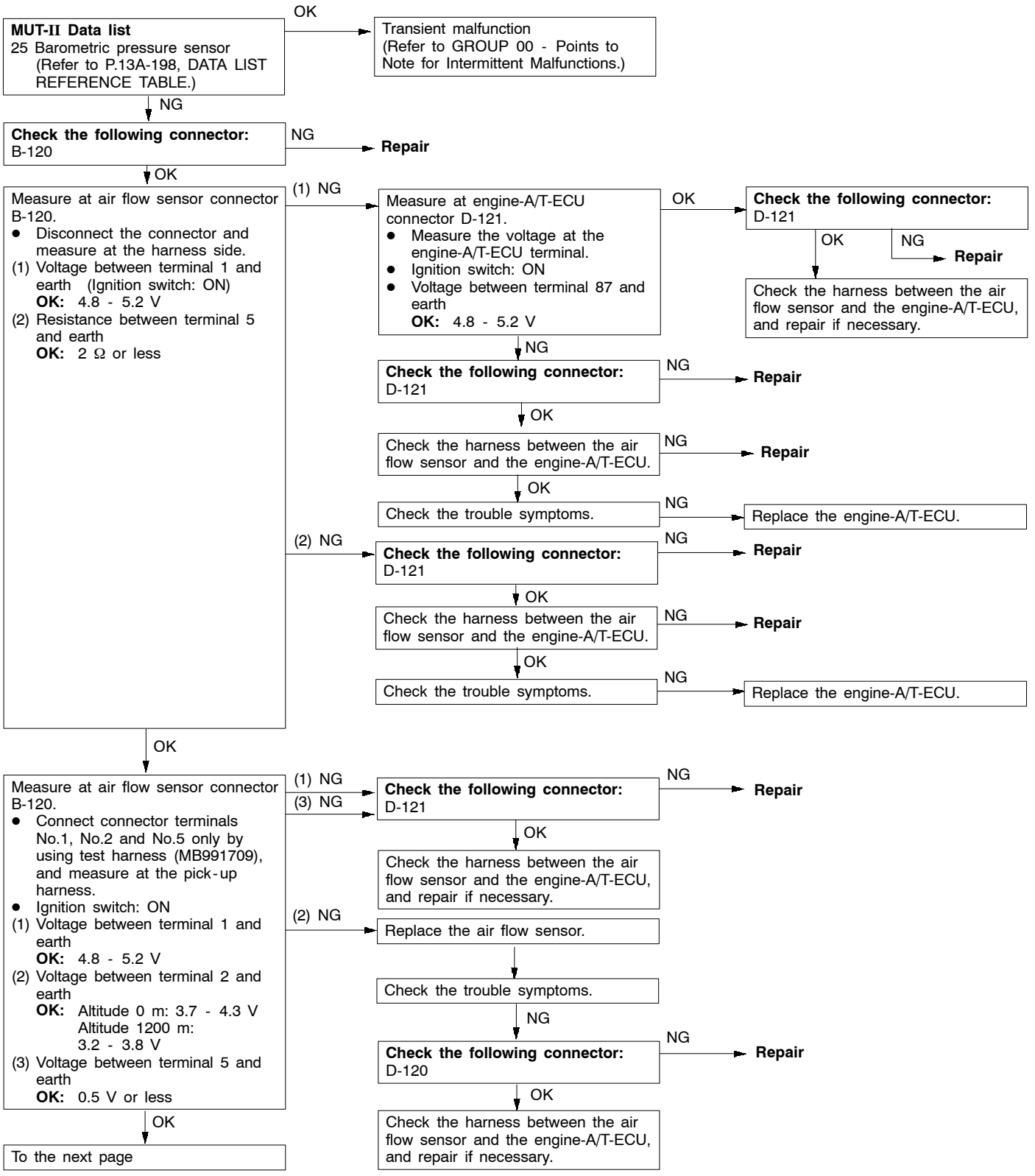
Code No.23 Camshaft position sensor system	Probable cause
Range of Check ● After the engine was started Set Conditions ● The sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the camshaft position sensor ● Open or short circuit in the camshaft position sensor circuit or loose connector contact. ● Malfunction of engine-A/T-ECU

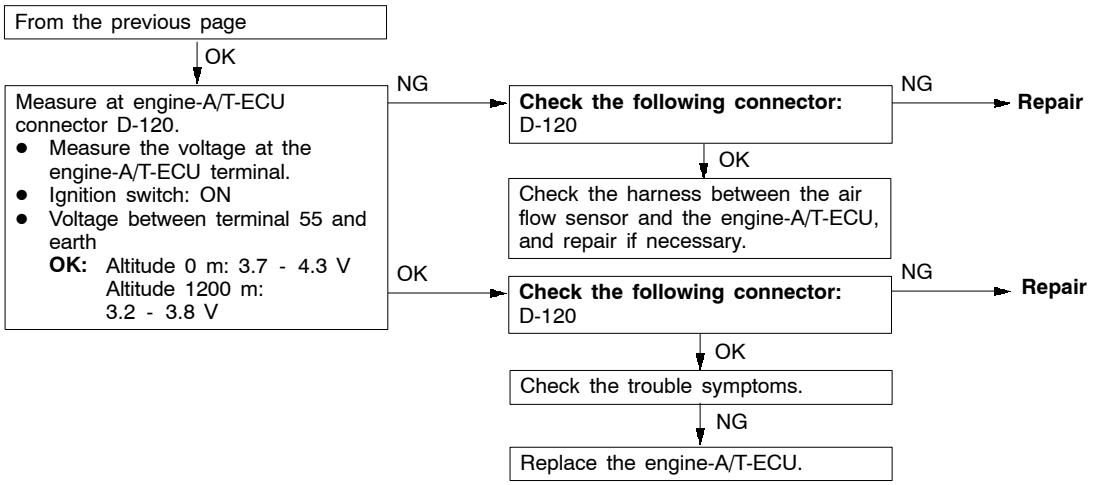

Check the following connector: B-110
NG
Repair
OK
Measure at intermediate connector B-110
● Disconnect the connector and measure at the harness side.
(1) The voltage between terminal 1 and earth (Ignition switch: ON)
OK: System voltage
(2) The voltage between terminal 2 and earth (Ignition switch: ON)
OK: 4.8 - 5.2 V
(3) The resistance between terminal 3 and earth
OK: 2 Ω or less
(1) NG
Check the following connector: B-25X
NG
Repair
OK
Check the harness wire between the intermediate connector and the engine control relay, and repair if necessary.
(2) NG
Measure at engine-A/T-ECU connector D-120.
● Measure the voltage at the engine-A/T-ECU terminal.
● Disconnect connector B-110.
● Ignition switch: ON
● The voltage between terminal 50 and earth
OK: 4.8 - 5.2 V
OK
Check the following connector: D-120
OK
NG
Repair
Check the harness wire between the intermediate connector and the engine-A/T-ECU, and repair if necessary.
NG
Check the following connector: D-120
NG
Repair
OK
Check the harness wire between the intermediate connector and the engine-A/T-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-A/T-ECU.
OK
(3) NG
Check the harness wire between the intermediate connector and earth, and repair if necessary.
Use an analyzer to measure the output waveform at intermediate connector B-110.
● Use test harness (MB991658) to connect the connector, and measure at the pick-up harness.
● Engine: Idling
● Selector lever position: P
● The voltage between terminal 2 and earth
OK: A normal waveform should be displayed as described on P.13A-212 (Inspection Procedure Using an Analyzer), its maximum value should be 4.8 V or more, and its minimum value should be 0.6 V or less with no noise in waveform.
(1) NG
Check the following connector: B-23
NG
Repair
OK
Check the harness wire between the camshaft position sensor and the intermediate connector.
NG
Repair
OK
Replace the camshaft position sensor
Check the trouble symptoms.
NG
Check the camshaft position sensing cylinder
NG
Replace
OK
Check the following connectors: B-25X, D-120
NG
Repair
OK
Check the harness wires between the intermediate connector and the engine-A/T-ECU, the intermediate connector and the engine control relay, and the intermediate connector and earth. Then, repair if necessary.
OK
Check the trouble symptoms.
OK
Intermittent malfunction
(Refer to GROUP 00 - Points to Note for Intermittent Malfunctions.)
NG
Replace the engine-A/T-ECU.

Code No.24 Vehicle speed sensor system	Probable cause
Range of Check ● Engine: Two seconds after the engine was started ● Idle switch: OFF ● Engine speed: 2,500 r/min or more ● During high engine load Set Conditions ● The sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the vehicle speed sensor ● Open or short circuit in the vehicle speed sensor circuit or loose connector contact ● Malfunction of engine-A/T-ECU

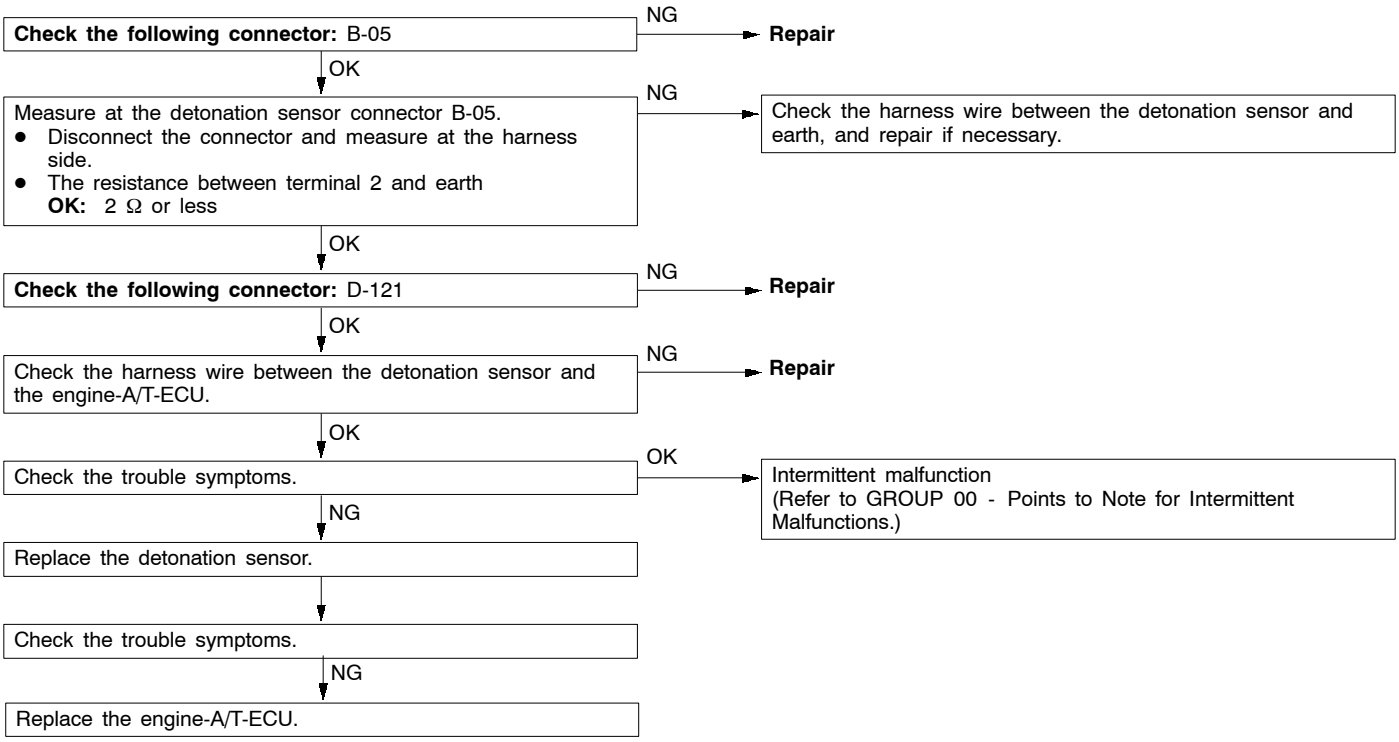


Code No.25 Barometric pressure sensor system	Probable cause
Range of Check ● Two seconds have passed since the ignition switch is turned ON or the engine starting process is completed. ● Battery voltage: 8 V or more Set Conditions ● The sensor output voltage is 4.5 V or more for four seconds (equivalent to 114 kPa of barometric pressure) or ● The sensor output voltage is 0.2 V or less (equivalent to 53 kPa of barometric pressure)	● Malfunction of barometric pressure sensor ● Open or short circuit in barometric pressure sensor circuit or loose connector contact ● Malfunction of engine-A/T-ECU

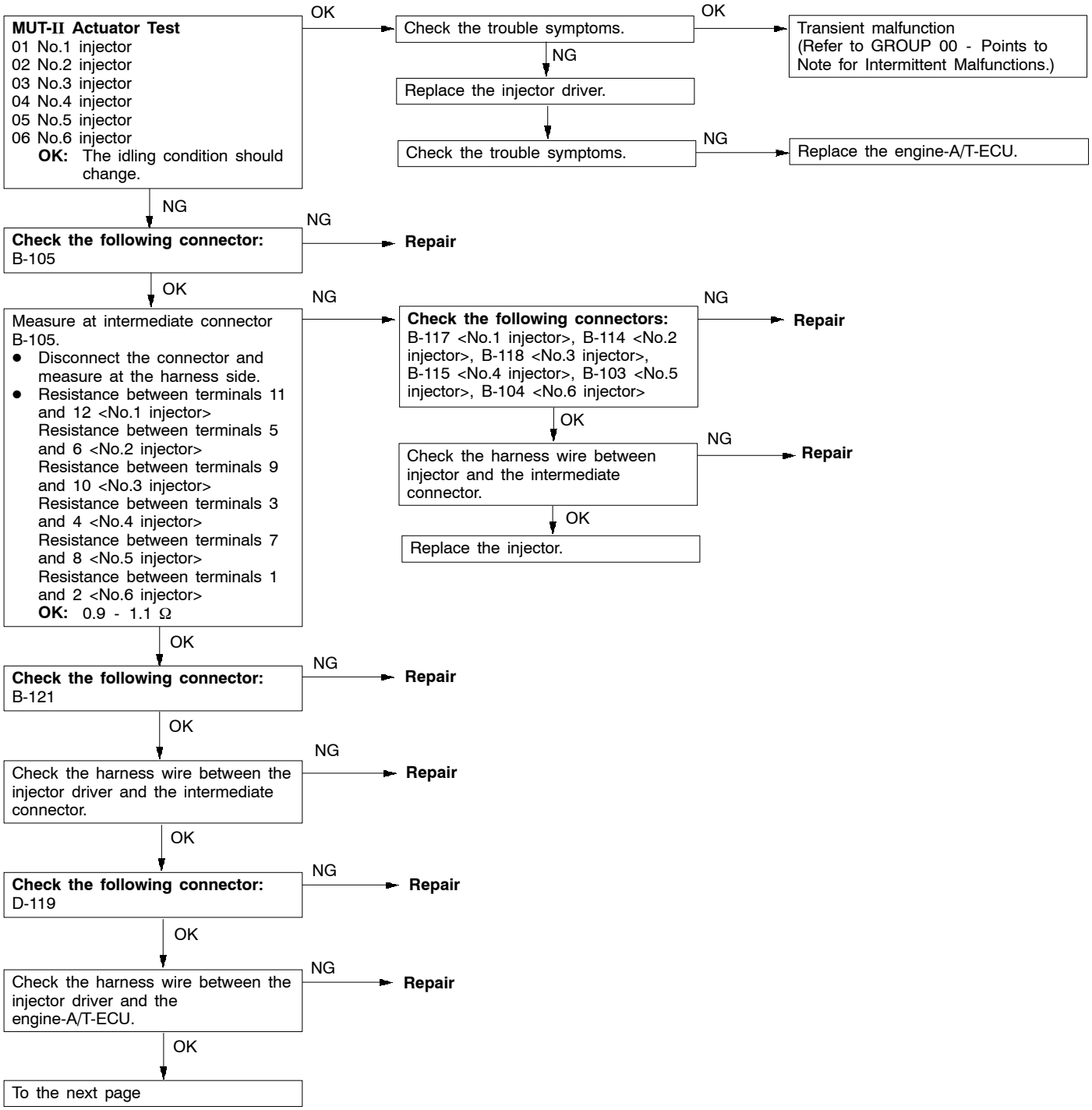


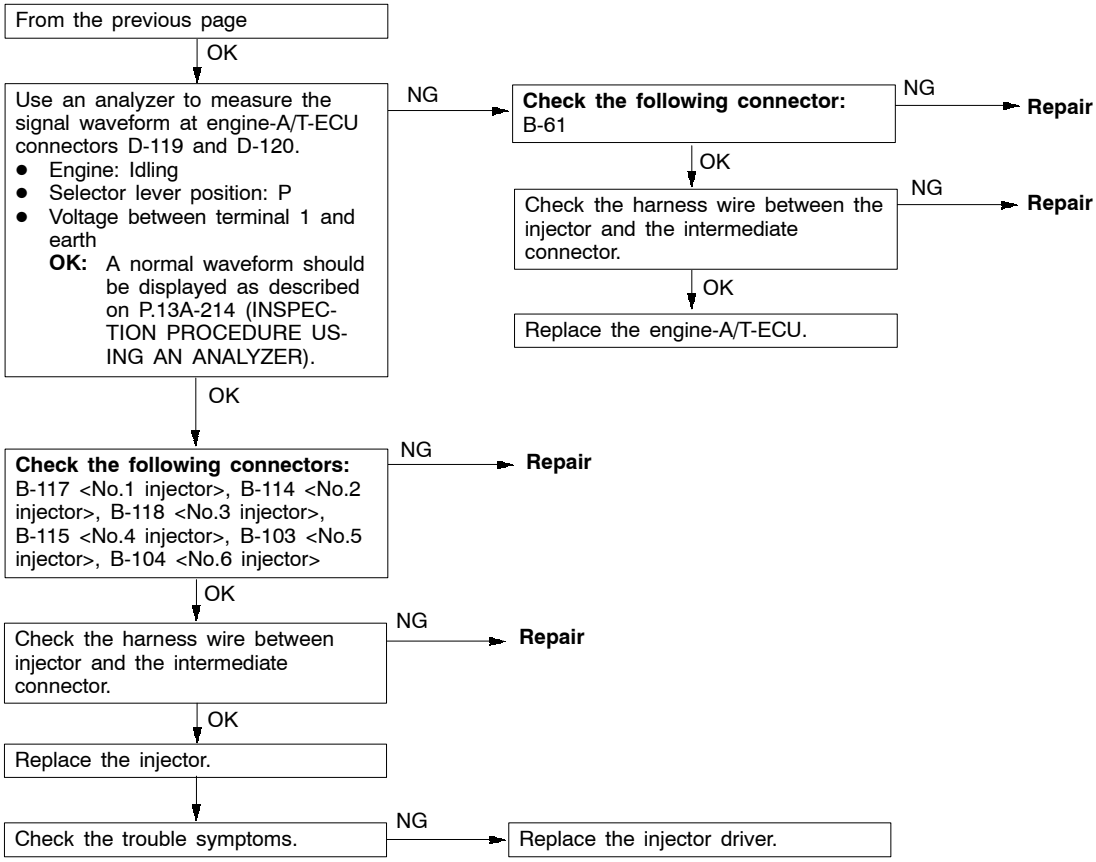


Code No.31 Detonation sensor system	Probable cause
Range of Check ● Engine: Two seconds after the engine has been started Set Conditions ● Changes in sensor output voltage (detonation sensor peak voltage per 1/3 crankshaft rotation) in 200 consecutive cycles are 0.08 V or less.	● Malfunction of the detonation sensor ● Open or short circuit in the detonation sensor circuit or loose connector contact ● Malfunction of engine-A/T-ECU



Code No.41 Injector system	Probable cause
Range of Check ● The engine speed is 4,000 r/min or less. ● The battery voltage is 10 V or more. ● The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. Set Conditions ● The injector driver is not transmitting a injector open circuit check signal for four seconds.	● Malfunction of injector ● Open or short circuit in the injector circuit or loose connector contact ● Malfunction of engine-A/T-ECU



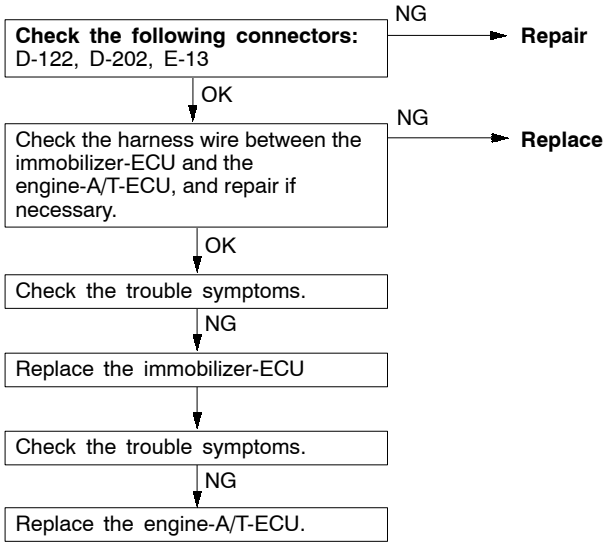


Code No.44, 52, 53 Ignition coil (incorporating power transistor) system	Probable cause
Range of Check ● Engine speed is approx. 50 - 4,000 r/min. ● Engine is not cranking. Set Conditions ● The ignition failure sensor does not send a signal about a certain cylinder for four seconds. However, except that the ignition failure sensor does not send a signal about all of cylinders.	● Malfunction of the ignition coil ● Malfunction of the ignition failure sensor ● Malfunction of spark plug ● Open or short circuit in the primary ignition circuit or loose connector contact ● Malfunction of engine-A/T-ECU

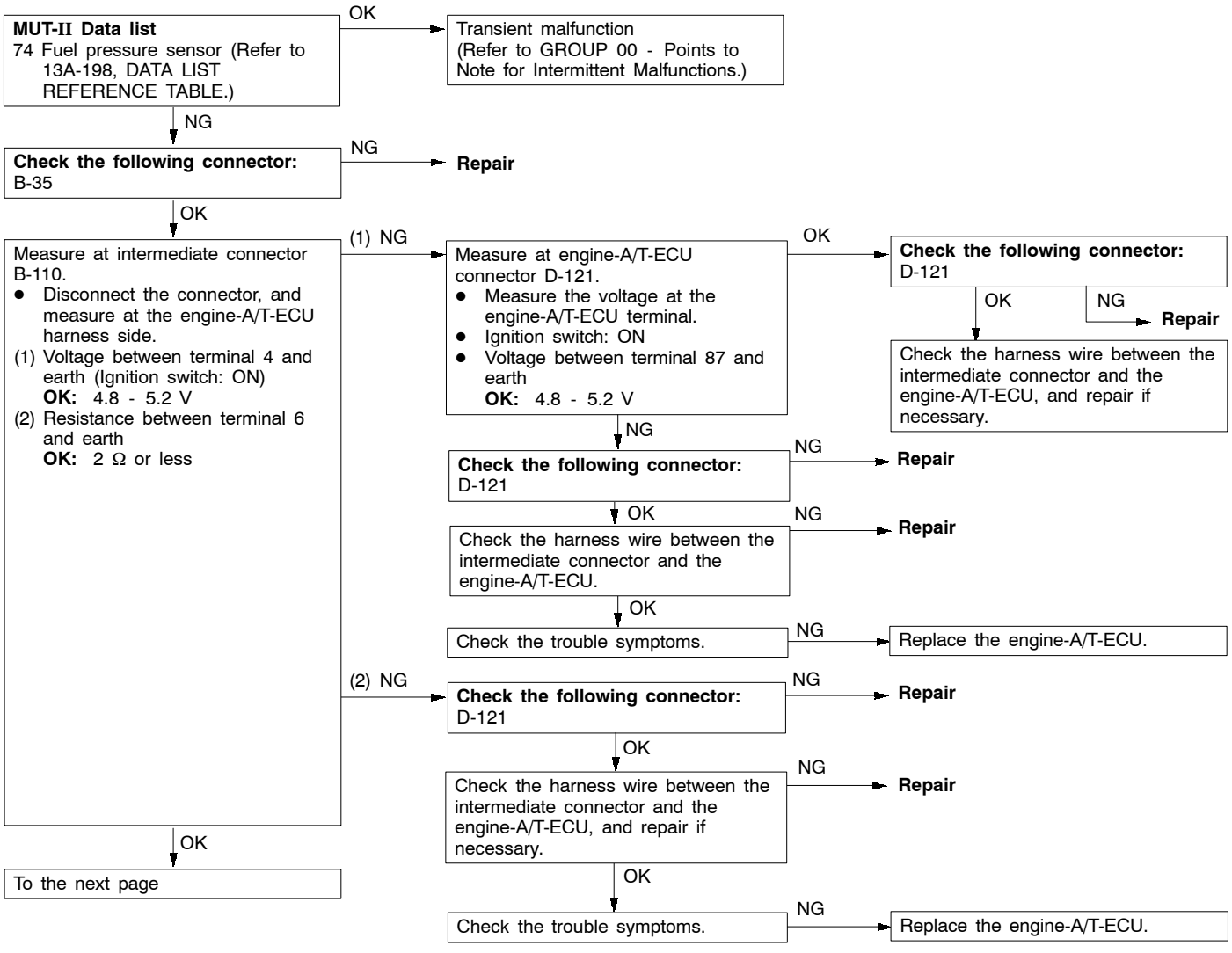
Check the ignition coil. (Refer to GROUP 16 - Ignition System.)
NG
Replace
OK
Check the ignition failure sensor. (Refer to GROUP 16 - Ignition System.)
NG
Replace
OK
Measure at the ignition coil connectors B-101, B-108, B-112, B-113, B-116, B-119.
● Disconnect the connector, and measure at the harness side.
(1) Voltage between 1 and earth (Ignition switch: ON)
OK: System voltage
(2) Voltage between 3 and earth (Engine: cranking)
OK: 0.5 - 4.0 V
(3) Continuity between 2 and earth
OK: Continuity
(1) NG
Check the following connectors: B-07, B-107, E-13, D-223 <LHD>
OK
NG
Repair
Check trouble symptom.
(2) NG
(3) NG
Check and repair the harness wire between the ignition coil and ignition failure sensor.
Check and repair the harness wire between the ignition failure sensor and ignition switch.
OK
Check the following connectors: B-101, B-108, B-112, B-113, B-116, B-119
OK
NG
Repair
Check the following connectors: B-107, D-119
OK
NG
Repair
Check trouble symptom.
NG
Check the harness wire between the engine-A/T-ECU and the ignition coil.
OK
NG
Repair
Replace the engine-A/T-ECU.
Check and repair the harness wire between the ignition coil and earth.
Check trouble symptom.
NG
Measure at the ignition failure sensor connector B-04.
● Disconnect the connector, and measure at the harness side.
(1) Voltage between 2 and earth (Ignition switch: ON)
OK: 4 V or more
(2) Continuity between 1 and earth
OK: Continuity
(1) NG
There is short circuit or open circuit in the ignition signal output harness of the ignition failure sensor. Check and repair the harness.
(2) NG
Check and repair the harness wire between the ignition failure sensor and earth.
OK
Measure at the engine-A/T-ECU connector D-120.
● Connect the connector.
● Voltage between 45 and earth (Engine: 3,000 r/min)
OK: 0.3 - 3.0 V
NG
Check the following connectors: B-04, D-120
OK
NG
Repair
Check the harness wire between the engine-A/T-ECU and the ignition failure sensor.
OK
NG
Repair
Replace the ignition failure sensor.
OK
Replace the engine-A/T-ECU.

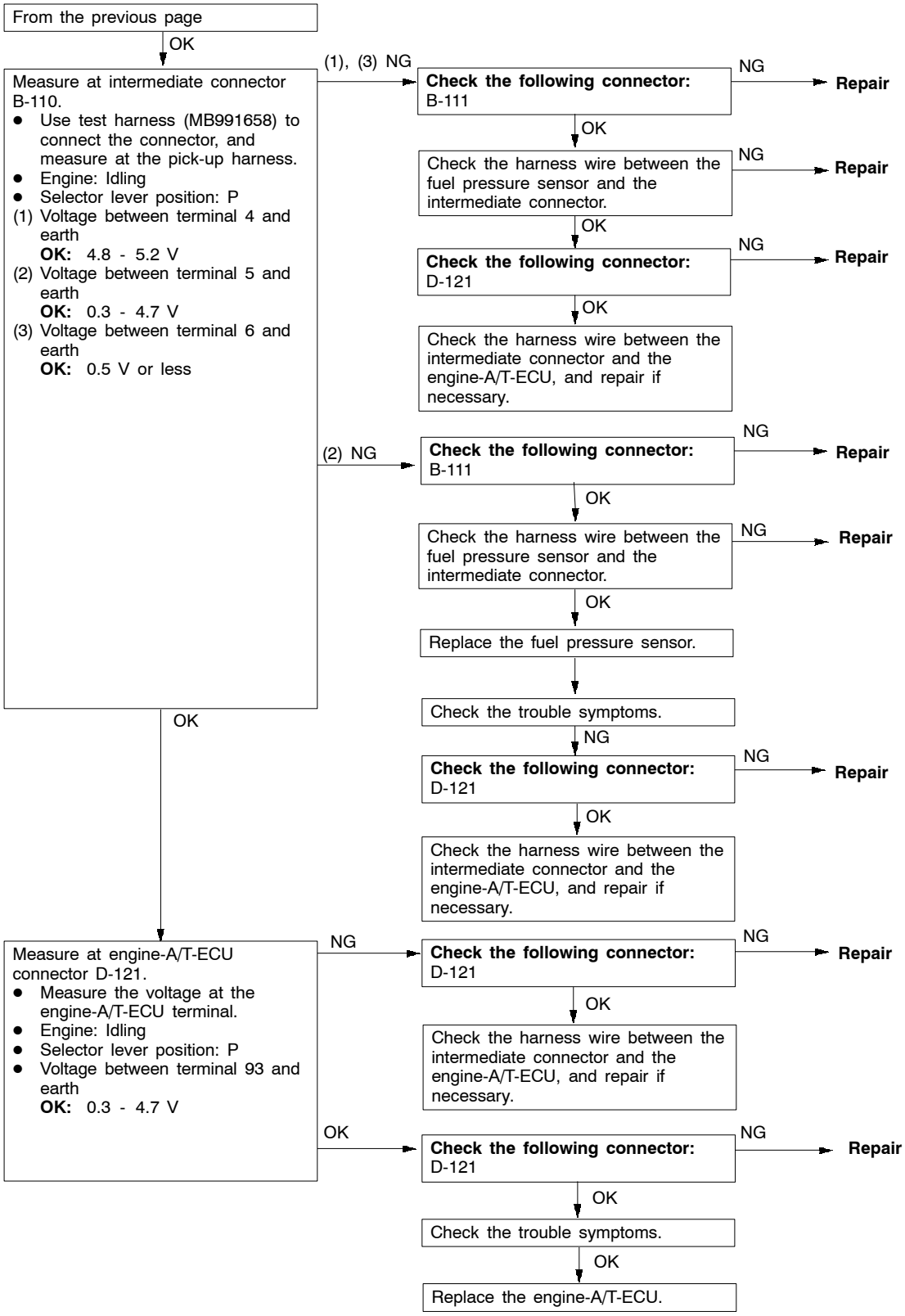
Code No.54 Immobilizer system	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● Improper communication between the engine-A/T-ECU and the immobilizer-ECU	● Open or short circuit, or loose connector contact ● Malfunction of the immobilizer-ECU ● Malfunction of the engine-A/T-ECU

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

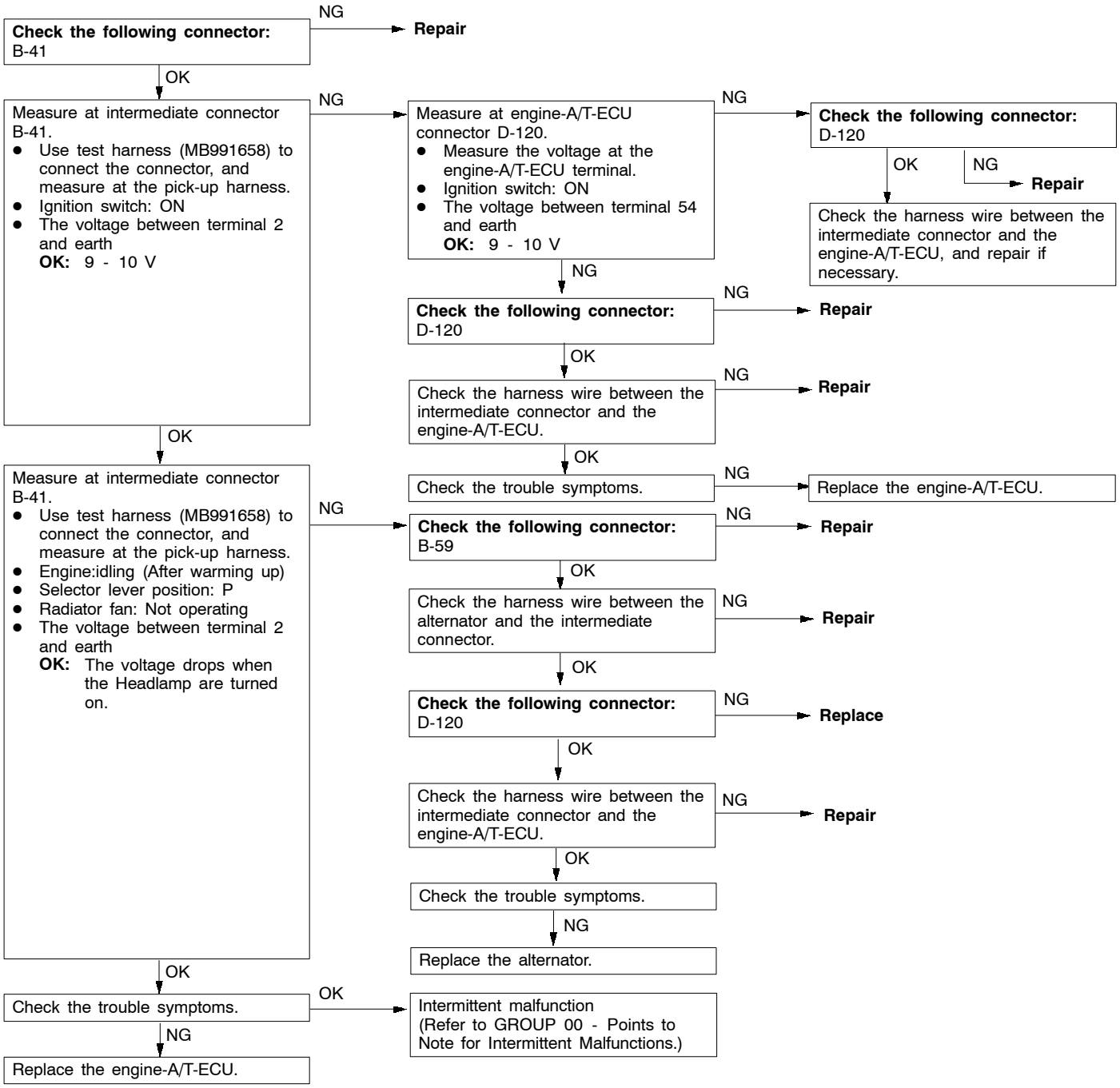


Code No.56 Abnormal fuel pressure	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● The sensor output voltage is 4.8V or more, or 0.2 V or less for four seconds.	● Malfunction of of fuel pressure sensor ● Open or short circuit in the fuel pressure sensor circuit or loose connector contact ● Malfunction of engine-A/T-ECU
Range of Check ● The following conditions are detected temporarily after the engine has been started. (1) Engine speed: 1,000 r/min or more (2) Fuel pressure: 2 MPa or more ● Engine running Set Conditions ● The fuel pressure is 6.9 MPa or more, or 2 MPa or less for four seconds.	● Malfunction of high-pressure fuel pump ● Clogging of high-pressure fuel lines
This diagnosis code will also be output when air is trapped into the high-pressure fuel lines (such as poor fuel level). In that case, the air can be evacuated by operating the engine for at least 15 seconds at 2,000 r/min. After the repair, use the MUT-II to erase the diagnosis code.	● Air trapped due to poor fuel level

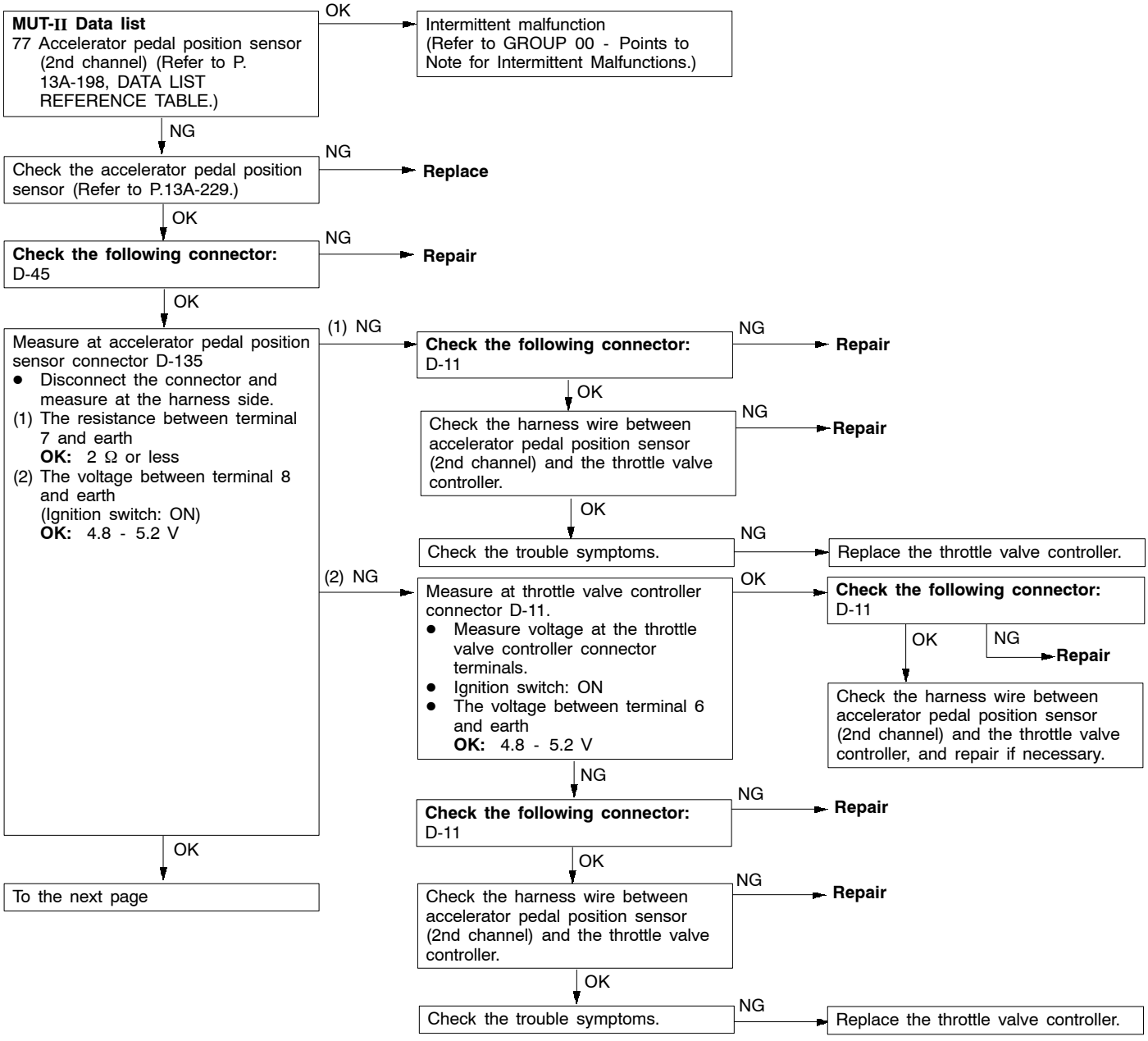


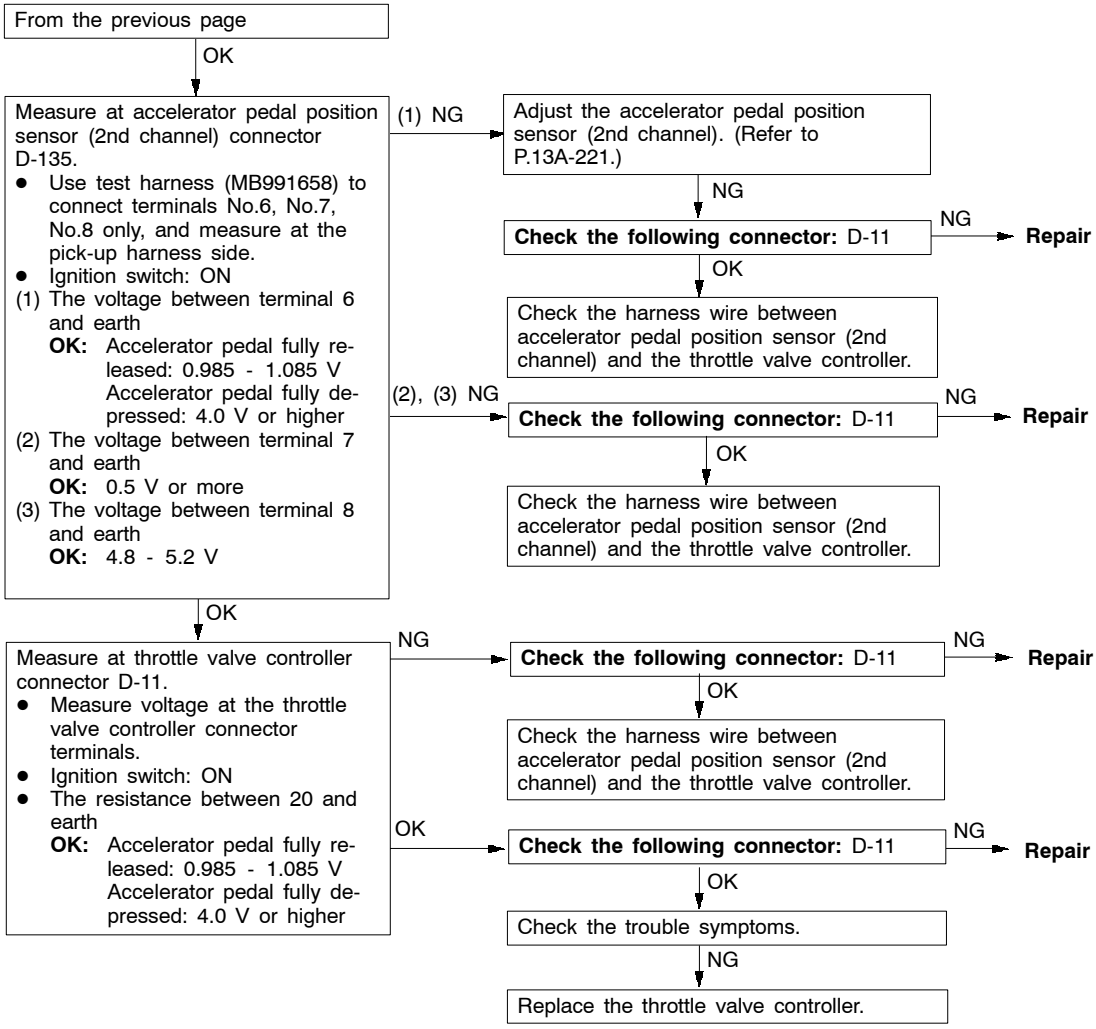

From the previous page
OK
Measure at intermediate connector B-110.
● Use test harness (MB991658) to connect the connector, and measure at the pick-up harness.
● Engine: Idling
● Selector lever position: P
(1) Voltage between terminal 4 and earth
OK: 4.8 - 5.2 V
(2) Voltage between terminal 5 and earth
OK: 0.3 - 4.7 V
(3) Voltage between terminal 6 and earth
OK: 0.5 V or less
(1), (3) NG
Check the following connector: B-111
NG
Repair
OK
Check the harness wire between the fuel pressure sensor and the intermediate connector.
NG
Repair
OK
Check the following connector: D-121
NG
Repair
OK
Check the harness wire between the intermediate connector and the engine-A/T-ECU, and repair if necessary.
(2) NG
Check the following connector: B-111
NG
Repair
OK
Check the harness wire between the fuel pressure sensor and the intermediate connector.
NG
Repair
OK
Replace the fuel pressure sensor.
OK
Check the trouble symptoms.
NG
Check the following connector: D-121
NG
Repair
OK
Check the harness wire between the intermediate connector and the engine-A/T-ECU, and repair if necessary.
Measure at engine-A/T-ECU connector D-121.
● Measure the voltage at the engine-A/T-ECU terminal.
● Engine: Idling
● Selector lever position: P
● Voltage between terminal 93 and earth
OK: 0.3 - 4.7 V
NG
Check the following connector: D-121
NG
Repair
OK
Check the harness wire between the intermediate connector and the engine-A/T-ECU, and repair if necessary.
OK
Check the following connector: D-121
NG
Repair
OK
Check the trouble symptoms.
OK
Replace the engine-A/T-ECU.

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



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

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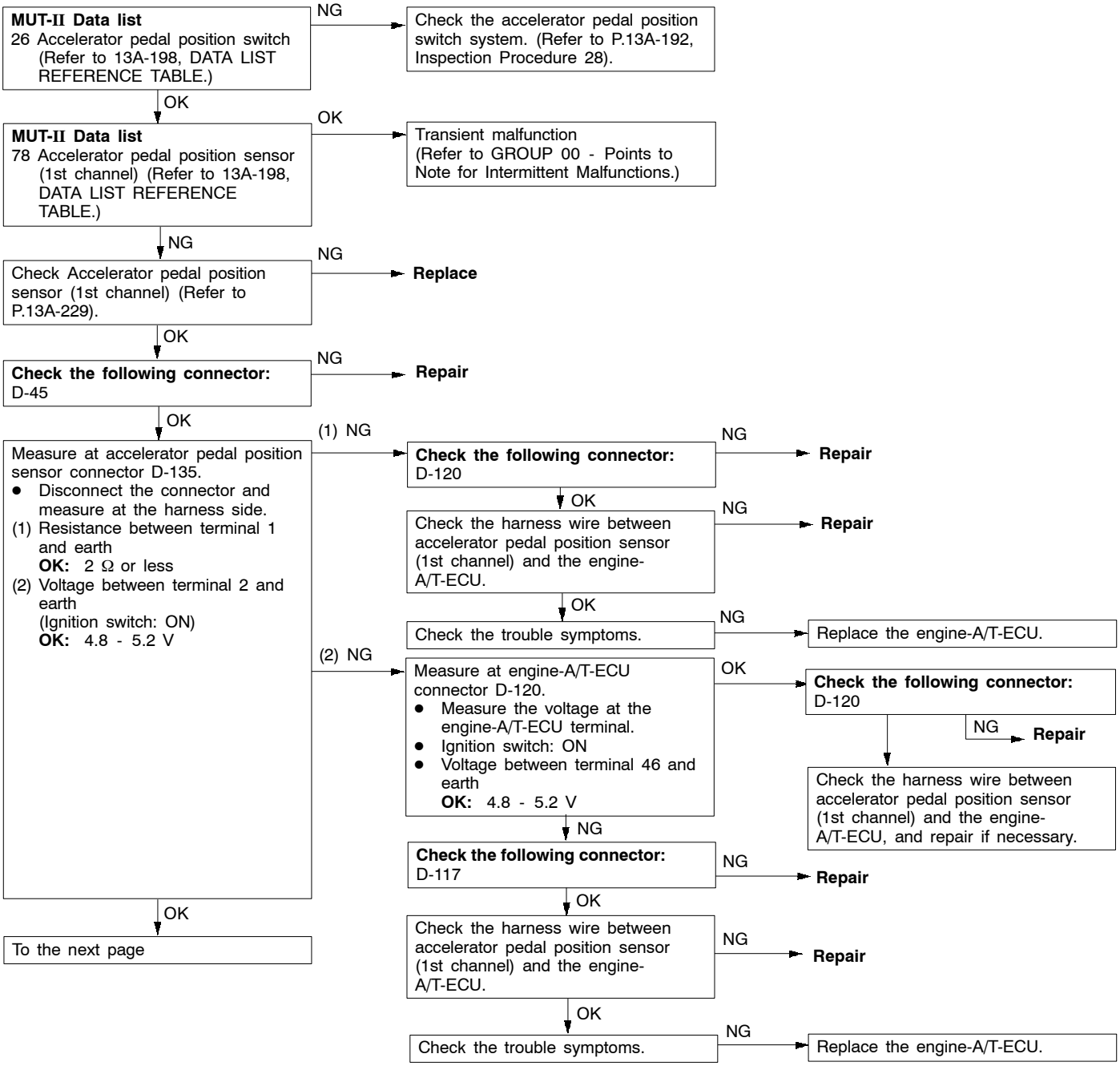
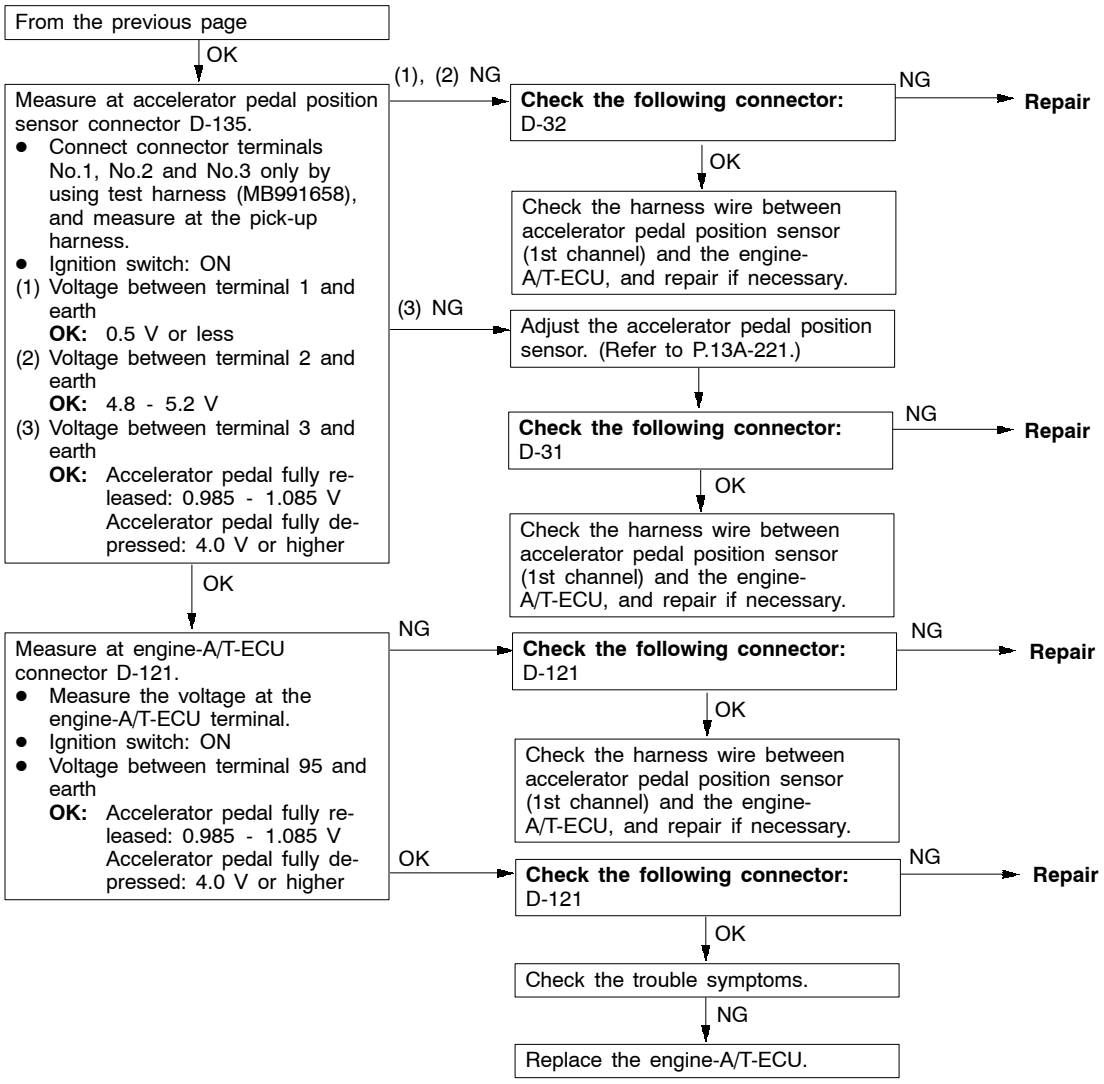
OK
Measure at accelerator pedal position sensor (2nd channel) connector D-135.
● Use test harness (MB991658) to connect terminals No.6, No.7, No.8 only, and measure at the pick-up harness side.
● Ignition switch: ON
(1) The voltage between terminal 6 and earth
OK: Accelerator pedal fully released: 0.985 - 1.085 V
Accelerator pedal fully depressed: 4.0 V or higher
(2) The voltage between terminal 7 and earth
OK: 0.5 V or more
(3) The voltage between terminal 8 and earth
OK: 4.8 - 5.2 V
(1) NG
Adjust the accelerator pedal position sensor (2nd channel). (Refer to P.13A-221.)
NG
Check the following connector: D-11
NG
Repair
OK
Check the harness wire between accelerator pedal position sensor (2nd channel) and the throttle valve controller.
(2), (3) NG
Check the following connector: D-11
NG
Repair
OK
Check the harness wire between accelerator pedal position sensor (2nd channel) and the throttle valve controller.
OK
Measure at throttle valve controller connector D-11.
● Measure voltage at the throttle valve controller connector terminals.
● Ignition switch: ON
● The resistance between 20 and earth
OK: Accelerator pedal fully released: 0.985 - 1.085 V
Accelerator pedal fully depressed: 4.0 V or higher
NG
Check the following connector: D-11
NG
Repair
OK
Check the harness wire between accelerator pedal position sensor (2nd channel) and the throttle valve controller.
OK
Check the following connector: D-11
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the throttle valve controller.

Code No.78 Accelerator pedal position sensor (1st channel) system	Probable cause
Range of Check ● Accelerator pedal position sensor (2nd channel) is normal. ● Communication between the engine-A/T-ECU and the throttle valve controller is normal. Set Conditions ● The output voltage of accelerator pedal position sensor (1st channel) is 0.2 V or less for one second. or ● The output voltage of accelerator pedal position sensor (2nd channel) is 2.5 V or less, and that of accelerator pedal position sensor (1st channel) is 4.5 V or more for one second or ● The difference between accelerator pedal position sensor (1st channel) and accelerator pedal position sensor (2nd channel) output voltages is 1.0 V or more (i.e. the throttle opening angle changes slightly). or ● The output voltage of accelerator pedal position sensor (1st channel) is 1.1 V or more for one second when the accelerator pedal position switch is turned on.	● Malfunction of accelerator pedal position sensor (1st channel) ● Open or short circuit in the accelerator pedal position sensor (1st channel) circuit or loose connector contact ● Accelerator pedal position switch seized ON ● Malfunction of throttle valve controller ● Malfunction of engine-A/T-ECU

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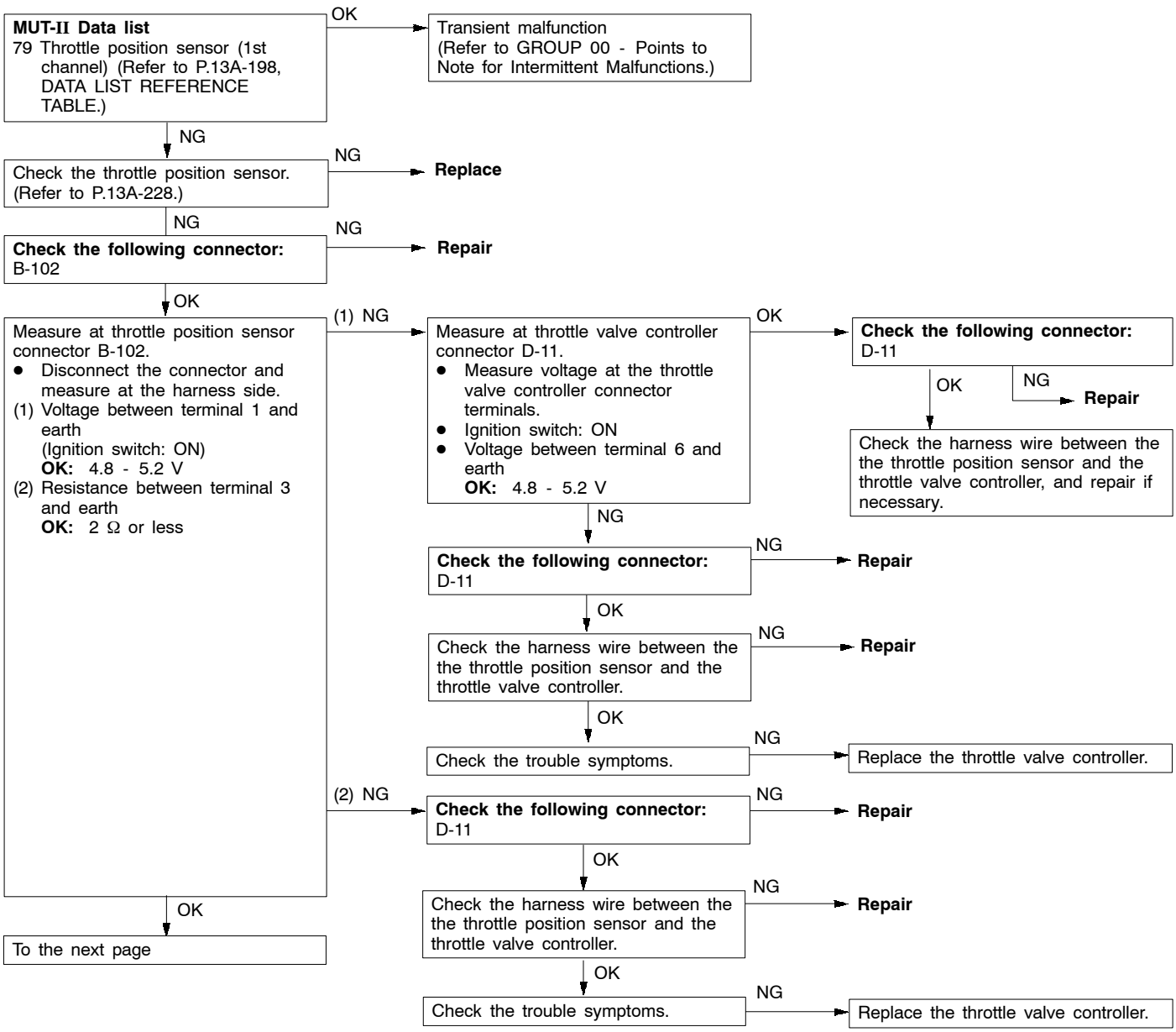
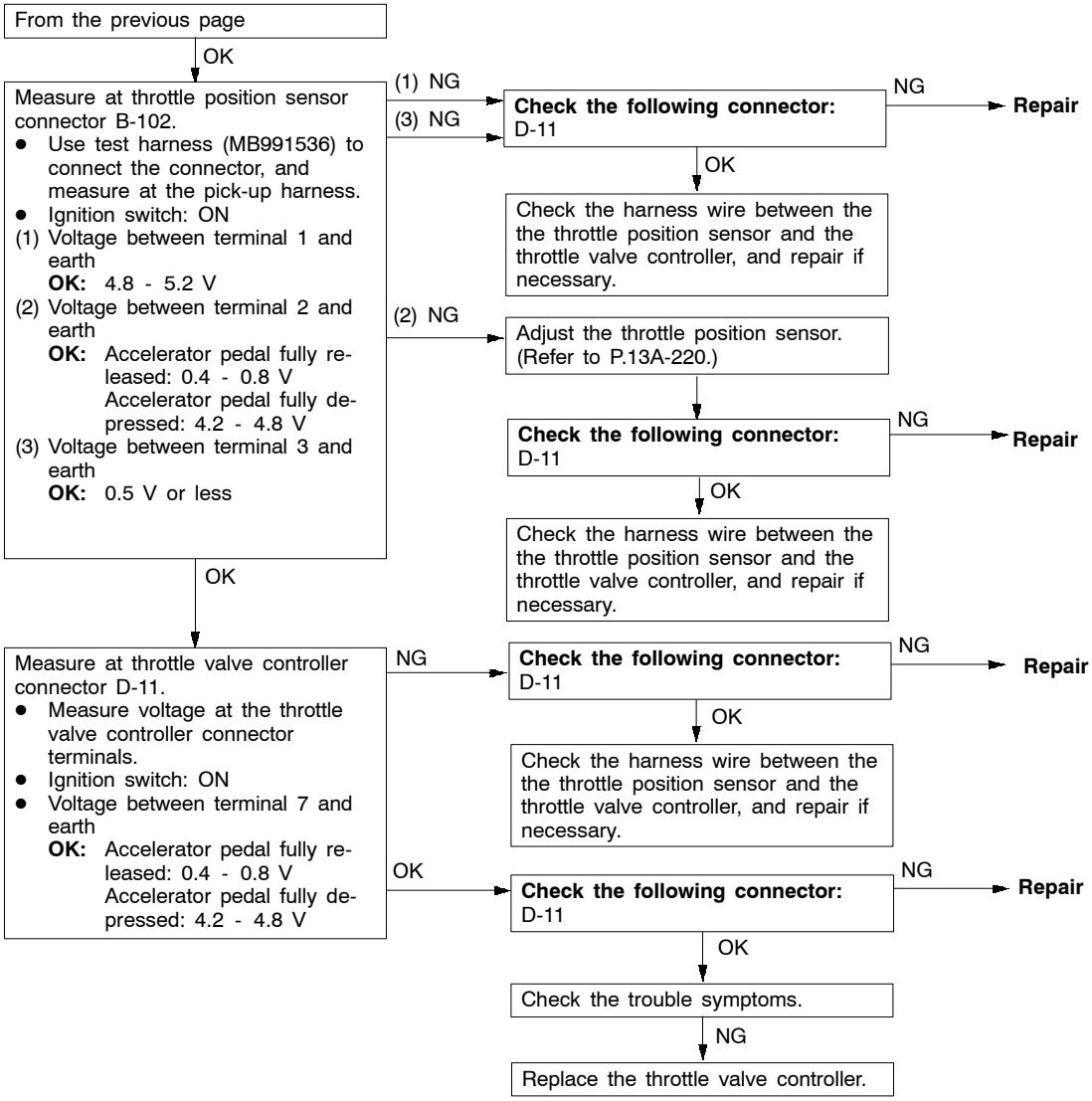
OK
Measure at accelerator pedal position sensor connector D-135.
● Connect connector terminals No.1, No.2 and No.3 only by using test harness (MB991658), and measure at the pick-up harness.
● Ignition switch: ON
(1) Voltage between terminal 1 and earth
OK: 0.5 V or less
(2) Voltage between terminal 2 and earth
OK: 4.8 - 5.2 V
(3) Voltage between terminal 3 and earth
OK: Accelerator pedal fully released: 0.985 - 1.085 V
Accelerator pedal fully depressed: 4.0 V or higher
(1), (2) NG
Check the following connector: D-32
NG
Repair
OK
Check the harness wire between accelerator pedal position sensor (1st channel) and the engine-A/T-ECU, and repair if necessary.
(3) NG
Adjust the accelerator pedal position sensor. (Refer to P.13A-221.)
Check the following connector: D-31
NG
Repair
OK
Check the harness wire between accelerator pedal position sensor (1st channel) and the engine-A/T-ECU, and repair if necessary.
OK
Measure at engine-A/T-ECU connector D-121.
● Measure the voltage at the engine-A/T-ECU terminal.
● Ignition switch: ON
● Voltage between terminal 95 and earth
OK: Accelerator pedal fully released: 0.985 - 1.085 V
Accelerator pedal fully depressed: 4.0 V or higher
NG
Check the following connector: D-121
NG
Repair
OK
Check the harness wire between accelerator pedal position sensor (1st channel) and the engine-A/T-ECU, and repair if necessary.
OK
Check the following connector: D-121
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-A/T-ECU.

Code No.79 Throttle position sensor (1st channel) system	Probable cause
The throttle valve controller judges a malfunction, and then transmit the result to the engine-A/T-ECU. Range of Check ● Ignition switch: ON Set Conditions ● The sensor output voltage is 0.2 V or less. or ● The sensor output voltage is 4.85 V or more and the throttle position sensor (2nd channel) output voltage is 2.5V or more. or ● The throttle position sensor (1st channel) and throttle position sensor (2nd channel) combination output voltage is outside 4 - 6V. or ● The opening angle of throttle position sensor (1st channel) is different from its target by 1V or more. or ● The throttle position sensor (1st channel) output changes within 25 mV when the throttle valve control servo moves one step.	● Malfunction of throttle position sensor ● Open or short circuit in the throttle position sensor (1st channel) circuit or loose connector contact ● Malfunction of throttle valve controller ● Malfunction of engine-A/T-ECU

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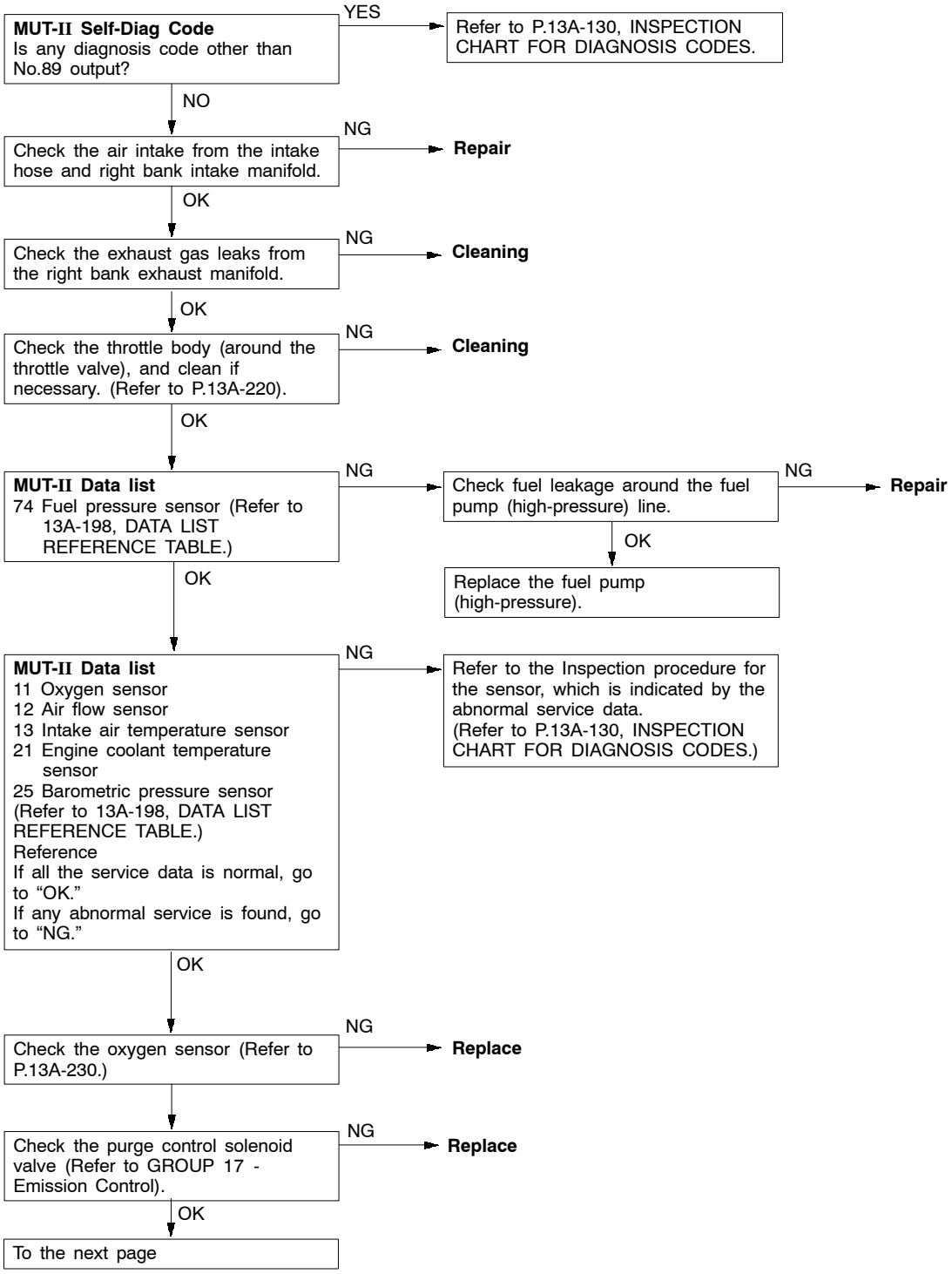
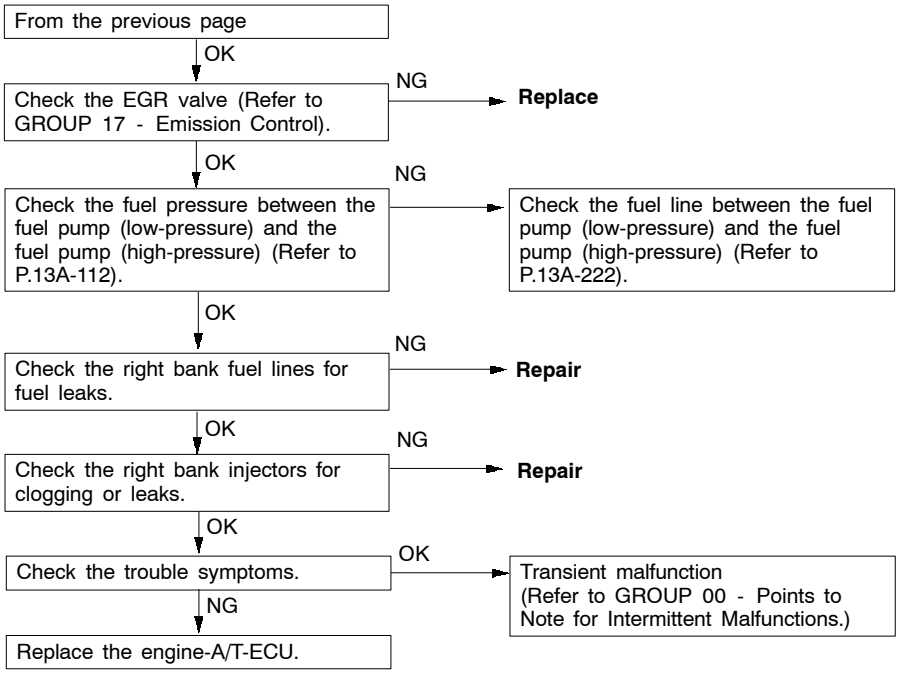
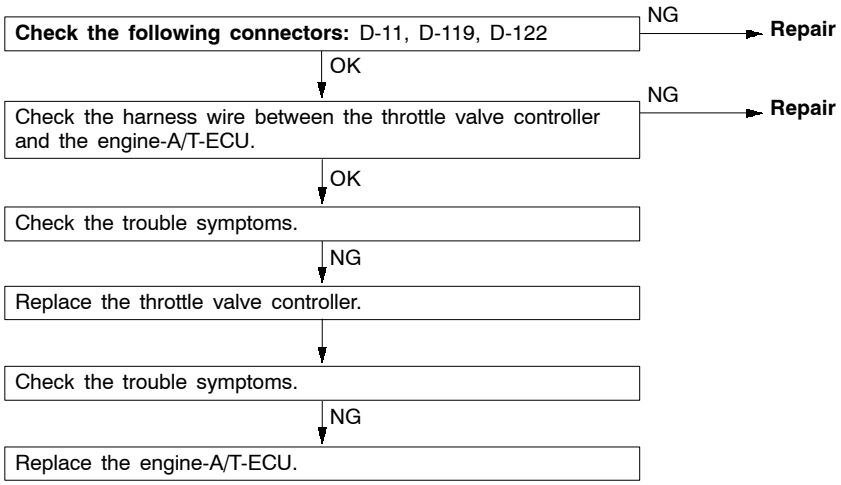
OK
Measure at throttle position sensor connector B-102.
● Use test harness (MB991536) to connect the connector, and measure at the pick-up harness.
● Ignition switch: ON
(1) Voltage between terminal 1 and earth
OK: 4.8 - 5.2 V
(2) Voltage between terminal 2 and earth
OK: Accelerator pedal fully released: 0.4 - 0.8 V
Accelerator pedal fully depressed: 4.2 - 4.8 V
(3) Voltage between terminal 3 and earth
OK: 0.5 V or less
(1) NG
(3) NG
Check the following connector: D-11
NG
Repair
OK
Check the harness wire between the the throttle position sensor and the throttle valve controller, and repair if necessary.
(2) NG
Adjust the throttle position sensor. (Refer to P.13A-220.)
Check the following connector: D-11
NG
Repair
OK
Check the harness wire between the the throttle position sensor and the throttle valve controller, and repair if necessary.
OK
Measure at throttle valve controller connector D-11.
● Measure voltage at the throttle valve controller connector terminals.
● Ignition switch: ON
● Voltage between terminal 7 and earth
OK: Accelerator pedal fully released: 0.4 - 0.8 V
Accelerator pedal fully depressed: 4.2 - 4.8 V
NG
Check the following connector: D-11
NG
Repair
OK
Check the harness wire between the the throttle position sensor and the throttle valve controller, and repair if necessary.
OK
Check the following connector: D-11
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the throttle valve controller.

Code No.89 Abnormal fuel system	Probable cause
Range of Check • Engine: Being learning the air-fuel ratio Set Conditions • Ten seconds or more have been passed while the fuel injection amount compensation value is too low. or • Ten seconds or more have been passed while the fuel injection amount compensation value is too high.	• Malfunction of fuel supply system • Malfunction of oxygen sensor • Malfunction of intake air temperature sensor • Malfunction of barometric pressure sensor • Malfunction of air flow sensor • Malfunction of engine-A/T-ECU

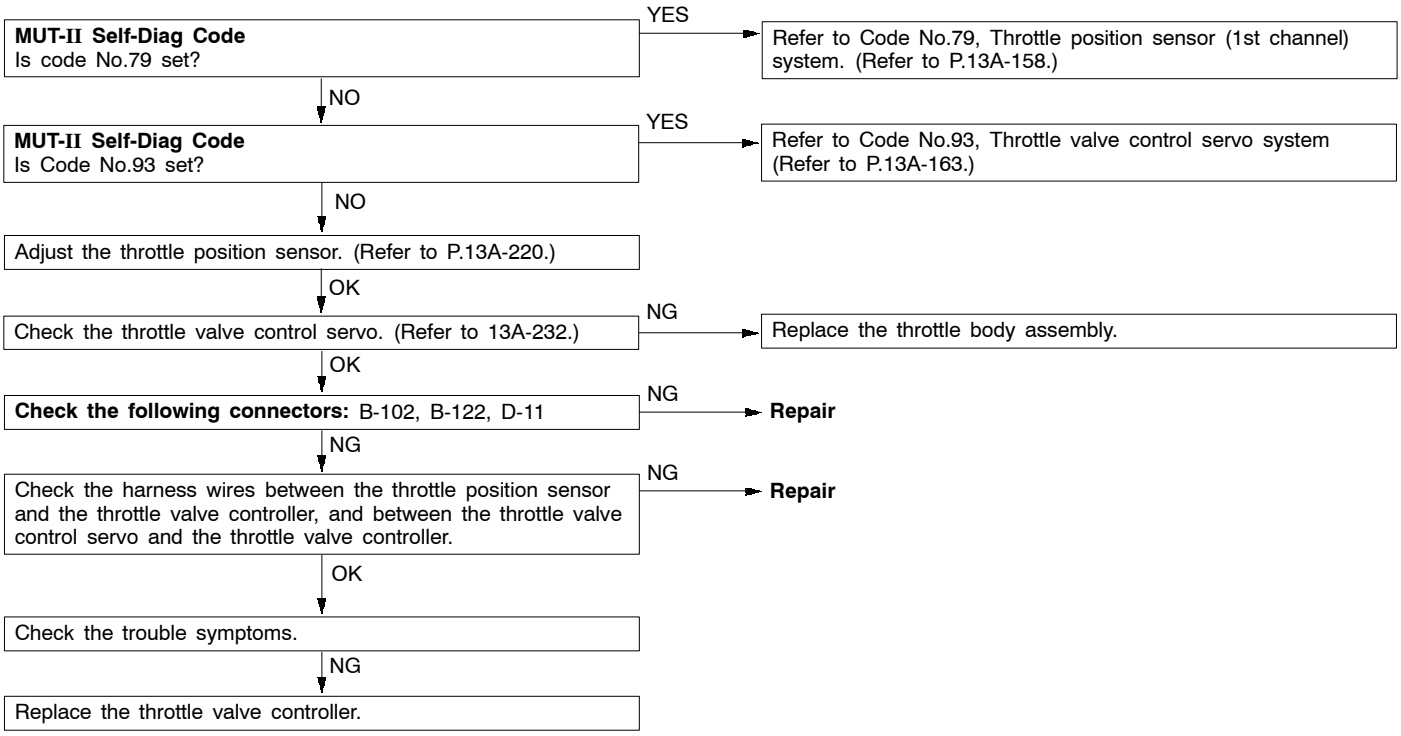




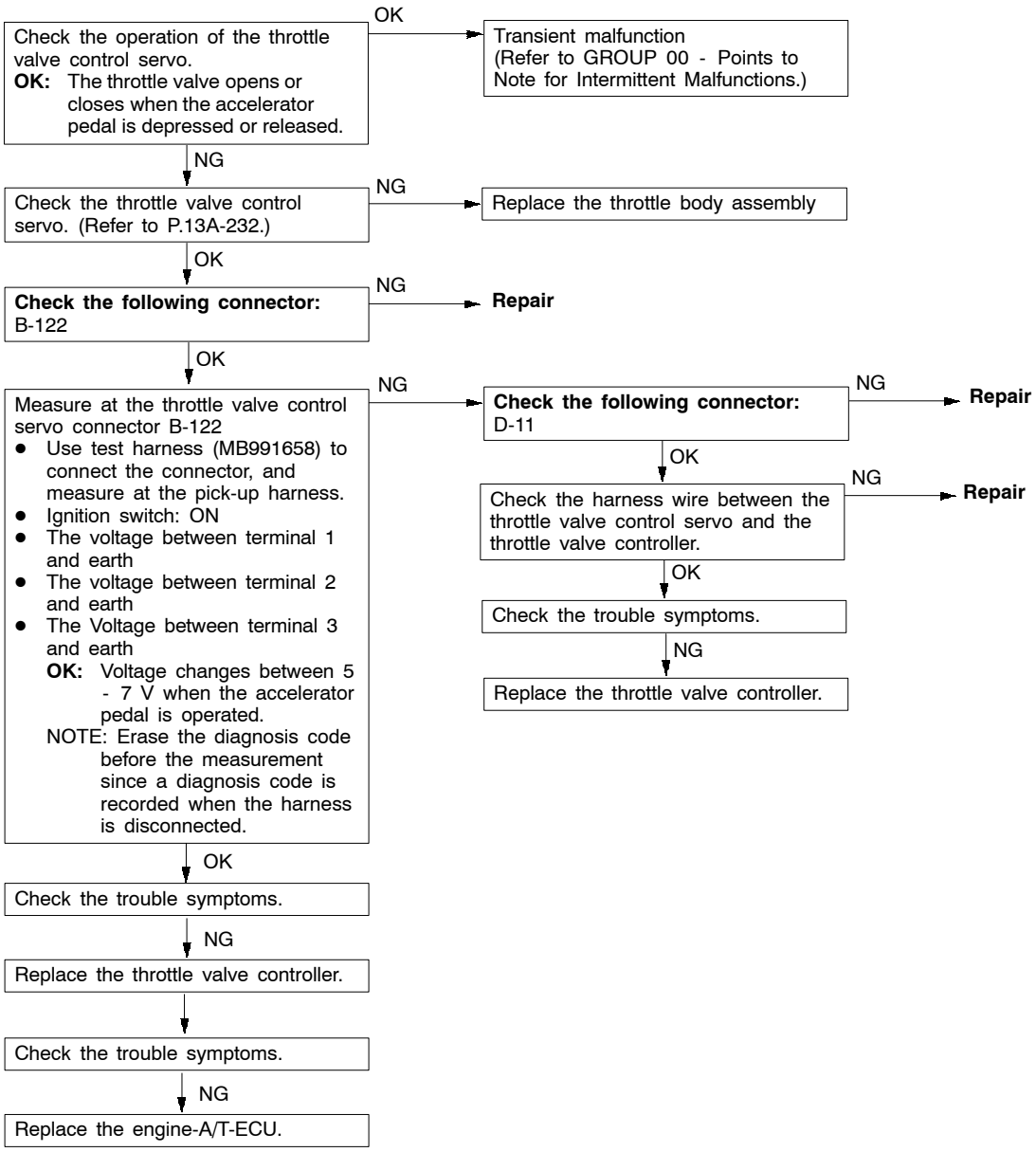
Code No.91 Electronic-controlled throttle valve system	Probable cause
Range of Check ● Ignition switch: ON ● Error in communication between the engine-A/T-ECU and the throttle valve controller Set Conditions ● Output voltage of throttle position sensor (2nd channel) fluctuates significantly (approx. 1 V or more) from an expected value, based on that of the accelerator pedal position sensor (2nd channel). Range of Check ● Ignition switch: ON ● Error in communication between the throttle valve controller and the engine-A/T-ECU Set Conditions ● The output voltage of the throttle position sensor (2nd channel) is significantly different (approx. 1 V) from the the throttle valve opening angle (voltage), which the engine-A/T-ECU request the throttle valve controller.	● Short in communication line ● Malfunction of the engine-A/T-ECU ● Malfunction of the throttle valve controller



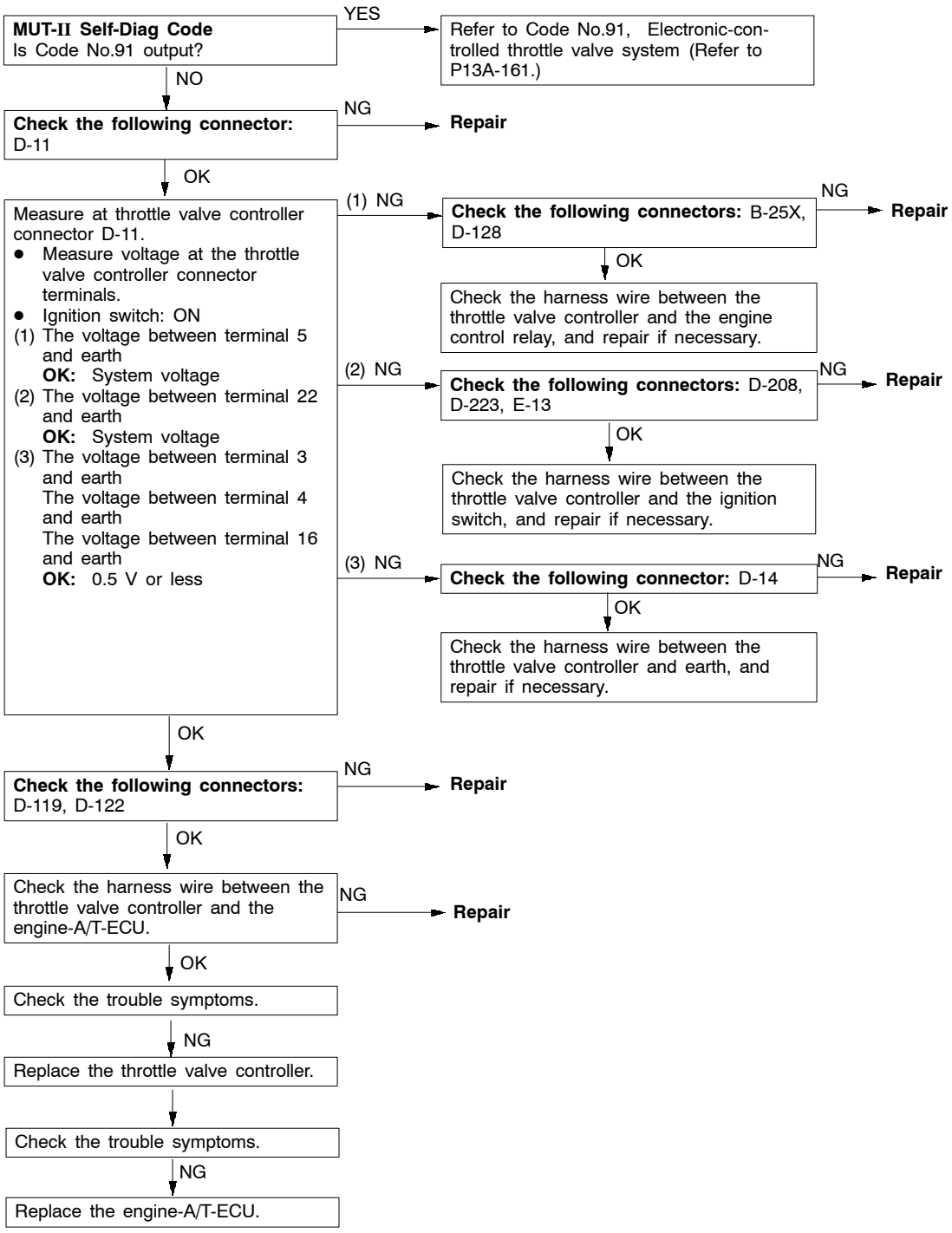
Code No.92 Throttle valve position feedback system	Probable cause
The throttle valve controller judges a malfunction, and then transmit the result to the engine-A/T-ECU. Range of Check ● Ignition switch: ON ● Battery voltage: 10 V or more Set Conditions ● Failure in the position feedback [The engine-A/T-ECU detects that the current in the motor is excessive and the opening angle difference between the target value of throttle position sensor (1st channel) and the actual value of throttle position sensor (1st channel) is 2.0V or more]	● Malfunction of throttle position sensor (1st channel) ● Open or short circuit in the throttle position sensor (1st channel) circuit or loose connector contact ● Malfunction of the throttle valve controller



Code No.93 Throttle valve control servo system	Probable cause
The throttle valve controller judges a malfunction, and then transmit the result to the engine-A/T-ECU. Range of Check ● Throttle valve control servo relay: ON Set Conditions ● Short circuit of the throttle valve control servo drive circuit to earth ● Power is supplied to the throttle valve control servo circuit from other sources. ● Open circuit in the throttle valve control servo power supply circuit	● Malfunction of the throttle valve control servo ● Open circuit in the throttle valve control servo power supply circuit ● Open or short circuit in the throttle valve control servo circuit or loose connector contact ● Malfunction of throttle valve controller



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



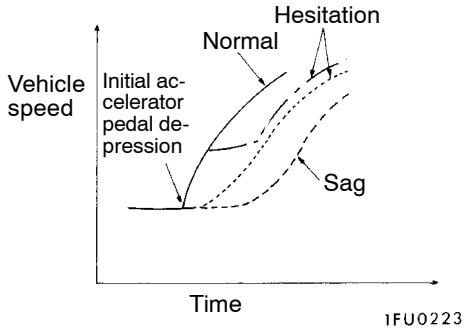
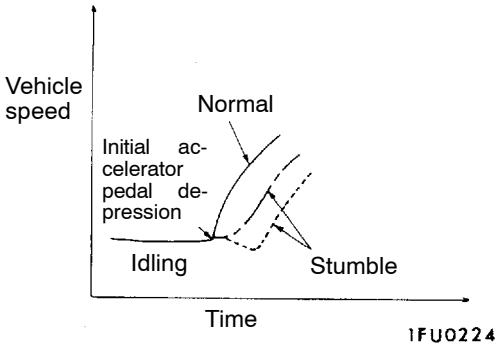
Code No.96 Throttle valve controller system	Probable cause
Set Conditions ● Errors in reading or writing to the throttle valve controller ROM.	● Malfunction of the throttle valve controller

Replace 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-169
	Communication with engine-A/T-ECU only is not possible.	2	13A-169
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-170
	The engine warning lamp remains illuminating and never goes out.	4	13A-170
Starting	No initial combustion (starting impossible)	5	13A-171
	Initial combustion but no complete combustion (starting impossible)	6	13A-172
	Long time to start (improper starting)		
Idling stability (Improper idling)	Unstable idling (Rough idling, hunting)	7	13A-174
	Idling speed is high. (Improper idling speed)	8	13A-176
	Idling speed is low. (Improper idling speed)		
Idling stability (Engine stalls)	When the engine is cold, it stalls at idling. (Die out)	9	13A-177
	When the engine is hot, it stalls at idling. (Die out)	10	13A-178
	The engine stalls when starting the car. (Pass out)	11	13A-180
	The engine stalls when decelerating.	12	13A-181
Driving	Hesitation, sag or stumble	13	13A-182
	Poor acceleration		
	Surge		
	The feeling of impact or vibration when accelerating	14	13A-183
	The feeling of impact or vibration when decelerating	15	13A-184
	Knocking	16	13A-184
Dieseling		17	13A-184
Too high CO and HC concentration when idling		18	13A-185
Low alternator output voltage (approx. 12.3 V)		19	13A-186
Engine idle speed is incorrect while the A/C is on (A/C switch 2 signal).		20	13A-187
Fans (radiator fan, A/C condenser fan) are inoperative		21	13A-187
GDI ECO indicator lamp system	GDI ECO indicator lamp does not illuminate.	22	13A-188
	GDI ECO indicator lamp remains illuminated and does not go off.	23	13A-188

PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

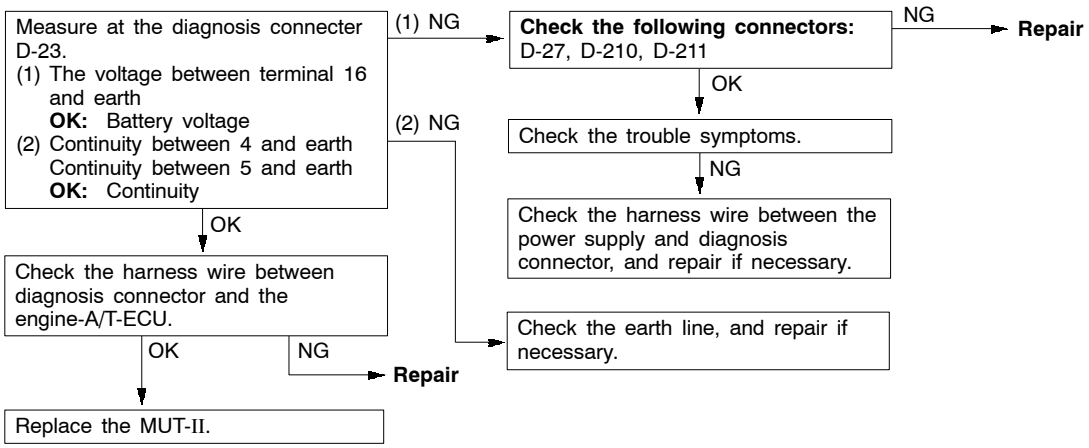
Items		Symptom
Starting	Won't start	The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.
	Fires up and dies	There is combustion within the cylinders, but then the engine soon stalls.
	Hard starting	Engine starts after cranking a while.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

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

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

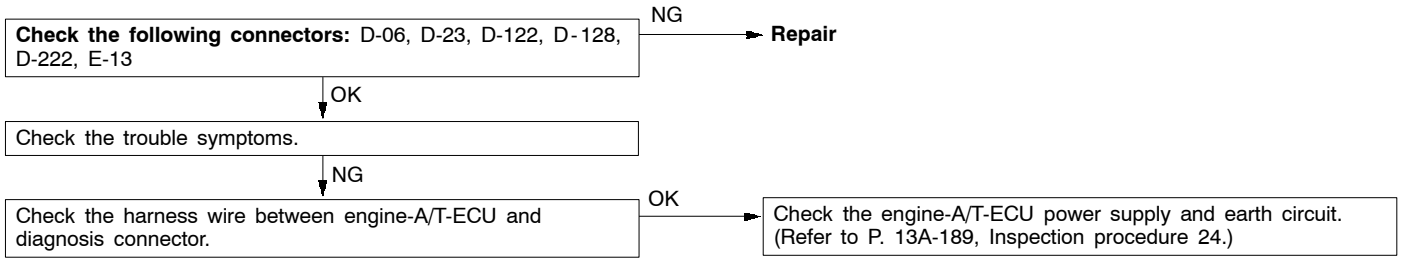
Inspection procedure 1

Communication with 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 diagnosis connector • Open circuit or short-circuited between engine-A/T-ECU and diagnosis connector circuit • Malfunction of the MUT-II



Inspection procedure 2

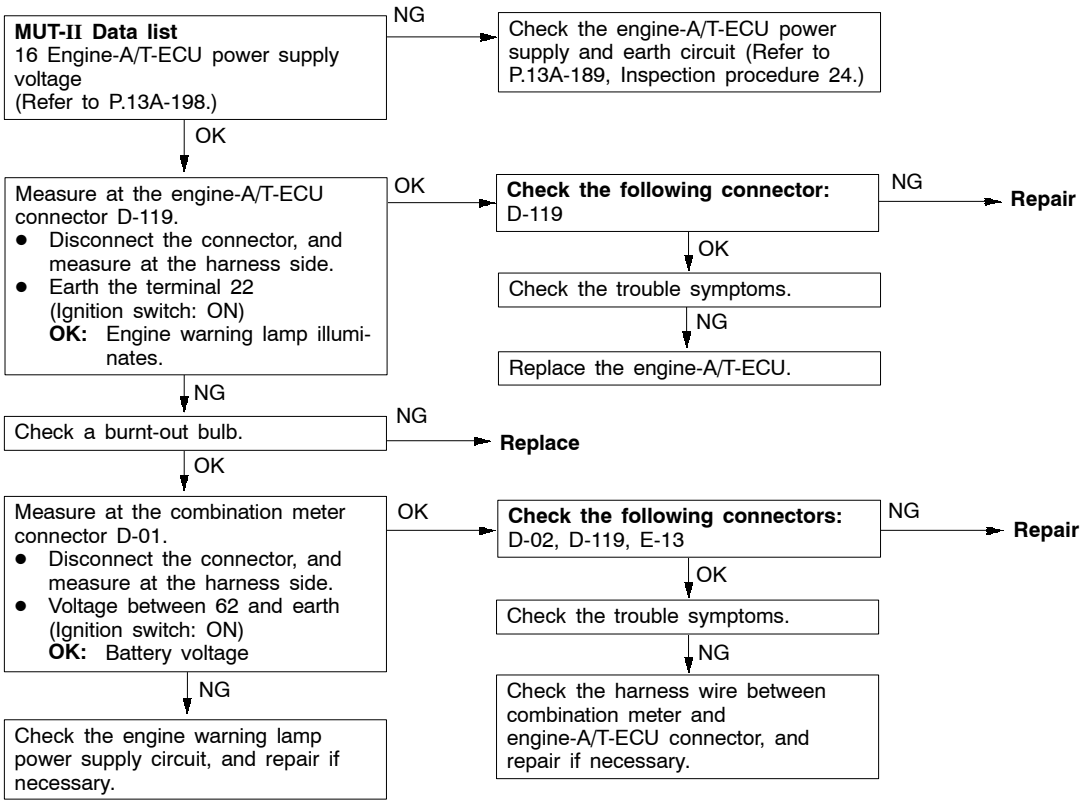
Communication with engine-A/T-ECU is not possible.	Probable cause
The cause is probably a defect in the engine-A/T-ECU power supply circuit (including earth).	• Open circuit or short-circuited harness wire in the engine-A/T-ECU power supply circuit. • Open circuit between engine-A/T-ECU and diagnosis connector • Malfunction of the engine-A/T-ECU



NOTE
On vehicles with multi communication system (MMCS) or RV meter, if a malfunction cannot be resolved after the procedure above, check the multi center display unit or RV meter and replace if necessary. (Refer to GROUP 54 - Clock, multi center display and RV meter.)

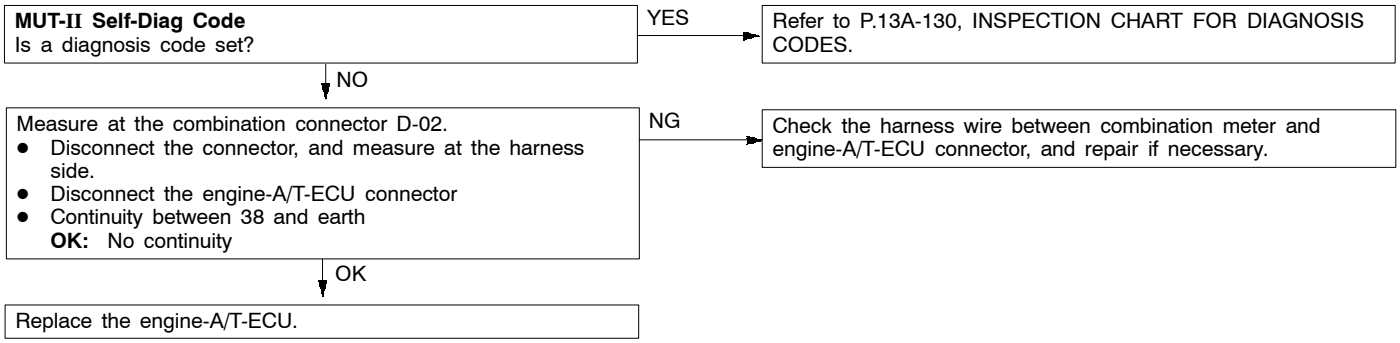
Inspection procedure 3

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-A/T-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 malfunction listed at right has probably occurred.	• Burnt-out bulb • Open circuit or short-circuit between the engine warning lamp and engine-A/T-ECU. • Malfunction of the engine-A/T-ECU



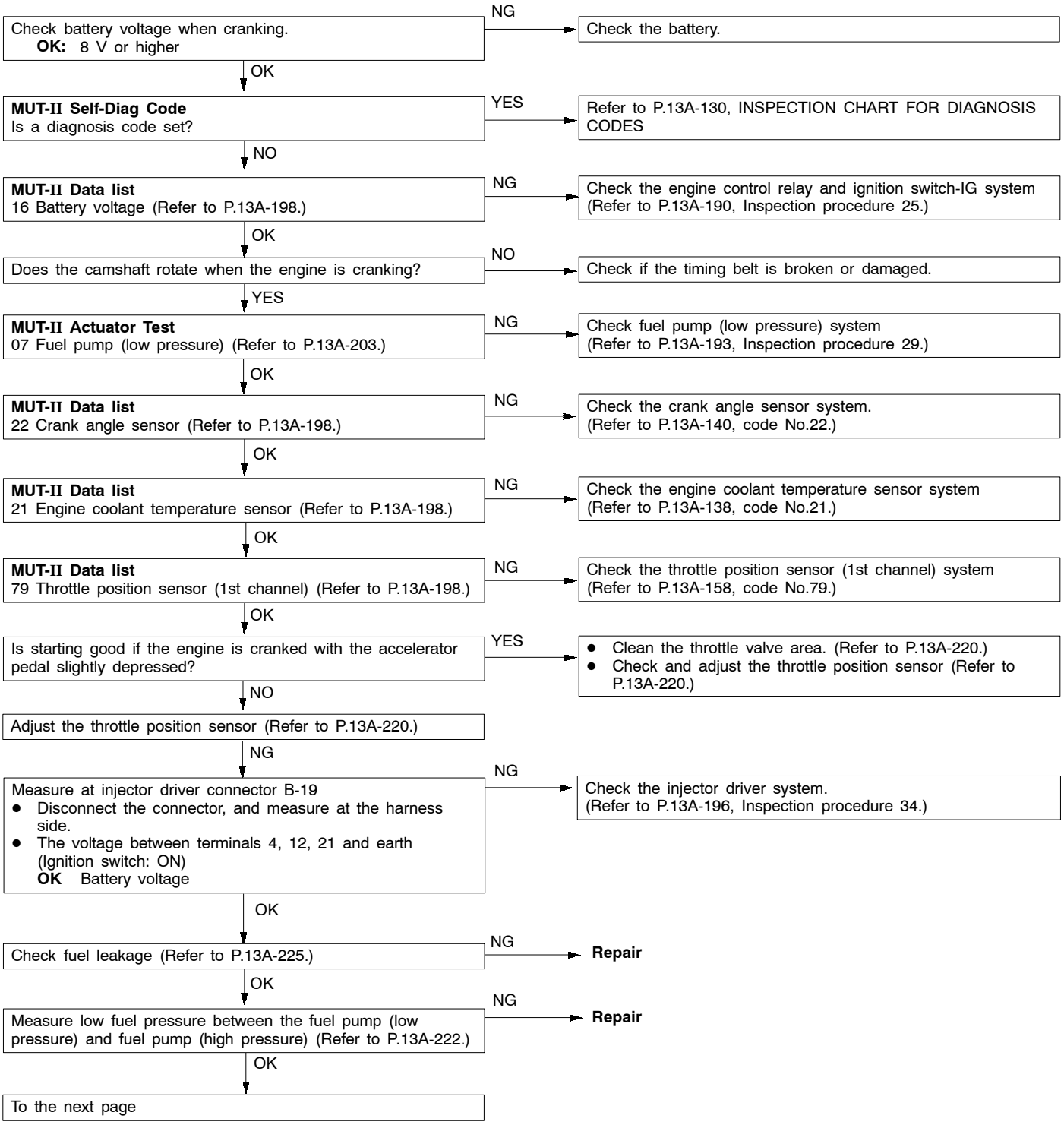
Inspection procedure 4

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-A/T-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-A/T-ECU • Malfunction of the engine-A/T-ECU



Inspection procedure 5

No initial combustion (starting impossible)	Probable cause
In cases such as the above, the cause is probably that a spark plug is defective, or that the supply of fuel to the combustion chamber is defective. In addition, foreign materials (water, kerosene, etc.) may be mixed with the fuel.	• Malfunction of the fuel supply system • Malfunction of the ignition system • Malfunction of the engine-A/T-ECU



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OK

Clamp the leads of the ignition coil No.1 terminal with a timing light pick-up in order. Does the timing light flash when the engine is cranked?

NO → Check the ignition coil (built-in power transistor) system (Refer to P.13A-148, code No.44.)

YES

Check the ignition timing when cranking.
OK: approx. 5 °BTDC

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

OK

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

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.
4. Earth the spark plug electrode securely.
5. Check that the spark plug ignites when the engine is cranked.

NG → Replace the ignition coil.

OK

Check the following items in that order.
- Check the spark plug
- Check the compression pressure
- Check if foreign materials (water, alcohol, etc.) got into fuel.

OK

Check the trouble symptoms.

NG

Replace the injector.

Inspection procedure 6

Initial combustion but no complete combustion (starting impossible), long time to start (hard starting)	Probable cause
In such cases as the above, the cause is probably that the spark plugs are generating sparks by the spark are weak, or the initial mixture is not appropriate.	• Malfunction of fuel supply system • Malfunction of of fuel pressure control solenoid valve • Malfunction of the ignition system • Malfunction of the electronic-controlled throttle valve system • Malfunction of the engine-A/T-ECU

Check the battery voltage when cranking.
OK: 8 V or higher

NG → Check the battery.

OK

MUT-II Self-Diag Code
Is a diagnosis code set?

YES → Refer to P.13A-130, INSPECTION CHART FOR DIAGNOSIS CODES.

NO

MUT-II Actuator Test
07 Fuel pump (low pressure) (Refer to P.13A-203.)

NG → Check fuel pump system (low-pressure) (Refer to P.13A-193, Inspection procedure 29.)

OK

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-198.)

NG → Check the engine coolant temperature sensor system (Refer to P.13A-138, code No.21.)

OK

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OK

MUT-II Data list
18 Cranking signal (Refer to P.13A-198.)

NG → Check the ignition switch-ST system and inhibitor switch (Refer to 13A-191, Inspection procedure 27.)

OK

MUT-II Actuator Test
74 Fuel pressure sensor (Refer to P.13A-203.)

NG → Check abnormal fuel pressure. (Refer to P.13A-151, code No.56.)

OK

Check fuel leakage. (Refer to P.13A-225.)

NG → **Repair**

OK

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-198.)

NG → Check the throttle valve position feedback system. (Refer to P.13A-162, code No.92.)

OK

Is starting good if the engine is cranked with the accelerator pedal slightly depressed?

YES →
- Clean the throttle valve area. (Refer to P.13A-220)
- Adjust the throttle position sensor (Refer to P.13A-220.)

NO

Adjust the throttle position sensor (Refer to P.13A-220.)

Check the ignition timing when cranking.
OK: Approx. 5 °BTDC

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

OK

Check ignition coil spark for each cylinder.
1. Remove the ignition coil.
2. Install a new spark plug to the removed ignition coil.

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

3. Disconnect the injector intermediate connector.
4. Earth the spark plug electrode securely.
5. Check that the spark plug ignites when the engine is cranked.

NG → Replace the ignition coil.

OK

Check the following items in that order.
- Check the spark plug
- Check the compression pressure
- Check the fuel lines for clogging.
- Check if foreign materials (water, alcohol, etc.) got into fuel.

Check the trouble symptoms.

NG → Replace the injector.

Inspection procedure 7

Unstable idling (Rough idling, hunting)	Probable cause
The cause is probably a malfunction of the ignition system, air/fuel ratio control system, electronic controlled throttle valve system, 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-controlled throttle valve system • Poor compression • Air sucking into the air intake system

Has the battery been disconnected recently?
- YES → After warming-up, let the engine run at idling for 10 minutes.
- NO ↓

MUT-II Self-Diag Code
Is a diagnosis code set?
- YES → Refer to P.13A-130, INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-198.)
- NG → Check the throttle valve position feedback system (Refer to P.13A-162, code No.92.)
- OK ↓

Does the idling speed fluctuate excessively?
- YES → • Clean around the throttle valve. (Refer to P.13A-220)
• Adjust the throttle position sensor (Refer to P.13A-220.)
- NO ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-198.)
- NG → Check the accelerator pedal position switch system (Refer to P.13A-192, Inspection procedure 28.)
- OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-198.)
- NG → Check the intake air temperature sensor system (Refer to P.13A-135, code No.13.)
- OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-198.)
- NG → Check the barometric pressure sensor system (Refer to P.13A-145, code No.25.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-198.)
- NG → Check the engine coolant temperature sensor system (Refer to P.13A-138, code No.21.)
- OK ↓

MUT-II Actuator Test
08 Purge control solenoid valve (Refer to P.13A-203.)
- NG → Check the purge control solenoid valve system (Refer to P.13A-197, Inspection procedure 36.)
- OK ↓

MUT-II Data list
11 Oxygen sensor (Refer to P.13A-198.)
OK: 600 - 1,000 mV when the engine is suddenly raced
- NG → 11 Oxygen sensor system check (Refer to P. 13A-131, code No.11.)
- OK ↓

MUT-II Data list
11 Oxygen sensor (Refer to P.13A-198.)
OK: 0 - 400 mV and 600 - 1,000 mV alternates when the engine is idling (wait for 2 minutes after the engine is started).
- NG → Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-222.)
  - OK ↓ Check that air is sucked in the air intake system.
    • Broken intake manifold gasket
    • Damaged vacuum hose
    • Damaged air intake hose
- OK ↓

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OK

MUT-II Data list
27 Power steering oil pressure switch (Refer to P.13A-198.)

NG → Check the power steering oil pressure switch system (Refer to P.13A-194, Inspection procedure 30.)

OK

MUT-II Data list
28 A/C switch (Refer to P.13A-198.)

NG → Check the A/C switch and A/C relay system (Refer to P.13A-194, Inspection procedure 31.)

OK

MUT-II Data list
67 Stop lamp switch (Refer to P.13A-198.)

NG → Check the stop lamp switch system (Refer to P.13A-195, Inspection procedure 32.)

OK

MUT-II Data list
31 Small lamp switch (Refer to P.13A-198.)

NG → Check the small lamp switch system (Refer to P.13A-195, Inspection procedure 33.)

OK

MUT-II Data list
14 Throttle position sensor (2nd channel)
After warming-up, let the engine run at idling with no load.
OK: When idling, 3,900 - 4,800 mV

NG →
- Clean around the throttle valve. (Refer to P.13A-220)
- Adjust the throttle position sensor (Refer to P.13A-220.)

OK

MUT-II Data list
68 EGR valve (Refer to P.13A-198.)

NG → Check the EGR valve system (Refer to P.13A-196, Inspection procedure 35.)

OK

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

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

OK

Clean around the throttle valve. (Refer to P.13A-220.)

OK

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

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

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

NG → Replace the ignition coil.

OK

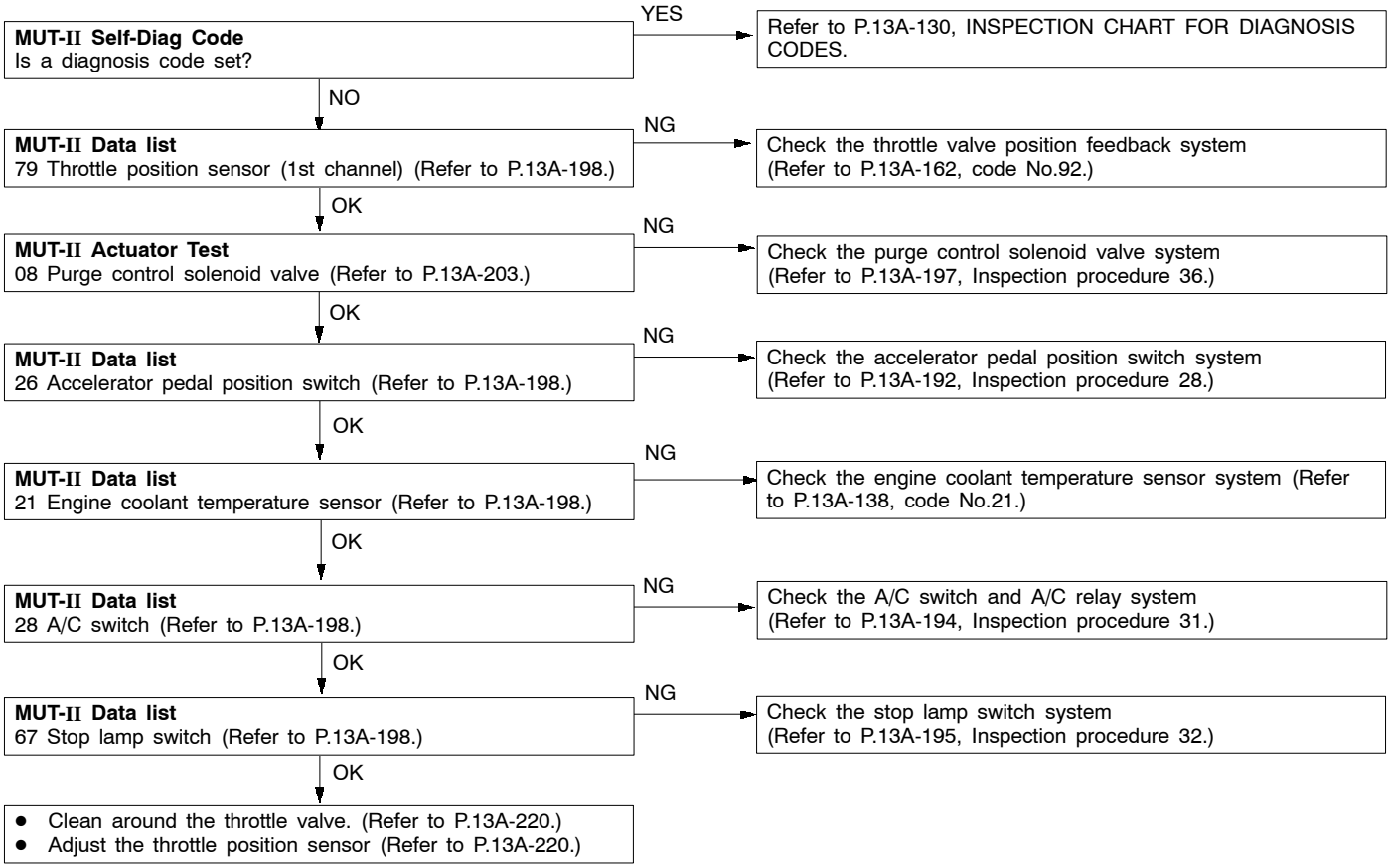
Check the following items in that order.
- Check the spark plug
- Check the exhaust gas emission control system
- Check the EGR control system
- Check the compression pressure
- Check if foreign materials (water, kerosine,etc.) got into fuel.

→ Check the trouble symptoms.

NG →
Air is sucked in the air intake system, or EGR gas leaks.
- Broken intake manifold gasket
- Damaged air intake hose
- Damaged vacuum hose
- Faulty EGR valve seat

Inspection procedure 8

Idling speed is high or low (Improper idling speed)	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
In such cases as the above, the cause is probably that the air/fuel mixture is inappropriate when the engine is cold, or that the intake air volume is insufficient.	• Malfunction of the electronic-controlled throttle valve system • Malfunction of the throttle body

Has the battery been disconnected recently?
- YES → After warming-up, let the engine run at idling for 10 minutes.
- NO ↓

MUT-II Self-Diag Code
Is a diagnosis code set?
- YES → Refer to P.13A-130, INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

Is engine-idling stable after the warming-up?
- YES → Check the unstable idling (rough, hunting). (Refer to P.13A-174, Inspection procedure 7.)
- NO ↓

MUT-II Data list
14 Throttle position sensor (2nd channel) (Refer to P.13A-198.)
- NG → Check the throttle valve position feedback system. (Refer to P.13A-162, code No.92.)
- OK ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-198.)
- NG → Check the accelerator pedal position switch system. (Refer to P.13A-192, Inspection procedure 28.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-198.)
- NG → Check the engine coolant temperature sensor system. (Refer to P.13A-138, code No.21.)
- OK ↓

MUT-II Data list
68 EGR valve (Refer to P.13A-198.)
- NG → Check the EGR valve system. (Refer to P.13A-196, Inspection procedure 35.)
- OK ↓

Does the engine stall right after the accelerator pedal is released?
- YES → • Clean around the throttle valve. (Refer to P.13A-220.) • Adjust the throttle position sensor. (Refer to P.13A-220.)
- NO ↓

Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-222.)
- OK ↓

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

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

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

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

- NG → Replace the ignition coil.
- OK → Check the following items in that order.
  - Check the spark plug
  - Check the compression pressure
  - Check the engine oil viscosity.

↓

Check the trouble symptoms.
- NG → Replace the injector.

Inspection procedure 10

When the engine becomes hot, it stalls at idling. (Die out)	Probable cause
In such cases as the above, the cause is probably that ignition system, air/fuel mixture, electronic-controlled throttle valve system, compression pressure is defective. In addition, if the engine suddenly stalls, the cause may also be a defective connector contact.	• Malfunction of the ignition system • Malfunction of the air/fuel ratio control system • Malfunction of the electronic-controlled throttle valve system • Malfunction of the throttle body • Improper connector contact • Drawing air into intake system

Has the battery been disconnected recently?
- YES → After warming-up, let the engine run at idling for 10 minutes.
- NO ↓

MUT-II Self-Diag Code
Is a diagnosis code set?
- YES → Refer to P.13A-130, INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-198.)
- NG → Check the throttle valve position feedback system. (Refer to P.13A-162, code No.92.)
- OK ↓

Does the engine stall easily again?
- NO → While carrying out an intermittent malfunction simulation test (Refer to GROUP 00 - Points to Note for Intermittent Malfunctions.), check for sudden changes in the signals shown below.
  - Crank angle sensor signal
  - Injector activating signal
  - Low pressure fuel pump drive signal
  - Air flow sensor
  - Primary ignition signal
  - Engine-A/T-ECU power supply voltage
- YES ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-198.)
- NG → Check the accelerator pedal position switch system. (Refer to P.13A-192, Inspection procedure 28.)
- OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-198.)
- NG → Check the intake air temperature sensor system. (Refer to P.13A-135, code No.13.)
- OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-198.)
- NG → Check the barometric pressure sensor system. (Refer to P.13A-145, code No.25.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-198.)
- NG → Check the engine coolant temperature sensor system. (Refer to P.13A-138, code No.21.)
- OK ↓

MUT-II Data list
11 Oxygen sensor (Refer to P.13A-198.)
OK 600 - 1,000 mV when the engine is suddenly raced.
- NG → Check Oxygen sensor system (Refer to P.13A-131, code No.11.)
- OK ↓

MUT-II Data list
11 Oxygen sensor (Refer to P.13A-198.)
OK 0 - 400 mV and 600 - 1,000 mV alternates when the engine is idling (wait for 2 minutes after the engine is started).
- NG → Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-222.)
  - OK ↓
  - Check that air is sucked in the air intake system.
    - Broken intake manifold gasket
    - Damaged vacuum hose
    - Damaged air intake hose
- OK ↓

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OK

MUT-II Data list
27 Power steering oil pressure switch (Refer to P.13A-198.)

NG → Check the power steering oil pressure switch system (Refer to P.13A-194, Inspection procedure30.)

OK

MUT-II Data list
28 A/C switch (Refer to P.13A-198.)

NG → Check the A/C switch and A/C relay system (Refer to P.13A-194, Inspection procedure 31.)

OK

MUT-II Data list
31 Small lamp switch (Refer to P.13A-198.)

NG → Check the small lamp switch system (Refer to P.13A-195, Inspection procedure 33.)

OK

MUT-II Data list
34 Air flow sensor reset signal (Refer to P.13A-198.)

NG → Check the air flow sensor system (Refer to P.13A-133, code No.12.)

OK

MUT-II Data list
14 Throttle position sensor (2nd channel)
After warming-up, let the engine run at idling with no load.
OK: 3,900 - 4,800 mV

NG →
- Clean around the throttle valve. (Refer to P.13A-220)
- Adjust the throttle position sensor (Refer to P.13A-220.)

OK

MUT-II Data list
68 EGR valve (Refer to P.13A-198.)

NG → Check the EGR valve system (Refer to P.13A-196, Inspection procedure 35.)

OK

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

YES → Clean around the throttle valve. (Refer to P.13A-220.)

NO

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

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

NG

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

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

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

NG → Replace the ignition coil.

OK

Check the following items in that order.
- Check the spark plug
- Check the compression pressure
- Check if foreign materials (water, kerosine,etc.) got into fuel.

Inspection procedure 11

The engine stalls when starting the car. (Pass out)	Probable cause
In cases such as the above, the cause is probably misfiring due to a weak spark, or an inappropriate air/fuel mixture when the accelerator pedal is depressed.	• Malfunction of the ignition system • Malfunction of the EGR valve • Air stuck in the air intake system

MUT-II Self-Diag Code
Is a diagnosis code set?
YES → Refer to P.13A-130, INSPECTION CHART FOR DIAGNOSIS CODES.
NO ↓

MUT-II Data list
68 EGR valve (Refer to P.13A-198)
NG → Check the EGR valve system (Refer to P.13A-196, Inspection procedure 35.)
OK ↓

MUT-II Actuator Test
08 Purge control solenoid valve (Refer to P.13A-203.)
NG → Check the purge control solenoid valve system (Refer to P.13A-197, Inspection procedure 36.)
OK ↓

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

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

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

NG → Replace the ignition coil.
OK ↓

Check the following items in that order.
- Check the spark plug
- Check that air is sucked in the air intake system.
- Broken intake manifold gasket
- Damaged or disconnected vacuum hose
- Damaged air intake hose

Inspection procedure 12

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

Has the battery been disconnected recently?
- YES → After warming-up, let the engine run at idling for 10 minutes.
- NO ↓

MUT-II Self-Diag Code
Is a diagnosis code set?
- YES → Refer to P.13A-130, INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-198.)
- NG → Check the accelerator pedal position switch system. (Refer to P.13A-192, Inspection procedure 28)
- OK ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-198.)
- NG → Check the throttle valve position feedback system (Refer to P.13A-162, code No.P92)
- OK ↓

Check the vehicle speed sensor system (Refer to P.13A-144, code No.24.)
- NG → **Repair**
- NO ↓

MUT-II Data list
68 EGR valve (Refer to P.13A-198.)
- NG → Check the EGR valve system (Refer to P.13A-196, Inspection procedure 35.)
- OK ↓

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

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

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

- NG → Replace the ignition coil.
- OK ↓

Check the following items in that order.
- Check the spark plug
- Clean around the throttle valve. (Refer to P.13A-220.)
- Adjust the throttle position sensor (Refer to P.13A-220.)

Inspection procedure 13

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

MUT-II Self-Diag Code
Is a diagnosis code displayed?
YES → Refer to P.13A-130, INSPECTION CHART FOR DIAGNOSIS CODES.
NO ↓

Check the ignition timing. (Refer to GROUP11A - Engine Adjustment)
NG → Check that the crank angle sensor and timing belt cover are properly installed.
OK ↓

MUT-II Data list
26 Accelerator pedal position switch
(Refer to P.13A-198.)
NG → Check the accelerator pedal position switch system. (Refer to P.13A-192, Inspection procedure 28.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-198.)
NG → Check the intake air temperature sensor system (Refer to P.13A-135, code No.13.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-198.)
NG → Check the barometric pressure sensor system (Refer to P.13A-145, code No.25.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-198.)
NG → Check the engine coolant temperature sensor system (Refer to P.13A-138, code No.21.)
OK ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-198.)
NG → Check the throttle valve position feedback system (Refer to P.13A-162, code No.92.)
OK ↓

MUT-II Data list
11 Oxygen sensor (Refer to P.13A-198.)
OK: 600 - 1,000 mV when the engine is suddenly raced
NG → Check the oxygen sensor system. (Refer to P.13A-131, code No.11.)
OK ↓

MUT-II Data list
11 Oxygen sensor (Refer to P.13A-198.)
OK: 0 - 400 mV and 600 - 1,000 mV alternates when the engine is idling (wait for 2 minutes after the engine is started).
NG → Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-222.)
OK → Check that air is sucked in the air intake system.
- Broken intake manifold gasket
- Damaged vacuum hose
- Damaged air intake hose

OK ↓

MUT-II Data list
68 EGR valve (Refer to P.13A-198.)
NG → Check the EGR valve system (Refer to P.13A-196, Inspection procedure 35.)
OK ↓

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OK

MUT-II Actuator Test
08 Purge control solenoid valve
(Refer to P.13A-203.)

NG → Check the purge control solenoid valve system (Refer to P.13A-197, Inspection procedure 36.)

OK

Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-222.)

NG → **Repair**

OK

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

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

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

NG → Replace the ignition coil.

OK

Check the following items in that order.
- Check the spark plug
- Check the EGR control system
- Check the compression pressure
- Check the fuel filter or fuel line for clogging

Check the trouble symptoms.

NG → Replace the injector.

Inspection procedure 14

The feeling of impact or vibration when accelerating	Probable cause
In cases such as the above, the cause is probably that there is an ignition leak accompanying the increase in the spark plug demand voltage during acceleration.	• Malfunction of the ignition system

MUT-II Self-Diag Code
Is a diagnosis code displayed?

YES → Refer to P.13A-130, INSPECTION CHART FOR DIAGNOSIS CODES.

NO

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-198.)

NG → Check the throttle valve position feedback system (Refer to P.13A-162, code No.92.)

OK

Check the spark plug

NG → **Replace**

OK

Check the trouble symptoms.

NG

Replace the ignition coil.

Inspection procedure 15

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

MUT-II Self-Diag Code
Are diagnosis codes displayed?
YES → Refer to P.13A-130, INSPECTION CHART FOR DIAGNOSIS CODES.
NO ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-198.)
NG → Check the throttle valve position feedback system (Refer to P.13A-162, code No.92.)
OK ↓

MUT-II Data list
26 Accelerator pedal position switch
(Refer to P.13A-198.)
NG → Check the accelerator pedal position switch system (Refer to P.13A-192, Inspection procedure 28.)
OK ↓

Clean around the throttle valve. (Refer to P.13A-220.)

Inspection procedure 16

Knocking	Probable cause
In case as the above, the cause is probably that the heat value of the spark plug is inappropriate.	• Malfunction of the detonation sensor • Improper heat range of the spark plugs.

MUT-II Self-Diag Code
Is a diagnosis code set?
YES → Refer to P.13A-130, INSPECTION CHART FOR DIAGNOSIS CODES.
NO ↓

Does knocking occur when the vehicle is driven with the detonation sensor disconnected?
(At this time, use the MUT-II to check whether the ignition timing is retarded from when the detonation sensor connector is connected.)
NO → Check the detonation sensor system. (Refer to P.13A-146, code No.31.)
YES ↓

Check the following items in that order.
- Spark plugs
- Check if foreign materials (water, kerosine,etc.) got into fuel.

Inspection procedure 17

Run-on (Dieseling)	Probable cause
Fuel leakage from injectors is suspected.	• Malfunction of the injector

Replace the injector.

Inspection procedure 18

Too high CO and HC concentration when idling	Probable cause
Abnormal air-fuel ratio is suspected.	• Malfunction of the air/fuel ratio control system • Deteriorated catalyst

MUT-II Self-Diag Code
Are diagnosis codes displayed?
YES → Refer to P.13A-130, INSPECTION CHART FOR DIAGNOSIS CODES.
NO ↓

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

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-198.)
NG → Check the engine coolant temperature sensor system (Refer to P.13A-138, code No.21.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-198.)
NG → Check the intake air temperature sensor system (Refer to P.13A-135, code No.13.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-198.)
NG → Check the barometric pressure sensor system (Refer to P.13A-145, code No.25.)
OK ↓

MUT-II Data list
68 EGR valve (Refer to P.13A-198.)
NG → Check the EGR valve system (Refer to P.13A-196, Inspection procedure 35.)
OK ↓

MUT-II Actuator Test
08 Purge control solenoid valve
(Refer to P.13A-203.)
NG → Check the purge control solenoid valve system (Refer to P.13A-197, Inspection procedure 36.)
OK ↓

MUT-II Data list
11 Oxygen sensor (Refer to P.13A-198.)
OK: 600 - 1,000 mV when the engine is suddenly raced
NG → Check the oxygen sensor system. (Refer to P.13A-131, code No.11.)
OK ↓

MUT-II Data list
11 Oxygen sensor (Refer to P.13A-198.)
OK: Repeat 0 - 400 mV and 600 - 1,000 mV alternately during idling (wait for at least 2 minutes after the engine started to run at idle).
OK → Replace the oxygen sensor.
Check the trouble symptoms.
NG ↓

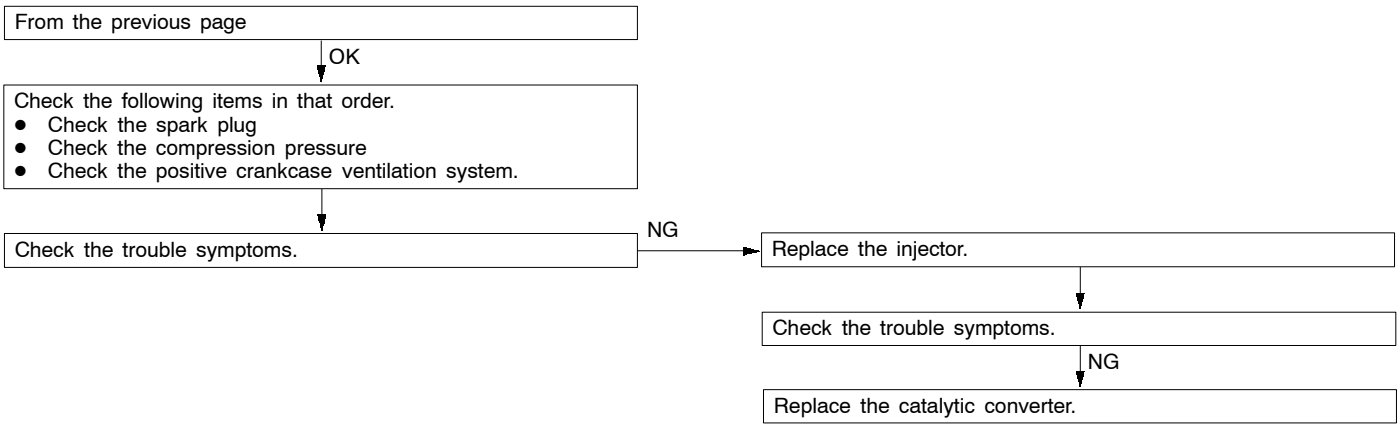
Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-223.)
OK ↓

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

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

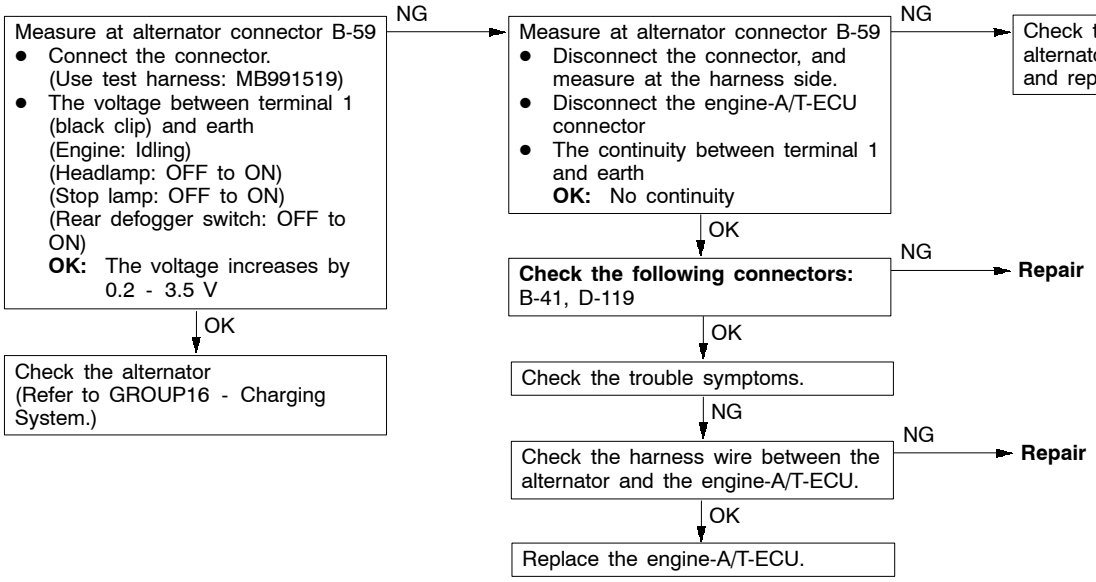
4. Earth the spark plug electrode securely.
5. Check that the spark plug ignites when the engine is cranked.

OK ↓ To the next page
NG → Replace the ignition coil.



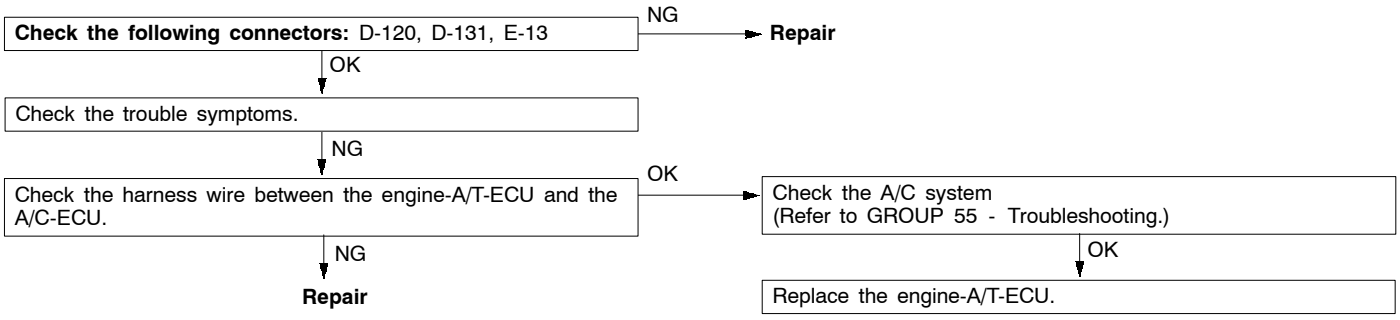
Inspection procedure 19

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-A/T-ECU ● Malfunction of the engine-A/T-ECU



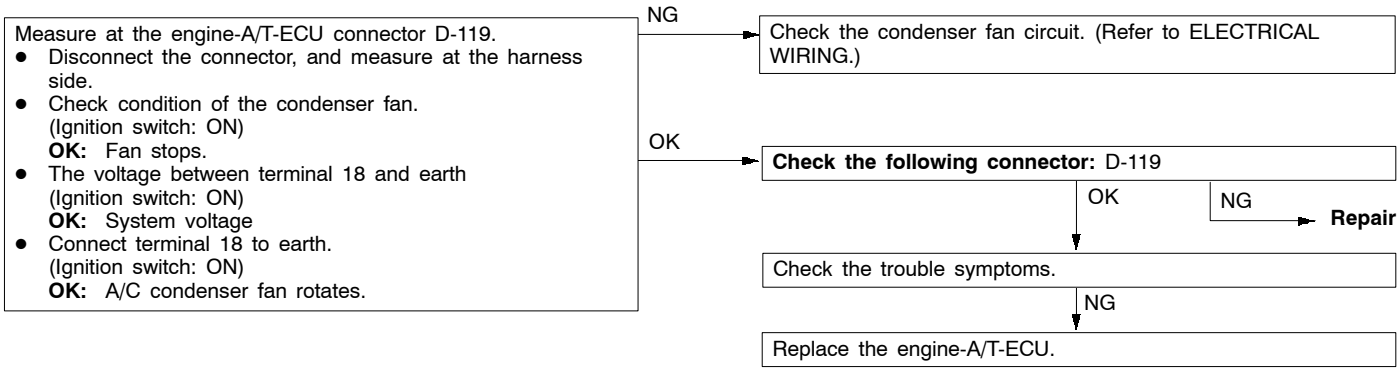
Inspection procedure 20

Idling speed is improper when A/C is operating (A/C switch 2 signal)	Probable cause
The A/C-ECU judges if load caused by air conditioner is high or low, and converts it to A/C switch 2 signal to send the engine-A/T-ECU it. Based on this signal, the engine-A/T-ECU operates the throttle control servo to control the idle-up speed.	• Malfunction of the A/C control system • Open or short circuit, or loose connector contact • Malfunction of the engine-A/T-ECU



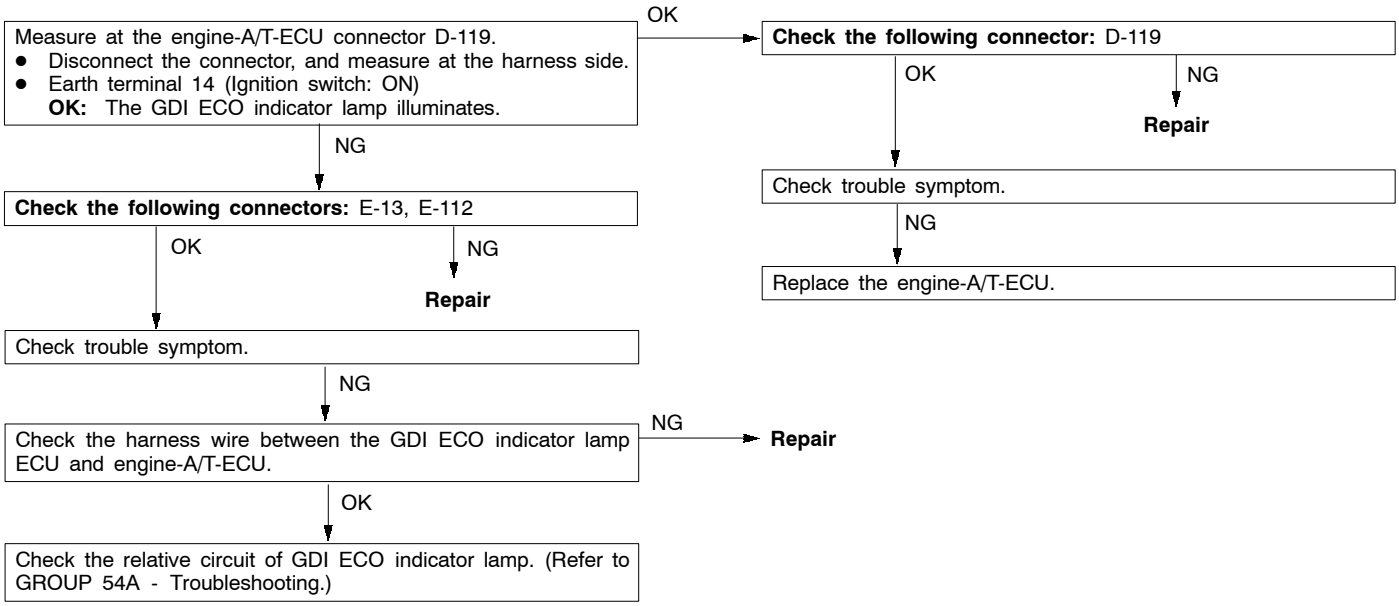
Inspection procedure 21

A/C condenser fan is inoperative	Probable cause
The fan motor relay is controlled by turning on and off the power transistor in the engine-A/T-ECU.	• Malfunction of the A/C condenser fan relay. • Malfunction of the A/C condenser fan motor. • Open or short circuit, or loose connector contact • Malfunction of the engine-A/T-ECU



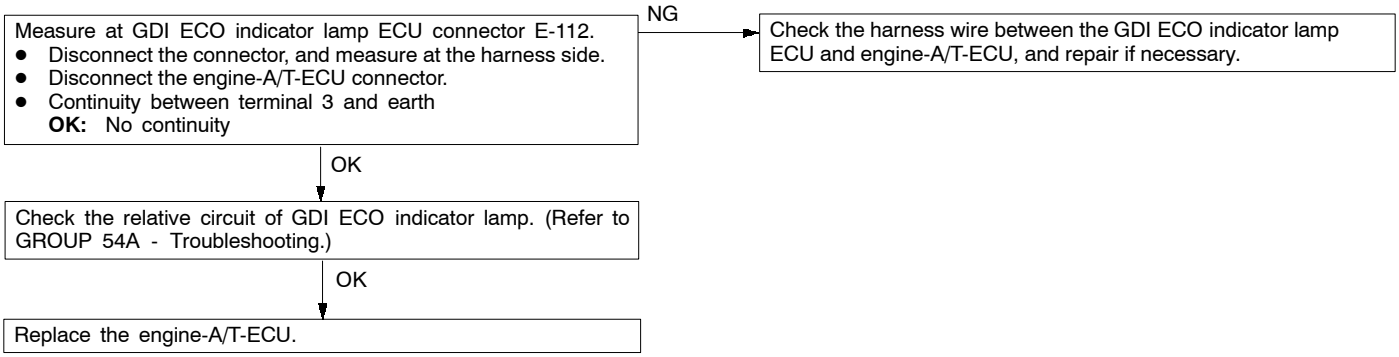
Inspection procedure 22

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



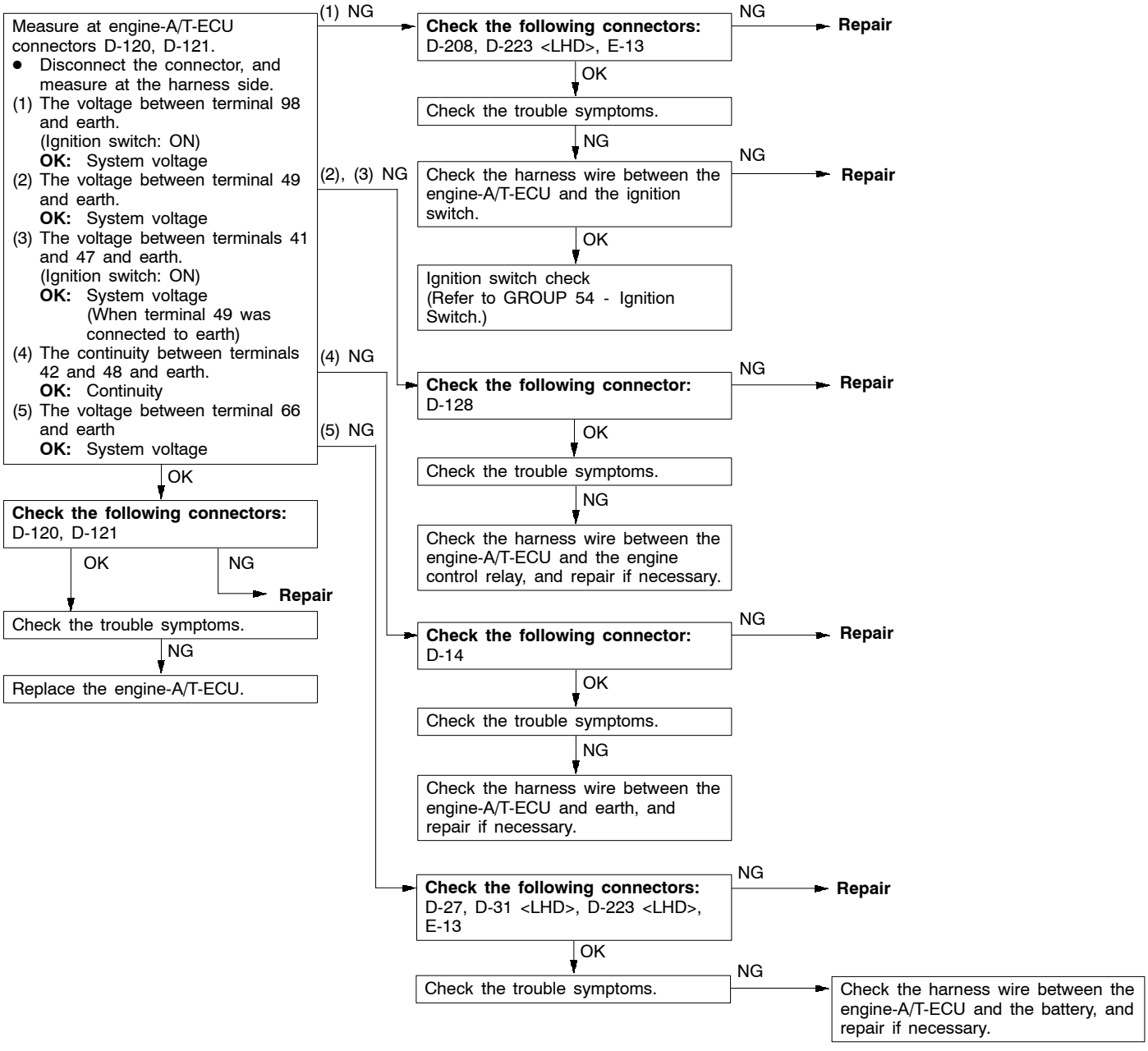
Inspection procedure 23

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



Inspection procedure 24

Engine-A/T-ECU power supply and earth circuit system	Probable cause
The cause is probably the malfunction of the engine-A/T-ECU, or the malfunctions listed at right.	• Open circuit or short-circuited harness wire in the engine-A/T-ECU power supply circuit. • Open circuit or short-circuited harness wire to earth in the engine-A/T-ECU. • Malfunction of the engine-A/T-ECU



Inspection procedure 25

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

Check the control relay. (Refer to P.13A-227.)
- NG → **Replace**
- OK ↓

Measure at control relay connector B-25X.
- Disconnect the connector, and measure at the harness side.
- The voltage between 2, 3 and earth
  OK: System voltage

- NG → Check the harness wire between the battery and the engine control relay, and repair if necessary.
- OK → Check the engine-A/T-ECU power supply and earth circuit. (Refer to P.13A-189, Inspection procedure 24.)

Inspection procedure 26

Injector driver relay system	Probable cause
When an ignition switch ON signal is input to the engine-A/T-ECU, the engine-A/T-ECU turns the injector driver relay ON. This causes system voltage to be supplied to the injector driver.	• Malfunction of the injector driver relay. • Open or short circuit, or loose connector contact • Malfunction of the engine-A/T-ECU

Check the injector driver relay (Refer to P.13A-227.)
- NG → **Replace**
- OK ↓

Measure at the injector driver relay connector B-28X.
- Disconnect the connector, and measure at the harness side.

(1) The voltage between terminal 3 and earth
OK: System voltage

(2) The voltage between terminal 4 and earth (Ignition switch: ON)
OK: System voltage

- (1) NG → Check the harness wire between the injector driver relay and the battery, and repair if necessary.
- (2)NG → **Check the following connectors:** D-208, D-223 <LHD>, E-13
  - OK → Check the trouble symptoms.
    - NG → Check the harness wire between the injector driver relay and the ignition switch, and repair if necessary.
    - OK ↓
  - NG → **Repair**

Measure at engine-A/T-ECU connector D-119.
- Disconnect the connector, and measure at the harness side.
- The voltage between terminal 6 and earth (Ignition switch: ON)
  OK: System voltage

- NG → **Check the following connector:** B-28X
  - OK → Check the trouble symptoms.
    - NG → Check the harness wire between the injector driver relay and the engine-A/T-ECU, and repair if necessary.
    - OK ↓
  - NG → **Repair**
- OK ↓

Check the following connector: D-119
- OK ↓
- NG → **Repair**

Check the trouble symptoms.
- NG ↓

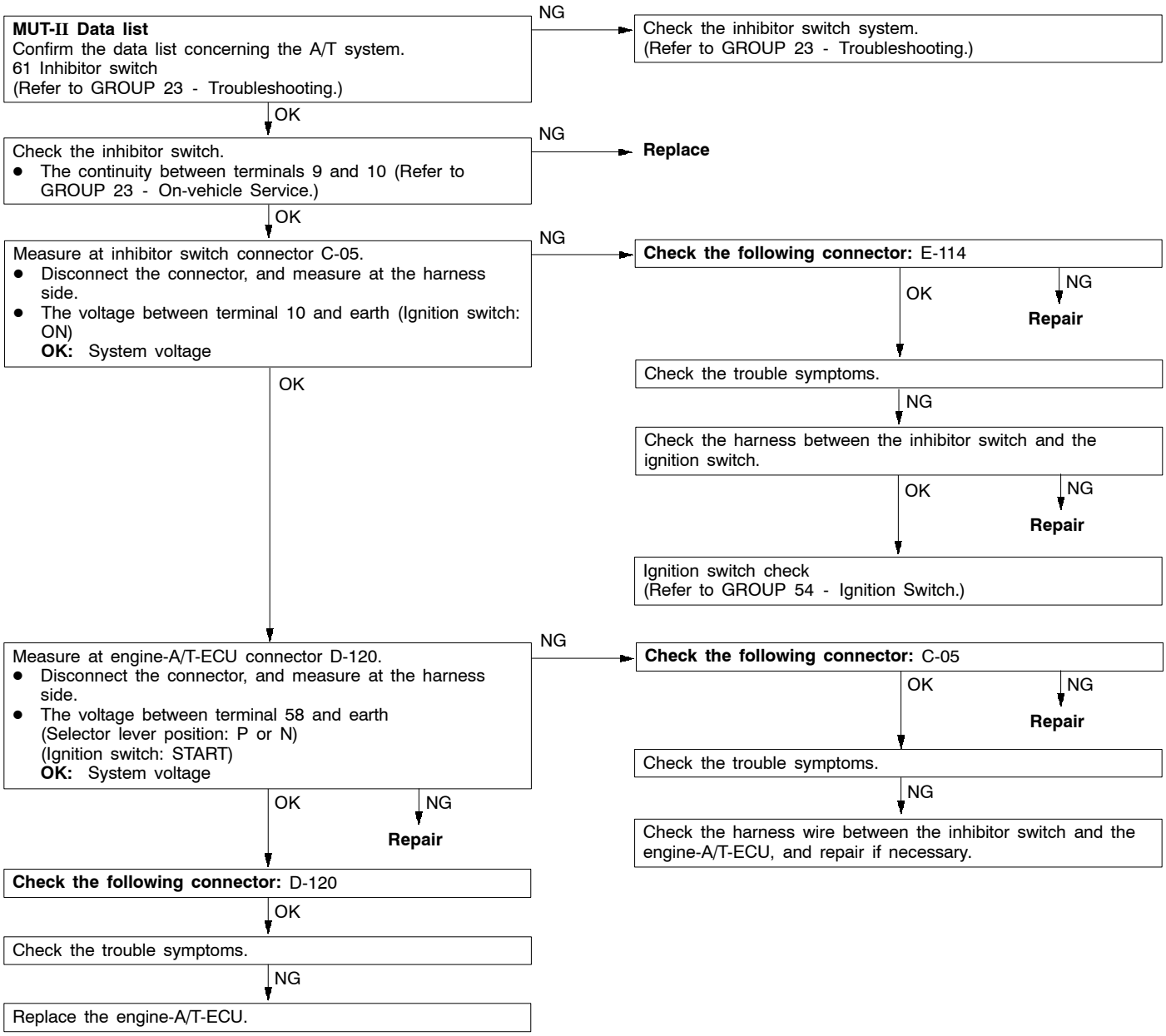
Measure at injector driver connector B-121.
- Connect the connector.
- The voltage between terminal 4, 12, 21 and earth (Ignition switch: ON)
  OK: System voltage

- NG → **Check the following connector:** B-28X
  - OK → Check the trouble symptoms.
    - NG → Check the harness wire between the injector driver relay and the injector driver, and repair if necessary.
    - OK ↓
  - NG → **Repair**
- OK ↓

Check the injector driver system. (Refer to P.13A-196, Inspection procedure 34.)

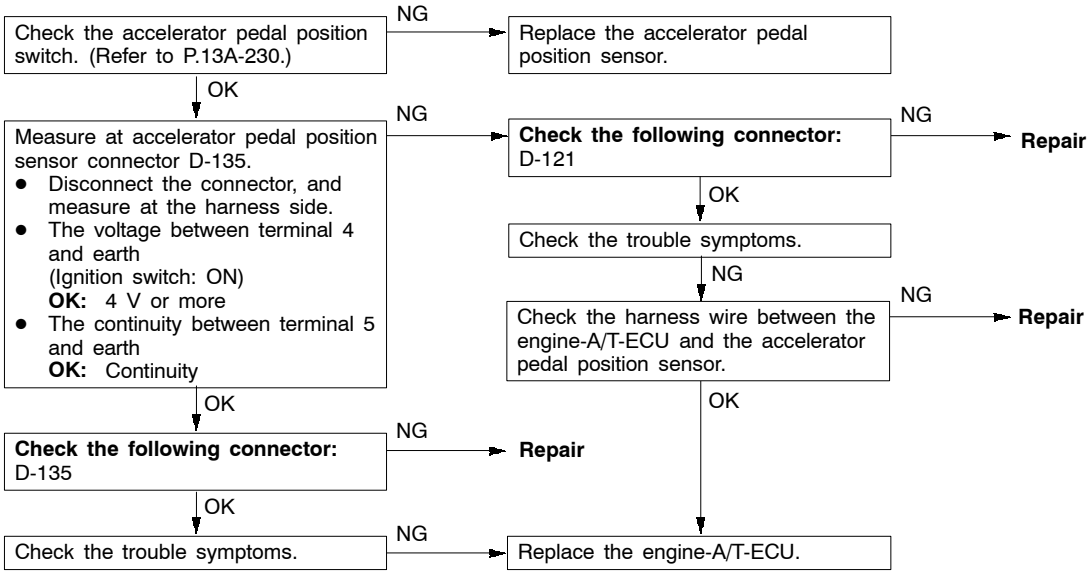
Inspection procedure 27

Ignition switch-ST and inhibitor switch system	Probable cause
The ignition switch-ST inputs a HIGH signal to the engine-A/T-ECU while the engine is cranking. The engine-A/T-ECU controls fuel injection, etc. during starting based on this input. The inhibitor switch inputs the position of the selector lever to the engine-A/T-ECU. The engine-A/T-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 the ignition switch and the inhibitor switch, or improper connector contact. • Malfunction of the engine-A/T-ECU



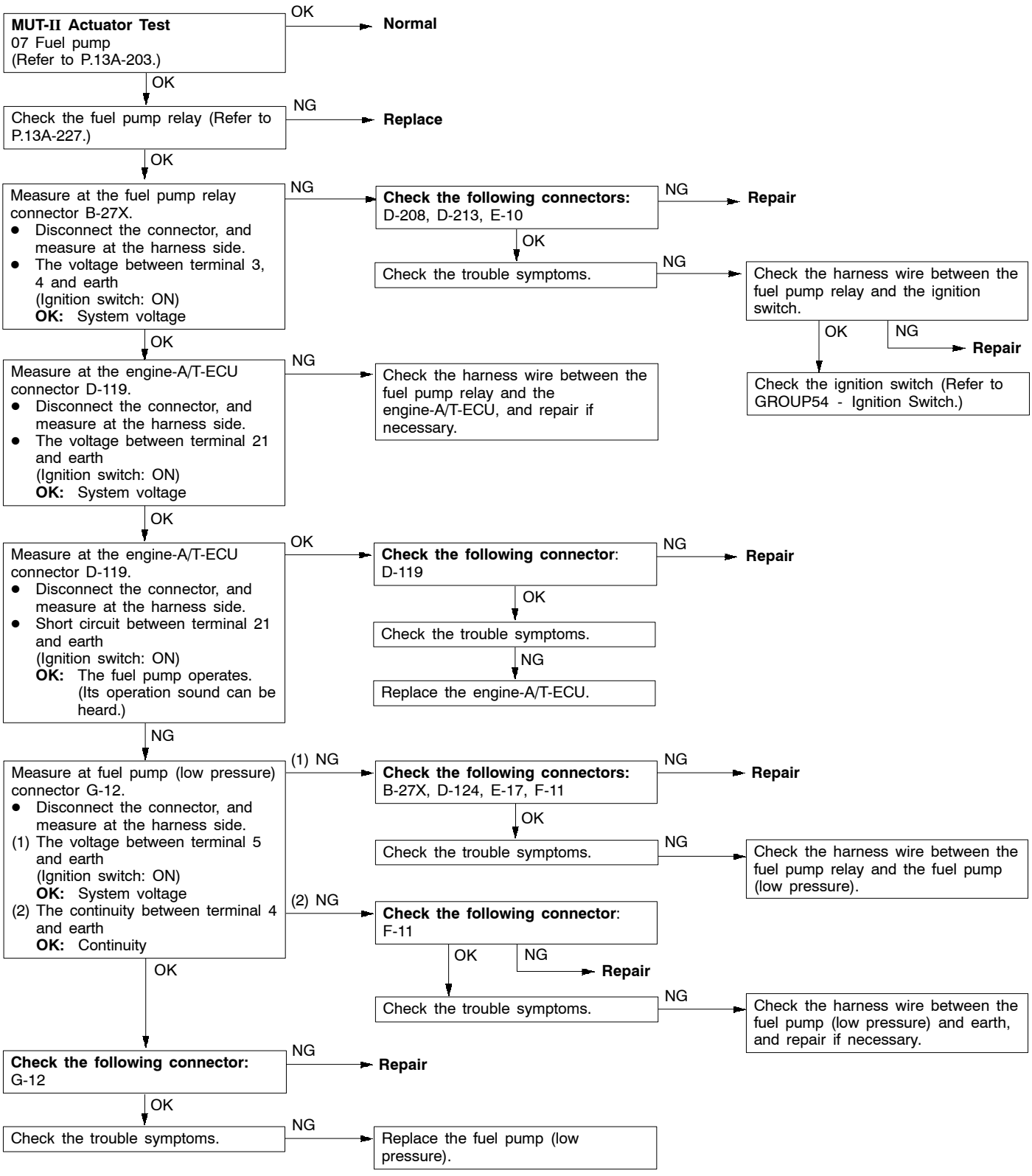
Inspection procedure 28

Accelerator pedal position switch system	Probable cause
The accelerator pedal position switch detects that the accelerator pedal is fully closed, and sends a signal to the engine-A/T-ECU. The engine-A/T-ECU uses this signal to carry out idle speed control.	• Maladjustment of the accelerator pedal position switch and the accelerator pedal position sensor. • Open circuit or short-circuited harness wire in the accelerator pedal position switch system, or poor connector contact • Malfunction of the engine-A/T-ECU



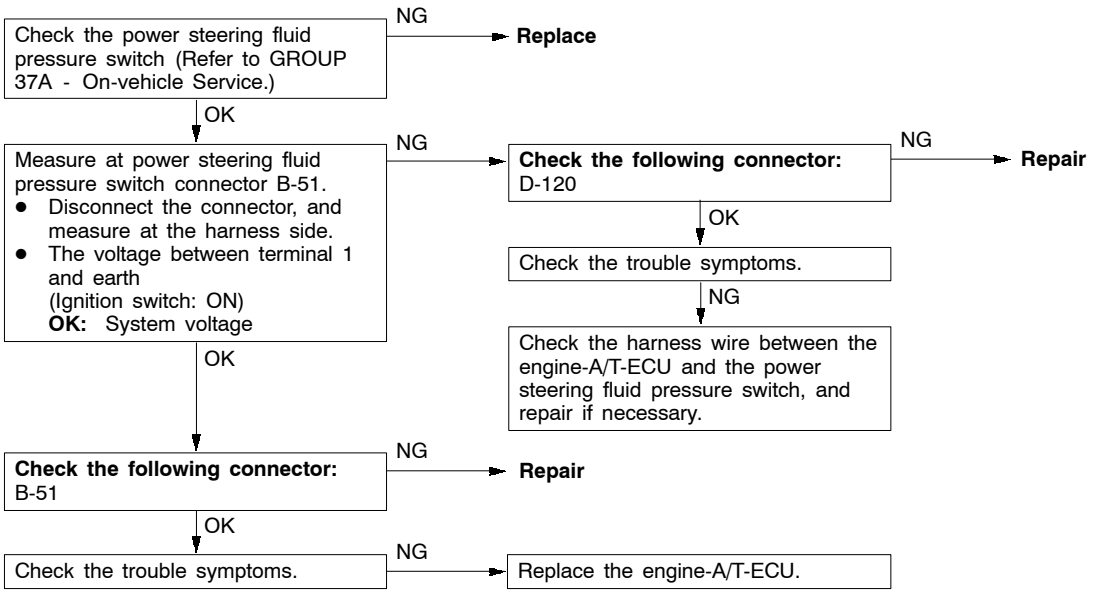
Inspection procedure 29

Fuel pump (low pressure) system	Probable cause
The engine-A/T-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) • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-A/T-ECU



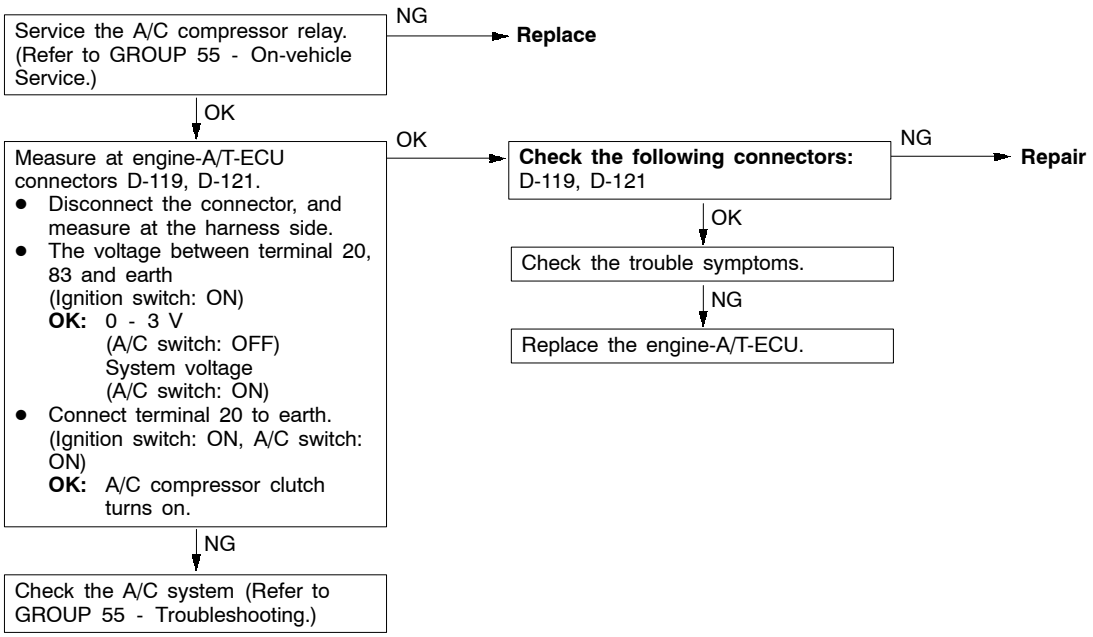
Inspection procedure 30

Power steering fluid pressure switch system	Probable cause
The presence or absence of power steering load is input to the engine-A/T-ECU. Based on this signal, the engine-A/T-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. • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-A/T-ECU



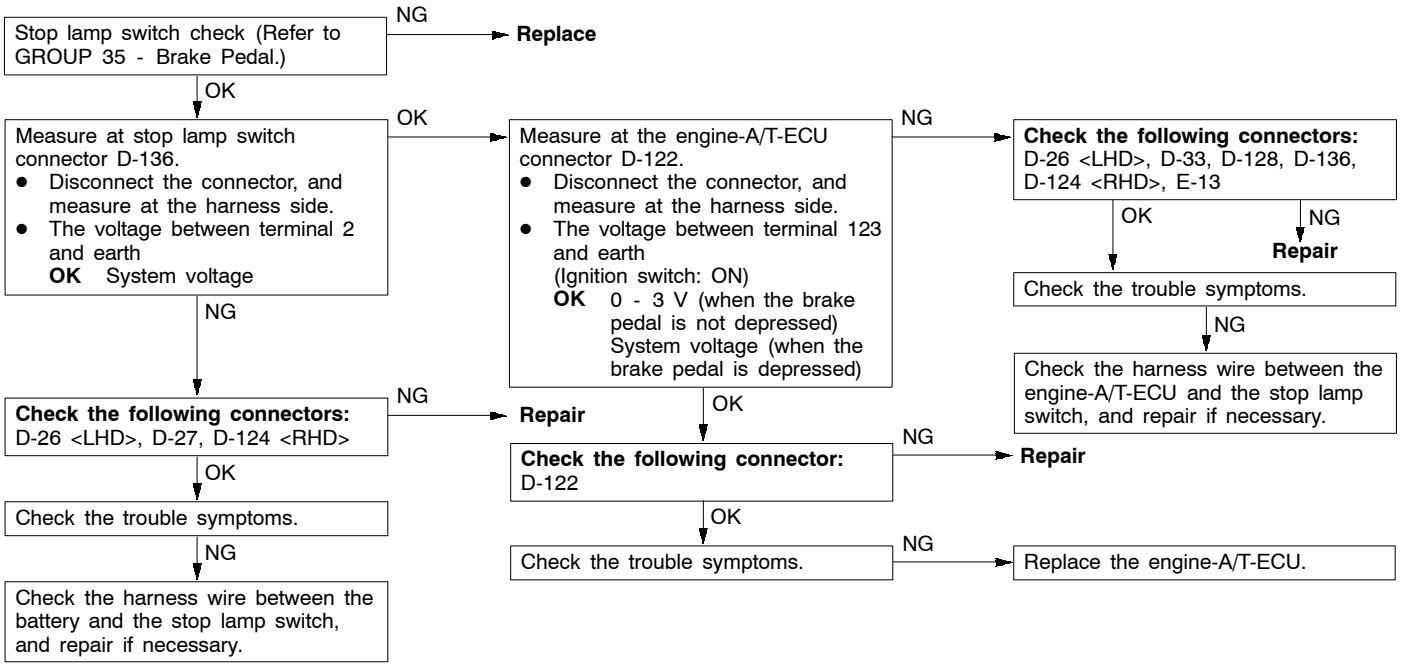
Inspection procedure 31

A/C switch and A/C relay system	Probable cause
When an A/C ON signal is input to the engine-A/T-ECU, the engine-A/T-ECU controls the throttle control servo so that idle speed increases, and also operates the A/C compressor magnetic clutch.	• Malfunction of the A/C control system • Malfunction of the A/C switch • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-A/T-ECU



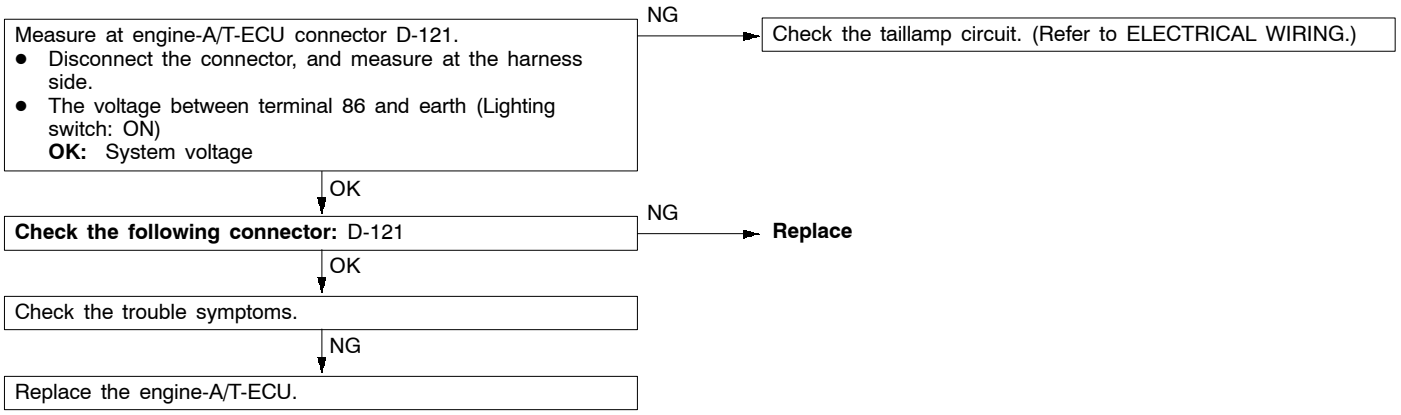
Inspection procedure 32

Stop lamp switch system	Probable cause
The engine-A/T-ECU determines whether the brake pedal is depressed or not. The engine-A/T-ECU selects a fuel injection mode by determining the brake operation according to this information.	• Malfunction of the stop lamp switch • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-A/T-ECU



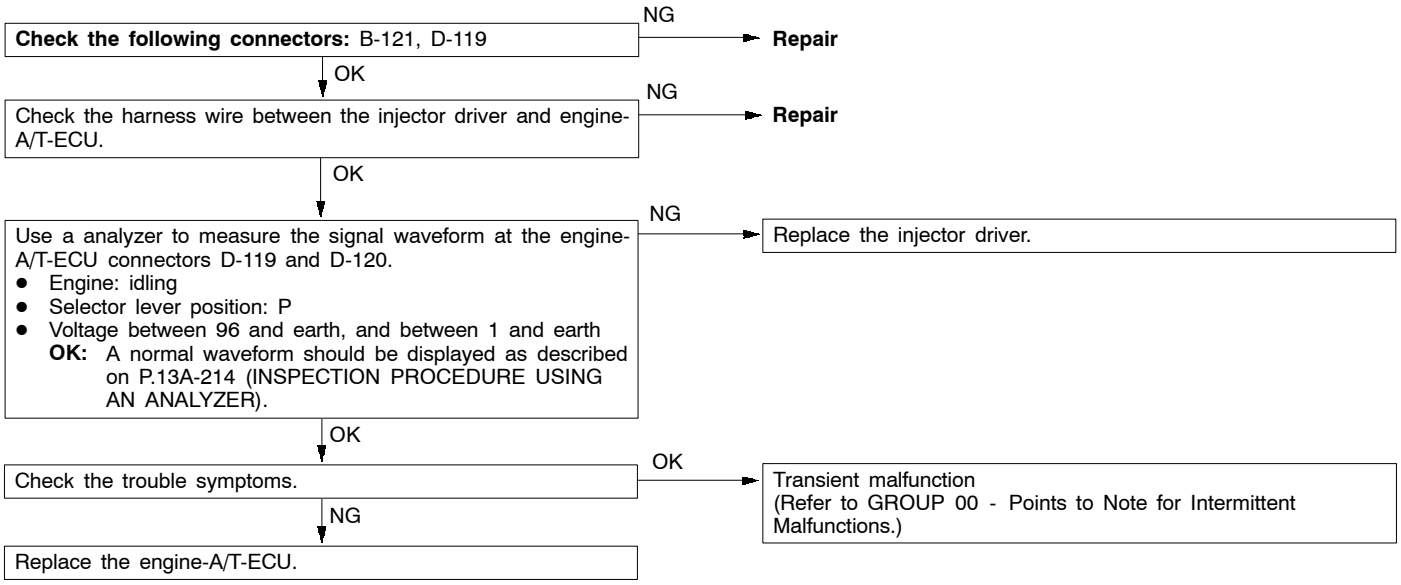
Inspection procedure 33

Small lamp switch system	Probable cause
The engine-A/T-ECU determines whether the small lamp switch is on or off. According to that information, the engine-A/T-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-A/T-ECU



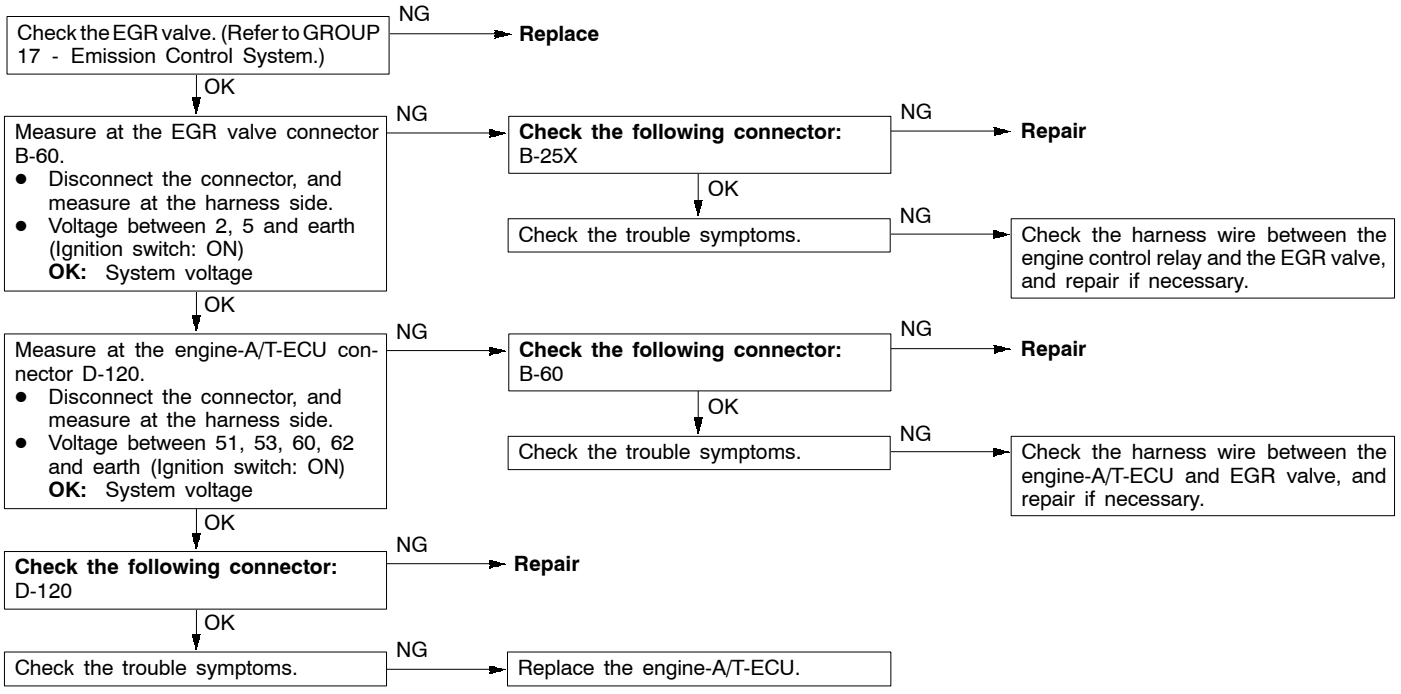
Inspection procedure 34

Injector driver	Probable cause
The engine-A/T-ECU drives the injector by the drive signal.	• Malfunction of the injector driver • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-A/T-ECU



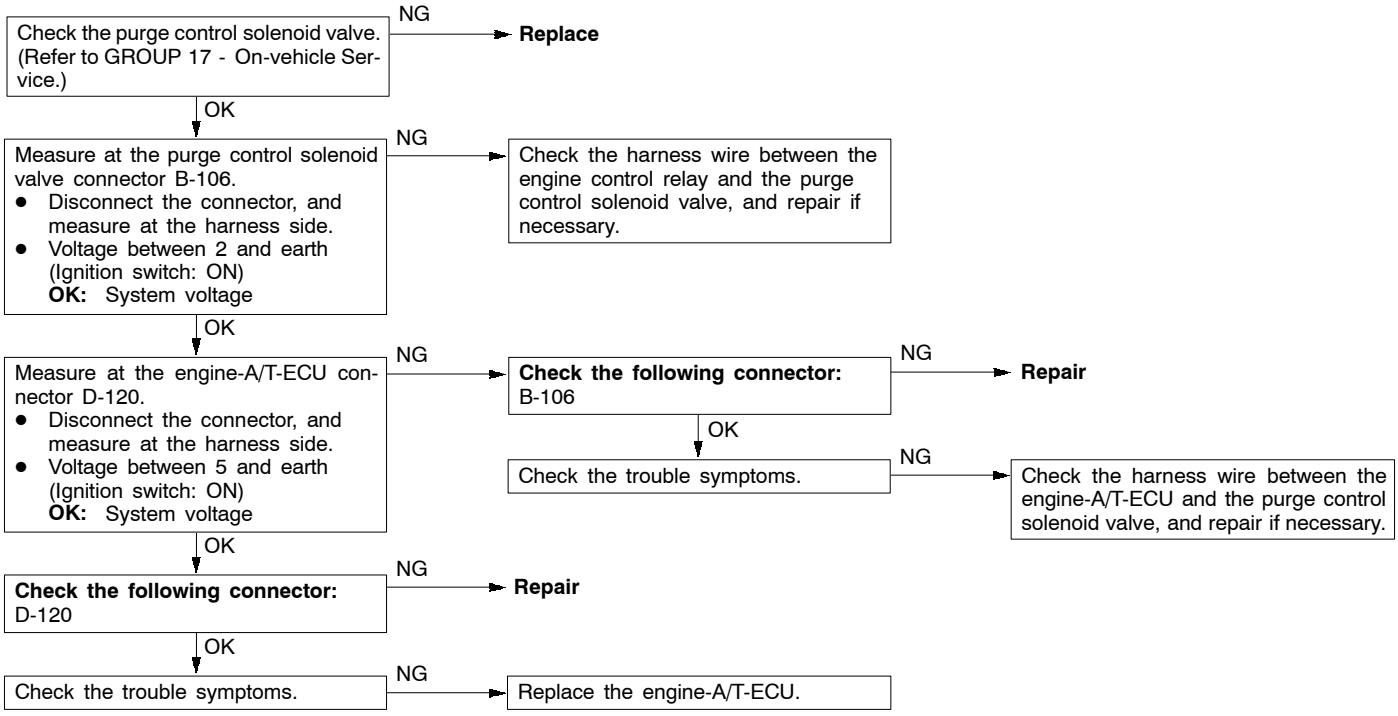
Inspection procedure 35

EGR valve (stepper motor) system	Probable cause
The engine-A/T-ECU controls the EGR valve (stepper motor) 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-A/T-ECU



Inspection procedure 36

Purge control solenoid valve system	Probable cause
The engine-A/T-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-A/T-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: Injector running time indicates the time where the power voltage is 11 V and the cranking speed is 250 r/min or less. As the engine speed increases and the time passes by, the injector running time decreases.
*2: There may be occasions of taking the injector running time approximately 10% longer than usual when a vehicle has not been driven for a long time (mileage is no more than 500 km.)
*3: It is normal that the idle switch turns from ON to OFF when accelerator pedal position sensor (1st channel) voltage increases by 200 - 600 mV from the idling position. Moreover, adjust the idle switch and accelerator pedal position sesor if the idle switch keeps turning after the accelerator pedal is depressed.

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
11	Oxygen sensor	Engine: After having warmed up (Air/fuel mixture is made leaner when decelerating, and is made richer when racing.)	When at 4,000 r/min, engine is decelerated	200 mV or less	Code No. 11	13A-131
			Race the engine suddenly.	600 - 1,000 mV		
		Engine: After having warmed up (The oxygen sensor signal is used to check the air/fuel mixture ratio, and control condition by the engine-A/T-ECU.)	Idling (after six minutes)	400 mV or less 600 - 1,000 mV (changes)		
			2,500 r/min			
12	Air flow sensor	• Engine coolant temperature: 80 - 95°C • Lamps and all accessories: OFF • Transmission: P range	Idling	22 - 48 Hz	Code No. 12	13A-133
			2,500 r/min	60 - 100 Hz		
			Racing	Frequency increases in response to racing		
13	Intake air temperature sensor	Ignition switch: ON or with engine running	When intake air temperature is -20°C	-20°C	Code No. 13	13A-135
			When intake air temperature is 0°C	0°C		
			When intake air is 20°C	20°C		
			When intake air is 40°C	40°C		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
14	Throttle position sensor (2nd channel)	• Engine: After having warmed up • Ignition switch: ON (Engine: Stopped)	Release the accelerator pedal.	4,000 mV or more	Code No. 14	13A-137
			Depress the accelerator pedal gradually.	Voltage decreases in response to the pedal depression.		
			Depress the accelerator pedal fully.	400 - 600 mV		
16	System voltage	Ignition switch: ON		System voltage	Procedure No. 25	13A-190
18	Cranking signal (ignition switch: ST)	Ignition switch: ON	Engine: Stopped	OFF	Procedure No.27	13A-191
			Engine: Cranking	ON		
21	Engine coolant temperature sensor	Ignition switch: ON or with engine running	When engine coolant temperature is -20°C	-20°C	Code No. 21	13A-138
			When engine coolant temperature is 0°C	0°C		
			When engine coolant temperature is 20°C	20°C		
			When engine coolant temperature is 40°C	40°C		
22	Crank angle sensor	• Engine: Cranking • Tachometer: Connected	Compare the tachometer with the MUT-II reading.	Identical	Code No. 22	13A-140
		• Engine: Idling • Idle position switch: ON • Within six minutes after engine starting (Only when engine coolant temperature is 80°C)	When engine coolant temperature is -20°C	1,250 - 1,450 r/min		
			When engine coolant temperature is 0°C	1,100 - 1,300 r/min		
			When engine coolant temperature is 20°C	1,000 - 1,200 r/min		
			When engine coolant temperature is 40°C	900 - 1,100 r/min		
			When engine coolant temperature is 80°C	550 - 650 r/min		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
25	Barometric pressure sensor	Ignition switch: ON	At altitude of 0 m	101 kPa	Code No. 25	13A-145
			At altitude of 600 m	95 kPa		
			At altitude of 1,200 m	88 kPa		
			At altitude of 1,800 m	81 kPa		
26	Accelerator pedal position switch	Ignition switch: ON (Depress and release the accelerator pedal several times)	Release the accelerator pedal.	ON	Procedure No.28	13A-192
			Depress the accelerator pedal slightly.	OFF		
27	Power steering fluid pressure switch	Engine: Idling	When steering wheel is turned	ON	Procedure No.30	13A-194
28	A/C switch	Engine: Idling (The A/C compressor is running when the A/C switch is on.)	A/C switch: OFF	OFF	Procedure No.31	13A-194
			A/C switch: ON	ON		
31	Small lamp switch	Engine: Idling	Lighting switch: OFF	OFF	Procedure No.33	13A-195
			Lighting switch: ON	ON		
34	Air flow sensor reset signal	Engine: After having warmed up	Idling	ON	Code No. 12	13A-133
			3,000 r/min	OFF		
37	Volumetric efficiency	• Engine coolant temperature: 85 - 95°C • Lamps and all accessories: OFF • Transmission: P range	Idling	20 - 40%	-	-
			2,500 r/min	10 - 30%		
			Engine is suddenly raced	Volumetric efficiency increases in response to racing		
38	Crank angle sensor	• Engine: Cranking (reading is possible at 2,000 r/min or less) • Tachometer: Connected		Engine speeds displayed on the MUT-II and tachometer are identical.	-	-

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
41	Injector drive time*1	• Engine: Cranking	When engine coolant temperature is 0°C	120 - 160 ms	Code No. 41	13A-147
			When engine coolant temperature is 20°C	70 - 90 ms		
			When engine coolant temperature is 80°C	20 - 35 ms		
	Injector drive time*2	• Engine coolant temperature: 85 - 95°C • Lamps and all accessories: OFF • Transmission: P range • Within six minutes after engine starting	Idling	0.3 - 0.8 ms		
			2,500 r/min	0.4 - 1.0 ms		
			When engine is suddenly raced	Increases		
44	Ignition advance value	• Engine: After having warmed up • Timing lamp is set. (The timing lamp is set in order to check actual ignition timing.) • Within six minutes after engine starting	Idling	12 - 28° BTDC	Code No. 44	13A-148
			2,500 r/min	15 - 35° BTDC		
49	A/C relay	Engine: After having warmed up, idling	A/C switch: OFF	OFF (compressor clutch is not operating)	Procedure No.31	13A-194
			A/C switch: ON	ON (compressor clutch is operating)		
67	Stop lamp switch	Ignition switch: ON	Brake pedal: Depressed	OFF	Procedure No.32	13A-195
			Brake pedal: Released	ON		
68	EGR valve	• Engine coolant temperature: 85 - 95°C • Lamps and all accessories: OFF • Transmission: P range	Idling	2 - 20 STEP	Procedure No.35	13A-196
			2,500 r/min	0 - 10 STEP		
74	Fuel pressure sensor	• Engine coolant temperature: 85 - 95°C • Lamps and all accessories: OFF • Transmission: P range	Engine: Cranking	2 MPa or more	Code No. 56	13A-151
			Engine: Idling	4.0 - 6.9 MPa		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
77	Accelerator pedal position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	985 - 1,085 mV	Code No. 77	13A-154
			Depress the accelerator pedal gradually.	Increases in response to the pedal depression stroke.		
			Depress the accelerator pedal fully.	4,000 mV or more		
78	Accelerator pedal position sensor (1st channel)	Ignition switch: ON	Release the accelerator pedal.	985 - 1085 mV	Code No. 78	13A-156
			Depress the accelerator pedal gradually.	Increases in response to the pedal depression stroke.		
			Depress the accelerator pedal fully.	4,000 mV or more		
79	Throttle position sensor (1st channel)	• Engine: After having warmed up • Ignition switch: ON (Engine stopped)	Release the accelerator pedal.	400 - 800 mV	Code No. 79	13A-158
			Depress the accelerator pedal gradually.	Increases in response to the pedal depression stroke.		
			Depress the accelerator pedal fully.	4,200 - 4,800 mV		
		Engine: Idling after warming-up	No load	450 - 1,000 mV		
			A/C switch: OFF to ON	Increases by 100 - 600 mV		
			Transmission: P to D range	Increases by 0 - 200 mV.		
99	Combustion mode	Engine: After having warmed up	Idling (several minutes after starting)	Compression lean	-	-
			2,500 r/min	Stoichiometric feedback		
			Race the engine suddenly while the engine is idling.	Open loop		

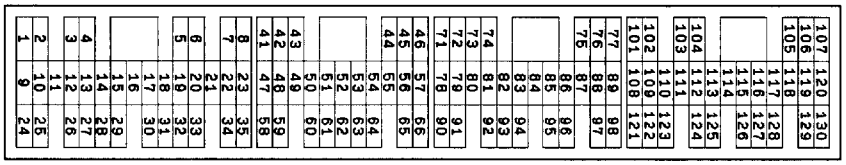
ACTUATOR TEST REFERENCE TABLE

Item No.	Inspection item	Drive Contents	Inspection contents		Normal condition	Inspection procedure No.	Reference page
01	Injector	Cut fuel to the No.1 injector.	Engine: Idling after warming-up (Cut the fuel supply to each injector in turn and check cylinders which does not affect idling.)		Idling condition becomes different (becomes unstable, or the engine stalls).	Code No. 41	13A-147
02		Cut fuel to the No.2 injector.					
03		Cut fuel to the No.3 injector.					
04		Cut fuel to the No.4 injector.					
05		Cut fuel to the No.5 injector.					
06		Cut fuel to the No.6 injector.					
07	Fuel pump (low-pressure)	Operates the fuel pump (low-pressure) to circulate fuel.	Ignition switch: ON	Pinch the return hose with fingers to feel the pulse of the fuel being circulated.	Pulse is felt.	Procedure No.29	13A-193
				Operating sound can be heard around the fuel tank.	Sound of operation can be heard		
08	Purge control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch: ON		Sound of operation can be heard when solenoid valve is driven.	Procedure No.36	13A-197
17	Basic ignition timing	Solenoid valve turns from OFF to ON.	● Engine: Idling ● Set a timing light.		5° BTDC	-	-
21	Condenser fan	Drive the fan motor	● Ignition switch: ON ● A/C switch: ON		Fan motor runs	Procedure No.21	13A-187
34	Electronic-controlled throttle valve system	Stop the throttle control servo	Ignition switch: ON		The throttle valve opens slightly	Code No. 91	13A-161

CHECK AT THE ENGINE-ECU TERMINALS

TERMINAL VOLTAGE CHECK CHART

Engine-A/T-ECU Connector Terminal Arrangement



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Terminal No.	Check item	Check condition (Engine condition)	Normal condition
1	No.1 injector	While engine is idling after having warmed up, suddenly depress the accelerator pedal.	From 9 - 13 V, momentarily drops slightly
9	No.2 injector		
24	No.3 injector		
2	No.4 injector		
10	No.5 injector		
25	No.6 injector		
3	Oxygen sensor heater	Engine: Idling	0 - 3 V
		Engine: 5,000 r/min	System voltage
6	Injector driver relay	Ignition switch: OFF	0 - 0.1 V
		Ignition switch: ON	0.5 - 1.0 V
8	Alternator G terminal	• Engine: Idling after warming-up • Radiator fan: Not operating • Headlamp: off to on • Stop lamp: off to on • Defogger switch: OFF to ON	The voltage increases by 0.2 - 3.5 V
54	Alternator FR terminal	• Engine: Idling after warming-up • Radiator fan: Not operating • Headlamp: off to on • Stop lamp: off to on • Defogger switch: OFF to ON	The voltage drops
11	No.1 ignition coil	Engine speed: 3,000 r/min	0.3 - 3.0 V
31	No.2 ignition coil		
13	No.3 ignition coil		
30	No.4 ignition coil		
12	No.5 ignition coil		
32	No.6 ignition coil		
14	Throttle control servo relay	Ignition switch: OFF	0 - 0.1 V
		Ignition switch: ON	0.5 - 1.0 V

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
18	Condenser fan relay	Condenser fan not operating		System voltage
		Condenser fan operating		0 - 3 V or more
19	Air flow sensor reset signal	Engine: Idling		0 - 1 V
		Engine speed: 3,000 r/min		6 - 9 V
20	A/C relay	• Engine: Idling • A/C switch: OFF to ON (Compressor operating)		System voltage or changes momentarily 6 V or more to 0 - 3 V
21	Fuel pump relay	Ignition switch: ON		System voltage
		Engine: Idling		0 - 3 V
22	Engine warning lamp	Ignition switch: OFF to ON		System voltage
23	GDI ECO indication lamp	Ignition switch: OFF to ON		0 - 3 V (system voltage after five seconds)
		Rev the engine suddenly.		System voltage
34	Purge control solenoid valve	• Engine coolant temperature: 80 - 95 °C • Ignition switch: ON	Engine: stopped	System voltage
			Engine: After starting, increase the engine speed up to 3,500 r/min	The voltage drops
41	Power supply	Ignition switch: ON		System voltage
47				
43	Engine ignition signal	Engine speed: 3,000 r/min		0.3 - 3.0 V
44	Engine coolant temperature sensor	Ignition switch: ON	When engine coolant temperature is 0°C	3.2 - 3.8 V
			When engine coolant temperature is 20°C	2.3 - 2.9 V
			When engine coolant temperature is 40°C	1.3 - 1.9 V
			When engine coolant temperature is 80°C	0.3 - 0.9 V
45	Crank angle sensor	Engine: Cranking		0.4 - 4.0 V
		Engine: Idling		1.5 - 2.5 V
46	Power supply voltage applied to accelerator pedal position sensor (1st channel)	Ignition switch: ON		4.5 - 5.5 V

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
49	Engine control relay	Ignition switch: OFF		0 - 3 V
		Ignition switch: ON		System voltage
51	EGR valve (A)	Ignition switch: OFF to ON		5 - 8 V (Repeatedly changes for approx. 3 seconds)
53	EGR valve (C)			
60	EGR valve (B)			
62	EGR valve (C)			
52	Power steering fluid pressure switch	Engine: Idling after warming-up	When steering wheel is stationary	System voltage
			When steering wheel is turned	0 - 3 V
55	Barometric pressure sensor	Ignition switch: ON	At an altitude of 0 m	3.7 - 4.3 V
			At an altitude of 1,200 m	3.2 - 3.8 V
56	Camshaft position sensor	Engine: Cranking		0.4 - 3.0 V
		Engine: Idling		0.5 - 2.0 V
58	Ignition switch-ST	Engine: Cranking		8 V or more
61	A/C switch 2	Refer to GROUP 55 - Troubleshooting (Check at A/C-ECU or Engine-ECU Terminal).		
63	Injector open circuit check signal	Engine: Increases from idling up to 4,000 r/min		The voltage decreases slightly (approx. 0.7 V) from 4.5 - 5.0 V.
64	Intake air temperature sensor	Ignition switch: ON	When intake air temperature is 0°C	3.2 - 3.8 V
			When intake air temperature is 20°C	2.3 - 2.9 V
			When intake air temperature is 40°C	1.5 - 2.1 V
			When intake air temperature is 80°C	0.4 - 1.0 V
65	Air flow sensor	Engine: Idling		2.2 - 3.2 V
		Engine speed: 2,500 r/min		
66	Backup power supply	Ignition switch: OFF		System voltage
71	Oxygen sensor	Engine: Running at 2,500 r/min after warming-up (Check by using a digital voltmeter.)		Voltages of 0 V and 0.8 V alternate

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
78	Throttle position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	4.0 V or higher
			Depress the accelerator pedal fully.	0.4 - 0.6 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 slowly forward		Voltages of 0 and 8 - 12 V alternate (changes repeatedly)
83	A/C switch 1	Engine: Idling	A/C switch: OFF	0 - 3 V
			A/C switch: ON (Compressor is operating)	System voltage
86	Small lamp switch	Lighting switch: OFF		0 - 3 V
		Lighting switch: Tail light position		System voltage
87	Sensor applied voltage	Ignition switch: ON		4.5 - 5.5 V
93	Fuel pressure sensor	Engine: Idling		0.3 - 4.7 V
95	Accelerator pedal position sensor (1st channel)	Ignition switch: ON	Release the accelerator pedal.	0.985 - 1.085 V
			Depress the accelerator pedal fully.	4.0 V or higher
98	Ignition switch-IG	Ignition switch: ON		System voltage
123	Stop lamp switch	Depress the brake pedal.		System voltage
		Release the brake pedal.		0 - 3 V

CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

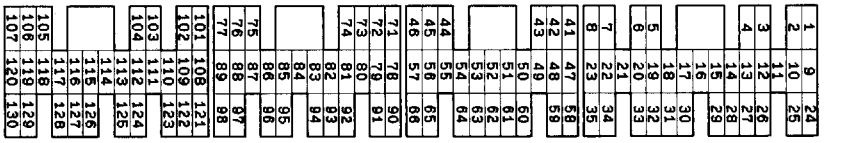
1. Turn the ignition switch to OFF.
2. Disconnect the engine-A/T-ECU connector.
3. Measure the resistance and check for continuity between the terminals of the engine-A/T-ECU harness-side connector while referring to the check chart.

   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-A/T-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-A/T-ECU Harness Side Connector Terminal Arrangement

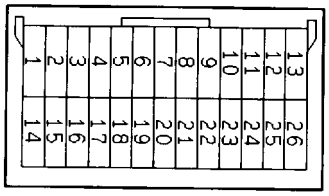


Terminal No.	Check item	Standard value, normal condition (check conditions)
3 - 41	Oxygen sensor heater	4.5 - 8.0 Ω (at 20°C)
34 - 41	Purge control solenoid valve	28 - 36 Ω (at 20°C)
42 - body earth	Earth	Continuity (0 Ω)
48 - body earth		
51 - 41	EGR valve (A)	15 - 20 Ω (at 20°C)
53 - 41	EGR valve (C)	
60 - 41	EGR valve (B)	
62 - 41	EGR valve (D)	
44 - 81	Engine coolant temperature sensor	5.1 - 6.5 kΩ (When coolant temperature is 0°C)
		2.1 - 2.7 kΩ (When coolant temperature is 20°C)
		0.9 - 1.3 kΩ (When coolant temperature is 40°C)
		0.26 - 0.36 kΩ (When coolant temperature is 80°C)
64 - 81	Intake air temperature sensor	5.3 - 6.7 kΩ (When intake air temperature is 0°C)
		2.3 - 3.0 kΩ (When intake air temperature is 20°C)
		1.0 - 1.5 kΩ (When intake air temperature is 40°C)
		0.30 - 0.42 kΩ (When intake air temperature is 80°C)
79 - 81	Accelerator pedal position switch	Continuity (when the accelerator pedal is released)
		No continuity (when the accelerator pedal is depressed slightly)

CHECK AT THROTTLE VALVE CONTROLLER TERMINALS

TERMINAL VOLTAGE CHECK CHART

Throttle Valve Controller Terminal Arrangement



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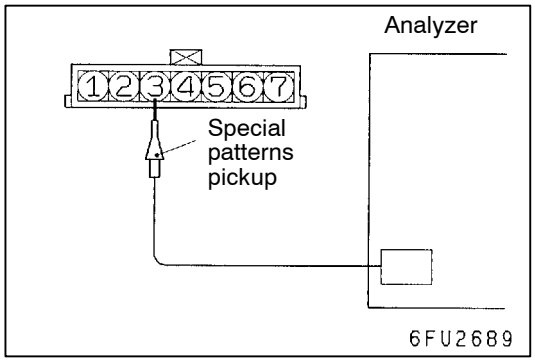
Terminal No.	Check item	Check condition (Engine condition)		Normal condition
1	Throttle control servo (U)	• Ignition switch: ON • Accelerator pedal: From released position to fully depressed position		Changes
14	Throttle control servo (V)			
15	Throttle control servo (W)			
2	Throttle control servo power supply	Ignition switch: ON		System voltage
5	Power supply	Ignition switch: ON		System voltage
6	Sensor applied voltage	Ignition switch: ON		4.5 - 5.5 V
7	Throttle position sensor (1st channel)	Ignition switch: ON	Release the accelerator pedal.	0.4 - 0.8 V
			Depress the accelerator pedal fully.	4.2 - 4.8 V
18	Backup power supply	Ignition switch: OFF		System voltage
20	Accelerator pedal position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	0.985 - 1.085 V
			Depress the accelerator pedal fully.	4.0 V or higher
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)

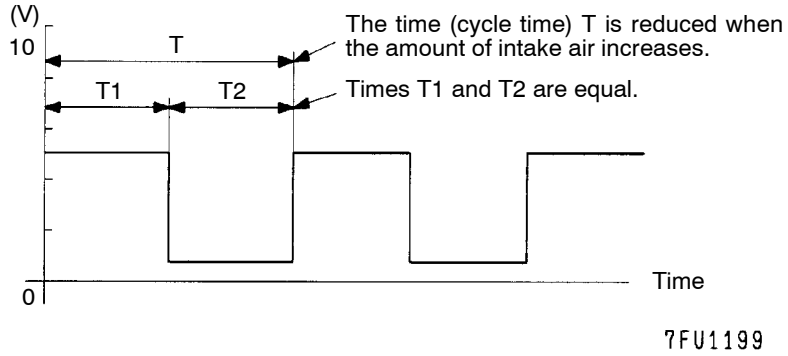
1. Connect the analyzer special patterns pickup to engine-A/T-ECU terminal 65.

Standard Wave Pattern

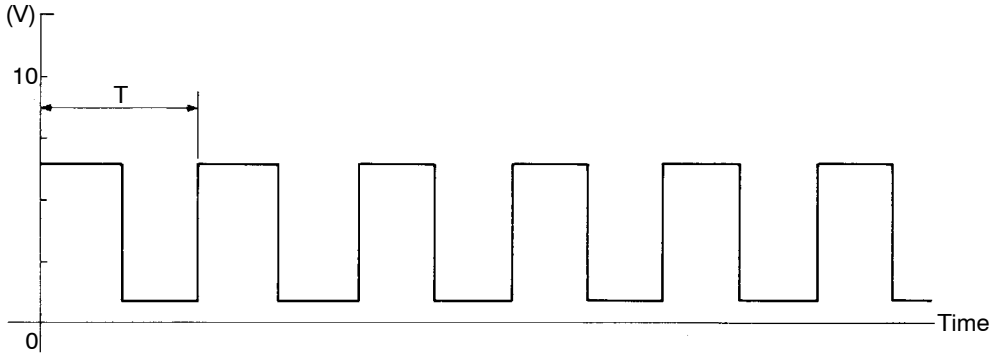
Observation conditions

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

Standard wave pattern

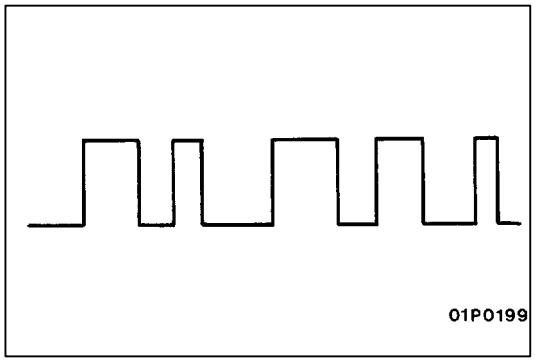


Observation conditions (from conditions above engine speed is increased by racing.)



Wave Pattern Observation Points

Check that cycle time T becomes shorter and the frequency increases when the engine speed is increased.



Examples of Abnormal Wave Patterns

- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

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

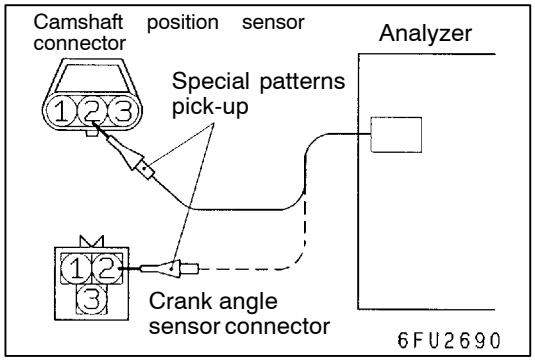
- Example 2

  Cause of problem

  Damaged rectifier or vortex generation column

  Wave pattern characteristics

  Unstable wave pattern with non-uniform frequency. However, when an ignition leak occurs during acceleration, the wave pattern will be distorted temporarily, even if the air flow sensor is normal.



CAMSHAFT POSITION SENSOR AND CRANK ANGLE SENSOR

Measurement Method

1. Disconnect the camshaft position sensor connector and connect the special tool (test harness: MB991709) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to camshaft position sensor terminal 2.
3. Disconnect the crank angle sensor connector and connect the special tool (test harness: MD998478) in between.
4. Connect the analyzer special patterns pickup to crank angle sensor terminal 2.

Alternate Method (Test harness not available)

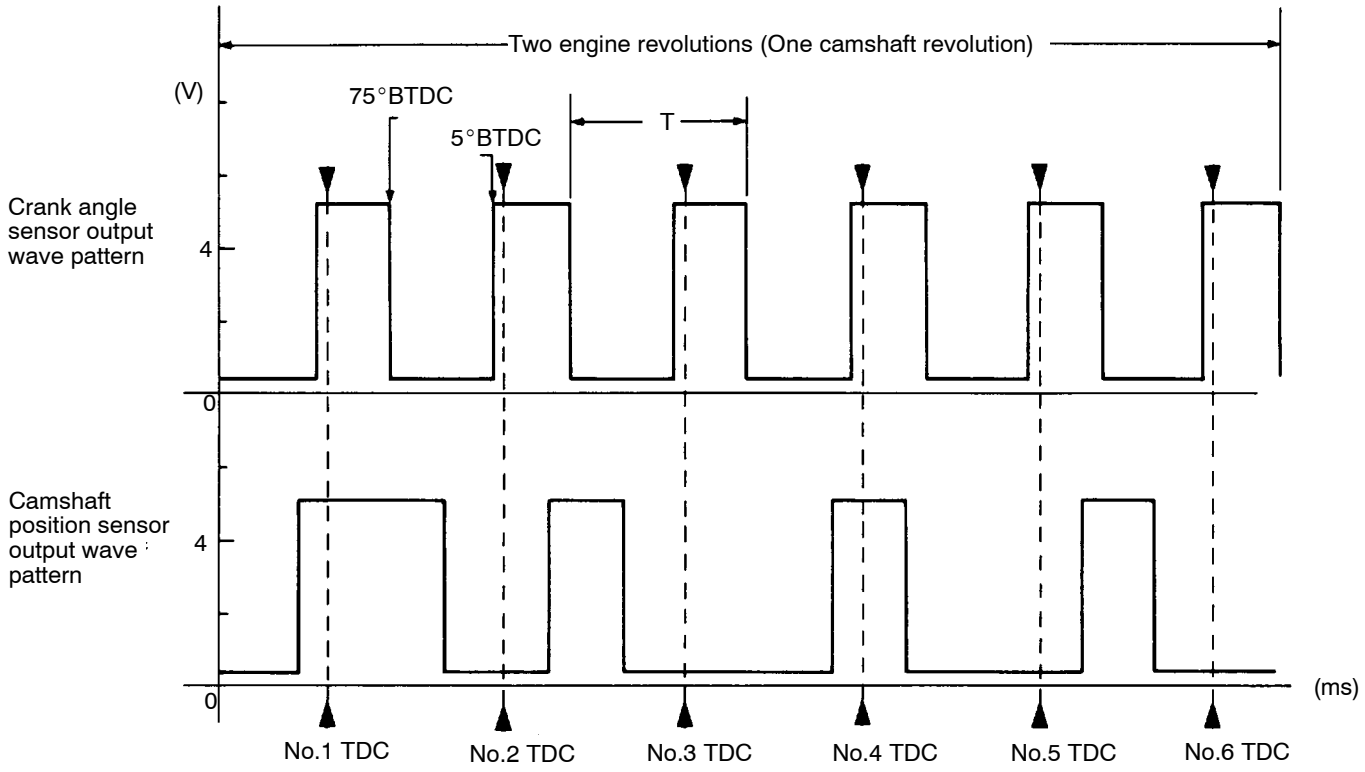
1. Connect the analyzer special patterns pickup to engine-A/T-ECU terminal 56. (When checking the camshaft position sensor signal wave pattern.)
2. Connect the analyzer special patterns pickup to engine-A/T-ECU terminal 45. (When checking the crank angle sensor signal wave pattern.)

Standard Wave Pattern

Observation conditions

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

Standard wave pattern



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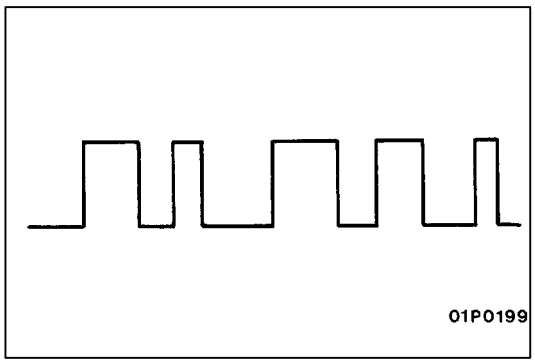
Wave Pattern Observation Points

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



Examples of Abnormal Wave Patterns

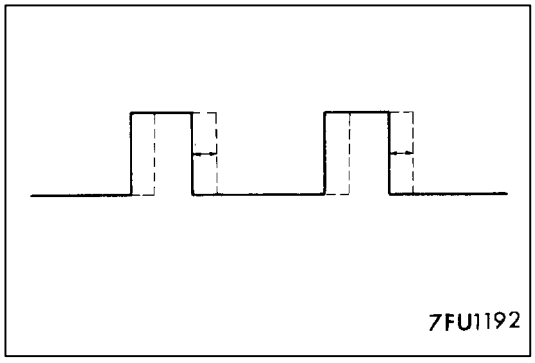
- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

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



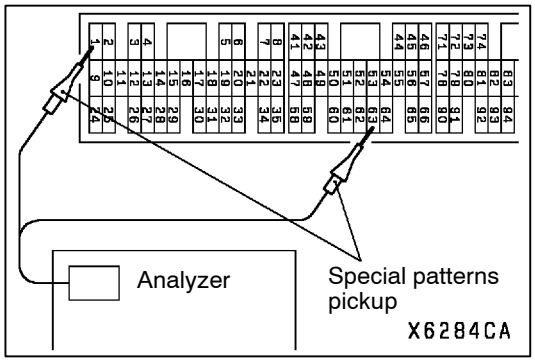
- Example 2

  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

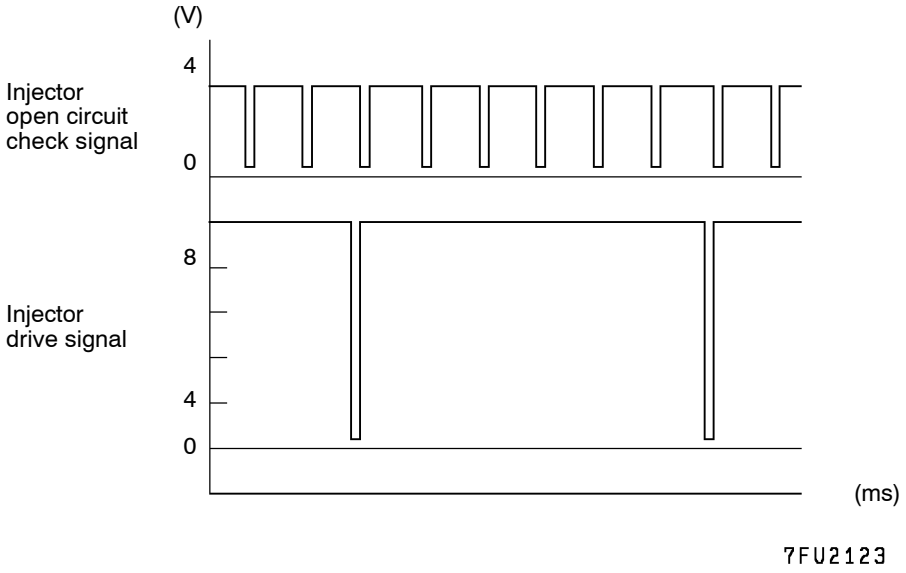
1. Connect the analyzer special patterns pickup to terminal 1 (No.1 injector) of the engine-A/T-ECU connector.
2. Connect the analyzer special patterns pickup to terminal 63 (injector open circuit check signal) of the engine-ECU connector.
3. After checking terminal 1, check terminal 9 (No.2 injector), terminal 24 (No.3 injector), terminal 2 (No.4 injector), terminal 10 (No.5 injector) and terminal 25 (No.6 injector).

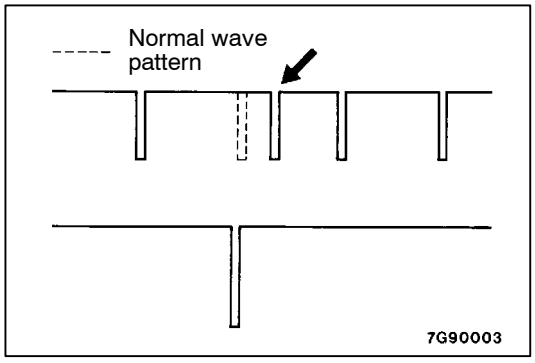
Standard Wave Pattern

Observation conditions

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

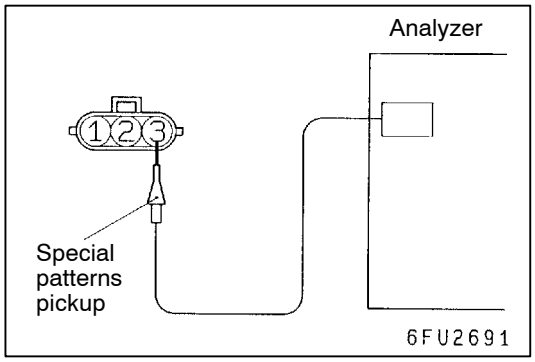
Standard wave pattern





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)

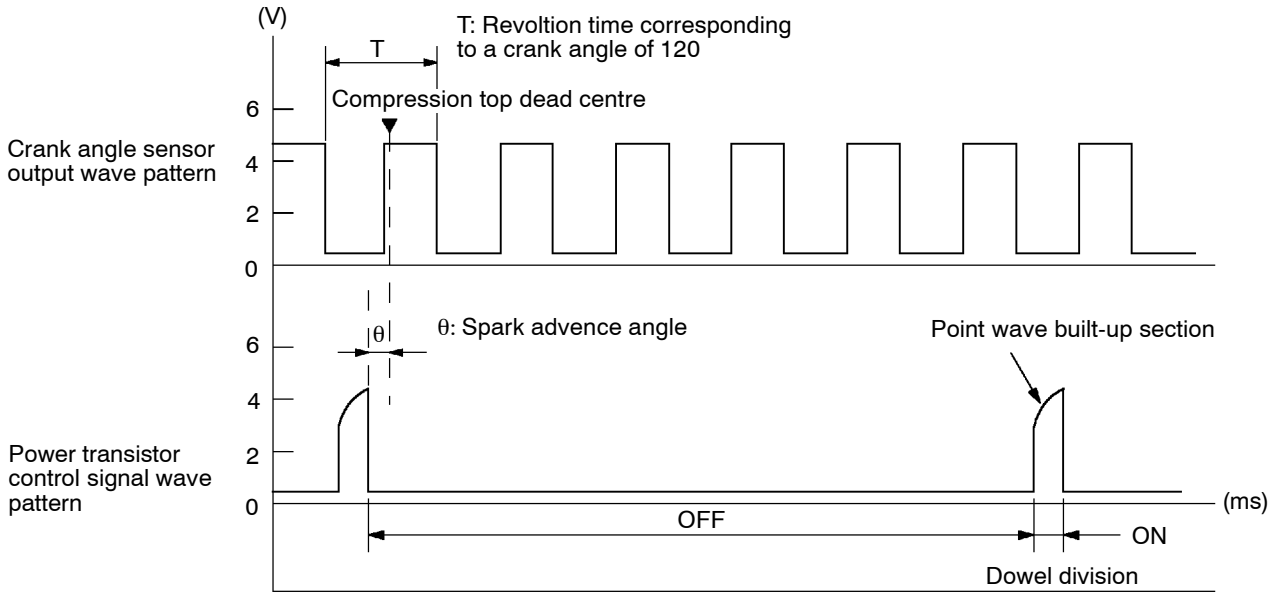
1. Connect the analyzer special patterns pickup to engine-A/T-ECU terminal 11 (No. 1 ignition coil), terminal 31 (No. 2 ignition coil), terminal 13 (No. 3 ignition coil), terminal 30 (No. 4 ignition coil), terminal 12 (No.5 ignition coil) and terminal 32 (No.6 ignition coil) respectively.

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



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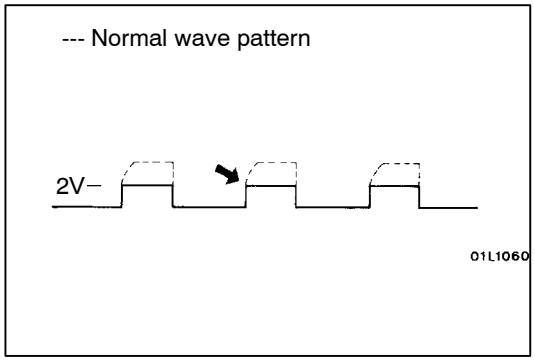
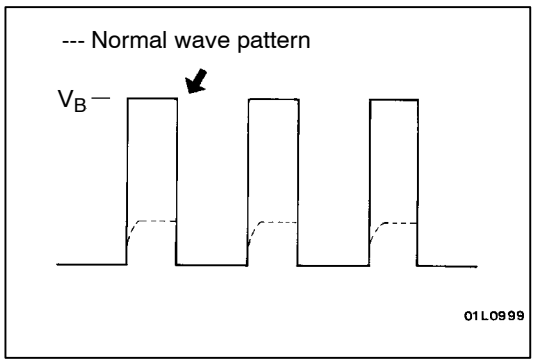
Wave Pattern Observation Points

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

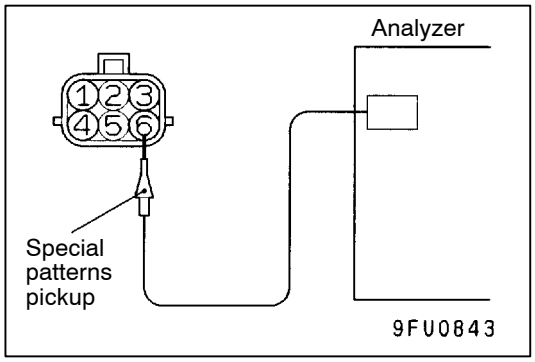
  Wave pattern during engine cranking

  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)

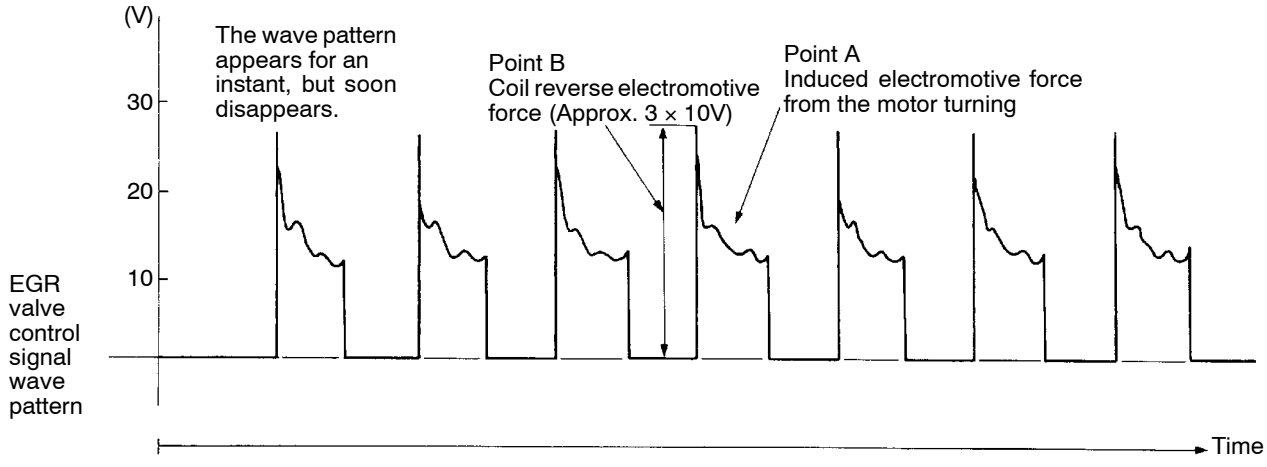
1. Connect the analyzer special patterns pickup to engine-A/T-ECU terminal 51, connection terminal 60, connection terminal 53, and connection terminal 62 respectively.

Standard Wave Pattern

Observation conditions

Function	Special patterns
Pattern height	High
Pattern selector	Display
Engine condition	When the engine coolant temperature is 20°C or below, turn the ignition switch from OFF to ON (without starting the engine).
	While the engine is idling, turn the A/C switch to ON.
	Immediately after starting the warm engine

Standard wave pattern



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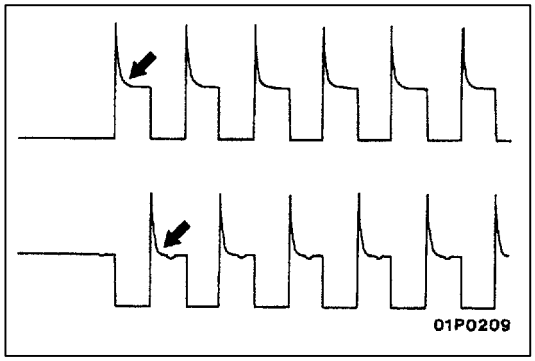
Wave Pattern Observation Points

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

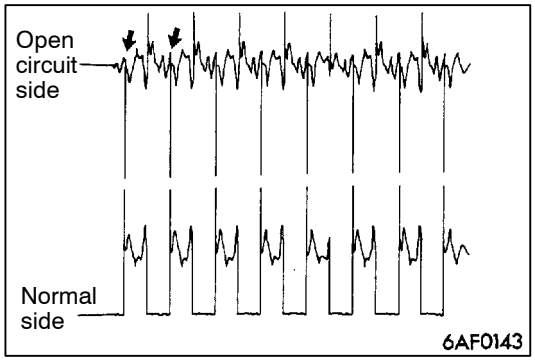
- Example 1

  Cause of problem

  Motor is malfunctioning. (Motor is not operating.)

  Wave pattern characteristics

  Induced electromotive force from the motor turning does not appear.



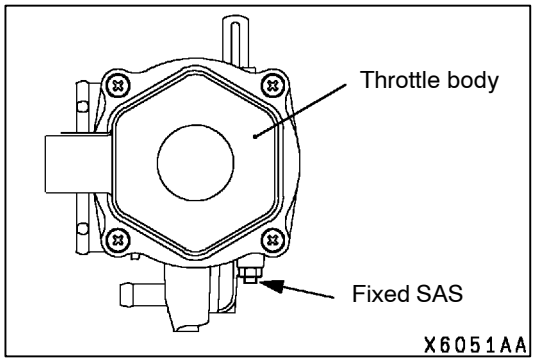
- Example 2

  Cause of problem

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

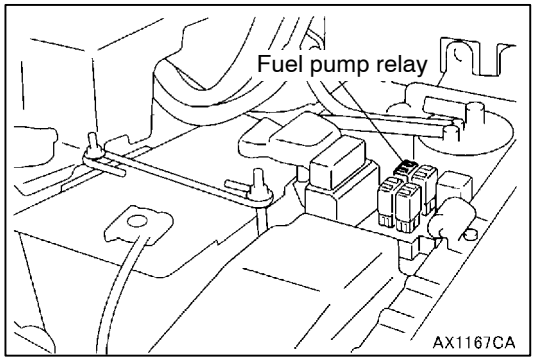
  Wave pattern characteristics

  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.



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.

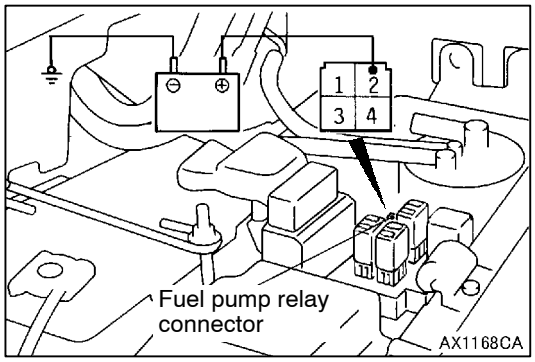
1. Remove the fuel filler cap to release pressure in the fuel tank.
2. Remove the fuel pump relay.
3. Connect the MUT-II to the diagnosis connector.

   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 (LOW PRESSURE) CHECK

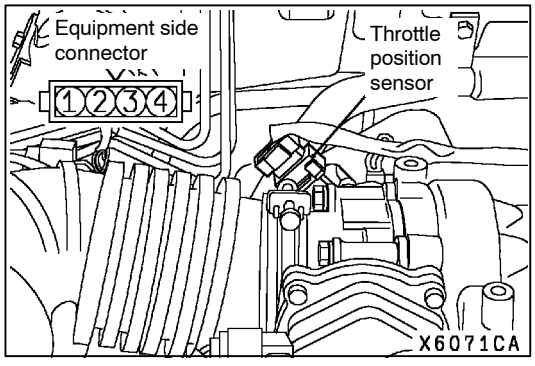
1. Check the operation of the fuel pump by using the MUT-II to force-drive the fuel pump.
2. If the fuel pump will not operate, check by using the following procedure, and if it is normal, check the drive circuit.
   (1) Turn the ignition switch to the LOCK (OFF) position.
   (2) Remove the fuel pump relay. Connect the terminal No.2 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.

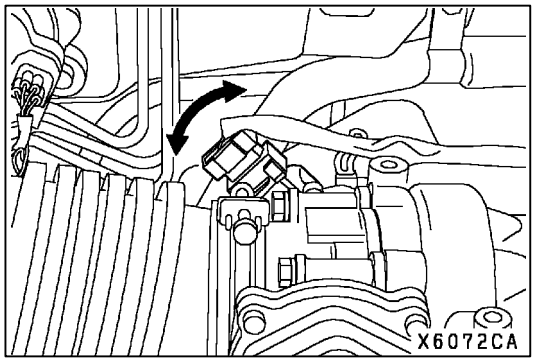
THROTTLE BODY (THROTTLE VALVE AREA) CLEANING

1. Start the engine, and warm it up until engine coolant temperature reaches 80°C. Then stop the engine.
2. Remove the air intake hose at the throttle body side.
3. Apply cleaning agent to the throttle valve through the intake port of the throttle valve, and then leave it for approx. five minutes.
4. Start the engine, race it several times, and then let it run at idle for approx. one minute.
5. If carbon deposits are not removed from the throttle vale area, repeat steps (3) and (4).
6. Install the air intake hose.
7. Use the MUT-II or disconnect the negative battery cable from the battery terminal in order to erase a diagnosis code. Wait for at least ten seconds, and then let the engine run at idle again for approx. ten minutes.



THROTTLE POSITION SENSOR (TPS) ADJUSTMENT

1. Connect the MUT-II to the diagnosis connector.



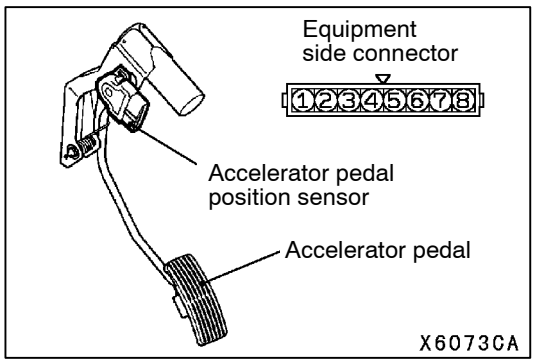
2. Check the output voltage of throttle position sensor (1st channel) while closing the throttle valve fully with your finger.

   Standard value: 0.4 - 0.6 V

3. If outside the standard value, loosen the throttle position sensor mounting bolts, and adjust the throttle position sensor by rotating it.
4. Check the output voltage of throttle position sensor (2nd channel) while closing the throttle valve fully with your finger.

   Standard value: 4.2 - 4.8 V

5. If outside the standard value, replace the throttle position sensor.
6. Turn the ignition switch to the LOCK (OFF) position.
7. Connect the throttle control servo connector.
8. Remove the MUT-II.
9. If a diagnosis code is set, erase it by using the MUT-II or by disconnecting the negative battery cable for ten seconds or more, reconnecting it.
10. Turn the ignition switch to the ON position, and then return it to the LOCK (OFF) position. Then maintain that condition for ten seconds or more.)
    If the negative battery cable is disconnected at step 11, let the engine run at idle for ten minutes.

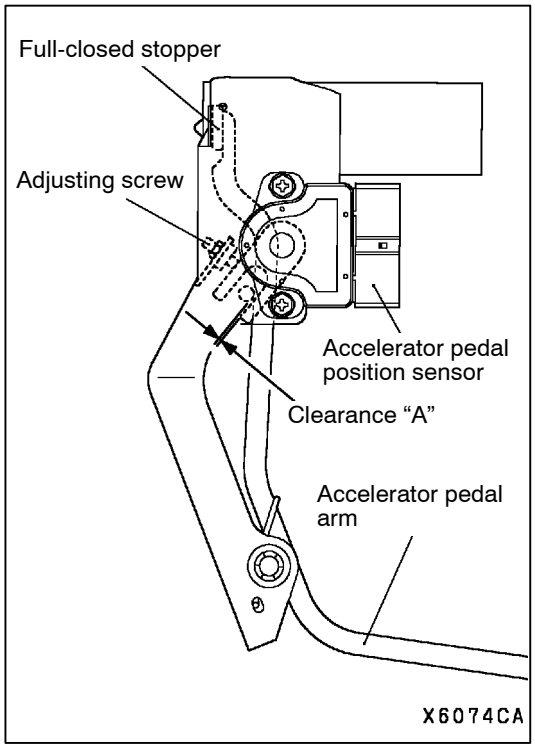


ACCELERATOR PEDAL POSITION SENSOR ADJUSTMENT

Caution

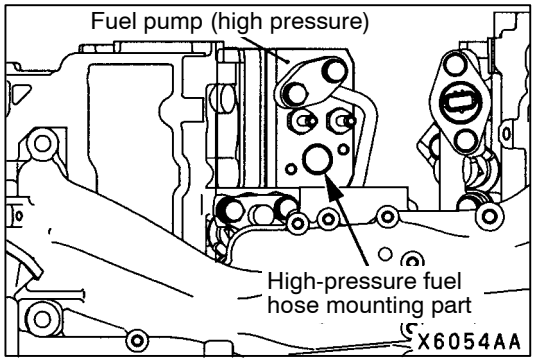
1. **The Accelerator pedal position sensor should not be moved unnecessarily; it has been precisely adjusted by the manufacturer.**
2. **If the adjustment is disturbed for any reason, readjust as follows.**

1. Remove the accelerator pedal complete.
2. Connect the MUT-II to the diagnosis connector.



3. Check that the accelerator pedal arm touches the full-closed stopper.
4. Adjust the pedal arm by the adjusting screw so that clearance “A” (see the illustration) is 0.5 - 0.93 mm.
5. Hold the adjusting screw with the lock nut.
6. Turn the ignition switch to the ON position. (but do not start the engine.)
7. Turn the accelerator pedal position sensor until the output from accelerator pedal position sensor (1st channel) satisfies the standard value.

   Standard value: 0.985 - 1.085 V
8. Tighten the accelerator pedal position sensor mounting bolts securely.
9. Install the accelerator pedal complete.

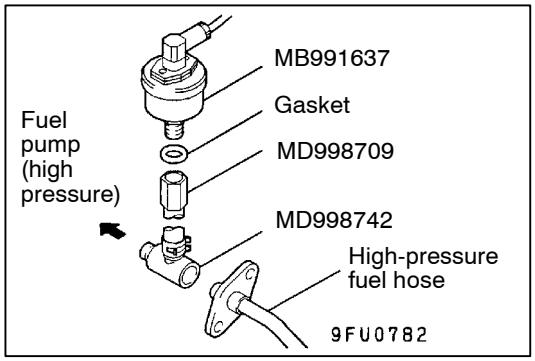


FUEL PRESSURE TEST

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-225.)
2. Disconnect the high-pressure fuel hose at the fuel pump (high pressure) side.

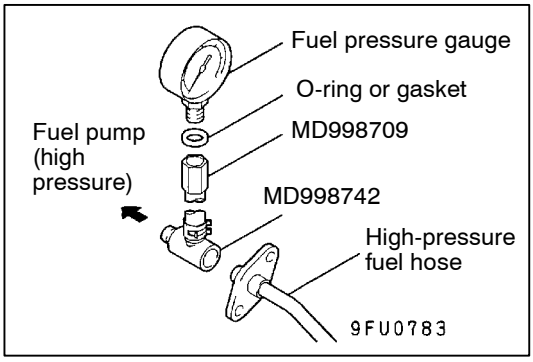
   Caution
   Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.



3. Remove the union joint and bolt from the special tool (adapter hose) and instead attach the special tool (hose adapter) to the adapter hose.
4. Install the special tool (for measuring the fuel pressure) that was set up in step 3.

   <When using the fuel pressure gauge set (special tool)>
   (1) Install the special tool (for measuring the fuel pressure) between the high-pressure fuel hose and the fuel pump (high pressure).

(2) Install the fuel pressure gauge set (special tool) on the special tool (for measuring the fuel pressure) putting the gasket between them.
(3) Connect the lead wire of the fuel pressure gauge set (special tool) to the power supply (cigarette lighter socket) and to the MUT-II.



<When using the fuel pressure gauge>
(1) Install the fuel pressure gauge on the special tool (for measuring the fuel pressure) putting a suitable O-ring or gasket between them.
(2) Install the special tool which was set up in step (1) between the high-pressure fuel hose and the fuel pump (high pressure).

5. Connect the MUT-II to the diagnosis connector.

Caution
Turn off the ignition switch before disconnecting or connecting the MUT-II.

6. Turn the ignition switch to ON. (But do not start the engine.)
7. Select "Item No.07" from the MUT-II Actuator test to drive the fuel pump (low pressure) at the fuel tank side. Check that there are no fuel leaks from any parts.
8. Finish the actuator test or turn the ignition switch to OFF.
9. Start the engine and run at idle.
10. Measure fuel pressure while the engine is running at idle.

Standard value: approximately 329 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

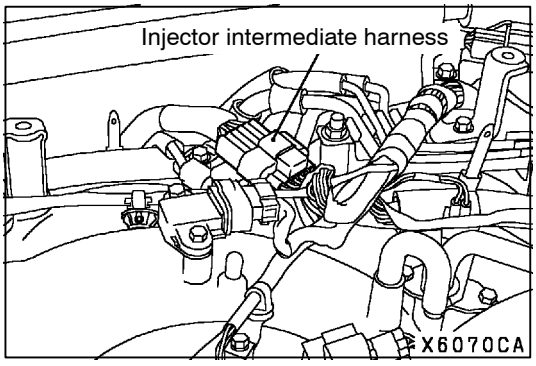
13. Stop the engine and check change of fuel pressure gauge reading. Normal if the reading does not drop within 2 minutes. If it does, observe the rate of drop and troubleshoot and repair according to the table below.

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-225.)
15. Remove the fuel pressure gauge and special tools from the fuel pump (high pressure).

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

16. Replace the O-ring at the end of the high-pressure fuel hose with a new one. Furthermore, apply engine oil to the new O-ring before replacement.
17. Fit the high-pressure fuel hose to the fuel pump (high pressure) and tighten the mounting bolt to specified torque.
18. Check for any fuel leaks by following the procedure in step 7.
19. Disconnect the MUT-II.



MEASUREMENT OF FUEL HIGH PRESSURE BETWEEN FUEL PUMP (HIGH PRESSURE) AND INJECTORS

NOTE
Measurement of the fuel pressure between the fuel pump (high pressure) and the injectors should be carried out after checking that the fuel pressure between the fuel pump (low pressure) and the fuel pump (high pressure) is normal.

1. Connect the MUT-II to the diagnosis connector.
2. Disconnect the injector intermediate harness connector.
3. Turn the ignition switch to ON.
4. Select “Item No.74” from the MUT-II Data list.
5. Crank the engine continuously for 2 seconds or more, and visually check that there are no fuel leaks from any parts.

   Caution
   If any fuel leaks appear, stop cranking immediately and repair the source of the leak.

6. Check if the fuel pressure is more than 1 MPa immediately after 20 seconds have passed since cranking was finished.

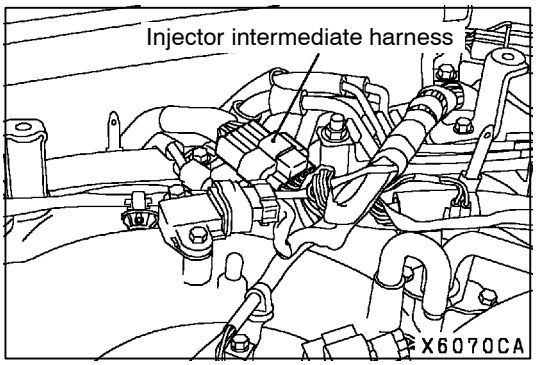
7. If the fuel pressure is lower than 1 MPa, it means that there is likely to be a leak in the high-pressure fuel system, so this system should be checked.
8. Turn the ignition switch to OFF.
9. Connect the injector intermediate harness connector.
10. Start the engine and run at idle.
11. Measure fuel pressure while the engine is running at idle.

    Standard value: 4 - 6.9 MPa

12. Check to see that fuel pressure at idle does not drop even after the engine has been raced several times.
13. If fuel pressure is out of the standard value, troubleshoot and repair according to the table below.

Symptom	Probable cause	Remedy
• Fuel pressure too low • Fuel pressure drops after racing	Fuel leaking to return side due to poor fuel pressure regulator (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

14. Stop the engine and turn the ignition switch to OFF.
15. 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.

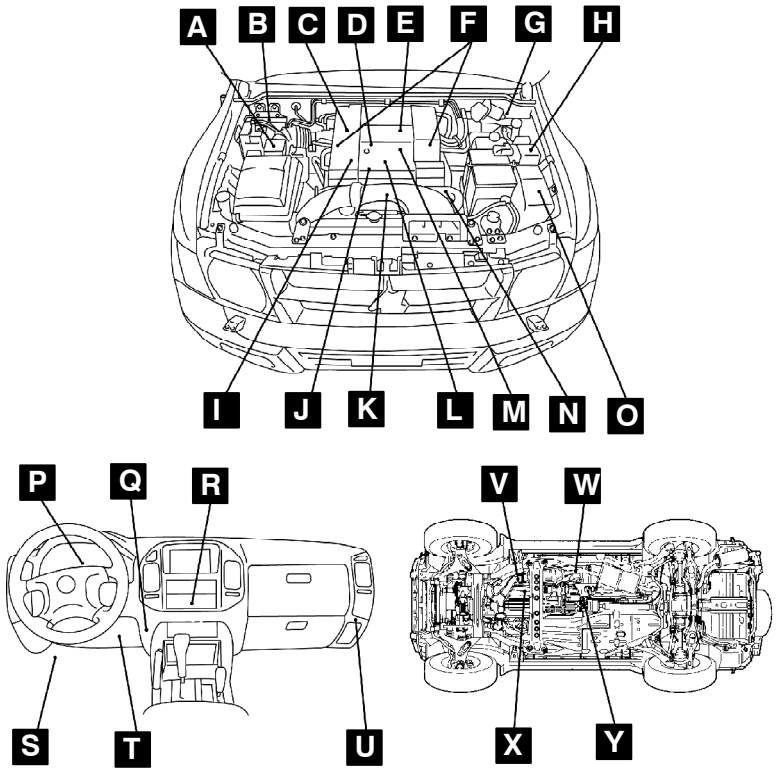
   Limit: Minimum 1 MPa

   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.

COMPONENT LOCATION

Name	Symbol	Name	Symbol
A/C relay	O	Fuel pump relay	H
A/C switch	R	Ignition coil	F
Accelerator pedal position sensor (1st and 2nd channels)	T	Ignition failure sensor	D
		Inhibitor switch <A/T>	X
Air flow sensor (with intake air temperature sensor and barometric pressure sensor)	A	Injectors	F
		Injector driver (L.H.D)	B
Camshaft position sensor	E	Injector driver (R.H.D)	G
Clutch switch <M/T>	S	Injector driver relay	H
Crank angle sensor	K	Oxygen sensor (front)	V
Detonation sensor	L	Oxygen sensor (rear) <M/T>	W
Diagnosis connector	Q	Power steering fluid pressure switch	N
EGR valve	I	Purge control solenoid valve	M
Engine control relay	H	Throttle position sensor	C
Engine coolant temperature sensor	J	Throttle valve controller	U
Engine-A/T-ECU <A/T>	U	Throttle valve control servo	C
Engine-ECU <M/T>	U	Throttle valve control servo relay	H
Engine warning lamp (CHECK ENGINE lamp)	P	Vehicle speed sensor	Y
Fuel pressure sensor	E		



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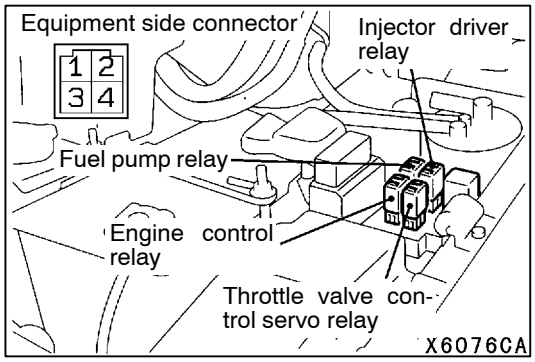
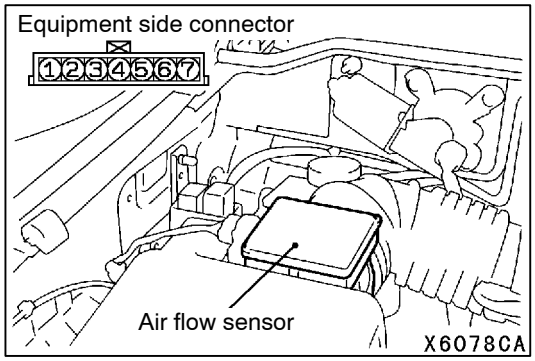


ENGINE CONTROL RELAY, FUEL PUMP RELAY, INJECTOR DRIVER CONTROL RELAY AND THROTTLE VALVE CONTROL SERVO RELAY CONTINUITY CHECK

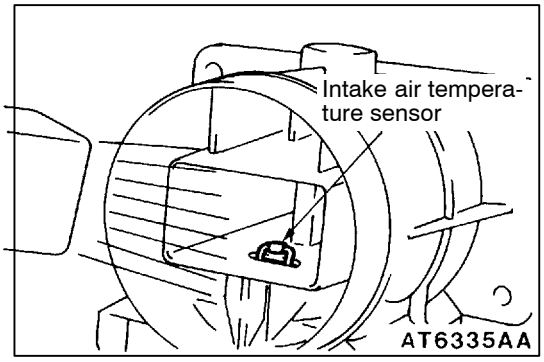
Battery voltage	Terminal No.			
	1	2	3	4
Not supplied		○		○
Supplied	○	⊖	○	⊕



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)

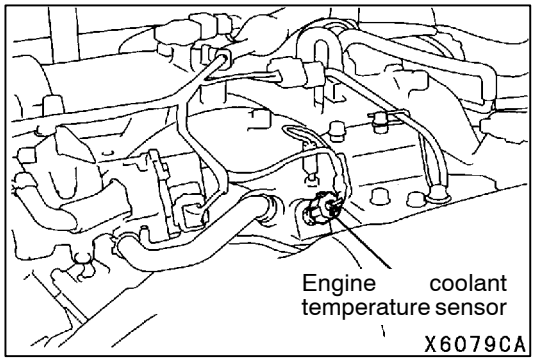


3. Measure resistance while heating the sensor using a hair drier.

   Normal condition:

Temperature (°C)	Resistance (kΩ)
Higher	Smaller

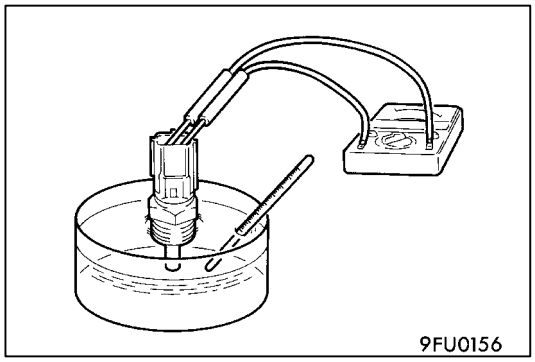
4. If the value deviates from the standard value or the resistance remains unchanged, replace the air flow sensor assembly.



ENGINE COOLANT TEMPERATURE SENSOR CHECK

Caution
Be careful not to touch the connector (resin section) with the tool when removing and installing.

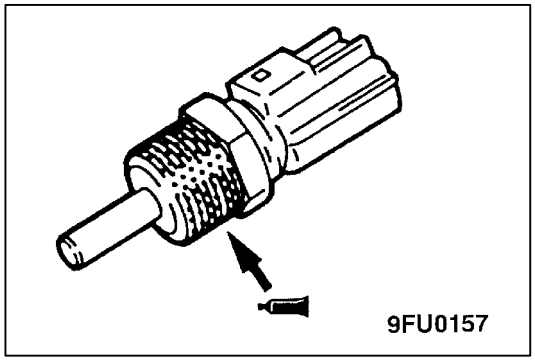
1. Remove the engine coolant temperature sensor.



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.

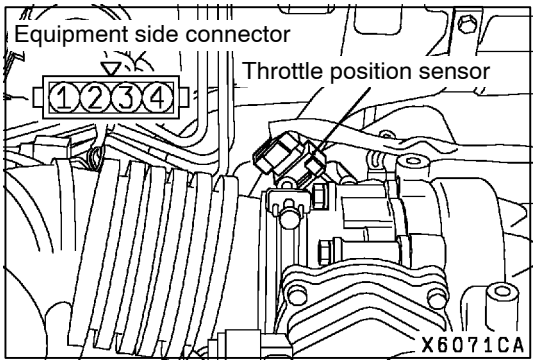


4. Apply sealant to threaded portion.

   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 N·m



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: 0.9 - 2.5 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

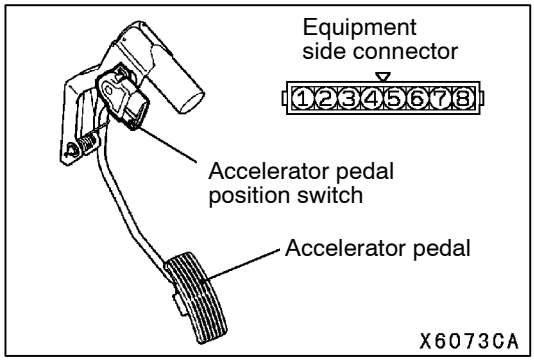
4. If the resistance is outside the standard value, or if it doesn't change smoothly, replace the throttle position sensor.

   NOTE
   For the throttle position sensor adjustment procedure, refer to P.13A-220.

ACCELERATOR PEDAL POSITION SENSOR CHECK

1. Disconnect the accelerator pedal position sensor connector.
2. Measure the resistance between accelerator pedal position sensor connector terminal (1) [accelerator pedal position sensor (1st channel) earth] and terminal (2) [accelerator pedal position sensor (1st channel) power supply], and between terminal (7) [accelerator pedal position sensor (2nd channel) earth] and terminal (8) [accelerator pedal position sensor (2nd channel) power supply].

   Standard value: 3.5 - 6.5 kΩ



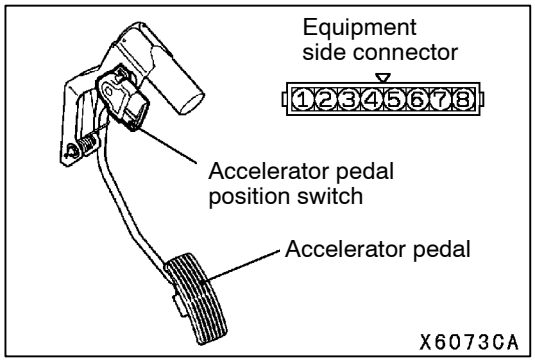
3. Measure the resistance between accelerator pedal position sensor connector terminal (2) [accelerator pedal position sensor (1st channel) power supply] and terminal (3) [accelerator pedal position sensor (1st channel) output]; and between terminal (8) [accelerator pedal position sensor (2nd channel) power supply] and terminal (6) [accelerator pedal position sensor (2nd channel) output].

   Normal condition:

When accelerator pedal is gently depressed	Changes comparatively smoothly in proportion to the accelerator pedal depression amount

4. If the measured values are outside the standard value range, or if the resistance does not change smoothly, replace the accelerator pedal position sensor.

   NOTE
   After replacement, adjust the accelerator pedal position sensor. (Refer to P.13A-221.)



ACCELERATOR PEDAL POSITION SWITCH CHECK

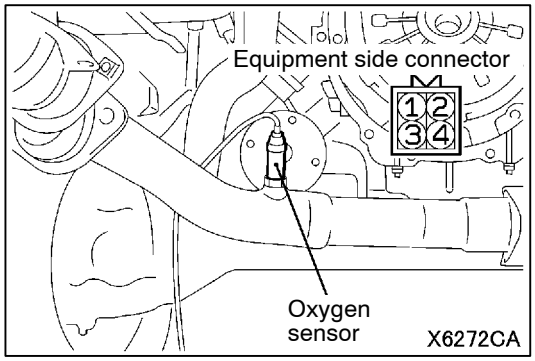
1. Disconnect the accelerator pedal position sensor (1st channel) connector.
2. Check continuity between terminal Nos. 4 (accelerator pedal position switch) and 5 (sensor earth) of the connector.

Normal condition

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

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

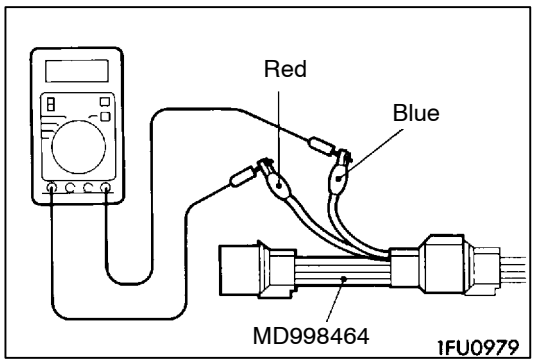
NOTE
After replacement, adjust the accelerator pedal position sensor and switch. (Refer to P.13A-221.)



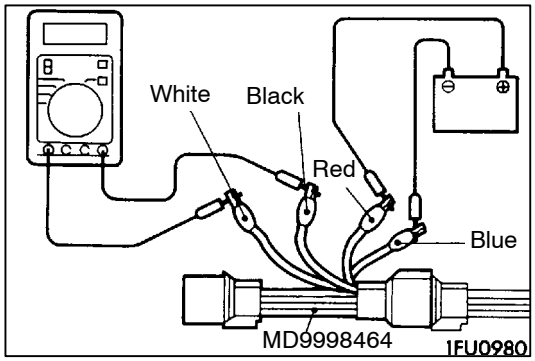
OXYGEN SENSOR CHECK

<Oxygen sensor (front)>

1. Disconnect the oxygen sensor connector and connect the special tool (test harness) to the connector on the oxygen sensor side.
2. Make sure that there is continuity (4.5 - 8.0 Ω at 20°C) between terminal 2 (red clip of special tool) and terminal 4 (blue clip of special tool) on the oxygen sensor connector.



3. If there is no continuity, replace the oxygen sensor.
4. Warm up the engine until engine coolant is 80°C or higher.



5. Use a jumper wire to connect terminal 1 (red clip) of the oxygen sensor connector to the battery (+) terminal and terminal 3 (blue clip) to the battery (-) terminal.

Caution
Be very careful when connecting the jumper wire; incorrect connection can damage the oxygen sensor.

6. Connect a digital voltage meter between terminal 2 (black clip) and terminal 4 (white clip).

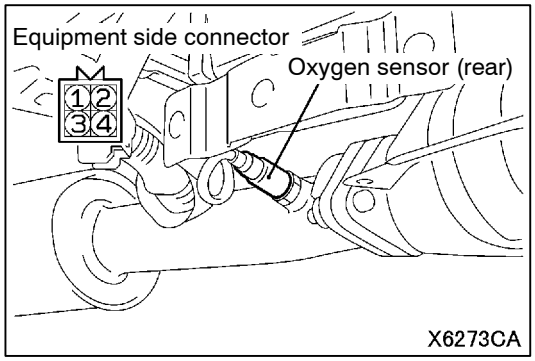
7. While repeatedly racing the engine, measure the oxygen sensor output voltage.

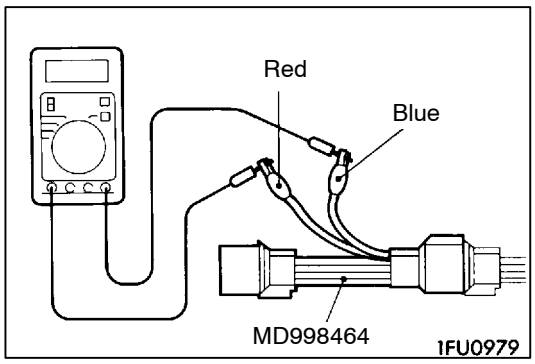
Standard value:

Engine	Oxygen sensor output voltage	Remarks
When racing the engine	0.6 - 1.0 V	If you make the air/fuel ratio rich by racing the engine repeatedly, a normal oxygen sensor will output a voltage of 0.6 - 1.0 V.

8. If the sensor is defective, replace the oxygen sensor.

NOTE
For removal and installation of the oxygen sensor, refer to GROUP 15 - Exhaust Pipe and Main Muffler.

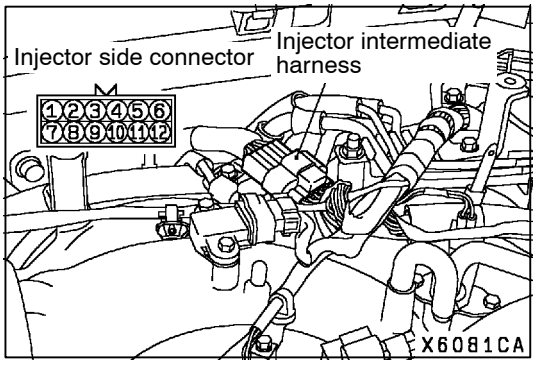




<Oxygen sensor (rear) M/T only>

1. Disconnect the oxygen sensor connector and connect the special tool (test harness set) to the connector on the oxygen sensor side.
2. Make sure that there is continuity (4.5 - 8.0 Ω at 20°C) between terminal 2 and terminal 4 on the oxygen sensor connector.
3. If there is no continuity, replace the oxygen sensor.

NOTE
(1) If the MUT-II does not display the standard value although no abnormality is found by the above mentioned continuity test and harness check, replace the oxygen sensor (rear).
(2) For removal and installation of the oxygen sensor, refer to GROUP 15 - Exhaust Pipe and Main Muffler.



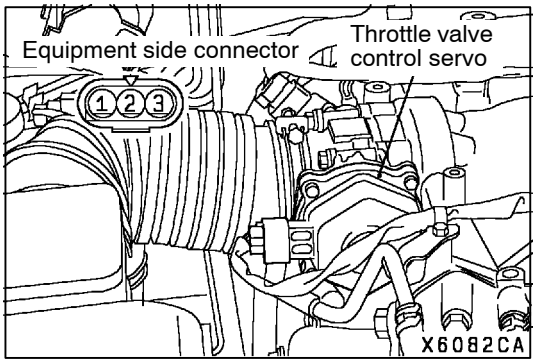
INJECTOR CHECK

1. Disconnect the injector intermediate harness connector.
2. Measure the resistance between each of the terminals.

Standard value: 0.9 - 1.1 Ω (at 20°C)

Injector	Measurement terminal
No.1 cylinder	11 - 12
No.2 cylinder	5 - 6
No.3 cylinder	9 - 10
No.4 cylinder	3 - 4
No.5 cylinder	7 - 8
No.6 cylinder	1 - 2

3. Connect the injector intermediate harness connector.



THROTTLE VALVE CONTROL SERVO CHECK

Operation Check

1. Disconnect the air intake hose from the throttle body.
2. Turn on the ignition switch.
3. Check that the throttle valve opens or closes in response to the accelerator pedal depression.

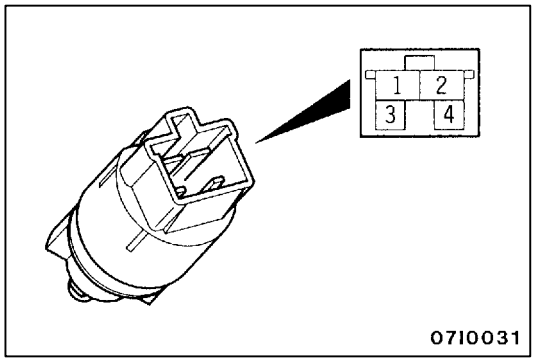
Check of Coil Resistance

1. Disconnect the throttle valve control servo connector.
2. Measure resistance between the throttle valve control servo connector terminals.

Standard value:

Terminals to be measured	Resistance value (Ω)
1 - 2	0.6 - 1.0 (at 20°C)
1 - 3	
2 - 3	

3. Check that there is no continuity between the terminals and body.



CLUTCH SWITCH CHECK

1. Disconnect the connector.
2. Check for continuity between the terminals of the switch.

Measurement conditions	Terminal No.	
	1	2
When clutch pedal is depressed.	○	○
When clutch pedal is not depressed.		

PURGE CONTROL SOLENOID VALVE CHECK

Refer to GROUP 17 - Emission Control System.

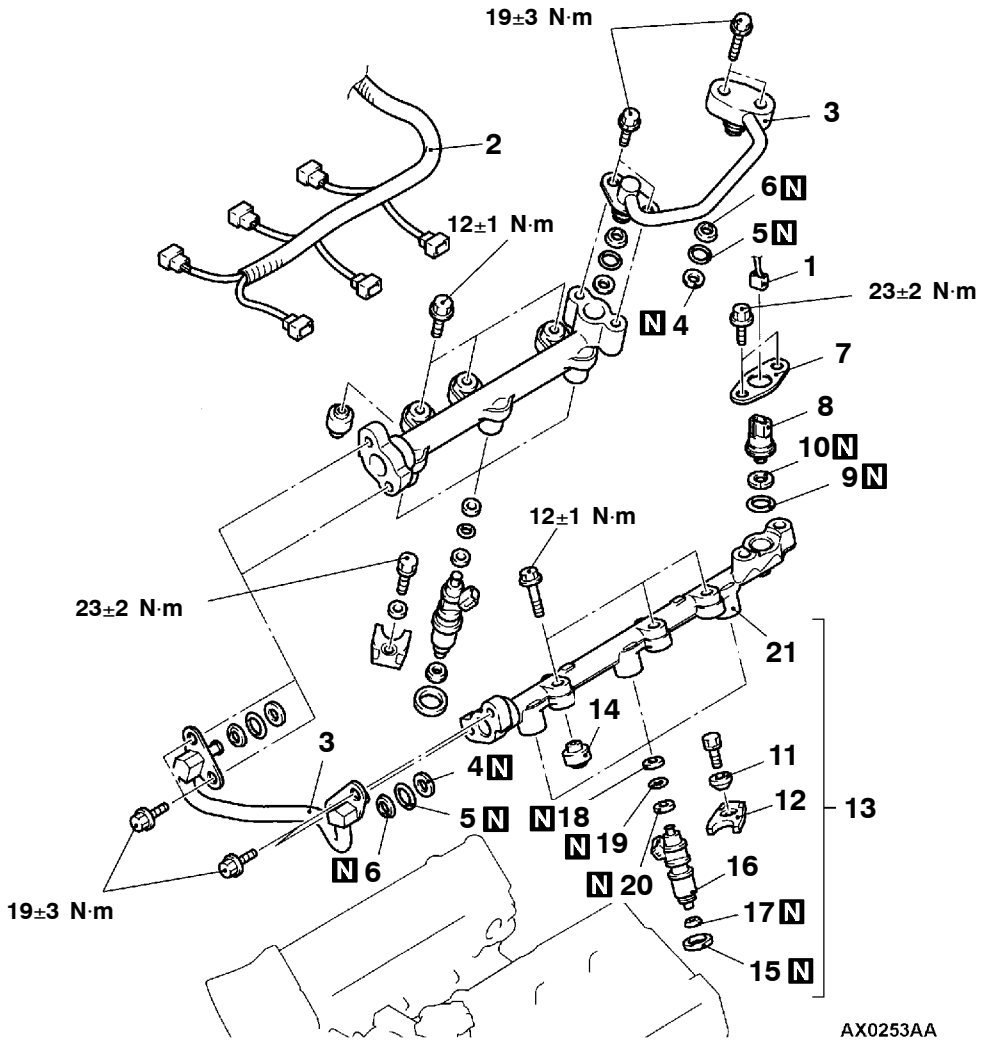
EGR VALVE CHECK

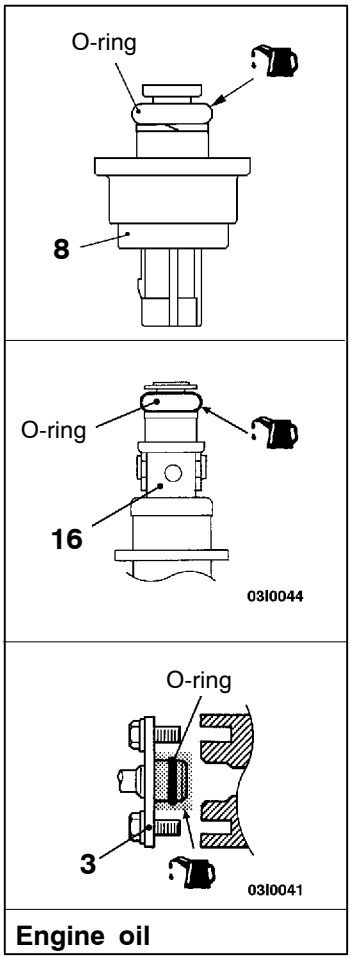
Refer to GROUP 17 - Emission Control System.

INJECTOR

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Fuel Line Pressure Reduction <before removal only> (Refer to P.13A-219.)
- Engine Cover Removal and Installation
- Air Intake Hose Removal and Installation (Refer to GROUP 15 - Air Cleaner.)
- Intake Manifold Removal and Installation (Refer to GROUP 15 - Intake Manifold.)
- Fuel Leak Check <after installation only> (Refer to P.13A-225.)





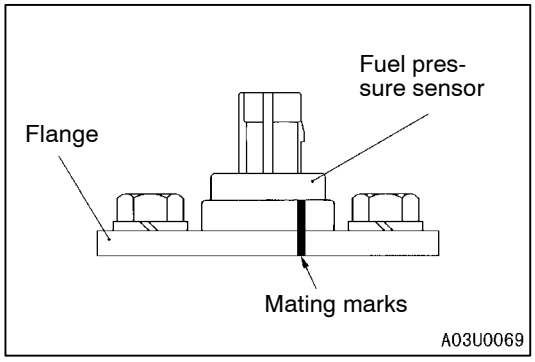
Removal steps

- ▶F◀ • Air bleeding from high-pressure fuel line
- 1. Fuel pressure sensor connector
- ◀A▶ 2. Injector harness
- ▶E◀ 3. Fuel feed pipe
- ▶E◀ 4. Back-up ring A
- ▶E◀ 5. O-ring
- ▶E◀ 6. Back-up ring B
- ◀B▶ ▶D◀ 7. Flange
- ▶D◀ 8. Fuel pressure sensor
- ▶C◀ 9. O-ring
- ▶C◀ 10. Back-up ring
- ▶B◀ 11. Injector washer
- ▶B◀ 12. Injector holder
- ◀C▶ ▶B◀ 13. Delivery pipe assembly and Fuel injector assembly
- ▶B◀ 14. Insulator
- ▶B◀ 15. Injector gasket
- 16. Fuel injector assembly
- ▶A◀ 17. Corrugated washer
- ▶A◀ 18. Back-up ring A
- ▶A◀ 19. O-ring
- ▶A◀ 20. Back-up ring B
- 21. Delivery pipe

REMOVAL SERVICE POINTS

◀A▶ INJECTOR HARNESS DISCONNECTION

Caution
Disconnect the negative battery cable from its terminal before carrying out this operation.



◀B▶ FLANGE REMOVAL

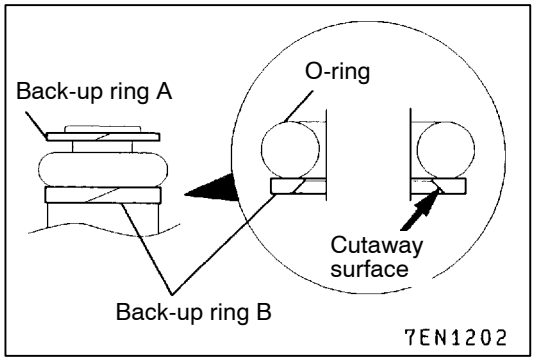
If the fuel pressure sensor is reused, make mating marks on the sensor and the flange.

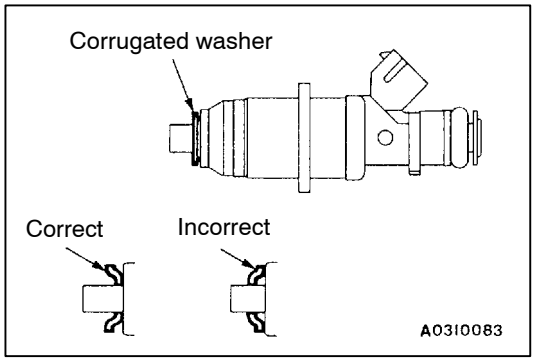
NOTE
The flange secures sealing performance of fuel pressure sensor and installation rigidity by bending to deform the shape at installation. Therefore, make mating marks to install the flange with the right phase and side. In addition, if the fuel pressure sensor is replaced with a new one, replace it together with the flange as a set.

◀C▶ 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.





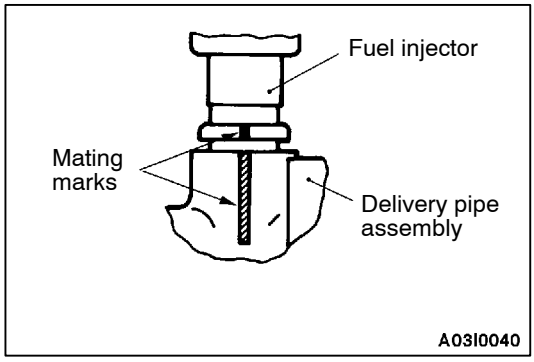
INSTALLATION SERVICE POINTS

▶A◀ BACK-UP RING B/O-RING/BACK-UP RING A/CORRUGATED WASHER INSTALLATION

1. Install the back-up rings and the O-ring as shown in the illustration.

   Caution
   (1) Install the back-up ring B facing its cutaway surface toward the opposite side of the O-ring as shown in the illustration.
   (2) Do not confuse back-up ring A with that for the fuel pressure sensor. (External diameter of back-up ring A: 14.8 mm)
2. Apply petroleum jelly to the corrugated washer to prevent it from dropping, and then install it to the direction shown.

   Caution
   The corrugated washer should always be replaced with a new part.



▶B◀ INJECTOR GASKET/INSULATOR/DELIVERY PIPE ASSEMBLY AND FUEL INJECTOR ASSEMBLY/INJECTOR HOLDER//INJECTOR WASHER INSTALLATION

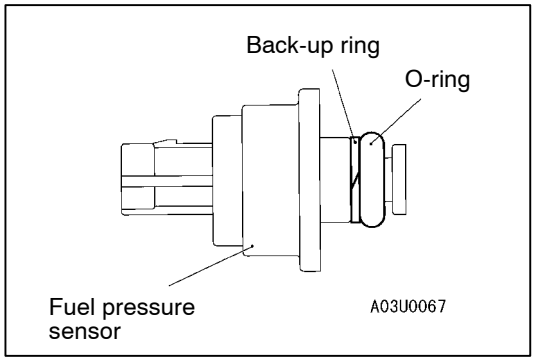
1. Apply a small amount of fresh engine oil to the O-ring.

   Caution
   Take care not to let any of the engine oil get inside the delivery pipe assembly.

2. 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 injector mating mark with the delivery pipe mating mark.
5. Install the injector gasket and the insulator to the cylinder head.
6. Install the delivery pipe and fuel injectors assembly to the cylinder head, and then tighten them provisionally.
7. Install the injector holders and washers, and then tighten them to the specified torque.

   Caution
   Observe the tightening torque.

8. Working from the centre mounting bolt, tighten the delivery pipe and injector assembly mounting bolts to the specified torque.



▶C◀ BACK-UP RING B/O-RING INSTALLATION

Install the back-up rings and the O-ring as shown in the illustration.

Caution
Be careful not to confuse this back-up ring with the back-up ring for the injector or back-up ring A for the fuel pipe. (External diameter of the back-up ring: 15.1 mm)

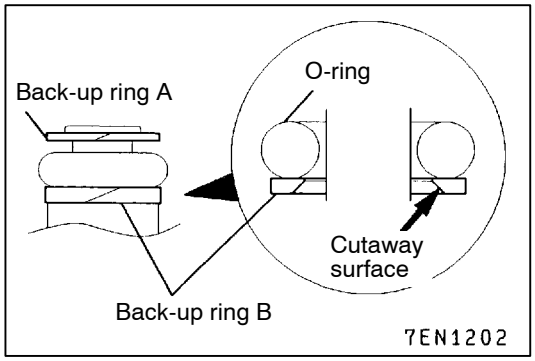
▶D◀ FUEL PRESSURE SENSOR/FLANGE INSTALLATION

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.

2. Align the mating marks, and then install the sensor to the delivery pipe.

   Caution
   If the fuel pressure sensor is replaced, replace it together with the flange as a set.



▶E◀ BACK-UP RING B/O-RING/BACK-UP RING A/FUEL PIPE INSTALLATION

1. Install the back-up rings and the O-ring as shown in the illustration.

   Caution
   (1) Install the back-up ring B facing its cutaway surface toward the opposite side of the O-ring as shown in the illustration.
   (2) Do not confuse back-up ring A with that for the fuel pressure sensor. (External diameter of back-up ring A: 14.8 mm)

2. Apply a small amount of fresh engine oil to the O-ring.

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

3. Insert the fuel pipe into the fuel pump (high-pressure) and the delivery pipe ports squarely. Insert the pipe securely, being careful not to twisting it, and then tighten the mounting bolts to the specified torque.

▶F◀ AIR BLEEDING FROM THE HIGH-PRESSURE FUEL LINE

1. Run the engine at 2,000 r/min for 15 seconds or more in order to bleed the air.

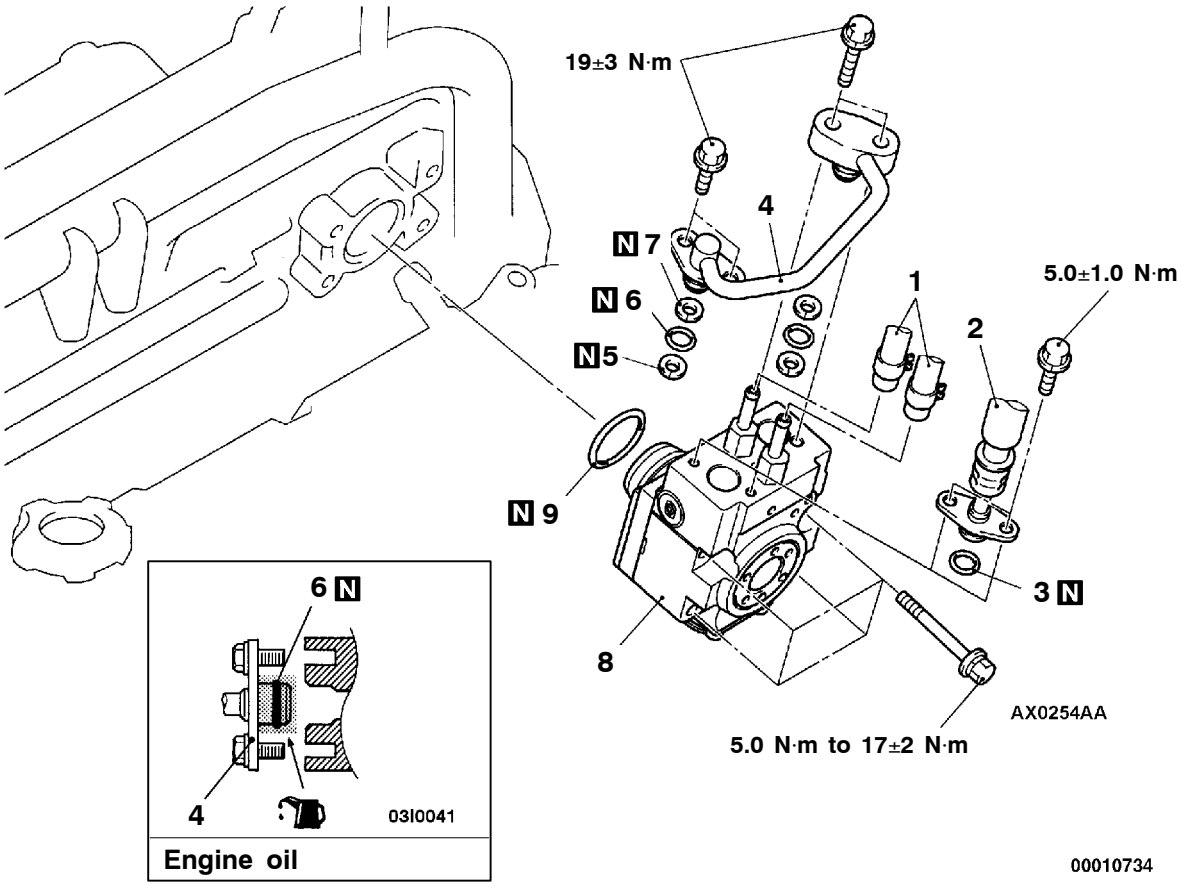
NOTE
When removing the fuel pump (high pressure), air may get into the fuel pump (high pressure). If air gets into the fuel pump (high pressure), diagnosis code No.56 for abnormal fuel pressure will be output.

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.

FUEL PUMP (HIGH PRESSURE)

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Fuel Line Pressure Reduction <before removal only> (Refer to P.13A-219.)
- Engine Cover Removal and Installation
- Air Intake Hose Removal and Installation (Refer to GROUP 15 - Air Cleaner.)
- Intake Manifold Removal and Installation (Refer to GROUP 15 - Intake Manifold.)
- Fuel Leak Check <after installation only> (Refer to P.13A-225.)
- Air Bleeding from High Pressure Fuel Line (Refer to P.13A-237.)



Removal steps

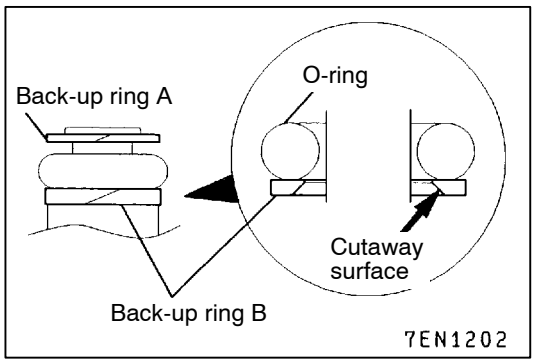
- ▶D◀ 1. Fuel return hose connection
- ▶C◀ 2. Fuel pressure hose connection
- ▶C◀ 3. O-ring
- ▶B◀ 4. Fuel feed pipe
- ▶B◀ 5. Back-up ring A
- ▶B◀ 6. O-ring
- ▶B◀ 7. Back-up ring B
- ▶A◀ 8. Fuel pump (high pressure)
- 9. O-ring

INSTALLATION SERVICE POINTS

▶A◀ 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. Insert the fuel pump (high-pressure) to the cylinder head ports squarely, and then tighten the mounting bolts temporarily (a little more tightly than finger-tightening).Tightening them to the specified torque should be carried out in later step ▶B◀.



▶B◀ BACK-UP RING B/O-RING/BACK-UP RING A/FUEL PIPE INSTALLATION

1. Install the back-up rings and the O-ring as shown in the illustration.

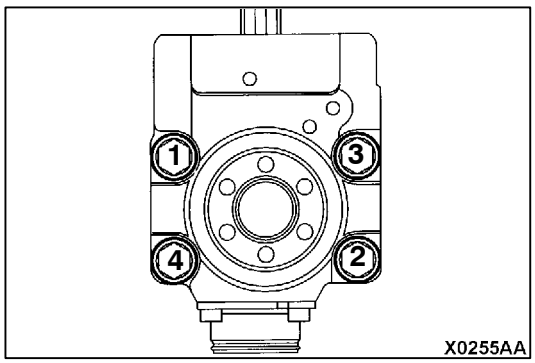
   Caution
   (1) Install the back-up ring B facing its cutaway surface toward the opposite side of the O-ring as shown in the illustration.
   (2) Confirm the outer diameter of the back-up ring A. Take care not to install the back-up ring for the fuel pressure sensor by mistake. (Outer diameter of the back-up ring A: 14.8 mm)

2. Apply a small amount of fresh engine oil to the O-ring.

   Caution
   Take care not to let any of the engine oil get inside the fuel pump (high pressure) or the delivery pipe assembly.

3. Insert the fuel pipe into the fuel pump (high-pressure) and the delivery pipe ports squarely.
   Insert the pipe securely, being careful not to twisting it, and then tighten the mounting bolts to the specified torque.

   Tightening torque: 19 ± 3 N·m



4. Tighten the temporarily tightened mounting bolts of the fuel pump (high-pressure) in the shown order to 5.0 N·**m**.
5. Tighten the bolts to 17 N·m in the order shown in the illustration. The overall difference in tightening torque between the four bolts should be within 2 N·m.

▶C◀ O-RING/FUEL PRESSURE HOSE INSTALLATION

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

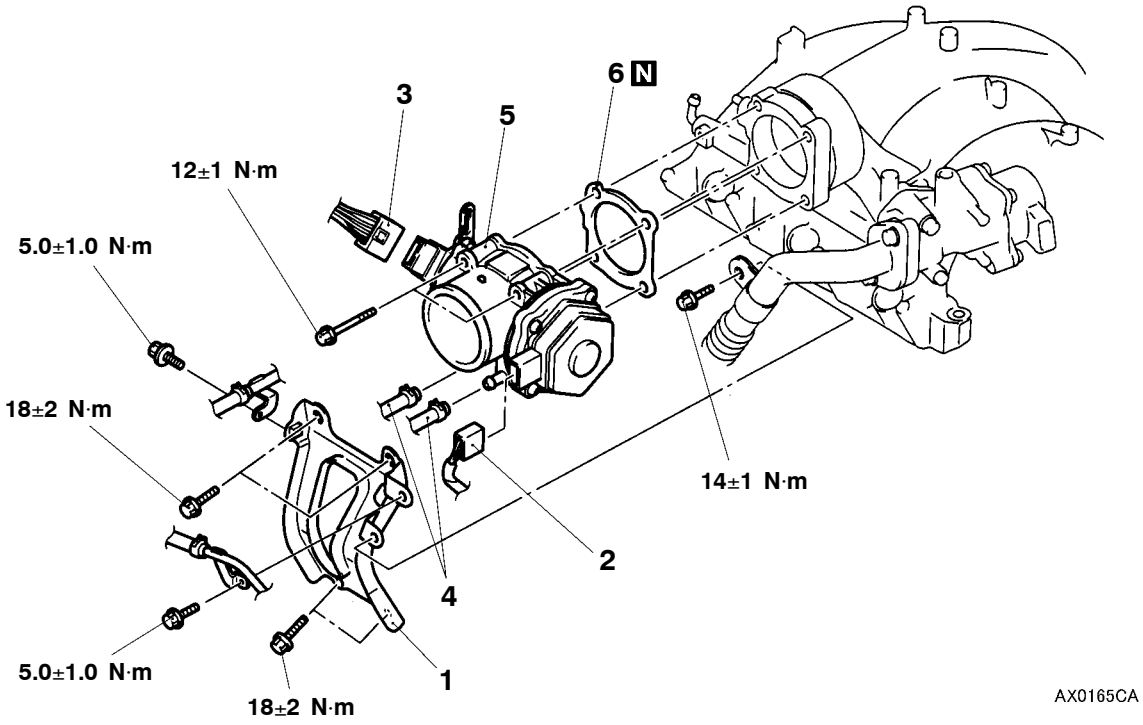
   Caution
   Take care not to let any of the engine oil get inside the fuel pump (high pressure) or the delivery pipe assembly.

2. While being careful not to damage the O-ring, turn the fuel pressure hose to the left and right and connect it to the delivery pipe assembly. After connecting, check that the fuel injector turns smoothly.
3. If the fuel pressure hose does not turn smoothly, the cause may be that the O-ring is getting caught. Remove the fuel pressure hose, check the O-ring for damage and re-connect the fuel pressure hose to the delivery pipe assembly and then re-check.

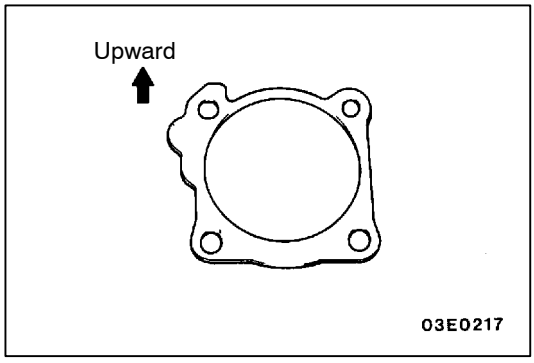
THROTTLE BODY

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
- Air Cleaner Removal and Installation (Refer to GROUP 15.)



Removal steps
1. Throttle body stay
2. Throttle control servo connector connection
3. Throttle position sensor connector connection
4. Water hose connection
- ▶B◀ 5. Throttle body assembly
- ▶A◀ 6. Throttle body gasket



INSTALLATION SERVICE POINTS

▶A◀ THROTTLE BODY GASKET INSTALLATION

The projection on the gasket should face upward.

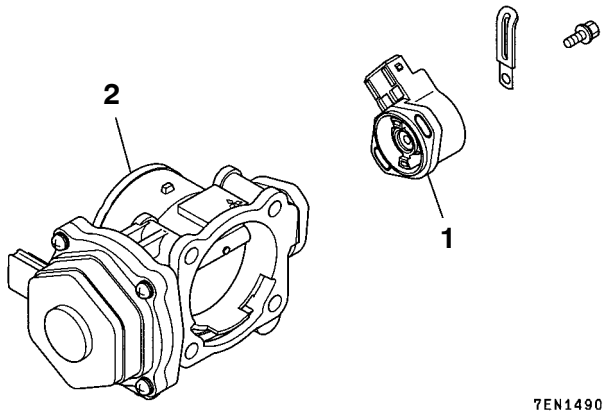
▶B◀ THROTTLE BODY INSTALLATION

If the throttle body is replaced, initialize the electronic-controlled throttle valve system.

Initialization

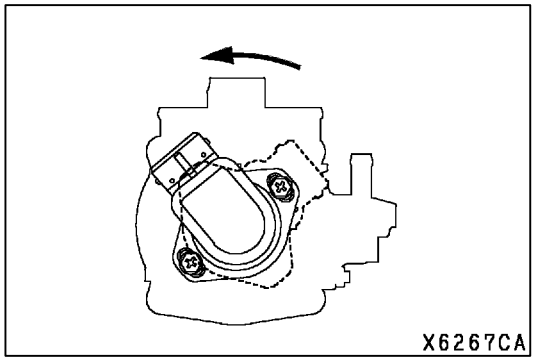
Turn on the ignition switch, and turn it to the LOCK (OFF) position within one second. Then leave it for at least ten seconds with the ignition switch in the LOCK (OFF) position.

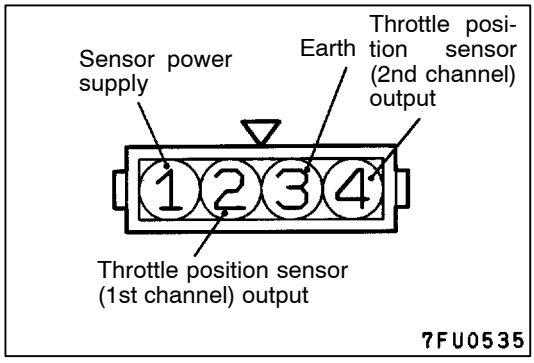
DISASSEMBLY AND REASSEMBLY



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).

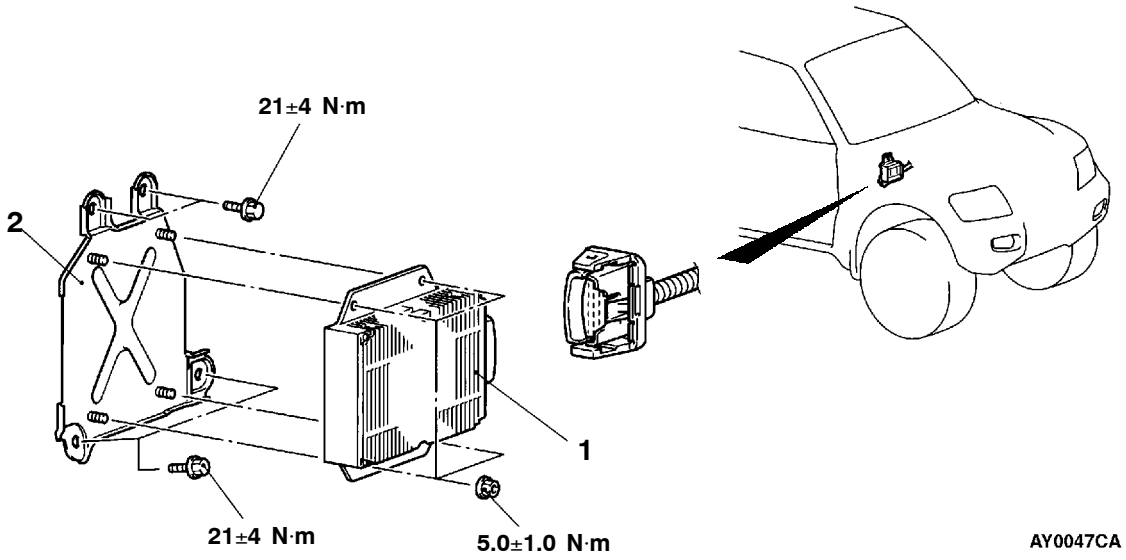
Normal condition

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.

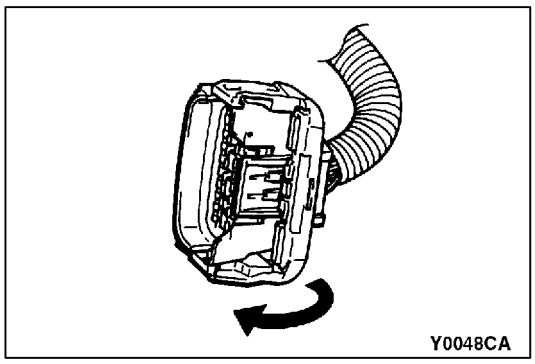
INJECTOR DRIVER

REMOVAL AND INSTALLATION



Removal steps

◀A▶ 1. Injector driver
2. Bracket



REMOVAL SERVICE POINT

◀A▶ INJECTOR DRIVER REMOVAL

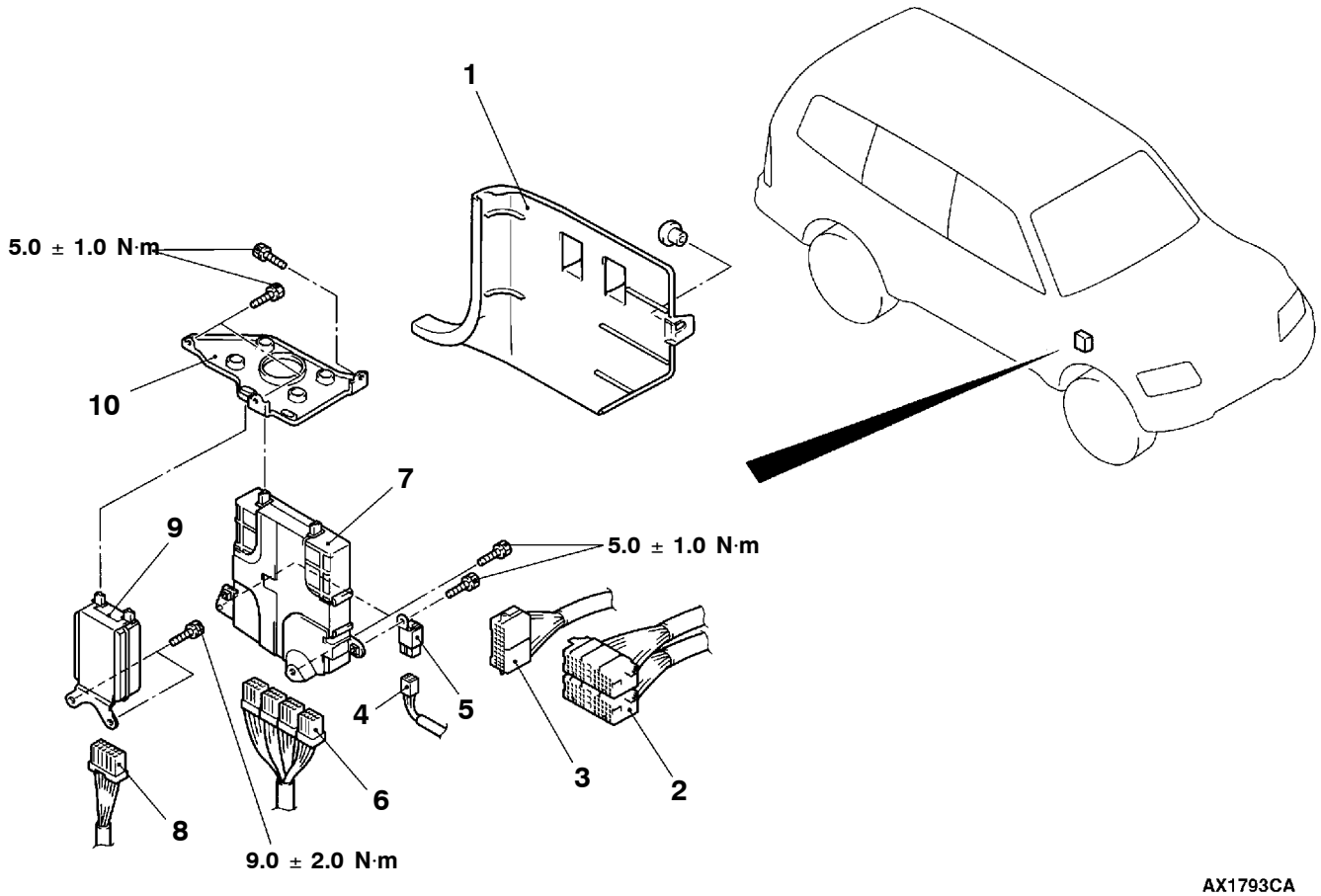
Press the injector driver connector in the place shown in the illustration to disconnect the injector driver connector.

Caution

1. **Disconnect the negative 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.**

ENGINE-ECU<M/T>, ENGINE-A/T-ECU<A/T>, THROTTLE VALVE CONTROLLER

REMOVAL AND INSTALLATION



Removal steps

1. Cowl side trim
2. Instrument panel harness and front door harness connection
3. Instrument panel harness and front floor harness connection
4. A/T control relay connector <A/T>
5. A/T control relay <A/T>
6. Engine-ECU <M/T>, Engine□A/T-ECU <A/T> connector
7. Engine-ECU <M/T>, Engine□A/T-ECU <A/T>
8. Throttle valve controller connector
- ▶A◀ 9. Throttle valve controller
  Instrument panel (Refer to GROUP 52A.)
10. Bracket

INSTALLATION SERVICE POINT

▶A◀ THROTTLE VALVE CONTROLLER INSTALLATION

If the throttle valve controller is replaced, initialize the electronic-controlled throttle valve system.

Initialization

Turn on the ignition switch, and turn it to the LOCK (OFF) position within one second. Then leave it for at least ten seconds with the ignition switch in the LOCK (OFF) position.

Service Bulletins

Click on the applicable bookmark to select the Service Bulletin.

SERVICE BULLETIN

QUALITY INFORMATION ANALYSIS
OVERSEAS SERVICE DEPT. MITSUBISHI MOTORS CORPORATION

SERVICE BULLETIN	**No.:** MSB-00E13-001	
	Date: 2001-06-03	**<Model>** / **<M/Y>**

Subject: AVAILABILITY OF DRIVE CYCLE PATTERNS FOR 2001 MODEL CARS

Group: FUEL

Draft No.: 00AL602317

INFORMATION

INTERNATIONAL CAR ADMINISTRATION OFFICE

T.MASAKI-MANAGER
TECHNICAL SERVICE PLANNING

<Model>	<M/Y>
(EC)GALANT(EA0)	01-10
(EC)SPACE STAR	
(EC) SPACE RUNNER/SPACE WAGON(N80, N90)	
(EC)PAJERO SPORT (K80W,K90W)	
(EC)PAJERO/ MONTERO (V60, V70)	
(EC)CARISMA	
(EC)PAJERO PININ (H60,H70)	

1. Description:

On the 2001 model cars equipped with the on-board diagnostics system, the drive cycle patterns have been made available.
Performing the running test of the car using these drive cycle patterns makes it possible to monitor all the diagnosis codes that are required for operation of the car in order to determine if the applicable system is operating properly or not.

2. Applicable Manuals:

Manual	Pub. No.	Language	Page(s)
2001 GALANT Workshop Manual Supplement	PWDE9611-B	(English)	4G64-GDI:13I-8
	PWDS9612-B	(Spanish)	4G63-MPI:13A-7
	PWDF9613-B	(French)	6A13-MPI:13A-97
	PWDG9614-B	(German)	
	PWDD9615-B	(Dutch)	
	PWDW9616-B	(Swedish)	
2001 SPACE RUNNER/ SPACE WAGON Workshop Manual Supplement	PWDE9803-C	(English)	4G64-GDI:13A-9
	PWDS9804-C	(Spanish)	4G63-MPI:13D-12
	PWDF9805-C	(French)	
	PWDG9806-C	(German)	
	PWDD9807-C	(Dutch)	
	PWDW9808-C	(Swedish)	
2001 CARISMA Workshop Manual Supplement	PWDE9502-E	(English)	4G93-GDI:13J-8
	PWDS9503-E	(Spanish)	4G92-MPI:13A-7
	PWDF9504-E	(French)	
	PWDG9505-E	(German)	
	PWDD9506-E	(Dutch)	
	PWDW9507-E	(Swedish)	
2001 SPACE STAR Workshop Manual Supplement	CMXE99E1-A	(English)	4G93-GDI:13A-9 4G13-MPI:13B-7
2001 COLT Workshop Manual Supplement	PWME9511-C	(English)	4G13-MPI:13A-7
	PWMS9512-C	(Spanish)	4G93-MPI:13A-88
	PWMF9513-C	(French)	
	PWMG9514-C	(German)	
	PWMD9515-C	(Dutch)	
	PWMW9516-C	(Swedish)	
2001 PAJERO Workshop Manual VOL1	PWJE0001(1/2)	(English)	6G74-GDI:13A-12
2001 MONTERO Workshop Manual VOL1	PWJS0002(1/2)	(Spanish)	
2001 PAJERO/MONTERO Workshop Manual CD-ROM	PWJT0008R	(English)	
		(Spanish)	
		(French)	
		(German)	
2001 PAJERO SPORT Workshop Manual Supplement	PWJE9812-B	(English)	6G72-MPI:13A-8
	PWJS9813-B	(Spanish)	
	PWJF9814-B	(French)	
	PWJG9815-B	(German)	
2001 PAJERO PININ Workshop Manual Supplement	CKRE99E1-A	(English)	4G93-GDI: 13A-9

DRIVE CYCLE

Performing the running test of the car using the following five drive cycle patterns makes it possible to monitor all the diagnosis codes that are required for operation of the car in order to determine if the applicable system is operating properly or not.
In other words, doing such a drive allows to regenerate any kind of trouble which involves illuminating the Engine Warning Lamp (Check Engine Lamp) and to verify the repair procedure has eliminated the trouble [the Engine Warning Lamp (Check Engine Lamp) is no longer illuminated].

Caution
Two technicians should always be in the vehicle when carrying out a test drive.

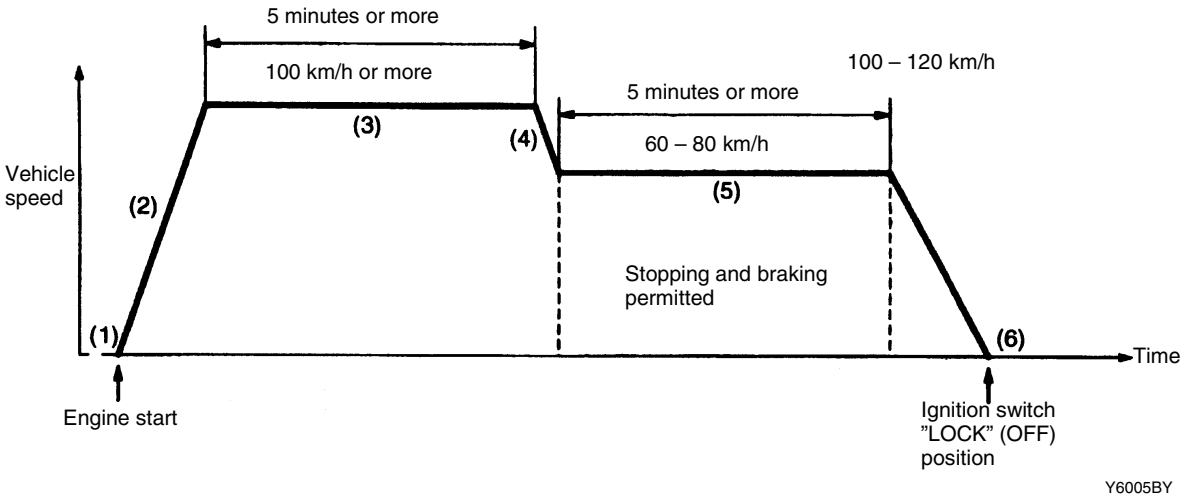
NOTE
Check that the diagnosis code is not output before traveling in the Drive cycle pattern. Erase the diagnosis code if it has been output.

DRIVE CYCLE PATTERN LIST

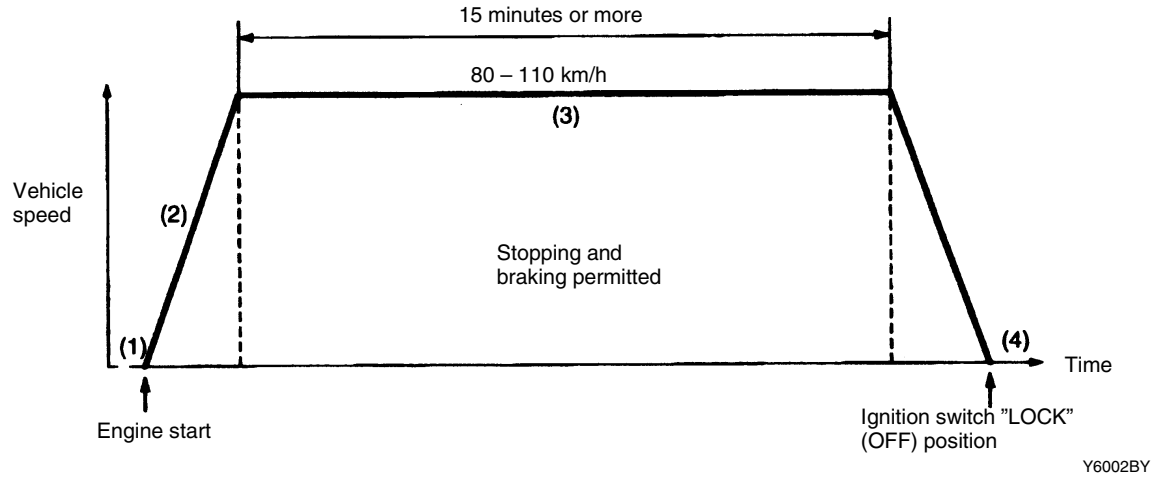
PROCEDURE	MONITOR ITEM	DIAGNOSIS CODE
1	Catalytic converter monitor	P0420
	Heated oxygen sensor <front> monitor	P0130
2	Fuel trim monitor	P0170
3	Feed back monitor	P0125
4	Other monitor	P0136, P0201, P0202, P0203, P0204, P0205, P0206, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0325

NOTE
The vehicle speed sensor (P0500) and the power steering fluid pressure switch (P0551) are used to determine if the system is operating properly or not through use of the Data List function of the MUT-II.

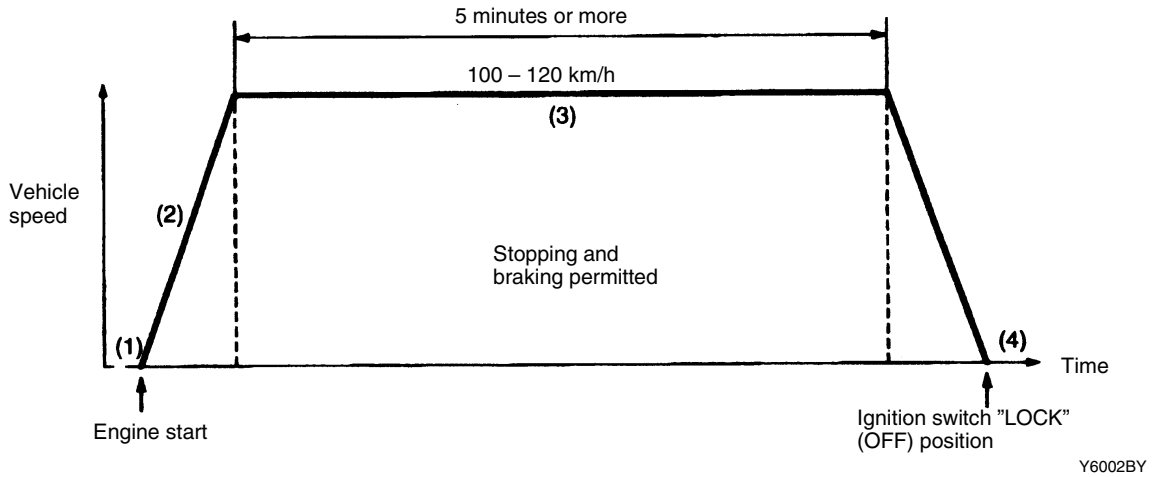
PROCEDURE 1

monitor item	**CATALYTIC CONVERTER MONITOR (P0420)** **OXYGEN SENSOR <FRONT> MONITOR (P0130)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 10 minutes or more. 
Inspection conditions	• Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 100 km/h or more. 3. Travel for 5 minutes or more while keeping the vehicle speed is 100 km/h or more. 4. Decelerate until the vehicle speed is 60 - 80 km/h or less. 5. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 60 - 80 km/h and travel for 5 minutes or more. • Stopping and braking during this operation are permitted. 6. Return the vehicle to the shop, then turn the ignition switch ”LOCK” (OFF) position.

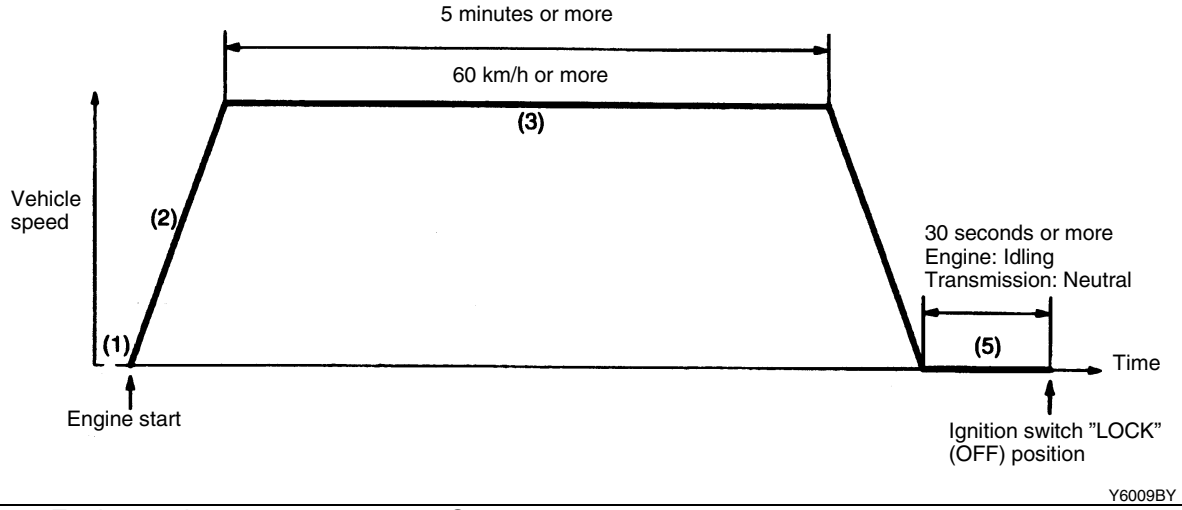
PROCEDURE 2

monitor item	**FUEL TRIM MONITOR (P0170)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 15 minutes or more. 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 80 – 110 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 80 – 110 km/h and travel for 15 minutes or more. 4. Return the vehicle to the shop, then turn the ignition switch “LOCK” (OFF) position.

PROCEDURE 3

monitor item	**FEED BACKK MONITOR (P0125)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 5 minutes or more. 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 100 – 120 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 100 – 120 km/h and travel for 5 minutes or more. 4. Return the vehicle to the shop, then turn the ignition switch “LOCK” (OFF) position.

PROCEDURE 4

monitor item	**OTHER MONITOR**
Diagnosis code No.	P0136, P0201, P0202, P0203, P0204, P0205, P0206, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0325
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 6 minutes or more. 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 60 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 60 km/h or more and travel for 5 minutes or more. 4. Return the vehicle to the shop 5. After stopping the vehicle, continue idling for 30 seconds, and then turn the ignition switch to ”LOCK” (OFF) position. • A/C switch : OFF • Light and all accessories: OFF • Transmission : Neutral

GASOLINE DIRECT INJECTION (GDI)

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GENERAL

OUTLINE OF CHANGE

The engine-ECU <M/T> and engine-A/T-ECU <A/T>, which feature communication port with stability control system, have been introduced. The service procedures for these ECUs are the same as before.

GENERAL INFORMATION

GENERAL SPECIFICATIONS

Items		Specifications
Engine-ECU <M/T>	Identification No.	E2T79275 <LHD> E2T79276 <RHD>
Engine-A/T-ECU <A/T>	Identification No.	E2T76290 <LHD> E2T76291 <RHD>

GASOLINE DIRECT INJECTION (GDI)

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GENERAL

OUTLINE OF CHANGES

Due to the changes as shown below, the service procedures regarding the different description from the previous version have been established.

- On M/T, the engine-ECU has been changed as diagnosis code P1603 has been added.
- On A/T, the engine-A/T-ECU has been changed as an on-board diagnosis system has been adopted. The engine warning lamp control, the diagnosis function, the service data output and the actuator test are basically the same as for M/T.
- On A/T, an dual oxygen sensor has been adopted. This sensor is the same as for the previous M/T.

GENERAL INFORMATION

GENERAL SPECIFICATIONS

Items		Specifications
Engine-ECU <M/T>	Identification No.	E2T79277 <LHD> E2T79278 <RHD>
Engine-A/T-ECU <A/T>	Identification No.	E2T76292 <LHD> E2T76293 <RHD>

TROUBLESHOOTING

DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

The following item has been added as diagnosis code P1603 has been added. The other items are the same as before.

Engine warning lamp inspection items

Code No.	Diagnosis item
P1603	Battery backup line malfunction

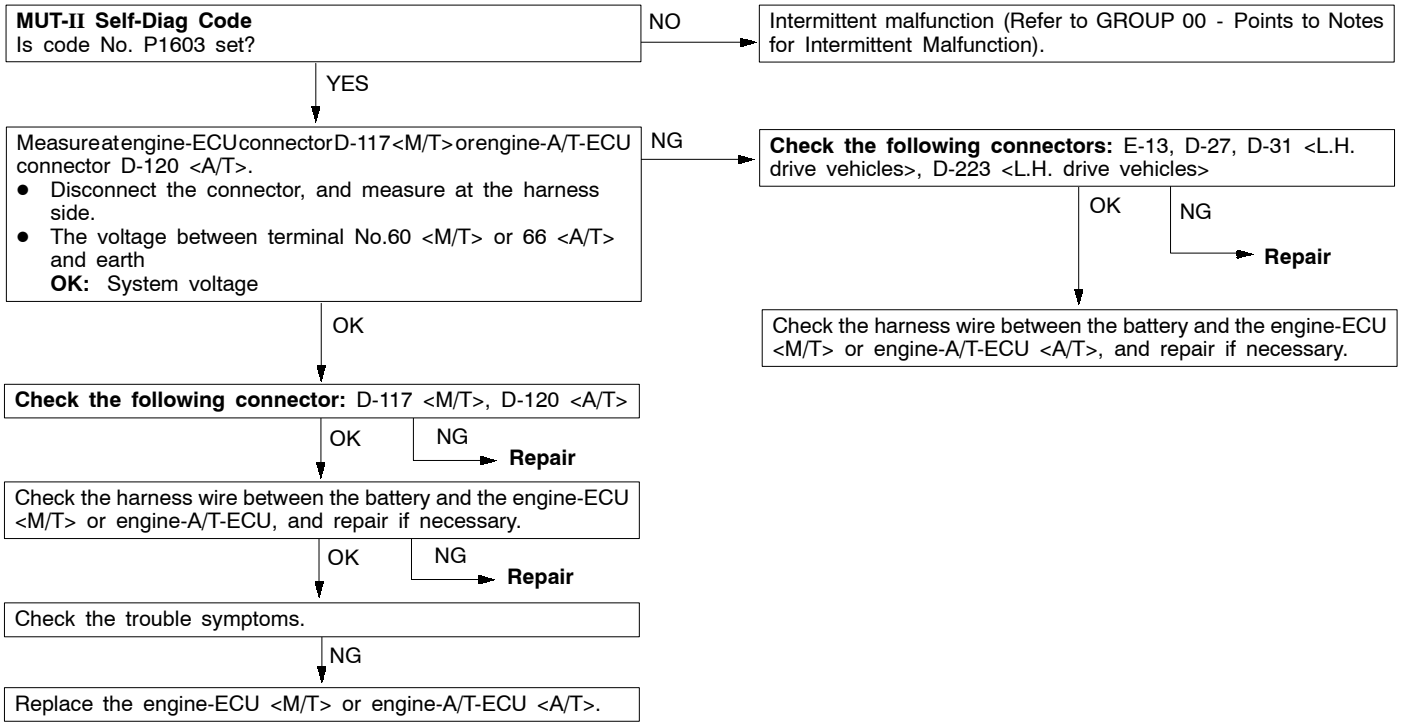
INSPECTION CHART FOR DIAGNOSIS CODES

Diagnosis code P1603 has been added. The other codes are the same as for the previous M/T.

Code No.	Diagnosis item	Reference page
P1603	Battery backup line malfunction	13A-4

INSPECTION PROCEDURE CLASSIFIED BY DIAGNOSIS CODE

Code No. P1603 Battery backup line malfunction	Probable cause
Range of Check ● Starting sequence was completed. ● The battery voltage is 10 V or more. Set Condition ● Battery backup line voltage is less than 2 V.	● Open or short circuit in the battery back-up line or loose connector contact ● Malfunction of engine-ECU <M/T> ● Malfunction of engine-A/T-ECU <A/T> NOTE: If the engine is started while the ignition-off current draw connector has been pulled off, the engine-ECU <M/T> or the engine-A/T-ECU <A/T> judges that the battery backup line is open, and illuminates the engine warning lamp and stores this diagnosis code.



DATA LIST REFERENCE TABLE

The data list has been changed as the engine-ECU and the engine-A/T-ECU have been changed. The other items are the same as for M/T.

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
22	Crank angle sensor	• Engine: Cranking • Tachometer: Connected	Compare the engine speed readings on the tachometer and the MUT-II.	Accord	Code No. P0335	13A-56*
		• Engine: Idling • Idle position switch: ON	When engine coolant temperature is -20°C	1,300 - 1,500 r/min		
			When engine coolant temperature is 0°C	1,300 - 1,500 r/min		
			When engine coolant temperature is 20°C	1,250 - 1,450 r/min		
			When engine coolant temperature is 40°C	1,100 - 1,300 r/min		
			When engine coolant temperature is 80°C (more than four minutes later after engine has started)	600 - 800 r/min		
A1★	Oxygen sensor	Engine: After having warmed up. (Air/fuel mixture is made leaner when decelerating, and is made richer when racing.)	When at 4,000 r/min, engine is decelerated	200 mV or less	Code No. P0130	13A-28*
			Rev the engine.	600 - 1000 mV		
		Engine: After having warmed up (The oxygen sensor signal is used to check the air/fuel mixture ratio, and control condition is also check by the engine-ECU <M/T> or engine-A/T-ECU <A/T>.)	Engine is idling (more than 4 minutes later after engine has started)	Voltage should alternate between 400 mV or less and 600 - 1,200 mV (more than 4 minutes after the engine has started).		
			2,500 r/min			
24★	Vehicle speed sensor	Drive at 40 km/h		Approximately 40 km/h	Code No. P0500	13A-63*

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
81★	Learned value	Engine: Warm, 2,500 r/min without any load (during closed loop lambda control)		-10 - 10 %	Code No. P0170	13A-34*
82★	Closed loop control	Engine: Warm, 2,500 r/min without any load (during closed loop lambda control)		-25 - 25 %	Code No. P0170	13A-34*
87★	Engine load	Engine: After having warmed up	Idling (more than 4 minutes later after the engine has started)	20 - 40 %	-	-
			2,500 r/min	10 - 30 %		
8A★	Throttle position sensor (1st channel) (throttle valve angle)	• Engine: After having warmed up • Ignition switch: ON (Engine: stopped)	Release the accelerator pedal.	0 - 20 %	Code No. P0120	13A-25*
			Depress the accelerator pedal.	Increase in proportion to the pedal stroke		
			Depress the accelerator pedal fully.	80 - 100 %		

NOTE
★: will not displayed if service data is selected on the check mode.
*: Refer to the 2001 PAJERO Workshop Manual (Pub.No. PWJE0001)

CHECK AT THE ENGINE-ECU TERMINALS

TERMINAL VOLTAGE CHECK CHART <A/T>

Engine-A/T-ECU Connector Terminal Arrangement

The terminals below have been changed as the engine-A/T-ECU has been changed. The other terminals are the same as before.

Terminal No.	Check item	Check requirements (Engine condition)	Normal condition
3	Oxygen sensor heater (front)	Engine: Idling	0 - 3 V
		Engine: 3,500 r/min	System voltage
26	Oxygen sensor heater (rear)	Engine: Idling	0 - 3 V
		Engine: 3,500 r/min	System voltage
71	Oxygen sensor (front)	Engine: Warmed up, and then hold the engine speed at 2,500 r/min (Use a digital voltmeter)	0 and 0.8 V alternate.
73	Oxygen sensor (rear)	● Transmission: 2nd gear ● Engine speed: 3,500 r/min or more ● Driving with the throttle valve widely open	0.6 - 1.0 V

Engine-A/T-ECU Harness-side Connector Terminal Arrangement

The terminals below have been changed as the engine-A/T-ECU has been changed. The other terminals are the same as before.

Terminal No.	Check item	Standard value, normal condition (check conditions)
3 - 41	Oxygen sensor heater (front)	11 - 18 Ω (at 20°C)
26 - 41	Oxygen sensor heater (rear)	11 - 18 Ω (at 20°C)

ON-VEHICLE SERVICE

OXYGEN SENSOR CHECK

On A/T, a dual oxygen sensor has been adopted. Its service procedure is the same as for the previous M/T.

NOTES

DIESEL FUEL <4D5>

Click on the applicable bookmark to selected the required model year.

DIESEL FUEL <4D5>

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SPECIAL TOOL 2

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- Engine Idle Speed Check and Adjustment 2
- Evacuation of Water from Fuel Filter 2
- Evacuation of Air from Fuel Line 3
- Fuel Filter Cartridge Replacement 3
- Fuel Injection Pump Check 3
- Boost Compensator Check 4
- Injection Nozzle Check and Adjustment 4

INJECTION NOZZLE 6

INJECTION PUMP 10

GENERAL INFORMATION

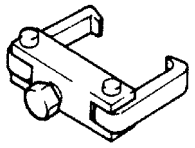
The fuel is drawn out of the fuel tank by means of the feed pump which is built into the fuel injection pump. It then passes through the fuel filter and is fed to the injection pump.
The fuel is pressurized by the feed pump, and this fuel pressure is controlled by the regulating valve which is built into the pump. Then, the fuel is compressed by the plunger and injected from the nozzles at high pressure in accordance with the injection sequence.

Engine speed (fuel injection amount) control is carried out by means of a centrifugal-type governor using a flyweight.
Fuel injection timing control is carried out by a hydraulic timer. The hydraulic timer operates by the fuel pressure inside the pump chamber. This pressure is controlled by the regulating valve.

SERVICE SPECIFICATIONS

Items	Standard value
Injection timing control solenoid coil resistance Ω	8 - 10
Fuel injection initial pressure kPa	14,710 - 15,690

SPECIAL TOOL

Tool	Number	Name	Use
	MD998388	Injection pump sprocket puller	Fuel injection pump sprocket removal

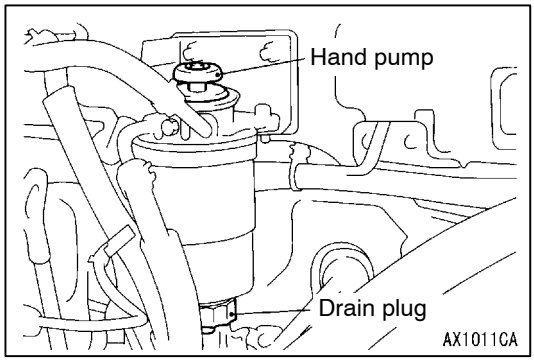
ON-VEHICLE SERVICE

FUEL INJECTION TIMING CHECK AND ADJUSTMENT

Refer to GROUP 11B - On-vehicle Service.

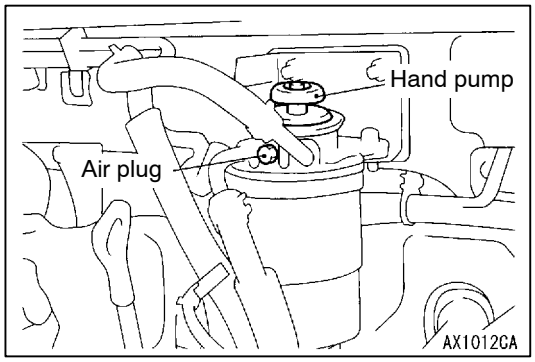
ENGINE IDLE SPEED CHECK AND ADJUSTMENT

Refer to GROUP 11B - On-vehicle Service.



EVACUATION OF WATER FROM FUEL FILTER

Water is in the filter when fuel filter warning lamp lights. Evacuate water by the following procedures.
1. Loosen drain plug.
2. Drain water with hand pump. Finger-tighten drain plug.



EVACUATION OF AIR FROM FUEL LINE

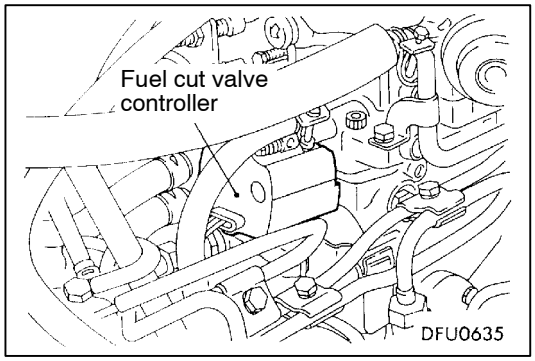
Bleed the air from the fuel line after refilling the fuel.

- When fuel is drained for service.
- When fuel filter is replaced.
- When main fuel line is removed.

1. Loosen fuel filter air plug.
2. Place rags around air plug hole. Operate hand pump repeatedly until no bubbles come from plug hole. Tighten air plug.
3. Repeat until hand pump operation becomes stiff.

FUEL FILTER CARTRIDGE REPLACEMENT

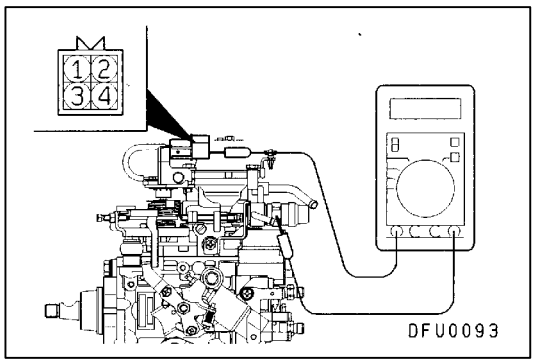
Refer to GROUP 13D.



FUEL INJECTION PUMP CHECK

FUEL CUT VALVE CONTROLLER OPERATION CHECK

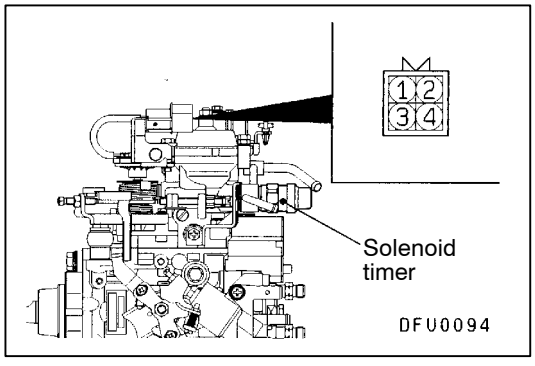
When a sound scope is held against the fuel cut valve controller and the ignition switch is turned to “ON”, check that the sound of the valve operating can be heard.
If no operating sound can be heard, check the immobilizer system while referring to GROUP 54.



INJECTION TIMING CONTROL SOLENOID COIL RESISTANCE CHECK

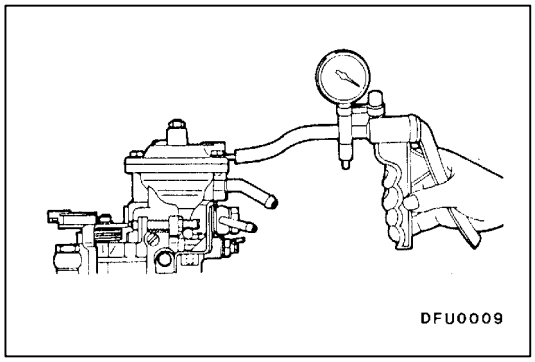
Measure the resistance between the injection pump connector terminal No.4 (injection timing control solenoid terminal) and the injection pump body.

Standard value: 8 - 10 Ω (at 20 °C)



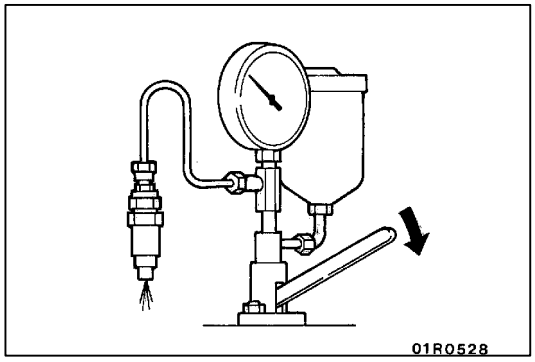
INJECTION TIMING CONTROL SOLENOID OPERATION CHECK

Check that operation sound of the injection timing control solenoid can be heard when connecting the injection pump connector terminal No.4 (injection timing control solenoid terminal) and the battery positive terminal.



BOOST COMPENSATOR CHECK

1. Connect a hand pump (pressurization type) to the nipple of the boost compensator.
2. Apply 30 kPa of pressure and check to be sure that the pressure is maintained.



INJECTION NOZZLE CHECK AND ADJUSTMENT

Caution
Never touch the injection spray that is injected from the nozzle.

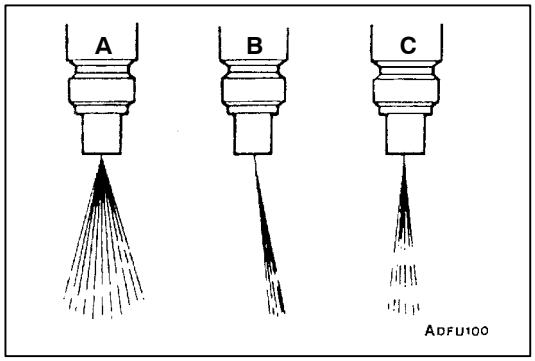
FUEL INJECTION INITIAL PRESSURE CHECK

1. Install the injection nozzle to a nozzle tester.
2. Move the lever of the nozzle tester 2 - 3 times to inject fuel and to bleed the air.
3. Gently press down the lever of the nozzle tester, and take a reading of the indication value on the pressure gauge at the point where the needle slowly rises and then suddenly drops.

   Standard value (Fuel injection initial pressure): 14,710 - 15,690 kPa

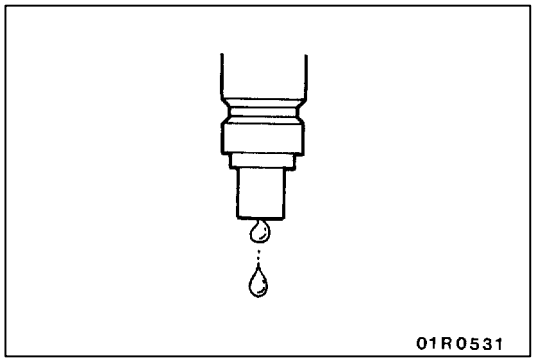
4. If the fuel injection initial pressure is outside the standard value, disassembly the nozzle holder to clean it, and then change the thickness of the shim to adjust the fuel injection initial pressure.

   NOTE
   (1) For disassembly, reassembly and adjustment of the nozzle holder, refer to P.13B-8.
   (2) There are 10 shims for adjustment, with thicknesses in the range of 0.10 - 0.80 mm.
   (3) When the shim thickness is increased by 0.1 mm, the fuel injection initial pressure increases by 2,350 kPa.

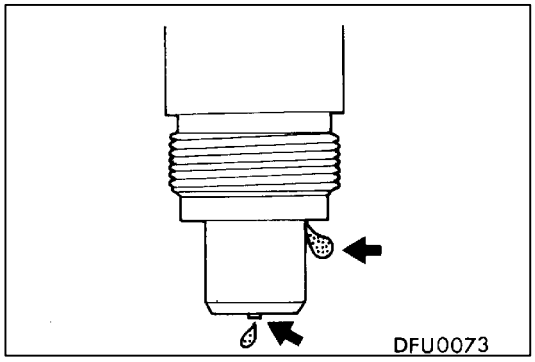


INJECTION SPRAY CONDITION CHECK

1. Move the lever of the nozzle tester rapidly (4 - 6 times per second) to eject the fuel continuously. Check to be sure that the injection spray comes out evenly in a cone shape (injection spray angle is 10 °). The injection spray patterns shown in the illustration at left are wrong.
   A. Injection angle is tool large
   B. Bias
   C. Intermittent fuel injection



2. Check to be sure that no fuel drips after injection is completed.
3. If there are any drips, disassemble the nozzle, clean it and reinspect, or replace the nozzle.



NOZZLE FUEL-TIGHT CHECK

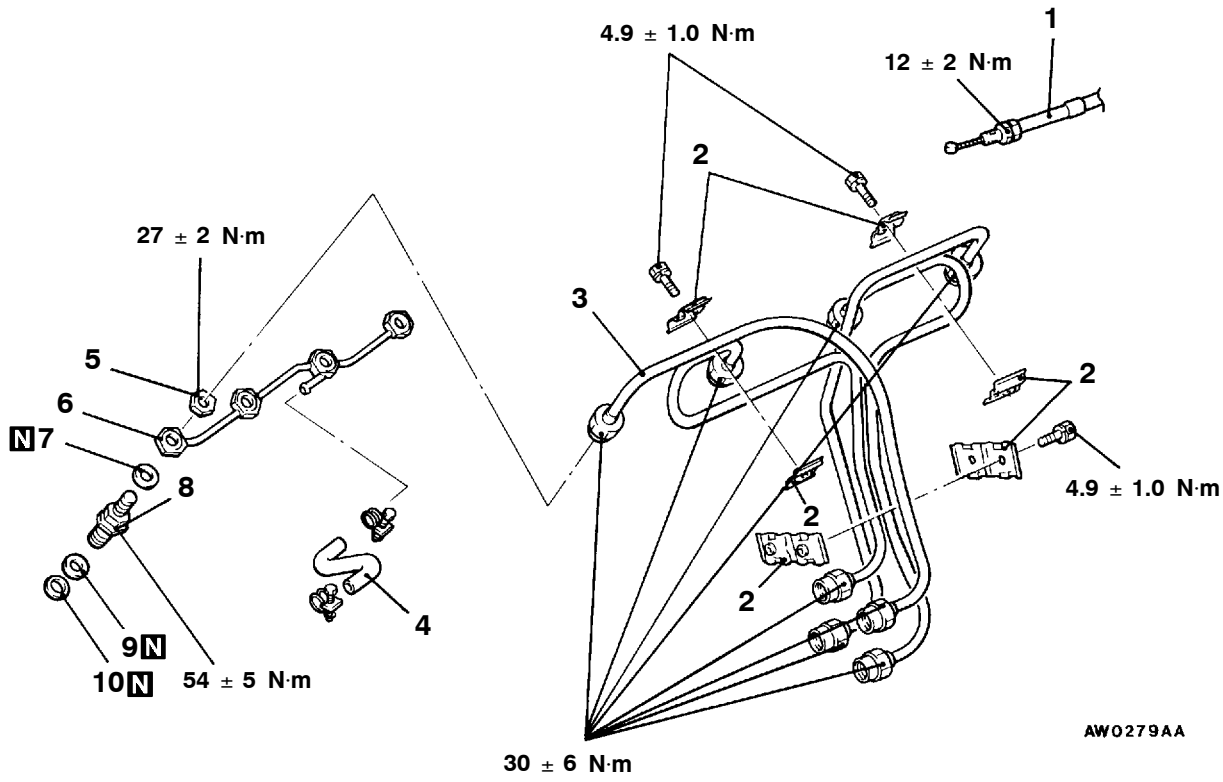
1. Gently raise the lever of the nozzle tester until the pressure inside the nozzle (value displayed on pressure gauge) becomes 12,750 - 13,730 kPa, and after holding this pressure for approximately 10 seconds, check to be sure that there are no fuel leaks from the nozzle.
2. If there are any leaks, disassemble the injection nozzle, clean it and re-inspect, or replace the nozzle.

INJECTION NOZZLE

REMOVAL AND INSTALLATION

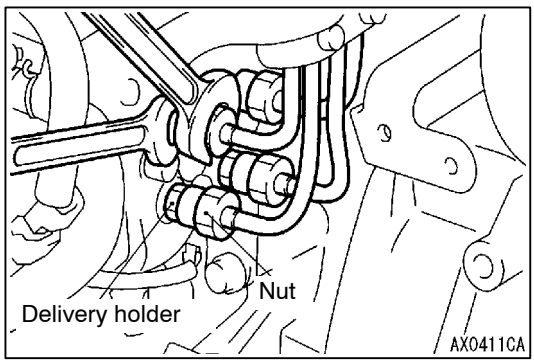
Pre-removal Operation
- Battery and Battery Tray Removal
- Air Pipe Removal (Refer to GROUP 15.)

Post-installation Operation
- Air Pipe Installation (Refer to GROUP 15.)
- Battery and Battery Tray Installation
- Accelerator Cable Adjustment (Refer to GROUP 17 - On-vehicle Service.)



Removal steps

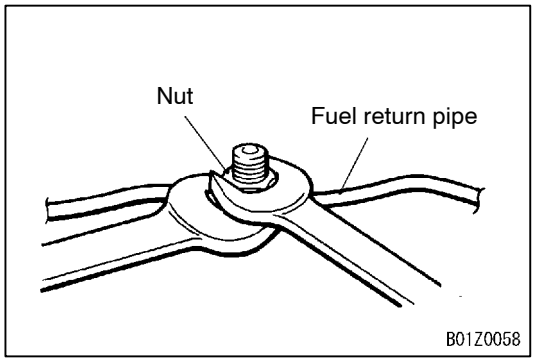
1. Accelerator cable connection
2. Injection pipe clamp
◀A▶ 3. Injection pipe
4. Fuel return hose
◀B▶ 5. Nut
◀B▶ 6. Fuel return pipe
7. Fuel return pipe gasket
◀C▶ 8. Injection nozzle assembly
▶A◀ 9. Holder gasket
▶A◀ 10. Nozzle gasket



REMOVAL SERVICE POINTS

◀A▶ INJECTION PIPE DISCONNECTION

When loosening nuts at both ends of injection pipe, hold the delivery holder (for pump side) and the injection nozzle assembly (for nozzle side) with wrench and loosen nut.

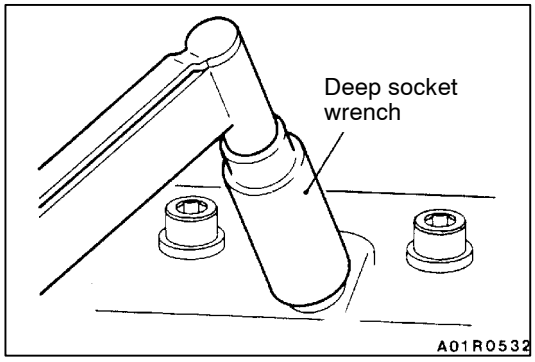


◀B▶ NUT/FUEL RETURN PIPE REMOVAL

1. While using a spanner or similar tool to hold the hexagonal nut of the fuel return pipe, remove the nut.

   Caution
   If an attempt is made to loosen the nut without first holding the fuel return pipe, the pipe may be broken or otherwise damaged.

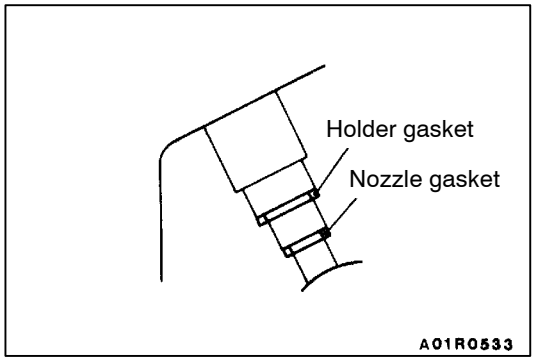
2. Disconnect the fuel return pipe.



◀C▶ INJECTION NOZZLE ASSEMBLY REMOVAL

Using a deep socket wrench, remove the injection nozzle assembly.

Caution
1. **Make a mark on the removed injection nozzle assembly (the cylinder No.).**
2. **Use a cap to prevent foreign material, etc. from entering the injection nozzle hole.**

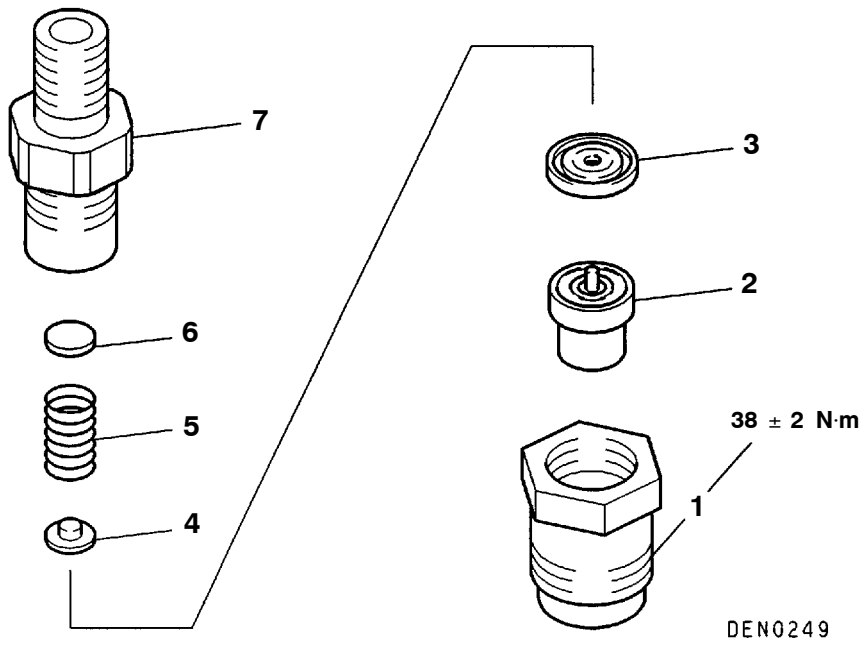


INSTALLATION SERVICE POINT

▶A◀ NOZZLE GASKET/HOLDER GASKET INSTALLATION

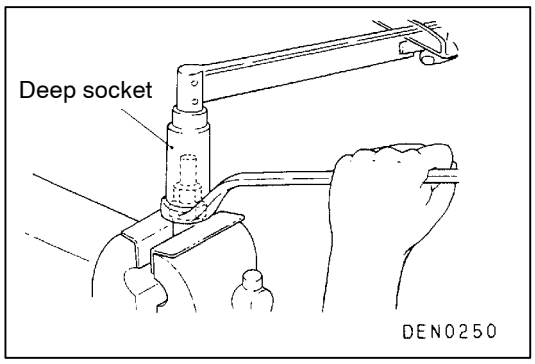
Clean the cylinder head's injection nozzle hole, and insert a new gasket.

DISASSEMBLY AND REASSEMBLY



Disassembly steps

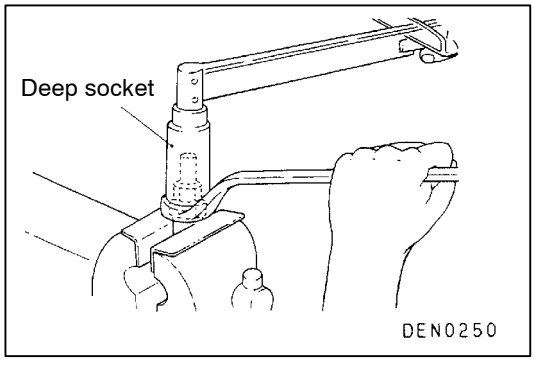
◀A▶ ▶A◀ 1. Retaining nut
2. Nozzle tip
3. Distance piece
4. Retaining pin
5. Pressure ring
6. Shim
7. Nozzle holder body



DISASSEMBLY SERVICE POINT

◀A▶ RETAINING NUT REMOVAL

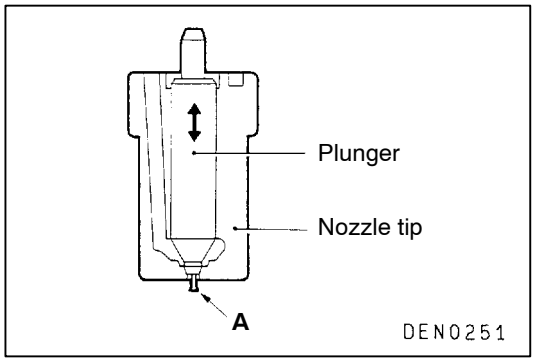
1. Lightly clamp the retaining nut in a vise with soft jaws.
2. Hold the retaining nut with a box wrench, and loosen the nozzle holder body using a deep socket.



REASSEMBLY SERVICE POINT

▶A◀ RETAINING NUT INSTALLATION

1. Finger-tighten the nozzle holder body.
2. Lightly clamp the retaining nut in a vise with soft jaws.
3. While holding the retaining nut with a box wrench, tighten the nozzle holder body to the specified torque with a deep socket.



INSPECTION

NOZZLE TIP

1. Check the nozzle tip for carbon deposits. Scape off carbon deposits with a piece of wood and clean each part with petrol. After cleaning, keep parts submerged in diesel fuel. Take particular care to protect the nozzle tip needle valve from damage.
2. While the nozzle tip is submerged in diesel fuel, check that the needle valve slides smoothly.
   If the needle valve does not slide smoothly, replace the nozzle tip.
   When replacing the nozzle tip, completely wash off the anticorrosive oil from the new nozzle tip with clean diesel fuel before using it.
3. Check plunger tip “A” for deformation and breakage. If “A” is damaged or broken, replace it.

DISTANCE PIECE

Check the surface in contact with the nozzle holder body by using minium.

PRESSURE SPRING

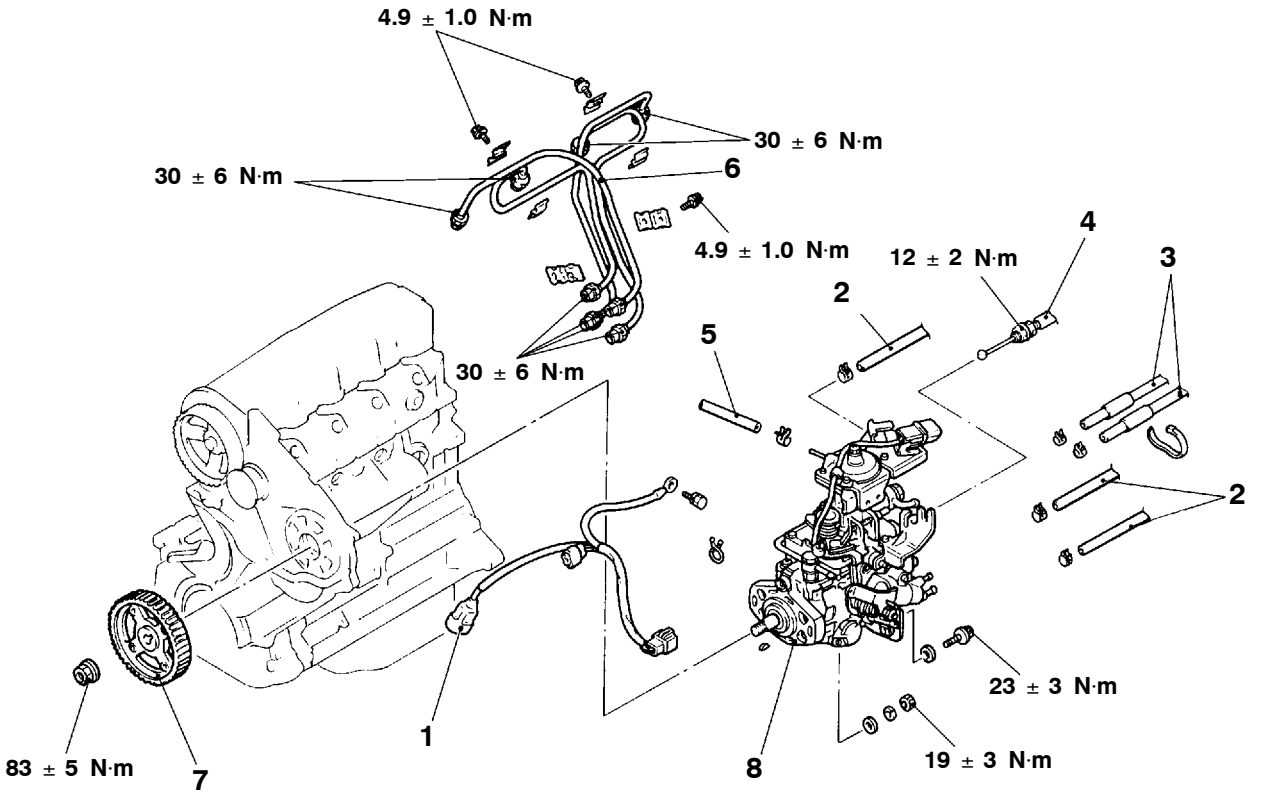
Check spring for weakness and breakage.

INJECTION PUMP

REMOVAL AND INSTALLATION

Pre-removal Operation
- Engine Coolant Draining (Refer to GROUP 14 - On-vehicle Service.)
- Battery and Battery Tray Removal
- Timing Belt Removal (Refer to GROUP 11B.)
- Air Pipe Removal (Refer to GROUP 15.)

Post-installation Operation
- Air Pipe Installation (Refer to GROUP 15.)
- Timing Belt Installation (Refer to GROUP 11B.)
- Battery and Battery Tray Installation
- Engine Coolant Supplying (Refer to GROUP 14 - On-vehicle Service.)
- Injection Timing Adjustment (Refer to GROUP 11B - On-vehicle Service.)
- Accelerator Cable Adjustment (Refer to GROUP 17 - On-vehicle Service.)

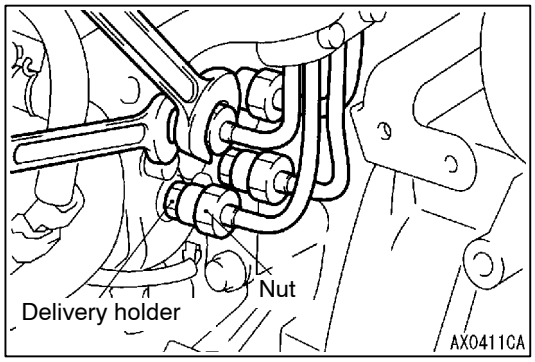


Removal steps

1. Fuel injection pump wiring harness
2. Water hoses connection
3. Fuel hoses connection
4. Accelerator cable connection

◀A▶
◀B▶

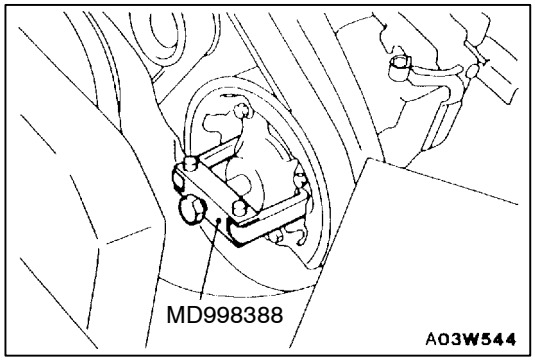
5. Boost hose connection
6. Fuel injection pipe
7. Fuel injection pump sprocket
8. Fuel injection pump



REMOVAL SERVICE POINTS

◀A▶ INJECTION PIPE REMOVAL

Loosen the nuts at the end of the injection pipe with the delivery holder (for pump side) and injection nozzle assembly (for nozzle side) retained by a spanner, etc.



◀B▶ FUEL INJECTION PUMP SPROCKET REMOVAL

Remove sprocket installing nut and remove sprocket from pump drive shaft with special tool.

Caution

1. **Do not hit pump drive shaft with hammer, etc.**
2. **When holding injection pump, do not allow to dangle by holding accelerator lever or fast idle lever. Do not remove these levers. Removal will cause injection pump malfunction.**

NOTES

DIESEL FUEL <4M4>

Click on the applicable bookmark to selected the required model year.

DIESEL FUEL <4M4>

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GENERAL INFORMATION

The electronically-controlled fuel injection system consists of sensors which detect the condition of the diesel engine, an engine-ECU which controls the system based on signals from these sensors, and actuators which operate according to control commands from the engine-ECU.
The engine-ECU carries out operations such as fuel injection rate control, fuel injection timing control and idle up control. In addition, the engine-ECU is equipped with several self-diagnosis functions which make troubleshooting easier in the event that a problem develops.

FUEL INJECTION RATE CONTROL

The fuel injection completion timing is controlled by means of a solenoid-type spill valve to ensure that the optimum amount of fuel is supplied to the engine in accordance with gradual changes in the engine running condition.
Before fuel injection starts, the solenoid-type spill valve is on (energized), so that the valve is closed. As the plunger turns and rises, fuel is sent out under pressure, and when the fuel flow rate reaches the target value for fuel injection, the solenoid-type spill valve turns off. When the solenoid-type spill valve turns off, the fuel under high pressure inside the plunger is leaked out into the pump chamber and fuel injection is completed.

FUEL INJECTION TIMING CONTROL

The position of the injection pump timer piston is controlled so that fuel injection is carried out at the optimum timing in accordance with the engine running condition.
The timer piston position is determined by duty control of the timing control solenoid valve which is located in the line between the high-pressure chamber and the low-pressure chamber of the timer piston.
The fuel injection timing is advanced by increasing the control duty of the timing control solenoid valve.

IDLE SPEED CONTROL

Controlling the fuel injection rate in accordance with the engine running condition maintains the idle speed at the optimum condition.

SELF-DIAGNOSIS FUNCTION

- When an abnormality is detected in any of the sensors or actuators, the engine warning lamp illuminates to warn the driver.
- When an abnormality is detected in any of the sensors or actuators, a diagnosis code number corresponding to the problem which occurred is output.
- The RAM data relating to the sensors and actuators which is stored in the engine-ECU can be read using the MUT-II. In addition, the actuators can be force-driven under certain conditions.

OTHER CONTROL FUNCTIONS

1. Power Supply Control
   When the ignition switch is turned to ON, the relay turns on and power is supplied to components such as the timing control solenoid valve.
2. Intake Air Throttle Control
   When the engine is idling after having warmed up, the throttle valve is half opened to restrict the amount of intake air in order to reduce vibration and noise.
3. A/C Relay Control
   Turns the compressor clutch of the A/C ON and OFF
4. Fan motor relay control
   The radiator fan and condenser fan operating speeds are controlled in accordance with the engine coolant temperature and the vehicle speed.
5. Glow Control
   Refer to GROUP 16.
6. EGR Control
   Refer to GROUP 17.

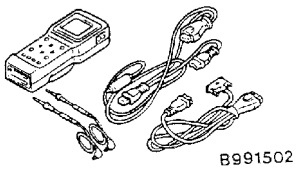
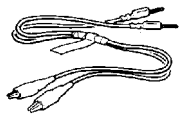
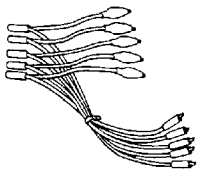
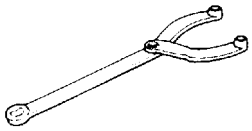
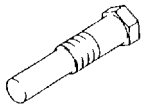
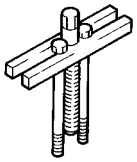
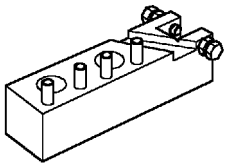
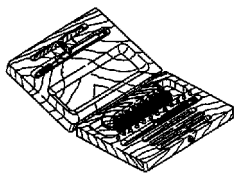
SERVICE SPECIFICATIONS

Item		Standard value
Accelerator pedal position sensor reference voltage V		0.985 - 1.085
Accelerator pedal position sensor resistance kΩ		3.5 - 6.5
Boost air temperature sensor (Intake air temperature sensor) resistance kΩ	When the temperature is 20°C	2.3 - 2.9
	When the temperature is 80°C	0.30 - 0.39
Engine coolant temperature sensor resistance kΩ	When the temperature is 20°C	2.3 - 2.6
	When the temperature is 80°C	0.30 - 0.34
Fuel cut solenoid valve resistance Ω		6.8 - 9.2
Timing control valve resistance Ω		10.8 - 11.2
Timer piston position sensor resistance Ω	Connector terminals No.1 - No.2	160 - 168
	Connector terminals No.1 - No.3	80 - 84
	Connector terminals No.2 - No.3	80 - 84
Control sleeve position sensor resistance Ω	Connector terminals No.4 - No.12	11.2 - 12.4
	Connector terminals No.4 - No.8	5.6 - 6.2
	Connector terminals No.8 - No.12	5.6 - 6.2
GE actuator (electronic governor) resistance Ω	Connector terminals No.6 - No.10	0.64 - 0.72
Fuel temperature sensor resistance kΩ	Connector terminals No.7 - No.11	1.4 - 2.6
Engine speed sensor resistance kΩ		2.15
Main/sub throttle solenoid valve resistance Ω		36 - 44

SEALANT

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

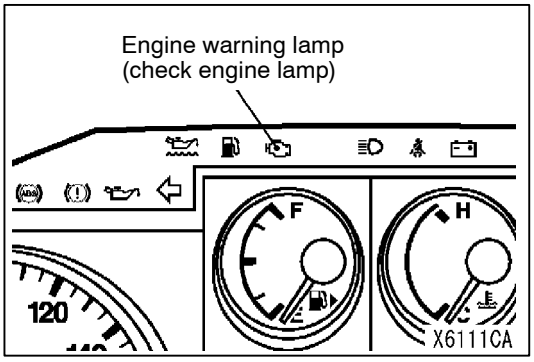
SPECIAL TOOLS

Tools	Number	Name	Application
 B991502	MB991502	MUT-II sub assembly	Electronically controlled fuel injection system check
	MB991529	Diagnosis code check harness	Diagnosis code reading
	MB991348, MB991658	Test harness set	• Boost pressure sensor check <MB991348> • APS adjustment <MB991658>
	MB990767	End yoke holder	Holding the crankshaft pulley
	MB998754	Crankshaft pulley holder pin	
 B990803	MH062567	Gear puller	Injection pump gear assembly removal
	157992-2820 (zexcel)	Plate	Retaining nut removal and installation
	105789-0010 (zexcel)	Nozzle cleaning tool	Cleaning of nozzle and needle valve

TROUBLESHOOTING

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING

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



DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

Engine warning lamp is lit when any abnormality takes place in the item related to electronically controlled fuel injection system shown in the following table.
If the malfunction indicator lamp has been on and/or is lit when the engine is in operation, check the diagnosis output.

Engine warning lamp check items

Accelerator pedal position sensor (main)
Accelerator pedal position sensor (sub)
Boost pressure sensor (Boost sensor)
Engine speed sensor
Control sleeve position sensor
Timer piston position sensor
Main throttle solenoid valve
GE actuator
Idle switch (built-in)
Engine-ECU

METHOD OF ERASING 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 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, BACKUP FUNCTIONS

When abnormalities in the major sensors are detected by diagnosis functions, pre-set control logic operates to maintain a safe driving condition for the vehicle.

Diagnosis item	Control features in malfunction
Accelerator pedal position sensor	● Accelerator pedal released (idle switch ON) Acceleration opening degree = 0% ● Accelerator pedal applied (idle switch OFF) Engine controlled at low speed Acceleration opening degree = 20% fixed
Idle switch	● Void idling speed control. ● Void cruise control.
Engine speed sensor	● Engine controlled at low speed ● Void cruise control.
Boost air temperature sensor	Maintain the intake air temperature at 50 °C.
Vehicle speed sensor	● Void idling speed control. ● Void cruise control.
Engine coolant temperature sensor	Maintain the engine coolant temperature at 80 °C.
Control sleeve position sensor	● Engine controlled at low speed ● Void cruise control.
Timer piston position sensor	● Injection timing stabilizing control ● Void cruise control.
Barometric pressure sensor (ECU built-in)	Keep the barometric pressure at 101 kPa.
Fuel temperature sensor	Maintain the fuel temperature at 50 °C.
Boost pressure sensor	Keep the boost pressure as barometric pressure (101 kPa).
Injection correction ROM	Void correction.
GE actuator	● Engine controlled at low speed ● Void cruise control.
Over boost	Void cruise control.
Timing control valve	● Injection timing stabilizing control ● Void cruise control.

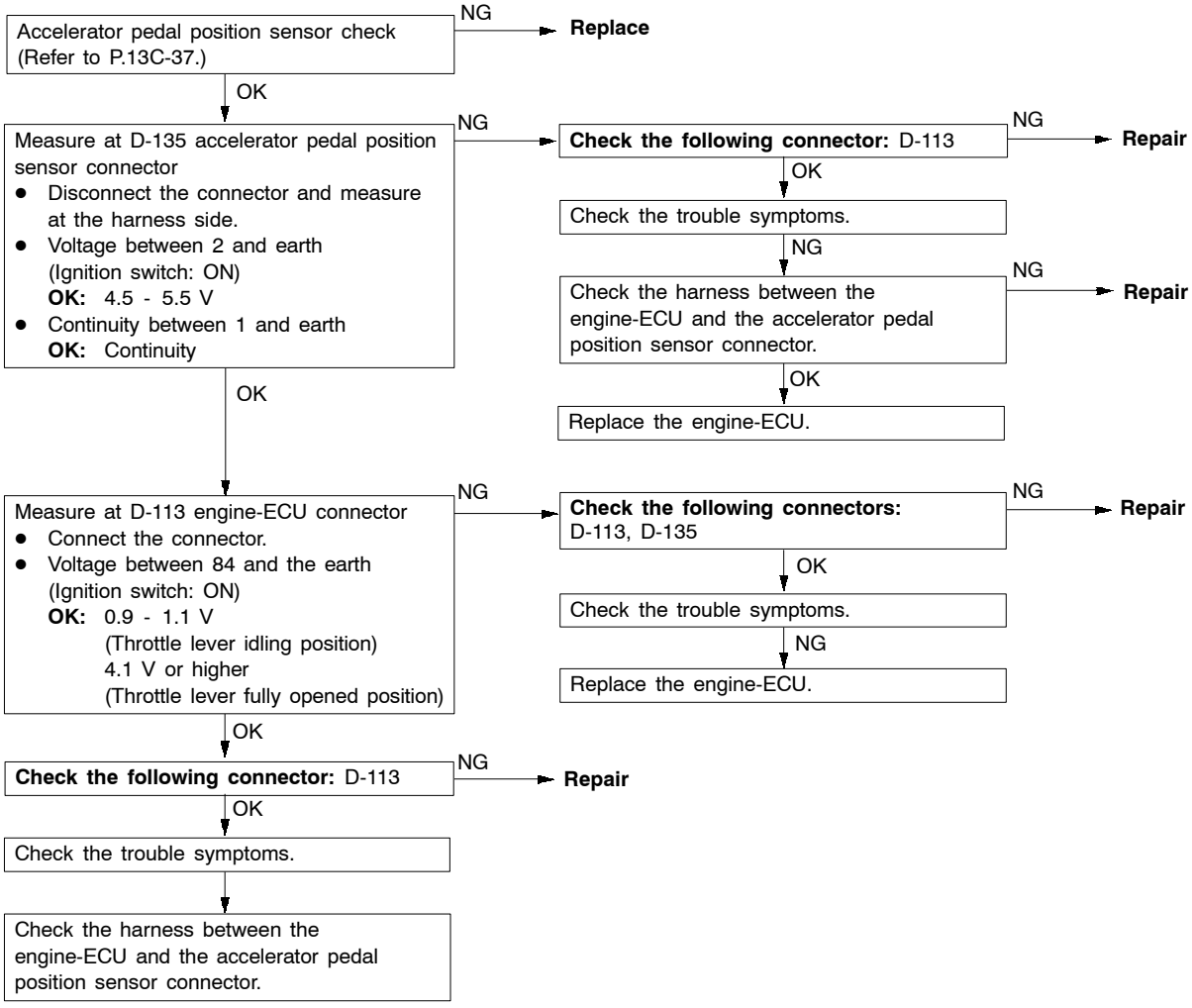
INSPECTION CHART FOR DIAGNOSIS CODES

Code No.	Diagnosis item	Reference page
11	Accelerator pedal position sensor (main) system	13C-8
12*	Boost pressure sensor system	13C-9
13	Barometric pressure sensor (ECU built-in) system	13C-10
14	Fuel temperature sensor system	13C-10
15	Engine coolant temperature sensor system	13C-11
16	Boost air temperature sensor system	13C-11
17	Vehicle speed sensor system	13C-12
18	Engine speed sensor (backup) system	13C-13
21	Engine speed sensor system	13C-14
23	Idle switch (accelerator pedal position sensor built-in) system	13C-15
25*	Timer piston position sensor system	13C-16
26*	Control sleeve position sensor system	13C-17
27	Accelerator pedal position sensor (sub) system	13C-18
41*	Main throttle solenoid valve system	13C-19
43	Timing control valve system	13C-20
46	Injection correction ROM system	13C-21
48*	GE actuator (in the middle of control sleeve position sensor inoperative) system	13C-21
49*	Over boost (turbocharger waste gate malfunction)	13C-22
54	Immobilizer system	13C-22

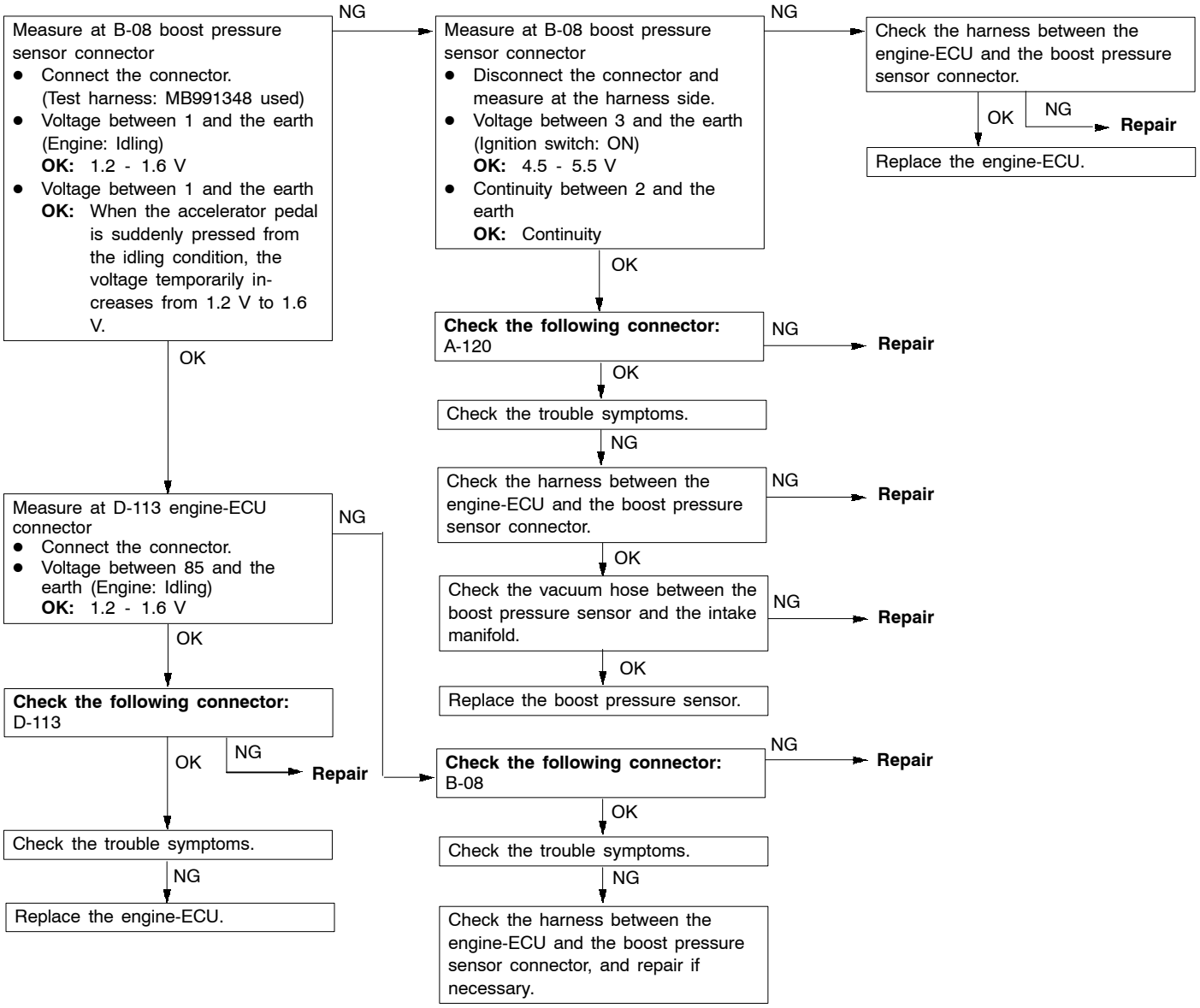
Caution
If the the above-mentioned diagnosis code number with the asterisks can be displayed along with another code number in parentheses simultaneously, check the other code number before replacing the engine-ECU.
12 (41, 49), 26 (48), 25 (43), 41 (12, 49), 48 (26), 49 (12, 41)

INSPECTION PROCEDURE FOR DIAGNOSIS CODE

Code No. 11 Accelerator pedal position sensor system	Probable cause
Range of Check ● Ignition switch: ON, accelerator pedal position sensor (sub) operative, except for during engine cranking Set Conditions ● Output voltage of accelerator pedal position sensor (sub) for one second is 0.2 V or higher and lower than 2.5V. Output voltage of accelerator pedal position sensor (main) for one second is 4.5V or higher, or lower than 0.2V. Range of Check ● Ignition switch:ON, except for during engine cranking Set Conditions ● The output voltage of accelerator pedal position sensor (main and sub) for 0.2 second is 0.2V or higher, or lower than 4.5V and the difference in sensor output voltage between the main and sub is 1V or higher, or idle switch:ON, and sensor main output voltage is 1.875V or higher.	● Accelerator pedal position sensor inoperative ● Accelerator pedal position sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative



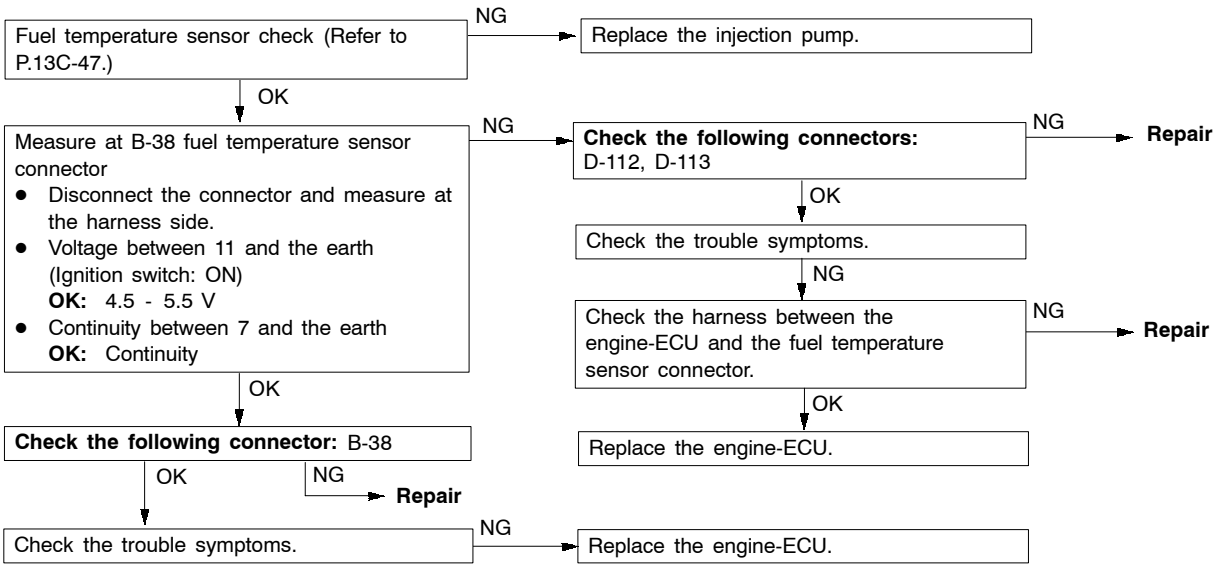
Code No. 12 Boost pressure sensor (boost sensor) system	Probable cause
Range of Check ● Ignition switch: ON, except for during engine cranking Set Conditions ● Sensor output voltage for one second is 4.5 Vor higher (boost pressure is approximately 306.7kPa). or ● Sensor output voltage for one second is 0.2 Vor lower (boost pressure is approximately 20kPa or lower) Range of Check ● Engine speed is 1600 r/min or higher and the acceleration opening degree is 60% or more. Set Conditions ● Boost pressure is lower than the barometric pressure + 13 kPa for two seconds.	● Boost pressure sensor inoperative ● Boost pressure sensor open circuit, short circuit, or connector contact inoperative ● Boost pressure sensor hose disconnected ● Engine-ECU inoperative



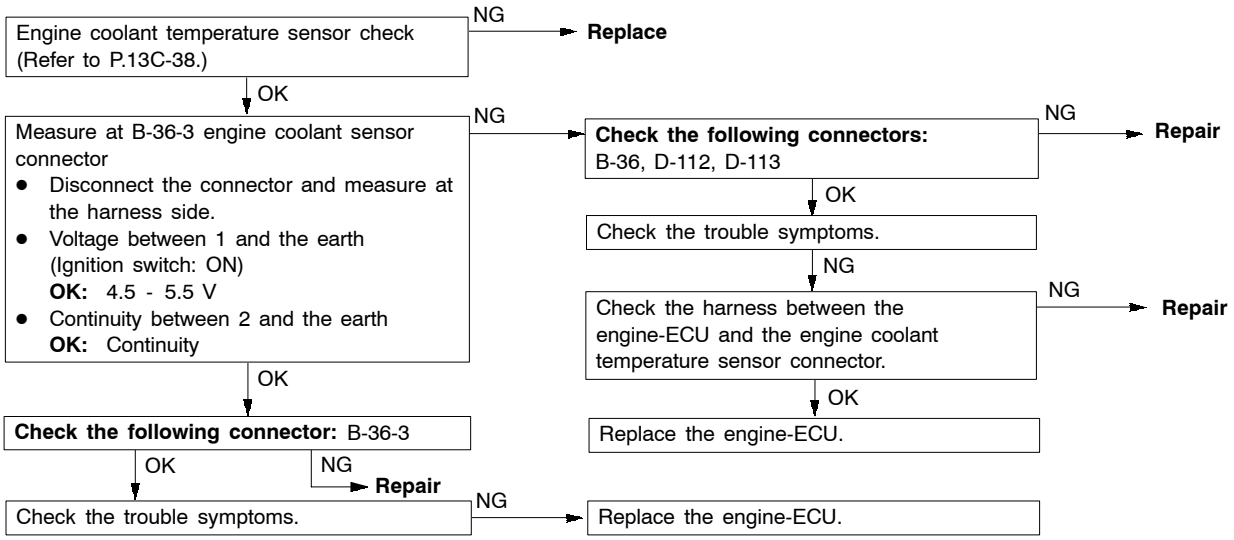
Code No. 13 Barometric pressure sensor system	Probable cause
Range of Check ● Ignition switch: ON, except for during engine cranking Set Conditions ● The sensor output voltage is for 3 seconds is 4.5V or higher (the barometric pressure is approximately 120 kPa or over). or ● The sensor output voltage is for 3 seconds is 1.5V or lower (the barometric pressure is approximately 33 kPa or under).	Engine-ECU inoperative

Check the trouble symptoms. → NG → Replace the engine-ECU.

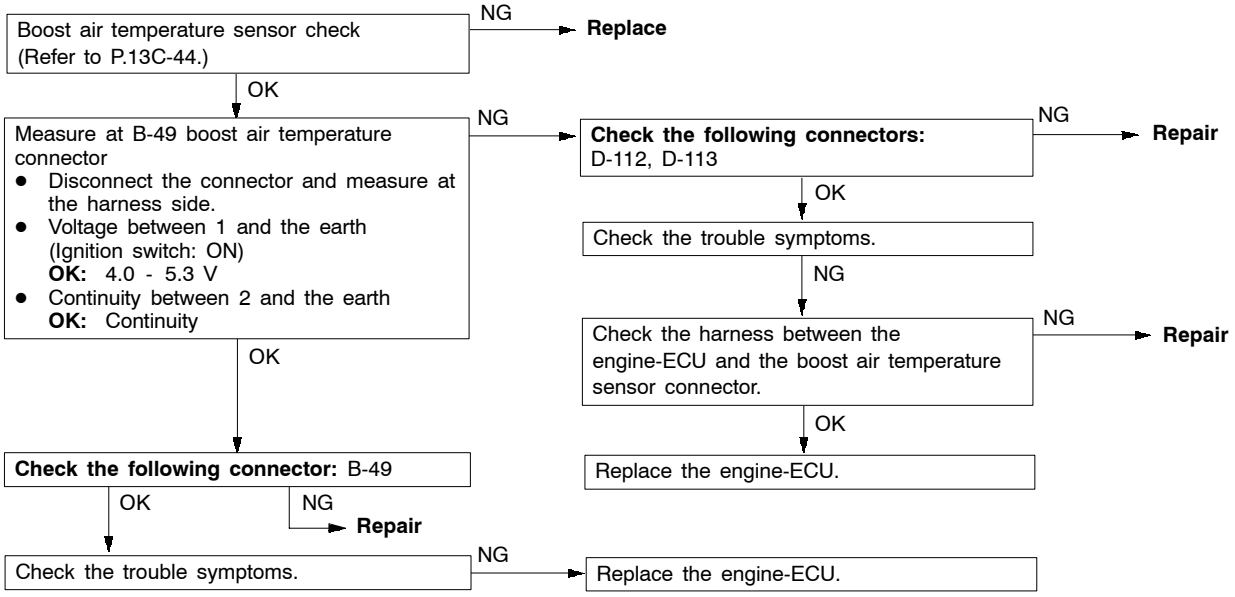
Code No. 14 Fuel temperature sensor system	Probable cause
Range of Check ● Ignition switch: ON, except for during engine cranking Set Conditions ● The sensor output voltage for 3 seconds is 0.2V or higher (the fuel temperature is approximately 120°C or higher). or ● The sensor output voltage for 3 seconds is 4.6V or lower (the fuel temperature is approximately 50°C or lower).	● Fuel temperature sensor inoperative ● Fuel temperature sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative



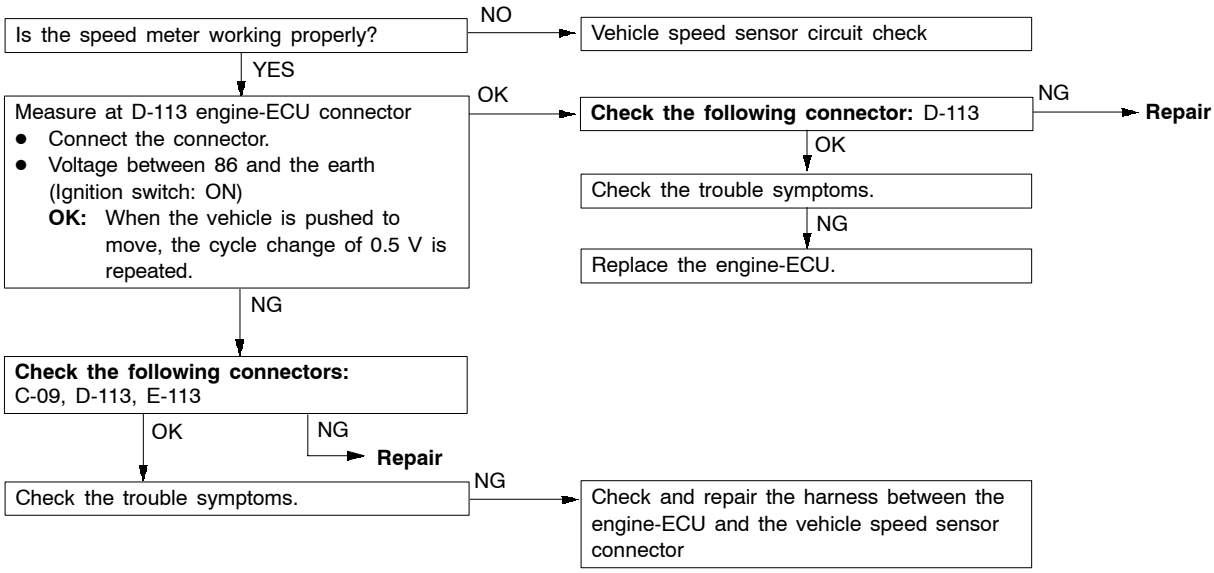
Code No. 15 Engine coolant temperature sensor system	Probable cause
Range of Check ● Ignition switch: ON, except for during engine cranking Set Conditions ● The sensor output voltage for 3 seconds is 4.9V or higher (the coolant temperature is approximately -45 °C or lower). or ● The sensor output voltage for 3 seconds is 0.2V or lower (the coolant temperature is approximately 140 °C or higher).	● Engine coolant temperature sensor inoperative ● Engine coolant temperature sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative



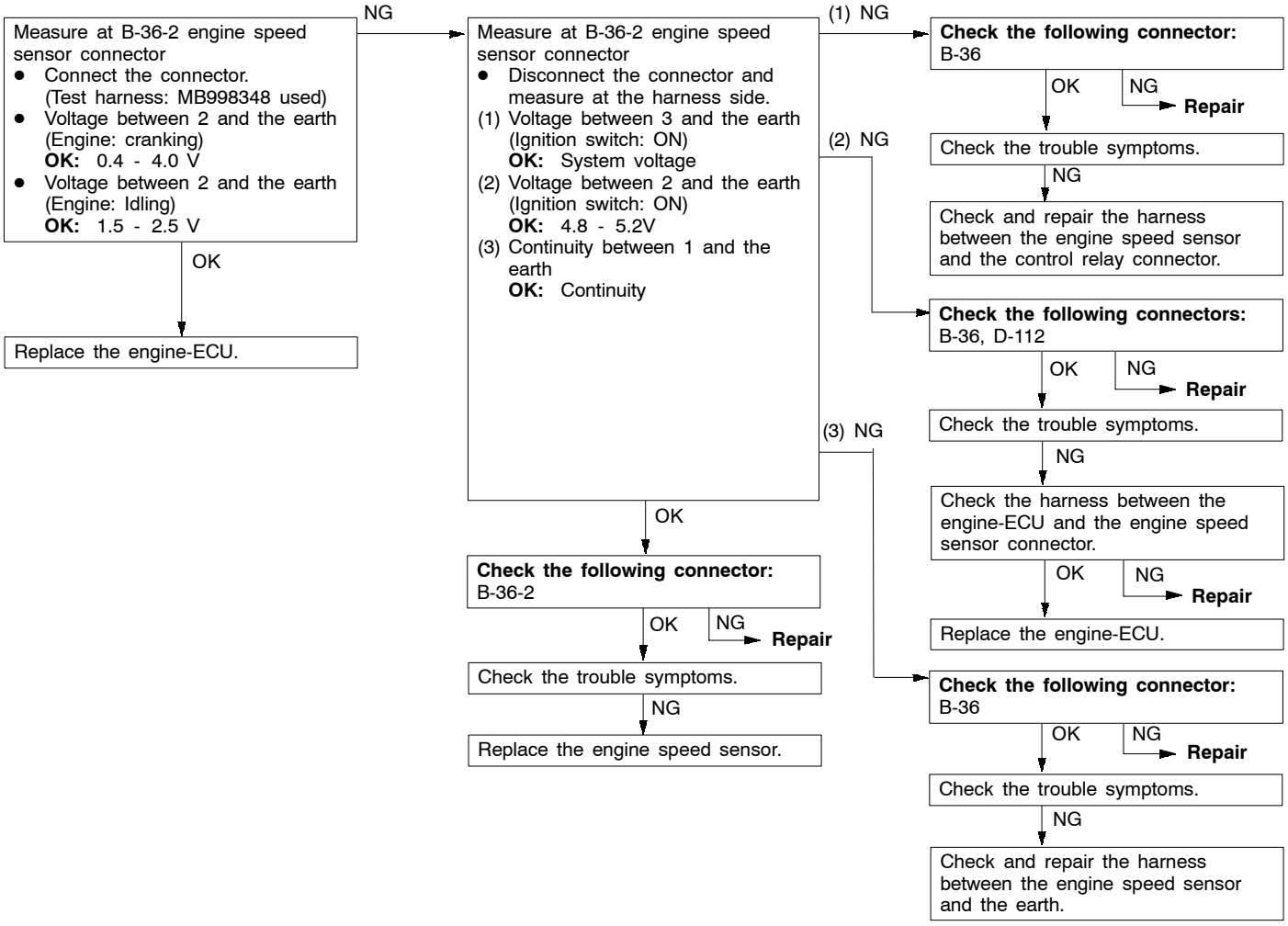
Code No. 16 Boost air temperature sensor (intake air sensor) system	Probable cause
Range of Check ● Ignition switch:ON, except for during engine cranking Set Conditions ● The sensor output voltage for 3 seconds is 4.6V or higher (the coolant temperature is approximately 45 °C or lower). or ● The sensor output voltage for 3 seconds is 0.3V or lower (the coolant temperature is approximately 110 °C or higher).	● Boost air temperature sensor inoperative ● Boost air temperature sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative



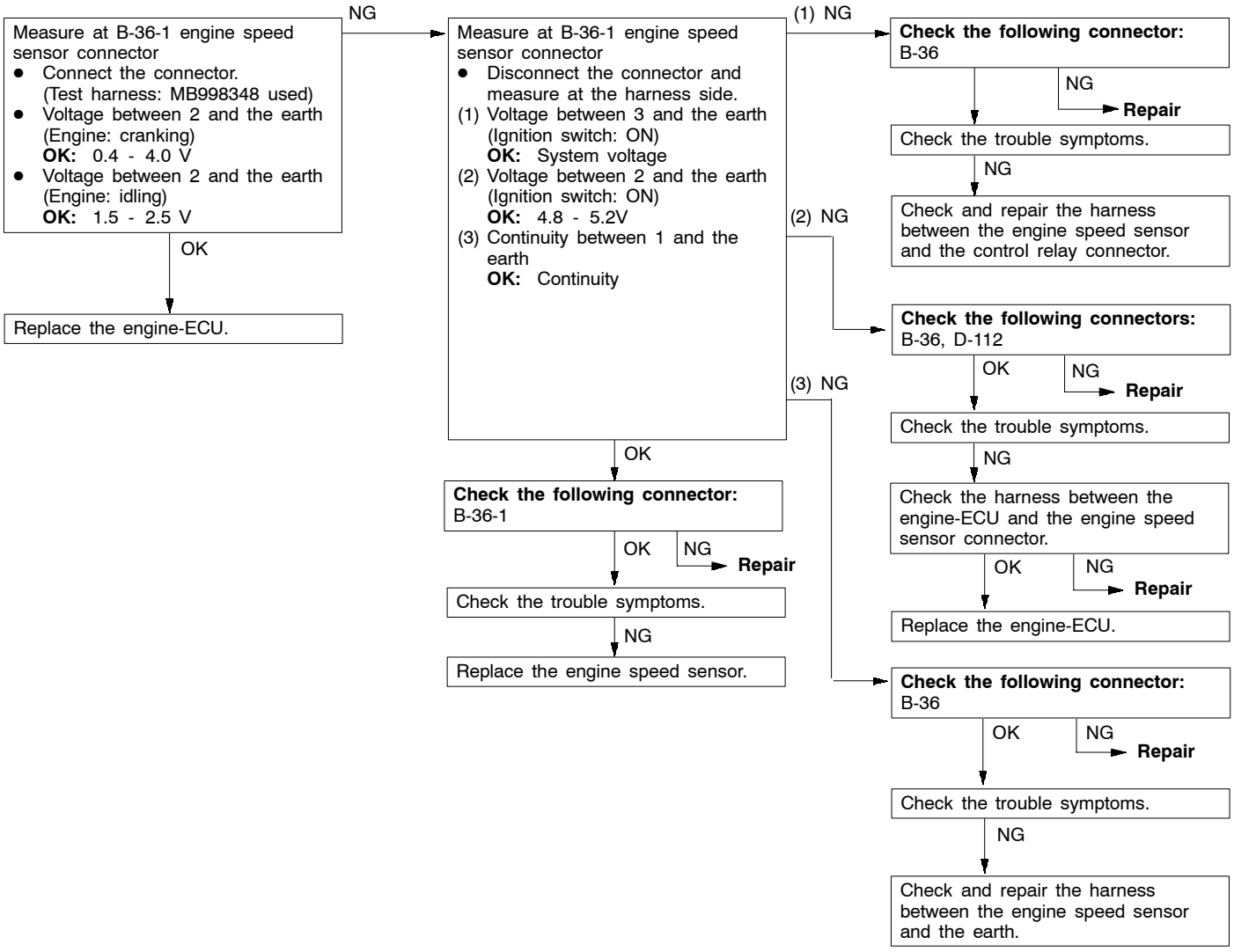
Code No. 17 Vehicle speed sensor system	Probable cause
Range of Check ● Ignition switch: ON ● Engine speed: 2800 r/min or higher ● Driving with heavy load Set Conditions ● Slower than vehicle speed of 3 km/h	● Vehicle speed sensor inoperative ● Vehicle speed sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative



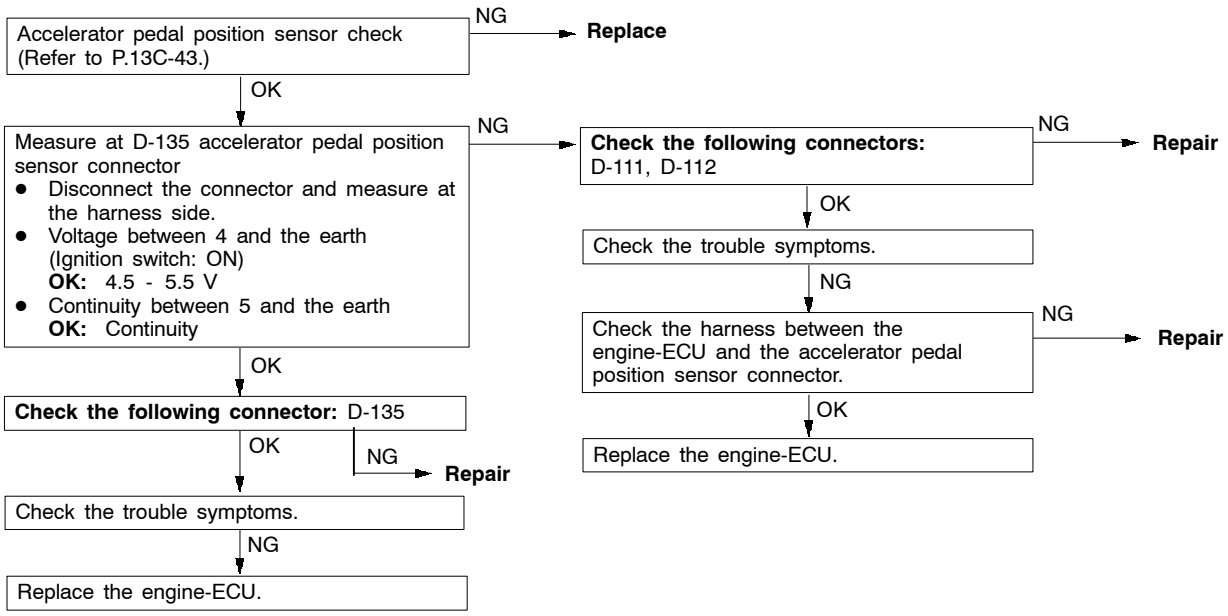
Code No. 18 Engine speed sensor (backup) system	Probable cause
Range of Check ● Except for during engine running and cranking Set Conditions ● The difference in the engine speed sensor output for 4 seconds: 325 r/min or more	● Engine speed sensor inoperative ● Engine speed sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative



Code No. 21 Engine speed sensor system	Probable cause
Range of Check ● During engine cranking Or ● Except for during engine running and cranking Set Conditions ● No change in the sensor output voltage for 3 seconds (no pulse signal has been input). Or ● No change in the engine speed sensor output for 0.06 seconds (for backup), or in the sensor output for 0.3 seconds	● Engine speed sensor inoperative ● Engine speed sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative

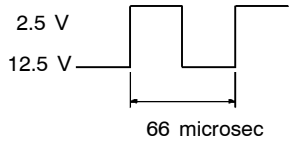


Code No. 23 Idle switch (accelerator pedal position sensor built-in) system	Probable cause
Range of Check Ignition switch: ON, accelerator pedal position sensor (main, sub) operative, except for during engine cranking Set Conditions • For 1 minute idle switch (built-in): ON, accelerator pedal position sensor (main, sub) output voltage 1.875V or higher or 10 minutes • Idle switch (built-in): OFF, accelerator pedal position sensor (main, sub) opening degrees less than 1%	• Accelerator pedal position sensor inoperative • Accelerator pedal position sensor open circuit, short circuit, or connector contact inoperative • Idle switch "ON" inoperative • Idle switch signal line short circuit • Engine-ECU inoperative



Code No. 25 Timer piston position sensor system	Probable cause
Range of Check ● Ignition switch: OK ● Not during the engine cranking Set Conditions ● The sensor output voltage for 1 second is 4.9V*1 or more or ● The sensor output voltage for 1 second is 0.25V*1 or less	● Timer piston position sensor inoperative ● Timer piston position sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative

NOTE:
*1: This voltage is derived from the input pulse signal converted in the engine-ECU and cannot be measured.
*2: This voltage is shown as a square wave with a cycle of 66 mircosec (High: 2.5V, Low: 1.25V).



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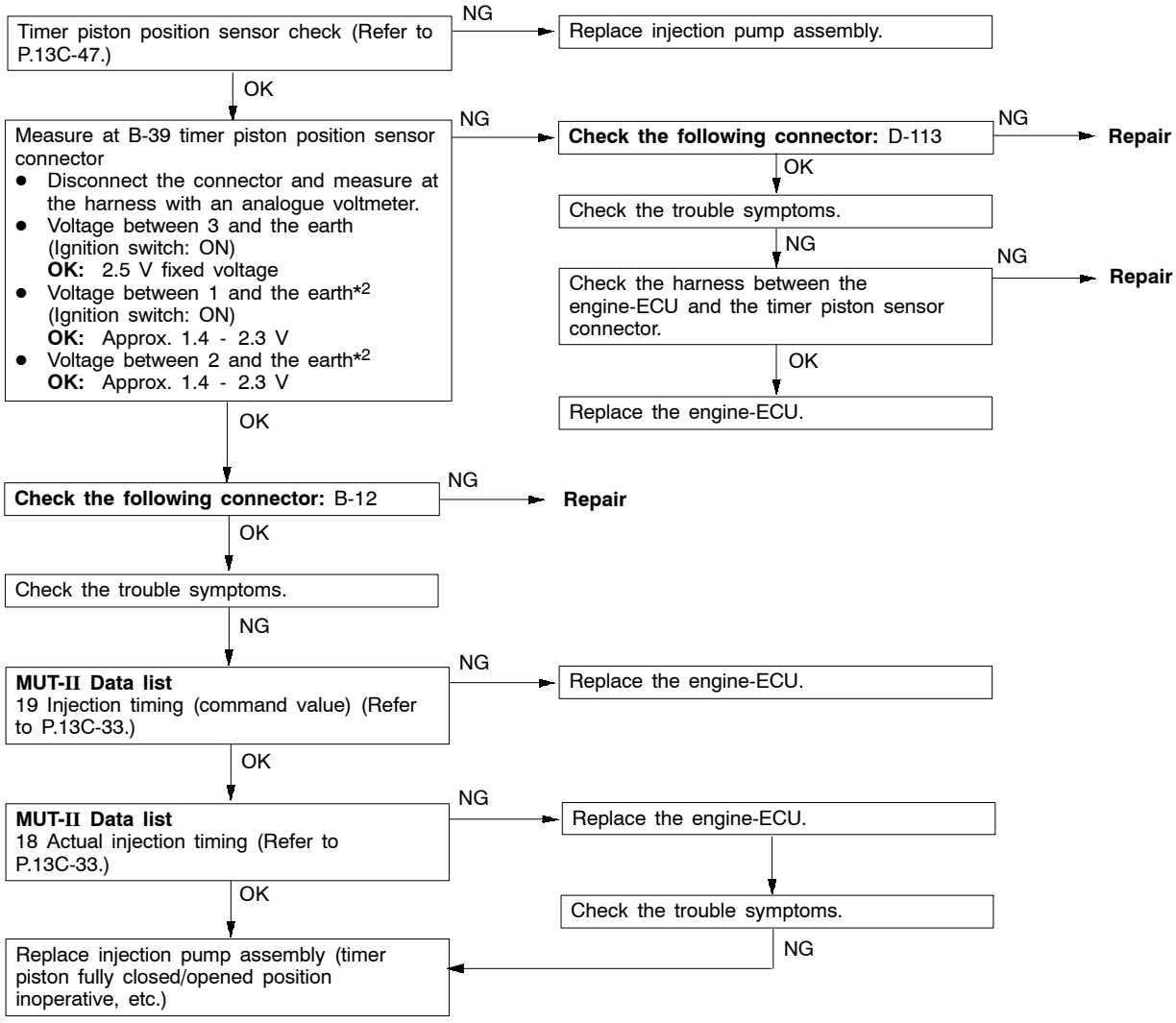
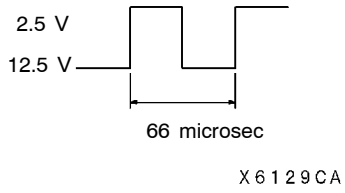
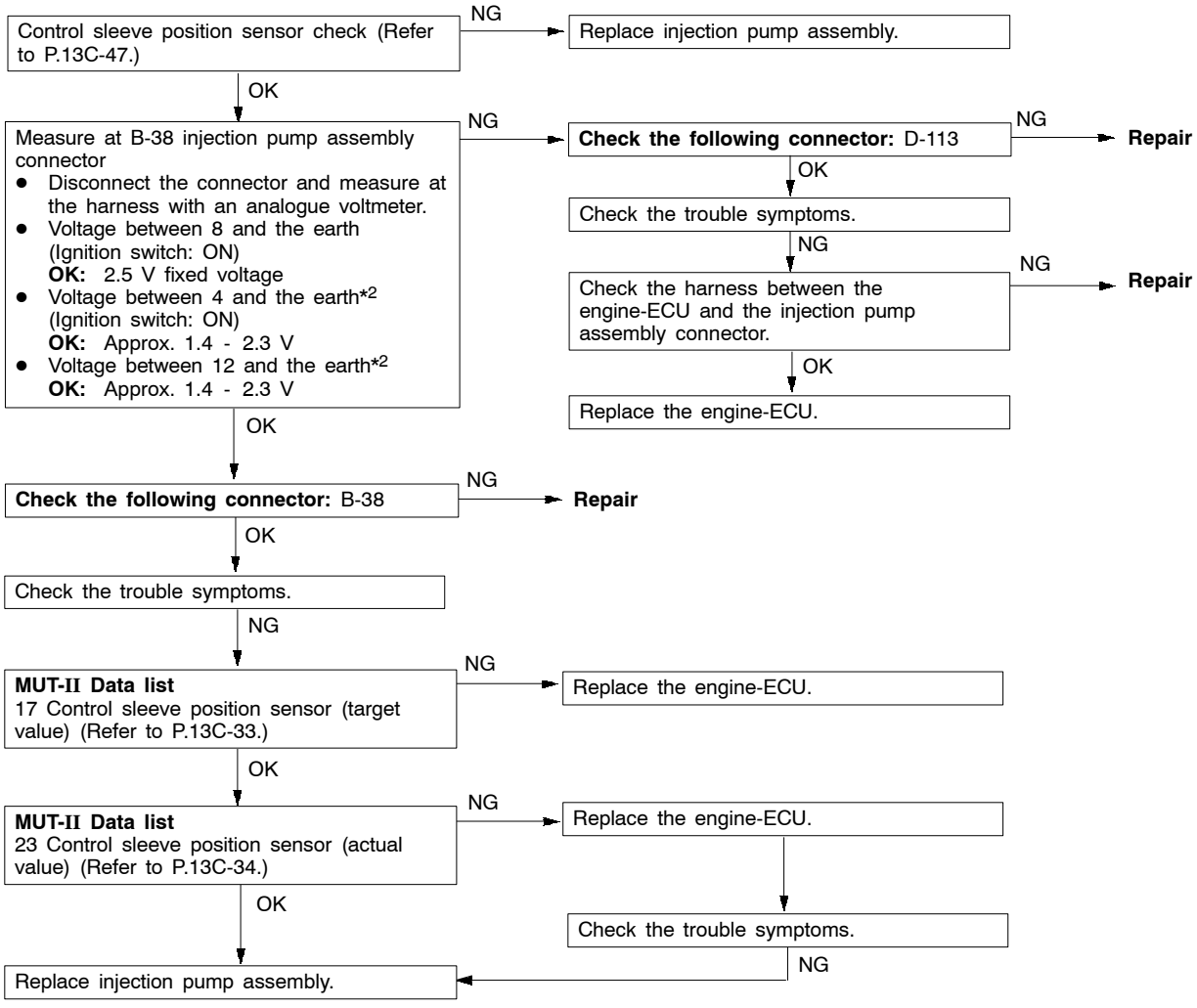


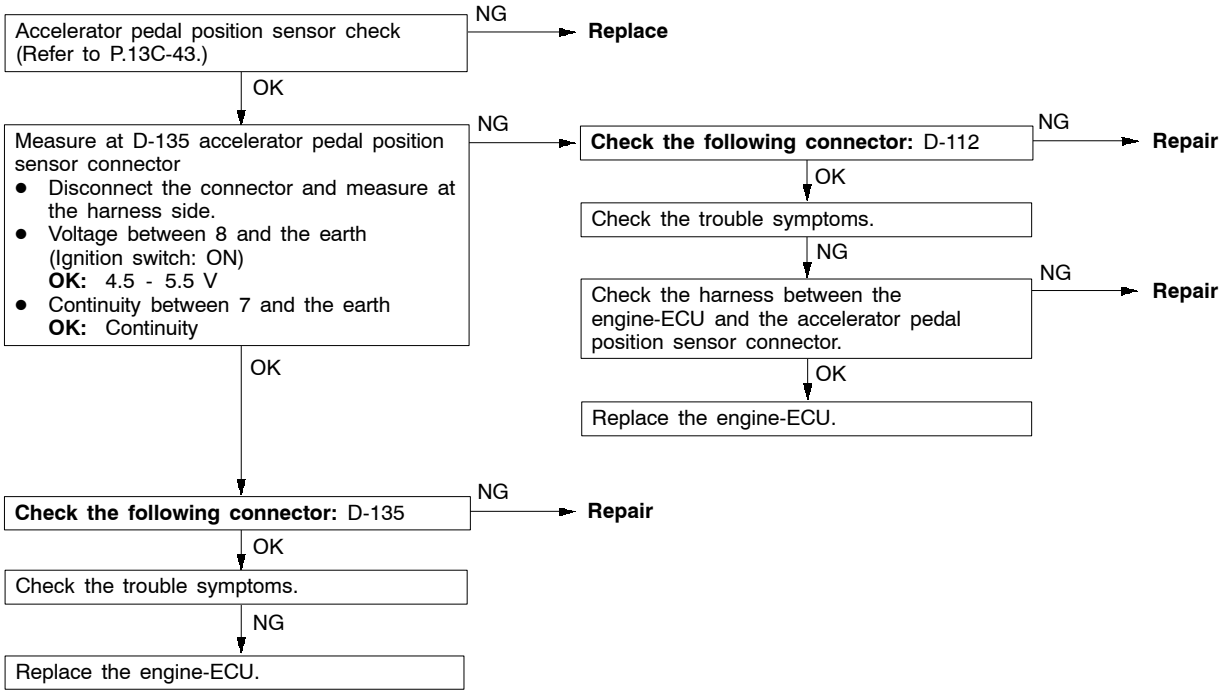
Code No. 26 Control sleeve position sensor system	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● The sensor output voltage for 1 second is 4.7V*1 or more or ● The sensor output voltage for 1 second is 0.25V*1 or less	● Control sleeve position sensor inoperative ● Control sleeve position sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative



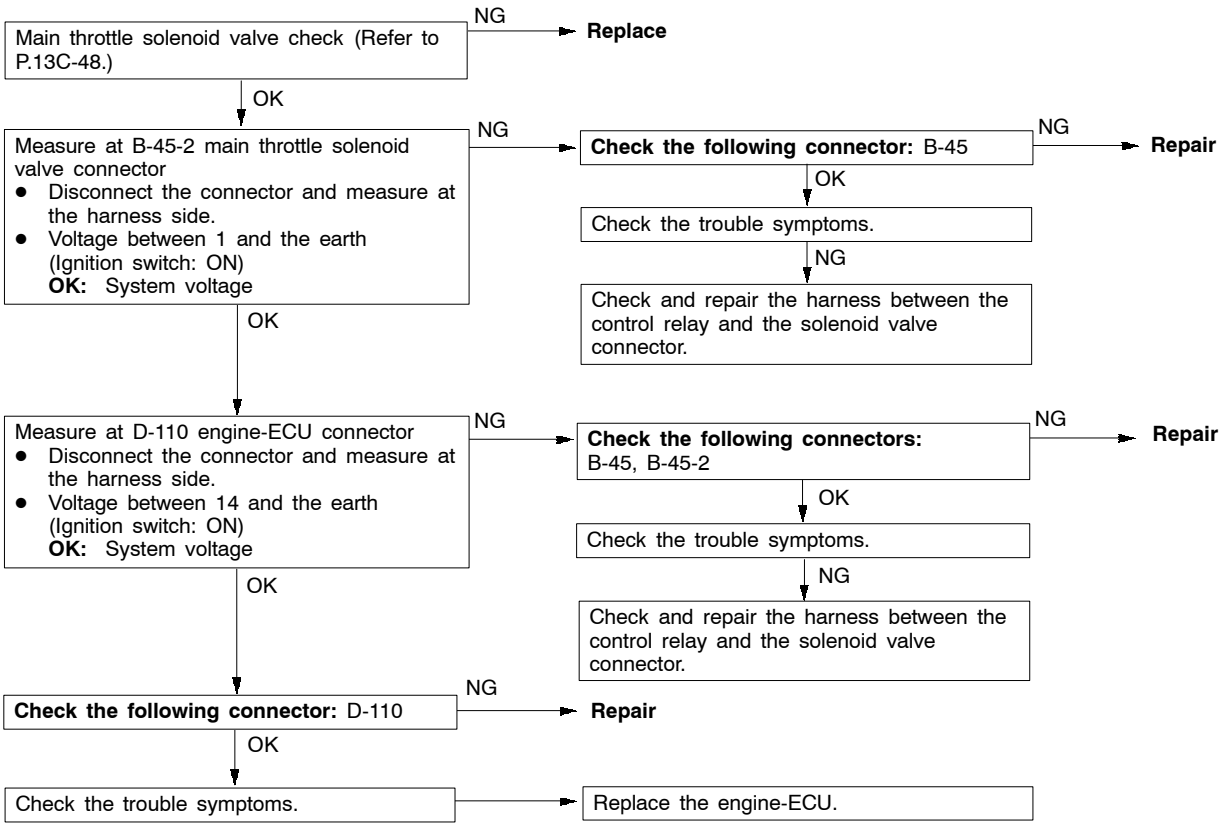
NOTE:
*1: This voltage is derived from the input pulse signal converted in the engine-ECU and cannot be measured.
*2: This voltage is shown as a square wave with a cycle of 16.7 microsec (High: 2.5V, Low: 1.25V.)



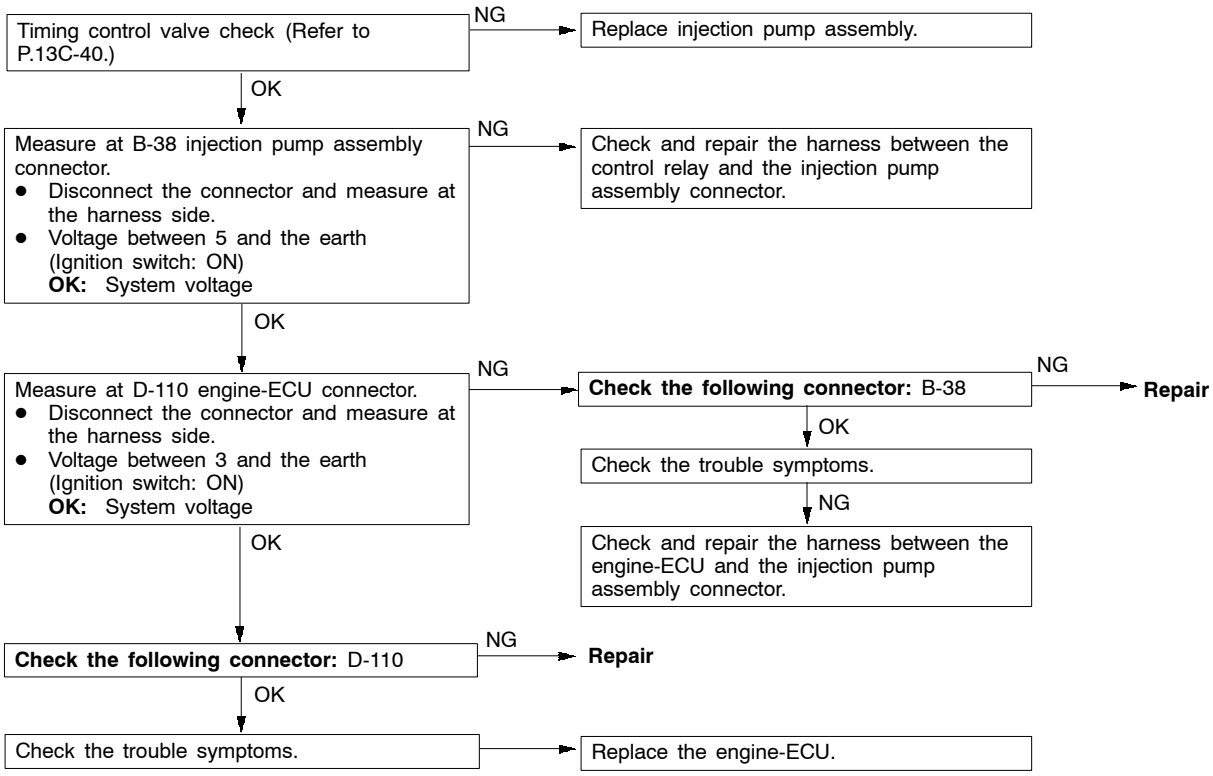
Code No. 27 Accelerator pedal position sensor (sub) system	Probable cause
Range of Check ● Ignition switch: ON, accelerator pedal position sensor (main) operative, except for during engine cranking Set Conditions ● Output voltage of accelerator pedal position sensor (main) for 1 second is 0.2V or higher and lower than 2.5V. Output voltage of accelerator pedal position sensor (sub) for 1 second is 4.5V or higher, or lower than 0.2V. Range of Check ● Ignition switch: ON, except for during engine cranking Set Conditions ● Output voltage of accelerator pedal position sensor (main, sub) for 1 second is 0.2 V or higher or lower than 4.5V. The difference in the output sensor voltage between the main and the sub sensor is 1V or higher, or the idle switch ON, and sensor main output voltage is 1.875V or higher.	● Accelerator pedal position sensor inoperative ● Accelerator pedal position sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative



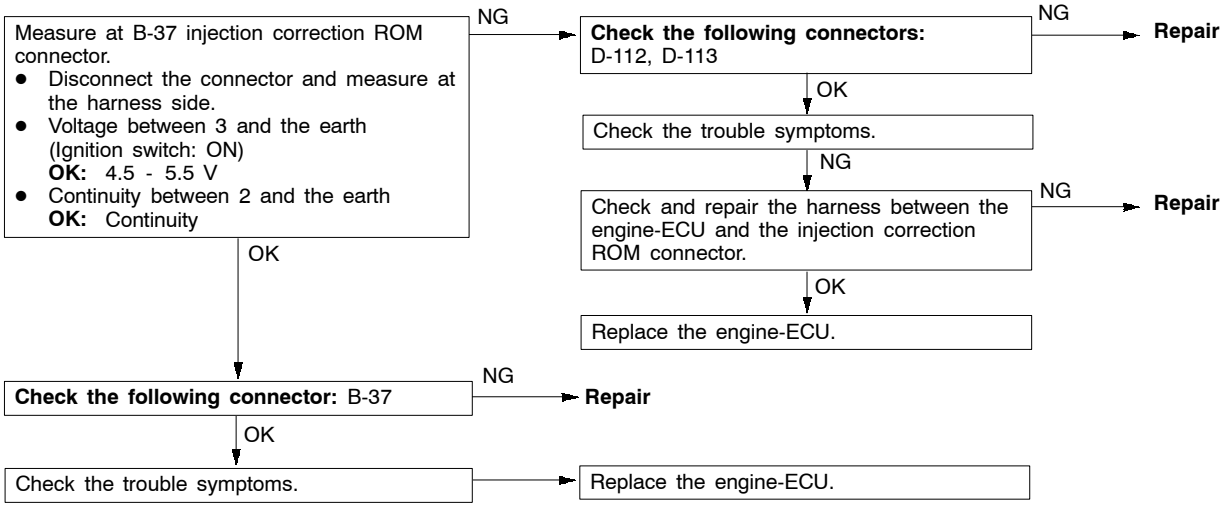
Code No. 41 Main throttle solenoid valve system	Probable cause
Range of Check ● Engine speed is 1600 r/min or higher and the acceleration opening degree is 60% or more. Set Conditions ● Boost pressure is lower than barometric pressure + 30 kPa for two seconds. Range of Check ● With the idling speed controlled, the engine warmed up, and no failure found Set Conditions ● Boost pressure is higher than barometric pressure - 2.7 kPa for 3 seconds.	● Main throttle solenoid valve inoperative ● Main throttle solenoid valve open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative



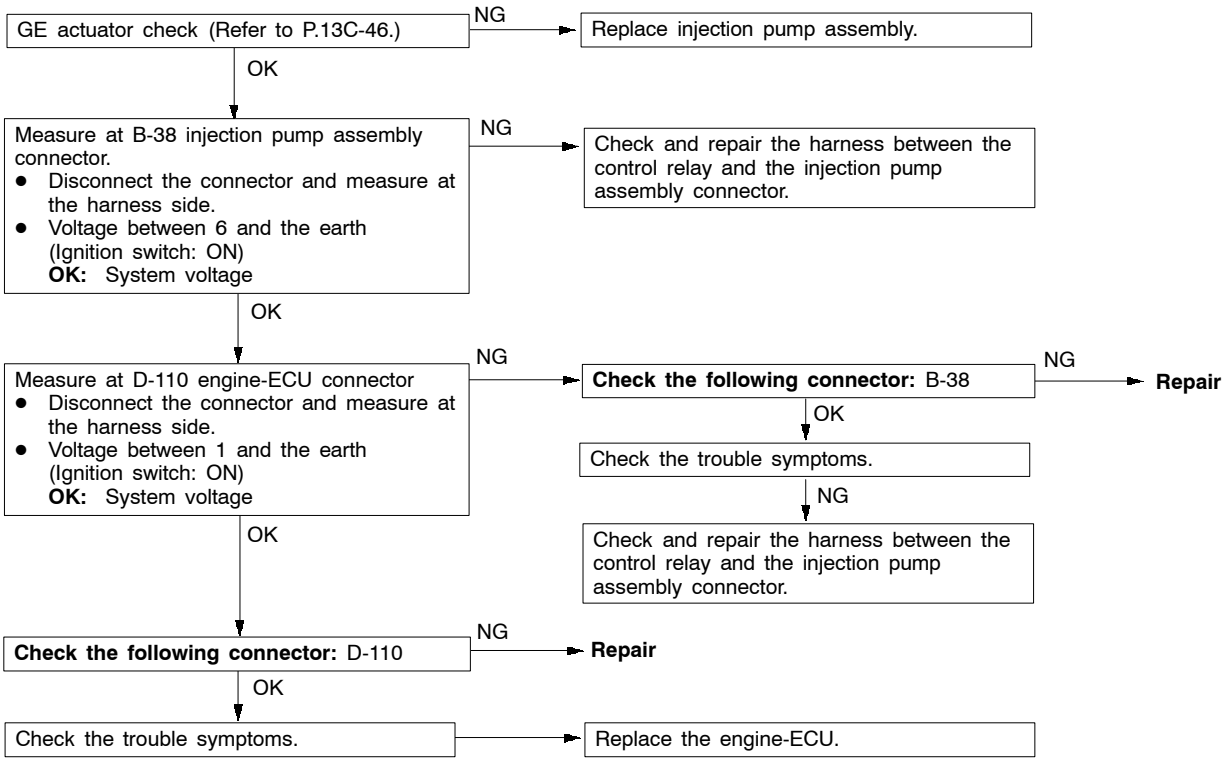
Code No. 43 Timing control valve system	Probable cause
Range of Check ● Engine coolant temperature 80 °C or higher and the engine running Set Conditions ● Target value minus actual value is 1 V or more.	● Timing control valve inoperative ● Timing control valve open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative



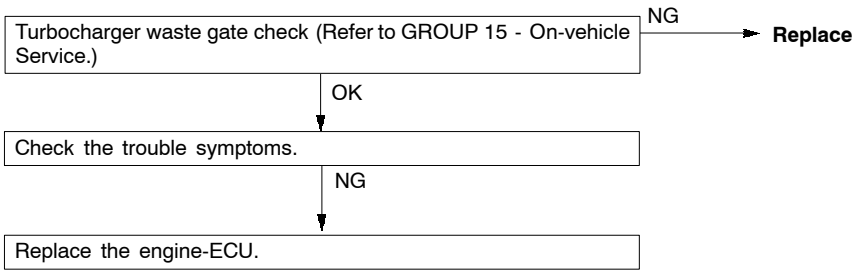
Code No. 46 Injection correction ROM system	Probable cause
Range of Check • Ignition switch: ON Set Conditions • When communication fails	• Injection correction ROM inoperative • Engine-ECU inoperative



Code No. 48 GE actuator (in the middle of control sleeve position sensor inoperative) system	Probable cause
Range of Check • Ignition switch: ON Set Conditions • Target value minus actual value is 1 V or more.	• Control sleeve position sensor inoperative • GE actuator inoperative • Control sleeve position sensor open circuit, short circuit, or connector contact inoperative • Engine-ECU inoperative

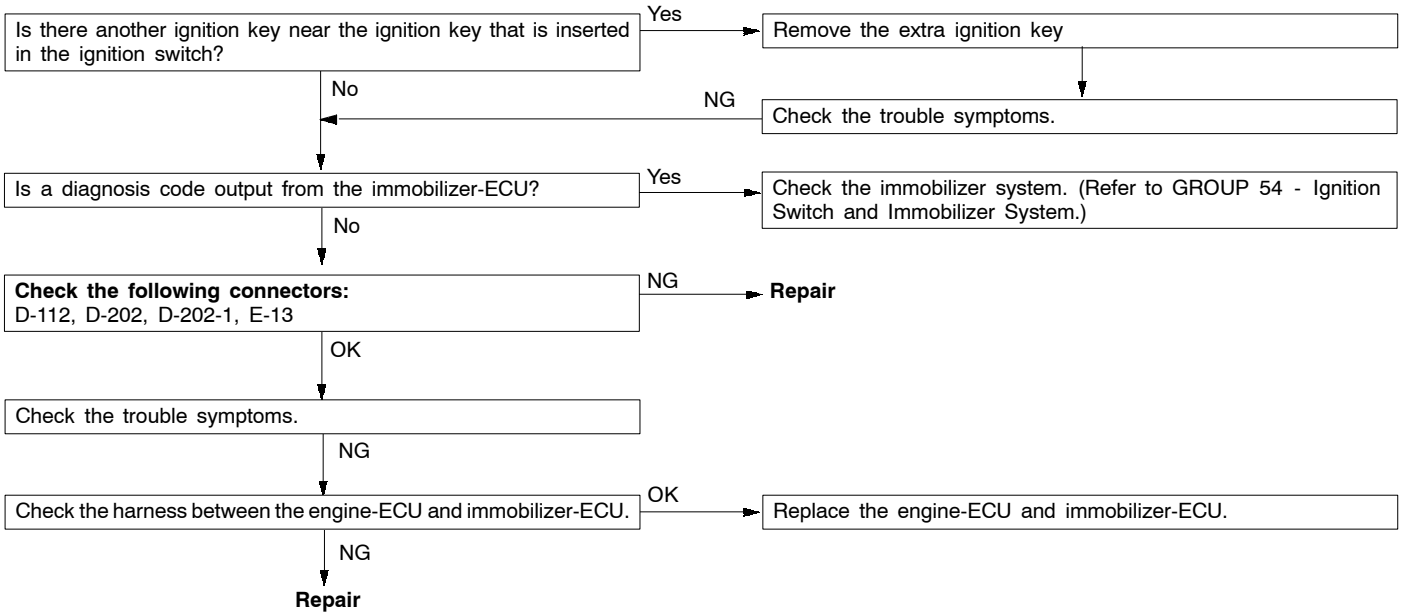


Code No. 49 Over boost	Probable cause
Range of Check ● Ignition switch: ON, except during engine cranking Set Conditions ● Boost pressure is higher than 305 kPa for 1 second.	● Malfunction of the turbocharger waste gate ● Engine-ECU inoperative



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 encrypted codes ● Incorrect encrypted code ● Malfunction of harness or connector ● Malfunction of immobilizer-ECU ● Engine-ECU inoperative

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 encrypted code.



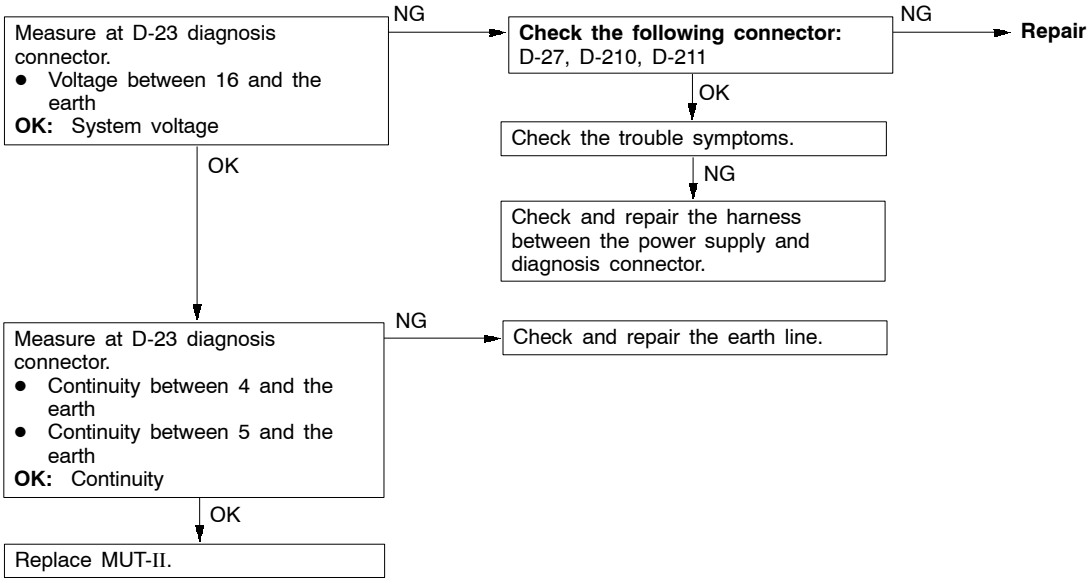
INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble Symptom		Inspection procedure No.	Reference page
No communication can be established between MUT-II and the engine-ECU.	No communication can be established with all systems.	1	13C-24
	No communication can be established only with the engine-ECU.	2	13C-24
Engine warning lamp related	Immediately after the ignition switch is “ON”, the engine warning lamp does not turn on.	3	13C-25
	The engine warning lamp keeps on and does not turn off.	4	13C-25
Starting performance	No initial combustion (unable to start)	5	13C-26
	Starting performance is bad when the engine is cold (difficult to start)	6	13C-26
	Starting performance is bad regardless of when the engine is hot or cold (difficult to start)	7	13C-26
Idling stability (idling inoperative)	Low idling speed when the engine is cold (improper idling speed)	8	13C-27
	High idling speed (improper idling speed)	9	13C-27
	Low idling speed (improper idling speed)	10	13C-27
	Idling instable (rough idling, hunting)	11	13C-28
Idling stability (idling sustainment inoperative)	The engine halts after running for a while.	12	13C-28
	The engine halts during idling.	13	13C-29
Driveability	Lack of output power	14	13C-29
	Occurrence of abnormal knocking	15	13C-29
	Abnormal black smoke	16	13C-30
	Abnormal white smoke	17	13C-30
	Hunting during driving	18	13C-31

INSPECTION PROCEDURES FOR TROUBLE SYMPTOMS

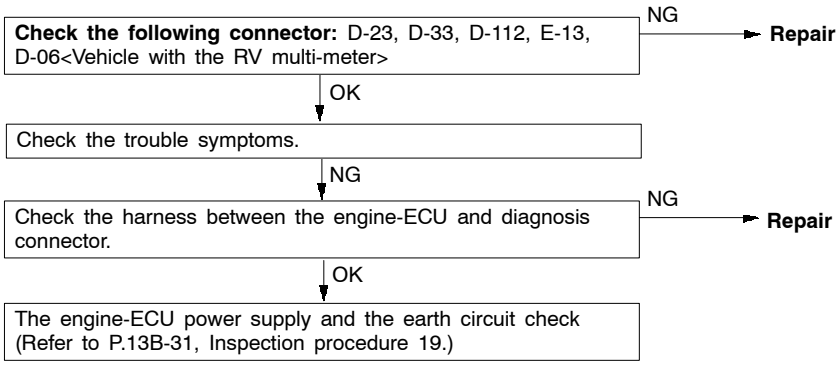
Inspection procedure 1

No communication can be established between MUT-II and all systems.	Probable cause
Probable cause can be found in troubles with the power supply circuit and the earth circuit to the diagnosis connector.	• Diagnosis connector inoperative • Harness inoperative



Inspection procedure 2

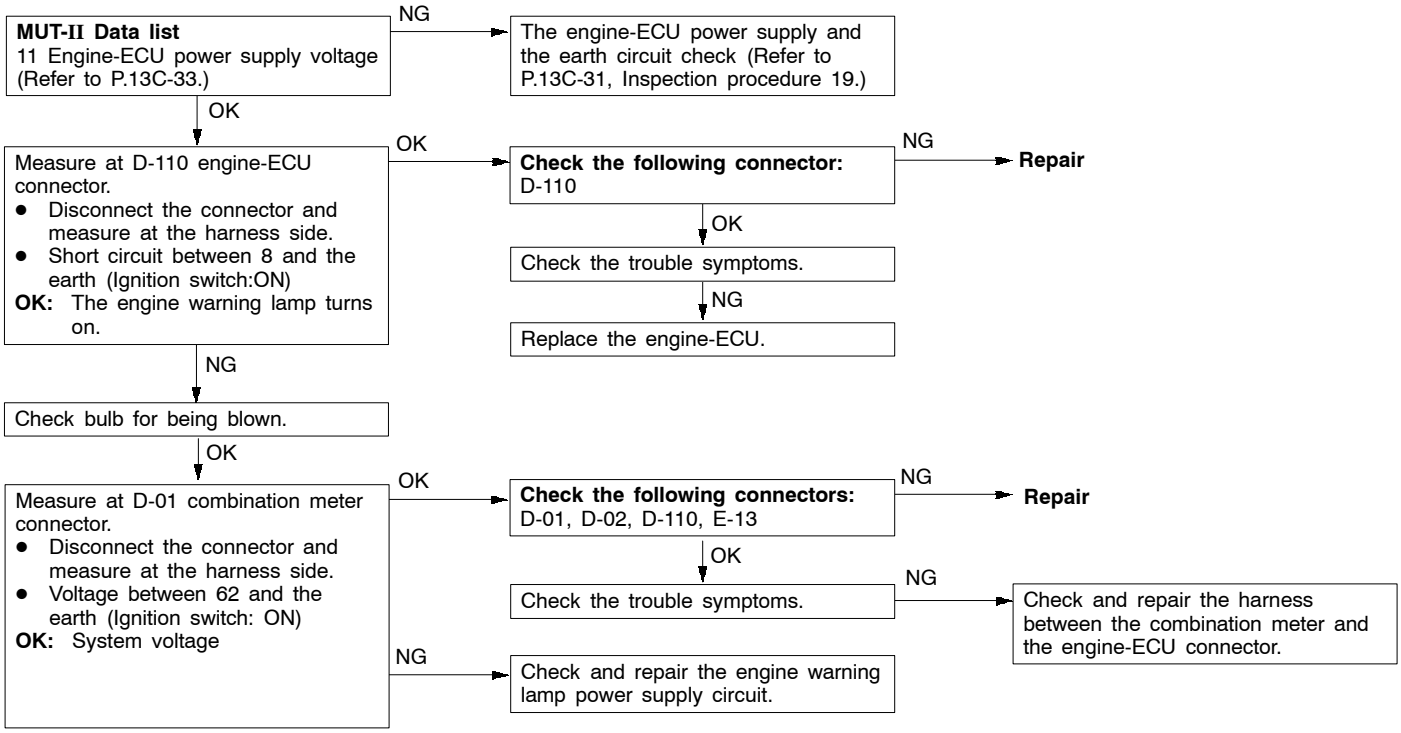
No communication can be established between MUT-II and the engine-ECU.	Probable cause
Probable causes are shown in the following: • The power is not supplied to the engine-ECU. • The earth circuit of the engine-ECU inoperative • The engine-ECU inoperative • Communication between the engine-ECU and MUT-II inoperative	• The power supply circuit of the engine-ECU inoperative • Engine-ECU inoperative • Open circuit at the harness between the engine-ECU and the diagnosis connector



NOTE
If the trouble symptoms persist even after implementing the above-mentioned inspection procedure to the vehicle with center display, check the center display and replace it if necessary. (Refer to GROUP 54A - Clock or Center display.)

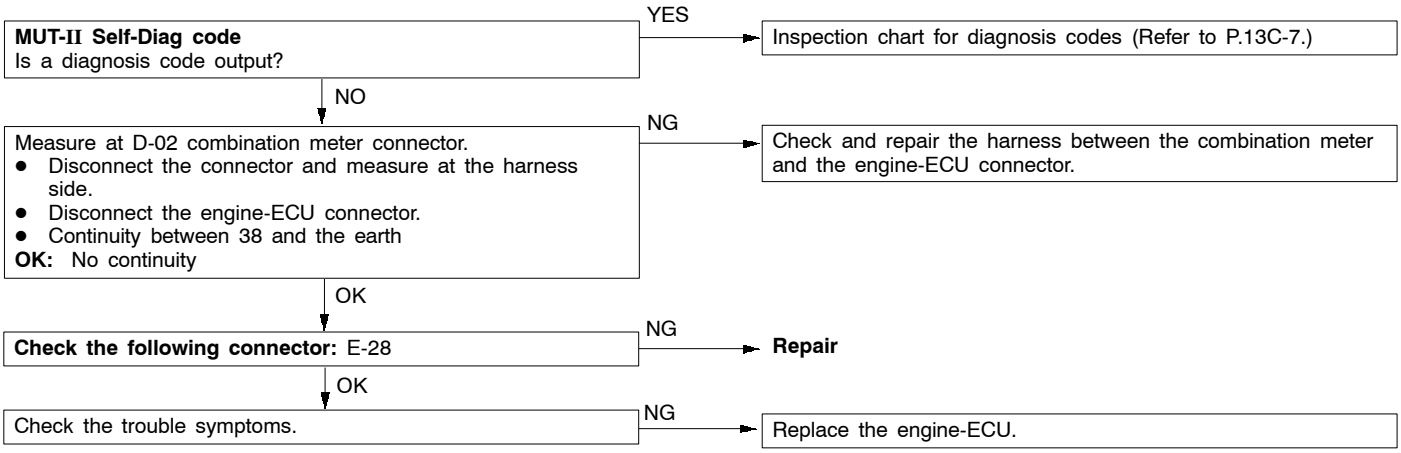
Inspection procedure 3

Immediately after the ignition switch is "ON", the engine warning lamp does not turn on.	Probable cause
The engine-ECU turns on the engine warning lamp for 5 seconds immediately after turning on the ignition switch to check the bulb for being blown. If the engine warning lamp does not turn on immediately after turning the ignition switch ON, problems shown in the right could exist.	• The engine warning lamp blown • The engine warning lamp circuit inoperative • Engine-ECU inoperative



Inspection procedure 4

The engine warning lamp keeps on and does not turn off.	Probable cause
The probable causes can be found in either the engine-ECU detecting the malfunction in the sensor and/or the actuator, or the problem shown in the right takes place.	• Short circuit at the harness between the engine warning lamp and the engine-ECU • Engine-ECU inoperative



Inspection procedure 5

No initial combustion (unable to start)	Probable cause
Probable causes can be found in troubles with control system, injection pump, glow system, and power supply system.	• Control system inoperative • Injection pump inoperative • Glow system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13C-7.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13C-30, 37.)
OK → Check the following items in order:
- Glow plug, glow plug relay
- Battery
- Injection nozzle
- Injection pump
- Compression pressure
- Existence of mixing foreign objects (water, kerosene) with the fuel

NG ↓
Repair

Inspection procedure 6

Starting performance is bad when the engine is cold (unable to start)	Probable cause
Probable causes can be found in troubles with control system, injection pump, fuel system, intake system, and glow system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Intake system inoperative • Glow system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13C-7.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13C-32, 37)
OK → Inspect the following items in order:
- Glow plug, glow plug relay
- Injection nozzle, fuel filter
- Throttle body assembly
- Existence of starter switch signal input
- Engine oil
- Injection pump
- Existence of mixing foreign objects (water, kerosene) with the fuel

NG ↓
Repair

Inspection procedure 7

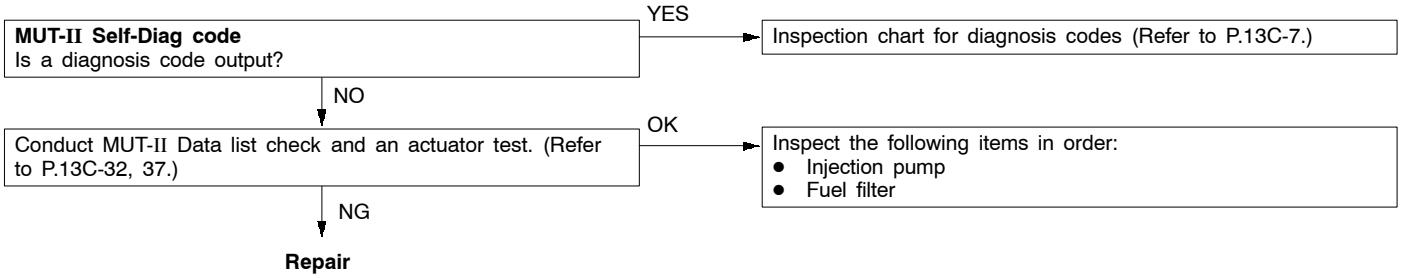
Starting performance is bad regardless of whether the engine is hot or cold (unable to start)	Probable cause
Probable causes can be found in troubles with control system, injection pump, fuel system, and intake system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Intake system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13C-7.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13C-32, 37.)
OK → Inspect the following items in order:
- Injection nozzle, fuel filter
- Throttle body
- Compression pressure
- Injection pump
- Existence of mixing foreign objects (water, kerosene) with the fuel

NG ↓
Repair

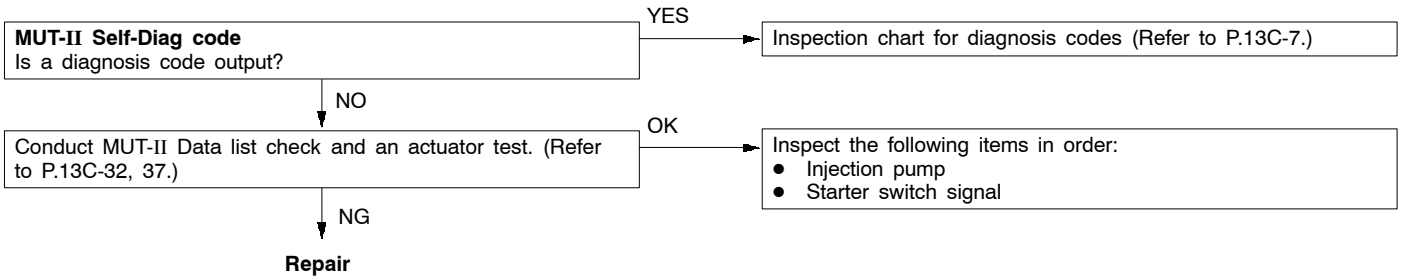
Inspection procedure 8

Low idling speed when the engine is cold (improper idling speed)	Probable cause
Probable causes can be found in troubles with control system, injection pump, and fuel system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Engine-ECU inoperative



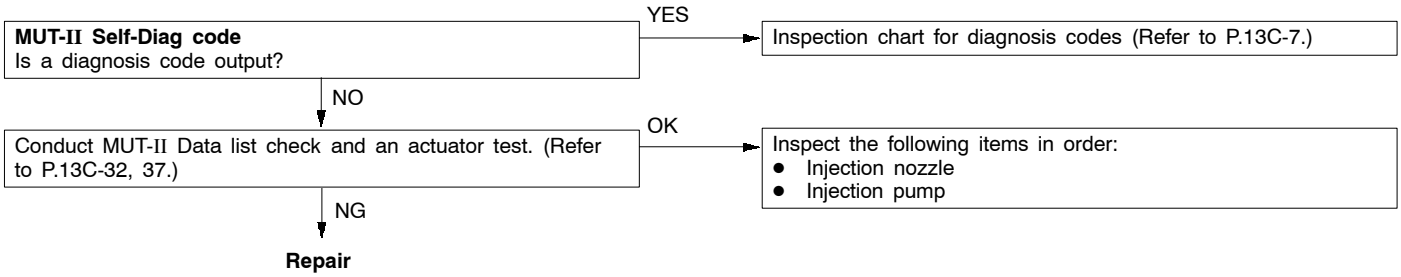
Inspection procedure 9

High idling speed (improper idling speed)	Probable cause
Probable causes can be found in troubles with control system and injection pump.	• Control system inoperative • Injection pump inoperative • Engine-ECU inoperative



Inspection procedure 10

Low idling speed (improper idling speed)	Probable cause
Probable causes can be found in troubles with control system, injection pump, and fuel.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Engine-ECU inoperative



Inspection procedure 11

Idling instable (rough idling, hunting)	Probable cause
Probable causes can be found in troubles with control system, injection pump, fuel system, glow system, intake system, and EGR system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Intake system inoperative • Glow system inoperative • EGR system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13C-7.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13C-32, 37.)
OK → Inspect the following items in order:
- Glow plug, glow plug relay
- EGR system
- Injection nozzle
- Compression pressure
- Valve clearance
- Throttle body assembly
- Injection timing
- Fuel line bleeding
- Injection pump

NG ↓
Repair

Inspection procedure 12

The engine stalls after running for a while.	Probable cause
Probable causes can be found in troubles with control system, injection pump, fuel system, and intake system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Intake system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13C-7.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13C-32, 37.)
OK → Inspect the following items in order:
- Throttle body assembly
- Fuel filter
- Injection pump

NG ↓
Repair

Inspection procedure 13

The engine stalls during idling.	Probable cause
Probable causes can be found in troubles with control system, injection pump, intake system, EGR system, and power supply.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • EGR system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13C-7.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13C-32, 37.)
OK → Inspect the following items in order:
- Power supply system
- Throttle body assembly
- EGR system
- Injection pump

NG ↓
Repair

Inspection procedure 14

Lack of output power	Probable cause
Probable causes can be found in troubles with control system, injection pump, fuel system, intake system, and EGR system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Intake system inoperative • EGR system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13C-7.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13C-32, 37.)
OK → Inspect the following items in order:
- Injection nozzle, fuel filter
- Throttle body assembly
- EGR system
- Turbocharger
- Compression pressure
- Injection timing
- Injection pump
- Existence of mixing foreign objects (water, kerosene) with the fuel

NG ↓
Repair

Inspection procedure 15

Occurrence of abnormal knocking	Probable cause
Probable causes can be found in troubles with control system, injection pump, fuel system, and EGR system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • EGR system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13C-7.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13C-32, 37.)
OK → Inspect the following items in order:
- Injection nozzle
- Injection timing
- EGR system
- Injection pump

NG ↓
Repair

Inspection procedure 16

Abnormal black smoke	Probable cause
Probable causes can be found in troubles with control system, injection pump, fuel system, intake system, and EGR system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Intake system inoperative • EGR system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13C-7.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13C-32, 37.)
OK → Inspect the following items in order:
- Air cleaner
- Injection nozzle
- Throttle body assembly
- EGR system
- Turbocharger
- Injection pump

NG ↓
Repair

Inspection procedure 17

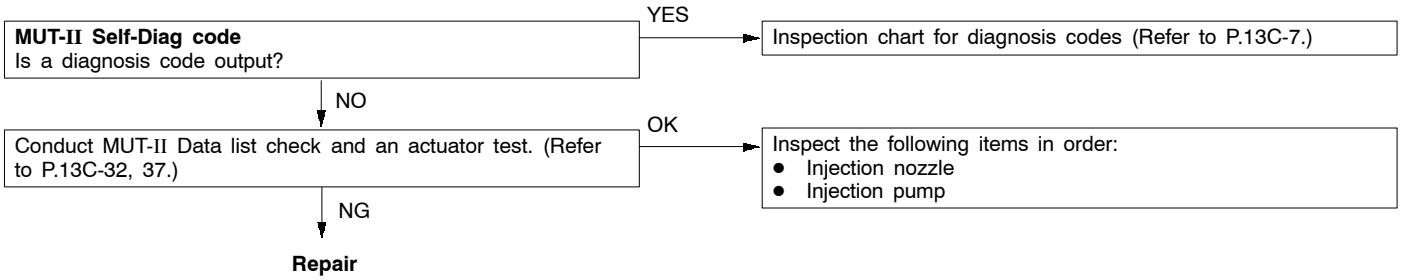
Abnormal white smoke	Probable cause
Probable causes can be found in troubles with control system, injection pump, fuel system, intake system, EGR system, and glow system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Intake system inoperative • EGR system inoperative • Glow system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13C-7.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13C-32, 37.)
OK → Inspect the following items in order:
- Glow plug, glow plug relay
- Injection nozzle
- Throttle body assembly
- EGR system
- Turbocharger
- Injection pump

NG ↓
Repair

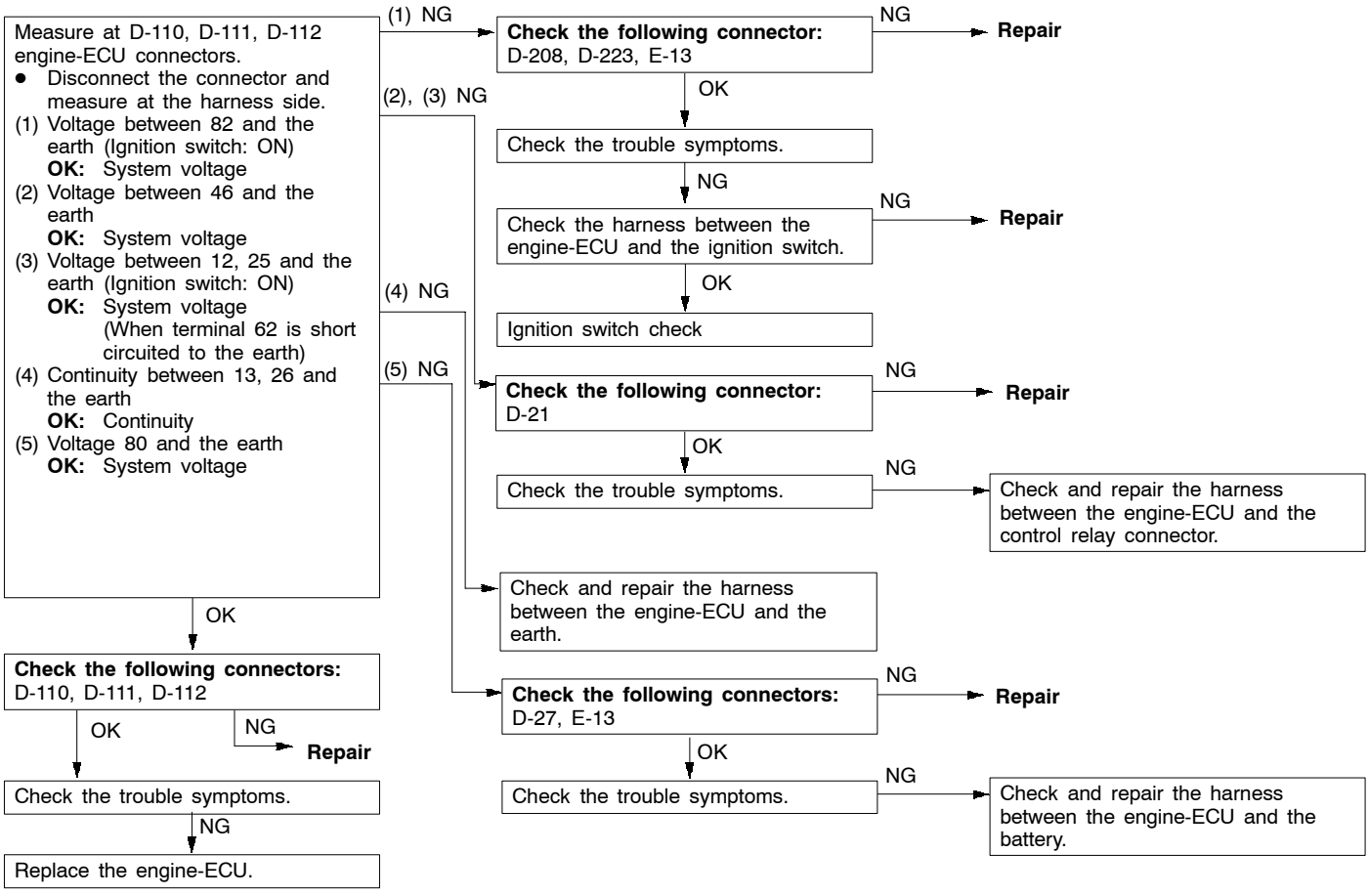
Inspection procedure 18

Hunting during driving	Probable cause
Probable causes can be found in troubles with control system, injection pump, and fuel system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Engine-ECU inoperative



Inspection procedure 19

Engine-ECU power supply and earth circuit check



DATA LIST REFERENCE TABLE

Item No.	Check item	Inspection conditions		Value to be determined as normal	Code No. or inspection procedure No.	Reference page
01	Boost air temperature sensor	Ignition switch: ON or the engine running	When the intake air temperature is -20°C	-20°C	Code No. 16	13C-11
			When the intake air temperature is 0°C	0°C		
			When the intake air temperature is 20°C	20°C		
			When the intake air temperature is 40°C	40°C		
			When the intake air temperature is 80°C	80°C		
02	Engine coolant temperature sensor	Ignition switch: ON or the engine running	When the engine coolant temperature is -20°C	-20°C	Code No. 15	13C-11
			When the engine coolant temperature is 0°C	0°C		
			When the engine coolant temperature is 20°C	20°C		
			When the engine coolant temperature is 40°C	40°C		
			When the engine coolant temperature is 80°C	80°C		
03	Barometric pressure sensor	Ignition switch: ON	Altitude 0 m	101 kPa	Code No. 13	13C-10
			Altitude 600 m	95 kPa		
			Altitude 1,200 m	88 kPa		
			Altitude 1,800 m	81 kPa		
04	Boost pressure sensor	• Engine coolant temperature: 80 - 95 °C • Lamps, electrical cooling fan, and accessories: OFF • Transmission: P range • Ignition switch: ON	Altitude 0 m	101 kPa	Code No. 12	13C-9
			Altitude 600 m	95 kPa		
			Altitude 1,200 m	88 kPa		
			Altitude 1,800 m	81 kPa		
			Idling	81 - 109 kPa		
			When sudden racing is done	Increased		
05	Fuel temperature sensor	Ignition switch: ON or the engine running	When the fuel temperature is -20°C	-20°C	Code No. 14	13C-10
			When the fuel temperature is 0°C	0°C		
			When the fuel temperature is 20°C	20°C		
			When the fuel temperature is 40°C	40°C		
			When the fuel temperature is 80°C	80°C		

Item No.	Check item	Inspection conditions		Value to be determined as normal	Code No. or inspection procedure No.	Reference page
06	Vehicle speed sensor	When driving	Compare the engine speed displayed in the speed meter with that in MUT-II	Matched	Code No. 17	13C-12
07	Engine speed sensor (backup)	Engine: Cranking Engine: Idling	Compare the engine speed displayed in the tachometer with that in MUT-II	Matched	Code No. 18	13C-13
08	Engine speed sensor	Engine: Cranking Engine: Idling	Compare the engine speed displayed in the tachometer with that in MUT-II	Matched	Code No. 21	13C-14
09	Accelerator pedal position sensor (main)	Ignition switch: ON	Accelerator pedal: Idling position	0.9 - 1.1V	Code No. 11	13C-8
			Accelerator pedal: Fully opened position	4.1 V or higher		
10	Idle switch	Ignition switch: ON	Release the foot from the accelerator pedal.	0 - 1V	Code No. 23	13C-15
			Step on the accelerator pedal slightly	4V or higher		
11	System voltage	Ignition switch: ON		System voltage	Procedure No. 19	13C-31
13	Timing control valve*1	Engine: After warming up the engine	Idling	0%*1	Code No. 25 or No. 43	13C-16 13C-20
			2,500 r/min	35 - 45%*1		
			High idling	20 - 30%*1		
14	EGR command value	Engine: Idling Engine: After warming up the engine		0 - 100%*2	–	-
17	Control sleeve position (target value)	Engine: After warming up the engine	Idling	1.535 - 1.735 V	Code No. 26	13C-17
			2,500 r/min	Slightly decreased.		
			High idling	1.884 - 2.084 V		
18	Actual injection timing	Engine: After warming up the engine	Idling	0.65 - 0.85 V	–	–
			2,500 r/min	2.325 - 2.525 V		
			High idling	3.814 - 4.014 V		
19	Injection timing command value	Engine: After warming up the engine	Idling	0.3 - 0.5 V	–	–
			2,500 r/min	2.325 - 2.525 V		
			High idling	3.814 - 4.014 V		

Item No.	Check item	Inspection conditions		Value to be determined as normal	Code No. or inspection procedure No.	Reference page
21	GE actuator	Engine: After warming up the engine	Idling	20 - 30%	Code No. 26 or No. 48	13C-17 13C-21
			2,500 r/min	20 - 30%		
			High idling	20 - 29%		
22	EGR duty value	Engine: Idling		0 - 100%*2	–	–
		Engine: After warming up the engine				
23	Control sleeve position (actual value)	Engine: After warming up the engine	Idling	1.535 - 1.735 V	Code No. 26	13C-17
			2, 500 r/min	Slightly decreased.		
			High idling	1.884 - 2.084 V		
24	Accelerator pedal position sensor (sub)	Ignition switch: ON	Accelerator pedal: Idling position	0.9 - 1.1 V	Code No. 27	13C-18
			Accelerator pedal: Fully opened position	4.1V or higher		
25	Accelerator pedal position sensor (sub)	Ignition switch: ON	Accelerator pedal: Idling position	0%	Code No. 27	13C-18
			Accelerator pedal: Fully opened position	99 - 100%		

NOTE
*1: The opening degree of the timing control valve is converted into percentage. (0%: timer non-advanced angle, 100%: timer maximum advanced angle)
*2: The opening degree of the EGR solenoid valve is converted into percentage.

Item No.	Check item	Inspection conditions		Value to be determined as normal	Code No. or inspection procedure No.	Reference page
41	Idle switch	Ignition switch: ON (check by repeated accelerator operation)	Release the foot from the accelerator pedal.	ON	–	–
			Step on the accelerator pedal slightly.	OFF		
43	A/C switch	Engine: Idling (The A/C compressor should be in operation when the A/C switch is "ON")	A/C switch: ON	ON	–	–
			A/C switch: OFF	OFF		
44	Ignition switch-ST	Ignition switch: ON	Engine: Stop	OFF	–	–
			Engine: Cranking	ON		
45	Ignition switch-IG	Ignition switch: ON		ON	–	–
46	Control relay	Ignition switch: ON		ON	–	–
47	A/C relay	Engine: Idling after warming up the engine	A/C switch: OFF	OFF (A/C compressor clutch not in operation)	–	–
			A/C switch: ON	ON (A/C compressor clutch in operation)		

Item No.	Check item	Inspection conditions		Value to be determined as normal	Code No. or inspection procedure No.	Reference page
50	Condenser fan relay	Ignition switch: ON	A/C switch: OFF (engine coolant temperature at 109°C or higher) A/C switch: ON (engine coolant temperature at 109°C or higher or no higher than 109°C and the vehicle speed at 60 km/h or slower)	ON	–	–
			A/C switch: OFF (engine coolant temperature at 109°C or lower) A/C switch: ON (engine coolant temperature at 109°C or lower or no higher than 109°C and the vehicle speed at 60 km/h or faster)	OFF		
52	Glow plug relay	Ignition switch: OFF → ON	Engine coolant temperature at 60°C or lower	ON	–	–
			Engine coolant temperature at 60°C or higher	OFF		
53	Main throttle solenoid valve	Ignition switch: ON (Engine stops)		OFF	–	–
		Engine: Idling after warming up the engine		ON		
54	Sub throttle solenoid valve	Engine: Idling after warming up the engine		OFF	–	–
		Engine: Idling → Stop (within 3 seconds)		ON		
55	Engine warning lamp	Ignition switch: OFF → ON		ON (For 5 seconds)	Procedure No. 3	13C-25
56	Glow lamp	Ignition switch: OFF → ON	The engine coolant temperature at 60°C or lower	ON	–	–
			The engine coolant temperature at 60°C or higher	OFF		

Item No.	Check item	Inspection conditions		Value to be determined as normal	Code No. or inspection procedure No.	Reference page
58	Neutral switch	Ignition switch: ON	N, P range	N, P	–	–
			None of the above	D, R		
60	Fuel cut relay	Ignition switch: ON → OFF afterwards for a certain period of time		ON	–	–
		None of the above		OFF		
61	EGR control solenoid valve No. 2	Turning off EGR quickly		ON	–	–
		None of the above		OFF		
62	AT/MT switch	Ignition switch: ON	Vehicles with A/T	A/T	–	–
			Vehicles with M/T	M/T		
68	A/C switch 2	A/C: Under high load or low load		ON	–	–
		A/C: OFF or under medium load		OFF		
69	Warm up switch	● Warm up switch: ON ● Heater temperature setting: Maximum ● Engine coolant temperature: 90°C or lower ● Blower fan: ON		ON	–	–
		None of the above		OFF		
70	PTC heater	● Warm up switch: ON ● Heater temperature setting: Maximum ● Engine coolant temperature: 65°C to 75°C or lower ● Blower fan: ON		ON	–	–
		None of the above		OFF		
71	Power steering switch	Power steering switch: ON		ON	–	–
		Power steering switch: OFF		OFF		

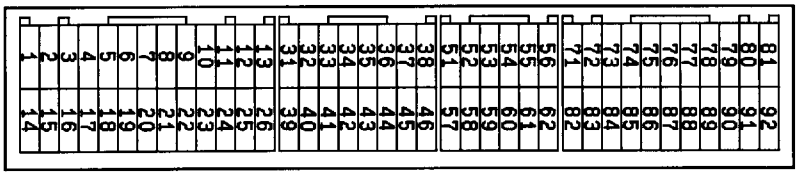
ACTUATOR TEST TABLE

Item No.	Check item	Drive Contents	Inspection conditions	Value to be determined as normal	Code No. or inspection procedure No.	Reference page
02	Glow plug relay	Turning the relay from OFF to ON or from ON to OFF	Ignition switch: ON	Battery charge is energized to the glow plug when the glow plug relay is ON.	–	–
03	A/C compressor relay	Turning the relay from OFF to ON or from ON to OFF	Ignition switch: ON	The A/C compressor clutch makes an audible sound.	–	–
11	Timing control valve	Turn the timing control valve to ON	• Ignition switch: ON • Engine: Idling • Timer piston position sensor: Normal	Makes an audible sound	Code No.43	13C-20
12		Turn the timing control valve to OFF				
15	Glow lamp	Turn the glow lamp on or off	Ignition switch: ON	The glow lamp turns on	–	–
16	Warning lamp	Turn the warning lamp on or off	Ignition switch: ON	The warning lamp turns on	Procedure No.3, 4	13C-25
22	Condenser fan relay	Turning the relay from OFF to ON or from ON to OFF	Ignition switch: ON	The condenser fan rotates.	–	–
23	Main throttle solenoid valve	Turn the solenoid valve from OFF to ON or from ON to OFF	• Ignition switch: ON • Vehicle speed: 0 km/h • Engine speed: 1,000 r/min or lower	Makes an audible sound	Code No.41	13C-19
24	Sub throttle solenoid valve	Turn the solenoid valve from OFF to ON or from ON to OFF	• Ignition switch: ON • Vehicle speed: 0 km/h • Engine speed: 1,000 r/min or lower	Makes an audible sound	–	–

Item No.	Check item	Drive Contents	Inspection conditions	Value to be determined as normal	Code No. or inspection procedure No.	Reference page
25	GE actuator	Turn the GE actuator to ON	● Ignition switch: ON ● Engine speed: 0 r/min or lower ● Control sleeve position sensor: Normal	Makes an audible sound	Code No.48	13C-21
26		Turn the GE actuator to OFF				
27	Fuel cut solenoid valve	Turn the solenoid valve to ON	● Ignition switch: ON ● Vehicle speed: 0 km/h	Makes an audible sound	–	–
28	EGR solenoid valve No.1	Turn the solenoid valve to ON	● Ignition switch: ON ● Vehicle speed: 0 km/h	Makes an audible sound	–	–
29		Turn the solenoid valve to ON				
30	EGR solenoid valve No.2	Turn the solenoid valve from OFF to ON or from ON to OFF	● Ignition switch: ON ● Vehicle speed: 0 km/h	Makes an audible sound	–	–
33	PTC heater	Switch the PTC heater relay ON/OFF.	● Ignition switch: ON	Voltage on the ECU terminal No.9: 0 - 1V	–	–
34	Middle position of GE actuator	Hold the injection governor in its middle position.	● Ignition switch: ON	When the crankshaft is turned clockwise during the adjustment of the injection timing, the injection pipes spray out fuel.	Code No.48	13C-21

ENGINE-ECU CHECK

TERMINAL VOLTAGE TABLE



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Terminal No.	Check item	Inspection conditions (engine status)		Normal condition:
1	GE actuator	Ignition switch: ON (Engine stops)		9 V or higher
2	Fuel cut solenoid valve	Ignition switch: OFF → ST		0 - 1 V
		Engine: Idling → Stop (in about 1 second)		System voltage
3	Timing control valve	Ignition switch: ON (Engine stops)		11 V or higher
4	Glow lamp	• Engine coolant temperature: 40°C or lower • Ignition switch: OFF → ON		0 - 1 V (In about 1 second: at 20°C) → System voltage
5	EGR control solenoid valve No. 2	Ignition switch: OFF → ON		System voltage
		Engine: After warming up the engine, conduct sudden racing from idling.		Decreased momentarily
7	Condenser fan relay	Condenser fan in operation		0 - 1 V
8	Engine warning lamp	Ignition switch: OFF → ON		0 -1 V (In few seconds) → System voltage
9	PTC heater relay	Heating switch: ON, outside temperature at 10°C or lower, and the engine coolant temperature at 65°C or lower		0 - 1 V
14	Main throttle solenoid valve	Ignition switch: ON (Engine stops)		System voltage
		Engine: After warming up the engine, conduct sudden racing from idling.		0 - 1 V
16	Glow plug relay	• Engine coolant temperature: 40°C or lower • Ignition switch: OFF → ON		System voltage (In about 8 seconds: at 20°C) → 0 - 1 V
18	Sub throttle solenoid valve	Engine: Idling		System voltage
		Engine: Idling → Stop (within approx. 3 seconds)		0 - 1 V
21	A/C relay	A/C switch: ON		0 - 1 V
31	Idle switch	Ignition switch: ON	Release the foot from the accelerator pedal.	0 - 1 V
			Step on the accelerator pedal slightly	4 V or higher
32	A/C switch	A/C in operation (compressor in operation)		System voltage
35	Power steering fluid pressure switch	Engine: Idling after warming up the engine	When turning steering wheel	0 - 1 V

Terminal No.	Check item	Inspection conditions (engine status)		Normal condition:
36	Selector switch between A/T and M/T	Ignition switch: ON		0 - 1 V
37	Inhibitor switch	Ignition switch: ON (Engine stops)	Set the selector lever to P or N	0 - 1 V
			Set the selector lever to D, 2, L, or R	System voltage
39	Stop lamp switch	Depress the brake pedal		System voltage
40	Brake switch	Depress the brake pedal		0 - 1 V
46	Control relay	Ignition switch: ON		0 - 1 V
		Ignition switch: ON → OFF (in about 8 seconds)		System voltage
51	Engine speed sensor (backup)	Engine: Idling		1.5 - 2.5 V
55	Accelerator pedal position sensor (sub)	Ignition switch: ON	Accelerator pedal: Idling position	0.9 - 1.1 V
			Accelerator pedal: Fully opened position	4.1 V or higher
71	Ignition switch-ST	Engine: Cranking		8 V or higher
74	Control sleeve position sensor	Ignition switch: ON (Engine stops)		2.2 - 2.7 V
73				2.0 - 4.0 V
75				2.0 - 4.0 V
76	Timer piston position sensor	Ignition switch: ON (Engine stops)		2.2 - 2.7 V
77				2.0 - 4.0 V
78				2.0 - 4.0 V
80	Back-up power supply	Ignition switch: OFF		System voltage
82	Ignition switch-IG	Ignition switch: ON		System voltage
83	Engine coolant temperature sensor	Ignition switch: ON	Engine coolant temperature: 0°C	3.4 - 4.5 V
			Engine coolant temperature: 20°C	2.6 - 3.6 V
			Engine coolant temperature: 40°C	1.8 - 2.5 V
			Engine coolant temperature: 80°C	0.7 - 1.1 V
84	Accelerator pedal position sensor (main)	Ignition switch: ON	Accelerator pedal: Idling position	0.9 - 1.1 V
			Accelerator pedal: Fully opened position	4.1 V or higher
85	Boost pressure sensor	Ignition switch: ON (760 mmHg)		1.2 - 1.6 V
86	Vehicle speed sensor	• Ignition switch: ON • Move the vehicle forward slowly		0 V ↔ 5 V (repeat the change)

Terminal No.	Check item	Inspection conditions (engine status)		Normal condition:
87	Fuel temperature sensor	Ignition switch: ON	Fuel temperature: 0°C	3.2 - 3.6 V
			Fuel temperature: 20°C	2.3 - 2.7 V
			Fuel temperature: 40°C	1.4 - 1.8 V
			Fuel temperature: 80°C	0.4 - 0.8 V
88	Boost 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
89	Engine speed sensor	Engine: Idling		1.5 - 2.5 V
91	Neutral switch	Ignition switch: ON (Engine stops)	Set the selector lever to P or N	0 - 1 V
			Set the selector lever to D, 2, L, or R	System voltage

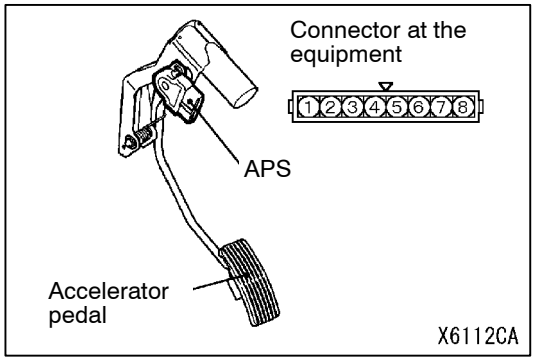
ON-VEHICLE SERVICE

INJECTION TIMING CHECK AND ADJUSTMENT

Refer to GROUP 11C - Engine Adjustment.

IDLE SPEED CHECK AND ADJUSTMENT

Refer to GROUP 11C - Engine Adjustment.



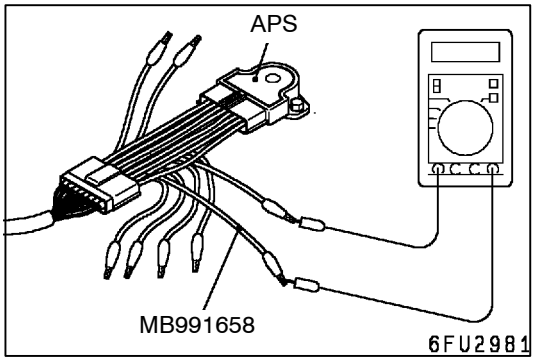
ACCELERATOR PEDAL POSITION SENSOR (APS) ADJUSTMENT

Caution

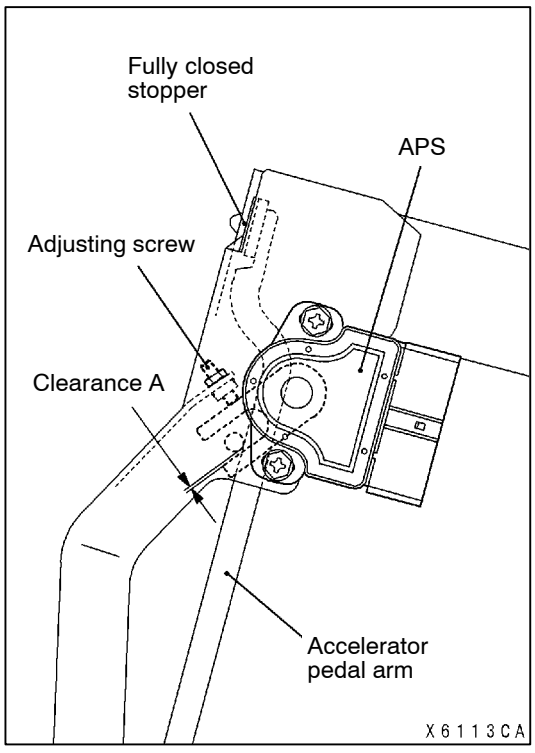
(1) APS is properly adjusted in the factory. Therefore, APS should not be moved carelessly.

(2) If the adjustment is not done correctly, carry out a new adjustment in the following procedure:

1. Remove accelerator pedal complete.



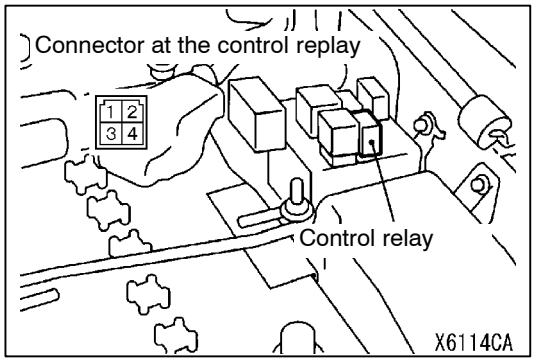
2. Connect MUT-II to the diagnosis connector. If MUT-II is not used, the following operation should be done:
   (1) Disconnect APS connector and connect the special tool (test harness: MB991658) between two connectors.
   (Be careful not to take a wrong terminal No.)
   (2) Connect a digital voltmeter between APS connector terminal No. 3 (APS1 output) and terminal No.1 (APS1 earth).
3. Loosen the APS mounting bolt to make it temporarily tightened.



4. Ensure that the accelerator pedal arm contacts the closing stopper.
5. Use the adjusting screw to make the clearance A (shown in the illustration) between 0.5 and 0.93 mm.
6. Secure the adjusting screw with the lock nut.
7. Turn on the ignition switch. (Engine does not start.)
8. Turn APS to make APS1 output the standard value.

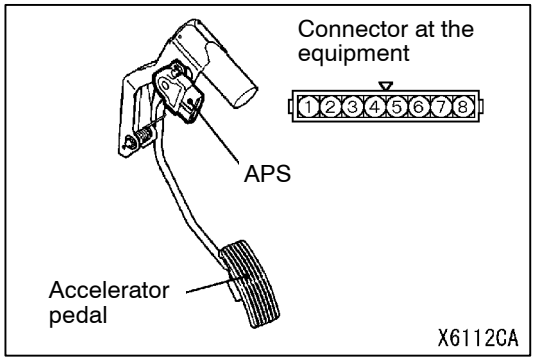
   Standard value: 0.985 - 1.085 V

9. Tighten the APS mounting bolt securely.
10. Install the accelerator pedal complete.



CONTROL RELAY CONTINUITY CHECK

System voltage	Terminal No.			
	1	2	3	4
When no current is supplied		○		○
When current is supplied	○		○	
		⊕		⊖



ACCELERATOR PEDAL POSITION SENSOR (APS) CHECK

1. Disconnect the APS connector.
2. Measure the resistance between APS connector terminal No.2 (APS1 power supply) and the terminal No.1 (APS1 earth) as well as the resistance between terminal No.8 (APS2 power supply) and terminal No.7 (APS2 output).

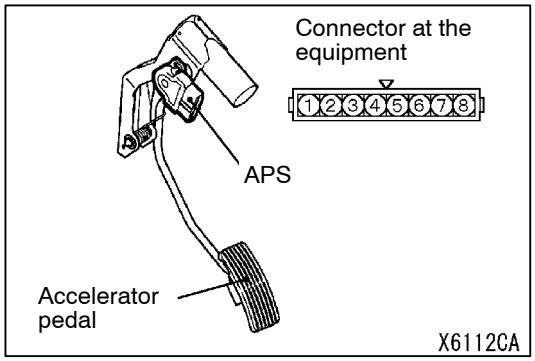
   Standard value: 3.5 - 6.5 kΩ
3. Measure the resistance between APS connector terminal No.2 (APS1 power supply) and the terminal No.3 (APS1 output) as well as the resistance between terminal No.8 (APS2 power supply) and terminal No.7 (APS2 earth).

   Normal condition:

Step on the accelerator pedal slowly.	Resistance smoothly changes in proportion to the travel of the accelerator pedal.

4. If the APS is out of the range of the standard value or the resistance does not change smoothly, replace APS.

   NOTE
   Make an adjustment on APS after replacement. (Refer to P.13C-42.)



IDLE SWITCH CHECK

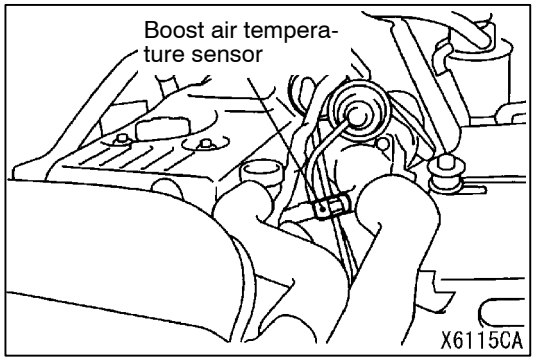
1. Disconnect the accelerator pedal position sensor (APS) connector.
2. Check the continuity between the idle switch connector terminal No.4 (idle switch) and terminal No.5 (earth).

Normal condition:

Accelerator pedal	Continuity
Step on	None
Release	Yes

3. Replace APS if it is inoperative.

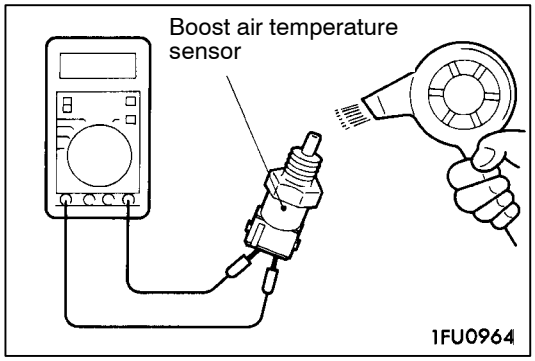
   NOTE
   Make an adjustment on APS after replacement.(Refer to P.13C-42.)



BOOST AIR TEMPERATURE SENSOR (INTAKE AIR TEMPERATURE SENSOR) CHECK

1. Remove the boost air temperature sensor.
2. Measure the resistance at the boost air temperature sensor connector terminal.

   Standard value:
   2.3 - 2.9 kΩ (at 20°C)
   0.3 - 0.39 kΩ (at 80°C)



3. Measure the resistance at the sensor part being warmed up by a hair dryer.

   Normal condition:

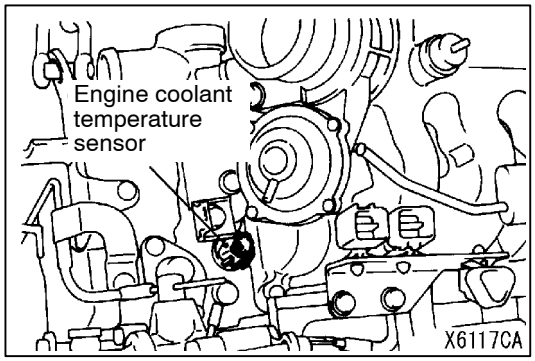
Temperature (°C)	Resistance value (kΩ)
Rising	Become smaller

4. If the resistance is not within the range of the standard value or does not change at all, replace the boost air temperature sensor.

   NOTE
   Replace the gasket as well.

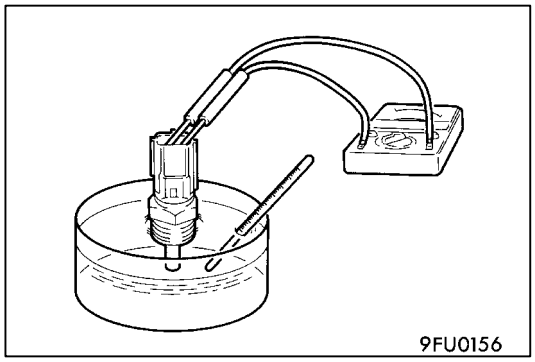
5. Tighten the boost air temperature sensor to the specified torque.

   Tightening torque: 15 ± 1 N·m



ENGINE COOLANT TEMPERATURE SENSOR CHECK

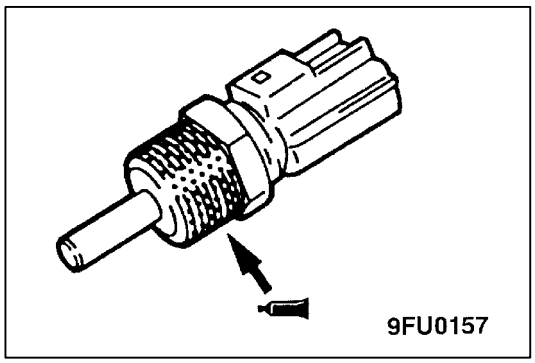
1. Remove the engine coolant temperature sensor.



2. Measure the resistance between the terminals of the connectors while immersing the sensor part of the engine coolant temperature sensor in the hot water.

   Standard value:
   2.3 - 2.6 kΩ (at 20°C)
   0.30 - 0.34 kΩ (at 80°C)

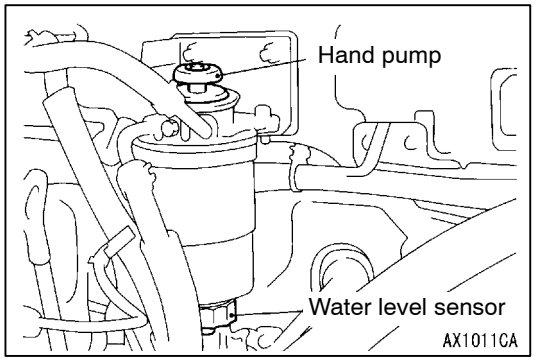
3. If the resistance is not within the range of the standard value, replace the engine coolant temperature sensor.



4. Apply the sealant to the thread of the engine coolant temperature sensor and tighten it to the specified torque.

   Sealant:
   3M Nut Locking Part No. 4171 or equivalent

   Tightening torque: 40 ± 4 N·m



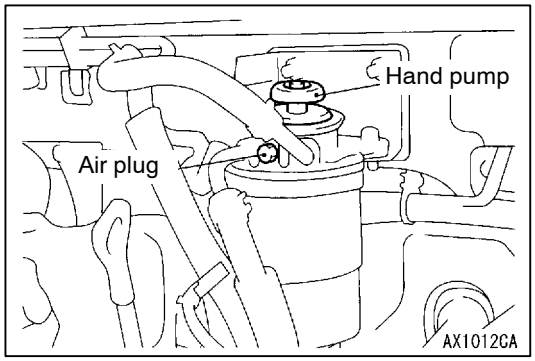
EVACUATION OF WATER FROM FUEL FILTER

Water is in the filter when fuel filter warning lamp illuminates. Evacuate water by the following procedure.

1. Loosen the water level sensor.
2. After water is evacuated by using a hand pump, tighten the water level sensor to the specified torque.
   Tightening torque: 2.5 ± 0.5 N·m

FUEL FILTER CARTRIDGE REPLACEMENT

Refer to GROUP 13D.



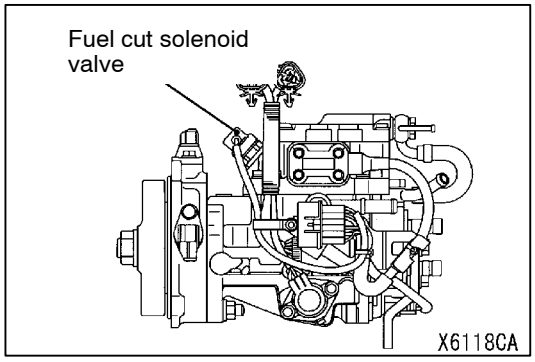
EVACUATION OF AIR FROM FUEL LINE

When the following service work(s) is done, refill the fuel tank and then evacuate air from the fuel line.

- Fuel hose is removed
- Fuel filter is replaced
- Fuel injection nozzle is removed
- If necessary for access, fuel is drained from the fuel tank.

1. Loosen the fuel filter air plug.

2. Cover the circumference of the air plug hole with cloth and use a manual pump repeatedly until no bubbles come out of the plug hole, then tighten the air plug to the specified torque.
   Tightening torque: 6.0 ± 1.0 N·m
3. Repeat until the hand pump operation becomes stiff.

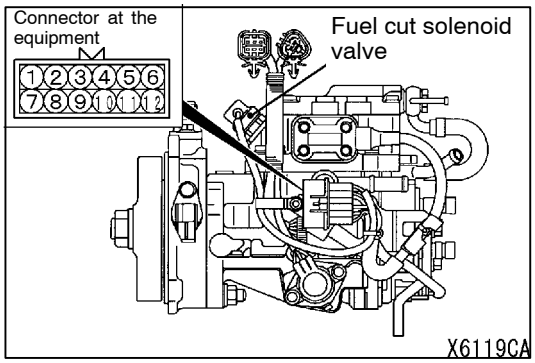


FUEL INJECTION PUMP CHECK

FUEL CUT SOLENOID VALVE CHECK

Operation noise check

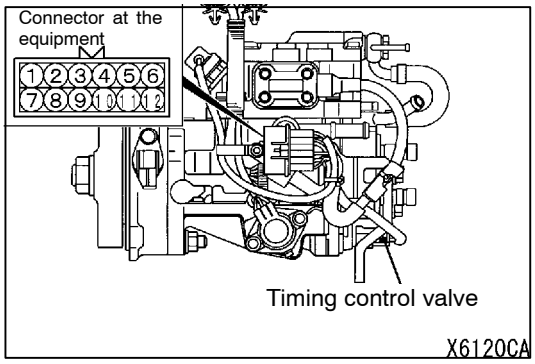
1. Attach the sound scope to the fuel cut solenoid valve to check for running noise when the ignition switch is "ON".



Coil resistance check

1. Disconnect the injection pump connector (12 pin).
2. Measure the resistance between terminal No.1 (fuel cut solenoid valve) and the injection pump body.

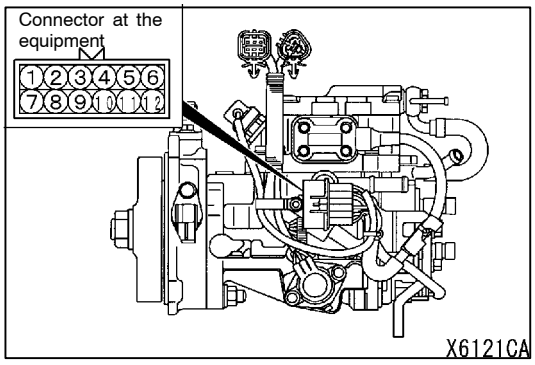
   Standard value: 6.8 - 9.2 Ω



Timing control valve check

1. Disconnect the injection pump connector (12 pin).
2. Measure the resistance between terminal No.5 and terminal No.9.

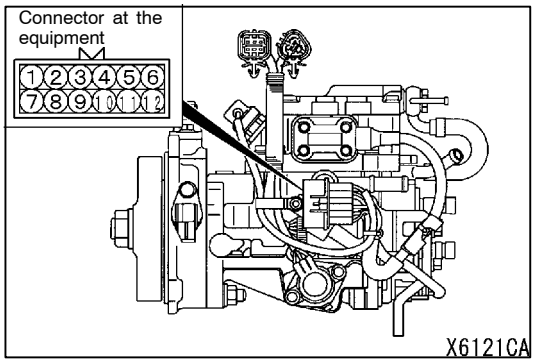
   Standard value: 10.8 - 11.2 Ω



GE actuator (electronic governor) check

1. Disconnect the injection pump connector (12 pin).
2. Measure the resistance between terminal No.6 and terminal No.10.

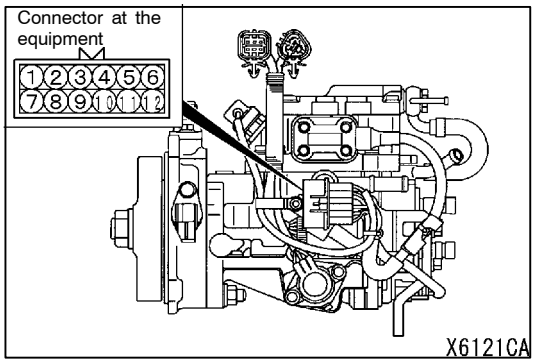
   Standard value: 0.64 - 0.72 Ω



Fuel temperature sensor check

1. Disconnect the injection pump connector (12 pin).
2. Measure the resistance between terminal No.7 and terminal No.11.

   Standard value: 1.4 - 2.6 Ω

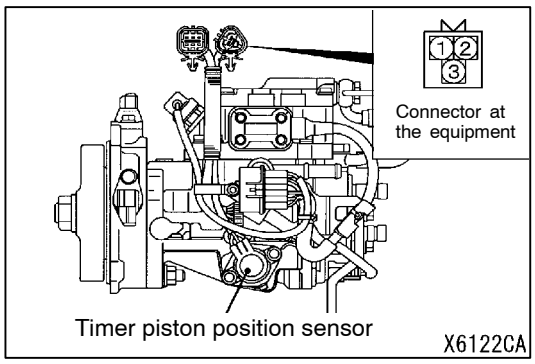


Control sleeve position sensor check

1. Disconnect the injection pump connector (12 pin).
2. Measure the resistance between the following terminals.

   Standard value:

Terminal No.4 - Terminal No.12	11.2 - 12.4 Ω
Terminal No.4 - Terminal No.8	5.6 - 6.2 Ω
Terminal No.8 - Terminal No.12	5.6 - 6.2 Ω

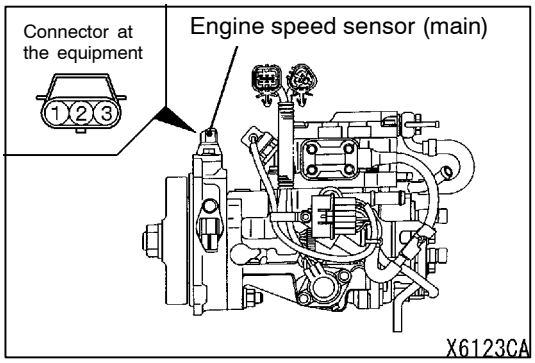


Timer piston position sensor check

1. Disconnect the timer piston position sensor connector.
2. Measure the resistance between the following terminals.

   Standard value:

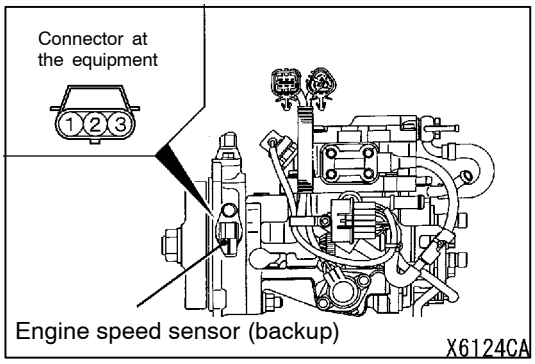
Terminal No.1 - Terminal No.2	160 - 168 Ω
Terminal No.1 - Terminal No.3	80 - 84 Ω
Terminal No.2 - Terminal No.3	80 - 84 Ω



Engine speed sensor (main) check

1. Disconnect the engine speed sensor connector.
2. Measure the resistance between terminal No.2 and terminal No.3.

   Standard value: 2.15 kΩ



Engine speed sensor (backup) check

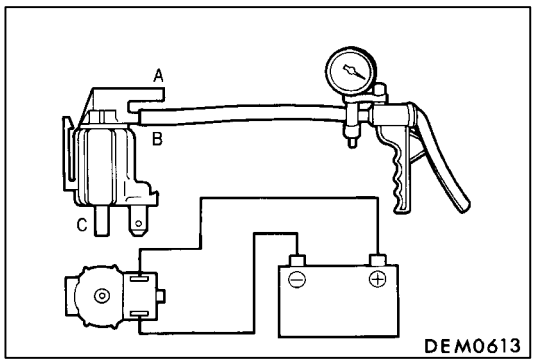
(1) Disconnect the engine speed sensor connector.
(2) Measure the resistance between terminal No.2 and terminal No.3.

   Standard value: 2.15 kΩ

INTAKE AIR RESTRICTION EQUIPMENT CHECK

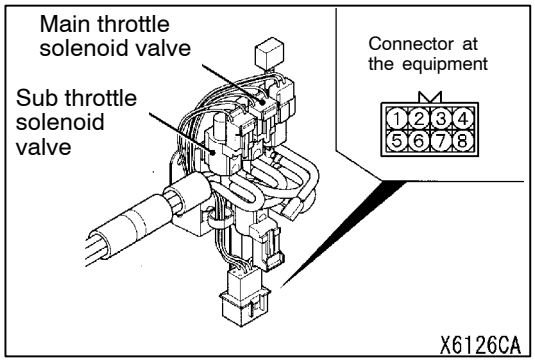
MAIN/SUB THROTTLE SOLENOID VALVE OPERATION CHECK

1. Remove the main/sub throttle solenoid valve connector and vacuum hose.
2. Apply negative pressure to each nipple of the main/sub throttle solenoid valve with a hand vacuum pump to check air density for applying electrical charge to each solenoid valve terminal or not.



Main/sub throttle solenoid valve

System voltage	Normal condition:
When current is supplied	Leak negative pressure (negative pressure maintained when nipple A is closed)
Cold	Leak negative pressure (negative pressure maintained when nipple C is closed)



MAIN/SUB THROTTLE SOLENOID VALVE RESISTANCE CHECK

1. Disconnect the main/sub throttle solenoid valve intermediate harness.
2. Main/sub throttle solenoid valve coil resistance.

Standard value:

Throttle solenoid valve	Terminal to be measured	Resistance value Ω
Main	2 - 6	36 - 44
Sub	1 - 5	36 - 44

INJECTION NOZZLE CHECK AND ADJUSTMENT

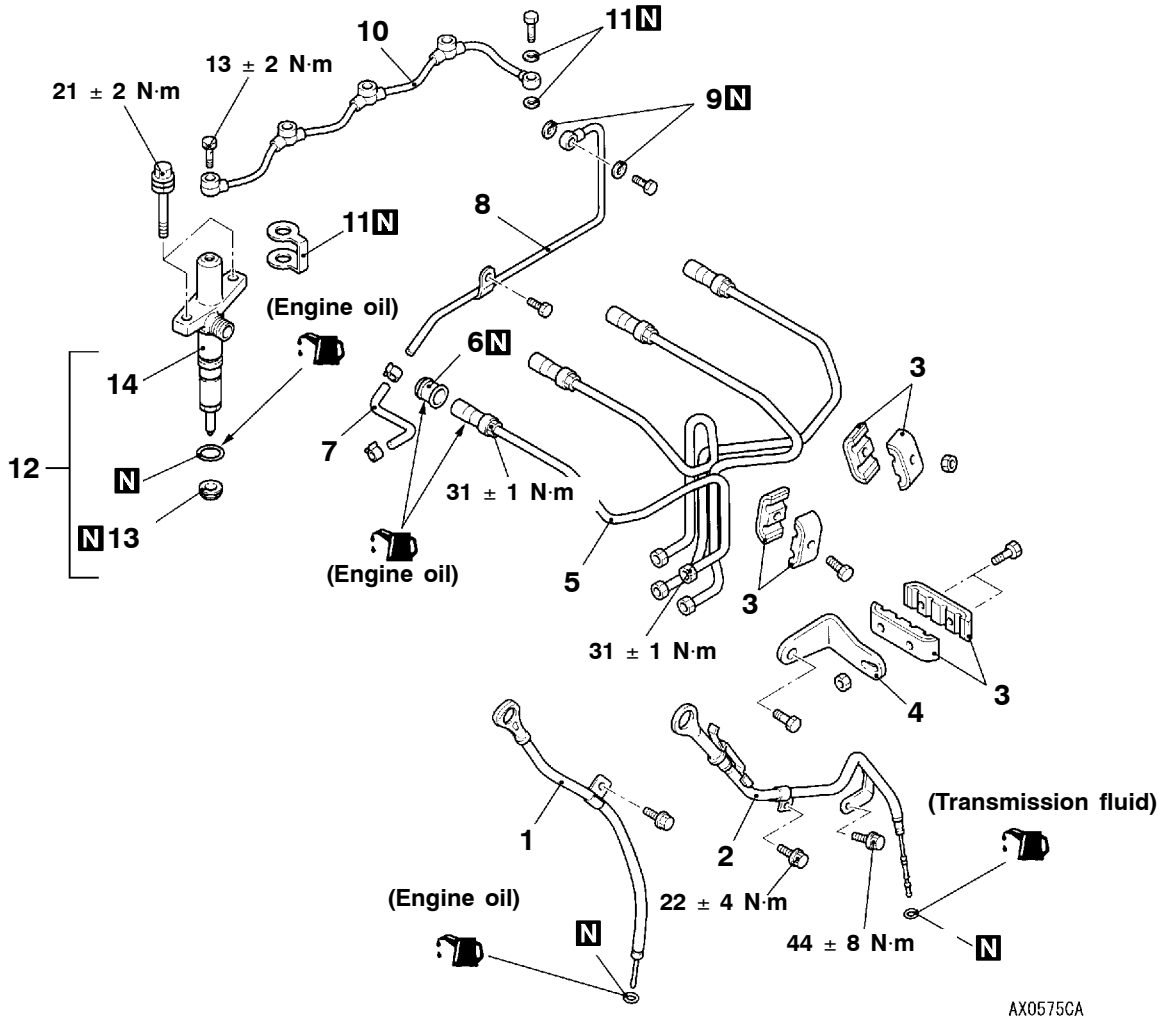
Refer to the Engine Workshop Manual.

INJECTION NOZZLE

REMOVAL AND INSTALLATION

Pre-removal Operations
- Engine Cover Removal (Refer to GROUP 11C - Camshaft.)
- Battery and Battery Tray Removal
- Fuel filter removal (Refer to GROUP 13D.)
- Skid Plate and Under Cover Removal

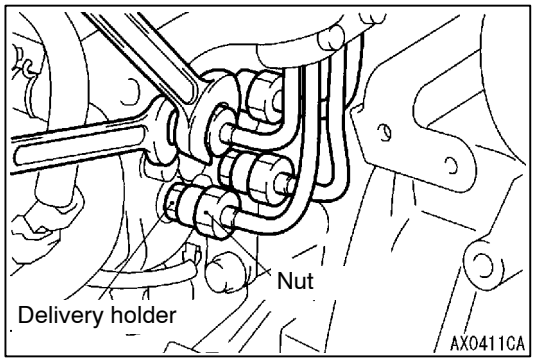
Post-installation Operations
- Skid Plate and Under Cover Installation
- Fuel Filter Installation (Refer to GROUP 13D.)
- Battery and Battery Tray Installation
- Fuel Line Bleeding (Refer to P.13C-45.)
- Engine Cover Installation (Refer to GROUP 11C - Camshaft.)



Removal steps

1. Engine oil level gauge and guide
2. A/T oil level gauge and guide
3. Clamp
4. Injection pipe stay
◀A▶ ▶C◀ 5. Injection pipe
▶C◀ 6. Injection pipe seal
▶B◀ 7. Fuel return hose
8. Fuel return pipe
9. Fuel return pipe gasket
- Rocker cover (Refer to GROUP 11C - Camshaft.)

10. Fuel leak off pipe
11. Fuel leak off pipe gasket
◀B▶ 12. Injection nozzle assembly
▶A◀ 13. Nozzle gasket
▶A◀ 14. Injection nozzle



REMOVAL SERVICE POINTS

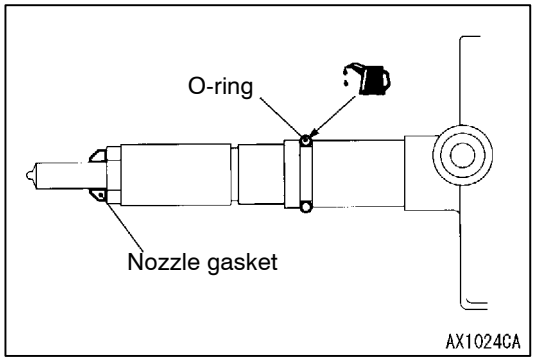
◀A▶ INJECTION PIPE REMOVAL

Hold the injection pump side delivery holder with a open-end wrench, and loosen the nut.

◀B▶ INJECTION NOZZLE ASSEMBLY REMOVAL

Caution

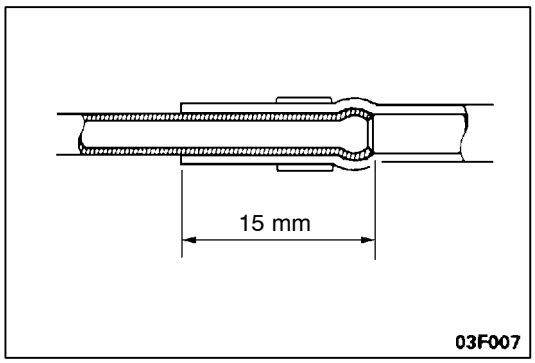
1. **Since the injection nozzle assembly is required to re-install to the same cylinder, paste a label of the cylinder number when it is removed.**
2. **Plug the injection nozzle holes to prevent foreign materials from entering the cylinders.**



INSTALLATION SERVICE POINTS

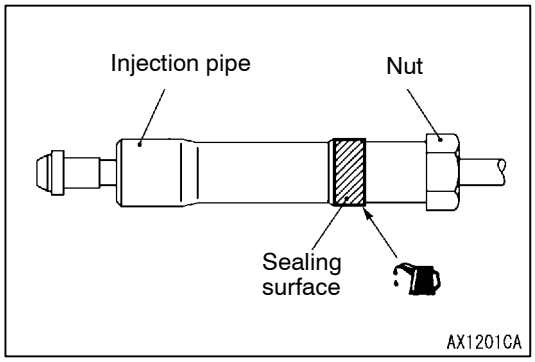
▶A◀ INJECTION NOZZLE/NOZZLE GASKET INSTALLATION

1. After cleaning the injection nozzle, apply a small amount of engine oil to a new O-ring, and install it, being careful not to damage it.
2. Install the nozzle gasket in the shown direction.



▶B◀ FUEL RETURN HOSE INSTALLATION

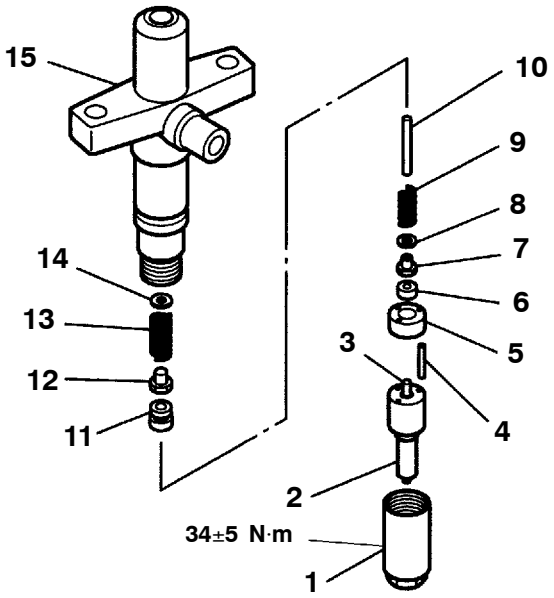
Insert the fuel return hose into the fuel pipe until the shown dimension is satisfied.



▶C◀ INJECTION PIPE SEAL/INJECTION PIPE INSTALLATION

1. Apply a small amount of engine oil to a new injection pipe seal, and install it, being careful not to damage it.
2. Apply a small amount of engine oil to the injection pipe sealing surface, and then connect the injection pipes.
3. Secure the delivery holder at the injection pump side with a spanner in the same way as the removal procedure, then install the injection pipe nut.
4. Tighten the injection pipe nut to the specified torque.
   Tightening torque: 31 ± 1 N·m

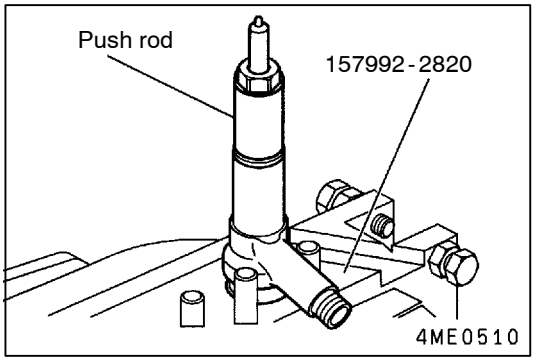
DISASSEMBLY AND REASSEMBLY



X6207CA

Disassembly steps

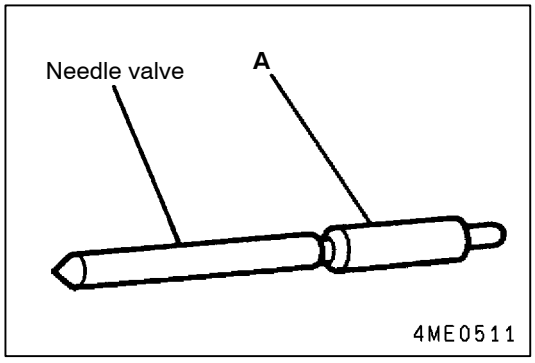
◀A▶ ▶A◀ 1. Retaining nut
2. Nozzle
3. Needle valve
4. Pin
5. Spacer
6. Lift piece
7. Spring seat
8. Shim
9. Second spring
10. Push rod
11. Collar
12. Spring seat
13. First spring
14. Shim
15. Nozzle holder



DISASSEMBLY SERVICE POINT

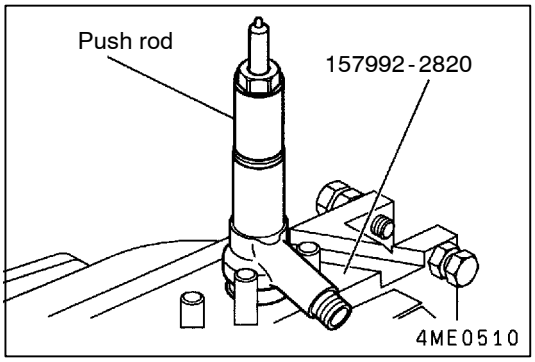
◀A▶ RETAINING NUT REMOVAL

Use the special tool to remove the retaining nut.



Caution

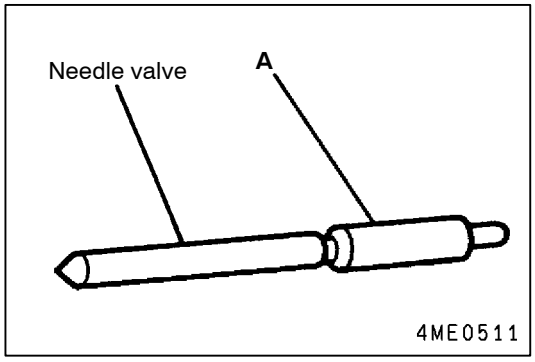
1. **Never touch the "A" part of the needle valve.**
2. **Always handle the needle valve and the nozzle as a set per cylinder.**



REASSEMBLY SERVICE POINT

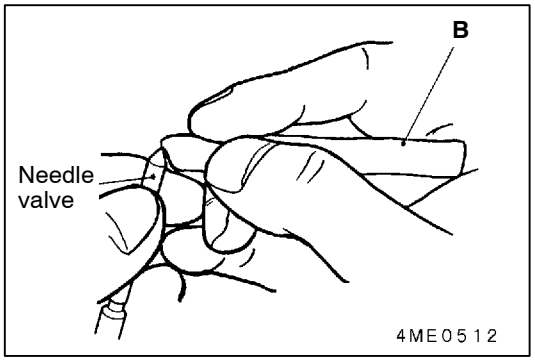
▶A◀ RETAINING NUT INSTALLATION

Use the special tool to install the retaining nut.



Caution

1. **Never touch the "A" part of the needle valve.**
2. **Always handle the needle valve and the nozzle as a set per cylinder.**



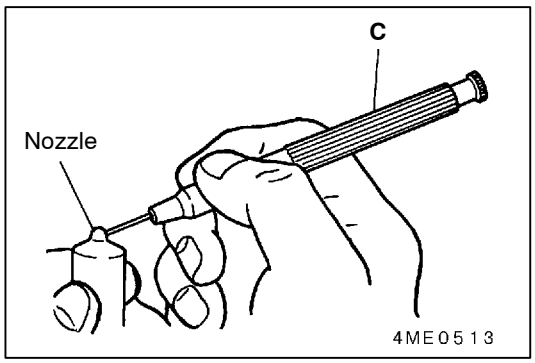
NOZZLE AND NEEDLE VALVE CLEANING

Clean the needle valve and nozzle with gas oil (cleaning solvant).

Remove carbon deposits with a cleaning tool in the following manner:

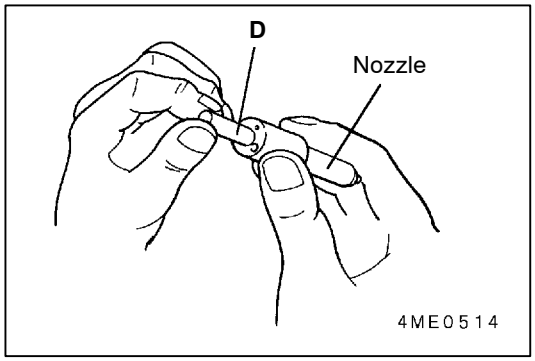
1. Clean the needle valve by removing carbon deposits from its tip using cleaning bar **B** of the cleaning tool.

   Never use a wire brush or hard steel for cleaning.

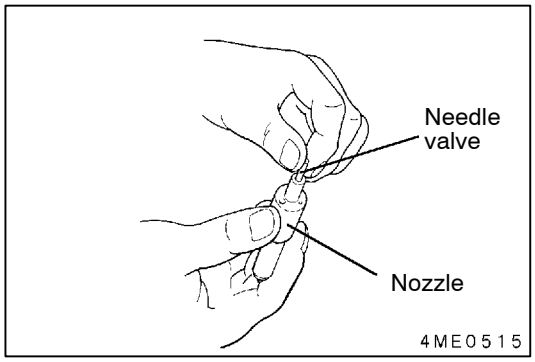


2. To clean the nozzle, remove carbon deposits from the orifices of the nozzle using needle cleaner **C** of the cleaning tool, by inserting it into the orifices and turning it.

   Needle cleaner diameter: ϕ0.21 mm or less.



3. Clean the seat of the nozzle using cleaning needle **D** of the cleaning tool.
4. Use carbon remover to remove hard-to-remove, burnt-on carbon deposits.



INSPECTION

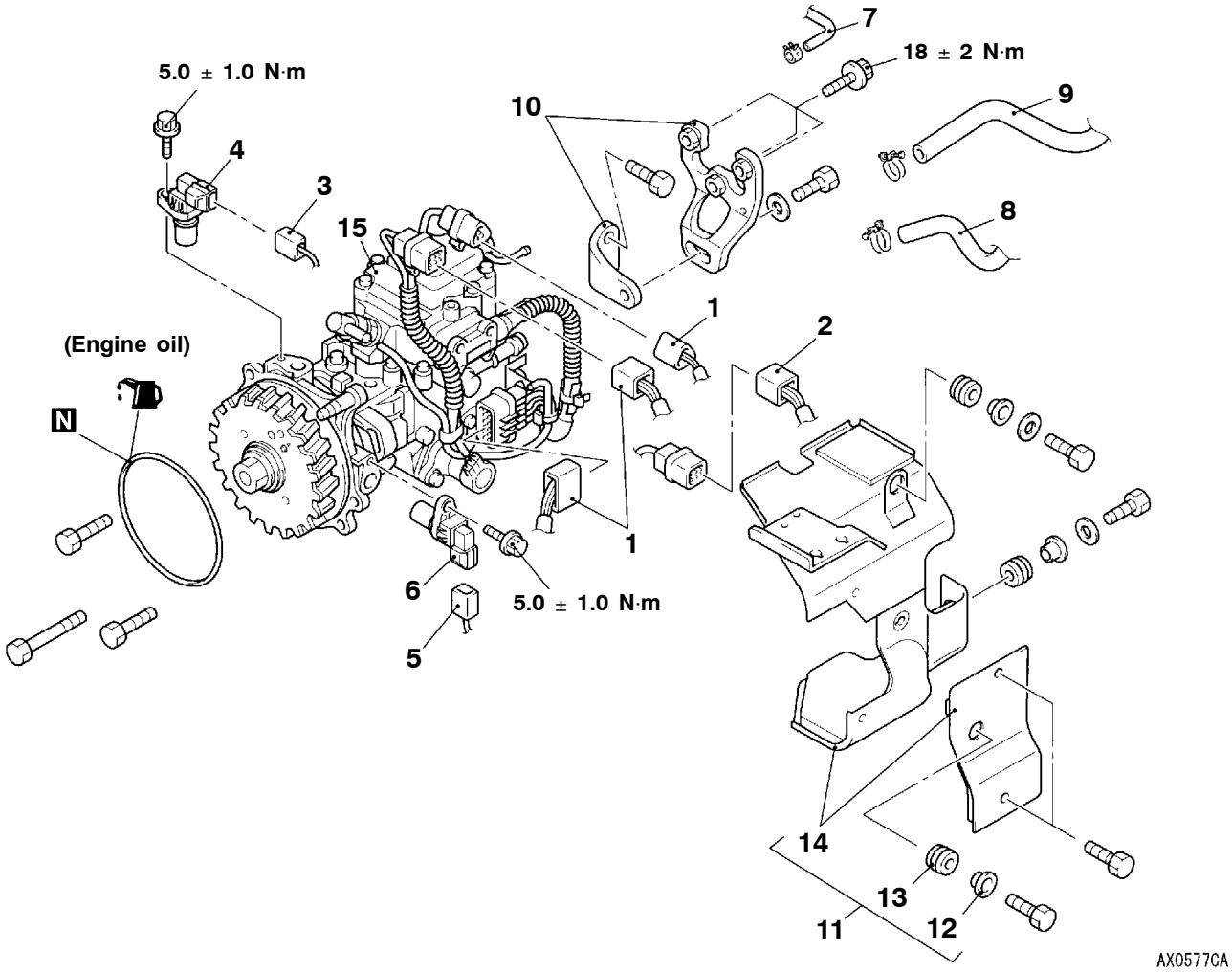
NOZZLE AND NEEDLE VALVE

1. Immerse the needle valve and nozzle in gas oil (cleaning solvent) and clean them thoroughly.
2. Check and see if the needle valve drops by its own weight into the nozzle from the position where a third of its length is pulled out. (Repeat this several times rotating the needle valve.)
3. If the needle valve does not drop smoothly, repeat cleaning and repeat the test. If any fault is still found, replace both the needle valve and nozzle together as a set.

INJECTION PUMP

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations
- Removal and Installation Of Engine Cover (Refer to GROUP 11C - Camshaft.)
- Removal and Installation of Battery and Battery Tray
- Removal and Installation of Injection Pipe (Refer to P.13C-50.)
- Removal and Installation of Air Cleaner (Refer to GROUP 15.)
- Removal and Installation of Intercooler Hose (Refer to GROUP 15.)
- Removal and Installation of Glow Plug Relay and Solenoid Valve Assembly
- Removal and Installation of Vacuum Pump (Refer to GROUP 11C.)



Removal steps

1. Injection pump connector
2. Engine speed sensor connector
3. Engine speed sensor 1 connector
4. Engine speed sensor 1
5. Engine speed sensor 2 connector
6. Engine speed sensor 2

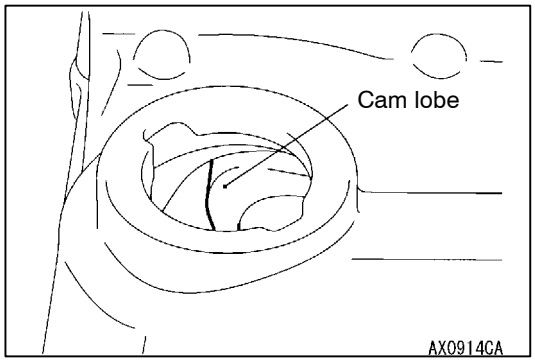
▶C◀ 7. Fuel return hose

▶B◀ 8. Fuel return hose

▶B◀ 9. Fuel main hose

10. Injection pump stay
11. Injection pump cover assembly
12. Insulator collar
13. Insulator
14. Injection pump cover

◀A▶ ▶A◀ 15. Injection pump assembly

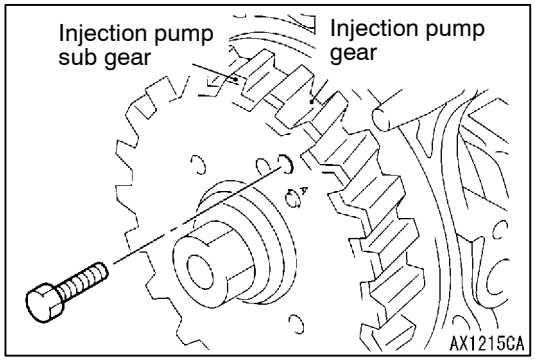


REMOVAL SERVICE POINT

◀A▶ INJECTION PUMP ASSEMBLY REMOVAL

Make the timing mark of "0" position on the crankshaft pulley with that of the timing case and set No.1 cylinder to compression stroke TDC.

NOTE
Remove the oil filler cap. If the camshaft cam lobe is at the shown position, the No.1 cylinder is on the compression stroke TDC.

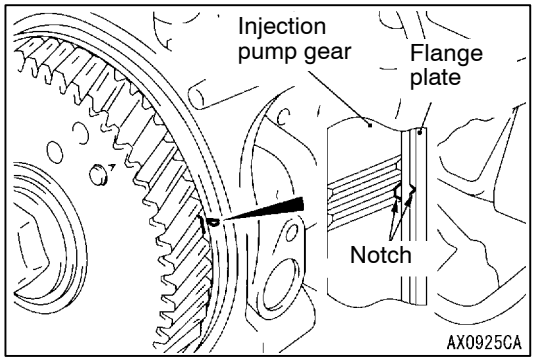


INSTALLATION SERVICE POINTS

▶A◀ INJECTION PUMP ASSEMBLY INSTALLATION

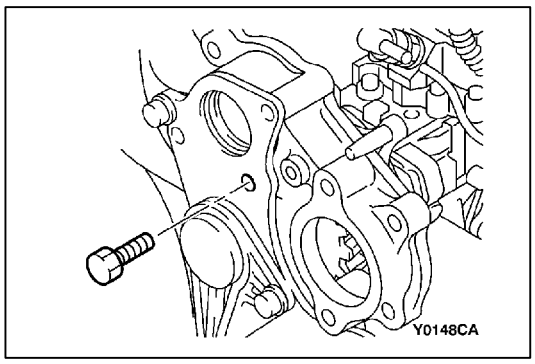
1. Install the bolt (M6 × 16) to the show position in order to hold the injection pump gear and the injection pump sub gear in position.

   NOTE
   If the injection pump assembly or the injection pump gear assembly is replaced, the bolt has been assembled beforehand.

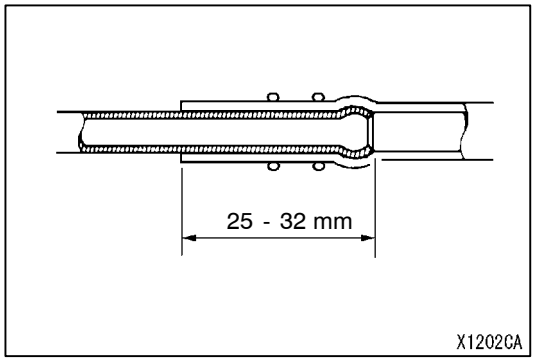


2. Make sure that No.1 cylinder is on the TDC of compression stroke.
3. Align the notch of the injection pump gear with the notch of the flange plate to install the injection pump assembly to the timing gear case.

   NOTE
   After installing the injection pump assembly, the characteristic of the gear makes the notch of the injection pump gear lag behind the notch of the flange plate by one tooth.

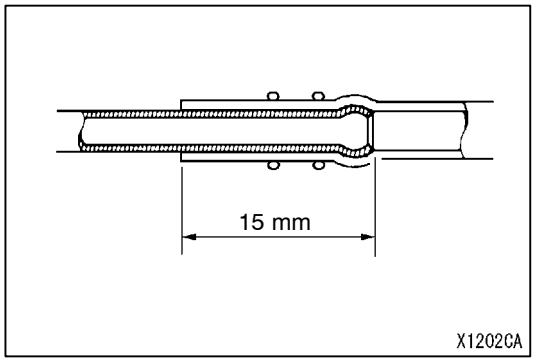


4. Remove the bolt, which has been assembled in Step 1.



▶B◀ FUEL MAIN HOSE/FUEL RETURN HOSE INSTALLATION

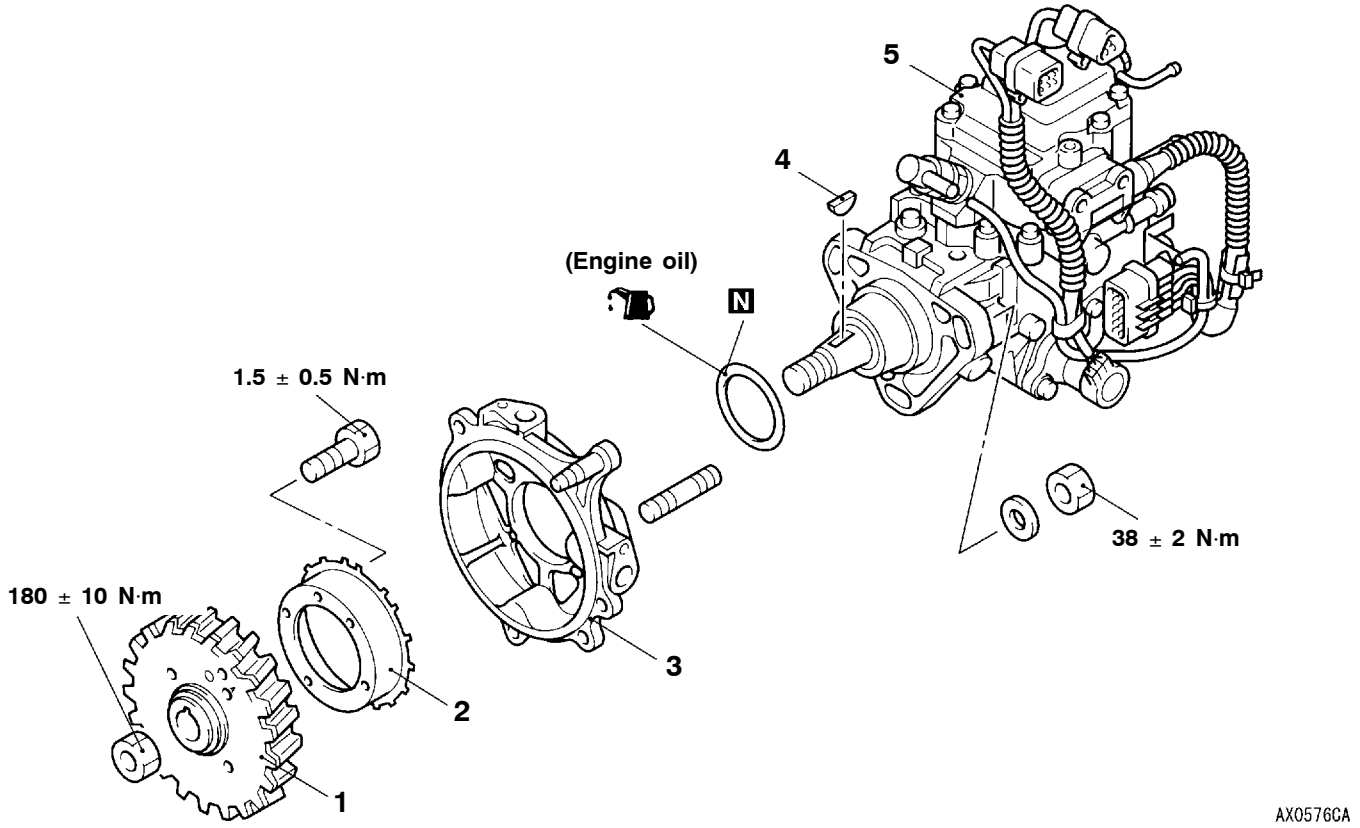
When connecting the fuel main hose or return hose to the fuel pipe, insert it up to the stepped part.



▶C◀ FUEL RETURN HOSE INSTALLATION

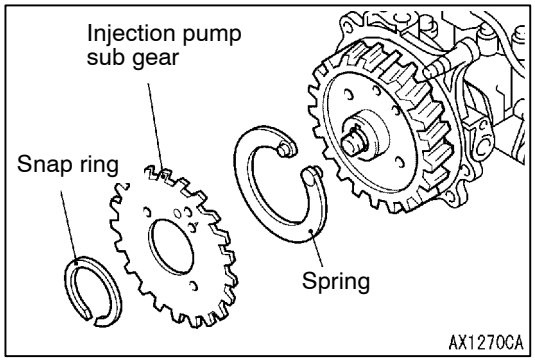
Insert the fuel return hose into the fuel pipe until the shown dimension is satisfied.

DISASSEMBLY AND ASSEMBLY



Disassembly steps

◀A▶ 1. Injection pump gear assembly
2. Sensor plate
3. Flange plate
4. Key
5. Injection pump

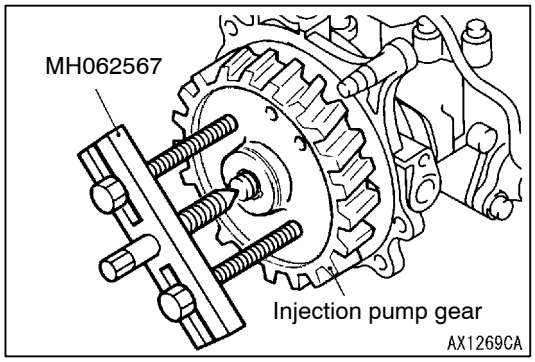


DISASSEMBLY SERVICE POINT

◀A▶ INJECTION PUMP GEAR ASSEMBLY REMOVAL

Remove the injection pump gear according to the following procedure.

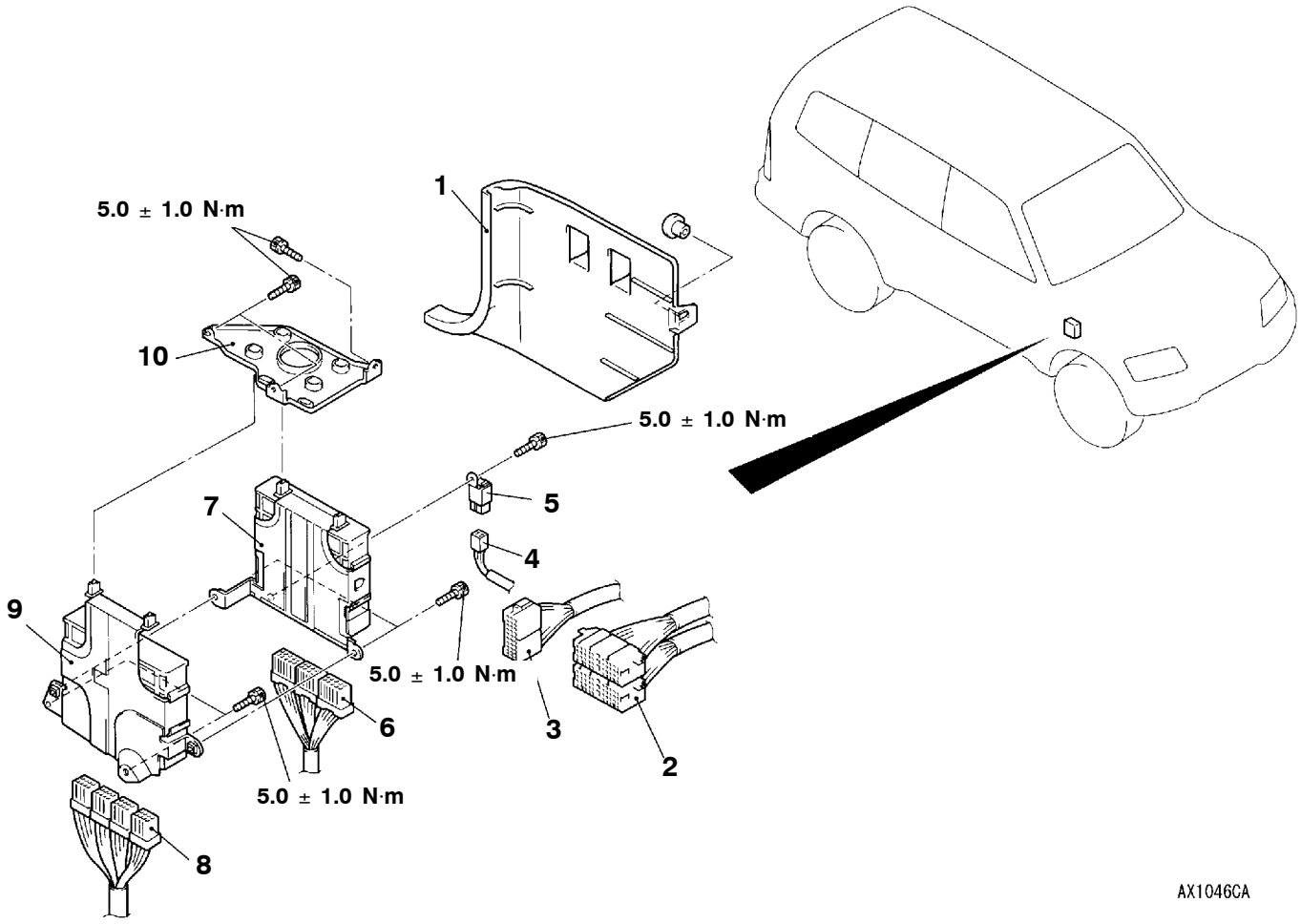
1. Remove the snap ring.
2. Remove the injection pump sub gear.
3. Remove the spring.



4. Remove the injection pump gear with special tools.

ENGINE-ECU

REMOVAL AND INSTALLATION



Removal steps

1. Cowl side trim (LH)
2. Joint of the instrument panel harness and front door harness (LH)
3. Joint of the instrument panel harness and floor harness (LH)
4. A/T control relay connector
5. A/T control relay
6. A/T-ECU connector
7. A/T-ECU
8. Engine-ECU connector
9. Engine-ECU
- Instrument panel (Refer to GROUP 52A.)
10. ECU bracket

NOTES

Service Bulletins

Click on the applicable bookmark to select the Service Bulletin.

SERVICE BULLETIN

QUALITY INFORMATION ANALYSIS
OVERSEAS SERVICE DEPT. MITSUBISHI MOTORS CORPORATION

SERVICE BULLETIN	**No.:** MSB-00E11-503	
	Date: 2000-11-30	**<Model>** (EC)PAJERO/ MONTERO (V60, 70) **<M/Y>** 01-10
Subject: CORRECTION TO INJECTION PUMP INSTALLATION SERVICE POINTS		
Group: ENGINE	**Draft No.:** 00SY052508	
CORRECTION	**INTERNATIONAL CAR ADMINISTRATION OFFICE**	T.NITTA - PROJECT LEADER AFTER SALES SERVICE & CS PROMOTION

1. Description:

On the 4M41 engine equipped vehicles, incorrect description of the injection pump installation given under INSTALLATION SERVICE POINTS has been corrected.

2. Applicable Manuals:

Manual	Pub. No.	Language	Page(s)
2001 PAJERO Workshop Manual VOL1	PWJE0001 (1/2)	(English)	13C-56, 57
2001 MONTERO Workshop Manual VOL1	PWJS0002 (1/2)	(Spanish)	

INJECTION PUMP

REMOVAL AND INSTALLATION

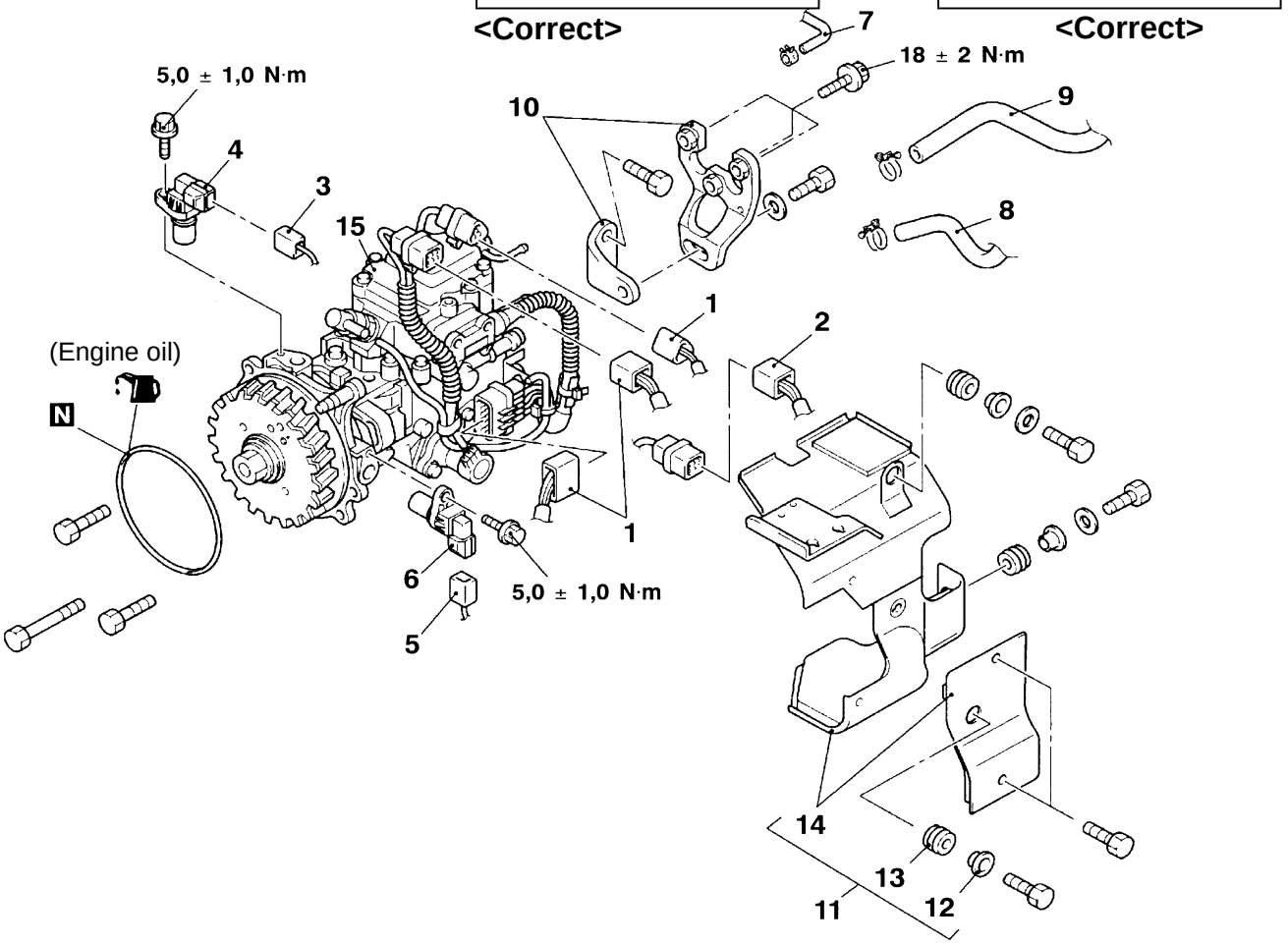
Pre-removal and Post-installation Operation

- Removal and installation Of Engine Cover (Refer to GROUP 11C - Camshaft.)
- Removal and Installation of Battery and Battery Tray
- Removal and Installation of Injection Pipe (Refer to P. 13C – 50.)
- Removal and Installation of Air Cleaner (Refer to GROUP 15.)
- Removal and Installation of Intercooler Hose (Refer to GROUP 15.)
- Removal and Installation of Glow Plug Relay and Solenoid Valve Assembly **<Incorrect>**
- Removal and Installation of Vacuum Pump (Refer to GROUP 11C.)

<Incorrect>

11C – Vacuum Pump **<Correct>**

Power Steering Oil **<Correct>**



Removal steps

1. Injection pump connector
2. Engine speed sensor connector
3. Engine speed sensor 1 connector
4. Engine speed sensor 1
5. Engine speed sensor 2 connector
6. Engine speed sensor 2

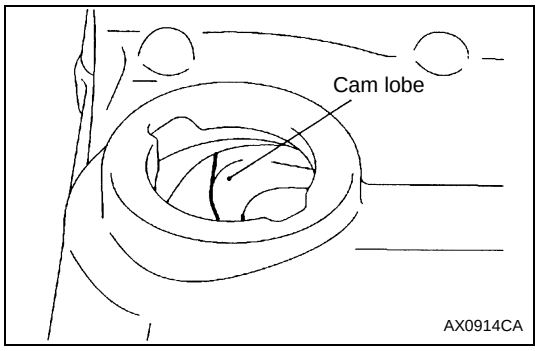
►C◄ 7. Fuel return hose

►B◄ 8. Fuel return hose

►B◄ 9. Fuel main hose

10. Injection pump stay
11. Injection pump cover assembly
12. Insulator collar
13. Insulator
14. Injection pump cover

◄A►►A◄ 15. Injection pump assembly



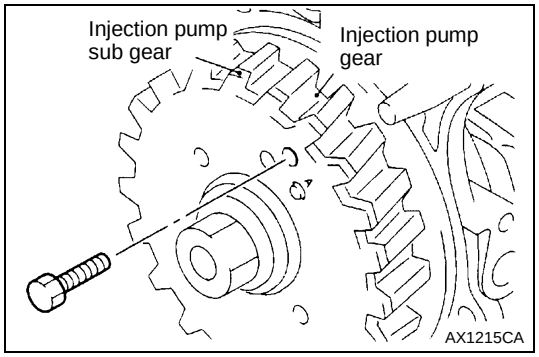
REMOVAL SERVICE POINT

◀A▶INJECTION PUMP ASSEMBLY REMOVAL

Make the timing mark of “0” position on the crankshaft pulley with that of the timing case and set No.1 cylinder to compression stroke TDC.

NOTE

Remove the oil filler cap. If the camshaft cam lobe is at the shown position, the No.1 cylinder is on the compression stroke TDC.

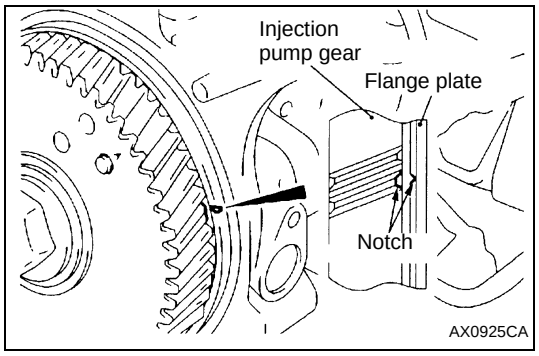


INSTALLATION SERVICE POINTS

▶A◀INJECTION PUMP ASSEMBLY INSTALLATION

1. Install the bolt (M6 x 16) to the show position in order to hold the injection pump gear and the injection pump sub gear in position.

   NOTE
   If the injection assembly or the injection pump gear assembly is replaced, the bolt has been assembled beforehand.



2. Make sure that No.1 cylinder is on the TDC of compression stroke.
3. Align the notch of the injection pump gear with the notch of the flange plate to install the injection pump assembly to the timing gear case.

   NOTE
   After installing the injection pump assembly, the characteristic of the of the gear makes the notch of the injection pump gear lag behind the notch of the flange plate by one tooth.

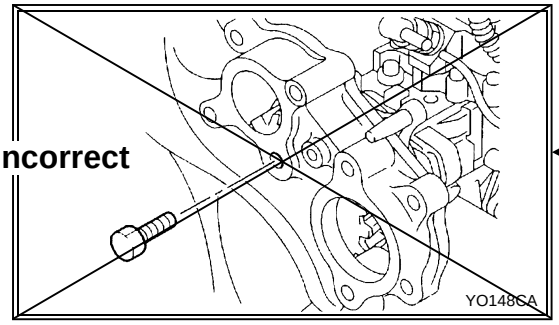
<Incorrect>

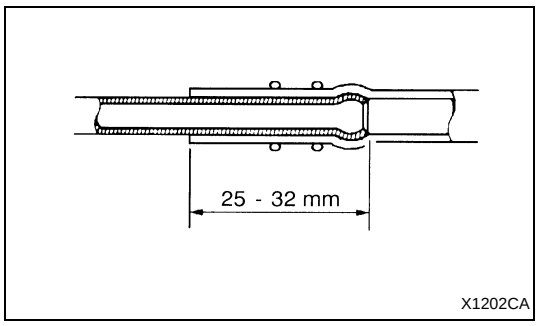
~~4. Remove the bolt, which has been assembled in Step 1.~~

<Correct>

4. Remove the drain plug.
5. Remove the bolt, which has been installed in Step 1, from the drain plug mounting hole.
6. Install the drain plug.

<Incorrect>

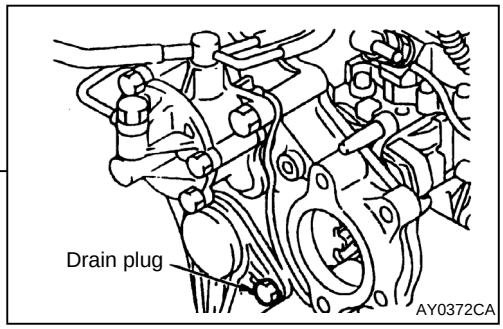




▶A◀FUEL MAIN HOSE/FUEL RETURN HOSE INSTALLATION

When connecting the fuel main hose or return hose to the fuel pipe, insert it up to the stepped part.

<Correct>



DIESEL FUEL <4M4>

CONTENTS

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Outline of Changes 2
SERVICE SPECIFICATIONS 2
TROUBLESHOOTING 2
ON-VEHICLE SERVICE 12
Throttle Body Assembly Check 12
INJECTION PUMP 13

GENERAL

OUTLINE OF CHANGES

Some service procedures have been established as the following changes have been made due to the compliance with the Emission Regulation Step III.

- The intake manifold cover and injection pump cover have been reshaped.
- The throttle body assembly has been changed.
- The EGR valve assembly has been changed.

SERVICE SPECIFICATIONS

Item		Standard value
Throttle body assembly resistance Ω	at -10 - 50°C	12 - 20
	at 50 - 100°C	12 - 23

TROUBLESHOOTING

FAIL-SAFE, BACKUP FUNCTIONS

When abnormalities in the major sensors are detected by diagnosis functions, pre-set control logic operates to maintain a safe driving condition for the vehicle.

Diagnosis item	Control features in malfunction
Accelerator pedal position sensor	• Accelerator pedal released (idle switch ON) Acceleration opening degree = 0 % • Accelerator pedal applied (idle switch OFF) Engine controlled at low speed Acceleration opening degree = 40 % <M/T>, 28 % <A/T> • Void cruise control
Idle switch	• Void idling speed control • Void cruise control
Engine speed sensor	• Engine controlled at low speed • Void cruise control
Boost air temperature sensor	Maintain the intake air temperature at 50°C
Vehicle speed sensor	• Void idling speed control • Void cruise control • With accelerator pedal released (when idle switch is on) Accelerator opening angle = 0 % • With accelerator pedal depressed (when idle switch is off) Accelerator opening angle = Fixed at 40 % (M/T), 28 % (A/T)
Engine coolant temperature sensor	Maintain the engine coolant temperature at 80°C (engine running), 0°C (engine stopped or just started)
Control sleeve position sensor	• With accelerator pedal released (when idle switch is on) Engine speed = 800 r/min • With accelerator pedal depressed (when idle switch is off) Engine speed = 2,000 r/min • Void cruise control
Timer piston position sensor	• Open control by means of engine speed • Void cruise control
Barometric pressure sensor (ECU built-in)	Keep the barometric pressure at 101 kPa

Diagnosis item	Control features in malfunction
Fuel temperature sensor	Maintain the fuel temperature at 90°C
Boost pressure sensor	● Keep the boost pressure as barometric pressure (101 kPa) ● Void cruise control
Injection correction ROM	● When backup data is normal: Correction calculation using backup data ● When backup data is corrupted: Fixed at correction value ±0 %
GE actuator	● With accelerator pedal released (when idle switch is on) Engine speed = 800 r/min ● With accelerator pedal depressed (when idle switch is off) Engine speed = 2,000 r/min ● Void cruise control
Over boost	Void cruise control
Timing control valve	● Open control by means of engine speed ● Void cruise control
Throttle body assembly	Void cruise control
EGR sensor	EGR control is prohibited
EGR motor	EGR control is prohibited

INSPECTION CHART FOR DIAGNOSIS CODES

Code No.	Diagnosis item	Reference page
11	Accelerator pedal position sensor system	13C-4
12	Boost pressure sensor (boost sensor) system	13C-4
13	Barometric pressure sensor system	13C-4
18	Engine speed sensor (backup) system	13C-4
21	Engine speed sensor system	13C-5
23	Idle switch (accelerator pedal position sensor built-in) system	13C-5
27	Accelerator pedal position sensor (sub) system	13C-5
41	Throttle valve system	13C-6
46	Injection correction ROM system	13C-6
48	GE actuator (in the middle of control sleeve position sensor inoperative) system	13C-7
51	EGR valve system	13C-8

INSPECTION PROCEDURE FOR DIAGNOSIS CODE

Code No. 11 Accelerator pedal position sensor system	Probable cause
Range of Check ● Ignition switch: ON, accelerator pedal position sensor (sub) operative, except for during engine cranking Set Conditions ● Output voltage of accelerator pedal position sensor (sub) for one second is 0.2 V or higher and lower than 2.5 V and output voltage of accelerator pedal position sensor (main) for one second is 4.5 V or higher, or lower than 0.2 V. ● Output voltage of accelerator pedal position sensor (main) for 1 second is lower than 0.2 V. Range of Check ● Ignition switch: ON, except for during engine cranking Set Conditions ● The output voltage of accelerator pedal position sensor (main and sub) for 0.2 second is 0.2 V or higher, or lower than 4.5 V and the difference in sensor output voltage between the main and sub for 0.2 second is 1 V or higher. ● Idle switch: ON, and sensor main output voltage is 1.875 V or higher for 1 second.	● Accelerator pedal position sensor inoperative ● Accelerator pedal position sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative

Inspection procedures are the same as before.

Code No. 12 Boost pressure sensor (boost sensor) system	Probable cause
Range of Check ● Ignition switch: ON, except for during engine cranking Set Conditions ● Sensor output voltage for one second is 4.5 V or higher (boost pressure is approximately 306.7 kPa) or ● Sensor output voltage for one second is 0.2 V or lower (boost pressure is approximately 13 kPa or lower) Range of Check ● Engine speed is 1600 r/min or higher and the acceleration opening degree is 75% <M/T> or 50% <A/T> or more Set Conditions ● Boost pressure is lower than the barometric pressure + 13 kPa for two seconds.	● Boost pressure sensor inoperative ● Boost pressure sensor open circuit, short circuit, or connector contact inoperative ● Boost pressure sensor hose disconnected ● Engine-ECU inoperative

Inspection procedures are the same as before.

Code No. 13 Boost pressure sensor system	Probable cause
Range of Check ● Ignition switch: ON, except for during engine cranking Set Conditions ● The sensor output voltage is 4.5 V or higher for 3 seconds or ● The sensor output voltage is 1.5 V or lower for 3 seconds	● Engine-ECU inoperative

Inspection procedures are the same as before.

Code No. 18 Engine speed sensor (backup) system	Probable cause
Range of Check ● Ignition switch: ON ● Except for during engine stall and cranking Set Conditions ● The difference in the engine speed sensor output for 4 seconds: 325 r/min or more	● Engine speed sensor inoperative ● Engine speed sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative

Inspection procedures are the same as before.

Code No. 21 Engine speed sensor system	Probable cause
Range of Check ● During engine cranking Set Conditions ● No change in the engine speed sensor output voltage for 1 seconds (on pulse signal has been input) Range of Check ● Ignition switch: ON ● Except for during engine stall and cranking ● Engine speed is more than or equal to 600 r/min Set Conditions ● No change in the engine speed sensor output 0.3 seconds	● Engine speed sensor inoperative ● Engine speed sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative

Inspection procedures are the same as before.

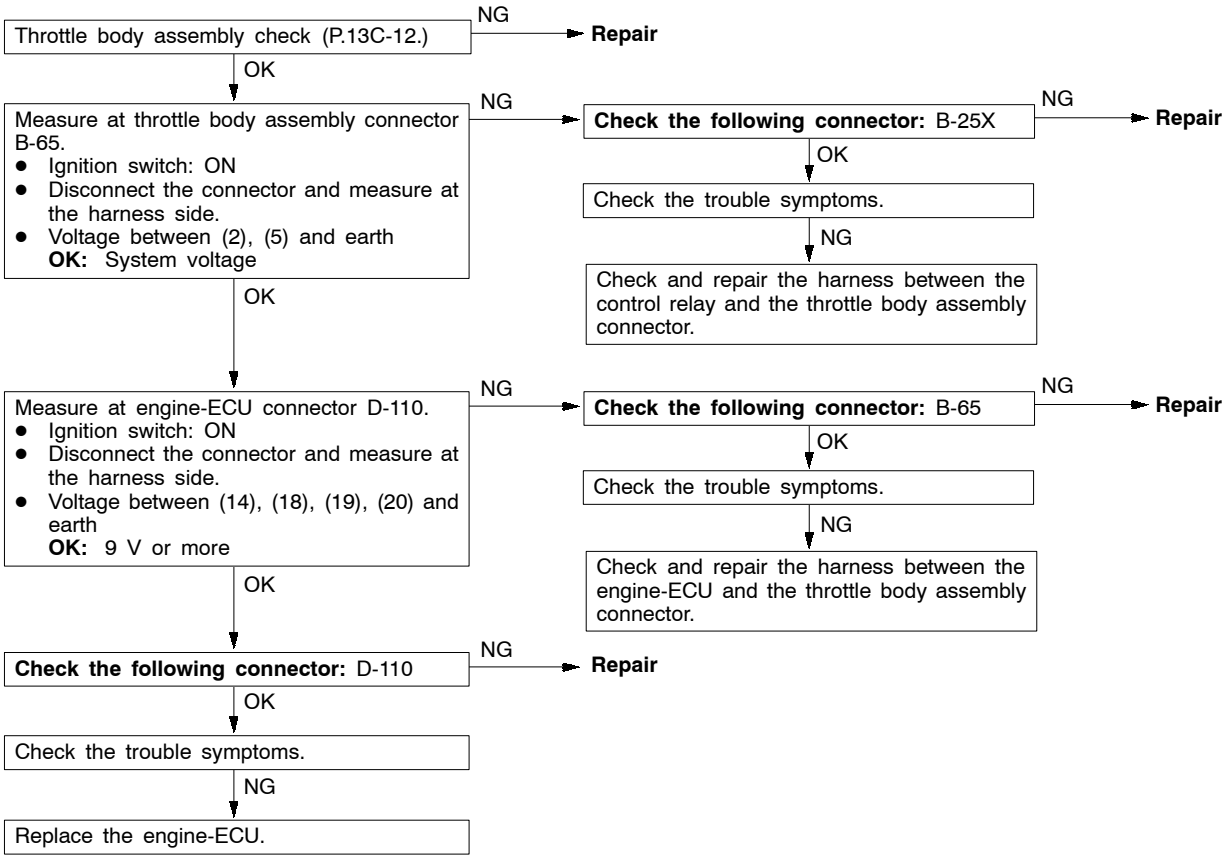
Code No. 23 Idle switch (accelerator pedal position sensor built-in) system	Probable cause
Range of Check Ignition switch: ON, accelerator pedal position sensor (main, sub) operative, except for during engine cranking Set Conditions ● Idle switch (built-in): ON, accelerator pedal position sensor (main, sub) output voltage for 0.8 second 1.875 V or higher ● Idle switch (built-in): OFF, accelerator pedal position sensor (main, sub) opening degrees less than 1 %	● Accelerator pedal position sensor inoperative ● Accelerator pedal position sensor open circuit, short circuit, or connector contact inoperative ● Idle switch “ON” inoperative ● Idle switch signal line short circuit ● Engine-ECU inoperative

Inspection procedures are the same as before.

Code No. 27 Accelerator pedal position sensor (sub) system	Probable cause
Range of Check ● Ignition switch: ON, accelerator pedal position sensor (main) operative, except for during engine cranking Set Conditions ● Output voltage of accelerator pedal position sensor (main) for 1 second is 0.2 V or higher and lower than 2.5 V. Output voltage of accelerator pedal position sensor (sub) for 1 second is 4.5 V or higher. ● Output voltage of accelerator pedal position sensor (sub) for 1 second is lower than 0.2 V. Range of Check ● Ignition switch: ON, except for during engine cranking Set Conditions ● Output voltage of accelerator pedal position sensor (main and sub) is 0.2 V or higher or lower than 4.5 V. ● The difference in the output sensor voltage between the main and the sub sensor for 0.2 seconds is 1.0 V or more.	● Accelerator pedal position sensor inoperative ● Accelerator pedal position sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative

Inspection procedures are the same as before.

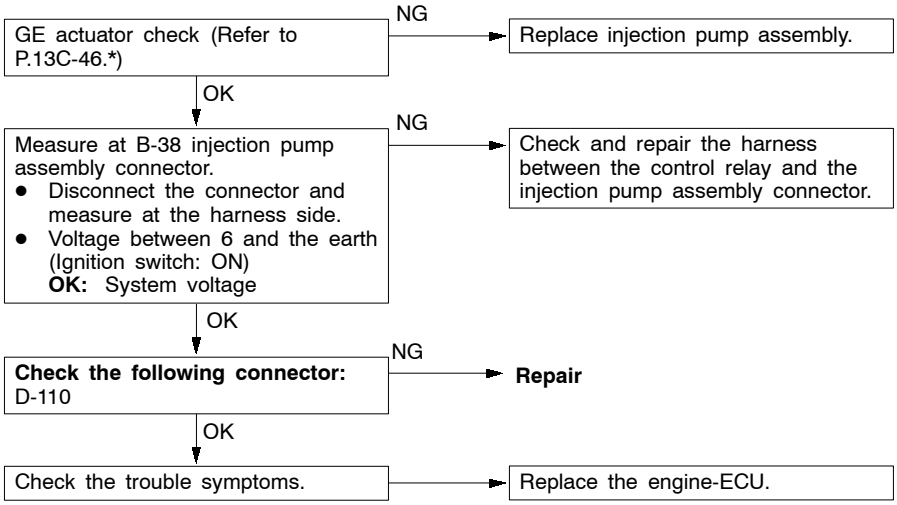
Code No. 41 Throttle valve system	Probable cause
Range of Check ● Engine speed is 1,600 r/min and accelerator opening angle is 50 % or more Set Conditions ● Boost pressure < barometric pressure + 33 kPa for 12 seconds	● Malfunction of throttle valve ● Open circuit or short-circuit in throttle valve circuit or poor connector connection ● Malfunction of engine-ECU



Code No. 46 Injection correction ROM system	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● When communication fails	● Injection correction ROM inoperative ● Engine-ECU inoperative ● Short circuit, open circuit, or connector contact inoperative

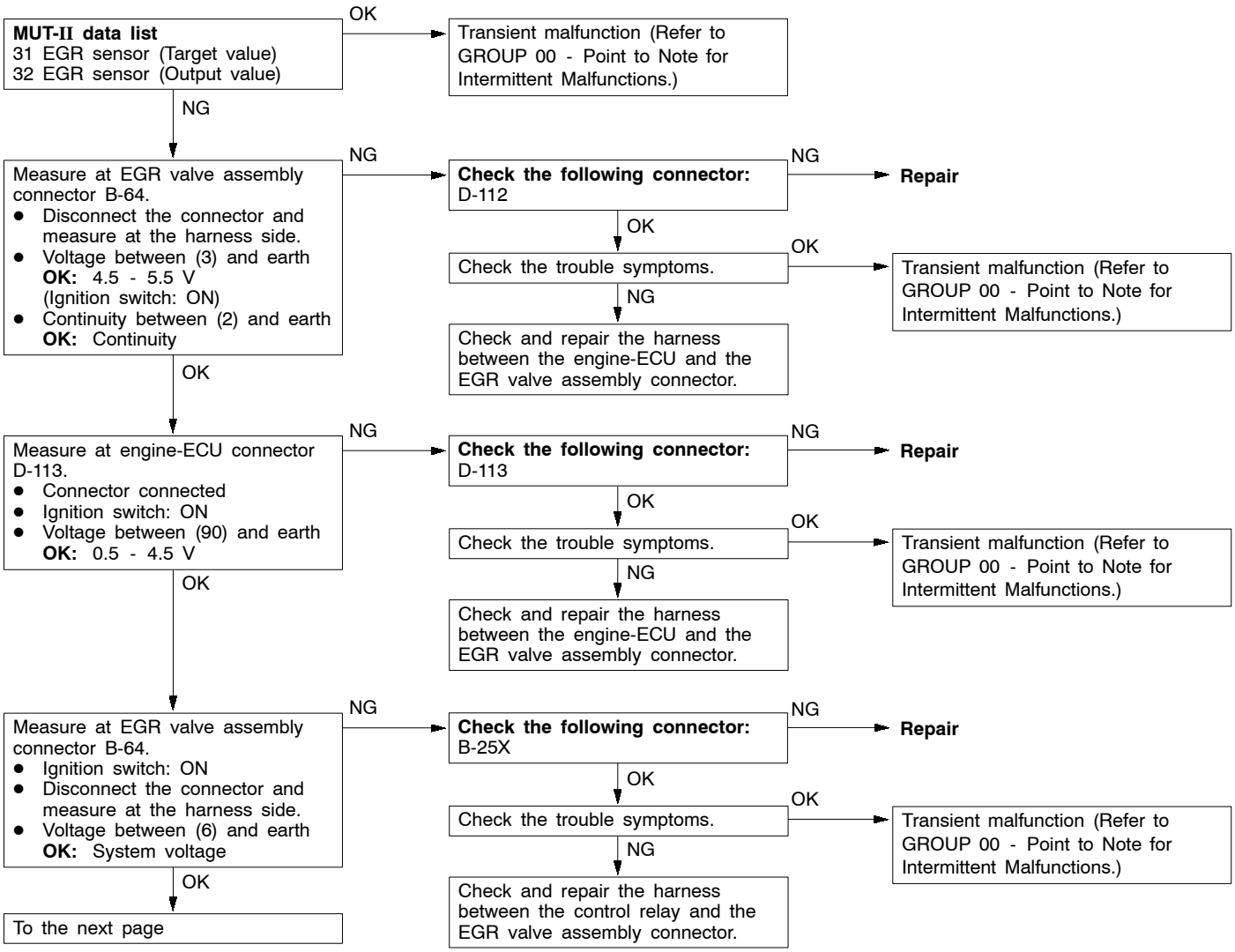
Inspection procedures are the same as before.

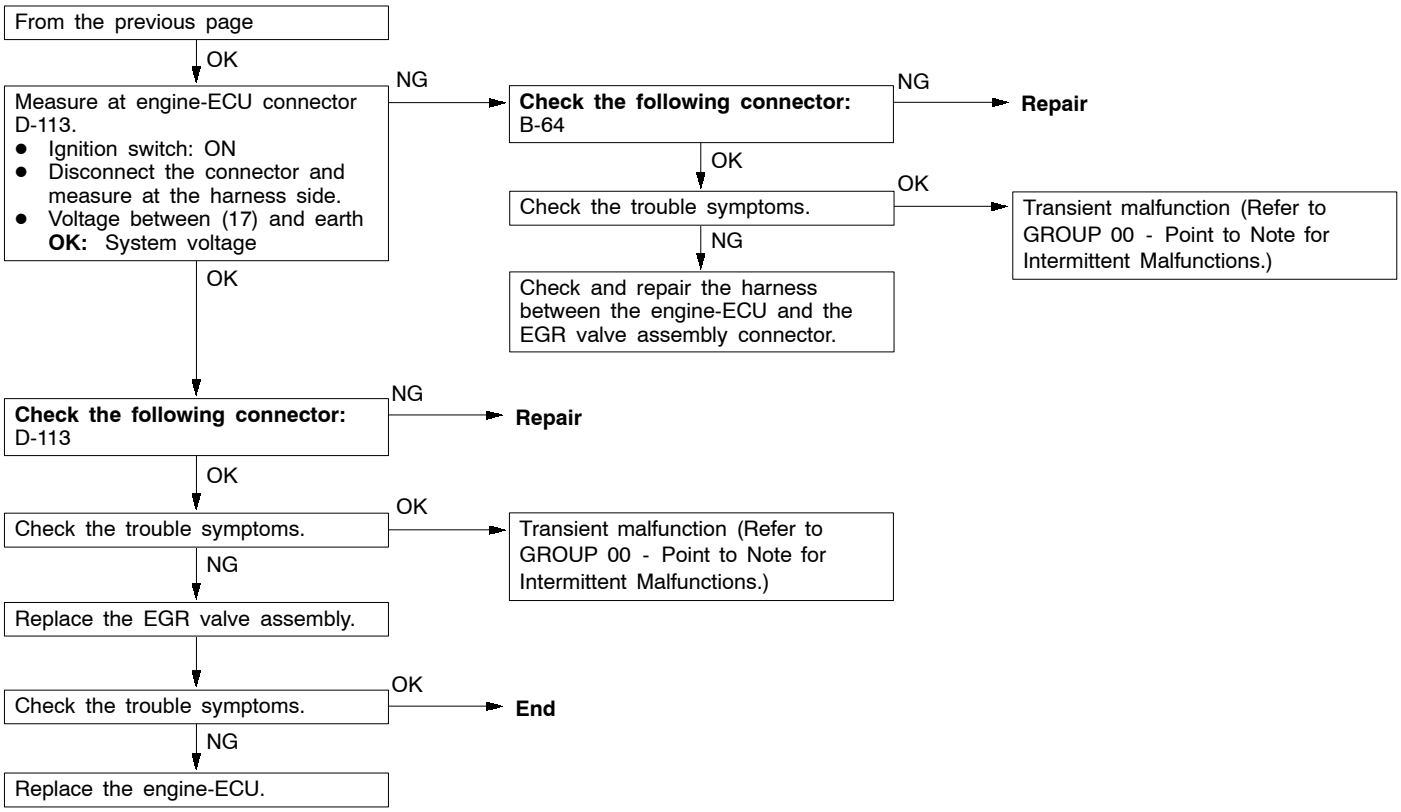
Code No. 48 GE actuator (in the middle of control sleeve position sensor inoperative) system	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● Target value minus actual value for 0.5 second is 1 V or more.	● Control sleeve position sensor inoperative ● GE actuator inoperative ● Control sleeve position sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative



NOTE:
*: Refer to the 2001 PAJERO Workshop Manual (Pub. No. PWJE0001).

Code No. 51 EGR valve assembly system	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● EGR sensor output voltage is continuously 0.5 V or less, or 4.5 V or more for 1 second or more ● Difference between EGR sensor output voltage target value and output is continuously 0.5 V or more for 3 seconds or more	● Malfunction of EGR valve assembly ● Open circuit or short-circuit in EGR valve assembly circuit or poor connector connection ● Malfunction of engine-ECU

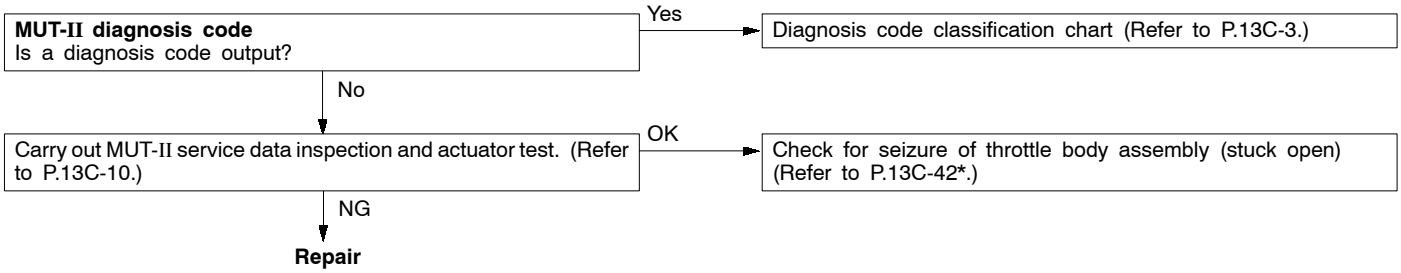




INSPECTION PROCEDURES FOR TROUBLE SYMPTOMS

Inspection procedure 20

Excessive engine vibration when engine stopped	Probable cause
The cause is probably a malfunction of the throttle body assembly.	● Malfunction of throttle body assembly (does not close) ● Open circuit or short-circuit in throttle body assembly circuit or poor connector connection



NOTE:
*: Refer to the 2001 PAJERO Workshop Manual (Pub. No. PWJE0001).

DATA LIST REFERENCE TABLE

Item No.	Check item	Inspection conditions	Value to be determined normal	Code No. or inspection procedure No.	Reference page
31	EGR sensor (Target value)	Engine: Racing	Changes between 0.5 V and 4.5 V	Code No. 51	13C-8
32	EGR sensor (Output value)	Engine: Racing	Approaches EGR sensor (target value).	Code No. 51	13C-8
36	Throttle body assembly (Target value)	Engine: Idling	30 deg	Code No. 41	13C-6

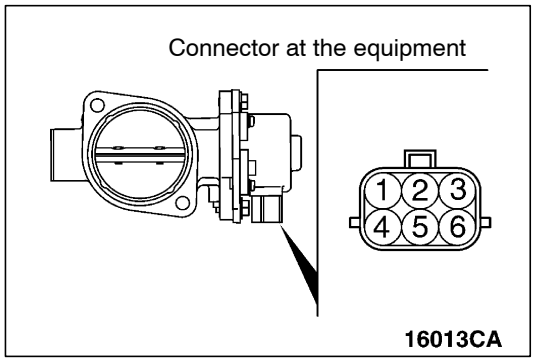
ACTUATOR TEST TABLE

Item No.	Check item	Drive contents	Inspection conditions	Value to be determined as normal	Code No. or inspection procedure No.	Reference page
07	Throttle body assembly	Throttle valve: Fully closed	● Ignition switch: ON ● Vehicle speed: 0 km/h ● Engine speed: 1,000 r/min or lower	Operating sound can be heard.	Code No. 41	13C-6
08		Throttle valve: Kept at half-open				
09		Throttle valve: Fully open				
28	EGR valve assembly	EGR valve: Open	● Ignition switch: ON ● Vehicle speed: 0 km/h	Operating sound can be heard.	Code No. 51	13C-8
29		EGR valve: Closed				

ENGINE-ECU CHECK

TERMINAL VOLTAGE TABLE

Terminal No.	Check item	Inspection conditions (engine status)		Normal condition
14	Throttle body assembly (1)	Ignition switch: ON (Engine stops)		9 V or more
17	EGR motor	Ignition switch: ON (Engine stops)		System voltage
18	Throttle body assembly (2)	Ignition switch: ON (Engine stops)		9 V or more
19	Throttle body assembly (3)	Ignition switch: ON (Engine stops)		9 V or more
20	Throttle body assembly (4)	Ignition switch: ON (Engine stops)		9 V or more
33	A/C load signal	Engine: Idle A/C switch: ON	During weak cooling or heating	System voltage
			During normal cooling	0 - 1 V
			During strong cooling	Changes repeatedly between 0 V and 12 V
37	Clutch switch <M/T>	Clutch pedal depressed		0 - 1 V
	Inhibitor switch <A/T>	Ignition switch: ON (Engine stops)	Move selector lever to N or P	0 - 1 V
			Move selector lever to D, 2, L or R	System voltage
38	Control relay (no immobilizer)	Ignition switch: ON		0 - 1 V
		Ignition switch: ON → OFF (after approx. 8 seconds)		System voltage
41	Select switch <M/T>	Ignition switch: ON (Engine stops)	Move shift lever to 4st or R	System voltage
42	1st - 2nd switch <M/T>	Ignition switch: ON (Engine stops)	Move shift lever to 1st or 2nd	System voltage
43	3rd - 4th switch <M/T>	Ignition switch: ON (Engine stops)	Move shift lever to 3rd or 4th	System voltage
44	5th - R switch <M/T>	Ignition switch: ON (Engine stops)	Move shift lever to 5th	0 - 1 V
			Move shift lever to R	System voltage
58	Tachometer	During idling		Changes repeatedly between 0 V and 12 V
90	EGR valve sensor	During racing		Changes between 0.5 V and 4.5 V



ON-VEHICLE SERVICE

THROTTLE BODY ASSEMBLY CHECK

1. Remove the air intake hose from the throttle body.
2. Move the throttle valve by hand and check that it moves smoothly.

   NOTE
   At this time, check that the throttle valve is not damaged or bent. If there is any problem, replace the throttle body assembly.
3. Disconnect the throttle body assembly connector.
4. Measure resistance between the throttle body assembly connector terminals.

   Standard value:

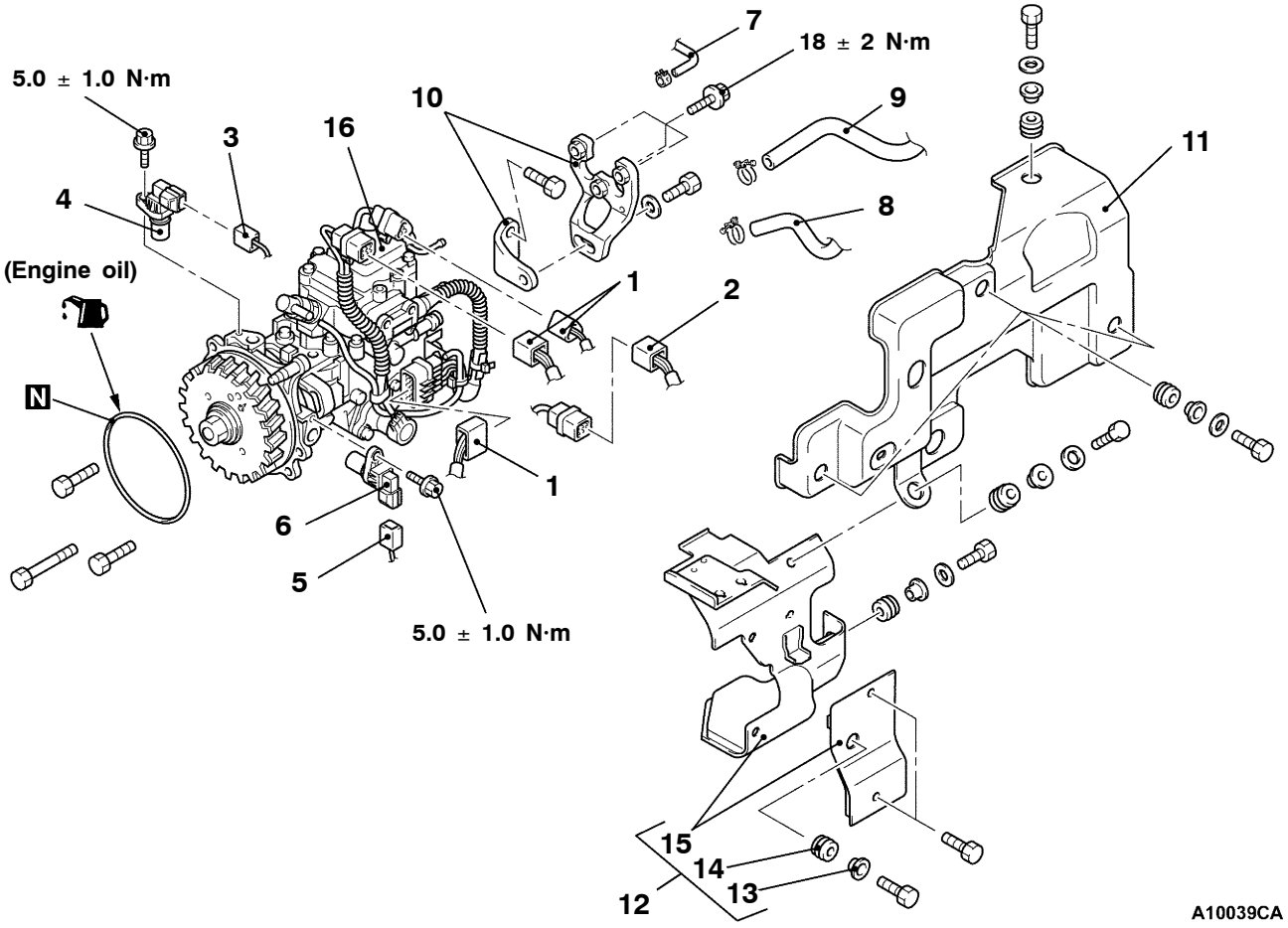
Terminals to be measured	Resistance value (Ω)
1 - 2	12 - 20 (at -10 - 50°C) 15 - 23 (at 50 - 100°C)
2 - 3	
4 - 5	
5 - 6	

5. Connect the throttle body assembly connector.
6. Attach the air intake hose.

INJECTION PUMP

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations
- Engine Cover Removal and Installation.
- Battery and Battery Tray Removal and Installation.
- Injection Pipe Removal and Installation.
- Air duct (A) Removal and Installation.
- Intercooler Hose Removal and Installation.
- Glow Plug Relay and Bracket Assembly Removal and Installation.
- Power Steering Oil Pump Removal and Installation.
- Fuel Filter Removal and Installation.



Removal steps

1. Injection pump connector
2. Engine speed sensor connector
3. Engine speed sensor 1 connector
4. Engine speed sensor 1
5. Engine speed sensor 2 connector
6. Engine speed sensor 2

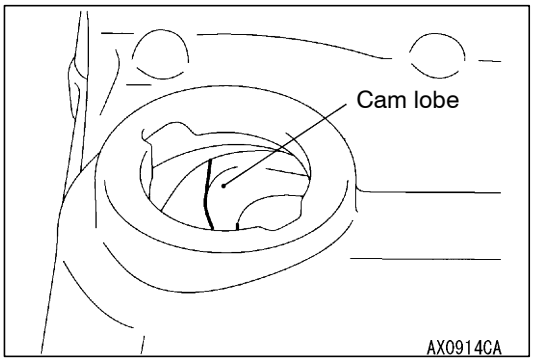
▶C◀ 7. Fuel return hose

▶B◀ 8. Fuel return hose

▶B◀ 9. Fuel main hose

10. Injection pump stay
11. Intake manifold cover
12. Injection pump cover assembly
13. Insulator collar
14. Insulator
15. Injection pump cover

◀A▶ ▶A◀ 16. Injection pump assembly

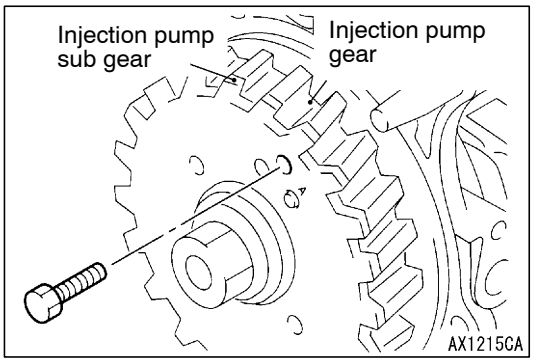


REMOVAL SERVICE POINT

◀A▶ INJECTION PUMP ASSEMBLY REMOVAL

Make the timing mark of "0" position on the crankshaft pulley with that of the timing case and set No. 1 cylinder to compression stroke TDC.

NOTE
Remove the oil filler cap. If the camshaft cam lobe is at the shown position, the No. 1 cylinder is on the compression stroke TDC.

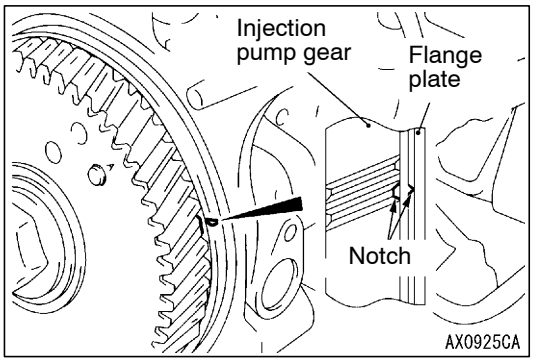


INSTALLATION SERVICE POINTS

▶A◀ INJECTION PUMP ASSEMBLY INSTALLATION

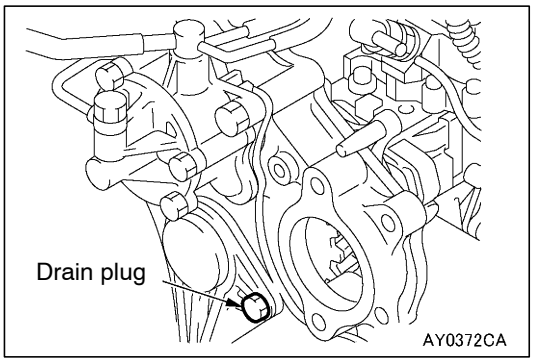
1. Install the bolt (M6 × 16) to the show position in order to hold the injection pump gear and the injection pump sub gear in position.

   NOTE
   If the injection pump assembly or the injection pump gear assembly is replaced, the bolt has been assembled beforehand.

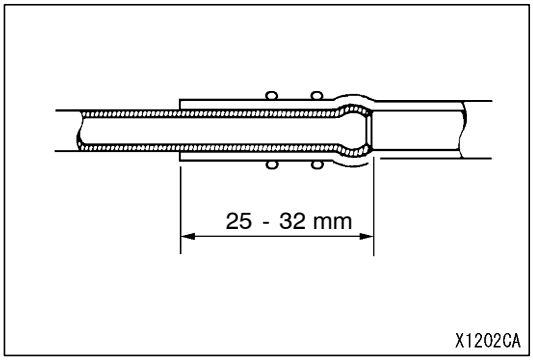


2. Make sure that No. 1 cylinder is on the TDC of compression stroke.
3. Align the notch of the injection pump gear with the notch of the flange plate to install the injection pump assembly to the timing gear case.

   NOTE
   After installing the injection pump assembly, the characteristic of the gear makes the notch of the injection pump gear lag behind the notch of the flange plate by one tooth.

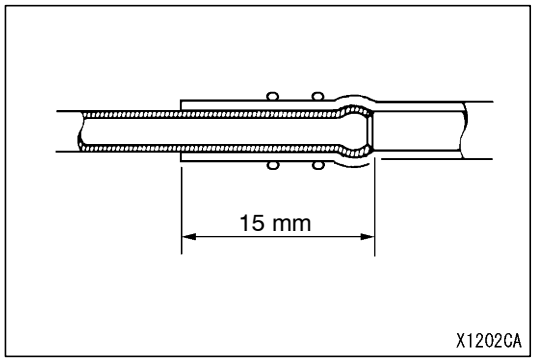


4. Remove the drain plug.
5. Remove the bolt, which is installed in step 1, from the drain plug hole.
6. Install the drain plug.



▶B◀ FUEL MAIN HOSE/FUEL RETURN HOSE INSTALLATION

When connecting the fuel main hose or return hose to the fuel pipe, insert it up to the stepped part.



▶C◀ FUEL RETURN HOSE INSTALLATION

Insert the fuel return hose into the fuel pipe until the shown dimension is satisfied.

NOTES

FUEL SUPPLY

Click on the applicable bookmark to selected the required model year.

FUEL SUPPLY

CONTENTS

GENERAL INFORMATION 2
FUEL TANK <6G7> 2
FUEL TANK <4D5, 4M4> 8
FUEL FILTER 13

GENERAL INFORMATION

The fuel tank is located under the floor below the rear seats.
The fuel pump module contains a fuel pump (low-pressure), fuel filter and fuel pressure regulator (low-pressure).
The valve assembly contains a cut-off valve, which prevents fuel to flow out, and a two-way valve, which regulates the fuel pressure inside the fuel tank.

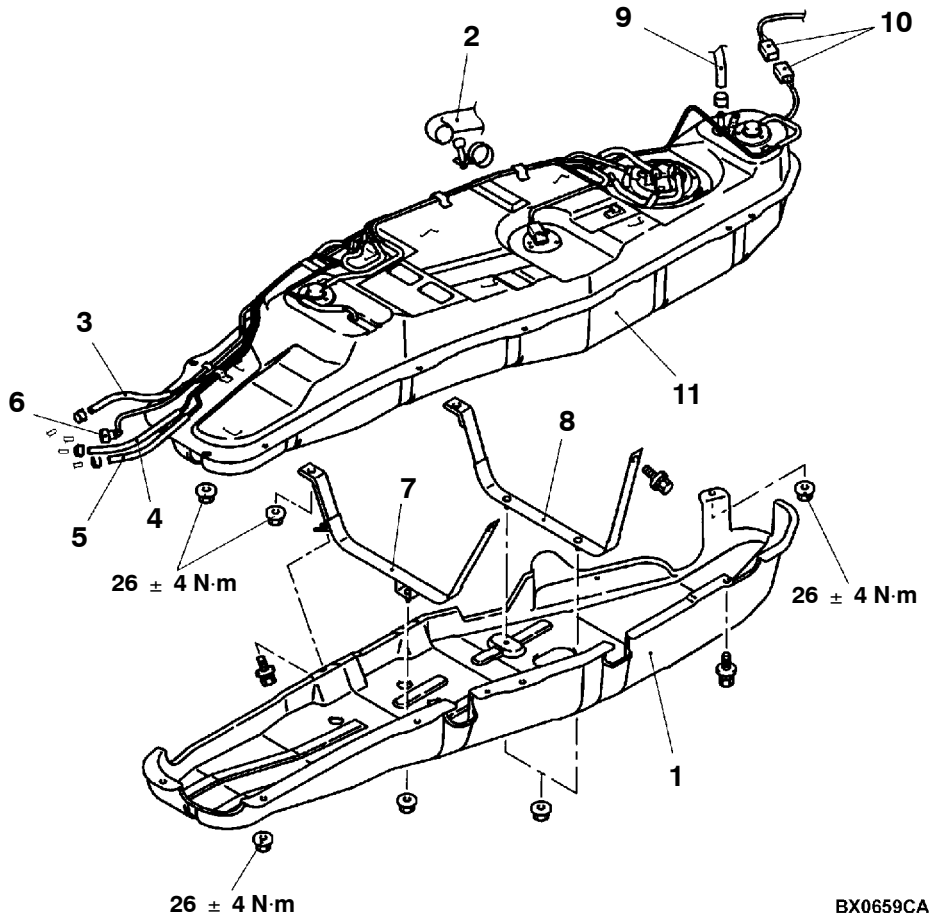
The high-pressure fuel hose is of an one-touch joint type.

FUEL TANK <6G7>

REMOVAL AND INSTALLATION

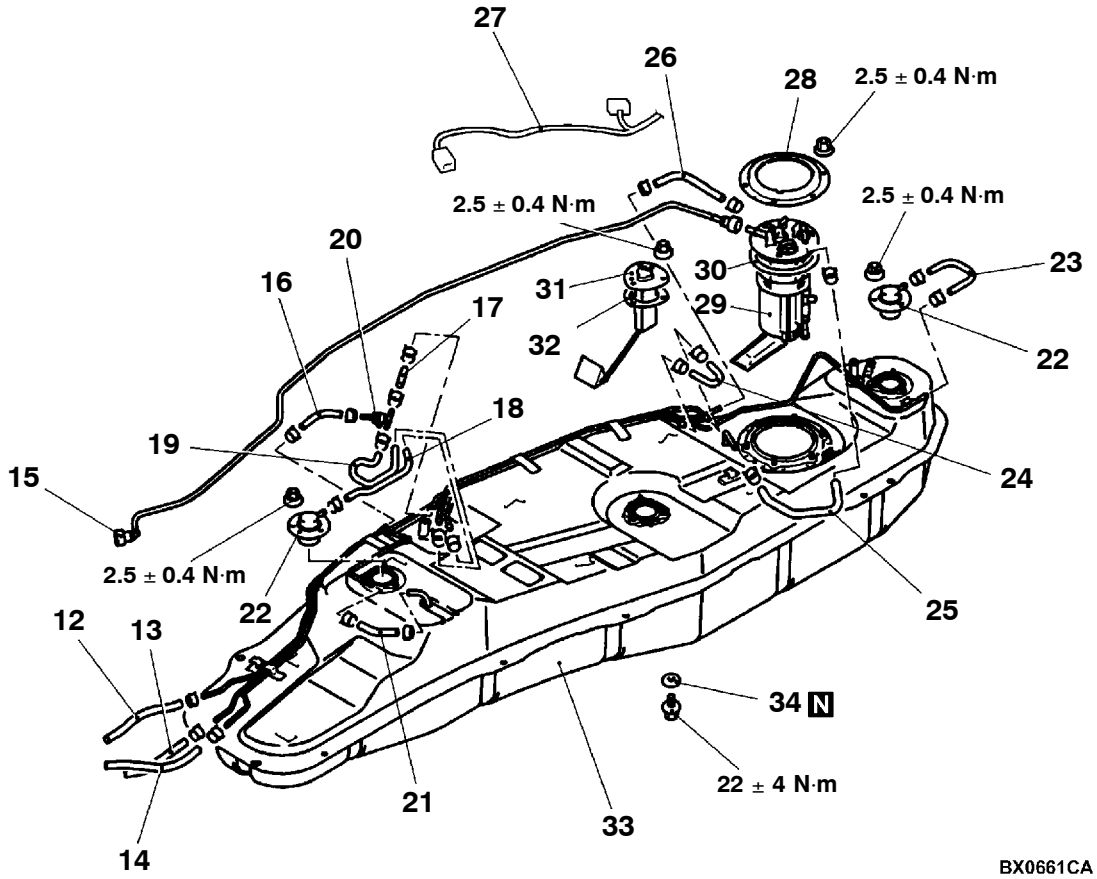
Pre-removal Operation
- Draining Fuel
- Fuel Line Pressure Reduction (Refer to GROUP 13A - On-vehicle Service.)
- Transmission Mount Center Member Assembly (Refer to GROUP 32.)

Post-installation Operation
- Transmission Mount Center Member Assembly (Refer to GROUP 32.)
- Fuel Leakage Inspection
- Refilling Fuel

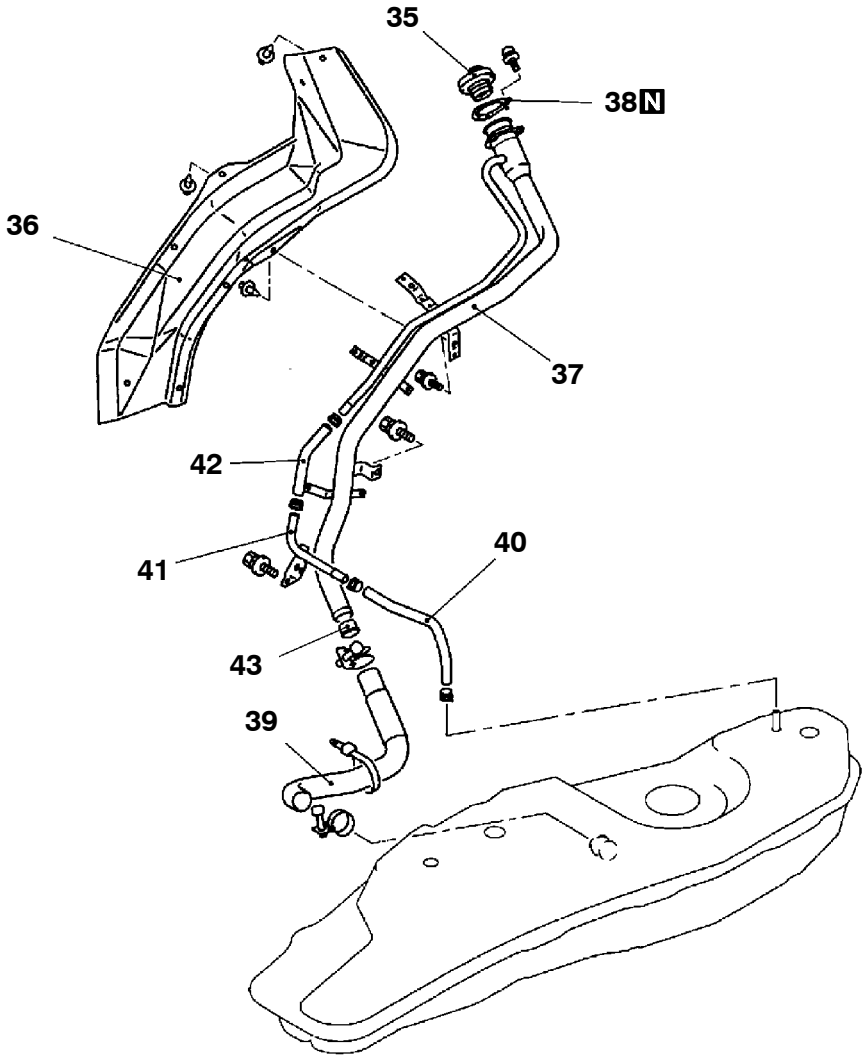


Removal steps

1. Fuel tank under protector
2. Fuel filler hose connection
3. Fuel return hose connection
4. Fuel vapor hose connection
5. Fuel return hose connection
6. ▶A◀ Fuel high-pressure hose connection
7. Fuel tank band, front
8. Fuel tank band, rear
9. Fuel tank breather hose connection
10. ◀A▶ Fuel tank harness connector connection
11. ◀A▶ Fuel tank assembly



12. Fuel return hose
13. Fuel vapor hose
14. Fuel return hose
15. Fuel high-pressure hose
16. Fuel tank vapor hose
17. Fuel tank vapor hose
18. Fuel tank vapor hose
19. Fuel tank vapor hose
20. Fuel check valve
21. Fuel tank hose
22. Valve assembly
23. Fuel tank vapor hose
24. Fuel tank vapor hose
25. Fuel tank suction hose
26. Fuel tank return hose
27. Fuel tank harness
28. Tapping plate
29. Fuel pump module assembly
30. Packing
31. Fuel gauge unit
32. Packing
33. Fuel tank
34. Gasket



AX0660CA

35. Fuel cap
36. Fuel filler neck protector
37. Fuel filler neck
38. Fuel filler neck gasket
39. Fuel filler hose
40. Fuel filler neck breather hose
41. Fuel filler pipe assembly
42. Fuel filler neck breather hose
43. Shut-off valve

REMOVAL SERVICE POINT

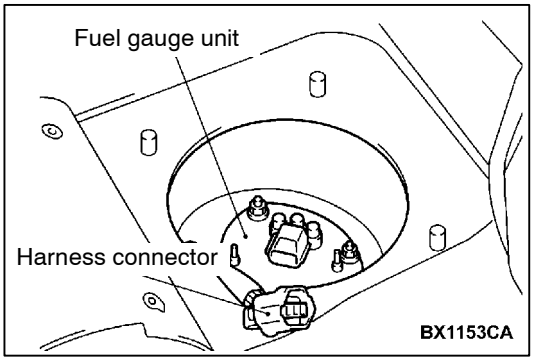
◀A▶ FUEL TANK BREATHER HOSE/FUEL TANK CONNECTOR DISCONNECTION

Lower the fuel tank until the fuel tank breather hose and the fuel tank harness connectors can be disconnected.

INSTALLATION SERVICE POINT

▶A◀ FUEL HIGH-PRESSURE HOSE INSTALLATION

Caution
Snap the high-pressure fuel hose one-touch joint into place, then pull back slightly on the hose to assure it is securely fitted. However, the connection should have a play of approx. 3 mm.



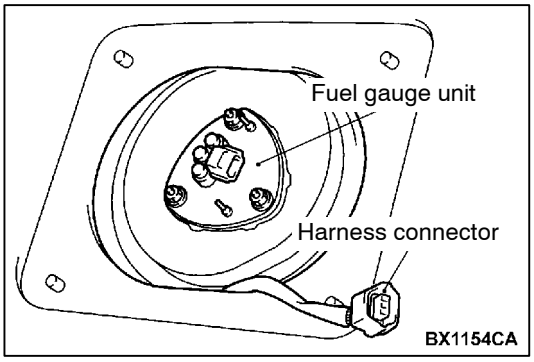
INSPECTION

FUEL GAUGE UNIT REPLACEMENT <SHORT WHEELBASE>

1. Slide the front seat (driver's side) forward and turn up the service hole notch on the carpet.
2. Remove the service hole cover and packing.
3. Disconnect the harness connector.
4. Unscrew the mounting nut to remove the fuel gauge unit.
5. Assemble the fuel gauge unit and tighten the mounting nut to the specified torque.

Tightening torque : 2.5 ± 0.4 N·m

6. Connect the harness connector.
7. Install the service hole cover and packing.
8. Return the floor carpet and slide the front seat (driver's side).



<LONG WHEELBASE>

1. Tumble the second seat.
2. Remove the service hole cover (upper side) and the packing located under the second seat.
3. Remove the second seat, the rear scuff plate, the anchor bolts for the outer seat belt (second) and mounting screws of the lower quarter trim. Tear off the carpet. (Refer to GROUP 52A.)
4. Remove the service hole cover and the packing located between the front seat and the second seat.
5. Disconnect the harness connector.
6. Unscrew the mounting nut to remove the fuel gauge unit.
7. Assemble the fuel gauge unit and tighten the mounting nut to the specified torque.

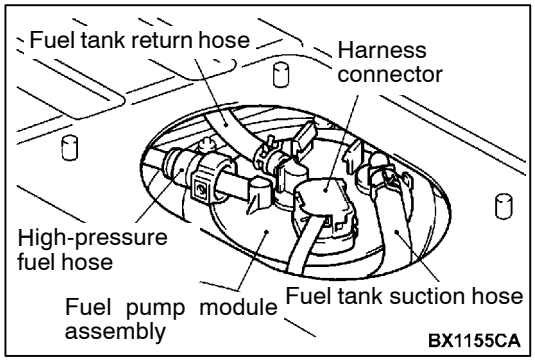
Tightening torque : 2.5 ± 0.4 N·m

8. Connect the harness connector.
9. Attach the service hole cover and the packing located between the front seat and the second seat.

10. Restore the carpet; attach the second seat, the rear scuff plate, anchor bolts for the outer seat belt (second) and mounting screws of the lower quarter trim. (Refer to GROUP 52A.)
11. Attach the service hole cover located under the second seat and the packing.
12. Restore the second seat.

FUEL GAUGE UNIT CHECK

Refer to GROUP 54 - Combination meter.

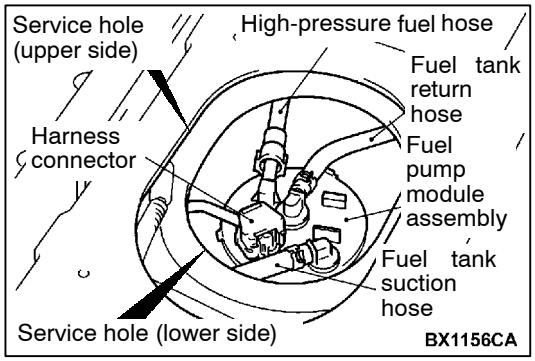


FUEL PUMP MODULE REPLACEMENT
<SHORT WHEELBASE>

1. Remove the front scuff plate and outer seat belt (rear) anchor bolt, and then turn the carpet up. (Refer to GROUP 52A.)
2. Remove the service hole cover and packing.
3. Disconnect the harness connector.
4. Disconnect the high-pressure fuel hose and the fuel tank hose.
5. Remove the mounting nuts, and remove the fuel pump module.
6. Install the fuel pump module, and tighten the mounting nuts to the specified torque.

Tightening torque: 2.5 ± 0.4 N·m

7. Connect the high-pressure fuel hose and the fuel tank hose.
8. Connect the harness connector.
9. Install the service hole cover and packing.
10. Spread the carpet and then install the front scuff plate and outer seat belt (rear) anchor bolt. (Refer to GROUP 52A.)



<LONG WHEELBASE>

1. Tumble the second seat.
2. Remove the service hole cover (upper side) and the packing.
3. Remove the service hole cover (lower side) and the packing.
4. Disconnect the harness connector.
5. Disconnect the fuel high-pressure hose and the fuel tank hose.

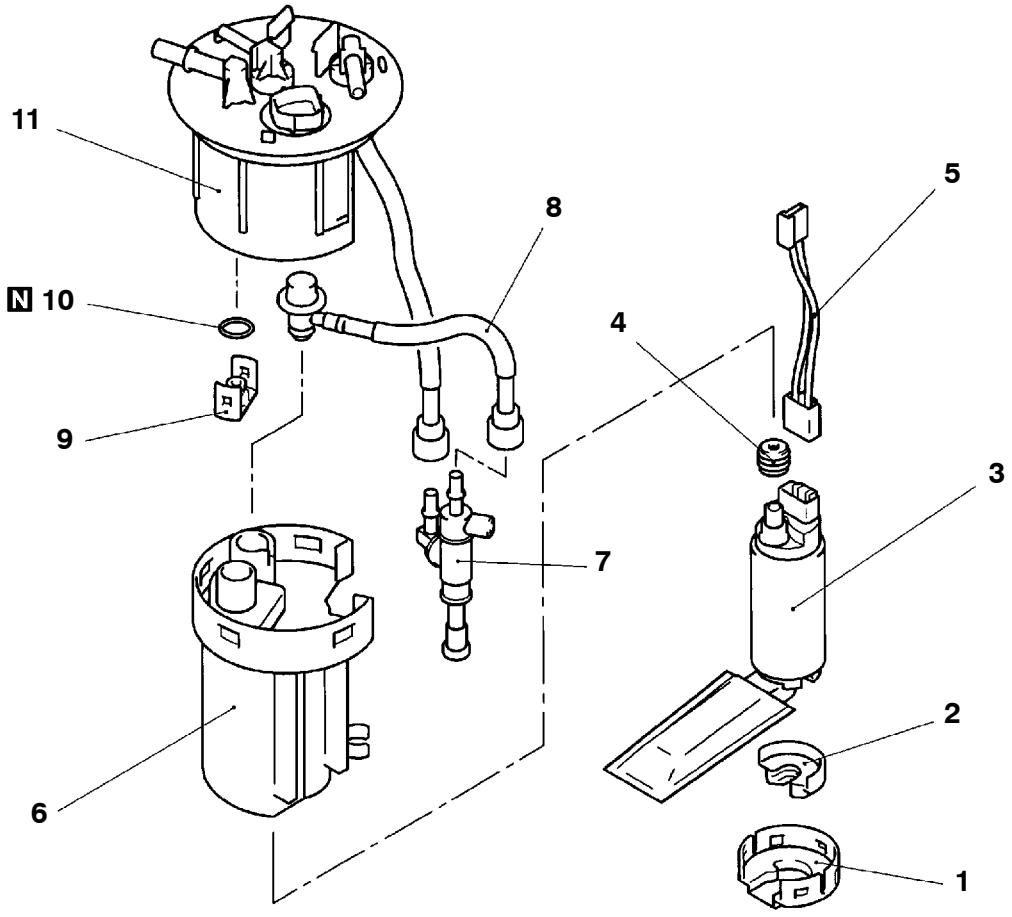
6. Unscrew the mounting nut to remove the fuel pump module.
7. Assemble the fuel pump module and tighten the mounting nut to the specified torque.

Tightening torque: 2.5 ± 0.4 N·m

8. Connect the fuel high-pressure hose and the fuel tank hose.
9. Connect the harness connector.
10. Attach the service hole cover (lower side) and the packing.
11. Attach the service hole cover (upper side) and the packing.
12. Restore the second seat.

DISASSEMBLY AND REASSEMBLY

FUEL PUMP MODULE



AX0962CA

Disassembly steps

1. Fuel pump bracket
2. Fuel pump cushion
3. Fuel pump (low-pressure)
▶A◀ 4. Grommet
5. Pump harness
6. Housing
7. Assist pump
8. Fuel pressure regulator (low-pressure)
9. Cap
▶A◀ 10. O-ring
11. Fuel high-pressure filter assembly

REASSEMBLY SERVICE POINTS

▶A◀ O-RING/GROMMET INSTALLATION

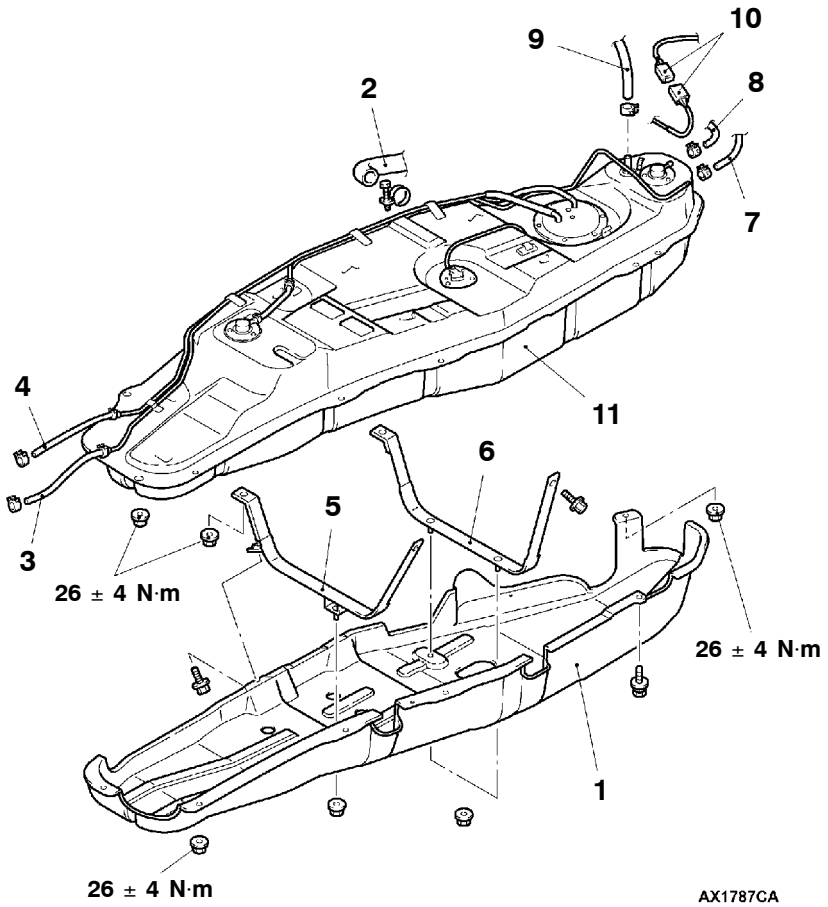
Apply a fuel to O-ring and grommet before installing them, to prevent them from being damaged or twisted.

FUEL TANK <4D5, 4M4>

REMOVAL AND INSTALLATION

Pre-removal Operation
- Draining Fuel
- Fuel Line Pressure Reduction (Refer to GROUP 13A – On-vehicle Service.)
- Transmission Mount Center Member Assembly (Refer to GROUP 32.)

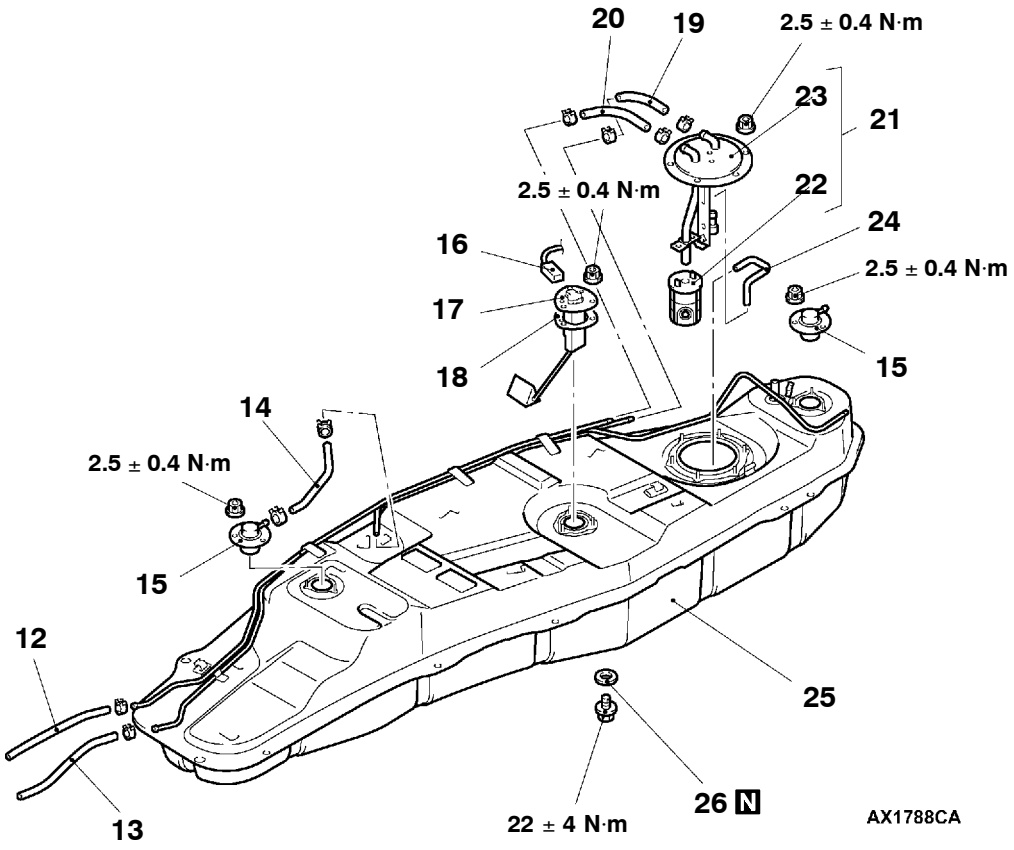
Post-installation Operation
- Transmission Mount Center Member Assembly (Refer to GROUP 32.)
- Fuel Leakage Inspection
- Refilling Fuel



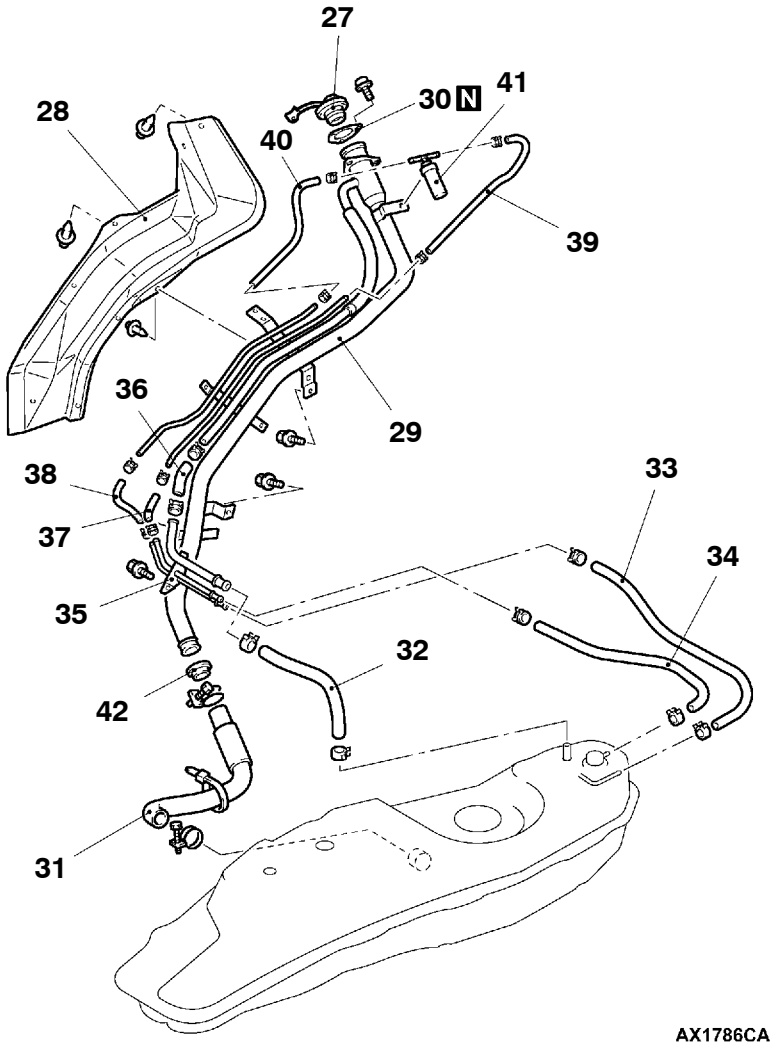
Removal steps
1. Fuel tank under protector
2. Fuel filler hose connection
3. Fuel return hose connection
4. Fuel main hose connection
5. Fuel tank band front
6. Fuel tank band rear

◀A▶◀A▶

7. Fuel filler neck vapor hose (B) connection
8. Fuel filler neck vapor hose (A) connection
9. Fuel tank breather hose connection
10. Fuel tank harness connector connection
11. Fuel tank assembly



12. Fuel return hose
13. Fuel main hose
14. Fuel tank vapor hose
15. Valve assembly
16. Fuel tank harness
17. Fuel gauge unit
18. Packing
19. Fuel tank return hose
20. Fuel tank main hose
21. Fuel filter pipe assembly
22. Fuel filter
23. Pipe assembly
24. Fuel tank suction hose
25. Fuel tank
26. Gasket

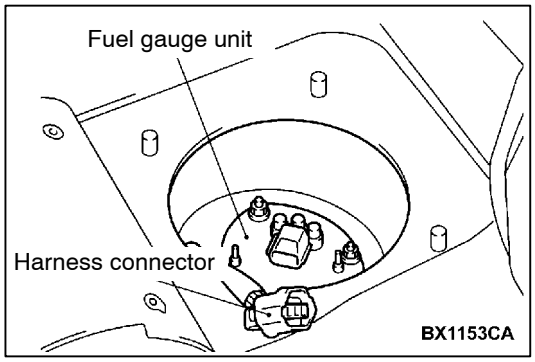


27. Fuel cap
28. Fuel filler neck protector
29. Fuel filler neck
30. Fuel filler neck gasket
31. Fuel filler hose
32. Fuel filler neck breather hose
33. Fuel filler neck vapor hose (B)
34. Fuel filler neck vapor hose (A)
35. Fuel filler pipe assembly
36. Fuel filler neck breather hose
37. Fuel filler neck vapor hose
38. Fuel filler neck vapor hose
39. Fuel filler neck vapor hose (B)
40. Fuel filler neck vapor hose (A)
41. Fuel filler neck check valve assembly
42. Shut-off valve

REMOVAL SERVICE POINT

◀A▶ FUEL TANK BREATHER HOSE/FUEL TANK CONNECTOR DISCONNECTION

Lower the fuel tank until the fuel tank breather hose and the fuel tank harness connectors can be disconnected.



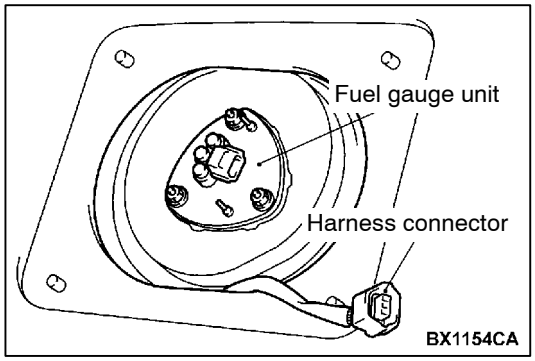
INSPECTION

FUEL GAUGE UNIT REPLACEMENT <SHORT WHEELBASE>

1. Slide the front seat (driver's side) forward and turn up the service hole notch on the carpet.
2. Remove the service hole cover and packing.
3. Disconnect the harness connector.
4. Unscrew the mounting nut to remove the fuel gauge unit.
5. Assemble the fuel gauge unit and tighten the mounting nut to the specified torque.

Tightening torque: 2.5 ± 0.4 N·m

6. Connect the harness connector.
7. Install the service hole cover and packing.
8. Return the floor carpet and slide the front seat (driver's side).



<LONG WHEELBASE>

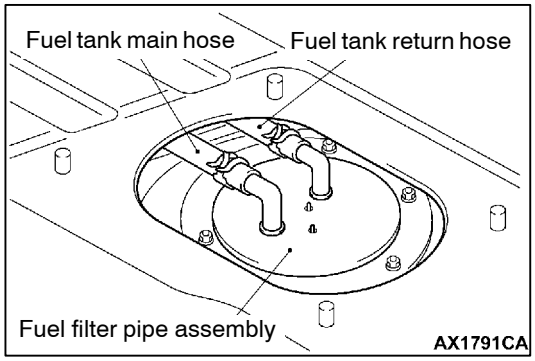
1. Tumble the second seat.
2. Remove the service hole cover (upper side) and the packing located under the second seat.
3. Remove the second seat, the rear scuff plate, the anchor bolts for the outer seat belt (second) and mounting screws of the lower quarter trim. Tear off the carpet. (Refer to GROUP 52A.)
4. Remove the service hole cover and the packing located between the front seat and the second seat.
5. Disconnect the harness connector.
6. Unscrew the mounting nut to remove the fuel gauge unit.
7. Assemble the fuel gauge unit and tighten the mounting nut to the specified torque.

Tightening torque : 2.5 ± 0.4 N·m

8. Connect the harness connector.
9. Attach the service hole cover and the packing located between the front seat and the second seat.
10. Restore the carpet; attach the second seat, the rear scuff plate, anchor bolts for the outer seat belt (second) and mounting screws of the lower quarter trim. (Refer to GROUP 52A.)
11. Attach the service hole cover located under the second seat and the packing.
12. Restore the second seat.

FUEL GAUGE UNIT CHECK

Refer to GROUP 54 - Combination Meter.

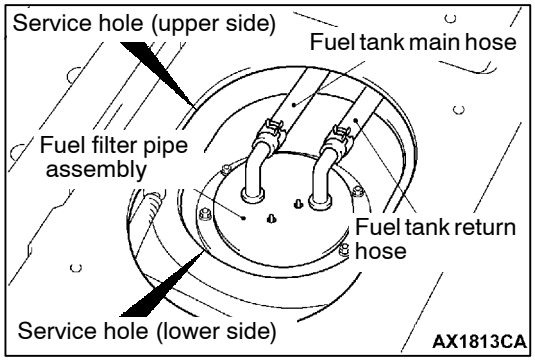


FUEL FILTER PIPE ASSEMBLY REPLACEMENT <SHORT WHEELBASE>

1. Remove the front scuff plate and outer seat belt (rear) anchor bolt, and then turn the carpet up. (Refer to GROUP 52A.)
2. Remove the service hole cover and packing.
3. Disconnect the fuel tank return hose and the fuel tank main hose.
4. Remove the mounting nuts, and remove the fuel filter pipe assembly.
5. Install the fuel filter pipe assembly, and tighten the mounting nuts to the specified torque.

Tightening torque: 2.5 ± 0.4 N·m

6. Connect the fuel tank return hose and the fuel tank main hose.
7. Install the service hole cover and packing.
8. Spread the carpet and then install the front scuff plate and outer seat belt (rear) anchor bolt. (Refer to GROUP 52A.)



<LONG WHEELBASE>

1. Tumble the second seat.
2. Remove the service hole cover (upper side) and the packing.
3. Remove the service hole cover (lower side) and the packing.
4. Disconnect the fuel tank return hose and the fuel tank main hose.
5. Unscrew the mounting nut to remove the fuel filter pipe assembly.
6. Assemble the fuel filter pipe assembly and tighten the mounting nut to the specified torque.

Tightening torque: 2.5 ± 0.4 N·m

7. Connect the fuel tank return hose and the fuel tank main hose.
8. Attach the service hole cover (lower side) and the packing.
9. Attach the service hole cover (upper side) and the packing.
10. Restore the second seat.

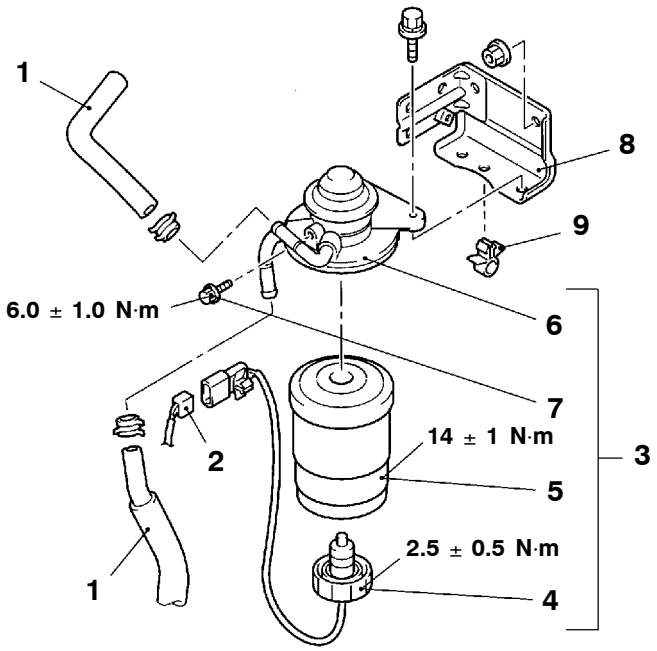
FUEL FILTER

REMOVAL AND INSTALLATION

Pre-removal Operation
- Engine Cover Removal
  (Refer to GROUP 11B - Camshaft)
- Battery, Battery Tray Removal

Post-installation Operation
- Fuel Line Air-bleeding
  (Refer to GROUP 13B - On-vehicle Service.)
- Battery, Battery Tray Installation
- Engine Cover Installation
  (Refer to GROUP 11B - Camshaft.)

<4D5>

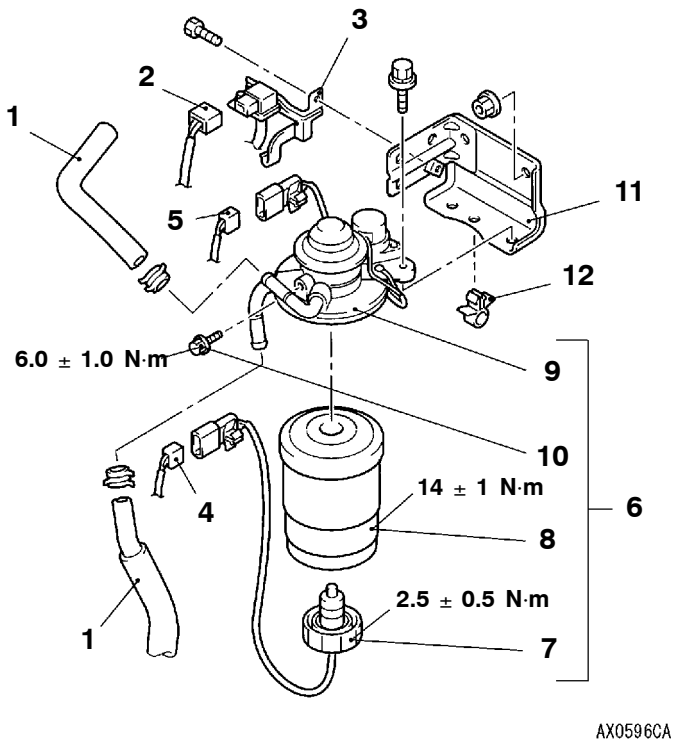


BX0596CA

Removal steps

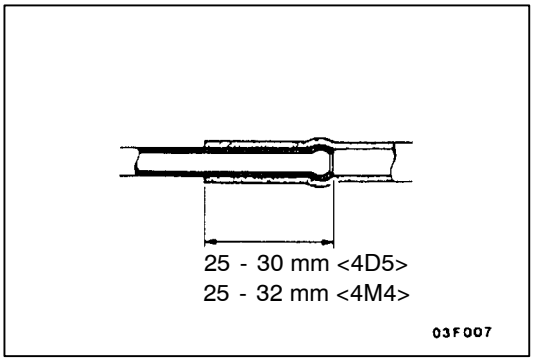
▶A◀ 1. Fuel hose
2. Water level sensor connector connection
3. Fuel filter assembly
4. Water level sensor
5. Fuel filter cartridge
6. Fuel filter pump
7. Air plug
8. Fuel filter bracket
9. Clip

<4M4>



Removal steps

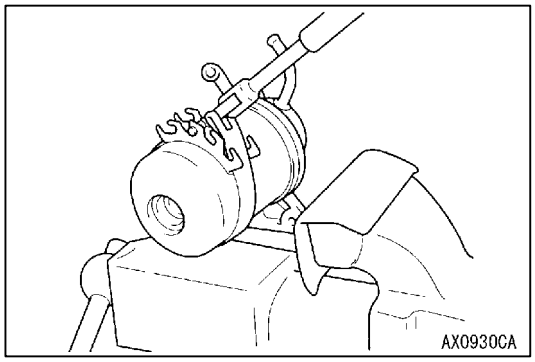
▶A◀ 1. Fuel hose
2. Boost sensor connector
3. Boost sensor bracket
4. Water level sensor connector connection
5. Fuel line heater connector <Vehicles for cold zone>
6. Fuel filter assembly
7. Water level sensor
8. Fuel filter cartridge
9. Fuel filter pump
10. Air plug
11. Fuel filter bracket
12. Clip



INSTALLATION SERVICE POINT

▶A◀ FUEL MAIN HOSE INSTALLATION

If the pipe has a stepped part, connect securely up to the stepped part. If the pipe has no stepped part, insert so that the inserted portion is 25 - 30 mm <4D5>, 25 - 32 mm <4M4> long.



INSPECTION

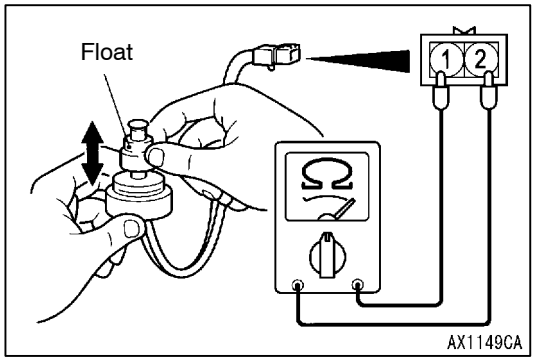
FUEL FILTER CARTRIDGE REPLACEMENT

1. Remove the fuel filler cap, and depressurise the fuel tank.
2. Disconnect the connector and the fuel hose.
3. Remove the boost sensor bracket from the fuel filter bracket. <4M4>
4. Remove the fuel filter assembly from the fuel filter bracket.
5. Remove the water level sensor from the fuel filter cartridge.
6. Use a filter wrench to remove the fuel filter cartridge from the fuel filter pump.

   Caution

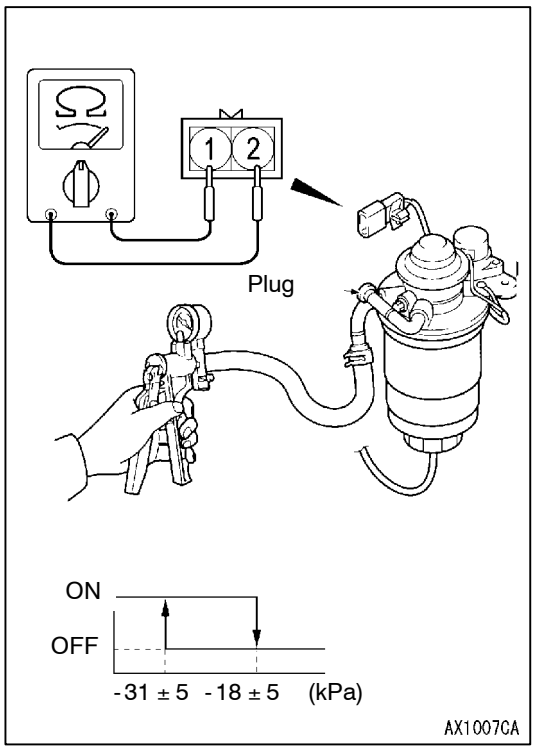
   Cover the cartridge port with rag to prevent fuel from flowing out.

7. Install a new filter, and bleed the air from fuel line. (Refer to GROUP 13B - On-vehicle Service.) <4D5> (Refer to GROUP 13C - On-vehicle Service.) <4M4>
8. Start the engine, and check that there is no fuel leakage.



WATER LEVEL SENSOR CHECK

1. Connect the circuit tester to the water level sensor.
2. There should be continuity when the float is raised, while there is no continuity when it is lowered.
3. Replace the water level sensor if it is faulty.



FUEL LINE HEATER CONTINUITY CHECK <4M4>

1. Connect a hand vacuum pump to the outlet port of the fuel filter pump, and plug the inlet port as shown.
2. Connect a circuit tester to the fuel line heater connector.
3. Using hand vacuum pump apply a vacuum to the fuel filter pump body, check that there is a continuity between terminals when the pressure becomes -31 ± 5 kPa or less.
4. Lower the load gradually and became -18 ± 5 kPa, check that there is no continuity.
5. The fuel line heater is normal if the conditions 3 and 4 above are satisfied.
6. Replace the fuel filter pump if defective.

NOTES

MITSUBISHI STABILITY CONTROL (MITSUBISHI SC)

Click on the applicable bookmark to selected the required model year.

MITSUBISHI STABILITY CONTROL (MITSUBISHI SC)

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Vehicle Speed Sensor Check 18

SC-ECU* 19

G SENSOR 20

WHEEL SPEED SENSOR (FR) 20

VEHICLE SPEED SENSOR 20

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.

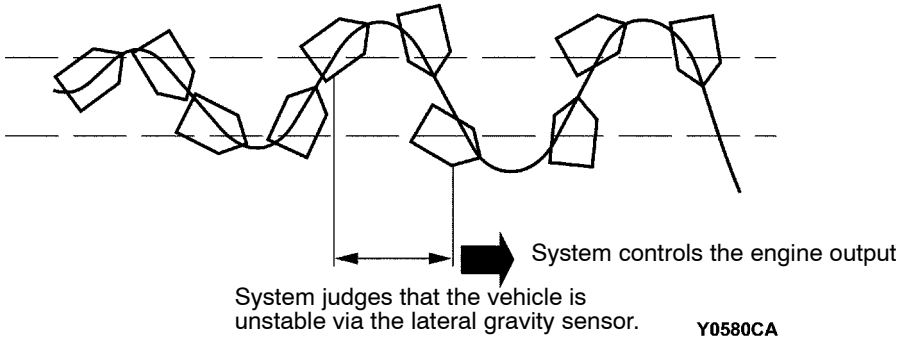
(3) MITSUBISHI dealer personnel must thoroughly review this manual, and especially its GROUP 52B - Supplemental Restraint System (SRS) before beginning any service or maintenance of any component of the SRS or any SRS-related component.

NOTE

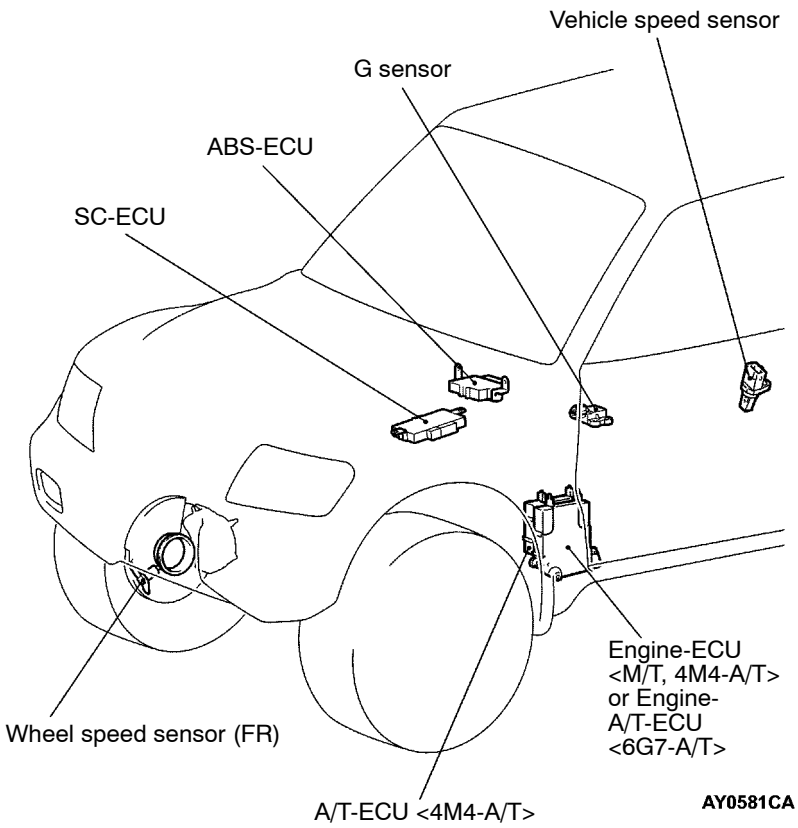
The SRS includes the following components: front impact sensors, SRS-ECU, SRS warning lamp, air bag module, clock spring and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents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

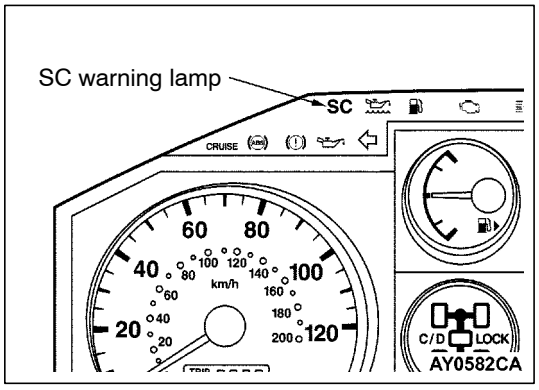
GENERAL INFORMATION

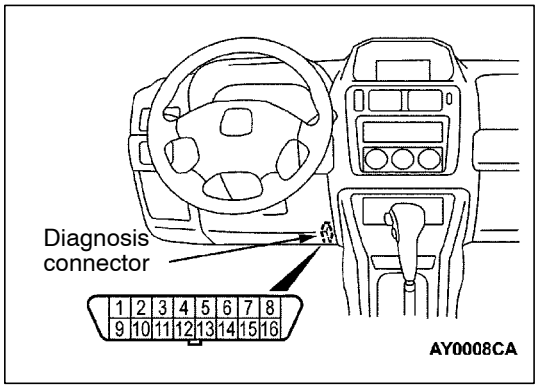
The MITSUBISHI Stability Control (MITSUBISHI SC) system, which compensates for an unsafe driving by controlling the engine output (i.e., traction control), has been introduced.
The MITSUBISHI SC judges that the vehicle is unstable via the lateral gravity sensor.
Then the system will control the engine output, based on the vehicle speed and the throttle opening angle.
In addition, if the system fails, the SC warning lamp inside the combination meter will illuminate or flash to warn the driver.



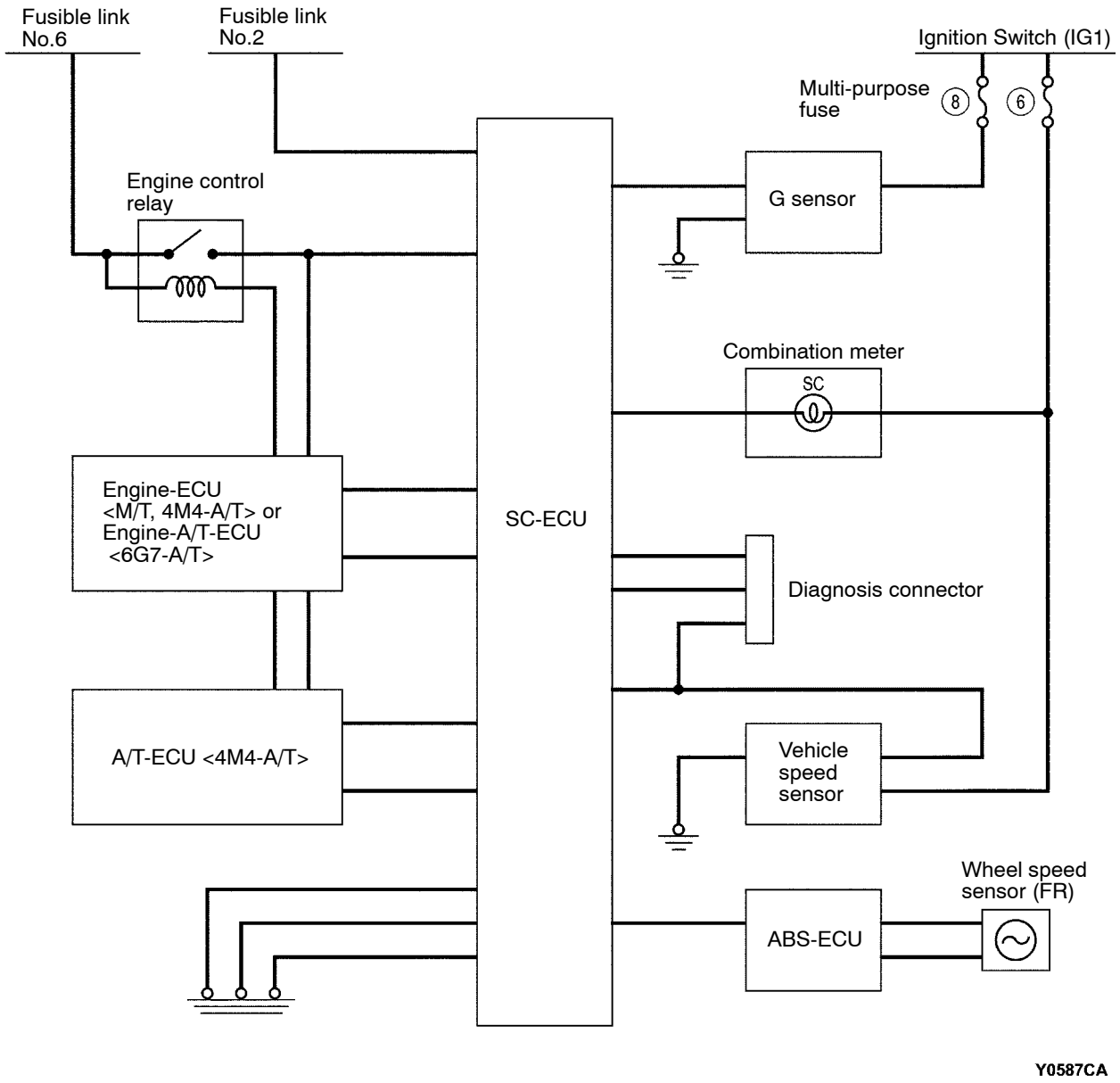
System Diagram







System Circuit Diagram



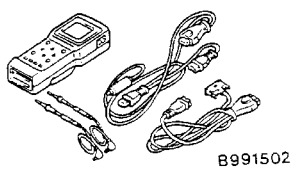
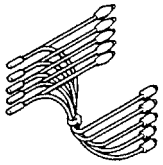
MAJOR COMPONENT REFERENCE TABLE

Components	Functions
SC-ECU	Receives signals from various sensors, and transmits an engine output control signal to the engine-ECU or engine-A/T-ECU, based on the information.
Engine-ECU <M/T, 4M4-A/T>	Transmits the engine information (such as APS signal and engine speed), which is required for control the Mitsubishi SC, to the SC-ECU.
	Compensate for the engine output according to the current engine condition on request from the SC-ECU.
Engine-A/T-ECU <6G7-A/T>	• Transmits the engine information (such as APS signal and engine speed), which is required for controlling the Mitsubishi SC, to the SC-ECU. • Transmits the transmission information (such as shift position), which is required for controlling the Mitsubishi SC, to the SC-ECU.
	Compensate for the engine output according to the current engine condition on request from the SC-ECU.
A/T-ECU <4M4-A/T>	Transmits the transmission information (such as shift position), which is required for controlling the Mitsubishi SC, to the SC-ECU.
ABS-ECU	Transmits the wheel speed sensor (FR) signal to the SC-ECU.
G sensor	Measures the vehicle lateral gravity, and transmit the information to the SC-ECU as a voltage signal.
Vehicle speed sensor	Transmits the vehicle speed (transmission output gear speed) signal to the SC-ECU.
SC warning lamp	Illuminates or flashes when the SC-ECU transmits a signal indicating the system error.
Diagnosis connector	When a diagnosis code is set, the MUT-II communicates with the system via this connector.

SERVICE SPECIFICATIONS

Items		Standard value
G sensor output voltageV	When the vehicle is stationary	2.35 - 2.65
	When an arrow on the G sensor label is facing down	3.3 - 3.7

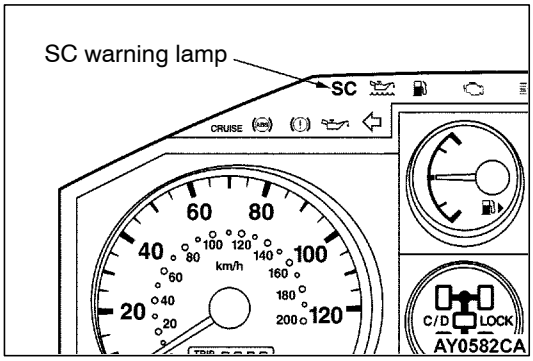
SPECIAL TOOLS

Tools	No.	Name	Application
 B991502	MB991502	MUT-II sub assembly	Checking the MITSUBISHI SC (Diagnosis display using the MUT-II)
 B991348	MB991348	Test harness set	Checking the G sensor

TROUBLESHOOTING

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING

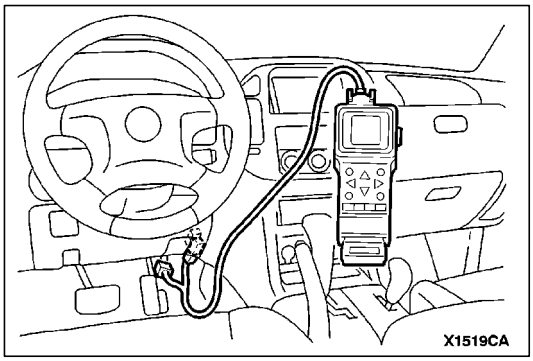
Refer to Basic Manual GROUP 00 - How to Use Troubleshooting/Inspection Service Points.



SC WARNING LAMP INSPECTION

Check that the SC warning lamp illuminates as follows.

1. When the ignition key is turned to “ON”, the SC warning lamp will illuminate.
2. When the engine is started, the SC warning lamp will be switched off.
3. If the illumination is other than the above, check the diagnosis codes.



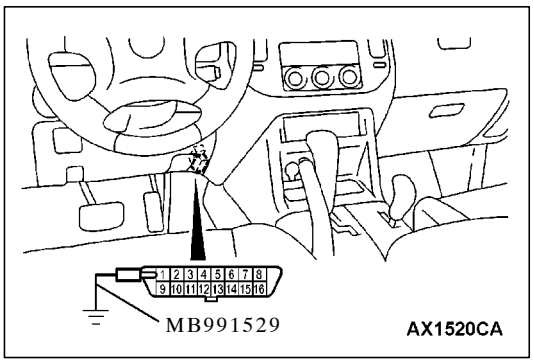
DIAGNOSIS FUNCTION

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 “LOCK” (OFF) position before connecting or disconnecting the MUT-II.



WHEN USING THE WARNING LAMP

1. Use the special tool to earth No.1 terminal (diagnosis control terminal) of the diagnosis connector.
2. Turn on the ignition switch.
3. Read out a diagnosis code by observing how the warning lamp flashes.
   (Refer to Basic Manual GROUP 00 - How to Use Troubleshooting/Inspection Service Points.)

ERASING DIAGNOSIS CODES

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

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

INSPECTION CHART FOR DIAGNOSIS CODES

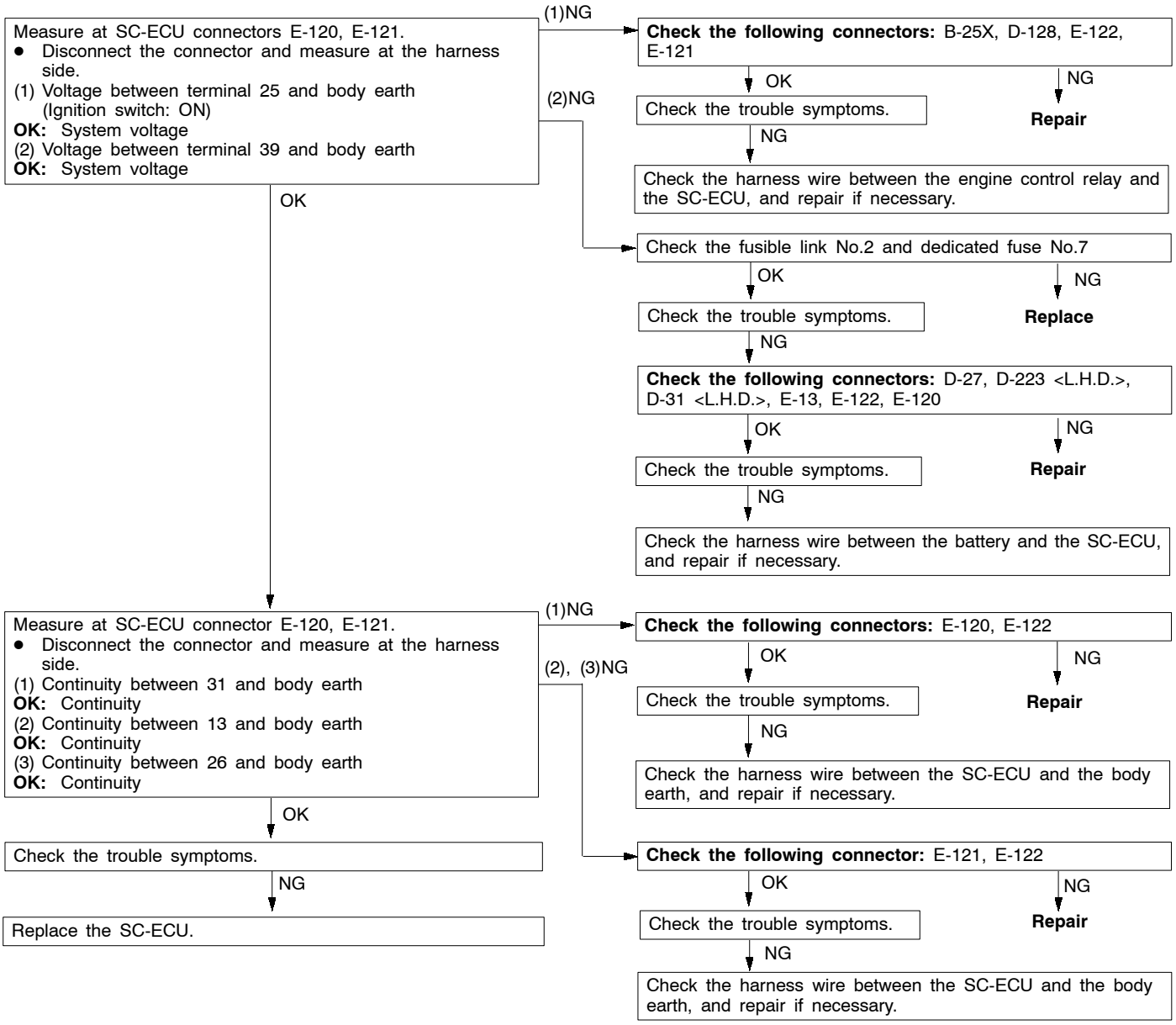
Diagnosis code No.	Diagnosis item	SC warning lamp	Reference page
27*1	SC-ECU power supply system (abnormal voltage drop)	Flashes	13E-6
51*2	Vehicle speed sensor wheel speed sensor system (output signal abnormality)	Flashes	13E-7
52	Vehicle speed sensor system (open circuit or short-circuit)	Flashes	13E-8
53*2	Wheel speed sensor system (open circuit or short-circuit)	Flashes	13E-8
55*2	G sensor system	Flashes	13E-9
71	Communication line between the engine-ECU or engine-A/T-ECU and the system	Flashes	13E-10
72	Engine-ECU or Engine-A/T-ECU system	Illuminates	13E-10
74*2	Communication line between the A/T-ECU and the system <4M4-A/T>	Flashes	13E-11
81*1	The SC-ECU is controlling the system too long	Flashes	13E-11

NOTE
*1: Code No.27 and 81 are erased from the memory if the condition returns to normal.
*2: For code Nos.51, 53, 55 and 74, a diagnosis code will be set in ten seconds after a failure is detected.

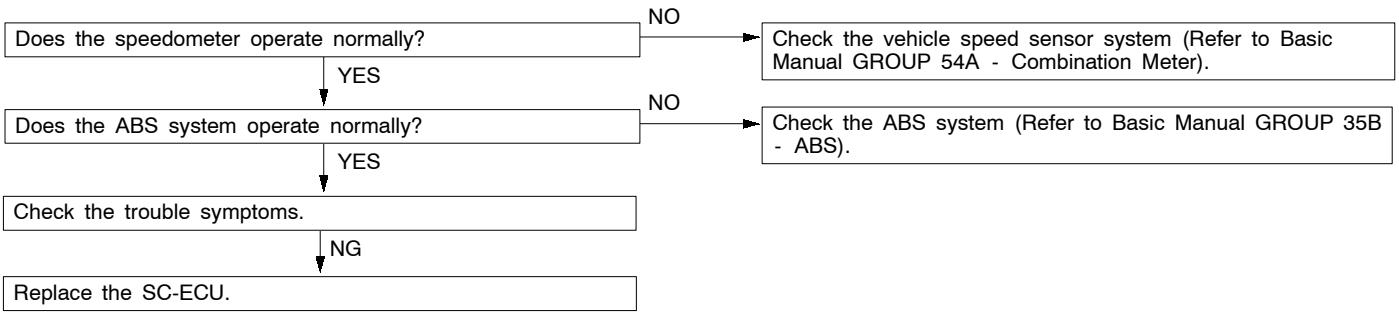
INSPECTION PROCEDURE FOR DIAGNOSIS CODE

Code No. 27 SC-ECU power supply system (abnormal voltage drop)	**Probable cause**
This diagnosis code will be set if the SC-ECU power supply voltage drops below a certain level.	• Malfunction of battery • Malfunction of harness or connector • Malfunction of the SC-ECU

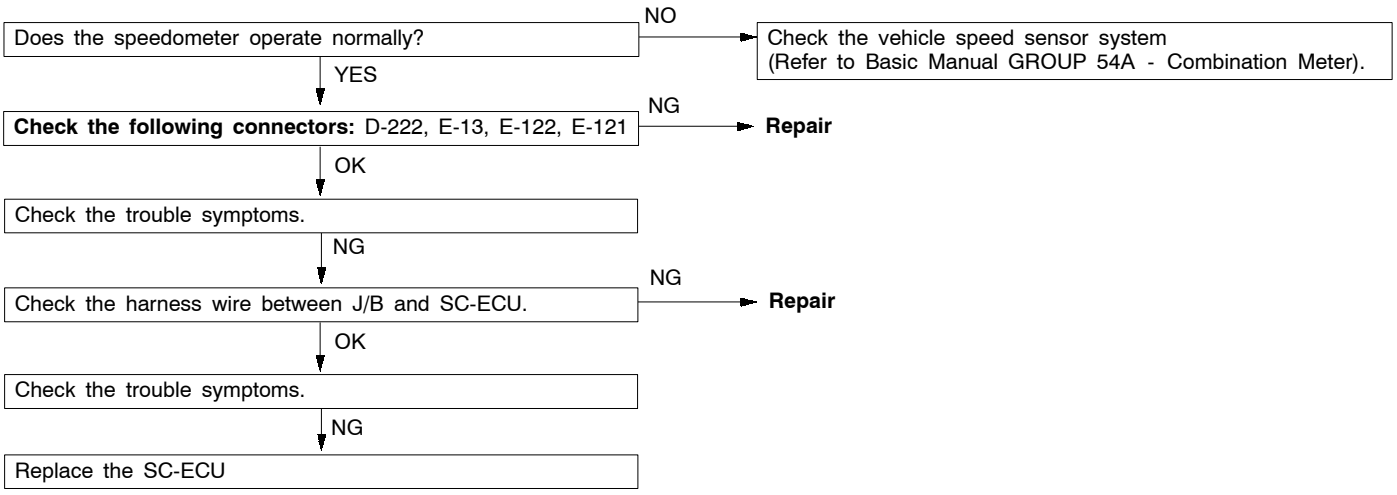
Caution
If the system voltage drops during inspection, this code will be output to indicate a current problem. And correct problem diagnosis will not be possible. Before carrying out the following procedure, check the battery and recharge it if necessary.



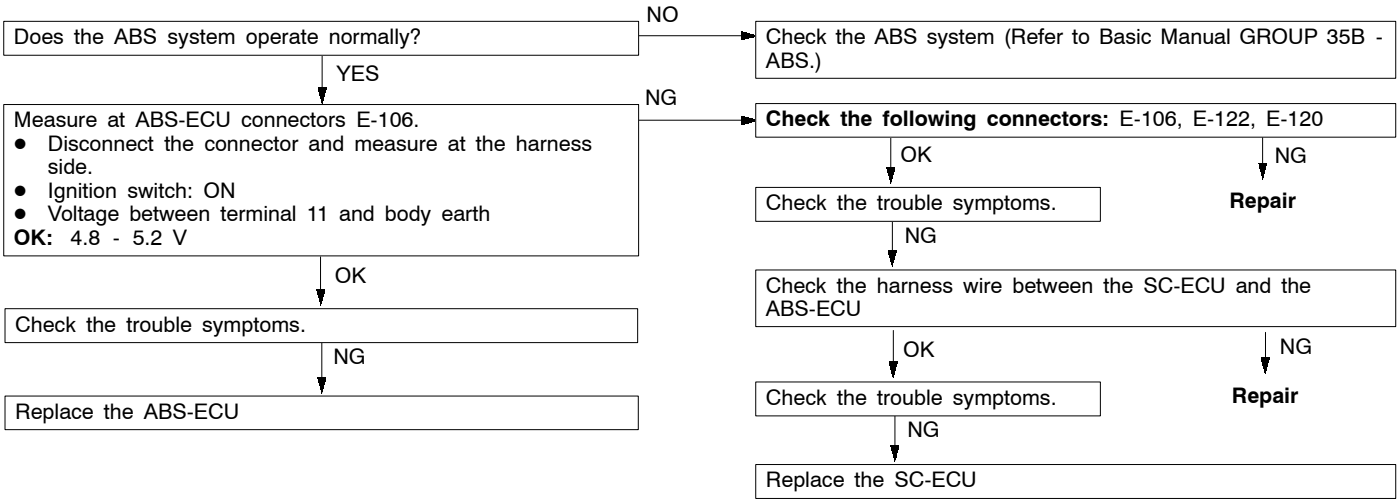
Code No. 51 Vehicle speed sensor system	Probable cause
This diagnosis code will be set when the vehicle speed signal from the vehicle speed sensor is not the same as that from the wheel speed sensor (FR).	● Malfunction of vehicle speed sensor system ● Malfunction of wheel speed sensor system ● Malfunction of the SC-ECU



Code No. 52 Vehicle speed sensor system (open circuit or short-circuit)	Probable cause
This diagnosis code will be set when the vehicle speed sensor does not send vehicle speed signal to the SC-ECU.	• Malfunction of vehicle speed sensor • Malfunction of harness or connector • Malfunction of the SC-ECU



Code No. 53 Wheel speed sensor system (open circuit or short-circuit)	Probable cause
This code is output when the open circuit or short-circuit detection carried out by the ABS-ECU hardware circuit detects that there is an open circuit or short-circuit in the (+) or (-) wire in one of the four wheel speed sensors and signals are consequently not being input.	• Malfunction of wheel speed sensor • Malfunction of harness or connector • Malfunction of the ABS-ECU



Code No. 55 G sensor system	Probable cause
This code is output at the following cases: ● When the G sensor output is lower than 0.5 V or higher than 4.5 V (Open circuit or short-circuit in G sensor circuit) ● When there is no variation in the G sensor output voltage (G sensor output seized)	● Malfunction of G sensor ● Malfunction of harness or connector ● Malfunction of the SC-ECU

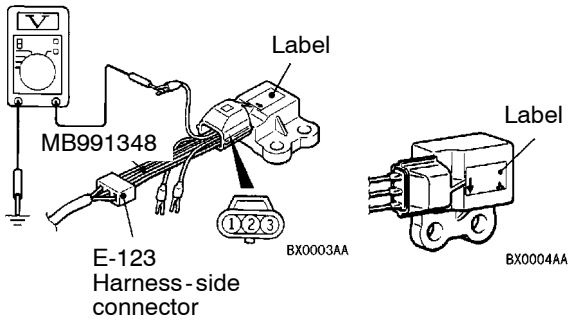
Measure at G sensor connector E-123.
- Disconnect the connector and measure at the harness side.

(1) Voltage between terminal 1 and body earth (Ignition switch: ON)
OK: System voltage
(2) Continuity between terminal 3 and body earth
OK: Continuity

(1)NG → **Check the following connectors:** D-208, D-213, D-32, E-115, E-123
- OK → Check the trouble symptoms.
  - NG → Check the harness wire, and repair if necessary.
    - Between ignition switch and G sensor
  - OK → **Repair**
- NG → **Repair**

(2)NG → **Check the following connectors:** E-123
- OK → Check the trouble symptoms.
  - NG → Check the harness wire, and repair if necessary.
    - Between the G sensor and body earth
  - OK → **Repair**
- NG → **Repair**

OK ↓



- Remove the G sensor (Refer to P.13E-19).
- Connect the special tool between the G sensor harness-side connector E-123 and the G sensor.
- Ignition switch: ON
- Voltage between terminal 2 and body earth when the G sensor is placed on a level surface

OK: 2.35 - 2.65 V
- Voltage between terminal 2 and body earth when the G sensor is placed so that the label is facing straight up

OK: 3.3 - 3.7 V

NG → Replace the G sensor.

OK ↓

Check the following connectors: E-123, E-113, E-122, E-121
- NG → **Repair**
- OK ↓

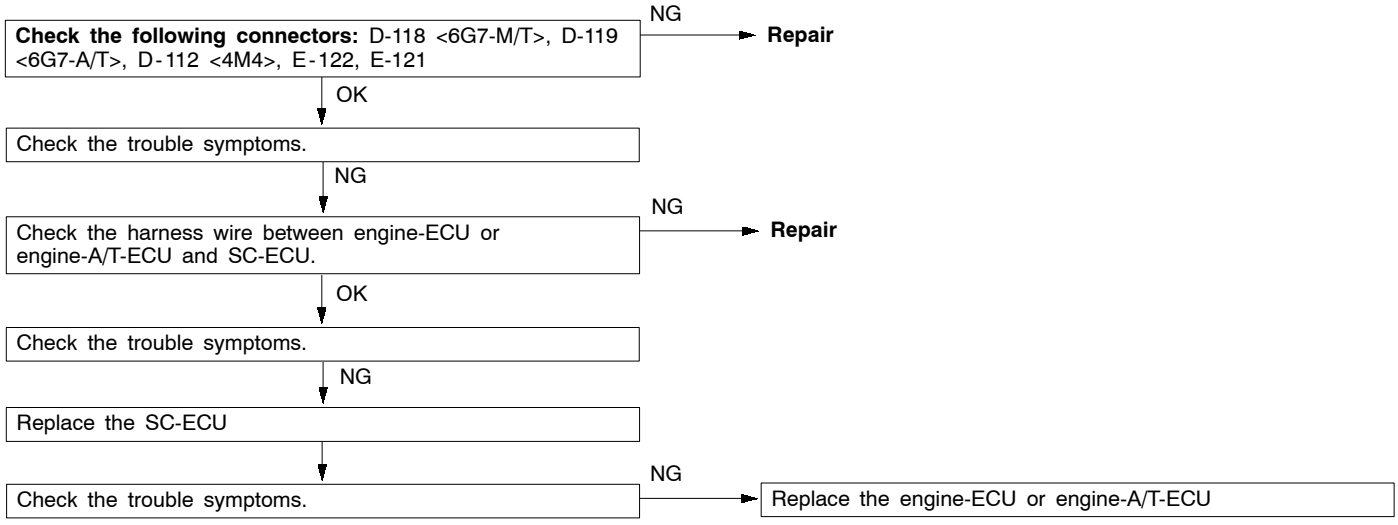
Check the trouble symptoms.
- NG ↓

Check the harness wire between the G sensor and SC-ECU
- NG → **Repair**
- OK ↓

Check the trouble symptoms.
- NG ↓

Replace the SC-ECU.

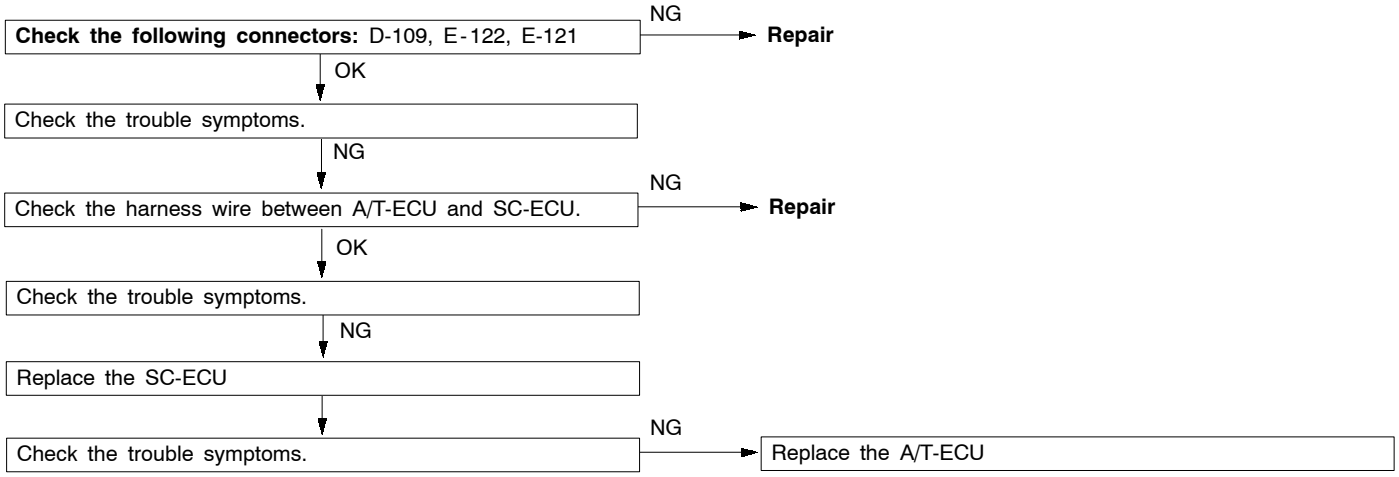
Code No. 71 Communication line between the engine-ECU or engine-A/T-ECU and the system	Probable cause
This diagnosis code will be set when an error takes place due to the open or short circuit in the serial communication line between the SC-ECU and the engine-ECU or engine-A/T-ECU, internal failure in the ECU or improper shield line.	• Malfunction of harness or connector • Malfunction of engine-ECU or engine-A/T-ECU • Malfunction of the SC-ECU



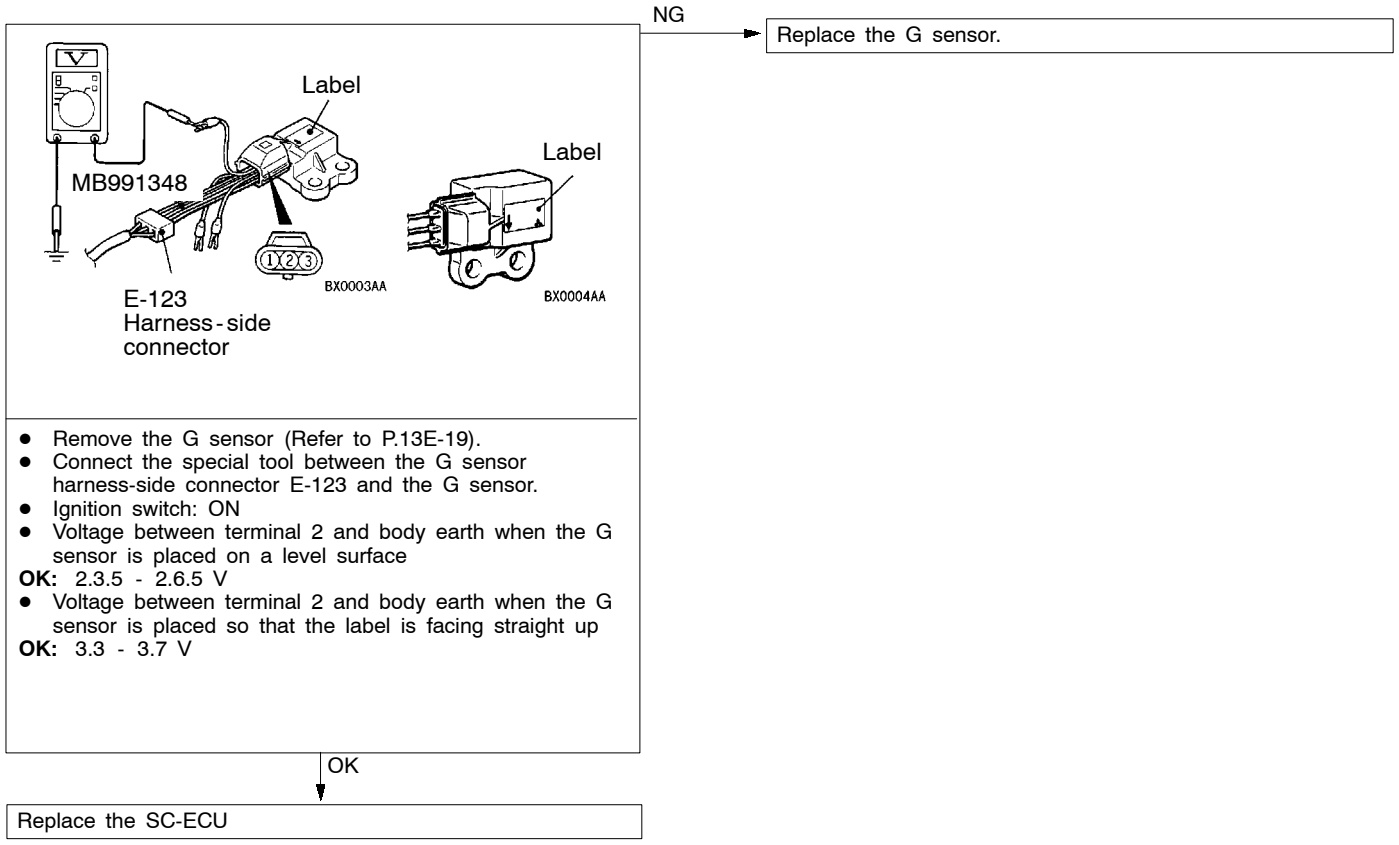
Code No. 72 Engine-ECU or Engine-A/T-ECU system	Probable cause
This diagnosis code will be set when the engine-ECU or engine-A/T-ECU detects a system failure. On the GDI system <6G7> or diesel fuel system <4M4>, the system failure is transmitted from the engine-ECU or engine-A/T-ECU via a scenical communication line to the SC-ECU.	• Malfunction of GDI system <6G7> • Malfunction of diesel fuel system <4M4>

- Carry out the troubleshooting regarding the GDI system. <6G7> (Refer to Basic Manual GROUP 13A - Troubleshooting.)
- Carry out the troubleshooting regarding the diesel fuel system. <4M4> (Refer to Basic Manual GROUP 13C - Troubleshooting.)

Code No. 74 Communication line between the A/T-ECU and the system <4M4-A/T>	Probable cause
This diagnosis code will be set when an error takes place due to the open or short circuit in the serial communication line between the SC-ECU and the A/T-ECU, internal failure in the ECU or improper shield line.	• Malfunction of harness or connector • Malfunction of A/T-ECU • Malfunction of the SC-ECU



Code No. 81 The SC-ECU is controlling the system too long	Probable cause
This diagnosis code will be set when the SC-ECU is controlling the system for 20 seconds or more.	• Malfunction of G sensor • Malfunction of SC-ECU



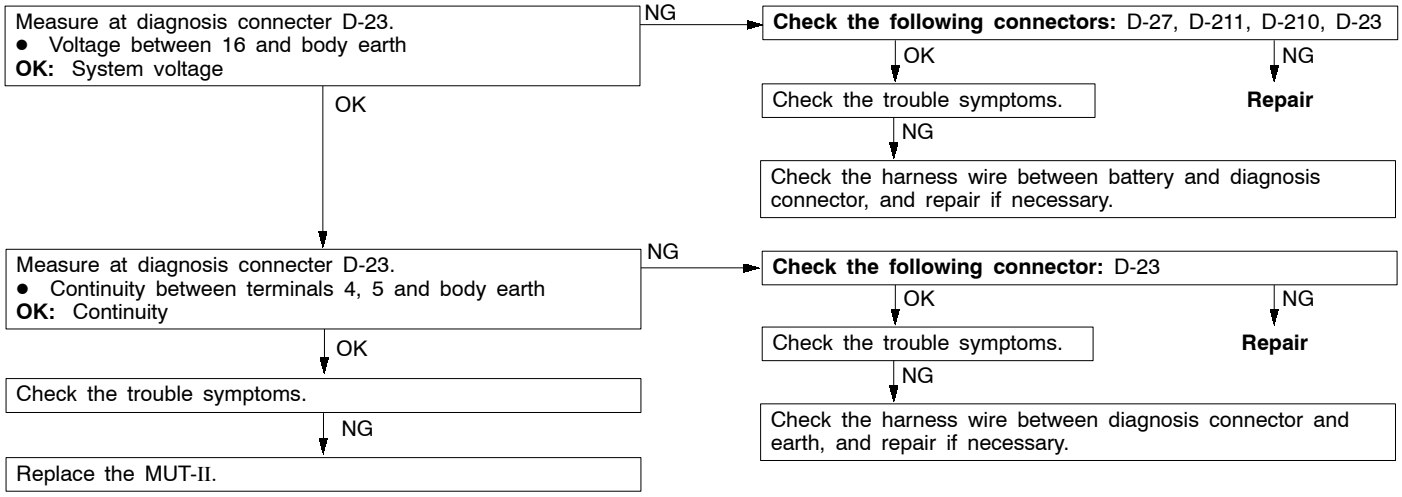
INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble Symptom	Inspection procedure No.	Reference page
Communication with MUT-II is not possible.	1	13E-12
Communication with MUT-II and the SC-ECU is not possible.	2	13E-13
The SC warning lamp does not illuminate when the ignition key is turned to ON (engine stopped).	3	13E-14
The SC warning lamp remains illuminated after the engine has started.	4	13E-14

INSPECTION PROCEDURES FOR TROUBLE SYMPTOMS

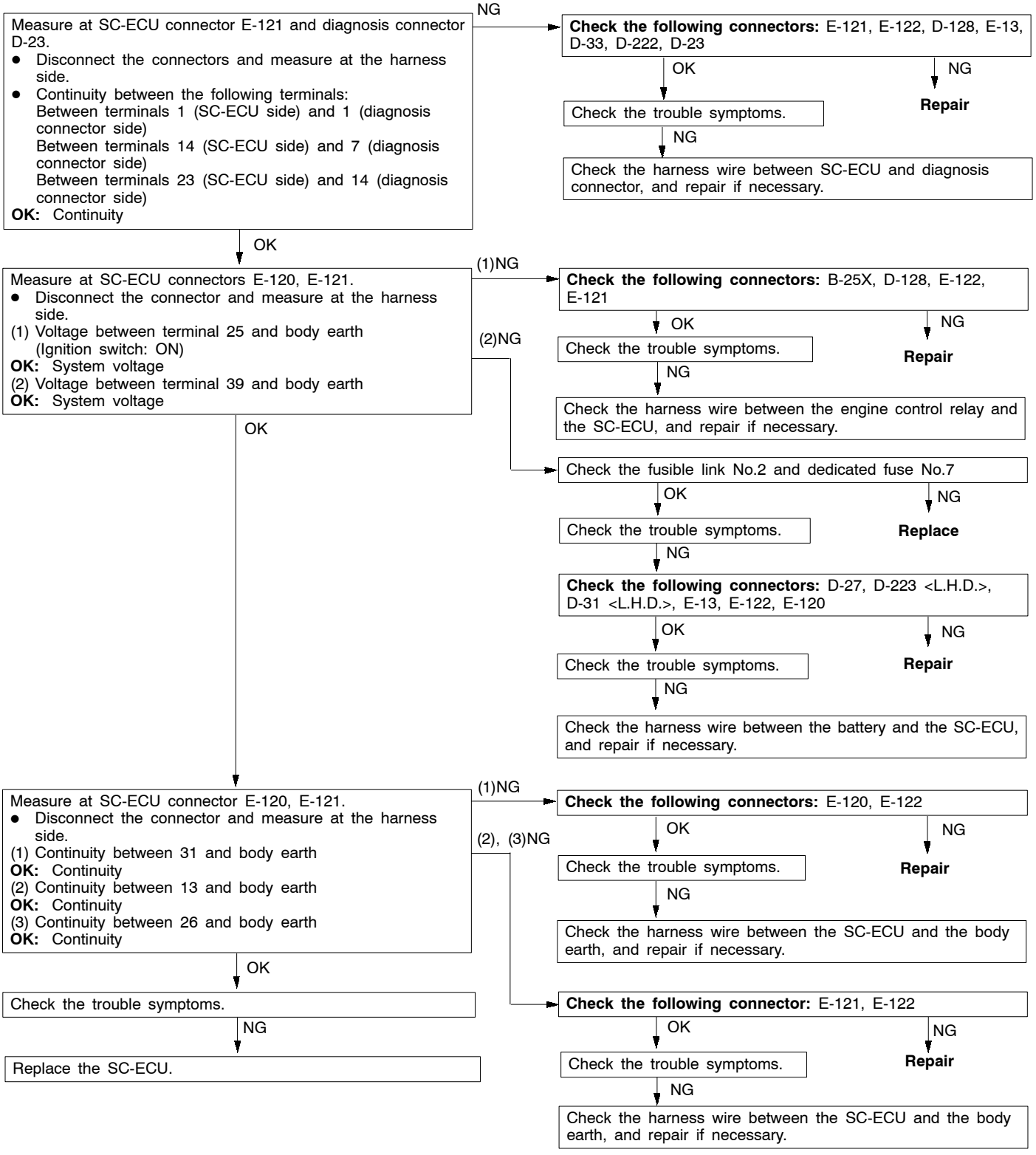
Inspection procedure 1

Communication with MUT-II is not possible.	**Probable cause**
The cause is probably a malfunction of the diagnosis connector power supply circuit or earth circuit.	• Malfunction of diagnosis connector • Malfunction of harness or connector



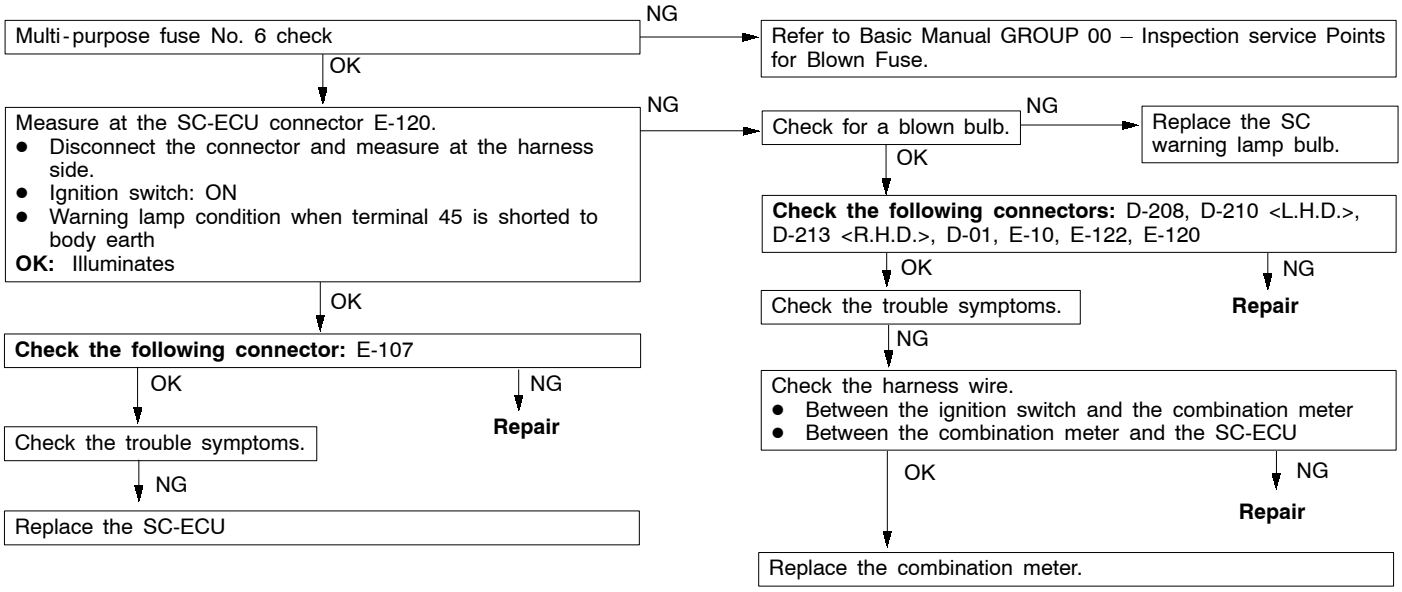
Inspection procedure 2

Communication with MUT-II and the SC-ECU is not possible.	Probable cause
The cause is probably an open circuit in the SC-ECU power supply circuit or an open circuit in the diagnosis output circuit.	• Malfunction of harness or connector • Malfunction of the SC-ECU



Inspection procedure 3

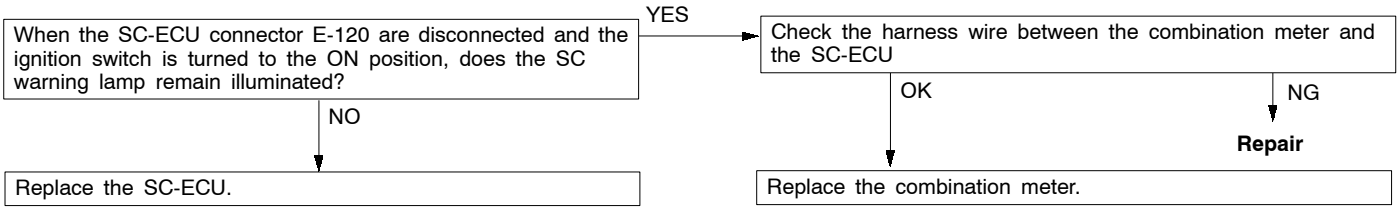
The SC warning lamp does not illuminate when the ignition key is turned to ON (engine stopped).	Probable cause
When the ignition switch is turned on, the SC-ECU starts to communicate with the engine-ECU or engine-A/T-ECU. Then the SC-ECU will illuminate the SC warning lamp if the engine speed is 350 rpm or less. If the SC warning lamp does not illuminate, the case is probably an open circuit in the SC warning lamp power supply circuit, a blow lamp bulb or an open circuit between the SC warning lamp and the SC-ECU.	• Blown fuse • Blown SC warning lamp bulb • Malfunction of harness or connector • Malfunction of combination meter • Malfunction of the SC-ECU



Inspection procedure 4

The SC warning lamp remains illuminated after the engine has started.	Probable cause
The cause is probably a short-circuit in the SC warning lamp illumination circuit.	• Malfunction of combination meter • Malfunction of harness (short-circuit) • Malfunction of the SC-ECU

NOTE
This trouble symptom is limited to cases where communication with the MUT-II is possible(SC-ECU power supply is normal) and the diagnosis code is a normal diagnosis code.



DATA LIST REFERENCE TABLE

The following ECU input data items can be read using the MUT-II.

Item No.	Check item	Inspection conditions		Normal condition
10	Vehicle speed	When vehicle is being driven		Speedometer display and MUT-II display are identical.
11	Accelerator pedal position sensor	Ignition switch: ON	Release the accelerator pedal.	0.9 - 1.1 V
			Depress the accelerator pedal gradually.	Increases in response to pedal depression stroke.
			Depress the accelerator pedal fully	4.0 V or more
18	Power supply voltage	Ignition switch: ON		System voltage
19	Accelerator pedal position switch (Idle switch)	Ignition switch: ON	Release the accelerator pedal	ON
			Depress the accelerator pedal slightly.	OFF
20	Ignition switch	Ignition switch: ON		ON
		Ignition switch: OFF		OFF
22	Front-right wheel speed	When vehicle is being driven		Speedometer display and MUT-II display are identical.
28	Engine type	Vehicles with the 6G74 engine		6G74
		Vehicles with the 4M41 engine		4M41
30	Trace control	SC system control is active		ON
		SC system control is not active		OFF
31	Engine specification 1	Vehicles with the 6G74 engine		DOHC
		Vehicles with the 4M41 engine		-
32	Engine specification 2	Vehicles with the 6G74 engine		N/A
		Vehicles with the 4M41 engine		-
33	Engine specification 3	Vehicles with the 6G74 engine		MIVEC/ETV
		Vehicles with the 4M41 engine		-
35	Destination	-		EC
40	Engine speed	Depress the accelerator pedal gradually.		Tachometer display and MUT-II display are identical.
51	Inhibitor switch	Ignition switch: ON Engine: stopped	Selector lever position: P	P
			Selector lever position: R	R
			Selector lever position: N	N
			Selector lever position: D	D
52	Shift position	Selector lever position: sports mode	Driving at a constant speed of 10 km/h in 1st	1st
			Driving at a constant speed of 30 km/h in 2nd	2nd
			Driving at a constant speed of 50 km/h in 3rd	3rd
			Driving at a constant speed of 50 km/h in 4th	4th
			Driving at a constant speed of 70 km/h in 5th	5th

Item No.	Check item	Inspection conditions	Normal condition
63	G sensor	• Ignition switch: ON • When vehicle is stationary (level)	2.35 - 2.65 V
		When vehicle is being driven	1.0 - 4.0 V

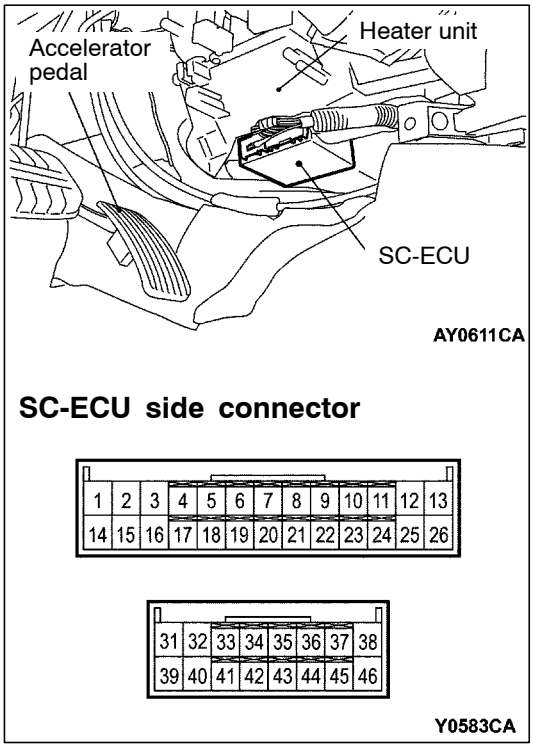
ACTUATOR TEST TABLE

The following actuators can be force-driven using the MUT-II.

NOTE
1. Actuator tests cannot be carried out when the operation of the SC-ECU has been stopped by the fail-safe function.
2. Actuator tests can only be carried out while the vehicle is stopped.

ACTUATOR TEST SPECIFICATIONS

Item No.	Check item	Drive Contents
05	Operation Test of MITSUBISHI SC	Transmits the signal, which requests no torque and wide open throttle, to the engine-ECU or engine-A/T-ECU for three seconds.

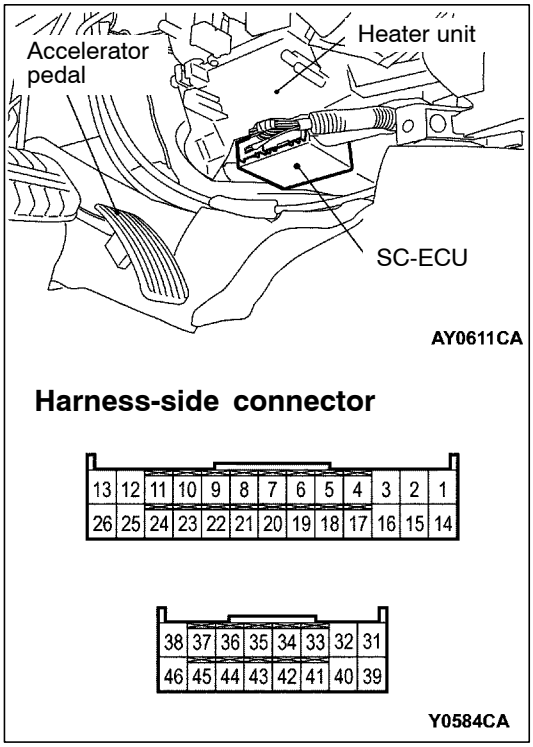


CHECK AT SC-ECU TERMINAL

TERMINAL VOLTAGE TABLE

1. Measure the voltages between the respective terminal and earth.
2. The terminal layout is shown in the illustration.

Terminal No.	Check item	Inspection conditions		Normal condition
1	Diagnosis select input	When the MUT-II is connected		1 V or less
		When the MUT-II is not connected		Approx. 5 V
14	MUT-II	When the MUT-II is connected		Serial communication with the MUT-II
		When the MUT-II is not connected		1 V or less
15, 16	A/T-ECU <4M41-A/T>	Ignition switch: ON		Serial communication with the SC-ECU
		Ignition switch: OFF		0 V
17, 18	Engine-ECU <M/T, 6G74-M/T> or Engine-A/T-ECU <6G74-A/T>	Ignition switch: ON		Serial communication with the SC-ECU
		Ignition switch: OFF		0 V
19	G sensor input	Ignition switch: ON Vehicle horizontal position		2.4 - 2.6 V
21	ABS-ECU [wheel speed sensor (FR)] input	Ignition switch: ON Move the vehicle slowly forward		0 V and 5 V alternates
23	Vehicle speed sensor input	Ignition switch: ON Move the vehicle slowly forward		0 V and 8 - 12 V alternates
25	SC-ECU power supply	Ignition switch: ON		System voltage
		Ignition switch: OFF		0 V
39	SC-ECU backup power supply	At all time		System voltage
45	SC warning lamp output	Ignition switch: ON	When lamp is switched off	System voltage
			When lamp is illuminated	2 V or less



CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

1. Turn the ignition switch to the LOCK (OFF) position.
2. Check the resistances and continuity with the SC-ECU connector disconnected.
3. Check the resistances and continuity between the terminals listed in the table below.
4. The terminal layout is shown in the illustration.

Terminal No.	Signal name	Normal condition
Between terminal 13 and body earth	Earth	Continuity
Between terminal 26 and body earth	Earth	
Between terminal 31 and body earth	Earth	

ON-VEHICLE SERVICE

OPERATION TEST OF MITSUBISHI SC

1. Connect the MUT-II to the 16-pin diagnosis connector.

   Caution
   Turn the ignition switch to the LOCK (OFF) position when connecting and disconnecting the MUT-II.
2. Move the shift lever to the neutral <M/T>, or the selector lever to the P range.
3. Start the engine.
4. Use the MUT-II to activate the Actuator Test (item No.05) while depressing the accelerator pedal fully. Check that the engine speed should decrease gradually.

   Caution
   Activate the Actuator Test for three seconds.
   Release the accelerator pedal immediately after the Actuator Test is complete, or the engine speed will rise.

   NOTE
   During the Actuator Test, the SC-ECU transmits the signal, which requests no torque and wide open throttle, to the engine-ECU or engine-A/T-ECU for three seconds.

WHEEL SPEED SENSOR (FR) CHECK

Refer to Basic Manual GROUP 35B - On-vehicle service.

VEHICLE SPEED SENSOR CHECK

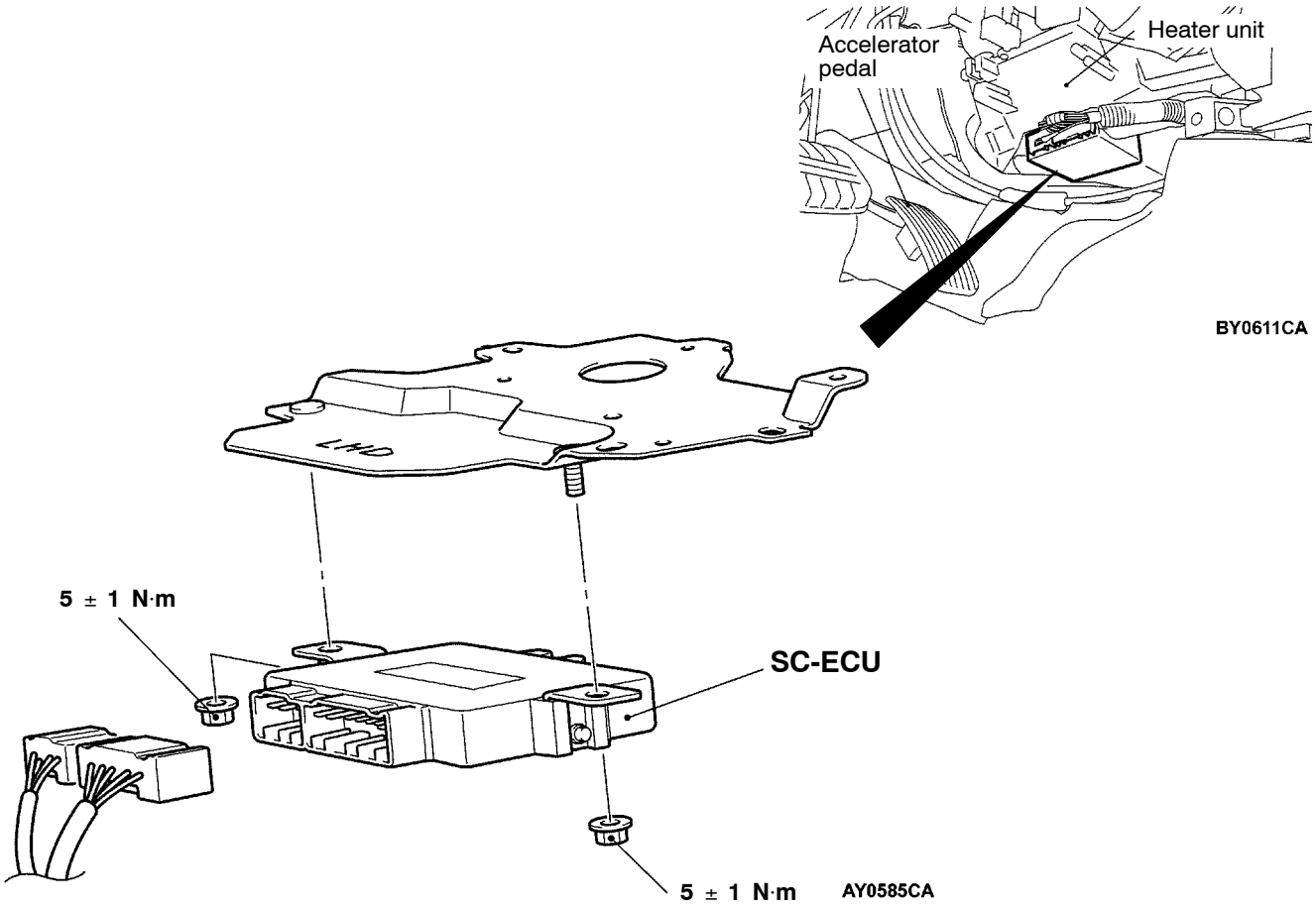
Refer to Basic Manual GROUP 54A - Combination Meter.

SC-ECU

REMOVAL AND INSTALLATION

Caution
When removing and installing the SC-ECU, do not let it bump against the SRS-ECU.

Pre-removal and Post-installation Operations
Front floor console removal and installation
(Refer to Basic Manual GROUP 52A.)

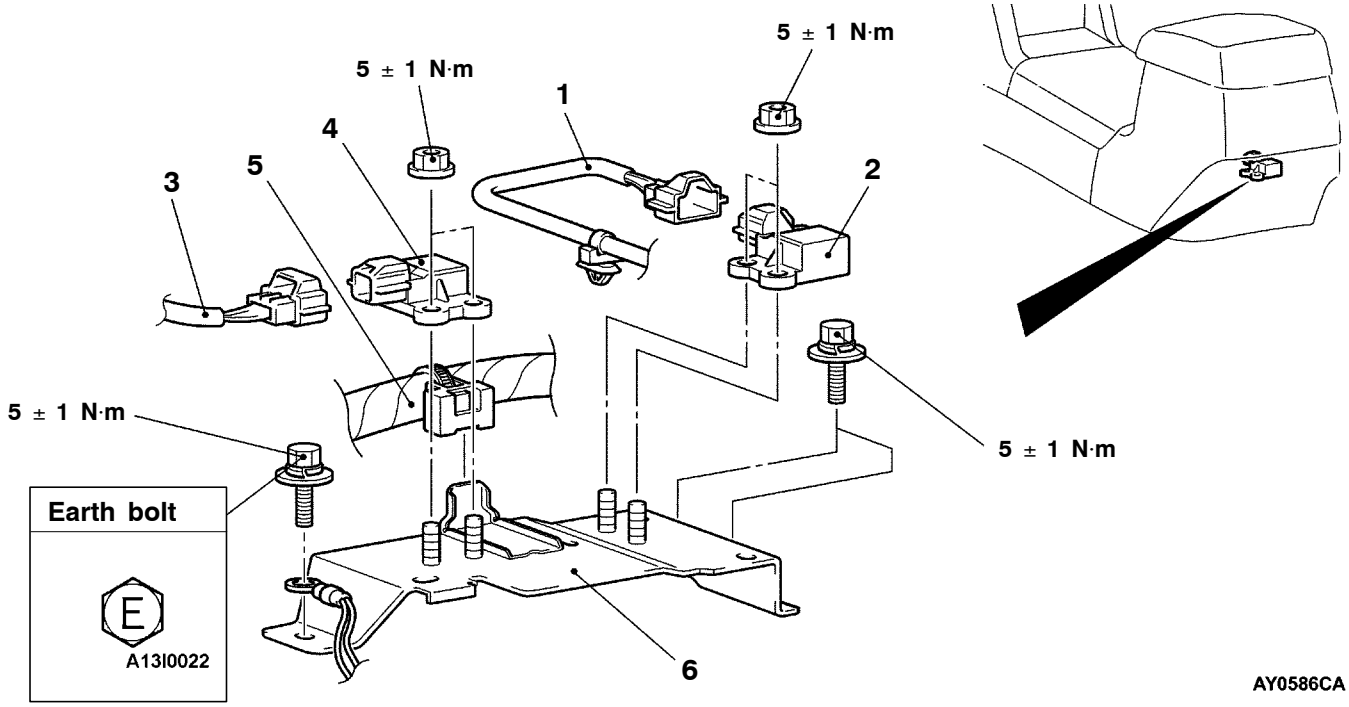


G SENSOR

REMOVAL AND INSTALLATION

Caution
Do not drop the G sensor or subject it to any shocks.

Pre-removal and Post-installation Operations
Rear floor console removal and installation
(Refer to Basic Manual GROUP 52A.)



Removal steps

1. G sensor (for SC) connector and harness clamp
2. G sensor (for SC)
3. G sensor (for ABS) connector
4. G sensor (for ABS)
5. Harness clamp <L.H.D>
6. G sensor bracket

WHEEL SPEED SENSOR (FR)

Refer to Basic Manual GROUP 35B - Wheel Speed Sensor.

VEHICLE SPEED SENSOR

Refer to Basic Manual GROUP 54A - Combination Meter.

DIESEL FUEL
<4D5-STEP III>

Click on the applicable bookmark to selected the required model year.

DIESEL FUEL <4D5-STEP III>

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GENERAL

OUTLINE OF CHANGE

An electronically-controlled injection pump has been added in order to comply with Regulation STEP III. Due to this, the following service procedures have been added.

GENERAL INFORMATION

The electronically-controlled fuel injection system consists of sensors which detect the condition of the diesel engine, an engine-ECU which controls the system based on signals from these sensors, and actuators which operate according to control commands from the engine-ECU.
The engine-ECU carries out operations such as fuel injection rate control, fuel injection timing control and idle up control. In addition, the engine-ECU is equipped with several self-diagnosis functions which make troubleshooting easier in the event that a problem develops.

FUEL INJECTION RATE CONTROL

The fuel injection completion timing is controlled by means of a solenoid-type spill valve to ensure that the optimum amount of fuel is supplied to the engine in accordance with gradual changes in the engine running condition.
Before fuel injection starts, the solenoid-type spill valve is on (energized), so that the valve is closed. As the plunger turns and rises, fuel is sent out under pressure, and when the fuel flow rate reaches the target value for fuel injection, the solenoid-type spill valve turns off. When the solenoid-type spill valve turns off, the fuel under high pressure inside the plunger is leaked out into the pump chamber and fuel injection is completed.

FUEL INJECTION TIMING CONTROL

The position of the injection pump timer piston is controlled so that fuel injection is carried out at the optimum timing in accordance with the engine running condition.
The timer piston position is determined by duty control of the timing control solenoid valve which is located in the line between the high-pressure chamber and the low-pressure chamber of the timer piston.
The fuel injection timing is advanced by increasing the control duty of the timing control solenoid valve.

IDLE SPEED CONTROL

Controlling the fuel injection rate in accordance with the engine running condition maintains the idle speed at the optimum condition.

SELF-DIAGNOSIS FUNCTION

- When an abnormality is detected in any of the sensors or actuators, the engine warning lamp illuminates to warn the driver.
- When an abnormality is detected in any of the sensors or actuators, a diagnosis code number corresponding to the problem which occurred is output.
- The RAM data relating to the sensors and actuators which is stored in the engine-ECU can be read using the MUT-II. In addition, the actuators can be force-driven under certain conditions.

OTHER CONTROL FUNCTIONS

1. Power Supply Control
   When the ignition switch is turned to ON, the relay turns on and power is supplied to components such as the timing control solenoid valve.
2. Intake Air Throttle Control
   When the engine-ECU detects an abnormality in any of the sensors or actuators, the throttle valve is half opened to restrict the amount of intake air in order to prevent the vehicle from running away.
3. A/C Relay Control
   Turns the compressor clutch of the A/C ON and OFF
4. Condenser Fan Motor Relay Control
   Controls the condenser fan motor relay based on the A/C switch, engine coolant temperature and vehicle speed input signals.
5. Glow Control
   Refer to GROUP 16.
6. EGR Control
   Refer to GROUP 17.

CONTROL SYSTEM DIAGRAM

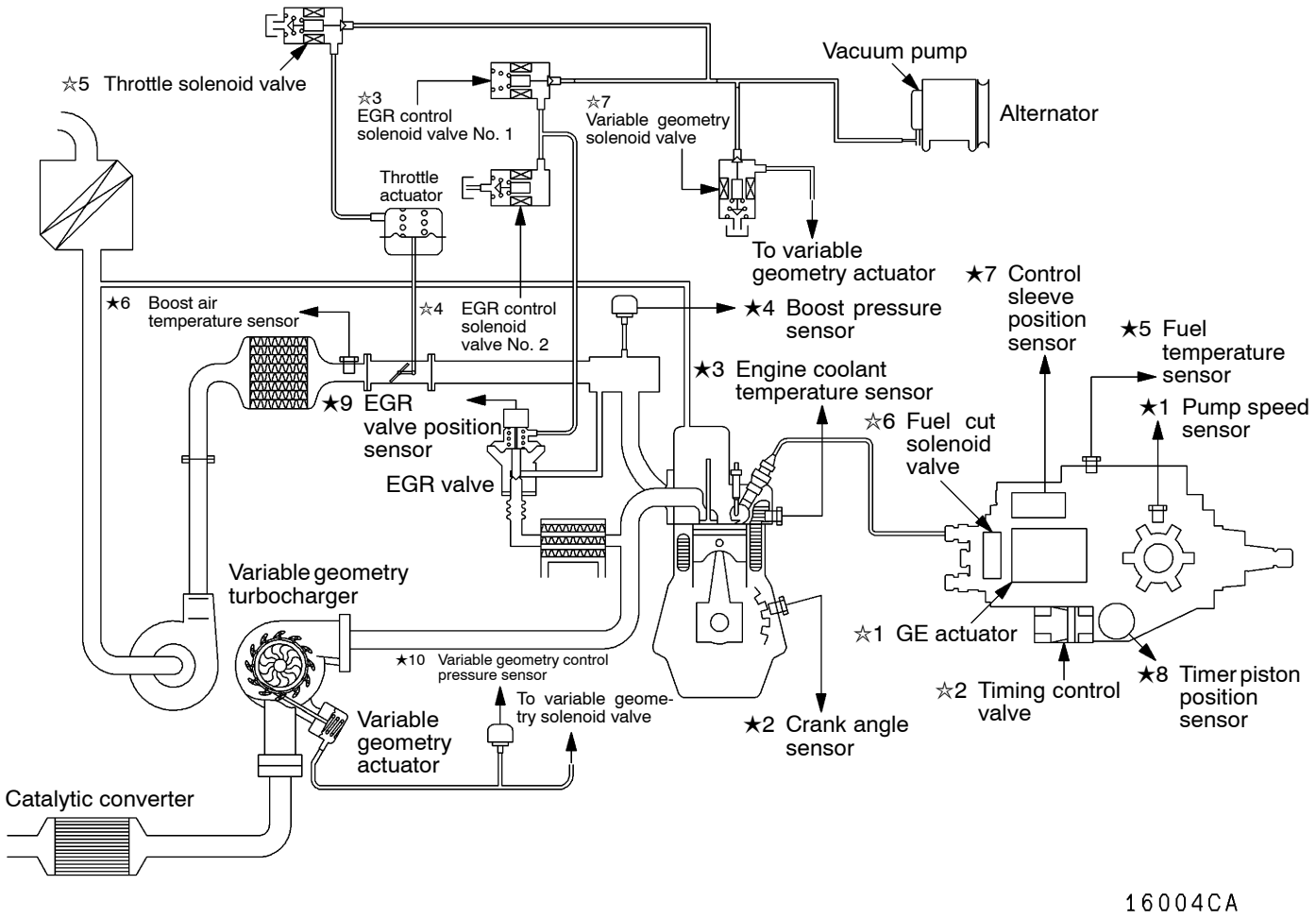
★1. Pump speed sensor
★2. Crank angle sensor
★3. Engine coolant temperature sensor
★4. Boost pressure sensor
★5. Fuel temperature sensor
★6. Boost air temperature sensor
★7. Control sleeve position sensor
★8. Timer piston position sensor
★9. EGR valve position sensor
★10. Variable geometry control pressure sensor

- Accelerator pedal position sensor (main)
- Accelerator pedal position sensor (sub)
- Idle switch
- Power supply
- Ignition switch-IG
- Ignition switch-ST
- Vehicle speed sensor
- A/C switch
- A/C relay switch
- Injection volume adjusting ROM
- Barometric pressure sensor (ECU built-in)

⇨ Engine-ECU ⇨

☆1. GE actuator (electronic governor)
☆2. Timing control valve
☆3. EGR control solenoid valve No. 1
☆4. EGR control solenoid valve No. 2
☆5. Throttle solenoid valve
☆6. Fuel cut solenoid valve
☆7. Variable geometry solenoid valve

- Control relay
- A/C relay
- Condenser fan relay
- Glow indicator lamp
- Glow plug relay
- Engine warning lamp
- Diagnosis output



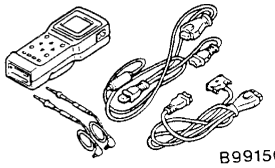
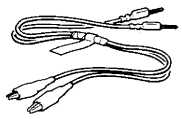
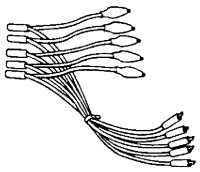
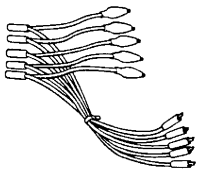
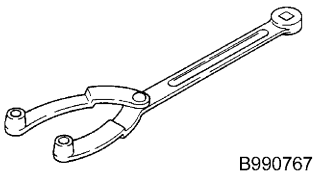
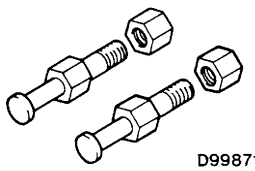
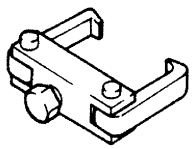
SERVICE SPECIFICATIONS

Item		Standard value
Fuel injection initial pressure kPa		14,710 - 15,490
Accelerator pedal position sensor reference voltage V		0.985 - 1.085
Accelerator pedal position sensor resistance kΩ		3.5 - 6.5
Boost air temperature sensor (Intake air temperature sensor) resistance kΩ	When the temperature is 20°C	2.3 - 3.0
	When the temperature is 80°C	0.30 - 0.42
Engine coolant temperature sensor resistance kΩ	When the temperature is 20°C	2.1 - 2.7
	When the temperature is 80°C	0.26 - 0.36
Fuel cut solenoid valve resistance Ω		6.8 - 9.2
Timing control valve resistance Ω		10.8 - 11.2
Timer piston position sensor resistance Ω	Connector terminals No. 1 - No. 2	160 - 168
	Connector terminals No. 1 - No. 3	80 - 84
	Connector terminals No. 2 - No. 3	80 - 84
Control sleeve position sensor resistance Ω	Connector terminals No. 4 - No. 12	11.2 - 12.4
	Connector terminals No. 4 - No. 8	5.6 - 6.2
	Connector terminals No. 8 - No. 12	5.6 - 6.2
GE actuator (electronic governor) resistance Ω	Connector terminals No. 6 - No. 10	0.64 - 0.72
Fuel temperature sensor resistance kΩ	Connector terminals No. 7 - No. 11	1.4 - 2.6
Pump speed sensor resistance kΩ		1.36 - 1.84
Throttle solenoid valve resistance Ω		36 - 44

SEALANT

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

SPECIAL TOOLS

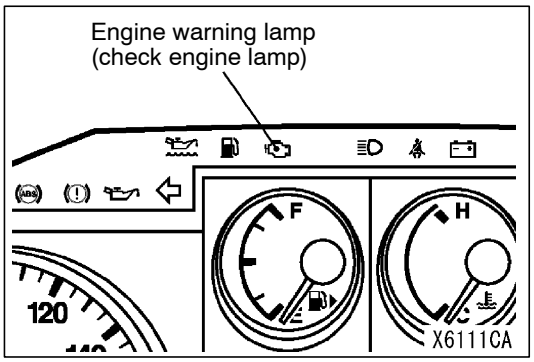
Tools	Number	Name	Application
 B991502	MB991502	MUT-II sub assembly	Electronically controlled fuel injection system check
	MB991529	Diagnosis code check harness	Diagnosis code reading
	MB991348	Test harness set	• Boost pressure sensor check • Variable geometry control pressure sensor check
	MB991658	Test harness set	• APS adjustment • Inspection using an analyzer
	MD998478	Test harness (3-pin, square)	• Crank angle sensor check • Inspection using an analyzer
 B990767	MB990767	End yoke holder	Holding the fuel injection pump sprocket
 D998719	MD998719	Crankshaft pulley holder pin	
	MD998388	Injection pump sprocket puller	Fuel injection pump sprocket removal

TROUBLESHOOTING

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING

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

NOTE
When replacing the engine-ECU, replace immobilizer-ECU and ignition key as well at the same time.



DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

Engine warning lamp is lit when any abnormality takes place in the item related to electronically controlled fuel injection system shown in the following table.
If the malfunction indicator lamp has been on and/or is lit when the engine is in operation, check the diagnosis output.

Engine warning lamp check items

Accelerator pedal position sensor (main)
Accelerator pedal position sensor (sub)
Boost pressure sensor (Boost sensor)
Crank angle sensor
Control sleeve position sensor
Timer piston position sensor
Throttle solenoid valve
GE actuator
Variable geometry control pressure sensor
Barometric pressure sensor
Timing control valve
Idle switch
Engine-ECU

METHOD OF ERASING 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 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, BACKUP FUNCTIONS

When abnormalities in the major sensors are detected by diagnosis functions, pre-set control logic operates to maintain a safe driving condition for the vehicle.

Diagnosis item	Control features in malfunction
Accelerator pedal position sensor	● Accelerator pedal released (idle switch ON) Acceleration opening degree = 0 % ● Accelerator pedal applied (idle switch OFF) Engine controlled at low speed Acceleration opening degree = 30 % fixed ● Void EGR control
Idle switch	Void idling speed control.
Engine speed sensor	● Engine controlled at low speed ● Void EGR control ● Void variable geometry turbocharger control
Boost air temperature sensor	● Maintain the intake air temperature at 50°C. ● Void EGR control
Vehicle speed sensor	● Void idling speed control. ● Void EGR control
Engine coolant temperature sensor	● Maintain the engine coolant temperature at 80°C (However, the system assumes the coolant temperature as 0°C). ● Void EGR control
Control sleeve position sensor	● Engine controlled at low speed ● Void EGR control ● Void variable geometry turbocharger control
Timer piston position sensor	● Injection timing stabilizing control ● Void EGR control
Barometric pressure sensor (ECU built-in)	● Keep the barometric pressure at 101 kPa. ● Void EGR control ● Void variable geometry turbocharger control
Fuel temperature sensor	Maintain the fuel temperature at 40°C.
Boost pressure sensor	● Keep the boost pressure as barometric pressure (101 kPa). ● Void EGR control ● Void variable geometry turbocharger control
Injection volume adjusting ROM	Void correction.
GE actuator	● Engine controlled at low speed ● Void EGR control ● Void variable geometry turbocharger control
Over boost	● Void variable geometry turbocharger control ● Engine controlled at low fuel injection
Timing control valve	● Injection timing stabilizing control ● Void EGR control
EGR valve position sensor	Void EGR control
Variable geometry control pressure sensor	● Void EGR control ● Void variable geometry turbocharger control

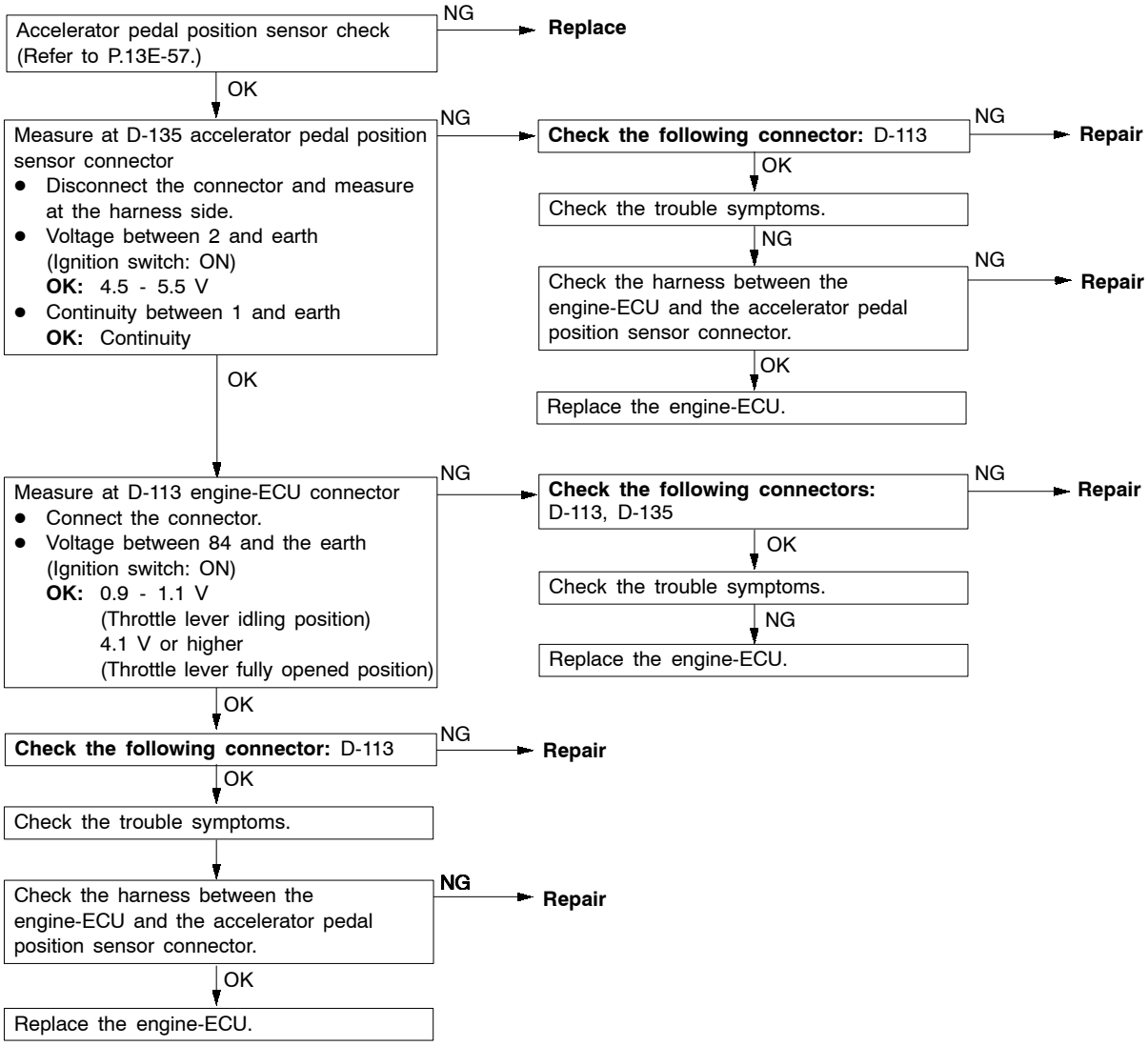
INSPECTION CHART FOR DIAGNOSIS CODES

Code No.	Diagnosis item	Reference page
11	Accelerator pedal position sensor (main) system	13E-9
12*	Boost pressure sensor system	13E-10
13	Barometric pressure sensor (ECU built-in) system	13E-11
14	Fuel temperature sensor system	13E-11
15	Engine coolant temperature sensor system	13E-12
16	Boost air temperature sensor system	13E-12
17	Vehicle speed sensor system	13E-13
18	Pump speed sensor system	13E-14
21	Crank angle sensor system	13E-15
23	Idle switch (accelerator pedal position sensor built-in) system	13E-16
25*	Timer piston position sensor system	13E-17
26*	Control sleeve position sensor system	13E-18
27	Accelerator pedal position sensor (sub) system	13E-19
41*	Throttle solenoid valve system	13E-20
43	Timing control valve system	13E-21
46	Injection volume adjusting ROM system	13E-22
48*	GE actuator (in the middle of control sleeve position sensor inoperative) system	13E-23
49*	Over boost (variable geometry control pressure sensor system malfunction)	13E-24
51	EGR valve position sensor system	13E-25
52	Variable geometry control pressure sensor system	13E-26
54	Immobilizer system	13E-27

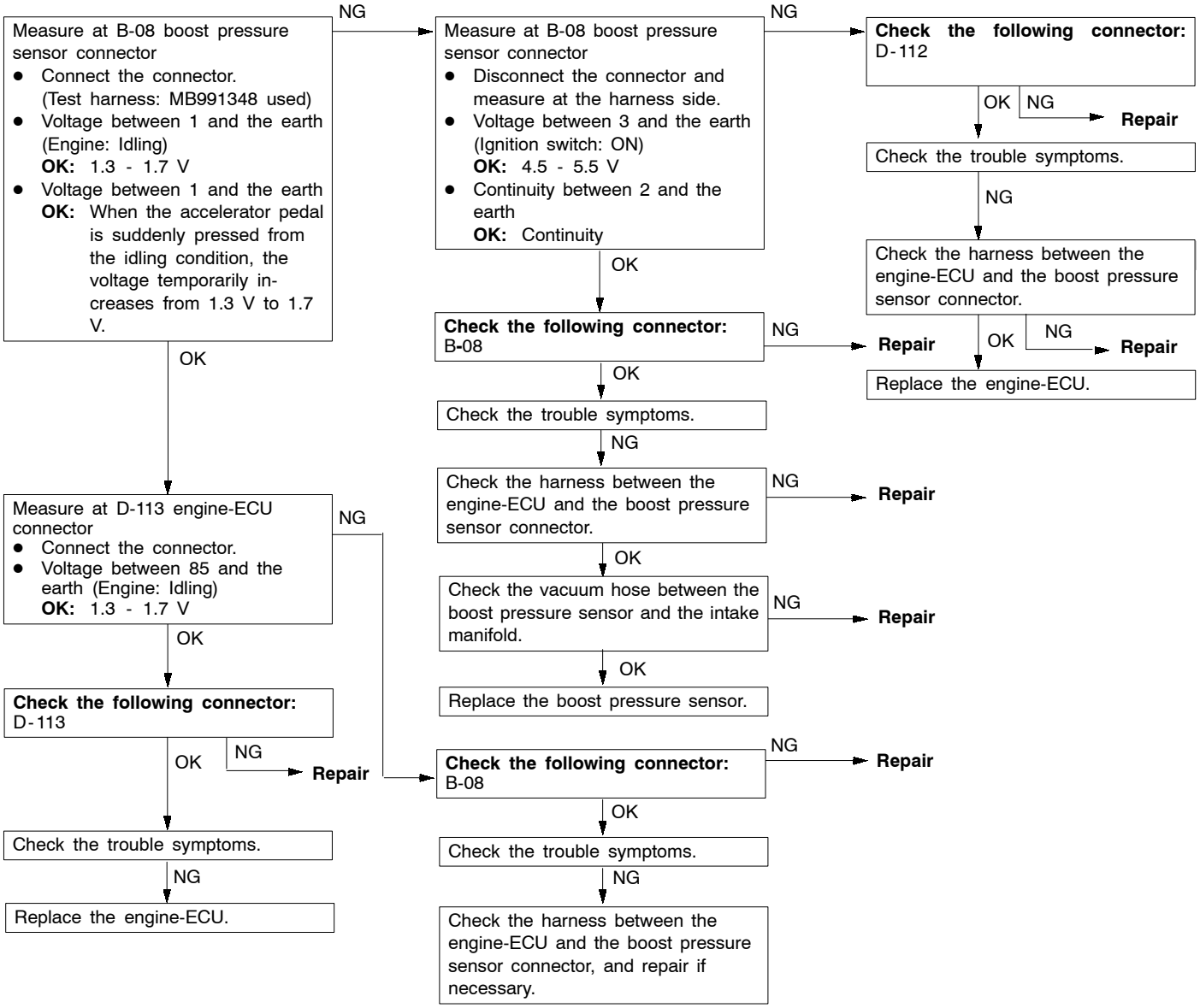
Caution
If the above-mentioned diagnosis code number with the asterisks can be displayed along with another code number in parentheses simultaneously, check the other code number before replacing the engine-ECU.
12 (41, 49), 26 (48), 25 (43), 41 (12, 49), 48 (26), 49 (12, 41)

INSPECTION PROCEDURE FOR DIAGNOSIS CODE

Code No. 11 Accelerator pedal position sensor (main) system	Probable cause
Range of Check ● Ignition switch: ON, accelerator pedal position sensor (sub) operative, except for during engine cranking Set Conditions ● Accelerator pedal position sensor output voltage is as below for 1 second: Sub side: 0.2 V or more, less than 2.5 V Main side: 4.5 V or more or Sub or main side: less than 0.2 V Range of Check ● Ignition switch: ON, except for during engine cranking Set Conditions ● The output voltage of accelerator pedal position sensor (main and sub) for 0.2 second is 0.2 V or higher, or lower than 4.5 V and the difference in sensor output voltage between the main and sub is 1 V or higher, or idle switch: ON, and sensor main output voltage is 1.875 V or higher.	● Accelerator pedal position sensor inoperative ● Accelerator pedal position sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative



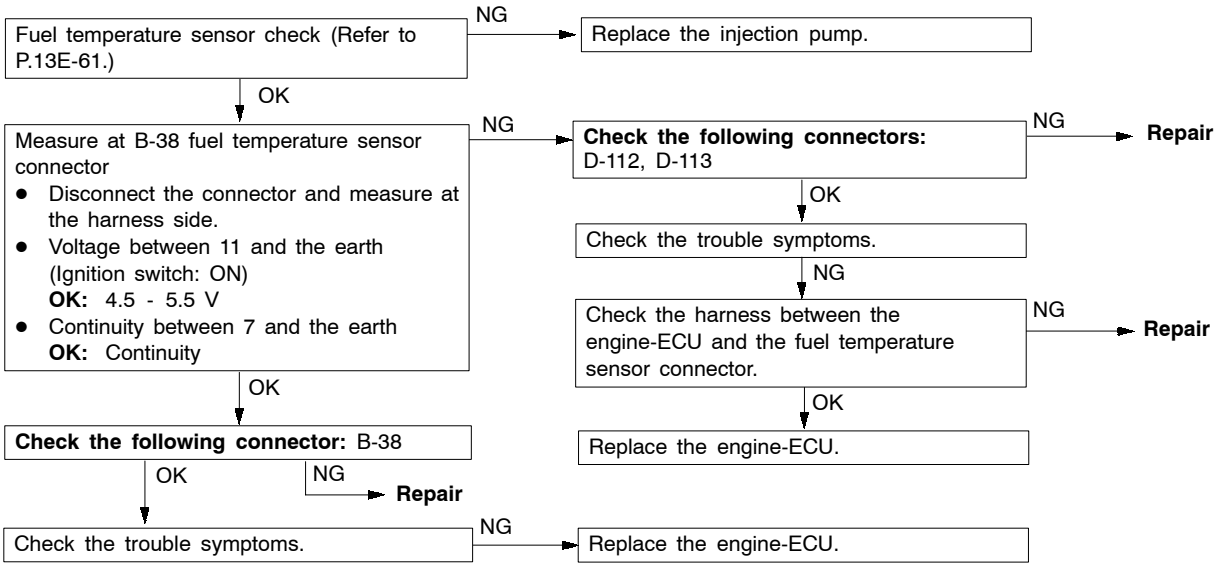
Code No. 12 Boost pressure sensor (boost sensor) system	Probable cause
Range of Check • Ignition switch: ON, except for during engine cranking Set Conditions • Sensor output voltage for 1 second is 4.5 V or higher (boost pressure is approximately 267 kPa). or • Sensor output voltage for 1 second is 0.2 V or lower (boost pressure is approximately 51.7 kPa or lower) Range of Check • Engine speed is 2,000 r/min or higher, barometric pressure is 69.7 kPa or less (equivalent to an altitude of 300 m) and under high load. Set Conditions • Boost pressure is lower than the barometric pressure + 13 kPa for 3 seconds.	• Boost pressure sensor inoperative • Boost pressure sensor open circuit, short circuit, or connector contact inoperative • Boost pressure sensor hose disconnected • Engine-ECU inoperative



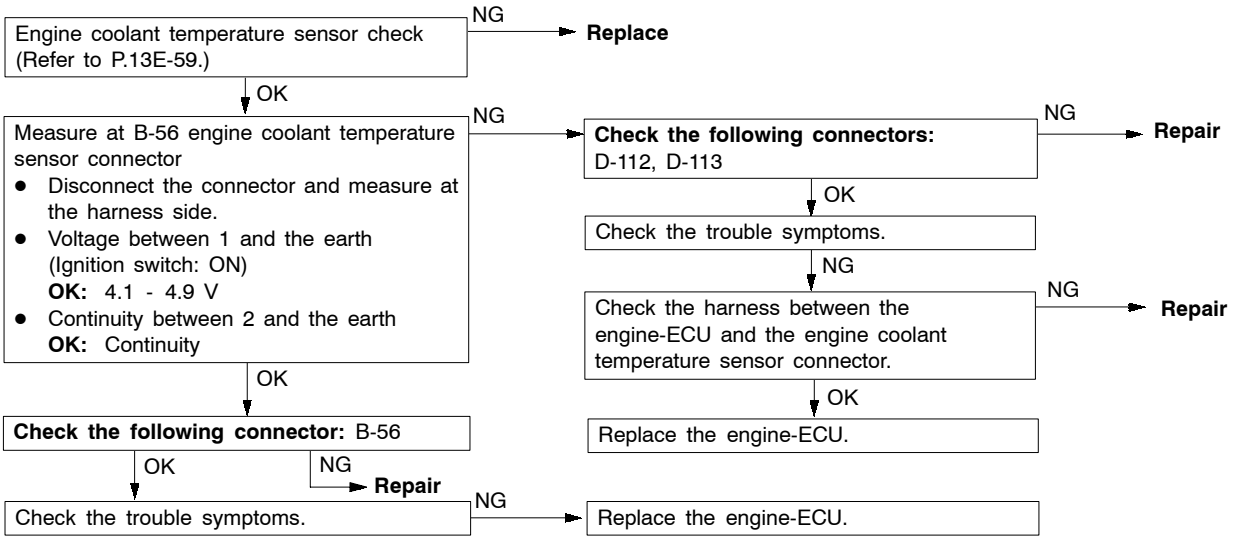
Code No. 13 Barometric pressure sensor system	Probable cause
Range of Check ● Ignition switch: ON, except for during engine cranking Set Conditions ● The sensor output voltage is for 3 seconds is 4.5 V or higher (the barometric pressure is approximately 114 kPa or over). or ● The sensor output voltage is for 3 seconds is 1.5 V or lower (the barometric pressure is approximately 40 kPa or under). Range of Check ● Ignition switch: ON ● The coolant temperature is 40°C or lower Set conditions ● Difference between the barometric pressure and boost pressure sensors is 13.3 kPa or more	Engine-ECU inoperative

Check the trouble symptoms. → NG → Replace the engine-ECU.

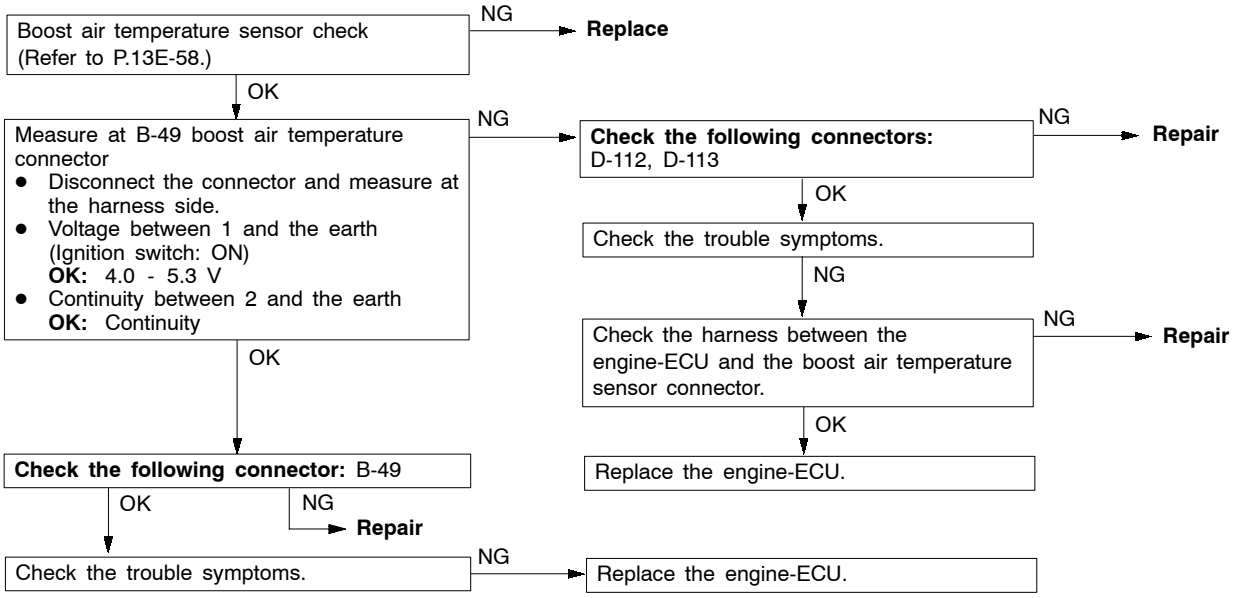
Code No. 14 Fuel temperature sensor system	Probable cause
Range of Check ● Ignition switch: ON, except for during engine cranking Set Conditions ● The sensor output voltage for 3 seconds is 0.2 V or lower (the fuel temperature is approximately 125°C or higher). or ● The sensor output voltage for 3 seconds is 4.6 V or higher (the fuel temperature is approximately -47°C or lower).	● Fuel temperature sensor inoperative ● Fuel temperature sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative



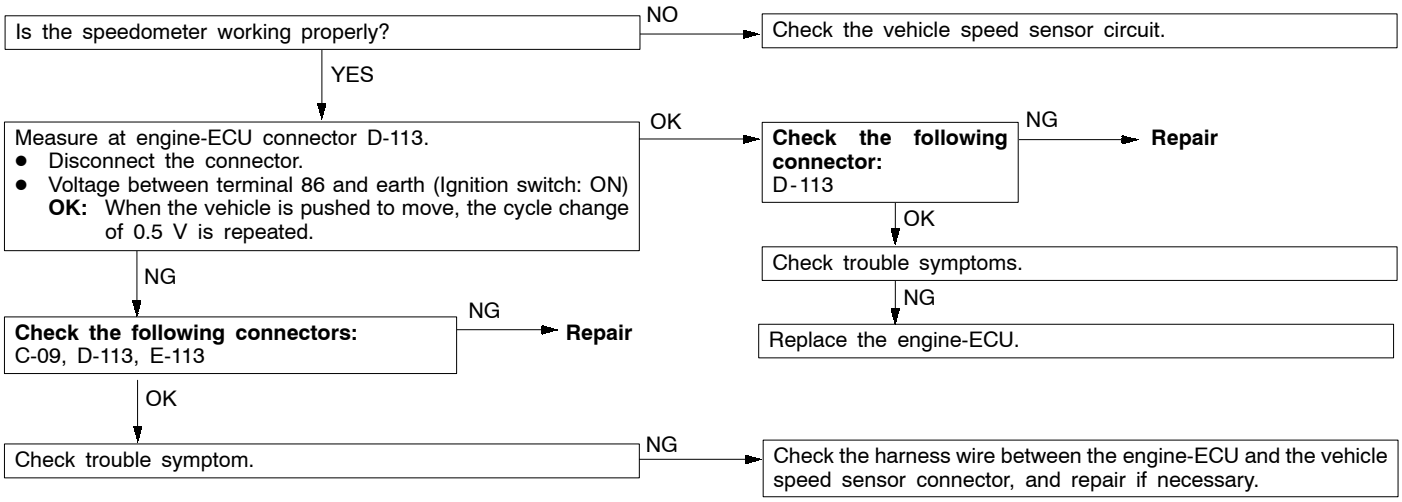
Code No. 15 Engine coolant temperature sensor system	Probable cause
Range of Check • Ignition switch: ON, except for during engine cranking Set Conditions • The sensor output voltage for 3 seconds is 4.9 V or higher (the coolant temperature is approximately -45°C or lower). or • The sensor output voltage for 3 seconds is 0.2 V or lower (the coolant temperature is approximately 140°C or higher).	• Engine coolant temperature sensor inoperative • Engine coolant temperature sensor open circuit, short circuit, or connector contact inoperative • Engine-ECU inoperative



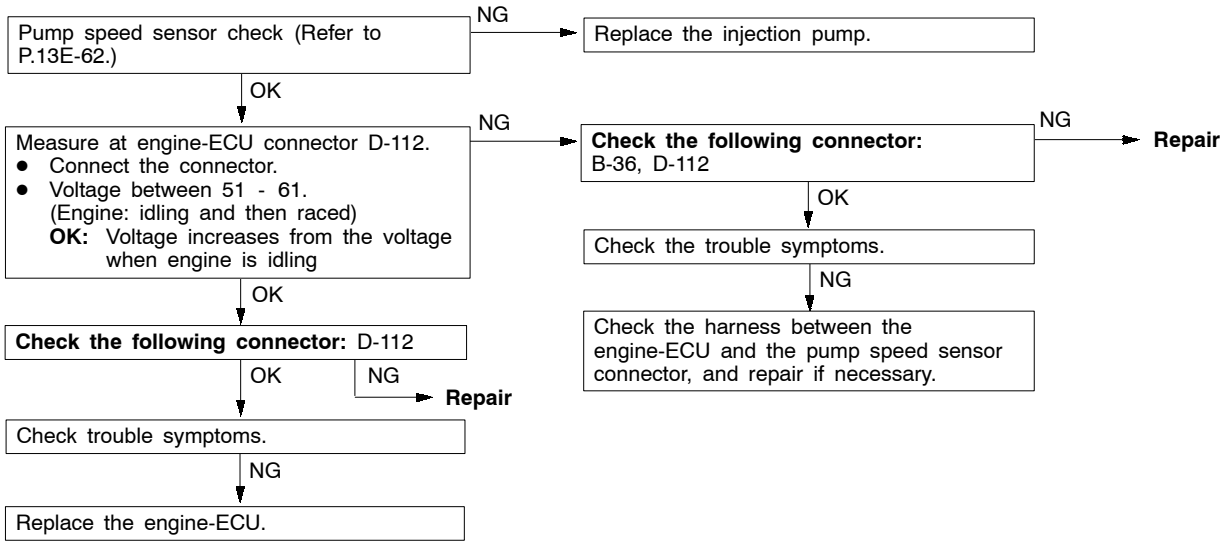
Code No. 16 Boost air temperature sensor (intake air sensor) system	Probable cause
Range of Check • Ignition switch: ON, except for during engine cranking Set Conditions • The sensor output voltage for 3 seconds is 4.6 V or higher (the intake air temperature is approximately -45°C or lower). or • The sensor output voltage for 3 seconds is 0.3 V or lower (the intake air temperature is approximately 110°C or higher).	• Boost air temperature sensor inoperative • Boost air temperature sensor open circuit, short circuit, or connector contact inoperative • Engine-ECU inoperative



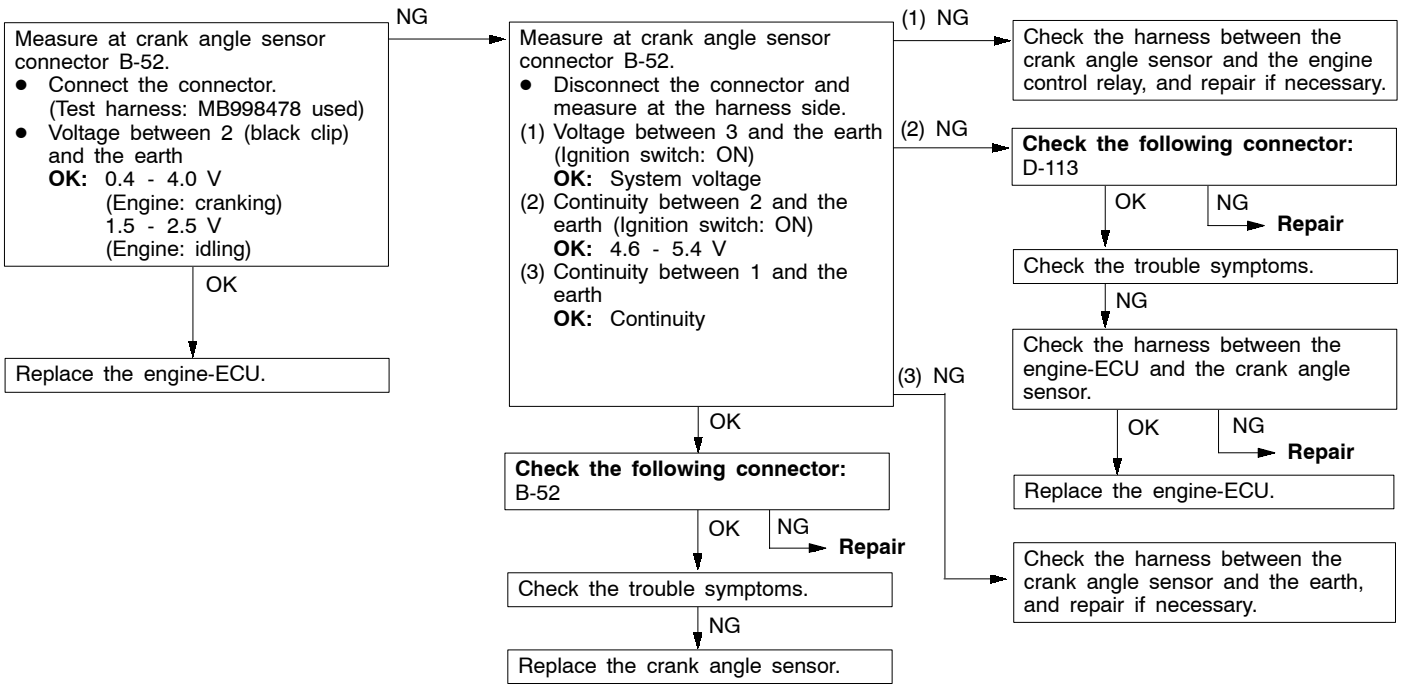
Code No. 17 Vehicle speed sensor system	Probable cause
Range of Check ● Ignition switch: ON ● Engine speed: 2,800 r/min or higher ● Driving with heavy load Set Conditions ● Slower than vehicle speed of 3 km/h	● Vehicle speed sensor inoperative ● Vehicle speed sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative



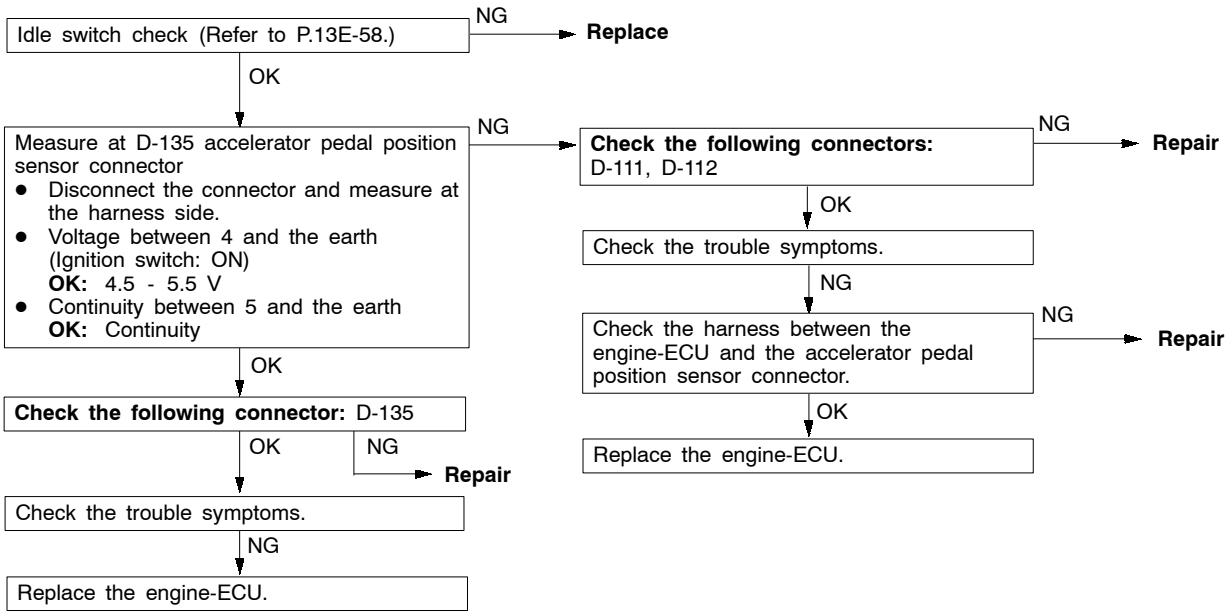
Code No. 18 Pump speed sensor system	Probable cause
Range of Check ● Ignition switch: ON ● Not during the engine cranking Set Conditions ● The difference between the pump speed sensor and the crank angle sensor output value is 500 r/min or higher for 4 seconds	● Malfunction of pump speed sensor ● Open circuit or short-circuit in pump speed sensor circuit, or poor sensor contact ● Engine-ECU inoperative



Code No. 21 Crank angle sensor system	Probable cause
Range of Check ● Engine cranking Set Conditions ● Sensor output voltage does not change for 2 seconds (no pulse signal input)	● Malfunction of crank angle sensor ● Open circuit or short-circuit in crank angle sensor circuit, or poor connector contact ● Engine-ECU inoperative
Range of Check ● Ignition switch: ON ● Not during the engine cranking ● Pump speed sensor circuit: Normal Set Conditions ● When crank angle sensor signal is being input normally, suddenly no sensor signal is input for 0.3 seconds or more	

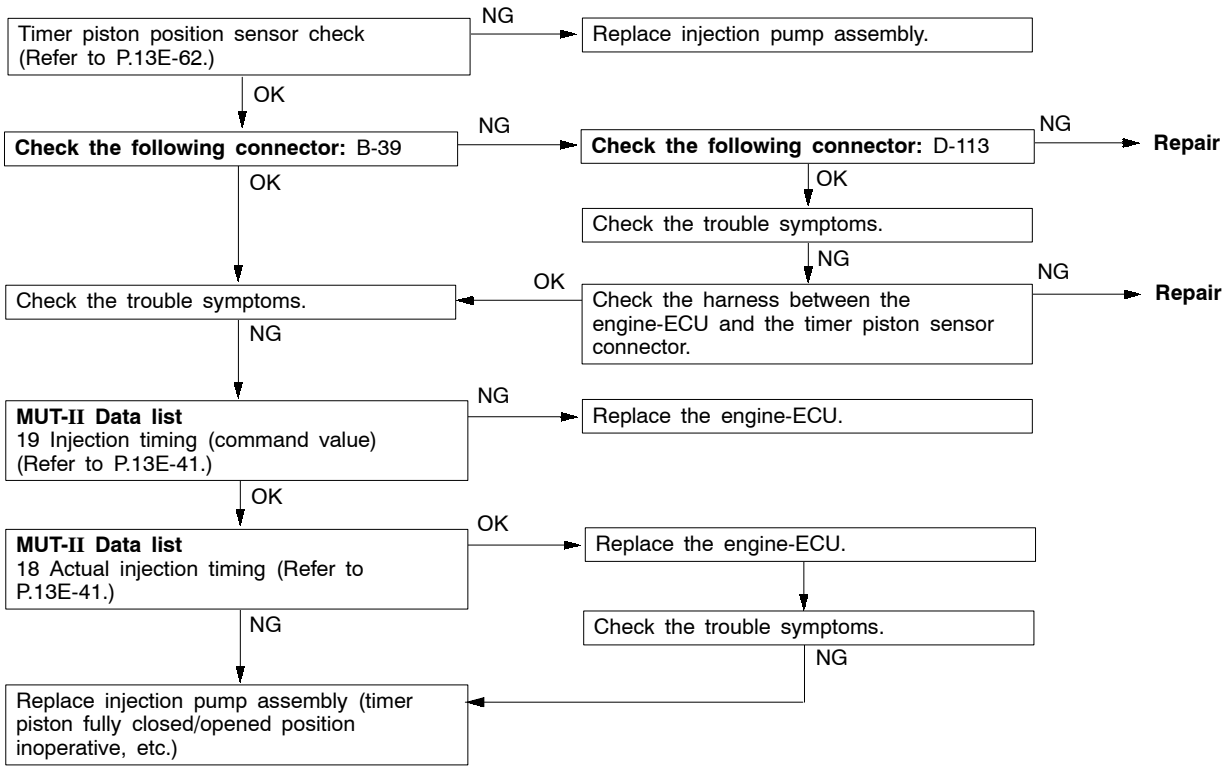


Code No. 23 Idle switch (accelerator pedal position sensor built-in) system	Probable cause
Range of Check Ignition switch: ON, accelerator pedal position sensor (main, sub) operative, except for during engine cranking Set Conditions ● Idle switch (built-in): ON for 0.8 second, accelerator pedal position sensor (main, sub) output voltage 1.875 V or higher ● Idle switch (built-in): OFF for 10 minutes, accelerator pedal position sensor (main, sub) opening degrees less than 1.17 %	● Accelerator pedal position sensor inoperative ● Accelerator pedal position sensor open circuit, short circuit, or connector contact inoperative ● Idle switch “ON” inoperative ● Idle switch signal line short circuit ● Engine-ECU inoperative



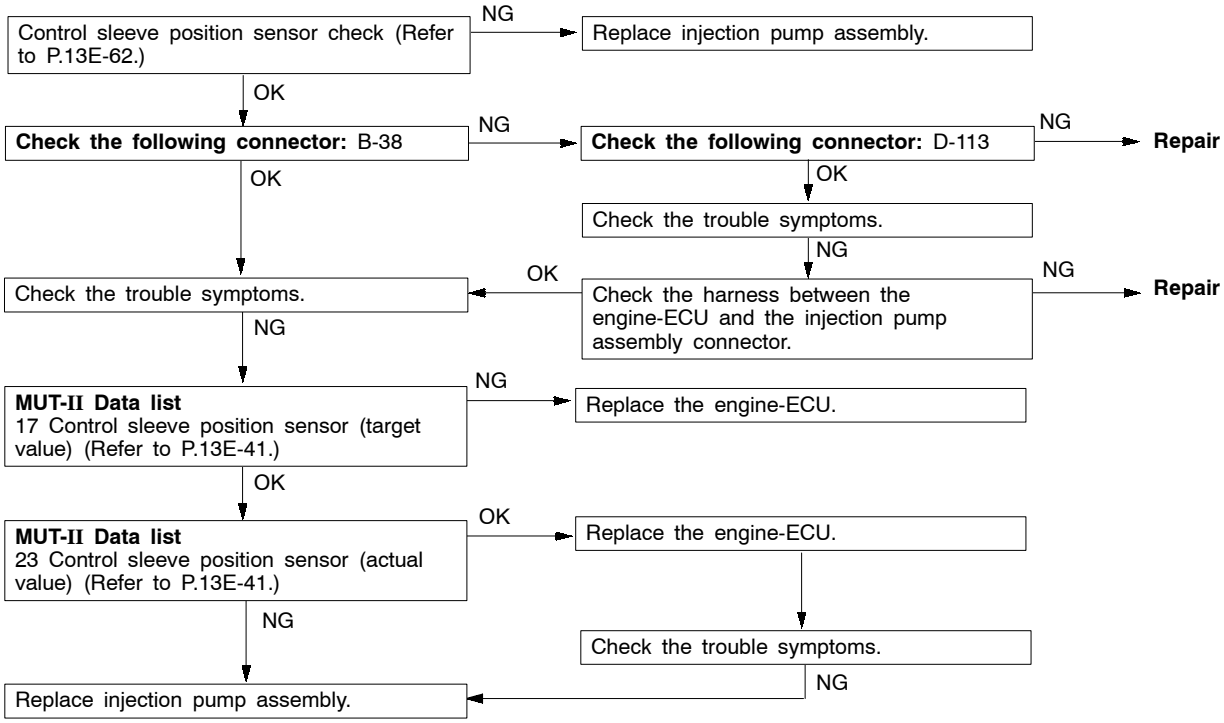
Code No. 25 Timer piston position sensor system	Probable cause
Range of Check ● Ignition switch: OK ● Not during the engine cranking Set Conditions ● The sensor output voltage for 1 second is 4.9 V* or more or ● The sensor output voltage for 1 second is 0.25 V* or less	● Timer piston position sensor inoperative ● Timer piston position sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative

NOTE:
*: This voltage is derived from the input pulse signal converted in the engine-ECU and cannot be measured.

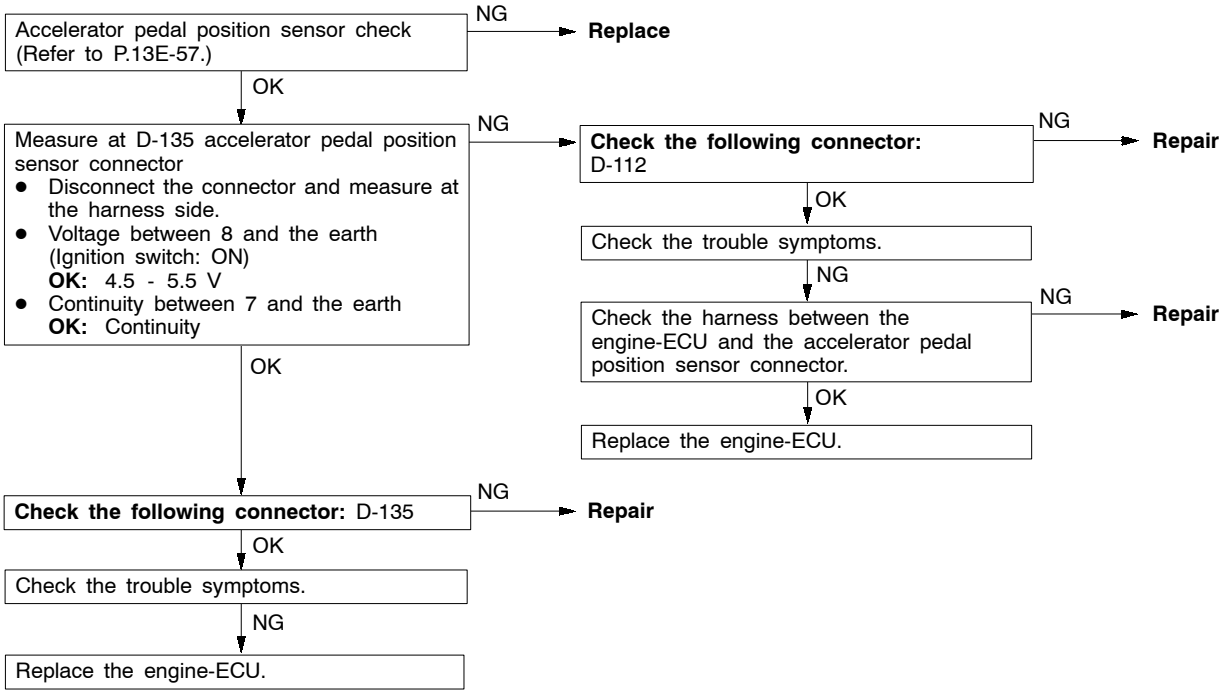


Code No. 26 Control sleeve position sensor system	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● The sensor output voltage for 0.3 second is 4.5 V* or more or ● The sensor output voltage for 0.3 second is 0.25 V* or less	● Control sleeve position sensor inoperative ● Control sleeve position sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative

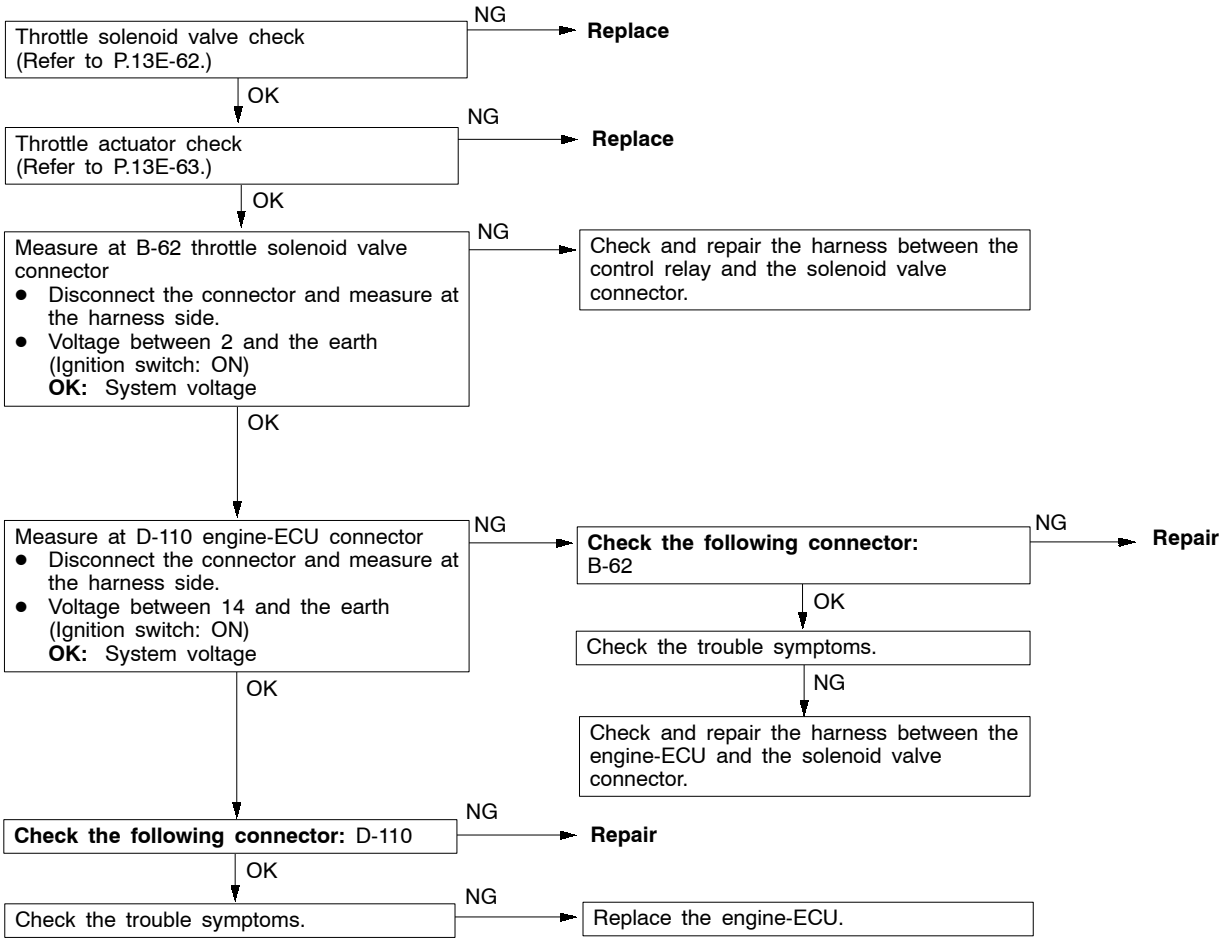
NOTE:
*: This voltage is derived from the input pulse signal converted in the engine-ECU and cannot be measured.



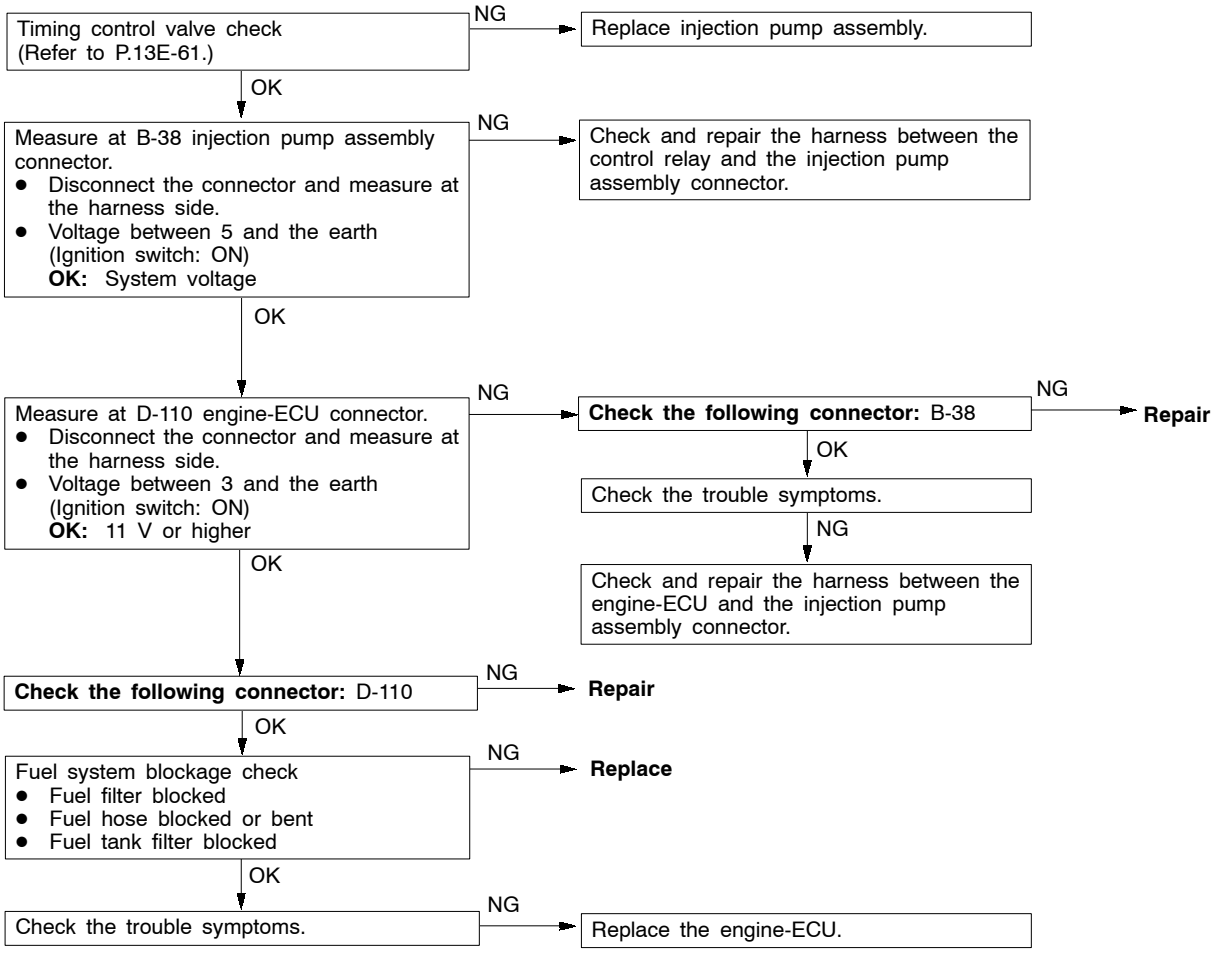
Code No. 27 Accelerator pedal position sensor (sub) system	Probable cause
Range of Check ● Ignition switch: ON, accelerator pedal position sensor (main) operative, except for during engine cranking Set Conditions ● Accelerator pedal position sensor output voltage for 1 second Sub side: 0.2 V or higher, lower than 2.5 V Main side: 4.5 V or higher or Sub or main: Lower than 0.2 V Range of Check ● Ignition switch: ON, except for during engine cranking Set Conditions ● The difference in the output sensor voltage between the main and the sub sensor is 1 V or higher, or the idle switch ON, and sensor main output voltage is 1.875 V or higher.	● Accelerator pedal position sensor inoperative ● Accelerator pedal position sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative



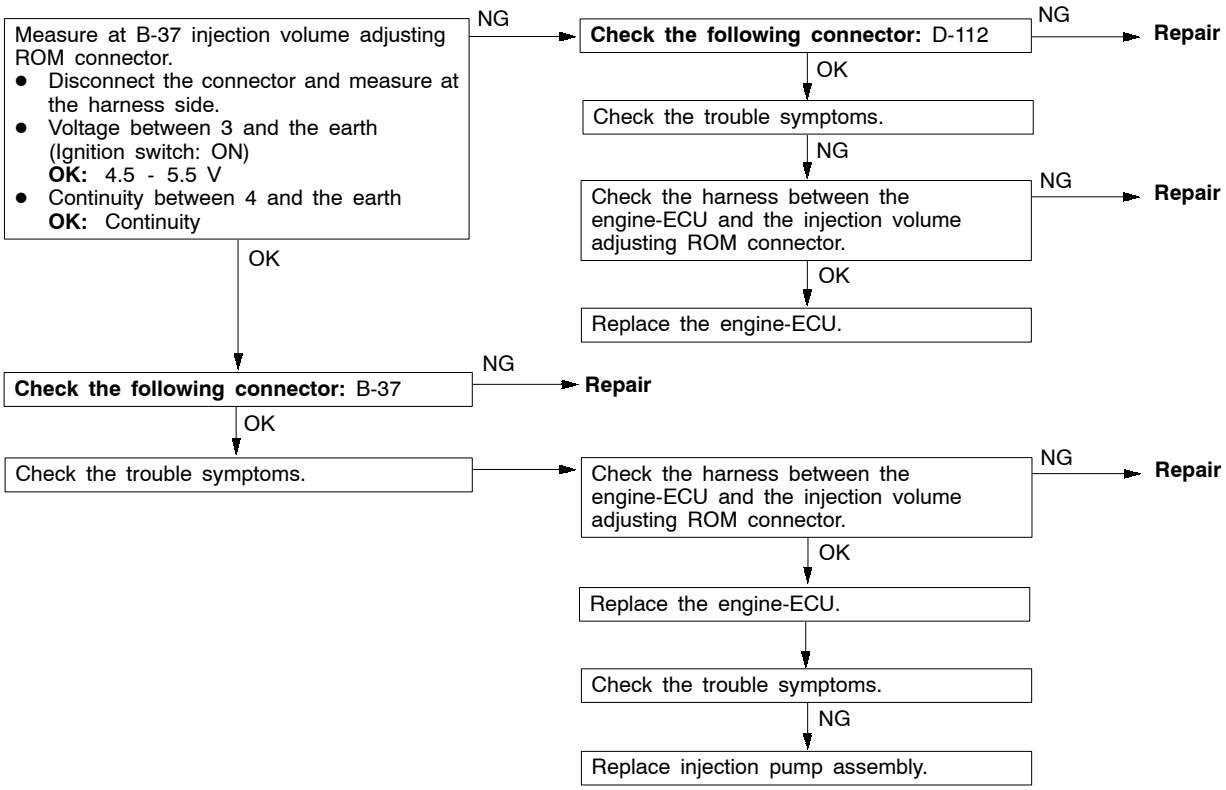
Code No. 41 Throttle solenoid valve system	Probable cause
Range of Check ● Ignition switch: OFF ● Barometric pressure is 95.4 kPa or over (equivalent to an altitude of 500 m). Set Conditions ● Boost pressure sensor output does not change.	● Throttle solenoid valve inoperative ● Throttle solenoid valve open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative ● Malfunction of throttle actuator



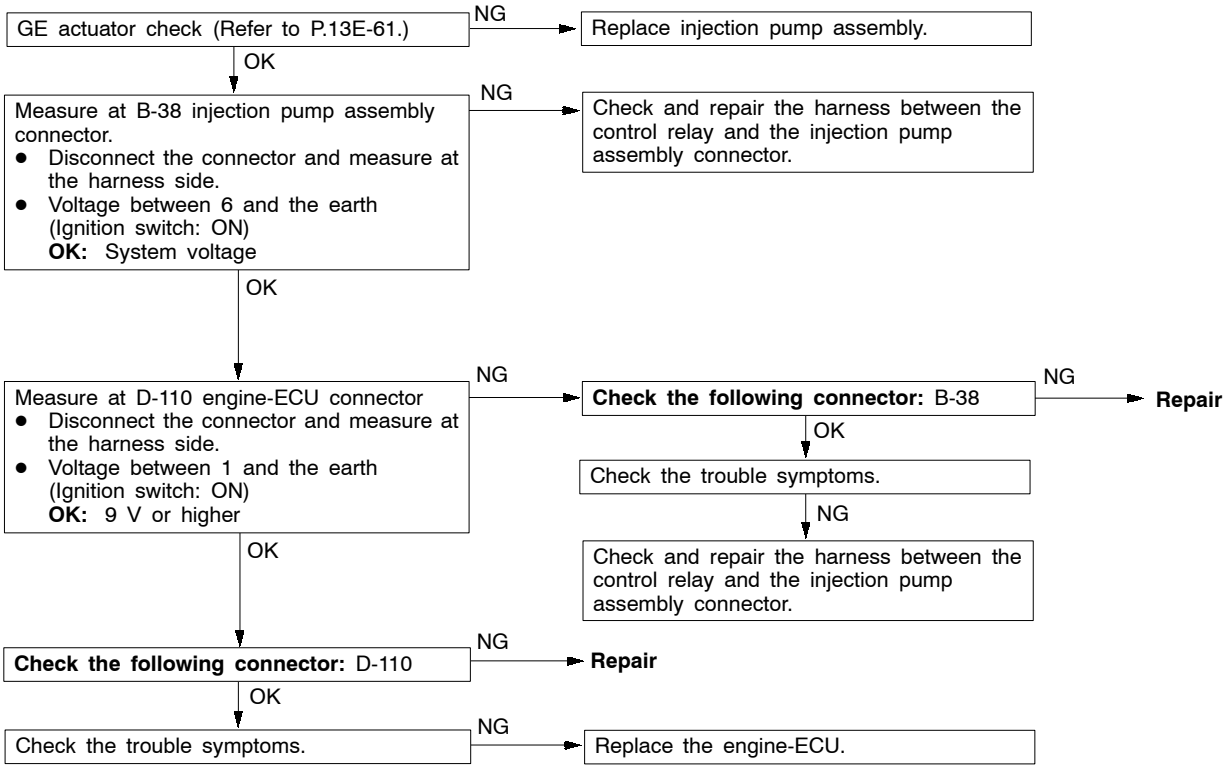
Code No. 43 Timing control valve system	Probable cause
Range of Check ● Engine coolant temperature 80°C or higher and the engine running Set Conditions ● Target value minus actual value is 0.64 V or more for 5 seconds	● Timing control valve inoperative ● Timing control valve open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative ● Blockage in fuel system



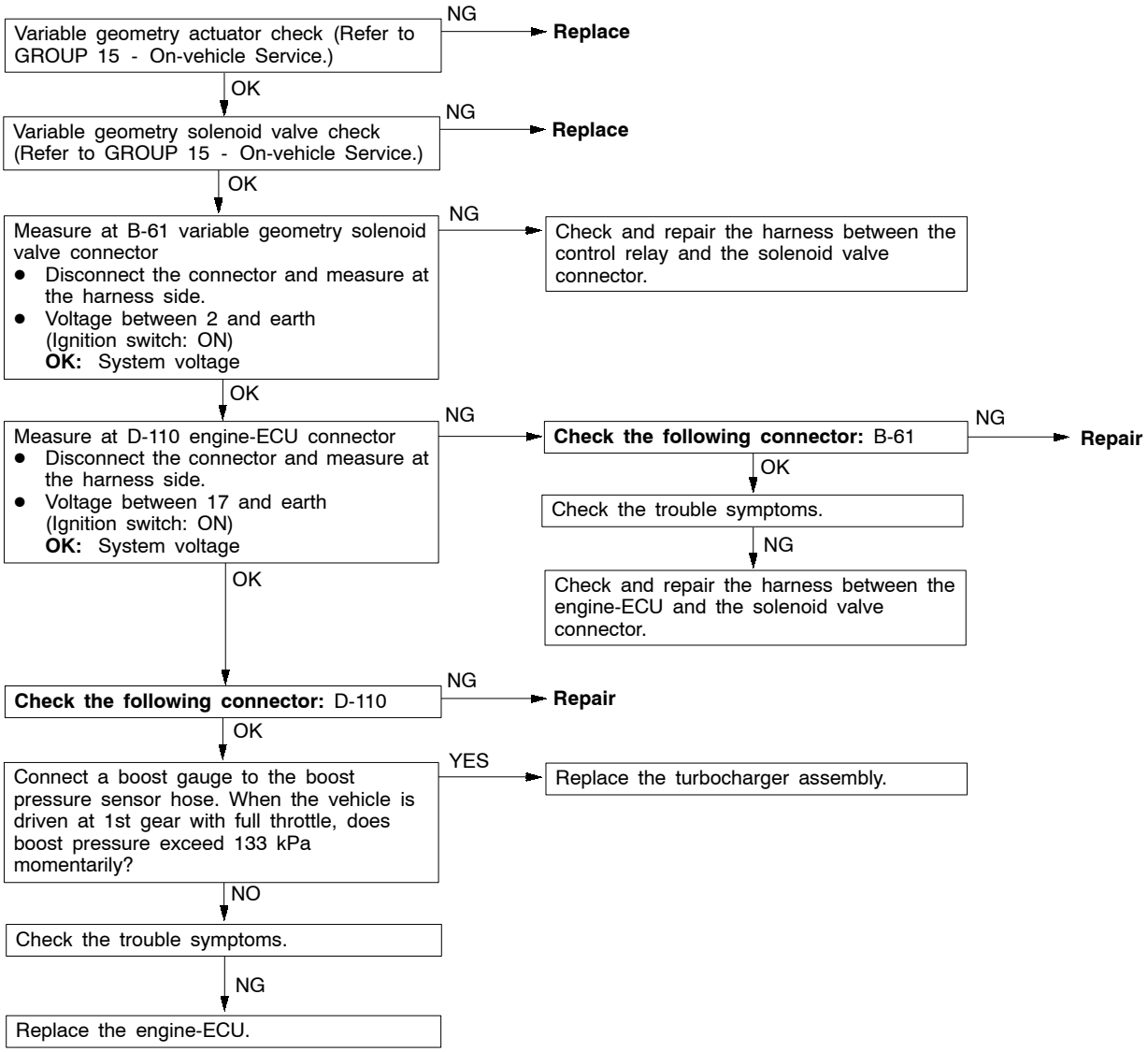
Code No. 46 Injection volume adjusting ROM system	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● When communication fails	● Injection volume adjusting ROM inoperative ● Engine-ECU inoperative



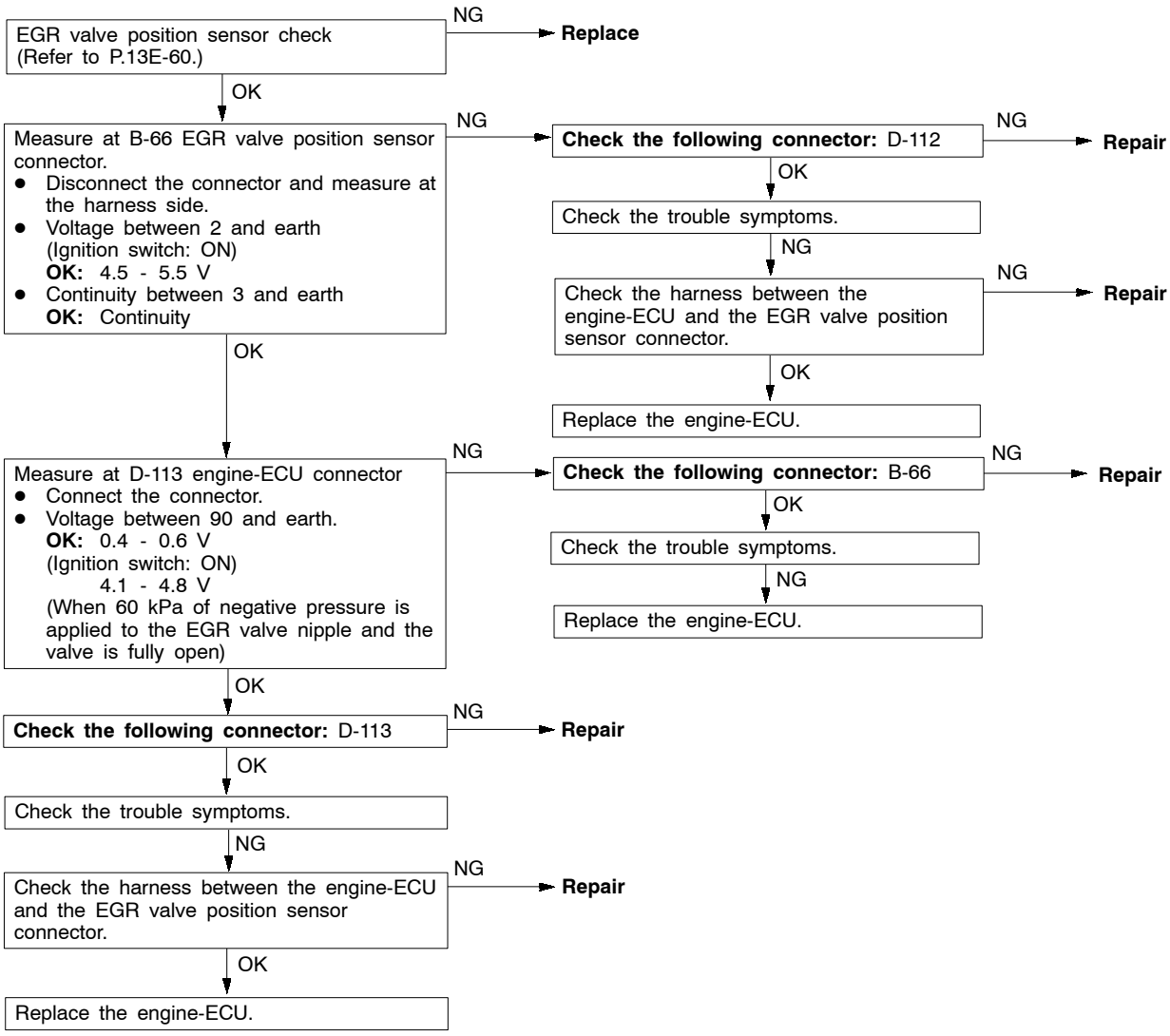
Code No. 48 GE actuator (in the middle of control sleeve position sensor inoperative) system	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● Target value minus actual value is 1 V or more for 1 second	● Control sleeve position sensor inoperative ● GE actuator inoperative ● Control sleeve position sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative



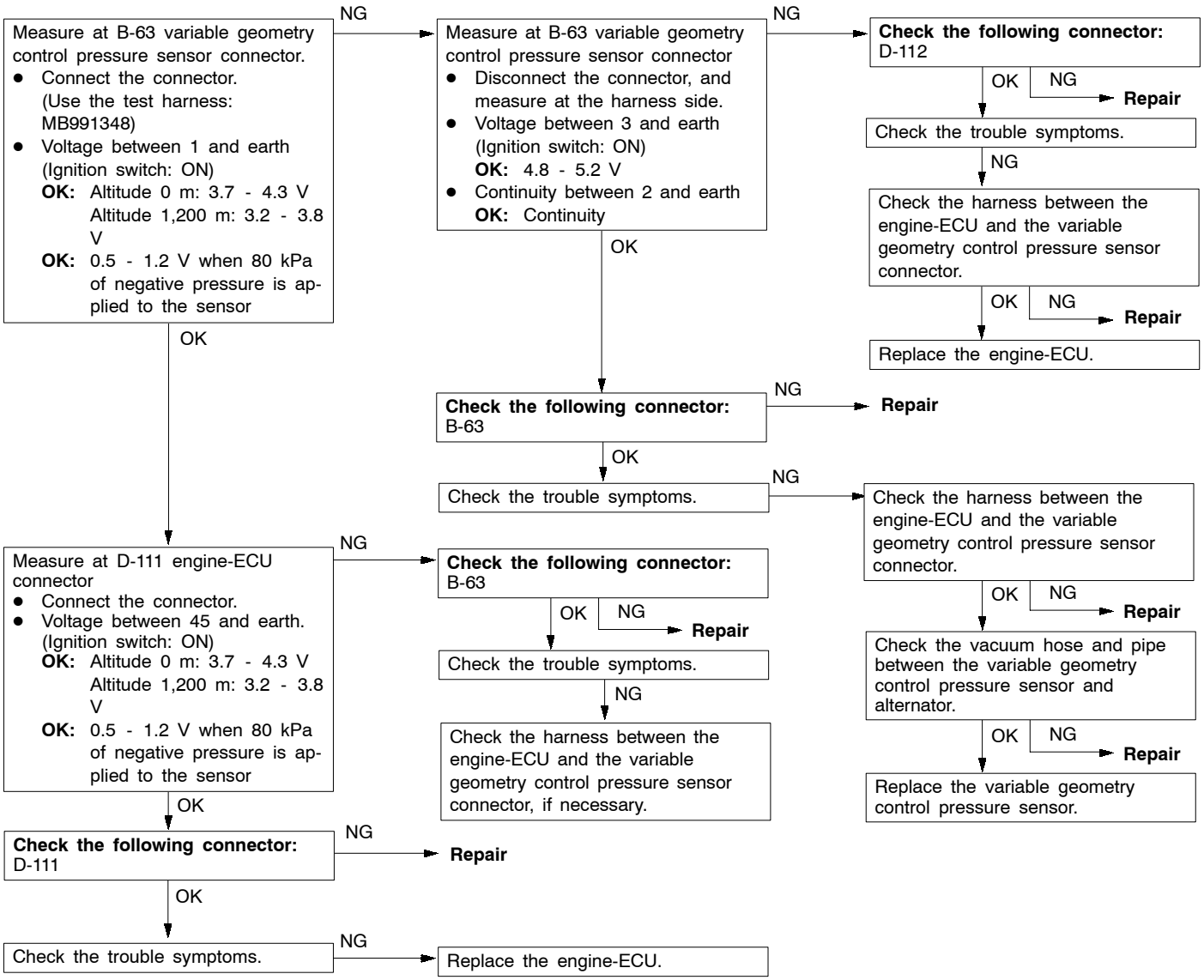
Code No. 49 Over boost	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● Boost pressure is higher than the barometric pressure + 133 kPa	● Malfunction of the variable geometry actuator ● Malfunction of variable geometry solenoid valve ● Variable geometry solenoid valve open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative



Code No. 51 EGR valve position sensor system	Probable cause
Range of Check ● Ignition switch: ON, except during engine cranking Set Condition ● Output voltage of EGR valve position sensor for 3 seconds is 4.85 V or higher, or lower than 0.15 V	● EGR valve position sensor inoperative ● EGR valve position sensor open circuit, short circuit or connector circuit inoperative ● Engine-ECU inoperative

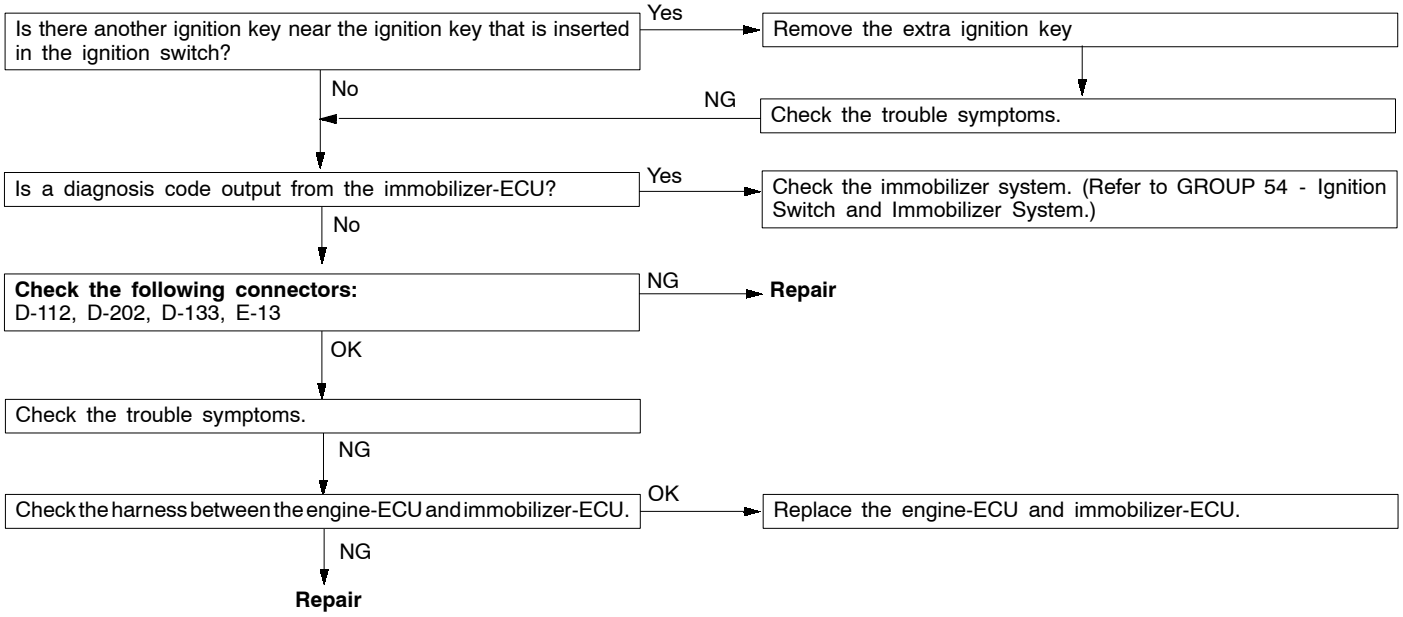


Code No. 52 Variable geometry control pressure sensor system	Probable cause
Range of Check • Ignition switch: ON, except during engine cranking Set Condition • 4.5 V or higher, or 0.2 V or lower Range of Check • Engine idling Set Conditions • The difference between target and actual negative pressures remains 10.6 kPa or more for 10 seconds.	• Variable geometry control pressure sensor inoperative • Variable geometry control pressure sensor open circuit, short circuit or connector contact inoperative • Vacuum hose disconnected or ruptured • Engine-ECU inoperative



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 encrypted codes ● Incorrect encrypted code ● Malfunction of harness or connector ● Malfunction of immobilizer-ECU ● Engine-ECU inoperative

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 encrypted code.



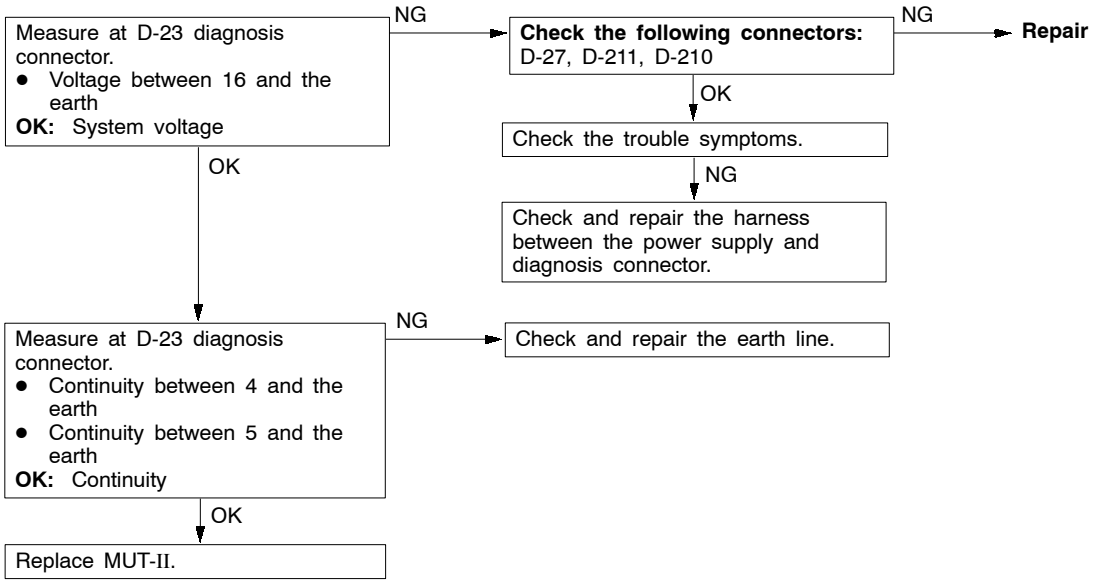
INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble Symptom		Inspection procedure No.	Reference page
No communication can be established between MUT-II and the engine-ECU.	No communication can be established with all systems.	1	13E-29
	No communication can be established only with the engine-ECU.	2	13E-29
Engine warning lamp related	Immediately after the ignition switch is “ON”, the engine warning lamp does not turn on.	3	13E-30
	The engine warning lamp keeps on and does not turn off.	4	13E-30
Starting performance	No initial combustion (unable to start)	5	13E-31
	Starting performance is bad when the engine is cold (difficult to start)	6	13E-31
	Starting performance is bad regardless of when the engine is hot or cold (difficult to start)	7	13E-32
Idling stability (idling inoperative)	Low idling speed when the engine is cold (improper idling speed)	8	13E-32
	High idling speed (improper idling speed)	9	13E-32
	Low idling speed (improper idling speed)	10	13E-33
	Idling instable (rough idling, hunting)	11	13E-33
Idling stability (idling sustainment inoperative)	The engine halts after running for a while.	12	13E-33
	The engine halts during idling.	13	13E-34
Driveability	Lack of output power	14	13E-34
	Occurrence of abnormal knocking	15	13E-34
	Abnormal black smoke	16	13E-35
	Abnormal white smoke	17	13E-35
	Hunting during driving	18	13E-35
A/C condenser fan malfunction		19	13E-36

INSPECTION PROCEDURES FOR TROUBLE SYMPTOMS

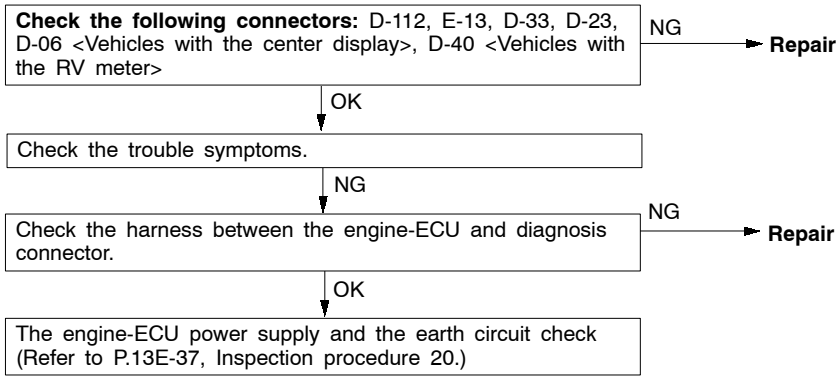
INSPECTION PROCEDURE 1

No communication can be established between MUT-II and all systems.	Probable cause
Probable cause can be found in troubles with the power supply circuit and the earth circuit to the diagnosis connector.	• Diagnosis connector inoperative • Harness inoperative



INSPECTION PROCEDURE 2

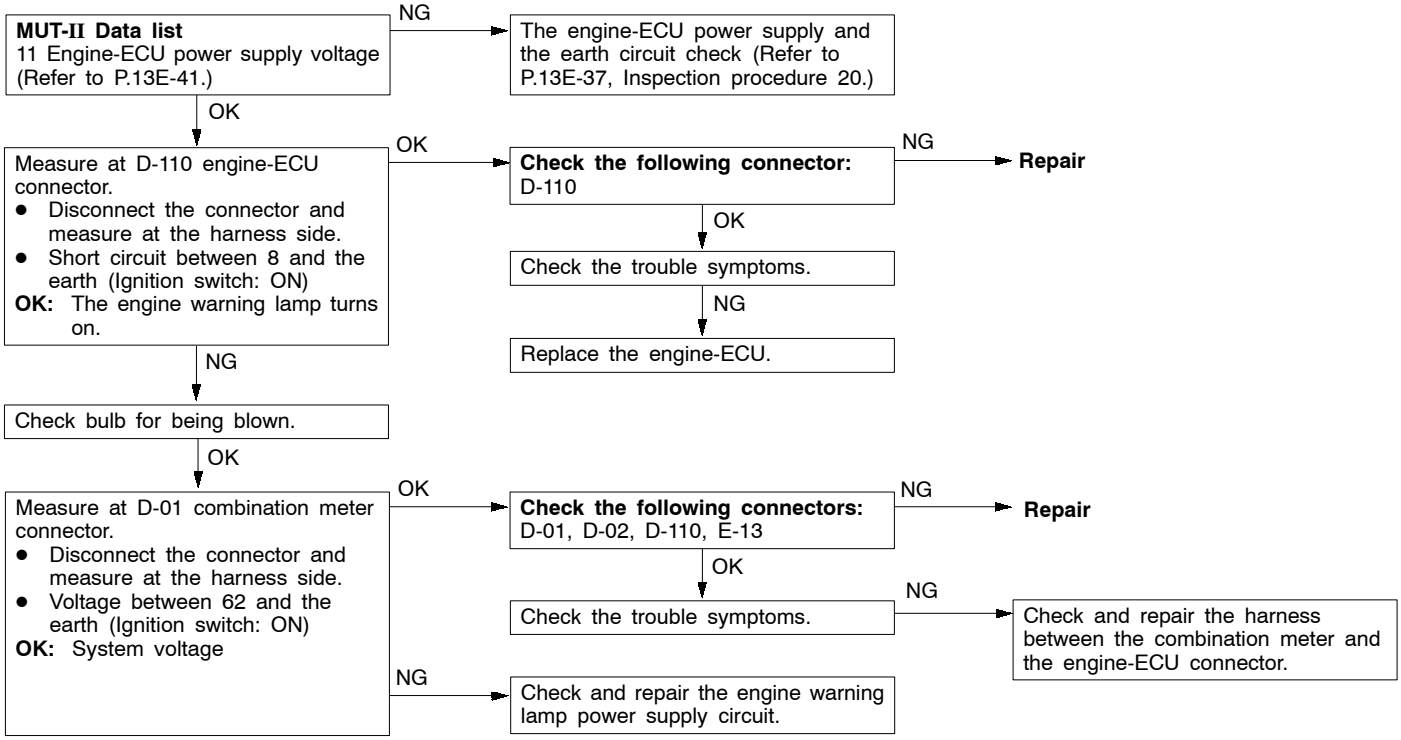
No communication can be established between MUT-II and the engine-ECU.	Probable cause
Probable causes are shown in the following: • The power is not supplied to the engine-ECU. • The earth circuit of the engine-ECU inoperative • The engine-ECU inoperative • Communication between the engine-ECU and MUT-II inoperative	• The power supply circuit of the engine-ECU inoperative • Engine-ECU inoperative • Open circuit at the harness between the engine-ECU and the diagnosis connector



NOTE
If the trouble symptoms persist even after implementing the above - mentioned inspection procedure to the vehicle with center display, check the center display or the RV meter and replace it if necessary. (Refer to GROUP 54A - Clock or Center display.)

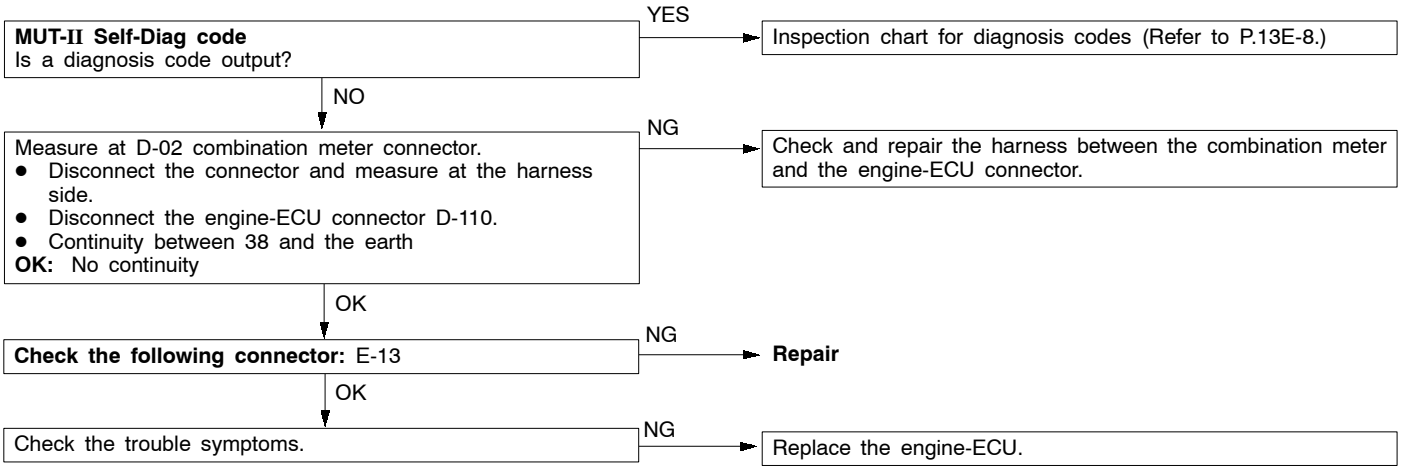
INSPECTION PROCEDURE 3

Immediately after the ignition switch is "ON", the engine warning lamp does not turn on.	Probable cause
The engine-ECU turns on the engine warning lamp for 5 seconds immediately after turning on the ignition switch to check the bulb for being blown. If the engine warning lamp does not turn on immediately after turning the ignition switch ON, problems shown in the right could exist.	• The engine warning lamp blown • The engine warning lamp circuit inoperative • Engine-ECU inoperative



INSPECTION PROCEDURE 4

The engine warning lamp keeps on and does not turn off.	Probable cause
The probable causes can be found in either the engine-ECU detecting the malfunction in the sensor and/or the actuator, or the problem shown in the right takes place.	• Short circuit at the harness between the engine warning lamp and the engine-ECU • Engine-ECU inoperative



INSPECTION PROCEDURE 5

No initial combustion (unable to start)	Probable cause
Probable causes can be found in troubles with control system, injection pump, glow system, and power supply system.	• Control system inoperative • Injection pump inoperative • Intake system inoperative • Glow system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13E-8.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13E-40, 44.)
OK → Check the following items in order:
- Glow plug, glow plug relay
- Battery
- Injection nozzle
- Throttle body assembly
- Injection pump
- Compression pressure
- Existence of mixing foreign objects (water, kerosene) with the fuel

NG ↓
Repair

INSPECTION PROCEDURE 6

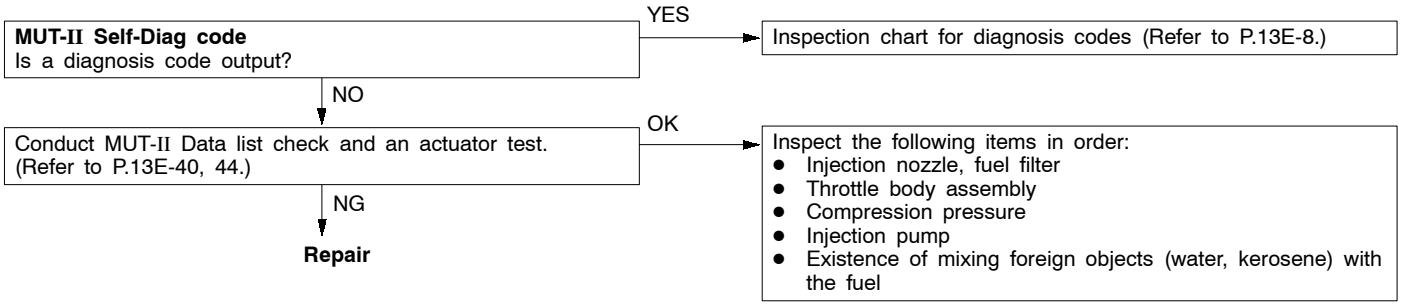
Starting performance is bad when the engine is cold (unable to start)	Probable cause
Probable causes can be found in troubles with control system, injection pump, fuel system, intake system, and glow system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Intake system inoperative • Glow system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13E-8.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13E-40, 44.)
OK → Inspect the following items in order:
- Glow plug, glow plug relay
- Injection nozzle, fuel filter
- Throttle body assembly
- Existence of starter switch signal input
- Engine oil
- Injection pump
- Existence of mixing foreign objects (water, kerosene) with the fuel

NG ↓
Repair

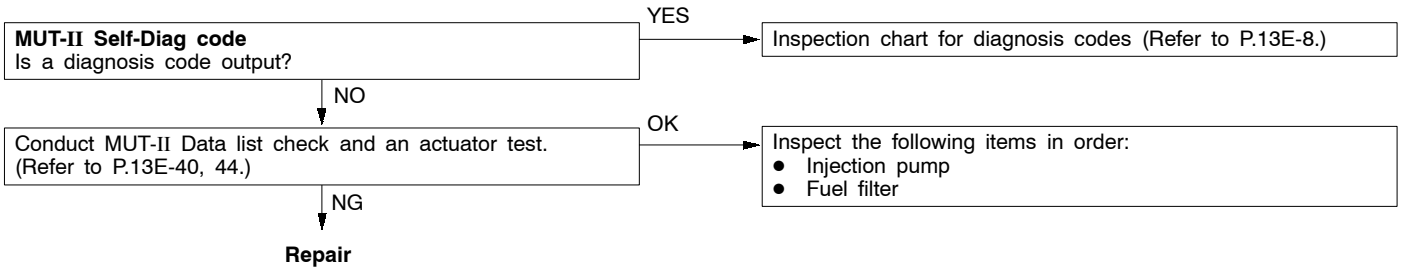
INSPECTION PROCEDURE 7

Starting performance is bad regardless of whether the engine is hot or cold (unable to start)	Probable cause
Probable causes can be found in troubles with control system, injection pump, fuel system, and intake system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Intake system inoperative • Engine-ECU inoperative



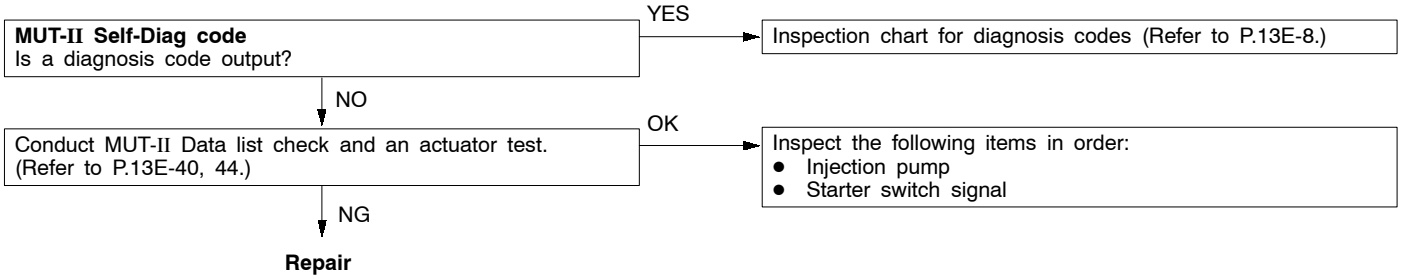
INSPECTION PROCEDURE 8

Low idling speed when the engine is cold (improper idling speed)	Probable cause
Probable causes can be found in troubles with control system, injection pump, and fuel system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Engine-ECU inoperative



INSPECTION PROCEDURE 9

High idling speed (improper idling speed)	Probable cause
Probable causes can be found in troubles with control system and injection pump.	• Control system inoperative • Injection pump inoperative • Engine-ECU inoperative



INSPECTION PROCEDURE 10

Low idling speed (improper idling speed)	Probable cause
Probable causes can be found in troubles with control system, injection pump, and fuel.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13E-8.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13E-40, 44.)
OK → Inspect the following items in order:
- Injection nozzle
- Injection pump

NG ↓
Repair

INSPECTION PROCEDURE 11

Idling instable (rough idling, hunting)	Probable cause
Probable causes can be found in troubles with control system, injection pump, fuel system, glow system, intake system, and EGR system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Intake system inoperative • Glow system inoperative • EGR system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13E-8.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13E-40, 44.)
OK → Inspect the following items in order:
- Glow plug, glow plug relay
- EGR system
- Injection nozzle
- Compression pressure
- Valve clearance
- Throttle body assembly
- Injection timing
- Fuel line bleeding
- Injection pump

NG ↓
Repair

INSPECTION PROCEDURE 12

The engine stalls after running for a while.	Probable cause
Probable causes can be found in troubles with control system, injection pump, fuel system, and intake system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Intake system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13E-8.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13E-40, 44.)
OK → Inspect the following items in order:
- Throttle body assembly
- Fuel filter
- Injection pump

NG ↓
Repair

INSPECTION PROCEDURE 13

The engine stalls during idling.	Probable cause
Probable causes can be found in troubles with control system, injection pump, intake system, EGR system, and power supply.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Intake system inoperative • EGR system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13E-8.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13E-40, 44.)
OK → Inspect the following items in order:
- Power supply system
- Throttle body assembly
- EGR system
- Injection pump

NG ↓
Repair

INSPECTION PROCEDURE 14

Lack of output power	Probable cause
Probable causes can be found in troubles with control system, injection pump, fuel system, intake system, and EGR system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Intake system inoperative • EGR system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13E-8.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13E-40, 44.)
OK → Inspect the following items in order:
- Injection nozzle, fuel filter
- Throttle body assembly
- EGR system
- Turbocharger
- Compression pressure
- Injection timing
- Injection pump
- Existence of mixing foreign objects (water, kerosene) with the fuel

NG ↓
Repair

INSPECTION PROCEDURE 15

Occurrence of abnormal knocking	Probable cause
Probable causes can be found in troubles with control system, injection pump, fuel system, and EGR system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • EGR system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13E-8.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13E-40, 44.)
OK → Inspect the following items in order:
- Injection nozzle
- Injection timing
- EGR system
- Injection pump

NG ↓
Repair

INSPECTION PROCEDURE 16

Abnormal black smoke	Probable cause
Probable causes can be found in troubles with control system, injection pump, fuel system, intake system, and EGR system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Intake system inoperative • EGR system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13E-8.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13E-40, 44.)
OK → Inspect the following items in order:
- Air cleaner
- Injection nozzle
- Throttle body assembly
- EGR system
- Turbocharger
- Injection pump

NG ↓
Repair

INSPECTION PROCEDURE 17

Abnormal white smoke	Probable cause
Probable causes can be found in troubles with control system, injection pump, fuel system, intake system, EGR system, and glow system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Intake system inoperative • EGR system inoperative • Glow system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13E-8.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13E-40, 44.)
OK → Inspect the following items in order:
- Glow plug, glow plug relay
- Injection nozzle
- Throttle body assembly
- EGR system
- Turbocharger
- Injection pump

NG ↓
Repair

INSPECTION PROCEDURE 18

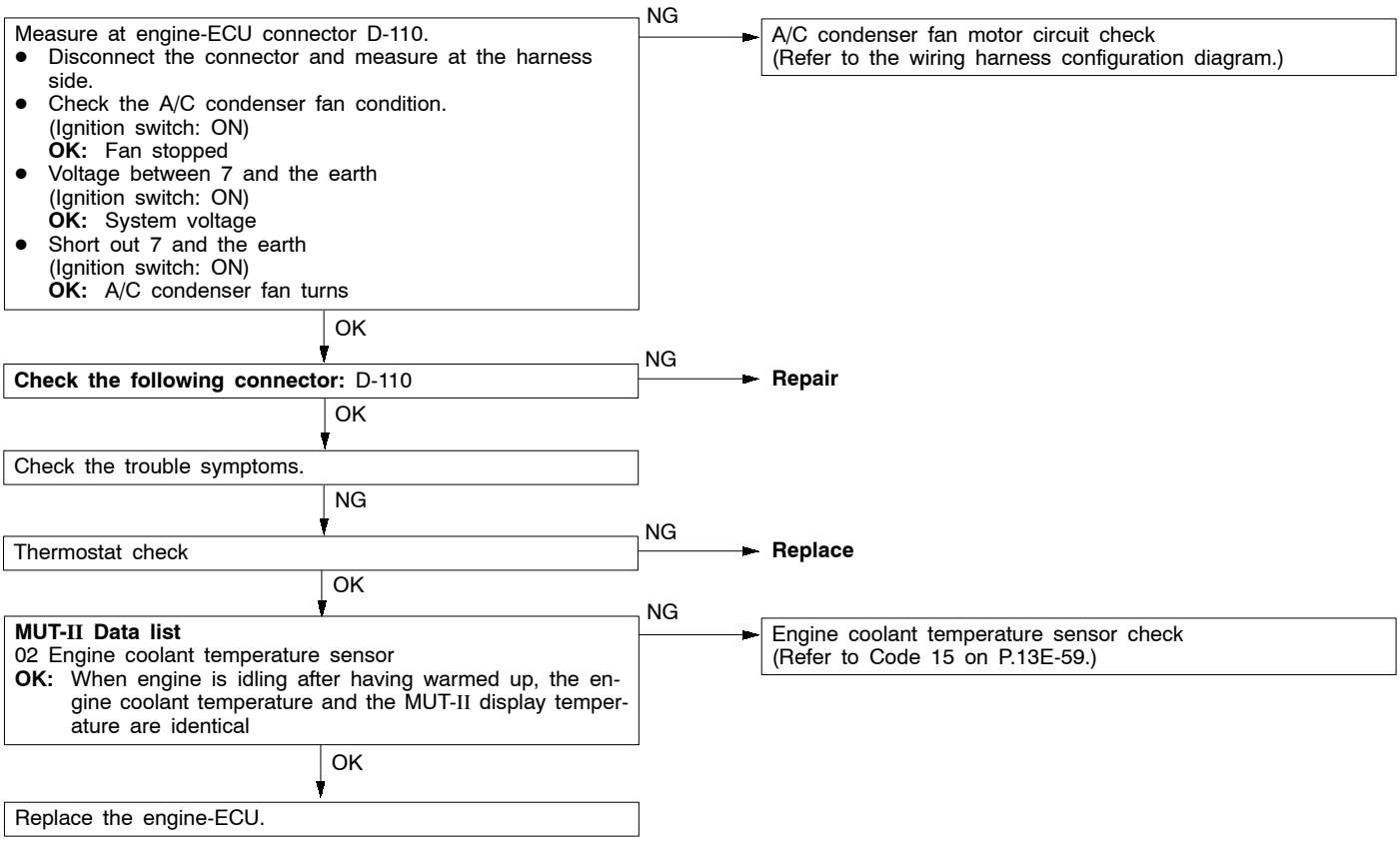
Hunting during driving	Probable cause
Probable causes can be found in troubles with control system, injection pump, and fuel system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13E-8.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13E-40, 44.)
OK → Inspect the following items in order:
- Injection nozzle
- Injection pump

NG ↓
Repair

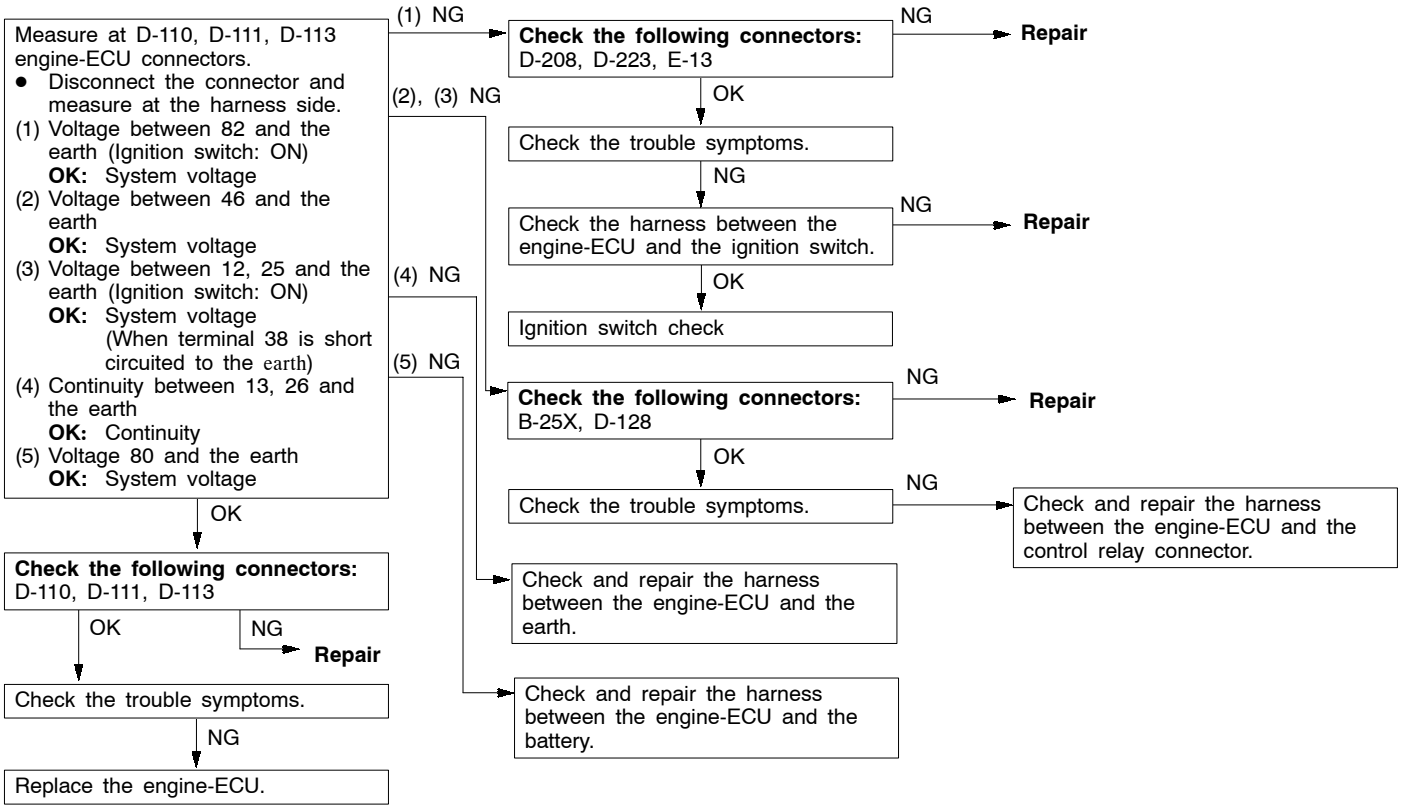
INSPECTION PROCEDURE 19

A/C condenser fan operating problem	Probable cause
The power transistor inside the engine-ECU turns on and off to control the A/C condenser fan motor relay.	• Malfunction of A/C condenser fan motor relay • Malfunction of A/C condenser fan motor • Malfunction of thermostat • Open circuit or short-circuit in circuit, or poor connector contact • Malfunction of engine-ECU



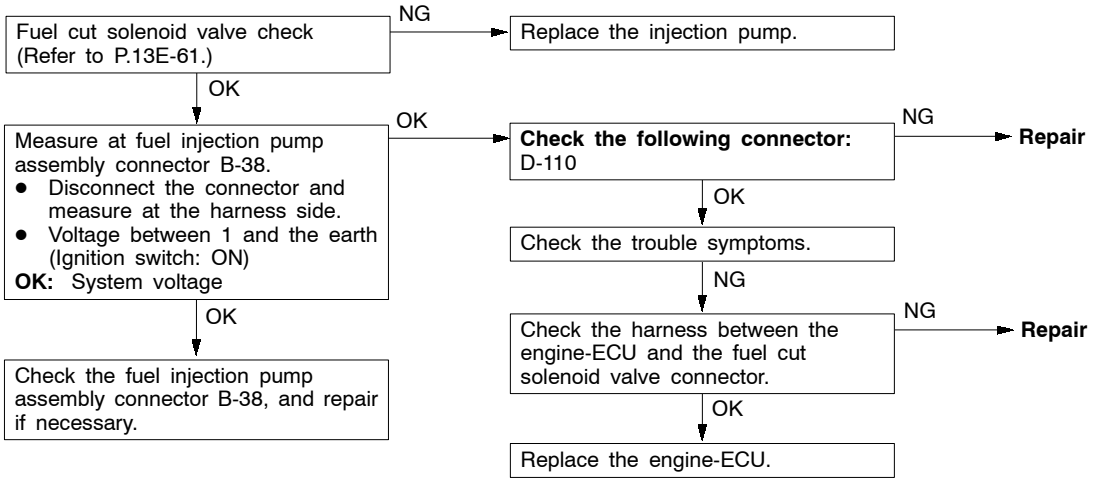
INSPECTION PROCEDURE 20

Engine-ECU power supply and earth circuit check



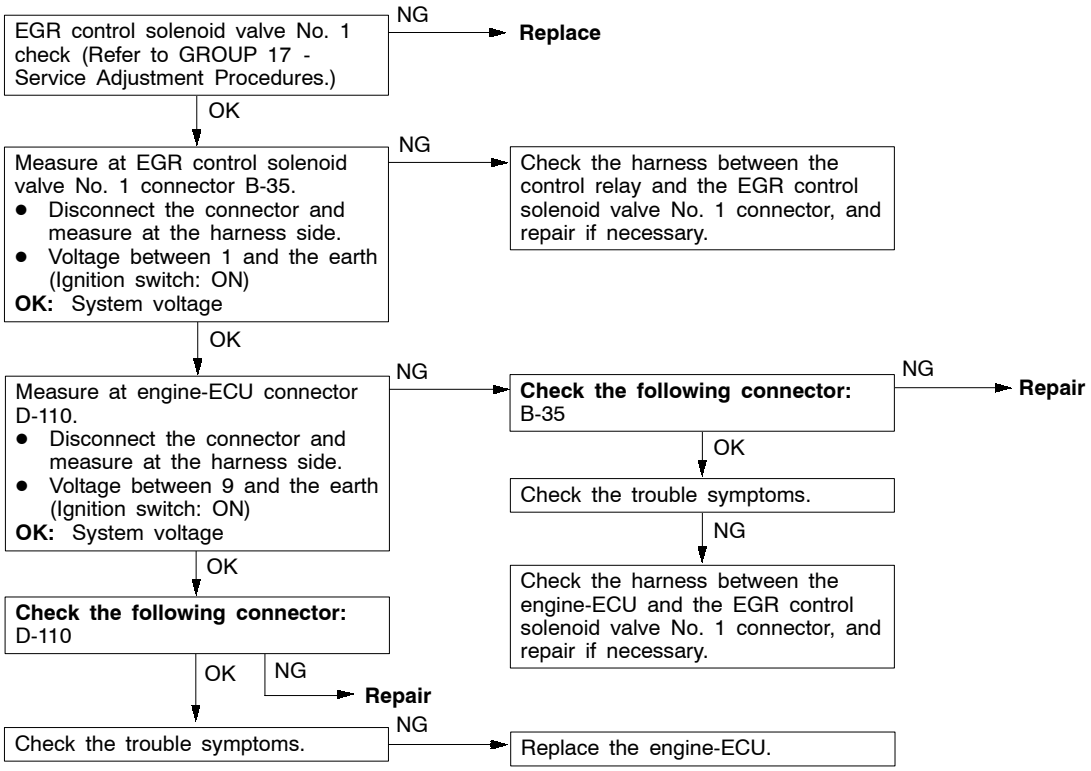
INSPECTION PROCEDURE 21

Fuel cut solenoid valve circuit inspection



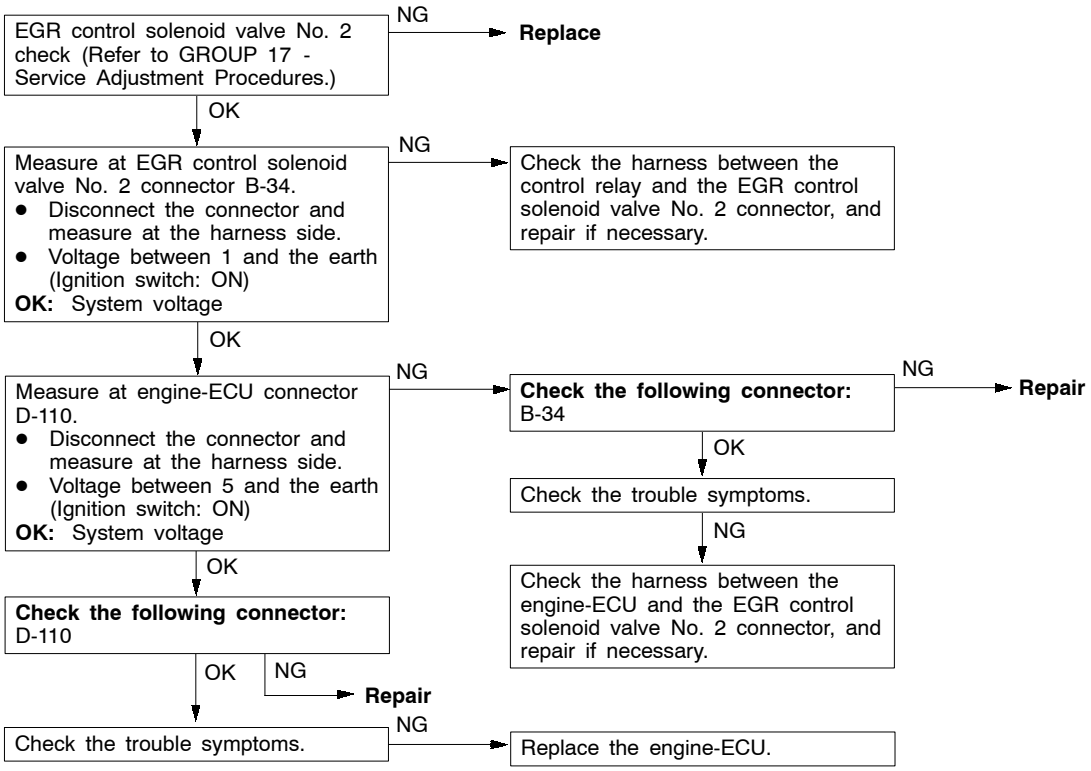
INSPECTION PROCEDURE 22

EGR control solenoid valve No. 1 circuit inspection



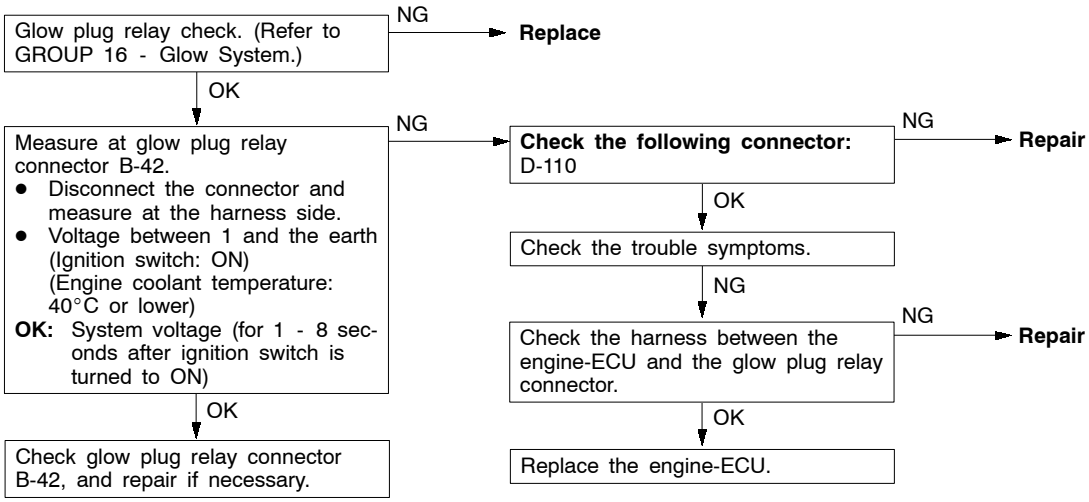
INSPECTION PROCEDURE 23

EGR control solenoid valve No. 2 circuit inspection



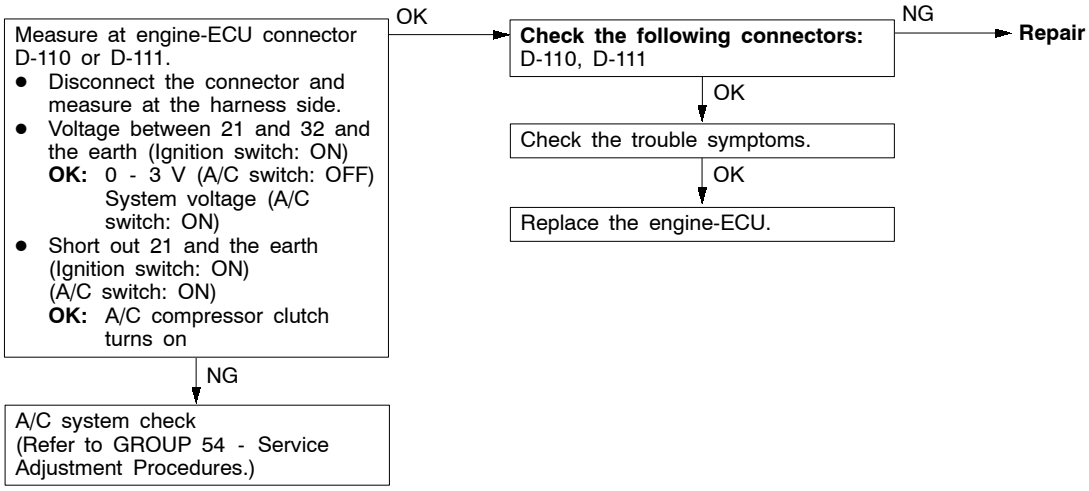
INSPECTION PROCEDURE 24

Glow plug relay inspection



INSPECTION PROCEDURE 25

A/C switch and A/C relay inspection



DATA LIST REFERENCE TABLE

Item No.	Check item	Inspection conditions		Value to be determined as normal	Code No. or inspection procedure No.	Reference page
01	Boost air temperature sensor	Ignition switch: ON or the engine running	When the intake air temperature is -20°C	-20°C	Code No. 16	13E-12
			When the intake air temperature is 0°C	0°C		
			When the intake air temperature is 20°C	20°C		
			When the intake air temperature is 40°C	40°C		
			When the intake air temperature is 80°C	80°C		
02	Engine coolant temperature sensor	Ignition switch: ON or the engine running	When the engine coolant temperature is -20°C	-20°C	Code No. 15	13E-12
			When the engine coolant temperature is 0°C	0°C		
			When the engine coolant temperature is 20°C	20°C		
			When the engine coolant temperature is 40°C	40°C		
			When the engine coolant temperature is 80°C	80°C		
03	Barometric pressure sensor	Ignition switch: ON	Altitude 0 m	101 kPa	Code No. 13	13E-11
			Altitude 600 m	95 kPa		
			Altitude 1,200 m	88 kPa		
			Altitude 1,800 m	81 kPa		
04	Boost pressure sensor	● Engine coolant temperature: 80 - 95°C ● Lamps, electrical cooling fan, and accessories: OFF ● Transmission: Neutral ● Ignition switch: ON	Altitude 0 m	101 kPa	Code No. 12	13E-10
			Altitude 600 m	95 kPa		
			Altitude 1,200 m	88 kPa		
			Altitude 1,800 m	81 kPa		
			Idling	81 - 109 kPa		
			When sudden racing is done	Increased		
05	Fuel temperature sensor	Ignition switch: ON or the engine running	When the fuel temperature is -20°C	-20°C	Code No. 14	13E-11
			When the fuel temperature is 0°C	0°C		
			When the fuel temperature is 20°C	20°C		
			When the fuel temperature is 40°C	40°C		
			When the fuel temperature is 80°C	80°C		

Item No.	Check item	Inspection conditions		Value to be determined as normal	Code No. or inspection procedure No.	Reference page
06	Vehicle speed sensor	When driving	Compare the engine speed displayed in the speed meter with that in MUT-II	Matched	Code No. 17	13E-13
07	Pump speed sensor	Engine: Cranking	Compare the engine speed displayed in the tachometer with that in MUT-II	Matched	Code No. 18	13E-14
		Engine: Idling				
08	Crank angle sensor	Engine: Cranking	Compare the engine speed displayed in the tachometer with that in MUT-II	Matched	Code No. 21	13E-15
		Engine: Idling				
09	Accelerator pedal position sensor (main)	Ignition switch: ON	Accelerator pedal: Idling position	1,015 - 1,055 mV	Code No. 11	13E-9
			Accelerator pedal: Fully opened position	4,035 - 4,500 mV or higher		
10	Accelerator pedal position sensor (main)	Ignition switch: ON	Accelerator pedal: Idling position	0 %	Code No. 11	13E-9
			Accelerator pedal: Fully opened position	99 - 100 %		
11	System voltage	Ignition switch: ON		System voltage	Procedure No. 20	13E-37
13	Timing control valve*1	Engine: After warming up the engine	Idling	70 - 90 %	Code No. 25 or No. 43	13E-17 13E-21
			When engine is suddenly raced	Changes		
14	EGR command value	Engine: After warming up the engine	Idling	0 - 100 %*2	–	-
			When engine is suddenly raced	Momentarily decreases		
17	Control sleeve position (target value)	Engine: After warming up the engine	Idling	2.1 - 2.5 V	Code No. 26	13E-18
			2,500 r/min (no load)	1.8 - 2.2 V		
18	Actual injection timing	Engine: After warming up the engine	Idling	0.7 - 1.2 V	–	–
			When engine is suddenly raced	Increases		
19	Injection timing command value	Engine: After warming up the engine	Idling	0.7 - 1.2 V	–	–
			When engine is suddenly raced	Increases		
21	GE actuator	Engine: After warming up the engine	Idling	0 %	Code No. 26 or No. 48	13E-18 13E-23
			2,500 r/min	18 - 38 %		
23	Control sleeve position (actual value)	Engine: After warming up the engine	Idling	2.1 - 2.5 V	Code No. 26	13E-18
			2,500 r/min (no load)	1.8 - 2.2 V		
24	Accelerator pedal position sensor (sub)	Ignition switch: ON	Accelerator pedal: Idling position	1,015 - 1,055 mV	Code No. 27	13E-19
			Accelerator pedal: Fully opened position	4,035 - 4,500 mV or higher		

Item No.	Check item	Inspection conditions		Value to be determined as normal	Code No. or inspection procedure No.	Reference page
25	Accelerator pedal position sensor (sub)	Ignition switch: ON	Accelerator pedal: Idling position	0 %	Code No. 27	13E-19
			Accelerator pedal: Fully opened position	99 - 100 %		
31	EGR valve position sensor (target value)	Engine: After warming up the engine	Idling under no load	2.3 - 3.3 V	Code No. 51	13E-25
			Engine is suddenly raced	Momentarily decreases (0.3 - 0.7 V)		
32	EGR valve position sensor (actual value)	Engine: After warming up the engine	Idling under no load	2.3 - 3.3 V	Code No. 51	13E-25
			Engine is suddenly raced	Momentarily decreases (0.3 - 0.7 V)		
33	Variable geometry control pressure sensor	Engine: After warming up the engine	Idling	53 - 59 kPa	Code No. 52	13E-26
			Engine is suddenly raced	Momentarily increases		

NOTE
*1: The opening degree of the timing control valve is converted into percentage. (0 %: timer non-advanced angle, 100 %: timer maximum advanced angle)
*2: The opening degree of the EGR solenoid valve is converted into percentage.

Item No.	Check item	Inspection conditions		Value to be determined as normal	Code No. or inspection procedure No.	Reference page
41	Idle switch	Ignition switch: ON (check by repeated accelerator operation)	Release the foot from the accelerator pedal.	ON	Code No. 23	13E-16
			Step on the accelerator pedal slightly.	OFF		
43	A/C switch	Engine: Idling (The A/C compressor should be in operation when the A/C switch is "ON")	A/C switch: ON	ON	Procedure No. 25	13E-39
			A/C switch: OFF	OFF		
44	Ignition switch-ST	Ignition switch: ON	Engine: Stop	OFF	–	–
			Engine: Cranking	ON		
45	Ignition switch-IG	Ignition switch: ON		ON	–	–
46	Control relay	Ignition switch: ON		ON	–	–
47	A/C relay	Engine: Idling after warming up the engine	A/C switch: OFF	OFF (A/C compressor clutch not in operation)	Procedure No. 25	13E-39
			A/C switch: ON	ON (A/C compressor clutch in operation)		

Item No.	Check item	Inspection conditions		Value to be determined as normal	Code No. or inspection procedure No.	Reference page
50	Condenser fan relay	Ignition switch: ON	A/C switch: OFF (engine coolant temperature at 102°C or higher)	ON	Procedure No. 19	13E-36
			A/C switch: ON (engine coolant temperature at 102°C or higher, or outside temperature at 15°C or higher)			
	Condenser fan relay	Ignition switch: ON	A/C switch: OFF (engine coolant temperature at 95°C or lower)	OFF		
			A/C switch: ON (engine coolant temperature at 95°C or lower, or outside temperature at 15°C or lower)			
52	Glow plug relay	• Ignition switch: ON • Select actuator test item No. 02.	Relay not driven	OFF	Procedure No. 24	13E-39
			Relay is forcibly driven	ON		
53	Throttle solenoid valve	Ignition switch: ON (Engine stops)		OFF	Code No. 41	13E-20
		Engine: main sensor or actuator is failed		ON		
55	Engine warning lamp	• Ignition switch: ON • Select actuator test item No. 16.	Engine warning lamp off	OFF	Procedure No. 3	13E-30
			Engine warning lamp is forced on	ON		
56	Glow lamp	• Ignition switch: ON • Select actuator test item No. 15.	Glow lamp off	OFF	–	–
			Glow lamp is forced on	ON		
60	Fuel cut relay	• Ignition switch: ON • Select actuator test item No. 27.	Relay not driven	OFF	Procedure No. 21	13E-37
			Relay is forcibly driven	ON		
62	AT/MT switch	Ignition switch: ON	Vehicles with M/T	M/T	–	–
73	EGR control solenoid valve No. 1	Engine: After warming up the engine	Idling under no load (stable condition)	OFF	Procedure No. 22	13E-38
			Engine is suddenly raced (EGR amount decreasing)	OFF		
			Engine is suddenly raced (EGR amount increasing)	ON (momentarily)		
74	EGR control solenoid valve No. 2	Engine: After warming up the engine	Idling (stable condition)	ON	Procedure No. 23	13E-38
			When engine is suddenly raced (EGR amount decreasing)	OFF (momentarily)		
			When engine is suddenly raced (EGR amount increasing)	ON		

ACTUATOR TEST TABLE

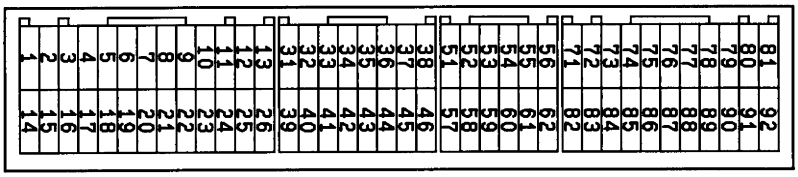
Item No.	Check item	Drive Contents	Inspection conditions	Value to be determined as normal	Code No. or inspection procedure No.	Reference page
02	Glow plug relay	Turning the relay from OFF to ON or from ON to OFF	Ignition switch: ON	Battery charge is energized to the glow plug when the glow plug relay is ON.	Procedure No. 24	13E-39
03	A/C compressor relay	Turning the relay from OFF to ON or from ON to OFF	Ignition switch: ON	The A/C compressor clutch makes an audible sound.	Procedure No. 25	13E-39
11	Timing control valve	Turn the timing control valve to ON	• Ignition switch: ON • Engine: Idling • Timer piston position sensor: Normal	Makes an audible sound	Code No. 43	13E-21
12		Turn the timing control valve to OFF				
15	Glow lamp	Turn the glow lamp on or off	Ignition switch: ON	The glow lamp turns on.	–	–
16	Warning lamp	Turn the warning lamp on or off	Ignition switch: ON	The warning lamp turns on.	Procedure No. 3, 4	13E-30
22	Condenser fan relay	Turning the relay from OFF to ON or from ON to OFF	Ignition switch: ON	The condenser fan rotates.	Procedure No. 19	13E-36
23	Throttle solenoid valve	Turn the solenoid valve from OFF to ON or from ON to OFF	• Ignition switch: ON • Vehicle speed: 0 km/h • Engine speed: 1,000 r/min or lower	Makes an audible sound	Code No. 41	13E-20
25	GE actuator	Turn the GE actuator to ON	• Ignition switch: ON • Engine speed: 0 r/min or lower • Control sleeve position sensor: Normal	Measure the wave pattern between engine-ECU connector terminals No. 1 and No. 15 using an analyzer and check the change in the duty ratio.	Code No. 48	13E-23
26		Turn the GE actuator to OFF				

Item No.	Check item	Drive Contents	Inspection conditions	Value to be determined as normal	Code No. or inspection procedure No.	Reference page
27	Fuel cut solenoid valve	Turn the solenoid valve from OFF to ON or from ON to OFF.	• Ignition switch: ON • Vehicle speed: 0 km/h	Makes an audible sound	–	–
34	Middle position of GE actuator	Hold the injection governor in its middle position.	• Ignition switch: ON	When the crankshaft is turned clockwise during the adjustment of the injection timing, the injection pipes spray out fuel.	Code No. 48	13E-23
35	Variable geometry solenoid valve	Turn the solenoid valve to ON	Ignition switch: ON	Makes an audible sound	Code No. 49	13E-24
36		Turn the solenoid valve to OFF	Engine: Idling	Operating sound and vibration, which accompany with the duty activation, cease.		
37	EGR control solenoid valve No. 1	Turn the solenoid valve from OFF to ON from ON to OFF	Ignition switch: ON	Makes an audible sound	Procedure No. 22	13E-38
38	EGR control solenoid valve No. 2	Turn the solenoid valve from OFF to ON from ON to OFF	Ignition switch: ON	Makes an audible sound	Procedure No. 23	13E-38

CHECK AT THE ENGINE-ECU TERMINALS

TERMINAL VOLTAGE CHECK CHART

Engine-ECU Connector Terminal Arrangement



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Terminal No.	Check item	Inspection conditions (engine status)		Normal condition:
1	GE actuator	Ignition switch: ON (Engine stops)		9 V or higher
2	Fuel cut solenoid valve	Other than below		0 - 1 V
		Engine: Idling → Stop (in about 1 - 3 second)		System voltage (for 3 - 5 seconds)
3	Timing control valve	Ignition switch: ON (Engine stops)		11 V or higher
4	Glow lamp	Ignition switch: OFF → ON		0 - 1 V (In few seconds) → System voltage
5	EGR control solenoid valve No. 2	Engine: Idling after warming up the engine (stable condition)		System voltage
		When any one of the following conditions is satisfied: ● Engine speed: 3,700 r/min or higher ● Engine speed: 450 r/min or lower ● Vehicle speed: 176 km/h or higher ● The accelerator pedal is fully depressed ● The accelerator pedal is released when engine speed is 2,700 r/min or higher and vehicle speed is 140 km/h or higher ● Engine coolant temperature: 112°C or higher		System voltage
7	Condenser fan relay	Condenser fan in operation		0 - 1 V
8	Engine warning lamp	Ignition switch: OFF → ON		0 -1 V (In few seconds) → System voltage
9	EGR control solenoid valve No. 1	Ignition switch: ON		System voltage
		Engine: After warming up the engine, conduct sudden racing from idling.		Very briefly rises from voltage during idling
12	Power supply	Ignition switch: ON		System voltage
25				
14	Throttle solenoid valve	Ignition switch: ON (Engine stops)		System voltage
		Engine: Idling after warming up the engine.		0 - 1 V
15	GE actuator power supply	Ignition switch: ON		System voltage
16	Glow plug relay	● Engine coolant temperature: 40°C or lower ● Ignition switch: OFF → ON		System voltage (In about 8 seconds: at 20°C) → 0 - 1 V
17	Variable geometry solenoid valve	Engine: After warming up the engine	Engine is idling	4.4 - 10.1 V
			Engine is suddenly raced	Voltage rises

Terminal No.	Check item	Inspection conditions (engine status)		Normal condition:
21	A/C relay	A/C switch: OFF → ON		System voltage → 0 - 1 V
31	Idle switch	Ignition switch: ON	Release the foot from the accelerator pedal.	0 - 1 V
			Step on the accelerator pedal slightly	3 V or higher
32	A/C switch	A/C in operation (compressor in operation)		System voltage
36	Selector switch between A/T and M/T	Ignition switch: ON		System voltage (M/T)
46	Control relay	Ignition switch: ON		0 - 1 V
		Ignition switch: ON → OFF (in about 8 seconds)		System voltage
51	Pump speed sensor	Engine: Idling (Use a digital voltage meter to check.)		0 V ↔ 5 V (repeat the change)
55	Accelerator pedal position sensor (sub)	Ignition switch: ON	Accelerator pedal: Idling position	0.9 - 1.1 V
			Accelerator pedal: Fully opened position	3.7 V or higher
60	Sensor power supply	Ignition switch: ON		4.6 - 5.4 V
71	Ignition switch-ST	Engine: Cranking		8 V or higher
80	Back-up power supply	Ignition switch: OFF		System voltage
81	Power supply to accelerator pedal position sensor (main)	Ignition switch: ON		4.6 - 5.4 V
82	Ignition switch-IG	Ignition switch: ON		System voltage
83	Engine coolant temperature sensor	Ignition switch: ON	Engine coolant temperature: 0°C	3.7 - 4.3 V
			Engine coolant temperature: 20°C	2.8 - 3.4 V
			Engine coolant temperature: 40°C	1.9 - 2.5 V
			Engine coolant temperature: 80°C	0.6 - 1.2 V
84	Accelerator pedal position sensor (main)	Ignition switch: ON	Accelerator pedal: Idling position	0.9 - 1.1 V
			Accelerator pedal: Fully opened position	3.7 V or higher
85	Boost pressure sensor	Ignition switch: ON (101 kPa)		1.0 - 1.4 V
86	Vehicle speed sensor	• Ignition switch: ON • Move the vehicle forward slowly		0 V ↔ 8 - 12 V (repeat the change)
87	Fuel temperature sensor	Ignition switch: ON	Fuel temperature: 0°C	3.2 - 3.6 V
			Fuel temperature: 20°C	2.3 - 2.7 V
			Fuel temperature: 40°C	1.5 - 1.9 V
			Fuel temperature: 80°C	0.4 - 0.8 V

Terminal No.	Check item	Inspection conditions (engine status)		Normal condition:
88	Boost 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	1.4 - 2.0 V
			Intake air temperature: 80°C	0.4 - 1.0 V
89	Crank angle sensor	Engine: Idling (Use a digital voltage meter to check.)		0 V ⇔ 5 V (repeat the change)
90	EGR valve position sensor	Engine: After warming up the engine	Idling under no load	2.3 - 3.3 V
			Engine is suddenly raced	Momentarily drops from voltage during idling
91	Parking switch	Ignition switch: ON (Engine stops)	Parking brake: ON	0 - 1 V
			Parking brake: OFF	System voltage

CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

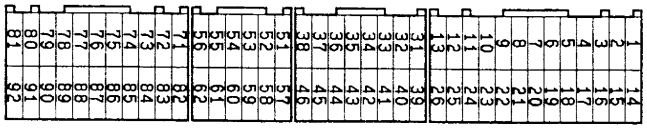
1. Turn the ignition switch to LOCK (OFF) position.
2. Disconnect the engine-ECU connector.
3. Measure the resistance and check for continuity between the terminals of the engine-ECU harness-side connector while referring to the check chart.

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

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

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

Engine-ECU Harness Side Connector Terminal Arrangement



9FU0392

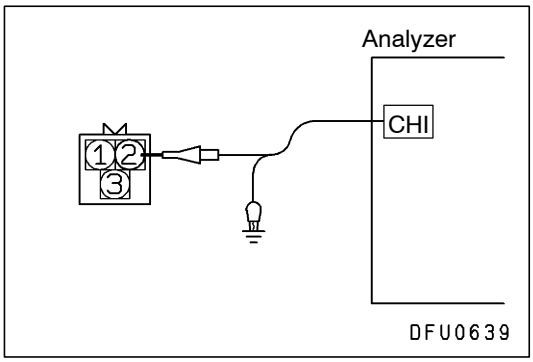
Terminal No.	Inspection item	Normal condition (Check condition)
1 - 15	GE actuator	0.64 - 0.72 Ω
2 - Body earth	Fuel cut solenoid valve	6.8 - 9.2 Ω
3 - 12	Timing control valve	10.8 - 11.2 Ω
5 - 12	EGR control solenoid valve No. 2	36 - 44 Ω (at 20°C)
9 - 12	EGR control solenoid valve No. 1	36 - 44 Ω (at 20°C)
13 - Body earth	Engine-ECU earth	Continuity (0 Ω)
26 - Body earth		
14 - 12	Throttle solenoid valve	29 - 35 Ω (at 20°C)
31 - 61	Idle switch	Continuity (Replace the foot from the accelerator pedal)
		No continuity (when accelerator pedal is fully depressed)
51 - 61	Pump speed sensor	1.36 - 1.84 kΩ
73 - 74	Control sleeve position sensor	5.6 - 6.2 Ω
73 - 75		5.6 - 6.2 Ω
74 - 75		11.2 - 12.4 Ω
77 - 78	Timer piston position sensor	160 - 168 Ω
76 - 77		80 - 84 Ω
76 - 78		80 - 84 Ω

Terminal No.	Inspection item	Normal condition (Check condition)
83 - 61	Engine coolant temperature sensor	5.1 - 6.5 kΩ (when the engine coolant temperature is 0°C)
		2.1 - 2.7 kΩ (when the engine coolant temperature is 20°C)
		0.9 - 1.3 kΩ (when the engine coolant temperature is 40°C)
		0.26 - 0.36 kΩ (when the engine coolant temperature is 80°C)
87 - 61	Fuel temperature sensor	5.1 - 6.5 kΩ (when the fuel temperature is 0°C)
		2.1 - 2.7 kΩ (when the fuel temperature is 20°C)
		0.9 - 1.3 kΩ (when the fuel temperature is 40°C)
		0.26 - 0.36 kΩ (when the fuel temperature is 80°C)
88 - 61	Boost air temperature sensor	5.3 - 6.7 kΩ (when the intake air temperature is 0°C)
		2.3 - 3.0 kΩ (when the intake air temperature is 20°C)
		1.0 - 1.5 kΩ (when the intake air temperature is 40°C)
		0.30 - 0.42 kΩ (when the intake air temperature is 80°C)

INSPECTION PROCEDURE USING AN ANALYZER

CRANK ANGLE SENSOR

An analyzer can be used to observe the wave pattern in order to visually check the crankshaft rotation and abnormalities in the sensor output.



Measurement Method

1. Disconnect the crank angle sensor connector and connect the special tool (test harness: MD998478) in between.
2. Connect the analyzer probe to terminal No. 2 of the crank angle sensor connector (black clip of special tool).

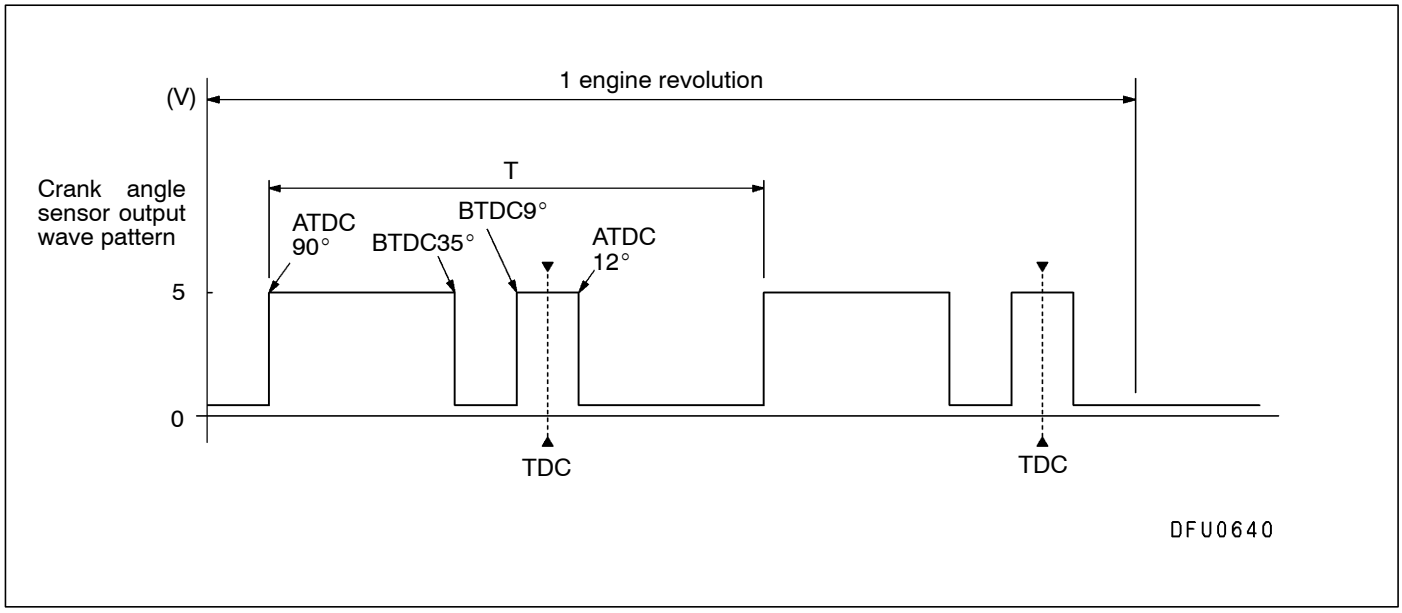
   NOTE
   When measuring at the engine-ECU connector, connect the analyzer probe to terminal No. 89.

Standard Wave Pattern

Observation conditions

	Crank angle sensor
Probe select switch	× 1
TIME/DIV.	10 ms
VOLTS/DIV.	2 V
AC - GND - DC	DC
Other	-
Engine r/min	Idle speed

Standard wave pattern



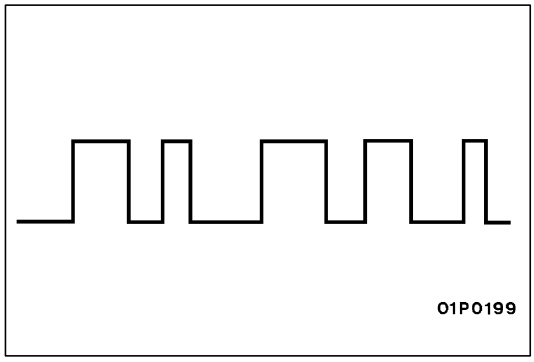
Explanation of Wave Pattern

The crank angle sensor detects the rotation of a sensing plate. Accordingly, the period T (seconds) can be measured and the engine speed can be calculated from the following formula.

$$\text{Engine speed (r/min)} = \frac{2}{4T\ (\text{sec})} \times 60 = \frac{30}{T\ (\text{sec})}$$

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

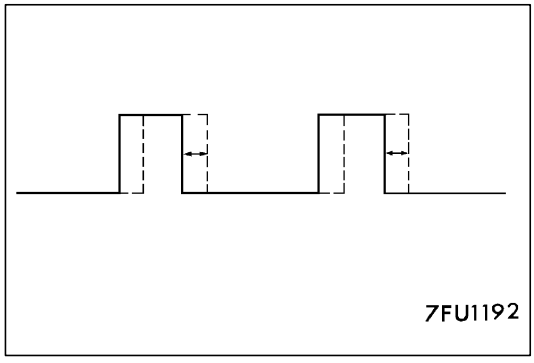
- Example 1

  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

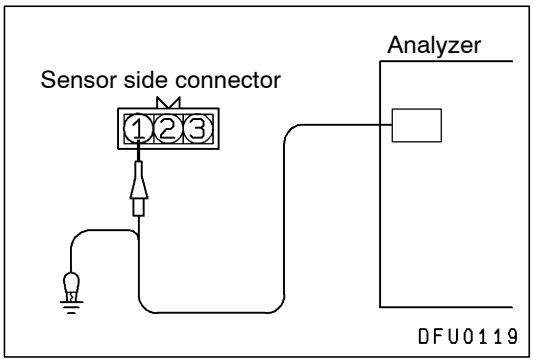
  Abnormality in sensor disk

  Wave pattern characteristics

  Wave pattern is displaced to the left or right.

PUMP SPEED SENSOR

An analyzer can be used to observe the wave pattern in order to visually check the pump shaft rotation and abnormalities in the sensor output.



Measurement Method

1. Disconnect the pump speed sensor connector and connect the special tool (test harness: MD991658) in between. (All terminals should be connected.)
2. Connect the analyzer probe to terminal No. 1 of the pump speed sensor connector (black clip of special tool).

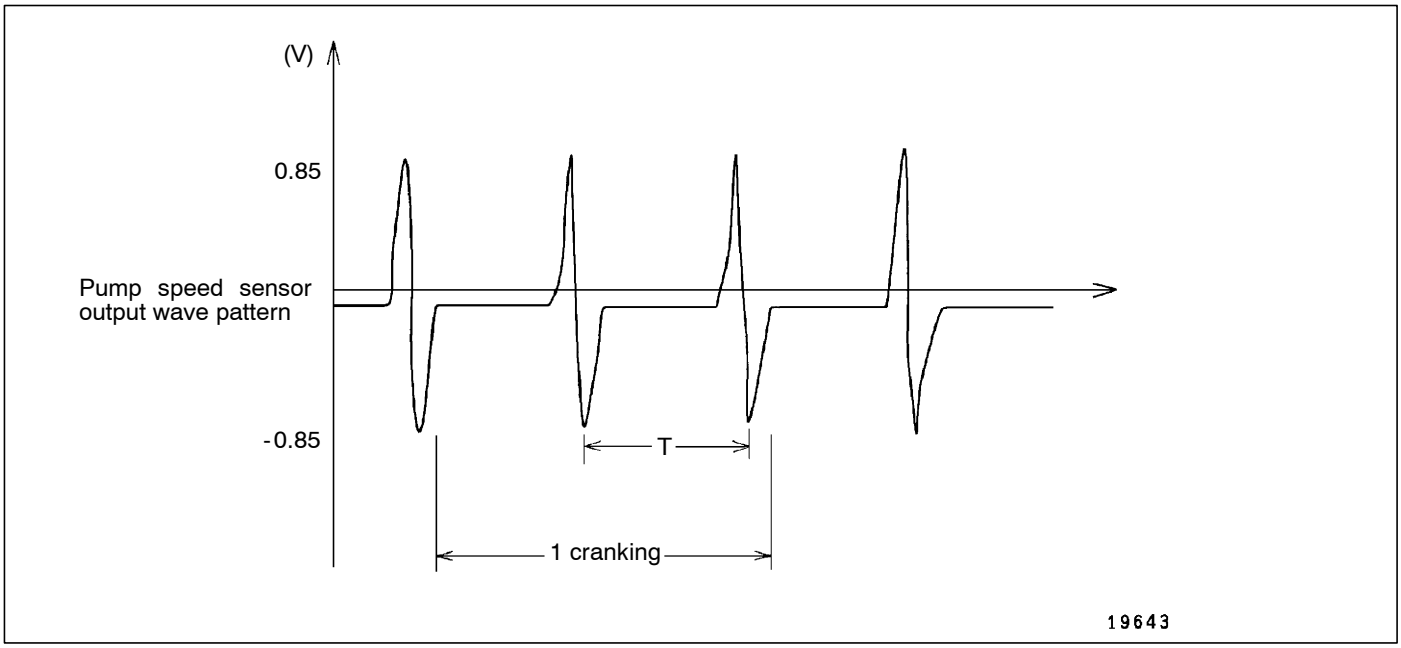
   NOTE
   When measuring at the engine-ECU connector, connect the analyzer probe to terminal No. 51.

Standard Wave Pattern

Observation conditions

	Pump speed sensor
Probe select switch	Set according to the probe.
TIME/DIV.	About 10 msec
VOLTS/DIV.	About 0.5 V
AC - GND - DC	DC
Engine r/min	Idle speed

Standard wave pattern



Explanation of Wave Pattern

The pump speed sensor detects the rotation of the pump shaft. Accordingly, the period T (seconds) can be measured and the engine speed can be calculated from the following formula.

$$\text{Engine speed} = \frac{2}{4 \times T\ (\text{sec})} \times 60$$

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

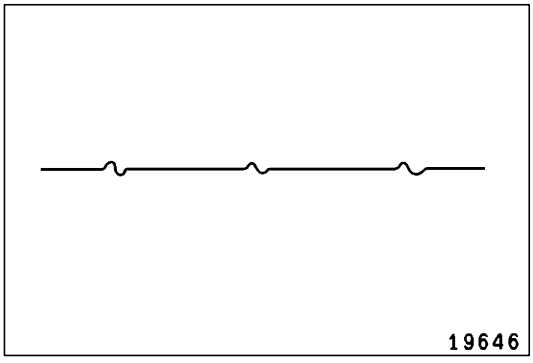
- Example 1

  Cause of problem

  Malfunction or open circuit in sensor

  Wave pattern characteristics

  No signal is output even when engine is started.



- Example 2

  Cause of problem

  Incorrect gap between sensor and sensing gear plate

  Wave pattern characteristics

  No signal is output even when engine is started, or signal amplitude is small.

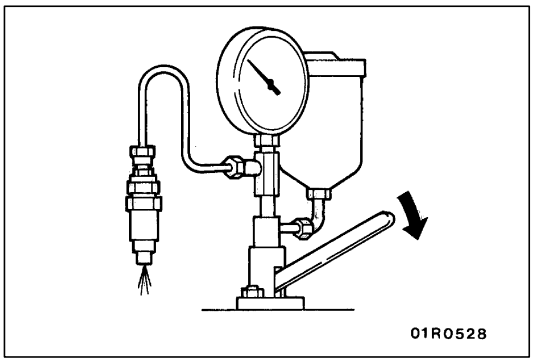
ON-VEHICLE SERVICE

INJECTION TIMING CHECK AND ADJUSTMENT

Refer to GROUP 11B - Engine Adjustment.

IDLE SPEED CHECK AND ADJUSTMENT

Refer to GROUP 11B - Engine Adjustment.



INJECTION NOZZLE CHECK AND ADJUSTMENT

Caution
Never touch the injection spray that is injected from the nozzle.

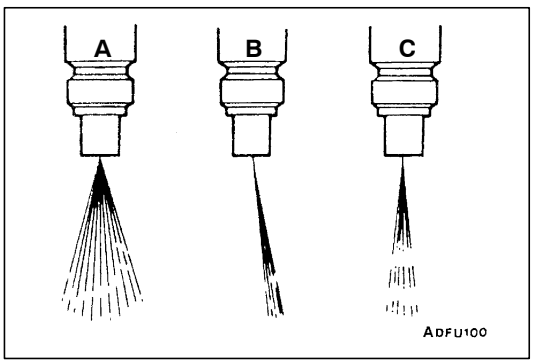
FUEL INJECTION INITIAL PRESSURE CHECK

1. Install the injection nozzle to a nozzle tester.
2. Move the lever of the nozzle tester 2 - 3 times to inject fuel and to bleed the air.
3. Gently press down the lever of the nozzle tester, and take a reading of the indication value on the pressure gauge at the point where the needle slowly rises and then suddenly drops.

   Standard value (Fuel injection initial pressure): 14,710 - 15,490 kPa

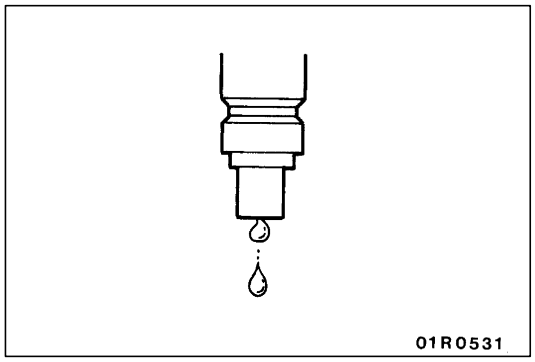
4. If the fuel injection initial pressure is outside the standard value, disassembly the nozzle holder to clean it, and then change the thickness of the shim to adjust the fuel injection initial pressure.

   NOTE
   (1) For disassembly, reassembly and adjustment of the nozzle holder, refer to P.13B-8.
   (2) There are 10 shims for adjustment, with thicknesses in the range of 0.10 - 0.80 mm.
   (3) When the shim thickness is increased by 0.1 mm, the fuel injection initial pressure increases by 2,350 kPa.

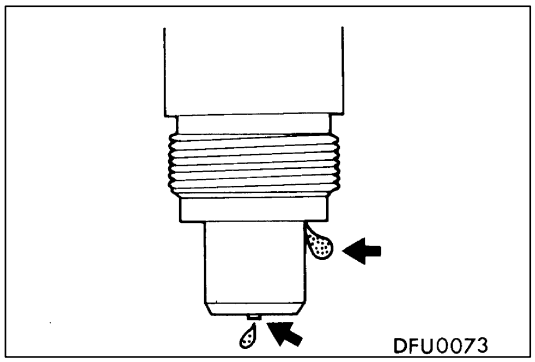


INJECTION SPRAY CONDITION CHECK

1. Move the lever of the nozzle tester rapidly (4 - 6 times per second) to eject the fuel continuously. Check to be sure that the injection spray comes out evenly in a cone shape (injection spray angle is 0°). The injection spray patterns shown in the illustration at left are wrong.
   A. Injection angle is tool large
   B. Bias
   C. Intermittent fuel injection

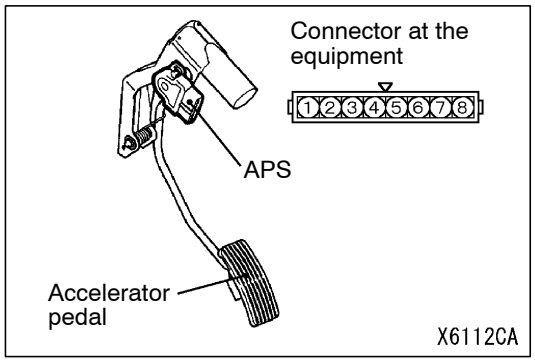


2. Check to be sure that no fuel drips after injection is completed.
3. If there are any drips, disassemble the nozzle, clean it and reinspect, or replace the nozzle.



NOZZLE FUEL-TIGHT CHECK

1. Gently raise the lever of the nozzle tester until the pressure inside the nozzle (value displayed on pressure gauge) becomes 12,750 - 13,730 kPa, and after holding this pressure for approximately 10 seconds, check to be sure that there are no fuel leaks from the nozzle.
2. If there are any leaks, disassemble the injection nozzle, clean it and re-inspect, or replace the nozzle.



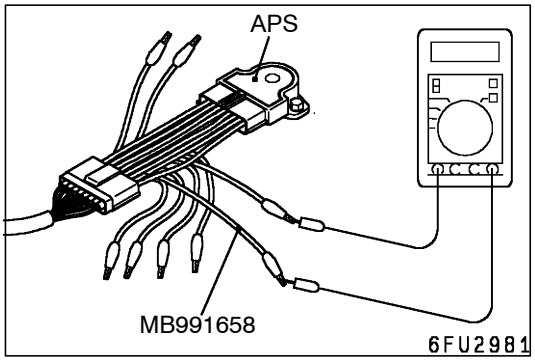
ACCELERATOR PEDAL POSITION SENSOR (APS) ADJUSTMENT

Caution

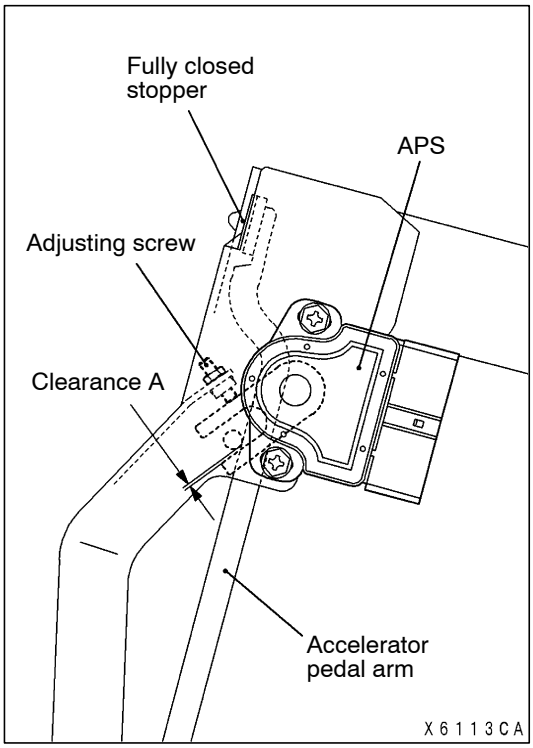
(1) APS is properly adjusted in the factory. Therefore, APS should not be moved carelessly.

(2) If the adjustment is not done correctly, carry out a new adjustment in the following procedure:

1. Remove accelerator pedal complete.



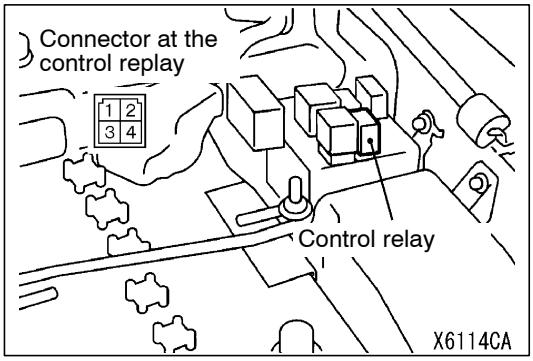
2. Connect MUT-II to the diagnosis connector. If MUT-II is not used, the following operation should be done:
   (1) Disconnect APS connector and connect the special tool (test harness: MB991658) between two connectors.
   (Be careful not to take a wrong terminal No.)
   (2) Connect a digital voltmeter between APS connector terminal No. 3 (APS main output) and terminal No. 1 (APS main earth).
3. Loosen the APS mounting bolt to make it temporarily tightened.



4. Ensure that the accelerator pedal arm contacts the closing stopper.
5. Use the adjusting screw to make the clearance A (shown in the illustration) between 0.5 and 0.93 mm.
6. Secure the adjusting screw with the lock nut.
7. Turn the ignition switch to “ON” position. (Engine does not start.)
8. Turn APS to make APS (main) output the standard value.

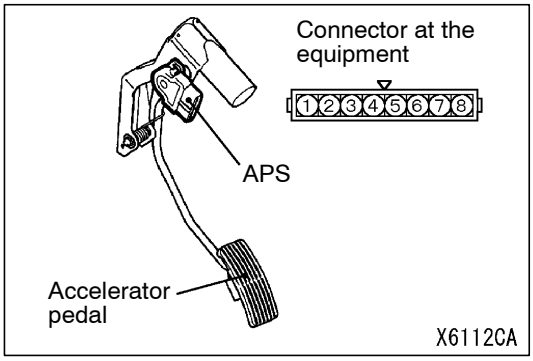
   Standard value: 0.985 - 1.085 V

9. Tighten the APS mounting bolt securely.
10. Install the accelerator pedal complete.



CONTROL RELAY CONTINUITY CHECK

Terminals to be connected	Battery voltage	Normal conation
2 - 4	Not applied	Continuity
1 - 3	Not applied	No continuity
	Connect a positive battery cable to No.2 terminal and a negative battery cable to No.4 terminal, respectively.	Continuity



ACCELERATOR PEDAL POSITION SENSOR (APS) CHECK

1. Disconnect the APS connector.
2. Measure the resistance between APS connector terminal No. 2 [APS main power supply] and the terminal No. 1 [APS main earth] as well as the resistance between terminal No. 8 [APS sub power supply] and terminal No. 7 [APS sub earth].

   Standard value: 3.5 - 6.5 kΩ

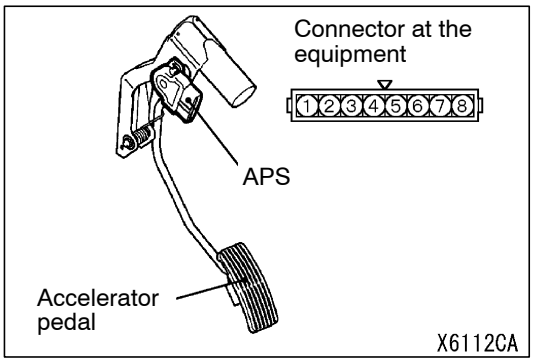
3. Measure the resistance between APS connector terminal No. 2 (APS main power supply) and the terminal No. 3 (APS main output) as well as the resistance between terminal No. 8 (APS sub power supply) and terminal No. 7 (APS sub output).

   Normal condition:

Step on the accelerator pedal slowly.	Resistance smoothly changes in proportion to the travel of the accelerator pedal.

4. If the APS is out of the range of the standard value or the resistance does not change smoothly, replace APS.

   NOTE
   Make an adjustment on APS after replacement. (Refer to P.13E-56.)



IDLE SWITCH CHECK

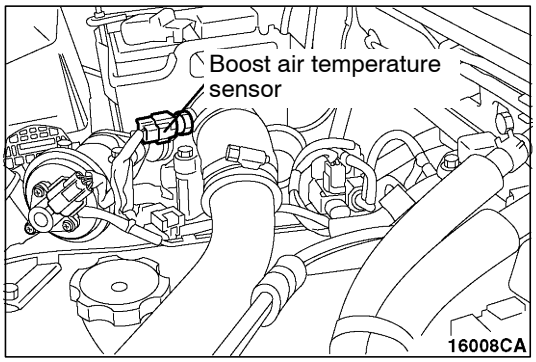
1. Disconnect the accelerator pedal position sensor (APS) connector.
2. Check the continuity between the idle switch connector terminal No. 4 (idle switch) and terminal No. 5 (earth).

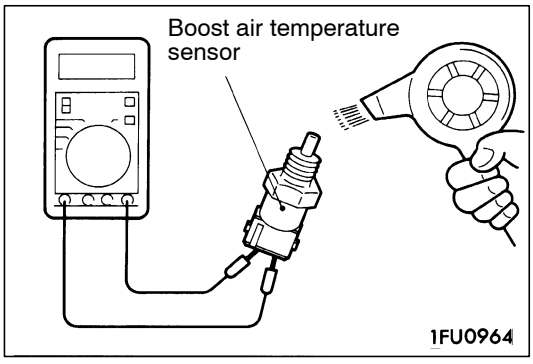
   Normal condition:

Accelerator pedal	Continuity
Step on	None
Release	Yes

3. Replace APS if it is inoperative.

   NOTE
   Make an adjustment on APS after replacement. (Refer to P.13E-56.)





BOOST AIR TEMPERATURE SENSOR (INTAKE AIR TEMPERATURE SENSOR) CHECK

1. Remove the boost air temperature sensor.
2. Measure the resistance at the boost air temperature sensor connector terminal.

   Standard value:
   2.3 - 3.0 kΩ (at 20°C)
   0.30 - 0.42 kΩ (at 80°C)

3. Measure the resistance at the sensor part being warmed up by a hair dryer.

   Normal condition:

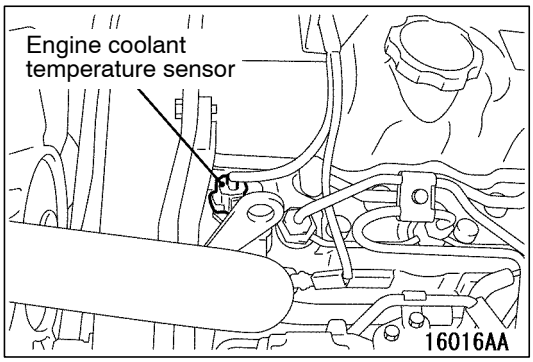
Temperature (°C)	Resistance value (kΩ)
Rising	Become smaller

4. If the resistance is not within the range of the standard value or does not change at all, replace the boost air temperature sensor.

NOTE
Replace the gasket as well.

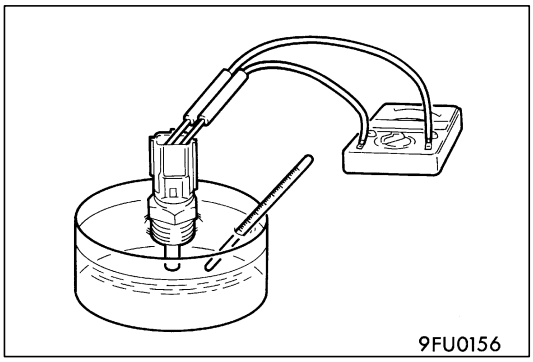
5. Tighten the boost air temperature sensor to the specified torque.

Tightening torque: 14 ± 1 N·m



ENGINE COOLANT TEMPERATURE SENSOR CHECK

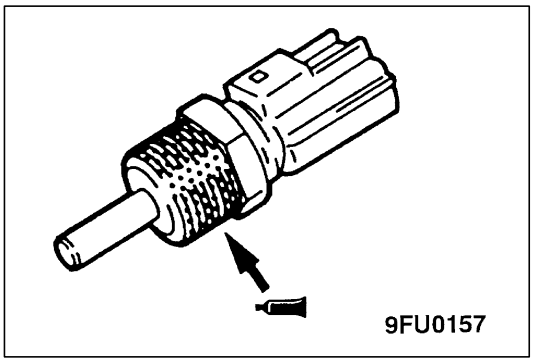
1. Remove the engine coolant temperature sensor.



2. Measure the resistance between the terminals of the connectors while immersing the sensor part of the engine coolant temperature sensor in the hot water.

Standard value:
2.1 - 2.7 kΩ (at 20°C)
0.26 - 0.36 kΩ (at 80°C)

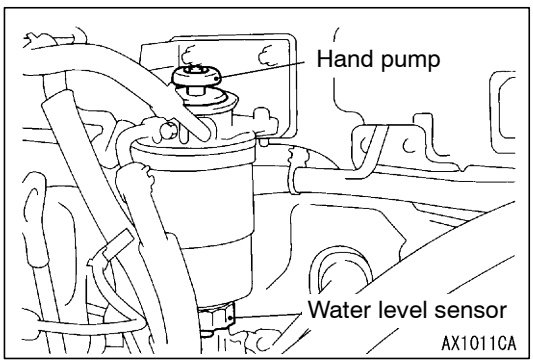
3. If the resistance is not within the range of the standard value, replace the engine coolant temperature sensor.



4. Apply the sealant to the thread of the engine coolant temperature sensor and tighten it to the specified torque.

Sealant:
3M Nut Locking Part No. 4171 or equivalent

Tightening torque: 36 ± 6 N·m



EVACUATION OF WATER FROM FUEL FILTER

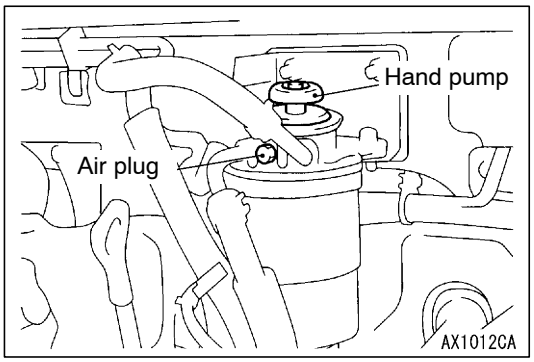
Water is in the filter when fuel filter warning lamp illuminates. Evacuate water by the following procedure.

1. Loosen the water level sensor.
2. After water is evacuated by using a hand pump, tighten the water level sensor to the specified torque.

Tightening torque: 2.5 ± 0.5 N·m

FUEL FILTER CARTRIDGE REPLACEMENT

Refer to GROUP 13D of the 2001 PAJERO Workshop Manual {Pub. No. PWJE0001 (1/2)}



EVACUATION OF AIR FROM FUEL LINE

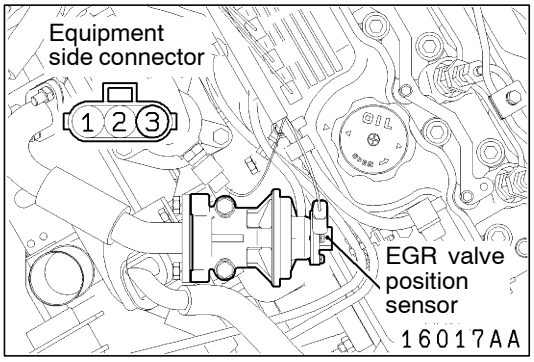
When the following service work(s) is done, refill the fuel tank and then evacuate air from the fuel line.

- Fuel hose is removed
- Fuel filter is replaced
- Fuel injection nozzle is removed
- If necessary for access, fuel is drained from the fuel tank.

1. Loosen the fuel filter air plug.
2. Cover the circumference of the air plug hole with cloth and use a manual pump repeatedly until no bubbles come out of the plug hole, then tighten the air plug to the specified torque.

   Tightening torque: 6.0 ± 1.0 N·m

3. Repeat until the hand pump operation becomes stiff.



EGR VALVE POSITION SENSOR CHECK

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

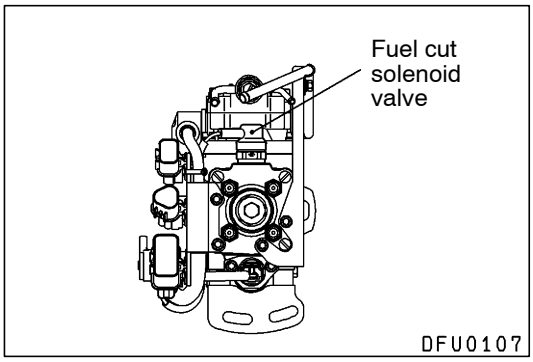
   Standard value: 3.5 - 6.5 kΩ

3. Install a hand vacuum pump to the EGR valve nipple.
4. Measure the resistance between the EGR valve position sensor-side connector terminal No. 1 and terminal No. 3 when a negative pressure is applied.

   Normal condition:

Slowly increase the negative pressure to 60 kPa.	Changes smoothly in proportion to the negative pressure

5. If the resistance is outside the standard value, or if it doesn't change smoothly, replace the EGR valve position sensor.

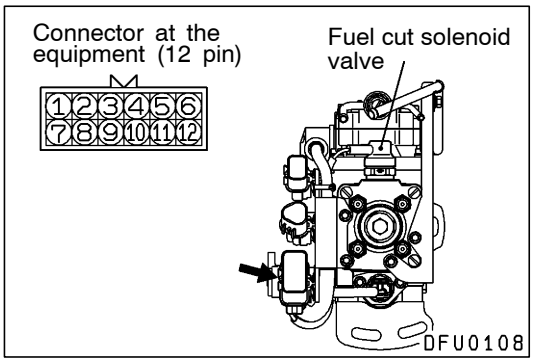


FUEL INJECTION PUMP CHECK

FUEL CUT SOLENOID VALVE CHECK

Operation noise check

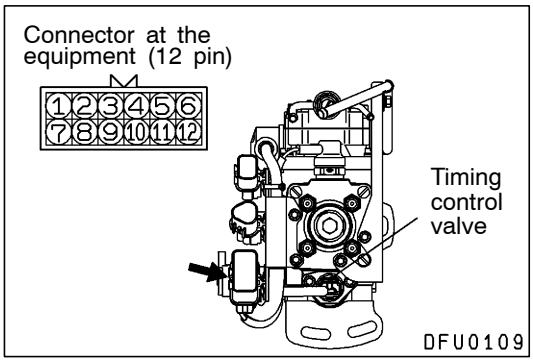
1. Attach the sound scope to the fuel cut solenoid valve to check for running noise when the ignition switch is "ON" position.



Coil resistance check

1. Disconnect the injection pump connector (12 pin).
2. Measure the resistance between terminal No. 1 (fuel cut solenoid valve) and the injection pump body.

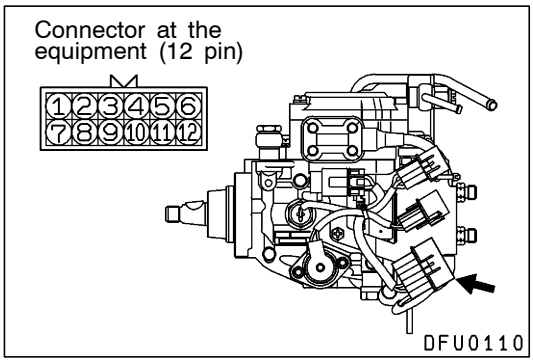
   Standard value: 6.8 - 9.2 Ω



TIMING CONTROL VALVE CHECK

1. Disconnect the injection pump connector (12 pin).
2. Measure the resistance between terminal No. 5 and terminal No. 9.

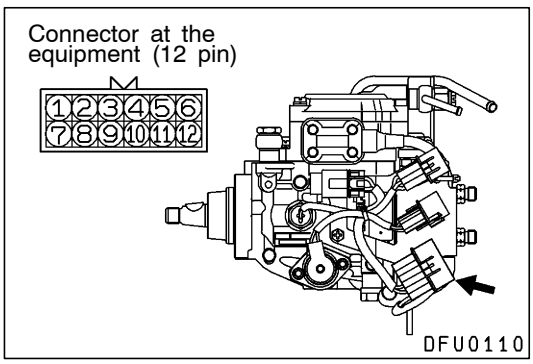
   Standard value: 10.8 - 11.2 Ω



GE ACTUATOR (ELECTRONIC GOVERNOR) CHECK

1. Disconnect the injection pump connector (12 pin).
2. Measure the resistance between terminal No. 6 and terminal No. 10.

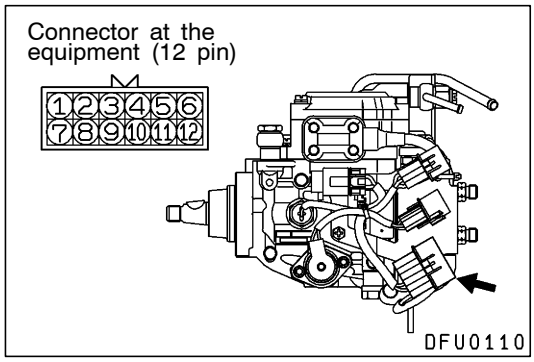
   Standard value: 0.64 - 0.72 Ω



FUEL TEMPERATURE SENSOR CHECK

1. Disconnect the injection pump connector (12 pin).
2. Measure the resistance between terminal No. 7 and terminal No. 11.

   Standard value: 1.4 - 2.6 kΩ

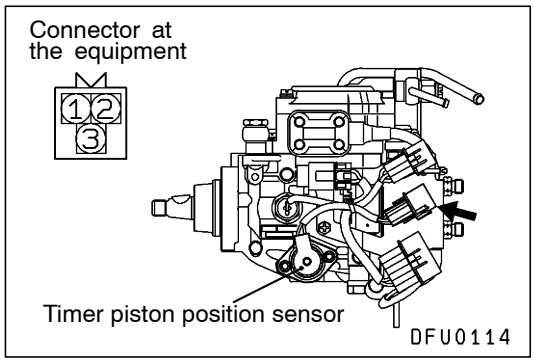


CONTROL SLEEVE POSITION SENSOR CHECK

1. Disconnect the injection pump connector (12 pin).
2. Measure the resistance between the following terminals.

Standard value:

Terminal No. 4 - Terminal No. 12	11.2 - 12.4 Ω
Terminal No. 4 - Terminal No. 8	5.6 - 6.2 Ω
Terminal No. 8 - Terminal No. 12	5.6 - 6.2 Ω

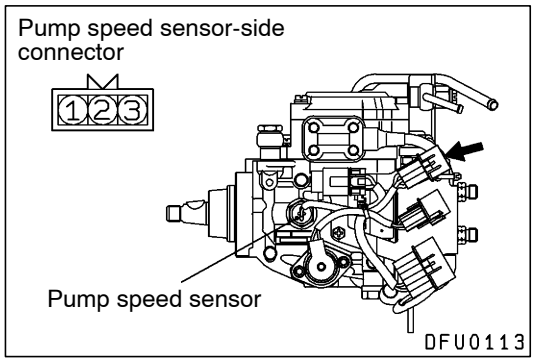


TIMER PISTON POSITION SENSOR CHECK

1. Disconnect the timer piston position sensor connector.
2. Measure the resistance between the following terminals.

Standard value:

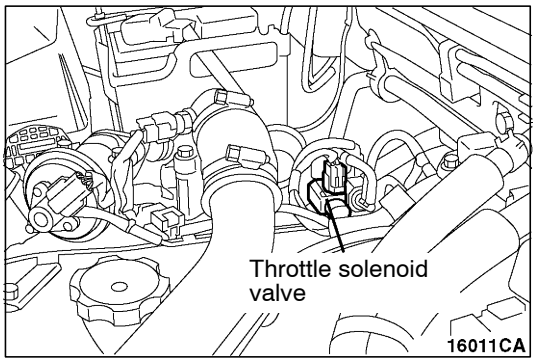
Terminal No. 1 - Terminal No. 2	160 - 168 Ω
Terminal No. 1 - Terminal No. 3	80 - 84 Ω
Terminal No. 2 - Terminal No. 3	80 - 84 Ω



PUMP SPEED SENSOR CHECK

1. Disconnect the pump speed sensor connector.
2. Measure the resistance between terminals No. 1 and No. 2.

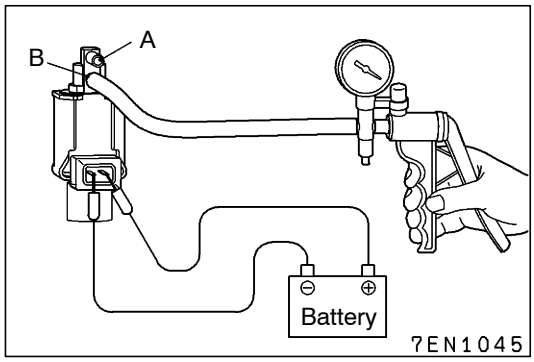
Standard value: 1.36 - 1.84 kΩ



THROTTLE SOLENOID VALVE CHECK

INSPECTION PROCEDURE

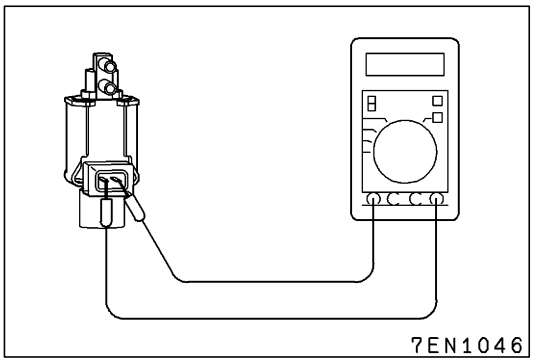
1. Disconnect the vacuum hose (black and yellow stripe) from the solenoid valve.
2. Disconnect the harness connector.



3. Install a hand vacuum pump to solenoid valve nipple B.
4. Use jumper leads to connect the solenoid valve terminals and the battery terminals.
5. Disconnect the jumper lead from the battery (-) terminal, and then apply negative pressure to check the air-tightness.

Standard value:

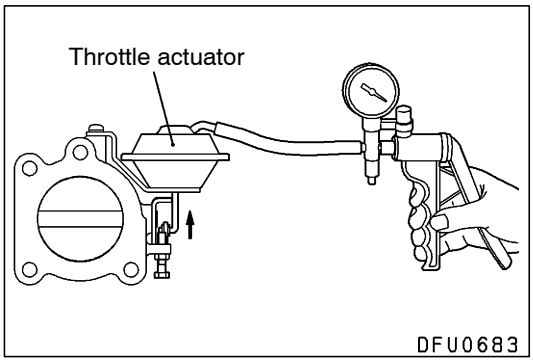
Jumper lead	Nipple A	Normal condition
Connected	Open	Negative pressure leaks
	Closed	Negative pressure maintained
Disconnected	Open	Negative pressure maintained



COIL RESISTANCE CHECK

1. Measure the resistance between the solenoid valve terminals.

   Standard value: 29 - 35 Ω (at 20°C)



THROTTLE ACTUATOR CHECK

1. Remove the vacuum hose (yellow stripe) from the throttle actuator and connect a hand vacuum pump to the throttle actuator nipple.
2. Check that the actuator rod moves smoothly when applying vacuum gradually.
   Also, check that the vacuum is maintained when applying 53 kPa of vacuum.

VARIABLE GEOMETRY SOLENOID VALVE CHECK

Refer to GROUP 15 - On-vehicle Service.

EGR CONTROL SOLENOID VALVE CHECK

Refer to GROUP 17 - Emission Control System <4D5-step III>.

FUEL INJECTION NOZZLE

REMOVAL AND INSTALLATION

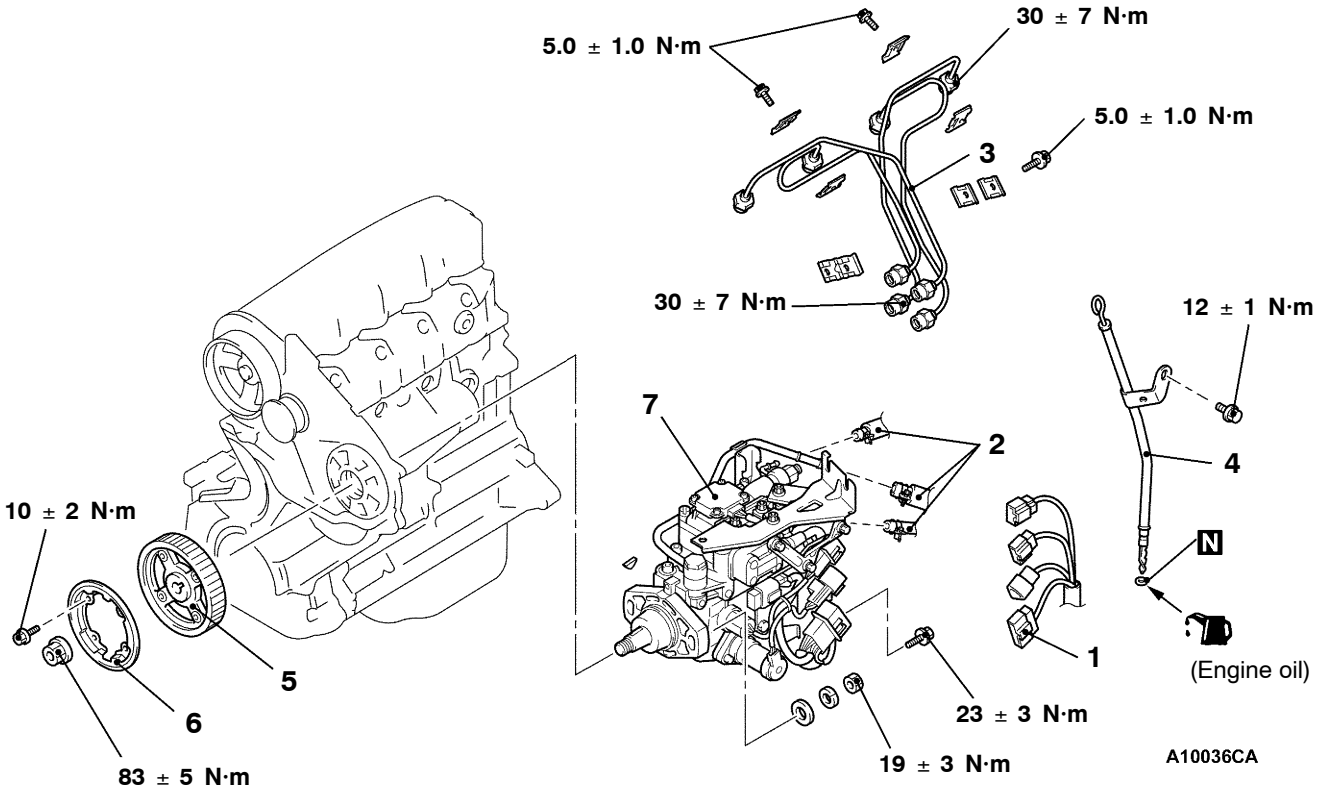
Refer to GROUP 13C of the 2001 PAJERO Workshop Manual {Pub. No. PWJE0001 (1/2)}

FUEL INJECTION PUMP

REMOVAL AND INSTALLATION

Pre-removal Operation
- Engine Coolant Draining.
- Battery and Battery Tray Removal
- Timing Belt Removal (Refer to GROUP 11B.)
- Air Pipe Removal (Refer to GROUP 15 - Intake and Exhaust Manifold, Turbocharger <4D5>.)

Post-installation Operation
- Air Pipe Installation (Refer to GROUP 15 - Intake and Exhaust Manifold, Turbocharger <4D5>.)
- Timing Belt Installation (Refer to GROUP 11B.)
- Battery and Battery Tray Installation
- Engine Coolant Supplying.
- Injection Timing Adjustment (Refer to GROUP 11B - On-vehicle Service.)



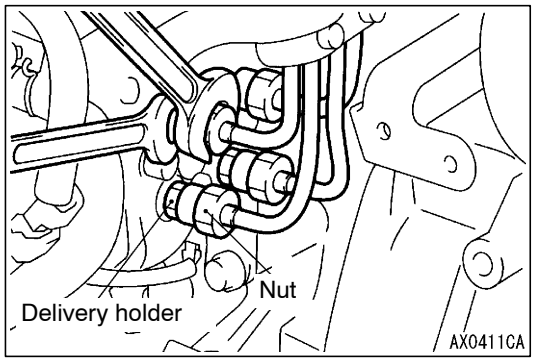
Removal steps

1. Fuel injection pump connector
2. Fuel hoses connection

◀A▶ 3. Fuel injection pipe

4. Engine oil level gauge guide and oil level gauge assembly

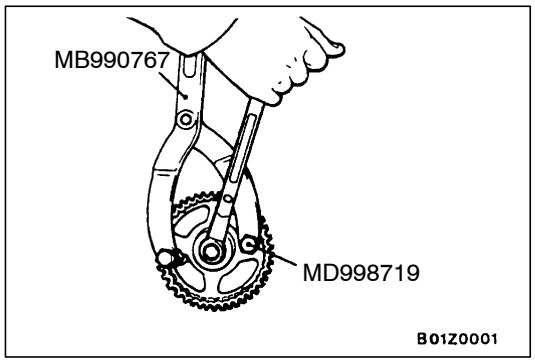
◀B▶ 5. Fuel injection pump sprocket
6. Flange
7. Fuel injection pump



REMOVAL SERVICE POINTS

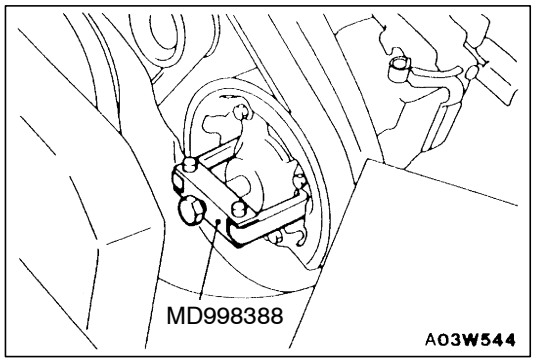
◀A▶ INJECTION PIPE REMOVAL

Loosen the nuts at the end of the injection pipe with the delivery holder (for pump side) and injection nozzle assembly (for nozzle side) retained by a spanner, etc.



◀B▶ FUEL INJECTION PUMP SPROCKET REMOVAL

1. Use the special tool to stop the fuel injection pump sprocket from turning, and remove the fuel injection pump sprocket mounting bolt.



2. Use the special tool to remove the fuel injection pump sprocket.

Caution

(1) Do not hit pump drive shaft with hammer, etc.

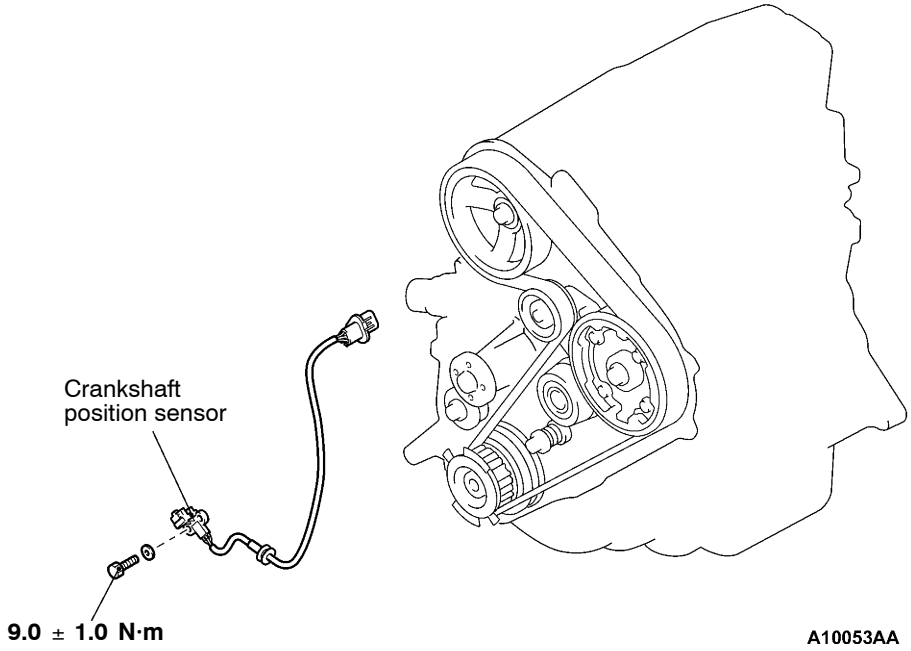
(2) When holding injection pump, do not allow to dangle by holding accelerator lever or fast idle lever.

Do not remove these levers. Removal will cause injection pump malfunction.

CRANKSHAFT POSITION SENSOR

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Timing Belt Cover Removal and Installation (Refer to GROUP 11B.)



ENGINE-ECU

REMOVAL AND INSTALLATION

Removal and installation is the same as for 6G7 engine or 4M4 engine. Refer to GROUP 13A or 13C of the 2001 PAJERO Workshop Manual {Pub. No. PWJE0001 (1/2)}

ENGINE COOLING

Click on the applicable bookmark to selected the required model year.

ENGINE COOLING

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WATER HOSE AND WATER PIPE 15

RADIATOR 20

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 drive belt from the crankshaft.
The radiator is the corrugated fin, down flow type.

Items			Specifications
Radiator	Performance kJ/h	6G7	203,023
		4D5, 4M4	232,326

SERVICE SPECIFICATIONS

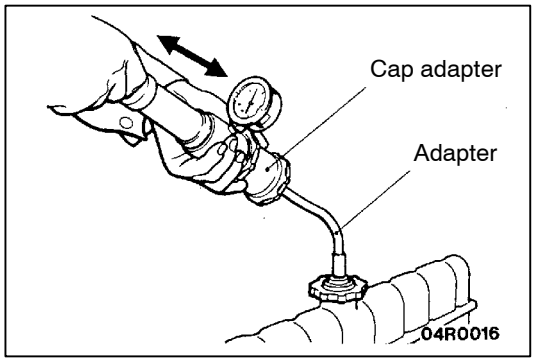
Items			Standard value	Limit
High pressure valve opening pressure of radiator cap kPa			74 - 103	64
Range of coolant antifreeze concentration of radiator %			30 - 60	-
Thermostat	Valve opening temperature of thermostat °C	6G7	88 ± 2.0	-
		4D5	82 ± 1.5	-
		4M4	76.5 ± 2.0	-
	Full-opening temperature of thermostat °C	6G7	100	-
		4D5	95	-
		4M4	90	-
	Valve lift mm	6G7	10 or more	-
		4D5, 4M4	8.5 or more	-

LUBRICANT

Item	Applicable model	Amount (including condense tank) L
MITSUBISHI GENUINE COOLANT or equivalent	Vehicles without rear heater	9.0
	Vehicles with rear heater	10.5

SEALANT

Items	Specified sealant	Remarks
Cylinder block drain plug	3M Nut Locking Part No. 4171 or equivalent	Drying sealant



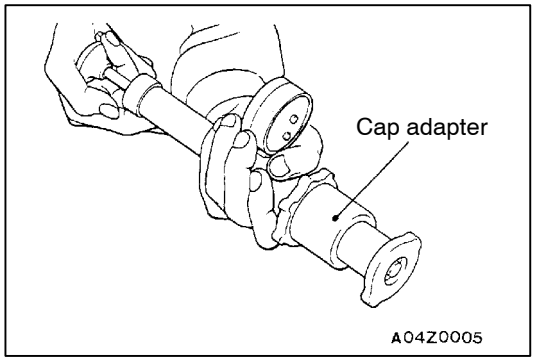
ON-VEHICLE SERVICE

ENGINE COOLANT LEAK CHECKING

1. Confirm that the coolant level is up to the filler neck. Install a radiator cap tester 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 filler neck of the radiator.

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 tester.
2. Increase the pressure until the indicator of the gauge stops moving.

   Limit: 64 kPa

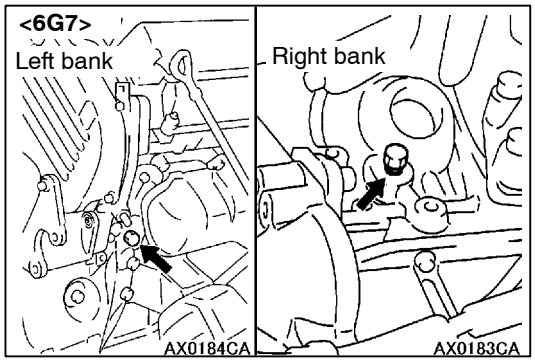
   Standard value: 74 - 103 kPa

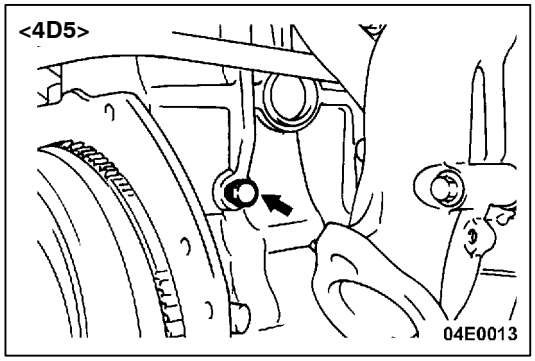
3. Replace the radiator cap if the reading does not remain at or above the limit.

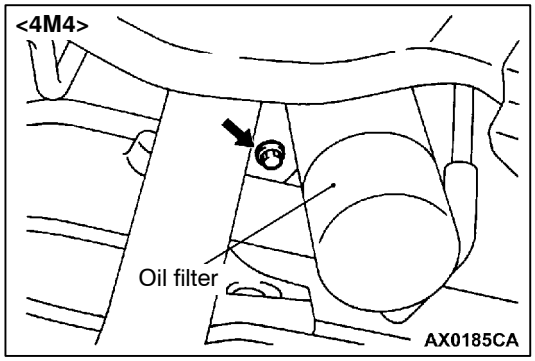
   NOTE
   Be sure that the cap is clean before testing, since rust or other foreign material on the cap seal will cause an improper indication.

ENGINE COOLANT REPLACEMENT

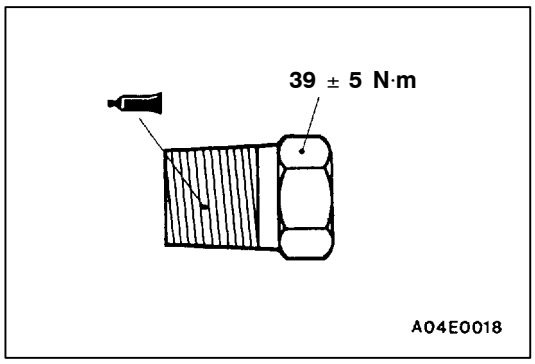
1. Drain the engine coolant by removing the drain plug and then the radiator cap.







2. Remove the cylinder block 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. Remove the air bleed bolt and replace the seal washer.
9. Fill the radiator until the engine coolant flows from the air bleed bolt section, and then close the air bleed bolt.
10. 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.

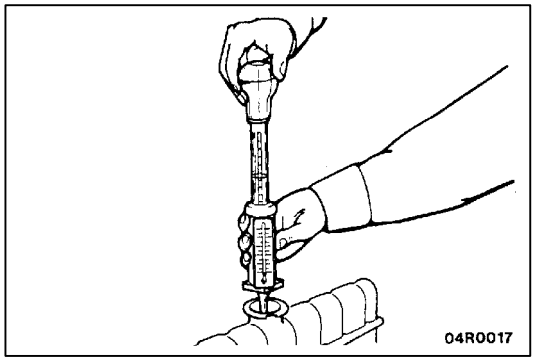
    Recommended anti-freeze:
    MITSUBISHI GENUINE COOLANT or equivalent

    Quantity:
    <Vehicles without rear heater> 9.0 L
    <Vehicles with rear heater> 10.5 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.

NOTE
For Norway, the non-amine type of anti-freeze should be used.

11. Install the radiator cap securely.
12. 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.)
13. After the thermostat opens, race the engine several times, and then stop the engine.
14. 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 ANTI-FREEZE

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

Caution
If the concentration of the anti-freeze 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.

COOLING FAN

REMOVAL AND INSTALLATION

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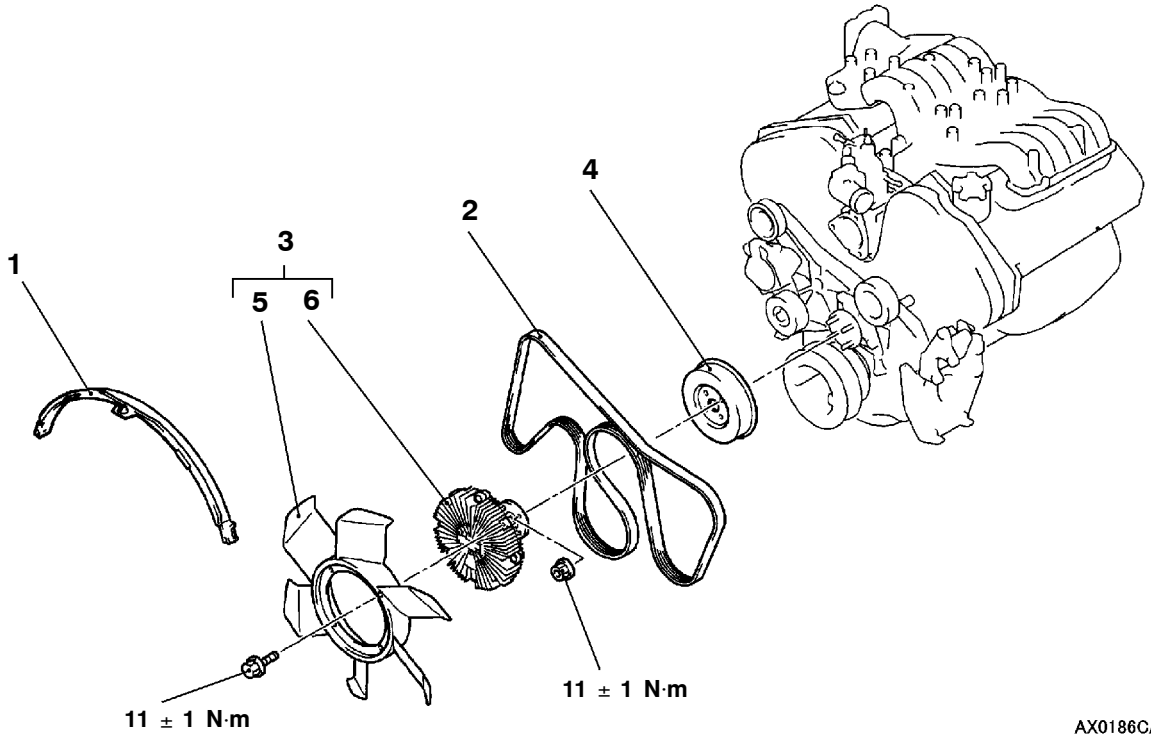

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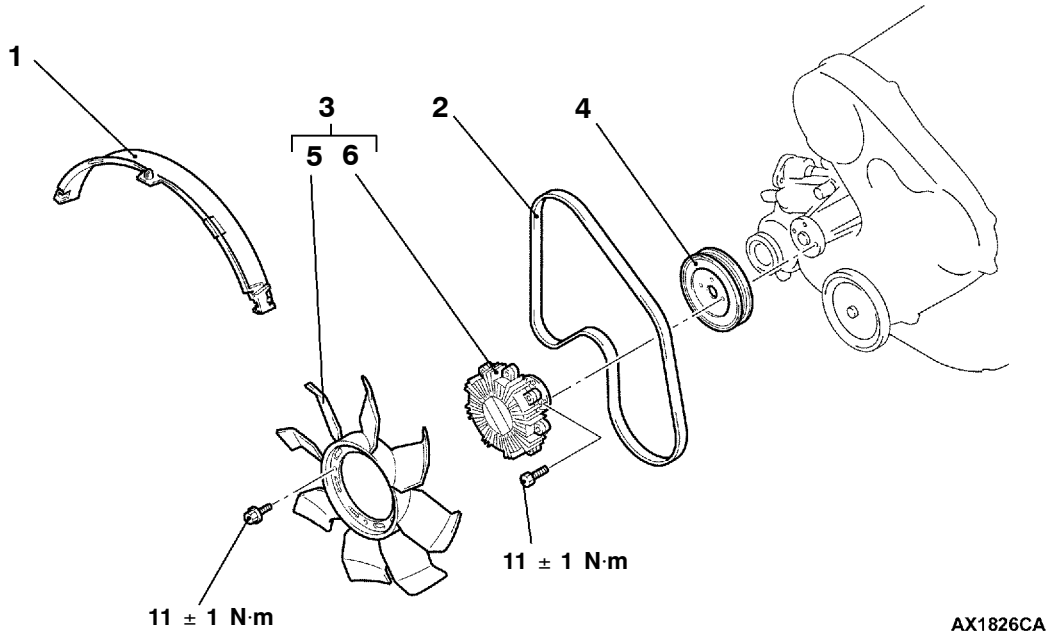

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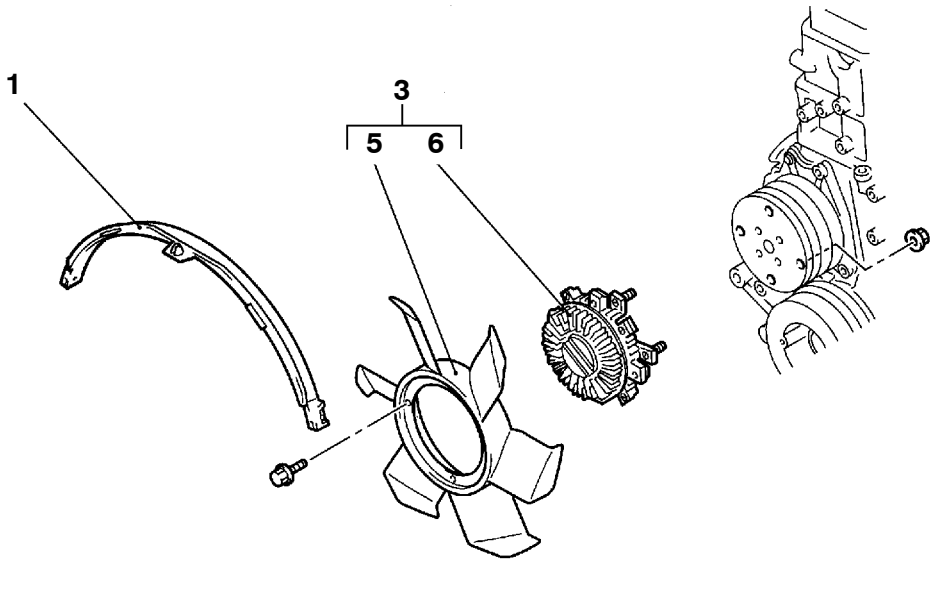


Removal steps

1. Radiator upper shroud
2. Drive belts
3. Cooling fan and fan clutch
4. Pulley
5. Cooling fan
6. Fan clutch

INSPECTION

COOLING FAN CHECK

- Check blades for damage and cracks.
- Check for cracks and damage around bolt holes in fan hub.
- If any portion of fan is damaged or cracked, replace cooling fan.

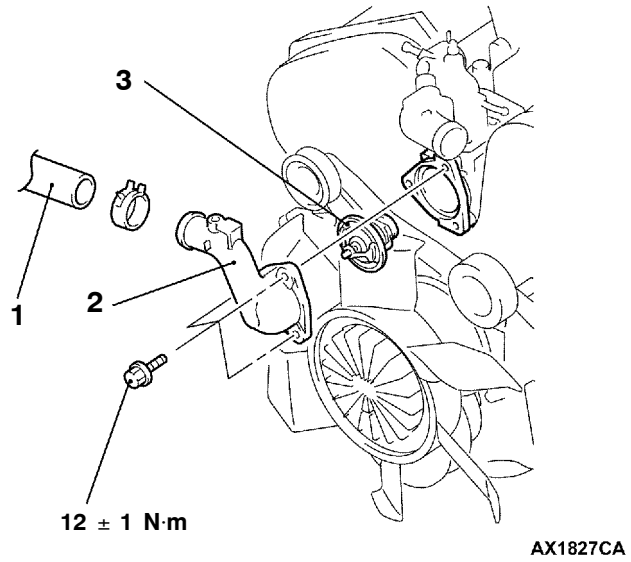
FAN CLUTCH CHECK

- Check to ensure that fluid in fan clutch is not leaking at case joint and seals. If fluid quantity decreases due to leakage, fan speed will decrease and engine overheating might result.
- When a fan attached to an engine is turned by hand, it should give a sense of some resistance. If fan turns lightly, it is faulty.
- Check bimetal strip for damage.

THERMOSTAT

REMOVAL AND INSTALLATION

<6G7>



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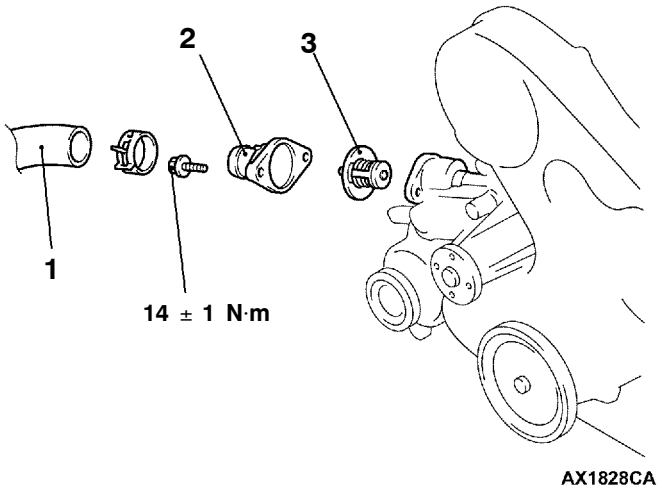

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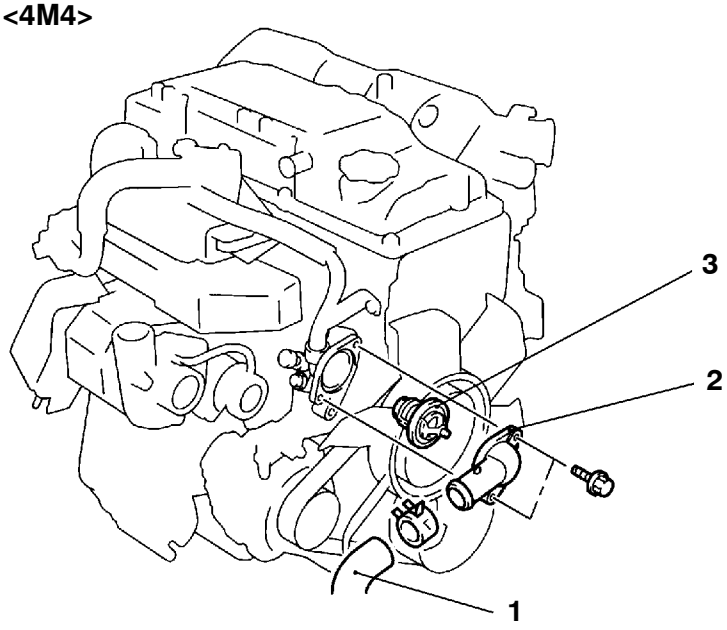


Removal steps

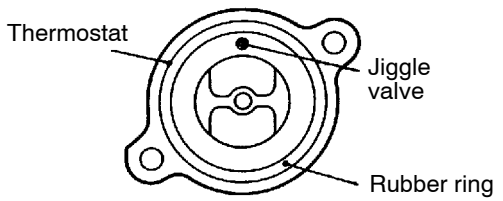
◀A▶ ▶B◀ 1. Radiator lower hose connection
2. Water inlet fitting
▶A◀ 3. Thermostat

REMOVAL SERVICE POINT

◀A▶ RADIATOR LOWER HOSE DISCONNECTION

After making mating marks on the radiator hose and the hose clamp,disconnect the radiator hose.

<6G7>



A04X0037

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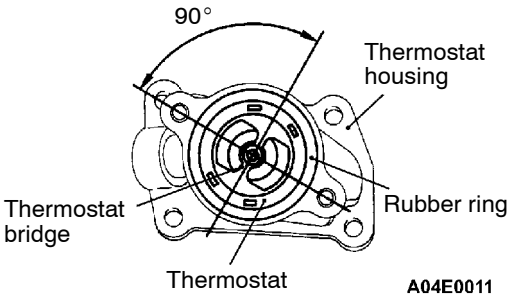

A04E0011

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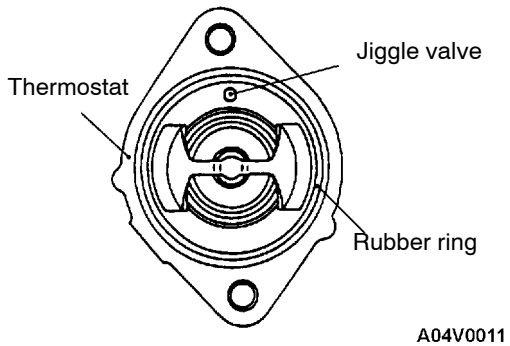


A04V0011

INSTALLATION SERVICE POINTS

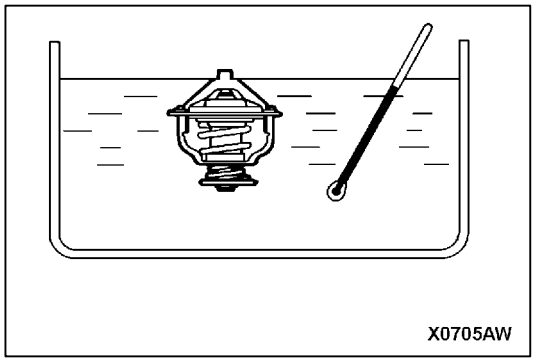
▶A◀ THERMOSTAT INSTALLATION

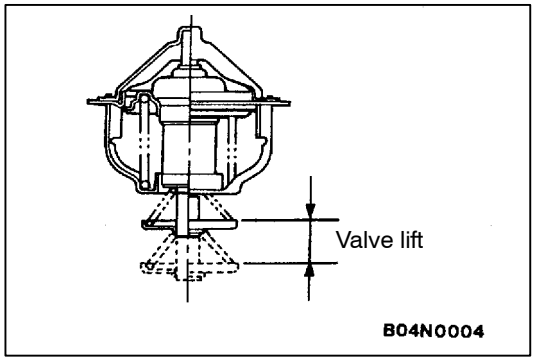
Install the thermostat so that the jiggle valve is facing straight up.

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 damage, replace the thermostat.

▶B◀ 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.





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:
   <6G7> 88 ± 2.0°C
   <4D5> 82 ± 1.5°C
   <4M4> 76.5 ± 2.0°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:

Items	6G7	4D5	4M4
Full-opening temperature °C	100	95	90
Amount of valve lift mm	10 or more	8.5 or more	8.5 or more

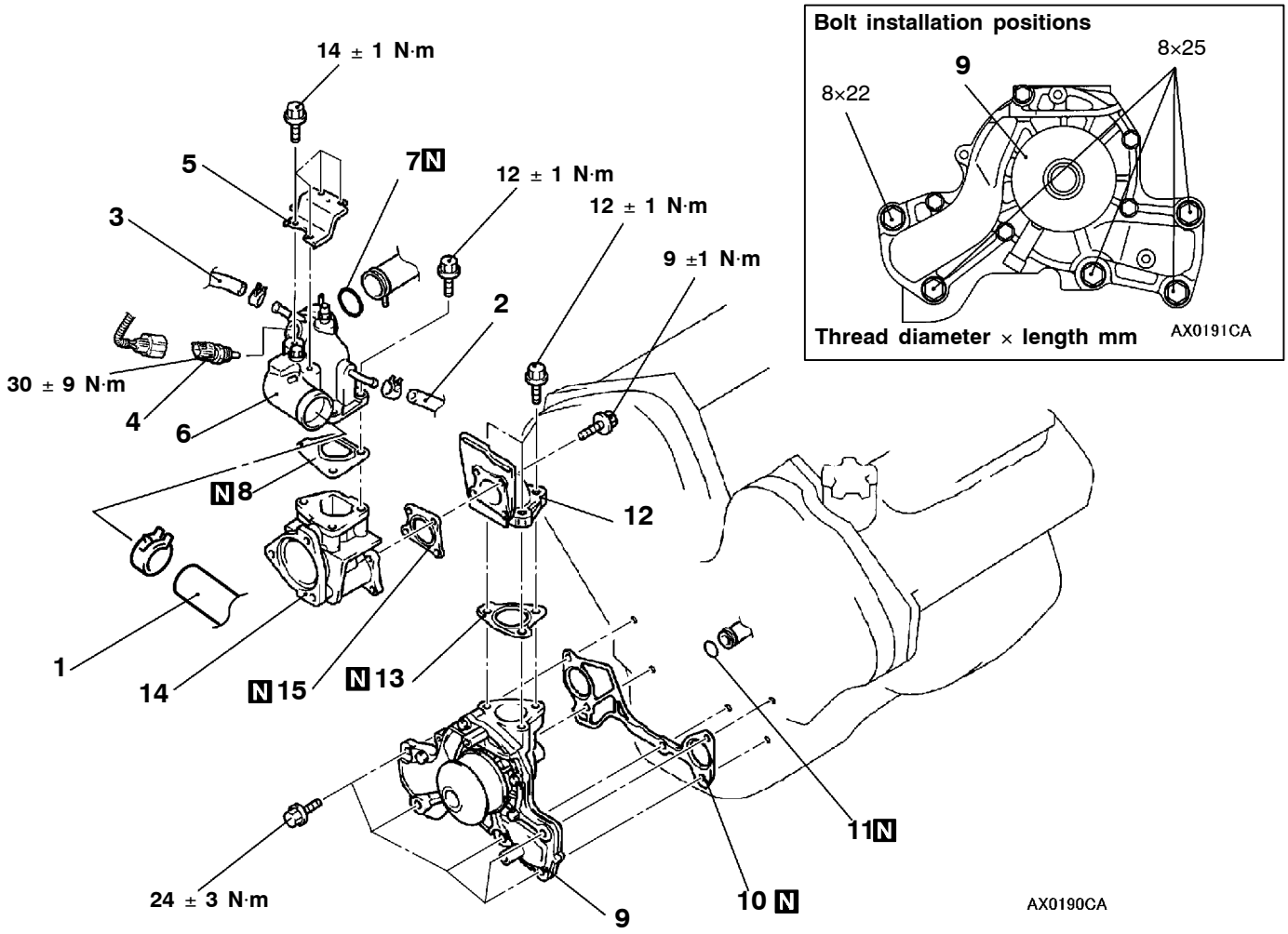
NOTE
Measure the valve height when the thermostat is fully closed, and use this measurement to calculate the valve height when the thermostat is fully open.

WATER PUMP

REMOVAL AND INSTALLATION

<6G7>

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying (Refer to P. 14-3.)
- Timing Belt Removal and Installation (Refer to GROUP 11A.)
- Camshaft Sprocket Removal and Installation (Refer to GROUP 11A.)
- Thermostat Removal and Installation (Refer to P.14-7.)

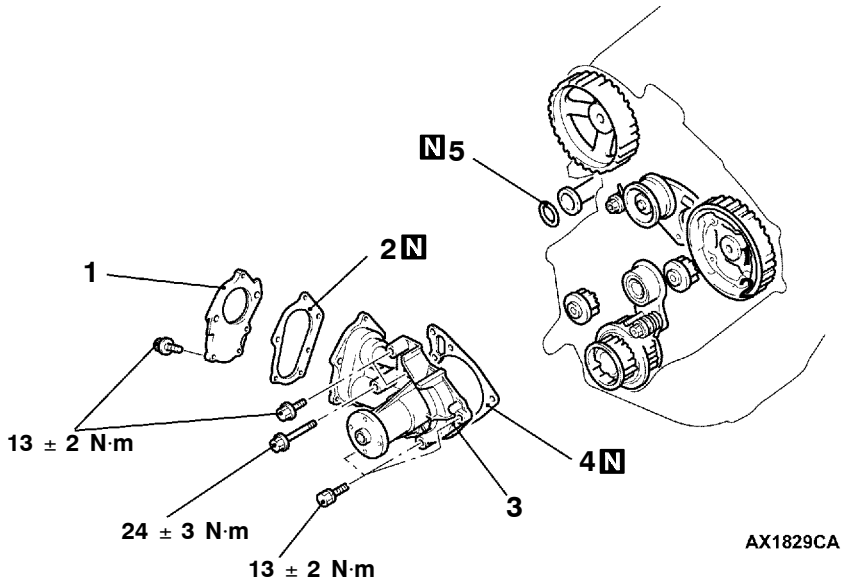


Removal steps

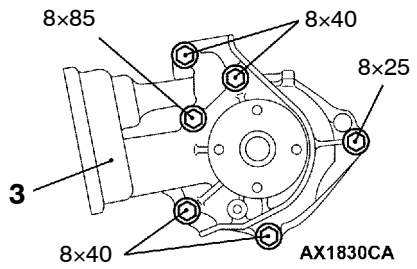
◀A▶ ▶C◀ 1. Radiator upper hose connection
2. Water hose
3. Water hose
4. Water temperature sensor
5. Water outlet fitting bracket
6. Water outlet fitting
▶A◀ 7. O-ring
8. Gasket
9. Water pump
10. Gasket
▶A◀ 11. O-ring
12. Fitting
13. Gasket
14. Thermostat case
15. Gasket

<4D5>

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying (Refer to P. 14-3.)
- Timing Belt Removal and Installation (Refer to GROUP 11B.)
- Thermostat Removal and Installation (Refer to P.14-7.)



Bolt installation positions



Thread diameter × length mm

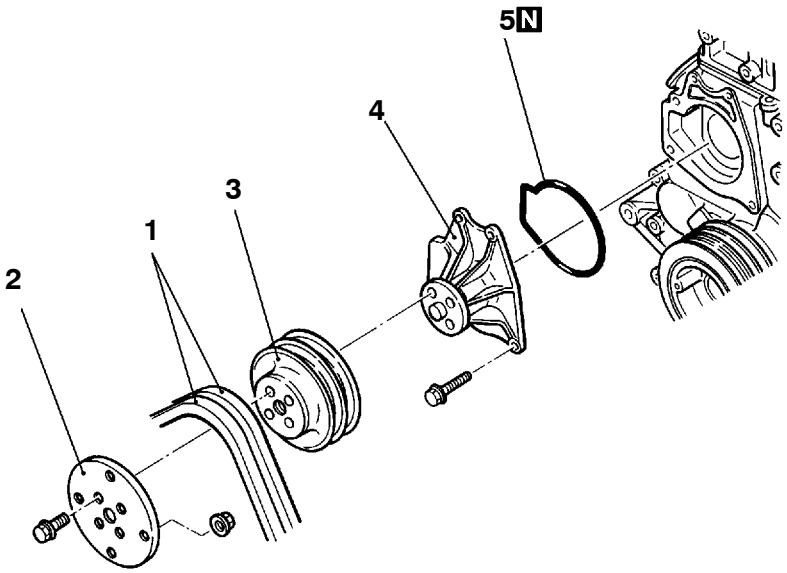
Removal steps
- Air intake hose (Refer to GROUP 15 - Air Cleaner.)
- Power steering oil pump (Refer to GROUP 37A.)

1. Plate
2. Gasket
3. Water pump assembly
4. Gasket

▶A◀ 5. O-ring

<4M4>

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying (Refer to P. 14-3.)
- Cooling Fan Removal and Installation (Refer to P.14-7.)



A04E0055

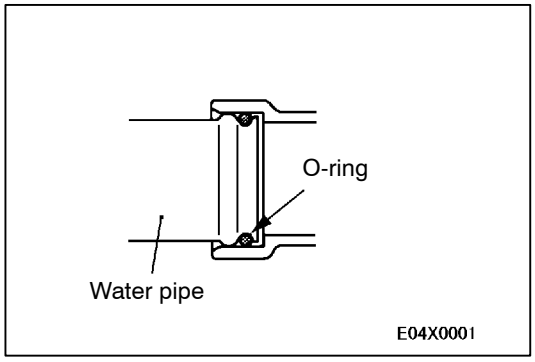
Removal steps

1. Drive belt
2. Coupling plate
3. Fan pulley
4. Water pump
▶B◀ 5. O-ring

REMOVAL SERVICE POINT

◀A▶ RADIATOR UPPER HOSE DISCONNECTION

After making mating marks on the radiator hose and the hose clamp,disconnect the radiator hose.



INSTALLATION SERVICE POINTS

▶A◀ O-RING INSTALLATION<6G7, 4D5>

Rinse the mounting location of the O-ring and water pipe with water, and install the O-ring and water pipe.

Caution

1. **Care must be taken not to permit engine oil or other greases to adhere to the O-ring.**
2. **When inserting the pipe, check to be sure that there is no sand, dirt, etc. on its inner surface.**

▶B◀ O-RING INSTALLATION <4M4>

Apply water around the O-ring before installing it.

Caution

Be careful not to contaminate the O-ring with engine oil or grease.

▶C◀ RADIATOR UPPER HOSE CONNECTION

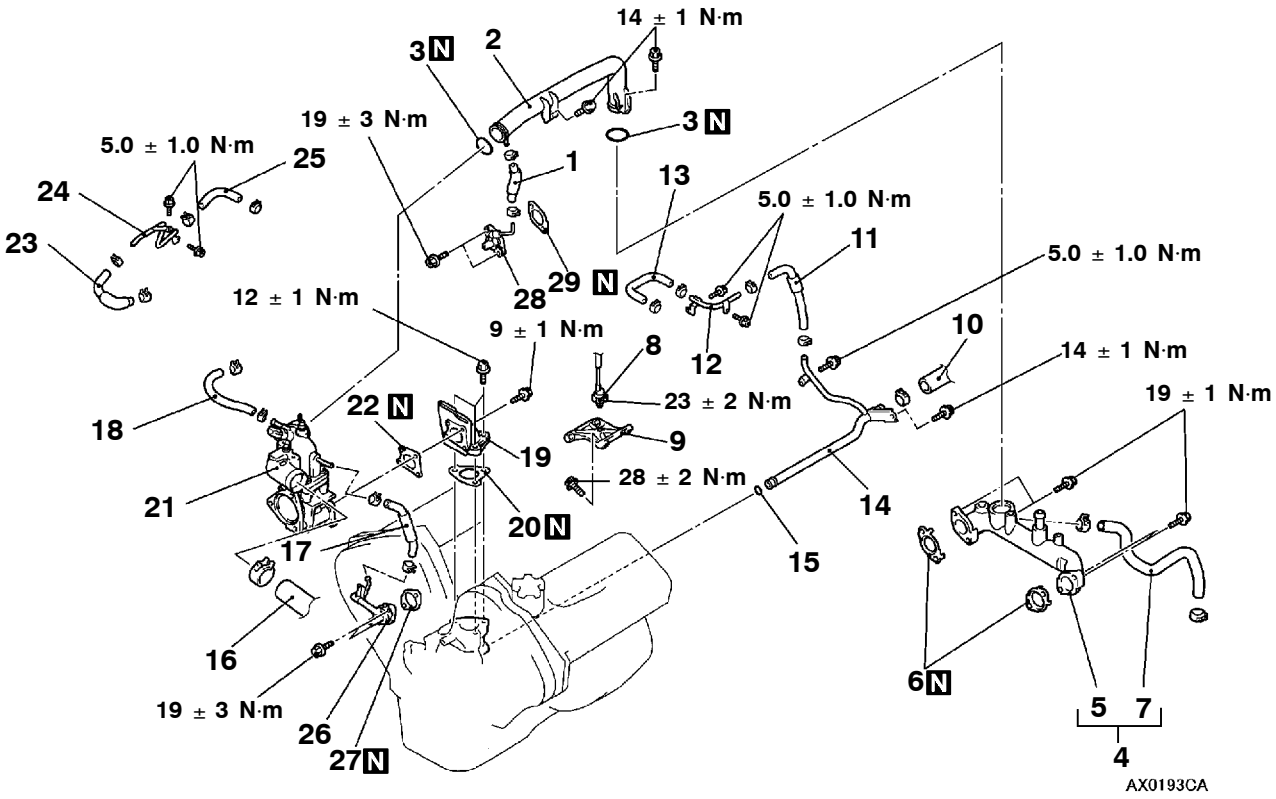
1. Insert each hose as far as the projection of the water inlet fitting.
2. Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.

WATER HOSE AND WATER PIPE

REMOVAL AND INSTALLATION

<6G7>

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying (Refer to P. 14-3.)
- Thermostat Removal and Installation (Refer to P. 14-8.)
- Intake Manifold Removal and Installation (Refer to GROUP 15.)
- Injector Removal and Installation (Refer to GROUP 13A.)
- Fuel Pump (high-pressure) Removal and Installation (Refer to GROUP 13A.)

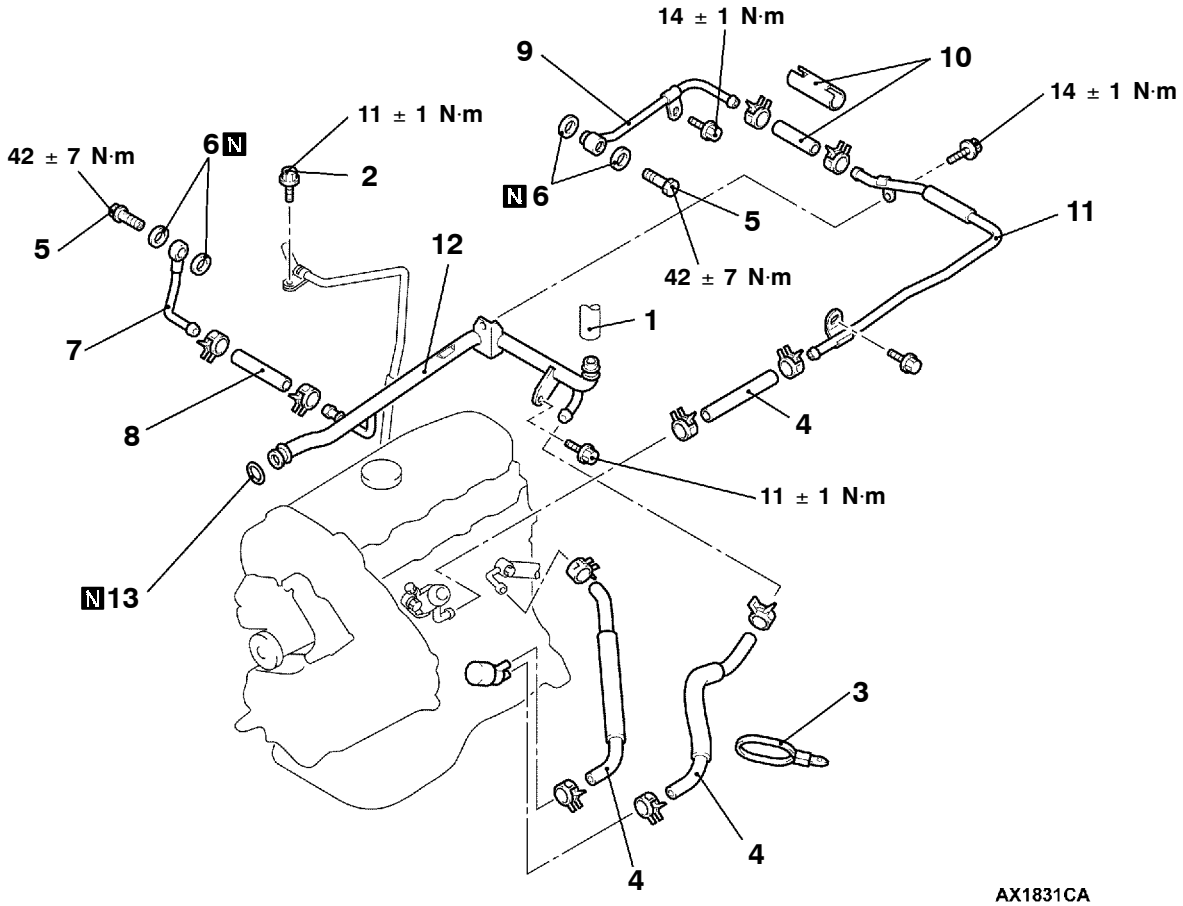


Removal steps

1. Water hose
2. Water outlet pipe
▶B◀ 3. O-ring
4. Heater hose and water passage assembly
5. Water passage assembly
▶D◀ 6. Gasket
7. Heater hose
◀A▶ ▶C◀ 8. Detonation sensor
9. Detonation sensor bracket
10. Heater hose connection
11. Water hose
12. Water pipe
13. Water hose
14. Water pipe assembly
▶B◀ 15. O-ring
◀B▶ ▶A◀ 16. Radiator upper hose connection
17. Water hose
18. Water hose
19. Fitting
20. Gasket
21. Water outlet fitting and thermostat case
22. Gasket
23. Water hose
24. Water pipe
25. Water hose
26. Left fitting
27. Gasket
28. Right fitting
29. Gasket

<4D5>

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying (Refer to P.14-3.)
- Injection Pipe Removal and Installation (Refer to GROUP 13E - Injection Nozzle.)
- Intake, Exhaust Manifold Removal and Installation (Refer to GROUP 15.)

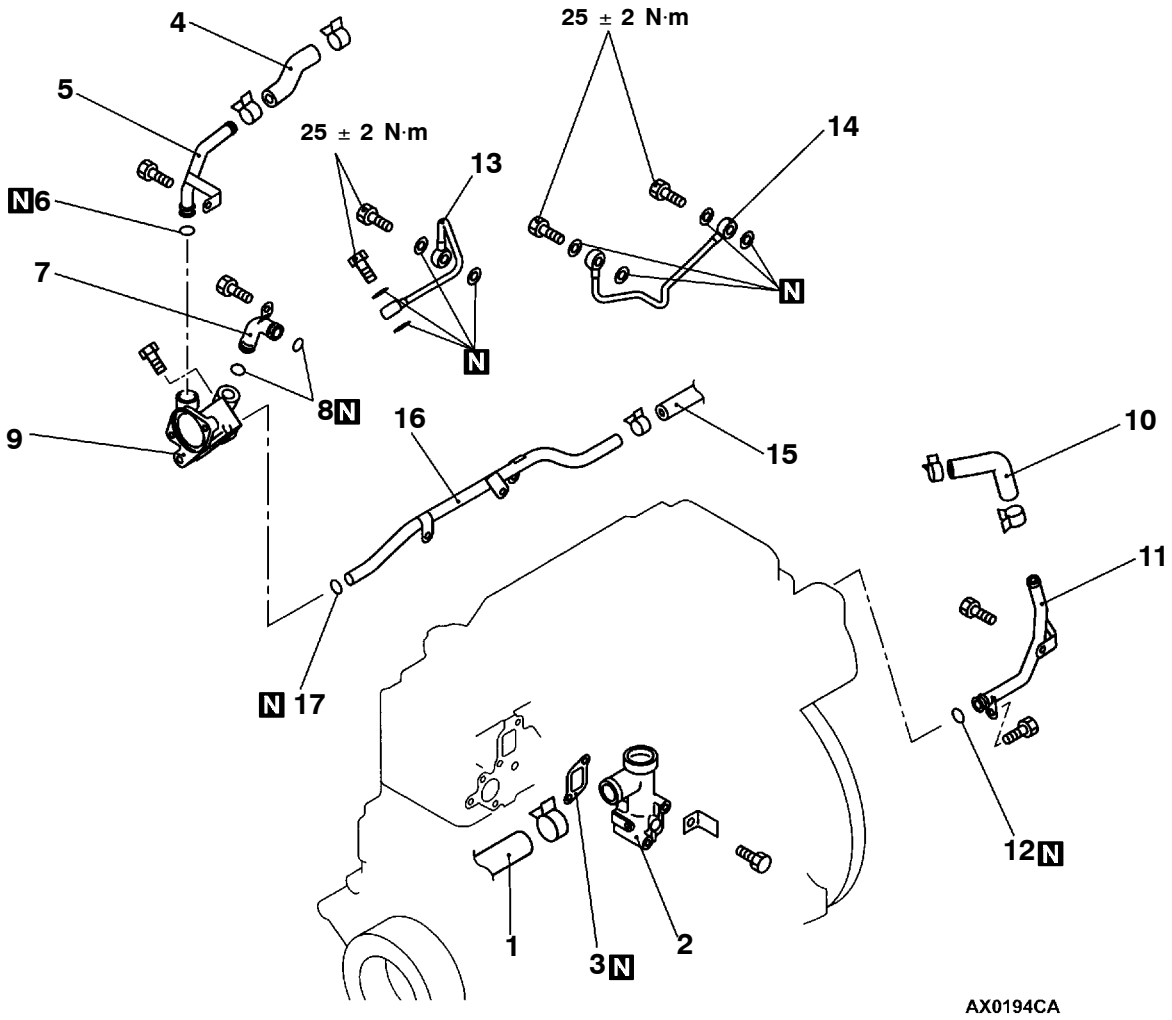


Removal steps

1. Heater hose connection
2. Vacuum pipe installation bolt
3. Cable ban
4. Water hose
5. Eye bolt
6. Gasket
7. Water pipe assembly A
8. Water hose
9. Water pipe assembly B
10. Water hose
11. Water pipe assembly C
12. Water pipe assembly
▶B◀ 13. O-ring

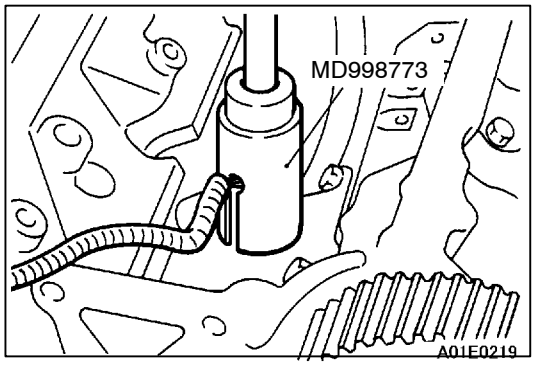
<4M4>

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying (Refer to P. 14-3.)
- Air Cleaner Removal and Installation (Refer to GROUP 15.)



Removal steps

◀B▶ ▶A◀ 1. Radiator upper hose connection
2. Water outlet pipe
3. Gasket
4. Water hose
5. EGR water outlet pipe
▶B◀ 6. O-ring
7. Bypass pipe
▶B◀ 8. O-ring
9. Thermostat case
10. Water hose
11. EGR water inlet pipe
▶B◀ 12. O-ring
13. Tuebocharger water outlet pipe
14. Tuebocharger water inlet pipe
15. Heater hose connection
16. Heater return pipe
▶B◀ 17. O-ring



REMOVAL SERVICE POINTS

◀A▶DETONATION SENSOR REMOVAL

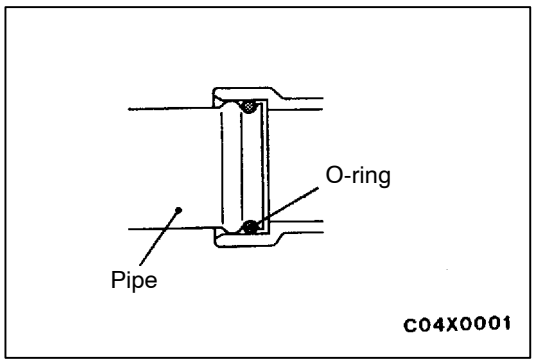
◀B▶ RADIATOR UPPER HOSE DISCONNECTION

After making mating marks on the radiator hose and the hose clamp,disconnect the radiator hose.

INSTALLATION SERVICE POINTS

▶A◀ RADIATOR UPPER HOSE CONNECTION

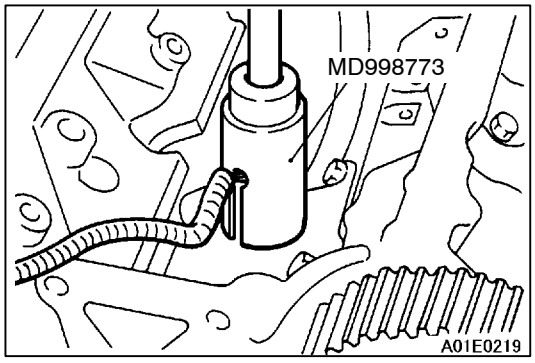
1. Insert each hose as far as the projection of the water inlet fitting.
2. Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.



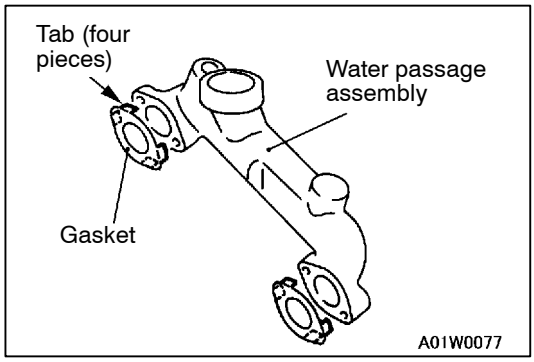
▶B◀ O-RING INSTALLATION

Insert the O-ring to pipe, and coat the outer circumference of the O-ring with water.

Caution
Care must be taken not to permit engine oil or other greases to adhere to the o-ring.



▶C◀DETONATION SENSOR INSTALLATION



▶D◀GASKET INSTALLATION <6G7>

Engage the gasket tabs with recesses on the water passage.

INSPECTION

WATER PIPE AND HOSE CHECK

Check the water pipe and hose for cracks, damage, clog and replace them if necessary.

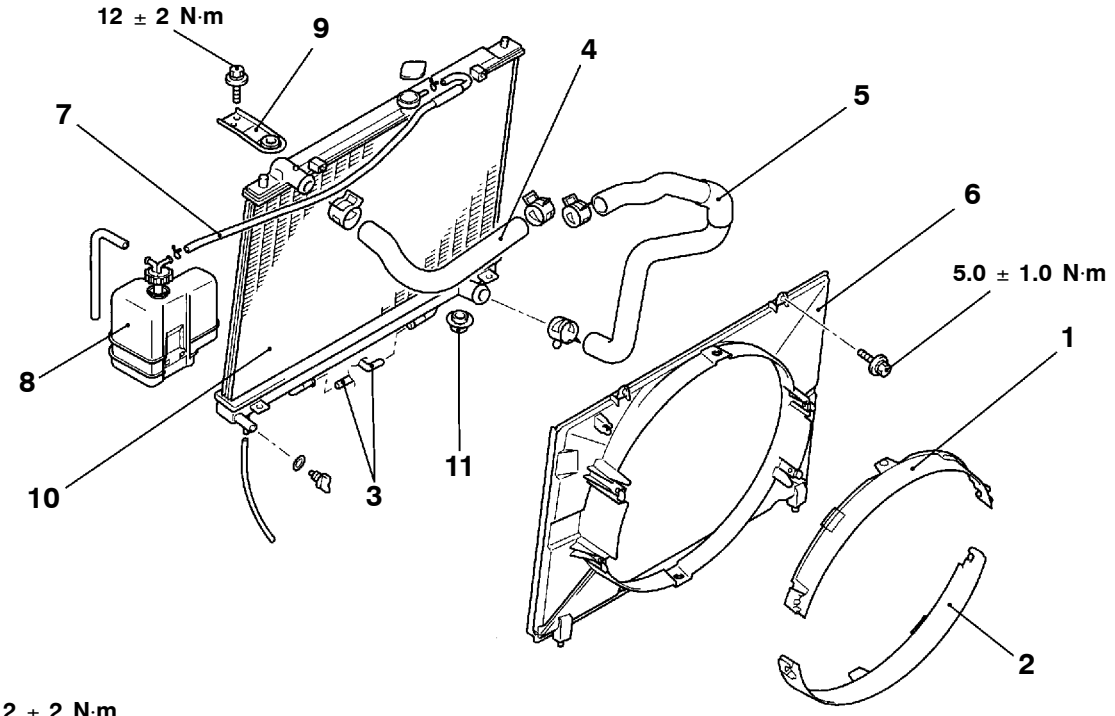
RADIATOR

REMOVAL AND INSTALLATION

Pre-removal Operation
Engine Coolant Draining (Refer to P. 14-3.)

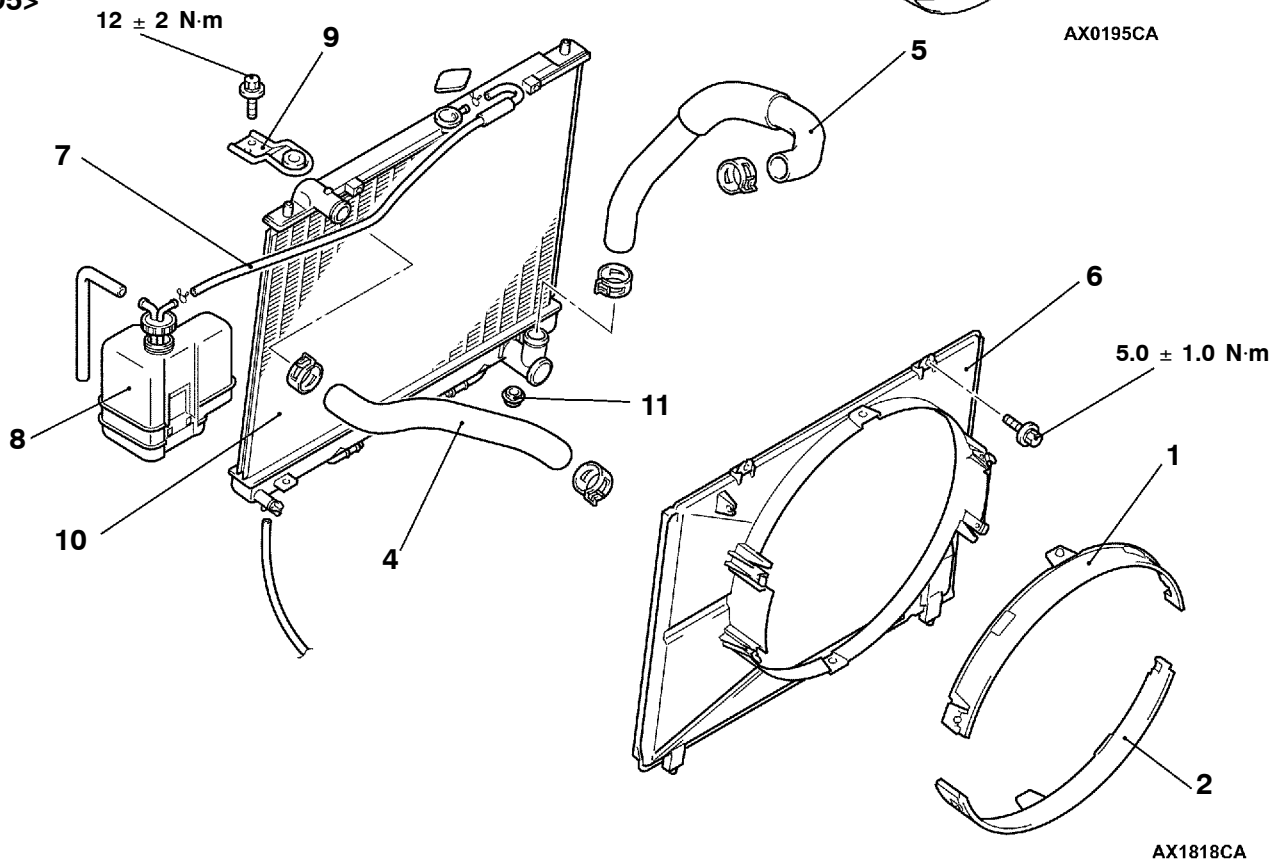
Post-installation Operation
- Engine Coolant Supplying (Refer to P. 14-3.)
- A/T Fluid Supplying and Checking (Refer to GROUP 23 - On-vehicle Service.)

<6G7>



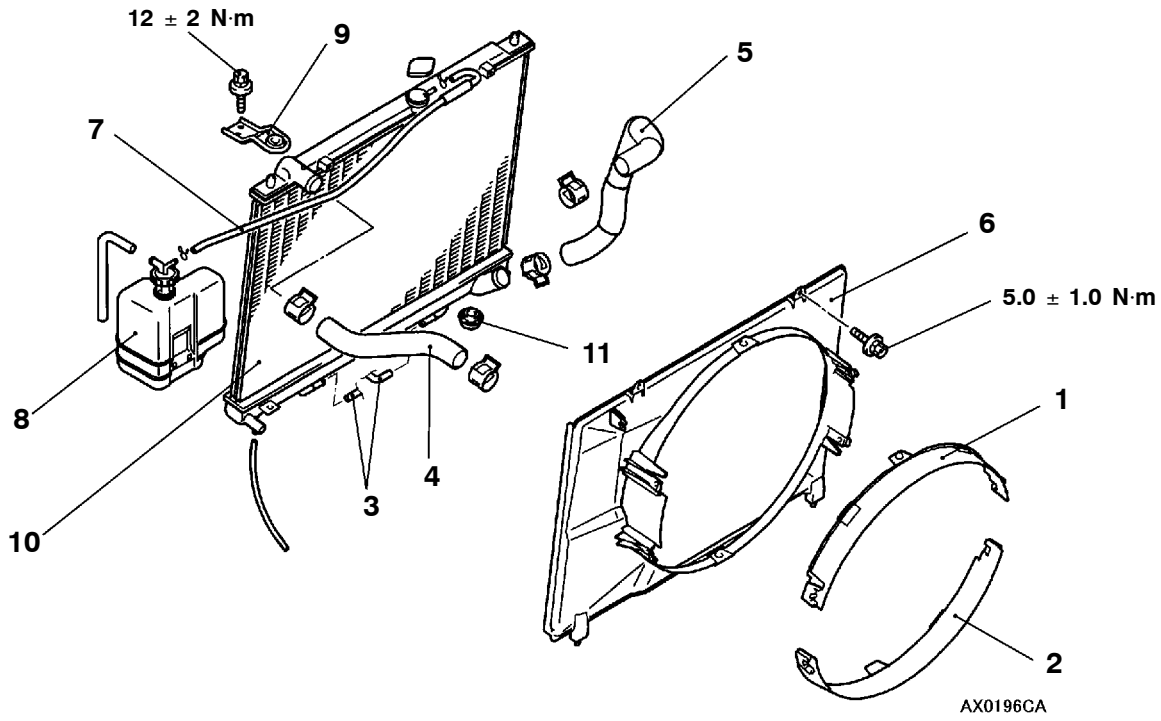
AX0195CA

<4D5>



AX1818CA

<4M4>



Removal steps

◀A▶ ▶B◀ 1. Radiator shroud upper cover
◀A▶ ▶B◀ 2. Radiator shroud lower cover
◀B▶ 3. Transmission fluid cooler hose connection <A/T>
◀C▶ ▶A◀ 4. Radiator upper hose
◀C▶ ▶A◀ 5. Radiator lower hose
6. Shroud
7. Rubber hose
8. Reserve tank assembly
9. Upper insulator
10. Radiator
11. Lower insulator

REMOVAL SERVICE POINTS

◀A▶ RADIATOR SHROUD UPPER COVER/RADIATOR SHROUD LOWER COVER REMOVAL

Tilt the lock lever at the shroud housing cover outward slightly, and remove the cover to the fan axial direction (The cover is secured at four positions).

Caution
If the lock lever is tilted too much, the lever may be damaged or deformed.

◀B▶ TRANSMISSION FLUID COOLER HOSE CONNECTION

After disconnecting the hose, plug it to avoid dust or foreign material.

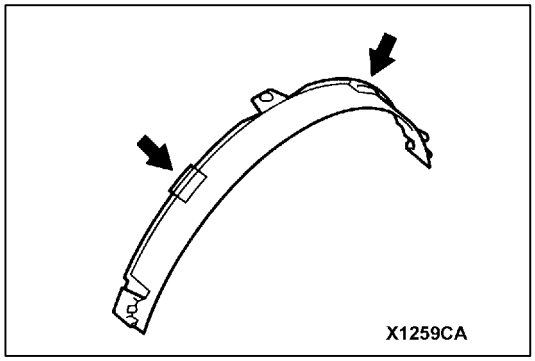
◀C▶ RADIATOR UPPER HOSE/RADIATOR LOWER HOSE DISCONNECTION

After making mating marks on the radiator hose and the hose clamp,disconnect the radiator hose.

INSTALLATION SERVICE POINTS

▶A◀ RADIATOR UPPER HOSE/RADIATOR LOWER HOSE CONNECTION

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



▶B◀ RADIATOR SHROUD UPPER COVER/RADIATOR SHROUD LOWER COVER INSTALLATION

1. Install the shrouds securely until a click can be heard at all four positions.
2. Two tabs on each cover should protrude outside the shroud.
3. On completion, confirm that the covers are not loose.

ENGINE COOLING

CONTENTS

GENERAL 2
Outline of Changes 2
WATER HOSE AND WATER PIPE <4D5> 3
WATER HOSE AND WATER PIPE <4M4> . . . 5

GENERAL

OUTLINE OF CHANGES

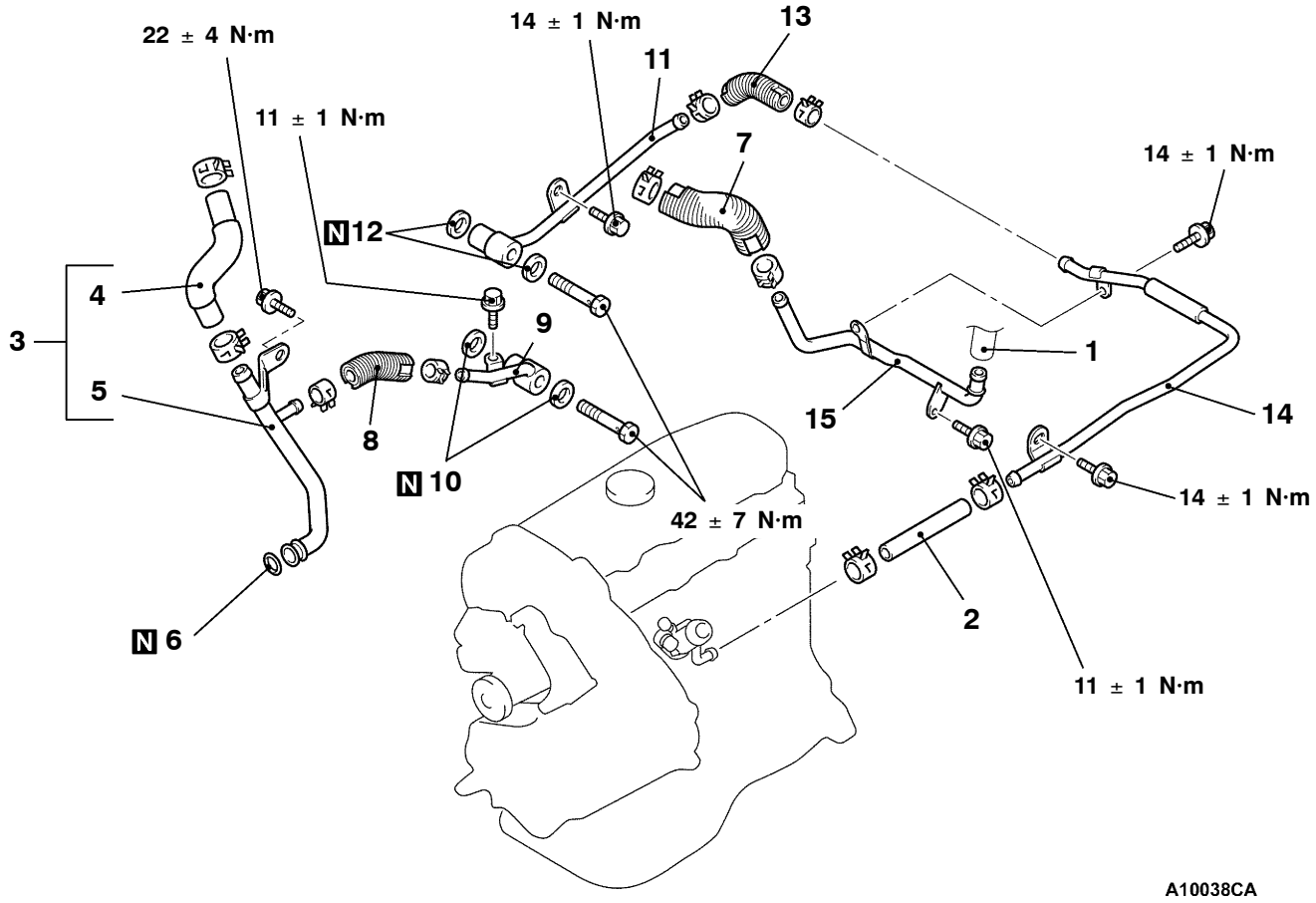
Some service procedures have been established as the following changes have been made due to the compliance with the Emission Regulation Step III.

- The turbocharger has been changed to a Variable Geometry (VG) type. Due to this change, an EGR cooler has been added and section ”Water hose and water pipe” has been changed. <4D5>
- The section ”Water hose and water pipe” has been changed due to the addition of the EGR cooler. <4M4>

WATER HOSE AND WATER PIPE <4D5>

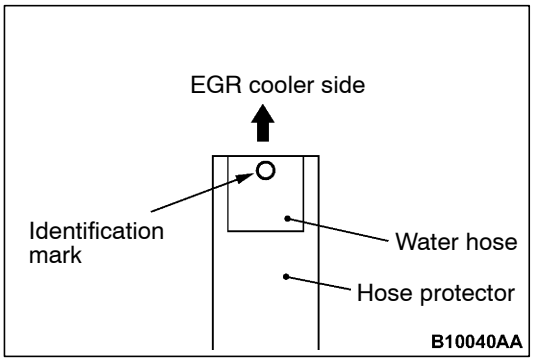
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying.
- Injection Pipe Removal and Installation.



Removal steps

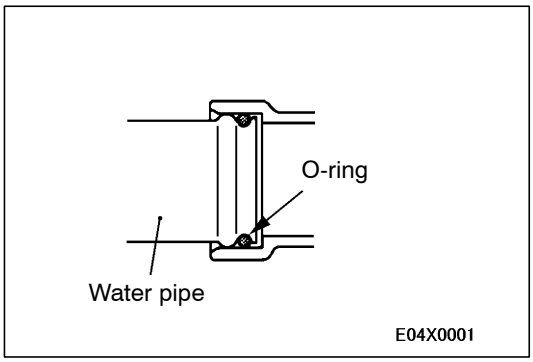
1. Heater hose connection
2. Water hose
   - Air cleaner assembly
3. Water pipe and hose assembly
▶A◀ 4. Water hose
5. Water pipe E
▶B◀ 6. O-ring
▶A◀ 7. Water hose
   - EGR valve, EGR cooler (Refer to GROUP 17.)
   - Turbocharger heat protector (Refer to GROUP 15 - Intake and exhaust manifold, turbocharger.)
8. Water hose
9. Water pipe A
10. Gasket
11. Water pipe B
12. Gasket
13. Water hose
14. Water pipe C
15. Water pipe D



INSTALLATION SERVICE POINTS

▶A◀ WATER HOSE INSTALLATION

The identification mark on the water hose end should face toward the EGR cooler.



INSTALLATION SERVICE POINTS

▶B◀ O-RING INSTALLATION

Rinse the mounting location of the O-ring and water pipe with water, and install the O-ring and water pipe.

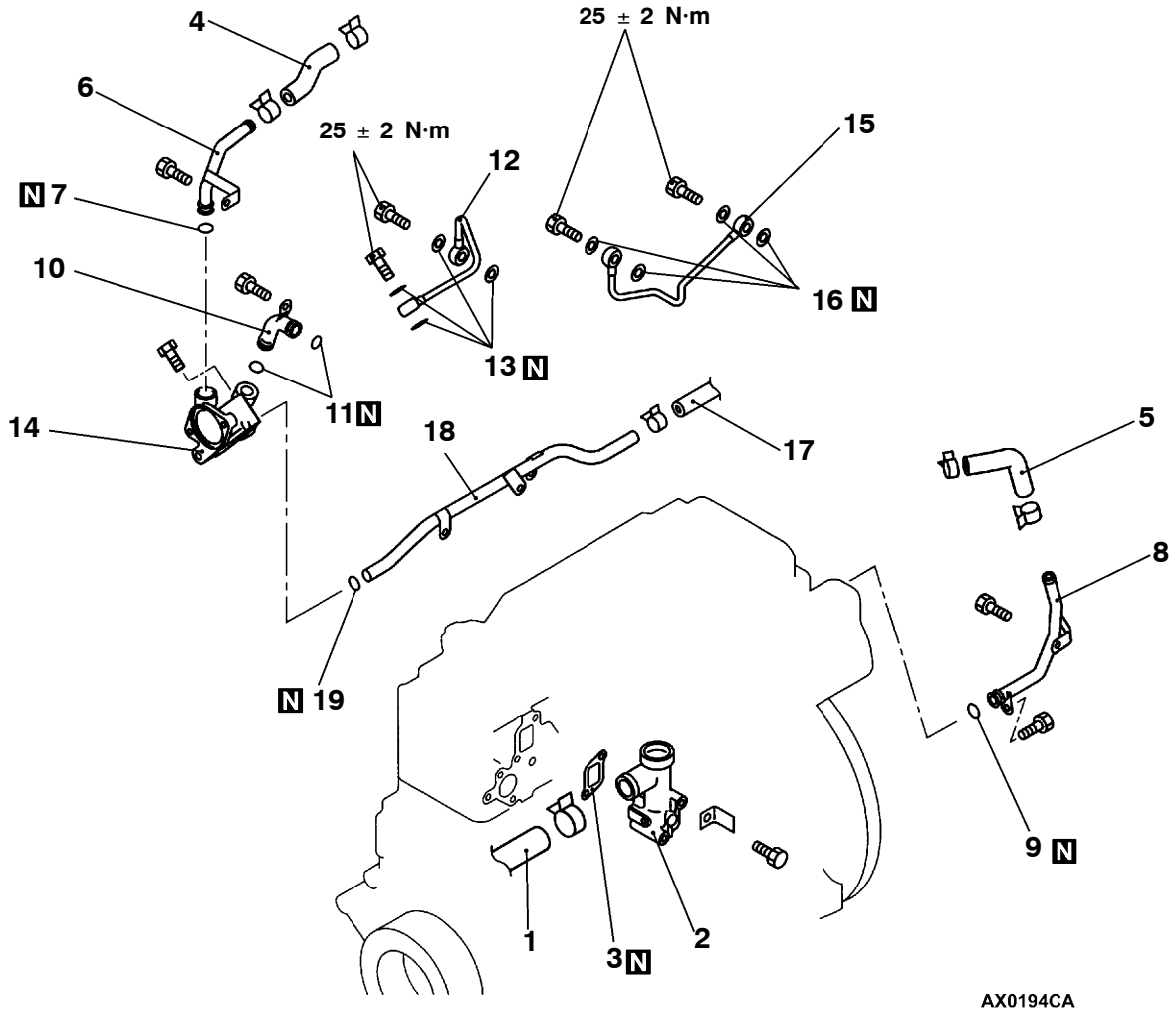
Caution

1. **Care must be taken not to permit engine oil or other greases to adhere to the O-ring.**
2. **When inserting the pipe, check to be sure that there is no sand, dirt, etc. on its inner surface.**

WATER HOSE AND WATER PIPE <4M4>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying
- Engine Cover Removal and Installation



Removal steps

◀A▶ ▶B◀ 1. Radiator upper hose connection
2. Water outlet pipe
3. Gasket
4. Water hose
5. Water hose
- Air cleaner assembly
- Thermostat
- EGR valve, EGR cooler (Refer to GROUP 17.)

6. EGR water outlet pipe
▶A◀ 7. O-ring
8. EGR water inlet pipe
▶A◀ 9. O-ring
10. Bypass pipe
▶A◀ 11. O-ring
- Turbocharger heat cover upper (Refer to GROUP 15.)

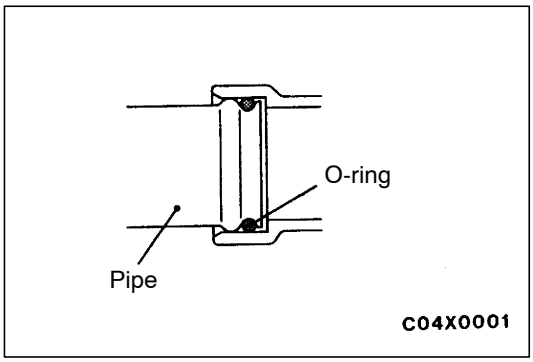
12. Turbocharger water outlet pipe
13. Gasket
14. Thermostat case
15. Turbocharger water inlet pipe
16. Gasket
- Exhaust manifold (Refer to GROUP 15.)

17. Heater hose connection
18. Heater return pipe
▶A◀ 19. O-ring

REMOVAL SERVICE POINT

◀A▶ RADIATOR UPPER HOSE DISCONNECTION

After making mating marks on the radiator hose and the hose clamp,disconnect the radiator hose.



INSTALLATION SERVICE POINTS

▶A◀ O-RING INSTALLATION

Insert the O-ring to pipe, and coat the outer circumference of the O-ring with water.

Caution
Care must be taken not to permit engine oil or other greases to adhere to the o-ring.

▶B◀ 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.

INTAKE AND EXHAUST

Click on the applicable bookmark to selected the required model year.

INTAKE AND EXHAUST

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SERVICE SPECIFICATIONS 2

SEALANT 2

SPECIAL TOOL 2

ON-VEHICLE SERVICE 2

- Intake Manifold Vacuum Check <6G7> 2
- Turbocharger Supercharging Check <4D5> 2
- Waste Gate Actuator Check <4D5> 3
- Waste Gate Actuator Check <4M4> 3

AIR CLEANER 4

INTERCOOLER<4D5, 4M4> 5

INTAKE MANIFOLD <6G7> 6

INTAKE MANIFOLD AND THROTTLE BODY <4M4> 8

EXHAUST MANIFOLD <6G7> 11

INTAKE MANIFOLD AND EXHAUST MANIFOLD, TURBOCHARGER <4D5> ... 12

TURBOCHARGER AND EXHAUST MANIFOLD <4M4> 14

TURBOCHARGER <4D5> 16

TURBOCHARGER <4M4> 19

EXHAUST PIPE AND MAIN MUFFLER <6G7> 21

EXHAUST PIPE AND MAIN MUFFLER <4D5> 23

EXHAUST PIPE AND MAIN MUFFLER <4M4> 25

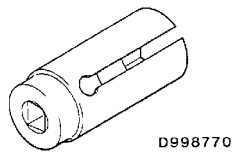
SERVICE SPECIFICATIONS

Items		Standard value	Limit
Waste gate actuator activation pressure kPa	4D5	Approx. 92	-
	4M4	Approx. 161	-
Manifold distortion of the installation surface mm		0.15 or less	0.20

SEALANT

Item	Specified sealant	Remarks
Thread of the intake manifold mounting bolts	3M Stud Locking No.4170 or equivalent	Anaerobic sealant

SPECIAL TOOL

Tool	Number	Name	Use
	MD998770	Oxygen sensor wrench	Removal/Installation of oxygen sensor <6G7>

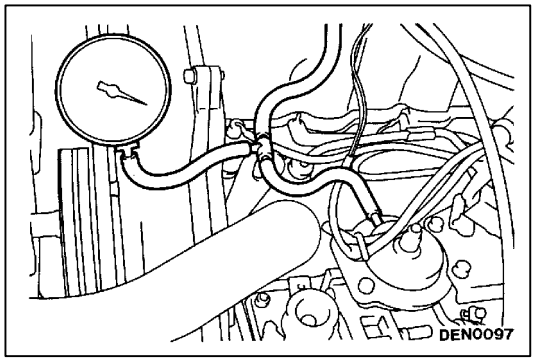
ON-VEHICLE SERVICE

INTAKE MANIFOLD VACUUM CHECK <6G7>

Refer to GROUP 11A - On-vehicle Service

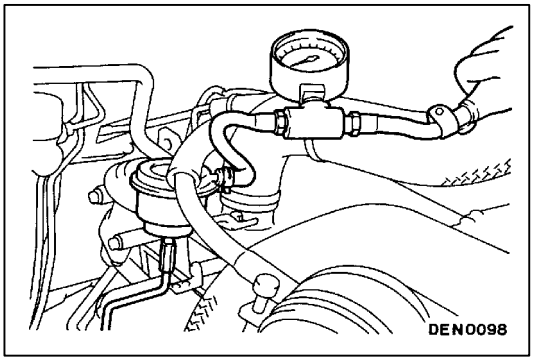
TURBOCHARGER SUPERCHARGING CHECK <4D5>

Caution
Conduct the driving test in a location where driving at full acceleration can be done with safety. Two person should be in the vehicle when the test is conducted; the person in the passenger seat should read the indications shown by the pressure meter.



1. Remove the boost compensator hose from the fuel injection pump, and install a pressure gauge as shown in the illustration.
2. Drive at full-throttle acceleration in second gear and then measure the supercharging when the engine speed in about 3,000 r/min.
3. When the indicated supercharging does not become positive pressure, check the following items.
   - Malfunction of the waste gate actuator
   - Leakage of supercharging pressure
   - Malfunction of the turbocharger

4. When the indicated supercharging is 84 kPa or more, supercharging control may be faulty, therefore check the followings.
   - Disconnection or cracks of the waste gate actuator rubber hose.
   - Malfunction of the waste gate actuator.
   - Malfunction of the waste gate valve.

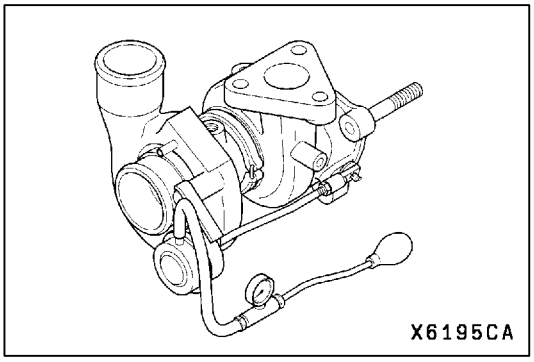


WASTE GATE ACTUATOR CHECK <4D5>

1. Connect a manual pump (pressure-application type) to nipple.
2. While gradually applying pressure, check the pressure that begins to activate (approx. 1 mm stroke) the waste gate actuator rod.

   Standard value: Approx. 92 kPa

   Caution
   In order to avoid damage to the diaphragm, do not apply a pressure of 105 kPa or higher.
3. If there is a significant deviation from the standard value, check the actuator or the waste gate valve: replace if necessary.



WASTE GATE ACTUATOR CHECK <4M4>

1. Connect a manual pump (pressure-application type) to nipple.
2. While gradually applying pressure, check the pressure that begins to activate (approx. 1 mm stroke) the waste gate actuator rod.

   Standard value: Approx. 161 kPa

   Caution
   In order to avoid damage to the diaphragm, do not apply a pressure of 181 kPa or higher.
3. If there is a significant deviation from the standard value, check the actuator or the waste gate valve: replace if necessary.

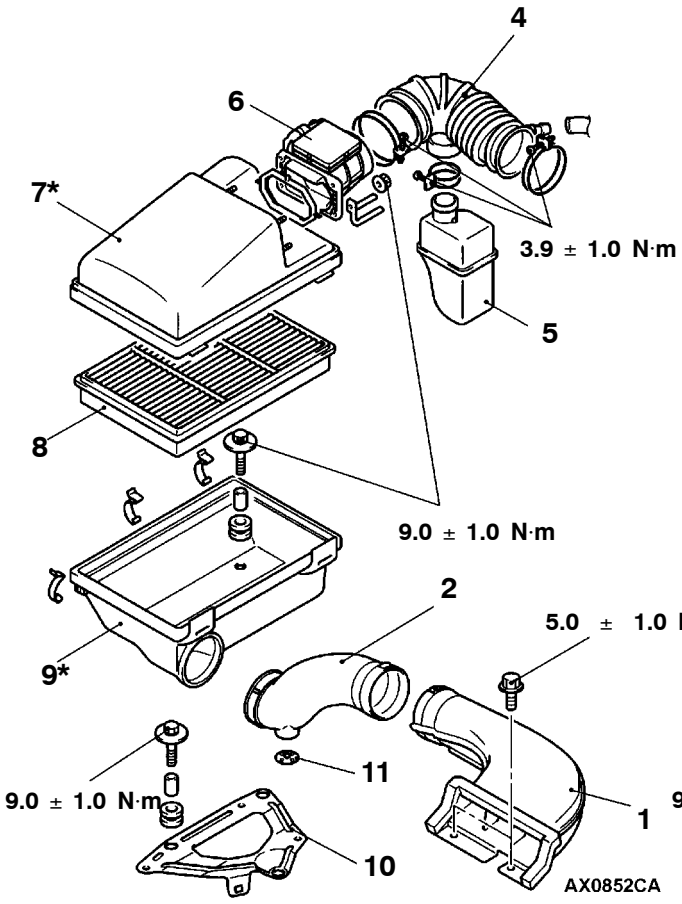
AIR CLEANER

REMOVAL AND INSTALLATION

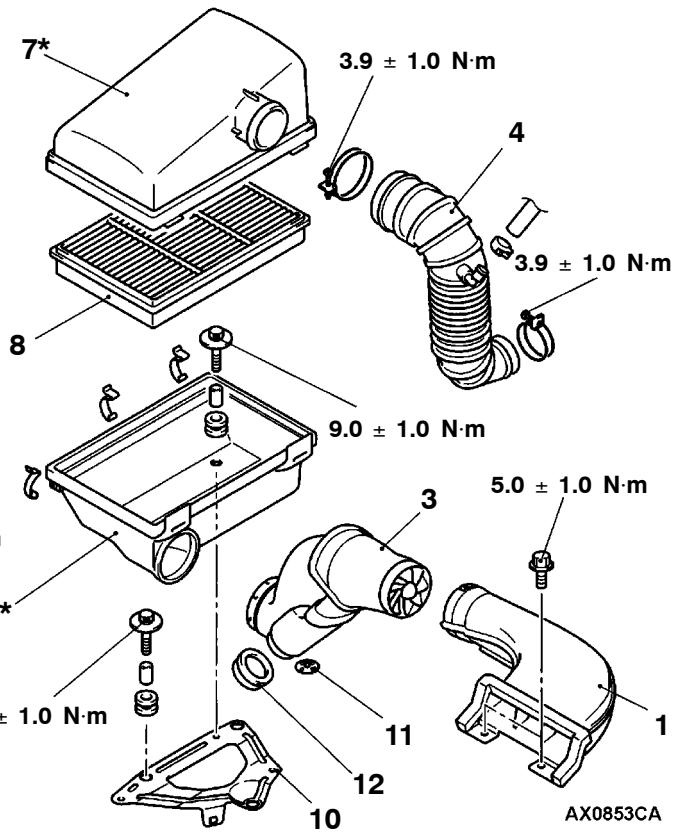
Caution
Parts marked by * are made of recycled-paper mixed plastic material, so observe the following precautions.
1. Avoid any shock or load to these parts when removing and installing them.
2. Engage the case hinges securely when assembling these parts.

NOTE
Parts marked by * are made of recycled-paper mixed plastic material, so can be disposed of by incineration.

<6G7>



<4D5, 4M4>



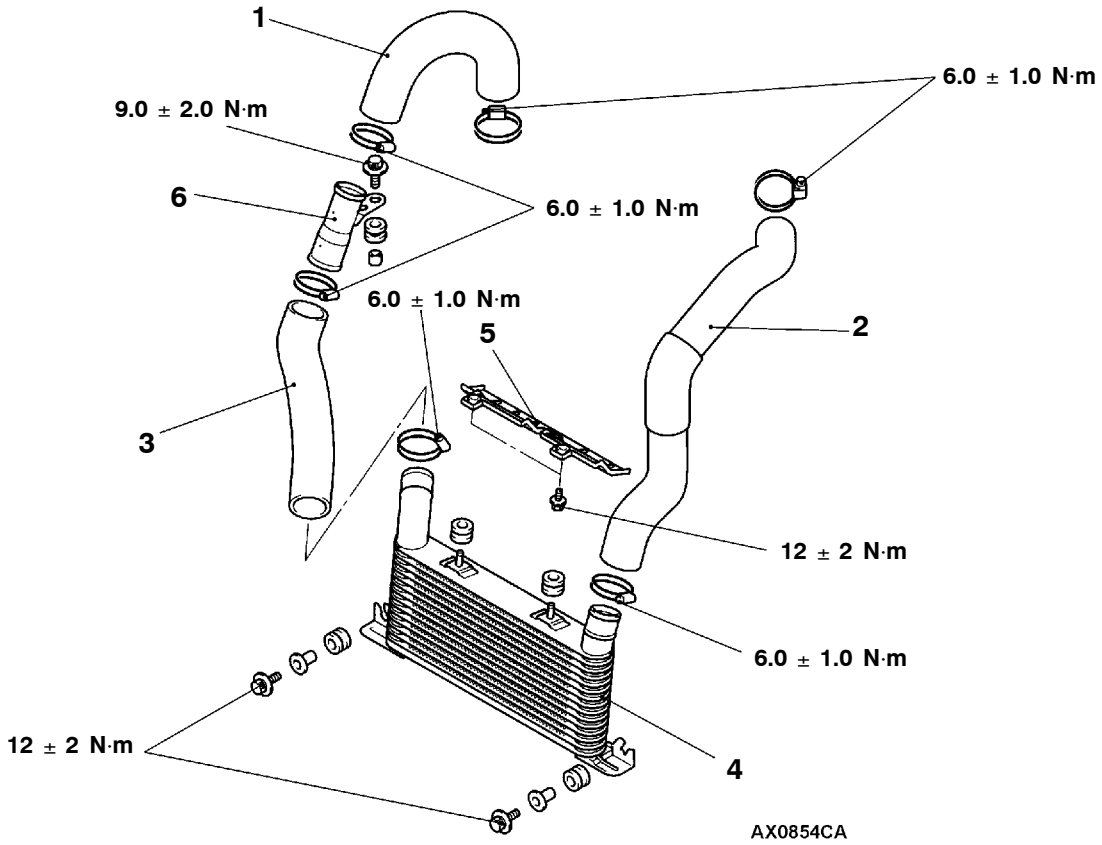
Removal steps

1. Air duct (A)
2. Air duct (B) <6G7>
3. Pre-cleaner assembly <4D5, 4M4>
4. Air intake hose
5. Resonator <6G7>
6. Air flow sensor assembly <6G7>
7. Air cleaner cover
8. Air cleaner element
9. Air cleaner body
10. Air cleaner bracket
11. Unloader valve
12. Unloader valve <4D5, 4M4>

INTERCOOLER <4D5, 4M4>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Air Cleaner Removal and Installation (Refer to P.15-4)
- Skid Plate and Under Cover Removal and Installation
- Radiator Shroud Cover Removal and Installation (Refer to GROUP 14.)



Removal steps

1. Intercooler air hose
2. Intercooler air hose
3. Intercooler air hose
4. Intercooler assembly
5. Deflector plate
6. Intercooler air pipe

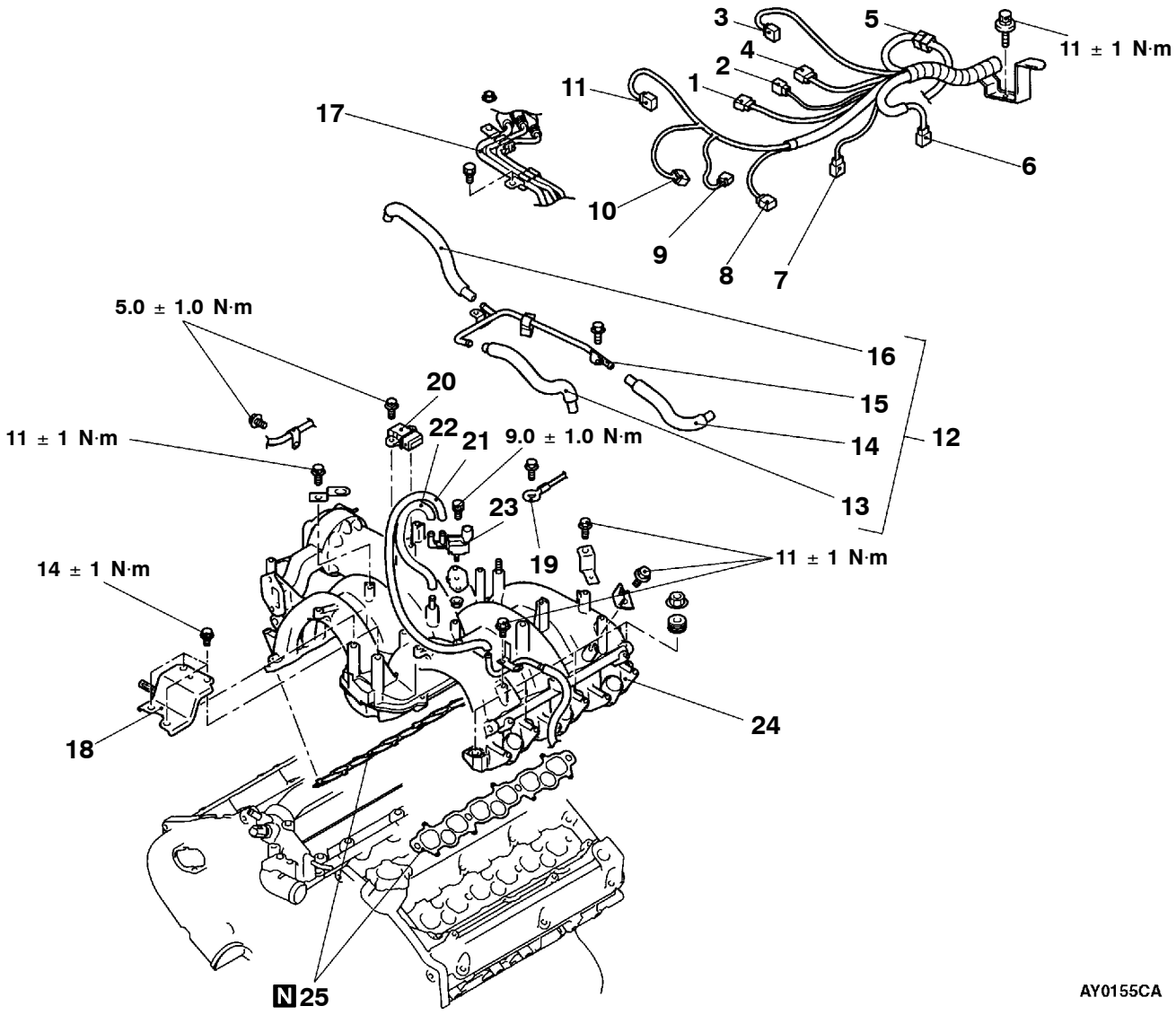
INSPECTION

- Check the intercooler fins for bending damage or foreign matter.
- Check the intercooler hoses for cracking, damage or wear.

INTAKE MANIFOLD <6G7>

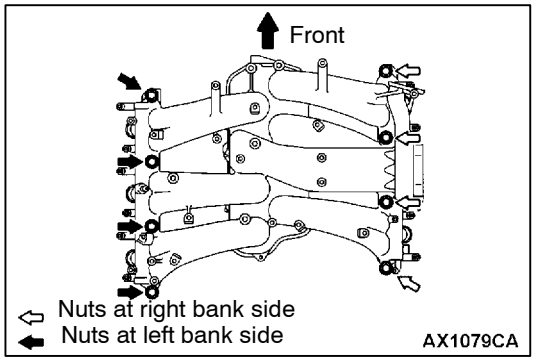
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Coolant Draining and Refilling (Refer to GROUP 14 - On-vehicle Service.)
- Engine Cover Removal and Installation (Refer to GROUP 11A - Timing Belt.)
- Air Cleaner Removal and Installation (Refer to P.15-4.)
- EGR Valve Removal and Installation (Refer to GROUP 17.)
- Ignition Coil Removal and Installation (Refer to GROUP 16.)
- Throttle Body Removal and Installation (Refer to GROUP 13A.)



Removal step

1. Ignition failure sensor connector
2. Detonation sensor connector
3. Throttle position sensor connector
4. Control harness and injector harness connection
5. Control harness and ignition coil harness connection
6. Control harness and fuel pressure sensor harness and camshaft position sensor harness connection
7. Purge solenoid valve connector
8. Crank angle sensor connector
9. Water temperature gauge unit
10. Engine coolant temperature sensor connector
11. Throttle control servo connector
12. PCV hose and pipe assembly
13. PCV hose A
14. PCV hose C
15. PCV hose B
16. PCV pipe
17. Fuel pipe clamp
18. Water outlet fitting bracket
19. Earth cable connection
20. Ignition failure sensor
21. Vacuum hose
22. Purge hose
23. Purge control solenoid valve
- ▶A◀ 24. Intake manifold
25. Intake manifold gasket



REMOVAL SERVICE POINT

▶A◀ INTAKE MANIFOLD INSTALLATION

Tighten the intake manifold mounting nuts in the order shown.

NOTE
Tighten the inside nuts first, and then outside nuts.

Order	Nuts to be tightened	Tightening torque N·m
1	Nuts at right bank side	6.5 ± 1.5
2	Nuts at left bank side	22 ± 1
3	Nuts at right bank side	22 ± 1
4	Nuts at left bank side	22 ± 1

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. Clogging of the negative pressure (vacuum) outlet port, or clogging of the gas passages.
3. Check distortion of installation surface with straight edge and thickness gauge.

   Standard value: 0.15 mm or less

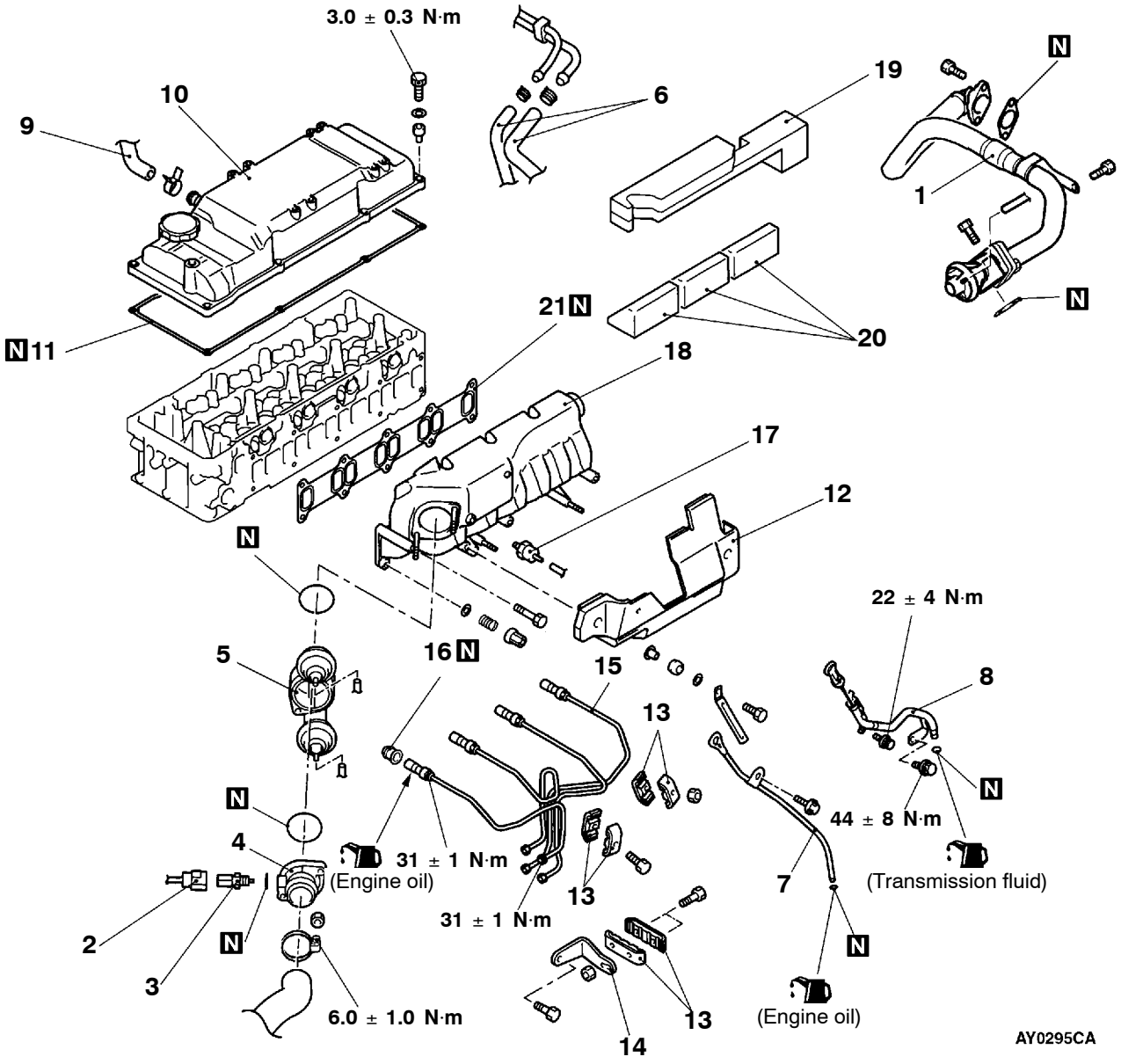
   Limit: 0.20 mm

INTAKE MANIHOLD AND THROTTLE BODY <4M4>

REMOVAL AND INSTALLATION

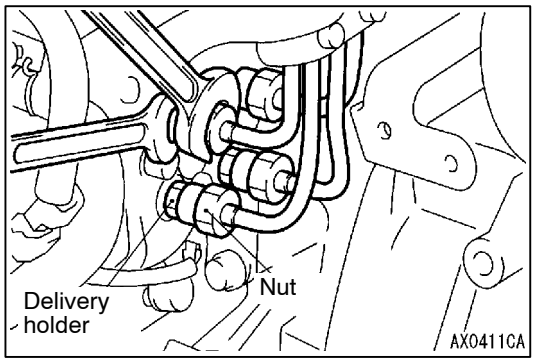
Pre-removal Operations
- Engine Cover Removal (Refer to GROUP 11B - Camshaft.)
- Battery and Battery Tray Removal
- Fuel Filter Removal (Refer to GROUP 13C.)
- Skid Plate And Under Cover Removal

Post-installation Operations
- Skid Plate and Under Cover Installation
- Fuel Filter Installation (Refer to GROUP 13C.)
- Battery and Battery Tray Installation
- Evacuation of Air from Fuel Line (Refer to GROUP 13B – On-vehicle Service.)
- Engine Cover Installation (Refer to GROUP 11B - Camshaft.)



Removal steps

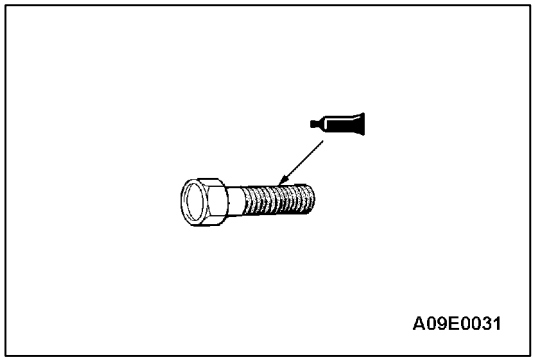
1. EGR valve and pipe assembly
2. Boost air temperature sensor connector
3. Boost air temperature sensor
4. Intake air fitting
5. Throttle body assembly
6. Fuel hose connection
7. Engine oil level gauge and guide
8. ATF level gauge and guide
9. Breather hose connection
10. Rocker cover
11. Rocker cover gasket
12. Intake manifold cover
13. Clamp
14. Injection pipe stay
- ◀A▶ ▶B◀ 15. Injection pipe
- ▶B◀ 16. Injection pipe seal
17. Gas filter assembly
- ▶A◀ 18. Intake manifold
19. Spacer A
20. Spacer B
21. Intake manifold gasket



REMOVAL SERVICE POINT

◀A▶ INJECTION PIPE REMOVAL

Hold the injection pump side delivery holder with a open-end wrench, and loosen the nut.

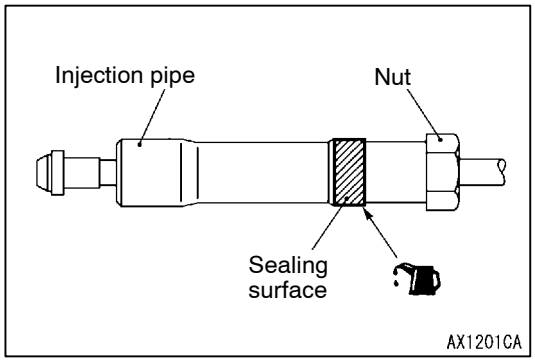


INSTALLATION SERVICE POINTS

▶A◀ INTAKE MANIFOLD INSTALLATION

1. Remove the old sealant from the intake manifold mounting bolt thread.
2. Use a tap (M8×1.25) to remove the old sealant from the bolt hole, and clean by using compressed air.
3. Apply the specified sealant to the intake manifold mounting bolt thread, and install the intake manifold by using the mounting bolts.

Specified sealant:
3M Stud Locking No. 4170 or equivalent



▶B◀ INJECTION PIPE SEAL/INJECTION PIPE INSTALLATION

1. Apply a small amount of engine oil to a new injection pipe seal, and install it, being careful not to damage it.
2. Apply a small amount of engine oil to the injection pipe sealing surface, and then connect the injection pipes.
3. Use a spanner to hold the delivery holder at the injection pump side in the same manner as removal,and then install the injection pipe nuts.
4. Tighten the injection pipe nut to the specified torque.
   Tightening torque: 31 ± 1 N·m

INSPECTION

INTAKE MANIFOLD CHECK

1. Check for damage or cracking of any part.
2. Clogging of the negative pressure (vacuum) outlet port, or clogging of the gas passages.
3. Check distortion of installation surface with straight edge and thickness gauge.

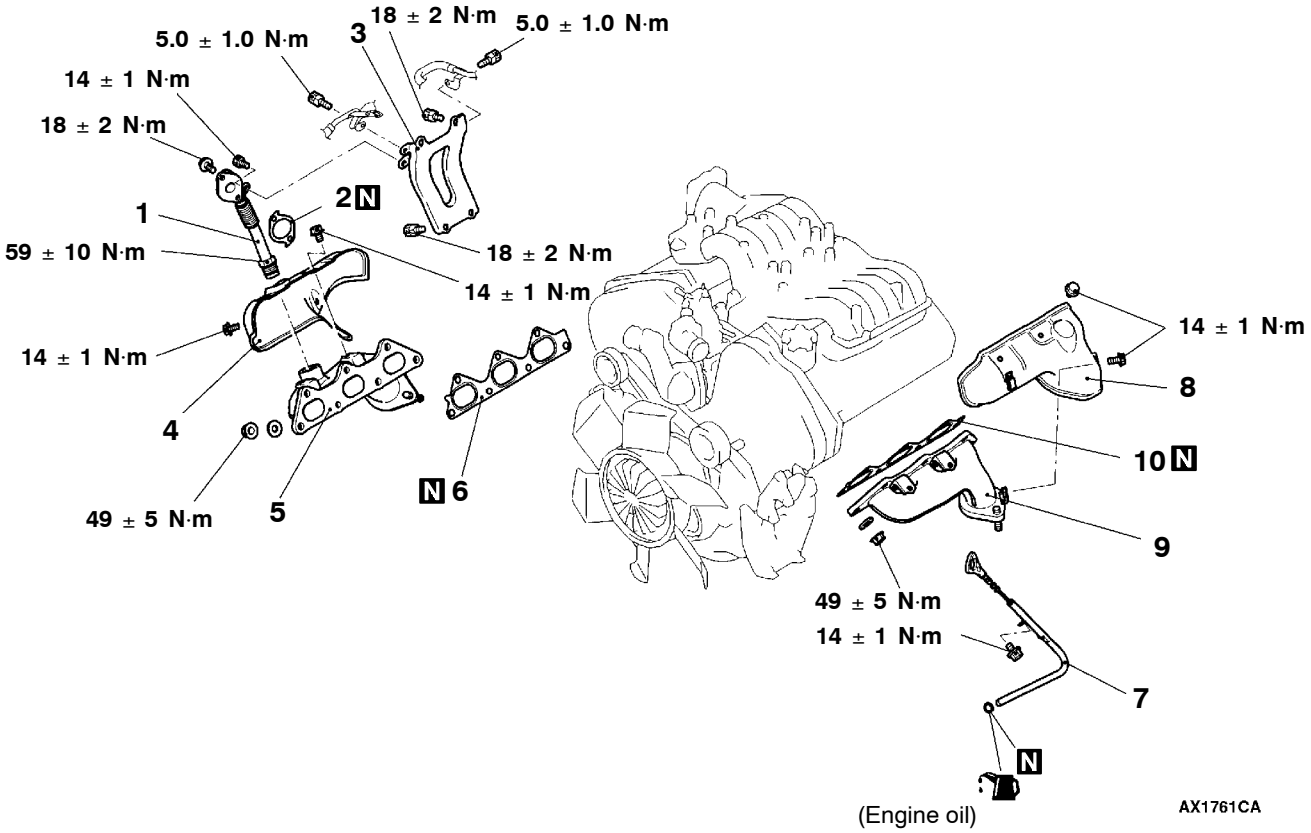
   Standard value: 0.15 mm or less

   Limit: 0.20 mm

EXHAUST MANIFOLD <6G7>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations
- Engine Cover Removal And Installation (Refer to GROUP 11A - Timing Belt)
- Battery, Battery Tray Removal And Installation
- Air Cleaner Assembly Removal And Installation (Refer to P.15-4.)
- Skid Plate And Under Cover Removal And Installation
- Front Exhaust Pipe Removal And Installation (Refer to P.15-21.)
- Front Catalytic Converter Removal And Installation (Refer to GROUP 17.)



Removal steps
1. EGR pipe
2. EGR pipe gasket
3. Throttle body stay
4. Heat protector
5. Exhaust manifold
6. Exhaust manifold gasket
7. Engine oil level gauge and guide
8. Heat protector
9. Exhaust manifold
10. Exhaust manifold gasket

INSPECTION

Check the following points; replace the part if a problem is found.

EXHAUST MANIFOLD CHECK

1. Check for damage or cracking of any part.
2. Using a straight edge and a thickness gauge, check for distortion of the cylinder head installation surface.

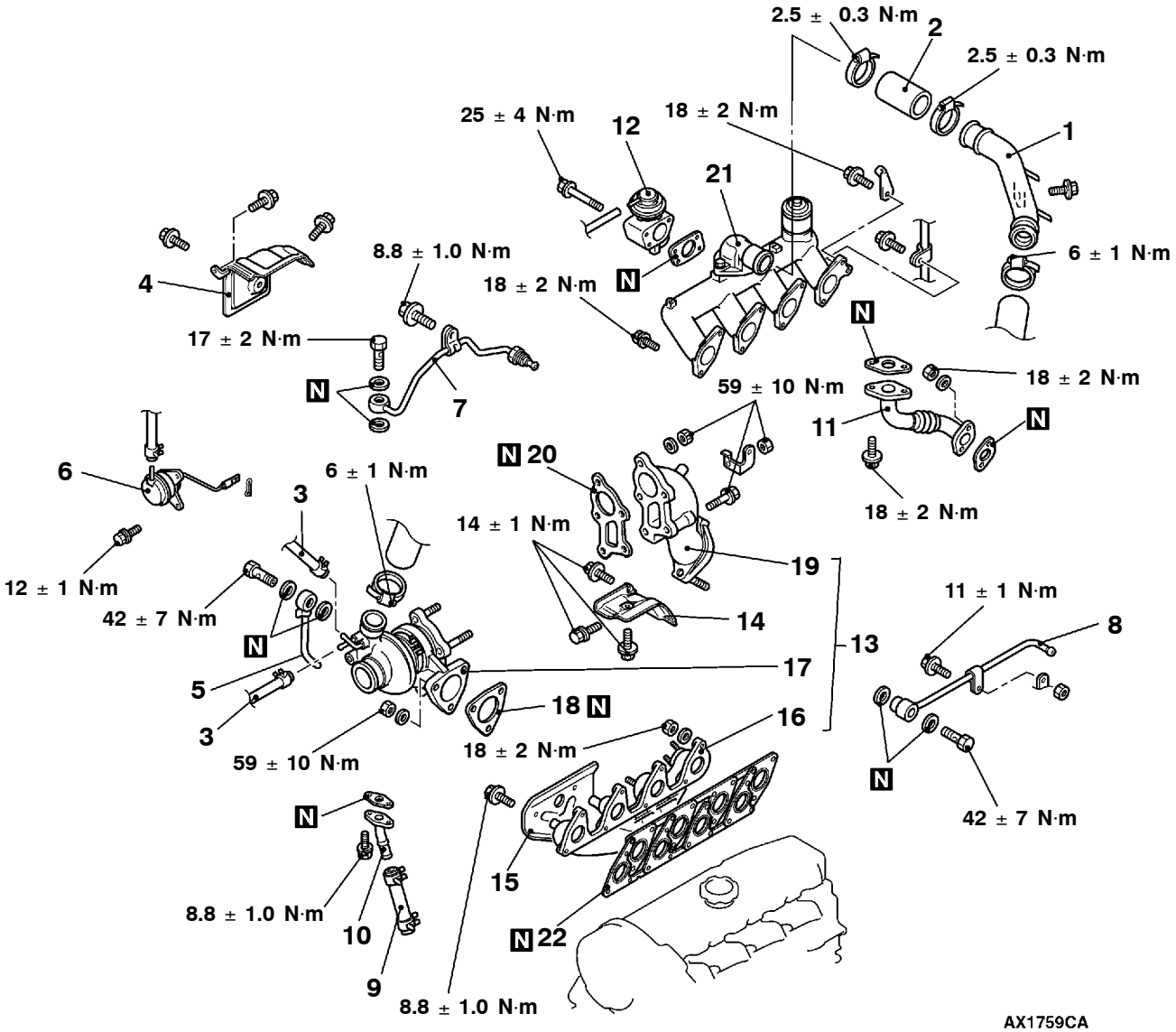
   Standard value: 0.15 mm or less

   Limit: 0.20 mm

INTAKE AND EXHAUST MANIFOLD, TURBOCHARGER <4D5>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations
- Engine Coolant Draining and Refilling (Refer to GROUP 14 - On-vehicle Service.)
- Battery, Battery Tray Removal and Installation
- Air Cleaner Assembly Removal and Installation (Refer to P.15-4.)
- Skid Plate and Under Cover Removal and Installation
- Front Exhaust Pipe Removal and Installation (Refer to P.15-23.)



Removal steps

1. Air pipe
2. Air intake hose
3. Vacuum hose connection
4. Turbocharger heat protector
5. Water pipe (B) connection
6. Waste gate actuator
7. Oil pipe
8. Water pipe (A)
9. Oil return hose
10. Oil return pipe
11. EGR pipe
12. EGR valve
13. Exhaust manifold and turbocharger assembly
14. Exhaust fitting heat protector
15. Exhaust manifold heat protector
16. Exhaust manifold
▶A◀ 17. Turbocharger assembly
18. Turbocharger gasket
19. Exhaust fitting assembly
20. Exhaust fitting gasket
21. Intake manifold
22. Intake and exhaust manifold gasket

INSTALLATION SERVICE POINT

▶A◀ TURBOCHARGER ASSEMBLY INSTALLATION

1. Check the internal surface, the eye bolt and the mating surface of the oil pipe and water pipe for clogging, and clean if necessary.
2. If deposits of carbon are accumulated on the turbocharger oil passage, remove them and clean using the compressed air.

   Caution
   Be careful not to allow foreign material to enter the turbocharger.

3. Add clean engine oil through the oil feed pipe port on the turbocharger.

INSPECTION

TURBOCHARGER ASSEMBLY CHECK

- Visually check the turbine wheel and the compressor wheel for cracking or other damage.
- Check whether the turbine wheel and the compressor wheel can be easily turned by hand.
- Check for oil leakage from the turbocharger assembly.
- Check whether or not the waste gate valve remains open.

If any problem is found, replace the part after disassembly.

OIL PIPE AND OIL RETURN PIPE CHECK

Check the oil pipe and oil return pipe for clogging, bending, or other damage. If there is clogging, clean it.

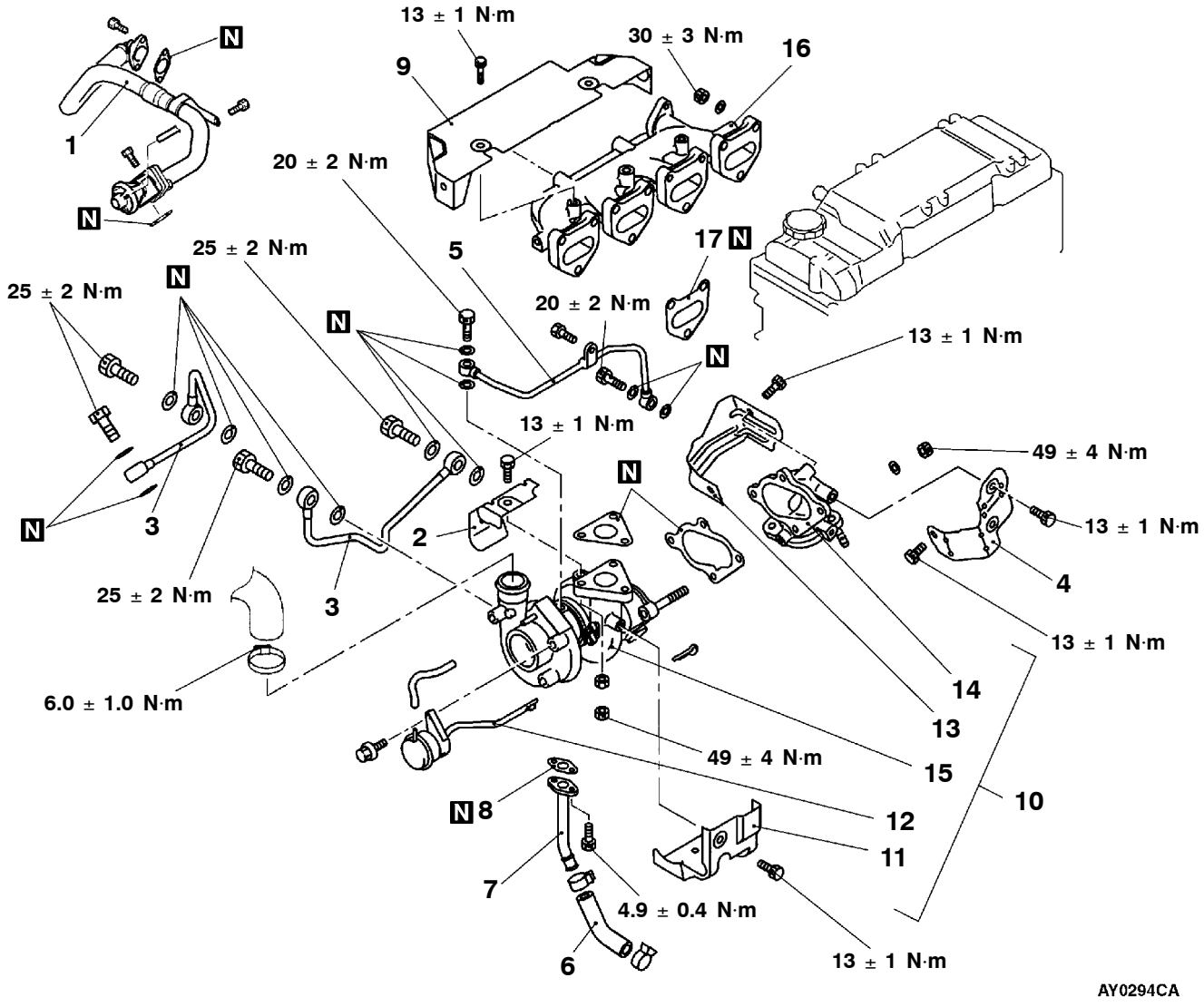
EXHAUST MANIFOLD CHECK

Damage or cracking of any part.

TURBOCHARGER AND EXHAUST MANIFOLD <4M4>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations
- Engine Coolant Draining and Refilling (Refer to GROUP 14 - On-vehicle Service.)
- Engine Cover Removal and Installation (Refer to GROUP 11C – Camshaft)
- Air cleaner Assembly Removal and Installation (Refer to P.15-4.)
- Skid Plate and Under Cover Removal and Installation
- Front Exhaust Pipe Removal and Installation (Refer to P.15-25.)



Removal steps

1. EGR valve and pipe assembly
2. Turbocharger cover
3. Water pipe
4. Turbocharger cover
5. Oil pipe
6. Oil return hose
7. Oil return pipe
8. Oil return pipe gasket
9. Heat protector
10. Turbocharger and exhaust fitting assembly
11. Turbocharger cover
12. Waste gate actuator
13. Turbocharger cover
14. Exhaust fitting

▶A◀ 15. Turbocharger assembly

16. Exhaust manifold
17. Exhaust manifold gasket

INSTALLATION SERVICE POINT

▶A◀ TURBOCHARGER ASSEMBLY INSTALLATION

1. Check the internal surface, the eye bolt and the mating surface of the oil pipe and water pipe for clogging, and clean if necessary.
2. If deposits of carbon are accumulated on the turbocharger oil passage, remove them and clean using the compressed air.

   Caution
   Be careful not to allow foreign material to enter the turbocharger.

3. Add clean engine oil through the oil feed pipe port on the turbocharger.

INSPECTION

Check the following points; replace the part if a problem is found.

EXHAUST MANIFOLD CHECK

1. Check for damage or cracking of any part.
2. Using a straight edge and a thickness gauge, check for distortion of the cylinder head installation surface.

   Standard value: 0.15 mm or less

   Limit: 0.20 mm

TURBOCHARGER ASSEMBLY CHECK

- Visually check the turbine wheel and the compressor wheel for cracking or other damage.
- Check whether the turbine wheel and the compressor wheel can be easily turned by hand.
- Check for oil leakage from the turbocharger assembly.
- Check whether or not the waste gate valve remains open. If any problem is found, replace the part after disassembly.

OIL PIPE AND OIL RETURN PIPE CHECK

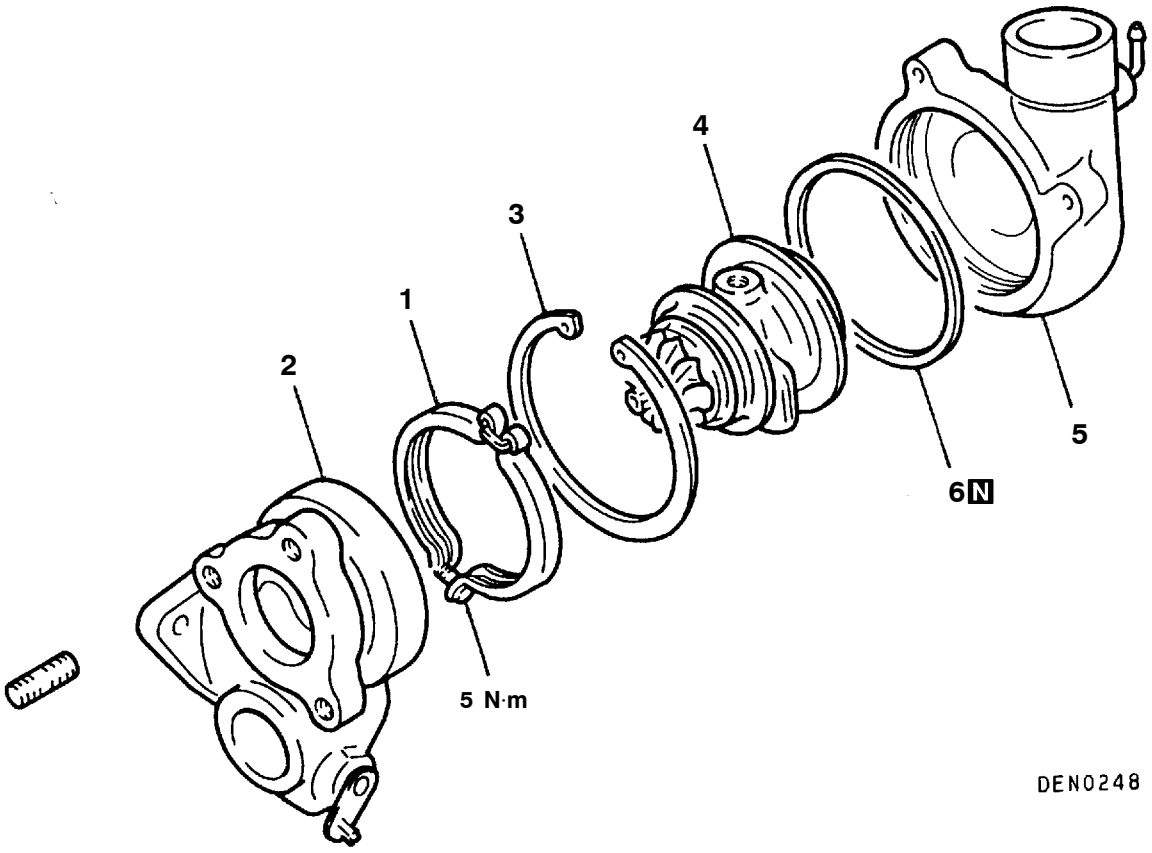
Check the oil pipe and oil return pipe for clogging, bending, or other damage. If there is clogging, clean it.

EXHAUST MANIFOLD CHECK

Damage or cracking of any part.

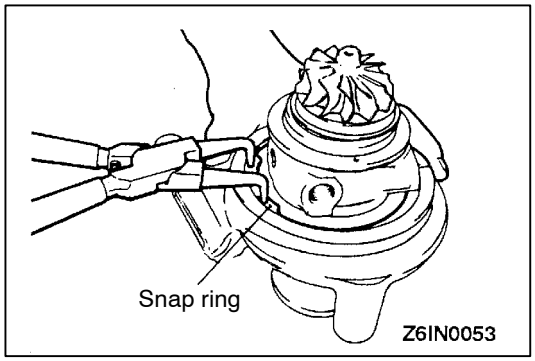
TURBOCHARGER <4D5>

DISASSEMBLY AND REASSEMBLY



Disassembly steps

	▶E◀	1. Coupling
	▶D◀	2. Turbine housing
◀A▶	▶C◀	3. Snap ring
◀B▶	▶B◀	4. Turbine wheel assembly
		5. Compressor cover
	▶A◀	6. O-ring

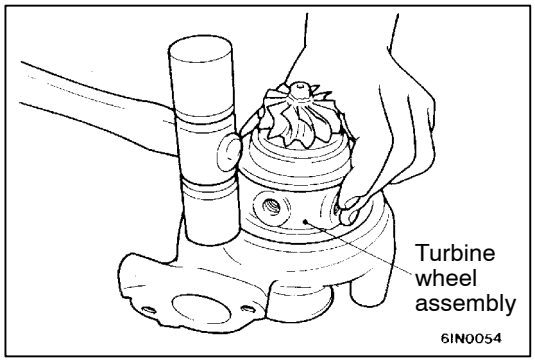


DISASSEMBLY SERVICE POINTS

◀A▶ SNAP RING REMOVAL

Lay the unit with the compressor cover side facing down and using snap ring pliers, remove the compressor cover attaching snap ring.

Caution
When removing the snap ring, hold it with fingers to prevent it from springing away.

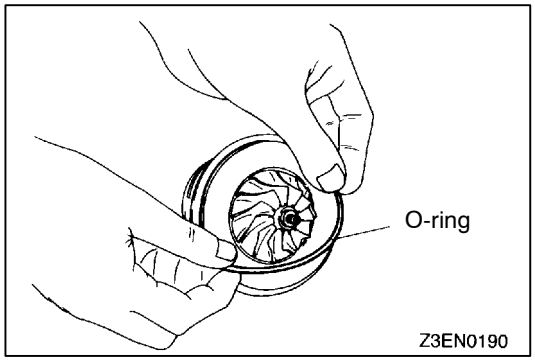


◀B▶ TURBINE WHEEL ASSEMBLY REMOVAL

Remove the turbine wheel assembly, striking the circumference of the compressor cover with a plastic hammer. The turbine wheel assembly may be a little hard to remove due to an O-ring put on the outer circumference.

CLEANING

1. Use a clean cleaning oil commercially available. Do not use corrosive cleaning oils as they could damage to some parts.
2. Use a plastic scraper or hard brush to clean aluminum parts.

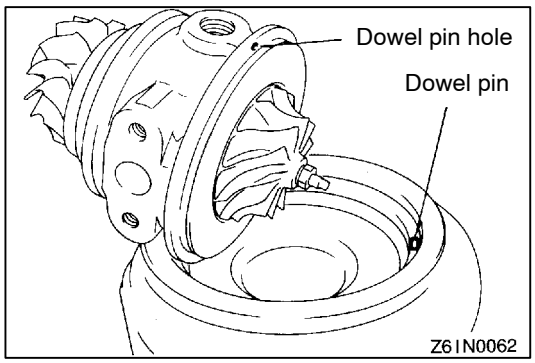


REASSEMBLY SERVICE POINTS

▶A◀ O-RING INSTALLATION

Apply a light coat of engine oil to a new O-ring and fit in the turbine wheel assembly groove.

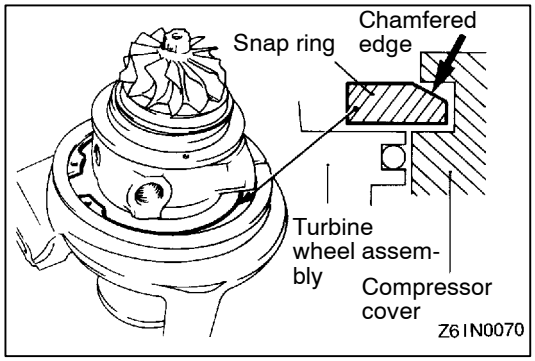
Caution
When installing the O-ring, use care not to damage it. A damaged O-ring causes oil leaks.



▶B◀ TURBINE WHEEL ASSEMBLY

1. Apply a light coat of engine oil to the periphery of the O-ring.
2. Install the turbine wheel assembly to the compressor cover in relation to the dowel pin.

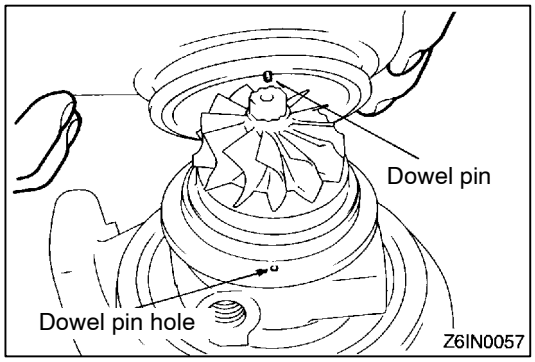
   Caution
   Use care not to damage the blades of turbine wheel and compressor wheel.



▶C◀ SNAP RING INSTALLATION

Lay the assembly with the compressor cover facing down and fit the snap ring.

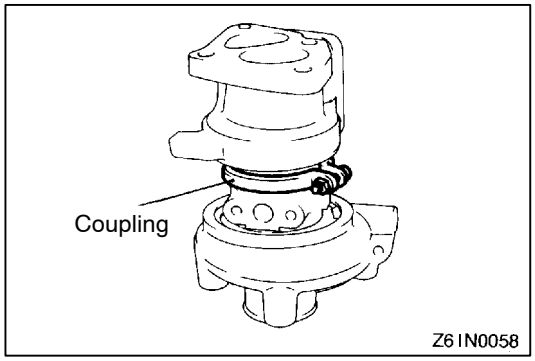
Caution
Fit the snap ring with its chamfered side facing up.



▶D◀ TURBINE HOUSING INSTALLATION

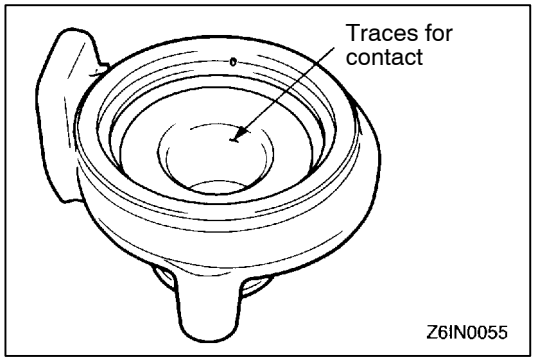
Install the turbine housing in relation to the dowel pin.

Caution
Use care not to damage the blades of turbine wheel.



▶E◀ COUPLING INSTALLATION

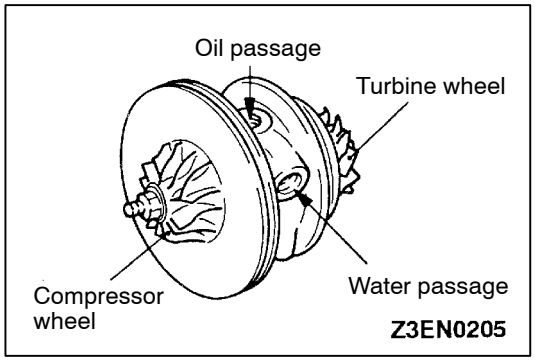
Install the coupling and tighten to specified torque.



INSPECTION

TURBINE HOUSING

1. Check the housing for traces of contact with the turbine wheel, cracks due to overheating, pitching, deformation and other damage. Replace with a new turbine housing if cracked.
2. Operate the waste gate valve lever manually to check that the gate can be operated and closed smoothly.



COMPRESSOR COVER

Check the compressor cover for traces of contact with the compressor wheel and other damage.

TURBINE WHEEL ASSEMBLY

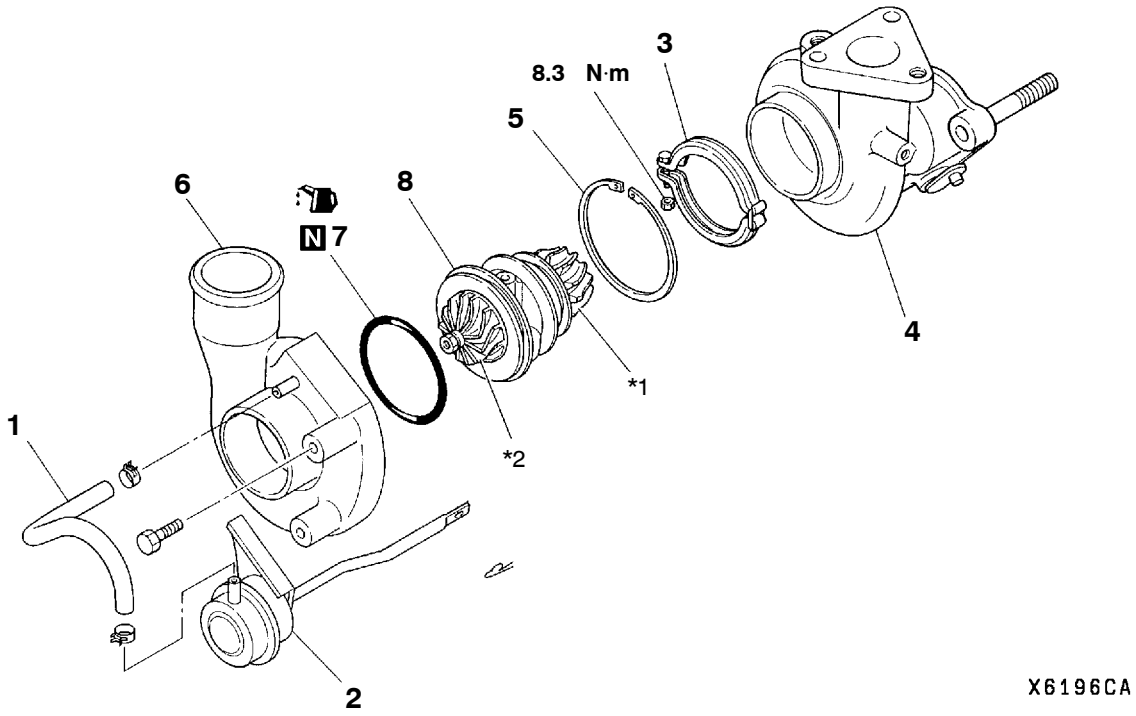
1. Check the turbine and compressor wheel blades for bend, burr, damage, corrosion and traces of contact on the back side and replace if defective.
2. Check the oil passage of the turbine wheel assembly for deposit and clogging.
3. In the case of water cooled type, check also the water passage for deposit and clogging.
4. Check the turbine wheel and compressor wheel for light and smooth turning.

OIL PIPE/OIL RETURN PIPE

Correct or replace the oil pipe and oil return pipe if clogged, collapsed, deformed or otherwise damaged.

TURBOCHARGER <4M4>

DISASSEMBLY AND REASSEMBLY



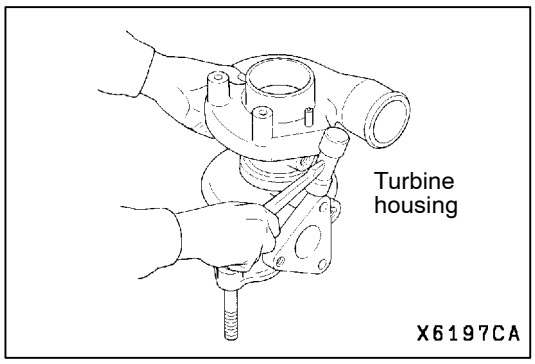
Disassembly steps

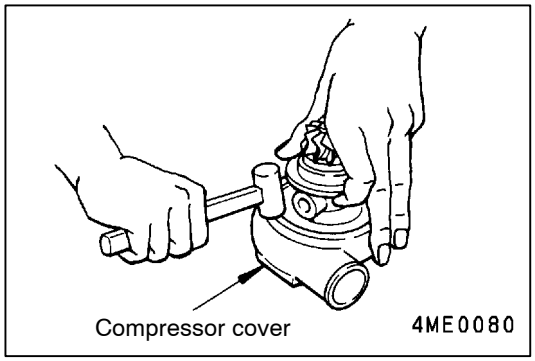
1. Hose
2. Actuator
3. Coupling
4. Turbine housing
5. Snap ring
6. Compressor cover

◀A▶ ▶B◀ ◀B▶

▶A◀ 7. O-ring
8. Cartridge assembly

*1: Turbine wheel
*2: Compressor wheel





DISASSEMBLY SERVICE POINTS

◀A▶ TURBINE HOUSING REMOVAL

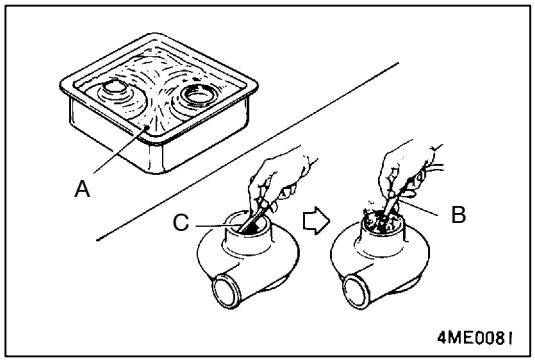
Caution

1. **Tap all over the circumferential surface of the turbine housing with a rubber hammer or any other similar tool, using care not to damage it.**
2. **The turbine wheel blades are easy to bend. Use care so that they do not contact the turbine housing.**

◀B▶ COMPRESSOR COVER REMOVAL

Caution

1. **Tap all over the circumferential surface of the compressor cover with a rubber hammer or any other similar tool, using care not to damage it.**
2. **The compressor wheel blades are easy to bend. Use care so that they do not contact the compressor cover.**



CLEANING

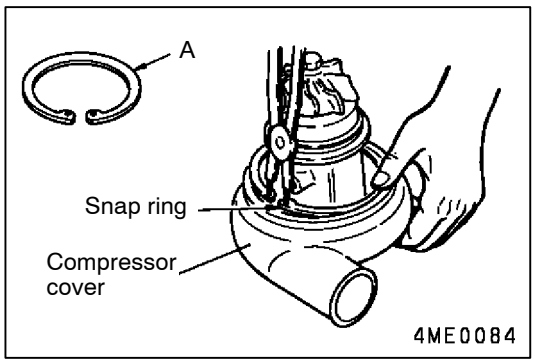
TURBINE HOUSING/COMPRESSOR COVER

1. Prior to cleaning, visually check the disassembled parts for evidences of burns, abrasions or other flaws because they may become unrecognizable after washing. Replace if necessary.
2. Immerse the disassembled parts in the nonflammable solvent A (DAI-CLEANER T-30 from Daido Chemical Industry Co., Ltd.). Remove them from the solvent and blow compressed air B against them.
   Scrape off foreign matters, if any, using a plastic scraper C before the immersion.

REASSEMBLY SERVICE POINTS

▶A◀ O-RING INSTALLATION

Apply a thin coat of engine oil evenly to the entire circumferential surface of O-ring before installing it.



▶B◀ SNAP RING INSTALLATION

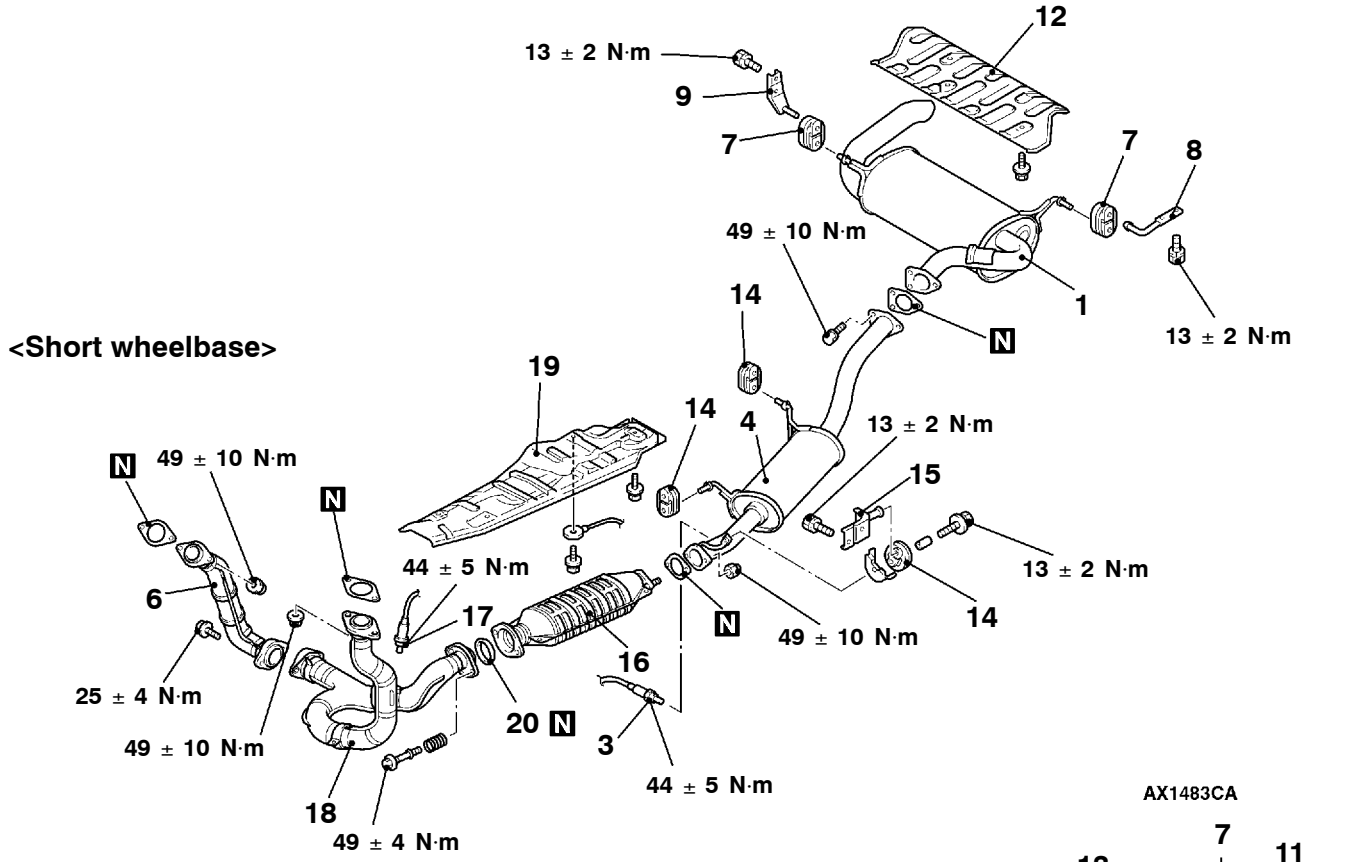
Install the snap ring in the compressor cover with the tapered surface A facing upward.

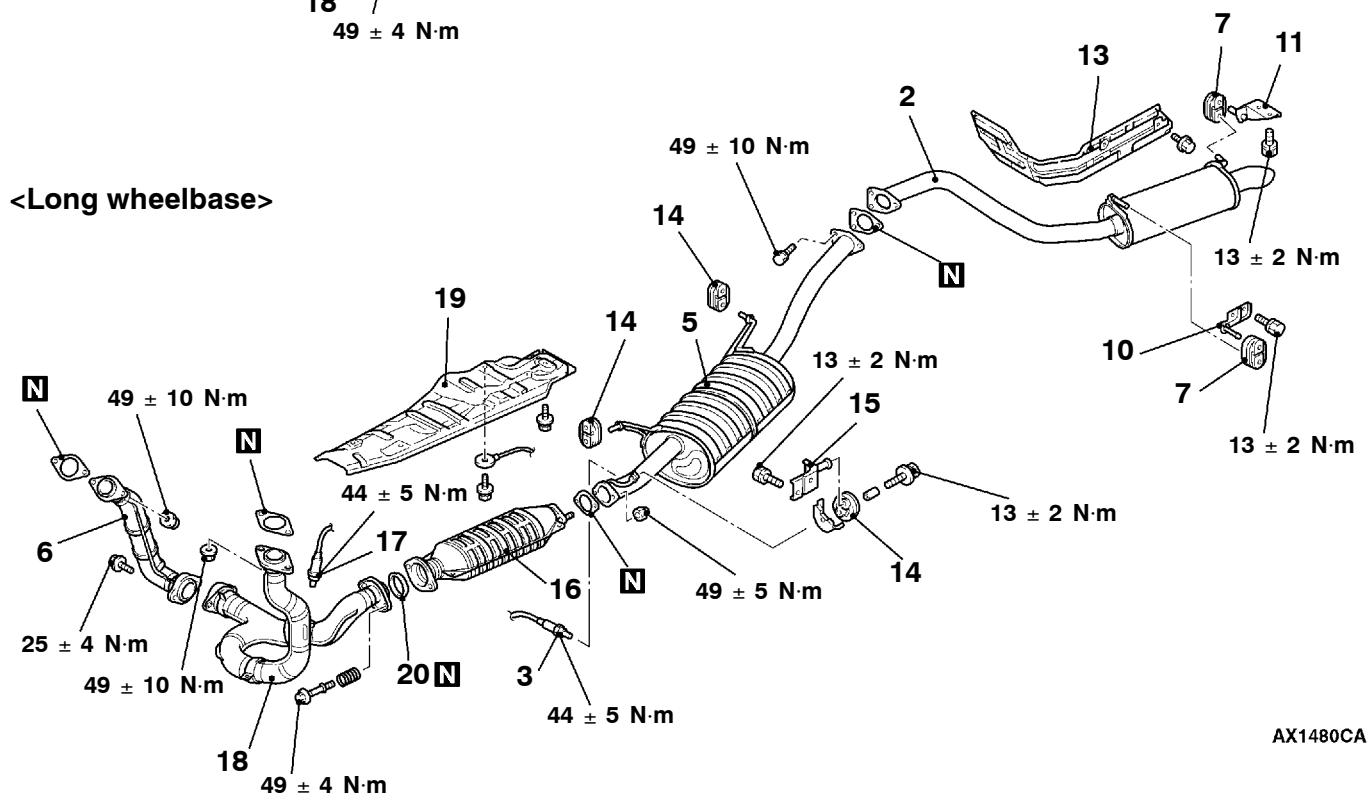
Caution
Hold the snap ring with one hand not to let it bounce out.

EXHAUST PIPE AND MAIN MUFFLER <6G7>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Front Under Cover Removal and Installation





Exhaust main muffler and rear floor heat protector removal steps <Short wheelbase>

1. Exhaust main muffler
7. Hanger
8. Hanger bracket
9. Hanger bracket
12. Rear floor heat protector

Tail exhaust pipe and rear floor heat protector removal steps <Long wheelbase>

2. Tail exhaust pipe
7. Hanger
10. Hanger bracket
11. Hanger bracket
13. Rear floor heat protector

Center exhaust pipe removal steps <Short wheelbase>

◀A▶ ▶A◀ 3. Oxygen sensor (rear) <M/T>
4. Center exhaust pipe
14. Hanger
15. Hanger bracket

Exhaust main muffler removal steps <Long wheelbase>

◀A▶ ▶A◀ 3. Oxygen sensor (rear) <M/T>
5. Exhaust main muffler
14. Hanger
15. Hanger bracket

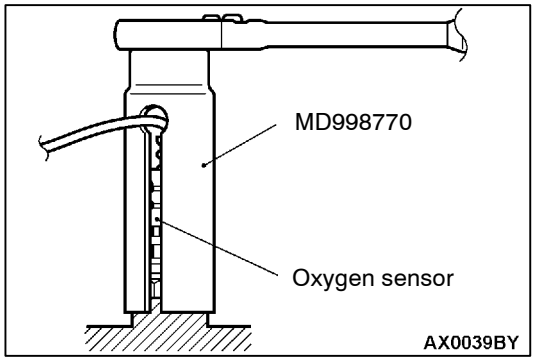
Front exhaust pipe removal

- Under cover

6. Front exhaust pipe (R.H.)
◀A▶ ▶A◀ 17. Oxygen sensor (front)
18. Front exhaust pipe (L.H.)
20. Seal ring

Front floor heat protector removal steps

16. Catalytic converter
◀A▶ ▶A◀ 17. Oxygen sensor (front)
18. Front exhaust pipe (L.H.)
19. Front floor heat protector
20. Seal ring



REMOVAL SERVICE POINT

◀A▶ OXYGEN SENSOR REMOVAL

Use special tool to remove the oxygen sensor.

INSTALLATION SERVICE POINT

▶A◀ OXYGEN SENSOR INSTALLATION

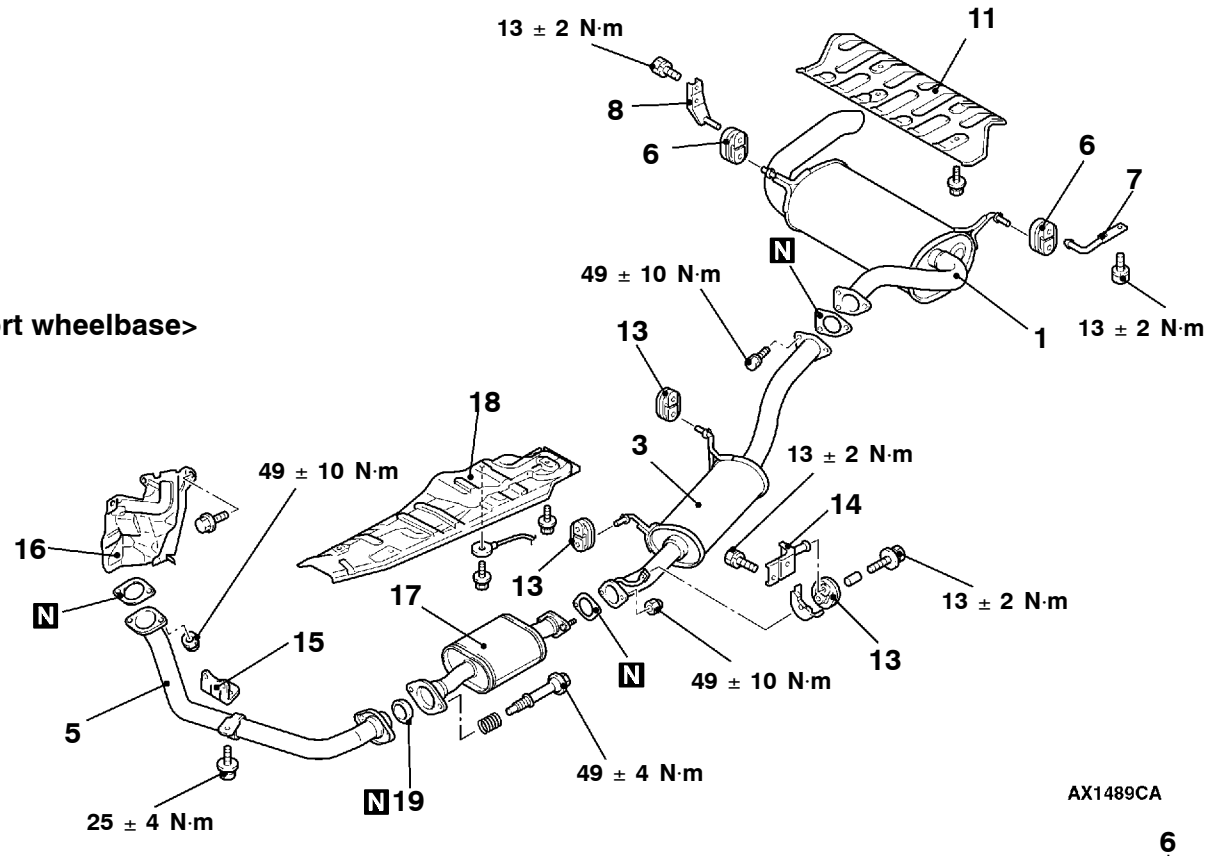
Use special tool to install the oxygen sensor.

EXHAUST PIPE AND MAIN MUFFLER <4D5>

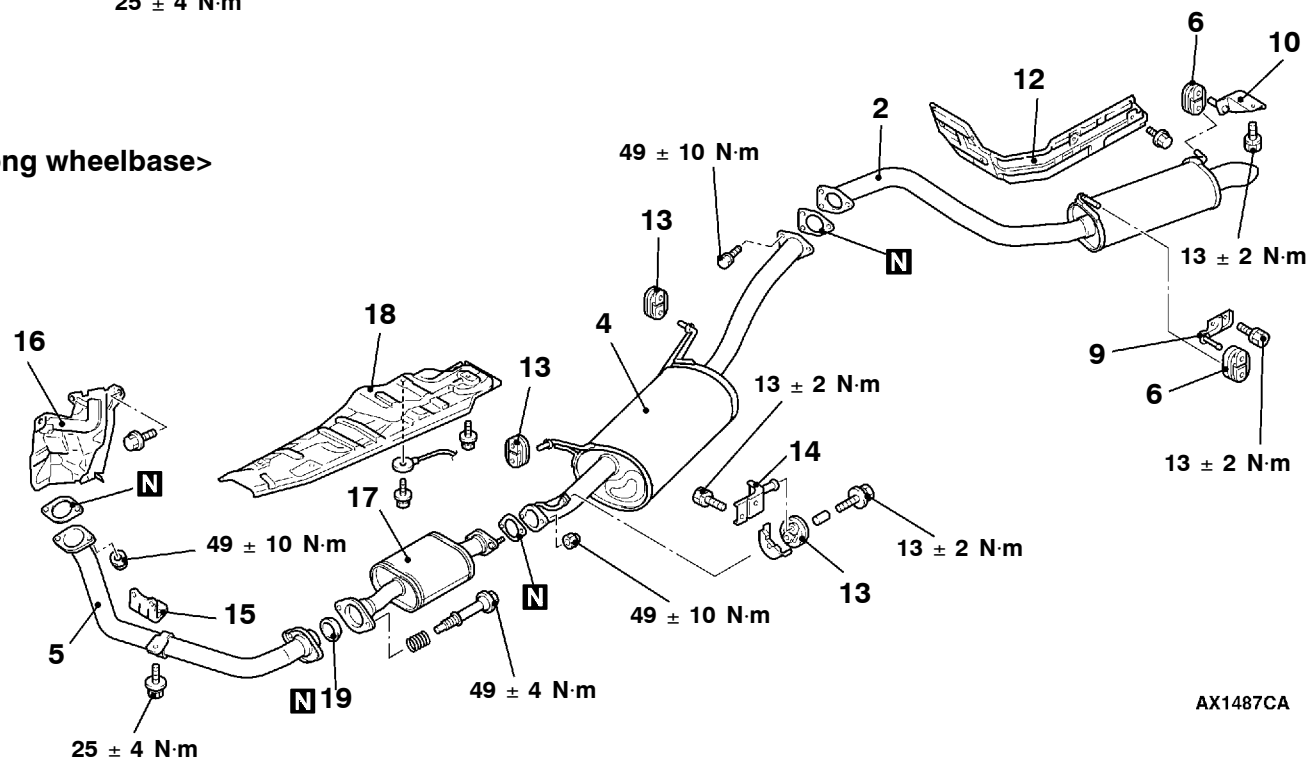
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Front Under Cover Removal and Installation

<Short wheelbase>



<Long wheelbase>



Exhaust main muffler and rear floor heat protector removal steps <Short wheelbase>

1. Exhaust main muffler
6. Hanger
7. Hanger bracket
8. Hanger bracket
11. Rear floor heat protector

Tail exhaust pipe and rear floor heat protector removal steps <Long wheelbase>

2. Tail exhaust pipe
7. Hanger
9. Hanger bracket
10. Hanger bracket
12. Rear floor heat protector

Center exhaust pipe removal steps <Short wheelbase>

3. Center exhaust pipe
13. Hanger
14. Hanger bracket

Exhaust main muffler removal steps <Long wheelbase>

4. Exhaust main muffler
13. Hanger
14. Hanger bracket

Front exhaust pipe and dash heat protector removal steps

- Under cover
5. Front exhaust pipe
15. Exhaust support bracket
16. Dash heat protector

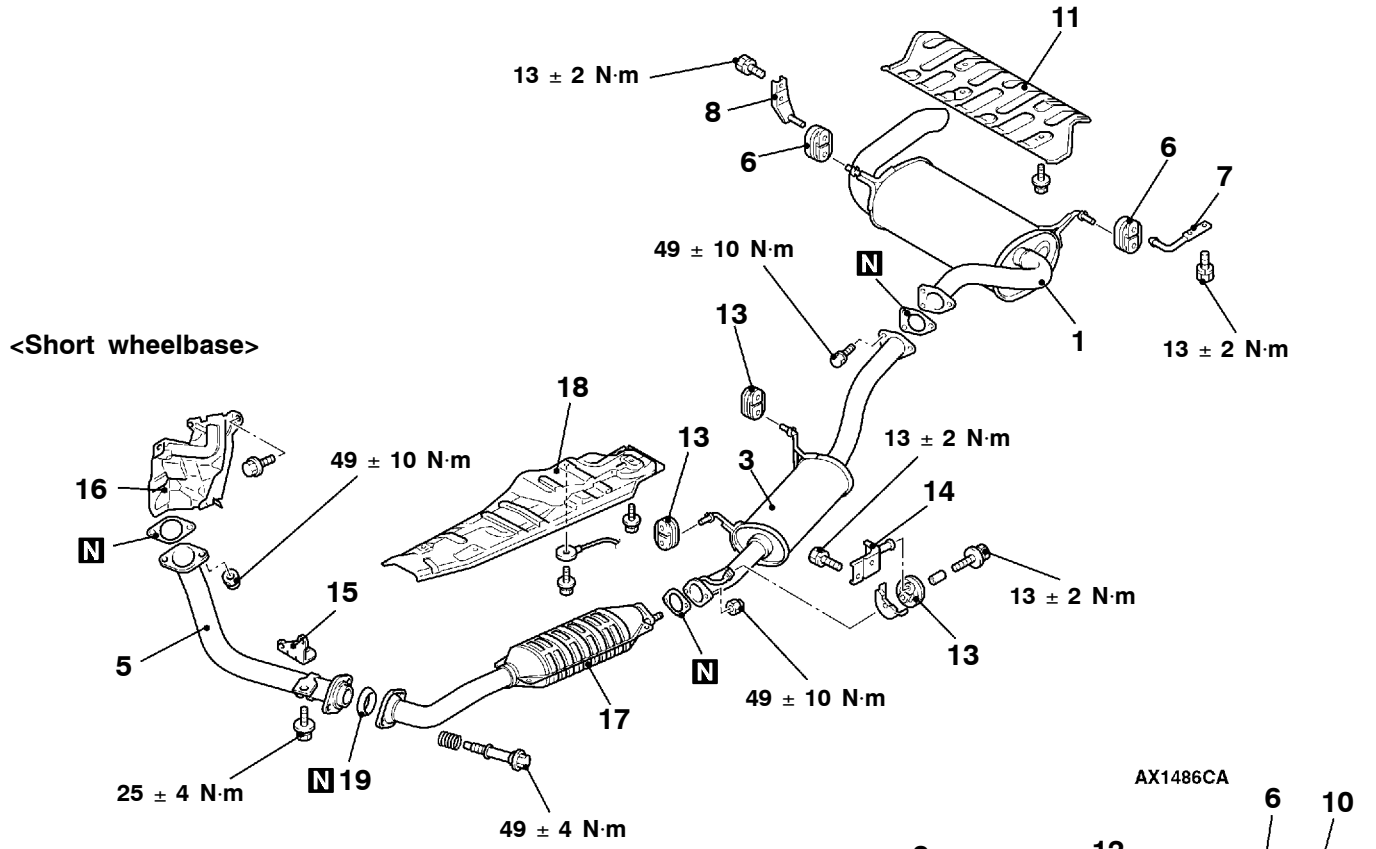
Pre-muffler and front floor heat protector removal steps

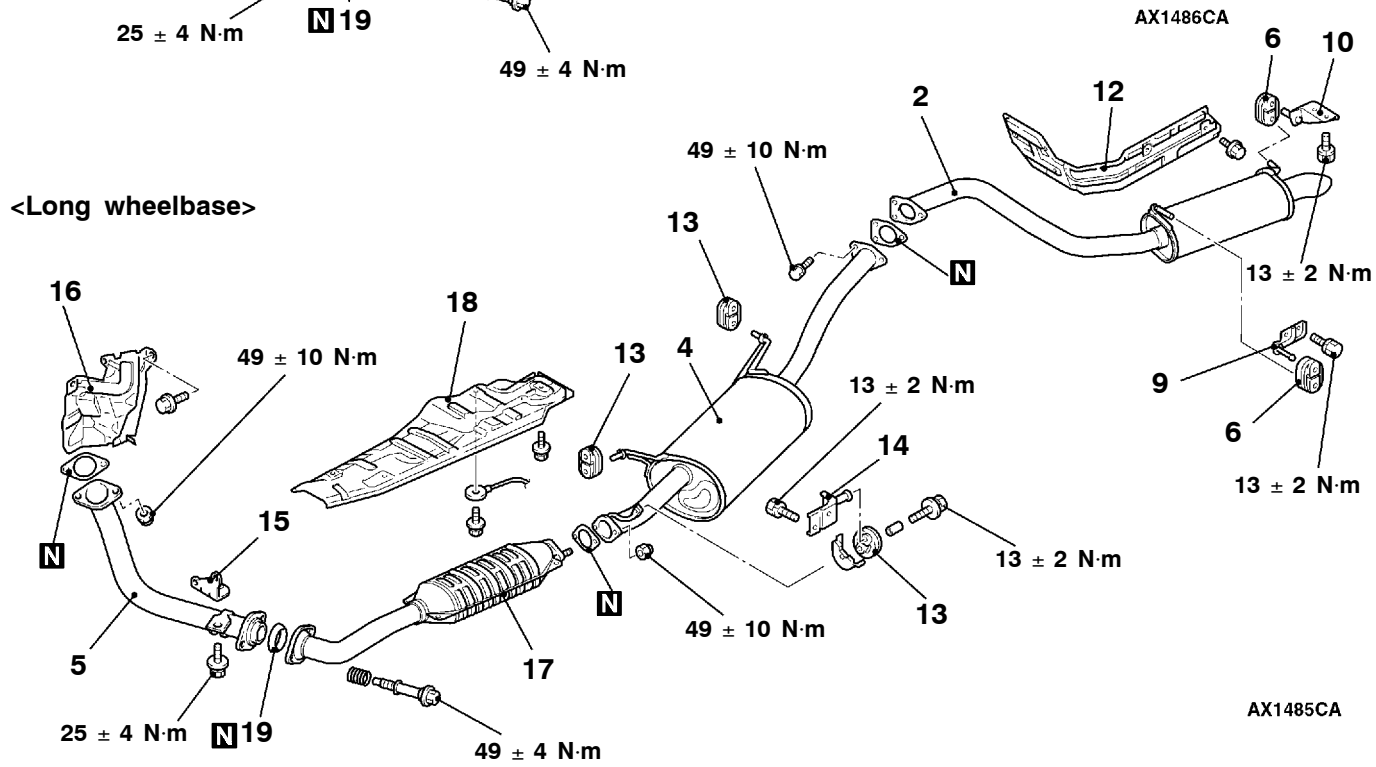
17. Pre-muffler
18. Front floor heat protector
19. Seal ring

EXHAUST PIPE AND MAIN MUFFLER <4M4>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Front Under Cover Removal and Installation





Exhaust main muffler and rear floor heat protector removal steps <Short wheelbase>

1. Exhaust main muffler
6. Hanger
7. Hanger bracket
8. Hanger bracket
11. Rear floor heat protector

Tail exhaust pipe and rear floor heat protector removal steps <Long wheelbase>

2. Tail exhaust pipe
7. Hanger
9. Hanger bracket
10. Hanger bracket
12. Rear floor heat protector

Center exhaust pipe removal steps <Short wheelbase>

3. Center exhaust pipe
13. Hanger
14. Hanger bracket

Exhaust main muffler removal steps <Long wheelbase>

4. Exhaust main muffler
13. Hanger
14. Hanger bracket

Front exhaust pipe and dash heat protector removal steps

- Under cover

5. Front exhaust pipe
15. Exhaust support bracket
16. Dash heat protector

Front floor heat protector removal steps

17. Catalytic converter
18. Front floor heat protector
19. Seal ring

INTAKE AND EXHAUST

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GENERAL

OUTLINE OF CHANGES

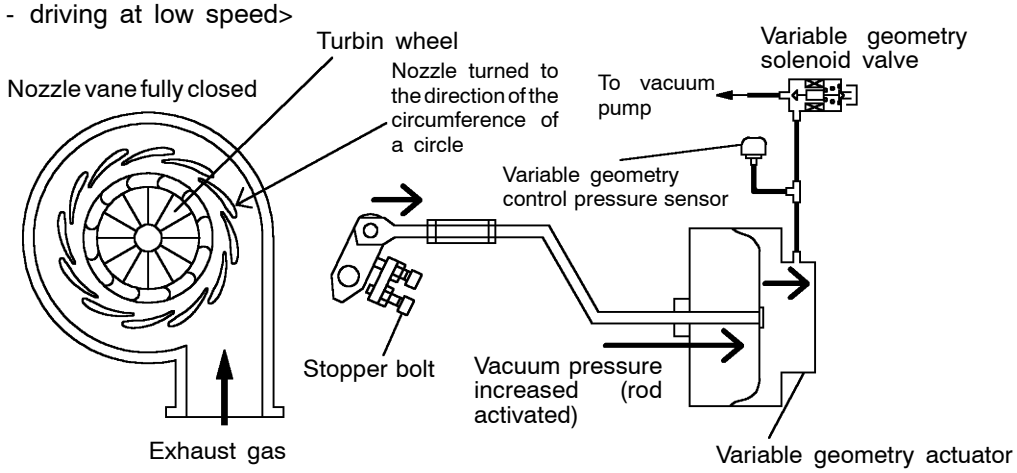
Some service procedures have been established as the following changes have been made due to the compliance with the Emission Regulation Step III.

- An oxygen sensor (rear) has been added. Its service procedure is the same as for the previous MT models <6G7-A/T>.
- The turbocharger has been changed to a Variable Geometry (VG) type <4D5>.
- A catalytic converter has been added <4D5>.
- The intake manifold has been reshaped <4M4>.
- An EGR cooler has been added <4M4>.
- The variable geometry turbocharger can not be disassembled, and must be always replaced as an assembly.

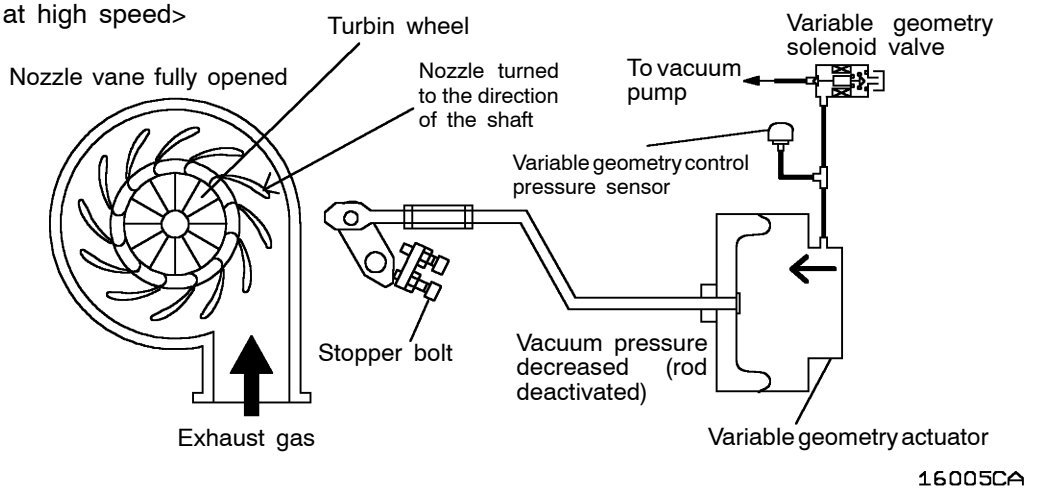
GENERAL INFORMATION

The variable geometry solenoid valve is duty controlled to control the variable nozzle opening angle of the variable geometry turbocharger. This allows to obtain the characteristic of boost pressure corresponding to the engine operation status.

<At starting - driving at low speed>



<Driving at high speed>



At starting and driving at low speed, the duty control value of the variable geometry solenoid valve is increased to apply the vacuum pressure of the vacuum pump to the variable geometry actuator. Applying the vacuum pressure to the variable geometry actuator pulls the actuator rod so that it can move towards the direction of closing the variable nozzle of the variable geometry turbocharger. As closing the nozzle reduces the exhaust gas mass, the speed of exhaust gas flow will be increased and efficiency will be improved. Since the characteristic of boost pressure becomes a low speed type, boost pressure will suddenly rise from low speed.
At driving at high speed, the duty control value of the variable geometry solenoid valve is decreased to reduce the vacuum pressure from the vacuum pump so that the actuator rod can return to the deactivated status and move towards the direction of opening the nozzle of the variable geometry turbocharger.
Opening the nozzle allows the characteristic of boost pressure to become a high speed type so that the appropriate boost pressure can be maintained.
Therefore, boost pressure can be controlled by appropriate duty control of the variable geometry solenoid valve. The engine-ECU calculates the correct boost pressure based on the engine speed and fuel injection amount. Furthermore, the duty control of the variable geometry solenoid valve is given feedback of the signals from the variable geometry control pressure sensor and the boost pressure sensor so that the variable nozzle opening angle of the variable geometry turbocharger can be quickly adjusted to obtain the desired boost pressure.

SERVICE SPECIFICATIONS

Items	Standard value
Variable geometry actuator activation vacuum (Approximately 1 mm stroke) kPa	Approximately 10.5 - 12.5
Variable geometry solenoid valve coil resistance (at 20°C) Ω	29 - 35

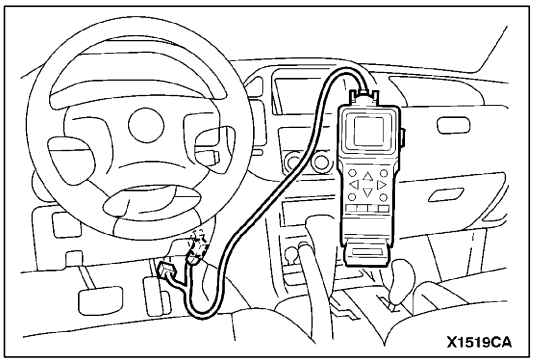
SEALANT

Item	Specified sealant	Remarks
Thread of the intake manifold mounting bolts	3M Stud Locking No.4170 or equivalent	Anaerobic sealant

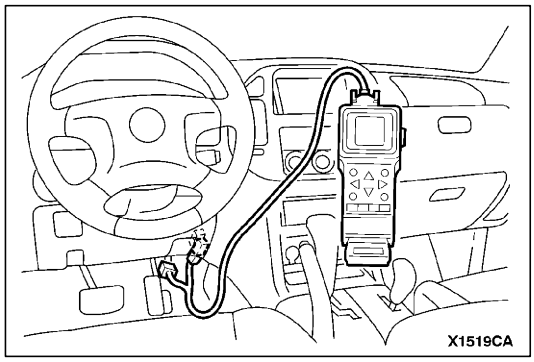
ON-VEHICLE SERVICE

TURBOCHARGER SUPERCHARGING CHECK

Caution
Conduct the driving test in a location where driving at full acceleration can be done with safety. Two person should be in the vehicle when the test is conducted; the person in the passenger seat should read the indications shown by the MUT-II.



1. Set the vehicle to the pre-inspection condition.
2. Turn the ignition switch to “LOCK” (OFF) position, and connect the diagnosis connector to the MUT-II.
3. Use the data list function named “Item No. 04” boost pressure sensor of the MUT-II to check the supercharging pressure when the engine speed increases to approximately 3,000 r/min or more by driving at full acceleration in 2nd.
4. When the indicated supercharger does not become positive pressure, check the following items.
   - Malfunction of the boost pressure sensor
   - Leakage of supercharging pressure
   - Malfunction of the turbocharger
5. When the indicated supercharger is 133 kPa or more, supercharging control may be faulty, therefore check the followings.
   - Malfunction of the variable geometry actuator
   - Malfunction of the variable nozzle
   - Malfunction of the variable geometry solenoid valve
   - Malfunction of the boost pressure sensor
   - Malfunction of the variable geometry control pressure sensor



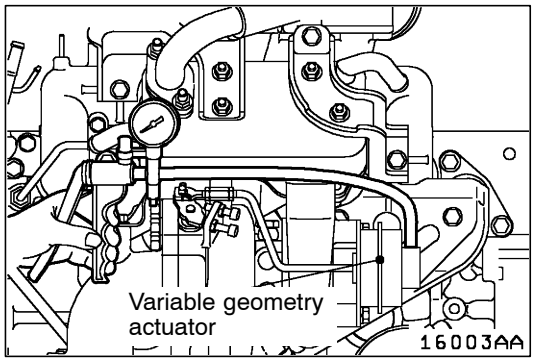
SUPERCHARGING PRESSURE CONTROL SYSTEM CHECK

1. Set the vehicle to the pre-inspection condition.
2. Turn the ignition switch to “LOCK” (OFF) position, and connect the diagnosis connector to the MUT-II.
3. Start the engine, and let it run at idle.
4. Select the actuator testing function named “Item No. 35 or No. 36” of the MUT-II to check that the variable geometry actuator vacuum and the supercharging pressure increase when the variable geometry solenoid valve is activated.

Variable geometry solenoid valve condition	Variable geometry actuator vacuum	Supercharging pressure
OFF	0 kPa	Approximately -1 kPa
ON	Approximately 80 kPa	Approximately 3 kPa

NOTE
(1) If the variable geometry actuator vacuum is not in a normal condition, the variable geometry actuator, variable geometry solenoid valve, variable geometry control pressure sensor, vacuum pump or hose may be faulty.
(2) If the variable geometry actuator vacuum is in a normal condition but the supercharging pressure is not in a normal condition, the variable geometry turbocharger nozzle, boost pressure sensor, or hose may be faulty.

Caution
Be careful not to forcibly activate the variable geometry solenoid valve to the fullest degree when running at a high speed. Too much supercharging pressure could damage the engine or the turbocharger.



VARIABLE GEOMETRY ACTUATOR CHECK

1. Connect the hand vacuum pump to nipple.
2. While gradually applying vacuum, check the vacuum that begins to active (approximately 1 mm stroke) the variable geometry actuator rod.

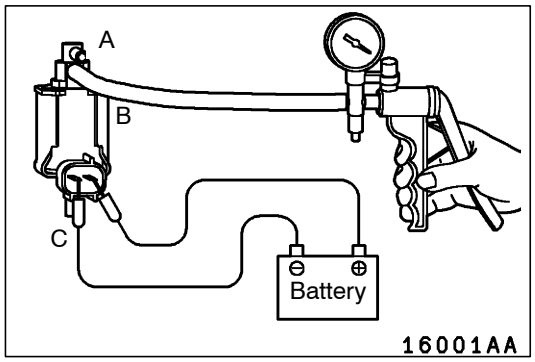
Standard value: Approximately 10.5 - 12.5 kPa

Caution
In order to avoid damage to the diaphragm, do not apply a vacuum of 59 kPa or higher.

3. If there is a significant deviation from the standard value, check the actuator or the variable nozzle: replace if necessary.

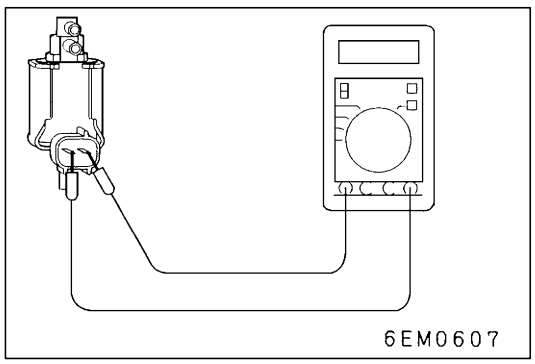
VARIABLE GEOMETRY SOLENOID VALVE CHECK

NOTE
When disconnecting the vacuum hose, always make a mark so that it can be reconnected at original position.



1. Disconnect the vacuum hose (black, red stripe) from the solenoid valve.
2. Disconnect the harness connector.
3. Connect a hand vacuum pump to the nipple to which the red striped vacuum hose was connected.
4. Check airtightness by applying a vacuum with voltage applied directly from the battery to the variable geometry solenoid valve and without applying voltage.

Battery voltage	Nipple condition	Normal condition
Applied	Both nipples are opened.	Vacuum leaks.
	Nipple A is closed.	Vacuum is maintained.
Not applied	Both nipples are opened.	Vacuum leaks.
	Nipple C is closed.	Vacuum is maintained.



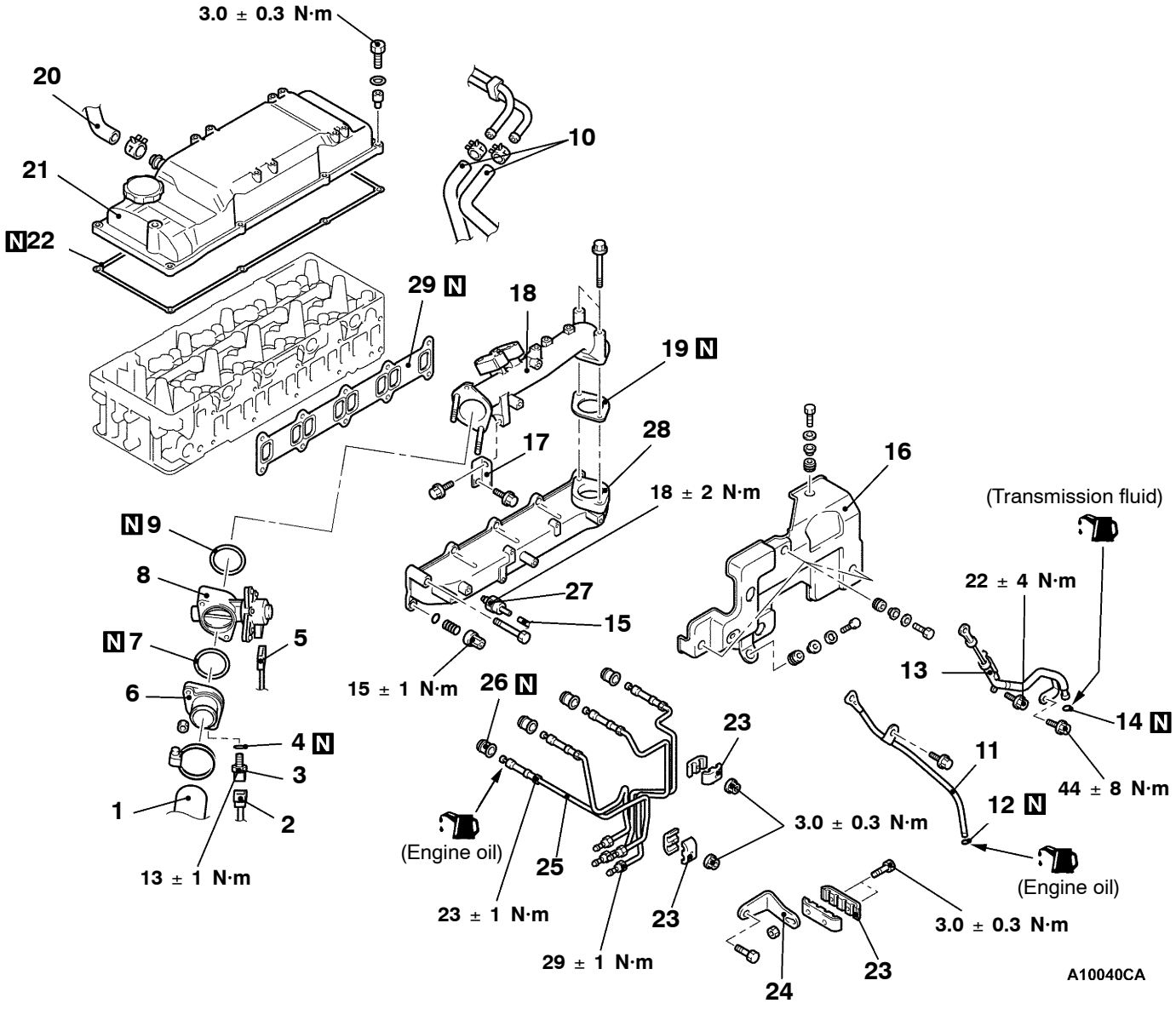
5. Measure the resistance between the terminals of the solenoid valve.

Standard value: 29 - 35 Ω (at 20°C)

INTAKE MANIFOLD AND THROTTLE BODY <4M4>

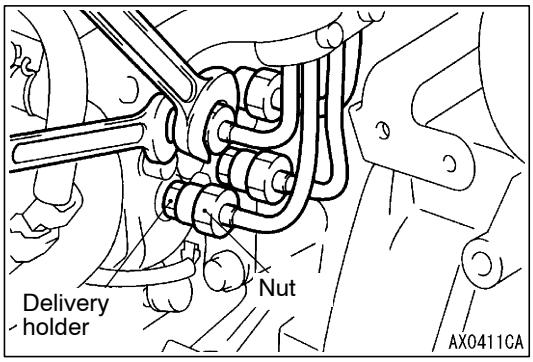
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations
- Engine Cover Removal and Installation.
- Skid Plate and Under Cover Removal and Installation.
- Battery, Battery Tray Removal and Installation.
- Fuel Filter Removal and Installation.
- EGR Valve and EGR Pipe A Removal and Installation (Refer to GROUP 17.)



Removal steps

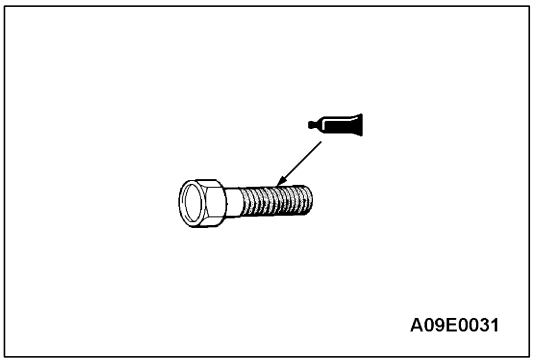
1. Intercooler air hose connection
2. Boost air temperature sensor connector
3. Boost air temperature sensor
4. Gasket
5. Throttle motor connector
6. Intake air fitting
7. O-ring
8. Throttle body assembly
9. O-ring
10. Fuel hose connection
11. Engine oil level gauge and guide
12. O-ring
13. ATF level gauge and guide
14. O-ring
15. Vacuum hose connection
16. Intake manifold cover
17. Air intake pipe stay
18. Air intake pipe
19. Air intake pipe gasket
20. Breather hose connection
21. Rocker cover
22. Rocker cover gasket
23. Clamp
24. Injection pipe stay
- ◀A▶ ▶B◀ 25. Injection pipe
- ▶B◀ 26. Injection pipe seal
27. Gas filter assembly
- ▶A◀ 28. Intake manifold
29. Intake manifold gasket



REMOVAL SERVICE POINT

◀A▶ INJECTION PIPE REMOVAL

Hold the injection pump side delivery holder with a open-end wrench, and loosen the nut.

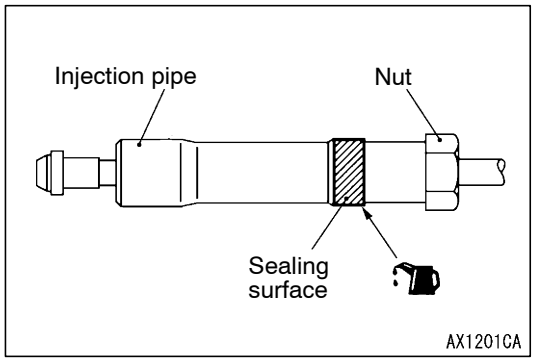


INSTALLATION SERVICE POINTS

▶A◀ INTAKE MANIFOLD INSTALLATION

1. Remove the old sealant from the intake manifold mounting bolt thread.
2. Use a tap (M8×1.25) to remove the old sealant from the bolt hole, and clean by using compressed air.
3. Apply the specified sealant to the intake manifold mounting bolt thread, and install the intake manifold by using the mounting bolts.

Specified sealant:
3M Stud Locking No. 4170 or equivalent



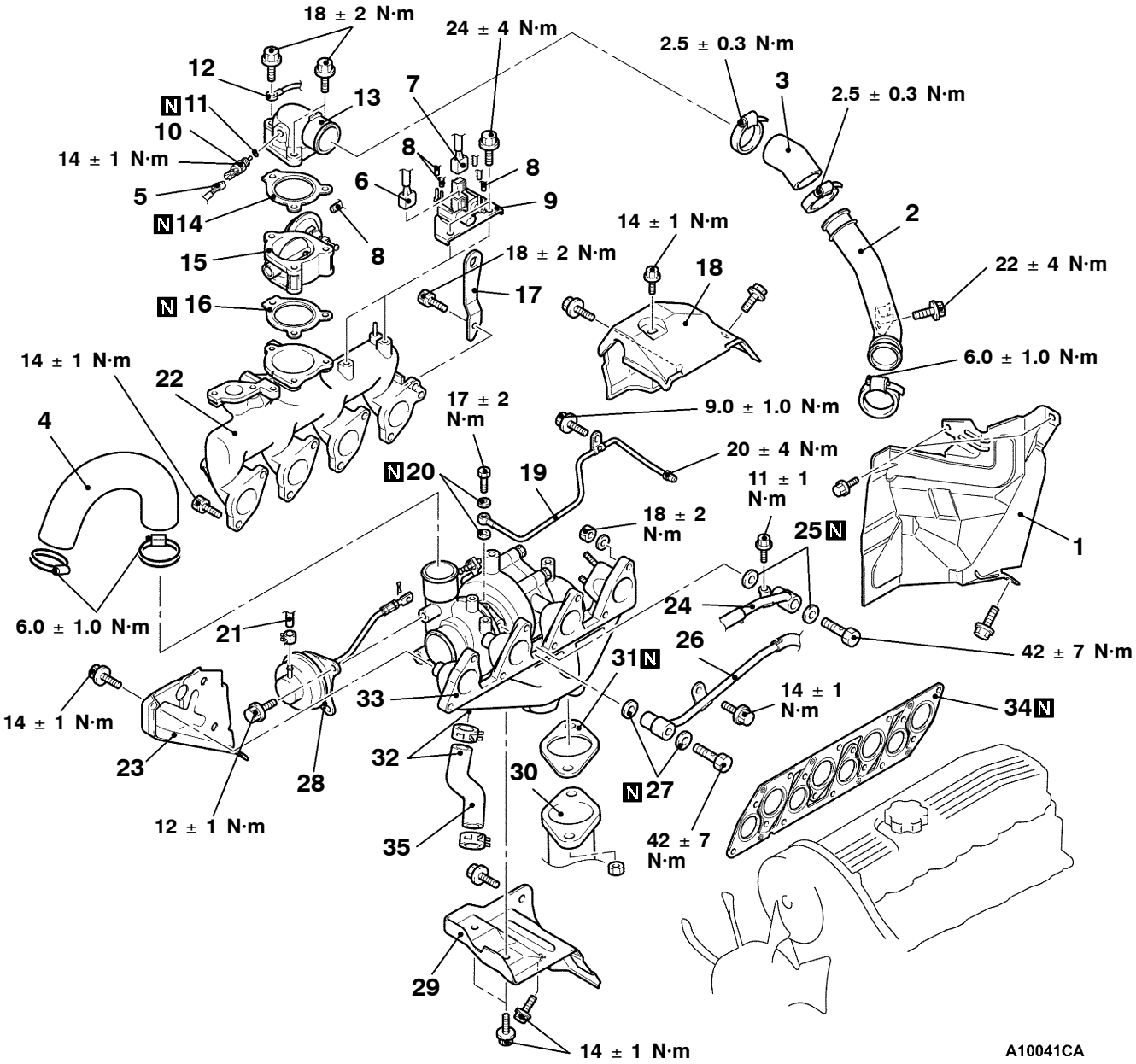
▶B◀ INJECTION PIPE SEAL/INJECTION PIPE INSTALLATION

1. Apply a small amount of engine oil to a new injection pipe seal, and install it, being careful not to damage it.
2. Apply a small amount of engine oil to the injection pipe sealing surface, and then connect the injection pipes.
3. Use a spanner to hold the delivery holder at the injection pump side in the same manner as removal,and then install the injection pipe nuts.
4. Tighten the injection pipe nut to the specified torque.
   Tightening torque: 23 ± 1 N·m

INTAKE AND EXHAUST MANIFOLD, THROTTLE BODY AND TURBOCHARGER <4D5>

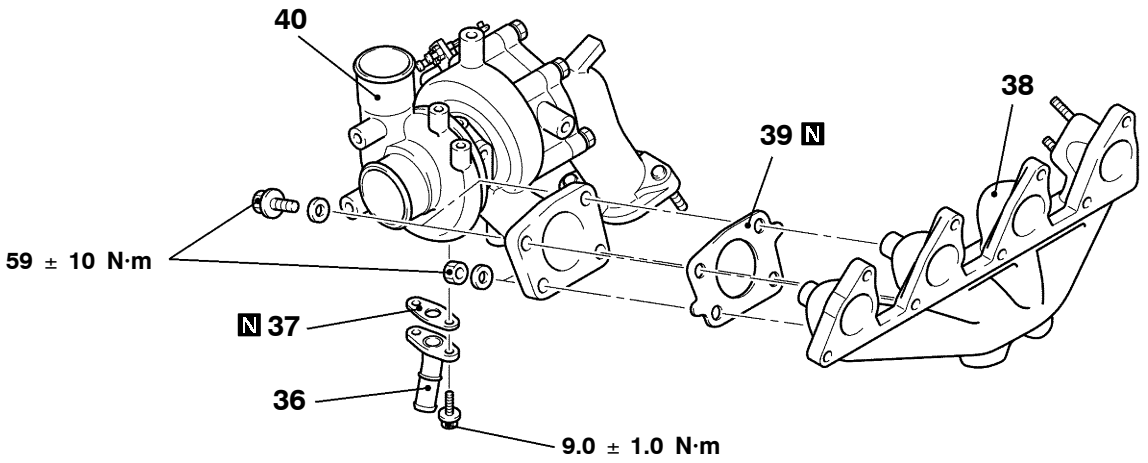
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations
- Engine Coolant Draining and Refilling.
- Skid Plate and Under Cover Removal and Installation.
- Battery, Battery Tray Removal and Installation.
- Air Cleaner Assembly Removal and Installation.
- Front Exhaust Pipe Removal and Installation (Refer to P.15-10.)
- EGR valve and EGR cooler Removal and Installation (Refer to GROUP 17.)

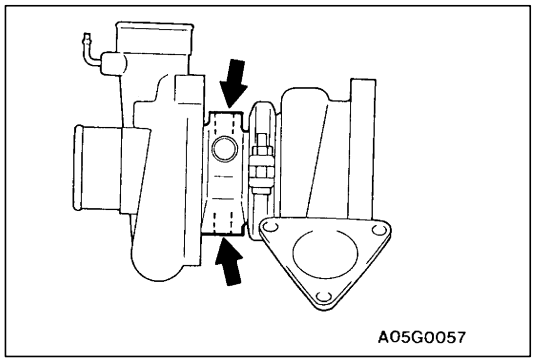


Removal steps

1. Dash panel heat protector
2. Air pipe
3. Air intake hose
4. Intercooler air hose
5. Air temperature sensor connector
6. Throttle solenoid valve connector
7. VGT solenoid valve connector
8. Vacuum hose connection
9. Solenoid valve assembly
10. Air temperature sensor
11. Gasket
12. Earth cable connection
13. Air intake fitting
14. Gasket
15. Throttle body assembly
16. Gasket
17. Engine hanger
18. Turbocharger upper heat protector
19. Oil pipe assembly
20. Gasket
21. Vacuum hose connection
22. Intake manifold
23. Exhaust manifold heat protector
24. Water pipe A and water hose assembly
25. Gasket
26. Water pipe B connection
27. Gasket
28. VG actuator
29. Exhaust fitting heat protector
30. Front exhaust pipe connection
31. Gasket
32. Oil return hose connection
33. Exhaust manifold and turbocharger assembly
34. Intake and exhaust manifold gasket
35. Oil return hose



36. Oil return pipe
37. Oil return pipe gasket
38. Exhaust manifold
39. Turbocharger gasket
▶A◀ 40. Turbocharger assembly



INSTALLATION SERVICE POINT

▶A◀ TURBOCHARGER ASSEMBLY INSTALLATION

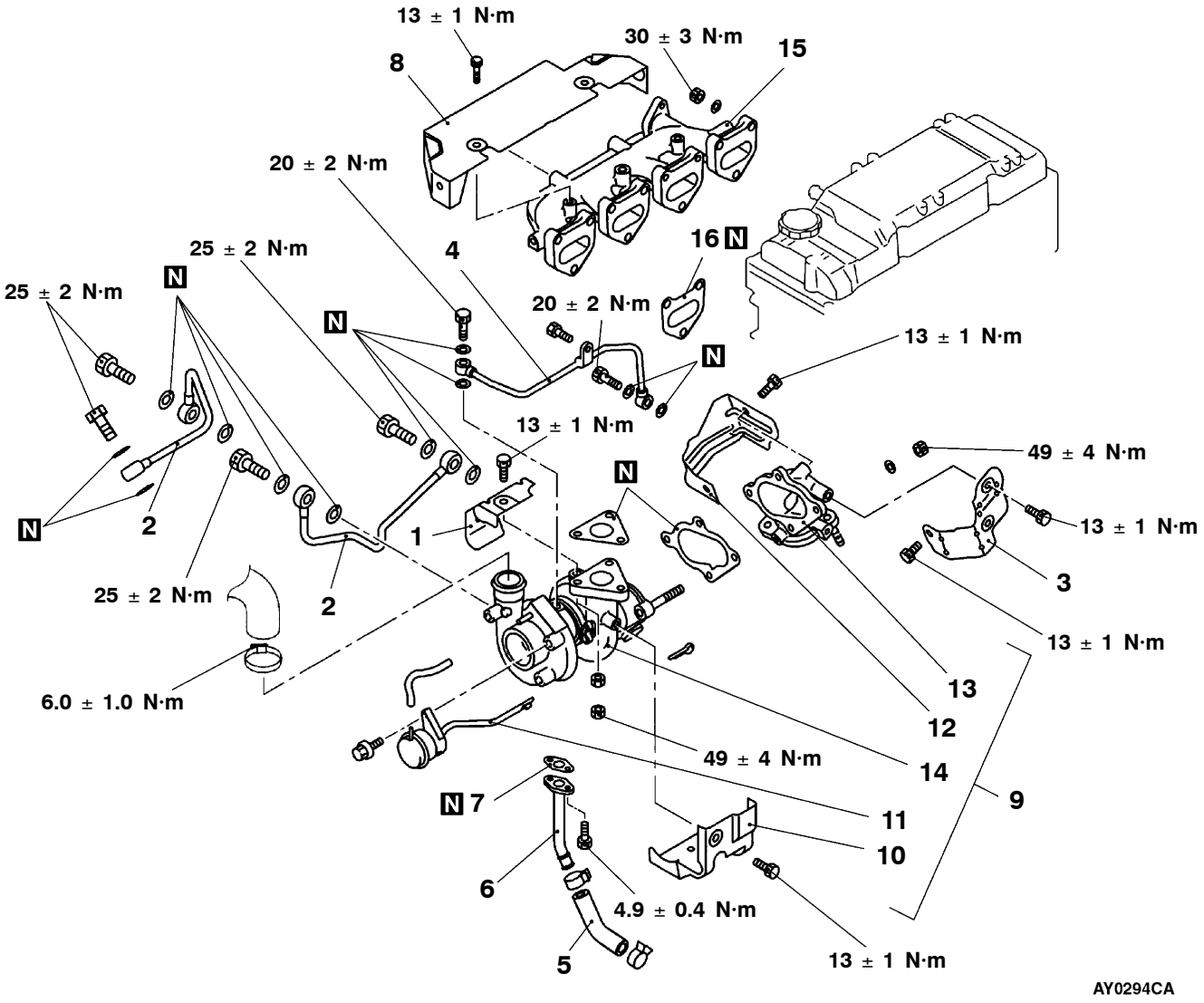
1. Clean the alignment surfaces shown in the illustration.
2. Supply clean engine oil from the oil pipe mounting hole of the turbocharger assembly.

Caution
When cleaning, take care that no foreign material gets into the engine coolant or oil passages hole.

TURBOCHARGER AND EXHAUST MANIFOLD <4M4>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations
- Engine Coolant Draining and Refilling.
- Skid Plate and Under Cover Removal and Installation
- Engine Cover Removal and Installation.
- Air cleaner Assembly Removal and Installation.
- Battery, Battery Tray Removal and Installation.
- EGR valve and EGR cooler Removal and Installation (Refer to GROUP 17.)
- Front Exhaust Pipe Removal and Installation.



Removal steps

1. Turbocharger cover
2. Water pipe
3. Turbocharger cover
4. Oil pipe
5. Oil return hose
6. Oil return pipe
7. Oil return pipe gasket
8. Heat protector
9. Turbocharger and exhaust fitting assembly
10. Turbocharger cover
11. Waste gate actuator
12. Turbocharger cover
13. Exhaust fitting

▶A◀ 14. Turbocharger assembly

15. Exhaust manifold
16. Exhaust manifold gasket

INSTALLATION SERVICE POINT

▶A◀ TURBOCHARGER ASSEMBLY INSTALLATION

1. Check the internal surface, the eye bolt and the mating surface of the oil pipe and water pipe for clogging, and clean if necessary.
2. If deposits of carbon are accumulated on the turbocharger oil passage, remove them and clean using the compressed air.

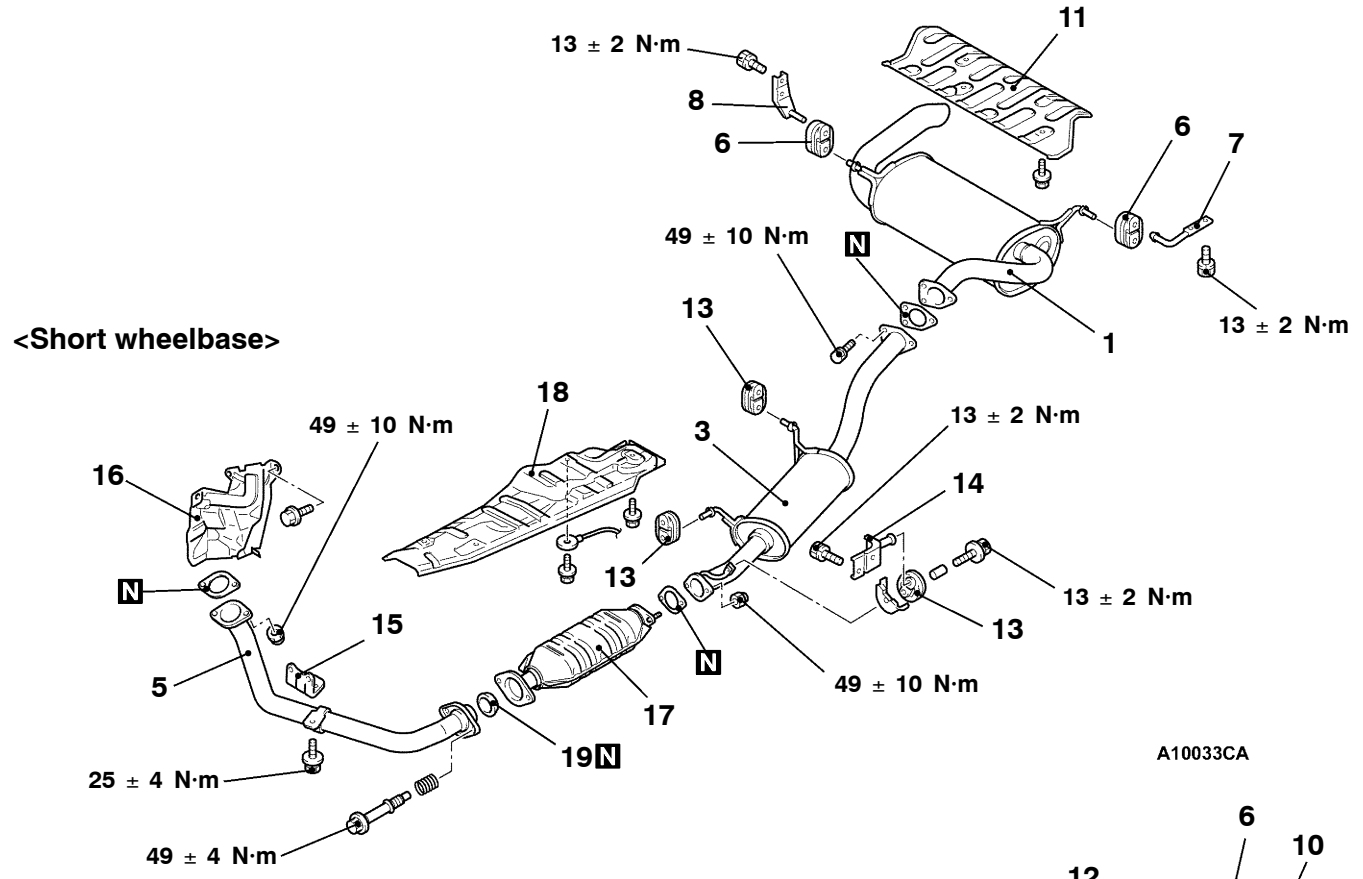
   Caution
   Be careful not to allow foreign material to enter the turbocharger.

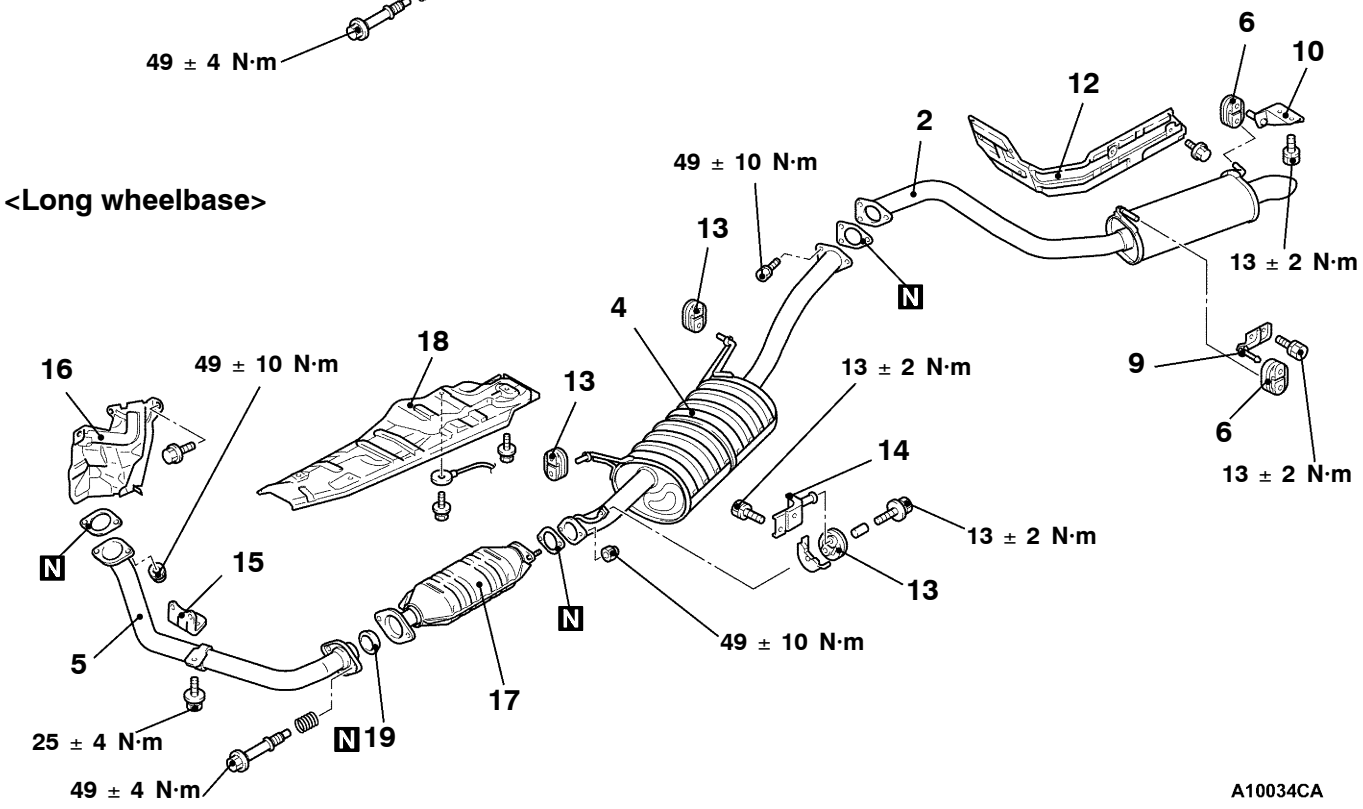
3. Add clean engine oil through the oil feed pipe port on the turbocharger.

EXHAUST PIPE AND MAIN MUFFLER <4D5>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Front Under Cover Removal and Installation





Exhaust main muffler and rear floor heat protector removal steps <Short wheelbase>

1. Exhaust main muffler
6. Hanger
7. Hanger bracket
8. Hanger bracket
11. Rear floor heat protector

Tail exhaust pipe and rear floor heat protector removal steps <Long wheelbase>

2. Tail exhaust pipe
6. Hanger
9. Hanger bracket
10. Hanger bracket
12. Rear floor heat protector

Center exhaust pipe removal steps <Short wheelbase>

3. Center exhaust pipe
13. Hanger
14. Hanger bracket

Exhaust main muffler removal steps <Long wheelbase>

4. Exhaust main muffler
13. Hanger
14. Hanger bracket

Front exhaust pipe and dash heat protector removal steps

- Under cover
5. Front exhaust pipe
15. Exhaust support bracket
16. Dash heat protector

Front floor heat protector removal steps

17. Catalytic converter
18. Front floor heat protector
19. Seal ring

ENGINE ELECTRICAL

Click on the applicable bookmark to selected the required model year.

ENGINE ELECTRICAL

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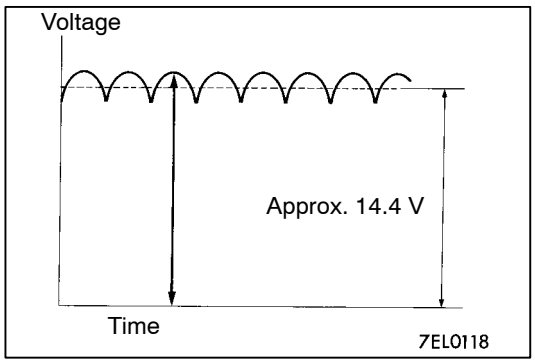
CHARGING SYSTEM

GENERAL INFORMATION

The charging system uses the alternator output to keep the battery charged at a constant level under various electrical loads.



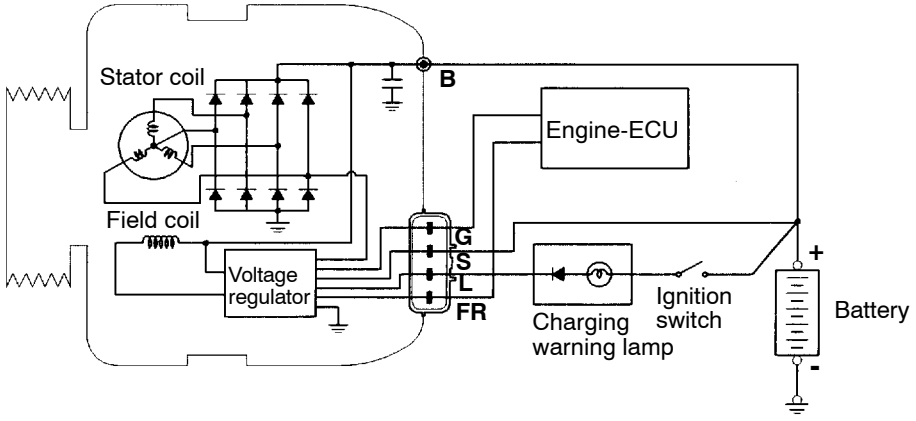
OPERATION

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.

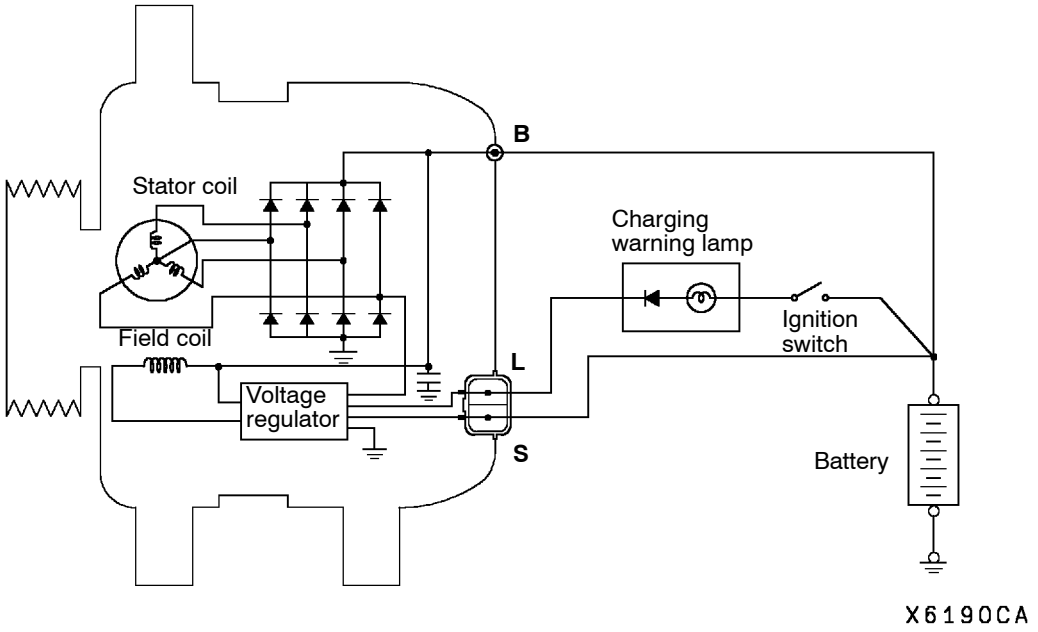
When the ignition switch is turned on, current flows in the field coil and initial excitation of the field coil occurs.
When the stator coil begins to generate power after the engine is started, the field coil is excited by the output current of the stator coil.
The alternator output voltage rises as 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 approximately 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

<6G7>



<4D5, 4M4>



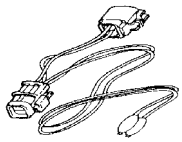
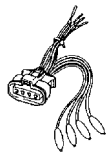
ALTERNATOR SPECIFICATIONS

Items	6G7, 4M4	4D5
Type	Battery voltage sensing	Battery voltage sensing
Rated output V/A	12/125	12/105
Voltage regulator	Electronic built-in type	Electronic built-in type

SERVICE SPECIFICATIONS

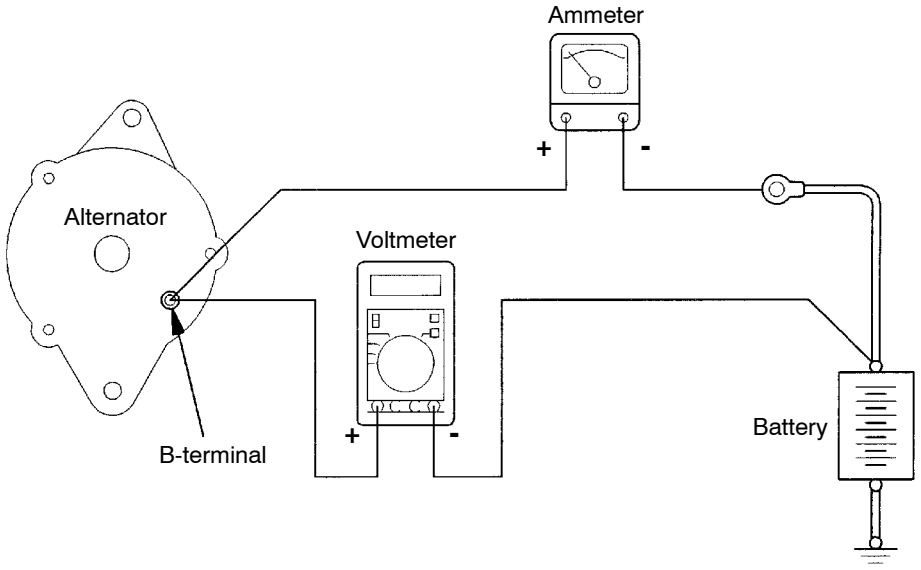
Items		Standard value	Limit
Alternator output line voltage drop (at 30A) V		-	Max. 0.3
Regulated voltage ambient temp. at voltage regulator V	-20°C	14.2 - 15.4	-
	20°C	13.9 - 14.9	-
	60°C	13.4 - 14.6	-
	80°C	13.1 - 14.5	-
Output current		-	70% of normal output current
Rotor coil resistance Ω		Approx. 2 - 5	-
Maximum vacuum (at 3,000 r/min) <4D56> kPa		90.6	-
Protrusion length of brush mm	6G7, 4D5	-	2
	4M4	-	5

SPECIAL TOOL

Tool	Number	Name	Use
	MD998467	Alternator test harness	Checking the alternator (S terminal voltage) <4D5, 4M4>
	MB991519	Alternator test harness	Checking the alternator (S terminal voltage) <6G7>

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 off.
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 - 150 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.)

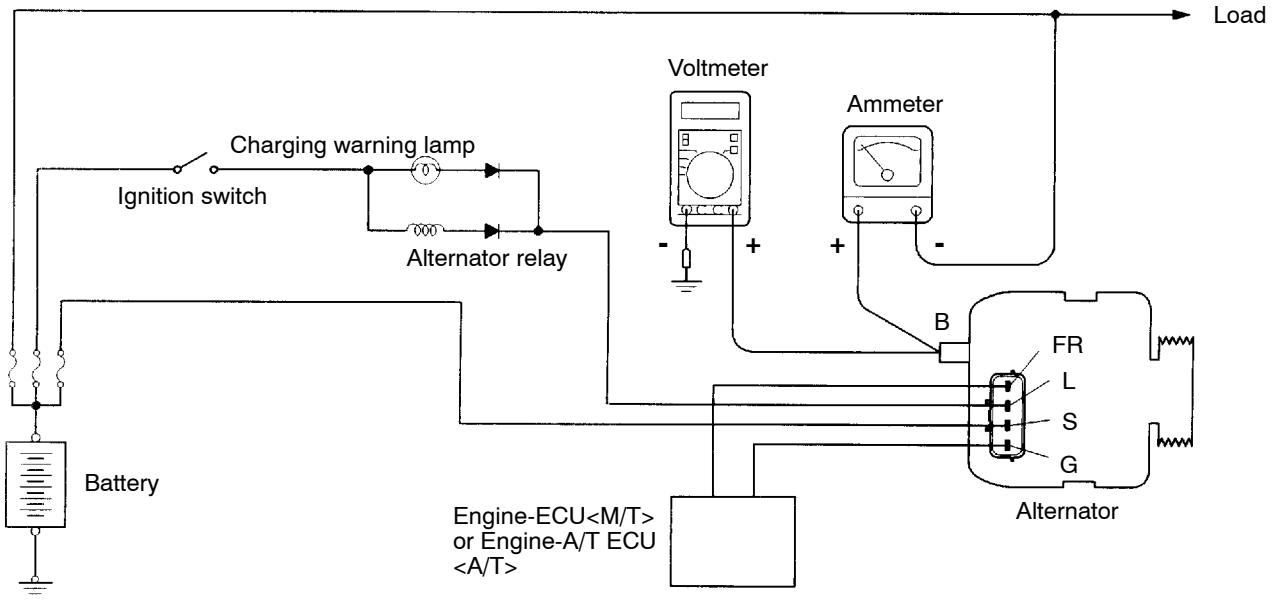
6. Reconnect the negative battery cable.
7. Connect a tachometer or the MUT-II.
8. Leave the hood open.
9. Start the engine.
10. With the engine running at 2,500 r/min, turn the headlamps and other lamps on and off to adjust the alternator load so that the value displayed on the ammeter is slightly above 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

<6G7>



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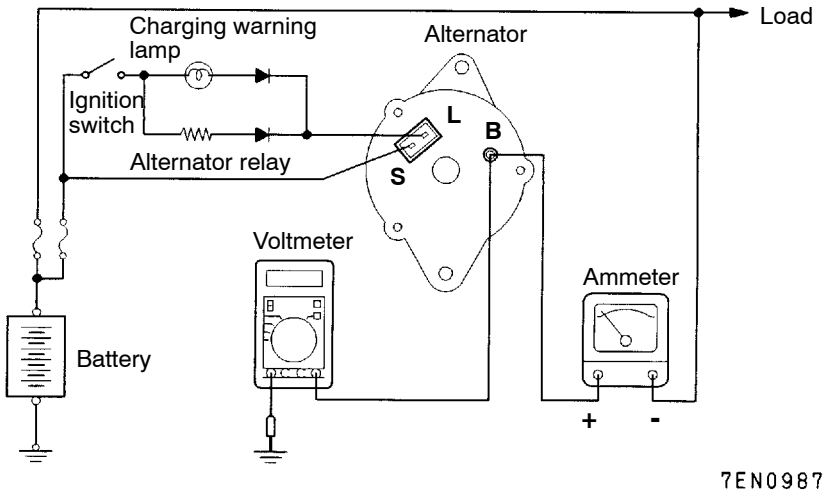


This test determines whether the alternator output current is normal.

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 off.
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.

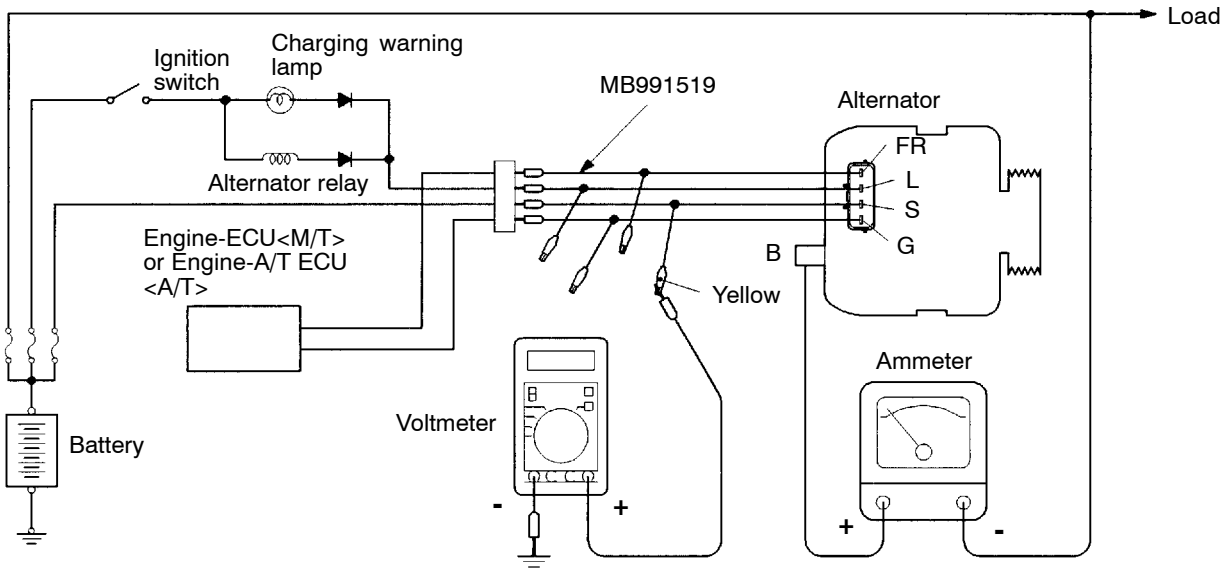
10. Turn the light switch on to turn on headlamps and then start the engine.
11. Immediately after setting the headlamps to high beam and turning the heater blower switch to the high revolution position, increase the engine speed to 2,500 r/min and read the maximum current output value displayed on the 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 off.
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

<6G7>



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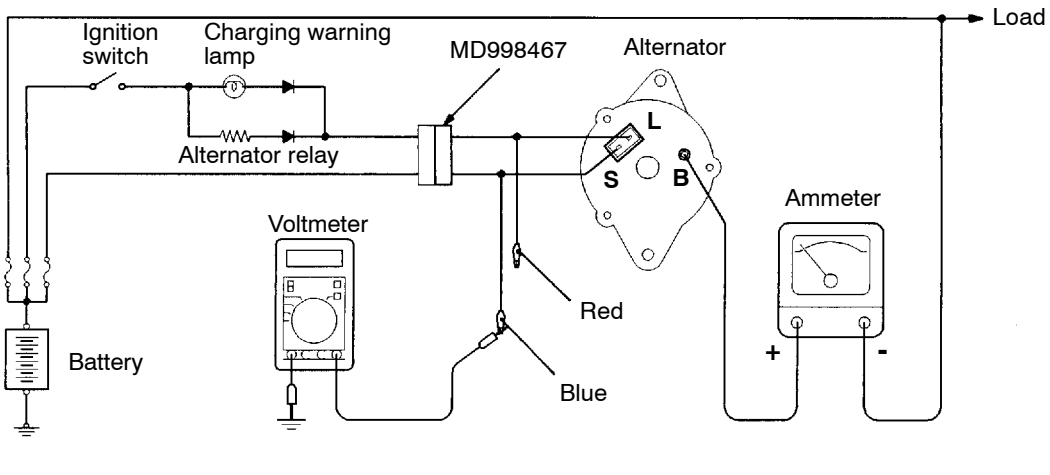


This test determines whether the voltage regulator is correctly controlling the alternator output voltage.

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 off.
3. Disconnect the negative battery cable.
4. Use the special tool (Alternator test harness: MD998467 or 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.

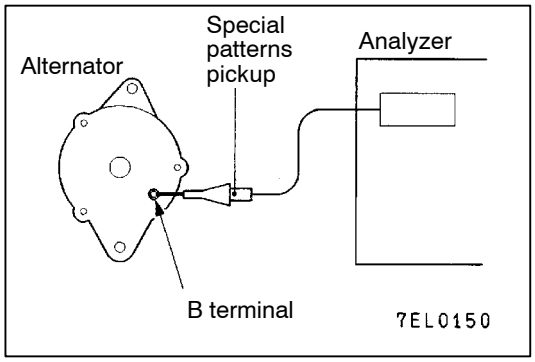
10. Turn all lamps and accessories off.
11. Start the engine.
12. Increase the engine speed to 2,500 r/min.
13. Read the value displayed on the voltmeter when the alternator output current alternator becomes 10 A or less.

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 off.
17. Remove the tachometer or the MUT-II.
18. Disconnect the negative battery cable.
19. Disconnect the ammeter and voltmeter.
20. Connect the alternator output wire to the alternator “B” terminal.
21. Remove the special tool, and return the connector to the original condition.
22. Connect the negative battery cable.

Voltage Regulation Table

Standard value:

Inspection terminal	Voltage regulator ambient temperature °C	Voltage V
Terminal “S”	-20	14.2 - 15.4
	20	13.9 - 14.9
	60	13.4 - 14.6
	80	13.1 - 14.5



WAVEFORM CHECK USING AN ANALYZER

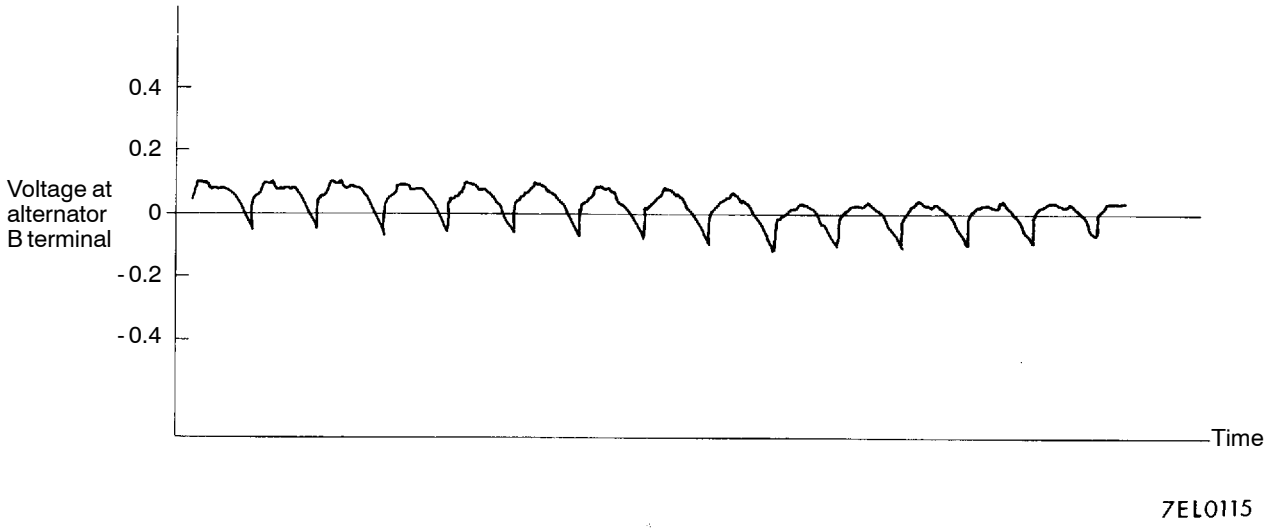
MEASUREMENT METHOD

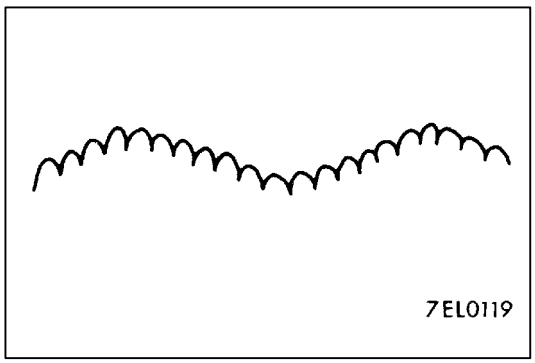
Connect the analyzer special patterns pick-up to the alternator B terminal.

STANDARD WAVEFORM

Observation Conditions

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





NOTE

The voltage waveform of the alternator B terminal can undulate as shown at left. This waveform is produced when the regulator operates according to fluctuations in the alternator load (current), and is normal for the alternator.

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

EXAMPLES OF ABNORMAL WAVEFORMS

NOTE
1. The size of the waveform patterns differs largely, depending on the adjustment of the variable knob on the analyzer.
2. Identification of abnormal waveforms is easier when there is a large output current (regulator is not operating). (Waveforms can be observed when the headlamps are illuminated.)
3. Check the conditions of the charging warning lamp (illuminated/not illuminated). Also, check the charging system totally.

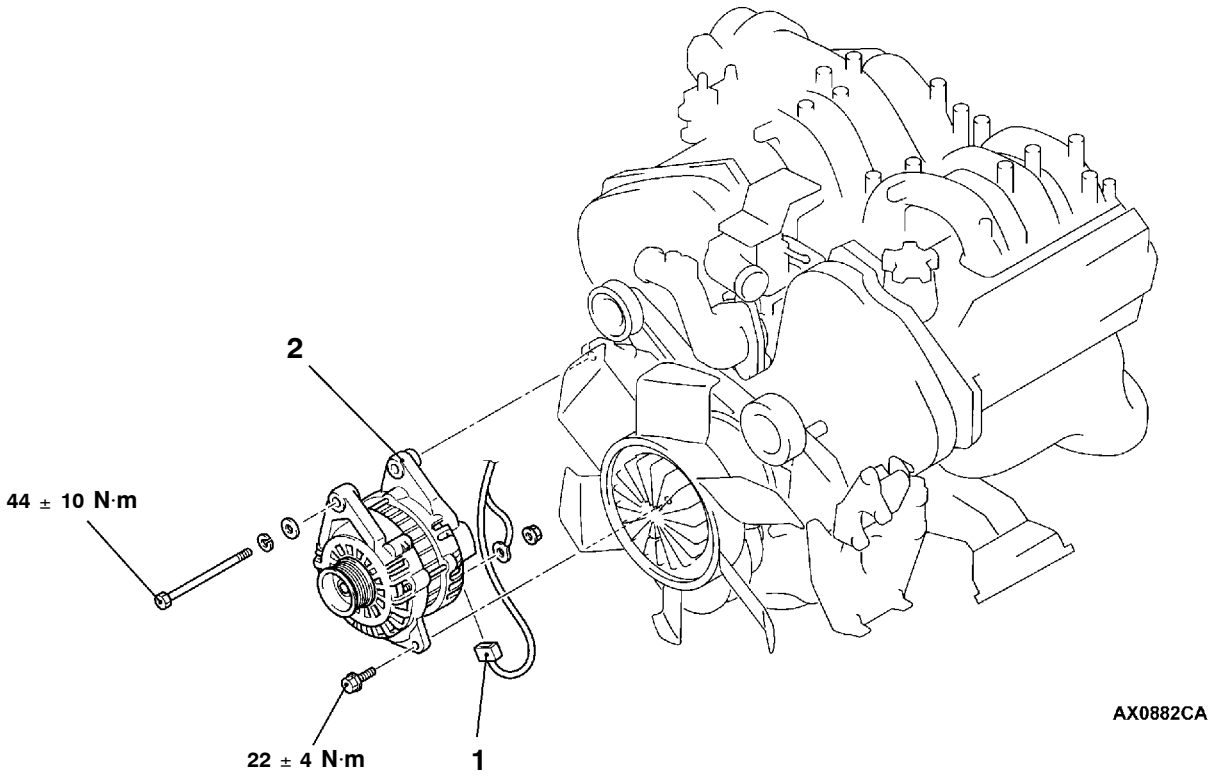
Abnormal waveforms	Problem cause	Abnormal waveforms	Problem cause
Example 1 A7EL0120	Open diode	Example 4 A7EL0123	Short in stator coil
Example 2 A7EL0121	Short in diode	Example 5 A7EL0124 NOTE At this time, the charging warning lamp is illuminated.	Open supplementary diode
Example 3 A7EL0122	Broken wire in stator coil		

ALTERNATOR

REMOVAL AND INSTALLATION

<6G7>

Pre-removal and Post-installation Operation
- Air Cleaner Assembly Removal and Installation (Refer to GROUP 15.)
- Drive Belt Removal and Installation (Refer to GROUP 11A.)



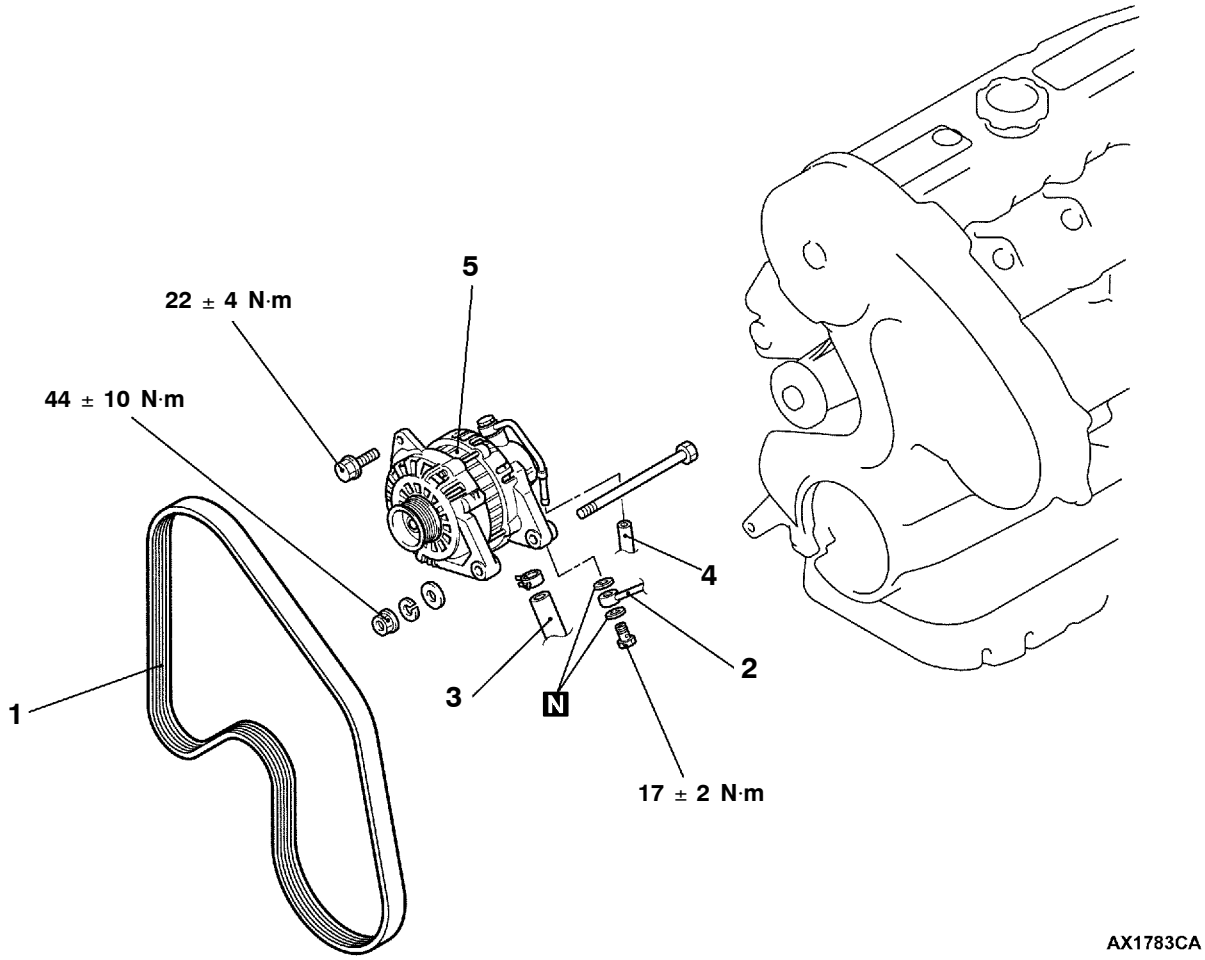
Disassembly steps

1. Alternator connector
2. Alternator

<4D5>

Pre-removal Operation
Under Cover Removal

Post-installation Operation
- Drive Belt Tension Adjustment (Refer to GROUP 11B – On-vehicle Service.)
- Under Cover Installation



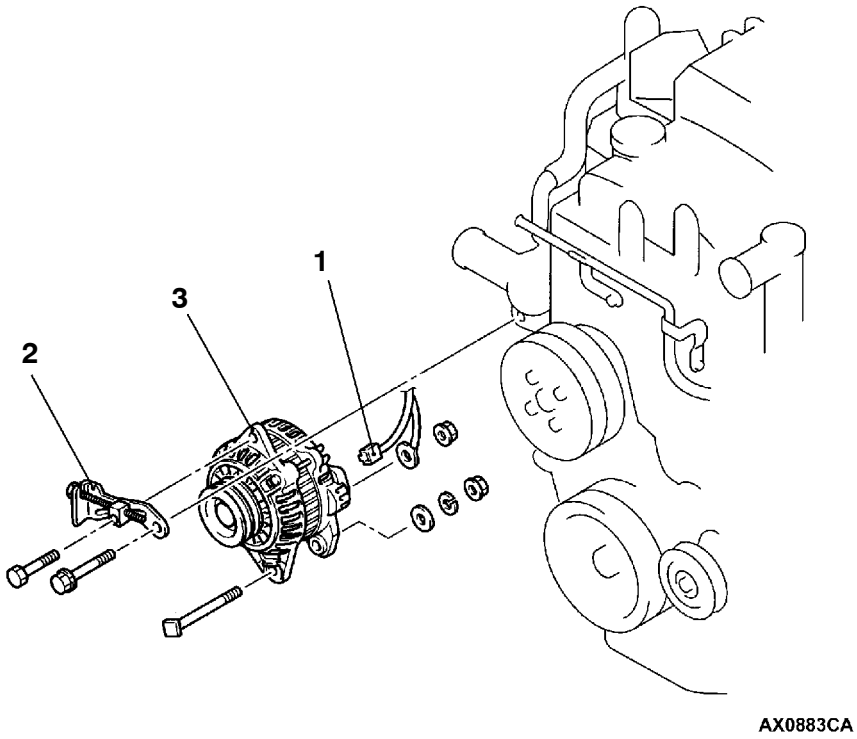
Disassembly steps

1. Drive belt
2. Oil pipe connection
3. Oil return hose connection
4. Vacuum hose connection
5. Alternator

<4M4>

Pre-removal Operation
- Air Cleaner Assembly Removal (Refer to GROUP 15.)
- Drive Belt Removal (Refer to GROUP 11C.)

Post-installation Operation
- Drive Belt Installation (Refer to GROUP 11C.)
- Drive Belt Tension Adjustment (Refer to GROUP 11C – On-vehicle Service.)
- Air Cleaner Assembly Installation (Refer to GROUP 15.)

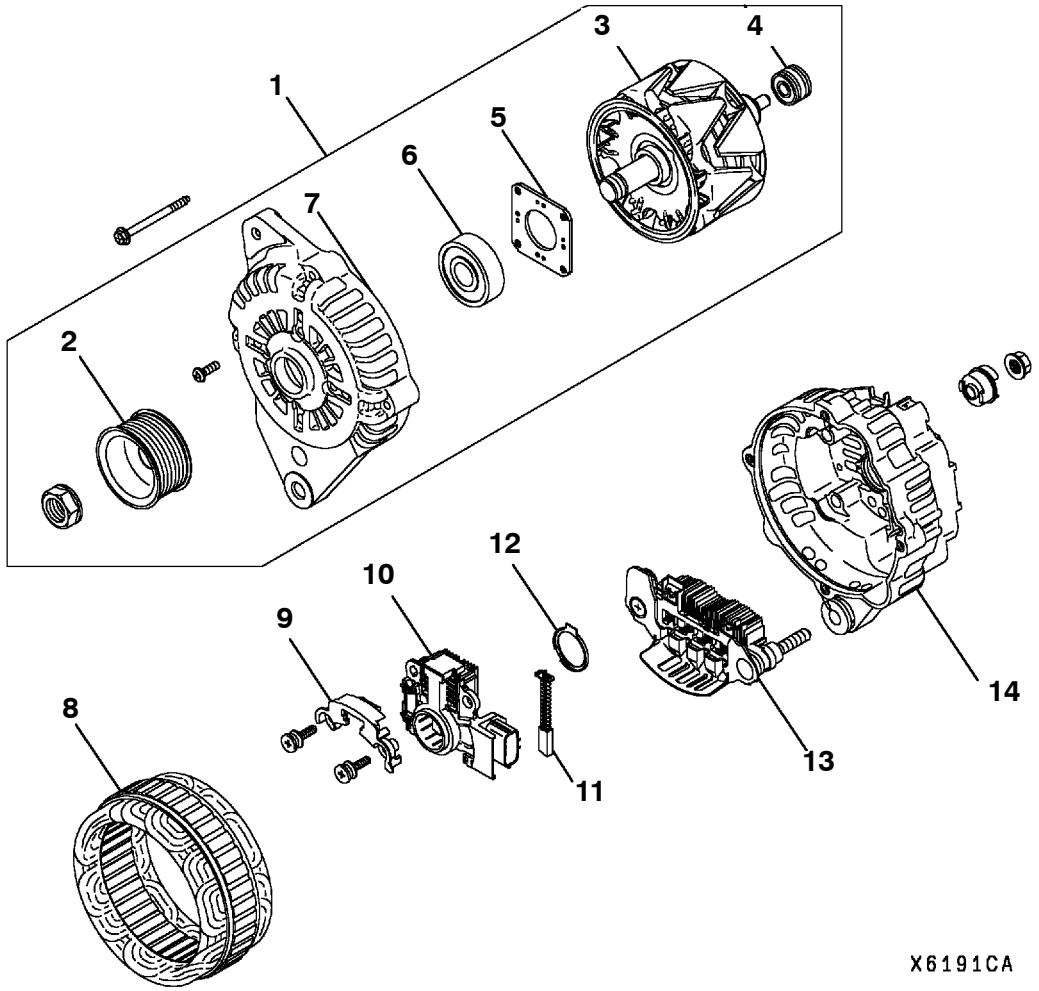


Disassembly steps

1. Alternator connector
2. Adjusting plate
3. Alternator

DISASSEMBLY AND REASSEMBLY

<6G7>

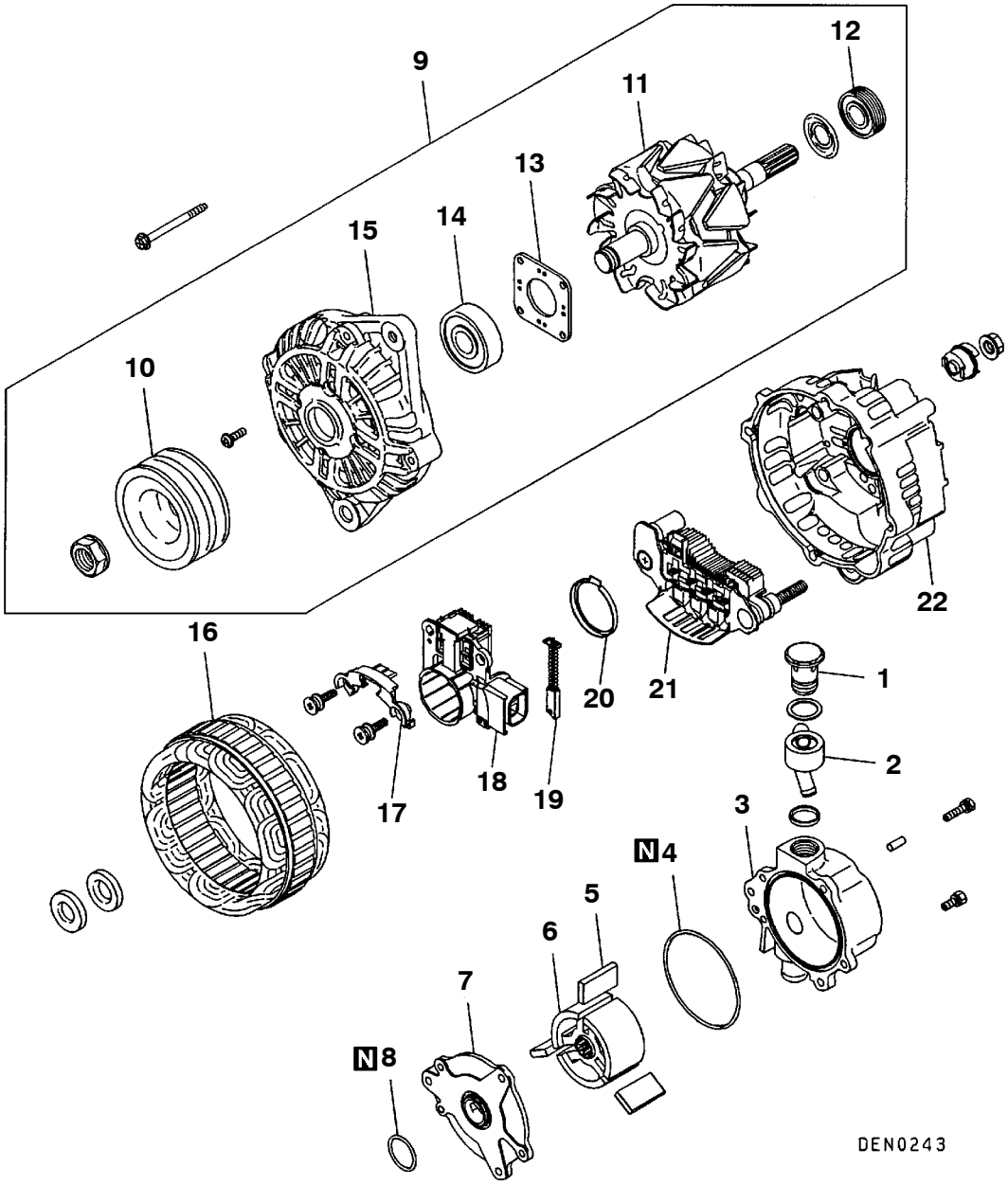


Disassembly steps

◀A▶ ◀B▶ 1. Front bracket assembly
2. Pulley
▶B◀ 3. Rotor
4. Rear bearing
5. Bearing retainer
6. Front bearing
7. Front bracket
◀C▶ 8. Stator
9. Plate
◀C▶ ▶A◀ 10. Regulator assembly
11. Brush
12. Slinger
13. Rectifier assembly
14. Rear bracket

DISASSEMBLY AND REASSEMBLY

<4D5>

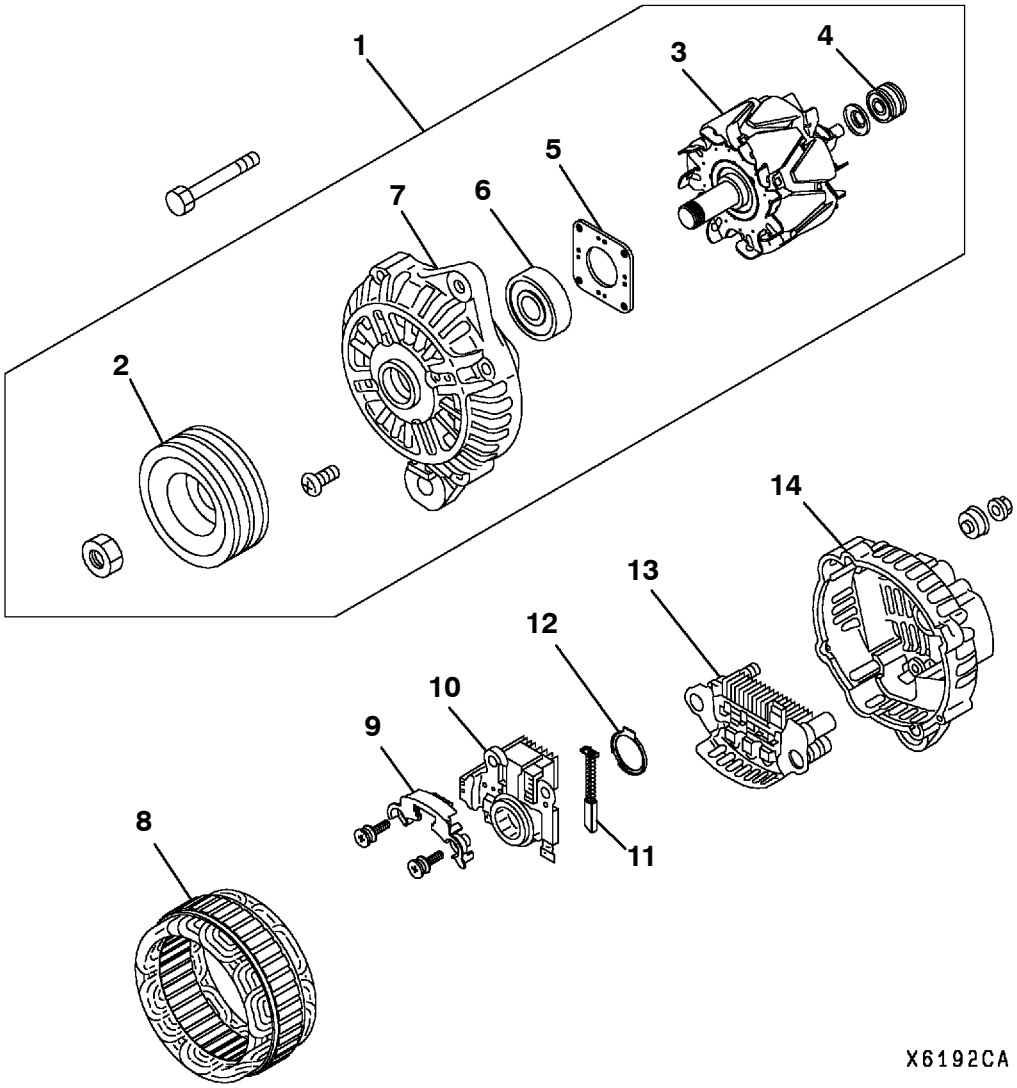


Disassembly steps

1. Check valve
2. Nipple
3. Vacuum pump housing
4. O-ring
▶C◀ 5. Vane
▶C◀ 6. Rotor
7. Vacuum pump plate
8. O-ring
◀A▶ 9. Front bracket assembly
◀B▶ 10. Pulley
▶B◀ 11. Rotor
12. Rear bearing
13. Bearing retainer
14. Front bearing
15. Front bracket
◀C▶ 16. Stator
17. Plate
◀C▶ ▶A◀ 18. Regulator assembly
19. Brush
20. Slinger
21. Rectifier assembly
22. Rear bracket

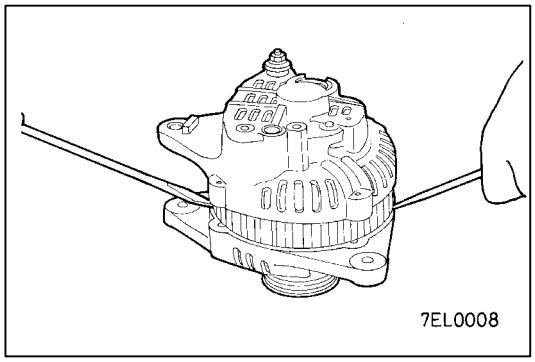
DISASSEMBLY AND REASSEMBLY

<4M4>



Disassembly steps

◀A▶ ◀B▶ 1. Front bracket assembly
2. Pulley
▶B◀ 3. Rotor
4. Rear bearing
5. Bearing retainer
6. Front bearing
7. Front bracket
◀C▶ 8. Stator
9. Plate
◀C▶ ▶A◀ 10. Regulator assembly
11. Brush
12. Slinger
13. Rectifier assembly
14. Rear bracket

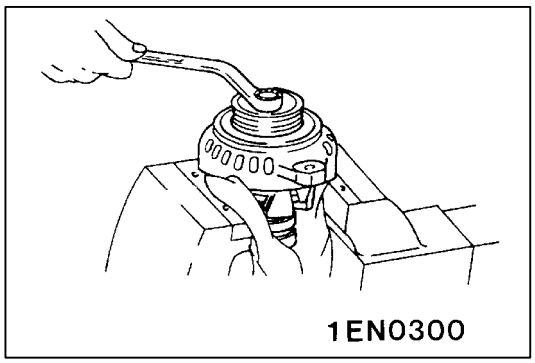


DISASSEMBLY SERVICE POINTS

◀A▶ FRONT BRACKET REMOVAL

1. Remove the bolts.
2. Insert a flat-tipped screwdriver between front bracket and stator core and pry downwards.

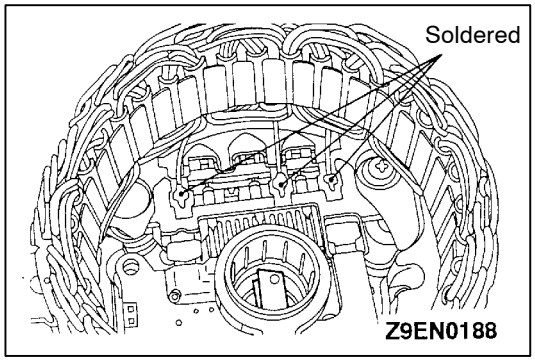
Caution
Do not insert a screwdriver too deep, as the stator coil will be damaged.



◀B▶ PULLEY REMOVAL

With the pulley side facing up, hold the rotor in a vice and remove the pulley.

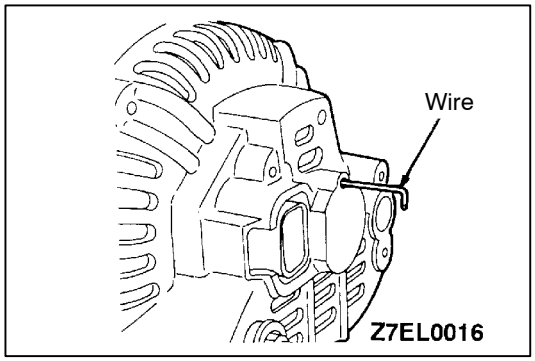
Caution
Use care not to damage the rotor.



◀C▶ STATOR REMOVAL/REGULATOR ASSEMBLY REMOVAL

1. When removing stator, unsolder three stator leads soldered to main diodes on rectifier.
2. When removing rectifier from brush holder, unsolder two soldered points to rectifier.

Caution
(1) When soldering or unsoldering, use care to make sure that heat of soldering iron is not transmitted to diodes for a long period. Finish soldering or unsoldering in as short a time as possible.
(2) Use care that no undue force is exerted to leads of diodes.

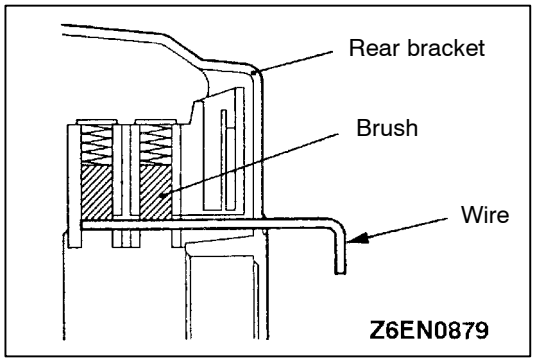


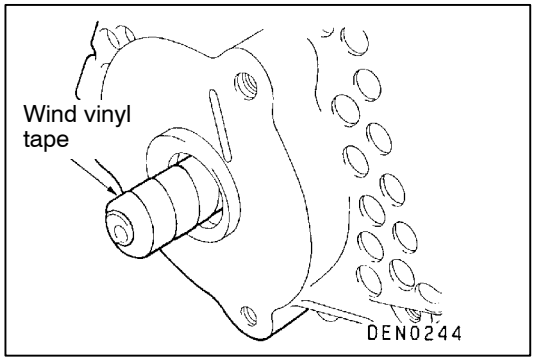
REASSEMBLY SERVICE POINT

▶A◀ REGULATOR ASSEMBLY INSTALLATION

Install the regulator assembly, insert a wire into the rear bracket hole while pushing in the brush, and hold the brush.

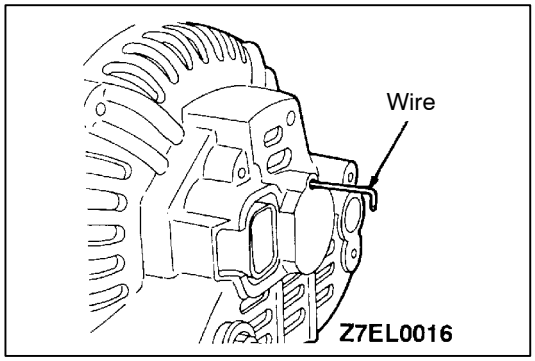
NOTE
Inserting a wire holds the brush, so that the rotor can be replaced easily.



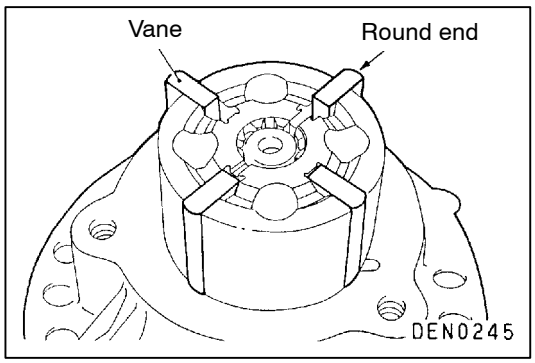


▶B◀ ROTOR INSTALLATION

1. When installing the rotor on the alternator rear bracket, wrap vinyl tape around the splined shaft to prevent damage to the oil seal. <4D5>

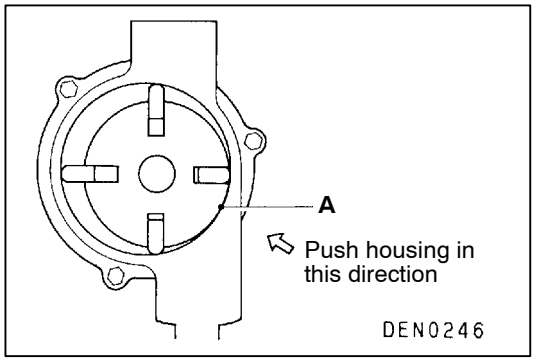


2. After rotor has been installed, remove the wire.



▶C◀ ROTOR/VANES INSTALLATION <4D5>

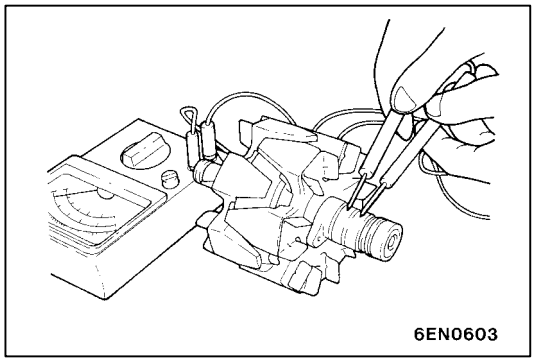
1. Carefully check the housing, rotor, etc. for chips and foreign matter. Then, apply engine oil and install.
2. Install the vanes with the round end facing outward.
3. Apply grease to the O-ring and fit in the housing groove so that it will not come out from the groove when the bolts are tightened.



4. When tightening the housing, lightly push it in the direction of arrow so as to minimize the clearance at “A” and tighten the bolts uniformly.

   NOTE
   After assembly, be sure to conduct a performance test to check to see that the maximum vacuum is as specified below.

   Standard value of maximum vacuum:
   90.6 kPa or greater at 3,000 r/min

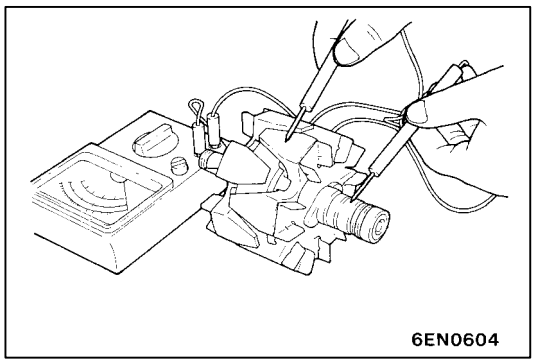

6EN0603

INSPECTION

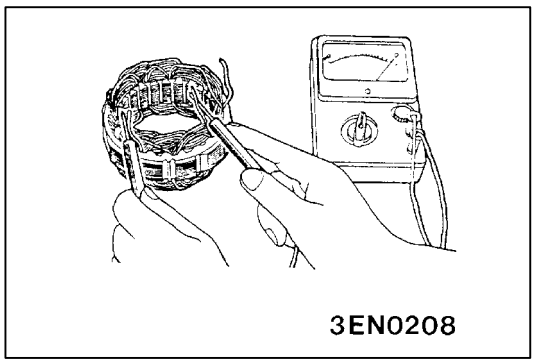
ROTOR

1. Check rotor coil for continuity. Check that there is no continuity between slip rings. If resistance is too small, it means that there is a short circuit. If there is no continuity or if there is a short circuit, replace rotor assembly.

   Resistance value: Approx. 2 - 5 Ω

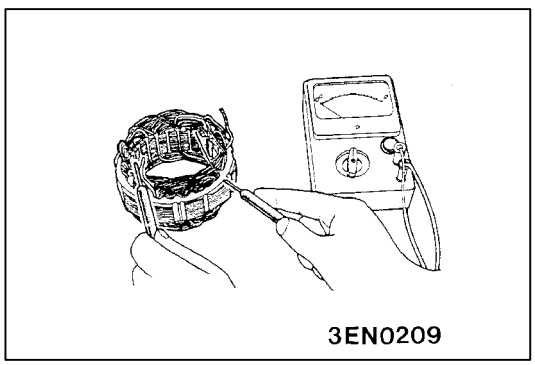

6EN0604

2. Check rotor coil for earthing. Check that there is no continuity between slip ring and core. If there is continuity, replace rotor assembly.

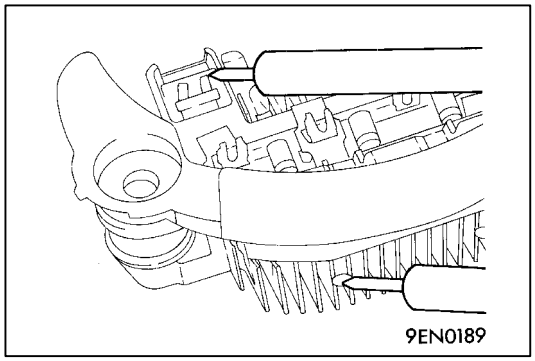

3EN0208

STATOR

1. Make continuity test on stator coil. Check that there is continuity between coil leads. If there is no continuity, replace stator assembly.

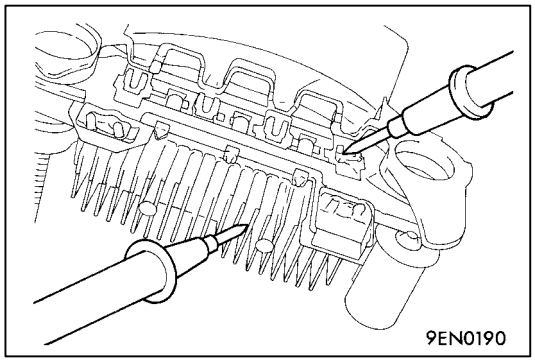

3EN0209

2. Check coil for earthing. Check that there is no continuity between coil and core. If there is continuity, replace stator assembly.

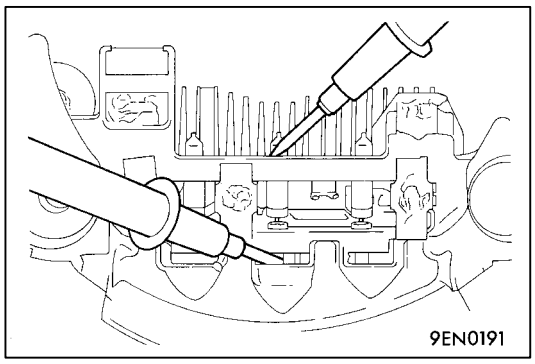

9EN0189

RECTIFIERS

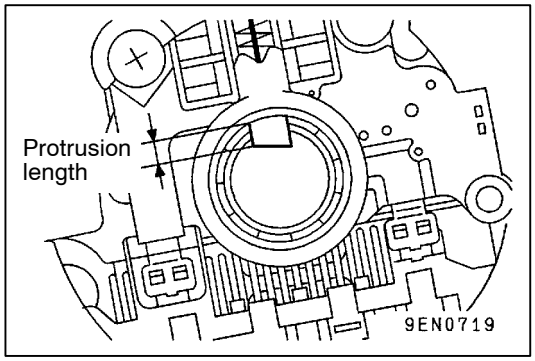
1. Check for continuity between positive rectifier and stator coil lead connection terminal with an ohmmeter. If there is continuity in both directions, diode is shorted. Replace rectifier assembly.



2. Check for continuity between negative rectifier and stator coil lead connection terminal. If there is continuity in both directions, diode is shorted, and rectifier assembly must be replaced.



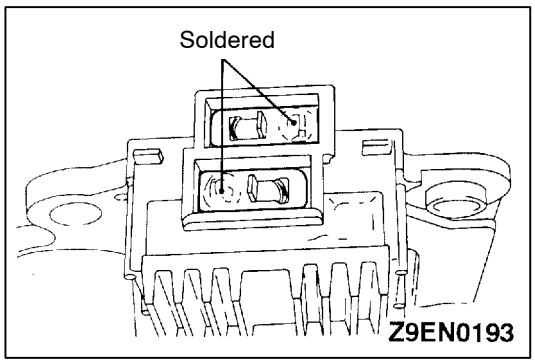
3. Check three diodes for continuity by connecting an ammeter to both ends of each diode. If there is no continuity in both directions, diode is faulty and heatsink assembly must be replaced.



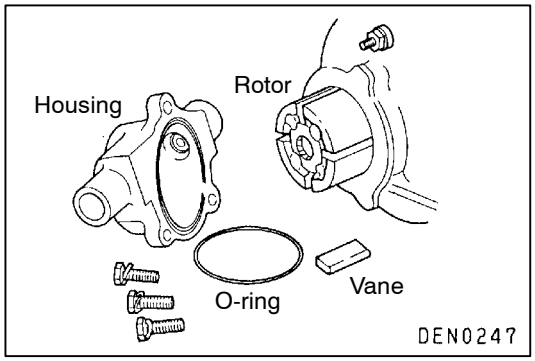
BRUSH

1. Replace the brush if its protrusion length is less than the limit.

   Limit: min. 2 mm <6G7, 4D5>
   min. 5 mm <4M4>



2. Unsolder pigtail and remove old brush and spring.



VACUUM PUMP <4D5>

Check the following and replace if defective.
1. Check the rotor ends for streaks or damage.
2. Check the housing surface in contact with the rotor for streaks or damage.
3. Check the vanes for damage or breaks.

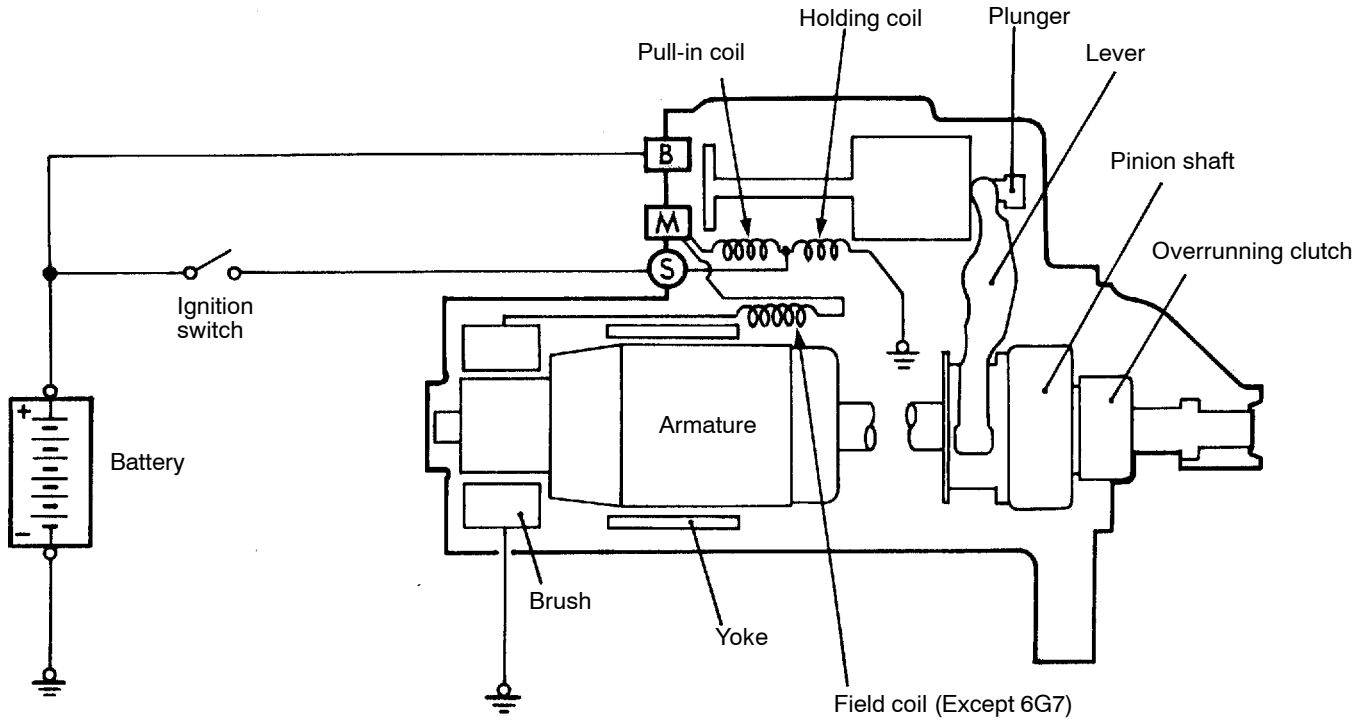
STARTING SYSTEM

16200010368

GENERAL INFORMATION

If the ignition switch is turned to the “START” position, current flows in the pull-in and holding 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



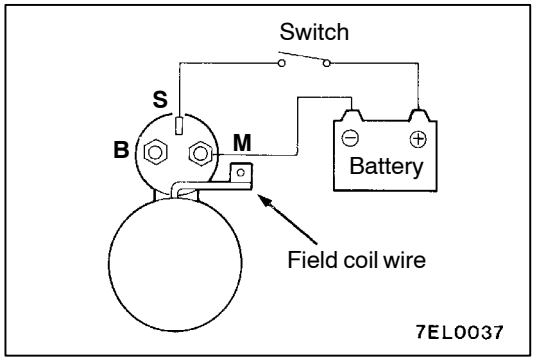
1EN0532

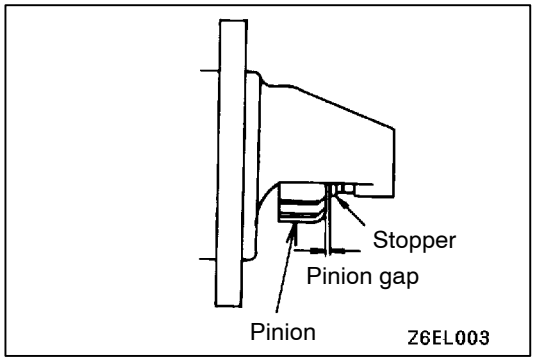
STARTER MOTOR SPECIFICATIONS

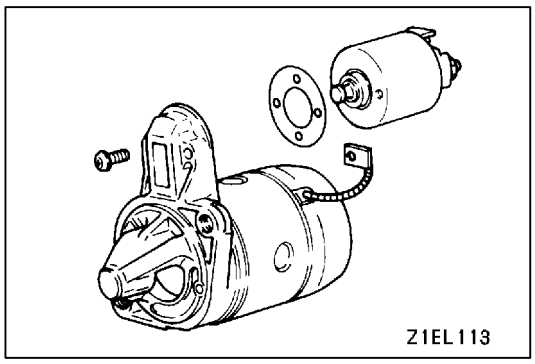
Items	6G7	4D5, 4M4
Type	Reduction drive with planetary gear	Reduction drive with planetary gear
Rated output kW/V	1.2/12	2.2/12
No. of pinion teeth	8	12

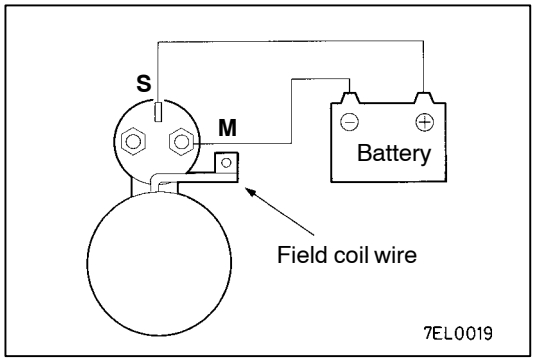
SERVICE SPECIFICATIONS

Items		Standard value	Limit
Pinion gap mm		0.5 - 2.0	-
Commutator outer diameter mm	6G7	29.4	28.8
	4D5, 4M4	32	31.4
Commutator runout mm		0.05	0.1
Commutator undercut mm		0.5	0.2









STARTER MOTOR

16200110327

INSPECTION

PINION GAP ADJUSTMENT

1. Disconnect field coil wire from M-terminal of magnetic switch.
2. Connect a 12V battery between S-terminal and M-terminal.
3. Set switch to “ON”, and pinion will move out.

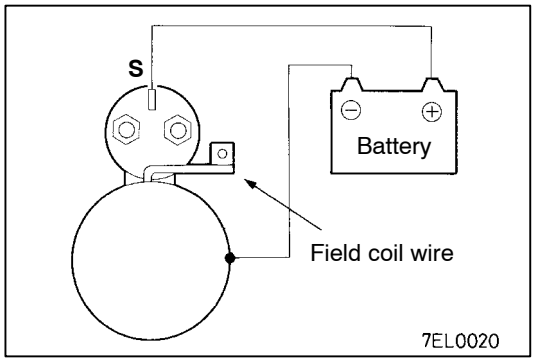
   Caution
   This test must be performed quickly (in less than 10 seconds) to prevent coil from burning.
4. Check pinion to stopper clearance (pinion gap) with a thickness gauge.

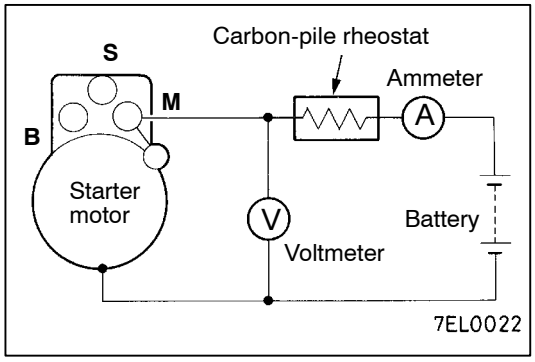
   Standard value: 0.5 - 2.0 mm
5. If pinion gap is out of specification, adjust by adding or removing gaskets between magnetic switch and front bracket.

MAGNETIC SWITCH PULL-IN TEST

1. Disconnect field coil wire from M-terminal of magnetic switch.
2. Connect a 12V 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

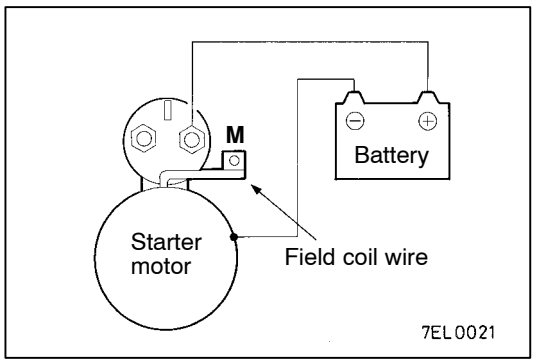
1. Disconnect field coil wire from M-terminal of magnetic switch.
2. Connect a 12V battery between S-terminal and body.

   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 V.
7. Confirm that the maximum amperage is within the specifications and that the starter motor turns smoothly and freely.

   Current: max. 90 Amps (6G7)
   max. 130 Amps (4D5, 4M4)



MAGNETIC SWITCH RETURN TEST

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

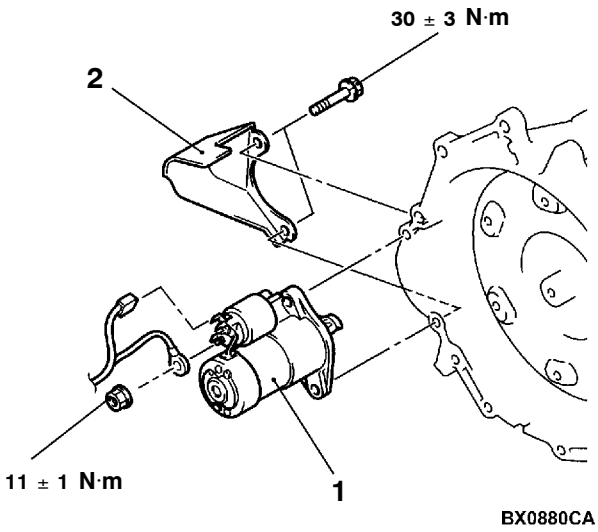
   Caution
   This test must be performed quickly (in less than 10 seconds) to prevent coil from burning.
3. Pull pinion out and release. If pinion quickly returns to its original position, everything is in order. If it doesn't, replace magnetic switch.

   Caution
   Be careful not to get your fingers caught when pulling out the pinion.

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Under Cover Removal and Installation

<6G7>



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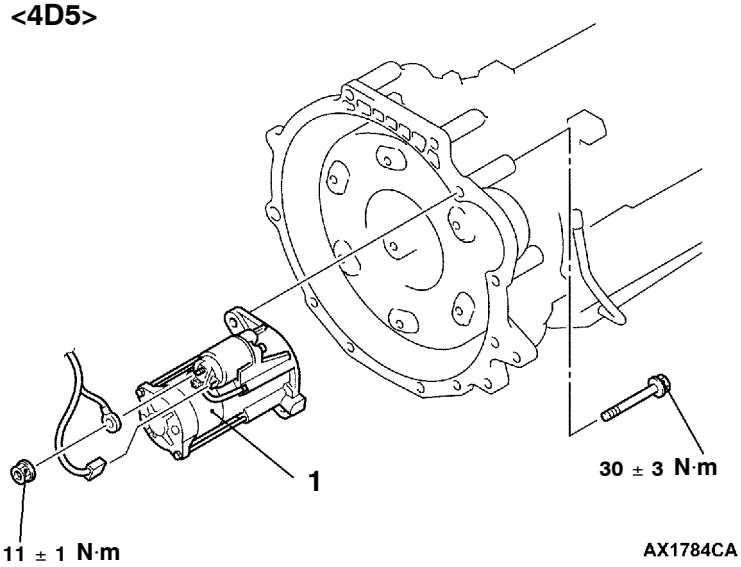

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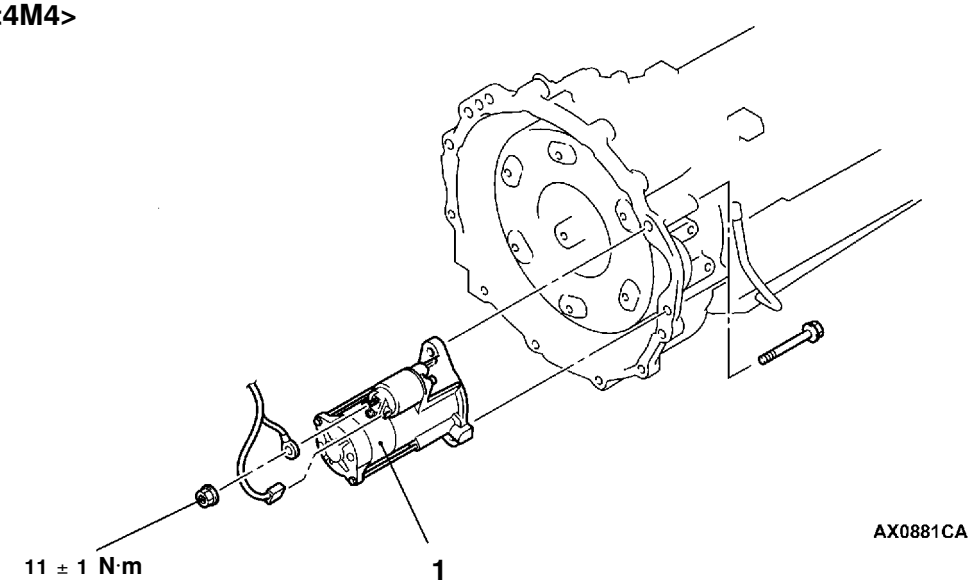
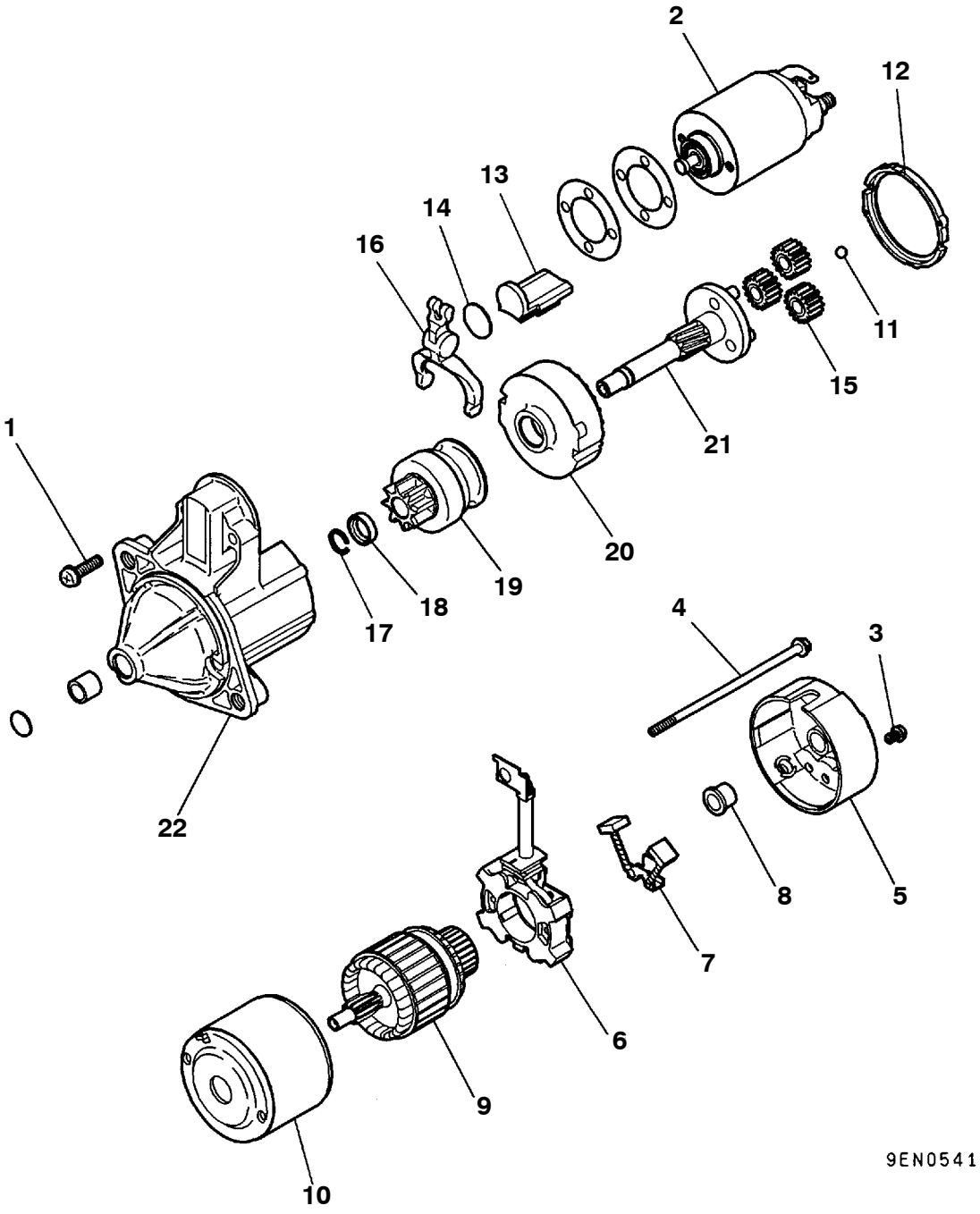


Disassembly steps

1. Starter motor assembly
2. Starter cover

DISASSEMBLY AND REASSEMBLY <6G7>

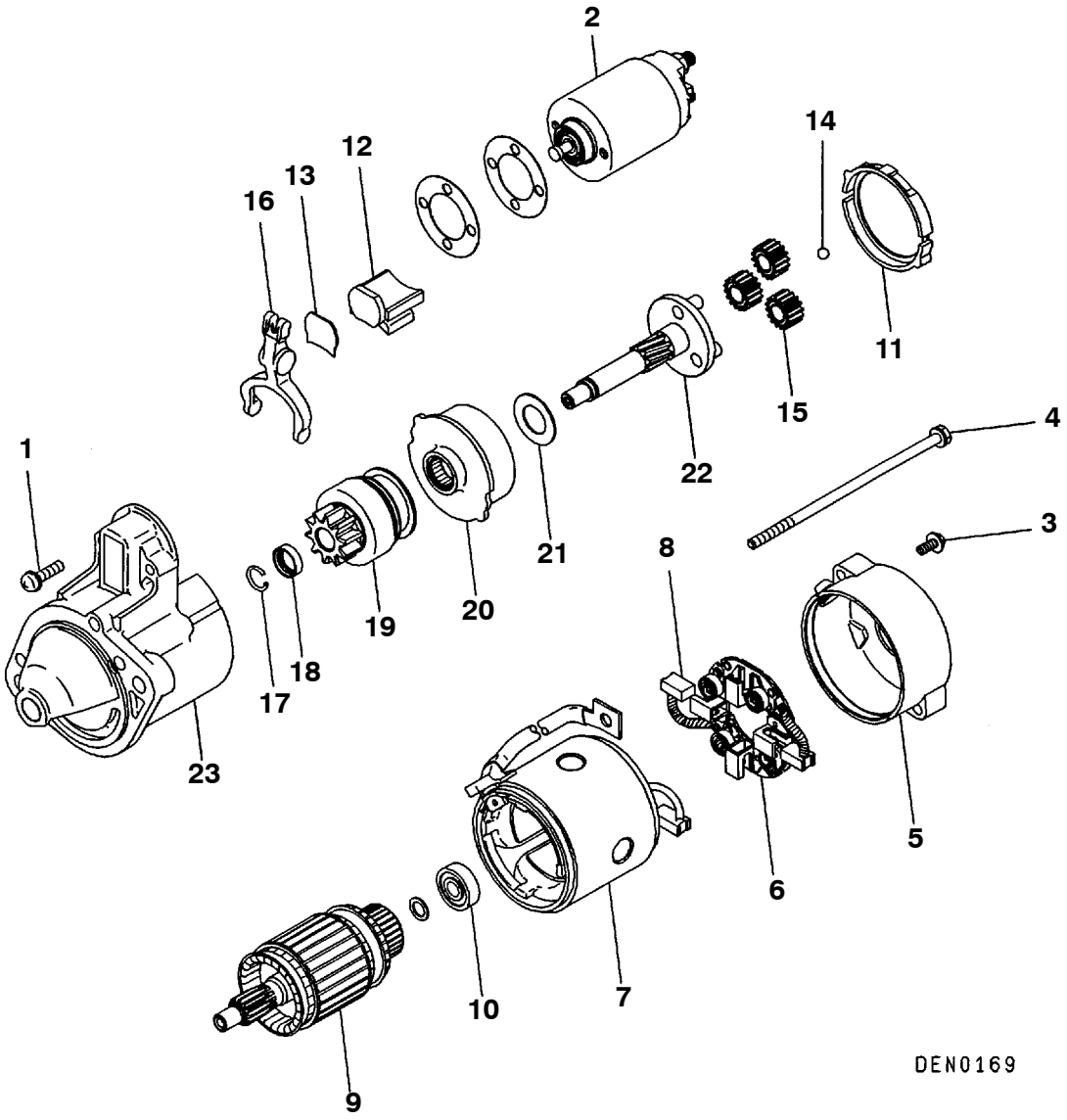
16200120290



Disassembly steps

1. Screw
◀A▶ 2. Magnetic switch
3. Screw
4. Screw
5. Rear bracket
6. Brush holder
7. Brush
8. Rear bearing
◀B▶ 9. Armature
10. Yoke assembly
◀B▶ 11. Ball
12. Packing A
13. Packing B
14. Plate
15. Planetary gear
16. Lever
◀C▶ ▶A◀ 17. Snap ring
◀C▶ ▶A◀ 18. Stop ring
19. Overrunning clutch
20. Internal gear
21. Planetary gear holder
22. Front bracket

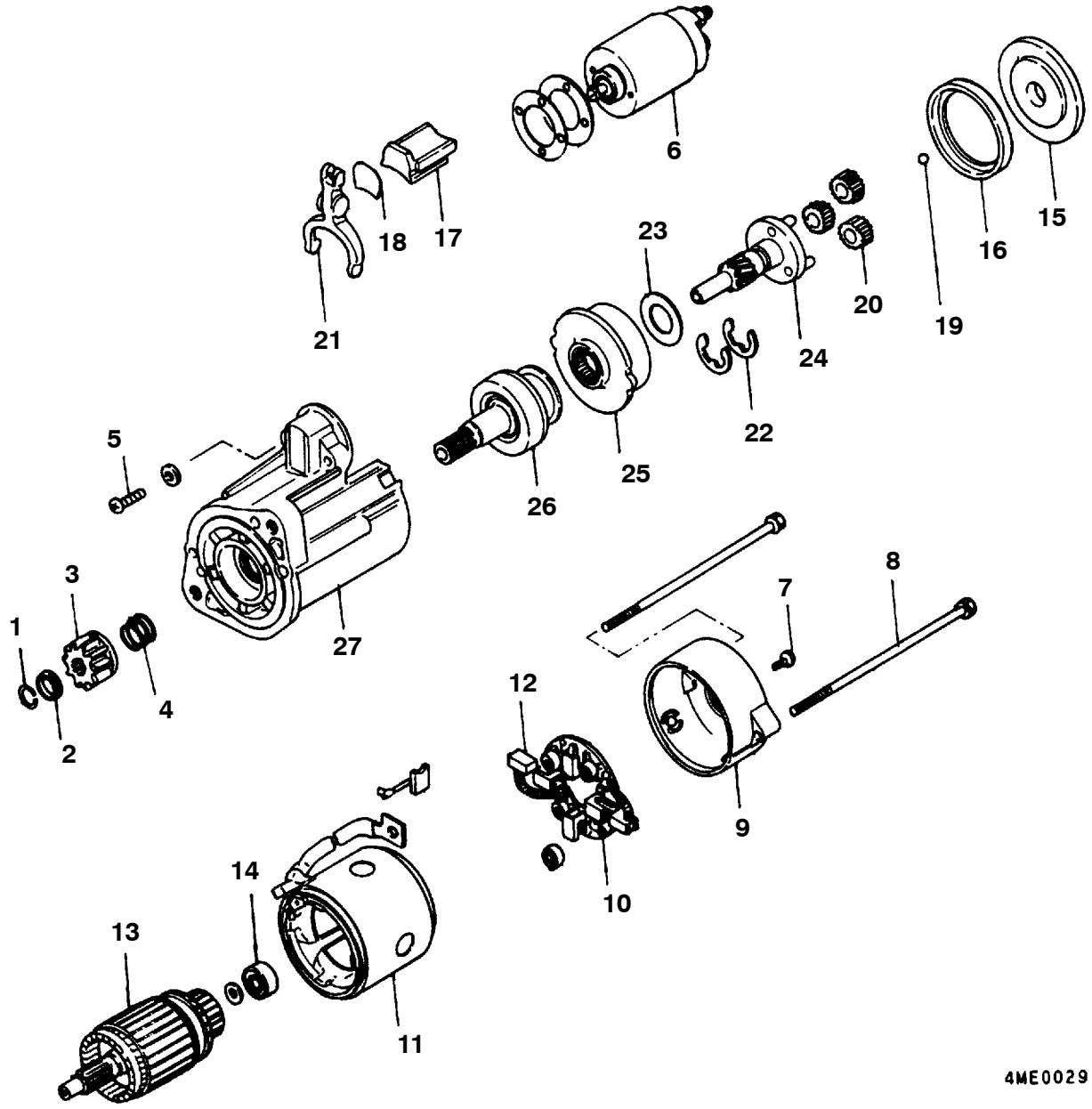
<4D5>



Disassembly steps

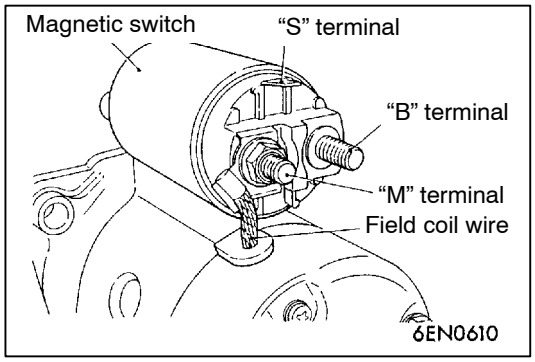
1. Screw
◀A▶ 2. Magnetic switch
3. Screw
4. Screw
5. Rear bracket
6. Brush holder
7. Yoke assembly
8. Brush
◀B▶ 9. Armature
10. Bearing
11. Packing A
12. Packing B
13. Plate
◀B▶ 14. Ball
15. Planetary gear
16. Lever
◀C▶ ▶A◀ 17. Snap ring
◀C▶ ▶A◀ 18. Stop ring
19. Overrunning clutch
20. Internal gear
21. Washer
22. Planetary gear holder
23. Front bracket

<4M4>



Disassembly steps

1. Stopper ring
2. Pinion stopper
◀D▶ ▶B◀ 3. Pinion
4. Spring
5. Screw
6. Magnetic switch
7. Screw
8. Screw
9. Rear bracket
10. Brush holder assembly
◀E▶ 11. Yoke assembly
12. Brush
◀B▶ 13. Armature
14. Rear bearing
15. Cover
16. Rubber packing A
17. Rubber packing B
18. Plate
◀B▶ 19. Ball
20. Planetary gear
21. Lever
22. Washer
23. Washer
24. Gear shaft
25. Internal gear
26. Overrunning clutch
27. Front bracket



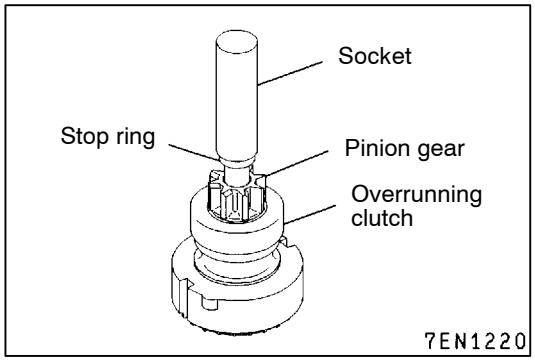
DISASSEMBLY SERVICE POINTS

◀A▶ MAGNETIC SWITCH REMOVAL

Disconnect field coil wire from "M" terminal of magnetic switch.

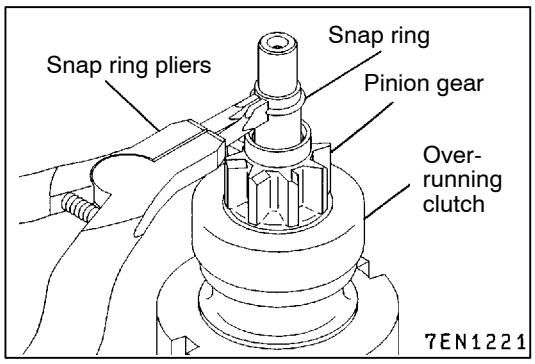
◀B▶ ARMATURE/BALL REMOVAL

Caution
When removing the armature, take care not to lose the ball (which is used as a bearing) in the armature end.

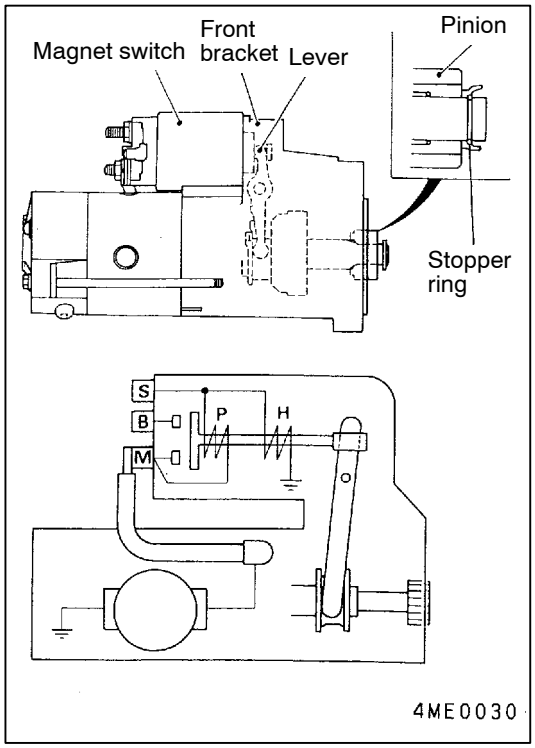


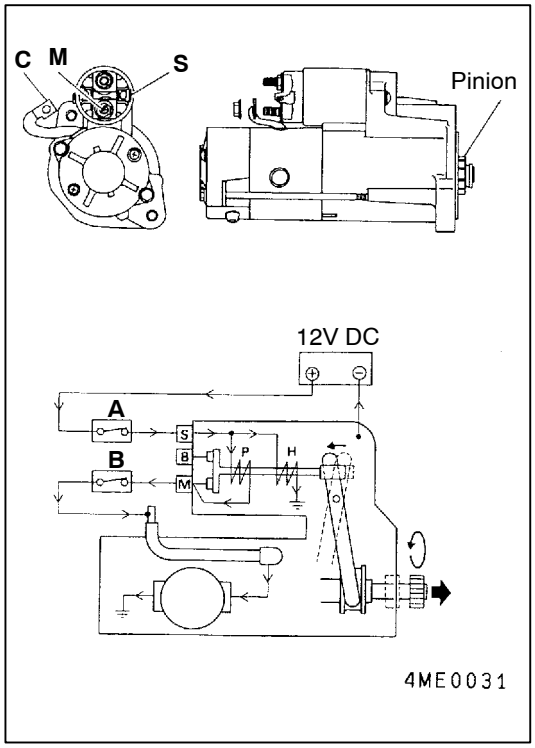
◀C▶ SNAP RING/STOP RING REMOVAL

1. Press stop ring off snap ring with a suitable socket.



2. Remove snap ring with snap ring pliers and then remove stop ring and overrunning clutch.





◀D▶ PINION REMOVAL <4M4>

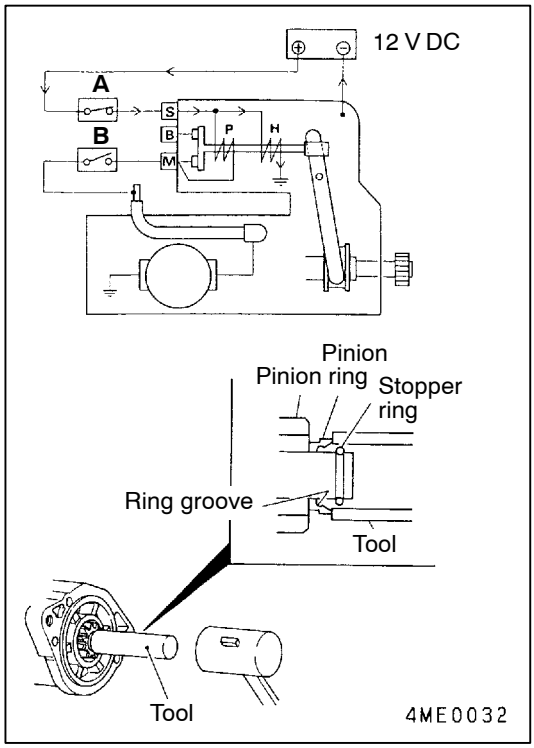
Remove the pinion with power supplied to the starter and the pinion in its popped-out position.

Caution

1. **When power is supplied to the starter, the pinion pops out and rotates. Keep your hands away from the pinion at this time.**
2. **The magnet switch may be extremely hot after inspection. Be careful not to touch it.**
3. **Do not supply power to the pull-in coil P for more than 10 seconds. Do not supply power to the holding coil H for more than 30 seconds. If these time limits are exceeded, the coil(s) may overheat and burn out.**
4. **The pinion must be popped out electrically by supplying power to the starter. Do not pop out the pinion by pulling the lever since the front bracket and lever may be damaged when the stopper ring is removed.**
5. **When the starter is energized, current of more than 100A flows. Thus, heavy-dury cables (as thick as booster cables) must be used to connect the starter for inspection, and all connections must be securely tightened.**

1. Connect the starter as shown in the illustration. Here,
   A: Switch,
   B: Switch,
   C: Cable,
   M: Starter M terminal,
   S: Starter S terminal.

   NOTE
   The following procedure must be carried out with power supplied to the starter. Thus, the pinion must be removed within 30 seconds of turning ON the power.
2. Supply power to the starter by turning ON switches A and B. The pinion will pop out and rotate.

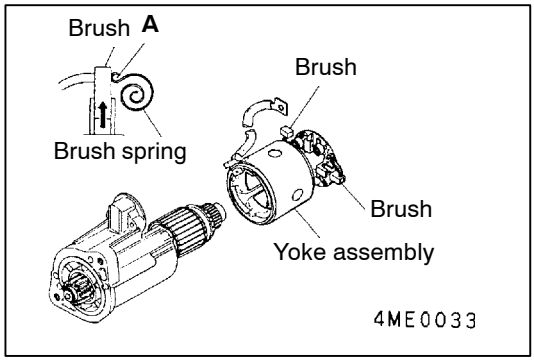


3. Within 5 seconds of the pinion's rotation, turn OFF switch B to stop the pinion from rotating.

Caution
With switches A and B turned ON, power is supplied to both the pull-in coil P and holding coil H. No voltage is applied to starter terminal B, so current flows in the pull-in coil while the pinion is rotating. To prevent the pull-in coil from burning out, switch B must therefore be turned OFF within 5 seconds of the pinion's rotation.

4. Apply a suitable tubular tool to the pinion stopper.
5. Lightly tap the tubular tool with a hammer to remove the stopper ring from the pinion stopper ring groove.
6. Remove the stopper ring and pinion.
7. Turn OFF switch A to cut the supply of power to the starter.

Caution
When the starter power is cut, the pinion may pop in, causing the stopper ring to go back into the ring groove. If this occurs, switch ON the starter power and repeat the procedure.

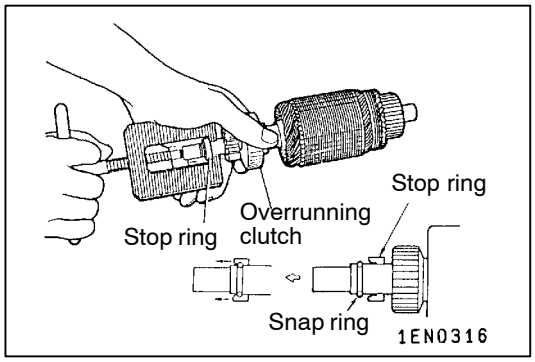


◀E▶ YOKE ASSEMBLY REMOVAL <4M4>

1. Pull the brush spring at point A and raise the brush.
2. After raising the brush, hold it in place with the brush spring as shown in the illustration.
3. Remove the yoke assembly.

STARTER MOTOR PARTS CLEANING

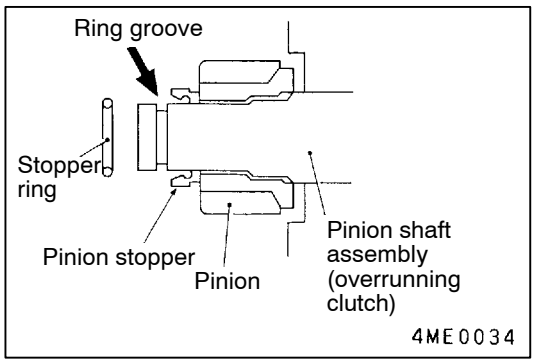
1. Do not immerse parts in cleaning solvent. Immersing the yoke and field coil assembly and/or armature will damage insulation. Wipe motor assembly with a cloth only.
2. Do not immerse drive unit in cleaning solvent. Overrunning clutch is pre-lubricated at the factory and solvent will wash lubrication 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

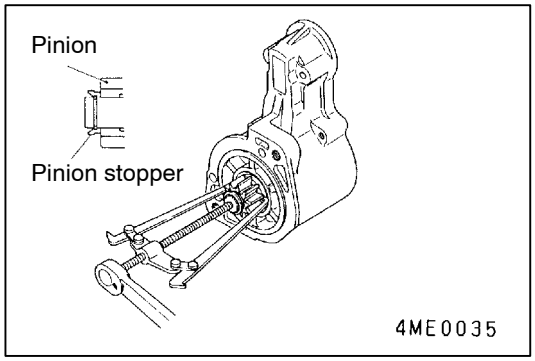
▶A◀ STOP RING/SNAP RING INSTALLATION

Using a suitable pulling tool, pull overrunning clutch stop ring over snap ring.



▶B◀ PINION INSTALLATION

1. Install the pinion and the pinion stopper in the direction shown in the illustration.
2. Install the stopper ring in the ring groove of the pinion shaft assembly (overrunning clutch).

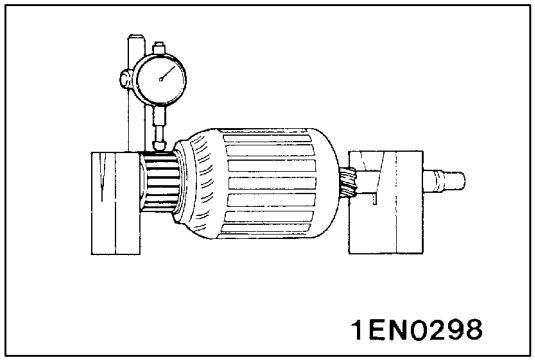


3. Pulling the pinion hard, secure the pinion stopper to the stopper ring.

INSPECTION

16200130286

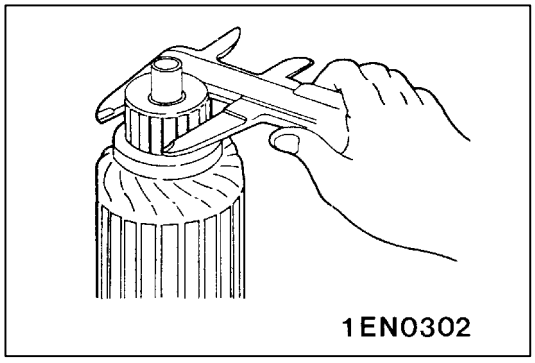
COMMUTATOR CHECK



1. Place the armature in a pair of “V” blocks and check the runout with a dial indicator.

   Standard value: 0.05 mm

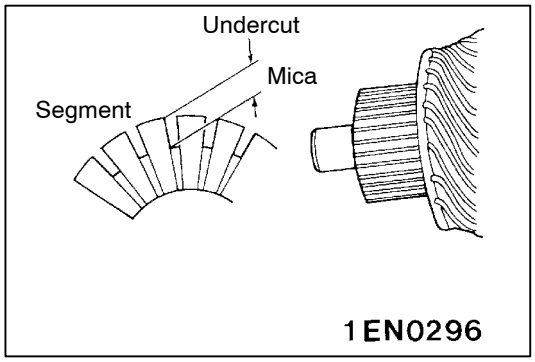
   Limit: 0.1 mm



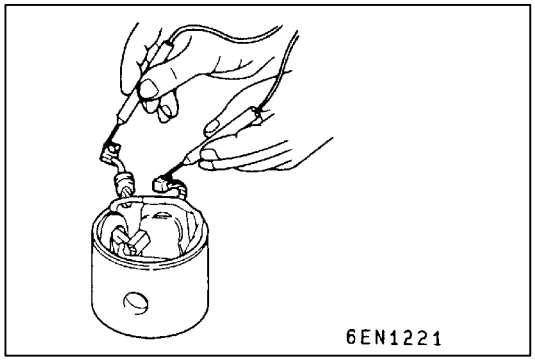
2. Measure the commutator outer diameter.

   Standard value: 29.4 mm

   Limit: 28.8 mm

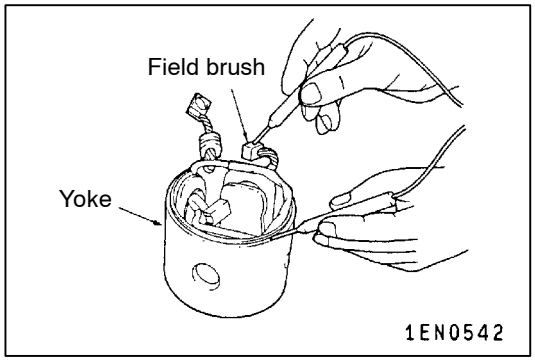


3. Check the undercut depth between segments.
   Standard value: 0.5 mm
   Limit: 0.2 mm



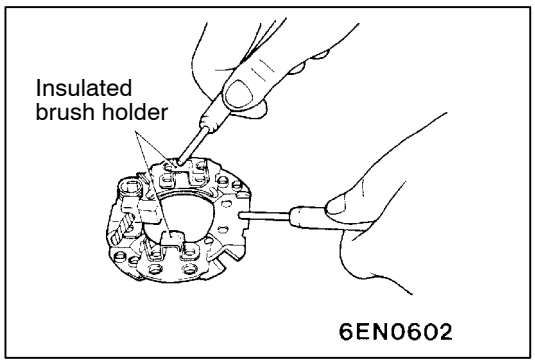
FIELD COIL OPEN-CIRCUIT TEST <4D5, 4M4>

Check the continuity between field brushes. If there is continuity, the field coil is in order.



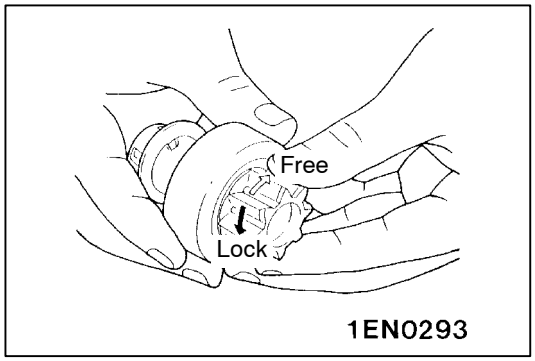
FIELD COIL GROUND TEST <4D5, 4M4>

Check the continuity between field coil brush and yoke. If there is no continuity, the field coil is free from earth.



BRUSH HOLDER CHECK

Check the continuity between brush holder plate and brush holder.
If there is no continuity, the brush holder is in order.

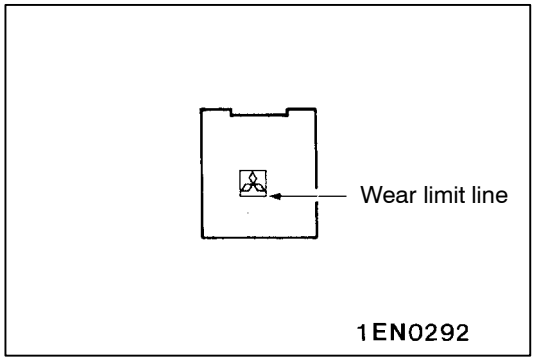


OVERRUNNING CLUTCH CHECK

1. While holding clutch housing, rotate the pinion. Drive pinion should rotate smoothly in one direction, but should not rotate in opposite direction. If clutch does not function properly, replace overrunning clutch assembly.
2. Inspect pinion for wear or burrs. If pinion is worn or burred, replace overrunning clutch assembly. If pinion is damaged, also inspect ring gear for wear or burrs.

FRONT AND REAR BRACKET BUSHING CHECK

Inspect bushing for wear or burrs. If bushing is worn or burred, replace front bracket assembly or rear bracket assembly.



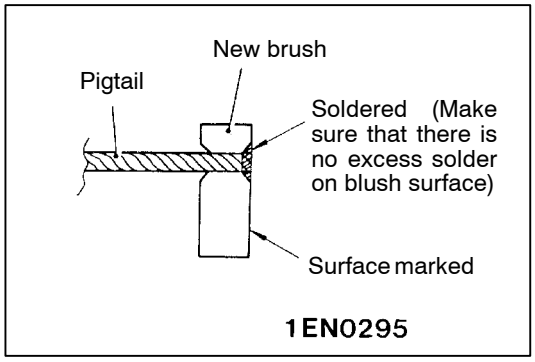
BRUSH AND SPRING REPLACEMENT

<6G7>

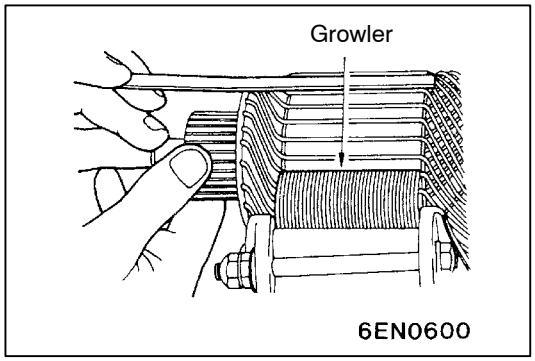
1. Brushes that are worn beyond wear limit line, or oil-soaked, should be replaced.
2. When replacing ground brush, slide the brush from brush holder by prying retaining spring back.

<4D5>

1. Brushes that are worn beyond wear limit line, or are oil-soaked, should be replaced.
2. When replacing field coil brushes, crush worn brush with pliers, taking care not to damage pigtail.



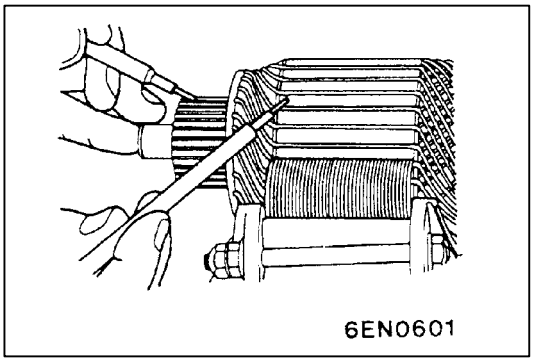
3. Sand pigtail end with sandpaper to ensure good soldering.
4. Insert pigtail into hole provided in new brush and solder it.
   Make sure that pigtail and excess solder do not come out onto brush surface.
5. When replacing ground brush, slide the brush from brush holder by prying retainer spring back.



ARMATURE TEST

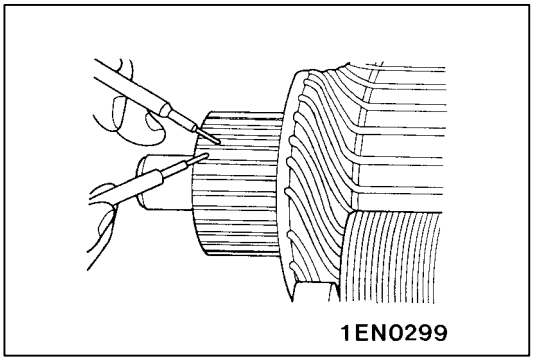
ARMATURE SHORT-CIRCUIT TEST

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.



ARMATURE COIL EARTH TEST

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.

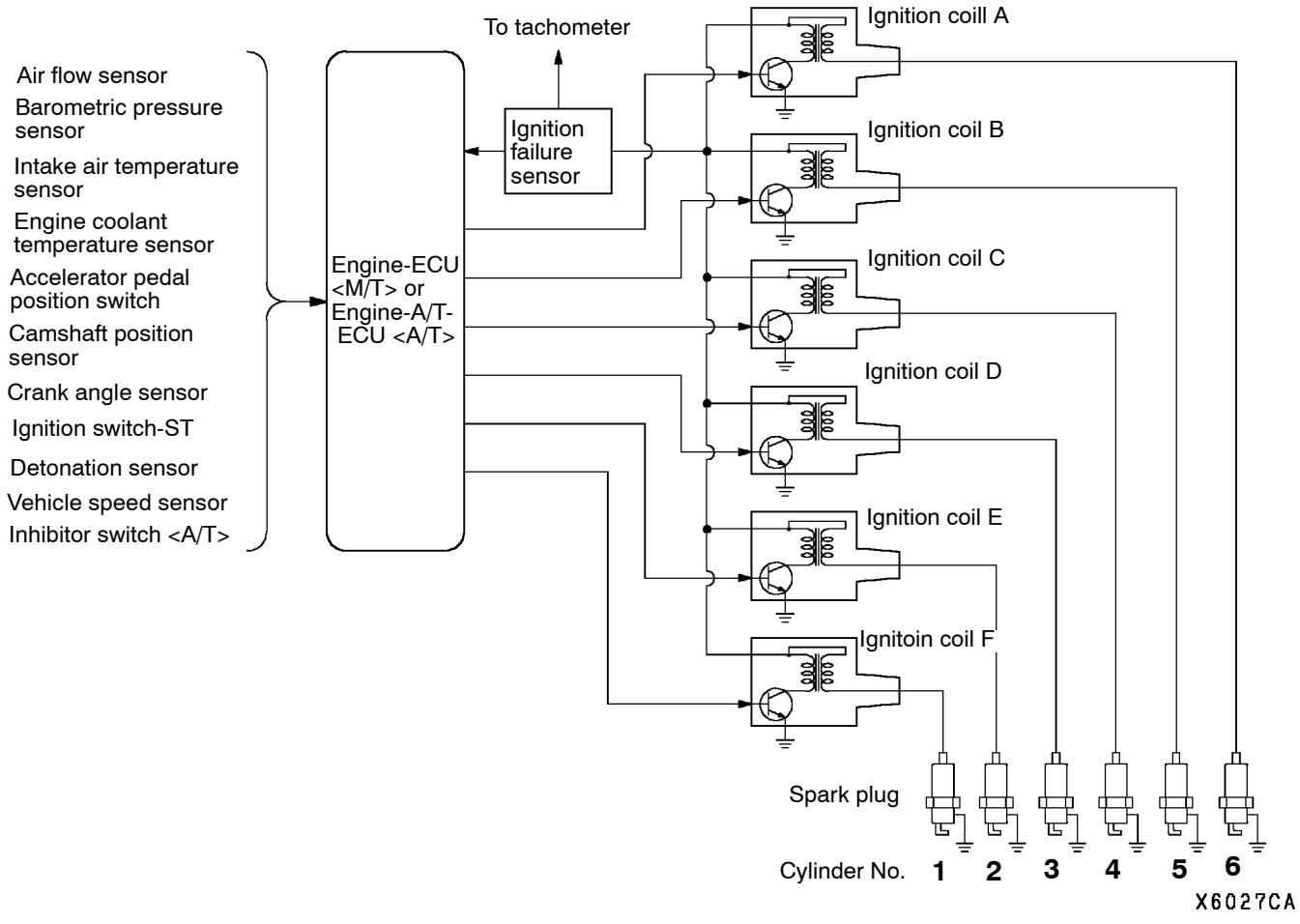
IGNITION SYSTEM

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 <M/T> or engine-A/T-ECU <A/T> 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 - 2 - 3 - 4 - 5 - 6.

The engine-ECU <M/T> or engine-A/T-ECU <A/T> 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 SPECIFICATION

Items	Specification
Type	Molded 6-coil

SPARK PLUG SPECIFICATION

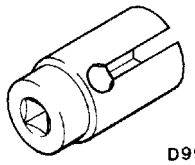
Items	6G7
NGK	IZFR5B

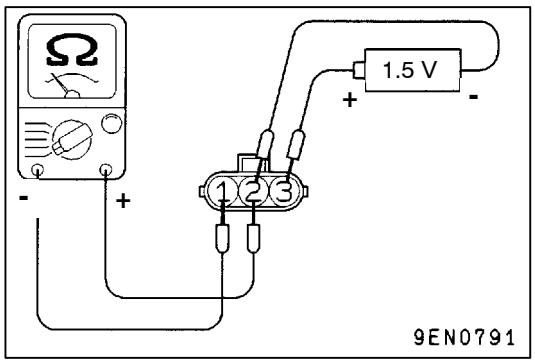
SERVICE SPECIFICATIONS

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

PRIMARY COIL AND POWER TRANSISTOR CONTINUITY CHECK

NOTE
1. An analogue-type circuit tester should be used.
2. Connect the negative (-) prove of the circuit tester to terminal 1.

Caution
This test must be performed quickly (in less than 10 seconds) to prevent coil from burning and power transistor from breakage.

Voltage: 1.5V	Terminal No.		
	1	2	3
When current is flowing		⊖	⊕
When current is not flowing			

SECONDARY COIL CHECK

NOTE

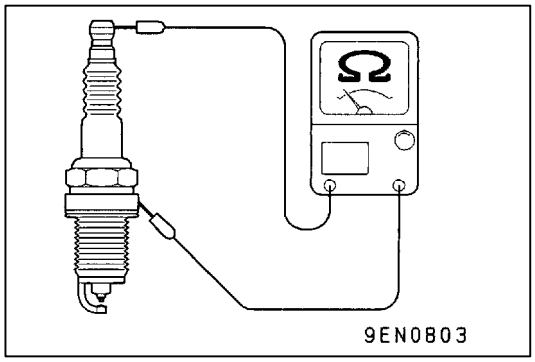
It is impossible to check the secondary coil through the continuity check as a diode is integrated in the secondary coil circuit of this ignition coil. So, check the secondary coil in the following procedure.

1. Disconnect the ignition coil connector.
2. Remove the ignition coil and install a new spark plug to the ignition coil.
3. Connect the ignition coil connector.
4. Earth the side electrode of the spark plug and crank the engine.
5. Check that spark is produced between the electrodes of the spark plug.
6. If no spark is produced, replace the ignition coil with a new one and recheck.
7. If spark is produced with the new ignition coil, replace the old one as it is faulty. If no spark is produced again, the ignition circuit is suspected as faulty. Check the ignition circuit.

SPARK PLUG CHECK AND CLEANING

Caution

1. **The spark plug gap for iridium plugs should not be adjusted.**
2. **Cleaning iridium plugs may result in damage to the iridium tip. Therefore, if cleaning is necessary because the plug is sooty, use a plug cleaner, and do not clean the plug for more than 20 seconds in order to preserve the electrodes. A wire brush should never be used.**
3. **The spark plugs in GDI engines are special iridium plugs in which the electrodes can become black even when the plugs are working normally. Carbon which may become deposited on these plugs burns off more readily than with conventional plugs, and so should not cause any problems with spark plug performance. Judgement of whether a spark plug is operating normally or not should be made by checking the insulation resistance.**

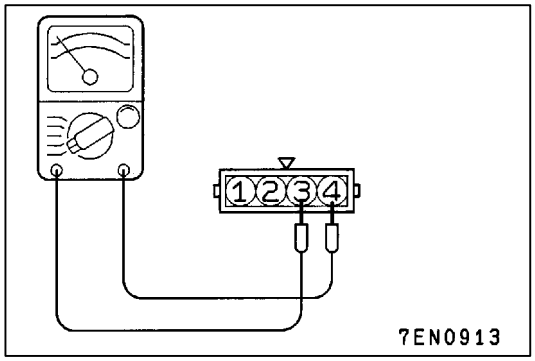


1. Remove the ignition coils.
2. Remove the spark plugs.
3. Check the spark plug gap. Replace the spark plug if the gap exceeds the limit.

   Limit: 0.75 mm

   Standard value: 0.5 - 0.6 mm
4. Measure the spark plug insulation resistance. Replace the spark plug if the measured value is lower than the limit value.

   Limit: 1 MΩ
5. Clean the spark plug holes.
6. Install the spark plugs.
7. Install the ignition coils.



IGNITION FAILURE SENSOR CHECK

NOTE
An analog-type ohmmeter should be used. Check that the resistance between terminals 3 and 4 is at the standrad value.

Standard value: 0.1 Ω or less.

CAMSHAFT POSITION SENSOR CHECK

Refer to GROUP 13A - Troubleshooting. <6G7>

CRANK ANGLE SENSOR CHECK

Refer to GROUP 13A - Troubleshooting. <6G7>

DETONATION SENSOR CHECK

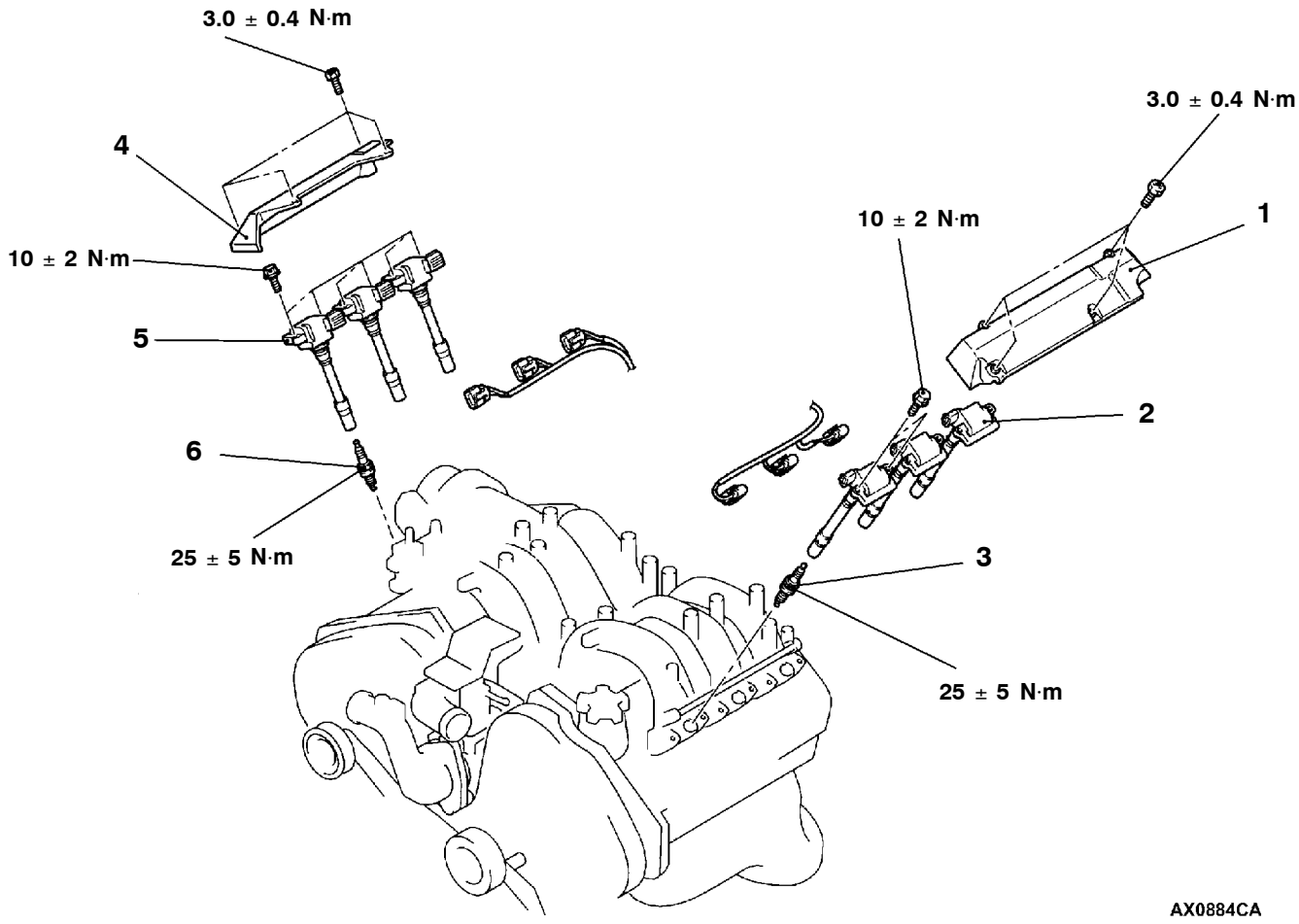
Check the detonation sensor circuit if self-diagnosis code, No. 31 is shown.

NOTE
For information concerning the self-diagnosis codes, refer to GROUP 13A - Troubleshooting. <6G7>

IGNITION COIL<6G7>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Cover Removal and Installation
- Air Cleaner Assembly Removal and Installation (Refer to GROUP 15.)



Removal steps <Left bank>

1. Center cover, left
2. Ignition coil
3. Spark plug

Removal steps <Right bank>

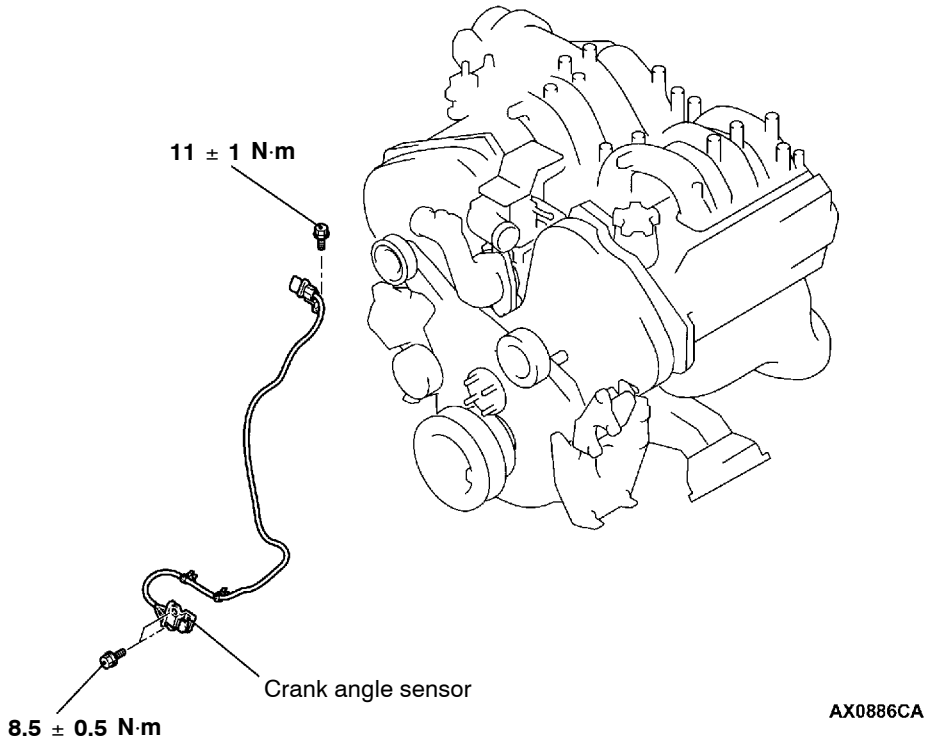
- Throttle body (Refer to GROUP 13A.)

4. Center cover, right
5. Ignition coil
6. Spark plug

CRANK ANGLE SENSOR<6G7>

REMOVAL AND INSTALLATION

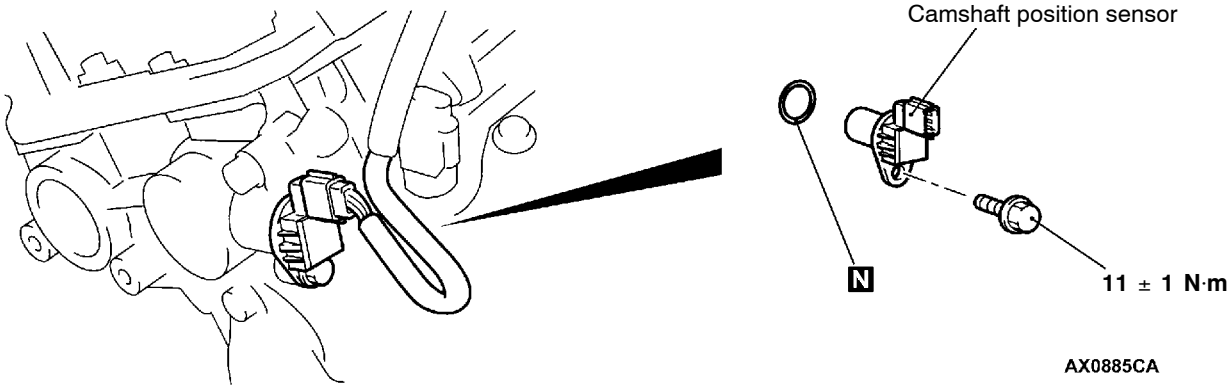
Pre-removal and Post-installation Operation
Timing Belt Cover Removal and Installation (Refer to GROUP 11.)



CAMSHAFT POSITION SENSOR <6G7>

REMOVAL AND INSTALLATION

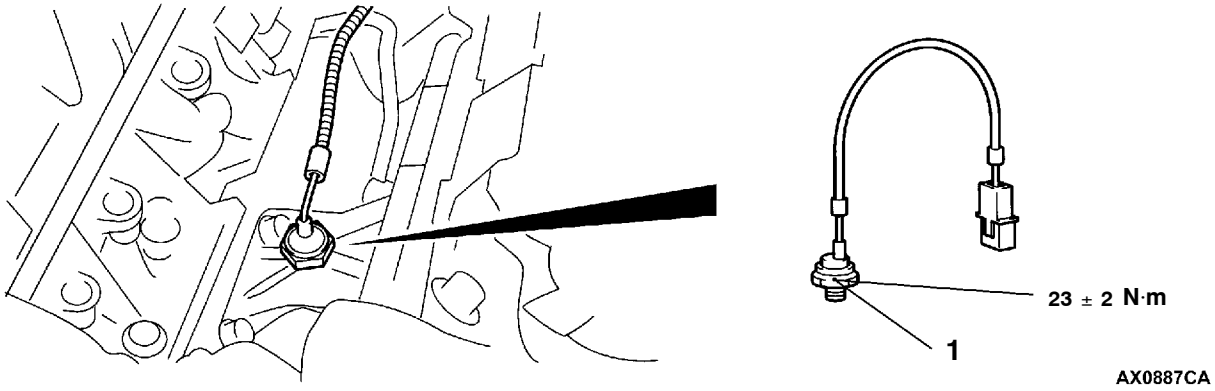
Pre-removal and Post-installation Operation
Engine Cover Removal and Installation (Refer to GROUP 11.)



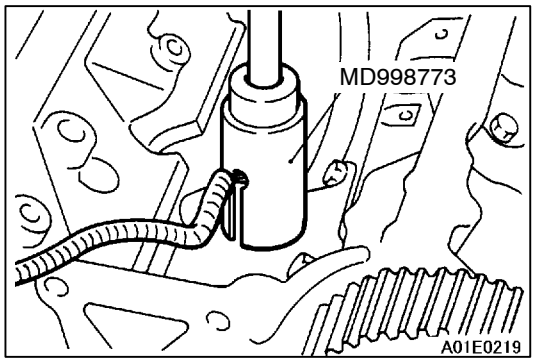
DETONATION SENSOR <6G7>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Intake Manifold Removal and Installation (Refer to GROUP 15.)



◀A▶ ▶A◀ 1. Detonation sensor



REMOVAL SERVICE POINT

◀A▶ DETONATION SENSOR REMOVAL

INSTALLATION SERVICE POINT

▶A◀ DETONATION SENSOR INSTALLATION

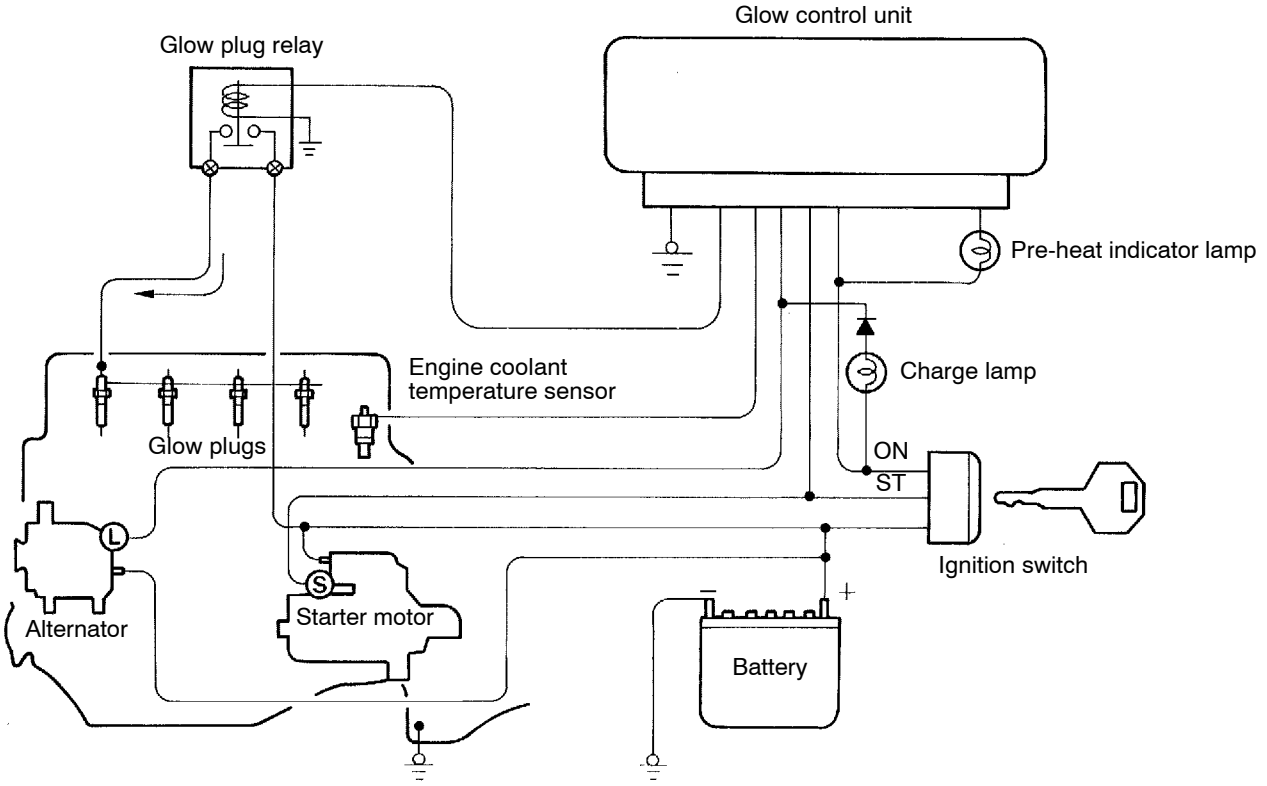
GLOW SYSTEM

16400010029

GENERAL INFORMATION

SELF-REGULATING GLOW SYSTEM

The self-regulating glow system reduces the time required for starting at low temperatures to provide a degree of starting and operation that is identical to petrol-engine vehicles by preheating the glow plugs at super-quick speed.
The glow control unit controls both the time during which current is supplied to the glow plugs after the ignition switch is turned to the ON position and also the glow indicator lamp illumination time in accordance with the engine coolant temperature. The resistances of the heating coils which are built into the glow plugs increase as the glow plug temperatures become higher. As a result of this, the flow of current gradually decreases, thus stabilizing the glow plug temperature at the specified temperature.



SERVICE SPECIFICATIONS

16400030070

Item			Standard value
Resistance between glow plug plate and glow plug body (parallel resistance for 4 glow plugs) (at 20 °C) Ω		4D5	0.15 - 0.25
		4M4	0.05 - 0.07
Voltage between glow plug plate and glow plug body V	Immediately after ignition switch is turned to ON (without starting the engine)	4D5	9 - 11 (Drops to 0 V after 4 - 8 seconds have passed)
		4M4	9 - 11 (Drops to 0 V after approx. 8 seconds have passed)
	While engine is cranking		6 or more
	While engine is warming up		12 - 15 (Drops to 0 V when the engine coolant temperature increases to 60 °C or more or if 180 seconds have passed since the engine was started)
Glow plug resistance (at 20 °C) Ω	4D5		0.6 - 1.0
	4M4		Approx. 1.1

ON-VEHICLE SERVICE

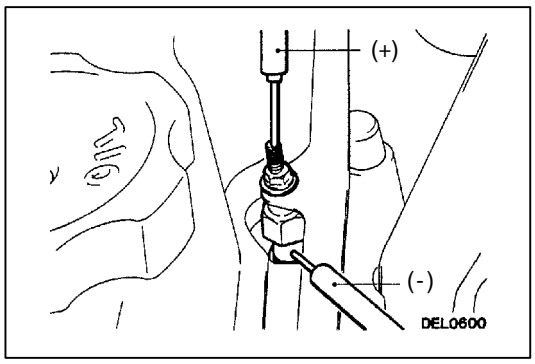
16400100061

SELF-REGULATING GLOW SYSTEM CHECK

<4D5>

1. Check that the battery voltage is 11 - 13 V.
2. Check that the engine coolant temperature is 40 °C or less.

   NOTE
   If the engine coolant temperature is too high, disconnect the engine coolant temperature sensor connector.



3. Measure the resistance between the glow plug plate and the glow plug body (earth).

   Standard value: 0.15 - 0.25 Ω (at 20 °C)

   NOTE
   The resistance value is the parallel resistance value for the four glow plugs.
4. Connect a voltmeter between the glow plug plate and the glow plug body (earth).
5. Measure the voltage immediately after the ignition switch is turned to ON (without starting the engine).

   Standard value:
   9 - 11 V (Drops to 0 V after 4 - 8 seconds have passed)

   In addition, check to be sure that the glow indicator lamp (red) illuminates immediately after the ignition switch is turned to ON.

   NOTE
   The time during which the voltage appears (energizing time) will depend on the engine coolant temperature.
6. Measure the voltage while the engine is cranking.

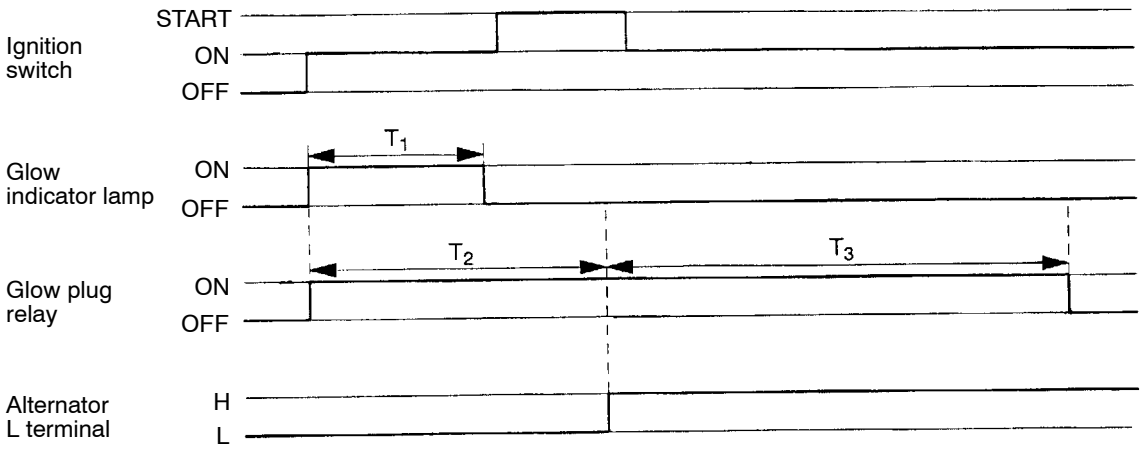
Standard value: 6 V or more

7. Start the engine and measure the voltage while the engine is warming up.
   However, if the engine coolant temperature rises above 60 °C or when 180 seconds have passed since the engine was started, the voltage will always return to 0 V. (Refer to the Glow Plug Energization Timing Chart.)

   Standard value: 12 - 15 V

<Reference>

Glow Plug Energization Timing Chart



T_1: Glow indicator lamp
T_2: Glow plug relay drive time after ignition switch is turned ON
T_3: Glow plug relay drive time after engine starts (after glow)

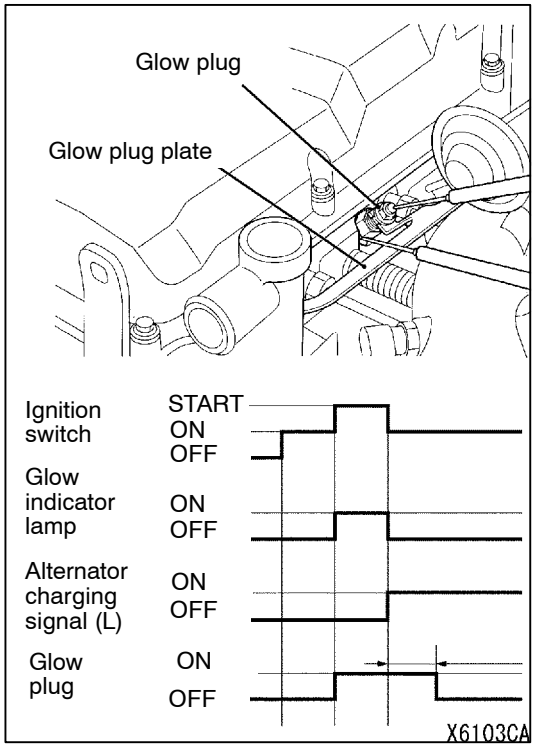
DEN0063

NOTE
After glow time T_3 becomes longer as the engine coolant temperature drops.

<4M4>

1. Check that the battery voltage is 11 - 13 V.
2. Check that the engine coolant temperature is 40 °C or less.

   NOTE
   If the engine coolant temperature is too high, disconnect the engine coolant temperature sensor connector.



3. Measure the resistance between the glow plug plate and the glow plug body (earth).

   Standard value: 0.05 - 0.07 Ω (at 20 °C)

   NOTE
   The resistance value is the parallel resistance value for the four glow plugs.
4. Connect a voltmeter between the glow plug plate and the glow plug body (earth).
5. Measure the voltage immediately after the ignition switch is turned to ON (without starting the engine).

   Standard value:
   9 - 11 V (Drops to 0 V after approx. 8 seconds have passed)

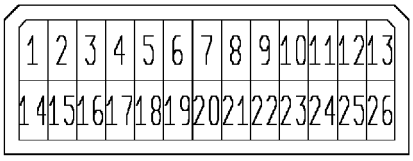
   In addition, check to be sure that the glow indicator lamp (red) illuminates immediately after the ignition switch is turned to ON.

   NOTE
   The time during which the voltage appears (energizing time) will depend on the engine coolant temperature.
6. Measure the voltage while the engine is cranking.

   Standard value: 6 V or more
7. Start the engine and measure the voltage while the engine is warming up.
   However, if the engine coolant temperature rises above 60 °C or when 180 seconds have passed since the engine was started, the voltage will always return to 0 V. (Refer to the Glow Plug Energization Timing Chart.)

   Standard value: 12 - 15 V

GLOW & EGR-CONTROL UNIT CHECK



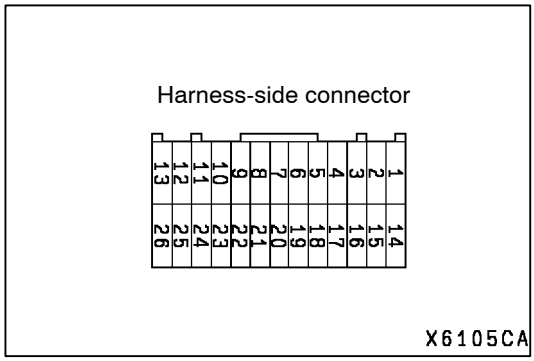
X6206CA

<Measure the voltage at the control unit terminals.>

NOTE
(1) Inspect with the control unit connector connected.
(2) When measuring the voltage, connect the control unit terminal (26) to the earth.

Terminal Voltage Reference Table

Inspection terminal	Inspection item	Inspection condition		Standard value
5	Engine coolant temperature sensor (Engine coolant temperature detection)	Ignition switch "OFF" → "ON"	Engine coolant temperature: - 20 °C	4.3 - 4.5 V
			Engine coolant temperature: 0 °C	3.7 - 3.9 V
			Engine coolant temperature: 20 °C	2.8 - 3.0 V
			Engine coolant temperature: 40 °C	1.9 - 2.1 V
			Engine coolant temperature: 80 °C	0.5 - 0.7 V
12	Ignition switch (power supply)	Ignition switch "LOCK(OFF)" → "START"		8 V or more
14	Glow plug relay (glow time control)	Ignition switch "LOCK(OFF)" → "ON" Engine coolant temperature: 40 °C or less (Pre-glow function inspection)		9 - 12 V 0 - 0.5 V after approx. 8 sec. (when engine coolant temperature is 20 °C)
17	Glow indicator lamp	Ignition switch "LOCK(OFF)" → "ON" Engine coolant temperature: 40 °C or less		0 - 1 V 11 - 13 V after approx. 1 sec. (when engine coolant temperature is 20 °C)
23	Alternator charging signal ("L" terminal)	Ignition switch "LOCK(OFF)" → "ON"		1 - 4 V
		Engine is idling		11 V or more
26	Earth	-		-

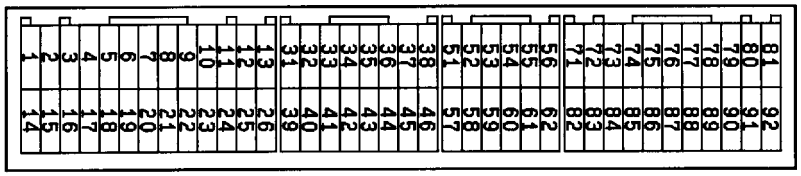


X6105CA

Remove the control unit connector and check the continuity between the harness-side connector terminals.

Inspection terminal	Inspection item	Continuity (resistance value)
14 - 26	Glow plug relay	Continuity (approx. 20Ω)

ENGINE-ECU CHECK



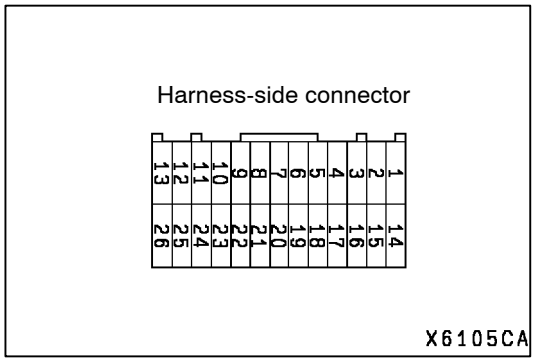
W6106AQ

<Measure the voltage at the control unit terminals.>

NOTE
(1) Inspect with the control unit connector connected.
(2) When measuring the voltage, connect the control unit terminal (26) to the earth.

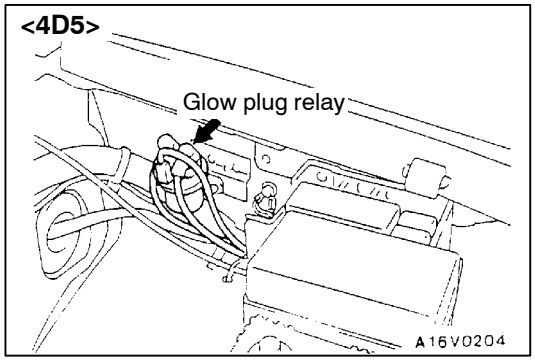
Terminal Voltage Reference Table

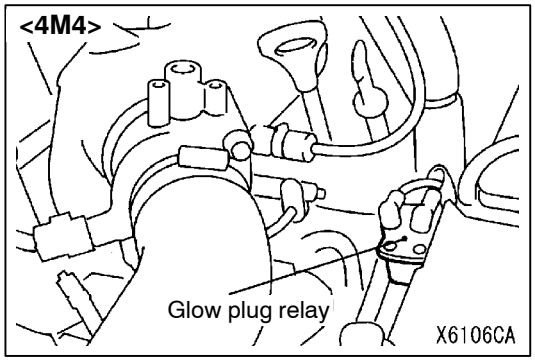
Inspection terminal	Inspection item	Inspection condition		Standard value
83	Engine coolant temperature sensor (Engine coolant temperature detection)	Ignition switch "LOCK (OFF)" → "ON"	Engine coolant temperature: - 20 °C	4.3 - 4.5 V
			Engine coolant temperature: 0 °C	3.7 - 3.9 V
			Engine coolant temperature: 20 °C	2.8 - 3.0 V
			Engine coolant temperature: 40 °C	1.9 - 2.1 V
			Engine coolant temperature: 80 °C	0.5 - 0.7 V
82	Ignition switch (power supply)	Ignition switch "LOCK (OFF)" → "START"		8 V or more
16	Glow plug relay (glow time control)	Ignition switch "LOCK (OFF)" → "ON" (Pre-glow function inspection)		9 - 12 V 0 - 0.5 V after approx. 8 sec. (when engine coolant temperature is 20 °C)
		After starting engine (After-glow function check)		12 V 0 V approx. 180 sec. (when engine coolant temperature is 20 °C)
4	Glow indicator lamp	Ignition switch "LOCK (OFF)" → "ON" Engine coolant temperature: 40 °C or less		0 - 1 V 11 - 13 V after approx. 1 sec. (when engine coolant temperature is 20 °C)
82	Alternator charging signal ("L" terminal)	Ignition switch "LOCK (OFF)" → "ON"		0 V
		Engine is idling		11 V or more
	Charge lamp	Ignition switch "LOCK (OFF)" → "ON" Immediately after the glow indicator lamp turns off and on.		12 V 0 V approx. 6 sec. (When engine coolant temperature is 20 °C)
26	Earth	-		-

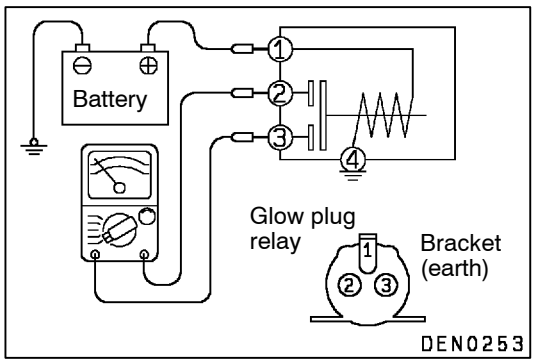


Remove the control unit connector and check the continuity between the harness-side connector terminals.

Inspection terminal	Inspection item	Continuity (resistance value)
13 - 16	Glow plug relay	Continuity (approx. 3Ω)







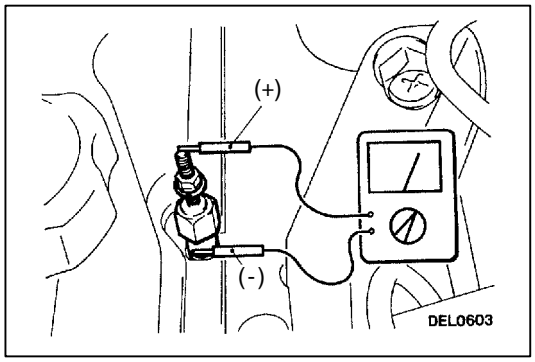
GLOW PLUG RELAY CHECK

16400250032

1. Check to be sure that there is continuity (approx. 20 Ω) between glow plug relay terminal (1) and the bracket (earth).
2. Use jumper cables to connect terminal (1) of the glow plug relay to the battery (+) terminal and the bracket to the battery (-) terminal

   Caution
   (1) Always be sure to disconnect the harnesses connected to glow plug relay terminals (2) and (3) before using the jumper cables.
   (2) The terminals of the disconnected harnesses must not be shorted to earth.
   (3) When connecting the jumper cables, be very careful not to make a mistake in connecting the terminals, as this will cause damage to the relay.
3. Check the continuity between glow plug relay terminals (2) and (3) while disconnecting and connecting the jumper cable at the battery (+) terminal

Jumper cable at battery (+) terminal	Continuity between terminals (2) - (3)
Connected	Continuity (0.01 Ω or less)
Disconnected	No continuity (infinite resistance)



GLOW PLUG CHECK

16400190082

1. Remove the glow plug plate.
2. Measure the resistance between the glow plug terminals and the body.

Standard value:
0.6 - 1.0 Ω (at 20 °C) <4D5>
Approx. 1.1 Ω (at 20 °C) <4M4>

ENGINE COOLANT TEMPERATURE SENSOR CHECK

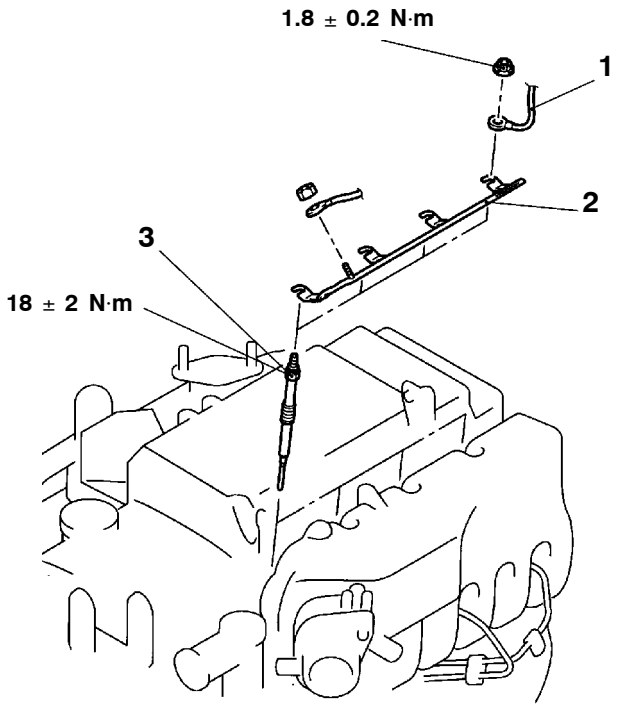
Refer to GROUP 13B - On-vehicle service <4D5> or GROUP 13C - On-vehicle service <4M4>

GLOW PLUG

REMOVAL AND INSTALLATION

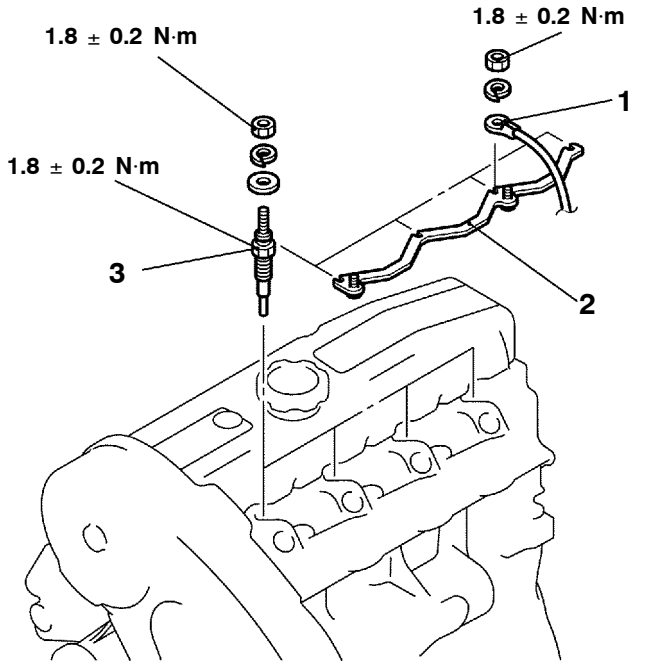
Pre-removal and Post-installation Operation
EGR Pipe Removal and Installation (Refer to GROUP 17.)

<4M4>



BX0888CA

<4D5>



AX1785CA

Removal steps
1. Connector connection
2. Glow plug plate
◀A▶ 3. Glow plug

REMOVAL SERVICE POINT

◀A▶ GLOW PLUG REMOVAL

The ceramic part of the glow plug can be easily damaged. When removing the glow plug, first loosen the plug with a wrench until the last one thread or more is remained, then remove it with your finger.

Caution
The glow plug, which has been dropped from a height of 10 cm or more, can not be reused.

GROUP 16
ENGINE ELECTRICAL

GLOW SYSTEM <4D5-STEP III>

GENERAL

OUTLINE OF CHANGE

Glow system control is now carried out by the engine-ECU to correspond to the adoption of an electronically-controlled fuel injection system.
Refer to GROUP 13E - Troubleshooting for details on measuring the ECU terminal voltage as a result of this.

ENGINE AND EMISSION CONTROL

Click on the applicable bookmark to selected the required model year.

ENGINE AND EMISSION CONTROL

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ENGINE CONTROL SYSTEM

GENERAL INFORMATION

On vehicles with 6G7 and 4M4 engines, an electronic-controlled throttle valve system has been used instead of a conventional cable-type accelerator mechanism.
On 4D5 engine, a cable-type accelerator mechanism and a suspended-type pedal have been used.

SERVICE SPECIFICATIONS

Items		Standard value
Accelerator cable play mm		1 - 2
Engine idle speed r/min	4D5	750 ± 100

ON-VEHICLE SERVICE

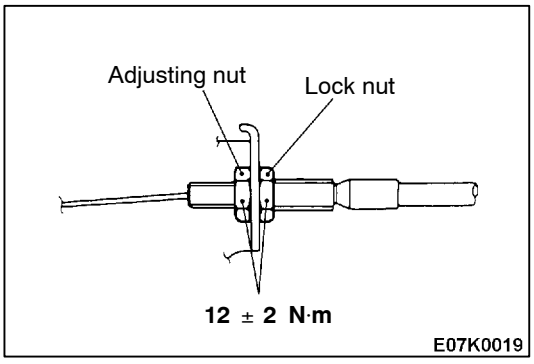
ACCELERATOR CABLE CHECK AND ADJUSTMENT <4D5>

1. Turn A/C and lamps OFF.
   Inspect and adjust at no load.
2. Warm engine until stabilized at idle.
3. Confirm idle speed is at prescribed value.

   Standard value: 750 ± 100 r/min

4. Stop engine (ignition switch OFF).
5. Confirm there are no sharp bends in accelerator cable.
6. Check inner cable for correct slack.

   Standard value: 1 - 2 mm



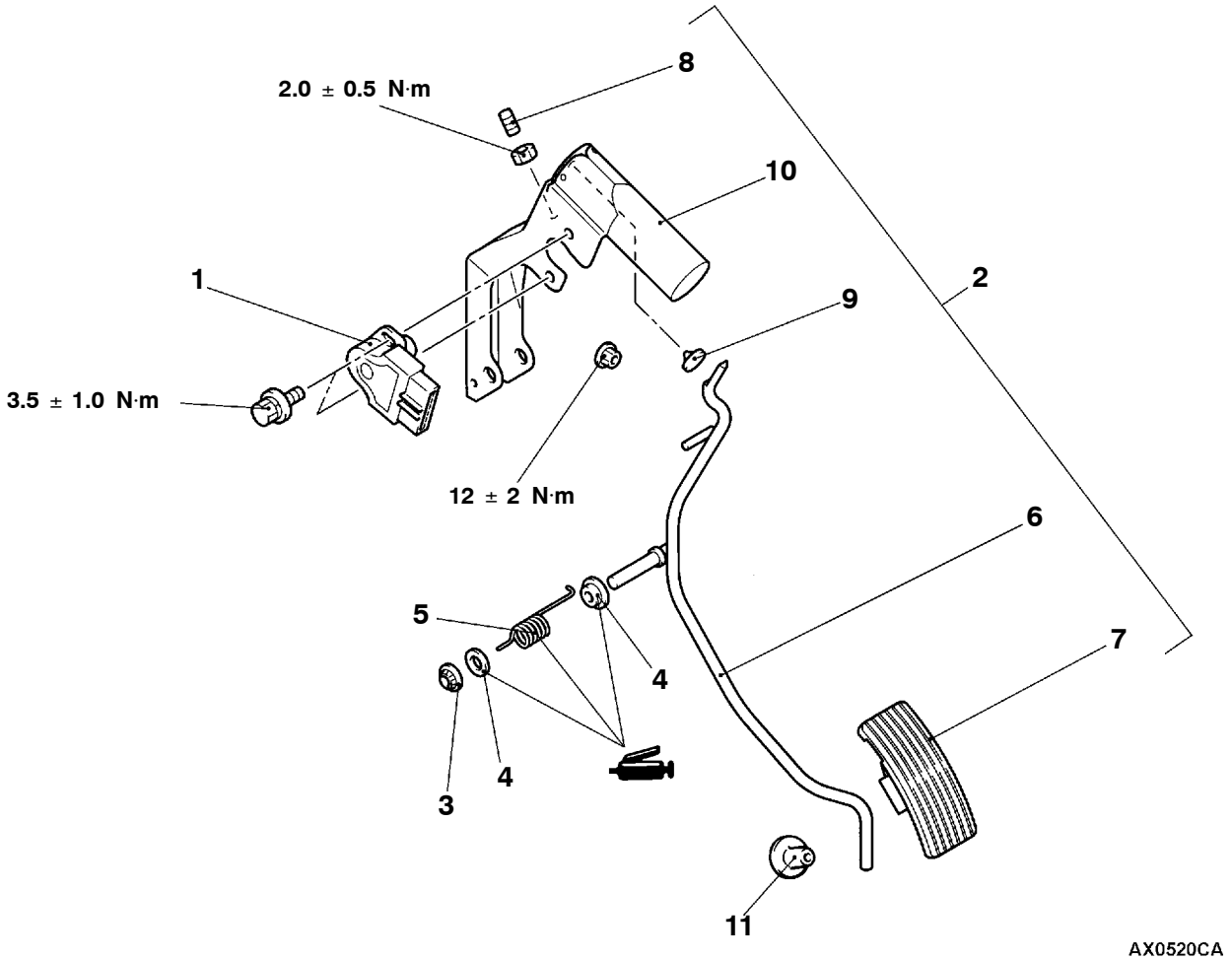
7. If there is too much slack or no slack, adjust play by the following procedures.
   (1) Loosen the lock nut and fully close the throttle lever.
   (2) Tighten the adjusting nut until immediately before the throttle lever starts to move.
   (3) By loosening the adjusting nut one turn, the accelerator cable play will be brought to the standard value.
   (4) Fix the adjusting nut with the lock nut.
   (5) After adjusting, check that the throttle lever is touching the stopper.

ACCELERATOR CABLE AND PEDAL

REMOVAL AND INSTALLATION

<6G7, 4M4>

Post-installation Operation
Check and Adjustment of the Accelerator Pedal Position Sensor (Refer to GROUP 13A, C - On-vehicle Service.)



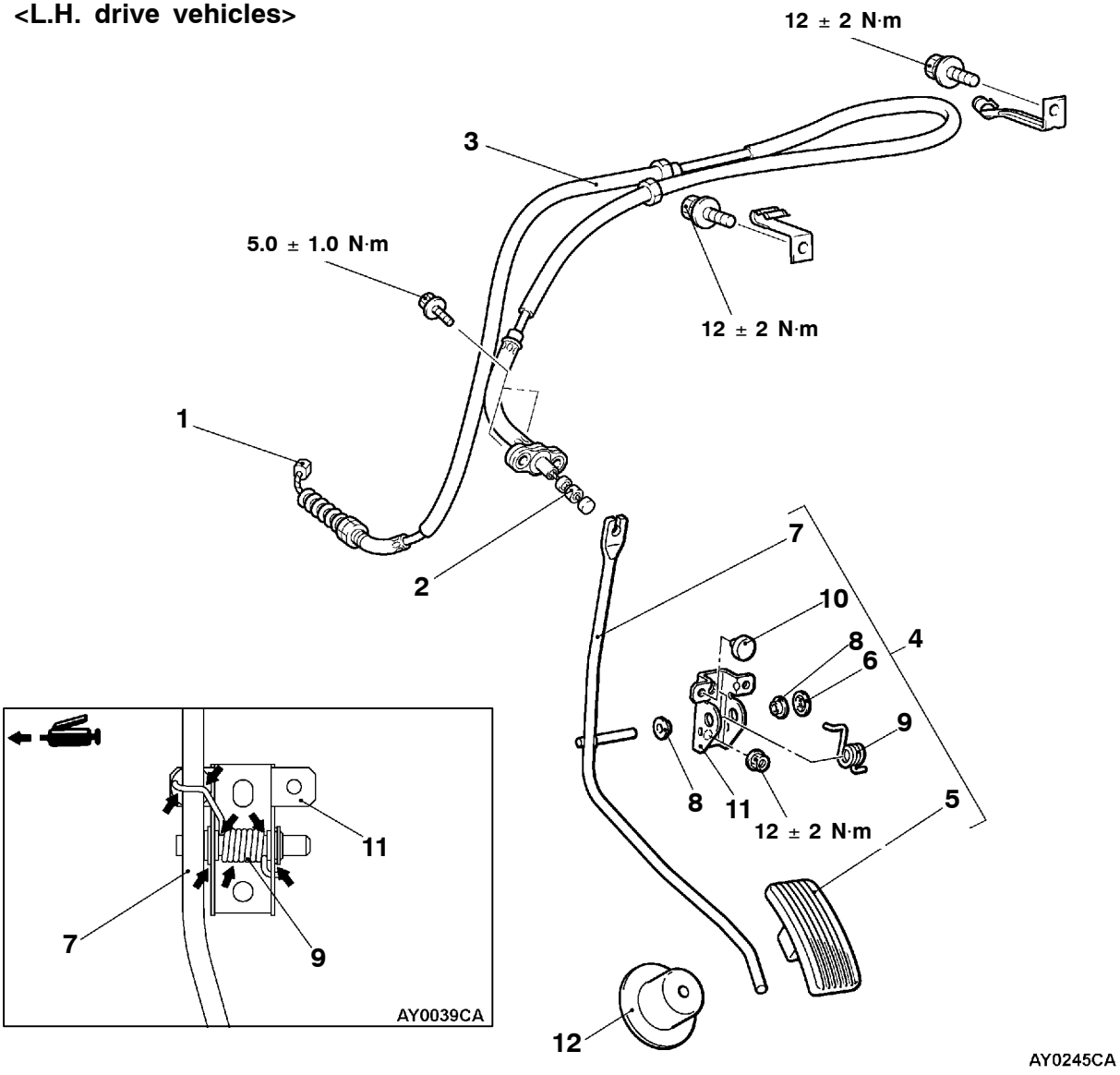
Removal steps

1. Accelerator pedal position sensor
2. Accelerator pedal assembly
3. Push-on spring nut
4. Bushing
5. Return spring
6. Accelerator pedal
7. Accelerator pedal pad
8. Adjusting screw
9. Stopper
10. Accelerator pedal bracket
11. Stopper <R.H. drive vehicles-M/T>

<4D5>

Post-installation Operation
Adjusting the Accelerator Cable (Refer to P.17-3.)

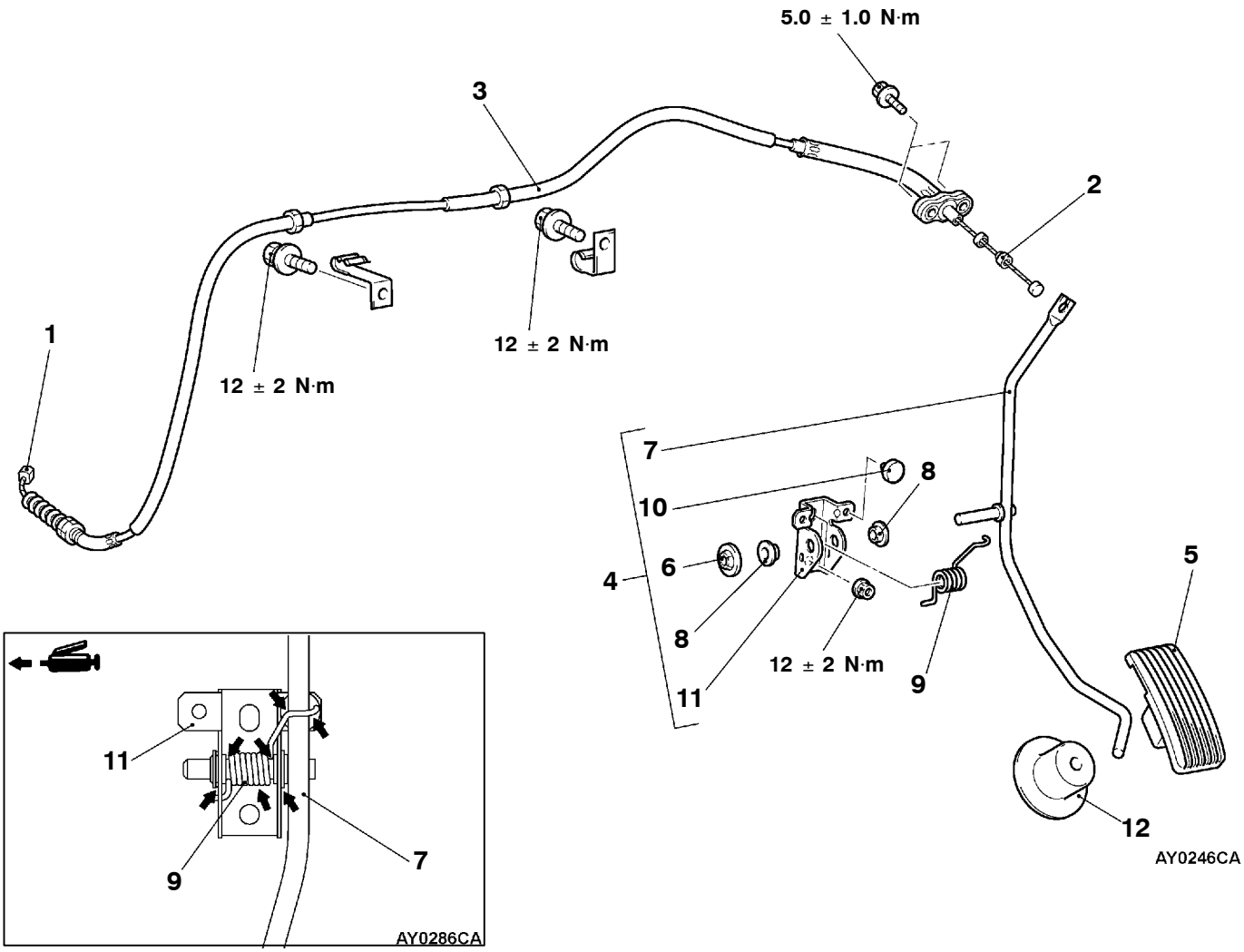
<L.H. drive vehicles>



Removal steps

1. Inner cable connection (Throttle body side)
2. Inner cable connection (Accelerator pedal side)
3. Accelerator cable
4. Accelerator pedal assembly
5. Accelerator pedal pad
6. Push-on spring nut
7. Accelerator arm
8. Bushing
9. Spring
10. Stopper
11. Accelerator pedal bracket
12. Accelerator pedal stopper

<R.H. drive vehicles>



Removal steps

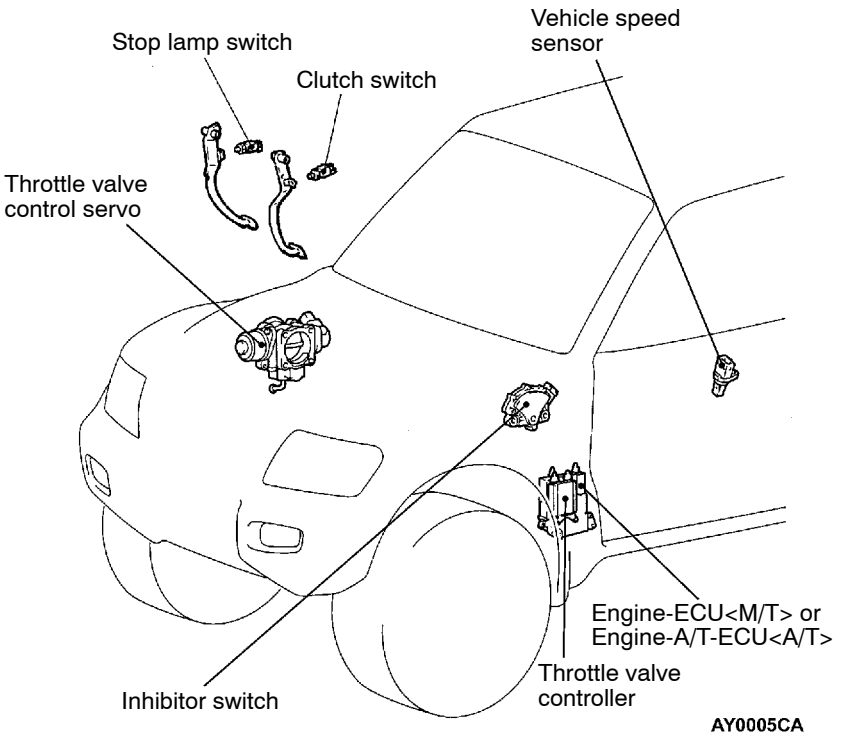
1. Inner cable connection (Throttle body side)
2. Inner cable connection (Accelerator pedal side)
3. Accelerator cable
4. Accelerator pedal assembly
5. Accelerator pedal pad
6. Push-on spring nut
7. Accelerator arm
8. Bushing
9. Spring
10. Stopper
11. Accelerator pedal bracket
12. Accelerator pedal stopper

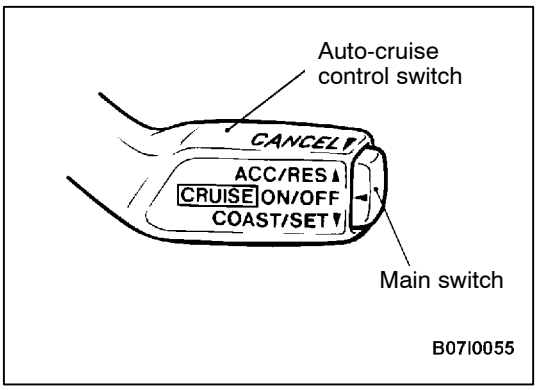
AUTO-CRUISE CONTROL SYSTEM

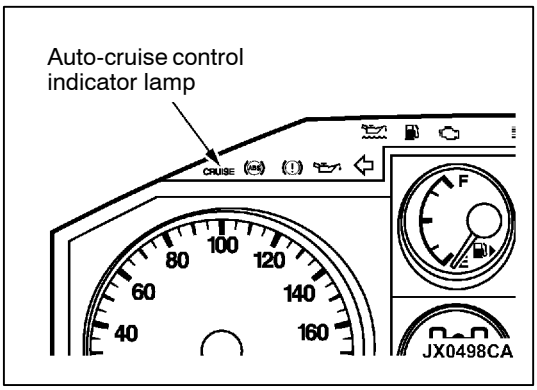
GENERAL INFORMATION

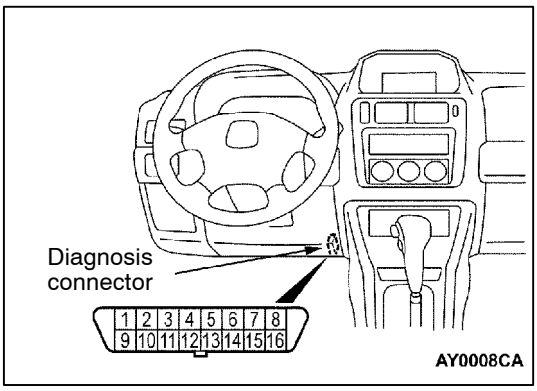
By using the auto-cruise control, the driver can drive at the speed he/she likes (in a range of approximately 40 - 200 km/h) without depressing the accelerator pedal.

<6G7>

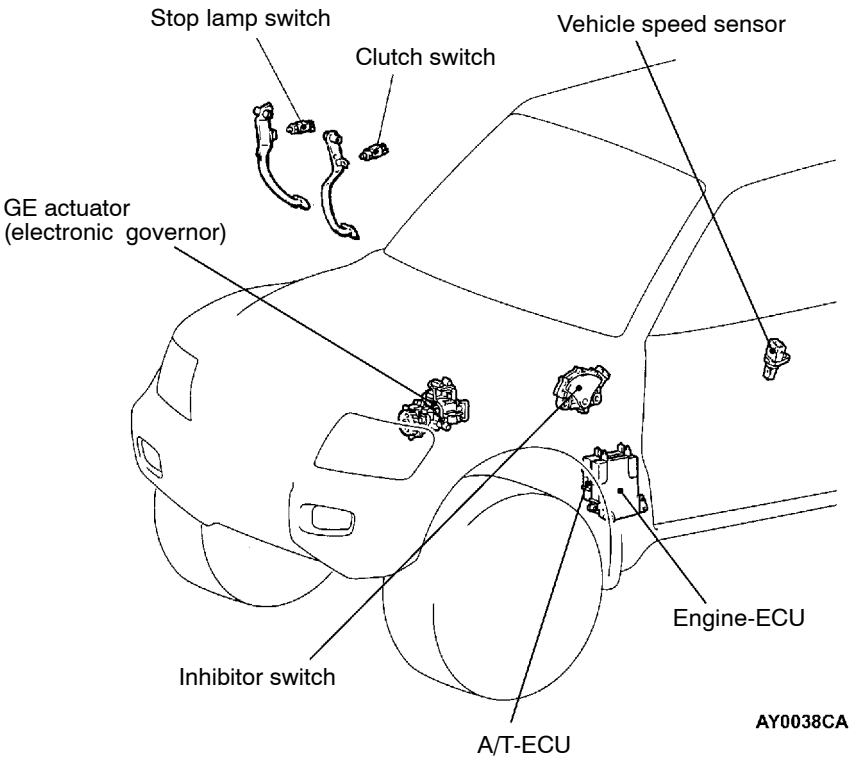


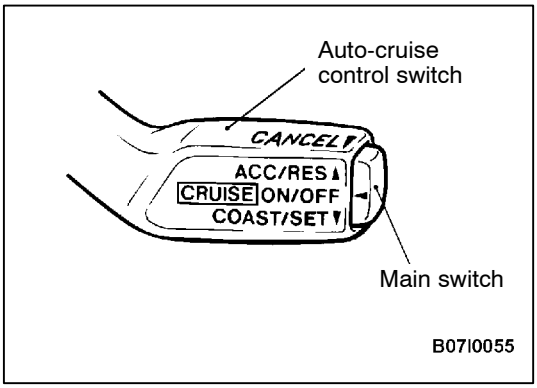


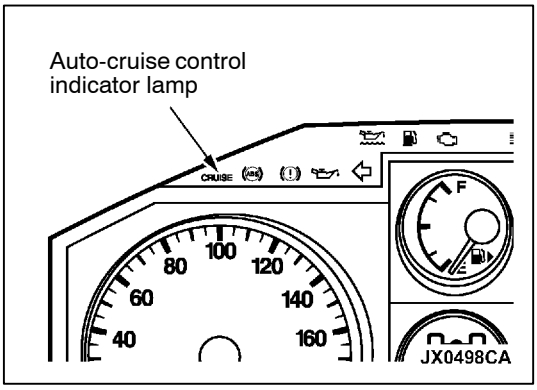


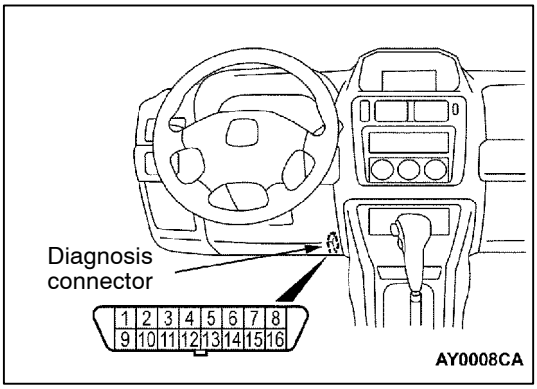


<4M4>

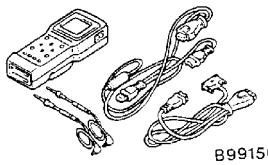








SPECIAL TOOL

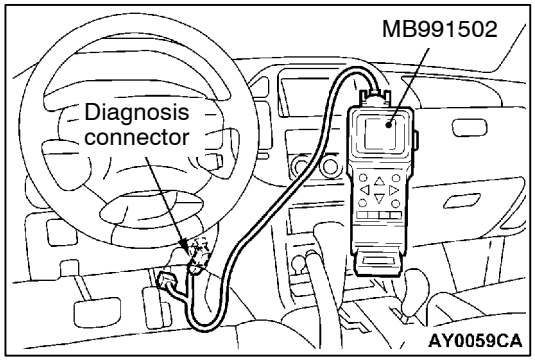
Tool	Number	Name	Use
 B991502	MB991502	MUT-II sub assembly	• Reading diagnosis codes • Auto-cruise control system check

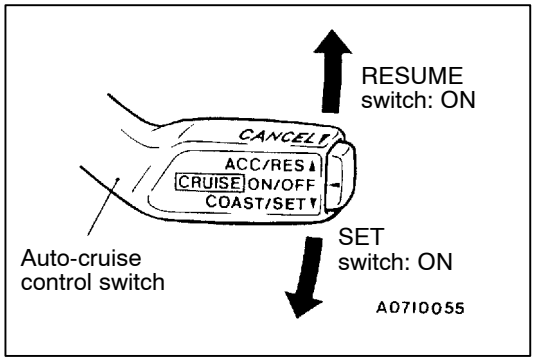
TROUBLESHOOTING

STANDARD FLOW OF DIAGNOSIS TROUBLESHOOTING

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

NOTE
Check that the vacuum hose is connected correctly and is not damaged, and then carry out the diagnosis.





DIAGNOSIS FUNCTION

METHOD OF READING THE DIAGNOSIS CODES

Using the MUT-II

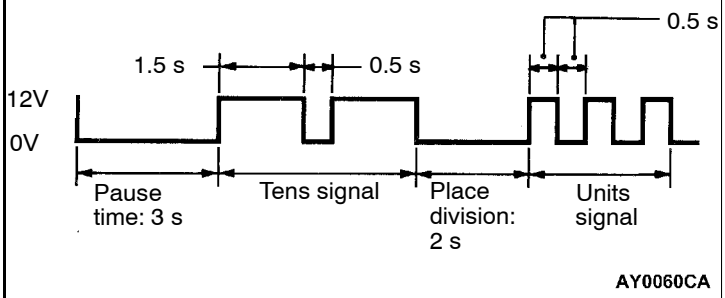
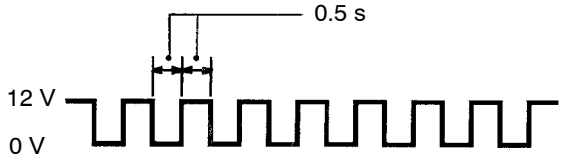
1. Connect the MUT-II to the diagnosis connector (16-pin) under the instrument under cover.
2. With the ignition switch in the ON position, take a reading of the diagnosis codes.

Caution
Turn off the ignition switch before connecting or disconnecting the MUT-II.

Using a Auto-cruise Control Indicator Lamp

1. Turn the ignition switch ON with the SET switch on. Then, turn the RESUME switch ON within 1 second.
2. Read a diagnosis code by observing the flash display pattern of the auto-cruise control indicator lamp in the combination meter.

Indication of diagnosis code by auto-cruise control indicator lamp

When the diagnosis code No.23 is output	When no diagnosis code is output
	

Continuous ON and OFF signals at intervals of 0.5 s

14N0174

NOTE
Other on-board diagnostic items are also output as voltage waveforms corresponding to diagnosis code numbers.

METHOD OF ERASING THE DIAGNOSIS CODES

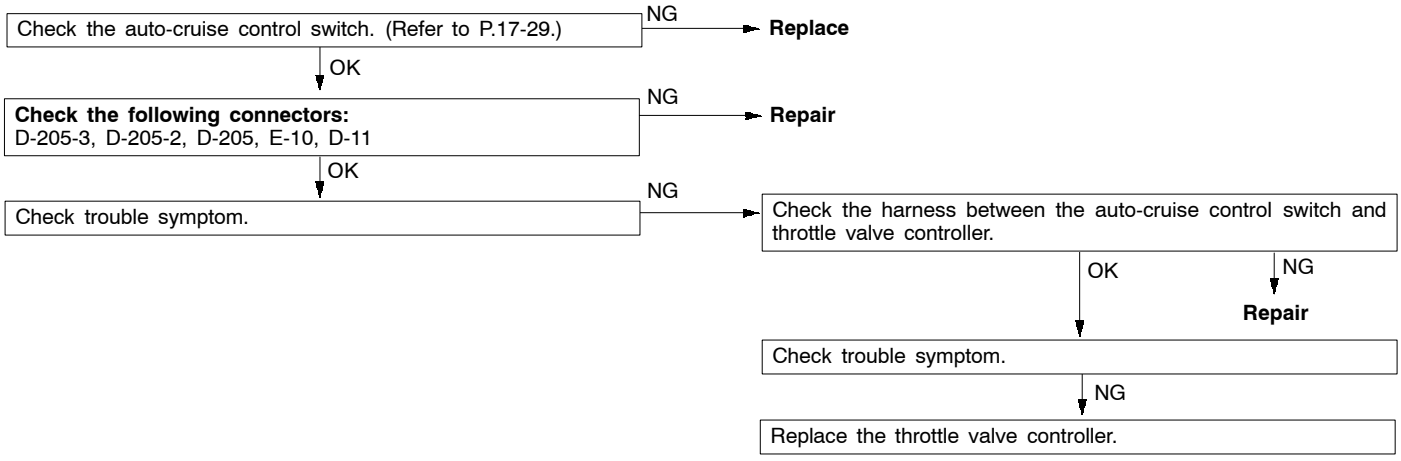
Refer to GROUP 00 - How to Use Troubleshooting/Inspection Service Points.

INSPECTION CHART FOR DIAGNOSIS CODES <6G7>

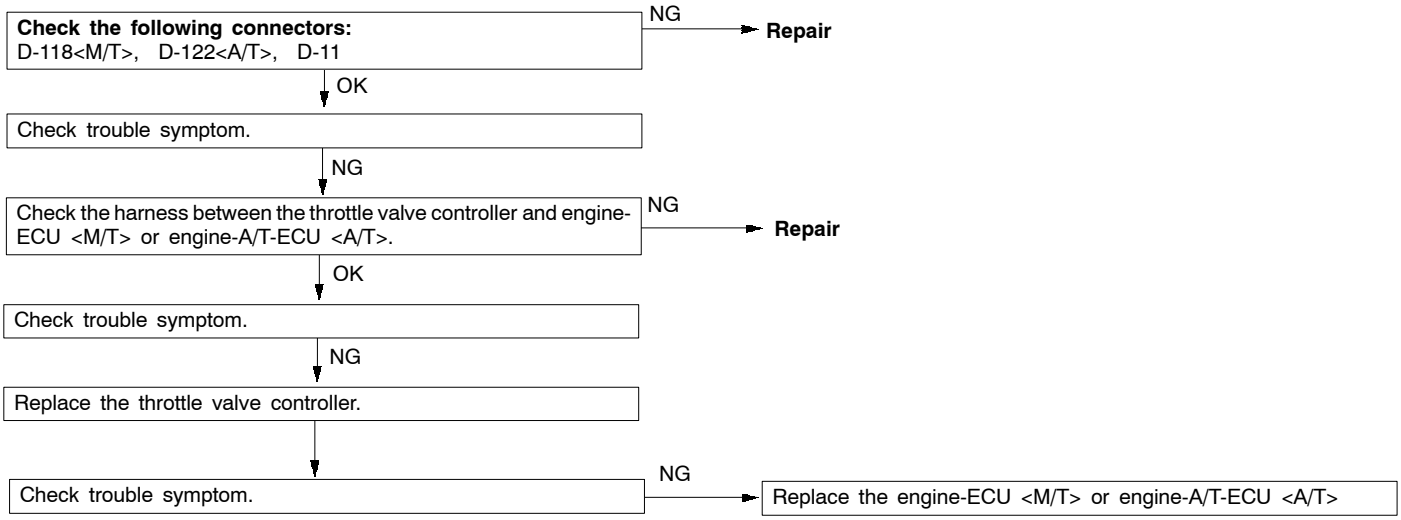
Code No.	Diagnosis item	Reference page
15	Auto-cruise control switch system	17-10
21	Cancel latch signal system	17-11
22	Stop lamp switch system	17-11
23	Engine-ECU <M/T> or engine-A/T-ECU <A/T> system	17-12

INSPECTION PROCEDURE FOR DIAGNOSIS CODES <6G7>

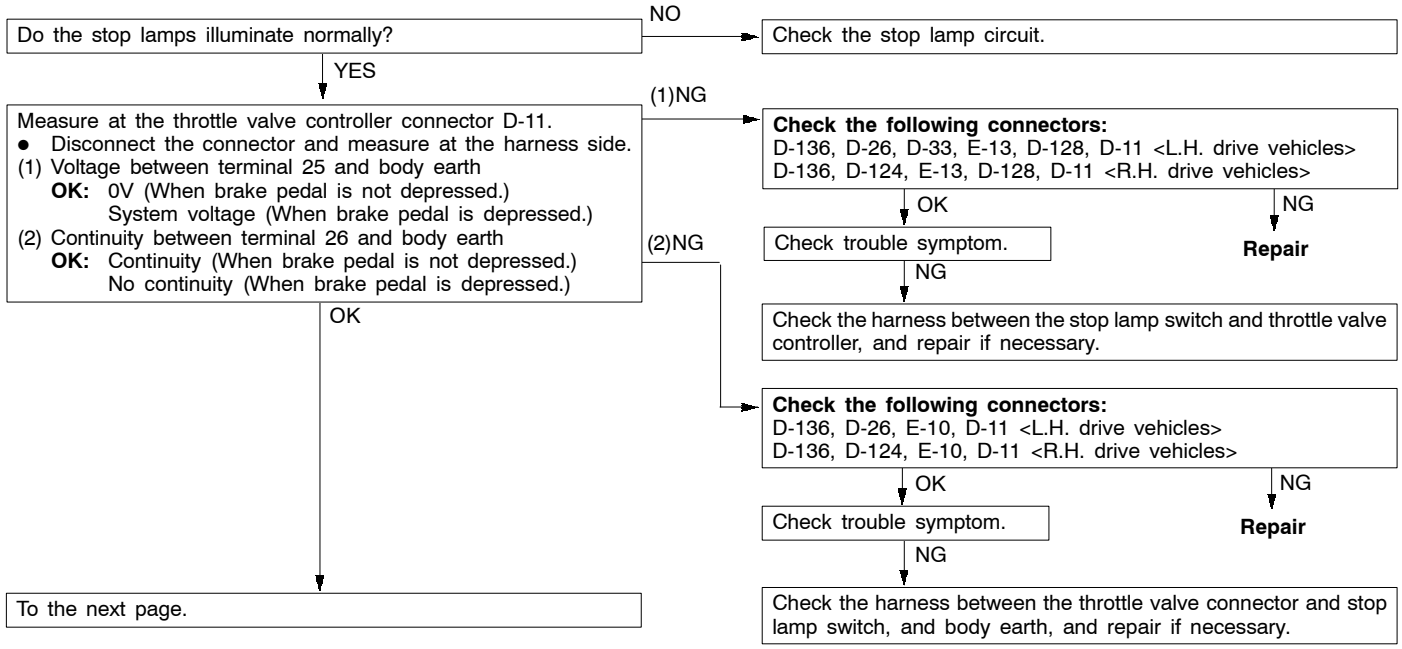
Code No. 15 Auto-cruise control switch system	Probable cause
This diagnosis code is output if the RESUME and SET switches of the auto-cruise control switch remain on.	• Malfunction of the auto-cruise control switch • Malfunction of the connector • Malfunction of the harness • Malfunction of the throttle valve controller

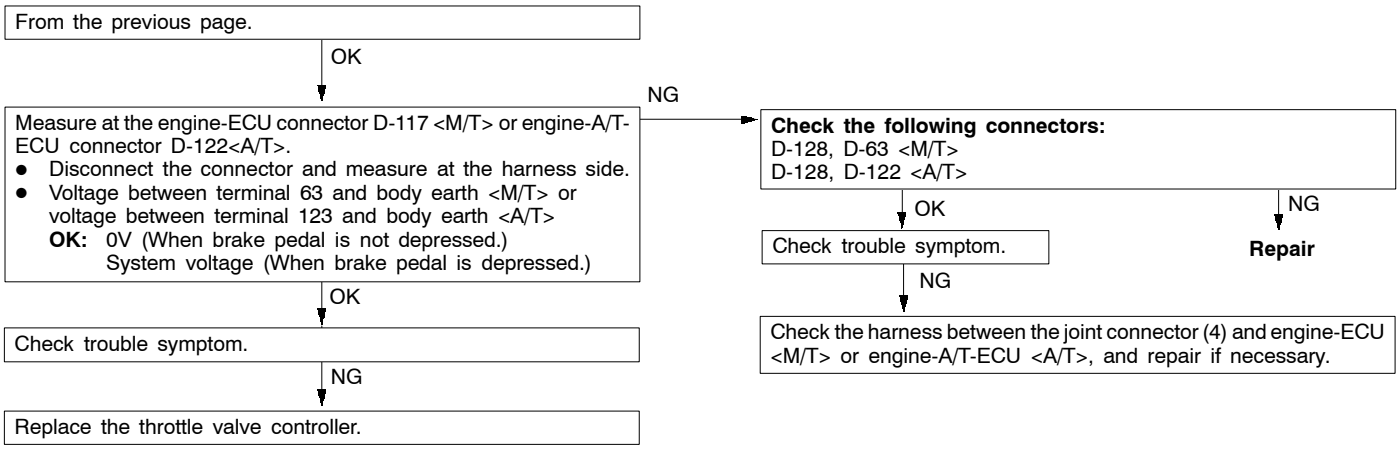


Code No. 21 Cancel latch signal system	Probable cause
The throttle valve controller and engine-ECU <M/T> or engine-A/T-ECU <A/T> send a cancel holding information to the engine-ECU <M/T> or engine-A/T-ECU <A/T> via a cancel latch signal line and the serial communication line. This diagnosis code is output if there is a failure in the cancel latch signal line, or a disaccord in the communication data.	• Malfunction of the connector • Malfunction of the harness • Malfunction of the throttle valve controller • Malfunction of the engine-ECU <M/T> • Malfunction of the engine-A/T-ECU <A/T>

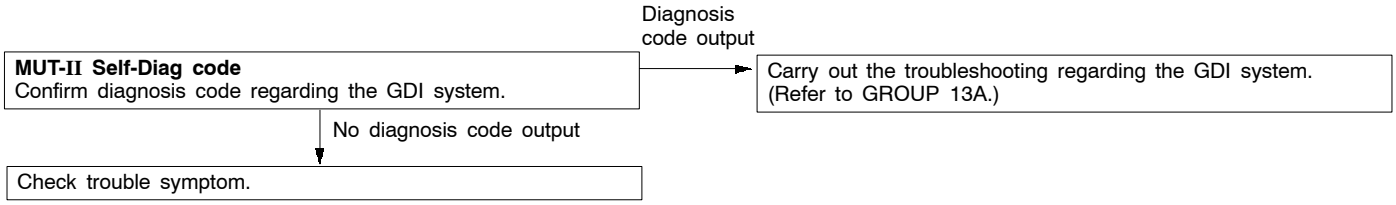


Code No. 22 Stop lamp switch system	Probable cause
This diagnosis code is output when the throttle valve controller detects a failure in the stop lamp switch output.	• Malfunction of the stop lamp switch • Malfunction of the connector • Malfunction of the harness • Malfunction of the throttle valve controller





Code No. 23 Engine-ECU <M/T> or engine-A/T-ECU <A/T> system	Probable cause
This diagnosis code is output if the engine-ECU <M/T> or engine-A/T-ECU <A/T> system is defective as follows: ● Communication error between the throttle valve controller and the engine-ECU <M/T> ● Communication error between the throttle valve controller and the engine-A/T-ECU <A/T> ● Malfunction of the engine-ECU <M/T> ● Malfunction of the engine-A/T-ECU <A/T> ● Malfunction of the throttle position sensor ● Malfunction of the accelerator pedal position sensor ● Malfunction of the throttle control servo ● Malfunction of the vehicle speed sensor	● Malfunction of the engine-ECU <M/T> ● Malfunction of the engine-A/T-ECU <A/T>

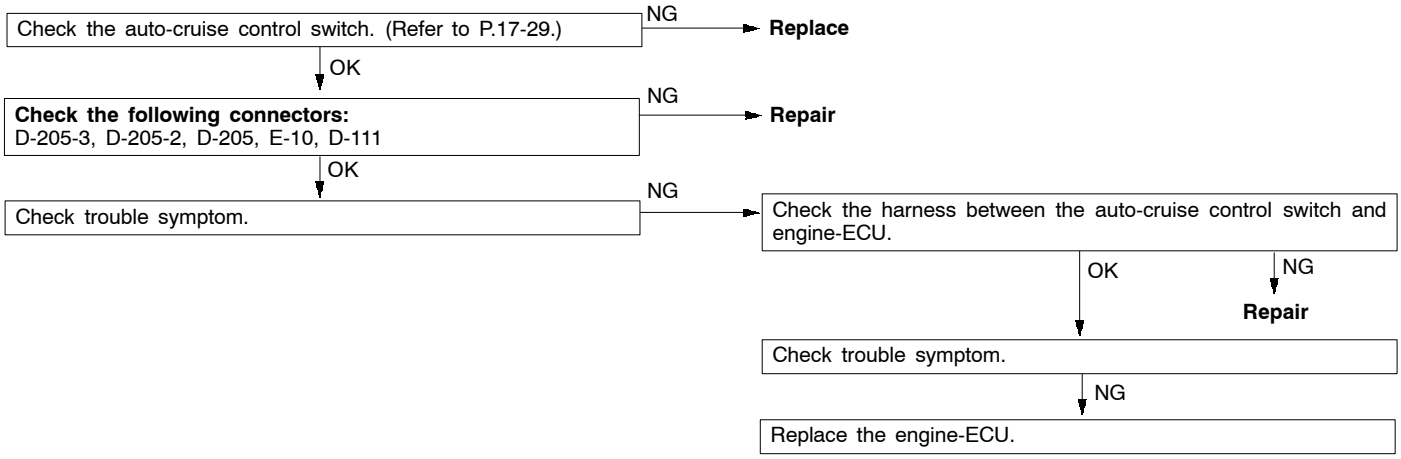


INSPECTION CHART FOR DIAGNOSIS CODES <4M4>

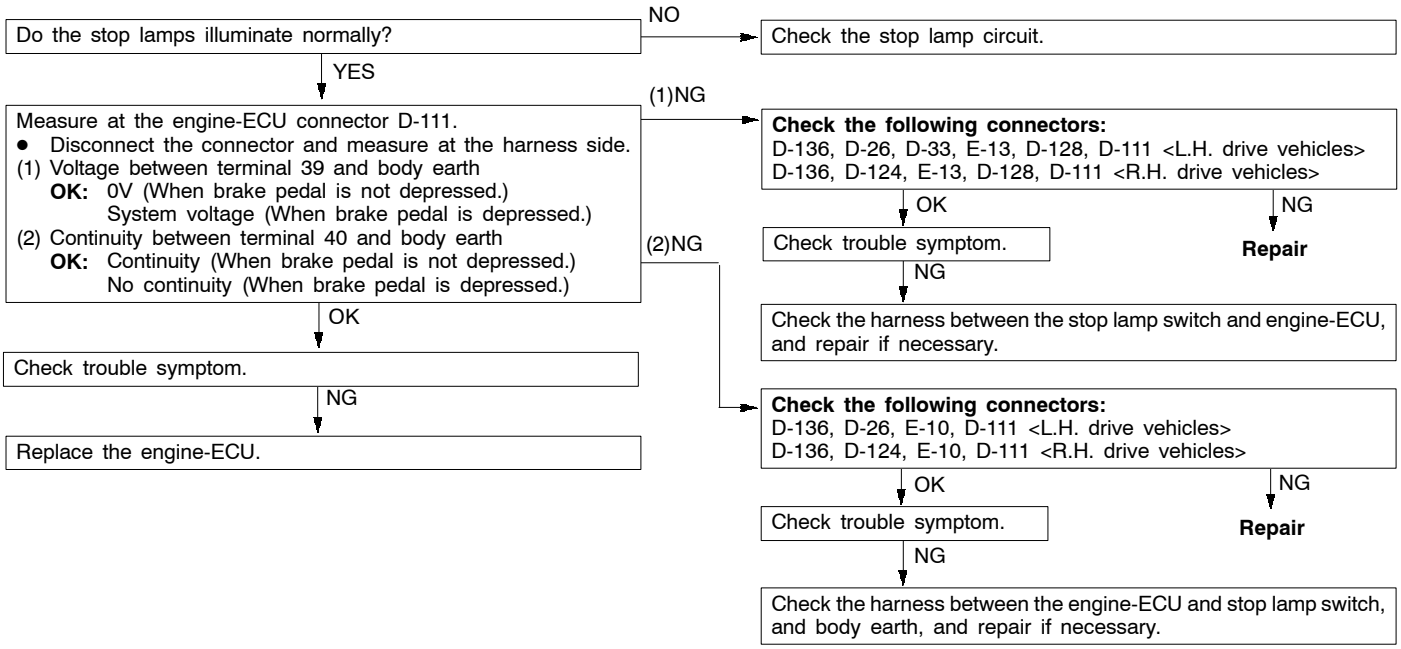
Code No.	Diagnosis item	Reference page
15	Auto-cruise control switch system	17-13
22	Stop lamp switch system	17-14
23	Engine-ECU system	17-14

INSPECTION PROCEDURE FOR DIAGNOSIS CODES <4M4>

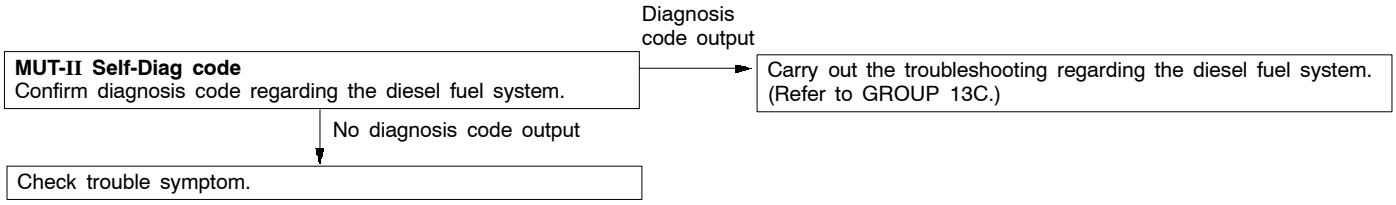
Code No. 15 Auto-cruise control switch system	Probable cause
This diagnosis code is output if the RESUME and SET switches of the auto-cruise control switch remain on.	• Malfunction of the auto-cruise control switch • Malfunction of the connector • Malfunction of the harness • Malfunction of the engine-ECU



Code No. 22 Stop lamp switch system	Probable cause
This diagnosis code is output when the engine-ECU detects a failure in the stop lamp switch output.	• Malfunction of the stop lamp switch • Malfunction of the connector • Malfunction of the harness • Malfunction of the engine-ECU



Code No. 23 Engine-ECU system	Probable cause
This diagnosis code is output if the engine-ECU system is defective as follows: • Malfunction of the engine-ECU • Malfunction of the accelerator pedal position sensor • Malfunction of the GE actuator (electronic governor) • Malfunction of the vehicle speed sensor	• Malfunction of the engine-ECU



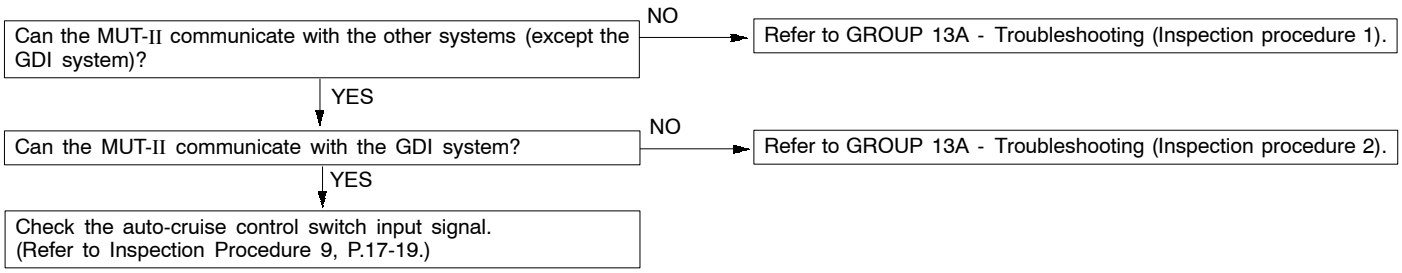
INSPECTION CHART FOR TROUBLE SYMPTOMS <6G7>

Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is not possible.		1	17-15
Auto-cruise control is not cancelled.	Even if brake pedal is depressed	2	17-16
	Even if clutch pedal is depressed <M/T>	3	17-16
	Even if select lever is set to N range <A/T>	4	17-17
	Even if CANCEL switch is set to ON	5	17-17
Auto-cruise control cannot be set.		6	17-17
Hunting (repeated acceleration and deceleration) occurs at the set vehicle speed.		7	17-18
When the MAIN switch of the auto-cruise control switch is turned ON, the auto-cruise control indicator lamp does not illuminate. (However, the auto-cruise control system is normal.)		8	17-18

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS <6G7>

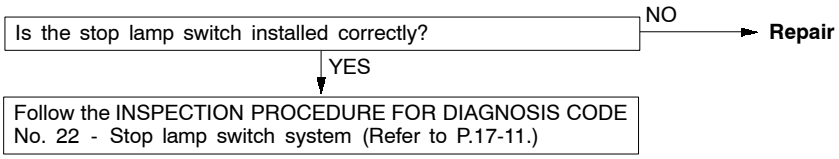
Inspection Procedure 1

Communication with MUT-II is not possible.	Probable cause
If the MUT-II can not also communicate with the systems other than the GDI system, the diagnosis line circuit may be defective. If the MUT-II can not communication with only the GDI system and the auto-cruise control system, the harness wire between the engine-ECU <M/T> or engine-A/T-ECU <A/T> and the diagnosis connector, may be defective. In addition, if the MUT-II can not communication with only the auto-cruise control system, the auto-cruise control switch may be defective.	• Malfunction of the connector • Malfunction of the harness • Malfunction of the auto-cruise control switch • Malfunction of the throttle valve controller • Malfunction of the engine-ECU <M/T> • Malfunction of the engine-A/T-ECU <A/T>



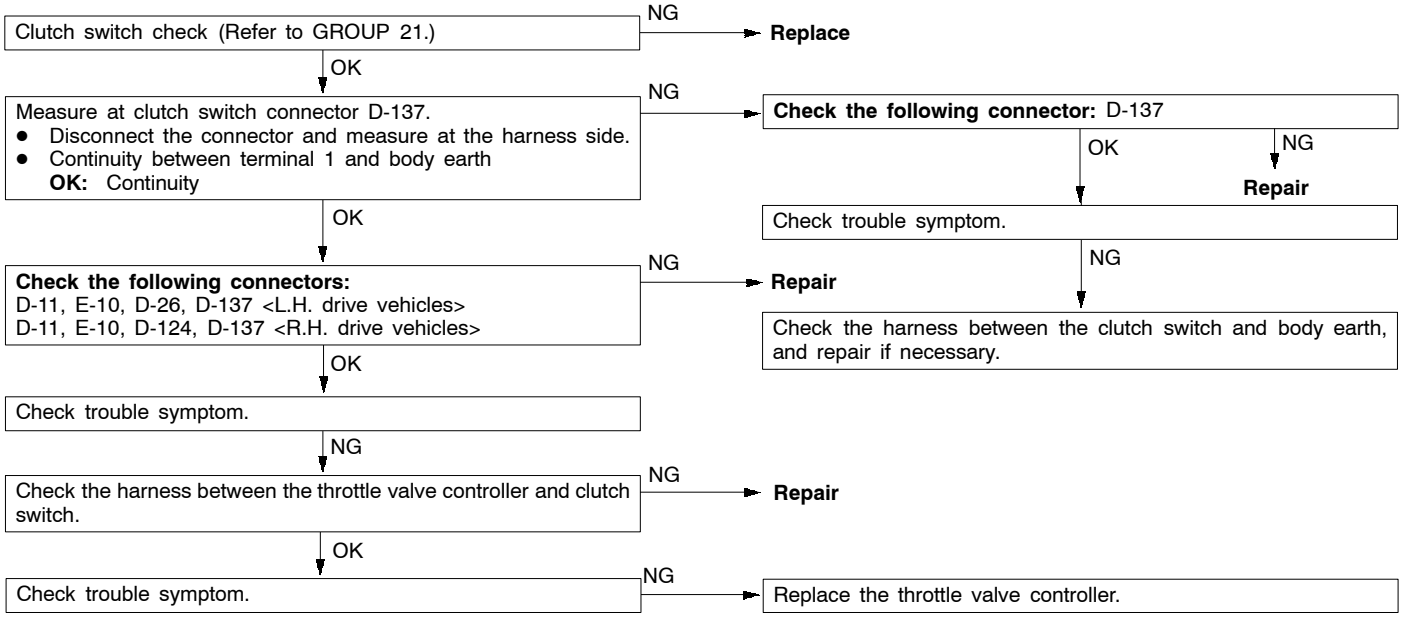
Inspection Procedure 2

Even if brake pedal is depressed, auto-cruise control is not cancelled.	Probable cause
The cause is probably a malfunction of stop lamp switch or a malfunction of stop lamp circuit.	• Malfunction of the stop lamp switch • Malfunction of the connector • Malfunction of the harness • Malfunction of the throttle valve controller



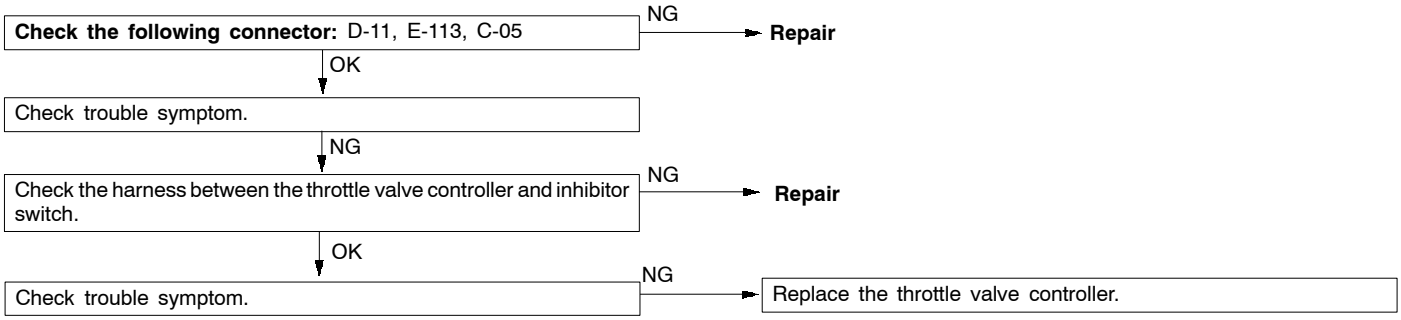
Inspection Procedure 3

Even if clutch pedal is depressed, auto-cruise control is not cancelled. <M/T>	Probable cause
The cause is probably a malfunction of clutch switch or clutch switch circuit.	• Malfunction of the clutch switch • Malfunction of the connector • Malfunction of the harness • Malfunction of the throttle valve controller



Inspection Procedure 4

Even if select lever is set to N range, auto-cruise control is not cancelled. <A/T>	Probable cause
The cause is probably a defective inhibitor switch circuit.	• Malfunction of the connector • Malfunction of the harness • Malfunction of the throttle valve controller



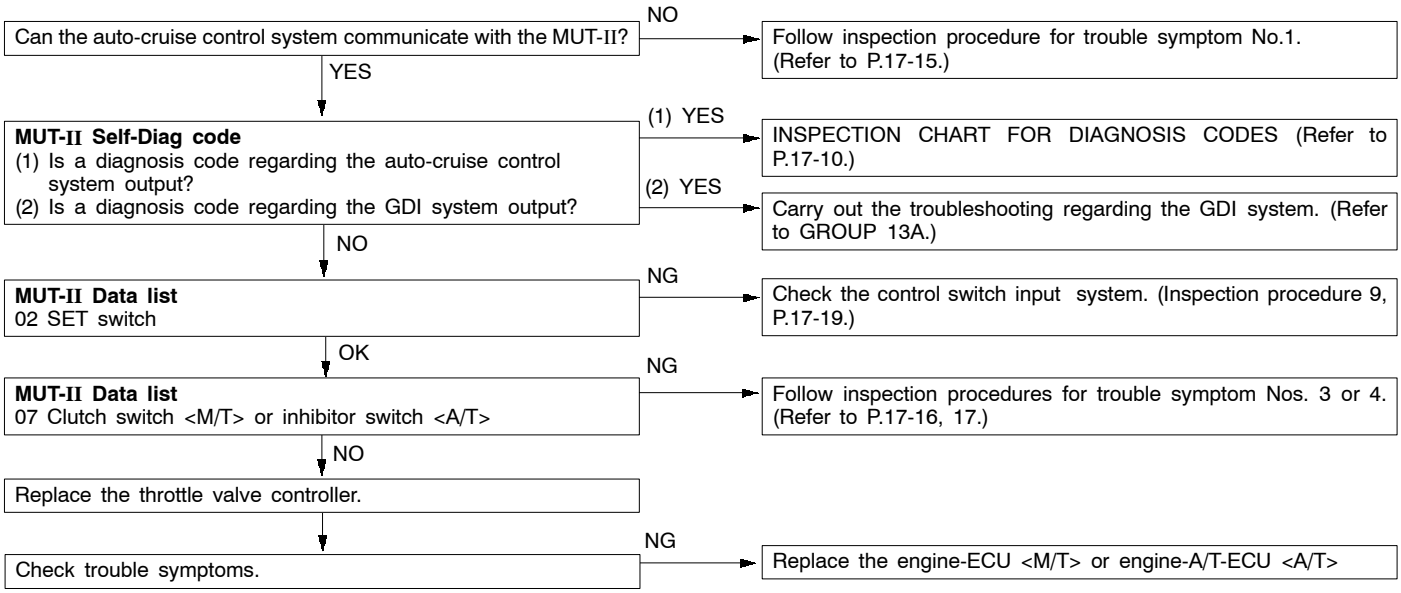
Inspection Procedure 5

Even if auto-cruise control CANCEL switch is set to ON, auto-cruise control is not cancelled.	Probable cause
The cause is probably an open-circuit in the circuit inside the CANCEL switch.	• Malfunction of the auto-cruise control switch

Replace the auto-cruise control switch.

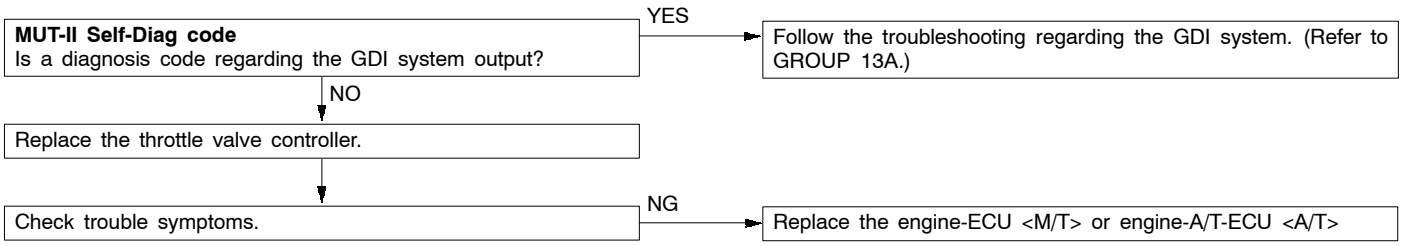
Inspection Procedure 6

Auto-cruise control cannot be set.	Probable cause
The cause is probably that the fail-safe function is cancelling auto-cruise control. In this case, the MUT-II can be used to check the trouble symptoms in each system by inspecting the diagnosis codes. The MUT-II can also be used to check if the circuits of each input switch are normal or not by inspecting the data list.	• Malfunction of the auto-cruise control switch • Malfunction of the harnesses • Malfunction of the connectors • Malfunction of the throttle valve controller • Malfunction of the engine-ECU <M/T> • Malfunction of the engine-A/T-ECU <A/T>



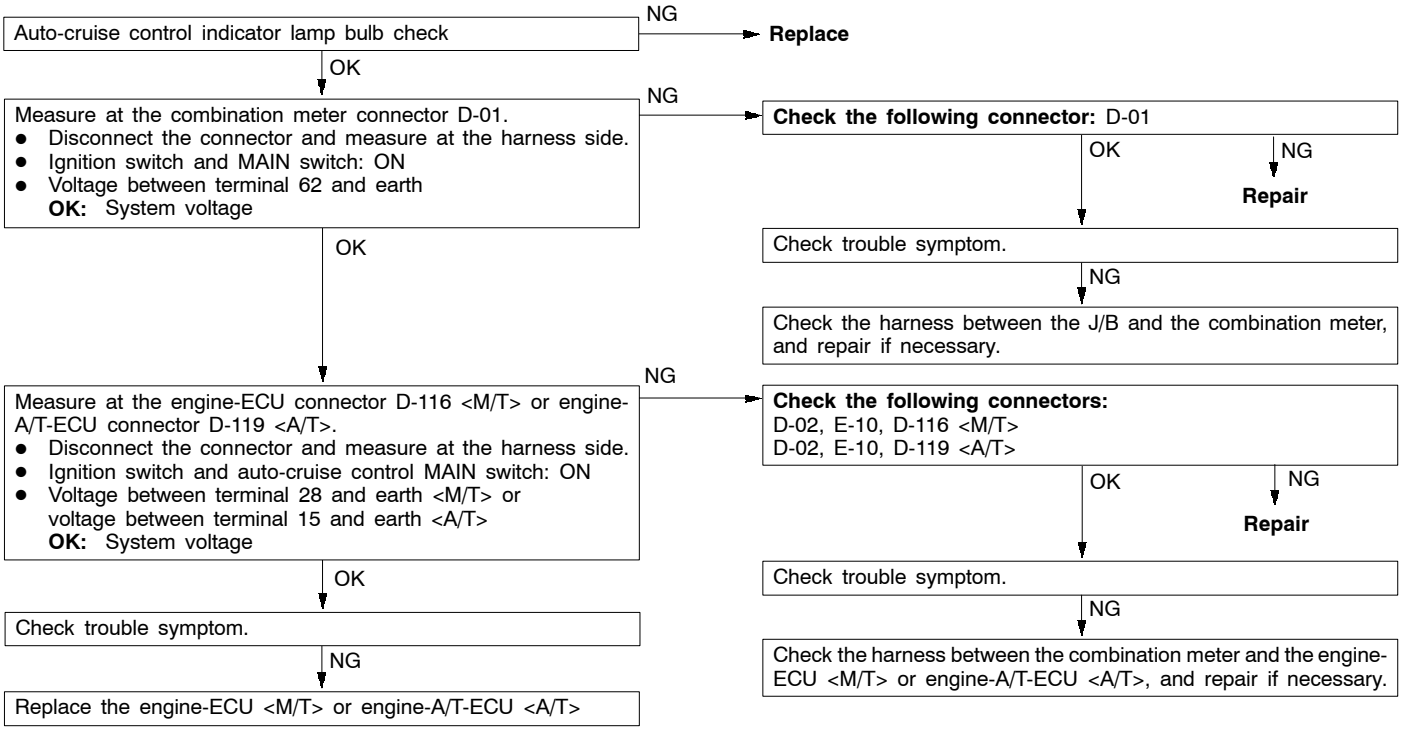
Inspection Procedure 7

Hunting (repeated acceleration and deceleration) occurs at the set vehicle speed.	Probable cause
The cause is probably a malfunction of vehicle speed sensor or throttle control servo. In either case, a diagnosis code regarding the GDI system must be confirmed.	• Malfunction of the vehicle speed sensor • Malfunction of the throttle control servo • Malfunction of the throttle valve controller • Malfunction of the engine-ECU <M/T> • Malfunction of the engine-A/T-ECU <A/T>



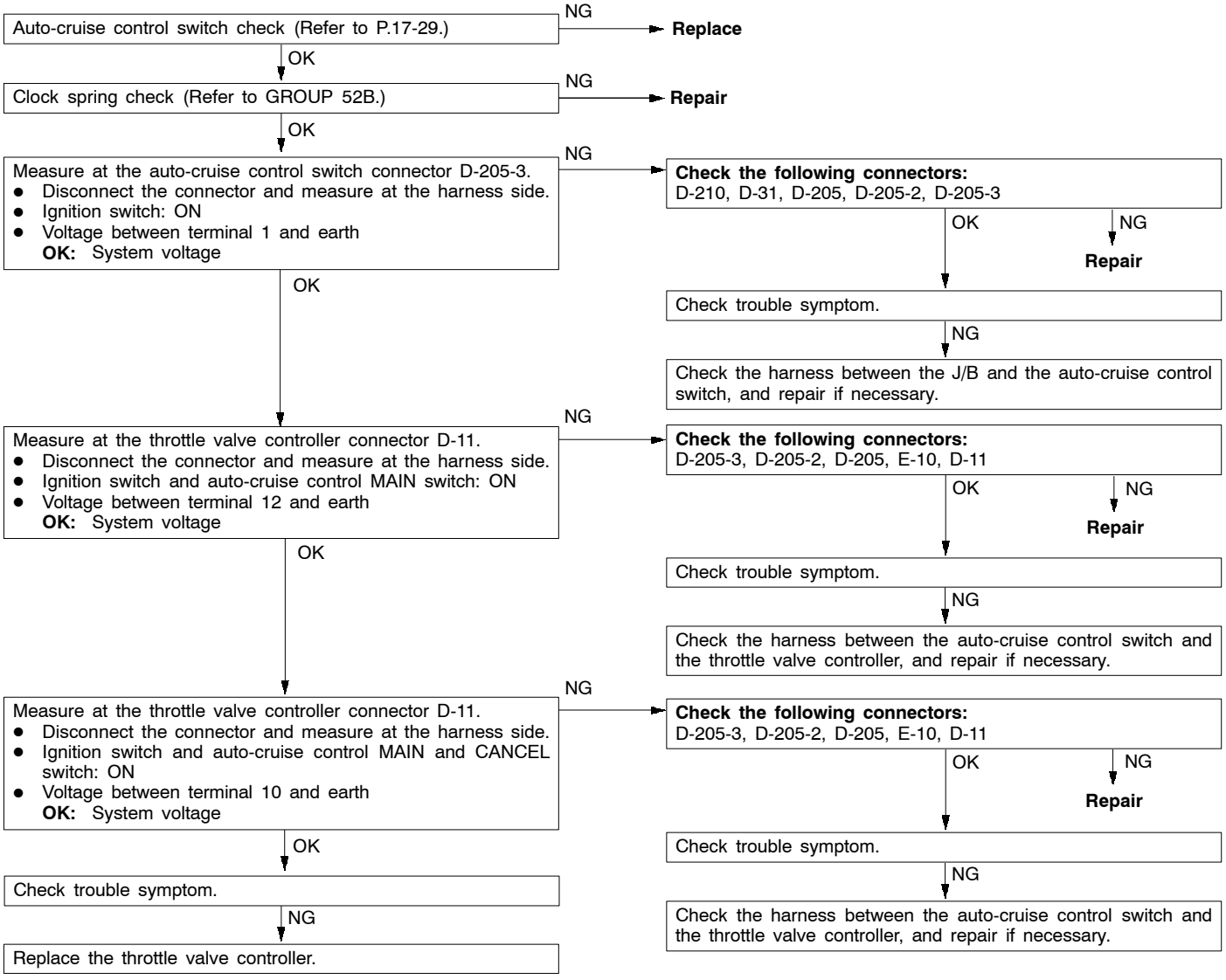
Inspection Procedure 8

When the MAIN switch of the auto-cruise control switch is turned on, the auto-cruise control indicator lamp does not illuminate. (However, the auto-cruise control in normal.)	Probable cause
There may be a burnt-out bulb or a malfunction of the auto-cruise control indicator lamp circuit.	• Burnt-out bulb • Malfunction of the harness • Malfunction of the connector • Malfunction of the engine-ECU <M/T> • Malfunction of the engine-A/T-ECU <A/T>



Inspection Procedure 9

Auto-cruise control switch input system check



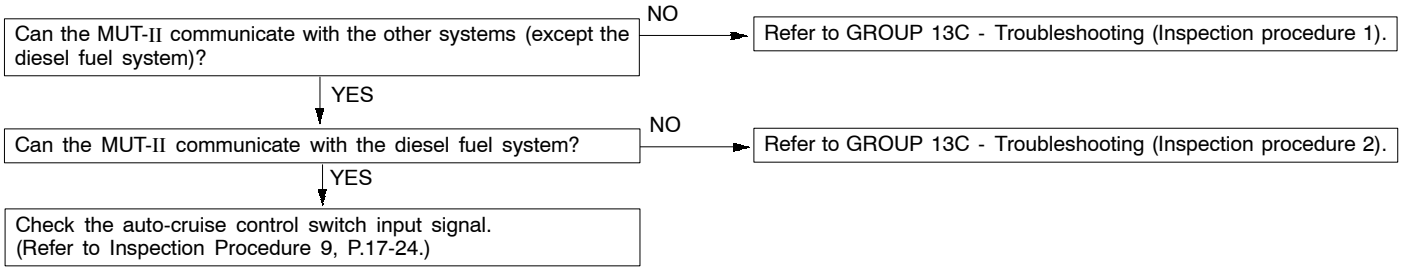
INSPECTION CHART FOR TROUBLE SYMPTOMS <4M4>

Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is not possible.		1	17-20
Auto-cruise control is not cancelled.	Even if brake pedal is depressed	2	17-21
	Even if clutch pedal is depressed <M/T>	3	17-21
	Even if select lever is set to N range <A/T>	4	17-22
	Even if CANCEL switch is set to ON	5	17-22
Auto-cruise control cannot be set.		6	17-22
Hunting (repeated acceleration and deceleration) occurs at the set vehicle speed.		7	17-23
When the MAIN switch of the auto-cruise control switch is turned ON, the auto-cruise control indicator lamp does not illuminate. (However, the auto-cruise control system is normal.)		8	17-23

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS <4M4>

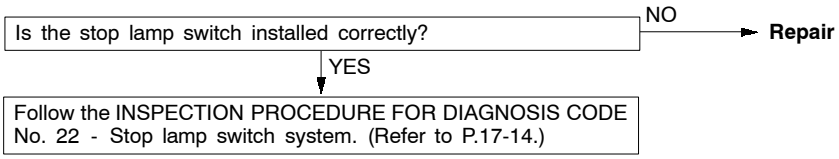
Inspection Procedure 1

Communication with MUT-II is not possible.	Probable cause
If the MUT-II can not also communicate with the systems other than the diesel fuel system, the diagnosis line circuit may be defective. If the MUT-II can not communicate with only the diesel fuel system and the auto-cruise control system, the harness wire between the engine-ECU and the diagnosis connector, may be defective. In addition, if the MUT-II can not communicate with only the auto-cruise control system, the auto-cruise control switch may be defective.	• Malfunction of the connector • Malfunction of the harness • Malfunction of the auto-cruise control switch • Malfunction of the engine-ECU



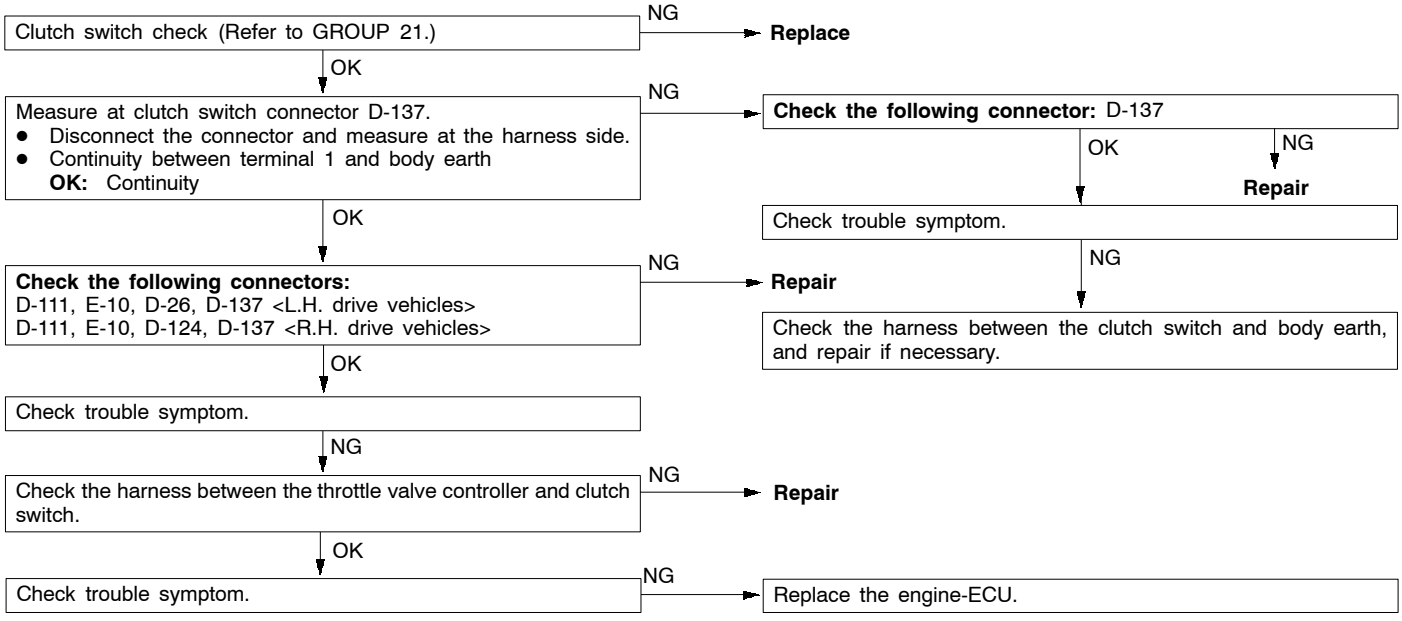
Inspection Procedure 2

Even if brake pedal is depressed, auto-cruise control is not cancelled.	Probable cause
The cause is probably a malfunction of stop lamp switch or a malfunction of stop lamp circuit.	• Malfunction of the stop lamp switch • Malfunction of the connector • Malfunction of the harness • Malfunction of the engine-ECU



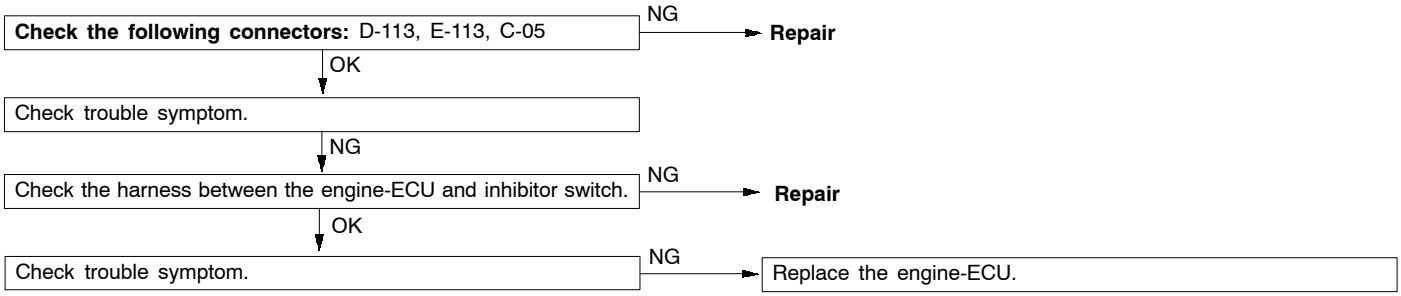
Inspection Procedure 3

Even if clutch pedal is depressed, auto-cruise control is not cancelled. <M/T>	Probable cause
The cause is probably a malfunction of clutch switch or clutch switch circuit.	• Malfunction of the clutch switch • Malfunction of the connector • Malfunction of the harness • Malfunction of the engine-ECU



Inspection Procedure 4

Even if select lever is set to N range, auto-cruise control is not cancelled. <A/T>	Probable cause
The cause is probably a defective inhibitor switch circuit.	• Malfunction of the connector • Malfunction of the harness • Malfunction of the engine-ECU



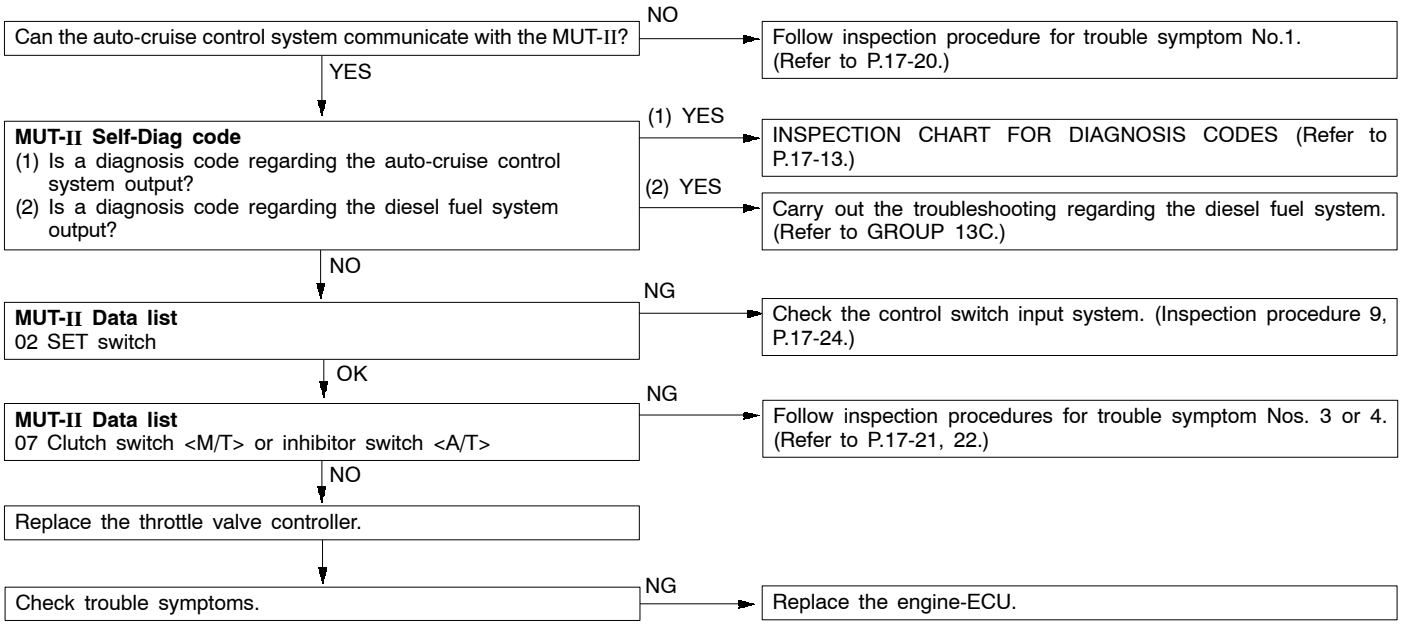
Inspection Procedure 5

Even if auto-cruise control CANCEL switch is set to ON, auto-cruise control is not cancelled.	Probable cause
The cause is probably an open-circuit in the circuit inside the CANCEL switch.	• Malfunction of the auto-cruise control switch

Replace the auto-cruise control switch.

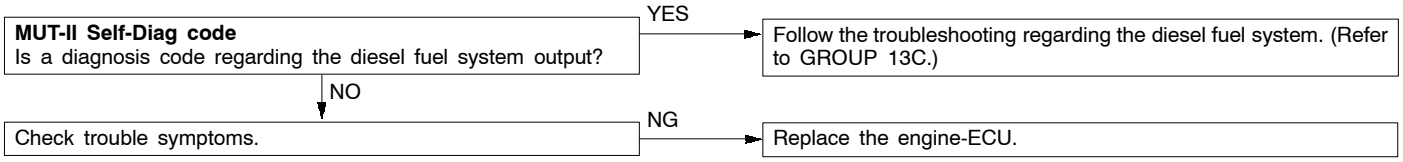
Inspection Procedure 6

Auto-cruise control cannot be set.	Probable cause
The cause is probably that the fail-safe function is cancelling auto-cruise control. In this case, the MUT-II can be used to check the trouble symptoms in each system by inspecting the diagnosis codes. The MUT-II can also be used to check if the circuits of each input switch are normal or not by inspecting the data list.	• Malfunction of the auto-cruise control switch • Malfunction of the harnesses • Malfunction of the connectors • Malfunction of the engine-ECU



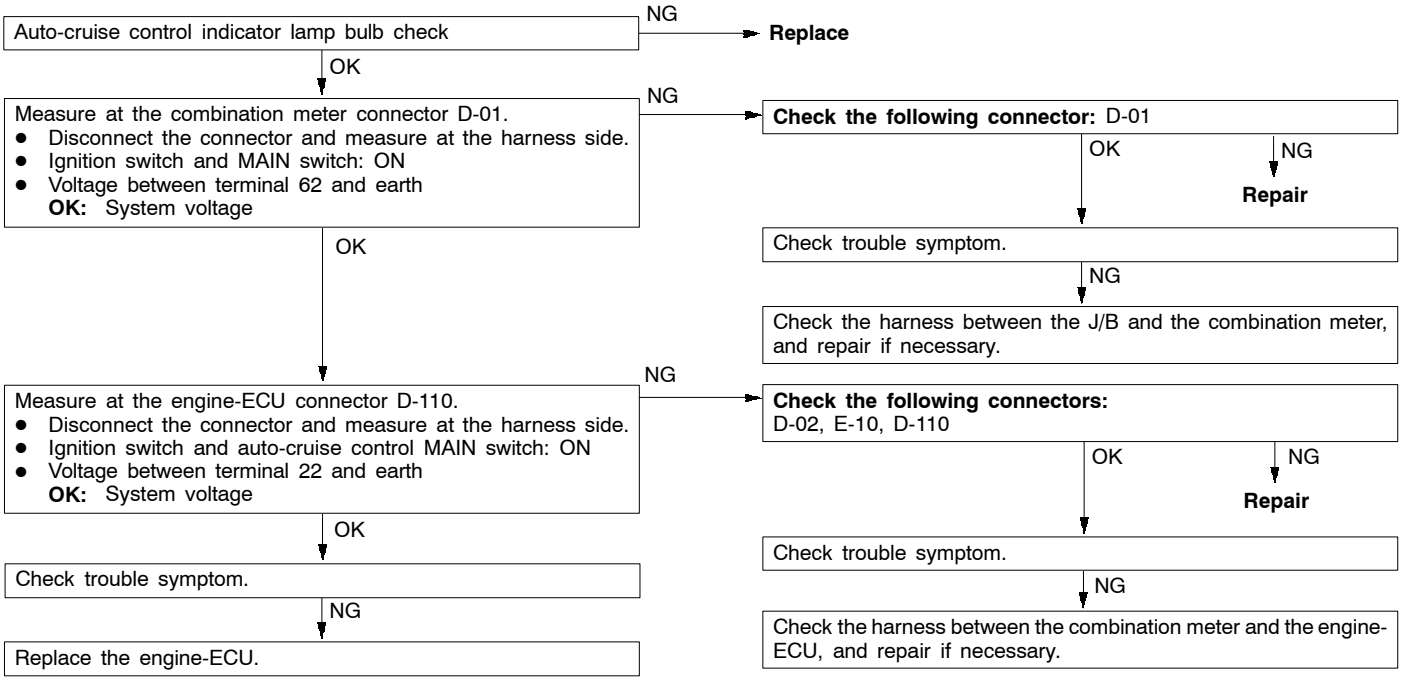
Inspection Procedure 7

Hunting (repeated acceleration and deceleration) occurs at the set vehicle speed.	Probable cause
The cause is probably a malfunction of vehicle speed sensor or GE actuator (electronic governor). In either case, a diagnosis code regarding the diesel fuel system must be confirmed.	• Malfunction of the vehicle speed sensor • Malfunction of the GE actuator (electronic governor) • Malfunction of the engine-ECU



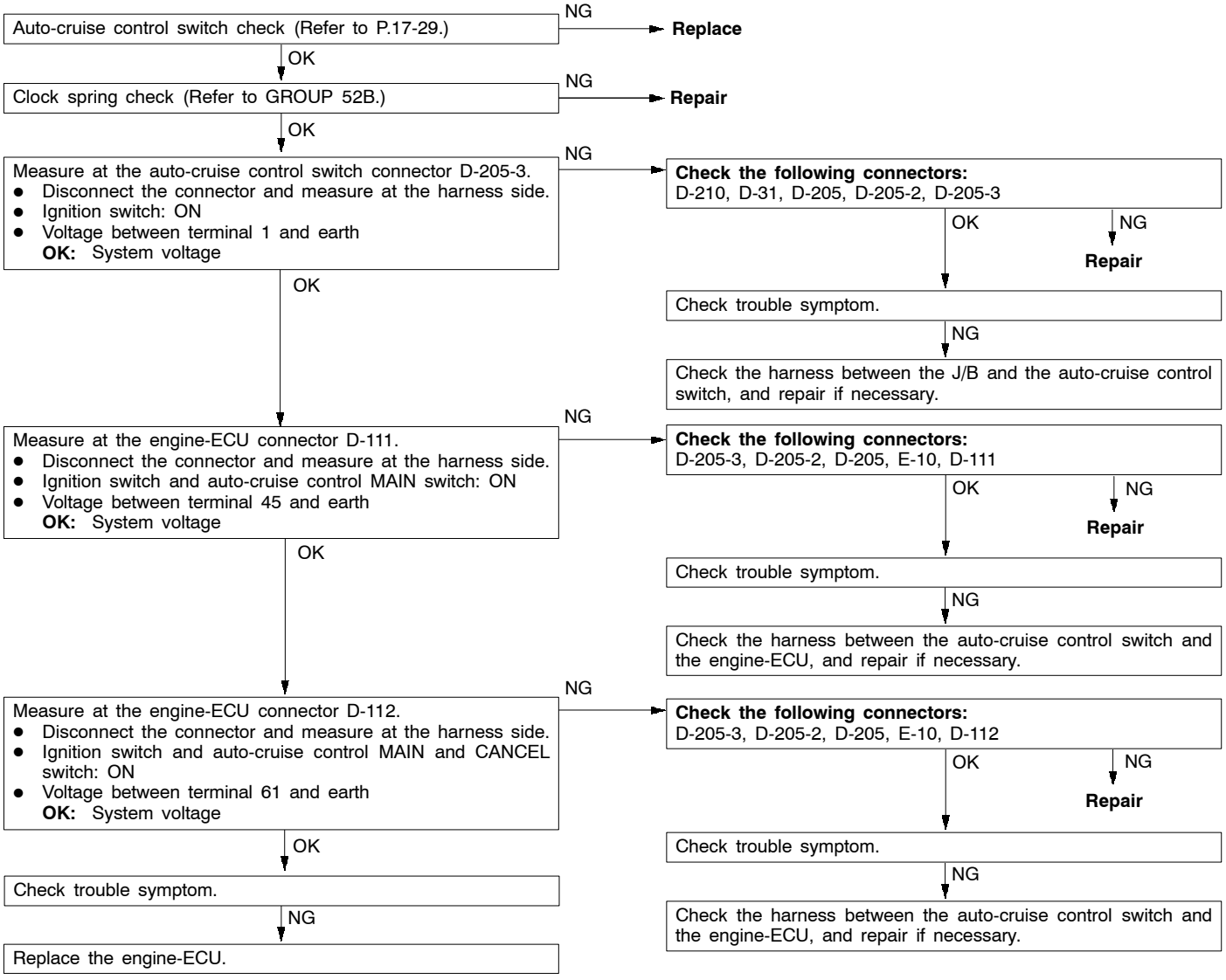
Inspection Procedure 8

When the MAIN switch of the auto-cruise control switch is turned on, the auto-cruise control indicator lamp does not illuminate. (However, the auto-cruise control in normal.)	Probable cause
There may be a burnt-out bulb or a malfunction of the auto-cruise control indicator lamp circuit.	• Burnt-out bulb • Malfunction of the harness • Malfunction of the connector • Malfunction of the engine-ECU



Inspection Procedure 9

Auto-cruise control switch input system check



DATA LIST REFERENCE TABLE

For the data, which is input to the engine-ECU <6G7-M/T, 4M4>, engine-A/T-ECU <6G7-A/T> and throttle valve controller <6G7>, the following items can be read out by using the MUT-II.

HOW TO READ OUT DATA LIST

1. Connect the MUT-II to the 16-pin diagnosis connector.

   Caution
   Turn off the ignition switch befor connecting and disconnecting the MUT-II.

2. Turn the ignition switch to “ON” position.
3. Select “auto-cruise control” on the MUT-II menu, and then read out the data list.

<6G7>

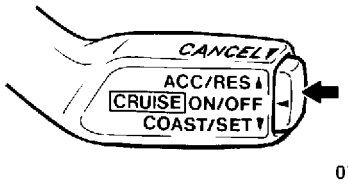
Terminal No.	Check item		Check conditions		Normal condition
01	Auto-cruise control switch	MAIN	MAIN switch: ON		ON
			MAIN switch: OFF		OFF
02		SET (COAST)	MAIN switch: ON	SET switch: ON	ON
				SET switch: OFF	OFF
03		RESUME (ACCEL)		RESUME switch: ON	ON
				RESUME switch: OFF	OFF
04		CANCEL		CANCEL switch: ON	ON
				CANCEL switch: OFF	OFF
05	Stop lamp switch (for stop lamp circuit)		Brake pedal: Depressed		ON
			Brake pedal: Released		OFF
06	Stop lamp switch (for auto-cruise control circuit)		Brake pedal: Depressed		OFF
			Brake pedal: Released		ON
07	Clutch switch <M/T>		Clutch pedal: Depressed		ON
			Brake pedal: Released		OFF
	Inhibitor switch <A/T>		Selector lever: “N“, “P” position		ON
			Selector lever: Other than “N“, “P” position		OFF
08	Accelerator switch (Idle position switch)		Accelerator pedal: Released		ON
			Accelerator pedal: Depressed		OFF
09	Auto-cruise control system		Auto-cruise control system: Activated		ON
			Auto-cruise control system: Not activated		OFF
10	Vehicle speed sensor		Road test the vehicle		The speedometer and the MUT-II display the same value.

Terminal No.	Check item	Check conditions	Normal condition
11	Throttle position sensor	Accelerator pedal: Fully depressed	450 - 800 mV
		Accelerator pedal: Depressed	The more deeply the pedal is depressed, the higher value the MUT-II display
		Accelerator pedal: Release	4,200 - 4,900 mV
12	Accelerator pedal position sensor	Accelerator pedal: Fully depressed	985 - 1,085 mV
		Accelerator pedal: Depressed	The more deeply the pedal is depressed, the higher value the MUT-II display
		Accelerator pedal: Release	4,000 mV or more

<4M4>

Terminal No.	Check item		Check conditions		Normal condition
01	Auto-cruise control switch	MAIN	MAIN switch: ON		ON
			MAIN switch: OFF		OFF
02		SET (COAST)	MAIN switch: ON	SET switch: ON	ON
				SET switch: OFF	OFF
03		RESUME (ACCEL)		RESUME switch: ON	ON
				RESUME switch: OFF	OFF
04		CANCEL		CANCEL switch: ON	ON
				CANCEL switch: OFF	OFF
05	Stop lamp switch (for stop lamp circuit)		Brake pedal: Depressed		ON
			Brake pedal: Released		OFF
06	Stop lamp switch (for auto-cruise control circuit)		Brake pedal: Depressed		OFF
			Brake pedal: Released		ON
07	Clutch switch <M/T>		Clutch pedal: Depressed		ON
			Brake pedal: Released		OFF
	Inhibitor switch <A/T>		Selector lever: “N”, “P” position		ON
			Selector lever: Other than “N”, “P” position		OFF
08	Accelerator switch (Idle position switch)		Accelerator pedal: Released		ON
			Accelerator pedal: Depressed		OFF
09	Auto-cruise control system		Auto-cruise control system: Activated		ON
			Auto-cruise control system: Not activated		OFF

Terminal No.	Check item	Check conditions	Normal condition
10	Vehicle speed sensor	Road test the vehicle	The speedometer and the MUT-II display the same value.
11	Acclelerator pedal position sensor	Accelerator pedal: Fully depressed	0.9 - 1.1 V
		Accelerator pedal: Release	4.1 V or more



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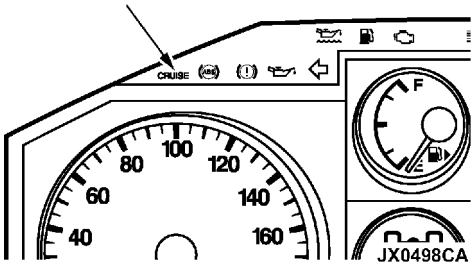
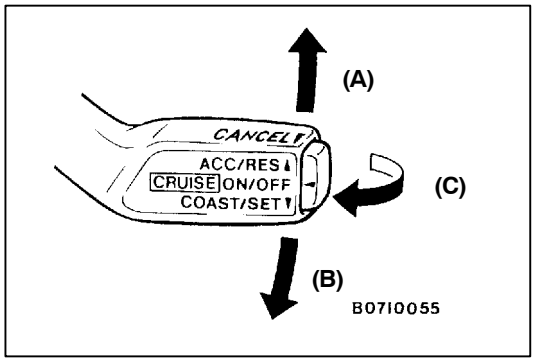
Auto-cruise control indicator lamp



ON-VEHICLE SERVICE

AUTO-CRUISE CONTROL MAIN SWITCH CHECK

1. Turn the ignition key to ON.
2. Check to be sure that the indicator lamp within the combination meter illuminates when the MAIN switch is switched ON.



AUTO-CRUISE CONTROL SWITCH CHECK

AUTO-CRUISE CONTROL SETTING

1. Switch ON the MAIN switch.
2. Drive at the desired speed within the range of approximately 40 - 200 km/h.
3. Push the auto-cruise control switch in the direction of arrow (B).
4. Check to be sure that when the switch is released the speed is the desired constant speed.

NOTE
If the vehicles speed decreases to approximately 15 km/h below the set speed because of climbing a hill for example, the auto-cruise control will be cancelled.

SPEED-INCREASE SETTING

1. Set to the desired speed.
2. Push the auto-cruise control switch in the direction of arrow (A).
3. Check to be sure that acceleration continues while the switch is hold, and that when it is released the constant speed at the time when it was released becomes the driving speed.

NOTE
Acceleration can be continued even if the vehicle speed has passed the high-speed limit (approx. 200 km/h). But the speed when the auto-cruise control switch is released will be recorded as the high-speed limit.

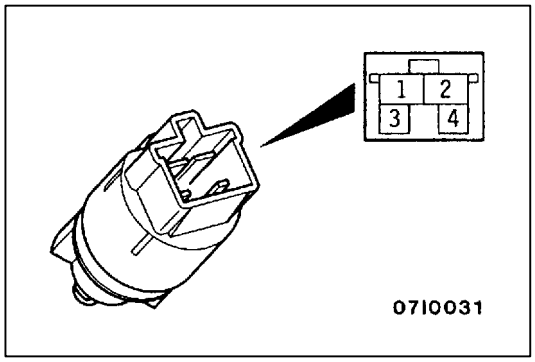
SPEED-REDUCTION SETTING

1. Set to the desired speed.
2. Push the auto-cruise control switch in the direction of arrow (B).
3. Check to be sure that deceleration continues while the switch is pressed, and that when it is released the constant speed at the time when it was released becomes the driving speed.

NOTE
When the vehicle speed reaches the low limit (approximately 40 km/h) during deceleration, the auto-cruise control will be cancelled.

RETURN TO THE SET SPEED BEFORE CANCELLATION AND AUTO-CRUISE CONTROL CANCELLATION

1. Set the auto-cruise speed control.
2. When any of the following operations are performed while at constant speed during auto-cruise control, check if normal driving is resumed and deceleration occurs.
   a. The auto-cruise control switch is pushed in the direction of arrow (C).
   b. The brake pedal is depressed.
   c. The clutch pedal is depressed. <M/T>
   d. The selector lever is moved to the “N” range. <A/T>
3. When the auto-cruise control switch is pushed in the direction of arrow (A) at a vehicle speed of 40 km/h or higher, check if the vehicle speed returns to the speed before auto-cruise control driving was cancelled, and constant speed driving occurs.
4. When the MAIN switch is turned to OFF while driving at constant speed, check if normal driving is resumed and deceleration occurs.

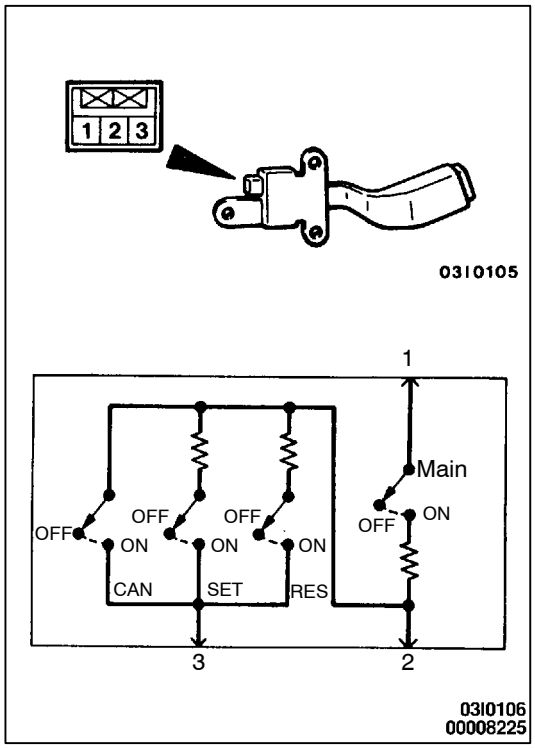


AUTO-CRUISE CONTROL COMPONENT CHECK

STOP LAMP SWITCH

1. Disconnect the connector.
2. Check for continuity between the terminals of the switch.

Measurement conditions	Terminal No.			
	1	2	3	4
When brake pedal is depressed. (for stop lamp circuit)	○	○		
When brake pedal is depressed. (for auto-cruise control circuit)			○	○



AUTO-CRUISE CONTROL SWITCH CHECK

Measure the resistance between the terminals when each of the SET, RESUME, CANCEL and MAIN switches is pressed. If the values measured at this time correspond to those in the table below, then there is no problem.

Switch position		Resistance between terminals	
MAIN switch: OFF		No continuity	
MAIN switch: ON		Terminals 1 and 2	Approx. 3.9 kΩ
MAIN switch: ON	CANCEL switch: ON	Terminals 2 and 3	Approx. 0 Ω
	RESUME switch: ON	Terminals 2 and 3	Approx. 910 Ω
	SET switch: ON	Terminals 2 and 3	Approx. 220 Ω

CLUTCH PEDAL POSITION SWITCH

Refer to GROUP 21 - On-vehicle Service.

THROTTLE POSITION SENSOR

Refer to GROUP 13A - On-vehicle Service.

VEHICLE SPEED SENSOR CHECK

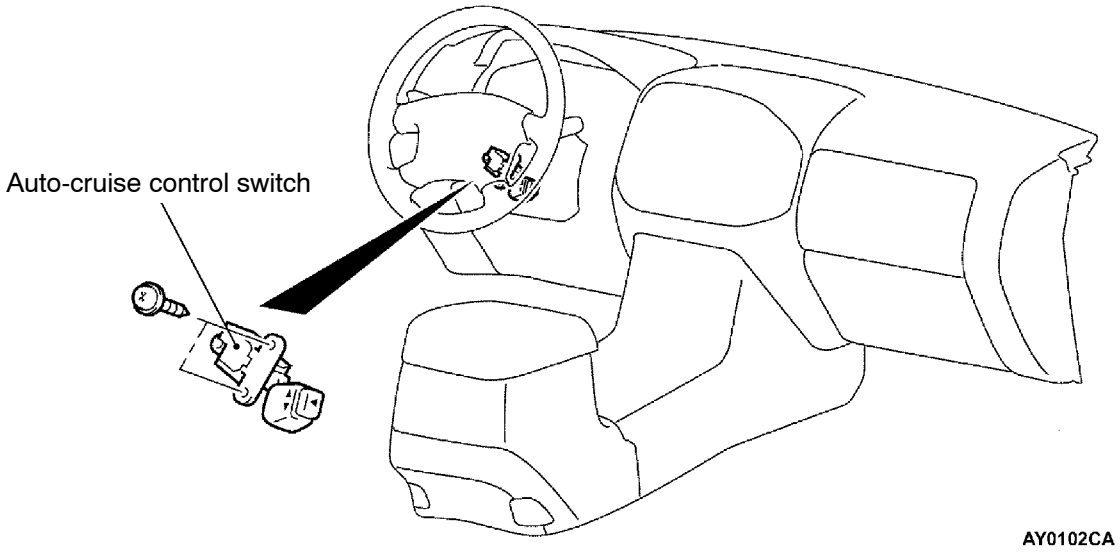
Refer to GROUP54 - Combination meters.

AUTO-CRUISE CONTROL SWITCH

REMOVAL AND INSTALLATION

CAUTION: SRS
Before removal of air bag module, refer to GROUP 52B - SRS Service Precautions and Air Bag Modules and Clock Spring.

Pre-removal and Post-installation Operation
Air Bag Module Removal and Installation
(Refer to GROUP 52B.)



EMISSION CONTROL SYSTEM <6G7>

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)

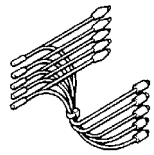
EMISSION CONTROL DEVICE REFERENCE TABLE

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	×					17-35
Purge control solenoid valve		×				17-38
GDI system component		×	×			GROUP 13A
Catalytic converter				×		17-44
EGR valve					×	17-40

SERVICE SPECIFICATIONS

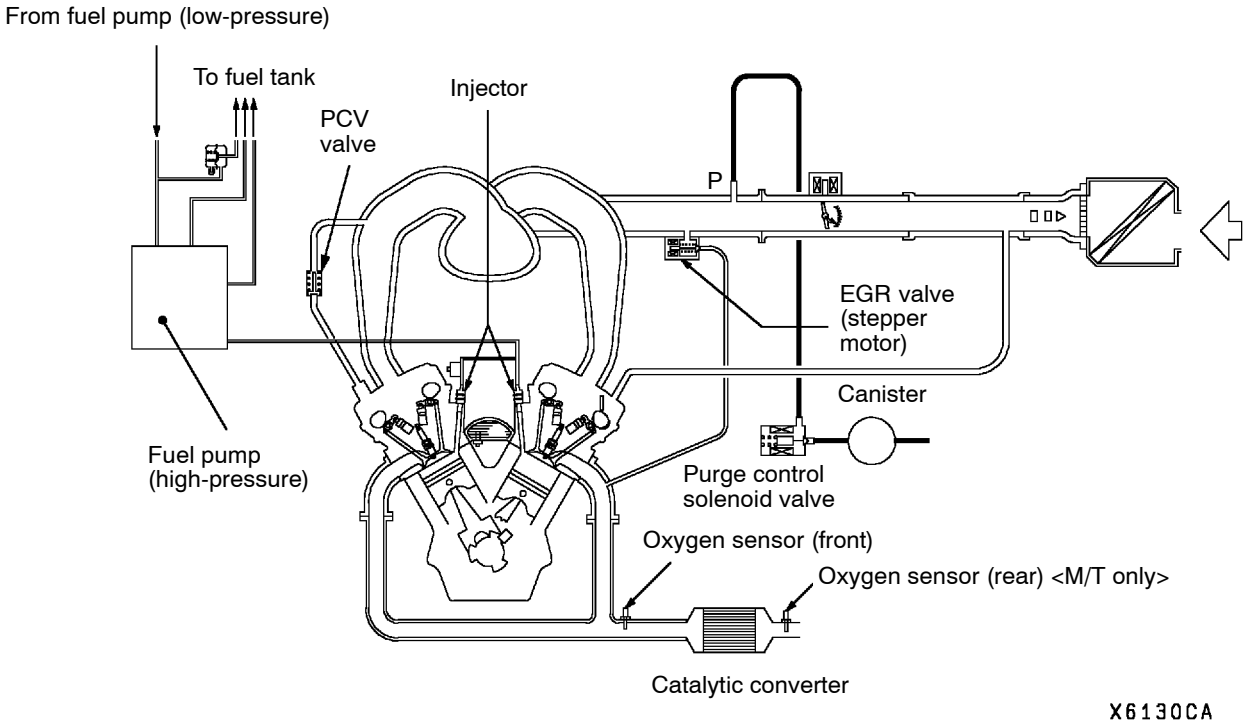
Items	Standard value
Purge control solenoid valve coil resistance (at 20°C) Ω	28 - 36
EGR valve coil resistance (at 20°C) Ω	10 - 20

SPECIAL TOOL

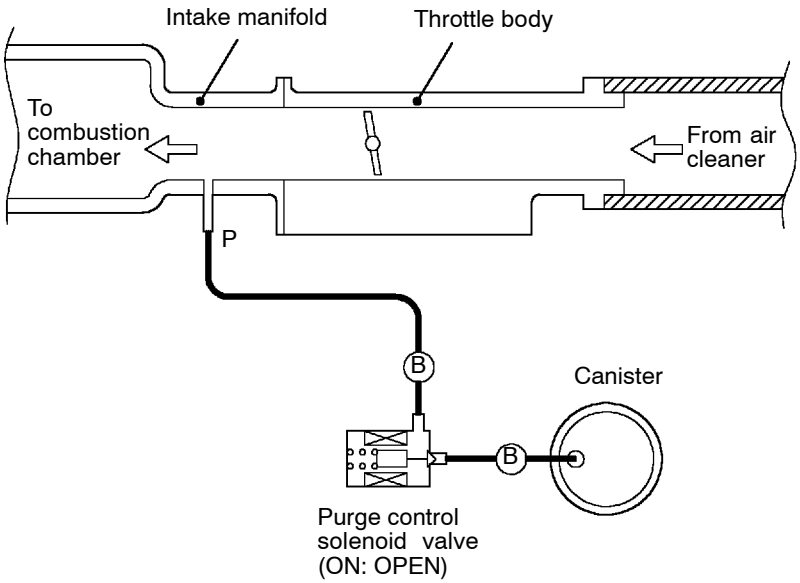
Tool	Number	Name	Use
 B991658	MB991658	Test harness set	Inspection of EGR valve

VACUUM HOSE

VACUUM HOSE PIPING DIAGRAM



VACUUM CIRCUIT DIAGRAM



Vacuum hose colour
B: Black

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VACUUM HOSE CHECK

1. Using the piping diagram as a guide, check to be sure that the vacuum hoses are correctly connected.
2. Check the connection condition of the vacuum hoses, (removed, loose, etc.) and check to be sure that there are no bends or damage.

VACUUM HOSE INSTALLATION

1. When connecting the vacuum hoses, they should be securely inserted onto the nipples.
2. Connect the hoses correctly, using the vacuum hose piping diagram as a guide.

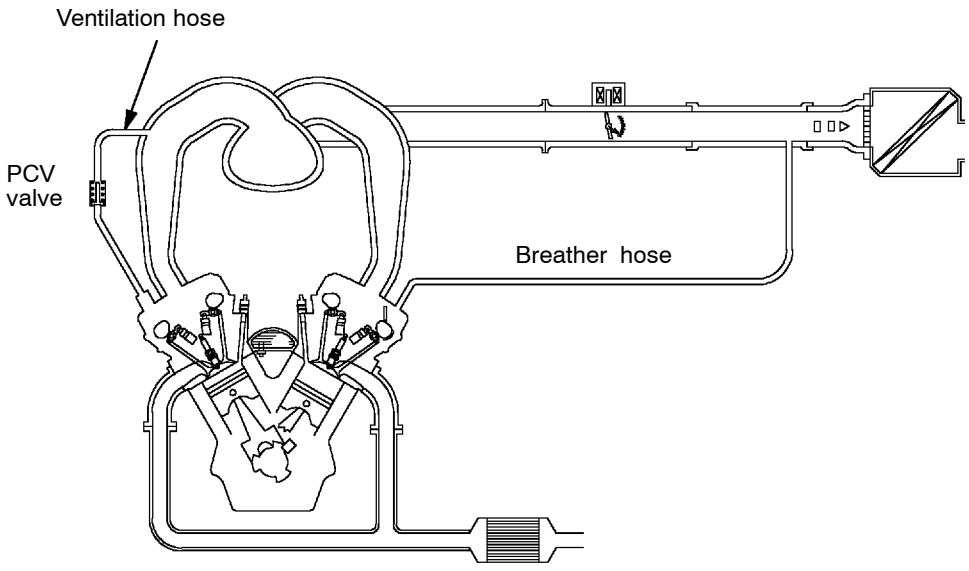
CRANKCASE EMISSION CONTROL SYSTEM

GENERAL INFORMATION

The crankcase emission control system prevents blow-by gases from escaping inside the crankcase into the atmosphere.
Fresh air is sent from the air cleaner into the crankcase through the breather hose. The air becomes mixed with the blow-by gases inside the crankcase.
The blow-by gas inside the crankcase is drawn into the intake manifold through the positive crankcase ventilation (PCV) valve.

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

SYSTEM DIAGRAM



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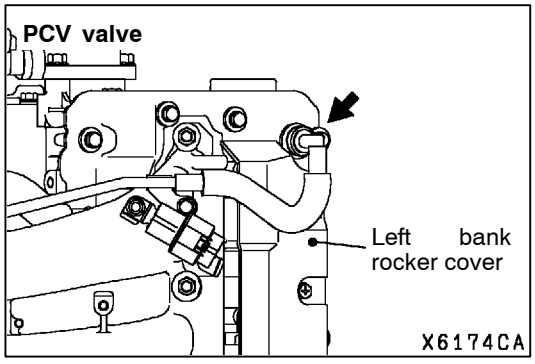
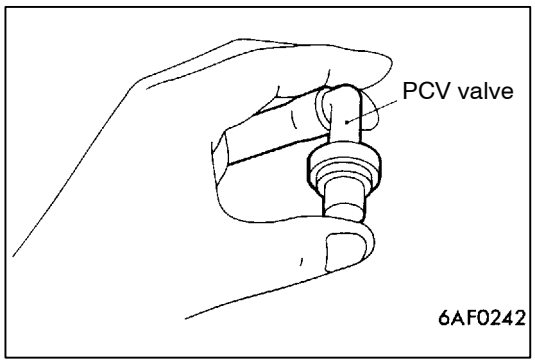
COMPONENT LOCATION



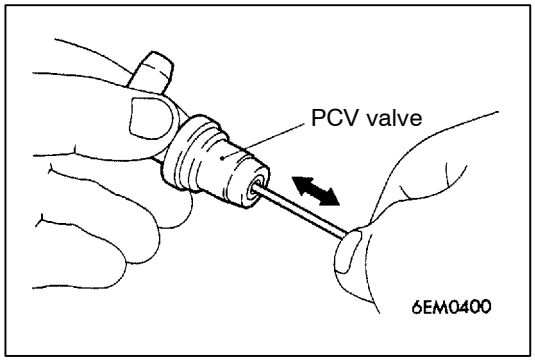
POSITIVE CRANKCASE VENTILATION SYSTEM CHECK

1. Remove the ventilation hose from the PCV valve.
2. Remove the PCV valve from the rocker cover.
3. Reinstall the PCV valve at the ventilation hose.
4. Start the engine and run at idle.



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

   NOTE
   At this moment, the plunger in the PCV valve moves back and forth.
6. If vacuum is not felt, clean the PCV valve or replace it.



PCV VALVE CHECK

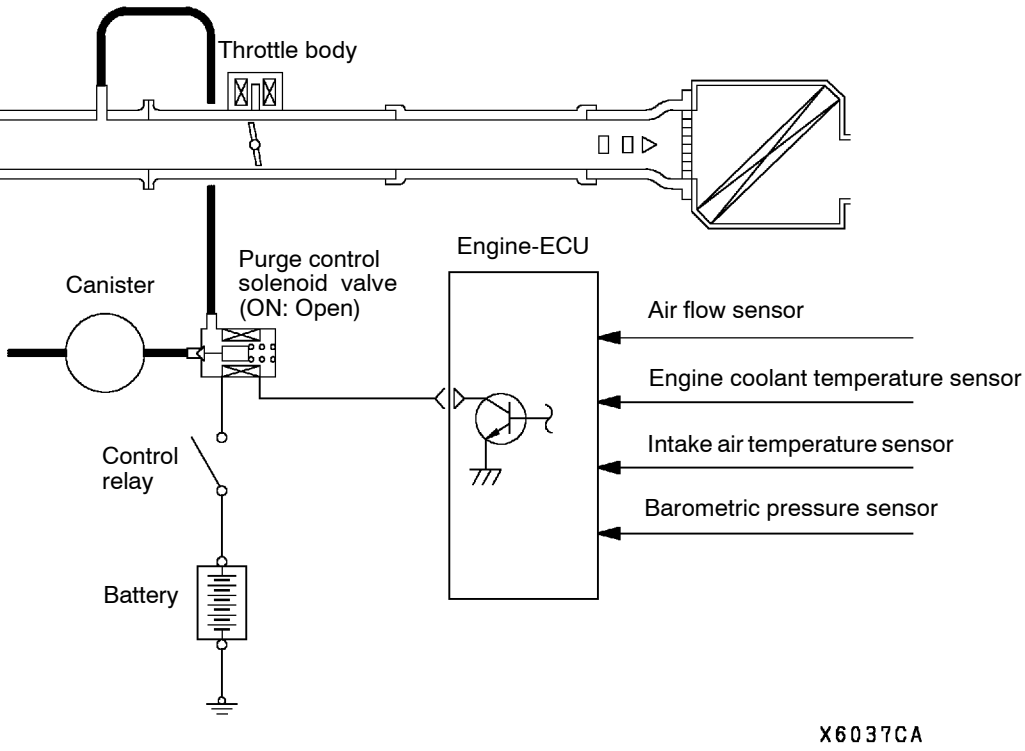
1. Insert a thin rod into the PCV valve from the side shown in the illustration (rocker cover installation side), and move the rod back and forth to check that the plunger moves.
2. If the plunger does not move, there is clogging in the PCV valve. In this case, clean or replace the PCV valve.

EVAPORATIVE EMISSION CONTROL SYSTEM

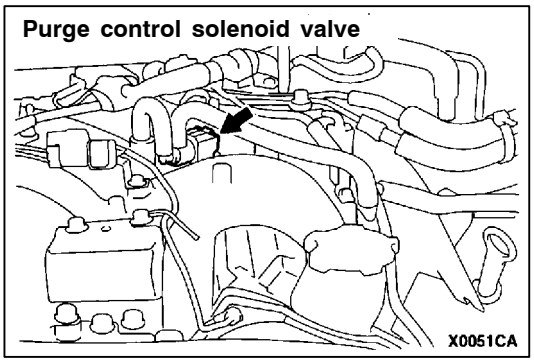
GENERAL INFORMATION

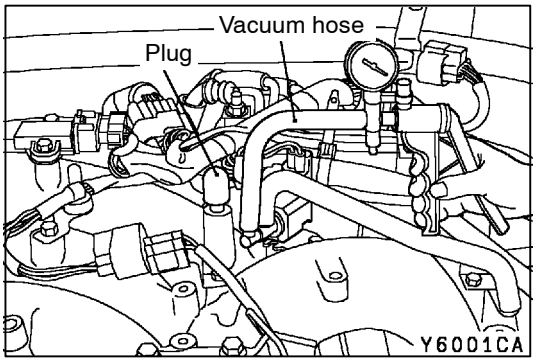
The evaporative emission control system prevents fuel vapours generated in the fuel tank from escaping into the atmosphere.
Fuel vapours from the fuel tank flow through the fuel tank pressure control valve and vapour pipe/hose to be stored temporarily in the canister.
When driving the vehicle, fuel vapours stored in the canister flow through the purge solenoid and purge port and go into the intake manifold to be sent to the combustion chamber.
When the engine coolant temperature is low or when the intake air quantity is small (when the engine is at idle, for example), the engine control unit turns the purge solenoid off to shut off the fuel vapour flow to the intake manifold.
This does not only insure the driveability when the engine is cold or running under low load but also stabilize the emission level.

SYSTEM DIAGRAM



COMPONENT LOCATION





PURGE CONTROL SYSTEM CHECK

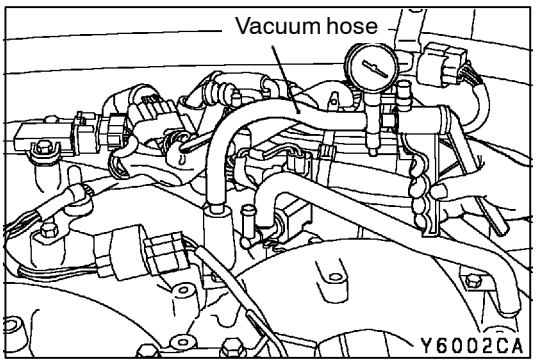
1. Disconnect the vacuum hose from the intake manifold and connect it to a hand vacuum pump.
2. Plug the nipple from which the vacuum hose was removed.
3. When the engine is cold or hot, apply a vacuum of 53 kPa, and check the condition of the vacuum.

When engine is cold
(Engine coolant temperature: 40°C or less)

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

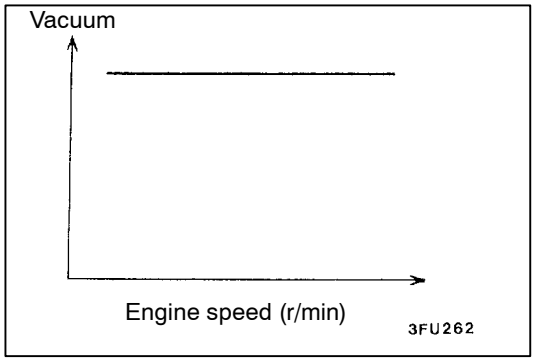
When engine is hot
(Engine coolant temperature: 80°C or higher)

Engine condition	Normal condition
• At idle • for approximately 6 minutes after the engine is started.	Vacuum is maintained.
• 3,000 r/min • for approximately 3 minutes after the engine is started.	Vacuum will leak.



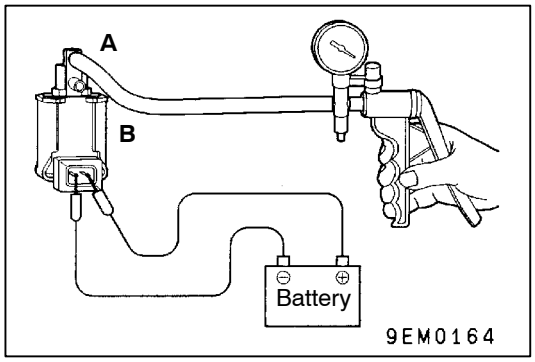
PURGE PORT VACUUM CHECK

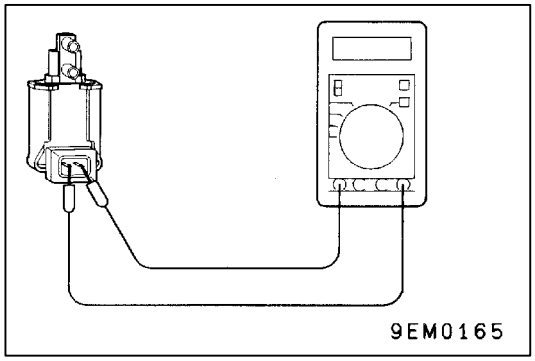
1. Disconnect the vacuum hose from the intake manifold purge vacuum nipple and connect a hand vacuum pump to the nipple.



2. Start the engine and check that the vacuum remains fairly constant after racing the engine.

NOTE
If vacuum changes, it is possible that the throttle body purge port may be clogged and require cleaning.





PURGE CONTROL SOLENOID VALVE CHECK

NOTE
When disconnecting the vacuum hose, always make a mark so that it can be reconnected at original position.

1. Disconnect the vacuum hose from the solenoid valve.
2. Disconnect the harness connector.
3. Connect a hand vacuum pump to nipple (A) of the solenoid valve (refer to the illustration at left).
4. Check airtightness by applying a vacuum with voltage applied directly from the battery to the purge control solenoid valve and without applying voltage.

Battery voltage	Normal condition
Applied	Vacuum leaks
Not applied	Vacuum maintained

5. Measure the resistance between the terminals of the solenoid valve.

   Standard value: 30 - 34 Ω (at 20°C)

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

GENERAL INFORMATION

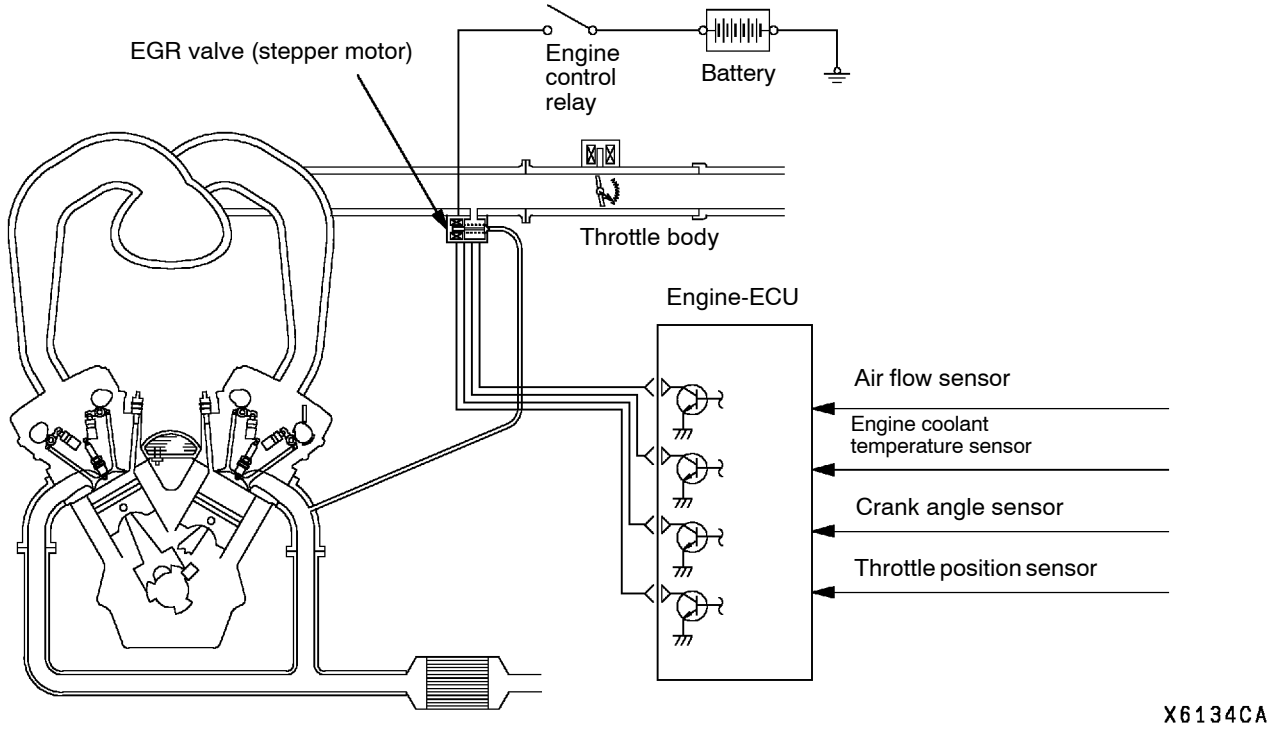
The exhaust gas recirculation (EGR) system lowers the nitrogen oxide (NOx) emission level. When the air/fuel mixture combustion temperature is high, a large quantity of nitrogen oxides (NOx) is generated in the combustion chamber. Therefore, this system recirculates part of emission gas from the exhaust 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

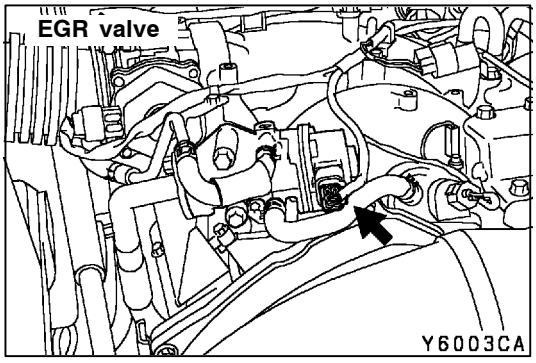
The EGR valve is being closed and does not recirculate exhaust gases under one of the following conditions. Otherwise, the EGR valve is opened and recirculate exhaust gases.

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

SYSTEM DIAGRAM

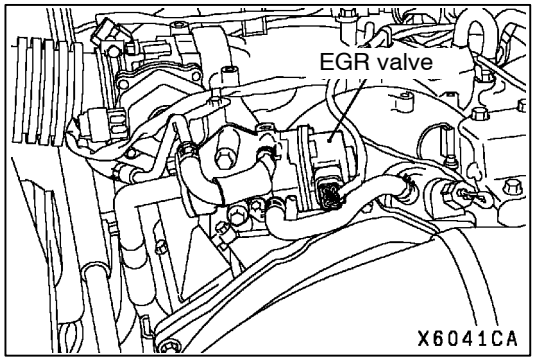


COMPONENT LOCATION



EXHAUST GAS RECIRCULATION (EGR) CONTROL SYSTEM CHECK

Refer to GROUP 13 - Troubleshooting.

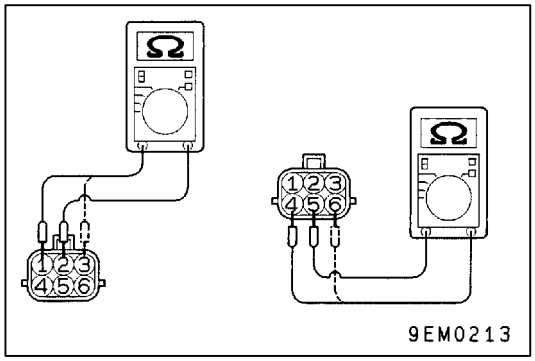


EGR VALVE (STEPPER MOTOR) CHECK

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.



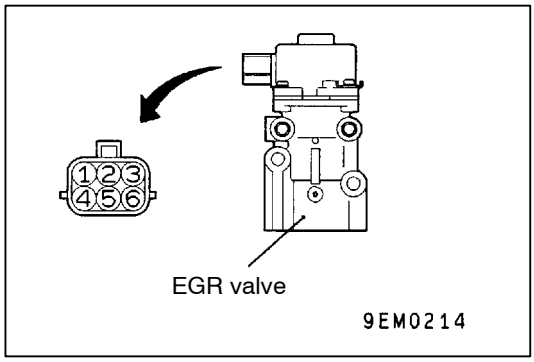
Checking the Coil Resistance

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)

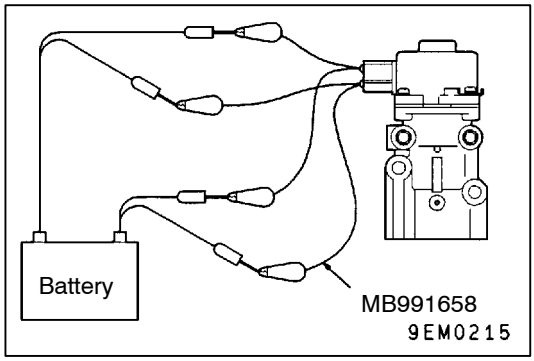
3. Measure the resistance between the EGR valve-side connector terminal No.5 and terminal No.4 or terminal No.6.

   Standard value: 10 - 20 Ω (at 20°C)



Operation Check

1. Remove the EGR valve.
2. Connect the special tool (test harness: MB991658) to the EGR valve-side connector.
3. Connect terminal No.2 to the positive (+) terminal of the battery.
4. Connect terminal No.1 and terminal No.3 to the negative (-) terminal of battery to test if any vibration occurs (as though the stepper motor is shaking slightly) due to the operation of the stepper motor.
5. Connect terminal No.5 to the positive (+) terminal of battery.

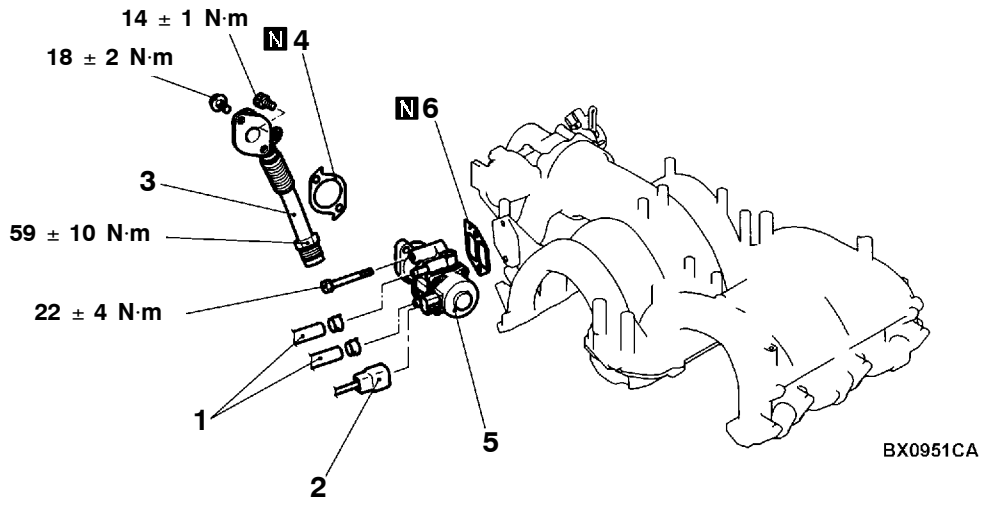


6. Connect terminal No.4 and terminal No.6 to the negative (-) terminal of battery to test if any vibration occurs (as though the stepper motor is shaking slightly) due to the operation of the stepper motor.
7. If the results of testing show that the vibration could be felt, the stepper motor is normal.

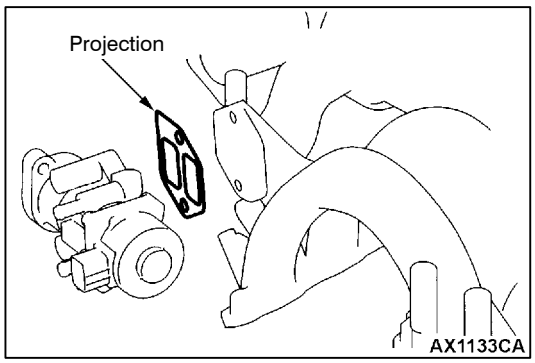
EGR VALVE

REMOVAL AND INSTALLATION

Pre-removal Operation
- Engine Coolant Draining and Refilling (Refer to GROUP 14 - On-vehicle Service.)
- Engine Cover Removal and Installation (Refer to GROUP 11A - Timing Belt.)
- Air Cleaner Assembly Removal and Installation (Refer to GROUP 15)



Removal steps
1. Water hose connection
2. EGR valve connector
3. EGR pipe
4. EGR pipe gasket
5. EGR valve
▶A◀ 6. EGR valve gasket



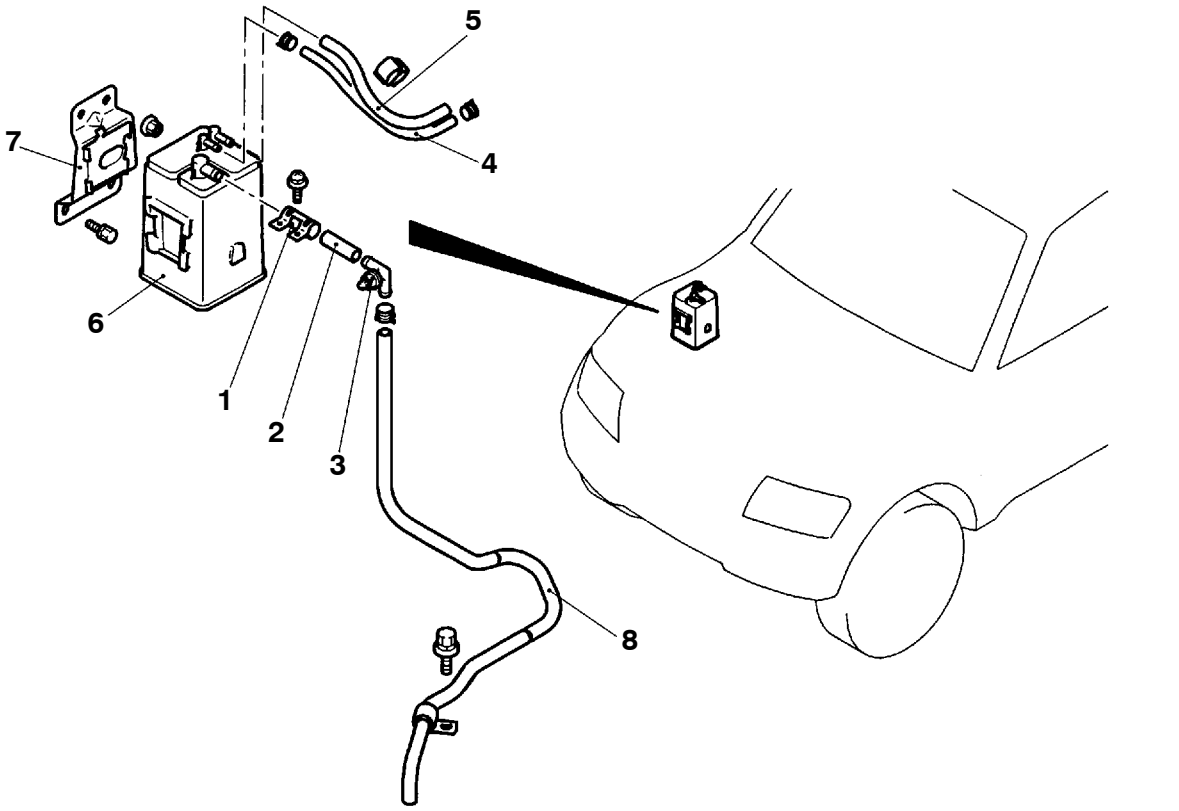
INSTALLATION SERVICE POINT

▶A◀ EGR VALVE GASKET INSTALLATION

Install the gasket so that its projection faces towards the direction shown.

CANISTER

REMOVAL AND INSTALLATION



AY0296CA

Removal steps

1. Hose clip
2. Vapor hose
3. Breather valve
4. Vapor hose connection
5. Purge hose connection
6. Canister
7. Canister bracket

CATALYTIC CONVERTER

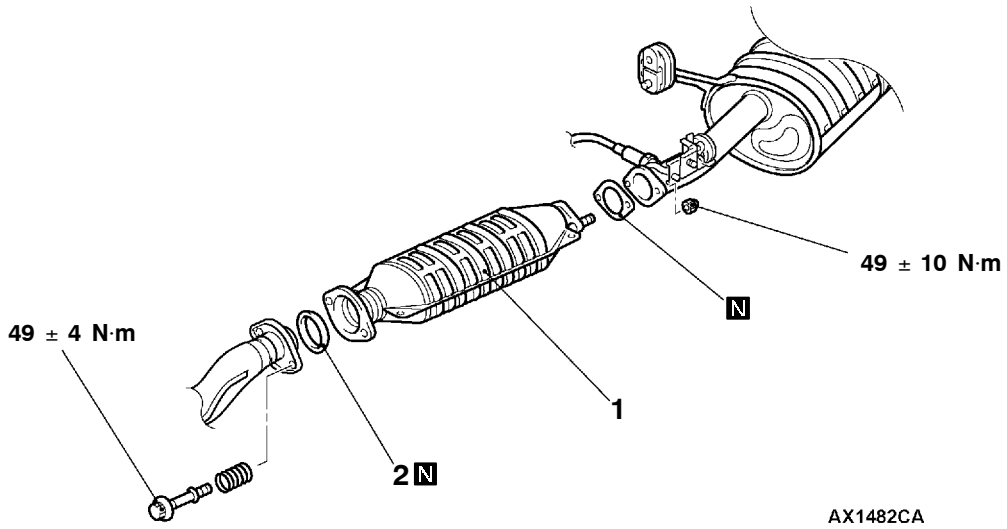
GENERAL INFORMATION

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

Pre-removal and Post-installation Operation
Under Cover Removal and Installation



Removal steps

1. Catalytic converter
2. Seal ring

EMISSION CONTROL SYSTEM <4D5>

GENERAL INFORMATION

The electronically-controlled EGR system and the fuel injection timing control system (load timer) reduce the level of exhaust gases (NO_x).

Items	Name	Specification
Exhaust emission control system	Exhaust gas recirculation system ● EGR valve ● EGR solenoid valve No.1 ● EGR solenoid valve No.2	Electronically-controlled EGR system Single type Duty cycle solenoid valve ON-OFF solenoid valve

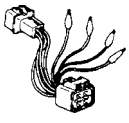
SERVICE SPECIFICATIONS

Items		Standard value
EGR solenoid valve Nos. 1 and 2 resistance (at 20°C) Ω		36 - 44
Lever position sensor output voltage V	Idle position	0.8 - 1.0
	Fully open	3.7 - 4.9
Engine speed sensor resistance kΩ		1.3 - 1.9
Engine coolant temperature sensor resistance (Built-in engine coolant temperature gauge unit) kΩ	At 0°C	7.7 - 9.5
	At 20°C	2.9 - 3.6
	At 40°C	1.3 - 1.7
	At 80°C	0.26 - 0.35

SEALANT

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

SPECIAL TOOL

Tool	Number	Name	Use
	MD998464	Test harness (4P, square)	Inspection of lever position sensor

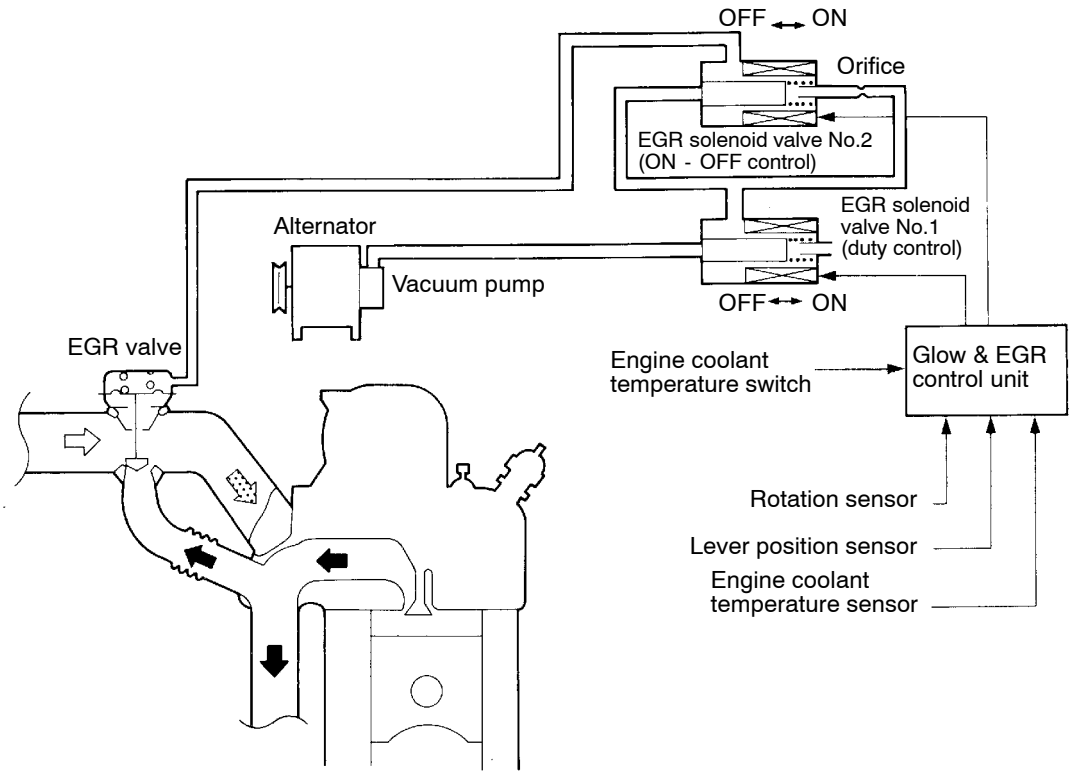
EXHAUST GAS RECIRCULATION (EGR) SYSTEM

GENERAL INFORMATION

The electronically-controlled EGR system consists of an EGR valve, a vacuum pump, EGR solenoid valves Nos.1 and 2, glow & EGR control unit and various sensors.
The EGR valve is controlled by the negative pressure inside the valve, which is controlled by EGR solenoid valves Nos.1 and 2.

The EGR solenoid valves Nos.1 and 2 are optimally controlled by the glow & EGR control unit in response to the engine operation conditions, based on data received from each sensor.
In this way, the EGR is controlled to reduce NOx emissions while maintaining good engine performance.

SYSTEM DIAGRAM



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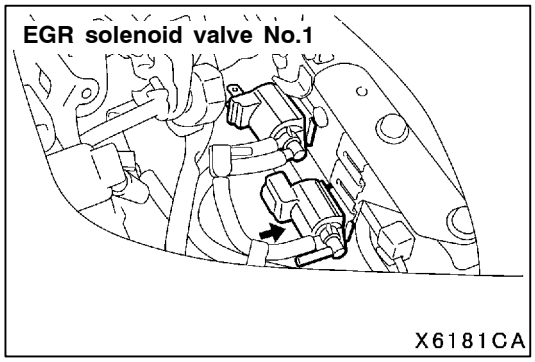
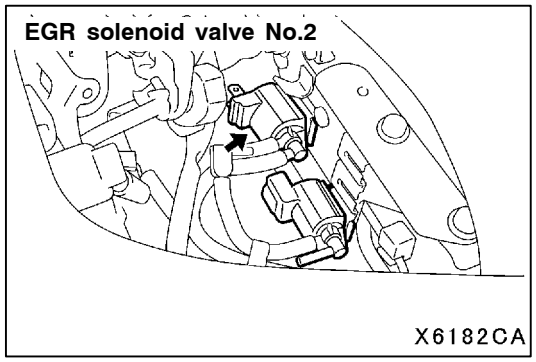
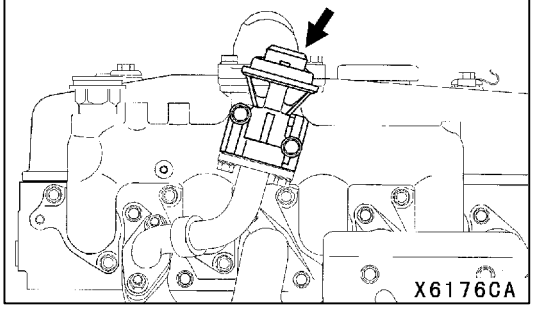
COMPONENT LOCATION

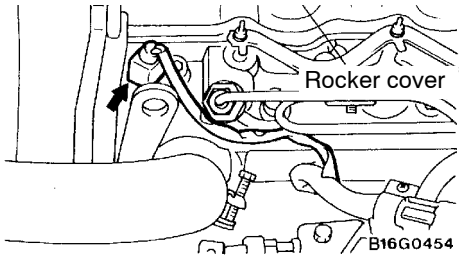




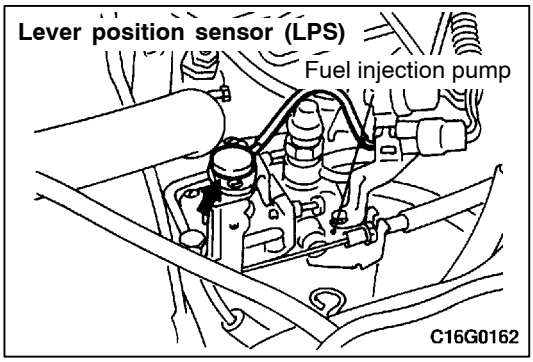
EGR valve

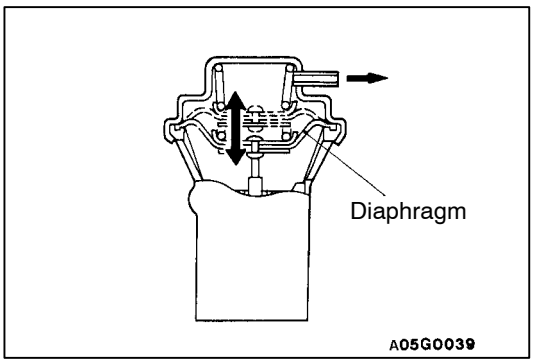


Engine coolant temperature gauge unit (built-in engine coolant temperature sensor)



Lever position sensor (LPS)



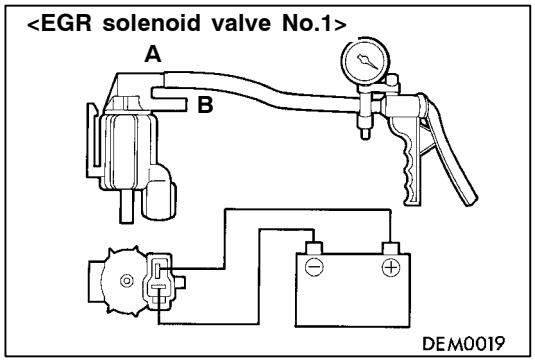


FUNCTION CHECK

1. Start the engine and warm it up until the engine coolant temperature reaches 65°C or above.
2. Race the engine by suddenly depressing the accelerator pedal, then check that the EGR valve diaphragm lifts.

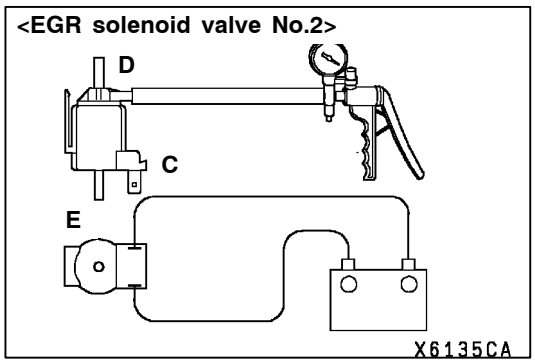
EGR SOLENOID VALVE OPERATION CHECK

1. Remove EGR solenoid valve Nos.1 and 2 connectors and vacuum hoses.
2. Attach a vacuum pump to each nipple of the EGR solenoid valve Nos. 1 and 2 connectors and apply negative pressure. Check that the valves are airtight both when voltage is applied to each terminal of the EGR solenoid valve Nos. 1 and 2 and when it is not applied.



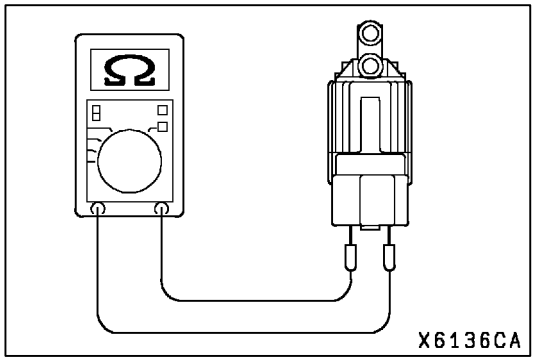
EGR solenoid valve No.1

Battery voltage	Normal condition
When current is flowing	Vacuum leaks (Vacuum is maintained when nipple B is plugged)
When current is not flowing	Vacuum is maintained



EGR solenoid valve No.2

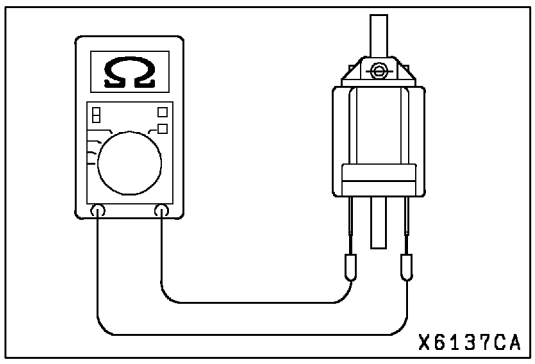
Battery voltage	Normal condition
When current is flowing	Vacuum leaks (Vacuum is maintained when nipple D is plugged)
When current is not flowing	Vacuum leaks (Vacuum is maintained when nipple E is plugged)

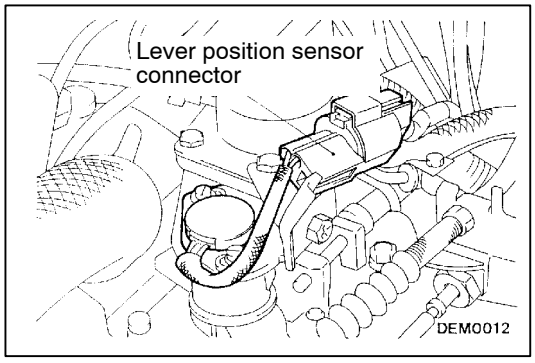


EGR SOLENOID VALVE RESISTANCE CHECK

Measure terminal resistance of EGR solenoid valves Nos. 1 and 2 with a circuit tester.

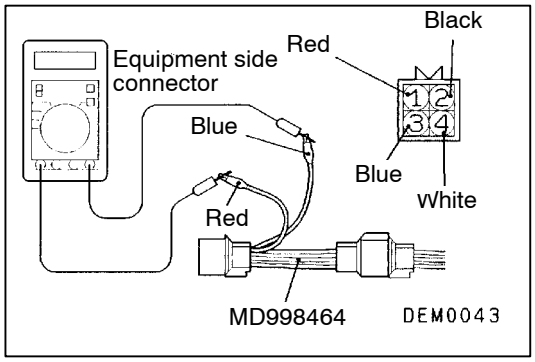
Standard value: 36 - 44 Ω (at 20°C)





LEVER POSITION SENSOR (LPS) ADJUSTMENT

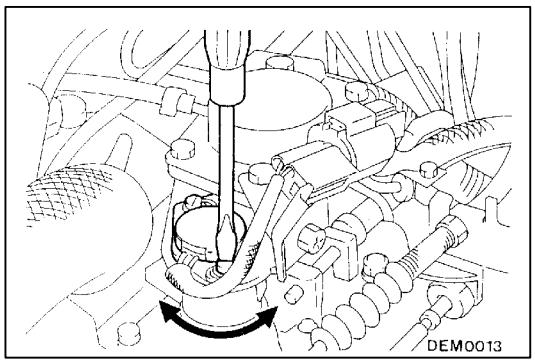
1. Run the engine until the engine coolant temperature reaches to 80°C or above, and then release the fast idle.
2. Loosen the accelerator cable tension sufficiently.
3. Connect the special tool (test harness) to the lever position sensor connector, as shown.



4. Connect a digital-type voltmeter between lever position sensor terminals 1 (red clip) and 3 (blue clip).
5. Turn the ignition switch to “ON”. (Do not start the engine.)
6. Measure output voltage of the lever position sensor.

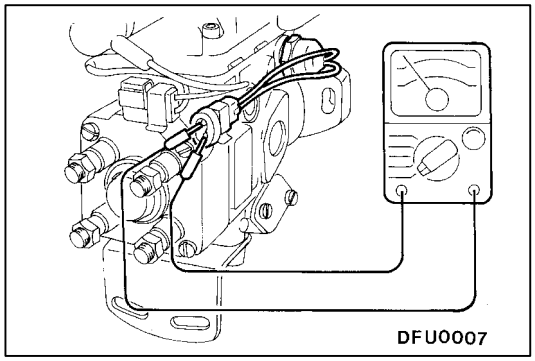
Standard value:

Lever condition	Voltage V
Idle position	0.8 - 1.0
Fully open	3.7 - 4.9



7. If the voltage is outside the standard value, adjust by loosening the lever position sensor mounting screw and turning the lever position sensor body. After adjustment, tighten the screw.

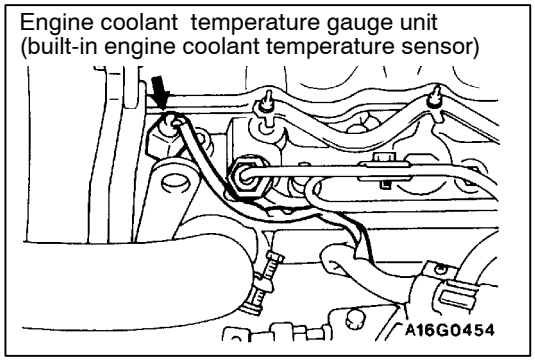
   NOTE
   Voltage increases when the lever position sensor body is turned clockwise.
8. Turn the ignition switch off.
9. Adjust the accelerator cable play.



ENGINE SPEED SENSOR CHECK

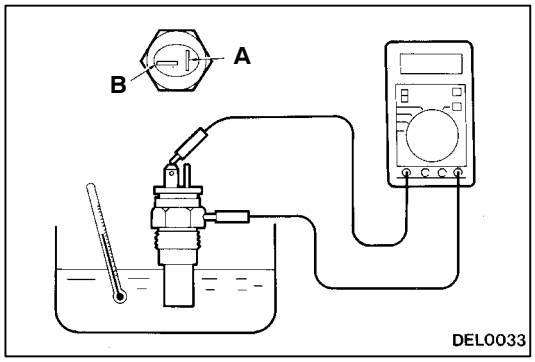
1. Disconnect the engine speed sensor connector.
2. Measure resistance between the engine speed sensor terminals.

Standard value: 1.3 - 1.9 kΩ



ENGINE COOLANT TEMPERATURE SENSOR CHECK

1. Remove the engine coolant temperature gauge unit.



2. Measure resistance between terminal (B) and the body earth when the temperature sensing portion of the engine coolant temperature gauge unit is immersed in hot water.

Temperature (°C)	Resistance (kΩ)
0	7.7 - 9.5
20	2.9 - 3.6
40	1.3 - 1.7
80	0.26 - 0.35

3. If the resistance deviates from the standard value greatly, replace the gauge unit.
4. Apply sealant to the threaded portion.

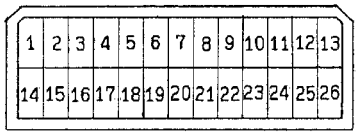
   Specified sealant:
   3M NUT Locking Part No. 4171 or equivalent
5. Install the engine coolant temperature gauge unit and tighten it to the specified torque.

   Sensor tightening torque: 35 Nm
6. Connect the wiring harness connectors.

CHECK AT THE GLOW & EGR CONTROL UNIT

TERMINAL VOLTAGE CHECK CHART

Glow & EGR Control Unit Connector Terminal Arrangement

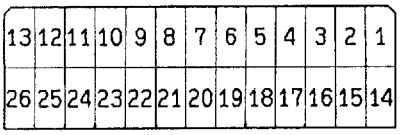


DEM0029

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
3	EGR solenoid valve No.1	Ignition switch: ON		Battery voltage
		While engine is idle after having warmed up, suddenly depress the accelerator pedal.		Momentarily increases
6	Lever position sensor	Ignition switch: ON	Set throttle lever to idle position	0.8 - 1.0 V
			Fully open throttle lever	3.7 - 4.9 V
7	Sensor impressed voltage	Ignition switch: ON		4.8 - 5.2 V
16	EGR solenoid valve No.2	Ignition switch: ON		Battery voltage
		While engine is idle after having warmed up, suddenly depress the accelerator pedal.		Momentarily decreases

HARNESS-SIDE CONNECTOR TERMINAL RESISTANCE AND CONTINUITY CHECK CHART

Glow & EGR Control Unit Harness-Side Connector Terminal Arrangement



DEM0026

Terminal No.	Check item	Normal condition (Check condition)
3 - 1	EGR solenoid valve No.1	36 - 44 Ω (At 20°C)
5 - Body earth	Engine coolant temperature sensor	7.7 - 9.5 kΩ (Coolant temperature at 0°C)
		2.9 - 3.6 kΩ (Coolant temperature at 20°C)
		1.3 - 1.7 kΩ (Coolant temperature at 40°C)
		0.26 - 0.35 kΩ (Coolant temperature at 80°C)
11 - 24	Engine speed sensor	1.3 - 1.9 kΩ
16 - 1	EGR solenoid valve No.2	36 - 44 Ω (At 20°C)

EMISSION CONTROL SYSTEM <4M4-VEHICLES WITH EGR>

GENERAL INFORMATION

The electronically-controlled EGR system and the fuel injection timing control system (load timer) reduce the level of exhaust gases (NO_x).

Items	Name	Specification
Exhaust emission control system	Exhaust gas recirculation system ● EGR valve ● EGR solenoid valve No.1 ● EGR solenoid valve No.2	Electronically-controlled EGR system Single type Duty cycle solenoid valve ON-OFF solenoid valve

SERVICE SPECIFICATIONS

Items	Standard value
EGR solenoid valve No.1/No. 2 resistance (at 20°C) Ω	36 - 44

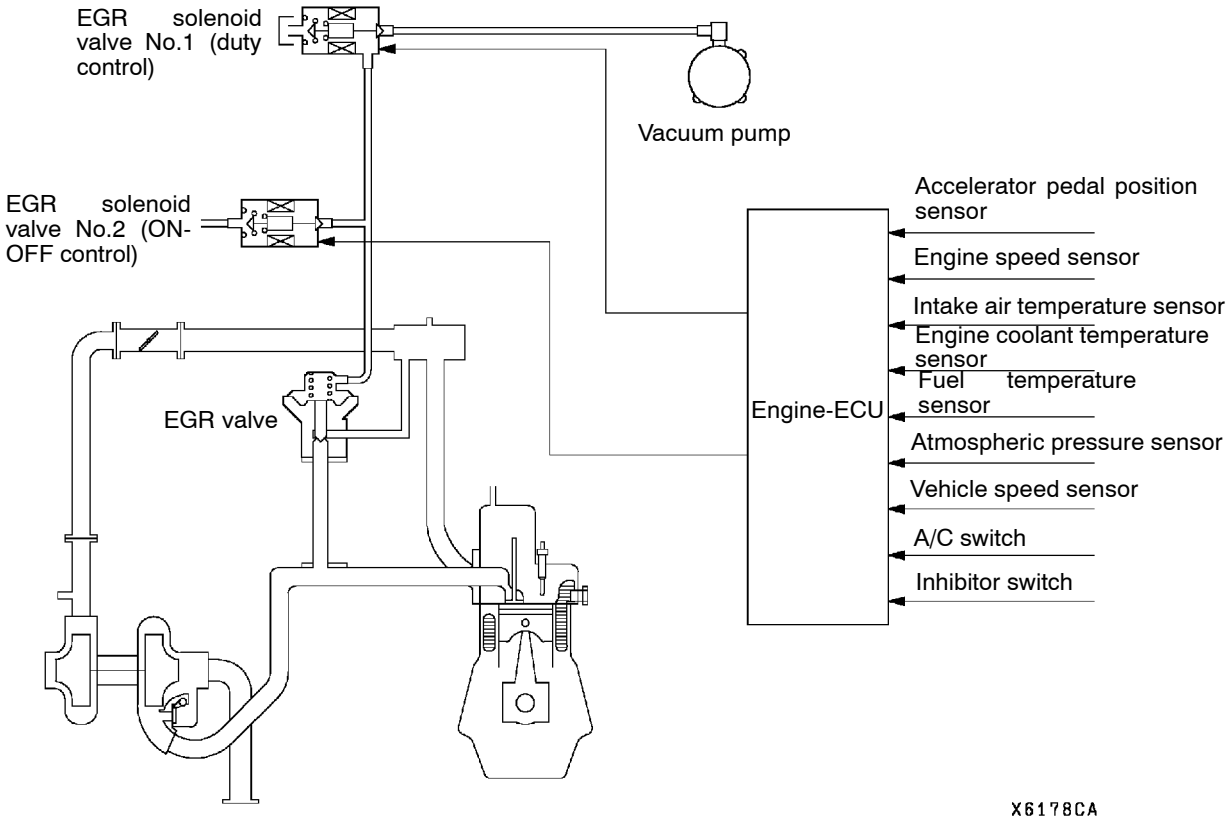
EXHAUST GAS RECIRCULATION (EGR) SYSTEM

GENERAL INFORMATION

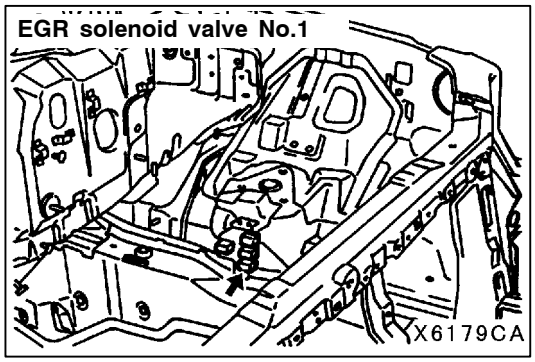
The electronically-controlled EGR system consists of an EGR valve, vacuum pump, EGR solenoid valves No. 1 and No. 2, glow & EGR control unit and various sensors.
The EGR valve is controlled by the negative pressure inside the valve, which is controlled by EGR solenoid valves No. 1 and No. 2.

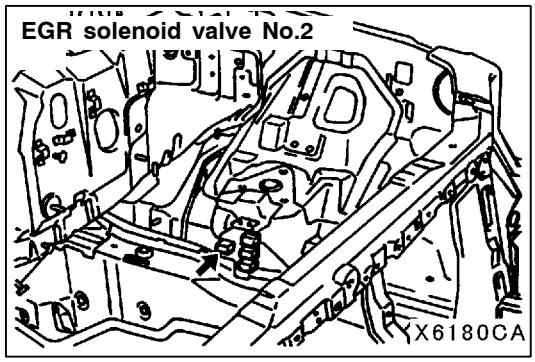
The EGR solenoid valves No.1 and No. 2 are optimally controlled by the glow & EGR control unit in response to the engine operation conditions, based on data input from each of the sensors. In this way, the EGR is controlled to reduce NO_x emissions while maintaining good engine performance.

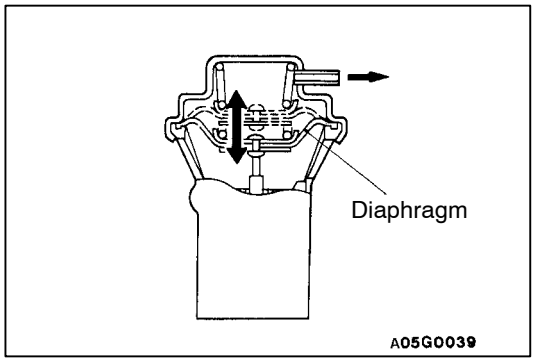
SYSTEM DIAGRAM



COMPONENT LOCATION







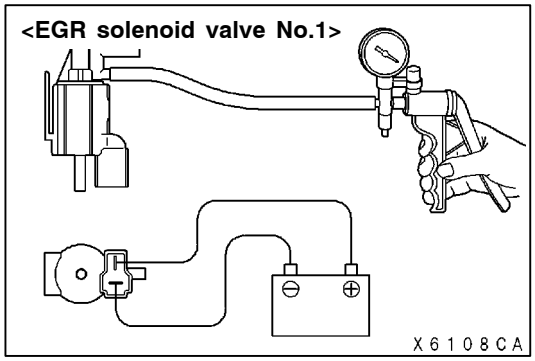
FUNCTION CHECK

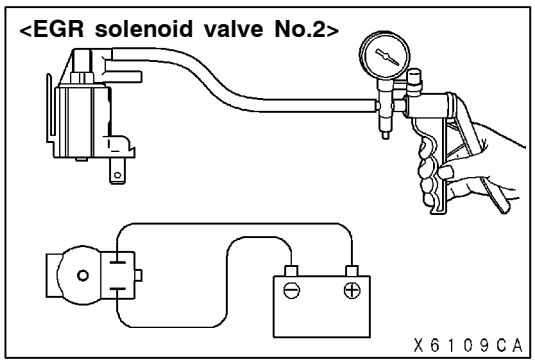
1. Start the engine and warm it up until the engine coolant temperature reaches 65°C or above.
2. Turn the A/C switch “OFF”.
3. Place the selector lever in P range.

4.Check the operation of the EGR valve.

Normal condition:

Engine condition	EGR valve condition
Idling without any load	Open
Sudden racing	Closed (Diaphragm lowers)





EGR SOLENOID VALVE OPERATION CHECK

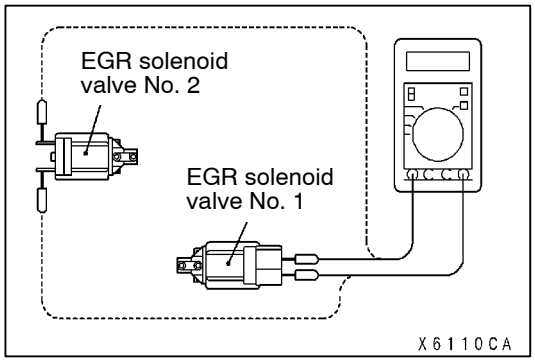
1. Attach a vacuum pump to each nipple of the EGR solenoid valves as shown and apply negative pressure.
2. Check that the valves are airtight both when voltage is applied to each terminal of the EGR solenoid valve and when it is not applied.

EGR solenoid valve No.1

Battery voltage	Normal condition
When current is flowing	Vacuum leaks (Vacuum is maintained when nipple A is plugged).
When current is not flowing	Vacuum leaks (Vacuum is maintained when nipple B is plugged).

EGR solenoid valve No.2

Battery voltage	Normal condition
When current is flowing	Vacuum leaks (Vacuum is maintained when nipple C is plugged).
When current is not flowing	Vacuum is maintained.



EGR SOLENOID VALVE RESISTANCE CHECK

Measure the resistance between the terminals of the solenoid valve.

Standard value: 36 - 44 Ω (at 20°C)

ACCELERATOR PEDAL POSITION SENSOR (APS), ENGINE COOLANT TEMPERATURE SENSOR, INTAKE AIR TEMPERATURE SENSOR, FUEL TEMPERATURE SENSOR CHECK

Refer to GROUP 13C - On-vehicle Service.

CHECK AT ENGINE-ECU

Refer to GROUP 13C - Troubleshooting.

CATALYTIC CONVERTER

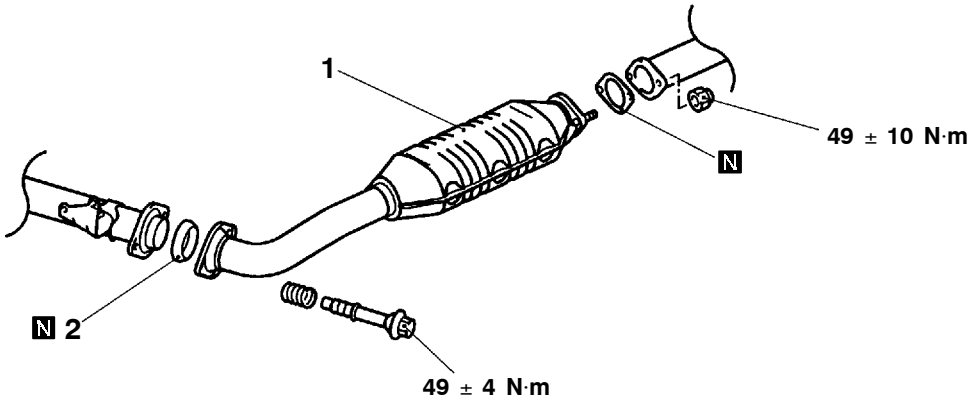
GENERAL INFORMATION

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

Pre-removal and Post-installation Operation
Under Cover Removal and Installation



Removal steps

1. Catalytic converter
2. Seal ring

NOTES

ENGINE AND EMISSION CONTROL

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ENGINE CONTROL SYSTEM

GENERAL

OUTLINE OF CHANGE

Electronic-controlled throttle valve system has been used instead of a conventional cable-type accelerator mechanism <4D5>.
Its service procedure is the same as for previous models with 6G7 or 4M4 engine.

EMISSION CONTROL SYSTEM <4D5-STEP III>

GENERAL

OUTLINE OF CHANGES

Some service procedures have been established as the following changes have been made due to the compliance with the Emission Regulation Step III.

- An electronic-controlled EGR valve and EGR cooler have been used.
- A catalytic converter has been added.

GENERAL INFORMATION

The electronically-controlled EGR system reduces the level of exhaust gases (NO_X).

Items	Name	Specification
Exhaust emission control system	Exhaust gas recirculation system ● EGR valve ● EGR solenoid valve No.1 ● EGR solenoid valve No.2 ● EGR valve position sensor	Electronically-controlled EGR system Single type ON-OFF solenoid valve ON-OFF solenoid valve Variable resistor type

SERVICE SPECIFICATIONS

Items	Standard value
EGR solenoid valve Nos. 1 and 2 resistance (at 20°C) Ω	36 - 44

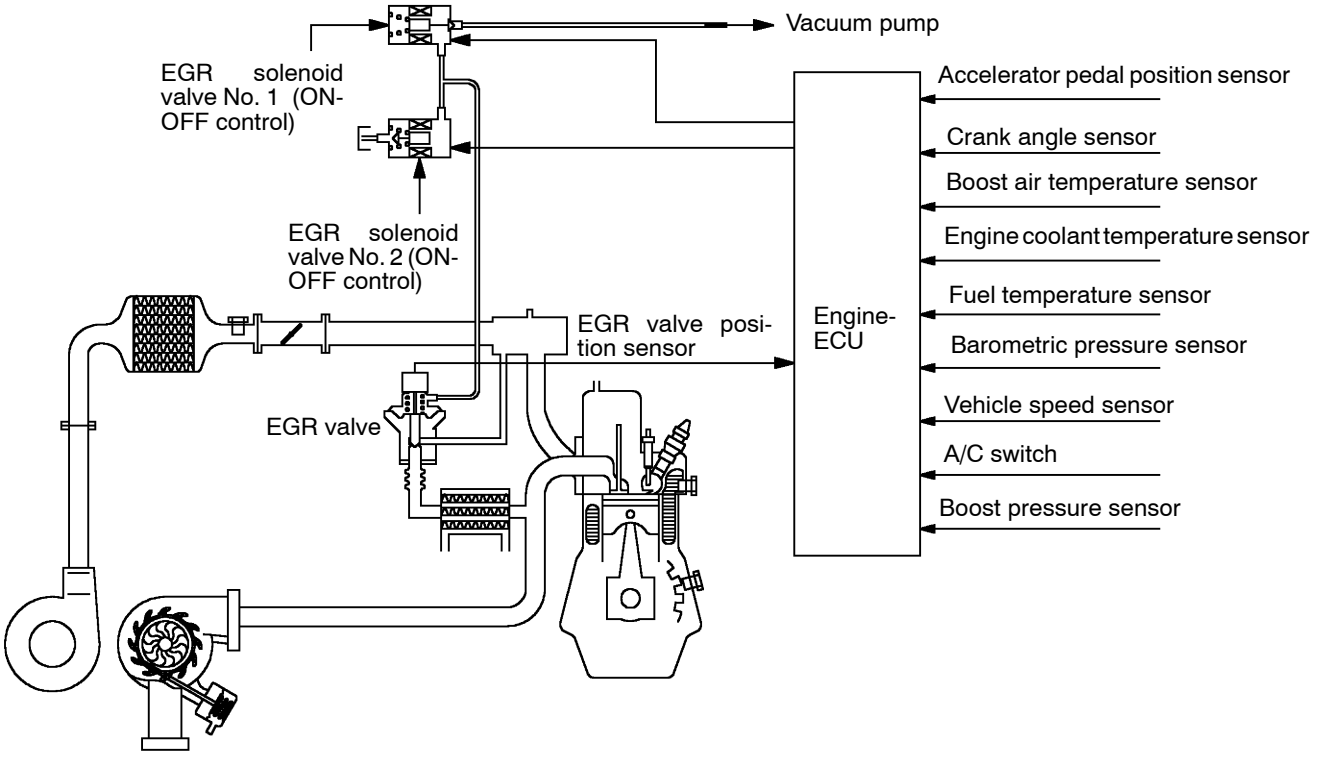
EXHAUST GAS RECIRCULATION (EGR) SYSTEM

GENERAL INFORMATION

The electronically-controlled EGR system consists of an EGR valve, a vacuum pump, EGR solenoid valves Nos.1 and 2, EGR valve position sensor and engine-ECU.
The EGR valve is controlled by the negative pressure inside the valve, which is controlled by EGR solenoid valves Nos.1 and 2.
In order to obtain EGR amount corresponding to each operating condition, the appropriate opening of the EGR valve is calculated based on the input signal from each sensor.

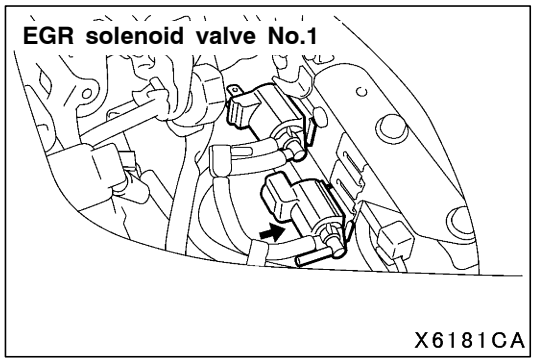
Feedback control of the EGR solenoid valves No. 1 and No. 2 operation is carried out based on the signal from EGR valve position sensor so that the opening of the EGR valve can be quickly adjusted to the target angle.
In this way, the EGR is controlled to reduce NOx emissions while maintaining good engine performance.

SYSTEM DIAGRAM

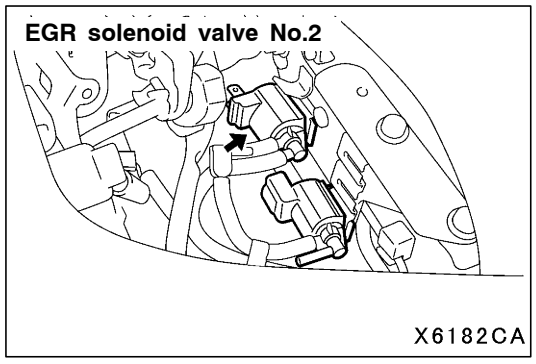


16006CA

COMPONENT LOCATION



X6181CA



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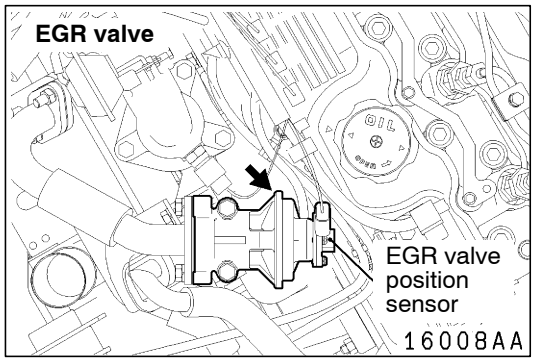
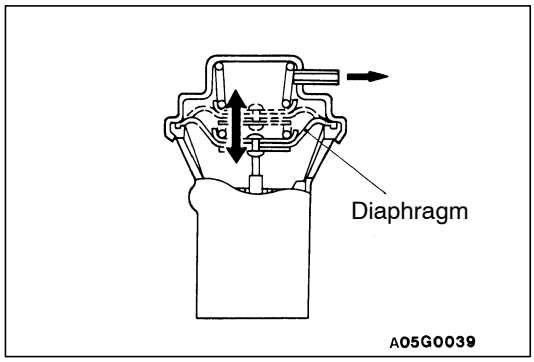


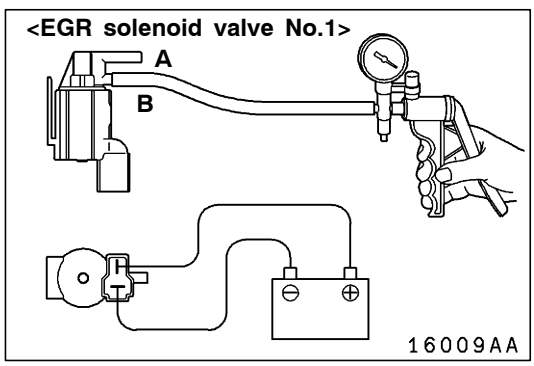


FUNCTION CHECK

1. Start the engine and warm it up until the engine coolant temperature reaches 65°C or above.
2. Race the engine by suddenly depressing the accelerator pedal, then check that the EGR valve diaphragm lifts.

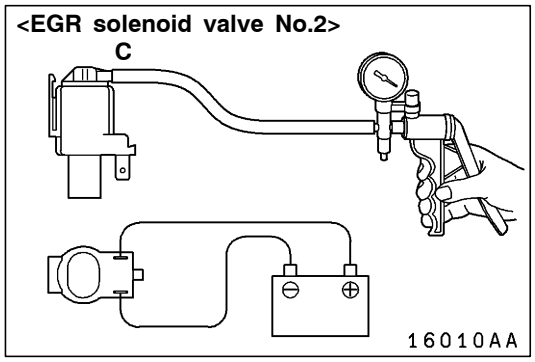
EGR SOLENOID VALVE OPERATION CHECK

1. Remove EGR solenoid valve Nos.1 and 2 connectors and vacuum hoses.
2. Attach a vacuum pump to each nipple of the EGR solenoid valve Nos. 1 and 2 and connect each connector of EGR solenoid valve to battery and apply negative pressure. Check that the valves are airtight both when voltage is applied to each terminal of the EGR solenoid valve Nos. 1 and 2 and when it is not applied.



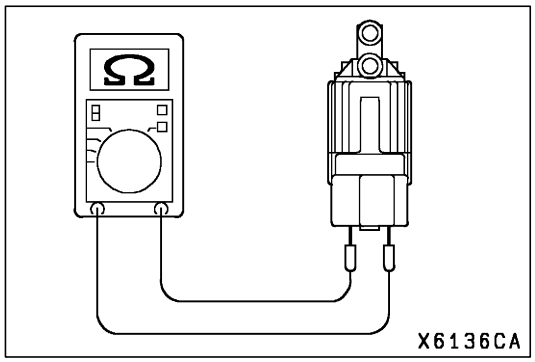
EGR solenoid valve No.1

Battery voltage	Normal condition
When current is flowing	Vacuum leaks (Vacuum is maintained when nipple A is plugged)
When current is not flowing	Vacuum is maintained



EGR solenoid valve No.2

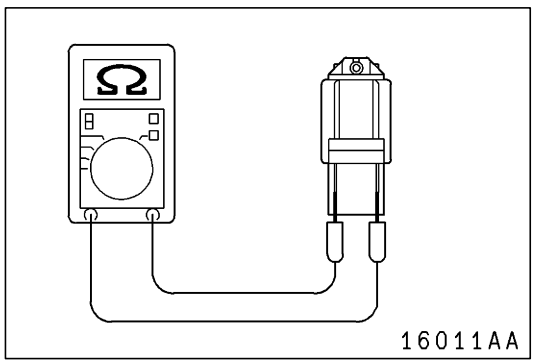
Battery voltage	Normal condition
When current is flowing	Vacuum is maintained
When current is not flowing	Vacuum leaks



EGR SOLENOID VALVE RESISTANCE CHECK

Measure terminal resistance of EGR solenoid valves Nos. 1 and 2 with a circuit tester.

Standard value: 36 - 44 Ω (at 20°C)



ACCELERATOR PEDAL POSITION SENSOR (APS), ENGINE COOLANT TEMPERATURE SENSOR, BOOST AIR TEMPERATURE SENSOR, FUEL TEMPERATURE SENSOR, EGR VALVE POSITION SENSOR CHECK

Refer to GROUP 13E - On-vehicle Service.

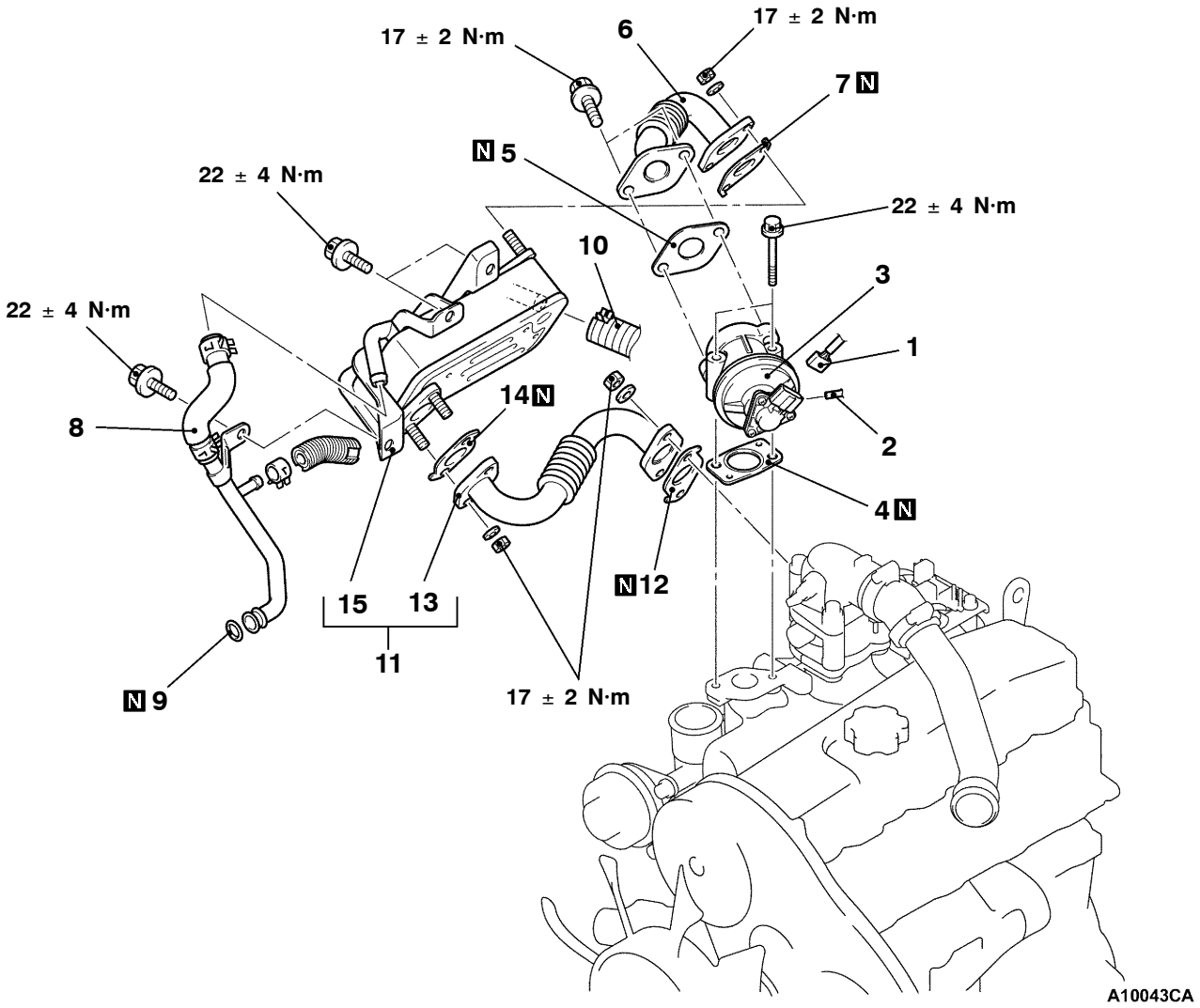
CHECK AT ENGINE-ECU TERMINALS

Refer to GROUP 13E - Troubleshooting.

EGR VALVE AND EGR COOLER

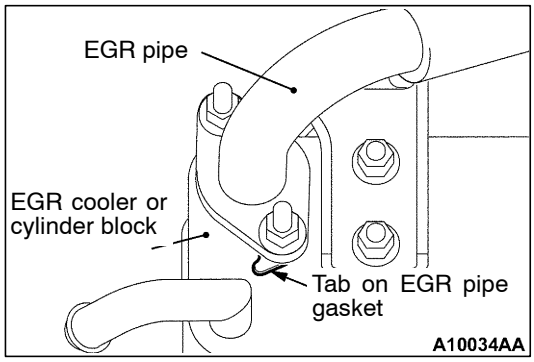
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying.



Removal steps

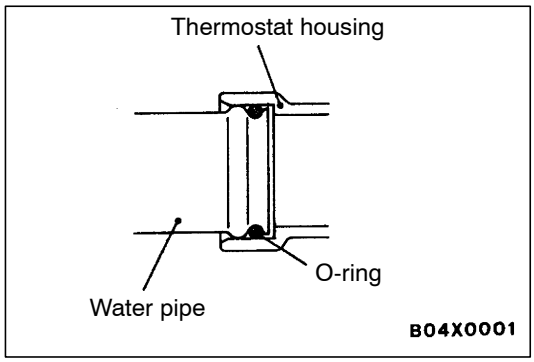
1. EGR valve connector
2. Vacuum hose connection
3. EGR valve
4. EGR gasket
5. EGR pipe gasket
6. EGR upper pipe
▶A◀ 7. EGR pipe gasket
▶C◀ 8. Water pipe and hose assembly
▶B◀ 9. O-ring
10. Water hose connection
11. EGR cooler and EGR lower pipe assembly
▶A◀ 12. EGR pipe gasket
13. EGR lower pipe
▶A◀ 14. EGR pipe gasket
15. EGR cooler



INSTALLATION SERVICE POINT

▶A◀ EGR PIPE GASKET INSTALLATION

The tab on the EGR pipe gasket should be positioned as shown.

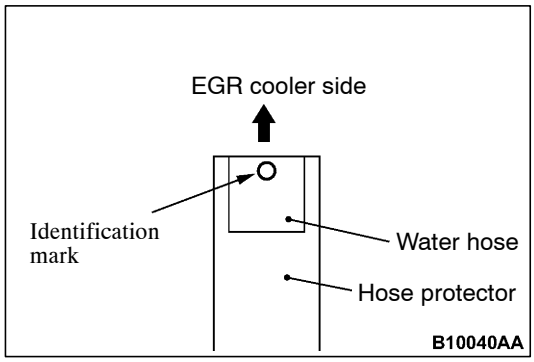


▶B◀ O-RING INSTALLATION

Rinse the mounting location of the O-ring and water pipe with water, and install the O-ring and water pipe.

Caution

1. **Care must be taken not to permit engine oil or other greases to adhere to the O-ring.**
2. **When inserting the pipe, check to be sure that there is no sand, dirt, etc. on its inner surface.**



▶C◀ WATER PIPE AND HOSE ASSEMBLY INSTALLATION

If the water hose is separated from the water pipe for any reason, the identification mark on the water hose end should face towards the EGR cooler.

CATALYTIC CONVERTER

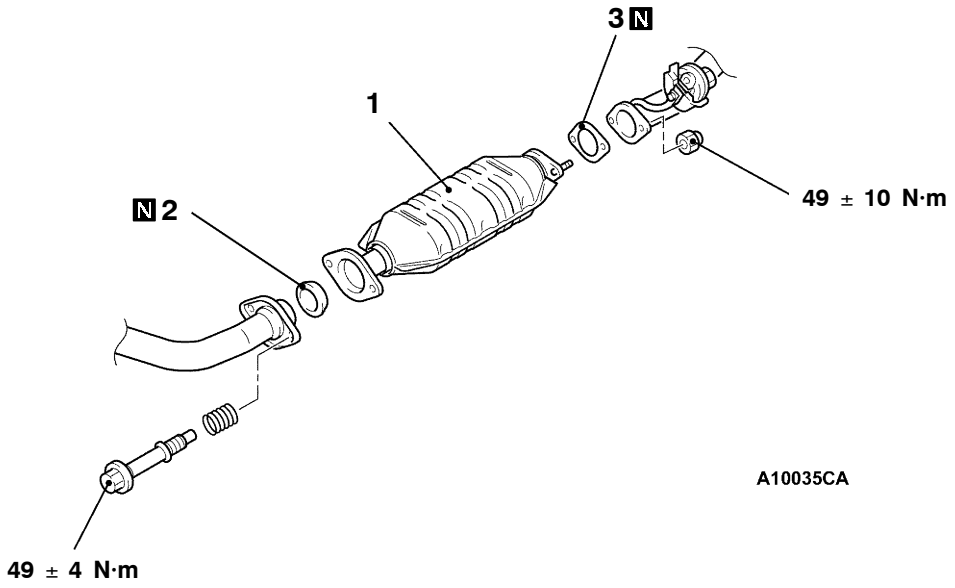
GENERAL INFORMATION

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

Pre-removal and Post-installation Operation
Under Cover Removal and Installation



Removal steps

1. Catalytic converter
2. Seal ring
3. Gasket

EMISSION CONTROL SYSTEM <4M4>

GENERAL

OUTLINE OF CHANGE

Some service procedures have been established as the following changes have been made due to the compliance with the Emission Regulation Step III.

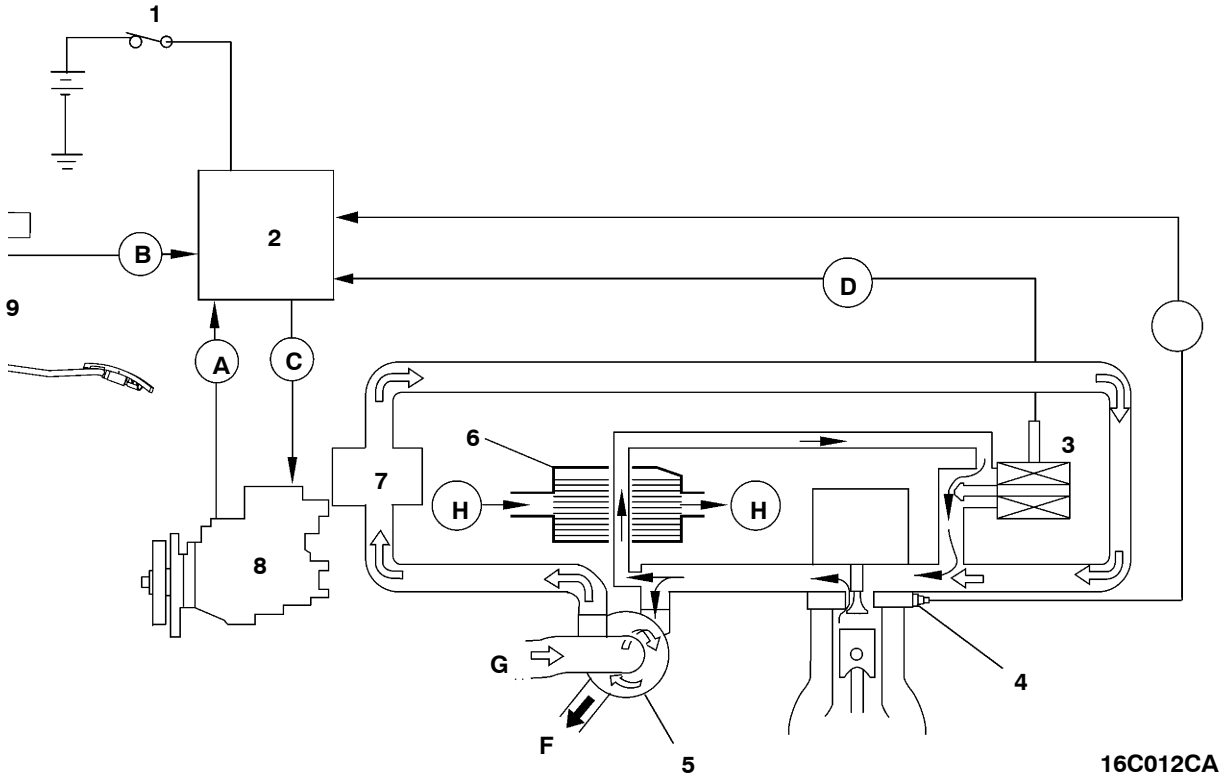
- An electronic-controlled EGR valve and EGR cooler have been used.

SERVICE SPECIFICATION

Items	Standard value
EGR valve assembly output voltage V	0.5 - 4.5

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

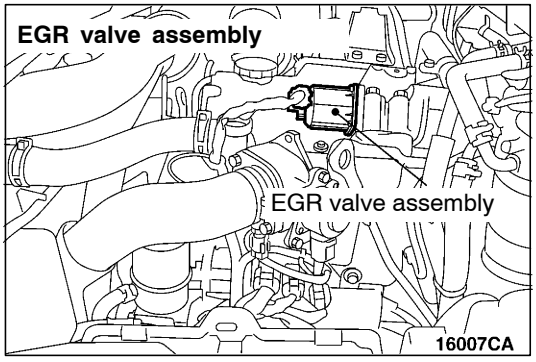
SYSTEM DIAGRAM

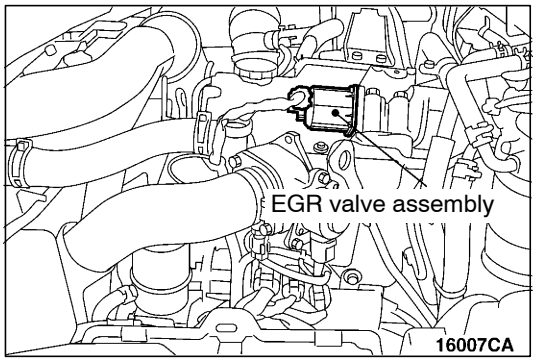


1. Ignition switch
2. Engine-ECU
3. EGR valve assembly
4. Engine coolant temperature sensor
5. Turbocharger
6. EGR cooler
7. Intercooler
8. Fuel injection pump
9. Accelerator pedal

A. Engine speed signal
B. Accelerator pedal opening angle signal
C. Fuel injection timing control signal
D. EGR valve control signal
E. Engine coolant temperature signal
F. Exhaust gas
G. Intake air
H. Engine coolant

COMPONENT LOCATION





EGR VALVE ASSEMBLY CHECK

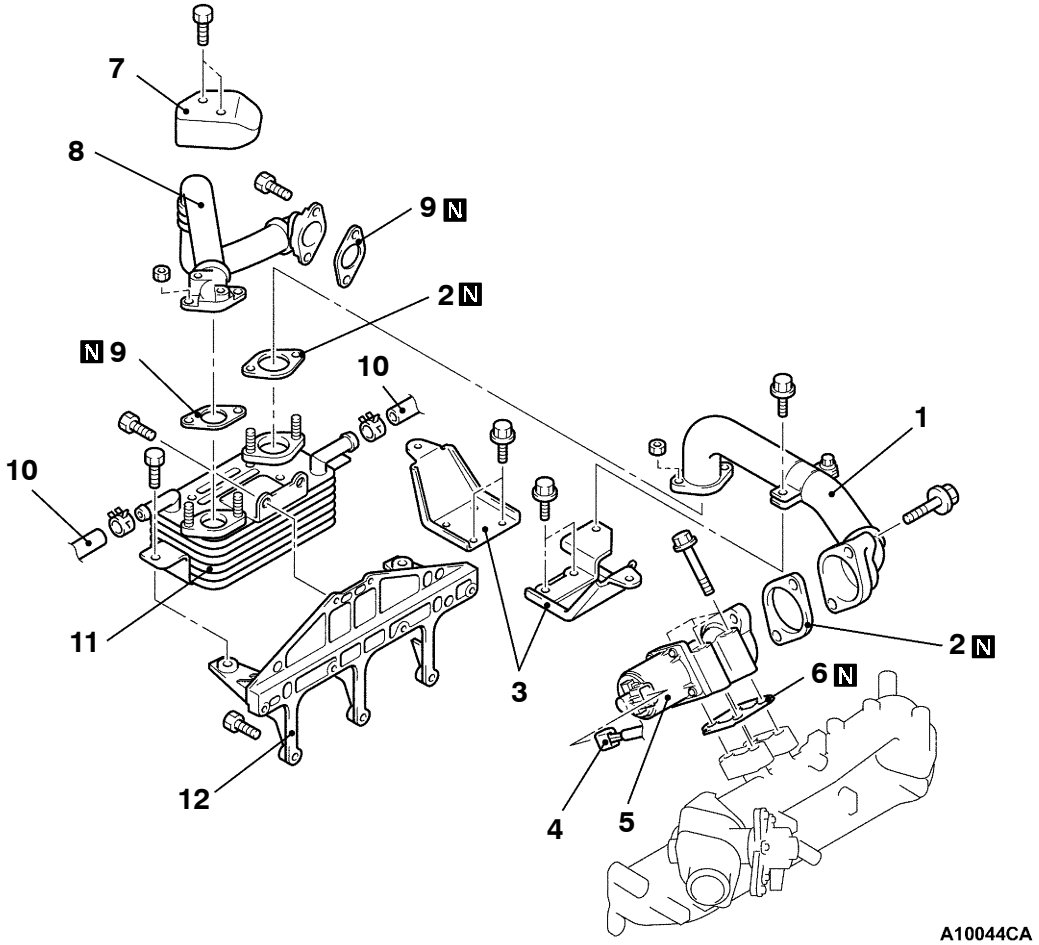
1. Connect the MUT-II to the diagnosis connector to check for data list item No.32.
2. Start the engine, and warm up the engine.
3. Raise the engine speed gradually, and make sure that the output voltage changes within the standard value range.

   Standard value: 0.5 - 4.5 V
4. If not within the standard value range, replace the EGR valve.

EGR VALVE AND EGR COOLER <4M4>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying.
- Engine Cover Removal and Installation.



Removal steps

1. EGR pipe B
2. EGR pipe gasket
3. Engine cover bracket
4. EGR valve connector
5. EGR valve
6. EGR valve gasket
- Air cleaner assembly
7. EGR pipe insulator
8. EGR pipe A
9. EGR pipe gasket
10. Water hose connection
11. EGR cooler assembly
12. EGR cooler bracket

NOTES

CLUTCH

Click on the applicable bookmark to selected the required model year.

CLUTCH

CONTENTS

GENERAL INFORMATION 2

SERVICE SPECIFICATIONS 2

LUBRICANTS 2

ON-VEHICLE SERVICE 2

Clutch Pedal Inspection and Adjustment 2

Clutch Pedal Position Switch Continuty Check 3

Bleeding 3

CLUTCH PEDAL 4

CLUTCH CONTROL 5

Clutch Master Cylinder 8

GENERAL INFORMATION

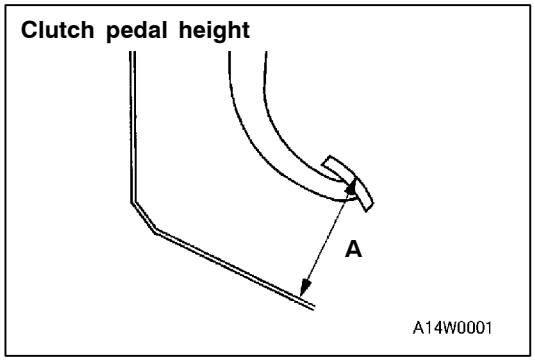
The clutch is a dry single-disc, diaphragm type; hydraulic pressure is used for the clutch control.

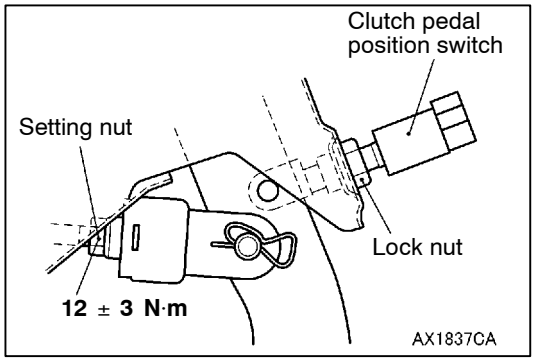
SERVICE SPECIFICATIONS

Items	Standard value
Clutch pedal height mm	202 - 205 <L.H. drive vehicles> 197 - 200 <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	75 or more <L.H. drive vehicles> 70 or more <R.H. drive vehicles>

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

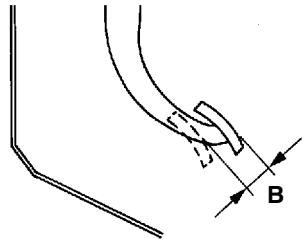
1. Turn up the carpet, etc. under the clutch pedal.
2. Measure the clutch pedal height.
   Standard value (A):

   202 - 205 mm <L.H. drive vehicles>

   197 - 200 mm <R.H. drive vehicles>

3. If the height of the clutch pedal is outside the standard value, loosen the setting nut or clutch pedal position switch lock nut <vehicles with auto-cruise control> to adjust the pedal height to the standard value.

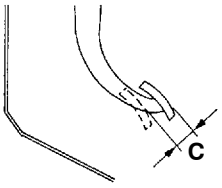
Clutch pedal clevis pin play



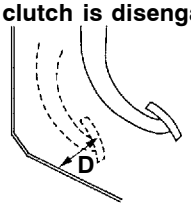
4. Measure the clutch pedal clevice pin play.
   Standard value (B): 1 - 3 mm
5. If the clutch pedal play is not within the standard value, loosen the setting nut to adjust the play to the standard value.

   Caution
   Do not push in the master cylinder push rod at this time, otherwise the clutch will not operate properly.

Clutch pedal free play

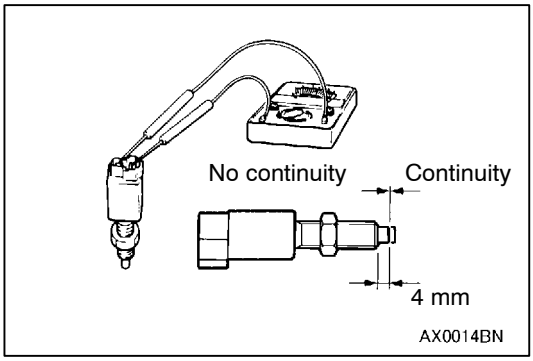


Distance between the clutch pedal and the toeboard when the clutch is disengaged



6. 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):
   75 mm or more <L.H. drive vehicles>
   70 mm or more <R.H. drive vehicles>
7. 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.
8. Turn back the carpet, etc.



CLUTCH PEDAL POSITION SWITCH CONTINUITY CHECK

1. Adjust the clutch pedal. (Refer to P.21-2.)
2. Depress the clutch pedal, and check the continuity between the terminals.

Measurement Conditions	Terminal No.	Terminal No.
	1	2
Clutch pedal depressed	○	○
Clutch pedal not depressed		

BLEEDING

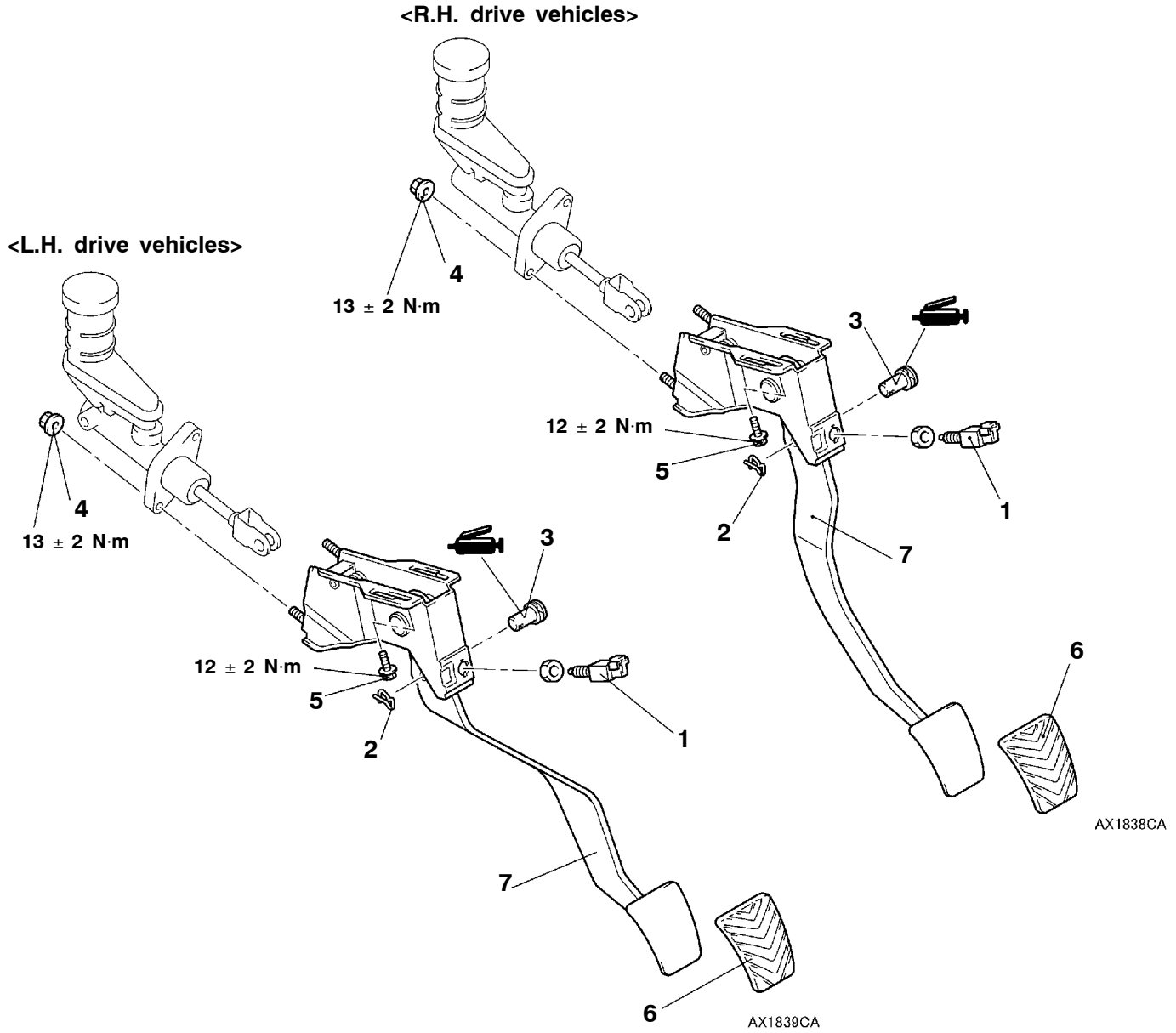
Specified fluid: Brake fluid DOT 3 or DOT 4

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)



Removal steps

- Stay A (Refer to GROUP 52A - Instrument Panel)

1. Clutch pedal position switch <vehicles with auto-cruise control>
2. Snap pin
3. Clevis pin
4. Clutch master cylinder mounting nut
5. Master cylinder member mounting bolt
6. Pedal pad
7. Clutch pedal assembly

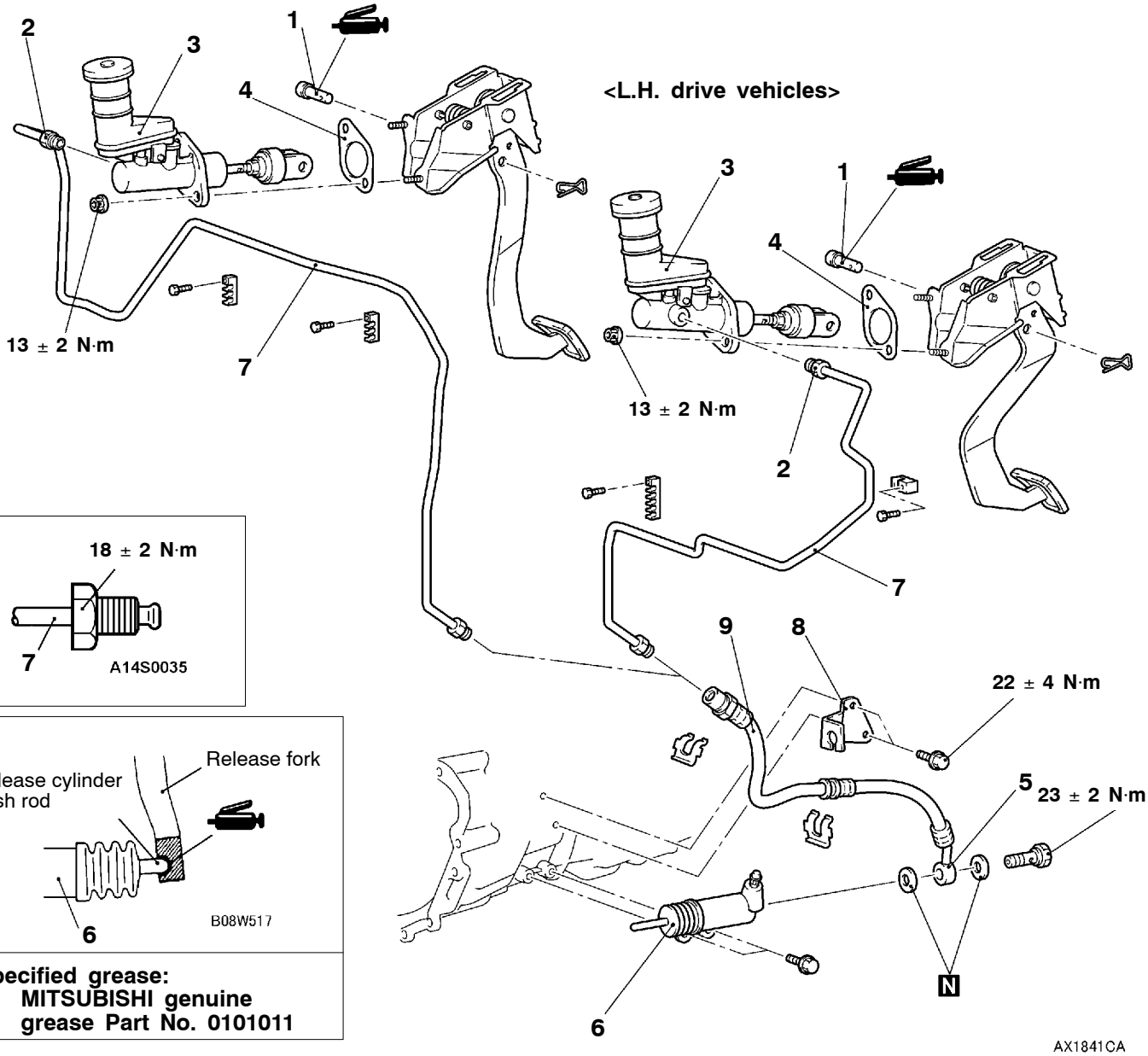
CLUTCH CONTROL

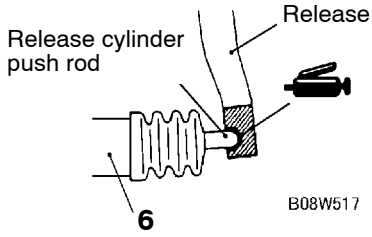
REMOVAL AND INSTALLATION

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)

<6G74>
<R.H. drive vehicles>





Specified grease:
MITSUBISHI genuine grease Part No. 0101011

Clutch master cylinder assembly removal steps

1. Clevis pin
2. Clutch tube connection
3. Clutch master cylinder assembly
4. Sealer

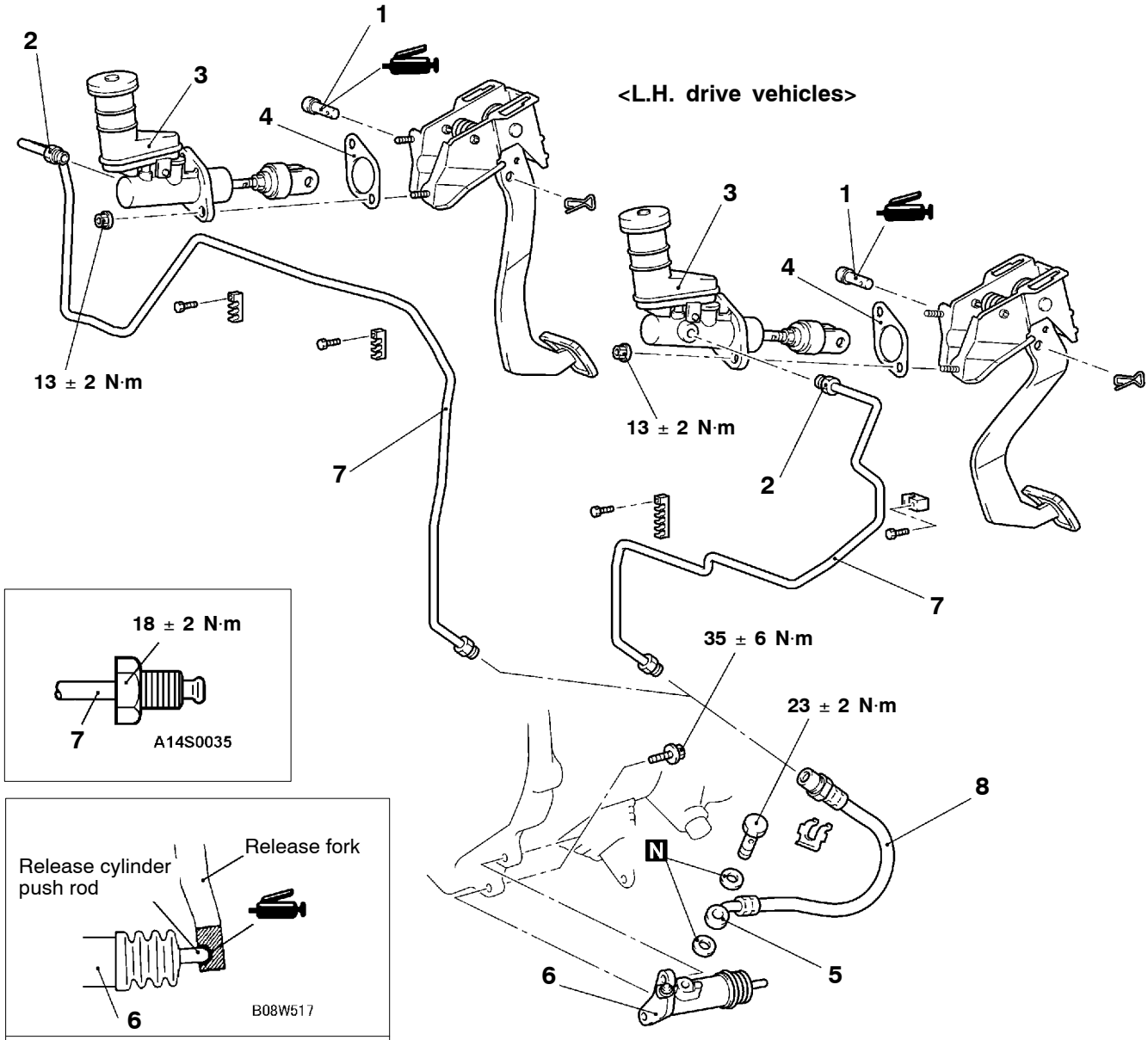
Clutch release cylinder assembly removal steps

5. Clutch hose connection
6. Clutch release cylinder assembly

Clutch line removal steps

7. Clutch tube
8. Bracket
9. Clutch hose

<4D56>
<R.H. drive vehicles>



Specified grease:
MITSUBISHI genuine grease Part No. 0101011

Clutch master cylinder assembly removal steps

1. Clevis pin
2. Clutch tube connection
3. Clutch master cylinder assembly
4. Sealer

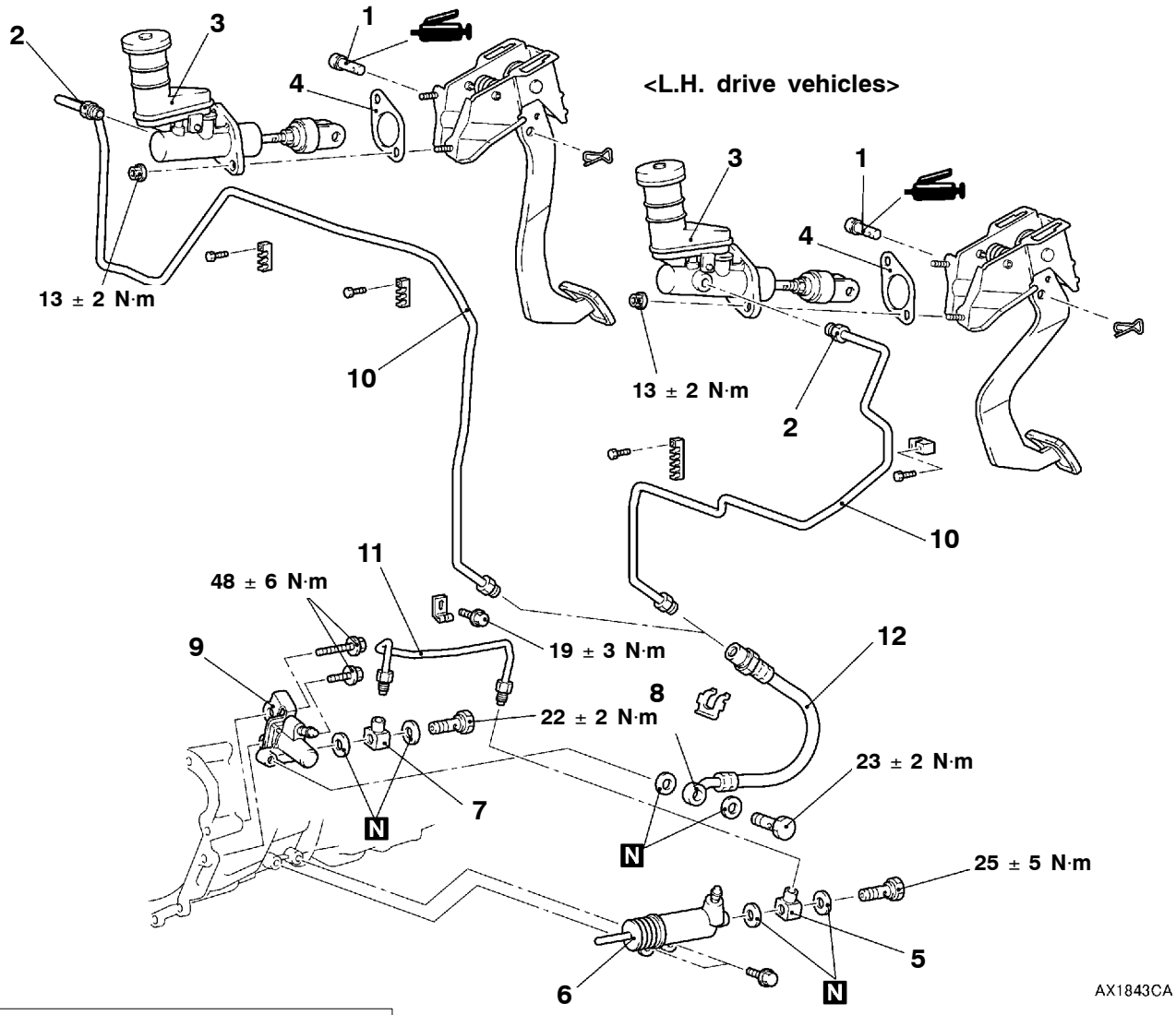
Clutch release cylinder assembly removal steps

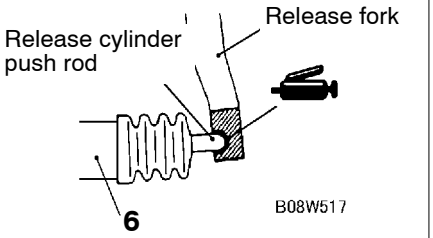
5. Clutch hose connection
6. Clutch release cylinder assembly

Clutch line removal steps

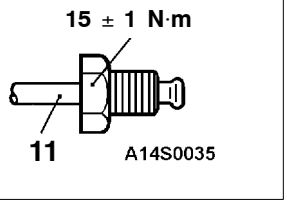
7. Clutch tube
8. Clutch hose

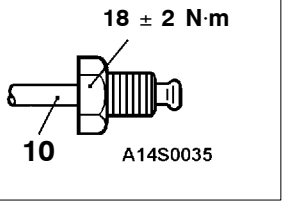
<4M41>
<R.H. drive vehicles>





Specified grease:
MITSUBISHI genuine grease Part No. 0101011





Clutch master cylinder assembly removal steps

1. Clevis pin
2. Clutch tube connection
3. Clutch master cylinder assembly
4. Sealer

Clutch release cylinder assembly removal steps

5. Union
6. Clutch release cylinder assembly

Clutch chamber assembly removal steps

7. Union
8. Clutch hose connection
9. Clutch chamber assembly

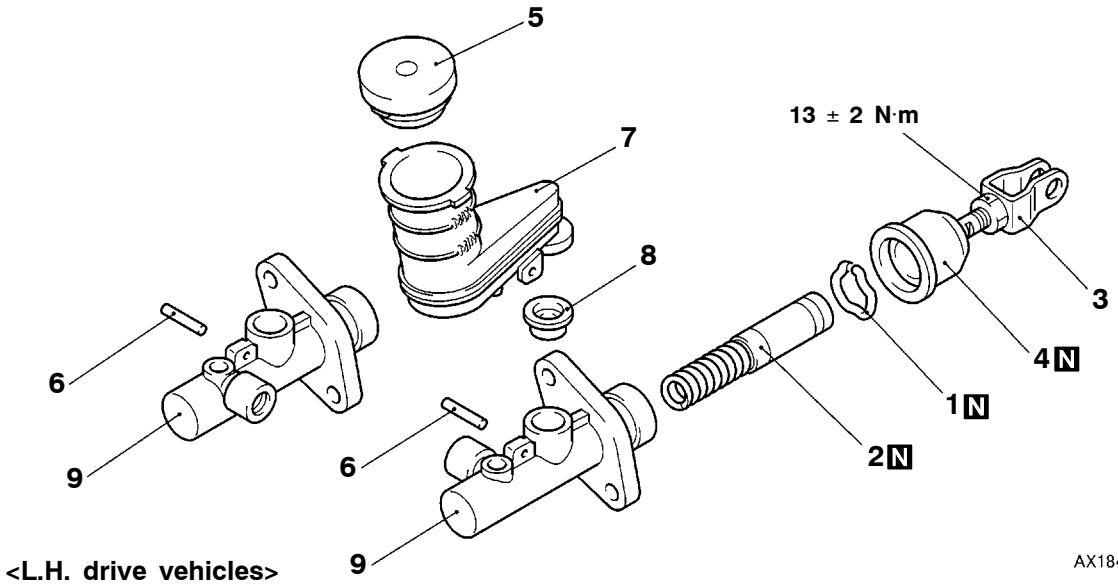
Clutch line removal steps

10. Clutch tube
11. Clutch tube
12. Clutch hose

DISASSEMBLY AND REASSEMBLY

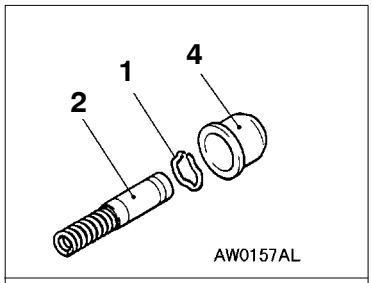
CLUTCH MASTER CYLINDER

Caution
Do not disassemble piston assembly.

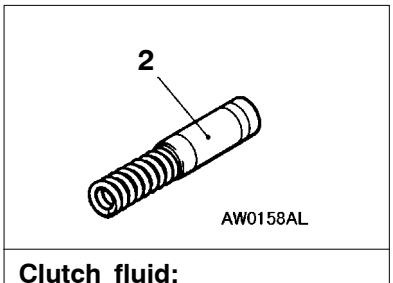


<L.H. drive vehicles>

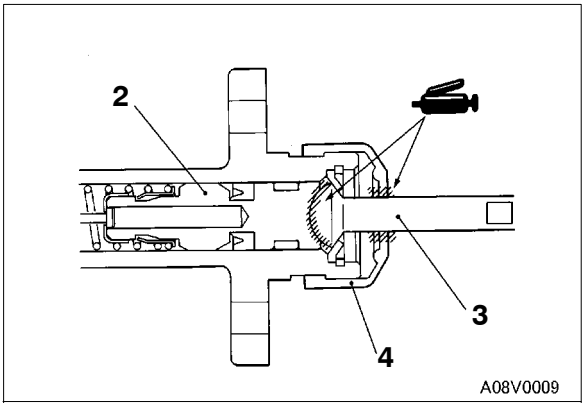
<R.H. drive vehicles>



Piston repair kit



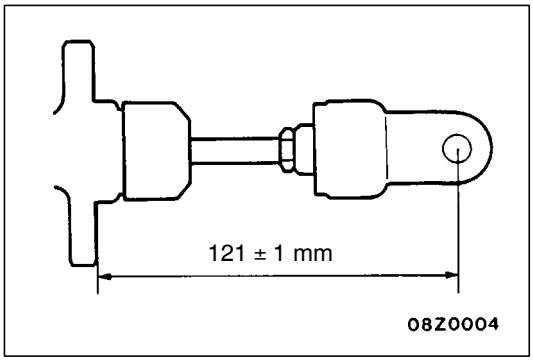
Clutch fluid:
Brake fluid DOT3 or DOT4



Grease: Rubber grease

Disassembly steps

1. Piston stopper ring
2. Piston assembly
▶A◀ 3. Push rod assembly
4. Boot
5. Reservoir cap
6. Spring pin
7. Reservoir tank
8. Seal
9. Master cylinder body



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.

MANUAL TRANSMISSION

Click on the applicable bookmark to selected the required model year.

MANUAL TRANSMISSION

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TRANSMISSION ASSEMBLY 10

4WD INDICATOR-ECU/TRANSFER-ECU 17

GENERAL INFORMATION

Items		Specifications			
Transmission model		V5MT1	V5M31		
Engine model		4D5	4D5	4M4	6G7
Type		5-speed, floor-shift			
Gear ratio	1st	3.918	3.952	4.234	
	2nd	2.261	2.238		
	3rd	1.395	1.398		
	4th	1.000			
	5th	0.829	0.819	0.761	0.819
	Reverse	3.925	3.553		
Transfer type		2-speed			
Gear ratio	High	1.000			
	Low	1.925	1.900		

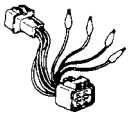
LUBRICANTS

Items	Specified lubricants	Quantity L
Transmission oil	Hypoid gear oil SAE 75W-90 or 75W-85W conforming to API GL-4	3.2
Transfer oil	Hypoid gear oil SAE 75W-90 or 75W-85W conforming to API GL-4	2.5

SEALANTS

Items	Specified sealant	Remarks
Oil filler plug	3M ATD Part No. 8660 or equivalent	Semi-drying sealant
Oil drain plug	3M ATD Part No. 8660 or equivalent	Semi-drying sealant

SPECIAL TOOL

Tool	Number	Name	Use
	MD998464	Test harness (4P, square)	Inspection of lever position sensor

TROUBLESHOOTING <SS4 II>

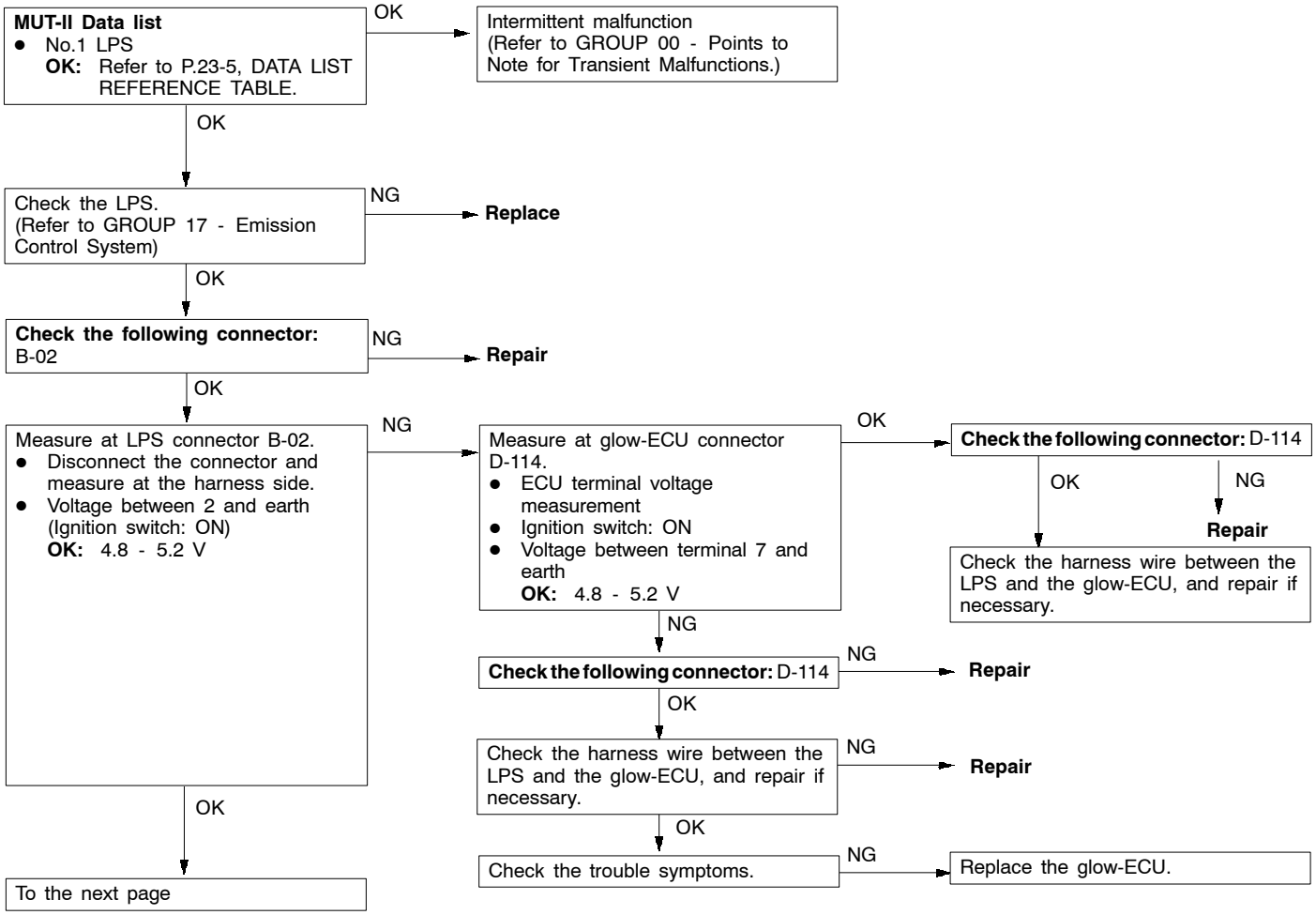
For items other than the following service procedures, refer to GROUP 23 - Troubleshooting <SS4 II>.

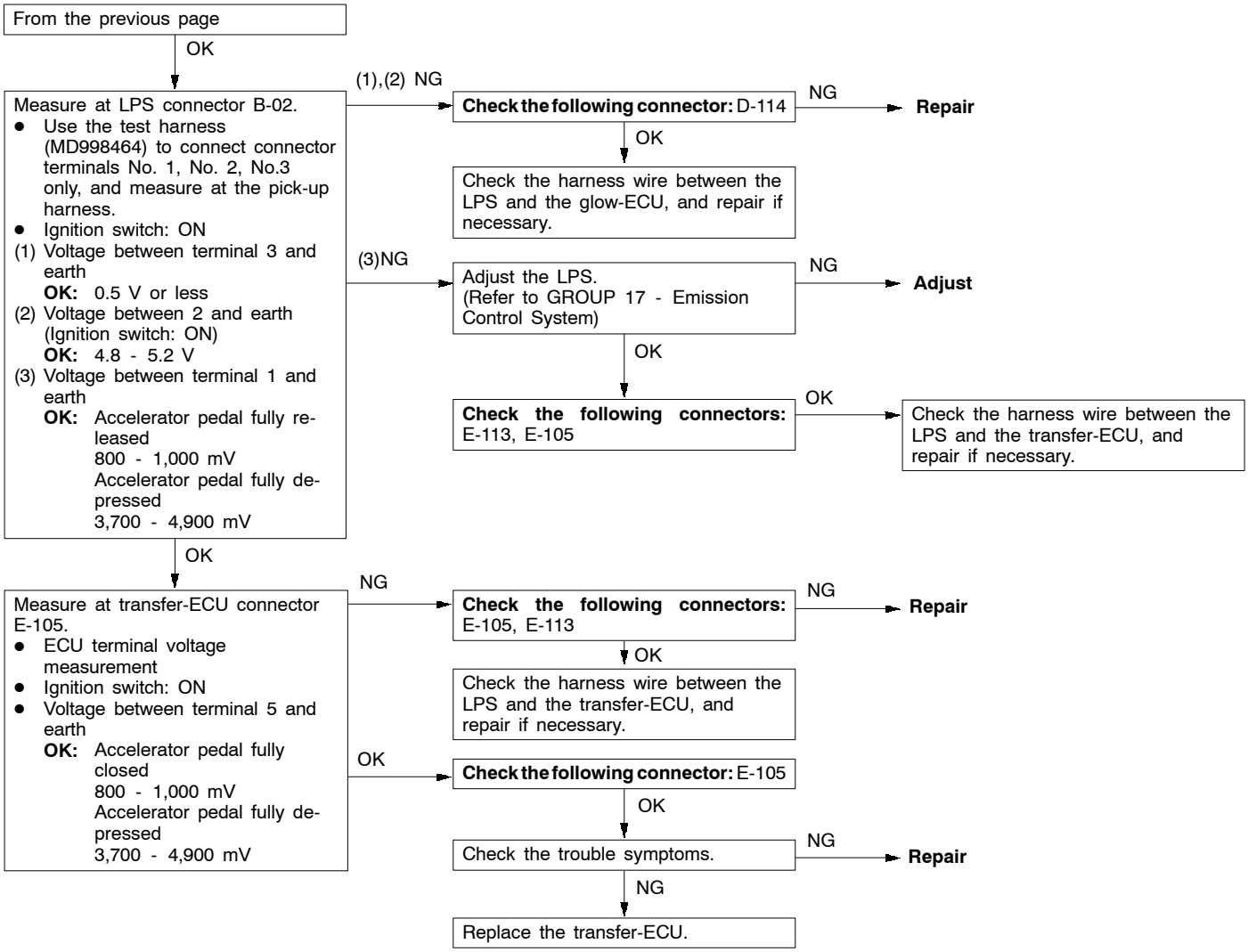
INSPECTION CHART FOR DIAGNOSIS CODES

Diagnosis code	Diagnosis item		Reference page
21	Lever position sensor (LPS) system <4D5>	Open circuit/Malfunction of sensor	22-3

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code No.21 Lever position sensor (LPS) system <4D5>	Probable cause
If the LPS output voltage becomes 0.2 V or less at idling, code No.21 will be set as open circuit or maladjustment of the LPS.	• Malfunction of the LPS • Malfunction of harness or connector • Malfunction of transfer-ECU • Malfunction of the glow-ECU



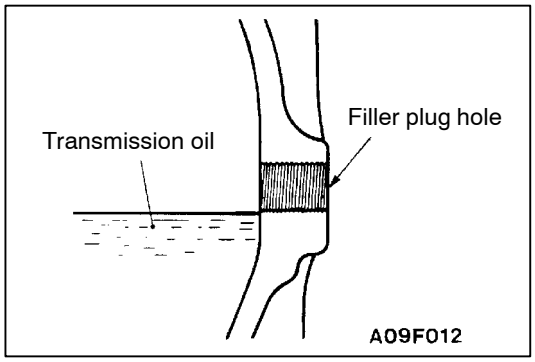

From the previous page
OK
Measure at LPS connector B-02.
● Use the test harness (MD998464) to connect connector terminals No. 1, No. 2, No.3 only, and measure at the pick-up harness.
● Ignition switch: ON
(1) Voltage between terminal 3 and earth
OK: 0.5 V or less
(2) Voltage between 2 and earth (Ignition switch: ON)
OK: 4.8 - 5.2 V
(3) Voltage between terminal 1 and earth
OK: Accelerator pedal fully released
800 - 1,000 mV
Accelerator pedal fully depressed
3,700 - 4,900 mV
(1),(2) NG
Check the following connector: D-114
NG
Repair
OK
Check the harness wire between the LPS and the glow-ECU, and repair if necessary.
(3)NG
Adjust the LPS.
(Refer to GROUP 17 - Emission Control System)
NG
Adjust
OK
Check the following connectors: E-113, E-105
OK
Check the harness wire between the LPS and the transfer-ECU, and repair if necessary.
OK
Measure at transfer-ECU connector E-105.
● ECU terminal voltage measurement
● Ignition switch: ON
● Voltage between terminal 5 and earth
OK: Accelerator pedal fully closed
800 - 1,000 mV
Accelerator pedal fully depressed
3,700 - 4,900 mV
NG
Check the following connectors: E-105, E-113
NG
Repair
OK
Check the harness wire between the LPS and the transfer-ECU, and repair if necessary.
OK
Check the following connector: E-105
OK
Check the trouble symptoms.
NG
Repair
NG
Replace the transfer-ECU.

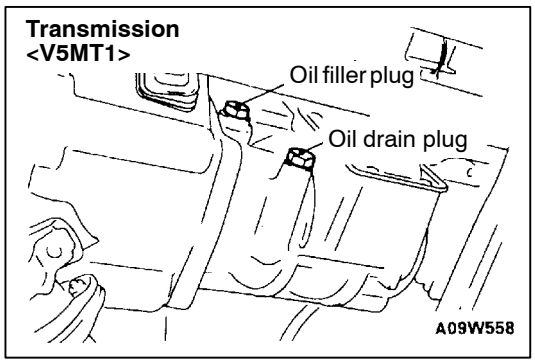
DATA LIST REFERENCE TABLE

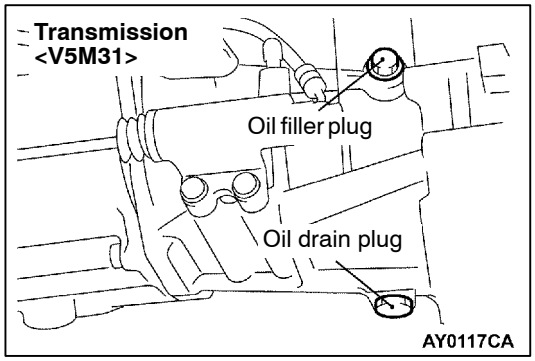
Data list No.	Check item	Check conditions		Normal condition
1	Lever position sensor (LPS) <4D5>	Engine: Stopped Selector lever position: P	Accelerator pedal: Fully closed	800 - 1,000 mV
			Accelerator pedal: Depressed	Gradually increases from the above value.
			Accelerator pedal: Fully open	3,700 - 4,900 mV

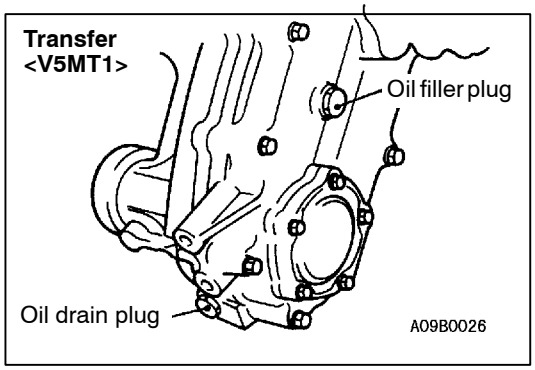
CHECK AT TRANSFER-ECU TERMINAL

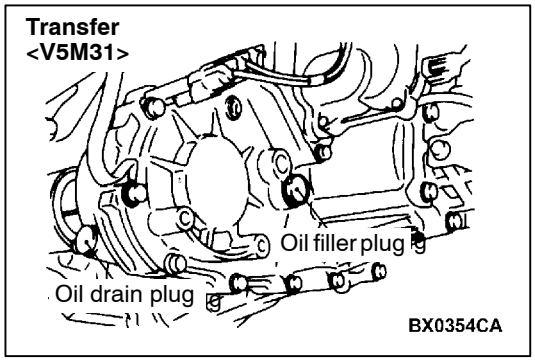
Terminal No.	Check item	Check conditions	Standard value
5	Lever position sensor (LPS) <4D5>	Accelerator pedal: Fully closed (engine stopped)	0.8 - 1.0 V
		Accelerator pedal: Fully open (engine stopped)	3.7 - 4.9 V











ON-VEHICLE SERVICE

TRANSMISSION OIL CHECK

1. Remove the oil filler plug.
2. Oil level should be at the lower portion of the filler plug hole.
3. Check that the transmission oil is not noticeably dirty, and that it has a suitable viscosity.
4. Tighten the filler plug to the specified torque.

Tightening torque: 32 ± 2 N·m

OIL REPLACEMENT

1. Remove oil filler plug and oil drain plug.
2. Drain oil.
3. Apply sealant to the oil drain plug threads.
4. Tighten the oil drain plug to the specified torque.

Tightening torque:

V5MT1 39 ± 5 N·m

V5M31 32 ± 2 N·m

Transfer 32 ± 2 N·m

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

5. Fill with specified oil till the level comes to the lower portion of oil filler plug hole.

Specified transmission oil:

Hypoid gear oil SAE 75W-90 or 75W-85W conforming to API GL-4

Quantity:

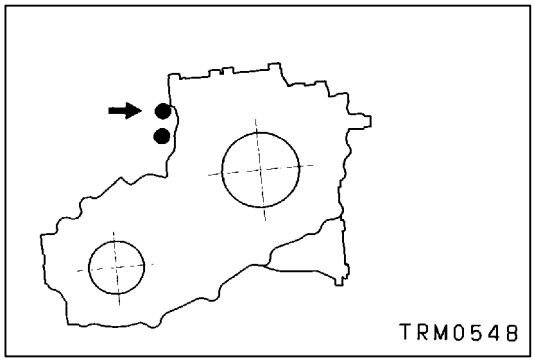
Transmission 3.2 L

Transfer 2.5 L

6. Apply sealant to the oil filler plug threads.
7. Tighten the oil filler plug to the specified torque.

Tightening torque: 32 ± 2 N·m

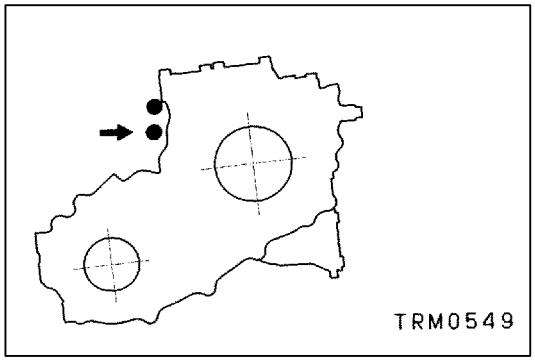
Specified sealant:
3M ATD Part No. 8660 or equivalent



4WD DETECTION SWITCH CONTINUITY CHECK <V5MT1>

Check the continuity between terminals of the black connector indicated in the illustration.

Transfer lever position	Terminal No.	
	1	2
2H		
4H	○	○



HIGH/LOW DETECTION SWITCH CONTINUITY CHECK <V5MT1>

Check the continuity between terminals of the gray connector indicated in the illustration.

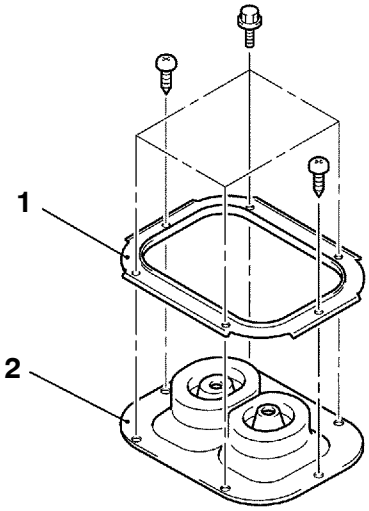
Transfer lever position	Terminal No.	
	1	2
4H	○	○
4L	○	○
4H-4L		

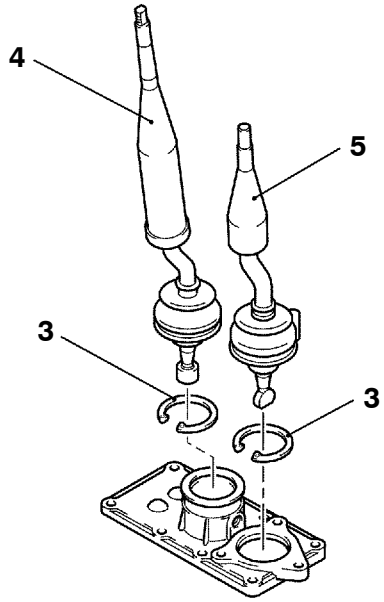
TRANSMISSION CONTROL <V5MT1>

REMOVAL AND INSTALLATION

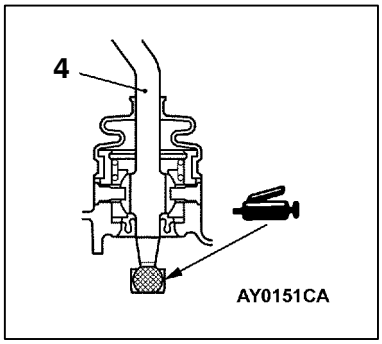
Pre-removal Operation
- Shift the Transmission Control Lever to the N Position.
- Shift the Transfer Control Lever to the 4H Position.

Post-installation Operation
Check the Operation of the Transmission and Transfer Control Levers and the Movement in Each Lever Position.





AY0150CA



Transmission control lever assembly removal steps
- Indicator panel (Refer to GROUP 52A - Floor Console)

1. Retainer plate
2. Shift control boot
3. Snap ring
4. Transmission control lever assembly

Transfer control lever assembly removal steps
- Indicator panel (Refer to GROUP 52A - Floor Console)

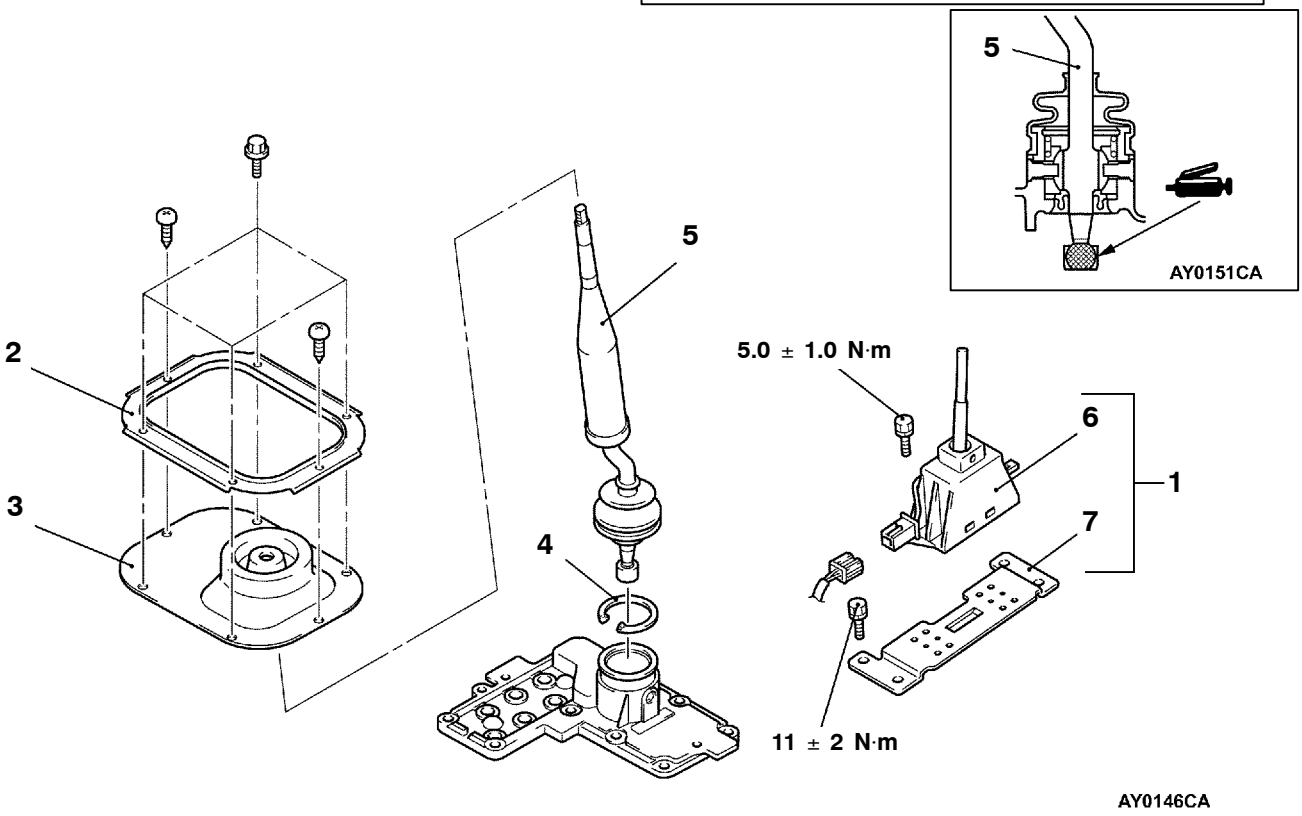
1. Retainer plate
2. Shift control boot
3. Snap ring
5. Transfer control lever assembly

TRANSMISSION CONTROL <V5MT3>

REMOVAL AND INSTALLATION

Pre-removal Operation
Shift the Transmission Control Lever to the N Position.

Post-installation Operation
Check the Operation of the Transmission and Transfer Control Levers and the Movement in Each Lever Position.



Transmission control lever assembly removal steps

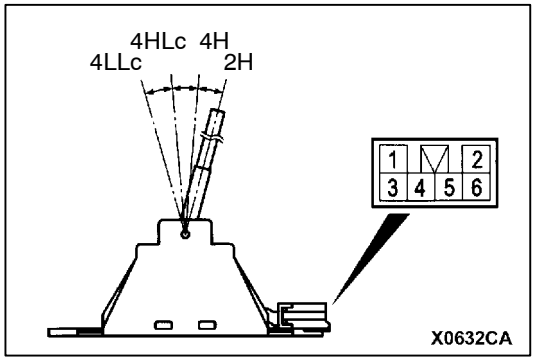
- Indicator panel (Refer to GROUP 52A - Floor Console)

1. Transfer select switch assembly
2. Retainer plate
3. Shift control boot
4. Snap ring
5. Transmission control lever assembly

Transfer select switch assembly removal steps

- Indicator panel (Refer to GROUP 52A - Floor Console)

6. Transfer select switch
7. Transfer select switch bracket



INSPECTION

TRANSFER SELECT SWITCH CONTINUITY CHECK

Switch position	Terminal number				
	1	2	3	5	6
2H	○		○		
4H	○			○	
4HLc	○				○
4LLc	○	○			

TRANSMISSION ASSEMBLY

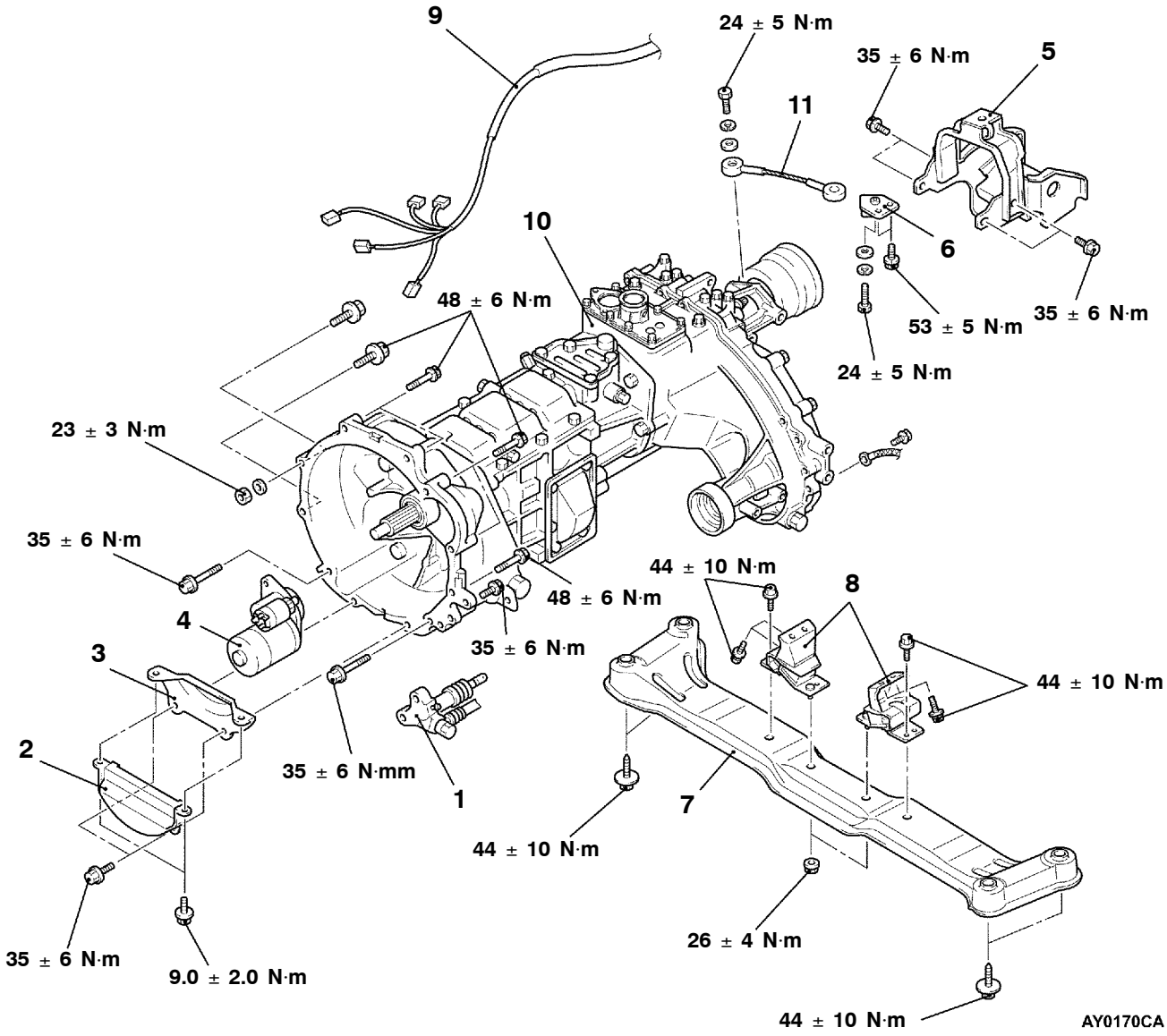
REMOVAL AND INSTALLATION

Caution
The rear propeller shaft is made of fiber-reinforced plastic tube, so always refer to GROUP 25 prior to its removal.

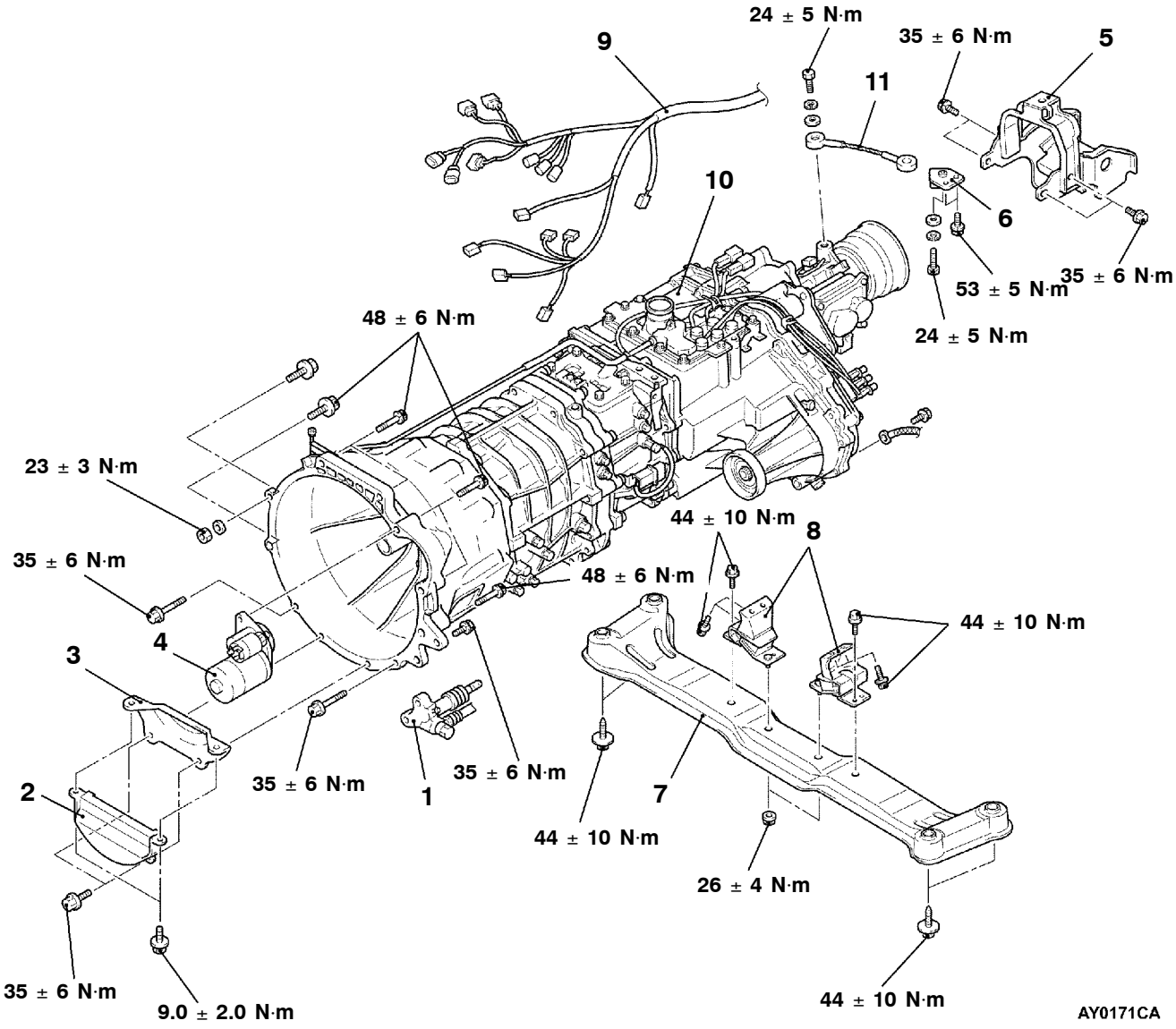
Pre-removal Operation
- Transmission and Transfer Control Lever Removal (Refer to P.22-8.)
- Transmission and Transfer Oil Draining (Refer to P.22-6.)
- Front and Rear Propeller Shaft Removal (Refer to GROUP 25 - Propeller Shaft.)
- Front and Center Exhaust Pipe Removal (Refer to GROUP 15 - Exhaust Pipe and Main Muffler)

Post-installation Operation
- Front and Center Exhaust Pipe Installation (Refer to GROUP 15 - Exhaust Pipe and Main Muffler)
- Front and Rear Propeller Shaft Installation (Refer to GROUP 25 - Propeller Shaft.)
- Transmission and Transfer Oil Filling (Refer to P.22-6.)
- Transmission and Transfer Control Lever Installation (Refer to P.22-8.)
- Transmission and Transfer Control Lever Operation Check

<4D5 with V5MT1>



<4D5 with V5M31>



Removal steps

1. Clutch release cylinder
2. Space rubber
3. Bell housing cover
4. Starter motor
5. Dynamic damper assembly
6. Tension wire bracket
   - Support the transmission with a transmission jack

◀A▶

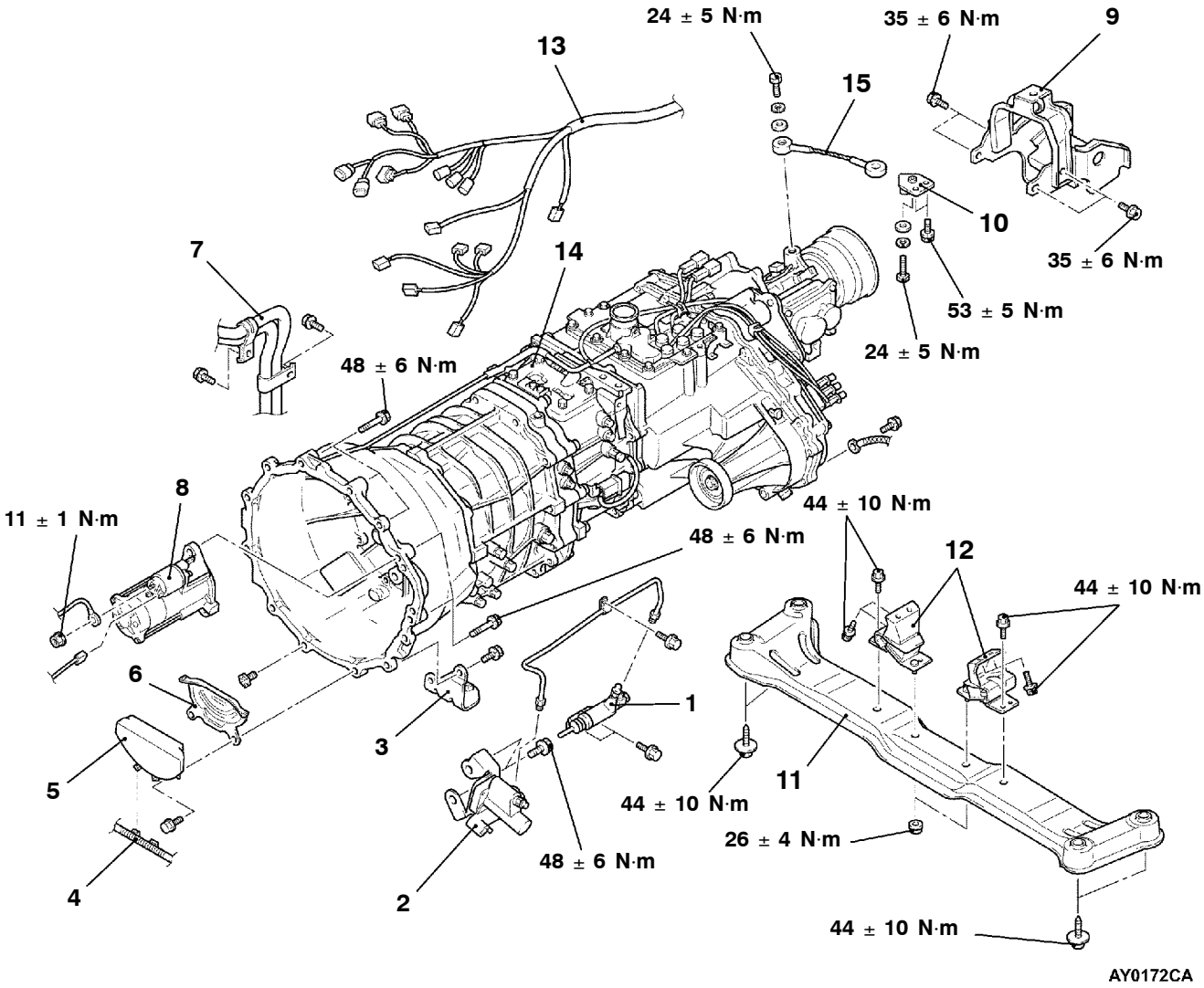
7. Transmission mount center member assembly
8. Transmission mount insulator assembly
9. Transmission wiring harness connector connection

▶A◀

10. Transmission assembly
11. Tension wire

<4M4 with V5M31>

Pre-removal and Post-installation Operations
- Skid Plate and Under Cover Removal and Installation
- Transmission Fluid and Transfer Oil Draining and Refilling (Refer to P.22-6.)
- Front and Rear Propeller Shaft Removal and Installation (Refer to GROUP 25.)
- Front Exhaust Pipe and Catalytic Converter Removal and Installation (Refer to GROUP 15.)
- Radiator Shroud Lower Cover Removal and Installation (Refer to GROUP 14.)
- Intercooler Removal and Installation (Refer to GROUP 15)



Removal steps

1. Clutch release cylinder (Refer to GROUP15)
2. Clutch dumper assembly (Refer to GROUP15)
3. Exhaust support bracket
4. Battery cable connection
5. Spacing rubber
6. Dust cover
7. Heater hose connection
8. Starter motor

9. Dynamic damper
10. Tension wire bracket
    - Support the transmission with a transmission jack
11. Transmission mount center member assembly
12. Transmission mount insulator assembly

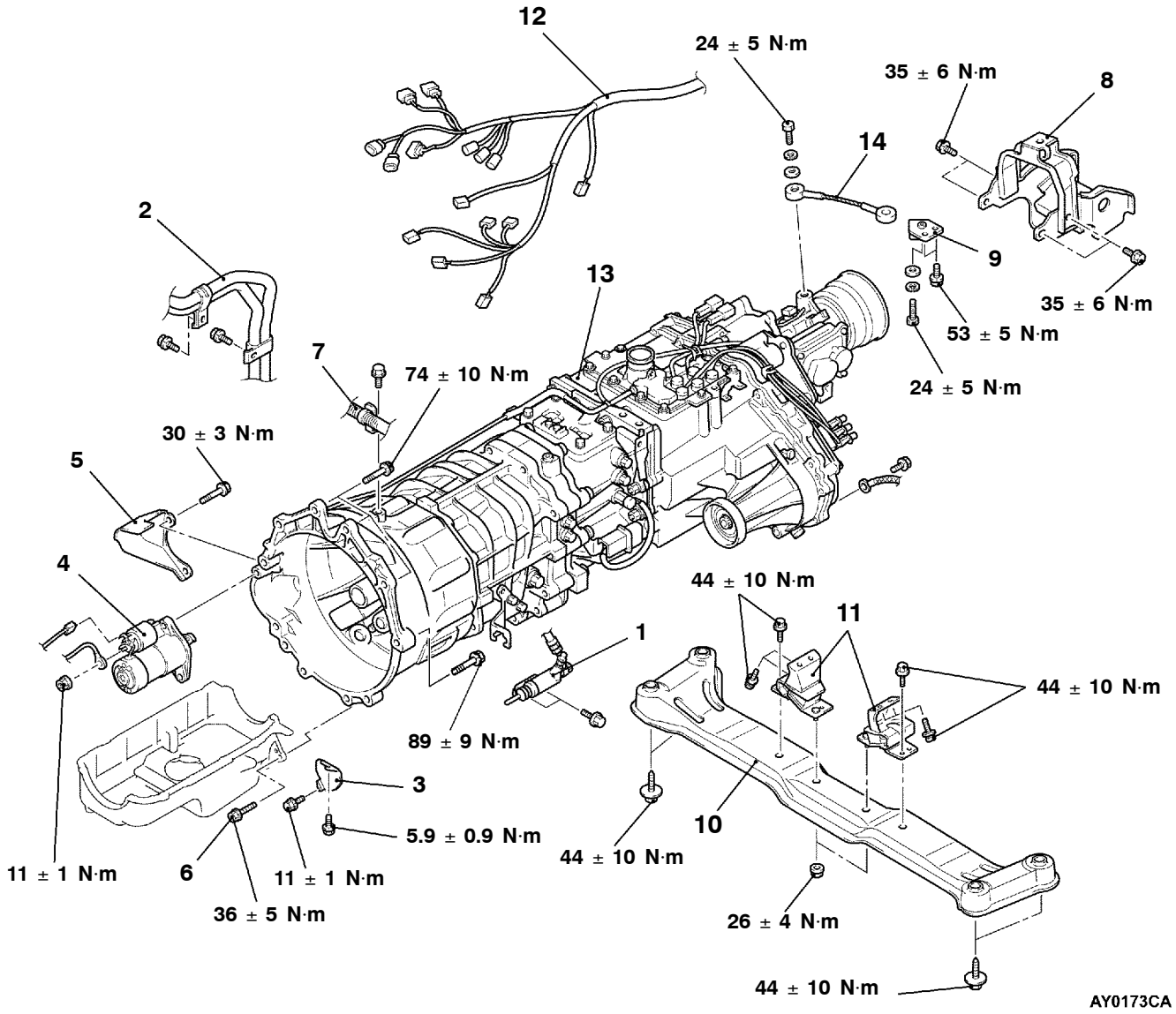
◀A▶ 13. Transmission harness connector connection

◀B▶
    - Clutch release bearing disconnection

▶A◀ 14. Transmission assembly
15. Tension wire

<6G7 with V5M31>

Pre-removal and Post-installation Operations
- Skid Plate and Under Cover Removal and Installation
- Transmission Fluid and Transfer Oil Draining and Refilling (Refer to P.22-6.)
- Front and Rear Propeller Shaft Removal and Installation (Refer to GROUP 25.)
- Front Exhaust Pipe Removal and Installation (Refer to GROUP 15.)
- Radiator Shroud Lower Cover Removal and Installation (Refer to GROUP 14.)



Removal steps

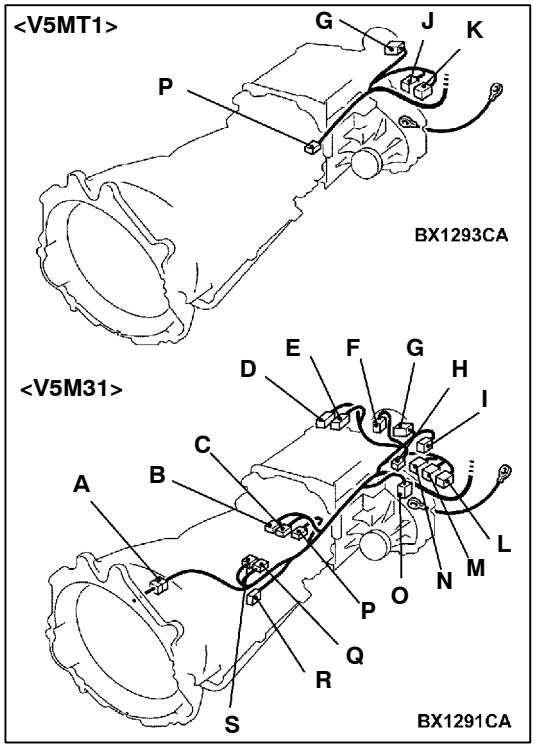
1. Clutch release cylinder (Refer to GROUP15)
2. Heater hose connection
3. Cover
4. Starter motor
5. Starter cover
6. Oil pan connection bolts
7. Battery cable connection
8. Dynamic damper
9. Tension wire bracket
- Support the transmission with a transmission jack
10. Transmission mount center member assembly
11. Transmission mount insulator assembly

◀A▶ 12. Transmission harness connector connection

◀B▶ - Clutch release bearing disconnection

▶A◀ 13. Transmission assembly

14. Tension wire

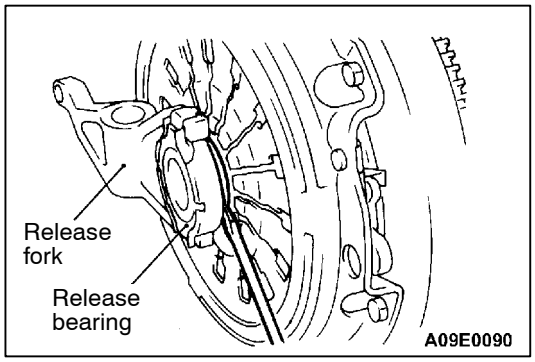


REMOVAL SERVICE POINT

◀A▶ TRANSMISSION WIRING HARNESS CONNECTOR DISCONNECTION

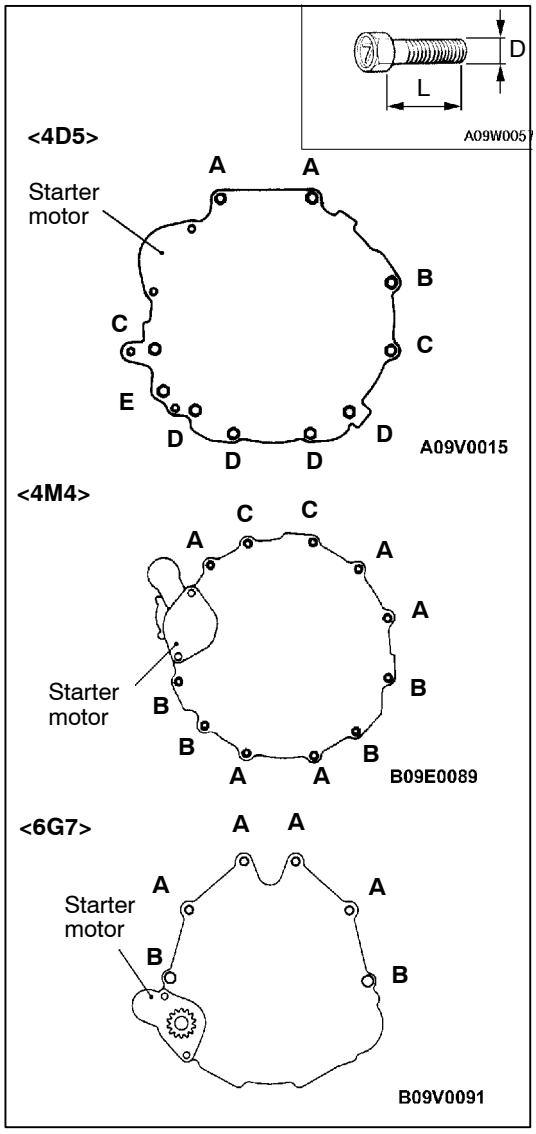
1. Lower the transmission to a position where the transmission harness connector can be disconnected, and then disconnect the connector.
2. Place the disconnected transmission harness so that it stays on the vehicle body.

Code	Connector name
A	Transmission wiring harness and battery wiring harness combination
B	Select rail switch <4M4>
C	1st and 2nd rail switch <4M4>
D	4LLC (Direct low range 4WD) switch
E	2WD operation detection switch
F	Rear propeller shaft speed sensor
G	Vehicle speed sensor
H	Oxygen sensor (Rear)
I	Shift actuator
J	High range/low range detection switch
K	4WD operation detection switch
L	2WD/4WD detection switch
M	4H (Full time 4WD) switch
N	Center differential lock detection switch
O	Front propeller shaft speed sensor
P	Back-up lamp switch
Q	Oxygen sensor (Front)
R	Back-up lamp switch <4M4>
S	3rd and 4th rail switch <4M4>



◀B▶ CLUTCH RELEASE BEARING DISCONNECTION

1. Remove the service hole cover at the clutch housing.
2. Operate the release fork, and push the release bearing towards the clutch side.
3. Insert the flat-tipped screwdriver to separate the release bearing.



INSTALLATION SERVICE POINT

▶A◀ TRANSMISSION ASSEMBLY INSTALLATION

The sizes of the mounting bolts are different. So be sure not to confuse them.

<4D5>

Bolt	Diameter (D) x Length (L) mm
A	10 x 45
B	8 x 30
C	10 x 80
D	10 x 25
E	10 x 35

<4M4>

Bolt	Diameter (D) x Length (L) mm
A	12 x 25
B	10 x 45
C	10 x 50

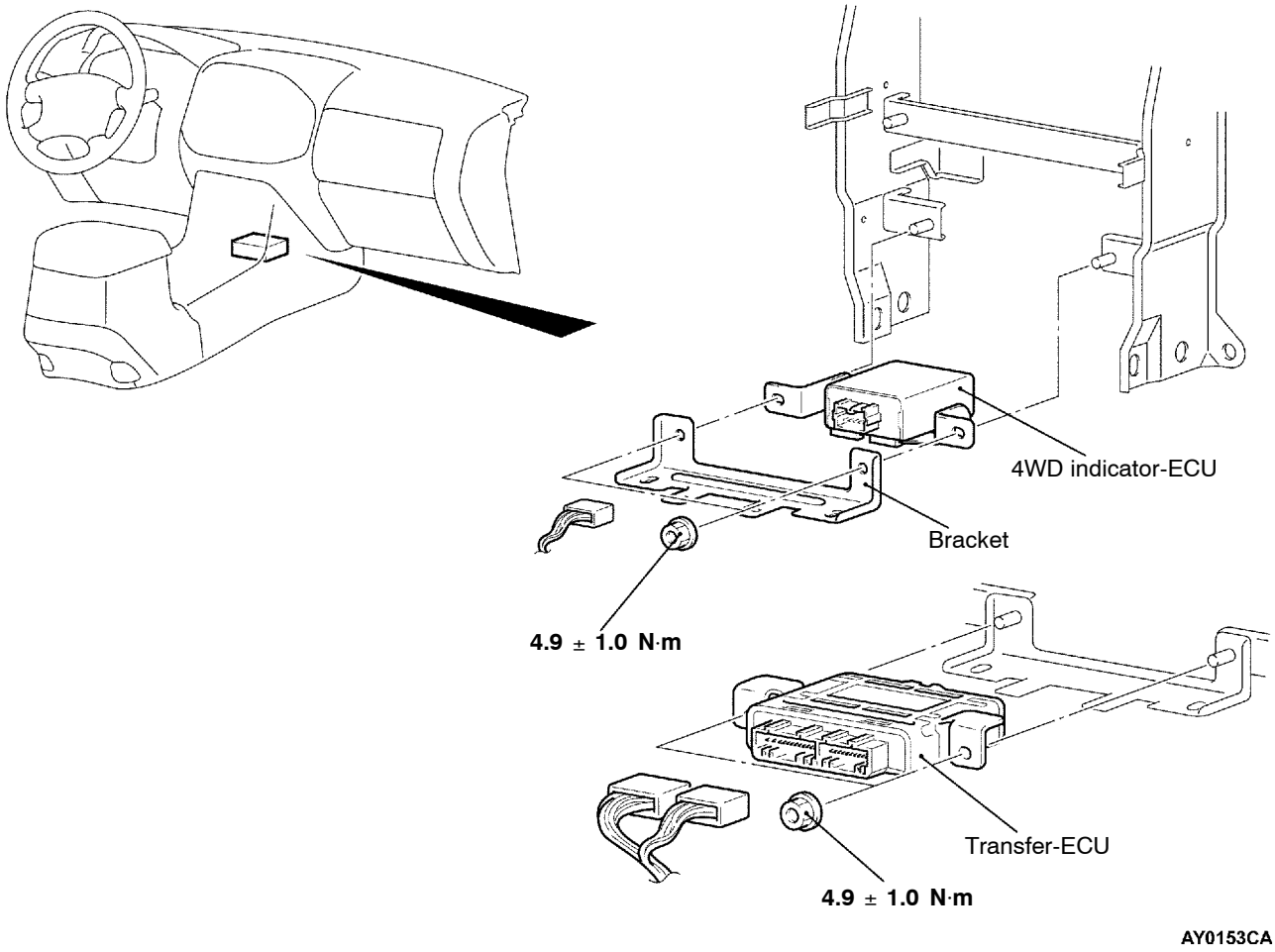
<6G7>

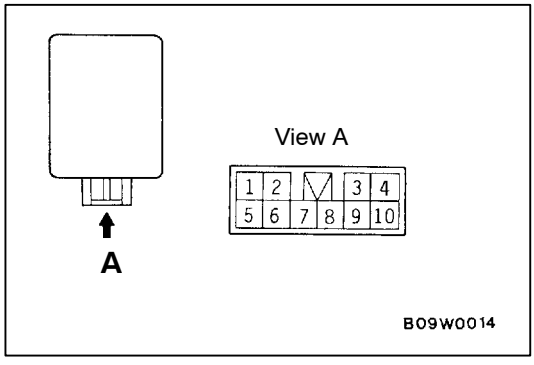
Bolt	Diameter (D) x Length (L) mm
A	12 x 40
B	12 x 55

4WD INDICATOR-ECU/TRANSFER-ECU

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Indicator panel, Floor console front panel removal and installation
(Refer to GROUP52A - Floor console)





INSPECTION

4WD INDICATOR-ECU

1. Measure the voltage with the control unit and harness still connected.
2. Earth terminal (8) and then measure terminal voltage.

Terminal No.	Inspection item	Inspection condition 1: Ignition switch	Inspection condition 2: Transfer lever position	Terminal voltage
1	Free wheel engage switch	ON	2H	System voltage
			4H*1	0 V
2	4WD detection switch	ON	2H	System voltage
			4H, 4L	0 V
3	Ignition switch (IG1)	OFF	-	0 V
		ON	-	System voltage
6	HI/LOW detection switch	ON	Shifting from 4H to 4L or vice versa	System voltage
			2H, 4H, 4L	0 V
7	Free wheel clutch changeover solenoid valve	ON	4H, 4L	0 V
			2H*2	System voltage
10	4WD Indicator lamp	ON	2H	0 V
			4H, 4L	System voltage

NOTE
*1: When vehicle has been moved once.
*2: Shift the lever from 4H to 2H, and then turn the ignition switch to OFF and then back to ON.

TRANSFER-ECU

Measure the terminal voltage (Refer to P.22-3).

GROUP 22
MANUAL TRANSMISSION

GENERAL

OUTLINE OF CHANGE

With additional vehicle with Emission Regulation Step III compatible 4D5 engine, the service procedure different from service adjustment procedure of the vehicle with 4D5 engine has been established.

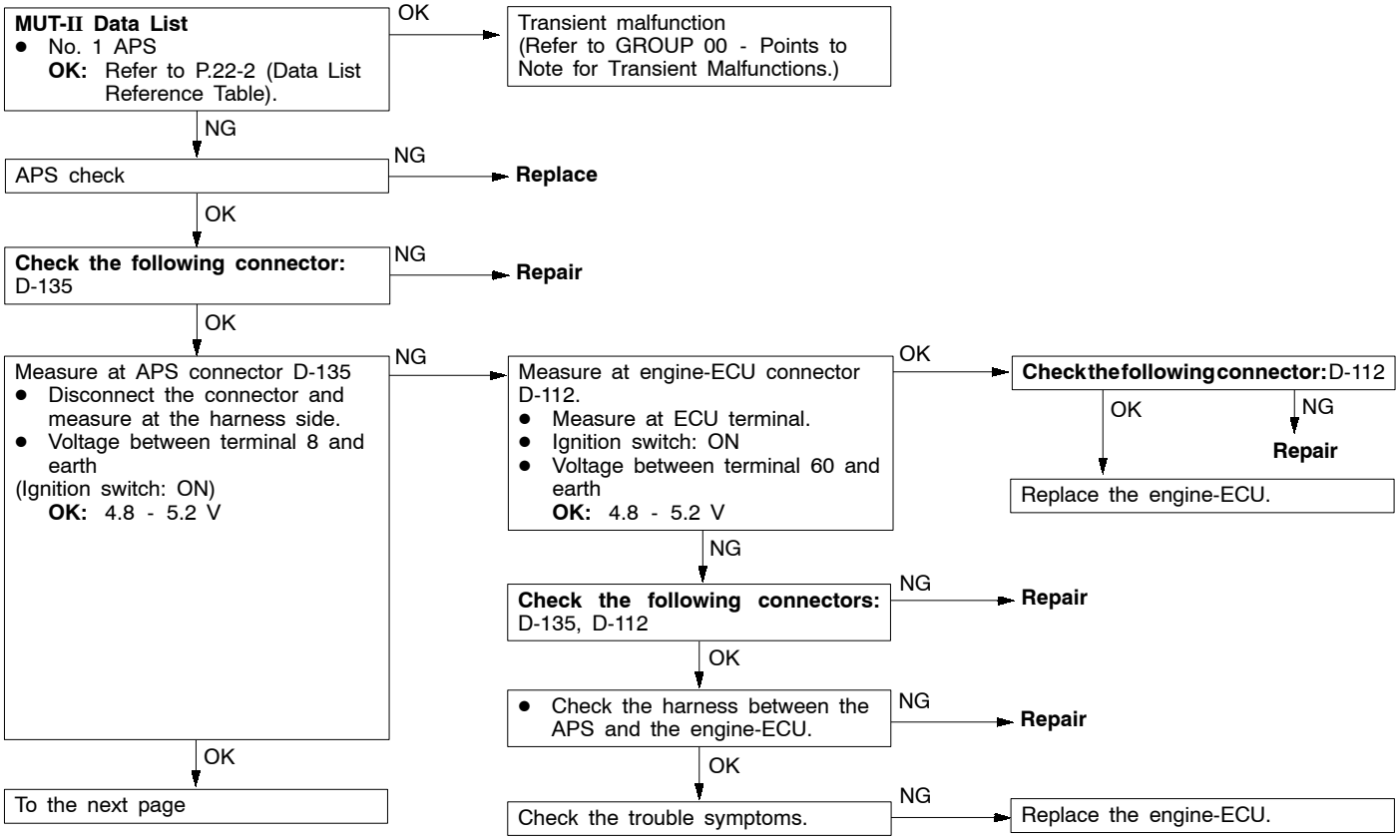
TROUBLESHOOTING <SS4 II>

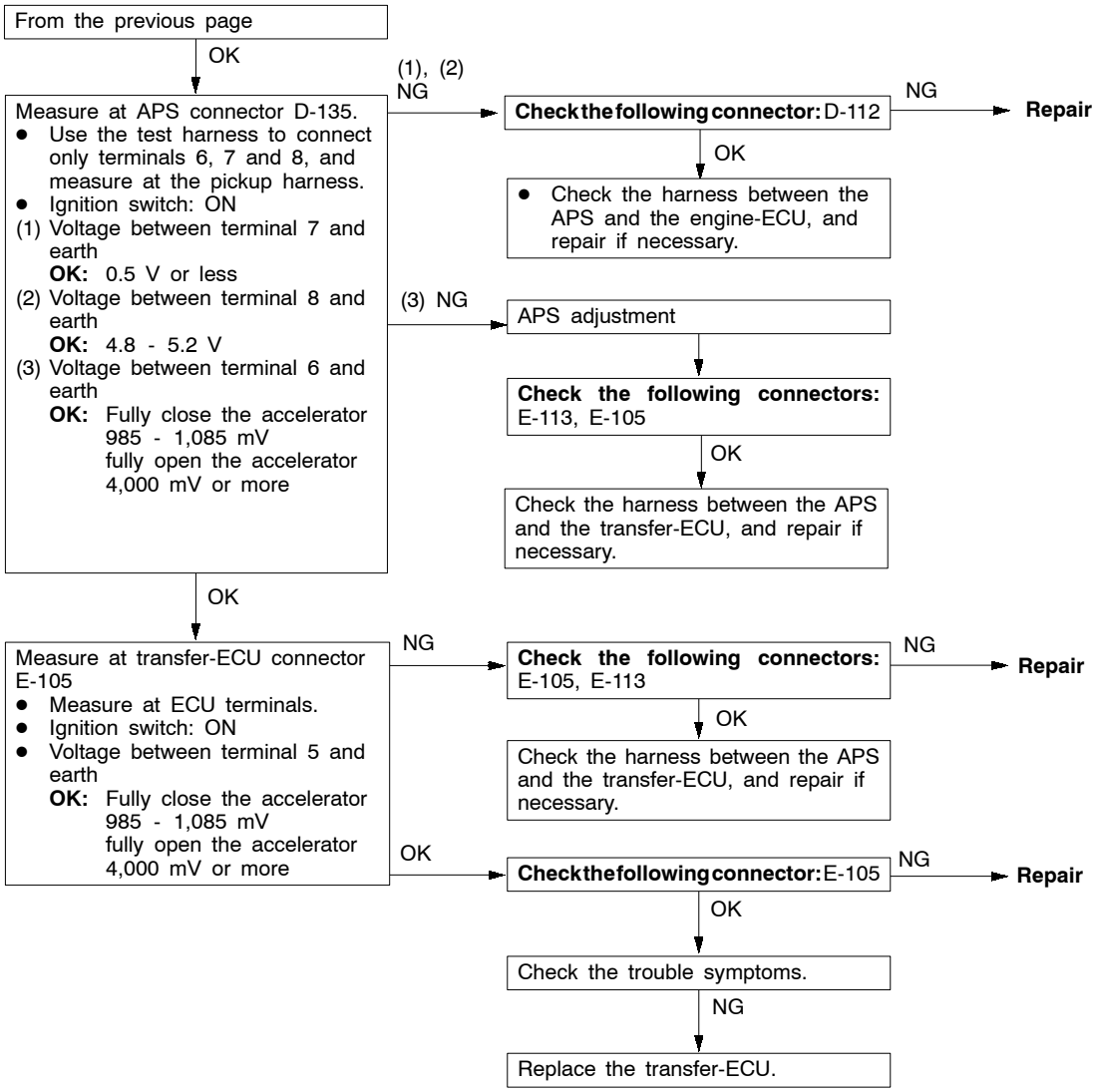
INSPECTION CHART FOR DIAGNOSIS CODE

Diagnosis code	Diagnosis item		Reference page
21	Accelerator pedal position sensor (APS) system <4D5>	Open circuit/Malfunction of sensor	22-1

INSPECTION PROCEDURE FOR DIAGNOSIS CODE

Code No.21 Accelerator pedal position sensor (APS) system <4D5>	**Probable cause**
Code No.21 is output to indicate an open circuit in the APS or an incorrect adjustment when the APS output voltage drops below 0.2 V while the engine is idling.	• Malfunction of APS • Malfunction of harness or connector • Malfunction of transfer-ECU • Malfunction of engine-ECU





DATA LIST REFERENCE TABLE

Data list No.	Check item	Check conditions		Normal condition
1	Accelerator pedal position sensor (APS) <4D5>	Engine: Stopped Selector lever position: P	Accelerator pedal: Fully closed	985 - 1,085 mV
			Accelerator pedal: Depressed	Gradually increases from the above value.
			Accelerator pedal: Fully open	4,000 mV or more

CHECK AT TRANSFER-ECU TERMINAL

Terminal No.	Check item	Check conditions	Standard value
5	Accelerator pedal position sensor (APS) <4D5>	Accelerator pedal: Fully closed (engine stopped)	0.985 - 1.085 V
		Accelerator pedal: Fully open (engine stopped)	4.0 V or more

AUTOMATIC TRANSMISSION

Click on the applicable bookmark to selected the required model year.

AUTOMATIC TRANSMISSION

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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 (*).

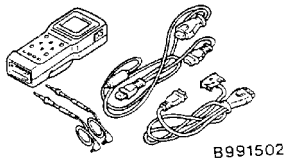
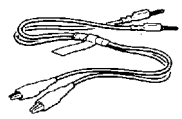
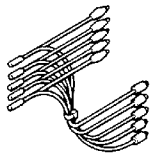
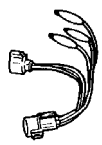
SERVICE SPECIFICATIONS

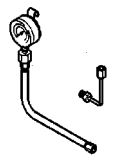
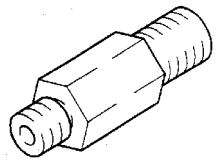
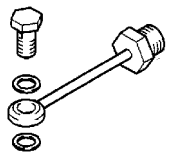
Item		Standard value
A/T fluid temperature sensor resistance kΩ	At 0°C	16.7 - 20.5
	At 20°C	7.3 - 8.9
	At 40°C	3.4 - 4.2
	At 60°C	1.9 - 2.2
	At 80°C	1.0 - 1.2
	At 100°C	0.57 - 0.69
Damper clutch control (DCC) solenoid valve coil resistance (at 20°C) Ω		2.7 - 3.4
Low & reverse (LR) solenoid valve coil resistance (at 20°C) Ω		2.7 - 3.4
Second (2ND) solenoid valve coil resistance (at 20°C) Ω		2.7 - 3.4
Underdrive solenoid valve (UD solenoid valve) coil resistance (at 20°C) Ω		2.7 - 3.4
Overdrive solenoid valve (OD solenoid valve) coil resistance (at 20°C) Ω		2.7 - 3.4
Resistance of reduction (RED) solenoid valve coil at (20°C) Ω		2.7 - 3.4
Stall speed r/min	6G7	2,200 - 2,700
	4M4	2,400 - 2,900
Line pressure adjustment value kPa		1,010 - 1,050

LUBRICANTS

Item	Brand	Quantity L
Transmission fluid	DIA QUEEN ATF SP II M, ATF SP III or equivalent	9.3
Transfer oil	Hypoid gear oil SAE 75W-90 or 75W-85W conforming to API GL-4	2.8

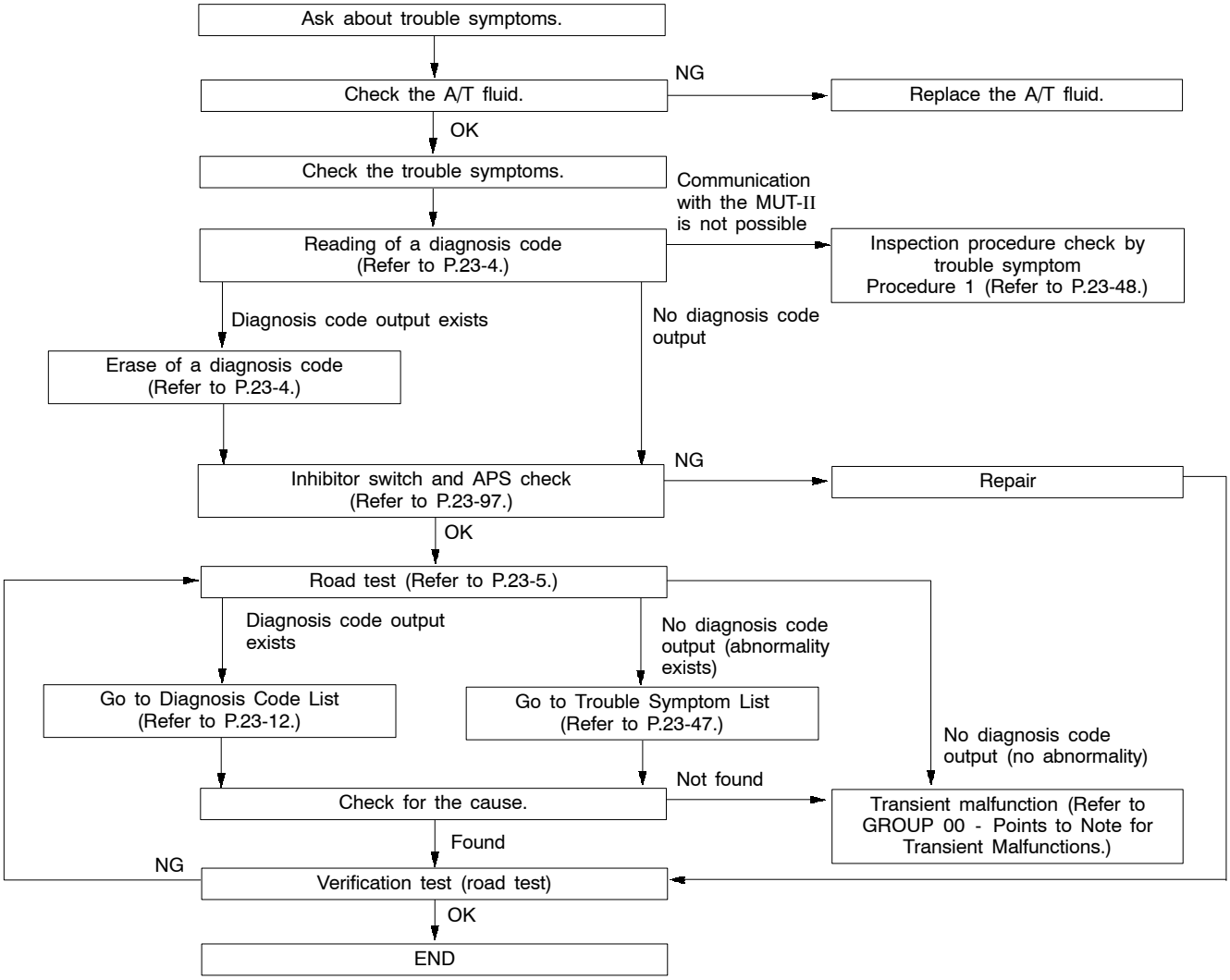
SPECIAL TOOLS

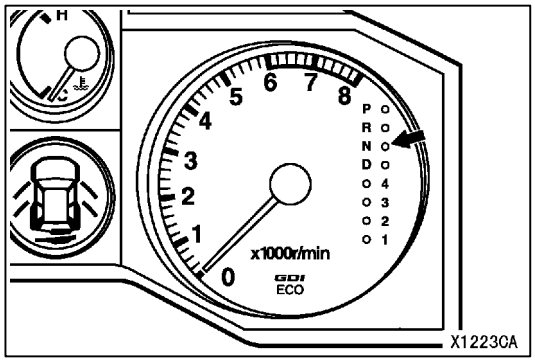
Tools	No.	Name	Application
 B991502	MB991502	MUT-II Sub assembly	Diagnosis code checking
	MB991529	Diagnosis code checking harness	
 B991658	MB991658	Test harness	Voltage measurement of APS
	MD998478	Test harness (3P, triangle)	Voltage measurement of crank angle sensor

Tools	No.	Name	Application
	MD998330 (including MD998331)	Oil pressure gauge (2,942 kPa)	Hydraulic pressure measurement
	MD998332	Adapter	Oil pressure gauge connection
	MD998900	Adapter	

TROUBLESHOOTING <A/T>

BASIC FLOW OF PROBLEM DIAGNOSIS





DIAGNOSIS FUNCTION

N RANGE LAMP

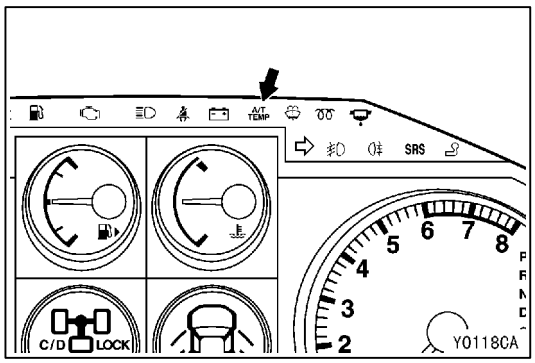
If there is a problem with any of the following items which are related to the A/T system, the N range lamp will flash at a rate of approximately 1 Hz.
If the N range lamp is flashing at a rate of approximately 1 Hz, check the diagnosis output.

- N range lamp flashing item

Input shaft speed sensor system
Output shaft sensor system
Solenoid valve system
Non-synchronization at various shift ranges
A/T control relay system

READING DIAGNOSIS CODES

Use the MUT-II or the warning lamp (N range indicator lamp) to take a reading of the diagnosis codes. (Refer to GROUP 00 - How to Use Troubleshooting/Inspection Procedures.)



A/T FLUID TEMPERATURE WARNING LAMP

Caution
If the N range lamp illuminates, this serves as an A/T fluid temperature warning. Stop the vehicle in a safe place and let the engine run at idle until the N range lamp switches off.

ROAD TEST

No.	Pre-test/operation conditions	Test/operation	Judgment value	Check item	Diagnosis code No.	Inspection procedure if there is an abnormality
1	Ignition switch: OFF	Ignition switch (1) ON	Data List No. 54 (1) 10 - 12 V	A/T control relay	54	A/T control relay system
2	Ignition switch: ON Engine:Stop Selector lever position: P	Selector lever position (1) P (2) R (3) N (4) D	Data List No. 61 (1) P (2) R (3) N (4) D	Inhibitor switch	-	Inhibitor switch system
		Selector lever operation (1) D (1st) (2) Sports mode selected (1st) (3) Lever moved to upshift position and held (2nd) (4) Lever moved to downshift position and held (1st)	Data List No.67 No.68 No.69 (1) OFF OFF OFF (2) ON OFF OFF (3) ON ON OFF (4) ON OFF ON Shift indicator lamp (1) D and 1 illuminate (2) Only 1 illuminates (3) Only 2 illuminates (4) Only 1 illuminates	Select switch Upshift switch Downshift switch	-	Sports mode switch system
		Accelerator pedal (1) Fully closed (2) Depressed (3) Fully opened	Data List No. 11 (1) 985 - 1,085 mV (2) Gradually increases from (1) (3) 4,000 mV or more	APS	11 12 14	APS system
			Data list No.25 (1) OFF (2) ON	Wide open throttle switch	25	Wide open throttle switch system
2	Ignition switch: ON Engine: Stop Selector lever position: P	Brake pedal (1) Depressed (2) Released	Data List No. 26 (1) ON (2) OFF	Stop lamp switch	26	Stop lamp switch system
		Transfer shift lever position (1) Except for 4LLc (2) 4LLc	Data List No. 75 (1) OFF (2) ON	4LLc switch	-	4LLc switch system

No.	Pre-test/operation conditions	Test/operation	Judgment value	Check item	Diagnosis code No.	Inspection procedure if there is an abnormality
3	Ignition switch: START Engine: Stopped	Starting test at P or N position	Starting should be possible	Starting possible/not possible	-	Starting not possible
4	Driving after engine has warmed up	Drive for 15 minutes or more until the A/T fluid temperature rises to 70 - 80°C.	Data list No.15 Gradually rises to 70 - 80°C	A/T fluid temperature sensor	15	A/T fluid temperature sensor system
5	Engine: Idling Selector lever position: N	Brake pedal (re-test) (1) Depressed (2) Released	Data List No. 26 (1) ON (2) OFF	Stop lamp switch	26	Stop lamp switch system
		A/C switch (1) ON (2) OFF	Data List No. 65 (1) ON (2) OFF	Dual pressure switch	-	Dual pressure switch system
		Accelerator pedal (1) Fully closed (2) Apply	Data List No. 21 (1) The engine speed displayed on the tachometer is identical to the engine speed displayed on MUT-II. (2) Gradually increases from (1)	Crank angle sensor <6G7> Engine speed sensor <4M4>	21	Crank angle sensor system <6G7> Engine speed sensor system <4M4>
			Data List No.73 <6G7> No.76 <4M4> (2) Data changes.	Communication with engine-ECU	51	Serial communication system
		Selector lever position (1) N to D (2) N to R	No abnormal shock during shifting Within 2 seconds of time lag	Malfunction when starting off	-	Engine stalls during shifting
					-	N-to-D shocks, large time lag
					-	N-to-R shocks, large time lag
					-	N-to-D, N-to-R shocks, large time lag
				Driving not possible	-	Does not move forward
					-	Does not reverse
					-	Does not move (forward or reverse)

No.	Pre-test/operation conditions	Test/operation	Judgment value	Check item	Diagnosis code No.	Inspection procedure if there is an abnormality
6	Selector lever position: Sports mode (Must be done on a level and straight road.)	Selector lever position and engine (1) Idling in 1st (Vehicle stopped) (2) Driving at a constant speed of 10 km/h in 1st (3) Driving at a constant speed of 30 km/h in 2nd (4) Driving at a constant speed of 50 km/h in 3rd (5) Driving at a constant speed of 50 km/h in 4th (6) Driving at a constant speed of 70 km/h in 5th (Each condition should be maintained for 10 seconds or more)	Data List No. 63 (2) 1st (3) 2nd (4) 3rd (5) 4th (6) 5th	Shift condition	-	-
			Data List No. 31 (2) 0% (3) 100% (4) 100% (5) 100% (6) 100%	Low & reverse solenoid valve (LR solenoid valve)	31	LR solenoid valve system
			Data List No. 32 (2) 0% (3) 0% (4) 0% (5) 0% (6) 100%	Underdrive solenoid valve (UD solenoid valve)	32	UD solenoid valve system
			Data List No. 33 (2) 100% (3) 0% (4) 100% (5) 100% (6) 0%	Second solenoid valve (2ND solenoid valve)	33	2nd solenoid valve system
			Data List No. 34 (2) 100% (5) 0% (3) 100% (6) 0% (4) 0%	Overdrive solenoid valve (OD solenoid valve)	34	OD solenoid valve system
			Data List No. 35 (2) 0% (5) 100% (3) 0% (6) 100% (4) 0%	Reduction solenoid valve (RED solenoid valve)	35	RED solenoid valve system
			Data List No. 29 (1) 0 km/h (5) 50 km/h	Vehicle speed sensor	-	Vehicle speed sensor system
			Data List No. 22 (5) 1,300 - 1,600 r/min	Input shaft speed sensor	22	Input shaft speed sensor system
			Data List No. 23 (5) 1,300 - 1,600 r/min	Output shaft speed sensor	23	Output shaft sensor system
		Selector lever position and engine (1) Driving at 30 km/h in 2 range, then fully close the accelerator. (2) Driving at a constant speed of 50 km/h in 4th	Data List No. 36 (1) 70% - 90% to 0% (2) 70% - 90%	Damper clutch control solenoid valve (DCC solenoid valve)	36 52	DCC solenoid valve system
			Data List No. 52 (1) -300 - -100 r/min or 100 - 300 r/min (2) -10 - 10 r/min			

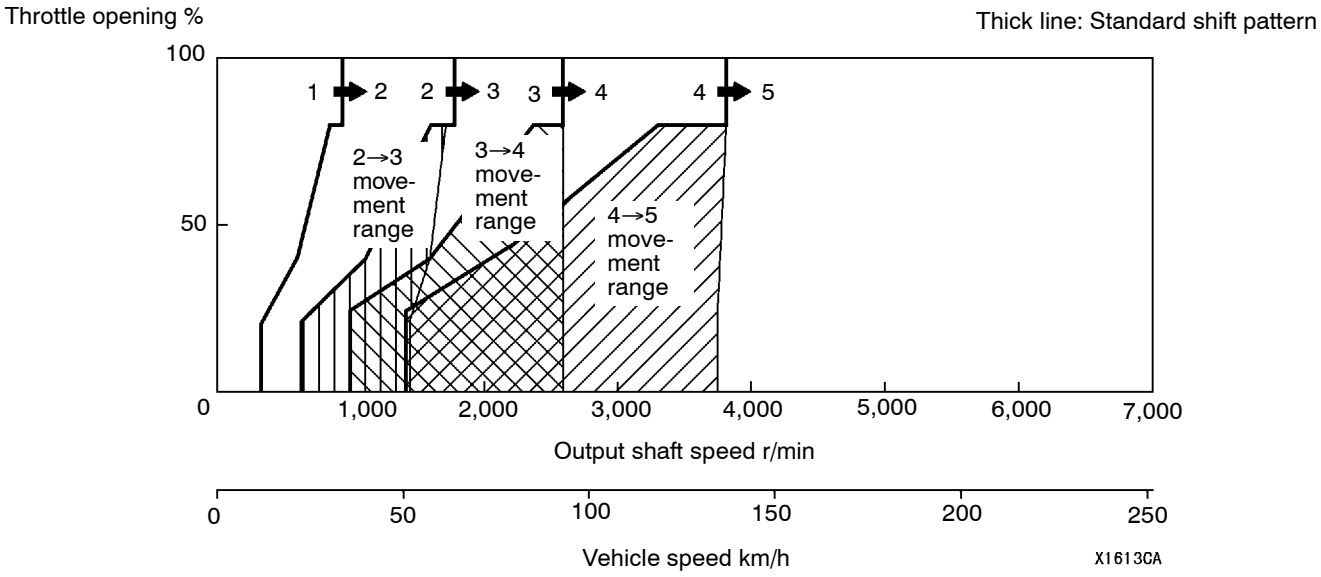
No.	Pre-test/operation conditions	Test/operation	Judgment value	Check item	Diagnosis code No.	Inspection procedure if there is an abnormality
7	Suspends the INVECS-II function using MUT-II Selector level position:D (Must be done on a level and straight road.)	Use the MUT-II to monitor data list Nos. 11, 23 and 63. (1) Accelerate to 5th gear at an APS output of 1.5 V (opening angle 30%). (2) Slowly decelerate and stop. (3) Accelerate to 5th gear at an APS output of 2.5 V (opening angle 50%). (4) At 60 km/h in 5th, select Sports mode and shift down to 4th. (5) At 40 km/h in 4th, select Sports mode and shift down to 3rd. (6) At 20 km/h in 3rd, shift down to 2nd. (7) At 20 km/h in 2nd, shift down to 1st.	For (1), (2) and (3), the output shaft speed (vehicle speed) should be identical, and there should be no abnormal shocks. For (4), (5) and (6), downshifting should occur immediately after the operation is carried out.	Problem during shifting	-	Shocks, engine racing
				Incorrect shift points	-	All points
					-	Some points
				No shifting	-	No diagnosis codes
					22	Input shaft speed sensor system
					23	Output shaft sensor system
				No shifting from 1st to 2nd, or no shifting from 2nd to 1st	31	LR solenoid valve system
					33	2nd solenoid valve system
					41	1st without completion of shifting
					42	2nd without completion of shifting
				No shifting from 2nd to 3rd, or no shifting from 3rd to 2nd	33	2nd solenoid valve system
					34	OD solenoid valve system
					42	2nd without completion of shifting
					43	3rd without completion of shifting
				No shifting from 3rd to 4th, or no shifting from 4th to 3rd	31	LR solenoid valve system
					35	RED solenoid valve system
					43	3rd without completion of shifting
					44	4th without completion of shifting
				No shifting from 4th to 5th, or no shifting from 5th to 4th	32	UD solenoid valve system
					33	2nd solenoid valve system
					44	4th without completion of shifting
					45	5th without completion of shifting

No.	Pre-test/operation conditions	Test/operation	Judgment value	Check item	Diagnosis code No.	Inspection procedure if there is an abnormality
8	Selector lever position: N	Use the MUT-II to monitor data list Nos. 22 and 23. (1) Select R and drive at 10 km/h.	The ration of data list No. 22 and No. 23 should be the same as the transmission ratio when reversing.	No shifting	22	Input shaft speed sensor system
					23	Output shaft sensor system
					46	Reverse without completion of shifting

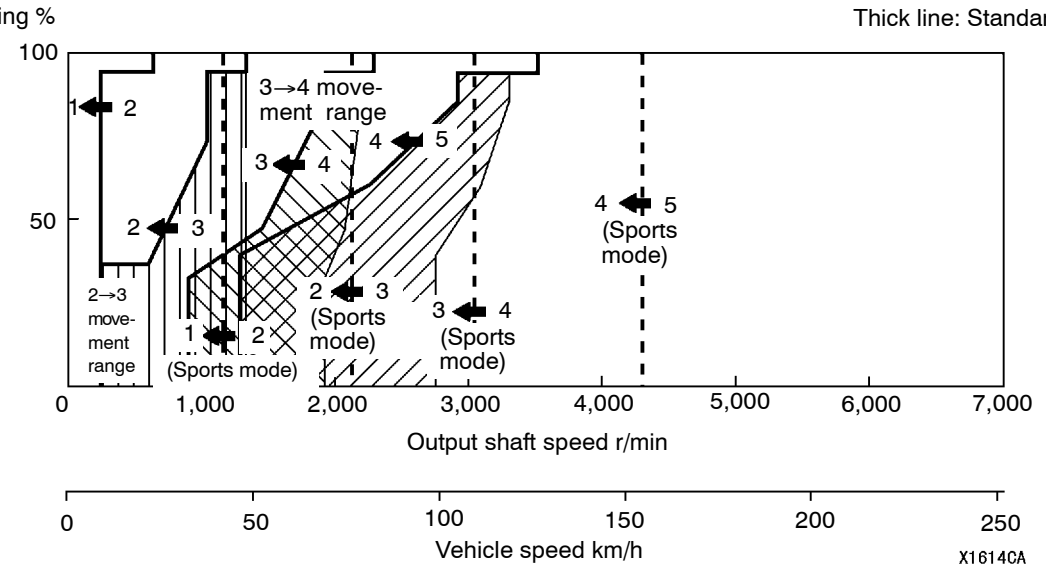
SHIFT PATTERN

<4M4>

Upshift pattern

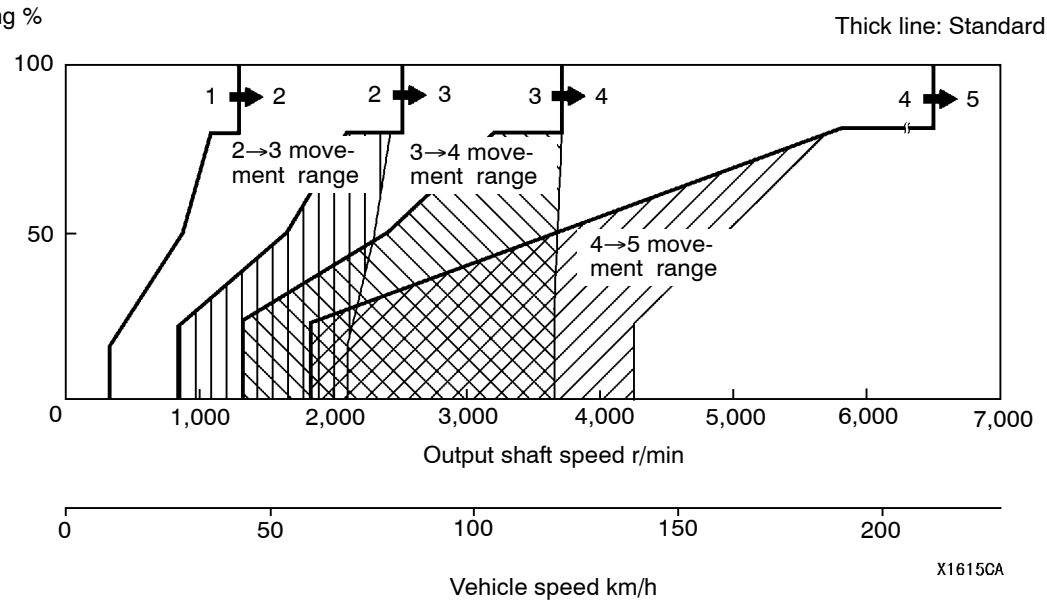


Downshift pattern



<6G7>

Upshift pattern



Downshift pattern

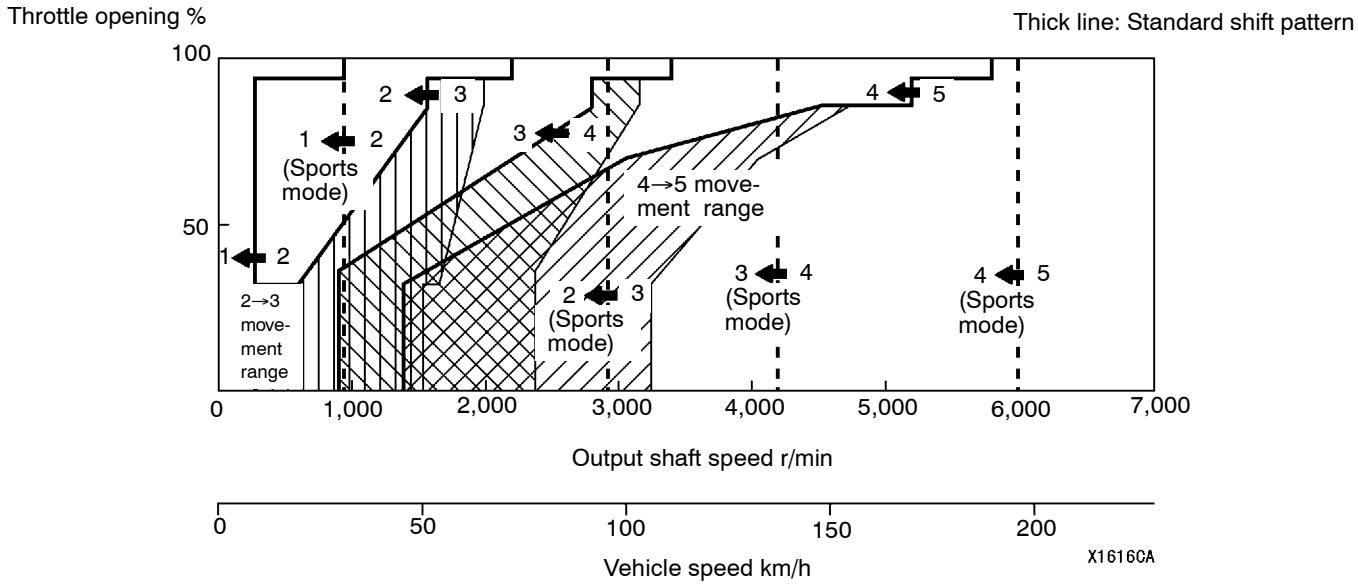
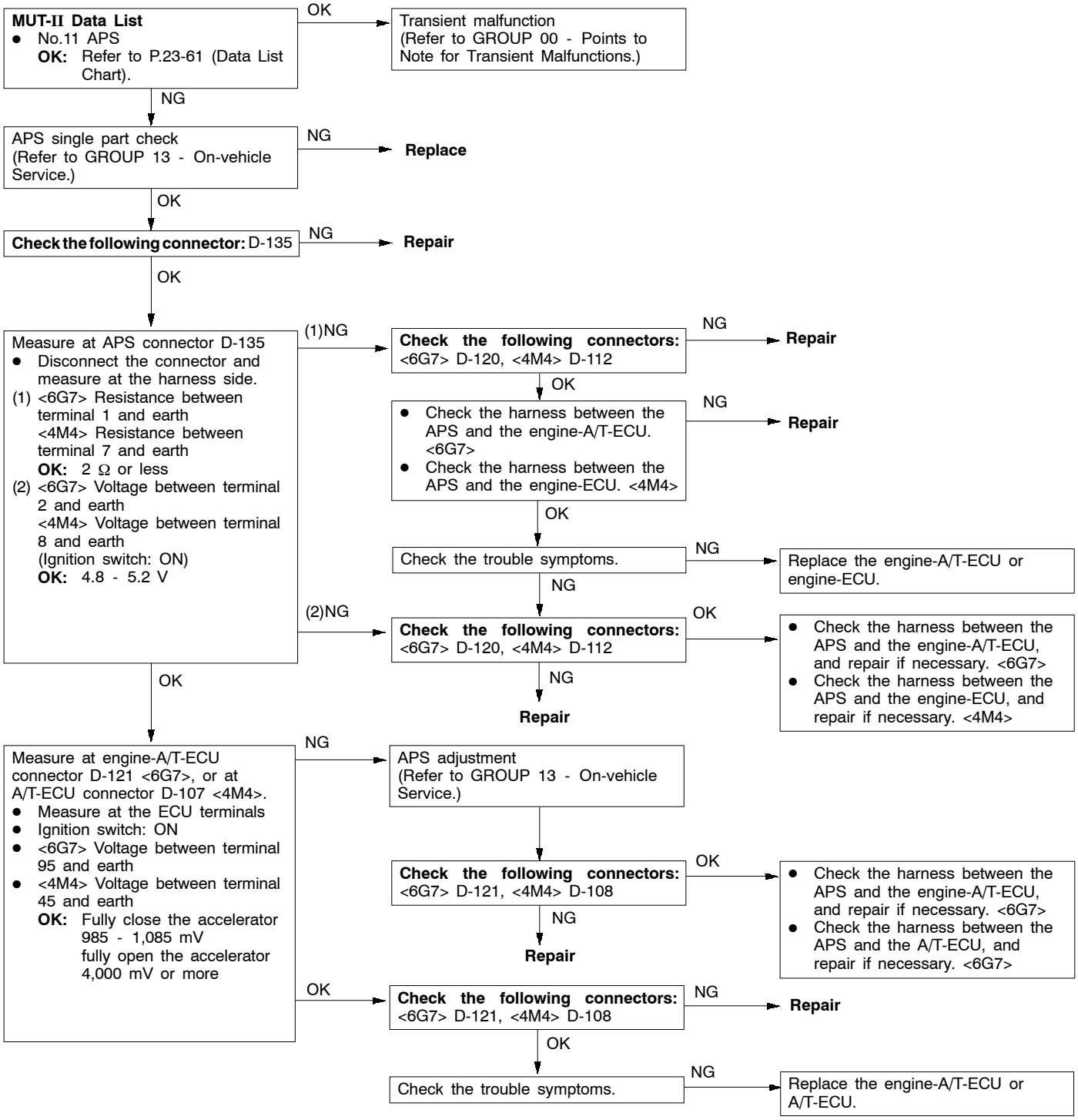


CHART CLASSIFIED BY DIAGNOSIS CODE

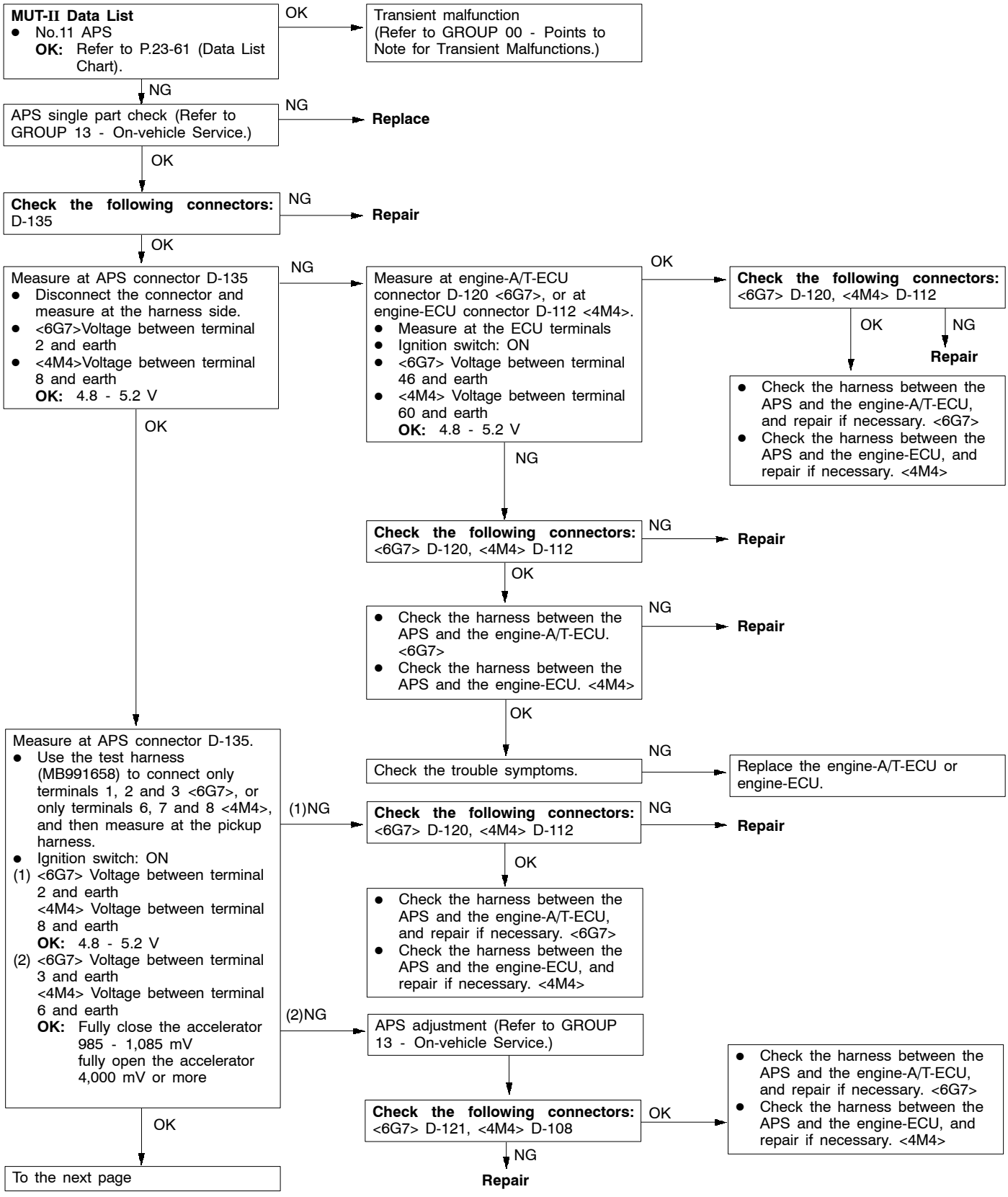
Diagnosis code	Diagnosis item		Reference page
11	Accelerator pedal position sensor (APS) system	Short-circuit	23-13
12		Open circuit	23-14
14		Incorrect sensor adjustment	23-15
15	A/T fluid temperature sensor system	Open circuit	23-17
21	Crank angle sensor system <6G7> or engine speed sensor system <4M4>	Open circuit	23-18
22	Input shaft speed sensor system	Short-circuit/Open circuit	23-20
23	Output shaft speed sensor system	Short-circuit/Open circuit	23-22
25	Wide open throttle switch system	Short-circuit/Open circuit	23-24
26	Stop lamp switch system	Short-circuit	23-25
31	LR solenoid valve system	Short-circuit/Open circuit	23-26
32	UD solenoid valve system	Short-circuit/Open circuit	23-27
33	2nd solenoid valve system	Short-circuit/Open circuit	23-28
34	OD solenoid valve system	Short-circuit/Open circuit	23-29
35	RED solenoid valve system	Short-circuit/Open circuit	23-30
36	DCC solenoid valve system	Short-circuit/Open circuit	23-31
41	1st without completion of shifting		23-32
42	2nd without completion of shifting		23-34
43	3rd without completion of shifting		23-36
44	4th without completion of shifting		23-38
45	5th without completion of shifting		23-40
46	Reverse without completion of shifting		23-42
51	Problem communicating with engine-ECU		23-43
52	Damper clutch control system	System malfunction	23-44
54	A/T control relay system	Short-circuit to earth/Open circuit	23-45
56	N range lamp system	Short-circuit to earth	23-46

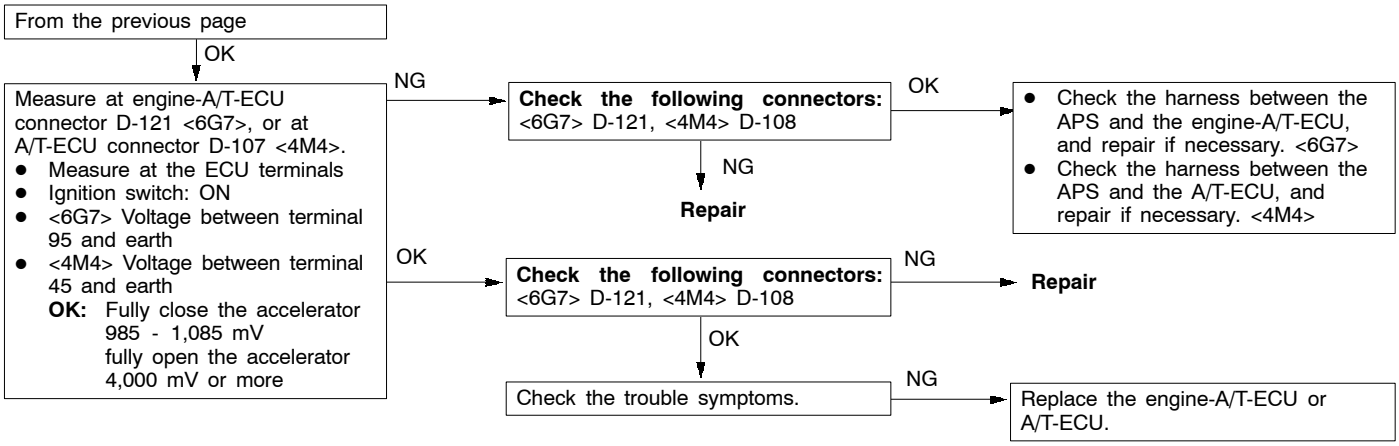
INSPECTION PROCEDURES CLASSIFIED BY DIAGNOSIS CODE

Code No. 11 Accelerator pedal position sensor (APS) short-circuit system	Probable cause
If the APS output during idling is 4.8 V or higher, it is judged that there is excessive output, and code No. 11 is output.	• Malfunction of APS • Malfunction of harness or connector • Malfunction of engine-A/T-ECU <6G7> • Malfunction of A/T-ECU <4M4> • Malfunction of engine-ECU <4M4>

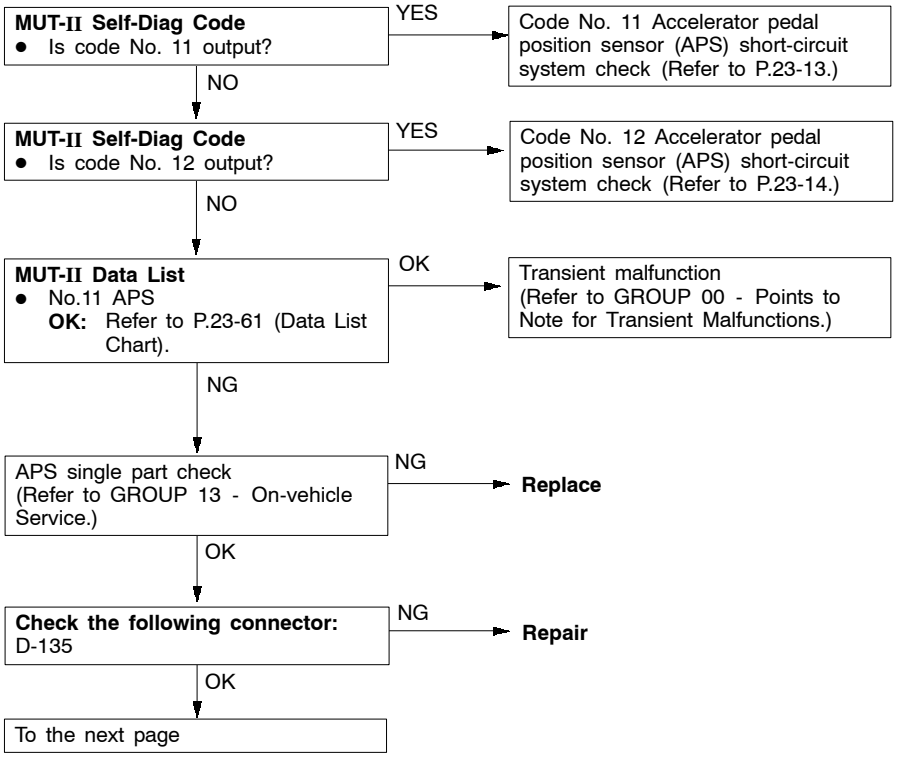


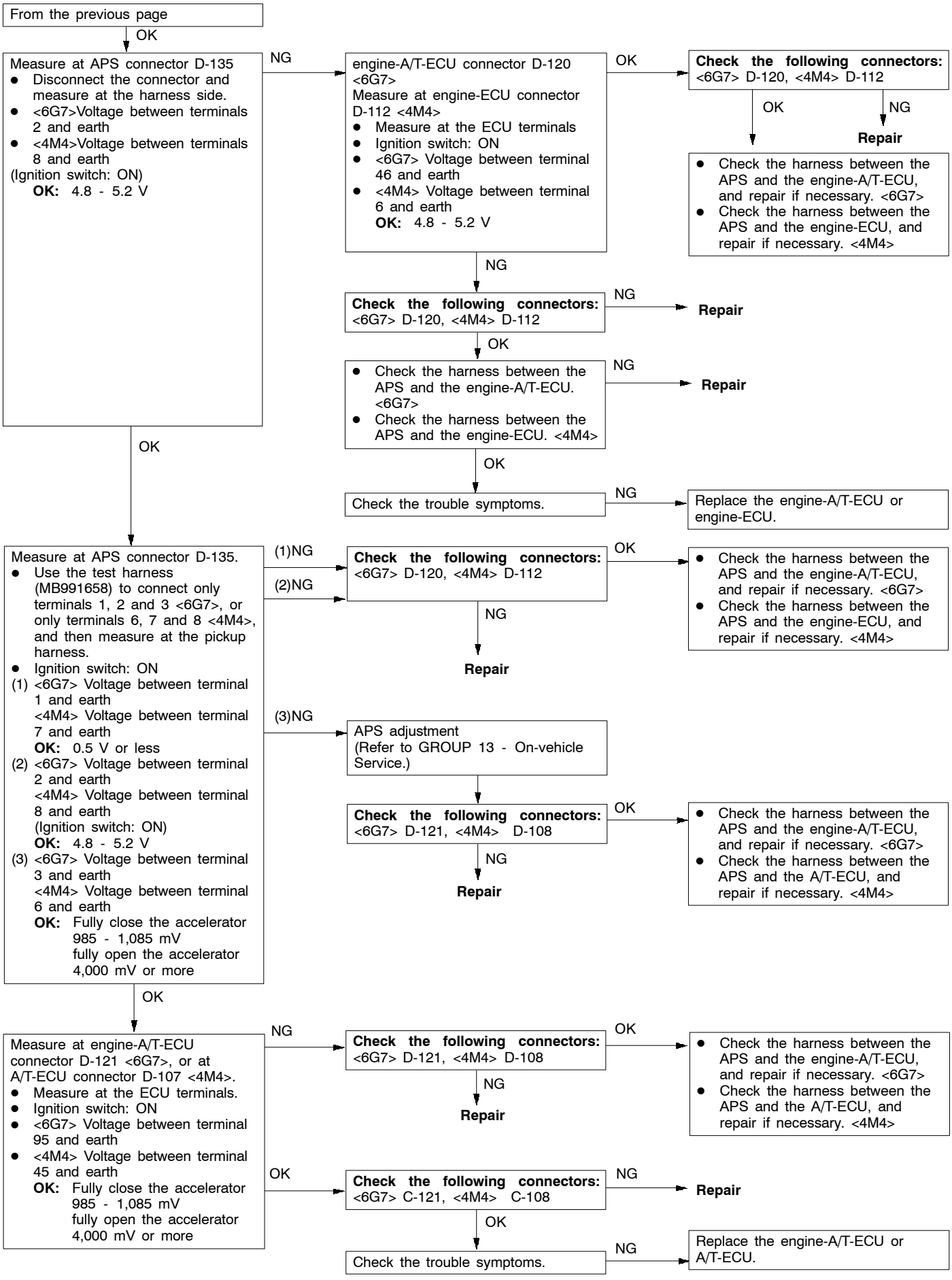
Code No. 12 Accelerator pedal position sensor (APS) open circuit system	Probable cause
When the APS output is 0.2 V or less while the engine is idling, it is judged that output is too low and code No. 12 is output.	• Malfunction of APS • Malfunction of harness or connector • Malfunction of engine-A/T-ECU <6G7> • Malfunction of A/T-ECU <4M4> • Malfunction of engine-ECU <4M4>





Code No. 14 Accelerator pedal position sensor (APS) incorrect adjustment system	Probable cause
If the APS output is 0.2 V or less or 1.2 V or higher while the engine is idling, it is judged that the APS is incorrectly adjusted, and code No. 14 is output.	● Malfunction of APS ● Malfunction of harness or connector ● Malfunction of engine-A/T-ECU <6G7> ● Malfunction of A/T-ECU <4M4> ● Malfunction of engine-ECU <4M4>




From the previous page
OK
Measure at APS connector D-135
● Disconnect the connector and measure at the harness side.
● <6G7>Voltage between terminals 2 and earth
● <4M4>Voltage between terminals 8 and earth
(Ignition switch: ON)
OK: 4.8 - 5.2 V
NG
engine-A/T-ECU connector D-120 <6G7>
Measure at engine-ECU connector D-112 <4M4>
● Measure at the ECU terminals
● Ignition switch: ON
● <6G7> Voltage between terminal 46 and earth
● <4M4> Voltage between terminal 6 and earth
OK: 4.8 - 5.2 V
OK
Check the following connectors: <6G7> D-120, <4M4> D-112
OK
NG
Repair
● Check the harness between the APS and the engine-A/T-ECU, and repair if necessary. <6G7>
● Check the harness between the APS and the engine-ECU, and repair if necessary. <4M4>
NG
Check the following connectors: <6G7> D-120, <4M4> D-112
NG
Repair
OK
● Check the harness between the APS and the engine-A/T-ECU. <6G7>
● Check the harness between the APS and the engine-ECU. <4M4>
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-A/T-ECU or engine-ECU.
OK
Measure at APS connector D-135.
● Use the test harness (MB991658) to connect only terminals 1, 2 and 3 <6G7>, or only terminals 6, 7 and 8 <4M4>, and then measure at the pickup harness.
● Ignition switch: ON
(1) <6G7> Voltage between terminal 1 and earth
<4M4> Voltage between terminal 7 and earth
OK: 0.5 V or less
(2) <6G7> Voltage between terminal 2 and earth
<4M4> Voltage between terminal 8 and earth
(Ignition switch: ON)
OK: 4.8 - 5.2 V
(3) <6G7> Voltage between terminal 3 and earth
<4M4> Voltage between terminal 6 and earth
OK: Fully close the accelerator
985 - 1,085 mV
fully open the accelerator
4,000 mV or more
(1)NG
(2)NG
Check the following connectors: <6G7> D-120, <4M4> D-112
OK
NG
Repair
● Check the harness between the APS and the engine-A/T-ECU, and repair if necessary. <6G7>
● Check the harness between the APS and the engine-ECU, and repair if necessary. <4M4>
(3)NG
APS adjustment
(Refer to GROUP 13 - On-vehicle Service.)
Check the following connectors: <6G7> D-121, <4M4> D-108
OK
NG
Repair
● Check the harness between the APS and the engine-A/T-ECU, and repair if necessary. <6G7>
● Check the harness between the APS and the A/T-ECU, and repair if necessary. <4M4>
OK
Measure at engine-A/T-ECU connector D-121 <6G7>, or at A/T-ECU connector D-107 <4M4>.
● Measure at the ECU terminals.
● Ignition switch: ON
● <6G7> Voltage between terminal 95 and earth
● <4M4> Voltage between terminal 45 and earth
OK: Fully close the accelerator
985 - 1,085 mV
fully open the accelerator
4,000 mV or more
NG
Check the following connectors: <6G7> D-121, <4M4> D-108
OK
NG
Repair
● Check the harness between the APS and the engine-A/T-ECU, and repair if necessary. <6G7>
● Check the harness between the APS and the A/T-ECU, and repair if necessary. <4M4>
OK
Check the following connectors: <6G7> C-121, <4M4> C-108
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-A/T-ECU or A/T-ECU.

Code No. 15 A/T fluid temperature sensor system	Probable cause
If the A/T fluid temperature sensor output is 4.5 V or higher even after driving for 10 minutes or more (fluid temperature does not rise), it is judged that there is an open circuit in the A/T fluid temperature sensor and code No. 15 is output.	• Malfunction of A/T fluid temperature sensor • Malfunction of harness or connector • Malfunction of engine-A/T-ECU <6G7> • Malfunction of A/T-ECU <4M4>

★ Refer to the Transmission Workshop Manual.

MUT-II Data List
- No.15 A/T fluid temperature sensor
  OK: When the engine is cold, the temperature is about the same as the atmospheric temperature (air temperature).
  When the engine is hot, the temperature is 70 - 80°C.

OK → Transient malfunction (Refer to GROUP 00 - Points to Note for Transient Malfunctions.)

NG

Measure at engine-A/T-ECU connector D-121 <6G7>, or at A/T-ECU connector D-107 <4M4>.
- Measure at the ECU terminals
- Ignition switch: ON
- <6G7> Voltage between terminal 81 and earth
- <4M4> Voltage between terminal 43 and earth
  OK: 0.5 V or less

NG → **Check the following connectors:** <6G7> D-121, <4M4> D-108
- OK → Check the trouble symptoms.
  - NG → Replace the engine-A/T-ECU or A/T-ECU.
- NG → **Repair**

OK

Measure at engine-A/T-ECU connector D-122 <6G7>, or at A/T-ECU connector D-108 <4M4>.
- Measure at the ECU terminals
- Ignition switch: ON
- <6G7> Voltage between terminal 124 and earth
- <4M4> Voltage between terminal 44 and earth
  OK: A/T fluid temperature
  3.8 - 4.0 V at 20°C
  3.2 - 3.4 V at 40°C
  1.7 - 1.9 V at 80°C

NG → **Check the following connectors:** <6G7> D-122, <4M4> D-108
- OK → Check the trouble symptoms.
  - NG → Replace the engine-A/T-ECU or A/T-ECU.
- NG → **Revision**

OK

Check the following connectors: <6G7> C-04, D-122, D-121,<4M4> D-108, C-04

NG → **Repair**

OK

Measure at solenoid valve assembly connector C-04.
- Disconnect the connector and measure at the sensor side.
- Resistance between terminals 1 and 2
  OK: A/T fluid temperature
  16.7 - 20.5 kΩ at 0°C
  7.3 - 8.9 kΩ at 20°C
  3.4 - 4.2 kΩ at 40°C
  1.9 - 2.2 kΩ at 60°C
  1.0 - 1.2 kΩ at 80°C
  0.57 - 0.69 kΩ at 100°C

NG → Replace the A/T fluid temperature sensor. ★

OK

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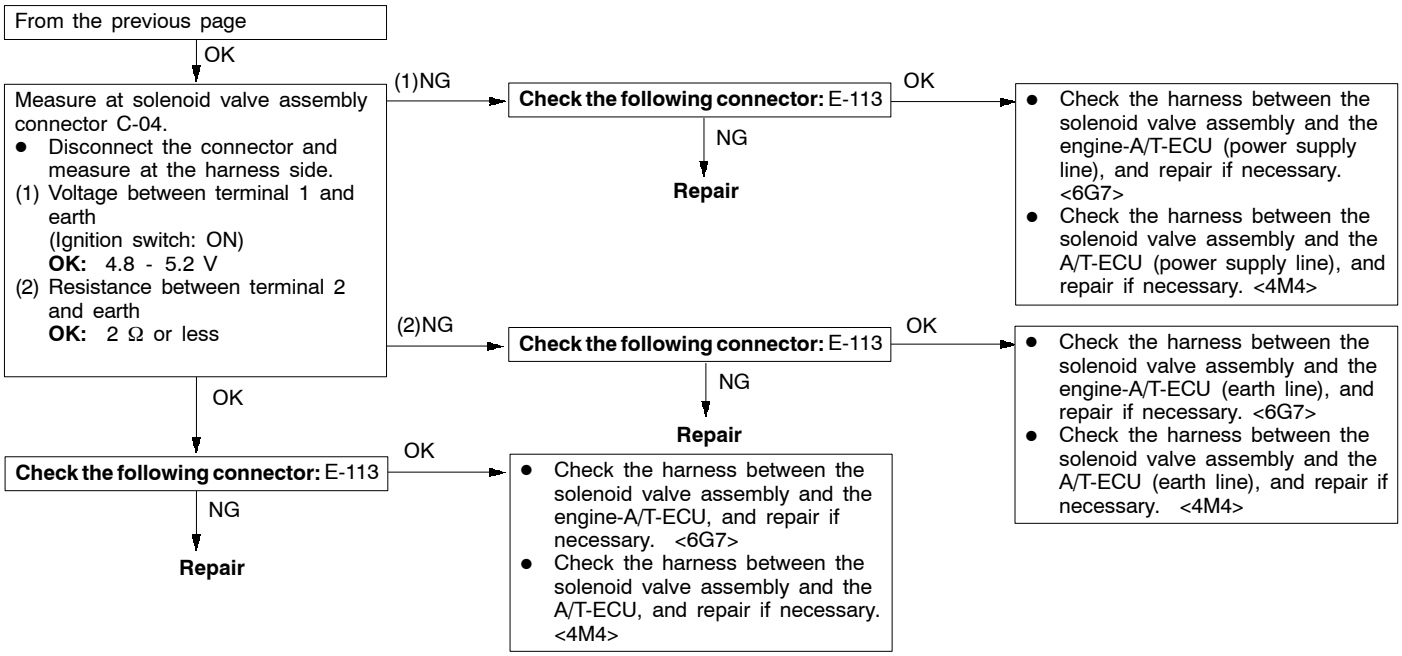
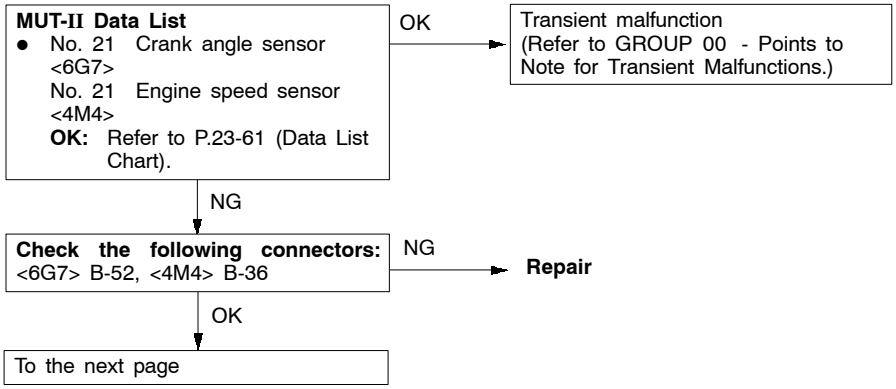


Code No. 21 Crank angle sensor <6G7> or engine speed sensor <4M4> system	Probable cause
If no output pulse from the crank angle sensor or engine speed sensor is detected for 5 seconds or more when the vehicle speed is 25 km/h or more, it is judged that there is an open circuit in the crank angle sensor or an open circuit in the engine speed sensor, and code No. 21 is output.	● Malfunction of crankshaft sensing blade <6G7> ● Malfunction of crank angle sensor <6G7> ● Malfunction of engine speed sensor <4M4> ● Malfunction of harness or connector ● Malfunction of engine-A/T-ECU <6G7> ● Malfunction of A/T-ECU <4M4>



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OK

Measure at crank angle sensor connector B-52 <6G7>, or at injection pump assembly connector B-36 <4M4>.
- Disconnect the connector and measure at the harness side.

(1) <6G7> Resistance between terminal 1 and earth
<4M4> Resistance between terminal 4 and earth
OK: 2 Ω or less

(2) Voltage between terminal 2 and earth
(Ignition switch: ON)
OK: 4.8 - 5.2 V

(3) Voltage between terminal 3 and earth
(Ignition switch: ON)
OK: System voltage

(1)NG → **Check the following connectors:** <6G7> B-52, <4M4> B-36

OK → Check the harness between the crank angle sensor and body earth, and repair if necessary. <6G7>
Check the harness between the injection pump assembly and body earth, and repair if necessary. <4M4>

NG → **Repair**

(2)NG → Measure at engine-A/T-ECU connector D-120 <6G7>, or at A/T-ECU connector D-107 <4M4>.
- Measure at the ECU terminals
- Disconnect connector B-52 <6G7>, or connector B-36 <4M4>.
- Ignition switch: ON
- <6G7> Voltage between terminal 45 and earth
- <4M4> Voltage between terminals 33 and earth

OK: 4.8 - 5.2 V

OK → **Check the following connectors:** <6G7> D-120,<4M4> D-113, D-108

OK → Check the harness between the crank angle sensor and the engine-A/T-ECU, and repair if necessary. <6G7>
Check the harness between the injection pump assembly and the A/T-ECU, and repair if necessary. <4M4>

NG → **Repair**

NG → **Check the following connectors:** <6G7> D-120, <4M4> D-113, D-108

NG → **Repair**

OK → Check the harness between the crank angle sensor and the engine-A/T-ECU. <6G7>
Check the harness between the injection pump assembly and the A/T-ECU. <4M4>

OK → Check the trouble symptoms.

NG → Replace the engine-A/T-ECU or A/T-ECU.

NG → **Repair**

(3)NG → **Check the following connector:** B-25X

OK → Check the harness between the crank angle sensor and the engine control relay, and repair if necessary. <6G7>
Check the harness between the injection pump assembly and the engine control relay, and repair if necessary. <4M4>

NG → **Repair**

OK → Measure the output wave pattern at crank angle sensor connector B-52 <6G7>, or at injection pump assembly connector B-36 <4M4> (using an oscilloscope).
- Use the test harness (MD998478) to connect the terminals, and then measure at the pickup harness.
- Engine: Idling
- Selector lever position: P
- Voltage between terminal 2 and earth

OK: A wave pattern such as the one shown on P.23-69 (Check Procedure Using an Oscilloscope) should be output, and the maximum value should be 4.8 V or more and the minimum value should be 0.6 V or less. There should be no noise in the output wave pattern.

NG → **Check the following connectors:** <6G7> B-52, D-120, B-25X <4M4> D-108, D-113, B-36, B-25X

NG → **Repair**

OK → Check the harness between the crank angle sensor and the engine-A/T-ECU, and repair if necessary. <6G7>
Check the harness between the engine speed sensor and the A/T-ECU, and repair if necessary. <4M4>
Check the harness between the crank angle sensor and the engine control relay, and repair if necessary. <6G7>
Check the harness between the engine speed sensor and the engine control relay, and repair if necessary. <4M4>
Check the harness between the crank angle sensor and body earth, and repair if necessary. <6G7>
Check the harness between the engine speed sensor and body earth, and repair if necessary. <4M4>

NG → **Repair**

OK → Check the trouble symptoms.

NG → Replace the crank angle sensor <6G7> or the engine speed sensor <4M4>.

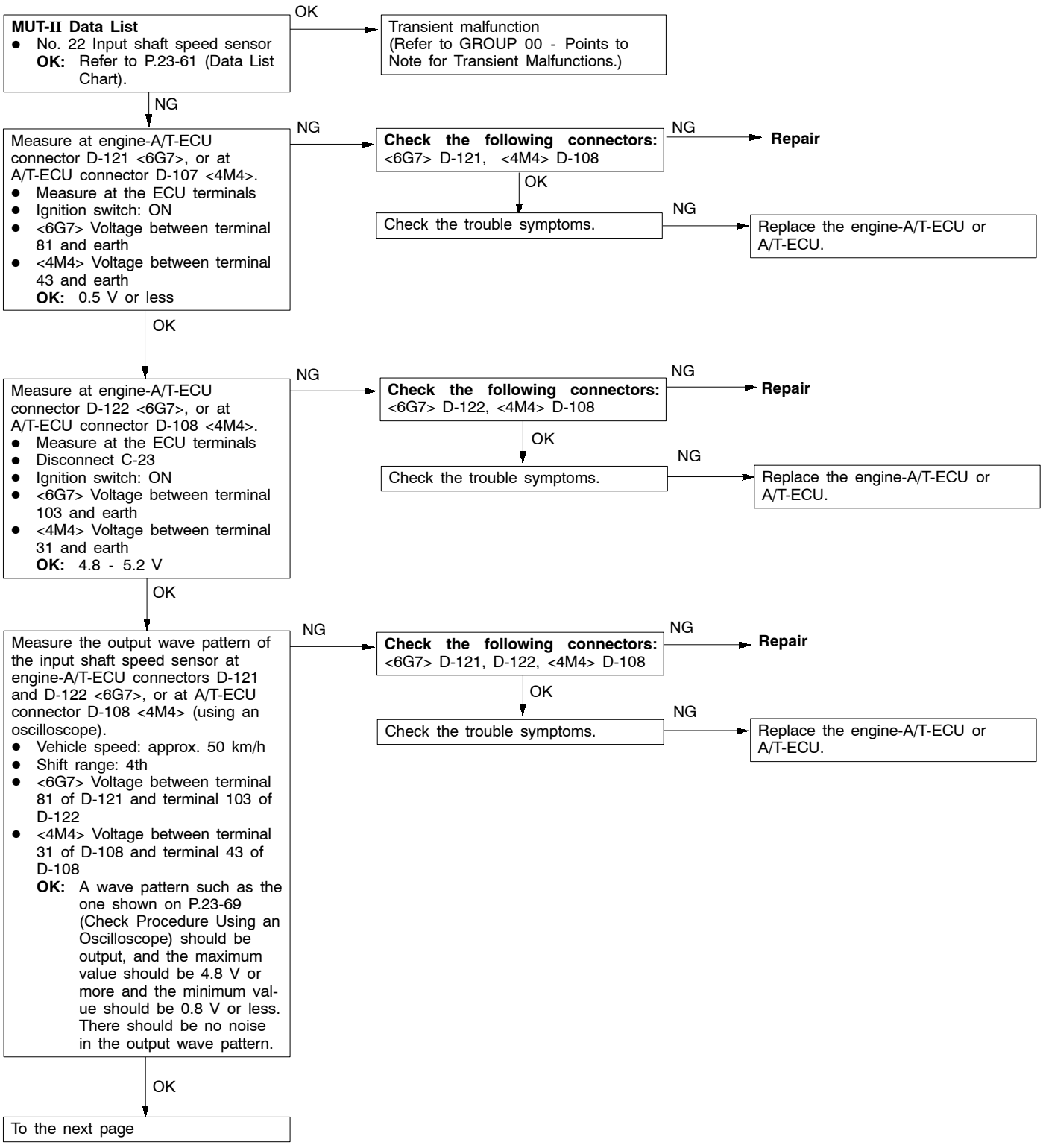
Replace the crankshaft sensing blade. <6G7>

OK → Check the trouble symptoms.

NG → Replace the engine-A/T-ECU or A/T-ECU.

Code No. 22 Input shaft speed sensor system	Probable cause
If no output pulse from the input shaft speed sensor is detected for 1 second or more while the vehicle is driving at 30 km/h or more in 4th, it is judged that there is a short-circuit or open circuit in the input shaft speed sensor, and code No. 22 is output. If code No. 22 is output 4 times, the transmission is locked at 3rd gear (D) or 2nd gear (downshift operation in Sports mode) as a fail-safe measure, and the N range indicator lamp flashes at 1 Hz.	● Malfunction of input shaft speed sensor ● Malfunction of reverse clutch retainer ● Malfunction of harness or connector ● Malfunction of engine-A/T-ECU <6G7> ● Malfunction of A/T-ECU <4M4>

★ Refer to the Transmission Workshop Manual.



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OK

Check the following connectors: <6G7> D-121, D-122, C-23, <4M4> D-108, C-23

NG → **Repair**

OK

Measure at input shaft speed sensor connector C-23.
- Disconnect the connector and measure at the harness side.

(1) Resistance between terminal 1 and earth
OK: 2 Ω or less

(2) Voltage between terminal 2 and earth
(Ignition switch: ON)
OK: 4.8 - 5.2 V

(3) Voltage between terminal 3 and earth
(Ignition switch: ON)
OK: System voltage

(1)NG → **Check the following connector:** E-113

OK →
- Check the harness between the input shaft speed sensor and the engine-A/T-ECU (earth line), and repair if necessary. <6G7>
- Check the harness between the input shaft speed sensor and the A/T-ECU (earth line), and repair if necessary.<4M4>

NG → **Repair**

(2)NG → **Check the following connector:** E-113

OK →
- Check the harness between the input shaft speed sensor and the engine-A/T-ECU (sensor line), and repair if necessary. <6G7>
- Check the harness between the input shaft speed sensor and the A/T-ECU (sensor line), and repair if necessary.<4M4>

NG → **Repair**

(3)NG → **Check the following connectors:** D-208, D-213, D-32, E-115

OK → Check the harness between the input shaft speed sensor and the ignition switch, and repair if necessary.

NG → **Repair**

OK

Replace the input shaft speed sensor. ★

Check the trouble symptoms.

NG

Check the following connectors: D-208, D-213, D-32, E-115, E-113

NG → **Repair**

OK

- Check the harness between the input shaft speed sensor and the engine-A/T-ECU (earth line). <6G7>
- Check the harness between the input shaft speed sensor and the A/T-ECU (earth line). <4M4>
- Check the harness between the input shaft speed sensor and the ignition switch.

NG → **Repair**

OK

Check the trouble symptoms.

NG

Overhaul the A/T. ★
- Replace the reverse clutch retainer.

→ Check the trouble symptoms.

OK → Eliminate the cause of the noise.

Code No. 23 Output shaft speed sensor system	Probable cause
If the output from the output shaft speed sensor is 50% or less continuously for 1 second or more while the vehicle is driving at 30 km/h or more in 4th, it is judged that there is a short-circuit or open circuit in the output shaft speed sensor, and code No. 23 is output. If code No. 23 is output 4 times, the transmission is locked at 3rd gear (D) or 2nd gear (downshift operation in Sports mode) as a fail-safe measure, and the N range indicator lamp flashes at 1 Hz.	● Malfunction of output shaft speed sensor ● Malfunction of direct planetary carrier ● Malfunction of harness or connector ● Malfunction of engine-A/T-ECU <6G7> ● Malfunction of A/T-ECU <4M4>

★ Refer to the Transmission Workshop Manual.

MUT-II Data List
- No. 23 Output shaft speed sensor system
  OK: Refer to P.23-61 (Data List Chart).

OK → Transient malfunction (Refer to GROUP 00 - Points to Note for Transient Malfunctions.) NG → **Repair**

NG

Measure at engine-A/T-ECU connector D-121 <6G7>, or at A/T-ECU connector D-107 <4M4>.
- Measure at the ECU terminals
- Ignition switch: ON
- <6G7>Voltage between terminals 81 and earth
- <4M4> Voltage between terminal 43 and earth
  OK: 0.5 V or less

NG → **Check the following connectors:** <6G7> D-122, <4M4> D-108 NG → **Repair**

OK → Check the trouble symptoms. NG → Replace the engine-A/T-ECU or A/T-ECU.

OK

Measure at engine-A/T-ECU connector D-122 <6G7>, or at A/T-ECU connector D-108 <4M4>.
- Measure at the ECU terminals
- Disconnect C-02
- Ignition switch: ON
- <6G7>Voltage between terminals 104 and earth
- <4M4> Voltage between terminal 32 and earth
  OK: 4.8 - 5.2 V

NG → **Check the following connectors:** <6G7> D-122, <4M4> D-108 NG → **Repair**

OK → Check the trouble symptoms. NG → Replace the engine-A/T-ECU or A/T-ECU.

OK

Measure the output wave pattern of the output shaft speed sensor at engine-A/T-ECU connectors D-121 and D-122 <6G7>, or at A/T-ECU connector D-108 <4M4> (using an oscilloscope).
- Vehicle speed: approx. 50 km/h
- Shift range: 4th
- <6G7> Voltage between terminal 81 of D-121 and terminal 104 of D-122
- <4M4> Voltage between terminal 32 of D-108 and terminal 43 of D-108
  OK: A wave pattern such as the one shown on P.23-69 (Check Procedure Using an Oscilloscope) should be output, and the maximum value should be 4.8 V or more and the minimum value should be 0.8 V or less. There should be no noise in the output wave pattern.

OK → **Check the following connectors:** <6G7> D-121, D-122, <4M4> D-108 NG → **Repair**

OK → Check the trouble symptoms. NG → Replace the engine-A/T-ECU or A/T-ECU.

NG

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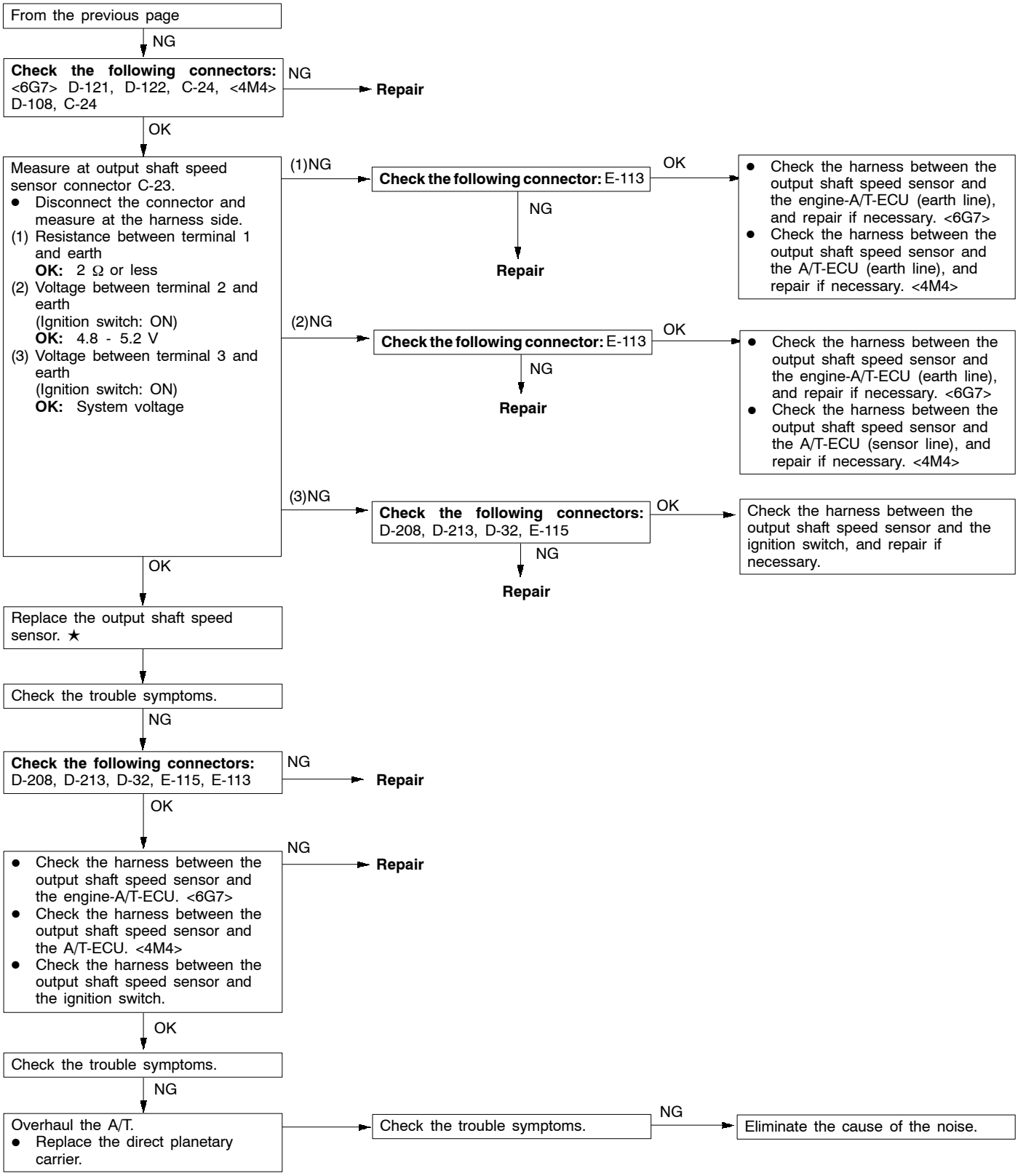
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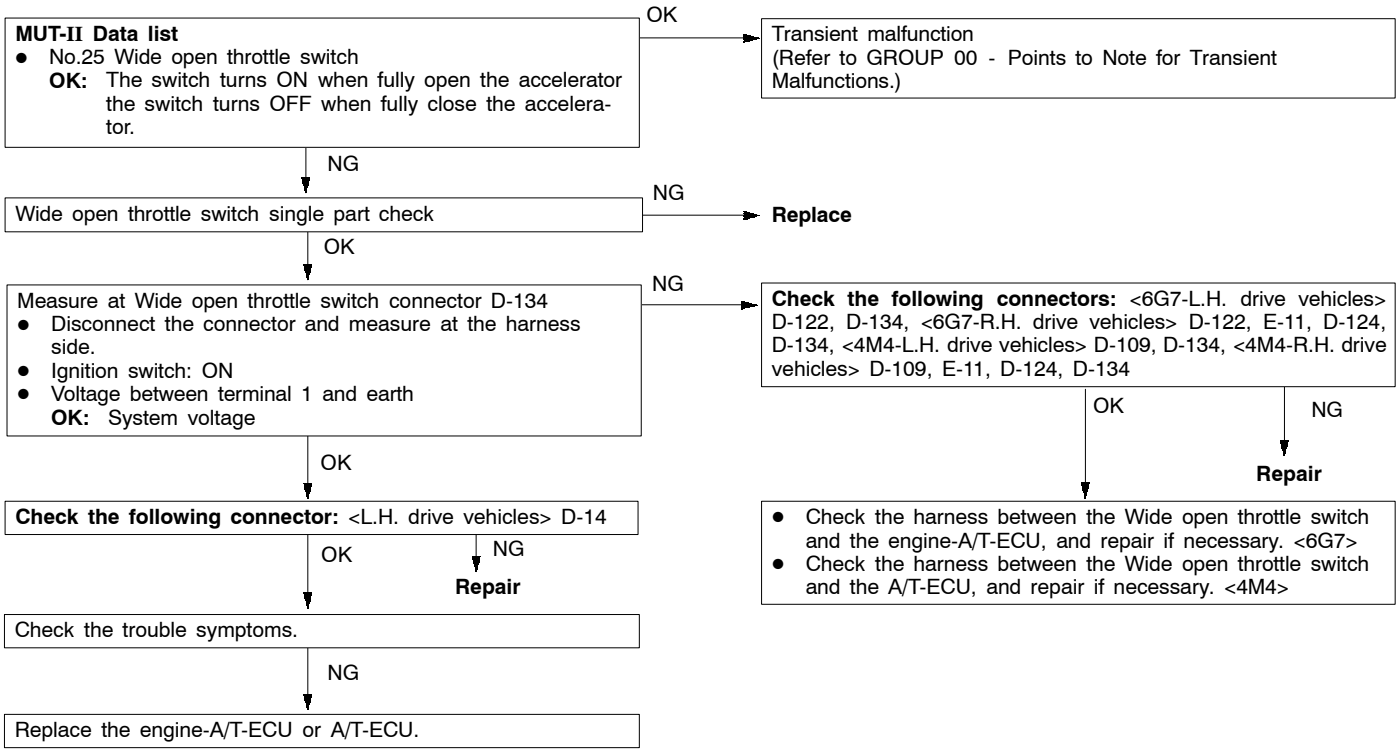
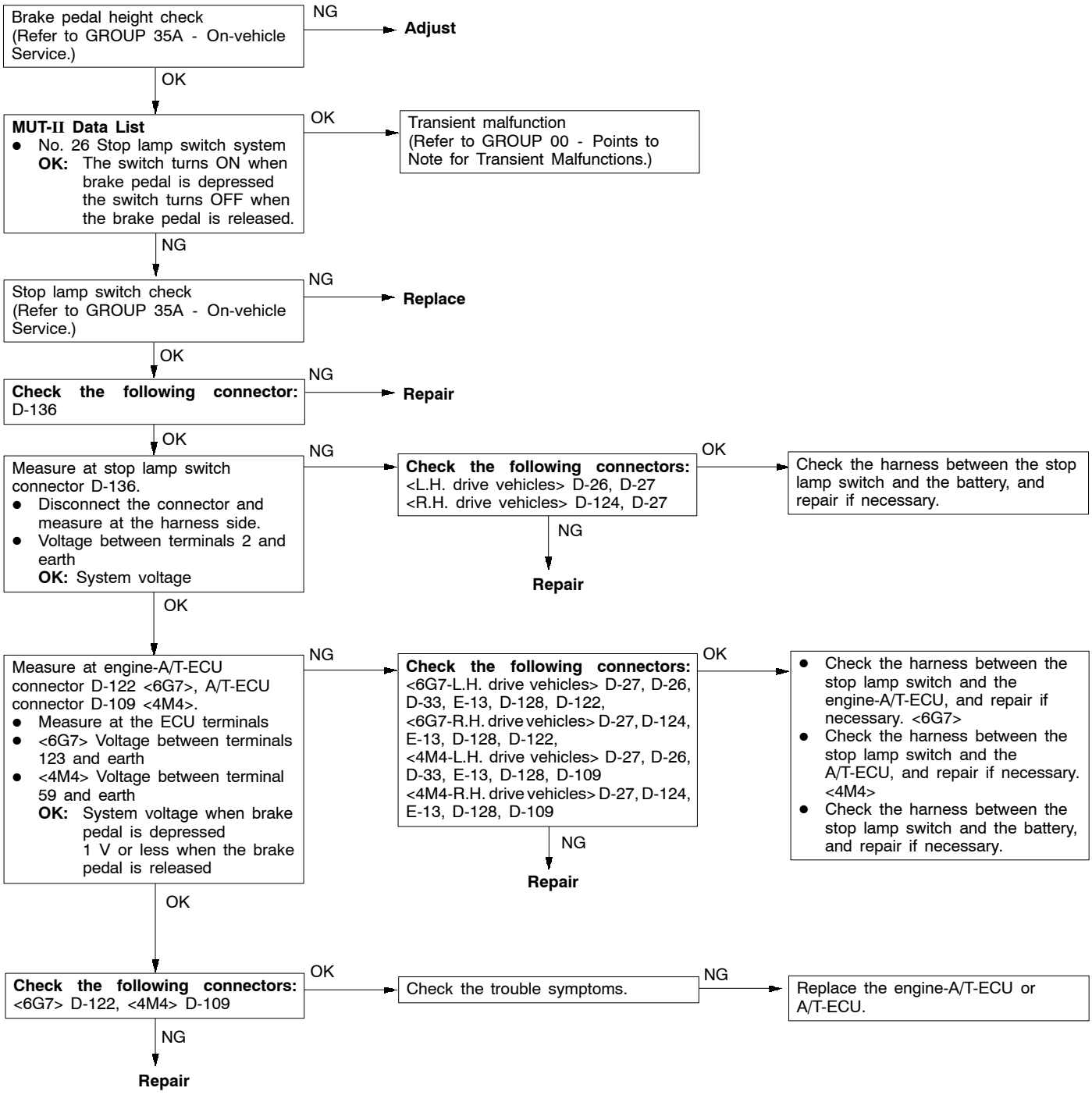
NG
Check the following connectors: <6G7> D-121, D-122, C-24, <4M4> D-108, C-24
NG
Repair
OK
Measure at output shaft speed sensor connector C-23.
● Disconnect the connector and measure at the harness side.
(1) Resistance between terminal 1 and earth
OK: 2 Ω or less
(2) Voltage between terminal 2 and earth
(Ignition switch: ON)
OK: 4.8 - 5.2 V
(3) Voltage between terminal 3 and earth
(Ignition switch: ON)
OK: System voltage
(1)NG
Check the following connector: E-113
OK
● Check the harness between the output shaft speed sensor and the engine-A/T-ECU (earth line), and repair if necessary. <6G7>
● Check the harness between the output shaft speed sensor and the A/T-ECU (earth line), and repair if necessary. <4M4>
NG
Repair
(2)NG
Check the following connector: E-113
OK
● Check the harness between the output shaft speed sensor and the engine-A/T-ECU (earth line), and repair if necessary. <6G7>
● Check the harness between the output shaft speed sensor and the A/T-ECU (sensor line), and repair if necessary. <4M4>
NG
Repair
(3)NG
Check the following connectors: D-208, D-213, D-32, E-115
OK
Check the harness between the output shaft speed sensor and the ignition switch, and repair if necessary.
NG
Repair
OK
Replace the output shaft speed sensor. ★
Check the trouble symptoms.
NG
Check the following connectors: D-208, D-213, D-32, E-115, E-113
NG
Repair
OK
● Check the harness between the output shaft speed sensor and the engine-A/T-ECU. <6G7>
● Check the harness between the output shaft speed sensor and the A/T-ECU. <4M4>
● Check the harness between the output shaft speed sensor and the ignition switch.
NG
Repair
OK
Check the trouble symptoms.
NG
Overhaul the A/T.
● Replace the direct planetary carrier.
Check the trouble symptoms.
NG
Eliminate the cause of the noise.

Code No.25 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 harness and connectors ● Malfunction of engine-A/T-ECU <6G7> ● Malfunction of A/T-ECU <4M4>



Code No. 26 Stop lamp switch system	Probable cause
If the stop lamp switch is continuously on for 5 minutes or more while the vehicle is being driven, it is judged that there is a short-circuit in the stop lamp switch and code No. 26 is output.	● Malfunction of brake pedal ● Malfunction of stop lamp switch ● Malfunction of harness or connector ● Malfunction of engine-A/T-ECU <6G7> ● Malfunction of A/T-ECU <4M4>



Code No. 31 LR solenoid valve system	Probable cause
If the drive terminal voltage of the LR solenoid valve is 3.0 V or less, it is judged that there is a short-circuit or open circuit in the LR solenoid valve, and the corresponding code is output. The transmission will be fixed in 3rd as a fail-safe measure, and the N range indicator will flash at a rate of 1 Hz.	● Malfunction of LR solenoid valve ● Malfunction of harness or connector ● Malfunction of engine-A/T-ECU <6G7> ● Malfunction of A/T-ECU <4M4>

★ Refer to the Transmission Workshop Manual.

MUT-II Self-Diag Code
● Is code No. 54 output?
YES → Code No. 54 - A/T control relay system check (Refer to P.23-103.)
NO ↓

MUT-II Actuator Test
● No. 1 LR solenoid valve
OK: Sound of operation can be heard
OK → Transient malfunction (Refer to GROUP 00 - Points to Note for Transient Malfunctions.)
NG ↓

Measure at engine-A/T-ECU connector D-122 <6G7>, or at A/T-ECU connector D-109 <4M4>.
● Measure at the ECU terminals
● Ignition switch: ON
● <6G7> Voltage between terminal 129 and earth
● <4M4> Voltage between terminal 62 and earth
OK: System voltage
NG → **Check the following connectors:** <6G7> D-122, <4M4> D-109
OK → Check the trouble symptoms.
NG → Replace the engine-A/T-ECU or A/T-ECU.
NG → **Repair**
OK ↓

Check the following connector: C-04
NG → **Repair**
OK ↓

Measure at solenoid valve assembly connector C-04.
● Disconnect the connector and measure at the solenoid valve side.
● Resistance between terminals 6 and 10
OK: 2.7 - 3.4 Ω
NG → Replace the LR solenoid valve ★
OK ↓

Measure at solenoid valve assembly connector C-04.
● Disconnect the connector and measure at the harness side.
● Ignition switch: ON
● Voltage between terminal 10 and earth
OK: System voltage
NG → **Check the following connectors:** E-113, D-12
OK → Check the harness between the solenoid valve assembly and the A/T control relay, and repair if necessary.
NG → **Repair**
OK ↓

Check the following connectors: <6G7> D-122, E-113, D-12 <4M4> D-109, E-113, D-12
NG → **Repair**
OK ↓

● Check the harness between the solenoid valve assembly and the engine-A/T-ECU, and repair if necessary. <6G7>
● Check the harness between the solenoid valve assembly and the A/T-ECU, and repair if necessary. <4M4>
● Check the harness between the solenoid valve assembly and the A/T control relay, and repair if necessary.

Code No. 32 UD solenoid valve system	Probable cause
If the drive terminal voltage of the UD solenoid valve is 3.0 V or less, it is judged that there is a short-circuit or open circuit in the UD solenoid valve, and the corresponding code is output. The transmission will be fixed in 3rd as a fail-safe measure, and the N range indicator will flash at a rate of 1 Hz.	● Malfunction of UD solenoid valve ● Malfunction of harness or connector ● Malfunction of engine-A/T-ECU <6G7> ● Malfunction of A/T-ECU <4M4>

★ Refer to the Transmission Workshop Manual.

MUT-II Self-Diag Code
- Is code No. 54 output?

YES → Code No. 54 - A/T control relay system check (Refer to P.23-103.)

NO ↓

MUT-II Actuator Test
- No.2 UD solenoid valve
  OK: Sound of operation can be heard

OK → Transient malfunction (Refer to GROUP 00 - Points to Note for Transient Malfunctions.)

NG ↓

Measure at engine-A/T-ECU connector D-122 <6G7>, or at A/T-ECU connector D-107 <4M4>.
- Measure at the ECU terminals
- Ignition switch: ON
- <6G7> Voltage between terminal 120 and earth
- <4M4> Voltage between terminal 1 and earth
  OK: System voltage

NG → **Check the following connectors:** <6G7> D-122, <4M4> D-107
- OK → Check the trouble symptoms.
  - NG → Replace the engine-A/T-ECU or A/T-ECU.
- NG → **Repair**

OK ↓

Check the following connector: C-04

NG → **Repair**

OK ↓

Measure at solenoid valve assembly connector C-04.
- Disconnect the connector and measure at the solenoid valve side.
- Resistance between terminals 3 and 9
  OK: 2.7 - 3.4 Ω

NG → Replace the UD solenoid valve. ★

OK ↓

Measure at solenoid valve assembly connector C-04.
- Disconnect the connector and measure at the harness side.
- Ignition switch: ON
- Voltage between terminals 9 and earth
  OK: System voltage

NG → **Check the following connectors:** E-113, D-12
- OK → Check the harness between the solenoid valve assembly and the A/T control relay, and repair if necessary.
- NG → **Repair**

OK ↓

Check the following connectors: <6G7> D-122, E-113, D-12, <4M4> D-107, E-113, D-12

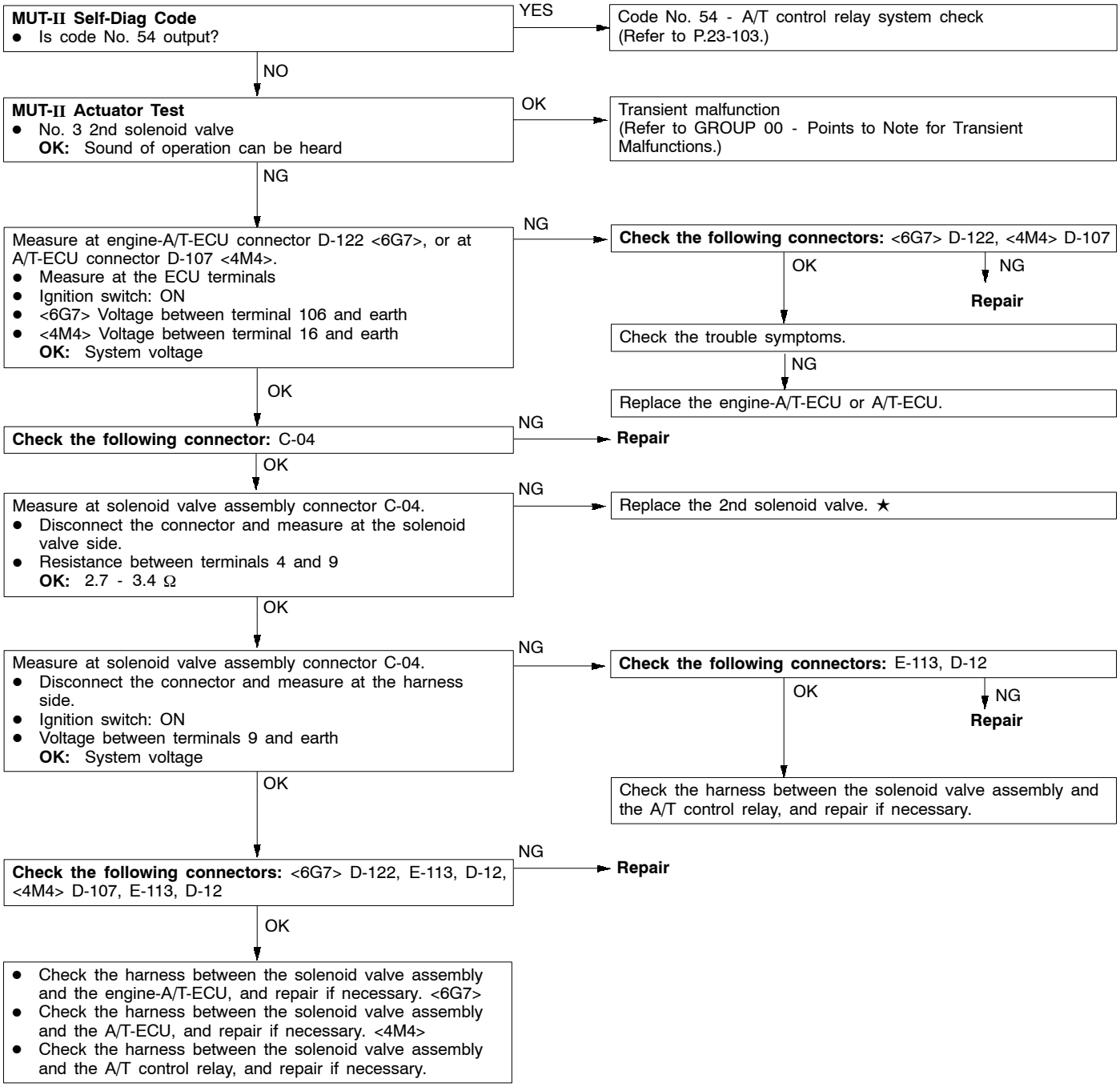
NG → **Repair**

OK ↓

- Check the harness between the solenoid valve assembly and the engine-A/T-ECU, and repair if necessary. <6G7>
- Check the harness between the solenoid valve assembly and the A/T-ECU, and repair if necessary. <4M4>
- Check the harness between the solenoid valve assembly and the A/T control relay, and repair if necessary.

Code No. 33 2nd solenoid valve system	Probable cause
If the drive terminal voltage of the 2nd solenoid valve is 3.0 V or less, it is judged that there is a short-circuit or open circuit in the 2nd solenoid valve, and the corresponding code is output. The transmission will be fixed in 3rd as a fail-safe measure, and the N range indicator will flash at a rate of 1 Hz.	● Malfunction of 2nd solenoid valve ● Malfunction of harness or connector ● Malfunction of engine-A/T-ECU <6G7> ● Malfunction of A/T-ECU <4M4>

★ Refer to the Transmission Workshop Manual.



Code No. 34 OD solenoid valve system	Probable cause
If the drive terminal voltage of the OD solenoid valve is 3.0 V or less, it is judged that there is a short-circuit or open circuit in the OD solenoid valve, and the corresponding code is output. The transmission will be fixed in 3rd as a fail-safe measure, and the N range indicator will flash at a rate of 1 Hz.	● Malfunction of OD solenoid valve ● Malfunction of harness or connector ● Malfunction of engine-A/T-ECU <6G7> ● Malfunction of A/T-ECU <4M4>

★ Refer to the Transmission Workshop Manual.

MUT-II Self-Diag Code
- Is code No. 54 output?

YES → Code No. 54 - A/T control relay system check (Refer to P.23-103.)

NO ↓

MUT-II Actuator Test
- No.4 OD solenoid valve
  OK: Sound of operation can be heard

OK → Transient malfunction (Refer to GROUP 00 - Points to Note for Transient Malfunctions.)

NG ↓

Measure at engine-A/T-ECU connector D-122 <6G7>, or at A/T-ECU connector D-107 <4M4>.
- Measure at the ECU terminals
- Ignition switch: ON
- <6G7> Voltage between terminal 130 and earth
- <4M4> Voltage between terminal 14 and earth
  OK: System voltage

NG → **Check the following connectors:** <6G7> D-122, <4M4> D-107
- OK → Check the trouble symptoms.
  - NG → Replace the engine-A/T-ECU or A/T-ECU.
- NG → **Repair**

OK ↓

Check the following connector: C-04

NG → **Repair**

OK ↓

Measure at solenoid valve assembly connector C-04.
- Disconnect the connector and measure at the solenoid valve side.
- Resistance between terminals 5 and 9
  OK: 2.7 - 3.4 Ω

NG → Replace the OD solenoid valve. ★

OK ↓

Measure at solenoid valve assembly connector C-04.
- Disconnect the connector and measure at the harness side.
- Ignition switch: ON
- Voltage between terminals 9 and earth
  OK: System voltage

NG → **Check the following connectors:** E-113, D-12
- OK → Check the harness between the solenoid valve assembly and the A/T control relay, and repair if necessary.
- NG → **Repair**

OK ↓

Check the following connectors: <6G7> D-122, E-113, D-12, <4M4> D-107, E-113, D-12

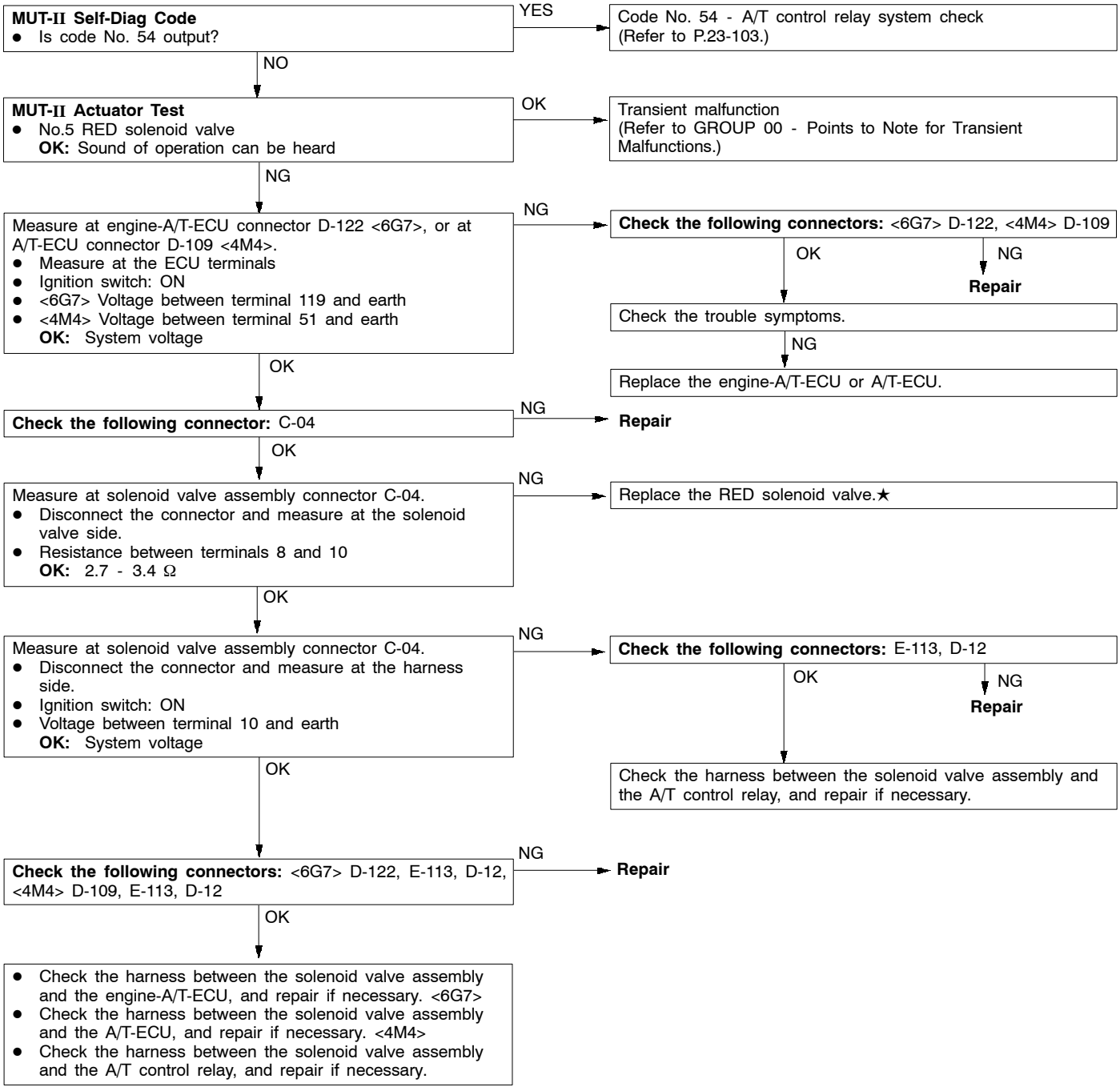
NG → **Repair**

OK ↓

- Check the harness between the solenoid valve assembly and the engine-A/T-ECU, and repair if necessary. <6G7>
- Check the harness between the solenoid valve assembly and the A/T-ECU, and repair if necessary. <4M4>
- Check the harness between the solenoid valve assembly and the A/T control relay, and repair if necessary.

Code No. 35 RED solenoid valve system	Probable cause
If the drive terminal voltage of the RED solenoid valve is 3.0 V or less, it is judged that there is a short-circuit or open circuit in the RED solenoid valve, and the corresponding code is output. The transmission will be fixed in 3rd as a fail-safe measure, and the N range indicator will flash at a rate of 1 Hz.	● Malfunction of RED solenoid valve ● Malfunction of harness or connector ● Malfunction of engine-A/T-ECU <6G7> ● Malfunction of A/T-ECU <4M4>

★ Refer to the Transmission Workshop Manual.



Code No. 36 DCC solenoid valve system	Probable cause
If the drive terminal voltage of the DCC solenoid valve is 3.0 V or less, it is judged that there is a short-circuit or open circuit in the DCC solenoid valve, and code No. 36 is output. The transmission will be fixed in 3rd as a fail-safe measure, and the N range indicator will flash at a rate of 1 Hz.	● Malfunction of DCC solenoid valve ● Malfunction of harness or connector ● Malfunction of engine-A/T-ECU <6G7> ● Malfunction of A/T-ECU <4M4>

★ Refer to the Transmission Workshop Manual.

MUT-II Self-Diag Code
● Is code No. 54 output?
YES → Code No. 54 - A/T control relay system check (Refer to P.23-103.)
NO ↓

MUT-II Actuator Test
● No. 6 DCC solenoid valve
OK: Sound of operation can be heard
OK → Transient malfunction (Refer to GROUP 00 - Points to Note for Transient Malfunctions.)
NG ↓

Measure at engine-A/T-ECU connector D-122 <6G7>, or at A/T-ECU connector D-107 <4M4>.
● Measure at the ECU terminals.
● Ignition switch: ON
● <6G7> Voltage between terminal 107 and earth
● <4M4> Voltage between terminal 15 and earth
OK: System voltage
NG → **Check the following connectors:** <6G7> D-122, <4M4> D-107
OK → Check the trouble symptoms.
NG → Replace the engine-A/T-ECU or A/T-ECU.
NG → **Repair**
OK ↓

Check the following connector: C-04
NG → **Repair**
OK ↓

Measure at solenoid valve assembly connector C-04.
● Disconnect the connector and measure at the solenoid valve side.
● <4M4> Resistance between terminal 7 and 10
OK: 2.7 - 3.4 Ω
NG → Replace the DCC solenoid valve. ★
OK ↓

Measure at solenoid valve assembly connector C-04.
● Disconnect the connector and measure at the harness side.
● Ignition switch: ON
● Voltage between terminal 10 and earth
OK: System voltage
NG → **Check the following connectors:** E-113, D-12
OK → Check the harness between the solenoid valve assembly and the A/T control relay, and repair if necessary.
NG → **Repair**
OK ↓

Check the following connectors: <6G7> D-122, E-113, D-12, <4M4> D-107, E-113, D-12
NG → **Repair**
OK ↓

● Check the harness between the solenoid valve assembly and the engine-A/T-ECU, and repair if necessary. <6G7>
● Check the harness between the solenoid valve assembly and the A/T-ECU, and repair if necessary. <4M4>
● Check the harness between the solenoid valve assembly and the A/T control relay, and repair if necessary.

Code No.41 1st without completion of shifting	Probable cause
If the output shaft speed sensor output multiplied by the 1st gear ratio is not identical to the input shaft speed sensor output after shifting to 1st, code No. 41 is output. If code No. 41 is output 4 times, the transmission is fixed in 3rd and the N range lamp flashes at a rate of 1 Hz.	● Malfunction of input shaft speed sensor ● Malfunction of output shaft speed sensor ● Malfunction of harness or connector ● Malfunction of solenoid valve ● Malfunction of reverse clutch retainer ● Malfunction of direct planetary carrier ● Malfunction of LR brake system ● Malfunction of UD clutch system ● Malfunction of RED brake system ● Malfunction of one-way clutch system ● Malfunction of engine-A/T-ECU <6G7> ● Malfunction of A/T-ECU <4M4> ● Noise is generated.

★ Refer to the Transmission Workshop Manual.

MUT-II Self-Diag Code
- Is code No. 22 output?

YES → Code No. 22 Input shaft speed sensor system check (Refer to P.23-20.)

NO

MUT-II Actuator Test
- Is code No. 23 output?

YES → Code No. 23 Input shaft speed sensor system check (Refer to P.23-22.)

NO

MUT-II Actuator Test
- No.1 LR solenoid valve
- No.2 UD solenoid valve
- No.3 2ND solenoid valve
- No.4 OD solenoid valve
- No.5 RED solenoid valve

OK: The sound of operation should be heard.

NG → Replace the appropriate solenoid valve. ★

OK

Measure the output wave pattern of the input shaft speed sensor at engine-A/T-ECU connectors D-121 and D-122 <6G7>, or at A/T-ECU connector D-108 <4M4> (using an oscilloscope).
- Vehicle speed: approx. 50 km/h
- Shift range: 4th

<6G7> Voltage between No.81 (D-121) and No.103 (D-122)
<4M4> Voltage between No.31 (D-108) and No.43 (D-108)
OK: A wave pattern such as the one shown on P.23-69 (Check Procedure Using an Oscilloscope) should be output, and the maximum value should be 4.8 V or more and the minimum value should be 0.8 V or less. There should be no noise in the output wave pattern.

NG →
- Check the harness between the input shaft speed sensor and the engine-A/T-ECU. <6G7>
- Check the harness between the input shaft speed sensor and the A/T-ECU. <4M4>

OK → Replace the input shaft speed sensor. ★

NG → **Repair**

Check the trouble symptoms.

NG → Overhaul the A/T. ★
- Replace the reverse clutch retainer.

Check the trouble symptoms.

NG → Eliminate the cause of the noise.

OK

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OK

Measure the output wave pattern of the output shaft speed sensor at engine-A/T-ECU connectors D-121 and D-122 <6G7>, or at A/T-ECU connector D-108 <4M4> (using an oscilloscope).
- Vehicle speed: approx. 50 km/h
- Shift range: 4th
  <6G7> Voltage between No.81 (D-121) and No.104 (D-122)
  <4M4> Voltage between No.32 (D-108) and No.43 (D-108)
  OK: A wave pattern such as the one shown on P.23-69 (Check Procedure Using an Oscilloscope) should be output, and the maximum value should be 4.8 V or more and the minimum value should be 0.8 V or less. There should be no noise in the output wave pattern.

NG

- Check the harness between the output shaft speed sensor and the engine-A/T-ECU. <6G7>
- Check the harness between the output shaft speed sensor and the A/T-ECU. <4M4>

OK

NG

Repair

Replace the output shaft speed sensor. ★

Check the trouble symptoms.

NG

Overhaul the A/T. ★
- Replace the direct planetary carrier.

Check the trouble symptoms.

NG

Eliminate the cause of the noise.

OK

Replace the valve body assembly. ★

Check the trouble symptoms.

NG

Replace the engine-A/T-ECU or A/T-ECU.

Check the trouble symptoms.

NG

Overhaul the A/T. ★
- Replace the UD clutch. (Code No. 42, 43 or No. 44 is output, or no other codes are output.)
- Replace the LR brake. (Code No. 46 is output, or no other codes are output.)
- Replace the RED brake. (Code No. 42, 43 or No. 46 is output, or no other codes are output.)
- Replace the one-way clutch (OWC-L). (No other codes are output.)
- Replace the one-way clutch (OWC-D). (Code No. 42 or No. 43 is output, or no other codes are output.)

Code No. 42 2nd without completion of shifting	Probable cause
If the output shaft speed sensor output multiplied by the 2nd gear ratio is not identical to the input shaft speed sensor output after shifting to 2nd, code No. 42 is output. If code No. 42 is output 4 times, the transmission is fixed in 3rd and the N range lamp flashes at a rate of 1 Hz.	• Malfunction of input shaft speed sensor • Malfunction of output shaft speed sensor • Malfunction of harness or connector • Malfunction of solenoid valve • Malfunction of reverse clutch retainer • Malfunction of direct planetary carrier • Malfunction of 2ND brake system • Malfunction of UD clutch system • Malfunction of RED brake system • Malfunction of one-way clutch system • Malfunction of engine-A/T-ECU <6G7> • Malfunction of A/T-ECU <4M4> • Noise is generated.

★ Refer to the Transmission Workshop Manual.

MUT-II Self-Diag Code
- Is code No. 22 output?

YES → Code No. 22 Input shaft speed sensor system check (Refer to P.23-20.)

NO ↓

MUT-II Actuator Test
- Is code No. 23 output?

YES → Code No. 23 Output shaft speed sensor system check (Refer to P.23-22.)

NO ↓

MUT-II Actuator Test
- No.1 LR solenoid valve
- No.2 UD solenoid valve
- No.3 2ND solenoid valve
- No.4 OD solenoid valve
- No.5 RED solenoid valve

OK: The sound of operation should be heard.

NG → Replace the appropriate solenoid valve. ★

OK ↓

Measure the output wave pattern of the input shaft speed sensor at engine-A/T-ECU connectors D-121 and D-122 <6G7>, or at A/T-ECU connector D-108 <4M4> (using an oscilloscope).
- Vehicle speed: approx. 50 km/h
- Shift range: 4th

<6G7> Voltage between No.81 (D-121) and No.103 (D-122)
<4M4> Voltage between No.31 (D-108) and No.43 (D-108)
OK: A wave pattern such as the one shown on P.23-69 (Check Procedure Using an Oscilloscope) should be output, and the maximum value should be 4.8 V or more and the minimum value should be 0.8 V or less. There should be no noise in the output wave pattern.

NG →
- Check the harness between the input shaft speed sensor and the engine-A/T-ECU. <6G7>
- Check the harness between the input shaft speed sensor and the A/T-ECU. <4M4>

OK ↓ / NG → **Repair**

Replace the input shaft speed sensor. ★ ↓

Check the trouble symptoms. ↓

NG →

Overhaul the A/T. ★
- Replace the reverse clutch retainer.

↓

Check the trouble symptoms. ↓

NG → Eliminate the cause of the noise.

OK ↓

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OK

Measure the output wave pattern of the output shaft speed sensor at engine-A/T-ECU connectors D-121 and D-122 <6G7>, or at A/T-ECU connector D-108 <4M4> (using an oscilloscope).
- Vehicle speed: approx. 50 km/h
- Shift range: 4th
  <6G7> Voltage between No.81 (D-121) and No.104 (D-122)
  <4M4> Voltage between No.32 (D-108) and No.43 (D-108)
  OK: A wave pattern such as the one shown on P.23-69 (Check Procedure Using an Oscilloscope) should be output, and the maximum value should be 4.8 V or more and the minimum value should be 0.8 V or less. There should be no noise in the output wave pattern.

NG →
- Check the harness between the output shaft speed sensor and the engine-A/T-ECU. <6G7>
- Check the harness between the output shaft speed sensor and the A/T-ECU. <4M4>

OK → NG → **Repair**

Replace the output shaft speed sensor. ★

Check the trouble symptoms.

NG

Overhaul the A/T. ★
- Replace the direct planetary carrier.

Check the trouble symptoms.

NG

Eliminate the cause of the noise.

OK

Replace the valve body assembly. ★

Check the trouble symptoms.

NG

Replace the engine-A/T-ECU or A/T-ECU.

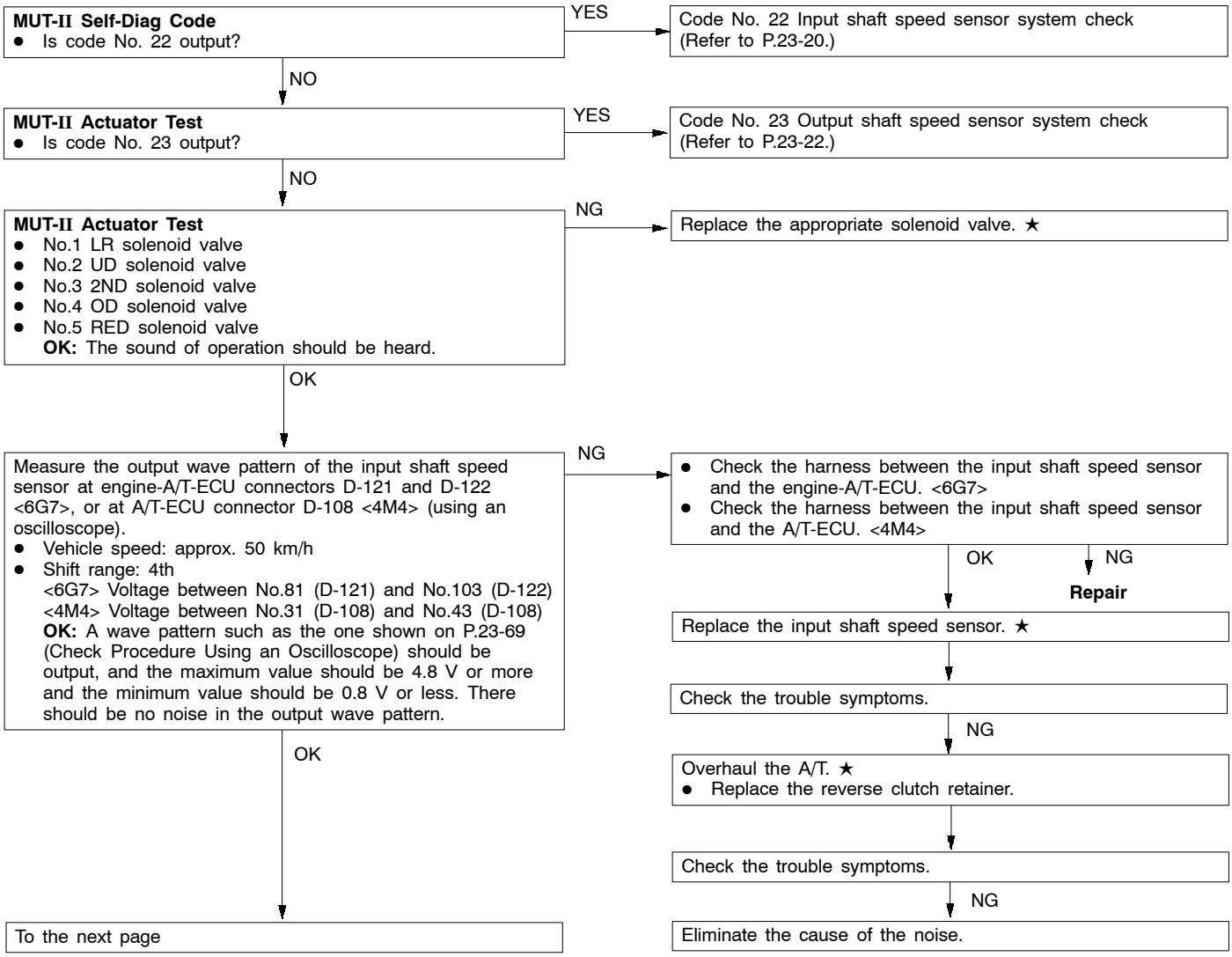
Check the trouble symptoms.

NG

Overhaul the A/T. ★
- Replace the UD clutch. (Code No. 41, 43 or No. 44 is output, or no other codes are output.)
- Replace the 2ND brake. (Code No. 44 or No. 45 is output, or no other codes are output.)
- Replace the RED brake. (Code No. 41, 43 or No. 46 is output, or no other codes are output.)
- Replace the one-way clutch (OWC-D). (Code No. 41 or No. 43 is output, or no other codes are output.)

Code No.43 3rd without completion of shifting	Probable cause
If the output shaft speed sensor output multiplied by the 3rd gear ratio is not identical to the input shaft speed sensor output after shifting to 3rd, code No. 43 is output. If code No. 43 is output 4 times, the transmission is fixed in 3rd and the N range lamp flashes at a rate of 1 Hz.	● Malfunction of input shaft speed sensor ● Malfunction of output shaft speed sensor ● Malfunction of harness or connector ● Malfunction of solenoid valve ● Malfunction of reverse clutch retainer ● Malfunction of direct planetary carrier ● Malfunction of UD clutch system ● Malfunction of OD clutch system ● Malfunction of RED brake system ● Malfunction of one-way clutch system ● Malfunction of engine-A/T-ECU <6G7> ● Malfunction of A/T-ECU <4M4> ● Noise is generated.

★ Refer to the Transmission Workshop Manual.



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OK

Measure the output wave pattern of the output shaft speed sensor at engine-A/T-ECU connectors D-121 and D-122 <6G7>, or at A/T-ECU connector D-108 <4M4> (using an oscilloscope).
- Vehicle speed: approx. 50 km/h
- Shift range: 4th
  <6G7>Voltage between No.81 (D-121) and No.104 (D-122)
  <4M4> Voltage between No.32 (D-108) and No.43 (D-108)
  OK: A wave pattern such as the one shown on P.23-69 (Check Procedure Using an Oscilloscope) should be output, and with the maximum value should be 4.8 V or more and the minimum value should be 0.8 V or less. There should be no noise in the output wave pattern.

NG

- Check the harness between the output shaft speed sensor and the engine-A/T-ECU. <6G7>
- Check the harness between the output shaft speed sensor and the A/T-ECU. <4M4>

OK

NG

Repair

Replace the output shaft speed sensor. ★

Check the trouble symptoms.

NG

Overhaul the A/T. ★
- Replace the direct planetary carrier.

Check the trouble symptoms.

NG

Eliminate the cause of the noise.

OK

Replace the valve body assembly. ★

Check the trouble symptoms.

NG

Replace the engine-A/T-ECU or A/T-ECU.

Check the trouble symptoms.

NG

Overhaul the A/T. ★
- Replace the UD clutch. (Code No. 41, 42 or No. 44 is output, or no other codes are output.)
- Replace the OD clutch. (Code No. 44 or No. 45 is output, or no other codes are output.)
- Replace the RED brake. (Code No. 41, 42 or No. 46 is output, or no other codes are output.)
- Replace the one-way clutch (OWC-D). (Code No. 41 or No. 42 is output, or no other codes are output.)

Code No.44 4th without completion of shifting	Probable cause
If the output shaft speed sensor output multiplied by the 4th gear ratio is not identical to the input shaft speed sensor output after shifting to 4th, code No. 44 is output. If code No. 44 is output 4 times, the transmission is fixed in 3rd and the N range lamp flashes at a rate of 1 Hz.	● Malfunction of input shaft speed sensor ● Malfunction of output shaft speed sensor ● Malfunction of harness or connector ● Malfunction of solenoid valve ● Malfunction of reverse clutch retainer ● Malfunction of direct planetary carrier ● Malfunction of UD clutch system ● Malfunction of 2ND brake system ● Malfunction of OD clutch system ● Malfunction of DIR clutch system ● Malfunction of engine-A/T-ECU <6G7> ● Malfunction of A/T-ECU <4M4> ● Noise is generated.

★ Refer to the Transmission Workshop Manual.

MUT-II Self-Diag Code
- Is code No. 22 output?

YES → Code No. 22 Input shaft speed sensor system check (Refer to P.23-20.)

NO

MUT-II Actuator Test
- Is code No. 23 output?

YES → Code No. 23 Output shaft speed sensor system check (Refer to P.23-22.)

NO

MUT-II Actuator Test
- No.1 LR solenoid valve
- No.2 UD solenoid valve
- No.3 2ND solenoid valve
- No.4 OD solenoid valve
- No.5 RED solenoid valve

OK: The sound of operation should be heard.

NG → Replace the appropriate solenoid valve. ★

OK

Measure the output wave pattern of the input shaft speed sensor at engine-A/T-ECU connectors D-121 and D-122 <6G7>, or at A/T-ECU connector D-108 <4M4> (using an oscilloscope).
- Vehicle speed: approx. 50 km/h
- Shift range: 4th

<6G7> Voltage between No.81 (D-121) and No.103 (D-122)
<4M4> Voltage between No.31 (D-108) and No.43 (D-108)
OK: A wave pattern such as the one shown on P.23-69 (Check Procedure Using an Oscilloscope) should be output, and the maximum value should be 4.8 V or more and the minimum value should be 0.8 V or less. There should be no noise in the output wave pattern.

NG →
- Check the harness between the input shaft speed sensor and the engine-A/T-ECU. <6G7>
- Check the harness between the input shaft speed sensor and the A/T-ECU. <4M4>

OK → Replace the input shaft speed sensor. ★

NG → **Repair**

Check the trouble symptoms.

NG → Overhaul the A/T. ★
- Replace the reverse clutch retainer.

Check the trouble symptoms.

NG → Eliminate the cause of the noise.

OK

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OK

Measure the output wave pattern of the output shaft speed sensor at engine-A/T-ECU connectors D-121 and D-122 <6G7>, or at A/T-ECU connector D-108 <4M4> (using an oscilloscope).
- Vehicle speed: approx. 50 km/h
- Shift range: 4th
  <6G7> Voltage between No.81 (D-121) and No.104 (D-122)
  <4M4> Voltage between No.32 (D-108) and No.43 (D-108)
  OK: A wave pattern such as the one shown on P.23-69 (Check Procedure Using an Oscilloscope) should be output, and the maximum value should be 4.8 V or more and the minimum value should be 0.8 V or less. There should be no noise in the output wave pattern.

NG

- Check the harness between the output shaft speed sensor and the engine-A/T-ECU. <6G7>
- Check the harness between the output shaft speed sensor and the A/T-ECU. <4M4>

OK

NG
Repair

Replace the output shaft speed sensor. ★

Check the trouble symptoms.

NG

Overhaul the A/T. ★
- Replace the direct planetary carrier.

Check the trouble symptoms.

NG

Eliminate the cause of the noise.

OK

Replace the valve body assembly. ★

Check the trouble symptoms.

NG

Replace the engine-A/T-ECU or A/T-ECU.

Check the trouble symptoms.

NG

Overhaul the A/T. ★
- Replace the UD clutch. (Code No. 41, 42 or No. 43 is output, or no other codes are output.)
- Replace the OD clutch. (Code No. 43 or No. 45 is output, or no other codes are output.)
- Replace the DIR clutch. (Code No. 45 is output, or no other codes are output.)

Code No.45 5th without completion of shifting	Probable cause
If the output shaft speed sensor output multiplied by the 5th gear ratio is not identical to the input shaft speed sensor output after shifting to 5th, code No. 45 is output. If code No. 45 is output 4 times, the transmission is fixed in 3rd and the N range lamp flashes at a rate of 1 Hz.	● Malfunction of input shaft speed sensor ● Malfunction of output shaft speed sensor ● Malfunction of harness or connector ● Malfunction of solenoid valve ● Malfunction of reverse clutch retainer ● Malfunction of direct planetary carrier ● Malfunction of 2ND brake system ● Malfunction of OD clutch system ● Malfunction of DIR clutch system ● Malfunction of engine-A/T-ECU <6G7> ● Malfunction of A/T-ECU. <4M4> ● Noise is generated.

★ Refer to the Transmission Workshop Manual.

MUT-II Self-Diag Code
● Is code No. 22 output?

YES → Code No. 22 Input shaft speed sensor system check (Refer to P.23-20.)

NO

MUT-II Actuator Test
● Is code No. 23 output?

YES → Code No. 23 Output shaft speed sensor system check (Refer to P.23-22.)

NO

MUT-II Actuator Test
● No.1 LR solenoid valve
● No.2 UD solenoid valve
● No.3 2ND solenoid valve
● No.4 OD solenoid valve
● No.5 RED solenoid valve
OK: The sound of operation should be heard.

NG → Replace the appropriate solenoid valve. ★

OK

Measure the output wave pattern of the input shaft speed sensor at engine-A/T-ECU connectors D-121 and D-122 <6G7>, or at A/T-ECU connector D-108 <4M4> (using an oscilloscope).
● Vehicle speed: approx. 50 km/h
● Shift range: 4th
<6G7> Voltage between No.81 (D-121) and No.103 (D-122)
<4M4> Voltage between No.31 (D-108) and No.43 (D-108)
OK: A wave pattern such as the one shown on P.23-69 (Check Procedure Using an Oscilloscope) should be output, and the maximum value should be 4.8 V or more and the minimum value should be 0.8 V or less. There should be no noise in the output wave pattern.

NG →
● Check the harness between the input shaft speed sensor and the engine-A/T-ECU. <6G7>
● Check the harness between the input shaft speed sensor and the A/T-ECU. <4M4>

OK → Replace the input shaft speed sensor. ★
NG → **Repair**

Check the trouble symptoms.

NG →
Overhaul the A/T. ★
● Replace the reverse clutch retainer.

Check the trouble symptoms.

NG → Eliminate the cause of the noise.

OK

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OK

Measure the output wave pattern of the output shaft speed sensor at engine-A/T-ECU connectors D-121 and D-122 <6G7>, or at A/T-ECU connector D-108 <4M4> (using an oscilloscope).
- Vehicle speed: approx. 50 km/h
- Shift range: 4th
  <6G7> Voltage between No.81 (D-121) and No.104 (D-122)
  <4M4> Voltage between No.32 (D-108) and No.43 (D-108)
  OK: A wave pattern such as the one shown on P.23-69 (Check Procedure Using an Oscilloscope) should be output, and the maximum value should be 4.8 V or more and the minimum value should be 0.8 V or less. There should be no noise in the output wave pattern.

NG

- Check the harness between the output shaft speed sensor and the engine-A/T-ECU. <6G7>
- Check the harness between the output shaft speed sensor and the A/T-ECU. <4M4>

OK

NG

Repair

Replace the output shaft speed sensor. ★

Check the trouble symptoms.

NG

Overhaul the A/T. ★
- Replace the direct planetary carrier.

Check the trouble symptoms.

NG

Eliminate the cause of the noise.

OK

Replace the valve body assembly. ★

Check the trouble symptoms.

NG

Replace the engine-A/T-ECU or A/T-ECU.

Check the trouble symptoms.

NG

Overhaul the A/T. ★
- Replace the OD clutch. (Code No. 43 or No. 44 is output, or no other codes are output.)
- Replace the 2ND brake. (Code No. 42 is output, or no other codes are output.)
- Replace the DIR clutch. (Code No. 44 is output, or no other codes are output.)

Code No. 46 Reverse without completion of shifting	Probable cause
If the output shaft speed sensor output multiplied by the reverse gear ratio is not identical to the input shaft speed sensor output after shifting to reverse, code No. 46 is output. If code No. 46 is output 4 times, the transmission is fixed in 3rd and the N range lamp flashes at a rate of 1 Hz.	● Malfunction of input shaft speed sensor ● Malfunction of output shaft speed sensor ● Malfunction of harness or connector ● Malfunction of solenoid valve ● Malfunction of reverse clutch retainer ● Malfunction of direct planetary carrier ● Malfunction of LR brake system ● Malfunction of REV clutch system ● Malfunction of RED clutch system ● Malfunction of engine-A/T-ECU <6G7> ● Malfunction of A/T-ECU <4M4> ● Noise is generated.

★ Refer to the Transmission Workshop Manual.

MUT-II Self-Diag Code
● Is code No. 22 output?

YES → Code No. 22 Input shaft speed sensor system check (Refer to P.23-20.)

NO

MUT-II Actuator Test
● Is code No. 23 output?

YES → Code No. 23 Output shaft speed sensor system check (Refer to P.23-22.)

NO

MUT-II Actuator Test
● No.1 LR solenoid valve
● No.2 UD solenoid valve
● No.3 2ND solenoid valve
● No.4 OD solenoid valve
● No.5 RED solenoid valve
OK: The sound of operation should be heard.

NG → Replace the appropriate solenoid valve. ★

OK

Measure the output wave pattern of the input shaft speed sensor at engine-A/T-ECU connectors D-121 and D-122 <6G7>, or at A/T-ECU connector D-108 <4M4> (using an oscilloscope).
● Vehicle speed: approx. 50 km/h
● Shift range: 4th
<6G7> Voltage between No.81 (D-121) and No.103 (D-122)
<4M4> Voltage between No.31 (D-108) and No.43 (D-108)
OK: A wave pattern such as the one shown on P.23-69 (Check Procedure Using an Oscilloscope) should be output, and the maximum value should be 4.8 V or more and the minimum value should be 0.8 V or less. There should be no noise in the output wave pattern.

NG →
● Check the harness between the input shaft speed sensor and the engine-A/T-ECU. <6G7>
● Check the harness between the input shaft speed sensor and the A/T-ECU. <4M4>

OK → Replace the input shaft speed sensor. ★
NG → **Repair**

Check the trouble symptoms.

NG →
Overhaul the A/T. ★
● Replace the reverse clutch retainer.

Check the trouble symptoms.

NG → Eliminate the cause of the noise.

OK

To the next page

From the previous page

OK

Measure the output wave pattern of the output shaft speed sensor at engine-A/T-ECU connectors D-121 and D-122 <6G7>, or at A/T-ECU connector D-108 <4M4> (using an oscilloscope).
- Vehicle speed: approx. 50 km/h
- Shift range: 4th
  <6G7> Voltage between No.81 (D-121) and No.104 (D-122)
  <4M4> Voltage between No.32 (D-108) and No.43 (D-108)
  OK: A wave pattern such as the one shown on P.23-69 (Check Procedure Using an Oscilloscope) should be output, and the maximum value should be 4.8 V or more and the minimum value should be 0.8 V or less. There should be no noise in the output wave pattern.

NG →
- Check the harness between the output shaft speed sensor and the engine-A/T-ECU. <6G7>
- Check the harness between the output shaft speed sensor and the A/T-ECU. <4M4>

OK → NG → **Repair**

Replace the output shaft speed sensor. ★

Check the trouble symptoms.

NG

Overhaul the A/T. ★
- Replace the reverse clutch.

Check the trouble symptoms.

NG

Eliminate the cause of the noise.

OK

Replace the valve body assembly. ★

Check the trouble symptoms.

NG

Replace the engine-A/T-ECU or A/T-ECU.

Check the trouble symptoms.

NG

Overhaul the A/T. ★
- Replace the LR brake. (Code No. 41 is output, or no other codes are output.)
- Replace the REV clutch. (No other codes are output.)
  Replace the RED brake. (Code No. 41, 42 or No. 43 is output, or no other codes are output.)

Code No. 51 Communication problem with engine-ECU	Probable cause
If normal communication cannot be carried out successfully for 1 second or more when the ignition switch is at the ON position, the system voltage is 10 V or higher and the engine speed is 450 r/min or higher, code No. 51 is output. Furthermore, code No. 51 is also output if a communication problem with receiving data continues for 4 seconds or more under the same conditions.	• Malfunction of engine-A/T-ECU <6G7> • Malfunction of engine-ECU <4M4> • Malfunction of A/T-ECU <4M4> • Malfunction of harness or connector <4M4>

<6G7>

Malfunction of engine-A/T-ECU

<4M4>

Check the following connectors: D-112, D-109

NG → **Repair**

OK

Check the harness between the engine-ECU and the A/T-ECU.

NG → **Repair**

OK

Check the trouble symptoms.

NG

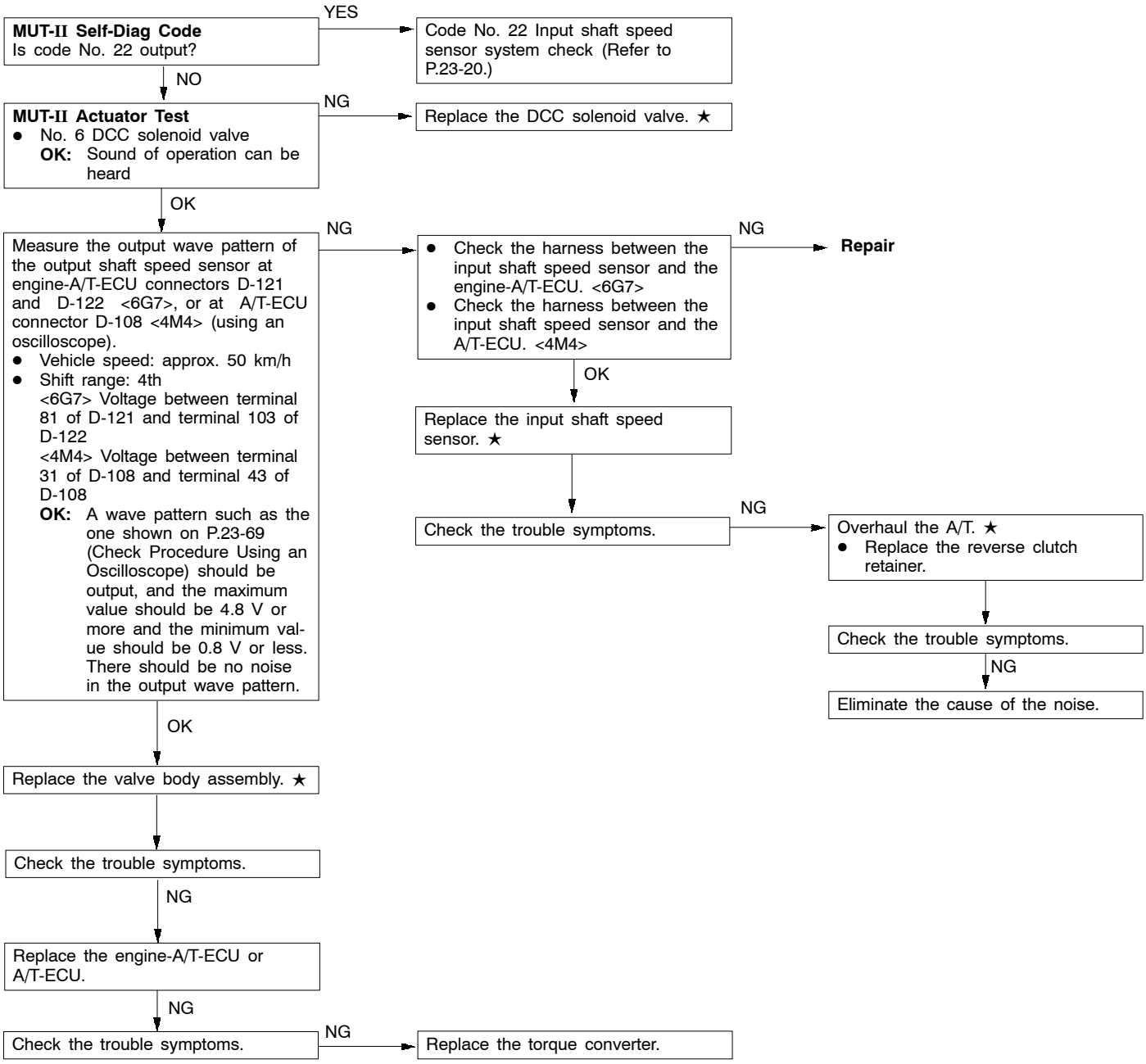
Malfunction of A/T-ECU

Check the trouble symptoms.

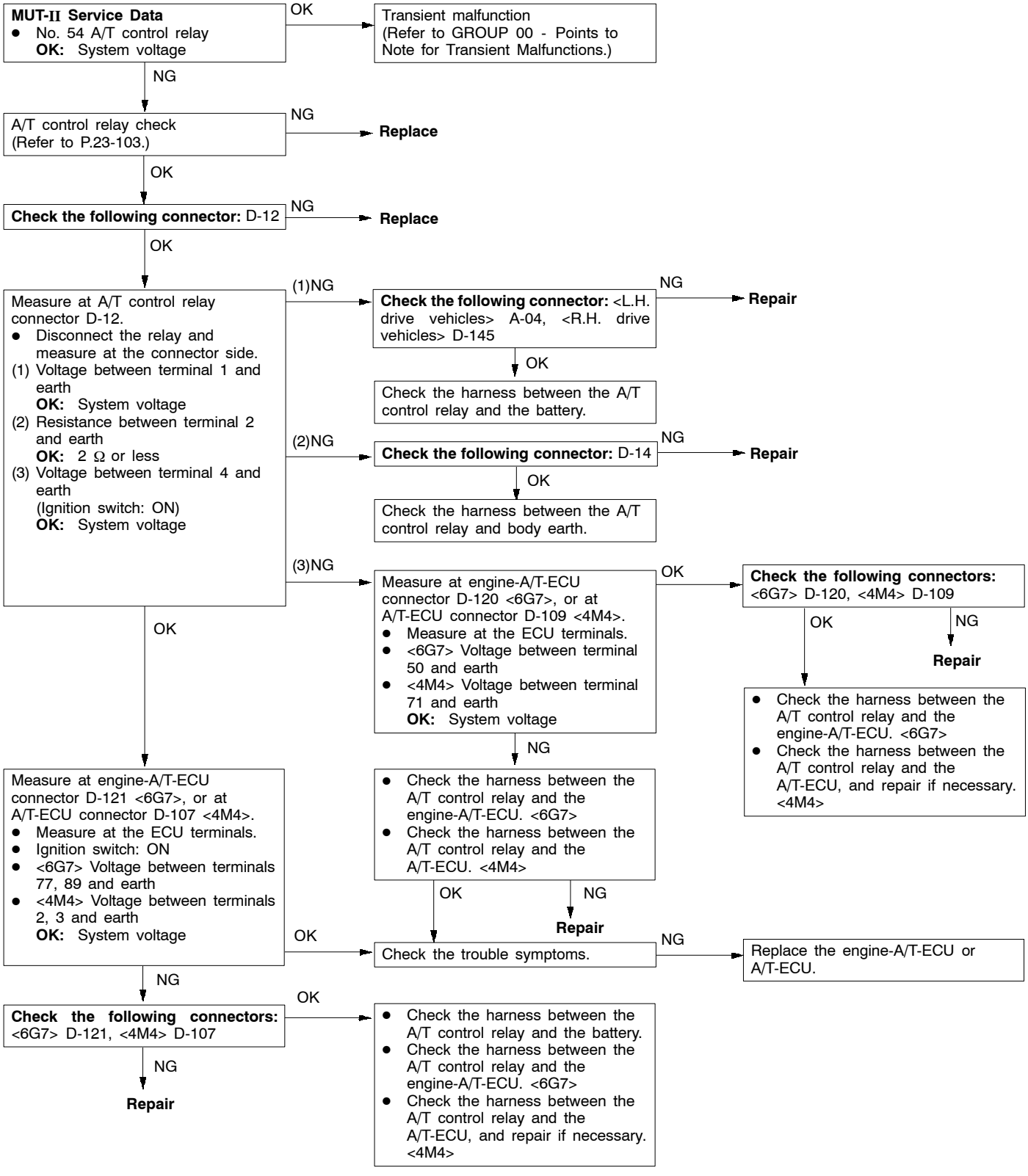
NG → Replace the engine-ECU.

Code No. 52 Damper clutch control system	Probable cause
If the DCC solenoid valve drive duty ratio is 100% for a continuous period of 4 seconds or more when the damper clutch starts operating, it is judged that there is a problem with the damper clutch control system, and code No. 52 is output.	● Malfunction of input shaft speed sensor ● Malfunction of DCC solenoid valve ● Malfunction of harness or connector ● Malfunction of reverse clutch retainer ● Malfunction of engine-A/T-ECU <6G7> ● Malfunction of A/T-ECU <4M4> ● Malfunction of torque converter

★ Refer to the Transmission Workshop Manual.



Code No. 54 A/T control relay system	Probable cause
If the A/T control relay voltage is less than 7 V after the ignition switch is turned to the ON position, it is judged that there is a short-circuit to earth or open circuit in the A/T control relay, and code No. 54 is output. The transmission will be fixed in 3rd as a fail-safe measure, and the N range indicator will flash at a rate of 1 Hz.	● Malfunction of A/T control relay ● Malfunction of harness or connector ● Malfunction of engine-A/T-ECU <6G7> ● Malfunction of A/T-ECU <4M4>



Code No. 56 N range lamp system	Probable cause
If the N range signal is OFF after the N range lamp illuminates (ON), it is judged that there is a short-circuit to earth in the N range lamp, and code No. 56 is output.	● Malfunction of Combination meter ● Malfunction of harness or connector ● Malfunction of engine-A/T-ECU <6G7> ● Malfunction of A/T-ECU <4M4>

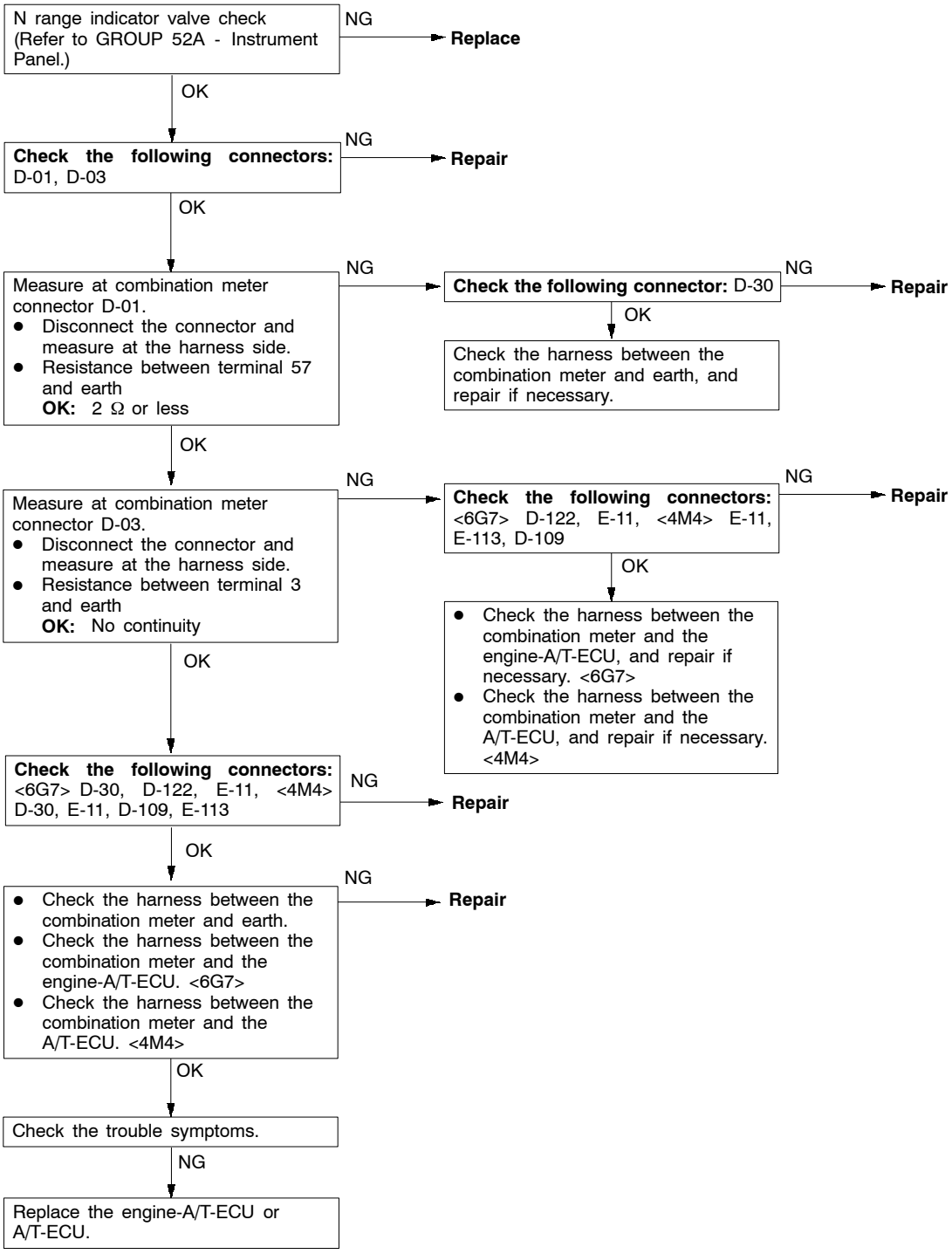


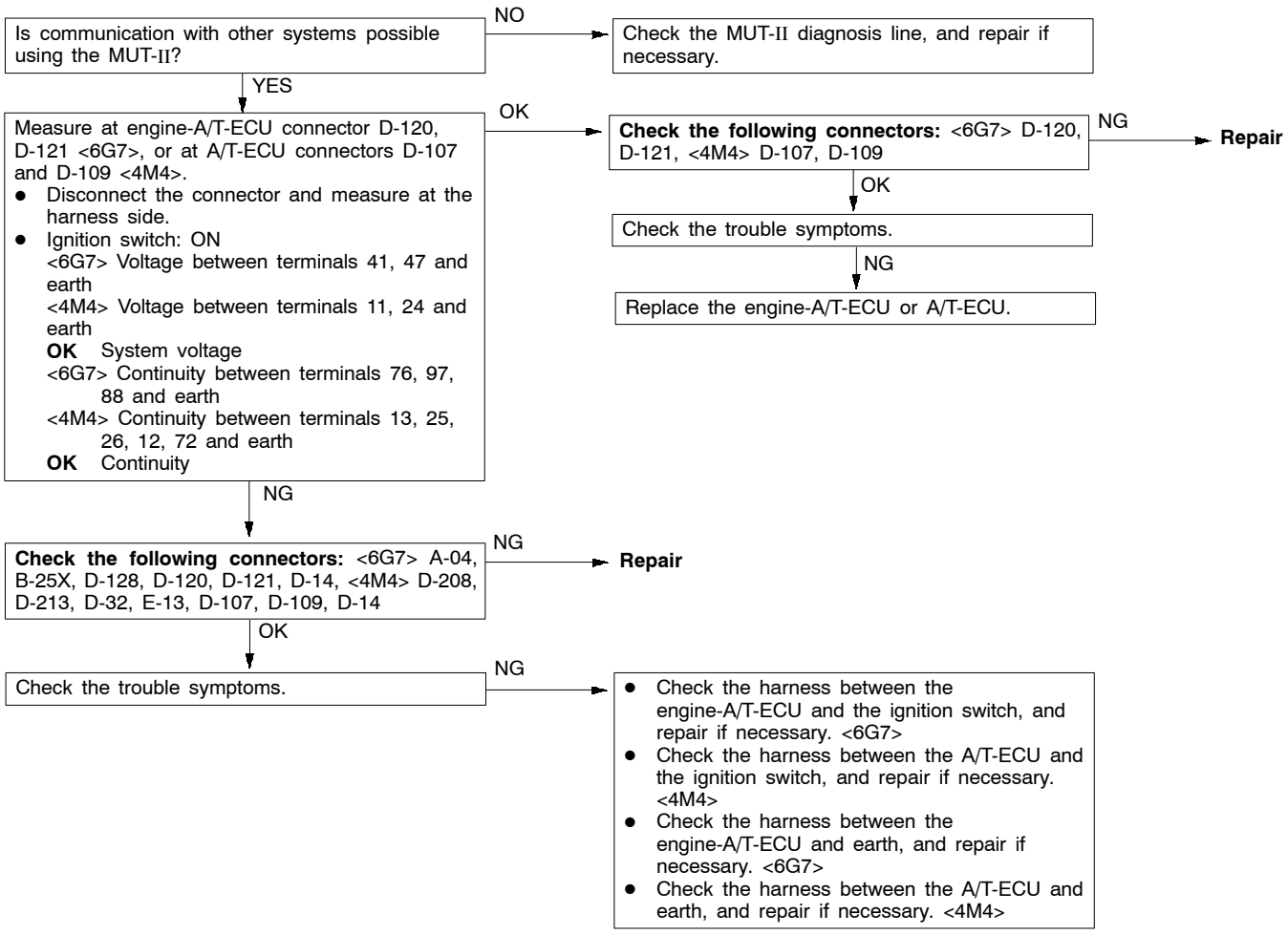
CHART CLASSIFIED BY TROUBLE SYMPTOMS

Trouble Symptom		Inspection procedure No.	Reference page
Communication with the MUT-II is not possible.		1	23-48
Driving not possible	Starting not possible	2	23-49
	Does not move forward	3	23-49
	Does not reverse	4	23-50
	Does not move (forward or reverse)	5	23-51
Malfunction when starting off	Engine stalls during shifting	6	23-51
	N-to-D shocks, large time lag	7	23-52
	N-to-R shocks, large time lag	8	23-53
	N-to-D, N-to-R shocks, large time lag	9	23-54
Problem during shifting	Shocks, engine racing	10	23-54
Incorrect shift points	All points	11	23-55
	Some points	12	23-56
No shifting	No diagnosis code	13	23-56
Problem during driving	Poor acceleration	14	23-57
	Vibration	15	23-57
Inhibitor switch system		16	23-58
Shift switch assembly system		17	23-58
Dual pressure switch system		18	23-59
Vehicle speed sensor system		19	23-59
4LLc switch system		20	23-60

INSPECTION PROCEDURES CLASSIFIED BY TROUBLE SYMPTOM

Inspection procedure 1

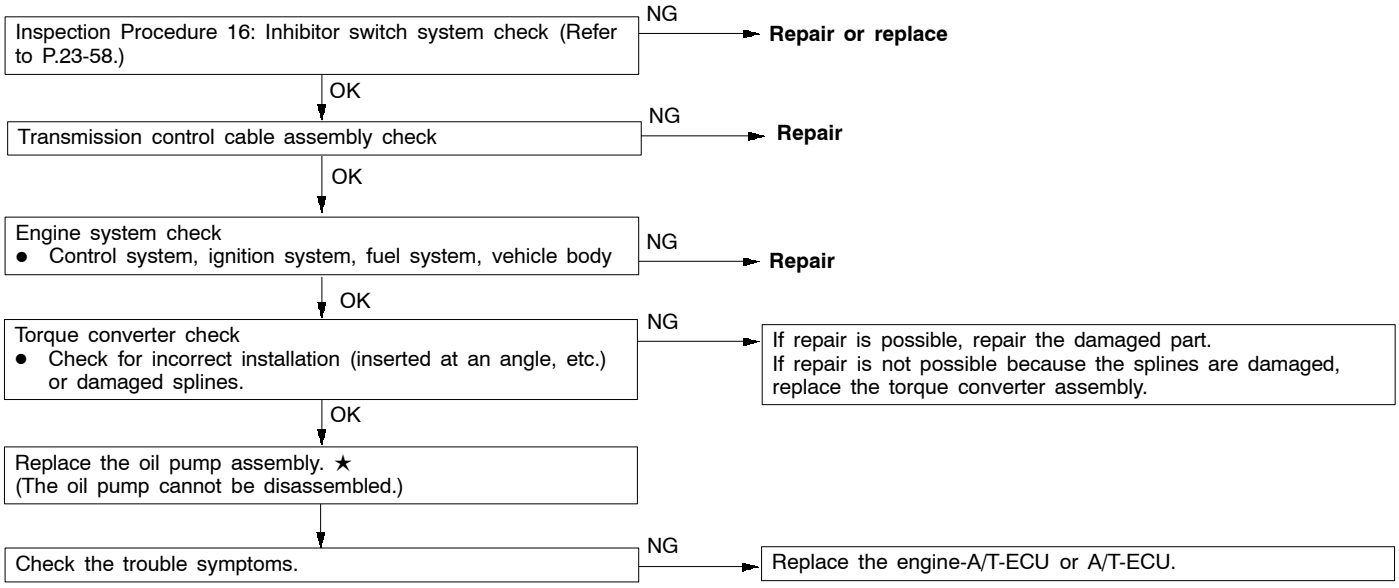
Communication with the MUT-II is not possible.	Probable cause
If communication with the MUT-II is not possible, the cause is probably a malfunction of the diagnosis line or the A/T-ECU is not functioning.	• Malfunction of diagnosis line • Malfunction of harness or connector • Malfunction of engine-A/T-ECU <6G7> • Malfunction of A/T-ECU <4M4>



Inspection procedure 2

Starting not possible	Probable cause
If the engine will not start when the selector lever is at the P or N position, the cause is probably a malfunction of the inhibitor switch system, the transmission control cable assembly, the engine system, the torque converter or the oil pump.	● Malfunction of inhibitor switch system ● Malfunction of transmission control cable assembly ● Malfunction of engine system ● Malfunction of torque converter ● Malfunction of oil pump ● Malfunction of engine-A/T-ECU <6G7> ● Malfunction of A/T-ECU <4M4>

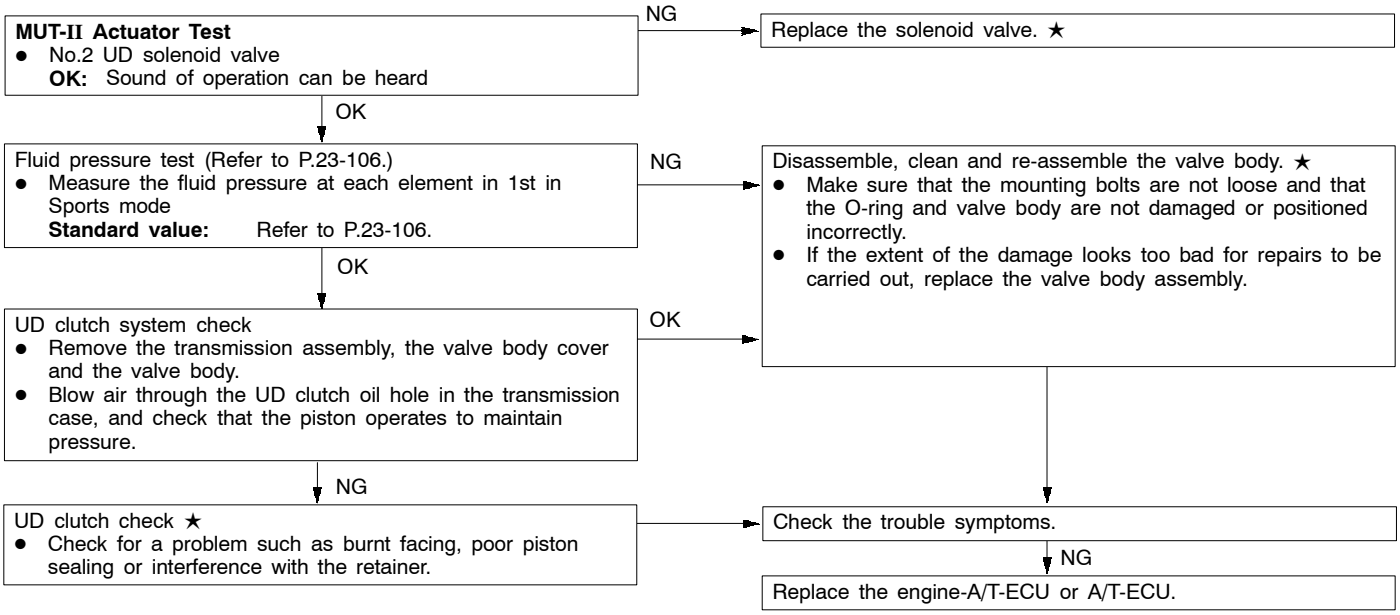
★ Refer to the Transmission Workshop Manual.



Inspection procedure 3

Does not move forward	Probable cause
If the vehicle does not move forward when the engine is idling and the selector lever is moved from N to D, 3, 2 or L, or if it is shifted to 1st or 2nd in Sports mode, the cause is probably a problem with line pressure, or a malfunction of the UD clutch or valve body.	● Abnormal line pressure ● Malfunction of UD solenoid valve ● Malfunction of UD clutch system ● Malfunction of valve body ● Malfunction of engine-A/T-ECU <6G7> ● Malfunction of A/T-ECU <4M4>

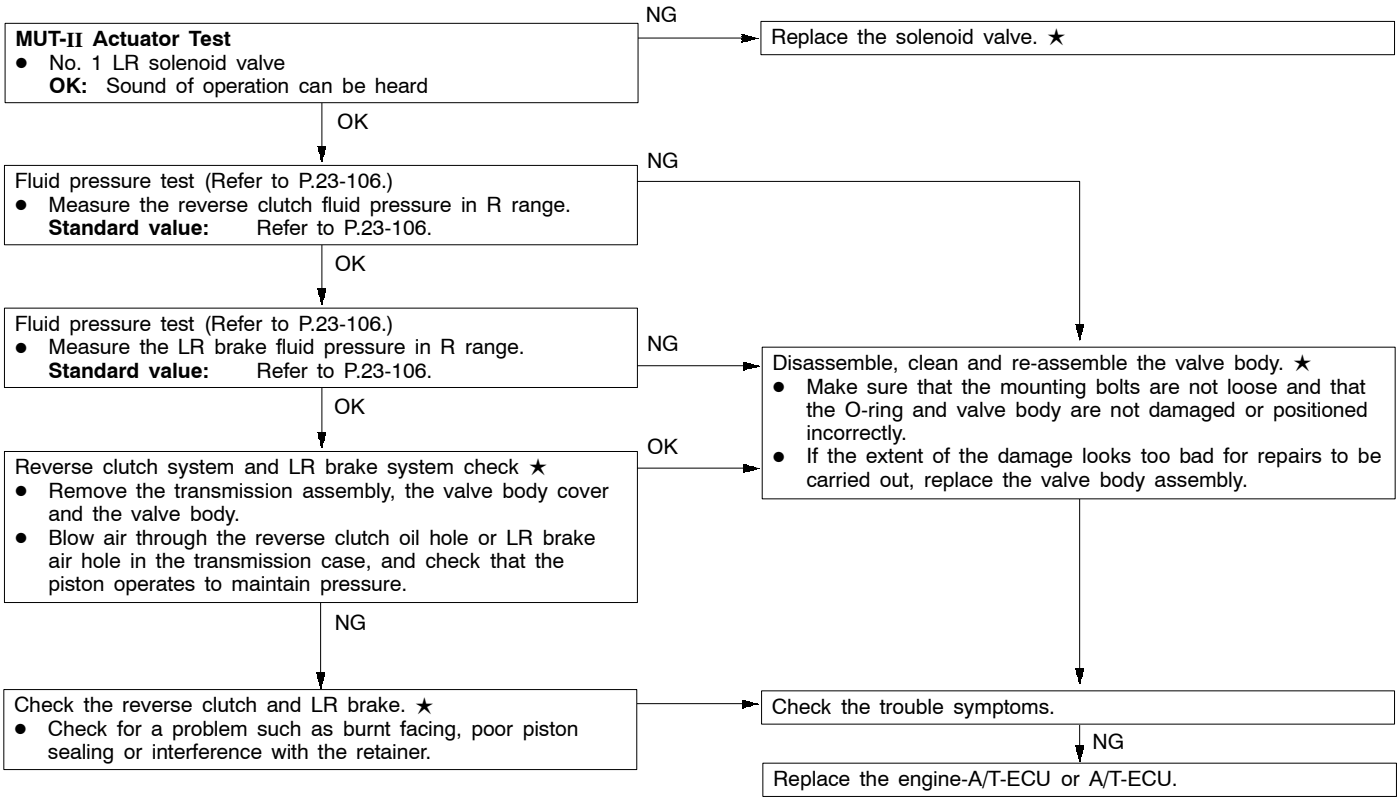
★ Refer to the Transmission Workshop Manual.



Inspection procedure 4

Does not reverse	Probable cause
If the vehicle does not reverse when the engine is idling and the selector lever is moved from N to R, the cause is probably a problem with reverse clutch pressure or LR brake pressure, or a malfunction of the reverse clutch, LD clutch or valve body.	• Abnormal reverse clutch pressure • Abnormal LR brake pressure • Malfunction of LR solenoid valve • Malfunction of reverse clutch • Malfunction of LR brake • Malfunction of valve body • Replacement of engine-A/T-ECU <6G7> • Replacement of A/T-ECU. <4M4>

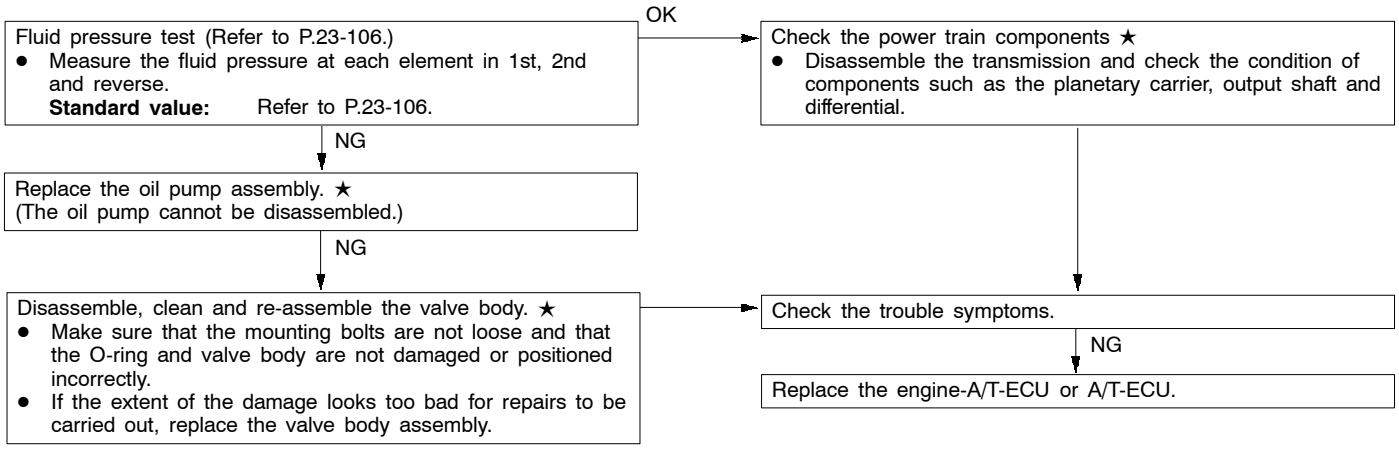
★ Refer to the Transmission Workshop Manual.



Inspection procedure 5

Does not move (forward or reverse)	Probable cause
If the vehicle does not move forward or reverse when the selector lever is moved to any position while the engine is idling, the cause is probably a problem with line pressure or a malfunction of the oil pumps and valve bodies in the power train.	● Abnormal line pressure ● Malfunction of power train components ● Malfunction of oil pump ● Malfunction of valve body ● Malfunction of engine-A/T-ECU <6G7> ● Malfunction of A/T-ECU <4M4>

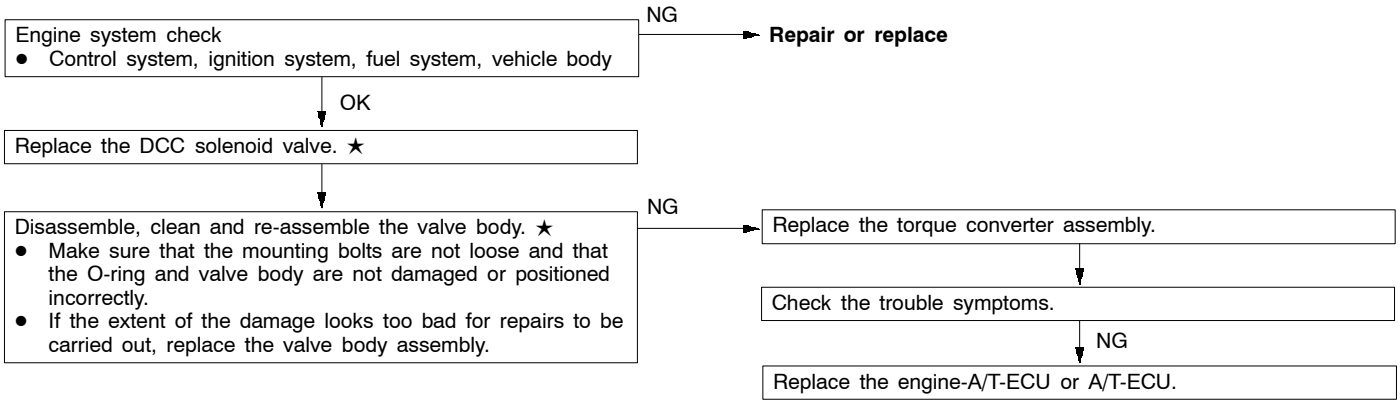
★ Refer to the Transmission Workshop Manual.



Inspection procedure 6

Engine stalls during shifting	Probable cause
If the engine stalls when the selector lever is moved from N to D or R while the engine is idling, the cause is probably a malfunction of the engine system, DCC solenoid valve, valve body, or torque converter (damper clutch).	● Malfunction of engine system ● Malfunction of DCC solenoid valve ● Malfunction of valve body ● Malfunction of torque converter (malfunction of damper clutch) ● Malfunction of engine-A/T-ECU <6G7> ● Malfunction of A/T-ECU <4M4>

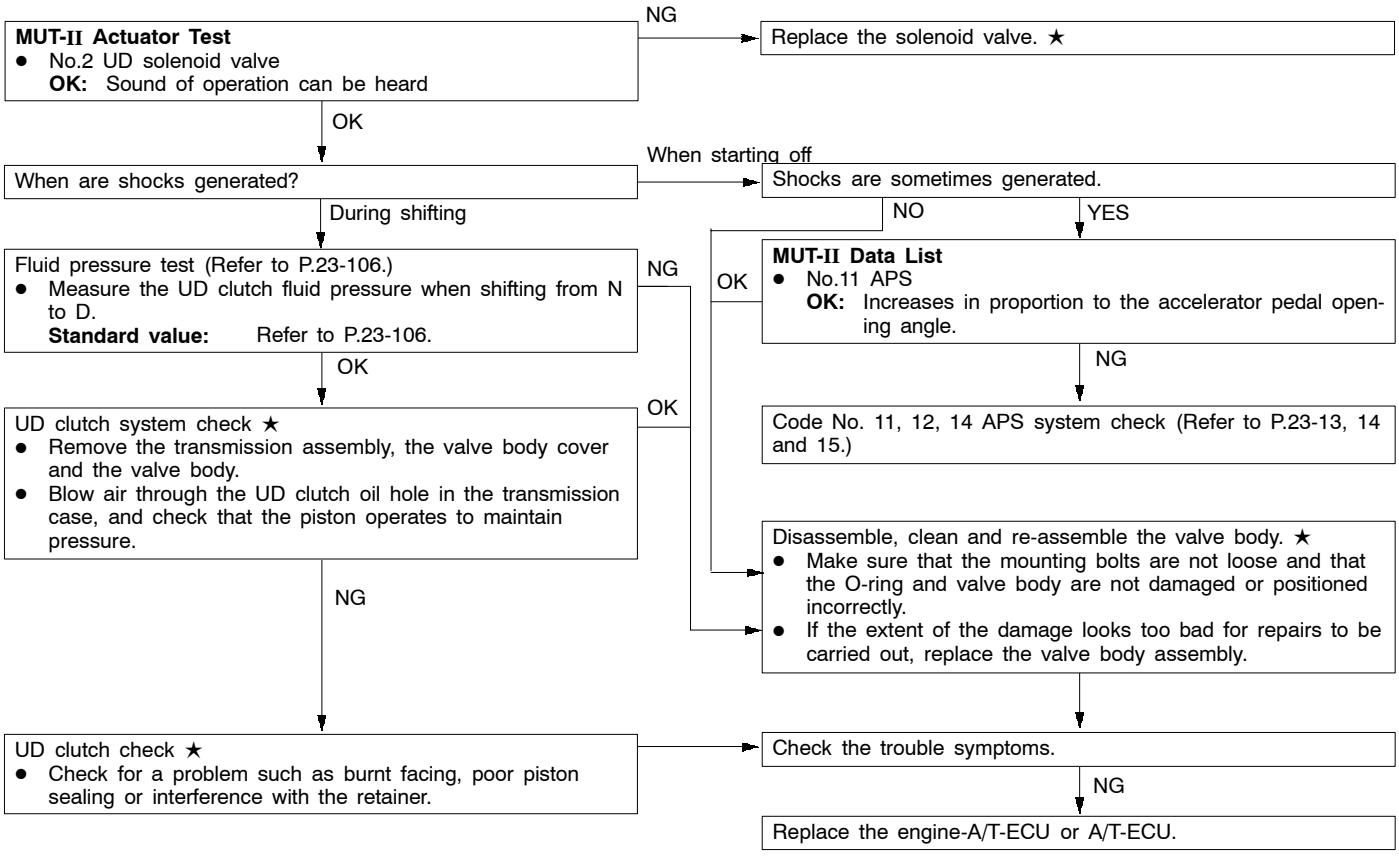
★ Refer to the Transmission Workshop Manual.



Inspection procedure 7

N-to-D shocks, large time lag	Probable cause
If abnormal shocks or a time lag of 2 seconds or more occurs when the selector lever is moved from N to D while the engine is idling, the cause is probably abnormal UD clutch pressure, or a malfunction of the UD clutch, valve body or APS.	• Abnormal UD clutch pressure • Malfunction of UD solenoid valve • Malfunction of UD clutch system • Malfunction of valve body • Malfunction of APS • Malfunction of engine-A/T-ECU <6G7> • Malfunction of A/T-ECU <4M4>

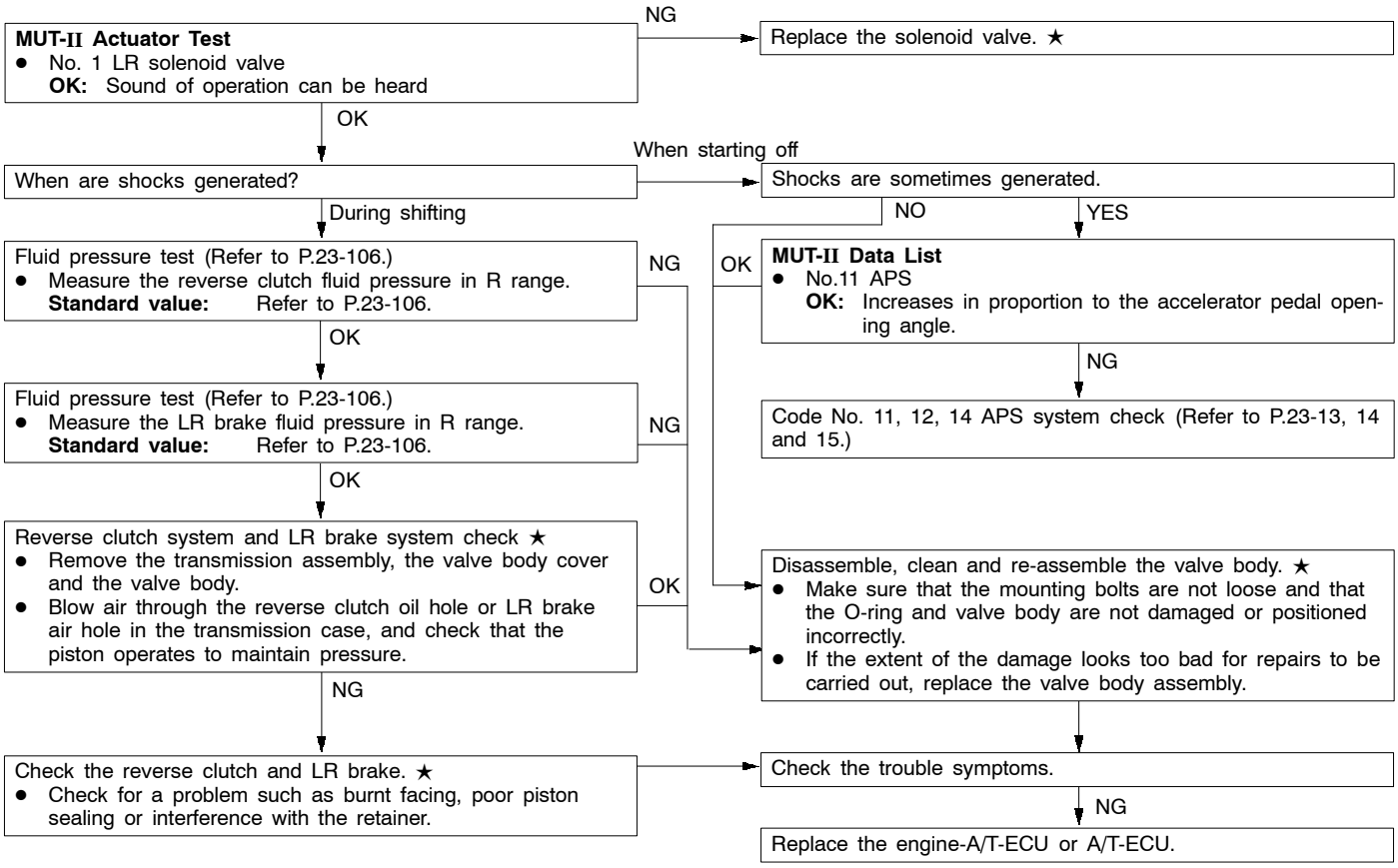
★ Refer to the Transmission Workshop Manual.



Inspection procedure 8

N to R shocks, large time lag	Probable cause
If abnormal shocks or a time lag of 2 seconds or more occurs when the selector lever is moved from N to R while the engine is idling, the cause is probably abnormal reverse clutch pressure or LD brake pressure, or a malfunction of the reverse clutch, LR brake, valve body or APS.	• Abnormal reverse clutch pressure • Abnormal LR brake pressure • Malfunction of LR solenoid valve • Malfunction of reverse clutch • Malfunction of LR brake • Malfunction of valve body • Malfunction of APS • Malfunction of engine-A/T-ECU <6G7> • Malfunction of A/T-ECU <4M4>

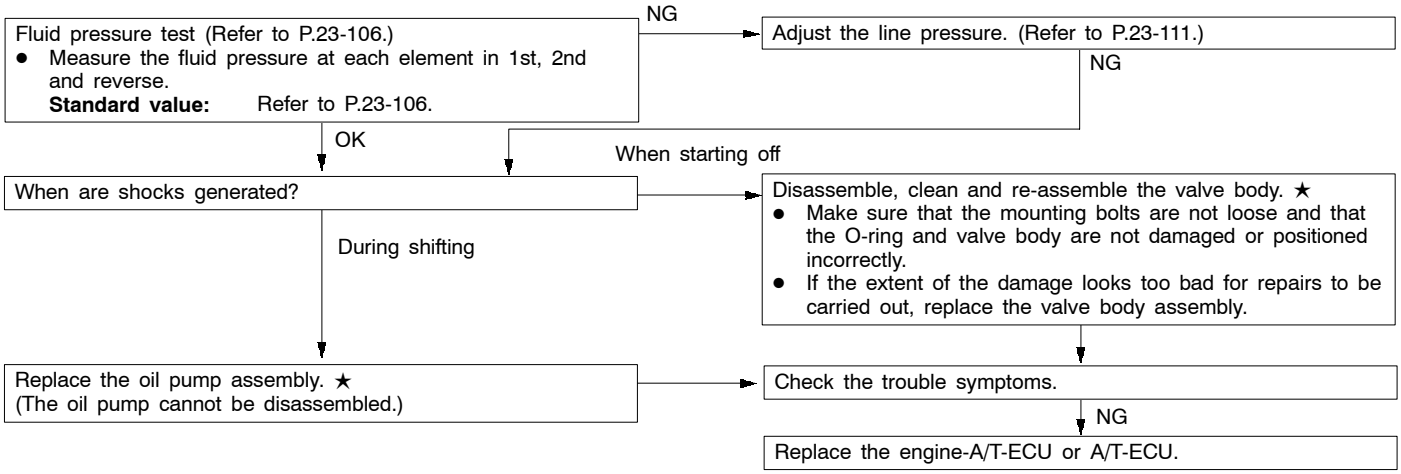
★ Refer to the Transmission Workshop Manual.



Inspection procedure 9

N-to-D and N-to-R shocks, large time lag	Probable cause
If abnormal shocks or a time lag of 2 seconds or more occurs when the selector lever is moved from N to both D and R while the engine is idling, the cause is probably abnormal line pressure, or a malfunction of the oil pump or valve body.	● Abnormal line pressure ● Malfunction of oil pump ● Malfunction of valve body ● Malfunction of engine-A/T-ECU <6G7> ● Malfunction of A/T-ECU <4M4>

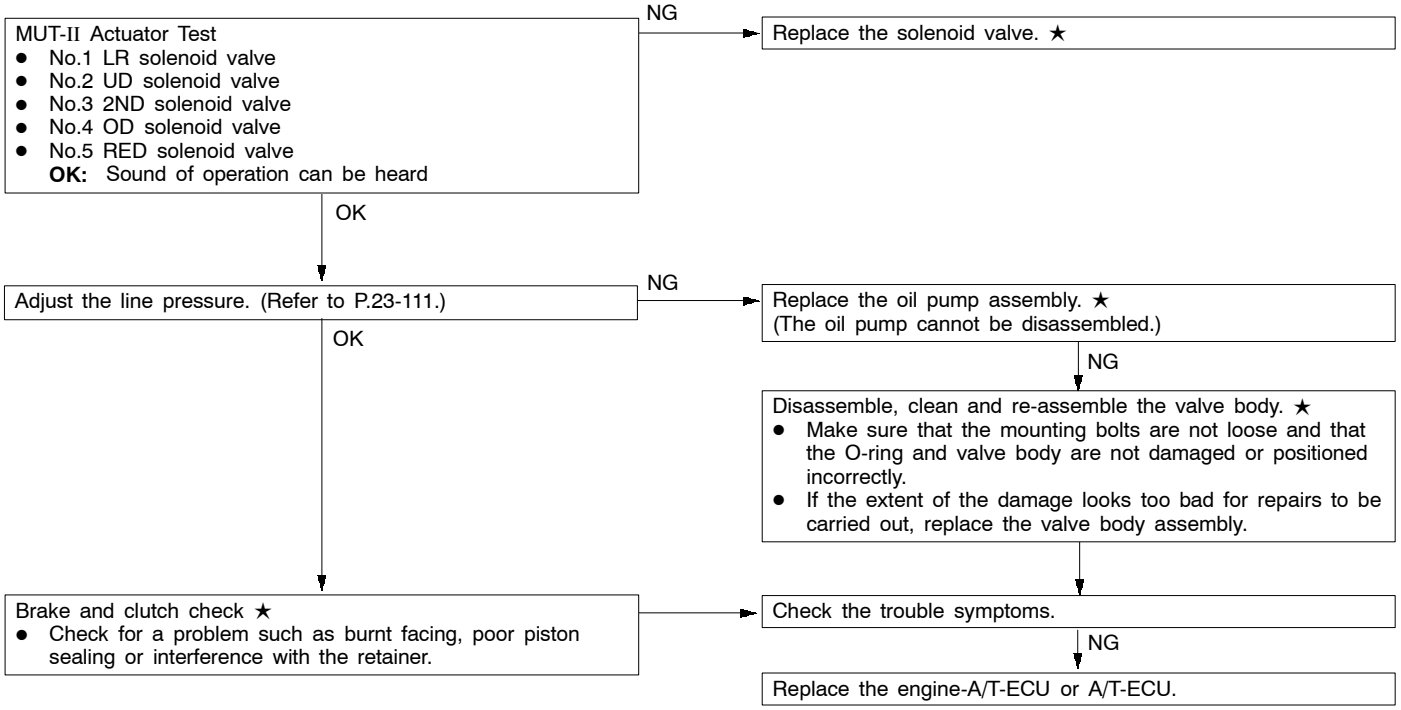
★ Refer to the Transmission Workshop Manual.



Inspection procedure 10

Shocks, engine racing	Probable cause
If shocks occur when driving due to upshifting or downshifting, or the transmission speed becomes higher than the engine speed, the cause is probably abnormal line pressure or a malfunction of a solenoid valve, oil pump, valve body or of a brake or clutch.	● Abnormal line pressure ● Malfunction of solenoid valve ● Malfunction of oil pump ● Malfunction of valve body ● Malfunction of brake or clutch ● Malfunction of engine-A/T-ECU <6G7> ● Malfunction of A/T-ECU <4M4>

★ Refer to the Transmission Workshop Manual.



Inspection procedure 11

All points (incorrect shift points)	Probable cause
If all shift points are incorrect during driving, the cause is probably a malfunction of the output speed sensor, APS or solenoid valve.	• Malfunction of output shaft speed sensor • Malfunction of APS • Malfunction of solenoid valve • Abnormal line pressure • Malfunction of valve body • Malfunction of engine-A/T-ECU <6G7> • Malfunction of A/T-ECU <4M4>

★ Refer to the Transmission Workshop Manual.

MUT-II Data List
- No. 23 Output shaft speed sensor system
  OK: Increases in proportion to vehicle speed.

NG → Code No. 23 Output shaft speed sensor system (Refer to P.23-22.)

OK ↓

MUT-II Data List
- No.11 APS
  OK: Increases in proportion to the accelerator pedal opening angle.

NG → Code No. 11, 12, 14 APS system check (Refer to P.23-13, 14 and 15.)

OK ↓

MUT-II Data List
- No. 31 RED solenoid valve duty ratio
- No. 32 UD solenoid valve duty ratio
- No. 33 2ND solenoid valve duty ratio
- No. 34 OD solenoid valve duty ratio
- No. 35 RED solenoid valve duty ratio

OK:

	No.31	No.32	No.33	No.34	No.35
Driving at aconstant speed in 1st	0%	0%	100%	100%	0%
Driving at a constant speed in 2nd	100%	0%	0%	100%	0%
Driving at a constant speed in 3rd	100%	0%	100%	0%	0%
Driving at a constant speed in 4th	0%	0%	100%	0%	100%
Driving at a constant speed in 5th	0%	100%	0%	0%	100%

NG → Replace the solenoid valve. ★

OK ↓

Adjust the line pressure. (Refer to P.23-111.)

NG ↓

Disassemble, clean and re-assemble the valve body. ★
- Make sure that the mounting bolts are not loose and that the O-ring and valve body are not damaged or positioned incorrectly.
- If the extent of the damage looks too bad for repairs to be carried out, replace the valve body assembly.

→ Check the trouble symptoms.

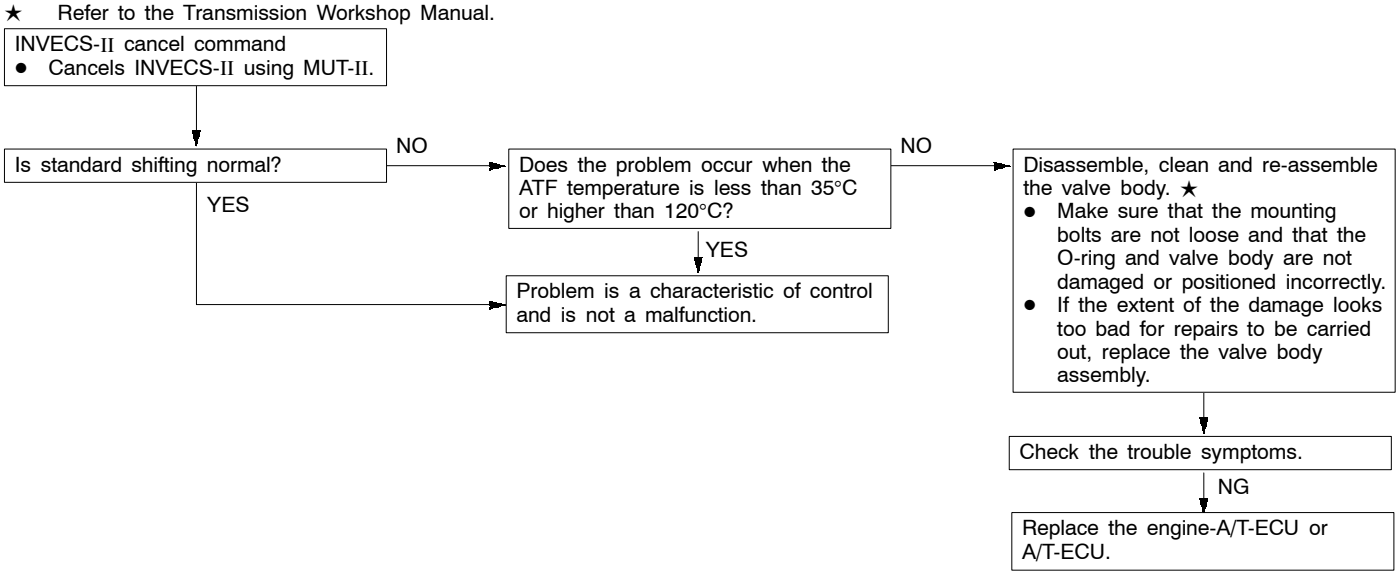
NG ↓

Replace the engine-A/T-ECU or A/T-ECU.

Inspection procedure 12

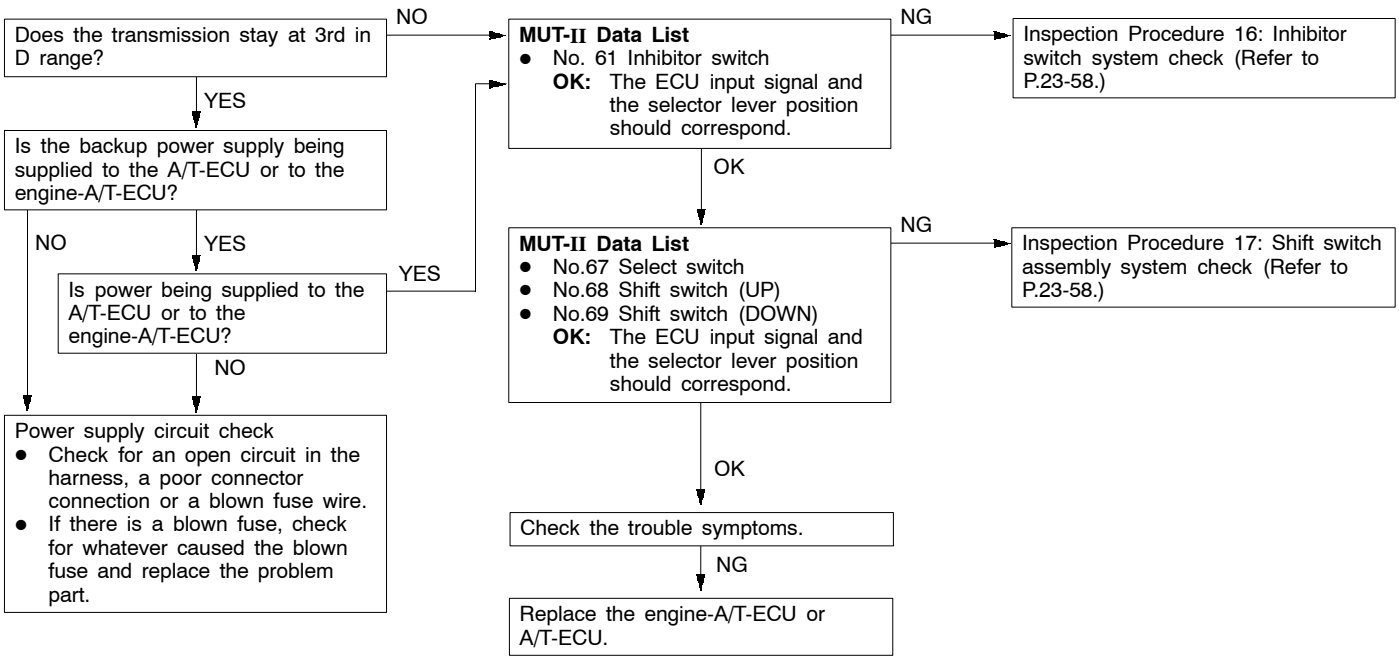
Some points (incorrect shift points)	Probable cause
If some of the shift points are incorrect while driving, the cause is probably a malfunction of the valve body, or it is a characteristic of control and is not a malfunction.	• Malfunction of valve body • Malfunction of engine-A/T-ECU <6G7> • Malfunction of A/T-ECU <4M4>

★ Refer to the Transmission Workshop Manual.



Inspection procedure 13

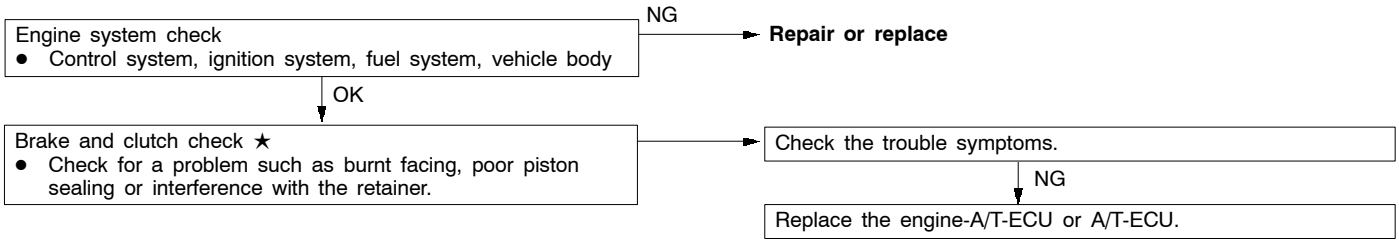
No diagnosis code (no shifting)	Probable cause
No shifting during driving However, if a diagnosis code is not output, the cause is probably malfunction of the inhibitor switch system, the shift switch assembly, the engine A/T-ECU or the A/T-ECU.	• Malfunction of Inhibitor switch • Malfunction of shift switch assembly system • Malfunction of engine-A/T-ECU <6G7> • Malfunction of A/T-ECU <4M4>



Inspection procedure 14

Poor acceleration	Probable cause
If the vehicle does not accelerate after downshifting, the cause is probably a malfunction of the engine system or of a brake or clutch.	• Malfunction of engine system • Malfunction of brake or clutch • Malfunction of engine-A/T-ECU <6G7> • Malfunction of A/T-ECU <4M4>

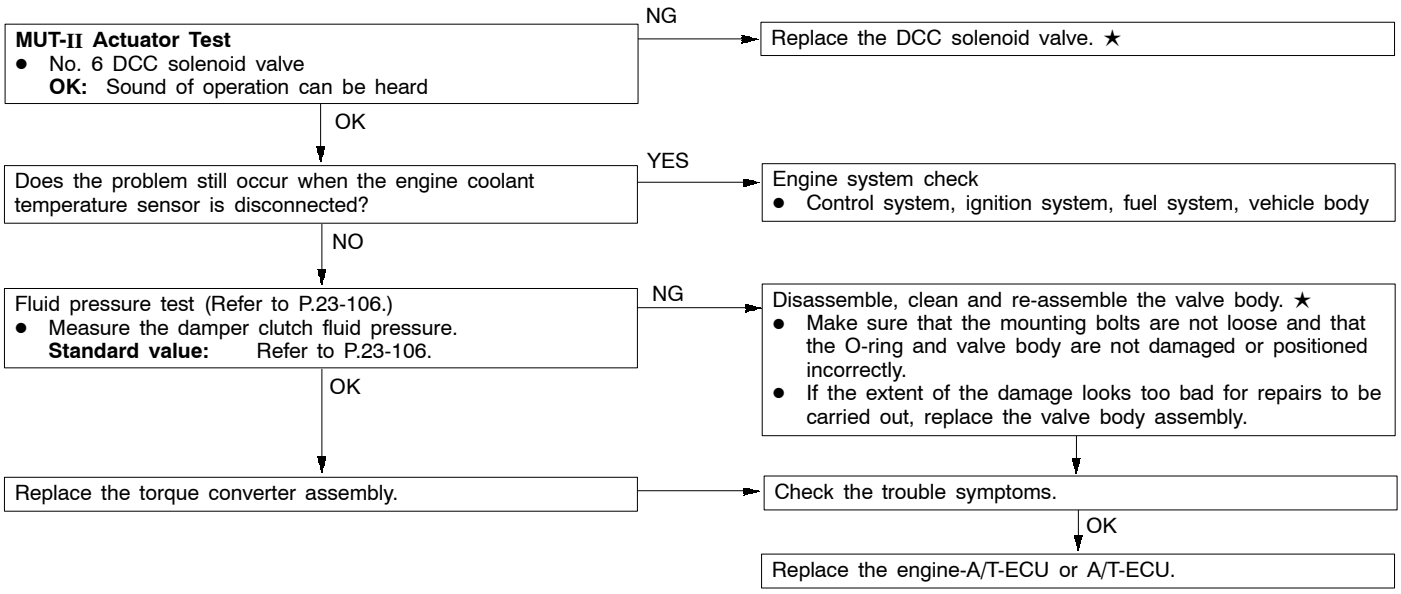
★ Refer to the Transmission Workshop Manual.



Inspection procedure 15

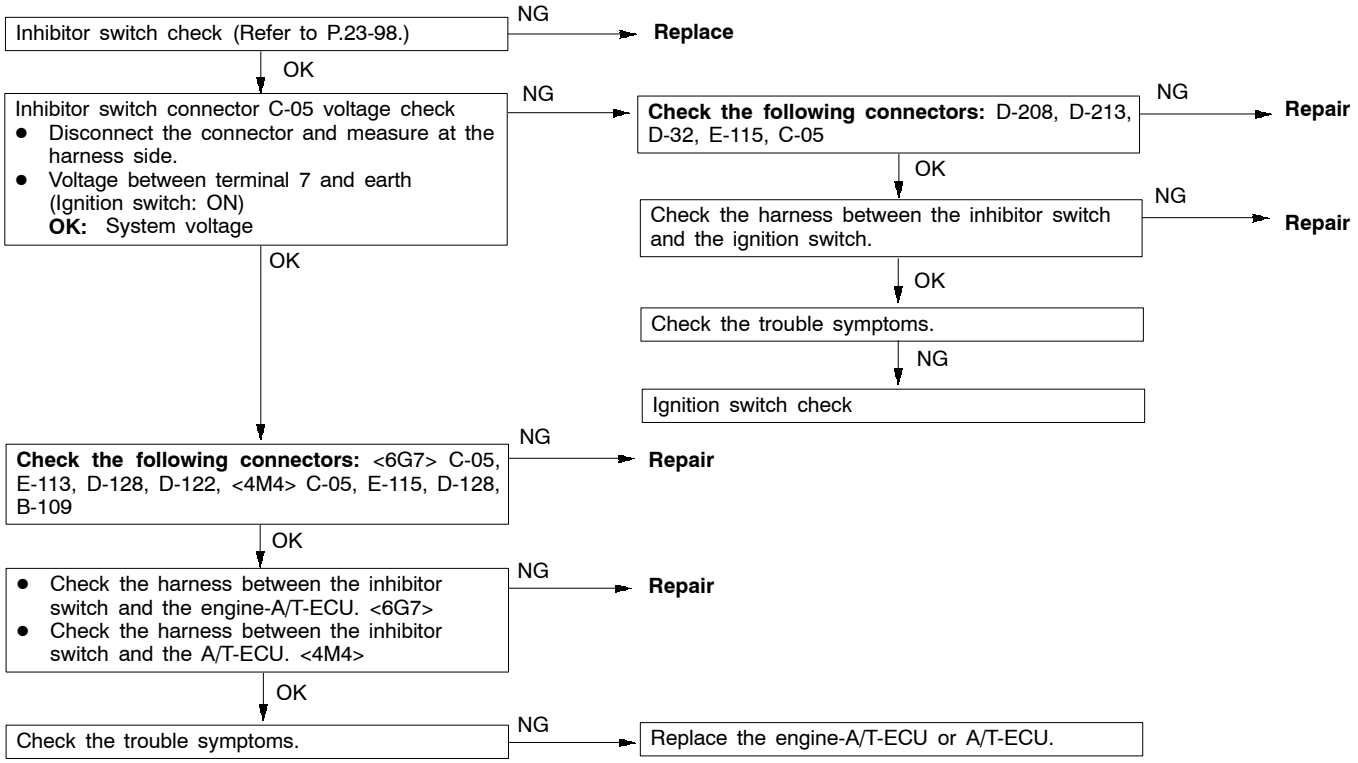
Vibration	Probable cause
If vibration occurs when accelerating or decelerating while driving at a constant speed or driving in top range, the cause is probably abnormal damper clutch pressure, or a malfunction of the engine system, DCC solenoid valve, torque converter or valve body.	• Abnormal damper clutch pressure • Malfunction of engine system • Malfunction of DCC solenoid valve • Malfunction of torque converter • Malfunction of valve body • Malfunction of engine-A/T-ECU <6G7> • Malfunction of A/T-ECU <4M4>

★ Refer to the Transmission Workshop Manual.



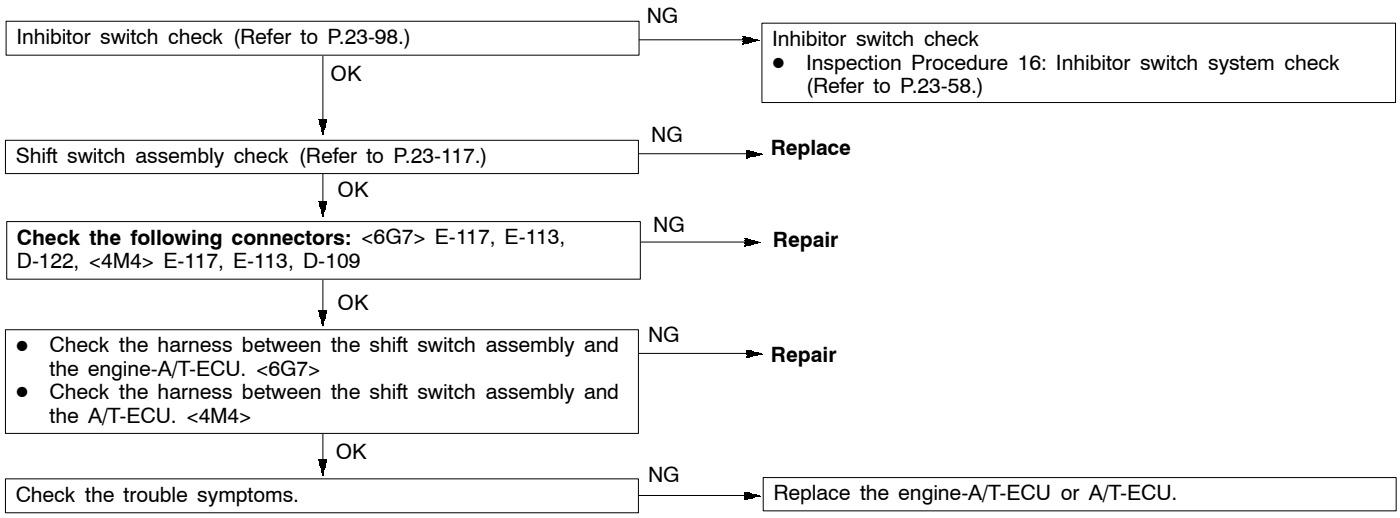
Inspection procedure 16

Inhibitor switch system	Probable cause
The cause is probably a malfunction of the inhibitor switch circuit or the ignition switch circuit.	• Malfunction of Inhibitor switch • Malfunction of ignition switch • Malfunction of harness or connector • Malfunction of engine-A/T-ECU <6G7> • Malfunction of A/T-ECU <4M4>



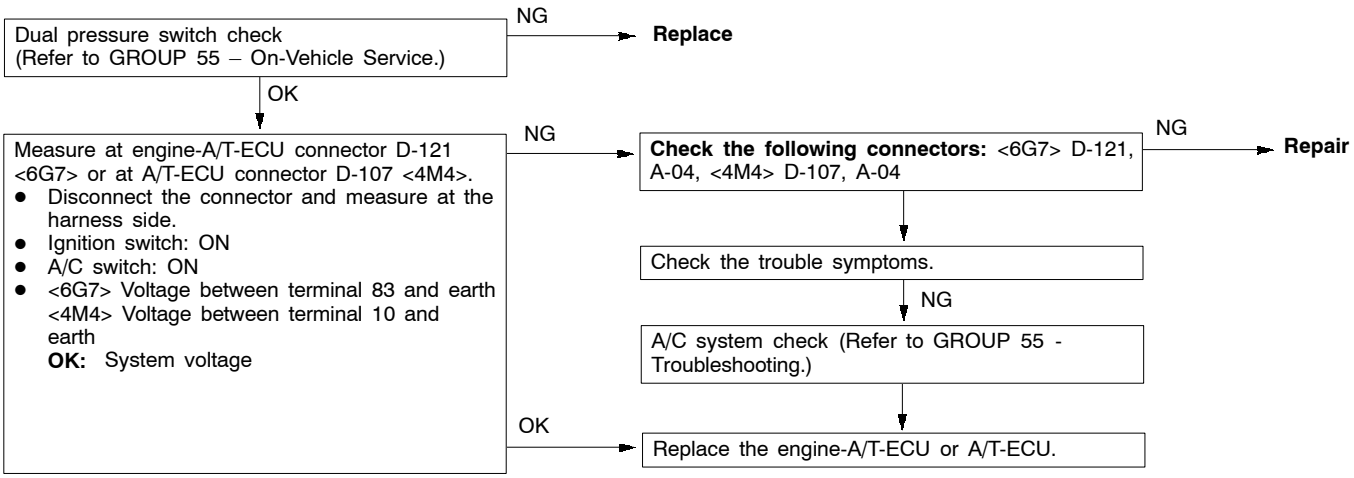
Inspection procedure 17

Shift switch assembly system	Probable cause
The cause is probably a malfunction of the inhibitor switch circuit, shift switch assembly circuit, or of the engine-A/T-ECU or A/T-ECU.	• Malfunction of inhibitor switch • Malfunction of select switch • Malfunction of shift switch (UP) • Malfunction of shift switch (DOWN) • Malfunction of harness or connector • Malfunction of engine-A/T-ECU <6G7> • Malfunction of A/T-ECU <4M4>



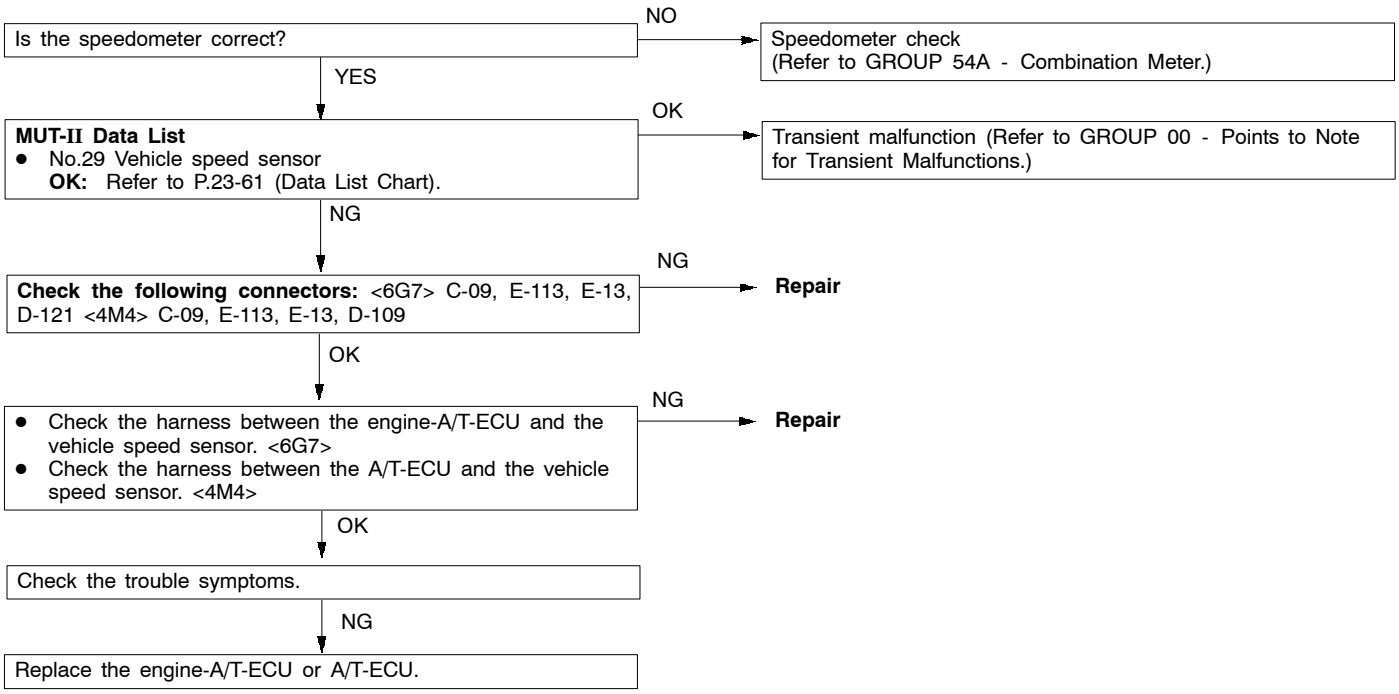
Inspection procedure 18

Dual pressure switch system	Probable cause
The cause is probably a malfunction of the dual pressure switch circuit, or of the engine-A/T-ECU or A/T-ECU.	• Malfunction of dual pressure switch • Malfunction of harness or connector • Malfunction of A/C system • Malfunction of engine-A/T-ECU <6G7> • Malfunction of A/T-ECU <4M4>



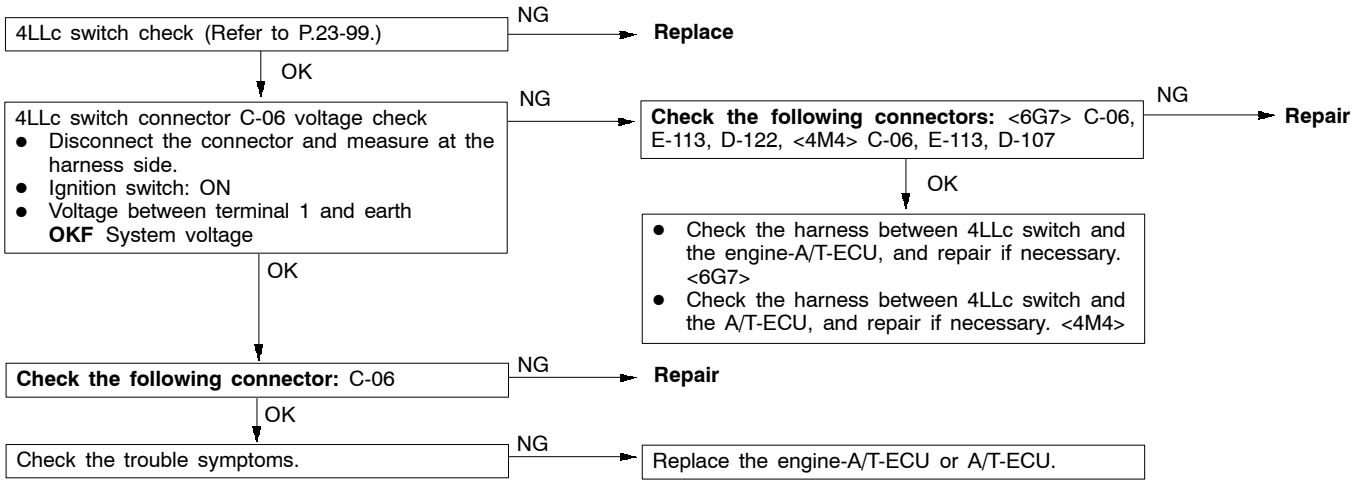
Inspection procedure 19

Vehicle speed sensor system	Probable cause
The cause is probably a malfunction of the vehicle speed sensor circuit, or of the A/T-ECU or the engine-A/T-ECU.	• Malfunction of vehicle speed sensor • Malfunction of connector • Malfunction of engine-A/T-ECU <6G7> • Malfunction of A/T-ECU <4M4>



Inspection procedure 20

4LLc switch system	Probable cause
The cause is probably a malfunction of the 4LLc switch circuit, or of the engine-A/T-ECU or A/T-ECU.	• Malfunction of 4LLc switch • Malfunction of harness or connector • Malfunction of engine-A/T-ECU <6G7> • Malfunction of A/T-ECU <4M4>



DATA LIST REFERENCE TABLE

Data list No.	Check item	Inspection conditions		Normal condition				
11	APS	Ignition switch: ON Engine: Stopped Selector lever position: P	Accelerator pedal: Fully closed	985 - 1085 mV				
			Accelerator pedal: Depressed	Gradually increases from the above value.				
			Accelerator pedal: Fully open	4000 mV or higher				
15	A/T fluid temperature sensor	Driving after engine has warmed up	Drive for 15 minutes or more until the ATF temperature reaches 70 - 80°C.	Gradually increases to 70 - 80°C.				
21	Crank angle sensor <6G7> Engine speed sensor <4M4>	Engine: Idling Selector lever position: P	Compare the engine speeds displayed on the tachometer and the MUT-II.	Identical				
22	Input shaft speed sensor	Shift range: 4th	Driving at a constant speed of 50 km/h in 4th	1300 - 1600 r/min				
23	Output shaft speed sensor	Shift range: 4th	Driving at a constant speed of 50 km/h in 4th	1300 - 1600 r/min				
25	Wide open throttle switch	Accelerator pedal position	Released	OFF				
			Depressed	ON				
26	Stop lamp switch	Ignition switch: ON Engine: Stopped	Brake pedal: Depressed	ON				
			Brake pedal: Released	OFF				
29	Vehicle speed sensor	Selector lever position: Sports mode	Idling in 1st (Vehicle stopped)	0 km/h				
			Driving at a constant speed of 50 km/h in 3rd	50 km/h				
31	LR solenoid valve duty ratio	Selector lever position: Sports mode	Data List No.	No. 31	No. 32	No. 33	No. 34	No.35
32	UD solenoid valve duty ratio		Driving at a constant speed in 1st	0%	0%	100%	100%	0%
33	2nd solenoid valve duty ratio		Driving at a constant speed in 2nd	100%	0%	0%	100%	0%
34	OD solenoid valve duty ratio		Driving at a constant speed in 3rd	100%	0%	100%	0%	0%
35	RED solenoid valve duty ratio		Driving at a constant speed in 4th	0%	0%	100%	0%	100%
			Driving at a constant speed in 5th	100%	100%	0%	0%	100%

Data list No.	Check item	Inspection conditions		Normal condition
36	DCC solenoid valve duty ratio	Shift range: 2nd	Driving at 30 km/h in 2 range, then fully close accelerator.	70% - 90% -to- 0%
			Driving at 50 km/h in 4th	70% - 90%
52	Damper clutch slip amount	Shift range: 2nd	Driving at 30 km/h in 2 range, then fully close accelerator.	-300 - 100 r/min or 100 - 300 r/min
			Driving at a constant speed of 50 km/h in 4th	-10 - 10 r/min
54	Control relay output voltage	Ignition switch: OFF	Ignition switch: ON	10 - 12 V
61	Inhibitor switch	Ignition switch: ON Engine: Stopped	Selector lever position: P	P
			Selector lever position: R	R
			Selector lever position: N	N
			Selector lever position: D	D
63	Shift position	Selector lever position: Sports mode	Driving at a constant speed of 10 km/h in 1st	1st
			Driving at a constant speed of 30 km/h in 2nd	2nd
			Driving at a constant speed of 50 km/h in 3rd	3rd
			Driving at a constant speed of 50 km/h in 4th	4th
			Driving at a constant speed of 70 km/h in 5th	5th
65	Dual pressure switch	Engine: Idling	A/C switch: ON	ON
			A/C switch: OFF	OFF
66	OD-OFF signal <Vehicles with auto-cruise control system>	While auto-cruise control is operating	While driving on a level road	OFF
			While climbing an incline	ON

Data list No.	Check item	Inspection conditions		Normal condition		
67	Select switch	Ignition switch: ON Engine: Stopped	(Data List No.)	No. 67	No. 68	No. 69
			Selector lever position: D	OFF	OFF	OFF
68	Upshift switch		Selector lever operation: Sports mode selected	ON	OFF	OFF
69	Downshift switch		Selector lever operation: Lever moved to upshift position and held	ON	ON	OFF
			Selector lever operation: Lever moved to downshift position and held	ON	OFF	ON
73	Target effective engine pressure <6G7>	Engine: Idling Selector lever position: N	Accelerator pedal: fully closed to depressed	Data changes.		
75	4LLc switch	Ignition switch: ON Engine: Stopped	Transfer lever position: 4LLc	ON		
			Transfer lever position: Other than the above	OFF		
76	Theoretical effective engine pressure <4M4>	Engine: Idling Selector lever position: N	Accelerator pedal: fully closed to depressed	Data changes.		

ACTUATOR TEST TABLE

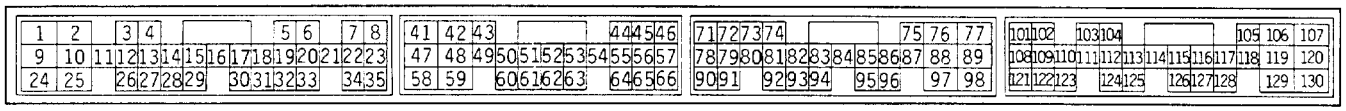
Item No.	Check item	Test contents	Inspection conditions	Normal condition
1	LR solenoid valve	The solenoid valve specified by the MUT-II is driven at 50% duty for 5 seconds. No other solenoid valves are energised.	Ignition switch: ON Selector lever position: P Engine: Stopped Throttle (accelerator) Opening angle voltage: Less than 1 V <6G7>, less than 1.2 V <4M4> The fail-safe function should not be operating.	The sound of operation should be heard when the solenoid valve is driven.
2	UD solenoid valve			
3	2nd solenoid valve			
4	OD solenoid valve			
5	RED solenoid valve			
6	DCC solenoid valve			
7	1st shift indicator lamp	The indicator lamp for the shift stage specified by the MUT-II illuminates for 3 seconds.		The shift indicator lamp illuminates.
8	2nd shift indicator lamp			
9	3rd shift indicator lamp			
10	4th shift indicator lamp			
11	5th shift indicator lamp			
12	A/T control relay	The A/T control relay turns off for 3 seconds.		Data List No. 54 (1) During test: 0 V (2) Normal: System voltage (V)

INVECS-II CANCEL COMMAND

Item No.	Item	Contents	NOTE
14	INVECS-II	Stops the INVECS-II control and changes gear according to the standard shift pattern.	Use this procedure when carrying out road test procedure 7. This function cancels the stopping of INVECS-II control when the ignition switch is turned OFF and then back ON.

A/T-ECU TERMINAL VOLTAGE TABLE

<6G7>



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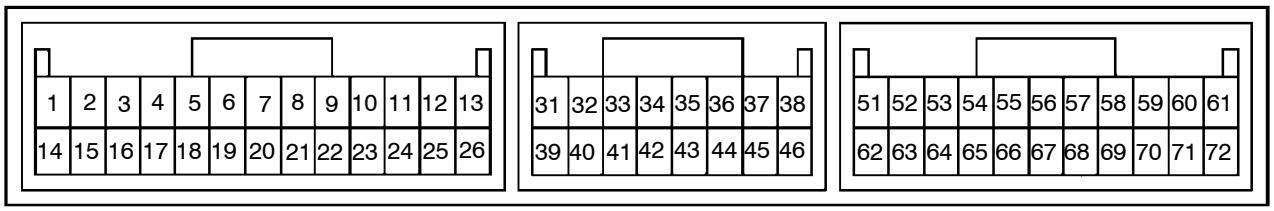
Terminal No.	Check item	Inspection conditions	Standard value
50	A/T control relay	Ignition switch: OFF	0 V
		Ignition switch: ON	10 - 12 V
76	Earth	At all times	0 V
77	Solenoid valve power supply	Ignition switch: OFF	0 V
		Ignition switch: ON	System voltage
81	Sensor earth	At all times	0 V
88	Earth	At all times	0 V
89	Solenoid valve power supply	Ignition switch: OFF	0 V
		Ignition switch: ON	System voltage
97	Earth	At all times	0 V
101	Inhibitor switch P	Ignition switch: ON Selector lever position: P	System voltage
		Ignition switch: ON Selector lever position: Other than the above	0 V
102	Inhibitor switch D	Ignition switch: ON Selector lever: D	System voltage
		Ignition switch: ON Selector lever position: Other than the above	0 V
103	Input shaft speed sensor	Measure between terminals (57) and (103) using an oscilloscope. Engine: 2 000 r/min Shift range: 4th	Check Procedure Using an Oscilloscope (Refer to P.23-69.)
104	Output shaft speed sensor	Measure between terminals (57) and (104) using an oscilloscope. Engine: 2 000 r/min Shift range: 4th	Check Procedure Using an Oscilloscope (Refer to P.23-69.)
105	1st shift indicator lamp	Shift range: 1st	System voltage
		Shift range: Other than the above	0 V

Terminal No.	Check item	Inspection conditions	Standard value
106	2nd solenoid valve	Engine: Idling Shift range: 2nd	System voltage
		Engine: Idling Shift range: Park	7–9 V
107	DCC solenoid valve	Engine: Idling Shift range: 1st	System voltage
108	Inhibitor switch R	Engine: Idling Selector lever position: R	System voltage
		Engine: Idling Shift range: Other than the above	0 V
109	Select switch	Ignition switch: ON Selector lever operation: Sports mode	System voltage
		Ignition switch: ON Selector lever operation: Other than the above	0 V
110	Downshift switch	Ignition switch: ON Selector lever operation: Downshifted in Sports mode and lever held	System voltage
		Ignition switch: ON Selector lever operation: Other than the above	0 V
112	4LLc switch	Ignition switch: ON Transfer lever position: 4LLc	System voltage
		Ignition switch: ON Transfer lever position: Other than the above	0 V
115	Wide open throttle switch	Accelerator pedal: Released	System voltage
		Accelerator pedal: Depressed	0 V
117	3rd shift indicator lamp	Shift range: 3rd	System voltage
		Shift range: Other than the above	0 V
118	2nd shift indicator lamp	Shift range: 2nd	System voltage
		Shift range: Other than the above	0 V
119	RED solenoid valve	Engine: Idling Shift range: 5th	System voltage
		Engine: Idling Shift range: Park	7 - 9 V
120	UD solenoid valve	Engine: Idling Shift range: 1st	System voltage
		Engine: Idling Shift range: Park	7 - 9 V
121	Inhibitor switch N	Ignition switch: ON Selector lever position: N	System voltage
		Ignition switch: ON Selector lever position: Other than the above	0 V
122	Upshift switch	Ignition switch: ON Selector lever operation: Upshifted in Sports mode and lever held	System voltage
		Ignition switch: ON Selector lever operation: Other than the above	0 V
123	Stop lamp switch	Ignition switch: ON Brake pedal Depressed	System voltage
		Ignition switch: ON Brake pedal Released	0 V

Terminal No.	Check item	Inspection conditions	Standard value
124	A/T fluid temperature sensor	ATF temperature: 20°C	3.8 - 4.0 V
		ATF temperature: 40°C	3.2 - 3.4 V
		ATF temperature: 80°C	1.7 - 1.9 V
127	5th shift indicator lamp	Shift range: 5th	System voltage
		Shift range: Other than the above	0 V
128	4th shift indicator lamp	Shift range: 4th	System voltage
		Shift range: Other than the above	0 V
129	LR solenoid valve	Engine: Idling Shift range: Park	System voltage
		Engine: Idling Shift range: 2nd	7 - 9 V
130	OD solenoid valve	Engine: Idling Shift range: 3rd	System voltage
		Engine: Idling Shift range: Park	7 - 9 V

<4M4>



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Terminal No.	Check item	Inspection conditions	Standard value
1	UD solenoid valve	Engine: Idling Shift range: 1st	System voltage
		Engine: Idling Shift range: Park	7 - 9 V
2	Solenoid valve power supply	Ignition switch: OFF	0 V
		Ignition switch: ON	System voltage
3	Solenoid valve power supply	Ignition switch: OFF	0 V
		Ignition switch: ON	System voltage
4	1st shift indicator lamp	Shift range: 1st	System voltage
		Shift range: Other than the above	0 V
5	3rd shift indicator lamp	Shift range: 3rd	System voltage
		Shift range: Other than the above	0 V
6	5th shift indicator lamp	Shift range: 5th	System voltage
		Shift range: Other than the above	0 V
9	4LLc switch	Transfer lever: 4LLc	System voltage
		Transfer lever: Other than the above	0 V

Terminal No.	Check item	Inspection conditions	Standard value
10	A/C compressor load signal	A/C switch: OFF	0 V
		A/C switch: ON	System voltage
11	Power supply	Ignition switch: OFF	0 V
		Ignition switch: ON	System voltage
12	Earth	At all times	0 V
13	Earth	At all times	0 V
14	OD solenoid valve	Engine: Idling Shift range: 3rd	System voltage
		Engine: Idling Shift range: Park	7 - 9 V
15	DCC solenoid valve	Engine: Idling Shift range: 1st	System voltage
16	2nd solenoid valve	Engine: Idling Shift range: 2nd	System voltage
		Engine: Idling Shift range: Park	7 - 9 V
17	2nd shift indicator lamp	Shift range: 2nd	System voltage
		Shift range: Other than the above	0 V
18	4th shift indicator lamp	Shift range: 4th	System voltage
		Shift range: Other than the above	0 V
24	Power supply	Ignition switch: OFF	0 V
		Ignition switch: ON	System voltage
25	Earth	At all times	0 V
26	Earth	At all times	0 V
31	Input shaft speed sensor	Measure between terminals (31) and (43) using an oscilloscope. Engine: 2 000 r/min Shift range: 4th	Check Procedure using an Oscilloscope (Refer to P.23-69.)
32	Output shaft speed sensor	Measure between terminals (32) and (43) using an oscilloscope. Engine: 2 000 r/min Shift range: 4th	Check Procedure using an Oscilloscope (Refer to P.23-69.)
33	Engine speed sensor	Engine: Idling	2.0 - 2.4 V
38	Backup power supply	At all times	System voltage
43	Sensor earth	At all times	0 V
44	A/T fluid temperature sensor	A/T fluid temperature 20°C	3.8 - 4.0 V
		A/T fluid temperature 40°C	3.2 - 3.4 V
		A/T fluid temperature 80°C	1.7 - 1.9 V
45	Accelerator pedal position sensor (APS)	Accelerator pedal: Fully closed (engine stopped)	0.985 - 1.085 V
		Accelerator pedal: Fully open (engine stopped)	4.0 V or higher
51	RED solenoid valve	Engine: Idling Shift range: 5th	System voltage
		Engine: Idling Shift range: Park	7 - 9 V
53	Output communication with engine-ECU	Engine: Idling Selector lever position: D	Other than 0 V

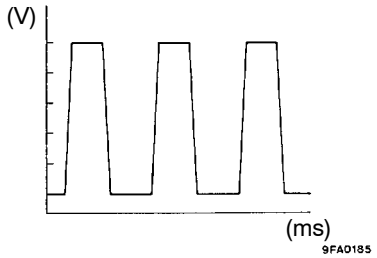
Terminal No.	Check item	Inspection conditions	Standard value
54	Input communication with engine-ECU	Engine: Idling Selector lever position: D	Other than 0 V
55	Inhibitor switch P	Ignition switch: ON Selector lever position: P	System voltage
		Ignition switch: ON Selector lever position: Other than the above	0 V
56	Inhibitor switch N	Ignition switch: ON Selector lever position: N	System voltage
		Ignition switch: ON Selector lever position: Other than the above	0 V
57	Select switch	Ignition switch: ON Selector lever operation: Sports mode	System voltage
		Ignition switch: ON Selector lever operation: Other than the above	0 V
58	Downshift switch	Ignition switch: ON Selector lever position: Downshifted in Sports mode and lever held	System voltage
		Ignition switch: ON Selector lever operation: Other than the above	0 V
59	Stop lamp switch	Ignition switch: ON Brake pedal Depressed	System voltage
		Ignition switch: ON Brake pedal Released	0 V
62	DIR solenoid valve	Engine: Idling Shift range: Park	System voltage
		Engine: Idling Shift range: 2nd	7 - 9 V
65	Wide open throttle switch	Accelerator pedal: Released	4.5 - 5.5 V
		Accelerator pedal: Depressed	Less than 0.4 V
66	Inhibitor switch R	Ignition switch: ON Selector lever position: R	System voltage
		Ignition switch: ON Selector lever position: Other than the above	0 V
67	Inhibitor switch D	Ignition switch: ON Selector lever position: D	System voltage
		Ignition switch: ON Selector lever position: Other than the above	0 V
68	Upshift switch	Ignition switch: ON Selector lever position: Upshifted in Sports mode and lever held	System voltage
		Ignition switch: ON Selector lever position: Other than the above	0 V
69	Vehicle speed sensor	When stopped	0 V
		When starting to drive forward slowly.	0 V and 5 V alternates
71	A/T control relay	Ignition switch: OFF	0 V
		Ignition switch: ON	10 - 12 V
72	Earth	Ignition switch: ON	0 V

CHECK PROCEDURE USING AN OSCILLOSCOPE

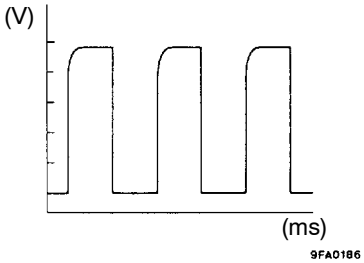
Check item	Inspection conditions		Normal condition (Wave pattern sample)
Crank angle sensor	Selector lever position: N	Idling (vehicle stopped)	Wave pattern A
Input shaft speed sensor	Shift range: 4th	Driving at a constant speed of 50 km/h in 4th (Engine: 1 800 - 2 100 r/min)	Wave pattern B
Output shaft speed sensor			
Vehicle speed sensor			
LR solenoid valve	Ignition switch: ON Engine: Stopped Selector lever position: P Throttle (accelerator) opening angle voltage: Less than 1 V <6G7>, less than 1.2 V <4M4>	Force-drive the solenoid valves (actuator test).	Wave pattern C
UD solenoid valve			
2nd solenoid valve			
OD solenoid valve			
RED solenoid valve			
DCC solenoid valve			

Wave pattern sample

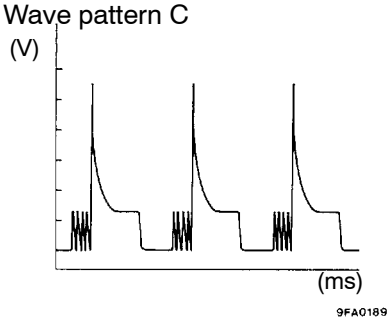
Wave pattern A

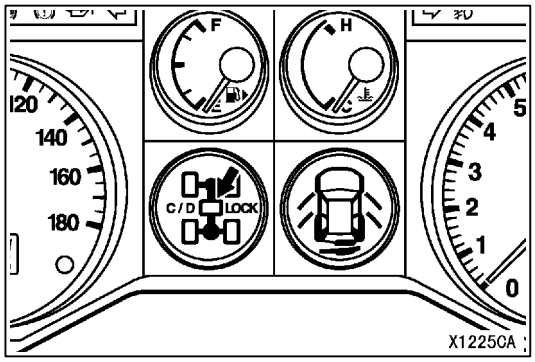


Wave pattern B



Wave pattern C





TROUBLESHOOTING <SS4 II>

DIAGNOSIS FUNCTION

CENTER DIFFERENTIAL LOCK LAMP

When a problem occurs in the transfer system, the center differential lock lamp flashes at a rate of 1 Hz.
When the center differential lock lamp is flashing at a rate of 1 Hz, check the diagnosis output.

READING DIAGNOSIS CODES

Use the MUT-II or the center differential lock lamp to read the diagnosis codes. (Refer to GROUP 00 - Guide to Troubleshooting and Inspection Procedures.)

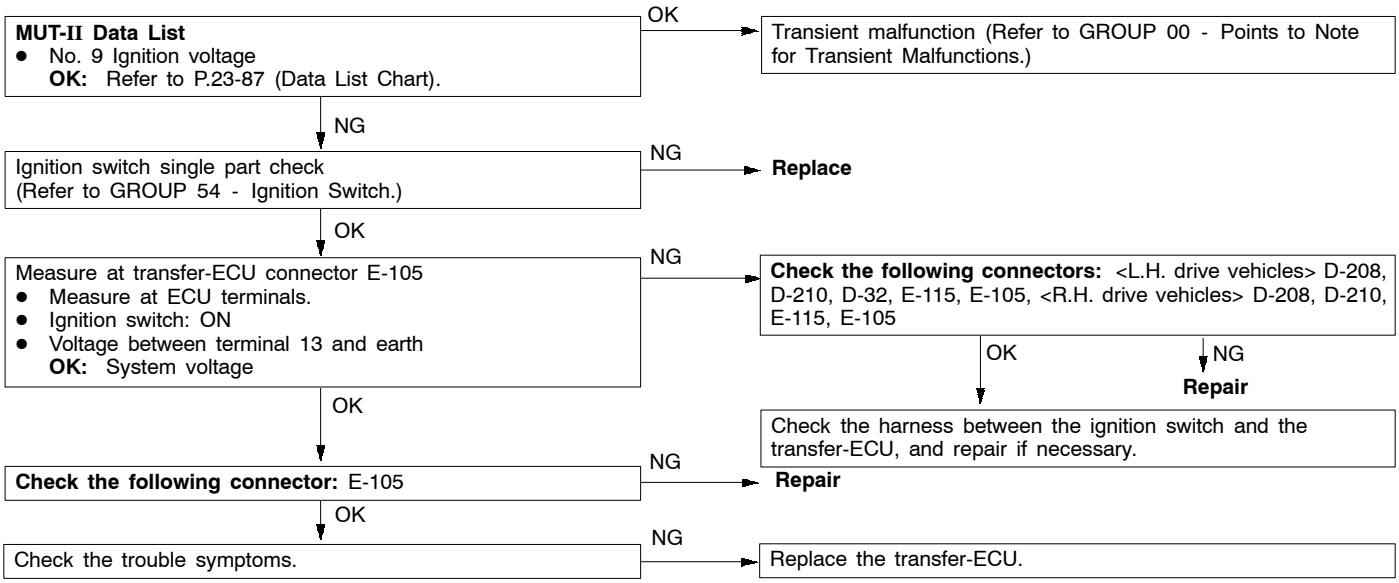
CHART CLASSIFIED BY DIAGNOSIS CODE

Diagnosis code	Diagnosis item		Reference page
11	Power supply voltage system	Voltage drop	23-72
12		Overvoltage	23-72
13	Main relay system (inside ECU)	Relay problem	23-72
21	Accelerator pedal position sensor (APS) system	Open circuit/Malfunction of sensor	23-73
22	Front propeller shaft speed sensor system	Open circuit/Short-circuit/Malfunction of sensor	23-75
23			
24	Rear propeller shaft speed sensor system	Open circuit/Short-circuit/Malfunction of sensor	23-77
25			
26	Stop lamp switch system	Open circuit/Short-circuit/Malfunction of lamp/Malfunction of switch	23-79
31	Transfer shift lever switch system	Open circuit/Short-circuit/Malfunction of switch	23-80
32	Transfer position switch system	Malfunction of transfer shift mechanism/Malfunction of actuator	23-81
33	Transfer position switch system	Open circuit/Short-circuit/Malfunction of switch	23-81
34	Freewheel engage solenoid valve system	Open circuit/Short-circuit/Malfunction of solenoid valve	23-82

Diagnosis code	Diagnosis item		Reference page
35	Freewheel engage switch system	Open circuit/Short-circuit/Malfunction of switch	23-83
41	Shift actuator (short-circuit/open circuit) system	Open circuit/Short-circuit/Malfunction of actuator/Malfunction of ECU	23-84
42	Shift actuator (short-circuit) system	Short-circuit/Malfunction of actuator/Malfunction of ECU	23-85
43	Shift actuator (open circuit) system	Open circuit/Malfunction of actuator/Malfunction of ECU	
44	Shift actuator (overload) system	Malfunction of transfer shift mechanism/Malfunction of actuator	23-86
45	Tyre problem	Incorrect tyre pressure/Uneven tyre sizes	23-86
51	Malfunction of transfer-ECU		23-86

INSPECTION PROCEDURES CLASSIFIED BY DIAGNOSIS CODE

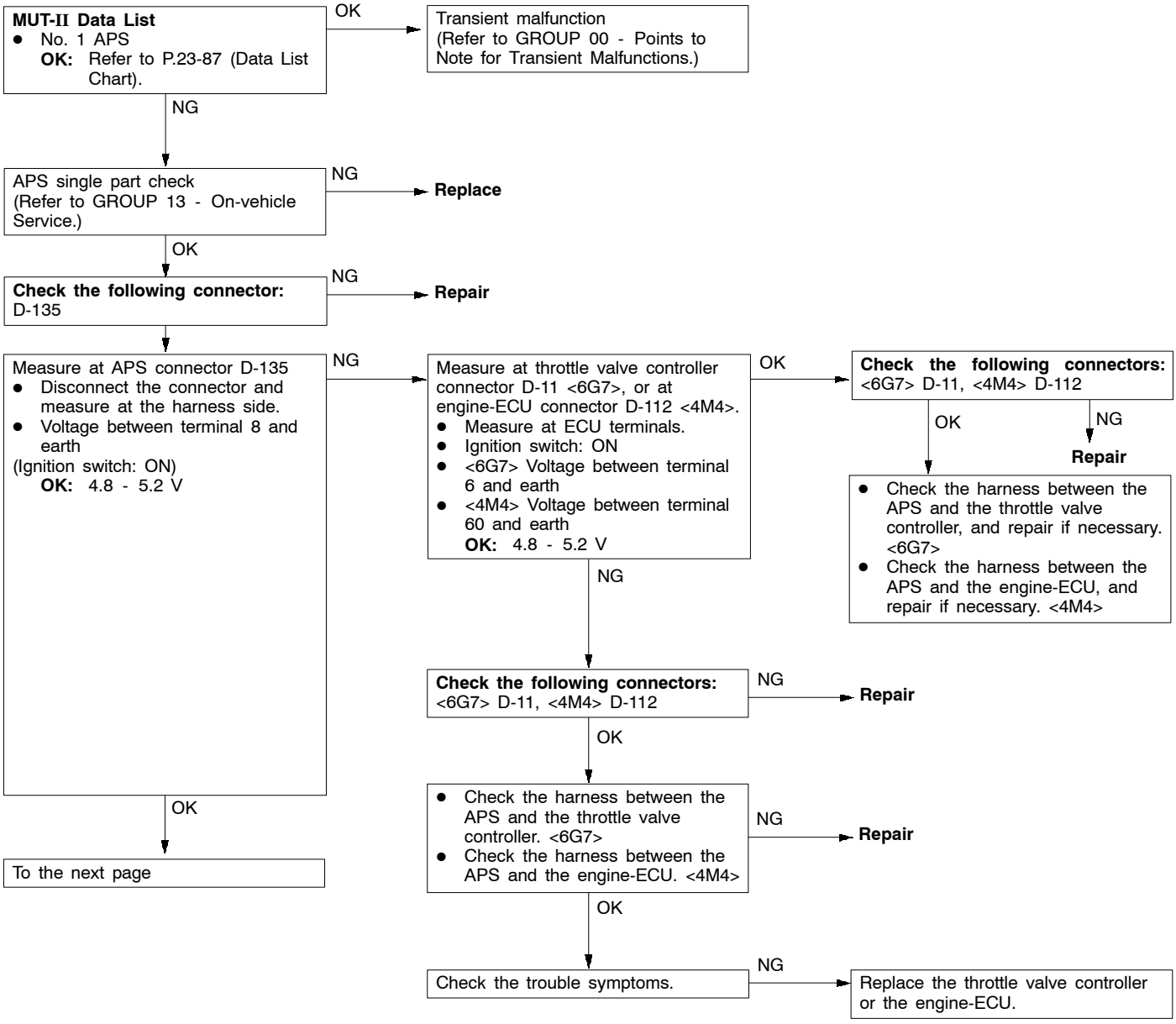
Code No. 11, 12 Power supply voltage system	Probable cause
Code No. 11 is output to indicate a drop in voltage if the power supply voltage drops below 9.5 V. Code No. 12 is output to indicate overvoltage if the power supply voltage rises above 18 V.	• Malfunction of ignition switch • Malfunction of harness or connector • Malfunction of transfer-ECU

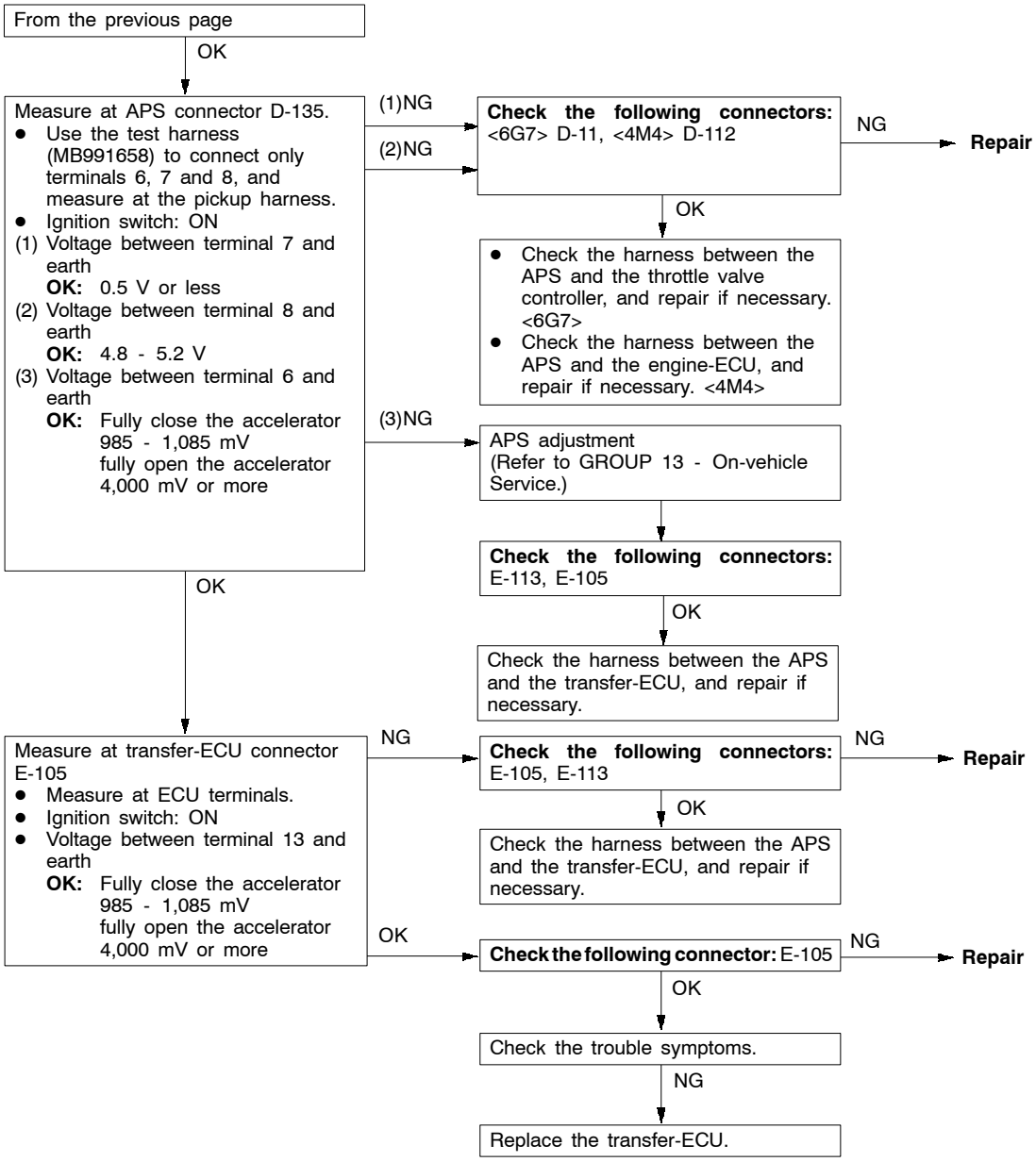


Code No. 13 Main relay (inside ECU) system	Probable cause
Code No. 13 is output to indicate a relay malfunction if the voltage rises to 6 V or higher when the relay is off, or if it drops below 6 V when the relay is on.	• Malfunction of transfer-ECU

Replace the transfer-ECU.

Code No. 21 Accelerator pedal position sensor (APS) system	Probable cause
Code No. 21 is output to indicate an open circuit in the APS or an incorrect adjustment when the APS output voltage drops below 0.2 V while the engine is idling.	• Malfunction of APS • Malfunction of harness or connector • Malfunction of transfer-ECU • Malfunction of throttle valve controller <6G7> • Malfunction of engine-ECU <4M4>




From the previous page
OK
Measure at APS connector D-135.
● Use the test harness (MB991658) to connect only terminals 6, 7 and 8, and measure at the pickup harness.
● Ignition switch: ON
(1) Voltage between terminal 7 and earth
OK: 0.5 V or less
(2) Voltage between terminal 8 and earth
OK: 4.8 - 5.2 V
(3) Voltage between terminal 6 and earth
OK: Fully close the accelerator 985 - 1,085 mV
fully open the accelerator 4,000 mV or more
(1)NG
(2)NG
Check the following connectors: <6G7> D-11, <4M4> D-112
NG
Repair
OK
● Check the harness between the APS and the throttle valve controller, and repair if necessary. <6G7>
● Check the harness between the APS and the engine-ECU, and repair if necessary. <4M4>
(3)NG
APS adjustment (Refer to GROUP 13 - On-vehicle Service.)
Check the following connectors: E-113, E-105
OK
Check the harness between the APS and the transfer-ECU, and repair if necessary.
OK
Measure at transfer-ECU connector E-105
● Measure at ECU terminals.
● Ignition switch: ON
● Voltage between terminal 13 and earth
OK: Fully close the accelerator 985 - 1,085 mV
fully open the accelerator 4,000 mV or more
NG
Check the following connectors: E-105, E-113
NG
Repair
OK
Check the harness between the APS and the transfer-ECU, and repair if necessary.
OK
Check the following connector: E-105
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the transfer-ECU.

Code No. 22, 23 Front propeller shaft speed sensor system	Probable cause
Code No. 22 is output to indicate an open circuit or short-circuit in the front propeller shaft speed sensor if no signal is input from the front propeller shaft speed sensor when shifting from 2WD to 4WD while driving at medium to low speeds. Code No. 23 is output to indicate an open circuit or short-circuit in the front propeller shaft speed sensor if the signal input from the front propeller shaft speed sensor is unstable when the freewheel engage switch is on.	• Malfunction of front propeller shaft speed sensor • Malfunction of harness or connector • Malfunction of transfer-ECU

MUT-II Data List
- No. 2 Front propeller shaft speed sensor
  OK: Refer to P.23-87 (Data List Chart).

OK → Transient malfunction (Refer to GROUP 00 - Points to Note for Transient Malfunctions.)

NG ↓

Measure at transfer-ECU connector E-105
- Measure at ECU terminals.
- Ignition switch: ON
- Voltage between terminals 18 and earth
  OK: 0.5 V or less

NG → **Check the following connector:** E-105
- OK → Check the trouble symptoms.
  - NG → Replace the transfer-ECU.
- NG → **Repair**

OK ↓

Measure at transfer-ECU connector E-105
- Measure at ECU terminals.
- Disconnect front propeller shaft speed sensor connector C-17.
- Ignition switch: ON
- Voltage between terminals 7 and earth
  OK: 4.8 - 5.2 V

NG → **Check the following connector:** C-17
- OK → Check the harness between the front propeller shaft speed sensor and the transfer-ECU.
  - OK → Check the trouble symptoms.
    - NG → Replace the transfer-ECU.
    - OK ↓
  - NG → **Repair**
- NG → **Repair**

OK ↓

Measure the front propeller shaft speed sensor output wave pattern at transfer-ECU connector E-105 (using an oscilloscope).
- Vehicle speed: approx. 50 km/h
- Shift range: 3rd
- Voltage between terminals 7 - 18
  OK: A wave pattern such as the one shown on P.23-69 (Check Procedure Using an Oscilloscope<Wave pattern B>) should be output, and the maximum value should be 4.8 V or more and the minimum value should be 0.8 V or less.
  There should be no noise in the output wave pattern.

OK → **Check the following connector:** E-105
- OK → Check the trouble symptoms.
  - NG → Replace the transfer-ECU.
  - OK ↓
- NG → **Repair**

OK ↓

Check the following connectors: C-17, E-105

NG → **Repair**

OK ↓

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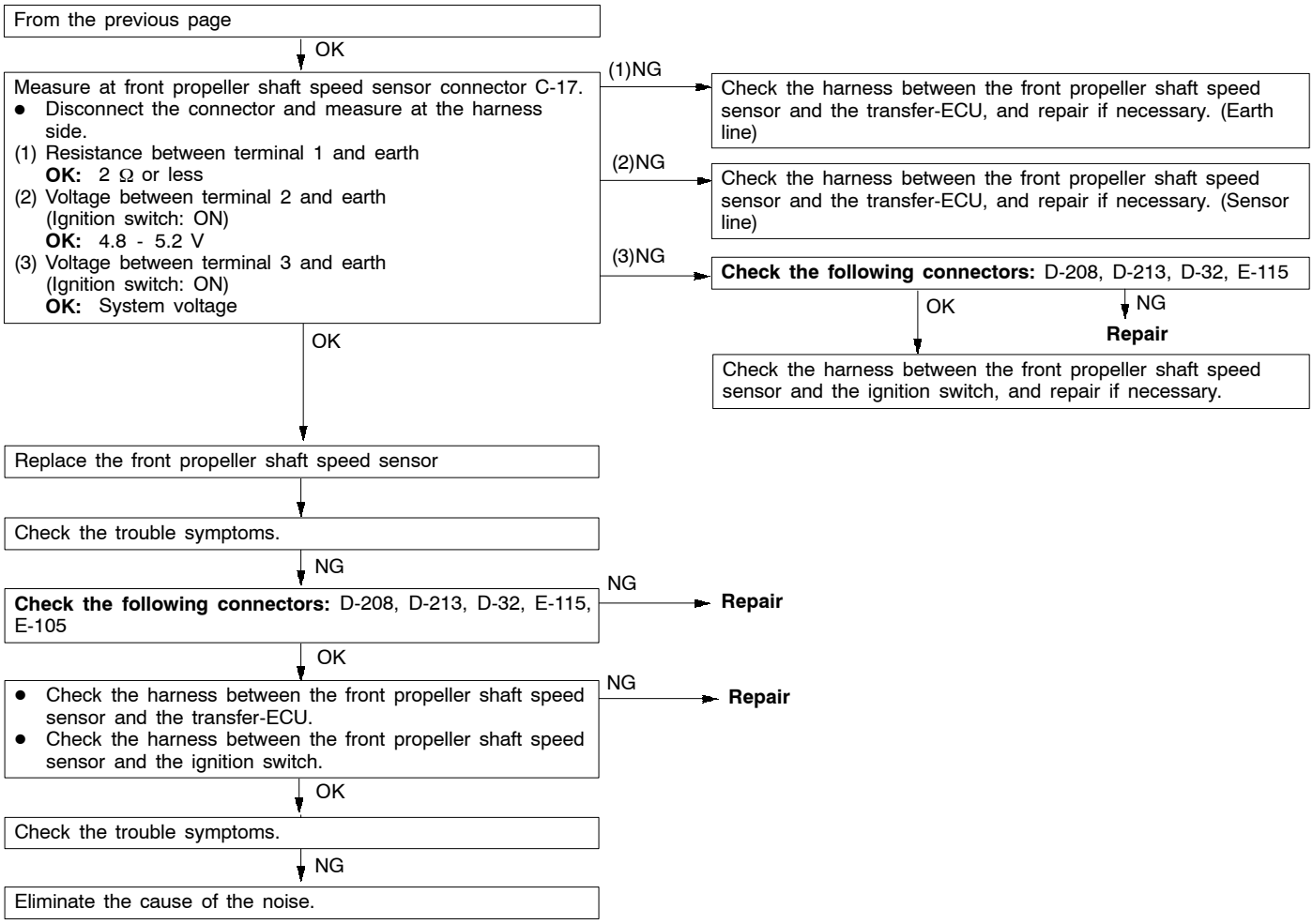
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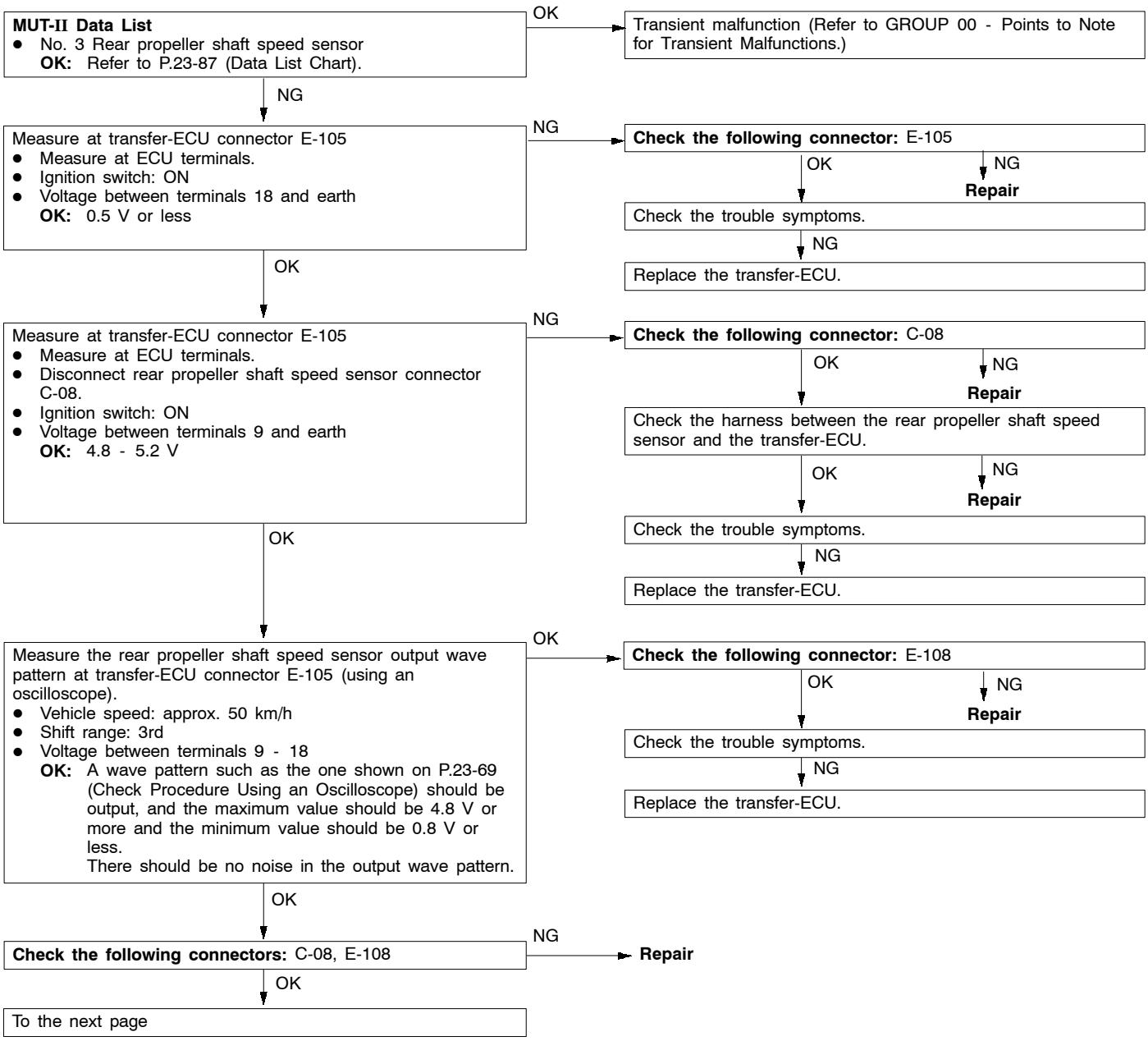
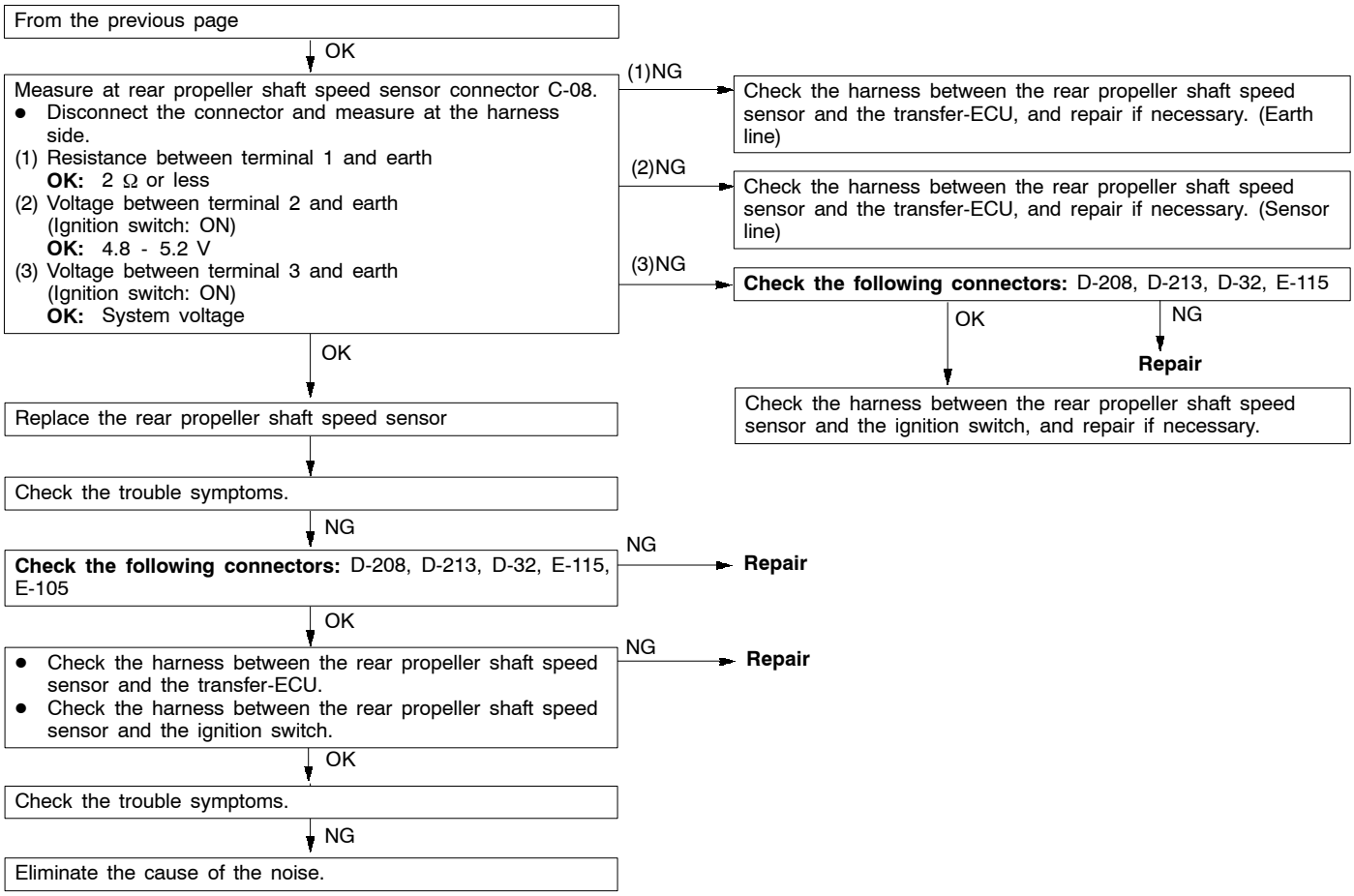
OK
Measure at front propeller shaft speed sensor connector C-17.
● Disconnect the connector and measure at the harness side.
(1) Resistance between terminal 1 and earth
OK: 2 Ω or less
(2) Voltage between terminal 2 and earth
(Ignition switch: ON)
OK: 4.8 - 5.2 V
(3) Voltage between terminal 3 and earth
(Ignition switch: ON)
OK: System voltage
(1)NG
Check the harness between the front propeller shaft speed sensor and the transfer-ECU, and repair if necessary. (Earth line)
(2)NG
Check the harness between the front propeller shaft speed sensor and the transfer-ECU, and repair if necessary. (Sensor line)
(3)NG
Check the following connectors: D-208, D-213, D-32, E-115
OK
NG
Repair
Check the harness between the front propeller shaft speed sensor and the ignition switch, and repair if necessary.
OK
Replace the front propeller shaft speed sensor
Check the trouble symptoms.
NG
Check the following connectors: D-208, D-213, D-32, E-115, E-105
NG
Repair
OK
● Check the harness between the front propeller shaft speed sensor and the transfer-ECU.
● Check the harness between the front propeller shaft speed sensor and the ignition switch.
NG
Repair
OK
Check the trouble symptoms.
NG
Eliminate the cause of the noise.

Code No. 24, 25 Rear propeller shaft speed sensor system	Probable cause
Code No. 24 is output to indicate an open circuit or short-circuit in the rear propeller shaft speed sensor if the signal input from the rear propeller shaft speed sensor is unstable when the APS voltage is 1.5 V or higher. Code No. 25 is output to indicate an open circuit or short-circuit in the rear propeller shaft speed sensor if the signal input from the rear propeller shaft speed sensor is unstable when the freewheel engage switch is on.	• No. 3 Rear propeller shaft speed sensor • Malfunction of harness or connector • Malfunction of transfer-ECU

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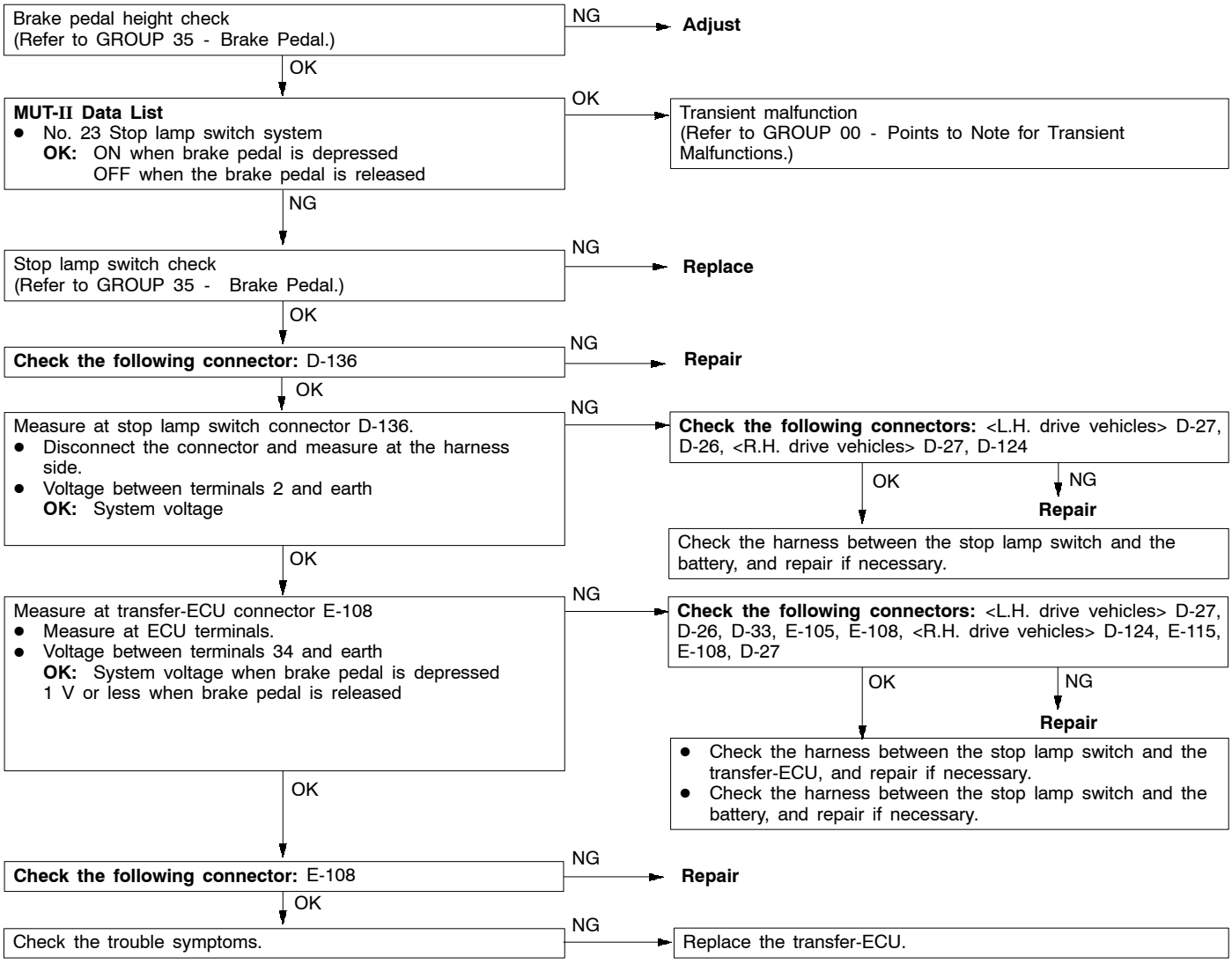
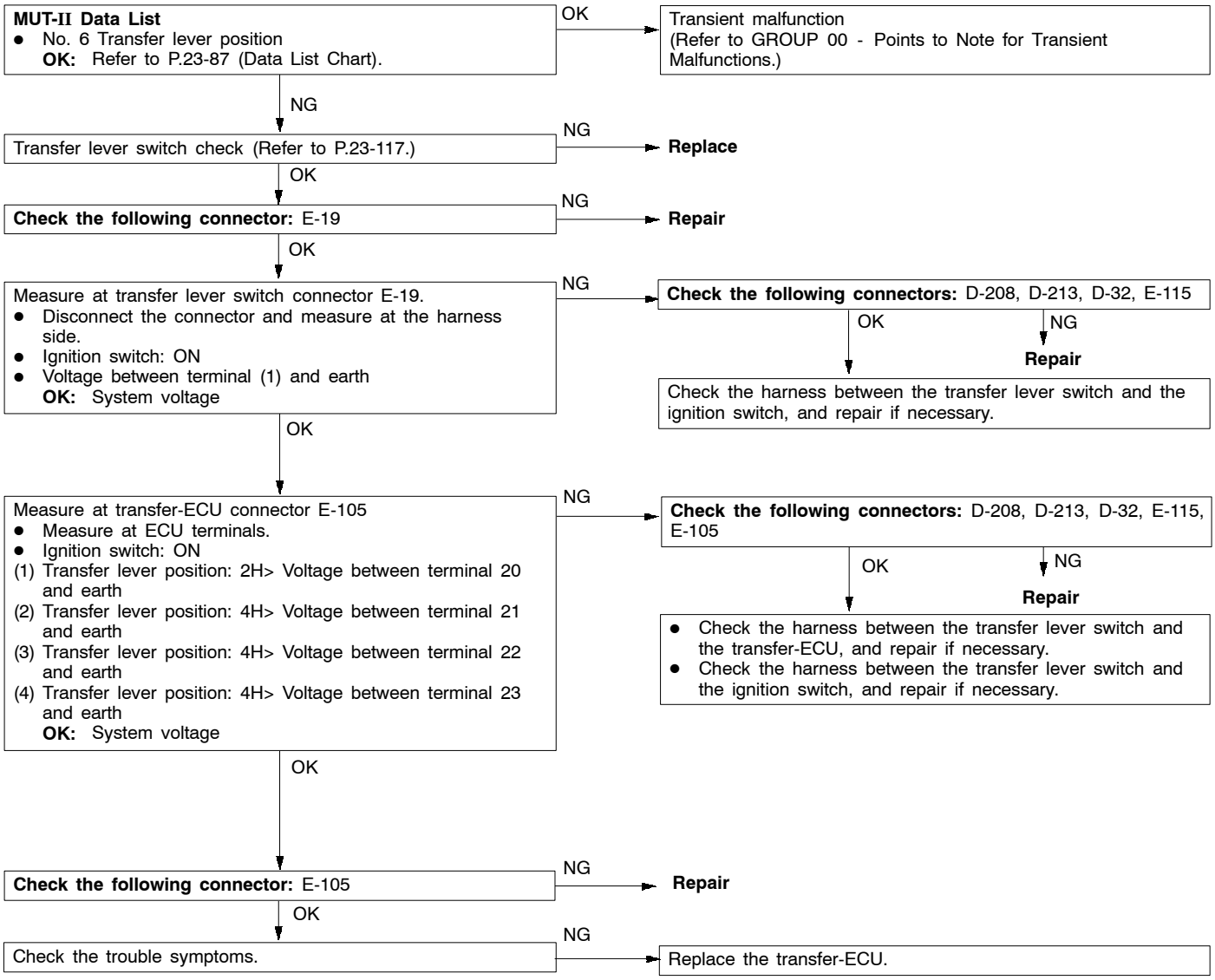
OK
Measure at rear propeller shaft speed sensor connector C-08.
● Disconnect the connector and measure at the harness side.
(1) Resistance between terminal 1 and earth
OK: 2 Ω or less
(2) Voltage between terminal 2 and earth
(Ignition switch: ON)
OK: 4.8 - 5.2 V
(3) Voltage between terminal 3 and earth
(Ignition switch: ON)
OK: System voltage
(1)NG
Check the harness between the rear propeller shaft speed sensor and the transfer-ECU, and repair if necessary. (Earth line)
(2)NG
Check the harness between the rear propeller shaft speed sensor and the transfer-ECU, and repair if necessary. (Sensor line)
(3)NG
Check the following connectors: D-208, D-213, D-32, E-115
OK
NG
Repair
Check the harness between the rear propeller shaft speed sensor and the ignition switch, and repair if necessary.
OK
Replace the rear propeller shaft speed sensor
Check the trouble symptoms.
NG
Check the following connectors: D-208, D-213, D-32, E-115, E-105
NG
Repair
OK
● Check the harness between the rear propeller shaft speed sensor and the transfer-ECU.
● Check the harness between the rear propeller shaft speed sensor and the ignition switch.
NG
Repair
OK
Check the trouble symptoms.
NG
Eliminate the cause of the noise.

Code No. 26 Stop lamp switch system	Probable cause
Code No. 26 is output to indicate a short-circuit in the stop lamp switch when the stop lamp switch is continuously on for 15 minutes or more when the vehicle speed is 15 km/h or higher.	• Malfunction of brake pedal • Malfunction of stop lamp switch • Malfunction of harness or connector • Malfunction of transfer-ECU

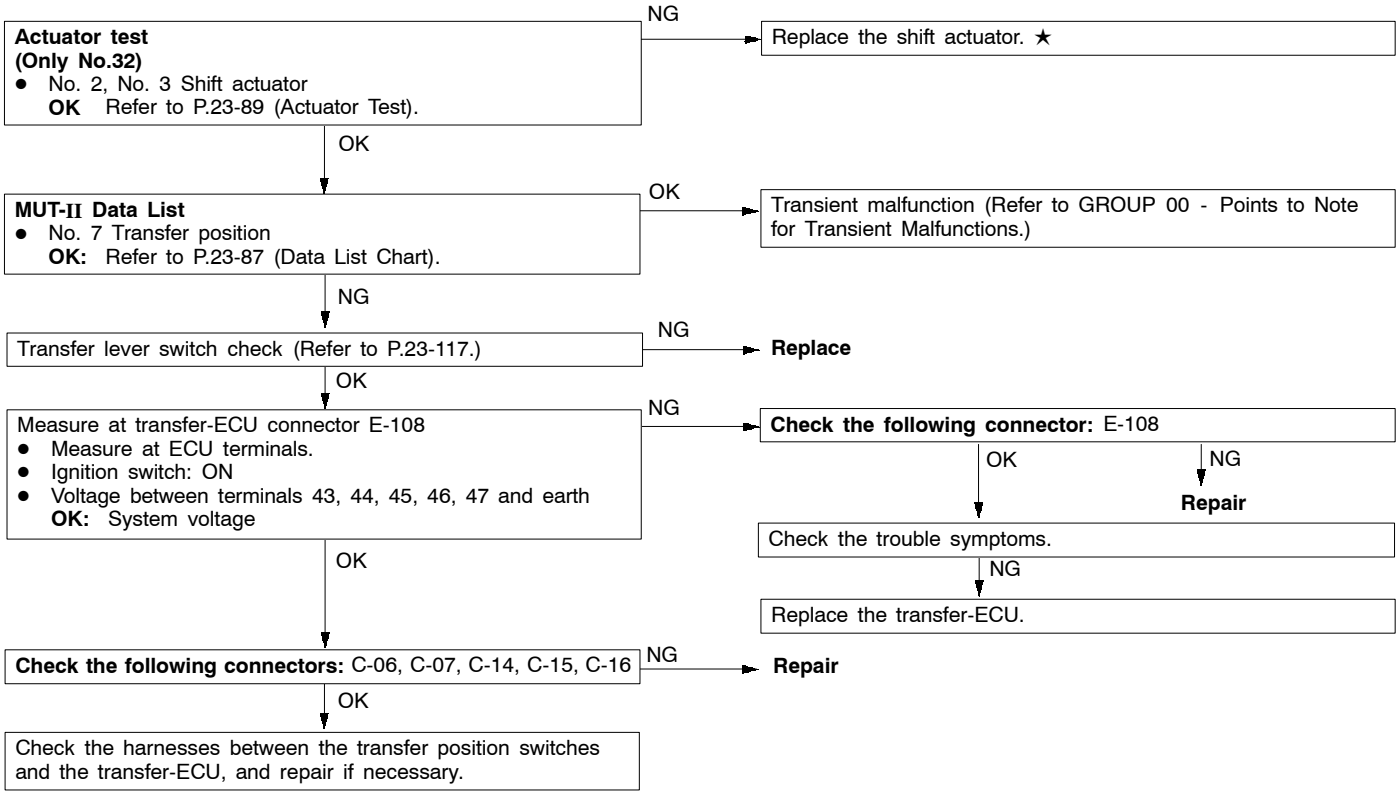


Code No. 31 Transfer lever switch system	Probable cause
Code No. 31 is output to indicate an open circuit or short-circuit in the transfer lever switch if the input signal from the transfer lever switch is unstable.	• Malfunction of transfer lever switch • Malfunction of harness or connector • Malfunction of transfer-ECU

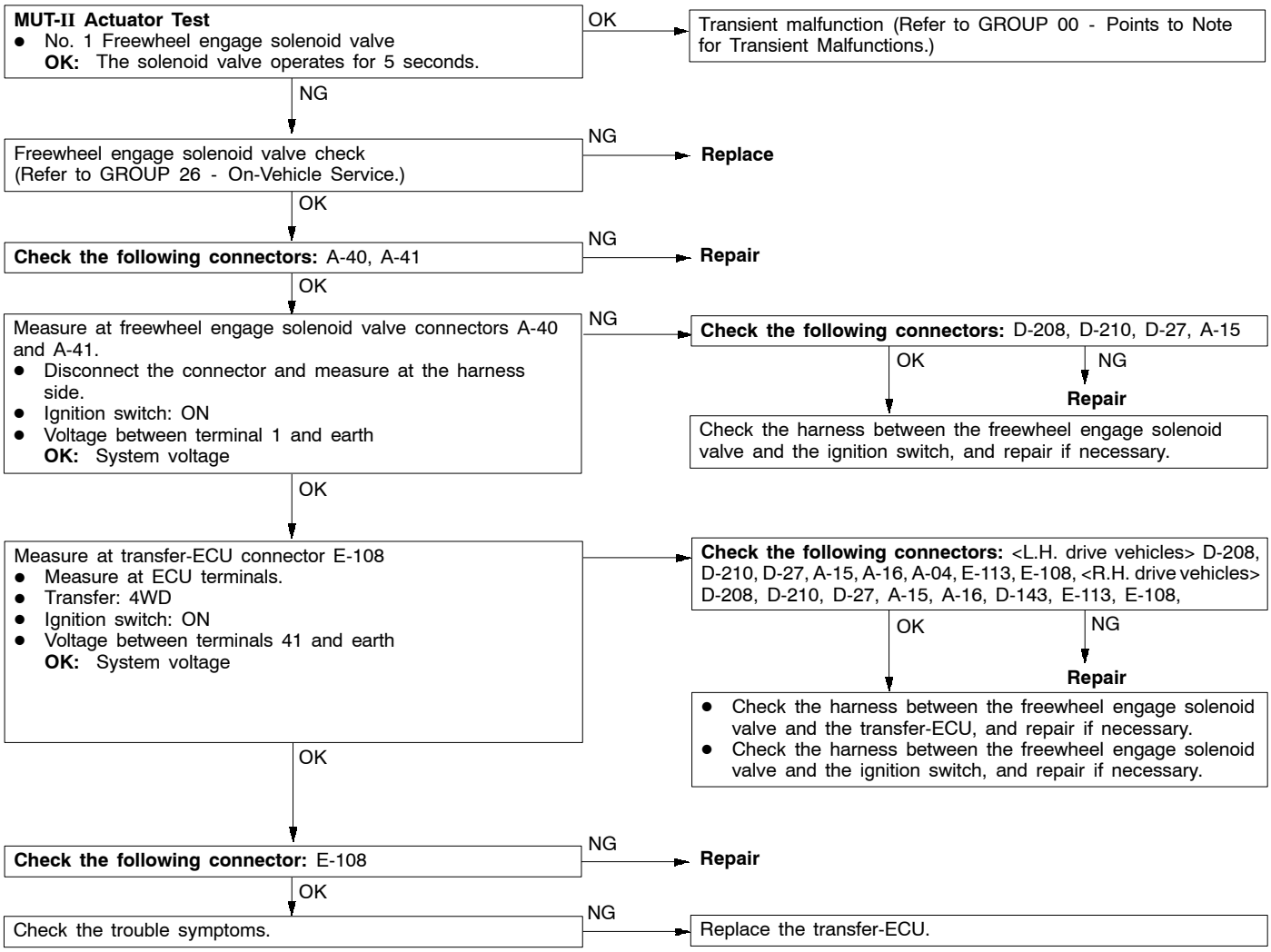


Code No. 32, 33 Transfer position switch system	Probable cause
Code No. 32 is output to indicate an open circuit or short-circuit in a transfer position switch, a malfunction of the shift actuator or a malfunction of the transfer shift mechanism when transfer selection does not complete while driving. Code No. 33 is output to indicate an open circuit or short-circuit in a transfer position switch if the input signal from the transfer position switch is unstable.	● Malfunction of transfer position switch ● Malfunction of harness or connector ● Malfunction of transfer-ECU ● Malfunction of shift actuator ● Malfunction of transfer shift mechanism

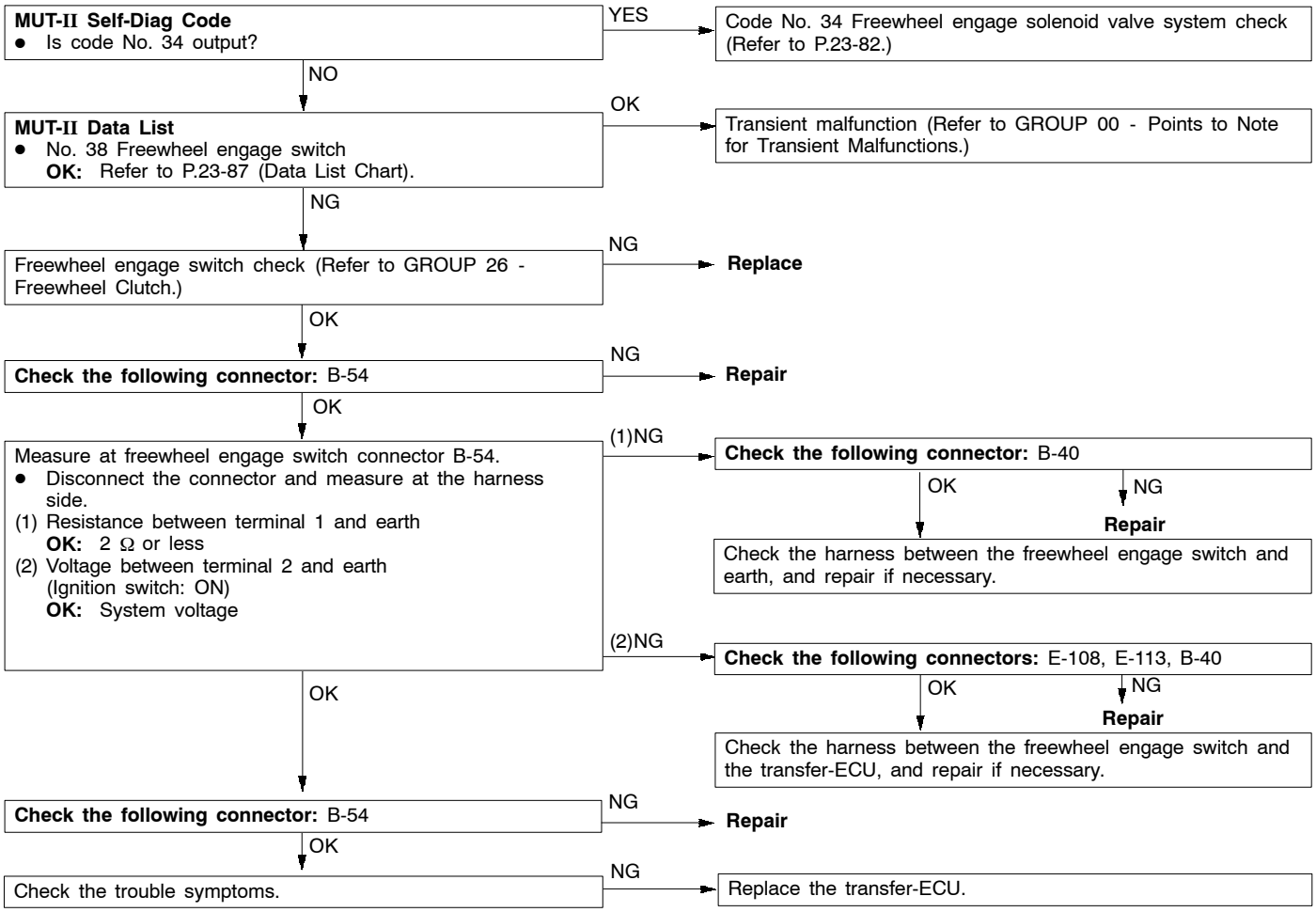
★ Refer to the Transmission Workshop Manual.



Code No. 34 Freewheel engage solenoid valve system	Probable cause
Code No. 34 is output to indicate an open circuit or short-circuit in the freewheel engage solenoid valve when the transfer-ECU terminal voltages are not the same while current is being supplied to the freewheel engage solenoid valve.	• Malfunction of freewheel engage solenoid valve • Malfunction of harness or connector • Malfunction of transfer-ECU



Code No. 35 Freewheel engage switch system	Probable cause
Code No. 35 is output to indicate an open circuit or short-circuit in the freewheel engage switch when the freewheel engage switch condition does not correspond to the fact that current is being supplied to the freewheel engage solenoid valve.	• Malfunction of freewheel engage switch • Malfunction of harness or connector • Malfunction of transfer-ECU



Code No. 41 Shift actuator system (open circuit or short-circuit)	Probable cause
Code No. 41 is output to indicate an open circuit or short-circuit in the shift actuator if the transfer-ECU terminal voltage is higher than the main relay voltage (90% of the rated voltage), or lower than the main relay voltage (10% of the rated voltage) when shift operation is not being carried out.	● Malfunction of shift actuator ● Malfunction of harness or connector ● Malfunction of transfer-ECU

★ Refer to the Transmission Workshop Manual.

MUT-II Data List
- No. 12 Shift actuator voltage
  OK: Refer to P.23-87 (Data List Chart).

OK → Transient malfunction (Refer to GROUP 00 - Points to Note for Transient Malfunctions.)

NG ↓

Measure at transfer-ECU connector E-105
- Measure at ECU terminals.
- Drive the shift actuator in accordance with MUT-II actuator test No. 2.
- Voltage between terminal 1 and earth
  OK: System voltage
- Drive the shift actuator in accordance with MUT-II actuator test No. 3.
- Voltage between terminals 3 and earth
  OK: System voltage

NG → **Check the following connector:** E-105
- OK → Replace the transfer-ECU.
- NG → **Repair**

OK ↓

Measure at shift actuator connector C-11.
- Disconnect the connector and measure at the harness side.
- Drive the shift actuator in accordance with MUT-II actuator test No. 2.
- Voltage between terminals 2 and earth
  OK: System voltage
- Drive the shift actuator in accordance with MUT-II actuator test No. 3.
- Voltage between terminal 1 and earth
  OK: System voltage

NG → **Check the following connectors:** C-11, E-105
- OK → Check the harness between the shift actuator and the transfer-ECU, and repair if necessary.
- NG → **Repair**

OK ↓

Check the following connector: C-11

NG → **Repair**

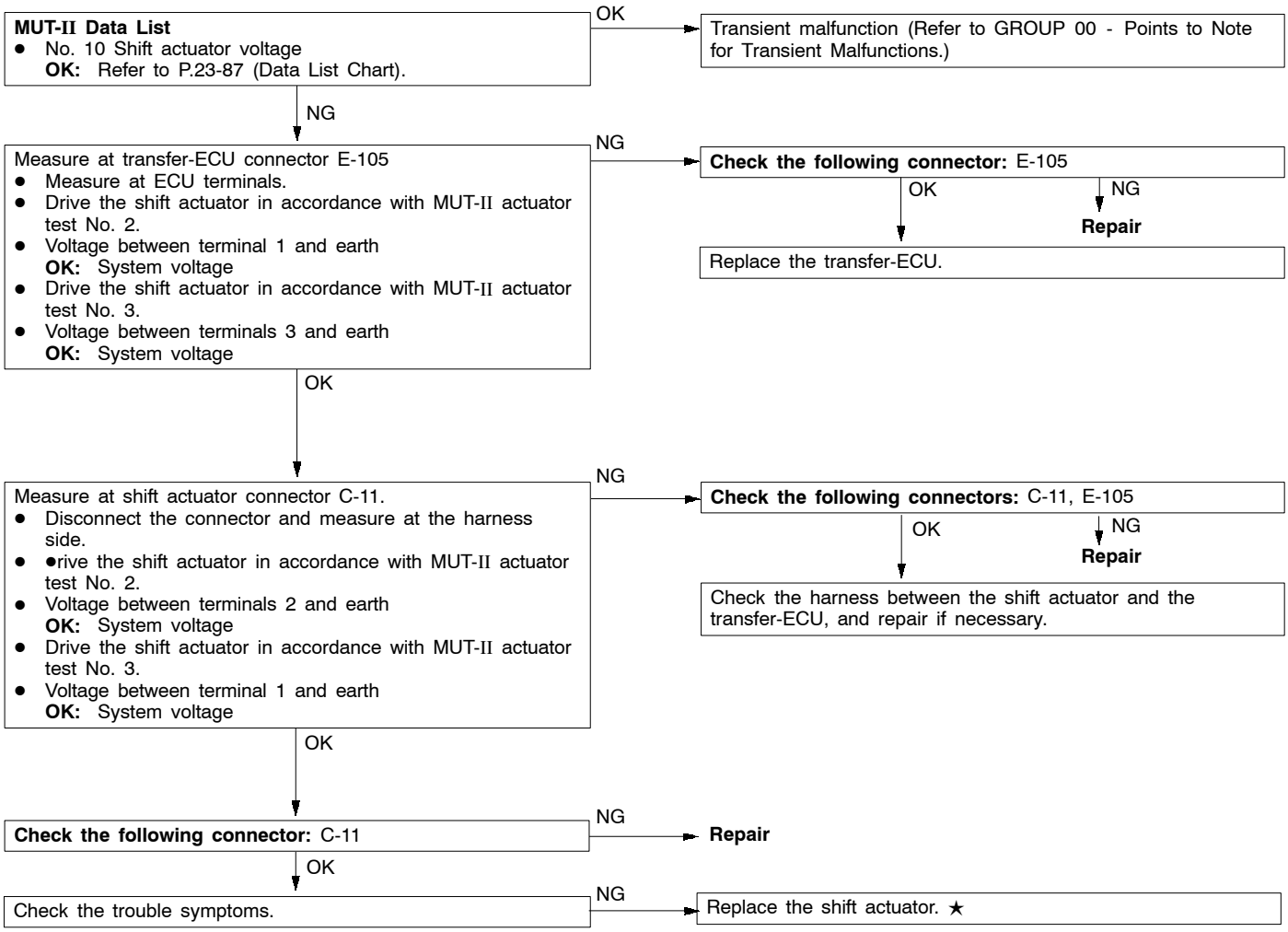
OK ↓

Check the trouble symptoms.

NG → Replace the shift actuator. ★

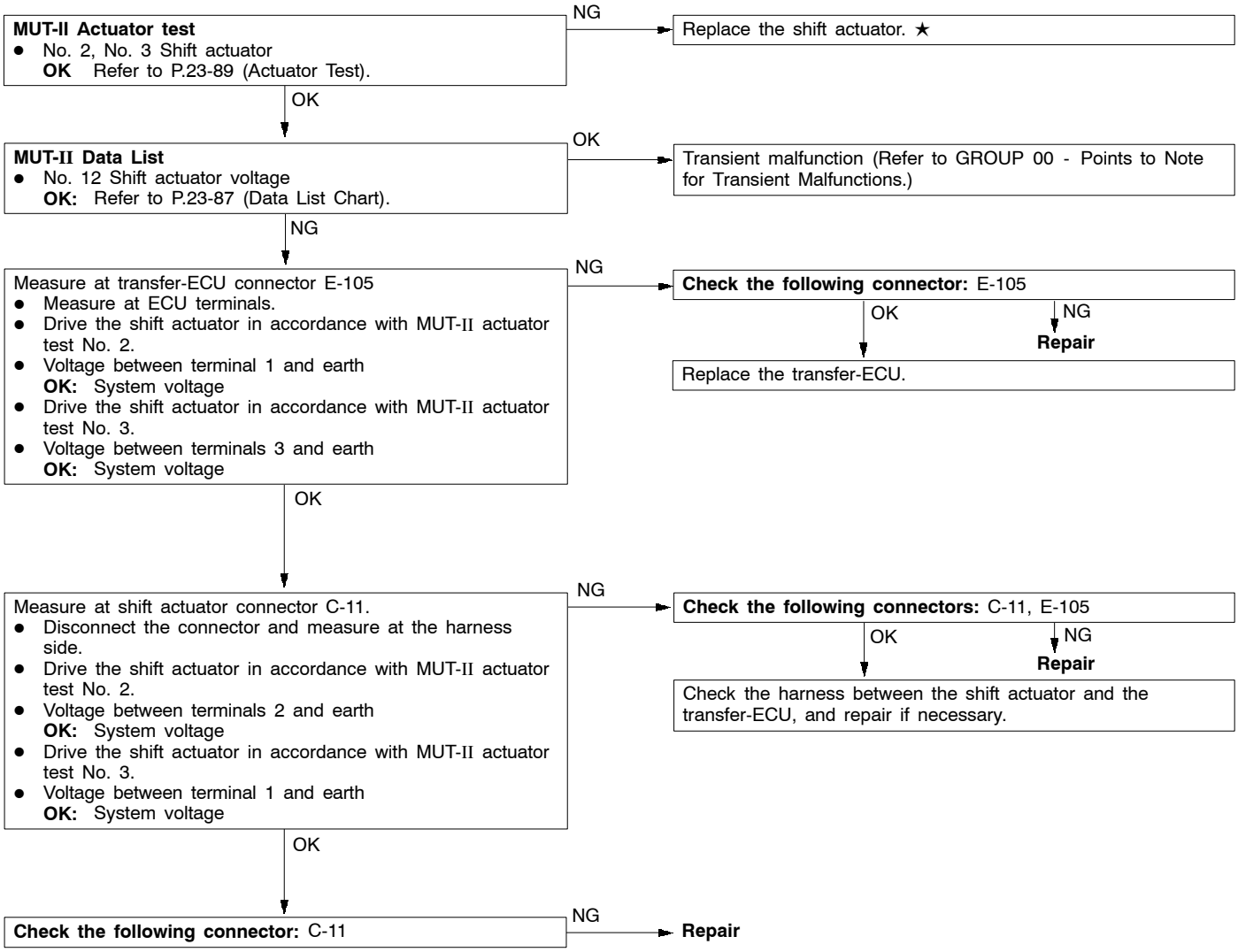
Code No. 42 Shift actuator system (short-circuit) Code No. 43 Shift actuator system (open circuit)	Probable cause
Code No. 42 is output to indicate a short-circuit in the shift actuator if the shift actuator current is +1 A greater than the target value while the actuator is being driven. Code No. 43 is output to indicate an open circuit in the shift actuator if the main relay voltage is lower than 6 V, or the shift actuator current is 0.1 A lower than the actual value while the actuator is being driven.	• Malfunction of shift actuator • Malfunction of harness or connector • Malfunction of transfer-ECU

★ Refer to the Transmission Workshop Manual.

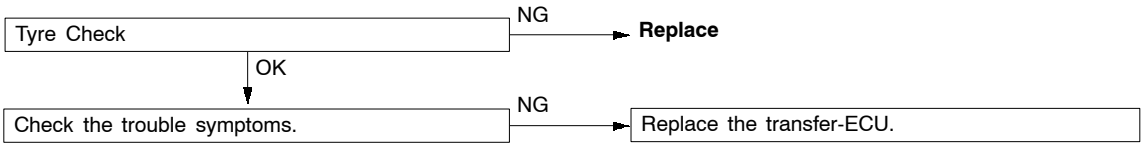


Code No. 44 Shift actuator system (overload)	Probable cause
Code No. 44 is output to indicate an overload of the shift actuator when the total time calculated for driving the shift actuator exceeds 5 minutes.	● Malfunction of shift actuator ● Malfunction of harness or connector ● Malfunction of transfer-ECU ● Malfunction of transfer shift mechanism

★ Refer to the Transmission Workshop Manual.



Code No. 45 Incorrect tyre diameters	Probable cause
Code No. 45 is output to indicate incorrect tyre pressure, uneven tyre sizes or non-uniform tyre brands, which have caused a large difference in speed between the front and rear wheel speeds and the setting values when the freewheel engage switch is on.	● Malfunction of tyre ● Malfunction of transfer-ECU



Code No. 51 Malfunction of transfer-ECU	Probable cause
Code No. 51 is output when a problem with the transfer-ECU is detected.	● Malfunction of transfer-ECU

Replace the transfer-ECU.

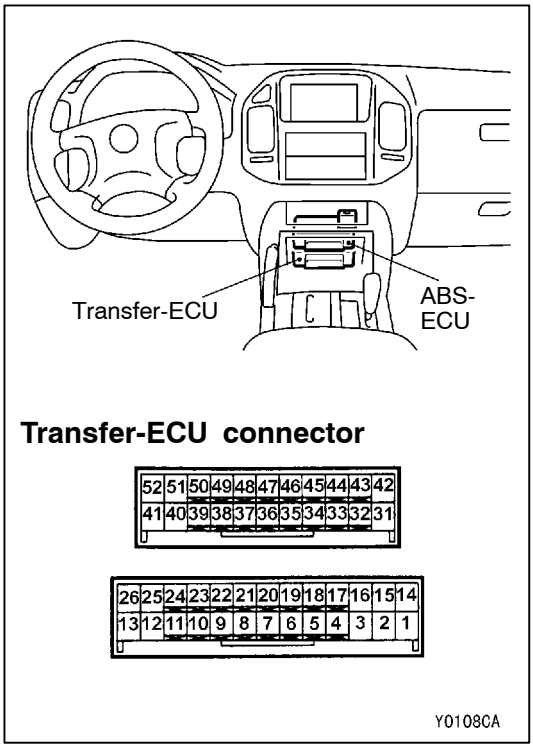
DATA LIST REFERENCE TABLE

Item No.	Check item	Inspection conditions		Normal condition
1	Accelerator pedal position sensor (APS)	Engine: Stopped Selector lever position: P	Accelerator pedal: Fully closed	985 - 1,085 mV
			Accelerator pedal: Depressed	Gradually increases from the above value.
			Accelerator pedal: Fully open	4000 mV or higher
2	Front propeller shaft speed sensor	Transfer position: 4WD	Driving at a constant speed of 30 km/h	30 km/h
3	Rear propeller shaft speed sensor	Transfer position: 4WD	Driving at a constant speed of 30 km/h	30 km/h
4	Difference between front and rear propeller shaft speeds	Transfer position: 4WD	Driving at a constant speed of 30 km/h	Within 5 km/h
5	Vehicle speed	Idling in 1st (Vehicle stopped)		0 km/h
		Driving at a constant speed of 50 km/h in 3rd		50 km/h
6	Transfer lever position	Ignition switch: ON Engine: Stopped	Transfer shift lever position: 2H	2H
			Transfer shift lever position: 4H	4H
			Transfer shift lever position: 4HLc	4HLc
			Transfer shift lever position: 4LLc	4LLc
7	Transfer position	Driving at a constant speed of 10 km/h	Transfer shift lever position: 2H → 4H	2H - 4H → 4H
			Transfer shift lever position: 4H → 4HLc	4H - 4HL → 4HL
		Engine: Stopped Selector lever position: N	Transfer shift lever position: 4HLc → 4LLc	4HL - 4LL → 4LL
			Transfer shift lever position: 4LLc → 4HLc	4HL - 4LL → 4HL
		Driving at a constant speed of 10 km/h	Transfer shift lever position: 4HLc → 4H	4H - 4HL → 4H
			Transfer shift lever position: 4H → 2H	2H - 4H → 2H
8	Main relay voltage	Ignition switch: ON		System voltage (V)
9	Ignition voltage	Ignition switch: ON		System voltage (V)
10	Shift actuator current	During transfer selection (while motor is running)		0 A → 0.2 A → 0 A
11	Target current	During transfer selection (while motor is running)		0 A → 1.5 A → 0 A
12	Shift actuator voltage	Ignition switch: ON Selector lever position: N Transfer shift lever position: 2H → 4H (or 4H → 4HLc, 4HLc → 4LLc)		System voltage (V)
		Ignition switch: ON Selector lever position: N Transfer shift lever position: 4LLc → 4HLc (or 4HLc → 4H, 4H → 2H)		System voltage (V)

Item No.	Check item	Inspection conditions		Normal condition
21	Ignition switch	Ignition switch: ON		ON
		Ignition switch: OFF		OFF
22	Transmission identification	Vehicles with A/T		A/T
23	Stop lamp switch	Ignition switch: ON Engine: Stopped	Brake pedal: Depressed	ON
			Brake pedal: Released	OFF
24	Transfer lever switch 2H	Transfer shift lever position: 2H		ON
		Transfer shift lever position: Other than the above		OFF
25	Transfer lever switch 4H	Transfer shift lever position: 4H		ON
		Transfer shift lever position: Other than the above		OFF
26	Transfer lever switch 4HLc	Transfer shift lever position: 4HLc		ON
		Transfer shift lever position: Other than the above		OFF
27	Transfer lever switch 4LLc	Transfer shift lever position: 4LLc		ON
		Transfer shift lever position: Other than the above		OFF
28	Engine identification	Petrol vehicles		PETROL
		Diesel vehicles		DIESEL
30	Freewheel engage solenoid valve	During 2WD		ON
		During 4WD		OFF
31	Inhibitor switch N	Selector lever position: N		ON
		Selector lever position: Other than the above		OFF
32	Inhibitor switch P	Selector lever position: P		ON
		Selector lever position: Other than the above		OFF
33	2WD switch	Driving conditions: 2WD (2H)		ON
		Driving conditions: Other than the above		OFF
34	2WD/4WD switch	Driving conditions: 2WD (2H), 4WD (4H)		ON
		Driving conditions: Other than the above		OFF
35	4H switch	Driving conditions: 4WD (4H), 4WD (4HLc)		ON
		Driving conditions: Other than the above		OFF
36	Center differential lock switch	Driving conditions: 4WD (4HLc), 4WD (4LLc)		ON
		Driving conditions: Other than the above		OFF
37	4LLc switch	Driving conditions: 4WD (4LLc)		ON
		Driving conditions: Other than the above		OFF
38	Freewheel engage switch	During 2WD		OFF
		During 4WD		ON

ACTUATOR TEST TABLE

Item No.	Check item	Test contents	Inspection conditions	Normal condition
1	Freewheel engage solenoid valve	The freewheel engage solenoid valve is driven.	Ignition switch: ON Selector lever position: P Engine: 0 r/min Vehicle speed: 0 km/h (vehicle stopped)	If the freewheel engage solenoid valve is on, it is turned off, and if it is off, it is turned on.
2	Shift actuator	The motor inside the shift actuator is run in the forward direction.		If the transfer is at the 2H, 4H or 4HLc position, it shifts from that position to the 2H, 4H, 4HLc, 4LLc positions in that order, and then returns to the original position. If it is at the 4LLc position, no shifting is carried out.
3		The motor inside the shift actuator is run in the reverse direction.		If the transfer is at the 4H, 4HLc or 4LLc position, it shifts from that position to the 4LLc, 4HLc , 4H, 2H positions in that order, and then returns to the original position. If it is at the 2H position, no shifting is carried out.



TRANSFER-ECU TERMINAL VOLTAGE TABLE

NOTE
There are two ECUs with the same shape inside the floor console, one above the other. The top ECU is the ABS-ECU, and it has a blue connector. The bottom ECU is the transfer-ECU, and it has a green connector.

Terminal No.	Check item	Inspection conditions	Standard value
1	Shift actuator	Transfer shift lever position: 2H → 4H	5.6 V → 11.0 V → 5.6 V
3	Shift actuator	Transfer shift lever position: 4H → 2H	5.6 V → 11.0 V → 5.6 V
5	Accelerator pedal position sensor (APS)	Accelerator pedal: Fully closed (engine stopped)	0.985 - 1.085 V
		Accelerator pedal: Fully open (engine stopped)	4.0 V or higher
7	Front propeller shaft speed sensor	Measure the voltage between terminals 7 and 18 using an oscilloscope. Engine: 2 000 r/min Shift range: 4th	Oscilloscope check procedure (Refer to P. 23-69 <Wave Pattern B>.)
9	Rear propeller shaft speed sensor	Measure the voltage between terminals 9 and 18 using an oscilloscope. Engine: 2 000 r/min Shift range: 4th	Oscilloscope check procedure (Refer to P. 23-69 <Wave Pattern B>.)
11	Diagnosis output	When normal (no diagnosis codes are output)	0 V and 5 V alternates
13	Power supply	Ignition switch: OFF	0 V
		Ignition switch: ON	System voltage
18	Sensor earth	At all times	0.5 V or less
20	Transfer lever switch 2H	Transfer shift lever position: 2H	System voltage
		Transfer shift lever position: Other than the above	0 V
21	Transfer lever switch 4H	Transfer shift lever position: 4H	System voltage
		Transfer shift lever position: Other than the above	0 V
22	Transfer lever switch 4HLc	Transfer shift lever position: 4HLc	System voltage
		Transfer shift lever position: Other than the above	0 V
23	Transfer lever switch 4LLc	Transfer shift lever position: 4LLc	System voltage
		Transfer shift lever position: Other than the above	0 V
24	Diagnosis control	–	–
25	Earth	At all times	0 V
26	Earth	At all times	0 V
31	Backup power supply	At all times	System voltage
32	Inhibitor switch N	Selector lever position: N	System voltage
		Selector lever position: Other than the above	0 V
33	Inhibitor switch P	Selector lever position: P	System voltage
		Selector lever position: Other than the above	0 V
34	Stop lamp switch	Brake pedal: Depressed	System voltage
		Brake pedal: Released	0 V
35	Earth	At all times	0 V
37	Rear wheel indicator lamp	Other than during transfer selection	System voltage
38	Front wheel indicator lamp	During 4WD	System voltage
39	Earth <6G7>	At all times	0 V

Terminal No.	Check item	Inspection conditions	Standard value
40	Center differential lock lamp	During 4WD (4HLc or 4LLc)	System voltage
41	Solenoid valve A, B	Transfer shift lever position: 2H	1 V
		Transfer shift lever position: Other than 2H	System voltage
42	Earth	At all times	0 V
43	2WD switch	Transfer shift lever position: 2H	0 V
		Transfer shift lever position: Other than 2H	10.5 V
44	2WD/4WD switch	Transfer shift lever position: 2H or 4H	0 V
		Transfer shift lever position: 4HLc or 4LLc	10.5 V
45	4H switch	Transfer shift lever position: 4H or 4HLc	0 V
		Transfer shift lever position: 2H or 4LLc	10.5 V
46	Center differential lock switch	Transfer shift lever position: 4HLc or 4LLc	0 V
		Transfer shift lever position: 2H or 4H	10.5 V
47	4HLc switch	Transfer shift lever position: 4LLc	0 V
		Transfer shift lever position: Other than 4LLc	10.5 V
50	Freewheel engage switch	Transfer position: 2WD	10.5 V
		Transfer position: 4WD	0 V

TROUBLESHOOTING <SHIFT LOCK AND KEY INTERLOCK MECHANISMS>

DIAGNOSIS FUNCTION

Input signal check procedure

Connect the MUT-II or a voltage meter to the diagnosis connector, and check the inhibitor switch (reverse) input signal.
(Refer to GROUP 00 - Guide to Troubleshooting and Inspection Procedures.)

INSPECTION CHART CLASSIFIED BY TROUBLE SYMPTOMS

Trouble Symptom	Inspection procedure No.	Reference page
When the ignition switch is at a position other than the LOCK position, the selector lever can be moved from the P to the R position even though the brake pedal is not depressed.	1	23-92
When the ignition switch is at a position other than the LOCK position, the selector lever cannot be moved from the P to the R position even though the brake pedal is being depressed.	2	23-92
The ignition switch is at the LOCK position, but the selector lever can be moved from the P to the R position when the brake pedal is depressed.	3	23-93
The selector lever cannot be easily moved from the P to the R position.	4	23-93
The selector lever cannot be moved from the R to the P position.	5	23-93
The ignition key cannot be turned to the LOCK position when the selector lever is at the P position.	6	23-93
The ignition key can be turned to the LOCK position even when the selector lever is at a position other than the P position.	7	23-93

INSPECTION PROCEDURES FOR TROUBLE SYMPTOM

Inspection procedure 1

When the ignition switch is at a position other than the LOCK position, the selector lever can be moved from the P to the R position even though the brake pedal is not depressed.	**Probable cause**
The cause is probably a malfunction of the selector lever assembly lock cam or of the shift lock cable unit.	• Malfunction of lock cam • Malfunction of shift lock cable unit

Check by referring to the probable causes.

Inspection procedure 2

When the ignition switch is at a position other than the LOCK position, the selector lever cannot be moved from the P to the R position even though the brake pedal is being depressed.	**Probable cause**
The cause is probably a malfunction of the selector lever assembly, transmission control cable, shift lock cable unit or the ignition key cylinder lock bar.	• Malfunction of selector lever assembly • Malfunction of transmission control cable • Malfunction of shift lock cable unit • Malfunction of lock bar

Check by referring to the probable causes.

Inspection procedure 3

The ignition switch is at the LOCK position, but the selector lever can be moved from the P to the R position when the brake pedal is depressed.	Probable cause
The cause is probably a malfunction of the shift lock cable unit or of the ignition key cylinder lock bar.	● Malfunction of shift lock cable unit ● Malfunction of lock bar

Check by referring to the probable causes.

Inspection procedure 4

The selector lever cannot be easily moved from the P to the R position.	Probable cause
The cause is probably a malfunction of the selector lever assembly, transmission control cable, shift lock cable unit or the ignition key cylinder lock bar.	● Malfunction of selector lever assembly ● Malfunction of transmission control cable ● Malfunction of shift lock cable unit ● Malfunction of lock bar

Check by referring to the probable causes.

Inspection procedure 5

The selector lever cannot be moved from the R to the P position.	Probable cause
The cause is probably a malfunction of the selector lever assembly or of the transmission control cable.	● Malfunction of selector lever assembly ● Malfunction of transmission control cable

Check by referring to the probable causes.

Inspection procedure 6

The ignition key cannot be turned to the LOCK position when the selector lever is at the P position.	Probable cause
The cause is probably a malfunction of the selector lever assembly, shift lock cable unit or the ignition key cylinder lock bar.	● Malfunction of selector lever assembly ● Malfunction of shift lock cable unit ● Malfunction of lock bar

Check by referring to the probable causes.

Inspection procedure 7

The ignition key can be turned to the LOCK position even when the selector lever is at a position other than the P position.	Probable cause
The cause is probably a malfunction of the shift lock cable unit or of the ignition key cylinder lock bar.	● Malfunction of shift lock cable unit ● Malfunction of lock bar

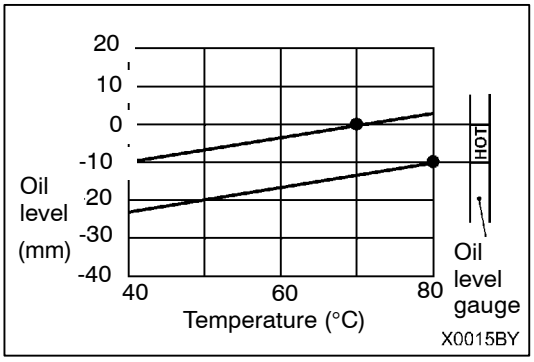
Check by referring to the probable causes.

ON-VEHICLE SERVICE

BASIC ADJUSTMENT PROCEDURES

AUTOMATIC TRANSMISSION FLUID (ATF) CHECK

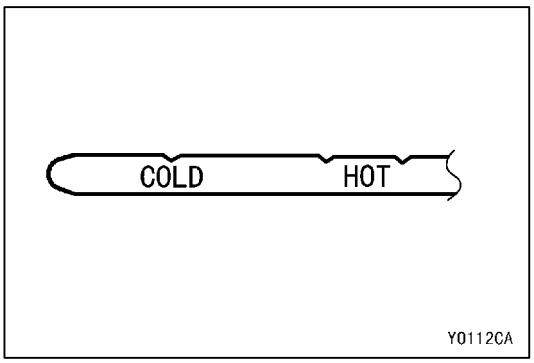
NOTE
When replacing the transmission with a new one, overhauling the existing transmission, or driving in a harsh condition, the ATF cooler line should always be flushed out and ATF should be replaced with a new one.



1. Drive the vehicle until the ATF temperature reaches the normal temperature (70 - 80°C).

   NOTE
   1) Measure ATF temperature using MUT-II.
   2) Check the oil level referring to the characteristics chart shown at left if it takes some time to reach the normal operation temperature of ATF (70 - 80°C.)
2. Park the vehicle on a level surface.
3. Move the selector lever to all positions to fully charge the torque converter and the fluid lines with ATF, and then move the selector lever to the “N” position.
4. After wiping away any dirt from around the oil level gauge, pull out the oil level gauge and check the level of ATF.

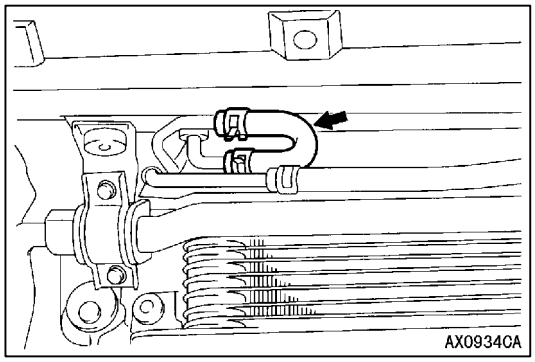
   NOTE
   If the ATF has a burnt smell, or if it has become very contaminated or dirty, it means that the ATF has become contaminated by minute particles from bushings (metal) or worn parts. In such a case, the transmission needs to be overhauled and the ATF cooler line needs to be flushed out.



5. Check that the ATF level is between the “HOT” marks on the oil level gauge. If the ATF level is too low, add more ATF until the level reaches between the “HOT” marks.

   Automatic transmission fluid:
   DIA QUEEN ATF SP II M, SP III or equivalent

   NOTE
   If the ATF level is too low, the oil pump draws air into the system along with the ATF, and air bubbles will thus form in the fluid circuit. This will cause a drop in fluid pressure and cause the shift points to change and the clutches and brakes to slip.
   If the ATF level is too high, the gear will churn the ATF and cause bubbles to develop, which can then cause the same problems as when the ATF fluid is too low. In either case, the air bubbles can cause overheating and oxidation of the ATF, and also prevent the valves, clutches and brakes from operating normally. In addition, if bubbles develop in the ATF, the ATF can overflow from the transmission vent holes and be mistaken for leaks.
6. Securely re-insert the oil level gauge.

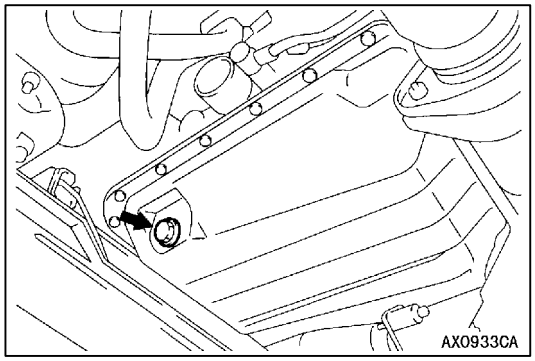


AUTOMATIC TRANSMISSION FLUID (ATF) REPLACEMENT

NOTE
Before replacing the transmission with a new one, overhauling the existing transmission, or connecting the cooler pipe to the transmission, the ATF cooler line should always be flushed out.
If you have an ATF changer, use the ATF changer to flush the ATF. If you do not have an ATF changer, follow the procedure given below.

1. Remove the hose shown in the illustration which allows the ATF to flow from the ATF cooler (built into the radiator) to the transmission.
2. Start the engine and discharge the ATF.
   Driving conditions: N range, idling

   NOTE
   The engine should be stopped within one minute of it being started. If the ATF has all been discharged before this, stop the engine at that point.
   Discharge amount: Approx. 4.0 L



3. Remove the drain plug at the bottom of the transmission case to drain out the remaining ATF.

   Discharge amount: Approx. 2.0 L

4. Install the drain plug with a gasket in between, and tighten it to the specified torque.

   Tightening torque: 32 ± 2 N·m

5. Pour in new ATF through the oil filler tube.

   Amount to add: Approx. 6.0 L

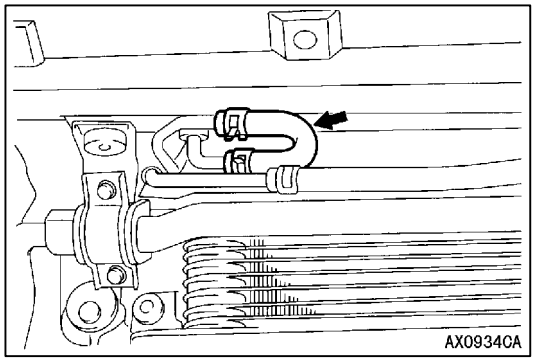
   NOTE
   Stop pouring in the ATF once 6.0 litre has been poured in.

6. Repeat the operation in step 2.

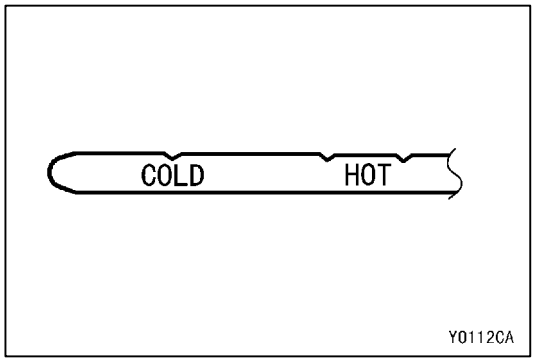
   NOTE
   Carry out steps 2 and 6 so that at least 8.0 litre has been discharged from the cooler hose. After this, discharge a small quantity of ATF and check for contamination. If the ATF is contaminated, repeat steps 5 and 6.

7. Pour in new ATF through the oil filler tube.

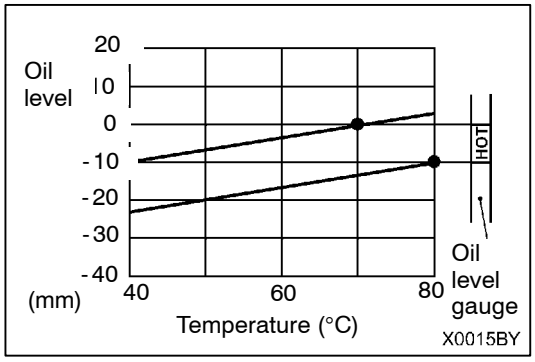
   Amount to add: Approx. 4.0 L



8. Connect the hose which was disconnected in step 1, and then securely re-insert the oil level gauge.
9. Start the engine, and let it run at idle for 1 - 2 minutes.
10. Move the selector lever to all positions once, and then return it to the N position.

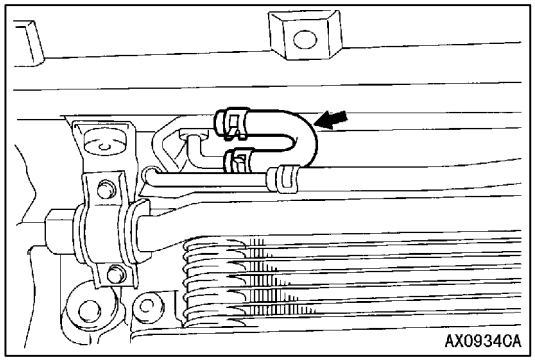


11. Check that the ATF level on the oil level gauge is at the "COLD" mark. If it is not up to this mark, add more ATF.



12. Drive the vehicle until the ATF temperature reaches the normal temperature (70 - 80°C), and then re-check the ATF level.
    The ATF level must be between the HOT marks.

    NOTE
    (1) The "COLD" mark is for reference only; the "HOT" marks should be used as the standard for judgment.
    (2) Measure ATF temperature using MUT-II.
    (3) Check the oil level referring to the characteristics chart shown at left if it takes some time until reaching the normal operation temperature of ATF (70 - 80C.)
13. Securely insert the oil level gauge into the oil filler tube.



ATF COOLER LINE FLUSHING PROCEDURE

NOTE
If replacing the transmission with a new one, if overhauling the existing transmission, or if the ATF has deteriorated or is contaminated, the ATF cooler line must always be flushed out.

1. Remove the hose shown in the illustration which allows the ATF to flow from the ATF cooler (built into the radiator) to the transmission.
2. Start the engine and discharge the ATF.
   Driving conditions: N range, idling

   NOTE
   The engine should be stopped within one minute of it being started.If the ATF has all been discharged before this, stop the engine at that point.

   Discharge amount: Approx. 4.0 L
3. Pour in new ATF through the oil filler tube.

   Amount to add: Approx. 4.0 L

NOTE
Stop pouring in the ATF once 4.0 litre has been poured in.

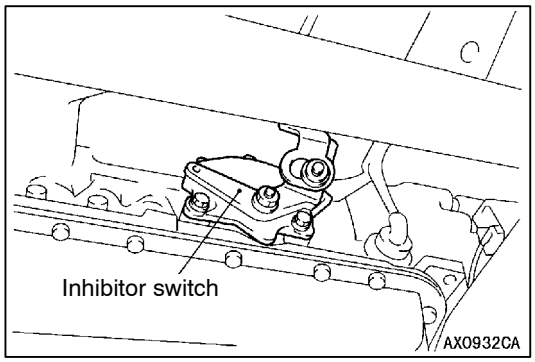
4. Repeat the operation in step 2.

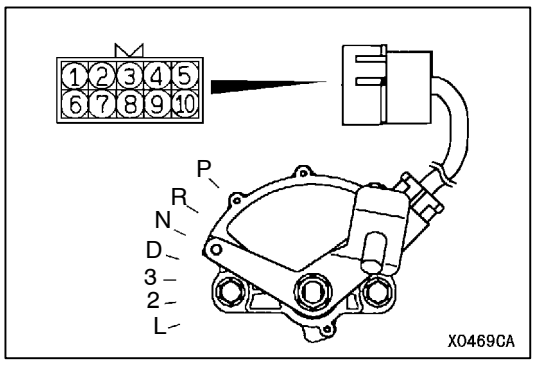
NOTE
Carry out steps 2 and 6 so that at least 8.0 L has been discharged from the cooler hose.After this, discharge a small quantity of ATF and check for contamination.If the ATF is contaminated, repeat steps 3 and 4.

5. Carry out the procedure in "Automatic Transmission Fluid (ATF) Replacement" from step 3 onwards.

ACCELERATOR PEDAL POSITION SENSOR (APS) ADJUSTMENT

Refer to GROUP 13 - On-vehicle Service.

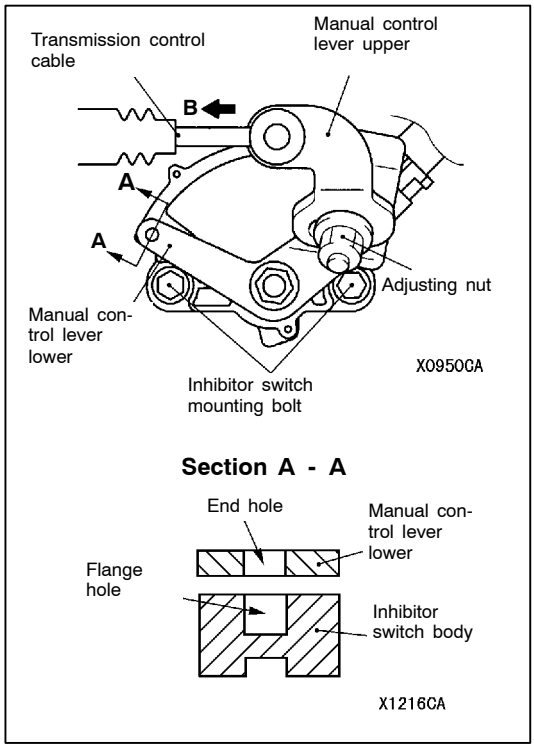




INHIBITOR SWITCH CONTINUITY CHECK

Item	Terminal No.						
	1	2	3	7	8	9	10
P	○			○		○	○
R				○	○		
N		○		○		○	○
D			○	○			

NOTE
The inhibitor switch has 7 positions, but only four positions (P, R, N and D) are used.



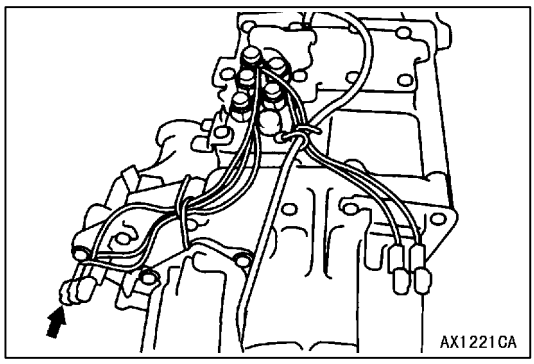
INHIBITOR SWITCH AND CONTROL CABLE ADJUSTMENT

1. Move the selector lever to the N position.
2. Loosen the adjusting nut, and set the manual control lever upper and lower to the free condition.
3. Move the manual control lever lower to the neutral position.
4. Loosen the inhibitor switch body mounting bolt, and then turn the inhibitor switch to adjust so that the hole at the end of the manual control lever lower and the hole in the inhibitor switch body flange (section A - A in the illustration at left) are aligned.
5. Tighten the inhibitor switch body mounting bolt to the specified torque.

   Tightening torque: 11 ± 1 N·m

   NOTE
   Be careful not to let the inhibitor switch body slip out of place.
6. Gently push the transmission control cable in the direction of B as shown in the illustration at left, and tighten the adjusting nut to the specified torque.

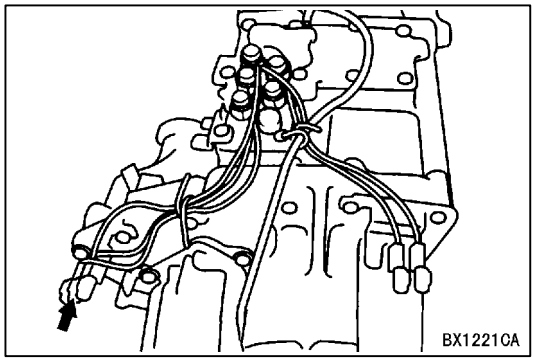
   Tightening torque: 24 ± 4 N·m
7. Check that the selector lever is at the “N” position.
8. Check that the transmission shifts to the correct range corresponding to the position of the selector lever, and that it functions correctly in that range.



2WD/4WD SWITCH CONTINUITY CHECK

Check the continuity between the terminals of the black connector shown in the illustration at left and the transfer case.

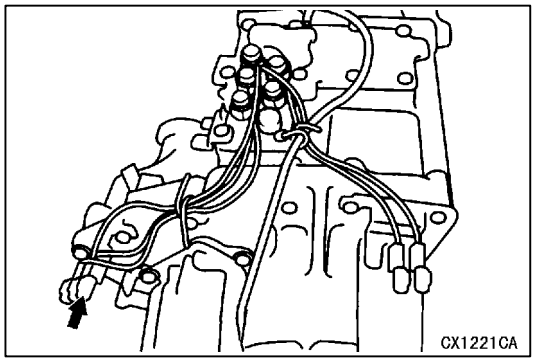
Transfer lever position	Continuity
2H, 4H	Continuity
4HLc, 4LLc	No continuity



4H SWITCH CONTINUITY CHECK

Check the continuity between the milky-white connector terminals shown in the illustration at left and the transfer case.

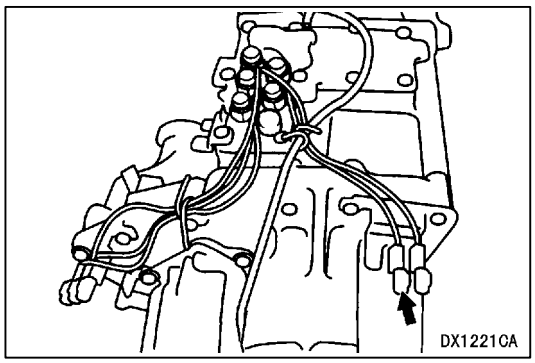
Transfer lever position	Continuity
2H, 4LLc	No continuity
4H, 4HLc	Continuity



CENTER DIFFERENTIAL LOCK SWITCH CONTINUITY CHECK

Check the continuity between the terminals of the brown connector shown in the illustration at left and the transfer case.

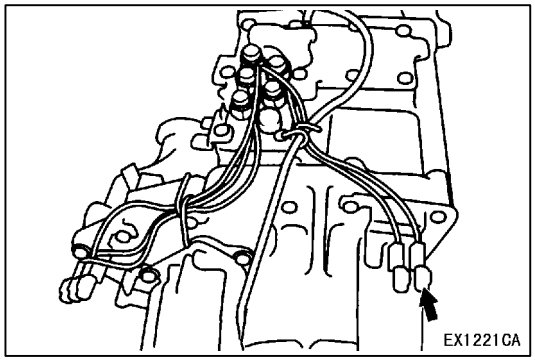
Transfer lever position	Continuity
2H, 4H	No continuity
4HLc, 4LLc	Continuity



2WD SWITCH CONTINUITY CHECK

Check the continuity between the terminals of the black connector shown in the illustration at left and the transfer case.

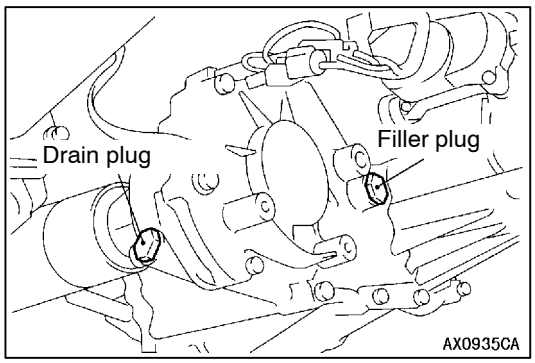
Transfer lever position	Continuity
2H	Continuity
4H, 4HLc, 4LLc	No continuity



4LLc SWITCH CONTINUITY CHECK

Check the continuity between the terminals of the brown connector shown in the illustration at left and the transfer case.

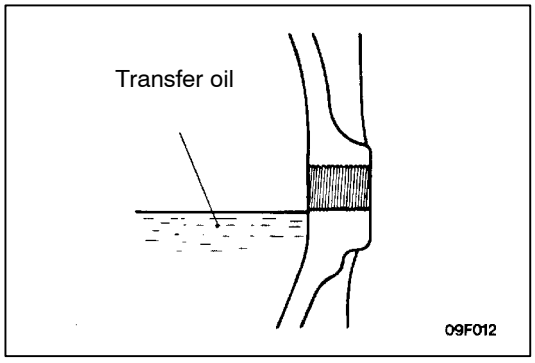
Transfer lever position	Continuity
4LLc	Continuity
2H, 4H, 4HLc	No continuity



TRANSFER OIL CHECK

1. Remove the oil filler plug.
2. Check that the oil reaches the hole at the bottom of the oil filler plug.
3. Check that the oil is not severely contaminated, and that it has an appropriate level of viscosity.
4. Install the oil filler plug, and tighten it to the specified torque.

   Tightening torque: 32 ± 2 N·m



TRANSFER OIL CHANGE

1. Remove the oil drain plug and drain the oil.
2. Install the oil filler plug, and tighten it to the specified torque.

   Tightening torque: 32 ± 2 N·m

3. Remove the oil filler plug, and pour in oil until it reaches the bottom of the oil filler plug.

Specified lubricant:
Hypoid gear oil SAE 75W-90 or 75W-85W conforming to API GL-4

Oil level: 2.8 L

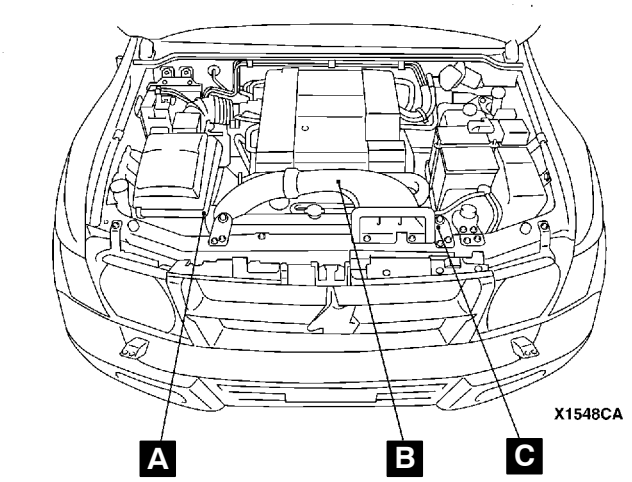
4. Install the oil filler plug, and tighten it to the specified torque.

Tightening torque: 32 ± 2 N·m

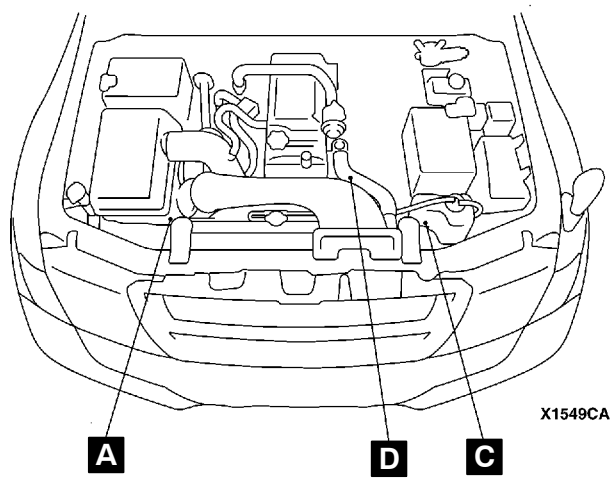
LOCATION OF CONTROL COMPONENTS

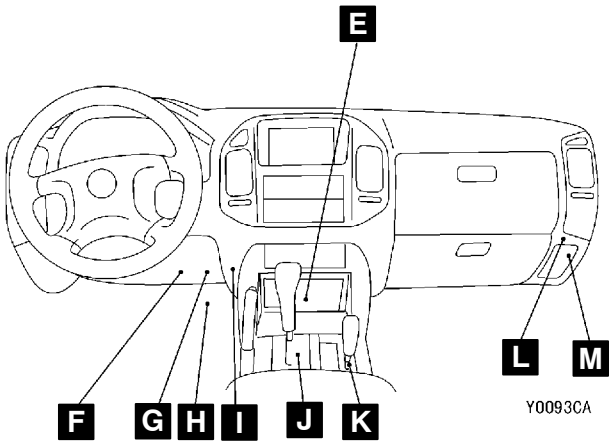
Name	Symbol	Name	Symbol
Input shaft speed sensor	O	Freewheel engage switch	N
Output shaft speed sensor	V	Vehicle speed sensor	T
Crank angle sensor <6G7>	B	Stop lamp switch	F
Engine speed sensor <4M4>	D	Shift actuator	S
A/T fluid temperature sensor	U	A/T control solenoid valve assembly	U
Inhibitor switch	P	Diagnosis connector	I
Wide open throttle switch	H	Engine-ECU <4M4>	L
Shift switch (UP, DOWN)	J	A/T-ECU <4M4>	L
Select switch	J	Engine-A/T-ECU <6G7>	L
Dual pressure switch	C	Transfer-ECU	E
Accelerator pedal position sensor (APS)	G	A/T control relay	M
		Center differential lock switch	R
Solenoid valve A, B	A	2WD/4WD switch	R
Transfer lever switch	K	2WD switch	R
Front propeller shaft speed sensor	Q	4H switch	R
Rear propeller shaft speed sensor	W	4LLc switch	R

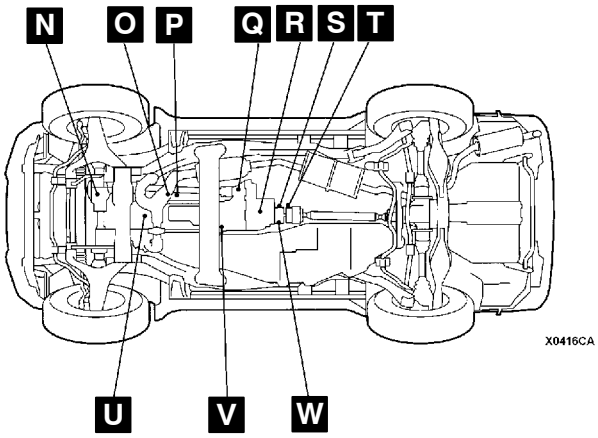
<6G7>



<4M4>







CONTROL COMPONENT CHECKS

CRANK ANGLE SENSOR CHECK <6G7>

Refer to GROUP 13A - Troubleshooting.

ENGINE SPEED SENSOR CHECK <4M4>

Refer to GROUP 13B - Troubleshooting.

ACCELERATOR PEDAL POSITION SENSOR (APS) CHECK

Refer to GROUP 13A - On-vehicle Service.

INHIBITOR SWITCH CONTINUITY CHECK

Refer to P.23-98.

STOP LAMP SWITCH CHECK

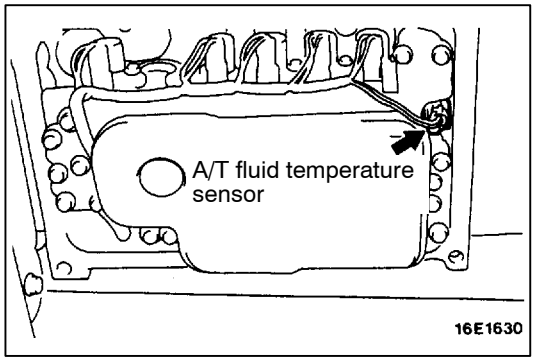
Refer to 35A - Brake Pedal.

VEHICLE SPEED SENSOR CHECK

Refer to GROUP 54 - Combination Meter.

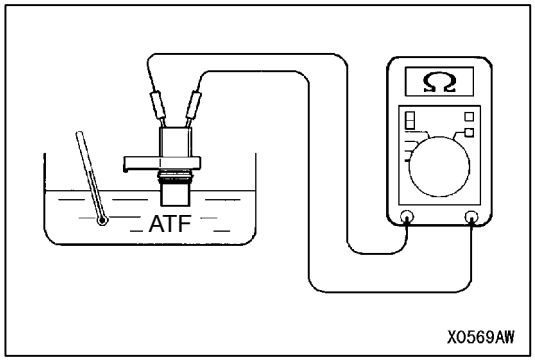
DUAL PRESSURE SWITCH CHECK

Refer to GROUP 55A - On-vehicle Service.



A/T FLUID TEMPERATURE SENSOR CHECK

1. Remove the A/T fluid temperature sensor.



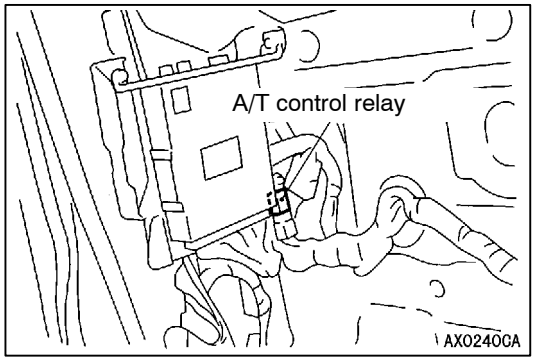
2. Measure the resistance between terminals (1) and (2) of the A/T fluid temperature sensor.

Standard value:

Temperature (°C)	Resistance [kΩ]
0	16.7 - 20.5
20	7.3 - 8.9
40	3.4 - 4.2
60	1.9 - 2.2
80	1.0 - 1.2
100	0.57 - 0.69

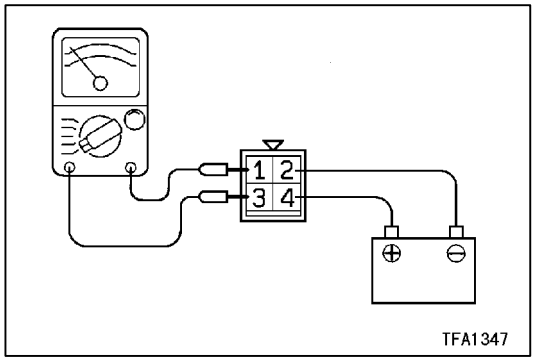
NOTE
The N range indicator lamp on the combination meter flashes when the temperature reaches approximately 125°C or higher, and then stops flashing when the temperature drops below approximately 115°C.

3. If the A/T fluid temperature sensor resistance and the temperature when the N range indicator lamp is flashing or switched off are outside the standard value ranges, replace the A/T fluid temperature sensor.



A/T CONTROL RELAY CHECK

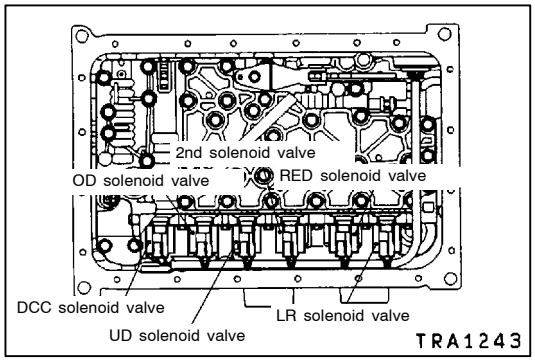
1. Remove the A/T control relay.



2. Use jumper leads to connect terminal (2) of the A/T control relay to the battery (–) terminal, and terminal (4) to the battery (+) terminal.
3. Check the continuity between terminals (1) and (3) of the A/T control relay while alternately connecting and disconnecting the jumper leads from the battery terminals.

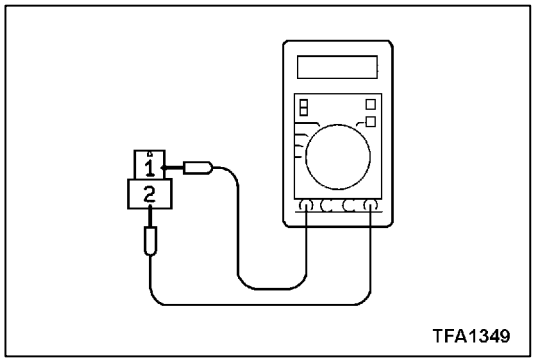
Jumper leads	Continuity between terminals (1) and (3)
Connected	Continuity
Disconnected	No continuity

4. If there is a malfunction, replace the A/T control relay.



A/T CONTROL SOLENOID VALVE ASSEMBLY CHECK

1. Remove the valve body cover.
2. Disconnect the connectors for each solenoid valve.



3. Measure the resistances between terminals (1) and (2) of each solenoid valve.

Standard value:

Name	Resistance value
Damper clutch control (DCC) solenoid valve	2.7 - 3.4 kΩ at 20°C
Low & reverse solenoid valve (LR solenoid valve)	
Second solenoid valve (2ND solenoid valve)	
Underdrive solenoid valve (UD solenoid valve)	
Overdrive solenoid valve (OD solenoid valve)	
Reduction (RED) solenoid valve	

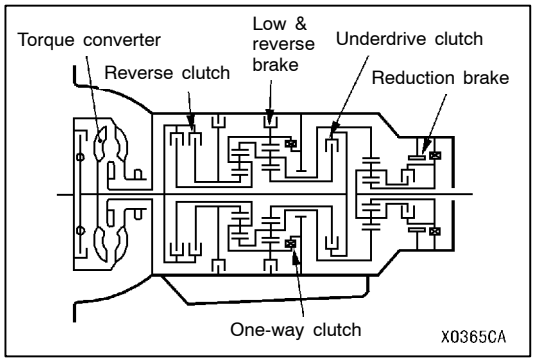
4. If a measurement value is outside the standard value range, replace the solenoid valve.

SELECT SWITCH CHECK

Refer to P.23-119.

SHIFT SWITCH ASSEMBLY CHECK

Refer to P.23-119.



TORQUE CONVERTER STALL TEST

The purpose of this test is to measure the maximum engine speed when the torque converter stalls in D or R ranges in order to check the torque converter operation and the holding performance of the clutches and brakes which are built into the transmission.

NOTE
For safety, the front and rear of the vehicle should be kept clear of other people while this test is being carried out.

1. Check the ATF level, the ATF temperature and the engine coolant temperature.
   - ATF level: “HOT” position on oil level gauge
   - ATF temperature: 70 - 80°C
   - Engine coolant temperature: 80 - 100°C
2. Place wheel locks on both the left and right front wheels.
3. Pull the parking brake lever to apply the parking brake and depress the brake pedal fully.
4. Start the engine.
5. Move the selector lever to the D position, fully depress the accelerator pedal and quickly take a reading of the maximum engine speed at this time.

   Caution
   (1) Do not keep the throttle fully open for any longer than 8 seconds.
   (2) If carrying out the stall test two or more times, move the selector lever to the N position and run the engine at a speed of 1000 r/min to let the ATF cool down before the next test is carried out.

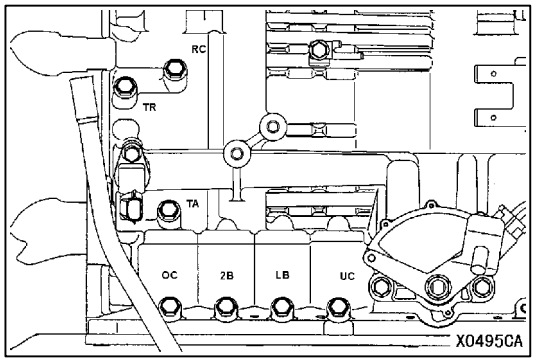
   Standard value - Stalling speed:
   2,200 - 2,700 r/min <6G7>
   2,400 - 2,900 r/min <4M4>

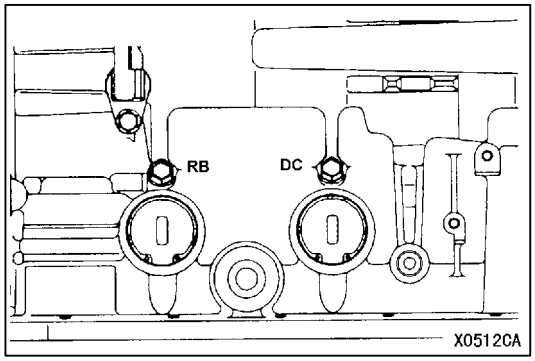
6. Move the selector lever to the R position and repeat the test described above.

   Standard value - Stalling speed:
   2,200 - 2,700 r/min <6G7>
   2,400 - 2,900 r/min <4M4>

Torque converter stall test judgment

1. High stalling speed in both D and R ranges
   - Low line pressure
   - Low & reverse brake slipping
2. High stalling speed in D range only
   - Underdrive clutch slipping
3. High stalling speed in D range only
   - Reverse clutch slipping
   - Reduction brake slipping
4. High stalling speed in both D and R ranges
   - Malfunction of torque converter
   - Poor engine output





FLUID PRESSURE TEST

1. Let the engine warm up until the ATF temperature is 70 - 80°C.
2. Jack up the vehicle so that the tires can spin freely.
3. Install the special tool (MD998330: 2 992 kPa oil pressure gauge) and the adapters (MD998332,MD998900) to each hydraulic pressure outlet port.
4. Measure the various hydraulic pressures under the conditions given in the standard hydraulic pressure table, and check that the measurements are within the standard value ranges.
5. If the measurements are outside the standard value range, remedy the problem while referring to the hydraulic pressure test diagnosis table.

NOTE
RC : Reverse clutch pressure port
TR : Torque converter pressure port
TA : Damper clutch pressure port
OC : Overdrive clutch pressure port
2B : Second brake pressure port
LB : Low & brake pressure port
UC : Underdrive clutch pressure port
RB : Reduction brake pressure port
DC : Direct clutch pressure port

STANDARD HYDRAULIC PRESSURE TABLE

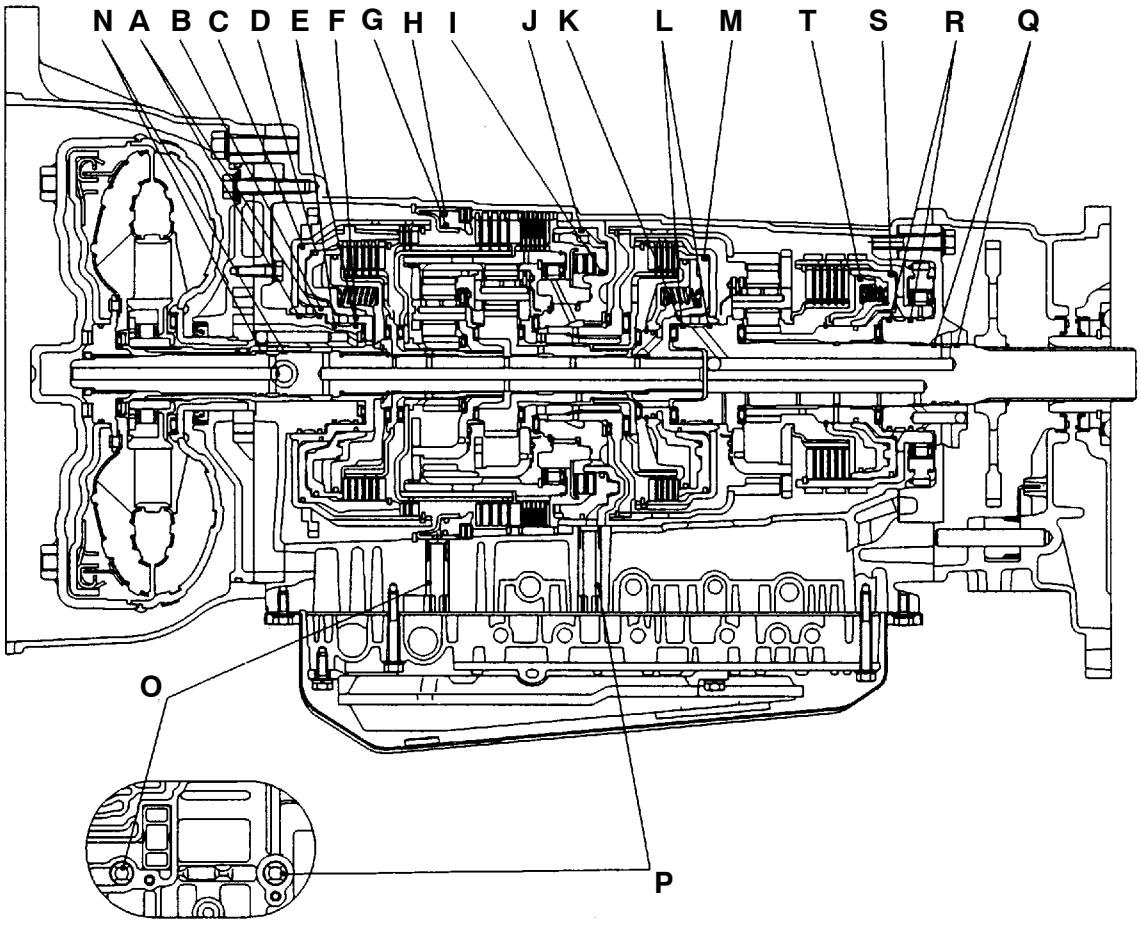
Measurement conditions			Standard hydraulic pressure kPa							
Selector lever position	Shift range position	Engine speed r/min	Underdrive clutch pressure [UD pressure]	Reverse clutch pressure [RC pressure]	Overdrive clutch pressure [OD pressure]	Direct clutch pressure port [DIR pressure]	Low & brake pressure [LR pressure]	Second brake pressure [2ND pressure]	Reduction brake pressure [RB pressure]	Torque converter pressure [DR pressure]
P	-	2,500	-	-	-	-	260 - 340	-	1,010 - 1,050	500 - 700
R	Reverse	2,500	-	1,270 - 1,770	-	-	1,270 - 1,770	-	1,270 - 1,770	500 - 700
N	-	2,500	-	-	-	-	260 - 340	-	260 - 340	500 - 700
Sports mode	1st	2,500	1,010 - 1,050	-	-	-	1,010 - 1,050	-	1,010 - 1,050	500 - 700
	2nd	2,500	1,010 - 1,050	-	-	-	-	1,010 - 1,050	1,010 - 1,050	500 - 700
	3rd	2,500	784 - 882	-	784 - 882	-	-	-	784 - 882	450 - 650
	4th	2,500	784 - 882	-	784 - 882	784 - 882	-	-	-	-
	5th	2,500	784 - 882	-	784 - 882	784 - 882	-	784 - 882	-	-

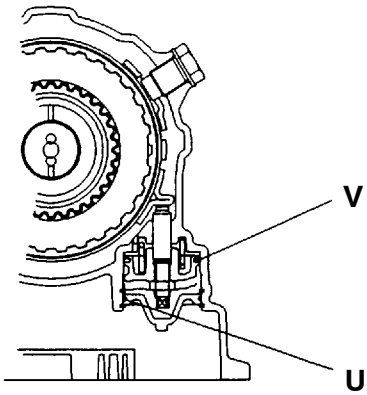
HYDRAULIC PRESSURE TEST DIAGNOSIS TABLE

Symptom	Problem location
All hydraulic pressures are too high	Malfunction of regulator valve
All hydraulic pressures are too low	Malfunction of oil pump Blocked oil filter Blocked oil cooler Malfunction of regulator valve Malfunction of relief valve Incorrect valve body installation
Abnormal hydraulic pressure in R range only	Malfunction of regulator valve
Abnormal hydraulic pressure in 3rd or 4th only	Malfunction of regulator valve Malfunction of switch bulb
Abnormal UD pressure only	Malfunction of oil seal K, L, M or Q Malfunction of underdrive solenoid valve Malfunction of underdrive pressure control valve Abnormality with check ball Blocked orifices Incorrect valve body installation
Abnormal REV pressure only	Malfunction of oil seal A, B or C Abnormality with check ball Blocked orifices Incorrect valve body installation
Abnormal OD pressure only	Malfunction of oil seal D, E or F Malfunction of overdrive solenoid valve Malfunction of overdrive pressure control valve Abnormality with check ball Blocked orifices Incorrect valve body installation
Abnormal DIR pressure only	Malfunction of oil seal R, S or T Malfunction of low & reverse solenoid valve (also used for the direct clutch) Malfunction of low & reverse pressure control valve Malfunction of switch bulb Malfunction of fail-safe valve C Blocked orifices Incorrect valve body installation
Abnormal LR pressure only	Malfunction of oil seal I, J or P Malfunction of low & reverse solenoid valve (also used for the direct clutch) Malfunction of low & reverse pressure control valve Malfunction of switch bulb Malfunction of fail-safe valve A Abnormality with check ball Blocked orifices Incorrect valve body installation
Abnormal 2ND pressure only	Malfunction of oil seal G, H or O Malfunction of second solenoid valve Malfunction of second pressure control valve Malfunction of fail-safe valve B Blocked orifices Incorrect valve body installation

Symptom	Problem location
Abnormal RED pressure only	Malfunction of oil seal U or V Malfunction of reaction solenoid valve Malfunction of reduction pressure control valve Blocked orifices Incorrect valve body installation
Abnormal DR pressure only	Blocked oil cooler Malfunction of oil seal N Malfunction of damper clutch control solenoid valve Malfunction of damper clutch control solenoid valve Malfunction of torque converter pressure control valve Blocked orifices Incorrect valve body installation
Pressure applied to non-operating element	Incorrect transmission control cable adjustment Malfunction of manual valve Incorrect valve body installation

Oil seal layout





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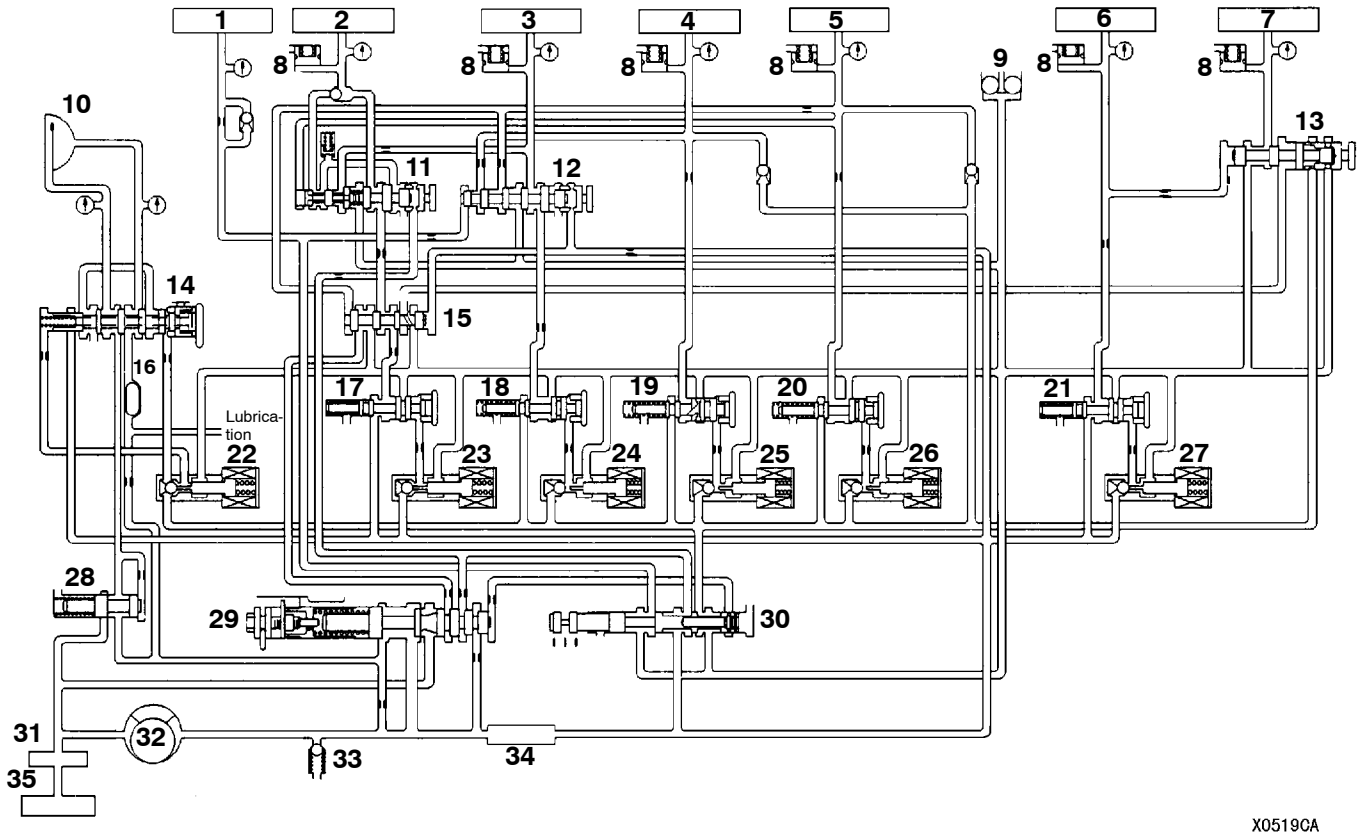
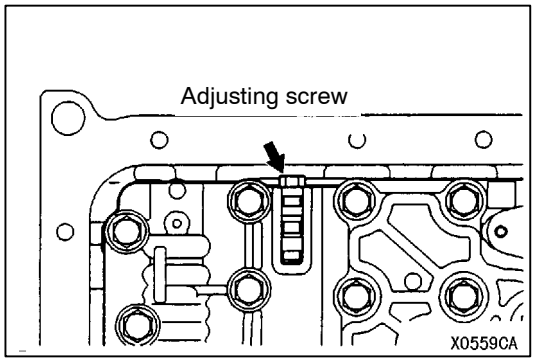
HYDRAULIC CIRCUIT

Parking & Neutral



1. Reverse clutch
2. LR brake
3. 2nd brake
4. UD clutch
5. OD clutch
6. RED clutch
7. DIR clutch
8. Accumulator
9. Check ball
10. Damper clutch
11. Fail-safe valve A
12. Fail-safe valve B
13. Fail-safe valve C
14. Damper clutch control solenoid valve
15. Switch bulb
16. Oil cooler
17. LR pressure control valve
18. 2nd pressure control valve
19. UD pressure control valve
20. OD pressure control valve
21. RED pressure control valve
22. DCC solenoid valve
23. LR solenoid valve
24. 2ND solenoid valve
25. UD solenoid valve
26. OD solenoid valve
27. RED solenoid valve
28. Torque converter pressure control valve
29. Regulator valve
30. Manual valve
31. Oil filter
32 Oil pump
33. Relief valve
34. Oil strainer
35. Oil pan



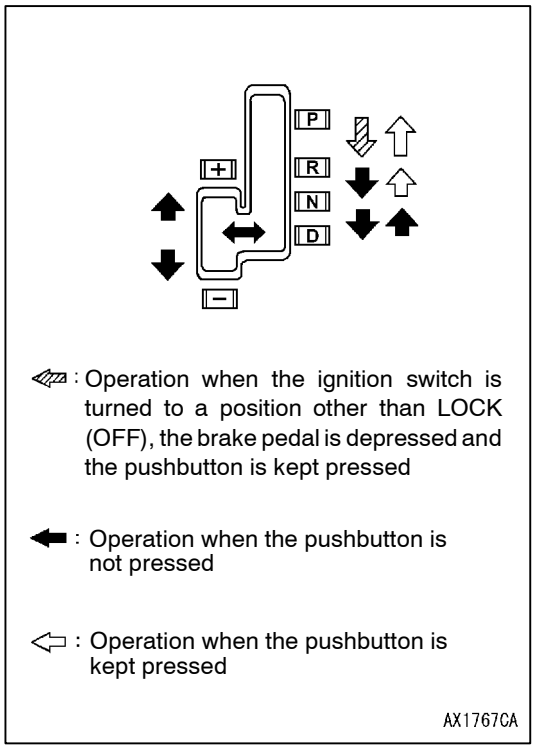
LINE PRESSURE ADJUSTMENT

1. Discharge the ATF, and then remove the valve body cover.
2. Turn the adjusting screw shown in the illustration at left to adjust the UD pressure until it is at the standard value. The pressure increases when the screw is turned anti-clockwise.

   NOTE
   Adjust to the middle of the standard range when the transmission is at the 1st or 2nd gear.

   Standard value: 1,010 - 1,050 kPa

   Change in pressure for a single full turn of the adjusting screw: 35 kPa
3. Install the valve body cover, and then pour in the specified amount of ATF.
4. Carry out a fluid pressure test. (Refer to P.23-106.) Readjust if necessary.



SELECTOR LEVER OPERATION CHECK

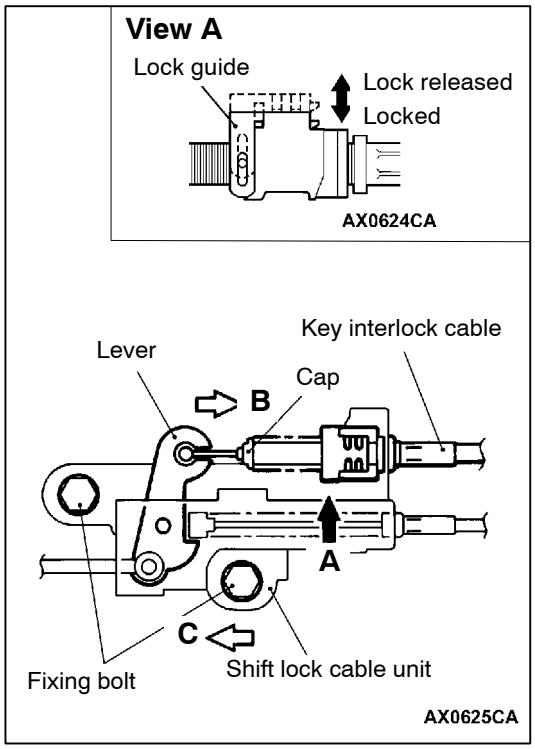
1. Apply the parking brake, and check that the selector lever moves smoothly and accurately to each range position.
2. Check that the engine starts when the selector lever is at the N or P position, and that it does not start when the selector lever is in any other position.
3. Start the engine, release the parking brake, and check that the vehicle moves forward when the selector lever is moved from N range to 1st or 2nd gear, and that the vehicle reverses when the selector lever is moved to R range.
4. Stop the engine.
5. Turn the ignition switch to the ON position, and check that the backup lamp illuminates and the buzzer sounds when the selector lever is shifted from P to R range.

   NOTE
   The A/T mis-operation prevention mechanism is provided so that the selector lever cannot be moved from the P position if the ignition switch is at a position other than the LOCK (OFF) position and the brake pedal is not depressed.

KEY INTERLOCK MECHANISM CHECK

1. Carry out the following check.

Inspection procedure	Inspection conditions		Check details (Normal condition)
1	Brake pedal: Depressed	Ignition switch position: LOCK (OFF) or pulled out	The selector lever cannot be moved from the P position to any other position when the pushbutton on the selector lever is not being pressed.
2		Ignition switch position: Other than “LOCK (OFF) or pulled out”	The selector lever can easily be moved from the P position to some other position when the pushbutton on the selector lever is being pressed.
3	Brake pedal: Released	Selector lever position: Other than “P”	The ignition switch will not turn to the LOCK position.
4		Selector lever position: “P”	The ignition switch can turn smoothly to the LOCK (OFF) position.



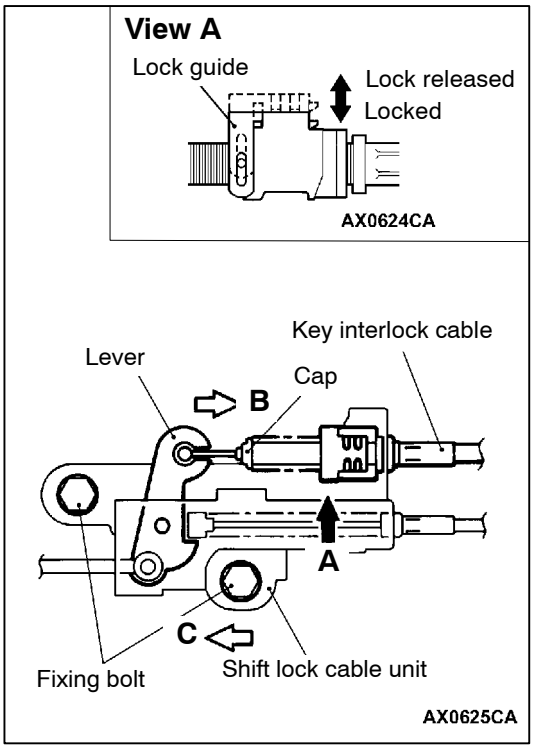
2. If the above operations do not occur correctly, adjust the shift lock cable unit by the following procedure.
   (1) Remove the front floor console, and then provisionally install the selector lever knob. (Refer to GROUP 52A.)
   (2) Move the selector lever to the P position and turn the ignition switch to the LOCK (OFF) position.
   (3) Loosen the shift lock cable unit fixing bolt, and then while pushing the lever in the direction of B and the unit in direction of C, tighten the bolt to the specified torque of 5.0 ± 1.0 N·m.
   (4) Lift the lock guide to unlock the key interlock cable.
   (5) While pushing the cap of the key interlock cable in the direction of B, lower the lock guide to lock the cable.

   NOTE
   The lock position at this time (the amount by which the cap is pushed) represents the amount of adjustment for the key interlock cable. If the key interlock cable does not operate correctly, adjust the lock position.
3. After adjusting, check the operation once more. If the operation is still incorrect, replace the shift lock cable unit. (Refer to P.23-120)

SHIFT LOCK MECHANISM CHECK

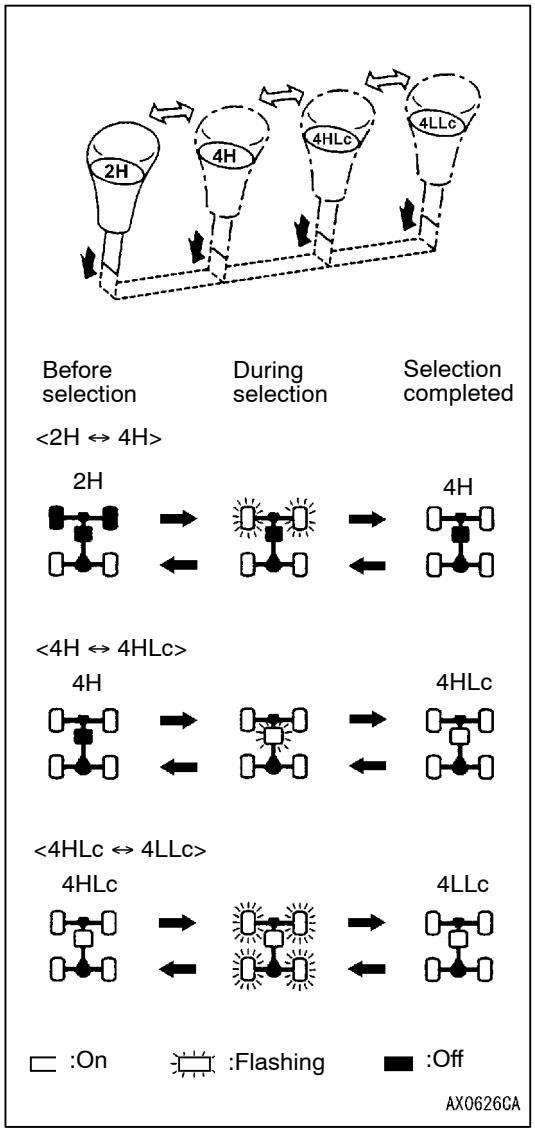
1. Carry out the following check.

Inspection procedure	Inspection conditions		Check details (Normal condition)
1	Brake pedal: Depressed	Ignition switch position: "ACC"	The selector lever cannot be moved from the P position to any other position when the pushbutton on the selector lever is not being pressed.
2			The selector lever can easily be moved from the P position to some other position when the pushbutton on the selector lever is being pressed.
3	Brake pedal: Released		The selector lever can easily be moved from the R position to the P position when the pushbutton on the selector lever is being pressed.



2. If the above operations do not occur correctly, adjust the shift lock cable unit by the following procedure.
   (1) Remove the front floor console, and then provisionally install the selector lever knob.(Refer to GROUP 52A.)
   (2) Move the selector lever to the P position and turn the ignition switch to the LOCK (OFF) position.
   (3) Loosen the shift lock cable unit fixing bolt, and then while pushing the lever in the direction of B and the unit in direction of C, tighten the bolt to the specified torque of 5.0 ± 1.0 N·m.
   (4) Lift the lock guide to unlock the key interlock cable.
   (5) While pushing the cap of the key interlock cable in the direction of B, lower the lock guide to lock the cable.

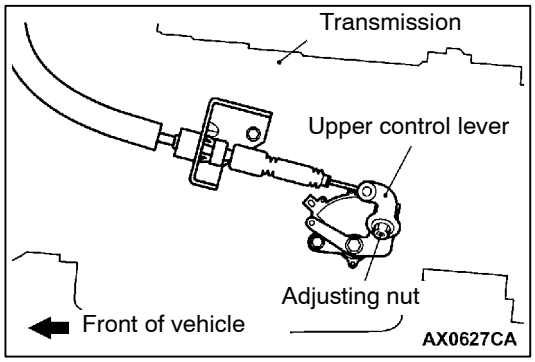
   NOTE
   The lock position at this time (the amount by which the cap is pushed) represents the amount of adjustment for the key interlock cable. If the key interlock cable does not operate correctly, adjust the lock position.
3. After adjusting, check the operation once more. If the operation is still incorrect, replace the shift lock cable unit. (Refer to P.23-120)



TRANSFER SHIFT LEVER OPERATION CHECK

1. Check that the transfer shift lever moves smoothly and correctly to each transfer position when the lever is pushed downwards and moved.
2. Apply the parking brake, turn the ignition switch to the ON position and move the selector lever to N range.
3. Check that the 4WD indicator lamp illuminates, flashes or switches off according to the pattern shown in the illustration when the transfer shift lever is move to each transfer position.
4. If the selection is not completed even after 5 seconds or more have passed, carry out the following procedure.
   (1) Return the transfer shift lever to the position it was at before selection.
   (2) Start the engine, drive the vehicle straight forward, and then stop the engine.
   (3) Apply the parking brake, and then move the selector lever to the N position.
   (4) Operate the transfer shift lever once more.

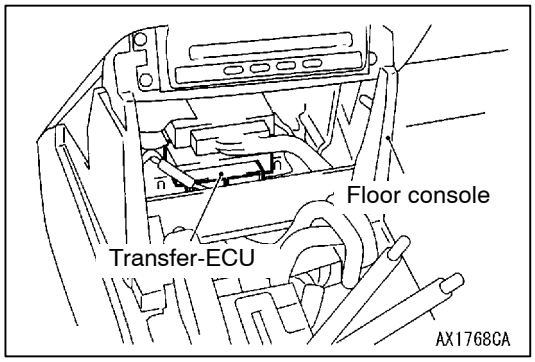
   NOTE
   If the vehicle is not fully stopped or if the selector lever is at a position other than N when selecting 4HLc or 4LLc, the 4WD indicator lamp will flash more quickly than normal, and the 4WD range will not be selected. This is a normal phenomenon which serves to control the smooth selection of 4HLc and 4LLc.



TRANSMISSION CONTROL CABLE ADJUSTMENT

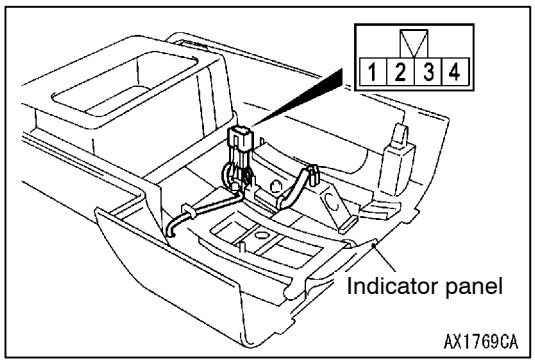
1. Move the selector lever to the N position.
2. Loosen the upper control lever adjusting nut.
3. Check that the inhibitor switch is at N range.
4. Adjust the upper control lever so that there is no slackness or excessive tightness in the transmission control cable, and then tighten the adjusting nut to the specified torque.

   Tightening torque: 24 ± 4 N·m
5. Check that the transmission shifts to the correct range corresponding to the position of the selector lever, and that it functions correctly in that range.



TRANSFER-ECU CHECK

1. Remove the indicator panel and the floor console front panel. (Refer to GROUP 52A - Floor Console.)
2. Measure the transfer-ECU terminal voltage. (Refer to P.23-89.)



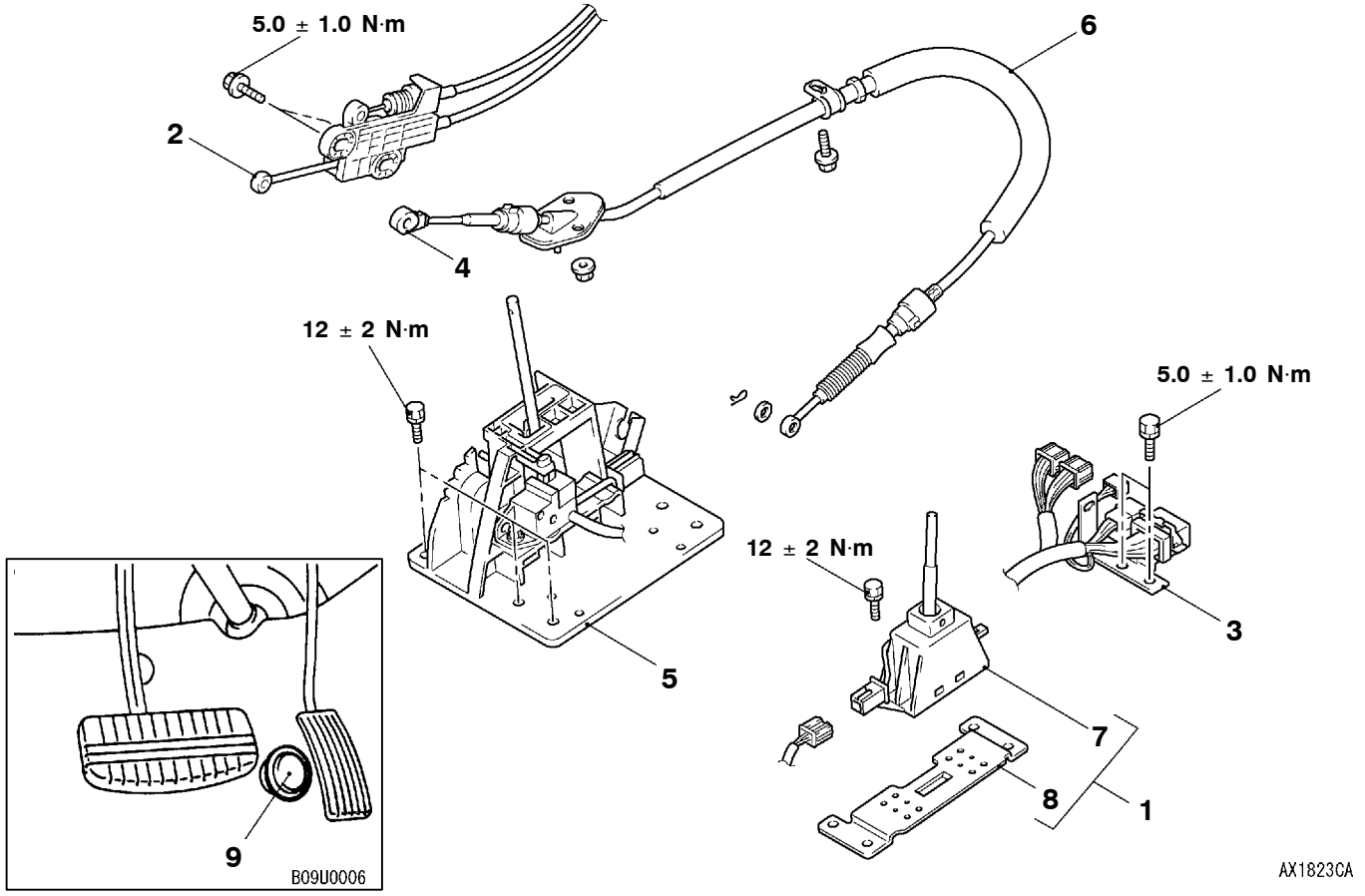
POSITION INDICATOR LAMP CHECK

1. Remove the indicator panel. (Refer to GROUP 52A - Floor Console.)
2. Check that there is continuity between terminals (1) and (2) and between terminals (3) and (4).

TRANSMISSION CONTROL

REMOVAL AND INSTALLATION

NOTE
When removing and installing the transmission control cable and shift lock cable unit, be careful not to hit them against the SRS-ECU.



Selector lever assembly and transmission control cable assembly removal steps

- Front floor console (Refer to GROUP 52A.)

1. Transfer shift lever and bracket assembly

▶B◀ 2. Shift lock cable unit connection
3. Transmission control harness connection
4. Transmission control cable connection
5. Selector lever assembly

- Front exhaust pipe (Refer to GROUP 15.)

◀A▶ ▶A◀ 6. Transmission control cable assembly

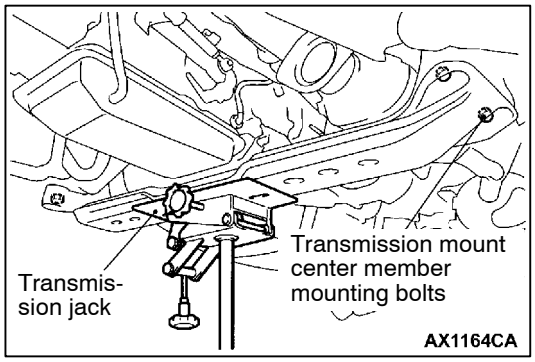
Transfer shift lever removal steps

- Indicator panel (Refer to GROUP 52A - Floor Console.)

7. Transfer shift lever
8. Bracket

Wide open throttle switch removal step

9. Wide open throttle switch



REMOVAL SERVICE POINT

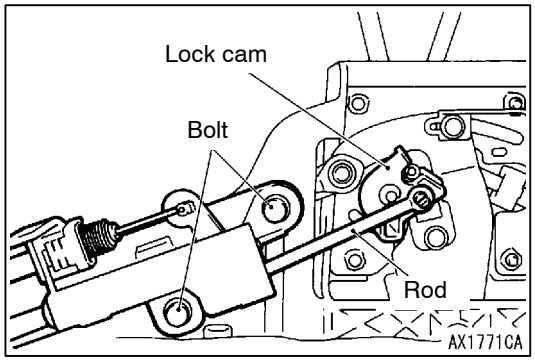
◀A▶ TRANSMISSION CONTROL CABLE ASSEMBLY REMOVAL

1. Support the transmission mount center member with a transmission jack, and then remove the transmission mount center member mounting bolts.
2. Lower the transmission so that there is enough room available to remove the transmission control cable assembly mounting nuts, and then remove the transmission control cable assembly mounting nuts.

INSTALLATION SERVICE POINTS

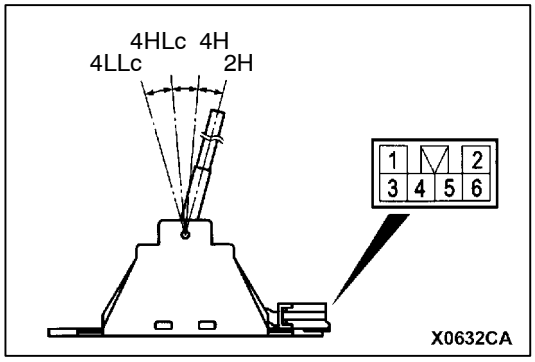
▶A◀ TRANSMISSION CONTROL CABLE ASSEMBLY INSTALLATION

After installing the transmission control cable assembly, install the transmission mount center member mounting bolts and tighten them to the specified torque of 44 ± 10 N·m.



▶B◀ SHIFT LOCK CABLE UNIT INSTALLATION

1. Provisionally install the selector lever knob, and then move the selector lever to the P position and turn the ignition switch to the LOCK (OFF) position.
2. After installing the rod of the shift lock cable unit to the lock cam of the selector lever assembly, install the bolts of the shift lock cable unit.
3. Check the operation of the selector lever assembly. (Refer to P.23-111.)

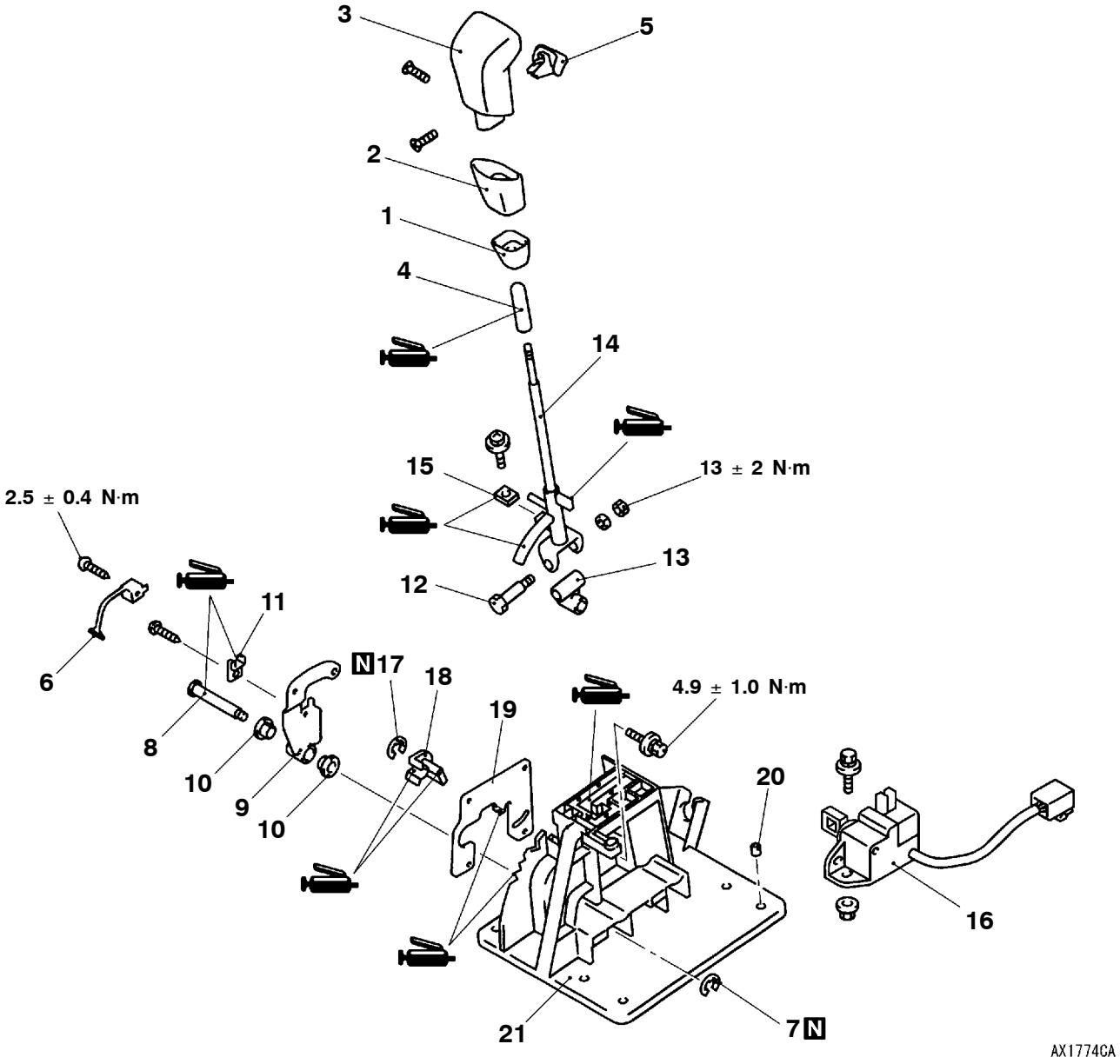


INSPECTION

TRANSFER SHIFT LEVER SWITCH CONTINUITY CHECK

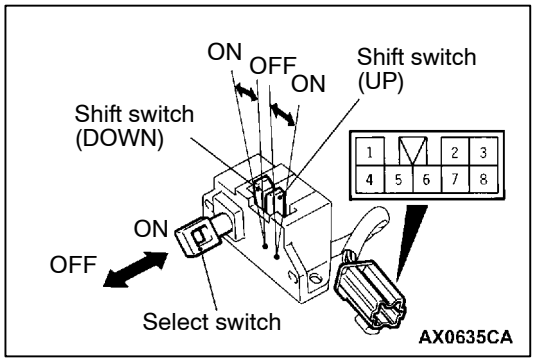
Switch position	Terminal No.				
	1	2	3	4	5
2H	○		○		
4H	○			○	
4HLc	○				○
4LLc	○	○			

SELECTOR LEVER ASSEMBLY
DISASSEMBLY AND REASSEMBLY



Disassembly steps

1. Knob cover B
2. Knob cover A
3. Shift knob
4. Sleeve
5. Pushbutton
6. Detent spring
7. Snap ring
8. Shaft
9. Arm assembly
10. Bushing
11. Arm cover
12. Bolt
13. Universal joint
14. Lever assembly
15. Stay cover
16. Shift switch assembly
17. Snap ring
18. Malfunction of lock cam
19. Detent plate assembly
20. Collar
21. Base bracket



INSPECTION

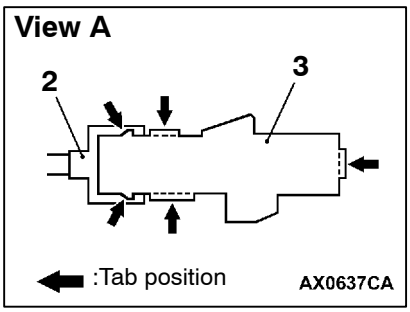
SHIFT SWITCH ASSEMBLY CONTINUITY CHECK

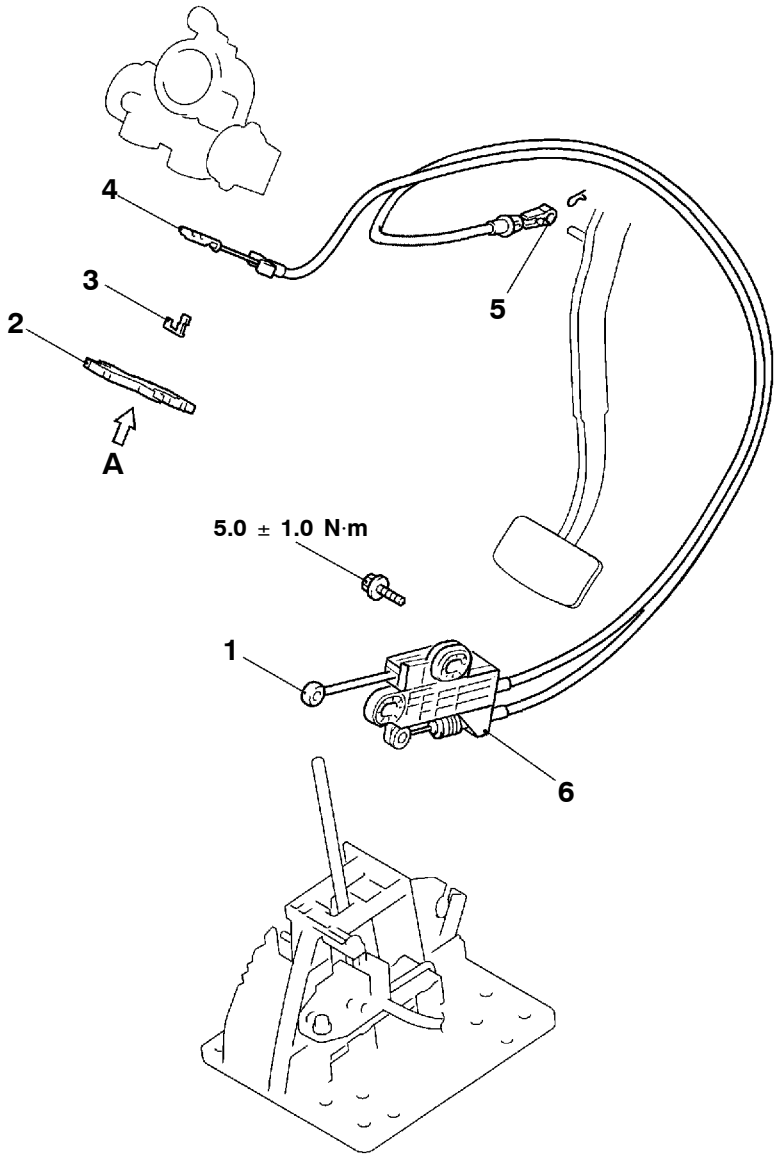
Switch position		Terminal No.					
		1	3	4	5	7	8
Select switch	ON	○		○			
	OFF	○			○		
Shift switch (UP)	ON		○			○	
	OFF						
Shift switch (DOWN)	ON		○				○
	OFF						

SHIFT LOCK AND KEY INTERLOCK MECHANISMS

REMOVAL AND INSTALLATION

NOTE
When removing and installing the transmission control cable and shift lock cable unit, be careful not to hit them against the SRS-ECU.





Removal steps

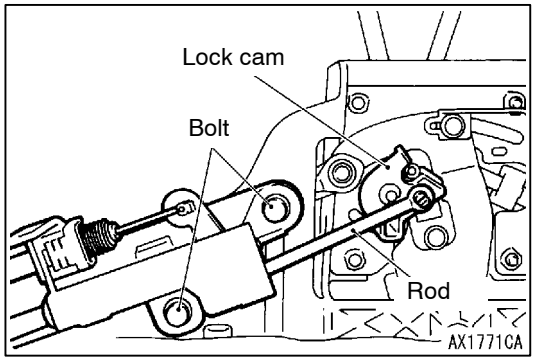
- Front floor console (Refer to GROUP 52A.)
- Switch panel and lower column cover (Refer to GROUP 52A - Instrument Panel.)

▶A◀ 1. Shift lock cable unit connection
◀A▶ 2. Key interlock cable connection
3. Cover
4. Lock bar
5. Shift lock cable connection
6. Shift lock cable unit

REMOVAL SERVICE POINT

◀A▶ KEY INTERLOCK CABLE REMOVAL

Turn the ignition switch to the ACC position, and then pull the key interlock cable out from the ignition key cylinder.



INSTALLATION SERVICE POINT

▶A◀ SHIFT LOCK CABLE UNIT INSTALLATION

1. Provisionally install the selector lever knob, and then move the selector lever to the P position and turn the ignition switch to the LOCK (OFF) position.
2. After installing the rod of the shift lock cable unit to the lock cam of the selector lever assembly, install the bolts of the shift lock cable unit.
3. Check the operation of the selector lever assembly.(Refer to P.23-111.)

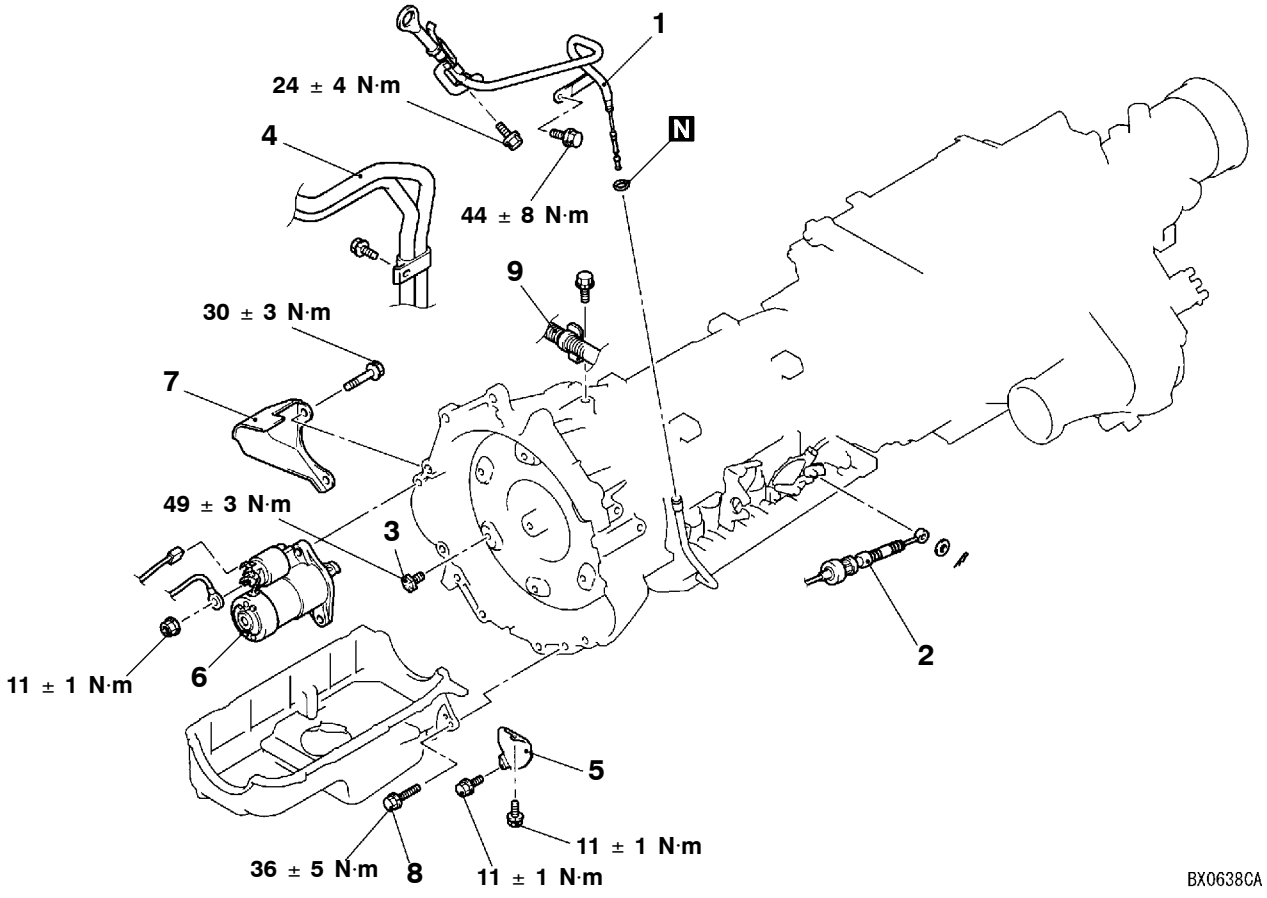
TRANSMISSION ASSEMBLY

REMOVAL AND INSTALLATION

NOTE
The rear propeller shaft incorporates a carbon fibre-reinforced plastic tube, so be sure to refer to GROUP 25 during removal.

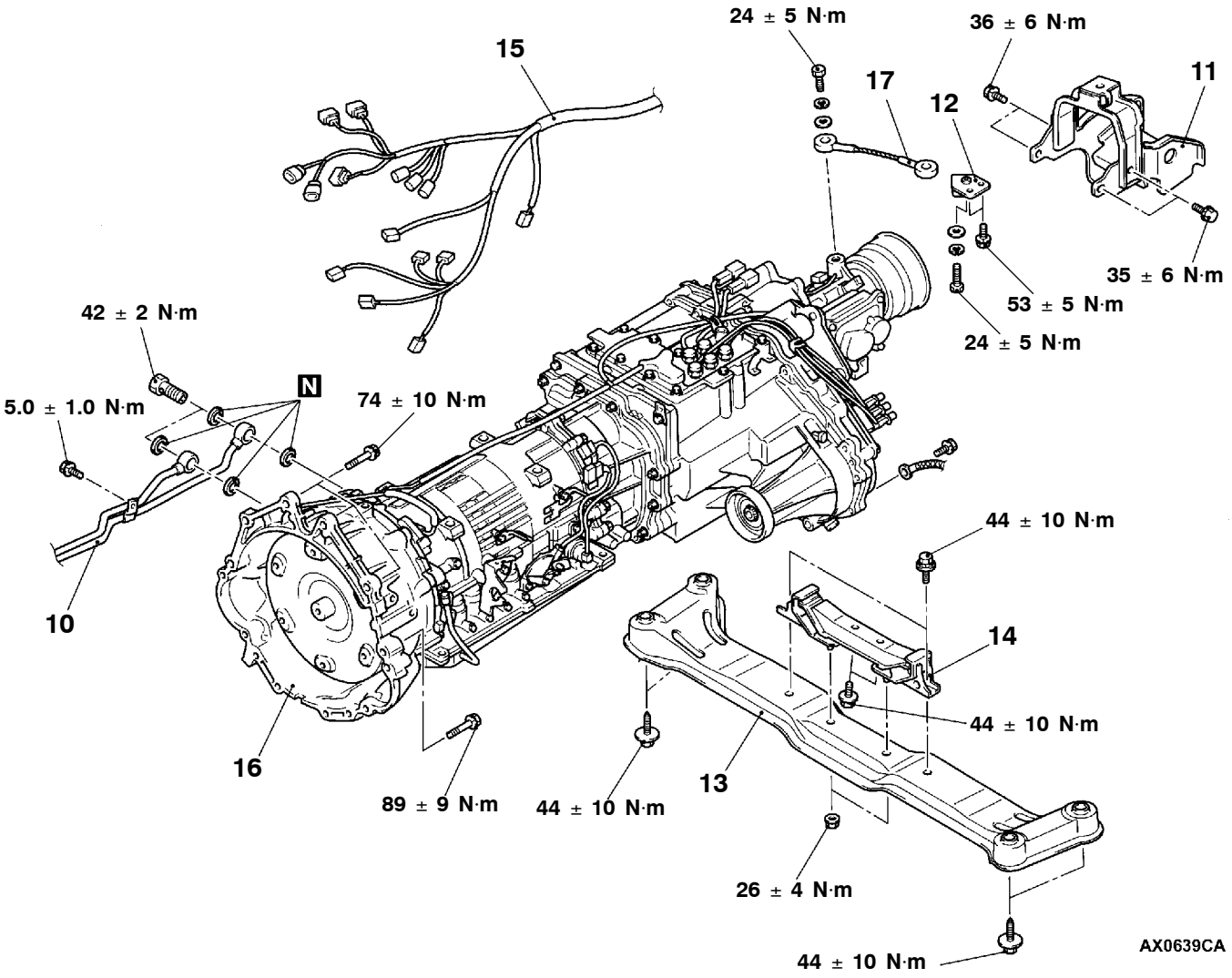
<6G7>

Pre-removal and Post-installation Operations
- Skid Plate And Under Cover Removal and Installation
- Transmission Fluid and Transfer Oil Draining and Filling (Refer to P.23-95 and P.23-99.)
- Front and Rear Propeller Shaft Removal and Installation (Refer to GROUP 25.)
- Front Exhaust Pipe Removal and Installation (Refer to GROUP 15.)
- Radiator Shroud Lower Cover Removal and Installation (Refer to GROUP 14.)



Removal steps

1. Oil level gauge assembly
2. Transmission control cable connection
◀A▶ 3. Drive plate connection bolts
4. Heater hose connection
5. Cover
6. Starter motor
7. Starter cover
8. Oil pan connection bolts
9. Battery cable connection



10. Oil cooler tube connection
11. Dynamic damper
12. Tension wire bracket
    - Support the transmission with a transmission jack
13. Transmission mount center member assembly
14. Transmission mount insulator assembly

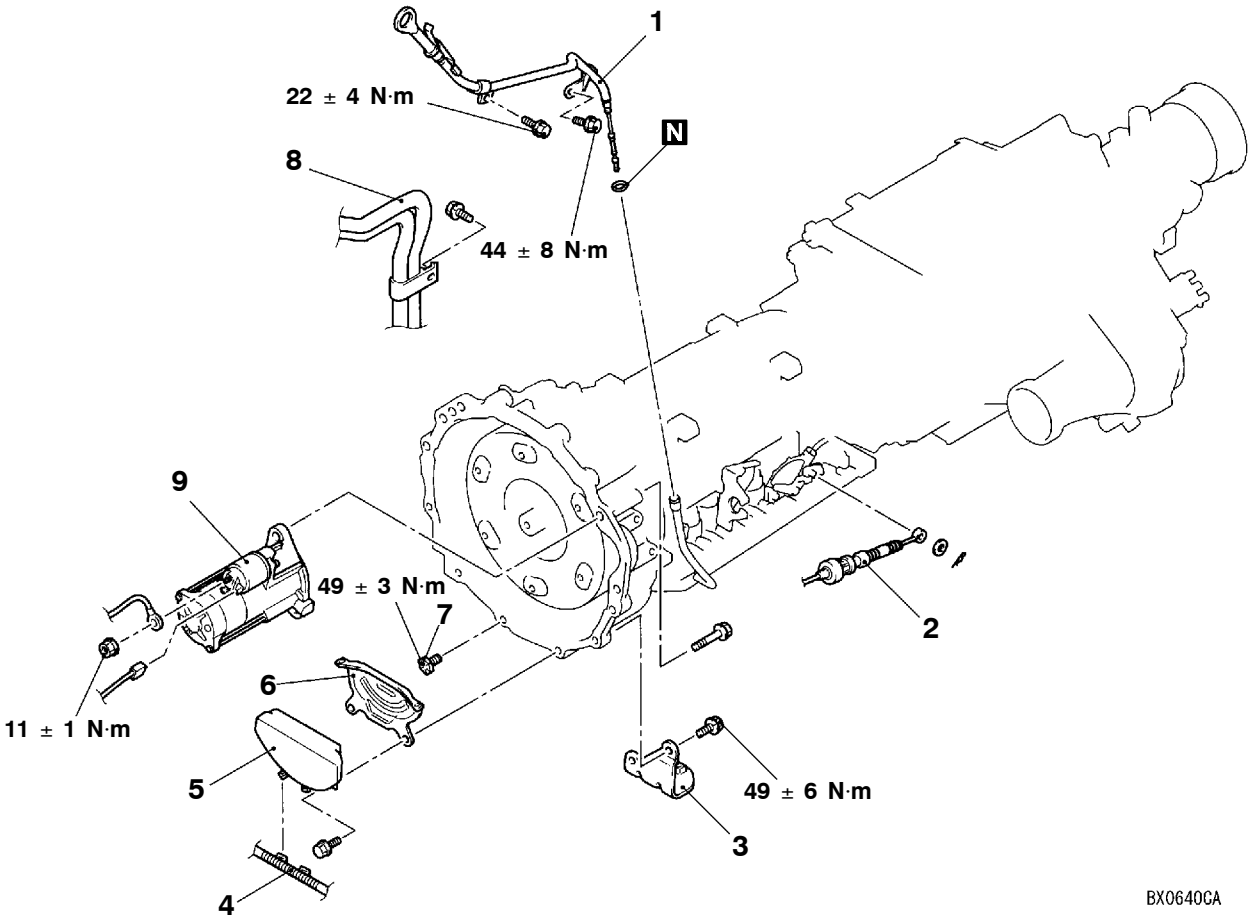
◀B▶ 15. Transmission harness connector connection

▶A◀ 16. Transmission assembly

17. Tension wire

<4M4>

Pre-removal and Post-installation Operations
- Skid Plate and Under Cover Removal and Installation
- Transmission Fluid and Transfer Oil Draining and Filling (Refer to P.23-95 and P.23-99.)
- Front and Rear Propeller Shaft Removal and Installation (Refer to GROUP 25.)
- Front Exhaust Pipe and Catalytic Converter Removal and Installation (Refer to GROUP 15.)
- Radiator Shroud Lower Cover Removal and Installation (Refer to GROUP 14.)
- Intercooler Assembly Removal and Installation (Refer to GROUP 15.)

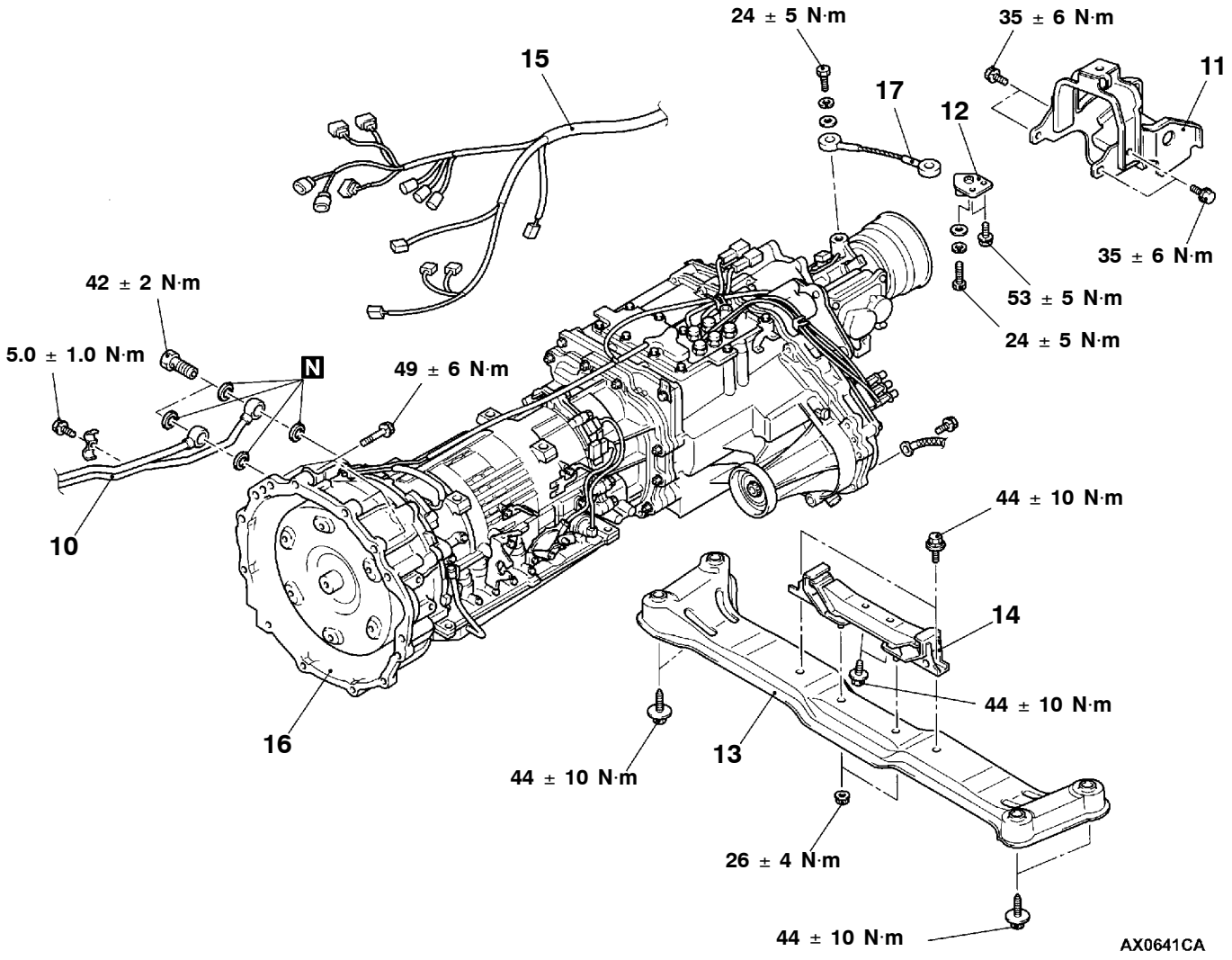


Removal steps

1. Oil level gauge assembly
2. Transmission control cable connection
3. Exhaust support bracket
4. Battery cable connection
5. Spacing rubber

◀A▶

6. Dust cover
7. Drive plate connection bolts
8. Heater hose connection
9. Starter motor



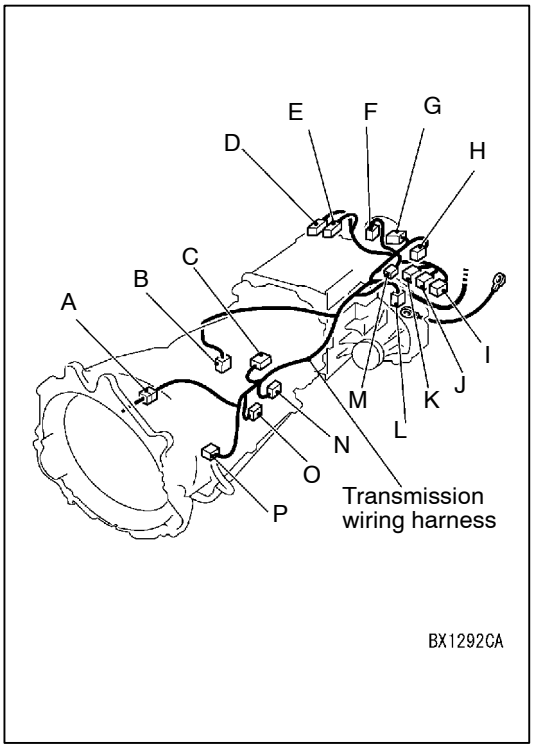
10. Oil cooler tube connection
11. Dynamic damper
12. Tension wire bracket
    - Support the transmission with a transmission jack
13. Transmission mount center member assembly
14. Transmission mount insulator assembly
15. Transmission harness connector connection
16. Transmission assembly
17. Tension wire

◀B▶
▶A◀

REMOVAL SERVICE POINTS

◀A▶ DRIVE PLATE CONNECTION BOLT REMOVAL

1. While turning the crankshaft, remove the six connection bolts.
2. Push the torque converter towards the transmission so that none of it is near the engine.

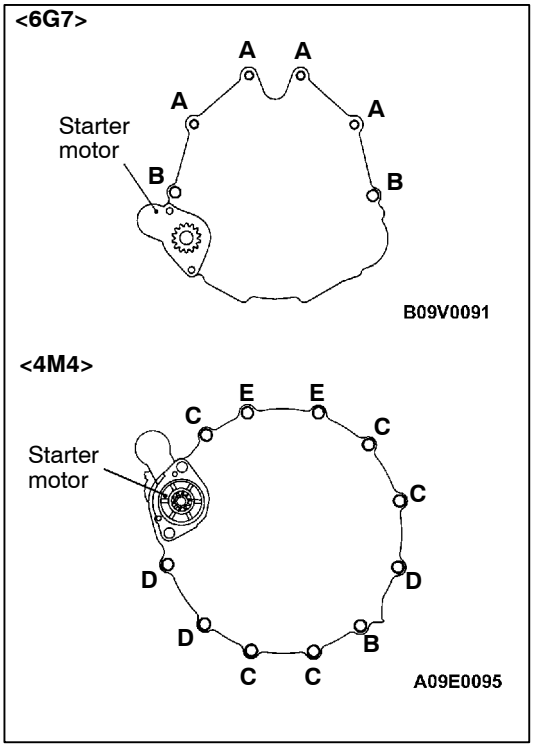


◀B▶ TRANSMISSION HARNESS CONNECTOR DISCONNECTION

1. Lower the transmission to a position where the transmission harness connector can be disconnected, and then disconnect the connector.

Symbol	Connector name
A	Transmission wiring harness and battery wiring harness combination
B	Output shaft speed sensor
C	A/T control solenoid valve assembly
D	4LLc (Direct low range 4WD) switch
E	2WHEY operation detection switch
F	Rear propeller shaft speed sensor
G	Vehicle speed sensor
H	Shift actuator
I	2WHEY/4WD detection switch
J	4H (Full time 4WD) detection switch
K	Center differential lock detection switch
L	Front propeller shaft speed sensor
M	Oxygen sensor (Rear)
N	Inhibitor switch
O	Oxygen sensor (Front)
P	Input shaft speed sensor

2. Place the disconnected transmission harness so that it stays on the vehicle body.



INSTALLATION SERVICE POINTS

▶A◀ TRANSMISSION ASSEMBLY INSTALLATION

The bolt lengths differ according to where they are to be installed, so do not install them in the wrong place.

<6G7>

Bolts	d × l mm
A	12 × 40
B	12 × 55

<4M4>

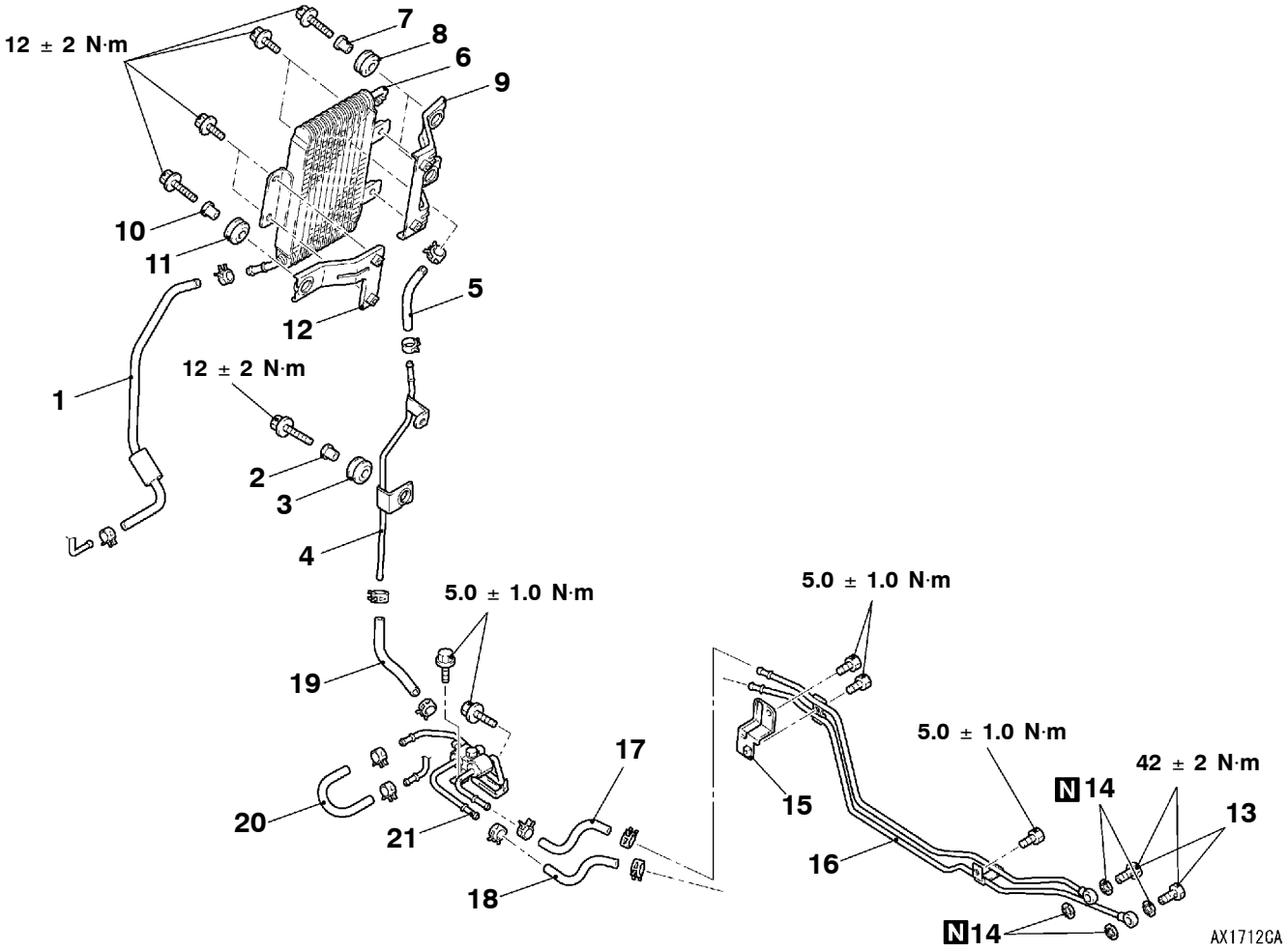
Bolts	d × l mm
C	10 × 25
D	10 × 45
E	10 × 50

TRANSMISSION OIL COOLER

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations
- Transmission Fluid Draining and Filling (Refer to P.23-95 and P.23-99.)
- Skid Plate and Under Cover Removal and Installation

<6G7>

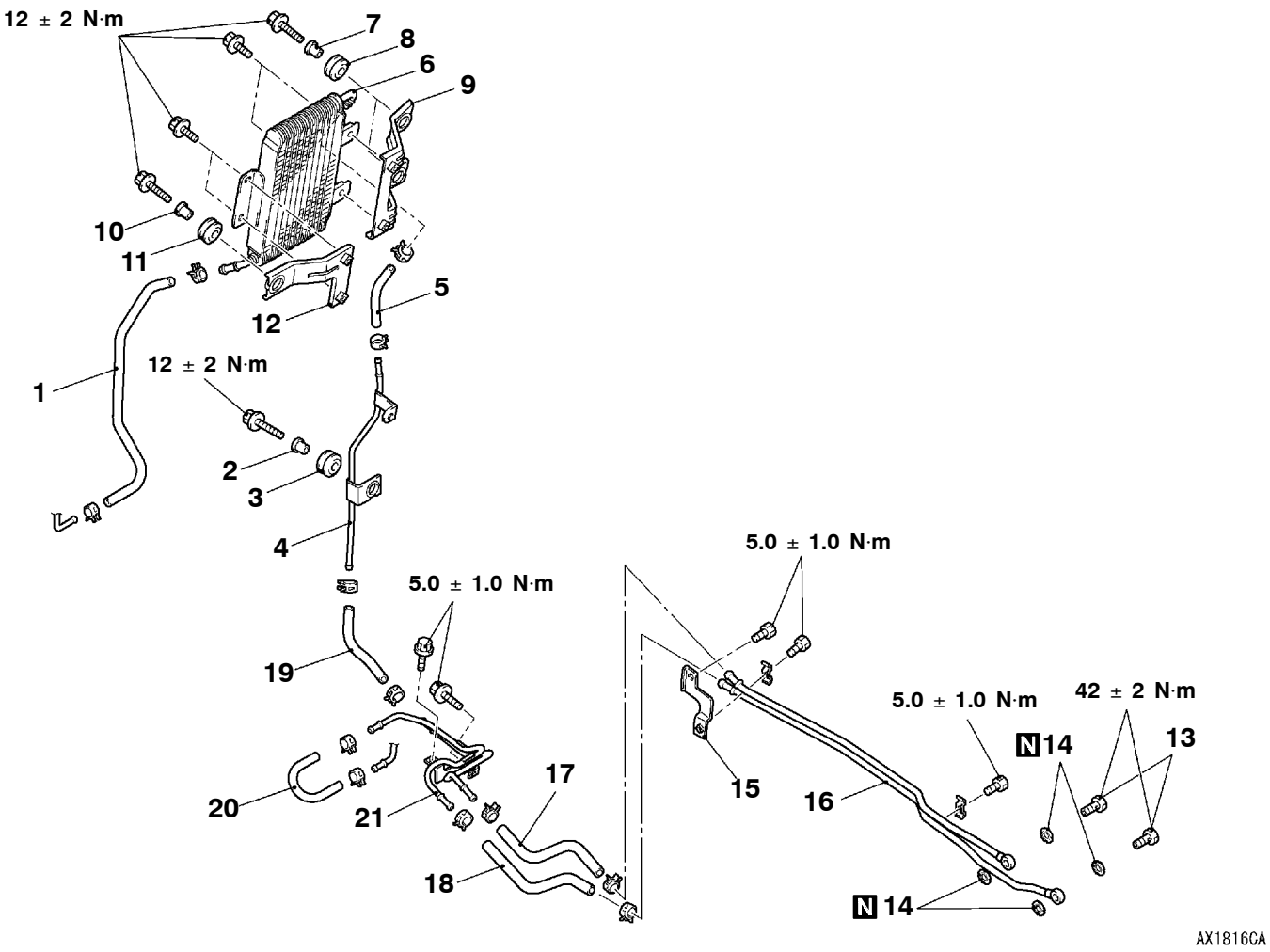


Transmission oil cooler removal steps
1. Hose
2. Distance piece
3. Bushing
4. Transmission oil return tube
5. Hose
6. Distance piece
- Headlight assembly (Refer to GROUP 54A.)

7. Bushing
8. Transmission oil cooler bracket
9. Distance piece
10. Bushing
11. Transmission oil cooler bracket
12. Transmission oil cooler

Transmission oil cooler tube assembly removal steps
- ▶B◀ 13. Eye bolt
- ▶B◀ 14. Gasket
- 15. Transmission oil cooler tube bracket
- ▶B◀ 16. Transmission oil cooler tube assembly
- ▶A◀ 17. Return hose
- ▶A◀ 18. Feed hose
- 19. Hose
- 20. Hose
- 21. Transmission oil cooler tube assembly

<4M4>



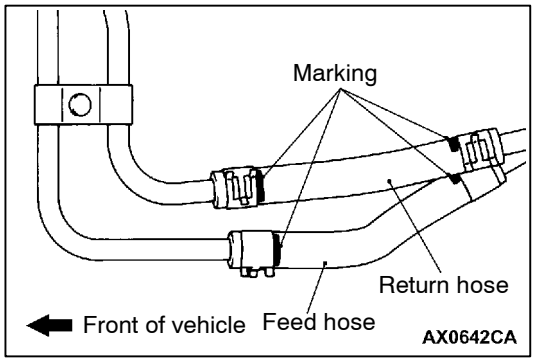
Transmission oil cooler removal steps

1. Hose
2. Distance piece
3. Bushing
4. Transmission oil return tube
5. Hose
6. Distance piece
- Headlight assembly (Refer to GROUP 54A.)

7. Bushing
8. Transmission oil cooler bracket
9. Distance piece
10. Bushing
11. Transmission oil cooler bracket
12. Transmission oil cooler

Transmission oil cooler tube assembly removal steps

▶B◀ 13. Eye bolt
▶B◀ 14. Gasket
15. Transmission oil cooler tube bracket
▶B◀ 16. Transmission oil cooler tube assembly
▶A◀ 17. Return hose
▶A◀ 18. Feed hose
19. Hose
20. Hose
21. Transmission oil cooler tube assembly



INSTALLATION SERVICE POINTS

▶A◀ FEED HOSE/RETURN HOSE INSTALLATION

Install the feed hose and return hose so that the markings are positioned as shown in the illustration.

▶B◀ TRANSMISSION OIL COOLER TUBE ASSEMBLY/ GASKET/ EYE BOLT INSTALLATION

Provisionally tighten the eye bolts onto the transmission and provisionally secure the pipes with the clamps, and then fully tighten the eye bolts.
Furthermore, tighten the clamps in order starting from the one closest to the transmission.

A/T-ECU

REMOVAL AND INSTALLATION

<6G7> Refer to GROUP 13A - Engine-A/T-ECU; <4M4>Refer to GROUP 13C - Engine-ECU.

INSPECTION

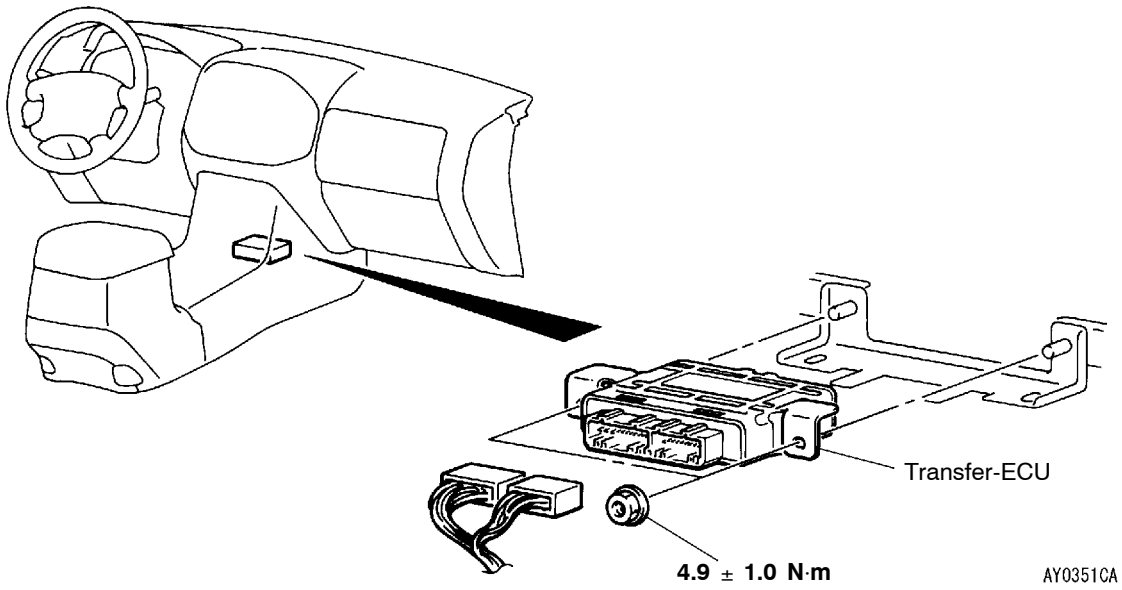
ECU TERMINAL VOLTAGE MEASUREMENT

<6G7>Refer to P.23-64; <4M4>Refer to P.23-66.

TRANSFER-ECU

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations
Indicator Panel and Floor Console Front Panel Removal and Installation (Refer to GROUP 52A - Floor Console.)



INSPECTION

ECU TERMINAL VOLTAGE MEASUREMENT

Refer to P.23-89.

Service Bulletins

Click on the applicable bookmark to select the Service Bulletin.

SERVICE BULLETIN

MITSUBISHI MOTORS

TECHNICAL SERVICE PLANNING
INTERNATIONAL CAR ADMINISTRATION OFFICE. MITSUBISHI MOTORS CORPORATION

SERVICE BULLETIN	NO. : MSB-01E23-501	
	DATE : 2001-3-20	<MODEL> (EC)PAJERO/MONTERO(V60,70) <M/Y> 01-10
SUBJECT : CORRECTION TO TRANSMISSION REMOVAL STEPS		
GROUP : AUTOMATIC TRANSMISSION	DRAFTNO. : 00SY122809	
CORRECTION	INTERNATIONAL CAR ADMINISTRATION OFFICE	T. MASAKI - MANAGER TECHNICAL SERVICE PLANNING

1. Description:

On the 6G7 engine equipped vehicle, correction has been made to the transmission removal steps.

2. Applicable Manuals:

Manual	Pub. No.	Page
2001 PAJERO Workshop Manual VOL.1	PWJE0001 (1/2) (English)	23-122
2001 MONTERO Workshop Manual VOL.1	PWJS0002 (1/2) (Spanish)	23-122
2001 PAJERO/MONTERO CD-ROM	PWJT0008R-A (English) (Spanish) (French) (Dutch)	-

3. Details:

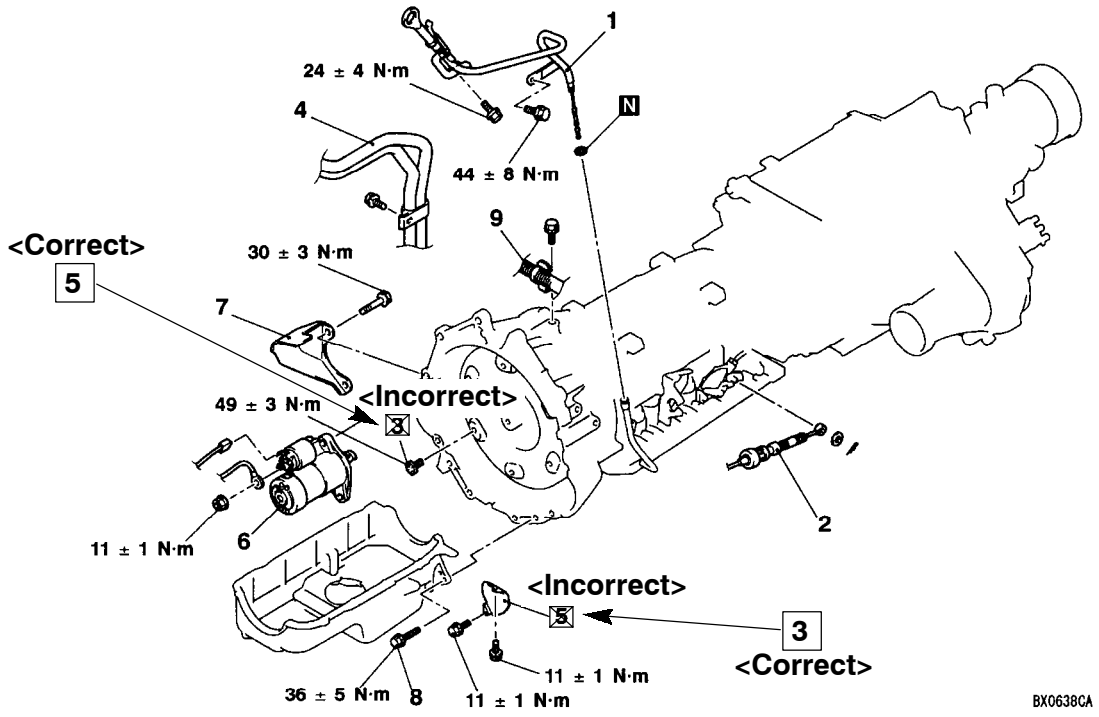
TRANSMISSION ASSEMBLY

REMOVAL AND INSTALLATION

NOTE
The rear propeller shaft incorporates a carbon fibre-reinforced plastic tube, so be sure to refer to GROUP 25 during removal.

<6G7>

Pre-removal and Post-installation Operations
- Skid Plate And Under Cover Removal and Installation
- Transmission Fluid and Transfer Oil Draining and Filling (Refer to P.23-95 and P.23-99.)
- Front and Rear Propeller Shaft Removal and Installation (Refer to GROUP 25.)
- Front Exhaust Pipe Removal and Installation (Refer to GROUP 15.)
- Radiator Shroud Lower Cover Removal and Installation (Refer to GROUP 14.)



Removal steps

<Deleted> ◀A▶
◀A▶ <Added>

1. Oil level gauge assembly
2. Transmission control cable connection
3. ~~Drive plate connection bolts~~ <Incorrect>
4. Heater hose connection
5. ~~Cover~~ <Incorrect>
6. Starter motor
7. Starter cover
8. Oil pan connection bolts
9. Battery cable connection

Cover <Correct>

Drive plate connection bolts <Correct>

GROUP 23
AUTOMATIC TRANSMISSION

GENERAL

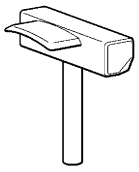
OUTLINE OF CHANGE

When the inhibitor switch is at the “P” position, it does not send a signal to the transfer-ECU any longer. Due to this change, data list item No.32 has be deleted from the section “Troubleshooting - SS4 II” and transfer-ECU terminal No.33 has been discontinued.

SEALANT

Item	Specified sealant	Remark
Oil pan	MITSUBISHI genuine sealant part No. MD166584 or equivalent	Semi-drying sealant

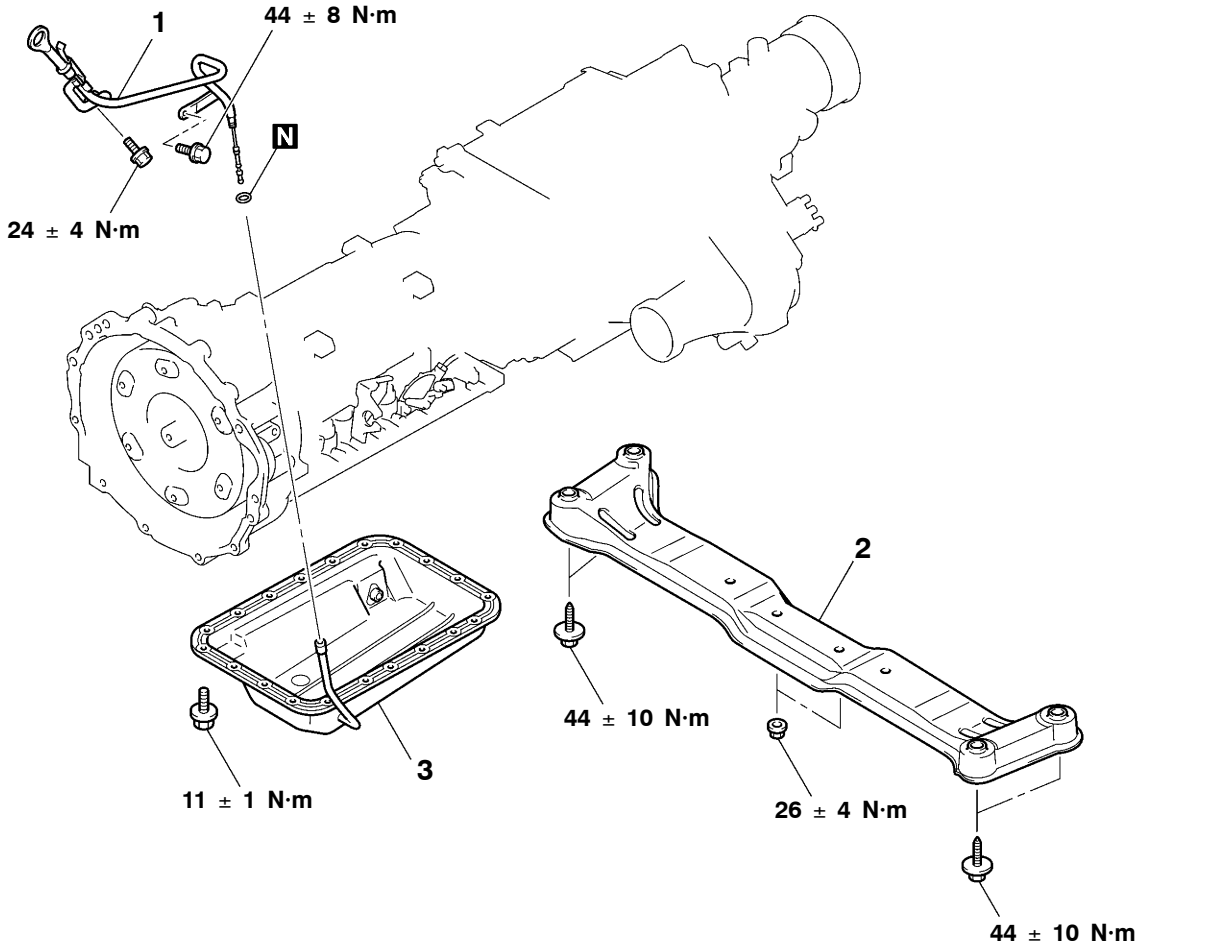
SPECIAL TOOL

Tool	No.	Name	Application
 D998727	MD998727	Oil pan remover	Oil pan removal

OIL PAN

REMOVAL AND INSTALLATION

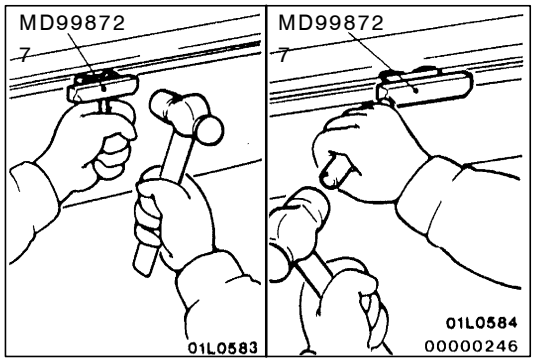
Pre-removal and Post-installation Operations
- Transmission Fluid Draining and Filling
- Under Cover Removal and Installation



Removal steps

1. Oil level gauge assembly
   - Support the transmission with a transmission jack
2. Transmission mount center member assembly

◀A▶ ▶A◀ 3. Oil pan



REMOVAL SERVICE POINT

◀A▶ OIL PAN REMOVAL

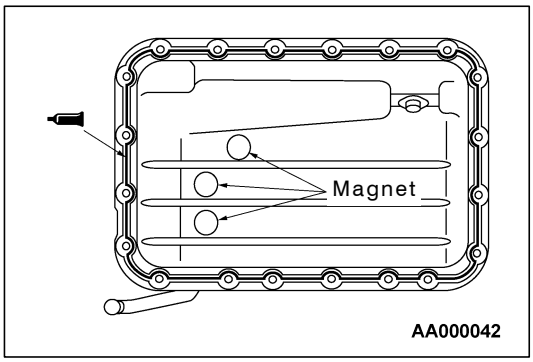
After removing the oil pan mounting bolts, remove the oil pan with special tool MD998727 and a brass bar.

INSTALLATION SERVICE POINT

▶A◀ OIL PAN INSTALLATION

1. Remove sealant from the oil pan and transmission case mating surfaces.
2. Degrease the sealant-coated surface and the transmission mating surface.
3. Clean the magnet and install it in the hollow of the oil pan base.

   NOTE
   If the oil pan is replaced, reuse the cleaned magnet.



4. Apply MITSUBISHI genuine sealant part No. MD166584 or equivalent around the gasket surface of the oil pan as specified in the illustration.

   NOTE
   The sealant should be applied in a continuous bead approximately 3 mm in diameter.

5. Tighten the mounting bolts to the specified torque.

   Tightening torque: 11 ± 1 N·m

PROPELLER SHAFT

Click on the applicable bookmark to selected the required model year.

PROPELLER SHAFT

CONTENTS

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

GENERAL INFORMATION

A two-joint propeller shaft was used for both the front and rear.
Rear propeller shaft is equipped with a carbon-fiber reinforced plastic (CFRP) tube.

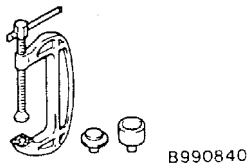
SERVICE SPECIFICATIONS

Items	Standard value	Limit
Propeller shaft runout mm	-	0.5
Clearance between rear propeller shaft tube end and shaft mm	0.2 - 0.5	-
Clearance of snap ring groove mm	0 - 0.06	-

LUBRICANT

Items	Specified lubricant	Quantity
Propeller shaft sleeve yoke	Hypoid gear oil SAE 75W-90 or 75W-85W or 80W conforming to API GL-4	As required

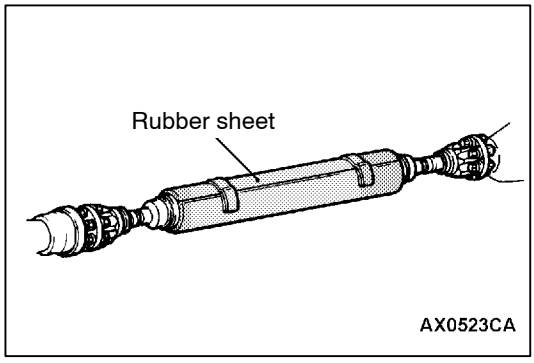
SPECIAL TOOL

Tool	Number	Name	Use
 B990840	MB990840	Universal joint remover and installer	Disassembly and reassembly of the universal joint

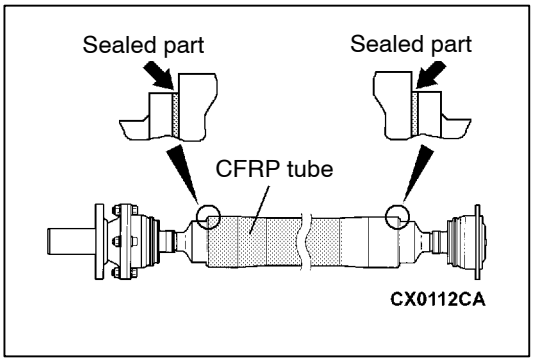
PROPELLER SHAFT

Caution
Observe the following precautions, as the rear propeller shaft uses a carbon fiber-reinforced plastic (CFRP) tube.

1. **If a scratch is found on the propeller shaft tube, check that the tube is damaged by using a dye penetrant method.**
2. **If the tube is cracked, chipped or bent, replace the propeller shaft.**
3. **Be careful not to impact or damage the tube.**
4. **If the propeller shaft has been dropped accidentally, replace it.**



5. **In order to prevent damage, wrap a rubber sheet thicker than 10 mm or a special rubber sheet (parts No.: MR534563 - for short wheel base/parts No.: MR534564 - for long wheelbase) around the propeller shaft tube during the operation.**

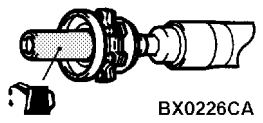


6. **Replace the propeller shaft if cracks or peelings are found at the sealed part.**
7. **It is recommended that a defective propeller shaft should be buried in the earth. Toxic material never leaks from the buried propeller shaft tube.**

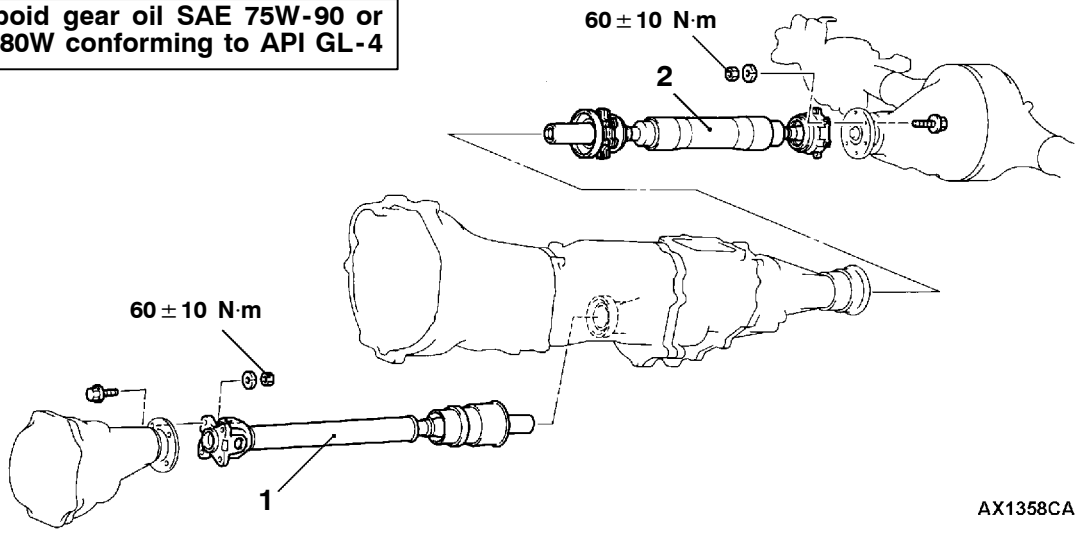
REMOVAL AND INSTALLATION

Pre-removal Operation
Wrap the rubber sheet around the rear propeller shaft (prior to the removal)

Post-installation Operation
- Remove the the rubber sheet, which is wrapped around the rear CFRP propeller shaft, and then visually check for any cracks.
  (After installation of the rear CFRP propeller shaft)
- Transfer Gear Oil Supplying
  (After the front propeller shaft installation)
  (M/T: Refer to GROUP 22 - On-vehicle Service.)
  (A/T: Refer to GROUP 23 - On-vehicle Service.)



Gear Oil: Hypoid gear oil SAE 75W-90 or 75W-85W or 80W conforming to API GL-4

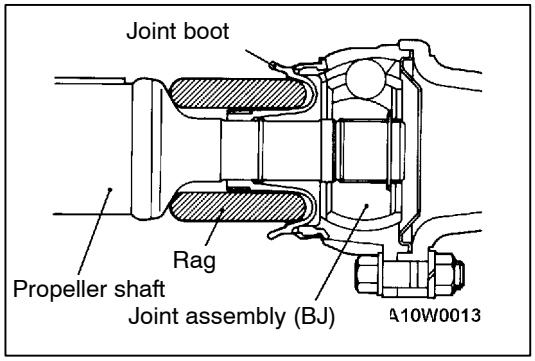


◀A▶ ▶B◀ 1. Front propeller shaft assembly
◀B▶ ▶A◀ 2. Rear propeller shaft assembly

REMOVAL SERVICE POINTS

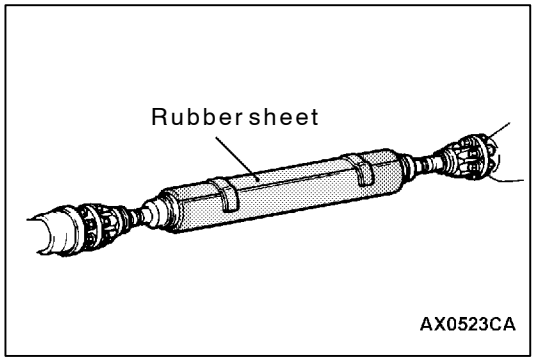
◀A▶ FRONT PROPELLER SHAFT ASSEMBLY REMOVAL

1. Set the transfer shift lever to “2H” range.
2. Drain the transfer gear oil.
   (M/T: Refer to GROUP 22 - On-vehicle Service.)
   (A/T: Refer to GROUP 23 - On-vehicle Service.)
3. Make mating marks on the differential companion flange and flange yoke.



4. Wrap a rag around the joint boot, and then remove the front propeller shaft assembly.

   Caution
   When removing the propeller shaft, be careful not to damage the joint boot by pinching it.
5. Cover the transfer to prevent the entrance of foreign material.

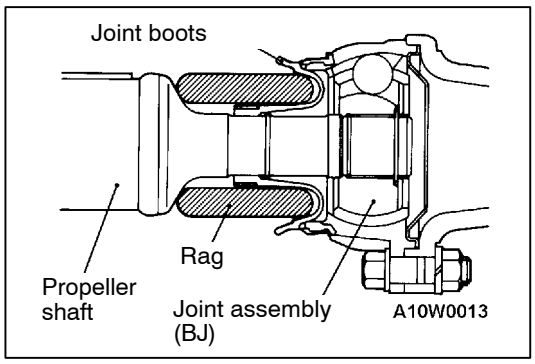


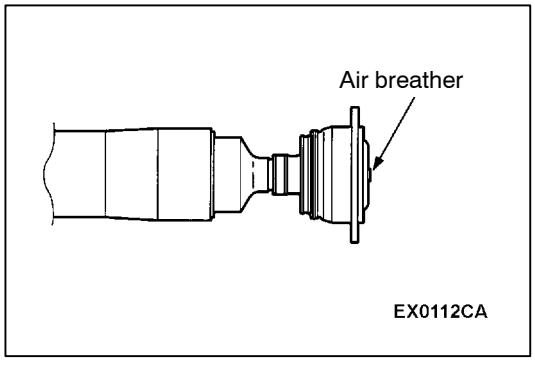
◀B▶ REAR PROPELLER SHAFT ASSEMBLY REMOVAL

1. Ensure that the rear propeller shaft assembly is wrapped by the rubber sheet.

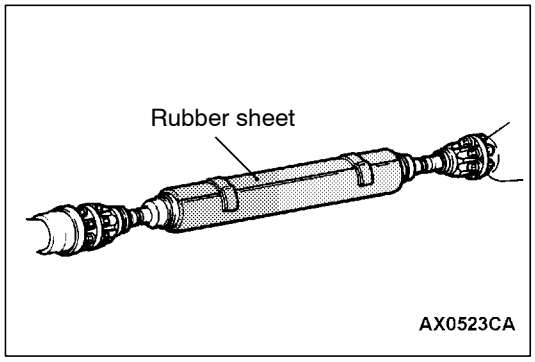
   Caution
   In order to prevent damage, make sure that the rubber sheet is wrapped around the carbon fiber-reinforced resin tube of the rear propeller shaft during the operation.
2. Make mating marks on the differential companion flange and the BJ assembly outer race.
3. Wrap a rag around the joint boot, and then remove the rear propeller shaft assembly.

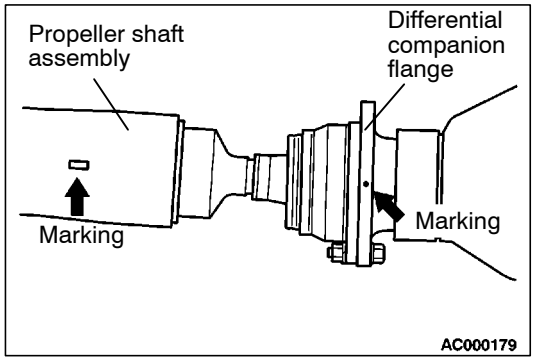
   Caution
   (1) When removing the propeller shaft, be careful not to damage the joint boot by pinching it.





   (2) The air breather is located at the rear end of the rear propeller shaft. Be careful not to drop the air breather into the BJ.
   (3) Be careful not to impact or damage the propeller shaft.
   (4) If the propeller shaft has been dropped accidentally, replace it.
4. Cover the transfer to prevent the entrance of foreign material.





INSTALLATION SERVICE POINTS

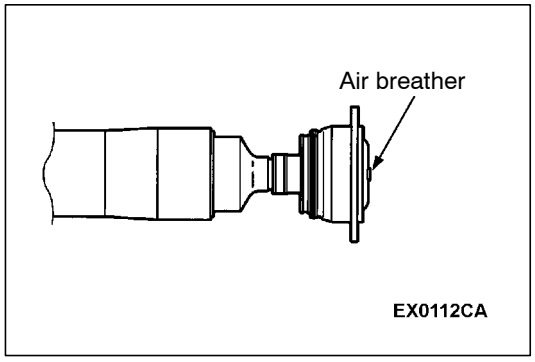
▶A◀ REAR PROPELLER SHAFT ASSEMBLY INSTALLATION

Ensure that the rubber sheet is wrapped around the rear propeller shaft assembly.

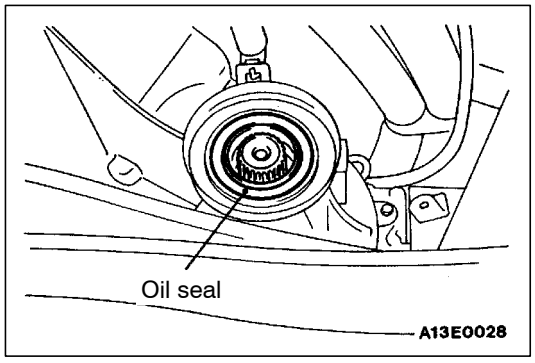
Caution
In order to prevent damage, make sure that the rubber sheet is wrapped around the carbon fiber-reinforced resin tube of the rear propeller shaft during the operation. Also, do not impact or damage the rear propeller shaft.

(1) When reusing the propeller shaft, align the mating marks and install the propeller shaft.
(2) When the rear propeller shaft assembly is installed, position it so that the marking on the propeller shaft assemlby is closest to that on the differential companion flange (within 30°).

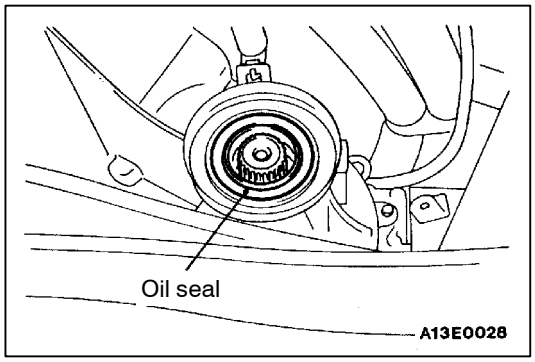
Caution
(1) Wipe out oil and grease on the threads of the mounting bolts and nuts before tightening, or they will loosen.
(2) Be careful not to impact or damage the propeller shaft.
(3) If the propeller shaft has been dropped accidentally, replace it.



(4) The air breather is located at the rear end of the rear propeller shaft. Be careful not to drop the air breather into the BJ.



(5) Do not damage the oil seal lips of the transfer.

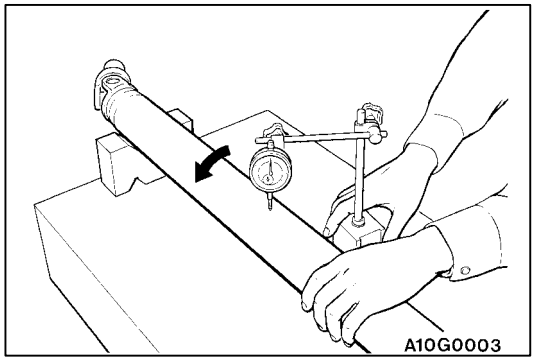


▶B◀ FRONT PROPELLER SHAFT ASSEMBLY INSTALLATION

When reusing the propeller shaft, align the mating marks and install the propeller shaft.

Caution

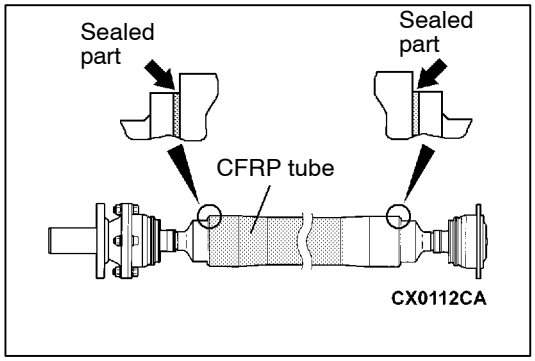
1. **Do not damage the oil seal lips of the transfer.**
2. **Wipe out oil and grease on the threads of the mounting bolts and nuts before tightening, or they will loosen.**



INSPECTION

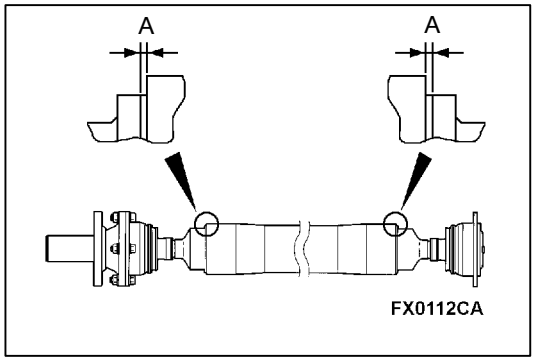
FRONT PROPELLER SHAFT RUNOUT

Limit: 0.5 mm



REAR PROPELLER SHAFT

1. Replace the propeller shaft if cracks or peelings are found at the sealed part.
2. Check the tube for cracks, chips or bends and replace the propeller shaft if damage is found. If defective, check for damage by a dye penetrant method.



3. Measure clearance (A) between the tube end and the shaft.

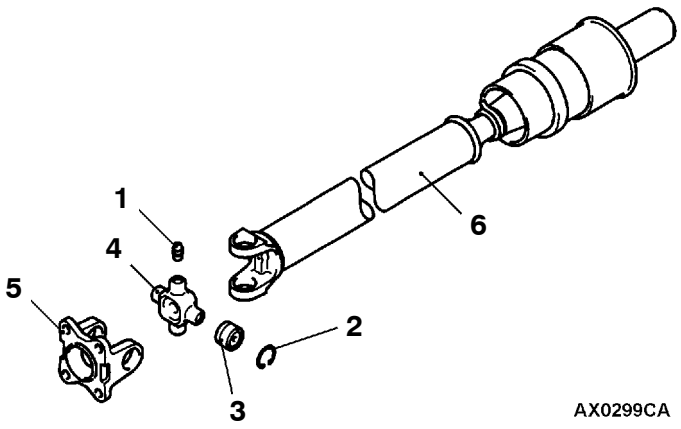
   Standard value (A) : 0.2 - 0.5 mm

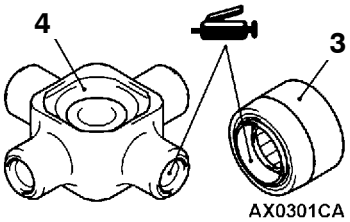
4. If the standard value is not met, replace the rear propeller shaft.

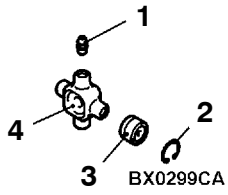
DISASSEMBLY AND REASSEMBLY

Caution
The rear propeller shaft is non-serviceable.

FRONT PROPELLER SHAFT



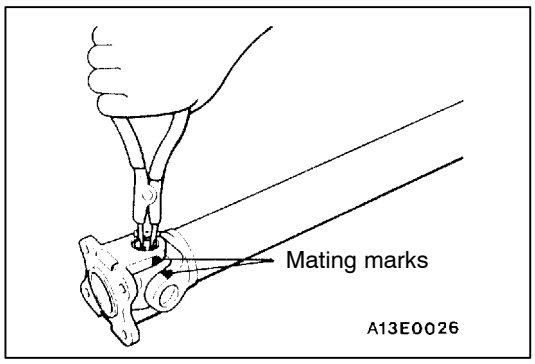




Universal joint repair kit

Disassembly steps

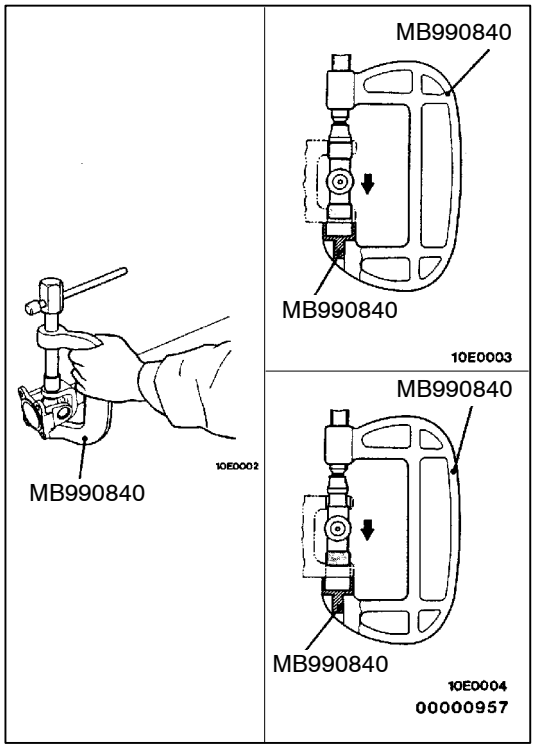
1. Grease fitting
◀A▶ ▶B◀ 2. Snap ring
◀B▶ ▶A◀ 3. Journal bearing
4. Journal
5. Flange yoke
6. Propeller shaft



DISASSEMBLY SERVICE POINTS

◀A▶ SNAP RING REMOVAL

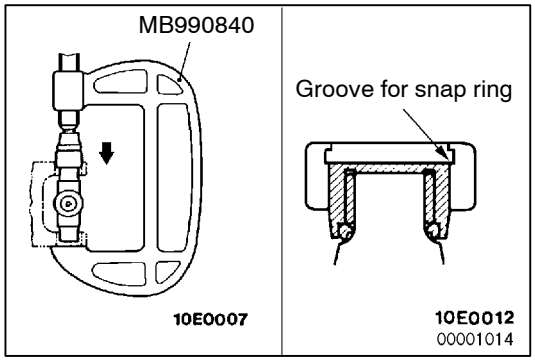
Make mating marks on the flange yoke and propeller shaft. Then, remove the snap rings.



◀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.

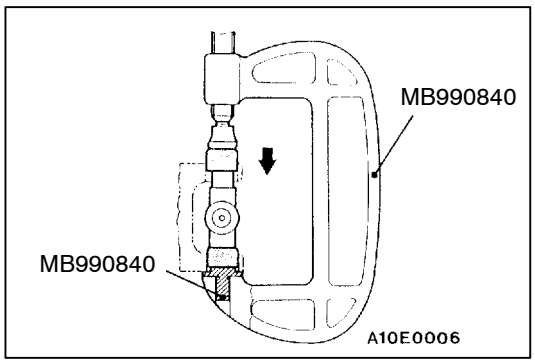
Caution
Do not tap the journal bearing to remove. Tapping the journal bearing will upset the balance of the propeller shaft.



REASSEMBLY SERVICE POINTS

▶A◀ JOURNAL BEARING INSTALLATION

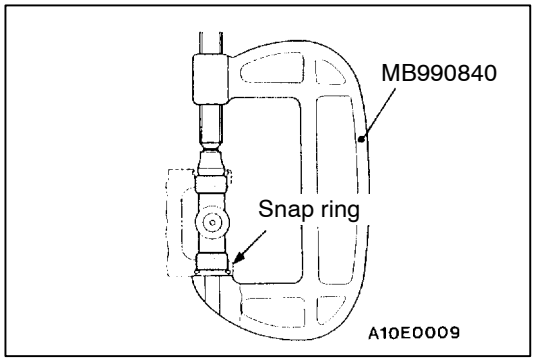
1. Using the special tool, press in the journal bearing to the yoke until the snap ring groove can be seen completely.



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

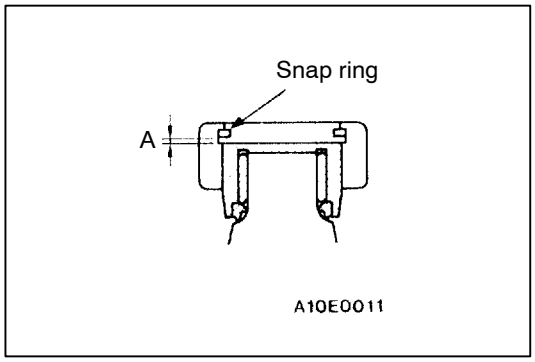
Caution
Press in the journal bearing straight, or the journal could damage the inside of the journal bearing.

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 (A) : 0 - 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.

Snap ring thickness mm	Identification colour
1.28	-
1.31	Yellow
1.34	Blue
1.37	Purple

NOTES

FRONT AXLE

Click on the applicable bookmark to selected the required model year.

FRONT AXLE

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GENERAL INFORMATION

The front axle consists of the front hubs, knuckles, drive shaft, wheel bearings, ball joints, front differential, and freewheel clutch.
The features are:

- The structural method of press fitting unit bearing into the front hub is applied.
- The wheel bearing uses a taper roller unit bearing. For vehicles with ABS, a rotor for detecting the wheel speed is press-fitted to the U.J. outer wheel.
- Drive shafts incorporate U.J.-B.J.-type constant velocity ball joint has high power transmission efficiency and reduces vibration and noise.

NOTE
U.J. is an abbreviation of Under cut Joint.

- A vacuum-type freewheel clutch has been adopted in the freewheel mechanism. Its solenoid valve and actuator switch powertrain between 2WD and 4WD.
- The differential support method is a four-point elastic support method which reduces vibration and noise.

Item			Specification
Wheel bearings	Wheel bearing type		Taper roller type unit bearing
	Bearing (outside diameter × inside diameter) mm		88 × 50
Drive shaft	Joint type	Outside	U.J.
		Inside	D.O.J.
	Shaft length*1 × Shaft diameter mm	Right	353 × 28*2, 361.5 × 26*3
		Left	323 × 28*2, 330 × 26*3
Inner shaft	Shaft length × Shaft diameter mm		389.2 × 31.5
	Bearing (outside diameter × inside diameter) mm		62 × 35

NOTE
*1: The shaft length indicates the length between the center points of each joint.
*2: 4M41-M/T
*3: 4D56, 4M41-A/T, 6G74 GDI

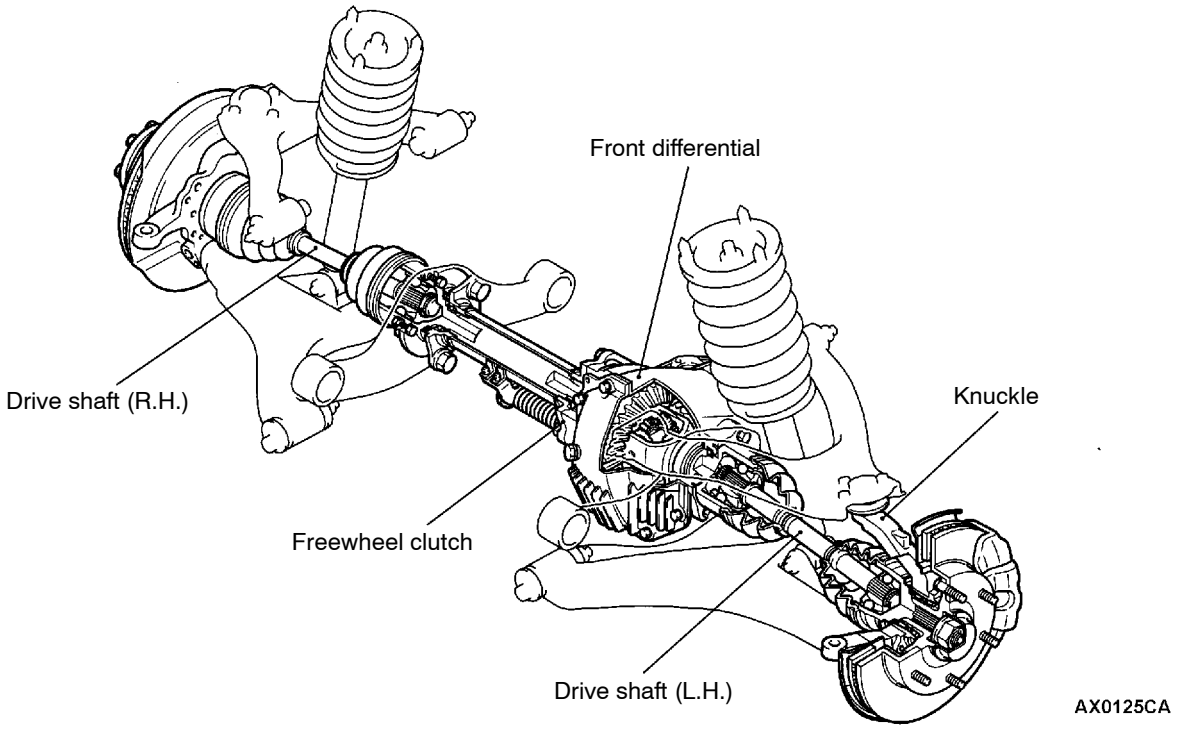
FRONT DIFFERENTIAL

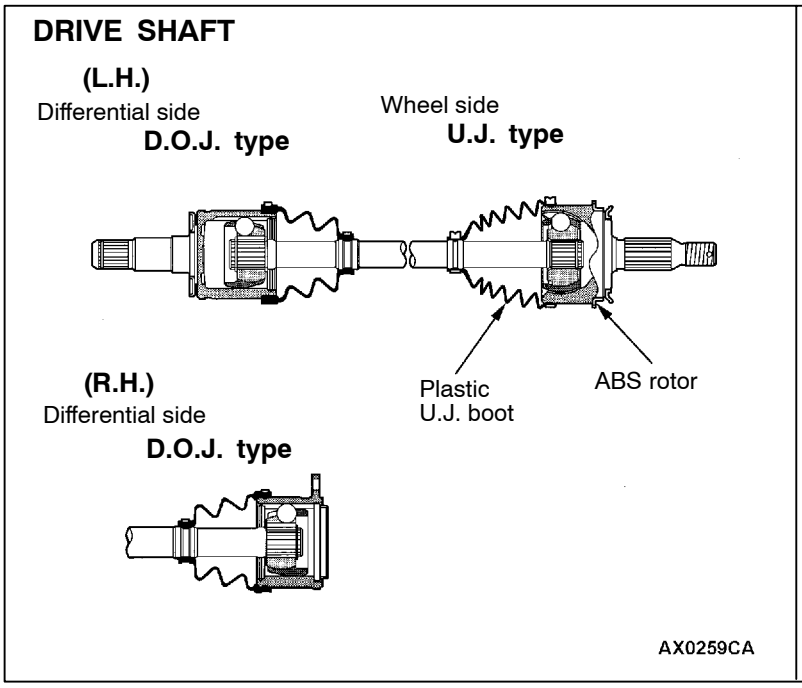
Item		Specification
Reduction gear type		Hypoid gear
Reduction ratio		4.900*1, 3.917*2, 4.100*3, 4.300*4
Differential gear type		Straight bevel gear
Number of teeth	Drive gear	49*1, 47*2, 41*3, 43*4
	Drive pinion	10*1,*3,*4, 12*2
	Side gear	14
	Pinion gear	10

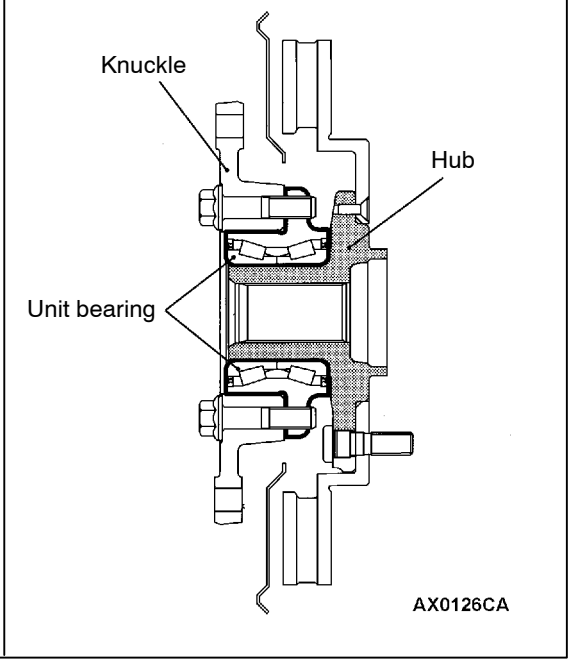
NOTE
*1: 4D56
*2: 4M41-A/T
*3: 4M41-M/T
*4: 6G74 GDI

Bearing (outside diameter × inside diameter) mm	Side	80.0 × 45.2
	Front	68.3 × 30.2
	Rear	72.2 × 36.5

STRUCTURAL DIAGRAM







SERVICE SPECIFICATIONS

Item		Standard value	Limit
Wheel bearing axis backlash mm		-	0
Front axle total backlash mm		-	11
Solenoid valve resistance Ω		36 - 46	-
Hub rotation starting torque N·m		-	1.75
Setting of D.O.J. boot length mm		80 ± 5	-
Opening dimension of the special tool (MB991561) mm	When the B.J. boot band (small) is crimped.	2.9	-
	When the B.J. boot band (big) is crimped.	3.2	-
Crimped width of the B.J. boot band mm		2.4 - 2.8	-
Crimped height of B. J. boot band (big) mm		-	9.5
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 N·m	Without oil seal	0.83 - 1.19	-
	With oil seal	Companion flange (oil seal contact surface) with anti-rust oil 0.93 - 1.128	-
		Companion flange (oil seal contact surface) with gear oil 0.97 - 1.32	-

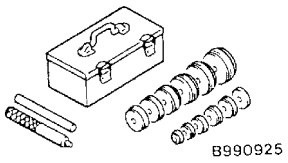
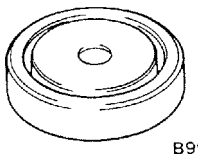
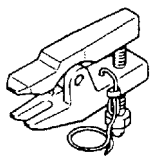
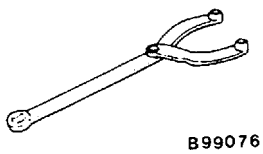
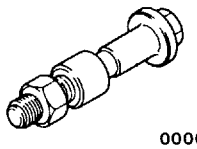
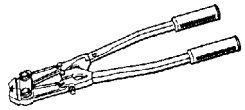
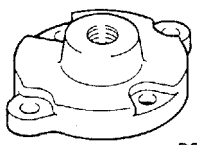
LUBRICANTS

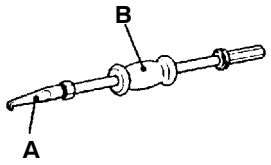
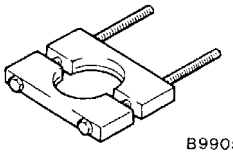
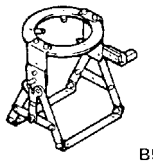
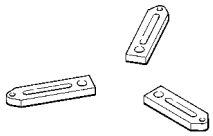
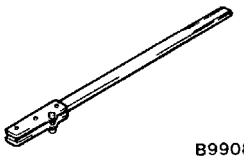
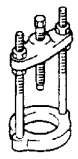
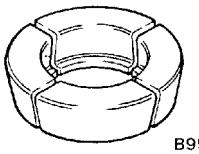
Items	Specified lubricants	Quantity
Front differential gear oil	Hypoid gear oil API classification GL-5 or higher, SAE viscosity No. 90, 80W	1.2 L
D.O.J. boot grease	Repair kit grease	4M41-M/T:135 ± 10 g 4M41-A/T, 6G7: 100 ± 10 g
U.J.boot grease	Repair kit grease	4M41-M/T:180 ± 10 g 4M41-A/T, 6G7: 135 ± 10 g

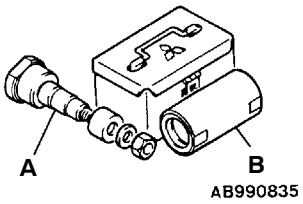
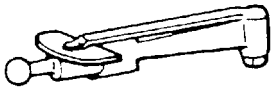
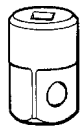
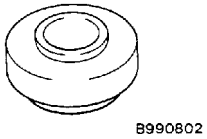
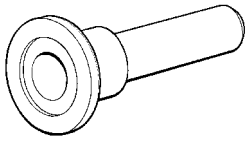
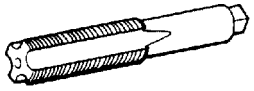
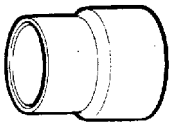
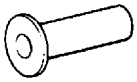
SEALANTS

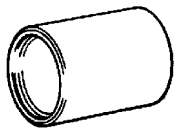
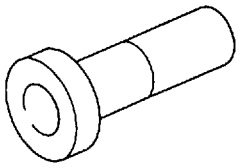
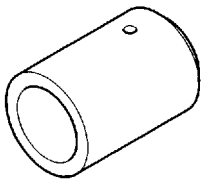
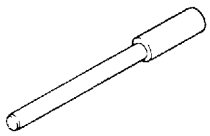
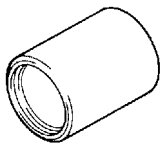
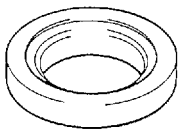
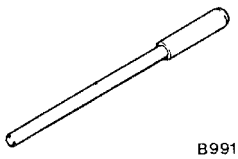
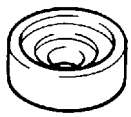
Items	Specified sealants	Remarks
Contact surface of differential cover and differential carrier	3M ATD Part No. 8661 or equivalent	Semi-drying sealant
Vent plug		
Freewheel clutch assembly		
Drive gear threaded hole	3M Stud Locking 4170 or equivalent	Anaerobic sealant

SPECIAL TOOLS

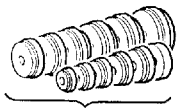
Tool	Number	Name	Use
 B990925	MB990925	Bearing and oil seal installer set	• Press-fitting of housing tube dust seal • Press-fitting of oil seal • Removal and installation of drive pinion front & rear bearing outer race • Checking of drive gear tooth contact
 B990955	MB990955	Oil seal installer	• Press-fitting of housing tube dust seal (Used together with MB990938)
 B991113	MB991113 or MB990635	Steering linkage puller	• Disconnection of ball joint
 B990767	MB990767	Front hub & flange yoke holder	Hub fixiation
 00005697	MB990998	Front hub remover & installer	Inspection of hub rotation starting torque
	MB991561	Boot band clipping tool	Resin boot band installation
 B990906	MB990906	Drive shaft attachment	Removal and installation of inner shaft (Used together with MB990211)

Tool	Number	Name	Use
	MB990590 A: MB990212 B: MB990211	Rear axle shaft oil seal remover A: Adapter B: Sliding hammer	• Removal of differential carrier oil seal • Removal and installation of inner shaft (Used together with MB990906)
	MB990560	Bearing remover	• Removal and press-fitting of inner shaft bearing • Removal of freewheel clutch bearing
	MB990909	Working base	Support of front differential carrier assembly
	MB991116	Adapter	Support of front differential carrier assembly
	MB990810	Side bearing puller	• Removal of side bearing inner race • Removal of companion flange
	MB990811	Differential side bearing cap	
	MB990850	End yoke holder	Removal and installation of companion flange
	MB990339	Bearing puller	Removal of drive pinion front bearing inner race
	MB990648	Bearing remover	

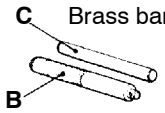
Tool	Number	Name	Use
	MB991171 A: MB990819 B: MB991170	Pinion height gauge set A: Drive pinion gauge assembly B: Cylinder gauge	• Inspection of drive pinion rotation starting torque • Measurement of drive pinion height
	MB990685	Torque wrench	• Inspection of hub rotation starting torque • Measurement of drive pinion rotation starting torque
	MB990326	Preload socket	
	MB990802	Bearing installer	• Press-fitting of drive pinion front bearing inner race • Press-fitting of side bearing inner race
	MB990031 or MB990699	Drive pinion oil seal installer	Press-fitting of drive pinion oil seal
	MB990813	Tap	Removal of adhesive
	MB990799	Ball joint remover and installer	Installation of freewheel clutch bearing
	MB991168	Differential oil seal installer	Installation of freewheel clutch oil seal

Tool	Number	Name	Use
	MB990890 or MB990891	Rear suspension bushing base	Installation of freewheel clutch bearing
	MD999547	Oil seal installer	Removal of front differential mount insulator <Front, rear L.H.>
	MD999570	Crankshaft front oil seal installer	Removal of front differential mount insulator <Rear R.H.>
	MB990947	Lower arm bush arbor	Press fitting of front differential mount insulator <Front, rear L.H.>
	MB990847	Rear suspension bush remover & installer base	
	MB990981	Mount bush remover & installer ring	
	MB991318	Lower arm bush arbor	Press fitting of front differential mount insulator <Rear R.H.>
	MB991183	Bush arbor	
	MB990843	Draglink bush remover & installer	

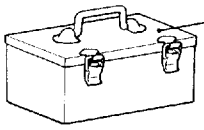
MB990925



A
Installer adapter



Bar (snap-in type)



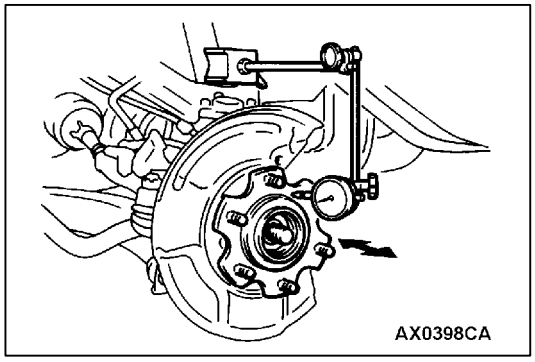
A11W0113

	Contents of tool (MB990925)	O.D. mm		Contents of tool (MB990925)	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
A	MB990931	57	B	MB990938	-
A	MB990932	61	C	MB990939	-

ON-VEHICLE SERVICE

WHEEL BEARING BACKLASH CHECK

1. Remove the caliper assembly and hold it with wires to prevent it from falling.
2. Remove the brake disk from hub.



3. Set the dial gauge as shown in the diagram and move the hub in the axis to measure backlash.

   Limit: 0 mm

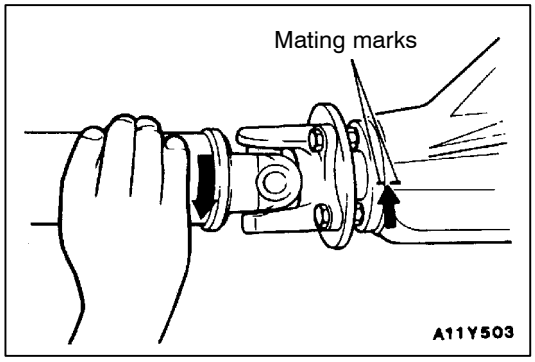
4. If the backlash exceeds the limit value, disassemble hub knuckle to check each component. If front hub assembly bearing is faulty, replace the front hub assembly.

FRONT AXLE TOTAL BACKLASH CHECK

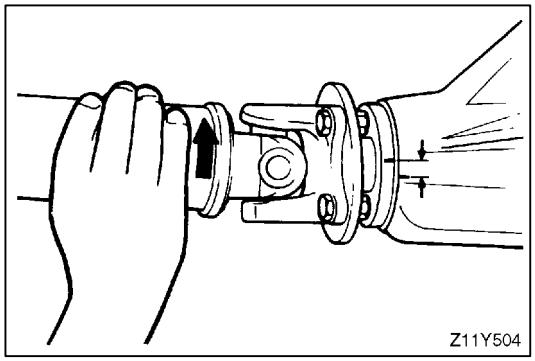
When the iginition switch is in LOCK(OFF) position, front wheel comes to stop after turning the propeller shaft by hand due to the force applied to front wheel actuator. Inspect the vehicle in the following procedure:

1. Turn the ignition switch to LOCK(OFF) position, and then put the transfer shift lever to the 2H position.

   Caution
   Do not jack up the vehicle.



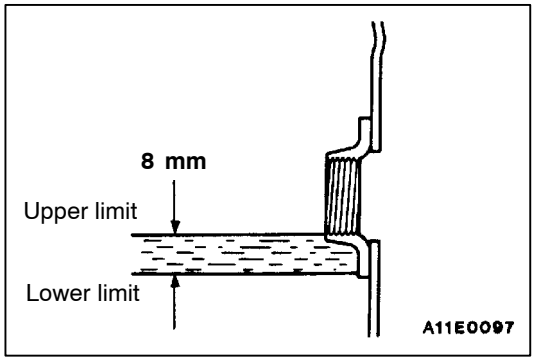
2. Turn the propeller shaft until a click is heard.
3. Turn the companion flange clockwise until all play is removed. Make mating marks on the dust cover of the companion flange with that on the differential carrier.



4. Turn the companion flange anti-clockwise until all play is removed and measure the amount of distance through which the mating marks moved.

   Limit: 11 mm

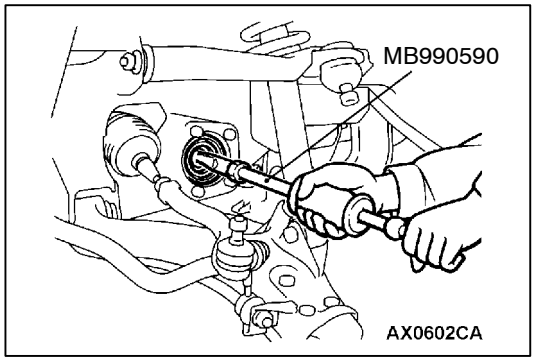
5. If the amount of movement exceeds the limit value, check the following.
   (1) Final drive gear backlash
   (2) Differential gear backlash
   (3) Play in the serrations and splines of the side gears, drive shaft, inner shaft and drive flange



FRONT AXLE GEAR OIL LEVEL CHECK

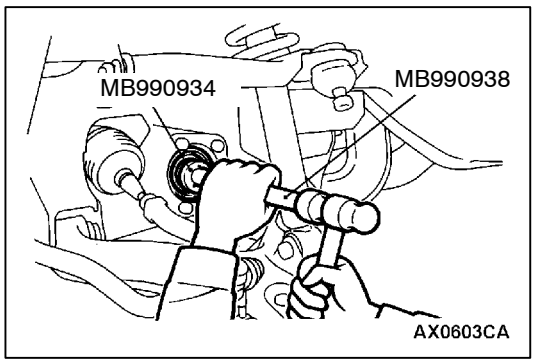
Remove the filler plug, and check the gear oil level. Check that gear oil level is not 8 mm below the bottom of filler plug hole.

Specified gear oil:
Hypoid gear oil API classification GL-5 or higher, SAE viscosity No. 90, 80W [Quantity: 1.2 L**]**

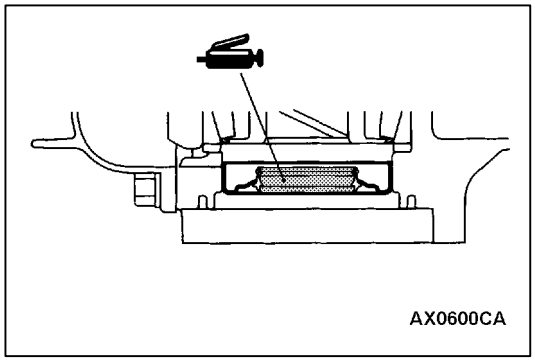


DIFFERENTIAL CARRIER OIL SEAL REPLACEMENT

1. Remove the drive shaft <L.H.>. (Refer to P.26-16.)
2. Remove the oil seal with special tools.

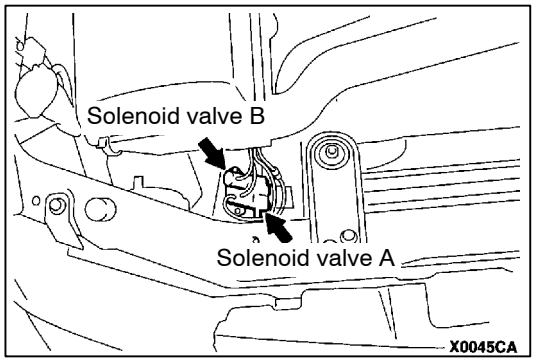


3. Install new oil seal with the special tools.



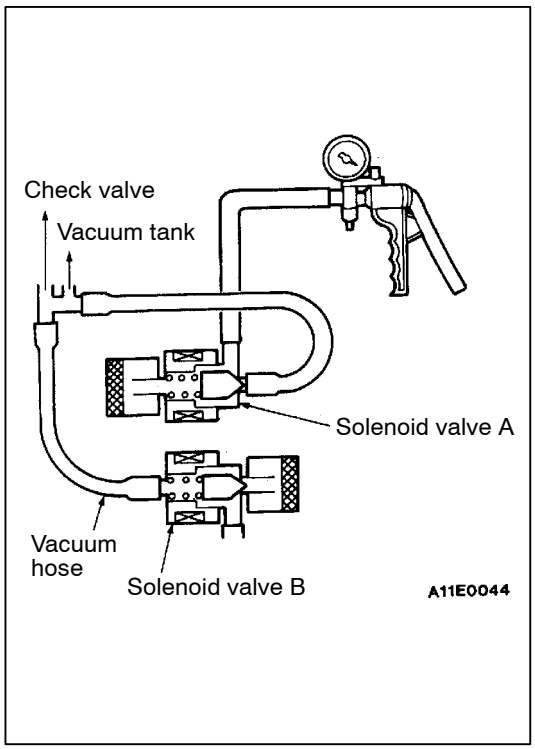
4. Apply multi-purpose grease to lip of oil seal to install drive shaft <L.H.>. (Refer to P.26-16)

Caution
1. Be careful not to damage the lip of oil seal
2. Replace the circlip attached to the spline of DOJ side of drive shaft <L.H.> with a new one.

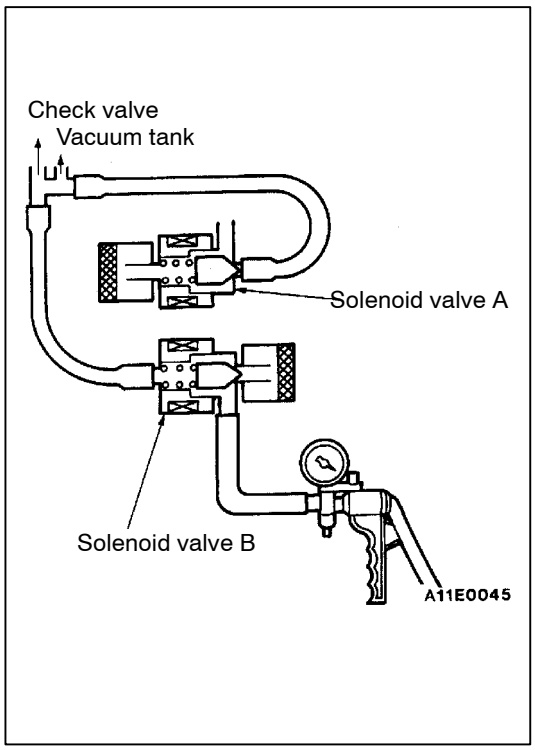


SOLENOID VALVE OPERATION CHECK

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) Even if the hand pump is operated with no other operation, no negative pressure develops.
   (2) Negative pressure does not develop when battery voltage is applied to solenoid valve A. Meanwhile, negative pressure is maintained when the vacuum hose of solenoid valve B is blocked by bending.
   (3) When battery voltage is applied to solenoid valves A and B, negative pressure is maintained.



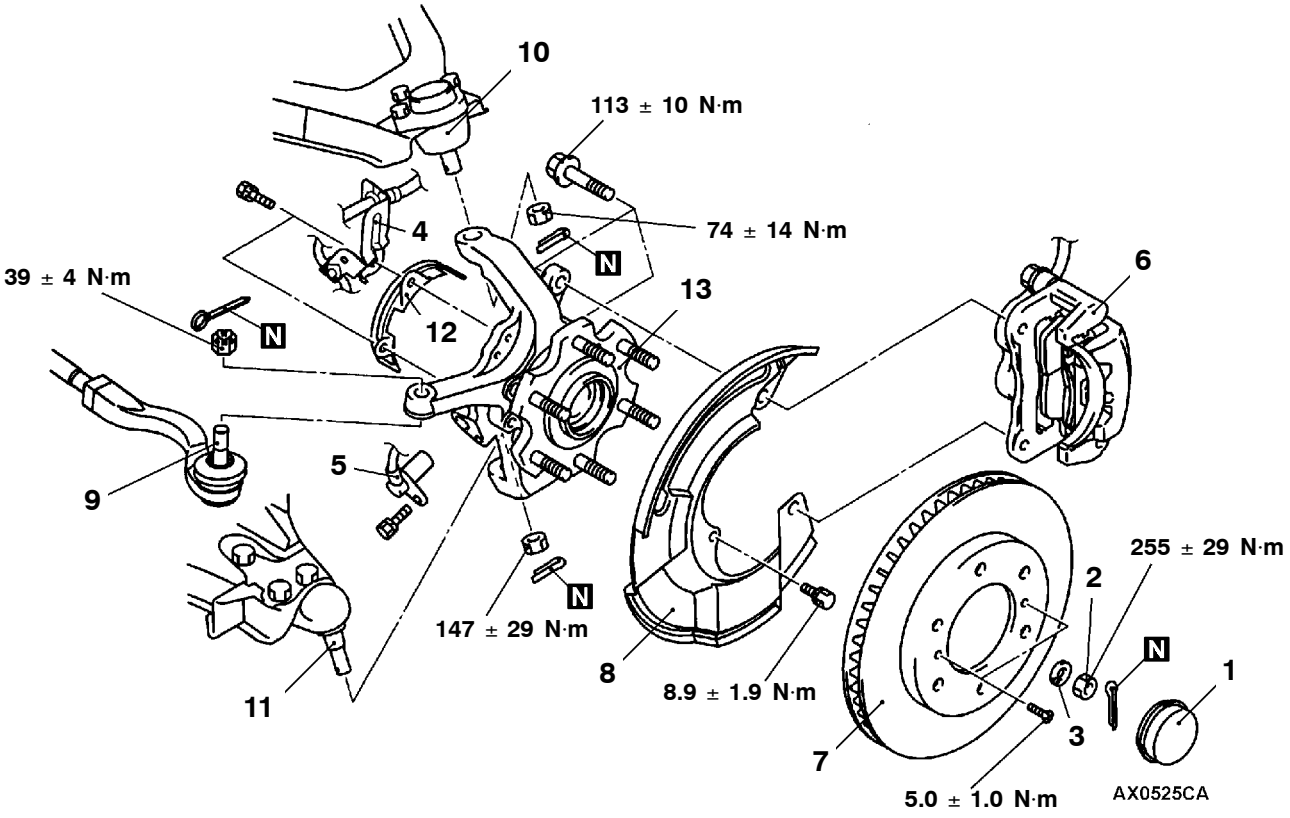
4. Connect the hand vacuum pump to solenoid valve B. Apply negative pressure and carry out the following inspections.
   (1) With no other operation, negative pressure is maintained.
   (2) When battery voltage is applied to solenoid valve B, negative pressure disappears.
   (3) When battery voltage is applied to solenoid valve A, negative pressure disappears.
5. Measure the resistance of the solenoid valves.

   Standard value: 36 - 46 Ω

HUB AND KNUCKLE ASSEMBLY

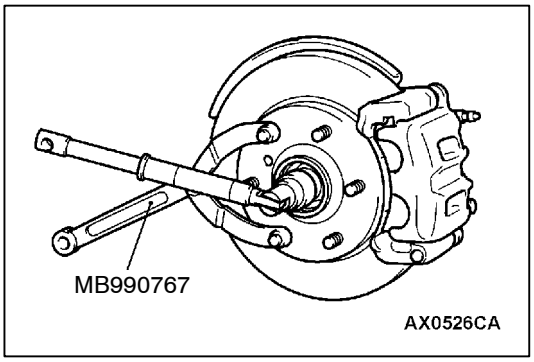
REMOVAL AND INSTALLATION

Post-installation Operation
Press dust cover with a finger to check for crack or damage in ball joint dust cover.



Removal steps

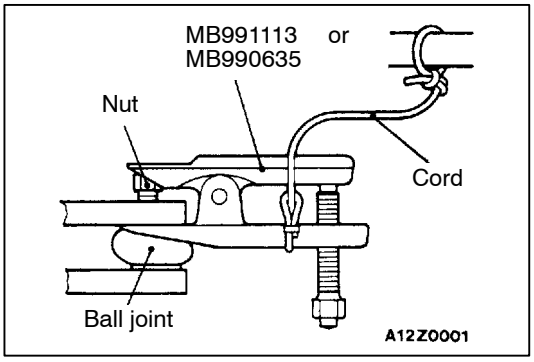
◀A▶ ▶A◀ 1. Hub cap
◀A▶ ▶A◀ 2. Castle nut
◀A▶ ▶A◀ 3. Washer
4. Brake hose & vehicle speed sensor clamp bracket
5. Wheel speed sensor <vehicles with ABS>
6. Disc brake assembly
7. Brake disc
8. Dust cover
◀B▶ 9. Tie rod end, hub and knuckle assembly connection
◀B▶ 10. Upper arm, hub and knuckle assembly connection
◀B▶ 11. Lower arm, hub and knuckle assembly connection
12. Rotor protector <vehicles with ABS>
13. Hub and knuckle assembly



REMOVAL SERVICE POINTS

◀A▶ CASTLE NUT REMOVAL

Caution
Do not apply pressure to wheel bearing by the vehicle weight to avoid possible damage when castle nut is loosened.



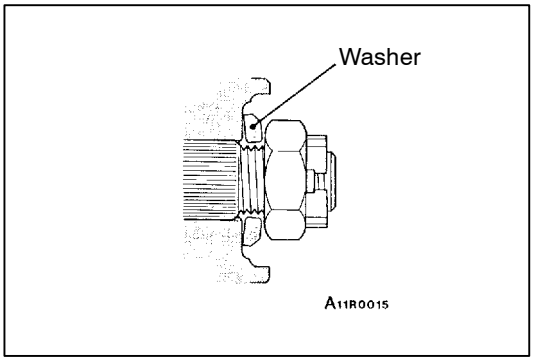
◀B▶ TIE ROD END, HUB AND KNUCKLE ASSEMBLY /UPPER ARM, HUB AND KNUCKLE ASSEMBLY /LOWER ARM, HUB AND KNUCKLE ASSEMBLY DISCONNECTION

Caution
1. **Do not remove nut from ball joint but loosen it and use special tools instead to avoid possible damage to ball joint threads.**
2. **Hang special tools with ropes to prevent them from falling.**

INSTALLATION SERVICE POINT

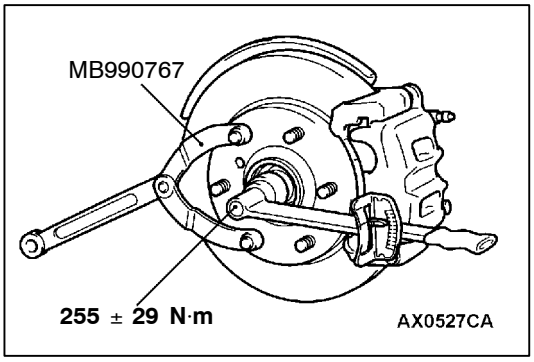
▶A◀ WASHER/CATSLE NUT INSTALLTION

1. Direct the flat side of a washer to a castle nut to install.



2. Tighten castle nut fully with special tools.

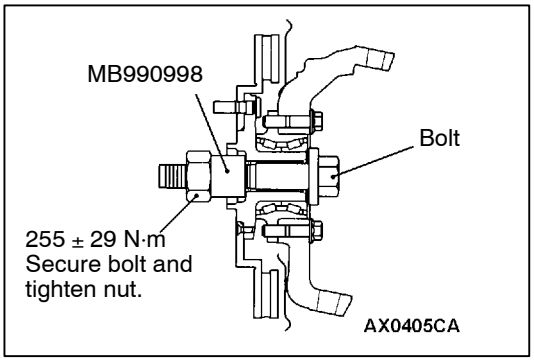
   Caution
   Do not apply pressure to wheel bearing by the vehicle weight to avoid possible damage to wheel bearing before tightening castle nut fully.
3. If the pin hole does not align with another, tighten the pin to 284 N·m and find the nearest hole then bend the sprit pin to fit in.

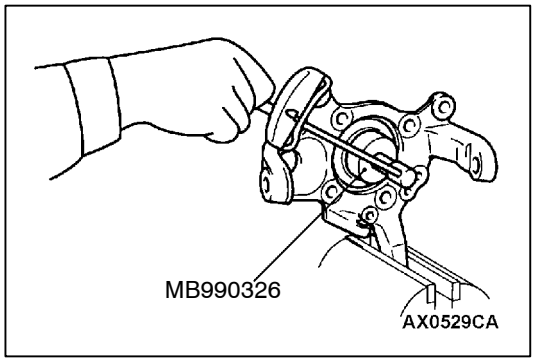


INSPECTION

INSPECTION OF HUB ROTATION STARTING TORQUE

1. Tighten special tools in hub and knuckle assembly to the specified torque.

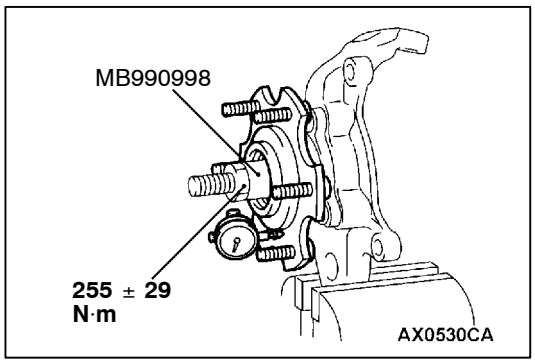




2. Measure the hub rotation starting torque with special tools.

   Limit: 1.75 N·m or less

3. Hub rotation starting torque must be under the limit value and there should be no roughness when rotating the hub.



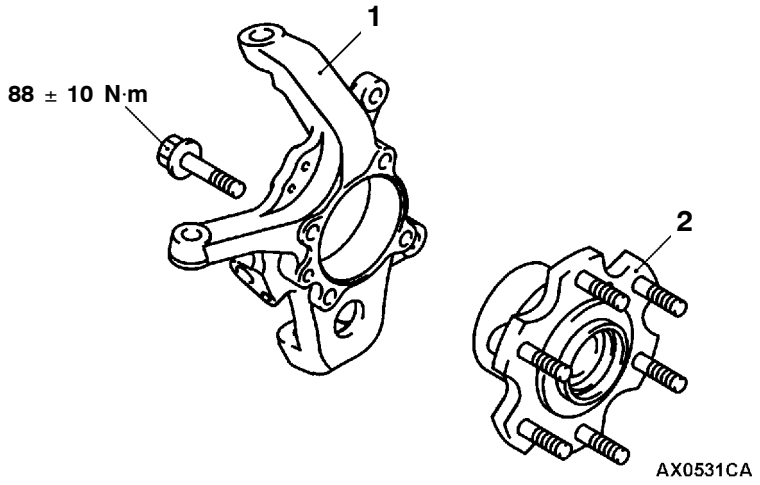
WHEEL BEARING BACKLASH CHECK

1. Secure knuckle in a vice to measure backlash in wheel bearing.

   Limit: 0 mm

2. If the limit value of backlash in hub axis cannot be obtained when tightened to the specified torque (255 ± 29 N·m), check mounting bolt for hub and knuckle assembly. If no defects are found, replace hub assembly.

DISASSEMBLY AND REASSEMBLY



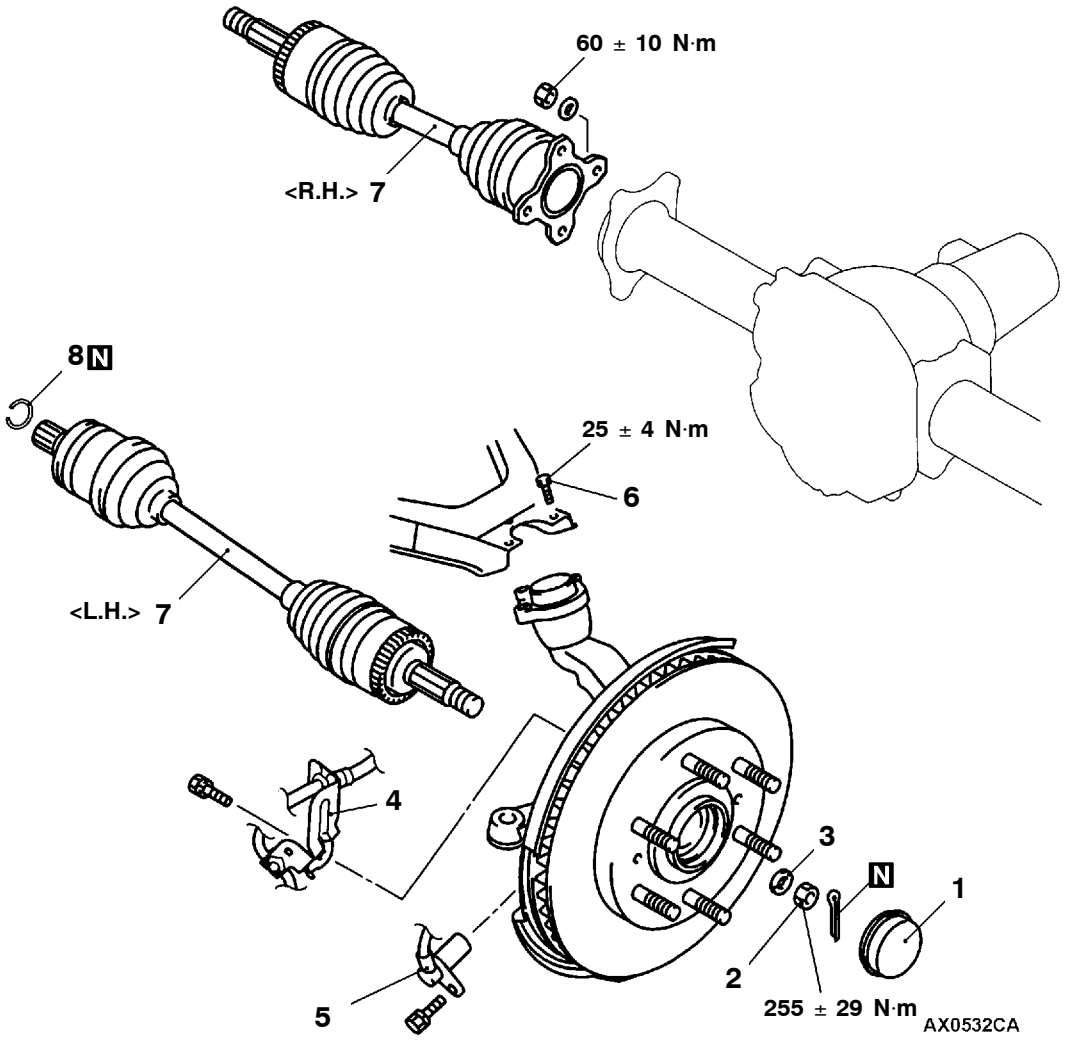
Disassembly steps

1. Knuckle
2. Front hub assembly

DRIVE SHAFT

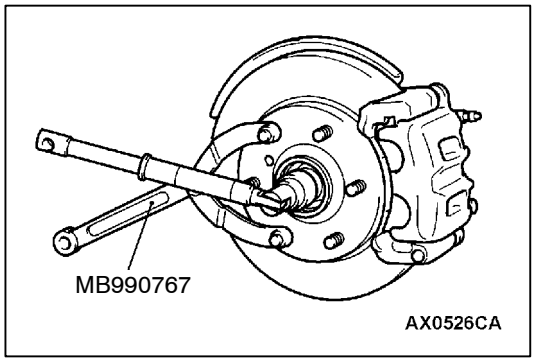
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations
- Removal and Installation of Under Cover and Skid Plate (Refer to GROUP 42.)
- Connection and Disconnection of Shock Absorber and Stabilizer Link in the Lower Arm Side (Refer to GROUP 33 - Lower Arm.)
- Removal and Installation of Front Brake Assembly (Refer to GROUP 35A.)
- Connection and Disconnection of Knuckle and Tie Rod End (Refer to GROUP 37 - Steering Gear Linkage.)



Removal steps

◀A▶ ▶B◀ 1. Hub cap
◀A▶ ▶B◀ 2. Castle nut
▶B◀ 3. Washer
4. Brake hose and vehicle speed sensor clamp bracket
5. Wheel speed sensor <vehicles with ABS>
6. Upper arm and upper arm ball joint connection
◀B▶ ▶A◀ 7. Drive shaft
8. Circlip <L.H.>



REMOVAL SERVICE POINTS

◀A▶ CASTLE NUT REMOVAL

Caution
Do not apply pressure to wheel bearing by the vehicle weight to avoid possible damage when a castle nut is loosened.

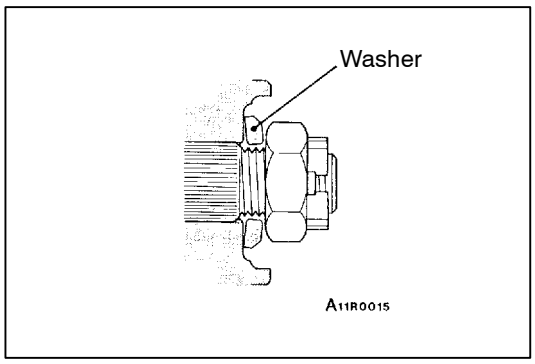
◀B▶ DRIVE SHAFT REMOVAL

Caution
When pulling the drive shaft out from the differential carrier, be careful that the spline part of the drive shaft does not damage the oil seal.

INSTALLATION SERVICE POINTS

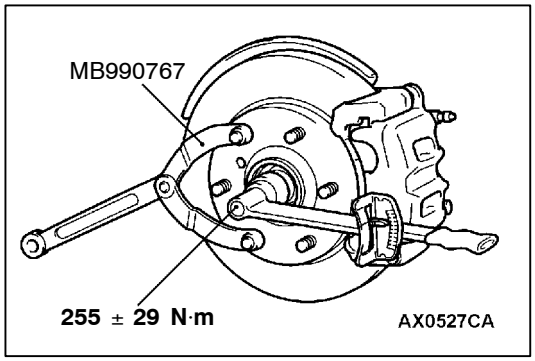
▶A◀ DRIVE SHAFT INSTALLATION

Caution
Do not damage the oil seal of the differential carrier by the drive shaft splines.



▶B◀ WASHER/CASTLE NUT INSTALLATION

1. Fit washer in castle nut with its smaller side facing the castle nut.



2. Tighten up castle nut with special tools.

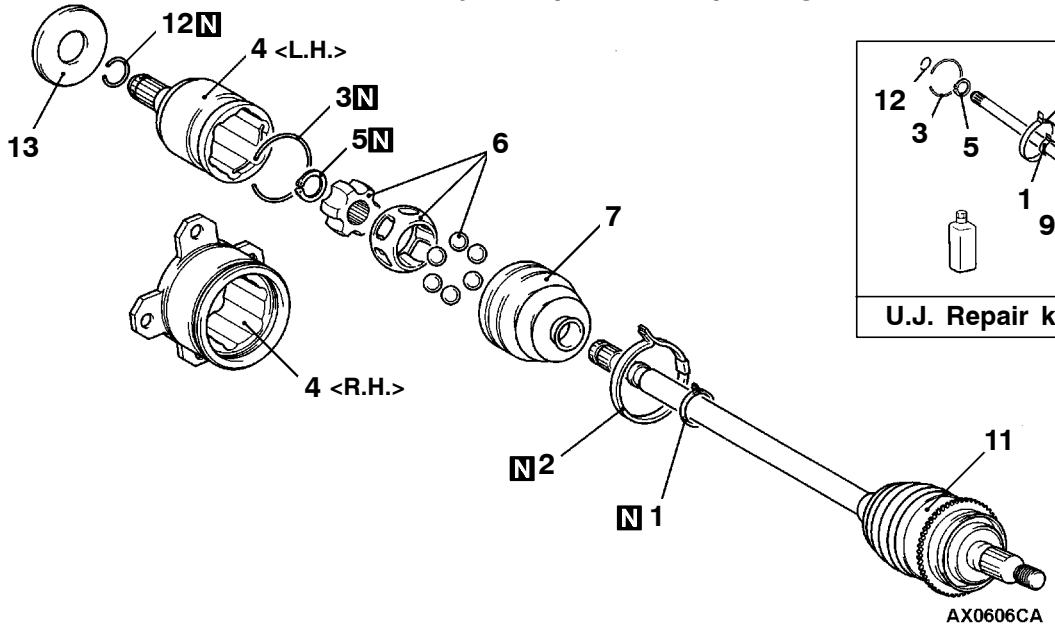
   Caution
   Do not apply pressure to wheel bearing by the vehicle weight to avoid possible damage before tightening up castle nut.
3. In this case, if the pin holes do not match, tighten the nut to 284 N·m and find the most suitable hole to bend the nut with a split pin.

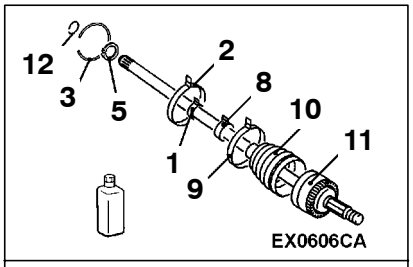
INSPECTION

- Check the boot for damage or deterioration.
- Check the ball joint for operating condition and excessive looseness.
- Check the splines for wear or damage.
- Check the differential carrier oil seal (L.H.) for damage.

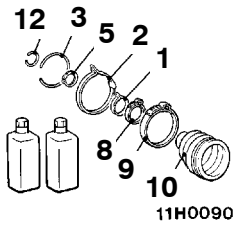
DISASSEMBLY AND REASSEMBLY

Caution
Never disassemble the U.J. assembly except when replacing the U.J. boot.

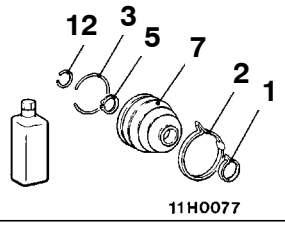




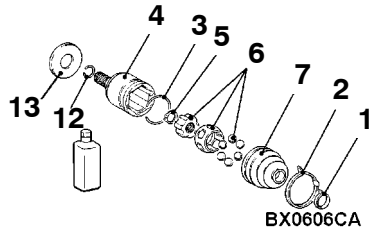
U.J. Repair kit



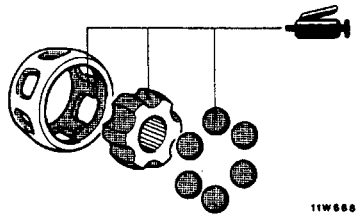
U.J. boot repair kit



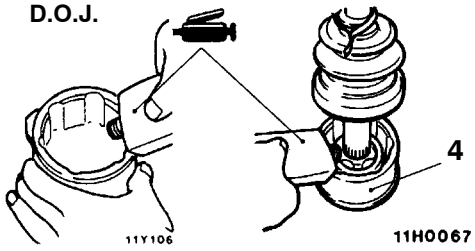
D.O.J. boot repair kit

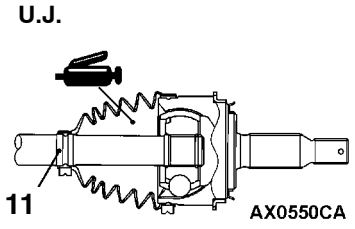


D.O.J. repair kit



Grease: repair kit grease



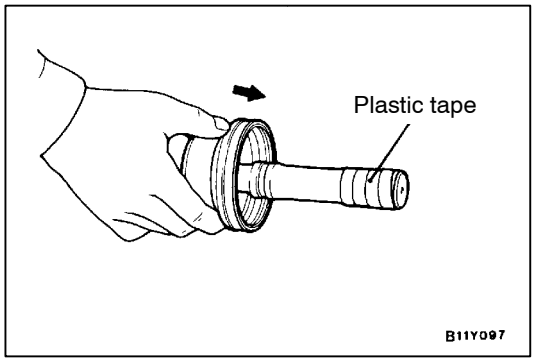


Grease: Repair kit grease
Quantity: <U.J.>4M41-M/T: 180 ± 10 g (90 ± 5 g inside joint, 90 ± 5 g inside boot), 4M41-A/T, 4D5 6G7:135 ± 10 g (65 ± 5 g inside joint, 70 ± 5 g inside boot) <D.O.J.>4M41-M/T: 135 ± 10 g (75 ± 5 g inside joint, 60 ± 5 g inside boot), 4M41-A/T, 4D5 6G7:100 ± 10g (60 ± 5 g inside joint, 40 ± 5 g inside boot)

Caution
Do not mix old and new or different types of grease, as a special grease is used in the joint.

Disassembly steps

▶B◀ 1. D.O.J. boot band (small)
▶B◀ 2. D.O.J. boot band (large)
3. Circlip
4. D.O.J. outer race
5. Snap ring
6. Inner race, cage and ball assembly
◀A▶ ▶A◀ 7. D.O.J. boot
8. U.J. boot band (small)
9. U.J. boot band (large)
10. U.J. boot
11. U.J. assembly
12. Circlip <L.H.>
13. Circlip <L.H.>



DISASSEMBLY SERVICE POINT

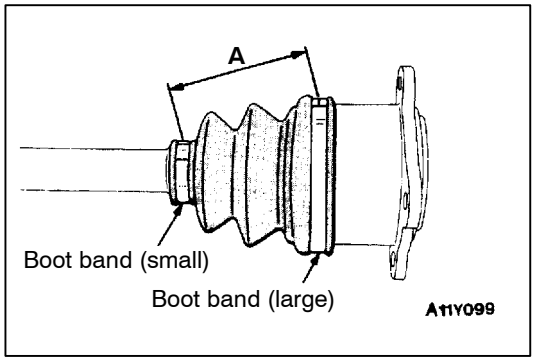
◀A▶ D.O.J. BOOT REMOVAL

Wrap plastic tape around the spline part on the U.J. assembly so that D.O.J. boot is not damaged when they are removed.

REASSEMBLY SERVICE POINTS

▶A◀ D.O.J. BOOT INSTALLATION

Install boot after wrapping plastic tape around the spline part on the U.J. assembly.

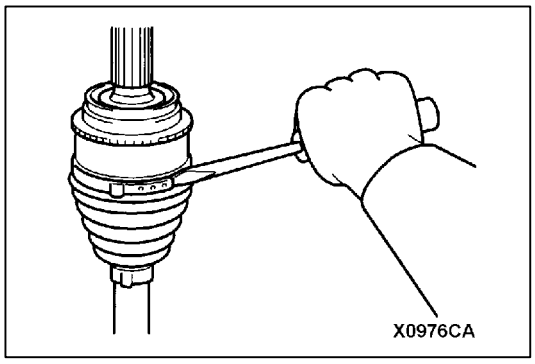


▶B◀ D.O.J. BOOT BAND/D.O.J. BOOT BAND INSTALLATION

1. Position the D.O.J. outer race so that the distance between the boot bands is at the standard value.

   Standard value (A): 80 ± 5 mm

2. Remove part of the D.O.J. boot from the D.O.J. outer race to release the air pressure inside the boot.

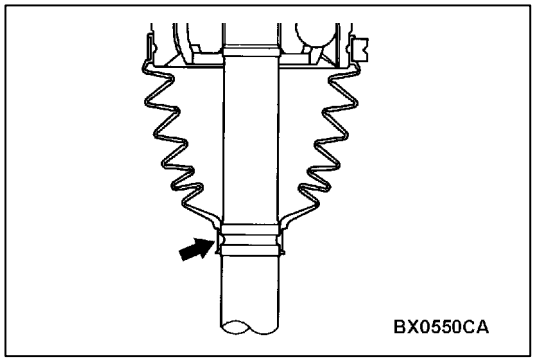


U.J. BOOT (RESIN BOOT) REPLACEMENT

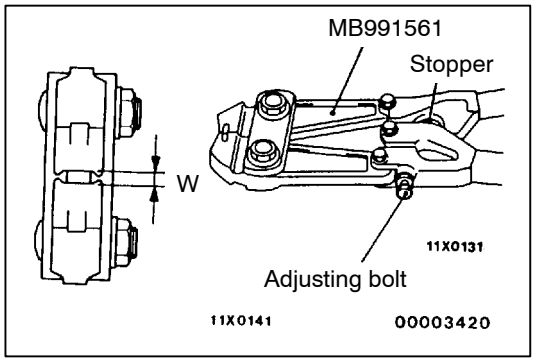
1. Remove the boot bands (large and small).

   NOTE
   The B.J. boot bands cannot be re-used.

2. Remove the B.J. boot.



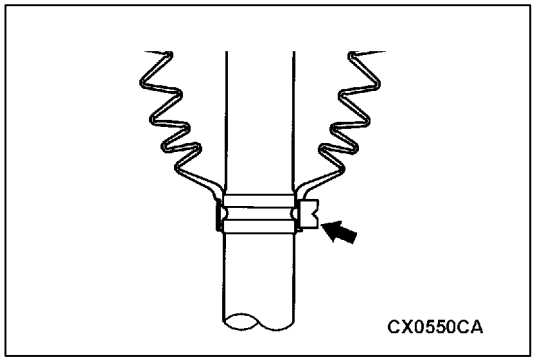
3. Install the small part on the plastic boot aligning the groove of the shaft.



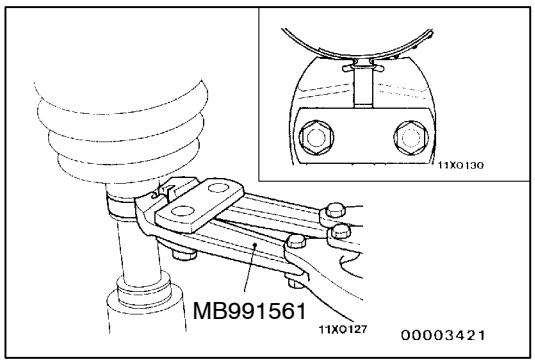
4. Turn the adjusting bolt on the special tool so that the size of the opening (W) is at the standard value.

Standard value (W): 2.9 mm
<If it is larger than 2.9 mm>
Tighten the adjusting bolt.
<If it is smaller than 2.9 mm>
Loosen the adjusting bolt.

NOTE
(1) The value of W will change by approximately 0.7 mm for each turn of the adjusting bolt.
(2) The adjusting bolt should not be turned more than once.

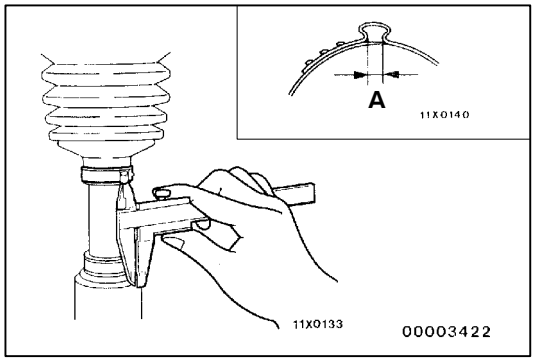


5. Install the U.J. boot band (small) to the U.J. boot.



6. Use the special tool to crimp the U.J. boot band (small).

Caution
(1) Secure the drive shaft in an upright position and clamp the part of the U.J. boot band to be crimped securely in the jaws of the special tool.
(2) Crimp the U.J. boot band until the special tool touches the stopper.



7. Check that crimping amount (A) of the U.J. boot band is at the standard value.

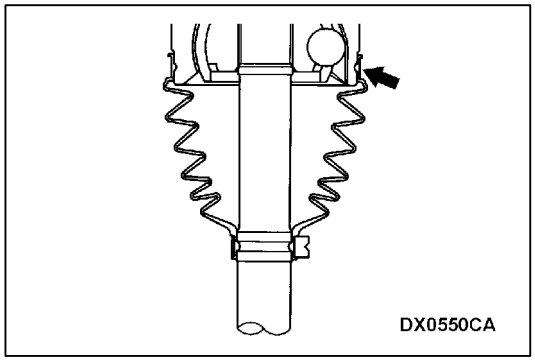
Standard value (A): 2.4 - 2.8 mm
<If the crimping amount is larger than 2.8 mm>
Readjust the value of (W) in step (4) according to the following formula, and then repeat the operation in step (6).
W = 5.5 mm - A
Example: If A = 2.9 mm, then W = 2.6 mm.

<If the crimping amount is smaller than 2.4 mm>
Remove the U.J. boot band, readjust the value of (W) in step (4) according to the following formula, and then repeat the operations in steps (5) and (6) using a new B.J. boot band.
W = 5.5 mm - A
Example: If A = 2.3, then W = 3.2 mm.

8. Check that the U.J. boot band is not sticking out past the place where it has been installed.
   If the U.J. boot band is sticking out, remove it and then repeat the operations in steps (4) to (7) using a new U.J. boot band.
9. Fill the inside of the U.J. boot with the specified amount of the specified grease.

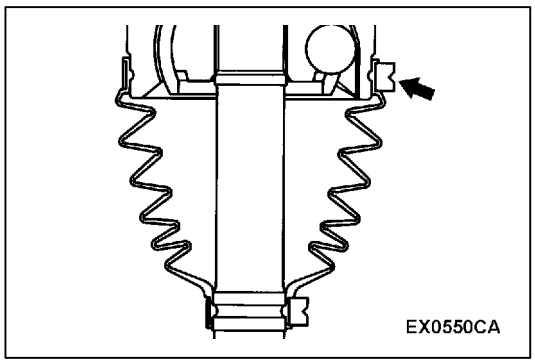
   Specified grease: Repair kit grease

   Amount to use:
   Vehicles with 4M41-M/T: 180 ± 10 g
   (90 ± 5 g inside joint, 90 ± 5 g inside boot)
   Vehicles with 4M41-A/T, 4D5 6G7: 135 ± 10 g
   (65 ± 5 g inside joint, 70 ± 5 g inside boot)

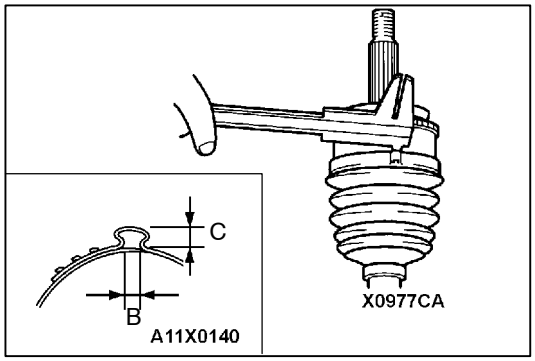


10. Install the large diameter part on the plastic boot alighning the groove of the shaft.
11. Follow the same procedure as in step (4) to adjust the size of the opening (W) on the special tool so that it is at the standard value.

    Standard value (W): 3.2 mm



12. Install the U.J. boot band (large) to the U.J. boot.
13. Use the special tool to crimp the U.J. boot band (large) in the same way as in step (6).



14. Check that the crimping amount (B) of the U.J. boot band is at the standard value and that the crimping amount (C) of the U.J. boot band is at the limited value

    Standard value (B): 2.4 - 2.8 mm

    Limit (C): 9.5 mm

<If the crimping amount is larger than 2.8 mm>
Readjust the value of (W) in step (11) according to the following formula, and then repeat the operation in step (13).
W = 5.8 mm - B
Example: If B = 2.9 mm, then W = 2.9 mm.

<If the crimping amount is smaller than 2.4 mm>
Remove the U.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 U.J. boot band.
W = 5.8 mm - B
Example: If B = 2.3 mm, then W = 3.5mm.

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

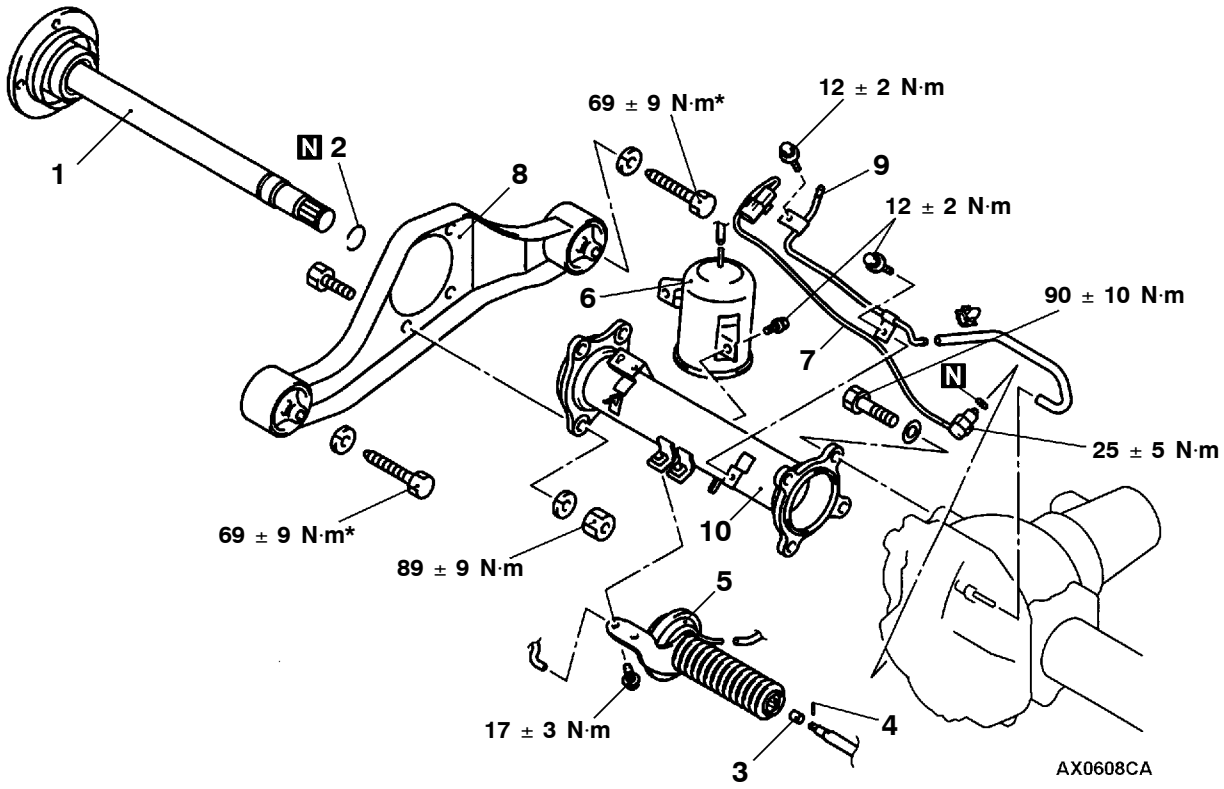
INNER SHAFT, HOUSING TUBE

REMOVAL AND INSTALLATION

Caution

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

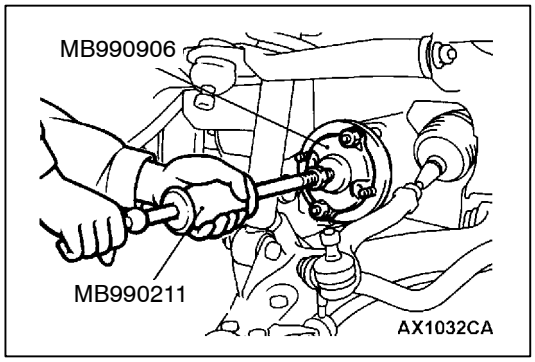
Pre-removal and Post-installation Operation
- Under Cover and Skid Plate Removal and Installation
- Drive Shaft <R.H.> Removal and Installation (Refer to P.26-16.)



Removal steps

◀A▶ ▶B◀ 1. Inner shaft
2. Clip
3. Collar
4. Pin
5. Actuator assembly
6. Vacuum tank assembly
7. Engage switch assembly

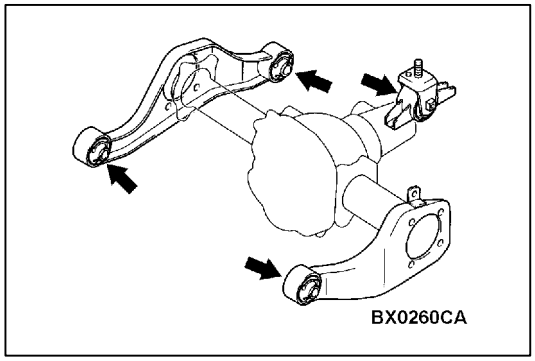
◀B▶ ▶A◀ • Loosening and tightening of differential mounting insulator bolt
• Support the differential by a transmission jack.
8. Differential mounting bracket <R.H.>
9. Breather pipe
12. Housing tube



REMOVAL SERVICE POINTS

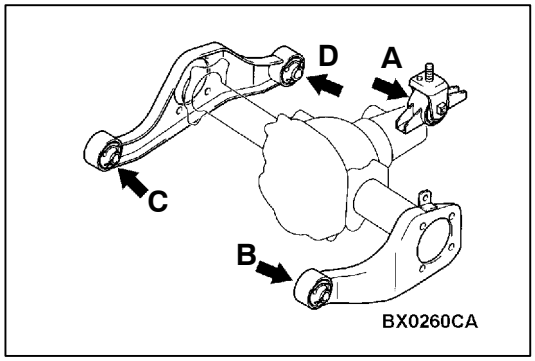
◀A▶ INNER SHAFT REMOVAL

Caution
When pulling the inner shaft out from the front differential carrier, be careful that the spline part of the inner shaft does not damage the oil seal.



◀B▶ DIFFERENTIAL MOUNTING INSULATOR BOLT LOOSENING

Loose the bolt shown in the diagram.



INSTALLATION SERVICE POINT

▶A◀ DIFFERENTIAL MOUNTING INSULATOR BOLT TIGHTENING

Tighten the bolts shown in the diagram in the serivce specification in the order of A, B, C, D or A, C, B, D.

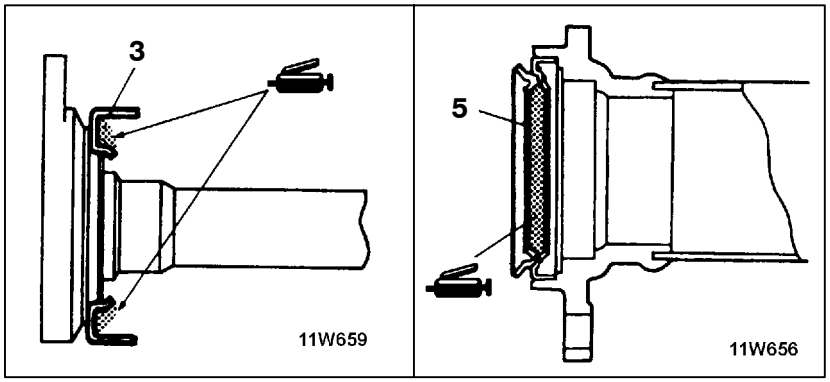
Tightening torque: 69 ± 9 N·m

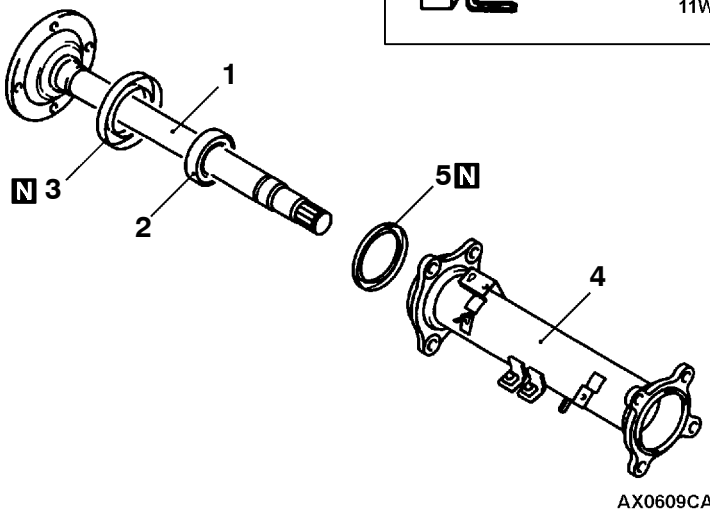
Caution
Place the vehicle on the ground after temporarily tighten bolts to prevent bushes from twisting and fully tighten the bolts in the unladen condition.

▶B◀ INNER SHAFT INSTALLATION

Caution
Be careful not to damage the lip of the dust seal and oil seal.

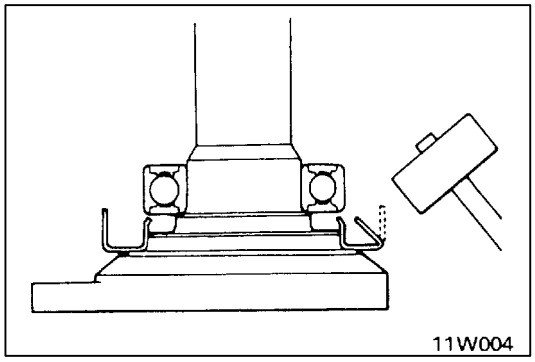
DISASSEMBLY AND REASSEMBLY

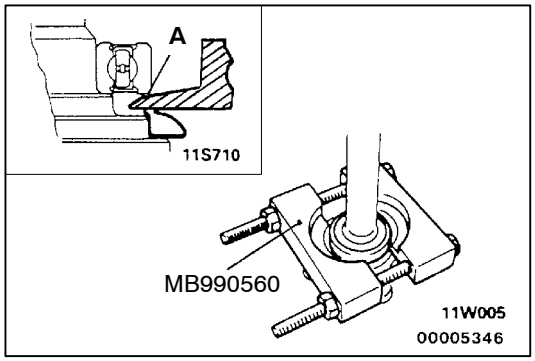




Disassembly steps

◀A▶ ▶C◀ ▶B◀ 1. Inner shaft
2. Bearing
3. Dust cover
4. Housing tube
▶A◀ 5. Dust seal

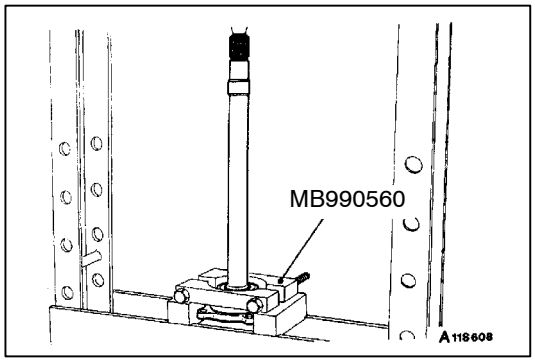




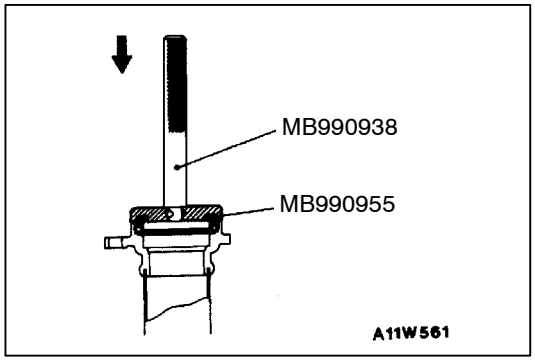
DISASSEMBLY SERVICE POINT

◀A▶ BEARING REMOVAL

1. Bend the outside periphery of dust cover inward with a hammer.
2. After the special tool has been installed as shown, tighten the nut of the special tool until the portion “A” of the special tool touches the bearing outer race.



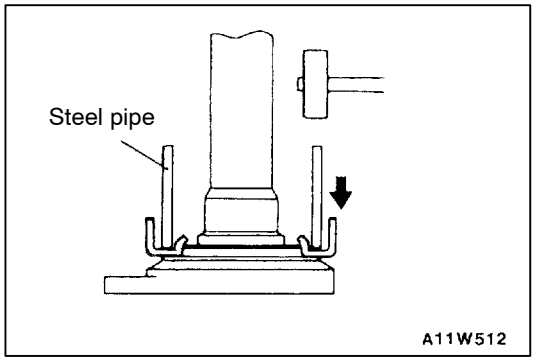
3. Press out the inner shaft from the bearing.



REASSEMBLY SERVICE POINTS

▶A◀ DUST SEAL INSTALLATION

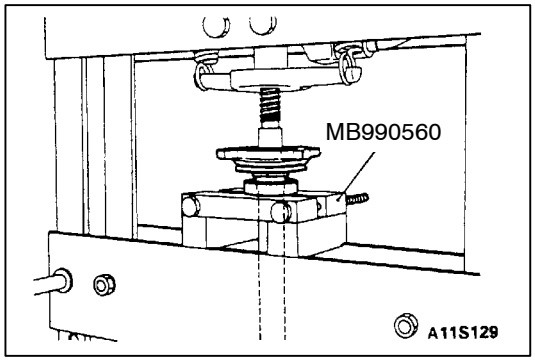
Press-fit the new dust seal into the housing tube by using the special tools, until it is flush with the housing tube end face.



▶B◀ DUST COVER INSTALLATION

Using a steel pipe, force a new dust cover onto the inner shaft.

Steel pipe	mm
Overall length	50
Outside diameter	75
Wall thickness	4



▶C◀ BEARING INSTALLATION

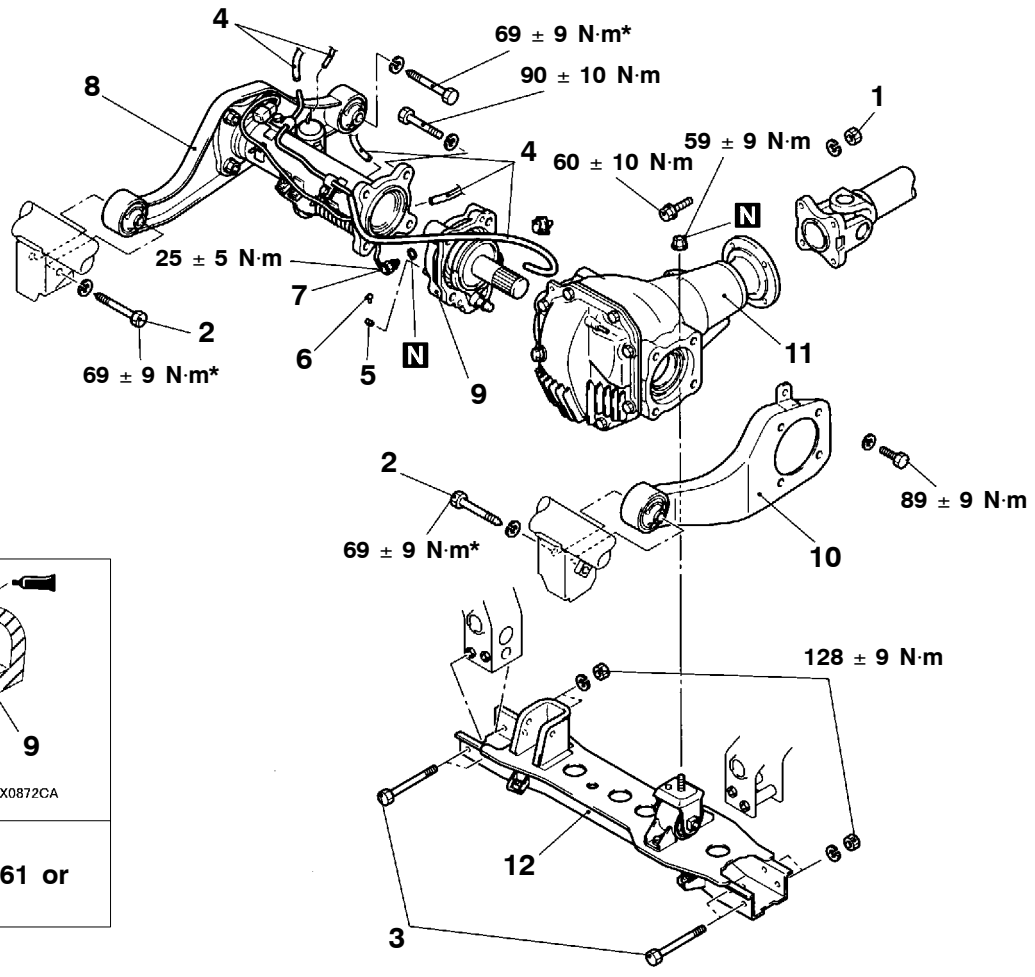
FREEWHEEL CLUTCH ASSEMBLY, DIFFERENTIAL CARRIER

REMOVAL AND INSTALLATION

Caution

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

Pre-removal and Post-installation
- Under Cover and Skid Plate Removal and Installation
- Gear Oil Draining and Refill (Refer to P.26-11.)
- Drive Shaft Removal and Installation (Refer to P.26-16.)
- Inner Shaft Removal and Installation (Refer to P.26-24.)



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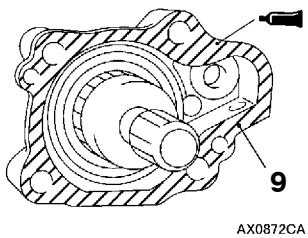
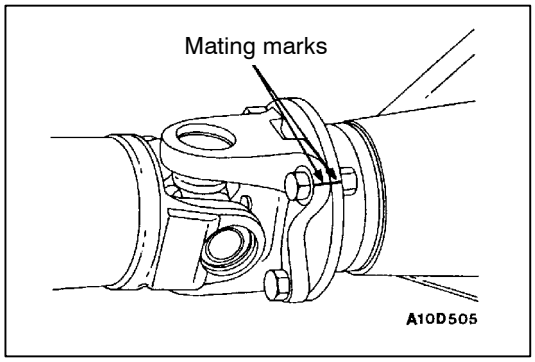


AX0872CA

Sealant:
3M ATD Part No. 8661 or equivalent

Removal steps

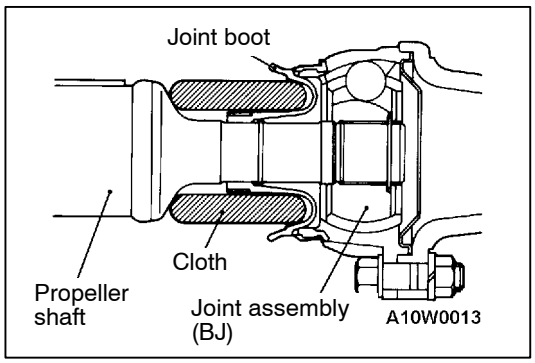
◀A▶ ▶B◀ 1. Front propeller shaft connection
2. Front frame and differential bracket connection
3. Front frame and No.2 crossmember assembly connection
4. Vacuum hose
5. Collar
◀B▶ 6. Pin
7. Freewheel engage switch assembly
▶A◀ 8. Differential mounting bracket <R.H.> and housing tube assembly
9. Freewheel clutch assembly
▶A◀ 10. Differential mounting bracket <L.H.>
11. Differential carrier
12. No.2 crossmember assembly



REMOVAL SERVICE POINTS

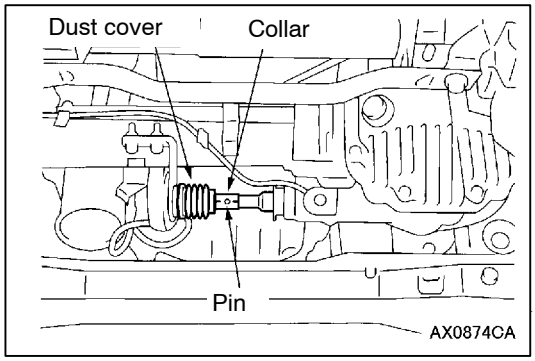
◀A▶ FRONT PROPELLER SHAFT DISCONNECTION

Make the mating marks on the flange yoke and the differential carrier companion flange and then remove the front propeller shaft.



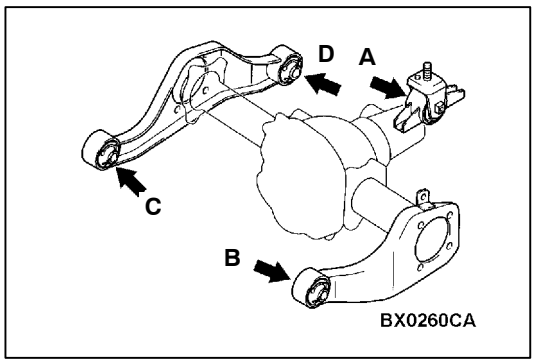
Caution

1. **Be careful not to damage joint boot by cramping with the bent propeller shaft joint.**
2. **Hang propeller shaft with wires to prevent it from falling.**



◀B▶ PIN REMOVAL

1. Remove one side of dust cover mounting part on the Vaccum Actuator Assembly.
2. Match a pin with a pin hole and remove the pin with with a punch.



INSTALLATION SERVICE POINTS

▶A◀ DIFFERENTIAL MOUNTING BRACKET ASSEMBLY TIGHTENING

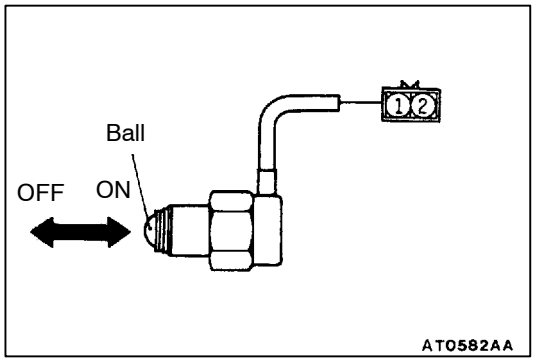
Tighten differential mounting insulator in the order of A, B, C, D or A, C, B, D as shown in the left diagram.

▶B◀ FRONT PROPELLER SHAFT INSTALLATION

Install the front propeller shaft so that the mating marks of the flange yoke and the differential carrier companion flange are aligned.

Caution

Do not tighten fasteners without removing grease from threads because fastner threads covered with oily products could become loose.



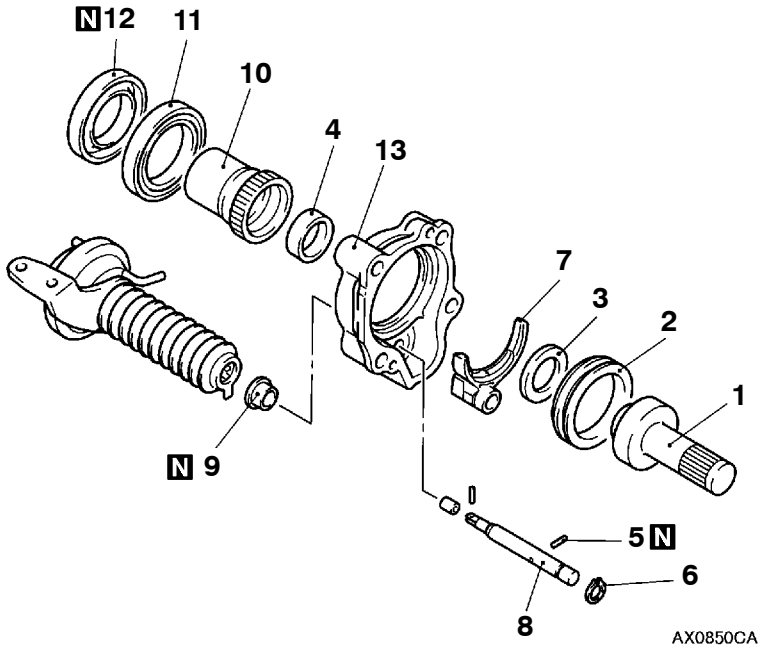
INSPECTION

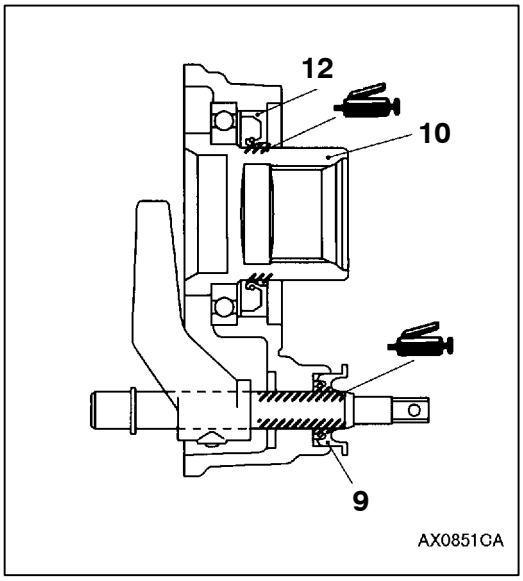
FREEWHEEL ENGAGE SWITCH

Shaft (switch) position	Terminal No. 1	Terminal No. 2
Pressed (ON)	○	○
Released (OFF)		

FREEWHEEL CLUTCH ASSEMBLY

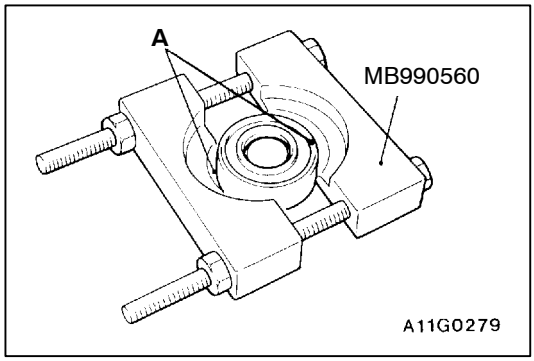
DISASSEMBLY AND REASSEMBLY





Disassembly steps

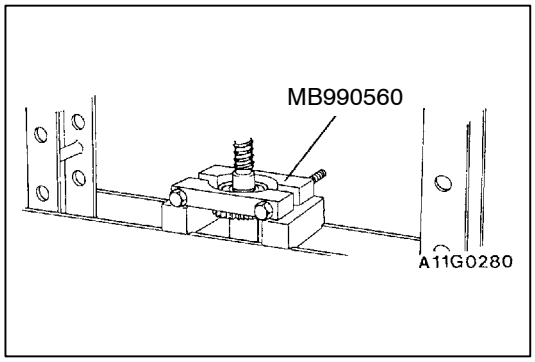
◀A▶ 1. Main shaft
2. Clutch sleeve
3. Spacer
◀A▶ ▶E◀ 4. Bearing
▶D◀ 5. Spring pin
6. Snap ring
7. Shift fork
8. Shift rod
▶C◀ 9. Oil seal
◀B▶ ▶B◀ 10. Clutch gear
◀B▶ ▶B◀ 11. Bearing
▶A◀ 12. Oil seal
13. Clutch housing



DISASSEMBLY SERVICE POINTS

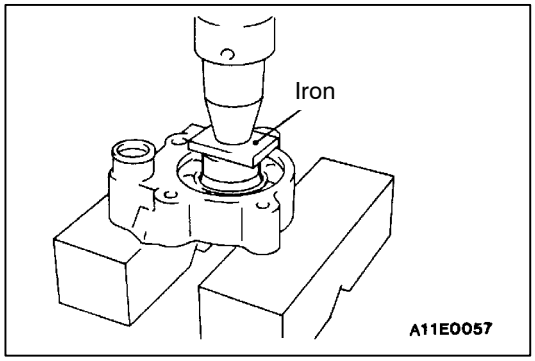
◀A▶ MAINSHAFT/BEARING REMOVAL

1. After the special tool has been installed as shown, tighten the nut of the special tool until the portion “A” of the special tool touches the bearing outer race.



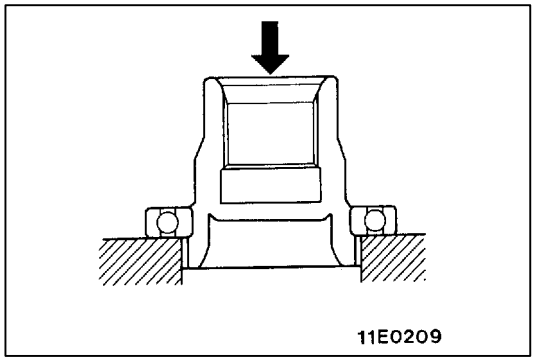
2. Press out the mainshaft from the bearing.

Caution
Do not allow the mainshaft to drop.



◀B▶ CLUTCH GEAR/BEARING REMOVAL

1. Use a press and steel plate to remove the clutch gear and bearing together.

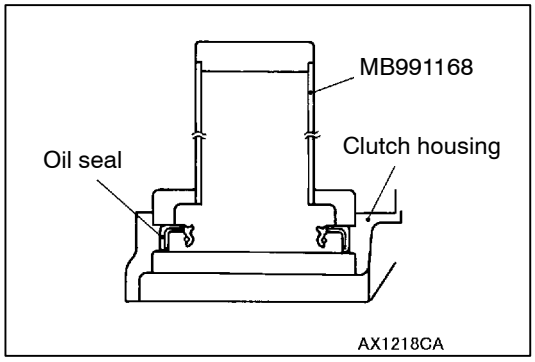


2. Use a press to hold the supports against the bearing inner race, and separate the clutch gear and bearing.

REASSEMBLY SERVICE POINTS

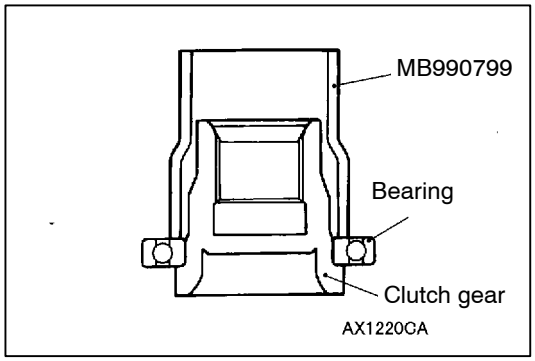
▶A◀ OIL SEAL INSTALLATION

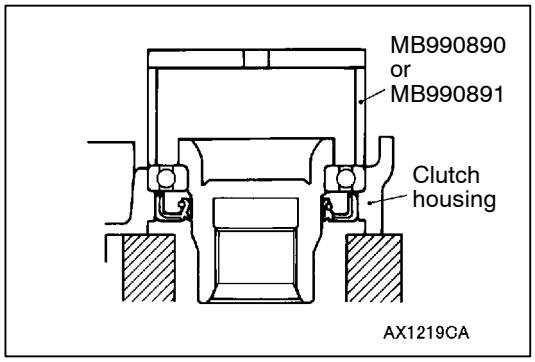
Use the special tool to tap the oil seal until it is flush with the clutch housing.



▶B◀ BEARING/CLUTCH GEAR INSTALLATION

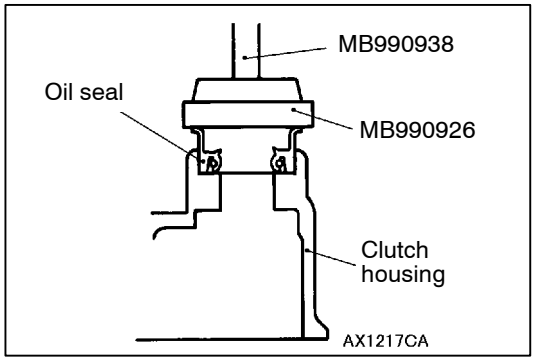
1. Use the special tool to press-fit the bearing to the shoulder of the clutch gear.



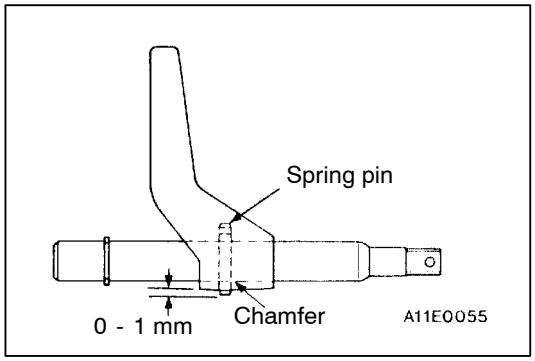


2. Use the special tool to press-fit the bearing to the side of the clutch housing.

Caution
Place the special tool against the outer race of the bearing.

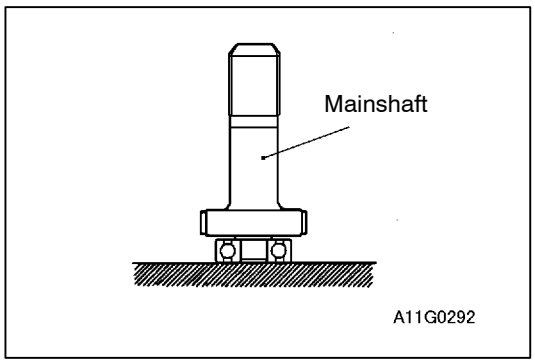


▶C◀ OIL SEAL INSTALLATION



▶D◀ SPRING PIN INSTALLATION

Tap the spring pin from the chamfered side of the shift rod until the projection length becomes length shown in the illustration.

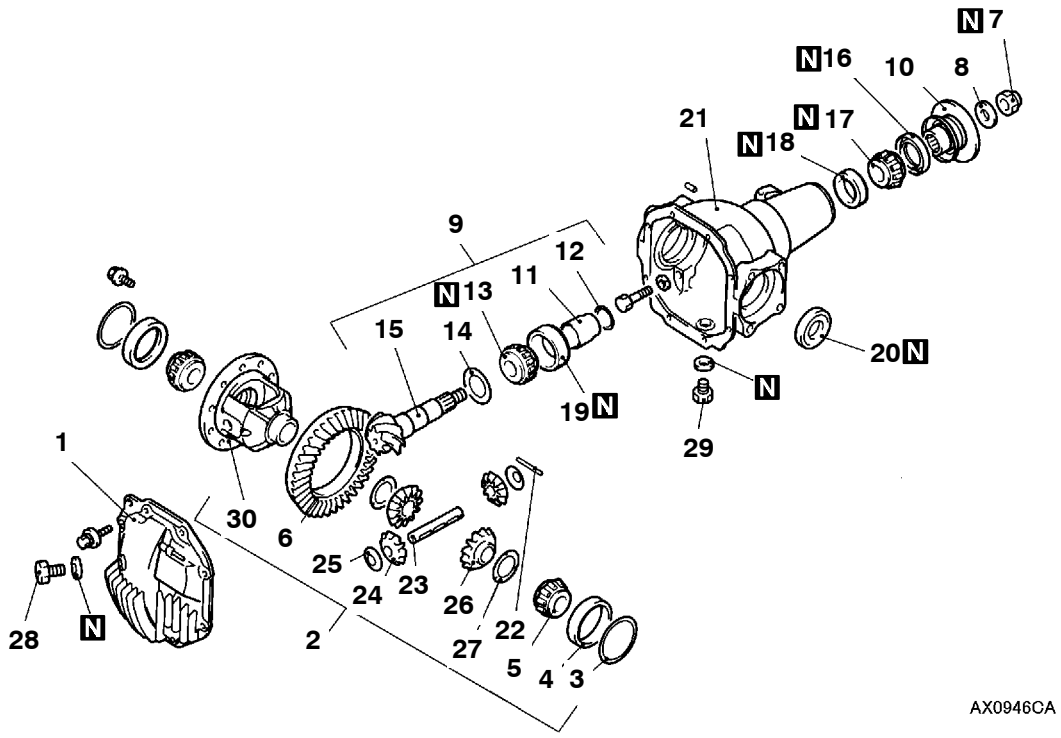


▶E◀ BEARING INSTALLATION

Press-fit the bearing to the shoulder of the mainshaft.

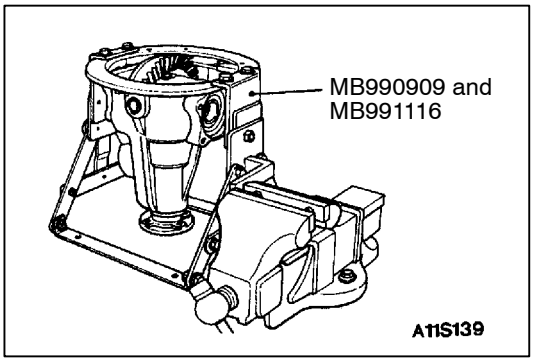
DIFFERENTIAL CARRIER

DISASSEMBLY



Disassembly steps

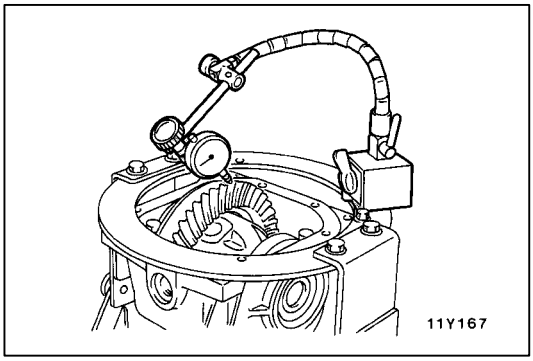
◀A▶ • Inspection before disassembly
1. Cover
◀B▶ 2. Differential case assembly
3. Side bearing spacer
4. Side bearing outer race
◀C▶ 5. Side bearing inner race
◀D▶ 6. Drive gear
◀E▶ 7. Self-locking nut
8. Washer
◀F▶ 9. Drive pinion assembly
10. Companion flange
11. Drive pinion spacer
12. Drive pinion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



DISASSEMBLY SERVICE POINTS

◀A▶ INSPECTION BEFORE DISASSEMBLY

1. Remove the cover and gasket.
2. Hold the special tool in a vise, and install the differential carrier assembly to the special tool.

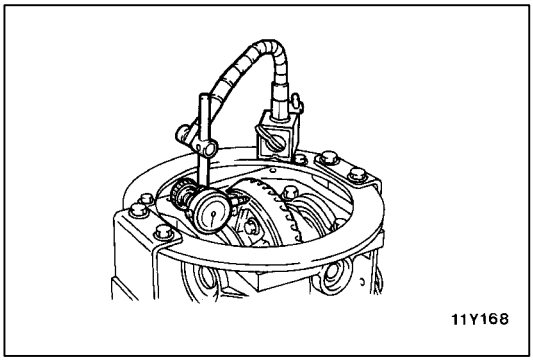


DRIVE GEAR BACKLASH

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 drive gear backlash (See P.26-47).
3. After the adjustment, inspect the drive gear tooth contact.

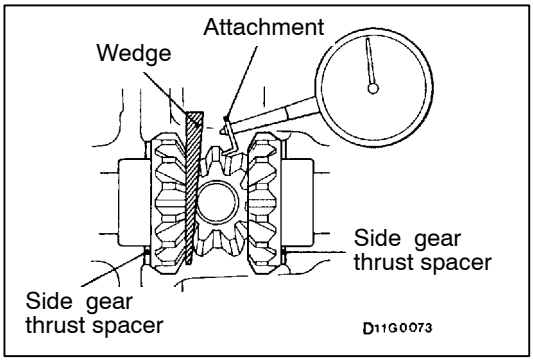


DRIVE GEAR RUNOUT

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.



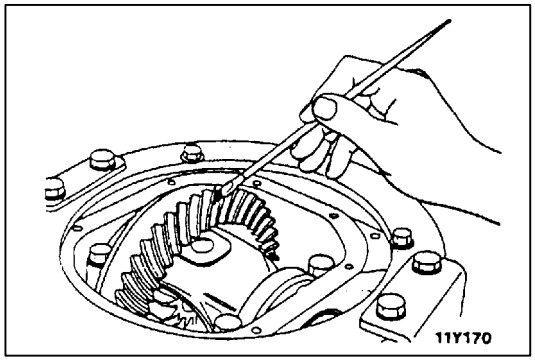
DIFFERENTIAL GEAR BACKLASH

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 both pinion gears.

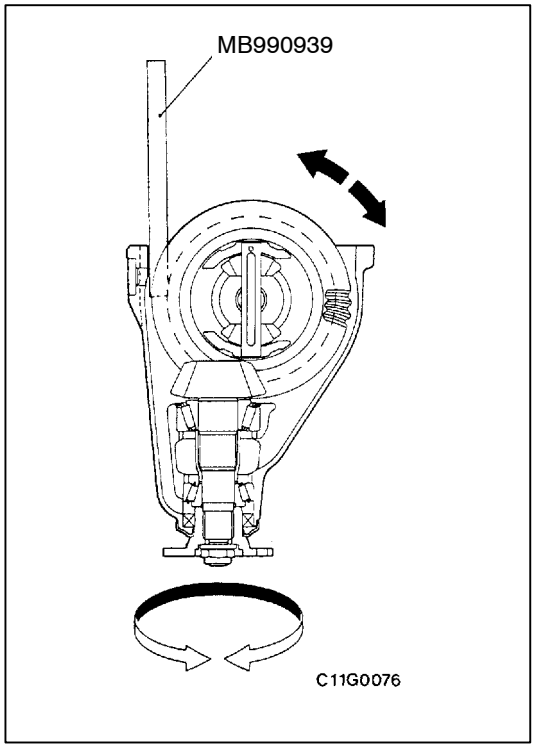
2. If the backlash exceeds the limit, adjust by using the side gear thrust spacers.
3. If adjustment is impossible, replace the side gear and pinion gear as a set.



DRIVE GEAR TOOTH CONTACT

Check the tooth contact of drive gear by following the steps below.

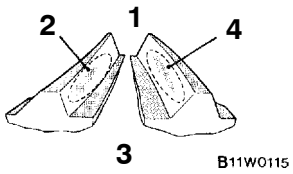
1. Apply a thin, uniform coat of machine blue to both surfaces of the drive gear teeth.

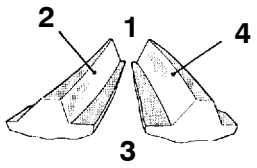


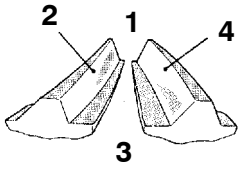
2. Insert the brass between the differential carrier and the differential case, and then rotate the companion flange by hand (once in the normal direction, and then once in the reverse direction) while applying a load to the drive gear so that the revolution torque (approximate 2.5 - 3.0 N·m) is applied to the drive pinion.

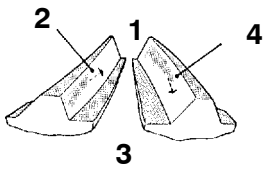
   Caution
   If the drive gear is rotated too much, the tooth contact pattern will become unclear and difficult to check.

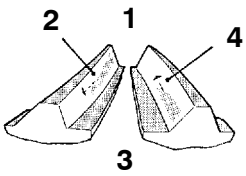
3. Check the tooth contact condition of the drive gear and drive pinion.

<table>
<tr><th>Standard tooth contact pattern</th><th>Problem</th><th>Solution</th></tr>
<tr><td rowspan="2">1 Narrow tooth side
2 Drive-side tooth surface (the side applying power during forward movement)
3 Wide tooth side
4 Coast-side tooth surface (the side applying power during reverse movement)
 

B11W0115</td><td>Tooth contact pattern resulting from excessive pinion height
 

B11W0116
The drive pinion is positioned too far from the centre of the drive gear.</td><td> 

B11W0118
Increase the thickness of the drive pinion rear shim, and position the drive pinion closer to the centre of the drive gear. Also, for backlash adjustment, position the drive gear farther from the drive pinion.</td></tr>
<tr><td>Tooth contact pattern resulting from insufficient pinion height
 

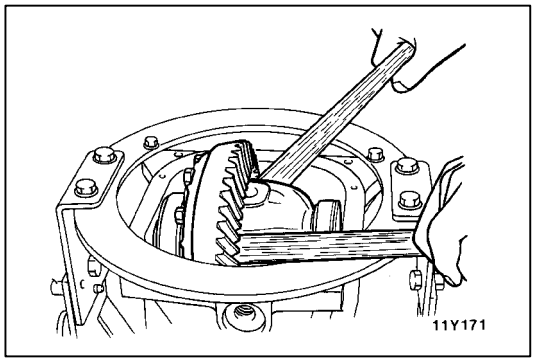
B11W0117
The drive pinion is positioned too close to the centre of the drive gear.</td><td> 

B11W0119
Decrease the thickness of the drive pinion rear shim, and position the drive pinion farther from the centre of the drive gear. Also, for backlash adjustment, position the drive gear closer to the drive pinion.</td></tr>
</table>

NOTE

Checking the tooth contact pattern is the way to confirm that the adjustments of the pinion height and backlash have been done properly. Continue to adjust the pinion height and backlash until the tooth contact pattern resembles the standard pattern.

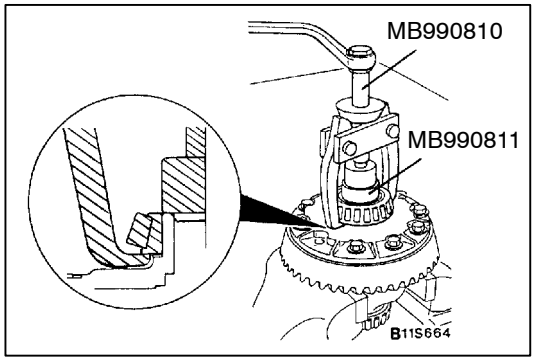
If, even after adjustments have been made, the correct tooth contact pattern cannot be obtained, it means that the drive gear and the drive pinion have become worn beyond the allowable limit. Replace the gear set.



◀B▶ DIFFERENTIAL CASE ASSEMBLY REMOVAL

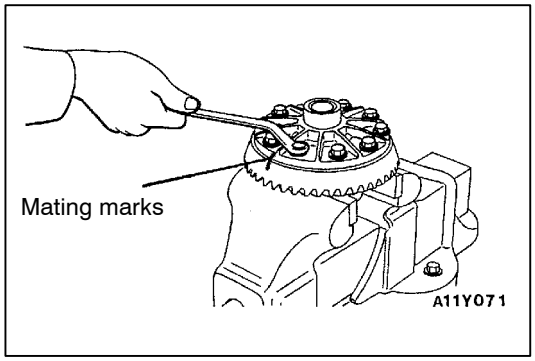
Caution
When taking out the differential case assembly, be careful not to drop and damage the side bearing outer races.

NOTE
Keep the right and left side bearings and side bearing adjusting spacers separate, so that they do not become mixed at the time of reassembly.



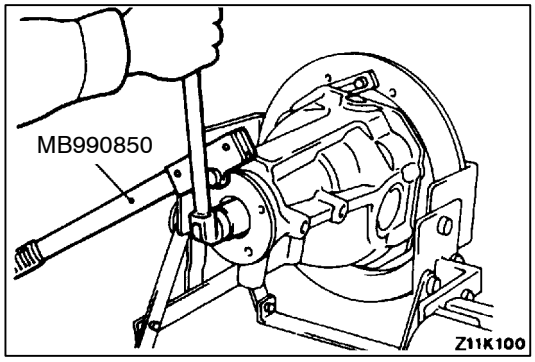
◀C▶ SIDE BEARING INNER RACE REMOVAL

NOTE
There are two notches provided (at the differential case side) for the claw part of the special tool; use the special tool at that position.
If notches of special tools touch the end of differential case and fail to hook with inner race, file the notches to be able to hook with inner race.

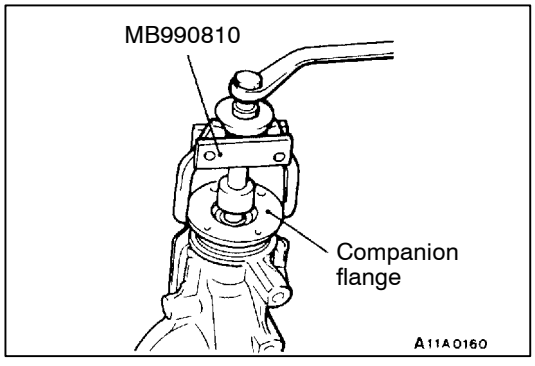


◀D▶ DRIVE GEAR REMOVAL

1. Make the mating marks to the differential case and the drive gear.
2. Loosen the drive gear attaching bolts in diagonal sequence to remove the drive gear.



◀E▶ SELF-LOCKING NUT REMOVAL

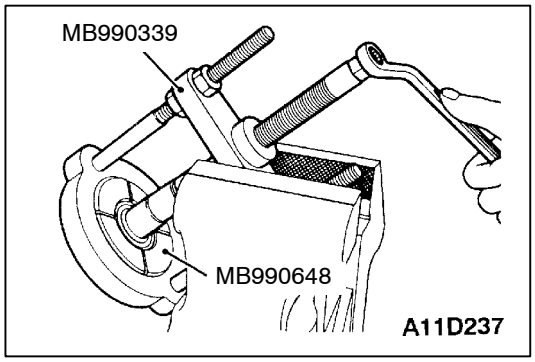


◀F▶ DRIVE PINION ASSEMBLY REMOVAL

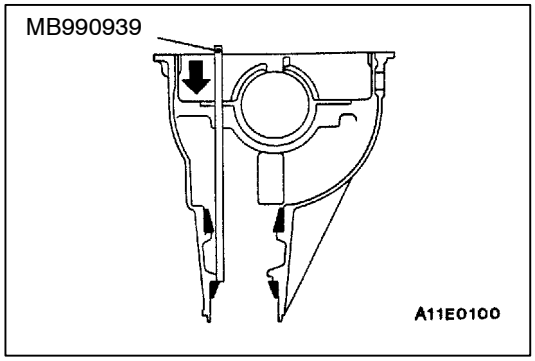
1. Make mating marks on the drive pinion and companion flange.

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

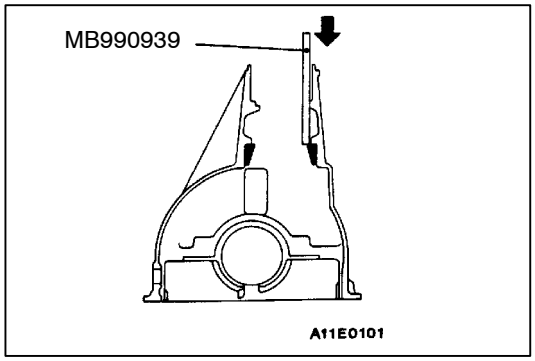
2. Pull out the drive pinion together with the special tool.



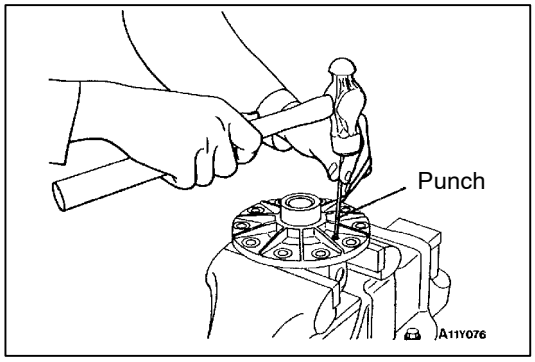
◀G▶ DRIVE PINION FRONT BEARING INNER RACE REMOVAL



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

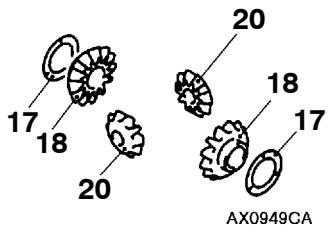


◀I▶ DRIVE PINION FRONT BEARING OUTER RACE REMOVAL

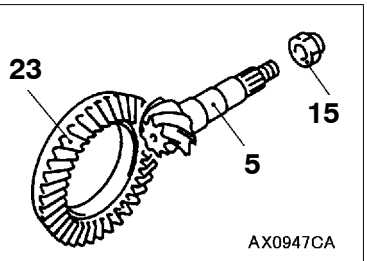


◀J▶ LOCK PIN REMOVAL

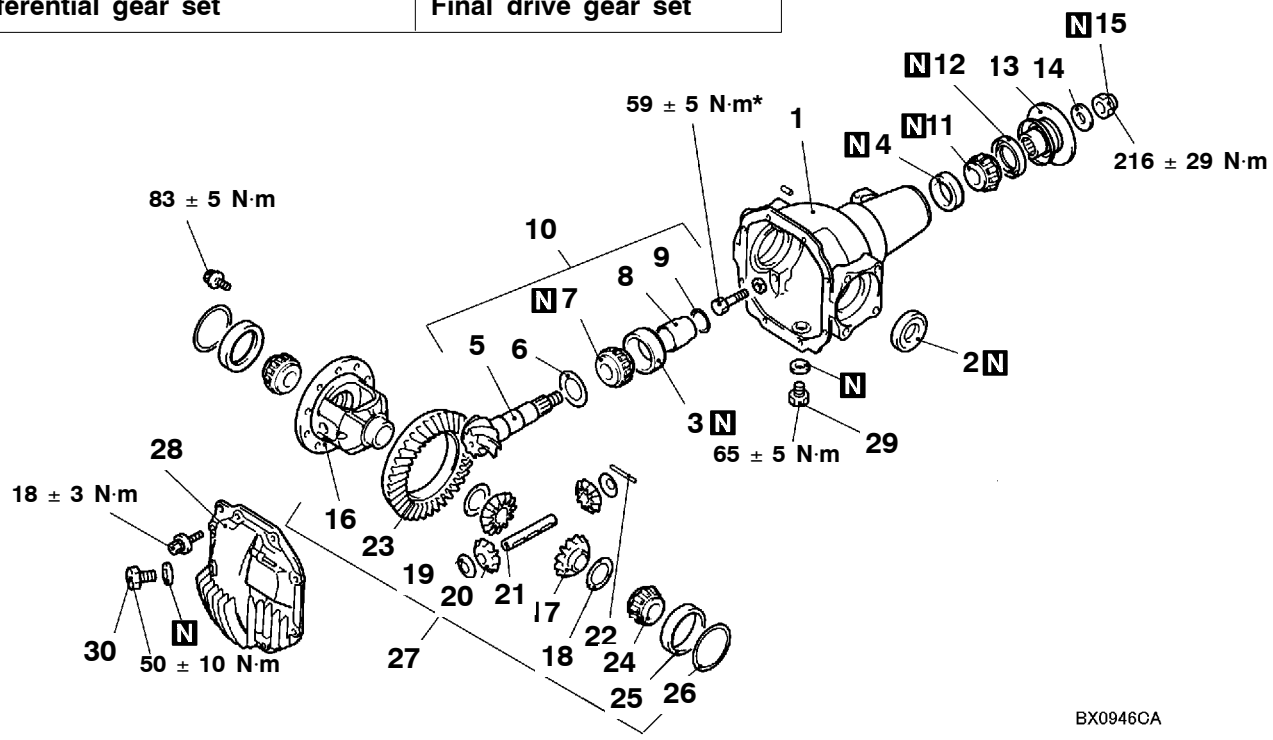
REASSEMBLY



Differential gear set



Final drive gear set

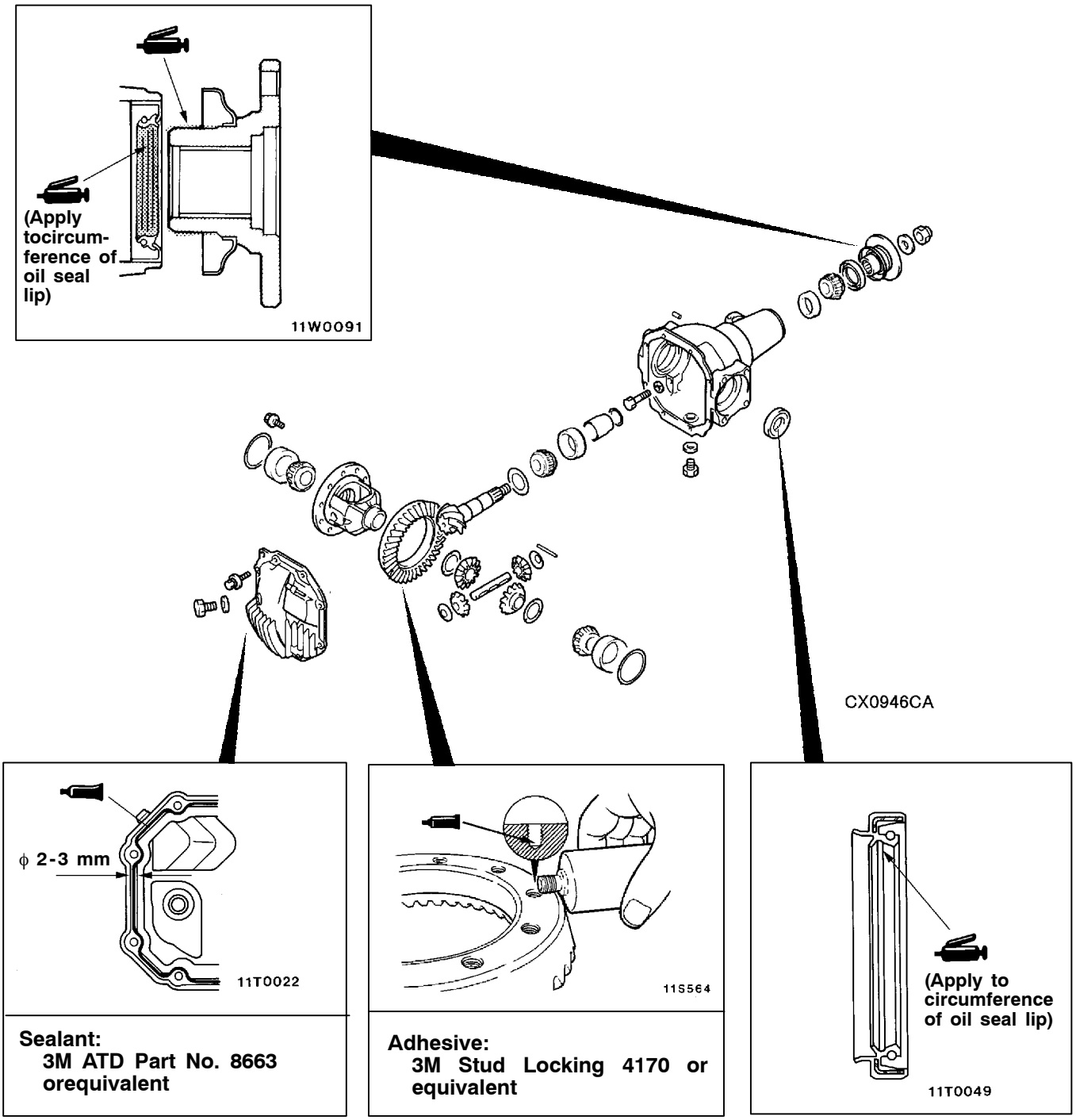


Reassembly steps

1. Differential carrier
- ▶A◀ 2. Oil seal
- ▶B◀ 3. Drive pinion front bearing outer race
- ▶C◀ 4. Drive pinion rear bearing outer race
- ▶D◀ ● Pinion height adjustment
5. Drive pinion
6. Drive pinion front shim (for pinion height adjustment)
7. Drive pinion front bearing inner race
8. Drive pinion spacer
- ▶E◀ ● Drive pinion turning torque adjustment
9. Drive pinion rear shim (for turning 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◀ ● Drive gear backlash adjustment
26. Side bearing spacer
27. Differential case assembly
28. Cover
29. Drain plug
30. Filler plug

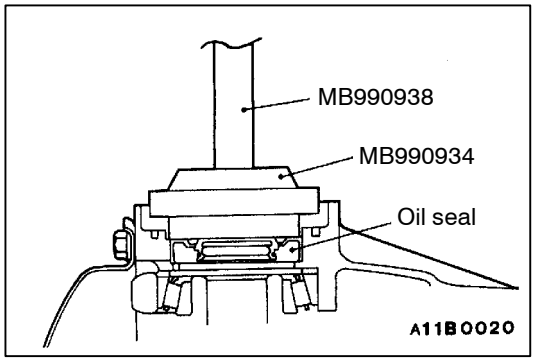
NOTE
Specified torque with astarisks means that it is covered with oil.

Lubrication, Sealing and Adhesive Points



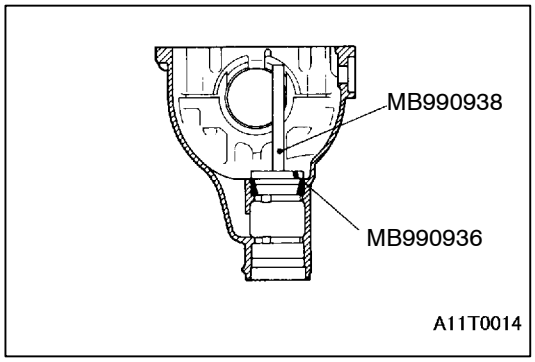
Sealant:
3M ATD Part No. 8663 orequivalent

Adhesive:
3M Stud Locking 4170 or equivalent

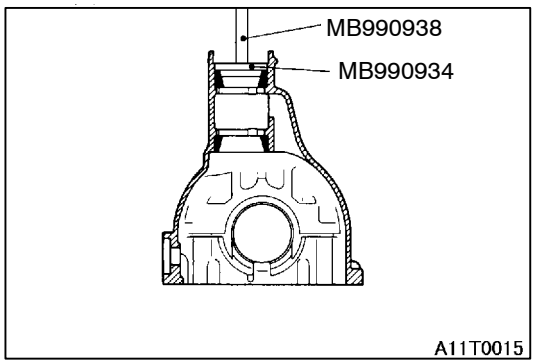


REASSEMBLY SERVICE POINTS

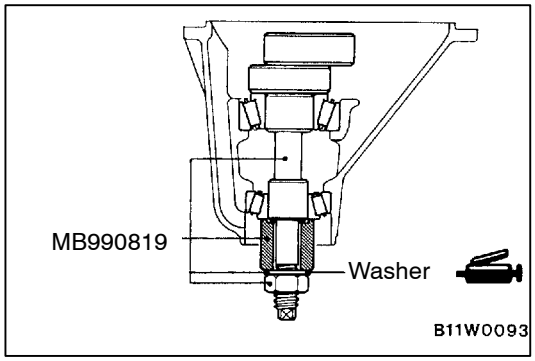
▶A◀ OIL SEAL INSTALLATION



▶B◀ DRIVE PINION FRONT BEARING OUTER RACE INSTALLATION



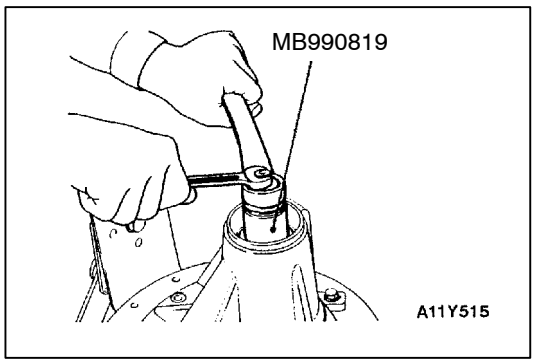
▶C◀ DRIVE PINION REAR BEARING OUTER RACE INSTALLATION



▶D◀ 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.

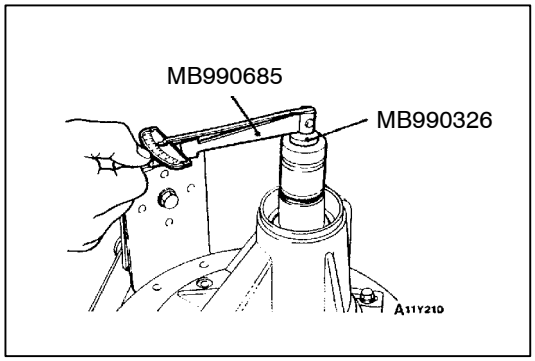


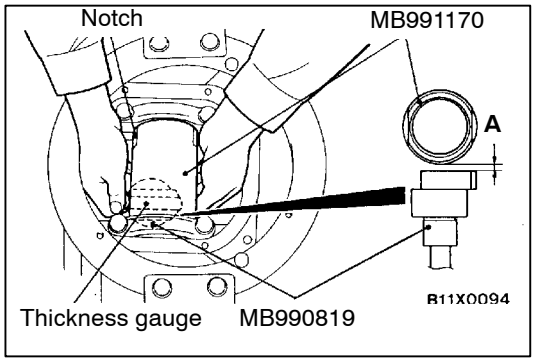
3. Tighten the nut of the special tool while measuring the turning torque of the drive pinion. Gradually keep tightening the nut of the special tool until the turning torque of the drive pinion (without oil seal) is at the standard value.

Standard value:
(Without oil seal)

Bearing division	Bearing lubrication	Turning torque
New	None (With anti-rust agent)	0.83 - 1.19 N·m

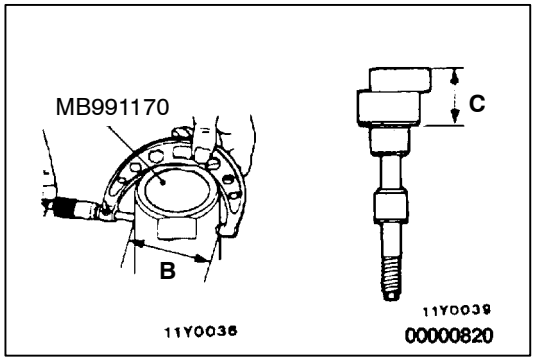
NOTE
The special tool cannot be turned a full revolution, so turn it several times within the range of movement to run in the bearing, and then measure the turning torque.



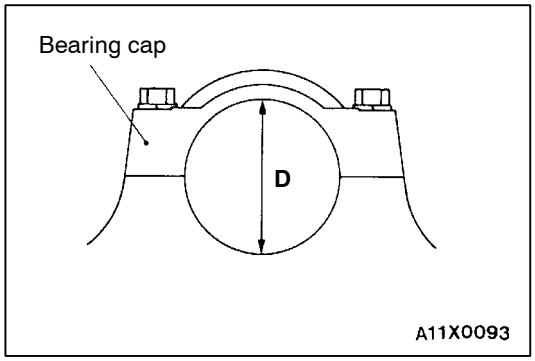


4. Clean the side bearing hub.
5. Install the special tools to the side bearing hub of the gear carrier, and then install the bearing cap.

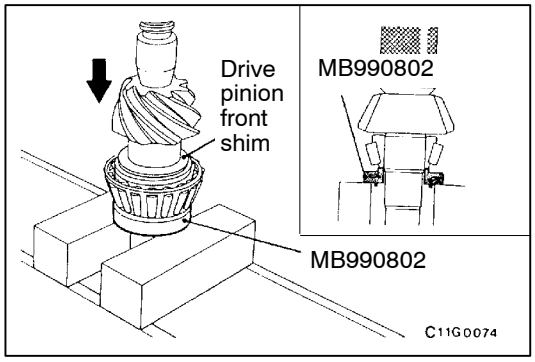
   NOTE
   Always check that the notch is in the shown position and that the special tools are touching firmly against the side bearing hub.
6. Use a thickness gauge to measure the clearance (A) between the special tools.



7. Remove the special tools (MB991170, MB990819).
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 - 100.0



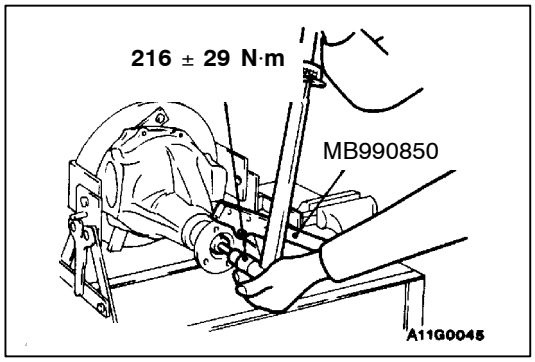
11. Fit the selected drive pinion front shim(s) to the drive pinion, and press-fit the drive pinion front bearing inner race by using the special tool.

▶E◀ DRIVE PINION TURNING TORQUE ADJUSTMENT

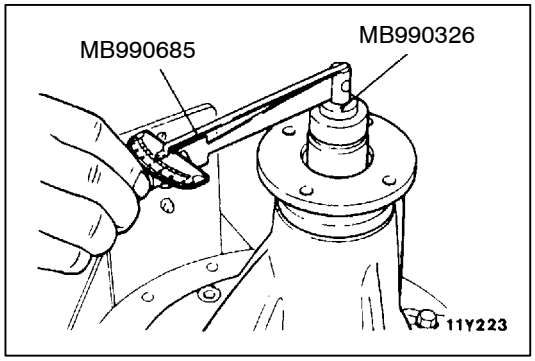
Adjust the drive pinion rotation torque by using the following procedure:

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.



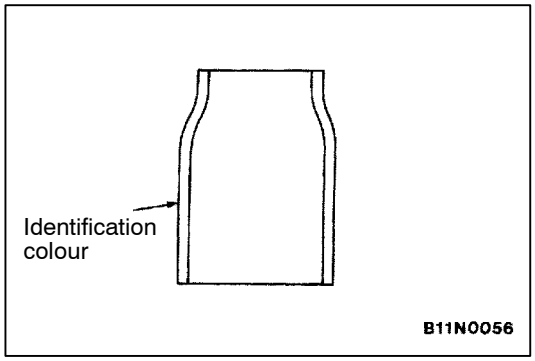
2. Tighten the companion flange to the specified torque by using the special tool.



3. Measure the drive pinion turning torque (without the oil seal) by using the special tools.

Standard value:
(Without oil seal)

Bearing division	Bearing lubrication	Turning torque
New	None (With anti-rust agent)	0.83 - 1.19 N·m

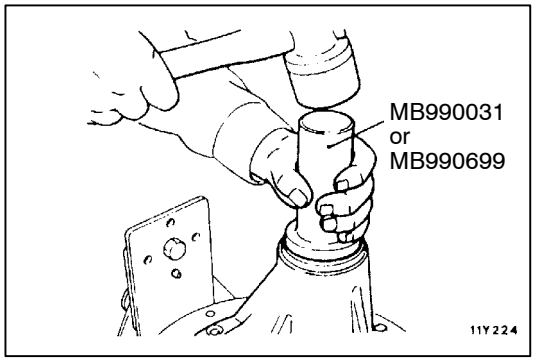


4. If the drive pinion turning torque is not within the range of the standard value, adjust the preload by replacing the drive pinion rear shim (s) or the drive pinion spacer.

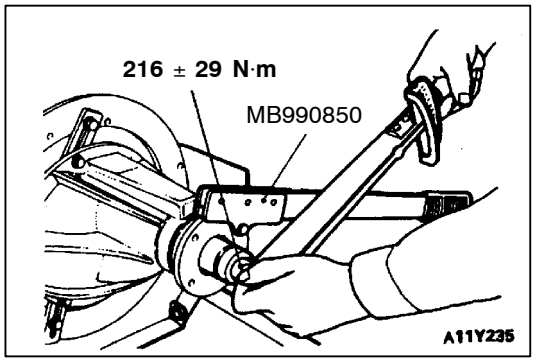
NOTE
When selecting the drive pinion rear shims, if the number of shims is large, reduce the number of shims to a minimum by selecting the drive pinion spacers. Also, select the drive pinion spacer from the following two types.

Drive pinion spacer height (mm)	Identification colour
56.67	White
57.01	-

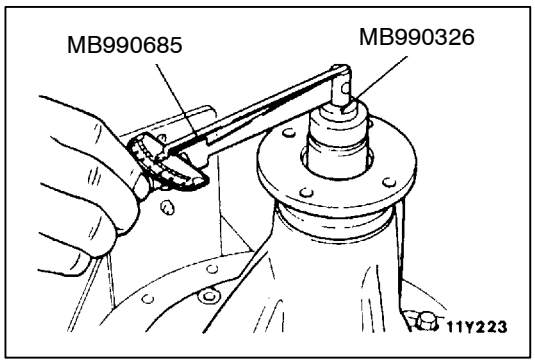
NOTE
Apply gear oil around the circumference of companion flange (and the mating surface of oil seal) when press fitting oil seal into companion flange.



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 tighten the companion flange self-locking nut to the specified torque by using the special tools.

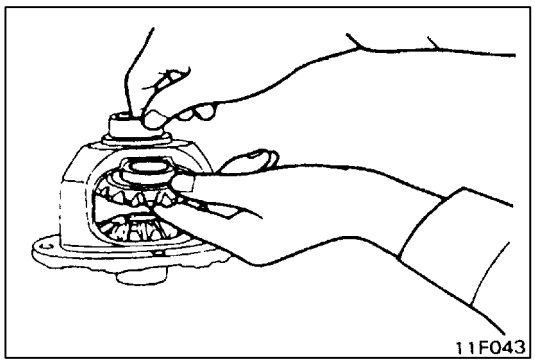


7. Measure the drive pinion turning torque (with the oil seal) by using the special tools.

Standard value:
(With oil seal)

Bearing division	Bearing lubrication	Turning torque
New	None (With anti-rust agent)	0.93 - 1.28 N·m
	Gear oil applied	0.97 - 1.32 N·m

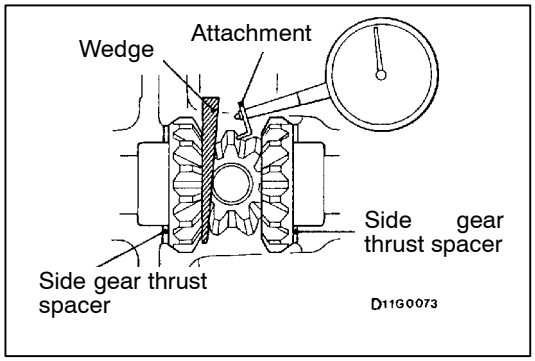
8. If the drive pinion turning torque is not within the standard value, check the tightening torque of the companion flange self-locking nut and the oil seal.



▶F◀ DIFFERENTIAL GEAR BACKLASH ADJUSTMENT

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.



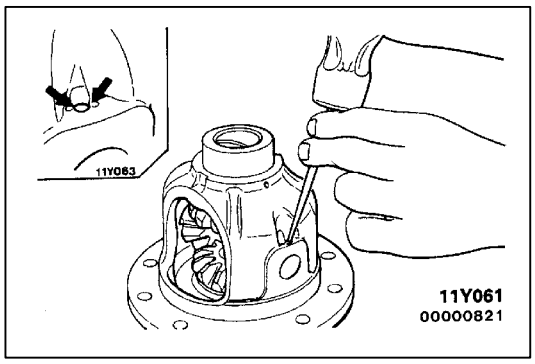
3. Insert a wedge between the side gear and the pinion shaft to lock the side gear.
4. Measure the differential gear backlash with a dial indicator on the pinion gear.

Standard value: 0 - 0.076 mm

Limit: 0.2 mm

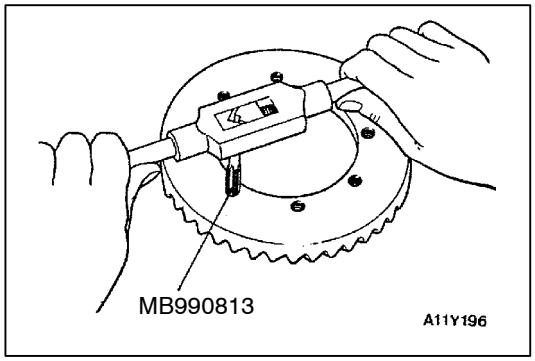
5. If the differential gear backlash exceeds the limit, adjust the backlash by installing thicker side gear spacers.

6. If adjustment is not possible, replace the side gears and pinion gears as a set.
7. Measure the differential gear backlash once again, and confirm that it is within the limit.



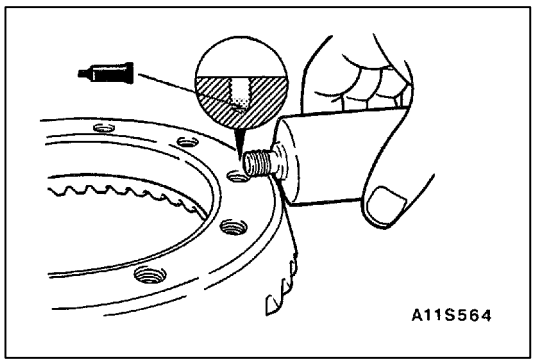
▶G◀ LOCK PIN INSTALLATION

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 the special tool (tap M10 x 1.25), and then clean the threaded holes by applying compressed air.

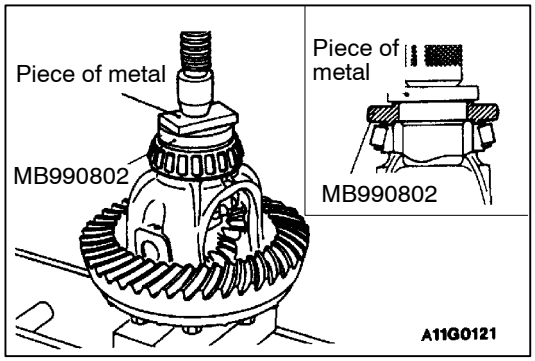


3. Apply the specified adhesive to the threaded holes of the drive gear.

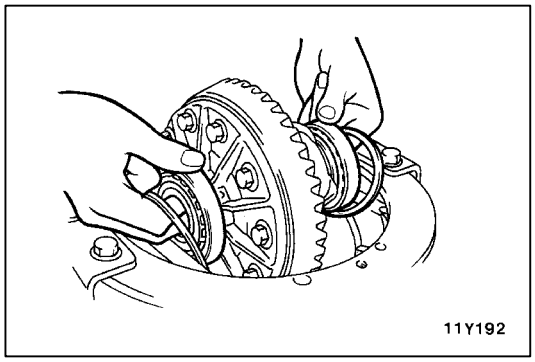
   Specified adhesive:
   3M Stud Locking 4170 or equivalent

4. Install the drive gear onto the differential case with the mating marks properly aligned. Tighten the bolts to the specified torque in a diagonal sequence.

   Tightening torque: 83 ± 5 N·m



▶I◀ SIDE BEARING INNER RACE INSTALLATION

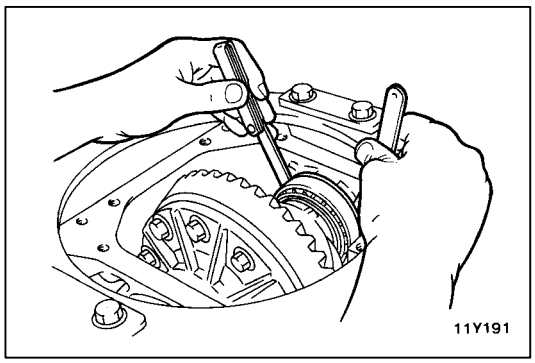


▶J◀ DRIVE GEAR BACKLASH ADJUSTMENT

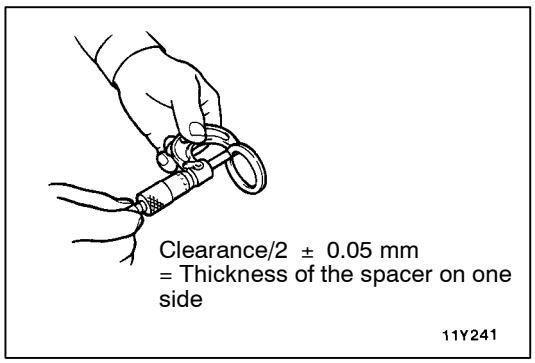
Adjust the drive gear backlash by the following procedures:

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.

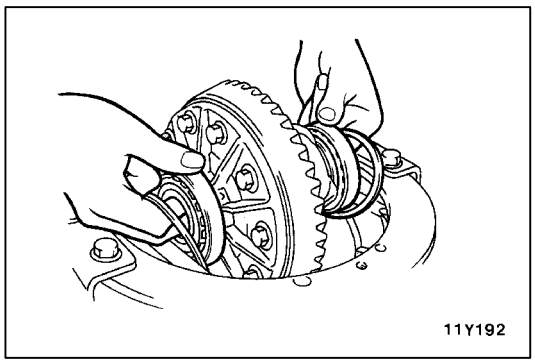
   NOTE
   Select side bearing spacers with the same thickness for both the drive pinion side and the drive gear side.



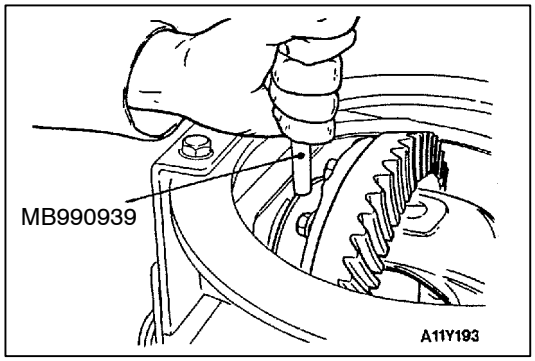
2. Push the differential case assembly to one side, and measure the clearance between the gear carrier and the side bearing adjusting spacer with a thickness gauge.



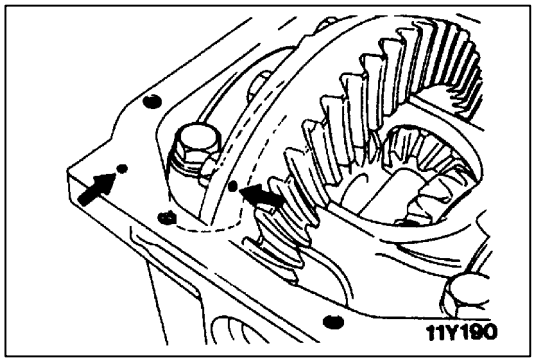
3. Measure the thickness of the side bearing adjusting spacers on one side, select two pairs of spacers which correspond to that thickness plus one half of the clearance plus 0.05 mm, and then install one pair each to the drive pinion side and the drive gear side.



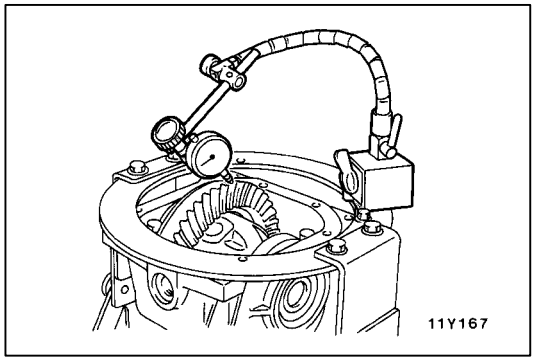
4. Install the side bearing adjusting spacers and differential case assembly, as shown in the illustration, to the gear carrier.



5. Tap the side bearing adjusting spacers with the special tool to fit them to the side bearing outer race.



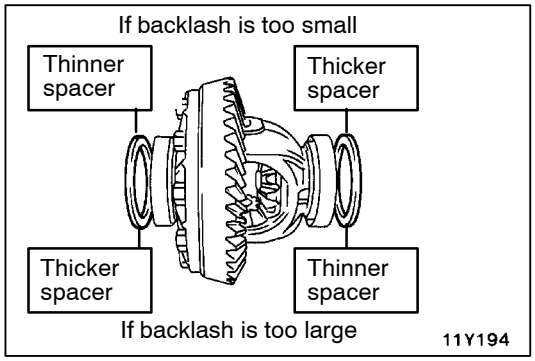
6. Align the mating marks on the gear carrier and the bearing cap, and then tighten the bearing cap.



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

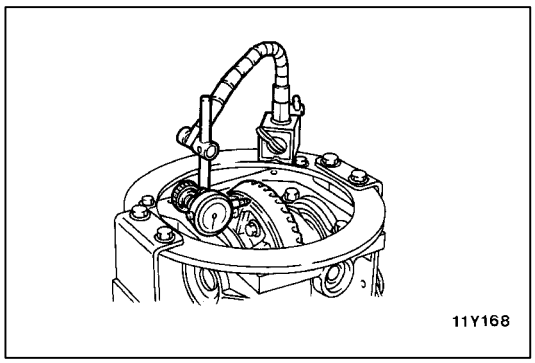
   NOTE
   Measure at four points or more on the circumference of the drive gear.

   Standard value: 0.11 - 0.16 mm



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

   NOTE
   When increasing the number of side bearing adjusting spacers, use the same number for each, and as few as possible.



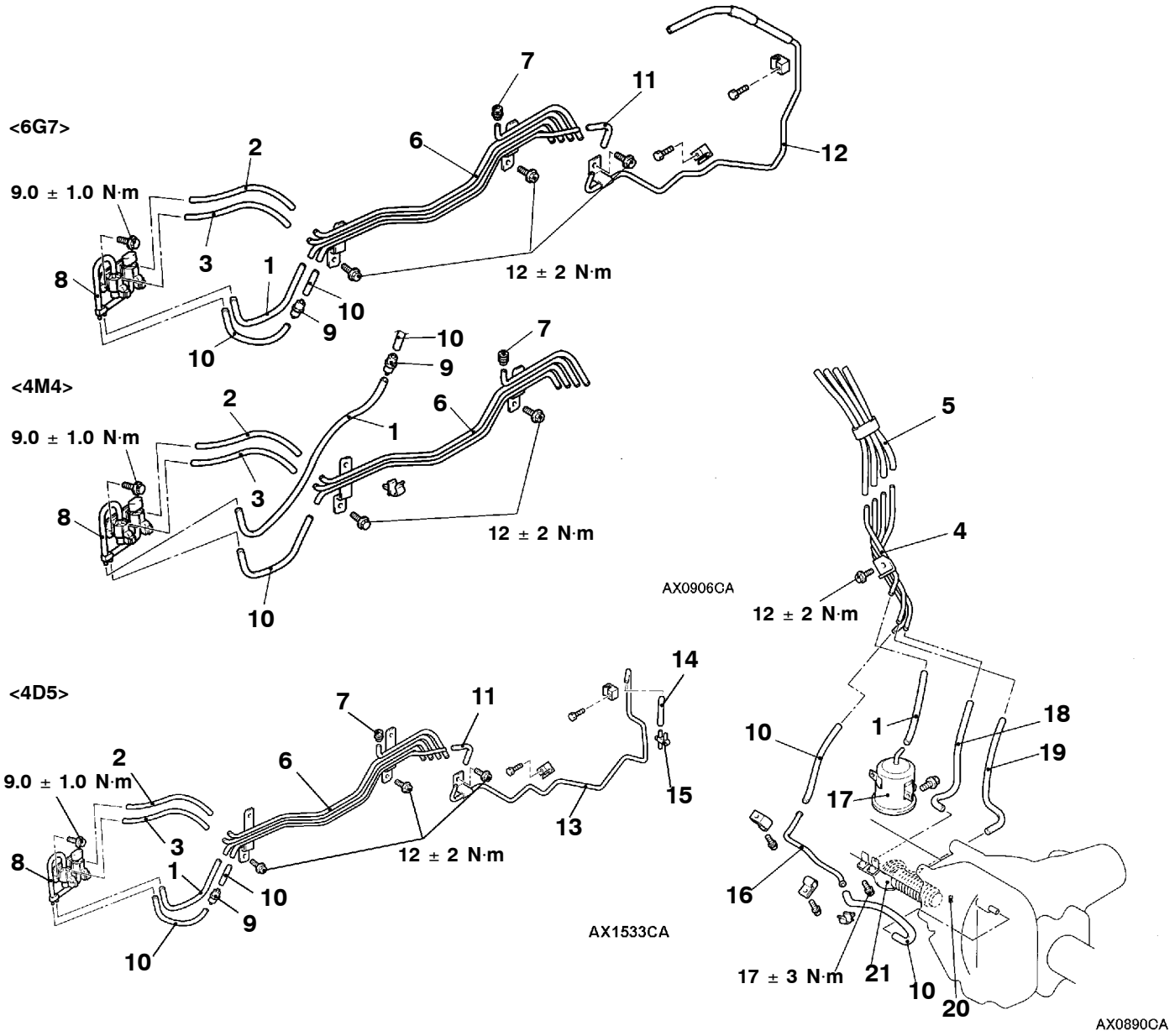
9. Check the drive gear and drive pinion for tooth contact. If poor contact is evident, make adjustment. (Refer to P. 26-39.)
10. Measure the drive gear runout at the shoulder on the reverse side of the drive gear.

    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.

SOLENOID VALVE, VACUUM PIPE, VACUUM TANK

REMOVAL AND INSTALLATION

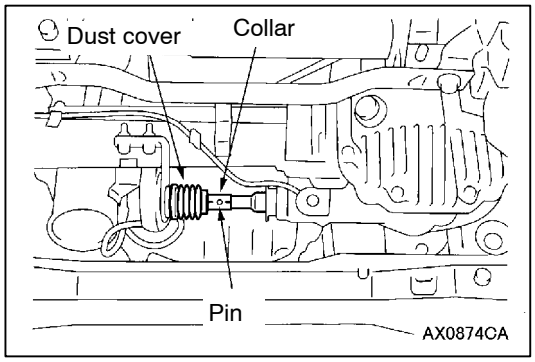


Solenoid valve assembly, Vacuum tank assembly removal steps

- ▶A◀ 1. Vacuum hose (white stripe)
- ▶A◀ 2. Vacuum hose (blue stripe)
- ▶A◀ 3. Vacuum hose (yellow stripe)
- 4. Vacuum pipe assembly
- 5. Vacuum hose assembly
- 6. Vacuum pipe assembly
- 7. Breather cap
- 8. Solenoid valve assembly
- ▶B◀ 9. Check valve
- 10. Vacuum hose
- 11. Vacuum hose
- 12. Vacuum pipe assembly (6G7)
- 13. Vacuum pipe assembly (4D5)
- 14. Vacuum hose
- 15. Vacuum terminal
- 16. Breather pipe
- 17. Vacuum tank assembly

Vacuum actuator assembly removal steps

- ▶A◀ 18. Vacuum hose (blue stripe) connection
- ▶A◀ 19. Vacuum hose (yellow stripe) connection
- ◀A▶ 20. Pin
- 21. Vacuum actuator assembly



REMOVAL SERVICE POINT

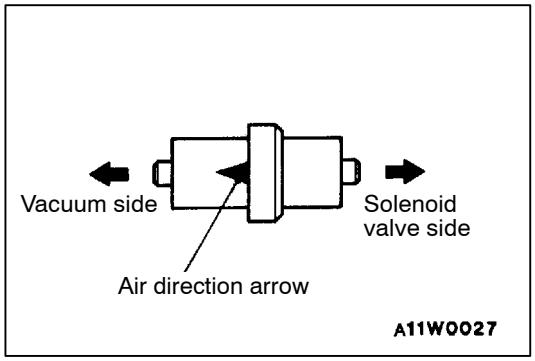
◀A▶ PIN REMOVAL

1. Remove one side of dust cover mounting part on vacuum actuator assembly.
2. Match collar of pin hole with that of another pin hole to remove a pin with a punch.

INSTALLATION SERVICE POINTS

▶A◀ VACUUM HOSE INSTALLATION

Match collar of each pipe of vacuum hose and solenoid valve and vacum pipe and assemble them.



▶B◀ CHECK VALVE INSTALLATION

Install so that air direction arrow points to the vacuum side.

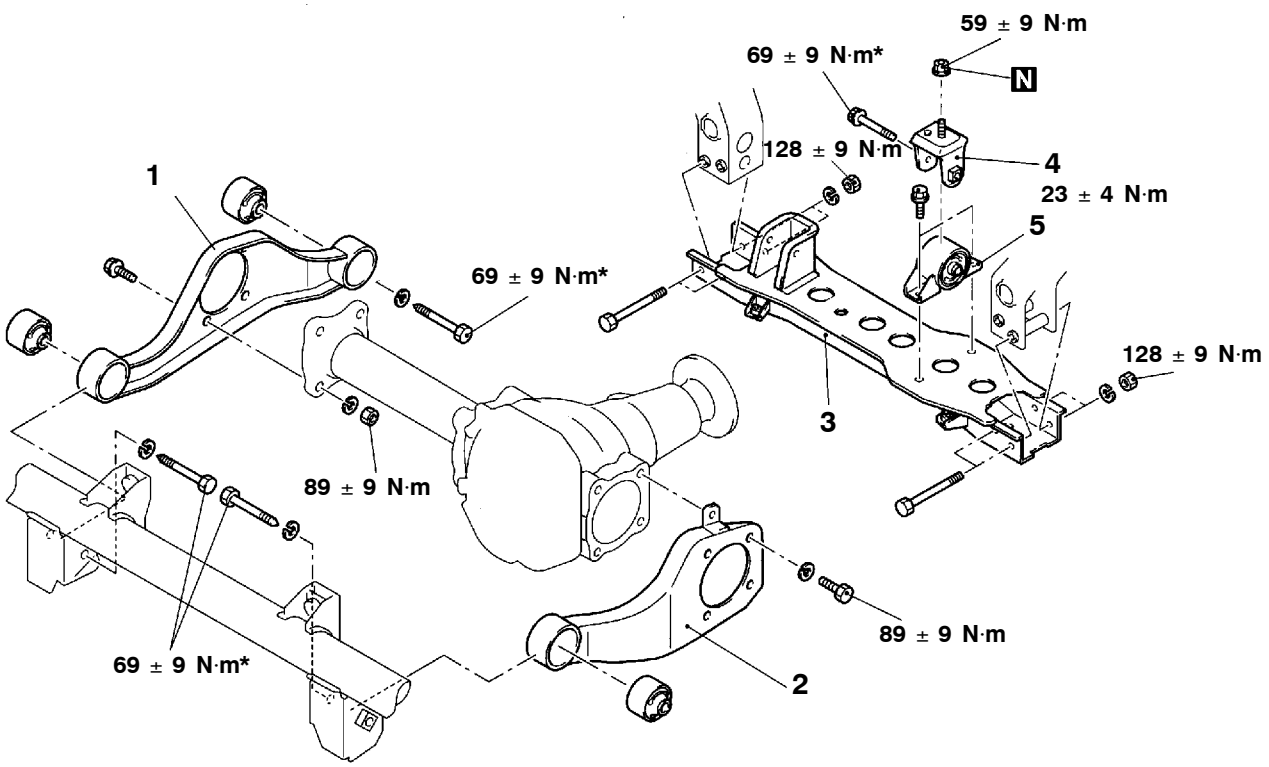
FRONT DIFFERENTIAL MOUNT

REMOVAL AND INSTALLATION

Caution

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

Pre-removal and Post-installation
- Under Cover and Skid Plate Removal and Installation
- Gear Oil Draining and Refill (Refer to P.26-11.)
- Drive Shaft Removal and Installation (Refer to P.26-16.)
- Inner Shaft Removal and Installation (Refer to P.26-24.)



Differential mount bracket assembly(L.H./R.H.) removal steps
- Drive shaft assembly removal (refer to P.26-16)

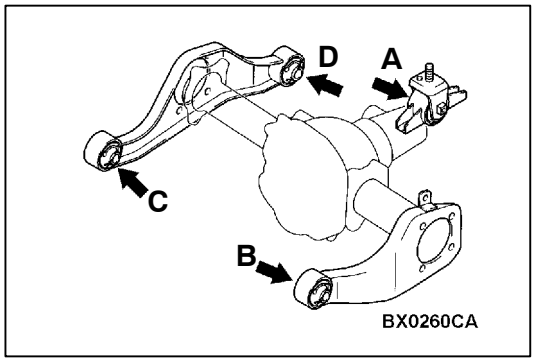
▶A◀ 1. Differential mount bracket assembly (R.H.)

▶A◀ 2. Differential mount bracket assembly (L.H.)

Differential mount bracket assembly (rear) removal steps

3. No.2 crossmember
4. Differential support bracket
- Differential carrier & housing assembly

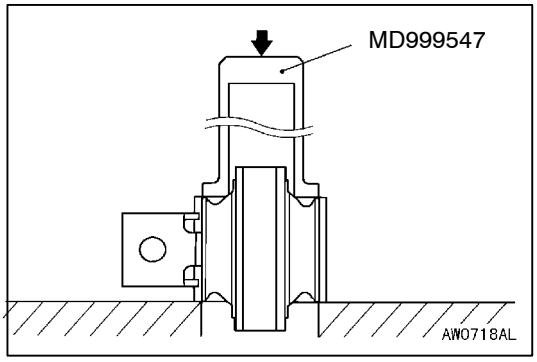
▶A◀ 5. Differential mount bracket assembly (rear)



INSTALLATION SERVICE POINT

▶A◀ DIFFERENTIAL MOUNT BRACKET ASSEMBLY INSTALLATION

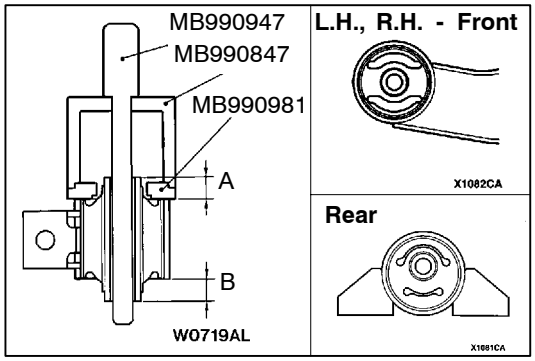
Tighten the bolts shown in the diagram with the specified torque in the order of A, B, C, D or A, C, B, D.



DIFFERENTIAL MOUNTING INSULATOR REPLACEMENT

DIFFERENTIAL MOUNTING BRACKET <L.H., R.H.-FRONT, REAR>

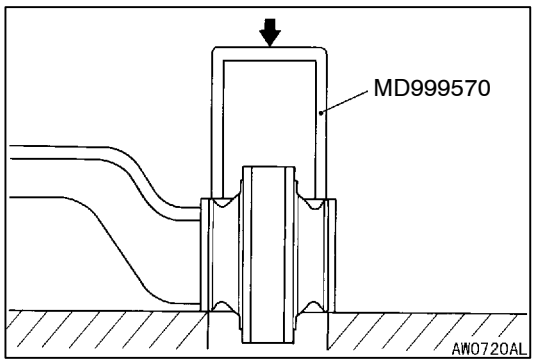
1. Remove insulator with special tools.

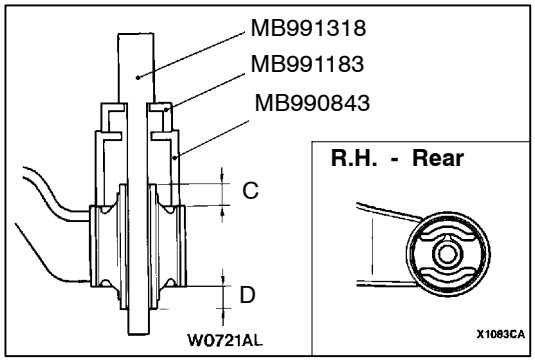


2. By using special tools along with a hydraulic press, press fit each insulator to adjust until the hollow part faces as shown and the difference between dimensions A, B should be within 0.7 mm.

DIFFERENTIAL MOUNT BRACKET <R.H.-REAR>

1. Remove the insulator with the special tool.





2. By using special tools along with a hydraulic press, press fit each insulator to adjust until the hollow part faces as shown and the difference between dimensions C, D should be within 0.7 mm.

REAR AXLE

Click on the applicable bookmark to selected the required model year.

REAR AXLE

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GENERAL INFORMATION

The rear axle has the following features.

- D.O.J.-type on the differential side and B.J.-type on the hub side constant velocity joints are featured in the drive shaft.
- Large capacity and high rigidity taper-roller type unit bearing in the wheel bearing is featured.
- The hybrid LSD and differential lock with LSD which benefit driving on muddy and rough roads are featured as an option.
- ABS rotor to detect wheel speed is press-fitted in the drive shaft.

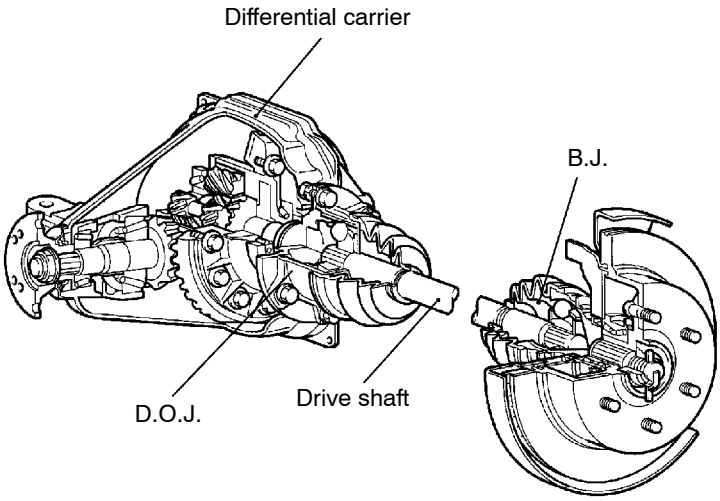
NOTE
The structure of normal differential and hybrid LSD is basically the same as featured in existing models.

SPECIFICATIONS

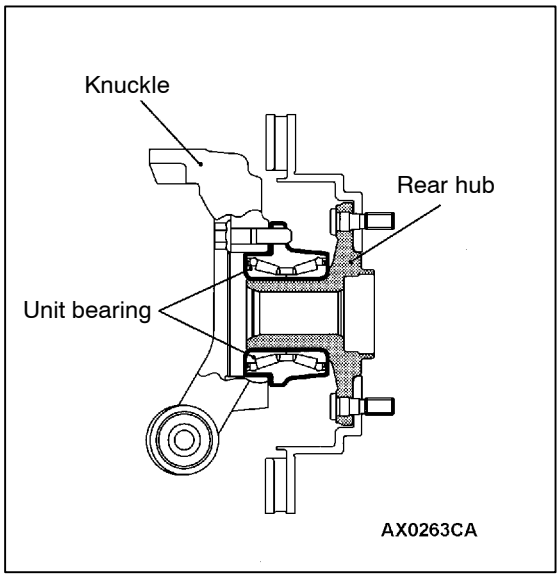
Item			Normal Differential	Hybrid LSD	Differential Lock with LSD
Reduction gear type			Hypoid gear	Hypoid gear	Hypoid gear
Reduction ratio			4.900*1, 3.917*2, 4.100*3, 4.300*4	4.900*1, 3.917*2, 4.100*3, 4.300*4	4.900*1, 3.917*2, 4.100*3, 4.300*4
LSD type			-	Torque sensing + VCU	Torque sensing
Differential gear type (Type × number of gears)		Side gear	Straight bevel gear × 2	Helical gear × 2	Helical gear × 2
		Pinion gear	Straight bevel gear × 2	Long pinion × 4, Short pinion × 4	Long pinion × 4, Short pinion × 4
Number of teeth	Drive gear		49*1, 47*2, 41*3, 43*4	49*1, 47*2, 41*3, 43*4	49*1, 47*2, 41*3, 43*4
	Drive pinion		10*1, *3, *4, 12*2	10*1, *3, *4, 12*2	10*1, *3, *4, 12*2
	Side gear		18	22	22
	Pinion gear		10	7	7
Bearings (Outside diameter × Inside diameter) mm		Side	90.0 × 55.0	90.0 × 55.0	90.0 × 55.0
		Front	68.3 × 30.2	68.3 × 30.2	68.3 × 30.2
		Rear	79.4 × 36.5	79.4 × 36.5	79.4 × 36.5

NOTE
*1: 4D56
*2: 4M41-A/T
*3: 4M41-M/T
*4: 6G74 GDI

CONSTRUCTION DIAGRAM



AX0262CA



SERVICE SPECIFICATIONS

Item			Standard value	Limit
Rear axle total backlash mm			-	5
Wheel bearing rotation starting torque N·m			-	1.76
Wheel bearing axial play mm			-	0
DOJ boot assembly dimension mm		Vehicles without 4M4-M/T	110 ± 3	-
		Vehicles with 4M4-M/T	115 ± 3	-
Rear differential lock air pump pressure kPa			25 – 40	-
Drive gear backlash mm			0.13 – 0.18	-
Drive gear runout mm			-	0.05
Differential gear backlash mm			0 – 0.076	0.2
Drive pinion turning torque N·m	Without oil seal		1.94 – 2.25	-
	With oil seal	Companion flange (oil seal contacting area) with anti-rust agent	2.03 – 2.34	-
		Companion flange (oil seal contacting area) with gear oil applied	2.10 – 2.40	-

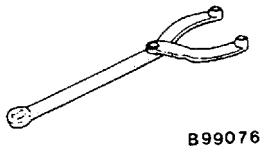
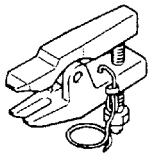
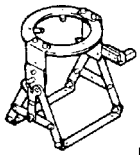
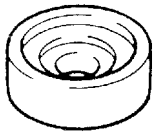
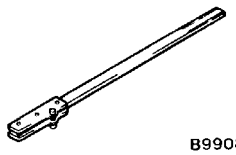
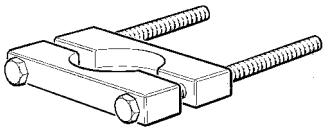
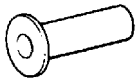
LUBRICANTS

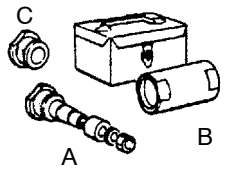
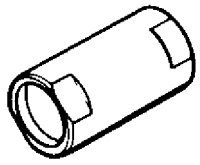
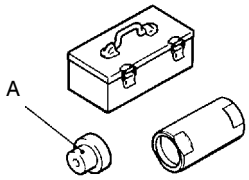
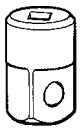
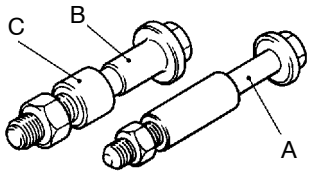
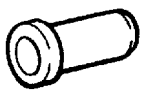
Item	Specified lubricants	Quantity
Rear differential gear oil	Hypoid gear oil API classification GL-5 or higher SAE viscosity No. 90, 80 W	Approx. 1.6 L
B.J. joint	Repair kit grease	245 ± 10 g
D.O.J. joint	Repair kit grease	295 ± 10 g

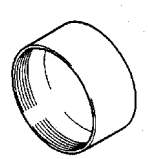
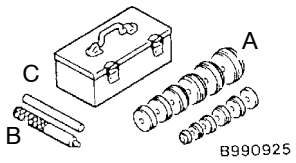
SEALANTS

Items	Specified sealants	Remarks
Differential cover	3M ATD Part No. 8661 or equivalent	Semi-drying sealant
Drive gear and differential case mounting part	3M Stud Locking 4170 or equivalent	Anaerobic sealant

SPECIAL TOOLS

Tool	Number	Name	Use
 B990767	MB990767	Front hub and flange yoke holder	Removal, installation of the drive shaft nut
 B991113	MB991113 or MB990635	Steering linkage puller	Disconnection of ball joint
 B990909	MB990909	Working base	Supporting of the differential carrier
B990810	MB990810	Side bearing puller	• Removal of the side bearing inner race • Removal of the companion flange
	MB991407	Differential rear support arbor	Removal of the side bearing inner race
 B990850	MB990850	End yoke holder	• Removal of the self-locking nut • Adjustment of the drive pinion turning torque
	MD998801	Bearing remover	Removal of the drive pinion rear bearing inner race
	MB991168	Differential oil seal installer	Installation of drive pinion oil seal
MB991445	MB991445	Bush remover and installer base	Installation of drive pinion rear bearing outer race

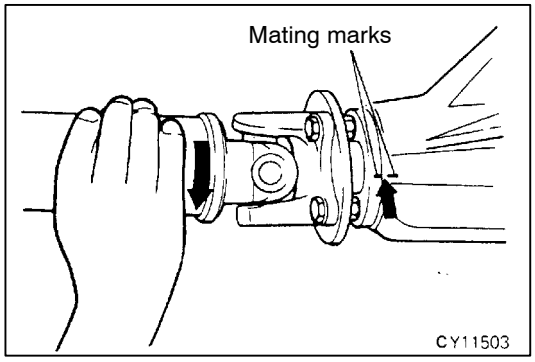
Tool	Number	Name	Use
	MB991171 A: MB990819 B: MB991170 C: MB991169	Pinion height gauge set A: Drive pinion gauge B: Cylinder gauge C: Drive pinion gauge attachment	Measurement of the pinion height
	MB991534	Cylinder gauge	
	MB991768 A: MB991770	Drive pinion gauge set A: Head	
	MB990685	Torque wrench	Measurement of the starting torque of ball bearing
	MB990326	Preload socket	
	A: MB991017 B: MB990998 C: MB991000	A, B: Front hub remover and installer C: Spacer	• Measure at the wheel bearing rotation starting torque • Wheel bearing backlash check
	MB990802	Bearing installer	Press-fitting of the drive pinion rear bearing inner race
	MB990727	Drive pinion oil seal installer	Press-fitting of the drive pinion oil seal

Tool	Number	Name	Use
	MD998812	Installer cap	Press-fitting of the side bearing inner race
	MD998829	Installer adaptor	
	MB990925 A: MB990926- MB990937 B: MB990938 C: MB990939	Bearing and oil seal installer set A: Installer adaptor B: Bar C: Brass bar	● Press-fitting of oil seal ● Inspection of drive gear tooth contact ● Removal of bearing outer race For details of each installer, refer to GROUP 26 - Special Tools.

ON-VEHICLE SERVICE

REAR AXLE TOTAL BACKLASH CHECK

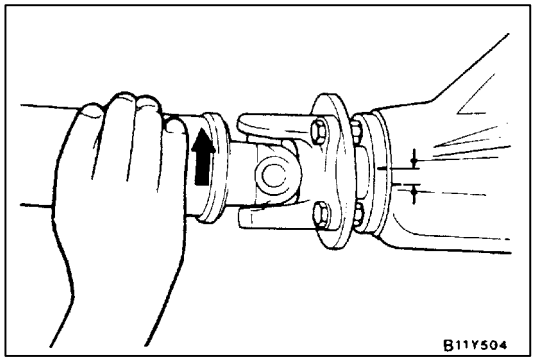
1. Park the vehicle on a flat, level surface.
2. Move the transmission control lever to the neutral position. Move the transfer control lever to the neutral position. Apply the parking brake. Raise the vehicle on a jack.



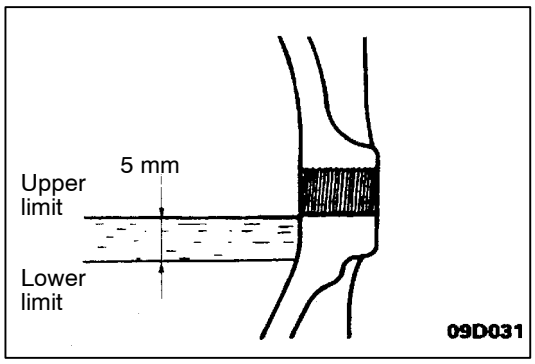
3. Turn the companion flange clockwise as far as it will go. Make the mating mark on the dust cover of the companion flange and on the differential carrier.
4. Turn the companion flange anti-clockwise as far as it will go, and measure the amount of distance the mating marks moved.

   Limit: 5 mm

5. If the backlash exceeds the limit value, remove the differential carrier assembly and check the following.
   - Final drive gear backlash (Refer to P.27-37.)
   - Differential gear backlash (Refer to P.27-36.)



GEAR OIL LEVEL CHECK

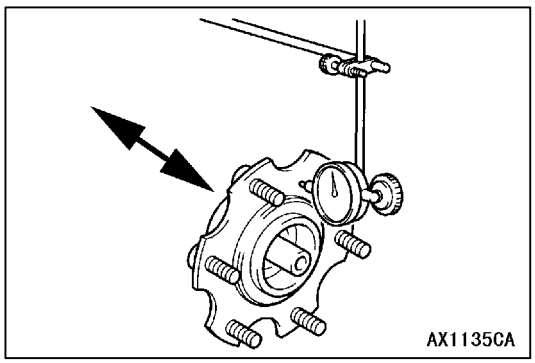


Check that gear oil level is not 5 mm below the bottom of filler plug hole.

Specified gear oil:

Hypoid gear oil API classification GL-5 or higher SAE viscosity Number 90, 80W

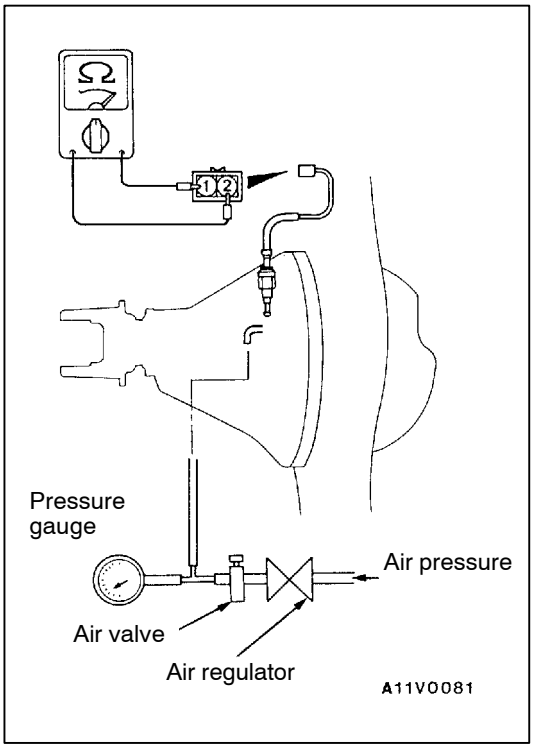
WHEEL BEARING AXIAL PLAY CHECK



1. Remove the rear brake assembly and remove the brake disc while holding it with wires to prevent it from falling.
2. Fit the dial gauge as shown in the diagram and move hub in the axial direction to measure the play.

   Limit: 0 mm

3. If the play exceeds the limit, replace the rear hub assembly.



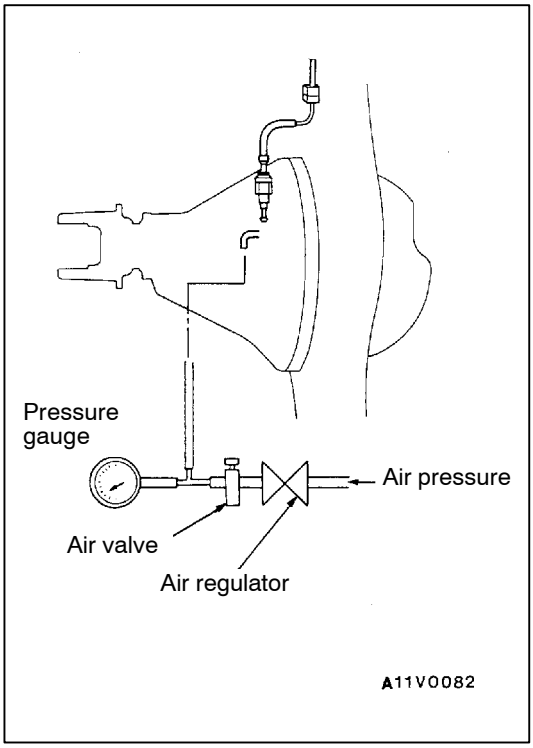
REAR DIFFERENTIAL LOCK DETECTION SWITCH CHECK

1. Raise up the vehicle.
2. Remove the air pipe and air hose connections.
3. Connect a pressure gauge and air regulator, for adjusting the compressed air pressure, to the air hose.
4. Adjust the compressed air pressure with the air regulator until the pressure gage shows a pressure of approximately 25 kPa.

   Caution
   Do not apply a higher pressure.
5. Hold the wheel on one side of the vehicle stationary, and slowly turn the wheel on the other side.
6. Check for continuity in the rear differential lock detection switch.

When air is supplied	Continuity
When air is released	No continuity

7. If the detection switch is defective, first remove the differential carrier, then remove the detection switch.



REAR DIFFERENTIAL LOCK SYSTEM AIR LEAKAGE CHECK

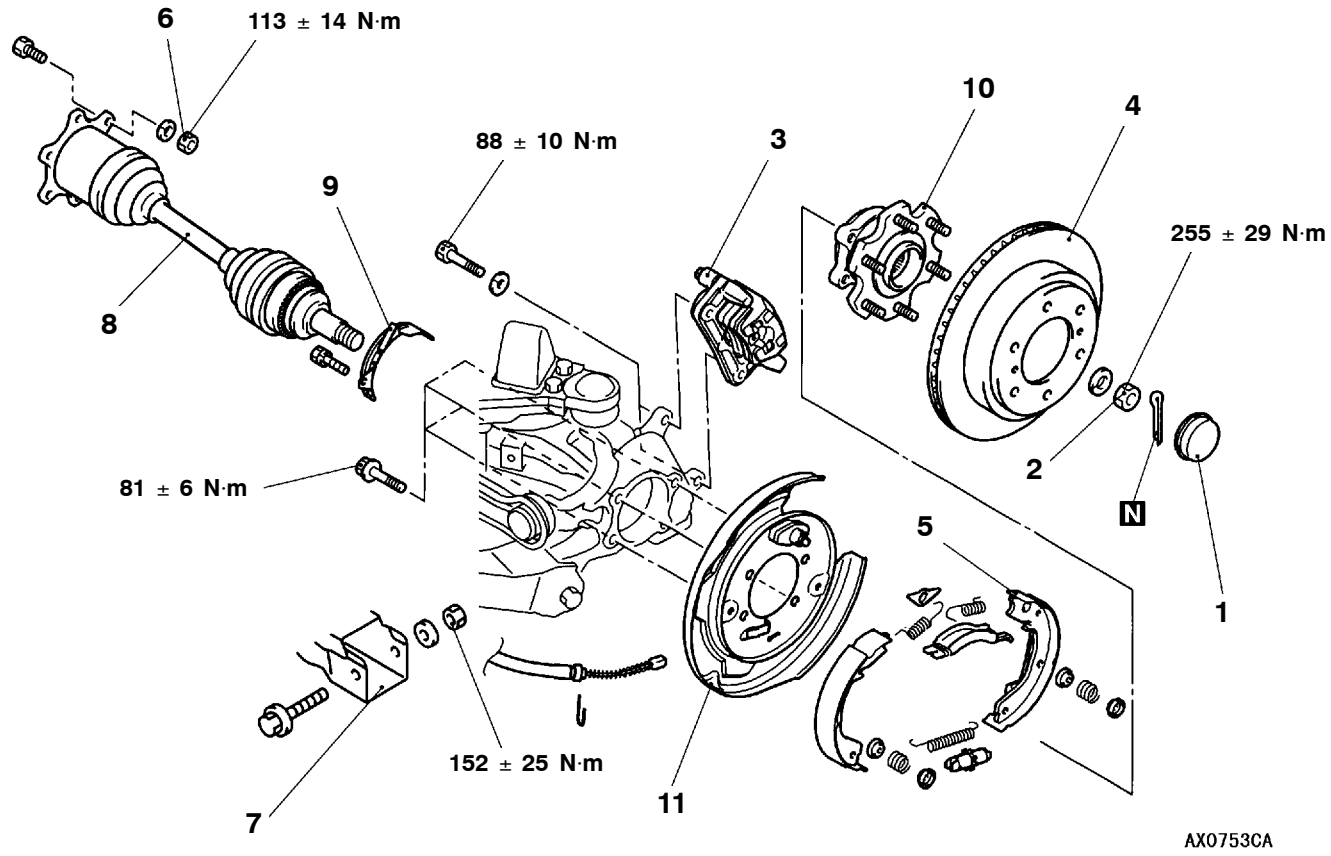
1. Remove the rear differential lock air pump and remove the air hose from the air pump. (Refer to P.27-20.)
2. Connect a pressure gage and air regulator, for adjusting the compressed air pressure to the air hose.
3. Adjust the compressed air pressure with the air regulator until the pressure gage shows a pressure of approximately 35 kPa.

   Caution
   Do not apply a higher pressure.
4. Shut off the air valve.
5. If after approximately 10 minutes have passed, the pressure has dropped, it can be concluded that there is no leaking of air from the air hose, etc.

REAR HUB ASSEMBLY

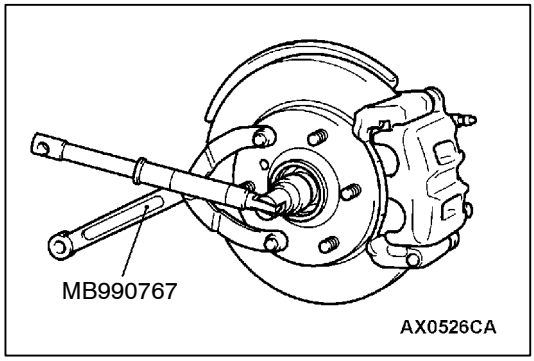
REMOVAL AND INSTALLATION

Post-installation Operation
Parking Brake Lever Stroke Adjustment (Refer to GROUP 36 – On-vehicle Service.)



Removal steps

1. Hub cap
◀A▶ ▶B◀ 2. Drive shaft nut
◀B▶ 3. Rear brake caliper
4. Rear brake disc
5. Parking brake shoe & lining assembly (Refer to GROUP 36 - Parking Brake Drum.)
6. Companion shaft and drive shaft connection
◀C▶ ▶A◀ 7. Lower arm and knuckle connection
8. Rear drive shaft assembly
9. ABS rotor protector
10. Rear hub assembly
11. Backing plate



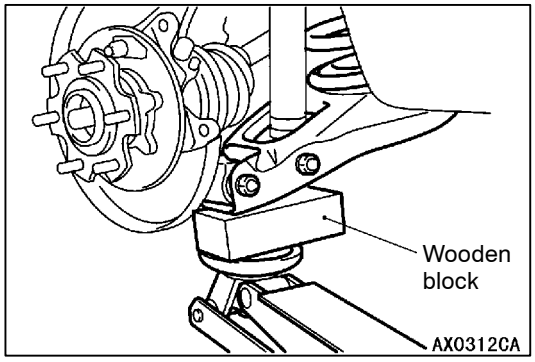
REMOVAL SERVICE POINTS

◀A▶ DRIVE SHAFT NUT REMOVAL

Caution
Do not apply pressure to wheel bearing by the vehicle weight to avoid possible damage to wheel bearing before tightening drive shaft nut fully.

◀B▶ REAR BRAKE CALIPER REMOVAL

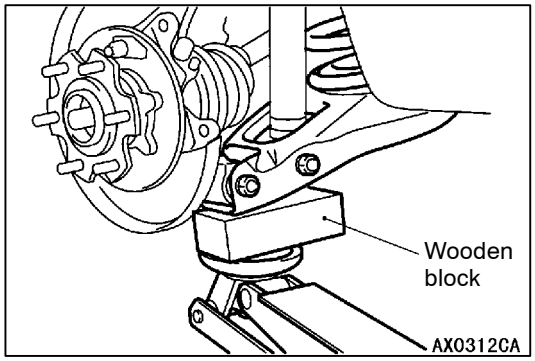
Suspend the rear brake caliper from the body with wire, etc. to prevent it from falling.



◀C▶ LOWER ARM AND KNUCKLE DISCONNECTION

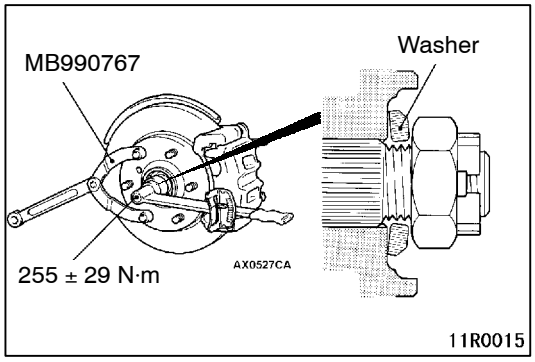
Attach wooden block to the lower arm as shown in the illustration and use the floor jack to remove the lower arm mounting bolt by compressing the coil spring.

INSTALLATION SERVICE POINTS



▶A◀ LOWER ARM AND KNUCKLE CONNECTION

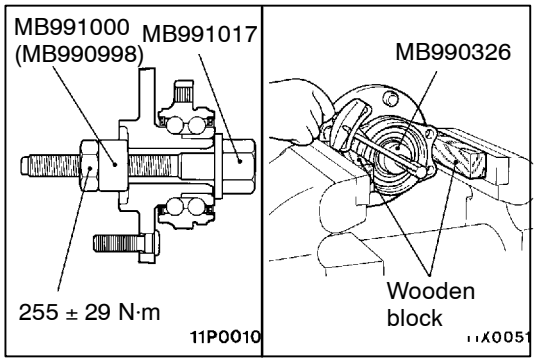
Attach wooden block to the lower arm as shown in the illustration and use the floor jack to install the lower arm mounting bolt by compressing the coil spring.



▶B◀ DRIVE SHAFT NUT INSTALLATION

1. Assemble the drive shaft washer in the illustrated direction.
2. Tighten the drive shaft nut fully with special tools.

   Caution
   Do not apply pressure to wheel bearing by the vehicle weight to avoid possible damage to wheel bearing before tightening drive shaft nut fully.
3. If the pin hole does not align with another, tighten the drive shaft nut (less than 284 N·m) and find the nearest hole then bend the split pin to fit in.



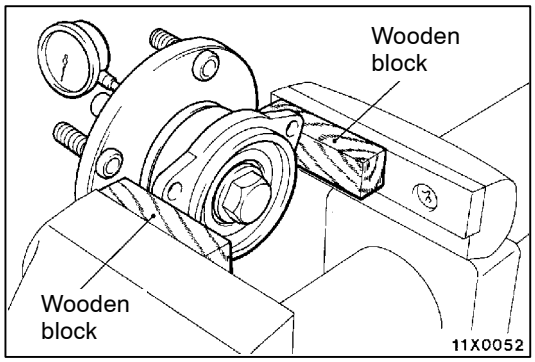
INSPECTION

WHEEL BEARING ROTATION STARTING TORQUE CHECK

1. Tighten special tools in rear hub assembly to the specified torque.
2. Hold rear hub assembly in a vice by way of wooden block.
3. Measure the wheel bearing rotation torque with special tools.

   Limit: 1.76 N·m

4. Hub rotation starting torque must be under the limit value and there should be no stickiness or roughness when rotating the hub.



WHEEL BEARING AXIAL PLAY CHECK

1. Check the wheel bearing axial play.

   Limit: 0 mm

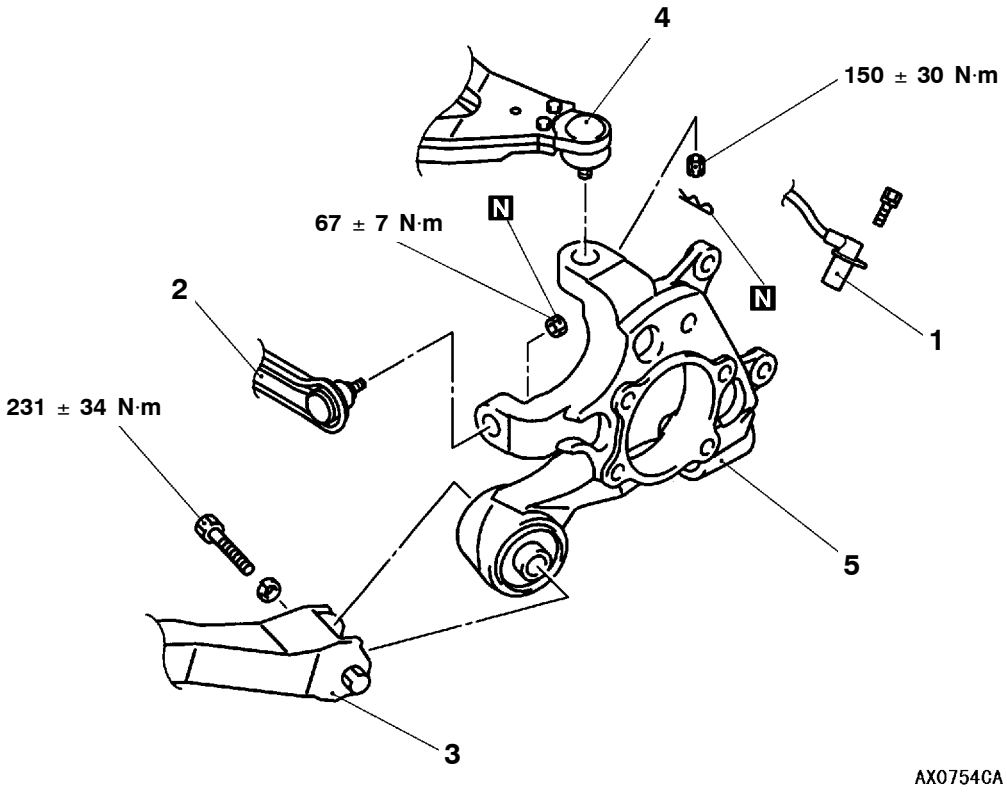
2. If the wheel bearing axial play exceeds the limit value at the specified torque of (255 ± 29 N·m), replace the rear hub assembly.

KNUCKLE

REMOVAL AND INSTALLATION

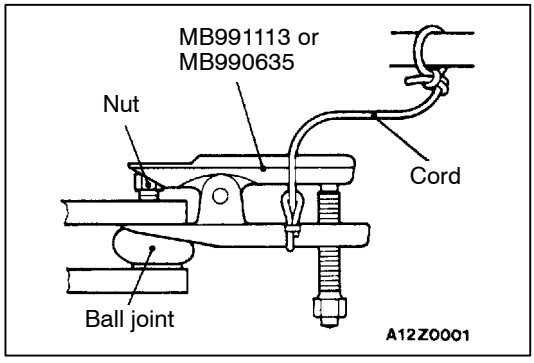
Pre-removal Operation
Rear Hub Assembly Removal (Refer to P.27-10.)

Post-installation Operation
- Press dust cover with a finger to check for crack or damage in the dust cover.
- Rear Hub Assembly Installation (Refer to P.27-10.)



Removal steps

1. Vehicle speed sensor
◀A▶ 2. Knuckle and toe-control arm connection
3. Knuckle and trailing arm connection
◀A▶ 4. Knuckle and upper arm connection
5. Knuckle assembly



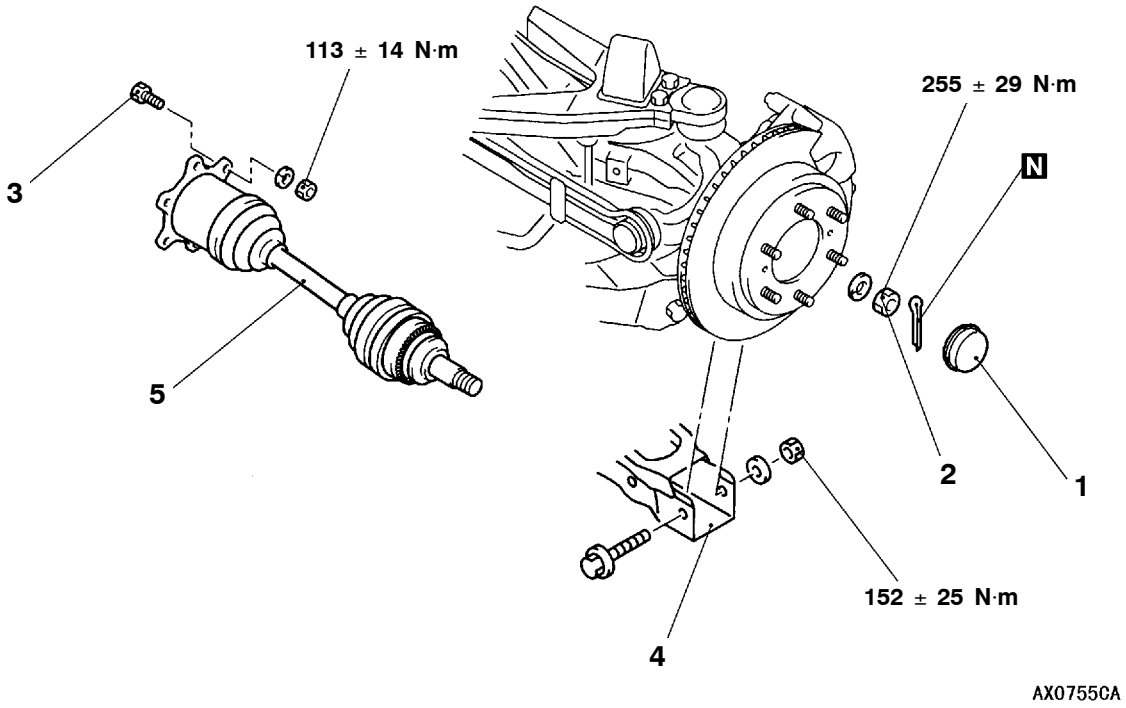
REMOVAL SERVICE POINT

◀A▶ KNUCKLE AND CONTROL ARM/UPPER ARM DISCONNECTION

Caution
1. **Use special tools to loosen the nut from the ball joint instead of removing it.**
2. **Hang special tools with ropes to prevent them from falling.**

DRIVE SHAFT

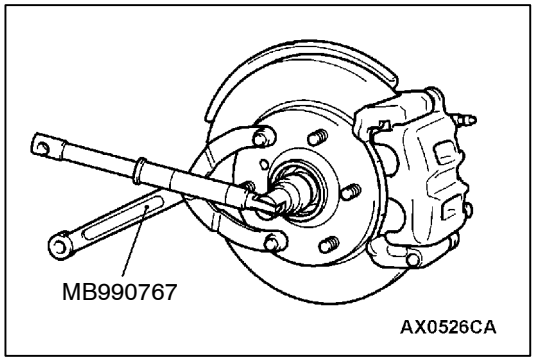
REMOVAL AND INSTALLATION



Removal steps

◀A▶ ▶B◀ 1. Cap
2. Drive shaft nut
3. Companion shaft and drive shaft connection

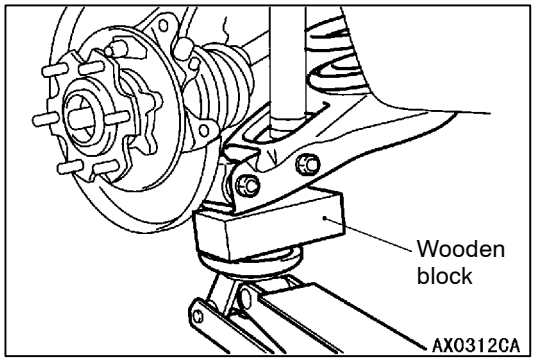
◀B▶ ▶A◀ 4. Knuckle and lower arm connection
5. Rear drive shaft assembly



REMOVAL SERVICE POINTS

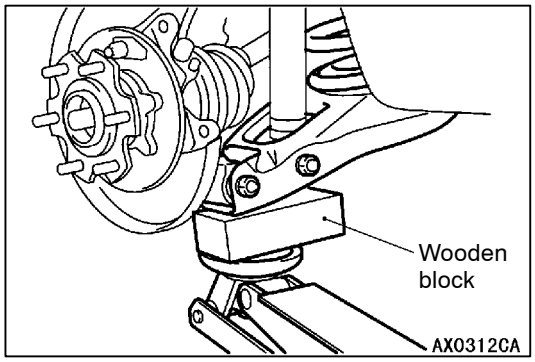
◀A▶ DRIVE SHAFT NUT REMOVAL

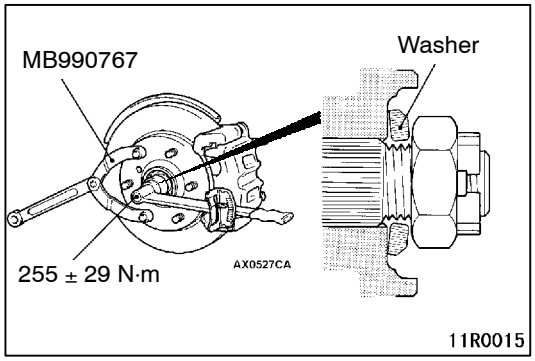
Caution
Do not apply pressure to wheel bearing by the vehicle weight to avoid possible damage to wheel bearing before tightening drive shaft nut fully.



◀B▶ LOWER ARM AND KNUCKLE DISCONNECTION

Attach wooden block to the lower arm as shown in the illustration and use the floor jack to remove the lower arm mounting bolt by compressing the coil spring.





INSTALLATION SERVICE POINTS

▶A◀ LOWER ARM AND KNUCKLE CONNECTION

Attach wooden block to the lower arm as shown in the illustration and use the floor jack to install the lower arm mounting bolt by compressing the coil spring.

▶B◀ DRIVE SHAFT NUT INSTALLATION

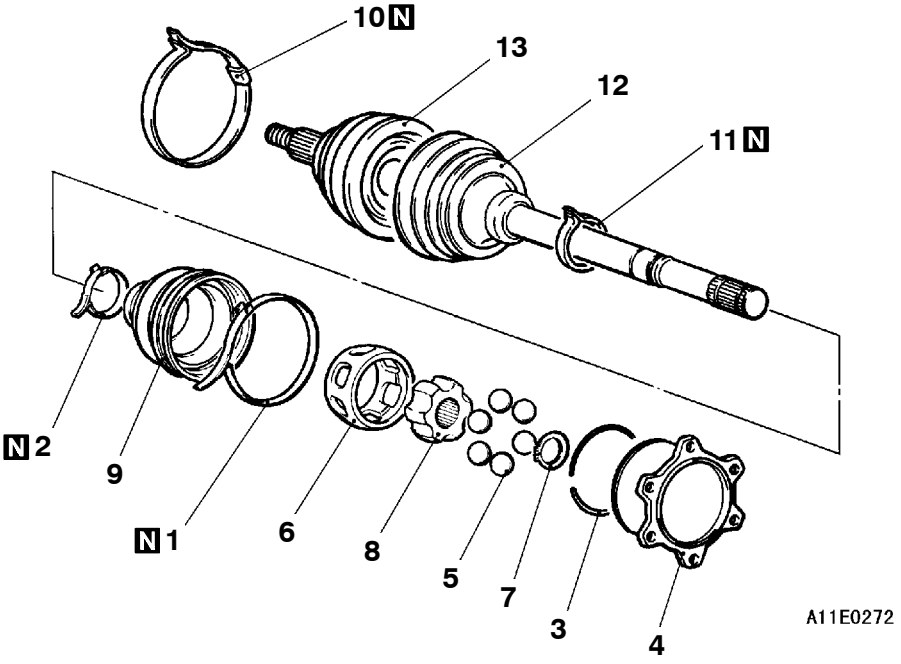
1. Assemble the drive shaft washer in the illustrated direction.
2. Tighten the drive shaft nut fully with special tools.

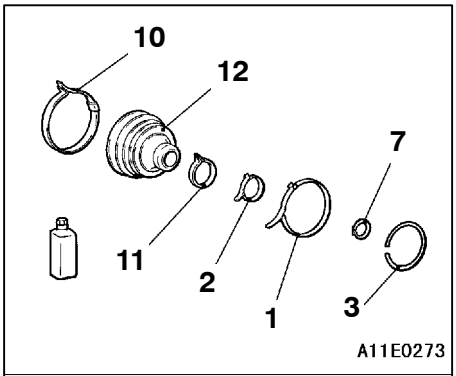
   Caution
   Do not apply pressure to wheel bearing by the vehicle weight to avoid possible damage to wheel bearing before tightening drive shaft nut fully.

3. If the pin hole does not align with another, tighten the drive shaft nut (less than 284 N·m) and find the nearest hole then bend the split pin to fit in.

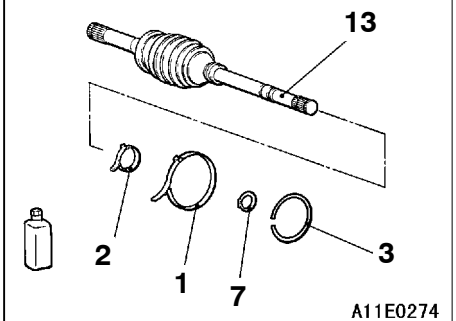
DISASSEMBLY AND REASSEMBLY

Caution
Never disassemble the B.J. assembly except when replacing the B.J. boot.

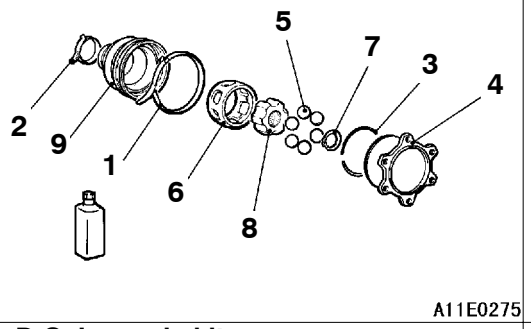




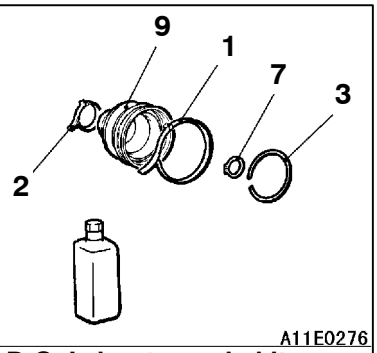
B.J. boot repair kit



B.J. repair kit



D.O.J. repair kit

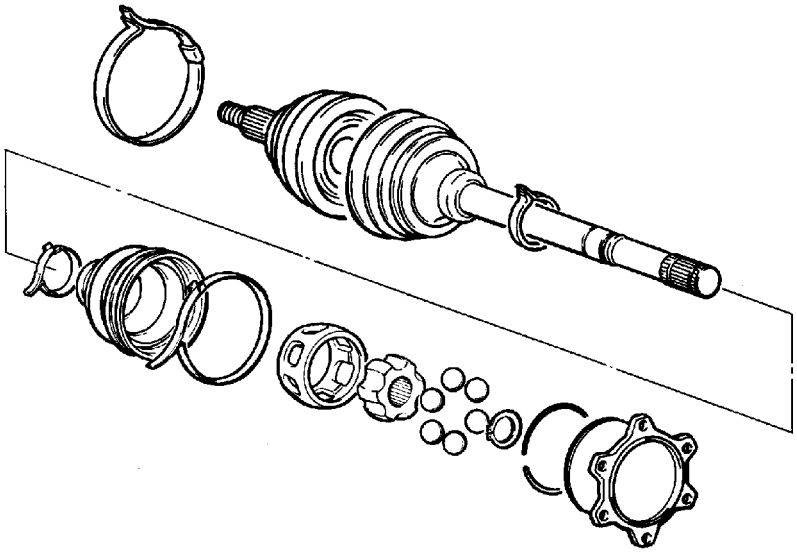


D.O.J. boot repair kit

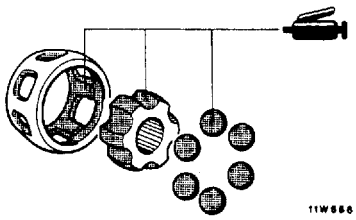
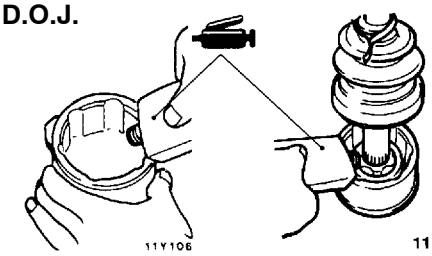
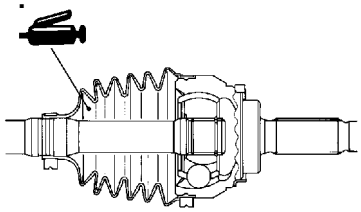
	Disassembly steps		Reassembly steps
	1. D.O.J. boot band (large)		13. B.J. assembly
	2. D.O.J. boot band (small)	▶A◀	12. B.J. boot
	3. Circlip		11. B.J. boot band (small)
	4. D.O.J. outer race		10. B.J. boot band (large)
◀A▶	5. Balls	▶A◀	9. D.O.J. boot
◀B▶	6. D.O.J. cage	▶B◀	6. D.O.J. cage
	7. Snap ring	▶B◀	8. D.O.J. inner race
	8. D.O.J. inner race		7. Snap ring
◀C▶	9. D.O.J. boot		5. Balls
	10. B.J. boot band (large)	▶C◀	4. D.O.J. outer race
	11. B.J. boot band (small)		3. Circlip
◀C▶	12. B.J. boot	▶D◀	2. D.O.J. boot band (small)
	13. B.J. assembly	▶D◀	1. D.O.J. boot band (large)

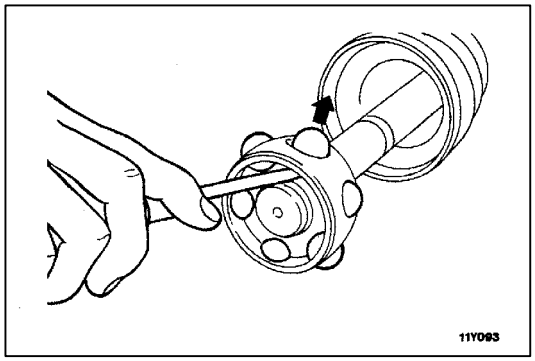
Lubrication Points

Caution
Do not mix old and new or different types of grease, as a special grease is used in the joint.



11E0272

 11W656	D.O.J.  11Y106 11H0067	B.J.  A11X0142
Grease: Repair kit grease	**Grease: Repair kit grease** **<B.J.>245 ± 10 g (135 ± 5 g inside joint, 110 ± 5 g inside boot)** **<D.O.J.>295 ± 10 g (185 ± 5 g inside joint, 110 ± 5 g inside boot)** Note The grease in the repair kit should be divided in half for use, respectively, at the joint and inside the boot.	



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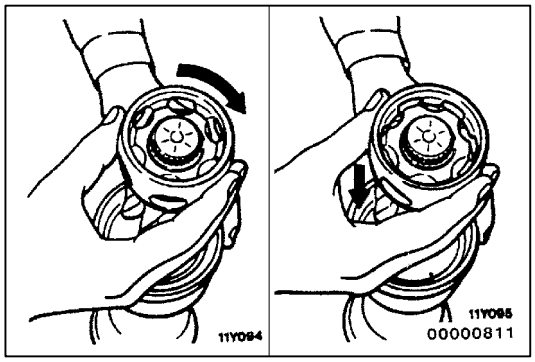
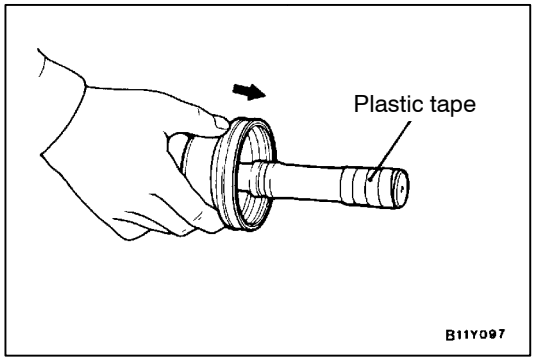
DISASSEMBLY SERVICE POINTS

◀A▶ BALLS REMOVAL



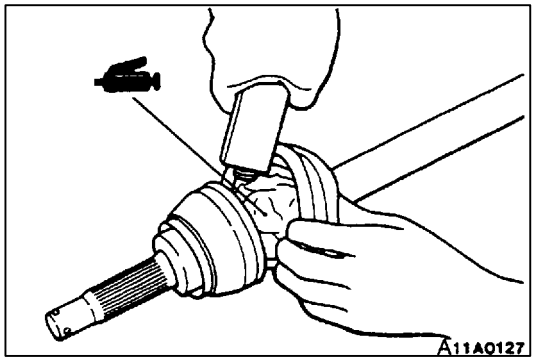
◀B▶ D.O.J. CAGE REMOVAL

Remove the D.O.J. cage from the D.O.J. inner race in the direction of the B.J.



◀C▶ D.O.J. BOOT/B.J. BOOT REMOVAL

Wrap plastic tape around the spline part on the D.O.J. side of the drive shaft so that D.O.J. boot/B.J. boot are not damaged when they are removed.



REASSEMBLY SERVICE POINTS

▶A◀ B.J. BOOT/D.O.J. BOOT INSTALLATION

1. Wrap the tape around the spline of the shaft, then install B.J. boot and D.O.J. boot in order.
2. Fill the inside of B.J. and B.J. boot with specified grease.

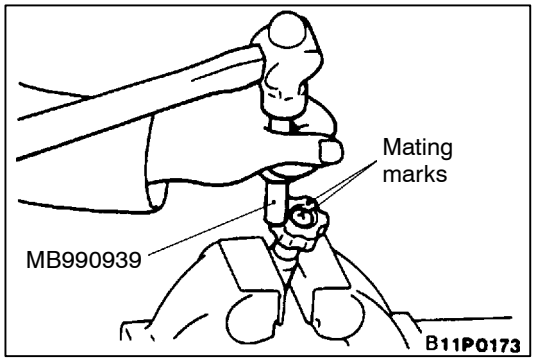
   Specified grease: Repair kit grease

   Used amount: 245 ± 10 g
   (135 ± 5 g inside joint, 110 ± 5 g inside boot)

   Caution
   Do not mix old and new or different types of grease, as a special grease is used in the joint.

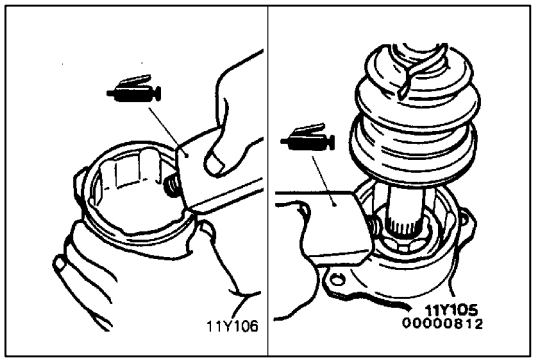
3. Tighten the boot band.

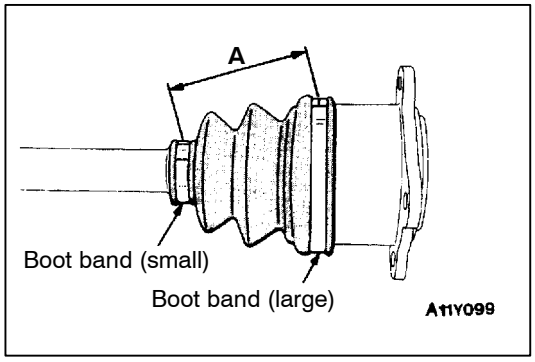
   Caution
   In order to fill the specified amount of air inside the BJ boot, keep the bent angle of the drive shaft to 0° during the operation.



▶B◀ D.O.J. CAGE/D.O.J. INNER RACE INSTALLATION

1. Install D.O.J. cage to the drive shaft and put it aside to B.J. assembly side.
2. Align the mating mark of D.O.J. inner race with that of the shaft.
3. Tap the inner race with even force to press-fit into the bump of the shaft with special tools.





▶C◀ D.O.J. OUTER RACE INSTALLATION

Fill the inside of the D.O.J. outer race and D.O.J. boot with the specified grease.

Specified grease:

Repair kit grease 295 ± 10 g (185 ± 5 g inside joint, 110 ± 5 g inside boot)

Caution

The drive shaft joint use special grease. Do not mix old and new or different types of grease.

▶D◀ D.O.J. BOOT/D.O.J. BOOT BAND INSTALLATION

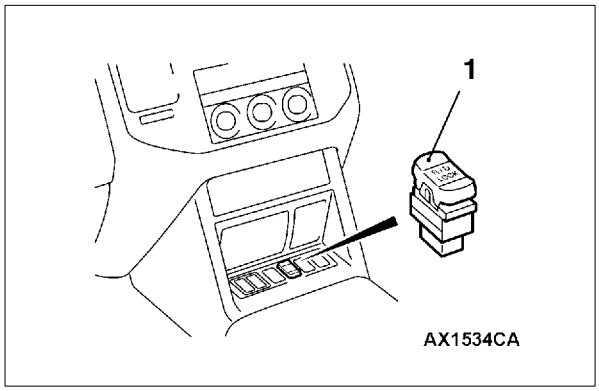
1. Position the D.O.J. outer race so that the distance between the boot bands is at the standard value.

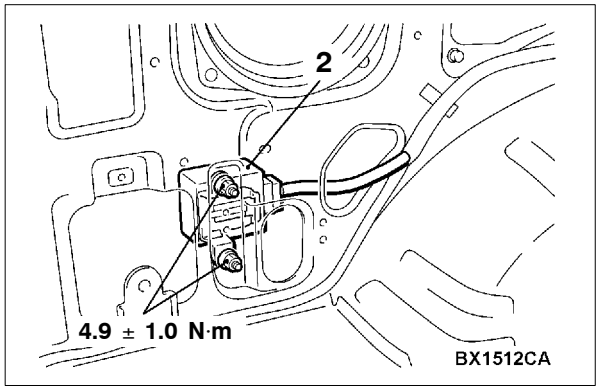
   Standard value (A): 110 ± 3 mm <4D5, 4M4-A/T, 6G7>
   115 ± 3 mm <4M4-M/T>

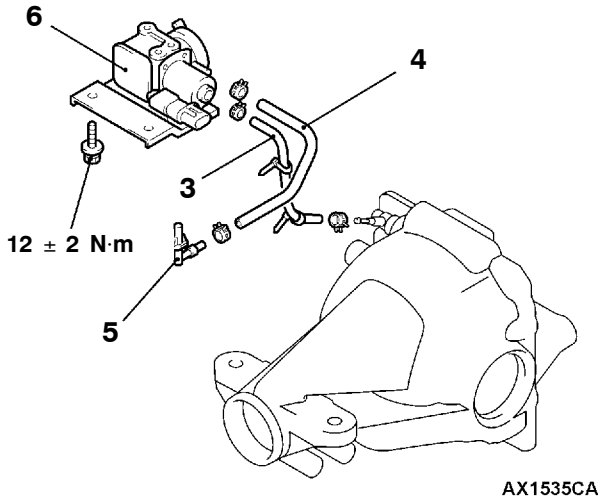
2. Remove part of the D.O.J. boot from the D.O.J. outer race to release the air pressure inside the boot.

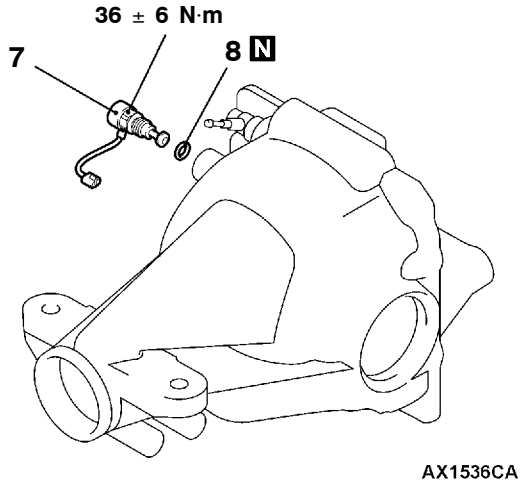
REAR DIFFERENTIAL LOCK

REMOVAL AND INSTALLATION









1. Rear differential lock switch

Rear differential lock-ECU removal steps

- Upper/Lower quarter trim (Refer to Group 52A – Trims.)

2. Rear differential lock-ECU

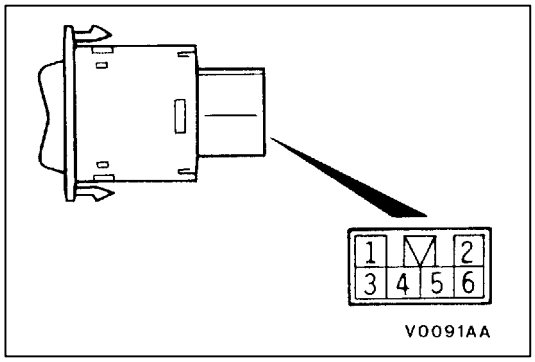
Rear differential lock air pump assembly removal steps

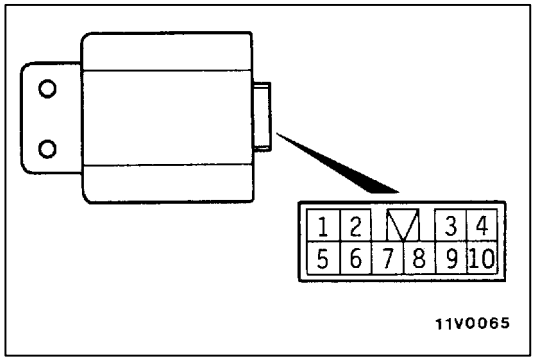
3. Hose
4. Vapor hose
5. Nipple
6. Rear differential lock air pump assembly

Rear differential lock position switch removal steps

- Differential carrier (Refer to P.27-23.)

7. Rear differential lock position switch
8. Gasket





INSPECTION

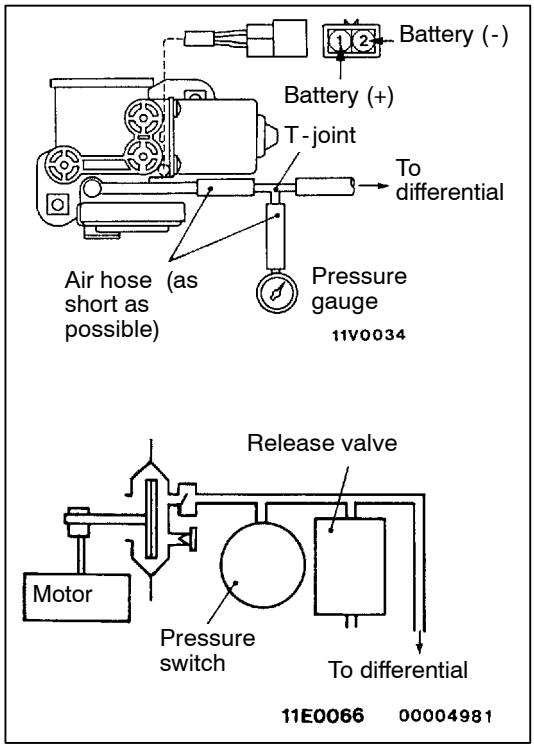
REAR DIFFERENTIAL LOCK SWITCH CHECK

Switch position	Terminal No.					
	1	ILL	2	3	5	6
OFF	○	○		○		○
ON	○	○			○	○

REAR DIFFERENTIAL LOCK-ECU CHECK

1. Measure the terminal voltage under each condition.
2. With the ECU connected to the harness and the probe inserted into rear of the harness connector, measure the voltage between terminal number 6 (earth terminal) and each terminal.

Terminal No.	Inspection item		Condition		Terminal voltage
1	Rear differential lock switch	OFF side	Ignition switch: ON	When in neutral	System voltage
2	Vehicle speed reed switch		Select “D” or “1” (1st gear) and drive forward slowly		5 V
3	Ignition switch (IG1)		Ignition switch (IG1)	OFF	0 V
				ON	Approximately 12 V (battery positive voltage)
4	Rear differential lock air pump		Ignition switch: ON	When filling or holding	System voltage
				When releasing	0 V
5	4WD detection switch		Ignition switch: ON	4WD	0 V
				2WD	System voltage
8	Rear differential lock detection switch		Ignition switch: ON	Rear differential is locked	0 V
				Rear differential is free	System voltage
9	Rear differential lock switch	ON side	Ignition switch: ON	ON side or OFF side	0 V
10	Rear differential lock indicator lamp		Ignition switch: ON	Rear differential is locked	0 V
				Rear differential is free	System voltage

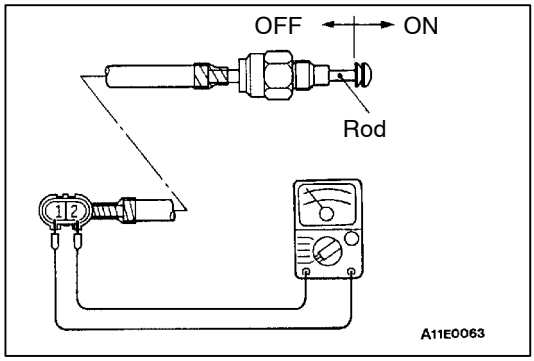


REAR DIFFERENTIAL LOCK AIR PUMP CHECK

1. Install air hose to the differential.
2. Connect a pressure gauge to the air pump discharge outlet nozzle, via the air hose and T-joint.
3. Apply battery voltage to the air pump connector.
4. Measure the time when the pump starts and stops operating, and if stops within five seconds, the pressure switch inside the pump is normal.
5. Measure the pressure 10 - 20 seconds after the pump has stopped.

   Standard value: 25 - 40 kPa

   If the pressure is within the standard value, the release valve inside the pump is normal.
6. Check that the pump does not begin operating for five minutes after it has stopped.
7. If the inspection for 4 - 6 is normal, then the pump is fully operational.



REAR DIFFERENTIAL LOCK DETECTION SWITCH CHECK

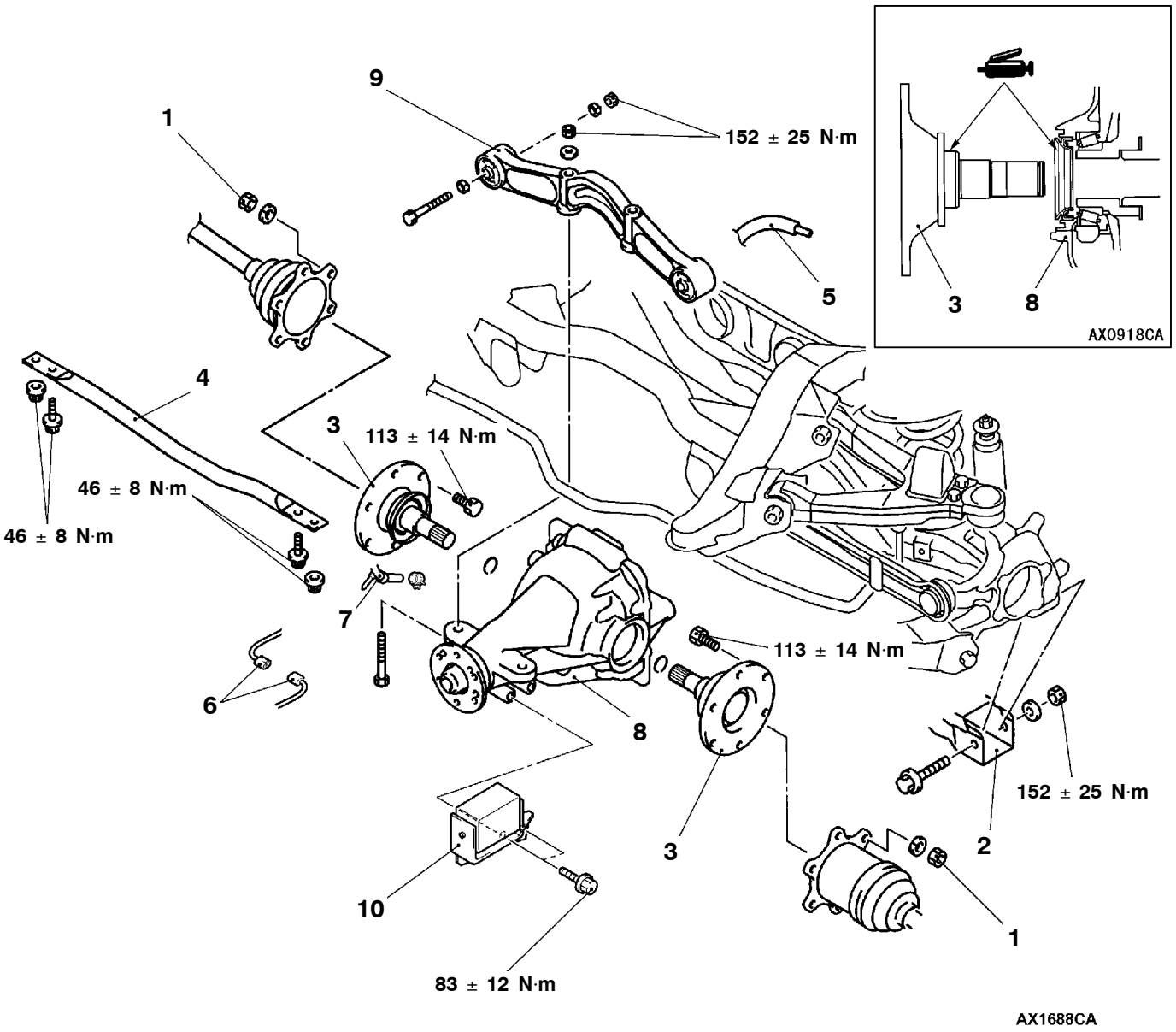
1. Connect an ohmmeter to the detection switch connector.
2. The rear differential lock switch is in good condition when the rod of the detection switch is pulled, there should be continuity, and when it returned to its normal position, no continuity.

DIFFERENTIAL CARRIER

REMOVAL AND INSTALLATION

Caution
Since a carbon fiber fortified plastic tube is used in the rear propeller shaft, make sure to refer to GROUP 25 for removal procedure.

Pre-removal and Post-installation Operation
Differential Gear Oil Draining and Refilling (Refer to P.27-8.)



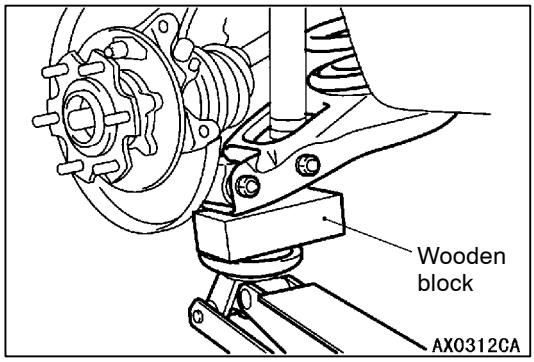
Removal steps

- Propeller shaft (Refer to GROUP 25.)

1. Drive shaft connection
◀A▶ ▶A◀ 2. Knuckle and lower arm connection
3. Companion shaft
4. Toe control tower bar
5. Breather hose connection
6. Harness connection <Vehicles with rear differential lock>
7. Hose connection <Vehicles with rear differential lock>
◀B▶ 8. Differential carrier assembly

- Fuel tank (Refer to GROUP 13B - Fuel Supply.)

9. Rear differential mount member
10. Dynamic damper



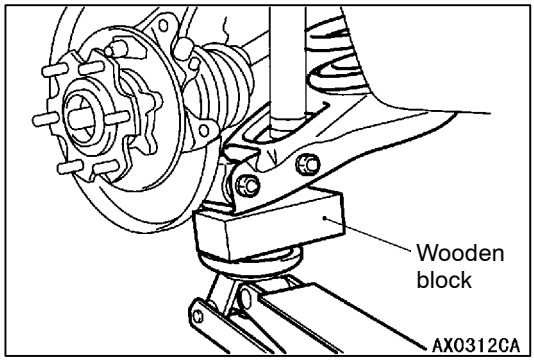
REMOVAL SERVICE POINTS

◀A▶ KNUCKLE AND LOWER ARM DISCONNECTION

Attach wooden block to the lower arm as shown in the illustration and use the floor jack to remove the lower arm mounting bolt by compressing the coil spring.

◀B▶ DIFFERENTIAL CARRIER ASSEMBLY REMOVAL

Support the differential carrier lower part by jacking to remove the joint bolt and the differential carrier assembly.



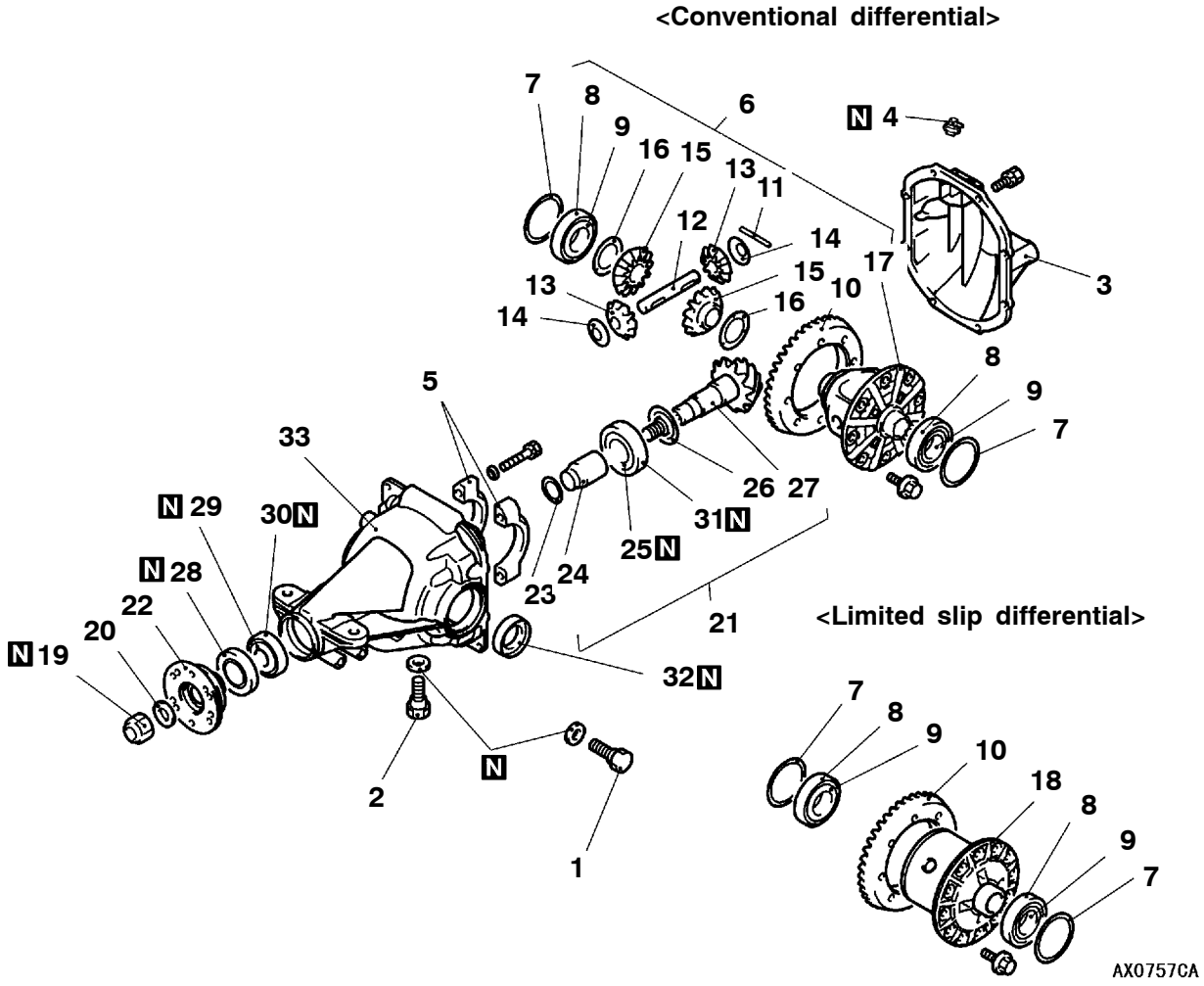
INSTALLATION SERVICE POINT

▶A◀ KNUCKLE AND LOWER ARM CONNECTION

Attach wooden block to the lower arm as shown in the illustration and use the floor jack to install the lower arm mounting bolt by compressing the coil spring.

DISASSEMBLY

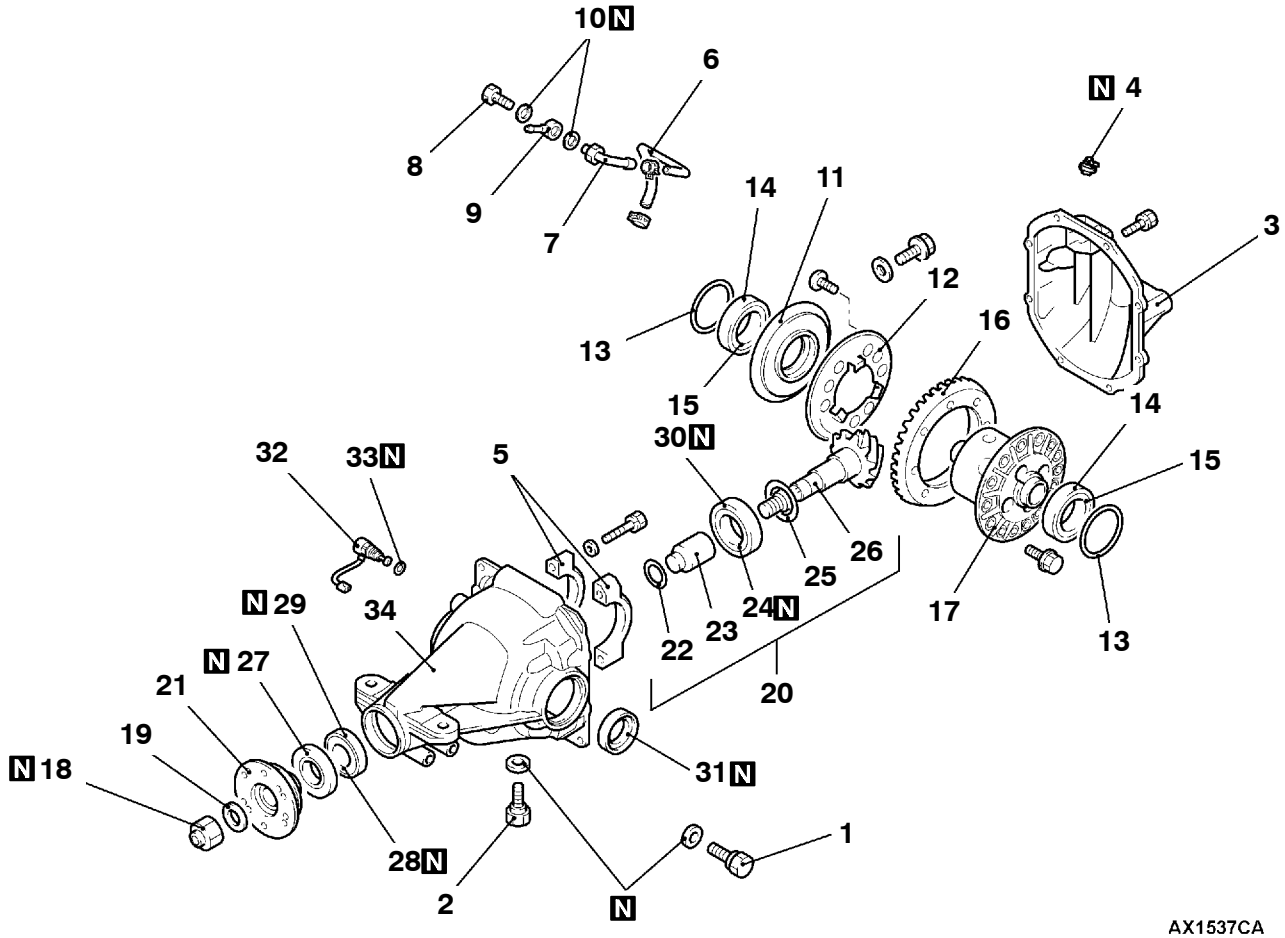
Caution
***: Do not disassemble the limited slip differential case assembly.**



Disassembly steps

◀A▶ ● Inspection before disassembly
1. Filler plug
2. Drain plug
3. Differential cover
4. Vent plug
5. Bearing cap
◀B▶ 6. Differential case assembly
◀B▶ 7. Differential side shim
◀B▶ 8. Side bearing outer race
◀C▶ 9. Side bearing inner race
◀D▶ 10. Drive gear
◀E▶ 11. Lock pin
12. Pinion shaft
13. Pinion gear
14. Pinion washer
15. Side gear
16. Side gear thrust spacer
17. Differential case
18. Limited slip differential case assembly*
◀F▶ 19. Self-locking nut
20. Washer
◀G▶ 21. Drive pinion assembly
◀G▶ 22. Companion flange
23. Drive pinion front shim (For adjusting preload of drive pinion)
24. Drive pinion spacer
◀H▶ 25. Drive pinion rear bearing inner race
26. Drive pinion rear shim (For adjusting drive pinion height)
27. Drive pinion
◀I▶ 28. Oil seal
◀I▶ 29. Drive pinion front bearing inner race
◀I▶ 30. Drive pinion front bearing outer race
◀J▶ 31. Drive pinion rear bearing outer race
32. Oil seal
33. Differential carrier

<Rear differential lock with limited slip differential>



Disassembly steps

◀A▶ ● Inspection before disassembly
1. Filler plug
2. Drain plug
3. Differential cover
4. Vent plug
5. Bearing cap
6. Hose
7. Air pipe assembly (A)
8. Eye bolt
9. Air pipe assembly (B)
10. Gasket
11. Actuator assembly
12. Pressure plate

◀B▶ 13. Differential side shim
◀B▶ 14. Side bearing outer race
◀C▶ 15. Side bearing inner race
◀D▶ 16. Drive gear
17. Limited slip differential case assembly*

◀F▶ 18. Self-locking nut
19. Washer

◀G▶ 20. Drive pinion assembly
◀G▶ 21. Companion flange
22. Drive pinion front shim (For adjusting preload of drive pinion)
23. Drive pinion spacer

◀H▶ 24. Drive pinion rear bearing inner race
25. Drive pinion rear shim (For adjusting drive pinion height)
26. Drive pinion

◀I▶ 27. Oil seal
◀I▶ 28. Drive pinion front bearing inner race
◀I▶ 29. Drive pinion front bearing outer race

◀J▶ 30. Drive pinion rear bearing outer race
31. Oil seal
32. Rear differential lock position switch
33. Gasket
34. Differential carrier

DISASSEMBLY SERVICE POINTS

◀A▶ INSPECTION BEFORE DISASSEMBLY

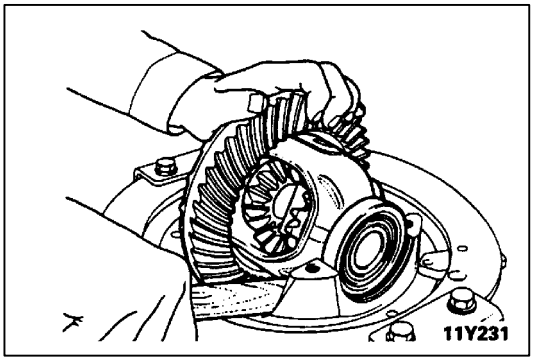
Except for the following standard values, inspection procedure is the same as GROUP 26 – Pre-removal Inspection.

DRIVE GEAR BACKLASH

Standard value: 0.13 - 0.18 mm

DIFFERENTIAL GEAR BACKLASH

Standard value: 0 - 0.076 mm

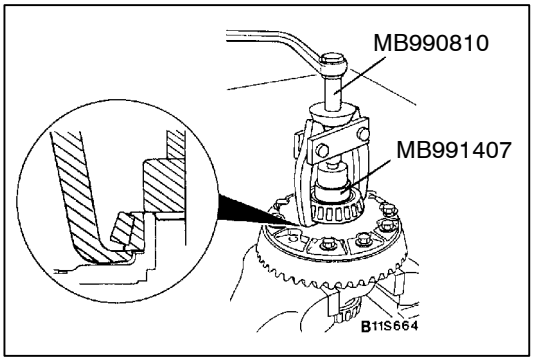


◀B▶ DIFFERENTIAL CASE ASSEMBLY/DIFFERENTIAL SIDE SHIM/SIDE BEARING OUTER RACE REMOVAL

Use the handle of a hammer to remove the differential case assembly, differential side shims and side bearings.

Caution
When taking out the differential case assembly, be careful not to drop and damage the differential side shims or the side bearing outer races.

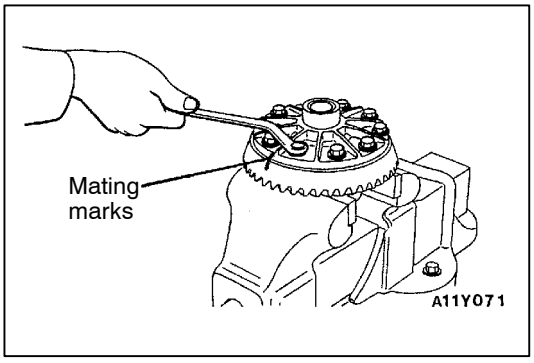
NOTE
Keep the right and left side bearings and side bearing outer race separate, so that they do not become mixed at the time of assembly.



◀C▶ SIDE BEARING INNER RACE REMOVAL

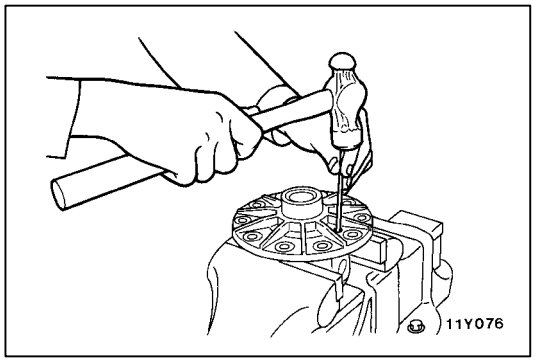
Use special tools to pull out the side bearing inner race.

NOTE
Attach the prongs of special tools to the inner race of the side bearing through the openings in the differential case.



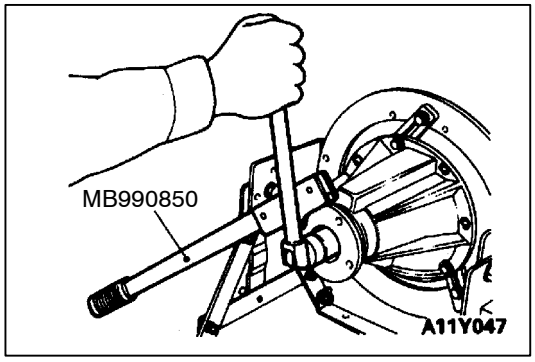
◀D▶ DRIVE GEAR REMOVAL

1. Make mating marks to the differential case and the drive gear.
2. Loosen the drive gear attaching bolts in diagonal sequence to remove the drive gear.



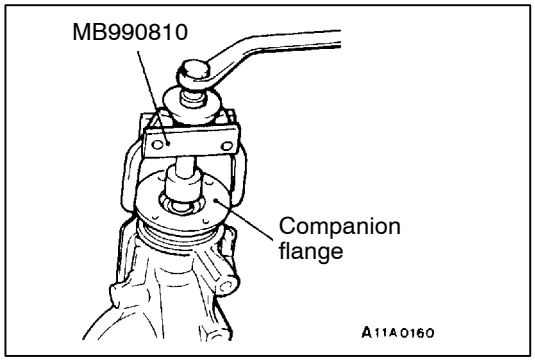
◀E▶ LOCK PIN REMOVAL

Drive out the lock pin with a punch.



◀F▶ SELF-LOCKING NUT REMOVAL

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

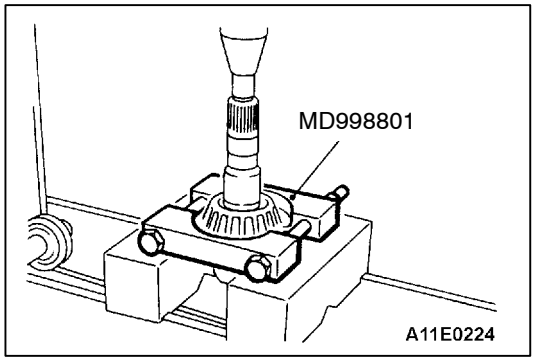


◀G▶ DRIVE PINION ASSEMBLY/COMPANION FLANGE REMOVAL

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

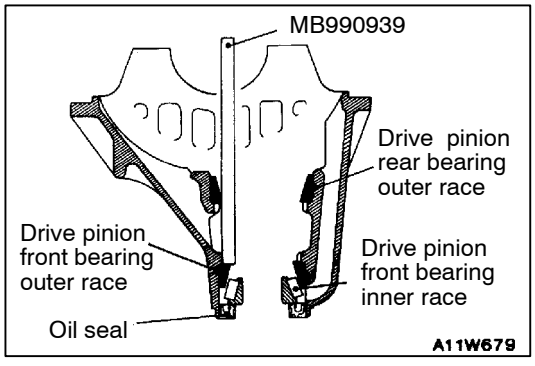
   Caution
   Do not make mating marks on the contact surfaces of the companion flange and propeller shaft.

2. Use special tools to pull out the companion flange.



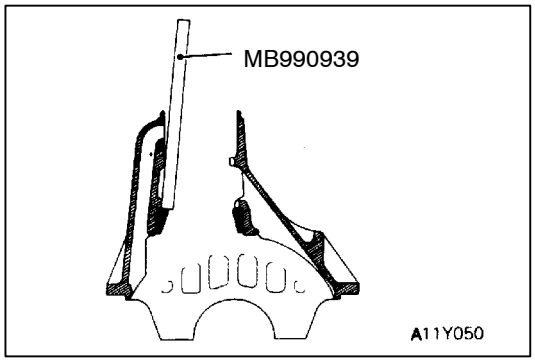
◀H▶ DRIVE PINION REAR BEARING INNER RACE REMOVAL

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



◀I▶ OIL SEAL/DRIVE PINION FRONT BEARING INNER RACE/DRIVE PINION FRONT BEARING OUTER RACE REMOVAL

Use special tool to remove drive pinion front bearing outer race.

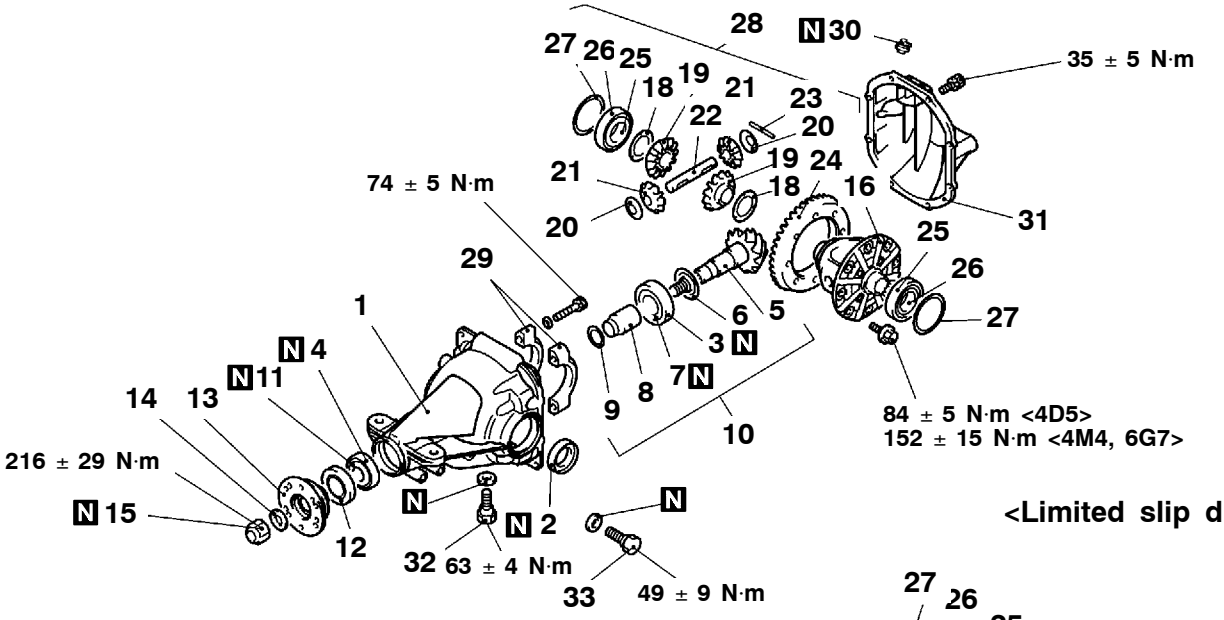


◀J▶ DRIVE PINION REAR BEARING OUTER RACE REMOVAL

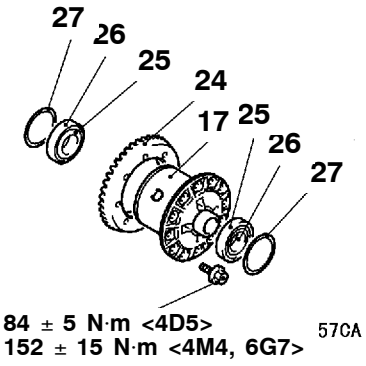
Use special tool to remove the drive pinion rear bearing outer race.

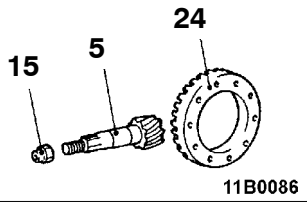
REASSEMBLY

<Conventional differential>

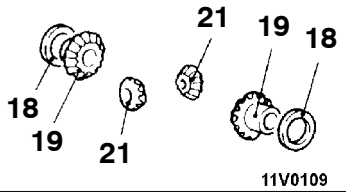


<Limited slip differential>





Differential gear set

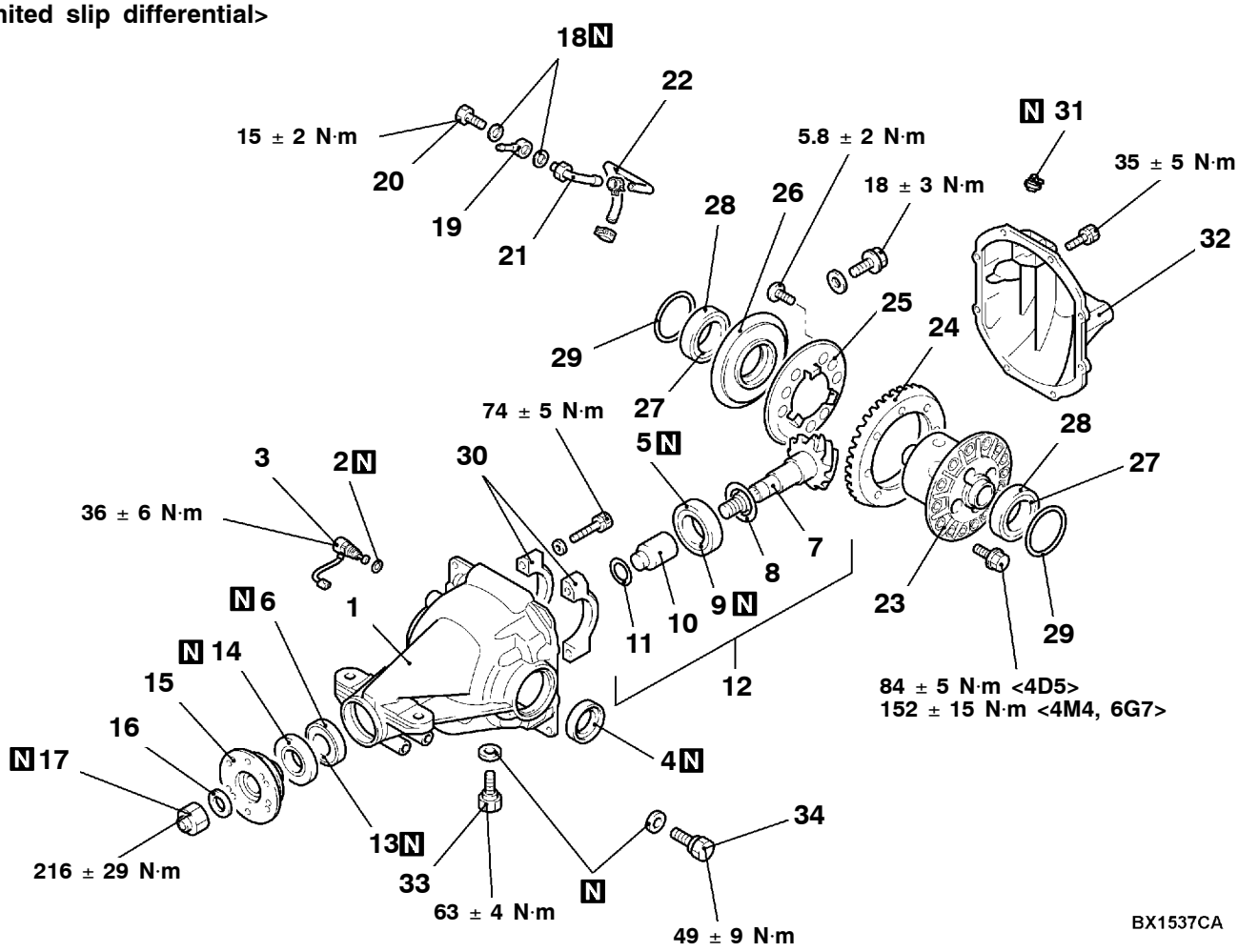


Final drive gear set

Reassembly steps

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

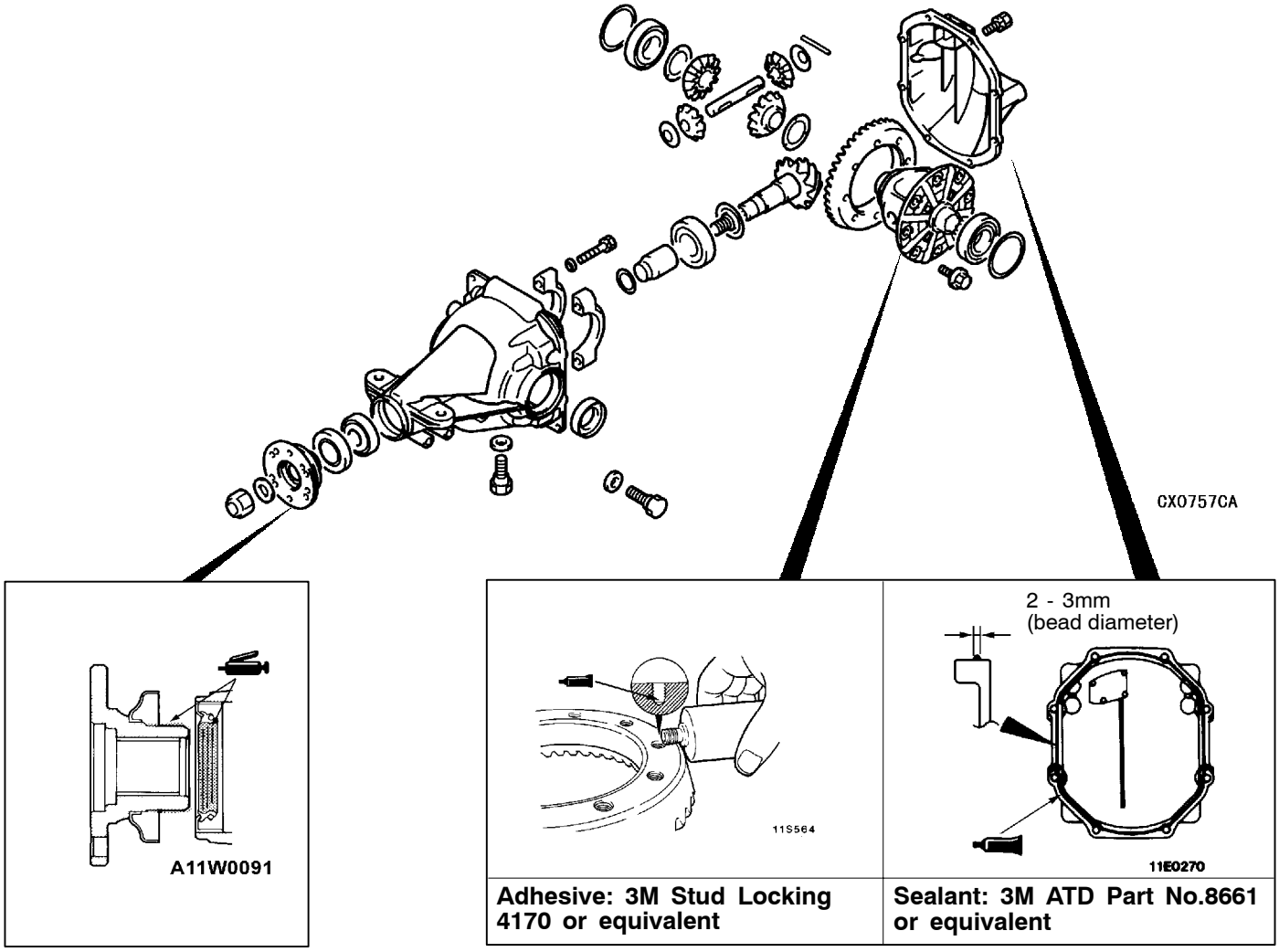
<Rear differential lock with limited slip differential>



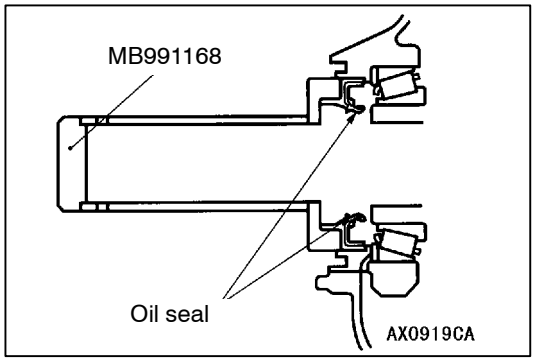
Reassembly steps

1. Differential carrier
2. Gasket
3. Rear differential lock position switch
- ▶A◀ 4. Oil seal
- ▶B◀ 5. Drive pinion rear bearing outer race
- ▶C◀ 6. Drive pinion front bearing outer race
- ▶D◀ ● Drive pinion height adjustment
7. Drive pinion
8. Drive pinion rear shim (For adjusting drive pinion height)
9. Drive pinion rear bearing inner race
10. Drive pinion spacer
- ▶E◀ ● Drive pinion turning torque adjustment
11. Drive pinion front shim (For adjusting drive pinion preload)
12. Drive pinion assembly
13. Drive pinion front bearing inner race
- ▶E◀ 14. Oil seal
15. Companion flange
16. Washer
17. Self-locking nut
18. Gasket
19. Air pipe assembly (B)
20. Eye bolt
21. Air pipe assembly (A)
22. Hose
23. Limited slip differential case assembly
- ▶H◀ 24. Drive gear
25. Pressure plate
26. Actuator assembly
- ▶I◀ 27. Side bearing inner race
28. Side bearing outer race
29. Side bearing shim
- ▶J◀ 30. Bearing cap
31. Vent plug
32. Differential cover
33. Drain plug
34. Filler plug
- ▶J◀ ● Final drive gear backlash adjustment

Lubrication and Adhesive Points

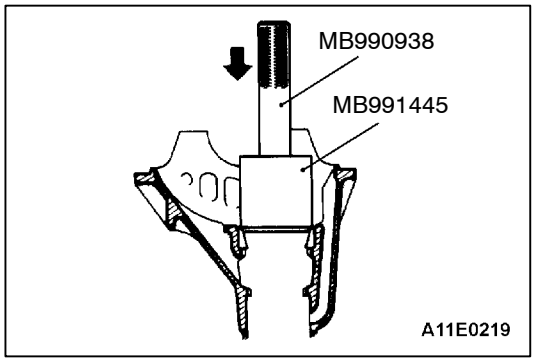


Adhesive: 3M Stud Locking 4170 or equivalent	**Sealant: 3M ATD Part No.8661 or equivalent**

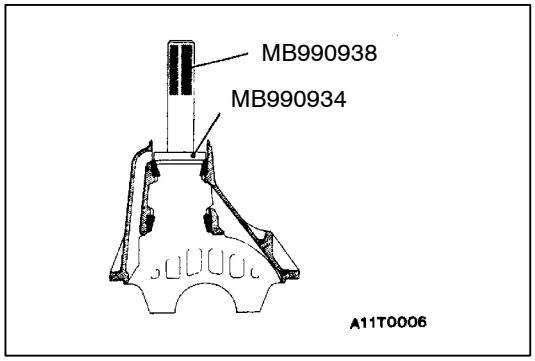


REASSEMBLY SERVICE POINTS

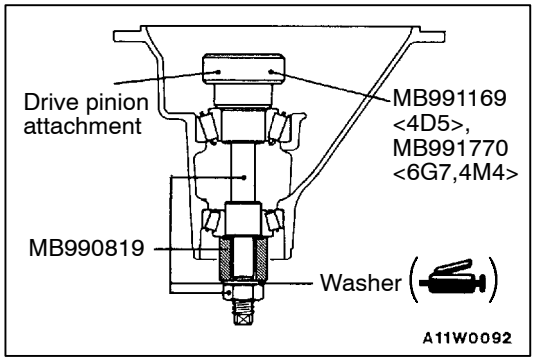
▶A◀ OIL SEAL PRESS-FITTING



▶B◀ DRIVE PINION REAR BEARING OUTER RACE PRESS-FITTING



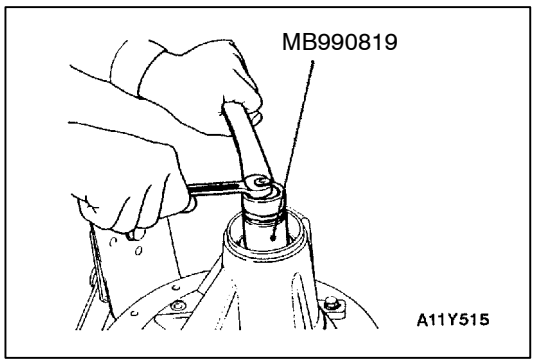
▶C◀ DRIVE PINION FRONT BEARING OUTER RACE PRESS-FITTING



▶D◀ DRIVE PINION HEIGHT ADJUSTMENT

Adjust the drive pinion height by the following procedures:

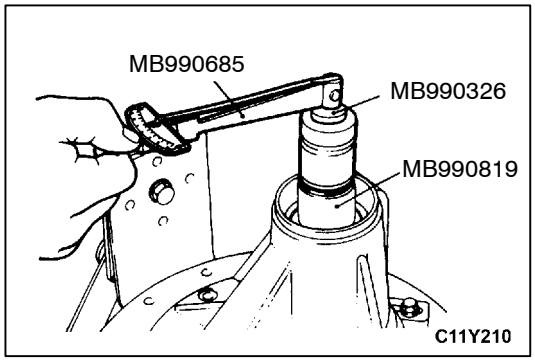
1. Apply multipurpose grease to the washer of special tool.
2. Install special tool and drive pinion front and rear bearing inner races to the gear carrier in the sequence shown in the illustration.

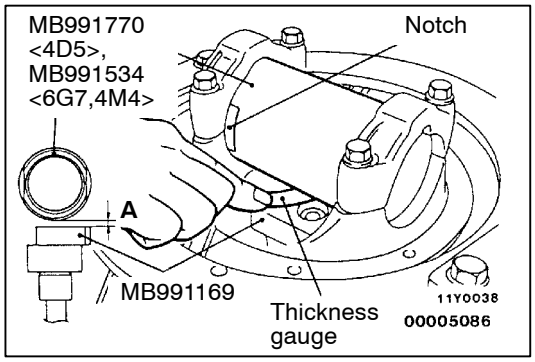


3. Tighten the nut of special tool a little at a time while measuring the turning torque of the drive pinion. Then confirm the turning torque(without the oil seal) is at the standard value.

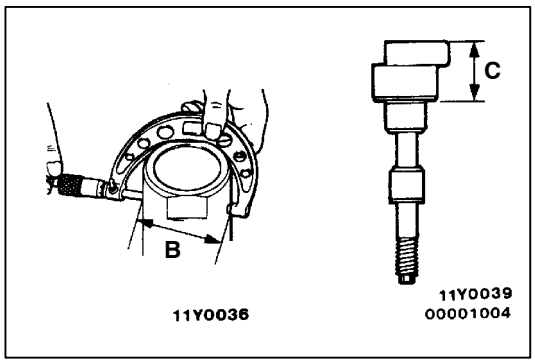
Standard value:

Bearing type	Turning torque
New	1.94 - 2.25 N·m

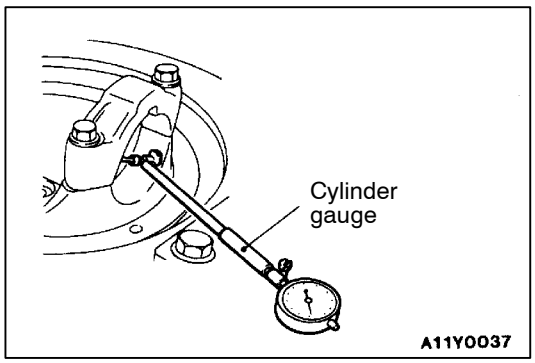




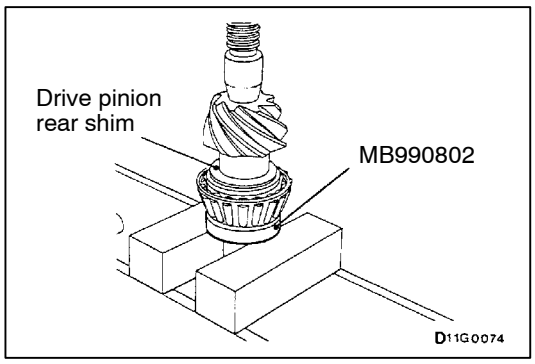
4. Clean the side bearing hub.
5. Place special tool between the side bearing hub of the gear carrier, and position the notch as shown in the illustration. Then tighten side bearing mounting bolt.
6. Use a thickness gauge to measure the clearance (A) between special tools.



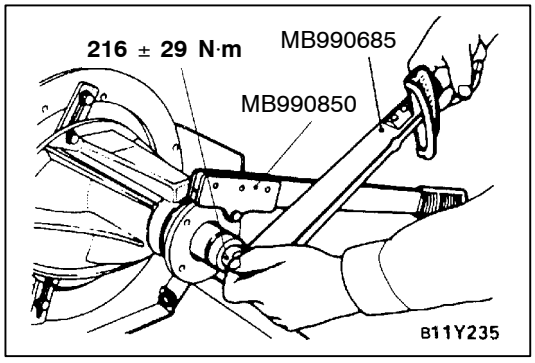
7. Remove special tools (MB991170, MB991169).
8. Use a micrometer to measure the shown dimensions (B, C) of special tools.



9. Install the bearing cap, and then use a cylinder gauge to measure inside diameter (D) of the bearing cap.
10. Calculate thickness (F) of the required drive pinion rear shim twice by the following formula. Select a shim which most closely matches this thickness.
    F = A + B + C - 1/2D - 86.00 mm



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 special tool.

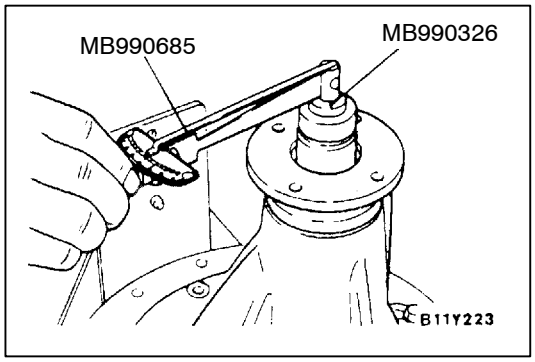


▶E◀ DRIVE PINION TURNING TORQUE ADJUSTMENT /OIL SEAL INSTALLATION

1. Insert the drive pinion into the gear carrier, and then install the following parts in sequence from the carrier rear side. Drive pinion spacer, drive pinion front shim and drive pinion front bearing inner race, companion flange.

   NOTE
   Do not install the oil seal.

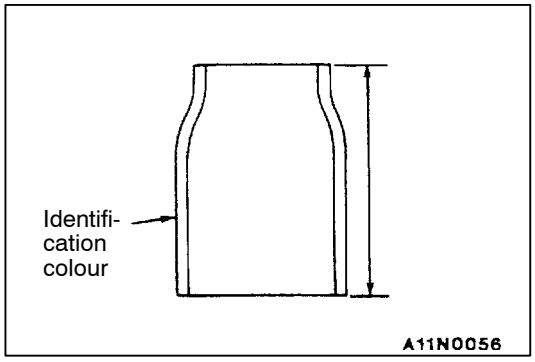
2. Tighten the companion flange to the specified torque by using special tool.



3. Measure the drive pinion turning torque (without the oil seal).

Standard value:

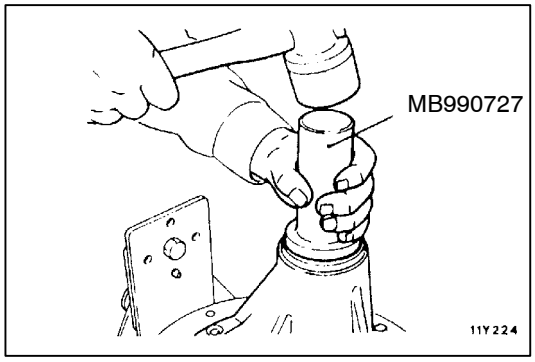
Bearing division	Turning torque
New	1.94 - 2.25 N·m



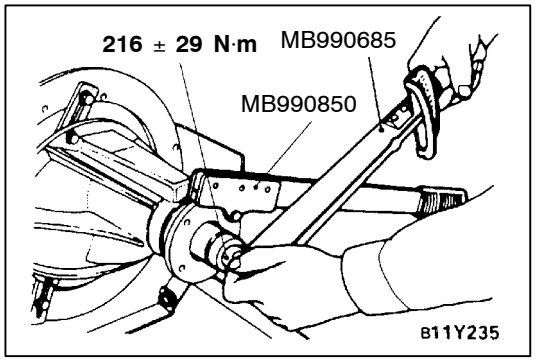
4. If the drive pinion turning torque is not within the standard value, adjust the turning torque by replacing the drive pinion front shim(s) or the drive pinion spacer.

NOTE
When selecting the drive pinion front shims, if the number of shims is large, reduce the number of shims to a minimum by selecting the drive pinion spacers.
Also, select the drive pinion spacer from the following two types.

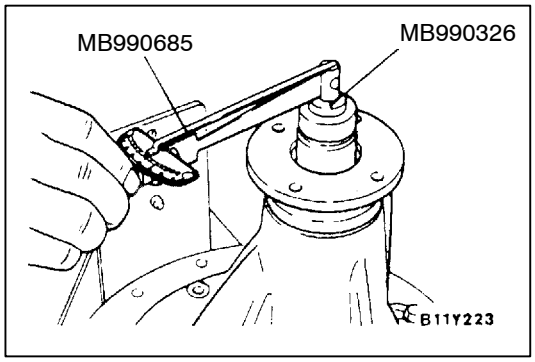
Height of drive pinion spacer mm	Identification colour
52.50	Yellow
52.84	Red



5. Remove the companion flange and drive pinion again. Then insert the drive pinion front bearing inner race into the gear carrier. Use special tool to press-fit the oil seal.



6. Install the drive pinion assembly and companion flange with mating marks properly aligned. Tighten the companion flange self-locking nut to the specified torque using special tool.

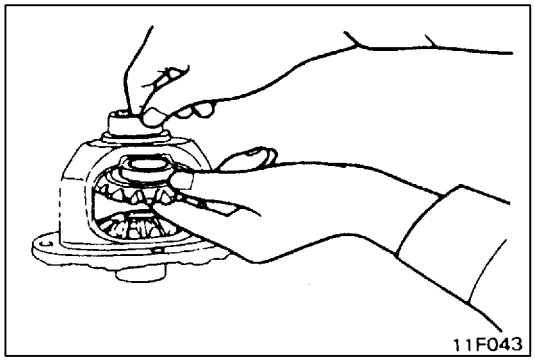


7. Measure the drive pinion turning torque (with oil seal) to verify that the drive pinion turning torque complies with the standard value.

Standard value:

Bearing division	Companion flange lubrication	Turning torque
New	None (With anti-rust agent)	2.03 - 2.34 N·m
	Gear oil applied	2.10 - 2.40 N·m

8. If the turning torque is not within the standard value, check the tightening torque of the companion flange self-locking nut, and the installation of the oil seal.

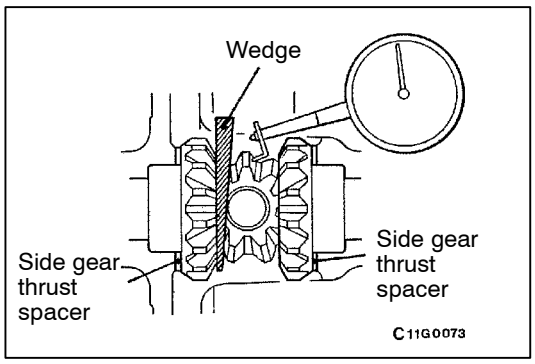


▶F◀ DIFFERENTIAL GEAR BACKLASH ADJUSTMENT

Adjust the differential gear backlash by the following procedure.

1. Assemble the side gears, side gear thrust spacers, pinion gears, and pinion washers into the differential case.
2. Temporarily install the pinion shaft.

NOTE
Do not assemble the thrust block and lock pin yet.



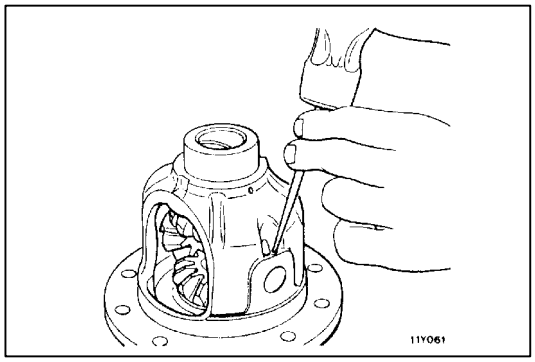
3. Insert a wedge between the side gear and the pinion shaft to lock the side gear.
4. While locking the side gear with the wedge, measure the differential gear backlash with a dial indicator on the pinion gear.

Standard value: 0 - 0.076 mm

Measure by the same procedure for the other pinion gear.

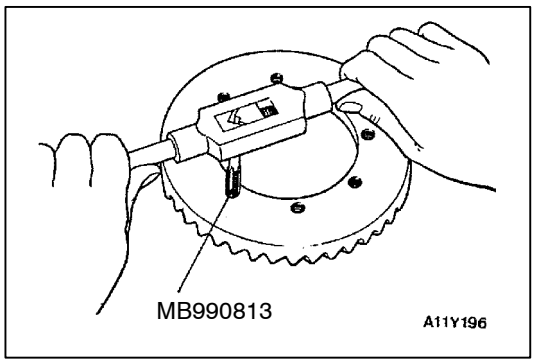
Limit: 0.2 mm

5. If the backlash exceeds the limit value, replace side bearing adjustment spacers.
6. If adjustment is not possible, replace the side gears and pinion gears as a set.
7. Check that the backlash is within the limit value and that the differential gear turns smoothly.



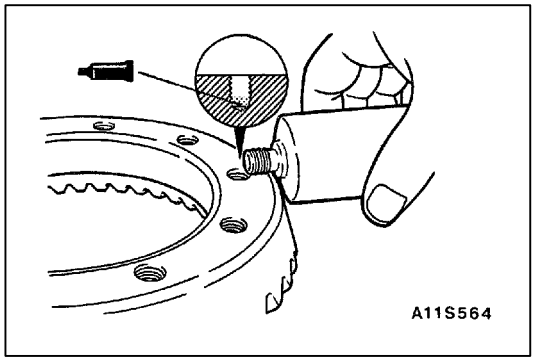
▶G◀ LOCK PIN INSTALLATION

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 on both sides.



▶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 the special tool (tap M10 x 1.25), and then clean the threaded holes by applying compressed air.

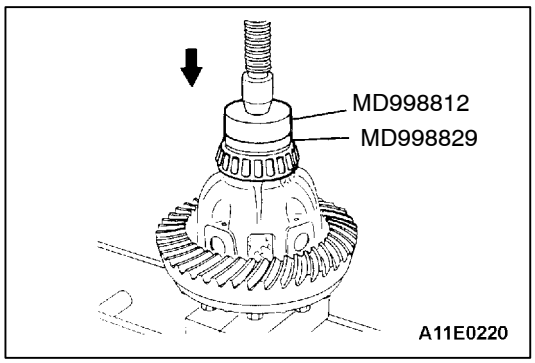


3. Apply the specified adhesive to the threaded holes of the drive gear.

   Specified adhesive:
   3M Stud Locking 4170 or equivalent

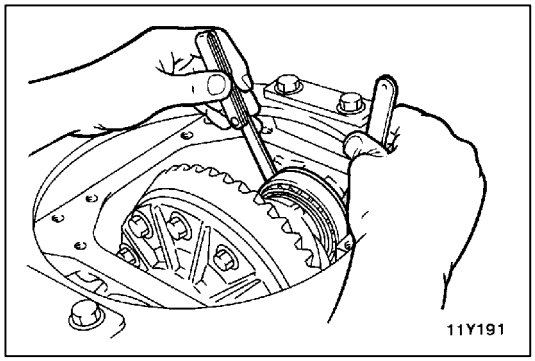
4. Install the drive gear onto the differential case with the mating marks properly aligned. Tighten the bolts to the specified torque in a diagonal sequence.

   Tightening torque: 84 ± 5 N·m <4D5>
   152 ± 15 N·m <4M4, 6G7>



▶I◀ SIDE BEARING INNER RACE INSTALLATION

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

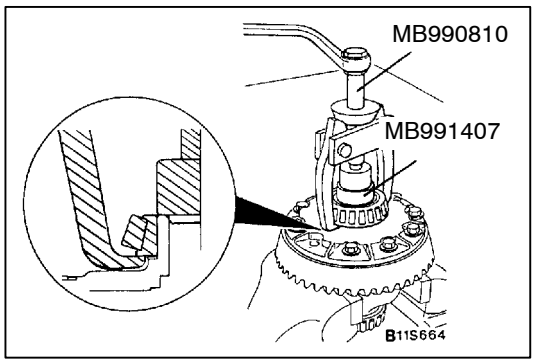


▶J◀ BEARING CAP INSTALLATION/FINAL DRIVE GEAR BACKLASH ADJUSTMENT

Adjust drive gear backlash as follows:

1. Assemble the differential case with the side bearing outer race to the gear carrier.
2. Press the differential case to one side to measure the clearance of the side bearing outer race and the gear carrier.

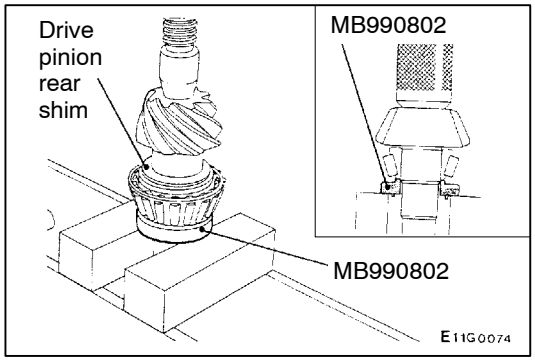
3. Select two pairs of the side bearing spacer with the thickness derived from the sum of the clearance and a half of pre-load, 0.05 mm.



4. Remove the side bearing with special tools.

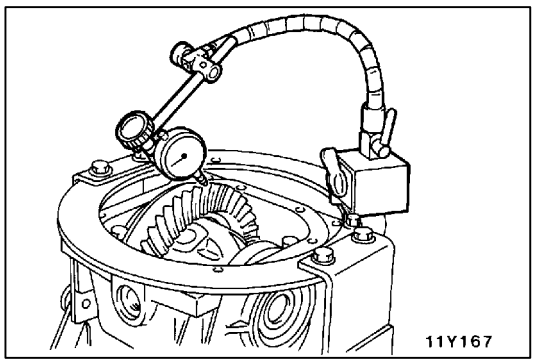
   NOTE
   Hook the claws of the special tool with the side bearing inner race by using the notches (two areas) of the differential case side.

5. Assemble the selected side bearing spacers to each side.



6. Use special tools to press-fit the side bearing inner case into the differential case. After installing the outer race, assemble the differential case to the gear carrier.
7. Align the mating marks of differential carrier and the bearing cap with each other to tighten to the specified torque.

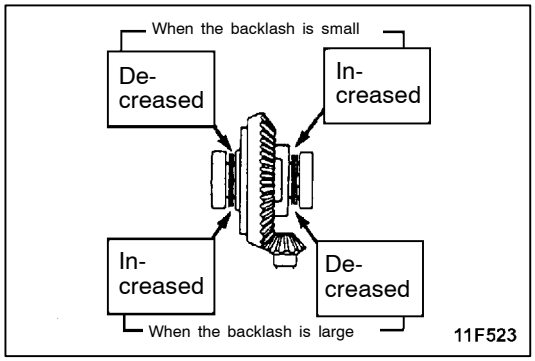
   Tightening torque: 74 ± 5 N·m



8. Measure the drive gear backlash.

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

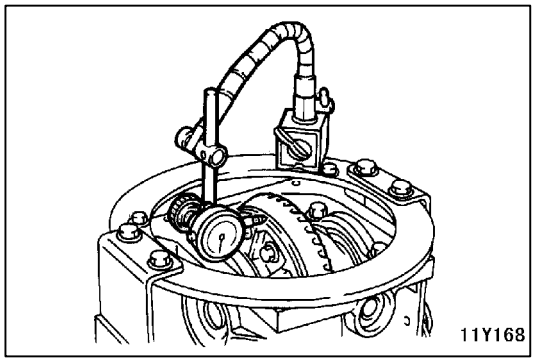
   Standard value: 0.13 - 0.18 mm



9. If the backlash is not within the standard value, move the side bearing spacer as shown in the illustration to adjust the backlash.

   NOTE
   The increment of side bearing spacer must be coincided with the decreased amount.

10. Inspect the tooth condition at the final drive gear and make an adjustment if required. (Refer to GROUP 26 – Pre-removal Inspection.)



11. Measure the drive gear runout.

    Limit: 0.05 mm

12. When drive gear runout exceeds the limit, remove the differential case and then the drive gears, moving them to different positions and reinstall them.
13. If adjustment is not possible, replace the differential case or drive gear and drive pinion as a set.

NOTES

WHEEL AND TYRE

Click on the applicable bookmark to selected the required model year.

WHEEL AND TYRE

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Wheel Runout Check 7

WHEEL AND TYRE 7

GENERAL INFORMATION

The wheels and tyres of the following specifications have been established.

SPECIFICATIONS

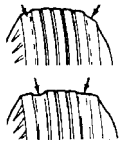
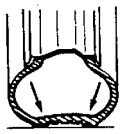
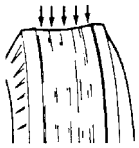
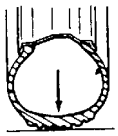
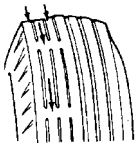
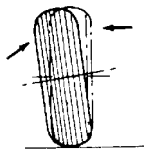
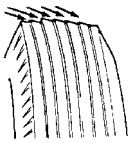
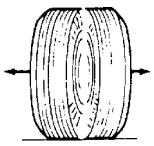
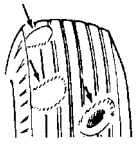
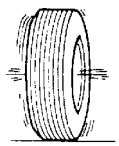
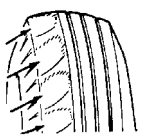
Items		4D5, 4M4		6G7
		GL, GLX	GLS	
Wheel	Type	Steel type Aluminium type*	Aluminium type	Aluminium type
	Size	16 × 6JJ 16 × 7JJ*	16 × 7JJ	16 × 7JJ
	Amount of wheel offset mm	46	46	46
	Pitch circle diameter (P.C.D.) mm	139.7	139.7	139.7
Tyre	Size	235/80R16 109S 265/70R16 112S*	265/70R16 112S	265/70R16 112H

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.	31-7.
Rapid wear at centre	 11X0110	Over-inflation or lack of rotation	 11X0117		
Cracked treads	11X0111	Under-inflation		Adjust the tyre pressure.	31-7.
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.	31-4.
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.

WHEEL BALANCE ACCURACY

PURPOSE

This section contains tips and procedures for achieving accurate wheel balance. Steering wheel vibration and /or body shake can result if any of these procedures are not carefully observed.

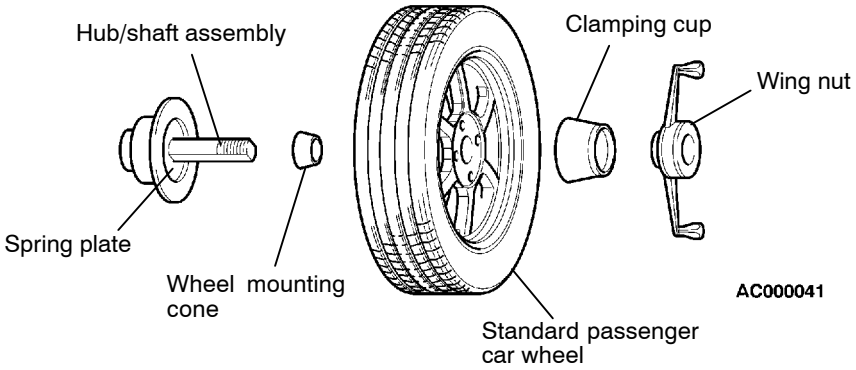
1. Wheels and tires must be properly mounted on a balancer in order to achieve correct balance. Centering the wheel on the shaft of the balancer is essential for proper mounting.
2. Off-the-car wheel balancers must be calibrated periodically to ensure good balancing results. An inaccurately calibrated balancer could cause unnecessary replacement of tires, shocks, suspension components, or steering components.

Check your balancer's calibration approximately every 100 balances. Your wheel balancer's instruction manual should include calibration procedures. If the calibration procedures specifically for your balancer are missing, use the generic steps in this section for zero calibration, static balance, and dynamic balance checks. The wheel balancer calibration checks are also described in the flowchart. (Refer to P.31-6)

PROCEDURE

Balancing Tips

1. Confirm that the balancer's cone and the wheel mounting cone are undamaged and free of dirt and rust.
2. On this vehicle the wheel's center hole on the hub side has a chamfered edge. Use a back-mounting cone on your wheel balancer to center the wheel on the balancer shaft.
3. Install a wheel mounting cone. The appropriate size cone for this vehicle is 67.0 mm.
4. Before balancing the wheel, remove any wheel weights from both sides. Also check both sides for any damage.
5. When installing wheel weights, hammer them at a straight (not diagonal) angle.



Confirming Proper Balance

1. After balancing the wheel, loosen the wing nut and turn the wheel 180° against the balancer's hub. Then retighten the wing nut and check the balance again. Repeat wheel balance if necessary.
2. Turn the wheel again 180° against the balancer's hub. If the wheel becomes out-of-balance each time it is turned against the balancer's hub, the wheel balancer may require calibration.

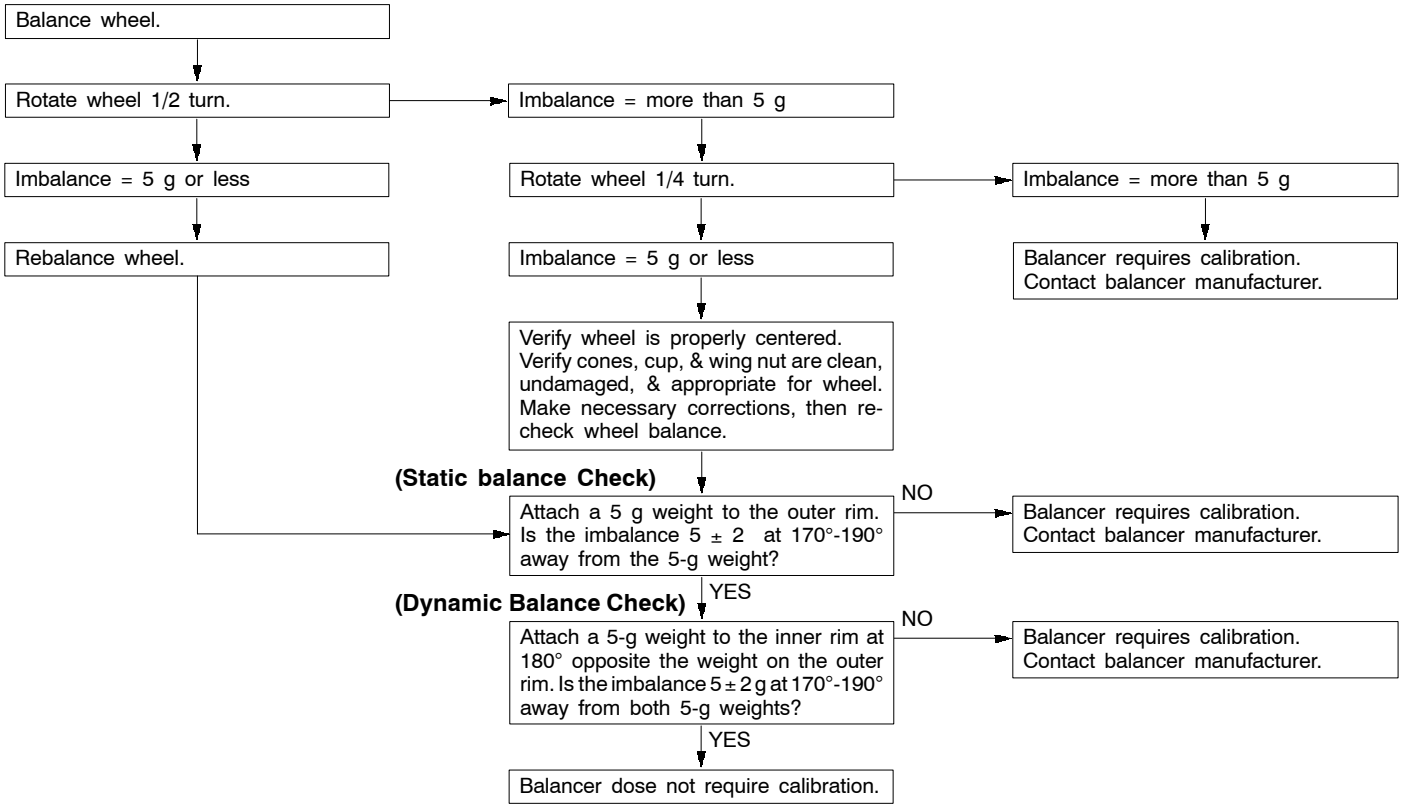
Wheel Balancer Calibration Checks

1. Mount an undamaged original-equipment alloy rim and tire assembly (wheel) onto your off-the-car wheel balancer. Balance the wheel.
2. <<Zero Calibration Check>>
   Loosen the balancer wing nut, rotate the wheel a half turn (180°), and retighten the nut. Recheck the balance.

- If the imbalance is 5 g or less, the zero calibration is OK. Rebalance the wheel, then go to Step 4 to check static balance.
- If the imbalance is more than 5 g, go to Step 3.

3. Loosen the balancer wing nut, rotate the wheel 1/4 turn (90°), and retighten the nut. Recheck the wheel balance.
   - If the imbalance is 5 g or less, the wheel may not be centered on the balancer, or the balancing cones, the cup, and/or wing nut are damaged, dirty, or inappropriate for the wheel. You may need to refer to the balancer manufacturer's instructions to verify the correct attachments. after making the necessary corrections, recheck the wheel balance. If OK, then go to Step 4.
   - If the imbalance is more than 5 g, the balancer requires calibration. Contact the balancer manufacturer for calibration by their repair representative.
4. <Static Balance Check>
   Attach a 5-g weight to the outer rim. Recheck the balancer. The balancer should detect 5 ± 2 g of imbalance 170° to 190° away from both the inner and outer 5-g weights.
   - If the imbalance is within specification, the static balance calibration is correct. Go to Step 5 to check the dynamic balance.
   - If the imbalance is out of specification, the balancer requires calibration. Contact the balancer manufacturer for calibration by their repair representative.
5. <Dynamic Balance Check>
   Attach a 5-g weight to the inner rim at 180° opposite the 5-g weight that was added in step 4. Recheck the balance. The balancer should detect 5 ± 2g of imbalance 170° to 190° away from both the inner and outer 5-g weights.
   - If the imbalance is within specification, the dynamic balance calibration is correct. The balancer calibration checks are complete.
   - If the imbalance is out of specification, the balancer requires calibration. Contact the balancer manufacturer for calibration by their repair representative.

WHEEL BALANCER CALIBRATION CHECKING FLOW CHART



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.

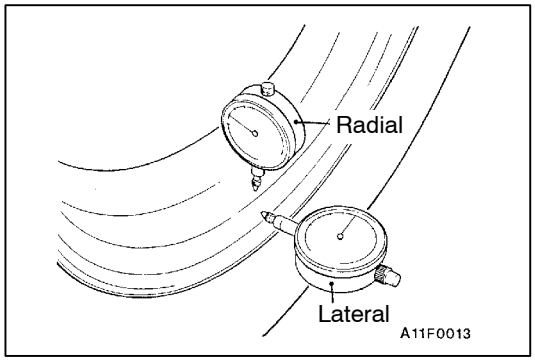
TYRE WEAR CHECK

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.



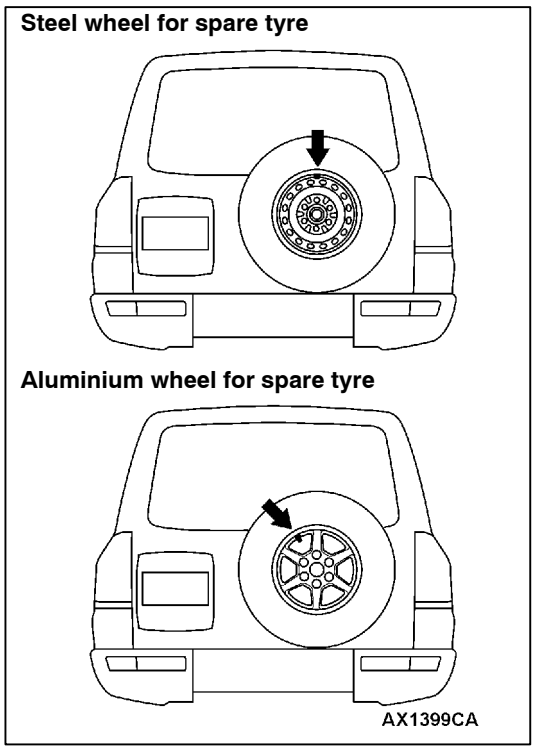
WHEEL RUNOUT CHECK

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: 108 ± 10 N·m

When installing the spare tyre to the back door, position the valve as shown, and then tighten the lock cylinder and bolt to the specified torque.

NOTE
If the valve is positioned at the bottom, rain water may leak into the valve, causing the valve corrosion.

Tightening torque: 46 ± 8 N·m

NOTES

Service Bulletins

Click on the applicable bookmark to select the Service Bulletin.

SERVICE BULLETIN

MITSUBISHI MOTORS

QUALITY INFORMATION ANALYSIS
OVERSEAS SERVICE DEPT. MITSUBISHI MOTORS CORPORATION

SERVICE BULLETIN	**No.:** MSB-00E31-001		
	Date: 2000-07-15	**<Model>**	**<M/Y>**
Subject: WHEEL BALANCE ADJUSTMENT PROCEDURE		ALL MODELS	00-00
Group: WHEEL & TIRES	**Draft No.:** 99AL121708		
INFORMATION/ CORRECTION	**INTERNATIONAL CAR ADMINISTRATIO OFFICE**	T.NITTA - PROJECT LEADER AFTER SALES SERVICE & CS PROMOTION	

1. Description:

There have been cases where the troubles failed to be removed completely because of incorrect balancer machine handling or use of an inaccurately calibrated balancer machine. This Service Bulletin informs you of the cautions to be taken when handling a balancer machine and the balance check procedures to prevent such a case from recurring in a dealer.

2. Details:

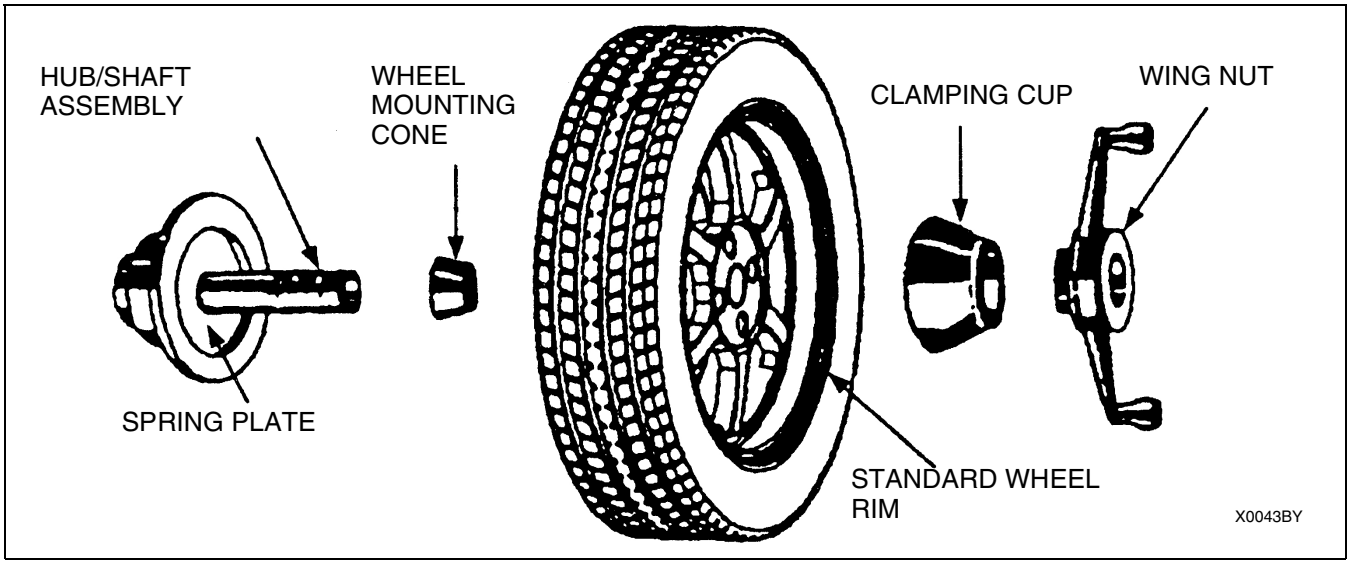
To solve the problems caused by steering or body vibrations, it is essential to balance the wheels and tires accurately. For this, the wheel and tire must be accurately centered with respect to the balancer shaft, and the balancer must also be calibrated accurately.

1. Check to ensure that the balancer cone and the cone-contacting portion of the wheel are free from any dirt, corrosion and damage.
2. Remove all balance weights attached, stones caught in the tire grooves and mud adhered from th wheel and tire.
3. Install the wheel and tire to the balancer in the following procedure:

   Caution:
   - **The socket diameter of a Mitsubishi genuine wheel is ϕ 67.0 mm (2.64 in) for passenger cars and ϕ 107.5 mm (4.23 in) the other types of vehicle. Be sure to use the balancer cone matching the socket diameter.**
   - **Use the black-mounted cone to secure the wheel to the balancer if possible. If installable i this method, go to Step 4.**
   - **If the socket diameter of the wheel is too large to secure it with the back-mounted cone, secure the wheel to the balancer with the front mounting cone. If the wheel is to be secured in this way, go to Step 6.**
   - **Do not use the log nut hole mounting method because it does not allow the accurat centering of the wheel.**
4. When securing with back-mounted cone:

   Operate the balancer to measure the imbalance, an attach weight in accordance with the measurements.

   Caution: Be sure to drive the weight straight in the wheel.

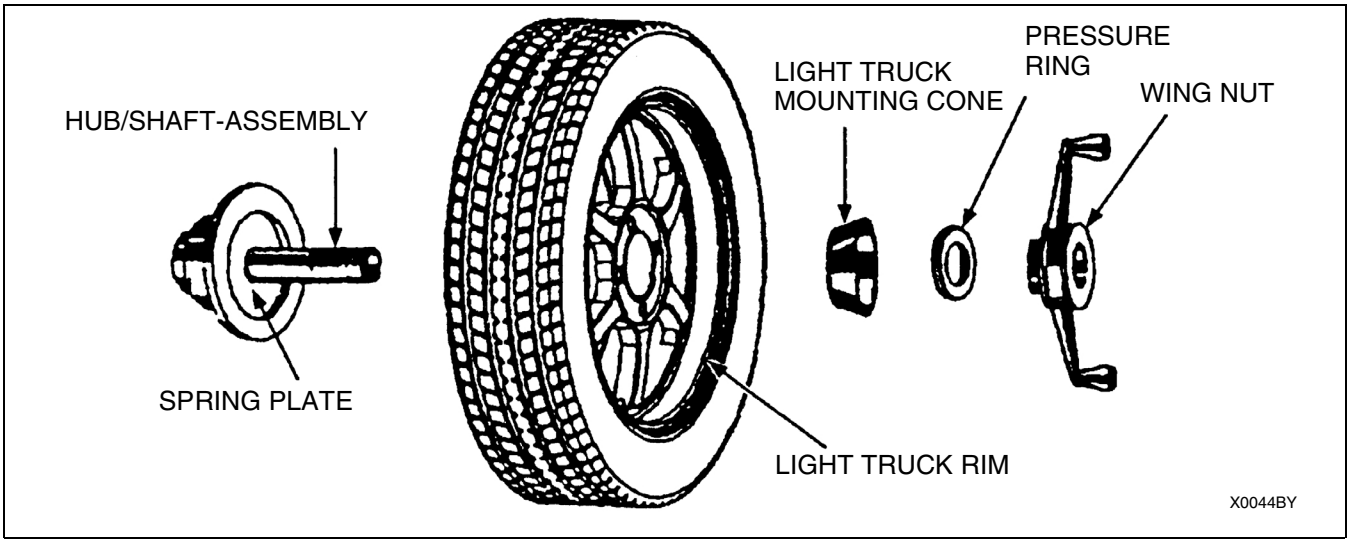


5. Loosen the wing nut, rotate the wheel half a turn (180°) and tighten the nut again. Then, perform the measurement again to confirm that the wheel is in balance. If not in balance, check if the balancer is correctly calibrated. Go to Step 11.

6. When securing with front-mounted cone:

   Caution:
   - **When pressing in the cone by tightening the wing nut slowly, hold the tire by hand such that the wheel may contact the spring plate of the balancer evenly.**
   - **If this work is not performed with care, the wheel would fail to be centered correctly. Futhermore, the cone-contacting area of the wheel would deform, preventing subsequent wheel balancing from being performed accurately.**

   Operate the balancer to measure the imbalance. Mark the point attributable to the imbalance with a piece of chalk.
   (Do not attach any balance weight.)



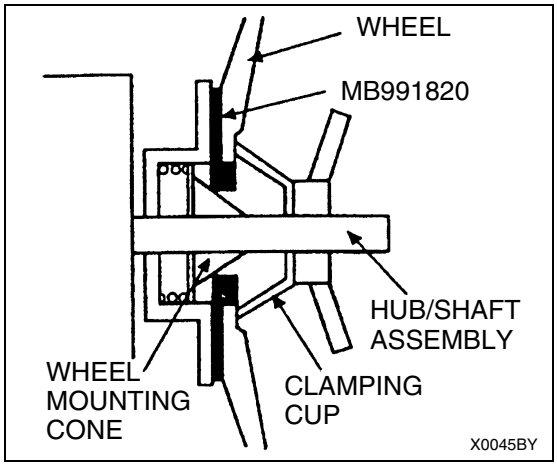
7. Loosen the wing nut, rotate the wheel half a turn (180°) and tighten the wing nut carefully again. Then, perform the measurement again.
8. Repeat the measurement three times in the same manner, and take either of the following measures according to the measurement again.

   Caution: Be sure to drive the weight straight in the wheel.

   a. If the results are the same in all measurements, attach a weight according to the indication on th machine.
   b. If the weight difference among the three measurements is less than 0.5 oz and the thre indicated points are all within a range of less than 8 inch (30°), attach a weight having the average weight at the mean position.
   c. If the weight difference among the three measurements is 0.5 oz or more or if the indicate positions are not within a range of less than 8 inch (30°), check if th balancer is correctly calibrated. Go to step 11.

9. Reinstall the tire to the vehicle, and perform a driving test. If the tire still generates vibration, perform the Ste 10.
10. Attach the adapter (MB991820) on the back side of th wheel, and install the wheel onto the machine using the back-mounted cone. Then, perform the balance adjustment again. For the procedure, refer to Steps 4 and 5

    Caution **Check to ensure that the contactin portions of the adapter, wheel and balancer are free from any dirt, corrosion and damage.**



11. Checking for calibration.

Check your balancer's calibration approximately every 100 balances. Your whee balancer's instruction manual should include calibration procedures. If the calibration procedures specifically for your balancer are missing, use following steps for zero calibration, static balance, and dynamic balance checks. Th wheel balancer calibration checks are also described in the flowchart on next page.

a. Mount an undamaged original-equipment alloy rim and tire assembly (wheel) onto your off-the-car wheel balancer. Balance the wheel.

b. ***Zero Calibration Check.*** Loosen the balancer wing nut, rotate the wheel a half-turn (180°), and retighten the nut. Recheck the balance.

   i) If the imbalance is 5 grams or less, the zero calibration is OK. Rebalance the wheel, then g to Step d to check the static balance.

   ii) If the imbalance is more than 5 grams, go to Step c.

c. Loosen th balancer wing nut, rotate the wheel ¼ turn (90°), and retighten the nut. Recheck th wheel balance

   i) If the imbalance is 5 grams or less, the wheel may not be centered on th balancer, or the balancing cones, the cup, and/or wing nut are damaged, dirty, or inappropriate for the wheel. You may need to refer to th balancer manufacturer's instructions to verify the correct attachments. After making the necessary correction, recheck the wheel balance. If OK, then go to Step d.

   ii) If the imbalance is more than 5 grams, th balancer requires calibration, Contact th balancer manufacturer for calibration by their repair representative.

d. ***Static Balance Check.*** Attach a 5-gram weight to the outer rim. Recheck the balancer. The balancer should detect 5±2 grams of imbalance 170° to190° away from the 5-gram weight.

   i) If the imbalance is within specification, the static balance calibration is correct, Go to Step e to check the dynamic balance.

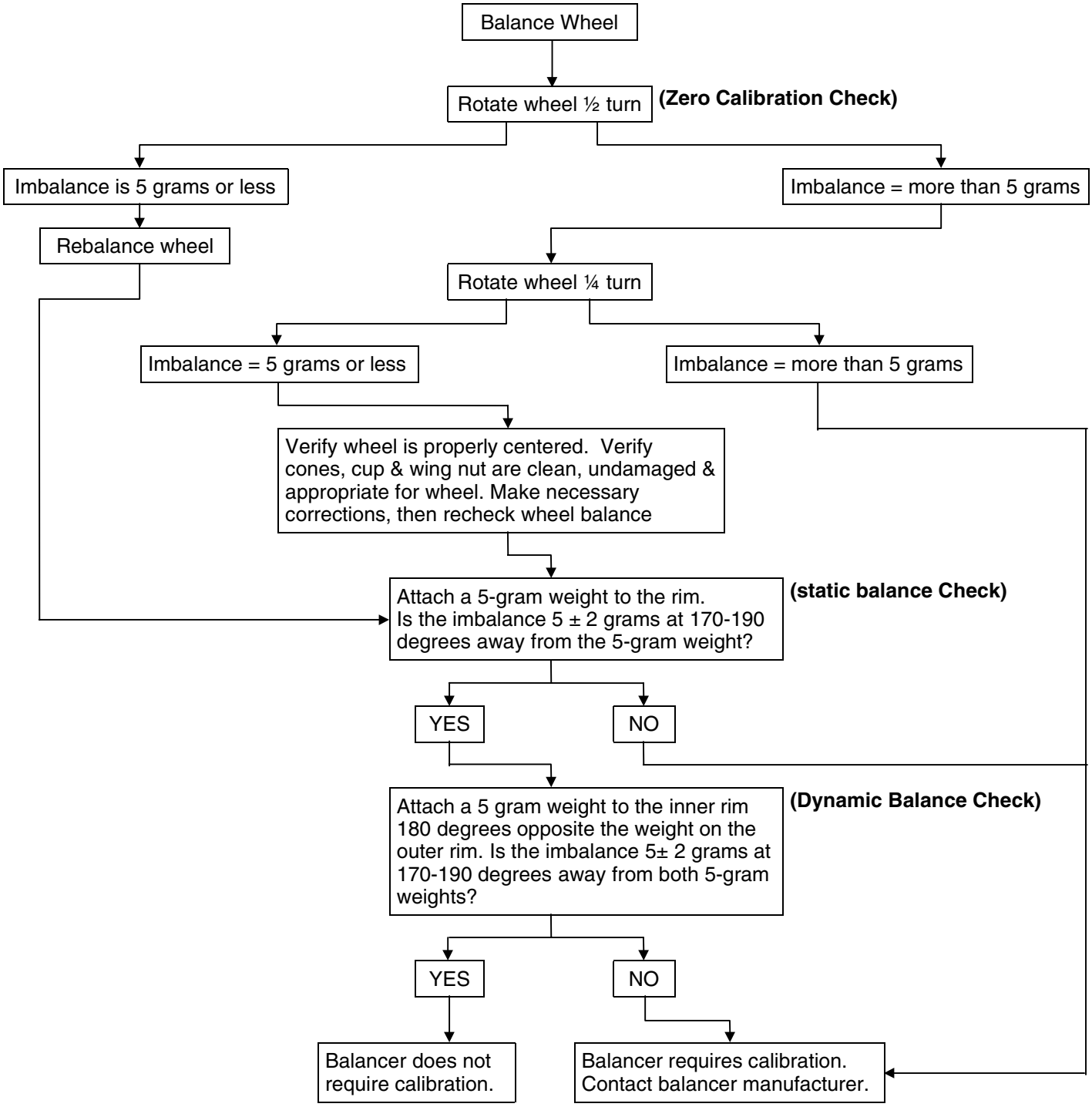
   ii) If the imbalance is out of specification, th balancer requires calibration. Contact th balancer manufacturer for calibration by their repair representative.

e. ***Dynamic Balance Check.*** Attach a 5-gram weight to the inner rim at 180° opposite the 5-gram weight that was added in Step d. Recheck the balance. Th balancer should detect 5±2 grams of imbalance 170° to 190° away from both the inner and outer 5-gram weights.

   i) If the imbalance is within specification, the dynamic balance calibration is correct. Th balancer calibration checks are complete.

   ii) If the imbalance is out of specification, th balancer requires calibration. Contact th balancer manufacturer for calibration by their repair representative.

WHEEL BALANCER CALIBRATION CHECKS



POWER PLANT MOUNT

Click on the applicable bookmark to selected the required model year.

POWER PLANT MOUNT

CONTENTS

GENERAL INFORMATION 2
SPECIAL TOOLS 3
ENGINE MOUNTING 4
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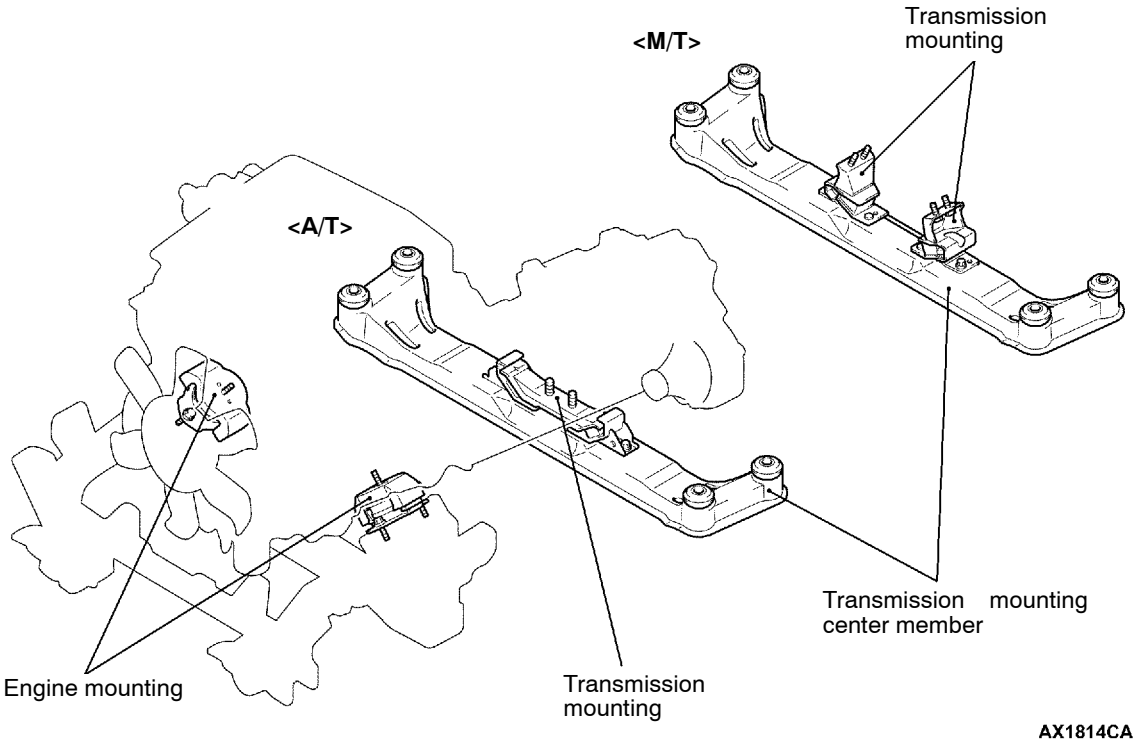
No.1 CROSSMEMBER 7

GENERAL INFORMATION

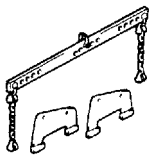
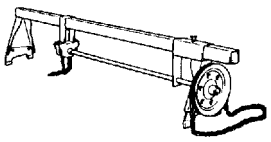
For vehicles with A/T, the engine and transmission assembly is supported at three points, where insulators are used. (Two points for the engine, one point for the transmission.)
For vehicles with M/T, the engine and transmission assembly is supported at four points, where insulators are used. (Two points for the engine, two points for the transmission.)

- For the engine mount, a liquid-charged mount has been introduced in order to improve driving comfort and reduce vibration and noise during idling.
- The transmission mount supports the transmission and the transmission mount center member elastically (dual anti-vibration method) in order to reduce vibration, which is transmitted to the vehicle body.
- For the transmission mount insulator, a shear-type insulator has been introduced.

CONSTRUCTION DIAGRAM



SPECIAL TOOLS

Tool	Number	Name	Use
 B991453	MB991453	Engine hanger	To support the engine assembly during removal and installation of the engine mounting
 Z203827	MZ203827	Engine lifter	

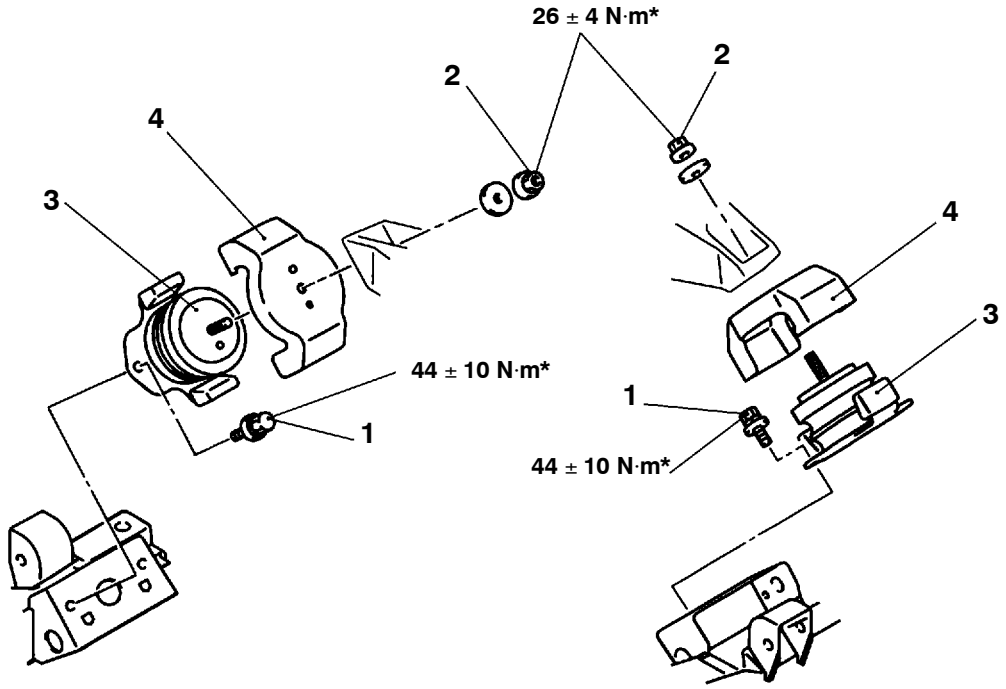
ENGINE MOUNTING

REMOVAL AND INSTALLATION

Caution

***: Indicates parts which should be initially 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
- Under Cover and Skid Plate Removal and Installation
- Battery Removal and Installation
- Air Cleaner Removal and Installation (Refer to GROUP 15.)
- Engine Cover Removal and Installation (Refer to GROUP 11A,11B,11C.)
- Radiator Removal and Installation (Refer to GROUP 14.)
- Glow Plug Relay and Solenoid Valve Assembly Removal and Installation <4M4>
- Intercooler Removal and Installation<4M4> (Refer to GROUP 15.)



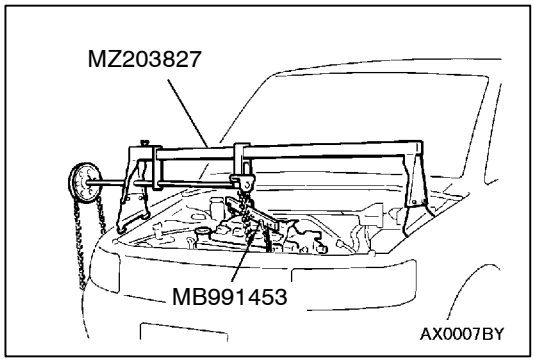
AX1247CA

Removal steps
- brake hose clip (Refer to GROUP 33A - Upper Arm Assembly.)
- Connecting bolt between steering gear and joint (Refer to GROUP 37A - Power Steering Gear and Linkage.)
- Power steering pressure hose mounting bolt (Refer to GROUP 37A - Power Steering Gear and Linkage.)
- A/T oil cooler tube mounting bolt (Refer to GROUP 23 - Transmission Oil Cooler.)

◀A▶
◀A▶
◀B▶

- Vacuum hose (Refer to GROUP 26 - Free Wheel Assembly, Differential Carrier.)

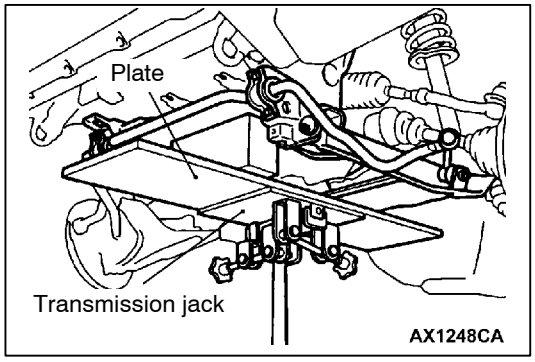
1. Engine mounting bolt
2. Engine mounting nut
3. Engine mounting bracket
4. Engine mounting stopper



REMOVAL SERVICE POINTS

◀A▶ ENGINE MOUNTING BOLT AND NUT REMOVAL

1. Use the special tool to support the engine.
2. Remove the engine mount mounting bolts and nuts.



◀B▶ ENGINE MOUNTING BRACKET REMOVAL

1. Support the No.1 crossmember using the transmission jack.
2. Unscrew the No.1 crossmember mounting nut and then put down the No.1 crossmember to remove the engine mount.

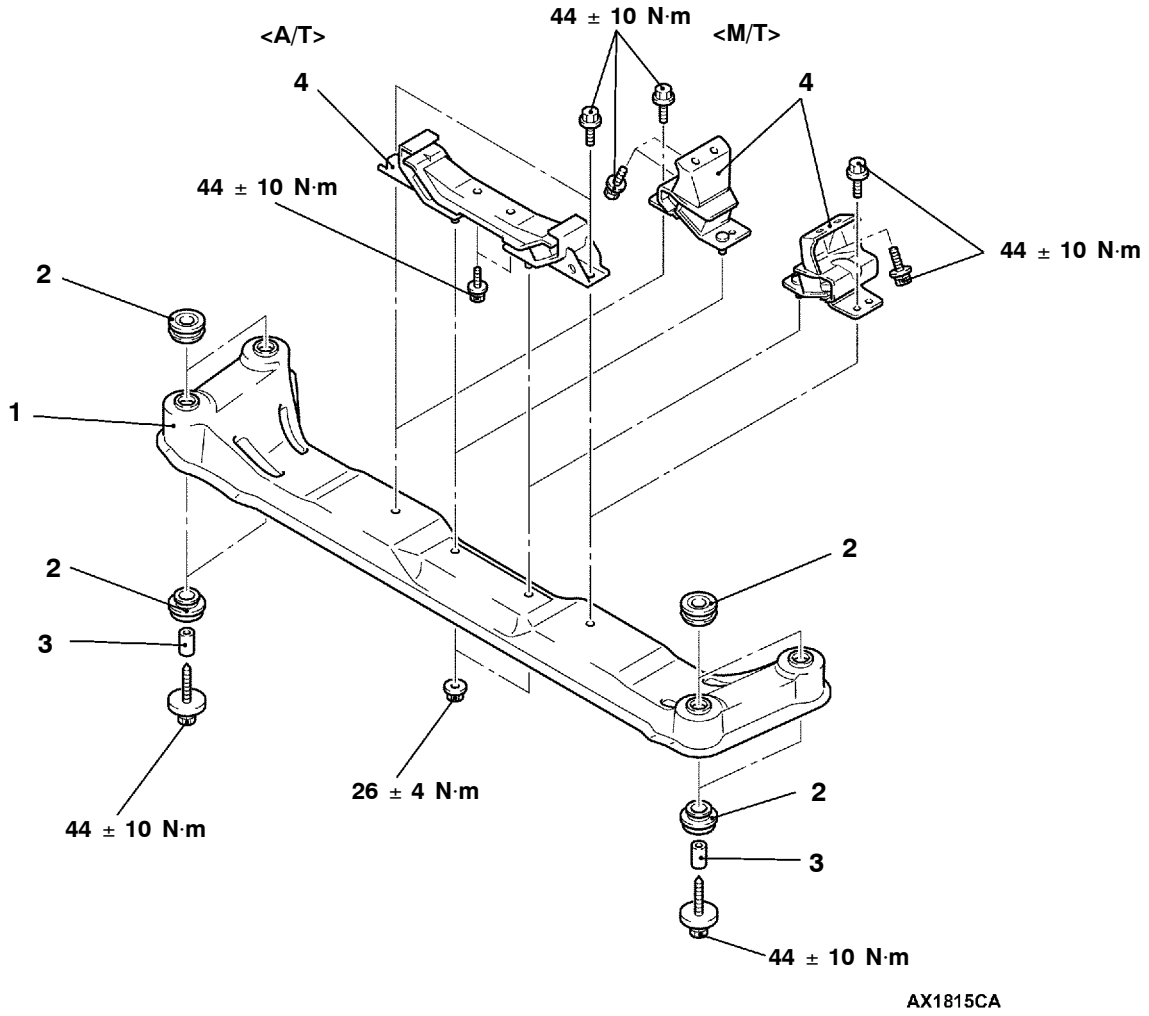
INSPECTION

- Check the engine mounting bracket for cracks, separation or deformation.
- Check the engine mounting stoppers for deformation.

TRANSMISSION MOUNTING

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Raise the engine and transmission assembly until its weight is not applied to the insulator, and support it securely.



Removal steps

1. Transmission mounting center member assembly
2. Transmission mounting bush
3. Collar
4. Transmission mounting insulator assembly

INSPECTION

- Check the transmission mounting insulator for cracks, separation or deformation.
- Check the transmission mounting center member for cracks or damage.

No.1 CROSSMEMBER

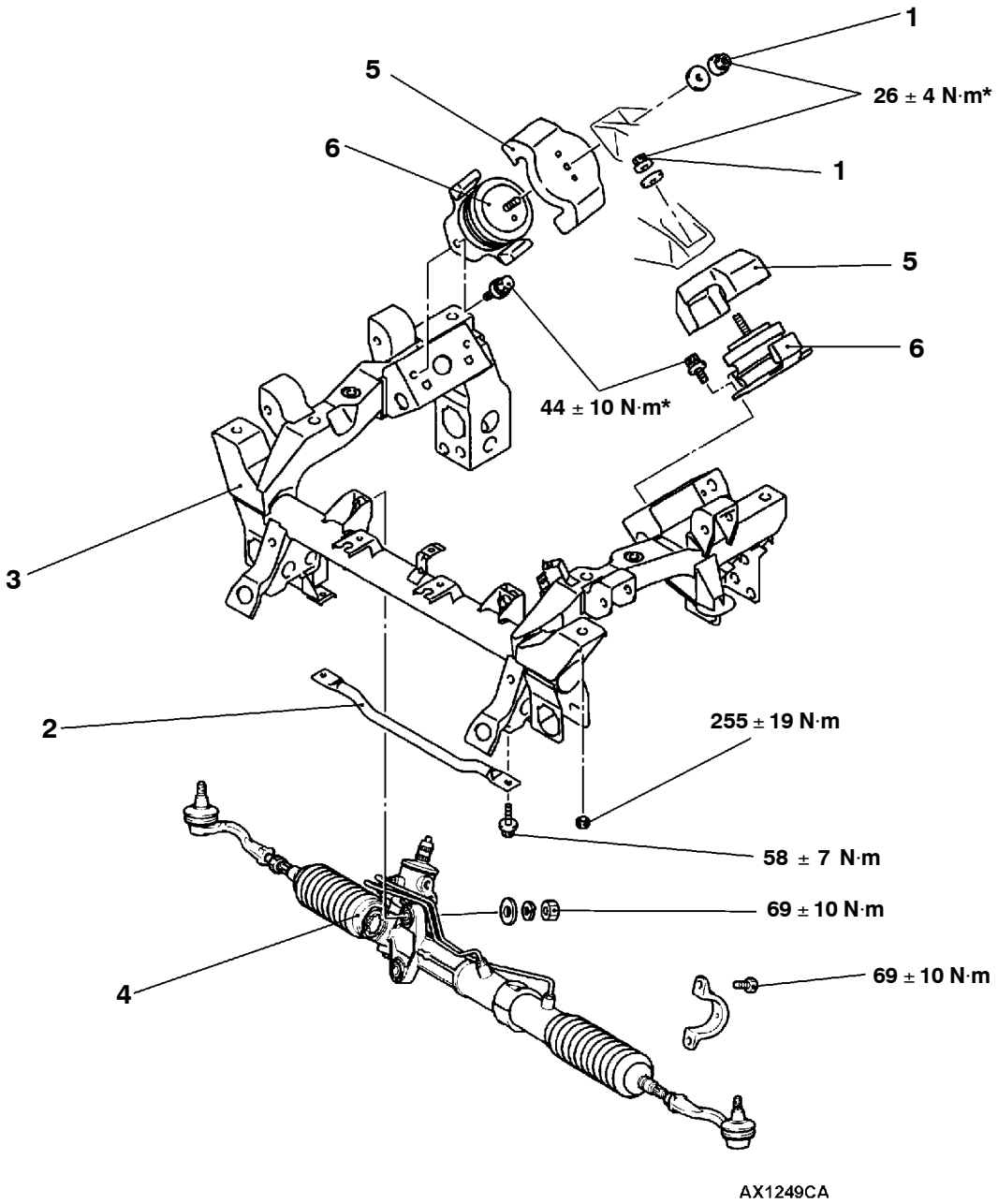
REMOVAL AND INSTALLATION

Caution

1. **Before removing the steering wheel and airbag module assembly, always refer to GROUP 52B - Service Precautions, Airbag Module and Clock Spring. Also, set the front wheels so that they are facing straight forward, and remove the ignition key. If you fail to do this, the SRS clock spring will be damaged, causing the SRS airbag to be inoperative and serious injury.**
2. ***: Indicates parts which should be initially tightened, and then fully tightened after placing the vehicle horizontally and loading the full weight of the engine on the vehicle body.**

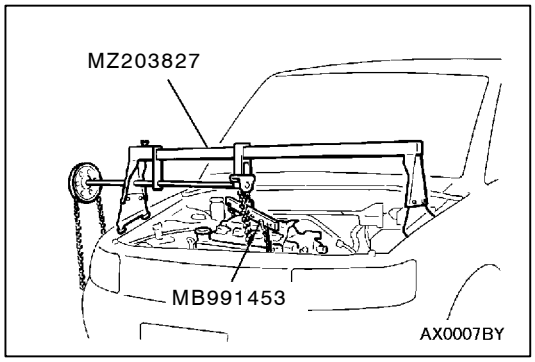
Pre-removal Operation
- Under Cover Removal
- Drive Shaft Removal (Refer to GROUP 26.)
- Differential Carrier and No.2 Crossmember Assembly Removal (Refer to GROUP 26 - Freewheel Assembly and Differential Carrier.)
- Upper Arm Removal (Refer to GROUP 33A.)
- Lower Arm Removal (Refer to GROUP 33A.)
- Stabilizer Bar Removal (Refer to GROUP 33A.)
- Engine Oil Cooler Removal<6G7> (Refer to GROUP 12.)
- Air Cleaner Removal<4M4> (Refer to GROUP 15.)
- Intercooler Removal<4M4> (Refer to GROUP 15.)
- Engine Cover Removal (Refer to GROUP 11A - Timing Belt.)
- Radiator Removal (Refer to GROUP 14.)
- Power Steering Fluid Draining (Refer to GROUP 37A - On-vehicle Service.)

Post-installation Operations
- Differential Carrier and No.2 Crossmember Assembly Installation (Refer to GROUP 26 - Freewheel Assembly and Differential Carrier.)
- Drive Shaft Installation (Refer to GROUP 26.)
- Lower Arm Installation (Refer to GROUP 33A.)
- Upper Arm Installation (Refer to GROUP 33A.)
- Stabilizer Bar Installation (Refer to GROUP 33A.)
- Air Cleaner Installation<4M4> (Refer to GROUP 15.)
- Intercooler Installation<4M4> (Refer to GROUP 15.)
- Radiator Installation (Refer to GROUP 14.)
- Engine Oil Cooler Installation (Refer to GROUP 12.)
- Power Steering Fluid Supplying (Refer to GROUP 37A - On-vehicle Service.)
- Power Steering Fluid Line Bleeding (Refer to GROUP 37A - On-vehicle Service.)
- Press the dust cover with a finger to check whether the dust cover is cracked or damaged.
- Checking Steering Wheel Position with Wheels Straight Ahead
- Front Wheel Alignment Check and Adjustment (Refer to GROUP 37A - On-vehicle Service.)
- Under Cover Installation
- Engine Cover Installation (Refer to GROUP 11A - Timing Belt.)



Removal steps

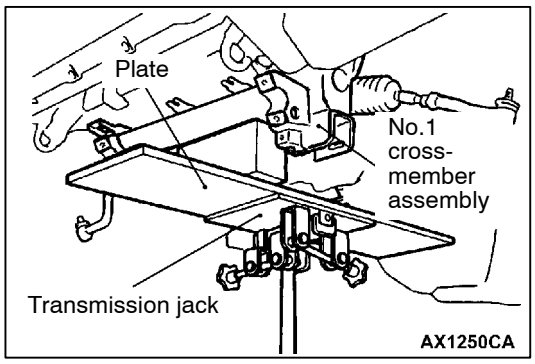
◀A▶ 1. Engine mounting nuts
2. Front reinforcement bar
◀B▶ 3. No.1 crossmember assembly
4. Power steering gear and linkage
5. Engine mounting stopper
6. Engine mounting



REMOVAL SERVICE POINTS

◀A▶ ENGINE MOUNTING NUT REMOVAL

1. Use the special tool to support the engine.
2. Remove the engine mount mounting nuts.



◀B▶No.1 CROSSMEMBER ASSEMBLY REMOVAL

Use a transmission jack to support the No.1 crossmember and remove the No.1 crossmember.

INSPECTION

- Check the No.1 crossmember for cracks and damage.

NOTES

FRONT SUSPENSION

Click on the applicable bookmark to selected the required model year.

FRONT SUSPENSION

CONTENTS

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SERVICE SPECIFICATIONS 3
SPECIAL TOOLS 3
ON-VEHICLE SERVICE 4
Wheel Alignment Check and Adjustment 4
Ball Joint Dust Cover Check 6
UPPER ARM ASSEMBLY 7
SHOCK ABSORBER ASSEMBLY 10
LOWER ARM ASSEMBLY 13
STABILIZER BAR 16

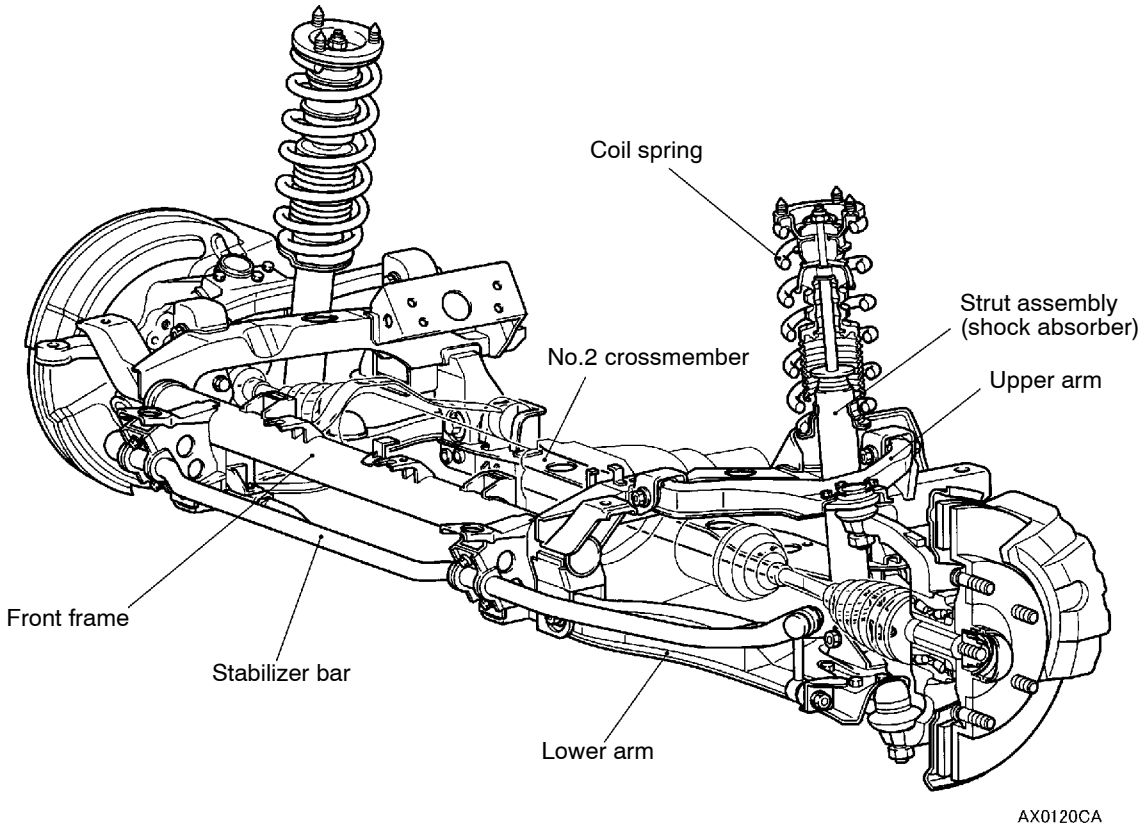
GENERAL INFORMATION

A coil spring-type double wishbone independent-type suspension has been adopted as the front suspension. This type of suspension is rigid, has very little variation in roll centre height and provides excellent riding comfort, making it ideal for cross-country vehicles.

COIL SPRING

Item	Short wheelbase-2500,3500, Long wheelbase -2500 (GL, GLX),3500 (GLX)	Short wheelbase-3200, Long wheelbase -2500 (GLS),3200,3500 (GLS)
Wire diameter × average diameter × free length mm	16 × 109 × 322	16 × 109 × 327

CONSTRUCTION DIAGRAM

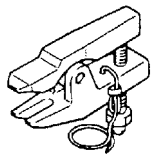
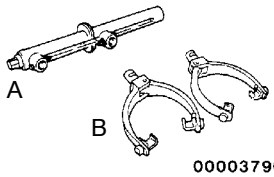
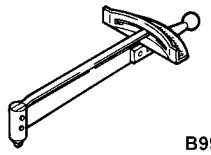
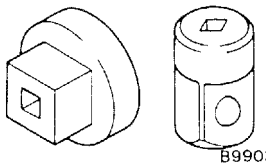


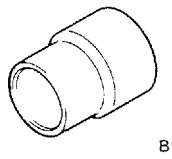
SERVICE SPECIFICATIONS

Items		Standard value
Toe-in	At the centre of tyre tread mm	2.5 ± 2.5
	Toe-angle (per wheel)	0° 05' ± 05'
Toe-out angle on turns (inner wheel when outer wheel at 20°)		21°48'
Camber		0°30' ± 30'*
Caster		3°50' ± 1°*
Side slip mm (per 1 m)		0 ± 3
Kingpin inclination		11°30'
Upper arm ball joint rotation torque N·m		0.4 - 2.5
Lower arm ball joint rotation torque N·m		0.3 - 4.5
Stabilizer link ball joint turning torque N·m		0.5 - 2.0

NOTE
*: difference between right and left wheels: less than 30'

SPECIAL TOOLS

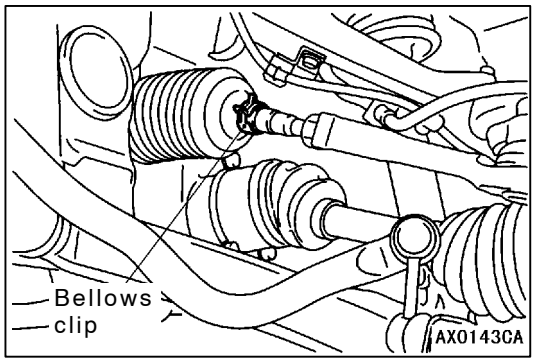
Tools	Number	Name	Use
 B991113	MB990635, MB991113 or MB991406	Steering linkage puller	Ball joint and knuckle disconnection
 A B 00003796	A: MB991237 B: MB991238	A: Spring compressor body B: Arm set	Coil spring compression
 B990968	MB990968	Torque wrench	Upper arm ball joint, lower arm ball joint and stabilizer link ball joint rotation starting torque measurement
 B990326	MB990326	Preload socket	

Tools	Number	Name	Use
 B990799	MB990799	Ball joint remover & installer	Lower arm ball joint dust cover press-in

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 2.5 ± 2.5 mm
Toe angle (per wheel) 0°05' ± 05'

1. Adjust the toe-in by undoing the clip and turning the left and right tie rod turnbuckles by the same amount (in opposite directions).

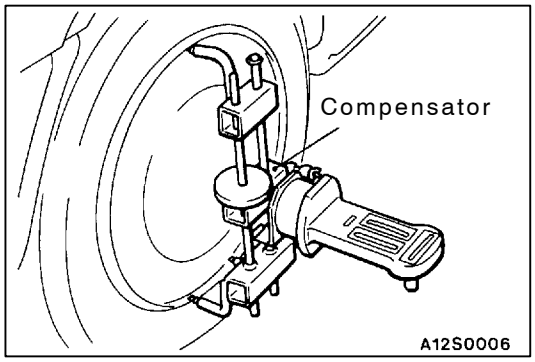
   NOTE
   The toe will move out as the left turnbuckle is turned toward the front of the vehicle and the right turnbuckle is turned toward the rear of the vehicle.

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°48'

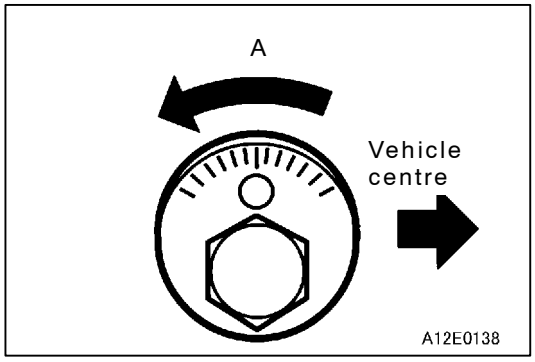


CAMBER, CASTER AND KINGPIN INCLINATION

Standard value:

Camber 0°30' ± 30' (difference between right and left wheel: less than 30')

Caster 3°50' ± 1°(difference between right and left wheel: less than 30')



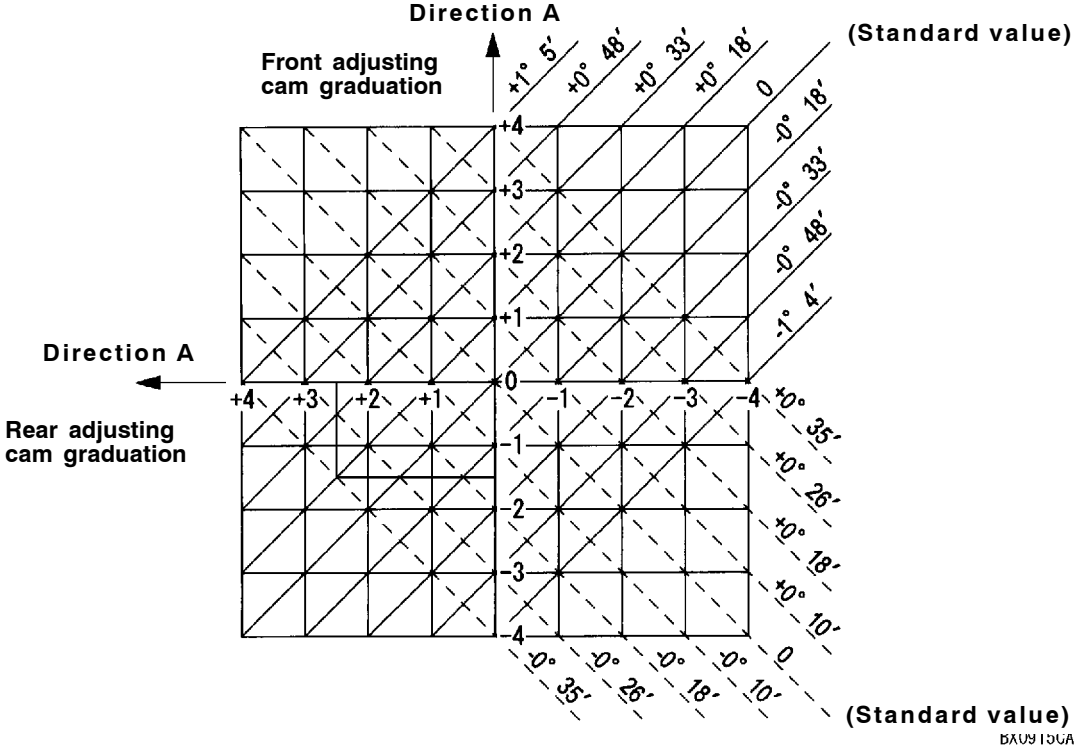
If camber or caster are not within the standard value, adjust by following procedures.

1. Adjust the camber and caster by turning the camber adjusting bolt of the lower arm. For the standard value, refer to the camber and caster adjusting table (P.33A-5).
2. After adjusting the camber, the toe should be adjusted.

Camber And Caster Adjusting Table

HOW TO READ
(EXAMPLE)
Compare the measurement value with the standard value. When the camber is -0°35' and caster is 0°18', turn the front adjusting cam by 1.5 graduations to the direction opposite to "A" and the rear adjusting cam by 2.5 graduations to the "A" direction.

NOTE
Solid lines show caster, broken lines shows camber.



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.

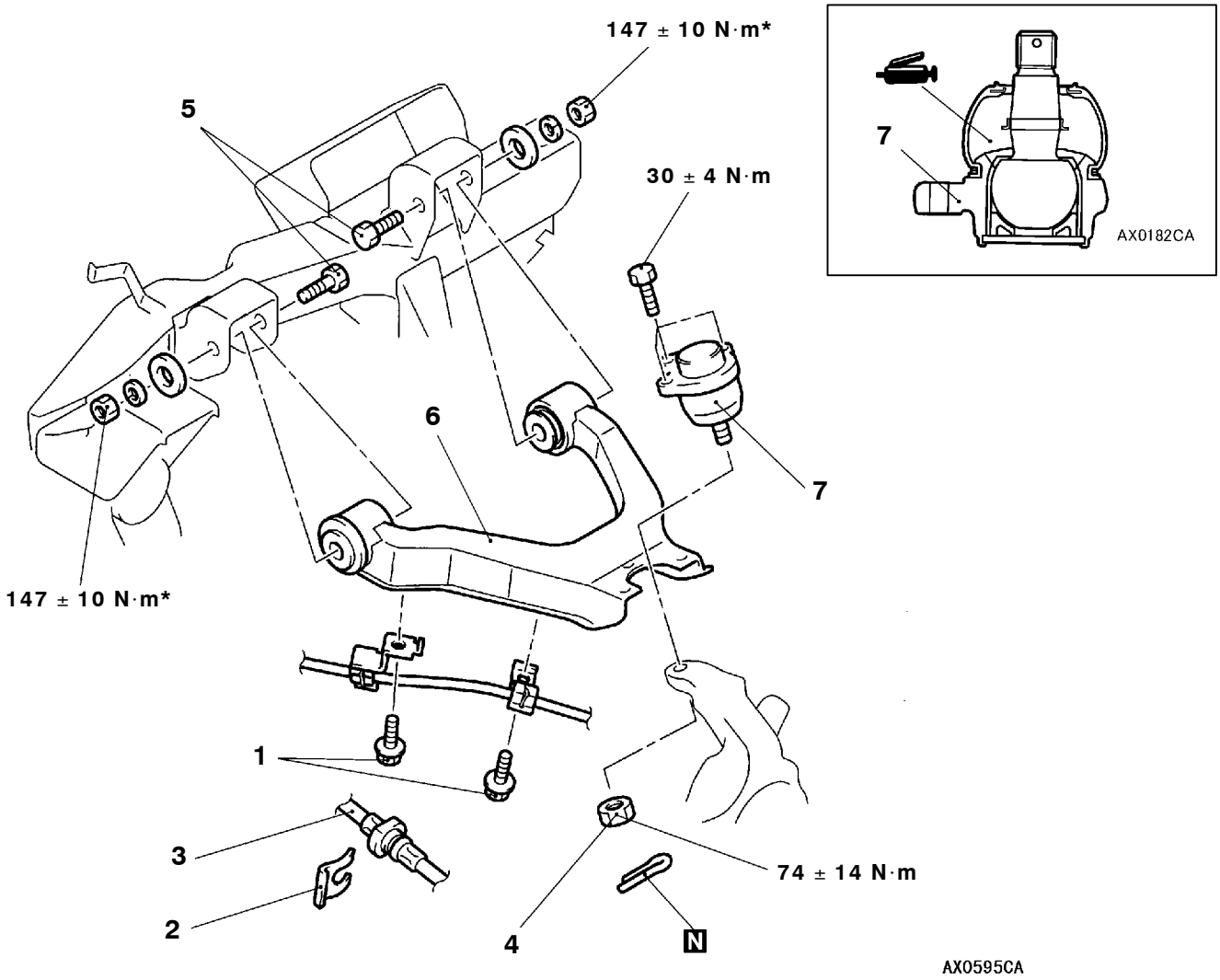
UPPER ARM ASSEMBLY

REMOVAL AND INSTALLATION

Caution

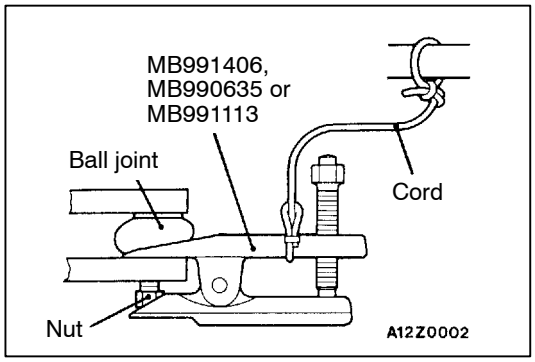
***: To prevent bushings from breakage, the parts indicated by * should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**

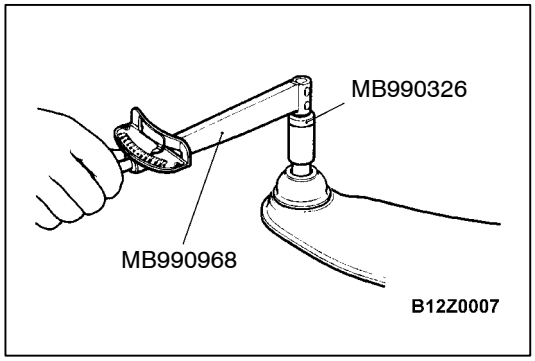
Post-installation Operation
- Check the dust cover for cracks or damage by pushing it with finger.
- Wheel alignment check and adjustment (Refer to P.33A-4.)



Removal steps

1. Front wheel speed sensor bracket mounting bolt <Vehicles with ABS>
2. Clip
3. Brake hose
4. ◀A▶ Upper arm assembly and knuckle connection
5. Upper arm assembly and front frame connection
6. Upper arm assembly
7. Upper arm ball joint assembly





REMOVAL SERVICE POINT

◀A▶ UPPER ARM BALL JOINT AND KNUCKLE DISCONNECTION

Caution

1. **To prevent the ball joint thread from damage, only loosen but do not remove the nut securing the upper arm to the knuckle from the ball joint and use the special tool.**
2. **Support the special tool with a cord to prevent it from coming off.**

INSPECTION

UPPER ARM BALL JOINT ROTATION TORQUE CHECK

1. After shaking the upper arm ball joint stud several times, use the special tool to measure the rotation torque of the upper arm ball joint.

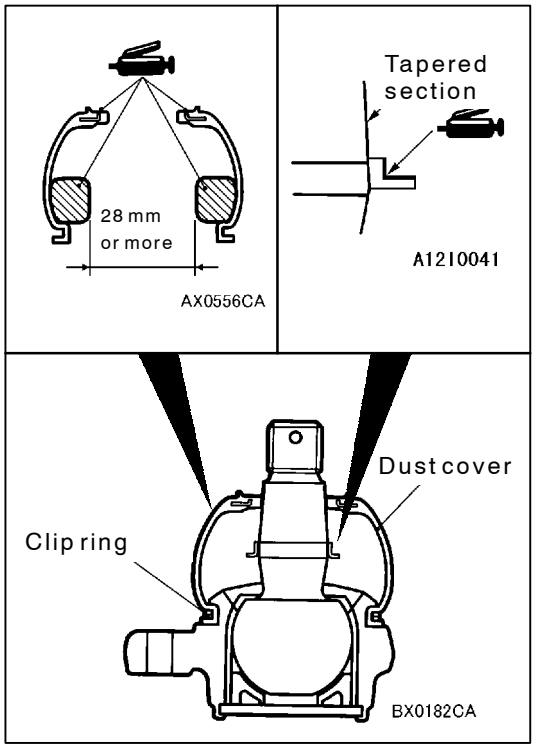
   Standard value: 0.4 - 2.5 N·m

2. When the measured value exceeds the standard value, replace the upper arm ball joint assembly.
3. When the measured value is lower than the standard value, check that the upper arm ball joint turns smoothly without excessive play. If there is no excessive play, the ball joint can be reused.

UPPER 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 upper 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.



UPPER 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 clip ring, and then remove the dust cover.
2. Fill the inside of the dust cover with the specified grease as shown in the illustration.
3. Apply the specified grease to the dust cover and ball joint stud as shown in the illustration.
4. Wrap plastic tape around the upper arm ball joint stud, and then install the dust cover to the upper arm ball joint.

Caution
Do not apply grease to the place (tapered section) where the threaded section of the ball joint connects with the knuckle. Wipe the grease off if it is applied.

5. Secure the dust cover in place with the clip ring.

Caution
To prevent the grease to be applied on the ball joint connection (taper) with knuckle, do not compress the dust cover before installation.

6. Press the dust cover with your finger to check that there are no cracks or damage in the dust cover.

SHOCK ABSORBER ASSEMBLY

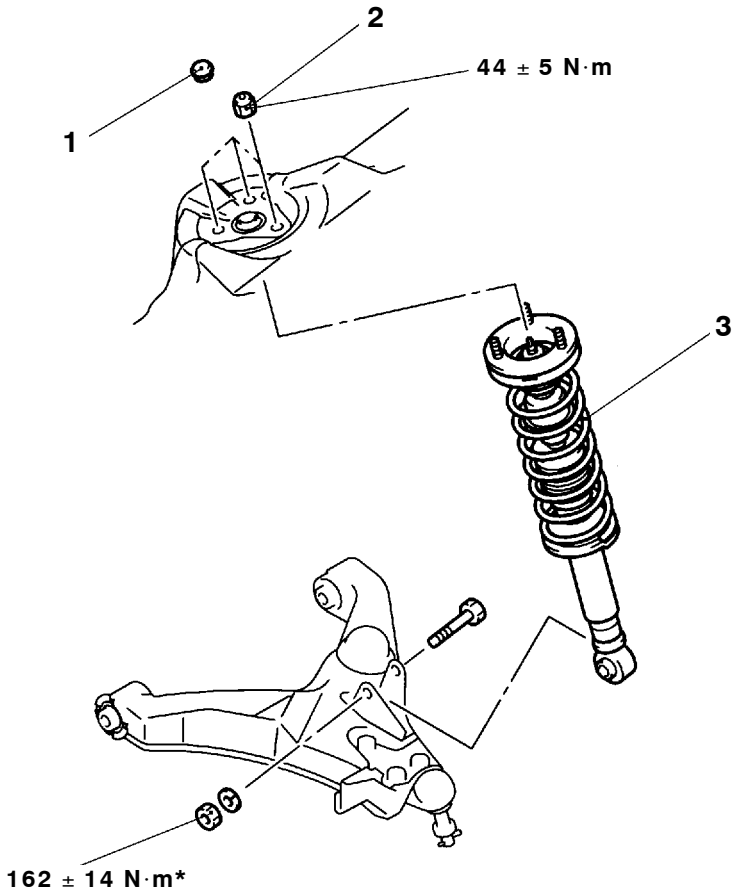
REMOVAL AND INSTALLATION

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 Operation
- Upper Arm Assembly Removal (Refer to P.33A-7.)
- Battery and Battery Tray (LH) Removal
- Condense Tank (LH) Removal (Refer to GROUP 14 – Radiator.)
- Air Cleaner (RH) Removal (Refer to GROUP 15 – Air Cleaner.)

Post-installation Operation
- Air Cleaner Assembly (RH) (Refer to GROUP 15 – Air Cleaner.)
- Condense Tank (LH) Installation (Refer to GROUP 14 – Radiator.)
- Battery and Battery Tray (LH) Removal
- Upper Arm Assembly Installation (Refer to P.33A-7.)
- Wheel Alignment Check and Adjustment (Refer to P.33A-4.)

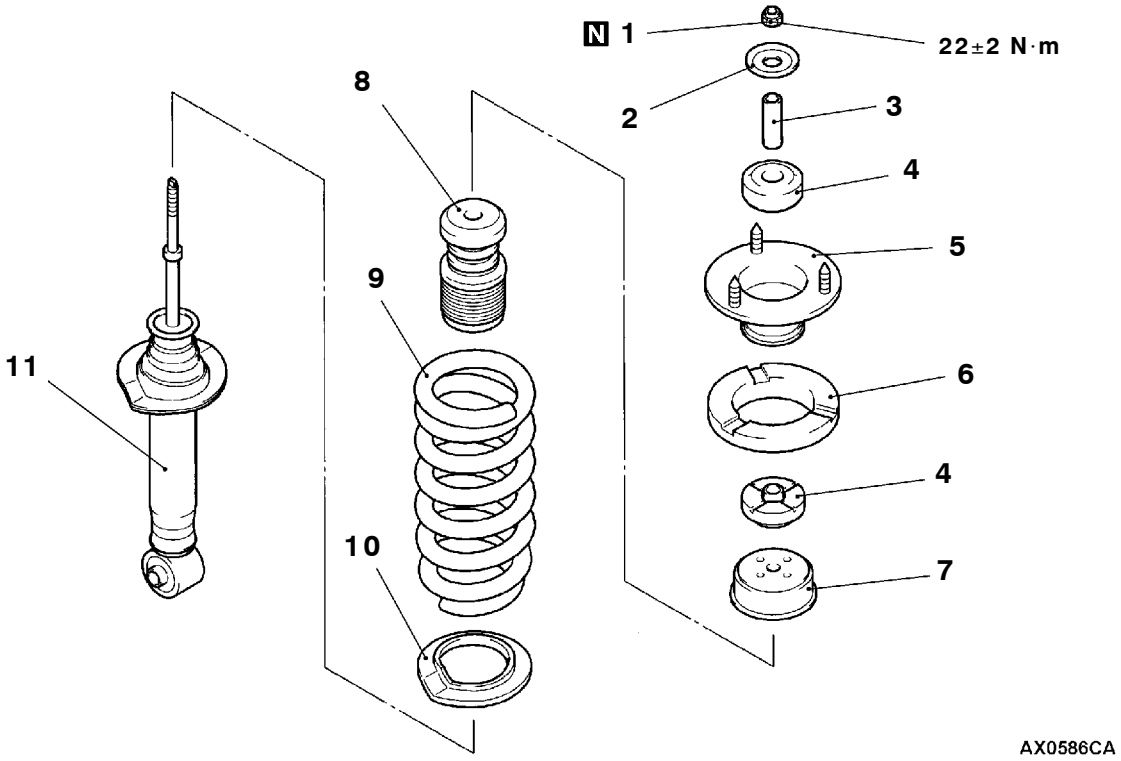


AX0558CA

Removal steps

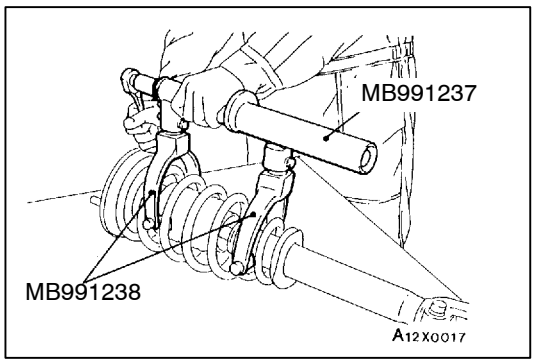
1. Cap
2. Shock absorber mounting nut
3. Shock absorber assembly

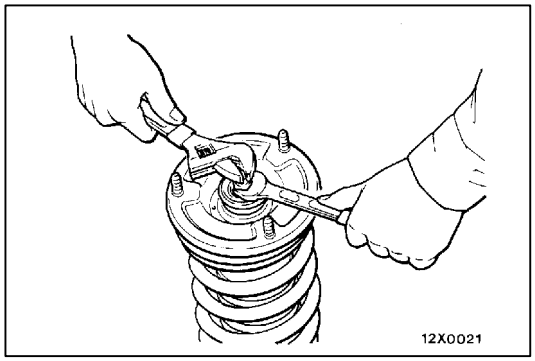
DISASSEMBLY AND REASSEMBLY



Disassembly steps

◀A▶ ▶C◀ 1. Self-locking nut
2. Seat
3. Collar
4. Upper bush
▶B◀ 5. Spring bracket assembly
6. Spring upper pad
7. Cup assembly
8. Helper rubber
▶A◀ 9. Coil spring
▶A◀ 10. Spring lower pad
11. Shock absorber assembly





DISASSEMBLY SERVICE POINT

◀A▶ SELF-LOCKING NUT REMOVAL

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

Caution
(1) Do not tighten the special tool bolt too tight. The special tool will be broken if the allowable tightening torque of 74 N·m is exceed.
(2) Install the special tools evenly, and so that the maximum length will be attained within the installation range.
(3) Do not use an impact wrench as it will cause the bolt of the special tool to be seized.

2. To prevent the piston rod from turning and unscrew the self-locking nut.

Caution
To prevent the piston rod lock nut inside the strut from loosening, do not use an impact wrench when the locking nuts are loosened.

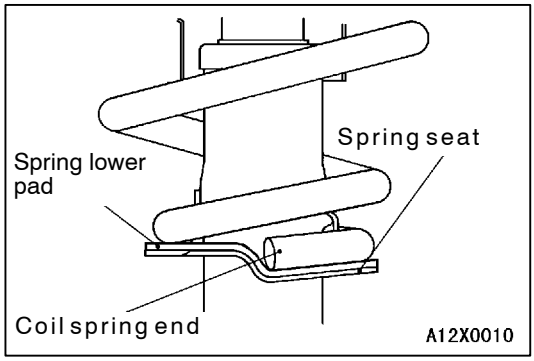
REASSEMBLY SERVICE POINTS

▶A◀ SELF-LOCKING NUT INSTALLATION

1. Install the special tool same as its removal and compress the coil spring to install to the shock absorber.

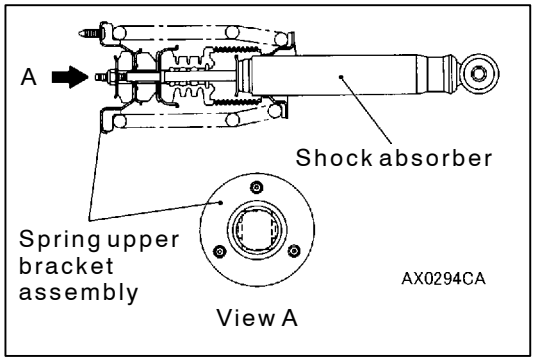
   Caution
   (1) Do not tighten the special tool bolt too tight. The special tool will be broken if the allowable tightening torque of 74 N·m is exceed.
   (2) Install the special tools evenly, and so that the maximum length will be attained within the installation range.
   (3) Do not use an impact wrench as it will cause the bolt of the special tool to be seized.

2. Align the coil spring lower end and the stepped spring lower pad with the shock absorber spring seat stepped part.



▶B◀ SPRING BRACKET ASSEMBLY INSTALLATION

Install the spring bracket assembly so that it faces as shown in respect to the shock absorber.



▶C◀ SELF-LOCKING NUT INSTALLATION

1. Tighten the self-locking nut loosely.
2. Remove the special tools (MB991237, MB991238) and then tighten the self-locking nut to the specified torque.

   Caution
   Do not use an impact wrench as it will cause the bolt of the special tool to be seized.

LOWER ARM ASSEMBLY

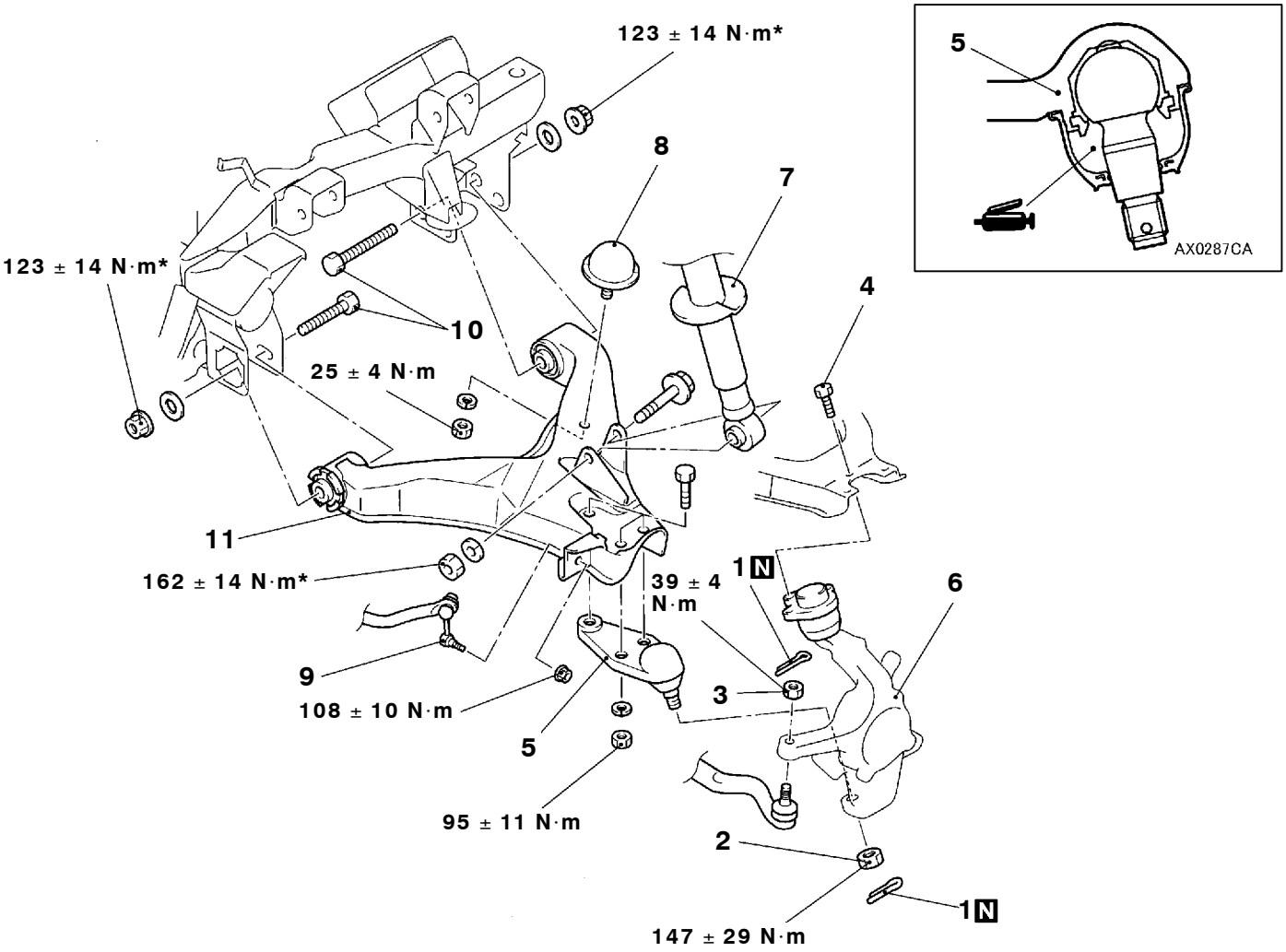
REMOVAL AND INSTALLATION

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.**

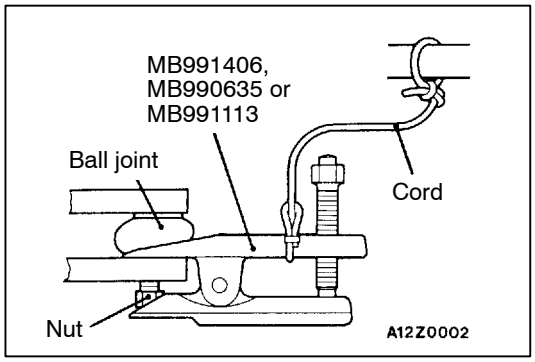
Pre-removal Operation
Drive Shaft Removal (Refer to GROUP 26 – Drive Shaft.)

Post-installation Operation
- Check the dust cover for cracks or damage by pushing it with finger.
- Drive Shaft Installation (Refer to GROUP 26 – Drive Shaft.)
- Wheel alignment check and adjustment (Refer to P.33A-4.)



Removal steps

1. Split pin
2. Lower arm ball joint and knuckle assembly connection
◀A▶ 3. Tie rod end and knuckle connection
4. Upper arm and upper arm ball joint connection
◀A▶ 5. Lower arm ball joint
6. Hub and knuckle assembly
7. Shock absorber and lower arm assembly connection
8. Bump stopper
9. Lower arm assembly and stabilizer link connection
◀B▶ 10. Lower arm mounting bolt
11. Lower arm assembly

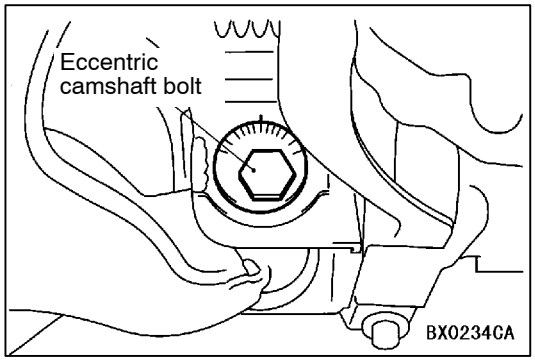


REMOVAL SERVICE POINTS

◀A▶ TIE ROD END AND KNUCKLE SEPARATION/LOWER ARM BALL JOINT REMOVAL

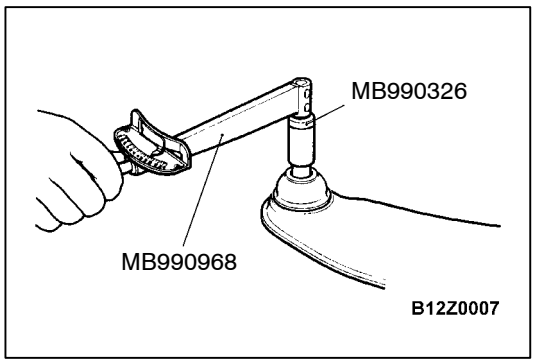
Caution

1. **To prevent the ball joint thread from damage, only loosen but do not remove the nut securing the lower arm and tie rod end to the knuckle from the ball joint and use the special tool.**
2. **Support the special tool with a cord to prevent it from coming off.**



◀B▶ LOWER ARM MOUNTING BOLT REMOVAL

After making the alignment mark on the bracket and eccentric cam bolt and remove them.



INSPECTION

LOWER ARM BALL JOINT ROTATION STARTING TORQUE CHECK

1. After shaking the ball joint stud several times, use the special tools to measure the rotation starting torque of the lower ball joint.

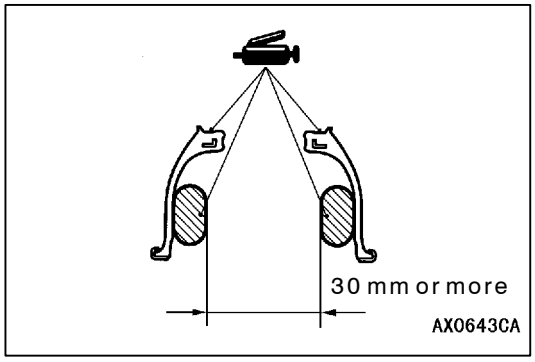
   Standard value: 0.3 - 4.5 N·m

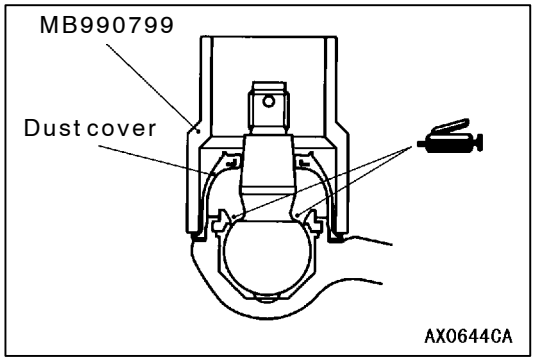
2. When the measured value exceeds the standard value, replace the lower arm ball joint assembly.
3. When the measured value is lower than the standard value, check that the lower arm ball joint turns smoothly without excessive play. If there is no excessive play, the ball joint can be reused.

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 ball joint assembly.

NOTE
If the dust cover is cracked or damaged, it is possible that there may also be damage to 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. Fill the inside of the dust cover with the specified grease as shown in the illustration.
3. Apply the specified grease to the dust cover and ball joint stud as shown in the illustration.
4. Wrap plastic tape around the lower arm ball joint stud, and then install the dust cover to the lower arm ball joint.

Caution
Do not apply grease to the place (tapered section) where the threaded section of the ball joint connects with the knuckle. Wipe the grease off if it is applied.

5. Using the special tool, drive the dust cover into the position shown in the illustration.

Caution
To prevent the grease to be applied on the ball joint connection (taper) with knuckle, do not compress the dust cover before installation.

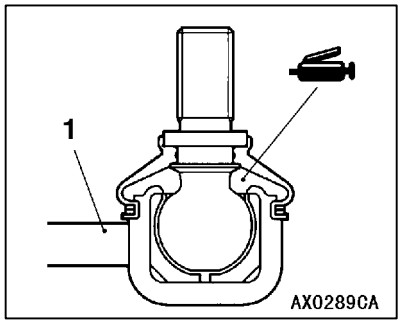
6. Press the dust cover with your finger to check that there are no cracks or damage in the dust cover.

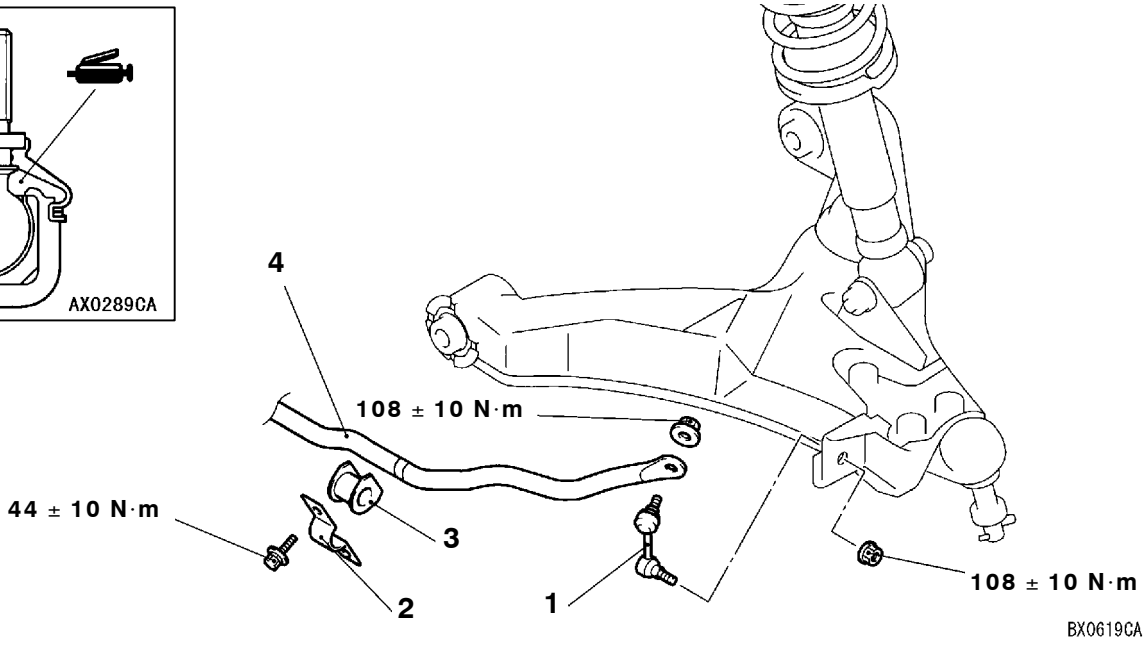
STABILIZER BAR

REMOVAL AND INSTALLATION

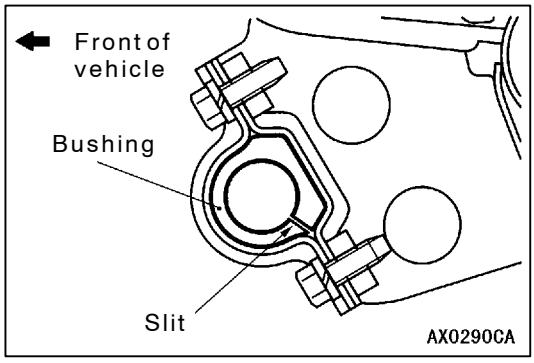
Pre-removal Operation
Under Cover Removal

Post-installation Operation
- Check the Dust Cover for Cracks or Damage by Pushing it with Finger.
- Under Cover Installation





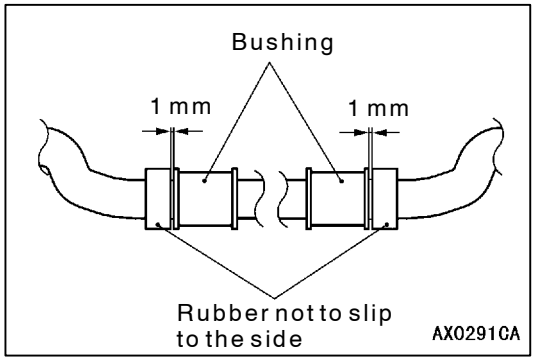
Removal steps
1. Stabilizer link
▶B◀ 2. Stabilizer clamp
▶A◀ 3. Stabilizer bush
4. Stabilizer bar



INSTALLATION SERVICE POINTS

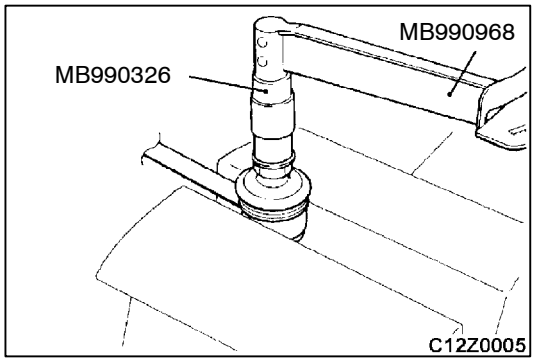
▶A◀ STABILIZER BUSHING INSTALLATION

Install the bush slit as shown in the illustration.



▶B◀ STABILIZER CLAMP INSTALLATION

Position the stabilizer clamp as shown in the illustration and then tighten the stabilizer clamp mounting bolt.



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.

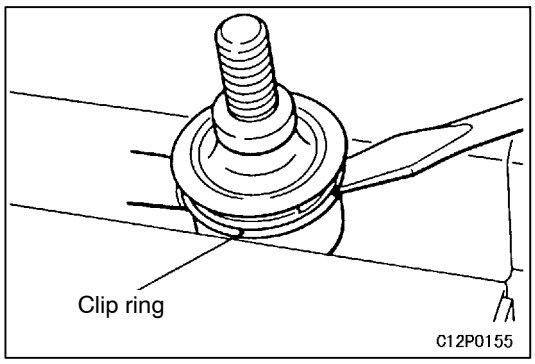
   Standard value: 0.5 - 2.0 N·m

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.

NOTES

REAR SUSPENSION

Click on the applicable bookmark to selected the required model year.

REAR SUSPENSION

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TOE CONTROL ARM ASSEMBLY/TOE CONTROL TOWER BAR 13

TRAILING ARM ASSEMBLY 16

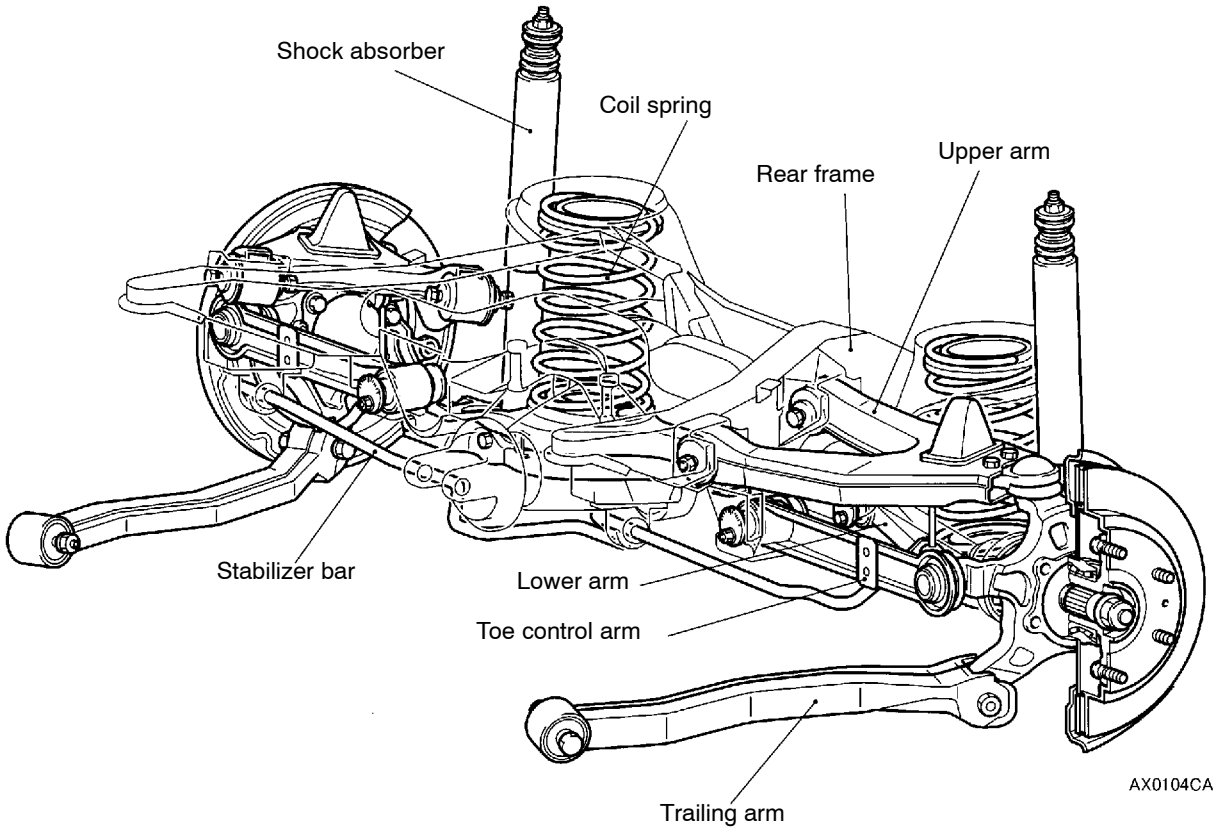
GENERAL INFORMATION

A multi-link type double wishbone independent suspension has been adopted as the rear suspension. Because the left and right wheels move independently with almost no change in tyre posture, the tyres contact the ground firmly, providing excellent steering stability as well as offering improved riding comfort.

COIL SPRING

Items	Short wheelbase-2500(GL)	Except short wheelbase-2500(GL)	Long wheelbase
Wire diameter × outer diameter × free length mm	16 × 133 × 330	16 × 134 × 336	18 × 134 × 337

CONSTRUCTION DIAGRAM

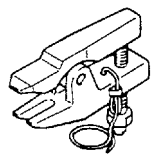
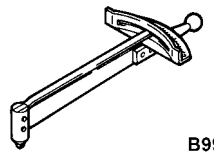
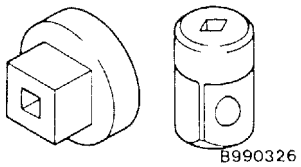
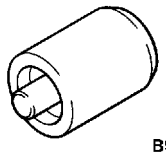
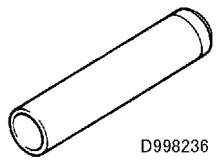
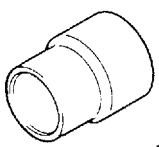


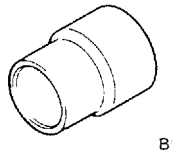
SERVICE SPECIFICATIONS

Items		Standard value
Toe-in	At the centre of tyre tread mm	3 ± 3
	Toe-angle (per wheel)	1° 06' ± 1° 06'
Camber		0° ± 30'*
Thrust angle		0° ± 9'
Upper arm ball joint rotation torque N·m		0.5 - 3.0
Stabilizer link ball joint turning torque N·m		0.5 - 2.0
Toe control arm ball joint turning torque N·m		1.0 - 2.5

NOTE
*: difference between right and left wheels: less than 30'

SPECIAL TOOLS

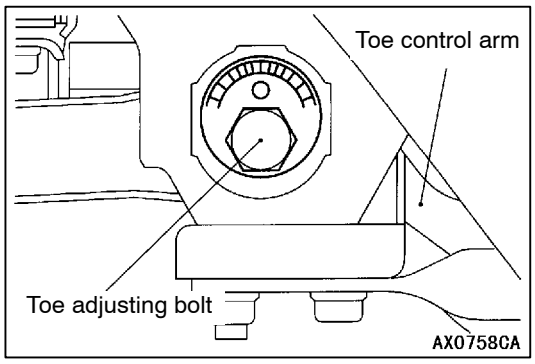
Tool	Number	Name	Use
 B991113	MB990635, MB991113 or MB991406	Steering linkage puller	Ball joint and knuckle disconnection
 B990968	MB990968	Torque wrench	Upper arm ball joint, lower arm ball joint and stabilizer link ball joint rotation starting torque measurement
 B990326	MB990326	Preload socket	
 B990880	MB990881	Rear suspension bushing arbor	Lower arm bushing removal and press-fitting
 D998236	MD998236	Output shaft bearing installer	Trailing arm bushing removal and press-fitting
 B990799	MB990799	Ball joint remover and installer	Upper arm ball joint dust cover press-in

Tool	Number	Name	Use
 B990799	MB990800	Ball joint remover and installer	Toe control arm ball joint dust cover press-in

ON-VEHICLE SERVICE

WHEEL ALIGNMENT CHECK AND ADJUSTMENT

1. The rear suspension, wheels and tyres should be serviced to normal condition prior to measurement of wheel alignment.
2. Measure the wheel alignment with the vehicle parked on a level surface.



TOE-IN

Standard value:

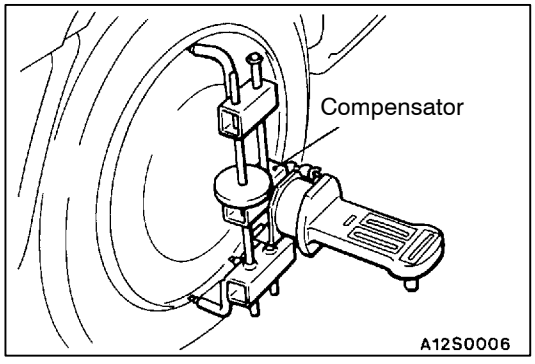
At the centre of tyre tread 3 ± 3 mm
Toe angle (per wheel) 1°06' ± 1°06'

If toe-in is not within the standard value, adjust by following procedures.

(1) Be sure to adjust the camber before making toe adjustment.
(2) Carry out adjustment by turning the toe adjusting bolt (toe control arm mounting bolt which faces the inside of the body).

Left wheel: Turning clockwise (-) toe-in

Right wheel: Turning clockwise (+) toe-in

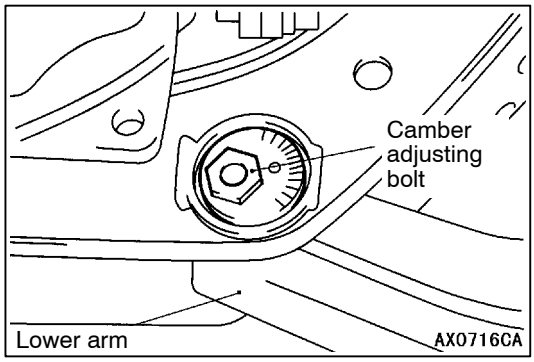


CAMBER

Use the compensator to measure camber.

Standard value:

Camber 0° ± 30' (difference between right and left wheel: less than 30')



If camber is not within the standard value, adjust by following procedures.

(1) Carry out adjustment by turning the camber adjusting bolt of the lower arm.

Left wheel: Turning clockwise (-) camber

Right wheel: Turning clockwise (+) camber

(2) After adjusting the camber, the toe should be adjusted.

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 upper arm ball joint assembly, toe control arm ball joint assembly or the stabilizer link.

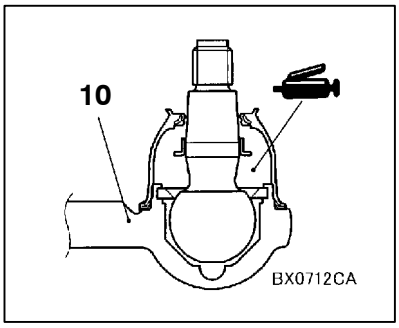
NOTE
Cracks or damage of the dust cover may cause damage of the ball joint.

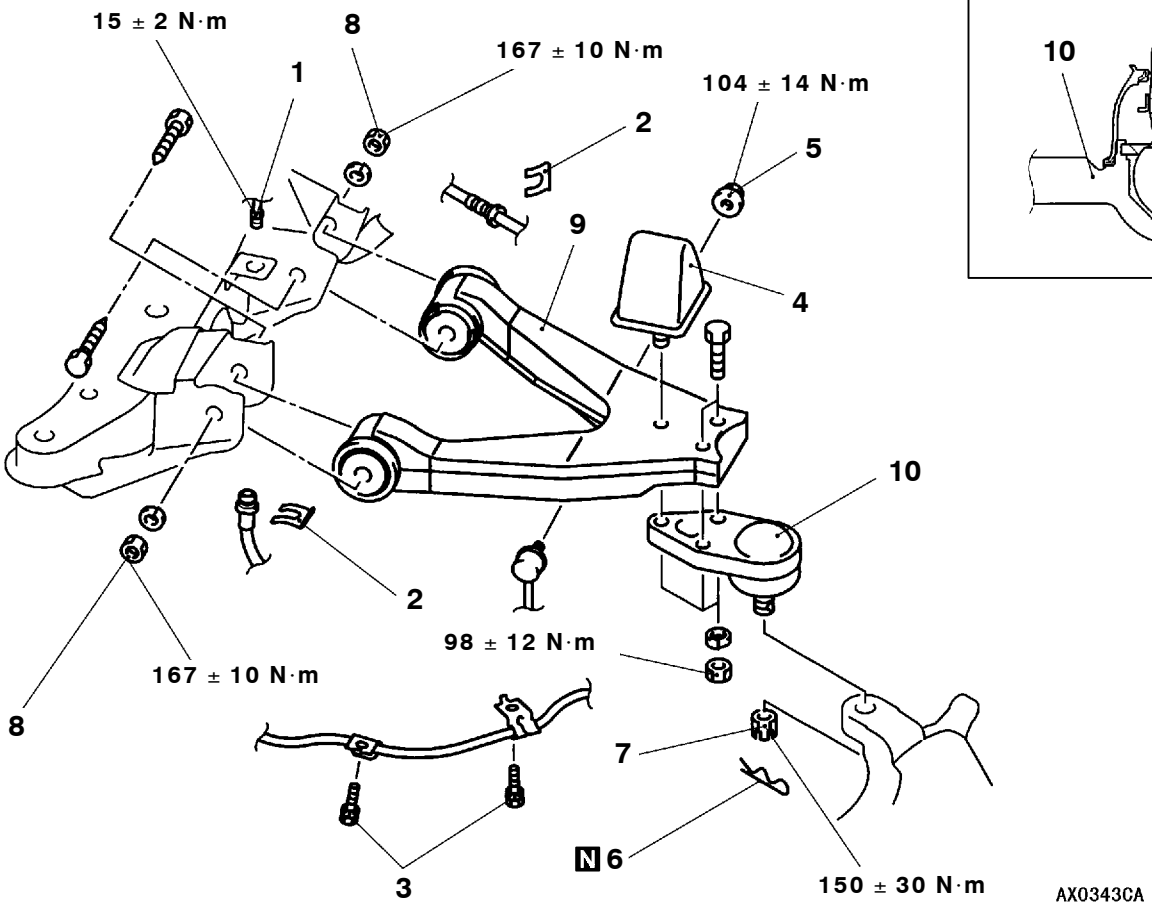
UPPER ARM ASSEMBLY

REMOVAL AND INSTALLATION

Pre-removal Operations
Brake Fluid Draining

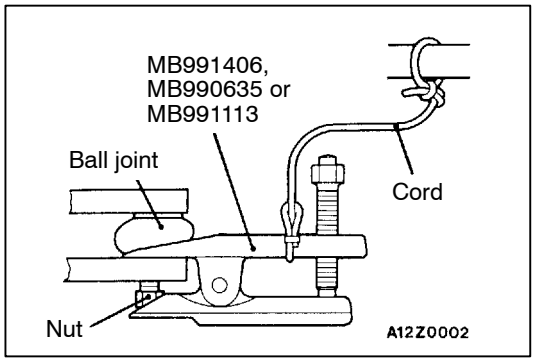
Post-installation Operations
- Press the dust cover with your finger to check that there are no cracks or damage in the dust cover.
- Brake Fluid Supplying and Bleeding (Refer to GROUP 35A – On-vehicle Service.)
- Wheel Alignment Check and Adjustment (Refer to P.34-4.)





Removal steps

1. Brake pipe connection
2. Clip
3. Rear wheel speed sensor and upper arm assembly connection <vehicles with ABS>
4. Bump stopper
5. Stabilizer link and upper arm assembly connection.
6. Split pin
◀A▶ 7. Upper arm ball joint and knuckle connection
◀B▶ ▶A◀ 8. Upper arm assembly and rear frame connection
9. Upper arm
10. Upper arm ball joint

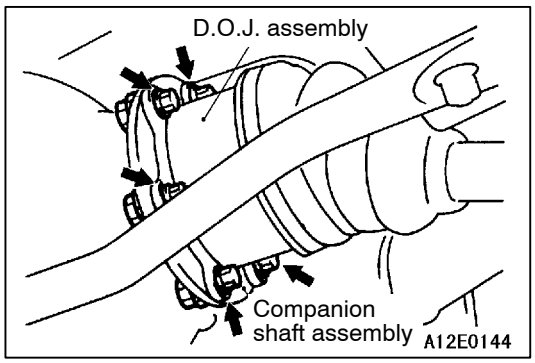


REMOVAL SERVICE POINTS

◀A▶ UPPER ARM BALL JOINT AND KNUCKLE DISCONNECTION

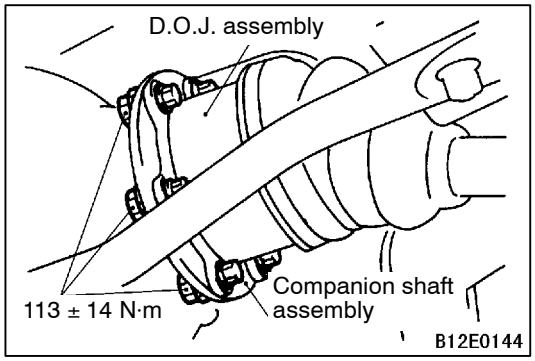
Caution

1. **To prevent the ball joint thread from damage, only loosen but do not remove the nut securing the upper arm to the knuckle from the ball joint and use the special tool.**
2. **The special tool should be suspended from a cord to prevent it from being dropped.**



◀B▶ UPPER ARM ASSEMBLY AND REAR FRAME DISCONNECTION

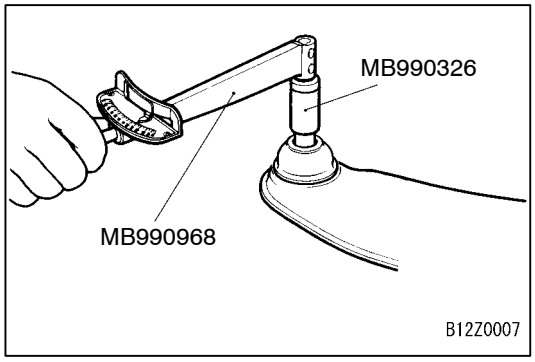
Disconnect the connection of the D.O.J. assembly and the companion shaft assembly.



INSTALLATION SERVICE POINT

▶A◀ UPPER ARM ASSEMBLY AND REAR FRAME CONNECTION

After installing the upper arm mounting bolt, tighten the connecting bolt of the D.O.J. assembly and the companion shaft assembly to the specified torque.



INSPECTION

UPPER ARM BALL JOINT ROTATION TORQUE CHECK

1. After shaking the upper arm ball joint stud several times, use the special tool to measure the rotation torque of the upper arm ball joint.

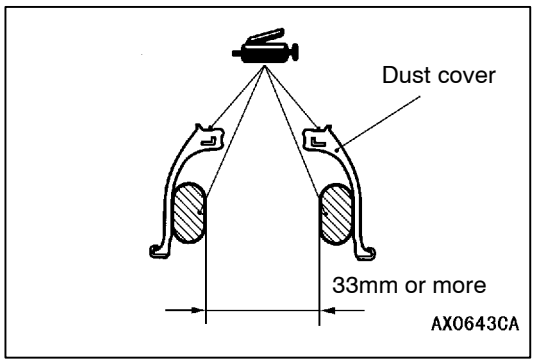
   Standard value: 0.5 – 3.0 N·m

2. When the measured value exceeds the standard value, replace the upper arm ball joint assembly.
3. When the measured value is lower than the standard value, check that the upper arm ball joint turns smoothly without excessive play. If there is no excessive play, the ball joint can be reused.

UPPER 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 upper 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.



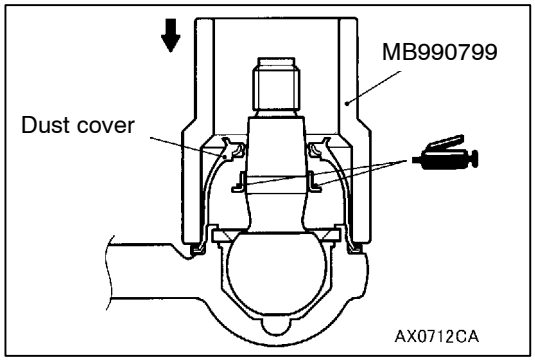
UPPER ARM BALL JOINT DUST COVER REPLACEMENT

Only when the dust cover is damaged accidentally during service work, replace the dust cover as follows:

1. Remove the dust cover.
2. Fill the inside of the dust cover with the specified grease as shown in the illustration.
3. Apply the specified grease to the dust cover and ball joint stud as shown in the illustration.
4. Wrap plastic tape around the lower arm ball joint stud, and then install the dust cover to the upper arm ball joint.

Caution

Do not apply grease to the place (tapered section) where the threaded section of the ball joint connects with the knuckle. Wipe away any grease which gets on this section.



5. Using the special tool, drive the dust cover into the position shown in the illustration.

Caution

To prevent the grease to be applied on the ball joint connection (taper) with knuckle, do not compress the dust cover before installation.

6. Press the dust cover with your finger to check that there are no cracks or damage in the dust cover.

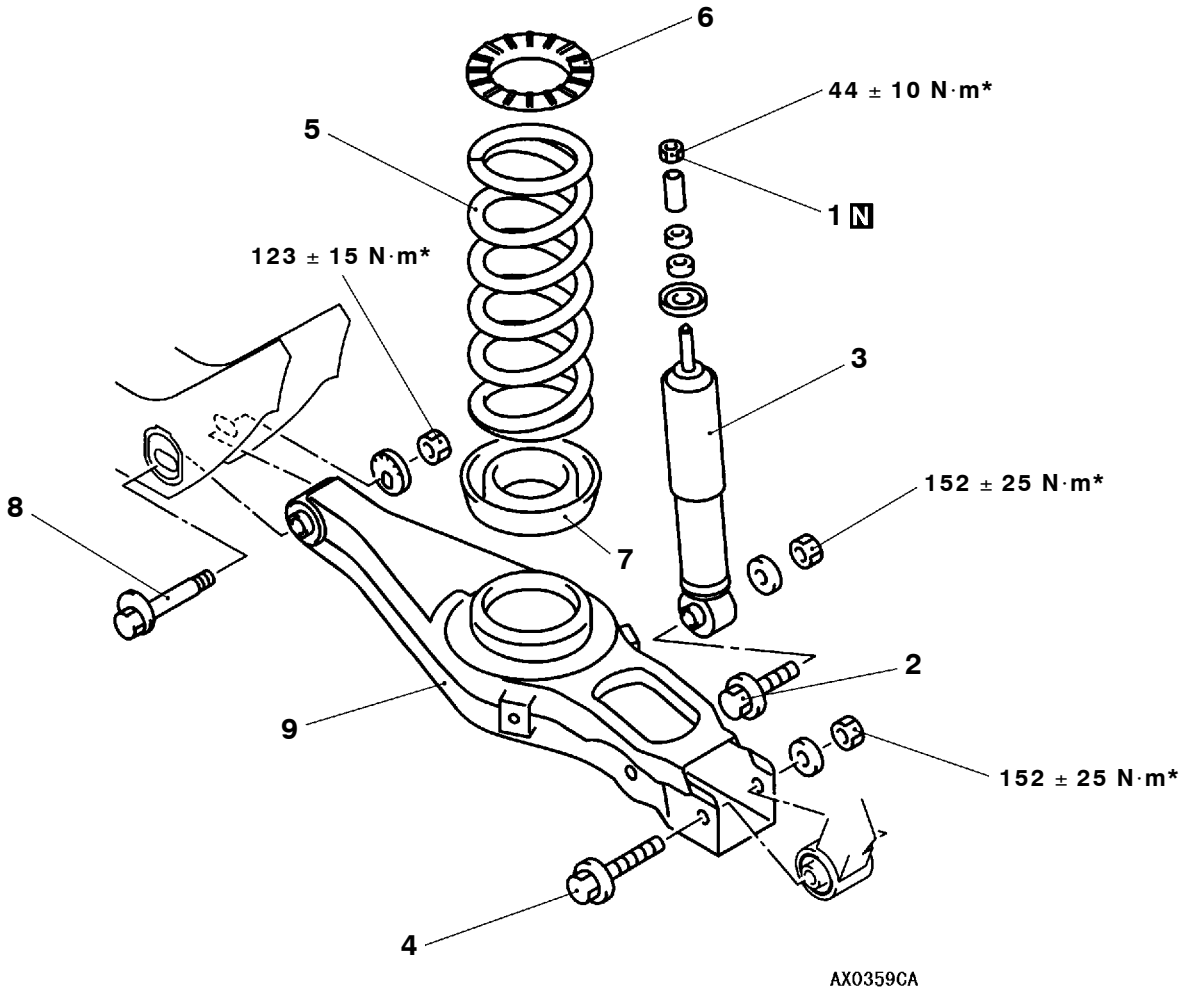
SHOCK ABSORBER/COIL SPRING/LOWER ARM ASSEMBLY

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.**

Post-installation Operation
Wheel Alignment Check And Adjustment
(P.34-4.)



Shock absorber removal steps

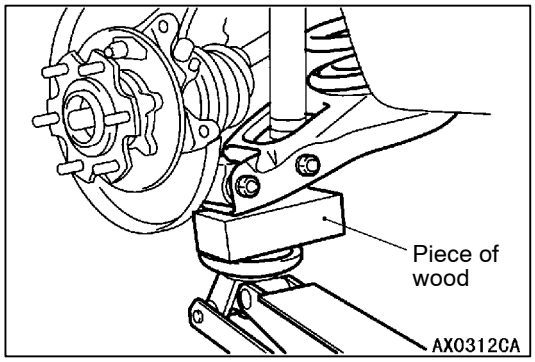
1. Shock absorber mounting nut
2. Shock absorber mounting bolt
3. Shock absorber

Coil spring removal steps

◀A▶ ▶A◀ 2. Shock absorber mounting bolt
◀A▶ ▶A◀ 4. Lower arm mounting bolt
◀A▶ ▶A◀ 5. Coil spring
6. Spring upper pad
7. Spring lower pad

Lower arm removal steps

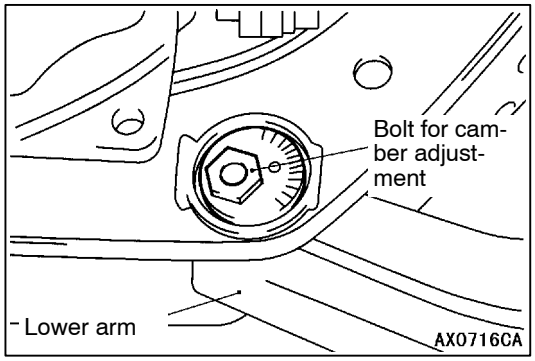
◀A▶ ▶A◀ 2. Shock absorber mounting bolt
◀A▶ ▶A◀ 4. Lower arm mounting bolt
◀A▶ ▶A◀ 5. Coil spring
6. Spring upper pad
7. Spring lower pad
◀B▶ 8. Bolt assembly (for camber adjustment)
9. Lower arm



REMOVAL SERVICE POINTS

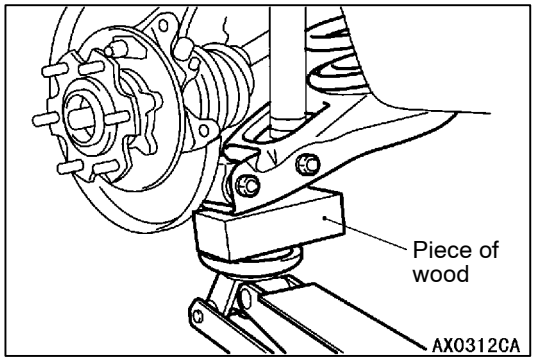
◀A▶ LOWER ARM MOUNTING BOLT REMOVAL

1. Place a piece of wood at the lower arm as shown in the illustration. Using the floor jack, compress the coil spring to remove the lower arm mounting bolt.
2. Lower the floor jack slowly, and then remove the coil spring.



◀B▶ BOLT ASSEMBLY (FOR CAMBER ADJUSTMENT) REMOVAL

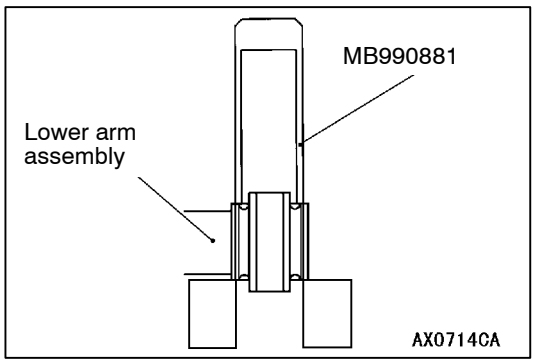
Make the mating marks to the bracket and the camber adjusting bolt, and then remove the camber adjusting bolt.



INSTALLATION SERVICE POINT

▶A◀ COIL SPRING/LOWER ARM MOUNTING BOLT INSTALLATION

1. The identification colour of the coil spring should be located at the lower side.
2. Align the coil spring end with the spring lower pad cavity.
3. Place a piece of wood at the lower arm as shown in the illustration. Using the floor jack, compress the coil spring to remove the lower arm mounting bolt.



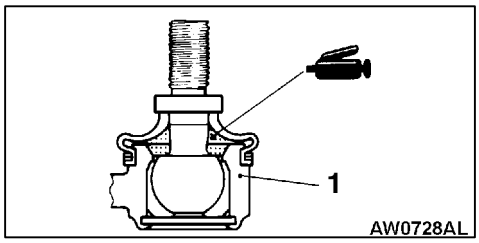
BUSHING REPLACEMENT

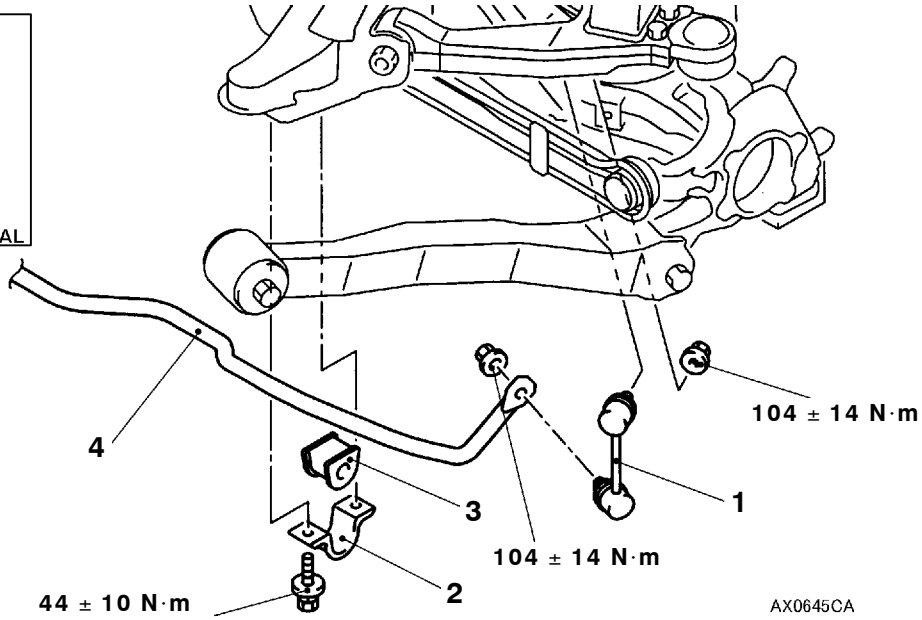
Use the special tool to drive out and press fit the lower arm bushing.

STABILIZER BAR

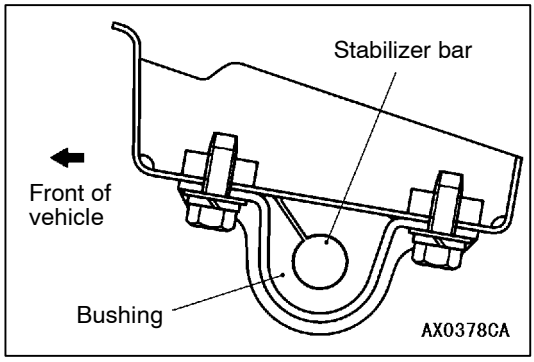
REMOVAL AND INSTALLATION

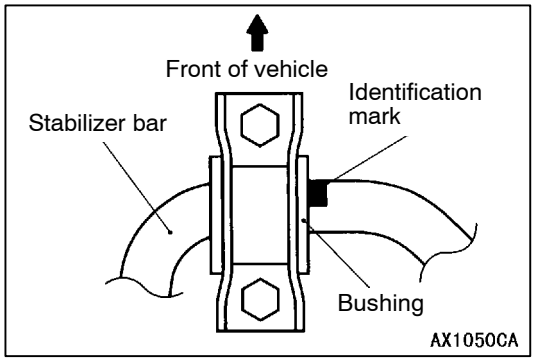
Post-installation Operations
Press the dust cover with your finger to check that there are no cracks or damage in the dust cover.





Removal steps
1. Stabilizer link assembly
2. Stabilizer clamp
▶A◀ 3. Bushing
4. Stabilizer bar

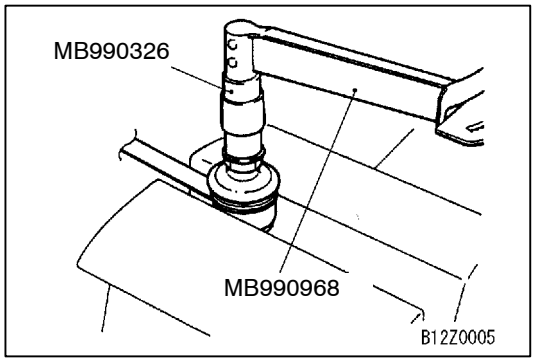




INSTALLATION SERVICE POINT

▶A◀ BUSHING INSTALLATION

1. Install the stabilizer bar so that its identification mark faces the left side of the vehicle.
2. Install the bushing so that its slit faces the direction shown in the illustration.
3. Align the end of the identification mark with the end of the bushing, before tightening the mounting screws.



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.

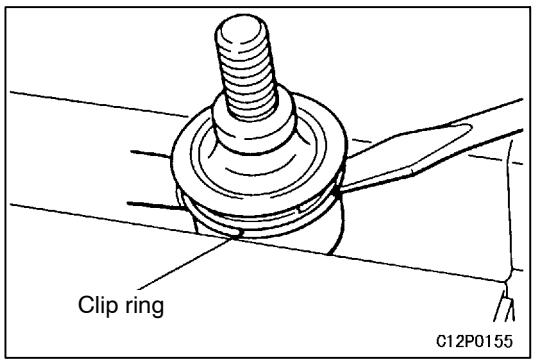
   Standard value: 0.5 - 2.0 N·m

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.

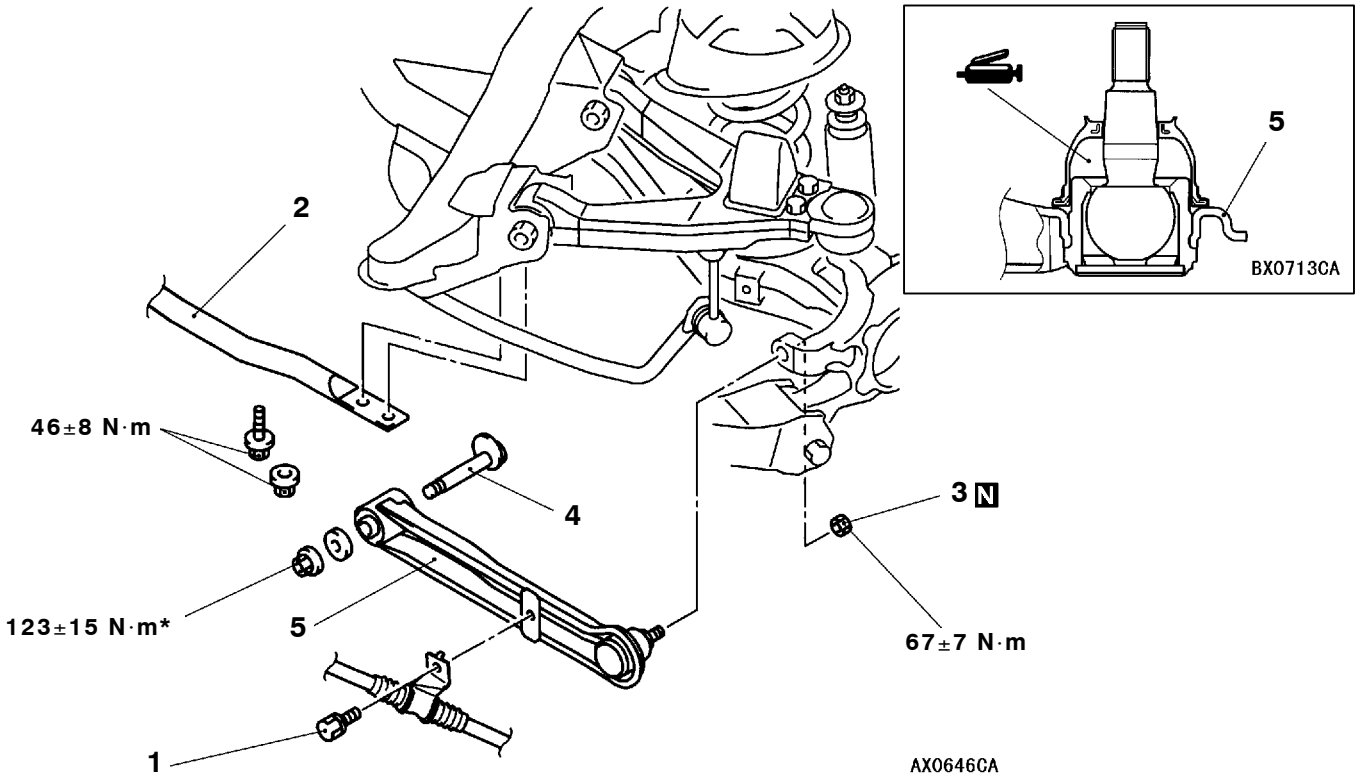
TOE CONTROL ARM ASSEMBLY/TOE CONTROL TOWER BAR

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.**

Post-installation Operations
- Press the dust cover with your finger to check that there are no cracks or damage in the dust cover.
- Wheel alignment check and adjustment (Refer to P.34-4.)

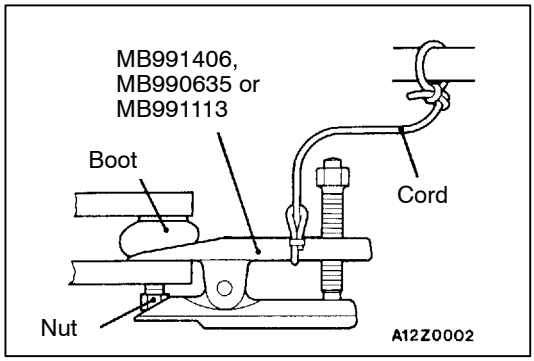


Removal steps

1. Parking brake cable mounting bolt
2. Toe control tower bar

◀A▶ 3. Toe control arm ball joint and knuckle connection

◀B▶ 4. Bolt assembly (for toe adjustment)
5. Toe control arm assembly



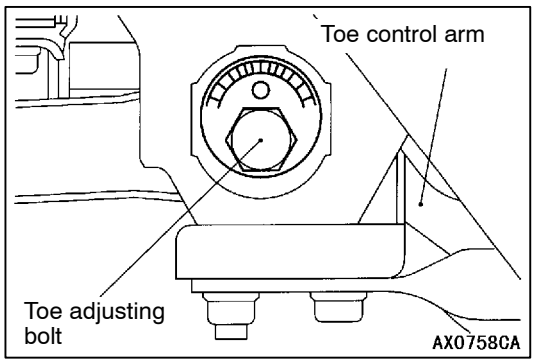
REMOVAL SERVICE POINTS

◀A▶ TOE CONTROL ARM BALL JOINT AND KNUCKLE SEPARATION

Caution

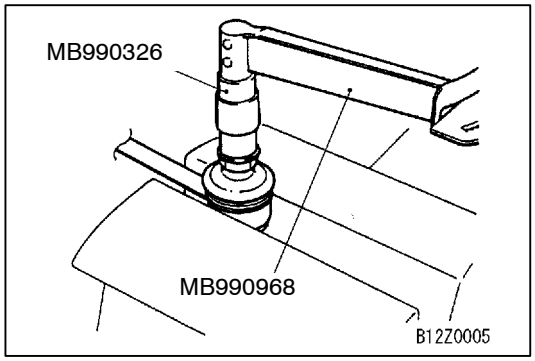
1. To prevent the ball joint thread from damage, only loosen but do not remove the nut securing the toe control arm to the knuckle from the ball joint and use the special tool.

2. **The special tool should be suspended from a cord to prevent it from being dropped.**



◀B▶ BOLT ASSEMBLY (FOR TOE ADJUSTMENT) REMOVAL

Make mating marks on the bracket and the toe adjusting bolt, and then remove the bolt.



INSPECTION

TOE CONTROL ARM BALL JOINT TURNING TORQUE CHECK

1. After shaking the toe control arm ball joint stud several times, use the special tool to measure the turning torque of the toe control arm ball joint.

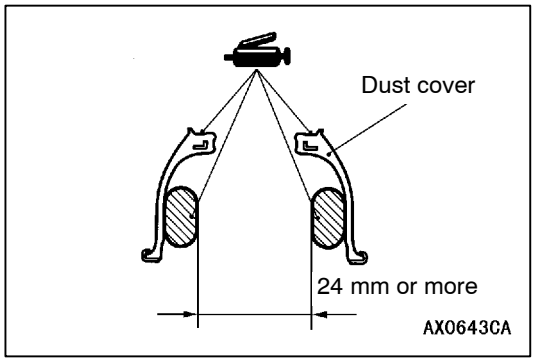
   Standard value: 1.0 - 2.5 N·m

2. When the measured value exceeds the standard value, replace the toe control arm ball joint assembly.
3. When the measured value is lower than the standard value, check that the toe control arm ball joint turns smoothly without excessive play. If there is no excessive play, the ball joint can be reused.

TOE CONTROL 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 toe control arm ball joint 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.



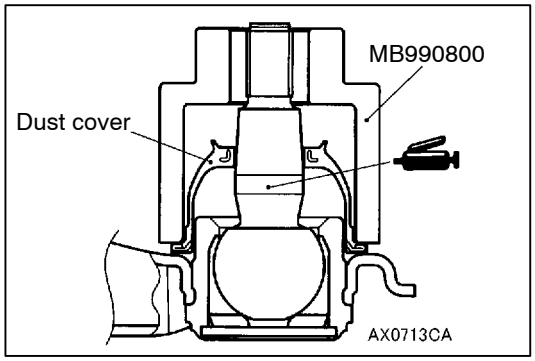
TOE CONTROL ARM BALL JOINT DUST COVER REPLACEMENT

Only when the dust cover is damaged accidentally during service work, replace the dust cover as follows:

1. Remove the dust cover.
2. Fill the inside of the dust cover with the specified grease as shown in the illustration.
3. Apply the specified grease to the dust cover and ball joint stud as shown in the illustration.
4. Wrap plastic tape around the lower arm ball joint stud, and then install the dust cover to the toe control arm ball joint.

Caution

Do not apply grease to the place (tapered section) where the threaded section of the ball joint connects with the knuckle. Wipe away any grease which gets on this section.



5. Using the special tool, drive the dust cover into the position shown in the illustration.

Caution

To prevent the grease to be applied on the ball joint connection (taper) with knuckle, do not compress the dust cover before installation.

6. Press the dust cover with your finger to check that there are no cracks or damage in the dust cover.

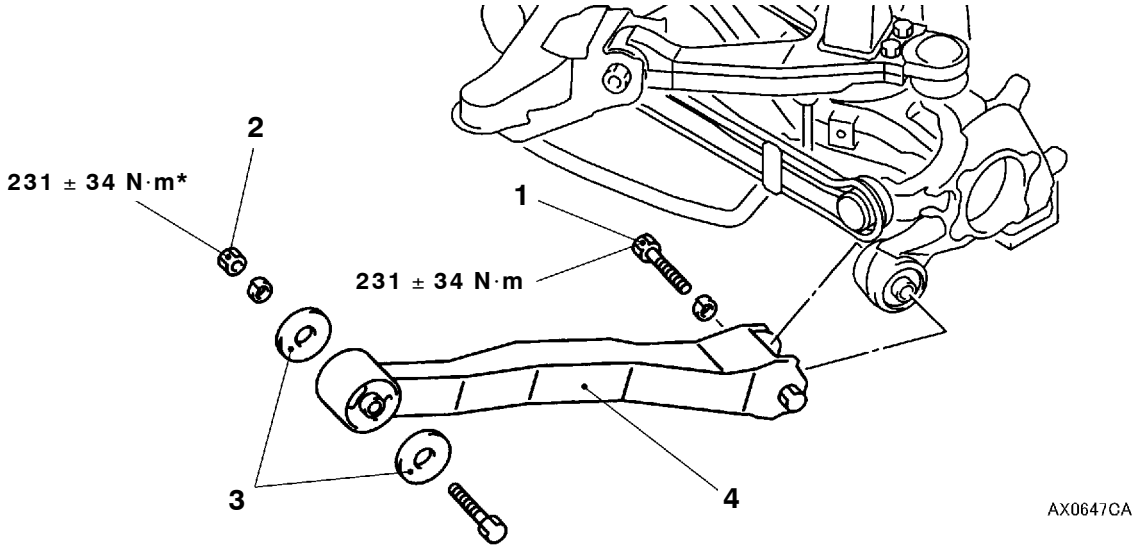
TRAILING ARM ASSEMBLY

REMOVAL AND INSTALLATION

Caution

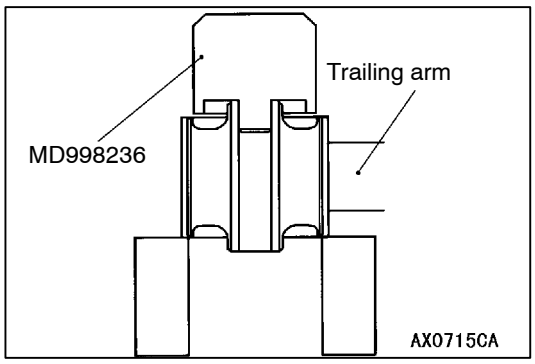
***: To prevent bushings from breakage, the parts indicated by * should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**

Post-installation Operations
Wheel Alignment Check and Adjustment (Refer to P.34-4.)



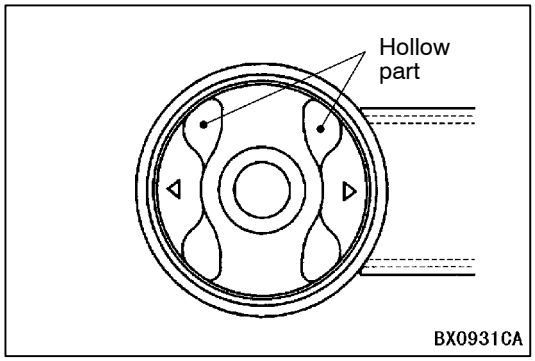
Removal steps

1. Trailing arm and knuckle connecting bolt
2. Trailing arm and rear frame connecting nut
3. Stopper
4. Trailing arm



BUSHING REPLACEMENT

1. Use the special tool to drive out and press fit the trailing arm bushing.



2. Apply a sufficient amount of soapy solution to the bushing and the inner surface of the trailing arm, and then press fit the bushing so that its hollow part is as shown and it protrudes by a same amount from the trailing arm.

Service Bulletins

Click on the applicable bookmark to select the Service Bulletin.

SERVICE BULLETIN

MITSUBISHI MOTORS

TECHNICAL SERVICE PLANNING
INTERNATIONAL CAR ADMINISTRATION OFFICE. MITSUBISHI MOTORS CORPORATION

SERVICE BULLETIN	NO. : MSB-00E34-501	
	DATE : 2001-01-20	<MODEL> (EC)PAJERO/ MONTERO (V60,V70) <M/Y> 01-10
SUBJECT : CORRECTION TO REAR SUSPENSION TOE ANGLE		
GROUP : REAR SUSPENSION	DRAFTNO. : 00SY102713	

CORRECTION	INTERNATIONAL CAR ADMINISTRATION OFFICE	T. MASAKI - MANAGER TECHNICAL SERVICE PLANNING

1. Description:

The rear suspension toe angle has been corrected.

2. Applicable Manuals:

Manual	Pub. No.	Page
2001 PAJERO Technical Information Manual	PYJE0001 (English)	3-7
2001 PAJERO Workshop Manual chassis VOL2	PWJE0001 (2/2) (English) PWJF0003 (French) PWJG0004 (German)	34-3, 4
2001 MONTERO Workshop Manual chassis VOL2	PWJS0002 (Spanish)	34-3, 4

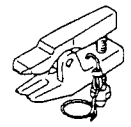
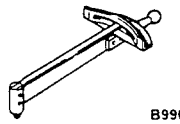
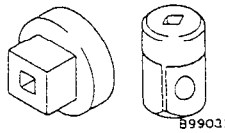
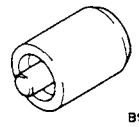
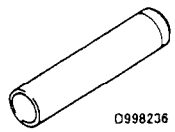
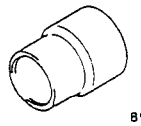
SERVICE SPECIFICATIONS

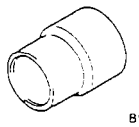
<Correct> 0°06' ± 0°06'

Items		Standard value
Toe-in	At the centre of tyre tread mm	3 ± 3
	Toe-angle (per wheel)	~~1° 06' ± 1° 06'~~ **<Incorrect>**
Camber		0° ± 30'*
Thrust angle		0° ± 9'
Upper arm ball joint rotation torque N·m		0.5 – 3.0
Stabilizer link ball joint turning torque N·m		0.5 – 2.0
Toe control arm ball joint turning torque N·m		1.0 – 2.5

NOTE
*: difference between right and left wheels: less than 30'

SPECIAL TOOLS

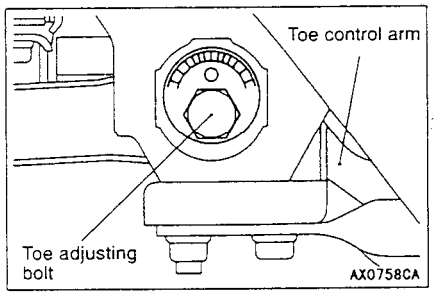
Tool	Number	Name	Use
 B991113	MB990635, MB991113 or MB991406	Steering linkage puller	Ball joint and knuckle disconnection
 B990968	MB990968	Torque wrench	Upper arm ball joint, lower arm ball joint and stabilizer link ball joint rotation starting torque measurement
 B990326	MB990326	Preload socket	
 B990880	MB990881	Rear suspension bushing arbor	Lower arm bushing removal and press-fitting
 D998236	MD998236	Output shaft bearing installer	Trailing arm bushing removal and press-fitting
 B990799	MB990799	Ball joint remover and installer	Upper arm ball joint dust cover press-in

Tool	Number	Name	Use
 B990799	MB990800	Ball joint remover and installer	Toe control arm ball joint dust cover press-in

ON-VEHICLE SERVICE

WHEEL ALIGNMENT CHECK AND ADJUSTMENT

1. The rear suspension, wheels and tyres should be serviced to normal condition prior to measurement of wheel alignment.
2. Measure the wheel alignment with the vehicle parked on a level surface.



TOE-IN 0°06' ± 0°06' **<Correct>**

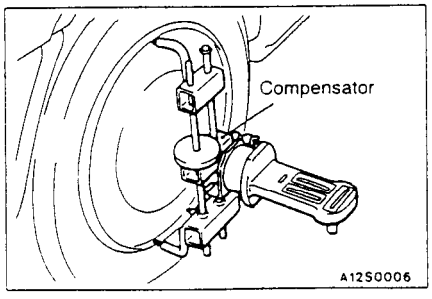
Standard value:
At the centre of tyre tread 3 ± 3 mm
Toe angle (per wheel) ~~1°06' ± 1°06'~~ **<Incorrect>**

If toe-in is not within the standard value, adjust by following procedures.

(1) Be sure to adjust the camber before making toe adjustment.
(2) Carry out adjustment by turning the toe adjusting bolt (toe control arm mounting bolt which faces the inside of the body).

Left wheel: Turning clockwise (–) toe-in

Right wheel: Turning clockwise (+) toe-in



CAMBER

Use the compensator to measure camber.

Standard value:

Camber 0° ± 30' (difference between right and left wheel: less than 30')

BASIC BRAKE SYSTEM

Click on the applicable bookmark to selected the required model year.

BASIC BRAKE SYSTEM

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- Hydraulic Brake Booster (HBB) Operation Check <Vehicles with ABS> 20
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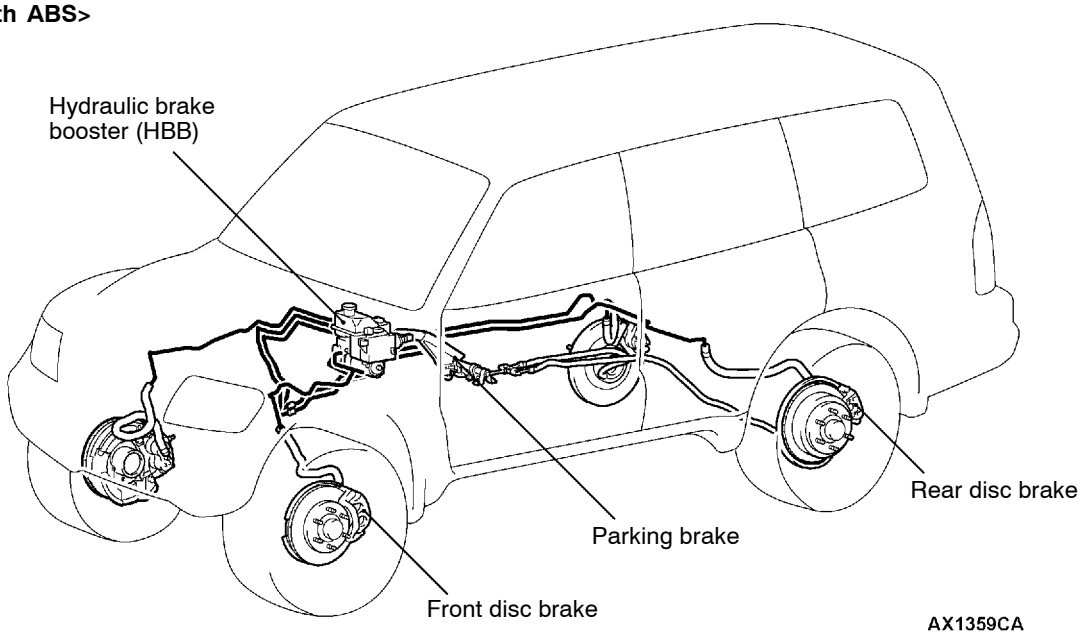
GENERAL INFORMATION

The brake system offers high dependability and durability along with improved braking performance and brake sensitivity.

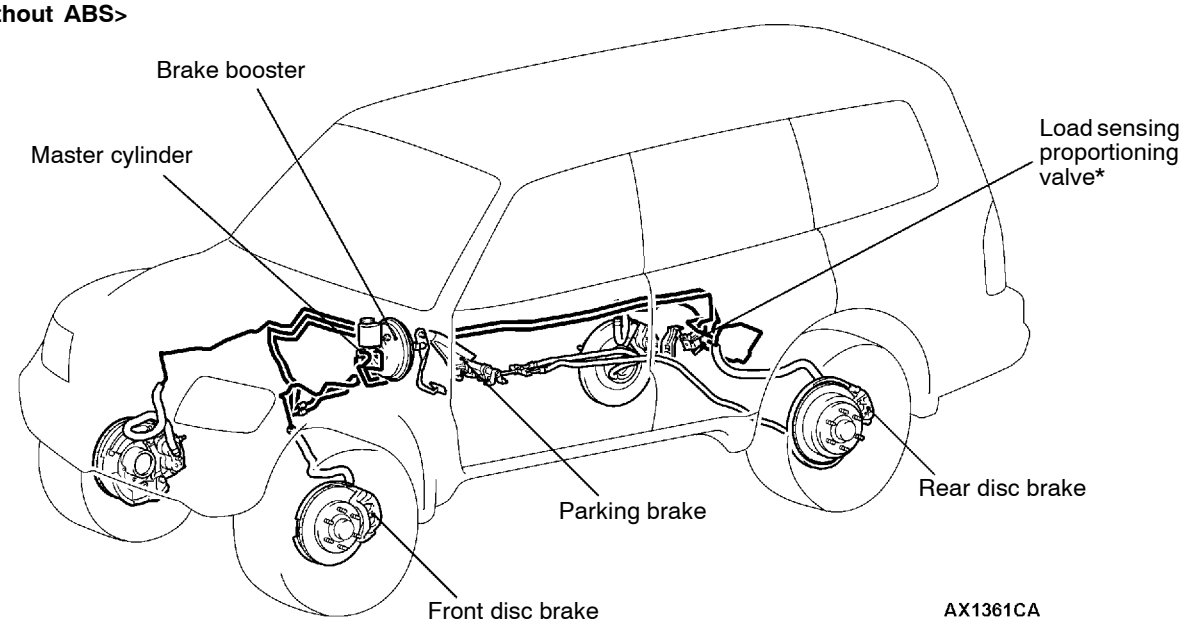
Items		Specifications
Hydraulic brake booster (HBB) <Vehicles with ABS>	Master cylinder type	Single type (with center valve)
	Master cylinder I.D. mm	22.22
	Boosting ratio	5.4 <Pedal depressing force: 274 N>
Master cylinder <Vehicles without ABS>	Type	Tandem type
	I.D. mm	23.81
Brake booster <Vehicles without ABS>	Type	Vacuum type, tandem
	Effective dia. of power cylinder mm	216 + 217
	Boosting ratio	6.5 <Pedal depressing force: 240 N>
Rear wheel hydraulic pressure control type <Vehicles with ABS>		Electronic brake-force distribution (EBD)
Load sensing proportioning valve<Vehicles without ABS>	Decompression ratio	0.3
Front brakes	Type	Floating caliper, 2 piston, ventilated disc
	Disc effective dia. × thickness mm	241 × 26
	Wheel cylinder I.D. mm	45.4
	Pad thickness mm	10.0
	Clearance adjustment	Automatic
Rear brakes	Type	Floating caliper, 1 piston, ventilated disc
	Disc effective dia. × thickness mm	256 × 22
	Wheel cylinder I.D. mm	44.5
	Pad thickness mm	10.0
	Clearance adjustment	Automatic
Brake fluid		DOT3 or DOT4

CONSTRUCTION DIAGRAM

<Vehicles with ABS>



<Vehicles without ABS>



NOTE
For short wheelbase, only the position indicated by the * is symmetrical.

SERVICE SPECIFICATIONS

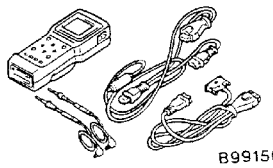
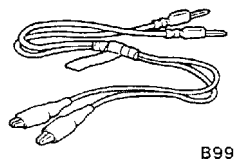
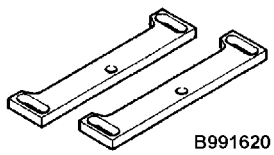
Items				Standard value	Limit
Brake pedal height mm	L.H. drive vehicles			192 - 195	-
	R.H. drive vehicles			187 - 190	-
Brake pedal play mm				3 - 8	-
Brake pedal to floorboard clearance when the brake pedal is depressed mm				90 or more	-
Hydraulic brake booster (HBB) <Vehicles with ABS>	Pump motor operation time second	When power supply system brake fluid pressure is not applied		20 - 80	-
		When power supply system brake fluid pressure is applied		2 - 11	-
	Hydraulic pressure during no vacuum operation test MPa	Pedal depression force: 100 N	Front	0.6 or more	-
			Rear	0	-
		Pedal depression force: 500 N	Front	4.5 or more	-
			Rear	0	-
	Hydraulic pressure during vacuum operation test MPa	Pedal depression force: 100 N	Front	3.0 - 4.0	-
			Rear	3.3 - 4.3	-
		Pedal depression force: 200 N	Front	8.0 - 10.0	-
			Rear	8.0 - 10.0	-
		Pedal depression force: 400 N	Front	14.0 - 18.0	-
			Rear	14.0 - 18.0	-
		Pedal depression force: 500 N	Front	15.0 - 19.0	-
			Rear	15.0 - 19.0	-
Clearance between brake booster push rod and primary piston mm <Vehicles without ABS>			6G7	0.5 - 0.9	-
			4D5, 4M4	0.8 - 1.2	-
Load sensing proportioning valve output fluid pressure (Input fluid pressure) MPa <Vehicles without ABS>	When load sensing spring length is 133 mm (when unladen)		Short wheelbase	4.9 - 5.9 (9.8)	-
			Long wheelbase	5.9 - 6.9 (9.8)	-
	When load sensing spring length is 149 mm (when laden)		Short wheelbase	7.5 - 8.5 (9.8)	-
				9.0 - 11.0 (16.7)	-
			Long wheelbase	9.3 - 10.3 (9.8)	-
				11.4 - 13.4 (16.7)	-
Load sensing spring length <Distance between spring ends> mm <Vehicles without ABS>				135 - 139	-

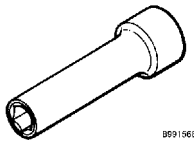
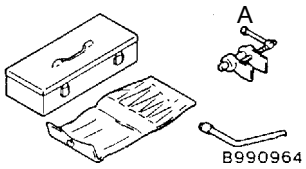
Items		Standard value	Limit
Front disc brake	Pad thickness mm	10.0	2.0
	Disc thickness mm	26.0	24.4
	Disc runout mm	-	0.06
	Drag force N	55	-
Rear disc brake	Pad thickness mm	10.0	2.0
	Disc thickness mm	22.0	20.4
	Disc runout mm	-	0.06
	Drag force N	55	-
Front hub end play mm		-	0
Rear hub end play mm		-	0

LUBRICANTS

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

SPECIAL TOOLS

Tool	Number	Name	Use
 B991502	MB991502	MUT-II sub assembly	• Hydraulic brake booster (HBB) check (Reading diagnosis code by using MUT-II) • Air bleeding of hydraulic brake booster (HBB) ABS system
 B991529	MB991529	Diagnosis code check harness	• Hydraulic brake booster (HBB) check (Reading diagnosis code by using brake warning lamp) • Erasing diagnosis code (not using MUT-II)
 B991620	MB991620	Valve spring compressor adapter	Holding hydraulic brake booster (HBB)

Tool	Number	Name	Use
	MB991568	Push rod adjusting socket	Adjustment of the brake booster push rod protrusion amount
	MB990964 A: MB990520	Brake tool set A: Disc brake piston expander	Pushing-in of the disc brake piston

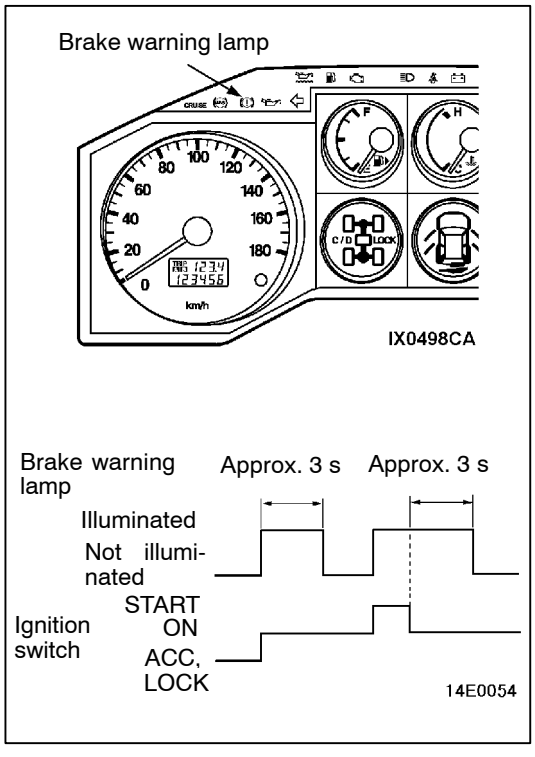
TROUBLESHOOTING <Vehicles with ABS>

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING

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

NOTES WITH REGARD TO DIAGNOSIS

1. The hydraulic brake booster (HBB) accumulates a high-pressure fluid in the accumulator by operating the pump motor, thus boosting the brake. Therefore, the pump motor generates an operating sound, but it indicates that the HBB is operating correctly, and it is not a malfunction.
2. 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.



BRAKE WARNING LAMP INSPECTION

Check that the brake warning lamp illuminates as follows.

1. When the ignition key is turned to “ON”, the brake warning lamp illuminates for approximately 3 seconds and then switches off.
2. When the ignition key is turned to “START”, the brake warning lamp remains illuminated.
3. When the ignition key is turned from “START” back to “ON”, the brake warning lamp illuminates for approximately 3 seconds and then switches off.
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 brake warning lamp. (Refer to GROUP 00 - How to Use Troubleshooting/Inspection Service Points.)

NOTE
Connect the MUT-II to the diagnosis connector (16-pin).

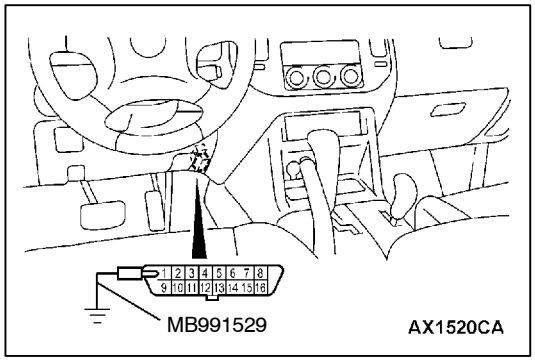
ERASING DIAGNOSIS CODES

When using the MUT-II

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

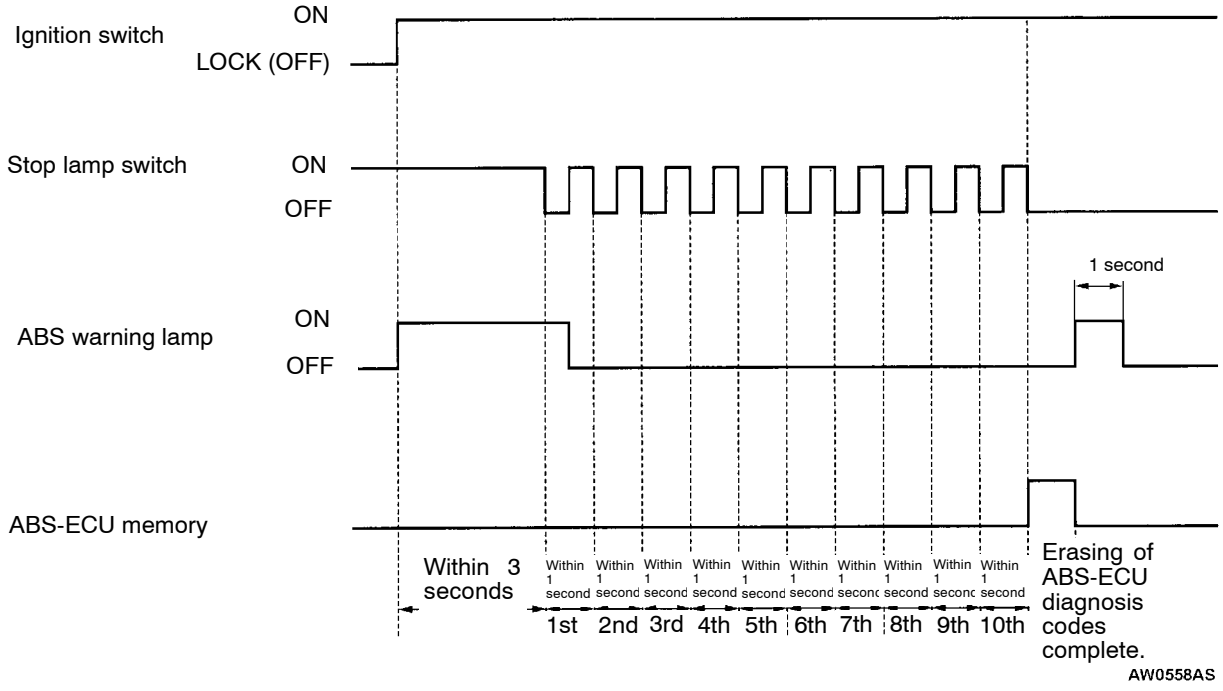
Caution
Turn the ignition key to the LOCK (OFF) position before connecting or disconnecting the MUT-II.
When not using the MUT-II

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

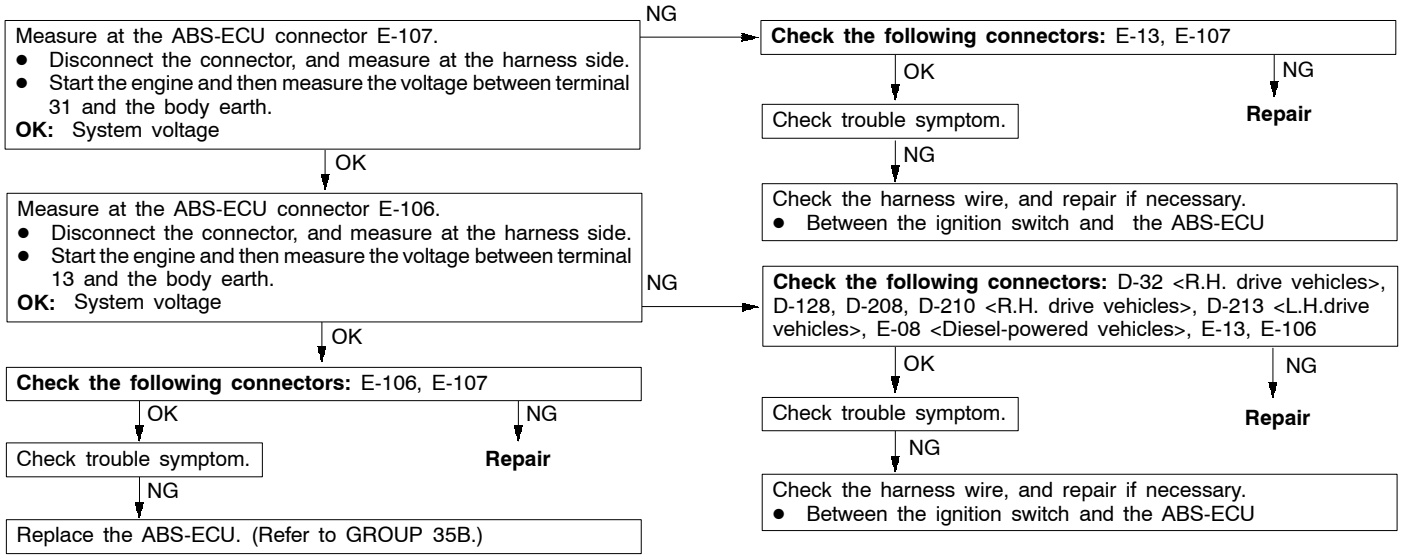
Diagnosis code No.	Diagnosis items	Reference page
16*	ABS-ECU power supply (Abnormal voltage decrease or increase)	35A-9
17, 18	ABS-ECU power supply (Open circuit or short circuit)	
53	Motor relay system (open circuit, short circuit or motor relay coil failure)	35A-10
55	Pump motor system (Pump motor seized or abnormal ABS-ECU current detection circuit)	35A-11
63	ABS-ECU system	Replace ABS-ECU (Refer to 35B.)
78	Accumulator system (Motor has been energized abnormally for long time or abnormal low-pressure accumulator)	35A-12
79	Pressure switch system (open circuit or short circuit)	35A-13

NOTE
*: Code No. 16 is erased by turning the ignition switch OFF.

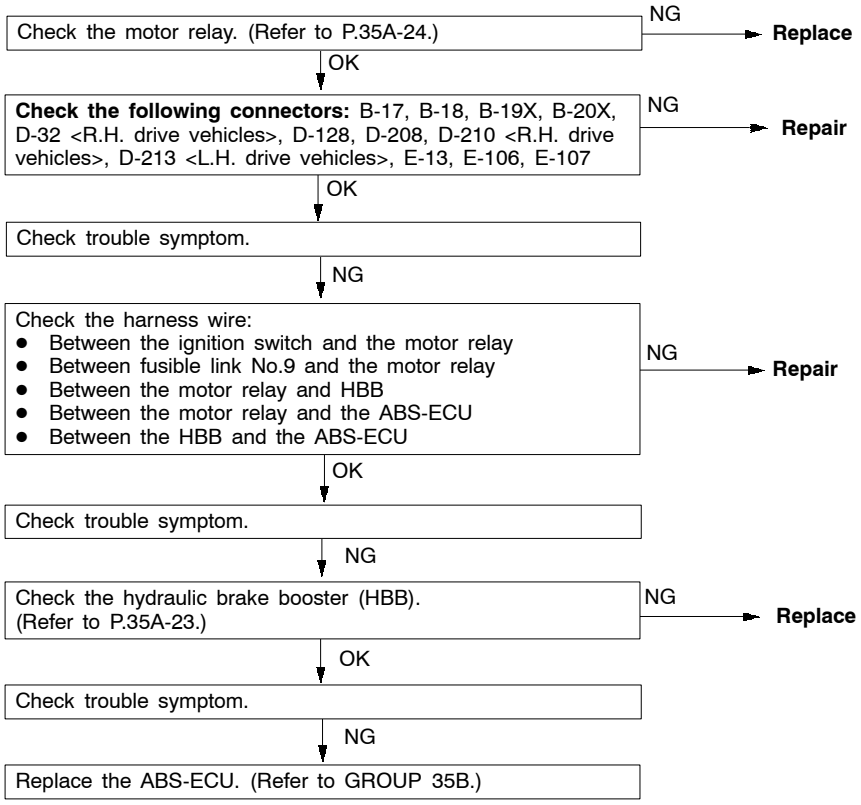
INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code No.16 ABB-ECU power supply system (abnormal voltage increase or decrease) **Code No.17, 18 ABS-ECU power supply system (open or short circuit)**	**Probable cause**
Code No.16 is output if the ABS-ECU power supply voltage is increased or decreased than the specified. Code No.17, 18 is output if the ABS-ECU power supply circuit is open or short, or the ABS-ECU internal circuit is defective. In addition, code No. 16 is erased by turning the ignition switch OFF.	• Malfunction of the battery • Malfunction of connector or harness • Malfunction of the ABS-ECU

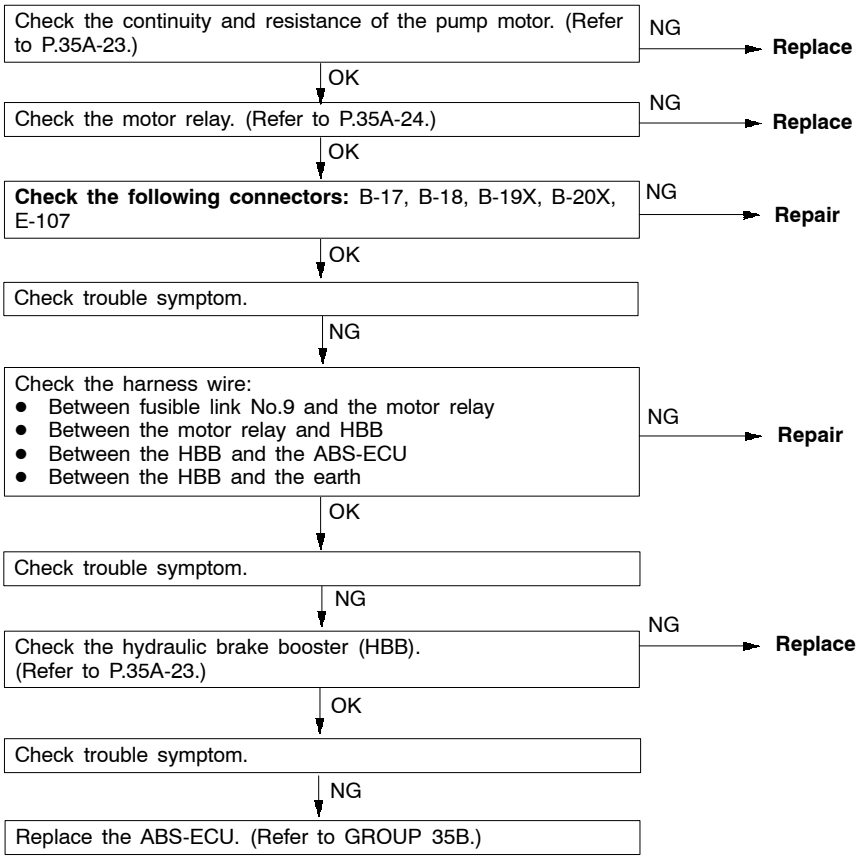
Caution
If the battery voltage is decreased or increased during the test, code No. 16 is output as a present malfunction, disabling a correct diagnosis. Check the battery and fully charge it if necessary before carrying out the following tests.



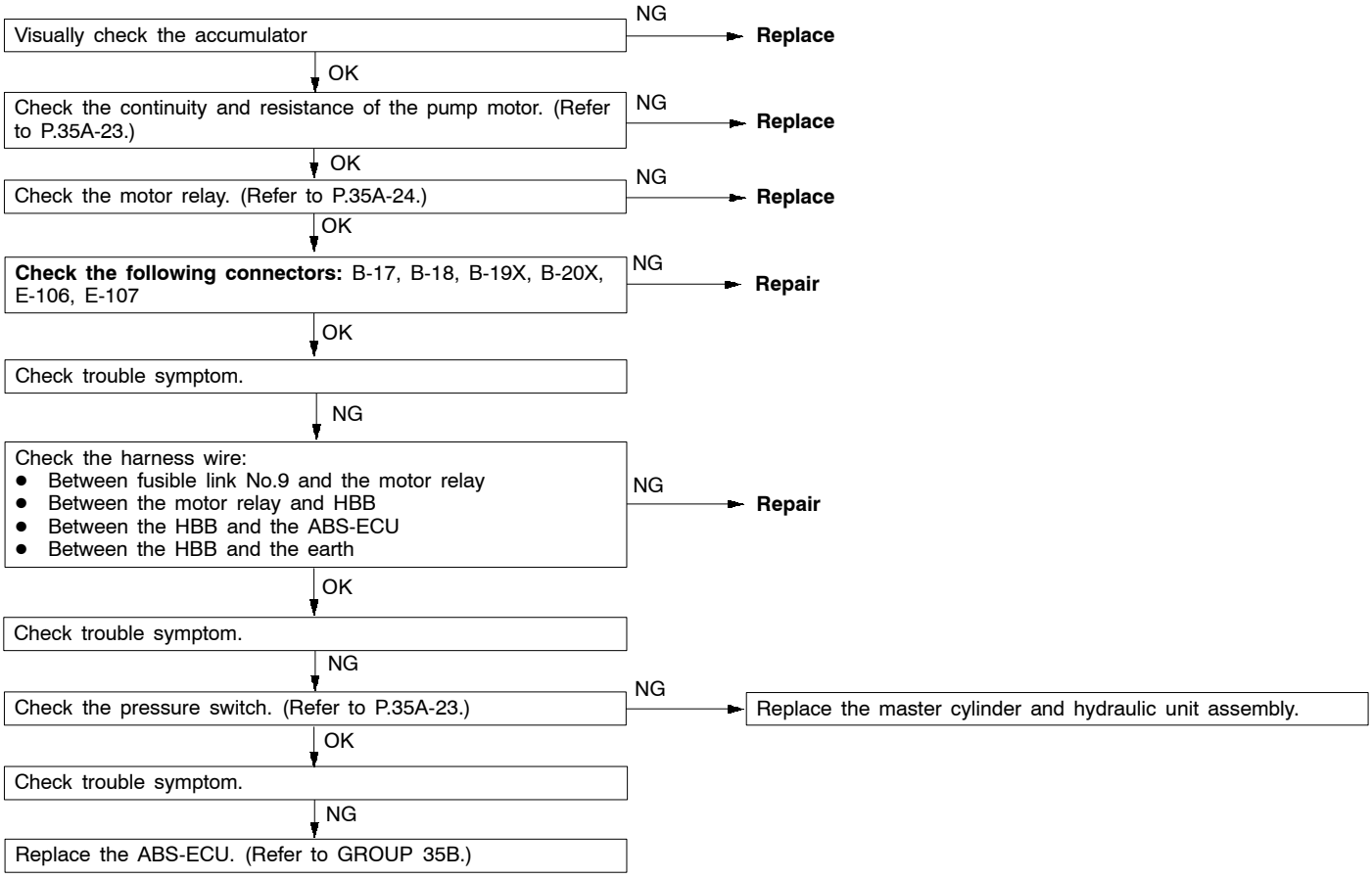
Code No.53 Motor relay system (open circuit, short circuit or a defective motor relay coil)	Probable cause
This code is output if the motor relay circuit is short or open, ABS-ECU internal circuit is defective, or the hydraulic brake booster (HBB) master cylinder and hydraulic unit assembly is defective.	• Malfunction of connector or harness • Malfunction of the motor relay • Malfunction of the ABS-ECU • Malfunction of the HBB (master cylinder and hydraulic unit assembly)



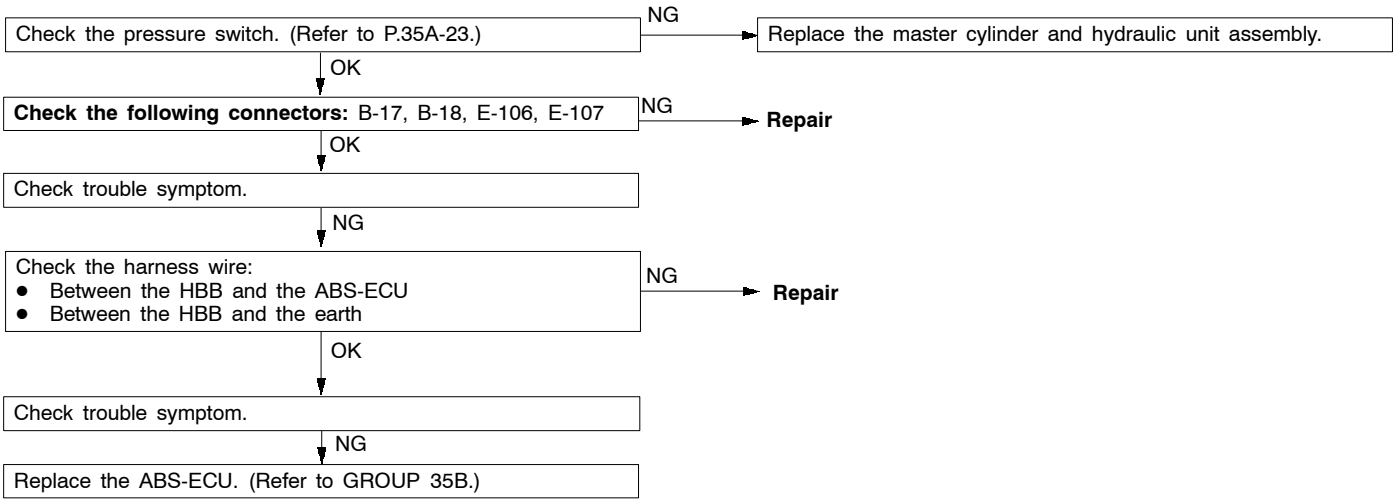
Code No.55 Pump motor system (pump motor seized or abnormal ABS-ECU current detection circuit)	Probable cause
This code is output if the motor relay drive circuit is short or open, the motor relay or the ABS-ECU internal circuit is defective, or the hydraulic brake booster (HBB) pump motor or master cylinder and hydraulic unit assembly is defective.	• Malfunction of connector or harness • Malfunction of the motor relay • Malfunction of the ABS-ECU • Malfunction of the HBB (pump motor or master cylinder and hydraulic unit assembly)



Code No. 78 Accumulator system (Motor has been energized abnormally for long time or abnormal low-pressure accumulator)	Probable cause
This code is output under the following cases: ● Pump motor is operated for consecutive 300 seconds ● Brake fluid pressure is decreased, the HBB buzzer sounds due to the operation of the pressure switch (for low pressure warning), and then the brake warning lamp illuminates.	● Brake fluid leaks inside the hydraulic brake booster (HBB) ● Malfunction of the HB motor relay ● Malfunction of connector or harness ● Malfunction of the ABS-ECU ● Malfunction of HBB (accumulator, pressure switch, pump motor or master cylinder and hydraulic unit assembly)



Code No.79 Pressure switch system (open or short circuit)	Probable cause
This code is output if the pressure switch circuit is short, ABS-ECU internal circuit is defective, or the hydraulic brake booster (HBB) pressure switch or master cylinder and hydraulic unit assembly is defective.	• Malfunction of connector or harness • Malfunction of the ABS-ECU • Malfunction of the HBB (pressure switch or master cylinder and hydraulic unit assembly)

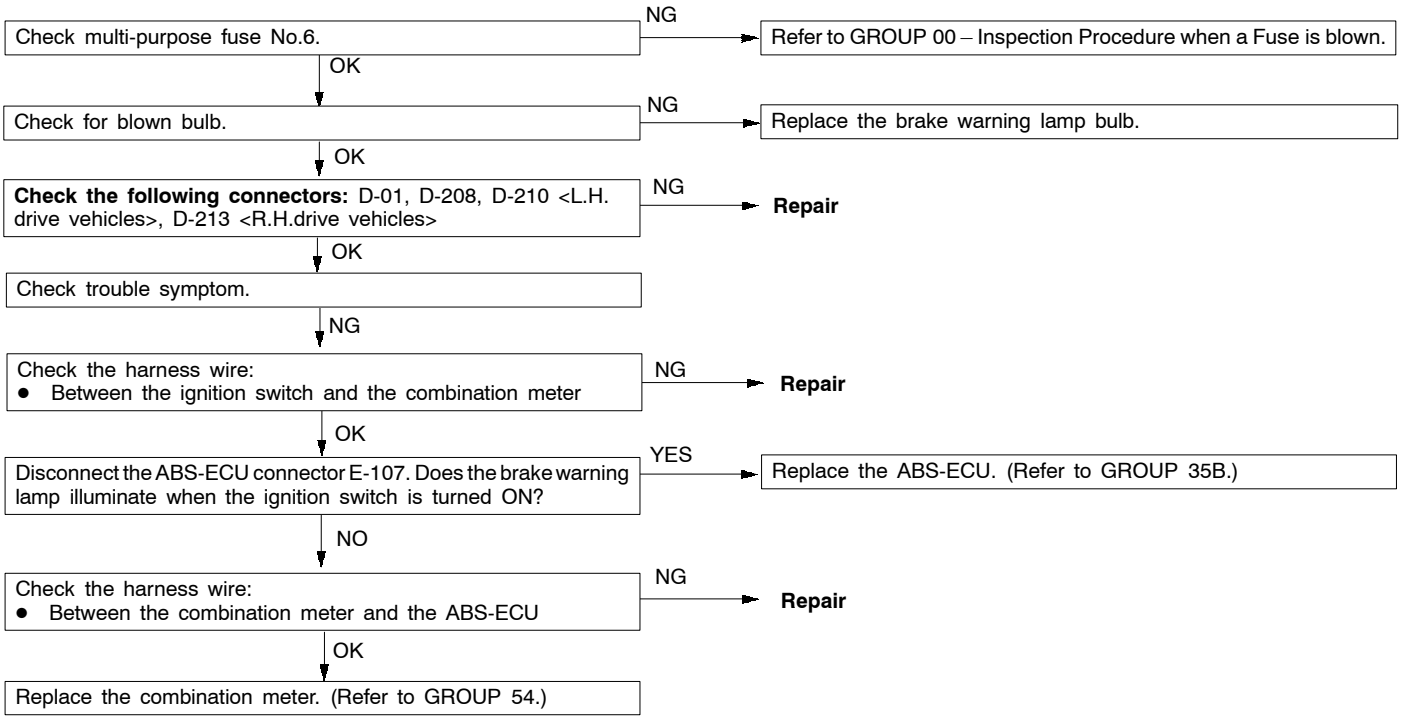


INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom	Inspection procedure No.	Reference page
The brake warning lamp does not illuminate when the ignition switch is turned ON (engine stopped).	1	35A-14
The brake warning lamp remains illuminated after the engine is started.	2	35A-15
The HBB buzzer does not sound when the hydraulic brake booster (HBB) is defective. (However, the brake warning lamp is illuminated.)	3	35A-15
The HBB buzzer does not stop sounding.	4	35A-16
Communication with MUT-II is not possible.	Refer to GROUP 35B.	
Communication with MUT-II and the ABS-ECU is not possible.		

Inspection procedure 1

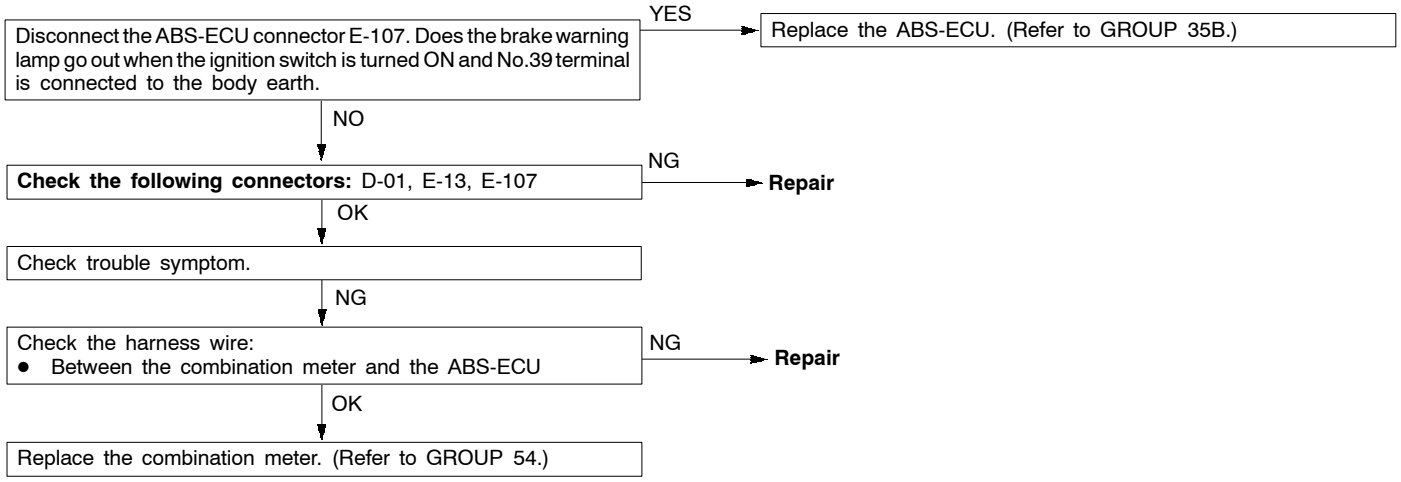
The brake warning lamp does not illuminate when the ignition switch is turned ON (engine stopped).	Probable cause
The cause may be an open circuit in the lamp power supply circuit, a blown lamp, a malfunction of the lamp drive transistor inside the ABS-ECU, an open circuit between the ignition switch and brake warning lamp or an short circuit between the brake warning lamp and the ABS-ECU.	• Blown fuse • Burn out brake warning lamp bulb • Malfunction of combination meter • Malfunction of connector or harness • Malfunction of ABS-ECU (lamp drive transistor)



Inspection procedure 2

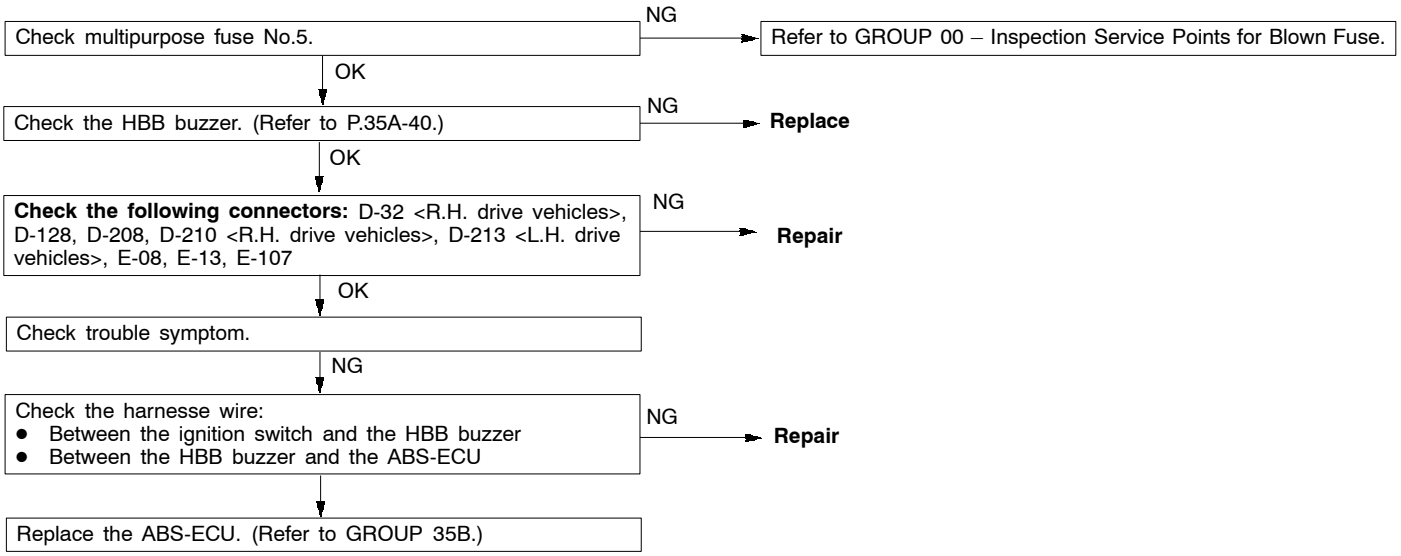
The brake warning lamp remains illuminated after the engine is started.	Probable cause
The cause is probably malfunction of the lamp drive transistor inside the ABS-ECU or an open circuit between the brake warning lamp and the ABS-ECU.	• Malfunction of combination meter • Malfunction of connector or harness • Malfunction of ABS-ECU (lamp drive transistor)

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 3

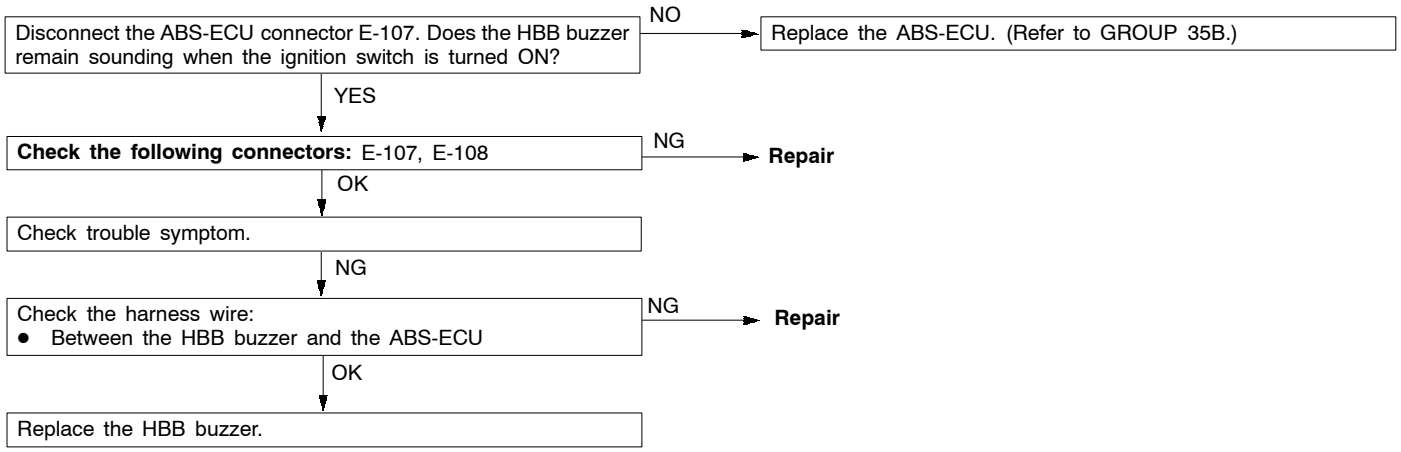
The HBB buzzer does not sound when the hydraulic brake booster (HBB) is defective. (However, the brake warning lamp is illuminated.)	Probable cause
The cause is probably an open circuit in the buzzer power supply circuit, a defective buzzer, a malfunction of the buzzer drive transistor inside the ABS-ECU or an open circuit from the ignition switch through the HBB buzzer to the ABS-ECU.	• Blown fuse • Malfunction of the HBB buzzer • Malfunction of connector or harness • Malfunction of ABS-ECU (buzzer drive transistor)



Inspection procedure 4

The HBB buzzer does not stop sounding.	Probable cause
The HBB buzzer circuit may be short.	• Malfunction of the HBB buzzer • Malfunction of the harness • Malfunction of ABS-ECU (buzzer drive transistor)

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.



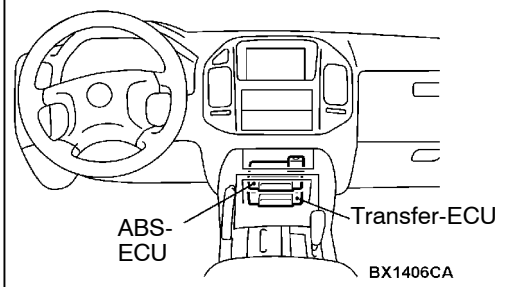
ACTUATOR TEST REFERENCE TABLE

The MUT-II activates the following actuators for testing.

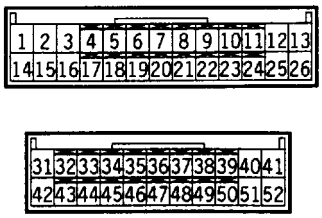
NOTE
1. If the ABS-ECU runs down, actuator testing cannot be carried out.
2. Actuator testing is only possible when the vehicle is stationary.

ACTUATOR TEST SPECIFICATIONS

Item No.	Inspection item	Drive contents
01	HBB pump motor	Operate the pump motor for one second.
02	HBB buzzer	Sound the buzzer for three seconds.



ABS-ECU side connector



CHECK AT ABS-ECU

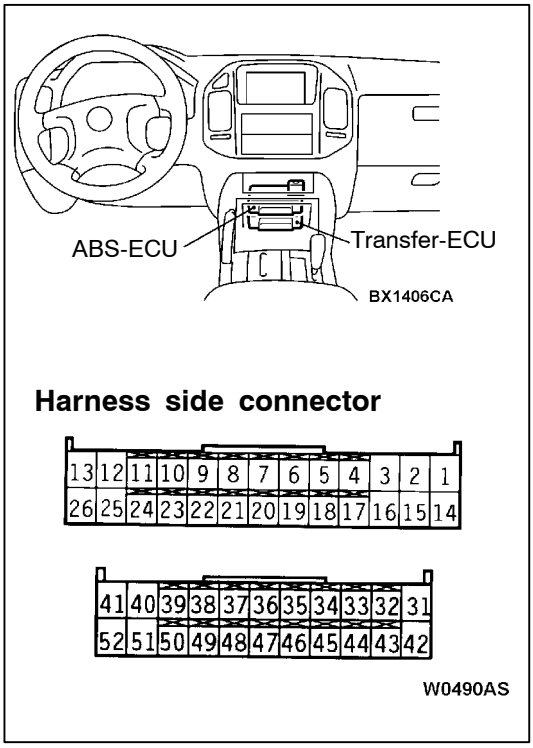
NOTE
The two same ECUs are installed behind the floor console. The upper ECU is the ABS-ECU and has a blue connector. The lower ECU is the transfer-ECU and has a green connector.

TERMINAL VOLTAGE CHECK CHART

1. Measure the voltage between each terminal and the earth.
2. The terminal layout is shown in the illustration.

Terminal No.	Check item	Check requirements		Normal condition
36	MUT-II	When the MUT-II is connected		Serial communication with the MUT-II
		When the MUT-II is not connected		1 V or less
13, 31	ABS-ECU power supply	Ignition switch: ON		System voltage
		Ignition switch: START		0 V
47	Diagnosis changeover input	When the MUT-II is connected		1 V or less
		When the MUT-II is not connected		Approximately 12 V
39	Output to brake warning lamp	Ignition switch: ON	When the lamp is off	2 V or less
			When the lamp is on	System voltage
44	Output to the HBB buzzer	Ignition switch: ON	When the HBB buzzer does not sound	System voltage
			When the HBB buzzer sounds	2 V or less
6, 38	Output to the motor relay	Ignition switch: ON	When the pump motor is not operating	System voltage
			When the pump motor is operating	2 V or less
17	Output to the pressure switch (for low pressure warning)	Ignition switch: ON	When the brake fluid pressure is low (When the HBB buzzer sounds)	Approximately 9 V
			When the brake fluid pressure is normal (When the HBB buzzer does not sound)	Approximately 4 V

Terminal No.	Check item	Check requirements		Normal condition
43	Output to pressure switch (for pump control)	Ignition switch: ON	When the brake fluid pressure is low (When the pump motor is operating)	Approx. 6V
			When the brake fluid pressure is high (When the pump motor is not operating)	2 V or less
35	Negative current detection input from the pump motor	Ignition switch: ON	When the pump motor is not operating	2 V or less
			When the pump motor is operating	2 V or less
49	Voltage detection input from the pump motor	Ignition switch: ON	When the pump motor is not operating	2 V or less
			When the pump motor is operating	2 V or less
45	Positive current detection input from the pump motor	Ignition switch: ON	When the pump motor is not operating	2 V or less
			When the pump motor is operating	System voltage

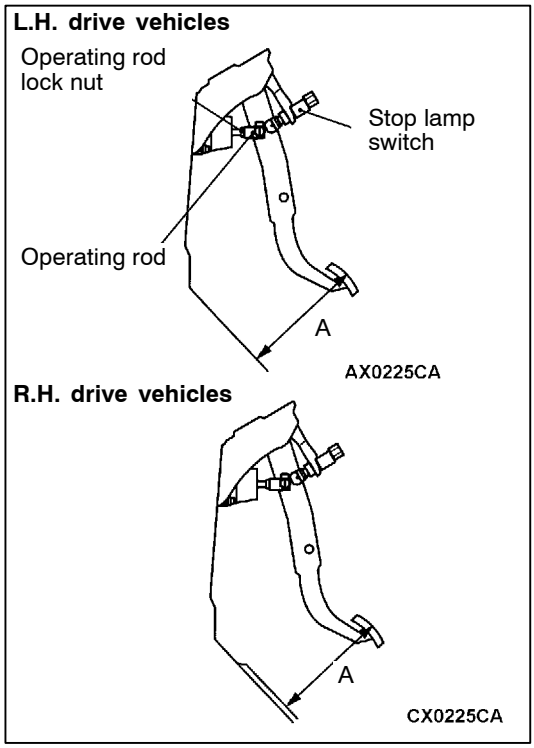


CONTINUITY BETWEEN HARNESS-SIDE CONNECTOR TERMINALS

NOTE
The two same ECUs are installed behind the floor console. The upper ECU is the ABS-ECU and has a blue connector. The lower ECU is the transfer-ECU and has a green connector.

1. Turn the ignition key to the LOCK (OFF) position.
2. Disconnect the ABS-ECU connector.
3. Check the continuity between the terminals indicated in the table below.
4. The terminal layout is shown in the illustration.

Terminal No.	Signal name	Normal condition
Between terminal 12 and the body earth	Earth	Continuity exists.
Between terminal 25 and the body earth	Earth	
Between terminal 26 and the body earth	Earth	
Between terminal 42 and the body earth	Earth	



ON-VEHICLE SERVICE

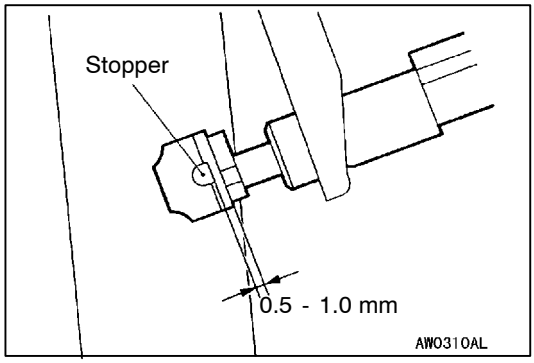
BRAKE PEDAL CHECK AND ADJUSTMENT

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> 192 - 195 mm
   <R.H. drive vehicles> 187 - 190 mm

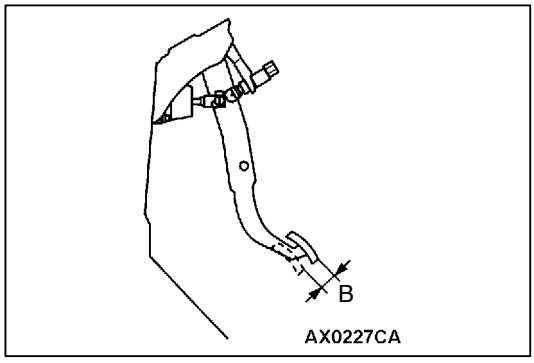
3. If the brake pedal height is not within the standard value, follow the procedure below.
   (1) Disconnect the stop lamp switch connector.
   (2) Loosen the stop lamp switch by turning it approx. 1/4 turns anticlockwise.
   (3) Remove the pin, and then adjust so that the brake pedal height meets the standard value by turning the clevis.



   (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.

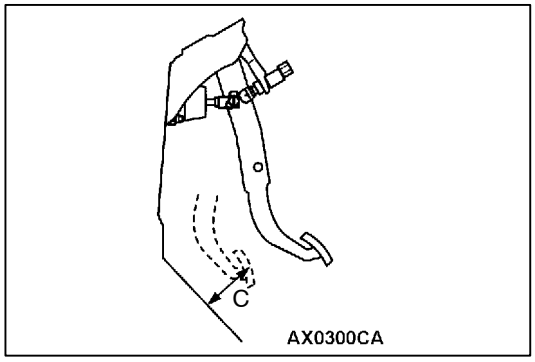


BRAKE PEDAL FREE PLAY

1. Turn the ignition switch to LOCK (OFF) position. Depressurise the power supply system of the hydraulic brake booster (HBB) by depressing the brake pedal at least forty times until the pedal effort becomes high. Then push the pedal with your finger to check the pedal height (free play) is within the standard value.

   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): 90 mm or more
3. If the clearance is outside the standard value, check for air trapped in the brake line and thickness of the disc brake pad.
   Adjust and replace defective parts as required.
4. Return the carpet, etc.

HYDRAULIC BRAKE BOOSTER (HBB) OPERATION CHECK <Vehicles with ABS>

Caution
A diagnosis code may be stored when carrying out the checks. Always erase the diagnosis codes after the checks, and then check that any diagnosis code is output.

POWER SUPPLY SYSTEM FUNCTION AND OPERATION CHECK

1. Turn the ignition switch to the LOCK (OFF) position. Depressurise the power supply system of the hydraulic brake booster (HBB) by depressing the brake pedal at least forty times until the pedal effort becomes high.
2. Check that the reservoir fluid level is at the MAX position.
3. Chock the wheels and release the parking brakes.
4. Turn the ignition switch ON, and measure how much time is elapsed after the pump motor starts until it stops.

   Standard value: 20 - 80 seconds
5. After the pump motor stopped, start the engine. The brake warning lamp should not be turned on.
6. Stop the engine, and then turn on the ignition switch again.

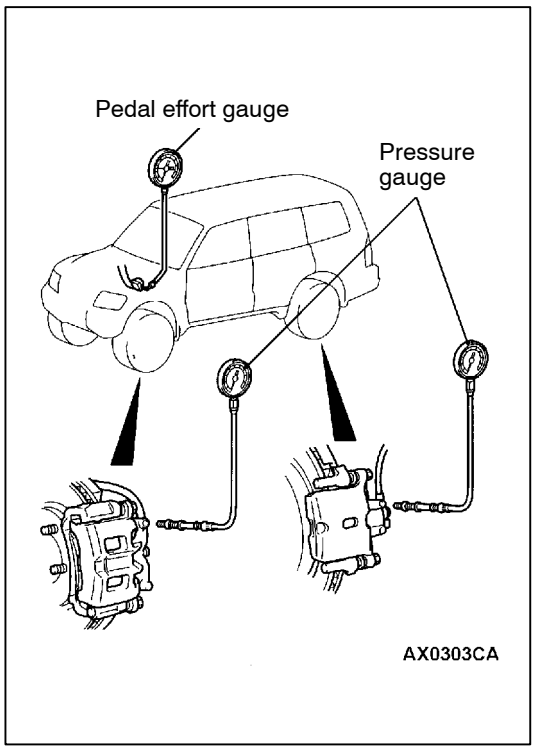
7. When the brake pedal is depressed four or five times, the pump motor should start and then stop.
8. Depress the brake pedal four or five times again, and then measure how much time is elapsed after the pump motor starts until it stops.

   Standard value: 2 - 11 seconds
9. Depress the brake pedal fully consecutive 15 - 20 times for ten seconds. The brake warning lamp should illuminate and the buzzer should sound.

   Caution
   Turn the ignition switch ON, and wait for at least 120 seconds before carrying out the checks.

SIMPLE INSPECTION OF HBB

1. Turn the ignition switch to LOCK (OFF) position. Depressurise the power supply system of the hydraulic brake booster (HBB) by depressing the brake pedal at least forty times until the pedal effort becomes high.
2. Depress the brake pedal, and turn the ignition switch ON. Then check the pedal. The pedal should be lowered. If no, the pedal is defective.



CHECK USING SIMPLE TESTER

1. Turn the ignition switch to the LOCK (OFF) position. Depressurise the power supply system of the hydraulic brake booster (HBB) by depressing the brake pedal at least forty times until the pedal effort becomes high.
2. Connect a pressure gauge and pedal effort gauge as shown, and bleed air from the pressure gauge.
3. Carry out the operation test without vacuum assist as follows:
   (1) Turn the ignition switch to the LOCK (OFF) position. Depressurise the power supply system of the hydraulic brake booster (HBB) by depressing the brake pedal at least forty times until the pedal effort becomes high to observe the relationship between the pedal effort and the fluid pressure.

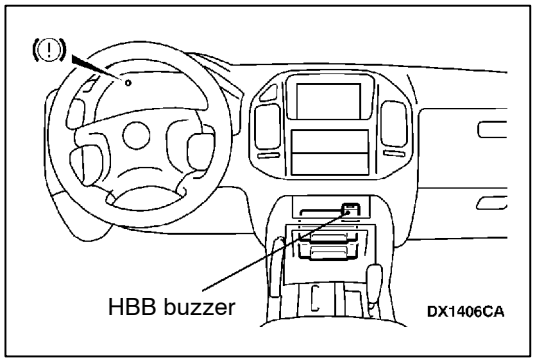
Standard value:

Pedal effort N	Fluid pressure at front wheels MPa	Fluid pressure at rear wheels MPa
100	0.6 or more	0
500	4.5 or more	0

4. Carry out the operation test with power assist as follows:
   (1) Turn the ignition switch ON. Stop the pump motor, and then check the relationship between the pedal effort and the fluid pressure.

   Standard value:

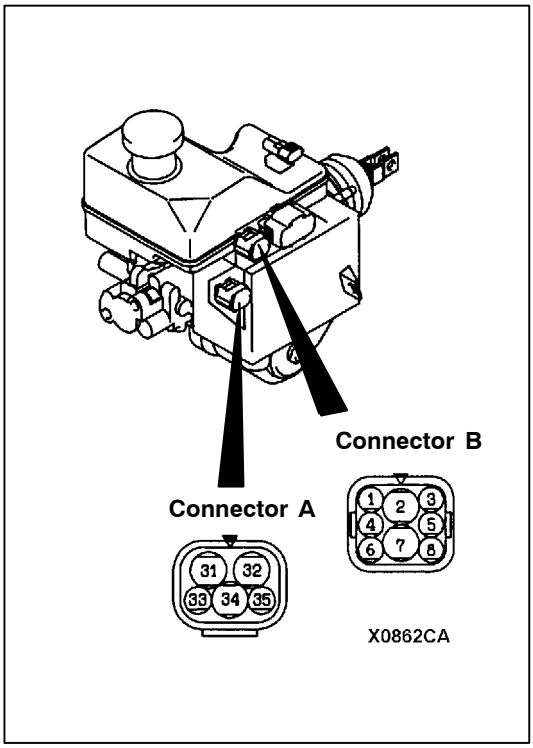
Pedal effort N	Fluid pressure at front wheels MPa	Fluid pressure at rear wheels MPa
100	3.0 - 4.0	3.3 - 4.3
200	8.0 - 10.0	8.0 - 10.0
400	14.0 - 18.0	14.0 - 18.0
500	15.0 - 19.0	15.0 - 19.0



BRAKE WARNING LAMP AND THE HBB BUZZER OPERATION CHECK

Caution
Turn the ignition switch ON, and wait for at least 120 seconds before carrying out the checks.

1. Chock the wheels and start the engine.
2. Release the parking brake lever, and depress the brake pedal fully consecutive 15 - 20 times for ten seconds. The brake warning lamp should illuminate and the buzzer should sound.

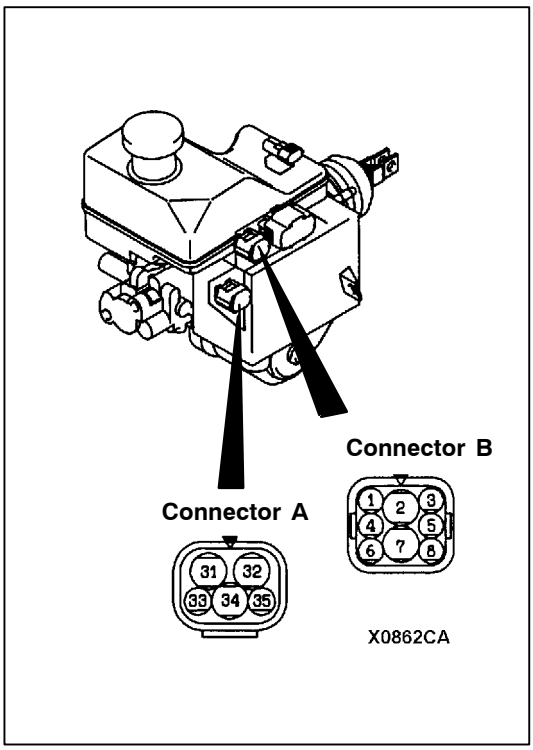


HBB CHECK <Vehicles with ABS>

CHECKING OF THE CONTINUITY AND RESISTANCE OF THE PUMP MOTOR

1. Disconnect the harness side connector.
2. Measure the continuity and resistance between the HBB side connector terminals.

Terminal No.									Resistance between the terminals (reference value)
Connector A			Connector B						
31	-	32	2	4	-	6	7	8	
○	Ⓜ	○							10 Ω or less
			○		Ⓜ		○		10 Ω or less
○			○						0 Ω
		○				○	○		0 Ω
			○					○	Approx. 33 Ω
○								○	Approx. 33 Ω
				○		○			Approx. 33 Ω
		○		○					Approx. 33 Ω



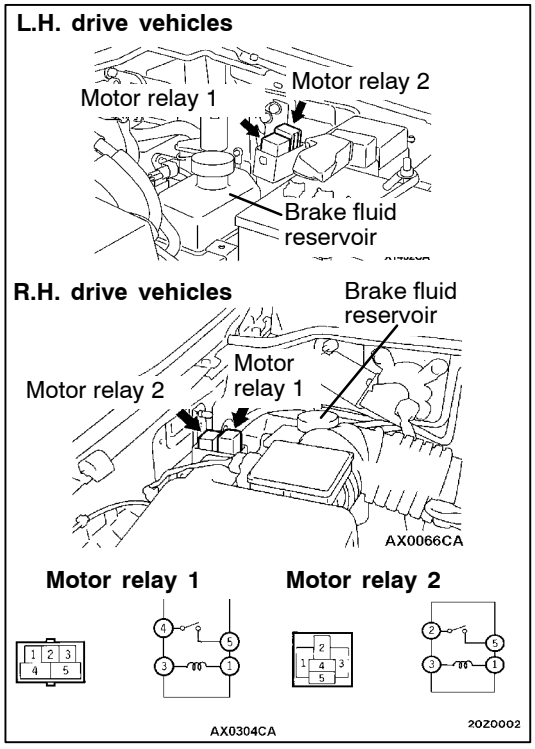
PRESSURE SWITCH (FOR PUMP CONTROL) CHECK

1. Turn the ignition switch to LOCK (OFF) position. Depressurise the power supply system of the hydraulic brake booster (HBB) by depressing the brake pedal at least forty times until the pedal effort becomes high.
2. Disconnect connector A of the HBB.
3. Measure the continuity between the HBB side connector A terminal No.33 and No.35. The continuity should not be present.
4. Turn on the ignition switch and operate the pump motor with connector A disconnected. Measure the continuity between the HBB side connector A terminal No.33 and No.35 while the pump motor is running. The continuity should be present.
5. Erase the diagnosis codes.(Refer to P.35A-8.)

PRESSURE SWITCH (FOR LOW PRESSURE WARNING) CHECK

1. Turn the ignition switch to the LOCK (OFF) position. Depressurise the power supply system of the hydraulic brake booster (HBB) by depressing the brake pedal at least forty times until the pedal effort becomes high.
2. Disconnect the HBB connector B.
3. Measure the continuity between the HBB side connector B terminals No.1 and No.5. The continuity should not be present.
4. Connect the HBB connector B to the harness side connector.
5. Then turn on the ignition switch, and operate the pump motor.
6. Wait until the pump motor stops, and then disconnect connector B of the HBB again.
7. Measure the continuity between the HBB side connector B terminals No.1 and No.5. The continuity should be present.

8. Erase the diagnosis codes. (Refer to P.35A-8.)



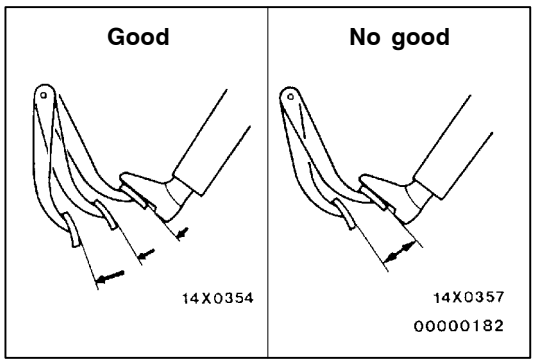
HBB MOTOR RELAY CONTINUITY CHECK <Vehicles with ABS>

Motor relay 1

Battery voltage	Terminal No.			
	1	3	4	5
When current is not flowing	○	○		
When current is flowing	⊕	⊖	○	○

Motor relay 2

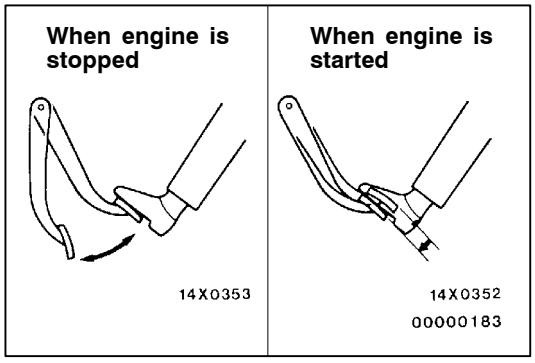
Battery voltage	Terminal No.			
	1	2	3	5
When current is not flowing	○		○	
When current is flowing	⊕	○	⊖	○



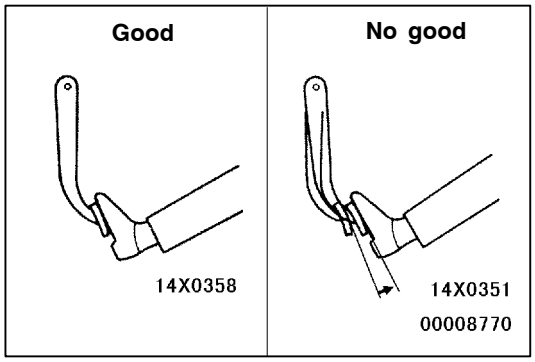
BRAKE BOOSTER OPERATING TEST <Vehicles without ABS>

For simple checking of the brake booster operation, carry out the following tests:

1. Run the engine for one or two minutes, and then stop it.
   If the pedal depresses fully the first time but gradually becomes higher when depressed succeeding times, the booster is operating properly. If the pedal height remains unchanged, the booster is defective.



2. With the engine stopped, step on the brake pedal several times.
   Then start the engine while the brake pedal is stepped on.
   If the pedal moves downward slightly, the booster is in good condition. If there is no change, the booster is defective.



3. With the engine running, step on the brake pedal and then stop the engine.
   Hold the pedal depressed for 30 seconds. If the pedal height does not change, the booster is in good condition.
   If the pedal rises, the booster is defective.

If the above three tests are okay, the booster performance can be determined as good.
If one of the above three tests is not okay at least, the check valve, vacuum hose, or booster will be defective.

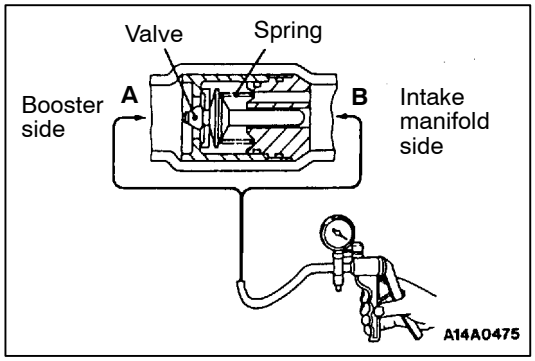
CHECK VALVE OPERATION CHECK <Vehicles without ABS>

1. Remove the vacuum hose. (Refer to P.35A-41.)

   Caution
   The check valve should not be disassembled from the vacuum hose as they are united as one part.

2. Check the operation of the check valve by using a vacuum pump.

Vacuum pump connection	Accept/reject criteria
Connection at the brake booster side (A)	A negative pressure (vacuum) is created and held.
Connection at the intake manifold side (B)	A negative pressure (vacuum) is not created.

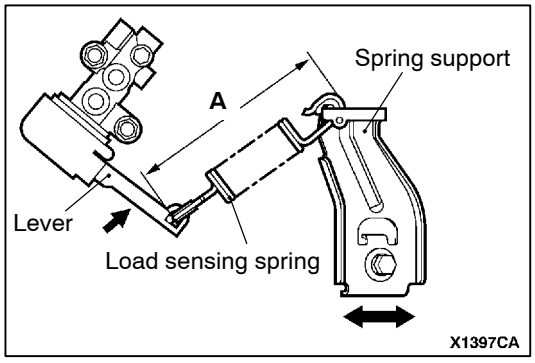


Caution
If the check valve is defective, always replace it as an assembly unit together with the vacuum hose.

LOAD SENSING SPRING LENGTH CHECK AND ADJUSTMENT <Vehicles without ABS>

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

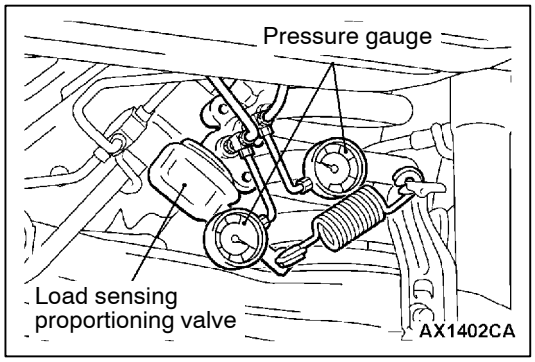
   Caution
   Never support the vehicle with jacks or other similar means.



2. With the lever pressed all the way to the load sensing proportioning valve side, check whether or not the length (shown in the figure) of the spring (the length between its ends) is the standard value.

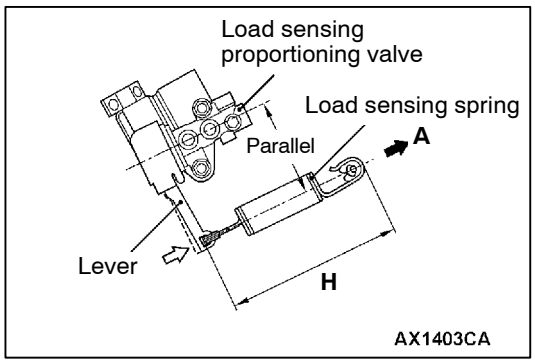
   Standard value (A): 135 - 139 mm

3. If the spring length is not within the standard value, loosen the bolt attaching the support and adjust the distance by moving the support.



LOAD SENSING PROPORTIONING VALVE FUNCTION TEST <Vehicles without ABS>

1. Connect pressure gauges to the input and output ports of the load sensing proportioning valve.
2. Bleed the system. (Refer to P.35A-29.)
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:

Items	Spring length H mm	Input fluid pressure MPa	Output fluid pressure MPa
Short wheelbase	133*1	9.8	4.9 - 5.9
	149*2	9.8	7.5 - 8.5
		16.7	9.0 - 11.0
Long wheelbase	133*1	9.8	5.9 - 6.9
	149*2	9.8	9.3 - 10.3
		16.7	11.4 - 13.4

   NOTE
   *1 and *2 indicate the applicable lengths for unladen and laden vehicles respectively.

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

BLEEDING <Vehicles with ABS>

Caution

Specified brake fluid: DOT3 or DOT4

1. **Always use the specified brake fluid. Avoid using a mixture of the specified brake fluid and other fluid.**
2. **Maintain the fluid reservoir level between the MIN and MAX marks during the air bleeding.**
3. **Do not depress the brake pedal hard during the air bleeding (normal air bleeding) to prevent the pump motor from operating frequently.**
4. **After the air bleeding, check that the brake dragging does not become stronger.**
5. **If the pedal is depressed with the reservoir cap removed, the brake fluid may overflow. Do not depress the brake pedal while the fluid is being added.**

NORMAL AIR BLEEDING

After the front brake or the rear brake is removed and installed, some fluid may remain in the hydraulic brake booster (HBB) reservoir. In this case, bleed air from the brake caliper.

HBB SYSTEM AIR BLEEDING

If all the brake fluid inside the reservoir is drained due to the removal and installation of the HBB, bleed air as follows:

Air bleeding from front brake system

1. Turn the ignition switch to the LOCK (OFF) position. Bleed air from the front brake calipers (right and left) by pumping the brake pedal.

Pump motor operation

2. Turn the ignition switch ON, and operate the pump motor. If the pump motor is running free, supply the brake fluid into the pump motor by depressing the brake pedal three or four times.

Air bleeding from accumulator system

3. After the pump motor stopped, depress the brake pedal three or four times with the ignition switch ON. Then observe the brake fluid in the reservoir. If the brake fluid looks whitish, wait for a few minutes until it becomes clear.
4. Repeat step 3 until the brake fluid becomes clear.

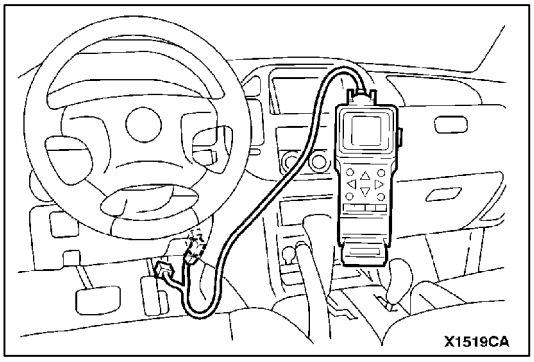
Air bleeding from rear brake system

5. While the ignition switch is turned ON and the brake pedal is depressed, bleed air from the right and left rear brake calipers.

   Caution
   (1) If too much brake fluid is drained at a time, the accumulator pressure may be dropped abnormally. So limit drain amount at a time to 100 cm^3 or less, and check that the pump motor stops per one air-bleeding.
   (2) If the brake fluid level in the reservoir has been dropped, air may enter the pump motor accidentally. To avoid this, always maintain the brake fluid between the MIN and MAX marks.

Air bleeding from power supply system

6. Turn the ignition switch to the LOCK (OFF) position. Depressurise the HBB power supply system by depressing the brake pedal several times until the braking effort becomes high.
7. Turn the ignition switch ON, and depress the brake pedal quickly twenty times. Then check that the pump motor stops.
8. Turn the ignition switch to the LOCK (OFF) position. Depressurise the power supply system of the hydraulic brake booster (HBB) by depressing the brake pedal until the pedal effort becomes high.
9. Then turn the ignition switch ON, and then operate the pump motor. The pump motor should stop within 25 seconds. If the pump motor does not stop, bleed air from the power supply system again (see steps 6 - 9).



Air bleeding from ABS system

10. Turn the ignition switch to the LOCK (OFF) position, and connect the MUT-II to the diagnosis connector.

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

11. Turn the ignition switch ON, and then select the menu display on the MUT-II as follows:
    "ABS/ASC" to "ACTUATOR TEST" to "AIR BLEEDING(1)"
12. While the ignition switch is turned ON and the brake pedal is depressed, carry out the actuator test "AIR BLEEDING(1)."

    Caution
    If you carry out the "AIR BLEEDING (1)" repeatedly, wait for at least twenty seconds before the second operation.

13. Then select "AIR BLEEDING (2)" on the MUT-II menu display, and carry out the "AIR BLEEDING(2)" while the ignition switch is turned ON and the brake pedal is depressed.

Air bleeding from rear brake system (final stage)

14. Bleed air from the rear brake calipers completely while the ignition switch is turned ON and the brake pedal is depressed.

    Caution

    (1) If too much brake fluid is drained at a time, the accumulator pressure may be dropped abnormally. So limit drain amount at a time to 100 cm^3 or less, and check that the pump motor stops per one air-bleeding.
    (2) If the brake fluid level in the reservoir has been dropped, air may enter the pump motor accidentally. To avoid this, always maintain the brake fluid between the MIN and MAX marks.

Air bleeding from front brake system (final stage)

15. Operate the pump motor while the ignition switch is turned ON. Bleed air from the front brake calipers completely by pumping the brake pedal.

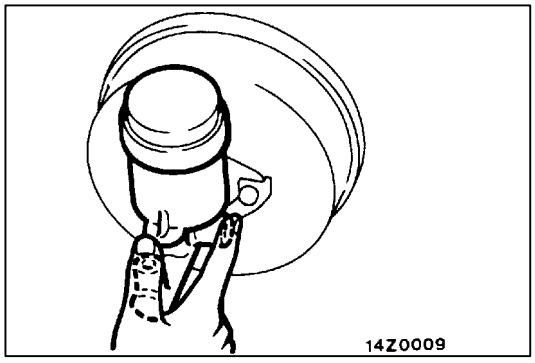
Adding brake fluid

16. Turn the ignition switch to the LOCK (OFF) position. Depressurise the power supply system of the hydraulic brake booster (HBB) by depressing the brake pedal at least forty times until the pedal effort becomes high.
17. Add the brake fluid up to the MAX mark on the reservoir.

BLEEDING <Vehicles without ABS>

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.

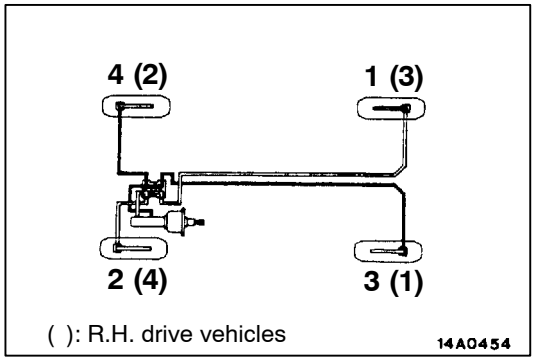


MASTER CYLINDER BLEEDING

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.)

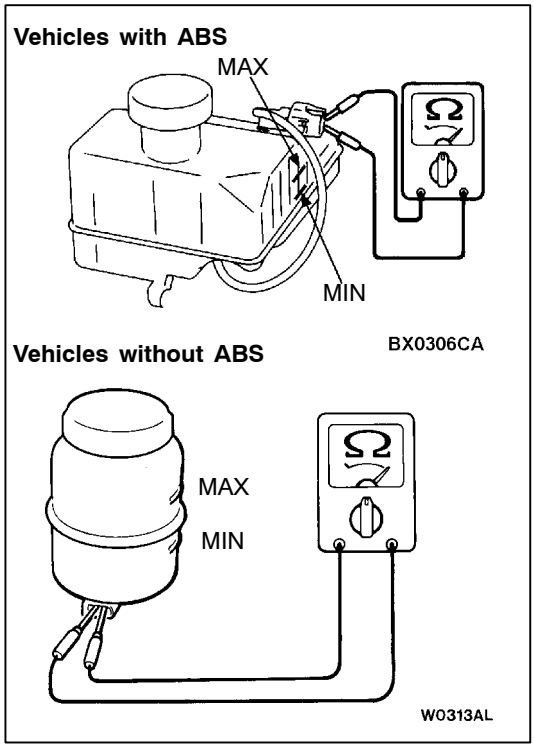
1. Fill the reserve tank with brake fluid.
2. Keep the brake pedal depressed.
3. Have another person cover the master cylinder outlet with a finger.
4. With the outlet still closed, release the brake pedal.

5. Repeat steps 2 - 4 three or four times to fill the inside of the master cylinder with brake fluid.



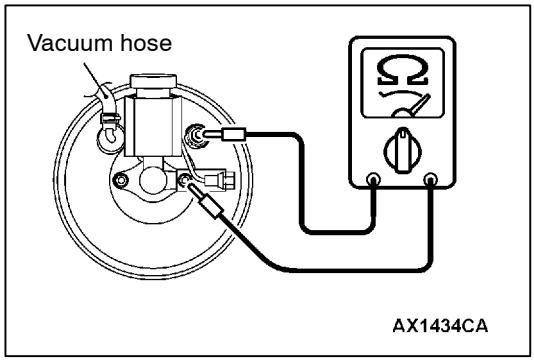
BRAKE PIPE LINE BLEEDING

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”.

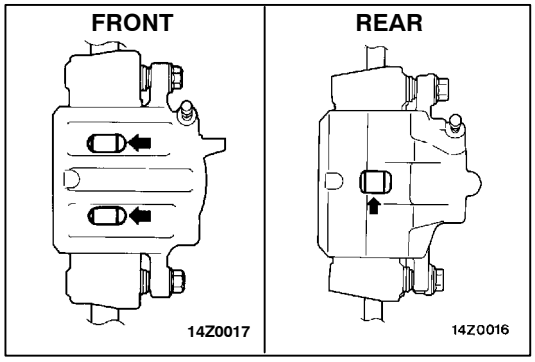


BRAKE BOOSTER VACUUM SWITCH CHECK <Vehicles with 4D5 engine>

1. Connect an ohmmeter to the connector of the vacuum switch.
2. Start the engine and check for continuity when the vacuum hose is connected and when it is disconnected.
   The vacuum switch is in good condition if there is no continuity when the vacuum hose is connected, and if there is continuity when it is not connected.
3. Disconnect the spring at the support side.

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.

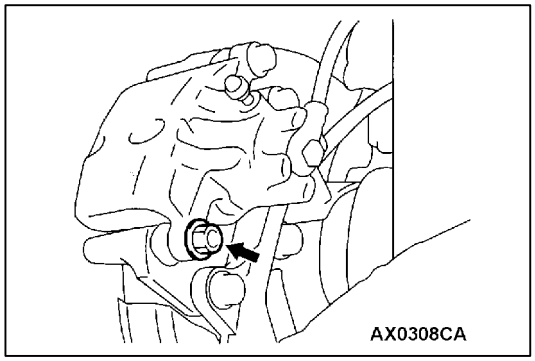


1. Check the brake pad thickness through the caliper body check port.

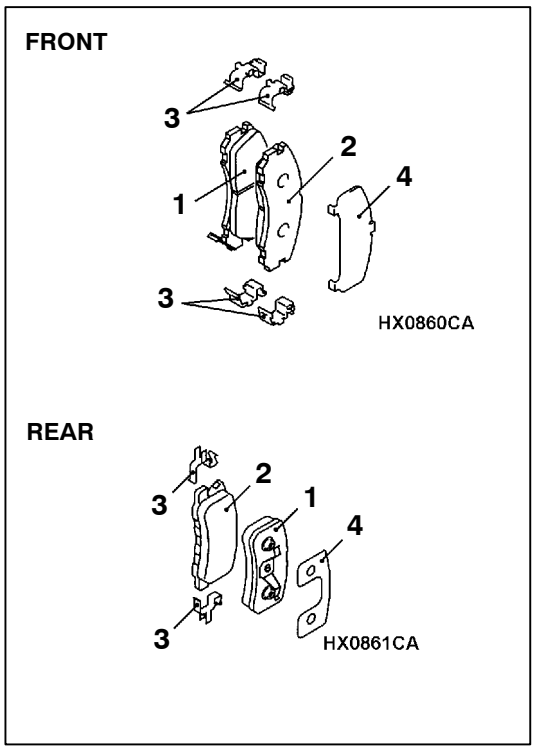
   Standard value: 10.0 mm

   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.



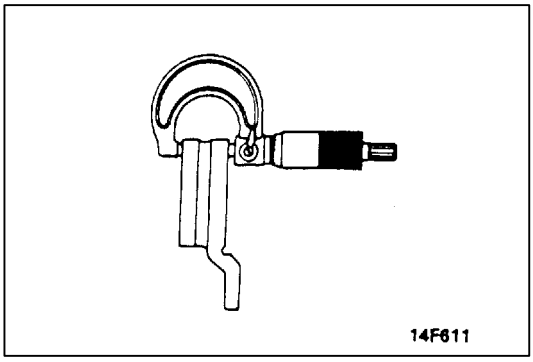
4. Remove the following parts from the caliper support.
   1. Pad and wear indicator assembly <front>
      Pad and clip assembly <rear>
   2. Pad assembly
   3. Clip
   4. Shim
5. In order to measure the brake drag force after pad installation, measure the rotary-sliding resistance of the hub with the pads removed. (Refer to P.35A-44, 49.)
6. Install the pads and caliper assembly, and then check the brake drag force. (Refer to P.35A-45, 50.)

DISC BRAKE ROTOR CHECK

Caution
When servicing disc brakes, it is necessary to exercise caution to keep the disc brakes within the allowable service values in order to maintain normal brake operation.

Before re-finishing or re-processing the brake disc surface, the following conditions should be checked.

Inspection items	Remarks
Scratches, rust, saturated lining materials and wear	• If the vehicle is not driven for a certain period, the sections of the discs that are not in contact with lining will become rusty, causing noise and shuddering. • If grooves resulting from excessive disc wear and scratches are not removed prior to installing a new pad assembly, there will momentarily be inappropriate contact between the disc and the lining (pad).
Run-out or drift	Excessive run-out or drift of the discs will increase the pedal depression resistance due to piston knock-back.
Change in thickness (parallelism)	If the thickness of the disc changes, this will cause pedal pulsation, shuddering and surging.
Inset or warping (flatness)	Overheating and improper handling while servicing will cause inset or warping.



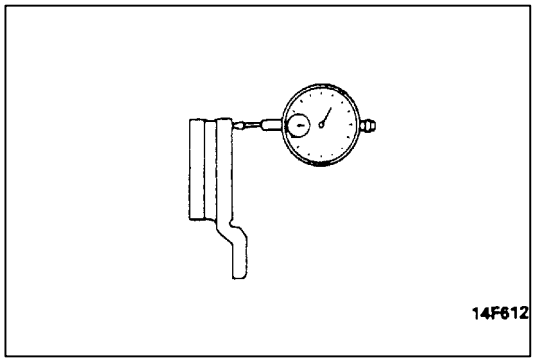
BRAKE DISC THICKNESS CHECK

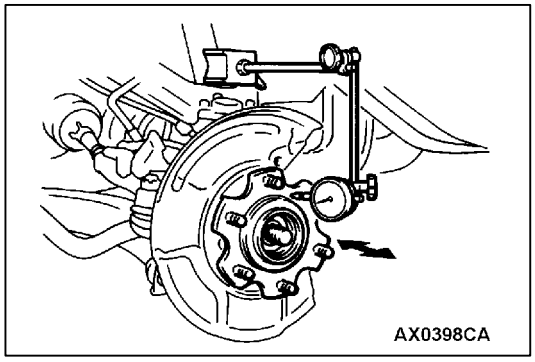
1. Using a micrometer, measure disc thickness at eight positions, approximately 45° apart and 10 mm in from the outer edge of the disc.

   Brake disc thickness

Item	Standard value	Limit
Front	26.0	24.4
Rear	22.0	20.4

   Thickness variation (at least 8 positions)
   The difference between any thickness measurements should not be more than 0.015 mm.
2. If the disc is beyond the limits for thickness, remove it and install a new one. If thickness variation exceeds the specification, replace the brake disc or grind it with on-the-car type brake lathe (“MAD, DL-8700PF” or equivalent).





BRAKE DISC RUN-OUT CHECK AND CORRECTION

1. Remove the brake assembly, and then hold it with wire.
2. Place a dial gauge approximately 5 mm from the outer circumference of the brake disc, and measure the run-out of the disc.

   Limit: 0.06 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 mm, <Rear> 0 mm

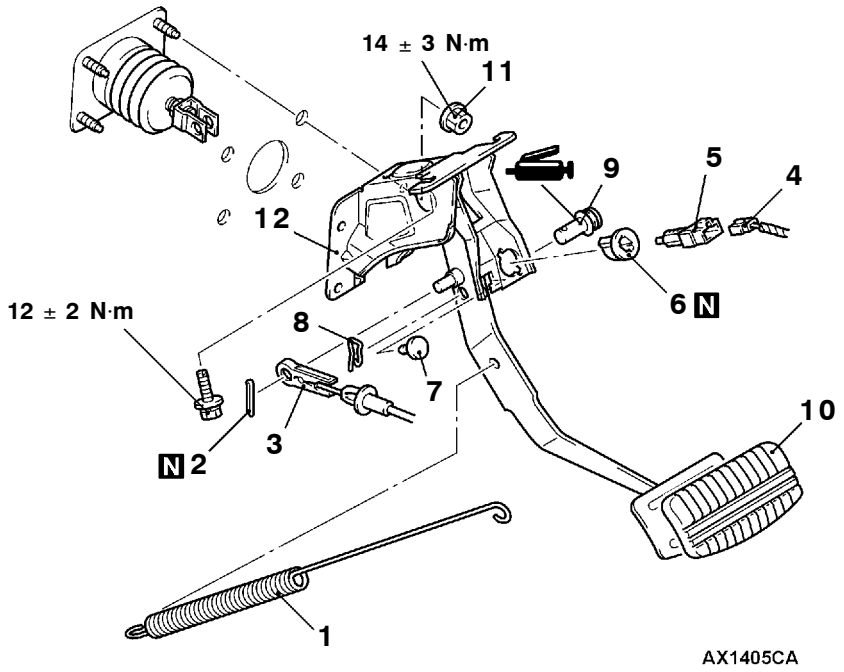
   (3) If the end play exceeds the limit, disassemble the hub and knuckle assembly to check each part.
   (4) If the end play does not exceed the limit, dephase the brake disc and secure it. Then recheck the brake disc run-out.

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 Operaion
Brake Pedal Adjustment (Refer to P.35A-19.)

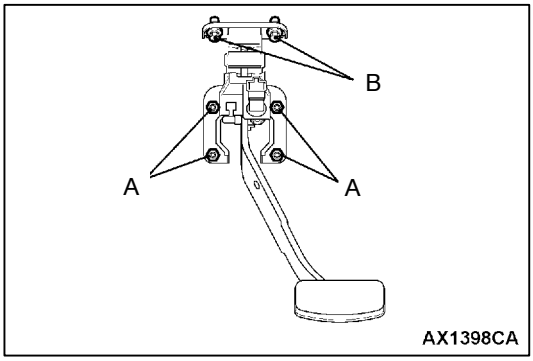


Removal steps

- Instrument panel lower panel (Refer to GROUP 52A.)

1. Return spring
2. Split pin <A/T>
3. Shift lock cable connection <A/T>
4. Harness connector
5. Stop lamp switch
6. Adjuster
7. Pedal stopper
8. Snap pin
9. Pin assembly
10. Pedal pad
11. Brake booster mounting nuts

▶A◀ 12. Brake pedal and pedal support member



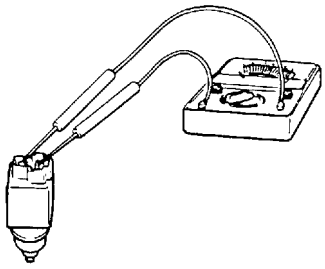
INSTALLATION SERVICE POINT

▶A◀ BRAKE PEDAL AND PEDAL SUPPORT MEMBER INSTALLATION

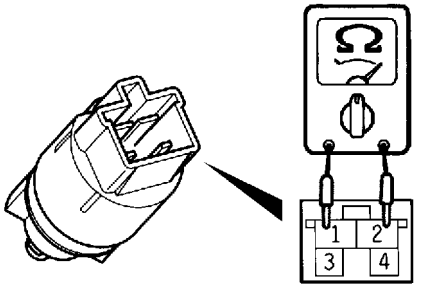
Tighten the brake booster mounting nuts (A), and then the brake pedal mounting bolts (B).

NOTE
The pedal support member can not be positioned correctly if the pedal mounting bolts (B) are tightened first as the their holes are oblong holes.

Vehicles without auto-cruise control



Vehicles with auto-cruise control



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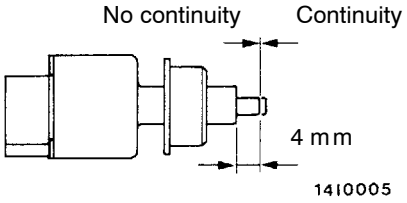

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INSPECTION

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.

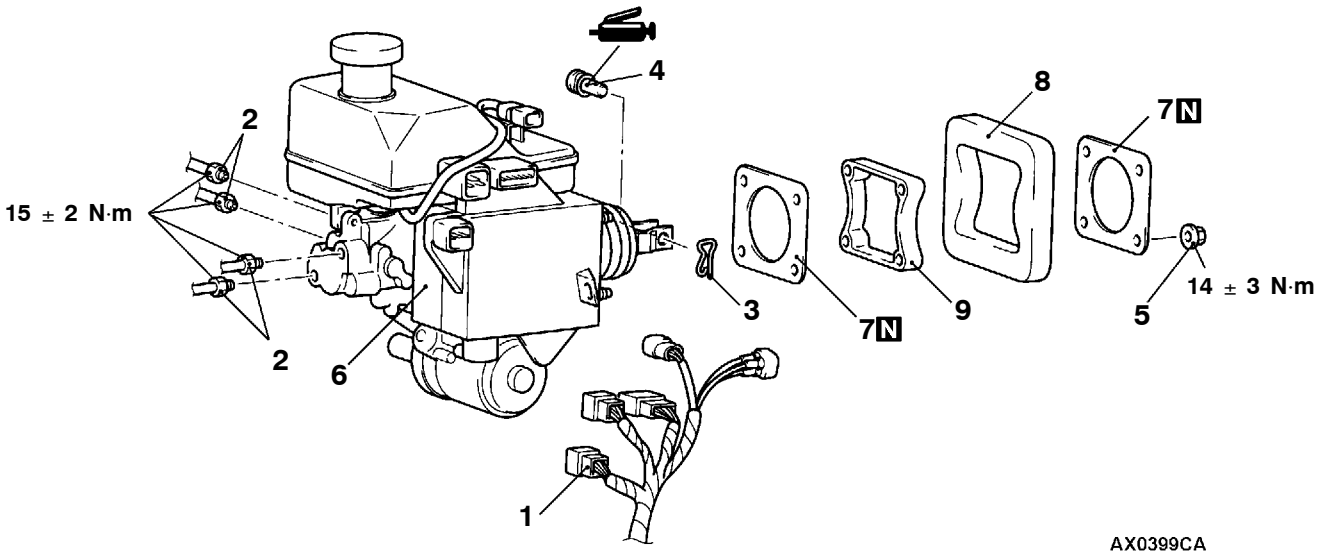
HYDRAULIC BRAKE BOOSTER (HBB) <Vehicles with ABS>

REMOVAL AND INSTALLATION

Caution
Do not turn the ignition switch ON before the brake fluid has been refilled to prevent the HBB pump motor from damage.

Pre-removal Operation
- Depressurise the Brake Fluid in the Power Supply System
  (Depress the brake pedal at least forty times when the ignition switch is turned to "LOCK"(OFF) position)
- Brake Fluid Draining

Post-installation Operations
- Brake Pedal Adjustment (Refer to P.35A-19.)
- Brake Fluid Supplying and Bleeding (Refer to P.35A-27.)
- Checking the Function and Operation of the HBB Power Supply System (Refer to P.35A-20.)

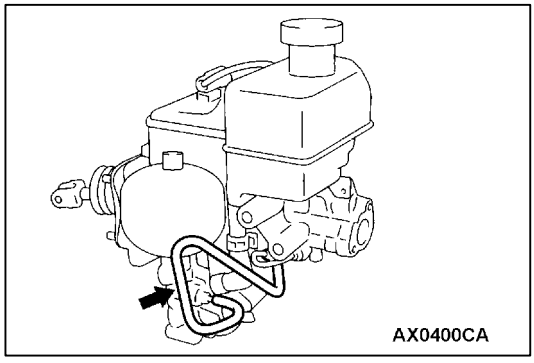


Removal steps
- Battery <L.H. drive vehicles>
- Air intake hose, and air cleaner <R.H. drive vehicles> (Refer to GROUP 15.)

1. Harness connector
2. Brake pipe connection
3. Snap pin
4. Pin assembly
5. HBB mounting nuts

◀A▶ ▶A◀ 6. HBB

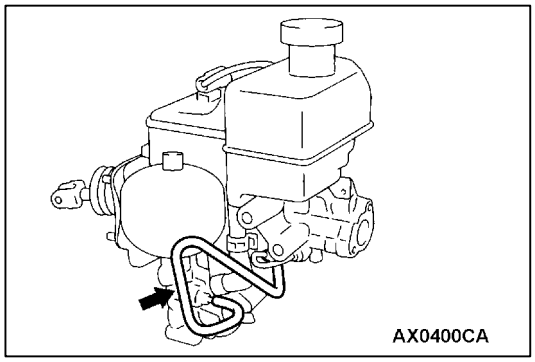
7. Seal
8. Insulator <4M4>
9. Spacer



REMOVAL SERVICE POINT

◀A▶ HBB REMOVAL

Caution
Never bend the shown tube as it is under high pressure.

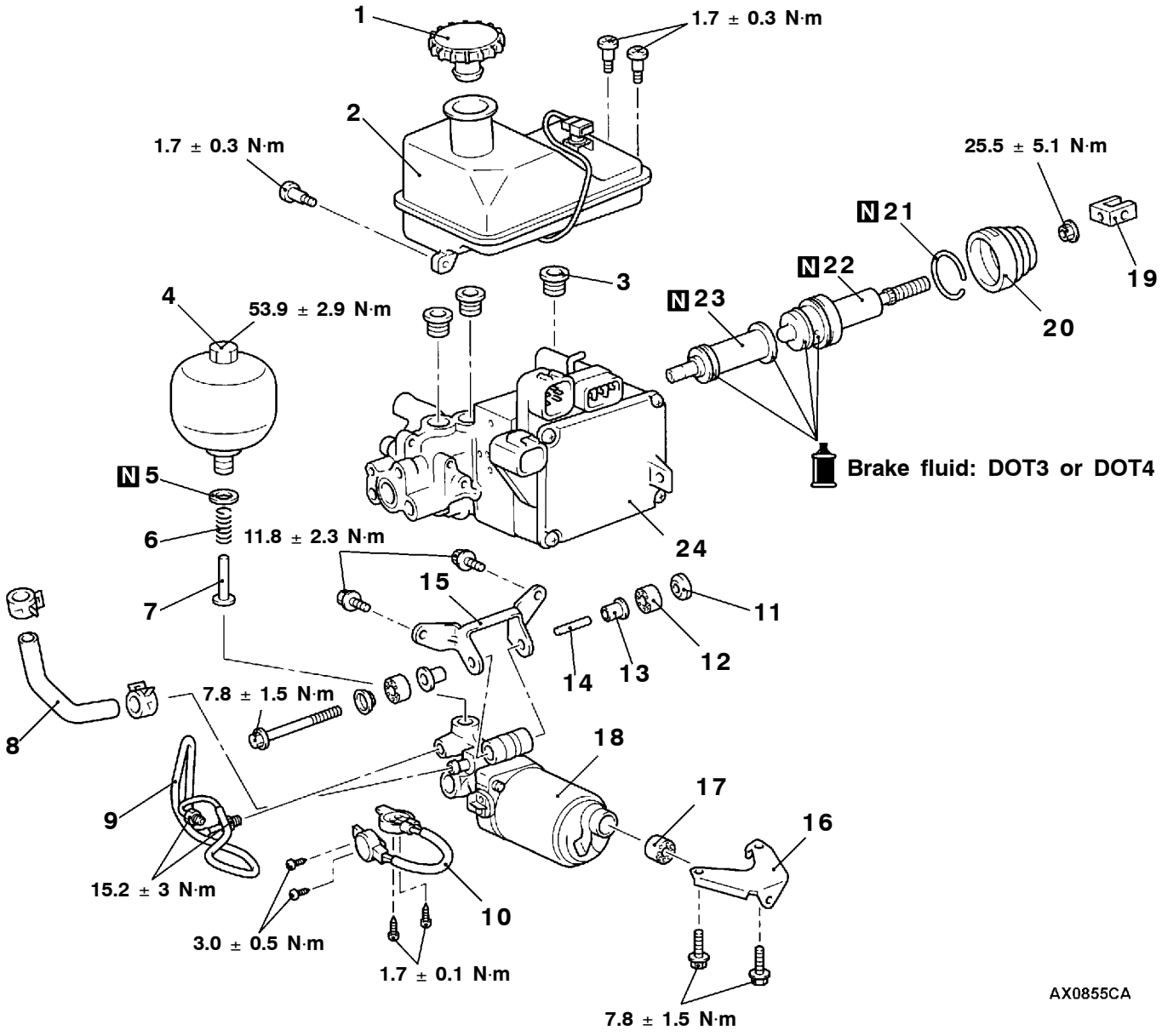


INSTALLATION SERVICE POINT

▶A◀ HBB INSTALLATION

Caution
Never bend the shown tube as it is under high pressure.

DISASSEMBLY AND REASSEMBLY



Disassembly steps

1. Filler cap
2. Reservoir assembly
3. Grommet
4. Accumulator
5. O-ring
6. Spring
7. Silencer tube
8. Hose
9. Tube
10. Lead wire
11. Washer
12. Bushing
13. Collar
14. Pin
15. Bracket
16. Bracket
17. Bushing
18. Pump motor
19. Clevis
20. Boot

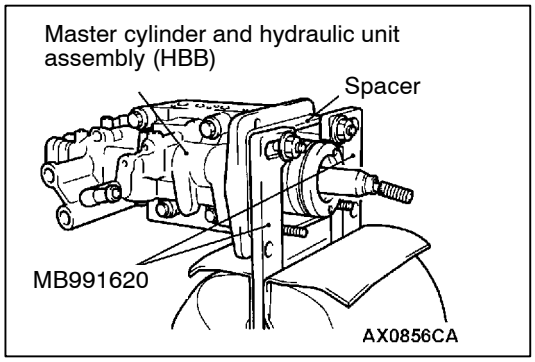
◀A▶ • Holding the HBB

◀B▶ 21. Snap ring

◀B▶ 22. Power piston assembly

◀B▶ 23. Master cylinder piston assembly

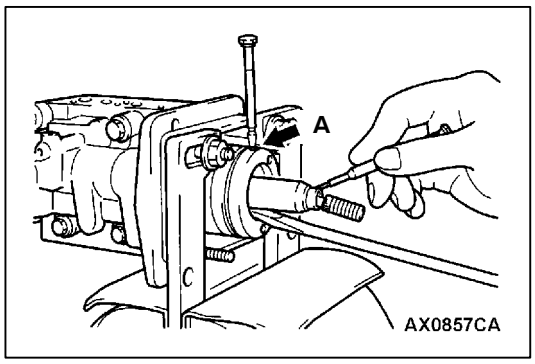
24. Master cylinder and hydraulic unit assembly



DISASSEMBLY SERVICE POINTS

◀A▶ HOLDING THE HBB

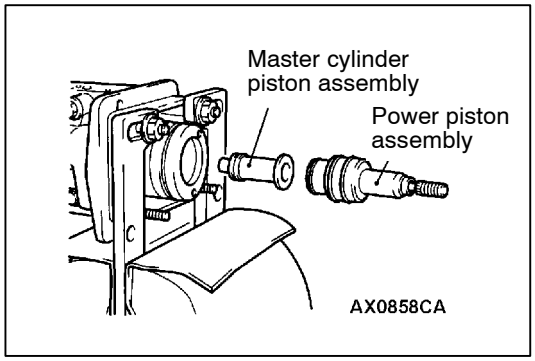
Use the special tools and the spacer to hold the HBB as shown.



◀B▶ SNAP RING, POWER PISTON ASSEMBLY AND MASTER CYLINDER PISTON ASSEMBLY REMOVAL

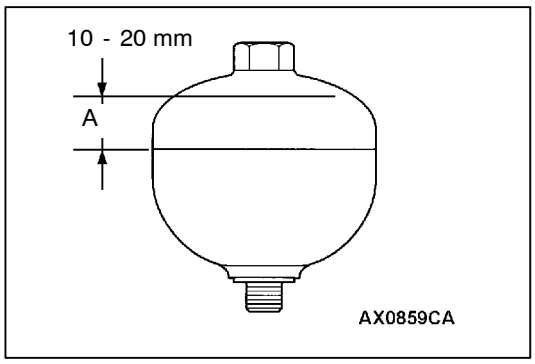
1. Push in the push rod of the power piston assembly, and then use a small flat-tipped screwdriver to remove the snap ring.

   NOTE
   If the snap ring can not be released easily, use a pin to push the snap ring out of the cylinder body hole (A).



2. Withdraw the power piston assembly and the master cylinder piston assembly squarely from the cylinder body.

   Caution
   Do not damage the cylinder wall.



ACCUMULATOR DISPOSAL

Use a saw to punch hole around (A) range of the accumulator, and discharge the gas.

Caution
1. **Cover the saw with a rag as metal particles may fly out.**
2. **Slowly and steadily carry out the work.**

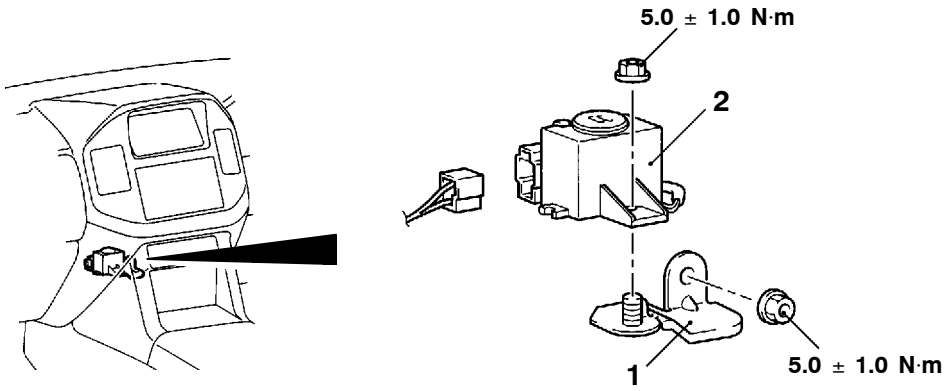
NOTE
The gas is an odorless, colorless and harmless (nitrogen gas).

HBB BUZZER <Vehicles with ABS>

REMOVAL AND INSTALLATION

Pre-removal Operation
Indicator panel and lower center panel removal (Refer to GROUP 52A - Floor Console.)

Post-installation Operations
- Indicator panel and lower center panel installation (Refer to GROUP 52A - Floor Console.)
- HBB buzzer operation check (Refer to P.35A-22.)



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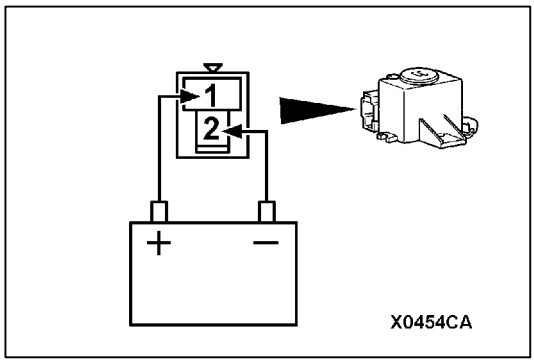
Removal steps
1. Bracket
2. HBB buzzer



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INSPECTION

HBB BUZZER CHECK

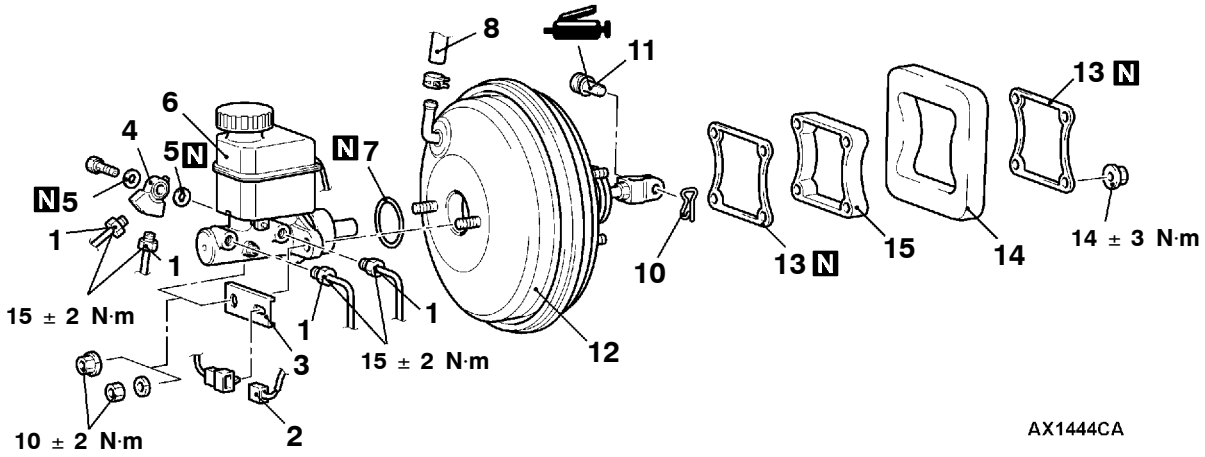
The buzzer should sound when the battery is connected as shown.

MASTER CYLINDER AND BRAKE BOOSTER <Vehicles without ABS>

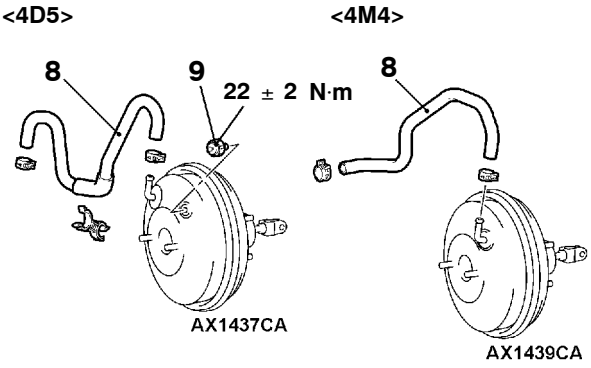
REMOVAL AND INSTALLATION

Pre-removal Operation
- Battery Removal <L.H. drive vehicles>
- Air Intake Hose and Air Cleaner Removal <R.H. drive vehicles> (Refer to GROUP 15.)
- Brake Fluid Draining

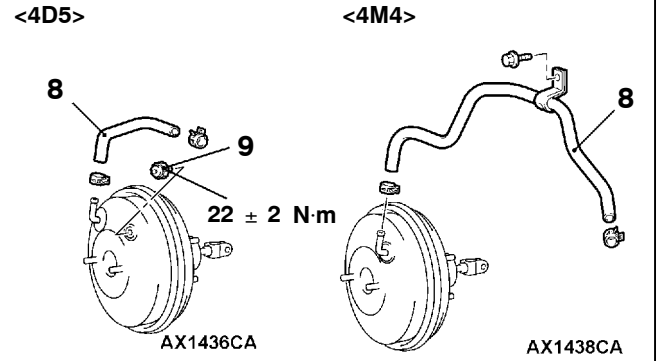
Post-installation Operation
- Brake Fluid Supplying and Air Bleeding (Refer to P.35A-29.)
- Brake Pedal Adjustment (Refer to P.35A-19.)
- Battery Installation <L.H. drive vehicles>
- Air Intake Hose and Air Cleaner Installation <R.H. drive vehicles> (Refer to GROUP 15.)



L.H. drive vehicles



R.H. drive vehicles



Master cylinder removal steps

1. Brake pipe connection
2. Brake fluid level sensor connector
3. Bracket
4. Connector
5. Gasket
6. Master cylinder
7. O ring

Brake booster removal steps

1. Brake pipe connection
2. Brake fluid level sensor connector
3. Bracket
4. Connector
5. Gasket
6. Master cylinder
7. O ring

▶B◀ • Clearance adjustment between brake booster push rod and primary piston

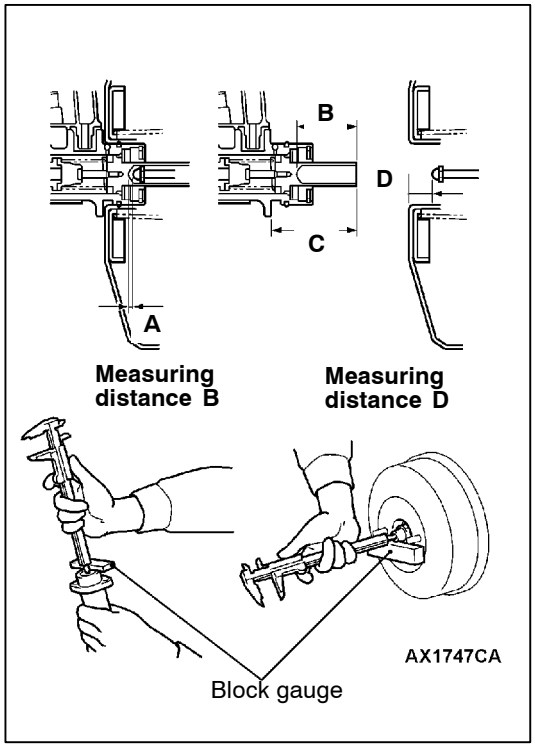
▶A◀ 8. Vacuum hose (With built-in check valve)

9. Vacuum switch <4D5>
10. Snap pin
11. Pin assembly
12. Brake booster
13. Sealer
14. Insulator <4M4>
15. Spacer

INSTALLATION SERVICE POINTS

▶A◀ VACUUM HOSE CONNECTION

Insert the vacuum hose to the brake booster with its paint mark facing forward, and then secure the hose by using the hose clip.

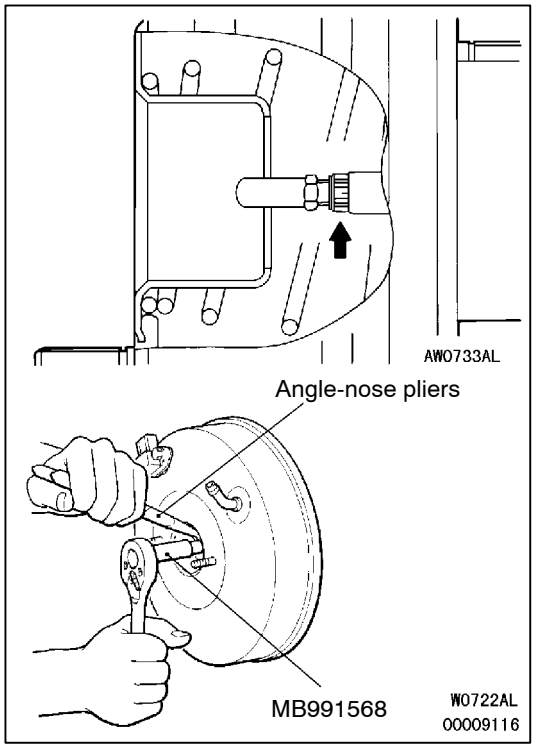


▶B◀ CLEARANCE ADJUSTMENT BETWEEN BRAKE BOOSTER PUSH ROD AND PRIMARY PISTON

1. Caluculate clearance A from the B, C and D measurements.
   A = B - C + D

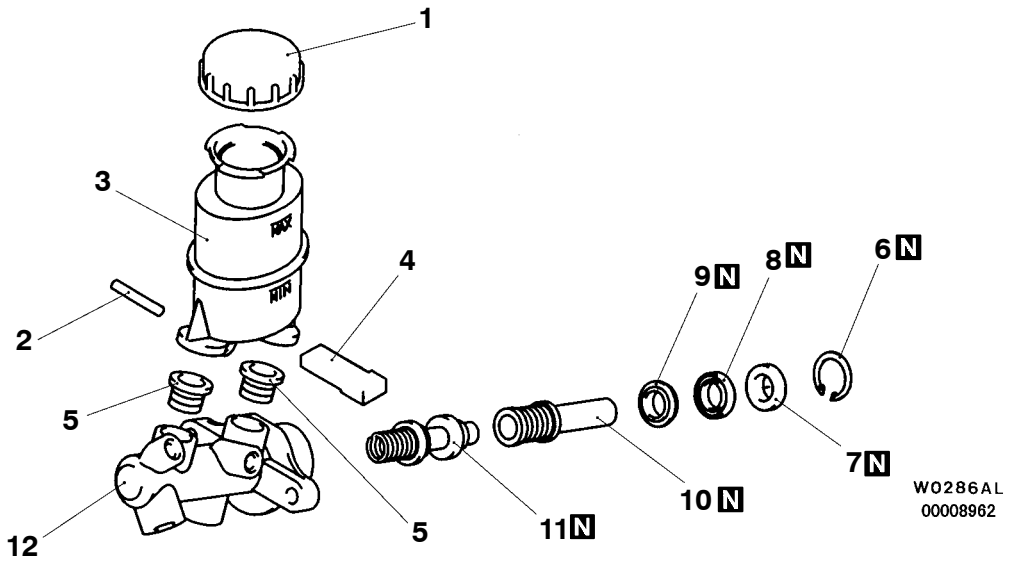
   Standard value (A) :
   <6G7> 0.5 – 0.9 mm
   <4D5, 4M4> 0.8 - 1.2 mm

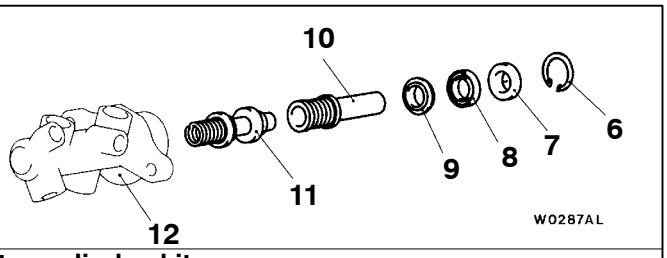
   NOTE
   (2) When a negative pressure of 66.7 kPa is applied to the brake booster, the clearance value will become 0.10 - 0.50 mm. <6G7>
   (3) When a negative pressure of 93.3 kPa is applied to the brake booster, the clearance value will become 0.10 - 0.50 mm. <4D5, 4M4>



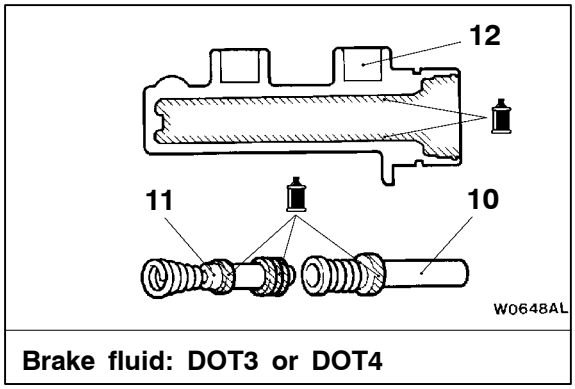
2. If the clearance is not within the standard value range, adjust by changing the push rod length by turning the push rod. Use the special tool to turn the push rod while holding the rod spline with angle-nose pliers.

MASTER CYLINDER
DISASSEMBLY AND REASSEMBLY





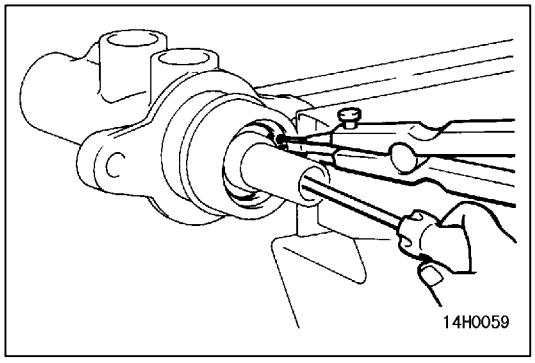
Master cylinder kit



Brake fluid: DOT3 or DOT4

Disassembly steps

1. Reservoir cap
2. Pin
3. Reservoir tank
4. Brake fluid level sensor
5. Reservoir seal
◀A▶ 6. Stopper ring
7. Piston guide
8. Cylinder cup
9. Plate
10. Primary piston assembly
11. Secondary piston assembly
12. Master cylinder body



DISASSEMBLY SERVICE POINT

◀A▶ STOPPER RING REMOVAL

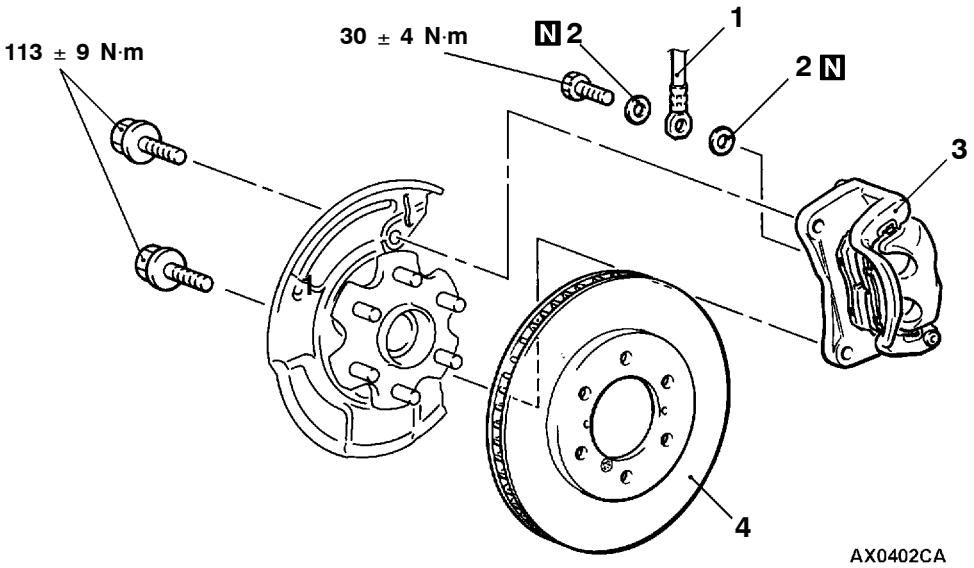
Push the primary piston assembly and remove the stopper ring.

FRONT DISC BRAKE

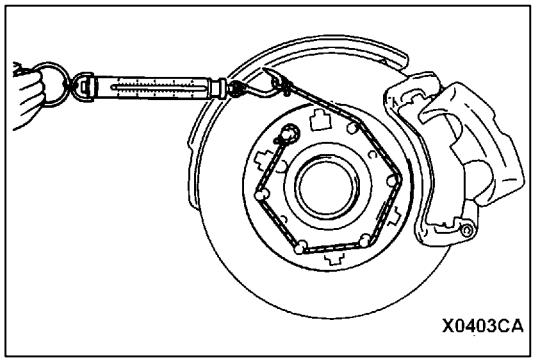
REMOVAL AND INSTALLATION

Pre-removal Operation
Brake Fluid Draining

Post-installation Operation
Brake Fluid Supplying and Air Bleeding
(Refer to P.35A-27, 29.)



Removal steps
1. Brake hose connection
2. Gasket
▶A◀ 3. Disc brake assembly
4. Brake disc

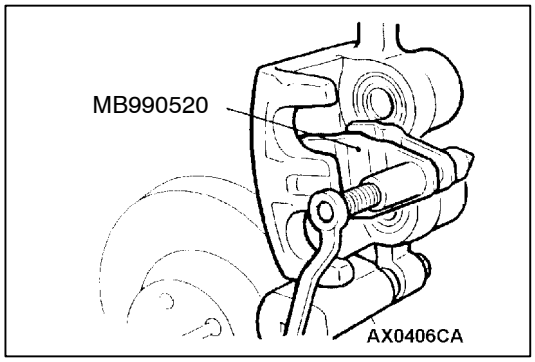


INSTALLATION SERVICE POINT

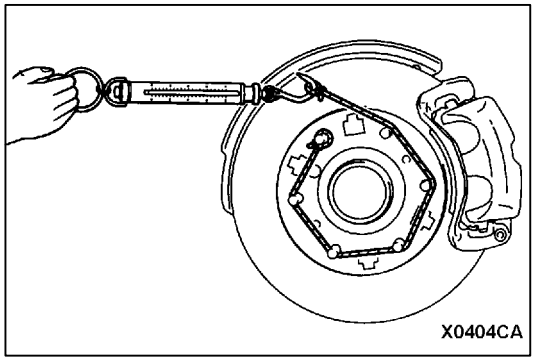
▶A◀ DISC BRAKE ASSEMBLY INSTALLATION

1. Use a spring balance to measure the hub rotation resistance by turning the hub to the forward direction with the pad removed in order to measure the brake dragging force.
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.

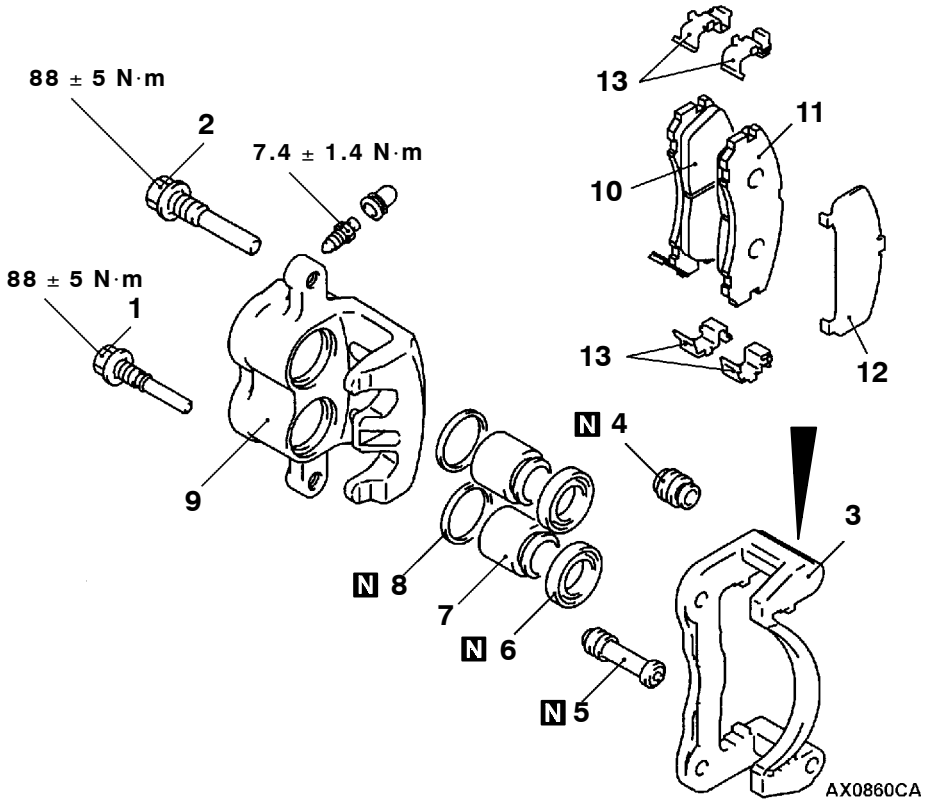


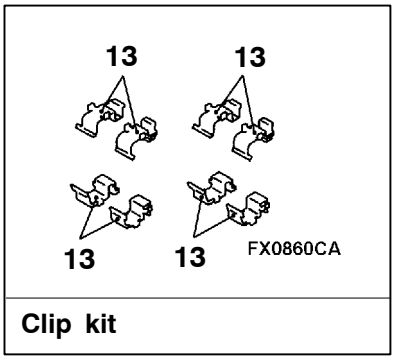
7. Use a spring balance to measure the rotary-sliding resistance of the hub.
8. Calculate the drag force of the disc brake [difference between the values measured at steps 1 and 7].

   Standard value: 55 N

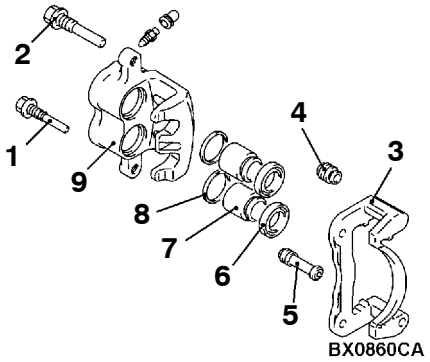
9. If that drag force exceeds the standard value, disassemble the piston assembly. Then check the piston for contamination or rust, and confirm if the piston or the piston seal is deteriorated, and if the lock pin and the guide pin slide smoothly.

DISASSEMBLY AND REASSEMBLY

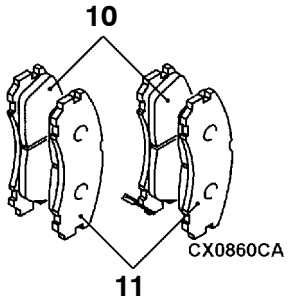




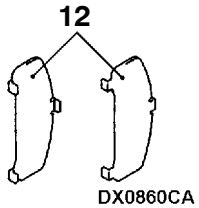
Clip kit



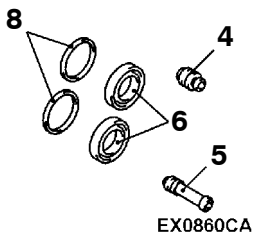
Brake caliper kit



Pad set



Shim kit

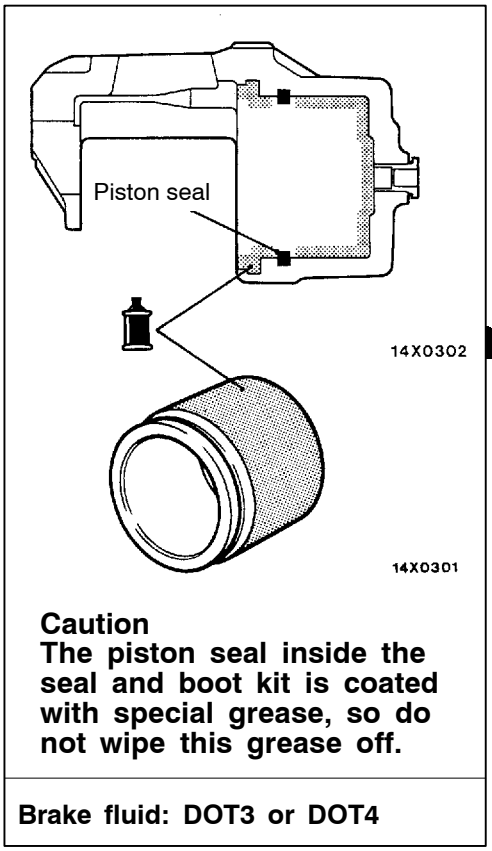


Seal and boot kit

Disassembly steps

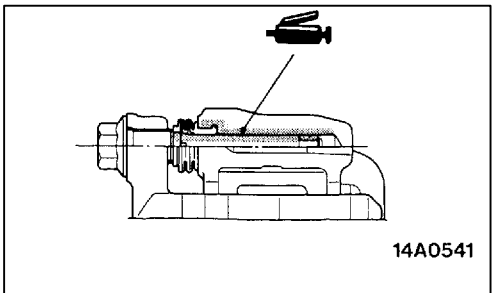
1. Guide pin lock bolt
2. Guide pin
3. Caliper support (including pad, clip and shim)
4. Boot
5. Bushing
◀A▶ 6. Piston boot
◀A▶ 7. Piston
◀B▶ 8. Piston seal
9. Caliper body
10. Pad and wear indicator assembly
11. Pad assembly
12. Shim
13. Clip

LUBRICATION POINTS

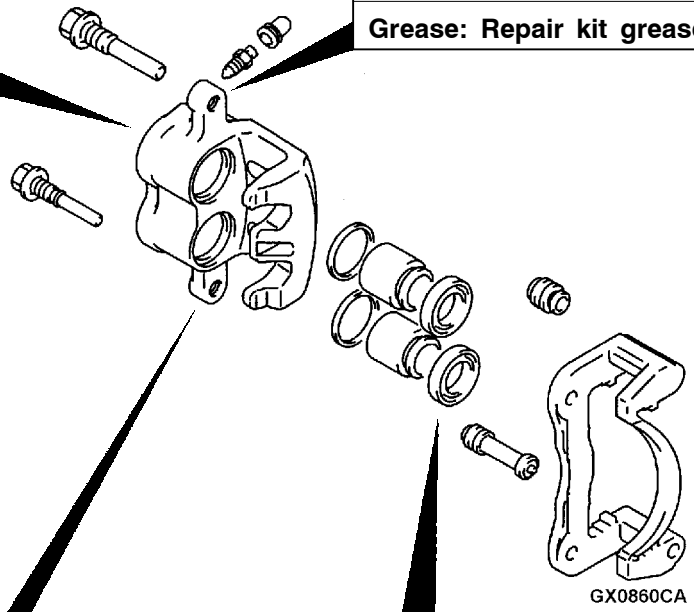


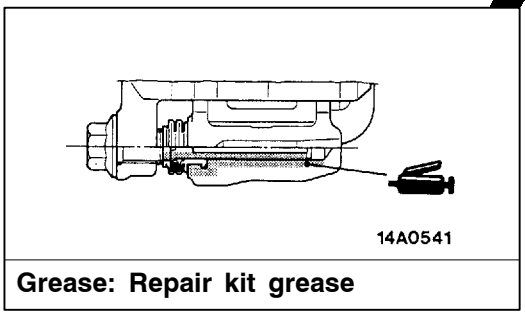
Caution
The piston seal inside the seal and boot kit is coated with special grease, so do not wipe this grease off.

Brake fluid: DOT3 or DOT4

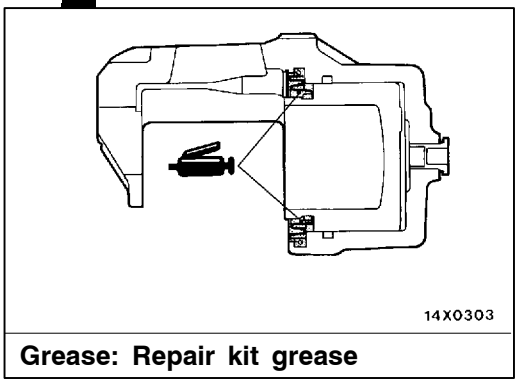


Grease: Repair kit grease

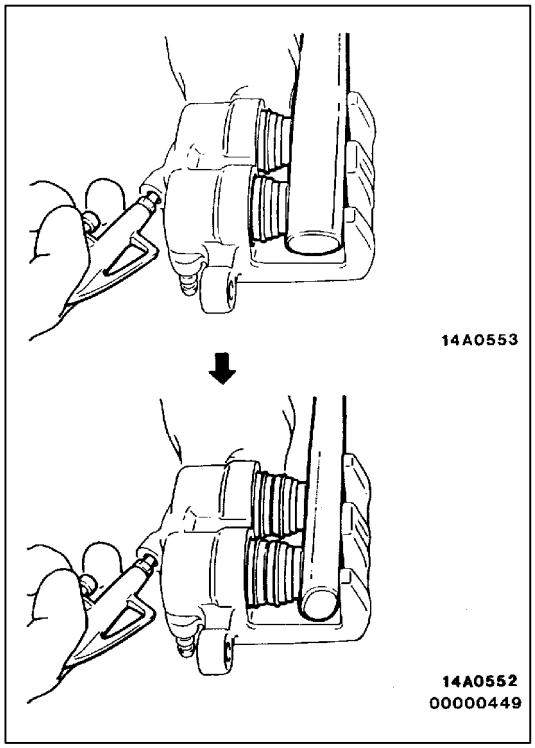




Grease: Repair kit grease



Grease: Repair kit grease

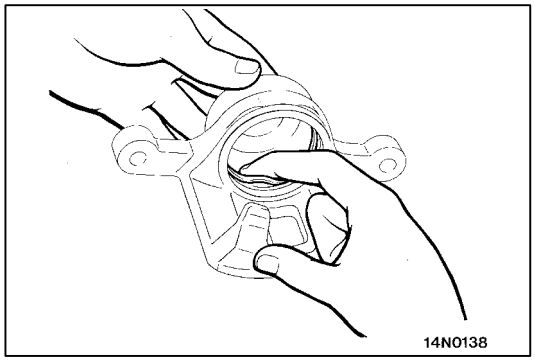


DISASSEMBLY SERVICE POINTS

◀A▶ PISTON BOOT/PISTON REMOVAL

Remove the piston boot by pumping in air slowly from the brake hose connection. Be sure to use the handle of a plastic hammer and adjust the height of the two pistons while so that the pistons protrude evenly.

Caution
Do not remove one piston completely before trying to remove the other piston, because it will become impossible to remove the second piston.



◀B▶ PISTON SEAL REMOVAL

1. Remove the piston seal with finger tip.

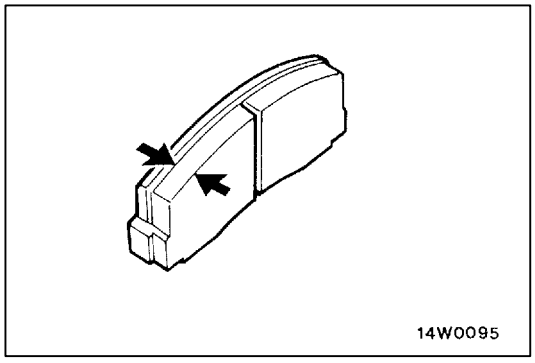
   Caution
   Do not use a flat-tipped screwdriver or other tool to prevent damage to inner cylinder.

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

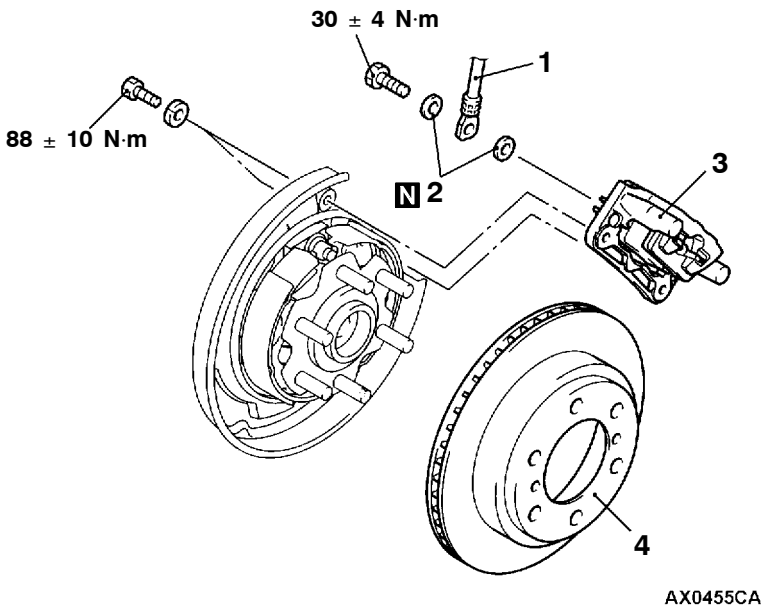
Caution
1. Always replace the brake pads as an axle set.

2. If an excessive difference is found in the thickness between the right and left brake pads, check moving parts.

REAR DISC BRAKE

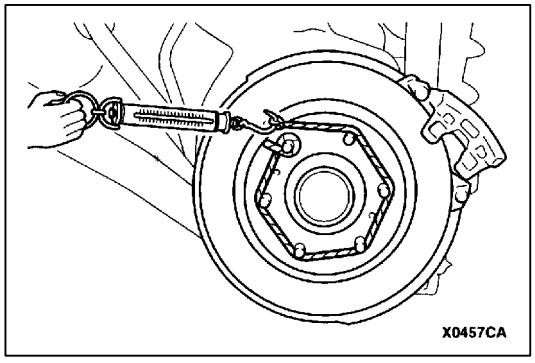
REMOVAL AND INSTALLATION

Pre-removal Operation	Post-installation Operation
Brake Fluid Draining	Brake Fluid Supplying and Air Bleeding (Refer to P.35A-27, 29.)



Removal steps

1. Brake hose connection
2. Gasket
▶A◀ 3. Disc brake assembly
4. Brake disc

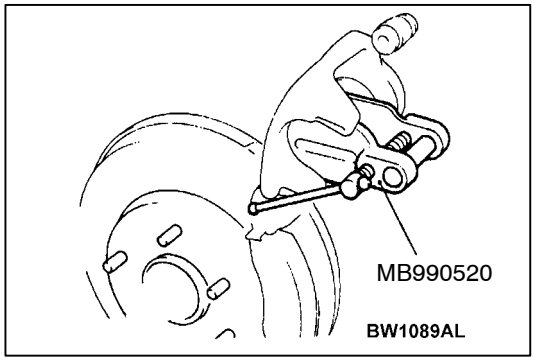


INSTALLATION SERVICE POINT

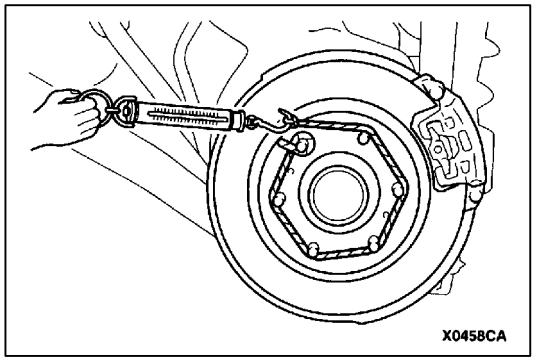
▶A◀ DISC BRAKE ASSEMBLY INSTALLATION

1. In order to measure the brake drag force after pad installation, 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.

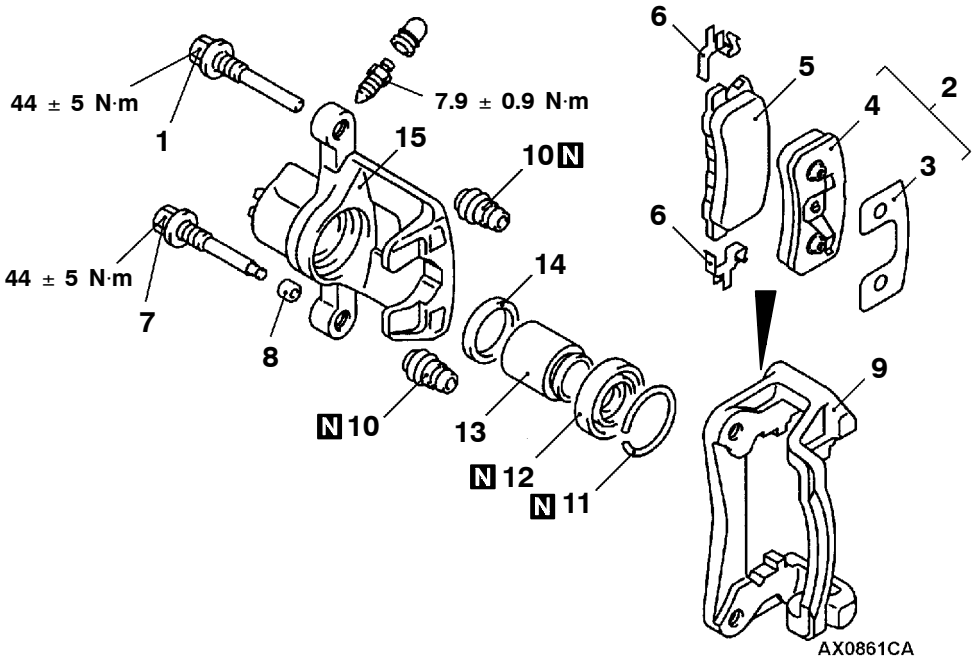


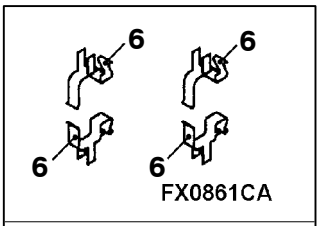
7. Use a spring balance to measure the rotary-sliding resistance of the hub.
8. Calculate the drag force of the disc brake [difference between the values measured at steps 1 and 7].

   Standard value: 55 N

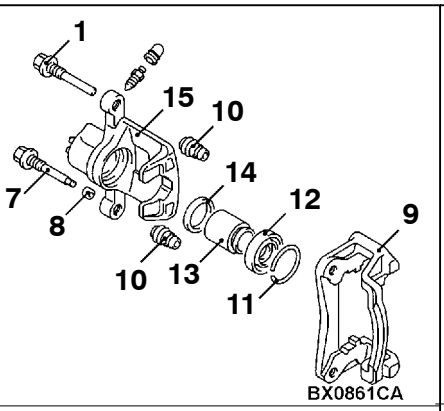
9. If that drag force exceeds the standard value, disassemble the piston assembly. Then check the piston for contamination or rust, and confirm if the piston or the piston seal is deteriorated, and if the lock pin and the guide pin slide smoothly.

DISASSEMBLY AND REASSEMBLY

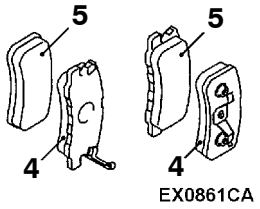




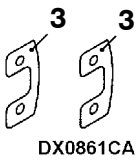
Clip set



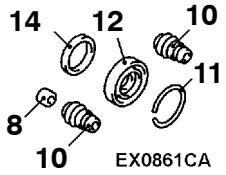
Brake caliper kit



Pad set



Shim set

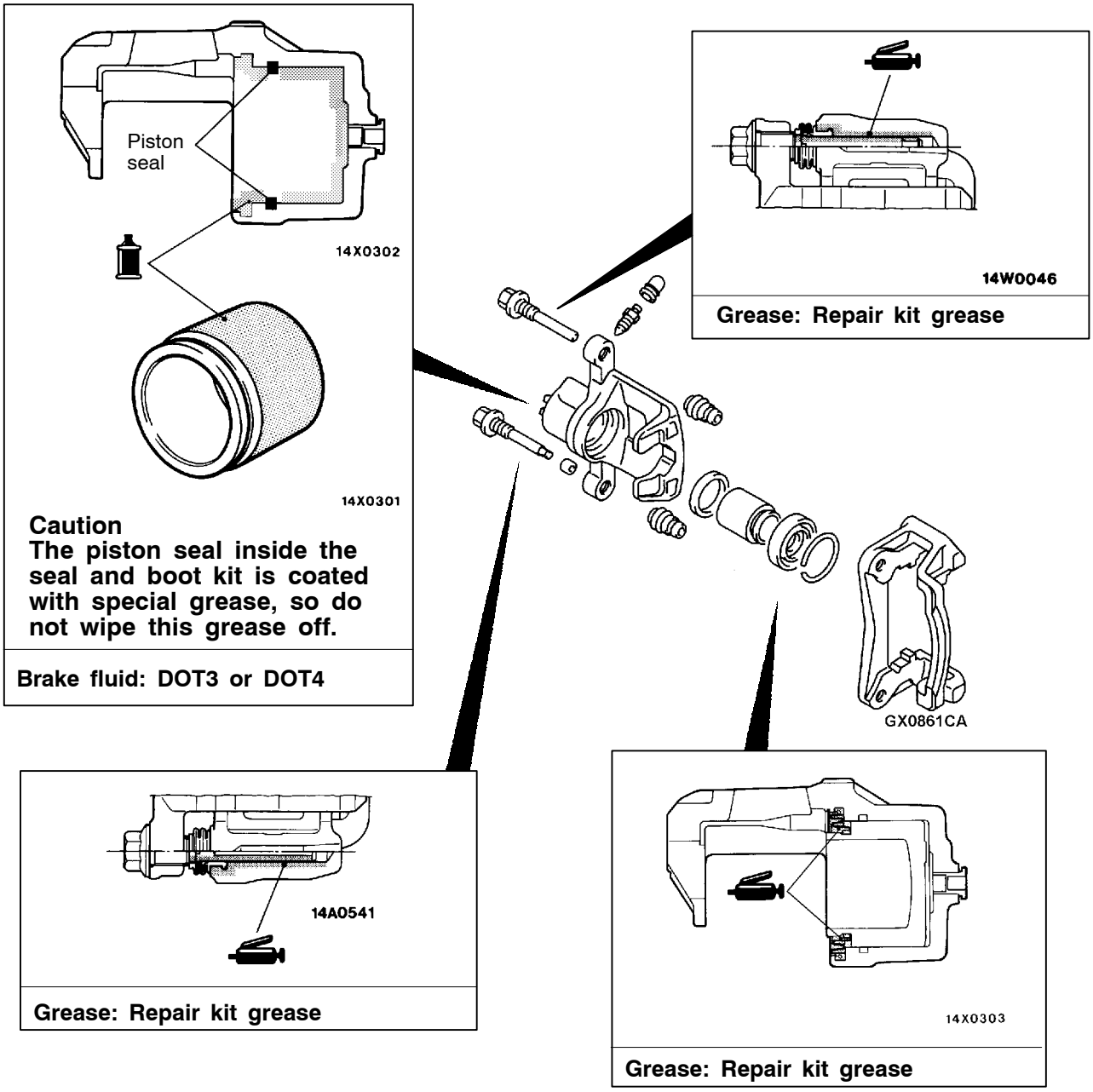


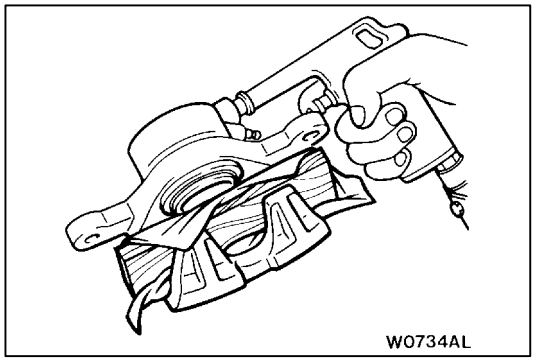
Seal and boots kit

Disassembly steps

▶A◀ 1. Guide pin
2. Pad and clip assembly, shim
3. Shim
4. Pad and clip assembly
5. Pad assembly
6. Pad clip
▶A◀ 7. Lock pin
8. Bushing
9. Caliper support
10. Pin boot
11. Boot ring
◀A▶ 12. Piston boot
◀A▶ 13. Piston
◀B▶ 14. Piston seal
15. Caliper body

LUBRICATION POINTS



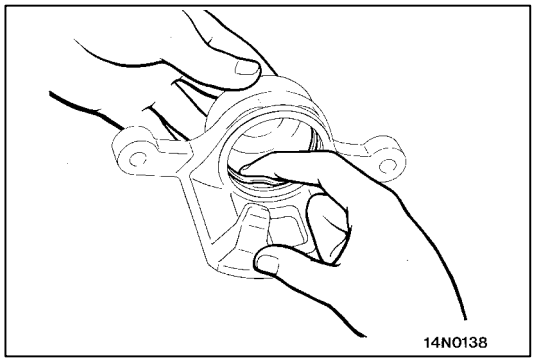


DISASSEMBLY SERVICE POINTS

◀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.



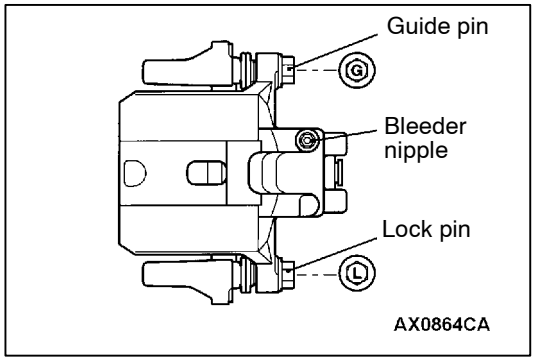
◀B▶ PISTON SEAL REMOVAL

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



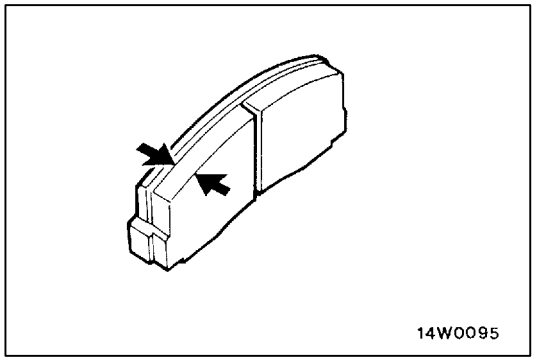
REASSEMBLY SERVICE POINT

▶A◀ LOCK PIN/GUIDE PIN INSTALLATION

Install the guide pin to the bleeder nipple side at the caliper body, the lock pin to its opposite side, respectively.

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.**

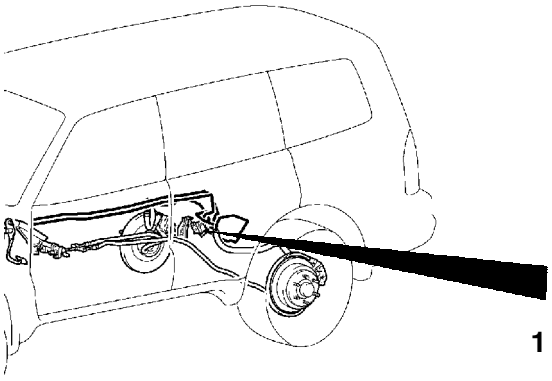
LOAD SENSING PROPORTIONING VALVE <Vehicles without ABS>

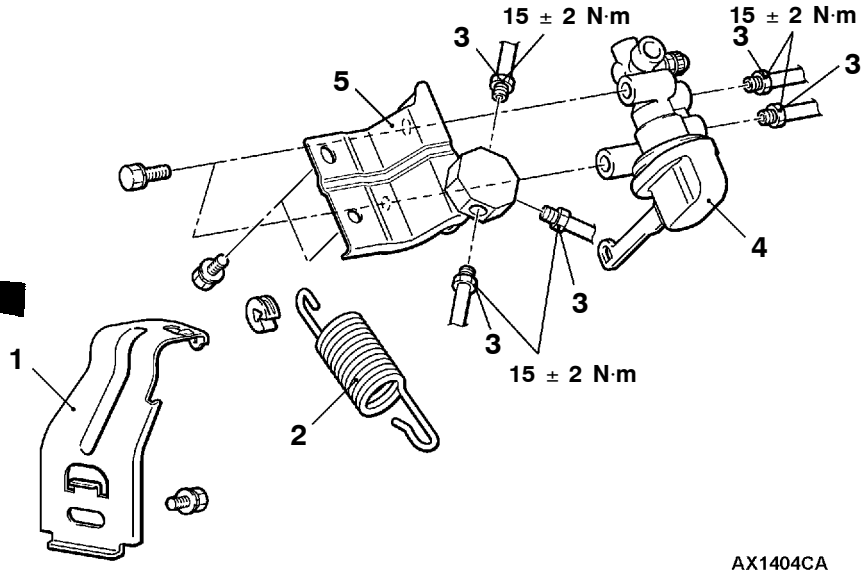
REMOVAL AND INSTALLATION

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-29.)

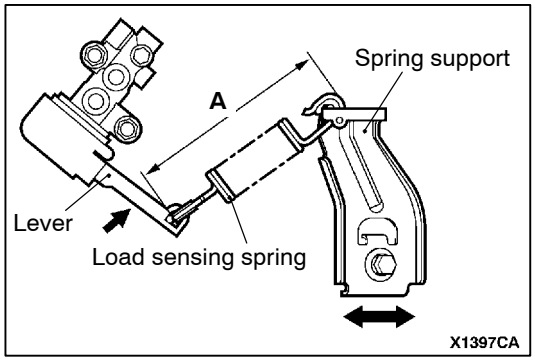

BX1361CA



AX1404CA

Removal steps

▶A◀ 1. Spring support
2. Load sensing spring
3. Brake pipe connection
4. Load sensing proportioning valve
5. Bracket assembly



X1397CA

INSTALLATION SERVICE POINT

▶A◀ SPRING SUPPORT INSTALLATION

1. Install the load sensing spring, and then tighten the spring support to the lower arm 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): 135 - 139 mm

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

Click on the applicable bookmark to selected the required model year.

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

CONTENTS

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ABS-ECU 32

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GENERAL INFORMATION

ABS has been adopted as standard equipment in all vehicles to maintain directional stability and steering performance during sudden braking.
The ABS control method used is a 4-sensor, 4-channel method (previous models: 4-sensor, 3-channel method) which allows the brake pressures for all four wheels to be controlled independently of each other. The system has the following features.

- EBD* (Electronic Brake force Distribution system) control has been added to provide the ideal braking force for the rear wheels.
- The hydraulic unit function has been integrated with the hydraulic brake booster (HBB).
- Select solenoid valves (two valves for FL and FR) have been adopted in order to reduce the pedal kickback and improve the operation feeling when the ABS is operating.
- Independent 4-wheel control is carried out wile the vehicle is turning in order to increase the braking force.

NOTE
*EBD: Electronic Brake-force Distribution

EBD CONTROL

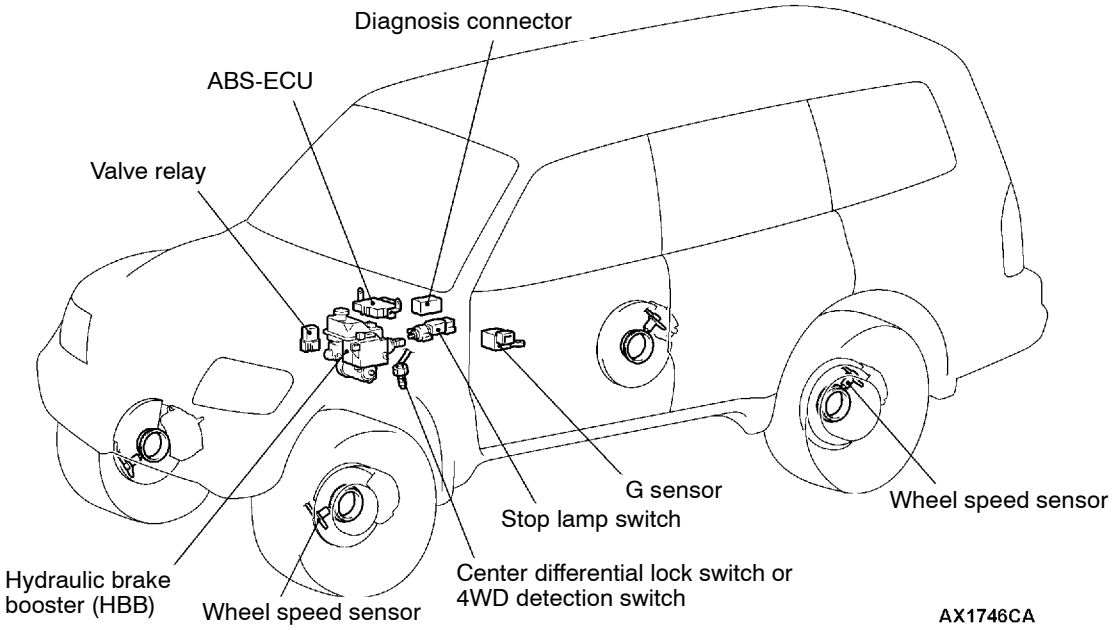
In ABS, electronic control method is used whereby the rear wheel brake hydraulic pressure during braking is regulated by rear wheel control solenoid valves in accordance with the vehicle's rate of deceleration and the front and rear wheel slippage which are calculated from the signals received from the various wheel sensors. EBD control is a control system which provides a high level of control for both vehicle braking force and vehicle stability. The system has the following features.

- Because the system provides the optimum rear wheel braking force regardless of the vehicle laden condition and the condition of the road surface, the system reduces the required pedal depression force, particularly when the vehicle is heavily laden or driving on road surfaces with high frictional coefficients.
- Because the duty placed on the front brakes has been reduced, the increases in pad temperature can be controlled during front brakes applying to improve the wear resistance characteristics of the pad.
- Control valves such as the proportioning valve are no longer required.

SPECIFICATIONS

Item		Specifications
ABS control method		4-sensor, 4-channel
No. of ABS rotor teeth	Front	50
	Rear	50
ABS speed sensor	Type	Magnet coil type
	Gap between sensor and rotor mm	0.9 (non-adjustable type)

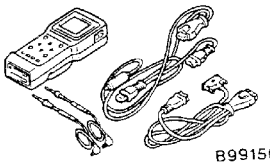
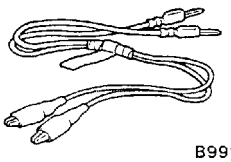
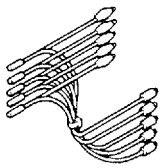
STRUCTURAL DIAGRAM



SERVICE SPECIFICATIONS

Item		Standard value
Control solenoid valve resistance Ω	IN	4.75 - 5.25
	OUT	2.0 - 2.4
Select solenoid valve resistance Ω		3.5 - 3.9
Wheel speed sensor terminal resistance kΩ		1.0 - 1.5
Wheel speed sensor insulation resistance kΩ		100 or more

SPECIAL TOOLS

Tools	No.	Name	Application
 B991502	MB991502	MUT-II sub assembly	Checking the ABS (Diagnosis display using the MUT-II)
 B991529	MB991529	Diagnosis code checking harness	Checking the ABS (Diagnosis display using the ABS warning lamp)
 B991348	MB991348	Test harness set	Checking the G sensor

TROUBLESHOOTING

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING

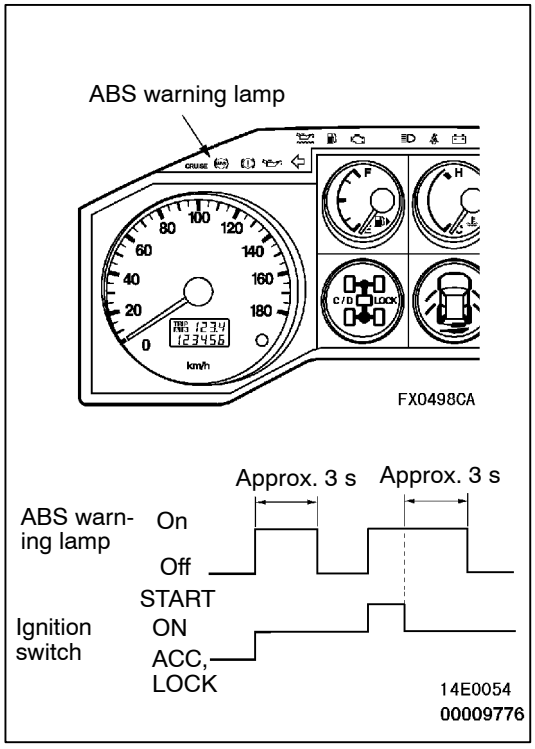
Refer to GROUP 00 - How to Use Troubleshooting/Inspection Service Points.

PRECAUTIONS WHEN CARRYING OUT DIAGNOSIS

(1) The ABS is a system which controls the brake pressure by means of the operation of the ECU. Accordingly, the following symptoms may occur at times, but these are a sign of normal ABS operation, and do not indicate a malfunction.

Symptom	Explanation of symptom
When the engine starts, a knocking sound can be heard coming from the engine compartment.	This sound occurs as a result of system operation checking, and is not a malfunction.
1. The brake pedal feeling changes and noise is generated.(Rattling) 2. When the ABS is operating, noise is generated by parts of the vehicle chassis as control turns on and off. (Thump: suspension; squeak: tyres)	This is the sound of normal system operation, and is not a malfunction.
Shocks are felt if the brake pedal is depressed when driving at low speed.	This is due to system operation checking (starting - of check when the vehicle speed reaches a certain number of km/h) and is not a malfunction.

(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 conditions vary according to the diagnosis code. When re-checking trouble symptoms, the conditions given in the “Explanation” column of the Inspection Chart Classified by Trouble Symptoms must always be satisfied.



ABS WARNING LAMP INSPECTION

Check that the ABS warning lamp illuminates in the following way.
Even if the pressure inside the accumulator of the hydraulic brake booster (HBB) is below the specified value, the ABS warning lamp will illuminate because ABS operation has been stopped. In such cases, if the HBB pump is driven by the accumulated pressure inside the accumulator and causes the ABS warning lamp to switch off, it does not indicate a system malfunction.
(1) When the ignition switch is turned to the ON position, the ABS warning lamp illuminates* for approximately 3 seconds, and then switches off.
(2) When the ignition switch is turned to the START position, the ABS warning lamp remains illuminated.
(3) When the ignition switch returns from the START to the ON position, the ABS warning lamp illuminates* for approximately 3 seconds, and then remains switched off.
(4) If any of the above do not occur, check the diagnosis codes.

NOTE
*: The ABS warning lamp may remain illuminated after the ignition switch is turned to the ON position and the vehicle starts moving until the vehicle speed reaches a speed of several km/h. This only occurs if a diagnosis code from No. 21 to No. 24 relating to a wheel speed sensor malfunction was generate when the ignition switch was last turned to the ON position and is still stored in the ABS-ECU. The ABS-ECU will cause the ABS warning lamp to illuminate until the point where it can ascertain (during the starting-off check) that the problem associated with this diagnosis code has returned to normal.

DIAGNOSIS FUNCTION

READING DIAGNOSIS CODES

Use the MUT-II or the ABS warning lamp to read the diagnosis codes.
(Refer to GROUP 00 - How to Use Troubleshooting/Inspection Service Points.)

NOTE
Connect the MUT-II to the 16-pin diagnosis connector.

ERASING DIAGNOSIS CODES

When using the MUT-II

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

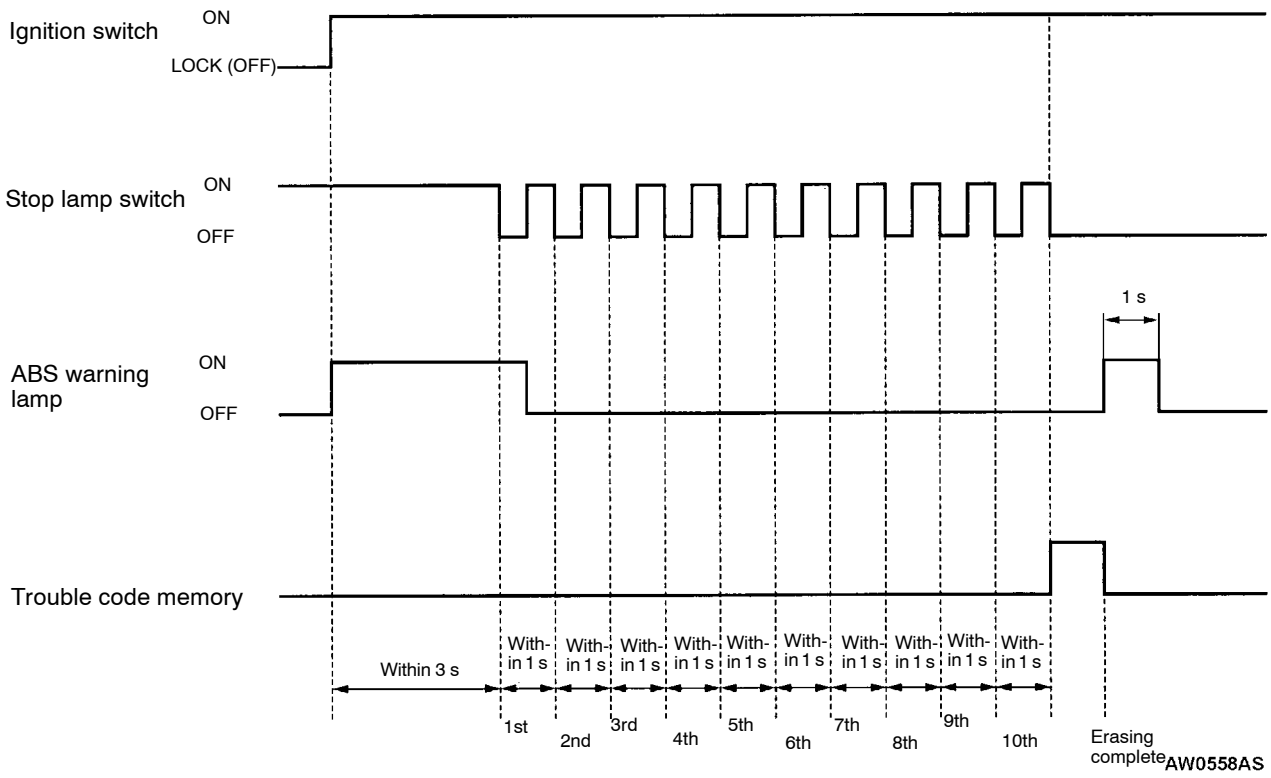
Caution
Turn the ignition switch to the LOCK (OFF) position when connecting and disconnecting the MUT-II.

NOTE
Connect the MUT-II to the 16-pin diagnosis connector.

When not using the MUT-II

(1) Stop the vehicle.
(2) Turn the stop lamp switch to ON (brake pedal depressed).
(3) In this condition (after carrying out steps 1) to 2)), turn the ignition switch to the ON position. Then turn off the stop lamp switch (release the brake pedal) within 3 seconds, and then turn the stop lamp switch on and off again a further 10 times.

NOTE
If the functioning of the ABS-ECU has been stopped by the fail-safe function, the diagnosis codes cannot be erased.



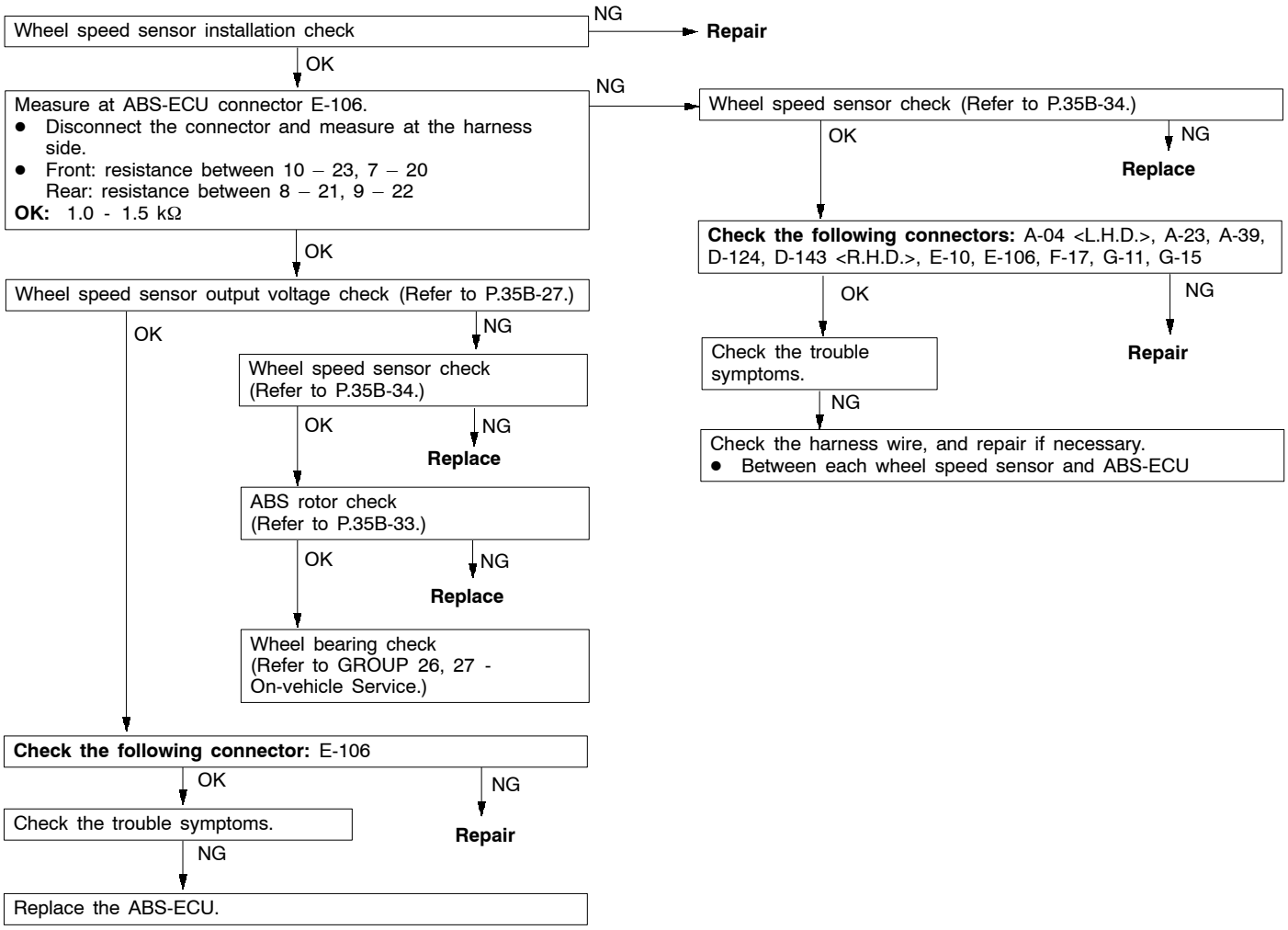
INSPECTION CHART FOR DIAGNOSIS CODES

Diagnosis code No.	Diagnosis item		Reference page
11	Wheel speed sensor (FR) system (open circuit or short-circuit)		35B-8
12	Wheel speed sensor (FL) system (open circuit or short-circuit)		35B-8
13	Wheel speed sensor (RR) system (open circuit or short-circuit)		35B-8
14	Wheel speed sensor (RL) system (open circuit or short-circuit)		35B-8
15	Wheel speed sensor system (output signal abnormality)		35B-9
16	ABS-ECU or valve relay power supply system (abnormal voltage drop or rise)		35B-10
21	Wheel speed sensor (FR) system		35B-8
22	Wheel speed sensor (FL) system		35B-8
23	Wheel speed sensor (RR) system		35B-8
24	Wheel speed sensor (RL) system		35B-8
26	Center differential lock switch system		35B-11, 12
27	Rear differential lock switch system		35B-11, 12
32	G sensor system		35B-13
33	Stop lamp switch system		35B-14
41	Control solenoid valve (FR) system	If there is no response to the solenoid valve drive signal corresponding to each respective item	35B-15
42	Control solenoid valve (FL) system		
43	Control solenoid valve (RR) system		
44	Control solenoid valve (RL) system		
45	Changeover solenoid valve (FR) system		
46	Changeover solenoid valve (FL) system		
51	Valve relay system (ON problem)		35B-16
52	Valve relay system (OFF problem)		35B-17
55	HBB system		Carry out HBB troubleshooting. (Refer to GROUP 35A.)
63	ABS-ECU system		35B-32 (ABS-ECU replacement)

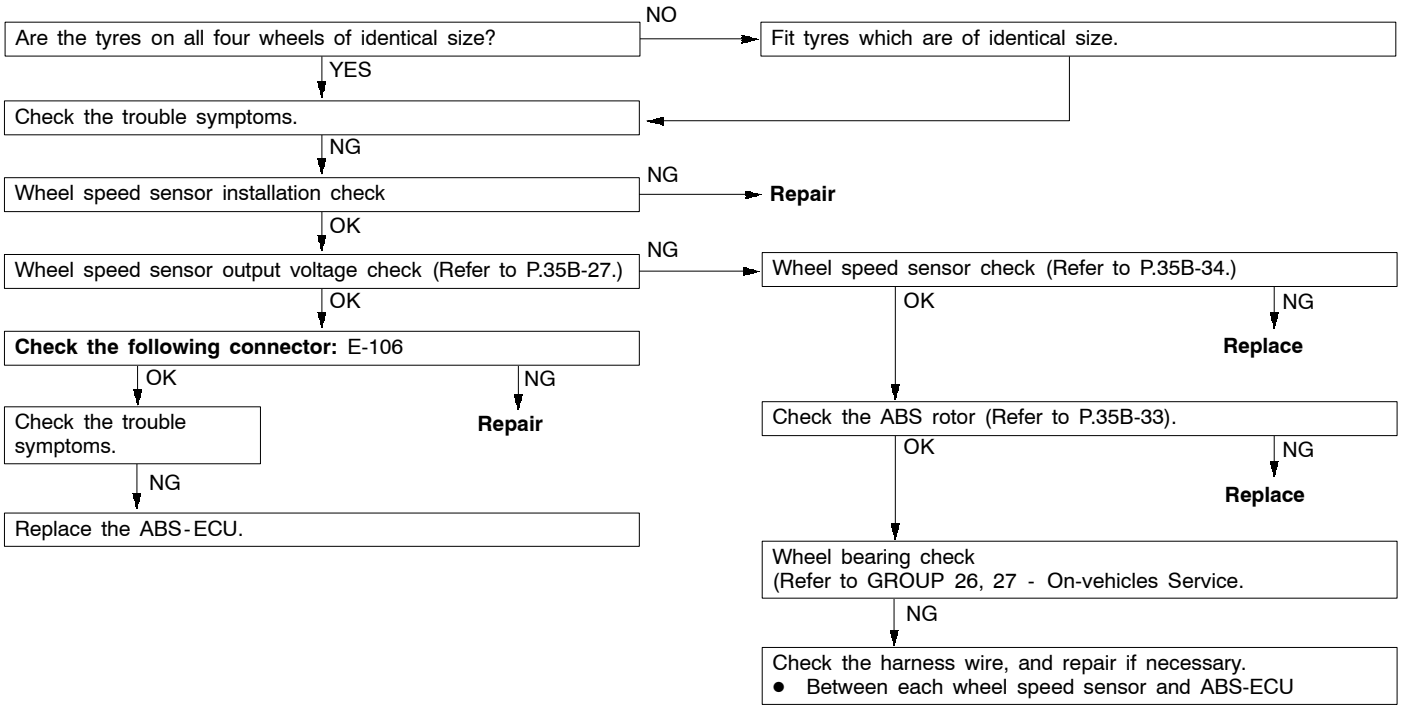
NOTE
*: Code No.16 is erased from the memory if the condition returns to normal.

INSPECTION PROCEDURE CLASSIFIED BY DIAGNOSIS CODE

Code No. 11, 12, 13, 14 Wheel speed sensor system (open circuit or short-circuit) Code No. 21, 22, 23, 24 Wheel speed sensor system	Probable cause
Code Nos. 11, 12, 13, 14 are output when the open circuit or short-circuit detection carried out by the ABS-ECU hardware circuit detects that there is an open circuit or short-circuit in the (+) or (-) wire in one of the four wheel speed sensors and signals are consequently not being input.	● Malfunction of wheel speed sensor ● Malfunction of harness or connector ● Malfunction of the ABS-ECU
Code No. 21, 22, 23, 24 are output at the following times: ● If an open circuit cannot be verified, but one or more of the wheel speed sensors does not output any signal when the vehicle speed is a certain number of km/h or higher. ● When a problem such as chipped or plugged-up rotor tooth is detected, or if the sensor output drops and anti-skid control is continuously carried out due to a malfunctioning sensor or a warped ABS rotor.	● Malfunction of wheel speed sensor ● Malfunction of harness or connector ● Malfunction of ABS rotor ● Excessive clearance between sensor and ABS rotor ● Malfunction of the ABS-ECU ● Malfunction of wheel bearing

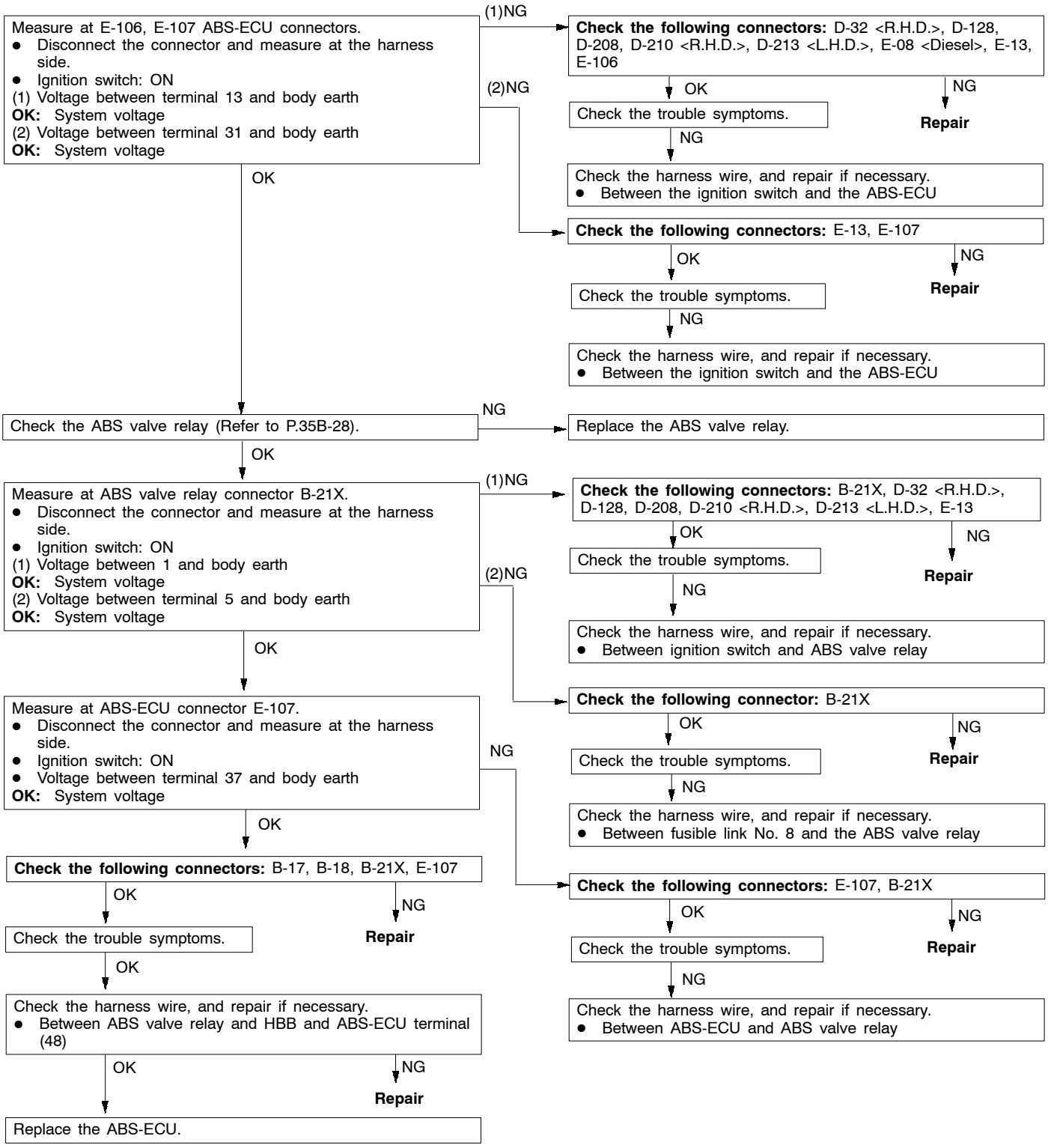


Code No. 15 Wheel speed sensor system (output signal abnormality)	Probable cause
This malfunction code is output when any one of the wheel speed sensor output signals during driving is abnormal (except open and short circuit).	• Uneven tyre size for all four wheels • Incorrect wheel speed sensor installation • Malfunction of wheel speed sensor • Malfunction of harness or connector • Malfunction of ABS rotor • Malfunction of wheel bearing • Malfunction of the ABS-ECU



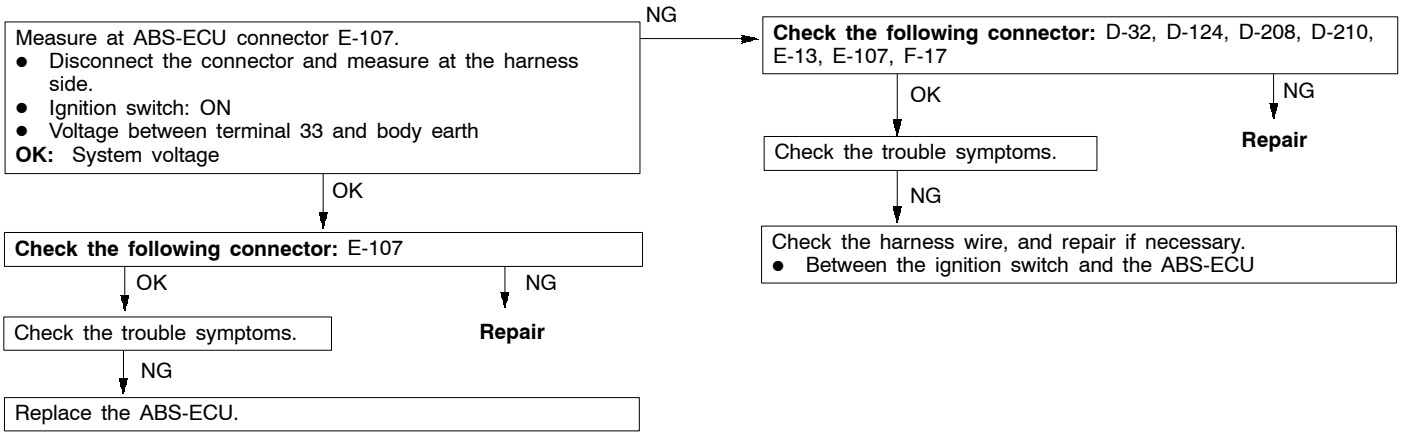
Code No.16 ABS-ECU power supply system (abnormal voltage increase or decrease)	Probable cause
This code is output if the ABS-ECU power supply voltage or valve relay power supply voltage drops below or rises above a certain level.	● Malfunction of battery ● Malfunction of harness or connector ● Malfunction of the ABS-ECU

Caution
If the system voltage drops or rises during inspection, this code will be output to indicate a current problem. And correct problem diagnosis will not be possible. Before carrying out the following procedure, check the battery and recharge it if necessary.



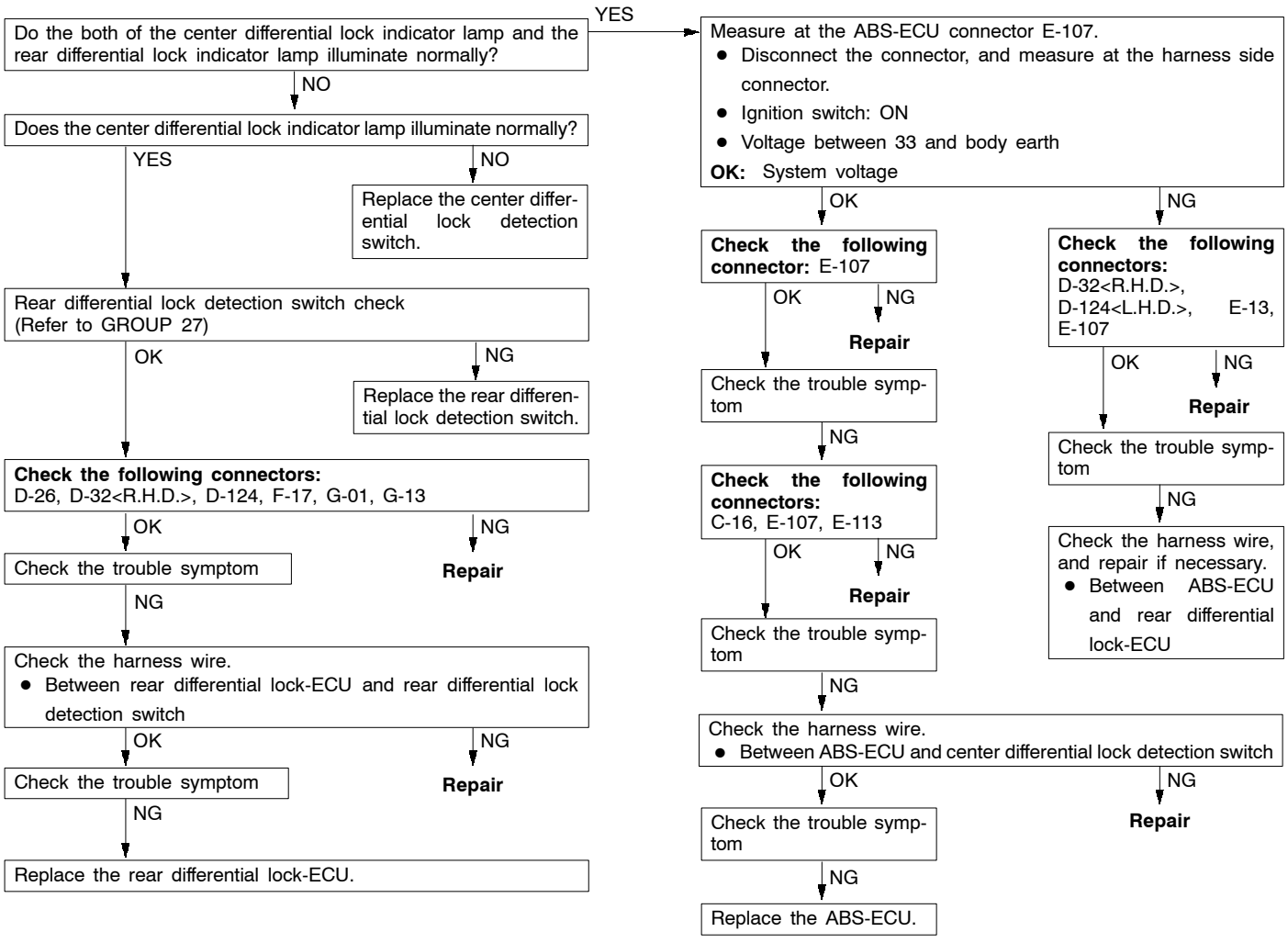
<Vehicles without rear differential lock system>

Code No. 26 Center differential lock switch system Code No. 27 Rear differential lock switch system	Probable cause
The ABS-ECU is designed to accommodate the fitting of a rear differential lock. Because of this, for vehicles which are not equipped with a rear differential lock, system voltage is applied to terminal (33) of the ABS-ECU instead of the rear differential lock switch signal. If there is an open circuit in the lines by which this system voltage is applied, the ABS-ECU outputs code Nos. 26 and 27.	● Malfunction of harness or connector ● Malfunction of the ABS-ECU



<Vehicles with rear differential lock system>

Code No.26 Center differential lock detection switch Code No.27 Rear differential lock detection switch	Probable cause
On vehicles with rear differential lock system, these codes will be set under the following conditions: ● The ABS-ECU detects an open-circuit in the center differential lock detection switch and the rear differential lock detection switch systems, so no signal is sent. ● The vehicle has been driven at 20 km/h or more for five minutes or more while the center differential lock detection switch is off and the rear differential lock detection switch is on, and then the vehicle speed decreases to 2 km/h in that condition.	● Malfunction of harness or connector ● Malfunction of the center differential lock detection switch ● Malfunction of the rear differential lock detection switch ● Malfunction of the rear differential lock-ECU ● Malfunction of the ABS-ECU



Code No. 32 G sensor system	Probable cause
This code is output at the following cases: ● When the G sensor output is lower than 0.5 V or higher than 4.5 V (Open circuit or short-circuit in G sensor circuit) ● When there is no variation in the G sensor output voltage (G sensor output seized)	● Malfunction of G sensor ● Malfunction of harness or connector ● Malfunction of the ABS-ECU

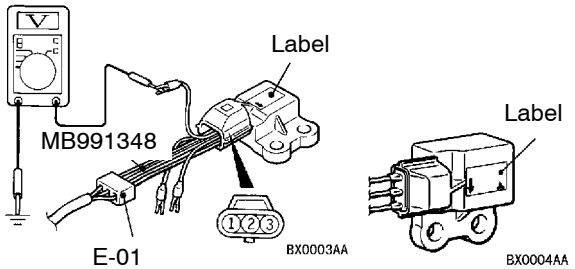
Measure at G sensor connector E-01.
- Disconnect the connector and measure at the harness side.

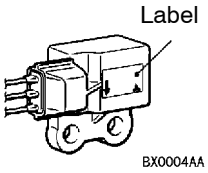
(1) Voltage between terminal 1 and body earth (Ignition switch: ON)
OK: System voltage
(2) Continuity between terminal 3 and body earth
OK: Continuity

(1)NG → **Check the following connectors:** D-32<L.H.D.>, D-208, D-210, E-01, E-115
- OK → Check the trouble symptoms.
  - NG → **Repair**
- NG → **Repair**

(2)NG → **Check the following connectors:** E-01, E-106, E-113
- OK → Check the trouble symptoms.
  - NG → **Repair**
- NG → Check the harness wire, and repair if necessary.
  - Between ignition switch and G sensor

OK ↓





- Remove the G sensor (Refer to P.35B-36).
- Connect the special tool between the G sensor harness-side connector E-01 and the G sensor.
- Ignition switch: ON
- Voltage between terminal 2 and body earth when the G sensor is placed on a level surface

OK: 2.4 - 2.6 V
- Voltage between terminal 2 and body earth when the G sensor is placed so that the label is facing straight up

OK: 3.3 - 3.7 V

NG → Replace the G sensor.

OK ↓

Check the following connectors: E-01, E-106, E-113
- NG → **Repair**
- OK ↓

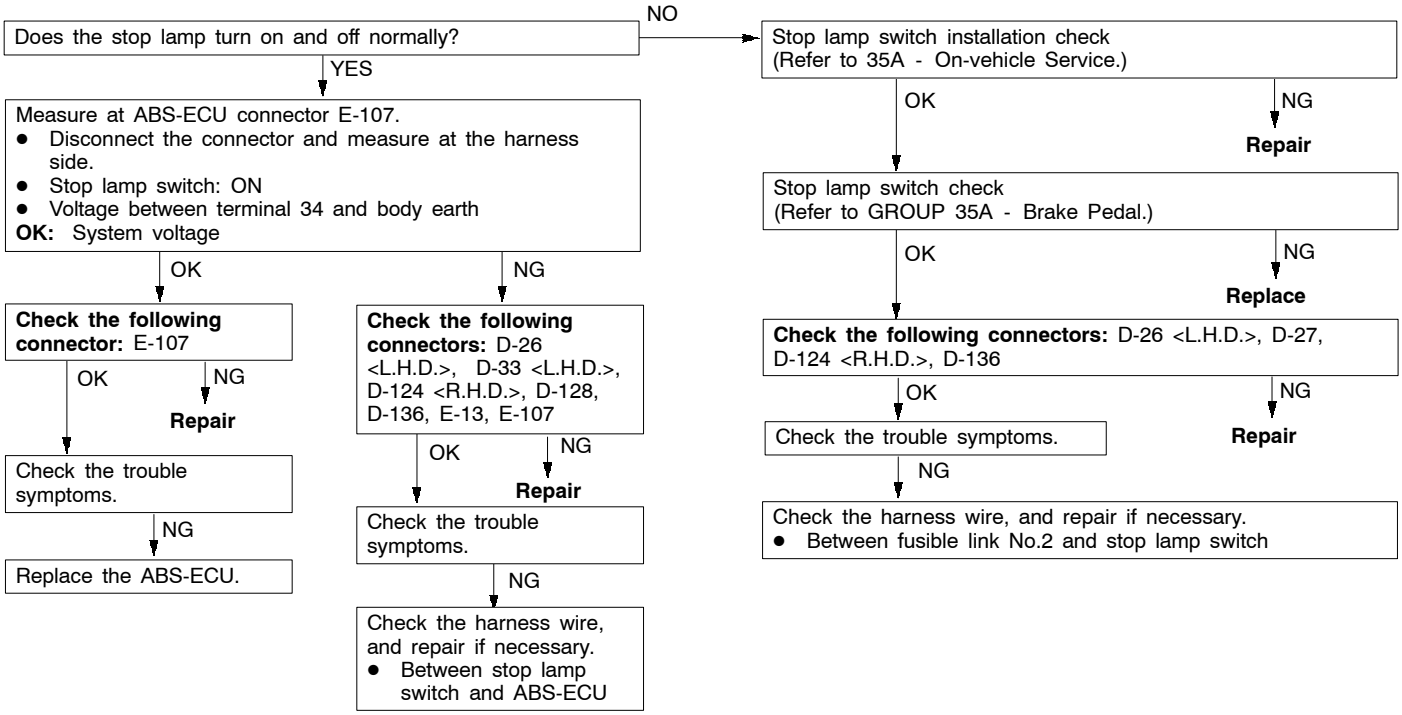
Check the trouble symptoms.
- NG ↓

Check the harness wire, and repair if necessary.
- Between the G sensor and ABS-ECU
  - NG → **Repair**
  - OK ↓

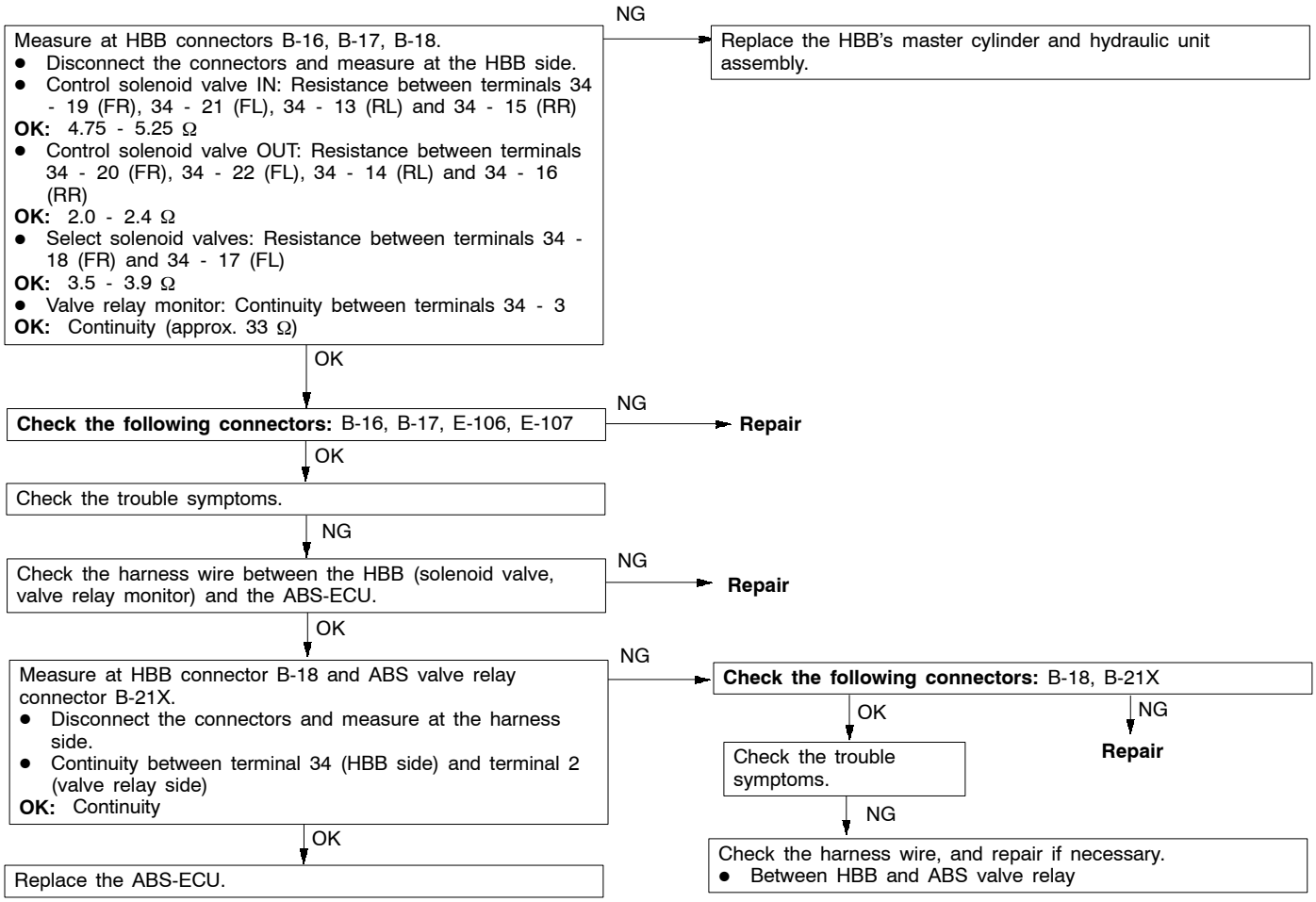
Replace the ABS-ECU.

- OK → Replace the ABS-ECU.
  - NG → **Repair**

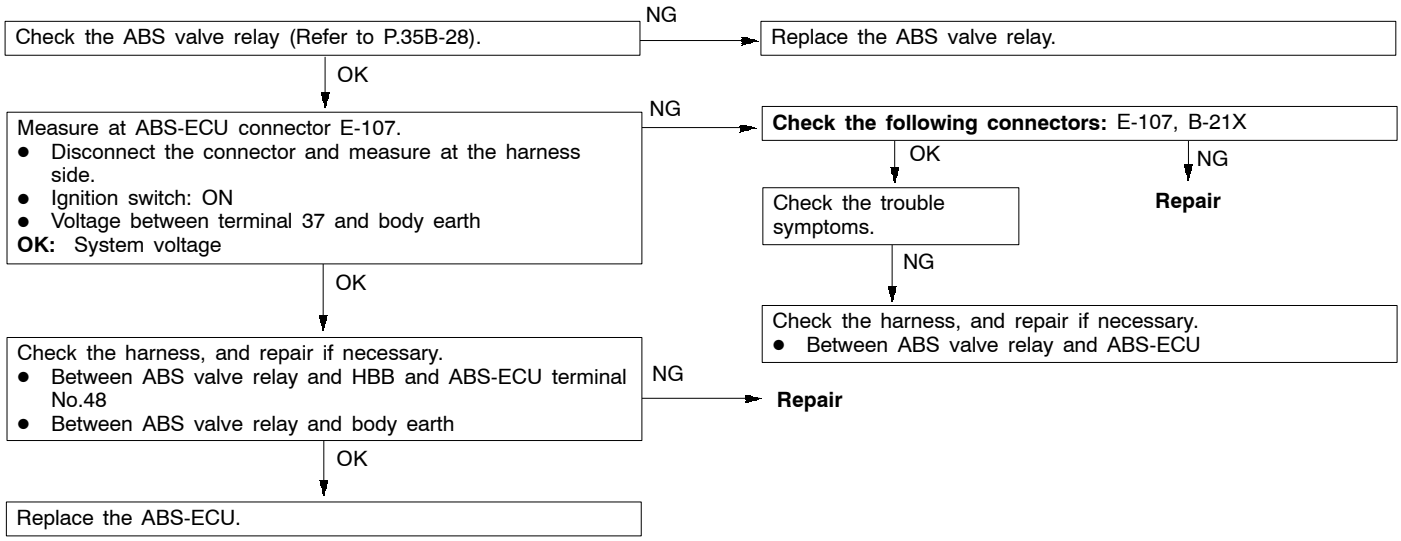
Code No. 33 Stop lamp switch system (open circuit or ON problem)	Probable cause
This code is output at the following cases: ● If the stop lamp switch is continuously on for 15 minutes or more while driving ● If there is an open circuit in the stop lamp switch input circuit harness	● Malfunction of stop lamp switch ● Malfunction of harness or connector ● Malfunction of ABS-ECU



Code No. 41, 42, 43, 44 Control solenoid valve system Code No. 45, 46 Select solenoid valve system	Probable cause
The ABS-ECU constantly monitors the solenoid valve drive circuits. These codes are output if the ABS-ECU judges that there is an open circuit or short-circuit in a solenoid coil or harness because the solenoid valve is on but no current flows to the solenoid valve, or if current continues flowing to the solenoid valve even thought the solenoid valve is off.	• Malfunction of harness or connector • Malfunction of HBB's master cylinder and hydraulic unit assembly • Malfunction of the ABS-ECU

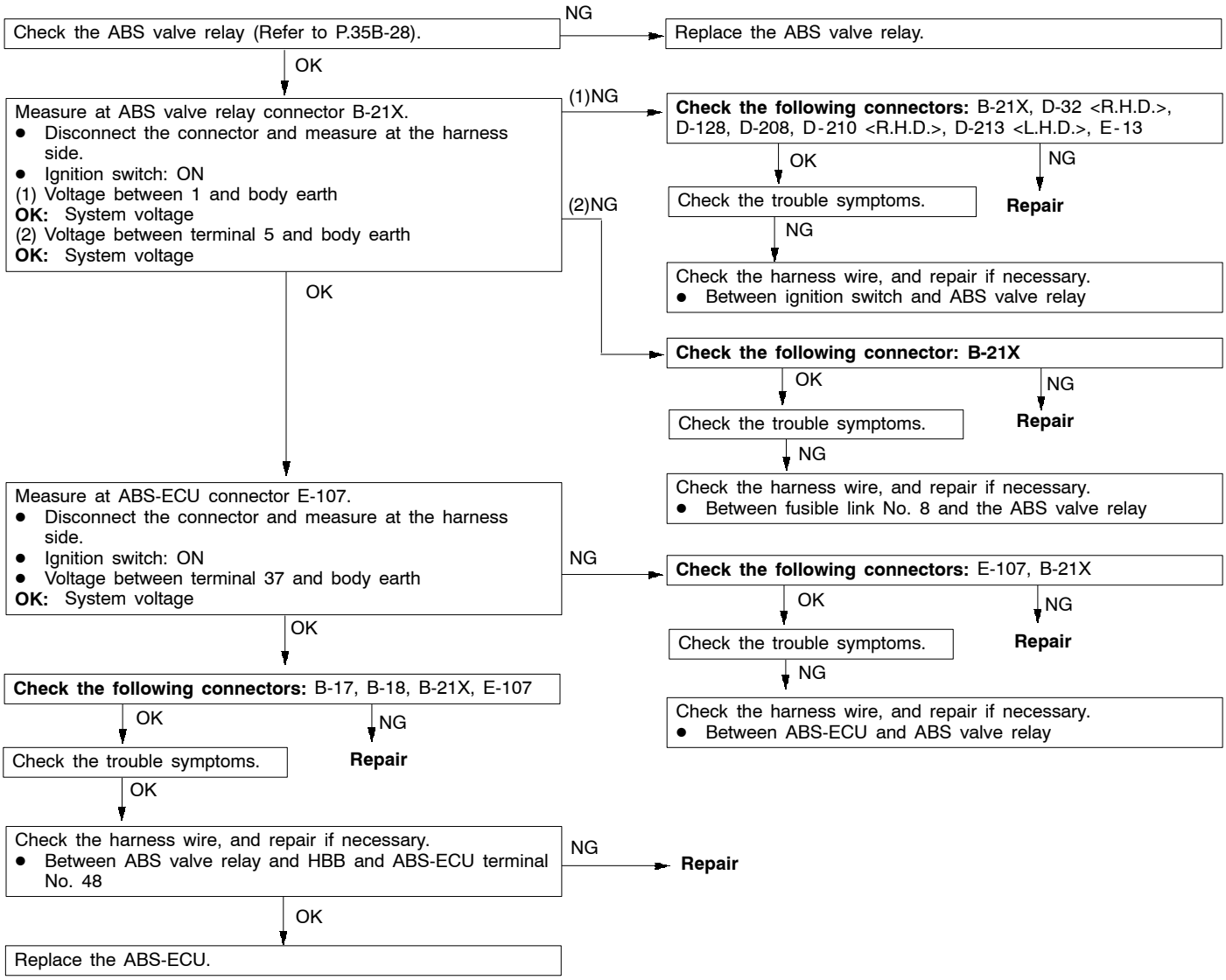


Code No. 51 Valve relay system (ON problem)	Probable cause
This code is output when the ABS-ECU judges during the initial check when the ignition switch is turned to the ON position and the valve relay is OFF that there is a fused relay contact or a short-circuit in the valve relay drive circuit when power is being supplied to the solenoid valve.	• Malfunction of harness or connector • Malfunction of ABS valve relay • Malfunction of the ABS-ECU



Code No. 52 Valve relay system (OFF problem)	Probable cause
This code is output if the ABS-ECU judges that there is a valve relay OFF problem when the valve relay is on and power is supplied to the solenoid valve.	● Malfunction of harness or connector ● Malfunction of ABS valve relay ● Malfunction of the ABS-ECU

NOTE
When reading the diagnosis codes using the ABS warning lamp (Refer to P.35B-5.), the valve relay connector is disconnected during inspection, with the result that this problem code will be output in addition to any other problem codes.
After the problem locations indicated by the problem diagnosis codes have been checked and repaired but the ABS warning lamp remains illuminated and no diagnosis codes other than code No. 52 are displayed, there is probably a malfunction of the valve relay system. In this case, carry out the following inspection.



INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble Symptom	Inspection procedure No.	Reference page
Communication with MUT-II is not possible.	1	35B-18
Communication with MUT-II and the ABS-ECU is not possible.	2	35B-19
The ABS warning lamp does not illuminate when the ignition key is turned to ON (engine stopped).	3	35B-20
The ABS warning lamp remains illuminated after the engine has started.	4	35B-20
The brake warning lamp does not illuminate when the ignition switch is turned ON (engine stopped).	Refer to GROUP 35A.	
The brake warning lamp remains illuminated after the engine has started.		
Abnormal brake operation	5	35B-21

Caution

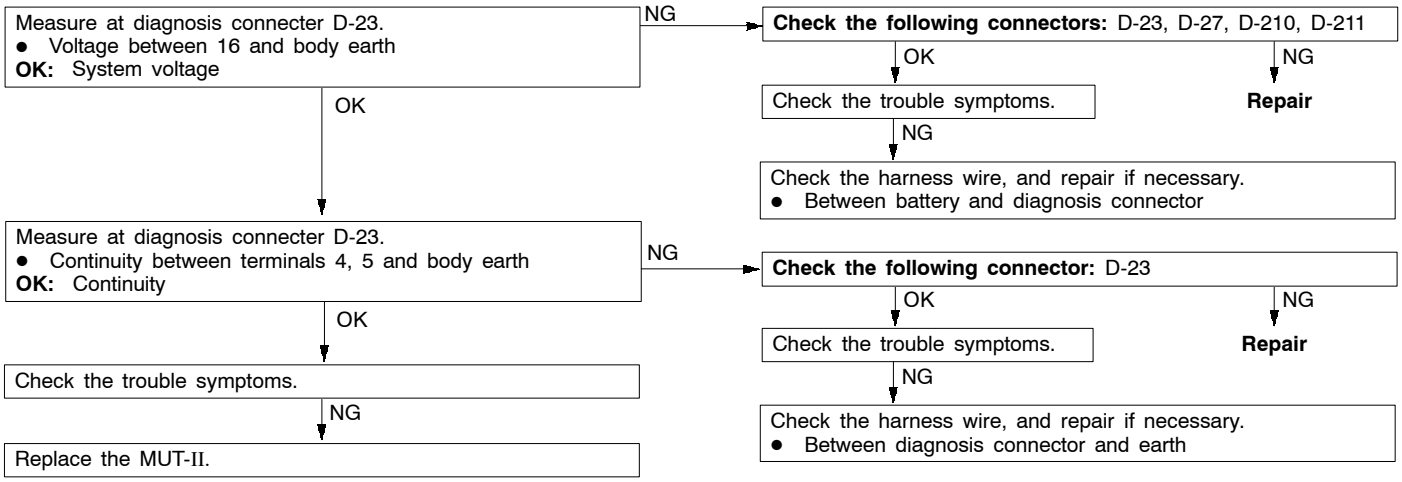
(1) Because the ABS may also operate at times when sudden braking is not being carried out, such as when driving on low frictional coefficient roads, when turning at high speed or during high-speed overtaking, check with the customer that the problems are not occurring when driving under conditions such as these.

(2) When the ABS is operating, changes in the brake pedal feel (vibration and difficulty depressing the pedal) may occur. This happens because the hydraulic pressure inside the brake line is continually changing in order to stop the wheels from locking up, and is not a malfunction.

INSPECTION PROCEDURES FOR TROUBLE SYMPTOMS

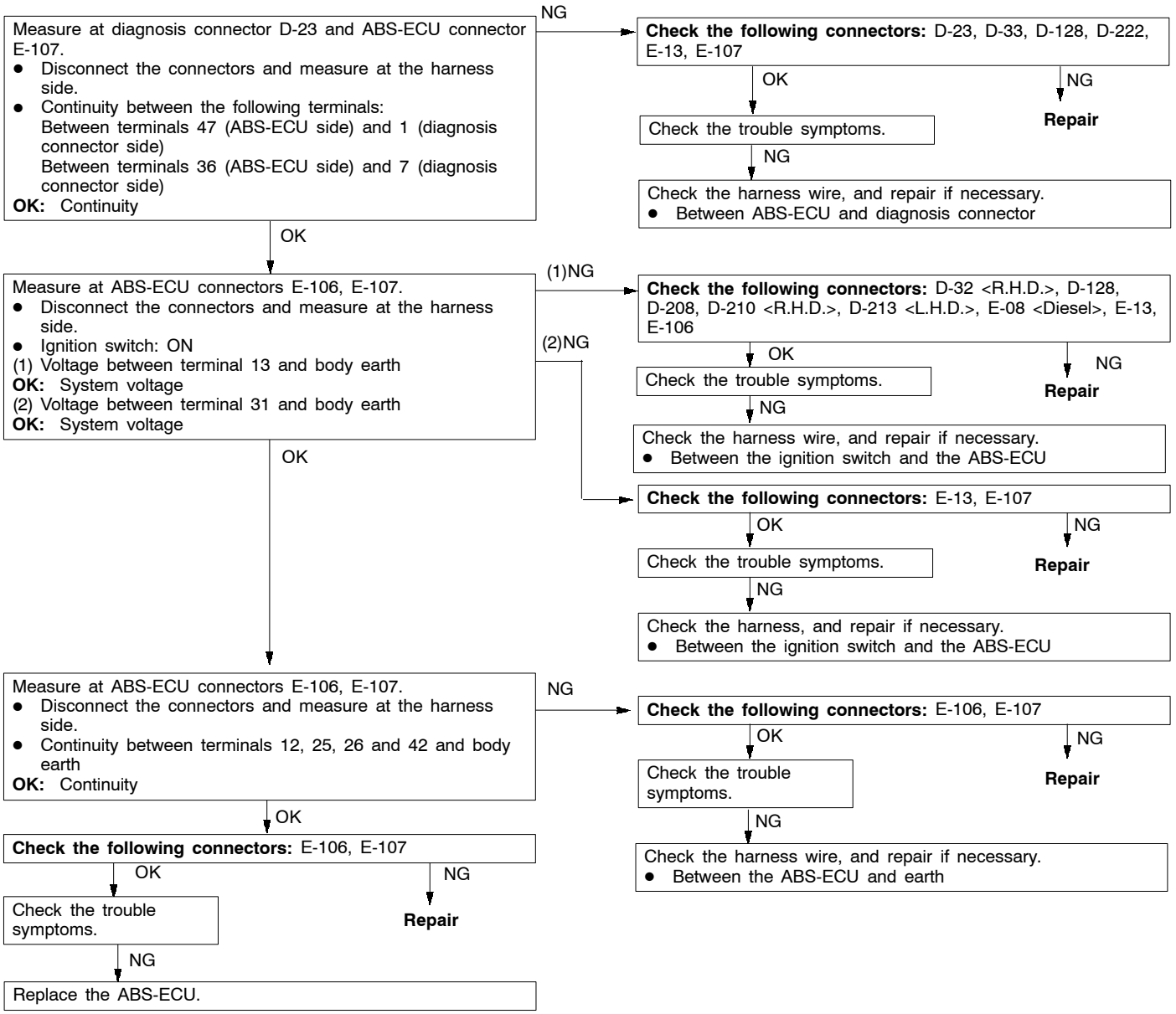
Inspection procedure 1

Communication with MUT-II is not possible.	Probable cause
The cause is probably a malfunction of the diagnosis connector power supply circuit or earth circuit.	● Malfunction of diagnosis connector ● Malfunction of harness or connector



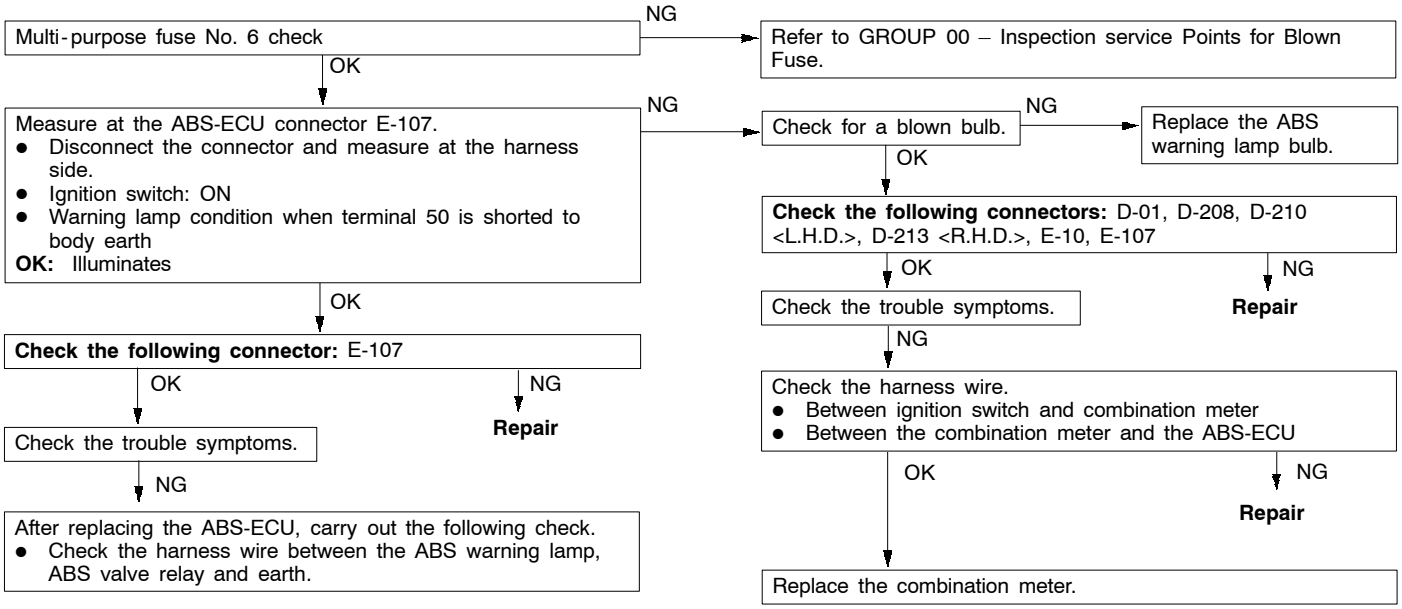
Inspection procedure 2

Communication with MUT-II and the ABS-ECU is not possible.	Probable cause
The cause is probably an open circuit in the ABS-ECU power supply circuit or an open circuit in the diagnosis output circuit.	• Blown fuse • Malfunction of harness or connector • Malfunction of the ABS-ECU



Inspection procedure 3

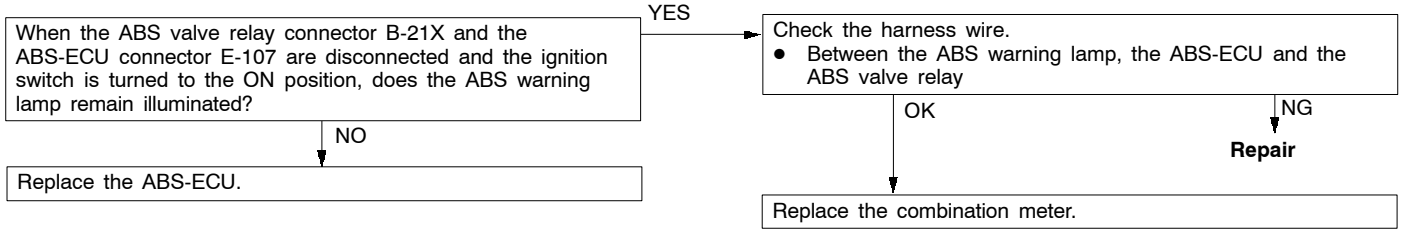
The ABS warning lamp does not illuminate when the ignition key is turned to ON (engine stopped).	Probable cause
When power is first supplied to the ABS-ECU, the ABS-ECU turns the ABS-ECU valve relay from off to on, off and back to on again as part of its initial check. Accordingly, if the ABS warning lamp does not illuminate, the cause is probably an open circuit in the ABS warning lamp power supply circuit, a blown lamp bulb or an open circuit between the ABS warning lamp and the ABS-ECU.	• Blown fuse • Blown ABS warning lamp bulb • Malfunction of ABS valve relay • Malfunction of harness or connector • Malfunction of combination meter • Malfunction of the ABS-ECU



Inspection procedure 4

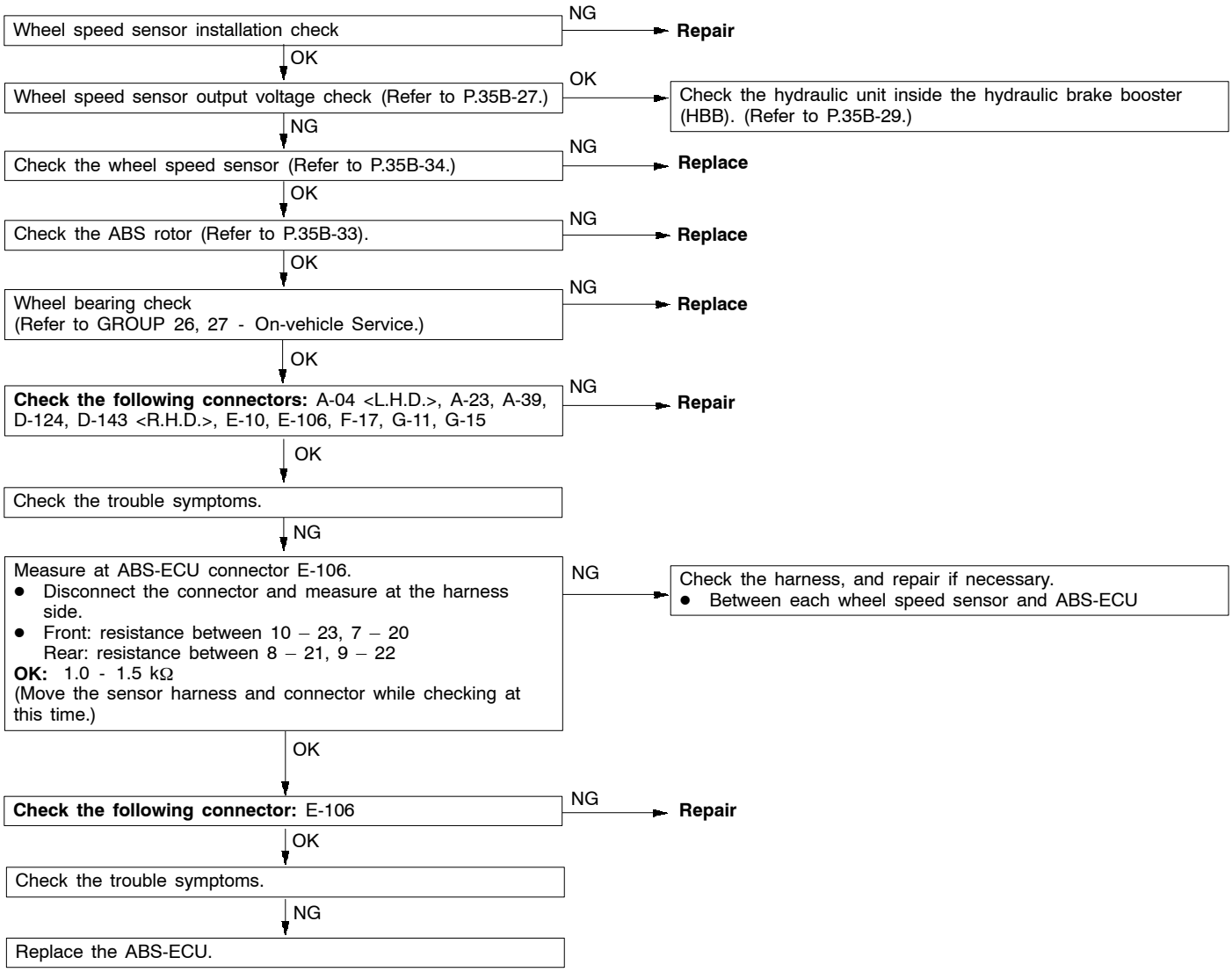
The ABS warning lamp remains illuminated after the engine has started.	Probable cause
The cause is probably a short-circuit in the ABS warning lamp illumination circuit.	• Malfunction of combination meter • Malfunction of harness (short-circuit) • Malfunction of the ABS-ECU

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

Abnormal brake operation	Probable cause
Braking operation varies depending on the driving conditions and the road surface, which can make it difficult to diagnose a problem. However, if the diagnosis codes displayed are normal, carry out the following inspection procedure.	• Incorrect wheel speed sensor installation • Malfunction of harness or connector • Malfunction of wheel speed sensor • Malfunction of ABS rotor • Foreign material adhering to speed sensor • Malfunction of wheel bearing • Malfunction of HBB • Malfunction of the ABS-ECU



DATA LIST REFERENCE TABLE

The following ECU input data items can be read using the MUT-II.

(1) When system is normal

Item No.	Check item	Inspection conditions		Normal condition
11	Front-right wheel speed	When vehicle is being driven		Speedometer display and MUT-II display are identical.
12	Front-left wheel speed			
13	Rear-right wheel speed			
14	Rear-left wheel speed			
16	System voltage	Ignition switch: ON		6.5-22.3 V
26	Center differential lock switch	Ignition switch: ON	Transfer selector lever position: 2H, 4H	OFF
			Transfer selector lever position: 4HLc, 4LLc	ON
27	Rear differential lock switch	Ignition switch: ON		OFF
32	G sensor	• Ignition switch: ON • When vehicle is stationary (level)		2.4-2.6 V
		When vehicle is being driven		1.0-4.0 V
33	Stop lamp Switch	Ignition switch: ON	When brake pedal is depressed	ON
			When brake pedal is released	OFF

(2) When system is interrupted by the ECU
When the diagnosis function has caused the operation of the ABS-ECU to be stopped, the MUT-II display data may be different from the actual condition.

ACTUATOR TEST TABLE

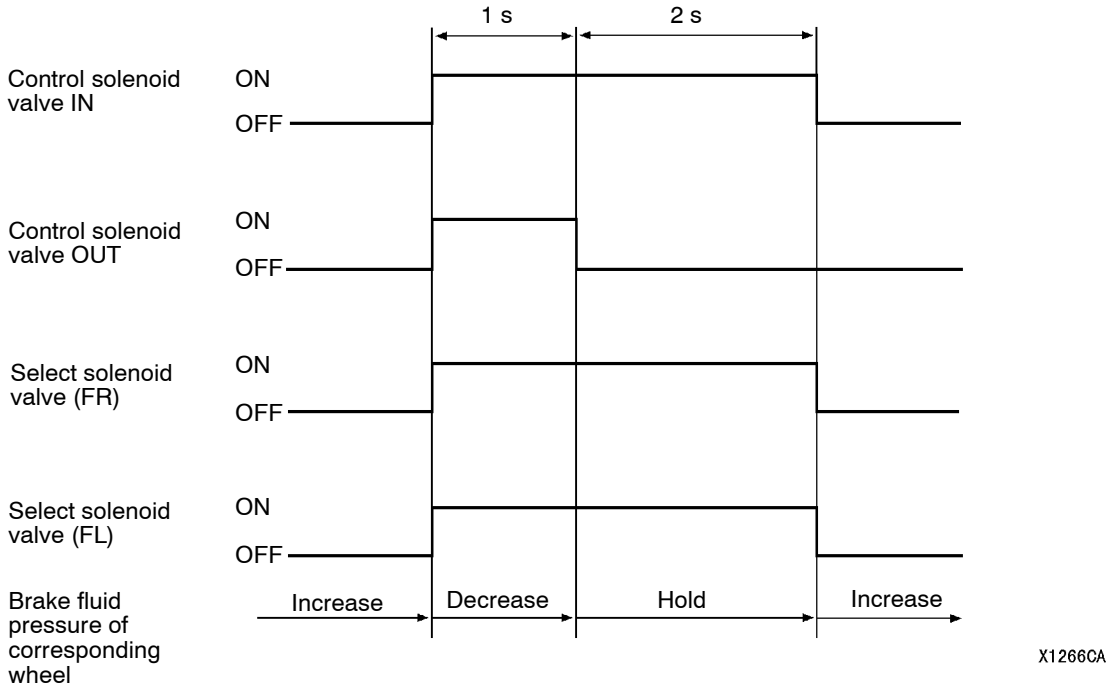
The following actuators can be force-driven using the MUT-II.

NOTE
(1) Actuator tests cannot be carried out when the operation of the ABS-ECU has been stopped by the fail-safe function.
(2) Actuator tests can only be carried out while the vehicle is stopped.

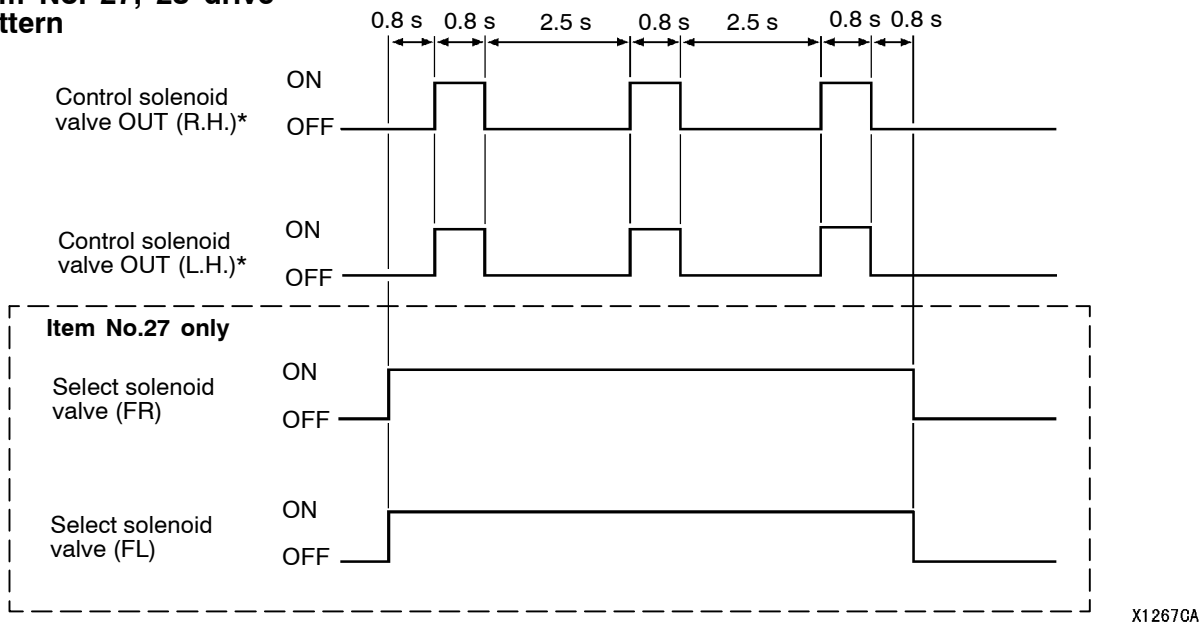
ACTUATOR TEST SPECIFICATIONS

Item No.	Check item	Drive Contents
01	FR wheel solenoid valve	HBB select solenoid valves and control solenoid valves for the respective channel
02	FL wheel solenoid valve	
03	RR wheel solenoid valve	
04	RL wheel solenoid valve	
27	Air bleeding (1)	HBB select solenoid valves and control solenoid valve OUT (FR, FL)
28	Air bleeding (2)	HBB control solenoid valve OUT (RR, RL)

Item No. 01 - 04 drive pattern

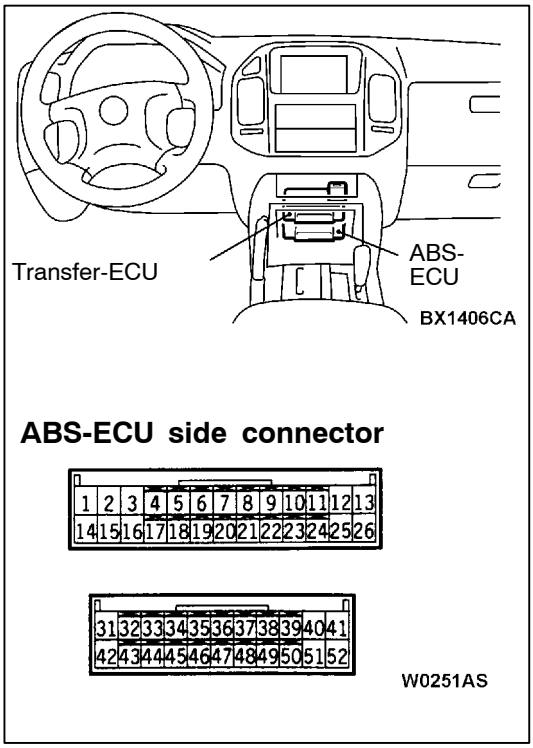


Item No. 27, 28 drive pattern



NOTE

*: When carrying out item No. 27, the front wheels are driven, and when carrying out item No. 28, the rear wheels are driven.



CHECK AT ABS-ECU TERMINAL

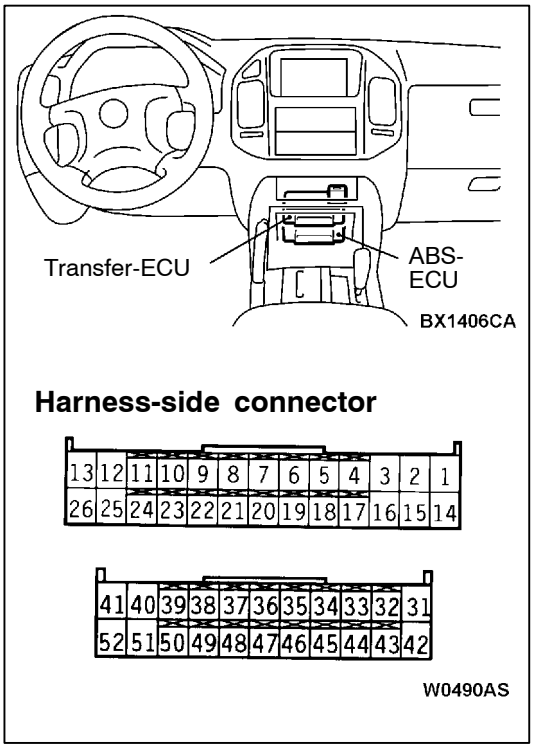
TERMINAL VOLTAGE TABLE

NOTE
There are two ECUs with the same shape inside the floor console, one above the other. The upper ECU is the ABS-ECU and has a blue connector. The lower ECU is the transfer-ECU and has a green connector.

(1) Measure the voltages between the respective terminal and earth.
(2) The terminal layout is shown in the illustration.

Terminal No.	Check item	Inspection conditions		Normal condition
1	Control solenoid valve OUT (FL)	Ignition switch: ON		System voltage
2	Control solenoid valve OUT (RR)	Ignition switch: ON		System voltage
3	Select solenoid valve (FL)	Ignition switch: ON		System voltage
4	G sensor input	Ignition switch: ON Vehicle horizontal position		2.4 - 2.6 V
13	ABS-ECU power supply	Ignition switch: ON		System voltage
		Ignition switch: START		0 V
14	Control solenoid valve IN (FL)	Ignition switch: ON		System voltage
15	Control solenoid valve IN (RR)	Ignition switch: ON		System voltage
16	Select solenoid valve (FR)	Ignition switch: ON		System voltage
18	G sensor earth	At all times		0.5 V or less
31	ABS-ECU power supply	Ignition switch: ON		System voltage
		Ignition switch: START		0 V
33	Rear differential lock switch	Ignition switch: ON		System voltage
34	Stop lamp switch input	Ignition switch: ON	Stop lamp switch: ON	System voltage
			Stop lamp switch: OFF	2 V or less
36	MUT-II	When the MUT-II is connected		Serial communication with the MUT-II
		When the MUT-II is not connected		1 V or less

Terminal No.	Check item	Inspection conditions		Normal condition
37	ABS valve relay output	Ignition switch: ON	When system abnormality is detected and relay is off	System voltage
			When relay is on approx. 1 second after engine starts	2 V or less
39	Brake warning lamp output	Ignition switch: ON	When lamp is switched off	2 V or less
			When lamp is illuminated	System voltage
40	Control solenoid valve OUT (RL)	Ignition switch: ON		System voltage
41	Control solenoid valve OUT(FR)	Ignition switch: ON		System voltage
46	Center differential lock switch input <Super Select 4WD-II>	Ignition switch: ON	Transfer selector lever position: 2H, 4H	System voltage
			Transfer selector lever position: 4HLc, 4LLc	2 V or less
	4WD detection switch input <Part time 4WD>	Ignition switch: ON	Transfer selector lever position: 2H	System voltage
			Transfer selector lever position: 4H	2 V or less
47	Diagnosis select input	When the MUT-II is connected		1 V or less
		When the MUT-II is not connected		Approx. 12 V
48	Valve relay monitor	Ignition switch: ON		System voltage
50	ABS warning lamp output	Ignition switch: ON	When lamp is switched off	System voltage
			When lamp is illuminated	2 V or less
51	Control solenoid valve IN (RL)	Ignition switch: ON		System voltage
52	Control solenoid valve IN (FR)	Ignition switch: ON		System voltage

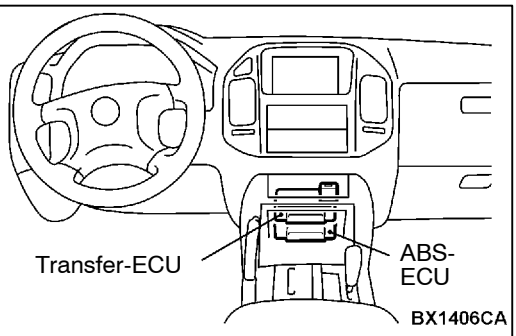


CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

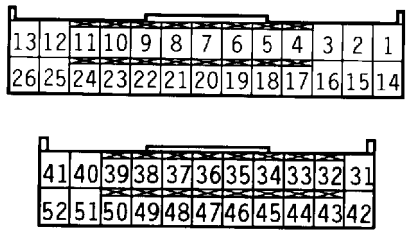
NOTE
There are two ECUs with the same shape inside the floor console, one above the other. Th upper ECU is the ABS-ECU and has a blue connector. The lower ECU is the transfer-ECU and has a green connector.

(1) Turn the ignition switch to the LOCK (OFF) position.
(2) Check the resistances and continuity with the ABS-ECU connector disconnected.
(3) Check the resistances and continuity between the terminals listed in the table below.
(4) The terminal layout is shown in the illustration.

Terminal No.	Signal name	Normal condition
7 - 20	Wheel speed sensor (FL)	1.0 - 1.5 kΩ
8 - 21	Wheel speed sensor (RR)	
9 - 22	Wheel speed sensor (RL)	
10 - 23	Wheel speed sensor (FR)	
Between terminal 12 and body earth	Earth	Continuity
Between terminal 25 and body earth	Earth	
Between terminal 26 and body earth	Earth	
Between terminal 42 and body earth	Earth	



Harness-side connector



ON-VEHICLE SERVICE

WHEEL SPEED SENSOR OUTPUT VOLTAGE MEASUREMENT

NOTE
There are two ECUs with the same shape inside the floor console, one above the other. The upper ECU is the ABS-ECU and has a blue connector. The lower ECU is the transfer-ECU and has a green connector.

(1) Lift up the vehicle and release the parking brake.
(2) Disconnect the ABS-ECU connector and measure at the harness-side connector.
(3) Rotate the wheel to be measured by 1/2 to 1 turn , and use a multimeter (AC mV range) or an oscilloscope to check the output voltage at this time.

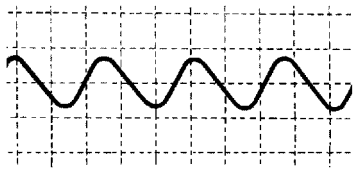
Terminal No.

Front-left	Front-right	Rear-left	Rear-right
7	10	9	8
20	23	22	21

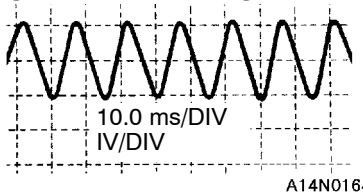
Output voltage:
42 mV or higher when measured using a multimeter
120 mVP-P or more when measured using an oscilloscope

(4) If the output voltage is lower than that given above, the cause may be the following, so check or replace the wheel speed sensor if necessary.
- Excessive clearance between pole piece of wheel speed sensor and ABS rotor
- Malfunction of wheel speed sensor

When rotated by hand



When engine is idling (5 - 6 km/h)
D range (A/T) or 1st gear (M/T)



WAVE PATTERN INSPECTION USING AN OSCILLOSCOPE

After checking the connection of the wheel speed sensor harness and the connector, take a reading of the output voltage wave patterns for each wheel speed sensor using an oscilloscope as follows.
Start the engine, move the transfer selector lever to the 4H position and the transmission selector lever to D range (A/T) or 1st gear (M/T), and then spin the wheel.

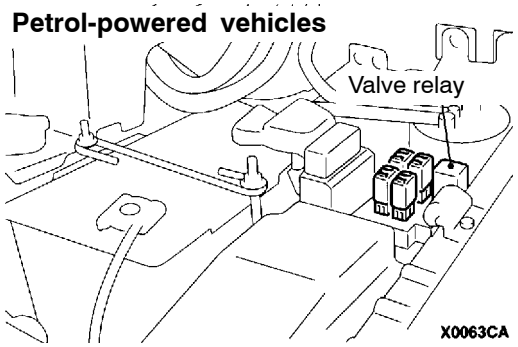
NOTE
(1) You can also take a reading of the wave pattern by actually driving the vehicle in this condition.
(2) The output voltage will be lower when the wheel speed is lower, and will become higher as the wheel speed becomes higher.

WAVE PATTERN OBSERVATION POINTS

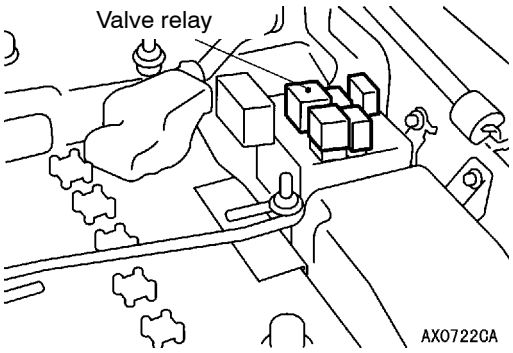
Symptom	Cause	Remedy
Wave pattern amplitude is too small or is non-existent.	Malfunction of wheel speed sensor	Replace the sensor.
Excessive variation in wave pattern amplitude (However, this is not a problem if the minimum amplitude is 120 mV or higher.)	Excessive axle hub runout or offset	Replace the hub.
	Malfunction of ABS-ECU earth	Repair
Noise appearing in wave pattern, or distorted wave pattern	Open circuit in sensor	Replace the sensor.
	Open circuit in harness	Repair the harness.
	Incorrect wheel speed sensor installation	Install the sensor correctly.
	Chipped or broken ABS rotor teeth	Replace the ABS rotor.

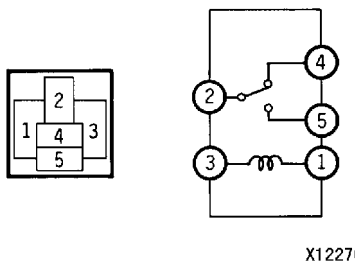
Caution
The wheel speed sensor cables move together with the movement of the front and rear suspension. Accordingly, you should shake the sensor harnesses while observing the wheel speed sensor output voltage wave patterns.

Petrol-powered vehicles



Diesel-powered vehicles





ABS VALVE RELAY CONTINUITY CHECK

Battery voltage	Terminal No.				
	1	2	3	4	5
When no current is supplied	○		○		
		○		○	
When current is supplied	⊕		⊖		
		○			○

HYDRAULIC BRAKE BOOSTER (HBB) - HYDRAULIC UNIT CHECK

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

(1) Jack up the vehicle, and support it in the specified location using a rigid rack, or place the vehicle on the rollers of a brake force tester.

Caution
1. The rollers of the brake force tester and the vehicle tyres should be dry during checking.
2. If using a brake force tester, apply the parking brake when testing the front brakes, and use a wheel lock to lock the front wheels when testing the rear brakes.

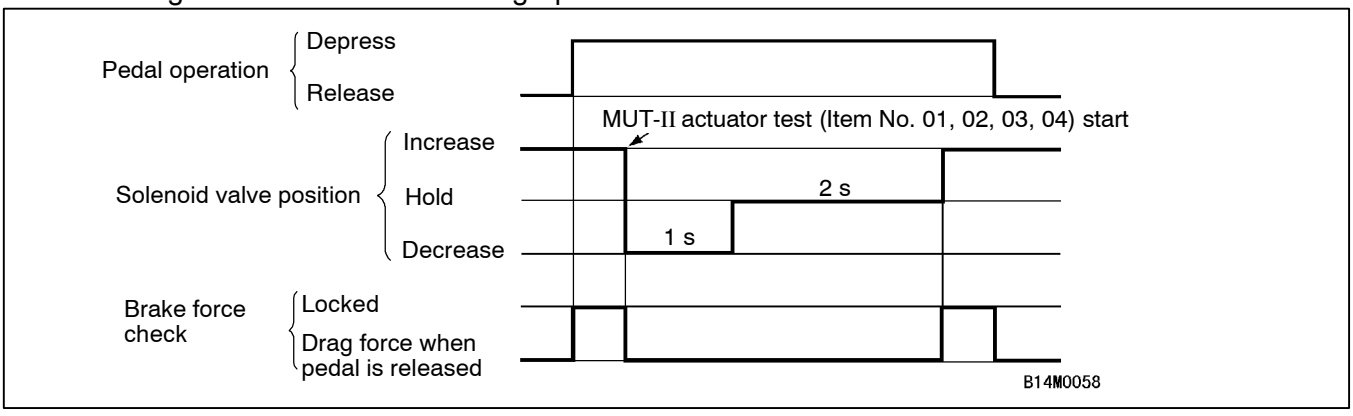
(2) Turn the ignition switch to the LOCK (OFF) position, and connect the MUT-II to the diagnosis connector.
(3) After checking that the selector lever is in the N position, start the vehicle's engine.
(4) Operate the MUT-II to carry out the actuator tests.

NOTE
1) When actuator tests are being carried out, the ABS warning lamp will illuminate and ABS control will be stopped.
2) MUT-II actuator tests cannot be carried out when the operation of the ABS-ECU has been stopped by the fail-safe function.

(5) Rotate the wheel by hand and check that the brake force changes when the brake pedal is depressed. If using a brake force tester, depress the brake pedal until the brake force reaches the following value, and then cheek that the brake force changes when the actuator test is carried out.

Front wheels	785 - 981 N
Rear wheels	785 - 981 N

Caution
The solenoid valves should be driven one wheel at a time, and the brake pedal should be released each time a wheel is checked.
The following illustration shows this in graphical form.

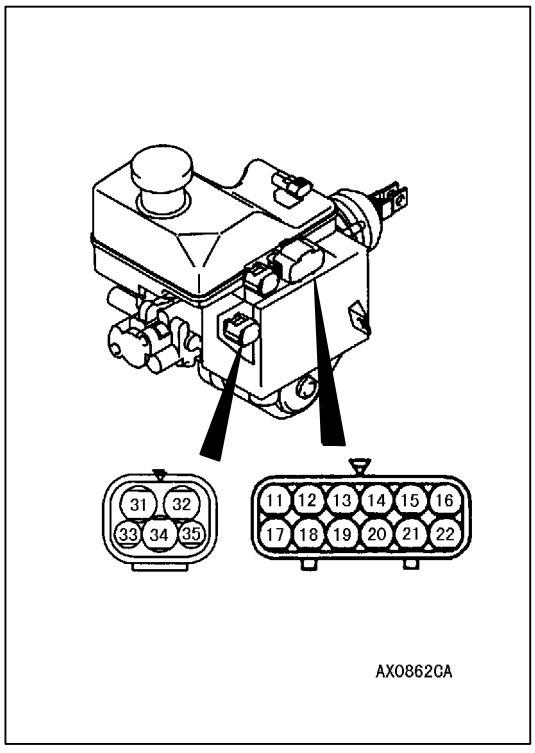


(6) If the results of checking show an abnormality, fix the problem by following the “Judgment Table” below.

Judgment Table

No.	MUT-II display	Operation	Judgment		Cause	Remedy
			Normal	Problem		
01	FR valve	(1) Depress the brake pedal to lock the wheels. (2) Use the MUT-II to select the wheel to be checked, and then force-drive the actuator. (3) Check the brake force for the selected wheel using a brake force tester or by rotating the wheel by hand.	Brake force lessens for 3 seconds after locking.	Wheel does not lock when brake pedal is depressed.	Blocked brake line other than HBB line	Check and clean the brake line.
02	FL valve				Blocked hydraulic circuit inside HBB	Replace the HBB.
03	RR valve			Brake force does not lessen.	HBB brake tubes connected incorrectly	Connect the tubes correctly.
04	RL valve				Malfunction of HBB solenoid valve	Replace the HBB.

(7) After checking, turn the ignition switch to the LOCK (OFF) position and then disconnect the MUT-II.



SOLENOID VALVE CHECK

Measure the resistance between the following solenoid valve terminals.

- Control solenoid valve IN (FR):
  Between terminals 19 - 34
- Control solenoid valve OUT (FR):
  Between terminals 20 - 34
- Control solenoid valve IN (FL)
  : Between terminals 21 - 34
- Control solenoid valve OUT (FL)
  : Between terminals 22 - 34
- Control solenoid valve IN (RR)
  : Between terminals 15 - 34)
- Control solenoid valve OUT (RR)
  : Between terminals 16 - 34
- Control solenoid valve IN (RL)
  : Between terminals 13 - 34
- Control solenoid valve OUT (RL)
  : Between terminals 14 - 34
- Select solenoid valve (FR)
  : Between terminals 18 - 34
- Select solenoid valve (FL)
  : Between terminals 17 - 34

Standard value:

Control solenoid valve IN: 4.75 - 5.25 Ω
Control solenoid valve OUT: 2.0 - 2.4 Ω
Select solenoid valve: 3.5 - 3.9 Ω

WHEN THE BATTERY IS FLAT

If the engine is started using a booster cable when the battery is completely flat, and the vehicle is then driven without waiting for the battery to be recharged, the engine may misfire and it may not be possible to drive the vehicle. This is because the ABS consumes a large amount of current when carrying out its initial checks. If this happens, recharge the battery fully.

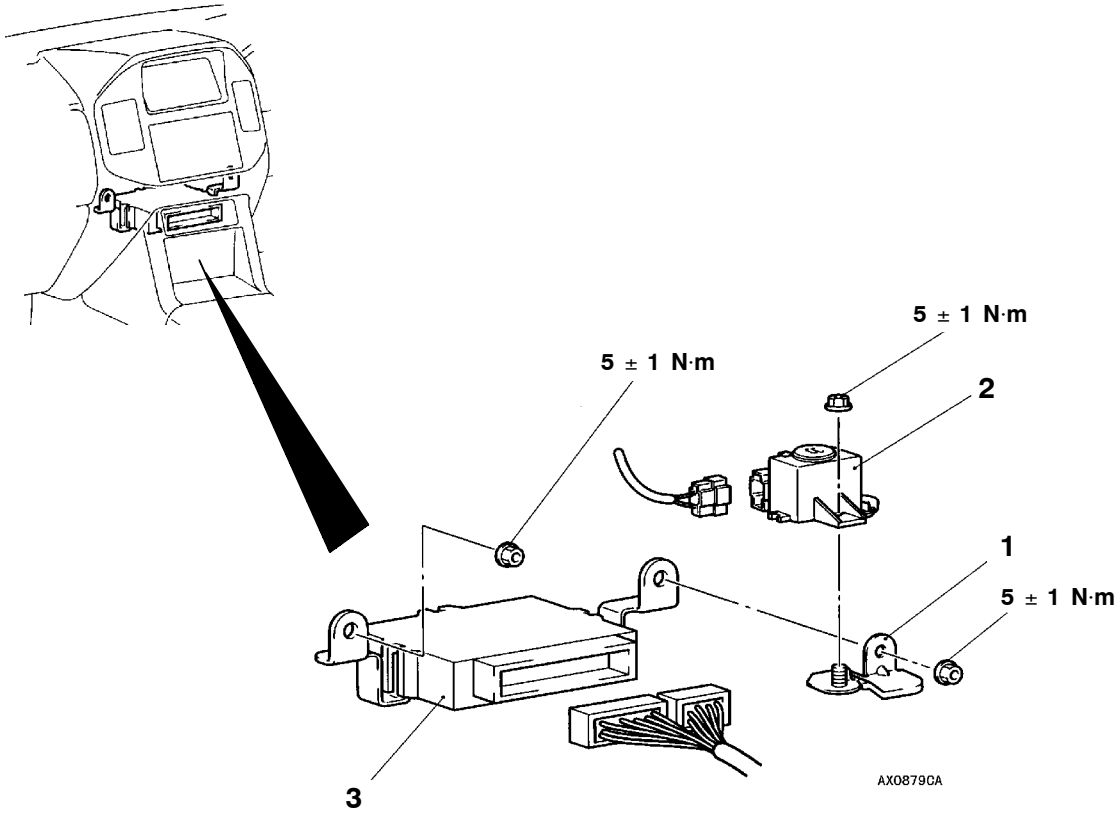
Caution

The vehicle posture will be unstable during braking, so do not drive the vehicle with the ABS-ECU connector disconnected or with the ABS not operating for any other reason.

ABS-ECU

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations
Indicator panel and front panel removal and installation (Refer to GROUP 52A - Floor Console.)



Removal steps

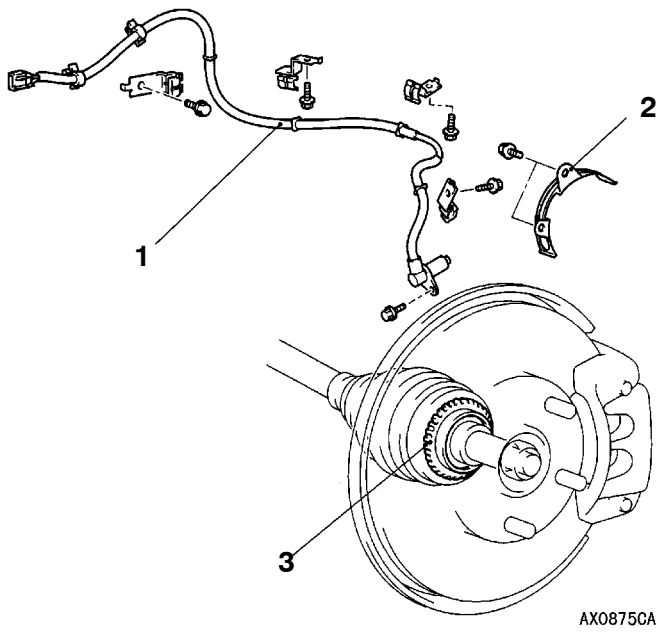
1. Buzzer bracket
2. Buzzer
3. ABS-ECU

WHEEL SPEED SENSOR

REMOVAL AND INSTALLATION

Post-installation Operations
Wheel speed sensor output voltage measurement (Refer to P.35B-27.)

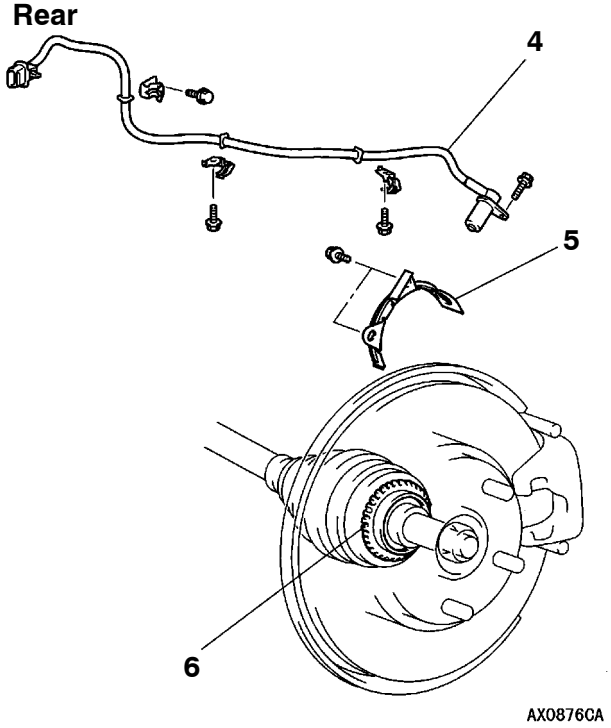
Front



Front wheel speed sensor removal steps

◀A▶ 1. Front wheel speed sensors
2. Front ABS rotor protector
3. Front ABS rotor
(Refer to GROUP 26 - Drive Shaft.)

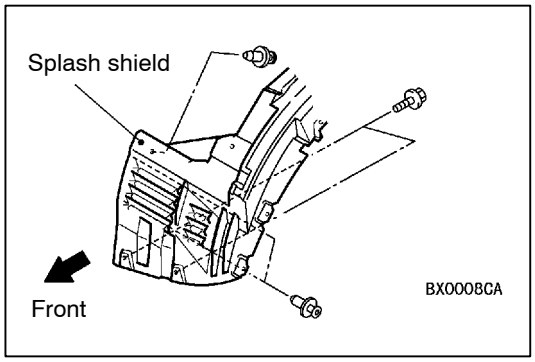
Rear



Rear wheel speed sensor removal steps

◀B▶ 4. Rear wheel speed sensor
5. Rear ABS rotor protector
6. Rear ABS rotor
(Refer to GROUP 27 - Drive Shaft.)

NOTE
The front and rear ABS rotors are integrated with the drive shaft and cannot be disassembled.



REMOVAL SERVICE POINTS

◀A▶ FRONT WHEEL SPEED SENSOR REMOVAL

(1) Remove the three splash shield clips and the two bolts shown in the illustration, and then disconnect the front wheel speed sensor connector.
(2) Remove the front wheel speed sensor.

Caution
When removing the wheel speed sensor, be careful not to strike the pole piece at the end against the teeth of the ABS rotor or against any other nearby parts.

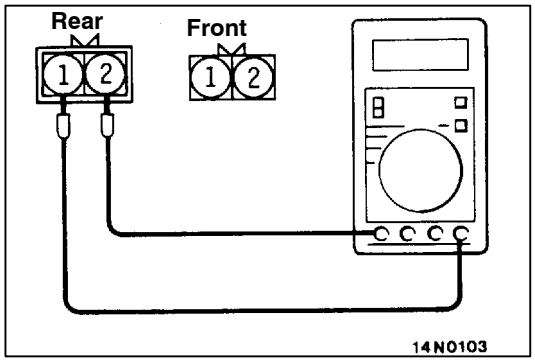
◀B▶ REAR WHEEL SPEED SENSOR REMOVAL

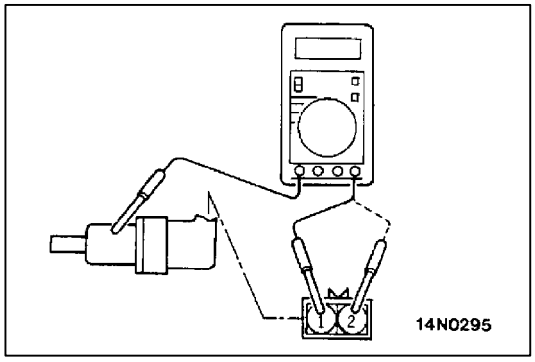
Caution
When removing the wheel speed sensor, be careful not to strike the pole piece at the end against the teeth of the ABS rotor or against any other nearby parts.

INSPECTION

WHEEL SPEED SENSOR TERMINAL RESISTANCE CHECK

Caution
The wheel speed sensors have magnets built into the sensors which magnetize the pole pieces. Because of this, care should be taken not to let metallic foreign particles get onto the pole pieces. In addition, if the poles become damaged, the sensors may not be able to detect the wheel speed correctly.





(1) Measure the resistance between the wheel speed sensor terminals.

Standard value: 1.0 - 1.5 kΩ

If the internal wheel speed sensor resistance is outside the standard value range, replace the wheel speed sensor with a new one.

(2) Check for open circuits in the wheel speed sensor cable. If a problem is found, replace the cable with a new one.

NOTE
When carrying out open circuit checks, remove the cable clamps from the vehicle, and flex the cable near the clamp locations to see if there are any transient open circuits. Also check the connection of the connector and that the terminals are inserted correctly.

WHEEL SPEED SENSOR INSULATION CHECK

(1) After removing the wheel speed sensor, measure the insulation resistance between terminals (1) and (2) and the wheel speed sensor body.

Standard value: 100 kΩ or more

(2) If the wheel speed sensor insulation resistance is outside the standard value range, replace the sensor with a new one.

ABS ROTOR CHECK

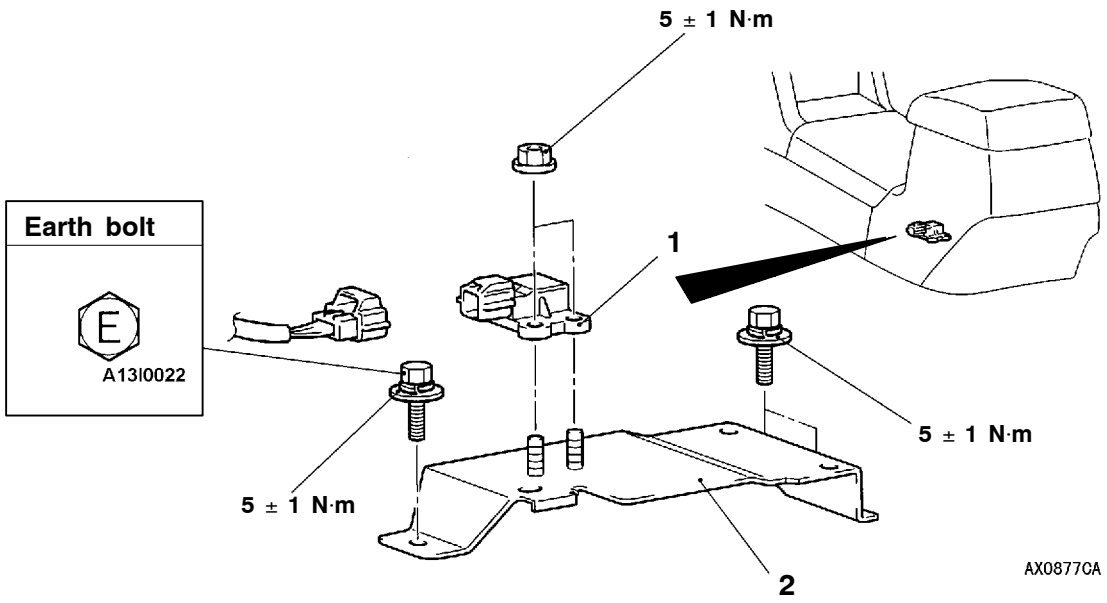
Check that none of the ABS rotor teeth are chipped, broken or bent. If any damage is found, replace the ABS rotor with a new one.

G SENSOR

REMOVAL AND INSTALLATION

Caution
Do not drop the G sensor or subject it to any shocks.

Pre-removal and Post-installation Operations
Floor console removal and installation
(Refer to GROUP 52A.)



Removal steps
1. G sensor
2. G sensor bracket

MITSUBISHI ACTIVE STABILITY AND TRACTION CONTROL SYSTEM (M-ASTC)

Click on the applicable bookmark to selected the required model year.

MITSUBISHI ACTIVE STABILITY AND TRACTION CONTROL SYSTEM (M-ASTC)

CONTENTS

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Outline of Changes 2
SERVICE SPECIFICATIONS 2
SPECIAL TOOLS 2
TROUBLESHOOTING 2
ON-VEHICLE SERVICE 41
Solenoid Valve Check 41
Initialization of Steering Wheel Sensor 41
M-ASTC-ECU 42
G AND YAW RATE SENSOR 44
STEERING WHEEL SENSOR* 45

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

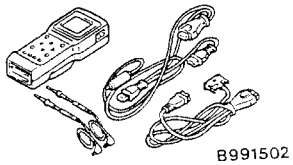
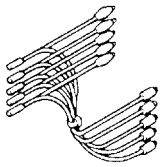
OUTLINE OF CHANGES

Due to the addition of MITSUBISHI Active Stability and Traction Control System (M-ASTC), the following service procedures have been established.

SERVICE SPECIFICATIONS

Item	Standard Value
Switch solenoid valve (SA1, SA2, SA3, STR) resistance Ω	3.5 - 3.9

SPECIAL TOOLS

Tool	Number	Name	Application
 B991502	MB991502	MUT-II Sub-Assembly	For checking of M-ASTC (Diagnosis code display when using the MUT-II)
 B991348	MB991348	Test harness set	For checking of G and yaw rate sensor

TROUBLESHOOTING

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING

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

NOTE

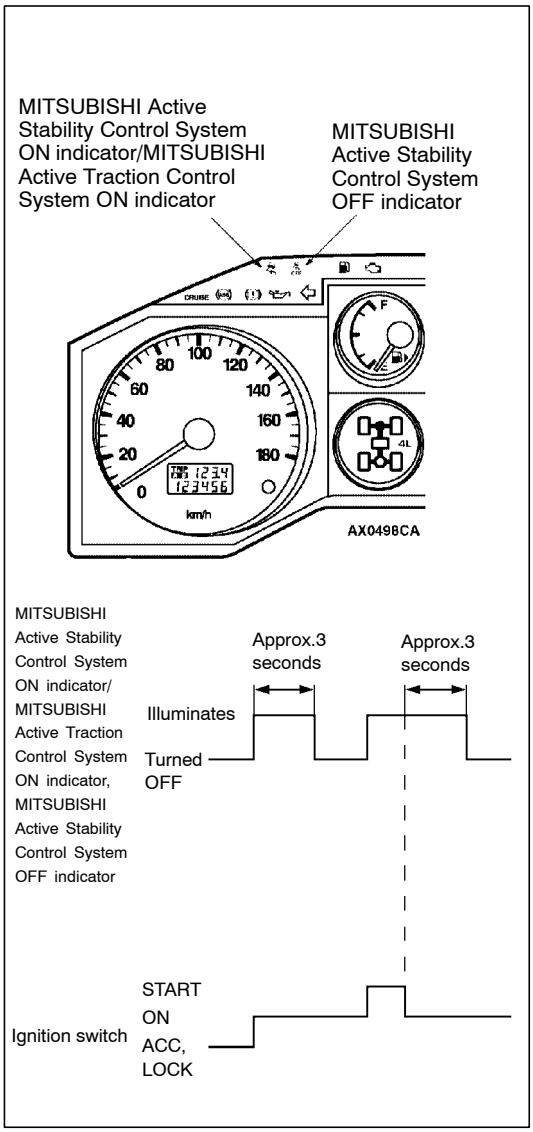
*: Refer to 2001 PAJERO Workshop Manual [Pub. No. PWJE 0001 (1/2)]

NOTES ON DIAGNOSIS

1. MITSUBISHI Active Stability Control System and MITSUBISHI Active Traction Control System control brake pressure with the help of the ECU's. Therefore, although the phenomena described in the following table may occur, they should not be regarded as faults because they are generated in a normal operation of MITSUBISHI Active Stability Control System and MITSUBISHI Active Traction Control System.

Symptom	Explanation of symptom
When the engine is started, light noise such as "clicking" sound may be generated from the engine room.	This system is performing operation check, and this is not abnormal.
● According to the change of brake pedal feeling, a noise is generated. (gargling sound) ● Noise occurs from the chassis parts because Active Stability Control System and Active Traction Control System repeat ON/OFF operations of these parts.(roaring sound from suspension, squeaky sound from tyres)	This is not a fault because of the noise in a normal operation.
When the brake pedal is lightly depressed in a low-speed driving, shock may occur.	This is not a fault because of system operation check (starting-off check at the speed of 2 - 3 km/h or over).

2. Diagnosis detecting conditions depend on diagnostic codes. To reconfirm the fault symptom, the requirements described in the explanatory column of Inspection Procedure Classified by Diagnostic Code must be fulfilled.



MITSUBISHI ACTIVE STABILITY CONTROL SYSTEM ON INDICATOR/MITSUBISHI ACTIVE TRACTION CONTROL SYSTEM ON INDICATOR, MITSUBISHI ACTIVE STABILITY CONTROL SYSTEM OFF INDICATOR CHECK

Check whether MITSUBISHI Active Stability Control System ON indicator/MITSUBISHI Active Traction Control System ON indicator and MITSUBISHI Active Stability Control System OFF indicator illuminate as follows:

1. When the ignition switch is turned to the “ON” position, MITSUBISHI Active Stability Control System ON indicator/MITSUBISHI Active Traction Control System ON indicator and MITSUBISHI Active Stability Control System OFF indicator illuminate for approx. 3 seconds, and then they are turned off.
2. When the ignition switch is further turned to the “START” position, MITSUBISHI Active Stability Control System ON indicator/MITSUBISHI Active Traction Control System ON indicator and MITSUBISHI Active Stability Control System OFF indicator remain illuminating.
3. When the ignition switch is turned back from the “START” to the “ON” position, MITSUBISHI Active Stability Control System ON indicator/MITSUBISHI Active Traction Control System ON indicator and MITSUBISHI Active Stability Control System OFF indicator illuminate for approx. 3 seconds, and then they are turned off.
4. In other cases, diagnostic codes must be inspected.

DIAGNOSTIC FUNCTION

HOW TO READ DIAGNOSIS CODE

Use MUT-II to read the diagnosis code.
(Refer to GROUP 00 - How to Use /Inspection Service Points.*)

NOTE:
- Connect MUT-II to the 16-pin diagnosis connector.
- *:Refer to 2001 PAJERO Workshop Manual [Pub.No. PWJE0001 (2/2)]

HOW TO ERASE DIAGNOSIS CODE

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

CAUTION:
Connection and disconnection of MUT-II must be carries out after the ignition switch is turned to the LOCK (OFF) position.

NOTE:
Connect MUT-II to the 16-pin diagnosis connector.

INSPECTION CHART FOR DIAGNOSIS CODES

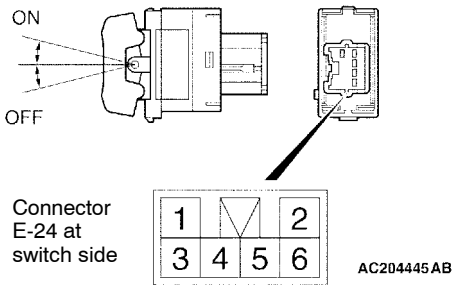
DTC No.	Item		Reference page
11	ABS sensor (FR) open circuit or short circuit		Refer to GROUP 35B.
12	ABS sensor (FL) open circuit or short circuit		Refer to GROUP 35B.
13	ABS sensor (RR) open circuit or short circuit		Refer to GROUP 35B.
14	ABS sensor (RL) open circuit or short circuit		Refer to GROUP 35B.
16*	Excessive decrease or increase in the power supply voltage of the M-ASTC-ECU		Refer to GROUP 35A.
17	Active stability control switch system		35C-6
21	ABS sensor (FR) system		Refer to GROUP 35B.
22	ABS sensor (FL) system		Refer to GROUP 35B.
23	ABS sensor (RR) system		Refer to GROUP 35B.
24	ABS sensor (RL) system		Refer to GROUP 35B.
25	Defective tyre with different diameter		Refer to GROUP 35B.
31	Ignition switch (IG2) system		Refer to GROUP 35A.
33	Stop light switch system		Refer to GROUP 35B.
34	CAN communication error		35C-7
35	Engine system fault		35C-7
36	Engine-ECU communication error		35C-7
37	A/T system fault		35C-7
38	A/T-ECU communication error		35C-7
41	Control solenoid valve (FR) system	In the case of no response for solenoid valve drive signals corresponding to individual items:	Refer to GROUP 35B.
42	Control solenoid valve (FL) system		Refer to GROUP 35B.
43	Control solenoid valve (RR) system		Refer to GROUP 35B.
44	Control solenoid valve (RL) system		Refer to GROUP 35B.
45	Switch solenoid valve (SA1) system		Refer to GROUP 35B.
46	Switch solenoid valve (SA2) system		Refer to GROUP 35B.
47	Switch solenoid valve (SA3) system		35C-8
48	Switch solenoid valve (STR) system		35C-8
51	Valve relay ON defective		Refer to GROUP 35B.
52	Valve relay OFF defective		Refer to GROUP 35B.
53	Motor system		Refer to GROUP 35A.
54	Motor relay system		Refer to GROUP 35A.
55	Motor system		Refer to GROUP 35A.
56	Pressure switch system		Refer to GROUP 35A.
57	Accumulator pressure sensor system		Refer to GROUP 35A.

DTC No.	Item	Reference page
58	Power supply drive circuit system	Replace the ASTC-ECU (Refer to 35C-42).
61	Master cylinder pressure sensor system	Refer to GROUP 35B.
63	G sensor output error	35C-9
64	G sensor clogging	35C-9
65	G sensor self-diagnosis error	35C-9
66	Steering wheel sensor self-diagnosis error	35C-10
67	Steering wheel sensor communication line error	35C-11
68	Steering wheel sensor output error	35C-10
71	Yaw rate sensor self-diagnosis error	35C-9
72	Yaw rate sensor 0-point error	35C-9
73	Yaw rate sensor output error	35C-9
74	G and yaw rate sensor communication line fault	35C-12
75	Transfer switch defect	35C-13
76	G sensor error	35C-9
77	Yaw rate sensor error	35C-9
78	Engine ECU inappropriately installed	35C-7
81	G sensor initialization incomplete	35C-13
82	Yaw rate sensor initialization incomplete	35C-13
83	Steering wheel sensor initialization incomplete	35C-14
84	Transfer switch initialization incomplete	35C-14
85	Master cylinder pressure sensor initialization incomplete	35C-14

NOTE
*: For Code No. 16, memory is erased if the system is returned to the normal state.

INSPECTION PROCEDURE CLASSIFIED BY DIAGNOSTIC CODE

Code No. 17 Active Stability Control Switch System	Probable Cause
This code is output when Active Stability Control Switch is turned on and off at the same time.	• Malfunction of Active Stability Control Swtich • Malfunction of harness or connector • Malfunction of M-ASTC-ECU



- Remove Active Stability Control Swtich
- Measure at E-24 Active Stability Control Swtich connector
- Active Stability Control Swtich: ON
  Continuity between terminals 3 - 6
  OK: Continuity
- Active Stability Control Swtich: ON
  Continuity between terminals 2 and 3
  Continuity between terminals 2 and 6
  OK: No continuity
- Active Stability Control Swtich: Neutral
  Continuity between terminals 2 and 3
  Continuity between terminals 2 and 6
  Continuity between terminals 3 and 6
  OK: No continuity
- Active Stability Control Swtich: OFF
  Continuity between terminals 2 and 3
  OK: Continuity
- Active Stability Control Swtich: OFF
  Continuity between terminals 2 and 6
  Continuity between terminals 3 and 6
  OK: No continuity

NG → **Replace**

OK → **Check the following connector:** E-24

- OK → Check trouble symptoms.
  - NG → **Repair**
  - NG → Check harness, and repair if necessary.
    - Between active stability control switch and earth
    - OK → Check trouble symptoms.
      - NG → **Repair**
      - NG → **Check the following connectors:** E-126, E-127, E-109
        - OK → Check trouble symptoms.
          - NG → **Repair**
          - NG → Check harness, and repair if necessary.
            - Between Active Stability Control Swtich and M-ASTC-ECU
            - OK → Replace M-ASTC-ECU.
            - NG → **Repair**
    - NG → **Repair**
- NG → **Repair**

Code No. 34 CAN communication error	Probable Cause
This code is ouput when communication error occurs at the same time on several ECU's or sensors linked with CAN-bus lines.	● CAN-bus line fault ● Connector fault ● Malfunction of M-ASTC-ECU

CAUTION

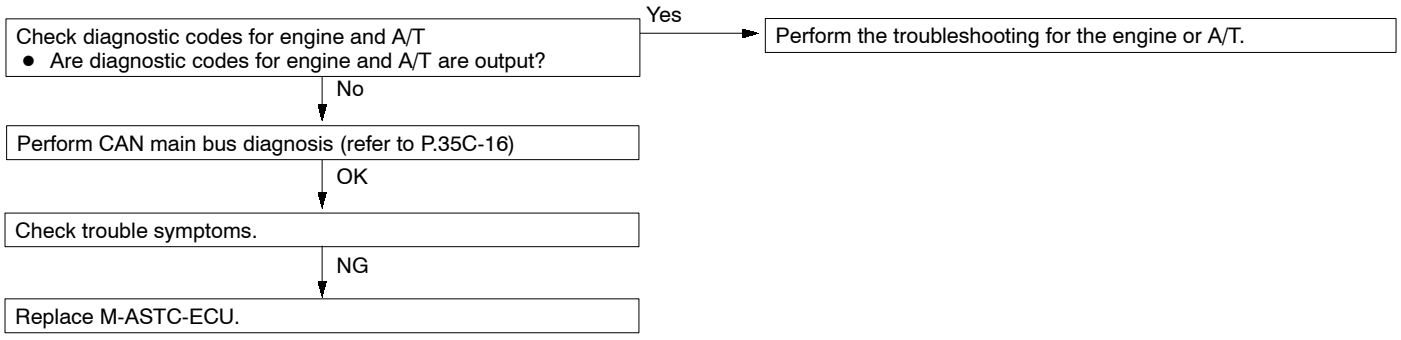
When the diagnostic code for CAN-bus line fault is displayed, always perform CAN main bus line diagnosis.

Perform CAN main bus diagnosis (refer to P.35C-16).

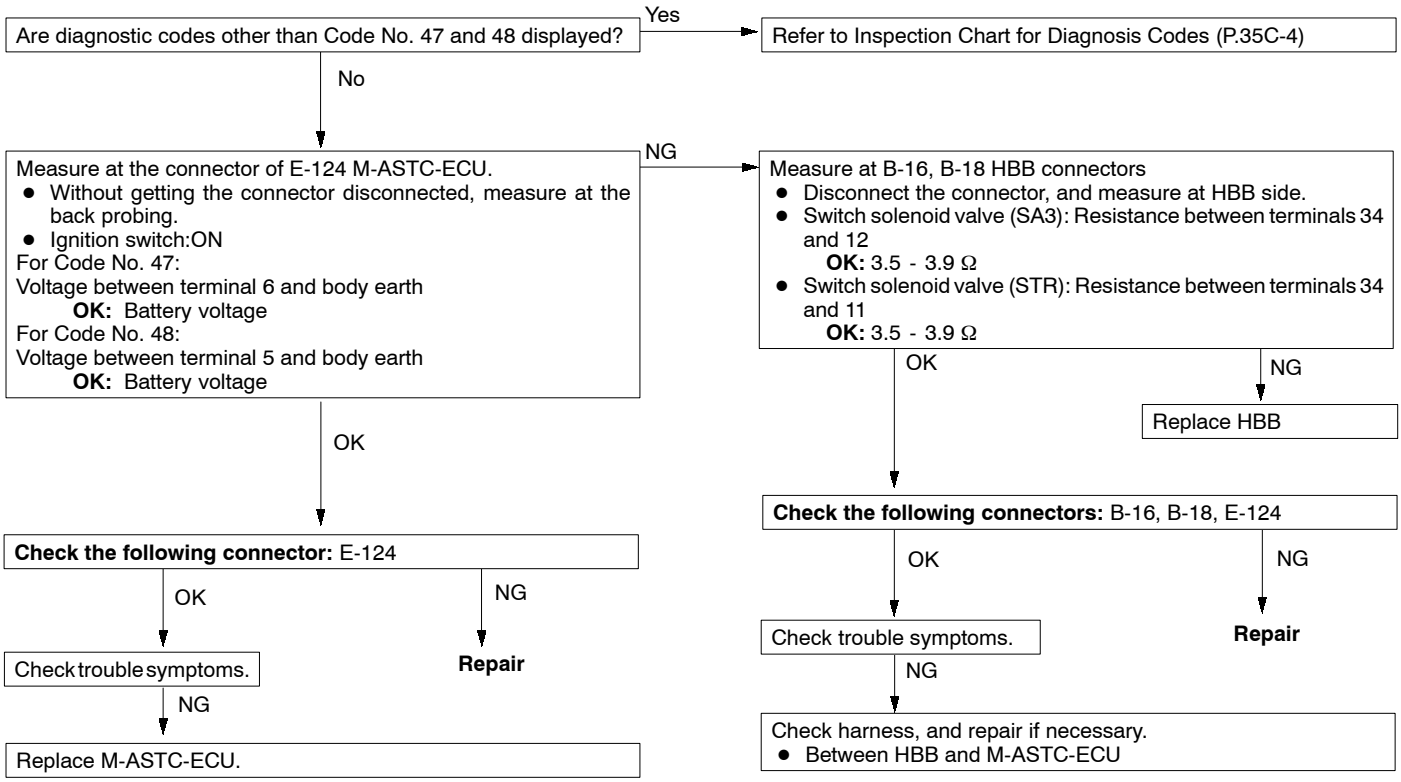
Code No. 35 Engine system fault Code No. 36 Engine-ECU communication error Code No. 37 A/T system fault Code No. 38 A/T-ECU communication error Code No. 78 Engine-ECU inappropriately installed	Probable Cause
Code No. 35 is output when an error is detected on the data related to the engine acquired by M-ASTC-ECU. (Data error in this case shows that data is transmitted from the engine and A/T-ECU, but there is an error on the data) Code No. 36 is output when all data related to the engine is not sent from the engine and A/T-ECU to the M-ASTC-ECU. Code No. 37 is output when an error is detected on the data related to the automatic transmission acquired by M-ASTC-ECU.(Data error in this case shows that data is transmitted from the engine and A/T-ECU, but there is an error on the data) Code No. 38 is output when all data related to the automatic transmission is not sent from the engine and A/T-ECU to the M-ASTC-ECU. Code No. 78 is output when the engine-ECU is improperly installed.	● CAN-bus line fault ● Connector fault ● Malfunction of engine-A/T-ECU <Petrol vehicles> ● Malfunction of engine-ECU <Diesel vehicles> ● Malfunction of A/T-ECU <Diesel vehicles> ● Malfunction of M-ASTC-ECU

CAUTION:

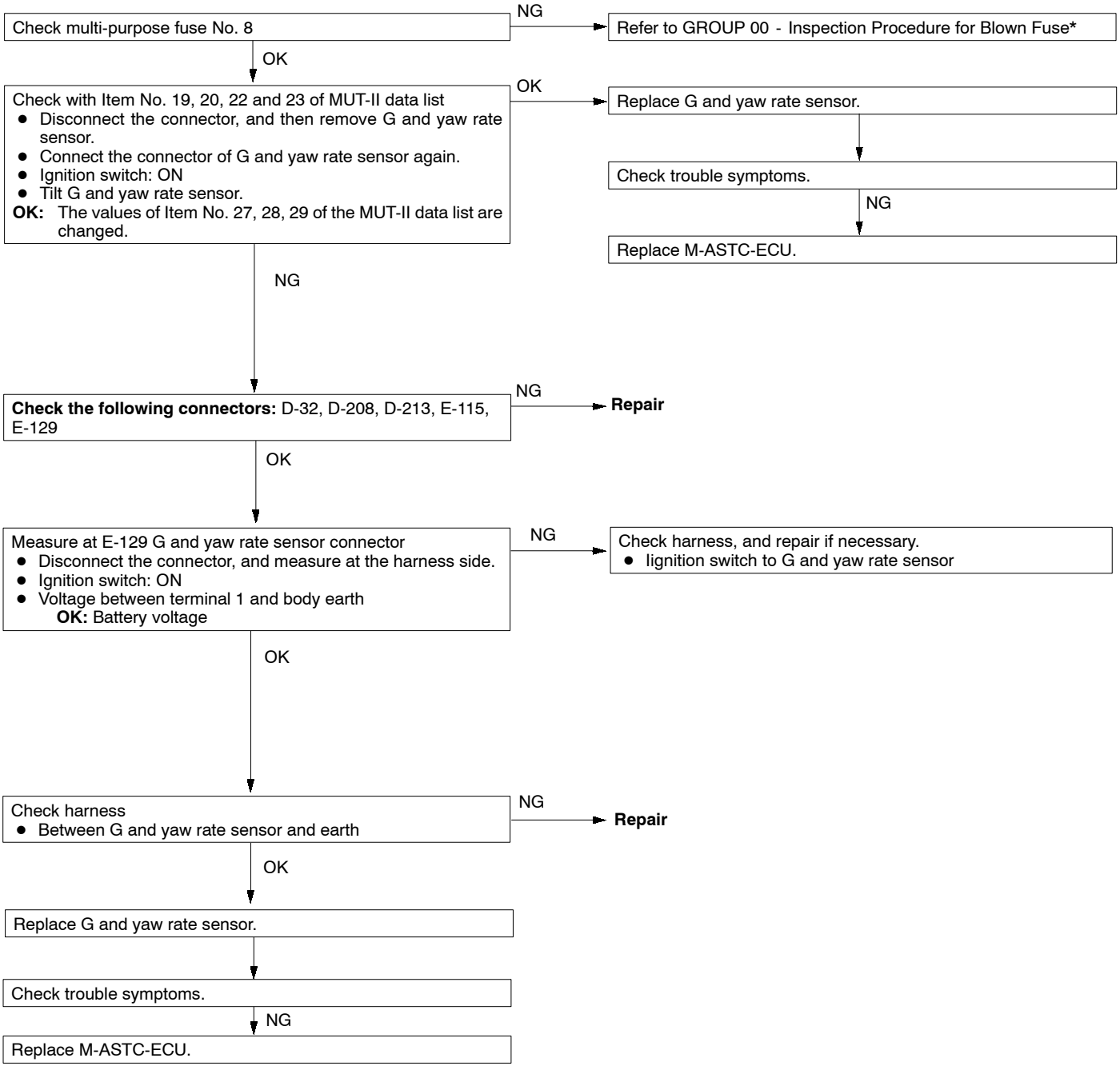
When these diagnostic code are displayed, always perform CAN main bus line diagnosis.



Code No. 47 Switch solenoid valve (SA3) system Code No. 48 Switch solenoid valve (STR) system	Probable Cause
M-ASTC-ECU is always monitoring the solenoid valve drive circuit. This code is output by determination of open/short circuit on the solenoid coil or harness when the solenoid is not energized even if M-ASTC-ECU activates it, or the solenoid keep energized even if either of the ECU's switches it off.	• Malfunction of HBB • Malfunction of harness or connector • Malfunction of M-ASTC-ECU

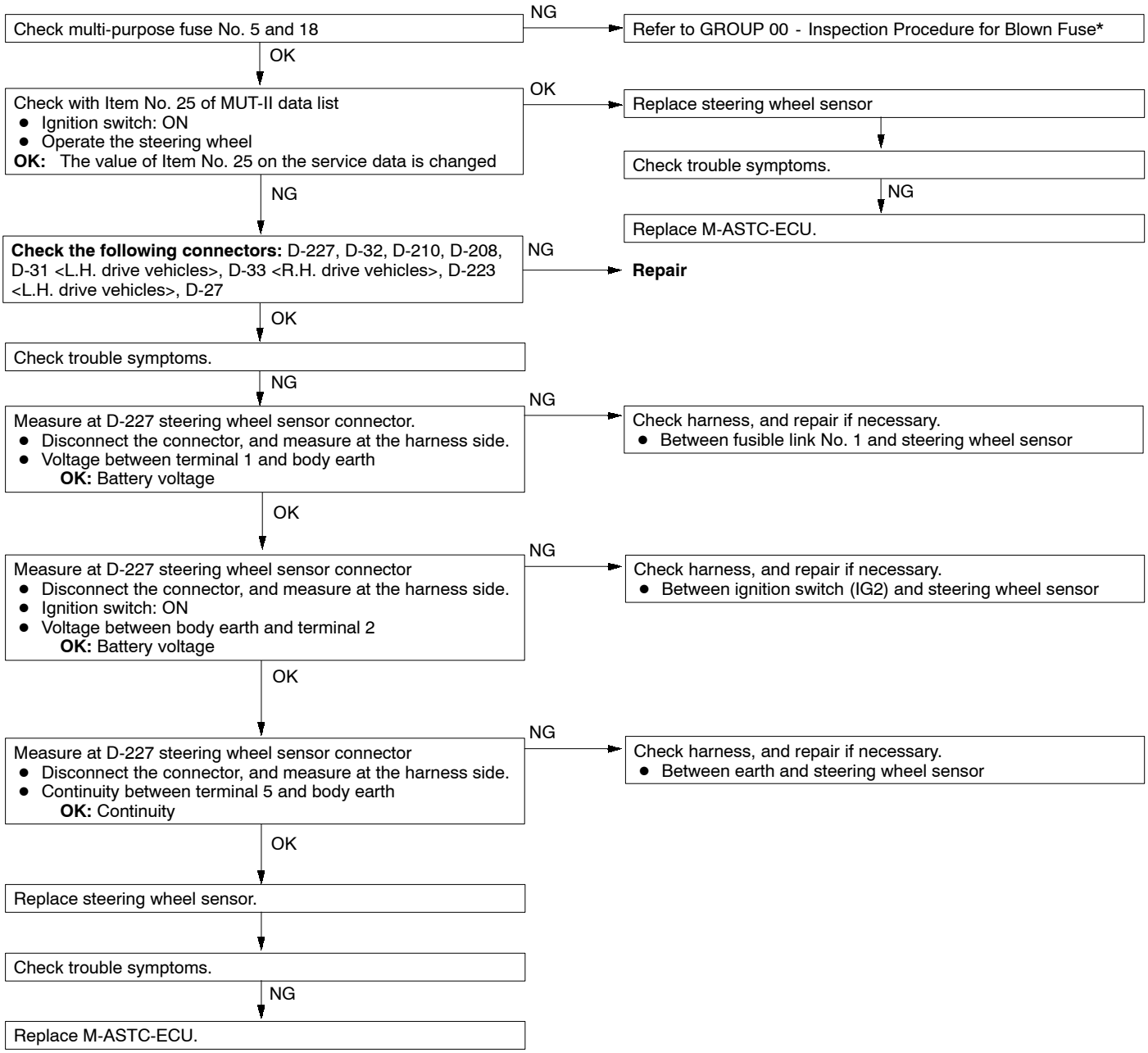


Code No. 63 G sensor output error Code No. 64 G sensor clogging Code No. 65 G sensor self-diagnosis error Code No. 71 Yaw rate sensor self-diagnosis error Code No. 72 Yaw rate sensor 0-point error Code No. 73 Yaw rate sensor output error Code No. 76 G sensor error Code No. 77 Yaw rate sensor error	Probable Cause
These codes are output when an error is detected on the data transmitted from the G and yaw rate sensor to M-ASTC-ECU. (Data error in this case shows that data is transmitted from the G and yaw rate sensor, but there is an error on the data)	● Malfunction of G and yaw rate sensor ● Malfunction of harness or connector ● Malfunction of M-ASTC-ECU



NOTE:
*: Refer to the 2001 PAJERO Workshop Manual [Pub. No. PWJE0001(1/2)].

Code No. 66 Steering wheel sensor self-diagnosis error Code No. 68 Steering wheel sensor output error	Probable Cause
These codes are output when an error is detected on the data transmitted from the steering wheel sensor to M-ASTC-ECU. (Data error in this case shows that data is transmitted from the steering wheel sensor, but there is an error on the data)	● Malfunction of steering wheel sensor ● Malfunction of harness or connector ● Malfunction of M-ASTC-ECU

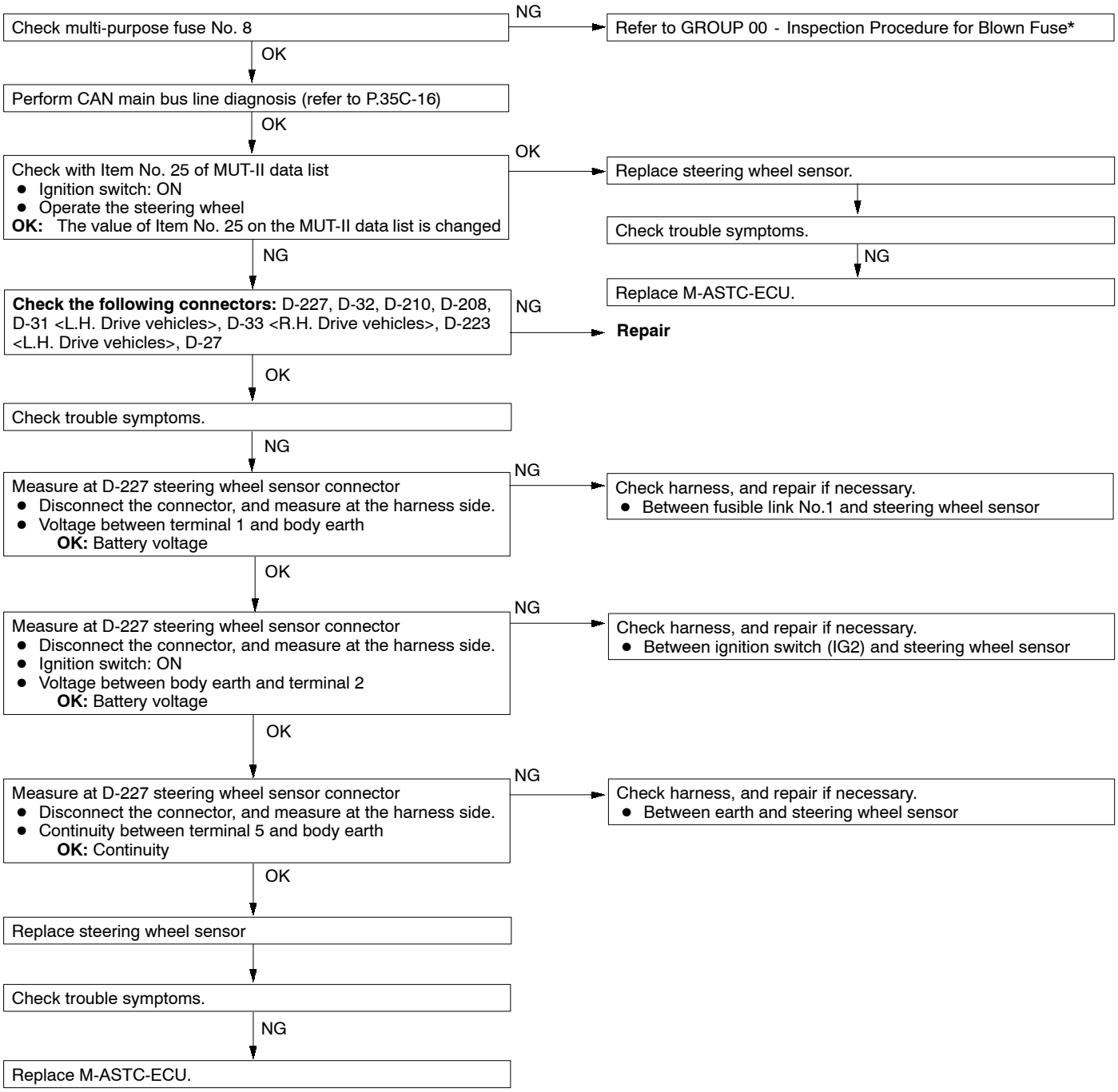


NOTE:
*: Refer to the 2001 PAJERO Workshop Manual [Pub. No. PWJE0001(1/2)].

Code No.67 Steering wheel sensor communication line error	Probable Cause
These codes are output when all data are not sent from the steering wheel sensor to M-ASTC-ECU.	● CAN-bus line fault ● Connector fault ● Malfunction of steering wheel sensor ● Malfunction of M-ASTC-ECU

CAUTION:

When DTC No. 67 is displayed, always perform CAN main bus line diagnosis.

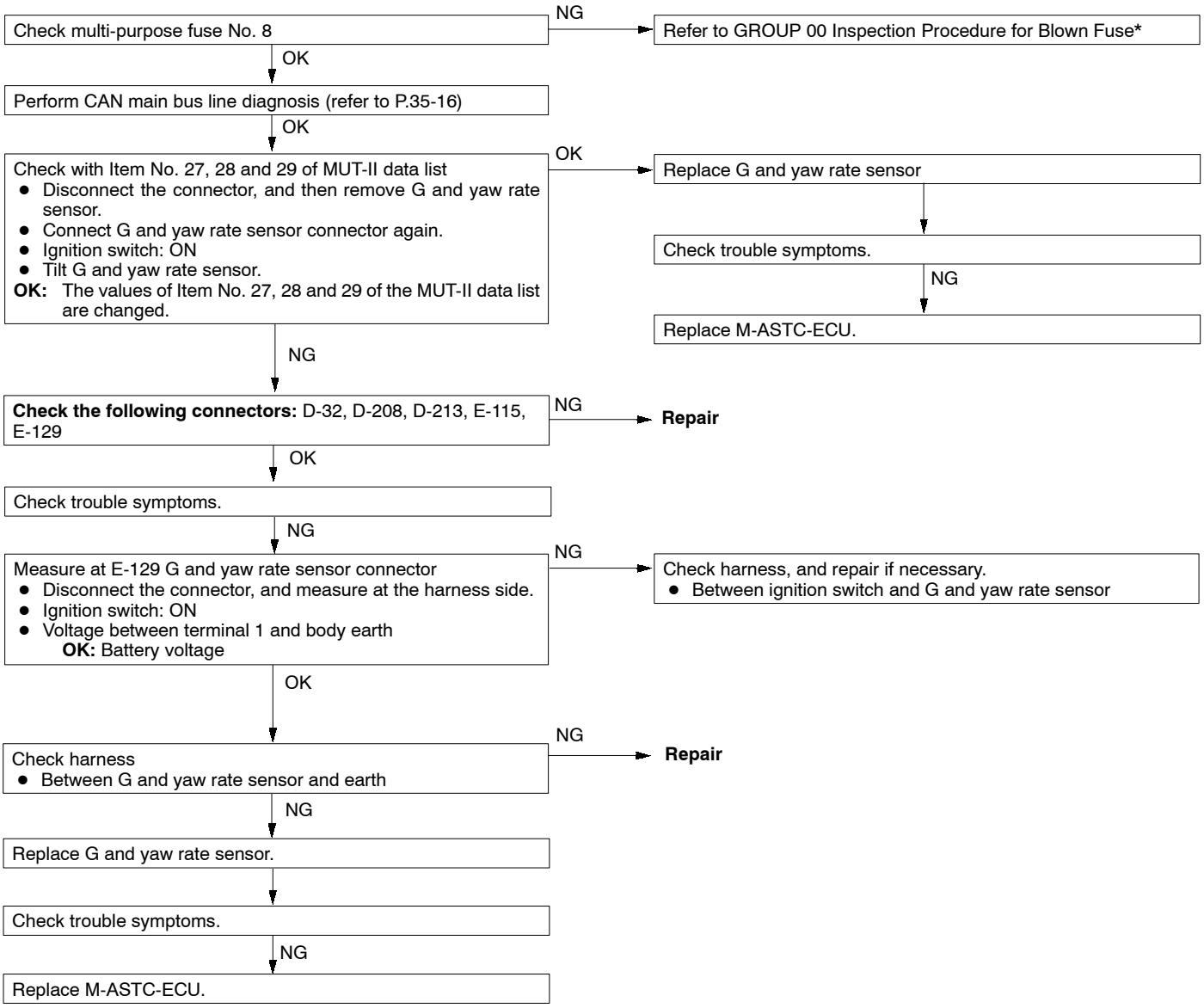


NOTE:

*: Refer to the 2001 PAJERO Workshop Manual [Pub. No. PWJE0001(1/2)].

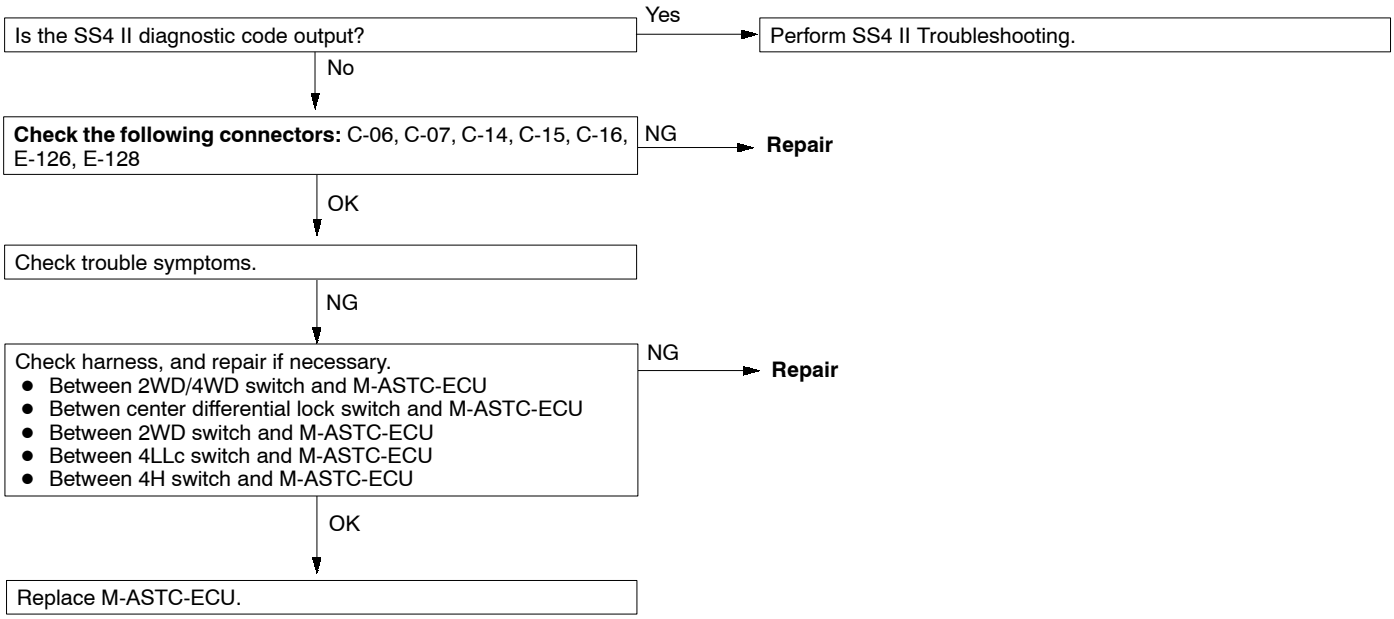
Code No. 74 G and yaw rate sensor communication line fault	Probable Cause
These codes are output when error is detected on the data transmitted from the G and yaw rate sensor to M-ASTC-ECU. (Data error in this case shows that data is transmitted from the G and yaw rate sensor, but there is an error on the data)	● Malfunction of G and yaw rate sensor ● Malfunction of harness or connector ● Malfunction of M-ASTC-ECU

CAUTION:
When the diagnostic code for G and yaw rate sensor communication system is displayed, always perform CAN main bus line diagnosis.

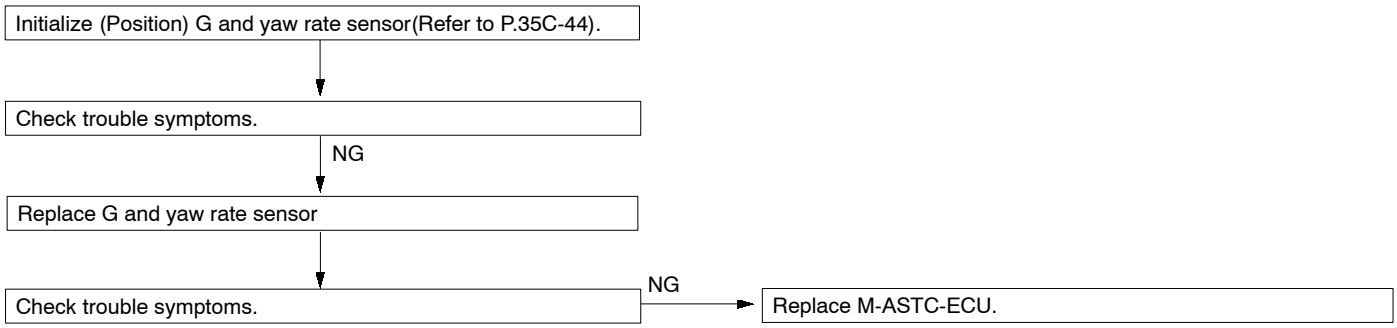


NOTE:
*: Refer to the 2001 PAJERO Workshop Manual [Pub. No. PWJE0001(1/2)].

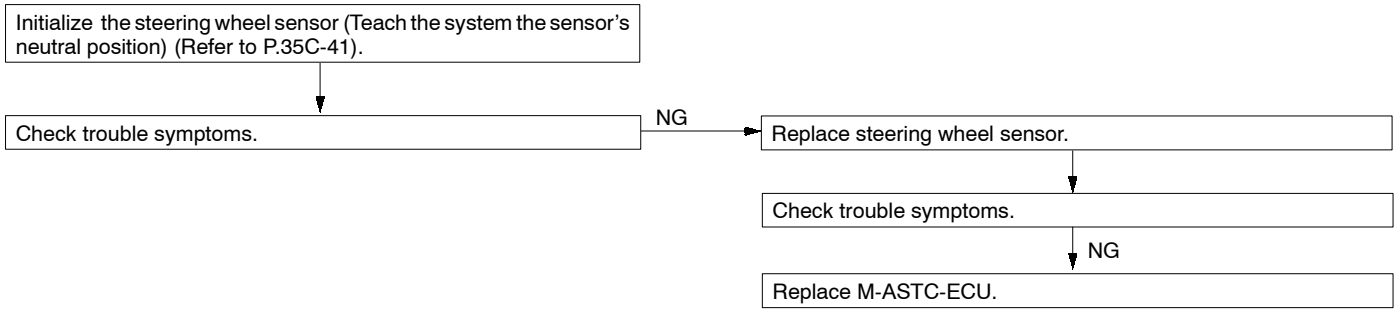
Code No. 75 Transfer switch defect	Probable Cause
This code is output when defective switching status is detected on 2WD/4WD switch, center differential lock switch, 2WD switch, 4LLc switch and 4H switch.	● Malfunction of 2WD/4WD switch ● Malfunction of center differential lock switch ● Malfunction of 2WD switch ● Malfunction of 4LLc switch ● Malfunction of 4H switch ● Malfunction of harness or connector ● Malfunction of M-ASTC-ECU



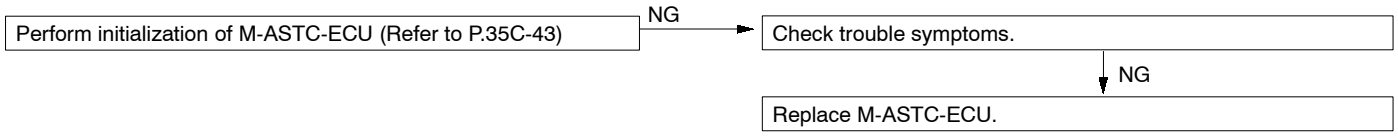
Code No. 81 G sensor intialization incomplete Code No. 82 Yaw rate sensor initialization incomplete	Probable Cause
When G and yaw rate sensor is replaced with a new one, initialization (positioning) of the sensor is required.These codes are displayed when the sensor is not initialized.	● Malfunction of G and yaw rate sensor ● Malfunction of M-ASTC-ECU



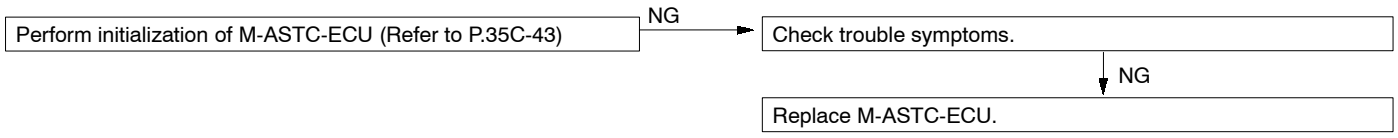
Code No. 83 Steering wheel sensor initialization incomplete	Probable Cause
This code is output immediately when the battery is removed and the learned neutral point of the steering wheel sensor is erased.	● Malfunction of steering wheel sensor ● Malfunction of M-ASTC-ECU

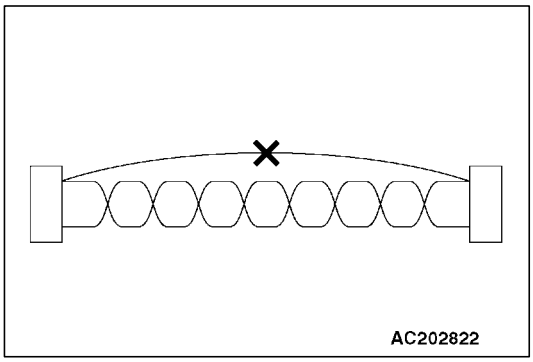


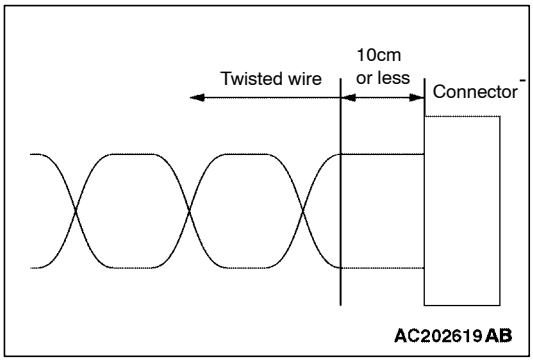
Code No. 84 Transfer switch initialization incomplete	Probable Cause
This code is output when the transfer switch is not initialized yet after M-ASTC-ECU is replaced with new one.	● Transfer switch of M-ASTC-ECU initialization incomplete ● Malfunction of M-ASTC-ECU

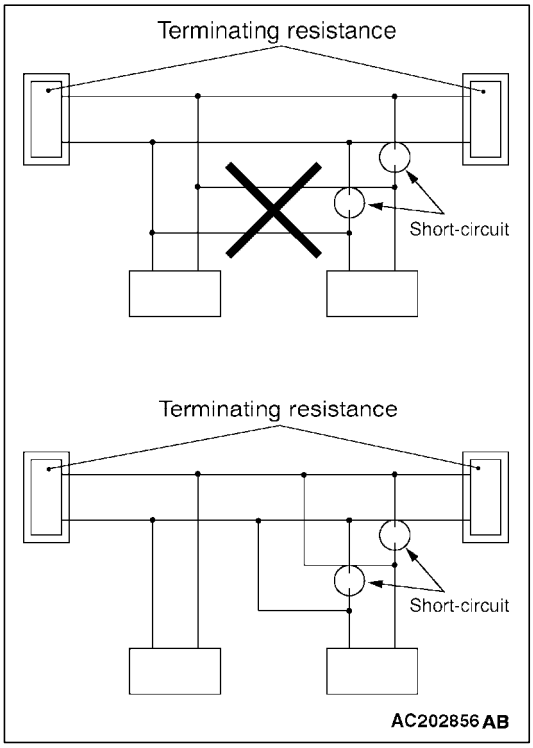


Code No. 85 Master cylinder pressure sensor initialization incomplete	Probable Cause
This code is output when the master cylinder pressure sensor is not initialized (positioned) after M-ASTC-ECU is replaced with a new one.	● Master cylinder pressure sensor of M-ASTC-ECU initialization incomplete ● Malfunction of M-ASTC-ECU









CAN-BUS DIAGNOSIS

NOTES ON CAN-BUS LINE REPAIR

Notes for CAN-bus line repair

- To repair the main bus line, CAN_L line or CAN_H line of the branch, route the entire twisted wire between the connectors at both ends again. If the harness is repaired partially, or CAN_L or CAN_H line is only corrected, deterioration of the noise-proof property results in communication error.
- To replace the main bus line, or connectors on the branch (including replacement of only terminals), or harnesses, loose twisted wire must be within 10 cm apart from the connector. When the loose twisted wire is over 10 cm apart from the connector, the harness must be twisted so that it can be matched with the original twisted wire. When the loose twisted wire is over 10 cm apart from the connector, deterioration of noise-proof property results in communication error.
- The branch must be repaired so that it can be separated directly from the main bus. If the branch is separated from the branch connected to the other devices, CAN communication is not established.

Notes for repair of terminating resistance

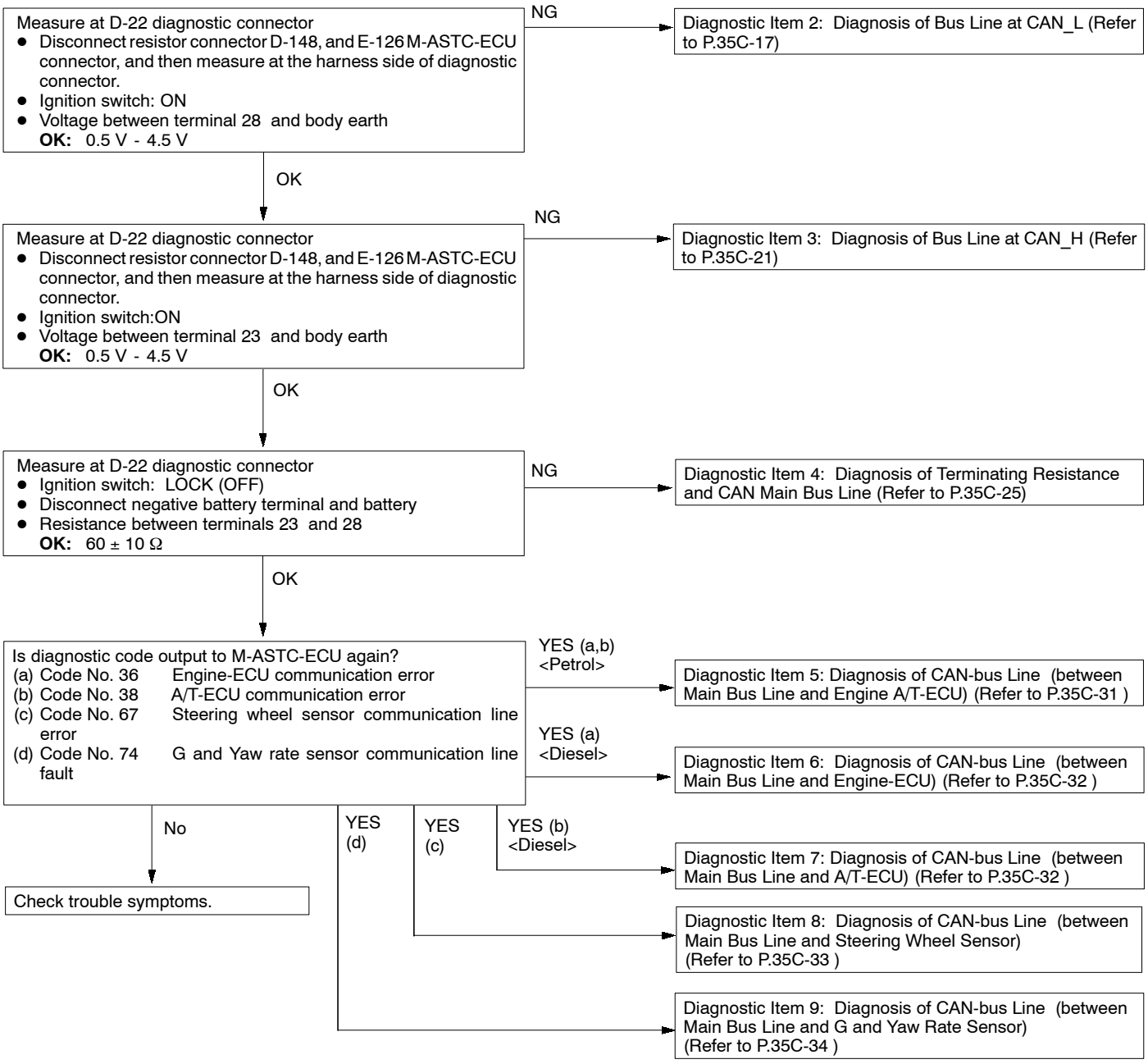
- Even if the terminating resistance at one end is damaged, communication continues, but deterioration of noise-proof property occurs. In this case, also ensure that the diagnostic code has been displayed, because no code may be displayed. When the damage is detected, replace the terminating resistance.

Diagnostic Item 1

Diagnosis of CAN Main Bus Line	Probable Cause
When a fault is detected on M-ASTC, CAN main bus line or terminating resistance may be defective. (Each ECU and sensor may be damaged, and therefore use this troubleshooting to check the status of CAN main bus line)	• CAN main bus line fault • Terminating resistance defect (integrated in M-ASTC-ECU or resistor) • Malfunction of harness or connector

Caution

- **Use digital tester to measure resistance or voltage of CAN-bus line. If other device than the digital tester is used, it may cause the damage of the equipment connected to CAN-bus line.**
- **To measure resistance of CAN-bus line, disconnect the negative battery terminal. If the resistance is measured with the negative battery terminal connected, it may cause the damage of the equipment connected to CAN-bus line.**
- **To measure resistance or voltage at a female connector, always use test harness. If resistance or voltage is measured with other device than the test harness, it may cause the damage of connector.**

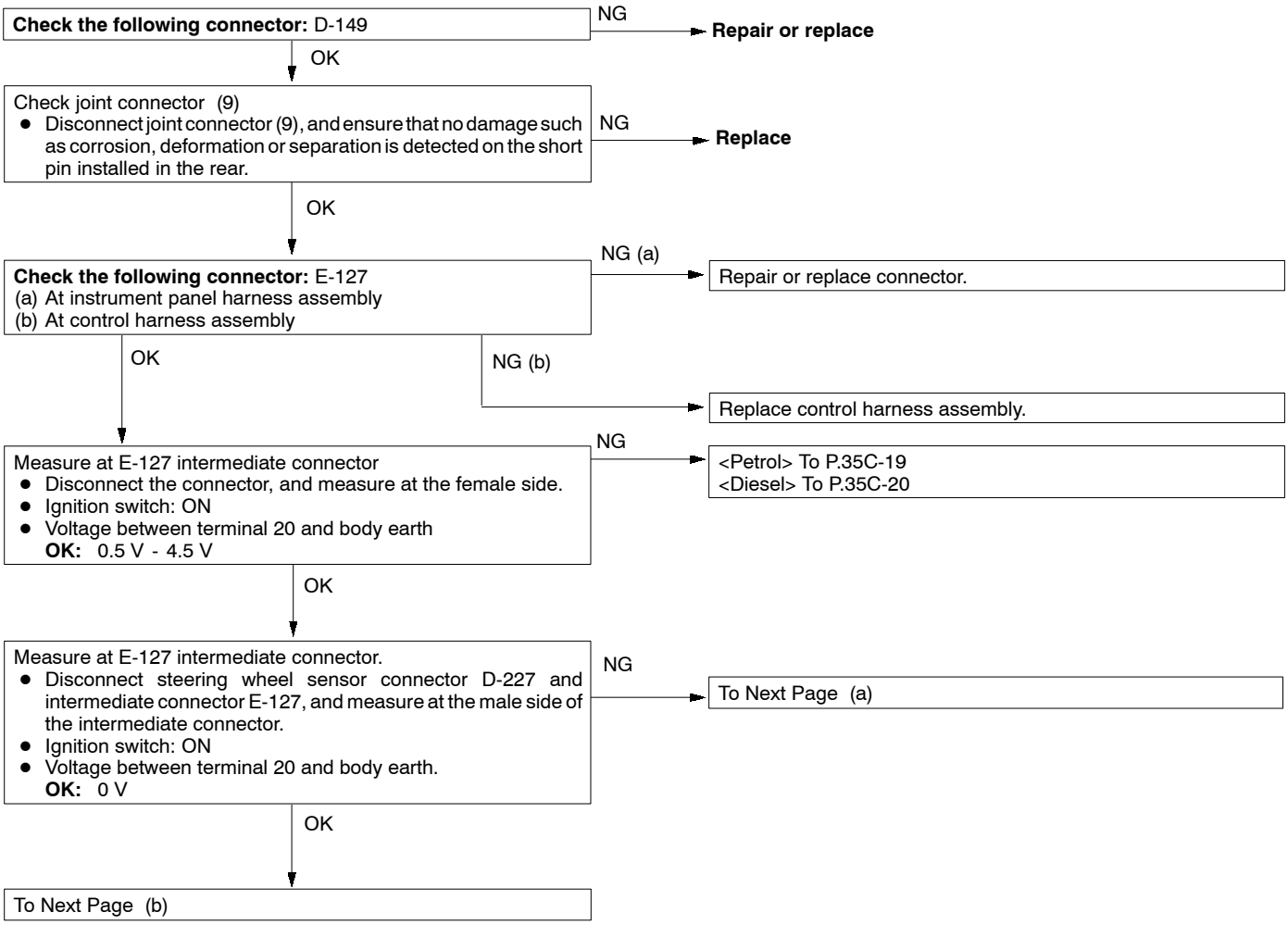


Diagnostic Item 2

Diagnosis of Bus Line at CAN_L

Caution

- **Use digital tester to measure resistance or voltage of CAN-bus line. If other device than the digital tester is used, it may cause the damage of the equipment connected to CAN-bus line.**
- **To measure resistance of CAN-bus line, disconnect the negative battery terminal. If the resistance is measured with the negative battery terminal connected, it may cause the damage of the equipment connected to CAN-bus line.**
- **To measure resistance or voltage at a female connector, always use test harness. If resistance or voltage is measured with other device than the test harness, it may cause the damage of connector.**
- **When defective connectors (including terminals) of instrument panel harness assembly (connected to steering wheel sensor, diagnostic connector and resistor) and transmission harness (connected to G and Yaw rate sensor connector and intermediate connector E-128) require harness cutting, loose twisted wire must be within 10 cm apart from the connector. When the loose twisted wire is over 10 cm apart from the connector, the harness must be twisted so that it can be matched with the original twisted wire. When the loose twisted wire is over 10 cm apart from the connector, it results in communication error.**
- **When CAN-bus line for the instrument panel harness assembly (connected to the steering wheel sensor, diagnostic connector and the resistor) and the transmission harness (connected to G and Yaw rate sensor connector and intermediate connector E-128) is repaired, notes on harness repair must be strictly followed. Redrawing CAN_L or CAN_H line only, or changing separation points causes CAN communication error.**
- **When a defect occurs on CAN-bus line or connector for the control harness assembly (connected to M-ASTC-ECU, engine A/T-ECU <Petrol>, engine-ECU <Diesel>, A/T-ECU <Diesel> and intermediate connector E-128), do not repair harness or connector only. Replace the harness assembly. Redrawing a new line or repairing connector causes CAN communication error.**



From previous page (NG)

(a)

Measure D-149 joint connector (9)
- Disconnect the connector, and measure at the harness side.
- Ignition switch:ON
- Voltage between terminal 12 and body earth

OK: 0.5 V - 4.5 V

OK

NG

Repair each harness between joint connector (9) and diagnostic connector.

Measure D-149 joint connector (9)
- Disconnect resistor connector D-148 and joint connector (9) D-149, and measure at the harness side of the joint connector (9)
- Ignition switch: ON
- Voltage between terminal 4 and body earth

OK: 0 V

OK

NG

Repair each harness between joint connector (9) and resistor connector.

Measure D-149 joint connector (9) .
- Disconnect steering wheel sensor connector D-227 and joint connector (9) D-149, and measure at the harness side of the joint connector (9)
- Ignition switch: ON
- Voltage between terminal 5 and body earth

OK: 0 V

OK

NG

Repair each harness between joint connector (9) and steering wheel sensor connector.

Measure D-149 joint connector (9)
- Disconnect intermediate connector E-127 and joint connector (9) D-149, and measure at the harness side of the joint connector (9)
- Ignition switch: ON
- Voltage between terminal 11 and the body earth

OK: 0 V

OK

NG

Check trouble symptoms.

Repair each harness between joint connector (9) and intermediate connector.

From previous page (OK)

(b)

Measure at E-127 intermediate connector
- Disconnect steering wheel sensor connector D-227 and intermediate connector E-127, and measure at the male side of the intermediate connector
- Ignition switch: LOCK (OFF)
- Disconnect negative battery terminal and battery
- Voltage between terminal 20 and body earth

OK: No continuity

OK

NG

Replace steering wheel sensor.

Measure D-149 joint connector (9)
- Disconnect the connector, and measure at the harness side.
- Ignition switch: LOCK (OFF)
- Disconnect negative battery terminal and battery
- Voltage between terminal 12 and body earth

OK: No continuity

OK

NG

Repair each harness between joint connector (9) and diagnostic connector.

Measure D-149 joint connector (9)
- Disconnect resistor connector D-148 and joint connector (9) D-149, and measure at the harness side of the joint connector (9)
- Ignition switch: LOCK (OFF)
- Disconnect negative battery terminal and battery
- Voltage between terminal 4 and body earth

OK: No continuity

OK

NG

Repair each harness between joint connector (9) and resistor connector.

Measure D-149 joint connector (9)
- Disconnect steering wheel sensor connector D-227 and joint connector (9) D-149, and measure at the harness side of the joint connector (9).
- Ignition switch: LOCK (OFF)
- Disconnect negative battery terminal and battery
- Voltage between terminal 5 and body earth

OK: No continuity

OK

NG

Repair each harness between joint connector (9) and steering wheel sensor connector.

Measure D-149 joint connector (9)
- Disconnect intermediate connector E-127 and joint connector (9) D-149, and measure at the harness side of the joint connector (9)
- Ignition switch: LOCK (OFF)
- Disconnect negative battery terminal and battery
- Voltage between terminal 11 and the body earth.

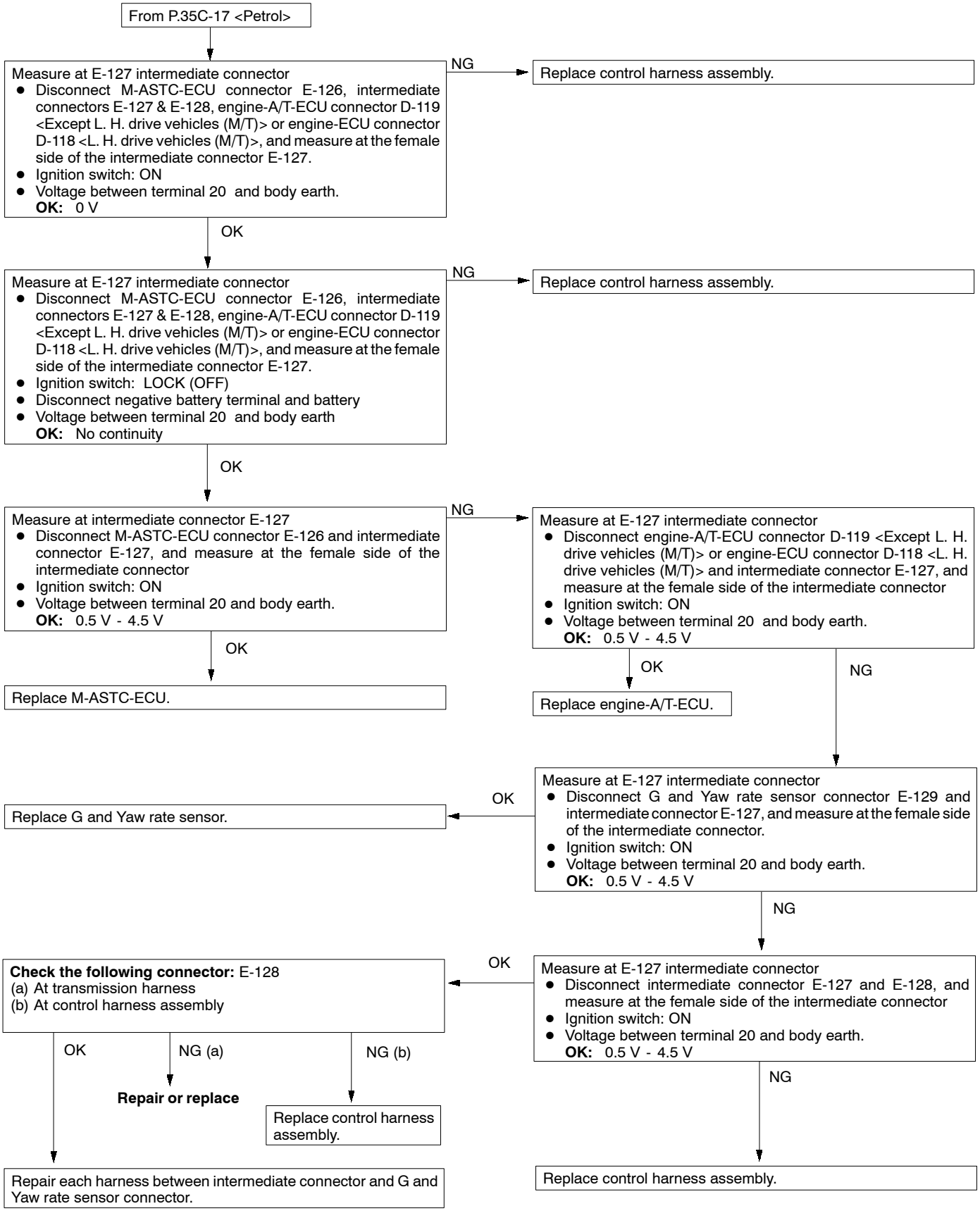
OK: No continuity

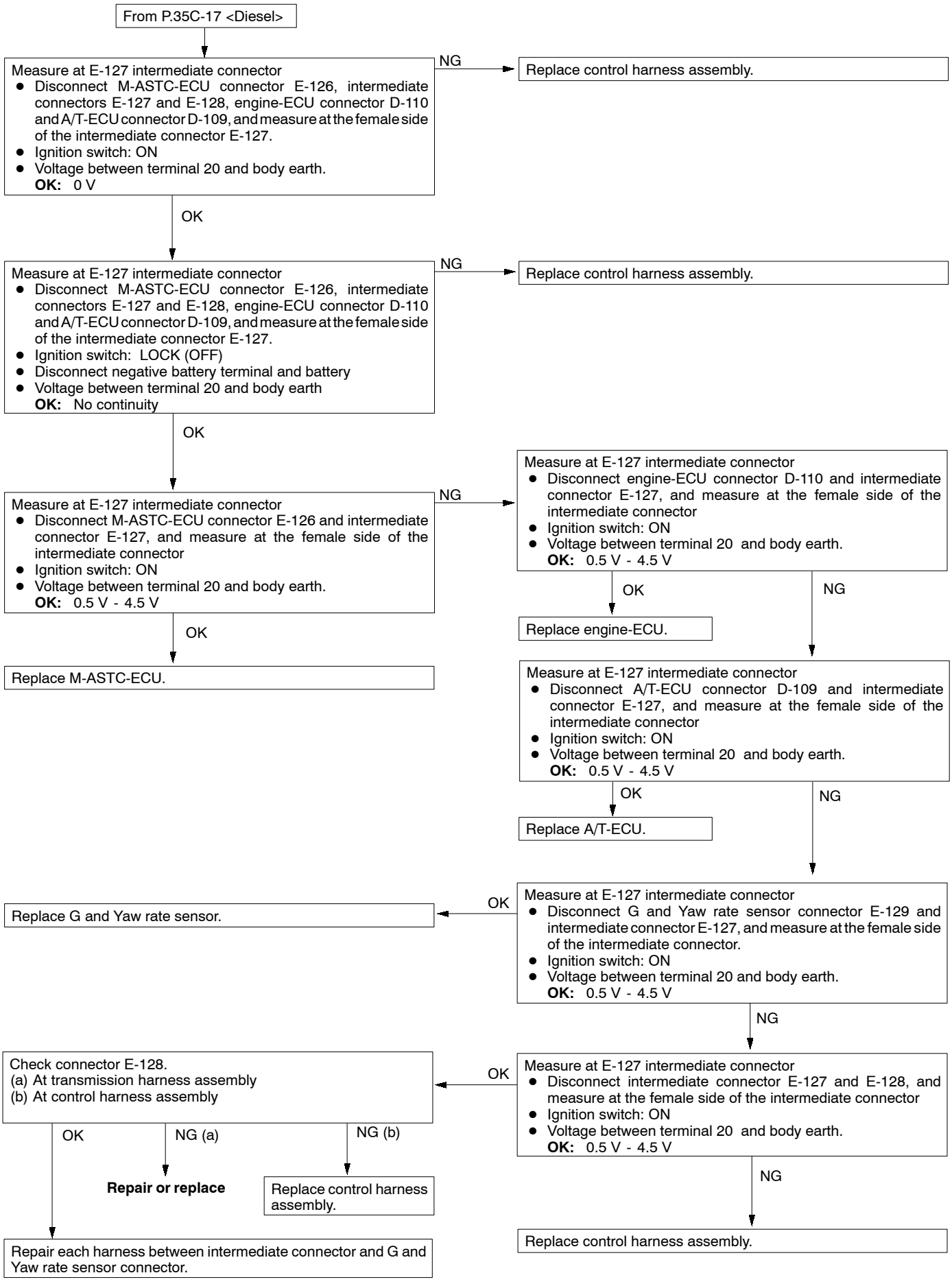
OK

Check trouble symptoms.

NG

Repair each harness between joint connector (9) and intermediate connector.


From P.35C-17 <Petrol>
Measure at E-127 intermediate connector
● Disconnect M-ASTC-ECU connector E-126, intermediate connectors E-127 & E-128, engine-A/T-ECU connector D-119 <Except L. H. drive vehicles (M/T)> or engine-ECU connector D-118 <L. H. drive vehicles (M/T)>, and measure at the female side of the intermediate connector E-127.
● Ignition switch: ON
● Voltage between terminal 20 and body earth.
OK: 0 V
NG
Replace control harness assembly.
OK
Measure at E-127 intermediate connector
● Disconnect M-ASTC-ECU connector E-126, intermediate connectors E-127 & E-128, engine-A/T-ECU connector D-119 <Except L. H. drive vehicles (M/T)> or engine-ECU connector D-118 <L. H. drive vehicles (M/T)>, and measure at the female side of the intermediate connector E-127.
● Ignition switch: LOCK (OFF)
● Disconnect negative battery terminal and battery
● Voltage between terminal 20 and body earth
OK: No continuity
NG
Replace control harness assembly.
OK
Measure at intermediate connector E-127
● Disconnect M-ASTC-ECU connector E-126 and intermediate connector E-127, and measure at the female side of the intermediate connector
● Ignition switch: ON
● Voltage between terminal 20 and body earth.
OK: 0.5 V - 4.5 V
NG
Measure at E-127 intermediate connector
● Disconnect engine-A/T-ECU connector D-119 <Except L. H. drive vehicles (M/T)> or engine-ECU connector D-118 <L. H. drive vehicles (M/T)> and intermediate connector E-127, and measure at the female side of the intermediate connector
● Ignition switch: ON
● Voltage between terminal 20 and body earth.
OK: 0.5 V - 4.5 V
OK
Replace engine-A/T-ECU.
NG
OK
Replace M-ASTC-ECU.
Measure at E-127 intermediate connector
● Disconnect G and Yaw rate sensor connector E-129 and intermediate connector E-127, and measure at the female side of the intermediate connector.
● Ignition switch: ON
● Voltage between terminal 20 and body earth.
OK: 0.5 V - 4.5 V
OK
Replace G and Yaw rate sensor.
NG
Measure at E-127 intermediate connector
● Disconnect intermediate connector E-127 and E-128, and measure at the female side of the intermediate connector
● Ignition switch: ON
● Voltage between terminal 20 and body earth.
OK: 0.5 V - 4.5 V
OK
Check the following connector: E-128
(a) At transmission harness
(b) At control harness assembly
NG
Replace control harness assembly.
OK
NG (a)
Repair or replace
NG (b)
Repair each harness between intermediate connector and G and Yaw rate sensor connector.
Replace control harness assembly.

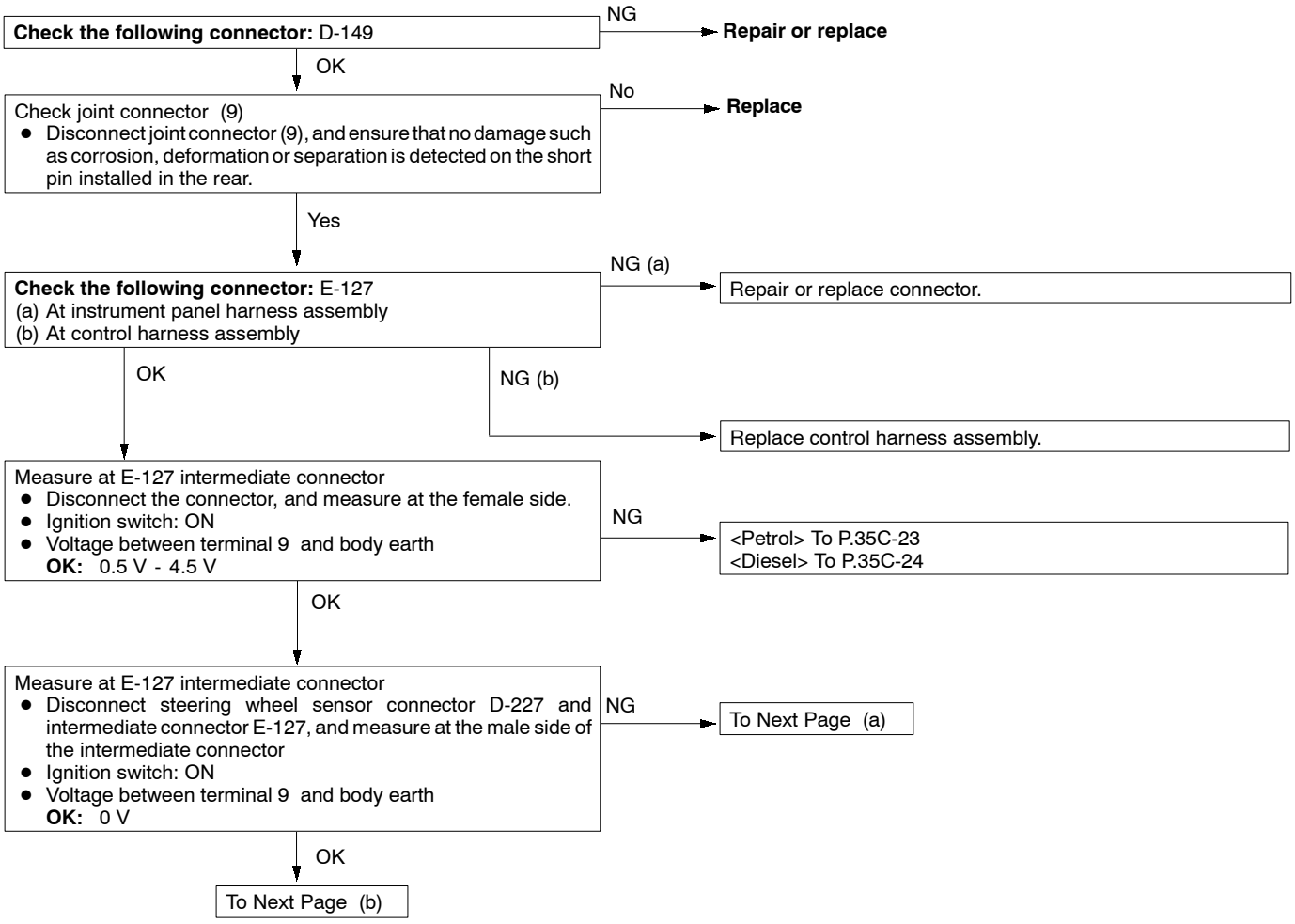

From P.35C-17 <Diesel>
Measure at E-127 intermediate connector
● Disconnect M-ASTC-ECU connector E-126, intermediate connectors E-127 and E-128, engine-ECU connector D-110 and A/T-ECU connector D-109, and measure at the female side of the intermediate connector E-127.
● Ignition switch: ON
● Voltage between terminal 20 and body earth.
OK: 0 V
NG
Replace control harness assembly.
OK
Measure at E-127 intermediate connector
● Disconnect M-ASTC-ECU connector E-126, intermediate connectors E-127 and E-128, engine-ECU connector D-110 and A/T-ECU connector D-109, and measure at the female side of the intermediate connector E-127.
● Ignition switch: LOCK (OFF)
● Disconnect negative battery terminal and battery
● Voltage between terminal 20 and body earth
OK: No continuity
NG
Replace control harness assembly.
OK
Measure at E-127 intermediate connector
● Disconnect M-ASTC-ECU connector E-126 and intermediate connector E-127, and measure at the female side of the intermediate connector
● Ignition switch: ON
● Voltage between terminal 20 and body earth.
OK: 0.5 V - 4.5 V
NG
Measure at E-127 intermediate connector
● Disconnect engine-ECU connector D-110 and intermediate connector E-127, and measure at the female side of the intermediate connector
● Ignition switch: ON
● Voltage between terminal 20 and body earth.
OK: 0.5 V - 4.5 V
OK
Replace engine-ECU.
NG
Measure at E-127 intermediate connector
● Disconnect A/T-ECU connector D-109 and intermediate connector E-127, and measure at the female side of the intermediate connector
● Ignition switch: ON
● Voltage between terminal 20 and body earth.
OK: 0.5 V - 4.5 V
OK
Replace A/T-ECU.
NG
Measure at E-127 intermediate connector
● Disconnect G and Yaw rate sensor connector E-129 and intermediate connector E-127, and measure at the female side of the intermediate connector.
● Ignition switch: ON
● Voltage between terminal 20 and body earth.
OK: 0.5 V - 4.5 V
OK
Replace G and Yaw rate sensor.
NG
Measure at E-127 intermediate connector
● Disconnect intermediate connector E-127 and E-128, and measure at the female side of the intermediate connector
● Ignition switch: ON
● Voltage between terminal 20 and body earth.
OK: 0.5 V - 4.5 V
OK
Check connector E-128.
(a) At transmission harness assembly
(b) At control harness assembly
OK
NG (a)
NG (b)
Repair or replace
Replace control harness assembly.
NG
Replace control harness assembly.
Repair each harness between intermediate connector and G and Yaw rate sensor connector.

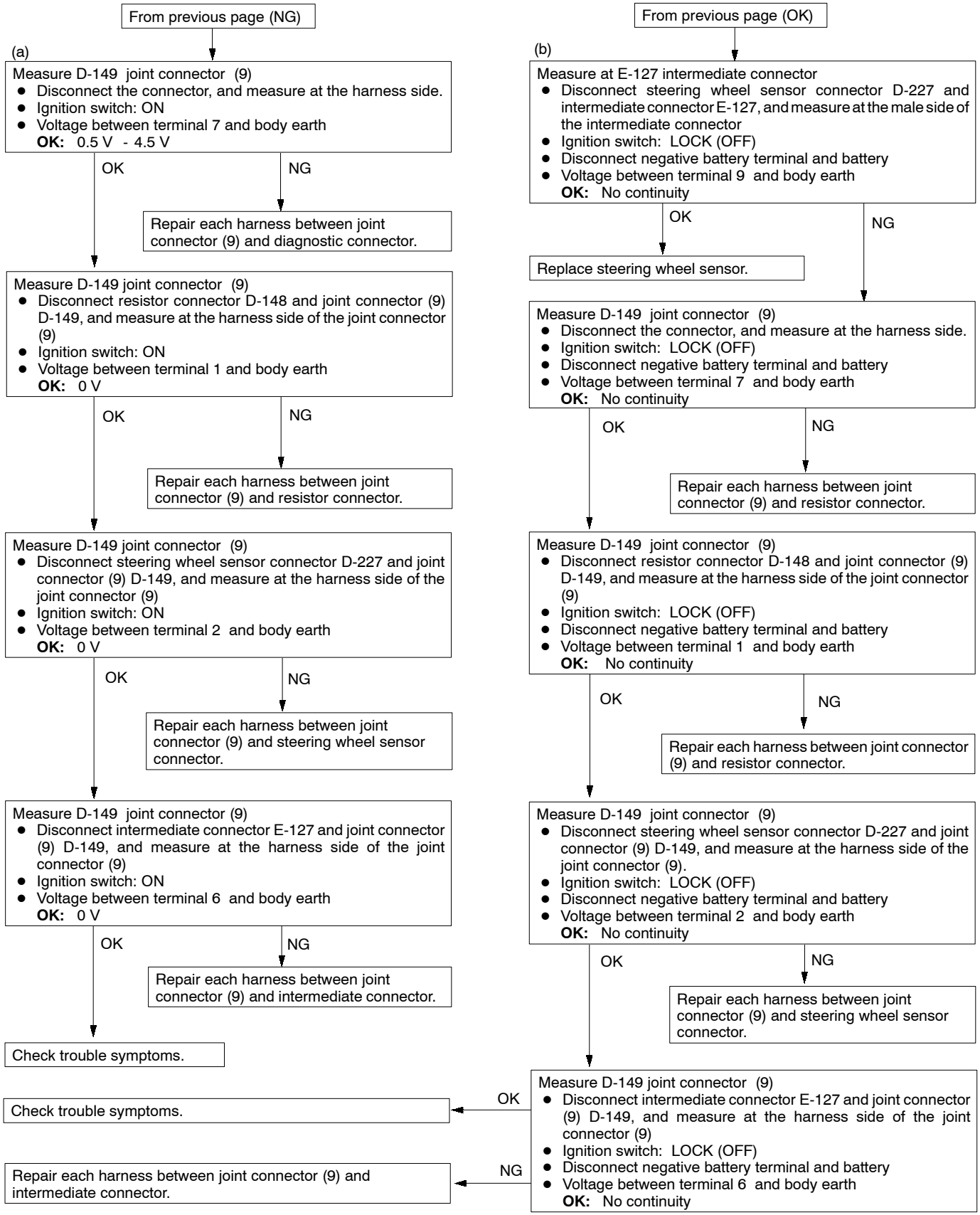
Diagnostic Item 3

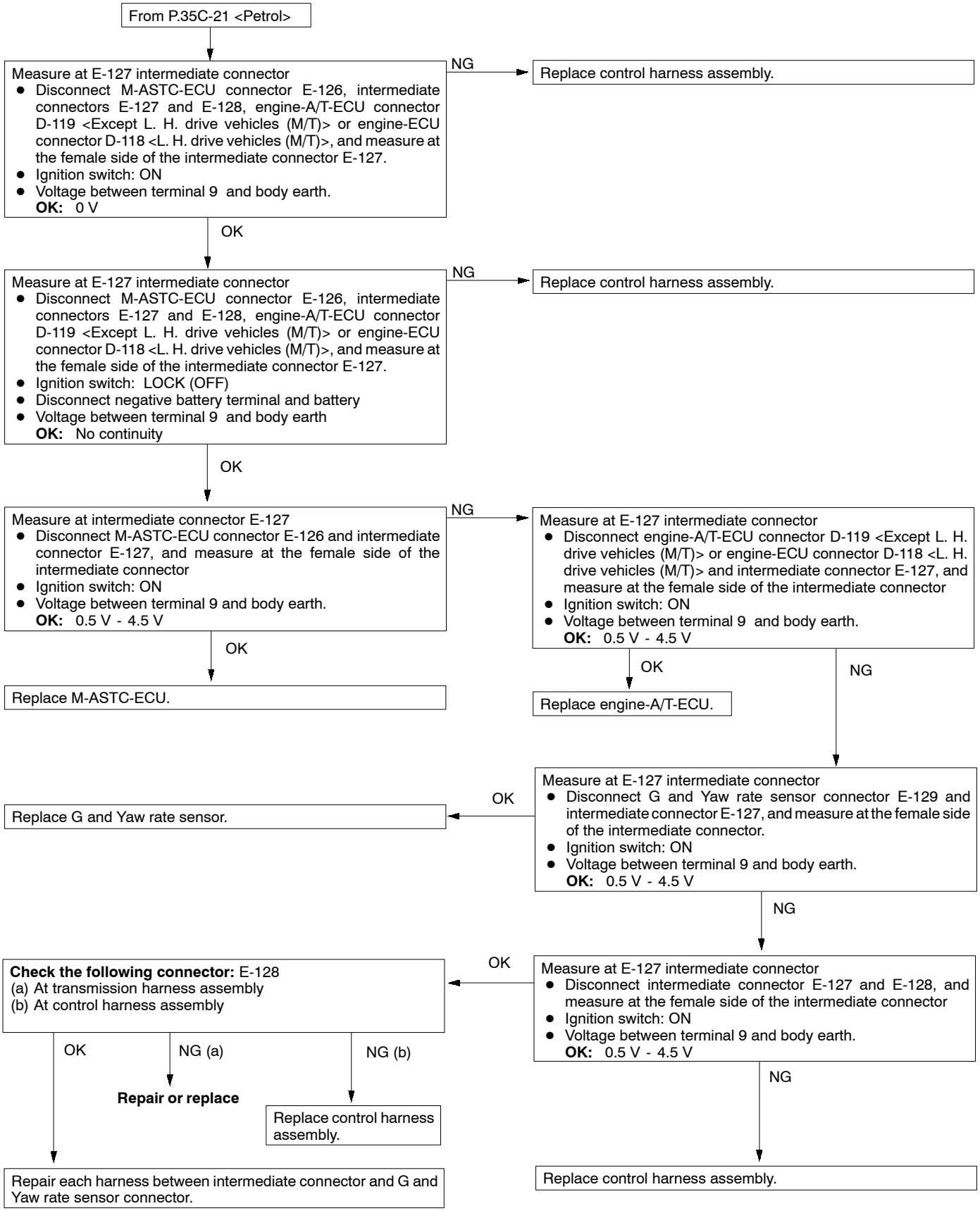
Diagnosis of Bus Line at CAN_H

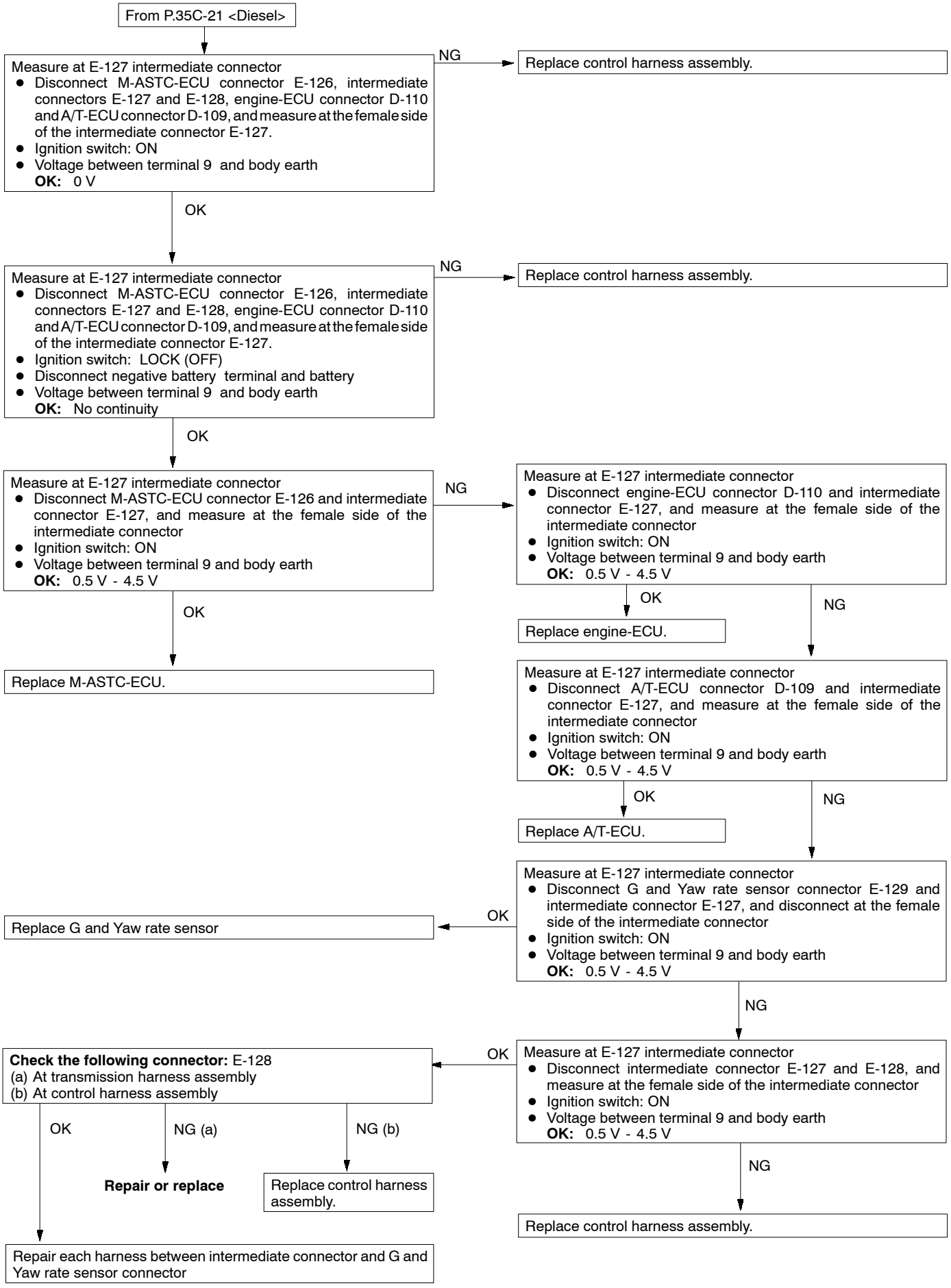
Caution

- **Use digital tester to measure resistance or voltage of CAN-bus line. If other device than the digital tester is used, it may cause the damage of the equipment connected to CAN-bus line.**
- **To measure resistance of CAN-bus line, disconnect the negative battery terminal. If the resistance is measured with the negative battery terminal connected, it may cause the damage of the equipment connected to CAN-bus line.**
- **To measure resistance or voltage at a female connector, always use test harness. If resistance or voltage is measured with other device than the test harness, it may cause the damage of connector.**
- **When defective connectors (including terminals) of instrument panel harness assembly (connected to steering wheel sensor, diagnostic connector and resistor) and transmission harness (connected to G and Yaw rate sensor connector and intermediate connector E-128) require harness cutting, loose twisted wire must be within 10 cm apart from the connector. When the loose twisted wire is over 10 cm apart from the connector, the harness must be twisted so that it can be matched with the original twisted wire. When the loose twisted wire is over 10 cm apart from the connector, it results in communication error.**
- **When CAN-bus line for the instrument panel harness assembly (connected to the steering wheel sensor, diagnostic connector and the resistor) and the transmission harness (connected to G and Yaw rate sensor connector and intermediate connector E-128) is repaired, notes on harness repair must be strictly followed. Redrawing CAN_L or CAN_H line only, or changing separation points causes CAN communication error.**
- **When a defect occurs on CAN-bus line or connector for the control harness assembly (connected to M-ASTC-ECU, engine A/T-ECU <Petrol>, engine-ECU <Diesel>, A/T-ECU <Diesel> and intermediate connector E-128), do not repair harness or connector only. Replace the harness assembly. Redrawing a new line or repairing connector causes CAN communication error.**




From previous page (NG)
(a)
Measure D-149 joint connector (9)
● Disconnect the connector, and measure at the harness side.
● Ignition switch: ON
● Voltage between terminal 7 and body earth
OK: 0.5 V - 4.5 V
OK
NG
Repair each harness between joint connector (9) and diagnostic connector.
Measure D-149 joint connector (9)
● Disconnect resistor connector D-148 and joint connector (9) D-149, and measure at the harness side of the joint connector (9)
● Ignition switch: ON
● Voltage between terminal 1 and body earth
OK: 0 V
OK
NG
Repair each harness between joint connector (9) and resistor connector.
Measure D-149 joint connector (9)
● Disconnect steering wheel sensor connector D-227 and joint connector (9) D-149, and measure at the harness side of the joint connector (9)
● Ignition switch: ON
● Voltage between terminal 2 and body earth
OK: 0 V
OK
NG
Repair each harness between joint connector (9) and steering wheel sensor connector.
Measure D-149 joint connector (9)
● Disconnect intermediate connector E-127 and joint connector (9) D-149, and measure at the harness side of the joint connector (9)
● Ignition switch: ON
● Voltage between terminal 6 and body earth
OK: 0 V
OK
NG
Repair each harness between joint connector (9) and intermediate connector.
Check trouble symptoms.
From previous page (OK)
(b)
Measure at E-127 intermediate connector
● Disconnect steering wheel sensor connector D-227 and intermediate connector E-127, and measure at the male side of the intermediate connector
● Ignition switch: LOCK (OFF)
● Disconnect negative battery terminal and battery
● Voltage between terminal 9 and body earth
OK: No continuity
OK
NG
Replace steering wheel sensor.
Measure D-149 joint connector (9)
● Disconnect the connector, and measure at the harness side.
● Ignition switch: LOCK (OFF)
● Disconnect negative battery terminal and battery
● Voltage between terminal 7 and body earth
OK: No continuity
OK
NG
Repair each harness between joint connector (9) and resistor connector.
Measure D-149 joint connector (9)
● Disconnect resistor connector D-148 and joint connector (9) D-149, and measure at the harness side of the joint connector (9)
● Ignition switch: LOCK (OFF)
● Disconnect negative battery terminal and battery
● Voltage between terminal 1 and body earth
OK: No continuity
OK
NG
Repair each harness between joint connector (9) and resistor connector.
Measure D-149 joint connector (9)
● Disconnect steering wheel sensor connector D-227 and joint connector (9) D-149, and measure at the harness side of the joint connector (9).
● Ignition switch: LOCK (OFF)
● Disconnect negative battery terminal and battery
● Voltage between terminal 2 and body earth
OK: No continuity
OK
NG
Repair each harness between joint connector (9) and steering wheel sensor connector.
Measure D-149 joint connector (9)
● Disconnect intermediate connector E-127 and joint connector (9) D-149, and measure at the harness side of the joint connector (9)
● Ignition switch: LOCK (OFF)
● Disconnect negative battery terminal and battery
● Voltage between terminal 6 and body earth
OK: No continuity
OK
NG
Check trouble symptoms.
Repair each harness between joint connector (9) and intermediate connector.


From P.35C-21 <Petrol>
Measure at E-127 intermediate connector
● Disconnect M-ASTC-ECU connector E-126, intermediate connectors E-127 and E-128, engine-A/T-ECU connector D-119 <Except L. H. drive vehicles (M/T)> or engine-ECU connector D-118 <L. H. drive vehicles (M/T)>, and measure at the female side of the intermediate connector E-127.
● Ignition switch: ON
● Voltage between terminal 9 and body earth.
OK: 0 V
NG
Replace control harness assembly.
OK
Measure at E-127 intermediate connector
● Disconnect M-ASTC-ECU connector E-126, intermediate connectors E-127 and E-128, engine-A/T-ECU connector D-119 <Except L. H. drive vehicles (M/T)> or engine-ECU connector D-118 <L. H. drive vehicles (M/T)>, and measure at the female side of the intermediate connector E-127.
● Ignition switch: LOCK (OFF)
● Disconnect negative battery terminal and battery
● Voltage between terminal 9 and body earth
OK: No continuity
NG
Replace control harness assembly.
OK
Measure at intermediate connector E-127
● Disconnect M-ASTC-ECU connector E-126 and intermediate connector E-127, and measure at the female side of the intermediate connector
● Ignition switch: ON
● Voltage between terminal 9 and body earth.
OK: 0.5 V - 4.5 V
NG
Measure at E-127 intermediate connector
● Disconnect engine-A/T-ECU connector D-119 <Except L. H. drive vehicles (M/T)> or engine-ECU connector D-118 <L. H. drive vehicles (M/T)> and intermediate connector E-127, and measure at the female side of the intermediate connector
● Ignition switch: ON
● Voltage between terminal 9 and body earth.
OK: 0.5 V - 4.5 V
OK
Replace engine-A/T-ECU.
NG
OK
Replace M-ASTC-ECU.
Measure at E-127 intermediate connector
● Disconnect G and Yaw rate sensor connector E-129 and intermediate connector E-127, and measure at the female side of the intermediate connector.
● Ignition switch: ON
● Voltage between terminal 9 and body earth.
OK: 0.5 V - 4.5 V
OK
Replace G and Yaw rate sensor.
NG
Measure at E-127 intermediate connector
● Disconnect intermediate connector E-127 and E-128, and measure at the female side of the intermediate connector
● Ignition switch: ON
● Voltage between terminal 9 and body earth.
OK: 0.5 V - 4.5 V
OK
Check the following connector: E-128
(a) At transmission harness assembly
(b) At control harness assembly
OK
NG (a)
NG (b)
Repair or replace
Replace control harness assembly.
NG
Repair each harness between intermediate connector and G and Yaw rate sensor connector.
Replace control harness assembly.

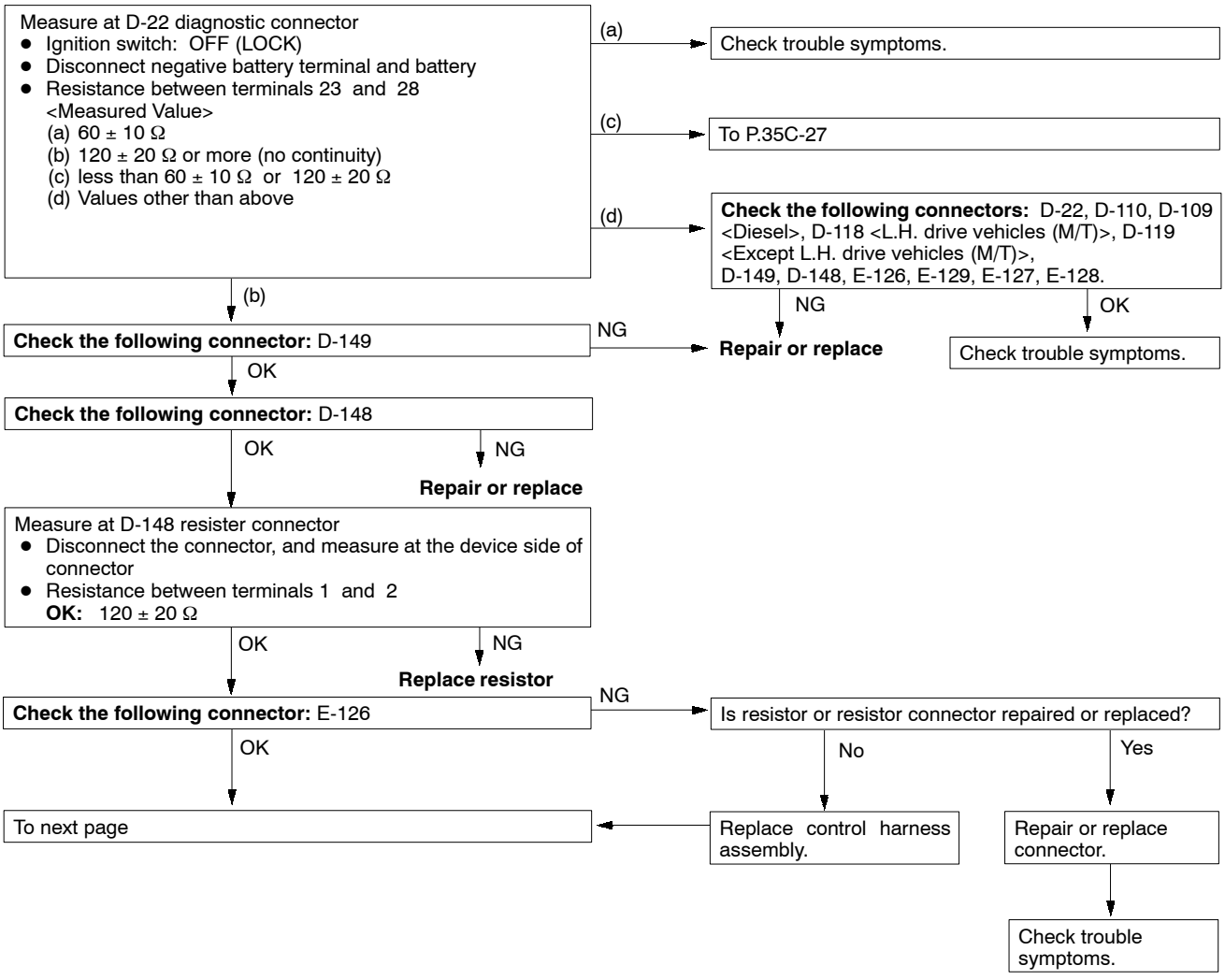

From P.35C-21 <Diesel>
Measure at E-127 intermediate connector
● Disconnect M-ASTC-ECU connector E-126, intermediate connectors E-127 and E-128, engine-ECU connector D-110 and A/T-ECU connector D-109, and measure at the female side of the intermediate connector E-127.
● Ignition switch: ON
● Voltage between terminal 9 and body earth
OK: 0 V
NG
Replace control harness assembly.
OK
Measure at E-127 intermediate connector
● Disconnect M-ASTC-ECU connector E-126, intermediate connectors E-127 and E-128, engine-ECU connector D-110 and A/T-ECU connector D-109, and measure at the female side of the intermediate connector E-127.
● Ignition switch: LOCK (OFF)
● Disconnect negative battery terminal and battery
● Voltage between terminal 9 and body earth
OK: No continuity
NG
Replace control harness assembly.
OK
Measure at E-127 intermediate connector
● Disconnect M-ASTC-ECU connector E-126 and intermediate connector E-127, and measure at the female side of the intermediate connector
● Ignition switch: ON
● Voltage between terminal 9 and body earth
OK: 0.5 V - 4.5 V
NG
Measure at E-127 intermediate connector
● Disconnect engine-ECU connector D-110 and intermediate connector E-127, and measure at the female side of the intermediate connector
● Ignition switch: ON
● Voltage between terminal 9 and body earth
OK: 0.5 V - 4.5 V
OK
Replace engine-ECU.
NG
Measure at E-127 intermediate connector
● Disconnect A/T-ECU connector D-109 and intermediate connector E-127, and measure at the female side of the intermediate connector
● Ignition switch: ON
● Voltage between terminal 9 and body earth
OK: 0.5 V - 4.5 V
OK
Replace A/T-ECU.
NG
Measure at E-127 intermediate connector
● Disconnect G and Yaw rate sensor connector E-129 and intermediate connector E-127, and disconnect at the female side of the intermediate connector
● Ignition switch: ON
● Voltage between terminal 9 and body earth
OK: 0.5 V - 4.5 V
OK
Replace G and Yaw rate sensor
NG
Measure at E-127 intermediate connector
● Disconnect intermediate connector E-127 and E-128, and measure at the female side of the intermediate connector
● Ignition switch: ON
● Voltage between terminal 9 and body earth
OK: 0.5 V - 4.5 V
OK
Check the following connector: E-128
(a) At transmission harness assembly
(b) At control harness assembly
OK
NG (a)
NG (b)
Repair or replace
Replace control harness assembly.
NG
Replace control harness assembly.
Repair each harness between intermediate connector and G and Yaw rate sensor connector
Replace M-ASTC-ECU.

Diagnostic Item 4

Diagnosis of Terminating Resistance and CAN Main Bus Line

Caution

- **Use digital tester to measure resistance or voltage of CAN-bus line. If other device than the digital tester is used, it may cause the damage of the equipment connected to CAN-bus line.**
- **To measure resistance of CAN-bus line, disconnect the negative battery terminal. If the resistance is measured with the negative battery terminal connected, it may cause the damage of the equipment connected to CAN-bus line.**
- **To measure resistance or voltage at a female connector, always use test harness. If resistance or voltage is measured with other device than the test harness, it may cause the damage of connector.**
- **When defective connectors (including terminals) of instrument panel harness assembly (connected to steering wheel sensor, diagnostic connector and resistor) and transmission harness (connected to G and Yaw rate sensor connector and intermediate connector E-128) require harness cutting, loose twisted wire must be within 10 cm apart from the connector. When the loose twisted wire is over 10 cm apart from the connector, the harness must be twisted so that it can be matched with the original twisted wire. When the loose twisted wire is over 10 cm apart from the connector, it results in communication error.**
- **When CAN-bus line for the instrument panel harness assembly (connected to the steering wheel sensor, diagnostic connector and the resistor) and the transmission harness (connected to G and Yaw rate sensor connector and intermediate connector E-128) is repaired, notes on harness repair must be strictly followed. Redrawing CAN_L or CAN_H line only, or changing separation points causes CAN communication error.**
- **When a defect occurs on CAN-bus line or connector for the control harness assembly (connected to M-ASTC-ECU, engine A/T-ECU <Petrol>, engine-ECU <Diesel>, A/T-ECU <Diesel> and intermediate connector E-128), do not repair harness or connector only. Replace the harness assembly. Redrawing a new line or repairing connector causes CAN communication error.**



From previous page

Measure at E-126 M-ASTC-ECU connector
- Disconnect the connector, and measure at the device side of connector
- Resistance between terminals 83 and 84
  OK: 120 ± 20 Ω

NG → Replace M-ASTC-ECU.

OK

Check the following connector: E-127
(a) At instrument panel harness assembly
(b) At control harness assembly
(c) When the resistor has been replaced at the stage of (a) or (b)

No ← Is resistor or resistor connector repaired or replaced?

Yes

OK

NG (a) → Repair or replace connector

NG (b) → Replace control harness assembly.

NG (c) → Repair connector → Check trouble symptoms.

Measure at E-127 intermediate connector
- Disconnect the connector, and measure at the female side.
- Ignition switch: LOCK (OFF)
- Disconnect negative battery terminal and battery
- Resistance between terminals 9 and 20
  OK: 120 ± 20 Ω

NG → Replace control harness assembly.

OK

Measure D-149 joint connector (9) and D-22 diagnostic connector
- Disconnect joint connector (9) D-149, and measure between connectors
- Ignition switch: LOCK (OFF)
- Disconnect negative battery terminal and battery
- Resistance between the following terminals

At D-149		At D-22
7	-	23
12	-	28

OK: 2 Ω or less

NG → Repair each harness between joint connector (9) and diagnostic connector.

OK

Measure at D-149 joint connector (9) and D-148 resistor connector
- Disconnect joint connector D-149 and resistor connector D-148, and measure between connectors
- Ignition switch: LOCK (OFF)
- Disconnect negative battery terminal and battery
- Resistance between the following terminals

At D-149		At D-148
1	-	1
4	-	2

OK: 2 Ω or less

OK → Measure at D-149 joint connector (9) and E-127 intermediate connector
- Disconnect joint connector (9) D-149 and intermediate connector E-127, and then measure between joint connector (9) and the male side of intermediate connector
- Ignition switch: LOCK (OFF)
- Disconnect negative battery terminal and battery
- Resistance between the following terminals

At D-149		At E-127
6	-	9
11	-	20

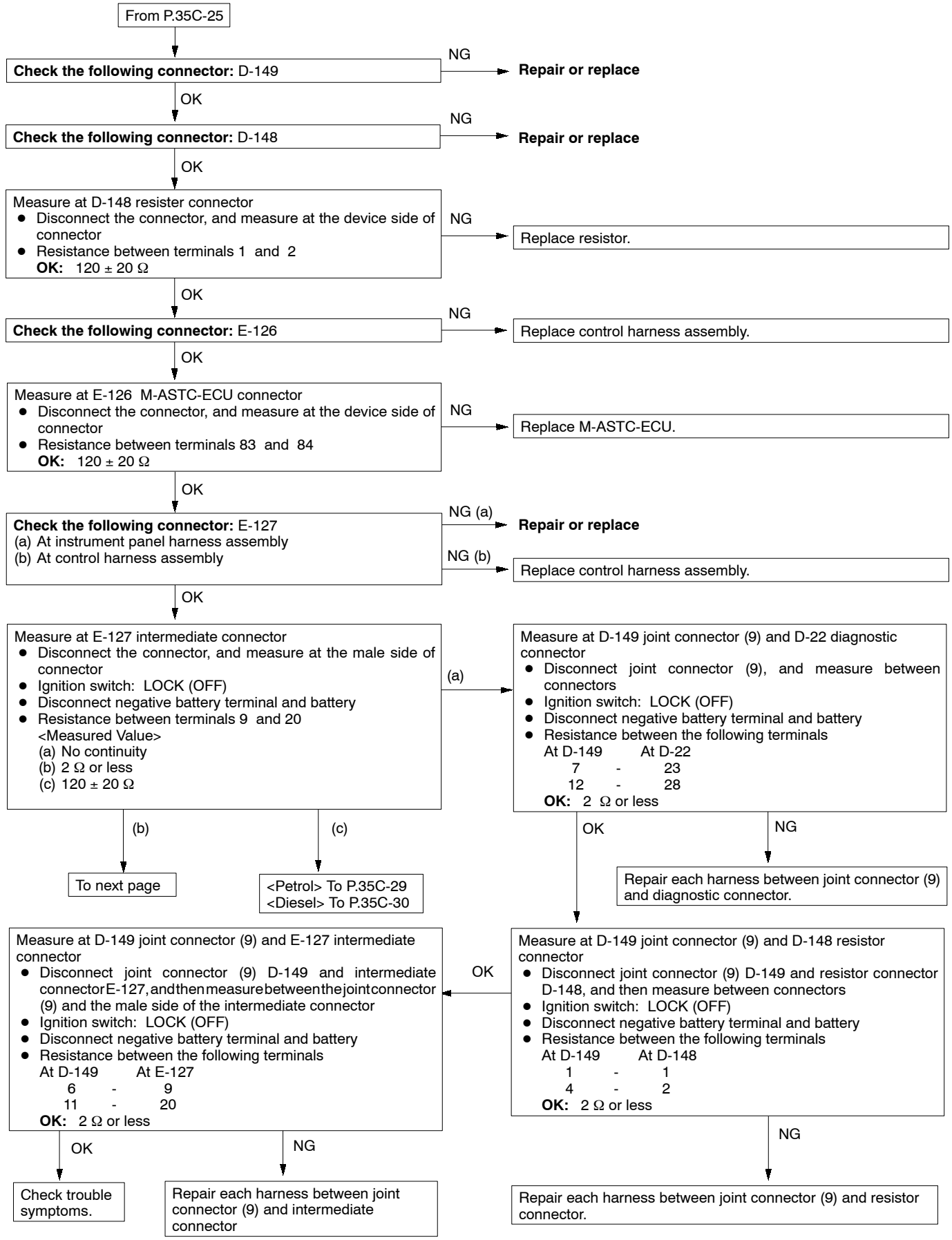
OK: 2 Ω or less

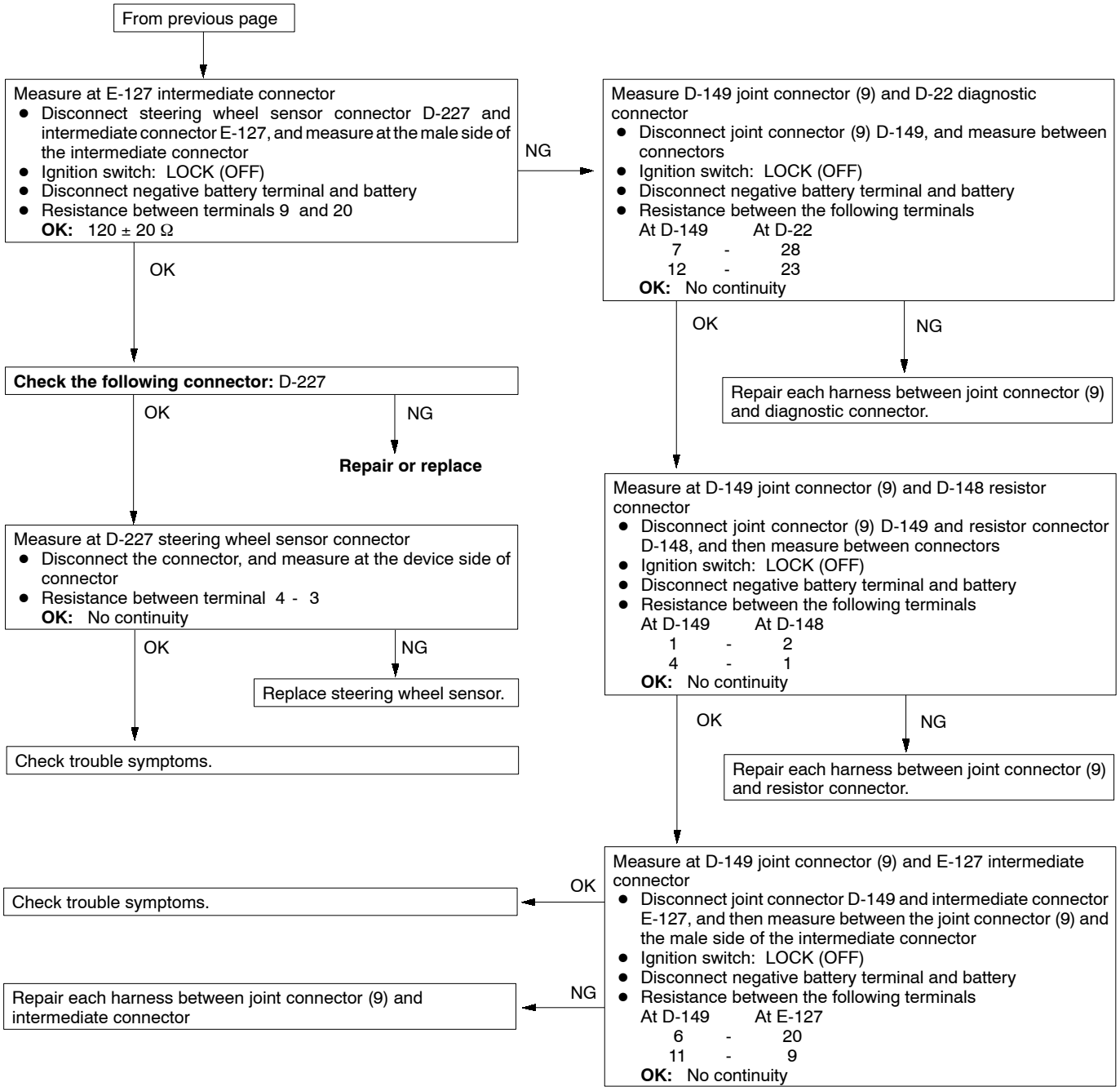
OK → Check trouble symptoms.

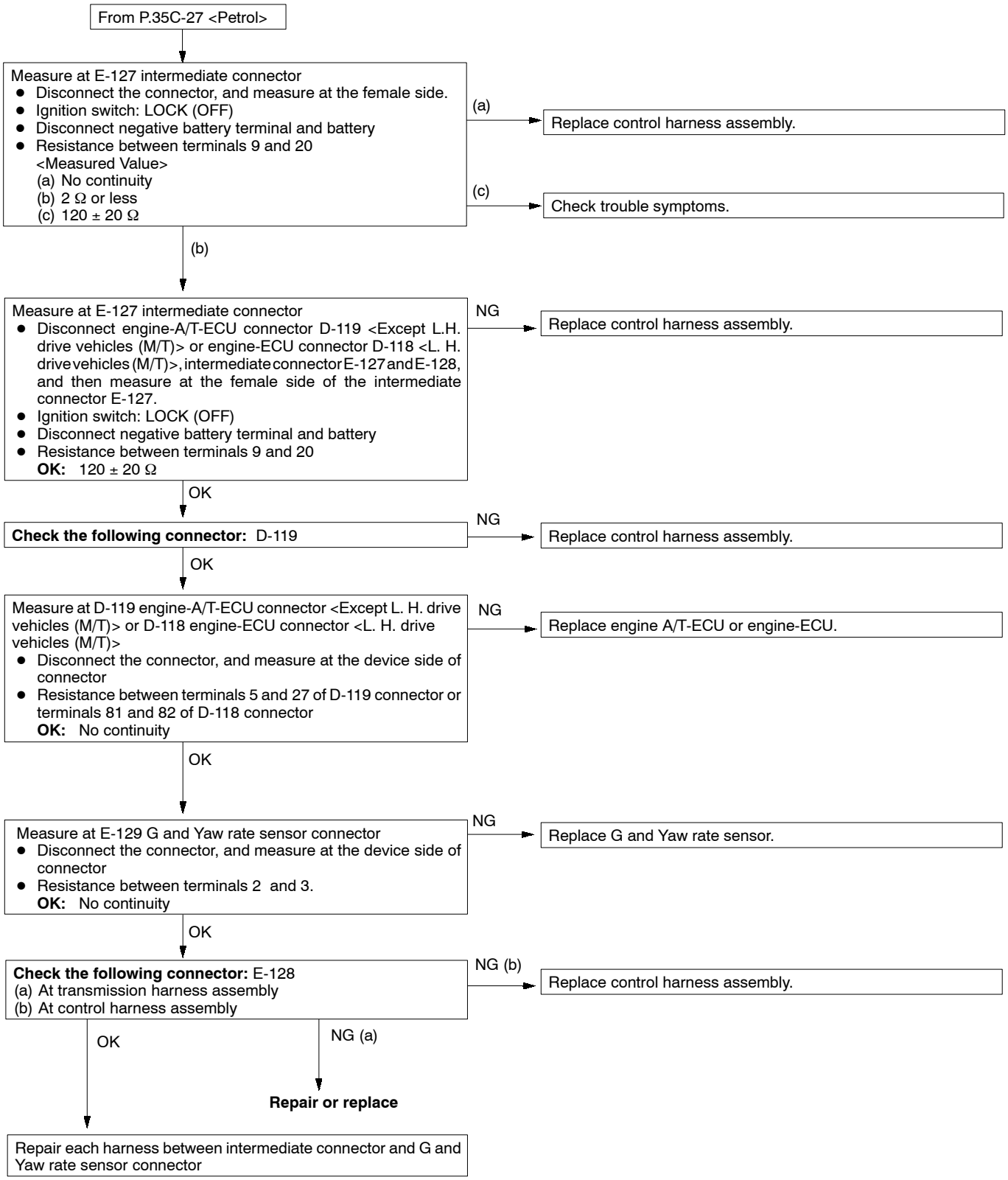
NG → Repair each harness between joint connector (9) and intermediate connector.

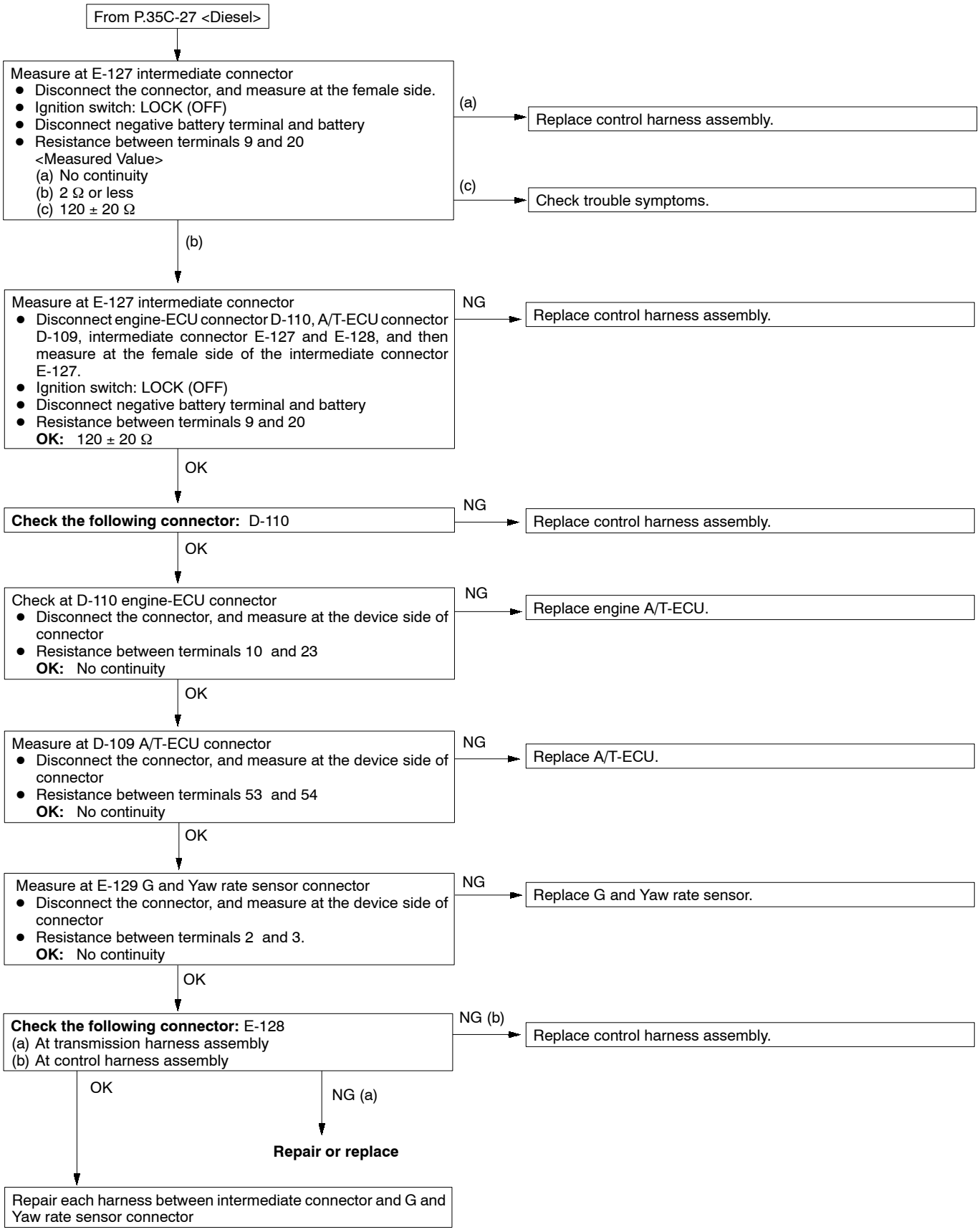
NG

Repair each harness between joint connector (9) and resistor connector.


From P.35C-25
Check the following connector: D-149
NG
Repair or replace
OK
Check the following connector: D-148
NG
Repair or replace
OK
Measure at D-148 resister connector
● Disconnect the connector, and measure at the device side of connector
● Resistance between terminals 1 and 2
OK: 120 ± 20 Ω
NG
Replace resistor.
OK
Check the following connector: E-126
NG
Replace control harness assembly.
OK
Measure at E-126 M-ASTC-ECU connector
● Disconnect the connector, and measure at the device side of connector
● Resistance between terminals 83 and 84
OK: 120 ± 20 Ω
NG
Replace M-ASTC-ECU.
OK
Check the following connector: E-127
(a) At instrument panel harness assembly
(b) At control harness assembly
NG (a)
Repair or replace
NG (b)
Replace control harness assembly.
OK
Measure at E-127 intermediate connector
● Disconnect the connector, and measure at the male side of connector
● Ignition switch: LOCK (OFF)
● Disconnect negative battery terminal and battery
● Resistance between terminals 9 and 20
<Measured Value>
(a) No continuity
(b) 2 Ω or less
(c) 120 ± 20 Ω
(a)
Measure at D-149 joint connector (9) and D-22 diagnostic connector
● Disconnect joint connector (9), and measure between connectors
● Ignition switch: LOCK (OFF)
● Disconnect negative battery terminal and battery
● Resistance between the following terminals
At D-149 At D-22
7 - 23
12 - 28
OK: 2 Ω or less
OK
NG
Repair each harness between joint connector (9) and diagnostic connector.
(b)
(c)
To next page
<Petrol> To P.35C-29
<Diesel> To P.35C-30
Measure at D-149 joint connector (9) and D-148 resistor connector
● Disconnect joint connector (9) D-149 and resistor connector D-148, and then measure between connectors
● Ignition switch: LOCK (OFF)
● Disconnect negative battery terminal and battery
● Resistance between the following terminals
At D-149 At D-148
1 - 1
4 - 2
OK: 2 Ω or less
OK
Measure at D-149 joint connector (9) and E-127 intermediate connector
● Disconnect joint connector (9) D-149 and intermediate connector E-127, and then measure between the joint connector (9) and the male side of the intermediate connector
● Ignition switch: LOCK (OFF)
● Disconnect negative battery terminal and battery
● Resistance between the following terminals
At D-149 At E-127
6 - 9
11 - 20
OK: 2 Ω or less
NG
Repair each harness between joint connector (9) and resistor connector.
OK
NG
Check trouble symptoms.
Repair each harness between joint connector (9) and intermediate connector


From previous page
Measure at E-127 intermediate connector
● Disconnect steering wheel sensor connector D-227 and intermediate connector E-127, and measure at the male side of the intermediate connector
● Ignition switch: LOCK (OFF)
● Disconnect negative battery terminal and battery
● Resistance between terminals 9 and 20
OK: 120 ± 20 Ω
NG
OK
Measure D-149 joint connector (9) and D-22 diagnostic connector
● Disconnect joint connector (9) D-149, and measure between connectors
● Ignition switch: LOCK (OFF)
● Disconnect negative battery terminal and battery
● Resistance between the following terminals
At D-149 At D-22
7 - 28
12 - 23
OK: No continuity
OK
NG
Repair each harness between joint connector (9) and diagnostic connector.
Check the following connector: D-227
OK
NG
Repair or replace
Measure at D-149 joint connector (9) and D-148 resistor connector
● Disconnect joint connector (9) D-149 and resistor connector D-148, and then measure between connectors
● Ignition switch: LOCK (OFF)
● Disconnect negative battery terminal and battery
● Resistance between the following terminals
At D-149 At D-148
1 - 2
4 - 1
OK: No continuity
Measure at D-227 steering wheel sensor connector
● Disconnect the connector, and measure at the device side of connector
● Resistance between terminal 4 - 3
OK: No continuity
OK
NG
Replace steering wheel sensor.
OK
NG
Repair each harness between joint connector (9) and resistor connector.
Check trouble symptoms.
Measure at D-149 joint connector (9) and E-127 intermediate connector
● Disconnect joint connector D-149 and intermediate connector E-127, and then measure between the joint connector (9) and the male side of the intermediate connector
● Ignition switch: LOCK (OFF)
● Disconnect negative battery terminal and battery
● Resistance between the following terminals
At D-149 At E-127
6 - 20
11 - 9
OK: No continuity
OK
Check trouble symptoms.
NG
Repair each harness between joint connector (9) and intermediate connector


From P.35C-27 <Petrol>
Measure at E-127 intermediate connector
● Disconnect the connector, and measure at the female side.
● Ignition switch: LOCK (OFF)
● Disconnect negative battery terminal and battery
● Resistance between terminals 9 and 20
<Measured Value>
(a) No continuity
(b) 2 Ω or less
(c) 120 ± 20 Ω
(a)
Replace control harness assembly.
(c)
Check trouble symptoms.
(b)
Measure at E-127 intermediate connector
● Disconnect engine-A/T-ECU connector D-119 <Except L.H. drive vehicles (M/T)> or engine-ECU connector D-118 <L. H. drive vehicles (M/T)>, intermediate connector E-127 and E-128, and then measure at the female side of the intermediate connector E-127.
● Ignition switch: LOCK (OFF)
● Disconnect negative battery terminal and battery
● Resistance between terminals 9 and 20
OK: 120 ± 20 Ω
NG
Replace control harness assembly.
OK
Check the following connector: D-119
NG
Replace control harness assembly.
OK
Measure at D-119 engine-A/T-ECU connector <Except L. H. drive vehicles (M/T)> or D-118 engine-ECU connector <L. H. drive vehicles (M/T)>
● Disconnect the connector, and measure at the device side of connector
● Resistance between terminals 5 and 27 of D-119 connector or terminals 81 and 82 of D-118 connector
OK: No continuity
NG
Replace engine A/T-ECU or engine-ECU.
OK
Measure at E-129 G and Yaw rate sensor connector
● Disconnect the connector, and measure at the device side of connector
● Resistance between terminals 2 and 3.
OK: No continuity
NG
Replace G and Yaw rate sensor.
OK
Check the following connector: E-128
(a) At transmission harness assembly
(b) At control harness assembly
NG (b)
Replace control harness assembly.
OK
NG (a)
Repair or replace
Repair each harness between intermediate connector and G and Yaw rate sensor connector

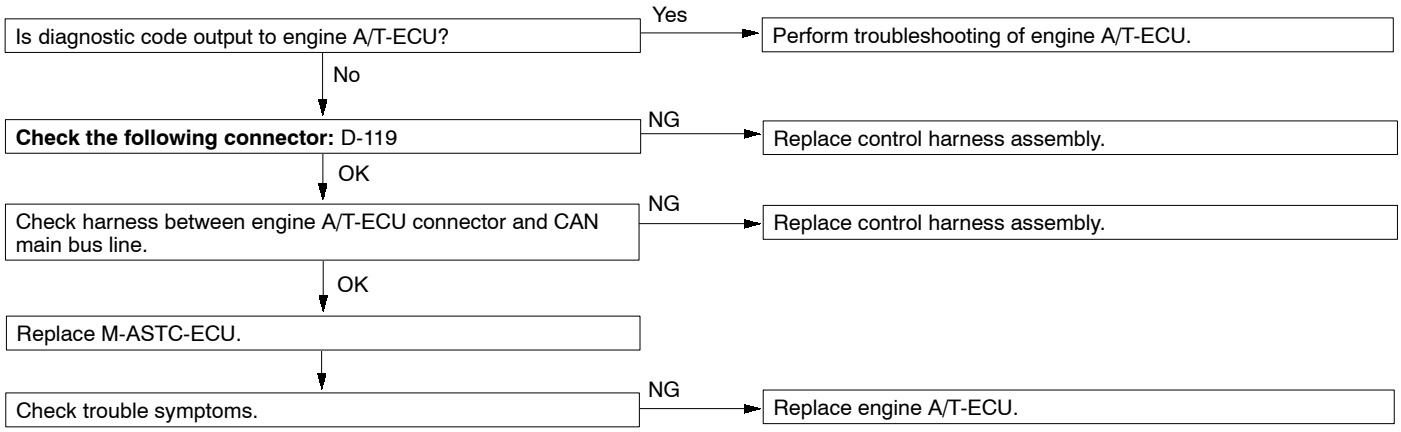

From P.35C-27 <Diesel>
Measure at E-127 intermediate connector
● Disconnect the connector, and measure at the female side.
● Ignition switch: LOCK (OFF)
● Disconnect negative battery terminal and battery
● Resistance between terminals 9 and 20
<Measured Value>
(a) No continuity
(b) 2 Ω or less
(c) 120 ± 20 Ω
(a)
Replace control harness assembly.
(c)
Check trouble symptoms.
(b)
Measure at E-127 intermediate connector
● Disconnect engine-ECU connector D-110, A/T-ECU connector D-109, intermediate connector E-127 and E-128, and then measure at the female side of the intermediate connector E-127.
● Ignition switch: LOCK (OFF)
● Disconnect negative battery terminal and battery
● Resistance between terminals 9 and 20
OK: 120 ± 20 Ω
NG
Replace control harness assembly.
OK
Check the following connector: D-110
NG
Replace control harness assembly.
OK
Check at D-110 engine-ECU connector
● Disconnect the connector, and measure at the device side of connector
● Resistance between terminals 10 and 23
OK: No continuity
NG
Replace engine A/T-ECU.
OK
Measure at D-109 A/T-ECU connector
● Disconnect the connector, and measure at the device side of connector
● Resistance between terminals 53 and 54
OK: No continuity
NG
Replace A/T-ECU.
OK
Measure at E-129 G and Yaw rate sensor connector
● Disconnect the connector, and measure at the device side of connector
● Resistance between terminals 2 and 3.
OK: No continuity
NG
Replace G and Yaw rate sensor.
OK
Check the following connector: E-128
(a) At transmission harness assembly
(b) At control harness assembly
NG (b)
Replace control harness assembly.
OK
NG (a)
Repair or replace
Repair each harness between intermediate connector and G and Yaw rate sensor connector

Diagnostic Item 5

Diagnosis of CAN-bus Line (between Main Bus Line and Engine A/T-ECU)	Probable Cause
When DTC No. 35 or 36 is output to M-ASTC-ECU, the harness from CAN main bus line to engine A/T-ECU, or engine A/T-ECU itself or M-ASTC-ECU may be damaged or defective.	• CAN-bus line damaged between CAN main bus line and Engine A/T-ECU • Connector fault • Engine-A/T-ECU inoperative • Malfunction of M-ASTC-ECU

Caution

- **This troubleshooting must be carried out after the diagnosis of CAN main bus line has been completed.**
- **When CAN-bus line or connector of the control harness assembly (connected to M-ASTC-ECU, engine A/T-ECU <Petrol>, engine-ECU <Diesel>, A/T-ECU <Diesel> and intermediate connector E-128) is defective, do not repair the harness or connector only. Always replace the harness assembly. Redrawing a new line or repairing connector causes CAN communication error.**

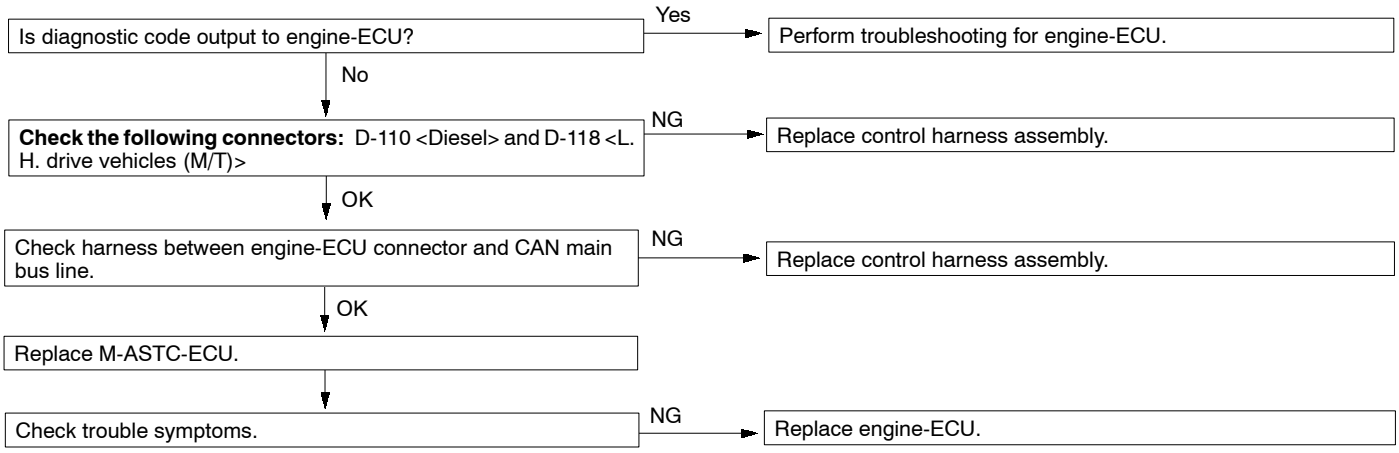


Diagnostic Item 6

Diagnosis of CAN Bus Line (between Main Bus Line and Engine-ECU)	Probable Cause
When DTC No. 35 is output to M-ASTC-ECU, harness from CAN main bus line to engine-ECU, or engine-ECU itself, or M-ASTC-ECU may be damaged or defective.	• CAN-bus line defect between CAN main bus line and engine-ECU • Connector fault • Malfunction of engine-ECU • Malfunction of M-ASTC-ECU

Caution

- **This troubleshooting must be carried out after the diagnosis of CAN main bus line has been completed.**
- **When CAN-bus line or connector of the control harness assembly (connected to M-ASTC-ECU, engine A/T-ECU <Petrol>, engine-ECU <Diesel>, A/T-ECU <Diesel> and intermediate connector E-128) is defective, do not repair the harness or connector only. Always replace the harness assembly. Redrawing a new line or repairing connector causes CAN communication error.**

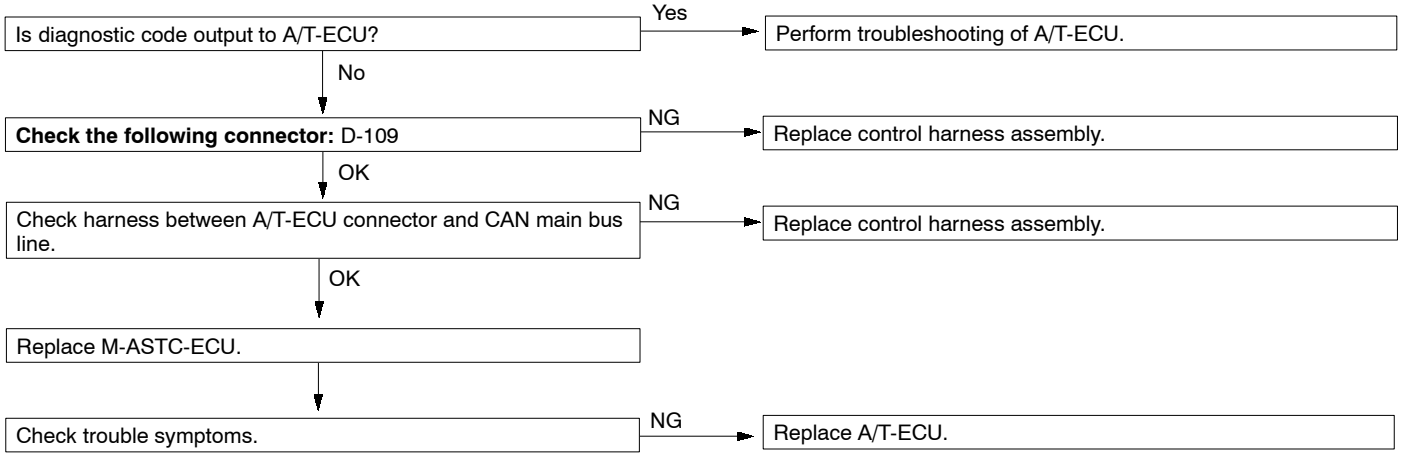


Diagnostic Item 7

Diagnosis of CAN-bus Line (between Main Bus Line and A/T-ECU)	Probable Cause
When DTC No. 35 or 36 is output to M-ASTC-ECU, the harness from CAN main bus line to A/T-ECU, or A/T-ECU itself or M-ASTC-ECU may be damaged or defective.	• CAN-bus line damaged between CAN main bus line and A/T-ECU • Connector fault • A/T-ECU inoperative • Malfunction of M-ASTC-ECU

Caution

- **This troubleshooting must be carried out after the diagnosis of CAN main bus line has been completed.**
- **When CAN-bus line or connector of the control harness assembly (connected to M-ASTC-ECU, engine A/T-ECU <Petrol>, engine-ECU <Diesel>, A/T-ECU <Diesel> and intermediate connector E-128) is defective, do not repair the harness or connector only. Always replace the harness assembly. Redrawing a new line or repairing connector causes CAN communication error.**

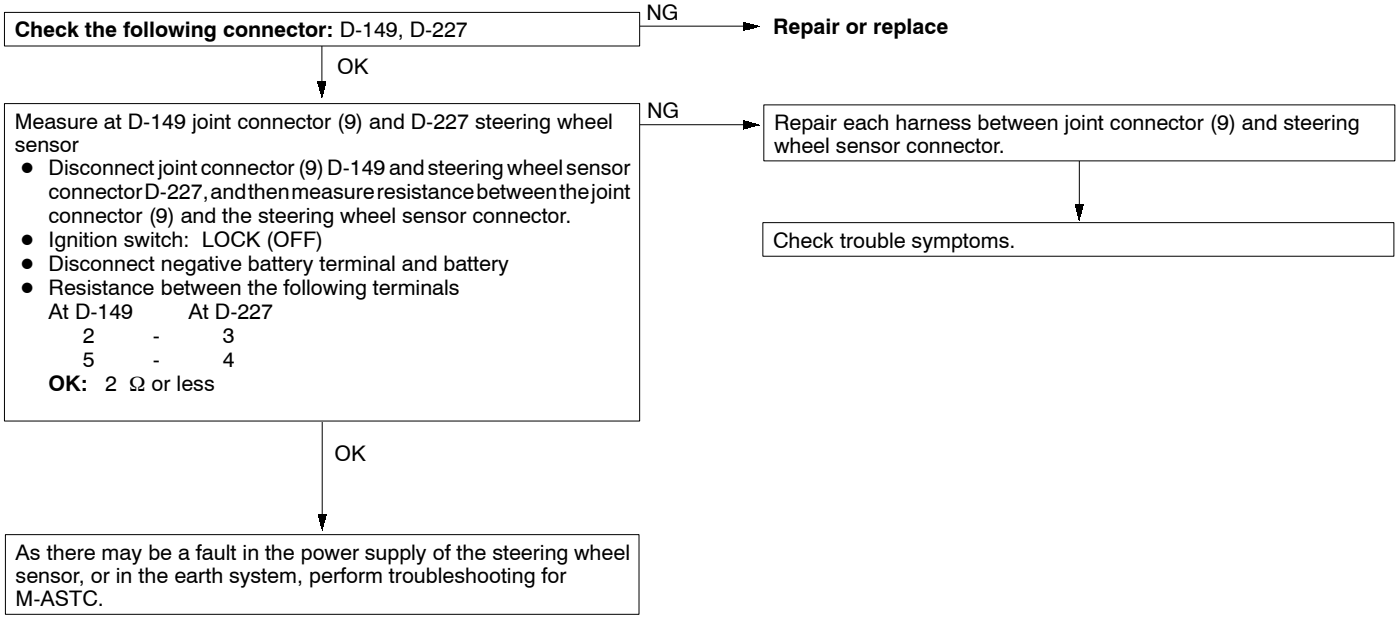


Diagnostic Item 8

Diagnosis of CAN Bus Line (between Main Bus Line and Steering Wheel Sensor)	Probable Cause
When DTC No. 67 is output to M-ASTC-ECU, harness from CAN main bus line to steering wheel sensor, steering wheel sensor itself, or M-ASTC-ECU may be defective.	• CAN-bus line defect between CAN main bus line and steering wheel sensor • Connector fault • Malfunction of steering wheel sensor • Malfunction of M-ASTC-ECU

Caution

- **This troubleshooting must be carried out after the diagnosis of CAN main bus line has been completed.**
- **Use digital tester to measure resistance or voltage of CAN-bus line. If other device than the digital tester is used, it may cause the damage of the equipment connected to CAN-bus line.**
- **To measure resistance of CAN-bus line, disconnect the negative battery terminal. If the resistance is measured with the negative battery terminal connected, it may cause the damage of the equipment connected to CAN-bus line.**
- **To measure resistance or voltage at a female connector, always use test harness. If resistance or voltage is measured with other device than the test harness, it may cause the damage of connector.**
- **When defective connectors (including terminals) of instrument panel harness assembly (connected to steering wheel sensor, diagnostic connector and resistor) and transmission harness (connected to G and Yaw rate sensor connector and intermediate connector E-128) require harness cutting, loose twisted wire must be within 10 cm apart from the connector. When the loose twisted wire is over 10 cm apart from the connector, the harness must be twisted so that it can be matched with the original twisted wire. When the loose twisted wire is over 10 cm apart from the connector, it results in communication error.**
- **When CAN-bus line for the instrument panel harness assembly (connected to the steering wheel sensor, diagnostic connector and the resistor) and the transmission harness (connected to G and Yaw rate sensor connector and intermediate connector E-128) is repaired, notes on harness repair must be strictly followed. Redrawing CAN_L or CAN_H line only, or changing separation points causes CAN communication error.**

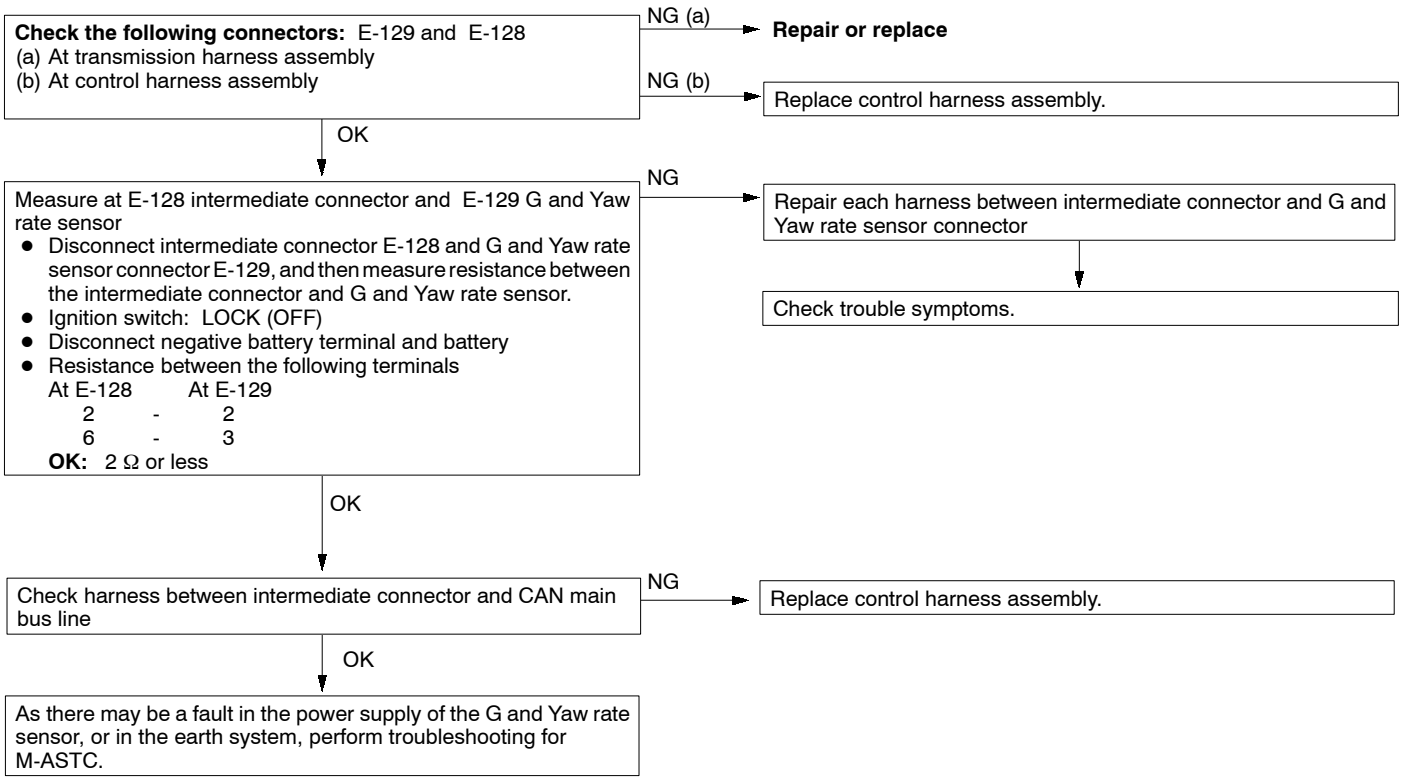


Diagnostic Item 9

Diagnosis of CAN-bus Line (between Main Bus Line and G and Yaw Rate Sensor)	Probable Cause
When DTC No. 74 is output to M-ASTC-ECU, harness between CAN main bus line and G and Yaw rate sensor, G and Yaw rate sensor itself, or M-ASTC-ECU may be defective.	• CAN-bus line defect between CAN main bus line and G and Yaw rate sensor • Connector fault • Malfunction of G and Yaw rate sensor • Malfunction of M-ASTC-ECU

Caution

- **This troubleshooting must be carried out after the diagnosis of CAN main bus line has been completed.**
- **Use digital tester to measure resistance or voltage of CAN-bus line. If other device than the digital tester is used, it may cause the damage of the equipment connected to CAN-bus line.**
- **To measure resistance of CAN-bus line, disconnect the negative battery terminal. If the resistance is measured with the negative battery terminal connected, it may cause the damage of the equipment connected to CAN-bus line.**
- **To measure resistance or voltage at a female connector, always use test harness. If resistance or voltage is measured with other device than the test harness, it may cause the damage of connector.**
- **When defective connectors (including terminals) of instrument panel harness assembly (connected to steering wheel sensor, diagnostic connector and resistor) and transmission harness (connected to G and Yaw rate sensor connector and intermediate connector E-128) require harness cutting, loose twisted wire must be within 10 cm apart from the connector. When the loose twisted wire is over 10 cm apart from the connector, the harness must be twisted so that it can be matched with the original twisted wire. When the loose twisted wire is over 10 cm apart from the connector, it results in communication error.**
- **When CAN-bus line for the instrument panel harness assembly (connected to the steering wheel sensor, diagnostic connector and the resistor) and the transmission harness (connected to G and Yaw rate sensor connector and intermediate connector E-128) is repaired, notes on harness repair must be strictly followed. Redrawing CAN_L or CAN_H line only, or changing separation points causes CAN communication error.**
- **When CAN-bus line or connector of the control harness assembly (connected to M-ASTC-ECU, engine A/T-ECU <Petrol>, engine-ECU <Diesel>, A/T-ECU <Diesel> and intermediate connector E-128) is defective, do not repair the harness or connector only. Always replace the harness assembly. Redrawing a new line or repairing connector causes CAN communication error.**



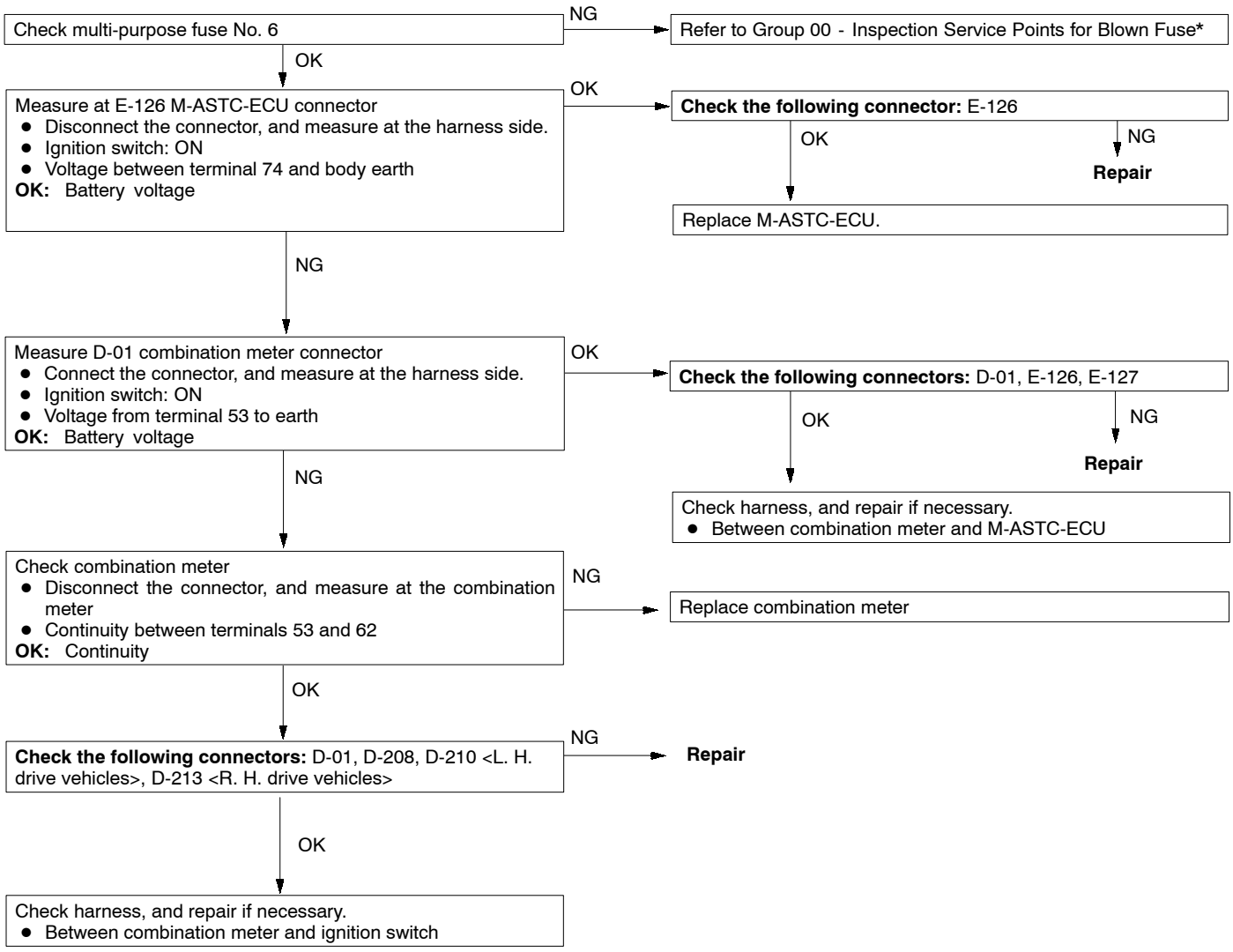
INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom	Inspection Procedure No.	Reference page
MUT-II cannot communicate with other systems.	Refer to GROUP 13A	
Communication between MUT-II and M-ASTC-ECU cannot be achieved.	Refer to GROUP 35B	
When the ignition switch is turned to the “ON” position (engine not running), Active Stability Control System ON indicator/Active Traction Control System ON indicator do not illuminate.	1	35C-36
When the ignition switch is turned to the “ON” position (engine not running), Active Stability Control System OFF indicator does not illuminate.	2	35C-37
After the engine is started, Active Stability Control System ON indicator/Active Traction Control System ON indicator remain illuminating.	3	35C-38
After the engine is started, Active Stability Control System OFF indicator remains illuminating.	4	35C-38
Even if Active Stability Control switch is operated after the engine is started, Active Stability Control System OFF indicator does not illuminate, or it illuminates but is not turned off.	5	35C-39

INSPECTION PROCEDURES FOR TROUBLE SYMPTOMS

Inspection Procedure 1

When the ignition switch is turned to the "ON" position (engine not running), Active Stability Control System ON indicator/Active Traction Control System ON indicator do not illuminate.	Probable cause
M-ASTC-ECU illuminates Active Stability Control System ON indicator/Active Traction Control System ON indicator during initial check operation when the ignition switch is turned to the "ON" position. Therefore, open circuit of the lamp power supply circuit, burnt bulb, or open circuit between Active Stability Control System ON indicator/Active Traction Control System ON indicator and M-ASTC-ECU may be the cause of not illuminating lamp.	● Blown fuse ● Burnt bulb (for Active Stability Control System ON indicator/Active Traction Control System ON indicator) ● Malfunction of harness or connector ● Malfunction of combination meter ● Malfunction of M-ASTC-ECU

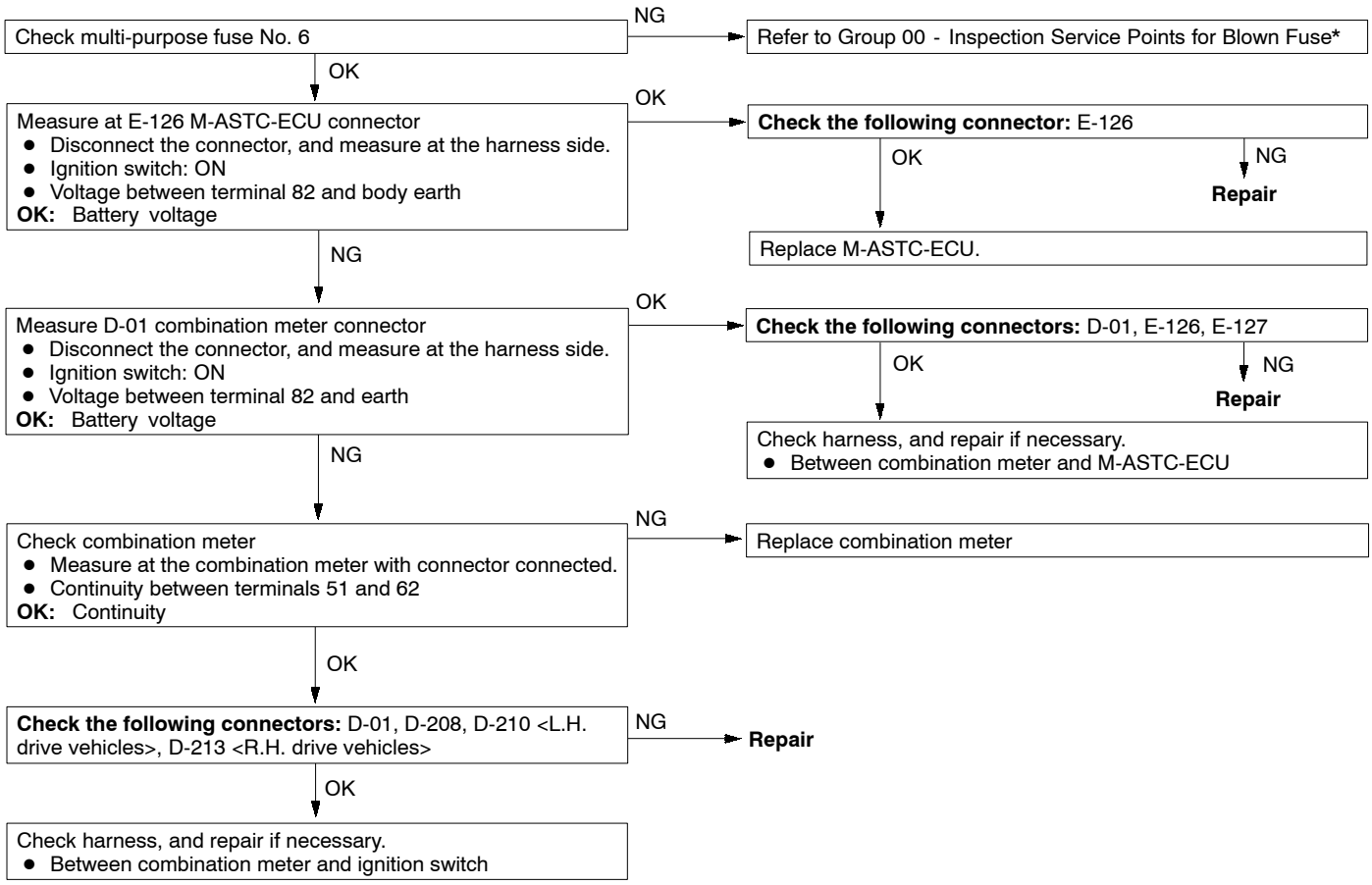


NOTE

*: Refer to 2001 PAJERO Workshop Manual [Pub. No. PWJE0001 (1/2)]

Inspection Procedure 2

When the ignition switch is turned to the "ON" position (engine not running), Active Stability Control System OFF indicator does not illuminate.	Probable cause
M-ASTC-ECU illuminates Active Stability Control System OFF indicator during initial check operation when the ignition switch is turned to the "ON" position. Therefore, open circuit of the lamp power supply circuit, burnt bulb, or open circuit between the Active Stability Control System OFF indicator and M-ASTC-ECU may be the cause of not illuminating lamp.	• Blown fuse • Burnt bulb for Active Stability Control System OFF indicator • Malfunction of harness or connector • Malfunction of combination meter • Malfunction of M-ASTC-ECU

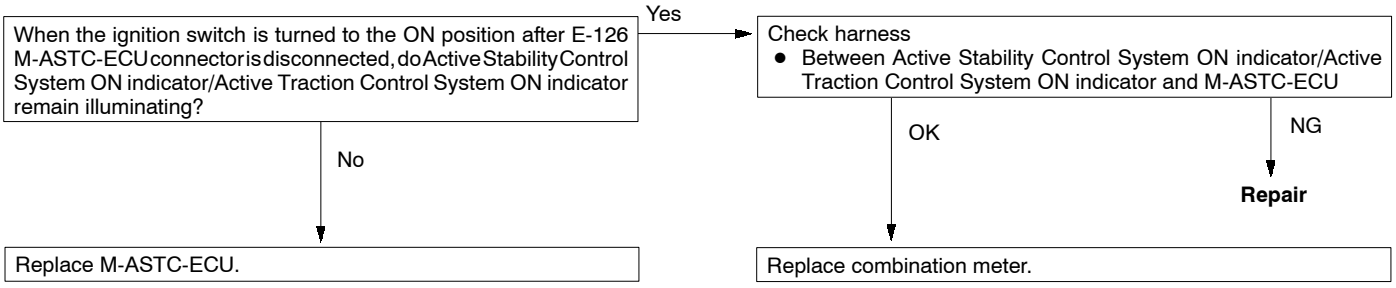


NOTE

*: Refer to 2001 PAJERO Workshop Manual [Pub. No. PWJE0001 (1/2)]

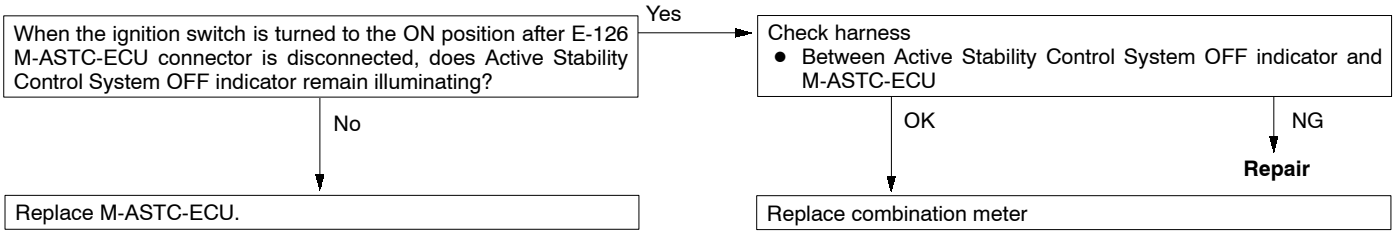
Inspection Procedure 3

After the engine is started, Active Stability Control System indicator/Active Traction Control System indicator remain illuminating.	Probable cause
Active Stability Control System ON indicator/Active Traction Control System ON indicator circuit may be open.	● Malfunction of harness (short-circuit) ● Malfunction of combination meter ● Malfunction of M-ASTC-ECU



Inspection Procedure 4

After the engine is started, Active Stability Control System OFF indicator remains illuminating.	Probable cause
Active Stability Control System OFF indicator circuit may be short-circuited.	● Malfunction of harness (short-circuit) ● Malfunction of combination meter ● Malfunction of M-ASTC-ECU



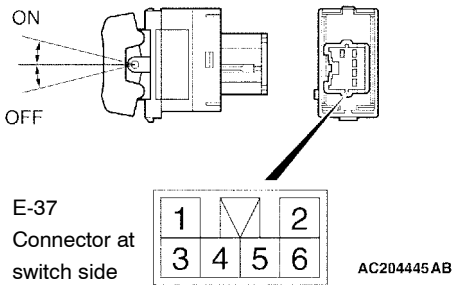
Inspection Procedure 5

Even if Active Stability Control switch is operated after the engine is started, Active Stability Control System OFF indicator does not illuminate, or it illuminates but is not turned off.	Probable cause
When Active Stability Control System OFF indicator does not illuminate, the indicator drive circuit may be defective, but if the indicator normally illuminates during the initial check operation, the input circuit of Active Stability Control switch may be defective.	● Malfunction of Active Stability Control Switch ● Malfunction of harness or connector ● Malfunction of M-ASTC-ECU <Only when the lamp does not illuminate> ● Blown fuse ● Burnt bulb for Active Stability Control System OFF indicator ● Malfunction of combination meter

<Only when the lamp does not illuminate>
- Does Active Stability Control System OFF indicator illuminate during initial check?

No → Refer to Inspection Procedure 2 (P.35C-37)

Yes



- Remove Active Stability Control Switch
- Measure at E-24 Active Stability Control Switch side connector
- Active Stability Control Switch: ON
  Continuity between terminals 3 and 6

OK: Continuity

- Active Stability Control Switch: ON
  Continuity between terminals 2 and 3
  Continuity between terminals 2 and 6

OK: No continuity

- Active Stability Control Switch: Neutral
  Continuity between terminals 2 and 3
  Continuity between terminals 2 and 6
  Continuity between terminals 3 and 6

OK: No continuity

- Active Stability Control Switch: OFF
  Continuity between terminals 2 and 3

OK: Continuity

- Active Stability Control Switch: OFF
  Continuity between terminals 2 and 6
  Continuity between terminals 3 and 6

OK: No continuity

NG → **Replace**

OK → **Check the following connector:** E-24

OK → Check trouble symptoms.

NG → Check harness, and repair if necessary.
- Between active stability control switch and earth

OK → Check trouble symptoms.

NG → **Check the following connectors:** E-109, E-127, E-126

OK → Check trouble symptoms.

NG → Check harness, and repair if necessary.
- Between Active Stability Control Switch and M-ASTC-ECU

OK → Replace M-ASTC-ECU.

NG → **Repair**

DATA LIST REFERENCE TABLE

Refer to Group 35B.

LIST OF ACTUATOR TESTS

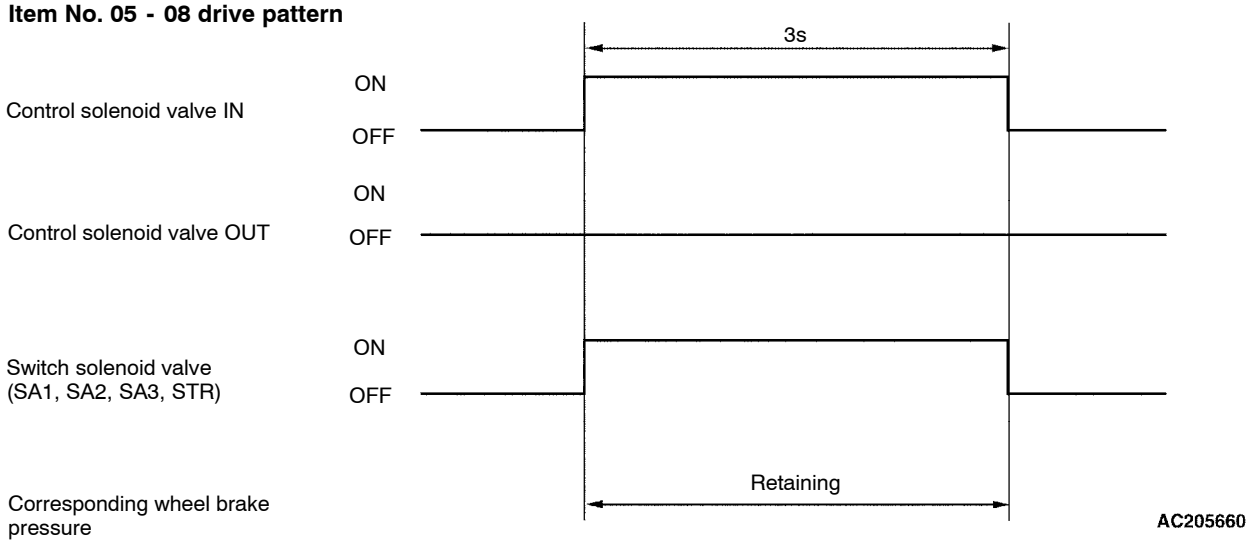
By using MUT-II, the next actuator can be driven forcibly.

NOTE
(1) When ABS-ECU is deactivated due to fail safe, actuator test cannot be performed.
(2) Actuator test can be performed only when the vehicle is stationary.

Actuator Test Specifications

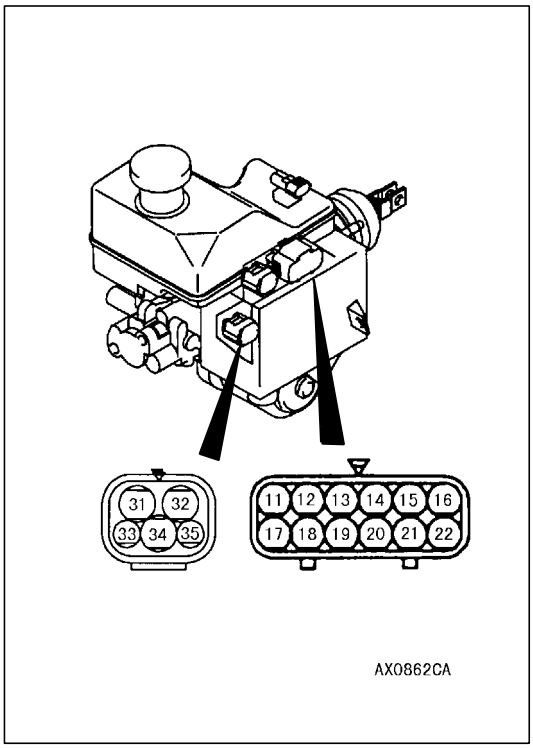
Item No.	Inspection Item	Drive Contents
05	Solenoid valve for front right wheel	Switch solenoid valve of Active Stability Control System and control solenoid valve corresponding to each channel
06	Solenoid valve for front left wheel	
07	Solenoid valve for rear right wheel	
08	Solenoid valve for rear left wheel	
11	Pump motor	Drive pump motor for 1 second.
12	HBB buzzer	Drive HBB buzzer for 3 seconds.
13	Engine	Reduce engine torque.
14	Steering wheel sensor	Initialize steering wheel sensor.
15	Yaw rate sensor	Initialize yaw rate sensor.
16	G sensor	Initialize G sensor.
23	Brake warning lamp	Make the brake warning lamp flash twice.
24	ABS warning lamp	Make the ABS warning lamp flash twice.
25	Active Stability Control System ON indicator/ Active Traction Control System ON indicator	Make Active Stability Control System ON indicator/Active Traction Control System ON indicator flash twice.
26	Active Stability Control System OFF indicator	Make Active Stability Control System OFF indicator flash twice.

Item No. 05 - 08 drive pattern



CHECK AT M-ASTC-ECU TERMINAL

Refer to GROUP 35B.



ON-VEHICLE SERVICE

SOLENOID VALVE CHECK

Measure resistance between the following solenoid valves and terminals respectively:

- Switch solenoid valve (SA1)
  :Between Terminals No. 18 - No. 34
- Switch solenoid valve (SA2)
  :Between Terminals No. 17 - No. 34
- Switch solenoid valve (SA3)
  :Between Terminals No. 12 - No. 34
- Switch solenoid valve (STR)
  :Between Terminals No. 11 - No. 34

Standard value: 3.5 - 3.9 Ω

INITIALIZATION OF STEERING WHEEL SENSOR

When the battery is removed, the learned neutral position of steering wheel sensor is erased, and Active Stability Control System OFF indicator illuminates, and DTC No. 83 is output. In this case, use either one of the following procedures to initialize the steering wheel sensor:

When using MUT-II:

1. After turning the ignition switch to the LOCK (OFF) position, place MUT-II.
2. Turn the ignition switch to the ON position.
3. Rotate the steering wheel over 8°, and then maintain it in a neutral position (in the straight-ahead position of the vehicle).
4. Perform actuator test item No. 14.
5. Ensure that the active stability control system OFF indicator has been turned OFF.
6. Turn the ignition switch to the LOCK (OFF) position.
7. Remove MUT-II.

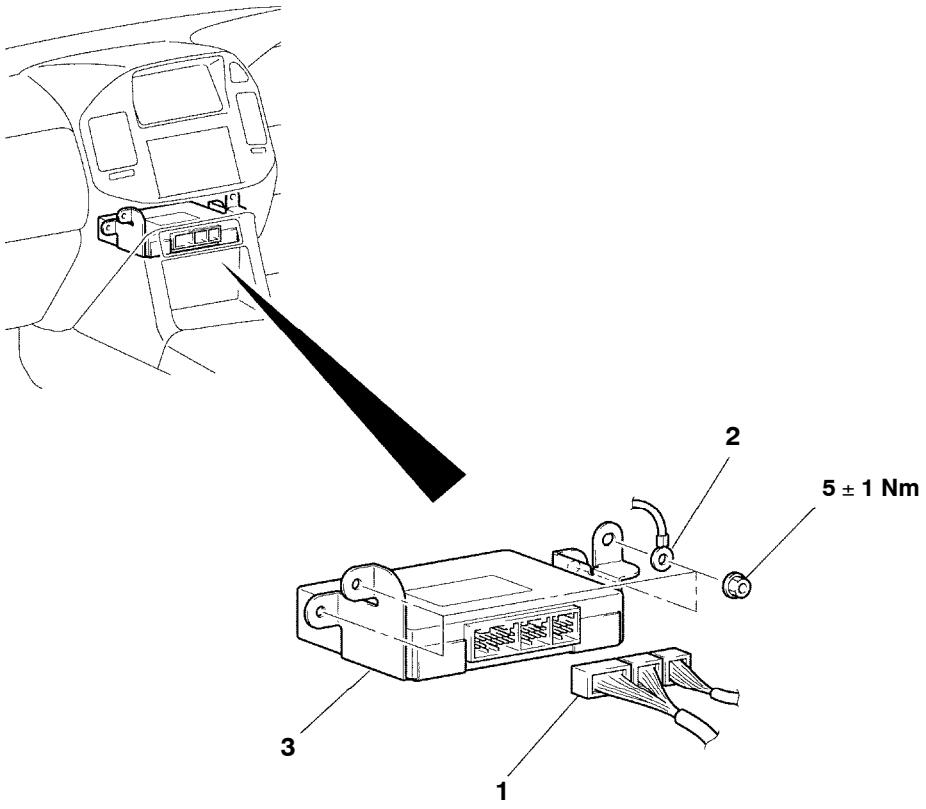
When not using MUT-II:

1. Rotate the steering wheel over 8°.
2. Drive the vehicle in a straight-ahead direction at 35 km/h or over for 1 second or more.
3. Ensure that the active stability control system OFF indicator has been turned OFF.

M-ASTC-ECU

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations
Removal and installation of indicator panel and front panel (Refer to GROUP 52A - Floor Console).



Removal steps

▶B◀ ● Deactivate HBB buzzer communication check mode (when M-ASTC-ECU is replaced)
1. M-ASTC-ECU connector
2. Earth
▶A◀ 3. M-ASTC-ECU

INSTALLATION SERVICE POINTS

▶A◀ INITIALIZATION OF M-ASTC-ECU

When the M-ASTC-ECU is replaced with a new one, Active Stability Control System OFF indicator illuminates to warn that the M-ASTC-ECU is not initialized yet, and DTC No. 81, No. 84 and No. 85 are output. In this case, use the following procedure to perform initialization:

1. Place the vehicle on a level surface.
2. After turning the ignition switch to the LOCK (OFF) position, place MUT-II.
3. Turn the ignition switch to the ON position.
4. Perform Item No. 16 of the actuator test.
5. Rapidly depress the brake pedal once with the pedal force of about 40 kgf.
6. Ensure that the transfer lever can be shifted to all positions (2H, 4H, 4HLc, 4LLc).
7. Ensure that the active stability control system OFF indicator has been turned OFF.
8. Turn the ignition switch to the LOCK (OFF) position.
9. Remove MUT-II.

▶B◀ DEACTIVATION OF HBB BUZZER COMMUNICATION CHECK MODE (WHEN ASTC-ECU IS REPLACED)

When the ignition switch is turned to the ON position after M-ASTC-ECU is replaced, HBB buzzer remains sounding for about 5 seconds. This is HBB buzzer communication check mode for M-ASTC-ECU (for inspection at the factory)

To stop the HBB buzzer, perform the following procedure:

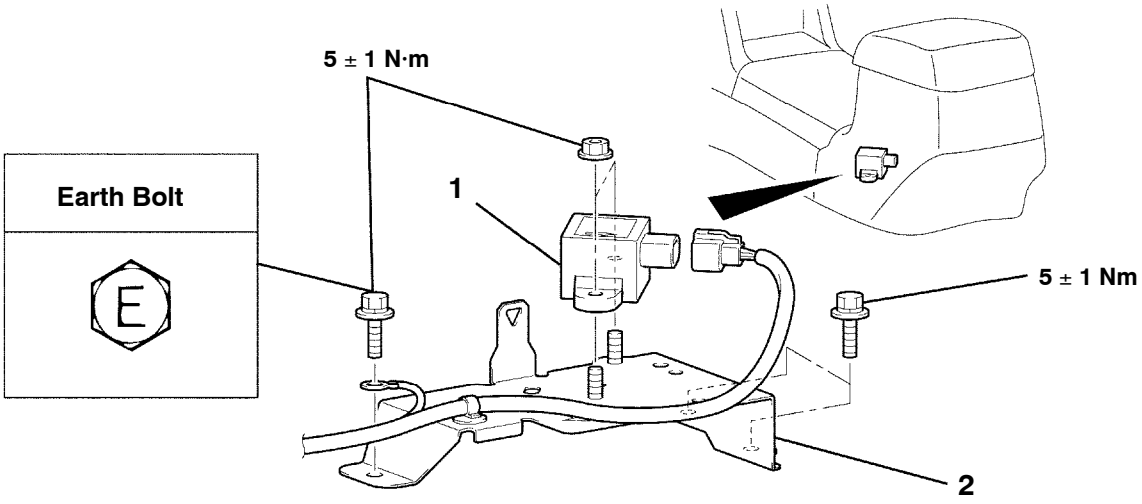
- Use MUT-II to erase the HBB diagnostic code.
- Drive the vehicle at the speed of 40 km/h or more.

G AND YAW RATE SENSOR

REMOVAL AND INSTALLATION

CAUTION:
Do not drop G and Yaw rate sensor or do not apply shock on the sensor.

Pre-removal and Post-installation Operations Removal and installation of floor console



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Removal steps

▶A◀ 1. G and yaw rate sensor
2. G and yaw rate sensor bracket

INSTALLATION SERVICE POINT

▶A◀ INSTALLATION OF G AND YAW RATE SENSOR

When G and Yaw rate sensor is replaced, the learned neutral point of the G and Yaw rate sensor is erased, and Active Stability Control System OFF indicator illuminates to warn that the sensor is not initialized yet, and DTC No. 81 and 82 are output. In this case, use the following procedure to initialize the G and Yaw rate sensor.

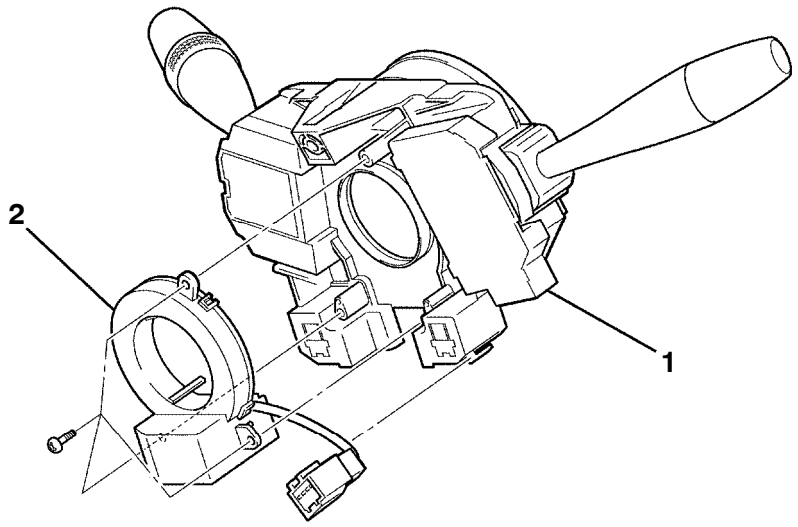
1. Place the vehicle on a level surface.
2. After turning the ignition switch to the LOCK (OFF) position, place MUT-II.
3. Turn the ignition switch to the ON position.
4. Rotate the steering wheel over 8°, and then maintain it in a neutral position (in the straight-ahead position of the vehicle).
5. Perform Item No. 16 of the actuator test.
6. Ensure that the active stability control system OFF indicator has been turned OFF.
7. Turn the ignition switch to the LOCK (OFF) position.
8. Remove MUT-II.

STEERING WHEEL SENSOR

REMOVAL AND INSTALLATION

CAUTION:
Before removing steering wheel airbag module assembly, always refer to GROUP 52B - Service Precautions, Airbag Modules and Clock Spring.

Pre-removal and Post-installation Operations
Removal and installation of steering wheel airbag module assembly and clock spring
(Refer to GROUP 52B)



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Removal steps
1. Column switch
▶A◀ 2. Steering wheel sensor

INSTALLATION SERVICE POINT

▶A◀ INITIALIZATION OF STEERING WHEEL SENSOR

When the battery is removed, the learned neutral point of the steering wheel sensor is erased, and Active Stability Control System OFF indicator illuminates, and DTC No. 83 is output. In this case, use either one of the following steps to initialize the steering wheel sensor:

When using MUT-II:
1. After turning the ignition switch to the LOCK (OFF) position, place MUT-II.
2. Turn the ignition switch to the ON position.
3. Rotate the steering wheel over 8°, and then maintain it in a neutral position (in the straight-ahead position of the vehicle).
4. Perform Item No. 14 of the actuator test.
5. Ensure that the active stability control system OFF indicator has been turned OFF.
6. Turn the ignition switch to the LOCK (OFF) position.
7. Remove MUT-II.

When not using MUT-II:

1. Rotate the steering wheel over 8°.
2. Drive the vehicle in a straight-ahead direction at 35 km/h or over for 1 second or more.
3. Ensure that the active stability control system OFF indicator has been turned OFF.

PARKING BRAKES

Click on the applicable bookmark to selected the required model year.

PARKING BRAKES

CONTENTS

GENERAL INFORMATION 2

SERVICE SPECIFICATIONS 2

LUBRICANTS 2

SEALANT 3

ON-VEHICLE SERVICE 3

Parking Brake Lever Stroke Check and Adjustment 3

Parking Brake Switch Check 4

Lining Running-In 4

PARKING BRAKE LEVER 5

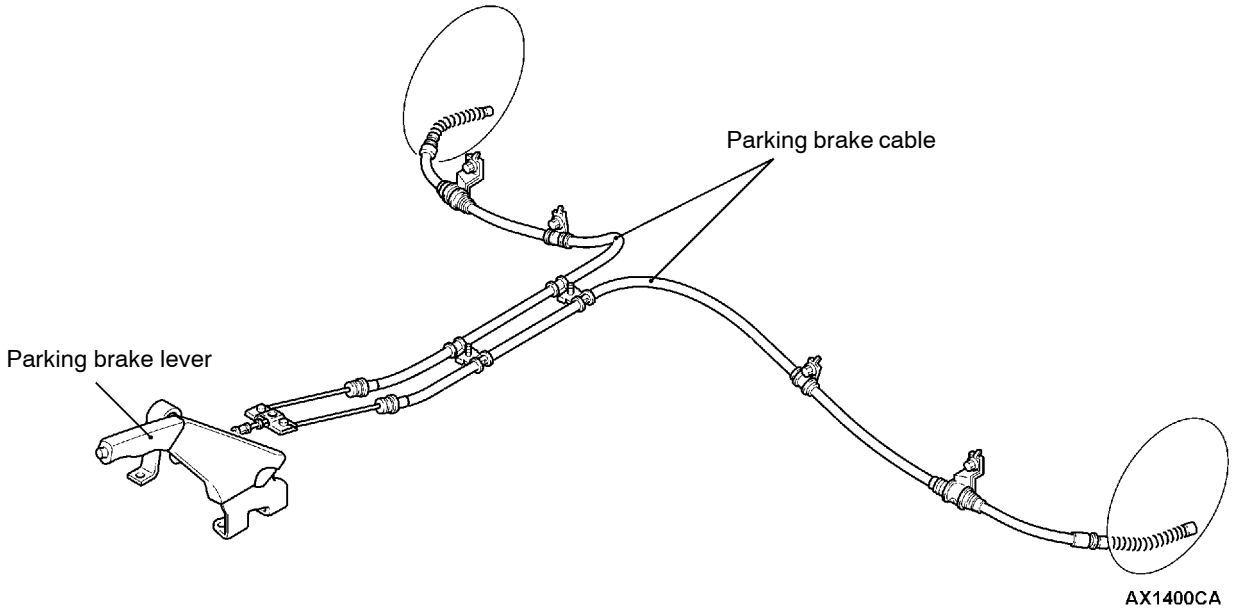
PARKING BRAKE CABLE 6

PARKING BRAKE DRUM 7

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



SERVICE SPECIFICATIONS

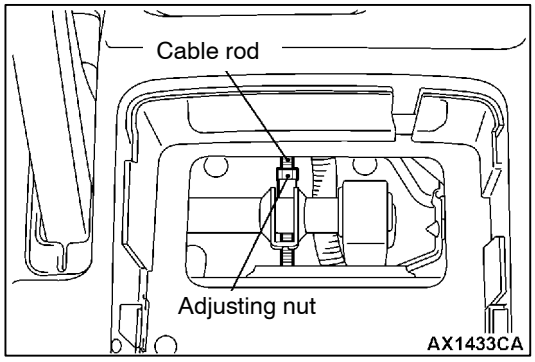
Items	Standard value	Limit
Parking brake lever stroke	5 - 7 notches	-
Rear brake lining thickness mm	3.0	1.0
Rear drum inside diameter mm	199.0	200.0

LUBRICANTS

Items	Specified lubricants
Backing plate	Multipurpose grease
Shoe and lining assembly	
Adjuster	

SEALANT

Items	Specified lubricants	Remarks
Shoe hold-down pin	3M ATD Part No. 8513 or equivalent	Drying sealant



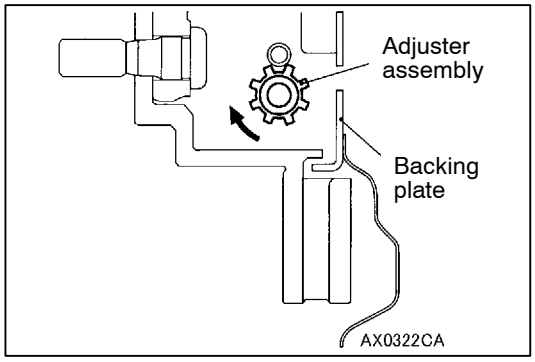
ON-VEHICLE SERVICE

PARKING BRAKE LEVER STROKE CHECK AND ADJUSTMENT

1. Pull the parking brake lever with a force of approx. 200 N and count the number of notches.

   Standard value: 5 - 7 notches

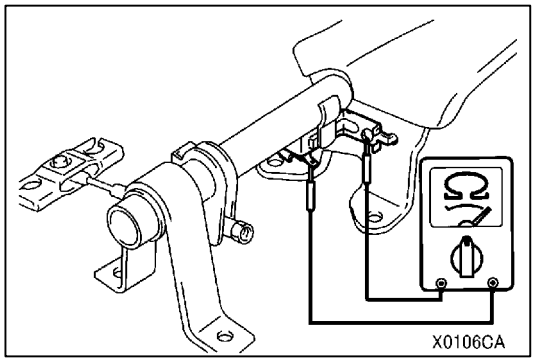
2. If the parking brake lever stroke is not the standard value, adjust as described below.
   (1) Remove the cup holder, and then loosen the adjusting nut to move it to the cable rod end so that the cable will be free.
   (2) Remove the rear wheels.



   (3) Remove the adjustment hole plug on the rear brake backing plate, 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 three or four 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.

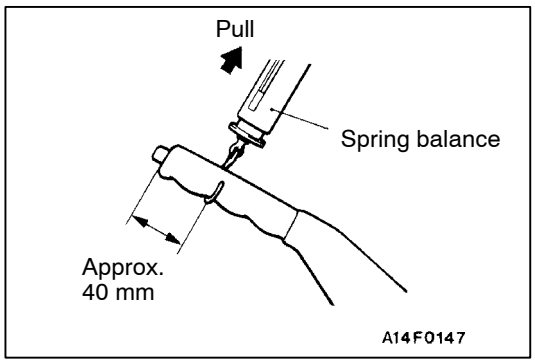
   (5) Release the parking brake and turn the rear wheels to check that the rear brakes are not dragging.



PARKING BRAKE SWITCH CHECK

1. Remove the cup holder and indicator panel.
2. 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. 200 N] : 5 - 7 notches

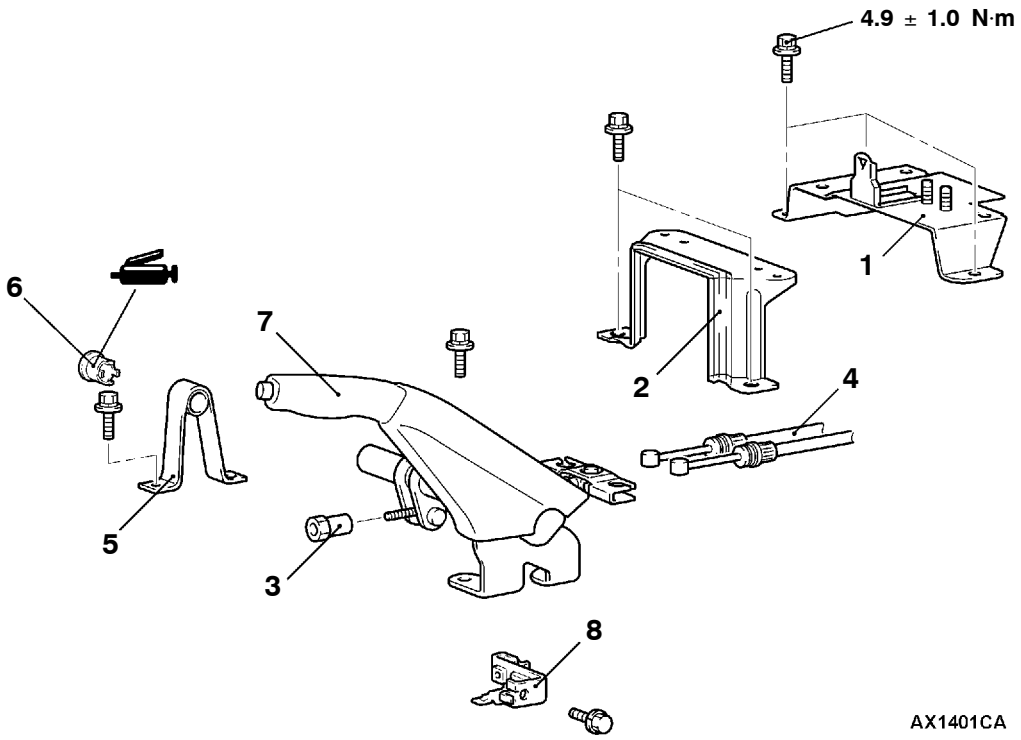
2. Hook a spring balance onto the centre of the parking brake lever grip and pull it with a force of 100 - 150 N in a direction perpendicular to the handle.
3. Drive the vehicle at a constant speed of 35 - 50 km/h for 100 metres.
4. Release the parking brake and let the brakes cool for 5 - 10 minutes.
5. Repeat the procedure in steps 2 to 4 four or five times.

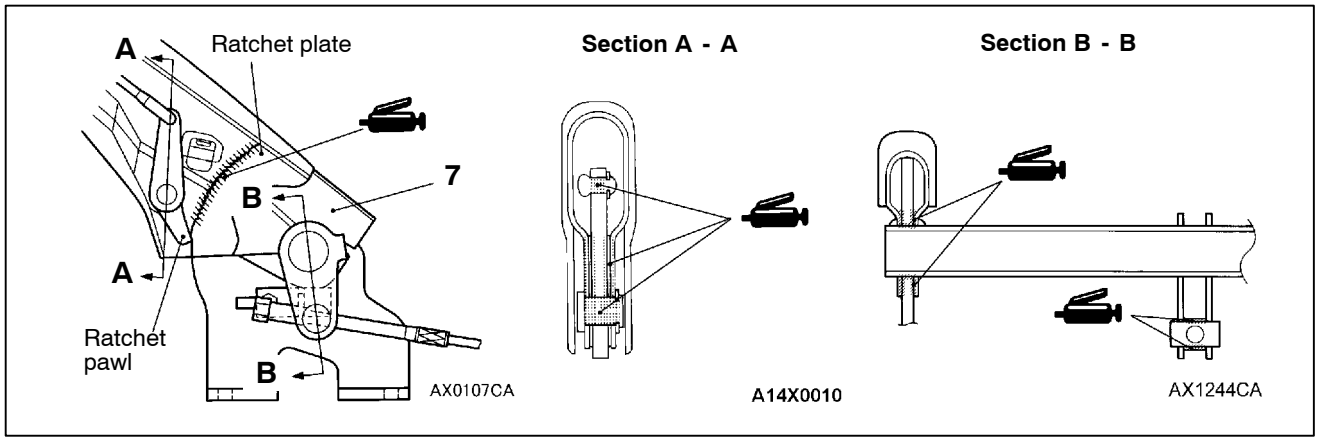
PARKING BRAKE LEVER

REMOVAL AND INSTALLATION

Pre-removal Operation
Floor Console Removal (Refer to GROUP 52A.)

Post-installation Operation
- Parking Brake Lever Stroke Adjustment (Refer to P.36-3.)
- Floor Console Installation (Refer to GROUP 52A.)





Removal steps

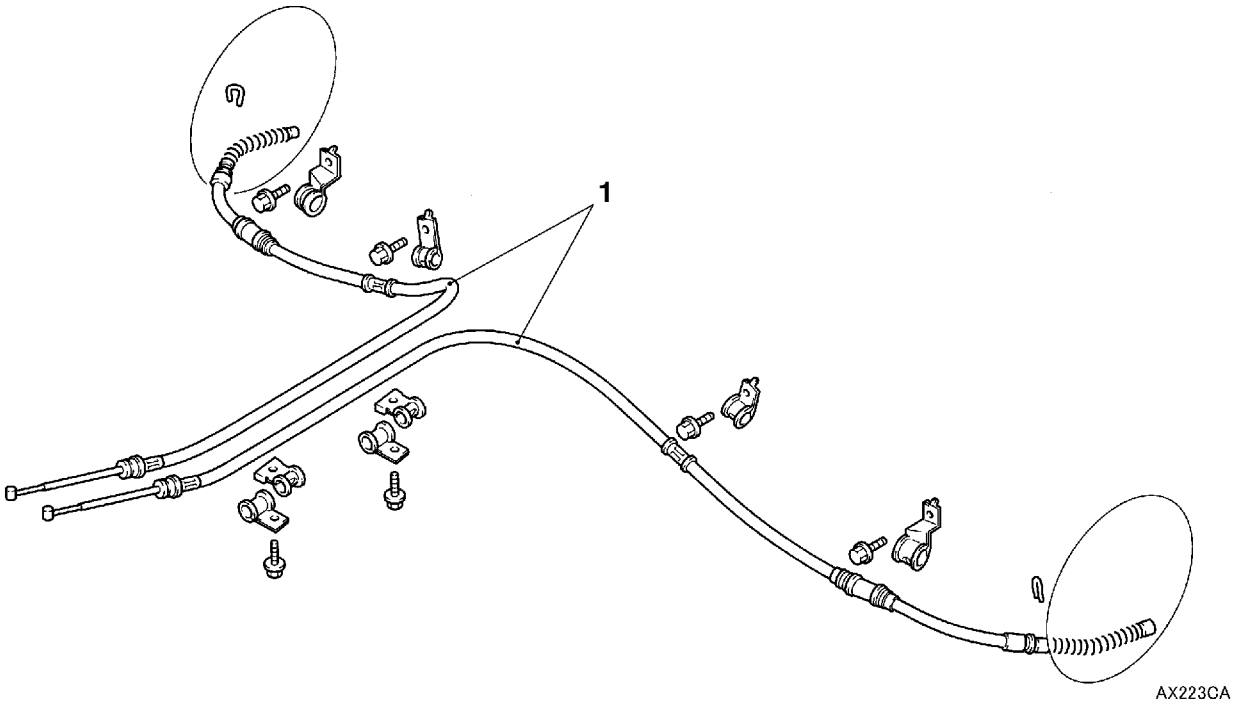
1. G sensor bracket
2. Floor console bracket
3. Adjusting nut
4. Parking brake cable assembly connection
5. Parking brake stay
6. Bushing
7. Parking brake lever assembly
8. Parking brake switch

PARKING BRAKE CABLE

REMOVAL AND INSTALLATION

Pre-removal Operation
Floor Console Removal (Refer to GROUP 52A.)

Post-installation Operation
- Parking Brake Lever Stroke Check and Adjustment (Refer to P.36-3.)
- Floor Console Installation (Refer to GROUP 52A.)

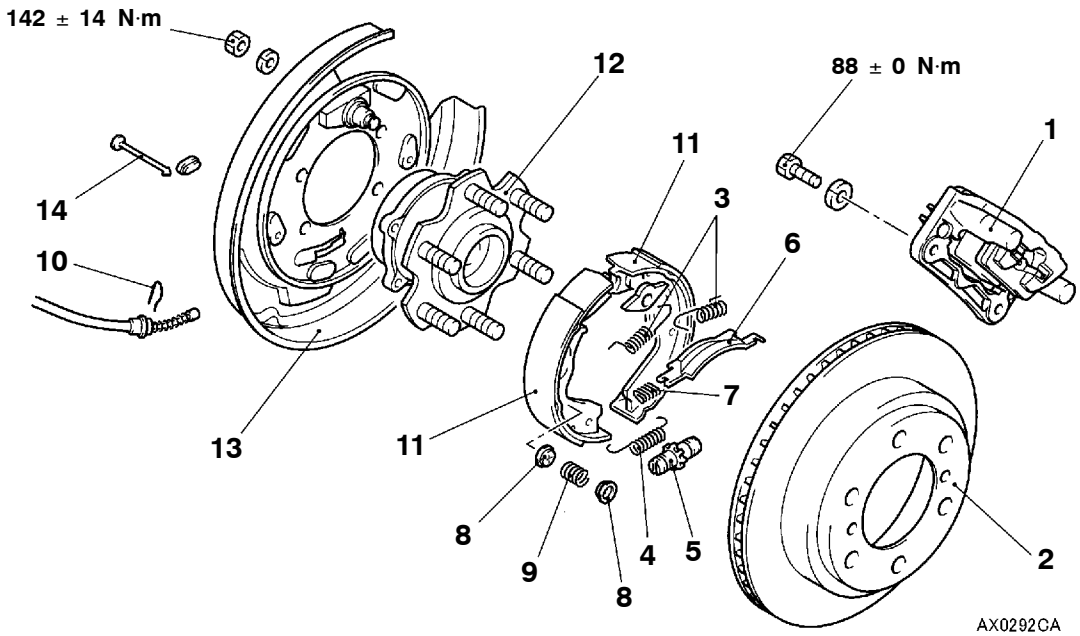


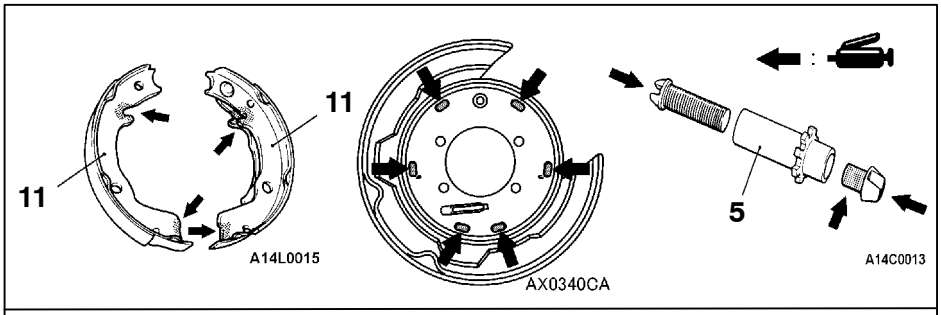
Removal steps
- Shoe and lining assembly (Refer to P.36-7.)
- Parking brake cable assembly connection (Refer to P.36-5.)

1. Parking brake cable

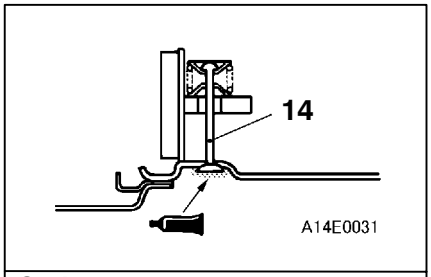
PARKING BRAKE DRUM

REMOVAL AND INSTALLATION





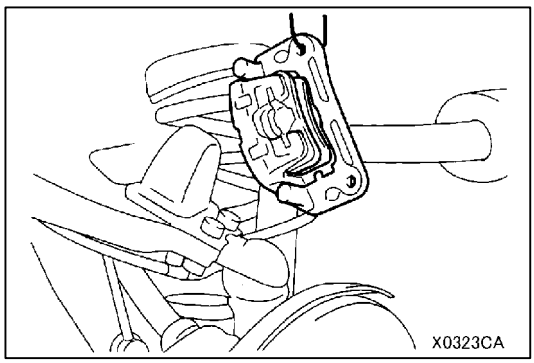
Brake grease: Multipurpose grease



Sealant:
3M ATD Part No. 8513 or equivalent

Removal steps

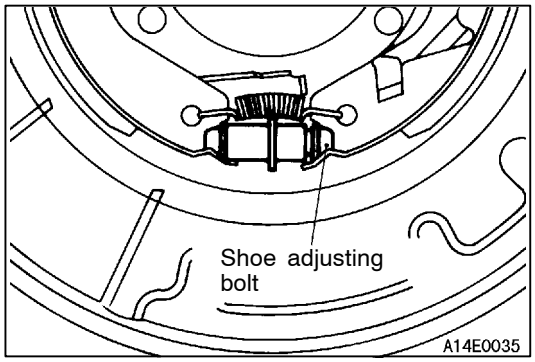
◀A▶ 1. Rear brake caliper assembly
2. Rear brake disc
▶B◀ 3. Shoe-to-anchor spring
4. Adjusting wheel spring
▶A◀ 5. Adjuster assembly
6. Strut
7. Strut-to-shoe spring
8. Shoe hold-down cup
9. Shoe hold-down spring
10. Clip
11. Shoe and lining assembly
12. Rear hub assembly (Refer to GROUP 27.)
13. Backing plate
14. Shoe hold-down pin



REMOVAL SERVICE POINT

◀A▶ REAR BRAKE CALIPER ASSEMBLY REMOVAL

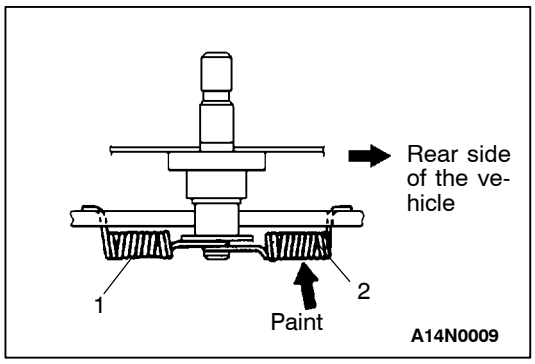
Remove the rear brake caliper assembly and support it with wire or similar.



INSTALLATION SERVICE POINTS

▶A◀ ADJUSTER ASSEMBLY INSTALLATION

Install the adjuster assembly so that the shoe adjusting bolt of left hand wheel is attached towards the rear of the vehicle, and the shoe adjusting bolt of right hand wheel is towards the front of the vehicle.

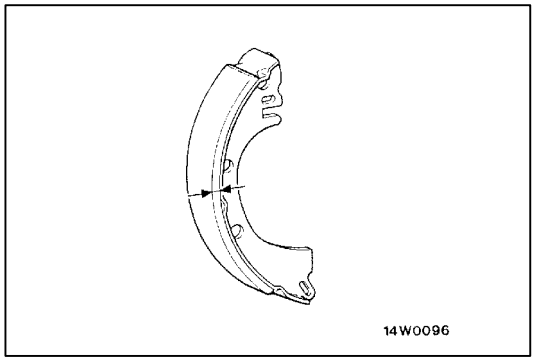


▶B◀ SHOE-TO-ANCHOR SPRING INSTALLATION

Install the shoe-to-anchor springs in the order shown in the illustration.

Caution
The shoe-to-anchor springs are not interchangeable, so be careful that the spring with the paint mark is installed at the vehicle's rear side.

NOTE
The figure shows the left wheel; for the right wheel, the position is symmetrical.



INSPECTION

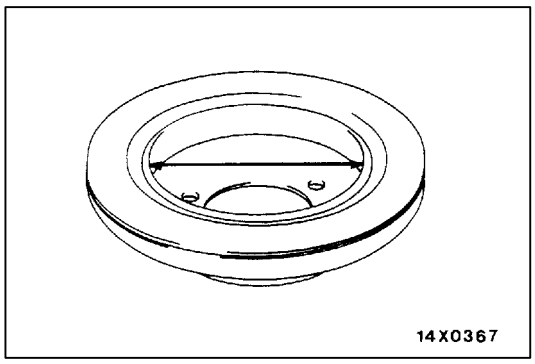
BRAKE LINING AND BRAKE DRUM CHECK

1. Measure the thickness of the brake lining at several places.

   Standard value: 3.0 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: 199.0 mm

   Limit: 200.0 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.

STEERING

Click on the applicable bookmark to selected the required model year.

STEERING

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- Stationary Steering Effort Check 9
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- Oil Pump Belt Tension Check <6G7,4D5> 9
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WARNINGS REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLES

WARNING!

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

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

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

NOTE

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

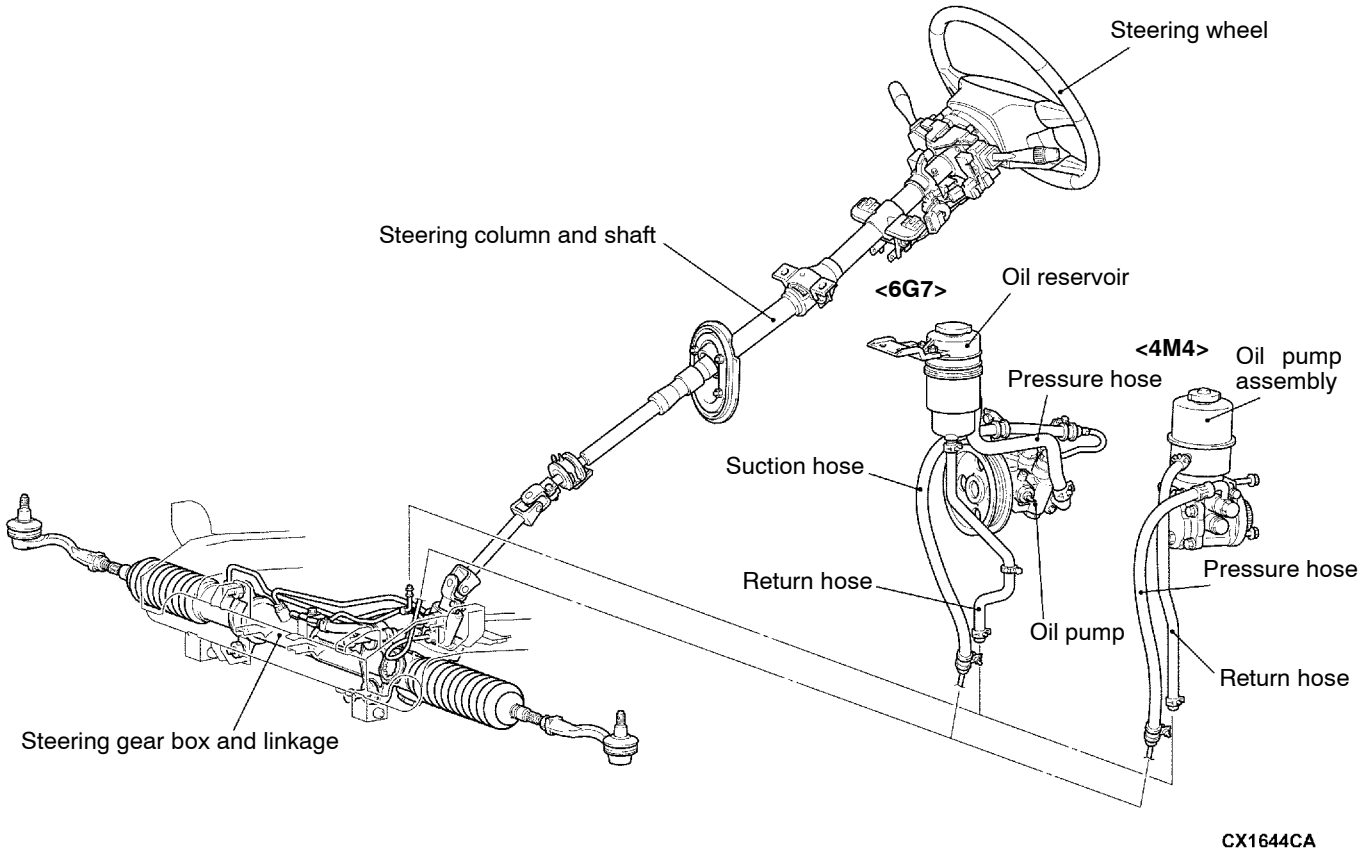
GENERAL INFORMATION

A 4-spoke type steering wheel has been mounted. All models have been equipped with the SRS as standard.
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.

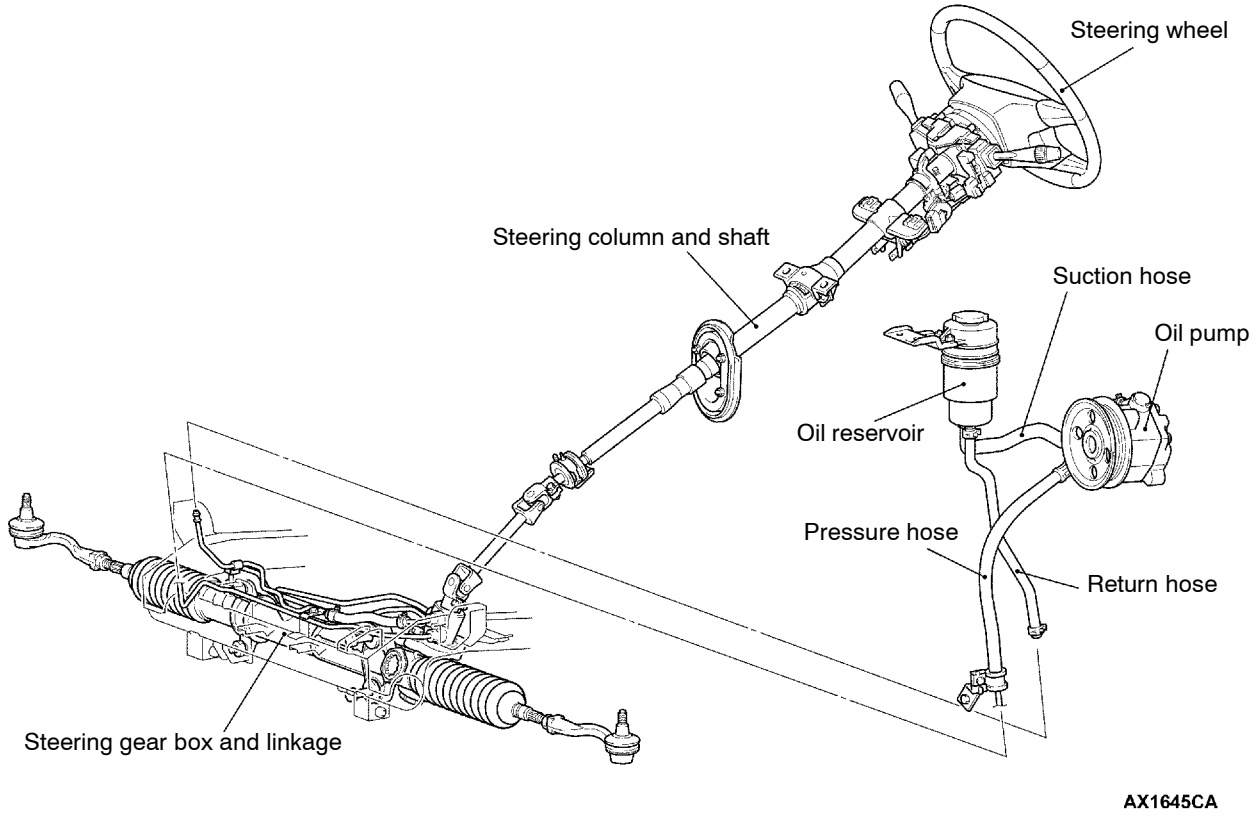
Item		Specifications
Steering gear and linkage	Type	Integral type
	Gear type	Rack and pinion
Oil pump	Type	Vane type
	Displacement ml/rev.	10.0
	Relief set pressure MPa	8.8

CONSTRUCTION DIAGRAM

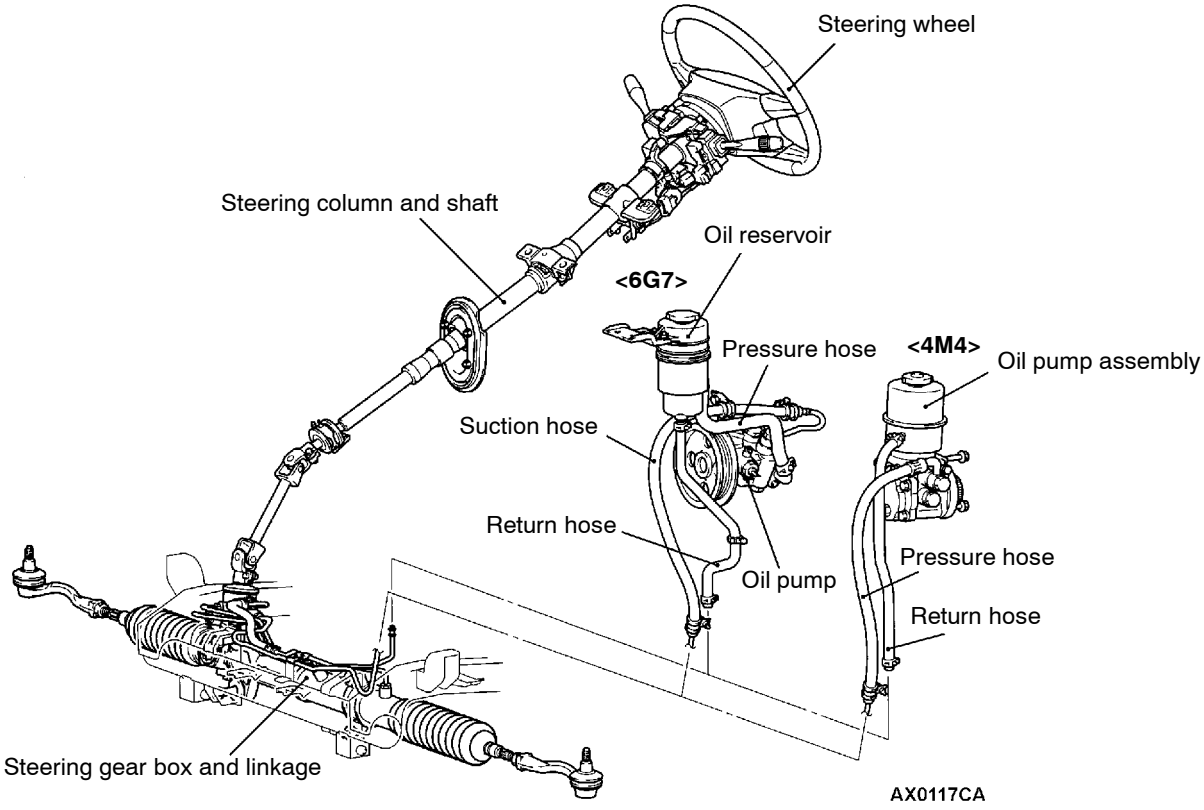
<L.H. drive vehicles–6G7, 4M4>



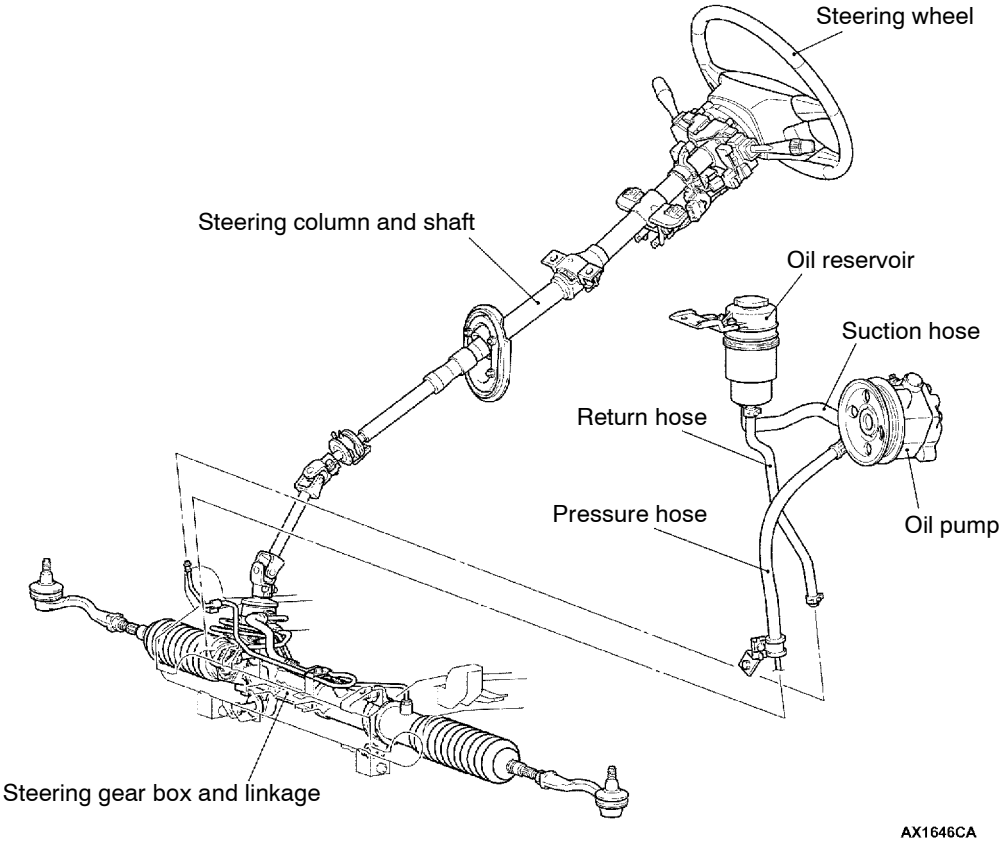
<L.H. drive vehicles–4D5>



<R.H. drive vehicles–6G7, 4M4>



<R.H. drive vehicles–4D5>



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	36°30' ± 1°30'	-
	Outer wheel <For reference>	31°40'	-
Ball joint turning torque N·m		0.49 - 2.45	-
Stationary steering effort N	Steering effort	39.2 or less	-
	Fluctuation allowance	5.9 or less	-
Oil pump relief pressure MPa		8.3 - 9.0	-
Pressure under no-load condition MPa	<6G7, 4D5>	0.34	-
	<4M4>	0.29	-
Steering gear retention hydraulic pressure MPa		8.3 - 9.0	-
Oil pressure switch operating pressure MPa <6G7, 4M4>	OFF→ON	1.5 - 2.0	-
	ON→OFF	1.5 - 2.0	-
Pinion total rotation torque N·m	Total rotation torque	0.6 - 1.7	-
	Torque variation	0.4 or less	-
Tie rod joint swing resistance N (Tie rod joint swing torque N·m)		11 - 35 (1.4 - 4.9)	-
Special tool aperture dimension (MB991561) mm		2.9	-
Band crimped width mm		2.4 - 2.8	-

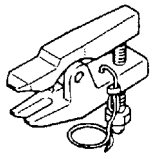
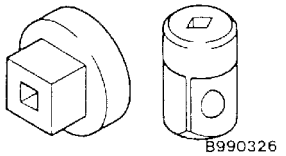
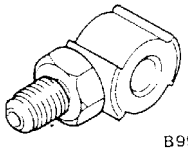
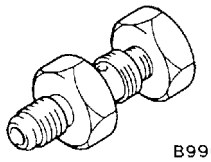
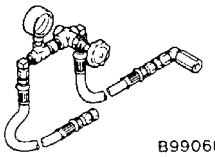
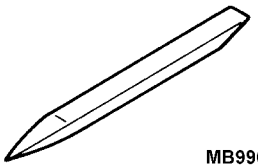
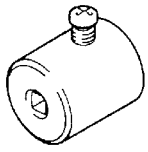
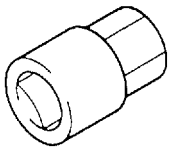
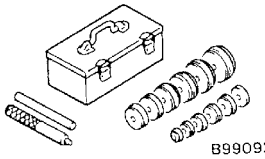
LUBRICANTS

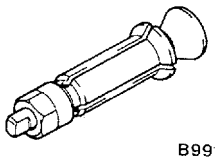
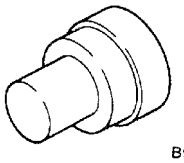
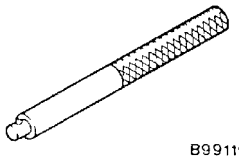
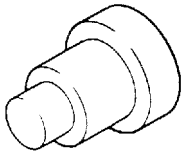
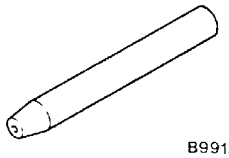
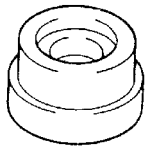
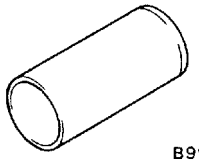
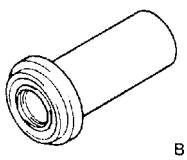
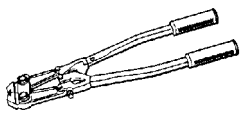
Item	Specified lubricant	Quantity
Power steering	Automatic transmission fluid DEXRON II	About 0.6 l
Tie rod bellows	Silicone grease	As required
Pinion and valve assembly	Repair kit grease	As required
Rack assembly	Repair kit grease	As required

SEALANT AND ADHESIVE

Item	Specified sealant	Remarks
Rack support cover end plug	3M ATD Part No. 8663 or equivalent	Semi-drying sealant

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	MB991548	Power steering oil pressure gauge adapter (pump side)	Oil pressure measurement
 B990994	MB991549	Power steering oil pressure gauge adapter (hose side)	
 B990662	MB990662	Oil pressure gauge assembly	
 MB990784	MB990784	Ornament remover	Steering wheel cover removal
 B991006	MB991006	Preload socket	Total pinion torque measurement
 B991204	MB991204	Torque wrench socket	• Rack support cover removal • Total pinion torque adjustment
 B990925	MB990925	Bearing and oil seal installer set	Oil seal and bearing press fitting (Refer to GROUP 26 - Special Tools.)

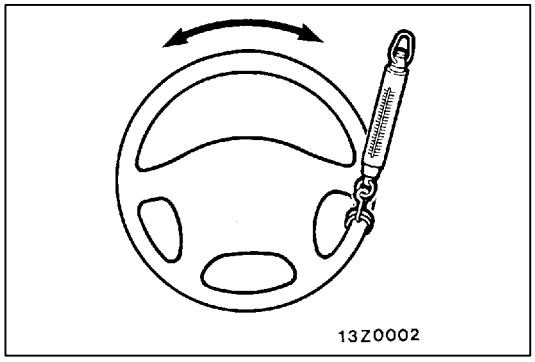
Tool	Number	Name	Use
 B991120	MB991120	Needle bearing puller	Valve housing needle bearing pressing-out
 B991198	MB991199	Oil seal installer	Gear housing oil seal press fitting
 B991197	MB991197	Bar (long type)	
 B991202	MB991202	Oil seal and bearing installer	Valve housing needle bearing and lower bearing press fitting
 B991212	MB991213	Oil seal protector	Rack assembly installation
 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

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-19.)

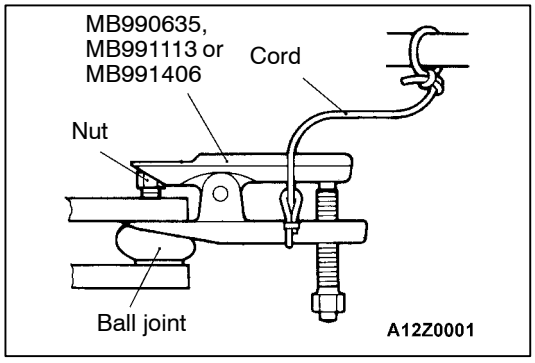
STEERING ANGLE CHECK

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

   Standard value:

Inner wheels	36°30' ± 1°30'
Outer wheels <For reference>	31°40'

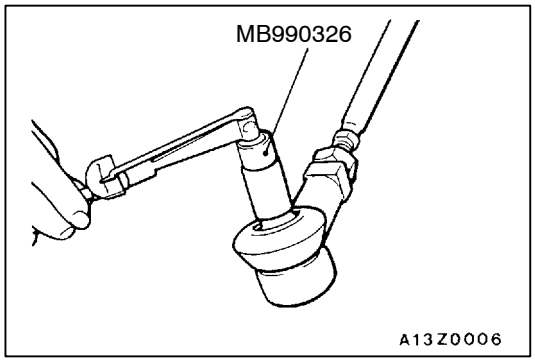
2. If the standard values are not met, toe-in is probably incorrect. Adjust the toe-in, seeing GROUP 33A - On-vehicle Service, and recheck the steering angle.



TIE ROD END BALL JOINT STARTING TORQUE CHECK

1. Use the special tool to disconnect the tie rod and knuckle.

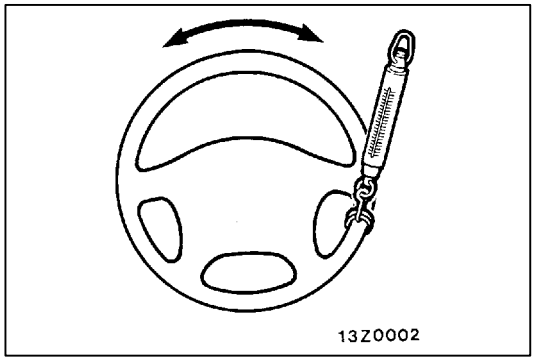
   Caution
   (1) In order not to damage the ball joint thread, the tie rod end mounting nut must be only loosened but not removed from the ball joint. Also, be sure to use the special tool.
   (2) Tie the special tool with a cord so as not to fall off.



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: 0.49 – 2.45 N·m

3. When the torque is over the standard value, replace the tie rod end.
4. When the torque is below the standard value, check the ball joint for looseness or ratcheting. If none of these found, the ball joint is still serviceable.



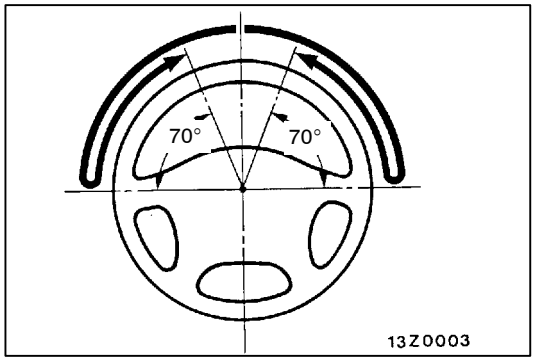
STATIONARY STEERING EFFORT CHECK

1. With the vehicle stopped on a flat, paved surface, put the steering wheel in straight-ahead position.
2. Start the engine and keep it at 1,000±100 r/min.
3. Attach a spring balance to the steering wheel outer bar. Measure steering effort required to turn the steering wheel from the straight-ahead position to the left and right (within a range of 1.5 turns). Also see that no significant fluctuation is present in the steering effort.

   Standard value:

Steering effort	39.2 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

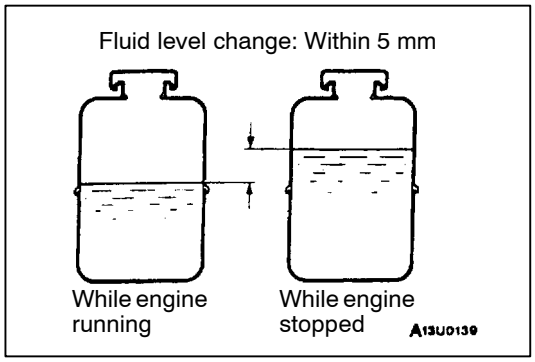
Check returnability as follows on road test:

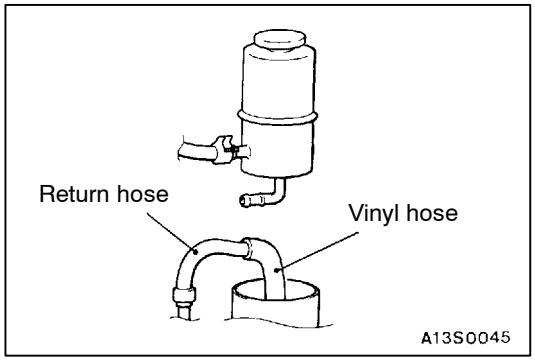
1. Make both gradual and sudden turns and see by your own feeling that the steering effort and returnability have no difference between the left and right turns.
2. At a speed of about 35 km/h, turn the steering wheel 90°, keep it there for 1 to 2 seconds and release. When the steering wheel returns 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 <6G7, 4D5>

Refer to GROUP 11A/11B - 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 II

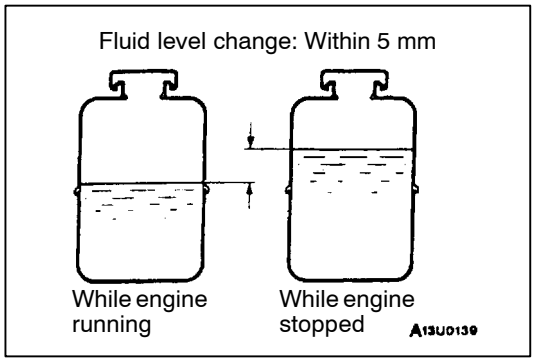
Caution
Do not use ATF-SP II M and ATF-SP III.

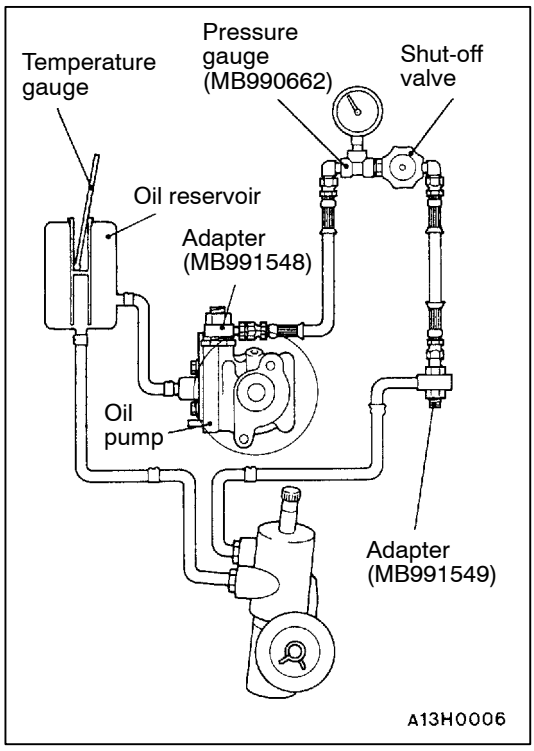
POWER STEERING SYSTEM BLEEDING

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:
   <6G7,4D5> 0.34 MPa
   <4M4> 0.29 MPa

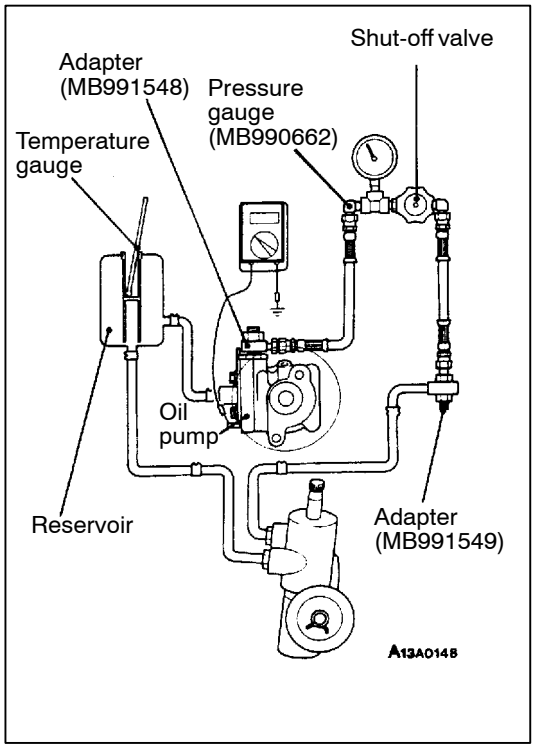
7. If the standard value is not met, the oil line or steering gear is probably defective. So, repair and measure oil pressure again.
8. Turn the steering wheel fully either left or right and check the retention hydraulic pressure.

   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 ± 7 N·m

11. Bleed the system.



POWER STEERING OIL PRESSURE SWITCH CHECK <6G7, 4M4>

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: 1.5 - 2.0 MPa
7. Remove the special tools and tighten the pressure hose to the specified torque.

   Tightening torque: 57 ± 7 N·m
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

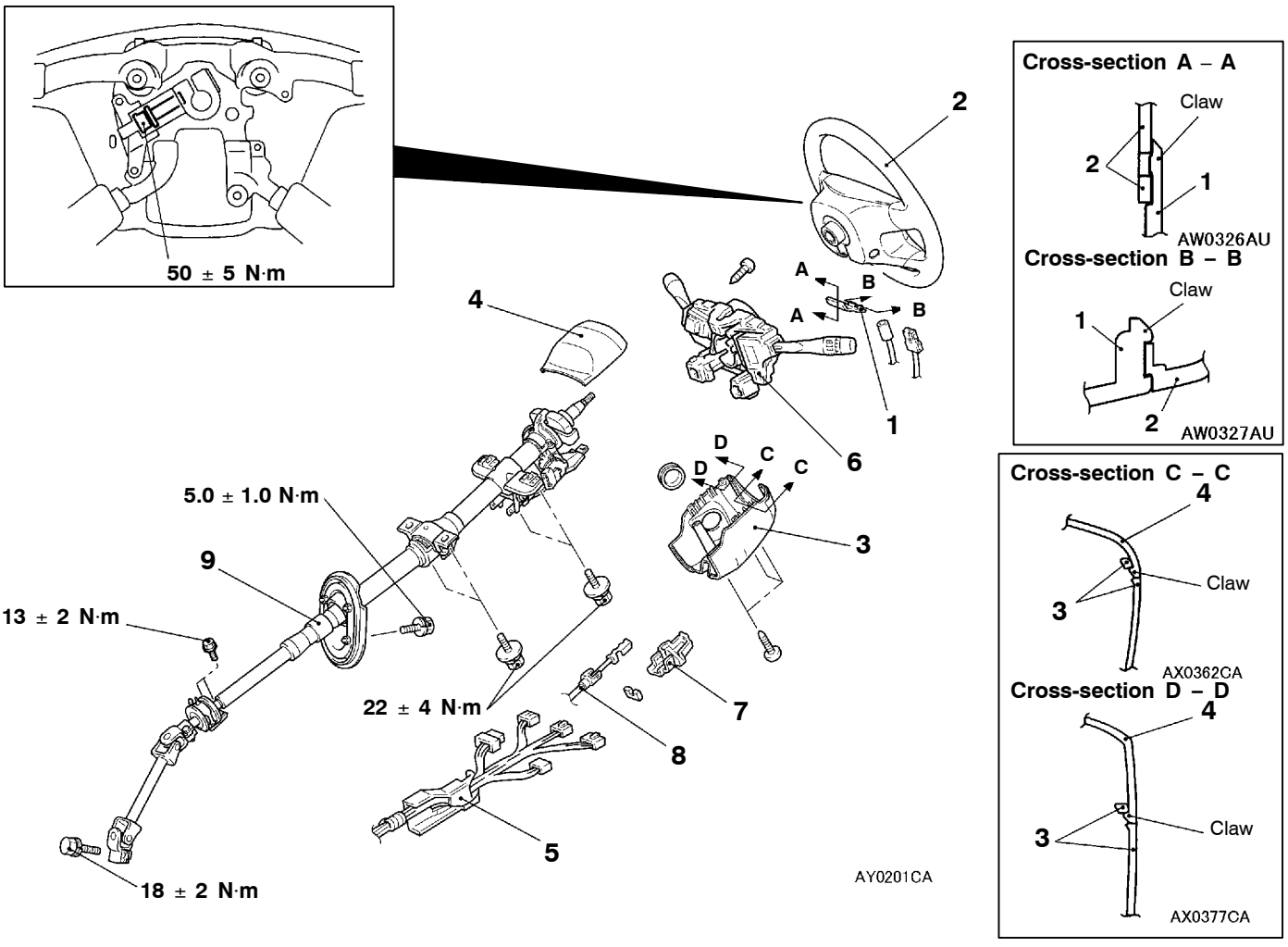
REMOVAL AND INSTALLATION

Caution:

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

Pre-removal Operation
- Air Cleaner, Resonance Hose and Air Intake Duct Removal (Refer to GROUP 15.)
- Instrument Under Cover Removal (Refer to GROUP 52A.)

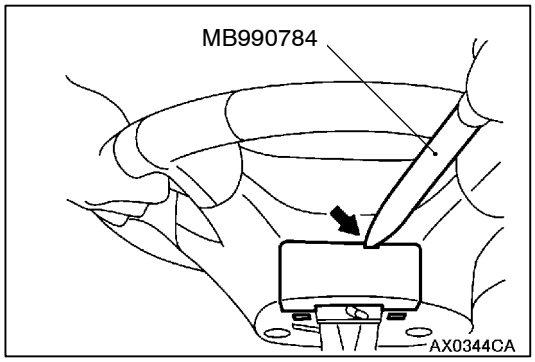
Post-installation Operation
- Instrument Under Cover Installation (Refer to GROUP 52A.)
- Air Cleaner, Resonance Hose and Air Intake Duct Installation (Refer to GROUP 15.)
- Checking Steering Wheel Position with Wheels Straight Ahead



Removal steps

◀A▶ ◀B▶
1. Cover
2. Steering wheel and air bag module assembly
3. Lower column cover
4. Upper column cover
5. Protector
6. Clock spring and column switch assembly <Refer to GROUP 52B.>
7. Cover <A/T>
8. Key interlock cable <A/T>
- Brake pedal return spring <Refer to GROUP 35A – Brake Pedal.>
9. Steering column shaft assembly

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

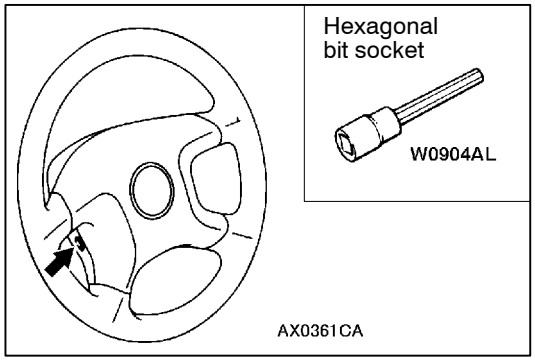


REMOVAL SERVICE POINTS

◀A▶ COVER REMOVAL

Insert the special tool from the indicated position to remove the cover.

NOTE
The special tool can be inserted through the notch behind the position shown.

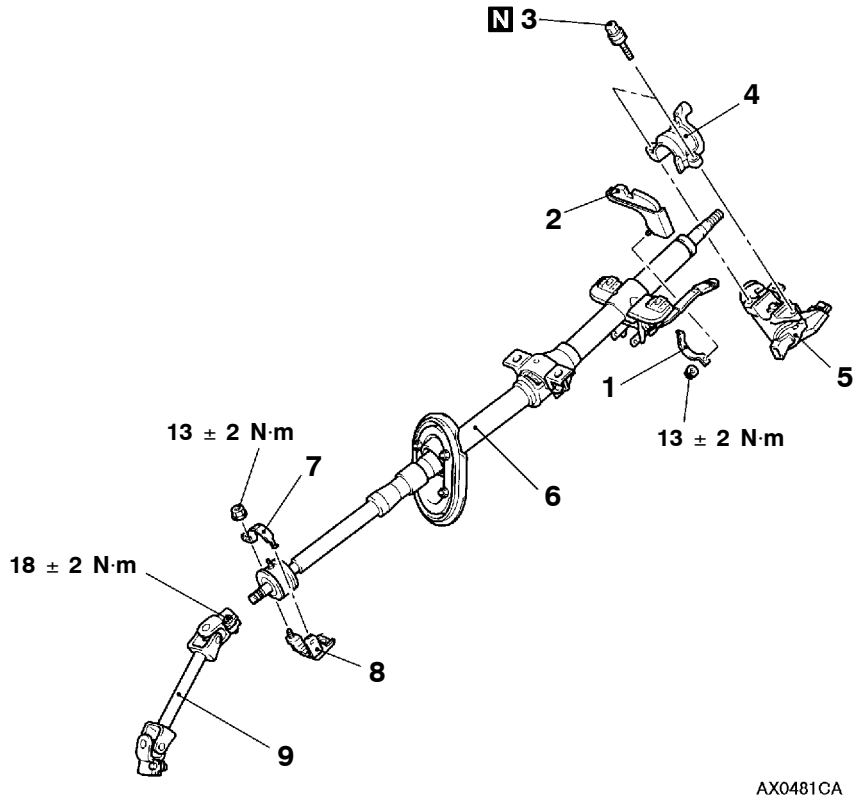


◀B▶ STEERING WHEEL AND AIRBAG MODULE ASSEMBLY REMOVAL

1. Disconnect the connectors of the air bag module and the horn switch through a hole made after the removal of the cover.
2. Loosen the bolt completely. Then, remove the steering wheel and airbag module assembly.

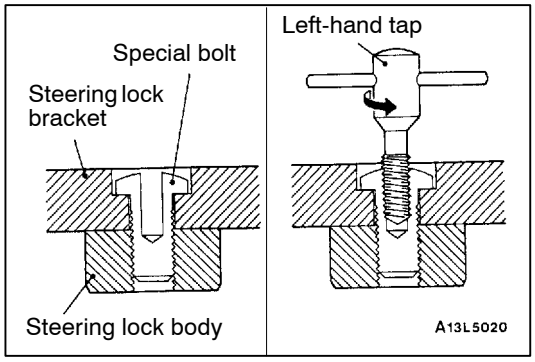
NOTE
Use a hexagonal bit socket or a hexagonal wrench having an effective length of 75 mm or more in the hexagonal section and the diameter of 8 mm or more.

DISASSEMBLY AND REASSEMBLY



Disassembly steps

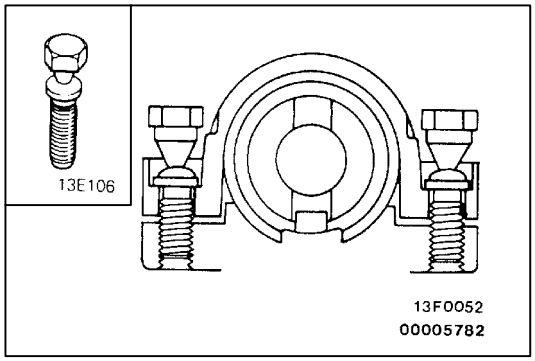
1. Steering dynamic damper lower plate
2. Steering dynamic damper
◀A▶ ▶A◀ 3. Special bolt
▶A◀ 4. Steering lock bracket
▶A◀ 5. Steering lock cylinder assembly
6. Steering column shaft
7. Shaft support bracket B
8. Shaft support bracket A
9. Joint assembly



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

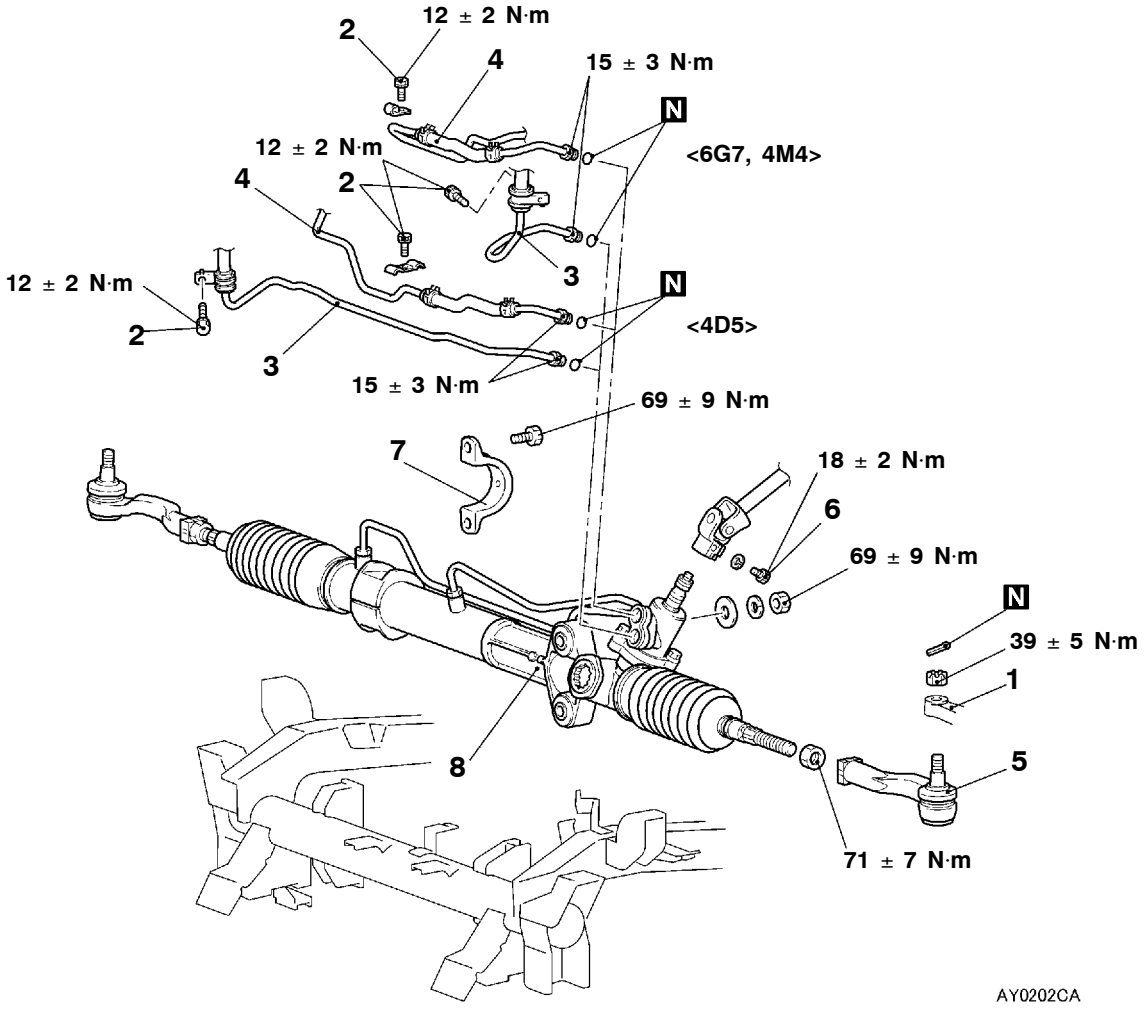
REMOVAL AND INSTALLATION

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-10.)

Post-installation Operation
- Power Steering Fluid Supplying and bleeding (Refer to P.37A-10.)
- Check the Dust Cover for Cracks or Damage by Pushing it with Finger.
- Checking Steering Wheel Position with Wheels Straight Ahead

<L.H. drive vehicles>

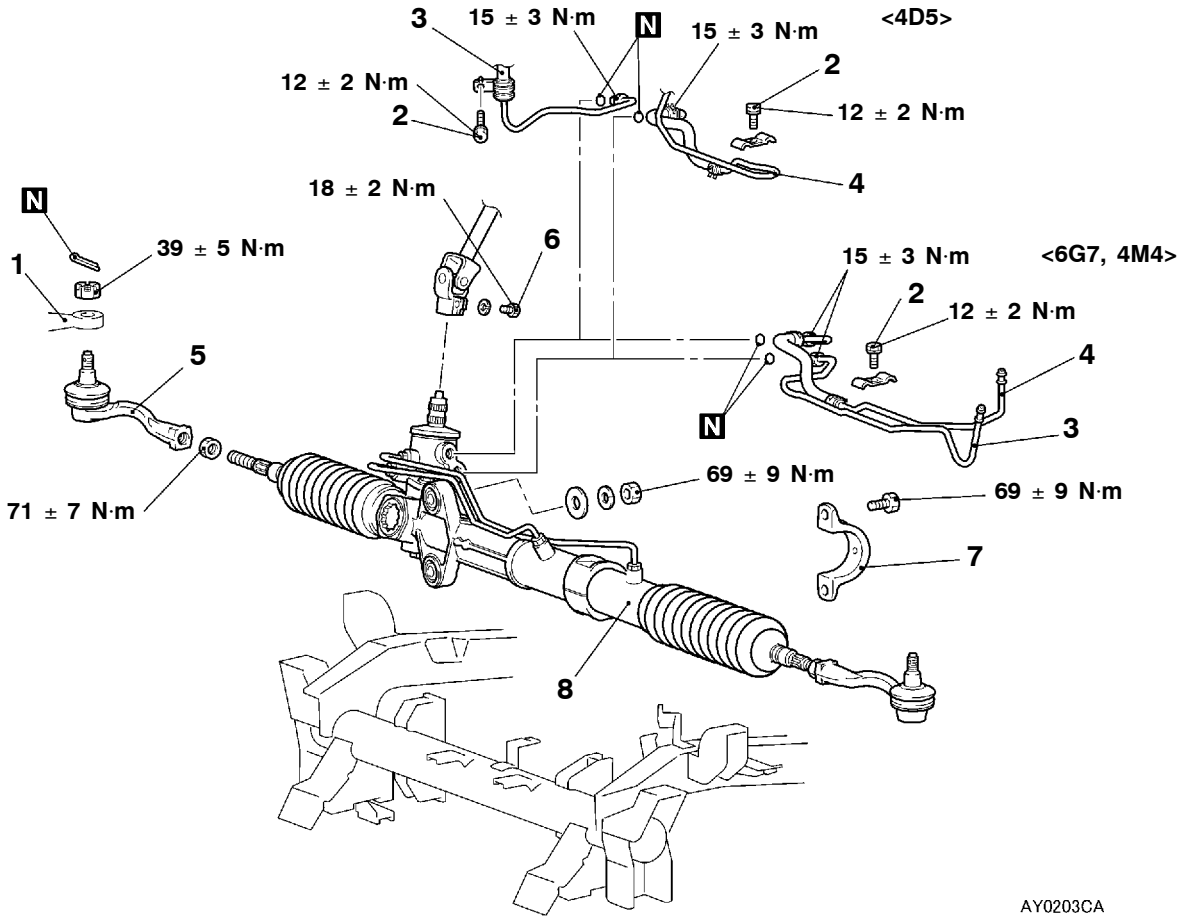


Removal steps
- Under cover removal

◀A▶ 1. Tie rod end and knuckle connection
2. Bolt
▶B◀ 3. Pressure hose assembly
▶B◀ 4. Return tube
▶A◀ 5. Tie rod end (LH)
◀B▶
- Differential mount bracket assembly (LH) separation

6. Steering gear and joint connecting bolt
7. Gear box clamp
◀C▶ 8. Steering gear and linkage

<R.H. drive vehicles>



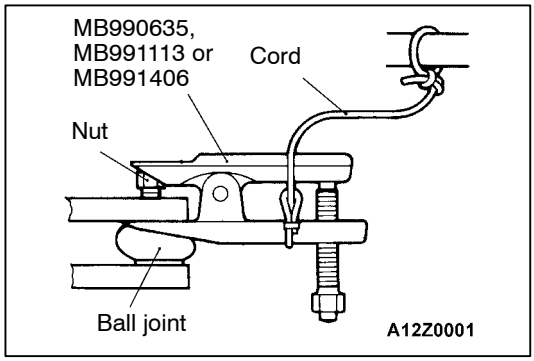
Removal steps

- Under cover removal

◀A▶ 1. Tie rod end and knuckle connection
2. Bolt
▶B◀ 3. Pressure hose assembly
▶B◀ 4. Return tube
▶A◀ 5. Tie rod end (RH)

- Differential mount bracket assembly (RH) separation

◀B▶
6. Steering gear and joint connecting bolt
7. Gear box clamp
◀C▶ 8. Steering gear and linkage



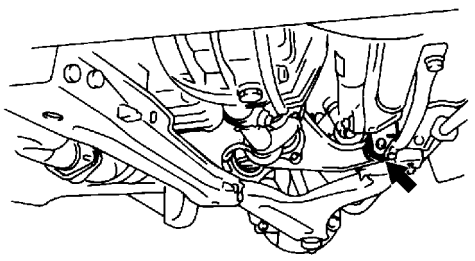
REMOVAL SERVICE POINTS

◀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.**

<L.H. drive vehicles>



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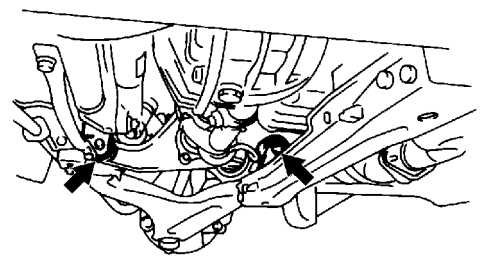
◀B▶ DIFFERENTIAL MOUNT BRACKET ASSEMBLY SEPARATION

1. Remove the bolts securing the differential mount bracket assembly (LH) to the front frame assembly <L.H. drive vehicles>.

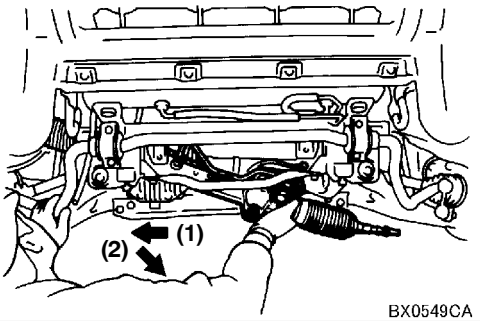
<R.H. drive vehicles>



AX0548CA

2. Remove the bolts securing the differential mount bracket assembly (RH) to the front frame assembly and the bolts securing the differential mount bracket assembly (RH) to the No.2 crossmember <R.H. drive vehicles>.

<L.H. drive vehicles>



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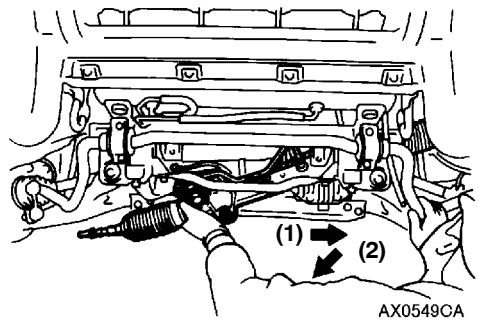
◀C▶ STEERING GEAR AND LINKAGE REMOVAL

1. Pull the rack to the right as far as it will go, and lower the steering gear and linkage through the space of the front frame by manipulating it <L.H. drive vehicles>.

Caution
Be careful not to damage the boot when removing the steering gear and linkage.

<R.H. drive vehicles>



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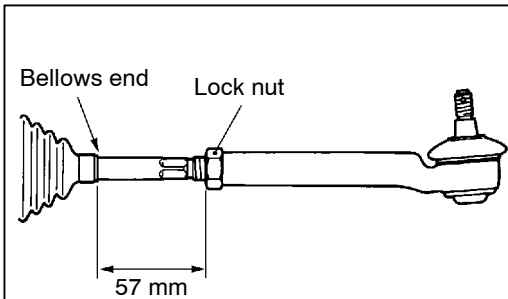
2. Pull the rack to the left as far as it will go, and lower the steering gear and linkage through the space of the front frame by manipulating it <R.H. drive vehicles>.

Caution
Be careful not to damage the boot when removing the steering gear and linkage.



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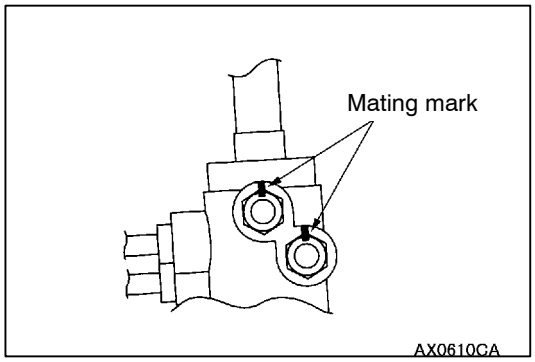
INSTALLATION SERVICE POINTS

▶A◀ TIE ROD END INSTALLATION

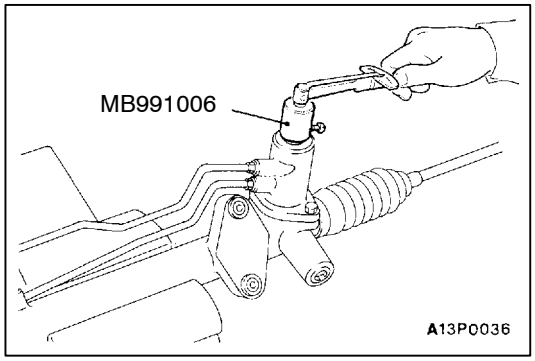
Screw in the tie-rod end by the amount shown in the illustration, and then provisionally tighten it with the lock nut.

NOTE
Install the steering gear and linkage to the vehicle body, and adjust the toe-in before tightening the lock nut to the specified torque.



▶B◀ RETURN TUBE/PRESSURE HOSE ASSEMBLY INSTALLATION

Align the markings on the gearbox side and the tube side.



INSPECTION

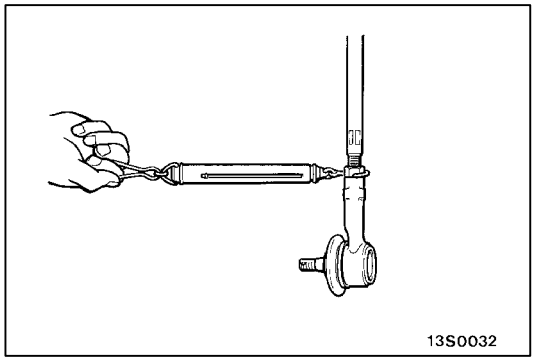
GEAR BOX PINION TOTAL ROTATION TORQUE CHECK

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 – 1.7 N·m
   Torque fluctuation: 0.4 N·m 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.37-27.)
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: 11 - 35 N (1.4 - 4.9 N·m)
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.

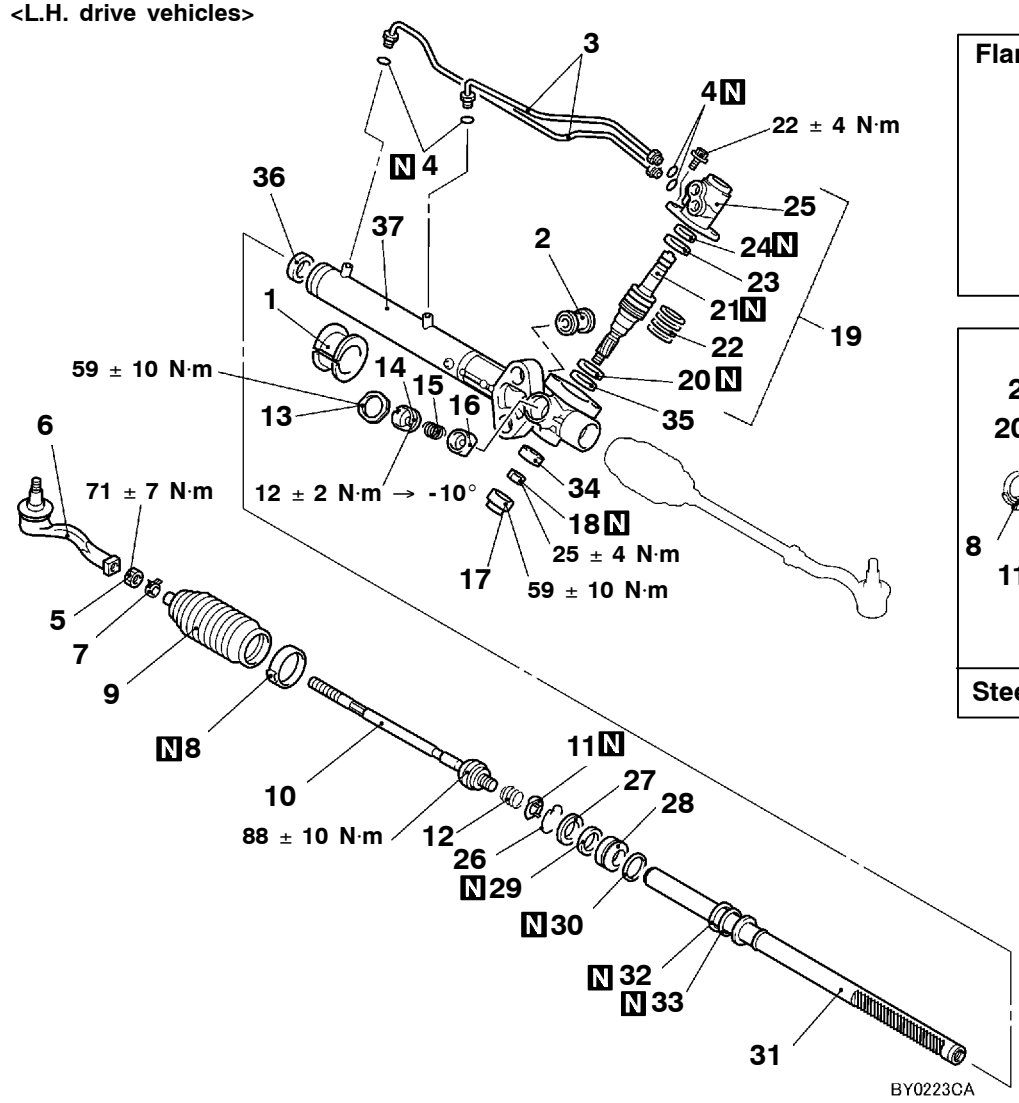
TIE ROD END BALL JOINT DUST COVER CHECK

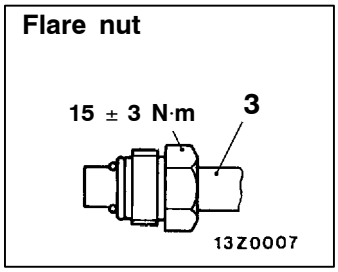
1. Check the dust cover for cracks or damage by pushing it with finger.
2. If the dust cover is cracked or damaged, replace the tie rod end. (Refer to P.37A-20, 21.)

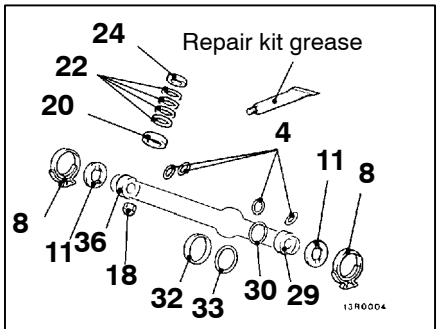
   NOTE
   A cracked or damaged dust cover may damage the ball joint. Replace the dust cover when it is damaged during service work.

DISASSEMBLY AND REASSEMBLY

<L.H. drive vehicles>





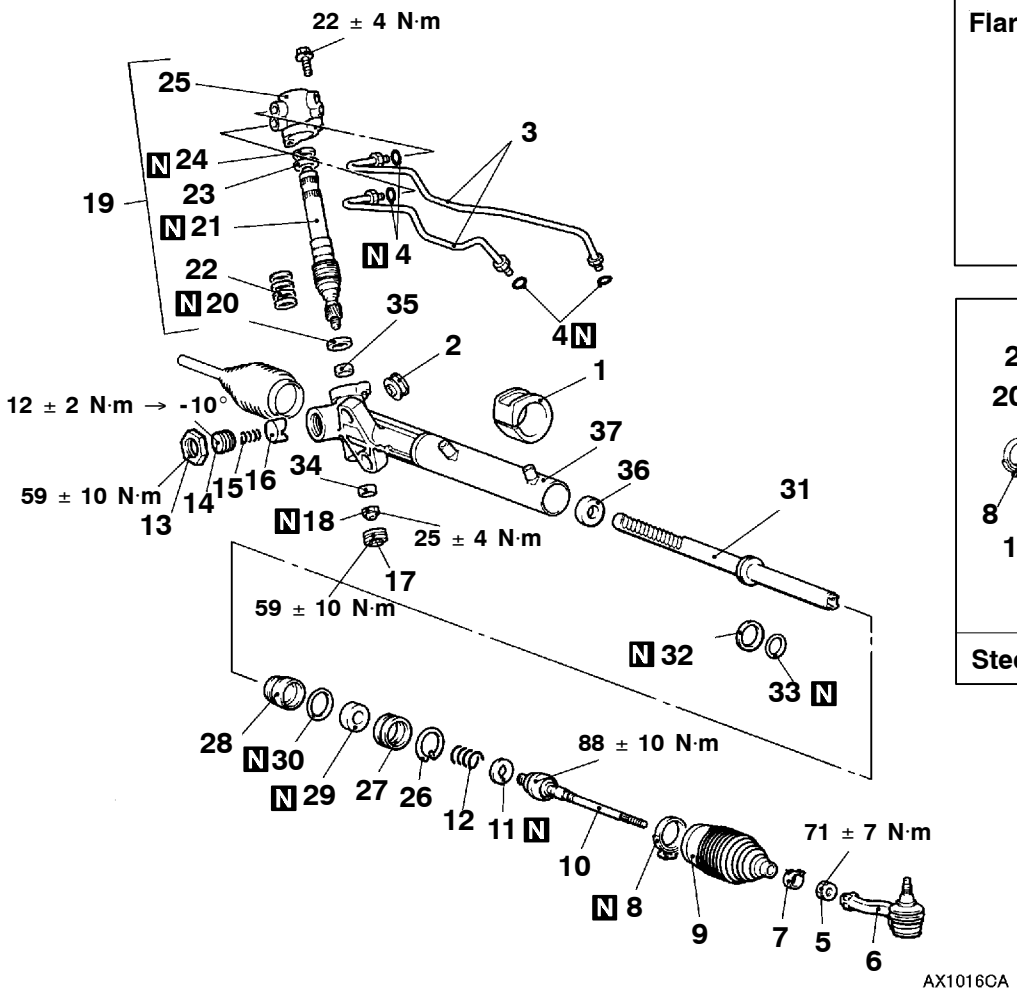


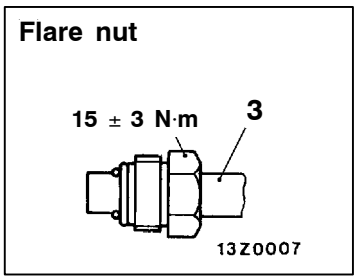
Steering gear seal set

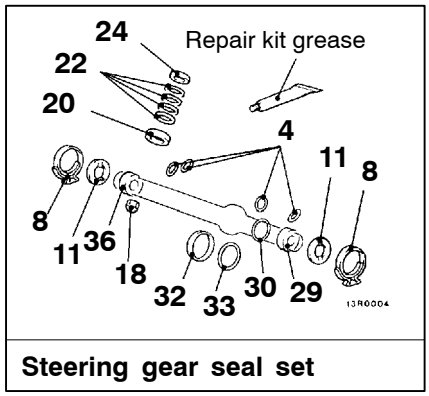
Disassembly steps

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

<R.H. drive vehicles>



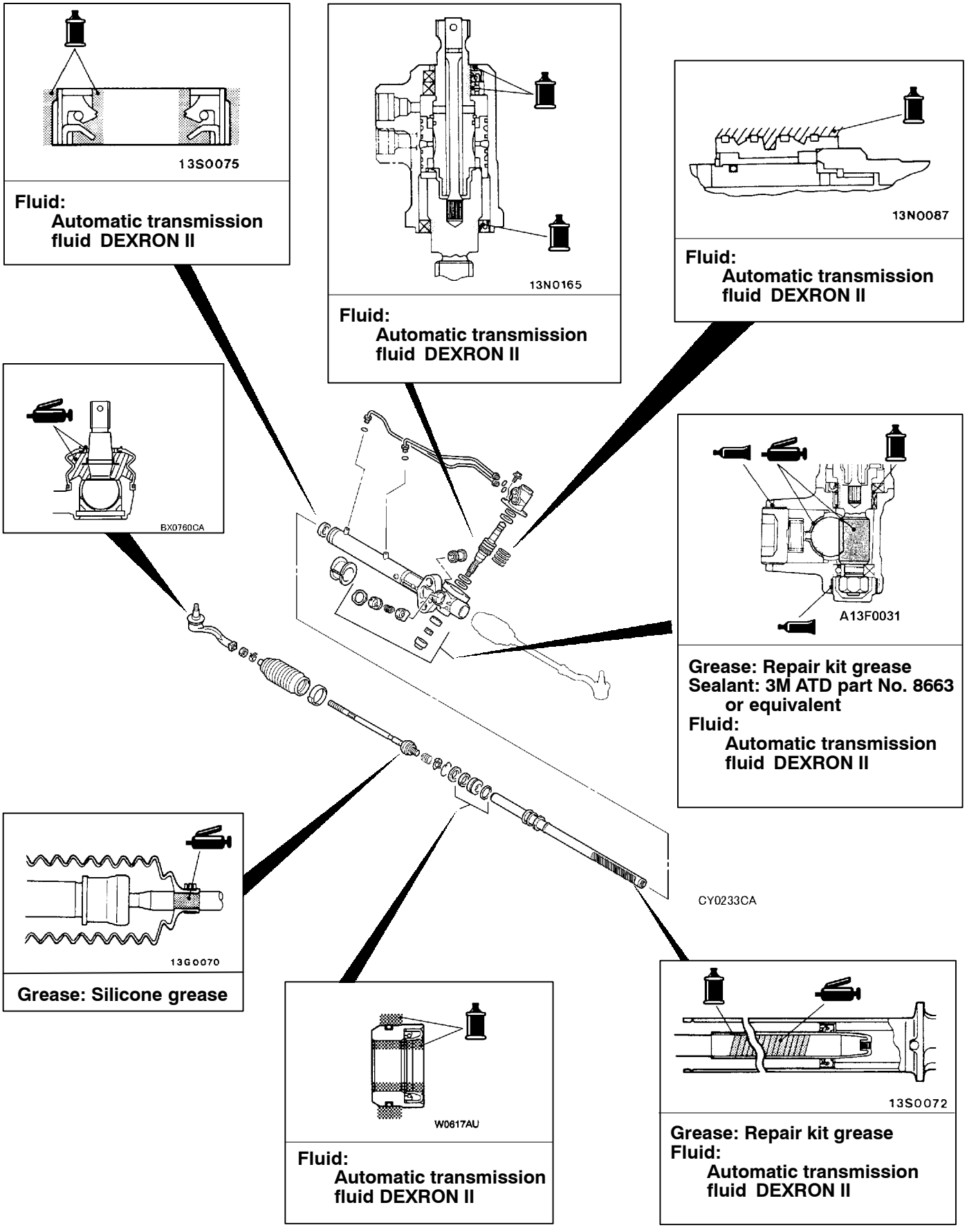


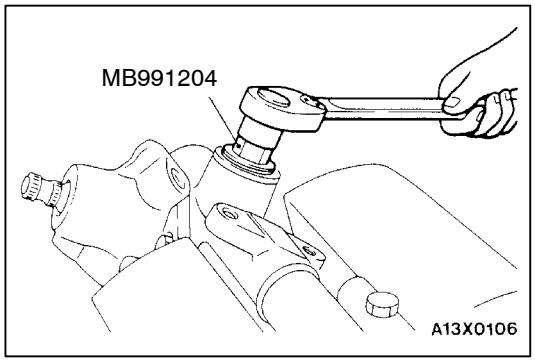


Disassembly steps

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

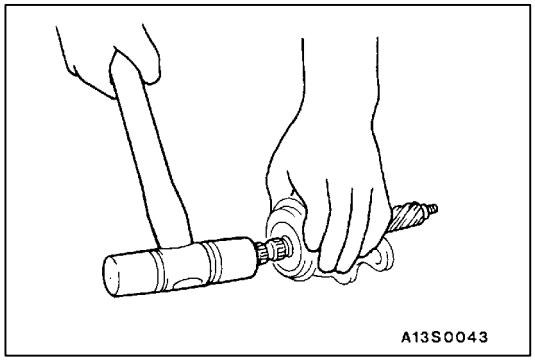
Lubrication and Sealing Points





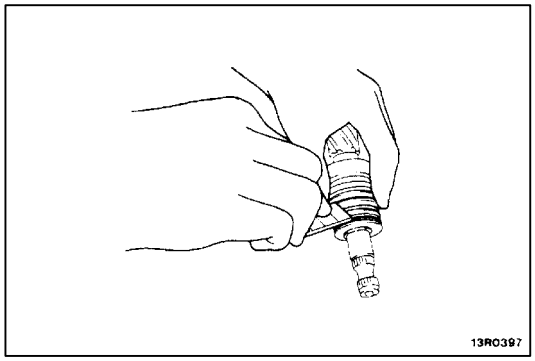
DISASSEMBLY SERVICE POINTS

◀A▶ RACK SUPPORT COVER REMOVAL



◀B▶ LOWER OIL SEAL/PINION AND VALVE ASSEMBLY REMOVAL

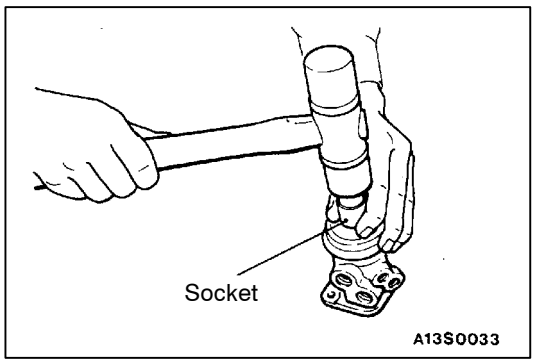
With a plastic hammer, lightly tap the pinion and valve assembly in its spline to remove the lower oil seal and pinion and valve assembly from the valve housing.



◀C▶ SEAL RING REMOVAL

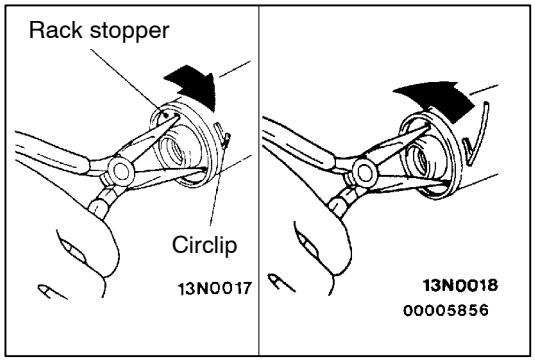
Cut the seal ring to remove from the pinion and valve assembly.

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



◀D▶ UPPER BEARING/UPPER OIL SEAL REMOVAL

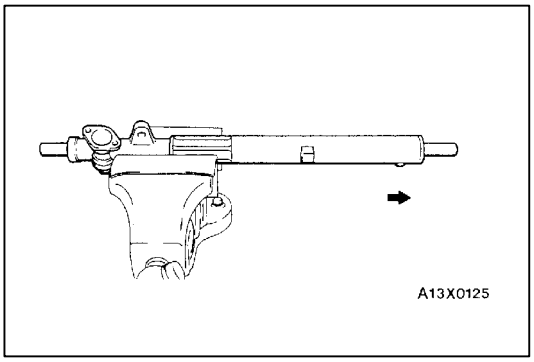
Using a socket, pull out the upper oil seal and bearing from the valve housing.



◀E▶ CIRCLIP REMOVAL

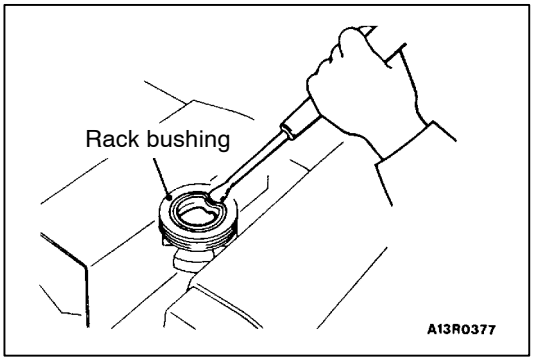
1. Turn the rack stopper clockwise until the circlip end comes out of the slot in the rack housing.
2. Turn the rack stopper anticlockwise to remove the circlip.

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.



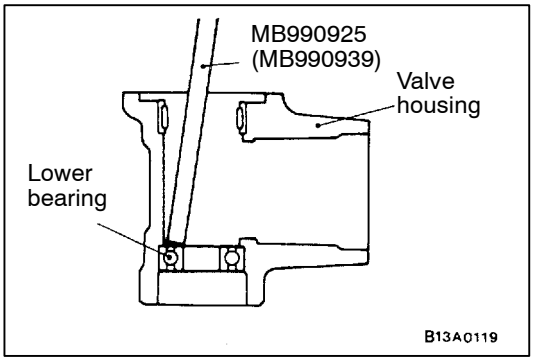
◀F▶ RACK STOPPER/RACK BUSHING/OIL SEAL/O-RING/RACK ASSEMBLY REMOVAL

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

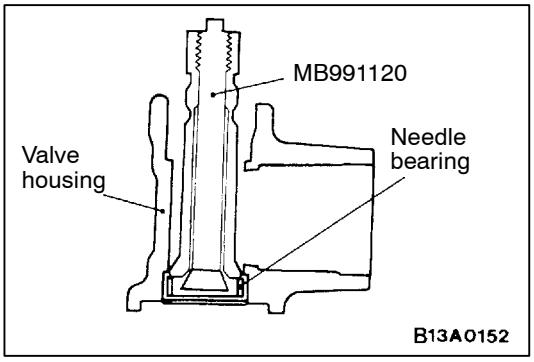


2. Partially bend the oil seal to remove from the rack bushing.

Caution
Use care not to damage the oil seal press-fitting surface of the rack bushing.

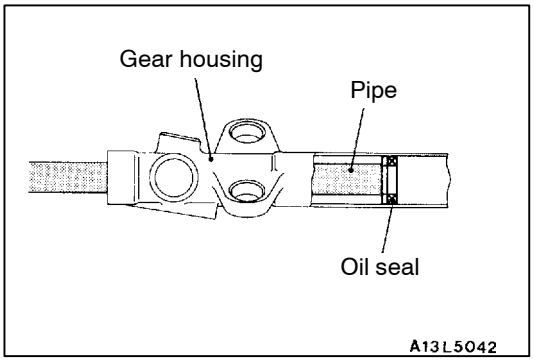


◀G▶ LOWER BEARING REMOVAL



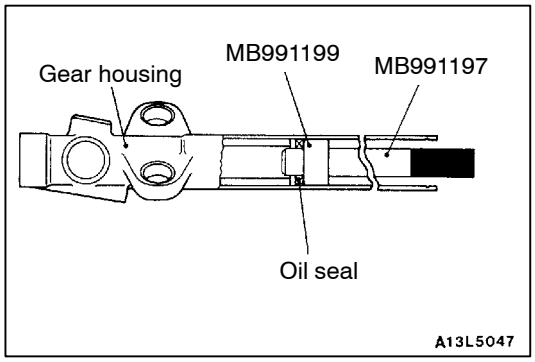
◀H▶ NEEDLE BEARING REMOVAL

Caution
Do not twist the special tool too much, otherwise it may damage the inside surface of the valve housing.



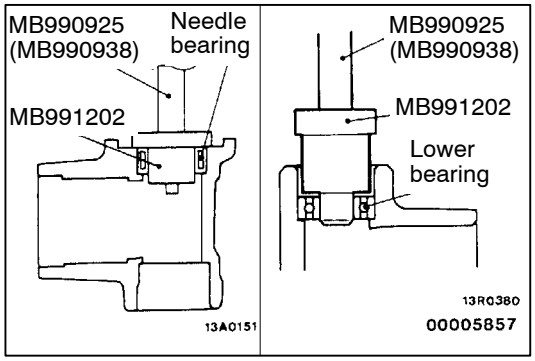
◀I▶ OIL SEAL REMOVAL

Use a pipe or the like to pull out the oil seal.

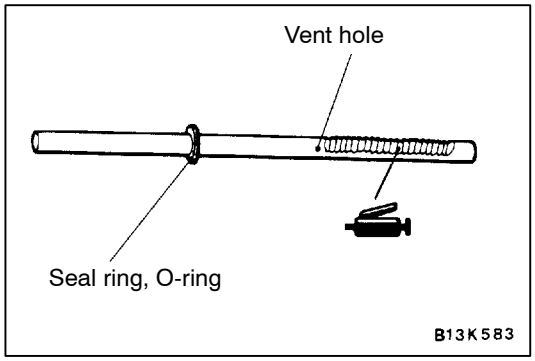


REASSEMBLY SERVICE POINTS

▶A◀ OIL SEAL INSTALLATION



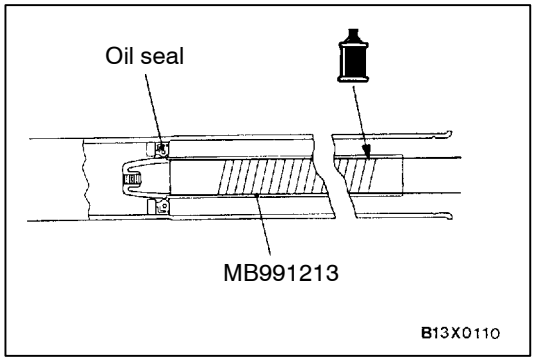
▶B◀ NEEDLE BEARING/LOWER BEARING INSTALLATION



▶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.



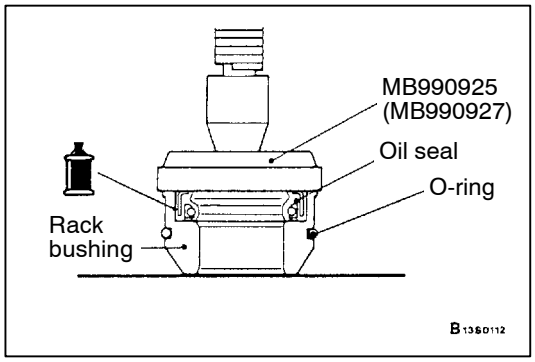
2. Cover the serrations of the rack assembly with the special tool.
3. Apply specified fluid to the outer surfaces of the special tool, seal ring and O-ring.

   Specified fluid:
   Automatic transmission fluid DEXRON II

   Caution
   Do not use ATF-SP II M and ATF-SP III.

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.

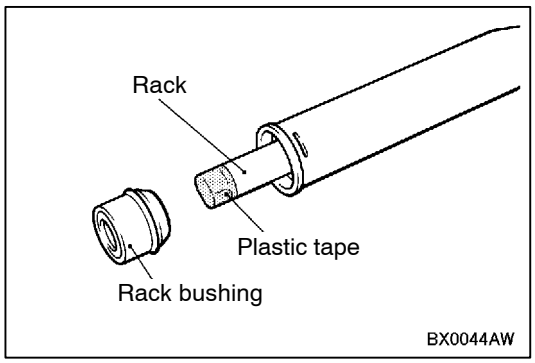


▶D◀ OIL SEAL/RACK BUSHING INSTALLATION

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 II

   Caution
   Do not use ATF-SP II M and ATF-SP III.

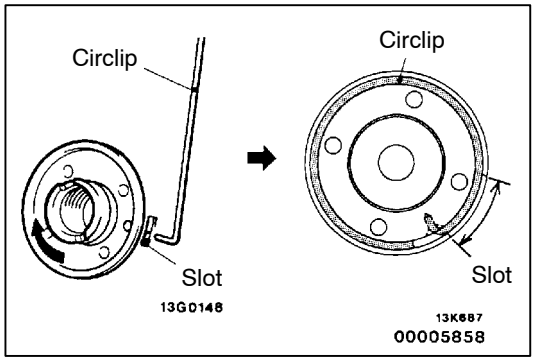


2. Apply the specified fluid to the oil seal inner surface and the O-ring.

   Specified fluid:
   Automatic transmission fluid DEXRON II

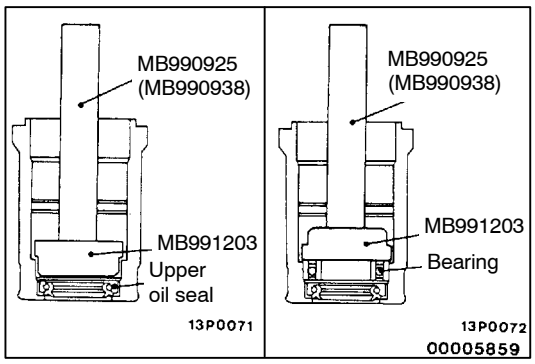
   Caution
   Do not use ATF-SP II M and ATF-SP III.

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

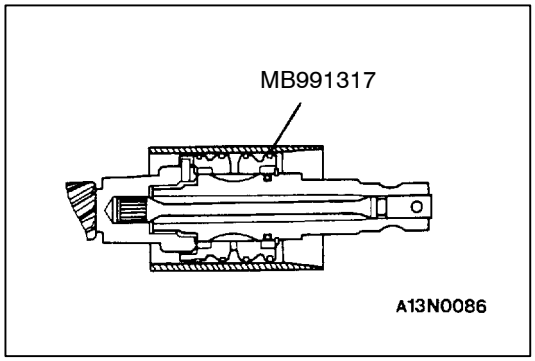


▶E◀ CIRCLIP INSTALLATION

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.

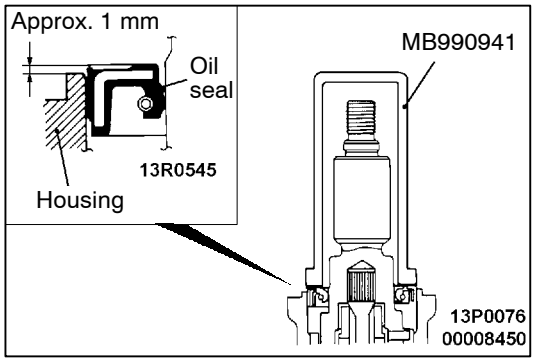


▶F◀ UPPER OIL SEAL/UPPER BEARING INSTALLATION



▶G◀ SEAL RING INSTALLATION

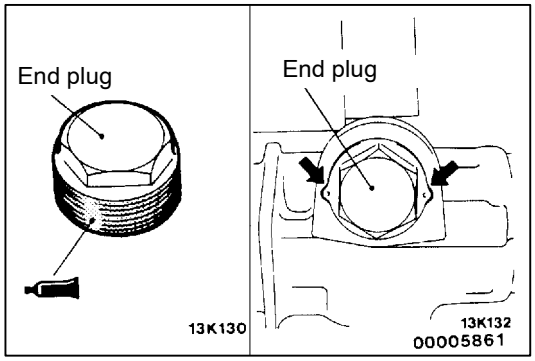
After installation, using the special tool or by hand, compress seal rings that expand during installation.



▶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.

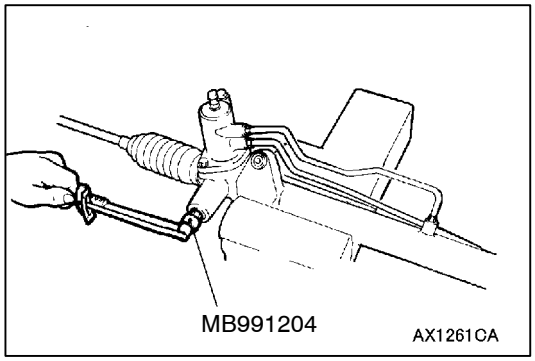
Caution
When the oil seal is flush with or lower than the housing edge, reassemble the components. Otherwise, oil leaks will result.



▶I◀ END PLUG INSTALLATION

1. Apply specified sealant to the threaded section of the end plug, and then install the end plug to the gear housing.

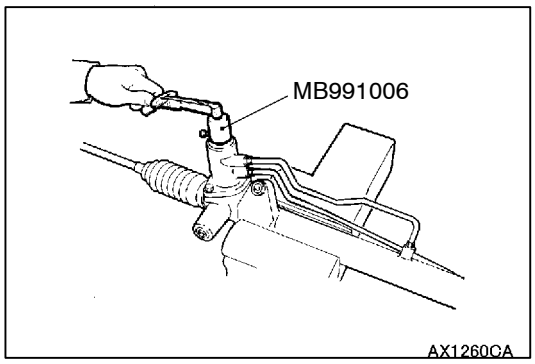
   Specified fluid:
   3M ATD Part No.8663 or equivalent
2. Use a punch to bend over the two tabs on the sides of the end plug to prevent the end plug from turning.



▶J◀ RACK SUPPORT COVER/LOCKING NUT INSTALLATION

1. Apply specified sealant to the rack cover support thread.

   Specified fluid:
   3M ATD Part No.8663 or equivalent
2. Using the special tool, tighten the rack support cover to 12 ± 2 N·m.
3. Return the rack support cover by about 10°.
4. Tighten the locking nut to the specified torque, using the special tool to prevent the rack support cover from spinning.

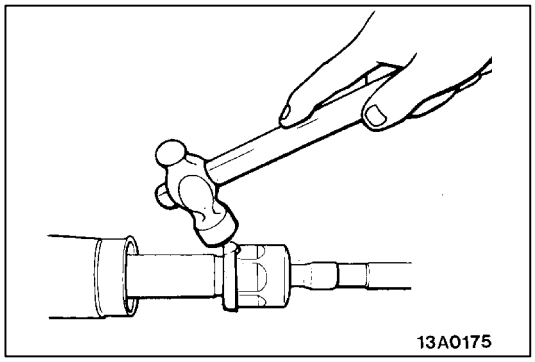


▶K◀ PINION TOTAL ROTATION TORQUE ADJUSTMENT

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.

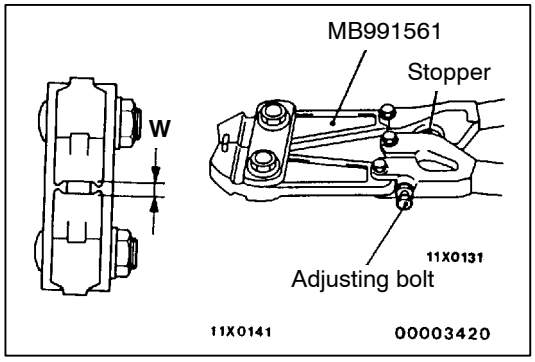
   Standard value:
   Total rotation torque: 0.6 - 1.7 Nm
   Torque fluctuation: 0.4 Nm or less
2. If the total rotation torque or torque fluctuation does not meet the standard values, adjust by returning the rack support cover within a range of 0 to 30°.

   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.



▶L◀ 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.

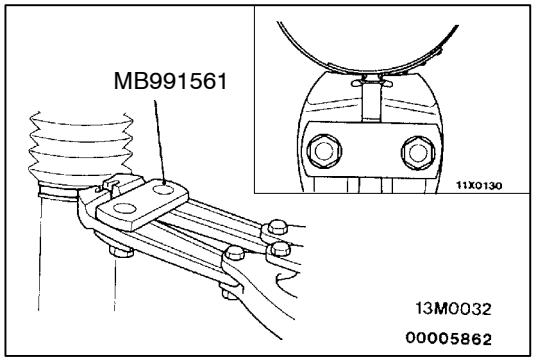


▶M◀BELLOWS BAND INSTALLATION

1. Turn the adjusting bolt of the special tool to adjust the opening dimension (W) to the standard value.

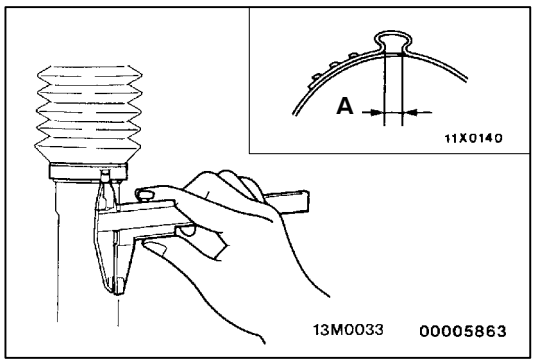
   Standard value (W): 2.9 mm
   <When more than 2.9 mm>
   Screw in the adjusting bolt.
   <When less than 2.9 mm>
   Loosen the adjusting bolt.

   NOTE
   (1) The dimension (W) is adjusted by about 0.7 mm per one turn.
   (2) Do not turn the adjusting bolt more than one turn.



2. Use the special tool to crimp the bellows band.

   Caution
   (1) Hold the rack housing, and use the special tool to crimp the bellows band securely.
   (2) Crimp the bellows band until the special tool touches the stopper.



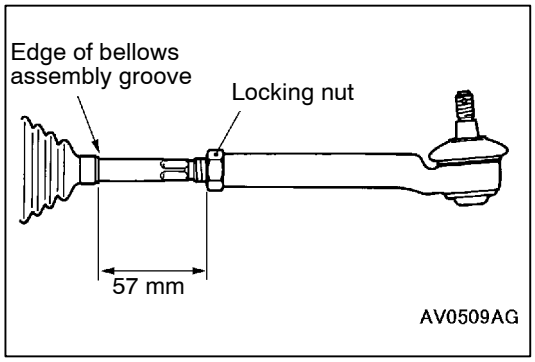
3. See that the crimped width (A) meets the standard value.

   Standard value (A): 2.4 - 2.8 mm
   <When more than 2.8 mm>
   Readjust the dimension (W) of step (1) to the value calculated by the following equation, and repeat step (2).

   W = 5.5 mm - A [Example: If (A) is 2.9 mm, (W) is 2.6 mm.]

   <When less than 2.4 mm>
   Remove the bellows band, readjust the dimension (W) of step (1) to the value calculated by the following equation, and use a new bellows band to repeat steps (2) to (3).

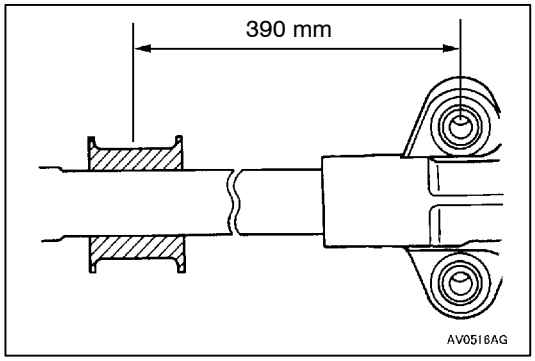
   W = 5.5 mm - A [Example: If (A) is 2.3 mm, (W) is 3.2 mm.]



▶N◀ TIE ROD END/LOCKING NUT INSTALLATION

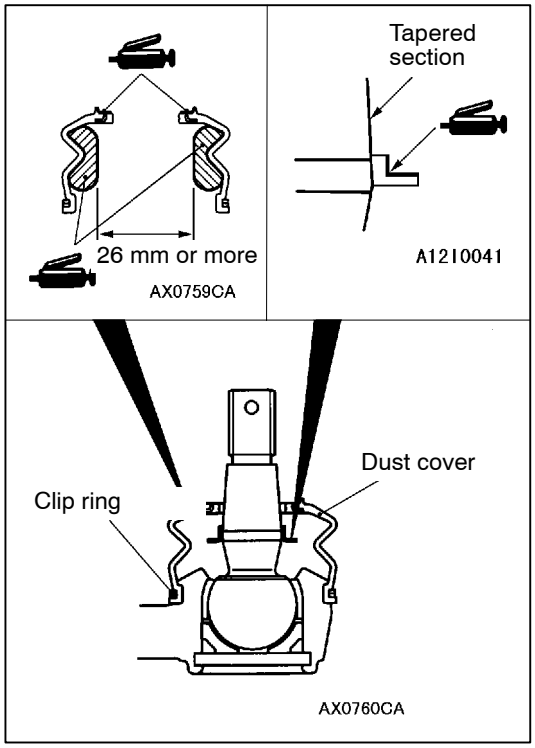
Screw in the tie rod end until the dimension shown is achieved. Then, temporarily tighten with the locking nut.

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.



▶O◀ GEAR MOUNTING RUBBER INSTALLATION

Install the gear mounting rubber to the rack housing so that the distance is as shown in the illustration.



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. Remove the clip ring, and then remove the dust cover.
2. Refill multi-purpose grease inside the dust cover as shown in the illustration.
3. Apply multi-purpose grease to the top of the dust cover and to the retainer of the ball joint stud.
4. Wrap the stud thread of the tie rod end ball joint with vinyl tape, and then install the dust cover to the tie rod end ball joint.

   Caution
   Do not apply multi-purpose grease to the place (tapered section) where the threaded section of the ball joint connects with the knuckle. Wipe away any grease which gets on this section.
5. Secure the dust cover in place with the clip ring.

   Caution
   To prevent the grease to be applied on the ball joint connection (taper) with knuckle, do not compress the dust cover before installation.
6. Press the dust cover with your finger to check that there are no cracks or damage in the dust cover.

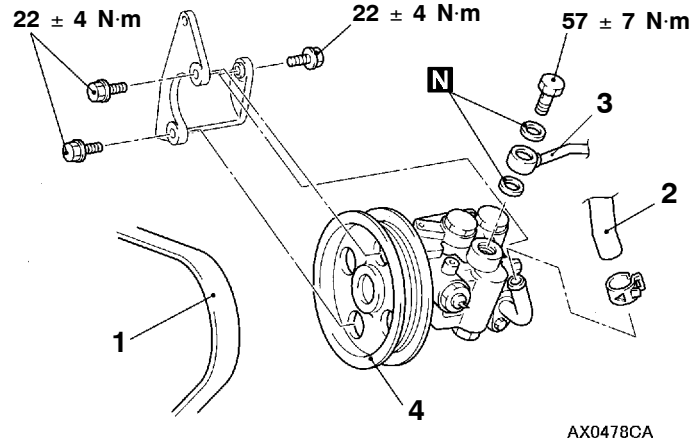
POWER STEERING OIL PUMP

REMOVAL AND INSTALLATION

Pre-removal Operation
- Battery and Battery Tray Removal
- Power Steering Fluid Draining (Refer to P.37A-9.)

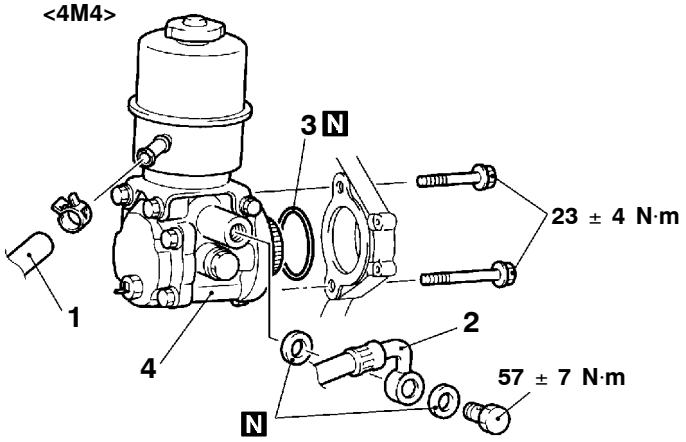
Post-installation Operation
- Power Steering Fluid Supplying and Bleeding (Refer to P.37A-9.)
- Battery and Battery Tray Installation
- Drive Belt Tension Adjusting <6G7, 4D5> (Refer to GROUP 11A/11B – On-vehicle Service.)

<6G7>



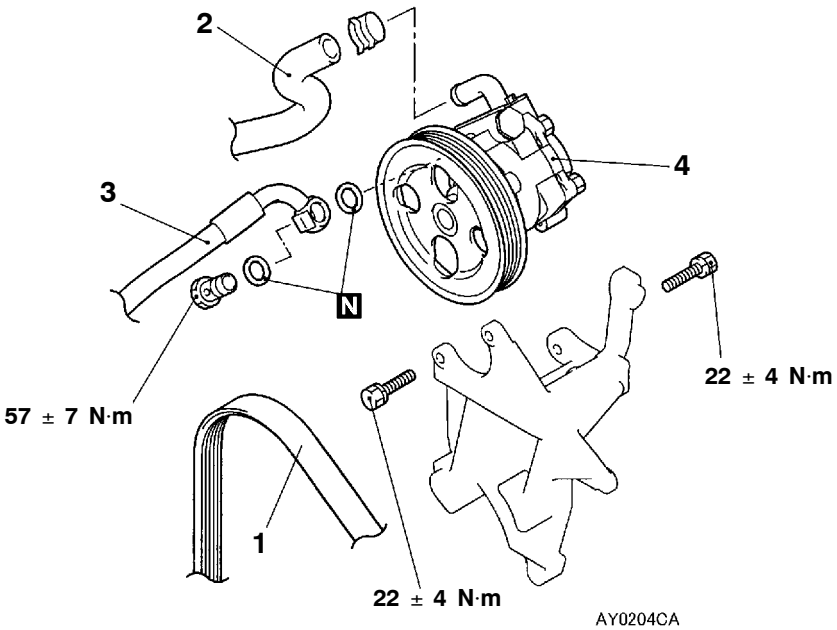
AX0478CA

<4M4>



AX0479CA

<4D5>



AY0204CA

Removal steps

<6G7, 4D5>
1. Drive belt (Refer to GROUP 11A, 11B.)
2. Suction hose
3. Pressure tube
4. Oil pump assembly

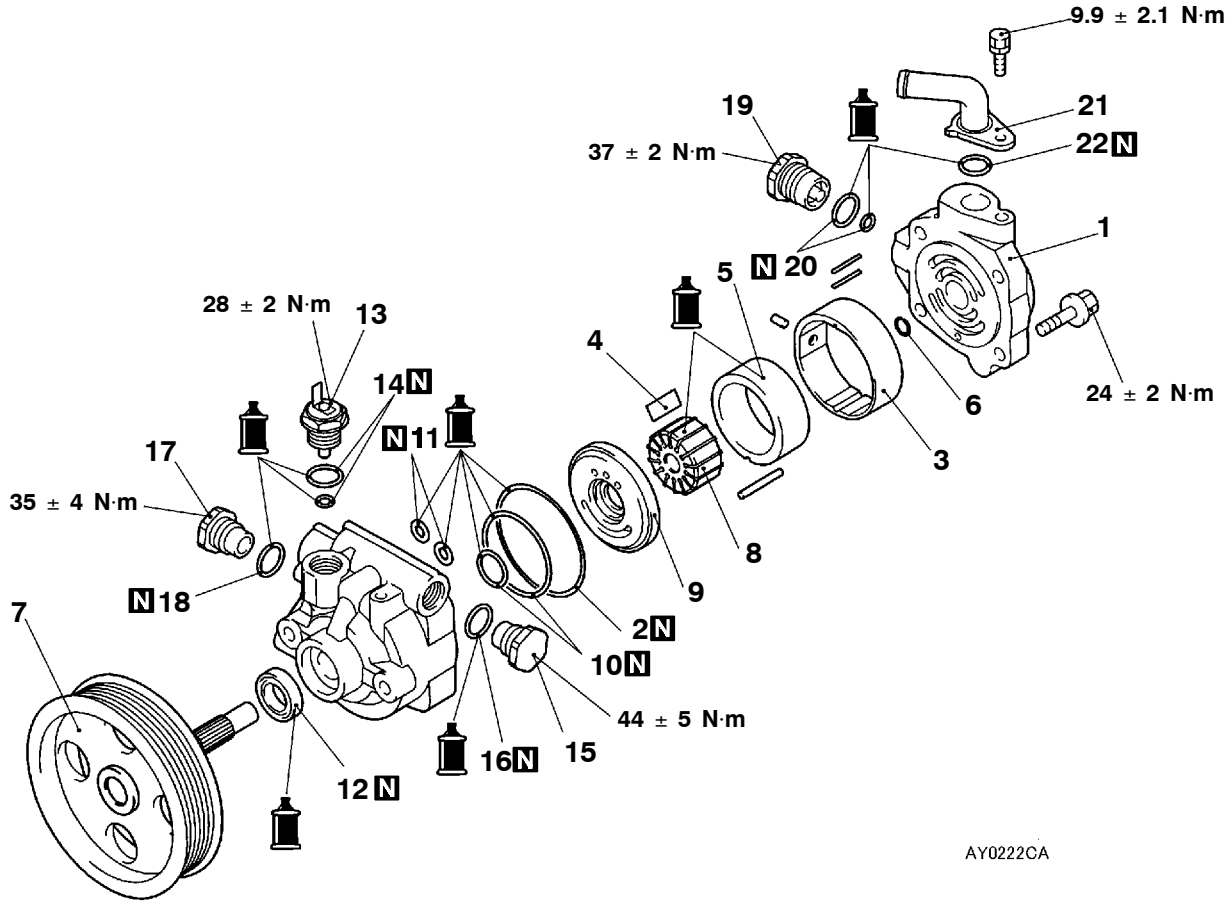
<4M4>
- Engine cover (Refer to GROUP 11C.)

1. Pressure hose
2. Return hose B
3. O-ring
4. Oil pump assembly

DISASSEMBLY AND REASSEMBLY

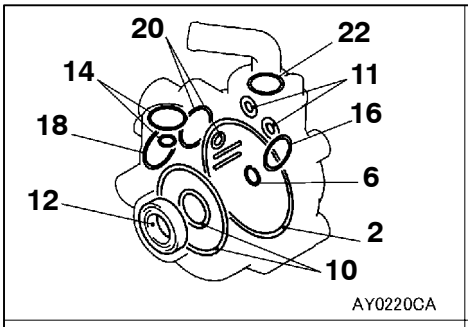
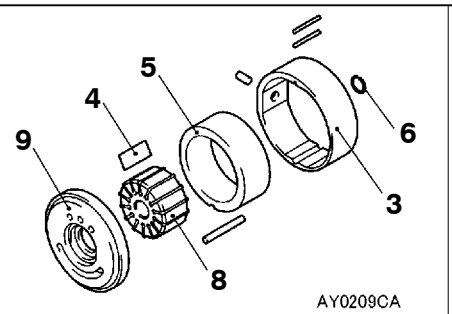
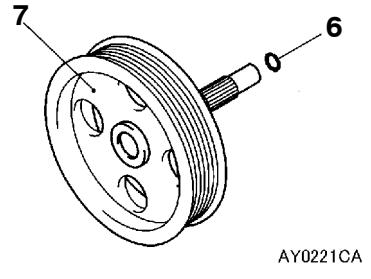
<6G7, 4D5>

Caution
Never disassemble the terminal assembly unable to be reassembled.



NOTE

: Automatic transmission fluid DEXRON II

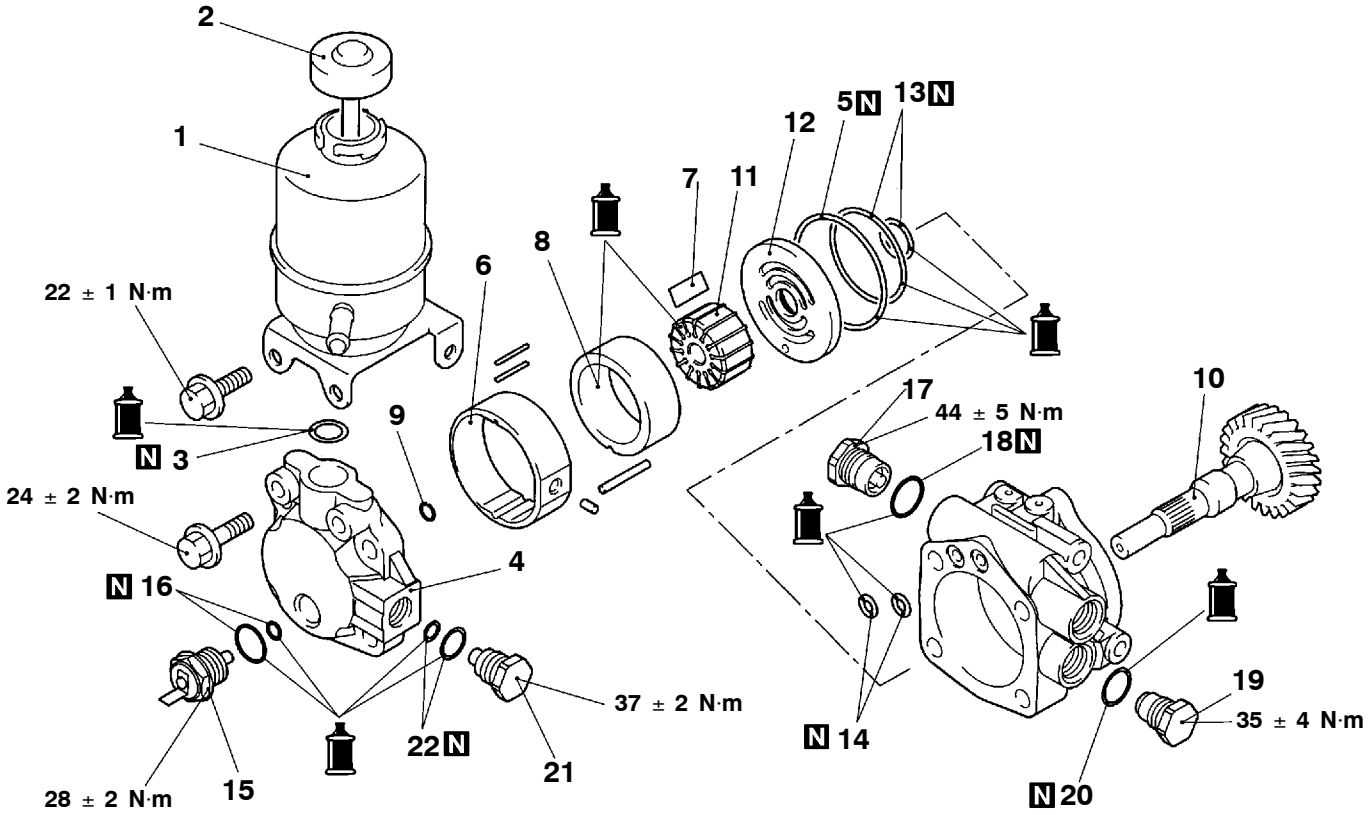
		
Oil pump seal kit	**Oil pump cartridge kit**	**Oil pump pulley and shaft kit**

Disassembly steps

1. Pump cover
2. O-ring
3. Adapter ring
- ▶E◀ 4. Vanes
- ▶D◀ 5. Cam ring
6. Snap ring
7. Pulley and shaft
- ▶C◀ 8. Rotor
9. Side plate
- ▶A◀ 10. O-ring
- ▶A◀ 11. O-ring
- ▶B◀ 12. Oil seal
13. Terminal assembly <6G7>
- ▶A◀ 14. O-ring <6G7>
15. Inner plug A
- ▶A◀ 16. O-ring
17. Inner plug B
- ▶A◀ 18. O-ring
19. Inner plug C
- ▶A◀ 20. O-ring
21. Suction connector
- ▶A◀ 22. O-ring

<4M4>

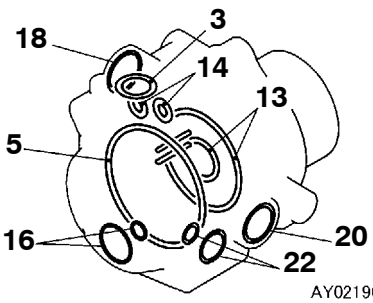
Caution
Never disassemble the terminal assembly unable to be reassembled.



AY0218CA

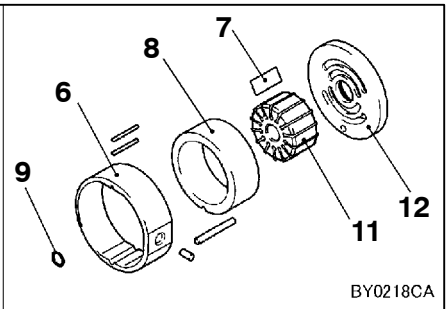
NOTE

: Automatic transmission fluid DEXRON II



AY0219CA

Oil pump seal kit

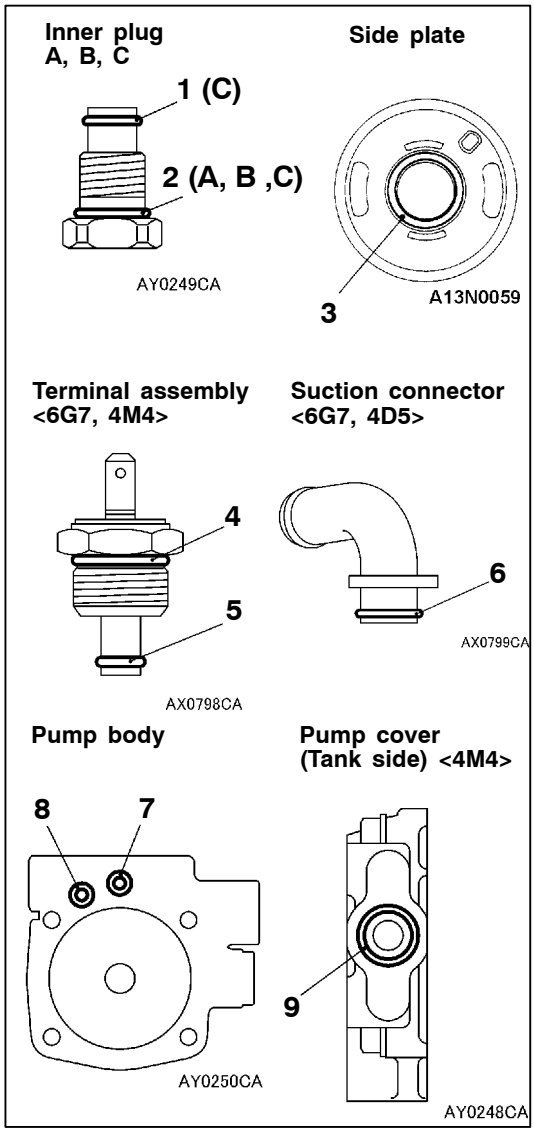


BY0218CA

Oil pump cartridge kit

Disassembly steps

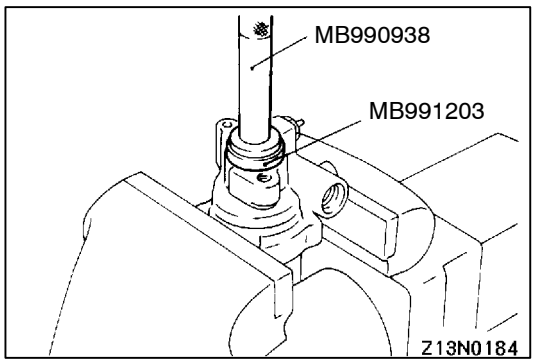
1. Tank assembly
2. Cap assembly
- ▶A◀ 3. O-ring
4. Pump cover
5. O-ring
6. Adapter ring
- ▶D◀ 7. Vanes
- ▶C◀ 8. Cam ring
9. Snap ring
10. Oil pump gear
- ▶B◀ 11. Rotor
12. Side plate
- ▶A◀ 13. O-ring
- ▶A◀ 14. O-ring
15. Terminal assembly
- ▶A◀ 16. O-ring
17. Inner plug A
- ▶A◀ 18. O-ring
19. Inner plug B
- ▶A◀ 20. O-ring
21. Inner plug C
- ▶A◀ 22. O-ring



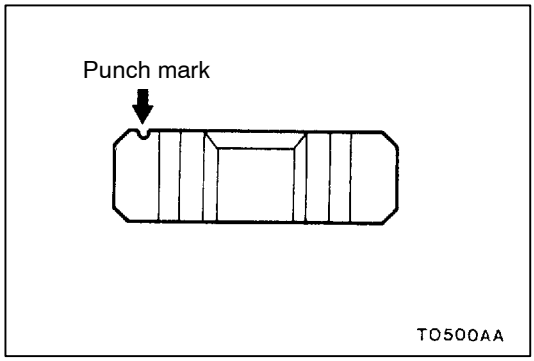
REASSEMBLY SERVICE POINTS

▶A◀ O-RING INSTALLATION

No.		ID × Width mm
1		6.8 × 1.9
2	Inner plug A, C	12.4 × 2.6
	Inner plug B	14.8 × 2.4
3		21 × 1.9
4		14.8 × 1.9
5		3.8 × 1.9
6		15.8 × 2.4
7		9.8 × 1.9
8		6.8 × 1.9
9		13.8 × 2.4

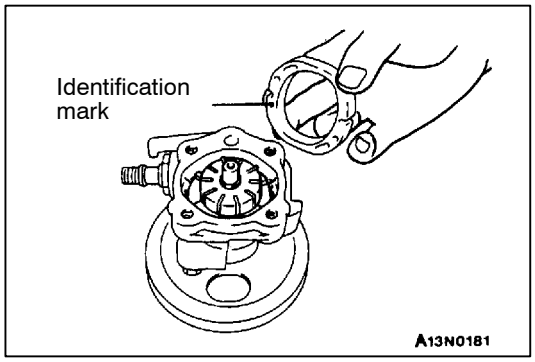


▶B◀ OIL SEAL INSTALLATION <6G7, 4D5>



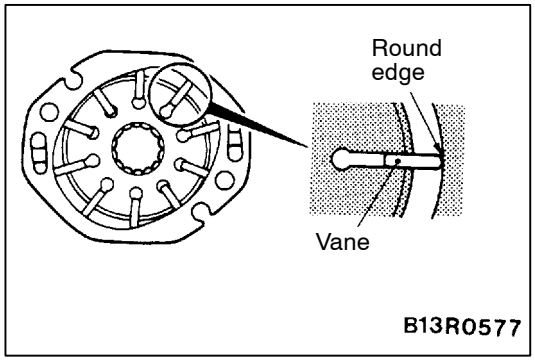
▶C◀ ROTOR INSTALLATION

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).

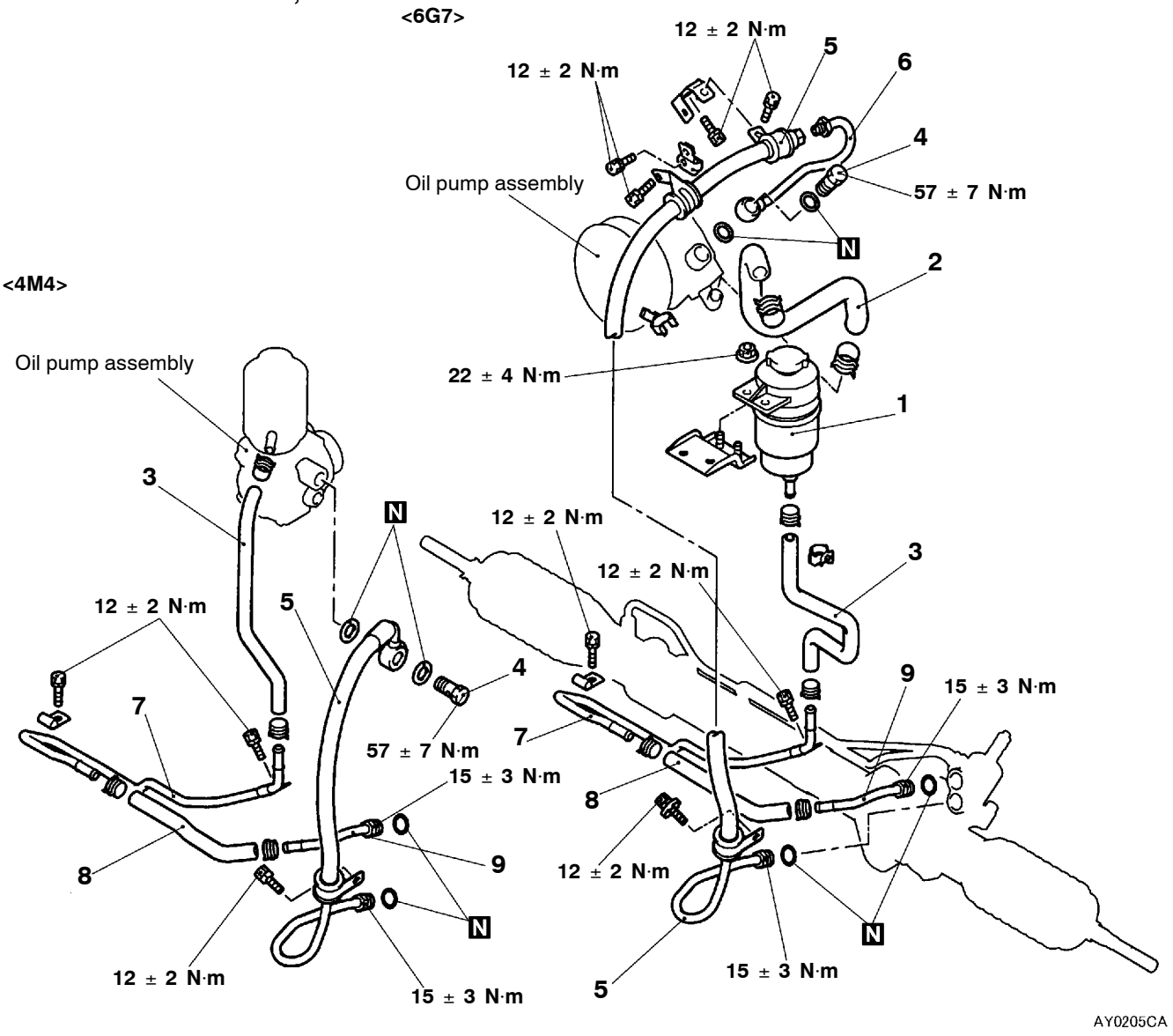
POWER STEERING OIL HOSES

REMOVAL AND INSTALLATION

Pre-removal Operation
- Under Cover Removal
- Power Steering Fluid Draining (Refer to P.37A-10.)
- Battery and Battery Tray Removal
- Condense Tank Removal (Refer to GROUP 14.)

Post-installation Operation
- Condense Tank Installation (Refer to GROUP 14.)
- Battery and Battery Tray Installation
- Power Steering Fluid Adding and Air Bleeding (Refer to P.37A-10.)
- Under Cover Installation
- Drive Belt Tension Check <6G7, 4D5> (Refer to GROUP11A/11B – On-vehicle Service.)

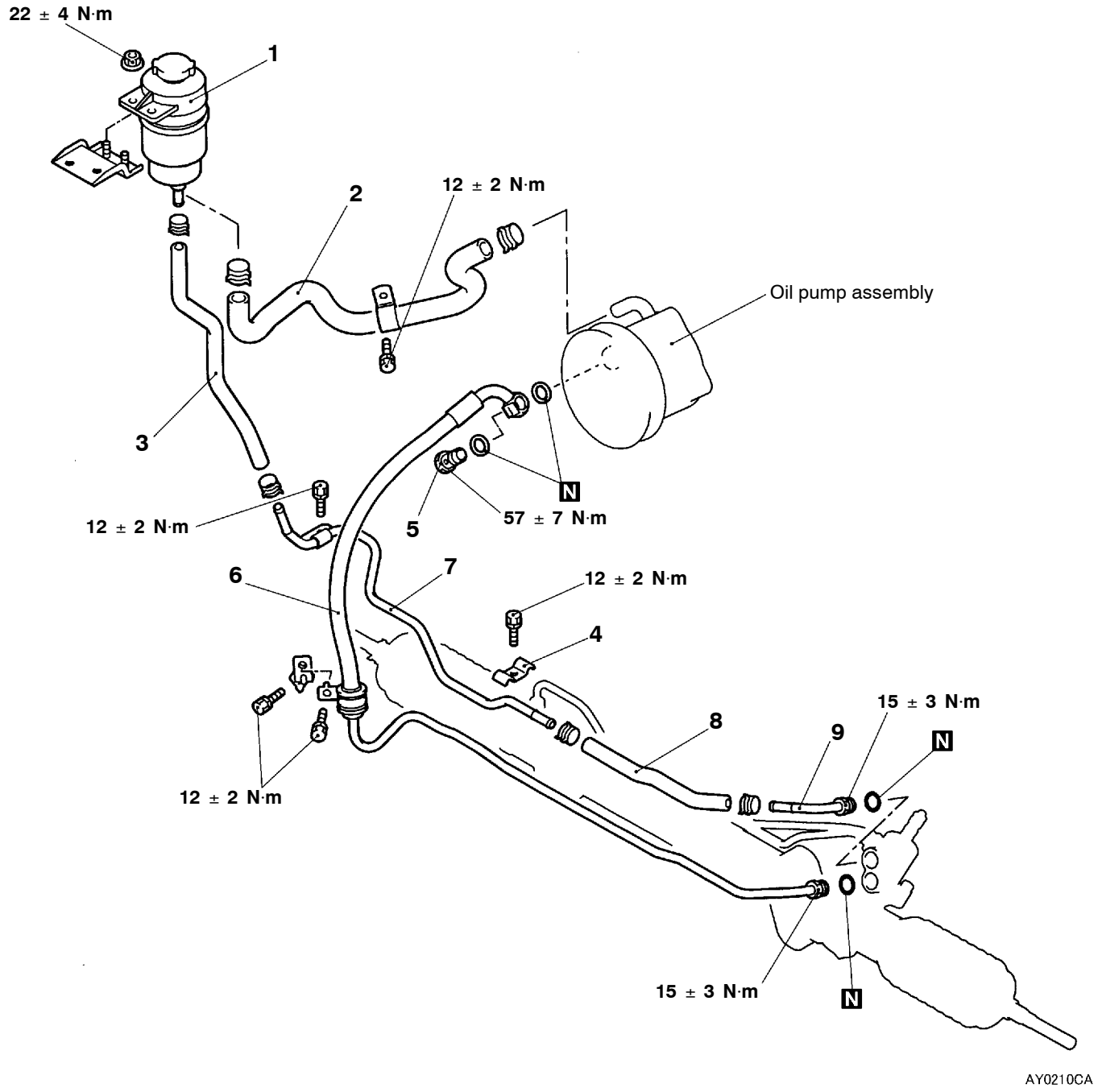
<L.H. drive vehicles – 6G7, 4M4>



Removal steps

1. Oil reservoir <6G7>
▶D◀ 2. Suction hose <6G7>
▶C◀ 3. Return hose B
4. Eye bolt
▶A◀ 5. Pressure hose assembly
▶A◀ 6. Pressure tube <6G7>
▶B◀ 7. Cooler tube
▶B◀ 8. Return hose A
▶A◀ 9. Return tube

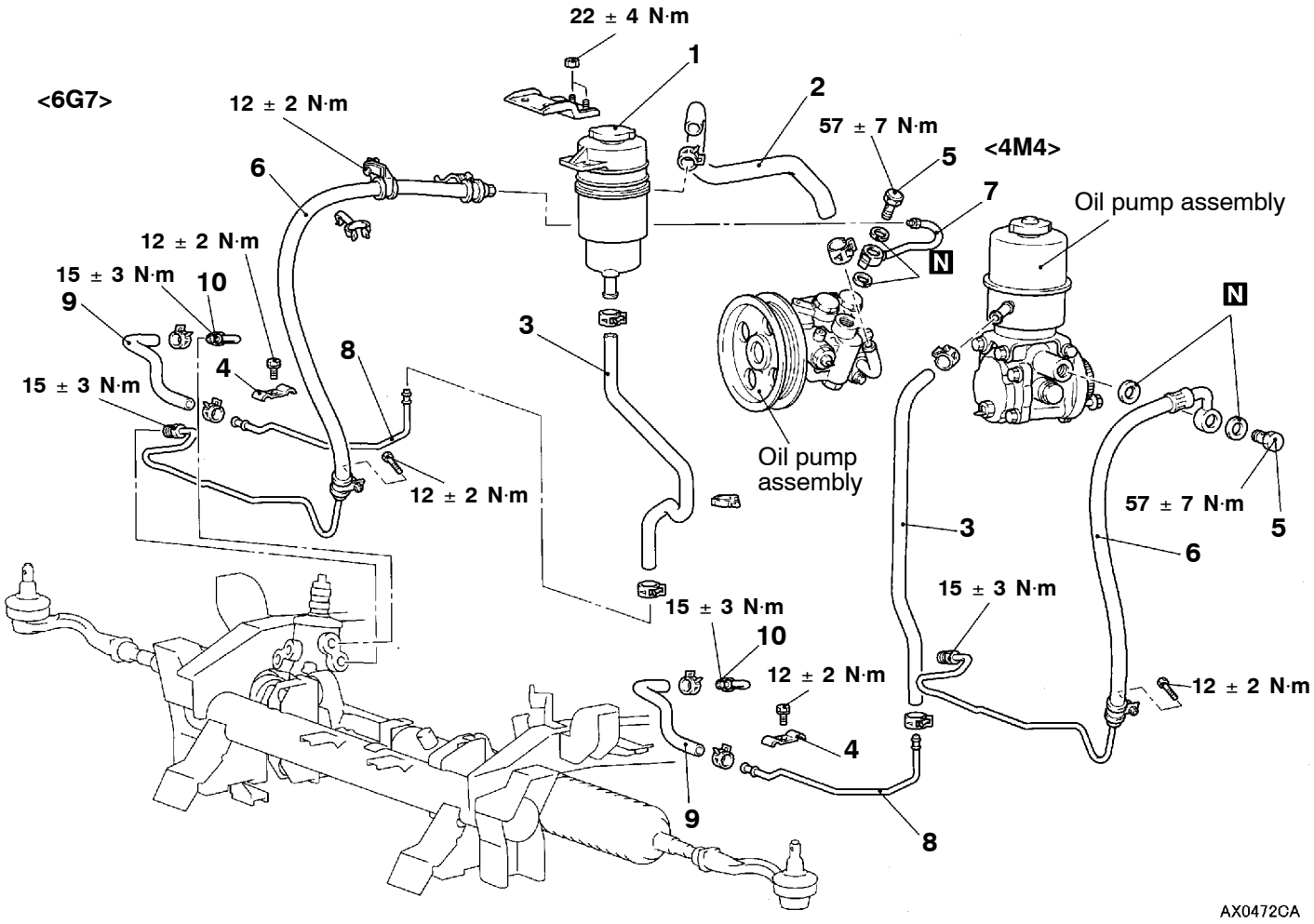
<L.H. drive vehicles – 4D5>



Removal steps

- 1. Oil reservoir
- ▶D◀ 2. Suction hose
- ▶C◀ 3. Return hose B
- 4. Tube clip
- 5. Eye bolt
- 6. Pressure hose assembly
- ▶B◀ 7. Cooler tube
- ▶B◀ 8. Return hose A
- ▶A◀ 9. Return tube

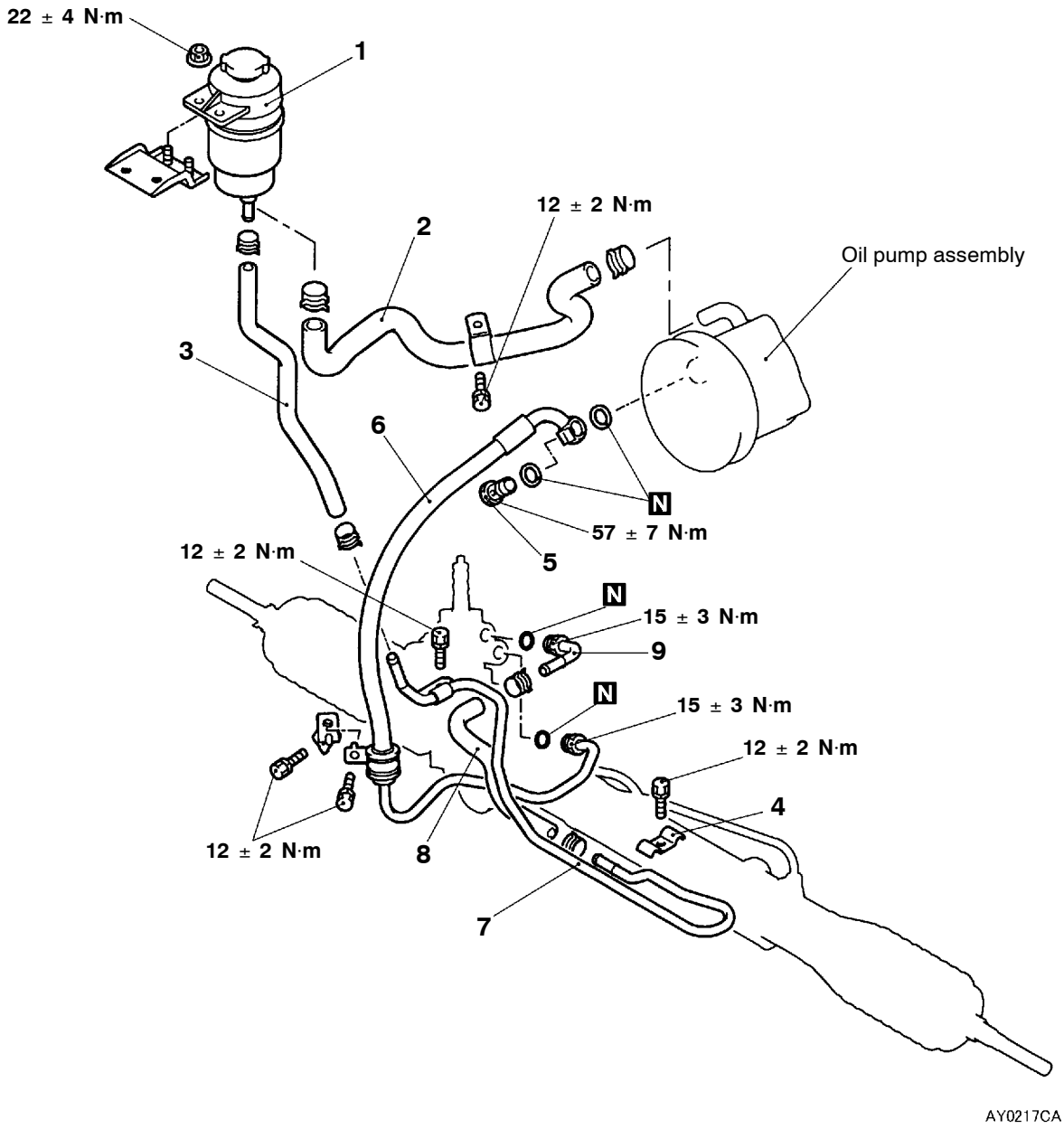
<R.H. drive vehicles – 6G7, 4M4>



Removal steps

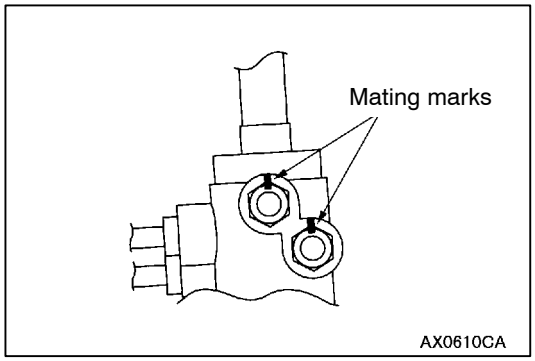
1. Oil reservoir <6G7>
▶D◀ 2. Suction hose <6G7>
▶C◀ 3. Return hose B
4. Tube clip
5. Eye bolt
▶A◀ 6. Pressure hose assembly
▶B◀ 7. Pressure tube <6G7>
▶B◀ 8. Cooler tube
▶B◀ 9. Return hose A
▶A◀ 10. Return tube

<R.H. drive vehicles – 4D5>



Removal steps

1. Oil reservoir
▶D◀ 2. Suction hose
▶C◀ 3. Return hose B
4. Tube clip
5. Eye bolt
6. Pressure hose assembly
▶B◀ 7. Cooler tube
▶B◀ 8. Return hose A
▶A◀ 9. Return tube

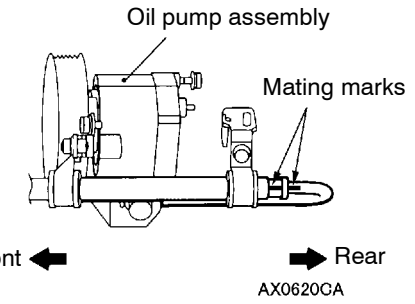


INSTALLATION SERVICE POINTS

▶A◀ RETURN TUBE/PRESSURE TUBE <6G7>/ PRESSURE HOSE ASSEMBLY <6G7> INSTALLATION

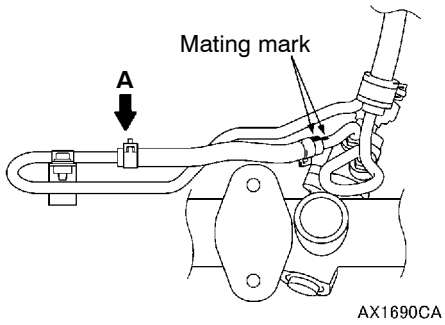
1. Align the mating marks on the gear box and return tubes when installing.

<6G7>

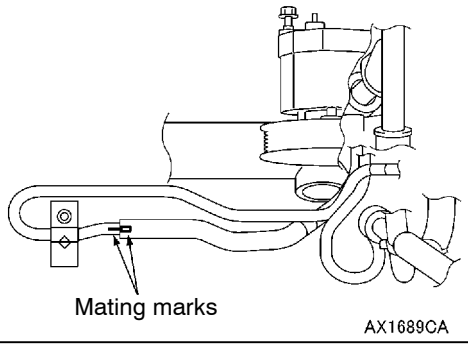


2. Install the pressure hose assembly and the pressure tubes so that the mating marks are facing upwards <6G7>.

<L.H. drive vehicles – 6G7, 4M4>



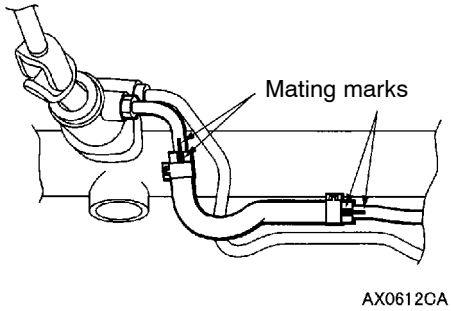
View A



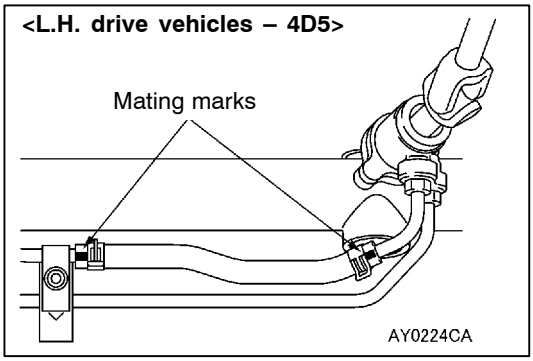
▶B◀ RETURN HOSE A/COOLER TUBE INSTALLATION

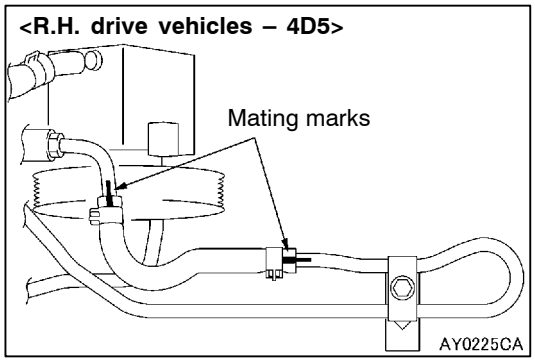
Install so that the mating marks are facing upwards.

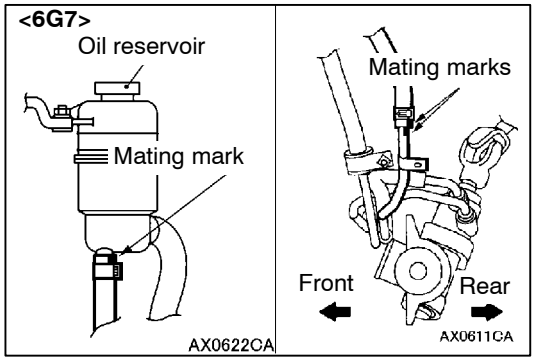
<R.H. drive vehicles – 6G7, 4M4>



<L.H. drive vehicles – 4D5>

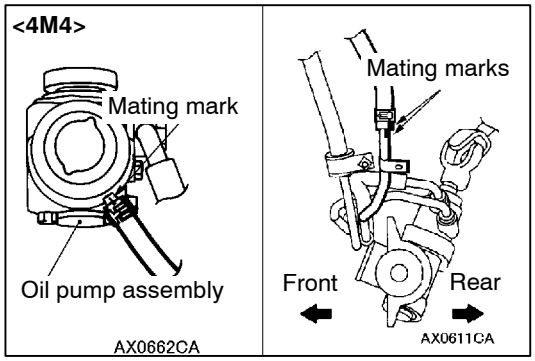




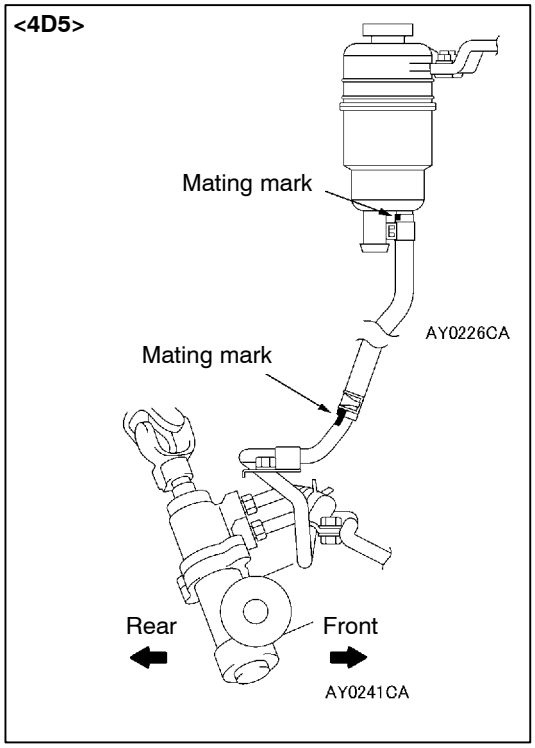


▶C◀ RETURN HOSE B INSTALLATION

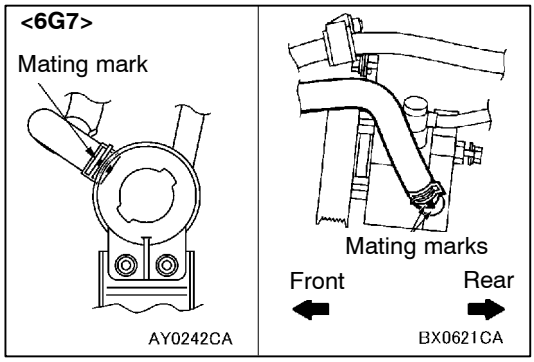
1. Install so that the mating marks are facing towards the rear <6G7>.



2. Install so that the pump-side mating marks are facing upwards, and the tube-side mating marks are facing towards the rear <4M4>.

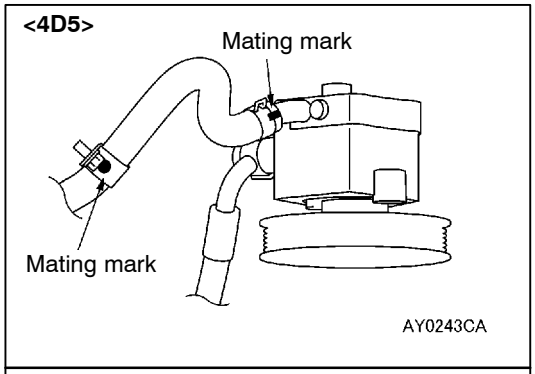


3. Install so that the mating marks are facing towards the rear <4D5>.

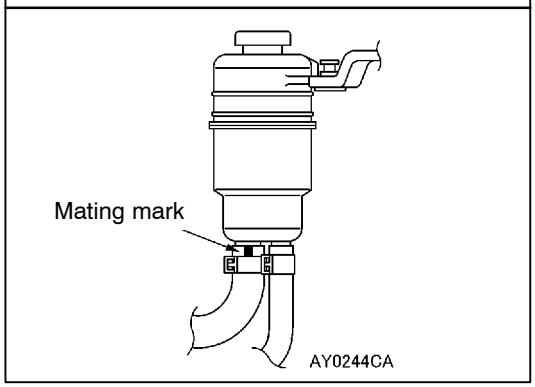


▶D◀ SUCTION HOSE INSTALLATION

1. Install so that the reservoir tank-side mating marks are facing upwards, and the pump-side mating marks are facing towards the outside <6G7>.



2. Install so that the pump-side mating marks are facing upwards, and the reservoir tank-side mating marks are facing towards the outside <4D5>.



NOTES

BODY

Click on the applicable bookmark to selected the required model year.

BODY

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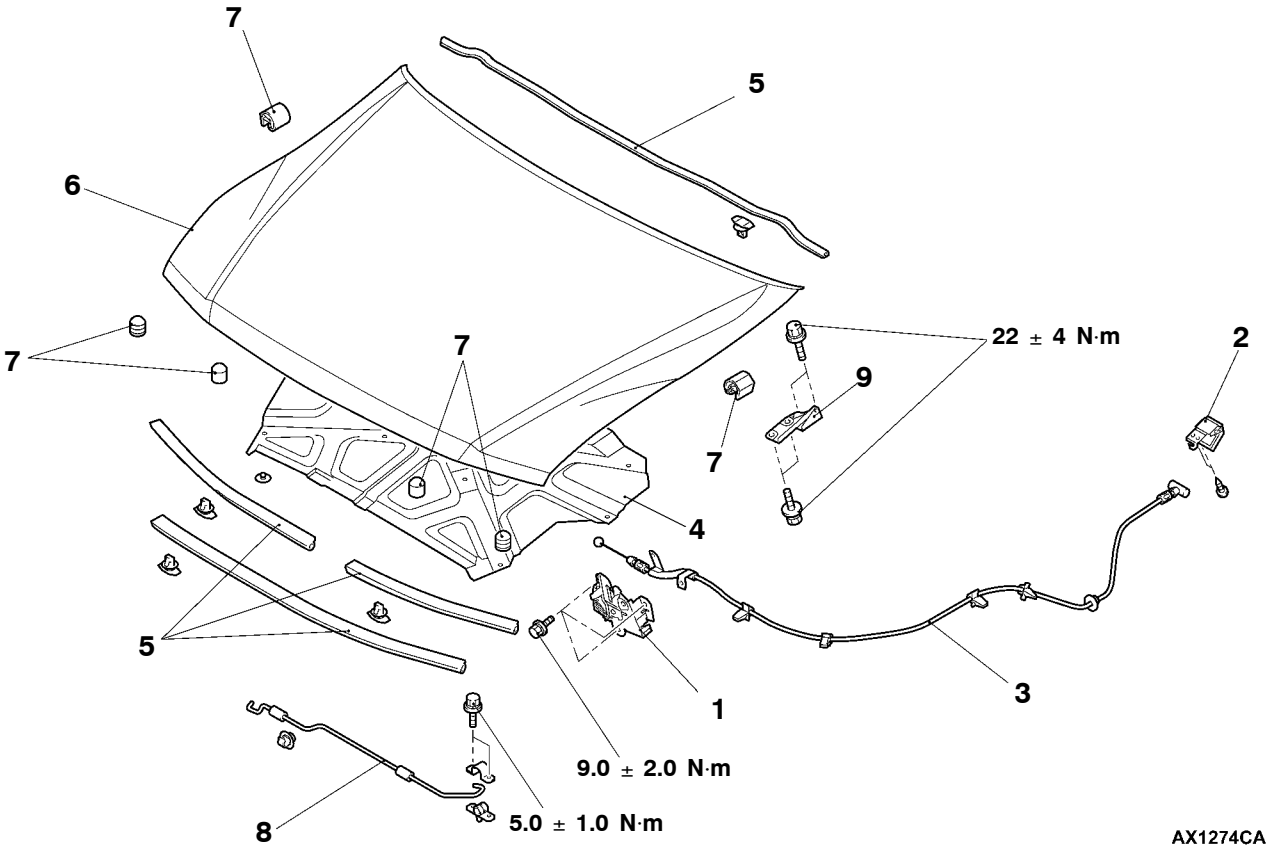
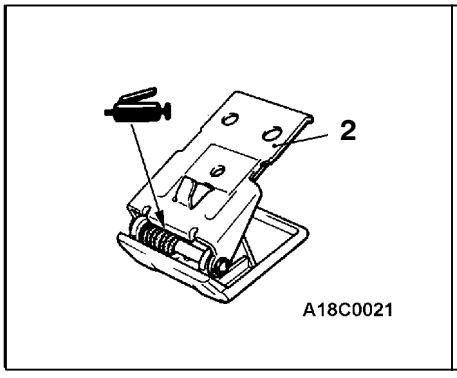
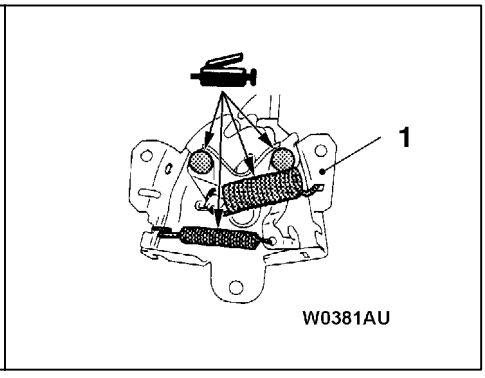
HOOD

REMOVAL AND INSTALLATION







Hood latch removal steps

- Front grille (Refer to GROUP 51.)

1. Hood latch

Hood lock release cable removal steps

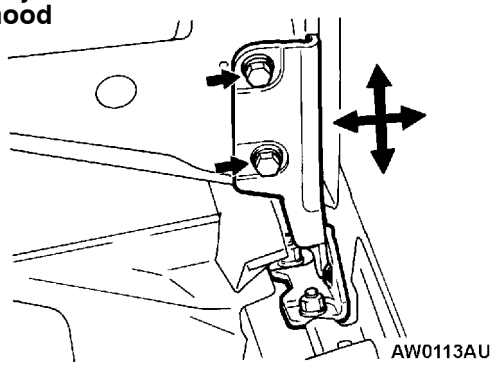
2. Hood lock release handle
3. Hood lock release cable

Hood removal steps

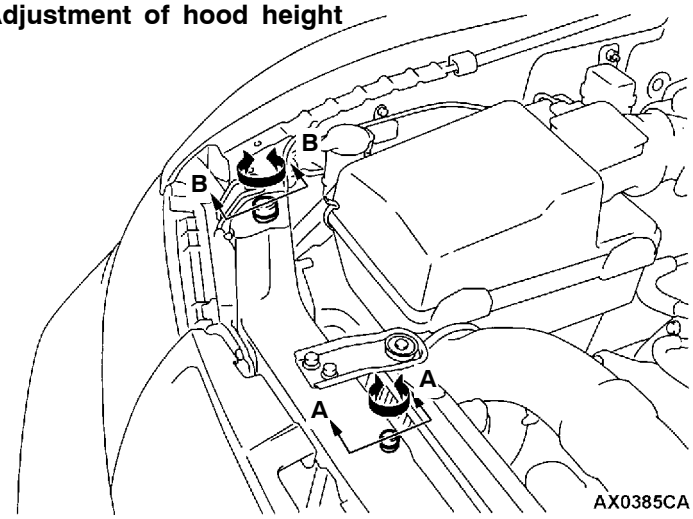
4. Hood silencer
5. Hood weatherstrip
- Washer hose (Refer to GROUP 51.)

6. Hood
7. Hood bumper
8. Hood support rod (Refer to GROUP 51.)
9. Hood support rod (Refer to GROUP 51.)

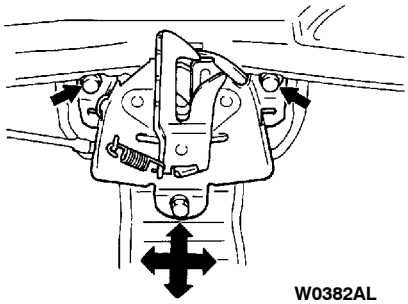
Adjustment of clearance around hood



Adjustment of hood height



Adjustment of hood step and hood striker linkage



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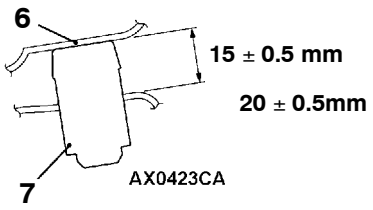

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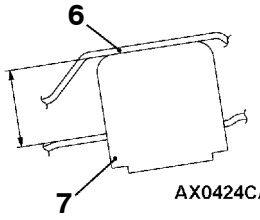
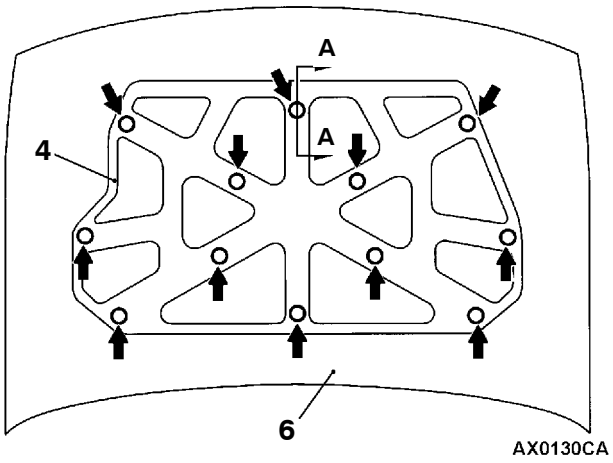
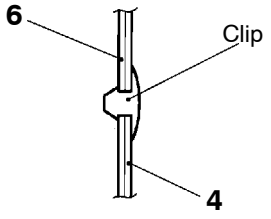


Clip positions



Section A - A



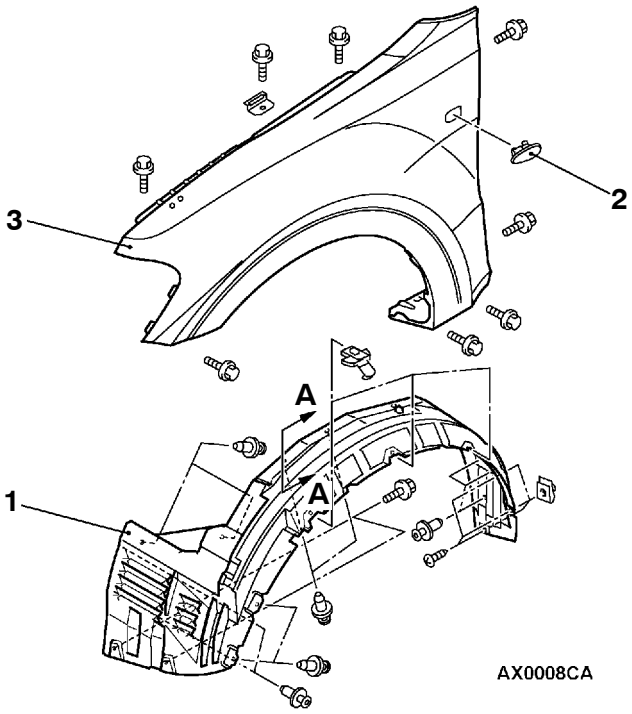
⬅ : Clip positions

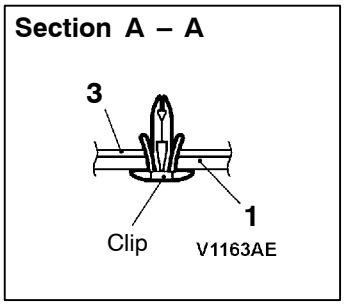
FENDER

REMOVAL AND INSTALLATION

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

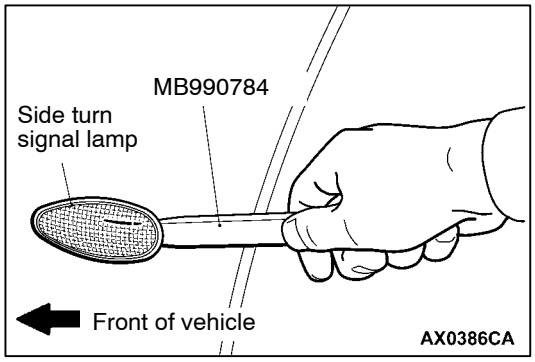
Pre-removal and Post-installation Operation
- Front Bumper Removal and Installation (Refer to GROUP 51.)
- Front Mud Guard Removal and Installation (Refer to GROUP 51.)
- Overfender Removal and Installation (Refer to GROUP 51.)





Removal steps

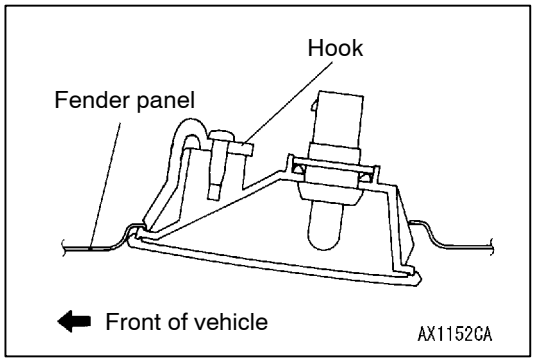
◀A▶ ▶A◀
1. Splash shield
2. Side turn signal lamp
3. Fender



REMOVAL SERVICE POINT

◀A▶ SIDE TURN SIGNAL LAMP REMOVAL

Use the special tool to unhook the fender, and then remove the side turn-signal lamp.



INSTALLATION SERVICE POINT

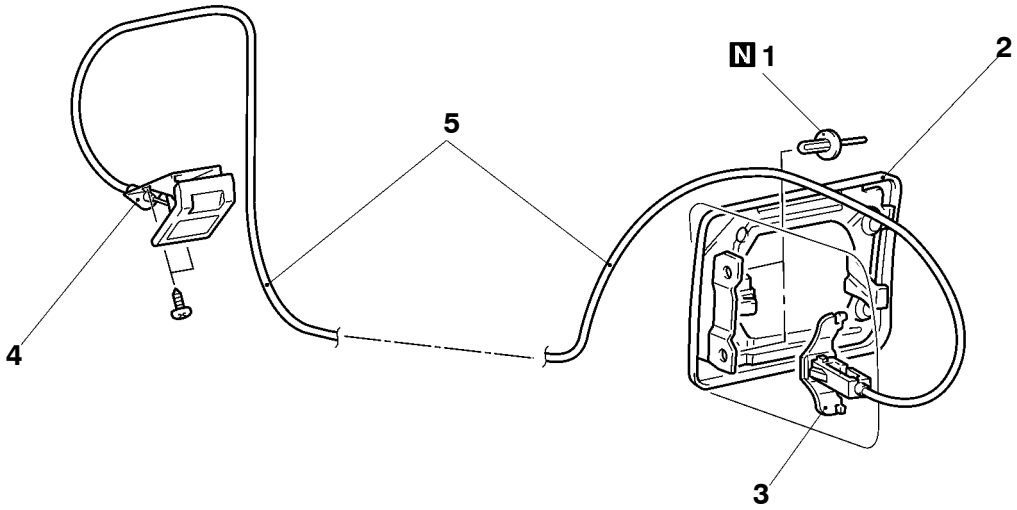
▶A◀ SIDE TURN SIGNAL LAMP INSTALLATION

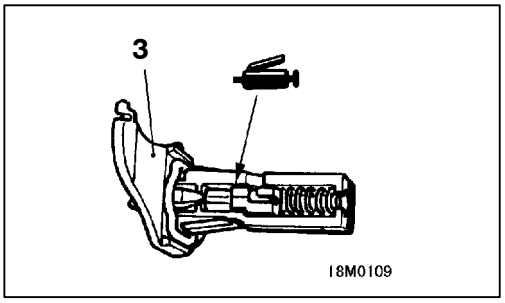
Engage the hook into the fender panel, and then install the side turn signal lamp.

FUEL FILLER DOOR

REMOVAL AND INSTALLATION

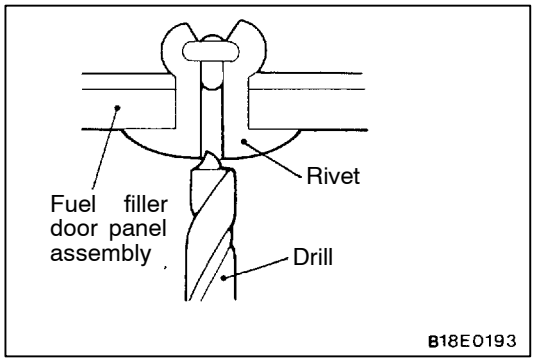
Pre-removal and Post-installation Operations
- Quarter Trim, Lower (R.H.) Removal and Installation (Refer to GROUP 52A.)
- Center Pillar Trim, Lower (Long Wheelbase - R.H.) Removal and Installation (Refer to GROUP 52A.)





Removal steps

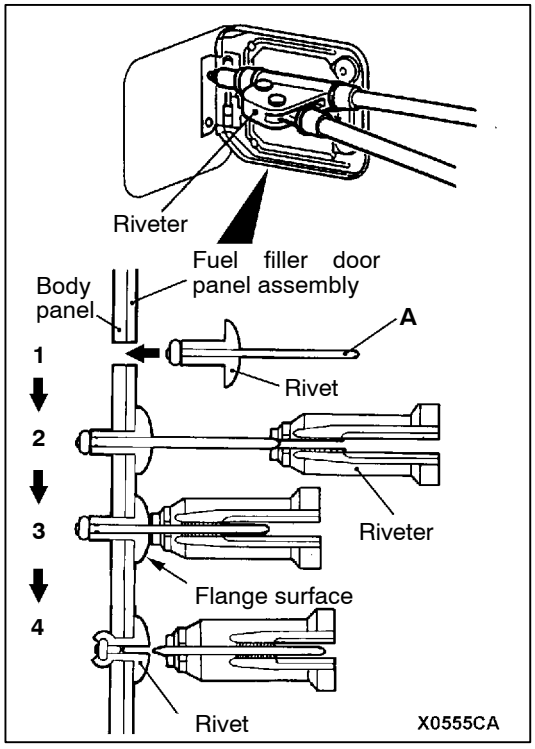
◀A▶ ▶A◀ 1. Rivet
2. Fuel filler door panel assembly
3. Fuel filler door lock hook assembly
4. Lid lock release handle
   - Heater deck cross assembly (Refer to GROUP 55.)
   - AC inverter (Long wheelbase) (Refer to GROUP 54.)
5. Fuel filler door lock release cable



REMOVAL SERVICE POINT

◀A▶ RIVET REMOVAL

Use a drill (Ø6.5 - 7.5 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:

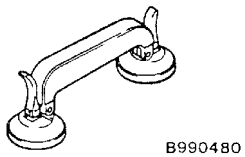
1. Insert a rivet in the body panel and fuel filler door panel assembly.
2. Insert the riveter to the rod (A shown) of a rivet.
3. Pressing the flange surface of the rivet with the riveter, handle the riveter.
4. The rod is cut at its thinnest point and the rivet is held in position.

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	
Quarter window garnish	3M ATD Part No. 8513 Grommeted Windshield Sealant or equivalent

SPECIAL TOOL

Tool	Number	Name	Use
 B990480	MB990480	Window glass holder	Removal and installation of windshield

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

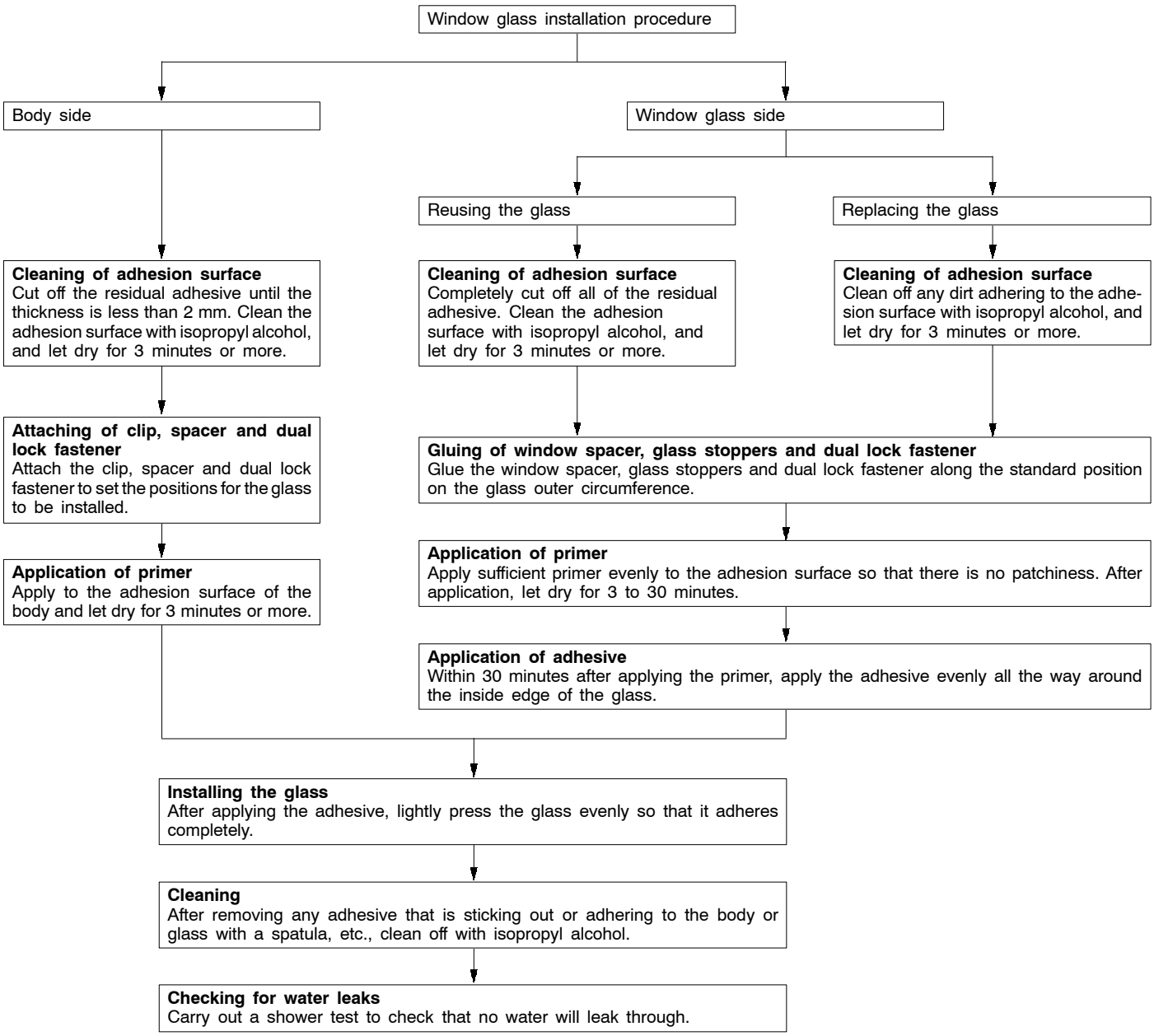
HANDLING OF AUTO WINDOW SEALER

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.

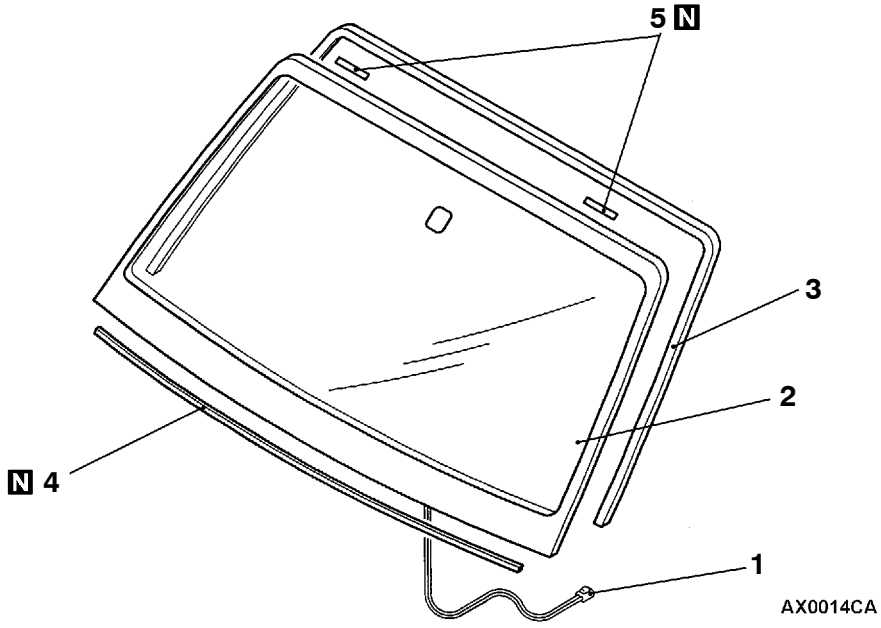
WORKING PROCESS

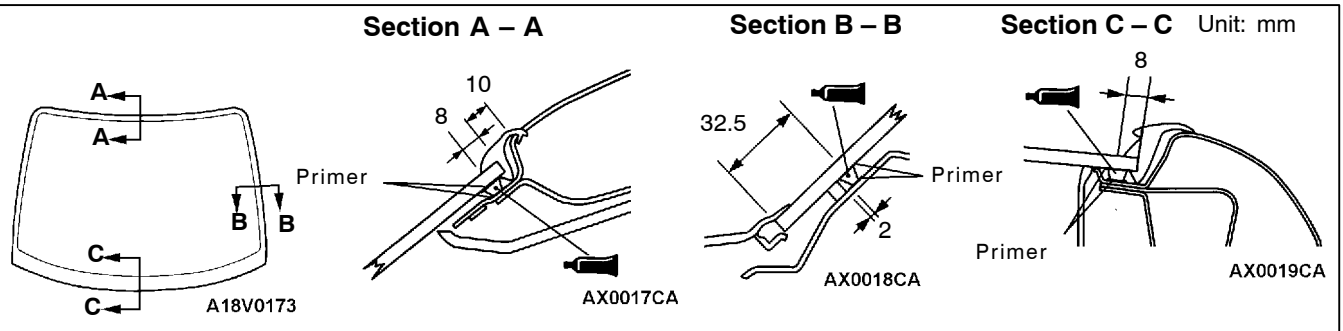


WINDSHIELD

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations
- Deck Garnish Removal and Installation (Refer to GROUP 51A.)
- Headlining Removal and Installation
- Front Pillar Trim Removal and Installation (Refer to GROUP 52A – Trim.)





Adhesive: 3M ATD Part No. 8609 Super Fast Urethane Auto Glass Sealant or equivalent

Removal steps

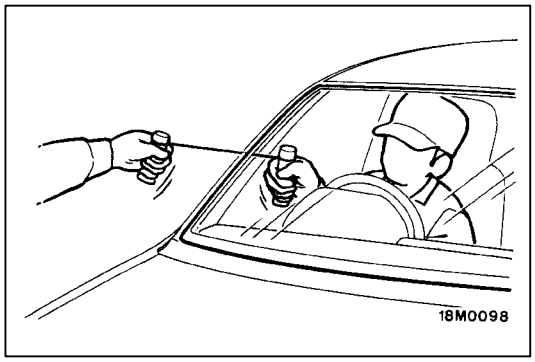
1. Wiper deicer connector (Refer to GROUP 51.)

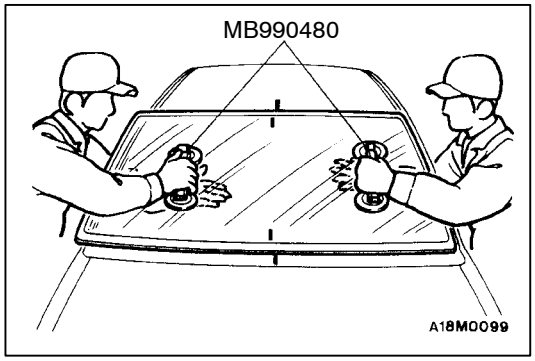
◀A▶ ▶A◀ 2. Windshield

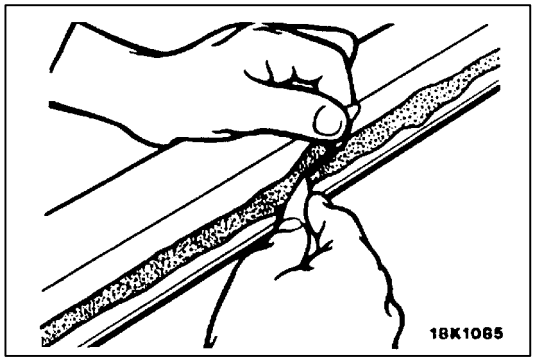
▶A◀ 3. Windshield moulding

▶A◀ 4. Windshield spacer

▶A◀ 5. Glass stopper







REMOVAL SERVICE POINT

◀A▶ 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.

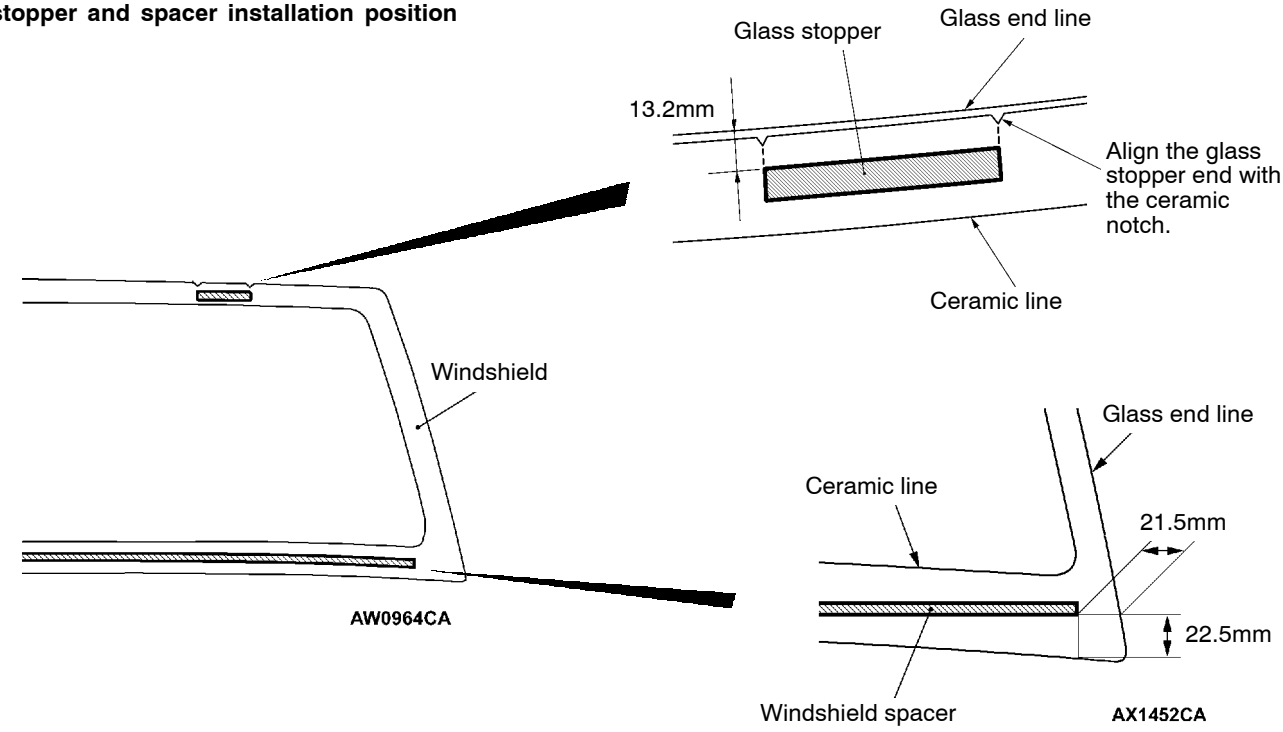
Caution
Before the next job, leave the decreased parts for 3 minutes or more to dry. Also, do not touch any cleaned surface.

INSTALLATION SERVICE POINT

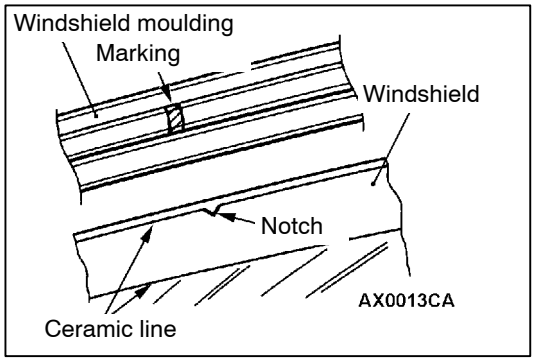
▶A◀GLASS STOPPER/WINDSHIELD MOULDING/WINDSHIELD SPACER/WINDSHIELD INSTALLATION

1. When replacing the windshield, first align it with the body, and then matchmark them.
2. Use isopropyl alcohol to clean the inside edge of the windshield and the body flange.
3. Use a primer dampened sponge to apply the clear gasoline to the specified area around the windshield and the body evenly.
4. After the application, let it dry for at least three minutes.
5. Position the glass stopper and the windshield spacer as shown, ensuring that there are no bends or warpages inside the windshield.

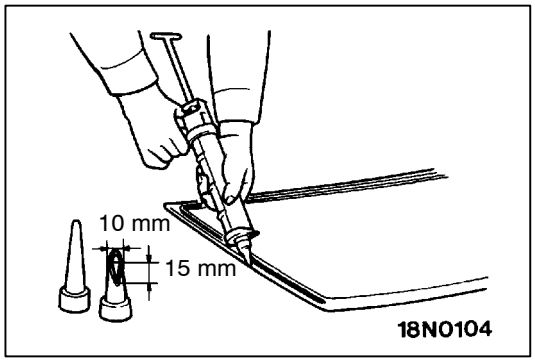
Glass stopper and spacer installation position



Caution
(1) The primer strengthens the adhesive, so be sure to apply it evenly around the entire circumference. However, a too thick application will weaken the adhesive.
(2) Never touch the primer-applied surface.



6. Align the marking on the windshield moulding with the windshield notch, and then install the windshield moulding.



7. Within thirty minutes after the primer application, fill a sealant gun with adhesive, and then apply the adhesive evenly around the windshield.

   NOTE
   Cut the tip of the sealant gun nozzle into a V shape to simplify adhesive application.
8. Align the mating marks on the windshield and the body, and lightly press the windshield evenly so that it adheres completely.
9. Use a spatula or the like to remove any excessive adhesive. Install the windshield moulding before the adhesive sets. After the windshield is installed, wait until the adhesive sets.(Refer to P.42-9.)
10. Wait thirty minutes or more, and then test for water leakage.

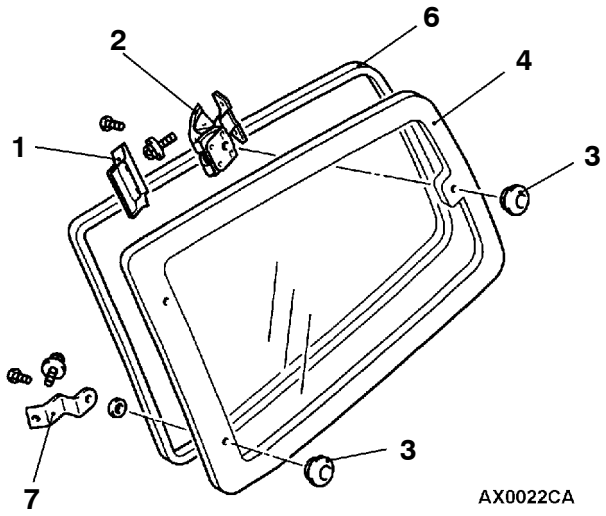
    Caution
    (1) Do not move the vehicle unless absolutely necessary.
    (2) When testing for water leakage, do not pinch the end of the hose to spray the water.

QUARTER WINDOW GLASS

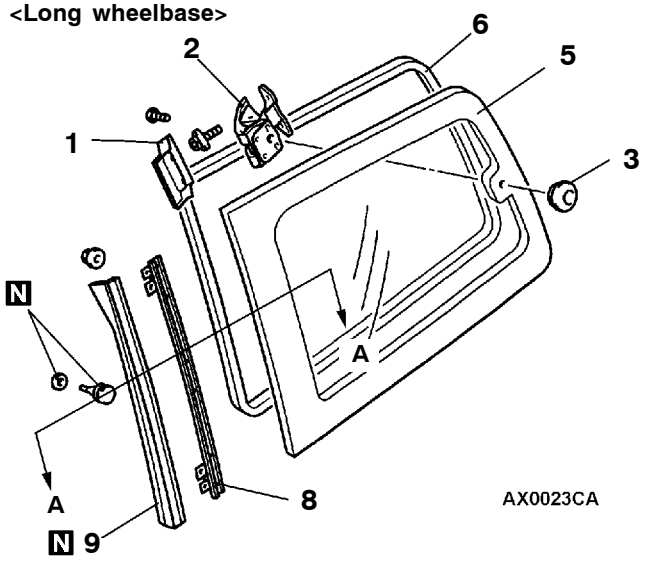
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Quarter Trim, Upper Removal and Installation
(Refer to GROUP 52A.)

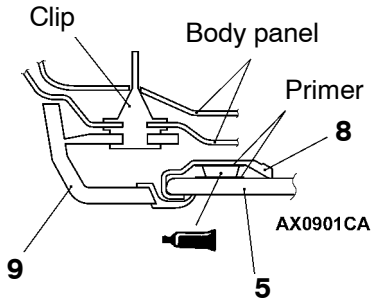
<Short wheelbase>



<Long wheelbase>



Section A – A



Adhesive: 3M ATD Part No. 8513 Grommeted Windshield Sealant or equivalent

Removal steps

1. Lever
2. Quarter window link
3. Rubber and nut
4. Quarter window glass
5. Quarter window glass

◀A▶

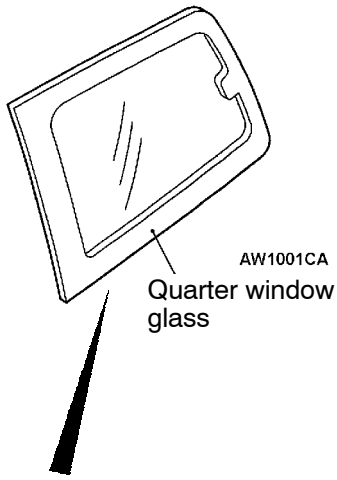
6. Quarter window weatherstrip
7. Quarter window hinge
8. Quarter window moulding
9. Quarter window garnish

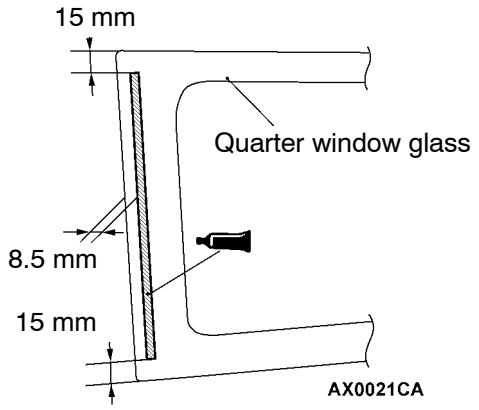
◀A▶ ▶A◀

REMOVAL SERVICE POINT

◀A▶ QUARTER WINDOW GLASS/QUARTER WINDOW MOULDING REMOVAL

Remove by the same procedure as for the windshield. (Refer to P.42-11.)





Adhesive: 3M ATD Part No. 8513 Grommeted Windshield Sealant or equivalent

INSTALLATION SERVICE POINT

▶A◀ QUARTER WINDOW MOULDING INSTALLATION

1. Wipe away all adhesive which is adhering to the channel in the quarter window moulding and to the quarter window glass, and then clean the surfaces with unleaded petrol.

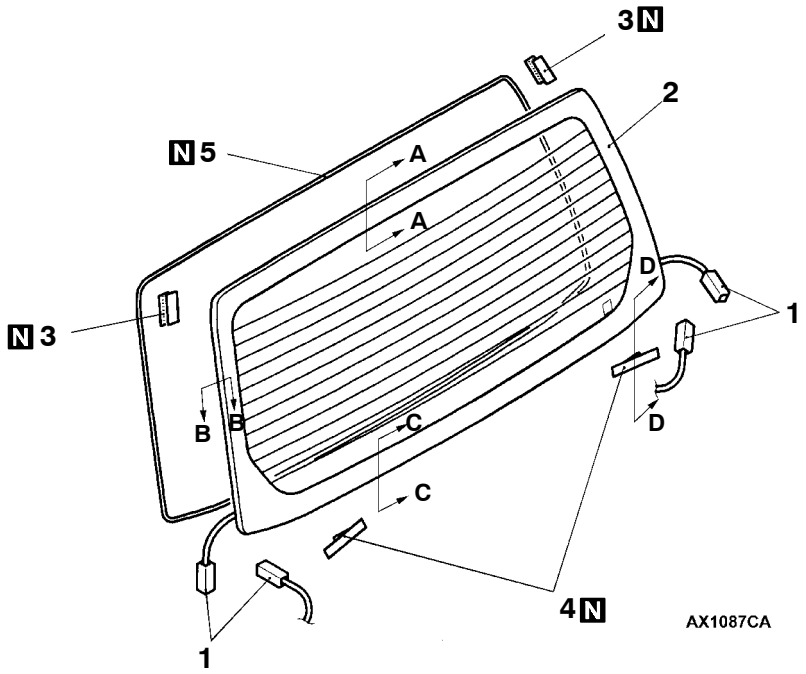
   Caution
   The areas which have been cleaned of adhesive should be allowed to stand for three minutes or more until they are completely dry before continuing to the next step. Furthermore, do not touch the surfaces after they have been cleaned.
2. Apply an even coating of primer to the adhesion surface of the quarter window glass, while being careful not to miss any places.
3. Apply the specified sealant to the quarter window glass in the locations specified, and then install the quarter window moulding to the quarter window glass.

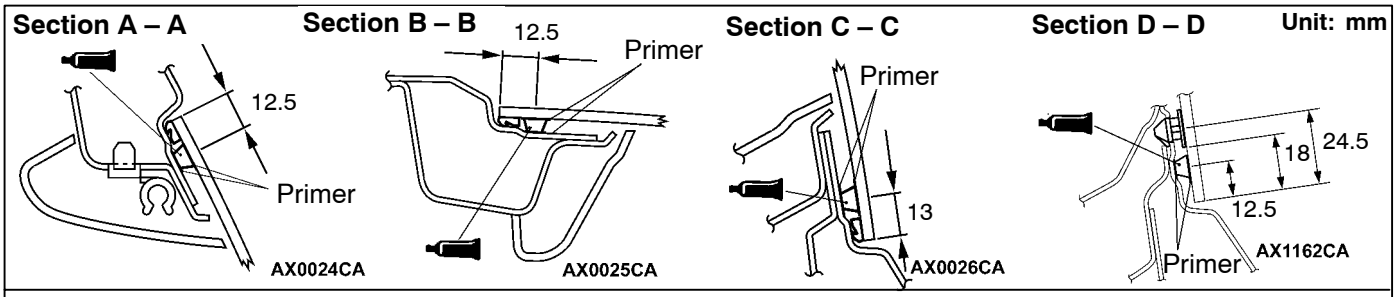
   Adhesive:
   3M ATD part No.8513 Grommeted Sealant or equivalent

BACK DOOR GLASS

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations
- Back Door Upper Trim Removal and Installation (Refer to P.42-43.)
- Spare Tire Removal and Installation





Adhesive: 3M ATD Part No. 8609 Super Fast Urethane Auto Glass Sealant or equivalent

Removal steps

◀A▶ ▶A◀ 1. Harness connector
2. Back door glass
▶A◀ 3. Dual lock fastener
▶A◀ 4. Glass stopper
▶A◀ 5. Window dam

REMOVAL SERVICE POINT

◀A▶ BACK DOOR GLASS REMOVAL

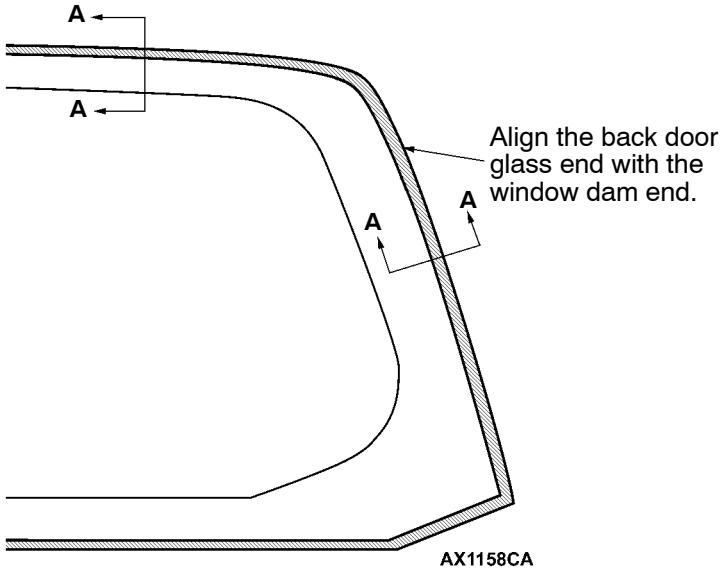
Remove the back door glass in the same manner as for the windshield. (Refer to P42-11.)

INSTALLATION SERVICE POINT

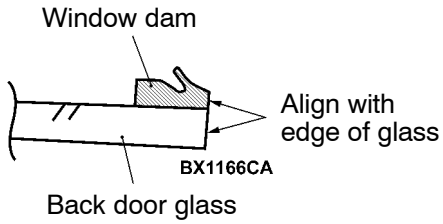
▶A◀WINDOW DAM/GLASS STOPPER/DUAL LOCK FASTENER/BACK DOOR GLASS INSTALLATION

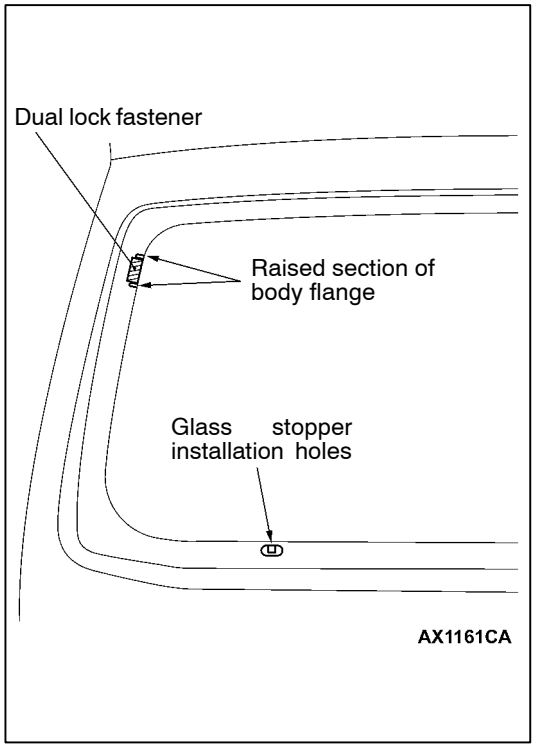
1. Clean both the glass side and vehicle body side of the window dam, dual lock fastener and glass stopper mounting surfaces with unleaded petrol.
2. Install the window dam.

Window dam installation position



Section A – A





3. Attach the dual lock fastener to the body flange in the correct position.
4. Attach the dual lock fastener and glass stopper to the back door window glass in the positions which correspond to the dual lock fastener and glass stopper mounting sections of the body flange.
5. Apply the primer and adhesive.
6. Install the glass by the same procedure as for the windshield. (Refer to P.42-12.)

DOORS

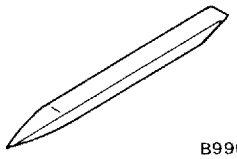
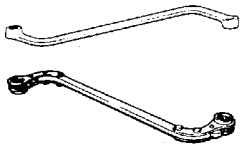
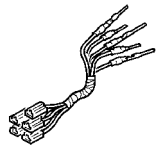
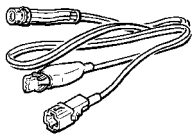
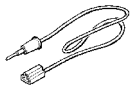
SERVICE SPECIFICATIONS

Items	Standard value
Door outside handle play mm	2.0 or more
Power window operating current A	5.0 ± 2 (power supply 14.5 ± 0.3 V at 23°C)
Door inside handle play mm	5.3 or more

SEALANT

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

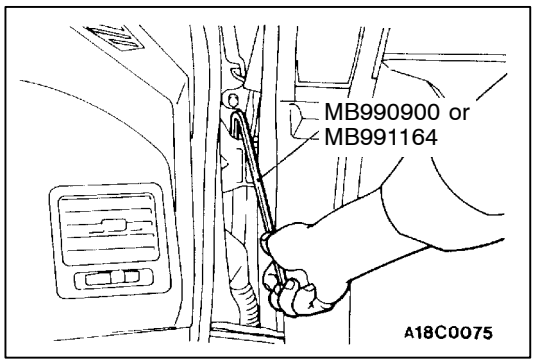
SPECIAL TOOLS

Tool	Number	Name	Use
 B990784	MB990784	Ornament remover	Door trim removal
 00003936	MB990900 or MB991164	Door hinge adjusting wrench	Adjustment of door fit
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	Terminal voltage measurement A: Connector pin contact pressure check B: Power circuit check C: Power circuit check D: Commercial tester connection

TROUBLESHOOTING

DIAGNOSIS FUNCTION

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

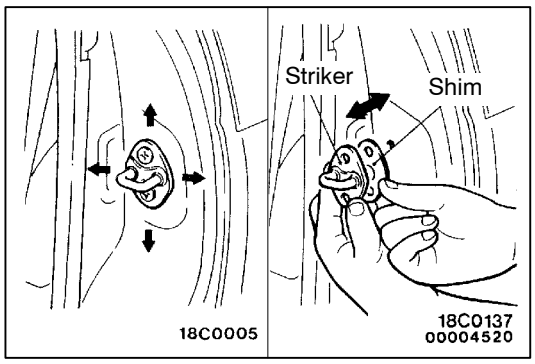


ON-VEHICLE SERVICE

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 N·m on the special tool.

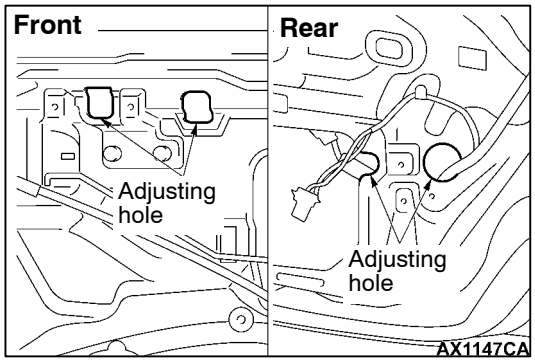


3. If the door opening and closing is heavy, adjust the meshing of the striker and the door latch (forward and backward) by adding shims to the striker and by moving the striker up and down or to the left and right.

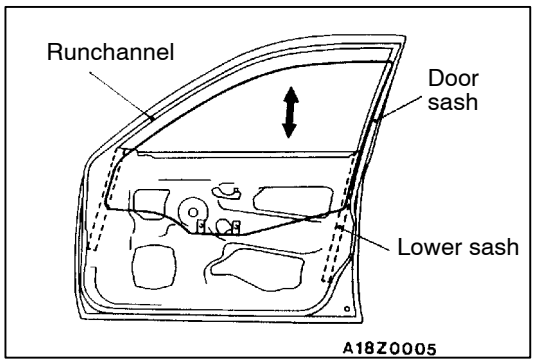
DOOR WINDOW GLASS ADJUSTMENT

Check that the door glass operates smoothly and moves along the door glass runchannel when the door window glass is fully raised and fully lowered. If there is a problem, adjust by the following procedure.

1. Remove the door trim and waterproof film. (Refer to P.42-24.)



2. With the door window glass fully closed, loosen the door glass mounting screws through the adjusting holes, and then lower the door window glass slightly.
3. Fully close the door window glass again, and then fully tighten the door glass mounting screws through the adjusting holes.



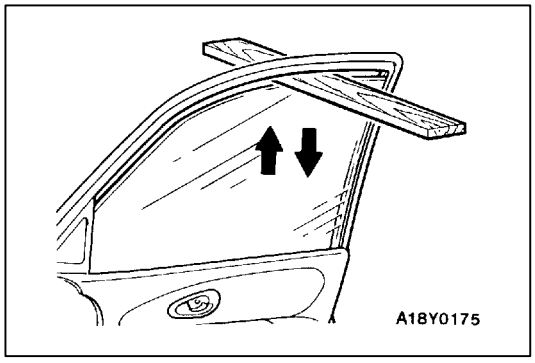
DEFECTIVE POWER WINDOW ADJUSTMENT AND REPLACEMENT

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.42-24.)
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.

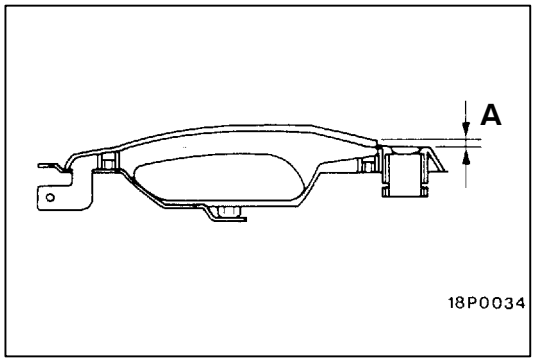
   NOTE
   Insert soft stuff like cushion to prevent damage to the glass if it falls down.
3. If the door window glass does not move up and down smoothly, do as follows:
   - Check the installation condition of the runchannel.
   - Straighten twist in the door sash.
   - Check the installation condition 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 P.42-19.)



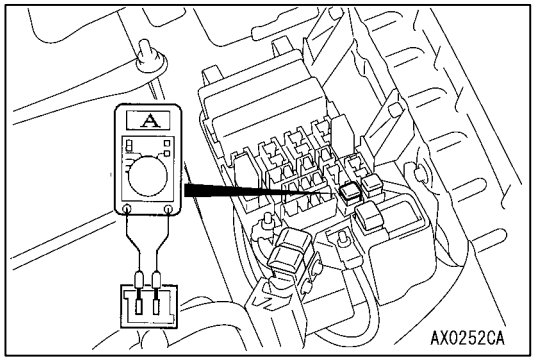
DOOR OUTSIDE HANDLE PLAY CHECK

1. Check that the door outer handle play is at the standard value.

   Standard value (A):
   Front 2.0 mm or less

   Rear 1.7 mm or less

2. Check the door outside handle and door latch assembly, and replace the assembly if there is a malfunction.



POWER WINDOW OPERATION CURRENT CHECK

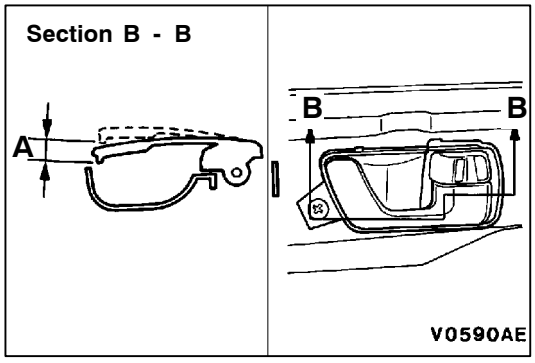
1. Remove the power window fuse, and connect a multimeter as shown in the illustration.
2. When the power window switch is pressed to the UP side, a large amount of operating current flows when the window starts and stops moving, so measure the current during the period between these two extremes.

   Standard value:
   5.0 ± 2 A (Power supply voltage 14.5 ± 0.3 V, at 23°C)

3. If the current is outside the standard value, refer to Troubleshooting (Refer to P.42-19.)

CIRCUIT BREAKER (INCORPORATED IN THE 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. Check that the door inside handle play is at the standard value.

   Standard value (A): 5.3 mm or less

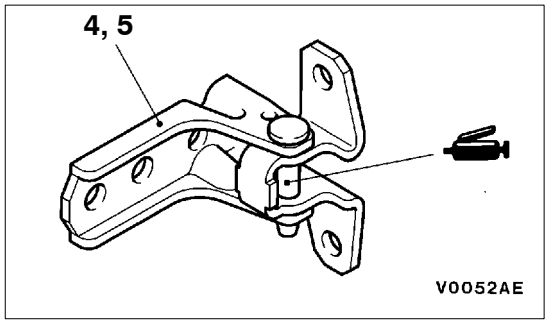
2. If the play is outside the standard value, remove the door trim. (Refer to P.42-24.)
3. Adjust the door inside handle play by using the clip which connects the door inside handle and the rod.

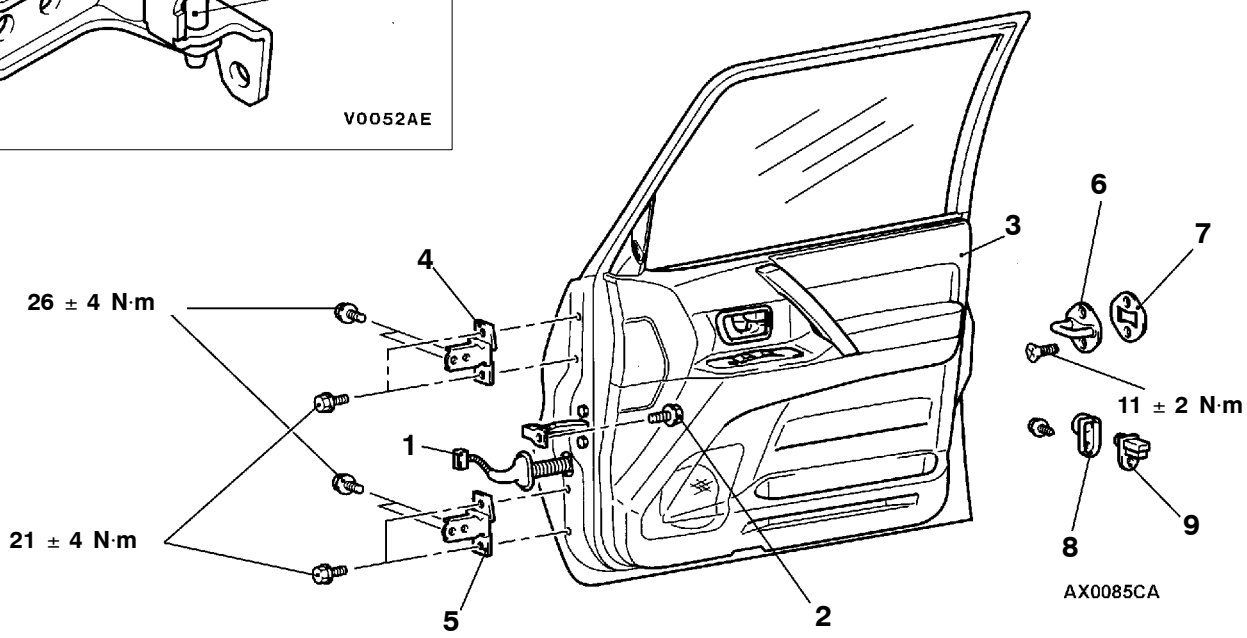
DOOR ASSEMBLY

REMOVAL AND INSTALLATION

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

FRONT DOOR



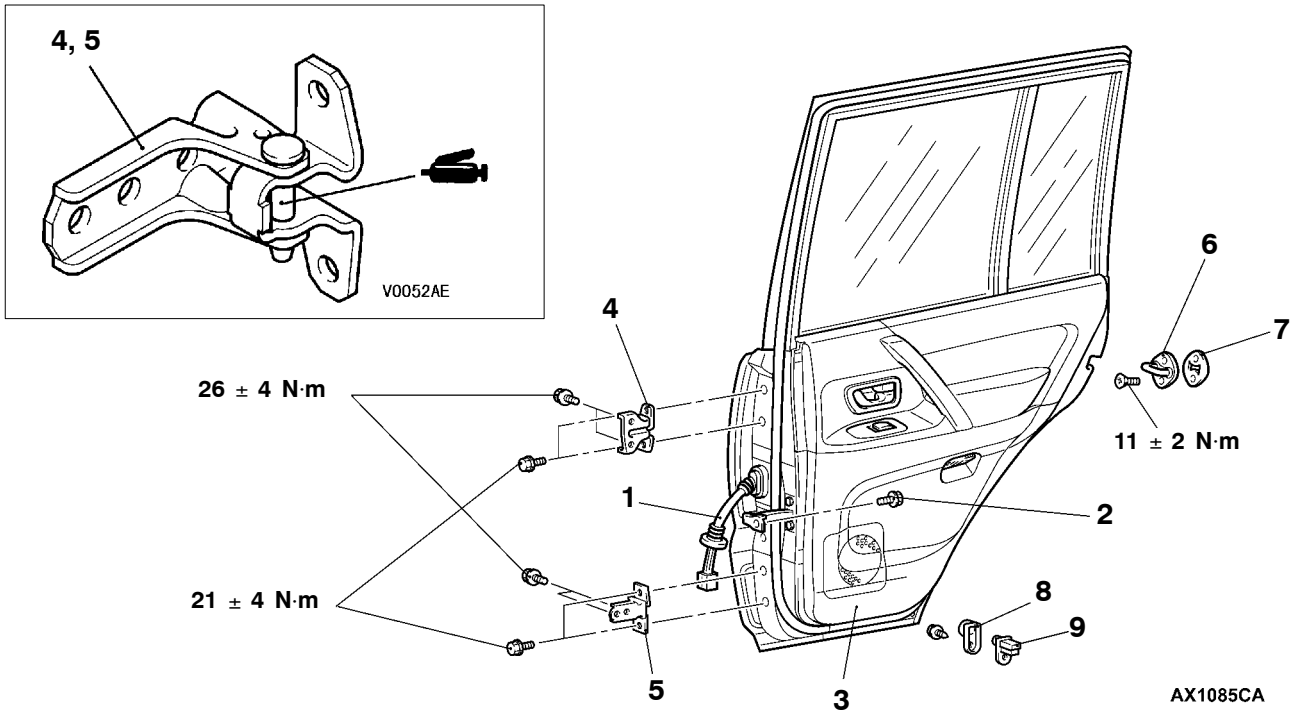


Door assembly removal steps
1. Harness connector
2. Door check connecting bolt
3. Door assembly
4. Door upper hinge
5. Door lower hinge

Striker removal steps
6. Striker
7. Striker shim

Door switch removal steps
8. Door switch cap
9. Door switch

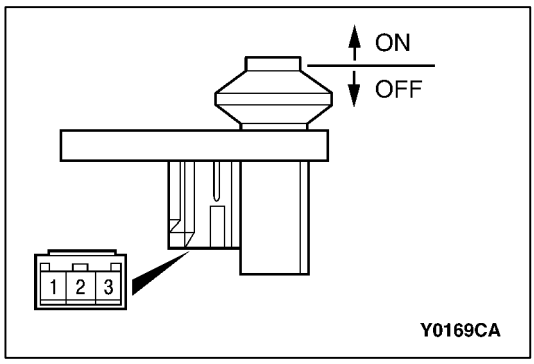
REAR DOOR



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

Striker removal steps
6. Striker
7. Striker shim

Door switch removal steps
8. Door switch cap
9. Door switch



INSPECTION

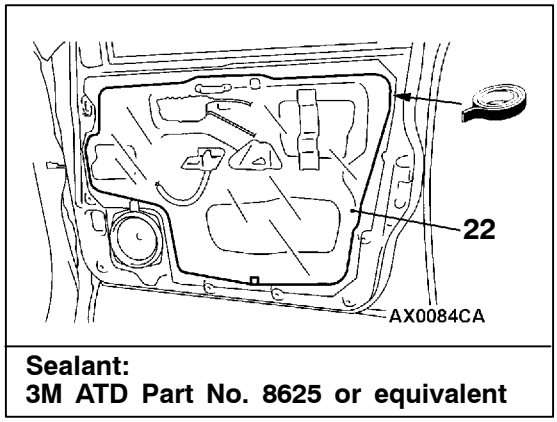
DOOR SWITCH CONTINUITY CHECK

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

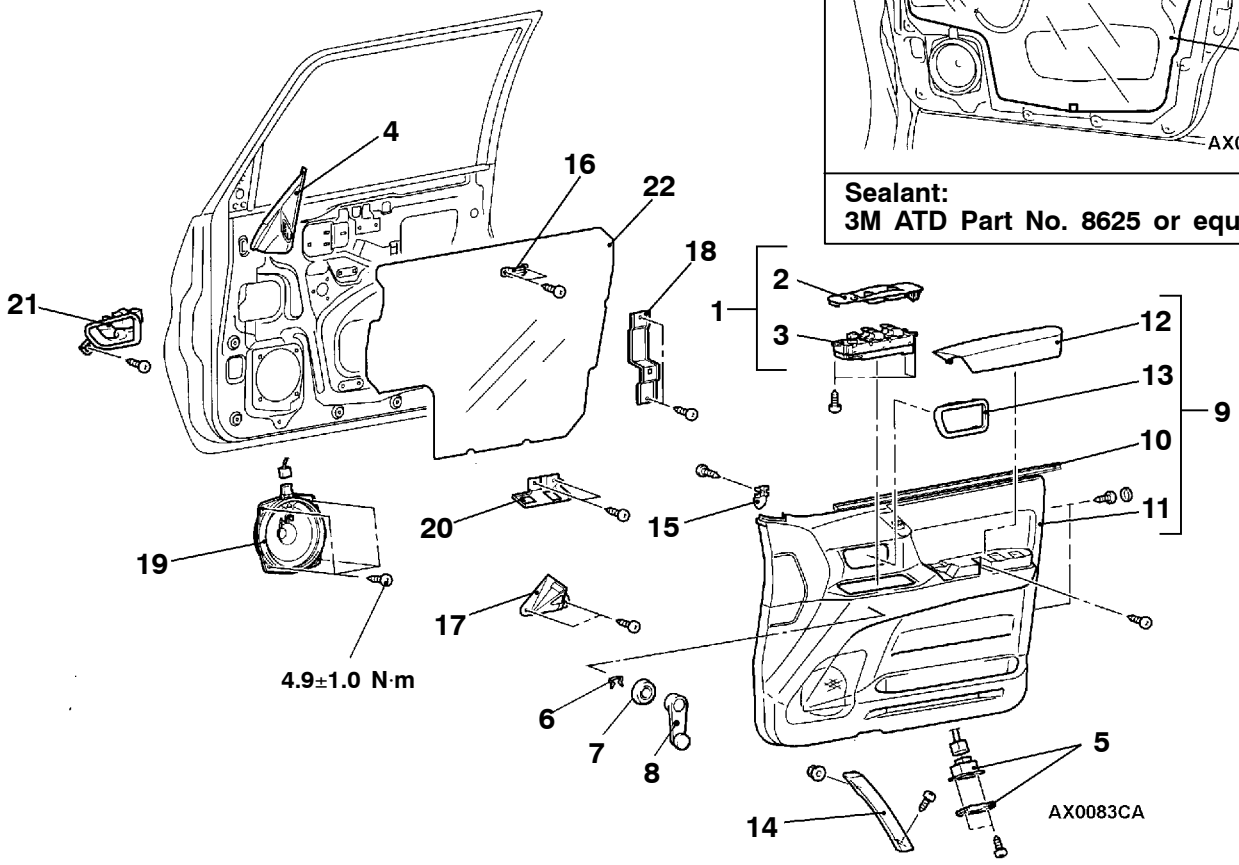
DOOR TRIM AND WATERPROOF FILM

REMOVAL AND INSTALLATION

FRONT DOOR



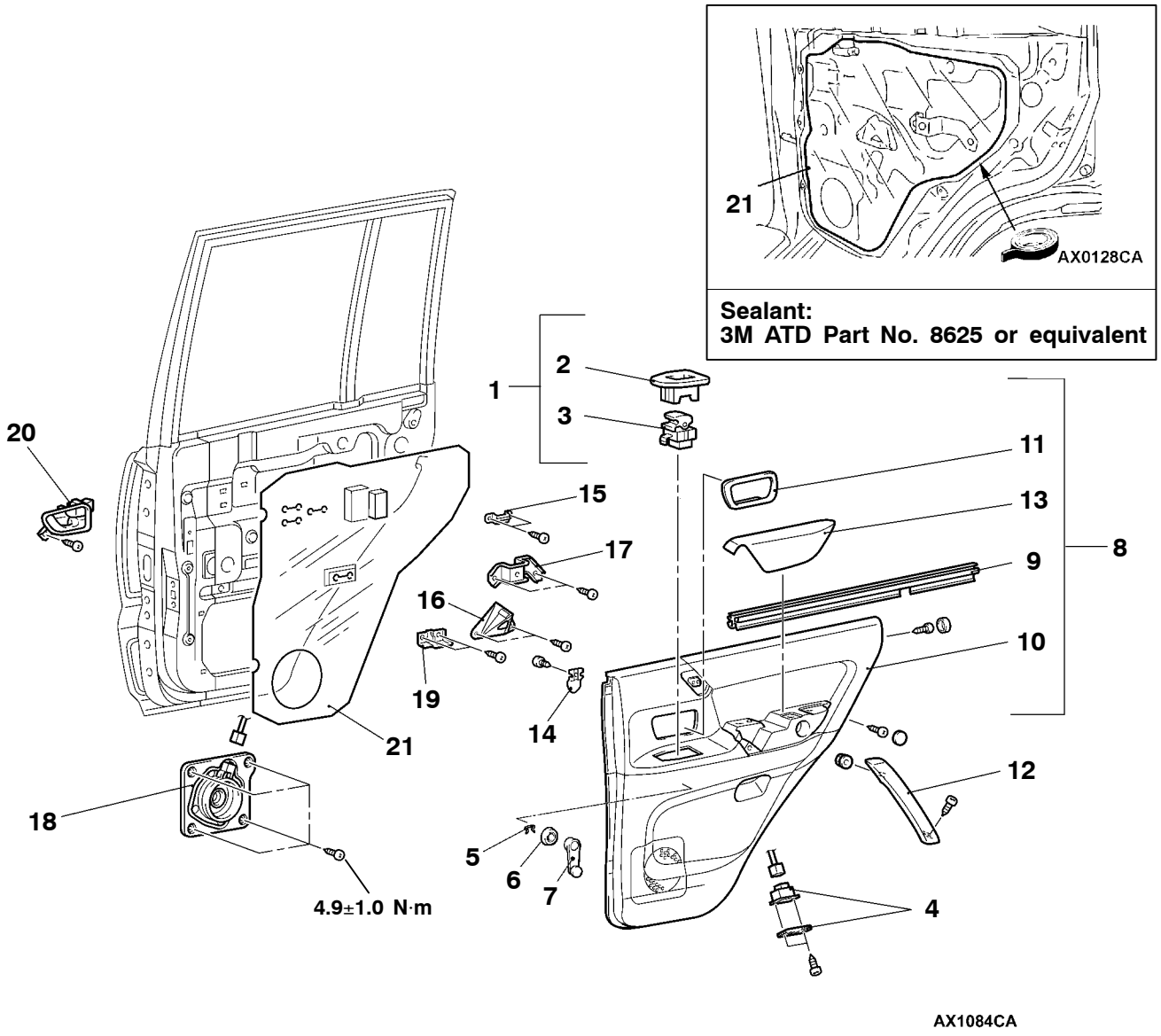
Sealant:
3M ATD Part No. 8625 or equivalent



Removal steps

◀A▶ 1. Power window switch and power window switch panel assembly
2. Power window switch panel
3. Power window switch
4. Delta cover, inner
5. Door lamp assembly
◀B▶ ▶B◀ 6. Clip <Vehicles without power windows>
▶B◀ 7. Escutcheon <Vehicles without power windows>
▶B◀ 8. Regulator handle <Vehicles without power windows>
9. Door inside handle cover and door trim assembly
10. Door belt line moulding assembly
11. Door trim
12. Front arm restraint cover
◀C▶ 13. Door inside handle cover
14. Door grip
15. Grip bracket
16. Door grip upper retainer
17. Door grip lower bracket
18. Arm restraint bracket
19. Speaker
20. Power window switch bracket
21. Door inside handle
▶A◀ 22. Waterproof film

REAR DOOR

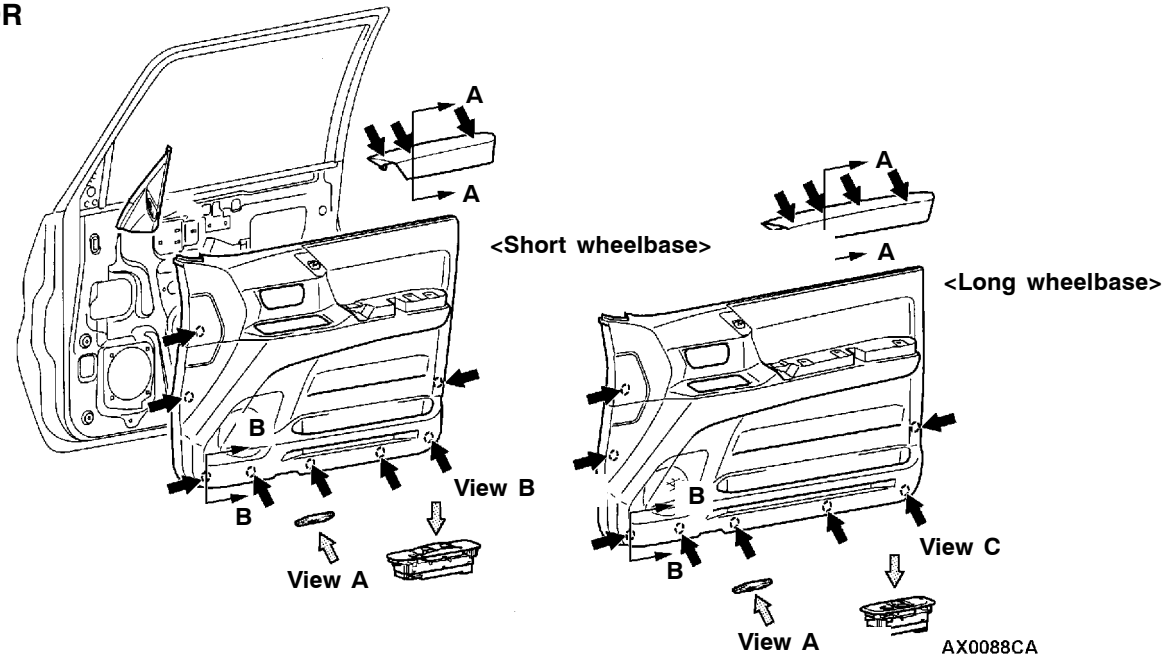


Removal steps

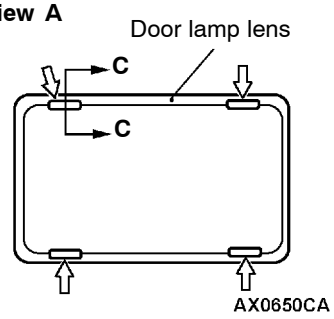
◀A▶ 1. Power window switch and power window switch panel assembly
2. Power window switch panel
3. Power window switch
4. Door lamp assembly
◀B▶ ▶B◀ 5. Clip <Vehicles without power windows>
▶B◀ 6. Escutcheon <Vehicles without power windows>
▶B◀ 7. Regulator handle <Vehicles without power windows>
8. Door inside handle cover
9. Door belt line moulding assembly
10. Door trim
◀C▶ 11. Door inside handle cover
12. Door grip
13. Rear arm restraint cover
14. Door grip bracket
15. Door grip upper retainer
16. Door grip lower bracket
17. Arm restraint bracket
18. Speaker
19. Power window switch bracket
20. Door inside handle
▶A◀ 21. Waterproof film

CLIP AND CLAW POSITIONS

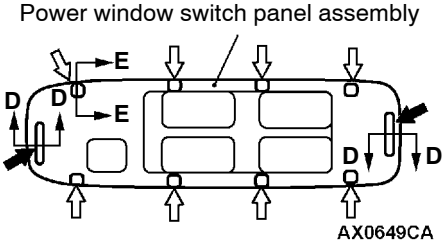
FRONT DOOR



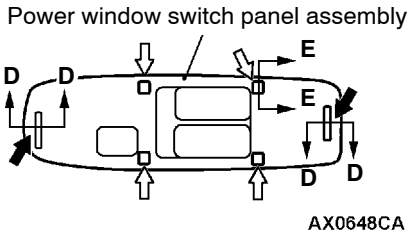
View A



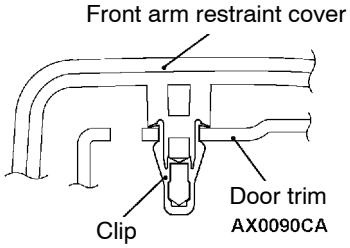
View B



View C



Section A - A



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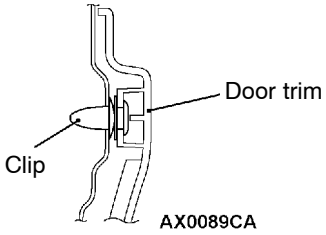

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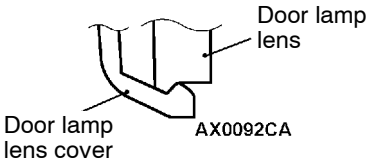
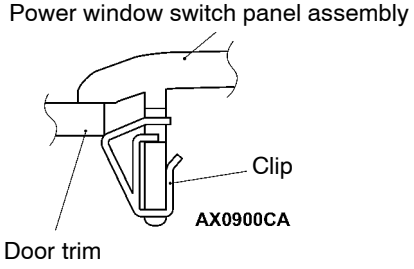
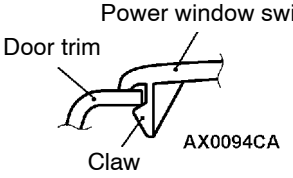


Section D - D

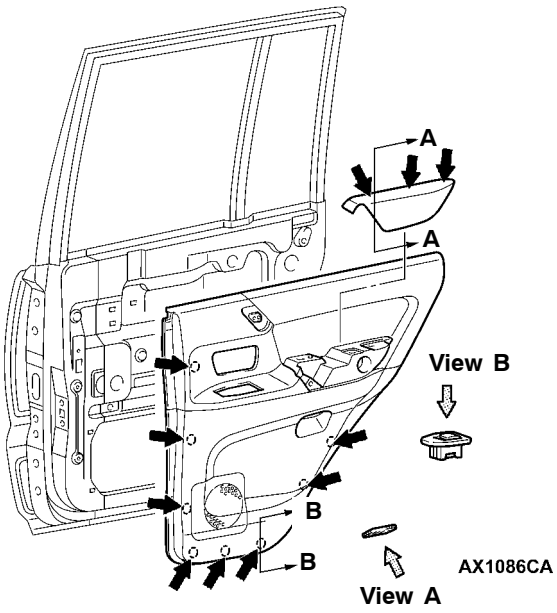


Section E - E

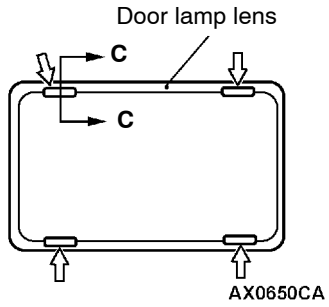


NOTE
⬅ : Clips positions
⇦ : Claws positions

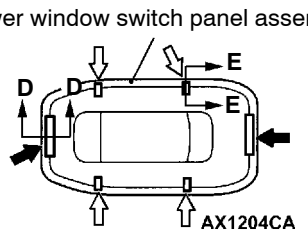
REAR DOOR



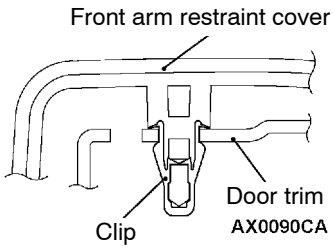
View A



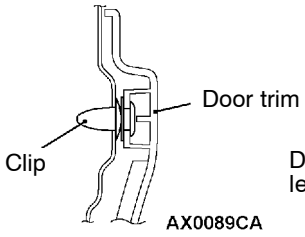
View B



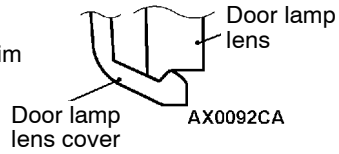
Section A - A



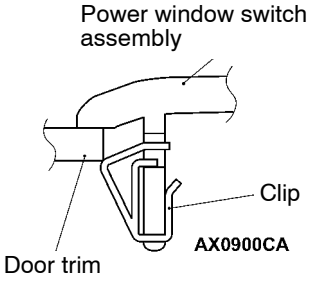
Section B - B



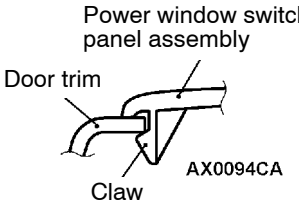
Section C - C



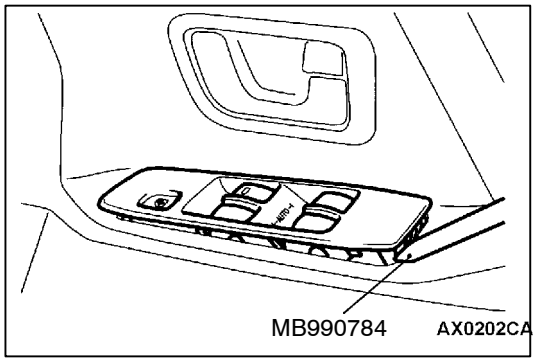
Section D - D



Section E - E



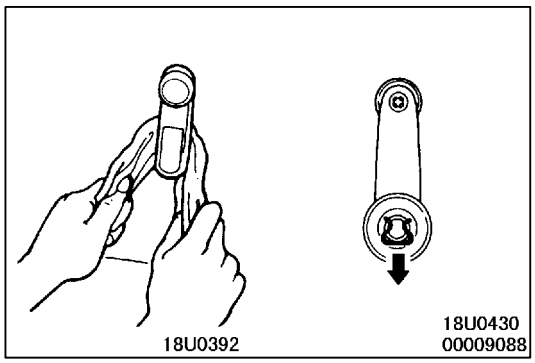
NOTE
⬅ : Clips positions
⇦ : Claws positions



REMOVAL SERVICE POINTS

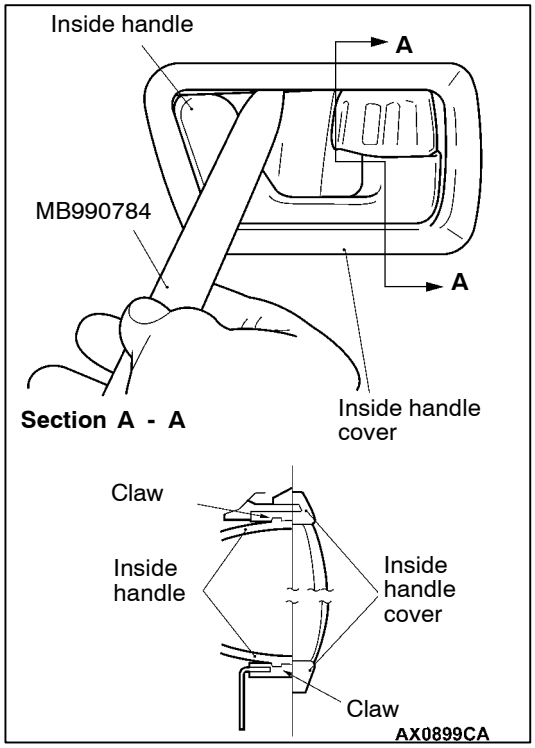
◀A▶ POWER WINDOW SWITCH AND POWER WINDOW SWITCH PANEL ASSEMBLY REMOVAL

Use the special tool to twist the front and rear of the power window switch and panel assembly to remove it. (Refer to P.42-26, 27, Clip and claw positions.)



◀B▶ CLIP REMOVAL

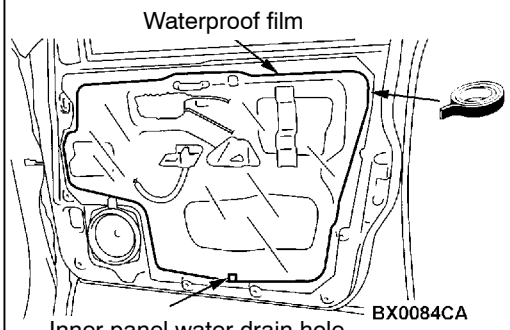
Use a cloth to remove the clip as shown in the illustration.



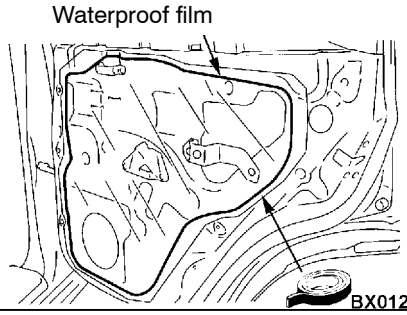
◀C▶ DOOR INSIDE HANDLE COVER REMOVAL

1. Insert the special tool between the inside handle upper part and the inside handle cover, and then disengage the upper claw of the inside handle.
2. Disengage the lower claw of the inside handle in the same manner as for the upper claw.
3. Remove the door trim.
4. Remove the inside handle cover from the door trim.

<Front door>



<Rear door>



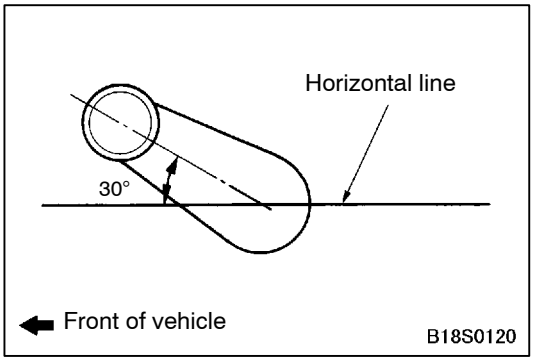
INSTALLATION SERVICE POINTS

▶A◀ WATERPROOF FILM INSTALLATION

Apply the specified sealant to the shown positions of waterproof film, and then attach the waterproof film.

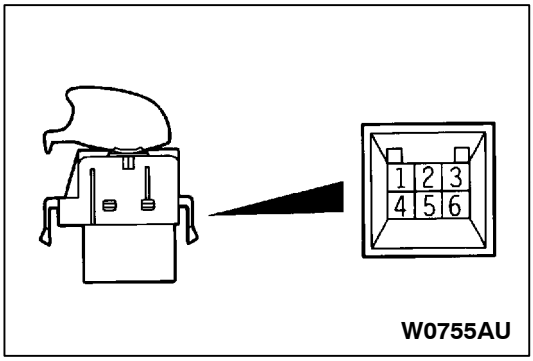
Specified sealant: 3M ATD Part No. 8625 or equivalent

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.



INSPECTION

POWER WINDOW SUB SWITCH CONTINUITY CHECK

Switch position	Terminal No.		
	1	4	6
UP		○	○
DOWN	○	○	

NOTE
Power window main switch uses SWS system, for the power window main switch check, refer to GROUP 54B - SWS.

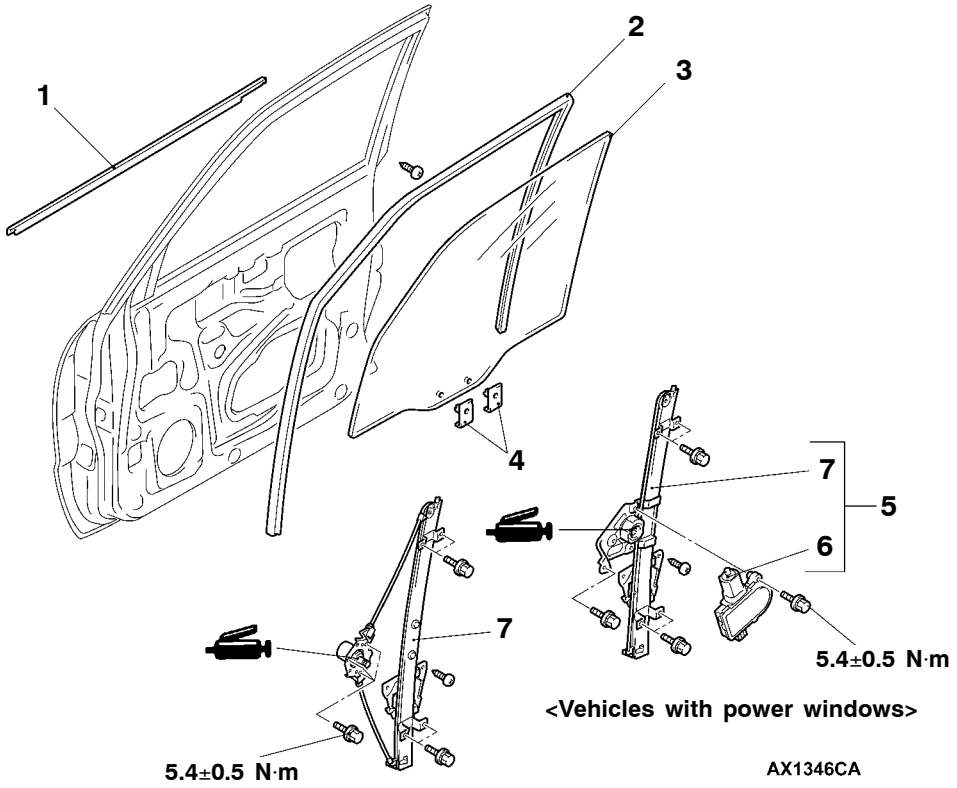
DOOR GLASS AND REGULATOR

REMOVAL AND INSTALLATION

FRONT DOOR

Pre-removal Operation
Door Trim and Waterproof Film Removal (Refer to P.42-24.)

Post-installation Operation
- Door Window Glass Adjustment (Refer to P.42-20.)
- Door Trim and Waterproof Film Installation (Refer to P.42-24.)



<Vehicles with power windows>

<Vehicles without power windows>

Door window glass removal steps
1. Door belt line moulding assembly
2. Door window glass runchannel

▶B◀ ● Check operation

3. Door window glass
4. Glass holder

Power window regulator and motor assembly removal steps
5. Power window regulator and motor assembly

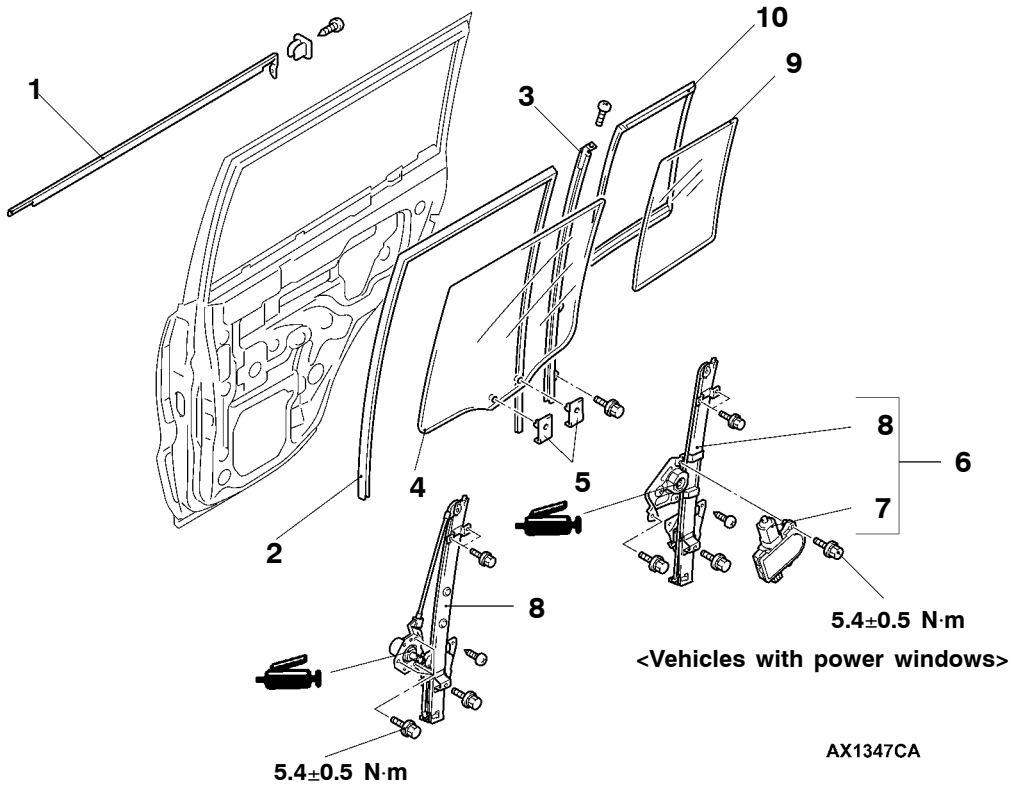
▶A◀ 6. Power window motor assembly

▶A◀ 7. Power window regulator assembly

REAR DOOR

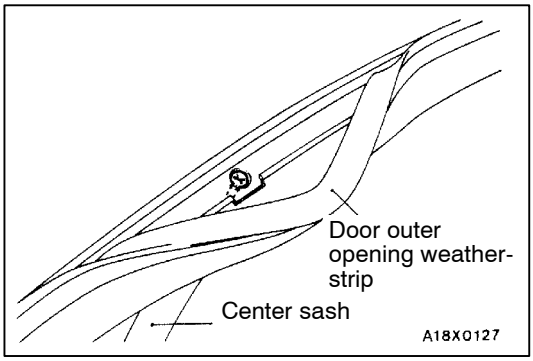
Pre-removal Operation
Door Trim and Waterproof Film Removal (Refer to P.42-25.)

Post-installation Operation
- Door Window Glass Adjustment (Refer to P.42-20.)
- Door Trim and Waterproof Film Installation (Refer to P.42-25.)



Removal steps

1. Door belt line moulding assembly
2. Door window glass runchannel
◀A▶ ▶C◀ 3. Center sash
▶B◀ ● Check operation
4. Rear door window glass
5. Glass holder
6. Power window regulator and motor assembly
▶A◀ 7. Power window motor assembly
▶A◀ 8. Power window regulator assembly
9. Stationary window glass
10. Stationary window weatherstrip



REMOVAL SERVICE POINT

◀A▶ CENTER SASH REMOVAL

1. Remove only the section of the door outer opening weatherstrip which is attached to the center sash.
2. Remove the center sash mounting screws, and then remove the center sash from the door panel.

INSTALLATION SERVICE POINTS

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

Power window motor assembly and window regulator assembly pre-installation operations

1. Connect the power window motor assembly to the body side harness connector, and then turn the ignition switch ON.
2. Operate the power window motor assembly for 5-10 seconds by pressing the power window switch to the UP position.

NOTE
This operation will cause the limit switch inside the power window motor assembly to be reset.

Caution
(1) The power window motor assembly should not be operated again until it is installed to the glass.
(2) The clamping prevention function does not operate the first time that the glass is fully closed.

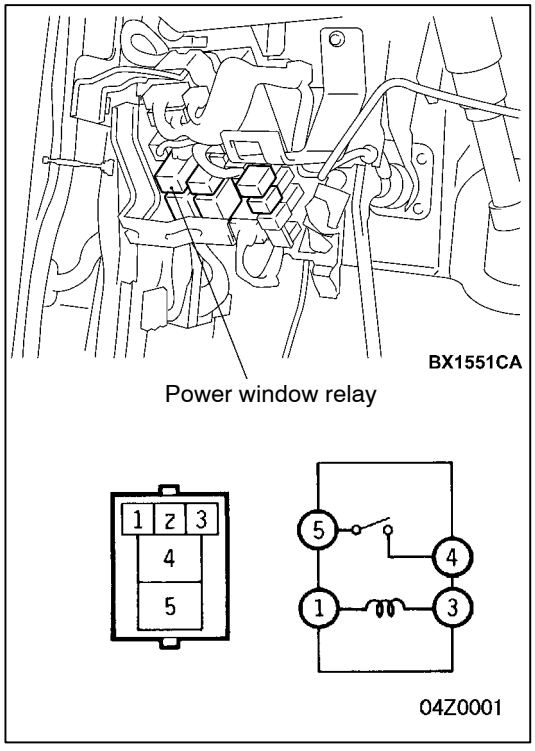
▶B◀ CHECK OPERATION

1. Install the glass to the power window motor assembly.
2. Press the power window switch to fully-close the glass, and then return the glass to the fully-open position.

NOTE
This operation will program the power window-ECU.

▶C◀ CENTER SASH INSTALLATION

Securely insert the center sash into the window rear sash (door).



INSPECTION

POWER WINDOW RELAY CONTINUITY CHECK

Battery voltage	Terminal No.			
	1	3	4	5
Not applied	○	○		
Applied	⊕	⊖	○	○

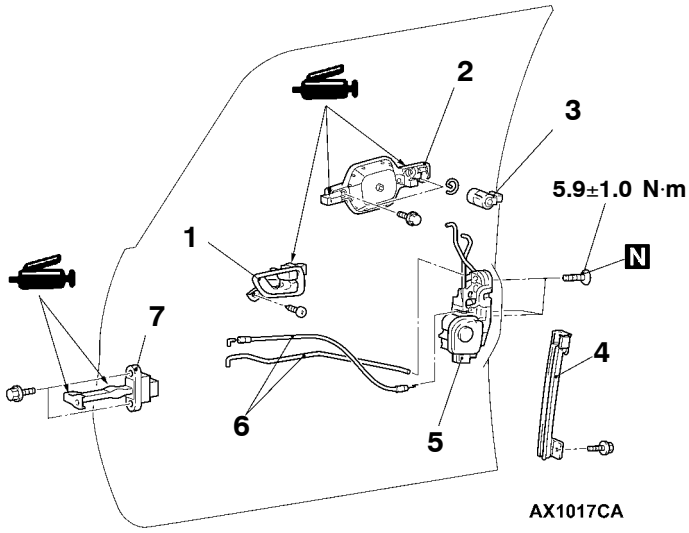
DOOR HANDLE AND LATCH

REMOVAL AND INSTALLATION

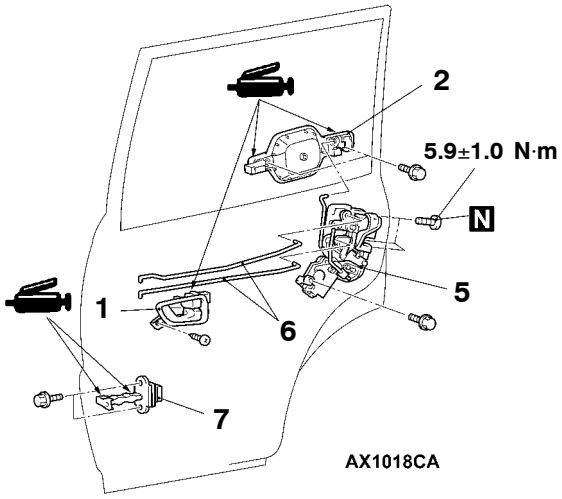
Pre-removal Operation
Door Trim Removal (Refer to P.42-27.)

Post-installation Operation
- Door Inside Handle Play Check (Refer to P.42-21.)
- Door Outside Handle Play Check (Refer to P.42-21.)
- Door Trim Installation (Refer to P.42-24.)

FRONT DOOR



REAR DOOR



Door handle and door latch assembly removal steps

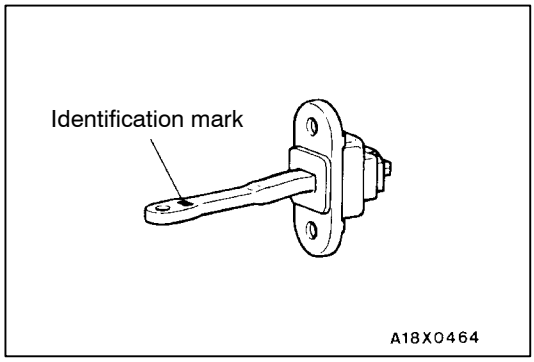
▶C◀ 1. Door inside handle
- Waterproof film (Refer to P.42-24.)

2. Door outside handle
3. Door lock key cylinder

▶B◀ 4. Rear lower sash
5. Door latch assembly
6. Link assembly

Door check removal steps
- Waterproof film (Refer to P.42-24.)

▶A◀ 7. Door check



INSTALLATION SERVICE POINTS

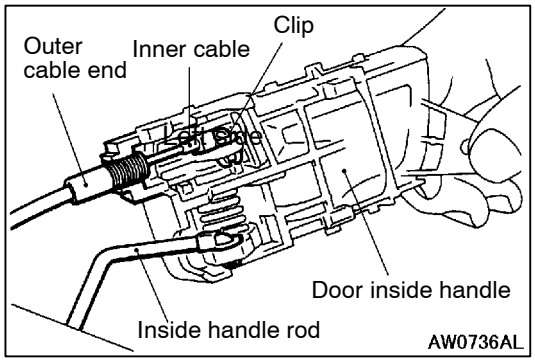
▶A◀ DOOR CHECK INSTALLATION

Install with the following identification marks upward.

Items		Identification mark
Front door	Left door	20L
	Right door	20R
Rear door	Left door	26L
	Right door	26R

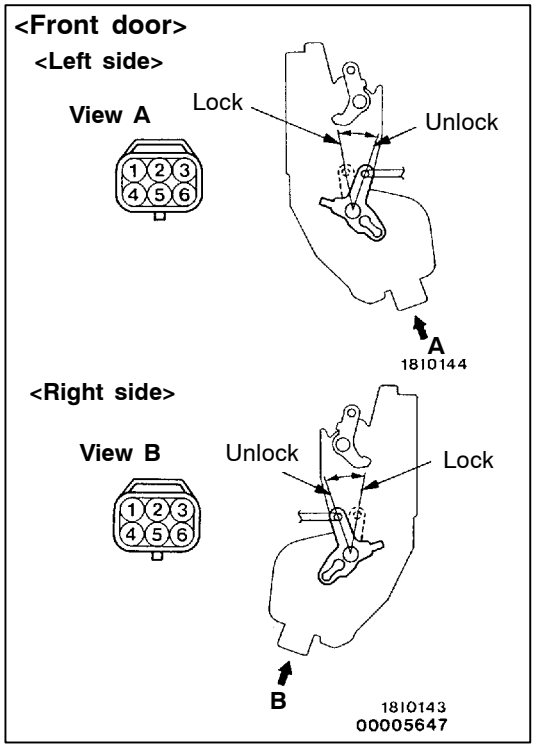
▶B◀ REAR LOWER SASH INSTALLATION

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

Front door

<Left side>

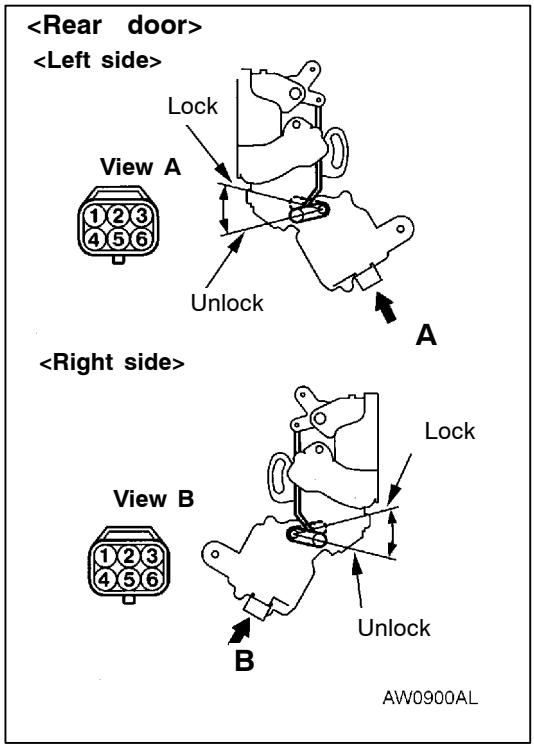
Rod position	Terminal No.					Rod operation
	1	2	3	4	6	Rod operation
LOCK				⊕	⊖	LOCK to UNLOCK
UNLOCK				⊖	⊕	UNLOCK to LOCK
LOCK*	○		○			
UNLOCK*	○	○				

NOTE :
*: driver's side only

<Right side>

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

NOTE :
*: driver's side only



Rear door

<Left side>

Rod position	Terminal No.		Rod operation
	2	3	
LOCK	⊕	⊖	LOCK to UNLOCK
UNLOCK	⊖	⊕	UNLOCK to LOCK

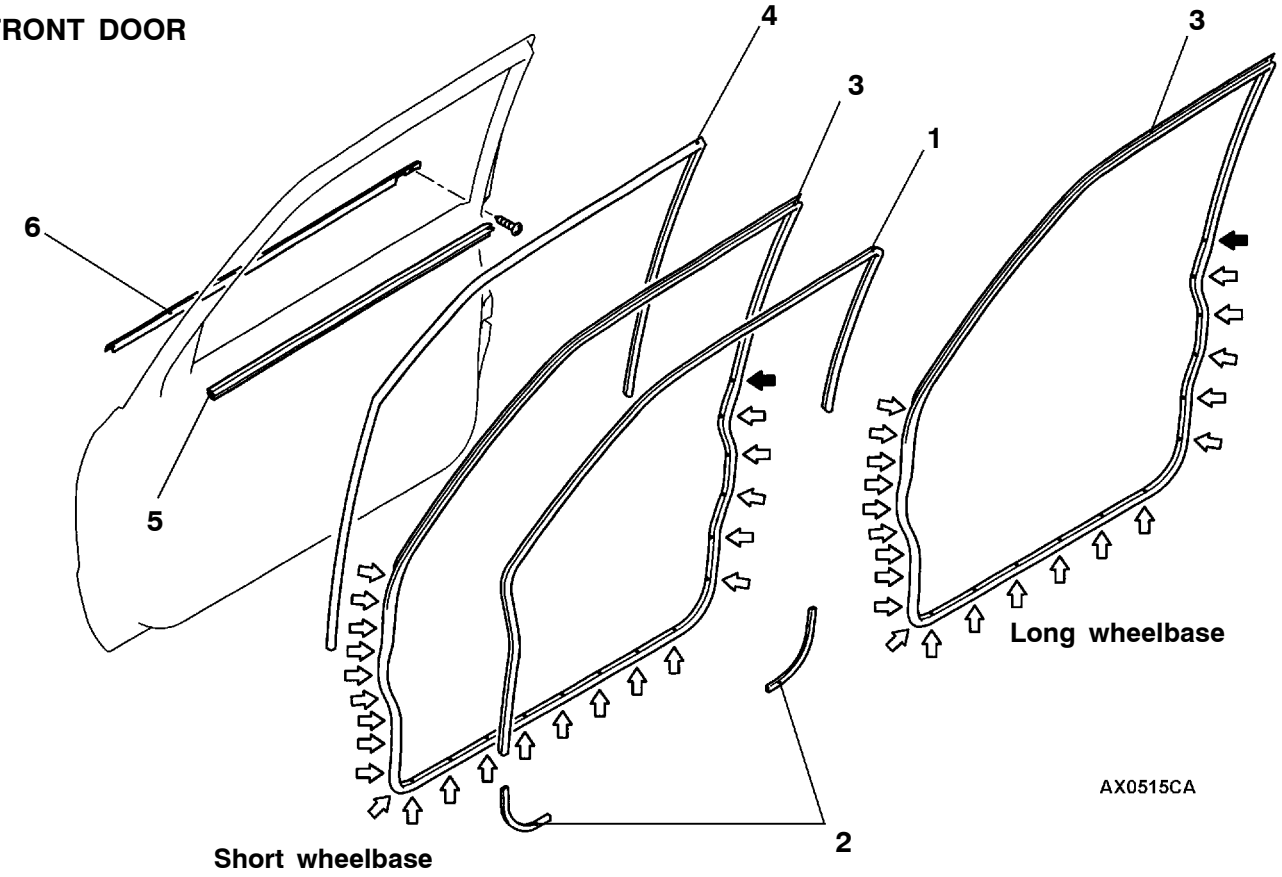
<Right side>

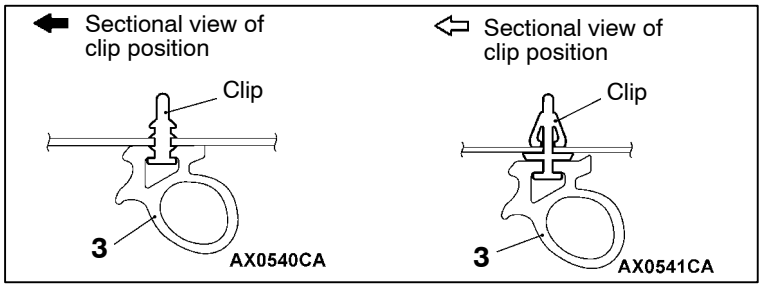
Rod position	Terminal No.		Rod operation
	2	3	
LOCK	⊖	⊕	LOCK to UNLOCK
UNLOCK	⊕	⊖	UNLOCK to LOCK

WINDOW GLASS RUNCHANNEL AND DOOR OPENING WEATHERSTRIP

REMOVAL AND INSTALLATION

FRONT DOOR





Door inner opening weatherstrip removal steps

▶B◀ 1. Door inner opening weatherstrip
- Scuff plate (Refer to GROUP 52A.)
- Cowl side trim (Refer to GROUP 52A.)
- Center pillar lower trim (Refer to GROUP 52A.)

▶B◀ 2. Edge seal rubber

Door outer opening weatherstrip removal steps

- Front door check mounting bolts (door side) (Refer to P.42-22.)

◀A▶ 3. Door outer opening weatherstrip

Door window glass runchannel removal steps

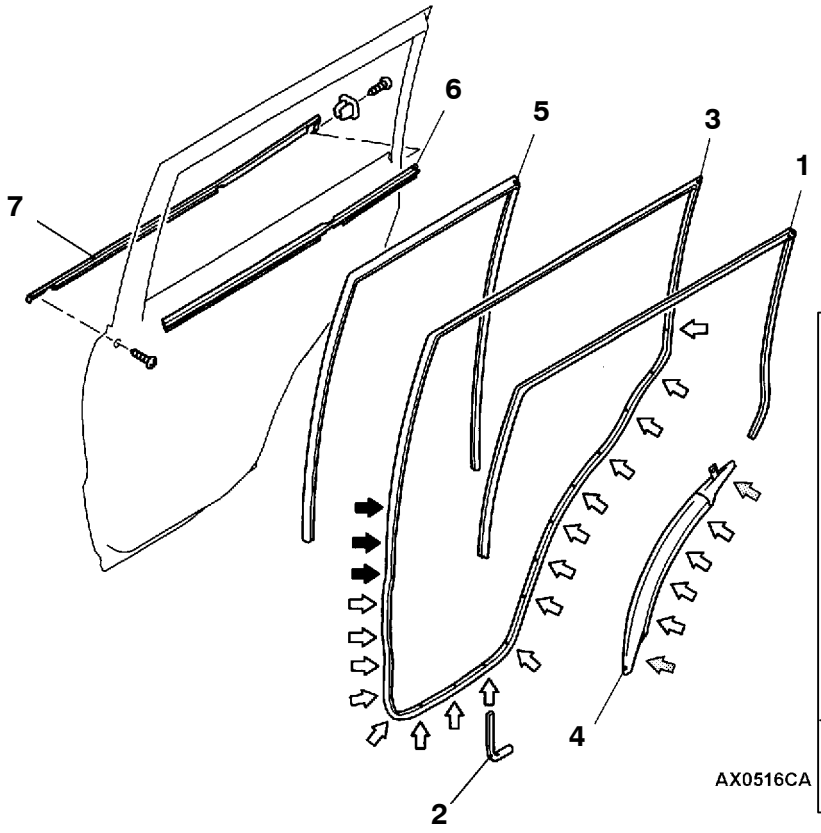
▶A◀ 4. Door window glass runchannel
- Front door trim (Refer to P.42-24.)

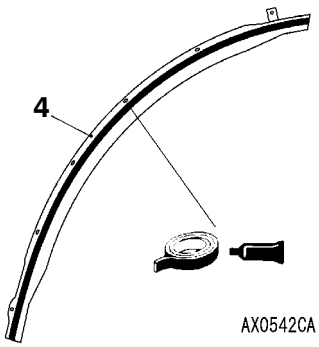
5. Door belt line inner weatherstrip

Door beltline moulding removal

6. Door beltline moulding

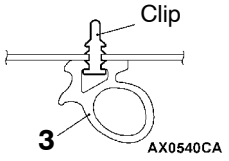
REAR DOOR



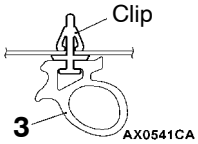


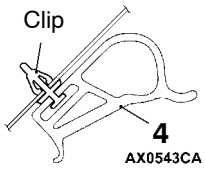
Adhesive tape:
Double-sided tape [23 mm width and 0.8 mm thickness], dry adhesive

Sectional view of clip position

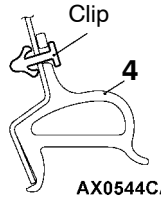


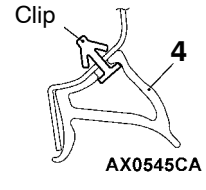
Sectional view of clip position





Sectional view of clip position





Door inner opening weatherstrip removal steps

▶B◀ 1. Door inner opening weatherstrip
- Center pillar lower trim (Refer to GROUP 52A.)

▶B◀ 2. Edge seal rubber

Door outer opening weatherstrip removal steps

- Rear door check mounting bolts (door side) (Refer to P.42-23.)

◀A▶ 3. Door outer opening weatherstrip
4. Door outer opening lower weatherstrip

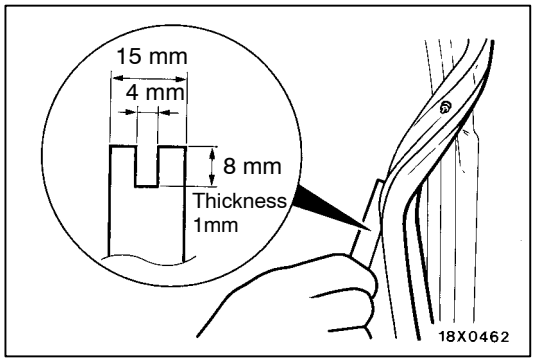
Door window glass runchannel removal steps

▶A◀ 5. Door window glass runchannel
- Rear door trim (Refer to P.42-25.)

6. Door belt line inner weatherstrip

Door beltline moulding removal

7. Door beltline moulding



REMOVAL SERVICE POINT

◀A▶ DOOR OUTER OPENING WEATHERSTRIP REMOVAL

Make a tool as shown and remove the door opening weatherstrip.

INSTALLATION SERVICE POINTS

▶A◀ DOOR WINDOW GLASS RUNCHANNEL INSTALLATION

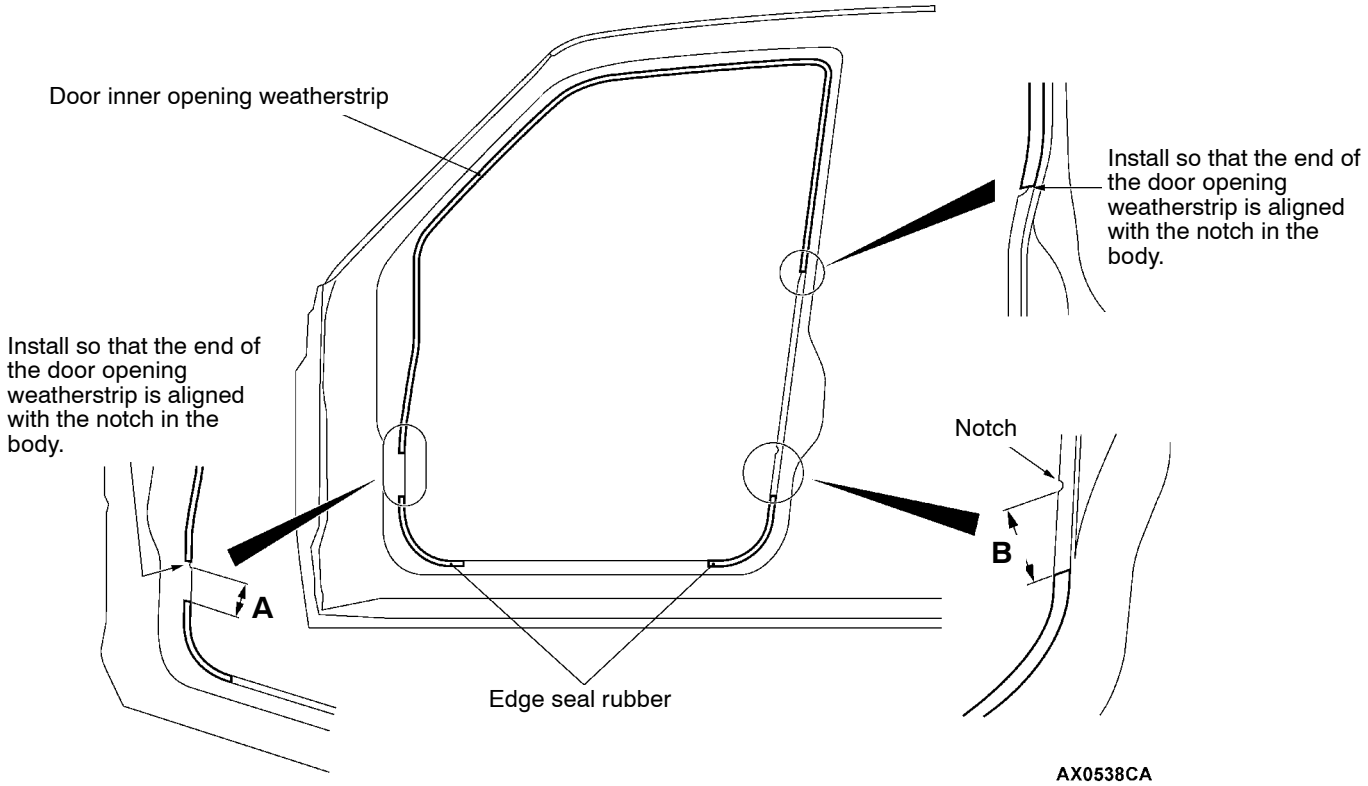
When installing the door window glass runchannel, remove the waterproof film.

▶B◀ EDGE SEAL RUBBER/DOOR INNER OPENING WEATHERSTRIP INSTALLATION

Attach the edge seal rubber and door inner opening weatherstrip in the places specified below.

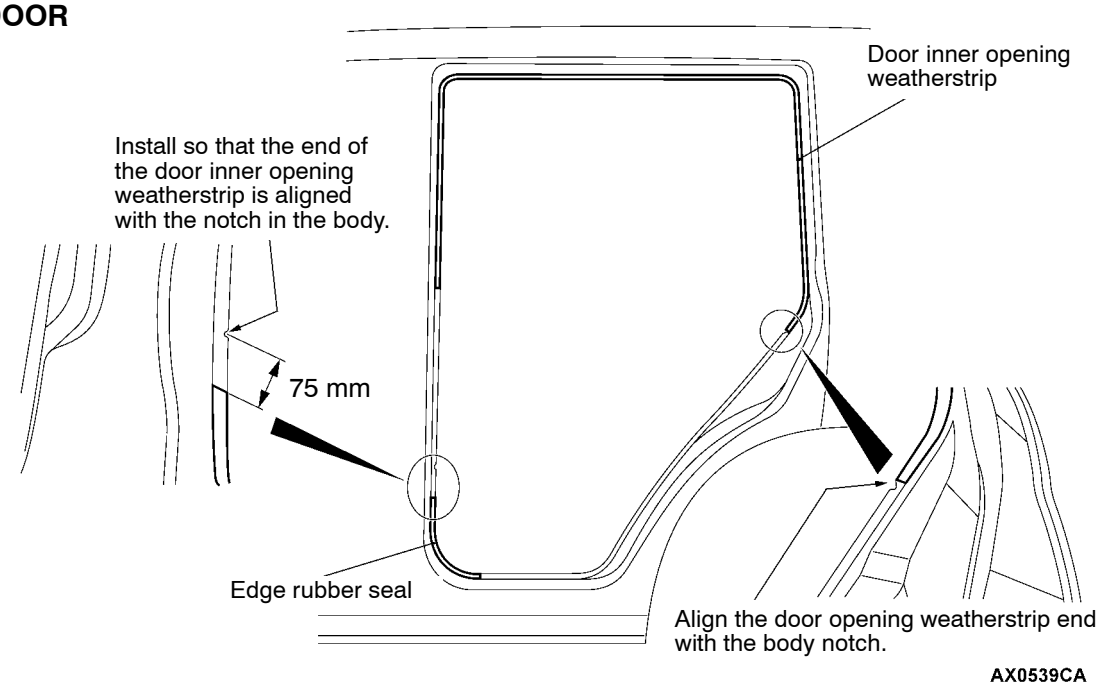
Edge seal rubber and door inner weatherstrip attachment locations

FRONT DOOR



A: 87 mm
B: 106 mm (Long wheelbase)
B: 98 mm (Short wheelbase)

REAR DOOR



BACK DOOR

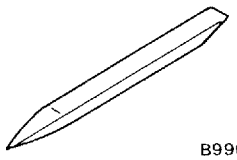
SERVICE SPECIFICATION

Item	Standard value
Back door handle play mm	2.3

SEALANT

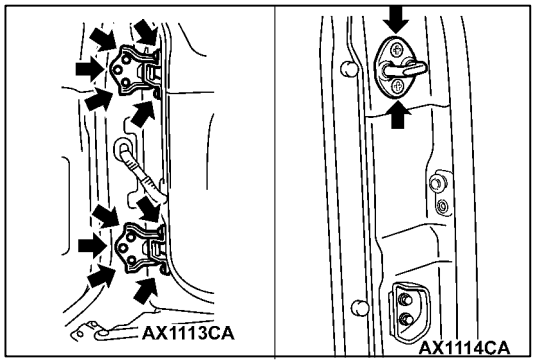
Item	Specified sealant	Remark
Waterproof film	3M ATD Part No. 8625 or equivalent	Ribbon sealer

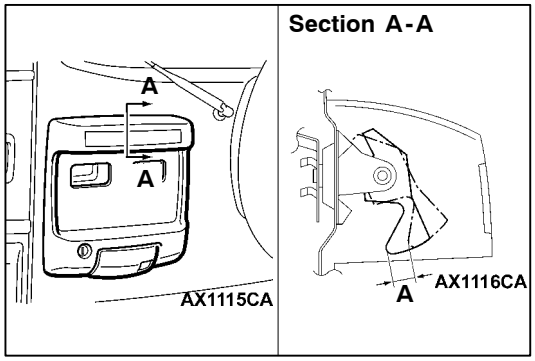
SPECIAL TOOL

Tool	Number	Name	Use
 B990784	MB990784	Ornament remover	Back door trim removal

TROUBLESHOOTING

NOTE
Power window main switch uses SWS system, for the power window main switch check, refer to GROUP 54B - SWS.





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.

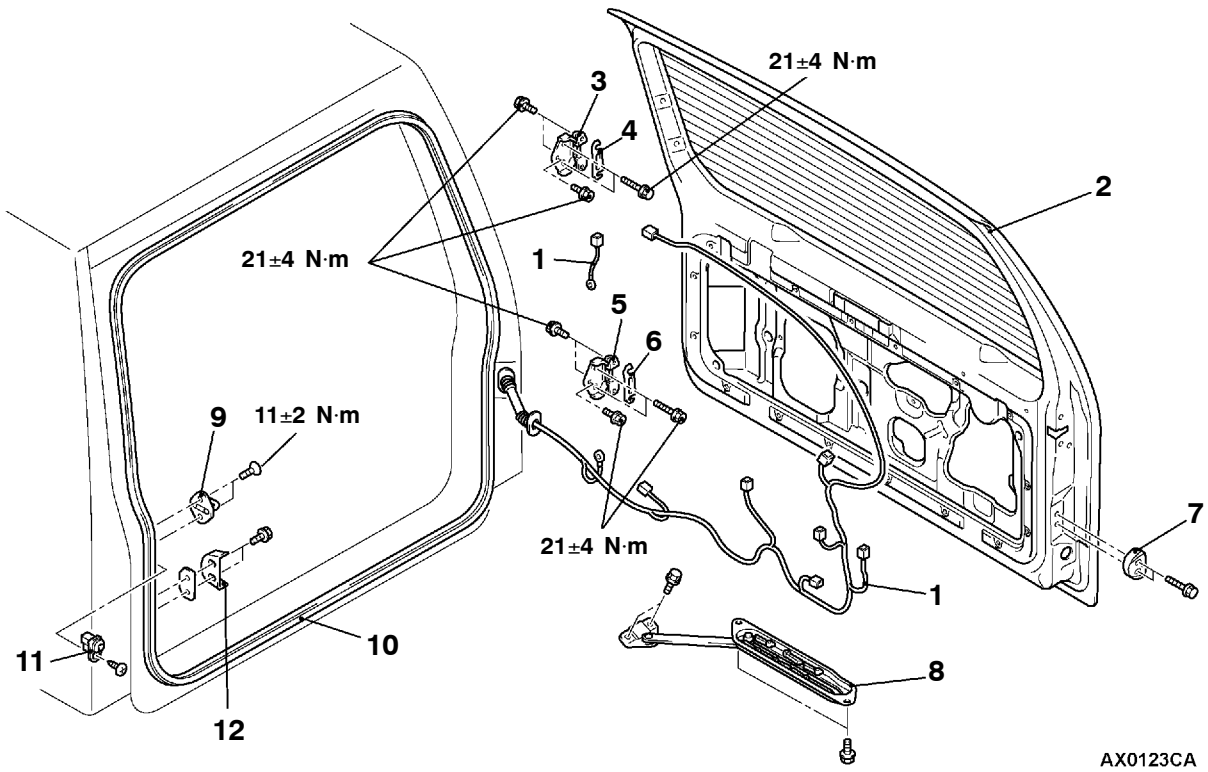
   Standard value (A): 2.3 mm
2. If the back door handle play is not within the standard value, check the back door handle and door latch assembly. Replace if necessary.

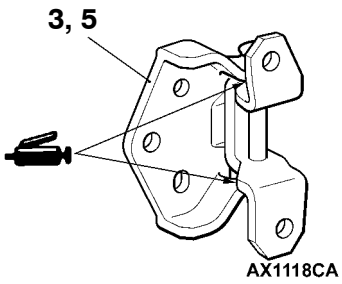
BACK DOOR ASSEMBLY

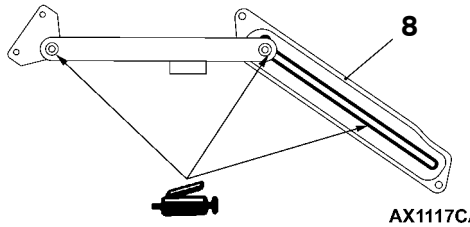
REMOVAL AND INSTALLATION

Pre-removal Operation
- High-mounted Stop Lamp Removal (Refer to GROUP 54A.)
- Spare Tyre Removal)

Pre-removal Operation
- High-mounted Stop Lamp Installation (Refer to GROUP 54A.)
- Spare Tyre Installation
- Back Door Fit Adjustment (Refer to P.42-40.)







Removal steps
- Back door trim and waterproof film (Refer to P.42-43.)

1. Harness connector
2. Back door assembly
3. Back door upper hinge
4. Shim
5. Back door lower hinge
6. Shim
7. Damper mail
8. Back door stopper

▶B◀ 9. Striker

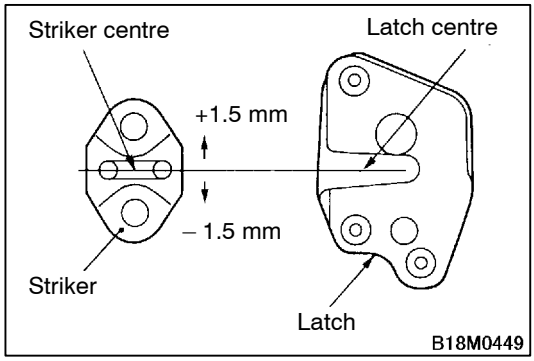
▶A◀ 10. Back door opening weatherstrip

11. Door switch
12. Back door bumper, female

INSTALLATION SERVICE POINTS

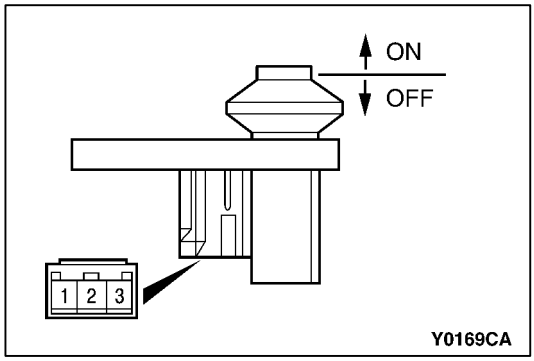
▶A◀ BACK DOOR OPENING WEATHERSTRIP INSTALLATION

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.



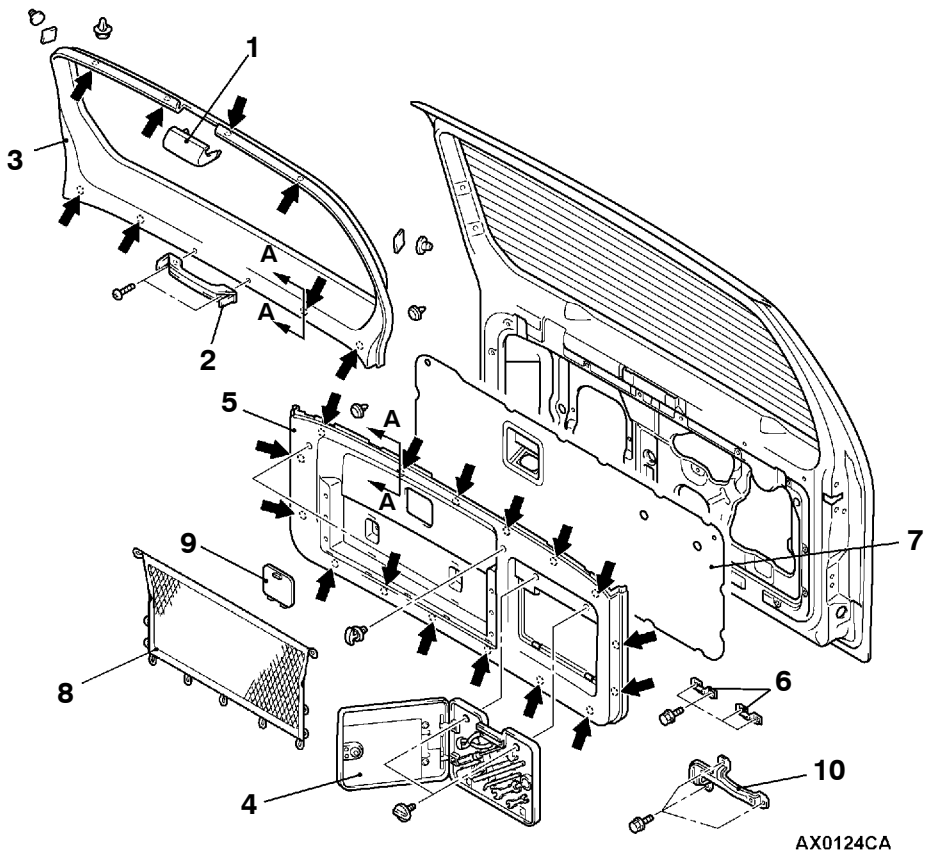
INSPECTION

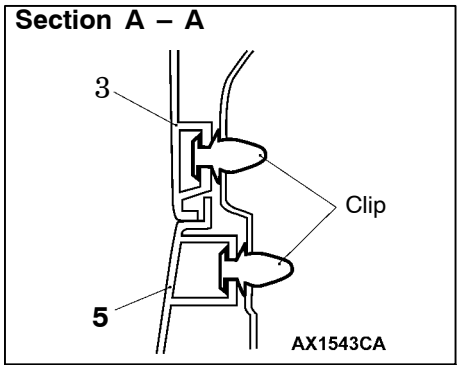
DOOR SWITCH CONTINUITY CHECK

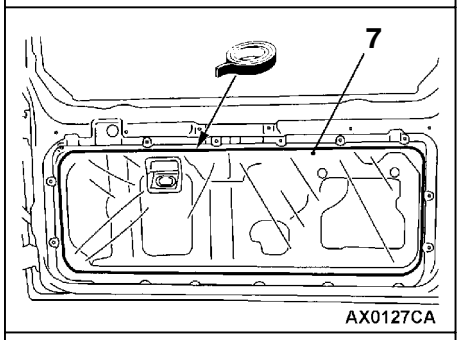
Switch position	Terminal No.		
	1	2	3
Released (ON)	○	○	○
Pressed (OFF)			

BACK DOOR TRIM AND WATERPROOF FILM

REMOVAL AND INSTALLATION







Sealant:
3M ATD Part No. 8625 or equivalent

⬅ : Clip positions

Removal steps

1. High-mounted stop lamp cover
   - High-mounted stop lamp (Refer to GROUP 54A.)
2. ▶A◀ Door pull handle
3. Back door upper trim
4. Toolbox assembly
5. Back door lower trim
6. Toolbox bracket, lower
7. Waterproof film
8. Back door lid
9. Washer tank lid
10. Toolbox bracket, upper

INSTALLATION SERVICE POINT

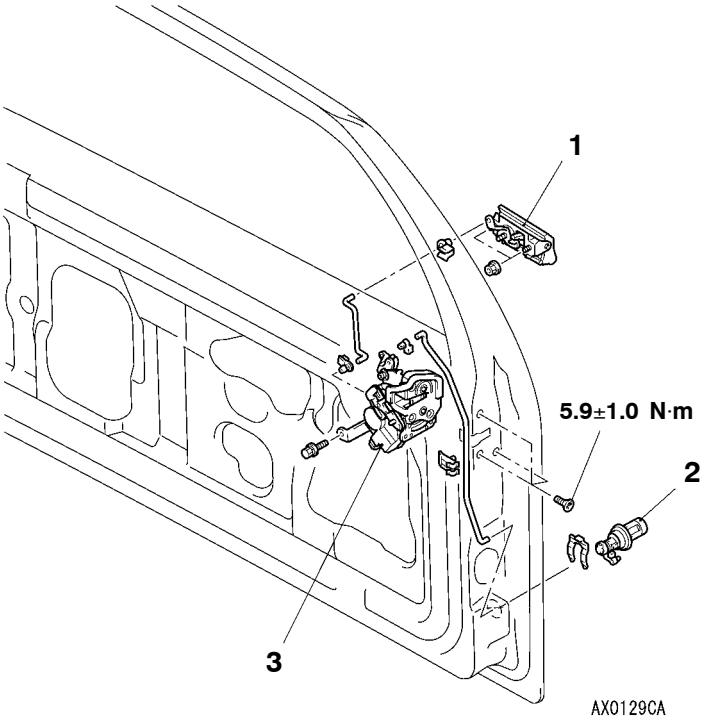
▶A◀ DOOR PULL HANDLE INSTALLATION

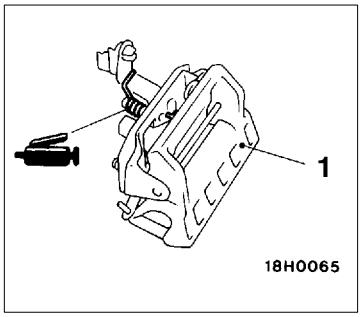
Install so that the arrow on the underside is pointing upwards.

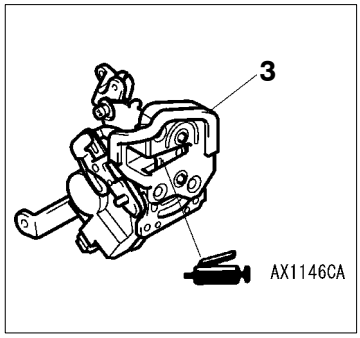
BACK DOOR HANDLE AND LATCH

REMOVAL AND INSTALLATION

Post-installation Operation
Outside Handle Play Check (Refer to P.42-40.)







Back door handle and lock key cylinder removal steps

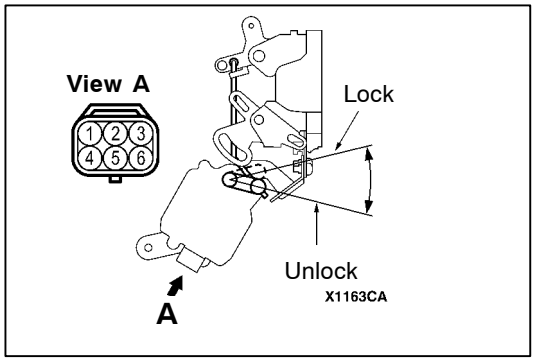
- Back door trim and waterproof film (Refer to P.42-43.)
- Back door garnish (Refer to GROUP 51.)

1. Back door handle
2. Back door lock key cylinder

Back door latch removal steps

- Back door trim and waterproof film (Refer to P.42-43.)

3. Back door latch assembly



INSPECTION

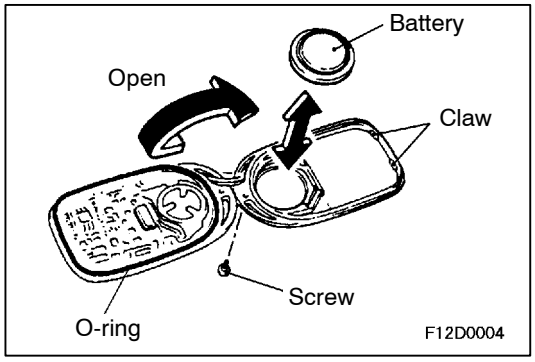
BACK DOOR LOCK ACTUATOR CHECK

Rod position	Terminal No.		Rod operation
	2	3	
LOCK	⊖	⊕	LOCK to UNLOCK
UNLOCK	⊕	⊖	UNLOCK to LOCK

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.

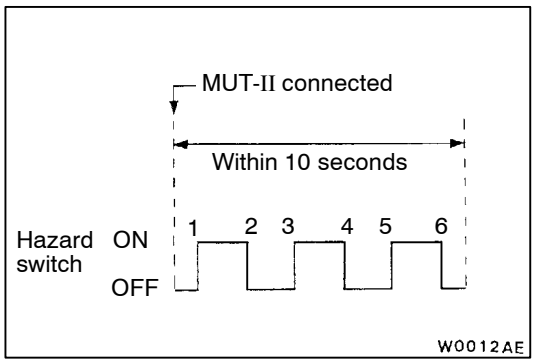
- When either the transmitter or ETACS-ECU is replaced;
- If a second transmitter is to be used;
- If it appears that a problem is occurring because of faulty registration of a code.

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.

KEYLESS ENTRY SYSTEM

REMOVAL AND INSTALLATION

For the removal and installation of the ETACS-ECU, refer to GROUP 54A.

SUNROOF

SERVICE SPECIFICATION

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

TROUBLESHOOTING

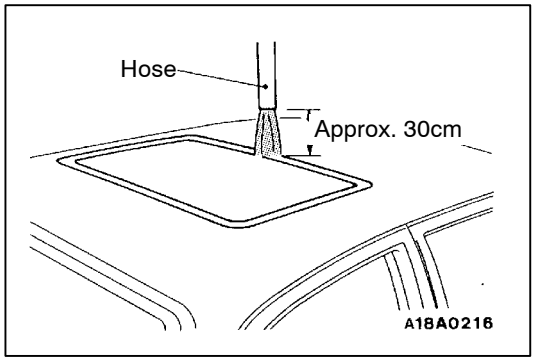
The sunroof is controlled by the SWS (Smart Wiring System). For troubleshooting procedures, refer to GROUP 54B - SWS Diagnosis.

ON-VEHICLE SERVICE

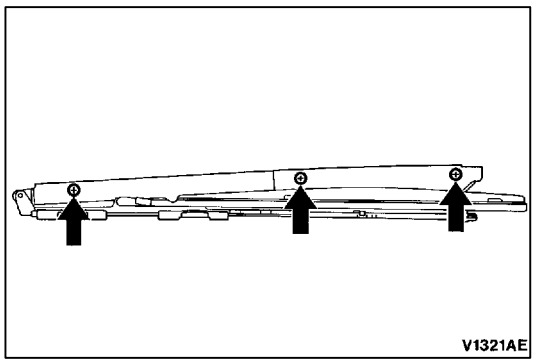
WATER TEST

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 letting the water run onto the weatherstrip, check that there is no water leaking into the passenger compartment.



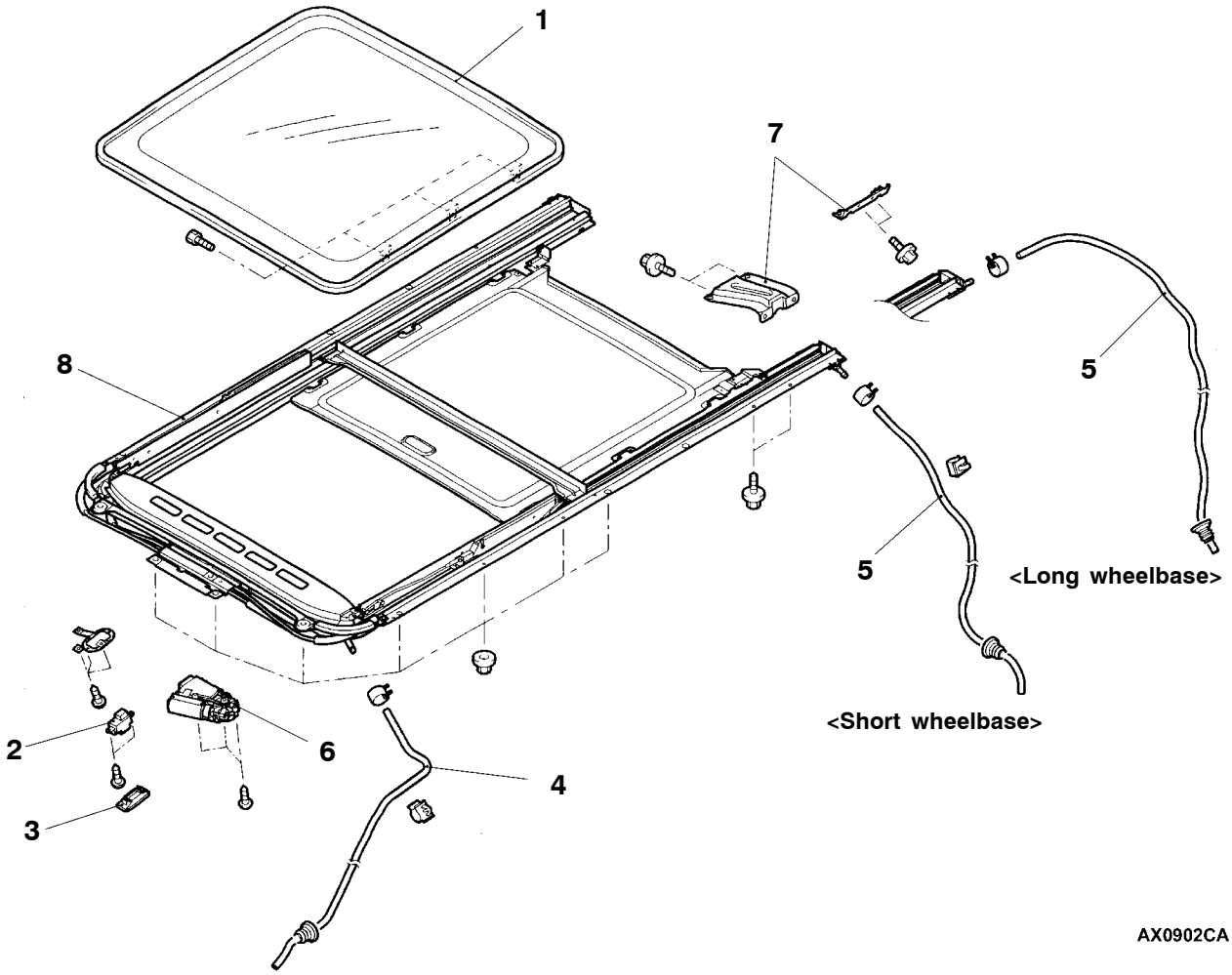
SUNROOF FIT ADJUSTMENT

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.42-47.)
- Sunroof Fit Adjustment (Refer to P.42-47.)



1. Roof lid glass assembly

Sunroof switch removal steps

2. Sunroof switch cover
3. Sunroof switch

Drain hose removal steps

- Headlining
- Rear mudguard (Rear drain hose)
- instrument panel assembly (Refer to GROUP 52A.)

◀A▶ ▶A◀ 4. Drain hose (Front side)
- Pillar duct (passenger's side) (Refer to GROUP 55.)
- Rear quarter duct (passenger's side) (Refer to GROUP 55.)

◀A▶ ▶A◀ 5. Drain hose (Rear side)

Sunroof motor assembly removal steps

- Headlining

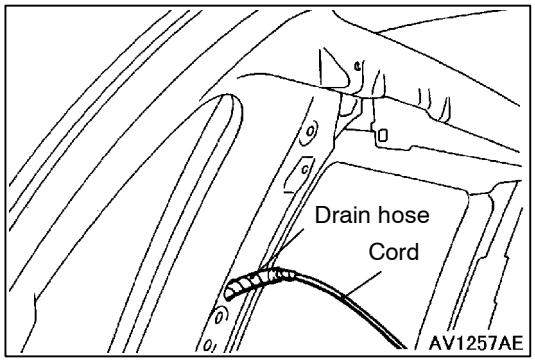
◀B▶ ▶B◀ 6. Sunroof motor assembly

Sunroof assembly removal steps

- Headlining

◀A▶ ▶A◀ 4. Drain hose (Front side)
- Pillar duct (passenger's side) (Refer to GROUP 55.)
- Rear quarter duct (passenger's side) (Refer to GROUP 55.)

◀A▶ ▶A◀ 5. Drain hose (Rear side)
7. Set bracket
8. Sunroof assembly



REMOVAL SERVICE POINTS

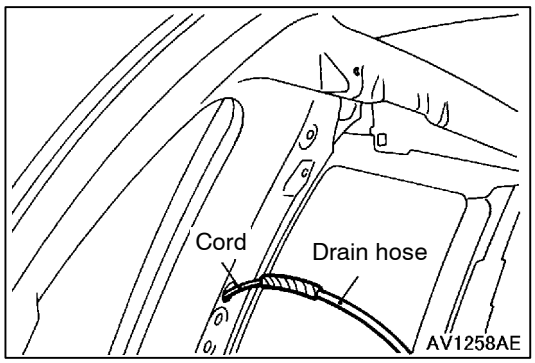
◀A▶ DRAIN HOSE REMOVAL

Tie a cord to the end of the drain hose, and wind tape around it so that there is no unevenness. Then pull the drain hose out from the passenger compartment.

◀B▶ SUNROOF MOTOR ASSEMBLY REMOVAL

Caution
Always close the roof lid glass fully before removing the sunroof motor. If the fully-closed positions of the roof lid glass and the sunroof motor are not the same, the sunroof will not operate properly.

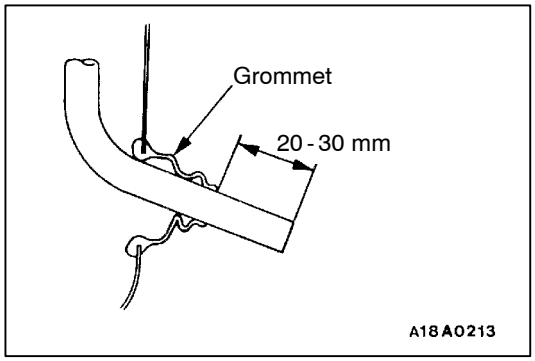
NOTE
If there is a problem with the sunroof motor so that the roof lid glass cannot close fully, use an Allen key to turn the gear section of the sunroof motor to fully close the roof lid glass.



INSTALLATION SERVICE POINTS

▶A◀ DRAIN HOSE INSTALLATION

1. Tie the cord that was used during removal to the end of the drain hose, and wind tape around it so that there is no unevenness.
2. Pull the cord to pull through the drain hose



3. Install the grommet, and then position the drain hose so that it protrudes from the grommet as shown in the illustration.

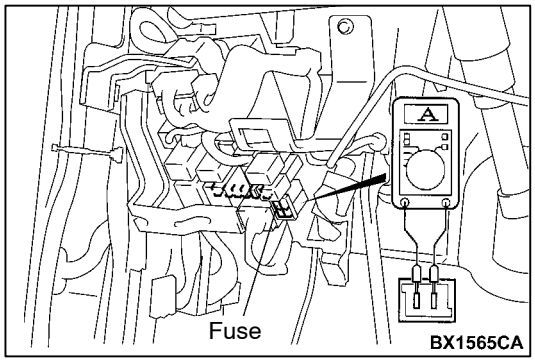
▶B◀ SUNROOF MOTOR ASSEMBLY INSTALLATION

<INSTALLATION OF REMOVED MOTOR ASSEMBLY>

1. Install the roof lid glass assembly and the sunroof motor assembly with the sunroof motor assembly in the fully-closed position.
2. Connect the sunroof motor assembly harness connector and the sunroof switch harness connector to the vehicle wiring harness connector.
3. Operate the sunroof and check that it operates correctly.

<ACCESSORY (NEW) SUNROOF MOTOR ASSEMBLY INSTALLATION>

1. Install the roof lid glass assembly and the sunroof motor assembly with the sunroof motor assembly in the fully-closed position.
2. Connect the sunroof motor assembly harness connector and the sunroof switch harness connector to the vehicle wiring harness connector.
3. Operate the sunroof switch to slide the roof lid glass to the fully-open position, and then tilt it up in steps of 30 mm to the fully-open position and then keep pressing the switch for 3 seconds or more.
4. Operate the sunroof switch (CLOSE) using the one-touch function to slide the roof lid glass to the fully-closed position.
5. Operate the sunroof switch (OPEN) using the one-touch function to slide the roof lid glass to the fully-open position.
6. Operate the sunroof switch (CLOSE) using the one-touch function to slide the roof lid glass to the fully-closed position.
7. Press the tilt-up switch to operate the sunroof and check that learning is complete.
   NOTE
   (1) During initialisation (learning mode), use only the CLOSE/DOWN switch to move the roof lid glass from the fully-closed position to the fully tilted open position. During initialisation, the TILT UP switch will not work when pressed. Furthermore, the sunroof-ECU will stop running in learning mode as soon as the roof lid glass is tilted up.
   (2) When the clamping prevention mechanism is cancelled, the operation is the same as when the roof lid glass operates 30 mm at a time.

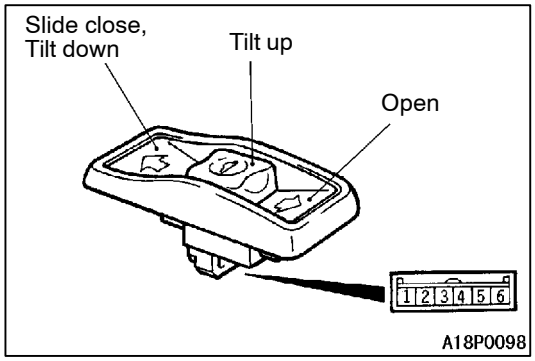


INSPECTION

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).

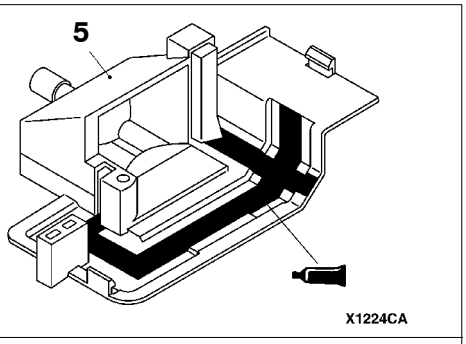
   Standard value: 7 A or less (at 20°C)
3. If the operation current is not within the standard value, check the following points.
   - Installation condition, warping or jamming of sunroof assembly
   - Sticking of drive cable
   - Tilt of roof lid glass



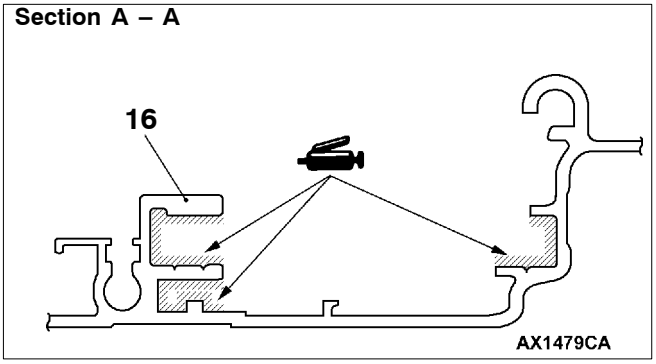
SUNROOF SWITCH CONTINUITY CHECK

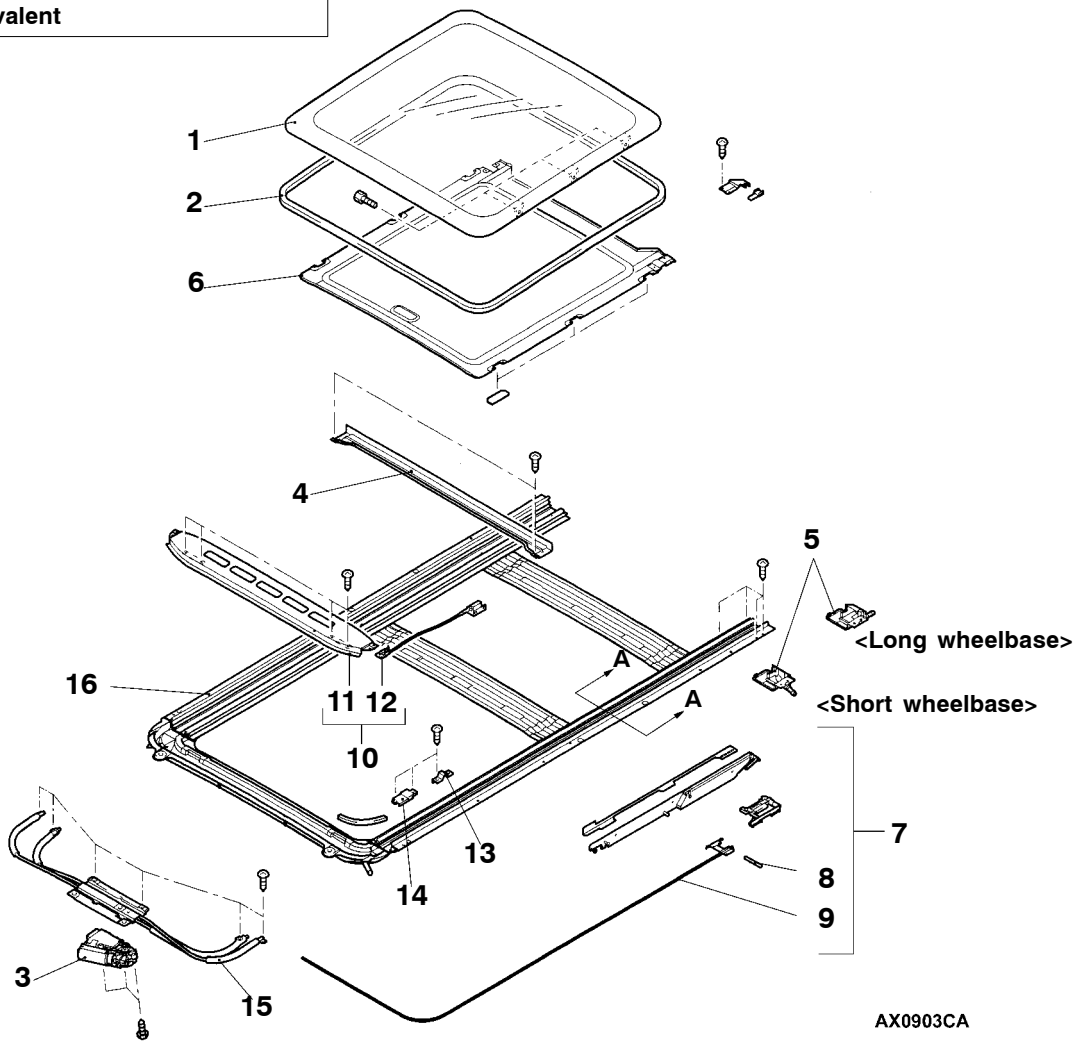
Switch position	Terminal No.			
	3	4	5	6
Open		○	○	
Off				
Tilt up	○	○		
Slide close, Tilt down		○		○

DISASSEMBLY AND REASSEMBLY



Sealant:
3M ATD Part No. 8531 or 8646 Auto Sealant or equivalent





Disassembly steps

1. Roof lid glass assembly
2. Weatherstrip
3. Sunroof motor
4. Roof drip channel
5. Rear drip assembly
6. Sun shade assembly
7. Drive cable assembly

◀A▶ ▶A◀ 8. Shaft

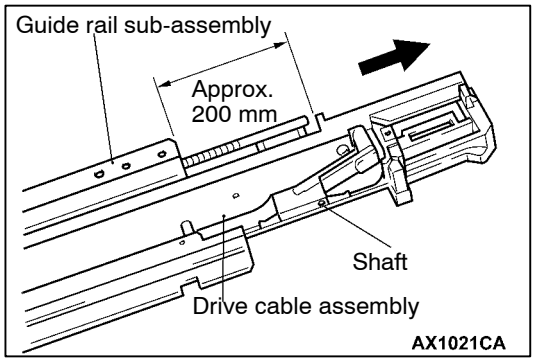
◀A▶ 9. Drive cable

◀B▶ 10. Roof window deflector panel assembly

◀C▶ 11. Deflector

◀C▶ 12. Deflector link

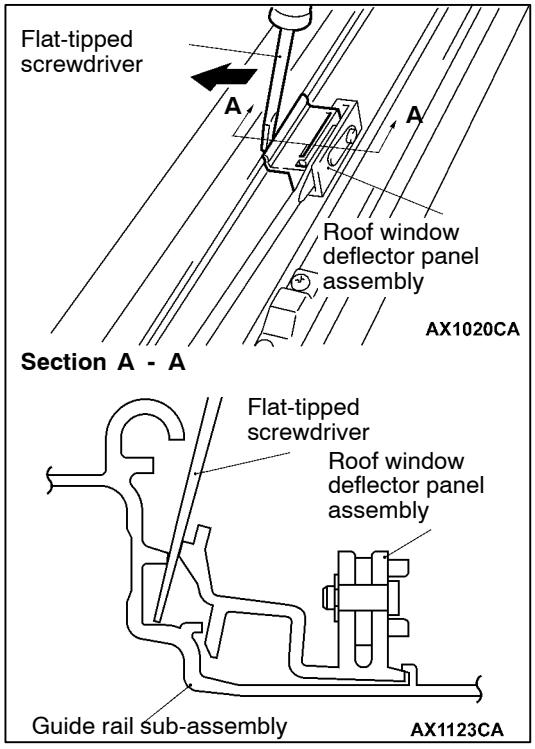
13. Set plate
14. Front cover
15. Cable guide casing
16. Guide rail sub-assembly



DISASSEMBLY SERVICE POINTS

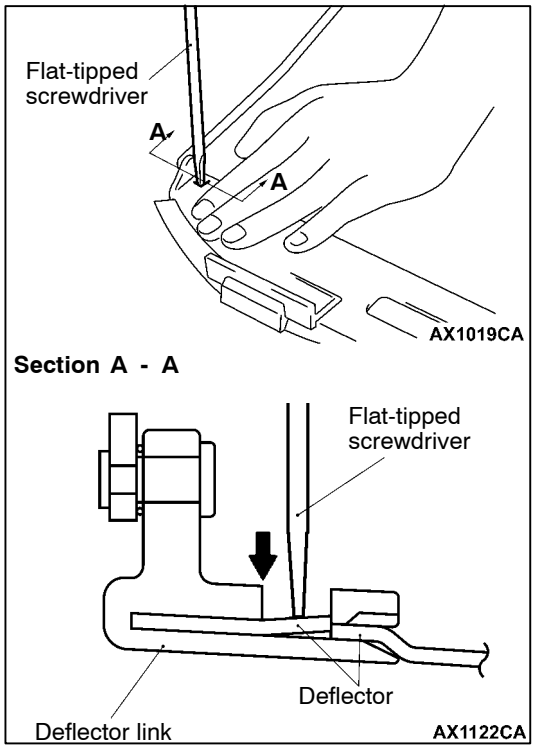
◀A▶ SHAFT/DRIVE CABLE REMOVAL

After pulling out the drive cable assembly as shown in the illustration, remove the shaft and the drive cable.



◀B▶ ROOF WINDOW DEFLECTOR PANEL ASSEMBLY REMOVAL

Twist a flat-tipped screwdriver or similar tool as shown in the illustration to remove the roof window deflector panel assembly.



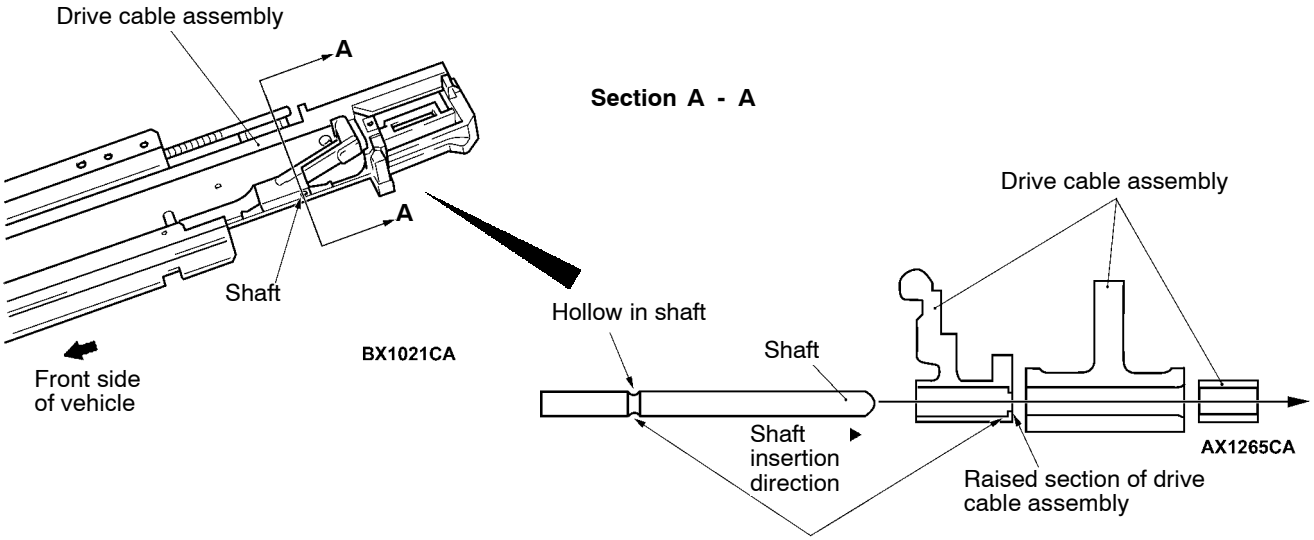
◀C▶ DEFLECTOR/DEFLECTOR LINK REMOVAL

Use a flat-tipped screwdriver or similar tool to separate the deflector and the deflector panel as shown in the illustration.

REASSEMBLY SERVICE POINT

▶A◀ SHAFT INSTALLATION

Working outside the vehicle, install the shaft to the drive cable according to the procedure below.



Insert the shaft until its concave part is engaged with the convex part of the drive cable.

EXTERIOR

Click on the applicable bookmark to selected the required model year.

EXTERIOR

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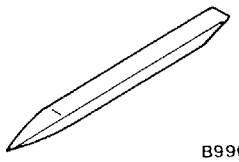
FRONT BUMPER

ADHESIVE

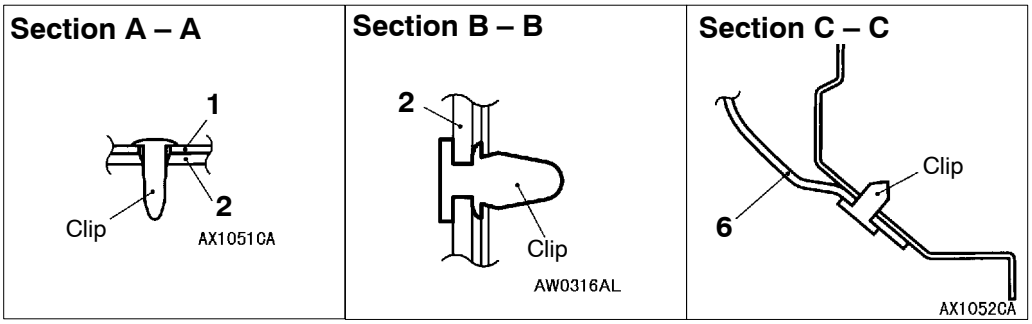
Items	Specified sealant and adhesive
Front bumper side extension	Double-sided tape [5 mm wide and 1.2 mm thick]

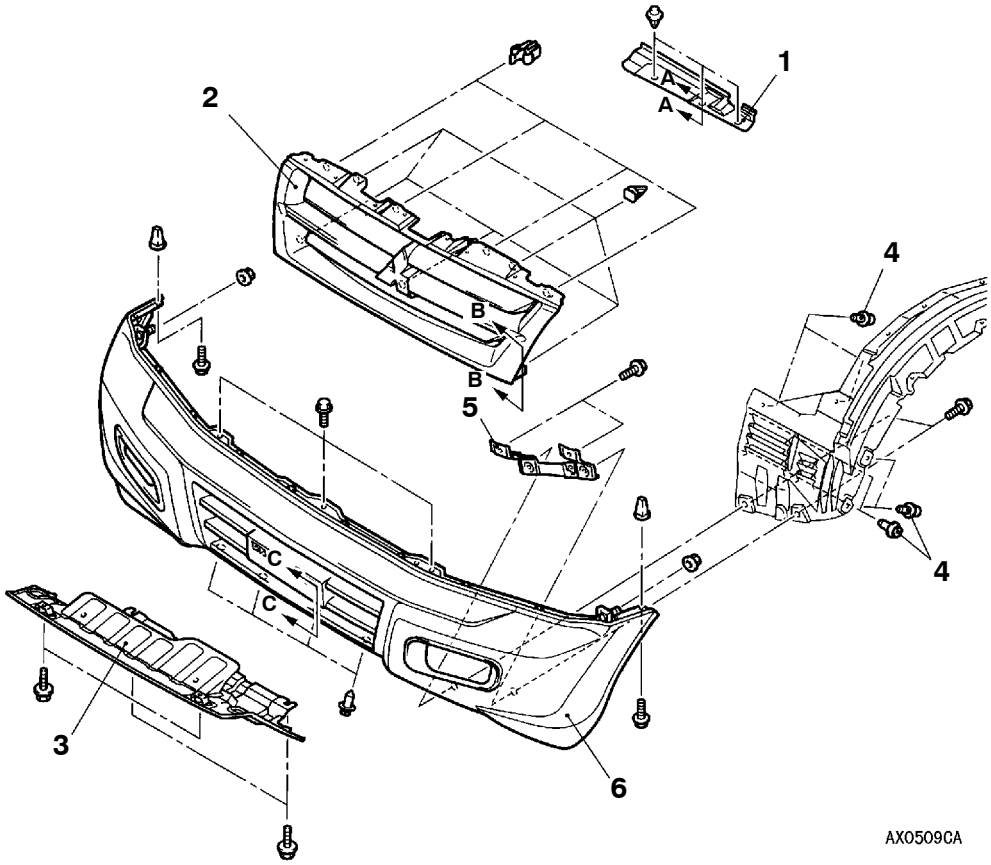
SPECIAL TOOL

Tool	Number	Name	Use
 B990784	MB990784	Ornament remover	Front bumper reinforcement assembly removal

FRONT BUMPER

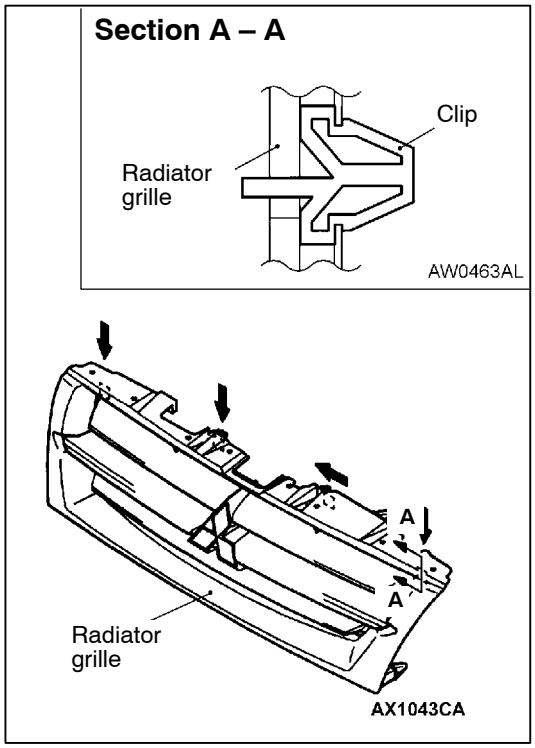
REMOVAL AND INSTALLATION





Removal steps

1. Radiator cover
◀A▶ 2. Radiator grille
3. Skid plate
4. Splash shield mounting clip
5. Front bumper lower stay
● Fog lamp connector connection
6. Front bumper face assembly



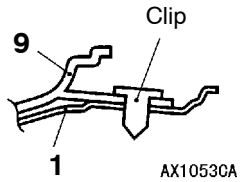
REMOVAL SERVICE POINT

◀A▶ RADIATOR GRILLE REMOVAL

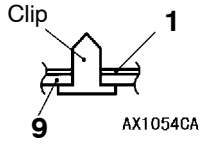
While pulling the radiator grille gently towards you, push the tabs of the clip in the direction of the arrow with a flat-tipped screwdriver to remove the radiator grille.

DISASSEMBLY AND REASSEMBLY

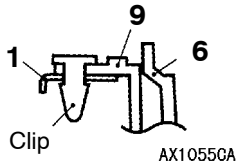
Section A – A



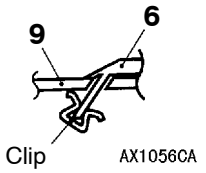
Section B – B



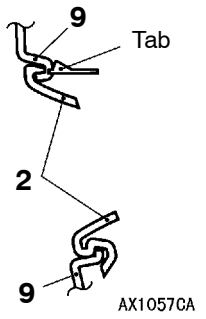
Section C – C

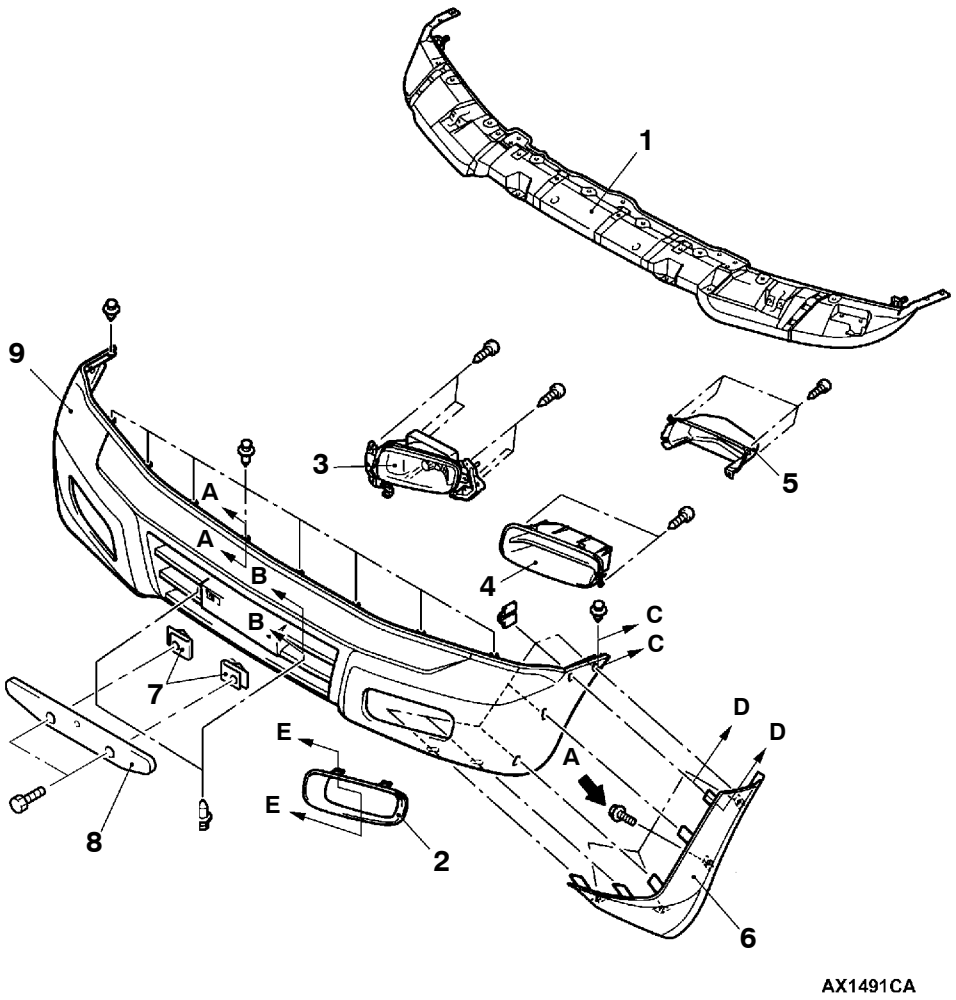


Section D – D

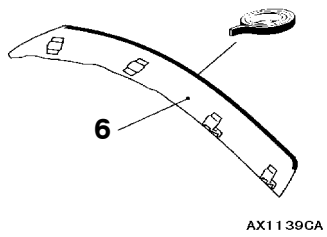


Section E - E





View A



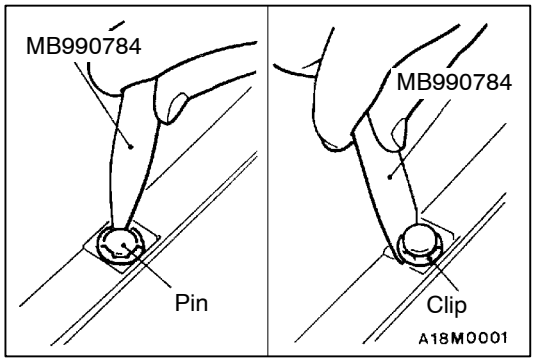
Adhesive tape: Double-side tape [5 mm width and 1.2 mm thickness.]

Disassembly steps

- Headlamp washer

◀A▶ 1. Front bumper reinforcement assembly
2. Fog lamp cover
3. Fog lamp
4. Air blower garnish <Vehicles without fog lamps>
5. Air duct <LH side in vehicles without fog lamps>

◀B▶ ▶A◀ 6. Front bumper side extension
7. Licence plate garnish
8. Licence plate bracket
9. Front bumper face



DISASSEMBLY SERVICE POINTS

◀A▶ FRONT BUMPER REINFORCEMENT ASSEMBLY REMOVAL

1. Use the special tool to lift up the pin in the centre of the clip.
2. Remove the clip.

◀B▶ FRONT BUMPER SIDE EXTENSION REMOVAL

Remove by the same procedure as given in FRONT DOOR MOULDING, FRONT WHEEL CUT MOULDING, REAR WHEEL CUT MOULDING AND REAR DOOR MOULDING REMOVAL. (Refer to P.51-14.)

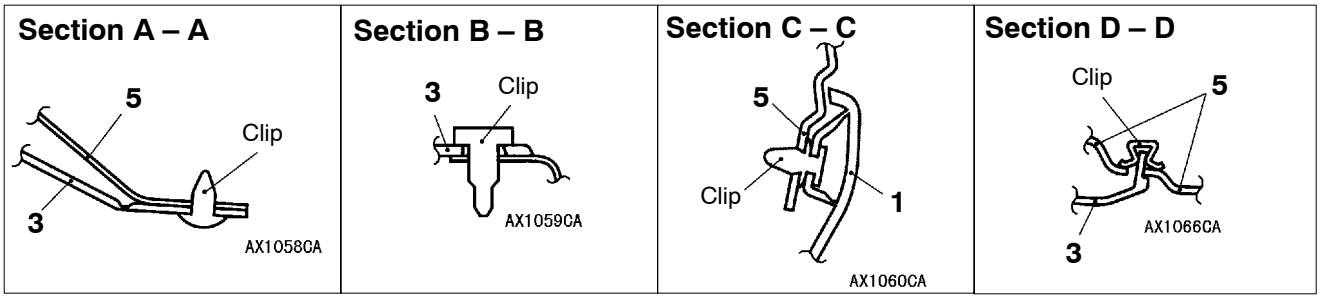
REASSEMBLY SERVICE POINT

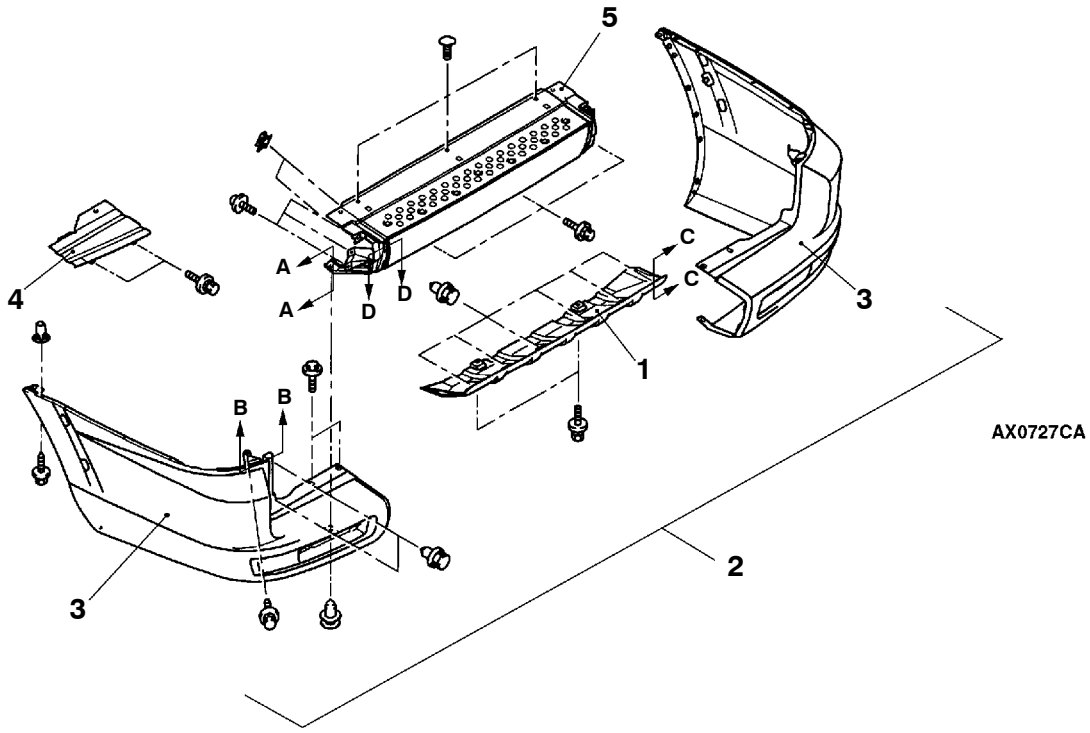
▶A◀ FRONT BUMPER EXTENSION INSTALLATION

Install by the same procedure as given in FRONT DOOR MOULDING, FRONT WHEEL CUT MOULDING, REAR WHEEL CUT MOULDING AND REAR DOOR MOULDING INSTALLATION. (Refer to P.51-14.)

REAR BUMPER

REMOVAL AND INSTALLATION





Rear bumper assembly removal steps

1. Rear bumper center lower face
2. Rear bumper assembly

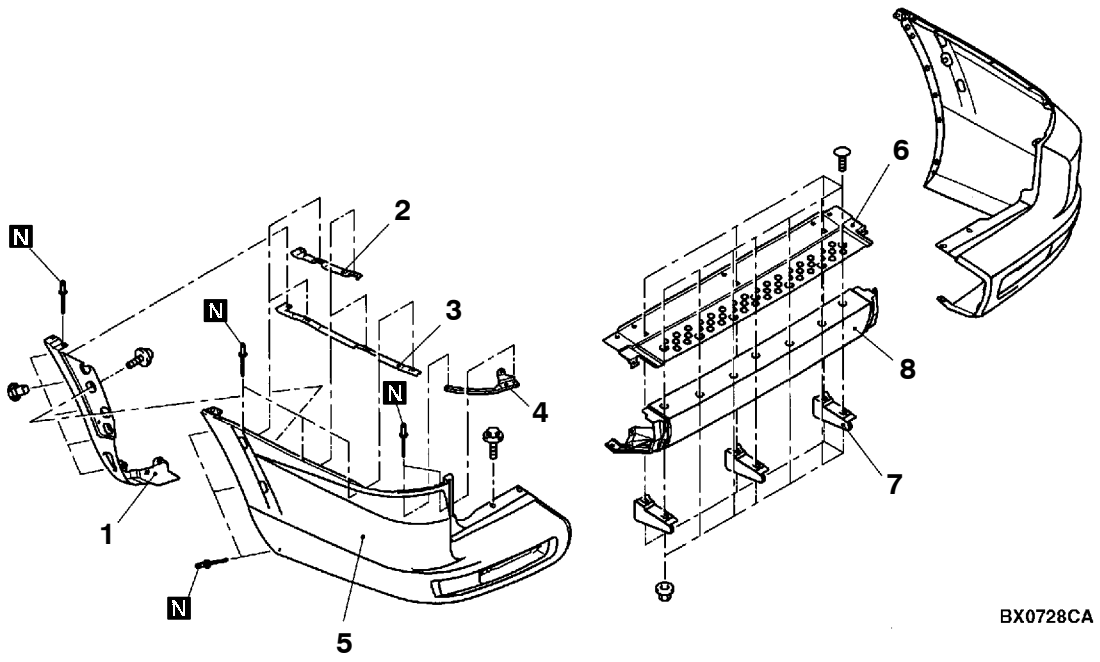
Rear bumper side face assembly removal steps

1. Rear bumper center lower face
3. Rear bumper side face assembly
4. Rear bumper side reinforcement

Rear bumper center face assembly removal steps

1. Rear bumper center lower face
3. Rear bumper side face assembly
5. Rear bumper center face assembly

DISASSEMBLY AND REASSEMBLY



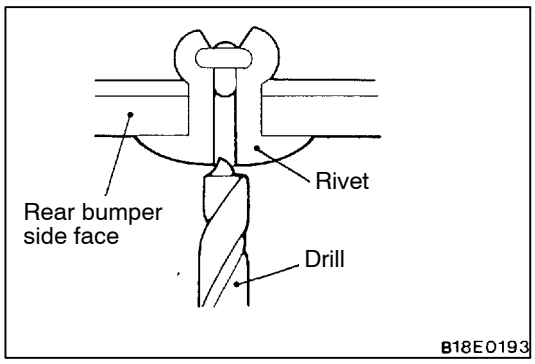
Rear bumper side face assembly disassembly steps

◀A▶ ▶A◀ 1. Rear mudguard reinforcement
◀A▶ ▶A◀ 2. Rear bumper side retainer (Short wheelbase)
◀A▶ ▶A◀ 3. Rear bumper side retainer (Long wheelbase)
◀A▶ ▶A◀ 4. Rear bumper corner bracket
- Rear lamp and rear lamp bracket (Refer to GROUP 54A.)

5. Rear bumper side face

Rear bumper center face assembly disassembly steps

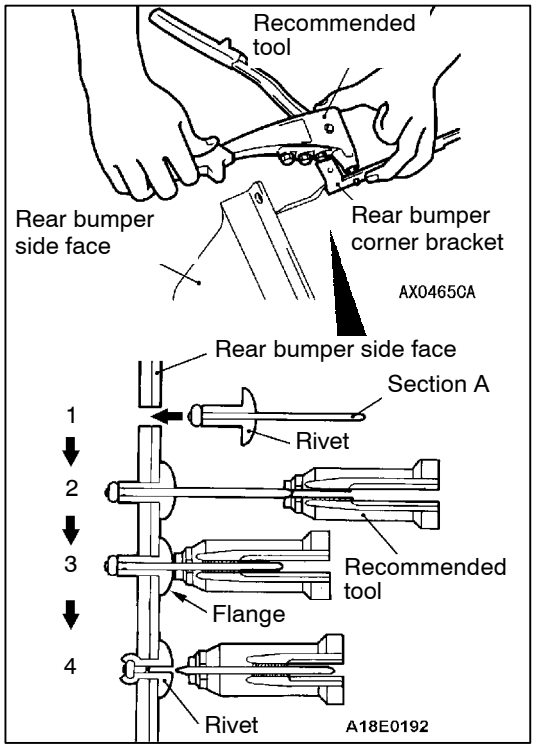
6. Rear bumper step plate
7. Rear bumper center face stay
8. Rear bumper center face



DISASSEMBLY SERVICE POINT

◀A▶ REAR MUDGUARD REINFORCEMENT, REAR BUMPER SIDE SILL RETAINER AND REAR BUMPER CORNER BRACKET REMOVAL

Use a drill (4.5 mm diameter) to make a hole in the rivet to break it, and then remove the rivet.



REASSEMBLY SERVICE POINT

▶A◀ REAR MUDGUARD REINFORCEMENT, REAR BUMPER SIDE SILL RETAINER AND REAR BUMPER CORNER BRACKET INSTALLATION

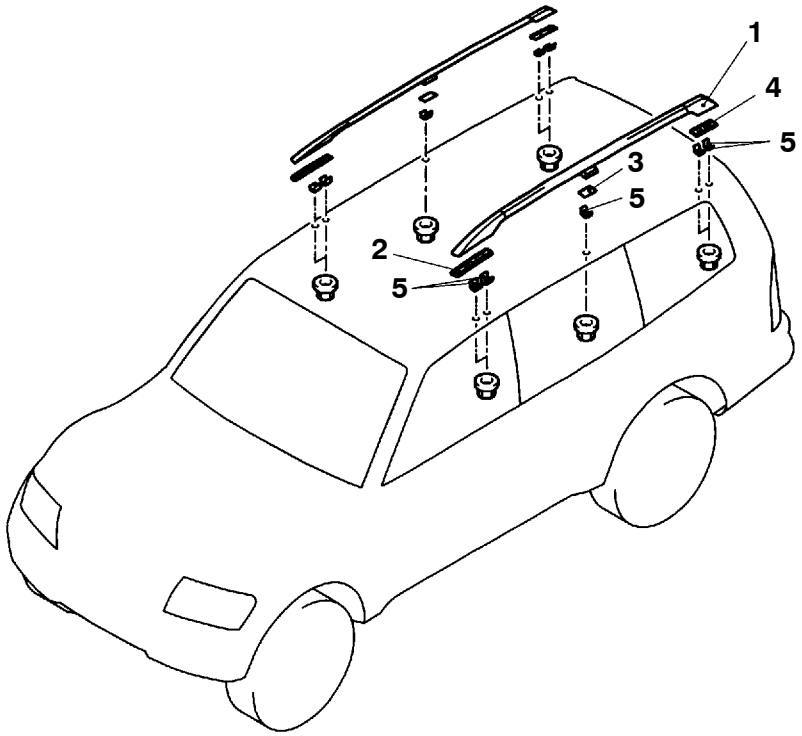
Use the recommended tool shown in the illustration to connect the rivet by the following procedure.

1. Insert the rivet into the base material (rear bumper side face, rear mudguard reinforcement, rear bumperside reinforcement or rear bumper corner bracket).
2. Place the recommended tool over section A of the rivet.
3. While pushing the flange surface of the rivet with the recommended tool, press the handle of the tool.
4. The thin part of section A of the rivet will break and the rivet will then be attached.

ROOF RAIL

ROOF RAIL

REMOVAL AND INSTALLATION



Removal steps

- Head lining
- Set bracket (Refer to GROUP 42 - Sunroof.)

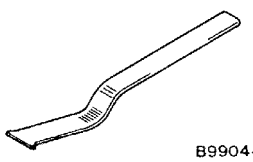
1. Roof rail assembly
2. Roof rail front seal
3. Roof rail center seal
4. Roof rail rear seal
5. Roof rail seal

MOULDING

ADHESIVE

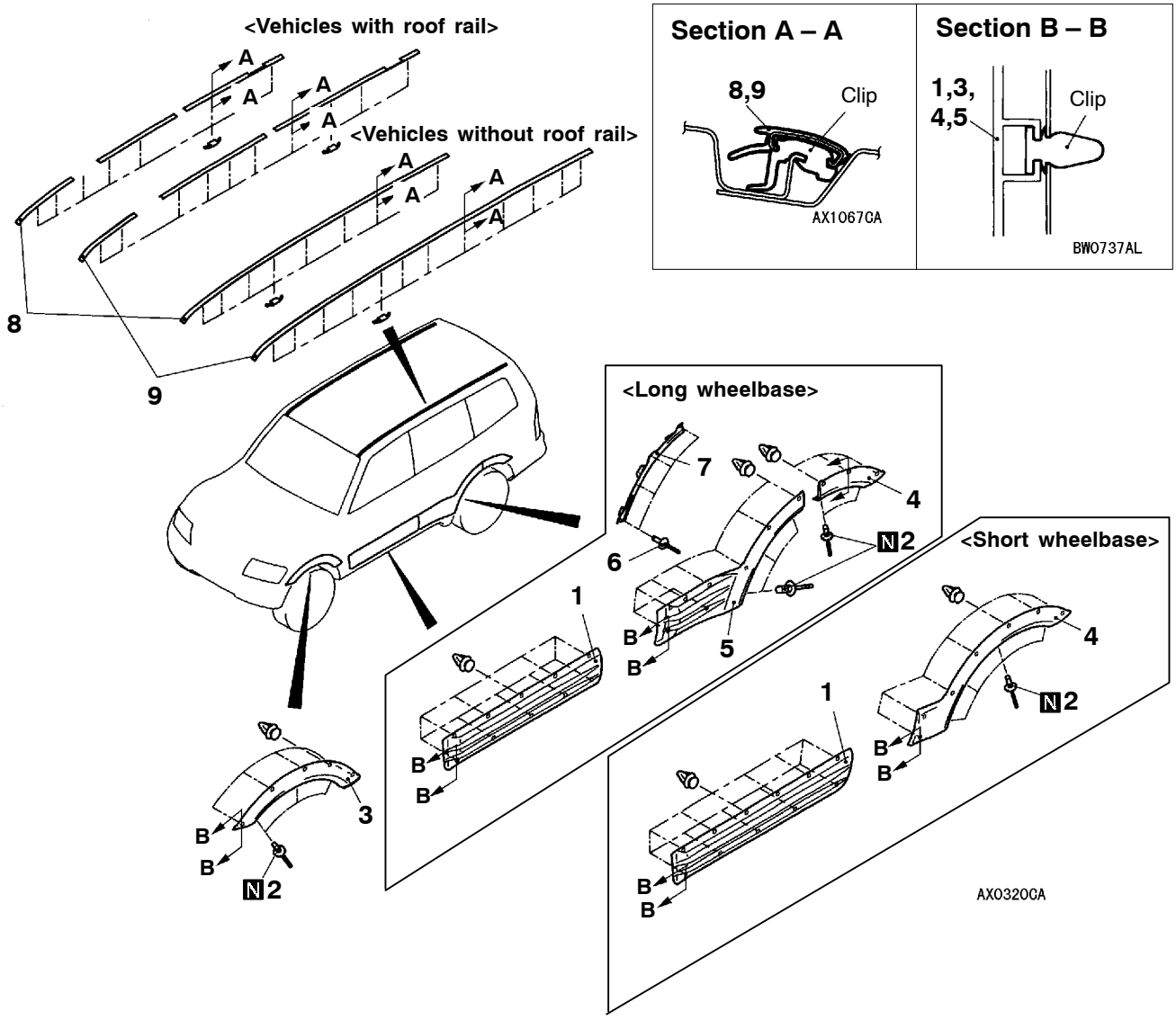
Items	Specified sealant and adhesive
Wheel cut moulding and door moulding	Double-sided tape [4 mm width and 1.2 mm thickness, 12 mm width and 1.2 mm thickness, 5 mm width and 1.2 mm thicknes.]

SPECIAL TOOL

Tools	No.	Name	Application
	MB990449	Window moulding remover	Roof drip moulding removal

MOULDING

REMOVAL AND INSTALLATION



◀A▶ ▶A◀ 1. Front door moulding

Front wheel cut moulding removal steps

◀B▶ ▶B◀ 2. Rivet A
◀A▶ ▶A◀ 3. Front wheel cut moulding

Rear wheel cut moulding removal steps

◀B▶ ▶B◀ 2. Rivet A
◀A▶ ▶A◀ 4. Rear wheel cut moulding

Rear door moulding removal steps

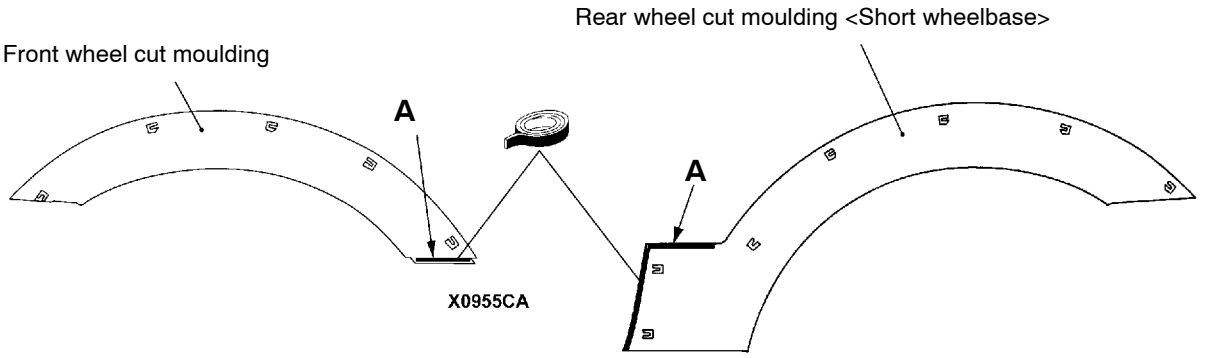
◀B▶ ▶B◀ 2. Rivet A
◀A▶ ▶A◀ 5. Rear door moulding
◀B▶ ▶C◀ 6. Rivet B
◀A▶ ▶A◀ 7. Rear door moulding bracket

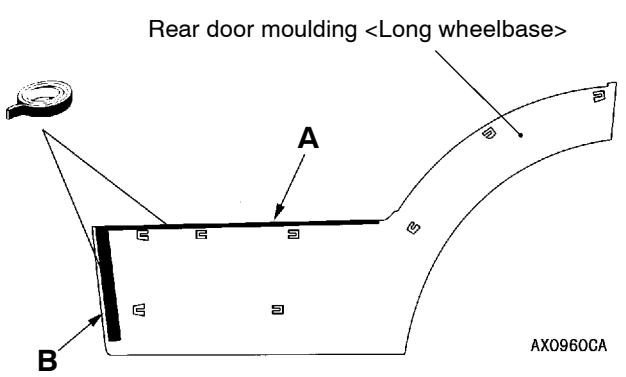
Roof drip moulding removal steps

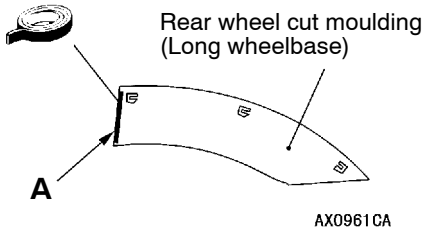
- Roof rail assembly

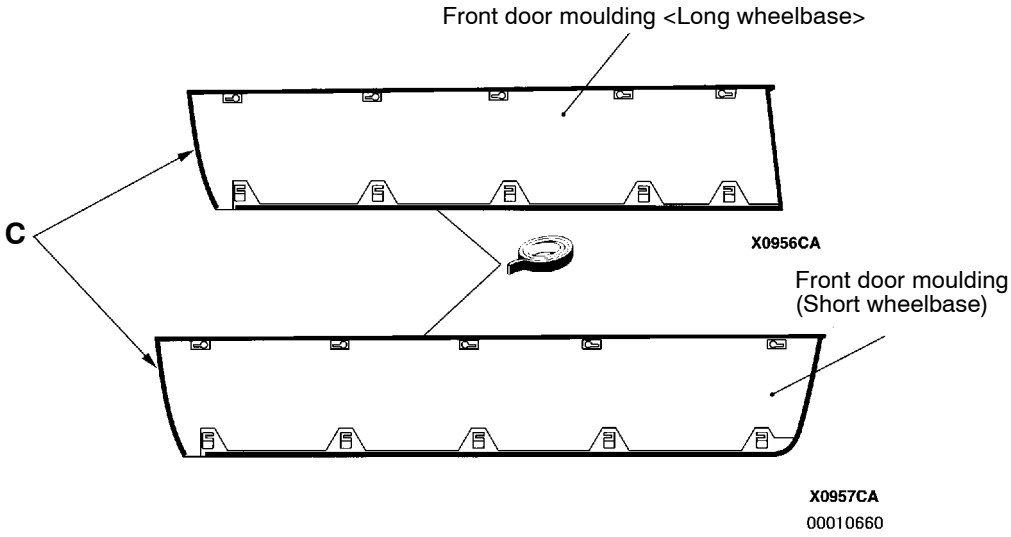
◀C▶ 8. Roof drip moulding <Short wheelbase>
◀C▶ 9. Roof drip moulding <Long wheelbase>

Double-sided tape application locations

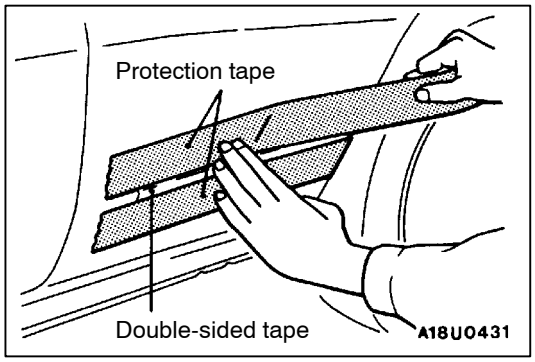








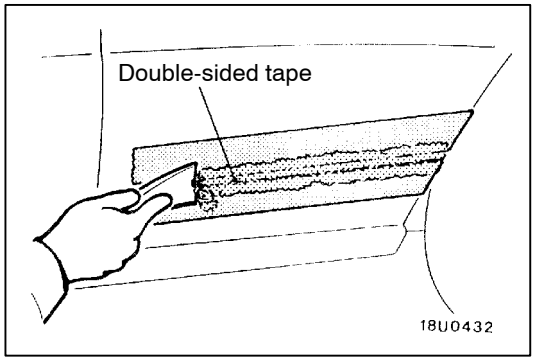
Adhesive tape: Double-side tape [A: 4 mm width and 1.2 mm thickness, B: 12 mm width and 1.2 mm thickness, C: 5 mm width and 1.2 mm thickness.]



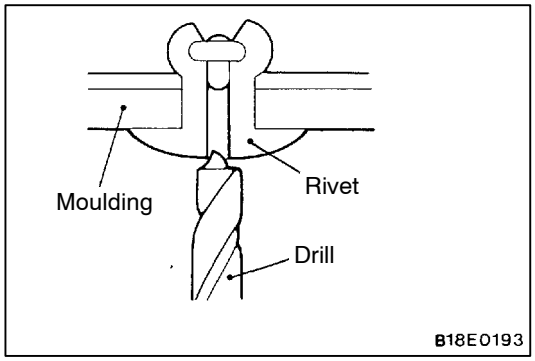
REMOVAL SERVICE POINTS

◀A▶ FRONT DOOR MOULDING, FRONT WHEEL CUT MOULDING, REAR WHEEL CUT MOULDING AND REAR DOOR MOULDING REMOVAL

1. Attach protection tape all the way along the edges of the double-sided tape which is still adhering to the body.

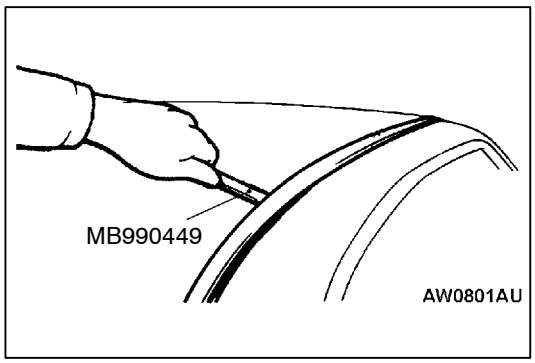


2. Use a resin spatula to scrape off the double-sided tape.
3. Peel off the protection tape.
4. Wipe the body surface and clean it with a rag moistened with isopropyl alcohol.



◀B▶ RIVET A AND B REMOVAL

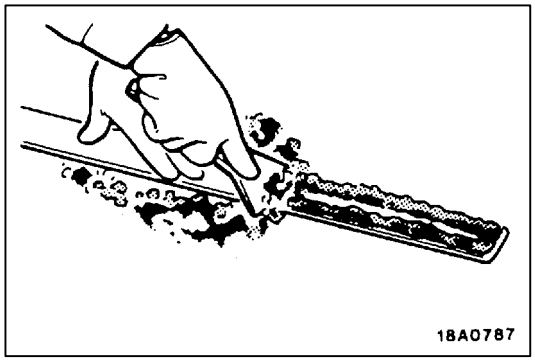
Use a drill (with a 4.0 mm bit for rivet A, or a 6.5 mm bit for rivet B) to make a hole in the rivet to break it, and then remove the rivet.



◀C▶ ROOF LID MOULDING REMOVAL

Use the special tool to remove the moulding from the rear of the vehicle by twisting it.

Caution
If the moulding becomes deformed, it should not be re-used.



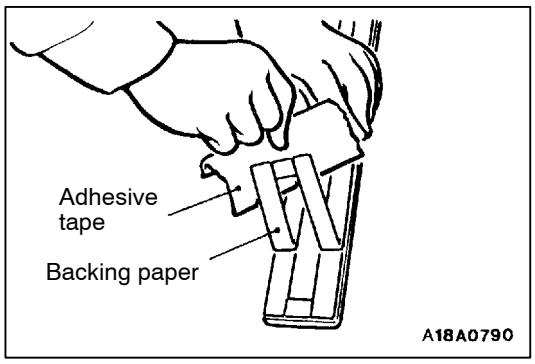
INSTALLATION SERVICE POINTS

▶A◀ FRONT DOOR MOULDING, FRONT WHEEL CUT MOULDING, REAR WHEEL CUT MOULDING AND REAR DOOR MOULDING INSTALLATION

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

1. Scrape off the double-sided tape with a resin spatula or gasket scraper.

2. Wipe off the moulding adhesion surface and clean it with a shop towel moistened with isopropyl alcohol.
3. Affix the specified double sided tape to the moulding. (Refer to P.51-13.)



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.51-13.)

5. Install the 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 moulding.

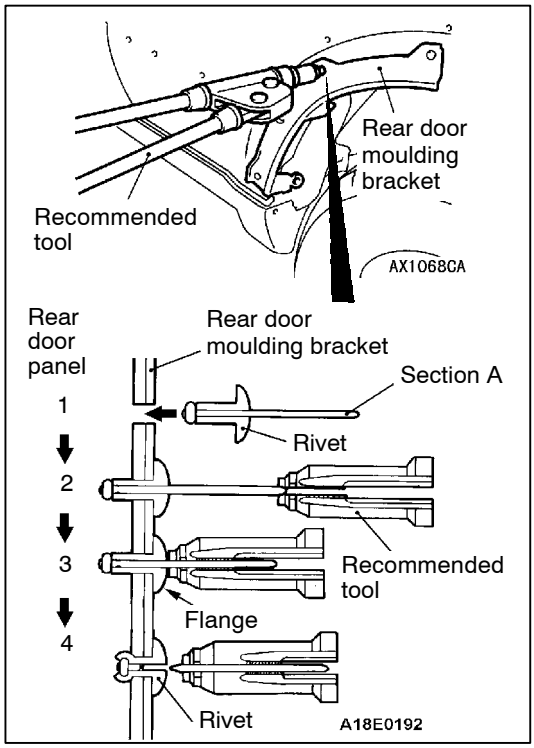
   Body 40 - 60°C

   Moulding 20 - 30 °C

   Apply pressure fully to the moulding.

▶B◀ RIVET A INSTALLATION

Install by the same procedure as for REAR MUDGUARD REINFORCEMENT, REAR BUMPER SIDE RETAINER, REAR BUMPER CORNER BRACKET INSTALLATION. (Refer to P.51-9.)



▶C◀ RIVET B INSTALLATION

Use the recommended tool shown in the illustration to connect the rivet by the following procedure.

1. Insert the rivet into the base material (vehicle body or rear door moulding bracket).
2. Place the recommended tool over section A of the rivet.
3. While pushing the flange surface of the rivet with the recommended tool, press the handle of the tool.
4. The thin part of section A of the rivet will break and the rivet will then be attached.

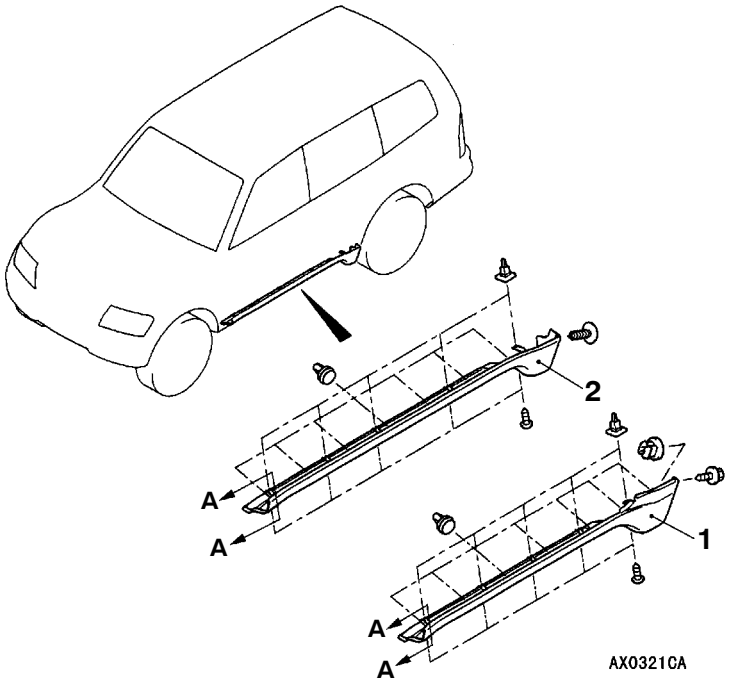
GARNISH

ADHESIVE

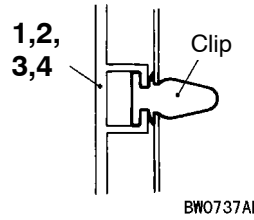
Items	Specified sealant and adhesive
Side sill garnish	Double-sided tape [4 mm width and 1.2 mm thickness.]

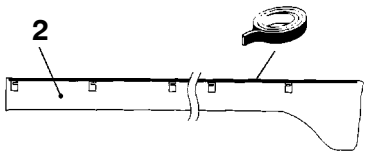
GARNISH

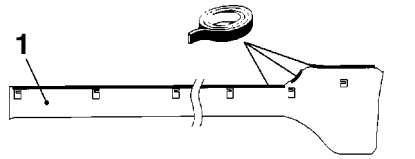
REMOVAL AND INSTALLATION



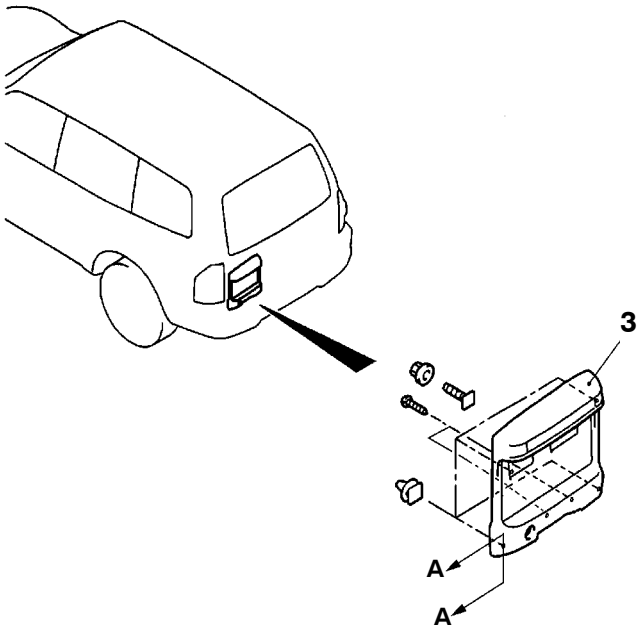
Section A – A







Adhesive tape: Double-side tape [4 mm width and 1.2 mm thickness.]



Side sill garnish removal steps

- Side step
- Front mudguard

◀A▶ ▶A◀ 1. Side sill garnish <Short wheelbase>
◀A▶ ▶A◀ 2. Side sill garnish <Long wheelbase>

Licence plate garnish removal steps

- Toolbox bracket, upper (Refer to GROUP 42 - Back door trim and waterproof film.)
- Licence lamp (Refer to GROUP 54A.)

3. Licence plate garnish

REMOVAL SERVICE POINT

◀A▶ SIDE SILL GARNISH REMOVAL

Remove by the same procedure as given in FRONT DOOR MOULDING, FRONT WHEEL CUT MOULDING, REAR WHEEL CUT MOULDING AND REAR DOOR MOULDING REMOVAL. (Refer to P.51-14.)

INSTALLATION SERVICE POINT

▶A◀ SIDE SILL GARNISH INSTALLATION

Install by the same procedure as given in FRONT DOOR MOULDING, FRONT WHEEL CUT MOULDING, REAR WHEEL CUT MOULDING AND REAR DOOR MOULDING INSTALLATION. (Refer to P.51-14.)

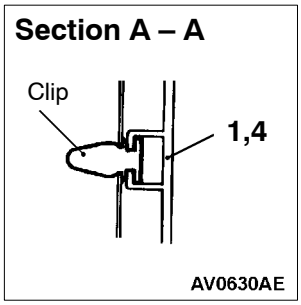
MUDGUARD

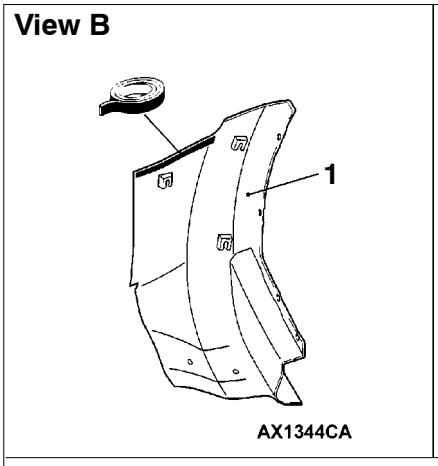
ADHESIVE

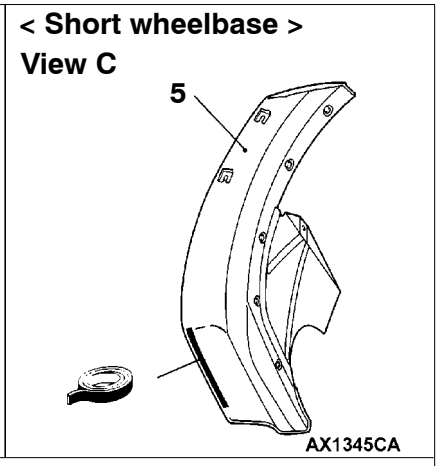
Items	Specified sealant and adhesive
Front mudguard	Double-sided tape [5 mm wide and 0.8mm thick]
Rear mudguard <Short wheelbase>	

MUDGUARD

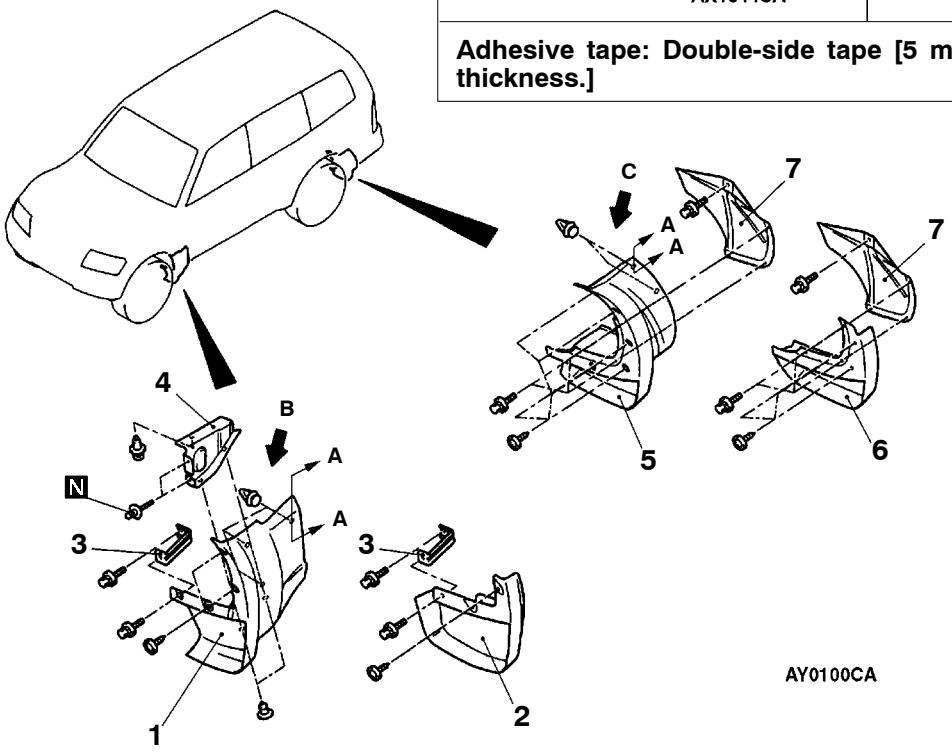
REMOVAL AND INSTALLATION







Adhesive tape: Double-side tape [5 mm width and 0.8 mm thickness.]



Front mudguard removal steps

◀A▶ ▶A◀ 1. Front mudguard (wide type)
2. Front mudguard (standard type)
3. Front mudguard bracket
◀B▶ ▶B◀ 4. Front mudguard cover

Rear mudguard removal steps

◀A▶ ▶A◀ 5. Rear mudguard (wide type)
6. Rear mudguard (standard type)
7. Rear mudguard protector

REMOVAL SERVICE POINTS

◀A▶ FRONT MUDGUARD, REAR MUDGUARD REMOVAL

Remove by the same procedure as given in FRONT DOOR MOULDING, FRONT WHEEL CUT MOULDING, REAR WHEEL CUT MOULDING AND REAR DOOR MOULDING REMOVAL. (Refer to P.51-14.)

◀B▶ FRONT MUDGUARD COVER REMOVAL

Remove by the same procedure as for REAR MUDGUARD REINFORCEMENT, REAR BUMPER SIDE RETAINER, REAR BUMPER CORNER BRACKET REMOVAL. (Refer to P.51-10.)

INSTALLATION SERVICE POINTS

▶A◀ FRONT MUDGUARD, REAR MUDGUARD INSTALLATION

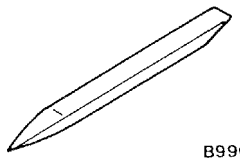
Install by the same procedure as given in FRONT DOOR MOULDING, FRONT WHEEL CUT MOULDING, REAR WHEEL CUT MOULDING AND REAR DOOR MOULDING INSTALLATION. (Refer to P.51-14.)

▶B◀ FRONT MUDGUARD COVER INSTALLATION

Install by the same procedure as for REAR MUDGUARD REINFORCEMENT, REAR BUMPER SIDE RETAINER, REAR BUMPER CORNER BRACKET INSTALLATION. (Refer to P.51-10.)

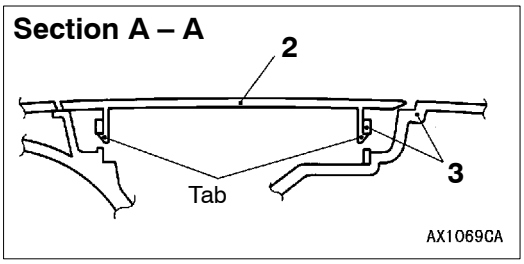
REAR DEFLECTOR

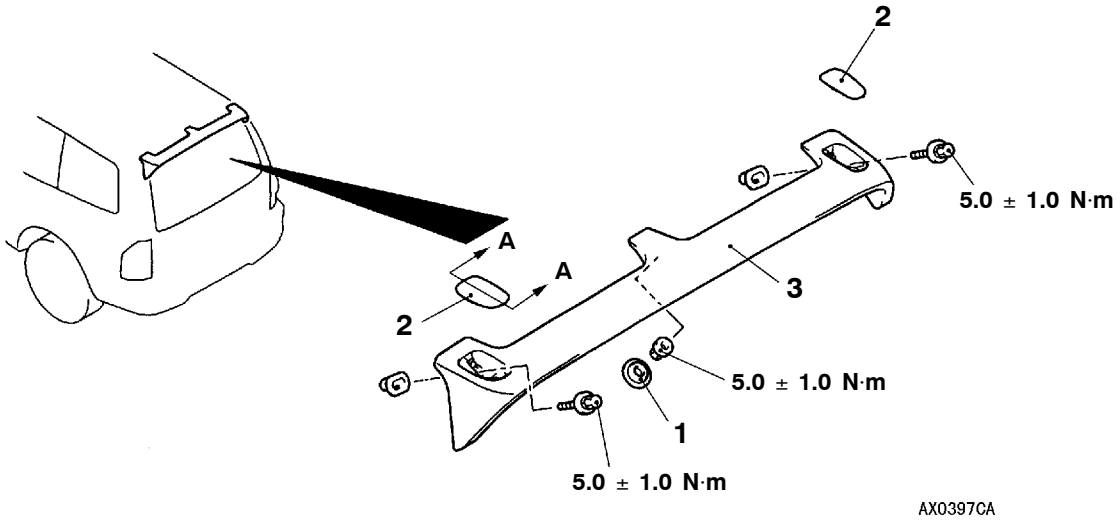
SPECIAL TOOL

Tools	Number	Name	Use
 B990784	MB990784	Ornament remover	Rear deflector cover removal

REAR DEFLECTOR

REMOVAL AND INSTALLATION

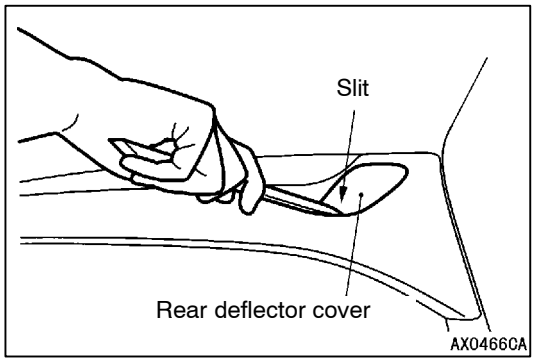




Rear deflector removal steps
1. Resin plug

◀A▶

2. Rear deflector cover
3. Rear deflector



REMOVAL SERVICE POINT

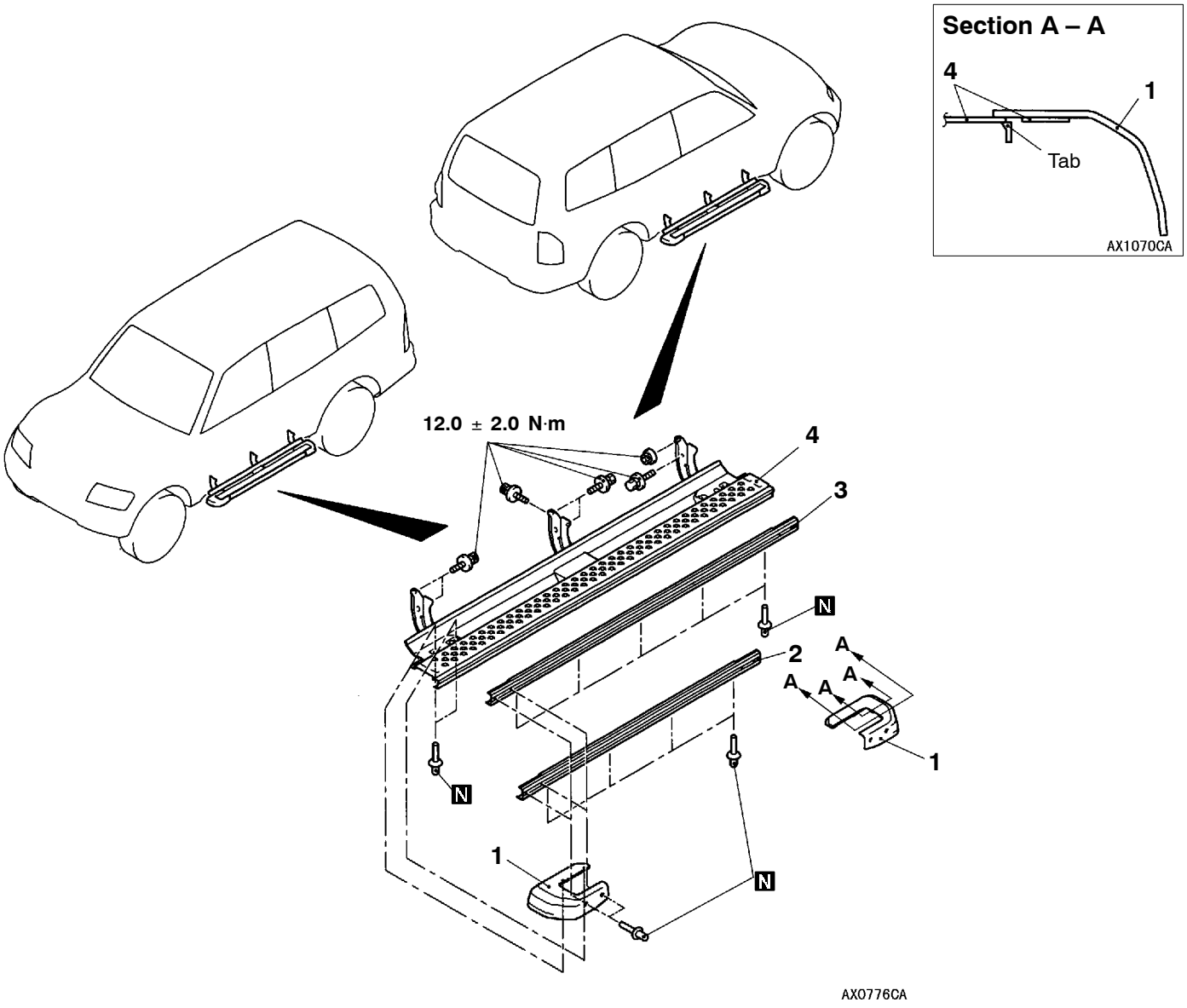
◀A▶ REAR DEFLECTOR COVER REMOVAL

1. Insert the special tool into the slit on the rear deflector cover.
2. Release the tab by prying it towards the frot of the vehicle.

SIDE STEP

SIDE STEP

REMOVAL AND INSTALLATION



Side step removal steps

◀A▶ ▶A◀ 1. Side step cover
◀A▶ ▶A◀ 2. Non-slip cover <Short wheelbase>
◀A▶ ▶A◀ 3. Non-slip cover <Long wheelbase>
4. Side step assembly

REMOVAL SERVICE POINT

◀A▶ SIDE STEP COVER, NON-SLIP COVER REMOVAL

Remove by the same procedure as for REAR MUDGUARD REINFORCEMENT, REAR BUMPER SIDE RETAINER, REAR BUMPER CORNER BRACKET REMOVAL. (Refer to P.51-9.)

INSTALLATION SERVICE POINT

▶A◀ SIDE STEP COVER, NON-SLIP COVER INSTALLATION

Install by the same procedure as for REAR MUDGUARD REINFORCEMENT, REAR BUMPER SIDE RETAINER, REAR BUMPER CORNER BRACKET INSTALLATION. (Refer to P.51-10.)

WINDSHIELD WIPER AND WASHER

SERVICE SPECIFICATIONS

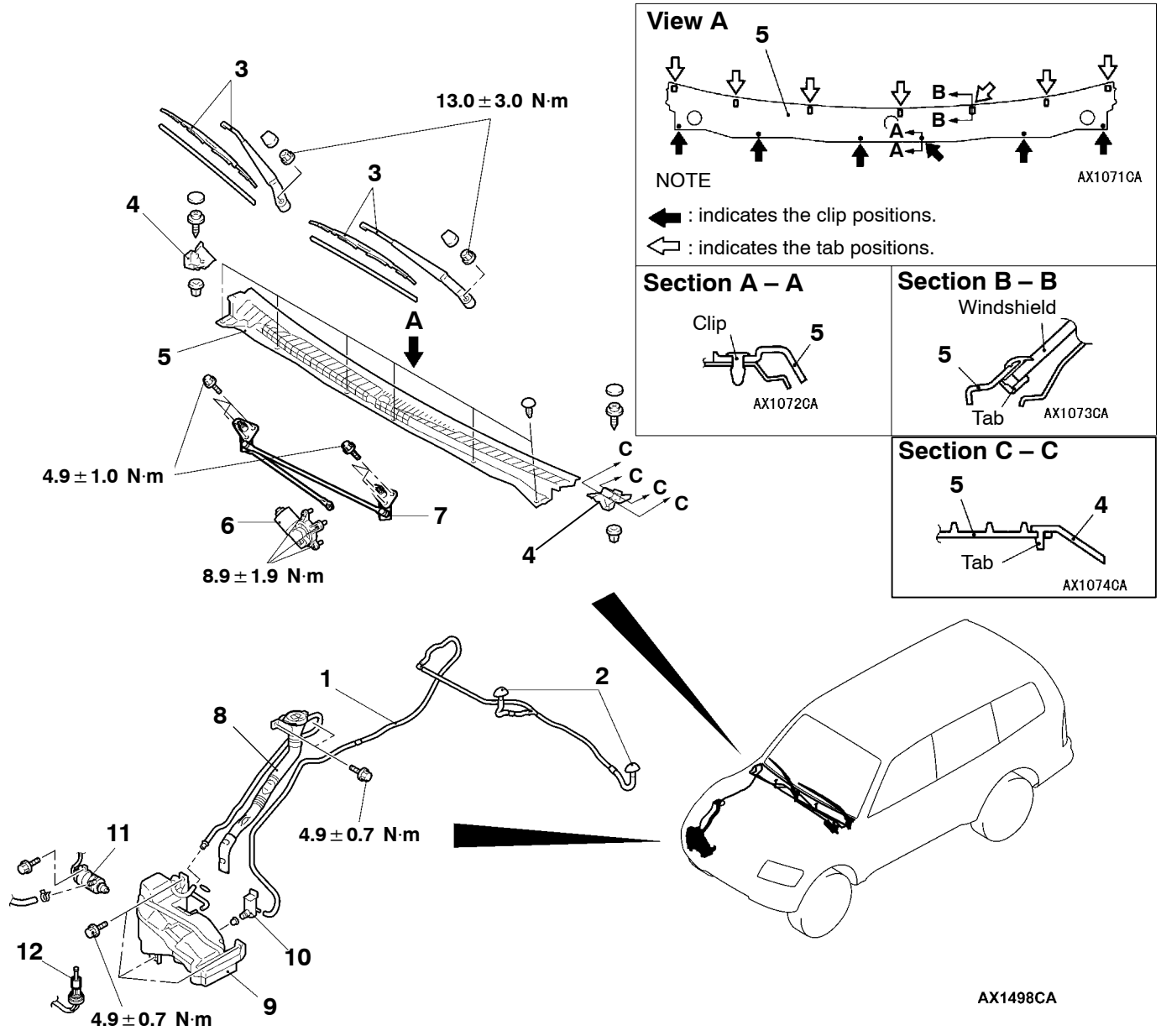
Items		Standard value
Park position of the windshield wiper arm and blade assembly (Distance from end of wiper blade to end of front deck garnish) mm	Driver's side	20 - 30
	Passenger's side	25 - 35

TROUBLESHOOTING

The windshield wiper and washer is controlled by the SWS (Smart Wiring System). For troubleshooting procedures, refer to GROUP 54B - SWS Diagnosis.

WINDSHIELD WIPER AND WASHER

REMOVAL AND INSTALLATION



1. Windshield washer hose assembly
2. Windshield washer nozzle

Windshield wiper motor assembly and link assembly removal steps

▶A◀ 3. Windshield wiper arm and blade assembly
4. Front deck side garnish
5. Front deck garnish

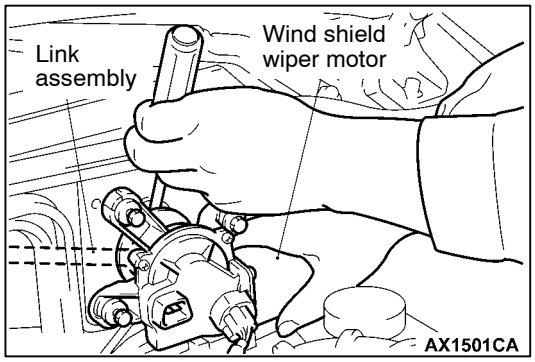
◀A▶ 6. Windshield wiper motor assembly
7. Link assembly

Windshield washer tank removal steps

- Front bumper face assembly (Refer to P.51- 4.)
- Headlamp assembly (Refer to GROUP 54A.)

8. Inlet assembly
9. Windshield washer tank assembly
10. Windshield washer motor
11. Headlamp washer motor
12. Washer fluid level sensor

NOTE
For the removal and installtion of the wiper and washer switch, refer to GROUP 54A - Colum switch.

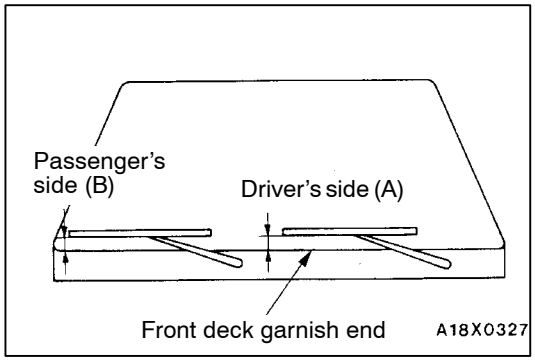


REMOVAL SERVICE POINT

◀A▶ WINDSHIELD WIPER MOTOR ASSEMBLY REMOVAL

1. Remove the windshield wiper motor assembly mounting bolts.
2. Use a flat-tipped screwdriver to separate the clamp arm of the windshield wiper motor assembly and the link assembly,and then remove the windshield wiper motor assembly.

Caution
The automatic stop angle is determined at the time that the clamp arm and the windshield wiper motor assembly areinstalled together, and so they should not be disassembled unless required.
Make markings on the vehicle body before removing the windshield wiper motor assembly.

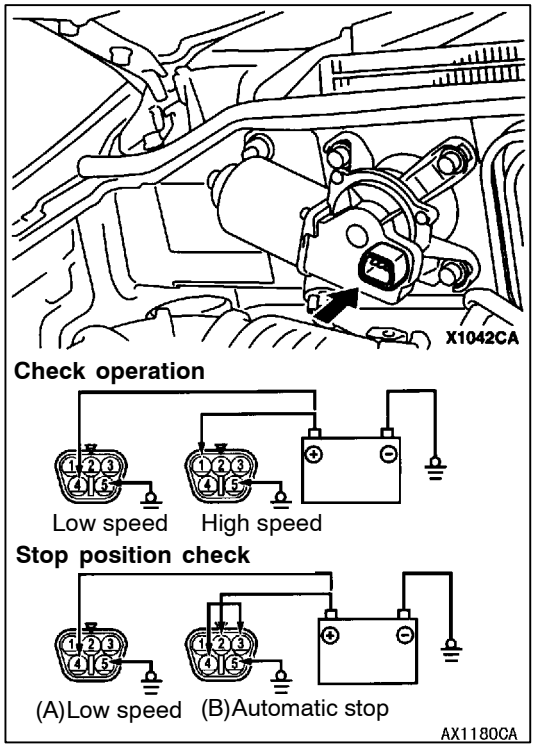


INSTALLATION SERVICE POINT

▶A◀ WINDSHIELD WIPER ARM AND BLADE ASSEMBLY INSTALLATION

Install the wiper blade in the specified position (standard value).

Standard value:
Driver's side (A) 20 - 30 mm
Passenger's side (B) 25 - 35 mm



INSPECTION

WINDSHIELD WIPER MOTOR ASSEMBLY CHECK

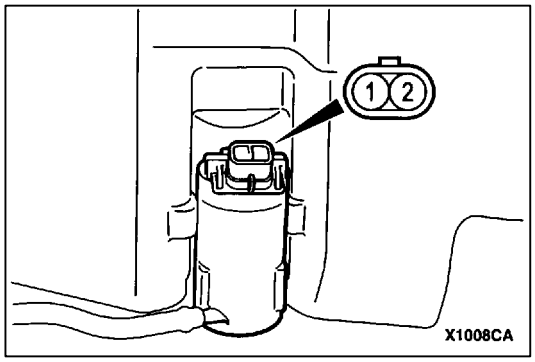
The windshield wiper motor assembly should be installed to the vehicle body and the harness connector should be disconnected when checking the wiper motor.

- **Low Speed and High Speed Wiper Motor Operation Check**

  Connect the battery to the wiper motor as shown in the illustration, and then check the operation of the wiper motor at low speed and at high speed.

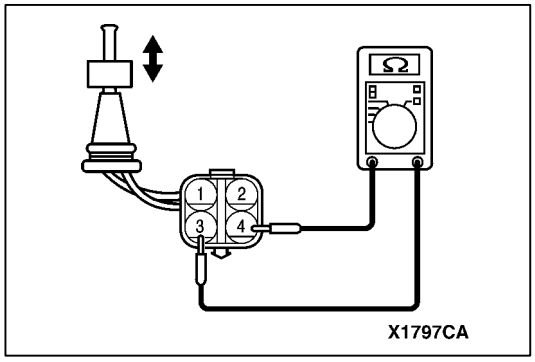
- **Windshield Wiper Motor Assembly Stop Position Check**

  1. Connect the battery to the wiper motor as shown in illustration (A), and then run the wiper motor at low speed. Then, while the motor is operating, disconnect the battery to make the wiper motor stop.
  2. Connect the terminals and the battery as shown in illustration (B), and then check whether the wiper motor automatically stops in the correct stop position after it has been running at low speed.



WINDSHIELD WASHER MOTOR CHECK

1. The windshield washer tank assembly should be installed and the windshield washer tank should be filled with water whenchecking the washer motor.
2. Check that water is circulated strongly when system voltage is applied to terminal (2) and terminal (1) is earthed.



WASHER FLUID LEVEL CHECK

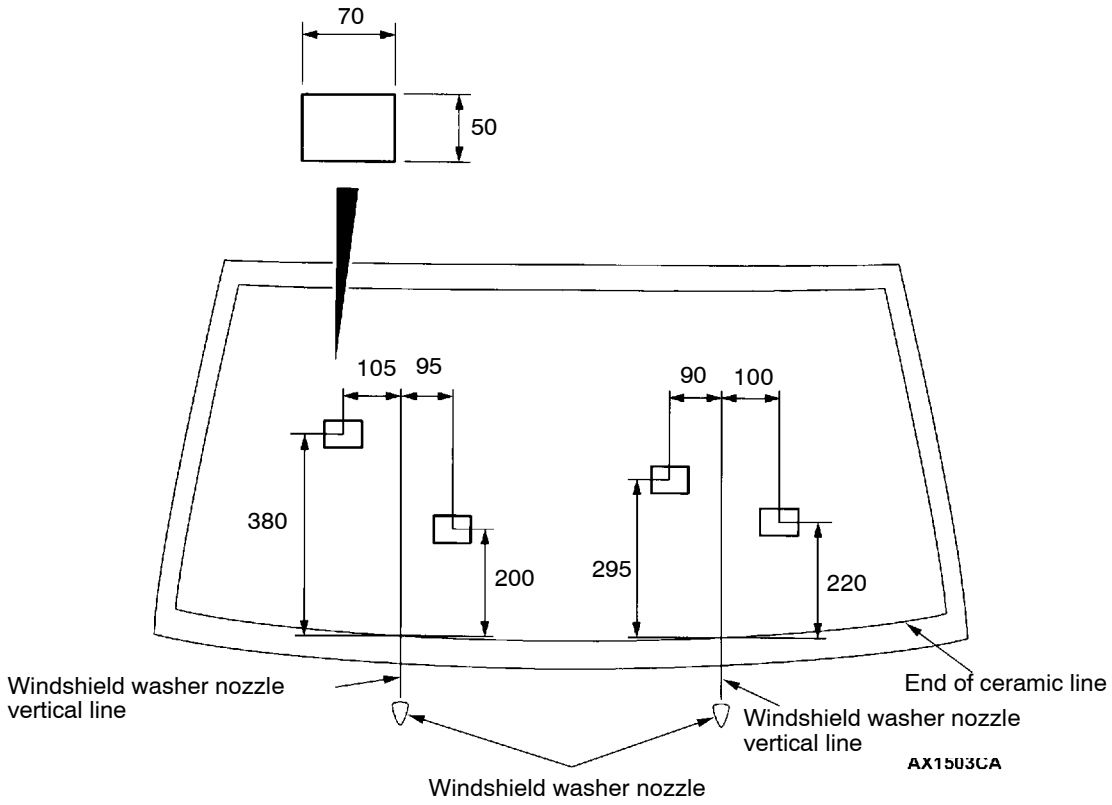
1. Connect a circuit tester to the connector of the level sensor as shown.
2. Check that when the float is moved down,the circuit is closed and that when the float is moved up,the circuit is opened.

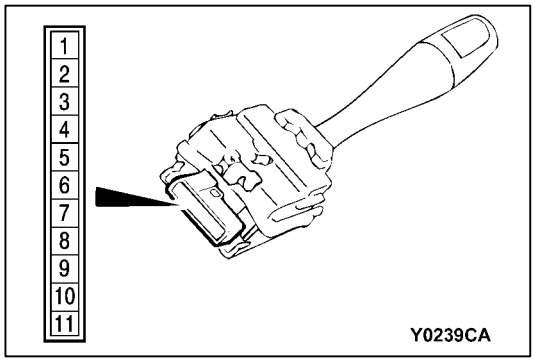
WINDSHIELD WASHER NOZZLE SPRAY POSITION CHECK

Move the nozzle to adjust so that the water is sprayed out within the range shown in the illustration.

Caution
On R.H. drive vehicles, the illustration is symmetrical.

Units: mm





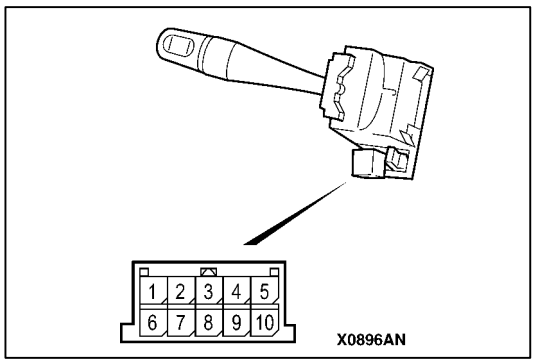
WINDSHIELD WIPER AND WINDSHIELD WASHER SWITCH AND WINDSHIELD INTERMITTENT WIPER INTERVAL ADJUSTING KNOB CHECK

<L.H. drive vehicles>

1. Windshield wiper and washer switch,rear wiper and washer switch

Switch position	Terminal No.					
	6	7	8	9	10	11
OFF						
Windshield wiper mist switch ON	○					○
Windshield intermittent wiper switch ON	○				○	
Windshield low-speed wiper switch ON	○			○		
Windshield high-speed wiper switch ON	○		○			
Windshield washer switch ON	○	○				

2. Windshield intermittent wiper interval adjusting knob
   Measure the resistance value at terminal numbers 3 and 6. The resistance value should rise smoothly from approximately 0 Ω (“FAST” position) to apporoximately 1 kΩ (“SLOW” position).



<R.H.drive vehicles>

WINDSHIELD INTERMITTENT WIPER INTERVAL ADJUSTING KNOB

Measure the resistance value at terminal numbers 4 and 6. The resistance value should rise smoothly from approximately 0 Ω (“FAST” position) to apporoximately 1 kΩ (“SLOW” position).

NOTE:
Windshield washer and wiper switch is integrated with the column-ECU, and can not be checked. However, its operation can be checked by the input signal check. (Refer to GROUP 54B – Troubleshooting.)

REAR WIPER AND WASHER

REFERENCE VALUE

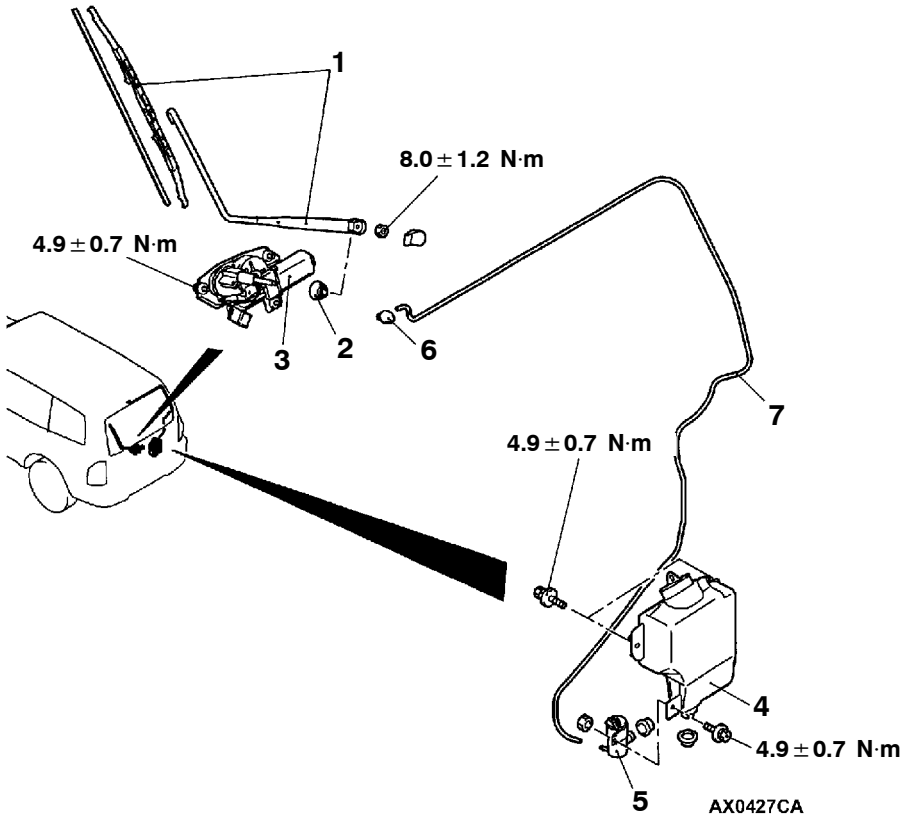
Item	Standard value
Rear wiper arm and blade assembly stop position (Distance from end of wiper blade to end of ceramic line) mm	30 ± 5

TROUBLESHOOTING

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

REAR WIPER AND WASHER

REMOVAL AND INSTALLATION



Rear wiper motor assembly removal steps

- Toolbox bracket, upper (Refer to GROUP 42 – Back Door Trim, Waterproof Film.)

▶A◀ 1. Rear wiper arm and blade assembly
▶B◀ 2. Grommet
3. Rear wiper motor assembly

Rear washer tank and rear washer motor removal steps

- Waterproof film (Refer to GROUP 42.)

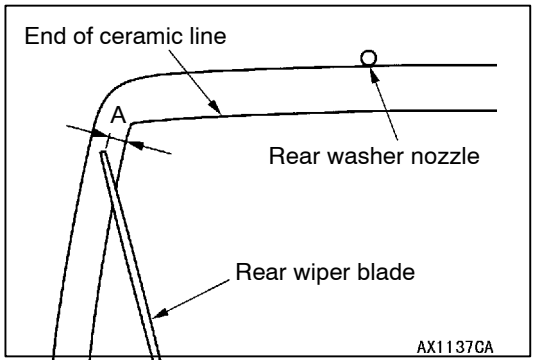
4. Rear washer tank assembly
5. Rear washer motor

Rear washer hose removal steps

6. Rear washer nozzle
- Waterproof film (Refer to GROUP 42.)

7. Rear washer hose

NOTE
For the removal and installtion of the wiper and washer switch, refer to GROUP 54A - Colum switch.

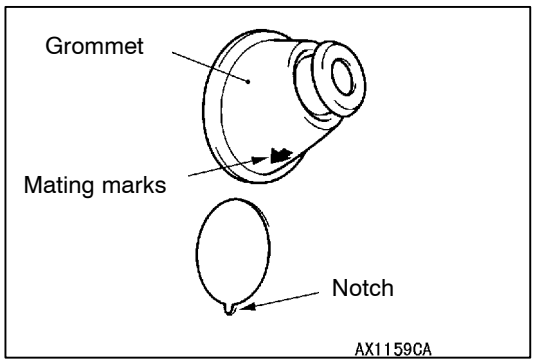


INSTALLATION SERVICE POINTS

▶A◀ REAR WIPER ARM AND BLADE ASSEMBLY INSTALLATION

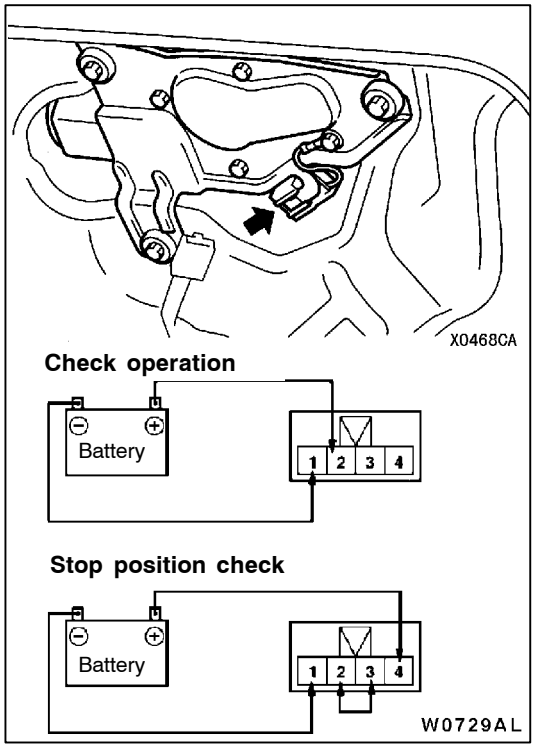
Install so that the end of the wiper blade stops at the specified position.

Standard value (A) : 30 ± 5 mm



▶B◀ GROMMET INSTALLATION

Install so that the mating mark on the grommet is aligned with the notch in the mounting hole.



INSPECTION

REAR WIPER MOTOR ASSEMBLY CHECK

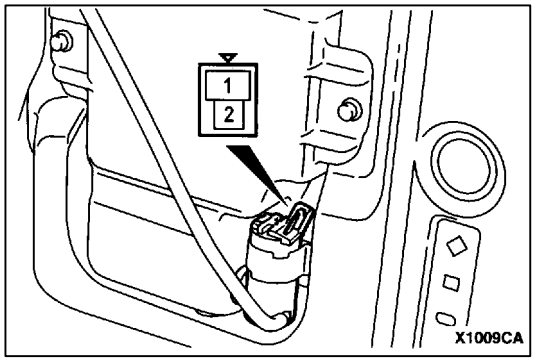
The rear wiper motor assembly should be installed to the vehicle body and the harness connector should be disconnected when checking the wiper motor.

- **Wiper Motor Operation Check**

  Connect the battery to the wiper motor as shown in the illustration, and then check the operation of the wiper motor.

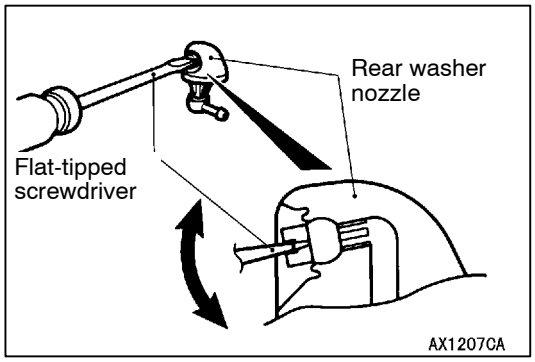
- **Wiper Motor Stop Position Check**

  1. Operate the wiper motor by the same method as described in the check procedure above. Then, while the motor is operating, disconnect the battery to make the wiper motor stop.
  2. Reconnect the battery as shown in the illustration, and then check whether the wiper motor automatically stops in the correct stop position after it has been running.



REAR WASHER MOTOR CHECK

1. The rear washer tank assembly should be installed and the rear washer tank should be filled with water when checking the washer motor.
2. Check that water is circulated strongly when system voltage is applied to terminal (2) and terminal (1) is earthed.



REAR WASHER NOZZLE SPRAY DIRECTION CHECK

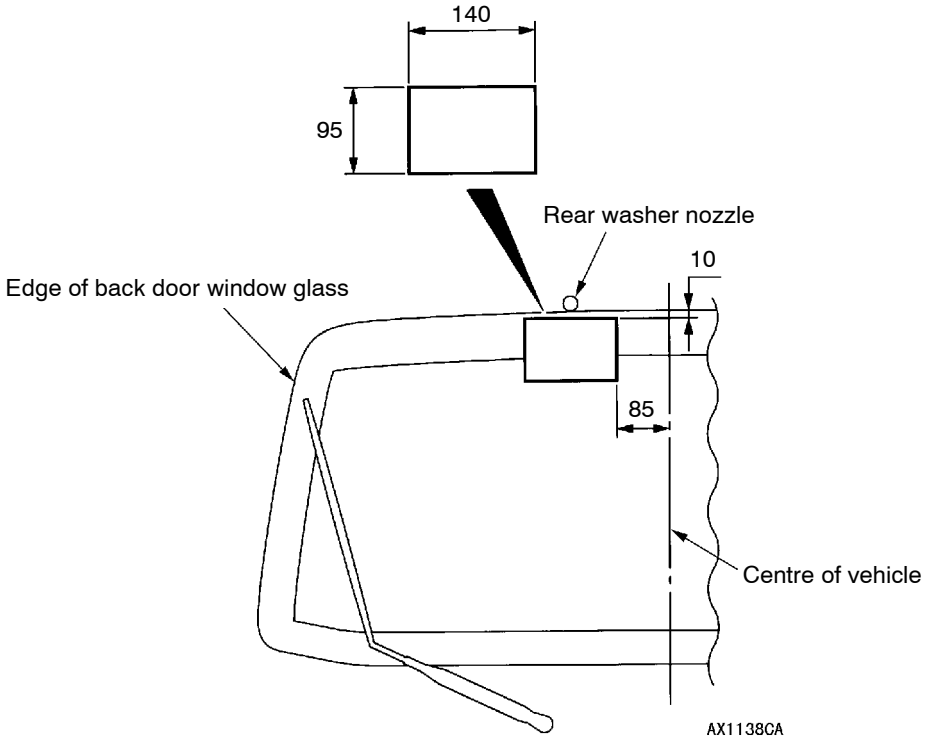
Move the nozzle to adjust so that the water is sprayed out within the range shown in the illustration.

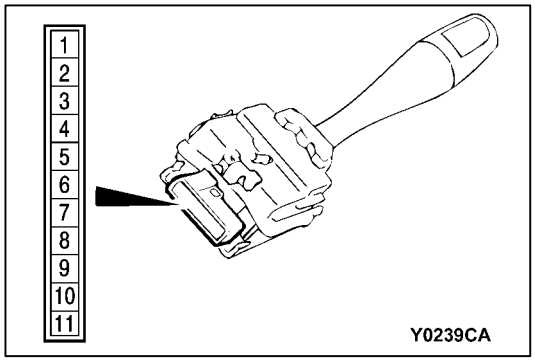
- **Rear Washer Nozzle Spray Position Vertical Direction Adjustment**

  To adjust the vertical direction of the rear washer nozzle spray position, insert a flat-tipped screwdriver into thespray hole of the rear washer nozzle and move it in the direction of the arrow.

  Caution
  Be careful not to damage the spray hole of the nozzle when inserting the flat-tipped screwdriver. Into the spray hole of the nozzle.

Units: mm





REAR WIPER AND WASHER SWITCH CHECK

<L.H.drive vehicles>

Switch position	Terminal No.		
	4	5	6
OFF			
Rear washer switch ON		○	○
Rear wiper switch ON	○		○

<R.H.drive vehicles>

Rear wiper and washer switch is integrated in the column-ECU, and can not be checked. However, its operation can be checked by the input signal check. (Refer to GROUP 54B – Troubleshooting.)

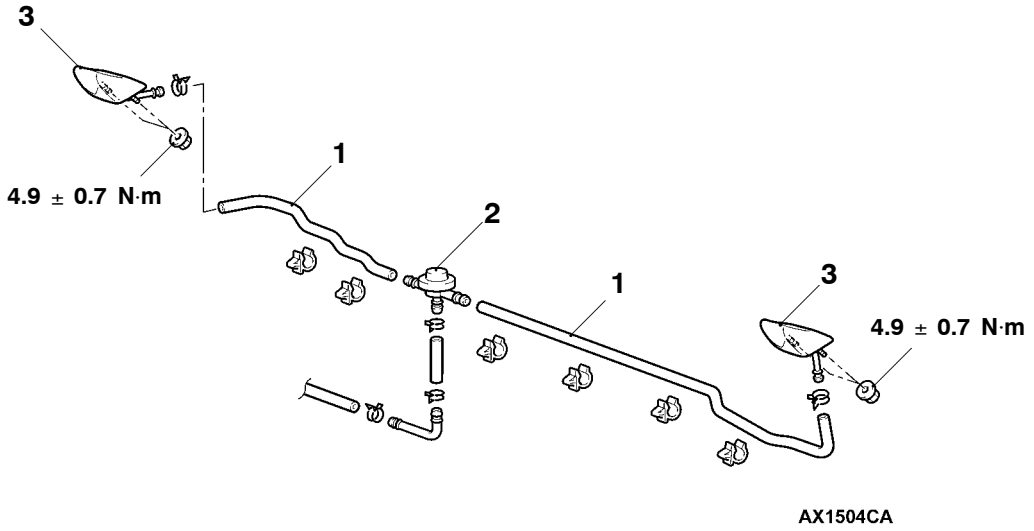
HEADLAMP WASHER

TROUBLESHOOTING

The headlamp washer is controlled by the Smart Wiring System (SWS). For troublesshooting, refer to GROUP 54B - Troubleshooting.

HEADLAMP WASHER

REMOVAL AND INSTALLATION



AX1504CA

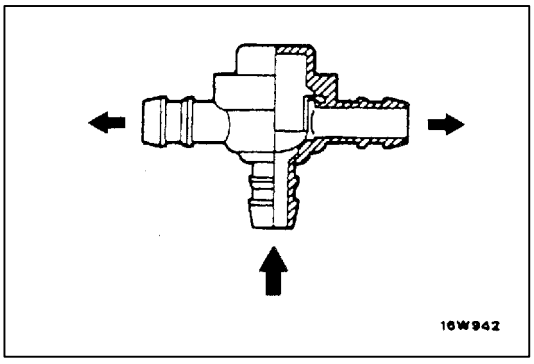
Washer nozzle and check valve removal steps

- Washer fluid draining
- Front bumper face assembly(Refer to P.51-4.)

1. Washer hose
2. Check valve
3. Washer nozzle

NOTE

1. For removal and installation of the Lighting switch, refer to GROUP 54A - Column switch.
2. For removal and installation of the washer tank, refer to P.51-24.

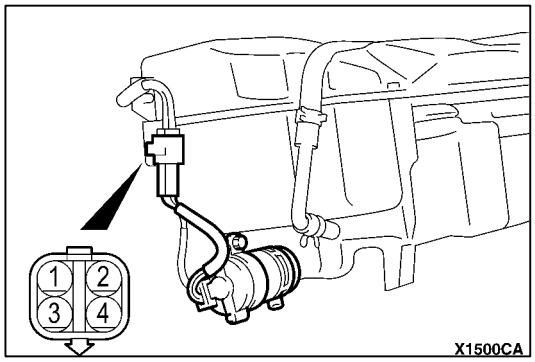


INSPECTION

CHECK VALVE CHECK

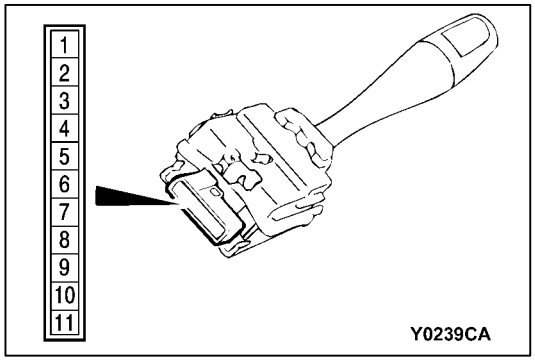
Apply pressure to the inlet of the check valve to check its opening pressure.

Opening pressure: 78 kPa



HEADLAMP WASHER MOTOR CHECK

1. With the headlamp 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 terminals (1) and (2).



HEADLAMP WASHER SWITCH CHECK

<R.H.drive vehicles>

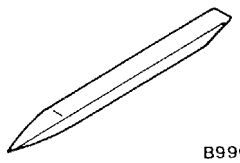
Switch position	Terminal No.	
	3	4
OFF		
Headlamp washer switch ON	○	○

<L.H.drive vehicles>

Headlamp washer switch is integrated in the column-ECU, and can not be checked. However, its operation can be checked by the input signal check. (Refer to GROUP 54B – Troubleshooting.)

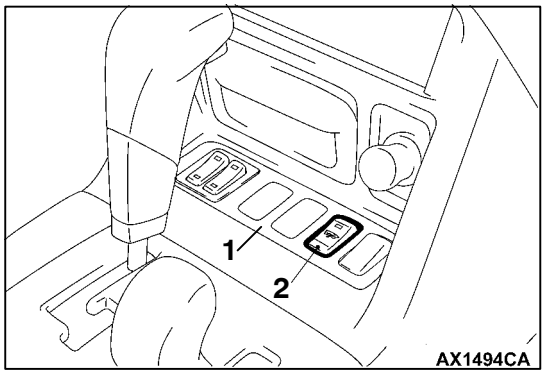
WIPER DEICER

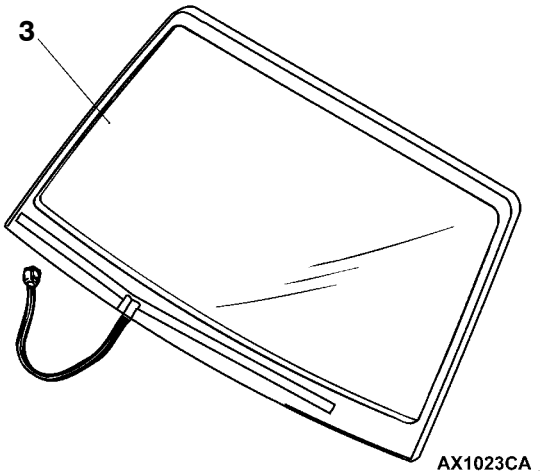
SPECIAL TOOL

Tools	No.	Name	Application
	MB990784	Ornament remover	Wiper deicer switch removal

WIPER DEICER

REMOVAL AND INSTALLATION



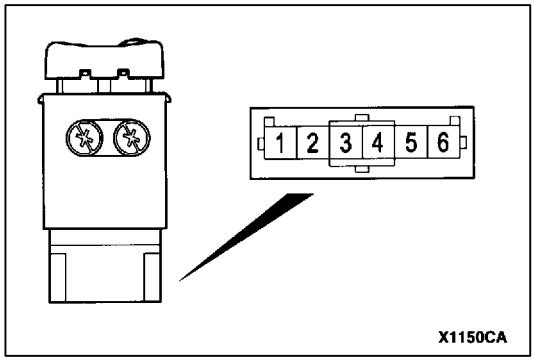


Wiper deicer switch removal steps

1. Switch panel (Refer to GROUP 52A - Instrument Panel.)
2. Wiper deicer switch

Windshield Removal

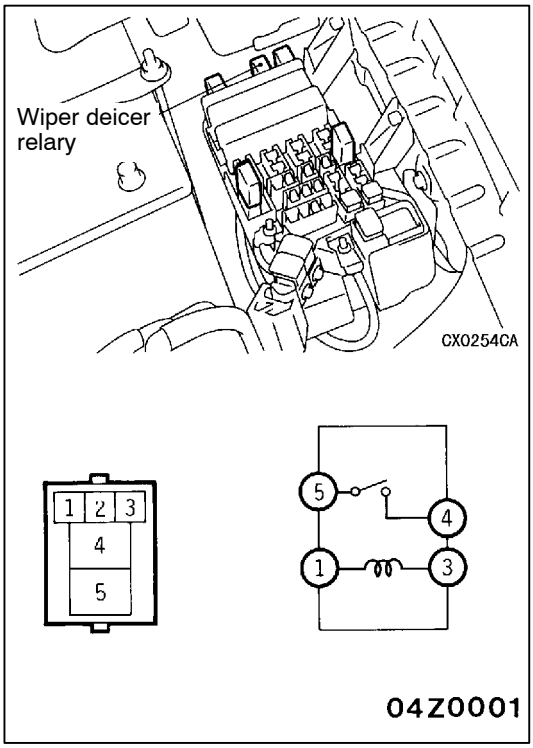
3. Windshield (Refer to GROUP 42.)



INSPECTION

WIPER DEICER SWITCH CONTINUITY CHECK

Switch position	Terminal No.							
	1	-	2	3	4	5	-	6
OFF							ILL	
ON		IND						



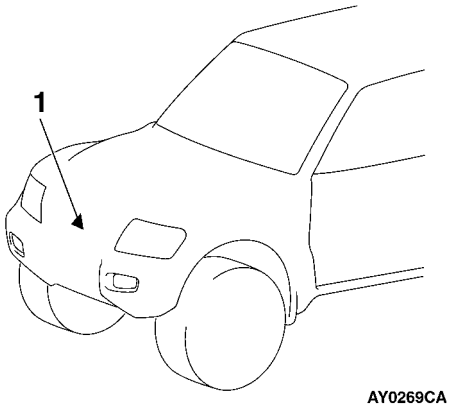
WIPER DEICER RELAY CHECK

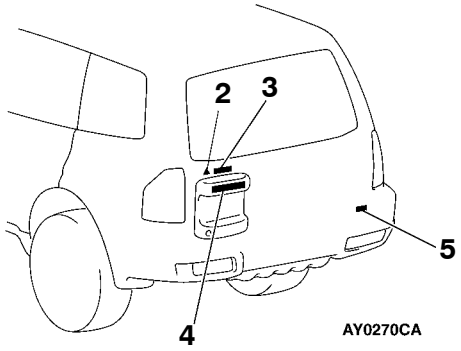
System voltage	Terminal No.			
	1	3	4	5
When current is not flowing	○	○		
When current is flowing	⊖	⊕	○	○

MARKS

MARKS

REMOVAL AND INSTALLATION





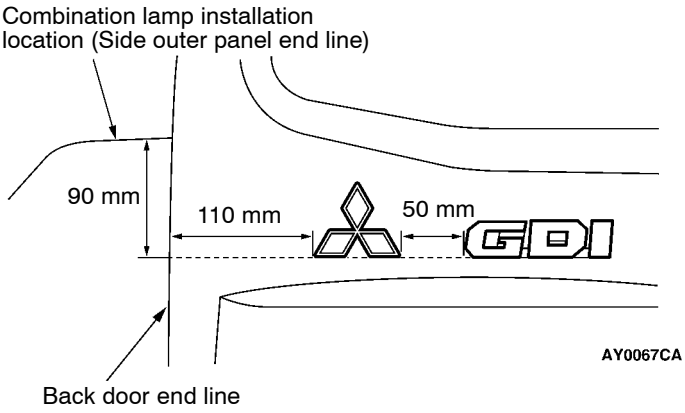
1. Three diamond mark
▶A◀ 2. Three diamond mark
▶A◀ 3. GDI or DI-D mark
4. Vehicle logo plate
▶A◀ 5. GLS or GLX mark

INSTALLATION SERVICE POINT

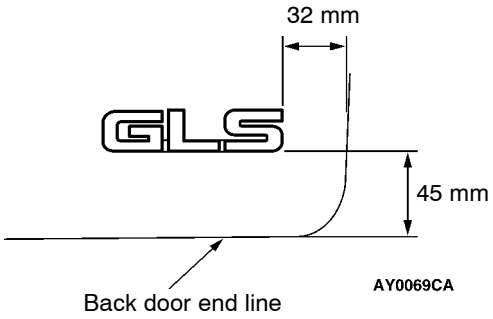
▶A◀ MARK INSTALLATION

1. INSTALLATION POSITION

(2) Tree diamond mark (3)GDI or DI-D mark



(5)GLS mark or GLX mark



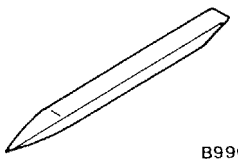
2. INSTALLATION SERVICE POINTS

(1) Clean the mark attachment location on the vehicle body with unleaded petrol.
(2) Peel off the protective paper from the reverse surface of the mark, and then attach the mark to the attachment location.
(3) Remove the application tape.

Caution
1) **Carry out this work in a location which has an ambient temperature of 20 - 38°C and which is free from dust.**
2) **If the ambient temperature is lower than 20°C, heat the mark and the vehicle body (application location) to 20 - 30°C.**

OUTSIDE DOOR MIRROR

SPECIAL TOOL

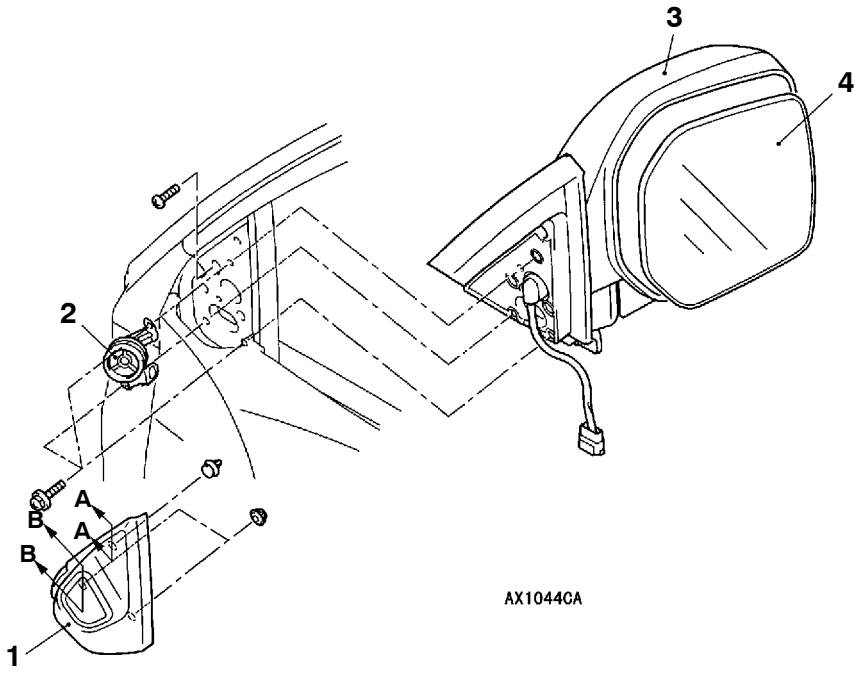
Tools	No.	Name	Application
 B990784	MB990784	Ornament remover	Motor-driven remote controlled door mirror switch removal

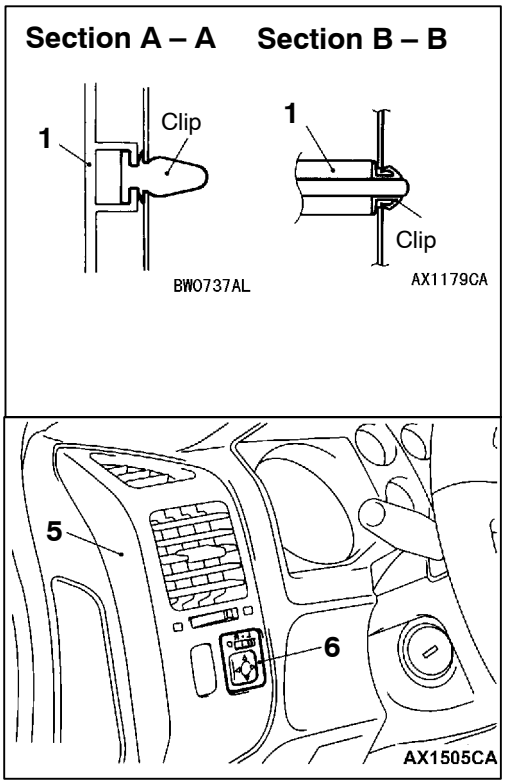
TROUBLESHOOTING

The outside mirrors are controlled by the SWS (Smart Wiring System). For troubleshooting procedures, refer to GROUP 54B - SWS Diagnosis.

OUTSIDE DOOR MIRROR

REMOVAL AND INSTALLATION





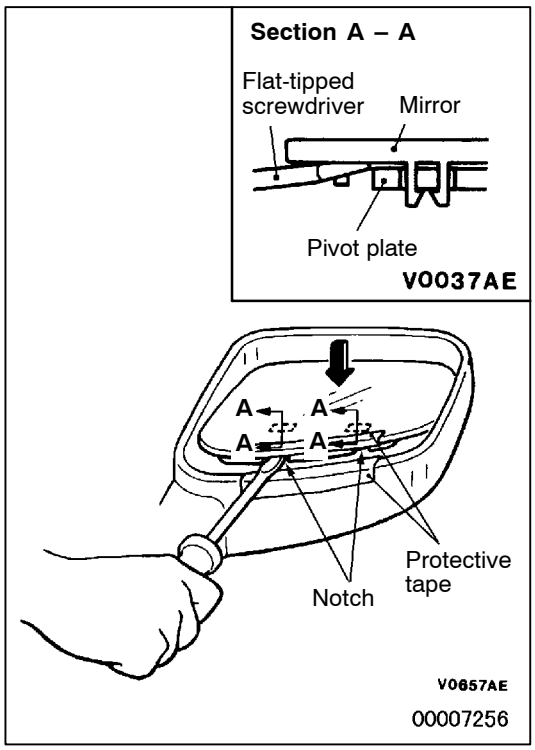
Door mirror removal steps

1. Delta inner cover
2. Tweeter assembly
3. Door mirror assembly

◀A▶ ▶A◀ 4. Mirror

Motor-driven remote controlled mirror switch removal steps

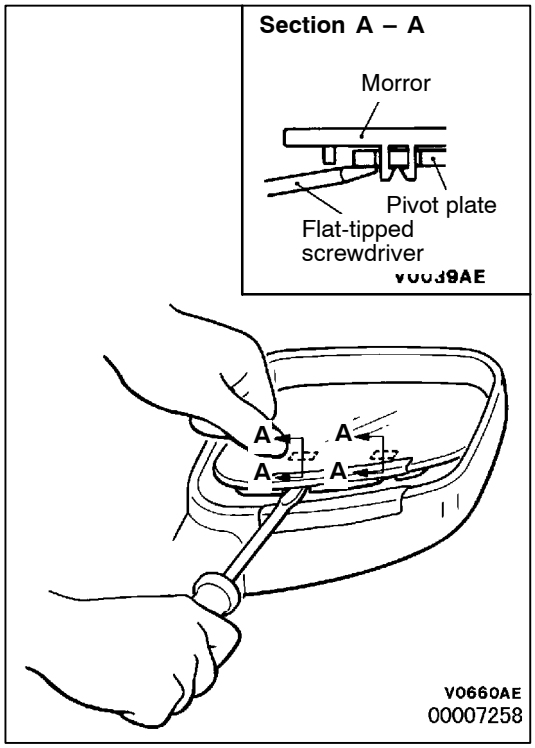
5. Air outlet assembly (Refer to GROUP 52A - Instrument Panel.)
6. Motor-driven remote controlled mirror switch



REMOVAL SERVICE POINT

◀A▶ MIRROR REMOVAL

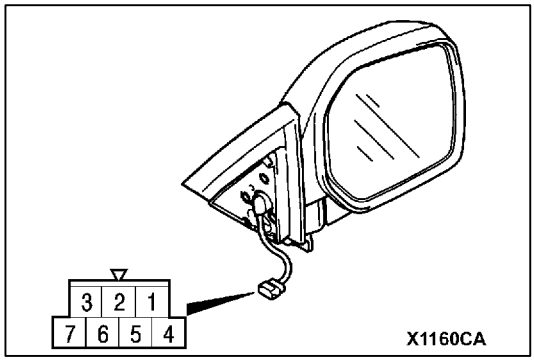
Push the top of the mirror with your hand to tilt it and attach the protective tape as shown in the illustration. Then insert a flat-tipped screwdriver in between the notch at the rear of the mirror and the pivot plate, and disengage the bottom of the mirror.



INSTALLATION SERVICE POINT

▶A◀ MIRROR INSTALLATION

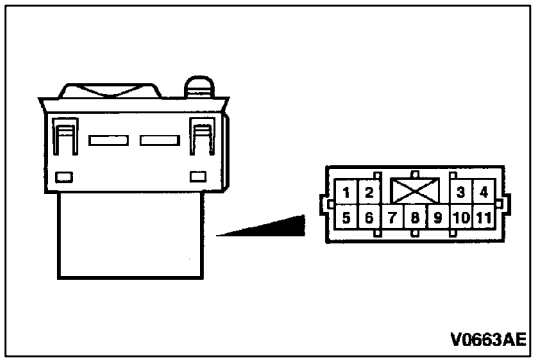
While supporting the clip position on the underside of the pivot plate with a flat-tipped screwdriver, press the clip at the front of the mirror to install the bottom of the mirror.



INSPECTION

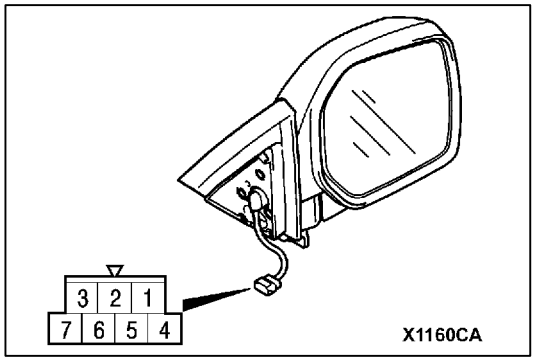
MIRROR ASSEMBLY OPERATION CHECK

Battery connection terminal					Direction of operation
3	4	5	6	7	
	⊕		⊖		UP
	⊖		⊕		DOWN
		⊖	⊕		LEFT
		⊕	⊖		RIGHT
○				○	Vehicles with heater mirror



MOTOR-DRIVEN REMOTE CONTROLLED MIRROR SWITCH CONTINUITY CHECK

Switch	Switch position	Terminal No.												
		Left side					Right side					5	8
		1	6	9	10	11	1	2	3	6	9		
Mirror adjustment switch	Up	○	○	○		○	○		○	○	○		
	Down		○	○		○	○		○	○	○		
	Left		○	○	○		○	○		○	○		
	Right	○	○	○	○		○	○	○	○	○		
Illumination												○	○



THERMAL PRINTED WIRE FUNCTION CHECK

For vehicles with thermal printed wires, check that there is continuity between terminals (3) and (7).

Service Bulletins

Click on the applicable bookmark to select the Service Bulletin.

SERVICE BULLETIN

MITSUBISHI MOTORS

QUALITY INFORMATION ANALYSIS
OVERSEAS SERVICE DEPT. MITSUBISHI MOTORS CORPORATION

SERVICE BULLETIN	**No.:** MSB-00E51-001	
	Date: 2001-06-03	**<Model>** (EC)PAJERO/ MONTERO(V60, 70) **<M/Y>** 01-10
Subject: CHANGE IN REMOVAL AND INSTALLATION OF SIDE STEP		
Group: EXTERIOR	**Draft No.:** 00SY090514	
INFORMATION	**INTERNATIONAL CAR ADMINISTRATION OFFICE**	T.MASAKI-MANAGER TECHNICAL SERVICE PLANNING

1. Description:

The mounting bolts, nuts, and tightening torque values of the side step assembly have been changed.

2. Applicable Manuals:

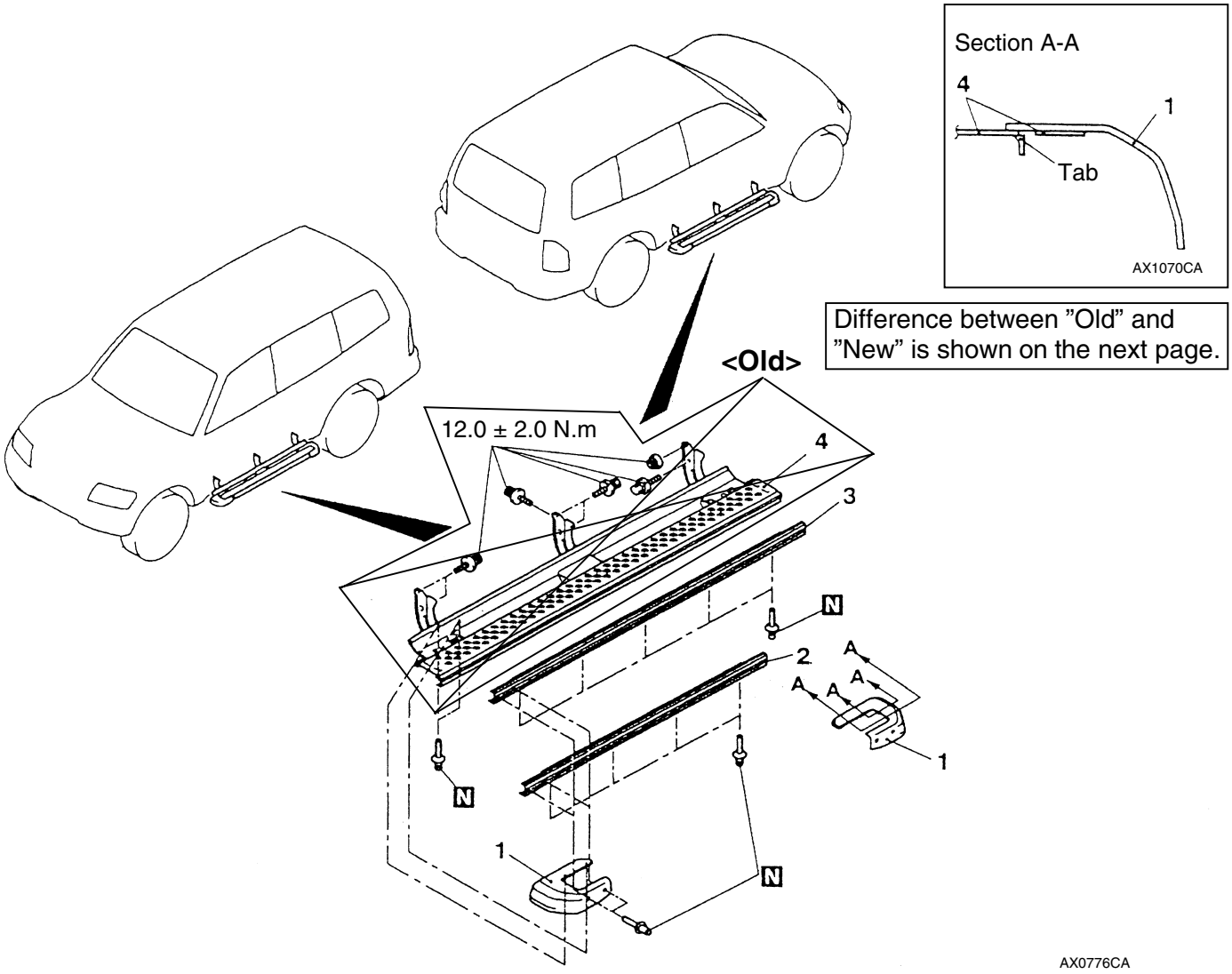
Manual	Pub. No.	Language	Page(s)
2001 PAJERO Workshop Manual Chassis	PWJE0001(2/2)	(English)	51-22
2001 MONTERO Workshop Manual Chassis	PWJS0002(2/2)	(Spanish)	
2001 PAJERO/MONTERO Workshop Manual Chassis CD-ROM	PWJT0008R	(English)	
	PWJT0008R	(Spanish)	
	PWJT0008R	(French)	
	PWJT0008R	(German)	

3. Effective date:

From August 2, 2000

SIDE STEP

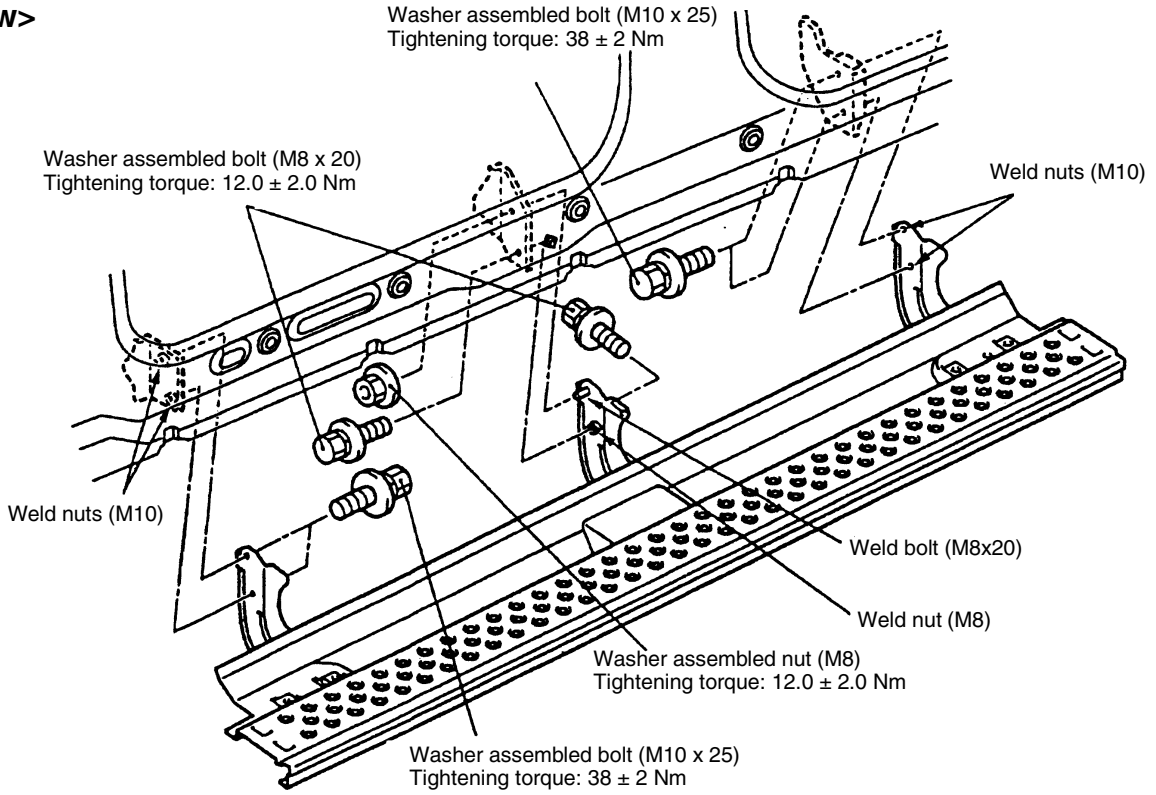
SIDE STEP
REMOVAL AND INSTALLATION



Side step removal steps

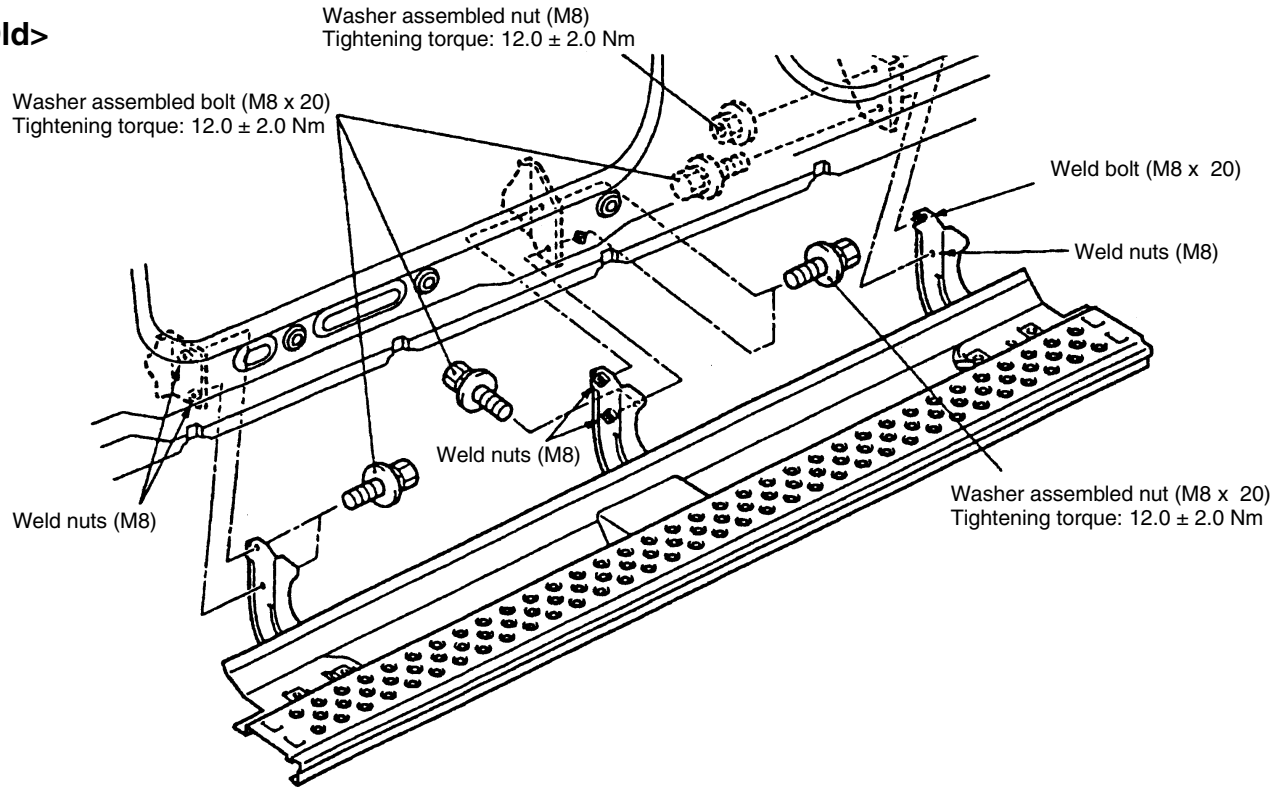
◄A► ►A◄ 1. Side step cover
◄A► ►A◄ 2. Non-slip cover <Short wheelbase>
◄A► ►A◄ 3. Non-slip cover <Long wheelbase>
4. Side step assembly

<New>



AY0456CA

<Old>



AY0455CA

GROUP 51
EXTERIOR

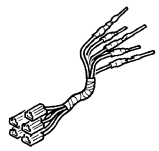
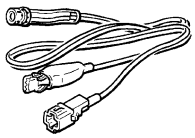
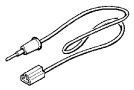
GENERAL

OUTLINE OF CHANGES

Service procedure has been added as electric-retractable mirrors and the mirror control unit have been added.

OUTSIDE MIRROR

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	For checking voltage (continuity and value) at harnesses and connectors A: For checking connector pin contact voltage B: For checking power supply circuits C: For checking power supply circuits D: For connection to commercially available testers

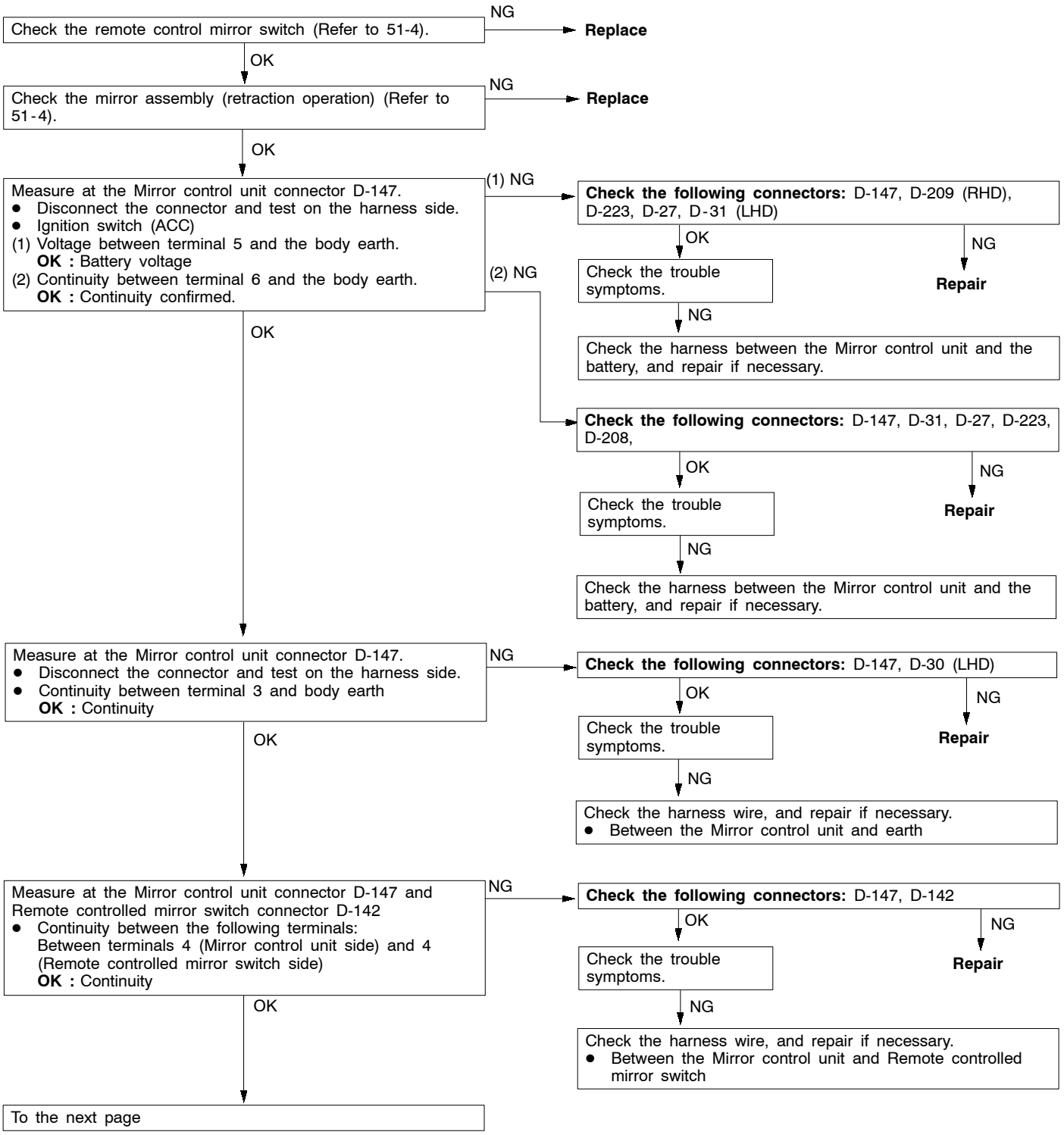
TROUBLESHOOTING

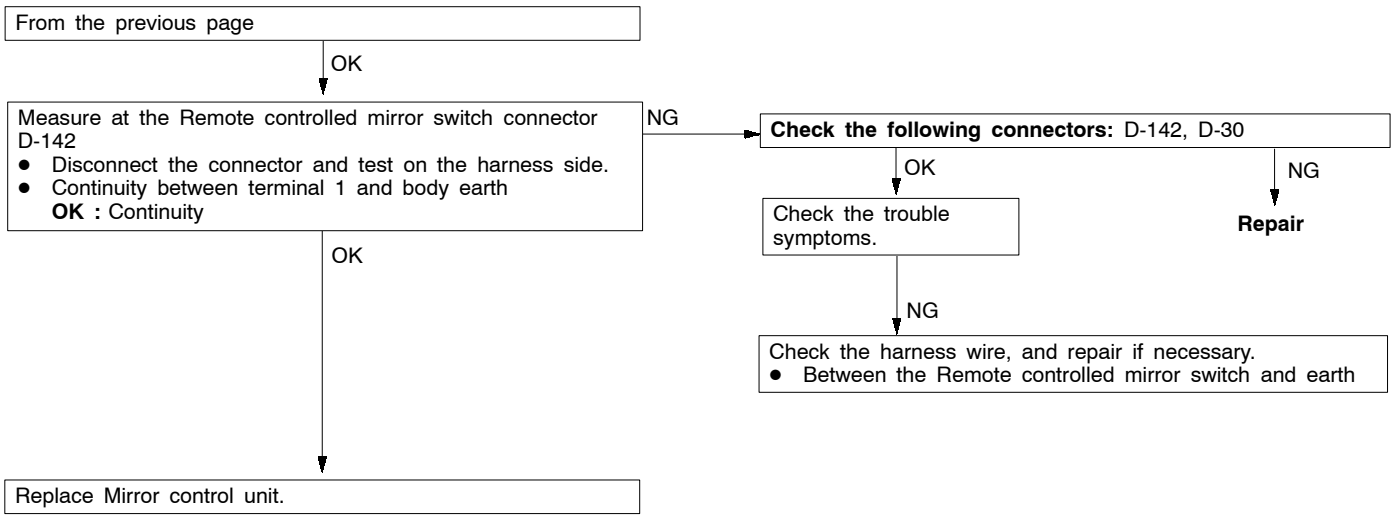
TROUBLE SYMPTOM CHART

Trouble symptom	Inspection procedure	Reference page
Both of the electric retractable door mirrors do not work at all.	1	51-2
Either of the electric retractable mirrors does not work.	2	51-3

Inspection Procedure 1

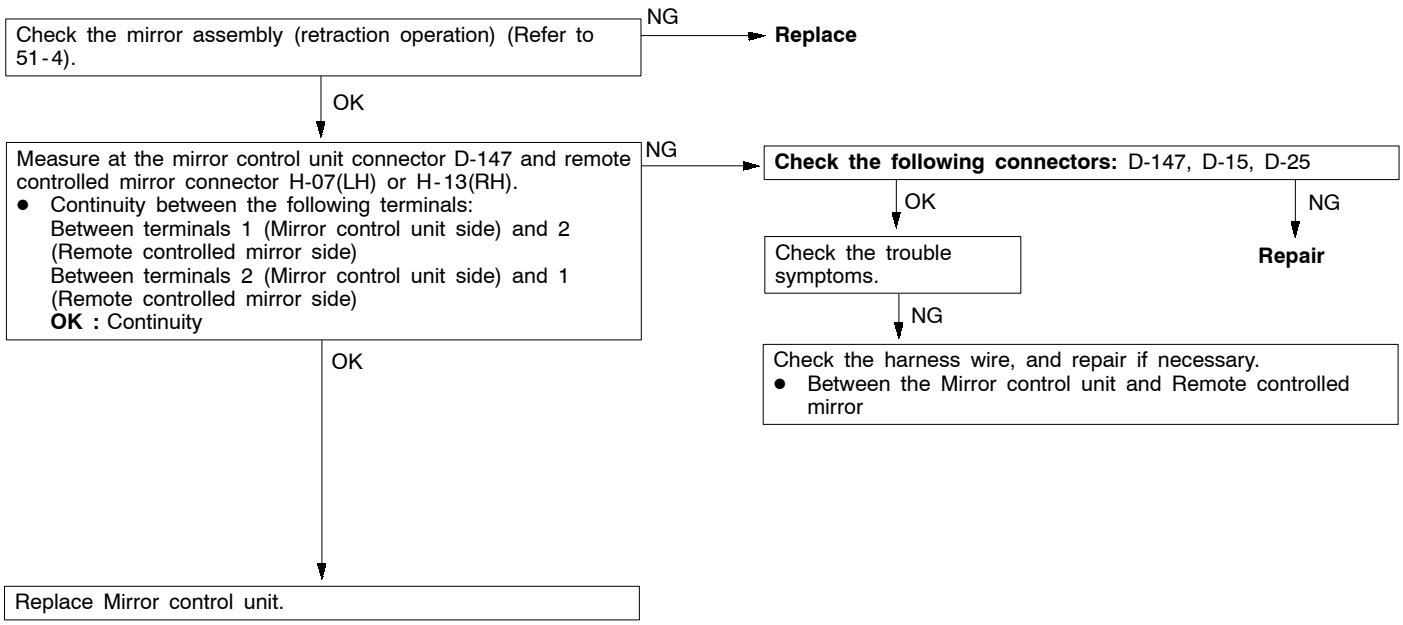
Both of the electric retractable mirrors do not work at all.	Probable cause
The Mirror control unit controls the electric retractable mirror based on input signals from the following switches. ● Ignition switch (ACC) ● Remote control mirror switch (for retracting and returning the mirror) If the electric retractable mirror does not operate normally, one of the above input circuit systems, the mirror assembly, or the Mirror control unit may be defective.	● Remote control mirror switch fault ● Mirror assembly fault ● Mirror control unit fault ● Harness or connector fault

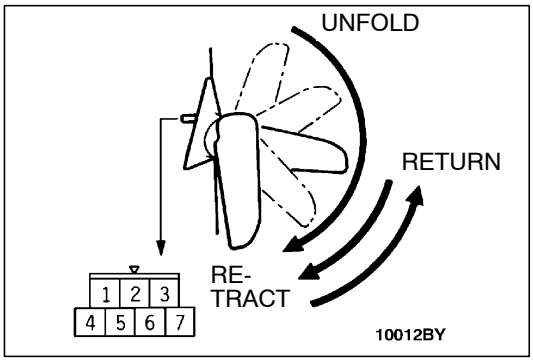




Inspection Procedure 2

Either of the electric retractable mirrors does not work.	Probable cause
The Mirror control unit controls the electric retractable mirror based on input signals from the following switches. ● Ignition switch (ACC) ● Remote control mirror switch (for retracting and returning the mirror) If the electric retractable mirror does not operate normally, one of the above input circuit systems, the mirror assembly, or the Mirror control unit may be defective.	● Mirror assembly fault ● Mirror control unit fault ● Harness or connector fault

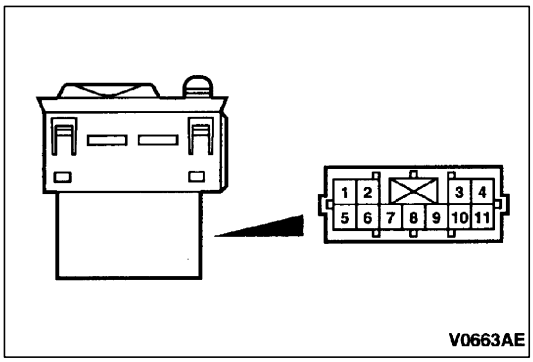




INSPECTION

MIRROR ASSEMBLY OPERATION CHECK

Battery connection terminal					Direction of operation
1	2	3	4	5	
		⊕		⊖	UP
		⊖		⊕	DOWN
			⊖	⊕	LEFT
			⊕	⊖	RIGHT
⊕	⊖				RETURN or UNFOLD position to RETRACT position
⊖	⊕				RETRACT position to RETURN position

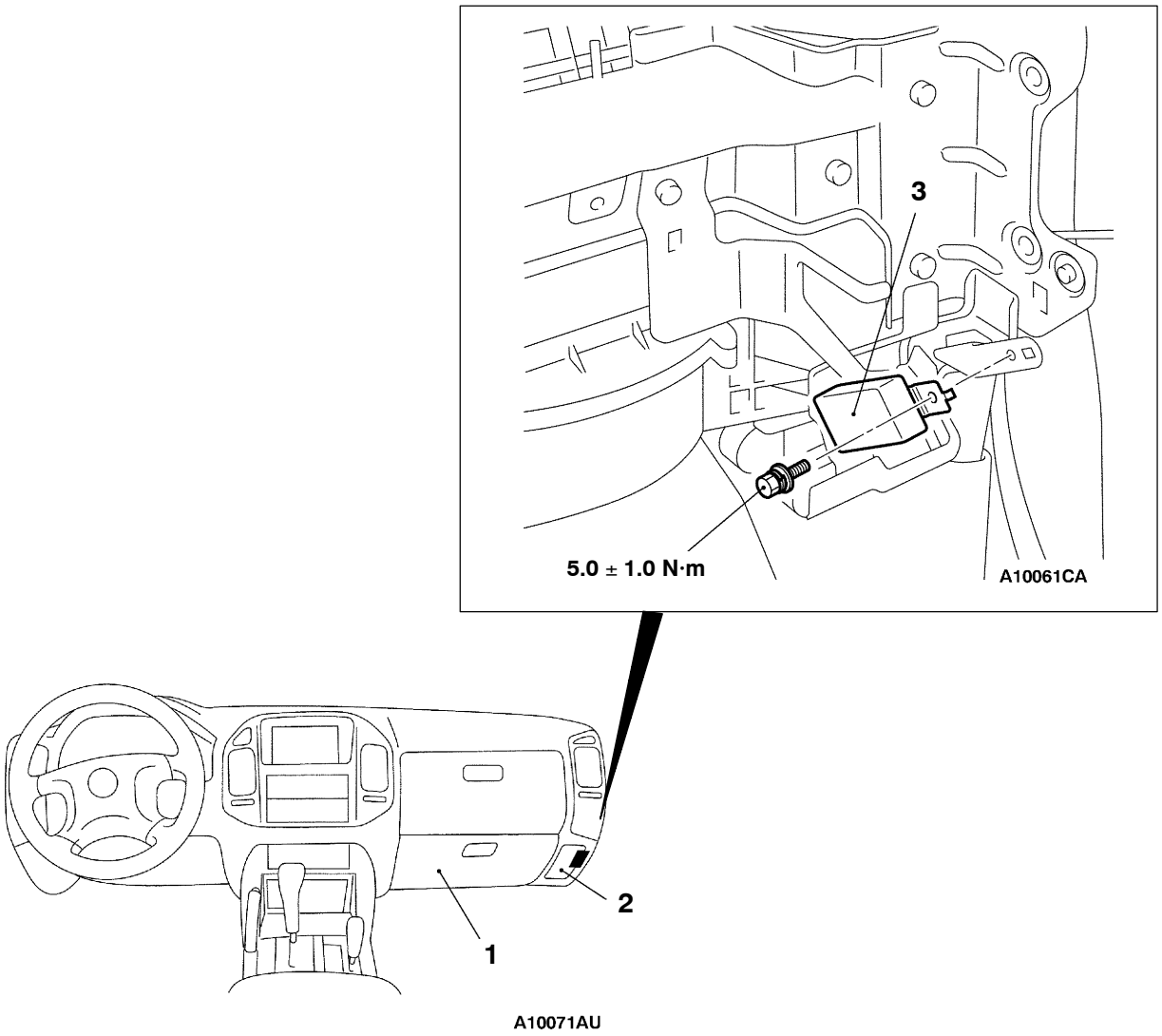


MOTOR-DRIVEN REMOTE CONTROLLED MIRROR SWITCH CONTINUITY CHECK

Switch	Switch position	Terminal No.											
		Left side					Right side					1	4
		1	6	9	10	11	1	2	3	6	9		
Mirror adjustment switch	Up	○	○				○			○			
				○		○			○		○		
	Down		○	○			○		○				
		○				○				○	○		
	Left		○	○			○	○					
		○			○					○	○		
	Right	○	○				○			○			
				○	○			○			○		
Mirror retracting switch	Retract and return											○	○

MIRROR CONTROL UNIT

REMOVAL AND INSTALLATION



Removal steps

1. Glove box assembly
2. Corner lower panel (Passenger's side)
3. Mirror control unit

INTERIOR

Click on the applicable bookmark to selected the required model year.

INTERIOR

CONTENTS

SERVICE SPECIFICATIONS 3

SPECIAL TOOL 3

INSTRUMENT PANEL <L.H. DRIVE VEHICLES>* 4

INSTRUMENT PANEL <R.H. DRIVE VEHICLES>* 8

FLOOR CONSOLE 12

TRIMS 13

SUNVISOR HOLDER 17

FRONT SEAT 18

REAR/SECOND SEAT 25

THIRD SEAT 35

FRONT SEAT BELT 38

REAR SEAT BELT<SHORT WHEELBASE> . 40

SECOND/THIRD SEAT BELT <LONG WHEELBASE> 41

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 (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.

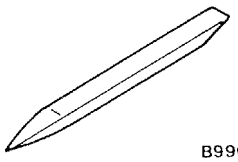
NOTE

The SRS includes the following components: front impact sensors, 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	
		Sport seat	Except sport seat
Seat cushion heater resistance Ω (at cabin temperature of 20°C)	Between terminals 1 and 3	6.4±10%	5.0 ± 10%
	Between terminals 2 and 3	6.0±10%	5.4 ± 10%
Seatback heater resistance Ω (at cabin temperature of 20°C)	Between terminals 1 and 2	6.0±10%	6.0 ± 10%

SPECIAL TOOL

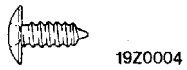
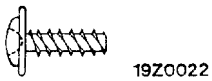
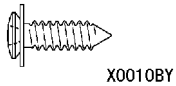
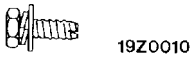
Tool	Number	Name	Use
 B990784	MB990784	Ornament remover	Removal of switch, trim, etc.

INSTRUMENT PANEL <L.H. DRIVE VEHICLES>

Caution
For removal of instrument panel and the passenger's side air bag module, always observe the service procedures described in GROUP 52B - Air Bag Module and Clock Spring.

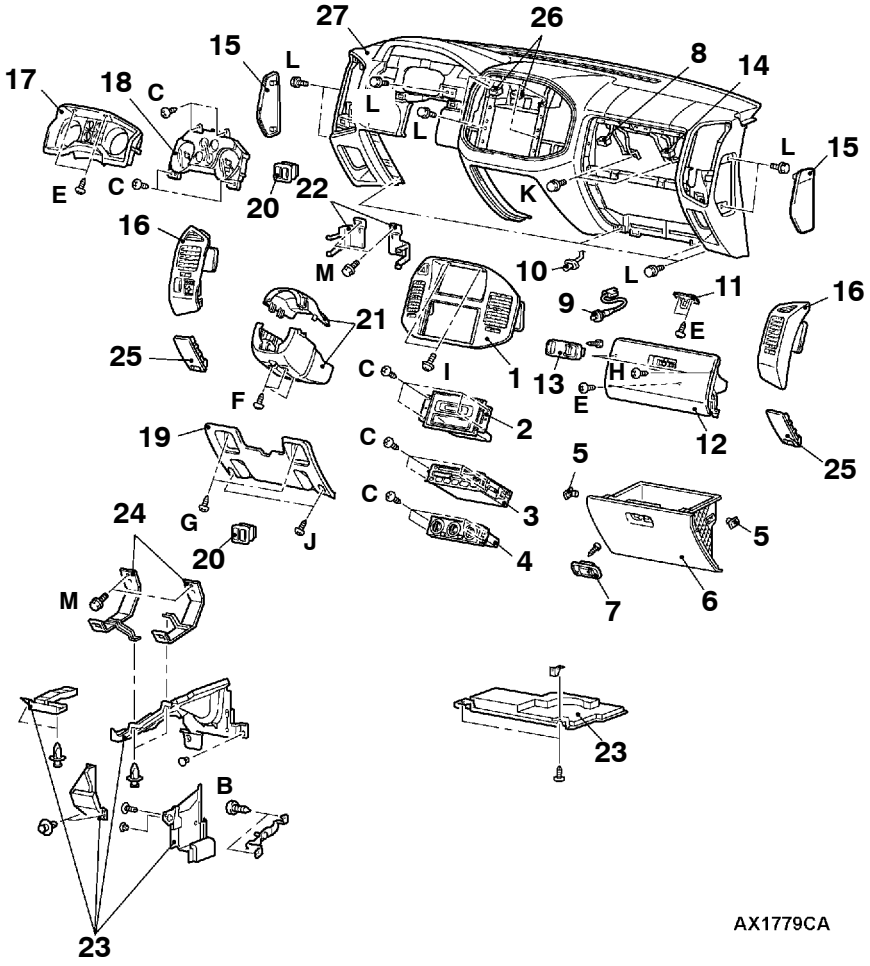
REMOVAL AND INSTALLATION

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 x L)	Colour	Shape
Tapping screw	A	5 x 10	-	 19Z0004
	B	5 x 12	-	
	C	5 x 16	-	 19Z0022
	D	5 x 16	-	
	E	5 x 16	Black	
	F	5 x 20	-	
	G	5 x 20	Black	
	H	5 x 16	-	19Z0003
Washer assembled screw	I	5 x 16	-	 X0010BY
Washer assembled bolt	J	5 x 20	Black	19Z0005
	K	6 x 16	-	
	L	6 x 16	Black	
	M	6 x 20	-	 19Z0010

D = Thread diameter
L = Effective thread length

CAUTION: SRS
When removing and installing the instrument panel (vehicles equipped with SRS), do not let it bump against the SRS-ECU.

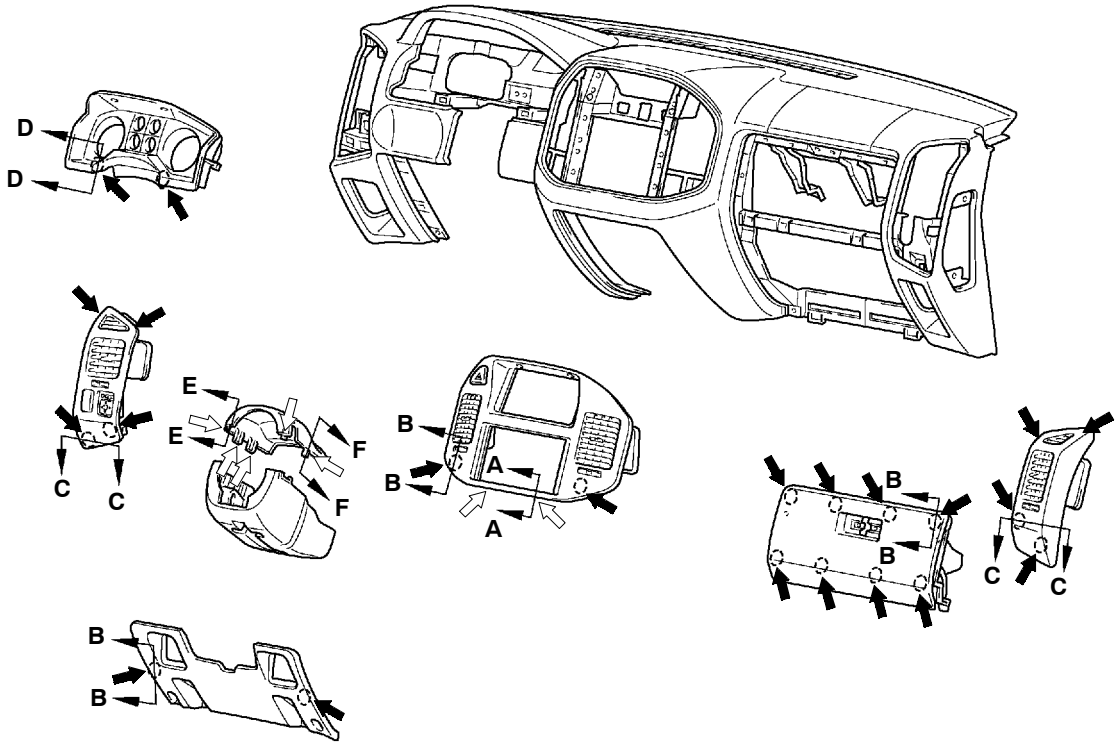


Removal steps

- Rear floor console assembly (Refer to P.52A-12.)
- CD player unit (Refer to GROUP 54A.)
- Front floor console (Refer to P.52A-12.)

1. Center panel assembly
2. Center display
3. Radio and tape player
4. Manual air conditioner assembly
5. Glove box stopper
6. Glove box assembly
7. Glove box lock
8. Glove box lamp switch harness connector
9. Glove box lamp switch
10. Glove box lamp
11. Upper glove box striker
12. Upper glove box assembly
13. Upper glove box lid lock
14. Front passenger's side air bag module harness connector
15. Instrument panel side cover
16. Air outlet assembly
17. Meter bezel
18. Combination meter assembly
    - Hood opener lever (Refer to GROUP 42.)
    - Fuel lid opener lever (Refer to GROUP 42.)
19. Lower panel
20. Switch panel
21. Column cover
22. Stay A
    - Assist grip (Refer to P.52A-13,15.)
    - Front pillar trim (Refer to P.52A-13,15.)
23. Under cover assembly
24. Stay B
25. Corner lower panel
26. Photo sensor harness connector
    - Steering shaft assembly bolt (Refer to GROUP 37A.)
27. Instrument panel assembly

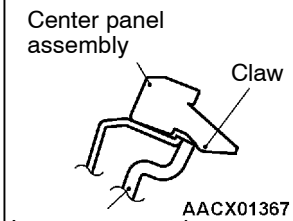
CLIP AND CLAW POSITION



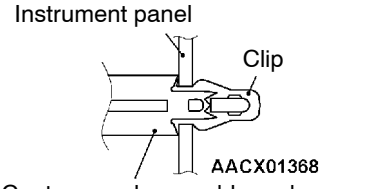
NOTE
⬅ : Clip position
⇦ : Claw position

ACX01533

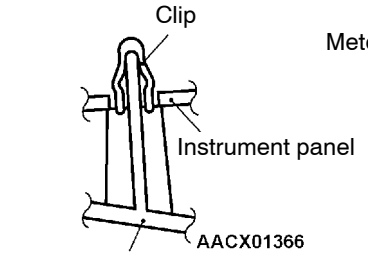
Section A - A



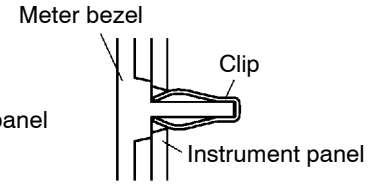
Section B - B



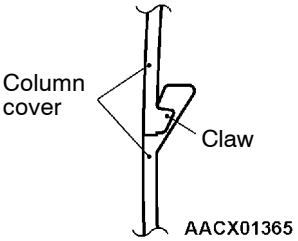
Section C - C



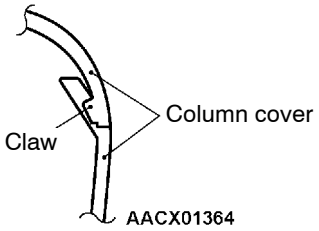
Section D - D



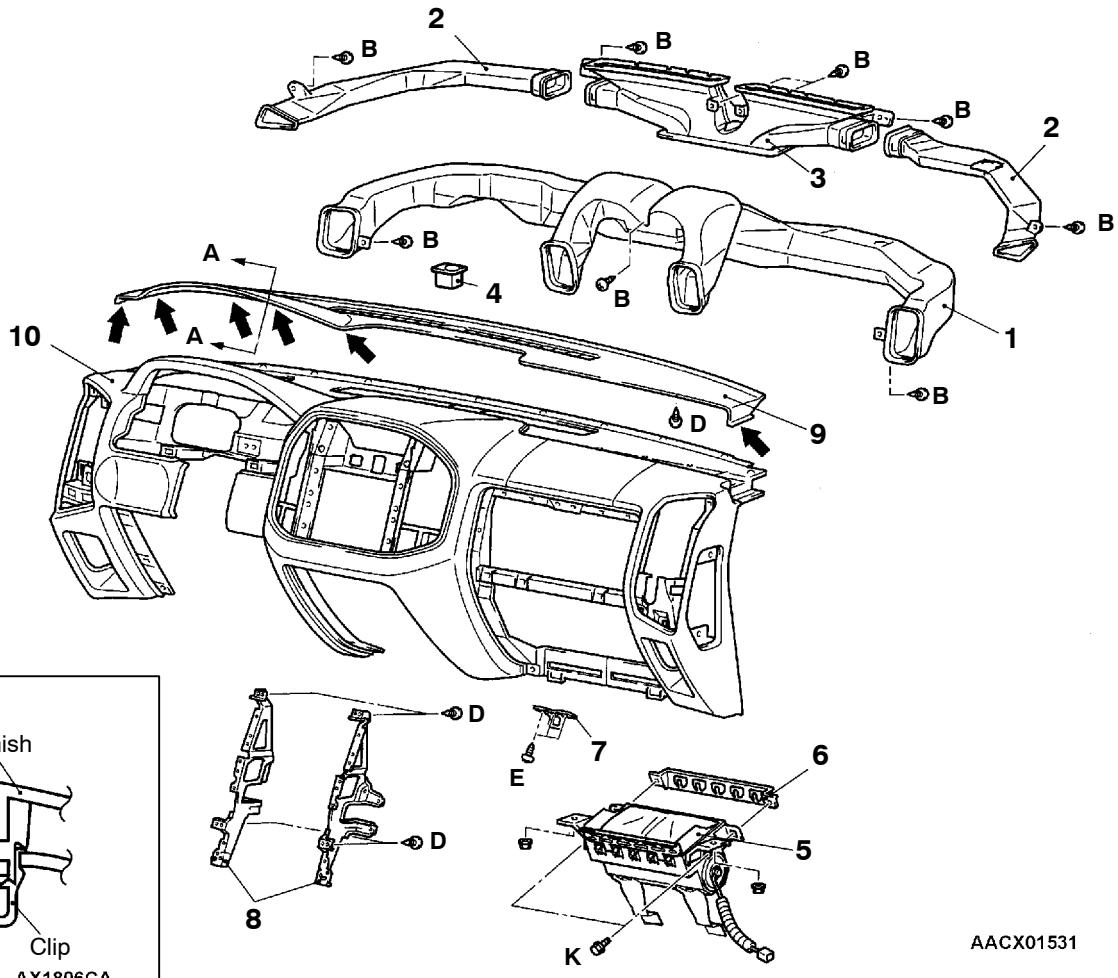
Section E - E

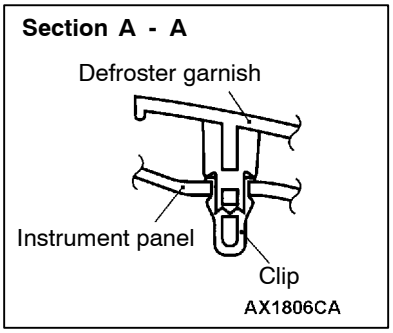


Section F - F



DISASSEMBLY AND REASSEMBLY





Disassembly steps

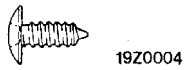
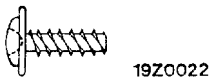
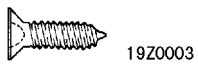
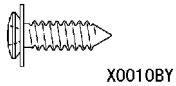
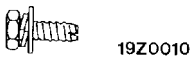
1. Distribution duct
2. Side defroster duct
3. Center defroster duct
4. Photo sensor
5. Front passenger's side air bag module
6. Air bag side plate
7. Glove box striker
8. Instrument panel center reinforcement
9. Defroster garnish
10. Instrument panel

INSTRUMENT PANEL <R.H. DRIVE VEHICLES>

Caution
For removal of instrument panel and the passenger's side air bag module, always observe the service procedures described in GROUP 52B - Air Bag Module and Clock Spring.

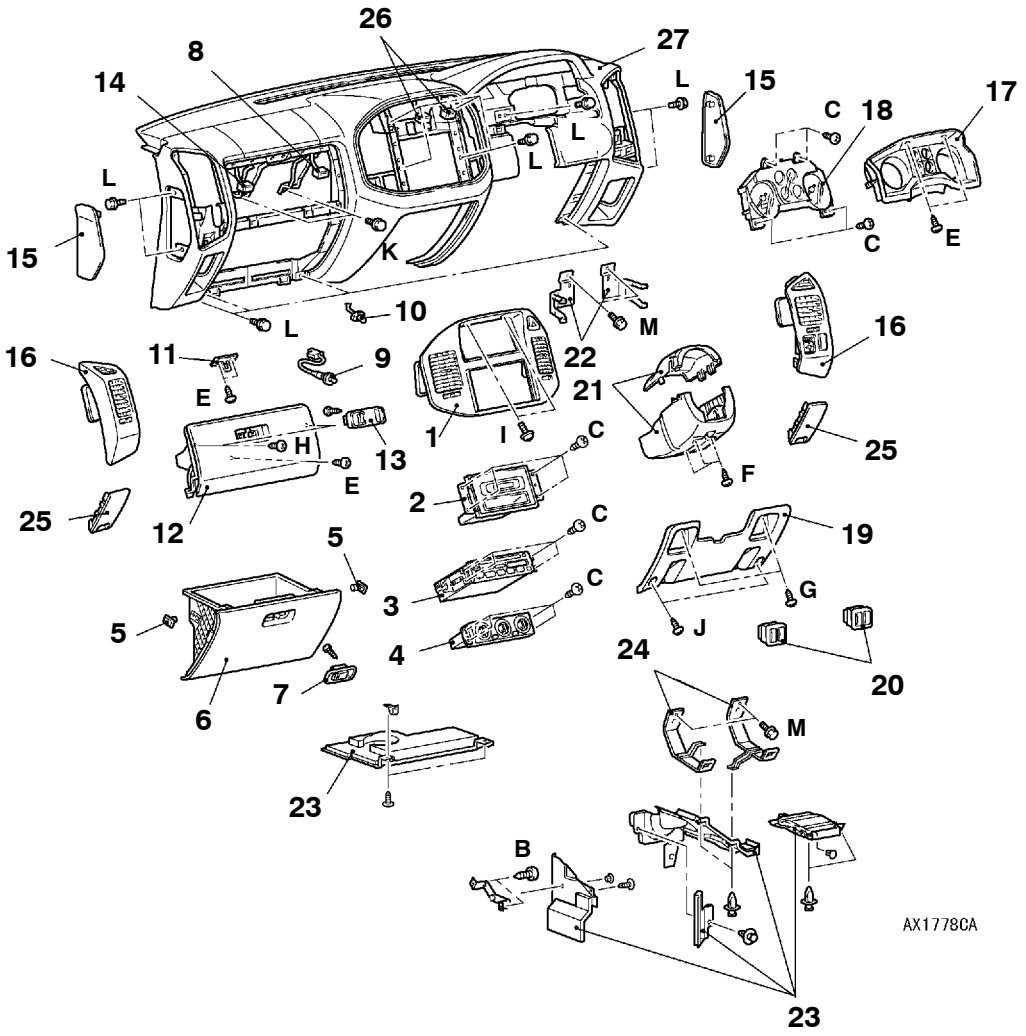
REMOVAL AND INSTALLATION

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 x L)	Colour	Shape
Tapping screw	a	5 x 10	-	 19Z0004
	b	5 x 12	-	
	c	5 x 16	-	 19Z0022
	d	5 x 16	-	
	e	5 x 16	Black	
	f	5 x 20	-	
	g	5 x 20	Black	
	h	5 x 16	-	 19Z0003
Washer assembled screw	i	5 x 16	-	 X0010BY
Washer assembled bolt	j	5 x 20	Black	19Z0005
	k	6 x 16	-	
	l	6 x 16	Black	
	m	6 x 20	-	 19Z0010

D = Thread diameter
L = Effective thread length

CAUTION: SRS
When removing and installing the instrument panel (vehicles equipped with SRS), do not let it bump against the SRS-ECU.

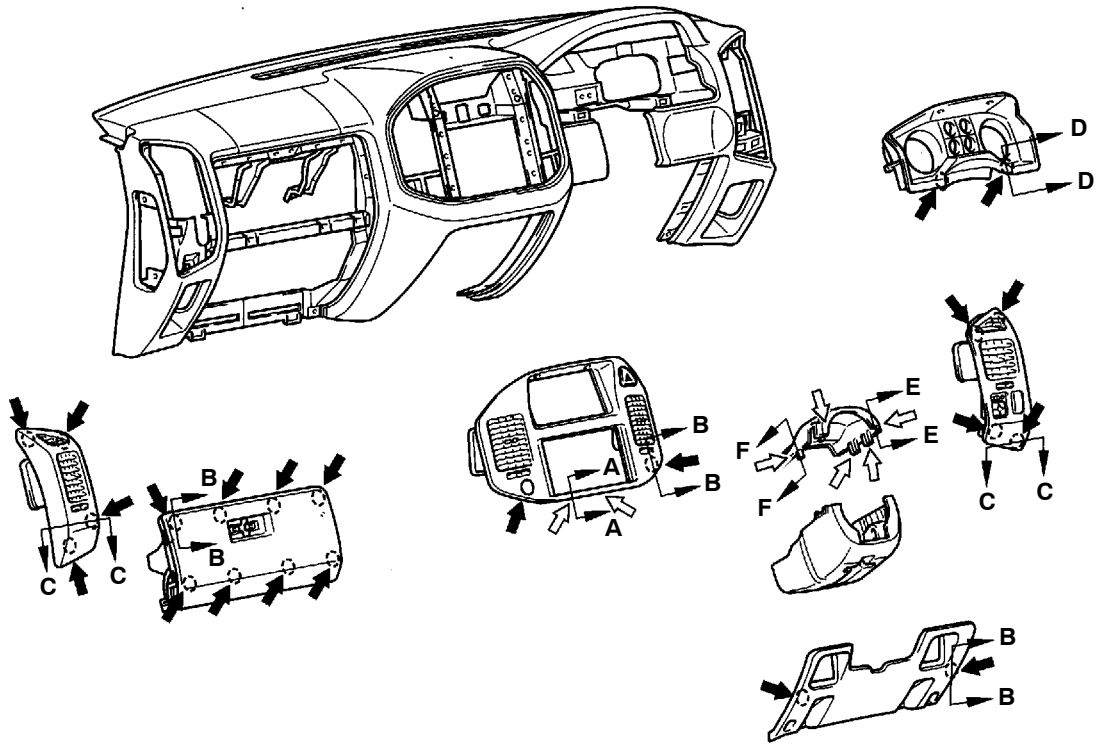


Removal steps

- Rear floor console assembly (Refer to P.52A-12.)
- CD player unit (Refer to GROUP 54A.)
- Front floor console (Refer to P.52A-12.)

1. Center panel assembly
2. Center display
3. Radio and tape player
4. Manual air conditioner assembly
5. Glove box stopper
6. Glove box assembly
7. Glove box lock
8. Glove box lamp switch harness connector
9. Glove box lamp switch
10. Glove box lamp
11. Upper glove box striker
12. Upper glove box assembly
13. Upper glove box lid lock
14. Front passenger's side air bag module harness connector
15. Instrument panel side cover
16. Air outlet assembly
17. Meter bezel
18. Combination meter assembly
    - Hood opener lever (Refer to GROUP 42.)
    - Fuel lid opener lever (Refer to GROUP 42.)
19. Lower panel
20. Switch panel
21. Column cover
22. Stay A
    - Assist grip (Refer to P.52A-13,15.)
    - Front pillar trim (Refer to P.52A-13,15.)
23. Under cover assembly
24. Stay B
25. Corner lower panel
26. Photo sensor harness connector
    - Steering shaft assembly bolt (Refer to GROUP 37A.)
27. Instrument panel assembly

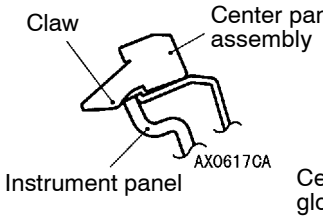
CLIP AND CLAW POSITION



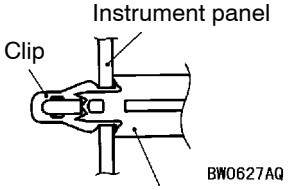
NOTE
⬅ : Clip position
⇦ : Claw position

AX0873CA

Section A - A

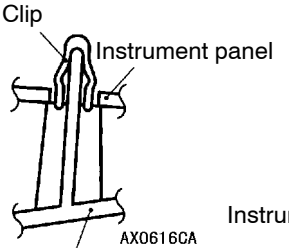


Section B - B



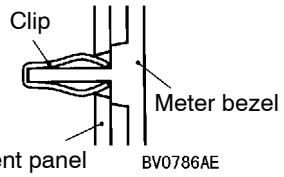
Center panel assembly and upper glove box assembly and lower panel

Section C - C

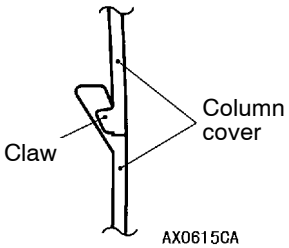


Air outlet assembly

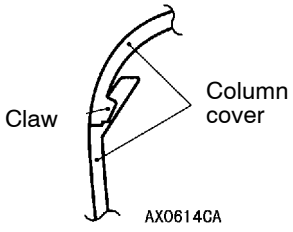
Section D - D



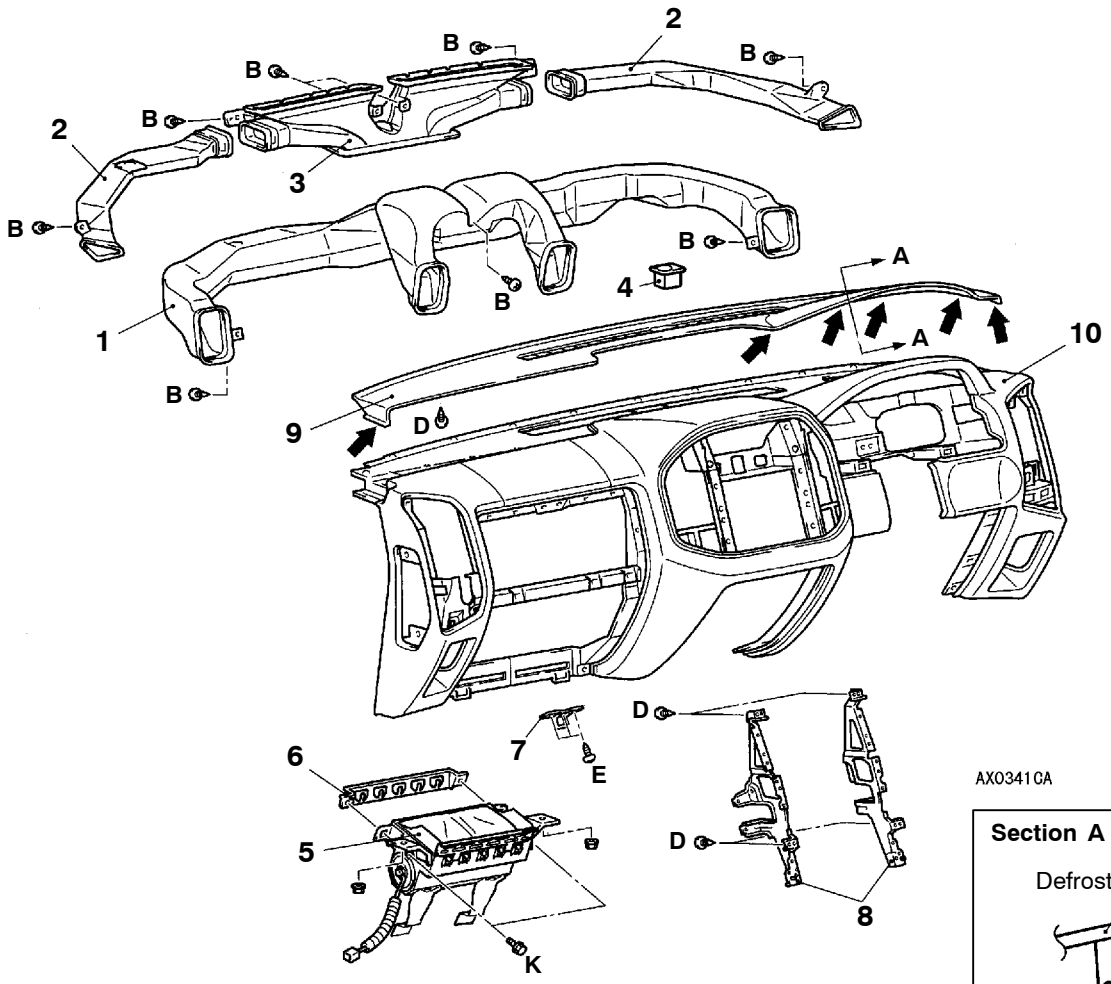
Section E - E

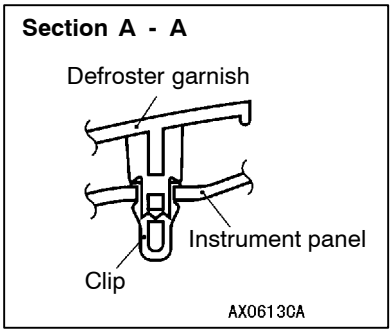


Section F - F



DISASSEMBLY AND REASSEMBLY



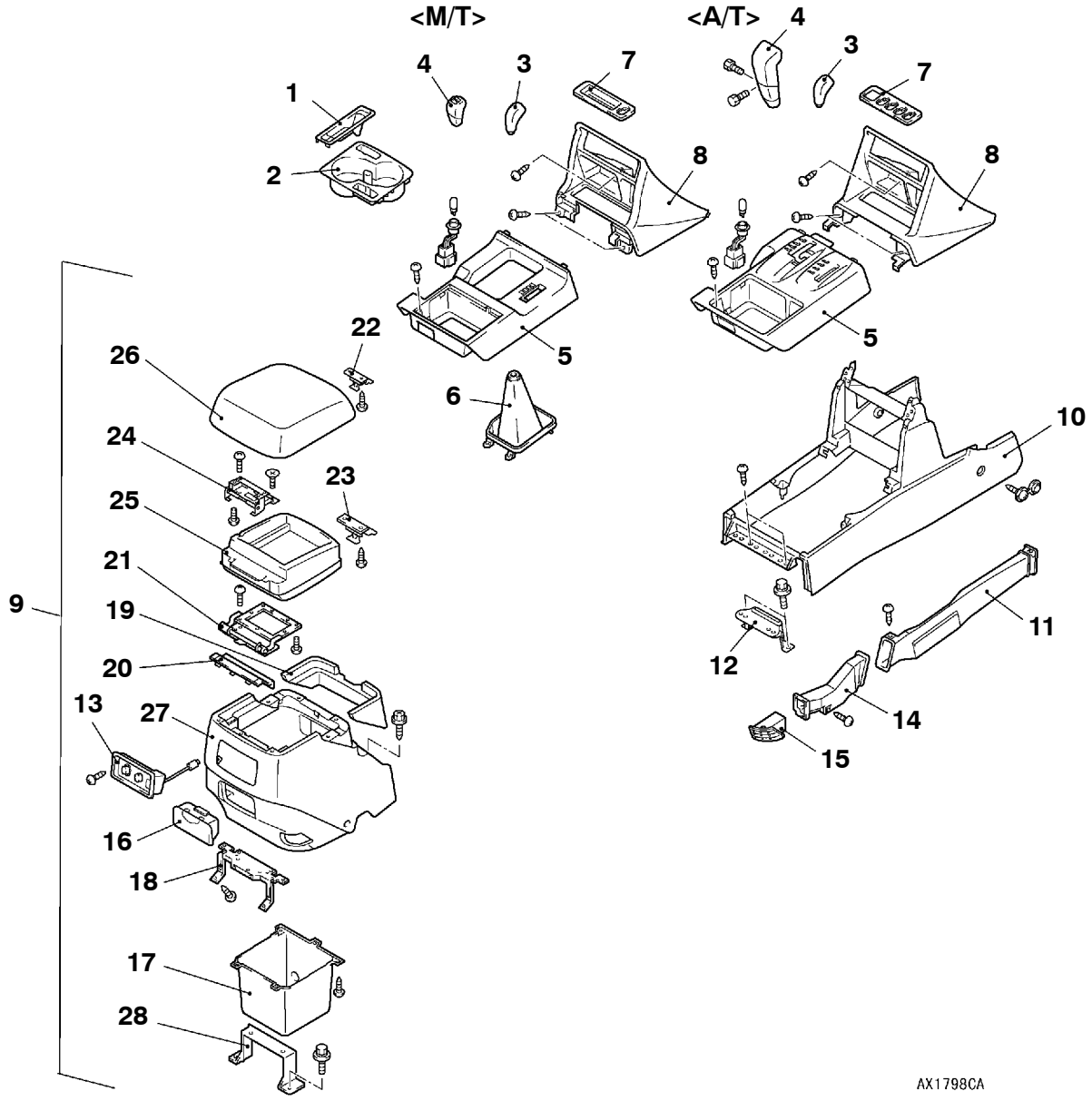


Disassembly steps

1. Distribution duct
2. Side defroster duct
3. Center defroster duct
4. Photo sensor
5. Front passenger's side air bag module
6. Air bag side plate
7. Glove box striker
8. Instrument panel center reinforcement
9. Defroster garnish
10. Instrument panel

FLOOR CONSOLE

REMOVAL AND INSTALLATION



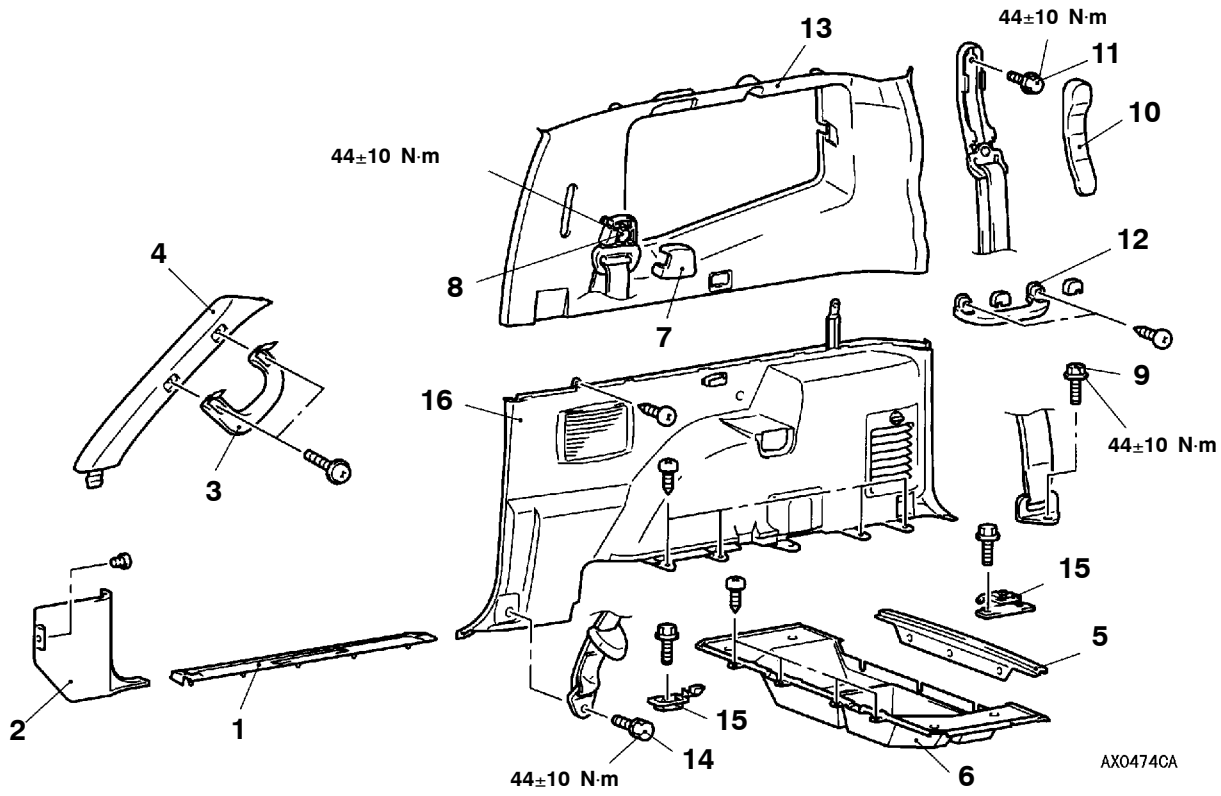
Removal steps

1. Parking brake lever cover
2. Cup holder
3. Transfer shift knob
4. Selector lever knob
5. Indicator panel
6. Shift lever cover
7. Switch panel
8. Lower center panel
- Parking brake lever mounting bolt
9. Rear floor console assembly
10. Front floor console
11. Rear heater duct A
12. Console bracket A
13. Rear control assembly
14. Rear heater duct B
15. Rear heater duct nozzle
16. Rear floor console ashtray
17. Rear floor console box
18. Rear floor console bracket
19. Rear floor console upper cover
20. Rear floor console hinge cover
21. Hinge bracket
22. Lock A
23. Lock B
24. Lid bracket
25. Lid box
26. Lid assembly
27. Rear floor console
28. Console bracket B

TRIMS

REMOVAL AND INSTALLATION

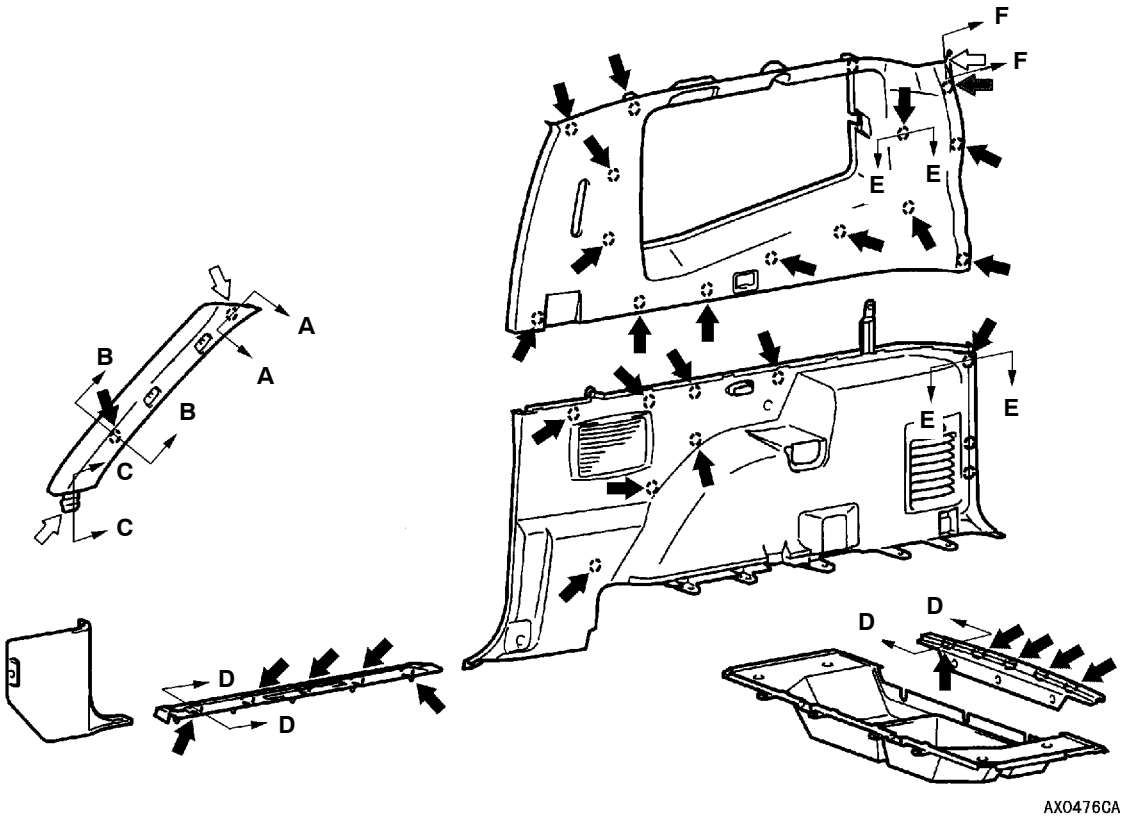
<Short Wheelbase>



NOTE
For door trims, refer to GROUP 42.

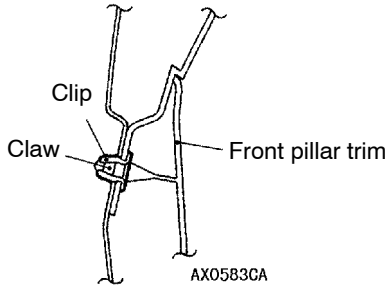
1. Front scuff plate
2. Cowl side trim
3. Assist grip
4. Front pillar trim
5. Back door scuff plate
6. Luggage floor box
7. Sash guide cover
8. Front seat belt connection
9. Rear seat belt connection
10. Sash guide cover
11. Rear seat belt connection
12. Assist grip
13. Quarter trim, upper
14. Front seat belt connection
15. Luggage hook
16. Quarter trim, lower

CLIP AND CLAW POSITION

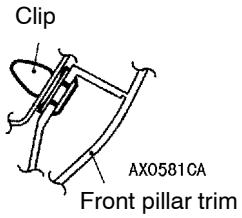


NOTE
⬅: Clip position
⇦: Claw position

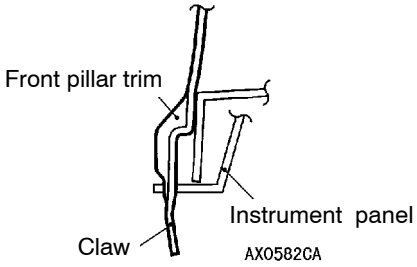
Section A - A



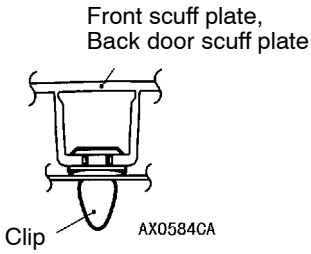
Section B - B



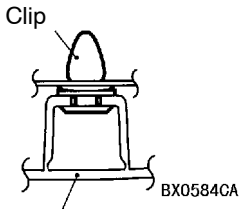
Section C - C



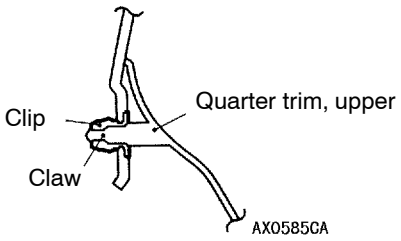
Section D - D



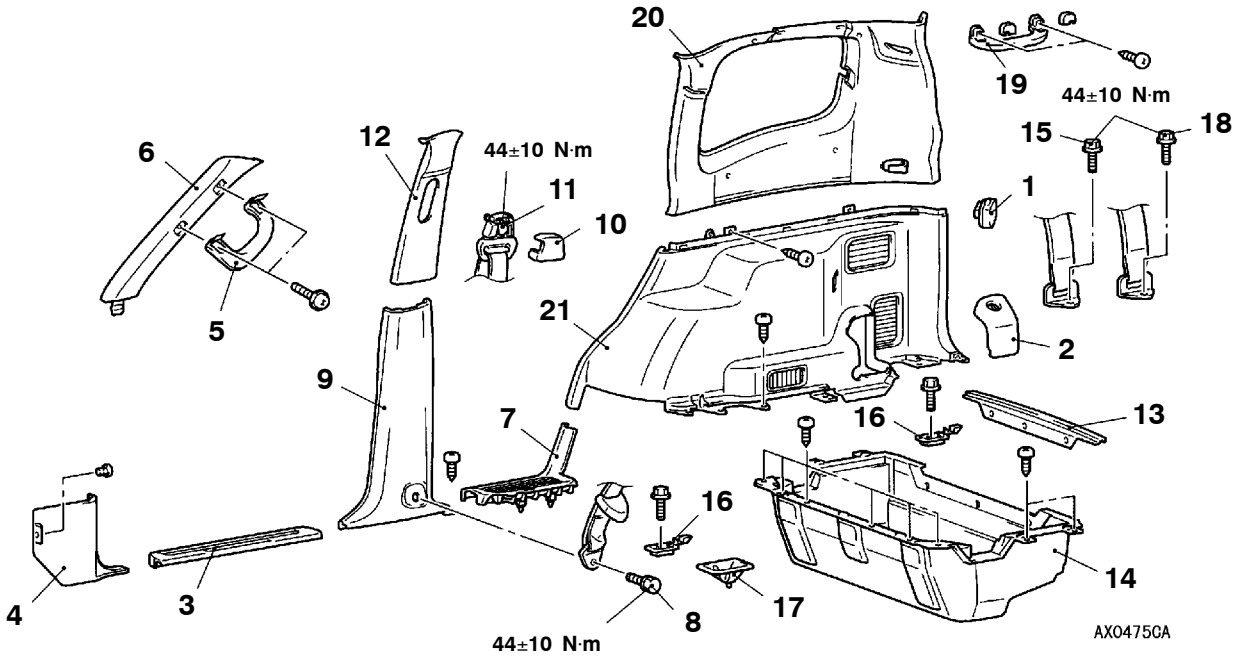
Section E - E



Section F - F



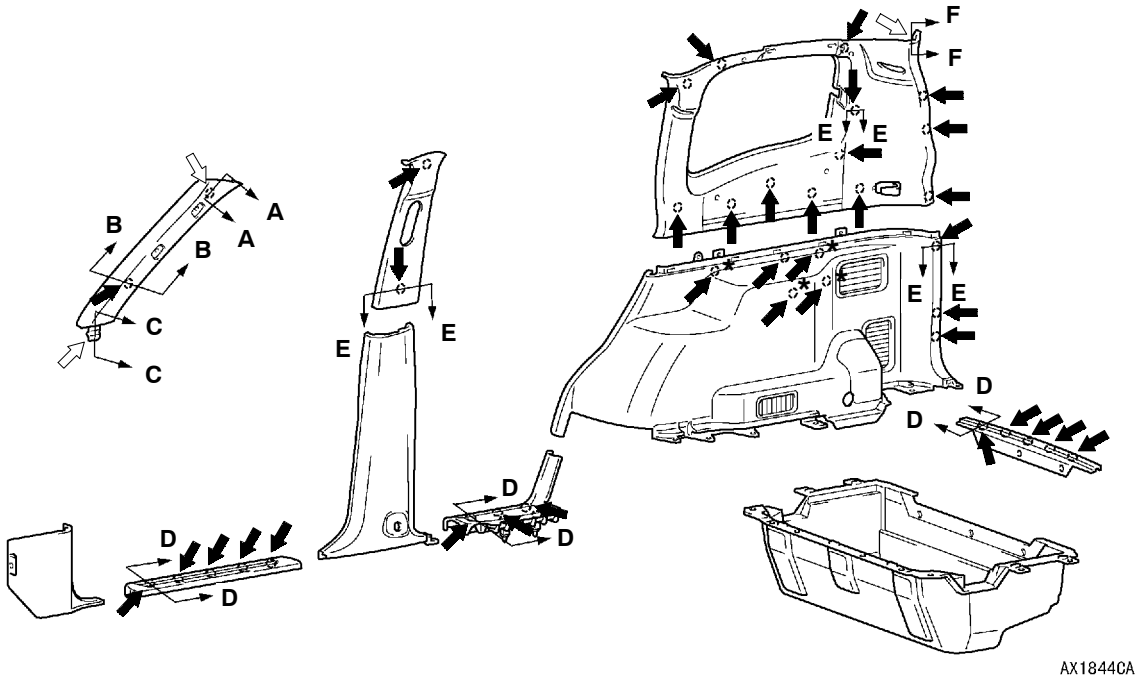
<Long Wheelbase>



NOTE
For door trims, refer to GROUP 42.

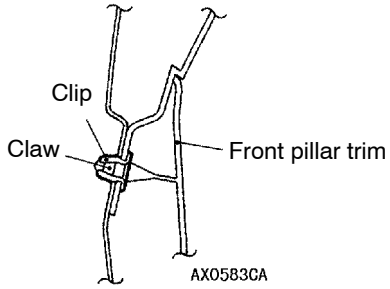
1. AC socket
2. Quarter trim cover
- Third seat assembly
3. Front scuff plate
4. Cowl side trim
5. Assist grip
6. Front pillar trim
7. Rear scuff plate
8. Front seat belt connection
9. Center pillar trim, lower
10. Sash guide cover
11. Front seat belt connection
12. Center pillar trim, upper
13. Back door scuff plate
14. Luggage floor box
15. Second seat belt connection
16. Luggage hook
17. Striker cover
18. Third seat belt connection
19. Assist grip
20. Quarter trim, upper
21. Quarter trim, lower

CLIP AND CLAW POSITION

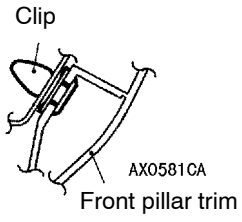


NOTE
⬅: Clip position (* mark shows L.H. side only)
⇦: Claw position

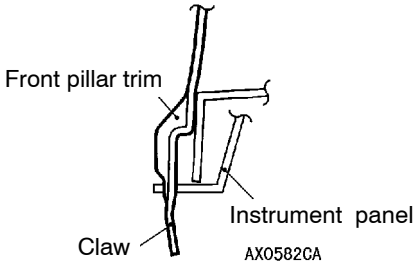
Section A - A



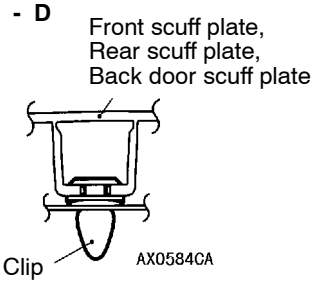
Section B - B



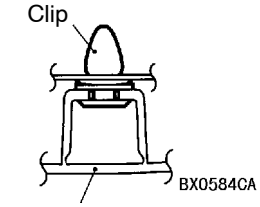
Section C - C



Section D - D

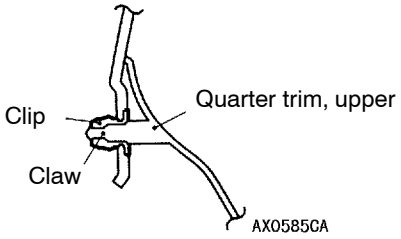


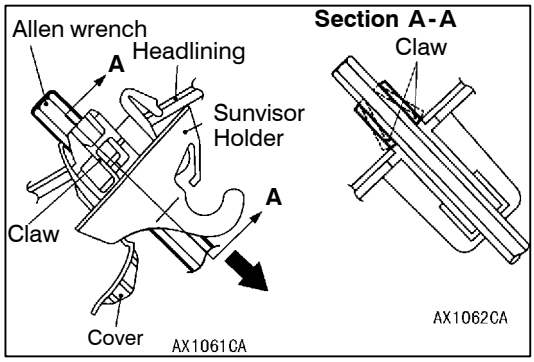
Section E - E



Quarter trim, upper,
Quarter trim, lower,
Center pillar trim

Section F - F





SUNVISOR HOLDER

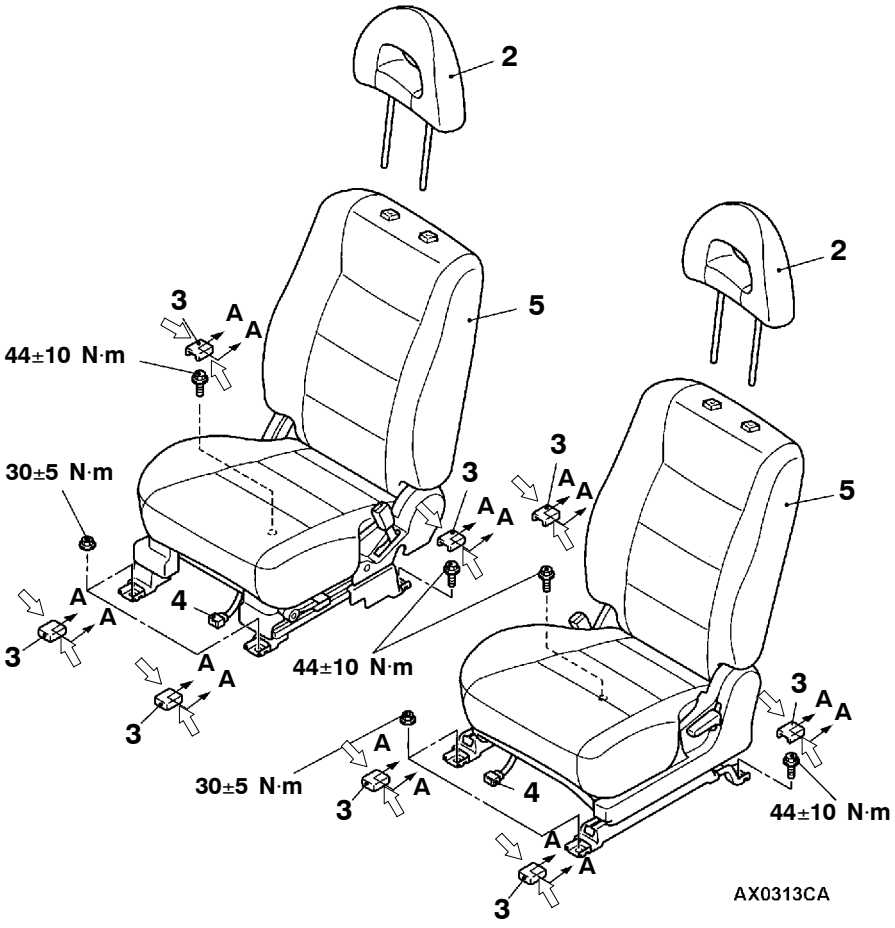
REMOVAL SERVICE POINT

SUNVISOR HOLDER REMOVAL

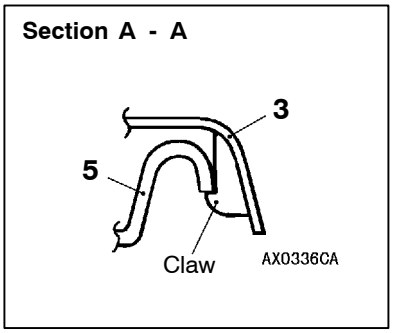
1. Remove the sunvisor holder cover, insert a 6 mm-Allen wrench to disengage the sunvisor holder side claws.
2. Pull out the sunvisor into the shown direction to remove the sunvisor holder.

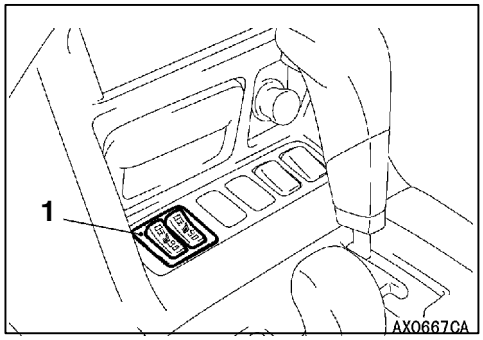
FRONT SEAT

REMOVAL AND INSTALLATION



NOTE:
⇦ marks show claw positions.

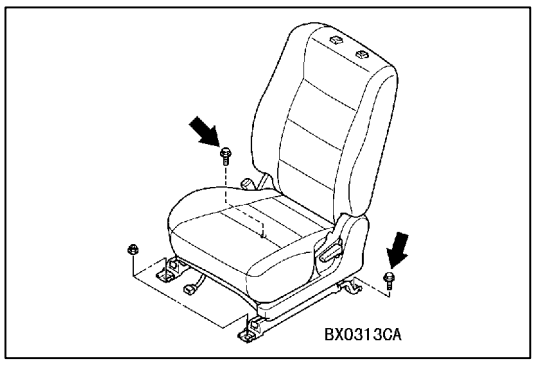




1. Heated seat switch
2. Headrestraint

Front seat assembly removal steps

3. Front seat anchor cover
4. Harness connector
▶A◀ 5. Front seat assembly



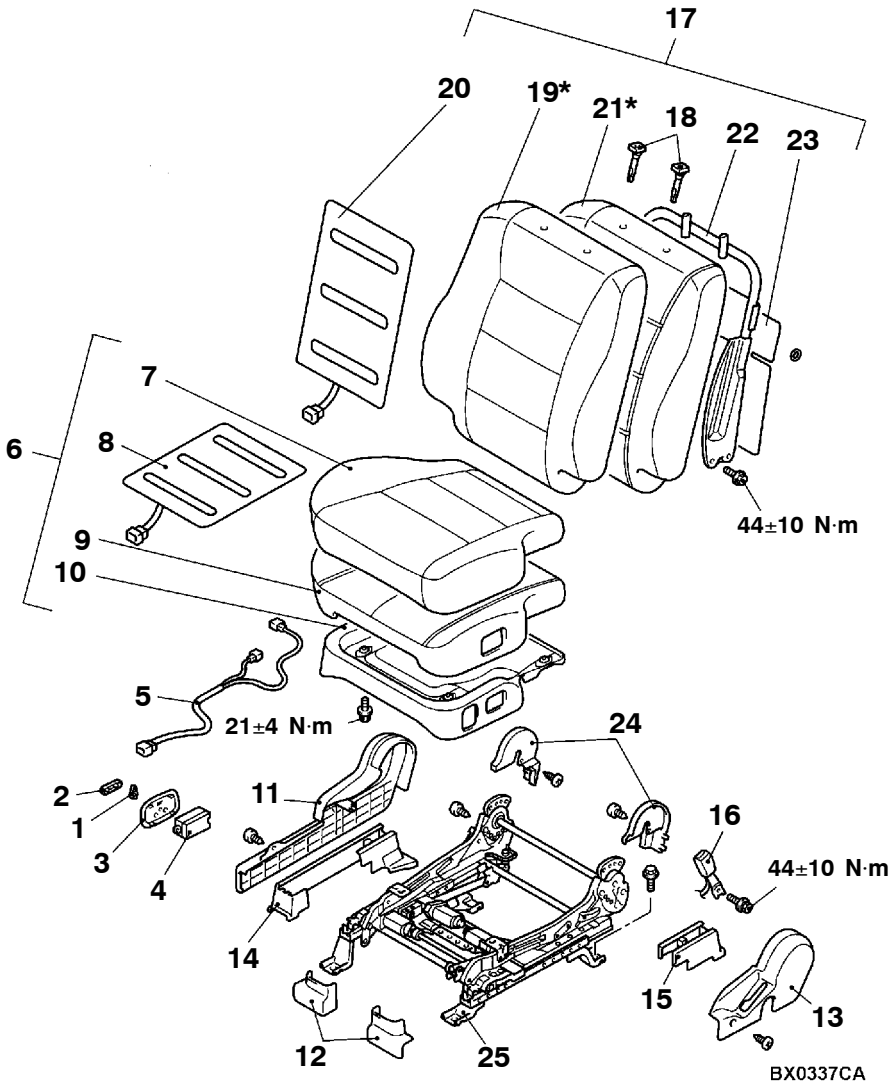
INSTALLATION SERVICE POINT

▶A◀ FRONT SEAT ASSEMBLY INSTALLATION

First install all of the front seat assembly mounting nuts and bolts, and then tighten them to the specified torque. The shown bolts should be tightened with no load applied to the front seat cushion.

DISASSEMBLY AND REASSEMBLY

<Power seat>



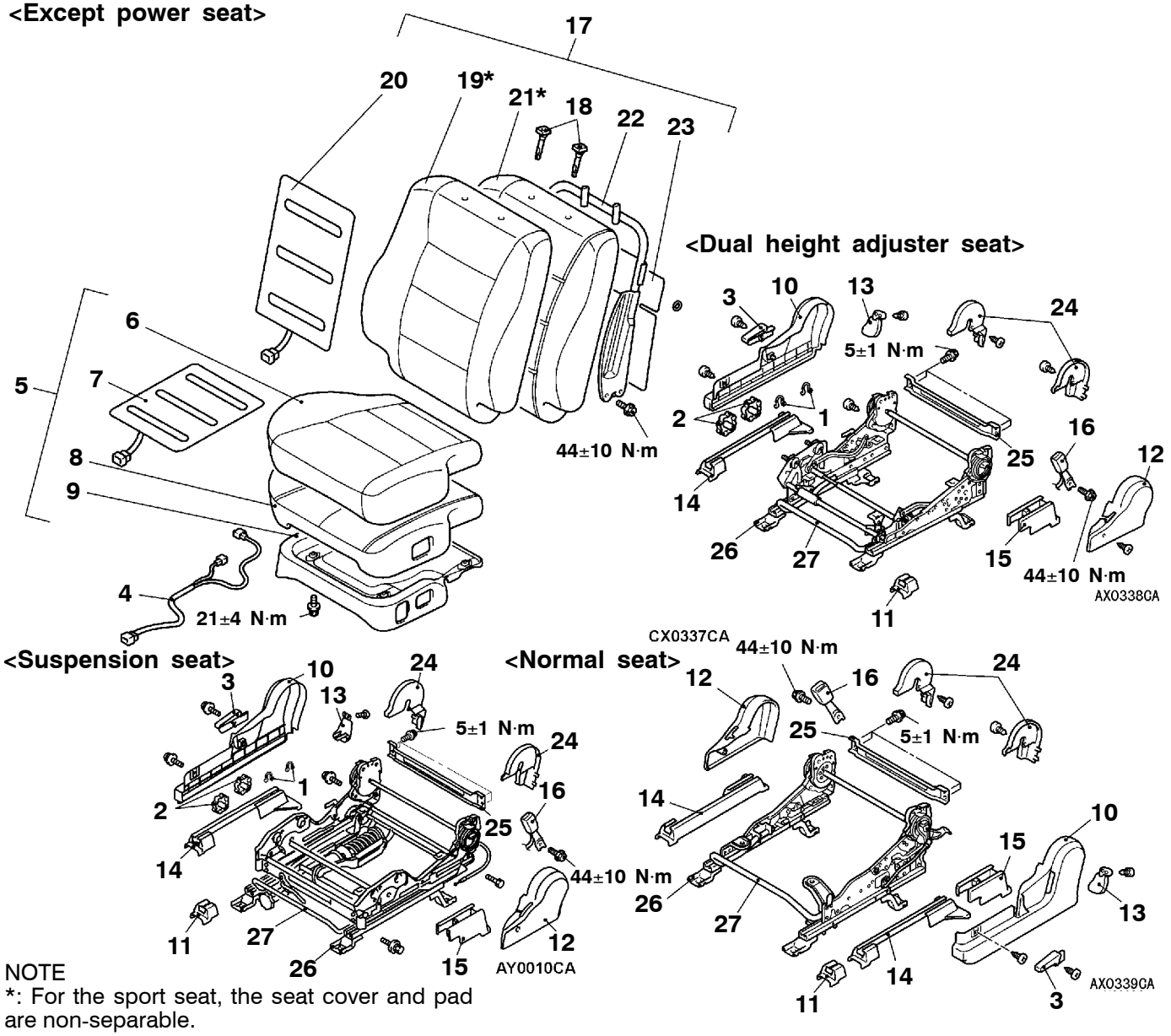
NOTE
*: For the sport seat, the seat cover and pad are non-separable.

Disassembly steps

1. Reclining adjuster knob
2. Slide adjuster knob
3. Power seat switch garnish
4. Power seat switch
5. Harness clamp
6. Front seat cushion assembly
7. Front seat cushion cover
8. Front seat cushion heater
9. Front seat cushion pad
10. Front seat cushion frame
11. Side shield cover
12. Front rail cover
13. Hinge cover

◀A▶

14. Seat slide adjuster side cover
15. Seat slide adjuster inner side cover
16. Inner seat belt
17. Front seat back assembly
18. Headrestraint guide
19. Front seatback cover
20. Front seatback heater
21. Front seatback pad
22. Front seatback frame
    <Vehicles without side air bag>
23. Front seatback board
24. Reclining adjuster lower cover
25. Seat slide adjuster



NOTE
*: For the sport seat, the seat cover and pad are non-separable.

Disassembly steps

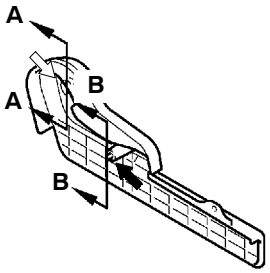
1. Clip<Vehicles with Suspension seat and dual height adjuster seat>
2. Height adjuster knob<Vehicles with Suspension seat and dual height adjuster seat>
3. Reclining adjuster lever
4. Harness clamp
5. Front seat cushion assembly
6. Front seat cushion cover
7. Front seat cushion heater
8. Front seat cushion pad
9. Front seat cushion frame
10. Side shield cover
11. Front rail cover
12. Hinge cover
13. Rear rail cover

◀A▶

14. Seat slide adjuster side cover
15. Seat slide adjuster inner side cover
16. Inner seat belt
17. Front seat back assembly
18. Headrestraint guide
19. Front seatback cover
20. Front seatback heater
21. Front seatback pad
22. Front seatback frame <Vehicles without side air bag>
23. Front seat back board
24. Reclining adjuster lower cover
25. Front seat frame
26. Seat slide adjuster
27. Seat slide adjuster lever

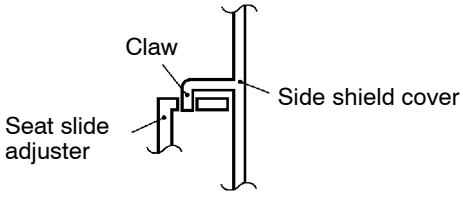
CLIP AND CLAW POSITION

<Side shield cover>



ACX01394

Section A - A



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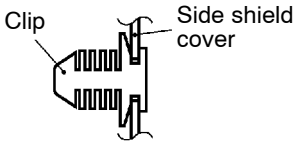
Section B - B



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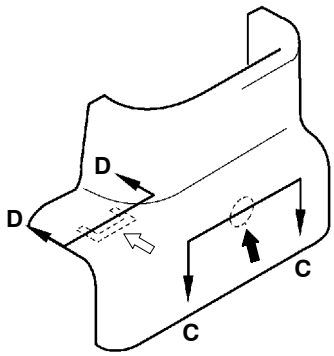
<Front rail cover>



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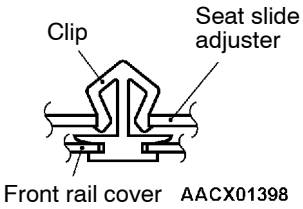
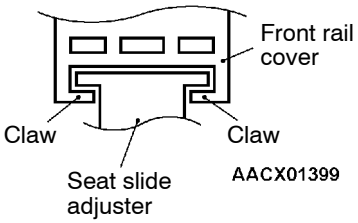
Section C - C



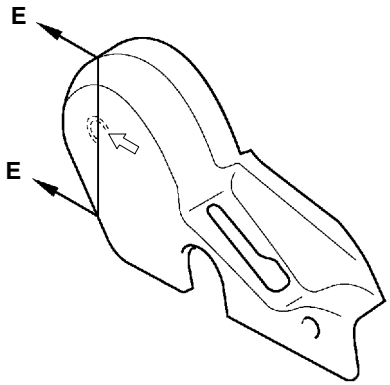
AACX01398

Section D - D



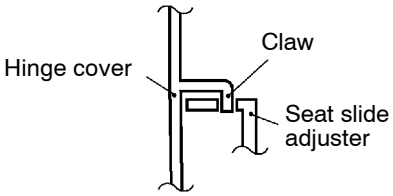
AACX01399

<Hinge cover>



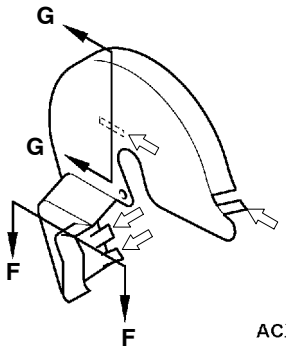
ACX01400

Section E - E



AACX01401

<Reclining adjuster lower cover>



ACX01402

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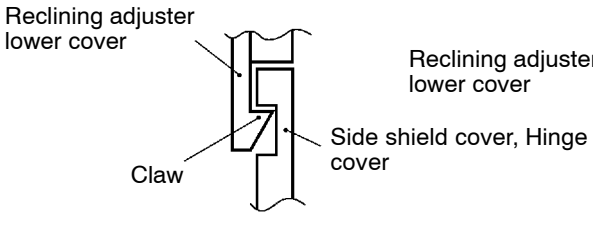
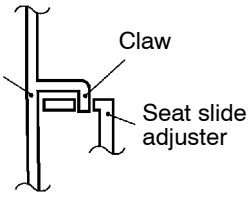


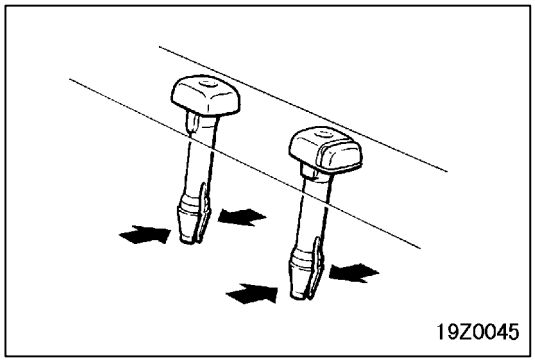
AACX01403

Section G - G



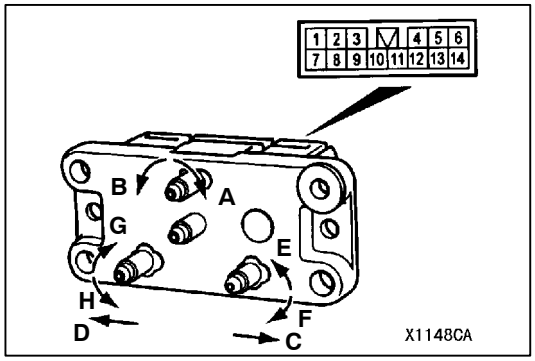
AACX01401

NOTE
⬅ : Clip position
⇦ : Claw position



REMOVAL SERVICE POINT

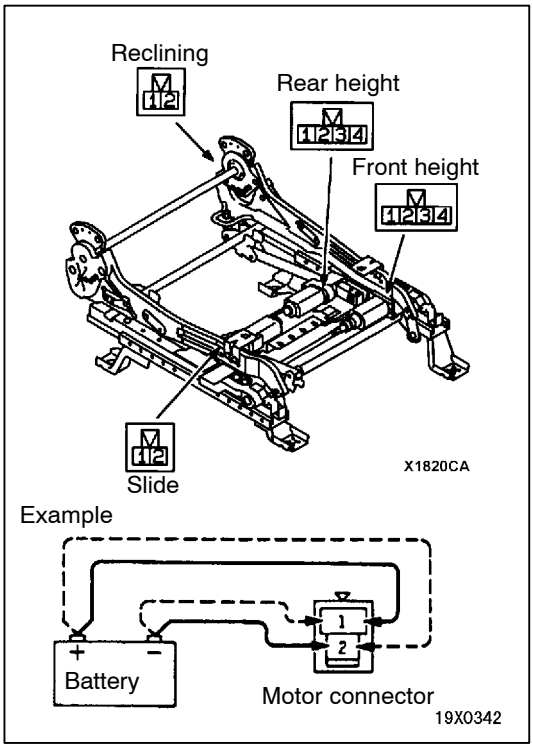
◀A▶ HEADRESTRAINT GUIDE REMOVAL



INSPECTION

POWER SEAT MANUAL SWITCH CONTINUITY CHECK

Switch position			Terminal No.									
			1	2	3	4	5	6	7	8	13	14
Reclining switch	Front	A			○							○
						○					○	
	Rear	B				○						○
					○						○	
Slide switch	Front	C								○		○
									○		○	
	Rear	D							○			○
										○	○	
Front height switch	Up	E		○								○
			○								○	
	Down	F	○									○
				○							○	
Rear height switch	Up	G					○					○
								○			○	
	Down	H						○				○
							○				○	

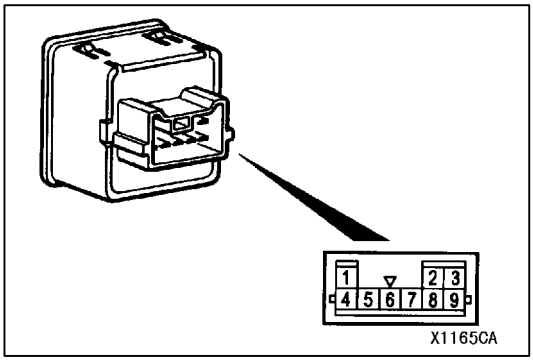


POWER SEAT SWITCH FUNCTION CHECK

1. Disconnect the motor connectors.
2. When the battery voltage is applied to the motor terminals, each motor should run smoothly and the seat adjusting mechanism should meet the table below.

Motor name	Function direction	Terminal No.				Stop position
		1	2	3	4	
Front height	Down	⊕	⊖	-	-	Should stop at predetermined limit position.
	Up	⊖	⊕	-	-	
Rear height	Down	-	-	⊕	⊖	
	Up	-	-	⊖	⊕	
Slide	Rear	⊕	⊖	-	-	
	Front	⊖	⊕	-	-	
Reclining	Rear	⊖	⊕	-	-	
	Front	⊕	⊖	-	-	

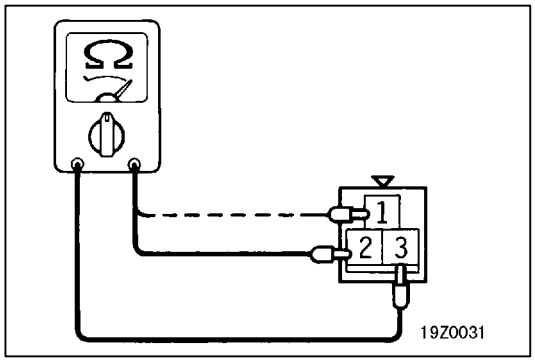
3. If defective, check the power seat adjuster assembly.



HEATED SEAT SWITCH CONTINUITY CHECK

	Switch position	1	3	4	5	IND	8	9	2	6
Driver's side	HI									
	OFF									
	LO									
Passenger's side	HI									
	OFF									
	LO									

ILL

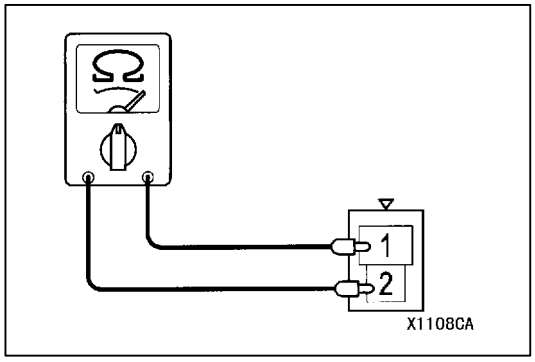


SEAT CUSHION HEATER CHECK

Measure the resistance between terminals.

Standard value (at cabin temperature of 20°C):

Terminal No.	Sport seat	Except sport seat
Between terminals 1–3	6.0Ω±10%	5.0Ω±10%
Between terminals 2–3	6.4Ω±10%	5.4Ω±10%



SEATBACK HEATER CHECK

Measure the resistance between terminals.

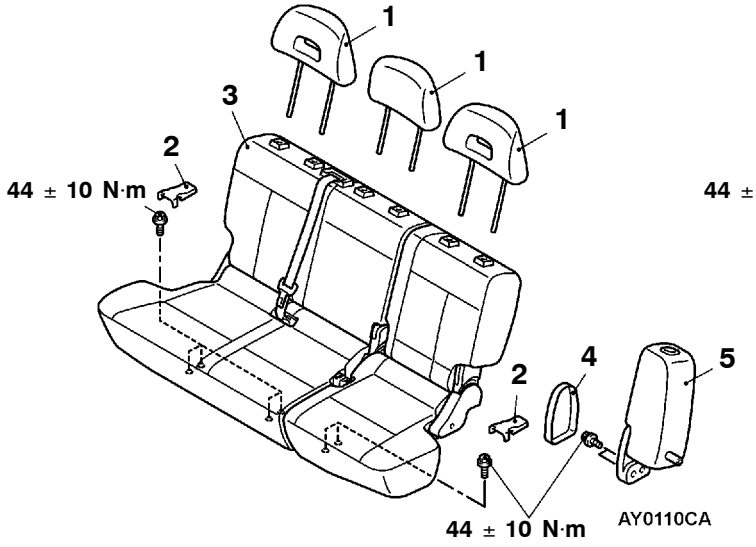
Standard value (at cabin temperature of 20°C):

Terminal No.	Sport seat	Except sport seat
Between terminals 1–2	6.0Ω±10%	6.0Ω±10%

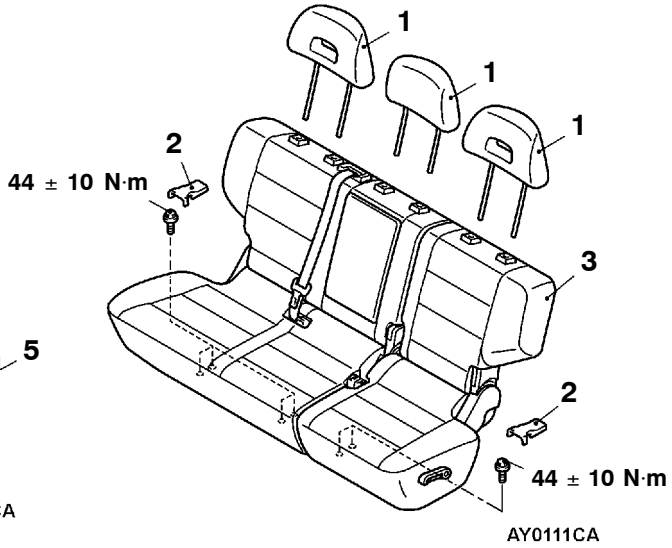
REAR/SECOND SEAT

REMOVAL AND INSTALLATION

<Short wheelbase>



<Long wheelbase>



1. Headrestraint

Rear/second seat assembly removal steps

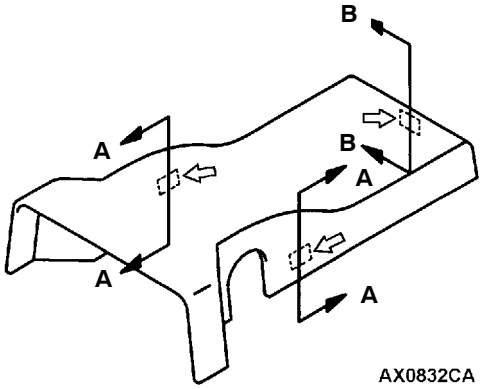
2. Seat anchor cover
3. Rear/second seat assembly

Seat side back assembly removal steps

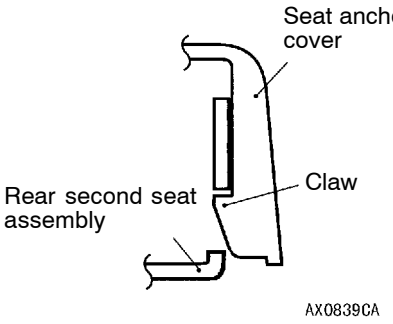
4. Seat hinge cover
5. Seat side back assembly

CLAW POSITION

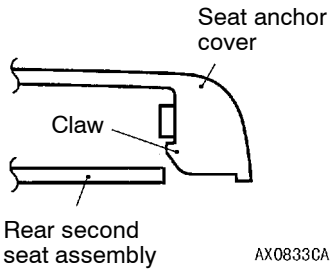
<Seat anchor cover>



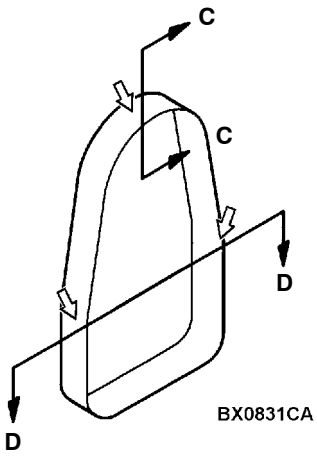
Section A - A



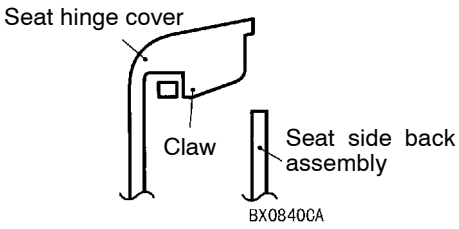
Section B - B



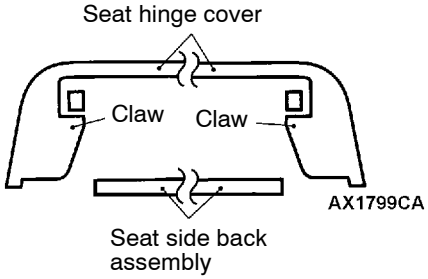
<Front rail cover>



Section C - C



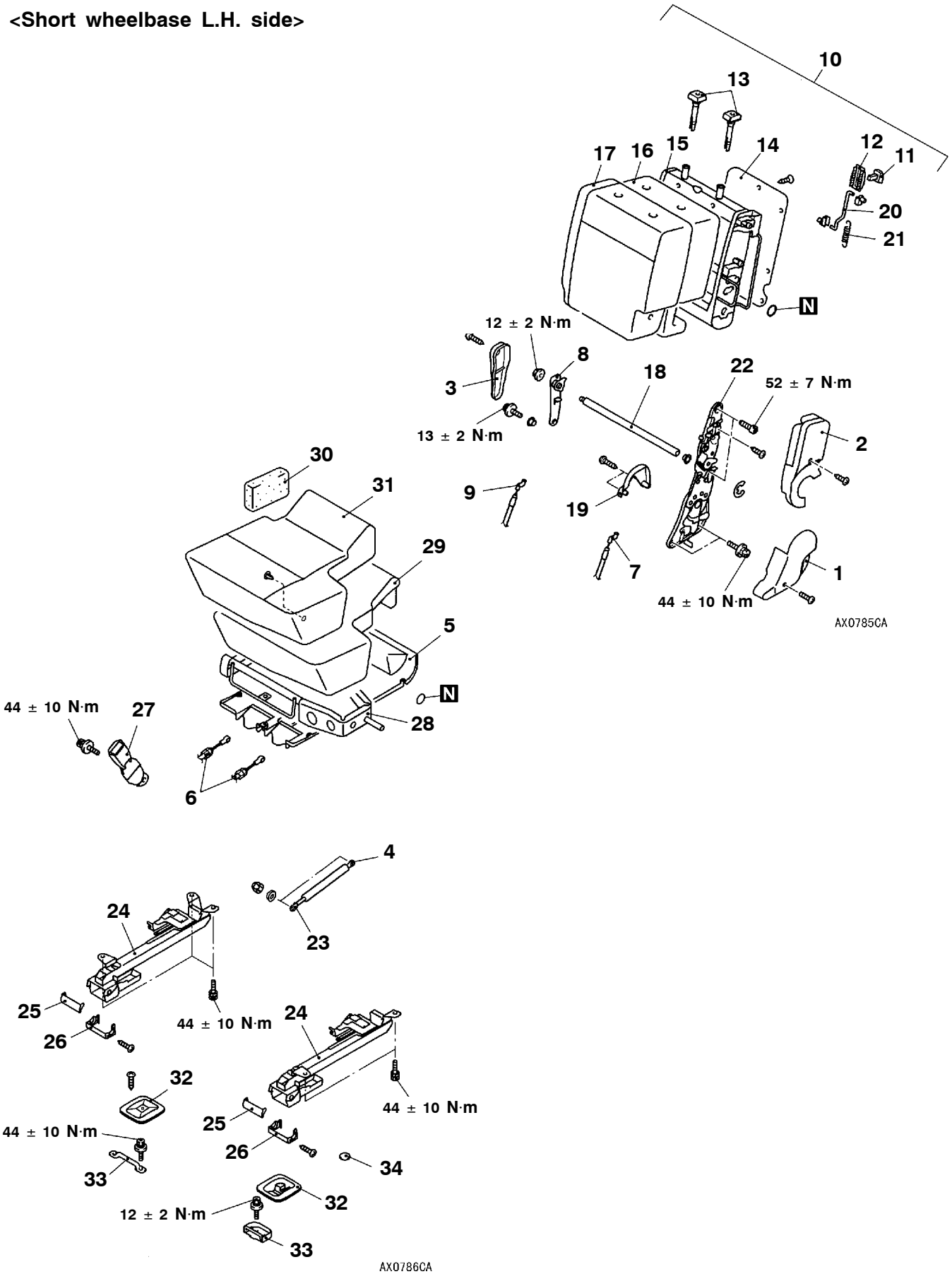
Section D - D



NOTE
⇦ : Claw position

DISASSEMBLY AND REASSEMBLY

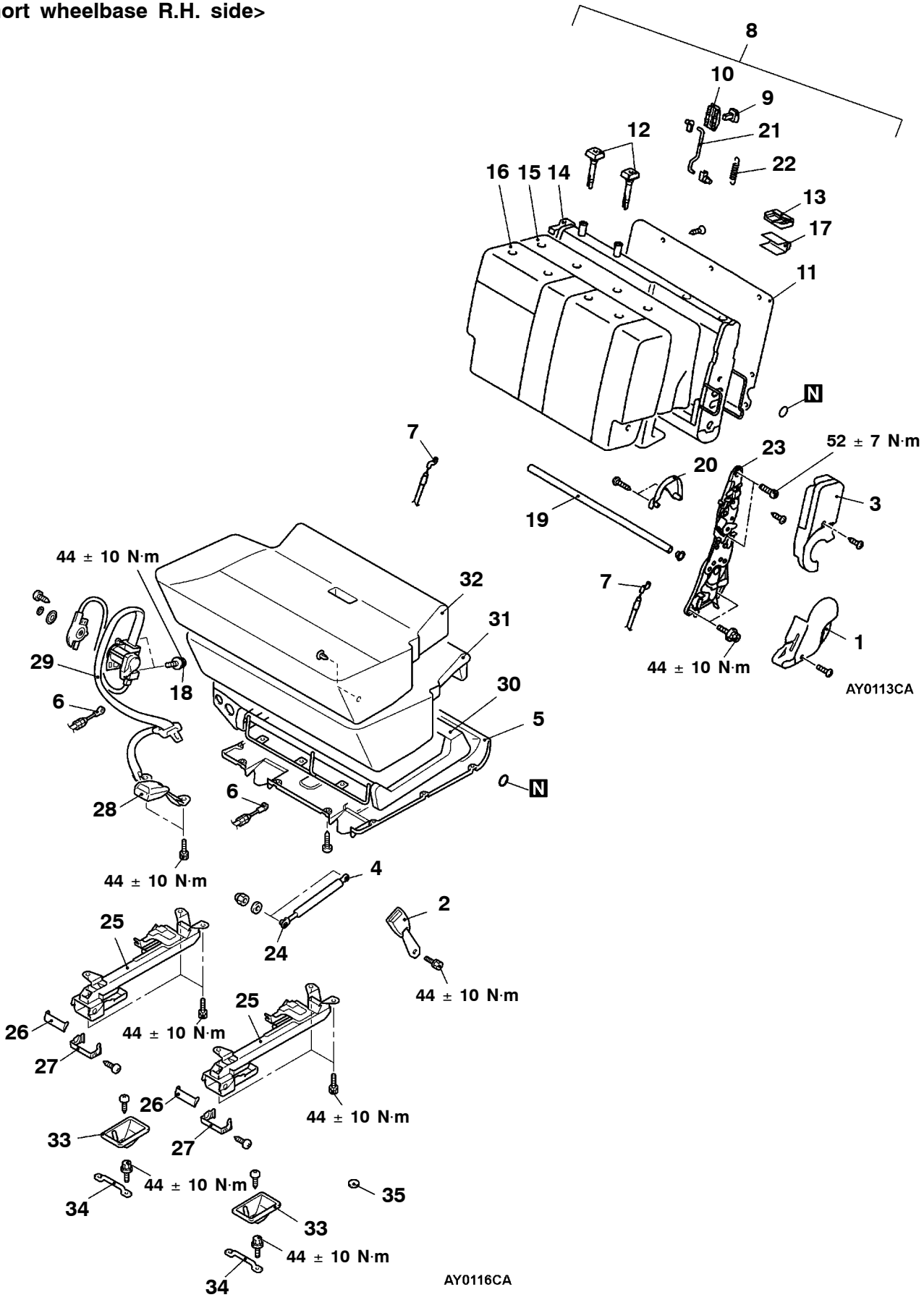
<Short wheelbase L.H. side>



Disassembly steps

1. Lower reclining adjuster cover
2. Center reclining adjuster cover
3. Free hinge cover
4. Gas damper connection
5. Rear seat cushion under cover
6. Catch cable A, B connection
7. Catch cable A
8. Hinge bracket
9. Catch cable B
10. Rear seat back assembly
11. Folding lever knob
12. Folding knob garnish
13. Headrestraint guide ◀A▶
14. Rear seat back board
15. Rear seat back frame
16. Rear seat back pad
17. Rear seat back cover
18. Shaft
19. Reclining adjuster back cover
20. Rod
21. Spring
22. Reclining adjuster
23. Gas damper
24. Rear seat catch assembly
25. Upper foot cover
26. Lower foot cover
27. Inner seat belt
28. Rear seat cushion frame
29. Rear seat cushion pad
30. Support pad
31. Rear seat cushion cover
32. Striker cover
33. Striker
34. Plug

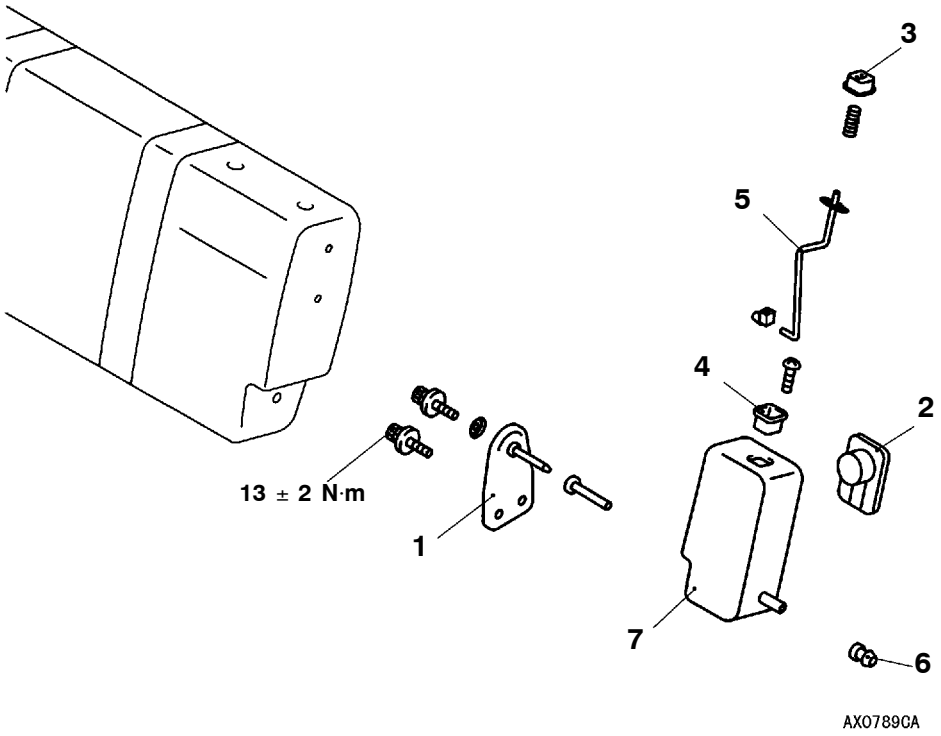
<Short wheelbase R.H. side>



Disassembly steps

1. Lower reclining adjuster cover
2. Inner seat belt
3. Center reclining adjuster cover
4. Gas damper connection
5. Rear seat cushion under cover
6. Catch cable A connection
7. Catch cable A
8. Rear seat back assembly
9. Folding lever knob
10. Folding knob garnish
11. Rear seat back board
◀A▶ 12. Headrestraint guide
13. Sash anchor garnish
14. Rear seat back frame
15. Rear seat back pad
16. Rear seat back cover
17. Seat belt protector
18. Center seat belt connection
19. Shaft
20. Reclining adjuster back cover
21. Rod
22. Spring
23. Reclining adjuster
24. Gas damper
25. Rear seat catch assembly
26. Upper foot cover
27. Lower foot cover
28. Inner seat belt
29. Center seat belt
30. Rear seat cushion frame
31. Rear seat cushion pad
32. Rear seat cushion cover
33. Striker cover
34. Striker
35. Plug

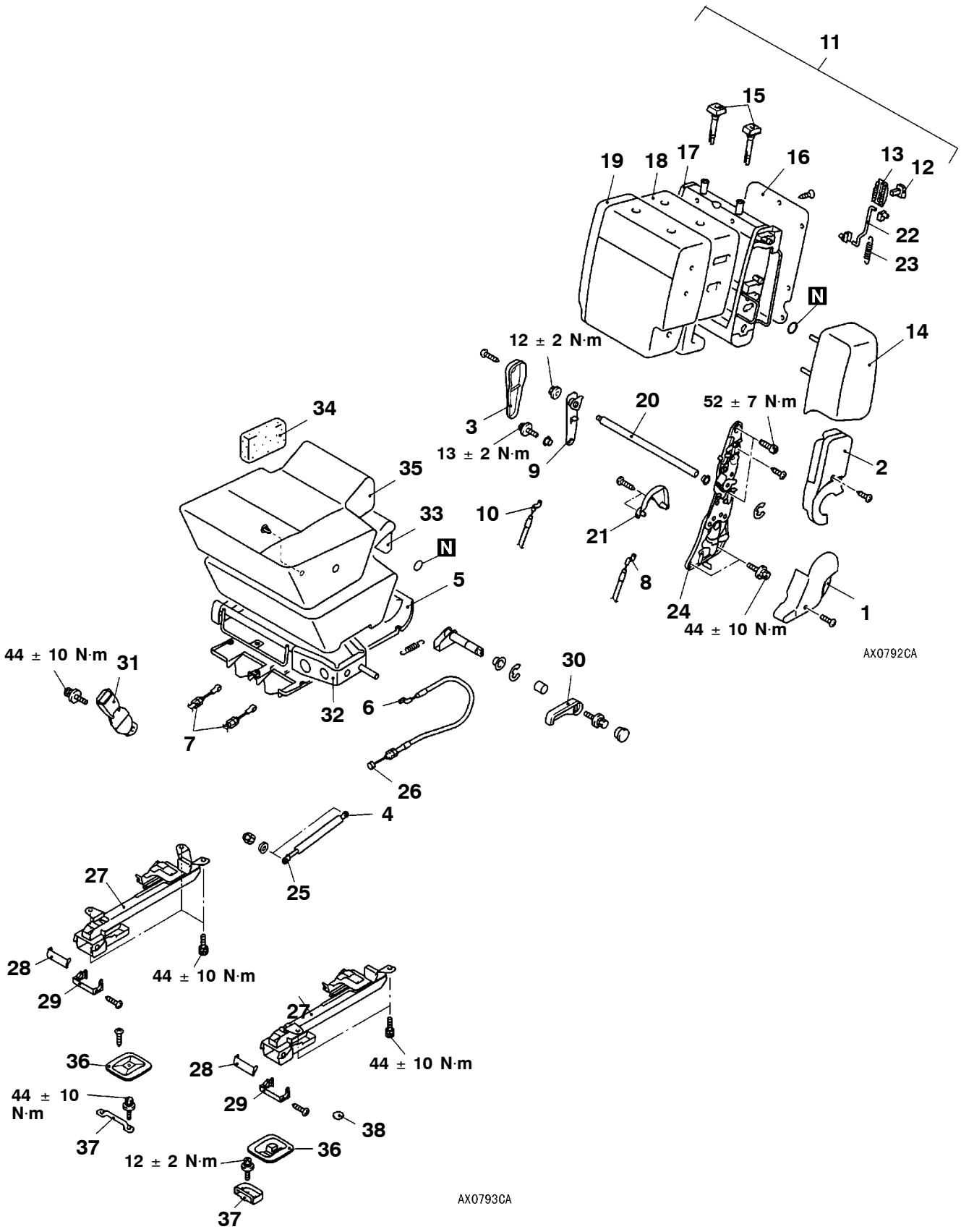
<Short wheelbase-Rear seat side back assembly>



Disassembly steps

1. Hinge bracket
2. Cup holder
3. Knob
4. Knob guide
5. Rod
6. Bushing
7. Rear seat side back

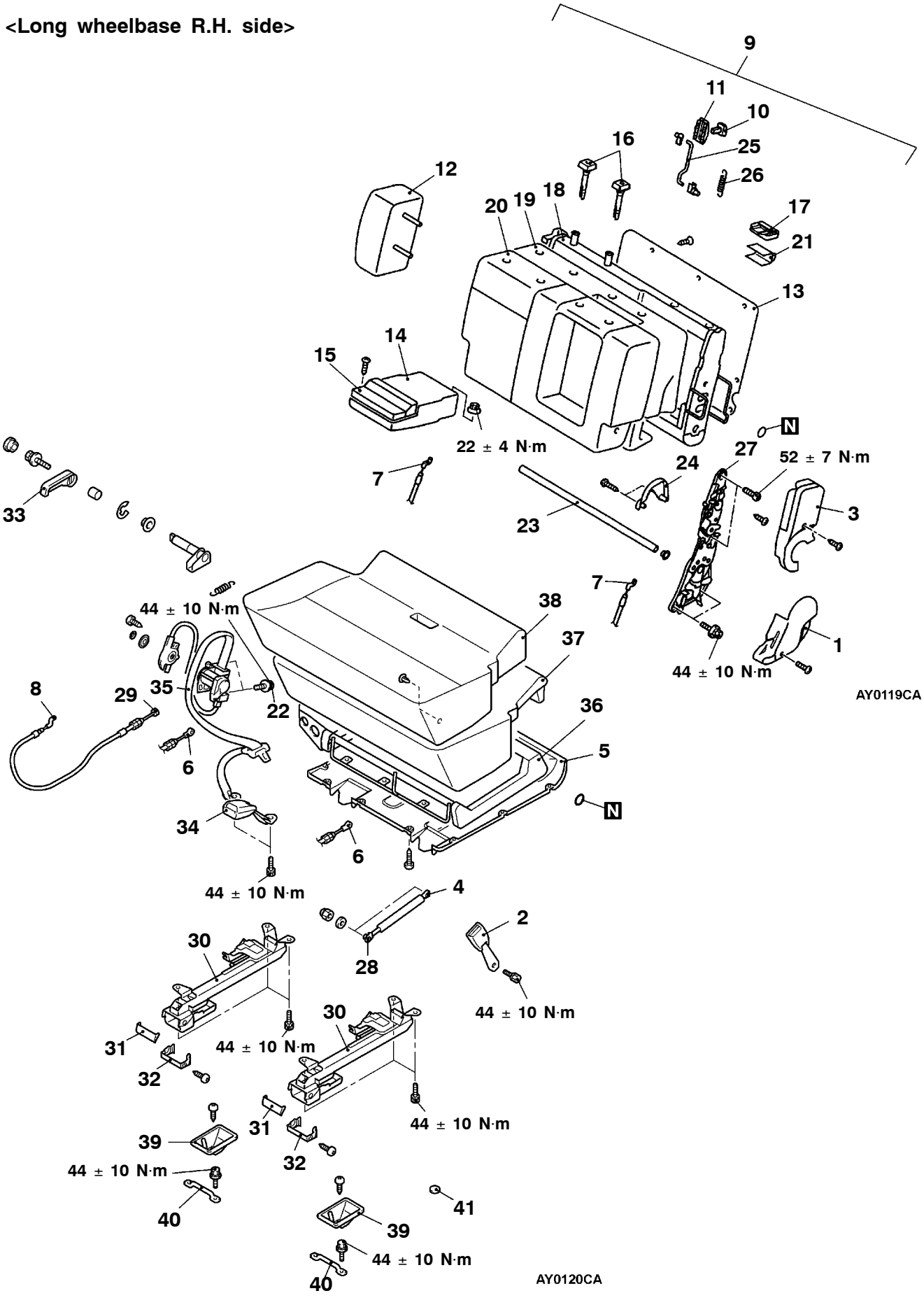
<Long wheelbase L.H. side>



Disassembly steps

1. Lower reclining adjuster cover
2. Center reclining adjuster cover
3. Free hinge cover
4. Gas damper connection
5. Rear seat cushion under cover
6. Reclining cable connection
7. Catch cable A, B connection
8. Catch cable A
9. Hinge bracket
10. Catch cable B
11. Second seat back assembly
12. Folding lever knob
13. Folding knob garnish
14. Second seat side back assembly
◀A▶ 15. Headrestraint guide
16. Second seat back board
17. Second seat back frame
18. Second seat back pad
19. Second seat back cover
20. Shaft
21. Reclining adjuster back cover
22. Rod
23. Spring
24. Reclining adjuster
25. Gas damper
26. Reclining cable
27. Second seat catch assembly
28. Upper foot cover
29. Lower foot cover
30. Reclining knob
31. Inner seat belt
32. Second seat cushion frame
33. Second seat cushion pad
34. Support pad
35. Second seat cushion cover
36. Striker cover
37. Striker
38. Plug

<Long wheelbase R.H. side>



Disassembly steps

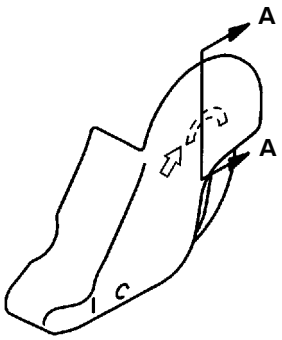
1. Lower reclining adjuster cover
2. Inner seat belt
3. Center reclining adjuster cover
4. Gas damper connection
5. Rear seat cushion under cover
6. Catch cable A connection
7. Catch cable A
8. Reclining cable connection
9. Second seat back assembly
10. Folding lever knob
11. Folding knob garnish
12. Second seat side back assembly
13. Second seat back board
14. Armrest
15. Cup holder

◀A▶ 16. Headrestraint guide

17. Sash anchor garnish
18. Second seat back frame
19. Second seat back pad
20. Second seat back cover
21. Seat belt protector
22. Center seat belt connection
23. Shaft
24. Reclining adjuster back cover
25. Rod
26. Spring
27. Reclining adjuster
28. Gas damper
29. Reclining cable
30. Second seat catch assembly
31. Upper foot cover
32. Lower foot cover
33. Reclining knob
34. Inner seat belt
35. Center seat belt
36. Second seat cushion frame
37. Second seat cushion pad
38. Second seat cushion cover
39. Striker cover
40. Striker
41. Plug

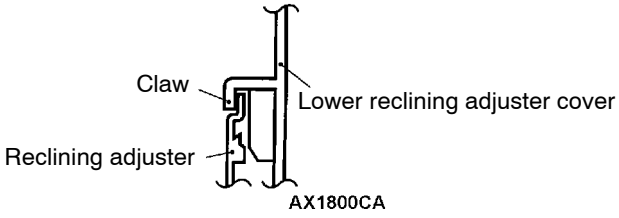
CLAW POSITION

<Lower reclining adjuster cover>



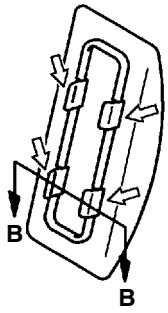
AX0800CA

Section A - A



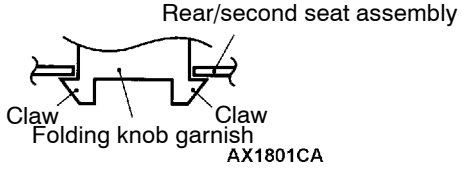
AX1800CA

<Folding knob garnish>



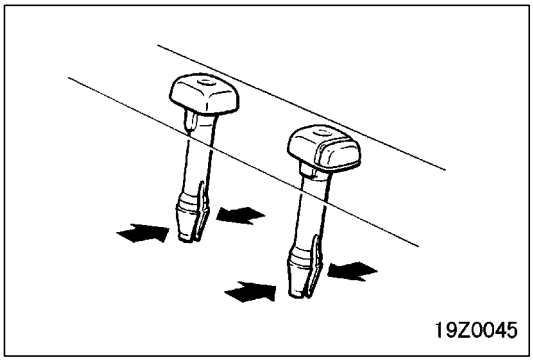
AX0830CA

Section B - B



AX1801CA

NOTE
⇦ : Claw position

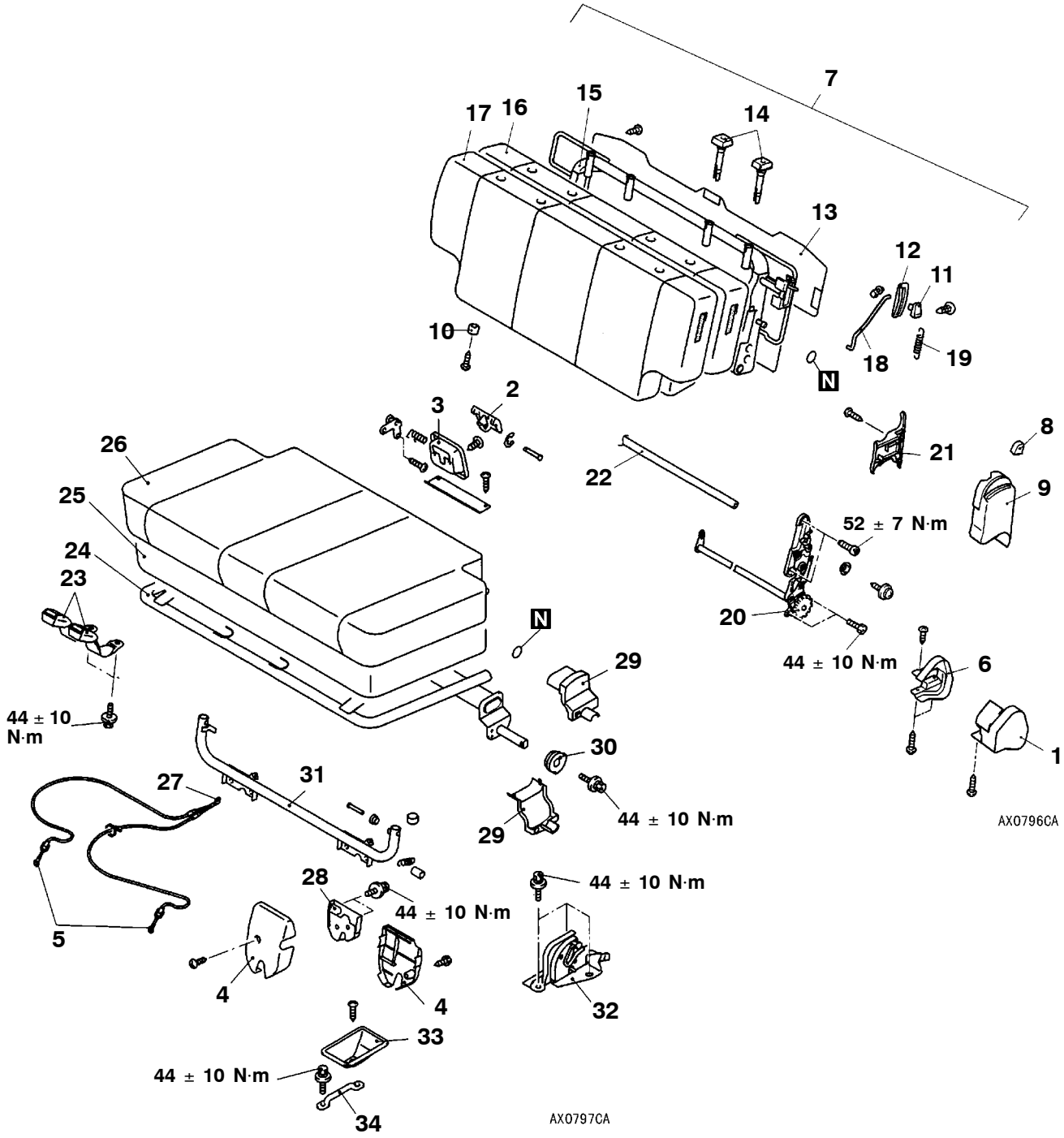


REMOVAL SERVICE POINT

◀A▶ HEADRESTRAINT GUIDE REMOVAL

THIRD SEAT

DISASSEMBLY AND REASSEMBLY

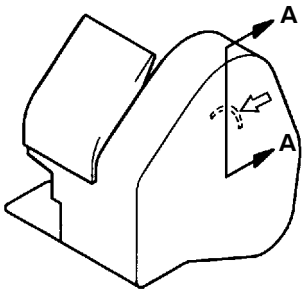


Disassembly steps

1. Outer reclining adjuster cover
2. Catch release knob
3. Catch release knob garnish
4. Latch cover
5. Catch cable connection
6. Inner reclining adjuster cover
7. Third seat back assembly
8. Reclining knob
9. Reclining adjuster cover
10. Damper
11. Folding lever knob
12. Folding knob garnish
13. Third seat back board
◀A▶ 14. Headrestraint guide
15. Third seat back frame
16. Third seat back pad
17. Third seat back cover
18. Rod
19. Spring
20. Reclining adjuster
21. Inner reclining adjuster cover
22. Shaft
23. Inner seat belt
24. Third seat cushion frame
25. Third seat cushion pad
26. Third seat cushion cover
27. Catch cable
28. Third seat latch
29. Arm cover
30. Cam
31. Third seat leg frame assembly
32. Catch assembly
33. Striker cover
34. Striker

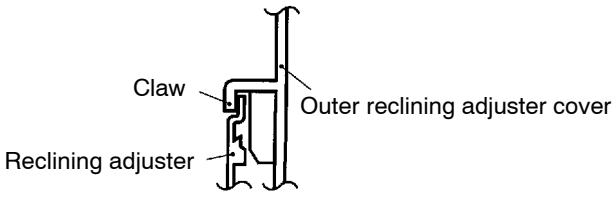
CLAW POSITION

<Outer reclining adjuster cover>



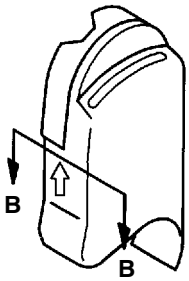
AX0805CA

Section A - A



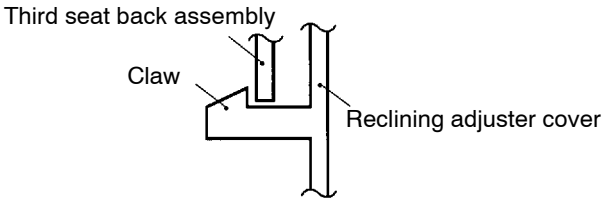
AX1264CA

<Reclining adjuster cover>



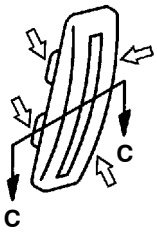
AX0806CA

Section B - B



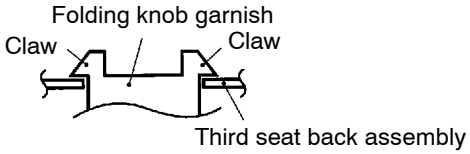
AX0834CA

<Folding knob garnish>



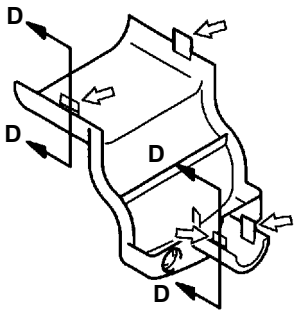
AX0829CA

Section C - C



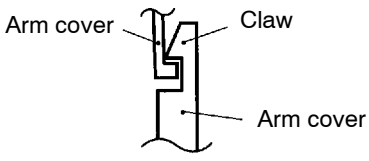
AX0835CA

<Arm cover>



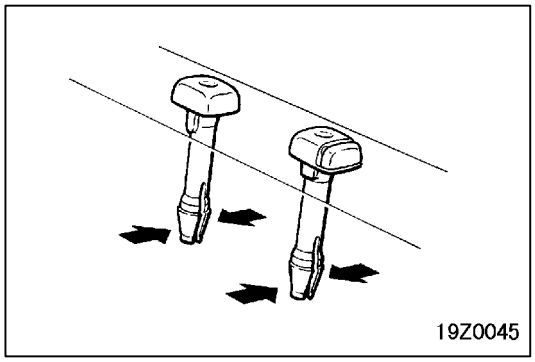
AX0807CA

Section D - D



AX0836CA

NOTE
⇦ : Claw position

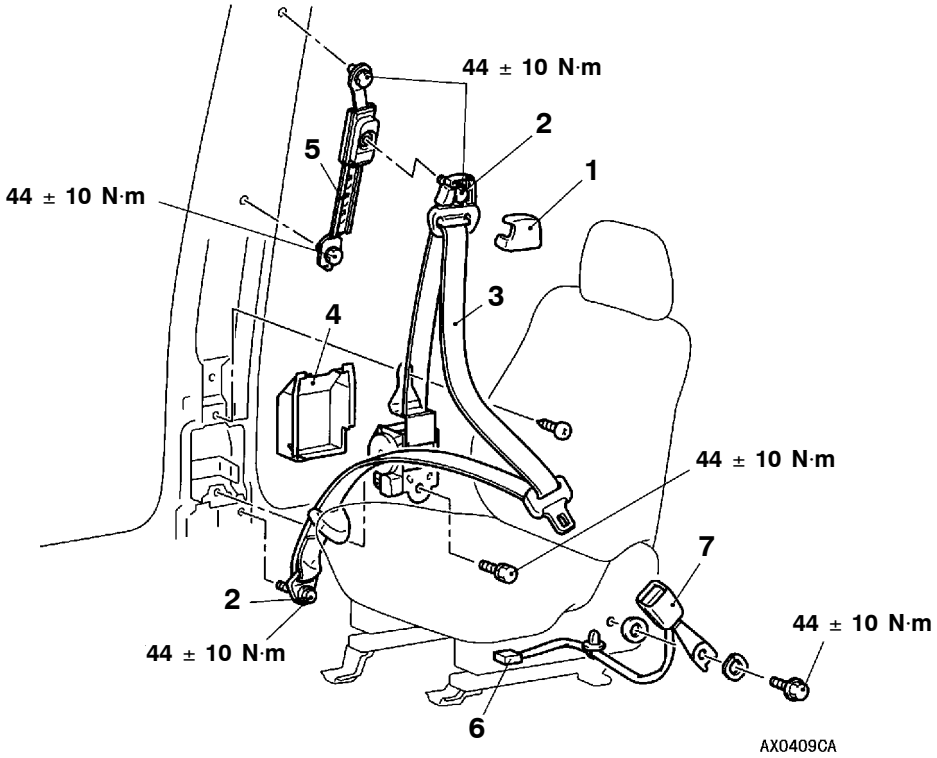


DISASSEMBLY SERVICE POINT

◀A▶ HEADRESTRAINT GUIDE REMOVAL

FRONT SEAT BELT

REMOVAL AND INSTALLATION



Outer seat belt removal steps

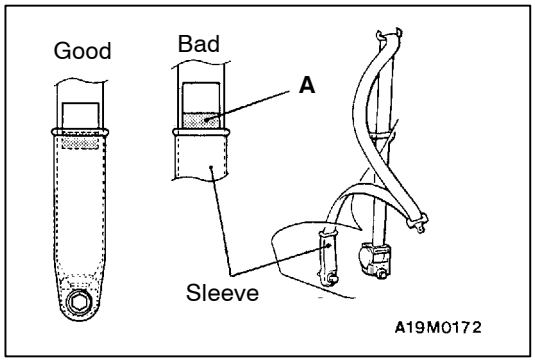
1. Sash guide cover
2. Outer seat belt connection
- Lower quarter trim <Short wheelbase> (Refer to P.52A-13.)
- Center pillar trim <Long wheelbase> (Refer to P.52A-15.)

3. Outer seat belt
4. Front noise protector
5. Shoulder anchor adjuster

Inner seat belt removal steps

- Front seat assembly (Refer to P.52A-18.)

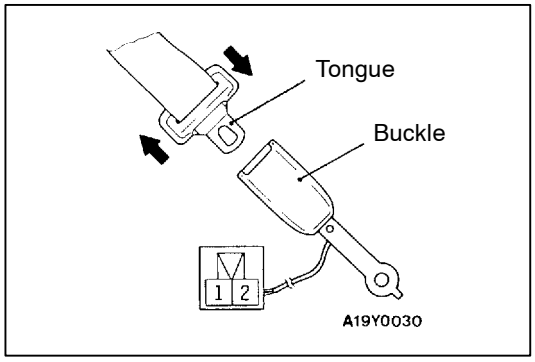
6. Seat belt switch harness connector
7. Inner seat belt



INSPECTION

OUTER SEAT BELT CHECK

Check that the A section (red) of the label attached to the outer seat belt is not exposed from the outer seat belt sleeve. If it is exposed, release the outer seat belt.

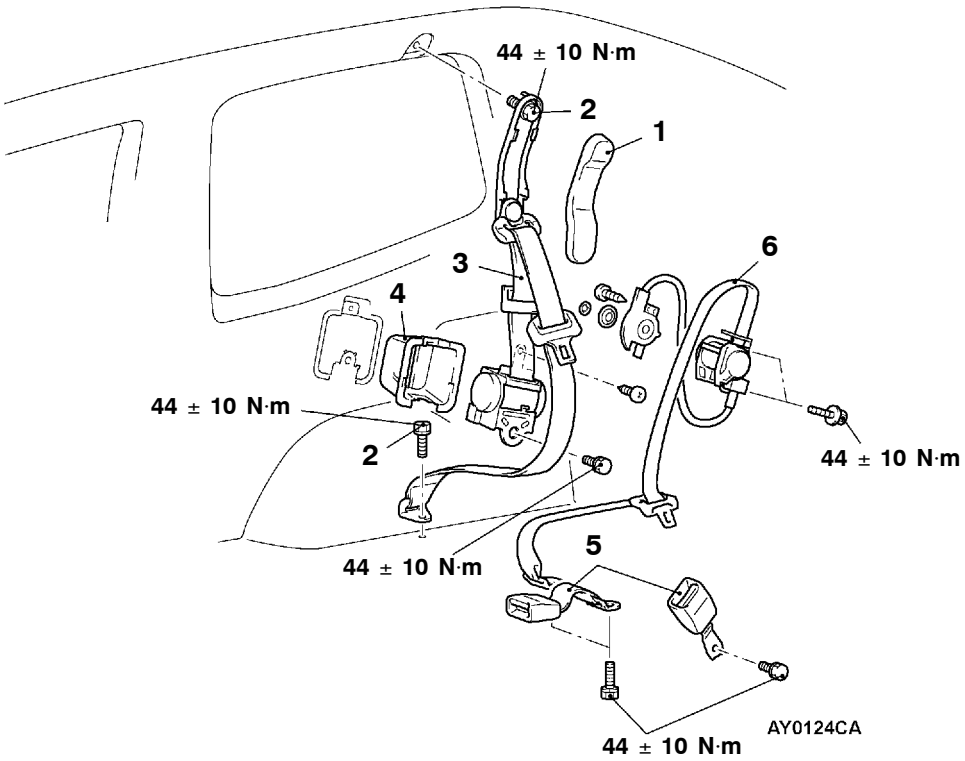


SEAT BELT BUCKLE CONTINUITY CHECK

Items	Terminal No.	
	1	2
Fastened seat belt		
Unfastened seat belt	○	○

REAR SEAT BELT<SHORT WHEELBASE>

REMOVAL AND INSTALLATION



Outer seat belt removal steps

- Rear seat assembly (Refer to P.52A-25.)
- Upper quarter trim (Refer to P.52A-13.)

1. Sash guide cover
2. Outer seat belt connection
3. Outer seat belt
4. ELR cover

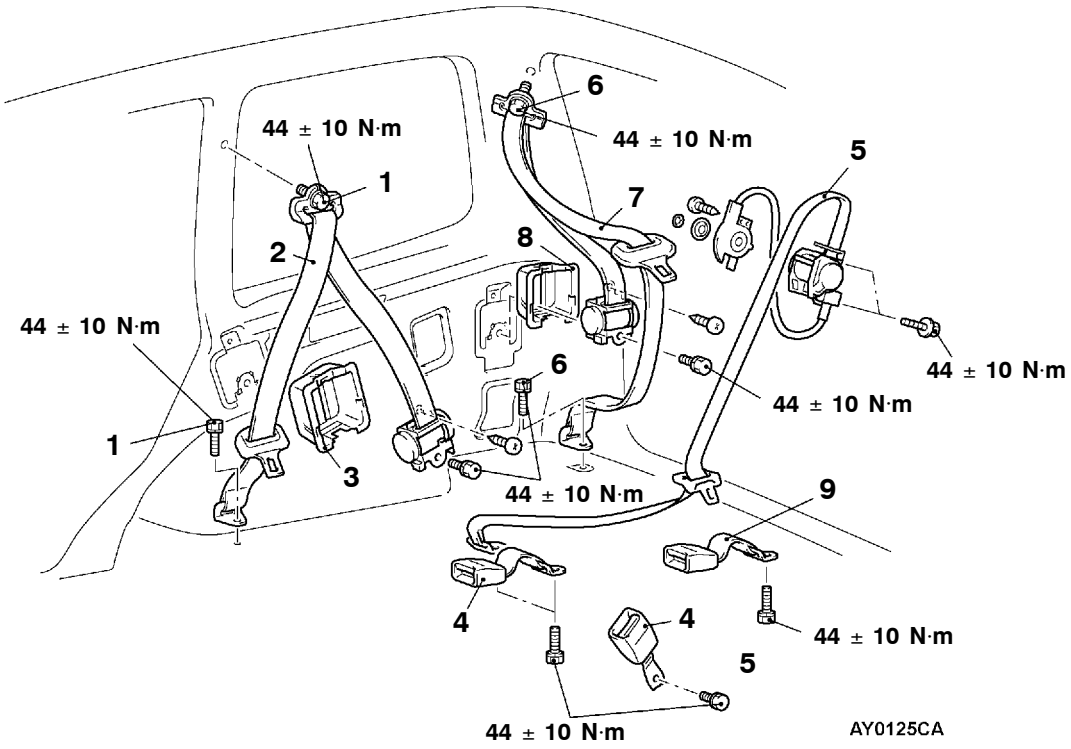
Inner seat belt and center seat belt removal steps

- Rear seat assembly (Refer to P.52A-25.)

5. Inner seat belt (Refer to P.52A-27,29.)
6. Center seat belt (Refer to P.52A-29.)

SECOND/THIRD SEAT BELT<LONG WHEELBASE>

REMOVAL AND INSTALLATION



Second seat belt removal steps

- Lower quarter trim
  (Refer to P.52A-15.)

1. Outer seat belt connection
2. Outer seat belt
3. ELR cover
4. Inner seat belt
   (Refer to P.52A-31,33.)
5. Center seat belt
   (Refer to P.52A-33.)

Inner seat belt removal steps

- Lower quarter trim
  (Refer to P.52A-15.)
- Pillar duct (R.H.)
  (Refer to GROUP 55A)
- Rear blower assembly (R.H.)
  (Refer to GROUP 55A)
- TV tuner (L.H.)(Refer to GROUP 54)

6. Outer seat belt connection
7. Outer seat belt
8. ELR cover
9. Inner seat belt
   (Refer to P.52A-35.)

NOTES

GROUP 52A
INTERIOR

GENERAL

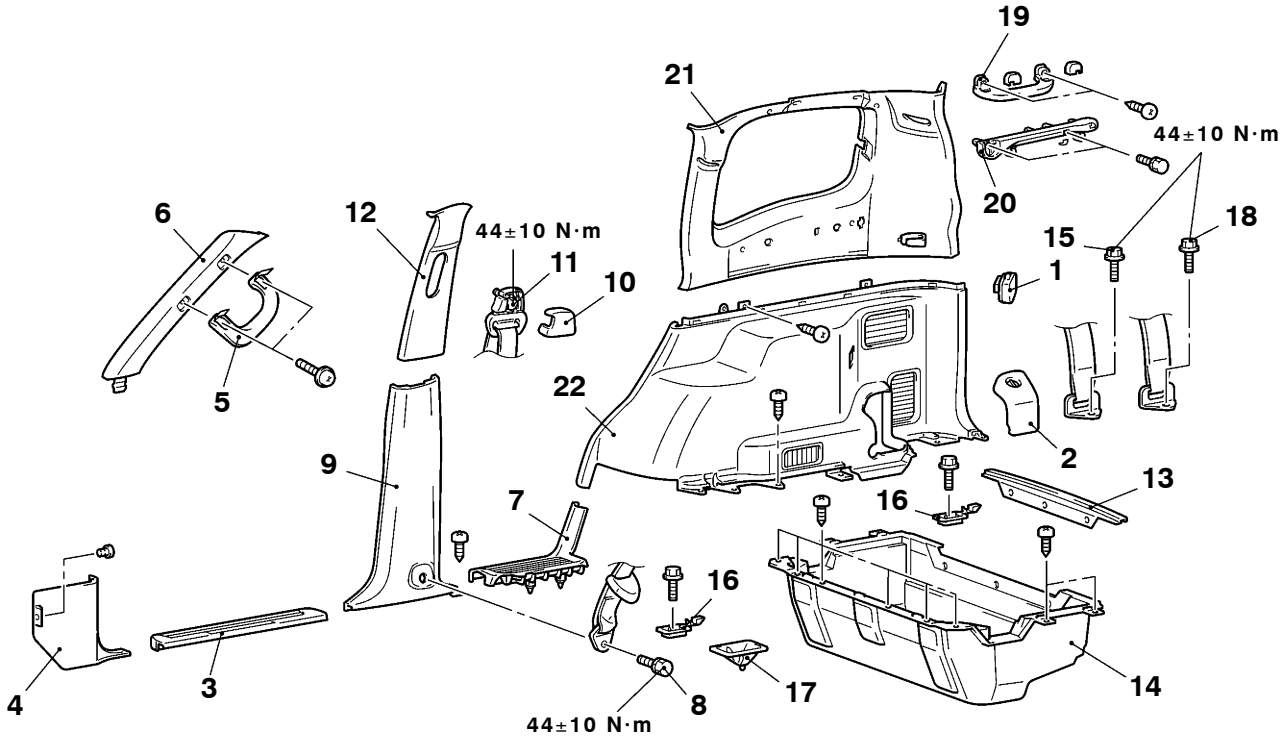
OUTLINE OF CHANGE

- Some models are equipped with a shelf holder assembly. Its service procedure is as follows:

TRIMS

REMOVAL AND INSTALLATION

<Long Wheelbase>



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NOTE
For door trims, refer to GROUP 42.

1. AC socket
2. Quarter trim cover
- Third seat assembly
3. Front scuff plate
4. Cowl side trim
5. Assist grip
6. Front pillar trim
7. Rear scuff plate
8. Front seat belt connection
9. Center pillar trim, lower
10. Sash guide cover
11. Front seat belt connection
12. Center pillar trim, upper
13. Back door scuff plate
14. Luggage floor box
15. Second seat belt connection
16. Luggage hook
17. Striker cover
18. Third seat belt connection
19. Assist grip
20. Shelf holder assembly
21. Quarter trim, upper
22. Quarter trim, lower

NOTES

SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

Click on the applicable bookmark to selected the required model year.

SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

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SRS SERVICE PRECAUTIONS 3

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TEST EQUIPMENT 6

TROUBLESHOOTING 7

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FRONT IMPACT SENSORS 28

SRS AIR BAG CONTROL UNIT (SRS-ECU) 30

AIR BAG MODULES AND CLOCK SPRING 32

SIDE IMPACT SENSOR 41

AIR BAG MODULE DISPOSAL PROCEDURES 43

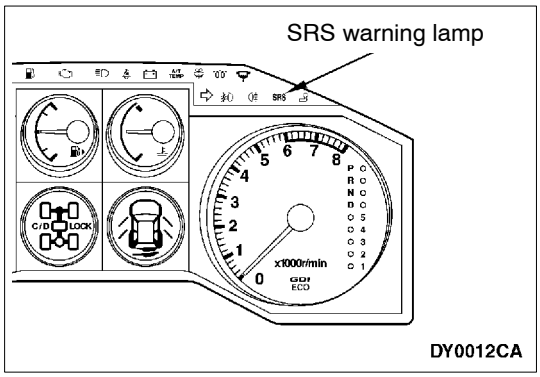
- Undeployed Air Bag Module Disposal 43
- Deployed Air Bag Module Disposal Procedures 52

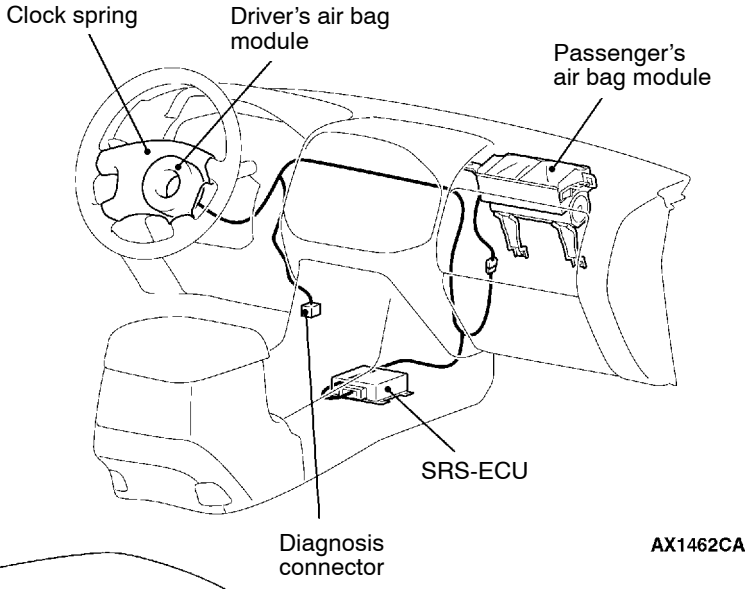
CAUTION

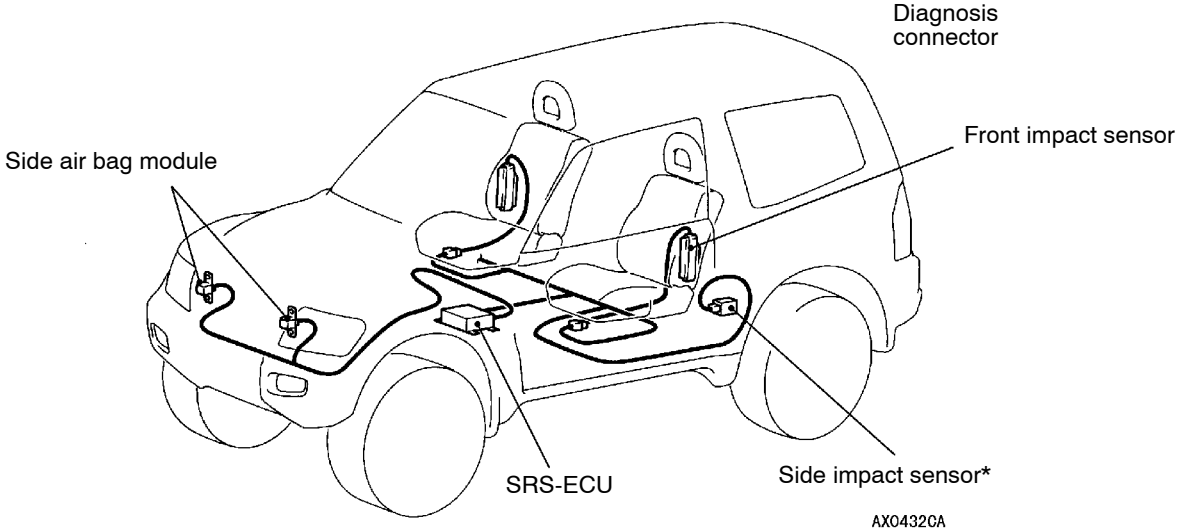
- **Carefully read and observe the information in the SERVICE PRECAUTIONS (P.52B-3.) prior to any service.**
- **For information concerning troubleshooting or maintenance, always observe the procedures in the Troubleshooting (P.52B-7.) section.**
- **If any SRS components are removed or replaced in connection with any service procedures, be sure to follow the procedures in the INDIVIDUAL COMPONENT SERVICE section (P.52B-26.) for the components involved.**
- **If you have any questions about the SRS, please contact your local distributor.**

GENERAL INFORMATION

To improve safety, the SRS are available as optional parts. These systems enhance collision safety by restraining the front passengers in case of an accident.
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 headlamp support panel. The side impact sensor, which is located inside the quarter panels <short wheelbase> or center pillar <long wheelbase> 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. Only authorized service personnel should do work on or around the SRS components. Those service personnel should read this manual carefully before starting any such work. Extreme care must be used when servicing the SRS to avoid injury to the service personnel (by inadvertent deployment of the air bags) or the driver (by rendering the SRS inoperative).







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

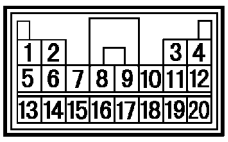
SRS SERVICE PRECAUTIONS

1. In order to avoid injury to yourself or others from accidental deployment of the air bag during servicing, read and carefully follow all the precautions and procedures described in this manual.
2. Do not use any electrical test equipment on or near SRS components, except those specified on P.52B-6.
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

   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, starting at page 52B-26.

SRS-ECU connector

Vehicles without side air bags



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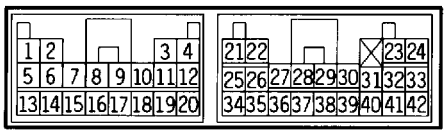
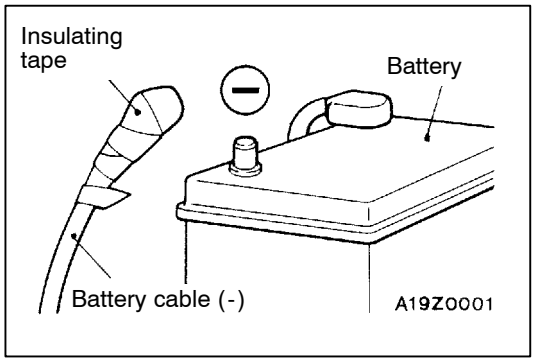
Vehicles with side air bags



W0582AU

4. **Do not attempt to repair the wiring harness connectors of the SRS. If a defective wiring harness is found, repair or replace it by referring to the table below.**

SRS-ECU terminal No.	Destination of harness	Remedy
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	Repair or replace the instrument panel wiring harness.
8	Instrument panel wiring harness → SRS warning lamp	
9, 10	Instrument panel wiring harness → Passenger's air bag module	
11, 12	Instrument panel wiring harness → Clock spring to driver's air bag module	Replace the clock spring or repair or replace the instrument panel wiring harness.
13	Instrument panel wiring harness → Junction block (fuse No.8)	Repair or replace the instrument panel wiring harness.
16	Instrument panel wiring harness → Junction block (fuse No.6)	
20	Instrument panel wiring harness → Diagnosis connector	
21, 22	Side air bag wiring harness → Left side air bag module	Repair or replace side air bag wiring harness.
23, 24	Side air bag wiring harness → Side air bag module (R.H.)	
34, 35, 36	Side air bag wiring harness → Floor wiring harness → Side impact sensor (L.H.)	Repair or replace each wiring harness.
40, 41, 42	Side air bag wiring harness → Floor wiring harness → Side impact sensor (R.H.)	



5. After disconnecting the battery cable, wait 60 seconds or more before proceeding with the following work. In addition, insulate the negative battery terminal with a tape. The condenser inside the SRS-ECU is designed to retain enough voltage to deploy the air bag for a short time even after the battery has been disconnected, so serious injury may result from unintended air bag deployment if work is done on the SRS system immediately after the battery cables are disconnected.

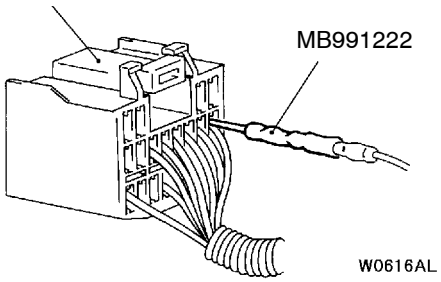
6. SRS components should not be subjected to heat over 93°C, so remove the SRS-ECU, front impact sensor, driver's air bag module, clock spring, passenger's air bag module, front seat assembly(side air bag module) and side impact sensor before drying or baking the vehicle after painting.

7. Whenever you finish servicing the SRS, always erase the diagnosis code and check warning lamp operation to make sure that the system functions properly. (Refer to P.52B-7)

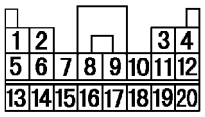
8. If checks are carried out by using the SRS-ECU harness connector, observe the following procedures:
Insert the special tool (probe in the harness set) into connector from harness side (rear side), and connect the tester to this probe. If any tool than special tool is used, damage to the harness and other components will result. Never insert the probe directly to 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.

Vehicles without side air bags

SRS-ECU harness connector

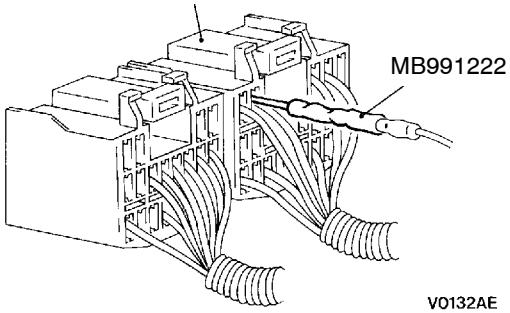


SRS-ECU harness connector (rear view)

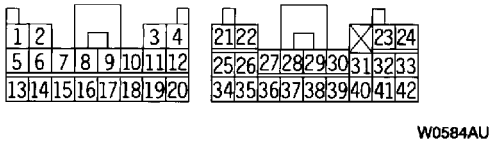


Vehicles with side air bags

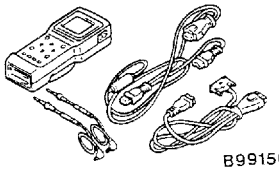
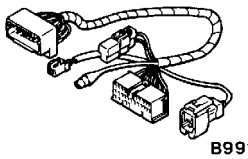
SRS-ECU harness connector

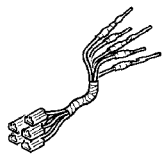
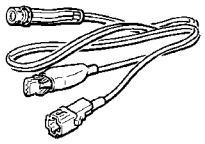
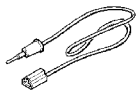
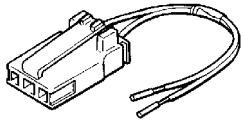
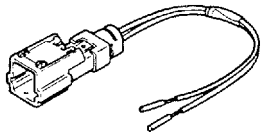


SRS-ECU harness connector (rear view)

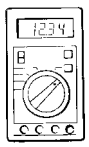


SPECIAL TOOLS

Tools	No.	Name	Application
 B991502	MB991502	MUT-II sub assembly	• Reading and erasing diagnosis code • Reading trouble period • Reading erase times
 B991613	MB991606 or MB991613	SRS check harness	Checking SRS electrical circuitry

Tools	No.	Name	Application
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 continuity and measuring voltage at SRS-ECU harness connector
 R372530	MR372530	SRS air bag adapter harness	Deploying driver's air bag module inside vehicle
 B686560	MB686560	SRS air bag adapter harness	Deploying front passenger's air bag module and side air bag modules inside or outside vehicle

TEST EQUIPMENT

Tool	Name	Application
 13R0746	Digital multi-meter	Checking SRS electrical circuitry (Use multi-meter for which the maximum test current is 2 mA or less at 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

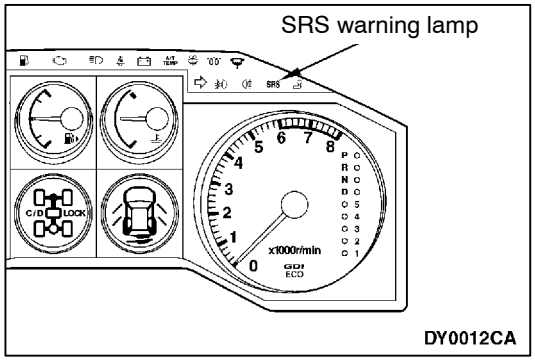
Connect the MUT-II to the diagnosis connector (16-pin) under the instrument cover, then check diagnosis codes.
(Refer to GROUP 00 - How to Use Troubleshooting/Inspection Service Points.)

ERASING DIAGNOSIS CODES

WHEN USING THE MUT-II

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 CHECK

1. Check that the SRS warning lamp comes on when the ignition switch is turned ON.
2. Check that the SRS warning lamp illuminates for about 7 seconds and then goes out.
3. If this is not the cause, check the diagnosis codes.

INSPECTION CHART FOR DIAGNOSIS CODES

Code No.	Diagnosis item	Reference page
11, 12, 13	Front impact sensor system	52B-8
14	Front impact analog G-sensor system inside SRS-ECU	52B-9
15, 16	Front impact safing G-sensor system inside SRS-ECU	52B-9
17	Side impact safing G-sensor system inside SRS-ECU	52B-9
21*2, 22*2, 61, 62	Driver's air bag module (squib) system	52B-10
24*2, 25*2, 64, 65	Passenger's air bag module (squib) system	52B-12
31, 32	DC-DC converter system inside SRS-ECU	52B-9
34*1	Connector lock system	52B-13
35	SRS-ECU (deployed air bag) system	52B-13
41*1	Power circuit system (fuse No.6 circuit)	52B-13
42*1	Power circuit system (fuse No.8 circuit)	52B-13

Code No.	Diagnosis item		Reference page
43*1	SRS warning lamp drive circuit system	Lamp does not illuminate.	52B-14
		Lamp does not go out off.	52B-14
44*1	SRS warning lamp drive circuit system		52B-14
45	Internal circuit system of non-volatile memory (EEPROM) inside SRS-ECU		52B-9
51, 52	Driver's air bag module (squib) system		52B-9
54, 55	Passenger's air bag module (squib) system		52B-9
71*2, 72*2, 75, 76	Side air bag module (R.H.) (squib) system		52B-15
73, 74	Side air bag module (R.H.) (squib) system		52B-9
79, 93	Side impact sensor (L.H.) communication system		52B-16
81*2, 82*2, 85, 86	Side air bag module (L.H.) (squib) system		52B-16
83, 84	Side air bag module (L.H.) (squib ignition drive circuit) system		52B-9
89, 96	Side impact sensor (R.H.) communication system		52B-17
91*1	Side impact sensor (L.H.) power supply circuit system		52B-17
92	Analog G-sensor system inside side impact sensor		52B-17
94*1	Side impact sensor (R.H.) power supply circuit		52B-18
95	Analog G-sensor system inside side impact sensor (R.H.)		52B-17

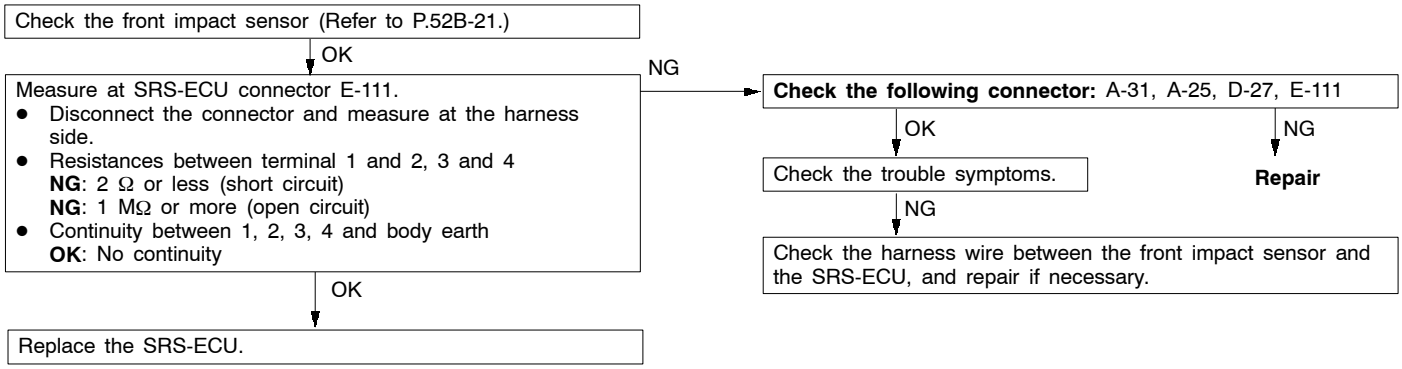
NOTE
1. *1: If the trouble(s) are extinguished, the SRS warning lamp will go out with diagnosis code history automatically erased.
2. *2: If the vehicle condition return to normal, the diagnosis code will be automatically erased, and the SRS warning lamp will return to normal.
3. If the vehicle has a discharged battery, it will store the fault 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 diagnosis codes are output if there is abnormal resistance between the input terminals of the front impact sensors inside the SRS-ECU. The trouble causes for each diagnosis code No. are as follow.	• Malfunction of harness or connector • Malfunction of front impact sensor • Malfunction of SRS-ECU

Table 1

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 and right front impact sensor or harness • Short circuit in front impact sensor harness leading to the power supply



Code No.14, 15, 16, 17, 31, 32, 45, 51, 52, 54, 55, 73, 74, 83, 84 System inside SRS-ECU	Probable cause
These diagnosis trouble codes are output when a fault is detected in the SRS-ECU. The trouble causes for each diagnosis code No. are as follows.	Malfunction of SRS-ECU

Table 2

Code No.	Defective part	Trouble Symptom
14	Front impact analog G-sensor	● When the analog G-sensor is not operating ● When the characteristics of the analog G-sensor are abnormal ● When the output from the analog G-sensor 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	● When the safing G-sensor is not operating ● When the characteristics of the safing G-sensor are abnormal ● When the output from the safing G-sensor is abnormal
31	DC-DC converter	Voltage at the DC-DC converter terminal is higher than the specified value for five seconds or more.
32		Voltage at the DC-DC converter 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)	When the non-volatile memory (EEPROM) is abnormal
51	Driver's side air bag module (squib)	Short circuit in the squib ignition drive circuit
52		Open circuit in the squib ignition drive circuit
54	Passenger's air bag module (squib)	Short circuit in the squib ignition drive circuit
55		Open circuit in the squib ignition drive circuit
73	Side air bag module (R.H.) (squib)	Short circuit in the squib ignition drive circuit
74		Open circuit in the squib ignition drive circuit
83	Side air bag module (L.H.) (squib)	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 side air bag module (squib) system	Probable cause
These diagnosis codes are output if there is an abnormal resistance between the input terminals of the driver's side air bag module (squib) inside the SRS-ECU. The trouble causes for each diagnosis code No. are as follow. However, as for code Nos.21 and 22, if the vehicle's condition return to normal, 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 ● Malfunction of harness or connector ● Malfunction of driver's air bag module (squib) ● Malfunction of SRS-ECU

Table 3

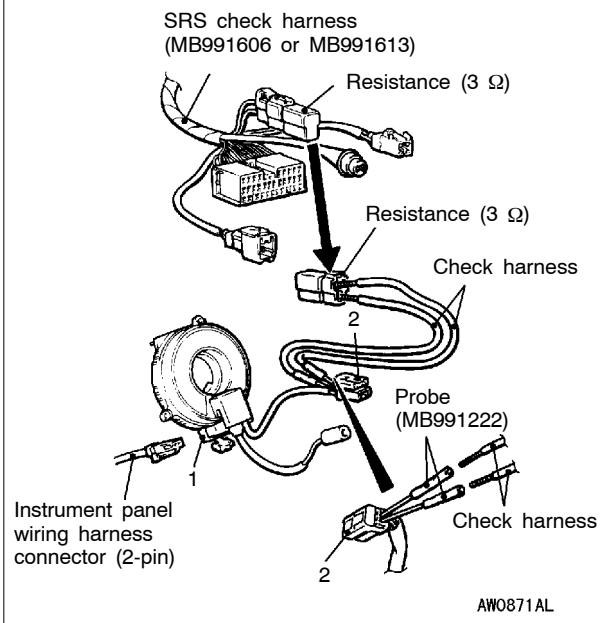
Code No.	Trouble Symptom
21	● Short circuit in driver's air bag module (squib) or harness short ● Short circuit in clock spring ● Poor connector contact*
22	● Open circuit in driver's air bag module (squib) or open harness ● Open circuit in clock spring ● Disconnected driver's air bag module (squib) connector ● Partially open as clock spring is not in neutral position ● Poor connector contact
61	Short circuit in driver's air bag module (squib) harness leading to the power supply
62	Short circuit in driver's air bag module (squib) harness leading 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 connecter.

Check the clock spring (Refer to P.52B-37.) — NG → **Replace**

OK



MUT-II Self-Diag Code

- Connect clock spring connector No.1 D-206 and the harness side connector(2-pin).
- Insert the probes (MB991222) from the rear of the clock spring No.2connector 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 (MB991606 or MB991613) and connect to the check harness.
- Connect the negative (-) battery terminal.
- Erase diagnosis code memory.

Is code Nos.21, 22, 61 or 62 displayed?

YES

Check the following connector: D-206, E-111

OK → Check the trouble symptoms.

NG → **Repair**

NG

Check wiring harness between clock spring and SRS-ECU.

OK → Replace the SRS-ECU.

NG → **Repair**

NO

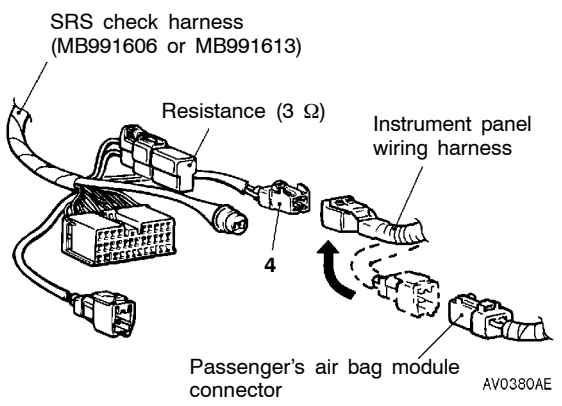
Replace driver's air bag module (squib).

Code No.24, 25, 64, 65 Passenger's air bag module (squib) system	Probable cause
These diagnosis codes are output if there is an abnormal resistance between the input terminals of the passenger's air bag module (squib) inside the SRS-ECU. The trouble causes for each diagnosis code No. are as follow. However, as for code Nos.24, 25, if the vehicle's condition return to normal, SRS warning lamp will go out. (Diagnosis code will remain stored).	• Malfunction of harness or connector • Malfunction of passenger's air bag module (squib) • Malfunction of SRS-ECU

Table 4

Code No.	Trouble Symptom
24	• Short in passenger's air bag module (squib) or harness short • Poor connector contact*
25	• Open circuit in passenger's air bag module (squib) or open harness • Poor connector contact
64	Short in passenger's air bag module (squib) harness leading to the power supply
65	Short in passenger's air bag module (squib) harness leading 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.



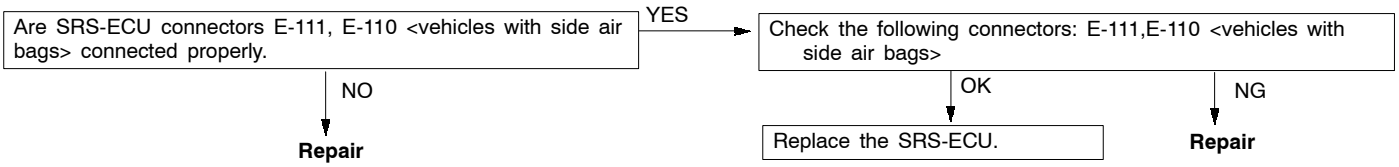
MUT-II Diagnosis Code
- Disconnect passenger's air bag module connector D-10, and connect the harness side connector to SRS check harness (MB991606 or MB991613) connector No.4.
- Connect the negative (-) battery terminal.
- Erase diagnosis code memory.

Is code Nos.24, 25, 64 or 65 output?

YES → **Check the following connectors:** D-10, E-111
- OK → Check the trouble symptoms.
  - NG → **Repair**
- NG → Check the harness wire between the passenger's air bag module (squib) and the SRS-ECU.
  - OK → Replace the SRS-ECU.
    - NG → **Repair**

NO → Replace passenger's air bag module (squib).

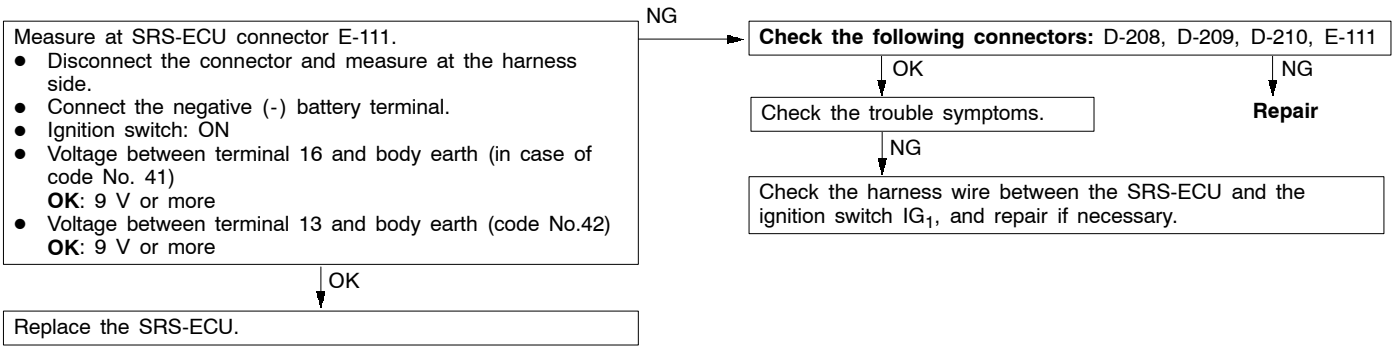
Code No.34 Connector lock system	Probable cause
This diagnosis code is output when the SRS-ECU detects that the SRS-ECU connector is improperly connected. However, when vehicle condition returns to normal, this code will be automatically erased, and the SRS warning lamp will go out.	• Malfunction of connector • Malfunction of SRS-ECU



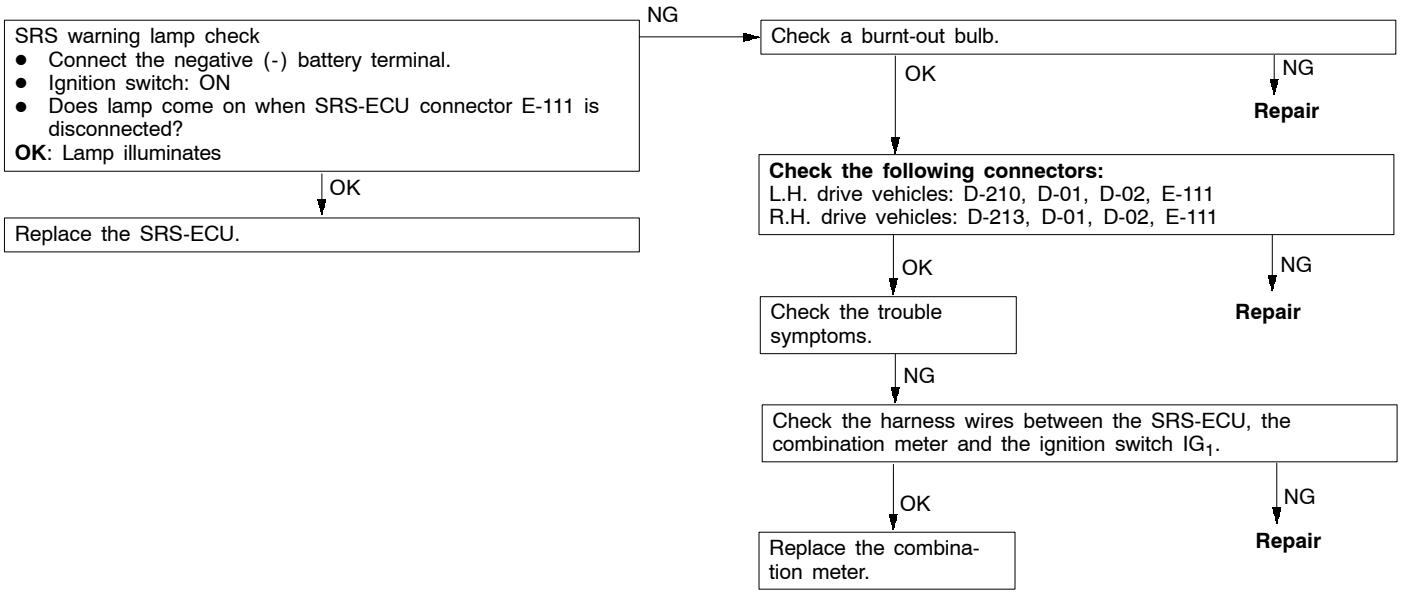
Code No.35 SRS-ECU (deployed air bag) system	Probable cause
This code is displayed after deployment of air bags. If displayed before deployment, the code indicates malfunction probably present in SRS-ECU.	Malfunction of SRS-ECU

Replace the SRS-ECU.

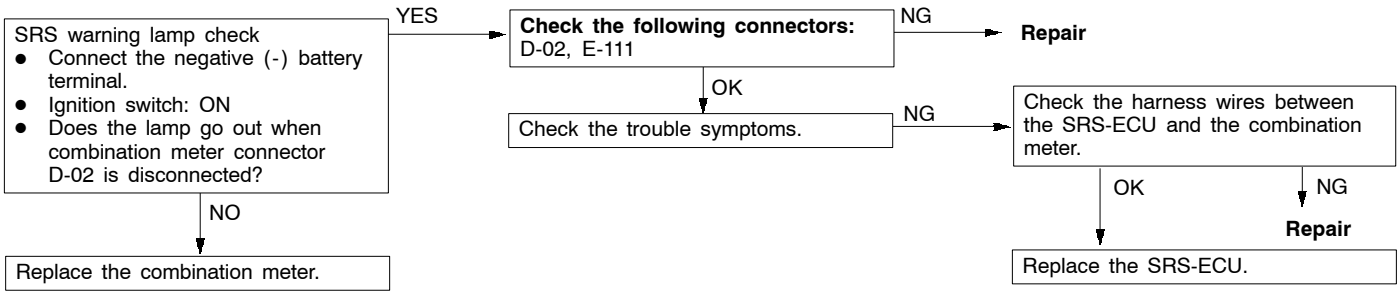
Code No.41 Power circuit system (fuse No.6 circuit) Code No.42 Power circuit system (fuse No.8 circuit)	Probable cause
Code No.41 is displayed if voltage between IG_1 terminal (SRS-ECU, terminal 16) and earth is lower than specified for five successive seconds or more. Code No.42 is displayed if voltage between IG_1 terminal (SRS-ECU, terminal 13) and earth is lower than specified for five successive seconds or more. However, when vehicle condition returns to normal, these codes will be automatically erased, and the SRS warning lamp will go out. If codes No.41 and 42 are displayed together, check the battery first as vehicle may have discharged battery.	• Malfunction of harness or connector • Malfunction of SRS-ECU



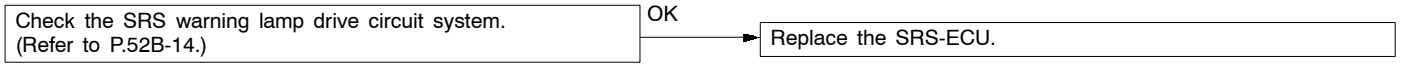
Code No.43 SRS warning lamp drive circuit system (Lamp does not come on.)	Probable cause
This diagnosis code is output when a open circuit is present for5 successive seconds or more in SRS warning lamp drive circuit. However, the vehicle condition return to normal condition, this code, if displayed due to open circuit, will be automatically erased.	• Malfunction of harness or connector • 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
This diagnosis code is output when a short to earth occurs in the harness between the SRS warning lamp and the SRS-ECU. However, the vehicle condition returns to normal condition, this code will be automatically erased, and SRS warning lamp will go out.	• Malfunction of harness or connector • Malfunction of SRS-ECU • Malfunction of combination meter



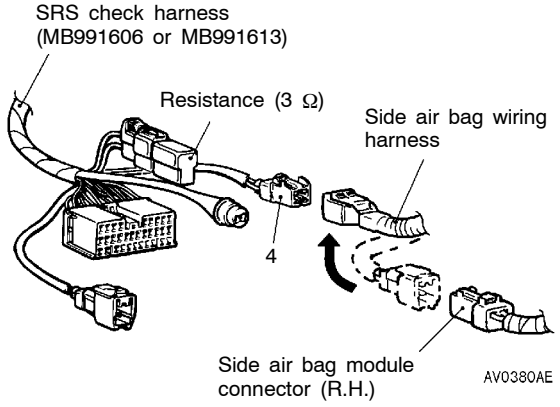
Code No.44 SRS warning lamp drive circuit system	Probable cause
This diagnosis code is output when a short occurs in the lamp drive circuit or a malfunction of the output transistor inside the SRS-ECU is detected while the SRS-ECU is monitoring the SRS warning lamp drive circuit. However, when vehicle condition returns to normal, these codes will be automatically erased, and the SRS warning lamp will go out.	• Malfunction of harness or connector • Malfunction of SRS-ECU



Code No. 71, 72, 75, 76 Side air bag module (R.H.) (squib) system	Probable cause
These diagnosis codes are output if there is an abnormal resistance between the input terminals of the side air bag module (R.H.) (squib) inside the SRS-ECU. The trouble causes for each diagnosis code No. are as follow. However, as for code No.71, 72, if the vehicle condition returns to normal, the SRS warning lamp will go out. (Diagnosis code will remain stored).	• Malfunction of harness or connector • Malfunction of side air bag module (R.H.) (squib) • Malfunction of SRS-ECU

Table 5

Code No.	Trouble Symptom
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	Short in side air bag module (R.H.) (squib) harness leading to the power supply
76	Short in side air bag module (R.H.) (squib) harness leading to the earth



MUT-II Self-Diag Code
- Disconnect the side air bag module (R.H.) connector F-28 and connect the harness side connector to the SRS check harness (MB991606 or MB991613) No.4 connector.
- Connect the negative (-) battery terminal.
- Erase diagnosis code memory.

Are code No.71, 72, 75 or 76 displayed?

YES → **Check the following connectors: F-28, E-110**
- OK → Check the trouble symptoms.
  - NG → Repair
  - NG → Check wiring harness between the side air bag module (R.H.) (squib) and SRS-ECU.
    - OK → Replace the SRS-ECU.
    - NG → **Repair**

NO → Replace the driver's front seat back assembly.

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

MUT-II Self-Diag Code
- Switch over the right side impact sensor (R.H.) and the side impact sensor (L.H.).
- Connect the negative (-) battery terminal.
- Erase diagnosis code memory.

Are code Nos.79 and 93 erased and code Nos.89 and 96 output?

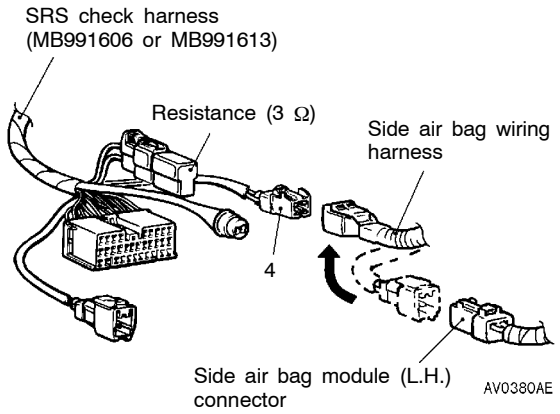
NO → **Check the following connectors:** F-19, E-21, E-110
- OK → Check the trouble symptoms.
  - NG → **Repair**
- NG → Check the harness wire between the left side impact sensor and the SRS-ECU.
  - OK → Replace the SRS-ECU.
  - NG → **Repair**

YES → Replace the side impact sensor (L.H.) mounted driver's side.

Code No.81, 82, 85, 86 Side air bag module (L.H.) (squib) system	Probable cause
These diagnosis codes are output if there is an abnormal resistance between the input terminals of the side air bag module (L.H.) (squib) inside the SRS-ECU. The trouble causes for each diagnosis code No. are as follow. However, as for code No.81, 82, if the vehicle condition returns to normal, the SRS warning lamp will go out. (Diagnosis code will remain stored)	• Malfunction of harness or connector • Malfunction of side air bag module (L.H.) (squib) • Malfunction of SRS-ECU

Table 6

Code No.	Trouble Symptom
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	Short in side air bag module (L.H.) (squib) harness leading to the power supply harness
86	Short in side air bag module (L.H.) (squib) harness leading to the earth



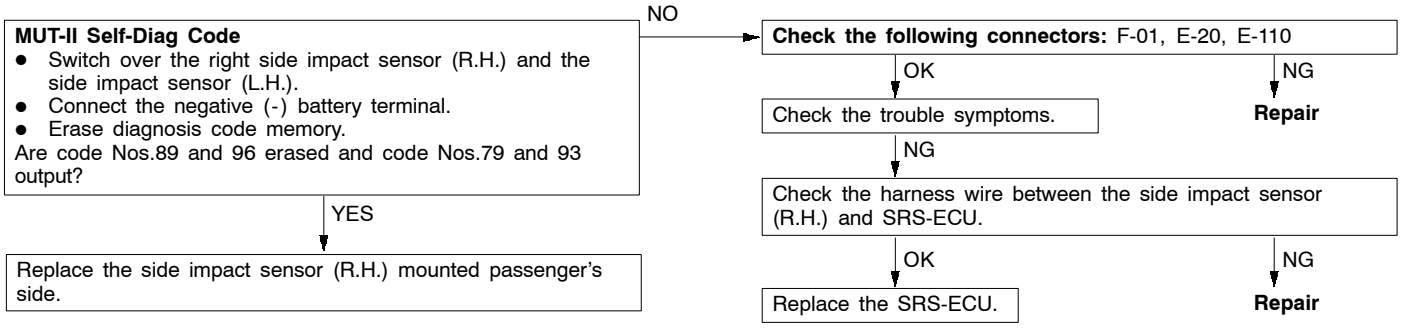
MUT-II Self-Diag Code
- Disconnect side air bag module connector (L.H.) F-21 and connect the harness side connector to SRS check harness (MB991606 or MB991613) connector No.4.
- Connect the negative (-) battery terminal.
- Erase diagnosis code memory.

Is code No.81, 82, 85 or 86 displayed?

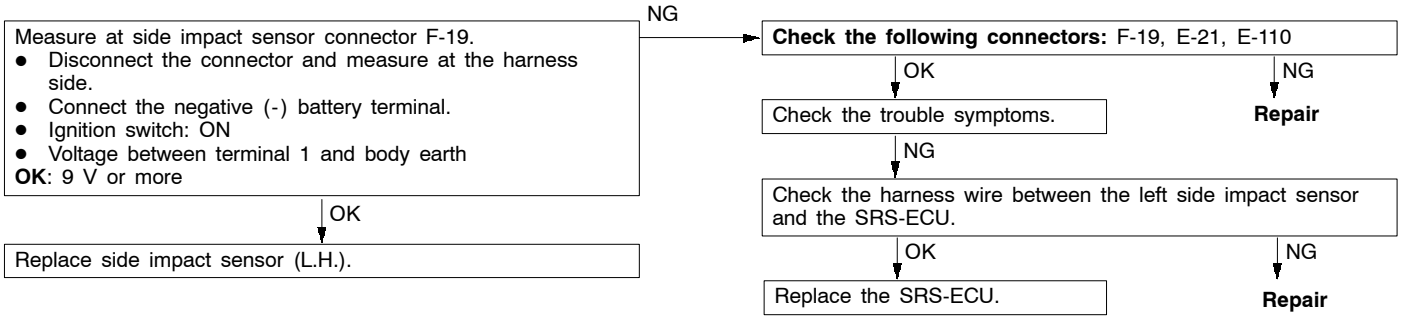
YES → **Check the following connectors:** F-21, E-110
- OK → Check the trouble symptoms.
  - NG → **Repair**
- NG → Check wiring harness between side air bag module (L.H.) (squib) and SRS-ECU.
  - OK → Replace the SRS-ECU.
  - NG → **Repair**

NO → Replace the passenger's front seat back assembly

Code No.89, 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.96) or abnormal (code No.89).	• Malfunction of harness or connector • 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, when vehicle condition returns to normal, this code will be automatically erased, and the SRS warning lamp will go out.	• Malfunction of harness or connector • Malfunction of side impact sensor (L.H.) • Malfunction of SRS-ECU



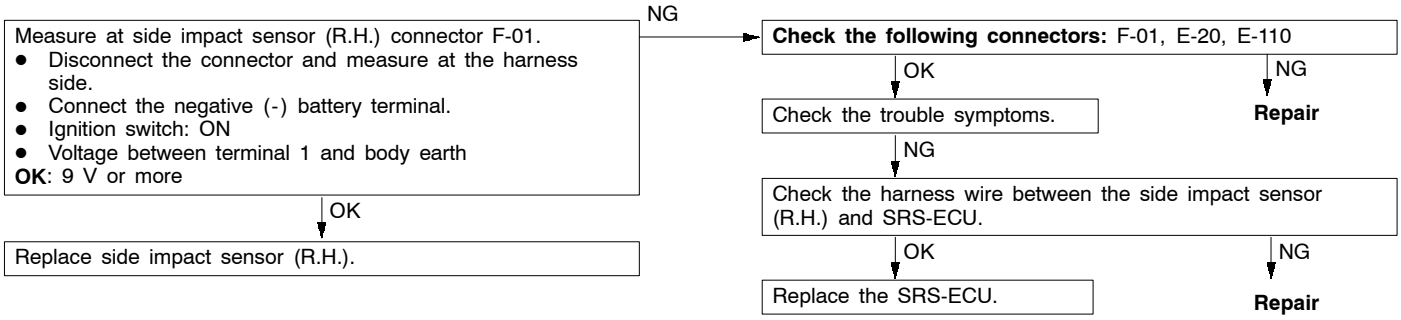
Code No.92, 95 Side impact sensor system	Probable cause
Code No.92 is displayed when malfunction is present inside side impact sensor (L.H.). Code No.95 is displayed when malfunction is present inside side impact sensor (R.H.). The trouble causes for each diagnosis code No. are as follows.	• Malfunction of side impact sensor (L.H.) (in case of code No.92) • Malfunction of side impact sensor (R.H.) (in case of code No.95)

Table 7

Code No.	Defective part	Trouble Symptom
92	Side impact analog G-sensor	• Not working • Having abnormal characteristics • Having abnormal output
95		

• Replace the side impact sensor (L.H.) (in case of code No.92) • Replace the side impact sensor (R.H.) (in case of 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 consecutive five seconds or more. However, when vehicle condition returns to normal, this code will be automatically erased, and the SRS warning lamp will go out.	• Malfunction of harness or connector • Malfunction of side impact sensor (R.H.) • Malfunction of SRS-ECU



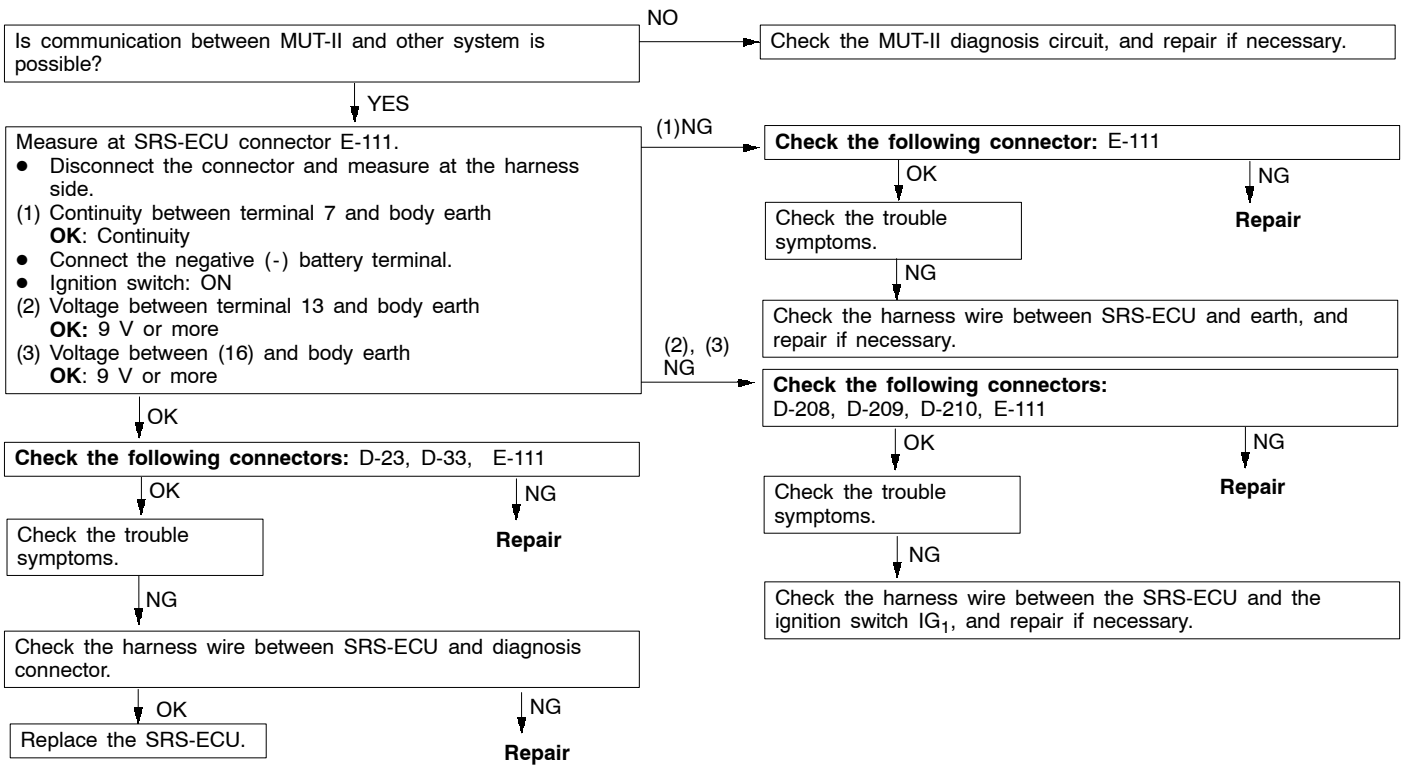
INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble Symptom	Inspection procedure No(s).	Reference page
Communication with the MUT-II is not possible.	1	52B-18
SRS warning lamp does not come on.	See diagnosis code No.43.	52B-14
SRS warning lamp does not go out.	See diagnosis code Nos.43, 44.	52B-14

INSPECTION PROCEDURES FOR TROUBLE SYMPTOMS

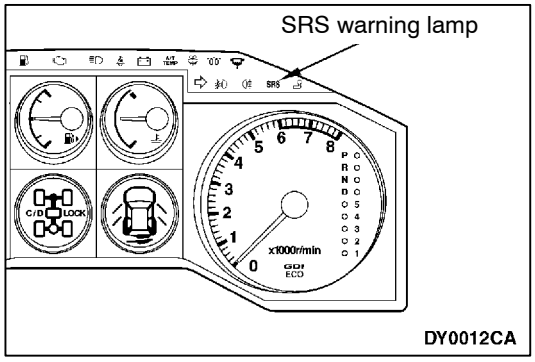
Inspection procedure 1

Communication with the MUT-II is not possible.	Probable cause
If communication with all other systems is not possible, there is a high possibility that there is a malfunction of the diagnosis line. When only communication with SRS air bags is impossible, open in diagnosis output circuit or power supply circuit including earth circuit may be present.	• Malfunction of harness or connector • Malfunction of SRS-ECU



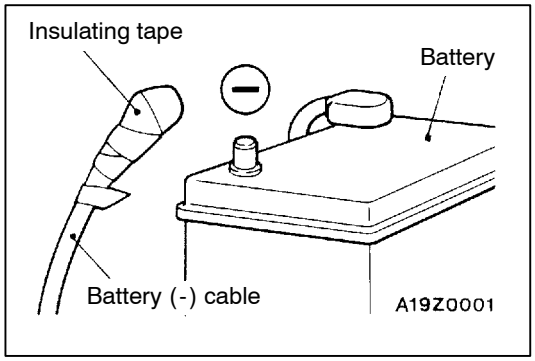
SRS MAINTENANCE

The SRS must be inspected by an authorized dealer 10 years after the date of vehicle registration.



SRS WARNING LAMP CHECK

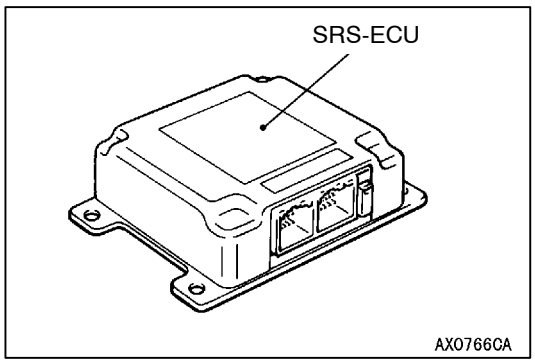
Turn the ignition key to the ON position. Does the SRS warning lamp illuminate for about 7 seconds, turn off and then remain extinguished for at least 5 seconds? If yes, SRS system is functioning properly. If no, consult page 52B-7.



SRS COMPONENT VISUAL CHECK

Turn the ignition key to the LOCK position, disconnect the negative battery cable and tape the terminal.

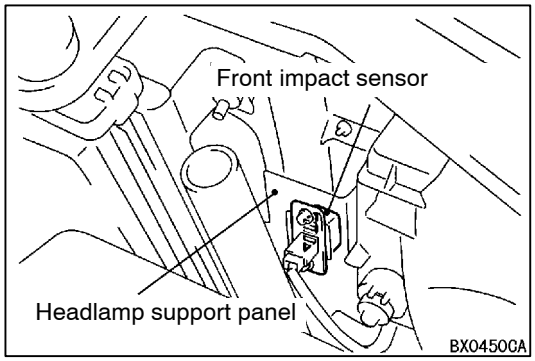
Caution
Wait at least 60 seconds after disconnecting the battery cable before doing any further work. (Refer to P.52B-4.)



SRS CONTROL UNIT (SRS-ECU)

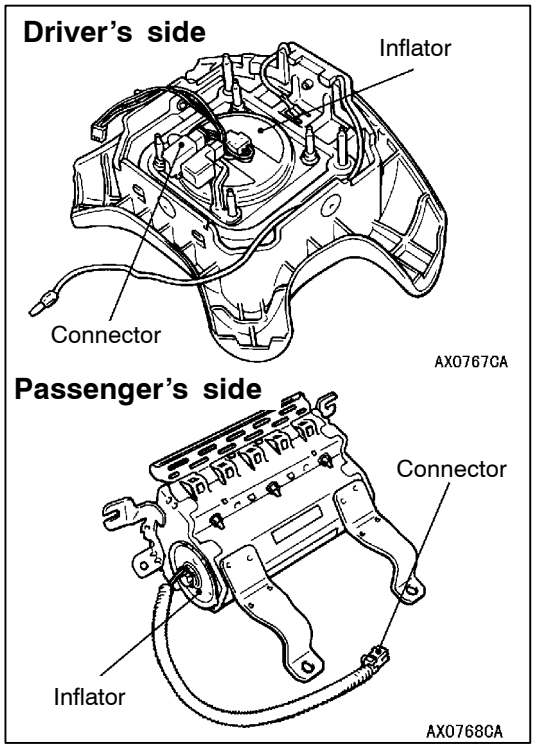
1. Check SRS-ECU case and brackets for dents, cracks, deformation or rust.

   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-30.)



FRONT IMPACT SENSORS

1. Check the headlamp support panel for deformation or rust.
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.

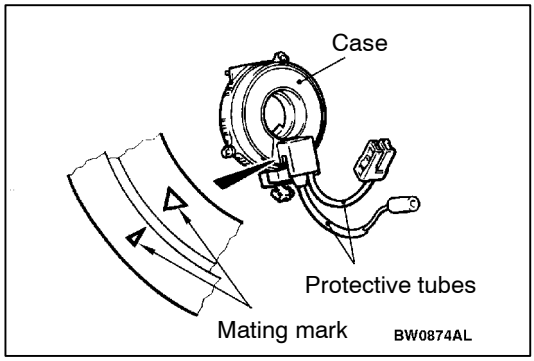


AIR BAG MODULES, STEERING WHEEL AND CLOCK SPRING

1. Remove the air bag modules, steering wheel and clock spring. (Refer to P.52B-32.)

   Caution
   The removed air bag modules should be stored in a clean, dry place with the pad cover face up.

2. Check pad 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.

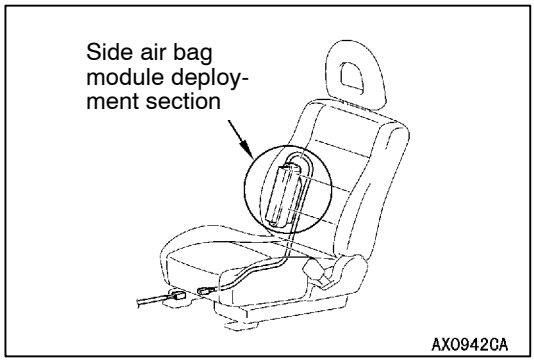
   Mating Mark Alignment

   Turn the clock spring clockwise fully, and then turn back it approx. 3 turns counterclockwise to align the mating marks.

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

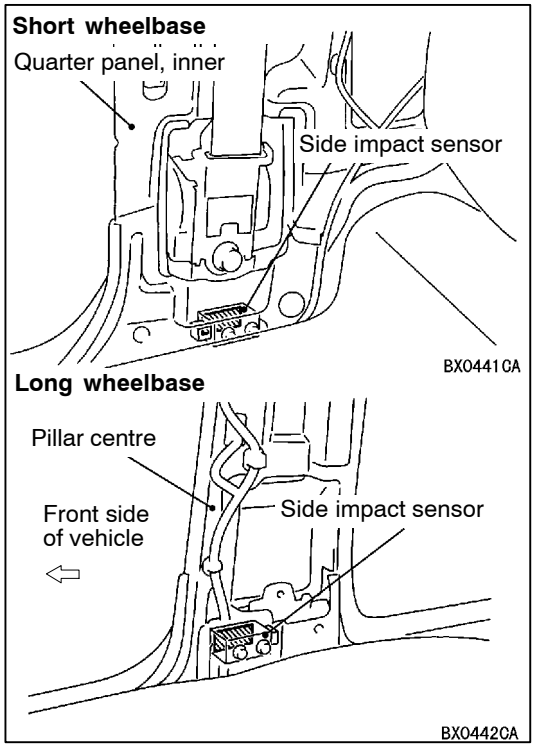
9. Install the steering column covers, steering wheel and the air bag module.
10. Check steering wheel for noise, binds of difficult operation.
11. Check steering wheel for excessive free play.
    REPLACE ANY VISUALLY INSPECTED PART IF IT FAILS THAT INSPECTION. (Refer to P.52B-38.)

    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 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.



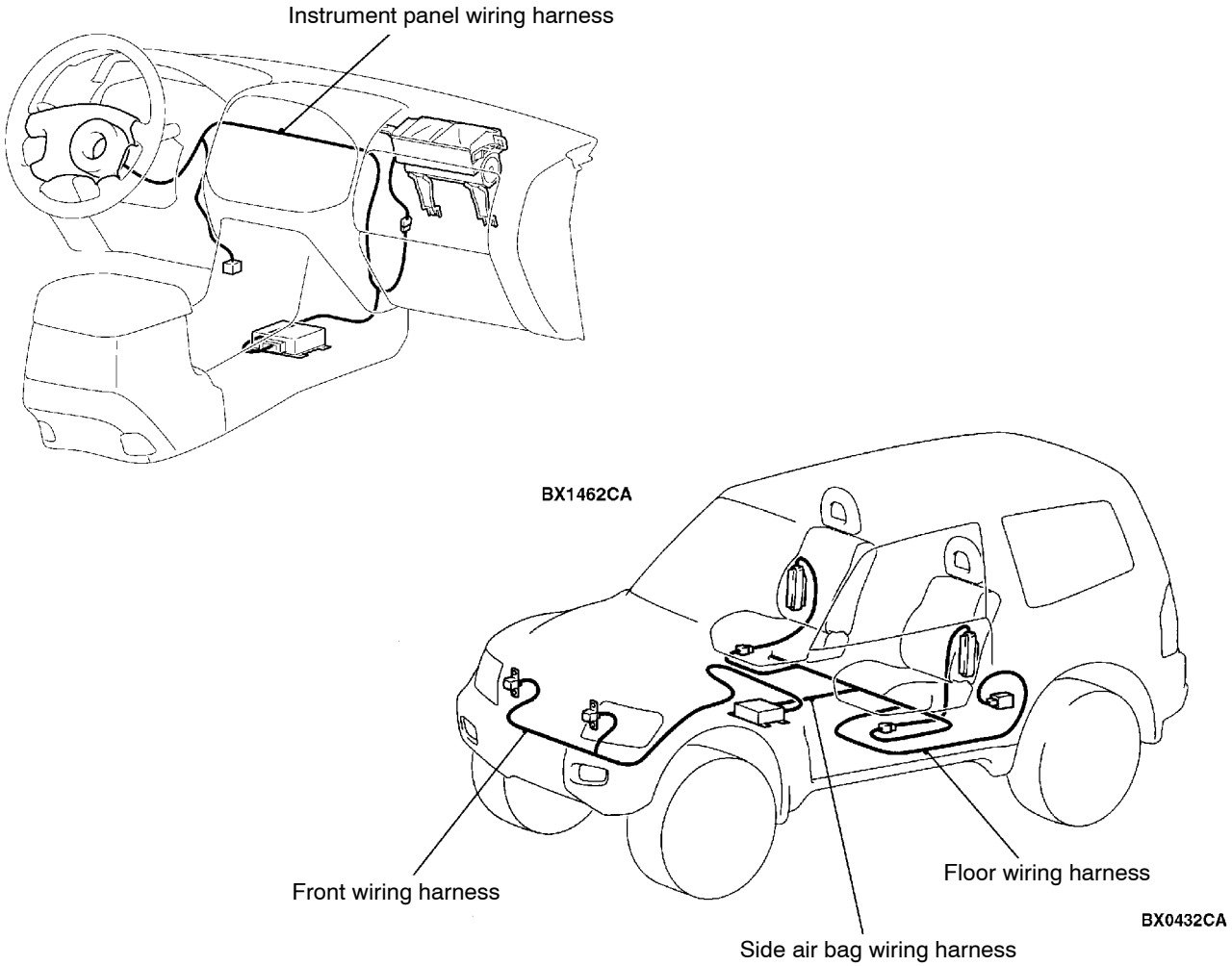
SIDE IMPACT SENSOR

1. Check the center pillar <long wheelbase> or quarter panel inner <short wheelbase> 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 (R.H.). The side impact sensors (L.H.) is symmetrical with the side impact sensors (R.H.).

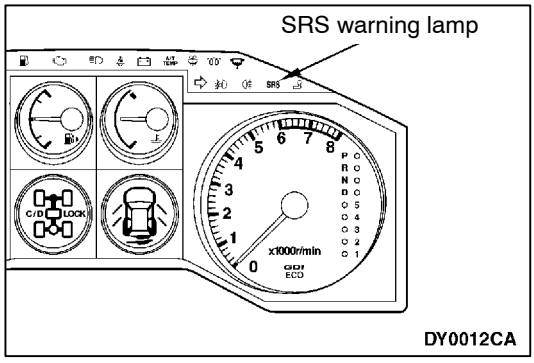
Caution
The SRS may not activate if the impact sensors are not installed properly, which could result in serious injury or death to the vehicle's driver or front passenger.

INSTRUMENT PANEL WIRING HARNESS/FRONT WIRING HARNESS/SIDE AIR BAG WIRING HARNESS/FLOOR WIRING HARNESS



1. Check connector for poor connection.
2. Check harnesses for binds, connectors for damage, and terminals for deformation.
   FAIL THE VISUAL INSPECTION. (Refer to P.52B-4.)

Caution
The SRS may not activate if SRS harnesses or connectors are damaged or improperly connected, which could result in serious injury or death to the vehicle's driver or front passenger.



POST-INSTALLATION INSPECTION

Reconnect the negative battery terminal. Turn the ignition key 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-7.

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-7.)

   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: 9999 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-7.)

REPAIR PROCEDURE

DEPLOYED DRIVER'S AND FRONT PASSENGER'S AIR BAGS

1. Replace the following parts with new ones.
   - SRS-ECU (Refer to P.52B-30.)
   - Driver's air bag module (Refer to P.52B-32.)
   - Front passenger's air bag module (Refer to P.52B-32.)
2. Check the following parts and replace if malfunction is found:
   - Clock spring (Refer to P.52B-32.)
   - Steering wheel, steering column and intermediate joint
     (1) Check the wiring harness (built into steering wheel) and connectors for damage, and terminals for deformation.
     (2) Check the driver's air bag module for proper installation to the steering wheel.

(3) Check the steering wheel for noise, binds or difficult operation and excessive free play.

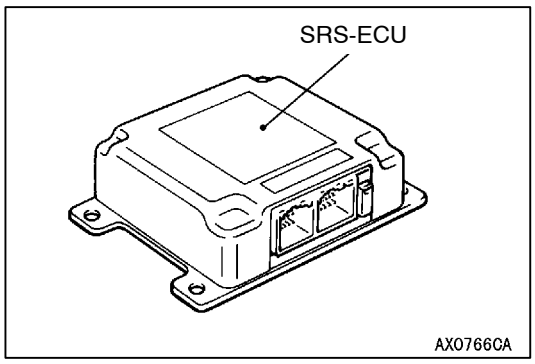
3. Check the harness for binding, connectors for damage, poor connections, and terminals for deformation. (Refer to P.52B-4.)

DEPLOYED SIDE AIR BAGS

1. Replace the following parts with new ones:
   - SRS-ECU (Refer to P.52B-30.)
   - Side impact sensors (Refer to P.52B-41.)
   - Front seat back assemblies (Refer to P.52B-32.)
2. Check harnesses for binding, connectors for damage, poor connections, and terminals for deformation. (Refer to P.52B-4.)

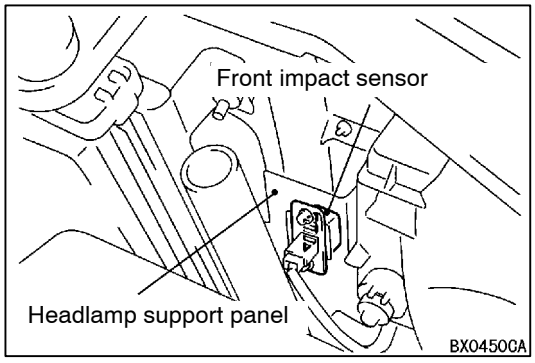
UNDEPLOYED AIR BAGS IN LOW-SPEED COLLISION

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-26



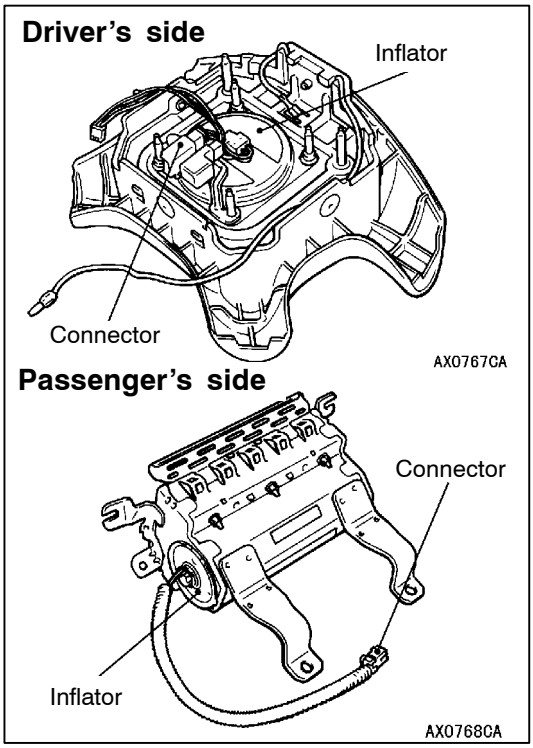
SRS-ECU

1. Check the SRS-ECU case and bracket for dents, cracks or deformation.
2. Check connectors for damage, and terminals for deformation.
3. Check the SRS-ECU and bracket for installation condition.



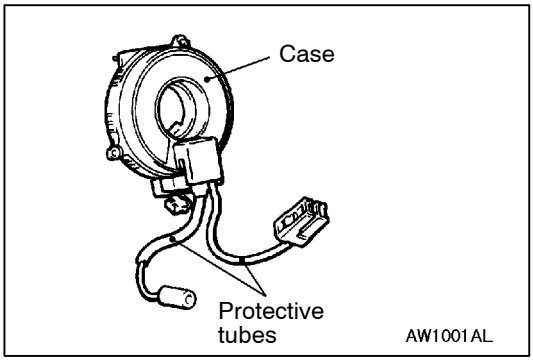
Front impact sensor

1. Check the headlamp support panel for deformation or rust.
2. Check the front impact sensor for dents, cracks, deformation or rust.
3. Check the sensor harness for binding, the connectors for damage, and the terminals for deformation.



Driver's and passenger's air bag modules

1. Check the pad cover for dents, cracks or deformation.
2. Check the connectors for damage, the terminals for deformation, and the harness for binds.
3. Check the air bag inflator cases for dents, cracks or deformation.
4. Check the air bag modules for proper installation.

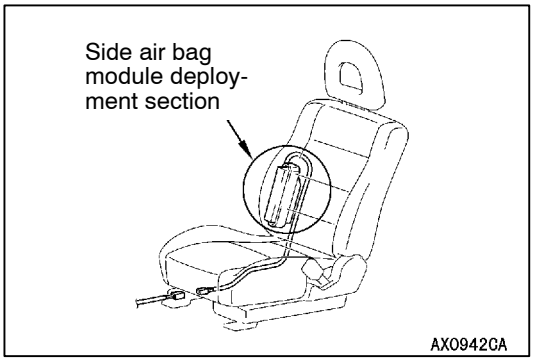


Clock spring

1. Check the connectors and protective tubes for damage and terminals for deformation.
2. Visually check the case for damage.

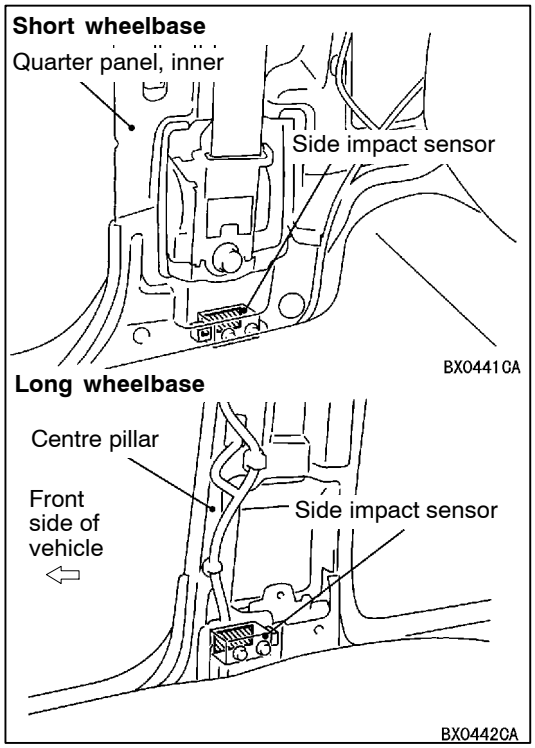
Steering wheel, steering column and lower shaft assembly

1. Check the driver's air bag module for proper installation to the steering wheel.
2. Check steering wheel for noise, binds or difficult operation and excessive free play.



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 connectors for damage, the terminals for deformation, and the harness for binds.



Side impact sensor

1. Check the center pillar <long wheelbase> or quarter panel inner <short wheelbase> for deformation or rust.
2. Check the side impact sensor for dents, cracks, deformation and rust.
3. Check connectors for damage, and terminals for deformation.

NOTE
The figures show side impact sensors (R.H.).The side impact sensors (L.H.) is symmetrical with the side impact sensors (R.H.).

Harness connectors (Instrument panel wiring harness, side air bag wiring harness, floor wiring harness)

Check harnesses for binding, connectors for damage and terminals for deformation.(Refer toP.52B-4.)

INDIVIDUAL COMPONENT SERVICE

If the SRS components are to be removed or replaced as a result of maintenance, troubleshooting etc., follow the service procedures that follow. (P.52B-28 to 42.)

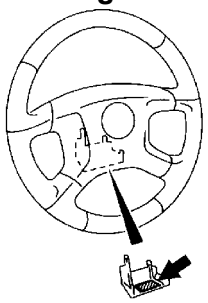
Caution

1. **SRS components should not be subjected to temperature over 93°C, so remove the SRS-ECU, front impact sensors, 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.**
2. **If the SRS components 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

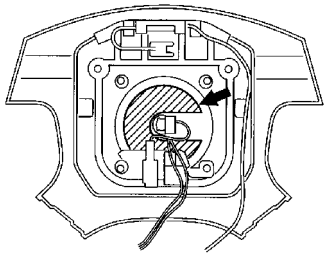
Caution labels on the SRS are attached in the vehicle as shown. Follow label instructions when servicing the SRS. If the label(s) are dirty or damaged, replace with new one(s).

Steering wheel



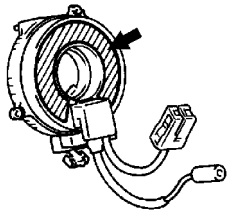
AX0433CA

Driver's air bag module



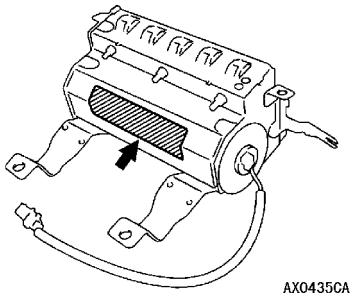
AX0434CA

Clock spring



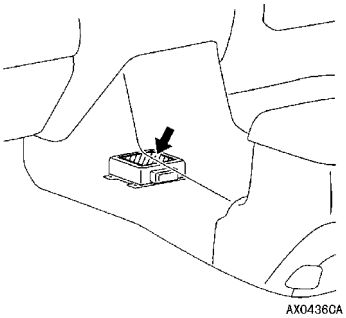
BW0963AL

Passenger's air bag module



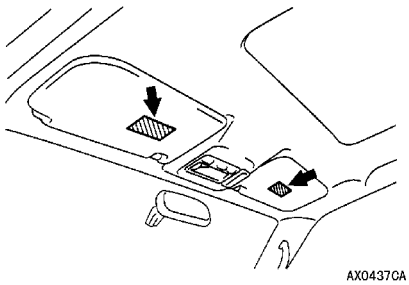
AX0435CA

SRS-ECU



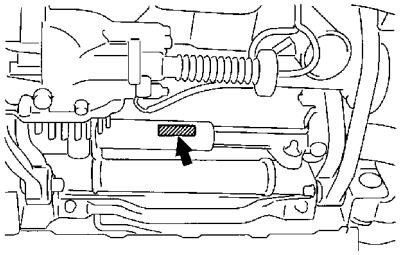
AX0436CA

Sun visor



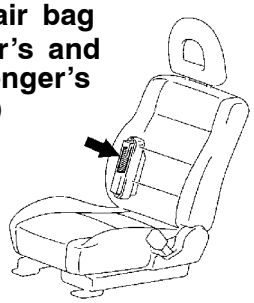
AX0437CA

Steering gear box



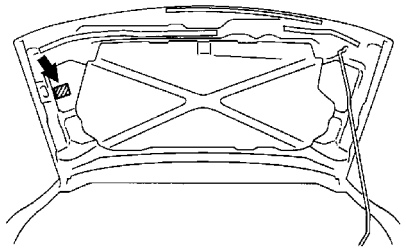
AX0438CA

Side air bag (driver's and passenger's sides)



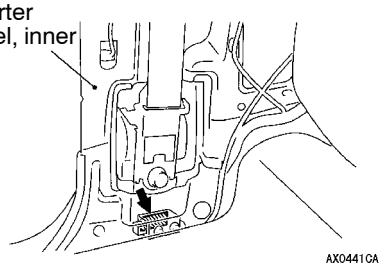
AX0439CA

Hood



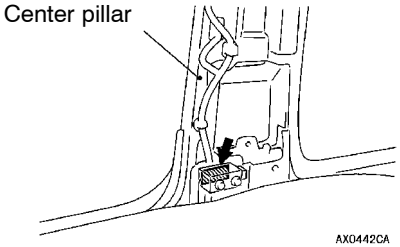
AX0440CA

Side impact sensor
Short wheelbase



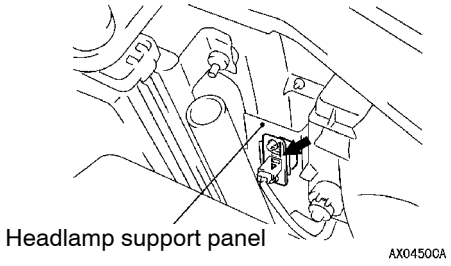
AX0441CA

Long wheelbase



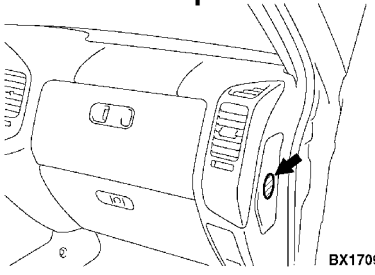
AX0442CA

Front impact sensor



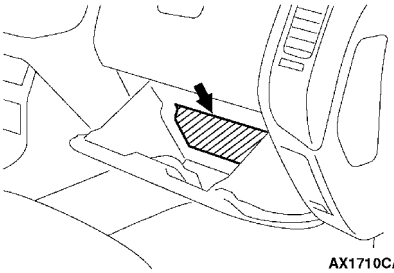
AX0450CA

Instrument panel



BX1709CA

Glove box



AX1710CA

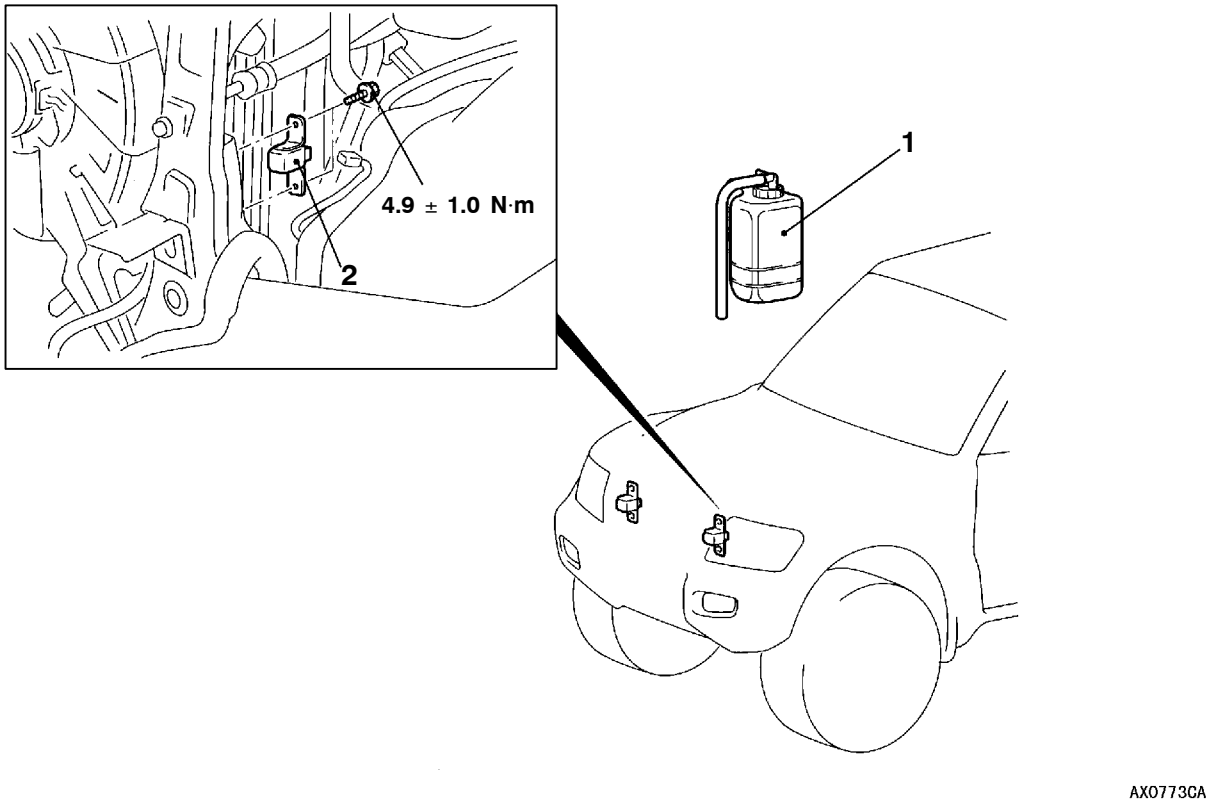
FRONT IMPACT SENSORS

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 Operations
- Turn the ignition switch to LOCK(OFF) position.
- Disconnect the negative battery (-) terminal.



AX0773CA

Removal steps
1. Condense tank
2. Front impact sensor

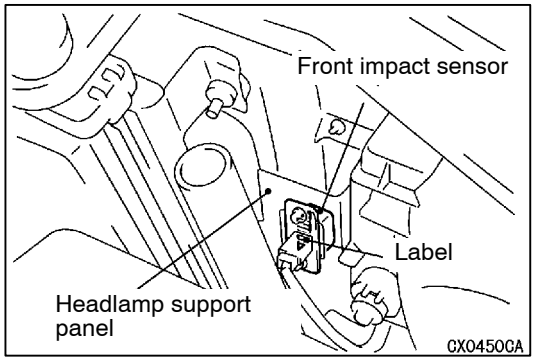
Installation steps
- ▶A◀ ● Pre-installation inspection
- ▶B◀ 2. Front impact sensor
  1. Condense tank
  ● Connect the negative (-) battery terminal.
- ▶C◀ ● Post-installation inspection

NOTE
The figure shows the front impact sensor (L.H.).

INSTALLATION SERVICE POINTS

▶A◀ PRE-INSTALLATION INSPECTION

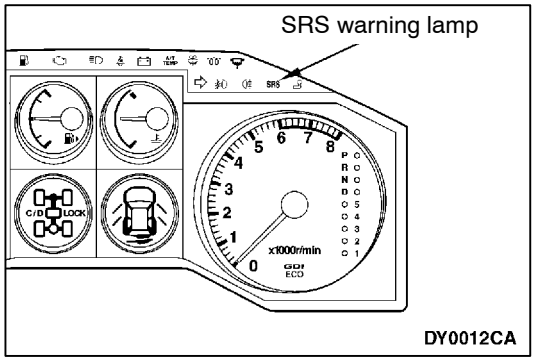
To mount the new front impact sensor, visually check it and measure the resistance between the terminals.(Refer to the previous item “INSPECTION”.)



▶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.

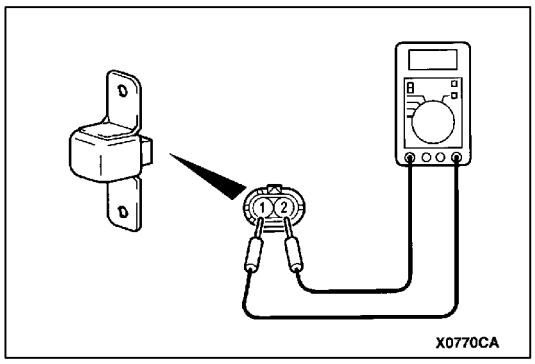
Caution
The SRS may not activate properly if a front impact sensor is not installed properly.



▶C◀ POST-INSTALLATION INSPECTION

1. Turn the ignition key to the ON position.
2. Does the SRS warning lamp illuminate for about 7 seconds, and then remain extinguished for at least 5 seconds after turning OFF?
3. If no, refer to troubleshooting.
   (Refer to P.52B-7)

INSPECTION

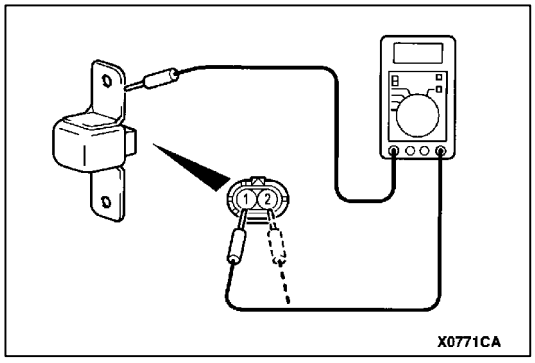


1. Check the front impact sensor for dents, cracks, deformation or rust.

Caution
If a dent, crack, deformation or rust is found, replace the sensor with a new one.

2. Check short or open circuit between the terminals of the front impact sensor.

Short circuit: 1 Ω or less
Open circuit: 1 MΩ or more



Caution
Always replace the sensor with a new one if the resistance shows a short or open circuit.

3. 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.
4. Check the headlamp support panel for deformation and rust.

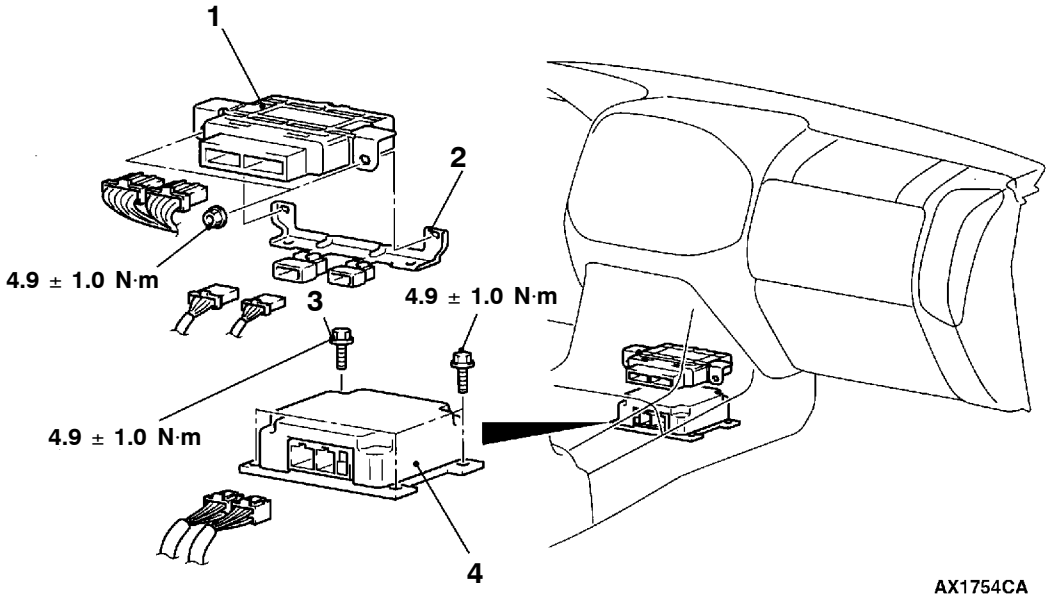
SRS AIR BAG CONTROL UNIT (SRS-ECU)

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 Operations
- Turn the ignition switch to LOCK(OFF) position.
- Disconnect the negative battery (-) terminal.



Removal steps
- Front floor console (Refer to GROUP 52A.)

1. Transfer-ECU
2. Connector bracket
3. SRS-ECU mounting bolts (earth bolt)
4. SRS-ECU

Installation steps

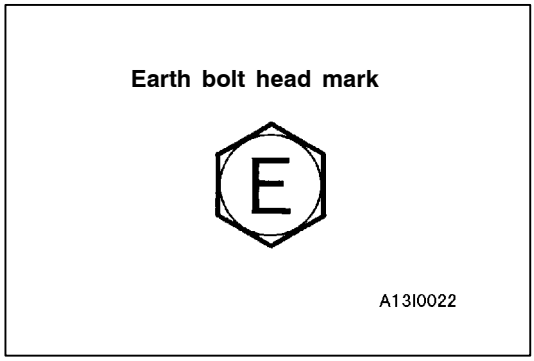
▶A◀ 4. SRS-ECU
▶B◀ 3. SRS-ECU mounting bolts (earth bolt)
2. Connector bracket
1. Transfer-ECU
- Front floor console (Refer to GROUP 52A.)
- Connect the negative (-) battery terminal.

▶C◀ • Post-installation inspection

INSTALLATION SERVICE POINTS

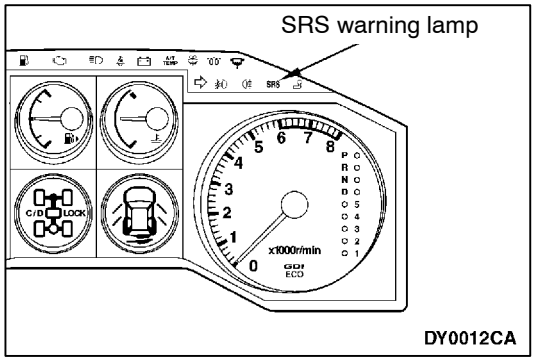
▶A◀ SRS-ECU INSTALLATION

Caution
The SRS may not activate if SRS-ECU is not installed properly.



▶B◀ SRS-ECU MOUNTING BOLT (EARTH BOLT) INSTALLATION

Before installation, check that the bolt is stamped mark “E” on the head.



▶C◀ POST-INSTALLATION INSPECTION

1. Turn the ignition key to the ON position.
2. Does the SRS warning lamp illuminate for about 7 seconds, and then remain extinguished for at least 5 seconds after turning OFF?
3. If no, refer to troubleshooting.
   (Refer to P.52B-7)

INSPECTION

1. Check the SRS-ECU case for dents, cracks or deformation.
2. Check connector for damage, and terminals for deformation.

   Caution
   If any problems are found, replace the SRS-ECU.

   NOTE
   For the checks other than the items above, refer to “Troubleshooting.”(Refer to P.52B-7.)

AIR BAG MODULES AND CLOCK SPRING

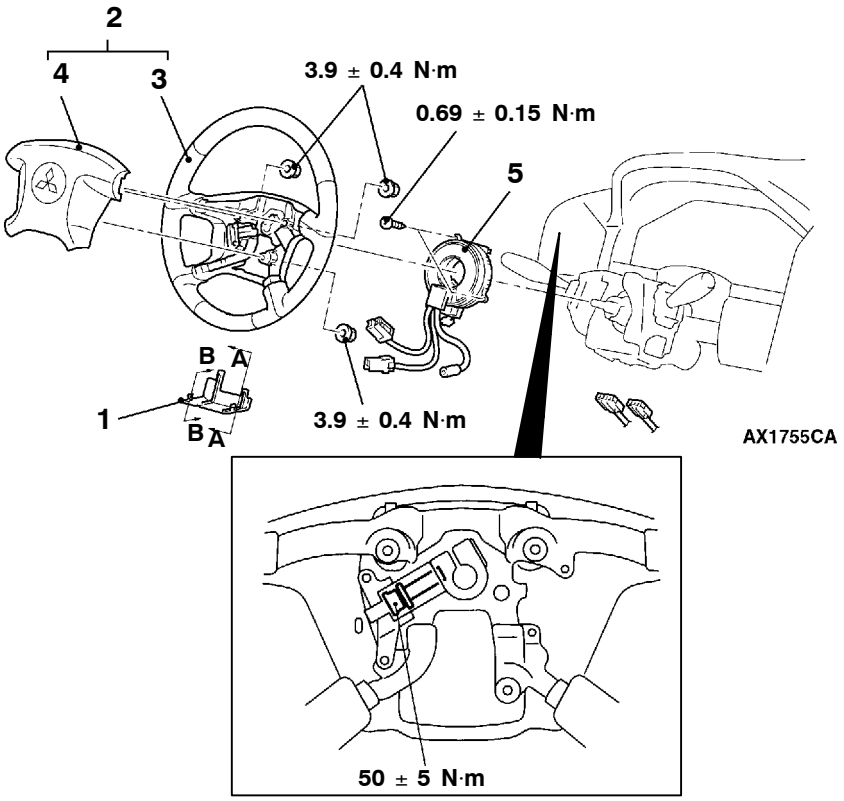
Caution

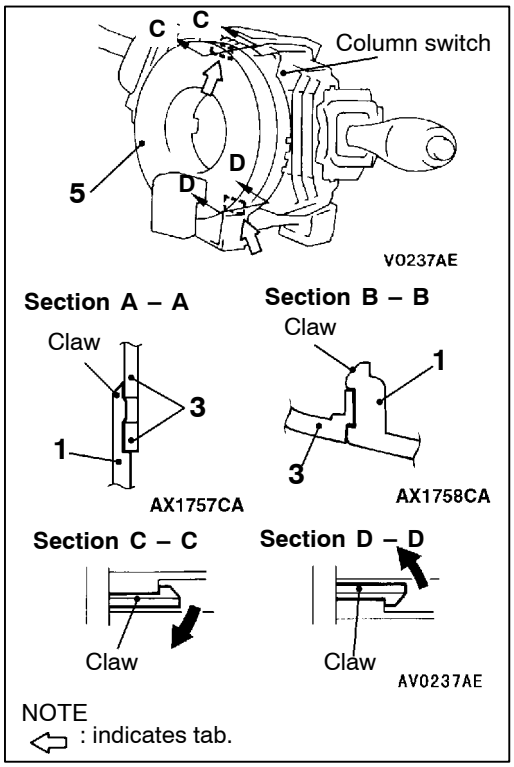
1. **Disconnect the negative (–) battery terminal and wait for 60 seconds or more before starting work. Also, the disconnected battery terminal should be insulated with tape. (Refer to P.52B-4.)**
2. **Never attempt to disassemble or repair the air bag modules and clock spring. If faulty, just replace 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-43.)**

REMOVAL AND INSTALLATION

Pre-removal Operations
- After setting the steering wheel and the front wheels to the straight ahead position, remove the ignition key.
- Disconnect the negative battery (-) terminal.

<Driver's air bag module and clock spring>





Driver's air bag module removal steps

◀A▶ 1. Cover
◀B▶ 2. Steering wheel and air bag module assembly
3. Steering wheel
◀C▶ 4. Driver's air bag module

Driver's air bag module installation steps

▶A◀ ● Pre-installation inspection
4. Driver's air bag module
3. Steering wheel
▶C◀ 2. Steering wheel and air bag module assembly
1. Cover
● Connect the negative (-) battery terminal.
▶D◀ ● Post-installation inspection

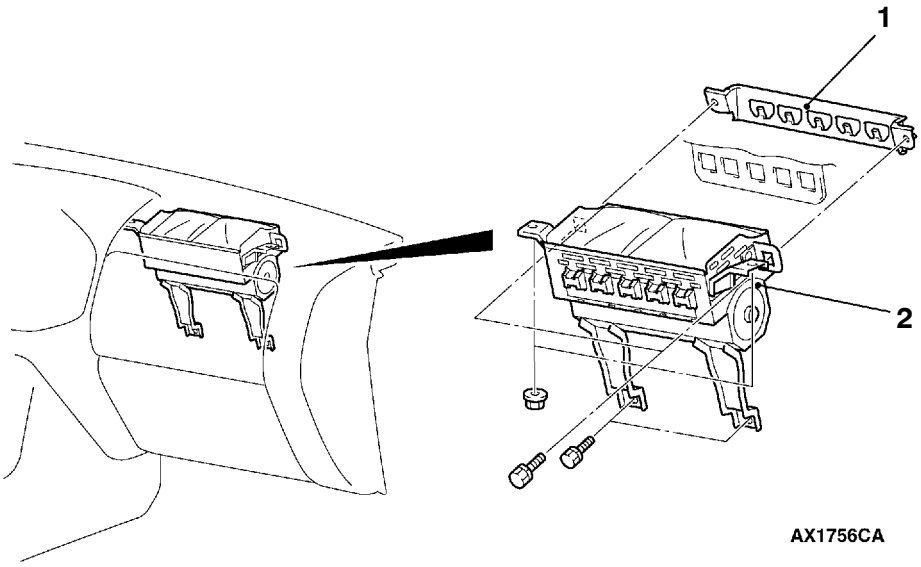
Clock spring removal steps

◀A▶ 1. Cover
◀B▶ 2. Steering wheel and air bag module assembly
● Lower column cover
◀D▶ 5. Clock spring

Clock spring installation steps

▶A◀ ● Pre-installation inspection
▶B◀ 5. Clock spring
● Lower column cover
▶C◀ 2. Steering wheel and air bag module assembly
1. Cover
● Connect the negative (-) battery terminal.
▶D◀ ● Post-installation inspection

<Passenger's air bag module>



Removal steps

- Upper glove box (Refer to GROUP 52A - Instrument Panel.)
- Glove box (Refer to GROUP 52A - Instrument Panel.)

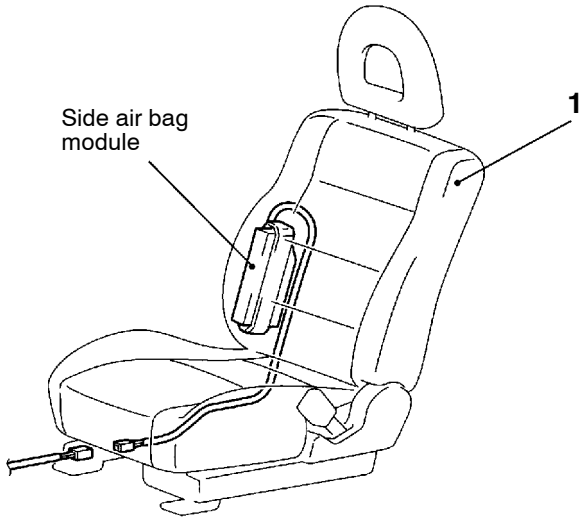
◀E▶ 1. Air bag side plate
◀F▶ 2. Passenger's air bag module

Installation steps

▶A◀ - Pre-installation inspection
2. Passenger's air bag module
1. Air bag side plate
- Glove box (Refer to GROUP 52A - Instrument Panel.)
- Upper glove box (Refer to GROUP 52A - Instrument Panel.)
- Connect the negative (-) battery terminal.

▶D◀ - Post-installation inspection

<Front seatback assembly equipped with side air bag module>

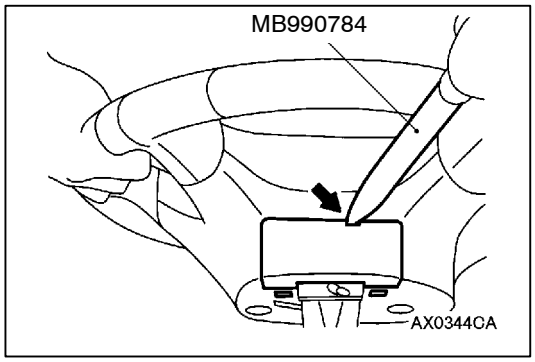


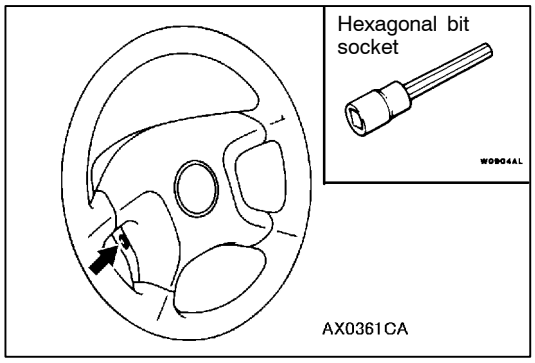
Removal steps

◀G▶ 1. Front seat back assembly

Installation steps

▶A◀ ● Pre-installation inspection
1. Front seat back assembly
● Connect the negative (-) battery terminal.
▶D◀ ● Post-installation inspection





REMOVAL SERVICE POINTS

◀A▶ COVER REMOVAL

Insert the special tool as shown in the illustration to remove the cover.

NOTE
The arrow in the illustration shows the notch for the special tool.

◀B▶ STEERING WHEEL AND AIR BAG MODULE ASSEMBLY REMOVAL

1. Remove the air bag module and disconnect the horn switch connector through space produced after the removal of the steering wheel.
2. Loosen the bolt completely and then remove the steering wheel assembly.

NOTE
Use a hexagonal bit socket or a hexagonal wrench having an effective length of 75 mm or more in the hexagonal section and the diameter of 8 mm or more.

◀C▶ DRIVER'S AIR BAG MODULE REMOVAL

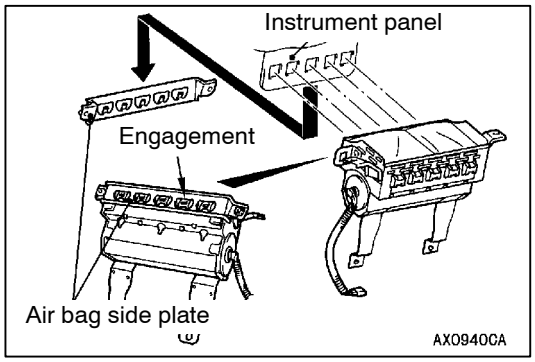
Caution

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.**

◀D▶ CLOCK SPRING REMOVAL

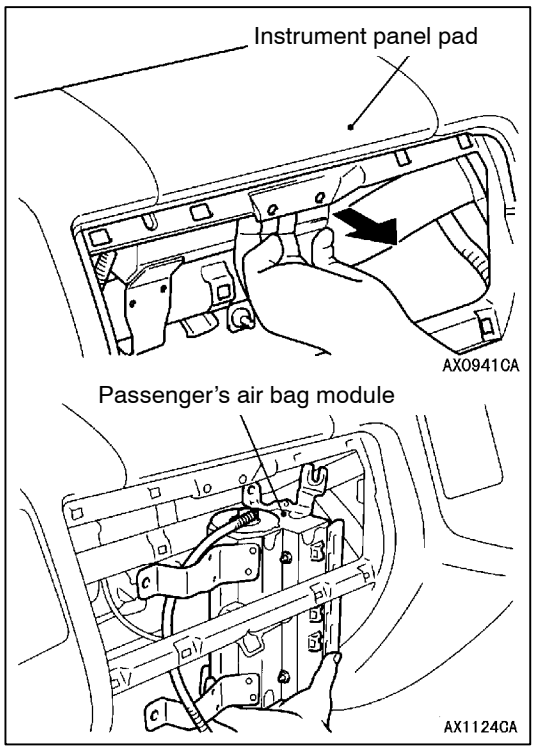
Caution

The removed clock spring should be stored in a clean, dry place.



◀E▶ AIR BAG SIDE PLATE REMOVAL

1. Remove the air bag side plate mounting bolt and slide downward the air bag side plate and then disengage it from the the passenger's air bag module.
2. After removal of the passenger's air bag module mounting bolt and nut, move the passenger's air bag aside and remove the air bag side plate.



◀F▶ PASSENGER'S AIR BAG MODULE REMOVAL

While the instrument panel pad as shown in the illustration is pulled forward, remove the air bag module and pull it out from the down side.

Caution

The removed passenger's air bag module should be stored in a clean, dry place with facing the deployment surface facing up.

◀G▶ FRONT SEATBACK 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, clock spring and front seat back assembly require inspection before installation. (Refer to P.52B-38.)

   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-43.)

2. Connect the negative (-) battery terminal.
3. Connect the MUT-II to the diagnosis connector (16 pin) .

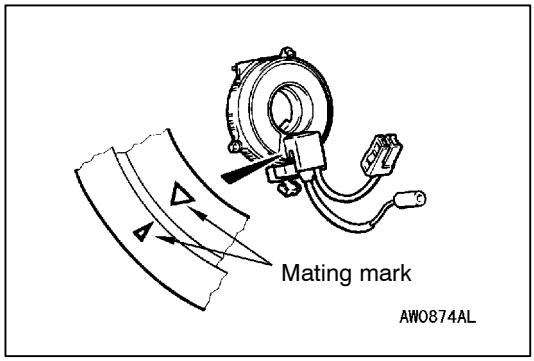
   Caution
   Turn the ignition switch to the LOCK (OFF) position when connecting and disconnecting the MUT-II.

4. Turn the ignition key to the ON position.
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.
7. 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, item 5 of the Service Precautions)

▶B◀ CLOCK SPRING INSTALLATION

Align the mating marks on the clock spring as mentioned in the next step. Then, install the clock spring to the column switch.



CLOCK SPRING CENTERING

Fully turn the clock spring clockwise and then turn it back about 3 times counterclockwise to align the mating marks.

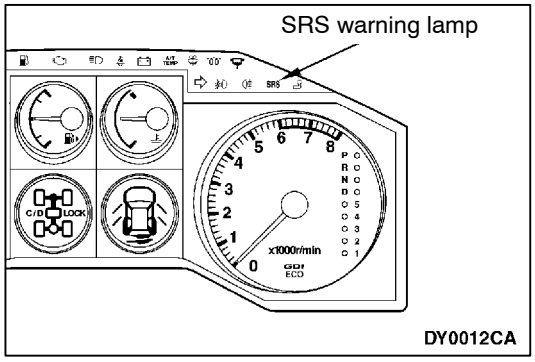
Caution
Unless the mating marks are properly aligned, the steering wheel gets stuck amid a turn or the flat cable in the clock spring is cut. These hinder the SRS air bag from proper operation, resulting in serious injury to the vehicle's driver.

▶C◀ STEERING WHEEL AND AIR BAG MODULE ASSEMBLY INSTALLATION

1. Refer to first that the clock spring has been centered properly. Then, install the steering wheel.

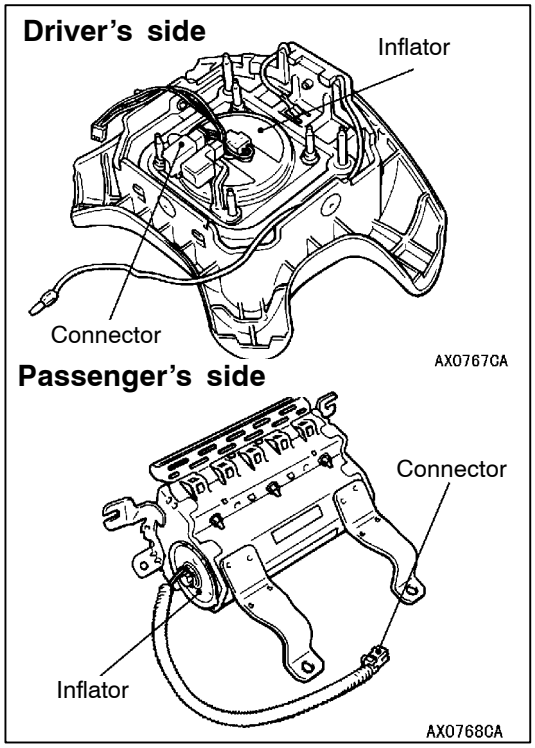
   Caution
   Be sure when installing the steering wheel, that the harness of the clock spring does not become caught or tangled.

2. After clamping, turn the steering wheel all the way in both directions to confirm that steering is normal.



▶D◀ POST-INSTALLATION INSPECTION

1. When the driver's airbag module or the clock spring is installed, turn the steering wheel clockwise and counterclockwise slowly to confirm that there is no noise or improper operation.
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 no, refer to troubleshooting.
   (Refer to P.52B-7)



INSPECTION

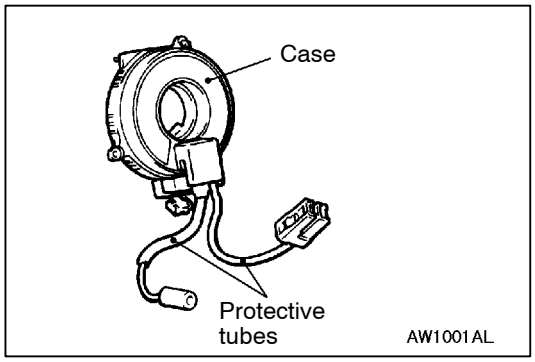
Driver's and passenger's air bag module

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-43.)

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 harness and connector for damage and the terminals for deformation.
3. Check the air bag inflator cases for dents, cracks or deformation.
4. Check the air bag module for proper installation.

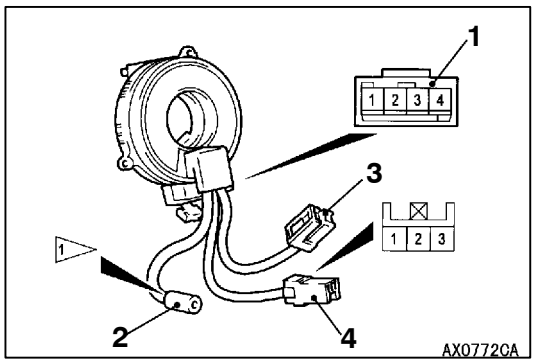
Caution
If a dent, crack or deformation is detected, replace with a new sensor. Discard the old one(s) as specified in the service procedure.
(Refer to P.52B-43.)



Clock spring

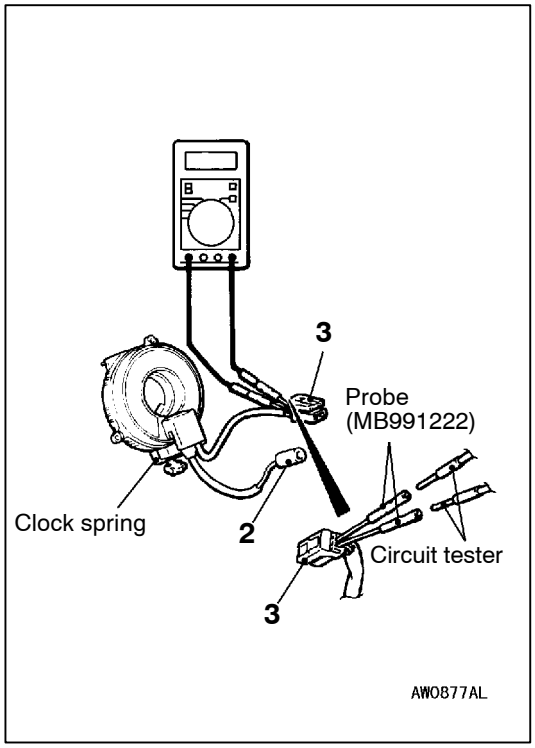
If any malfunction is found in the following inspections, replace the clock spring with a new one.

1. Check the connectors and protective tubes for damage, and terminals for deformation.
2. Visually check the case for damage.



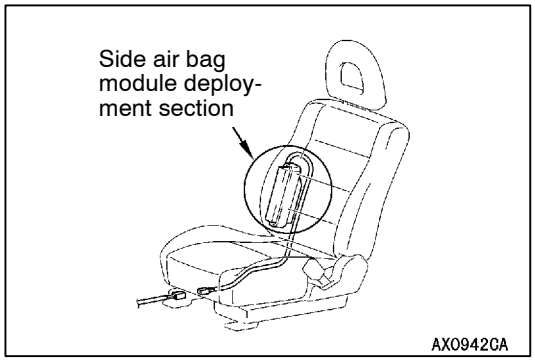
3. Refer to that the clock spring has continuity between connectors No.1, No.2, No.4 <vehicles with auto-cruise control>.

Connector No.	1				2	4		
Terminal No.	1	2	3	4	1	1	2	3
Continuity	○					○		
		○						○
			○				○	
				○	○			



4. Insert the probes (MB991222) from the rear of the clock spring No.3 connector.
   Caution
   Never insert the probe directly to the terminals from the front of the connector.
5. Connect a digital multimeter to the probe (MB991222) as shown, to check that the resistance is 1 Ω or less. Also, check that there is a open circuit.

   Open circuit: 1 MΩ or more



Front seat back assembly equipped 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-43.)

Caution
Never measure circuit resistance in the side 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.

SIDE IMPACT SENSOR

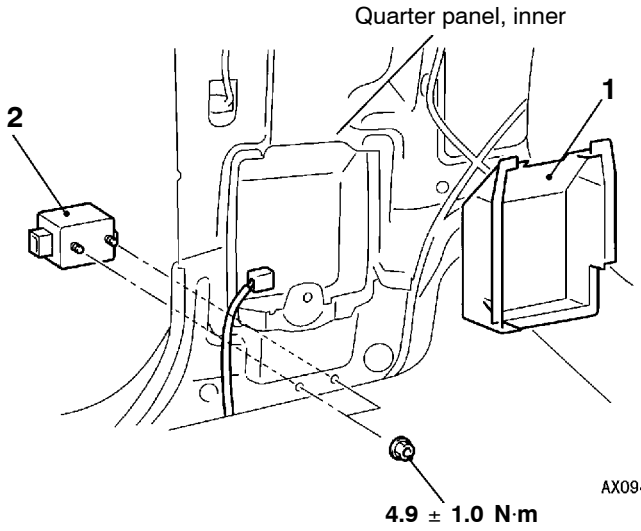
Caution

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.**

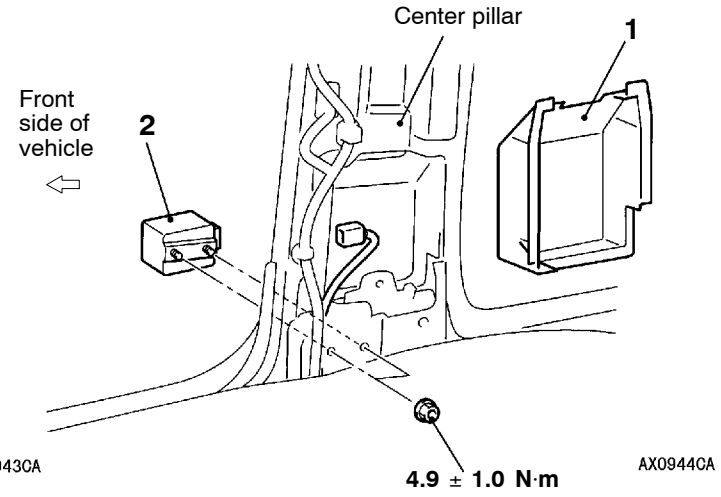
REMOVAL AND INSTALLATION

Pre-removal Operations
- Turn the ignition switch to LOCK(OFF) position.
- Disconnect the negative battery (-) terminal.

Short wheelbase



Long wheelbase



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.)
- Connect the negative (-) battery terminal.

▶C◀ ● Post-installation inspection

NOTE
The figure shows the side impact sensor (R.H.).

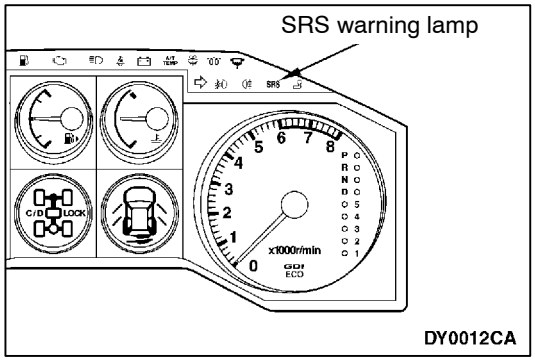
INSTALLATION SERVICE POINTS

▶A◀ PRE-INSTALLATION INSPECTION

Even new side impact sensor requires inspection before installation. (Refer to the previous item “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 key to the ON position.
2. Does the SRS warning lamp illuminate for about 7 seconds, and then remain extinguished for at least 5 seconds after turning OFF?
3. If no, refer to troubleshooting.
   (Refer to P.52B-7)

INSPECTION

1. Check the side impact sensor for dents, cracks, deformation and rust.
2. Check connector for damage, and terminals for deformation.
3. Check the center pillar or quarter panel, inner for deformation and rust.

   Caution
   If a dent, crack, deformation or rust is found, replace the sensor with a new one.

   NOTE
   For other inspections than described above, go to Troubleshooting. (Refer to P.52B-7.)

AIR BAG MODULE DISPOSAL PROCEDURES

When discarding the air bag modules or a vehicle with SRS air bags, be sure to deploy the air bags in advance as specified in the service procedure that follows.

UNDEPLOYED AIR BAG MODULES

Caution

1. **If the vehicle is to be scrapped or otherwise disposed of, deploy the air bags inside the vehicle. If the vehicle is still to be used and only the air bag modules are to be discarded, deploy the air bags outside the vehicle.**
2. **Since a large amount of smoke is produced when the air bags are deployed, avoid residential areas whenever possible.**
3. **Since there is substantial report when the air bags are deployed, avoid residential areas whenever possible. If anyone is nearby, give warning of the impending noise.**
4. **Suitable ear protection must be put on by personnel performing these procedures or by people in the immediate area.**

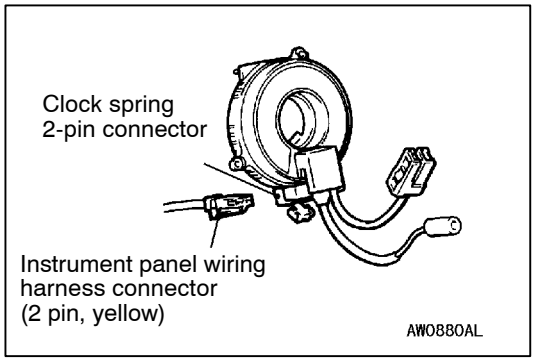
DEPLOYMENT INSIDE THE VEHICLE

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

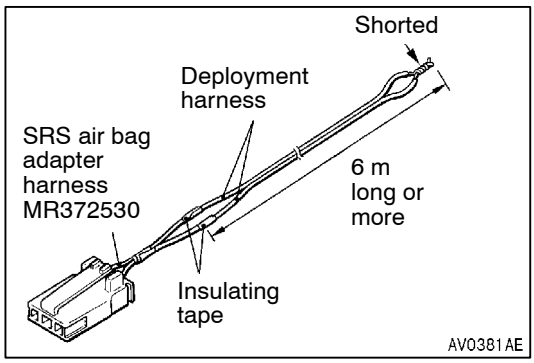
   Caution
   Wait at least 60 seconds after the disconnection of the battery cables before any further job.
   (Refer to P.52B-4.)

3. Deploy each air bag module as specified in the service procedures that follow.

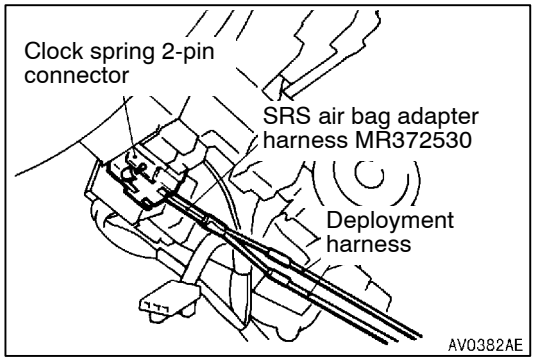
   Driver's air bag module
   (1) Remove the steering column cover, lower. (Refer to GROUP 52A - Instrument Panel.)
   (2) Disconnect the clock spring 2-pin connector and instrument panel wiring harness connector (2-pin, yellow).



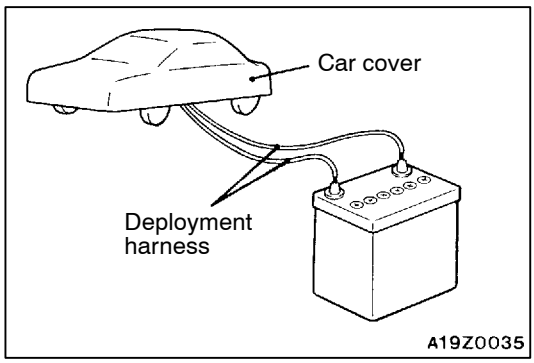
NOTE
Once disconnected from the instrument panel wiring harness, both electrodes of the clock spring connector short automatically. This prevents the driver's air bag from accidental deployment caused by static, etc.



(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.



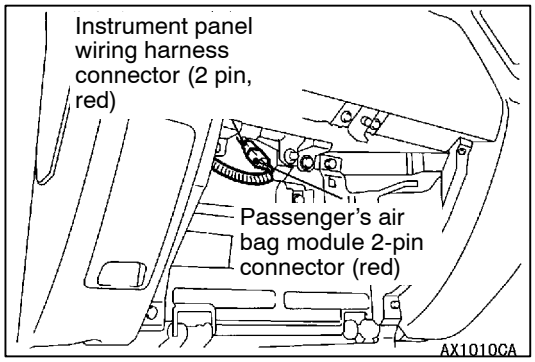
(5) Close all the doors with the windows fully closed and put a cover over the vehicle to minimize report.

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 the passenger's air bag module.

Caution
1) Before deploying the air bag, see that no one is in and near the vehicle.
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 distributor.

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

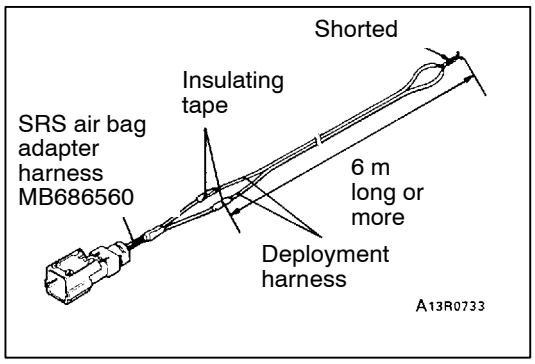


Passenger's air bag module

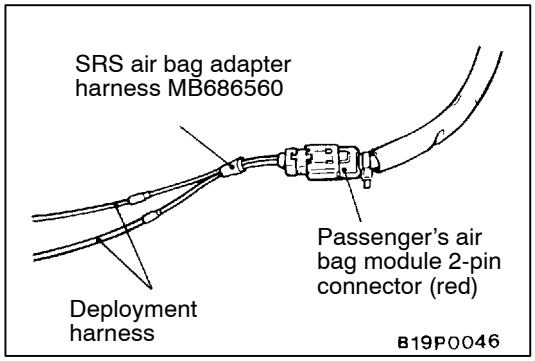
(1) Remove the glove box.
(Refer to GROUP 52A - Instrument Panel.)

(2) Disconnect the front passenger's air bag module 2-pin connector (red) and instrument panel wiring harness connector (2-pin, red).

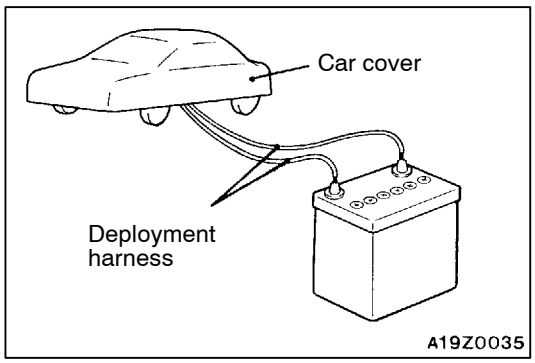
NOTE
Once disconnected from the instrument panel wiring harness, both electrodes of the passenger's air bag module short automatically. This prevents the passenger's air bag from accidental deployment caused by static, etc.



(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 passenger's air bag from accidental deployment caused by static etc.



(4) Connect the SRS air bag adapter harness to the passenger's air bag module 2-pin (red) connector and route the deployment harnesses out of the vehicle.



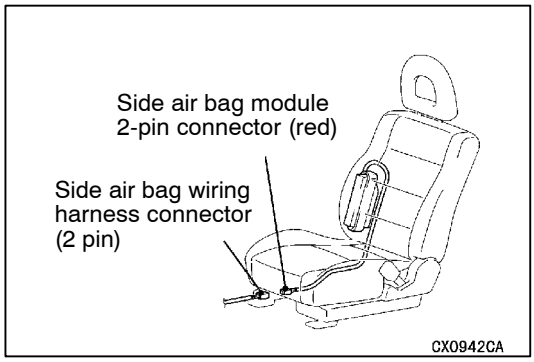
(5) Close all the doors with the windows fully closed and put a cover over the vehicle to minimize report.

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 the passenger's air bag module.

Caution
1) Before deploying the air bag, see that no one is in and near the vehicle.
2) The deployment makes the inflator of the 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 air bag module, discard as specified in the procedure. (Refer to P.52B-52)

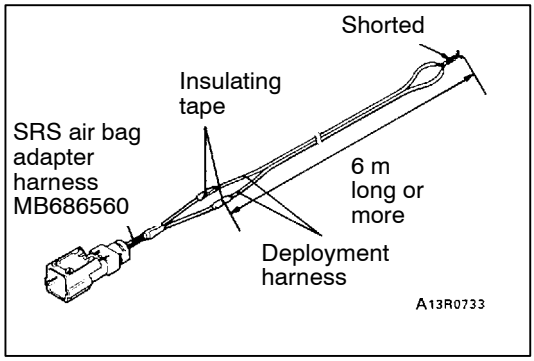


Side air bag module

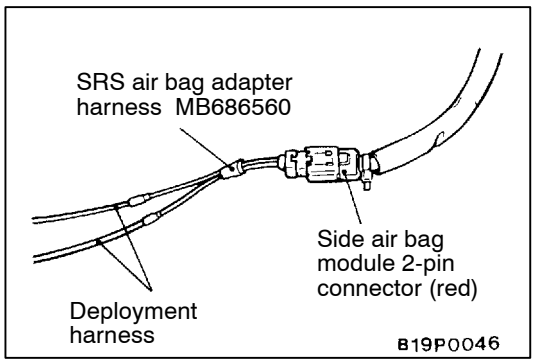
(1) Disconnect the side airbag module 2-pin connector (red) and side airbag wiring harness connector(2-pin).

Caution
The side air bag modules both in the driver's and passenger's sides should be deployed.

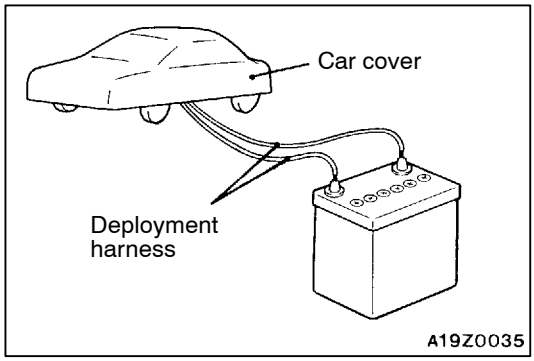
NOTE
Once disconnected from the side air bag wiring harness, both electrode of the side air bag module connector short automatically. This prevents the side air bag from accidental deployment caused by static etc.



(2) 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 side air bag from accidental deployment caused by static etc.



(3) Connect the SRS air bag adapter harness to the side air bag module 2-pin connector (red) and route the deployment harness out of the vehicle.



(4) 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.

(5) 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 the side air bag module.

Caution
1) **Before deploying the air bag, see that no one is in and near the vehicle.**
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.**

(6) After deployment of the air bag module, discard as specified in the procedure. (Refer to P.52B-52.)

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.**

1. Disconnect the negative (-) and positive (+) battery cables from the battery terminals, and then remove the battery from the vehicle.

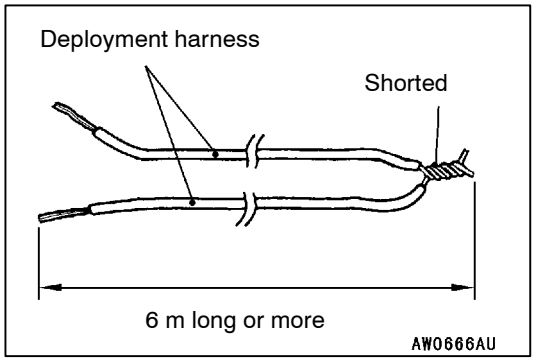
   Caution
   Wait at least 60 seconds after disconnecting the battery cables before doing any further work. (Refer to P.52B-4, item 5 of the Service Precautions)

2. Deploy each air bag module as specified in the service procedures that follows.

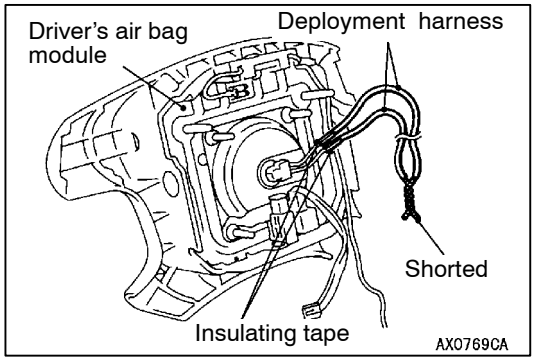
   Driver's air bag module
   (1) Remove the driver's air bag module from the vehicle. (Refer to P.52B-32)

   Caution
   Once disconnected, both electrodes of the driver'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. Do not place anything on top of it.

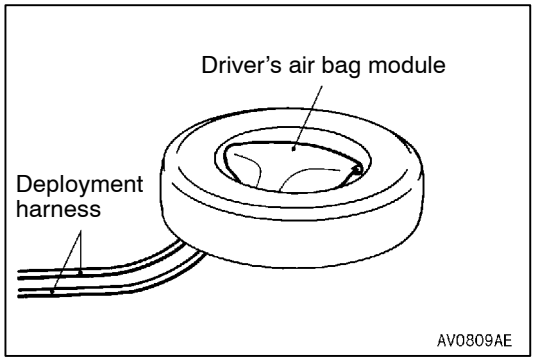
   (2) Connect two wires, each 6 meters or longer, to the two leads of SRS air bag adapter harness and cover the connections with insulation tape. The other ends of the two wires should be connected to each other(short-circuited), to prevent sudden unexpected deployment of the driver's air bag.
   (3) Touch 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.



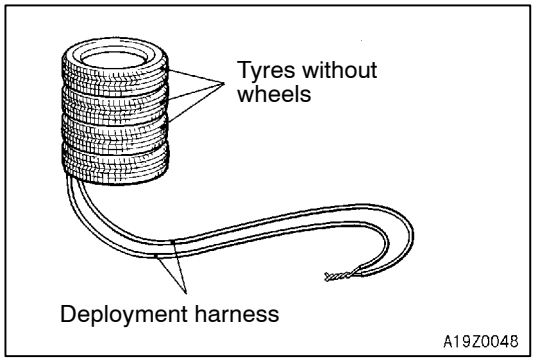
(4) Using pliers, cut the driver's air bag module connector from the harnesses. Connect the deployment harnesses to each harness that has been cut and insulate the connections with plastic tape.



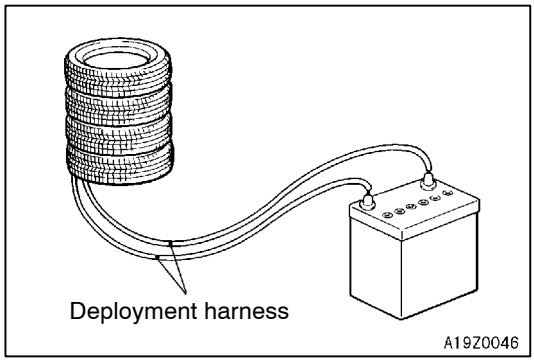
(5) Install a nut to the bolt behind the driver's air bag module and tie thick wire for securing to the wheel.

(6) 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. 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
The deployment harnesses must not be tight below the wheel. Otherwise, the adapter harness could get damaged at deployment.



(7) Place three old tyres without wheels on top of the tyre secured to the driver's air bag module.



(8) 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 the air bag.

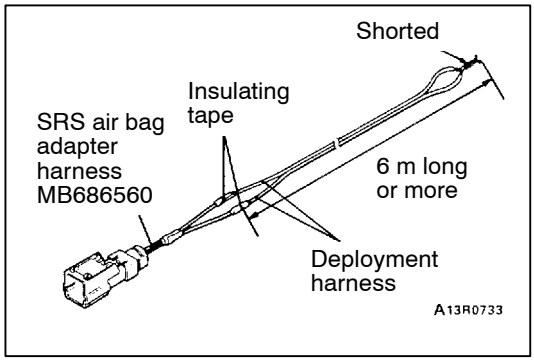
Caution
1) Before the deployment, be sure that no one is near the driver's air bag module.
2) The deployment makes the inflator of the driver's air bag very hot. Before handling the inflator, wait more than 30 minutes for cooling.
3) If the driver's air bag module fails to deploy although the procedure is respected, do not go near the module. Contact your distributor.

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

Passenger's air bag module

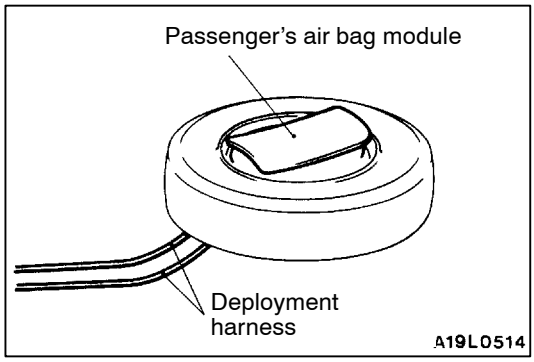
(1) Remove the passenger's air bag module from the vehicle.
(Refer to P.52B-32.)

Caution
Once disconnected, both electrodes of the 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. Do not place anything on top of it.



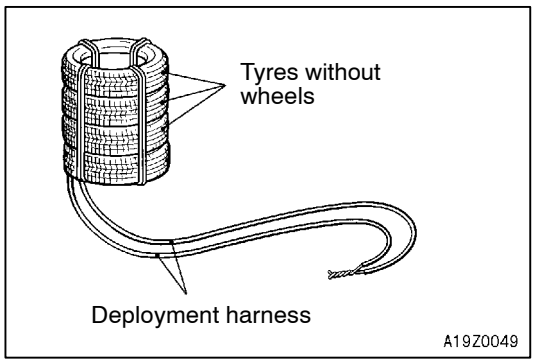
(2) Connect deployment harnesses longer than 6 m to each SRS air bag adapter harness and insulate the connections with plastic tape.
Also, connect the deployment harnesses in the other ends to short, thereby preventing the passenger's air bag from accidental deployment caused by static etc.

(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 passenger's air bag module.

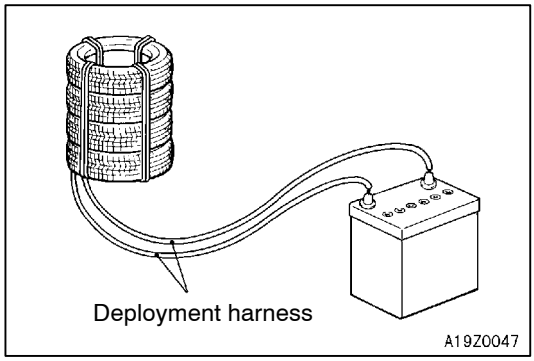


(4) Route a thick wire through the holes in the passenger's air bag module bracket. With the deployment surface facing up, secure the passenger's air bag module to the old tyre and wheel assembly.

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 passenger's air bag module. Secure all the tyres with ropes (4 locations).



(6) Disconnect the deployment harnesses as far from the passenger's air bag module as possible and connect the harnesses to the battery removed from the vehicle. Then deploy the airbag.

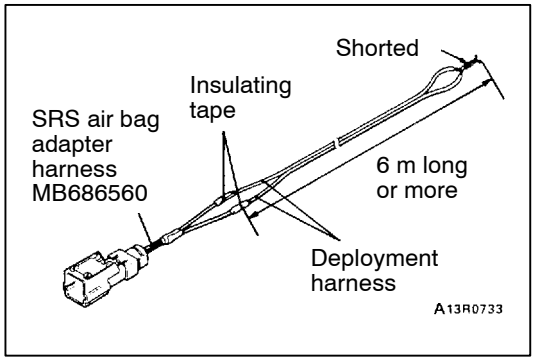
Caution
1) **Before the deployment, see that no one is near the passenger's air bag module.**
2) **The deployment makes the inflator of the passenger's air bag very hot. Before handling the inflator, wait more than 30 minutes for cooling.**
3) **If the passenger's air bag module fails to deploy although the procedure is respected, do not go near the module. Contact your local distributor.**

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

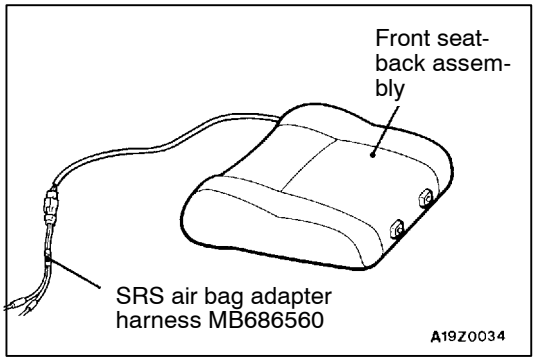
<Side air bag module>

(1) Remove the front seat back assembly with side air bag module from the vehicle. (Refer to 52B-32.).

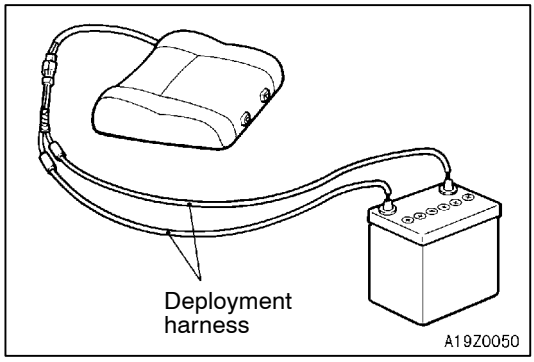
Caution
Once disconnected, both electrodes of the side air bag module connector short automatically to prevent accidental deployment caused by static etc. Still, in consideration of the accidental deployment, store the air bag module on flat place with deployment surface facing up. Do not place anything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



(2) 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 side air bag from accidental deployment caused by static etc.



(3) Place the front seat back assembly with its back facing the ground.
(4) Connect the SRS air bag adapter harness which connected with the deployment harness to the side air bag module connector.



(5) Disconnect the deployment harnesses as far from the front seat back assembly as possible and connect the harnesses to the battery removed from the vehicle. Then deploy the air bag.

Caution
1) **Before the deployment, see that no one is near the front seat back assembly.**
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 side air bag module fails to deploy when the procedures above are followed, do not go near the module. Contact your local distributor.**

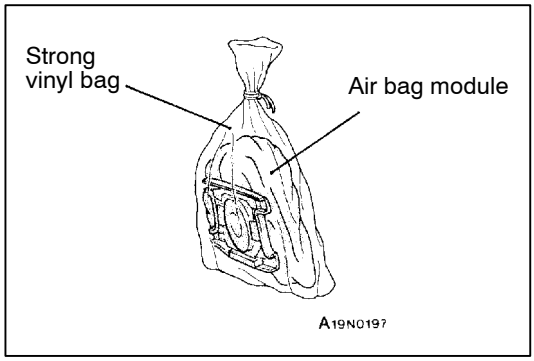
(6) Remove the deployed side air bag module from the seat back assembly and discard as specified in the procedure. (Refer to P.52B-52.)

DEPLOYED AIR BAG MODULE DISPOSAL PROCEDURES

After the deployment, discard the air bag modules the same way as any other scrap parts, respecting local laws and/or legislation that may be in force.
However, note the following points at the disposal:

1. The inflators will be quite hot just after deployment. So, wait at least 30 minutes to cool it before handling.
2. Do not put water or oil on the air bags after deployment.
3. There may be, adhered to the deployed air bag modules, material that could irritate the eye and/or skin, so put on gloves and safety glasses when handling the deployed air bag module.

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. Discard the air bag module in a vinyl bag tightly sealed.
5. Be sure to always wash your hands after completing this operation.

SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

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- Operated Seat Belt Pre-tensioner Disposal Procedures 18

CAUTION

- **Carefully read and observe the information in the SRS SERVICE PRECAUTIONS (P.52B-3.) prior to any service.**
- **For information concerning troubleshooting or maintenance, always observe the procedures in the Troubleshooting (P.52B-6.) 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-11.) for the components involved.**
- **If you have any questions about the SRS, please contact your local distributor.**

GENERAL

OUTLINE OF CHANGES

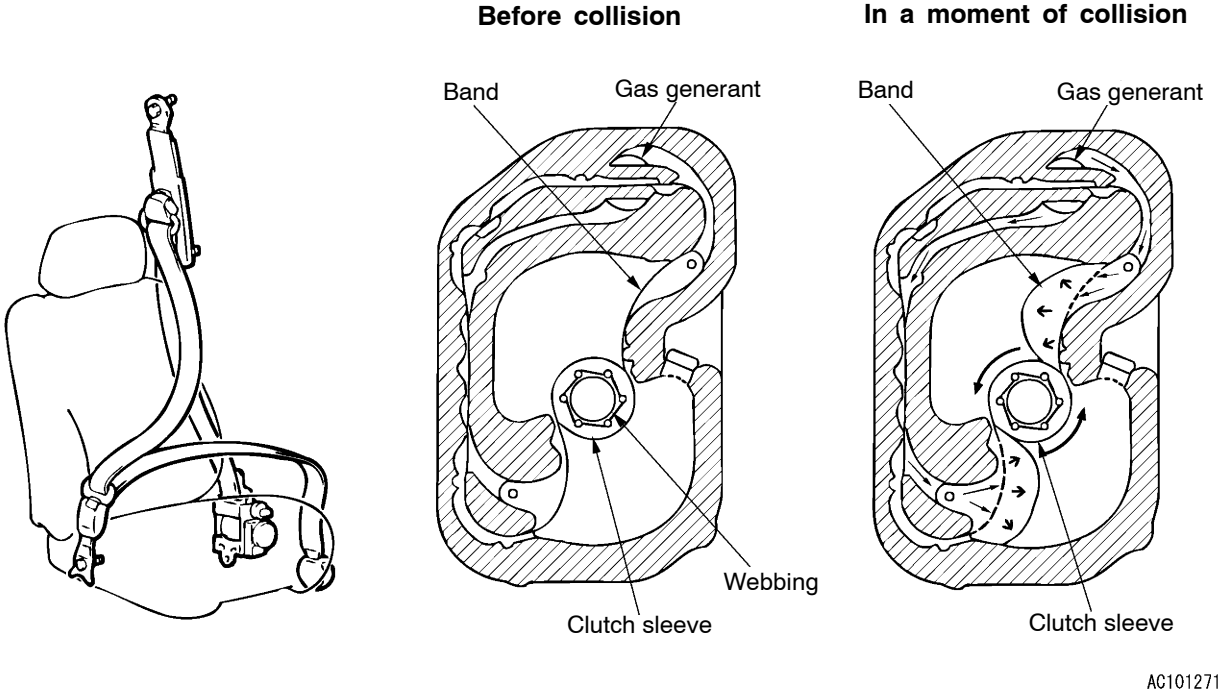
- A service procedure has been established as seat belts with pre-tensioner have been added.
- The side impact sensor circuit has been changed. The sensor service procedure is the same as before.

SEAT BELT WITH PRE-TENSIONER

Caution
Never disassemble the seat belt with pre-tensioner.

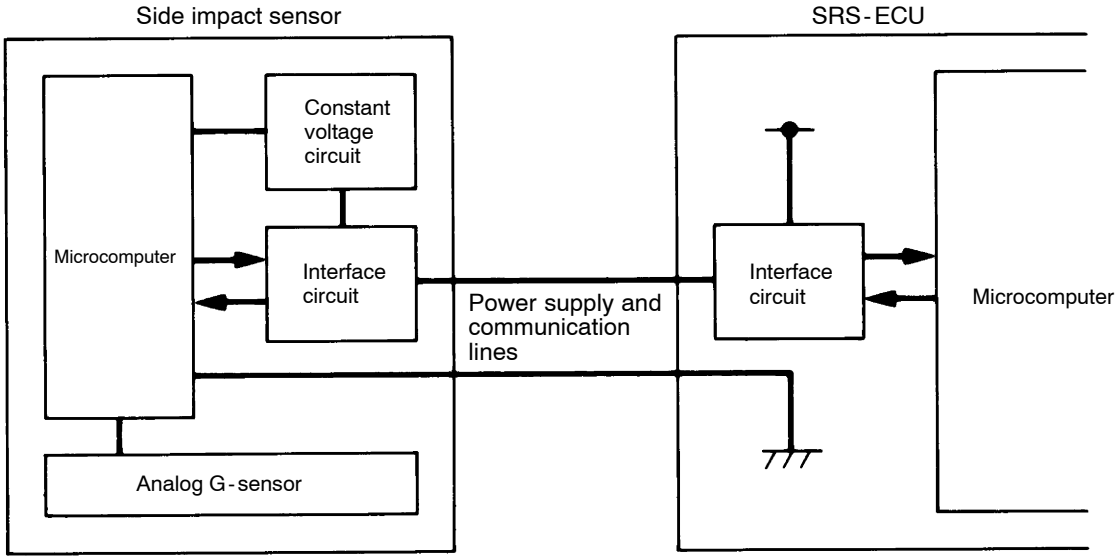
The driver's and passenger's seat belt pre-tensioners take up seat belt slack immediately when a collision takes place, thus restraining the pre-tensioners on the seats simultaneously with the SRS air bags. this improves the passive safety. when the G sensor in the SRS-ECU detects impact above a certain level during a collision, the pre-tensioner operates as follows:

1. The igniting heater heats up according to the signal from the SRS-ECU.
2. this ignites the gas generant and explosive gas will be generated.
3. The strip is pushed outwards by the gas pressure. As the strip wound around the clutch sleeve is pulled out, the clutch sleeve rotates at high speed.
4. The clutch sleeve rotates to wind the webbing.



SIDE IMPACT SENSOR

The power supply circuit to the side impact sensor and the communication line have been unified. This contributes to simplifying wiring harnesses and improving reliability.



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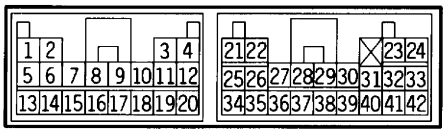
SRS SERVICE PRECAUTIONS

1. In order to avoid injury to yourself or others from accidental deployment of the air bag and accidental operation of the seat belt with pre-tensioner 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 G.52B-6.
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
   - Front impact sensors
   - Side impact sensors
   - 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, starting at page G.52B-26.

SRS-ECU connector



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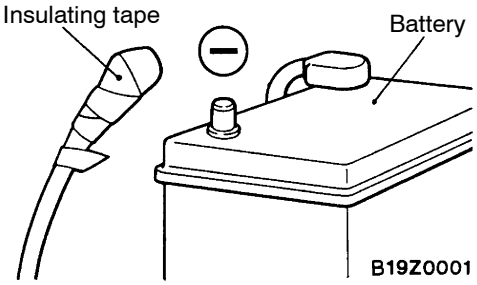
4. **Do not attempt to repair the wiring harness connectors of the SRS. If a defective wiring harness is found, repair or replace it by referring to the table follows.**

   NOTE
   The table below shows the pre-tensioner related terminals only. The other terminals are the same as before.

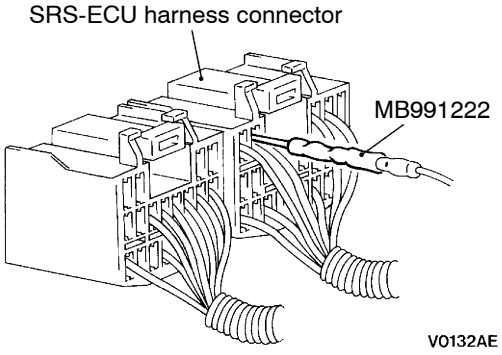
SRS-ECU Terminal No.	Destination of harness	Corrective action
27, 28	Floor wiring harness → Seat belt with pre-tensioner (Front passenger's side)	Correct or replace each wiring harness.
29, 30	Floor wiring harness → Seat belt with pre-tensioner (Driver's side)	



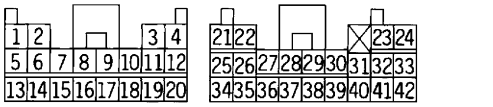
5. **After disconnecting the negative (–) battery cable, wait 60 seconds at least before any service and insulate the disconnected cable with tape. The SRS retain enough voltage to deploy the air bags for a short time even after the disconnection of the battery. So, serious injury may result by accidental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

6. **SRS components and seat belt with pre-tensioner should not be subjected to heat, so remove the SRS-ECU, air bag module (driver's side and front passenger's side), clock spring, side impact sensor, front seat assembly (side air bag module), and seat belt with pre-tensioner before drying or baking the vehicle after painting.**
   - **SRS-ECU, air bag module, clock spring, side impact sensor: 93°C or more**
   - **Seat belt with pre-tensioner: 90°C or more**
7. **Whenever you finish servicing the SRS, check warning lamp operation to make sure that the system functions properly.**

8**If checks are carried out by using the SRS-ECU harness connector, observe the following procedures:**
Insert the special tool (probe in the harness set) into connector from harness side (rear side), and connect the tester to this probe. If any tool than special tool is used, damage to the harness and other components will result. Never insert the probe directly to the terminals from the front of the connector. The terminals are plated to increase their conductivity, so that if they are touched directly by the probe, the plating may break, which will cause drops in reliability.



SRS-ECU harness connector (rear side)



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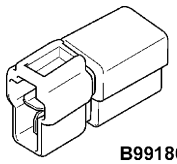
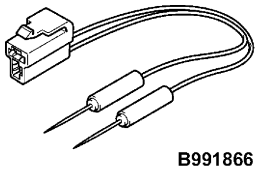
SPECIAL TOOLS

The items other than below are the same as before.

Tools	No.	Name	Application
 B991865	MB991865	Dummy resistor	SRS air bag circuit check
 B991866	MB991866	Resistor harness	

TROUBLESHOOTING

The following items have been changed. The other items are the same as before.

INSPECTION CHART FOR DIAGNOSIS CODES

Code No.	Diagnosis item	Reference page
26*, 27*, 66, 67	Driver's side pre-tensioner (squib) system	52B-7
28*, 29*, 68, 69	Front passenger's side pre-tensioner (squib) system	52B-8
56, 57	Driver's side pre-tensioner (squib ignition drive circuit) system	52B-9
58, 59	Front passenger's side pre-tensioner (squib ignition drive circuit) system	52B-9

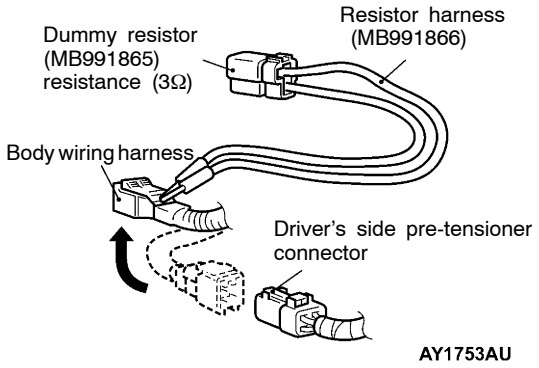
NOTE

*: If the system returns to normal, the SRS warning lamp will go out, but the relevant diagnosis code will be retained in memory.

INSPECTION PROCEDURE CLASSIFIED BY DIAGNOSIS CODE

Code No.26, 27, 66 or 67 Driver's side pre-tensioner (squib) system	Probable cause
These diagnosis codes are output if there is abnormal resistance between the input terminals of the driver's side pre-tensioner (squib). The trouble causes for each diagnosis code No. are as follows.	• Malfunction of wiring harnesses or connectors • Malfunction of driver's side pre-tensioner (squib) • Malfunction of SRS-ECU

Code No.	Trouble causes
26	• Short in driver's side pre-tensioner (squib) or harness short
27	• Open circuit in driver's side pre-tensioner (squib) or open harness • Malfunction of connector contact
66	• Short in driver's side pre-tensioner (squib) harness leading to the power supply
67	• Short in driver's side pre-tensioner (squib) harness leading to the earth



MUT-II Self-diag code

- Connect the dummy resistor (MB991865) to the resistor harness (MB991866).
- Disconnect driver's side pre-tensioner connector F-34 <L.H. drive vehicles> or F-31 <R.H. drive vehicles> 28, and insert probe of resistor harness MB991866 to the connector by backprobling.

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

- Connect the negative (-) battery terminal.
- Erase diagnosis code memory.

Is code No.26, 27, 66 or 67 displayed?

YES

Check the following connectors: E-110, E-21, F-34 <L.H. drive vehicles>, E-20, F-31 <R.H. drive vehicles>

OK

Check trouble symptoms.

NG

Check wiring harness between the driver's side pre-tensioner and SRS-ECU.

OK

Replace SRS-ECU.

NG

Repair

NG

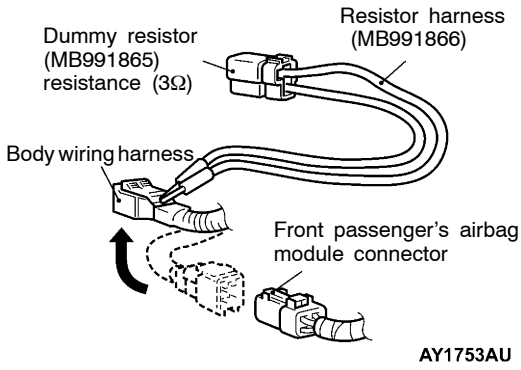
Repair

NO

Replace the driver's side seat belt with pre-tensioner.

Code No.28, 29, 68 or 69 Front passenger's side pre-tensioner (squib) system	Probable cause
These diagnosis codes are output if there is abnormal resistance between the input terminals of the front passenger's side pre-tensioner (squib). The trouble causes for each diagnosis code No. are as follows.	• Malfunction of wiring harnesses or connectors • Malfunction of front passenger's side pre-tensioner (squib) • Malfunction of SRS-ECU

Code No.	Trouble causes
28	• Short in front passenger's side pre-tensioner (squib) or harness short
29	• Open circuit in front passenger's side pre-tensioner (squib) or open harness • Malfunction of connector contact
68	• Short in front passenger's side pre-tensioner (squib) harness leading to the power supply
69	• Short in front passenger's side pre-tensioner (squib) harness leading to the earth



MUT-II Self-diag code
- Connect the dummy resistor (MB991865) to the resistor harness (MB991866).
- Disconnect front passenger's side pre-tensioner connector F-31 <L.H. drive vehicles> or F-34 <R.H. drive vehicles>, and insert probe of resistor harness MB991866 to the connector by backprobing.

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

- Connect the negative (-) battery terminal.
- Erase diagnosis code memory.

Is code No.28, 29, 68 or 69 displayed?

YES

Check the following connectors: E-110, E-20, F-31 <L.H. drive vehicles>, E-21, F-34 <R.H. drive vehicles>

OK

Check trouble symptoms.

NG

Check wiring harness between the front passenger's side pre-tensioner and SRS-ECU.

OK

Replace SRS-ECU.

NG

Repair

NG

Repair

NO

Replace the front passenger's side pre-tensioner.

Code No.56, 57, 58, 59 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
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

If the diagnosis code(s) above is set, replace the SRS-ECU.

POST-COLLISION DIAGNOSIS

Check and service the vehicle after collision as follows regardless of the operation of the pre-tensioner:

SRS-ECU MEMORY CHECK

The check procedure is the same as before.

REPAIR PROCEDURE

WHEN PRE-TENSIONER OPERATES IN A COLLISION.

1. Replace the following parts with new ones.
   - SRS-ECU
   - Front impact sensor
   - Seat belt with pre-tensioner (Refer to P.52B-12.)
2. Check harnesses for binding, connectors for damage, poor connections, and terminals for deformation.

UNDEPLOYED AIR BAGS IN LOW-SPEED COLLISION

Check the SRS-ECU and Front impact sensor and Seat belt with pre-tensioner. If visible damage such as dents, cracks, or deformation are found on the the SRS-ECU and Front impact sensor and Seat belt with pre-tensioner, replace them with new ones. Concerning parts removed for inspection, replacement with new parts and cautions in working, refer to INDIVIDUAL COMPONENT SERVICE.

SRS-ECU

The check procedure is the same as before.

Front impact sensor

The check procedure is the same as before.

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 seat belt with pre-tensioner are to be removed or replaced as a result of maintenance, troubleshooting, etc., follow each procedure (P.52B-10 - P.52B-13.)

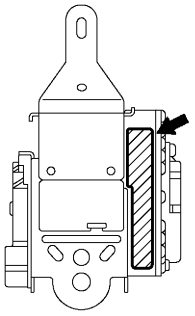
Caution

1. **The seat belt with pre-tensioner should not be subjected to temperature 90°C, so remove the seat belts with pre-tensioner before drying or baking the vehicle after painting.**
2. **If the seat belt 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 seat belt with pre-tensioner are attached in the vehicle as shown. Follow label instructions when servicing the seat belt with pre-tensioner. If the label(s) are dirty or damaged, replace with new one(s).

Seat belt with pre-tensioner



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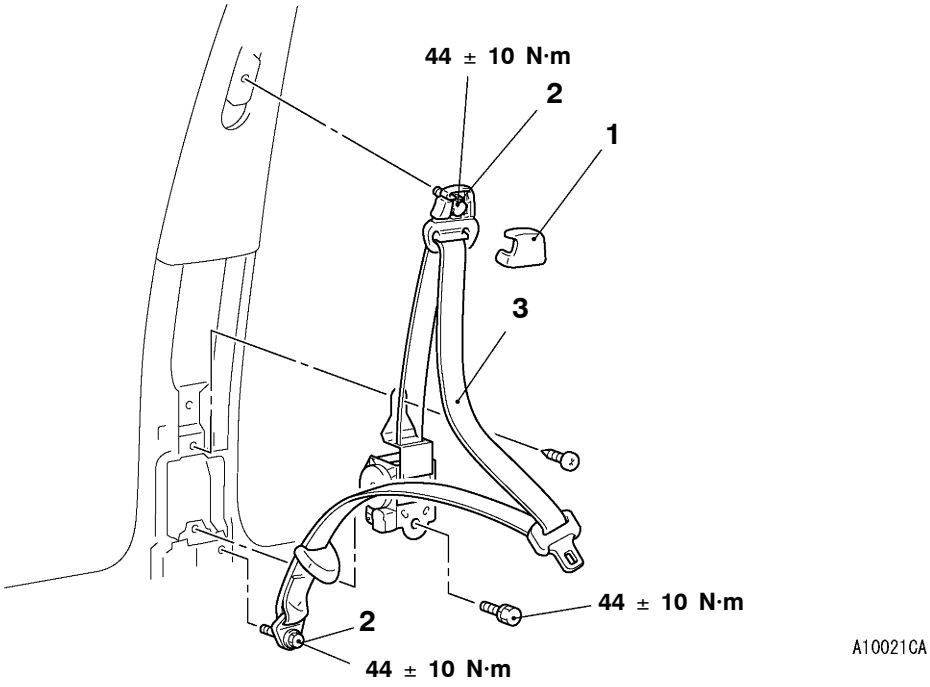
SEAT BELT WITH PRE-TENSIONER

Caution

1. **Never attempt to disassemble or repair the 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 pre-tensioner.**
4. **Do not expose the seat belt with pre-tensioner to temperatures over 90°C.**
5. **After operating the 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-14.)**

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Turn Ignition Key to LOCK (OFF) Position
- Disconnect the Negative (-) Battery Terminal.



Removal steps

1. Sash guide cover
2. Outer seat belt connection
- Center pillar trim, lower
3. Seat belt with pre-tensioner

Installation steps

▶A◀
- Post-installation inspection

3. Seat belt with pre-tensioner
- Center pillar trim, lower
2. Outer seat belt connection
1. Sash guide cover
- Negative (-) battery cable connection

▶B◀
- Pre-installation inspection

NOTE
The figure shows the seat belt with pre-tensioner (RH)

INSTALLATION SERVICE POINTS

▶A◀ PRE-INSTALLATION INSPECTION

1. Even new seat belt with pre-tensioner require inspection before installation.

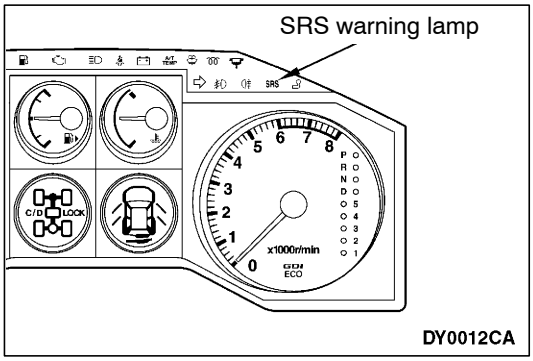
   Caution
   When discarding the seat belt with pre-tensioner, operate the pre-tensioner as specified in the service procedure. (Refer to P.52B-14.)

2. Connect the negative (-) battery terminal.
3. Connect the MUT-II to the diagnosis connector (16 pin).

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

4. Turn the ignition key to the ON position.
5. Read a diagnosis 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.
7. 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, item 5 of the Service Precautions)



▶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 after turning OFF?
4. If no, refer to troubleshooting.
   (Refer to P.52B-6)

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-14.)

- Check pre-tensioner for dents, cracks or deformation.

SEAT BELT PRE-TENSIONER DISPOSAL PROCEDURES

Before disposing of a vehicle which is equipped with seat belts with pre-tensioner, or when disposing of the seat belts with pre-tensioner themselves, the following procedures must be used to deploy the pre-tensioners before disposal.

UNDEPLOYED SEAT BELT PRE-TENSIONER DISPOSAL

Caution

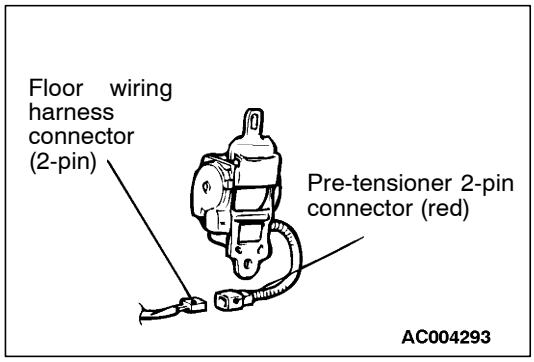
1. **If the vehicle is to be scrapped or otherwise disposed of, operate the pre-tensioners inside the vehicle. If the vehicle is still to be used and only the seat belt pre-tensioner are to be disposed of, operate the pre-tensioners outside the vehicle.**
2. **Since a large amount of smoke is produced when the pre-tensioner is operated, avoid residential areas whenever possible.**
3. **Since there is a loud noise when the 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.)

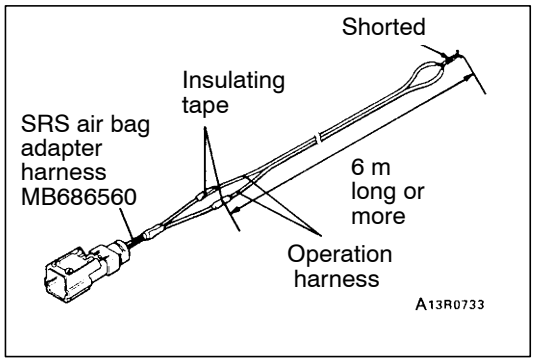
3. Operate the pre-tensioner as specified in the service procedures that follows.
   (1) Remove the center pillar trim, lower.



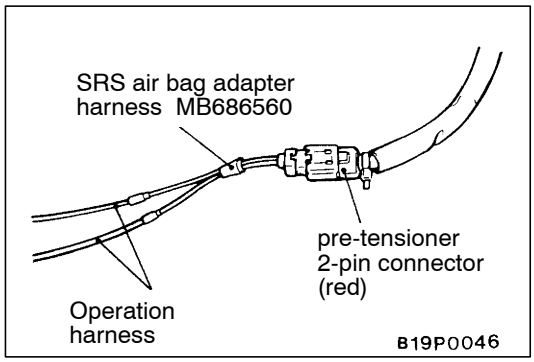
(2) Remove the connection between the pre-tensioner 2-pin connector (red) and the floor wiring harness connector (2-pin).

Caution
The pre-tensioner both in the driver's and passenger's sides should be operated.

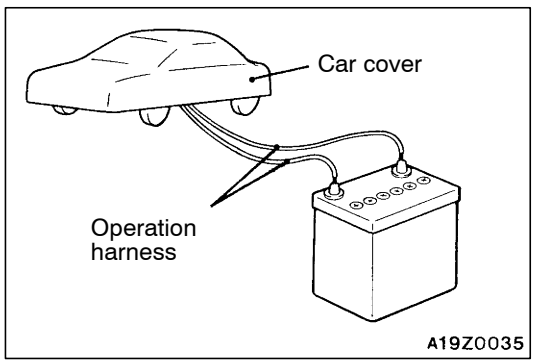
NOTE
Once disconnected from the body wiring harness, both electrode of the pre-tensioner connector short automatically. This prevents the pre-tensioner from accidental operation caused by static etc.



(3) Connect operation harness longer than 6 m to each SRS air bag adapter harness and insulate the connections with plastic tape.
Also, connect the operation harness in the other ends to short, thereby preventing the pre-tensioner from accidental operation caused by static etc.



(4) Connect the SRS air bag adapter harness to the pre-tensioner 2-pin connector (red) and route the operation harness 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 operation harness as far from the vehicle as possible and connect to the terminals of the battery removed from the vehicle. Then operate the pre-tensioner.

Caution
1) Before operating the pre-tensioner, see that no one is in and near the vehicle.
2) The operation of the pre-tensioner makes the inflator very hot. Before handling the inflator, wait more than 30 minutes for cooling.
3) If the pre-tensioner fails to operate when the procedures above are followed, do not go near the pre-tensioner. Contact your local distributor.

(7) After operation of the pre-tensioner, discard as specified in the procedure. (Refer to P.52B-18.)

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 operate outside if wind is high. Even in a soft wind, ignite to windward of the pre-tensioner.

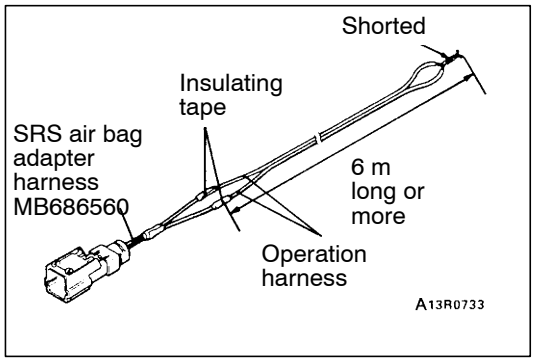
1. Disconnect the negative (-) and positive (+) battery cables from the battery terminals, and then remove the battery from the vehicle.

   Caution
   Wait at least 60 seconds after disconnecting the battery cables before doing any further work. (Refer to P.52B-4.)

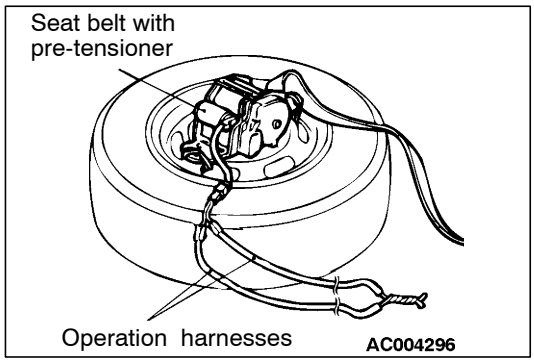
2. Operate pre-tensioner as specified in the service procedures that follows.

(1) Remove the seat belt pre-tensioner from the vehicle. (Refer to P.52B-12.)

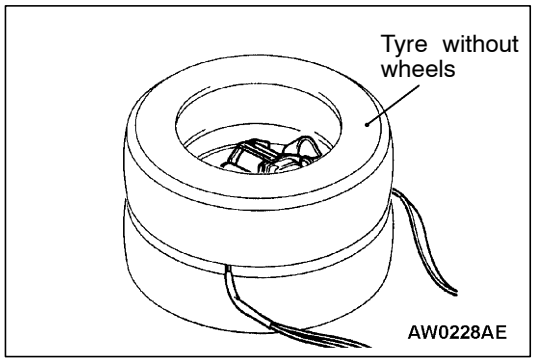
Caution
The pre-tensioner should be stored on a flat surface and placed so that the pre-tensioner operation surfaces are facing upward. Do not place anything on top of them.



(2) Connect operation harness longer than 6 m to each SRS air bag adapter harness and insulate the connections with plastic tape.
Also, connect the operation harness in the other ends to short, thereby preventing the pre-tensioner from accidental operation caused by static etc.

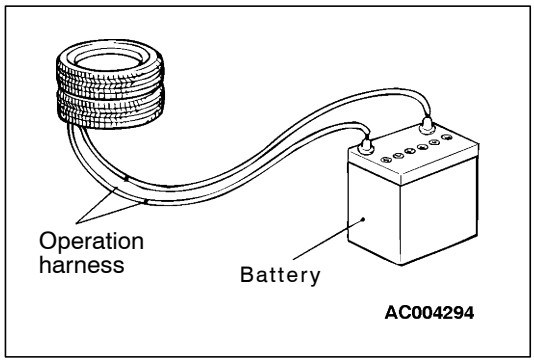


(3) Feed a thick wire through the bracket of the seat belt with pre-tensioner, and connect it to a old tyre with a wheel.
(4) Connect the operation harness to the pre-tensioner.
(5) Pull out the seat belt outside the tyre.



(6) Place an old tyre (without a wheel) on the tyre, which the seat belt with pre-tensioner is secured on.

Caution
Be careful not to trap the SRS air bag adapter harness connector between tyres.



(7) Untie the operation harness ends at the place as far as possible from the seat belt with pre-tensioner, and connect the harness wires to the vehicle battery to activate the pre-tensioner.

Caution
1) **Before the operation, be sure that no one is near the pre-tensioner.**
2) **The operation of the pre-tensioner makes itself very hot. Before handling the pre-tensioner, wait more than 30 minutes for cooling.**
3) **If the pre-tensioner fails to operate when the procedures above are followed, do not go near the pre-tensioner. Contact your local distributor.**

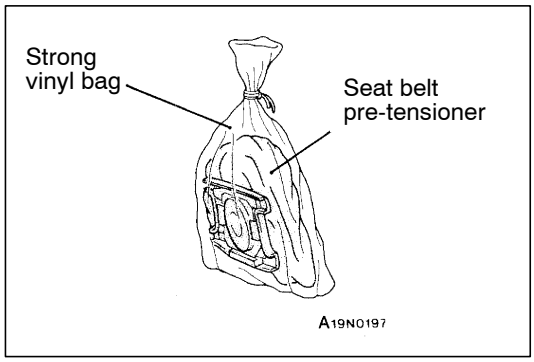
(8) After operation of the pre-tensioner, discard as specified in the procedure.

OPERATED PRE-TENSIONER DISPOSAL PROCEDURES

After operation, the 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 operation, so wait at least 30 minutes to allow it cool before attempting to handle it.
2. Do not put water or oil on the pre-tensioner after operation.
3. There may be, adhered to the operated pre-tensioner, material that could irritate the eye and/or skin, so wear gloves and safety glasses when handling a operated 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 pre-tensioner in a strong vinyl bag for disposal.
5. Be sure to always wash your hands after completing this operation.

CHASSIS ELECTRICAL

Click on the applicable bookmark to selected the required model year.

CHASSIS ELECTRICAL

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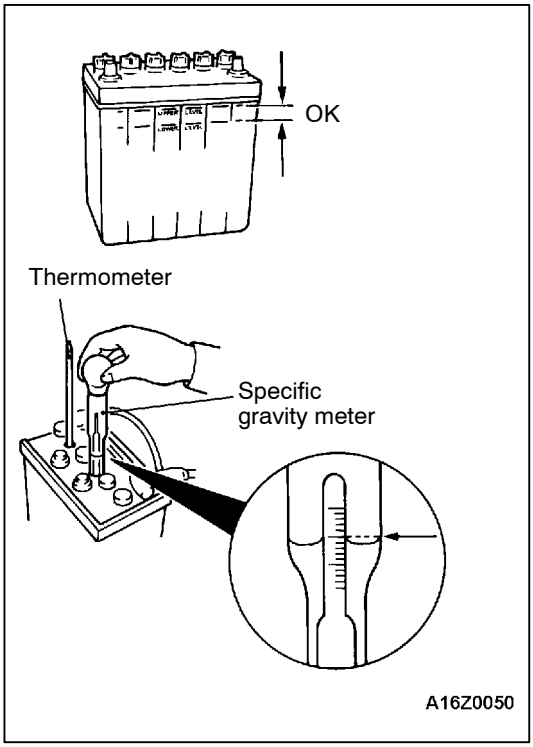
BATTERY

SERVICE SPECIFICATIONS

Item	Standard value
Battery electrolyte specific gravity	1.220 - 1.290 (electrolyte temperature 20°C)



ON-VEHICLE SERVICE

ELECTROLYTE LEVEL AND SPECIFIC GRAVITY CHECK

1. Check that the battery electrolyte level is between the UPPER LEVEL and LOWER LEVEL indications.

   Caution
   (1) If the battery is used with the electrolyte level below the LOWER LEVEL indicator, there is the danger that explosions may occur, so add water to the battery until the electrolyte level is between the LOWER LEVEL and UPPER LEVEL indications.
   (2) If too much water is added to make the level rise above the UPPER LEVEL indication, the electrolyte may leak out, so adjust so that the electrolyte level is between the LOWER LEVEL and UPPER LEVEL indications.

2. Use a specific gravity meter and a thermometer to measure the specific gravity.

   Standard value:
   1.220 - 1.290 (electrolyte temperature 20°C)

   The specific gravity of the battery electrolyte changes according to the temperature, so the specific gravity when the electrolyte is at a temperature of 20°C can be calculated using the following formula.
   Use the converted value to judge whether the electrolyte is okay or not.

   $D_{20}=(t-20) \times 0.0007+Dt$

   D_{20}: Specific gravity converted to a value for electrolyte temperature of 20C°
   t: Electrolyte temperature at the time of measurement
   Dt: Actual specific gravity

CHARGING

1. Remove the battery from the vehicle.
2. The normal charging current is a value in amperes which is 1/10th of the battery capacity. If the battery needs to be charged rapidly because of reasons such as time limitations, the maximum charging current for rapid charging is the battery capacity expressed as an ampere value.

Battery type	Capacity (5-hour rate)	Normal charging current	Rapid charging current
75D23	54 A	5.4 A	54 A
80D26	58 A	5.8 A	58 A
95D31	70 A	7.0 A	70 A

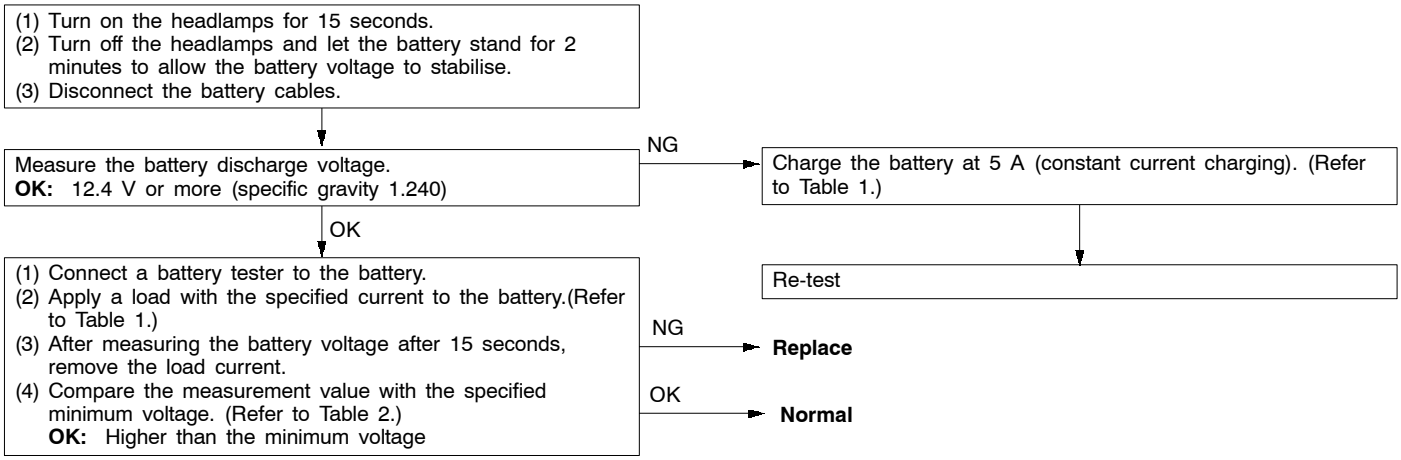
3. Determine when charging is finished.
   - When the specific gravity of the battery electrolyte is constantly within 1.250 - 1.290 for a continuous period of one hour or more
   - When the voltage per cell during charging is 2.5 - 2.8 V constantly for a continuous period of one hour or more

Caution

1. The battery plugs should be removed during charging.
2. The battery electrolyte level may rise and overflow from the battery during charging.
3. Explosions may occur if the battery is brought close to naked flames during charging.
4. Be careful to avoid tasks that might produce sparks or other danger while the battery is charging.
5. After charging is complete, replace the battery plugs, pour water over the battery to rinse away any sulphuric acid, and let the battery stand to dry.
6. Charge the battery in a well-ventilated location.
7. Do not let the battery electrolyte temperature rise above approximately 45°C (approximately 55°C during rapid charging).

BATTERY TEST

Test procedure



(Table 1)

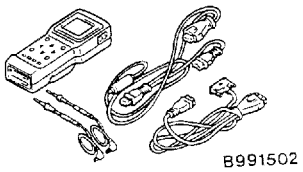
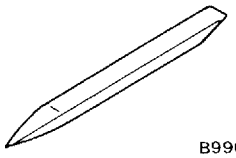
Battery type	75D23	80D26	95D31
Charging time when fully discharged [5 A constant current charging] (H)	11	12	14
Load current (A)	260	281	311

(Table 2)

Outside air temperature (°C)	21 or more	16 - 20	10 - 15	4 - 9	–1 - 3	–1 - –1	–12 - –1	–18 - –13
Minimum voltage (V)	9.6	9.5	9.4	9.3	9.1	8.9	8.7	8.5

IGNITION SWITCH AND IMMOBILIZER <EXCEPT FOR 4D56>

SPECIAL TOOLS

Tools	No.	Name	Application
 B991502	MB991502	MUT-II Sub assembly	Checking the ETACS-ECU input signals
 B990784	MB990784	Ornament remover	Instrument panel under cover and column cover removal

TROUBLESHOOTING

IGNITION SWITCH

The ignition switch is controlled by the Smart Wiring System (SWS), For troubleshooting procedures, refer to GROUP 54B.

IMMOBILIZER

BASIC FLOW OF PROBLEM DIAGNOSIS

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

DIAGNOSIS FUNCTION

READING DIAGNOSIS CODES

The diagnosis codes can be read using the MUT-II or by using the Simple Check Diagnosis mode. (Refer to GROUP 00 - How to Use Troubleshooting/Inspection Service Points)

NOTE
Connect the MUT-II to the 16-pin diagnosis connector (black).

DIAGNOSIS CODE MEMORY ERASING PROCEDURE

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

INSPECTION USING SIMPLE CHECK DIAGNOSIS MODE

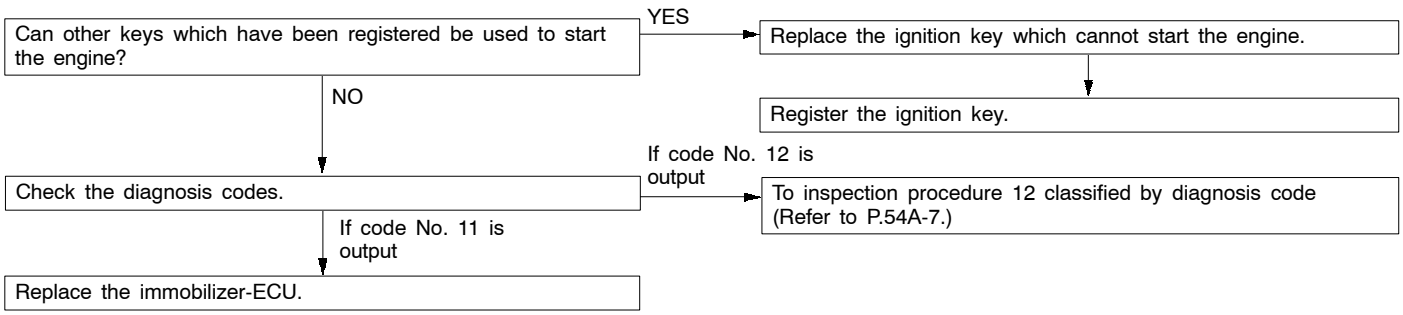
1. Change to Simple Check Diagnosis mode and activate switch diagnosis mode. (Refer to GROUP 00 - How to Use Troubleshooting/Inspection Service Points.)
2. In this condition, the input signals for the following switches can be checked.

CHART CLASSIFIED BY DIAGNOSIS CODES

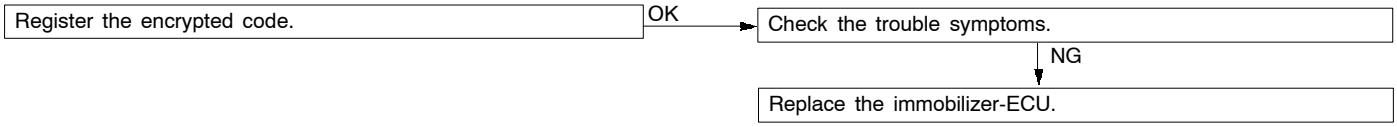
Code No.	Diagnosis contents	Reference page
11	Problem related to communication with the ignition key	54A-7
12	Ignition key is not registered, or encrypted code from ignition key does not match.	54A-7

INSPECTION PROCEDURES FOR EACH DIAGNOSIS CODE

Code No. 11 Problem related to communication with the ignition key	**Probable cause**
When the ignition switch is at the ON position, the encrypted codes are not transmitted from the ignition key to the immobilizer-ECU.	● Malfunction of ignition key ● Malfunction of immobilizer-ECU



Code No. 12 Ignition key is not registered, or encrypted code from ignition key does not match.	**Probable cause**
The ignition key has not been registered with the immobilizer-ECU.	● The ignition key has not been registered with the immobilizer-ECU. ● Malfunction of immobilizer-ECU



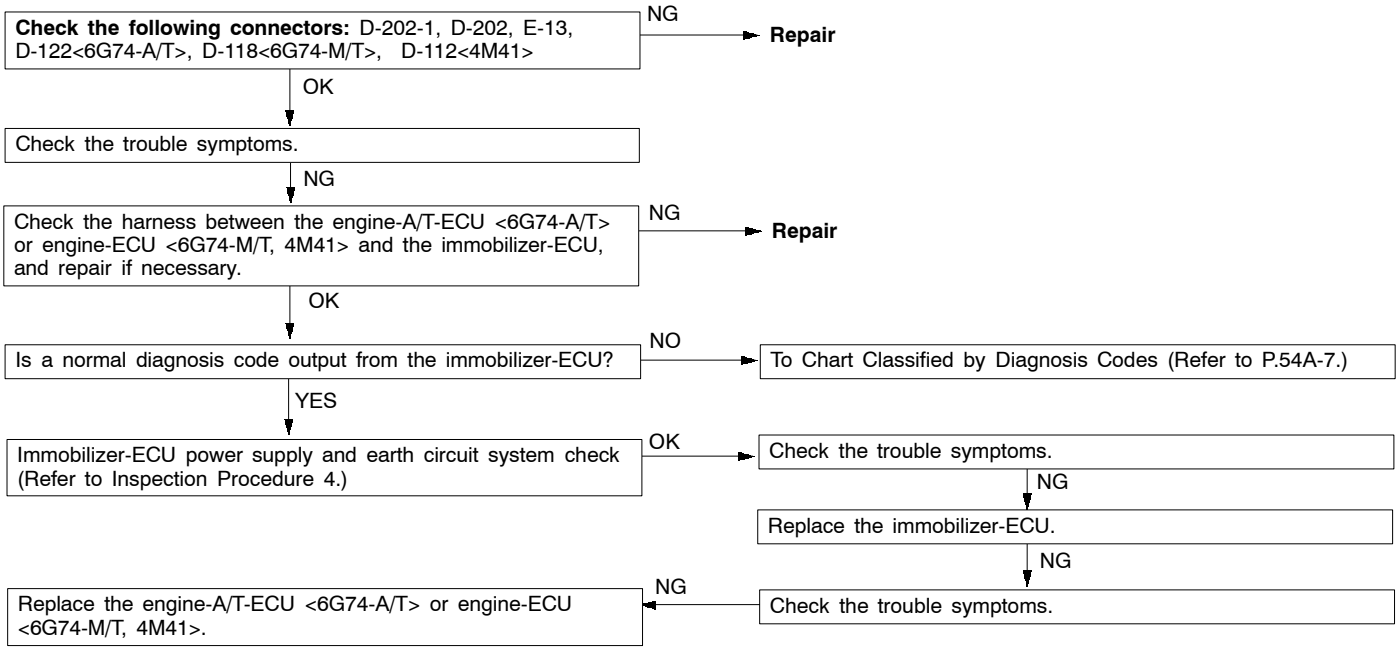
INSPECTION PROCEDURES FOR EACH TROUBLE SYMPTOM

Trouble Symptom	Inspection procedure No.	Reference page
Communication with MUT-II is not possible.	–	GROUP 13B, 13C - Trouble-shooting
Diagnosis code No. 54 is generated by the engine-A/T-ECU <6G74-A/T> or by the engine-ECU <6G74-M/T, 4M41>.	1	54A-8
The ignition keys cannot be registered using the MUT-II.	2	54A-9
The engine does not start.(The engine cranks but does not fire.)	3	54A-9
Immobilizer-ECU power supply and earth circuit system check	4	54A-10

INSPECTION PROCEDURES FOR EACH TROUBLE SYMPTOM

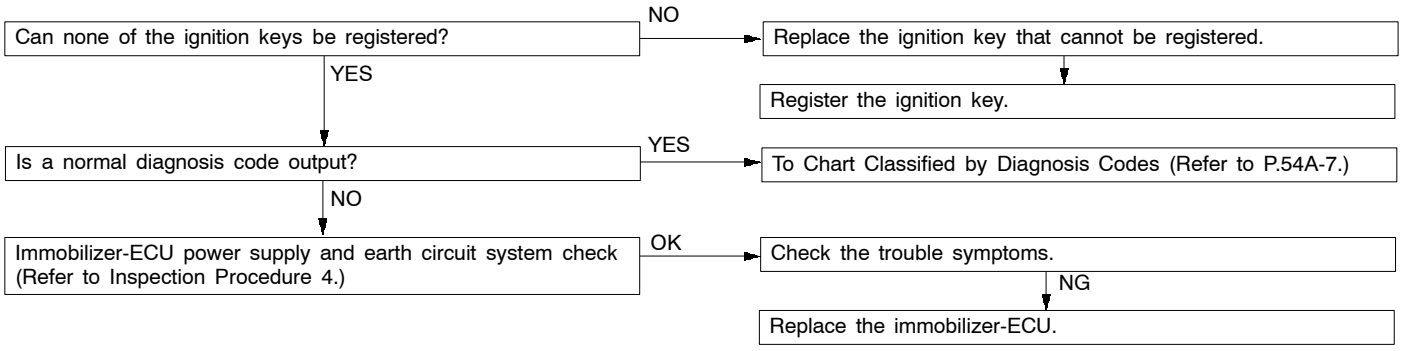
Inspection procedure 1

Diagnosis code No. 54 is generated by the engine-A/T-ECU <6G74-A/T> or by the engine-ECU <6G74-M/T, 4M41>.	**Probable cause**
The cause is probably a problem with communication between the engine-A/T-ECU <6G74-A/T> or engine-ECU <6G74-M/T, 4M41> and the immobilizer-ECU.	● Malfunction of harness or connector ● Malfunction of engine-A/T-ECU <6G74-A/T> or engine-ECU <6G74-M/T, 4M41> ● Malfunction of immobilizer-ECU ● Malfunction of ignition key ● The ignition key has not been registered with the immobilizer-ECU.



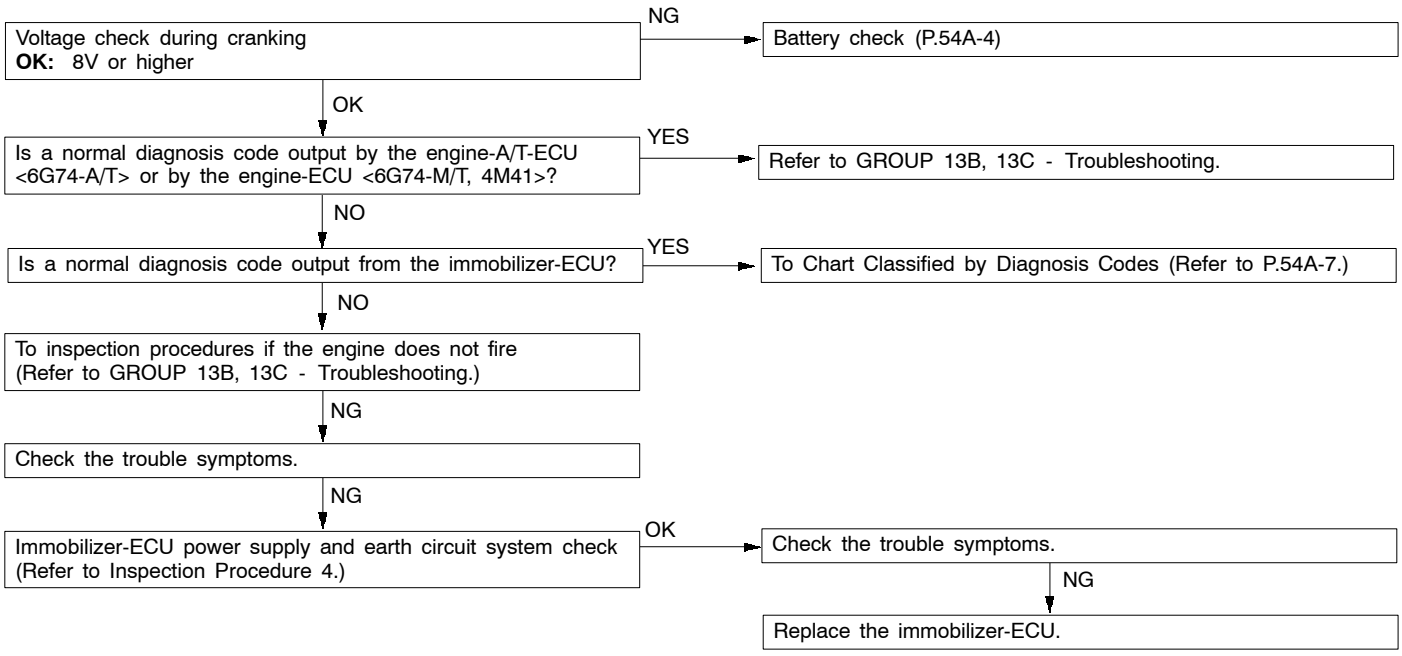
Inspection procedure 2

The ignition keys cannot be registered using the MUT-II.	Probable cause
The ignition key has not been registered with the immobilizer-ECU. Or that thee is a problem with the immobilizer-ECU.	● Malfunction of ignition key ● Malfunction of harness or connector ● Malfunction of immobilizer-ECU



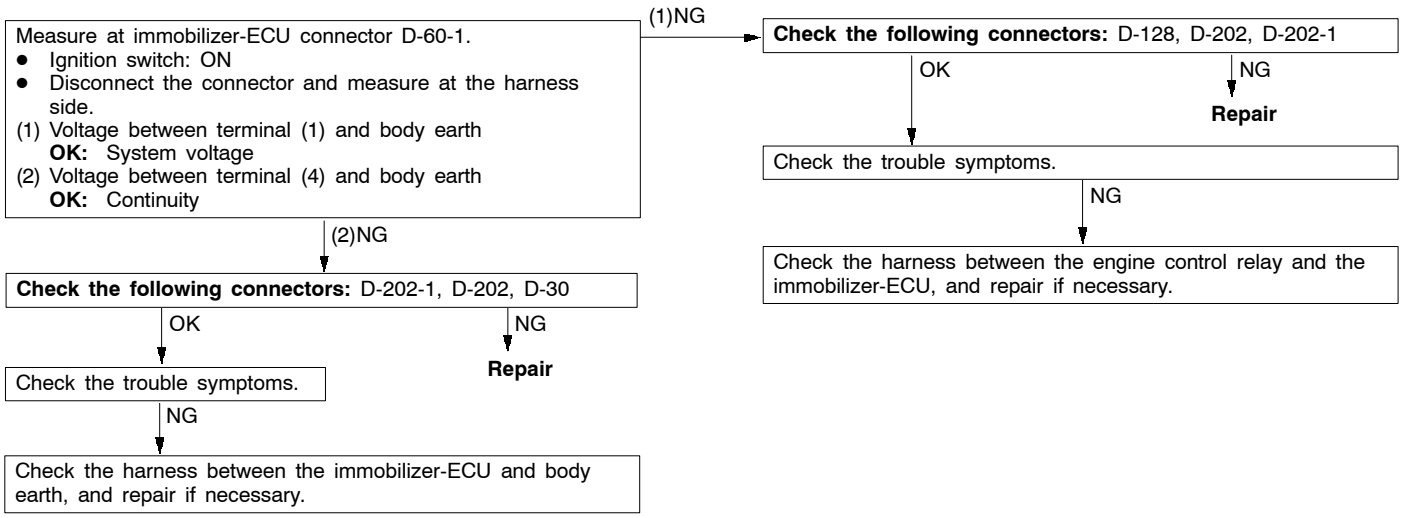
Inspection procedure 3

The engine does not start. (The engine cranks but does not fire.)	Probable cause
If the fuel injection does not operate, the cause is probably a problem with the immobilizer-ECU, or it could also be a problem with the GDI system or the DIESEL system. If an attempt has been made to start the engine with a key that has not been properly registered, the above symptom is a sign of normal operation.	● Malfunction of GDI system or Diesel fuel system ● Malfunction of immobilizer-ECU



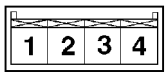
Inspection procedure 4

Immobilizer-ECU power supply and earth circuit system check



IMMOBILIZER-ECU CHECK

TERMINAL VOLTAGE CHECK TABLE

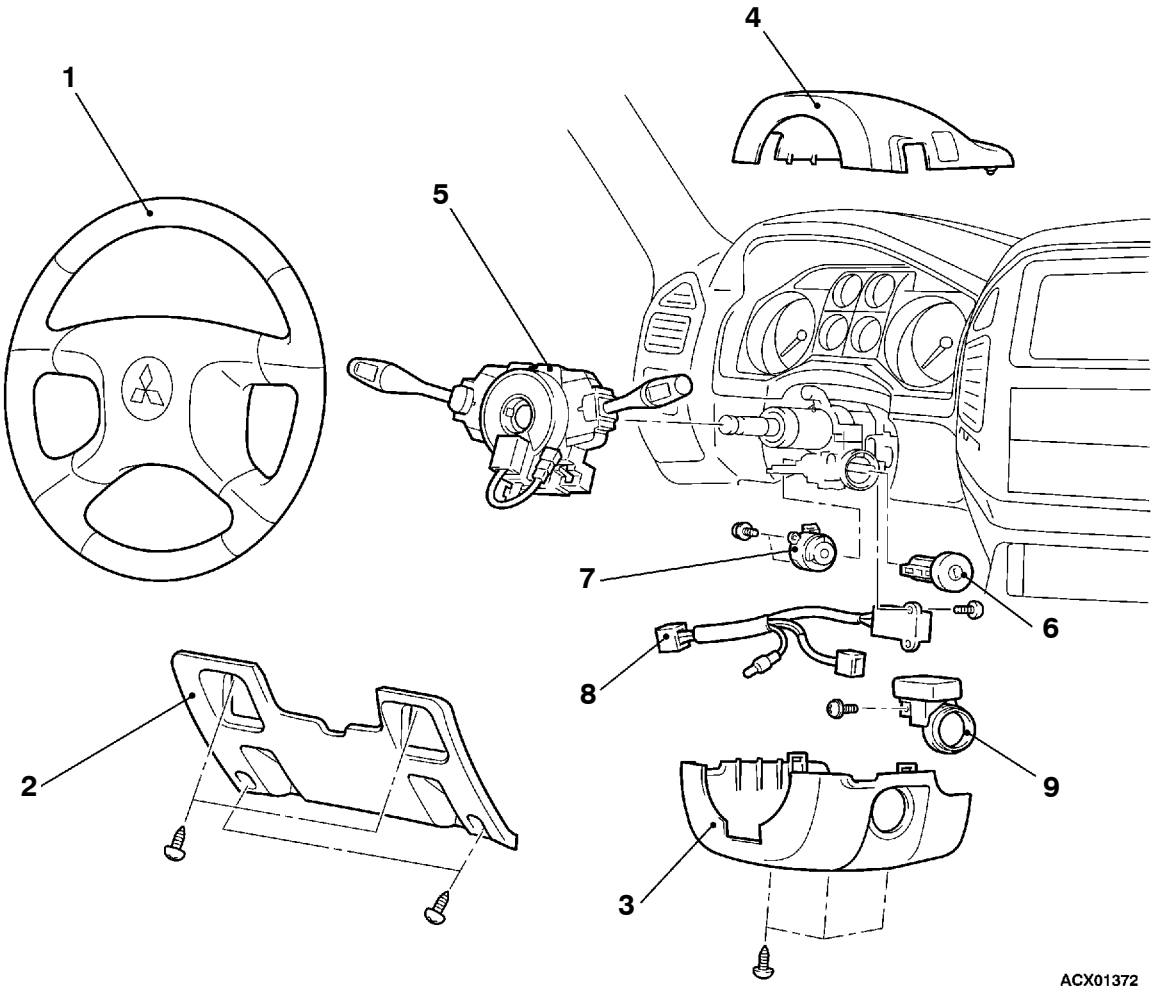


X1185CA

Terminal No.	Signal	Inspection conditions	Terminal voltage
1	Immobilizer-ECU power supply	Ignition switch: ON	System voltage
2	-	-	-
3	Engine-A/T-ECU <6G74·A/T>, Engine-ECU <6G74·M/T, 4M41>	-	-
4	Immobilizer-ECU earth	At all times	0V

IGNITION SWITCH AND IMMOBILIZER-ECU

REMOVAL AND INSTALLATION

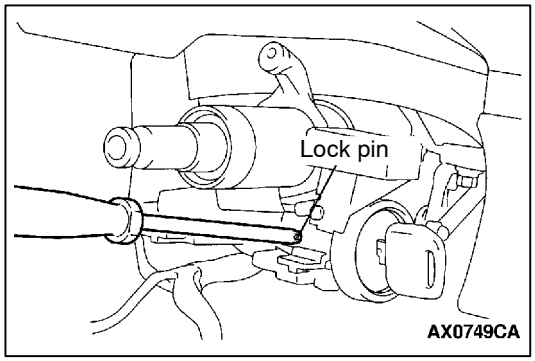


Removal steps

1. Steering wheel (Refer to GROUP 37A.)
2. Instrument panel under cover (Refer to GROUP 52A - Instrument Panel.)
3. Lower column cover (Refer to GROUP 52A - Instrument Panel.)

◀A▶

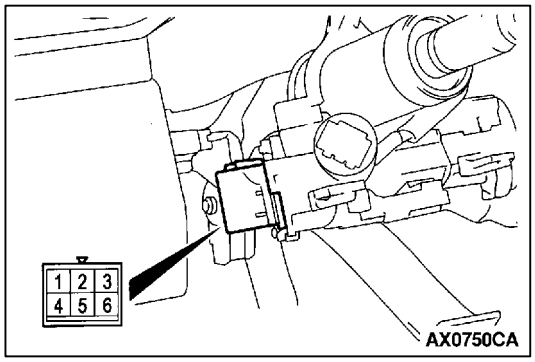
4. Upper column cover (Refer to GROUP 52A - Instrument Panel.)
5. Column Switch
6. Steering lock cylinder
7. Ignition switch
8. Key Reminder Switch
9. Immobilizer-ECU



REMOVAL SERVICE POINTS

◀A▶ STEERING LOCK CYLINDER REMOVAL

1. Insert the key into the steering lock cylinder, and then turn the ignition switch to the ACC position.
2. While using a Phillips screwdriver (small) or similar tool to push the lock pin, remove the steering lock cylinder.

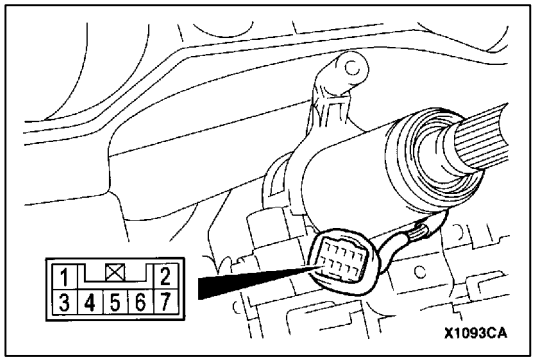


INSPECTION

IGNITION SWITCH CONTINUITY CHECK

With the ignition switch installed to the vehicle, disconnect and check the ignition switch connector.

Ignition switch position	Terminal No.				
	1	2	4	5	6
LOCK					
ACC	○				○
ON	○	○	○		○
START	○	○		○	



KEY REMINDER SWITCH CONTINUITY CHECK

With the key reminder switch installed to the vehicle, disconnect and check the key reminder switch connector.

Ignition key condition	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.

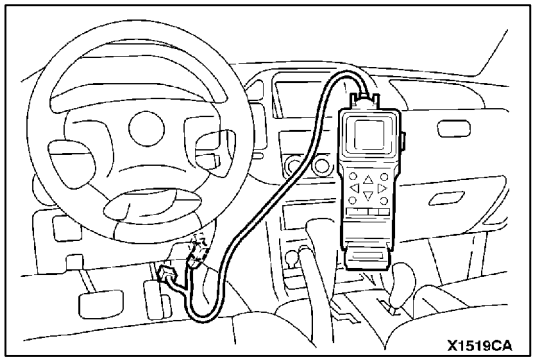
Replacement part	Encrypted code
Ignition key	Necessary
Ignition key ring antenna and immobilizer-ECU	Necessary
Engine-ECU*	Necessary

NOTE
* : If the engine-ECU is replaced, the ignition key ring antenna and 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.

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 register the password that the user specifies into the immobilizer-ECU. (Refer to the MUT-II instruction manual for instructions on using the MUT-II.)

Caution
Because 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.

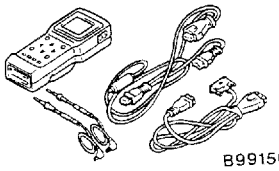
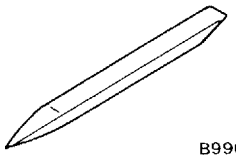


1. Connect the MUT-II to the diagnosis connector.

   Caution
   Turn the ignition switch to the LOCK (OFF) before connecting or disconnecting of the MUT-II.
2. Check that diagnosis code No.54 is not set by the engine-ECU. If it is set, check according to the Troubleshooting Procedures. (Refer to GROUP 13A - Troubleshooting.)
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. If you are registering two or more codes, use the next key to the registered to turn on the ignition switch without disconnecting the MUT-II.
5. Turn the ignition switch to the LOCK (OFF) position.
6. Check that the engine can be started with each of the ignition keys.
7. Check the diagnosis output from the engine-ECU, and erase code No.54 if it appears. (Refer to GROUP 13A - Troubleshooting.)
8. Disconnect the MUT-II. This completes the registration operation.

IGNITION SWITCH AND IMMOBILIZER<4D56>

SPECIAL TOOLS

Tools	No.	Name	Application
 B991502	MB991502	MUT-II Sub assembly	Checking the ETACS-ECU input signals
 B990784	MB990784	Ornament remover	Instrument panel under cover and column cover removal

TROUBLESHOOTING

IGNITION SWITCH

The ignition switch is controlled by the Smart Wiring System (SWS), for troubleshooting procedures, refer to GROUP 54B.

IMMOBILIZER

BASIC FLOW OF PROBLEM DIAGNOSIS

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

DIAGNOSIS FUNCTION

READING DIAGNOSIS CODES

The diagnosis codes can be read using the MUT-II or by using the Simple Check Diagnosis mode. (Refer to GROUP 00 - How to Use Troubleshooting/Inspection Service Points.)

NOTE
Connect the MUT-II to the 16-pin diagnosis connector (black).

DIAGNOSIS CODE MEMORY ERASING PROCEDURE

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

INSPECTION USING SIMPLE CHECK DIAGNOSIS MODE

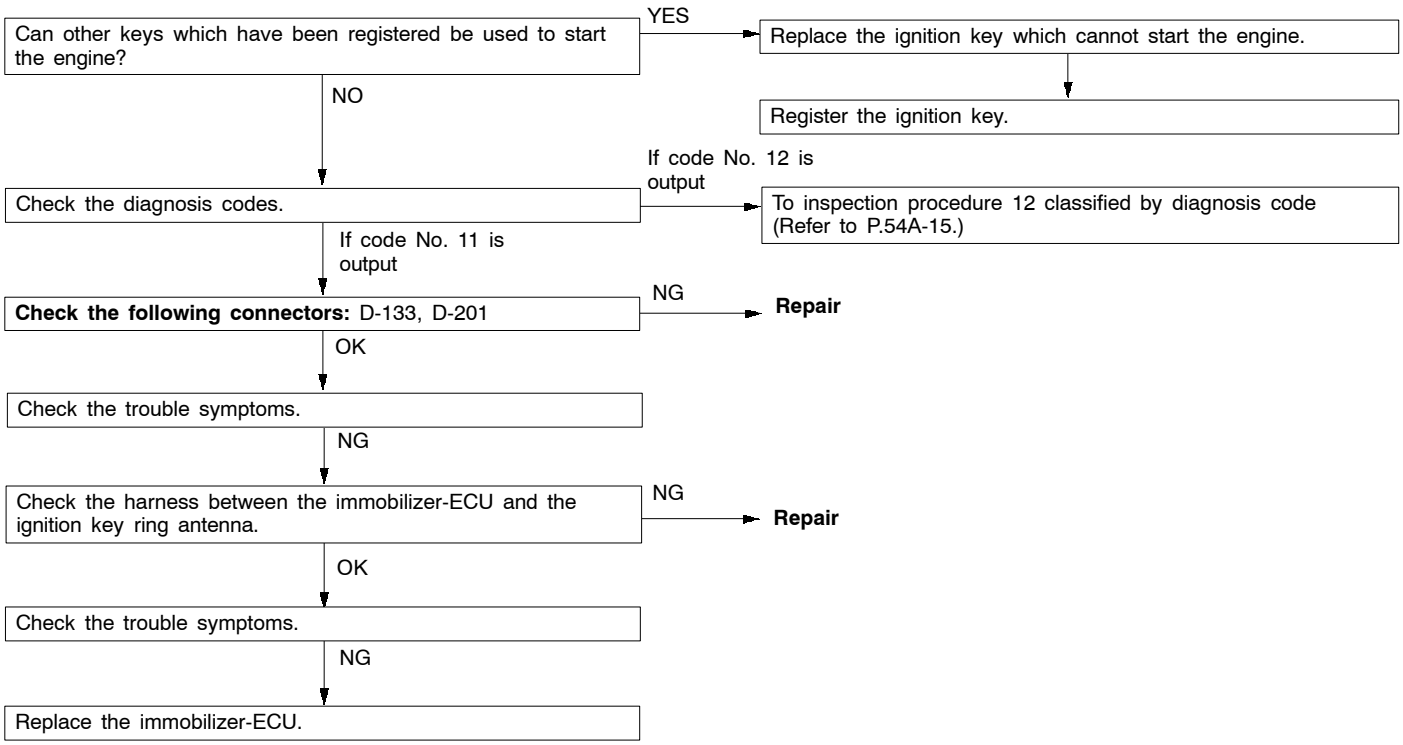
1. Change to Simple Check Diagnosis mode and activate switch diagnosis mode. (Refer to GROUP 00 - How to Use Troubleshooting/Inspection Service Points.
2. In this condition, the input signals for the following switches can be checked.

CHART CLASSIFIED BY DIAGNOSIS CODES

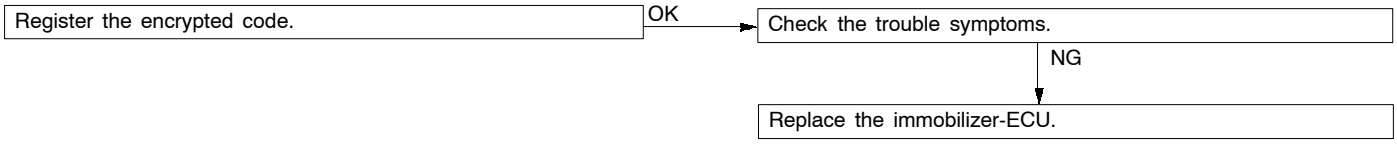
Code No.	Diagnosis contents	Reference page
11	Problem related to communication with the ignition key	54A-15
12	Ignition key is not registered, or encrypted code from ignition key does not match.	54A-15

INSPECTION PROCEDURES FOR EACH DIAGNOSIS CODE

Code No. 11 Problem related to communication with the ignition key	Probable cause
When the ignition switch is at the ON position, the encrypted codes are not transmitted from the ignition key to the immobilizer-ECU.	● Malfunction of ignition key ● Malfunction of immobilizer-ECU ● Malfunction of harness or connector



Code No. 12 Ignition key is not registered, or encrypted code from ignition key does not match.	Probable cause
The ignition key has not been registered with the immobilizer-ECU.	● The ignition key has not been registered with the immobilizer-ECU. ● Malfunction of immobilizer-ECU



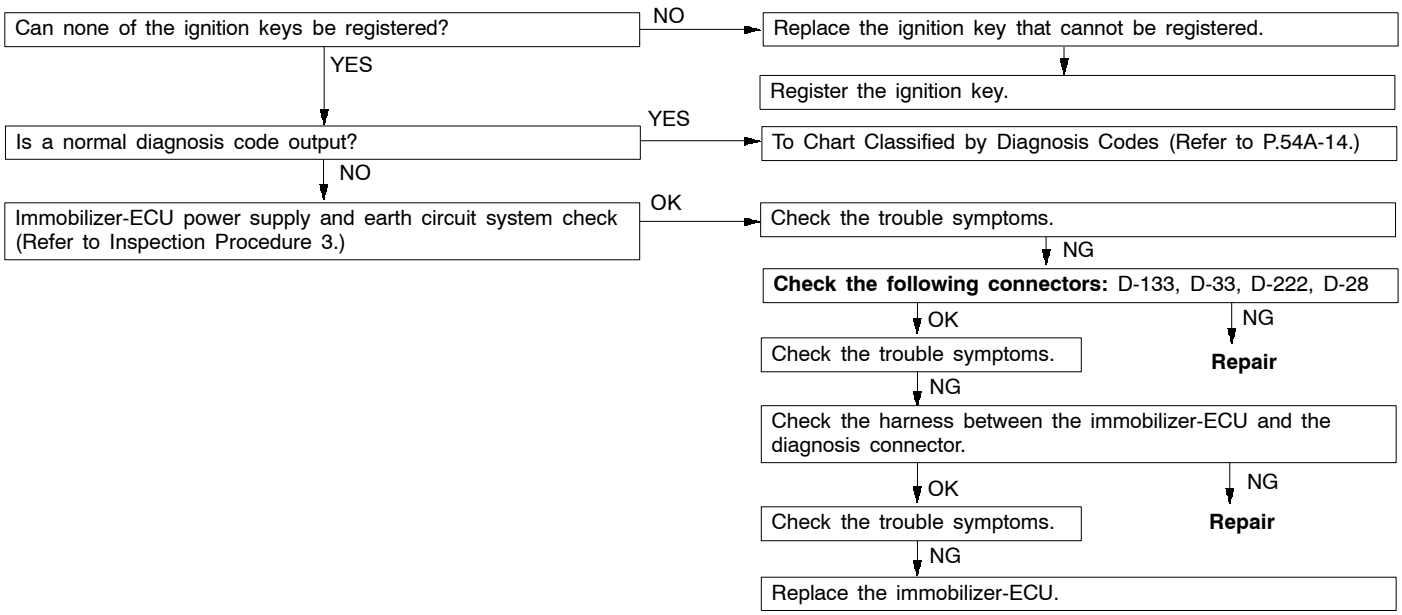
INSPECTION PROCEDURES FOR EACH TROUBLE SYMPTOM

Trouble Symptom	Inspection procedure No.	Reference page
Communication with MUT-II is not possible.	–	GROUP 13B, 13C - Trouble-shooting
The ignition keys cannot be registered using the MUT-II.	1	54A-16
The engine does not start. (The engine cranks but does not fire.)	2	54A-17
Immobilizer-ECU power supply and earth circuit system check	3	54A-18

INSPECTION PROCEDURES FOR EACH TROUBLE SYMPTOM

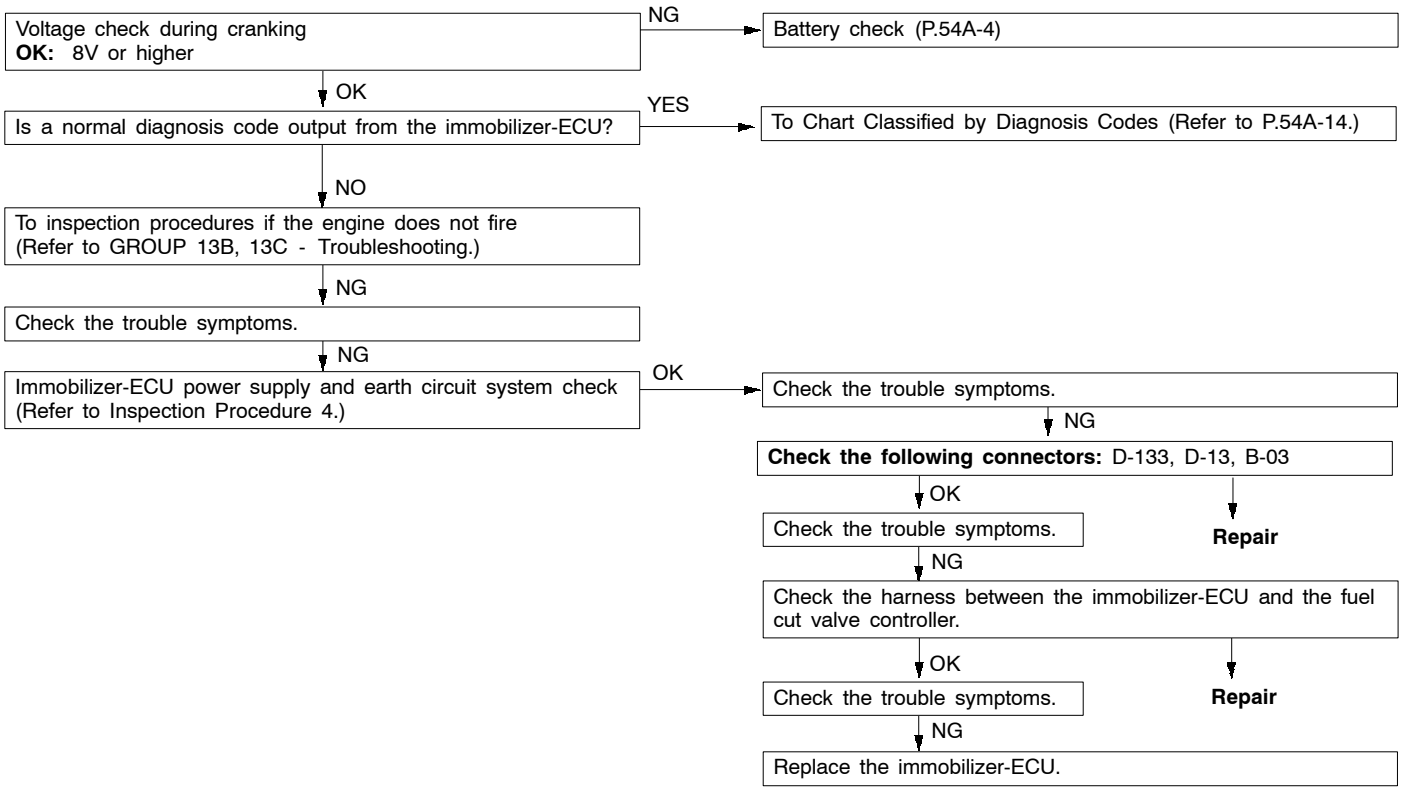
Inspection procedure 1

The ignition keys cannot be registered using the MUT-II.	Probable cause
The ignition key has not been registered with the immobilizer-ECU. Or that there is a problem with the immobilizer-ECU.	● Malfunction of ignition key ● Malfunction of harness or connector ● Malfunction of immobilizer-ECU



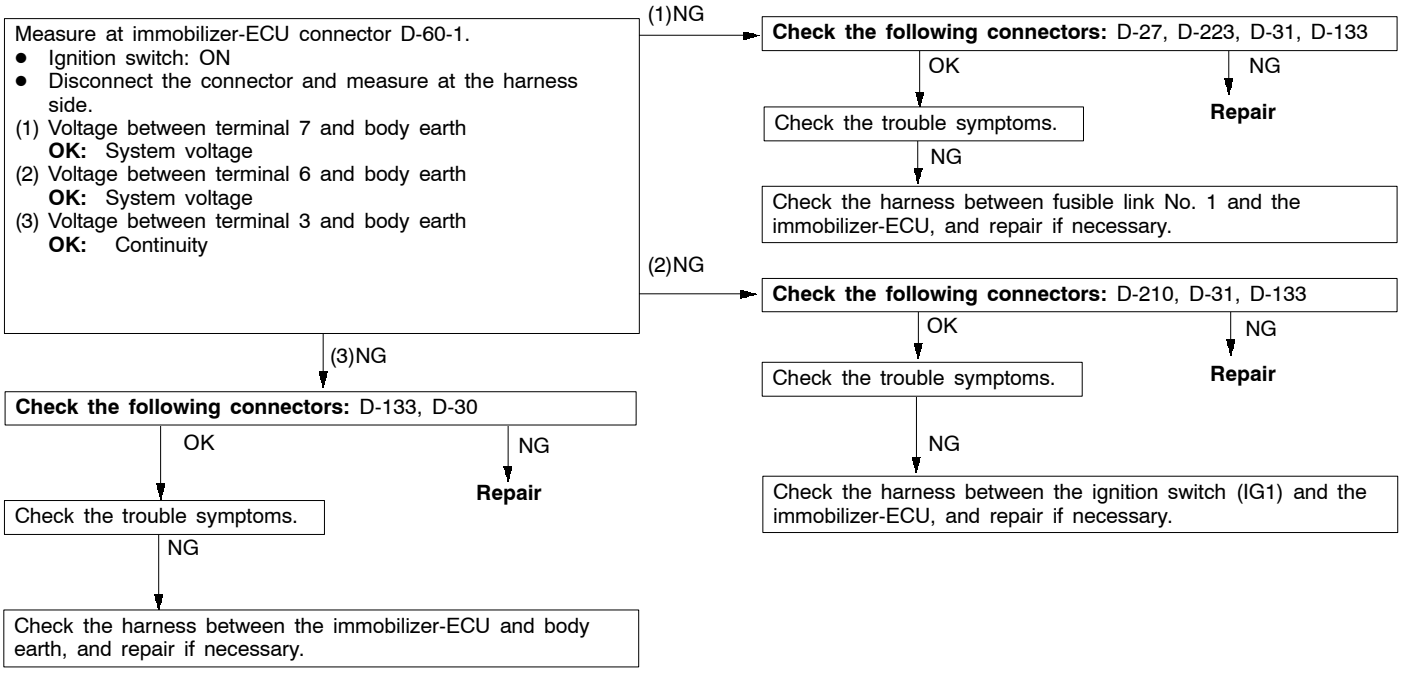
Inspection procedure 2

The engine does not start. (The engine cranks but does not fire.)	Probable cause
If the fuel injection does not operate, the cause is probably a problem with the immobilizer-ECU, or it could also be a problem with the diesel fuel system. If an attempt has been made to start the engine with a key that has not been properly registered, the above symptom is a sign of normal operation.	● Malfunction of diesel fuel system ● Malfunction of immobilizer-ECU



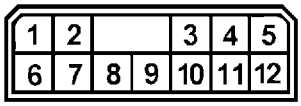
Inspection procedure 3

Immobilizer-ECU power supply and earth circuit system check



IMMOBILIZER-ECU CHECK

TERMINAL VOLTAGE CHECK TABLE

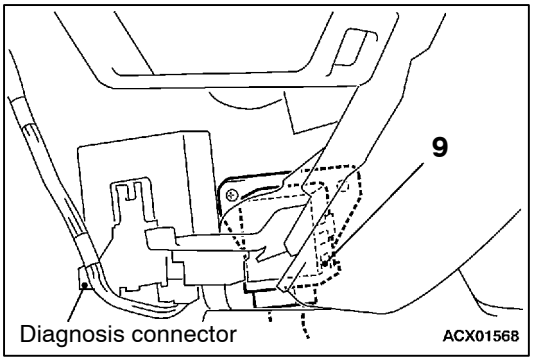


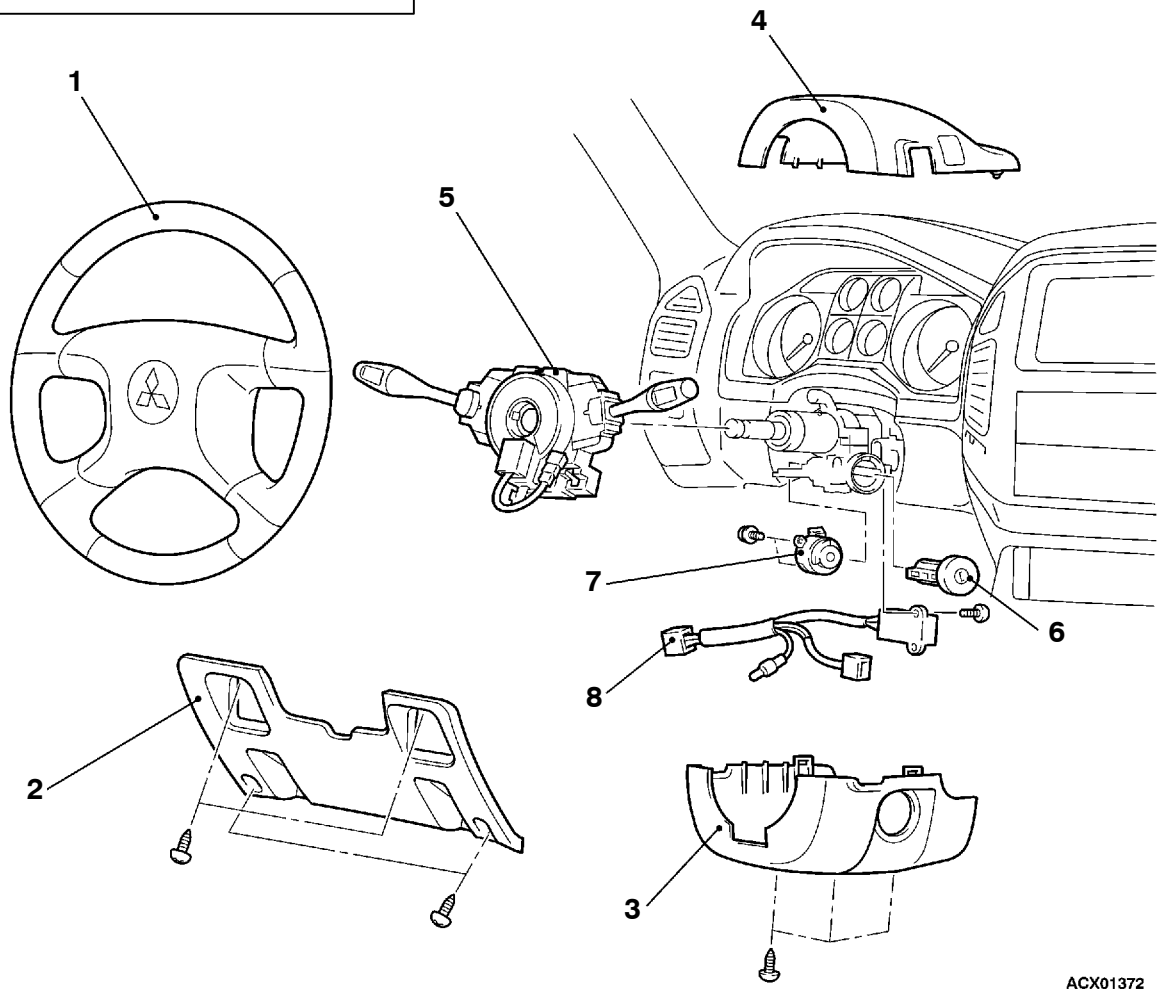
ACX01564 AB

Terminal No.	Signal	Inspection conditions	Terminal voltage
1	Diagnosis connector	-	-
2	-	-	-
3	Immobilizer-ECU earth	Always	0 V
4	-	-	-
5	Engine-ECU	-	-
6	Ignition switch (IG1) power supply	Ignition switch : ON	System voltage
7	Immobilizer-ECU power supply	Always	System voltage
8, 9	-	-	-
10	Ignition key ring antenna	-	-
11	Ignition key ring antenna	-	-
12	Diagnosis connector	-	-

IGNITION SWITCH AND IMMOBILIZER-ECU

REMOVAL AND INSTALLATION



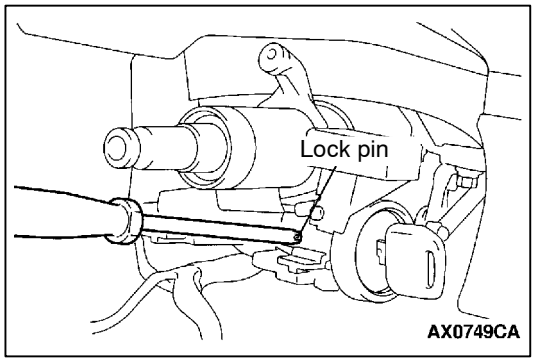


Removal steps

1. Steering wheel (Refer to GROUP 37A.)
2. Instrument panel under cover (Refer to GROUP 52A - Instrument Panel.)
3. Lower column cover (Refer to GROUP 52A - Instrument Panel.)
4. Upper column cover (Refer to GROUP 52A - Instrument Panel.)
5. Column Switch

◀A▶

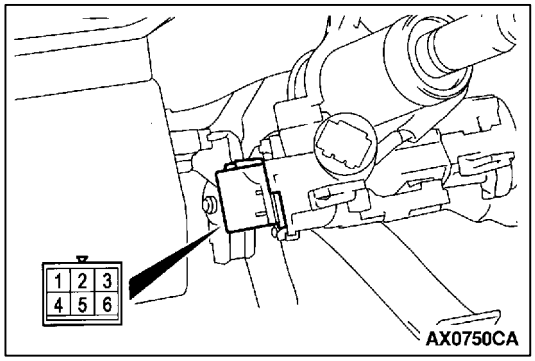
6. Steering lock cylinder
7. Ignition switch
8. Key Reminder Switch
9. Immobilizer-ECU



REMOVAL SERVICE POINTS

◀A▶ STEERING LOCK CYLINDER REMOVAL

1. Insert the key into the steering lock cylinder, and then turn the ignition switch to the ACC position.
2. While using a Phillips screwdriver (small) or similar tool to push the lock pin, remove the steering lock cylinder.

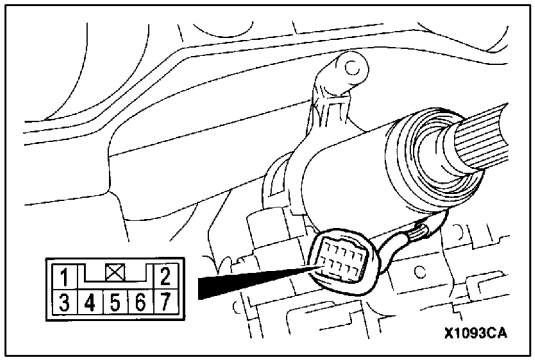


INSPECTION

IGNITION SWITCH CONTINUITY CHECK

With the ignition switch installed to the vehicle, disconnect and check the ignition switch connector.

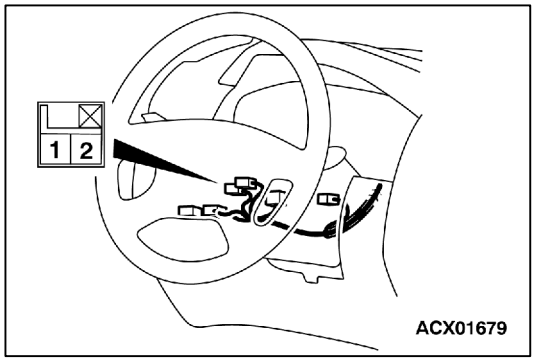
Ignition switch position	Terminal No.				
	1	2	4	5	6
LOCK					
ACC	○				○
ON	○	○	○		○
START	○	○		○	



KEY REMINDER SWITCH CONTINUITY CHECK

With the key reminder switch installed to the vehicle, disconnect and check the key reminder switch connector.

Ignition key condition	Terminal No.	
	4	6
Removed	○	○
Inserted		



IGNITION KEY RING ANTENNA CONTINUITY CHECK

Use a circuit tester to check the continuity between the terminals.

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.

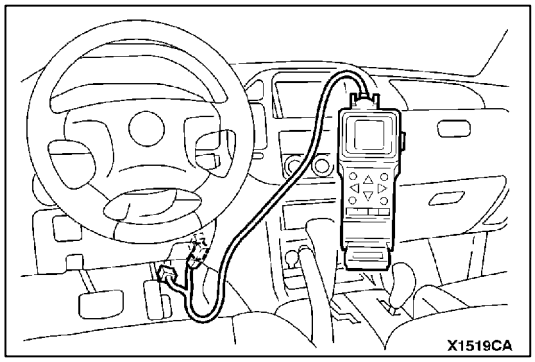
Replacement part	Encrypted code
Ignition key	Necessary
Ignition key ring antenna and immobilizer-ECU	Necessary
Engine-ECU*	Necessary

NOTE
* : If the engine-ECU is replaced, the ignition key ring antenna and 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.

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 register the password that the user specifies into the immobilizer-ECU. (Refer to the MUT-II instruction manual for instructions on using the MUT-II.)

Caution
Because 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 the LOCK (OFF) before connecting or disconnecting of the MUT-II.
2. Check that diagnosis code No.54 is not set by the engine-ECU. If it is set, check according to the Troubleshooting Procedures. (Refer to GROUP 13A - Troubleshooting.)
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. If you are registering two or more codes, use the next key to the registered to turn on the ignition switch without disconnecting the MUT-II.
5. Turn the ignition switch to the LOCK (OFF) position.
6. Check that the engine can be started with each of the ignition keys.
7. Check the diagnosis output from the engine-ECU, and erase code No.54 if it appears. (Refer to GROUP 13A - Troubleshooting.)
8. Disconnect the MUT-II. This completes the registration operation.

COMBINATION METER

SERVICE SPECIFICATIONS

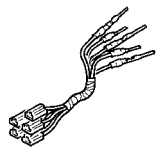
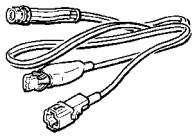
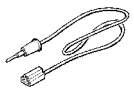
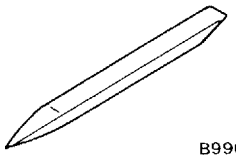
Item			Standard value	Limit
Speedometer indication range km/h	At 20 km/h		18 - 23	–
	At 40 km/h		37 - 45	–
	At 80 km/h		75 - 88	–
	At 120 km/h		113 - 132	–
	At 160 km/h		150 - 176	–
Speedometer needle swing km/h (when driving at 35 km/h or higher)			–	± 3
Tachometer indication error r/min	When engine speed is 700 r/min		± 120	–
	When engine speed is 2,000 r/min	Petrol	-175+225	–
		Diesel	±175	–
	When engine speed is 3,000 r/min	Petrol	-175+300	–
		Diesel	± 225	–
	When engine speed is 4,000 r/min	Petrol	-225+375	–
		Diesel	± 300	–
	When engine speed is 4,750 r/min <Diesel vehicles>		± 260	–
	When engine speed is 5,000 r/min <Petrol vehicles>		-225+425	–
	When engine speed is 6,000 r/min <Petrol vehicles>		-225+475	–
Fuel gauge unit standard resistance value Ω	F position		3	–
	E position		110	–
Fuel gauge unit float height mm	F position		11.9	–
	E position		195.2	–
Engine coolant temperature gauge unit standard resistance value Ω			104 ± 13.5	–
Combination meter internal resistance value Ω (Measured at connector D-38 and connector D-40)	62 - 11 (IG power supply - earth)		1MΩ or more	–
	62 - 25 (IG power supply - earth)		1MΩ or more	–
	62 - 63 (IG power supply - fuel gauge)		1MΩ or more	–
	62 - 64 (IG power supply - engine coolant temperature gauge)		1MΩ or more	–
	63 - 11 (fuel gauge - earth)		180	–
	63 - 25 (fuel gauge - earth)		180	–
	64 - 11 (engine coolant temperature gauge - earth)		210	–
	64 - 25 (engine coolant temperature gauge - earth)		210	–
	67 - 11 (battery power supply - earth)		1MΩ or more	–
	67 - 25 (battery power supply - earth)		1MΩ or more	–
	67 - 63 (battery power supply - fuel gauge)		1MΩ or more	–
	67 - 64 (battery power supply - engine coolant temperature gauge)		1MΩ or more	–

SEALANTS

Usage location	Brand
Engine coolant temperature gauge unit	Semi-drying sealant: Threebond 1104 [0110207], Threebond 1141E (Manufactured by Threebond)

NOTE
Numbers in [ ] indicate genuine parts numbers.

SPECIAL TOOLS

Tools	No.	Name	Application
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	Fuel gauge simple checking Engine coolant temperature gauge simple checking A: For checking contact pin contact pressure B: For checking the power supply C: For checking the power supply D: For checking the power supply circuit
 B990784	MB990784	Ornament remover	Meter bezel removal

TROUBLESHOOTING

DIAGNOSIS FUNCTION

Input signal check procedure

1. Connect the MUT-II or a voltage meter to the diagnosis connector, and check the input. (Refer to GROUP 00 - How to Use Troubleshooting/Inspection Service Points.)
2. The vehicle speed sensor input signal can be checked.

   NOTE
   If the vehicle speed sensor input signal cannot be checked using the MUT-II, the cause is probably a malfunction of the diagnosis circuit system.

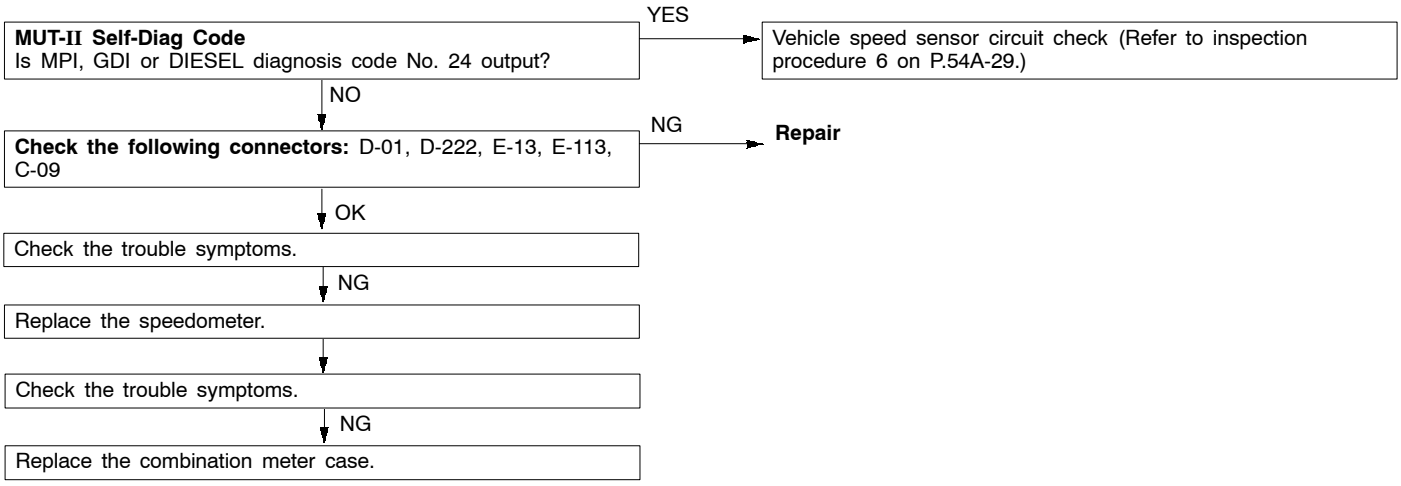
CHART CLASSIFIED BY TROUBLE SYMPTOMS

Trouble Symptom	Inspection procedure No.	Reference page
Speedometer does not operate. (Other meters and gauges operate.)	1	54A-25
Tachometer does not operate. (Other meters and gauges operate.)	2	54A-26
Fuel gauge does not operate. (Other meters and gauges operate.)	3	54A-27
Engine coolant temperature gauge does not operate. (Other meters and gauges operate.)	4	54A-28
None of the meters and gauges operate.	5	54A-29

INSPECTION PROCEDURES FOR EACH TROUBLE SYMPTOM

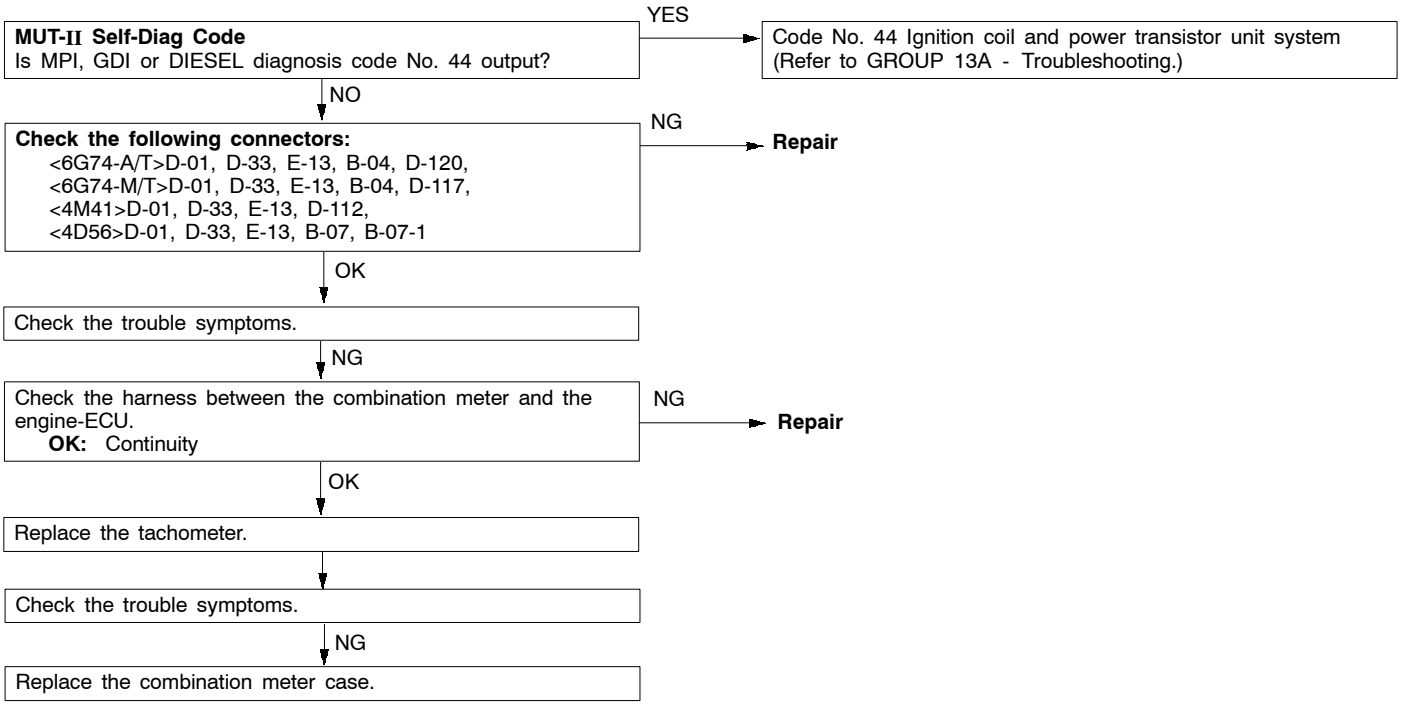
Inspection procedure 1

Speedometer does not operate. (Other meters and gauges operate.)	**Probable cause**
The cause is probably a malfunction of the vehicle speed sensor input system.	● Malfunction of vehicle speed sensor ● Malfunction of harness or connector ● Malfunction of speedometer ● Malfunction of printed circuit board



Inspection procedure 2

Tachometer does not operate.(Other meters and gauges operate.)	Probable cause
The cause is probably that the ignition signal is not being input from the engine, or that there is a malfunction of the meter power supply or earth circuit.	● Malfunction of tachometer ● Malfunction of harness or connector ● Malfunction of printed circuit board



Inspection procedure 3

Fuel gauge does not operate. (Other meters and gauges operate.)	Probable cause
If the speedometer and tachometer are normal, the harness from the power supply to the combination meter is normal.	● Malfunction of fuel gauge unit ● Malfunction of fuel gauge and engine coolant temperature assembly ● Malfunction of harness or connector ● Malfunction of printed circuit board

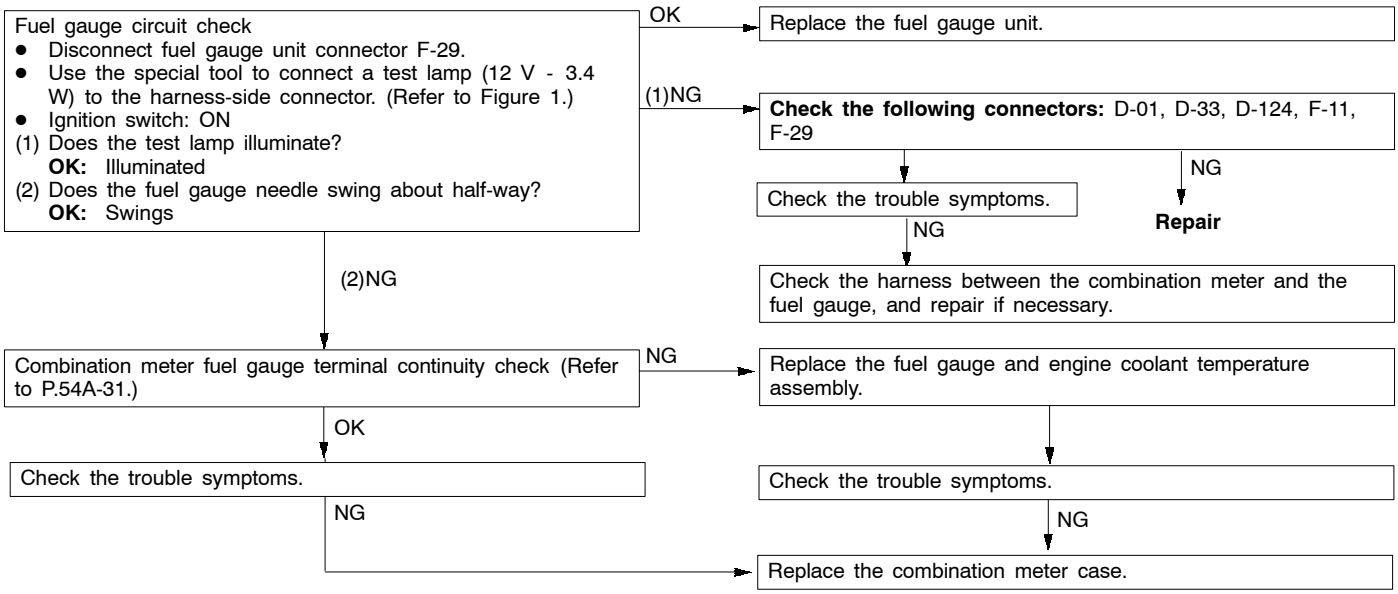
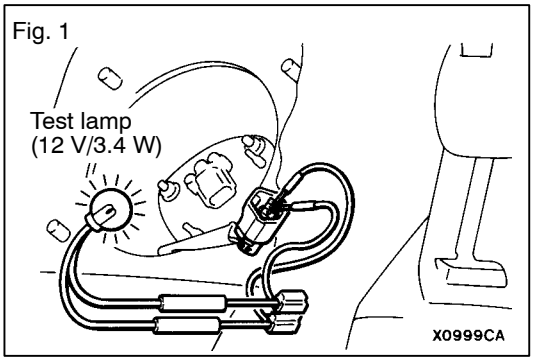


Fig. 1



Inspection procedure 4

Engine coolant temperature gauge does not operate. (Other meters and gauges operate.)	Probable cause
If the speedometer and tachometer are normal, the harness from the power supply to the combination meter is normal.	• Malfunction of engine coolant temperature gauge unit • Malfunction of fuel gauge and engine coolant temperature assembly • Malfunction of harness or connector • Malfunction of printed circuit board

Engine coolant temperature gauge circuit check
- Disconnect engine coolant temperature gauge unit connector <other than 4D56>B-50, <4D56>B-07-2.
- Connect a test lamp (12V - 4W) to the harness-side connector. (Refer to Figure 2, 3 and Figure 5.)
- Ignition switch: ON

(1) Does the test lamp illuminate?
OK: Illuminated
(2) Does the engine coolant temperature gauge needle swing about half-way?
OK: Swings

OK → Replace the engine coolant temperature gauge unit.

(1)NG → **Check the following connectors:** <other than 4D56> D-01, E-13, B-50
<4D56> D-01, E-13, B-07, B-07-2

OK → Check the trouble symptoms.
NG → **Repair**

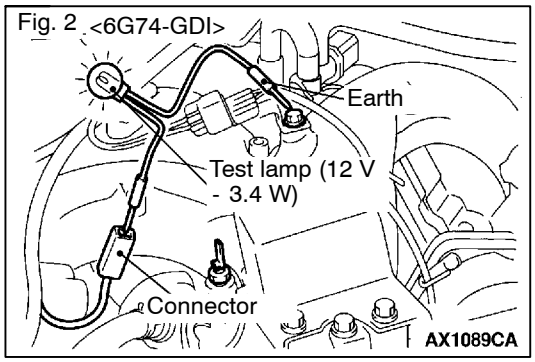
NG → Check the harness between the combination meter and the engine coolant temperature gauge, and repair if necessary.

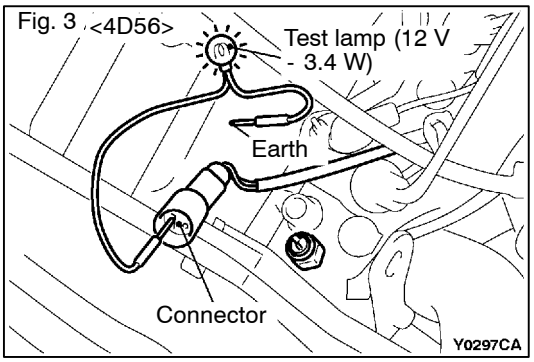
(2)NG → Engine coolant temperature gauge check (P.54A-32.)

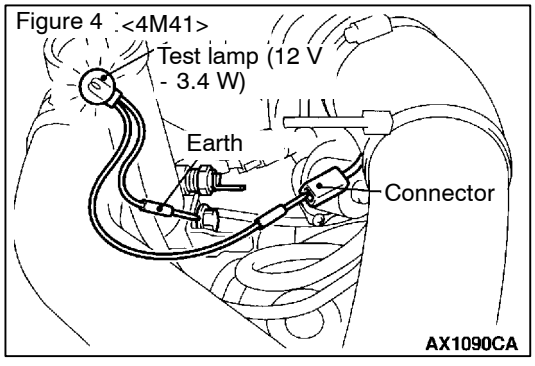
NG → Replace the fuel gauge and engine coolant temperature assembly.

Check the trouble symptoms.

NG → Replace the combination meter case.

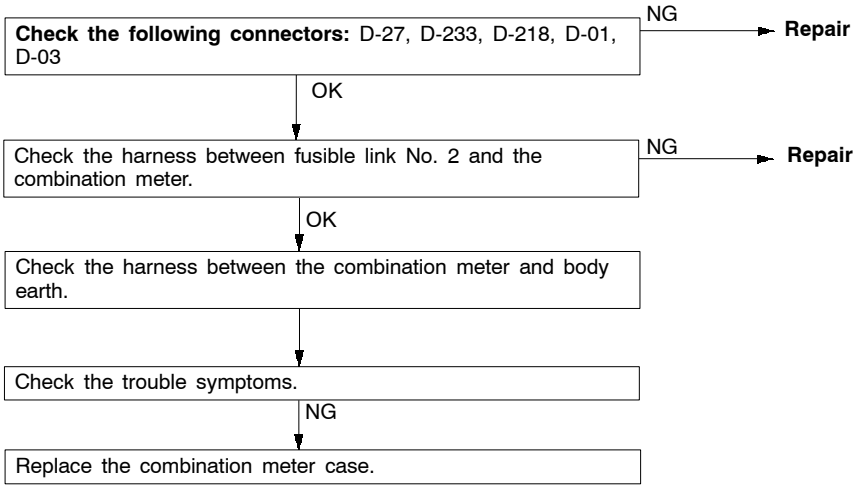






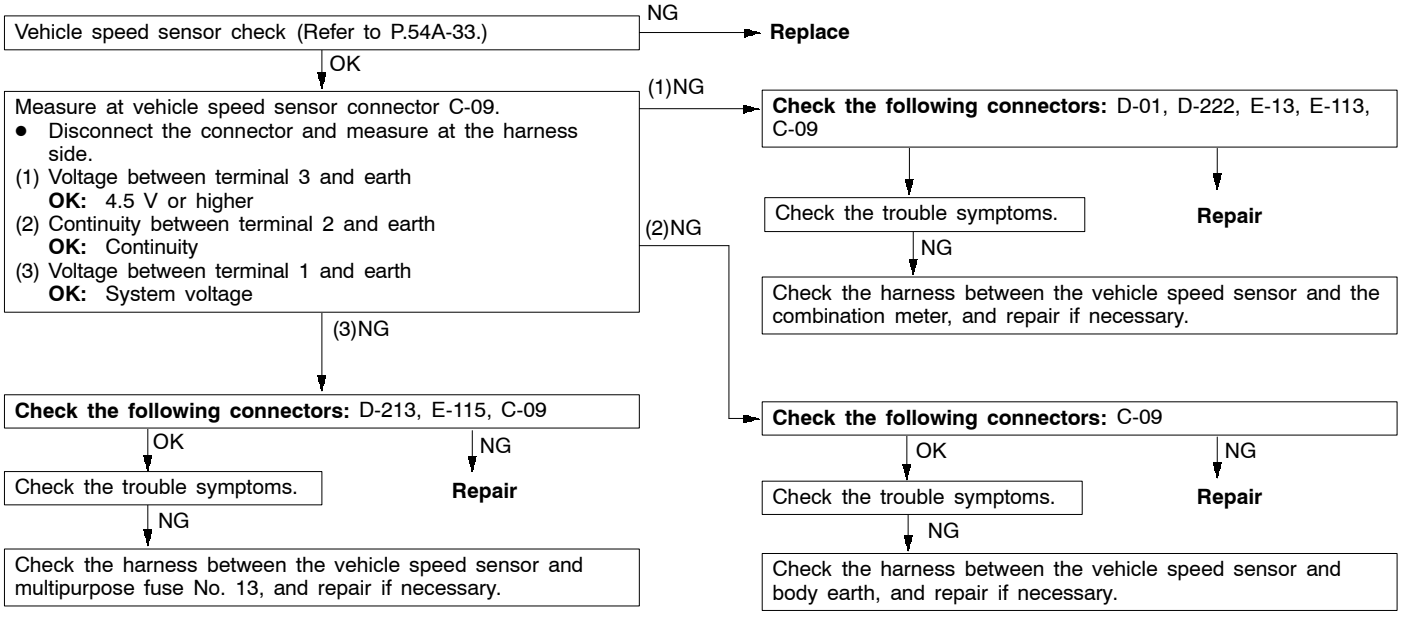
Inspection procedure 5

None of the meters and gauges operate.	Probable cause
If the indicators and warning lamps are normal, then the harness from the power supply (IG1) to the combination meter is normal.	● Malfunction of printed circuit board ● Malfunction of harness or connector

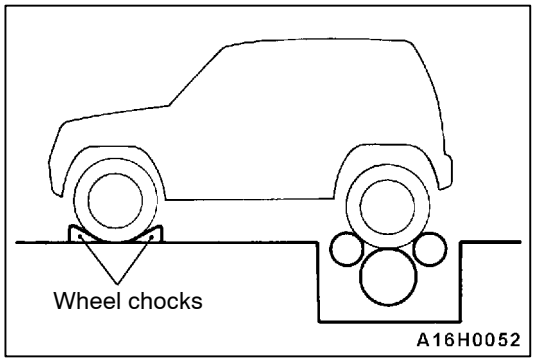


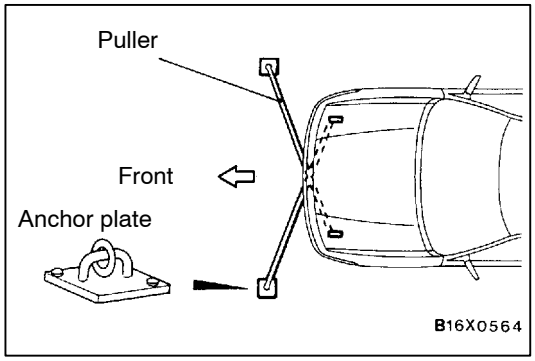
Inspection procedure 6

Vehicle speed sensor check
The vehicle speed sensor is used by the speedometer, engine-ECU and A/T-ECU.



NOTE
If the trouble symptoms cannot be eliminated by the above checks, there is probably a short-circuit at the vehicle speed sensor output side (harness, speedometer, engine-ECU or A/T-ECU), and so this should be checked.





ON-VEHICLE SERVICE

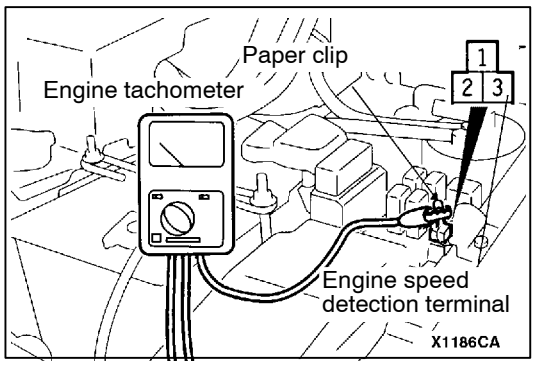
SPEEDOMETER CHECK

1. Check that the tyre inflation pressure is at the value indicated on the tyre pressure labels.
2. Place the vehicle onto a speedometer tester.
3. Place wheel locks on front wheels.
   NOTE
   Set the vehicle to 2WD.
4. Install a puller to the towing hook and tie-down hook a the front of the vehicle to stop the front wheels from moving sideways, and secure both ends of the puller to anchor plates.
5. Connect a chain or wire cable to the rear towing hook and secure the other end to a strong, rigid support, to stop the vehicle from moving.
6. Check that the speedometer display range is within the standard value, and that the needle swing is within the limit value.

Standard value:

Speed km/h	20	40	80	120	160
Speedometer display range km/h	18 - 23	37 - 45	75 - 88	113 - 132	150 - 176

Limit: Needle swing (driving at a speed of 35 km/h or higher) ± 3 km/h

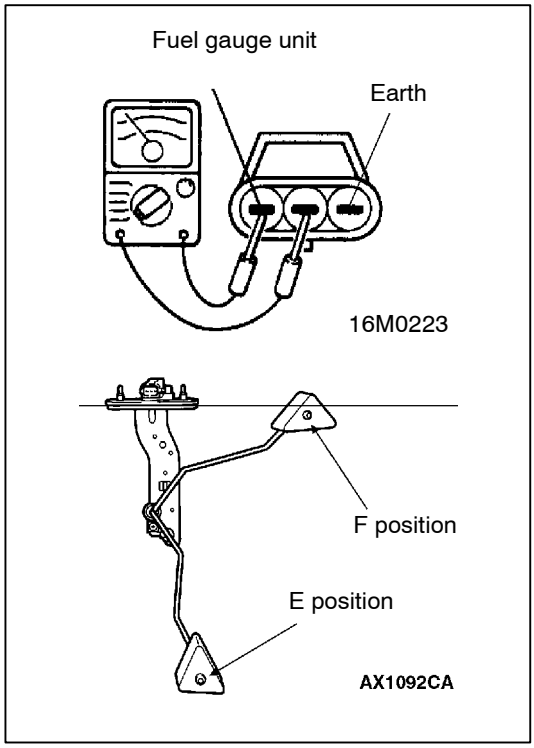


TACHOMETER CHECK

1. Insert a paper clip into the harness-side engine speed detection terminal and connect an engine tachometer.
2. Compare the engine tachometer display and the vehicle tachometer display at various engine speeds, and check that the display errors are within the standard value ranges.

Standard value:

Engine speed r/min		Tachometer display error r/min
700		± 120
2,000	Petrol	-175+225
	Diesel	± 175
3,000	Petrol	-175+300
	Diesel	± 225
4,000	Petrol	-225+375
	Diesel	± 300
4,750 (Diesel)		± 260
5,000 (Petrol)		-225+425
6,000 (Petrol)		-225+475



FUEL GAUGE UNIT CHECK

Remove the fuel gauge unit from the fuel tank.

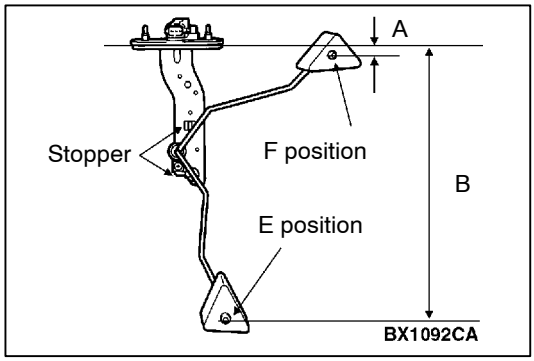
Fuel gauge unit standard resistance value

1. Check that the resistance between the fuel gauge unit terminal and the earth terminal is at the standard value when the float of the fuel gauge unit is at the F position and the E position.

   Standard value:

Float position	Gauge resistance value
F position	3 Ω
E position	110 Ω

2. Check that the resistance value changes smoothly when the float is moved slowly between the F position and the E position.

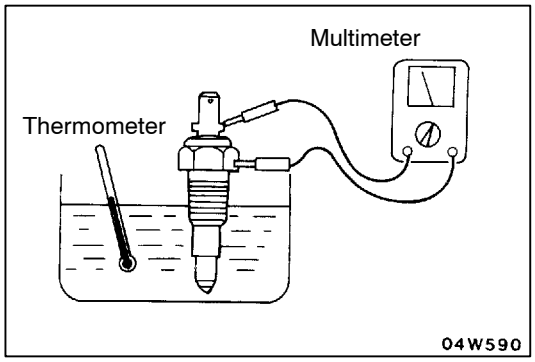


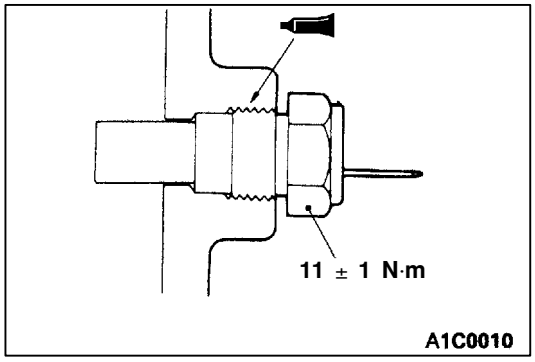
Fuel gauge unit float height

Move the float and check that F position height (A) and E position height (B) are at the standard values when the float arm touches the stopper.

Standard value:

Float position	Float centre height
F position (A)	11.9 mm
E position (B)	195.2 mm





ENGINE COOLANT TEMPERATURE GAUGE UNIT CHECK

1. Drain the engine coolant. (Refer to GROUP 14 - On-vehicle Service.)
2. Remove the engine coolant temperature gauge unit.
3. Immerse the engine coolant temperature gauge unit in water at a temperature of 70°C and check that the basic resistance is at within the standard value range.

   Standard value: 104 ± 13.5 Ω

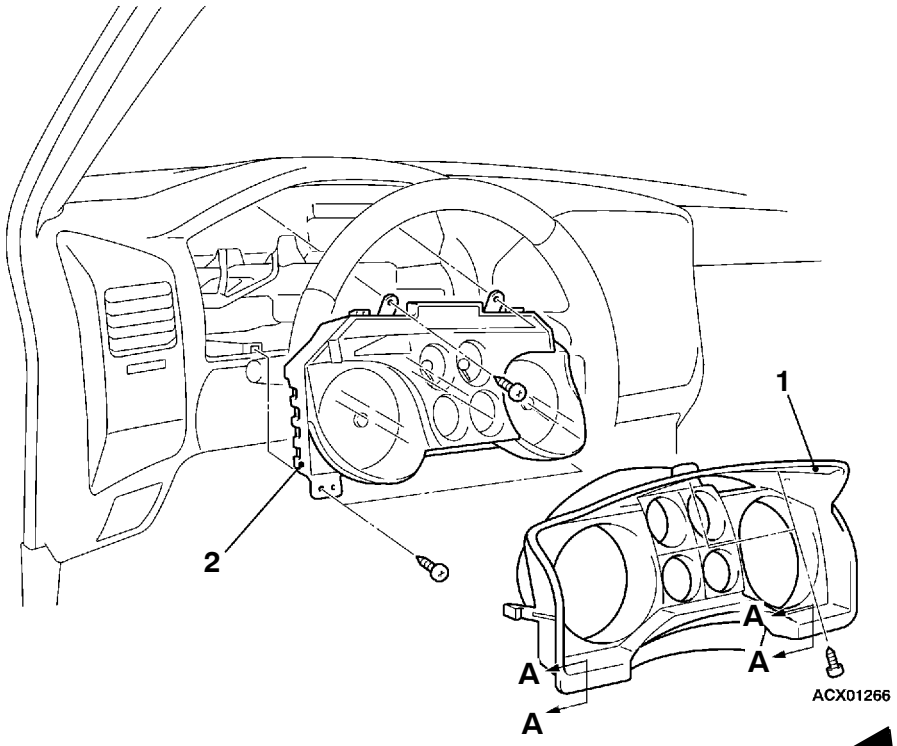
4. After checking, apply specified sealant to the threaded section of the engine coolant temperature gauge unit, and then tighten it to the specified torque.

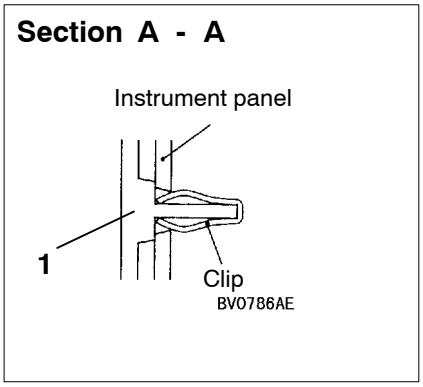
   Semi-drying sealant: Threebond 1104 or equivalent

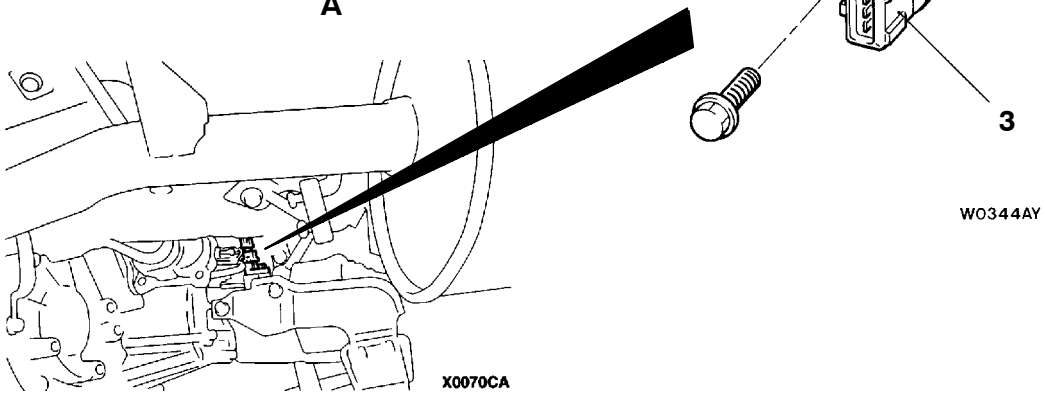
5. Refill the engine coolant. (Refer to GROUP 14 - On-vehicle Service.)

COMBINATION METER

REMOVAL AND INSTALLATION





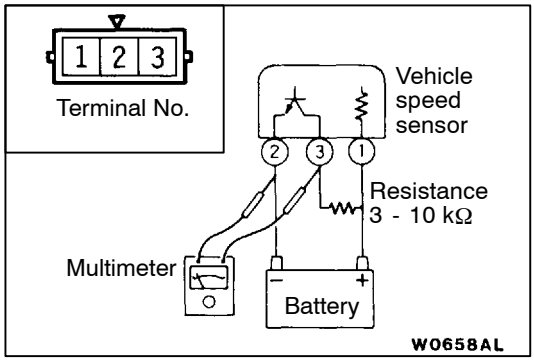


Combination meter removal steps

1. Meter bezel
2. Combination meter

Vehicle speed sensor removal

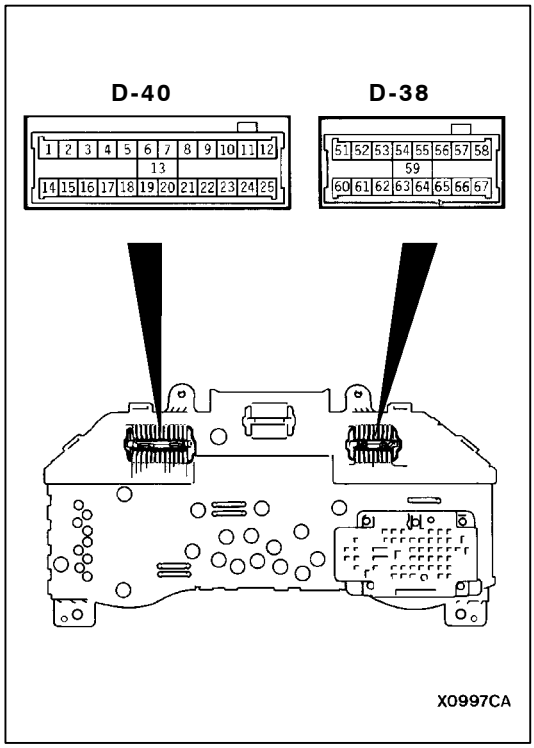
3. Vehicle speed sensor



INSPECTION

VEHICLE SPEED SENSOR CHECK

1. Jack up the vehicle.
2. Remove the vehicle speed sensor, and then connect a 3 - 10 kΩ resistance as shown in the illustration at left.
3. Use a multimeter to check the change in voltage between terminals (2) and (3) when the propeller shaft is rotated (4 pulses per rotation).



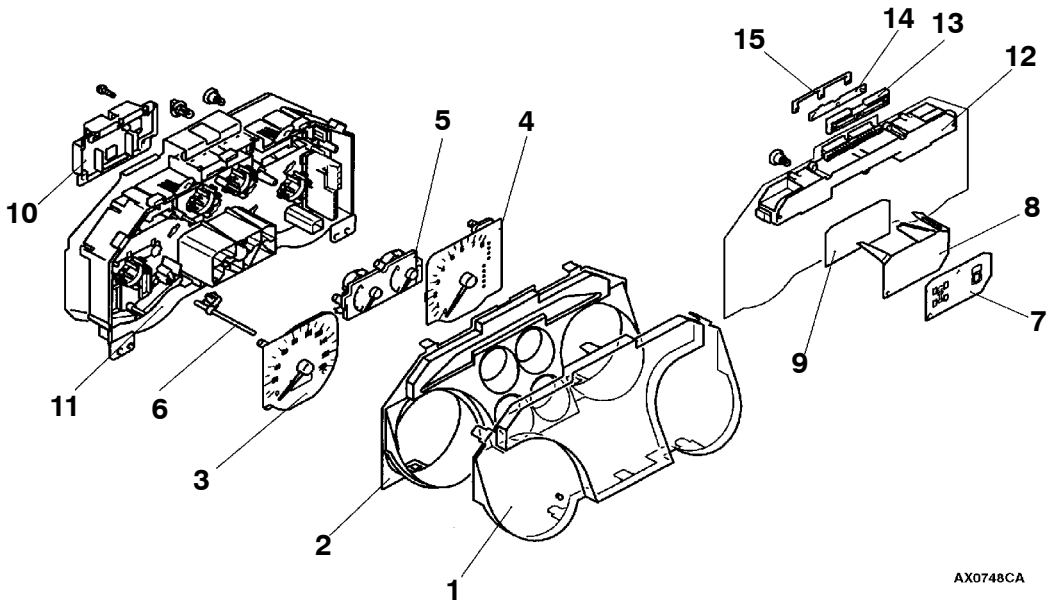
COMBINATION METER INTERNAL RESISTANCE VALUE CHECK

Use a multimeter to measure the resistance between the terminals.

Standard value:

Measurement terminal No.	Terminal name	Standard value
62 - 11	IG power supply - Earth	1MΩ or more
62 - 25	IG power supply - Earth	1MΩ or more
62 - 63	IG power supply - Fuel gauge	1MΩ or more
62 - 64	IG power supply - Engine coolant temperature gauge	1MΩ or more
63 - 11	Fuel gauge - Earth	180 Ω
63 - 25	Fuel gauge - Earth	180 Ω
64 - 11	Engine coolant temperature gauge - Earth	210 Ω
64 - 25	Engine coolant temperature gauge - Earth	210 Ω
67 - 11	Battery power supply - Earth	1MΩ or more
67 - 25	Battery power supply - Earth	1MΩ or more
67 - 63	Battery power supply - Fuel gauge	1MΩ or more
67 - 64	Battery power supply - Engine coolant temperature gauge	1MΩ or more

DISASSEMBLY AND REASSEMBLY



Disassembly steps

1. Glass
2. Window plate
3. Speedometer
4. Tachometer
5. Fuel gauge and engine coolant temperature assembly
6. Trip meter knob
7. Indicator plate
8. Indicator prism
9. Indicator lens
10. Instrument panel printed circuit board
11. Replace the combination meter case
12. Indicator case
13. Combination plate A
14. Combination plate B
15. Combination plate C

HEADLAMP ASSEMBLY

SERVICE SPECIFICATIONS

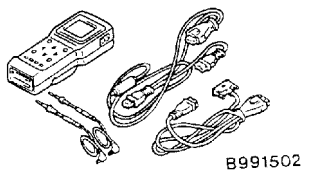
Item			Standard value	Limit
Headlamp emitter adjustment [Cut-off line (light/dark boundary line) position]	Low-beam	Vertical direction	0.57° (10 mm) down from horizontal line H	–
		Horizontal direction	Position where 15° rising portion intersects vertical line V	–
Headlamp illumination measurement cd (Corresponding to road surface 40 m in front at low beam)			–	6,400 or higher for each lamp

NOTES ON HANDLING HEADLAMPS AND FRONT TURN-SIGNAL LAMPS

The headlamps and front turn-signal lamps have plastic outer lenses, and so the following points should be noted during handling.

- **Do not leave the headlamps on for more than 3 minutes while they are covered with protectors, otherwise damage may result.**
- **Do not mask the surfaces of the outer lenses by attaching tape.**
- **Do not scrape the surfaces of the outer lenses with tools that have sharp points.**
- **Use only the specified wax remover, and wash thoroughly with water.**
- **Only the specified genuine bulbs should be used.**

SPECIAL TOOLS

Tools	No.	Name	Application
 B991502	MB991502	MUT-II sub assembly	Checking the ETACS-ECU input signals

TROUBLESHOOTING

The headlamps are controlled by the Smart Wiring System (SWS). For troubleshooting procedures, refer to GROUP 54B.

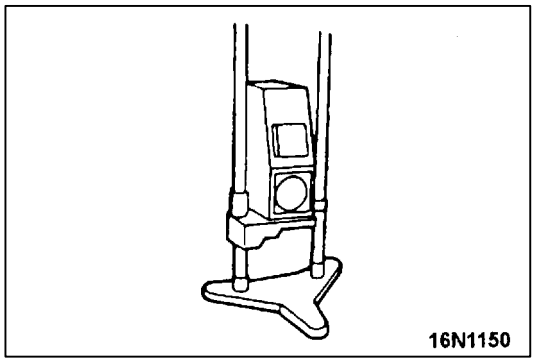
ON-VEHICLE SERVICE

HEADLAMP AIMING ADJUSTMENT

After setting the vehicle to the following condition, adjust the headlamp aiming.

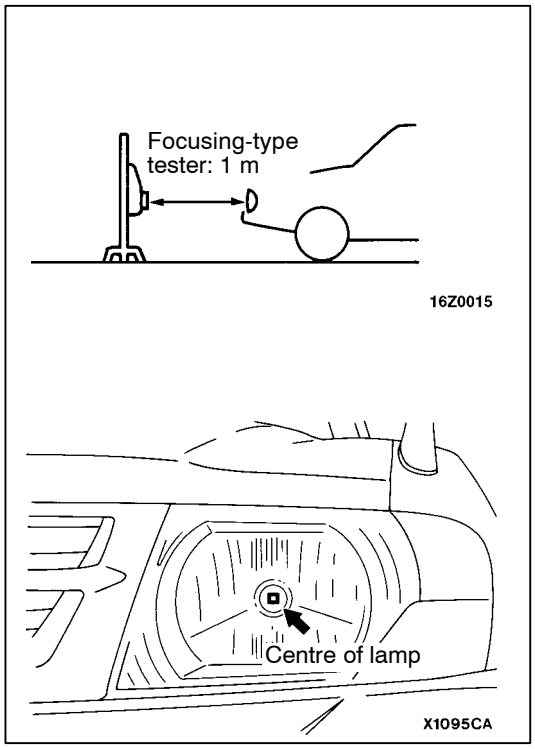
- Check that the tyre inflation pressure is at the value indicated on the tyre pressure labels.
- Set the vehicle to the unladen condition and park it on a level surface.
- Have a single person (approximately 55 kg) sit in the driver's seat.

- Run the engine at a speed of 2000 r/min to fully charge the battery.
- Turn the headlamp level control switch to position ”0”.

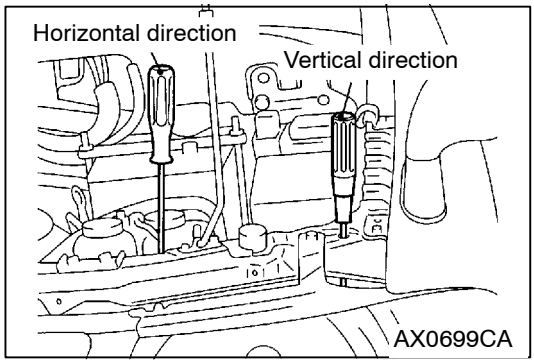


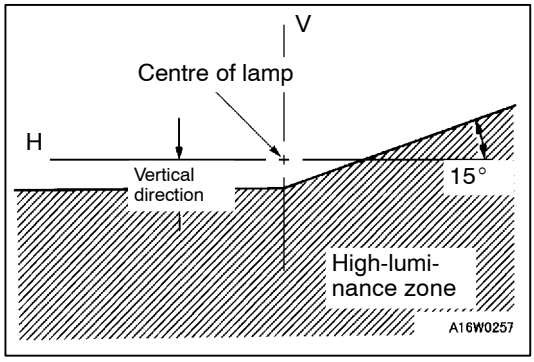
LOW BEAM ADJUSTMENT

1. Adjust the low-beam light axis by following the procedure given for the focusing-type headlamp tester which you are using.



2. Set the tester so that the centre of the focusing lens is 1 m directly in front of the centre of the headlamp.





3. Turn the adjusting screws to adjust so that the deviation in the centre of the high-luminance zone (main optical axis) is at the standard value.

Standard value:

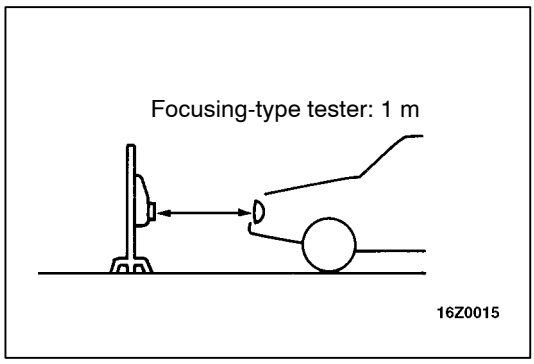
Vertical direction	0.57 ° (10 mm) down from horizontal line H
Horizontal direction	Position where 15 ° rising portion intersects vertical line V

Caution

(1) For the headlamp which is not being measured, disconnect that headlamp's connector if possible so that it does not illuminate while carrying out the adjustment. Furthermore, make sure that the light axis does not get shifted when re-connecting the connector.

(2) The headlamps have outer lenses which are made of plastic, so if covering the lens surface with an object which does not let light pass through, the headlamp should not be turned on for any more than 3 minutes. In addition, do not mask the outer lens surface by attaching tape or similar.

(3) The adjustment should always be completed by turning the adjusting screws in the tightening direction.



LUMINANCE MEASUREMENT

1. Place the tester receiver so that it is directly opposite the headlamp at the distance shown in the illustration.
2. Run the engine at a speed of 2000 r/min to fully charge the battery.
3. Align with the centre of the lamp.

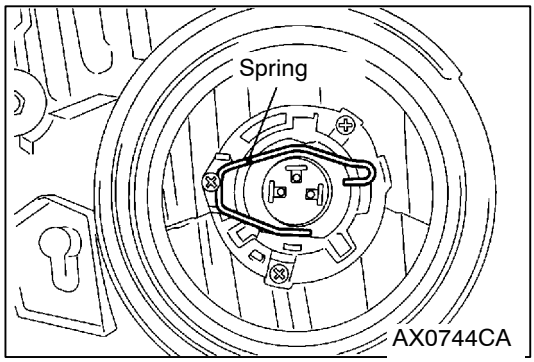
   NOTE
   Check that the light/dark separation line on the adjustment screen and the low-beam cut-off line are aligned at this time.
4. With the headlamps set to low beam, check that the luminance satisfies the limit value.

   Limit: 6,400 cd or higher for each lamp

Caution

(1) For the headlamp which is not being measured, disconnect that headlamp's connector if possible so that it does not illuminate while carrying out the adjustment. Furthermore, make sure that the light axis does not get shifted when re-connecting the connector.

(2) The headlamps have outer lenses which are made of plastic, so if covering the lens surface with an object which does not let light pass through, the headlamp should not be turned on for any more than 3 minutes. In addition, do not mask the outer lens surface by attaching tape or similar.



HEADLAMP BULB REPLACEMENT

1. Remove the air cleaner case (R.H. side) and the ABS valve relay (L.H. side).
2. Disconnect the connector.
3. Remove the socket cover.
4. Remove the bulb retainer spring, and then take out the bulb.
5. After replacing the bulb, securely connect the connector.

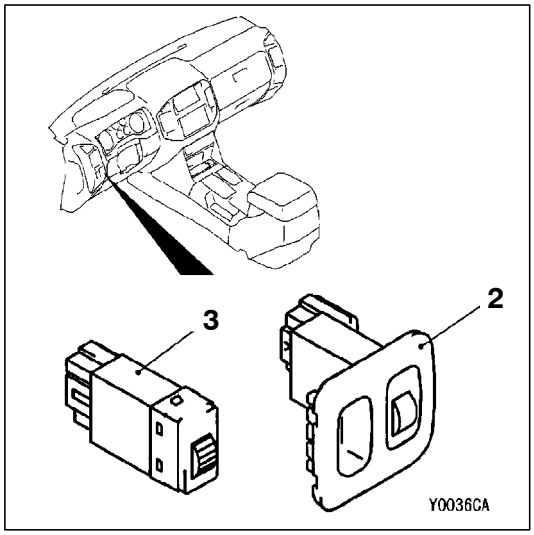
Caution

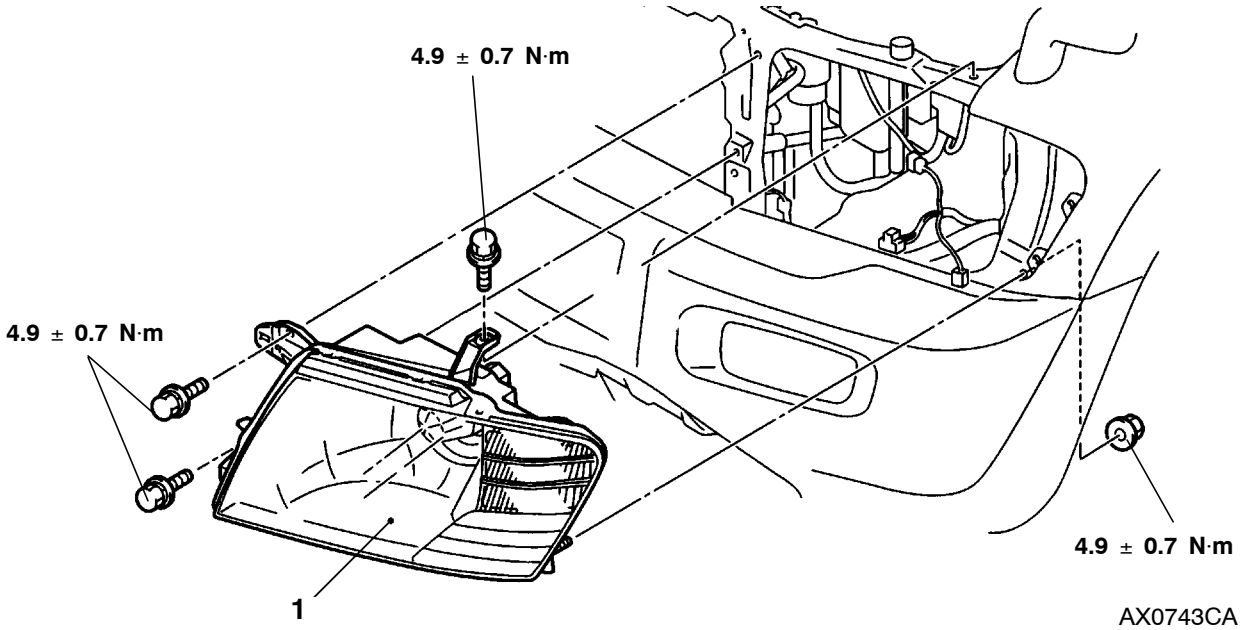
Do not touch the surface of the bulb with bare hands or with dirty gloves.

If the surface (glass section) should become dirty, clean it immediately with alcohol or thinner, and let it dry thoroughly before installing it.

HEADLAMP ASSEMBLY

REMOVAL AND INSTALLATION





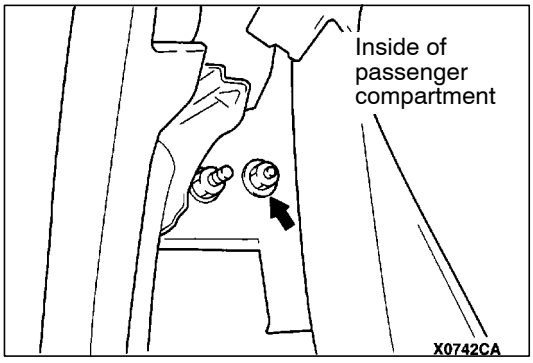
Headlamp removal steps

- Radiator grille (Refer to GROUP 51 – Front Bumper.)

◀A▶ 1. Headlamp Assembly

Headlamp level control switch removal steps

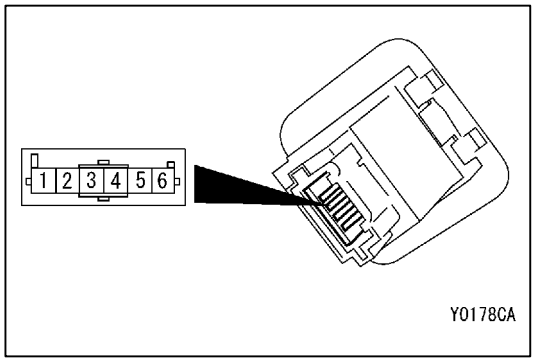
2. Switch garnish
3. Headlamp level control switch



REMOVAL SERVICE POINT

◀A▶ HEADLAMP ASSEMBLY REMOVAL

The headlamp mounting nut is the nut on the inside of the nut which is visible inside the passenger compartment when the front splash shield mounting is removed, and it is this nut which should be removed.



INSPECTION

HEADLAMP LEVEL CONTROL SWITCH CHECK

If the resistance value in the table shown below cannot be obtained after operating the headlamp level control switch, replace the headlamp level control switch.

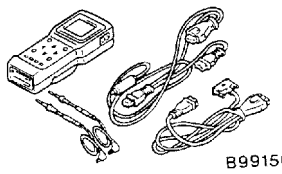
Terminal No. to measure resistance	Switch position				
	0	1	2	3	4
Resistance between terminals (4) and (5)	120	300	620	1,100	2,000

FOG LAMPS

SERVICE SPECIFICATIONS

Item	Standard value
Fog lamp light axis check	Illuminates to within 40 metres

SPECIAL TOOLS

Tools	No.	Name	Application
	MB991502	MUT-II sub assembly	Checking the ETACS-ECU input signals

TROUBLESHOOTING

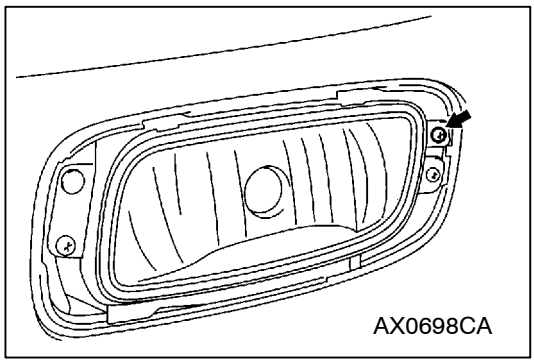
The fog lamp are controlled by the Smart Wiring System (SWS). For troubleshooting procedures, refer to GROUP 54B.

ON-VEHICLE SERVICE

FOG LAMP AIMING CHECK

After setting the vehicle to the following condition, adjust the headlamp aiming.

- Check that the tyre inflation pressure is at the value indicated on the tyre pressure labels.
- Set the vehicle to the unladen condition and park it on a level surface.
- Have a single person (approximately 55 kg) sit in the driver's seat.



- Run the engine at a speed of 2,000 r/min to fully charge the battery.

Turn on the fog lamps and check that the illumination is within the standard value range.

Standard value: Illuminates to within 40 metres

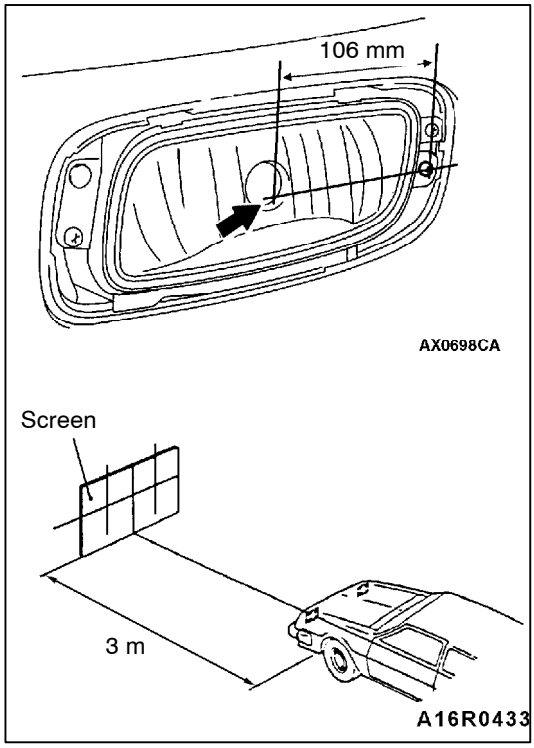
If the value is outside the standard value range, adjust using the adjusting screw.

NOTE

Horizontal adjustment is not possible.

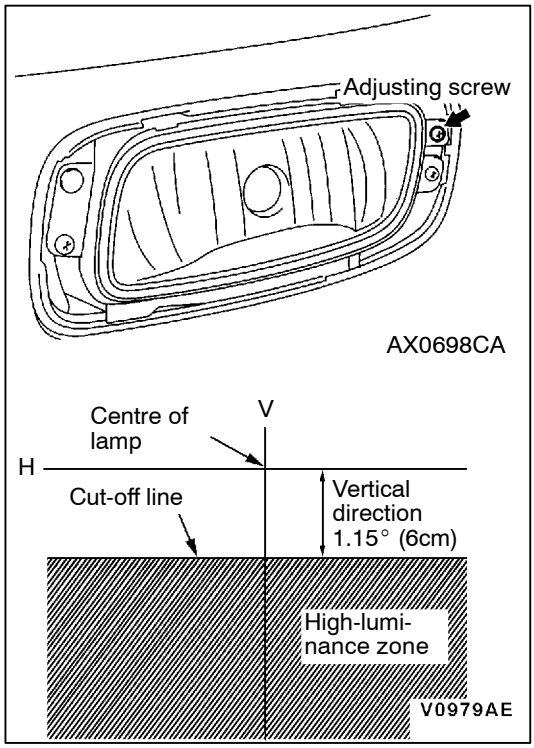
Caution

1. **For the headlamp which is not being measured, disconnect that headlamp's connector if possible so that it does not illuminate while carrying out the adjustment. Furthermore, make sure that the light axis does not get shifted when re-connecting the connector.**
2. **The adjustment should always be completed by turning the adjusting screws in the tightening direction.**



In addition, the method of checking the light axis on a screen (simple check) is given below.

1. Measure the centre of the fog lamp as shown in the illustration.
2. Place the screen so that it is directly opposite the centre of the fog lamp at a distance of 3 metres, and turn on the fog lamps.



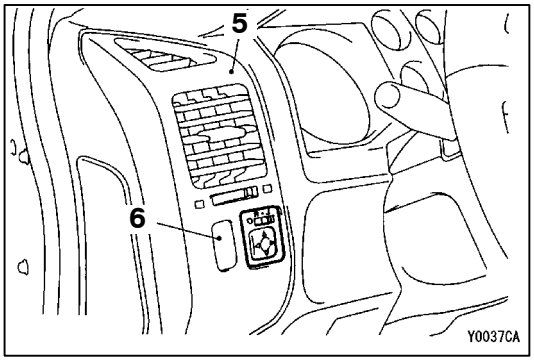
3. Turn the adjusting screw to adjust so that the position of the cut-off line (light/dark border line) is as shown in the figure.

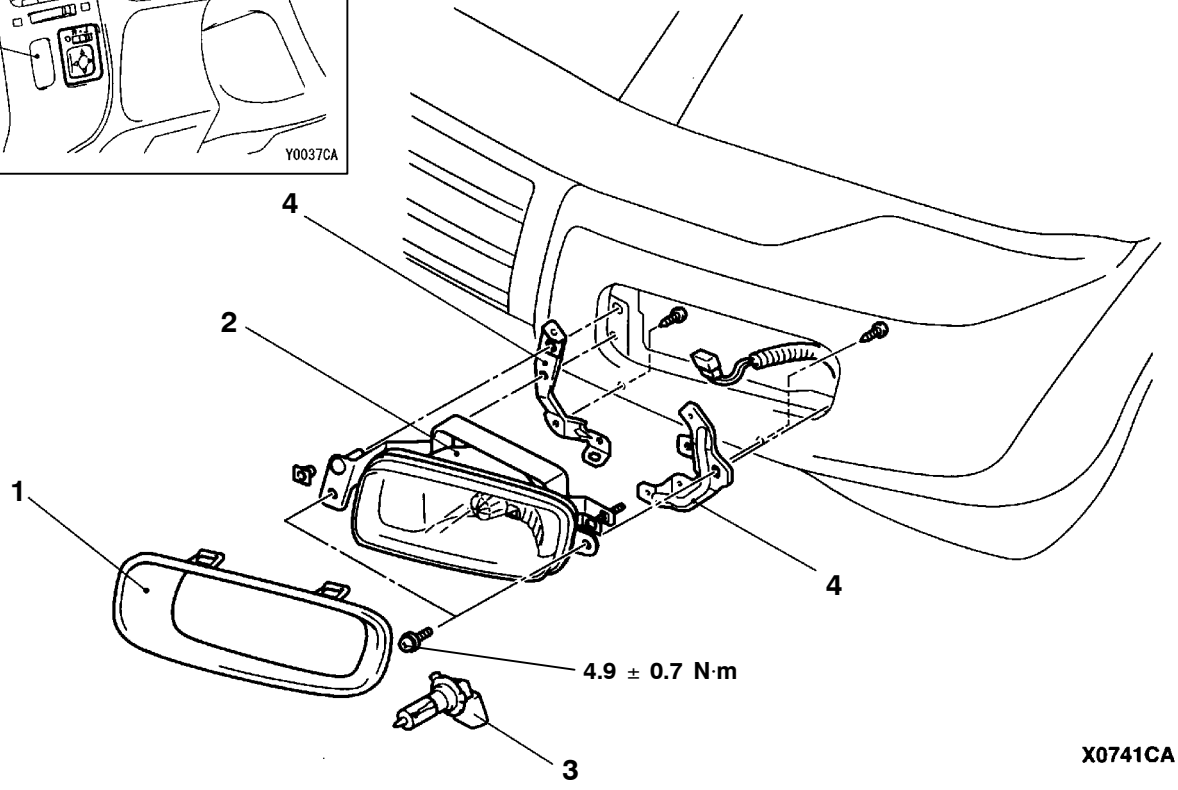
   NOTE
   Horizontal adjustment is not possible.

   Caution
   (1) For the headlamp which is not being measured, disconnect that headlamp's connector if possible so that it does not illuminate while carrying out the adjustment. Furthermore, make sure that the light axis does not get shifted when re-connecting the connector.
   (2) The adjustment should always be completed by turning the adjusting screws in the tightening direction.

FOG LAMPS

REMOVAL AND INSTALLATION





Fog lamp removal steps

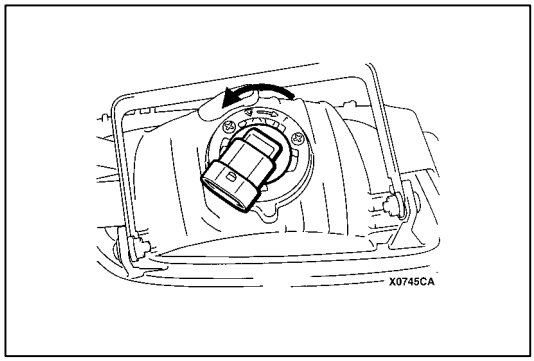
1. Fog lamp bezel
2. Fog lamp

◀A▶ 3. Bulb

4. Fog lamp bracket

Fog lamp switch removal steps

5. Air outlet assembly (Refer to GROUP 52A - Instrument Panel.)
6. Fog lamp switch

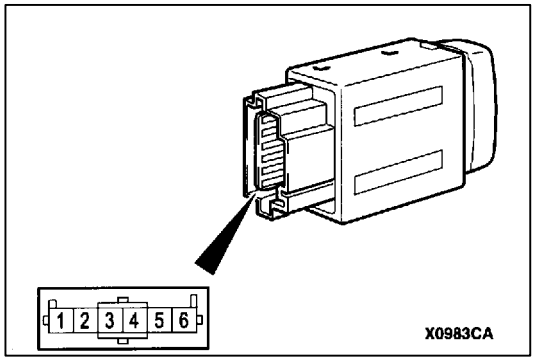


REMOVAL SERVICE POINT

◀A▶ BULB REMOVAL

Turn the bulb assembly anti-clockwise to remove the bulb.

Caution
1. **Only the specified genuine bulbs should be used.**
2. **Do not touch the surface of the bulb with bare hands or with dirty gloves.**
   If the surface (glass section) should become dirty, clean it immediately with alcohol or thinner, and let it dry thoroughly before installing it.



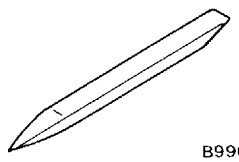
INSPECTION

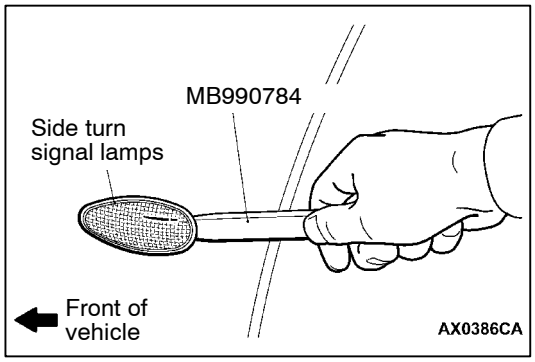
FOG LAMP SWITCH CONTINUITY CHECK

Switch position		Terminal No.						
		1	2	3	ILL	4	5	6
ON	FRONT	○—○		○—◎—○				
	REAR			○—◎—○			○—○	
OFF				○—◎—○				

SIDE TURN-SIGNAL LAMPS

SPECIAL TOOL

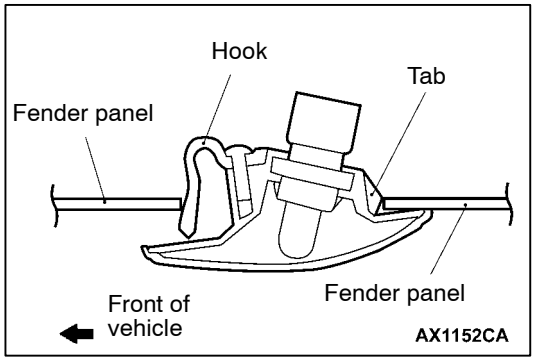
Tools	No.	Name	Application
	MB990784	Ornament remover	Side turn-signal lamp removal



SIDE TURN-SIGNAL LAMPS

REMOVAL SERVICE POINTS

Use the special tool or similar tool to disengage the hook from the fender, and then remove the side turn-signal lamp.



INSTALLATION SERVICE POINTS

Hook the tab onto the fender panel to install the side turn-signal lamp.

ROOM LAMP

TROUBLESHOOTING

The room lamps are controlled by the Smart Wiring System (SWS). For troubleshooting procedures, refer to GROUP 54B.

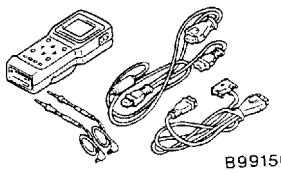
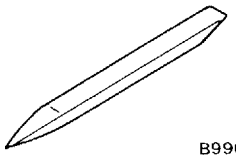
ON-VEHICLE SERVICE

ROOM LAMP DELAY-OFF TIME ADJUSTMENT PROCEDURE

The-room lamps are controlled by the Smart Wiring System (SWS). For room lamp delay-off time adjustment procedures, refer to GROUP 54B.

REAR COMBINATION LAMPS

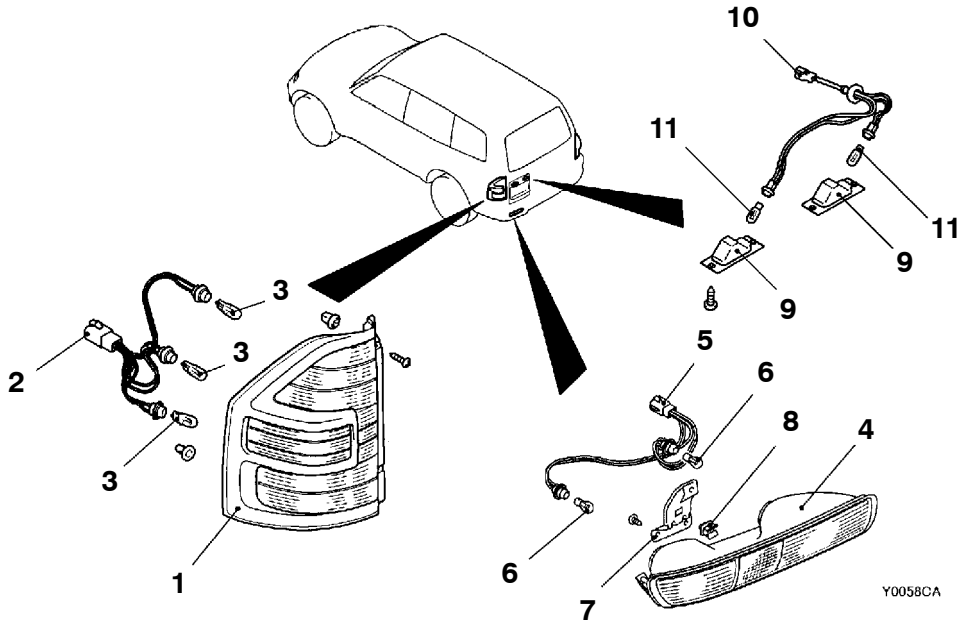
SPECIAL TOOLS

Tools	No.	Name	Application
 B991502	MB991502	MUT-II Sub assembly	Checking the ETACS-ECU input signals
 B990784	MB990784	Ornament remover	Rear combination lamp removal

TROUBLESHOOTING

Rear combination lamps are controlled by the Smart Wiring System (SWS). For troubleshooting procedures, refer to GROUP 54B.

REAR COMBINATION LAMPS
REMOVAL AND INSTALLATION



Rear combination lamp removal steps

1. Rear combination lamp
2. Socket assembly
3. Bulb

Rear lamp removal steps

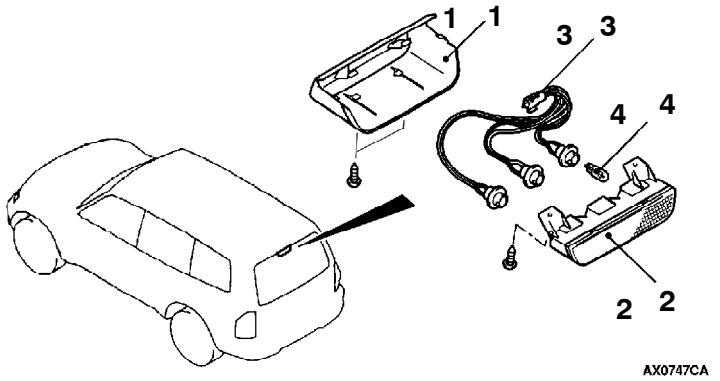
4. Rear lamp
5. Socket assembly
6. Bulb
7. Rear lamp bracket
8. Clip

Licence plate lamp removal steps

9. Licence plate lamp
10. Socket assembly
11. Bulb

HIGH-MOUNTED STOP LAMP

REMOVAL AND INSTALLATION

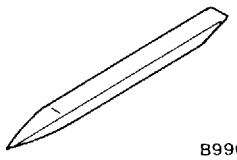


Removal steps

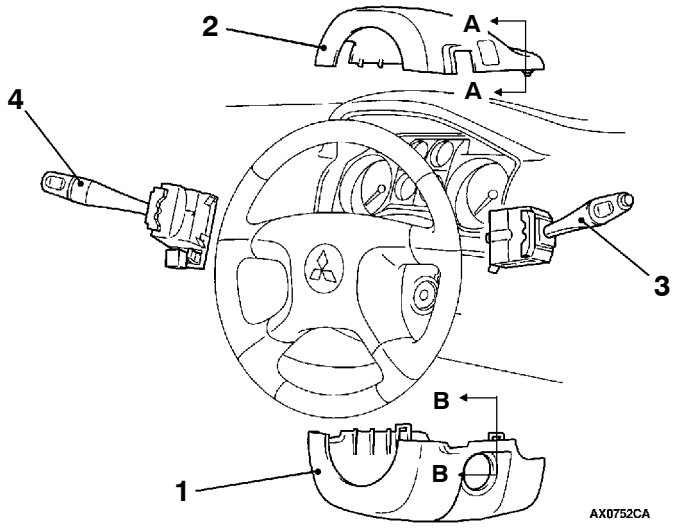
1. High-mounted stop lamp cover
2. High-mounted stop lamp body
3. Socket assembly
4. Bulb

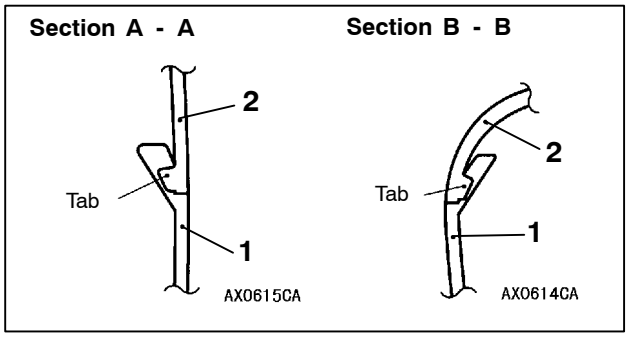
COLUMN SWITCH

SPECIAL TOOL

Tools	No.	Name	Application
 B990784	MB990784	Ornament remover	Column cover removal

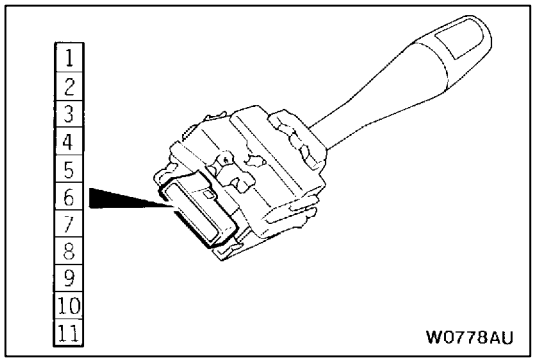
REMOVAL AND INSTALLATION





Removal steps

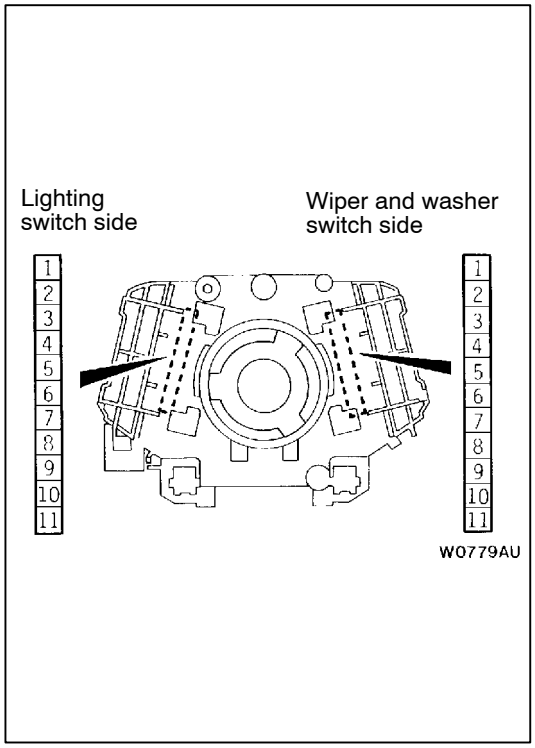
1. Lower column cover (Refer to GROUP 52A - Instrument Panel.)
2. Upper column cover (Refer to GROUP 52A - Instrument Panel.)
3. Wiper and washer switch
4. Lighting switch



INSPECTION

LIGHTING SWITCH CONTINUITY CHECK <R.H. DRIVE VEHICLES>

Switch position	Terminal No.						
	3	6	7	8	9	10	11
OFF							
Tail gate lamps	○		○				
Headlamps	○	○					
Passing lamps	○			○			
Dimmer	○				○		
Turn-signal lamp R.H.	○					○	
Turn-signal lamp L.H.	○						○



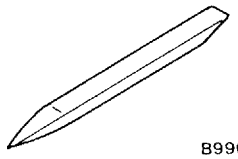
COLUMN SWITCH (SWITCH BODY) CONTINUITY CHECK

(1) Remove the lighting switch and the wiper and washer switch.
(2) Check that there is continuity between the same terminals [terminals (3) and (11)] of each connector of the column switch body which is still on the steering column.

Terminal No.		Lighting switch-side connector								
		3	4	5	6	7	8	9	10	11
Wiper and washer switch-side connector	3	○								
	4		○							
	5			○						
	6				○					
	7					○				
	8						○			
	9							○		
	10								○	
	11									○

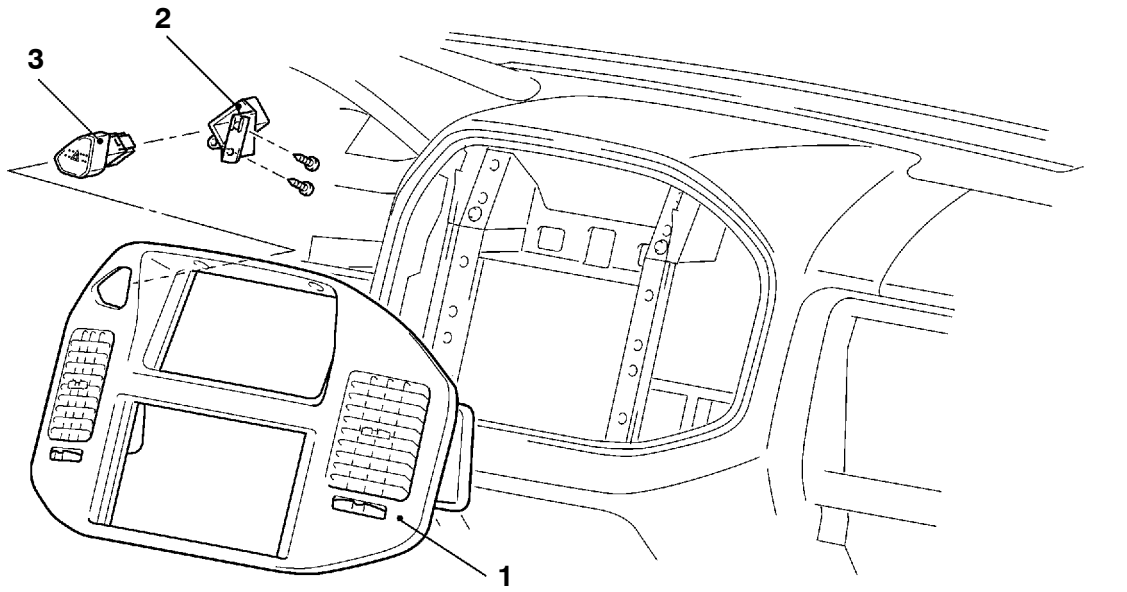
HAZARD WARNING LAMP SWITCH

SPECIAL TOOL

Tools	No.	Name	Application
	MB990784	Ornament remover	Center panel removal

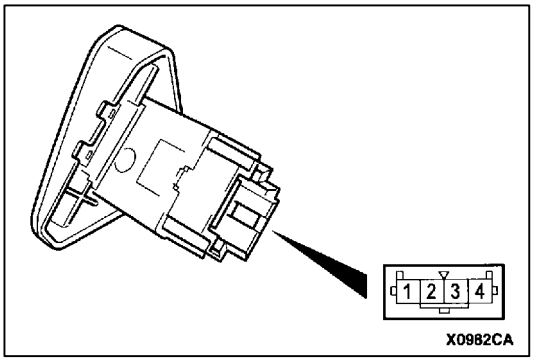
HAZARD WARNING LAMP SWITCH

REMOVAL AND INSTALLATION



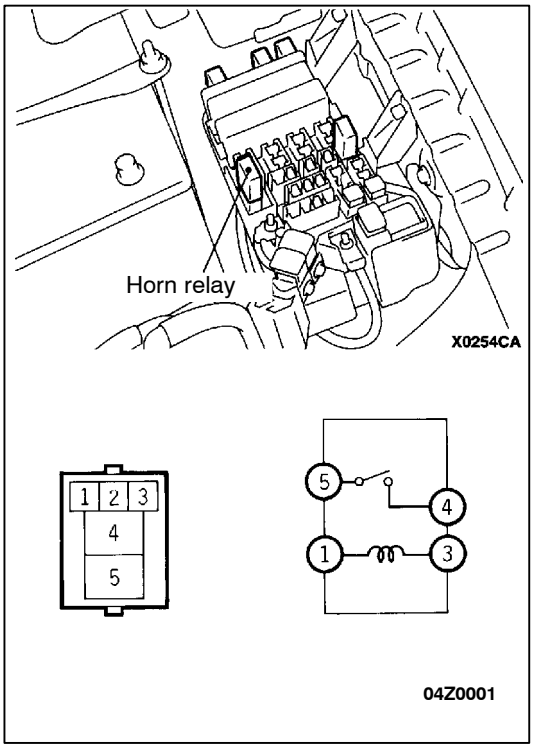
Removal steps

1. Center panel (Refer to GROUP 52A - Instrument Panel.)
2. Bracket
3. Hazard Warning Lamp Switch



HAZARD LAMP SWITCH CONTINUITY CHECK

Switch position	Terminal No.				
	1	2	3	ILL	4
OFF			○	○	○
ON	○	○	○	○	○

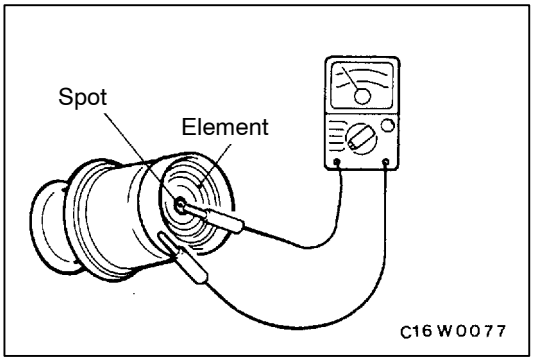


HORN

INSPECTION

HORN RELAY CONTINUITY CHECK

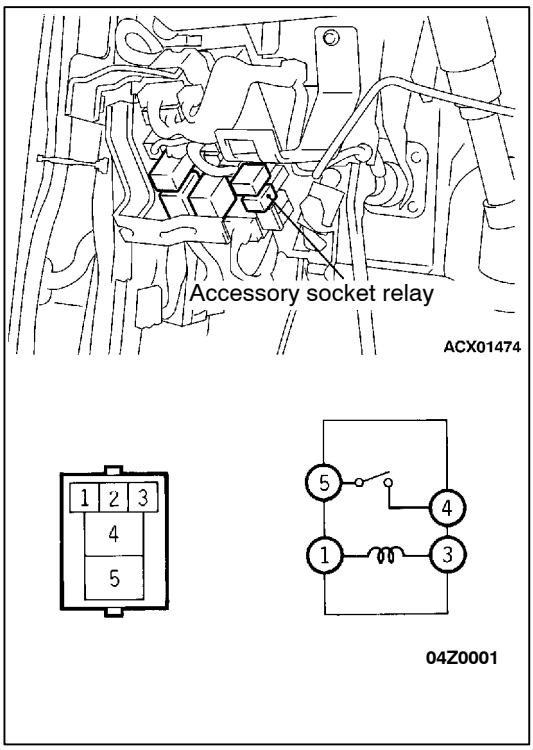
Switch position	Terminal No.			
	1	3	4	5
When current is not supplied	○	○		
When current is supplied	⊖	⊕	○	○



CIGARETTE LIGHTER

INSPECTION

- Remove the plug and check the spot for wear.
- Check that there are no tobacco stains or foreign particles on the element.
- Use a multimeter to check the continuity of the element.

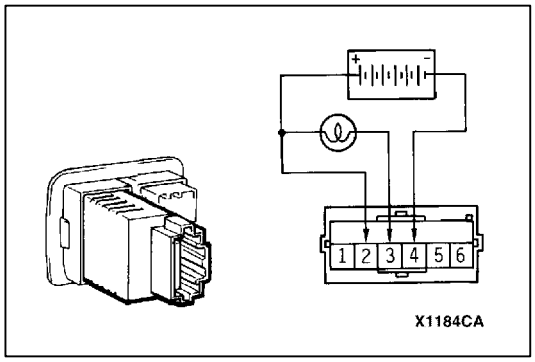


ACCESSORY SOCKET

INSPECTION

ACCESSORY SOCKET RELAY CONTINUITY CHECK

Switch position	Terminal No.			
	1	3	4	5
When current is not supplied	○	○		
When current is supplied	⊖	⊕	○	○



RHEOSTAT

INSPECTION

1. Connect a test lamp (40 W) to the battery as shown in the illustration.
2. Operate the rheostat. If the luminance of the lamp changes steadily with no flashing, the rheostat is functioning normally.

CLOCK OR CENTER DISPLAY

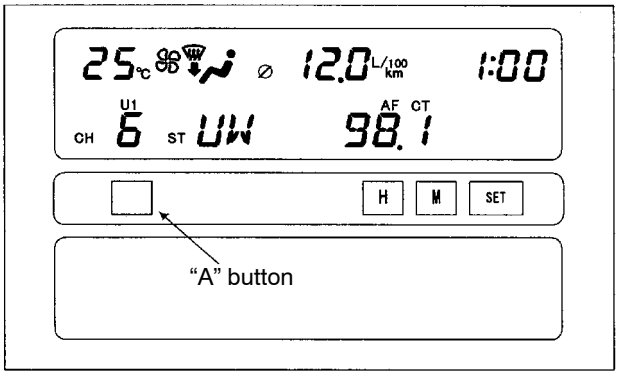
PRECAUTIONS WITH REGARD TO CENTER DISPLAY SERVICE WORK

When the battery is disconnected, model selection screen is shown in center display. Select the model with “H” key or “M” key and enter the selection with “SET” key. If model selection needs to be corrected, press the key on the left end to display the setting screen.

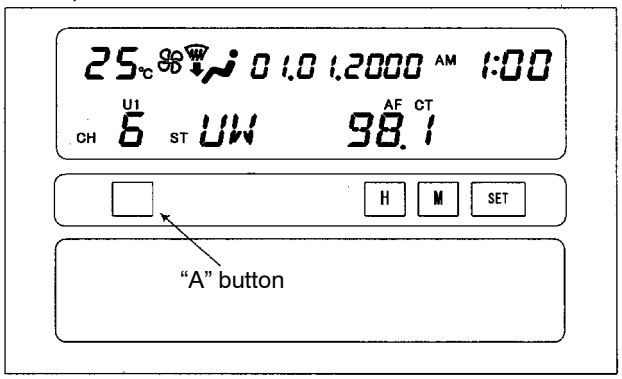
TROUBLESHOOTING

Vehicle	Center display unit
Petrol-powered vehicles	MR532880
	DU-435-1
Diesel-powered vehicles	MR532881
	DU-435-2

Petrol-powered vehicles



Diesel-powered vehicles



BEFORE REMOVING THE BATTERY

The Center display has a large amount of data unique to the vehicle in its memory. When the battery cable is disconnected, that memory 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 cable.

Function	Input function/memory	When battery cable is disconnected
Clock set on display	Current time	Retains data for approx. 1 hour
Vehicle model set	Short (3-door models)/long (5-door models)	Retains data for approx. 1 hour
Brightness set for display	Position set on display	Retains data for approx. 1 hour
Unit set for trip computer	km or mile, L/100km or mpg or km/L Average vehicle speed after reset	Retains data for approx. 1 hour
Average vehicle speed on display	Average vehicle speed after reset	Retains data for approx. 1 hour
Average fuel consumption on display	Average fuel consumption after reset	Retains data for approx. 1 hour
Cruising range on display	Cruising range, fuel economy	Retains data for approx. 1 hour
Outside temperature on display	Outside temperature after the ignition switch is turned to the OFF(LOCK) position.	Retains data for approx. 1 hour * The outside temperature sensor is located near the engine. Therefore, incorrectly high temperature may be displayed when the battery cable is reconnected within one hour.

DIAGNOSIS FUNCTION FOR CENTER DISPLAY

Center display has the following diagnosis function:

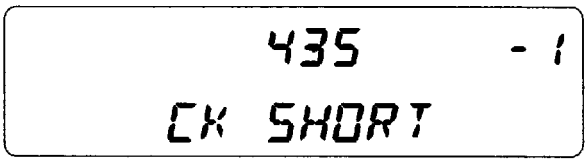
Function	Contents
Service function	There are the following 4 diagnosis modes available
1. Check of vehicle information	The vehicle, short (3-door models)/long (5-door models) set
2. Check of LCD segments	The LCD segments for display available to light on or not
3. Check of sensors	Outside temperature, voltage of fuel gauge unit, system voltage, fuel amount remains, fuel economy calculated after supply of fuel
4. Check of units connected into the center display	The units connected on display Voltage (%) on terminal for MUT-II Vehicle speed signal sent by engine-ECU Oscillating signal

SERVICE MODE FOR CENTER DISPLAY

ENTERING AND TERMINATING THE SERVICE MODE

(1) To enter the service mode, turn the ignition switch to the LOCK (OFF) position.
(2) Turn the ignition switch to the ON position while pushing “A” button, and then push “H” button twice while pushing “A” button.
(3) Now the center display has entered the service mode. Each mode is displayed when the “SET” button is pushed.
(4) To terminate the service mode, press any button other than the “SET” button.

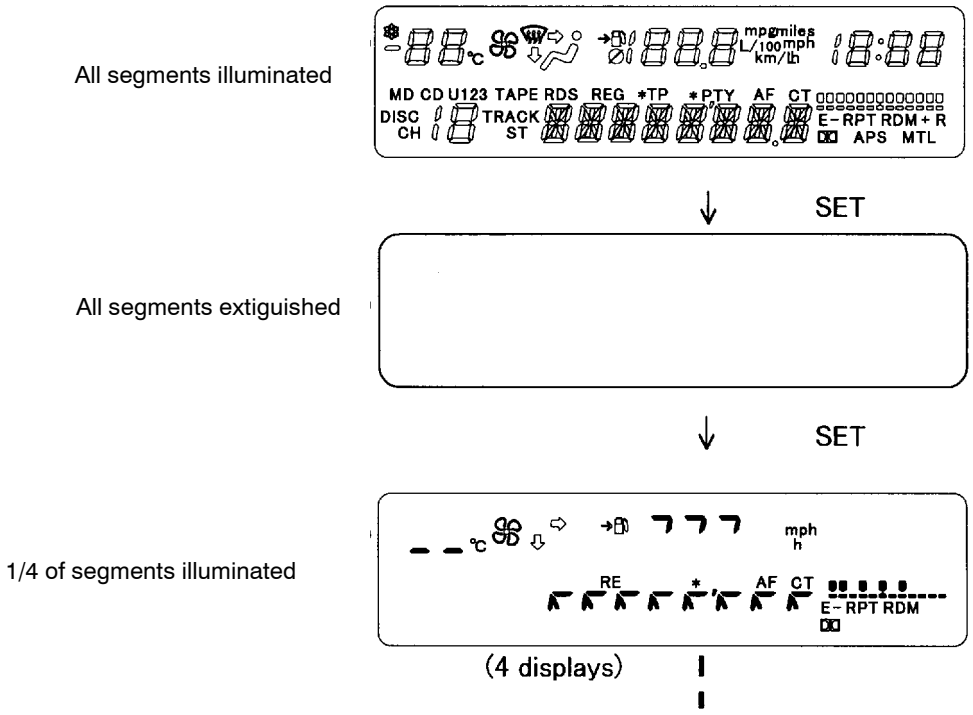
1. Check of vehicle information
   The following screen is displayed first when the unit enters the service mode.



Parts No.	MR532881	MR532880	
Vehicle type	Diesel-powered vehicles	Petrol-powered vehicles	
		Short wheelbase	Long wheelbase
Display	435 - 2 CK	435 - 1 CK SHORT	435 - 1 CK LONG

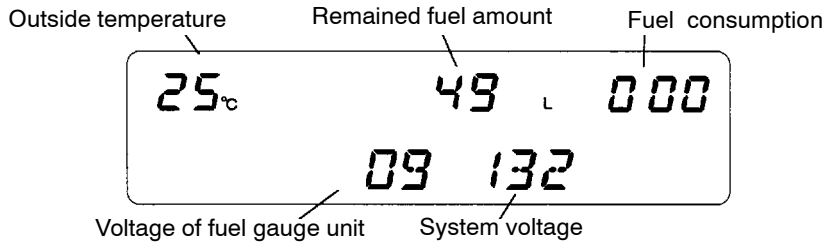
   When the “SET” button is pushed on this screen, the unit proceeds to the next service mode, Check of LCD segments.

2. Check of LCD segments
   This service mode consists of 6 display screens; the screen where all segments are illuminated, the screen where all segments are extinguished, and four kind of screens where 1/4 of segments are illuminated. Each screen can be changed sequentially when pushing on the “SET” button.



When the “SET” button is pushed on this screen six times, the unit proceeds to the next service mode, Check of Sensors.

3. Check of Sensors
   This service mode checks outside temperature, remained fuel amount, fuel consumption, system voltage, and fuel consumption after supply of fuel.



Fuel gauge unit characteristics (only petrol-powered vehicles)

Remained fuel amount [L]	MR532880	
	Petrol-powered vehicles	
	Short wheelbase	Long wheelbase
	Voltage of fuel gauge unit [V] +0.2/-0.2V	
80	-	0.3
70	-	0.7
60	0.4	0.9
50	0.8	1.2
40	1.2	1.5
30	1.6	1.9
20	2.0	2.3
10	2.5	2.7
5	2.8	2.9
0	3.0	3.1

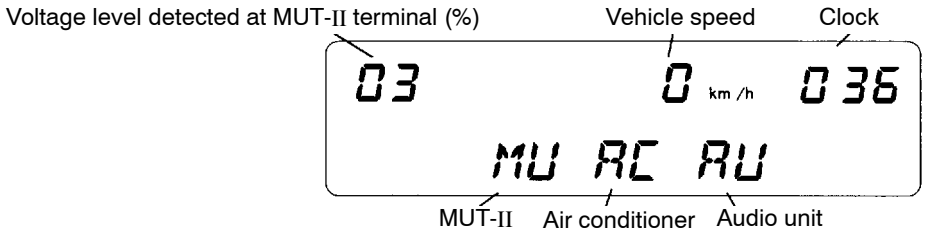
The voltage of fuel gauge unit depends on the system voltage.

Battery	12.0 V	13.2 V	14.4 V
Fuel gauge unit	1.8 V	2.0 V	2.2 V

The remained fuel amount, which is displayed on the screen, is less than the actual amount. This will give the vehicle an extra amount of 5-Litre fuel in case of shortage of gasoline. Moreover, the fuel remaining under the fuel gauge unit (pump) cannot be sucked. Therefore, there is more than 5 Litre difference between the actual remaining fuel amount and the displayed amount of fuel.

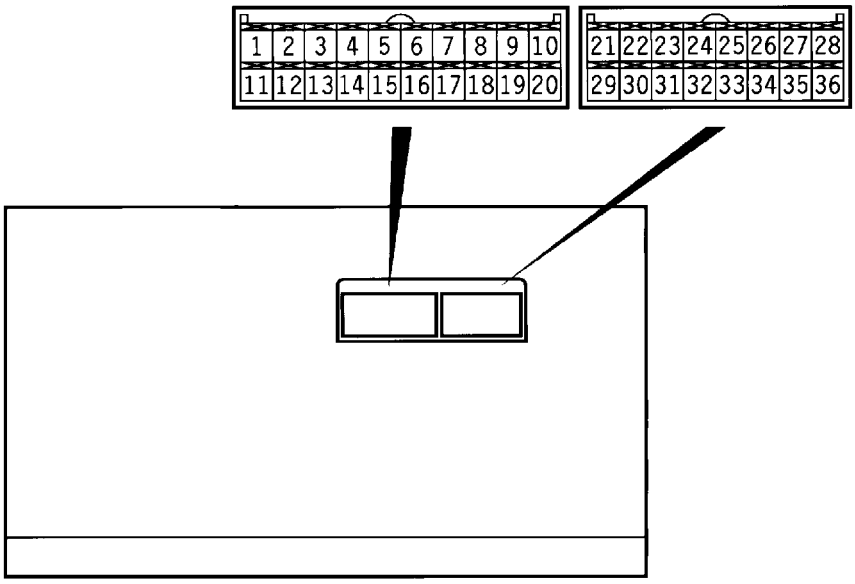
When the “SET” button is pushed on this screen, the unit proceeds to the next service mode, Check of Unit connected Sensors.

4. Check of units connected into the center display
   The lower column of this screen shows whether an audio unit, air-conditioner or the MUT-II is connected. The upper column shows voltage level (%) detected at the MUT-II terminal, the vehicle speed and clock.



When the “SET” button is pushed on this screen, the unit returns to the first screen, Check of Vehicle Information.

VOLTAGE AT CENTER DISPLAY UNIT TERMINALS



V0844AE

Terminal No.	Input/ Output	Signal symbol	Terminal voltage (V)	Wiring harness problem		Trouble symptom caused by wiring harness problem
				Open circuit	Short circuit	
1-4	-	-	-	-	-	
5	Input	ISOK	Hi: System voltage Lo: 0-1	Exists	Exists	MUT-II cannot be used to check the engine-ECU.
6	-	-	-	-	-	
7	Input/ Output	M-DATA (AUDIO)	Hi: 4-5 Lo: 0-1	Exists	Exists	Audio display does not appear. Panel switch cannot be operated for audio unit. Nighttime illumination does not appear for audio unit.
8	Input/ Output	M-CLOCK (AUDIO)	Hi: 4-5 Lo: 0-1	Exists	Exists	Audio display does not appear. Panel switch cannot be operated for audio unit. Nighttime illumination does not appear for audio unit.
9	Input/ Output	M-DATA (A/C)	Hi: 4-5 Lo: 0-1	Exists	Exists	A/C display does not appear. Outside air temperature does not appear
10	Input/ Output	M-CLOCK (AUDIO)	Hi: 4-5 Lo: 0-1	Exists	Exists	A/C display does not appear. Outside air temperature does not appear
11-14	-	-	-	-	-	-

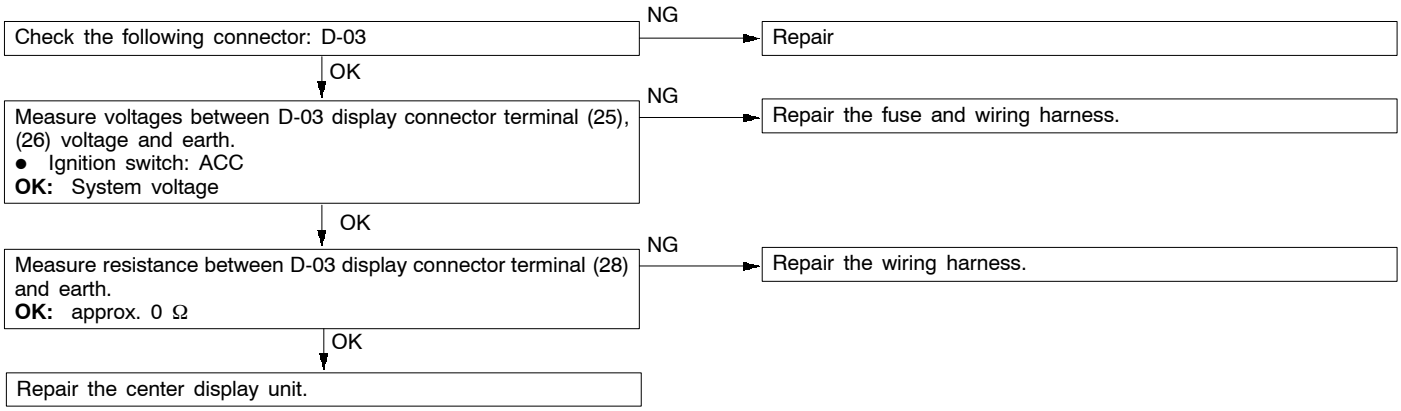
Terminal No.	Input/ Output	Signal symbol	Terminal voltage (V)	Wiring harness problem		Trouble symptom caused by wiring harness problem
				Open circuit	Short circuit	
15	Input/ Output	K	Hi: System voltage Lo: 0-1	Exists	Exists	Values on trip information screen (average vehicle speed, fuel consumption and cruising distance) are abnormal. Communication is impossible between the engine-ECU and the MUT-II.
16	-	-	-	-	-	-
17	Input/ Output	M-BUSY (AUDIO)	Hi: 4-5 Lo: 0-1	Exists	Exists	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	Input/ Output	M-BUSY (A/C)	Hi: 4-5 Lo: 0-1	Exists	Exists	A/C display does not appear. Outside air temperature does not appear
20	-	SHIELD-GND	-	-	-	-
21, 22	-	-	-	-	-	-
23	Input	EX-TEMP		Exists	Exists	Outside air temperature does not appear.
24	Input	ILL+	Hi: System voltage Lo: 0-1	Exists	-	Nighttime illumination does not appear for audio units.
				-	Exists	Blown multipurpose fuse.
25	Input	ACC (ACC power supply)	System voltage	Exists	-	Screen display does not appear.
				-	Exists	Blown multipurpose fuse.
26	Input	+B	System voltage	Exists	-	Screen display does not appear.
				-	Exists	Blown multipurpose fuse.
27	Input	VSS	Hi: System voltage Lo: 0-1	Exists	Exists	Abnormal outside air temperature appears. (only diesel-powered vehicles)
28	-	GND (earth)	-	Exists	-	Screen display does not appear.
29, 30	-	-	-	-	-	-
31	-	GND-TEMP		Exists	Exists	Outside air temperature does not appear.
32	Input	ILL-		Exists	Exists	The display screen can not be dimmed.
33	Input	FUEL GAUGE	-		Exists	Abnormal cruising distance appears.
34, 35	-	-	-	-	-	-
36	Input	IG1	Hi: System voltage	Exists	-	Communication with engine-ECU is impossible. Abnormal driving data values appear.
				-	Exists	Communication with engine-ECU is impossible. Abnormal driving data values appear. Blown multipurpose fuse.

INSPECTION CHART CLASSIFIED BY TROUBLE SYMPTOMS

Related unit	Trouble Symptom	Inspection procedure No.	Reference page
Malfunction of center display, related sensors, and wiring harnesses	No display appears after the ignition key is turned to the ACC position.	1	54A-62
	Outside air temperature does not appear or abnormal outside air temperature appears.	2	54A-62
	Abnormal vehicle speed is displayed on the service mode.	3	54A-63
	Abnormal driving data are displayed: ● Abnormal average fuel consumption (momentary fuel consumption) and average vehicle speed ● Abnormal cruising distance	4	54A-64
	Clock runs fast or slow.	5	54A-64
	The display screen is dim.	6	54A-65
	Air conditioning display does not apper.	7	54A-66

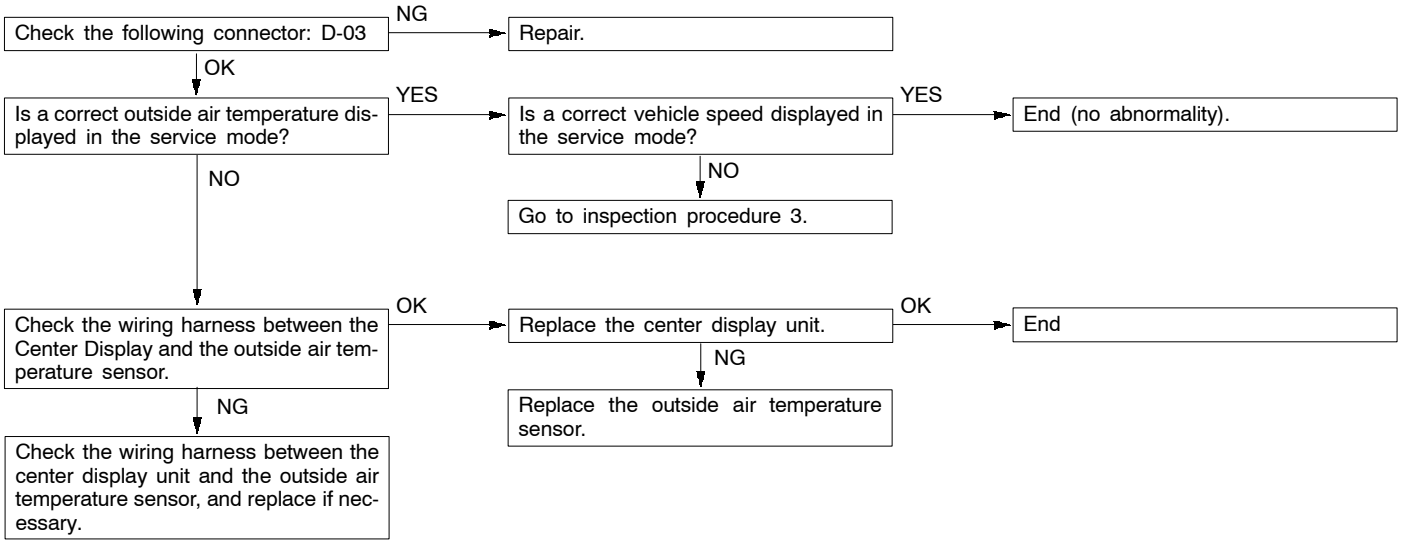
INSPECTION PROCEDURE 1

No display appears after the ignition key is turn to the ACC position.

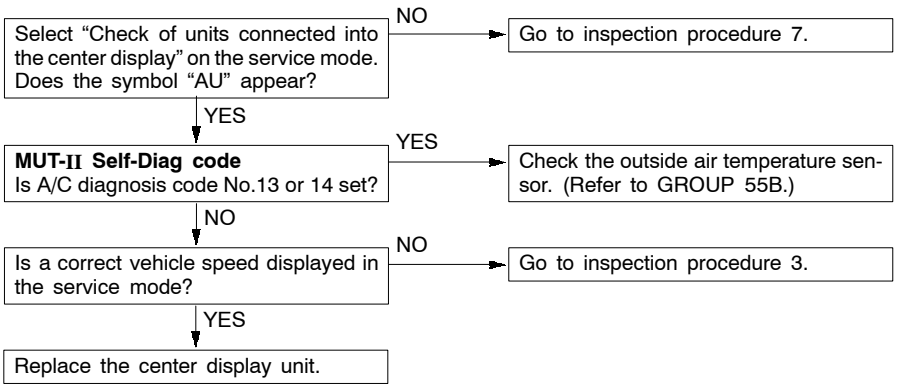


INSPECTION PROCEDURE 2

Outside air temperature does not appear or abnormal outside air temperature appears.
<Vehicles without automatic air conditioner system>



<Vehicles with automatic air conditioning system>

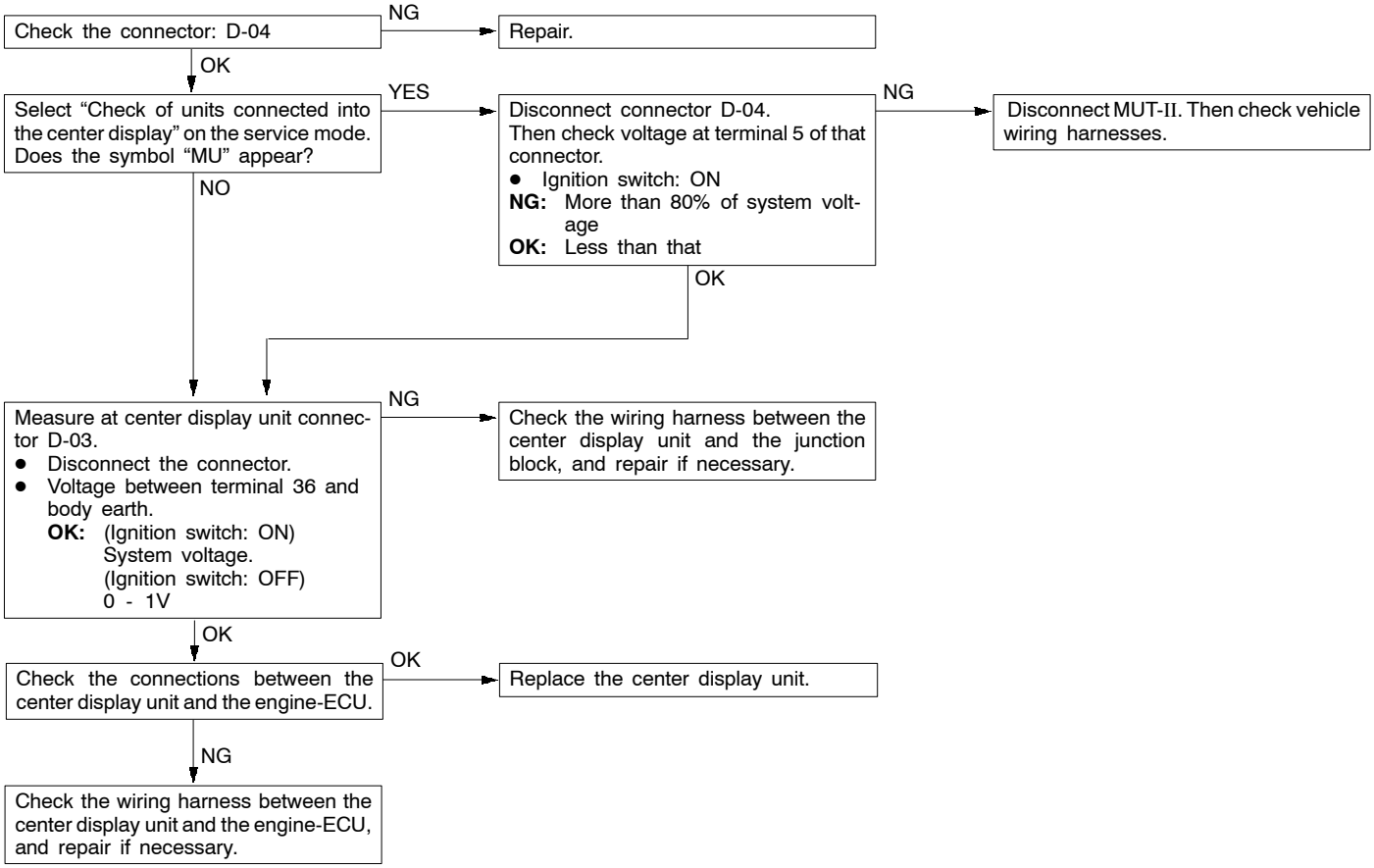


NOTE: It is necessary to drive for a while and get accurate temperature in display if you pass a area in which temperature is much different. It might show high temperature on display in case it is high around sensor due to high temperature of engine after battery is exchanged, or a display unit is reinstalled.

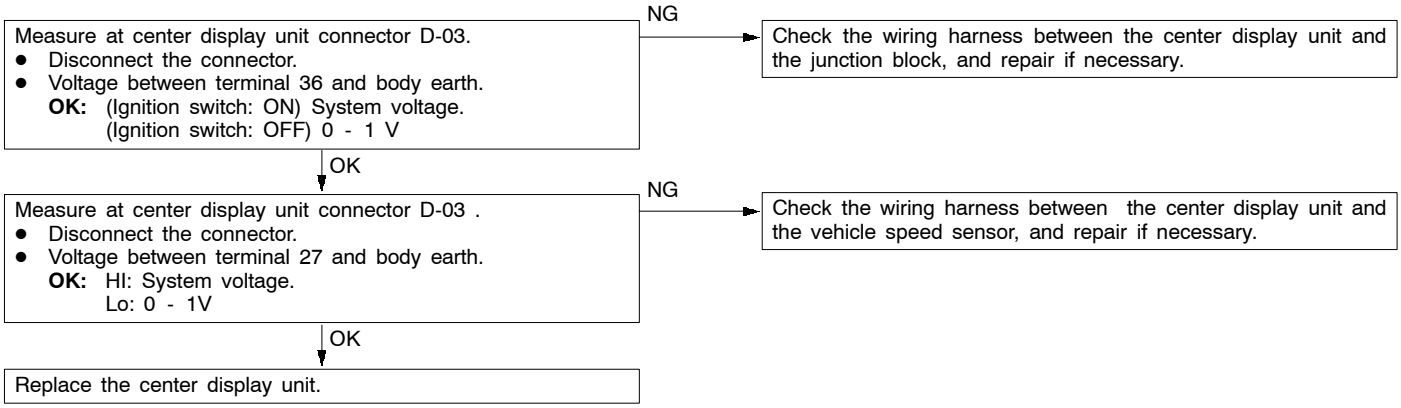
INSPECTION PROCEDURE 3

Abnormal vehicle speed is displayed on the service mode.

<Petrol-powered vehicles>



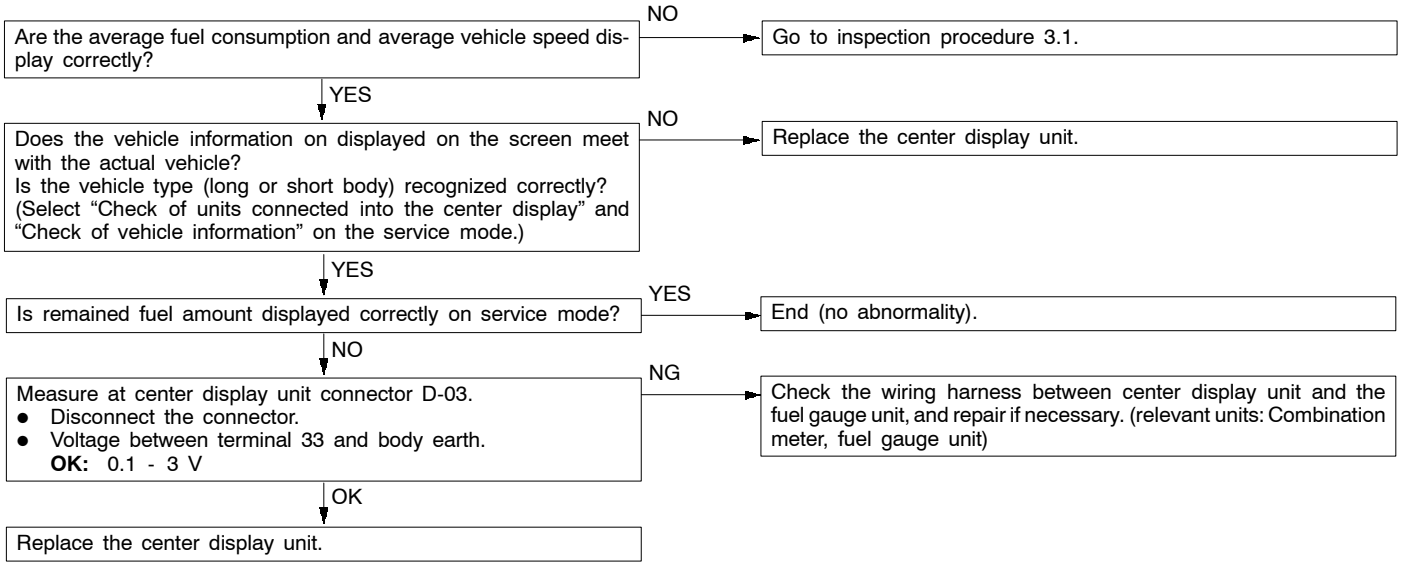
<Diesel-powered vehicles>



INSPECTION PROCEDURE 4

Abnormal driving data are displayed:

- Abnormal average fuel consumption (momentary fuel consumption) and average vehicle speed
- Abnormal cruising distance

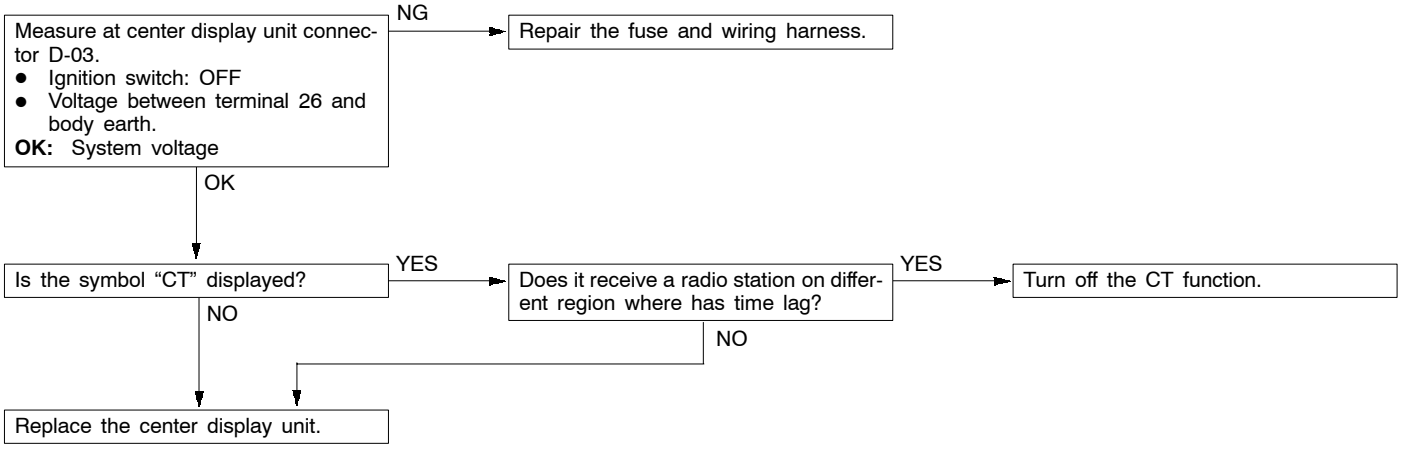


NOTE

(1) If the remained fuel amount is so small that the fuel gauge unit can not detect a correct amount, incorrect cruising range may be displayed.
(2) Fuel consumption is updated each time fuel is supplied. Furthermore, the cruising range depends on road and driving conditions.

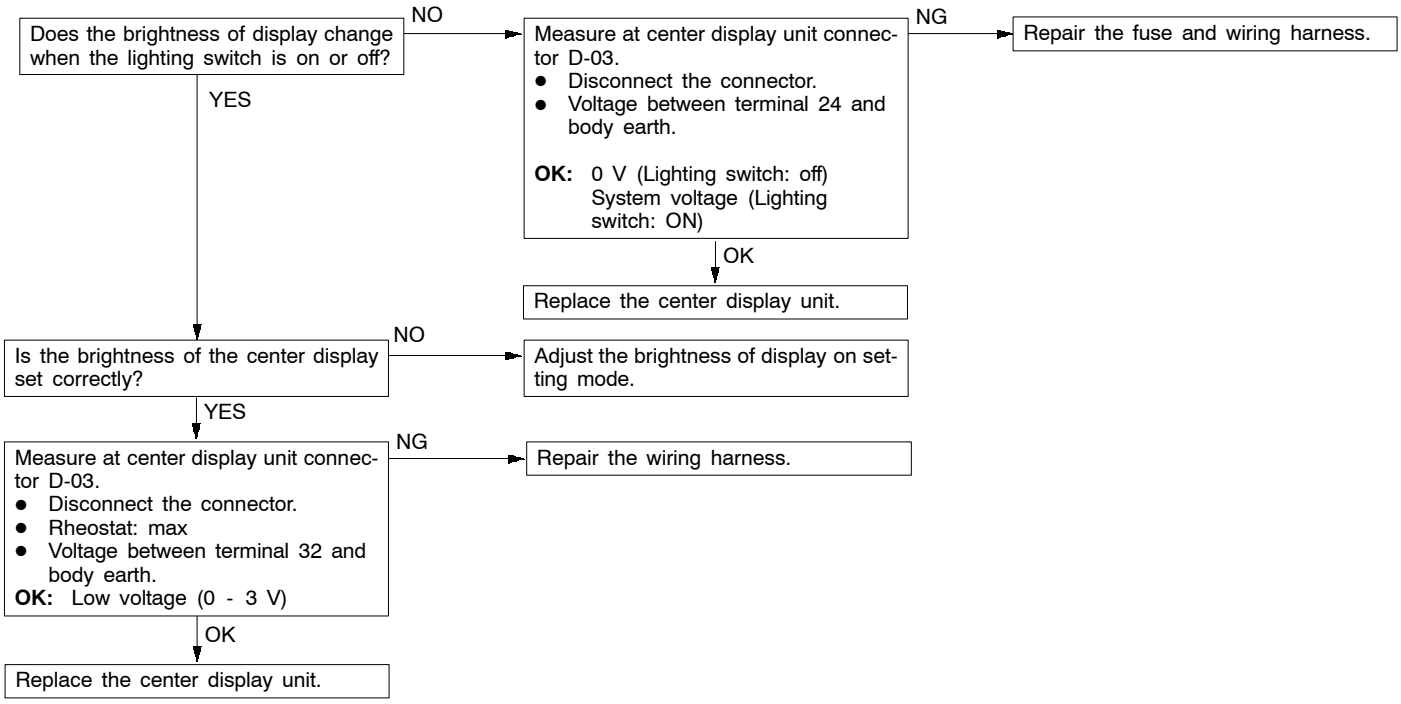
INSPECTION PROCEDURE 5

Clock runs fast or slow.



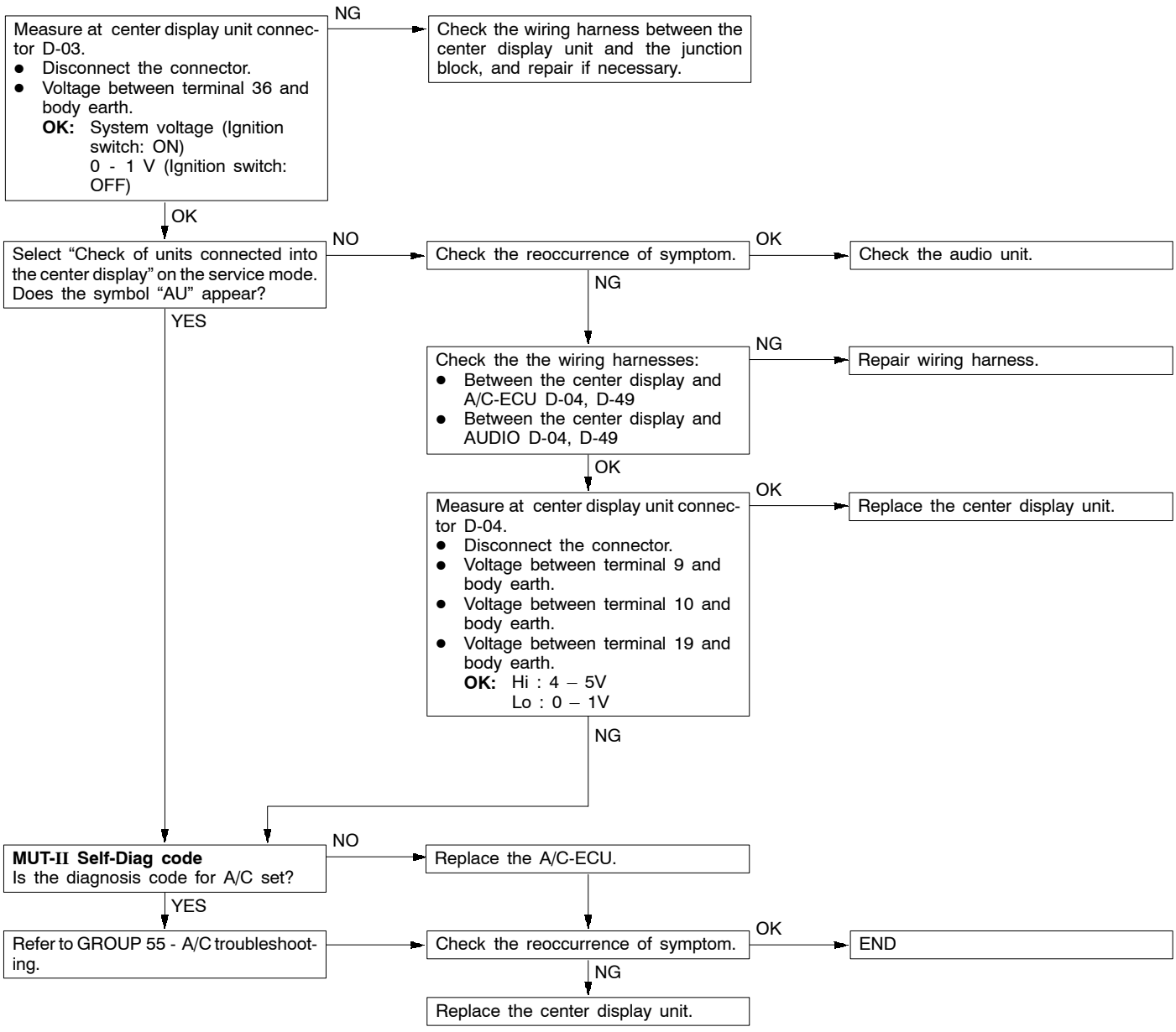
INSPECTION PROCEDURE 6

The display screen is dim.



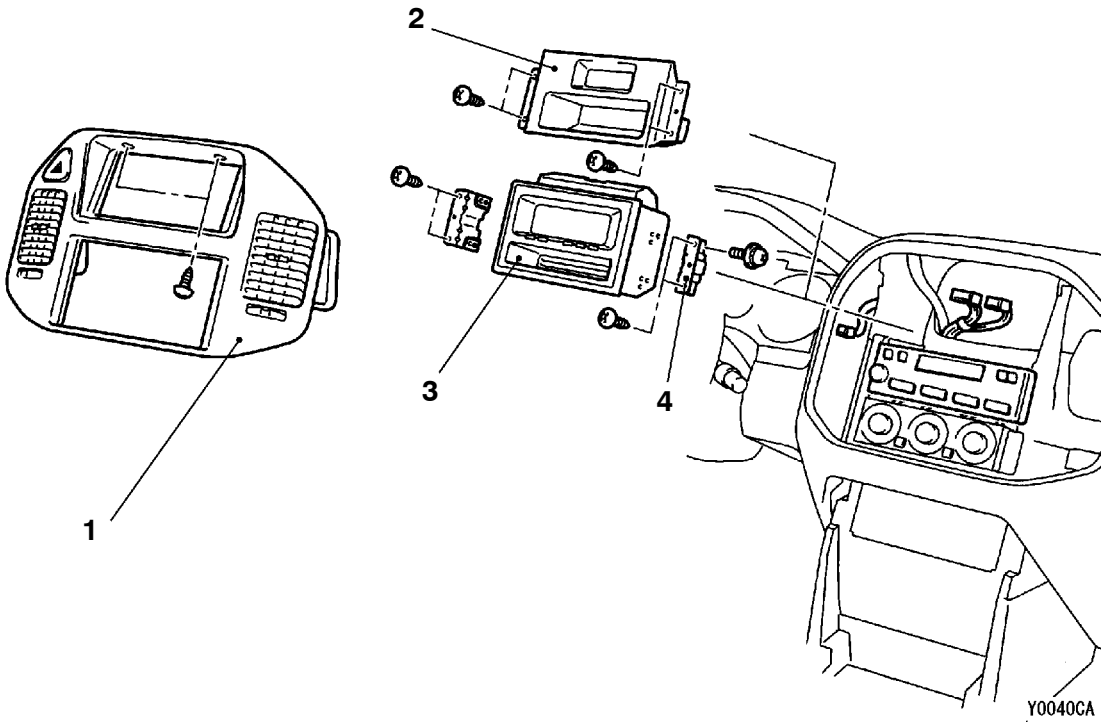
INSPECTION PROCEDURE 7

Air conditioning display is not available.



CLOCK OR CENTER DISPLAY

REMOVAL AND INSTALLATION



Removal steps

1. Center panel
   (Refer to GROUP 52A - Instrument Panel.)
2. Clock
3. Center display
4. Bracket

RADIO/TAPE PLAYER

TROUBLESHOOTING

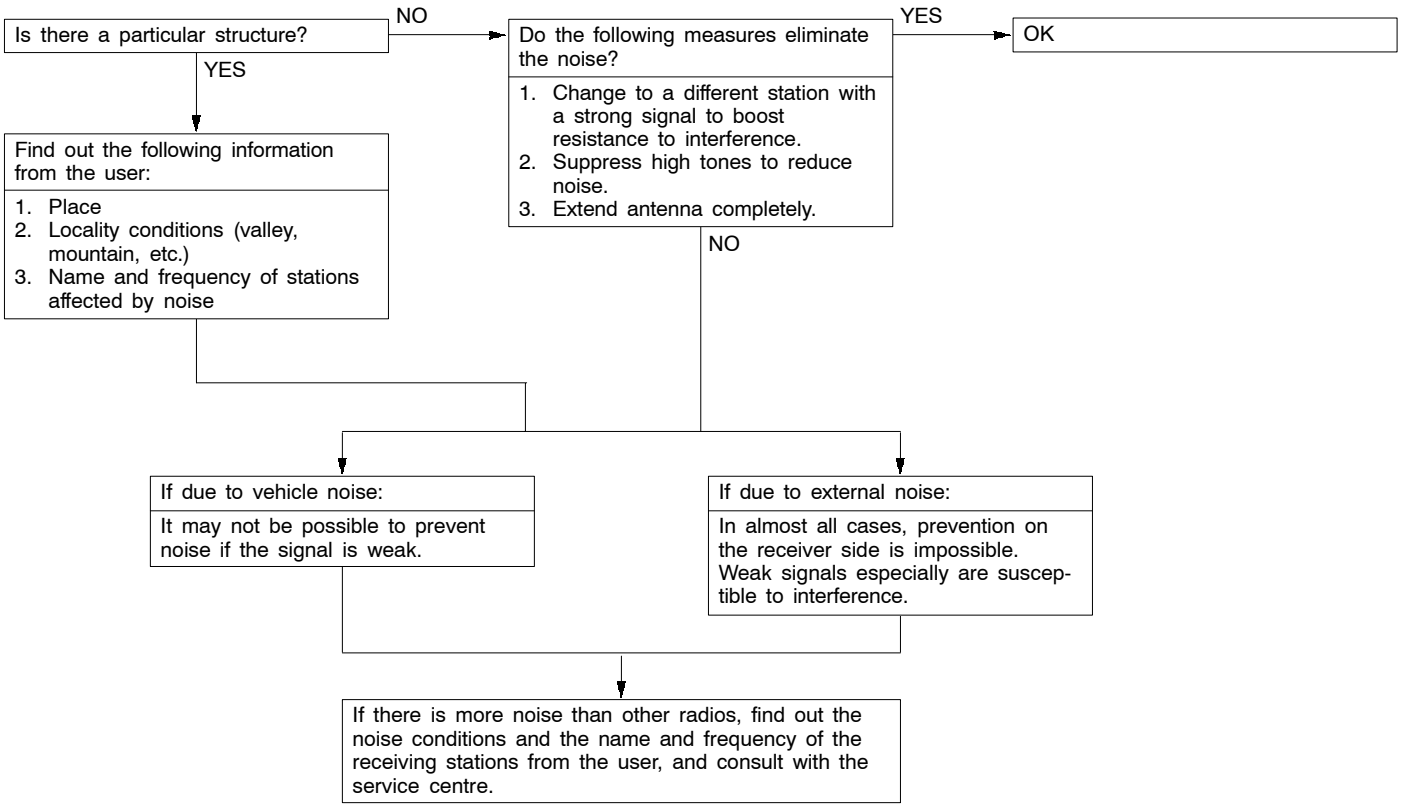
QUICK-REFERENCE TROUBLESHOOTING CHART

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 UKW/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 UKW/MW/LW or no sound from UKW/MW/LW.	B-3
	Insufficient sensitivity.	B-4
	Distortion on UKW/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

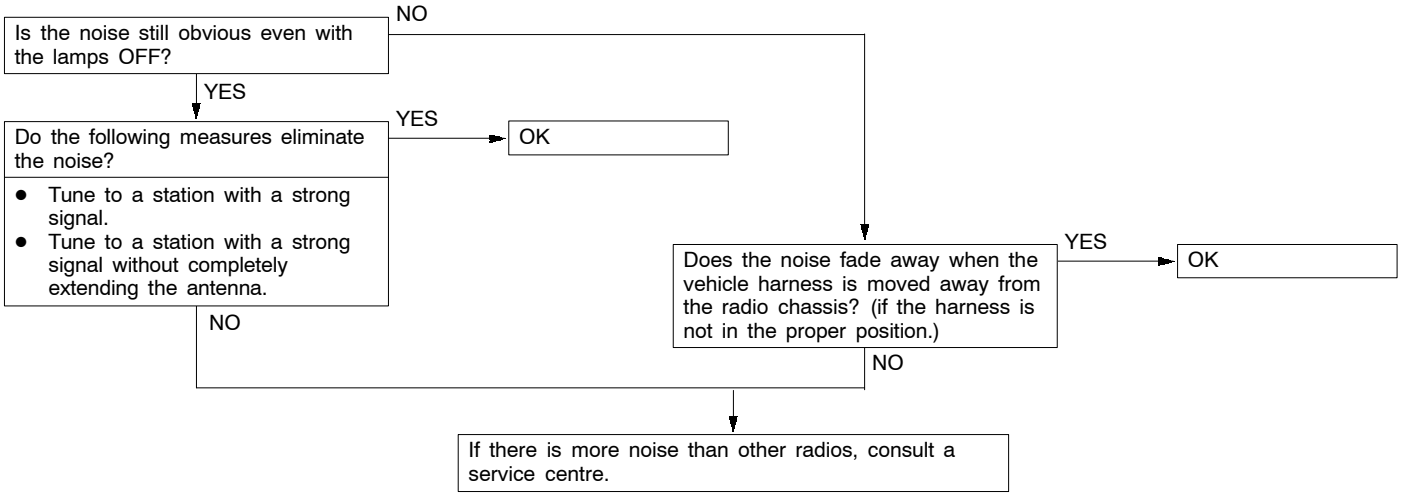
A-1 Noise appears at certain places when travelling.



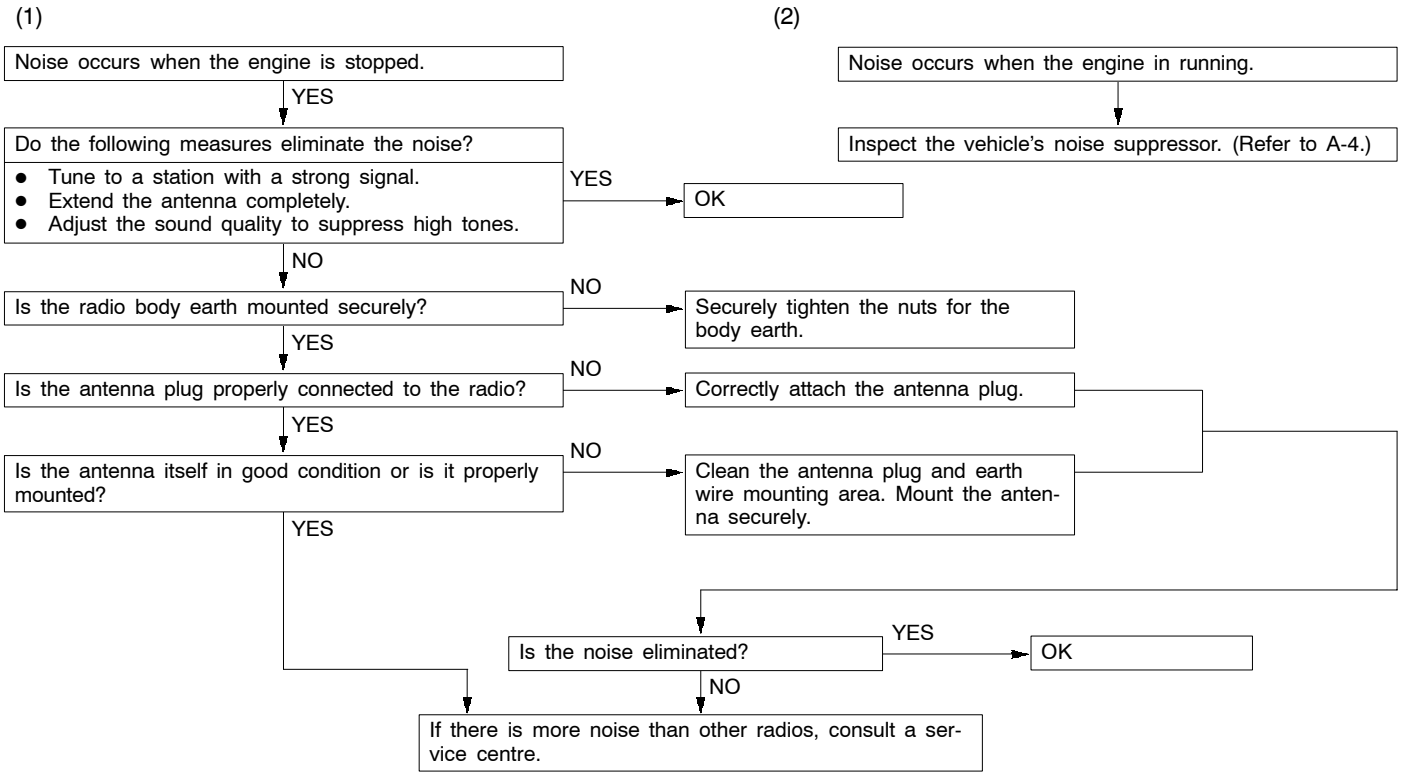
A-2 Mixed with noise, only at night.

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 UKW/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
UKW/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, 2, 3 and 4 on P.54-58 and 54-59.) • Check or replace the noise capacitor.
Other electrical components	-	Noise may appear as electrical components become older.	Repair or replace electrical components.
Static electricity (Cracking, crinkling)	• Disappears when the vehicle is completely stopped. • Severe when the clutch is engaged.	Occurs when parts or wiring move for some reason and contact metal parts of the body.	Return parts or wiring to their proper position.
	• Various noises are produced depending on the body part of the vehicle.	Due to detachment from the body of the front hood, bumpers, exhaust pipe and muffler, suspension, etc.	Tighten the mounting bolts securely. Cases where the problem is not eliminated by a single response to one area are common, due to several body parts being imperfectly earthed.

Caution

1. **Connecting a high tension cable to the noise filter may destroy the noise filter and should never be done.**
2. **Check that there is no external noise. Since failure caused by this may result in misdiagnosis due to inability to identify the noise source, this operation must be performed.**
3. **Noise prevention should be performed by suppressing strong sources of noise step by step.**

NOTE

1. Capacitor
   The capacitor does not pass D.C. current, but as the number of waves increases when it passes A.C. current, impedance (resistance against A.C.) decreases, and current flow is facilitated. A noise suppressing condenser which takes advantage of this property is inserted between the power line for the noise source and the earth. This suppresses noise by earthing the noise component (A.C. or pulse signal) to the body of the vehicle.
2. Coil
   The coil passes D.C. current, but impedance rises as the number of waves increases relative to the A.C. current. A noise suppressing coil which takes advantage of this property is inserted into the power line for the noise source, and works by preventing the noise component from flowing or radiating out of the line.

Fig. 1 <4D56>

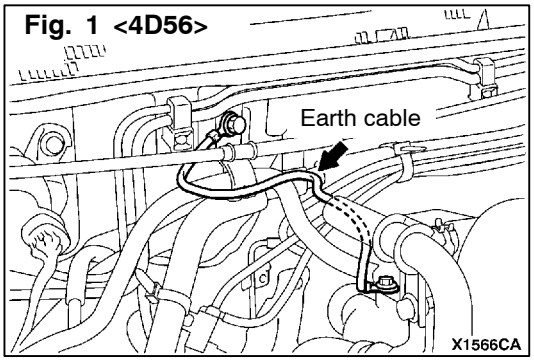


Fig. 2 <4M41>

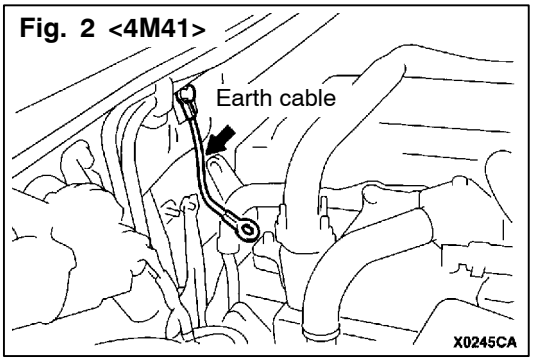


Fig. 3 <6G74-GDI>

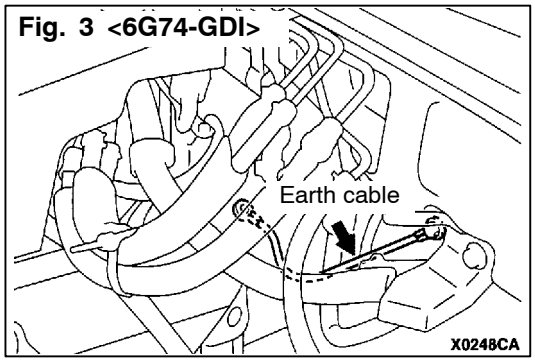
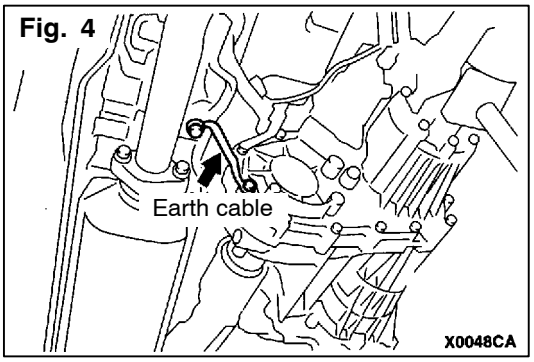
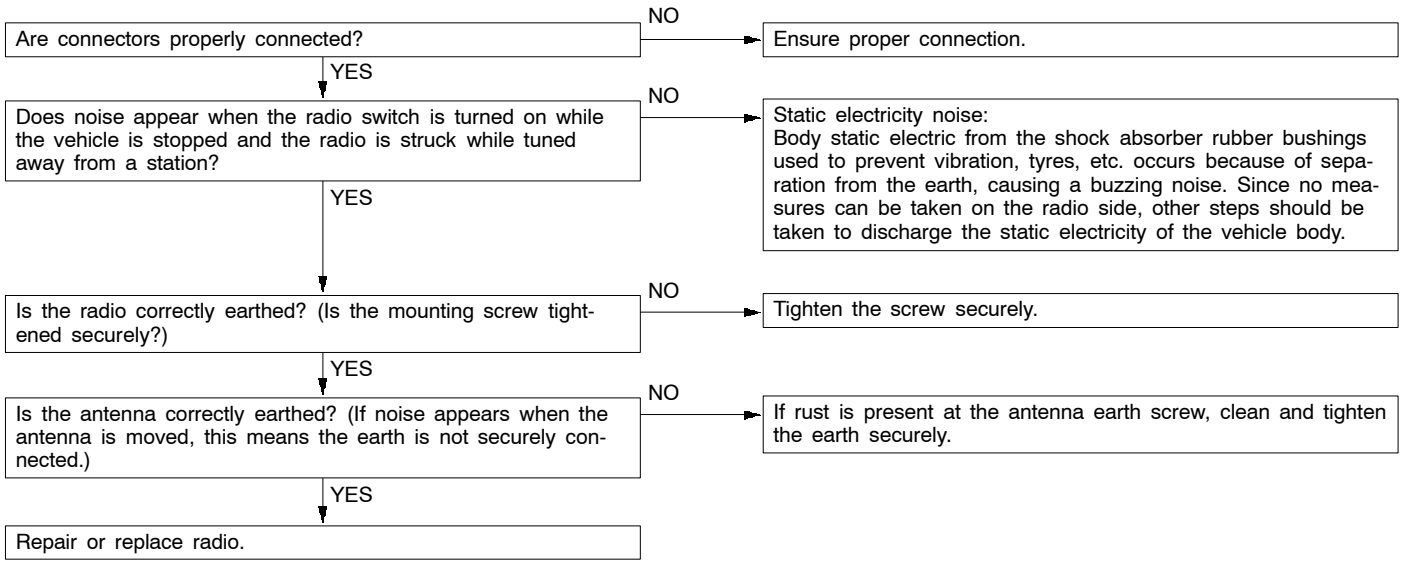


Fig. 4



A-5 Some noise appears when there is vibration or shocks during travelling.



A-6 Ever-present noise.

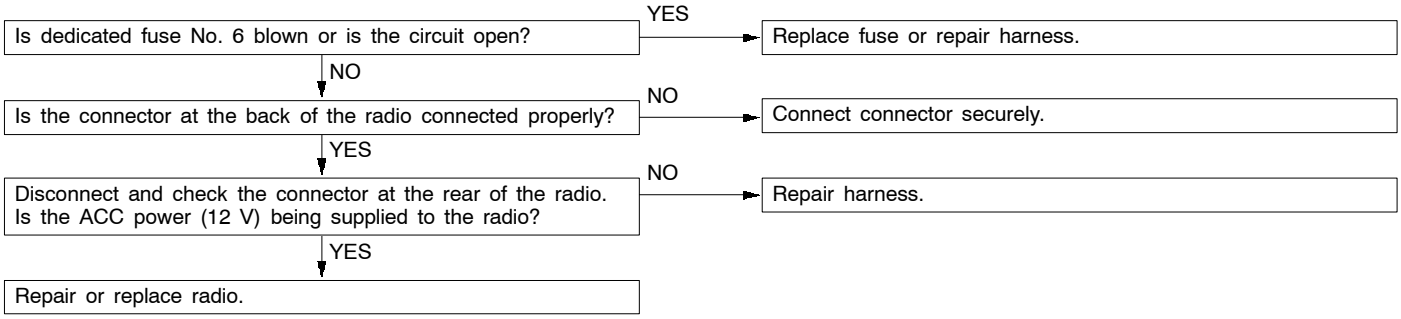
Noise is often created by the following factors, and often the radio is OK when it is checked individually.

- Travelling conditions of the vehicle
- Terrain of area travelled through
- Surrounding buildings
- Signal conditions
- Time period

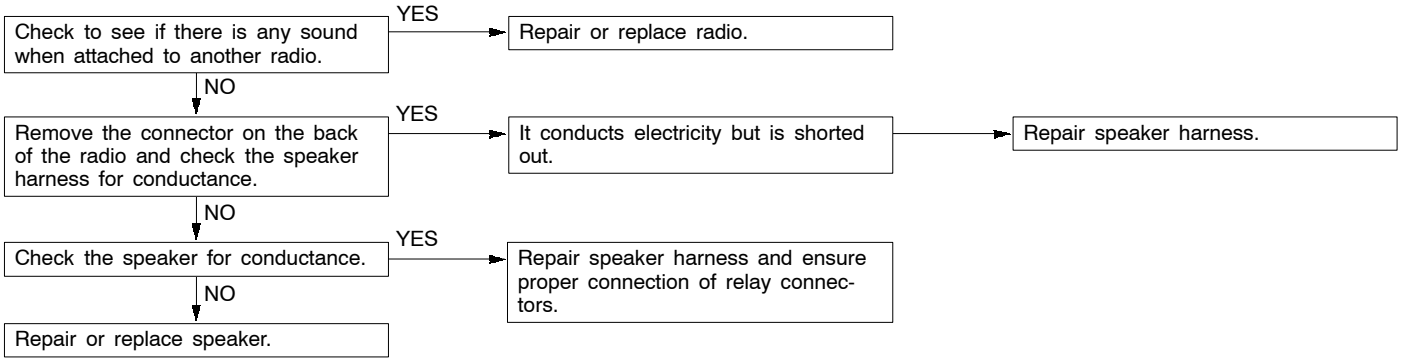
For this reason, if there are still problems with noise even after the measures described in steps A-1 to A-8 have been taken, get information on the factors listed above as well as determining whether the problem occurs with UKW/MW/LW, the station names, frequencies, etc., and contact a service centre.

B. RADIO

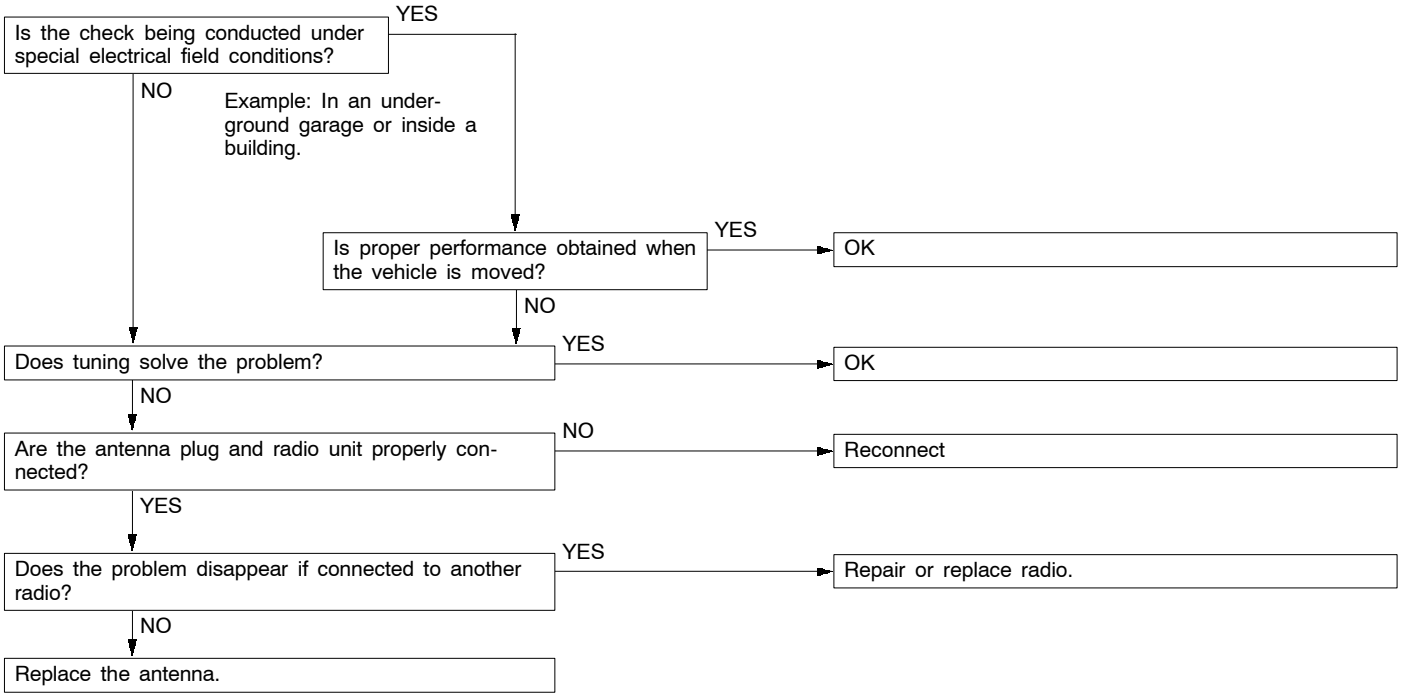
B-1 No power is supplied when the switch is set to ON.



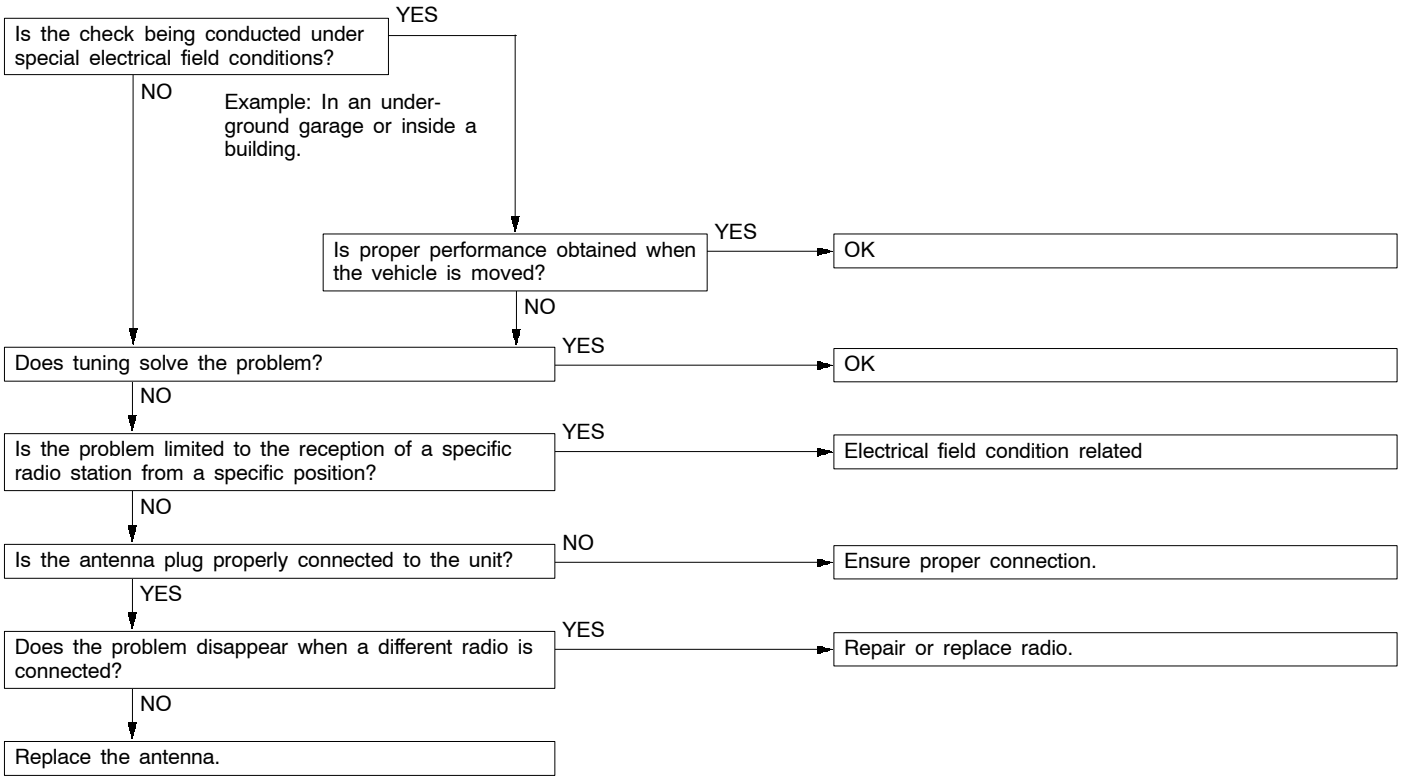
B-2 No sound from one speaker.



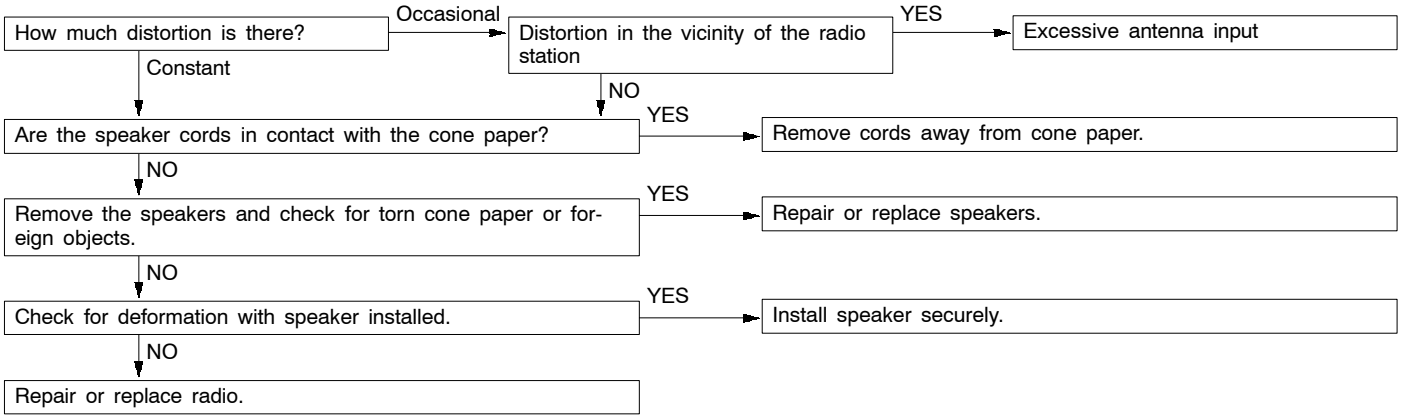
B-3 There is noise but no reception for UKW/MW/LW or no sound from UKW/MW/LW.



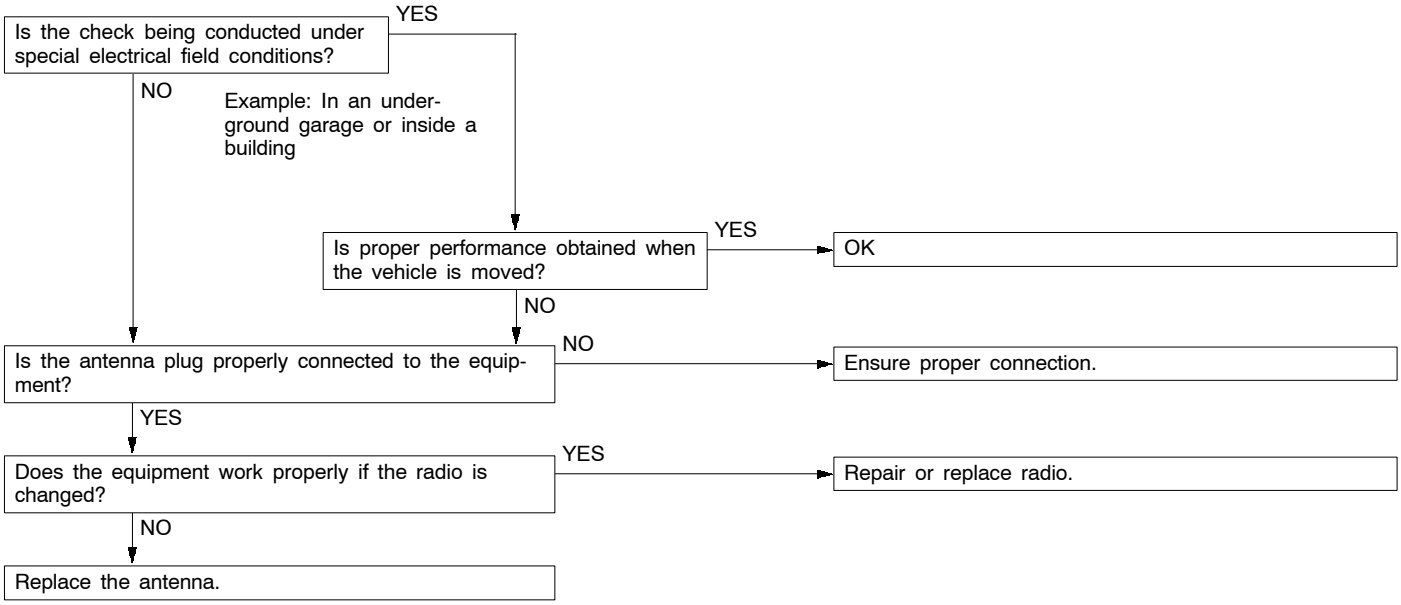
B-4 Insufficient sensitivity.



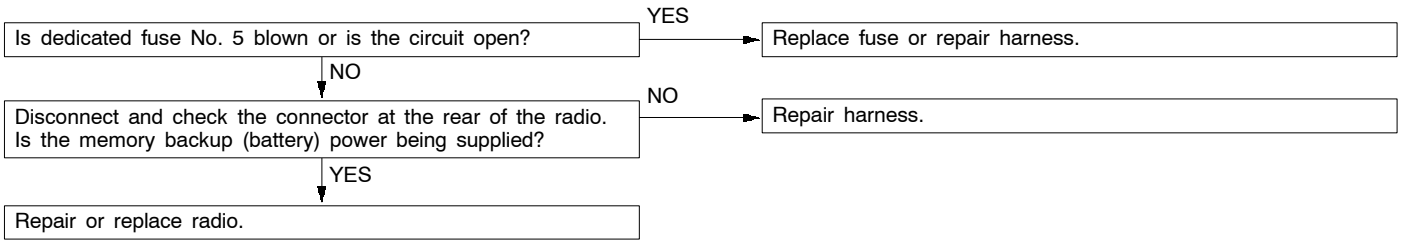
B-5 Distortion on UKW/MW/LW.



B-6 Too few automatic select stations.

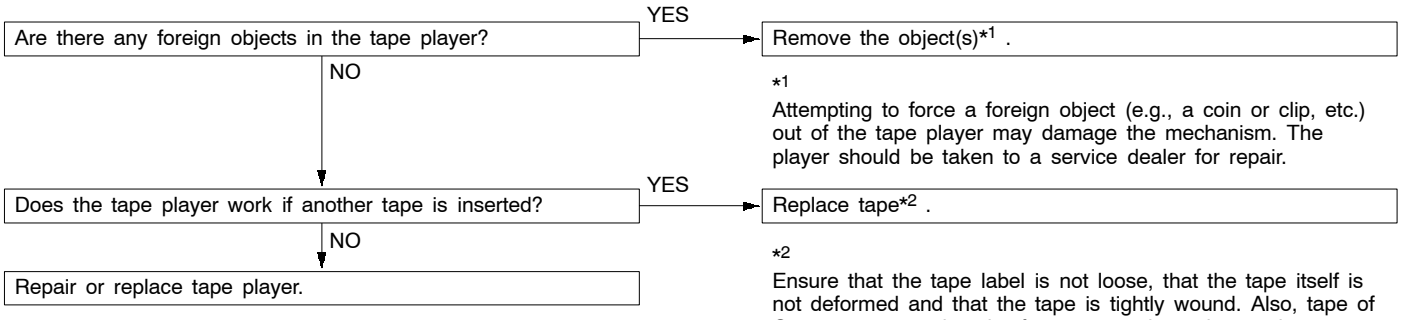


B-7 Insufficient memory (preset stations are erased).



C. TAPE PLAYER

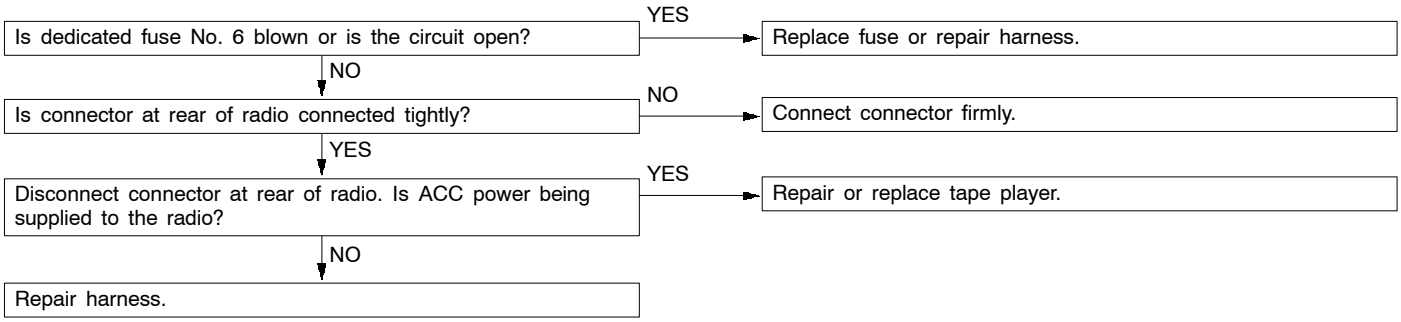
C-1 Cassette tape will not be inserted.



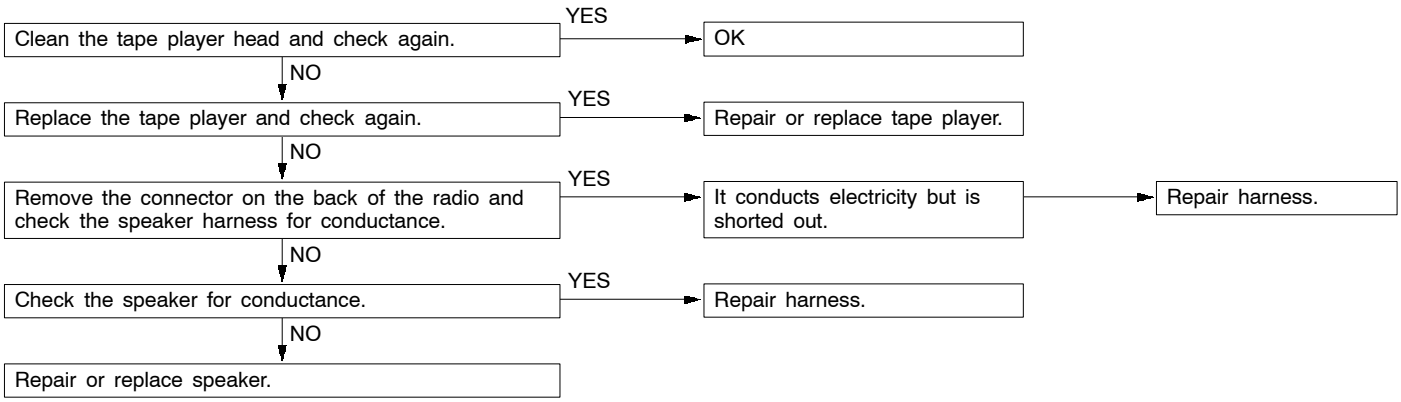
*1
Attempting to force a foreign object (e.g., a coin or clip, etc.) out of the tape player may damage the mechanism. The player should be taken to a service dealer for repair.

*2
Ensure that the tape label is not loose, that the tape itself is not deformed and that the tape is tightly wound. Also, tape of C-120 or greater length often get caught in the mechanism and should not be used.

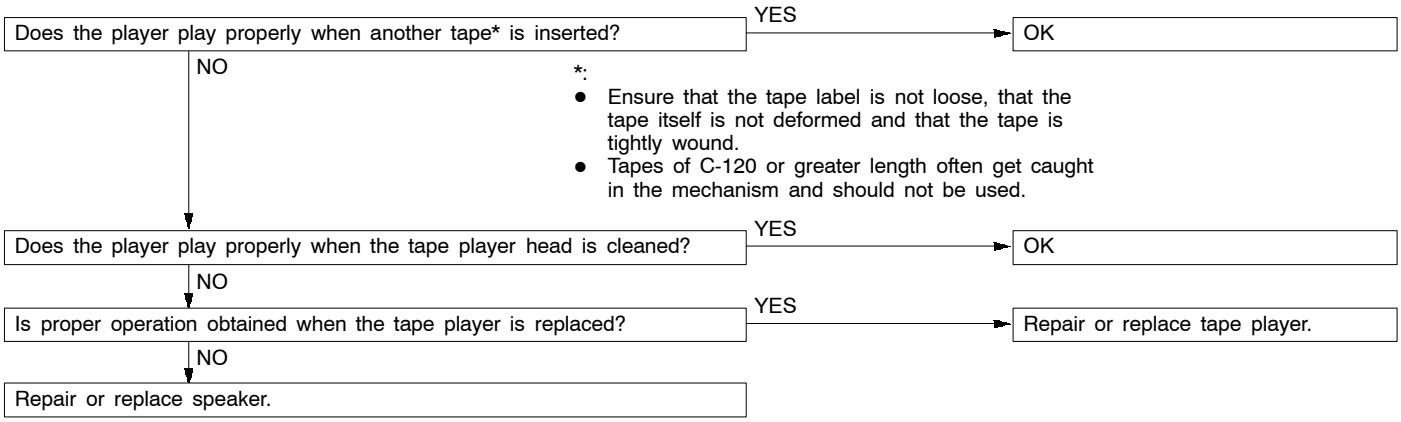
C-2 No sound (even after a tape has been inserted).



C-3 No sound from one speaker.



C-4 Sound quality is poor, or sound is weak.



C-5 Cassette tape will not be ejected.

The problems covered here are all the result of the use of a bad tape (deformed or not properly tightened) or of a malfunction of the tape player itself. Malfunctions involving the tape becoming caught in the mechanism and ruining the case are also possible, and attempting to force the tape out of the player can cause damage to the mechanism. The player should be taken to a service dealer for repair.

C-6 Uneven revolution. Tape speed is fast or slow.

Does the player play OK if the tape*1 is changed?
- YES → OK
- NO

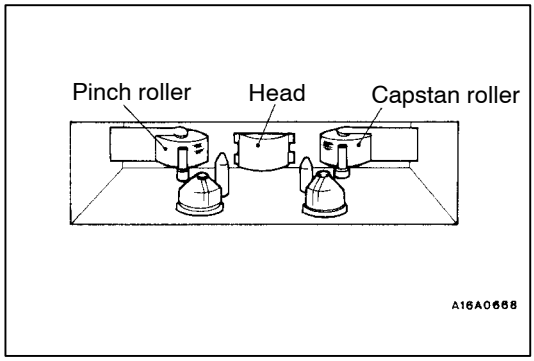
*1
Ensure that the tape label is not loose, that the tape itself is not deformed and that the tape is tightly wound. Also, tape of C-120 or greater length often get caught in the mechanism and should not be used.

Are there any foreign objects *2 inside the tape player?
- YES → Remove foreign object(s).
- NO

*2
Attempting to force a foreign object (e.g., a coin or clip, etc.) out of the tape player may damage the mechanism. The player should be taken to a service dealer for repair.

Is the head or capstan roller dirty? (Refer to the illustration below.)
- YES → Clean.
- NO

Repair or replace tape player.



C-7 Faulty auto reverse.

Does the player play OK if the tape* is changed?
- YES → OK
- NO

*:
- Ensure that the tape label is not loose, that the tape itself is not deformed and that the tape is tightly wound.
- Tapes of C-120 or greater length often get caught in the mechanism and should not be used.

Does the problem only occur while the vehicle is being driven?
- NO → Repair or replace tape player.
- YES

Is the tape player properly installed to the vehicle?
- NO → Ensure tape player installation.
- YES

Repair or replace tape player.

C-8 Tape gets caught in mechanism*1.

*1
When the tape is caught in the mechanism, the case may not eject. When this occurs, do not try to force the tape out as this may damage the tape player mechanism. Take the cassette to a service dealer for repair.

Does the player play OK if the tape*2 is changed?

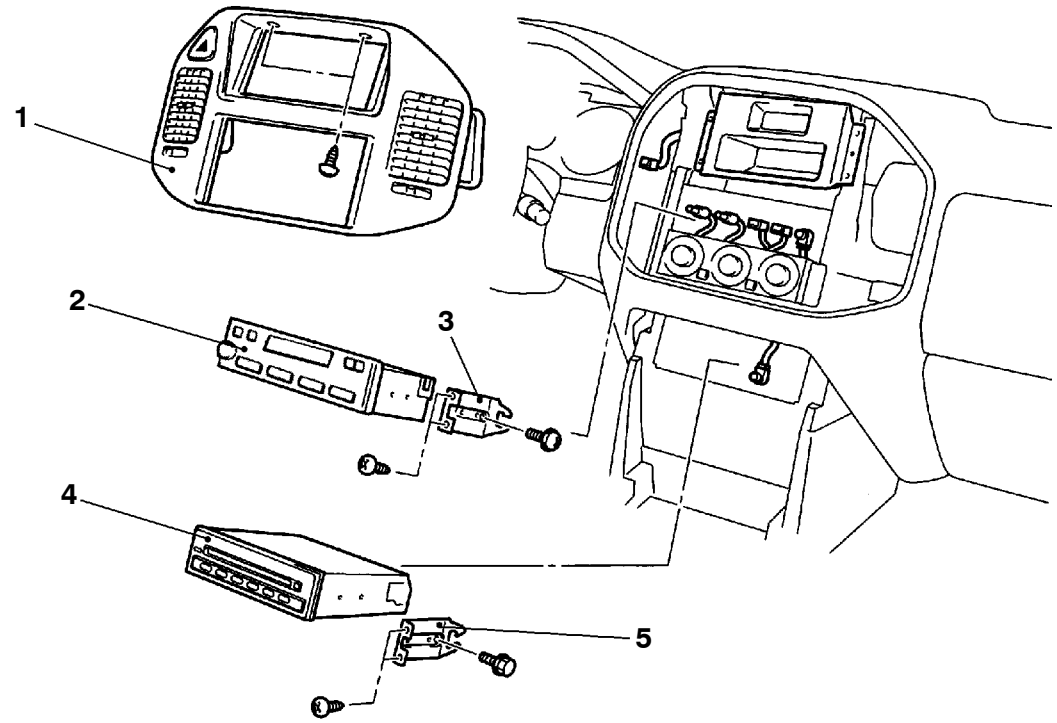
YES → Tape used is bad.

NO → Repair or replace tape player.

*2
Ensure that the tape label is not loose, that the tape itself is not deformed and that the tape is tightly wound. Also, tapes of C-120 or greater length often get caught in the mechanism and should not be used.

RADIO AND CD AUTO CHANGER

REMOVAL AND INSTALLATION



Radio removal steps

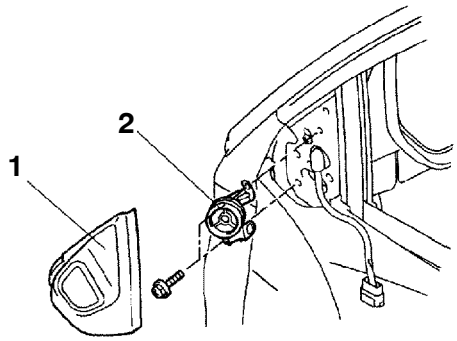
1. Center panel
   (Refer to GROUP 52A - Instrument Panel.)
2. Radio/tape player
3. Radio/tape player bracket

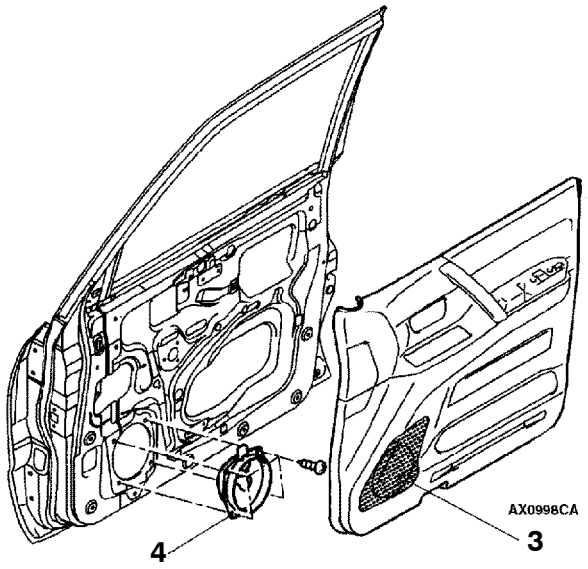
CD auto changer removal steps

- Lower center panel
  (Refer to GROUP 52A - Instrument Panel.)
4. CD auto changer
5. CD auto changer bracket

FRONT SPEAKERS

REMOVAL AND INSTALLATION





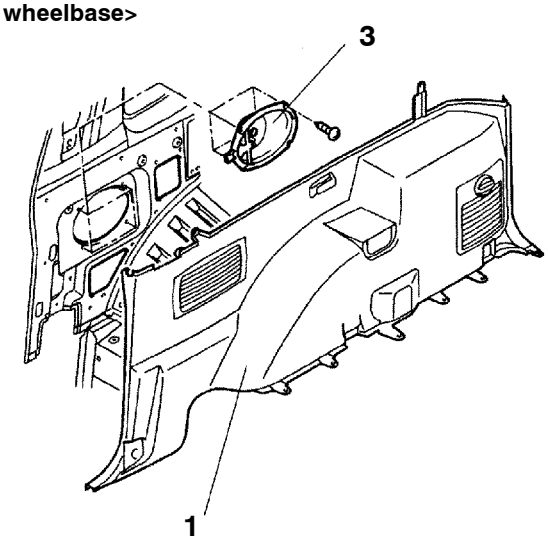
Tweeter removal steps
1. Delta inner cover
2. Tweeter

Front door speaker removal steps
3. Front door trim (Refer to GROUP 42.)
4. Front door speaker

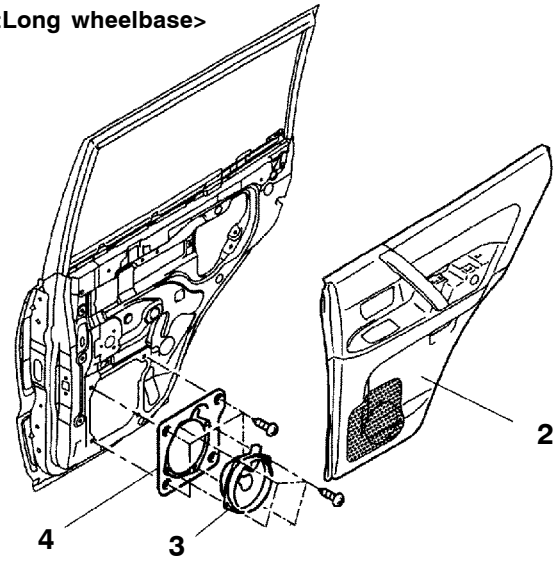
REAR SPEAKERS

REMOVAL AND INSTALLATION

<Short wheelbase>



<Long wheelbase>

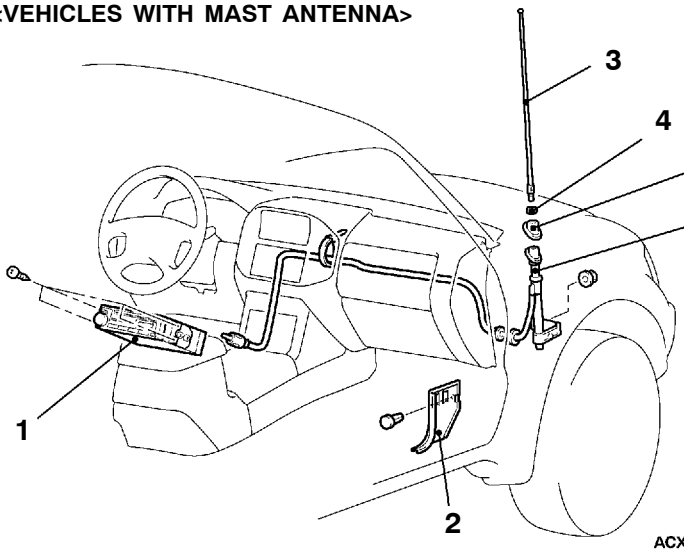


Removal steps
1. Lower quarter trim (Refer to GROUP 52A - Instrument Panel.)
2. Rear door trim (Refer to GROUP 52A - Instrument Panel.)
3. Rear speakers
4. Rear speaker bracket

ANTENNA

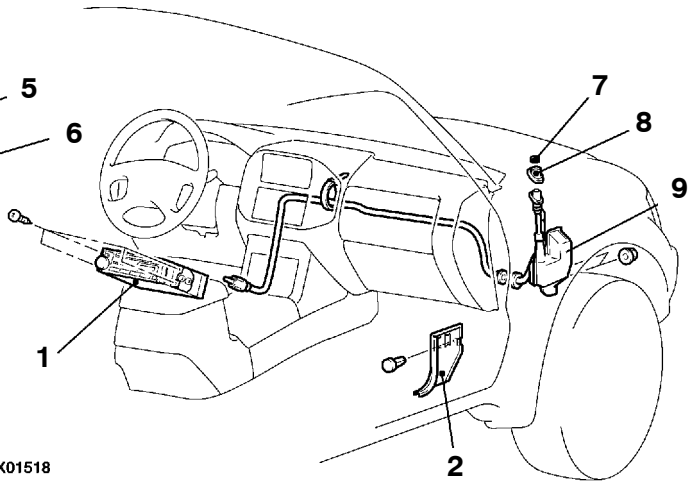
REMOVAL AND INSTALLATION

<VEHICLES WITH MAST ANTENNA>

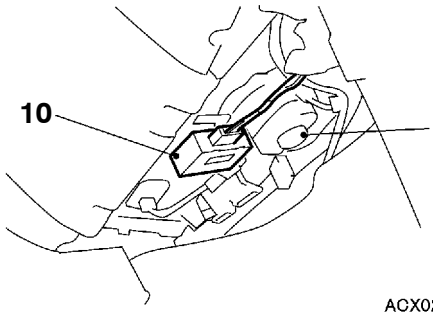


ACX01518

<VEHICLES WITH MOTOR ANTENNA>



ACX01519



ACX02075AB

Mast antenna removal steps

- Center panel (Refer to GROUP 52A – Instrument Panel.)

1. Radio/tape player (Refer to P.54-81.)
2. Scuff plate, cowl side trim (Refer to GROUP 52A.)
3. Mast antenna
4. Mounting nut
5. Base

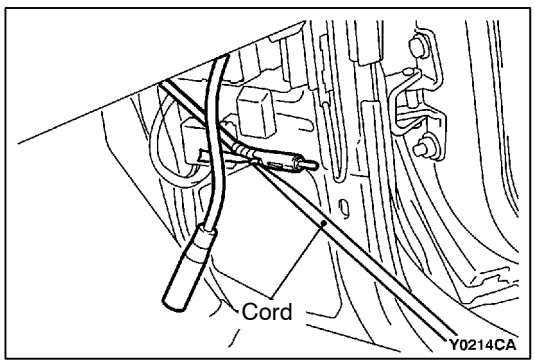
◀A▶ 6. Mast antenna body

Motor antenna removal steps

- Center panel (Refer to GROUP 52A – Instrument Panel.)

1. Radio/tape player (Refer to P.54-81.)
2. Scuff plate, cowl side trim (Refer to GROUP 52A.)
7. Ring nut
8. Base

◀B▶ 9. Motor antenna body
10. Motor antenna-ECU



REMOVAL SERVICE POINTS

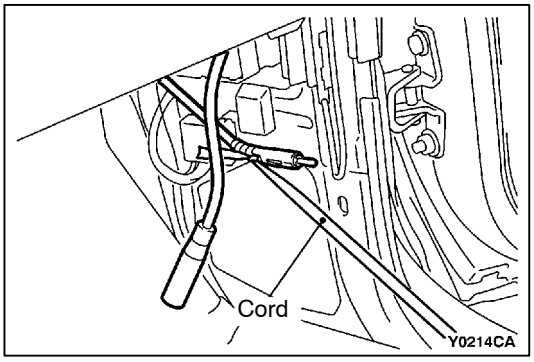
◀A▶ MAST ANTENNA BADY REMOVAL

Carry out the following procedure to allow the feeder cable of the base antenna assembly for an easy installation.

1. Tie the cord with the end of the feeder cable.
2. Pull out the base antenna assembly slowly until the pipe end appears.
3. Insert the cord into the hole of the pipe end to wrap the cord around with a plastic tape.

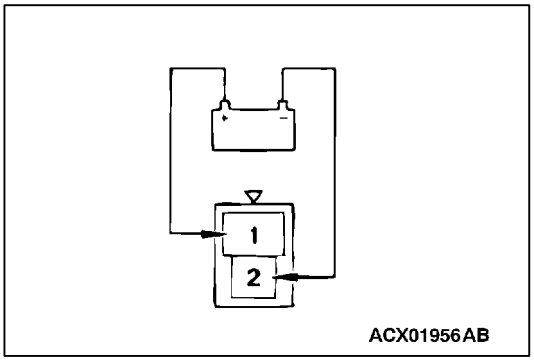
Caution
Ensure that the cord is wrapped tightly to prevent it from coming off.

4. Pull out the base antenna assembly slowly to remove.



◀A▶ MOTOR ANTENNA BADY REMOVAL

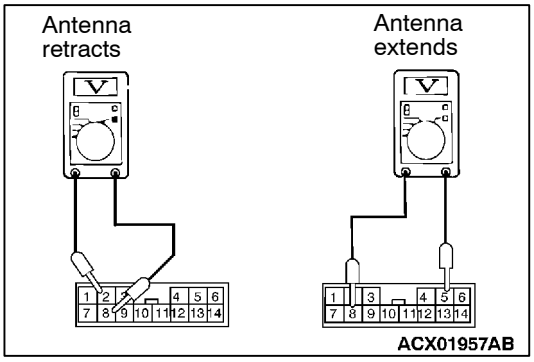
Pull out the cord after tying it with the feeder cable of the base antenna ass'y for an easy installation.



INSPECTION

MOTOR ANTENNA CHECK

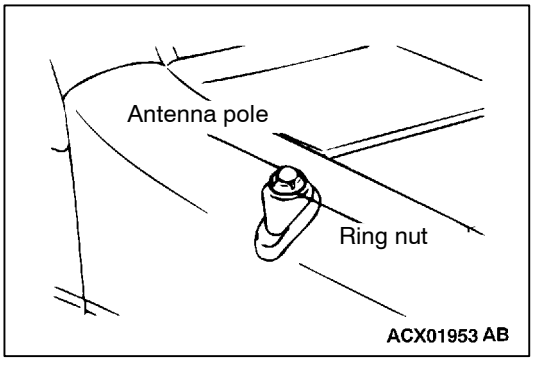
Check the antenna for extension if the connector of the motor antenna-ECU is disconnected, the (+) terminal of the battery is connected to terminal No.1, and the (-) terminal of the battery is connected to terminal No. 2. Check the antenna for retraction if the connection is reversed.



MOTOR ANTENNA-ECU CHECK

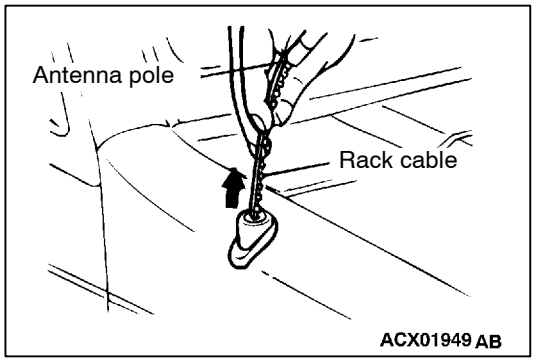
1. Remove the motor antenna-ECU mounting bolt.
2. With the ignition switch at the ACC or the ON position, check the voltage between the terminals during extension or retraction of the antenna by operating the radio switch.

Direction of antenna movement	Measurement terminal	Voltage (V)
Rectracting	2 - 8	10 - 13
Extending	8 - 5	10 - 13

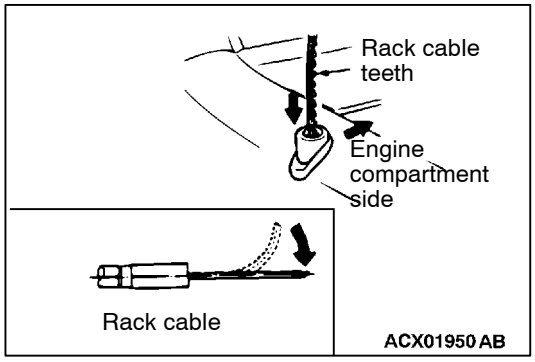


ANTENNA POLE REPLACEMENT

1. Remove ring nut.



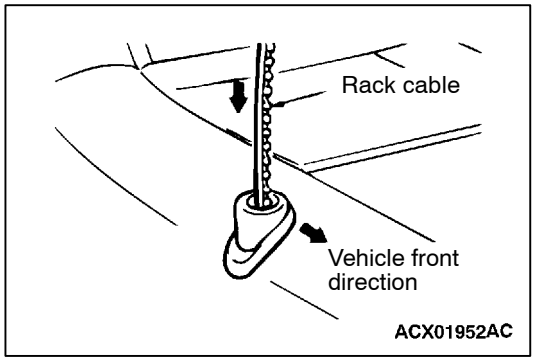
2. After the ignition switch is turned to the ACC or ON position, turn on the radio and extend the antenna pole to remove it with the rack cable.



3. Extend the antenna pole completely.

   NOTE
   If there is any bend at the motor end of the rack cable, repair the bend.

4. Face the teeth of the rack cable to the engine room side to push the rack cable into the motor assembly.

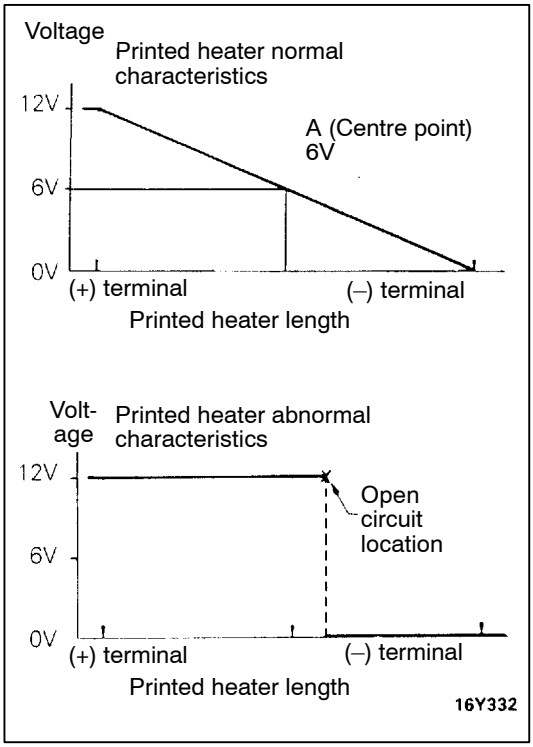


5. Rotate the teeth of the rack cable to the front of the vehicle (905 to the right) to engage the cable with the motor gears.
6. If the rack cable comes off easily by pulling it out slightly, it indicates that the rack cable does not engage with the motor gears. In that case, carry out the above-mentioned procedures in (3) and (4) after checking the end of the rack cable for bend again.
7. Set the antenna pole perpendicular and turn off the radio to wind the rack cable. Insert the antenna pole into the motor antenna side corresponding with winding the rack cable.

DEFOGGER

TROUBLESHOOTING <VEHICLE WITH AUTOMATIC AIR CONDITIONER>

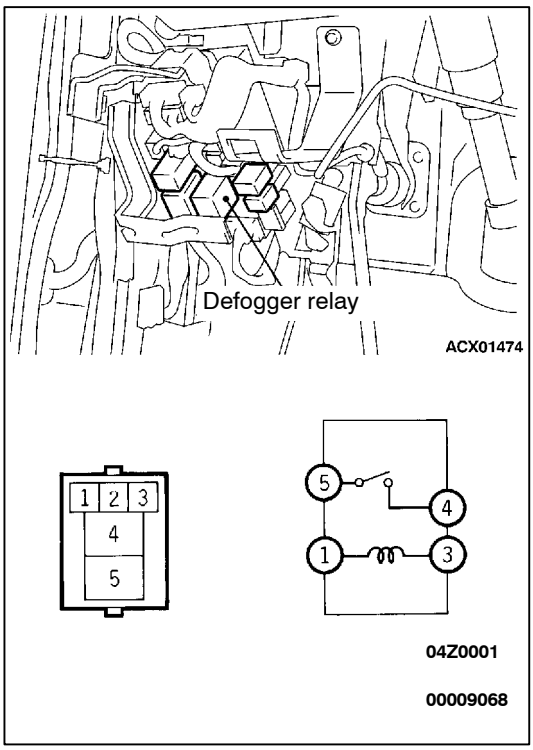
Refer to GROUP 55B.



ON-VEHICLE SERVICE

PRINTED HEATER CHECK

1. Run the engine at a speed of 2000 r/min to fully charge the battery, and then check the printed heater.
2. With the defogger switch turned on, use a multimeter to measure the voltages of each printed heater at centre point A on the window glass. The printed heater is okay if 6 V is displayed.
3. If a voltage of 12 V is indicated at point A, the open circuit location is between point A and the (-) terminal. Move the test bar gradually towards the (-) terminal to find the point where the voltage suddenly changes (0 V). The point where the voltage changes is the location of the open circuit.
4. In addition, if a voltage of 0 V is indicated at point A, the open circuit location is between point A and the (+) terminal. Use the same procedure as described above to find the point where the voltage changed to 12 V.



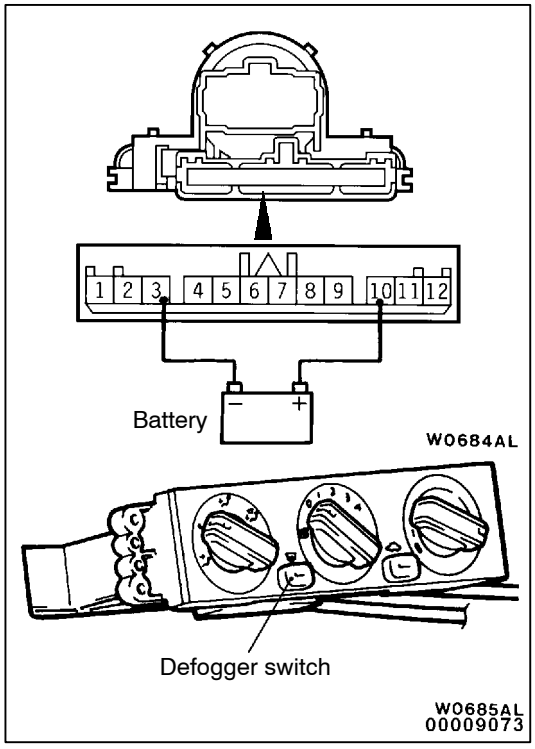
DEFOGGER RELAY CONTINUITY CHECK

Switch position	Terminal No.			
	1	3	4	5
When current is not supplied	○	○		
When current is supplied	⊕	⊖	○	○

DEFOGGER SWITCH <VEHICLE WITH MANUAL AIR CONDITIONER>

REMOVAL AND INSTALLATION

Refer to GROUP 55A - Heater Control Assembly, A/C Switch, Ventilation Switch.



INSPECTION

DEFOGGER SWITCH CONTINUITY CHECK

Check the battery voltage between terminal 3 and 10 while being energized.

Switch position	Terminal No.				
	3	10	-	11	12
OFF			IND		
ON			IND		

NOTE

After turning the defogger switch to the ON position, check the continuity between terminal 3 and 12 for 9 to 13 minutes. Afterwards, the switch is turned to the OFF position.

NOTES

Service Bulletins

Click on the applicable bookmark to select the Service Bulletin.

SERVICE BULLETIN

QUALITY INFORMATION ANALYSIS
OVERSEAS SERVICE DEPT. MITSUBISHI MOTORS CORPORATION

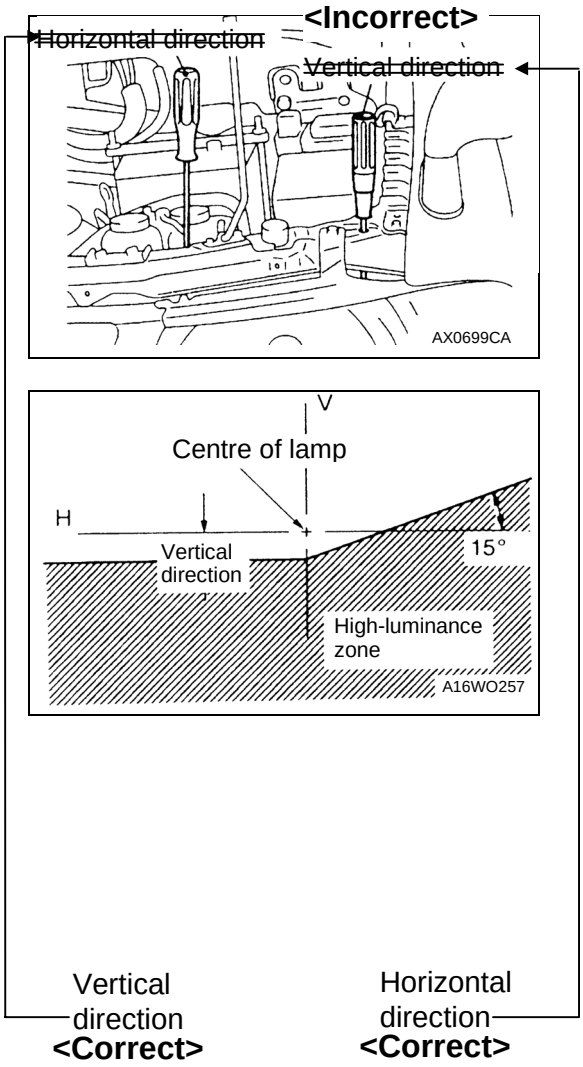
SERVICE BULLETIN	**No.:** MSB-00E54-506	
	Date: 2000-11-30	**<Model>** (EC)PADERO/ MONTERO(V60,70) **<M/Y>** 01-10
Subject: CORRECTION OF ERRORS IN ILLUSTRATION FOR HEADLAMP AIMING ADJUSTMENT		
Group: CHASSIS ELECTRICAL	**Draft No.:** 00sy051817	
CORRECTION **INTERNATIONAL CAR ADMINISTRATION OFFICE**	T.NITTA - PROJECT LEADER AFTER SALES SERVICE & CS PROMOTION	

1. Description:

This Service Bulletin informs you that correction has been made of errors in the illustration for headlamp aiming adjustment.

2. Applicable Manuals:

Manual	Pub. No.	Language	Page(s)
2001 PAJERO Workshop Manual VOL.2	PWJE0001 (2/2)	(English)	54A-38
2001 MONTERO Workshop Manual VOL.2	PWJS0002 (2/2)	(Spanish)	



3. Turn the adjusting screws to adjust so that the deviation in the centre of the high-luminance zone (main optical axis) is at the standard value

Standard value:

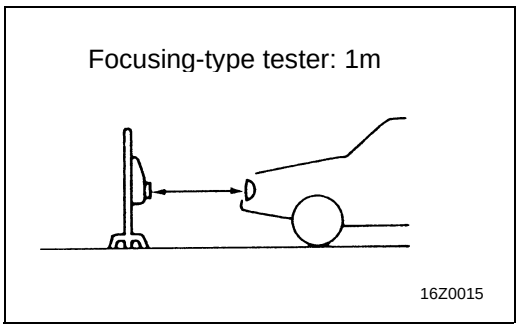
Vertical direction	0.57° (10 mm) sown from horizontal line H
Horizontal direction	Position where 15° rising portion intersects vertical line V

Caution

(1) For the headlamp which is not being measured, disconnect that headlamp's connector if possible so that it does not illuminate while carrying out the adjustment. Furthermore, make sure that the light axis does not get shifted when re-connecting the connector.

(2) The headlamp have outer lenses which are made of plastic, so if covering the lens surface with the headlamp should not be turned on for any more than 3 minutes. In addition, do not mask the outer lens surface by attaching tape or similar.

(3) The adjustment should always be completed by turning the adjustment screws in the tightening direction.



LUMINANCE MEASUREMENT

1. Place the tester receiver so that it is directly opposite the headlamp at the distance shown in the illustration.
2. Run the engine at a speed of 2000 r/min to fully charge the battery.
3. Align with the centre of the lamp.
   NOTE
   Check that the light/dark separation line on the adjustment screen and the low-beam cut-off line are aligned at this time
4. With the headlamps set to low beam, check that the luminance satisfies the limit value.

Limit: 6,400 cd or higher for each lamp

CHASSIS ELECTRICAL

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GENERAL 2
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General Information 2
Construction Diagram 3
IMMOBILIZER SYSTEM 5
COMBINATION METER 5
Troubleshooting 5
RV METER 6
Troubleshooting 6
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GENERAL

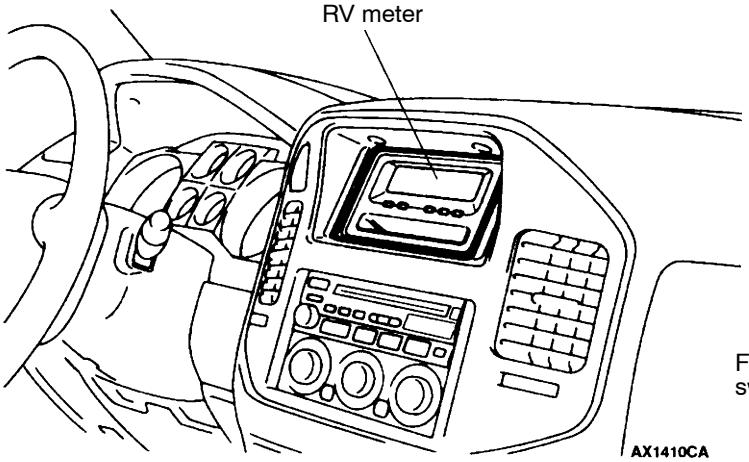
OUTLINE OF CHANGES

- Since the immobilizer-ECU location has been moved from the ignition key cylinder to near the diagnosis connector, the removal and installation procedure has been changed.
- The troubleshooting for speedometer has been changed to the method employing simulated vehicle speed signal input check with the MUT-II.
- Due to the adoption of an RV meter, the service adjustment procedure has been added.
- Due to the adoption of a glass antenna on the left of a quarter window glass, the removal and installation procedure of feeder cables has been added.

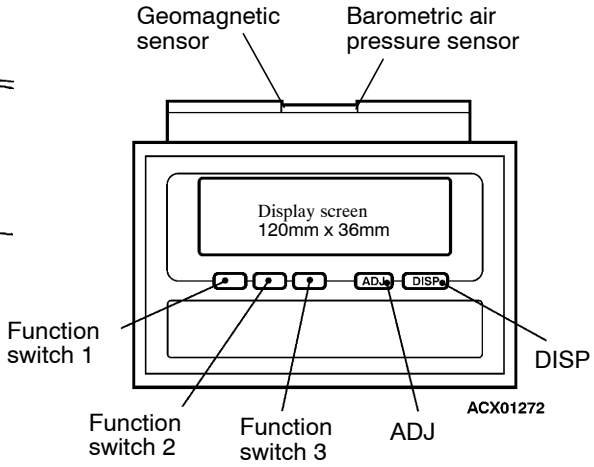
The service adjustment procedures which are not described here are the same as before.

GENERAL INFORMATION

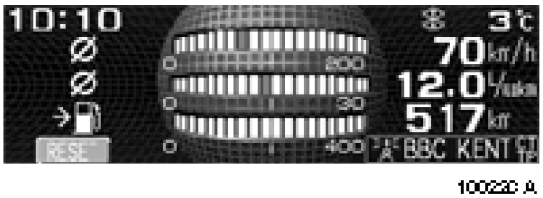
The RV meter, which displays various vehicle information has been used for some models.
By operating each function switch, including "ADJ" and "DISP" switches, driving information screen, A/C information screen, environment information screen, clock information screen, and audio screen can be called up.



RV meter



DRIVING INFORMATION



The driving information screen displays the average vehicle speed, average fuel efficiency, and possible travel distance based on the information derived from the engine-ECU and the fuel gauge unit.

A/C INFORMATION

The screen displays set temperature, fan air mass, rear defogger operation, compressor operation, front defroster operation, and inside and outside air mode.

ENVIRONMENT INFORMATION

10025CA

The environment information screen displays ambient temperature, direction, altitude, and barometric air pressure. If the ambient temperature is 3°C or lower when starting the vehicle, a frozen marking blinks and an alarm sound warns a driver.

CLOCK INFORMATION

10026CA

Digitally displayed clock and date are featured. When the function switch 3 on the clock display screen is pressed for 3 seconds or longer, the time adjustment screen can be called up.

AUDIO INFORMATION

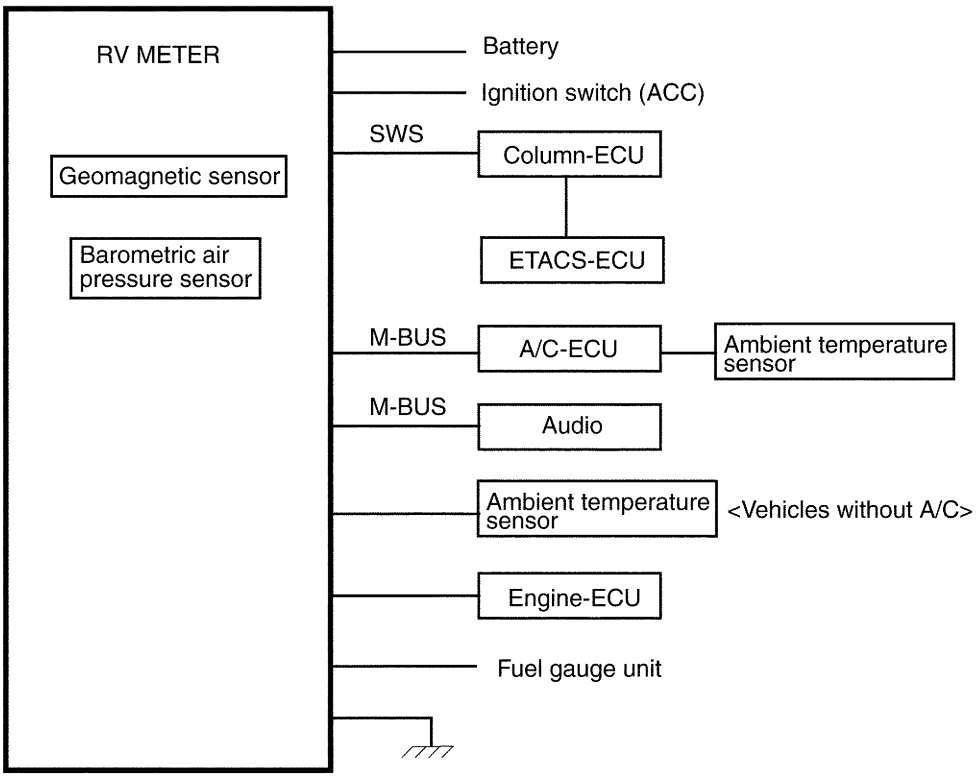
10024CA

The audio function and setting of radio, tape, and CD are displayed.

CONSTRUCTION DIAGRAM

This system:

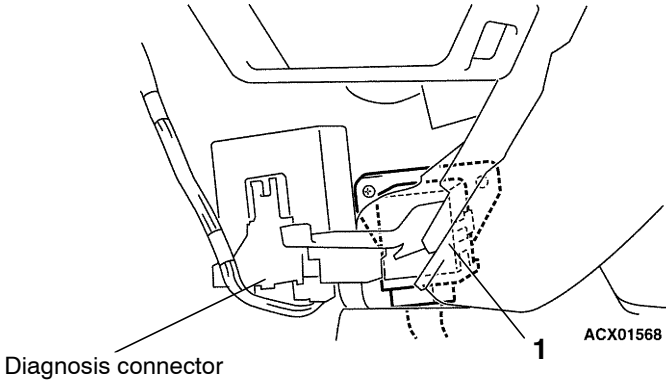
1. receives A/C information, such as ambient temperature sensor from the A/C-ECU and audio information from the audio system through M-BUS.
2. receives information regarding buzzer sound and ignition switch position recognition from the RV meter through SWS communication.
3. receives the vehicle speed data from the engine-ECU to calculate the average vehicle speed. Moreover, this system receives the fuel injection amount data to calculate the average fuel efficiency and possible travel distance.
4. calculates the direction of a vehicle by using the geomagnetic sensor.
5 calculates the outside air temperature by using the ambient temperature sensor.
6. measures the ambient pressure by using the barometric air pressure sensor to calculate the altitude based on the information.
7. obtains information on remaining fuel amount required for calculating the possible travel distance by using the fuel gauge unit.


RV METER
Geomagnetic sensor
Barometric air pressure sensor
Battery
Ignition switch (ACC)
SWS
Column-ECU
ETACS-ECU
M-BUS
A/C-ECU
Ambient temperature sensor
M-BUS
Audio
Ambient temperature sensor
<Vehicles without A/C>
Engine-ECU
Fuel gauge unit

10014CA

IMMOBILIZER SYSTEM

REMOVAL AND INSTALLATION



Immobilizer-ECU removal steps

- Lower center panel <LH> panel
  (Refer to GROUP 52A - Floor console assembly)

1. Immobilizer-ECU

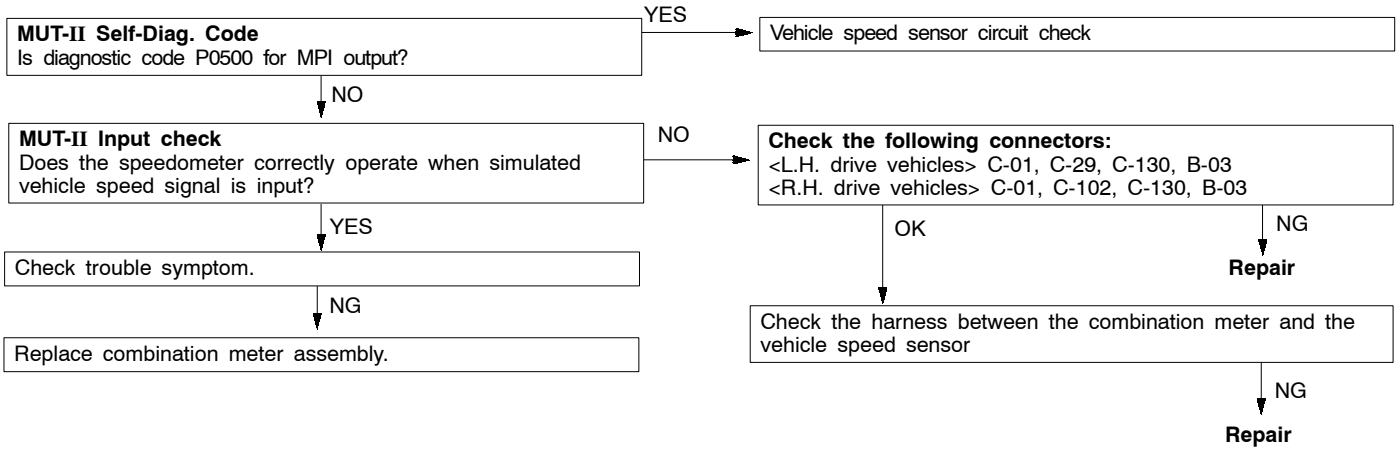
NOTE
On vehicles with the 4D5 engine, the ignition key registration procedure is the same as for the 4M41 engine.

COMBINATION METER

TROUBLESHOOTING

INSPECTION PROCEDURES FOR TROUBLE SYMPTOM

Speedometer inoperative (other meters are operated)	Probable cause
Failure may occur on vehicle speed sensor, harnesses, connectors, meter assembly.	• Malfunction of vehicle speed sensor • Malfunction of vehicle harness or connector • Malfunction of combination meter



NOTE
When vehicle speed signal is checked with MUT-II in the ETACS-ECU input signal test, drive the vehicle with MUT-II connected to diagnostic connector. When the buzzer sounds, this test is evaluated OK.

RV METER

TROUBLESHOOTING

PRECAUTIONS WITH REGARD TO RV METER SERVICE WORK

PROBLEM DIAGNOSIS POINTS RELATING TO THE OVERALL SYSTEM

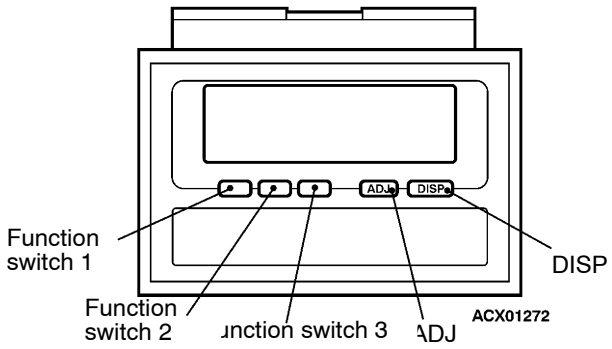
1. Check the connections of all related harness connectors. If any problems are found, repair the problem location and then re-check the trouble symptoms.
2. If there are no problems with the harness connections, check the harnesses. If there are no problems with the harnesses, replace the related unit. Make a note of the service function data at this time.

   NOTE
   If the cause of the problem is thought to be related to system communication, carry out troubleshooting.

PROBLEM DIAGNOSIS POINTS FOR TROUBLE WITH SPECIAL FUNCTIONS ONLY

1. Check the connections of the harnesses connectors which are related to the special function. If any problems are found, repair the problem location and then re-check the trouble symptoms.
2. If there are no problems with the connector connections, check the harnesses. If there are no problems with the harnesses, replace the unit which controls that function.

RV METER UNIT OPERATING PANEL

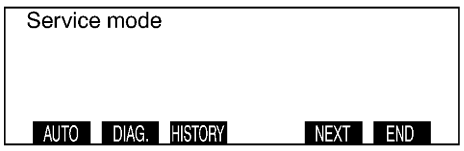


TROUBLE DIAGNOSIS SERVICE FUNCTIONS

The RV meter is equipped with the following trouble diagnosis service functions.

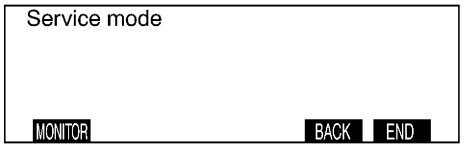
Service function		Contents	Reference Page
Automatic mode diagnosis		checks vehicle signal information communication, audio, A/C, fuel information, monitor automatically whenever function switch 1 (NEXT) is pressed.	54A-7
Diagnosis mode		checks version, vehicle signal, communication information (audio, A/C, and fuel).	54A-9
History mode		displays history of communication error.	54A-11
Monitor check mode	Display check mode	checks the display.	54A-11
	Geomagnetic check mode	checks the geomagnetic sensor.	54A-12
	Altimeter adjust mode	adjusts the altimeter.	54A-13

1st menu of the service mode



ACX01984

2nd menu of the service mode

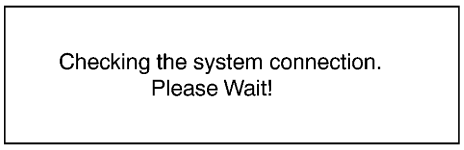


ACX01985

SERVICE FUNCTION STARTING

1. Turn the ignition switch to the ”LOCK” (OFF) position, and then while pressing and holding the ”ADJ” switch, turn the ignition switch to the ”ACC” position.
   After the adjustment switch has been pressed continuously for 5 seconds or longer, the reception signal sound (beep) will sound, and at the same time the service function will start up and the first menu of the service mode screen will be displayed.

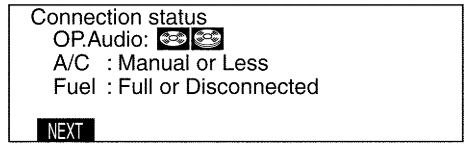
2. When ADJ switch (NEXT) is pressed at the 1st menu of the oservice mode screen, the mode is switched to the 2nd menuf the service mode screen.
   When function switch 1 (MONITOR) is pressed at the current screen, the screen mode is switched to monitor check mode.(Refer to P.54A-11.)



ACX01986

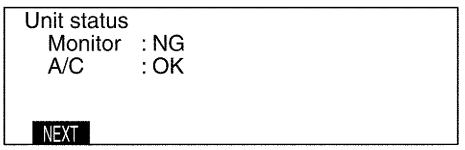
AUTOMATIC MODE

1. When function switch 1 (AUTO) is pressed at the 1st menu of the service mode screen, the mode is switched to automatic checking mode.
   At this time, a display will appear to prompt you to turn the ignition switch to the ON position.
2. When the ignition switch is turned to the ON position, communication and wiring check is carried out.



10004CA

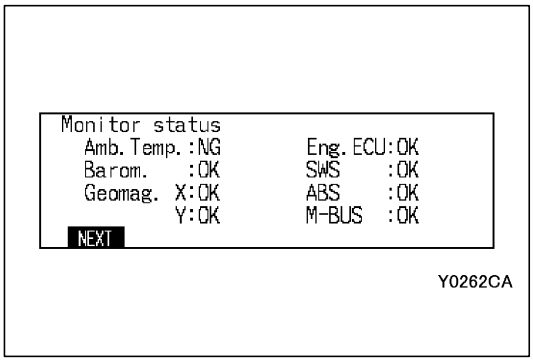
3. When the communication check is completed, the communication and wiring check results are displayed on the screen.
   If the audio system is recognized, the applicable icon is displayed.
   Air conditioner input (Automatic, Manual or without air conditioning) is displayed.
   Fuel gauge input (OK, not connected or fuel tank full) is displayed.



10018CA

4. When function switch 1 (NEXT) is pressed at the previous screen, the status of unit is displayed.

Item	Display example
Monitor	NG
Air conditioner	OK

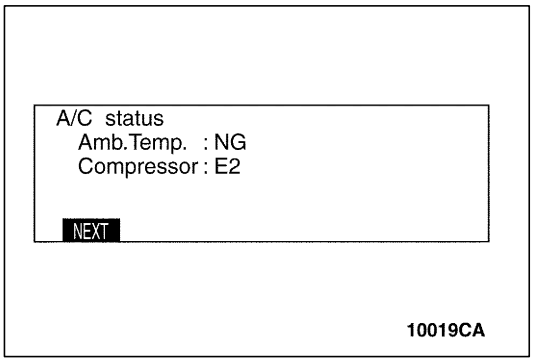


5. When function switch 1 (NEXT) is pressed at the previous screen, a list of monitor check items and results is displayed.

Item	Display example	Contents or conditions
Ambient temperature	OK	–
Barometric pressure	OK	–
Geomagnetic sensor X direction, Y direction	OK	–
Engine-ECU, SWS, M-BUS	E1	Communication error
	E2	Open circuit or not connected

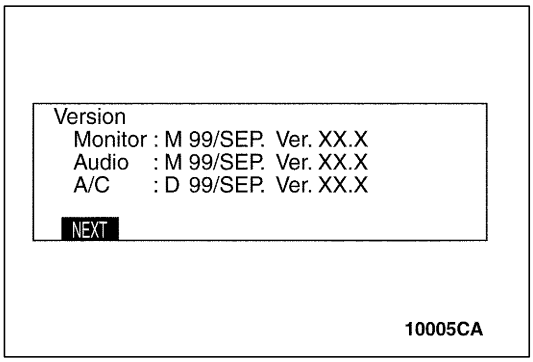
NOTE

For diesel vehicles, E2 is normally displayed for Engine-ECU. (meaning that it is not connected)

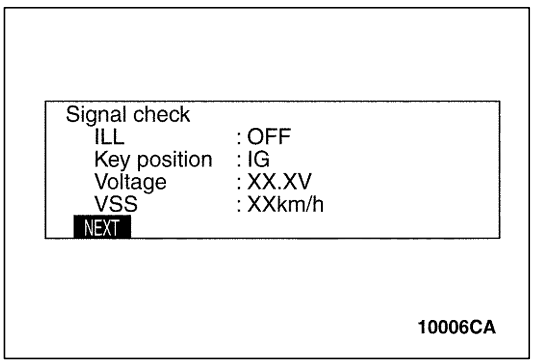


6 . When function switch 1 (NEXT) is pressed at the previous screen, A/C related item list is displayed.
For vehicles without air conditioner or with a manual air conditioner, the version is not displayed.

Item	Display example
Ambient temperature sensor	NG
Compressor	OK



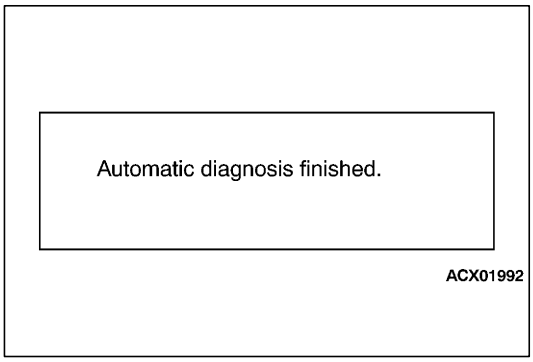
7. When function switch 1 (NEXT) is pressed at the previous screen, the version of monitor, audio and air conditioner is displayed.
For vehicles without air conditioner or with a manual air conditioner, the version is not displayed.



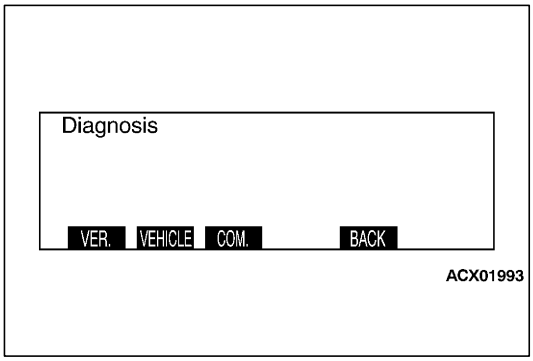
8. When function switch 1 (NEXT) is pressed at the previous screen, the status of vehicle signal is displayed.

Item	Display example	Contents or conditions
Illumination	OFF	Conditions of illumination
Ignition key position	IG	Ignition switch position
Voltage	12V	Power supply voltage

Item	Display example	Contents or conditions
VSS	XX km/h	Speed on basis of vehicle speed pulse

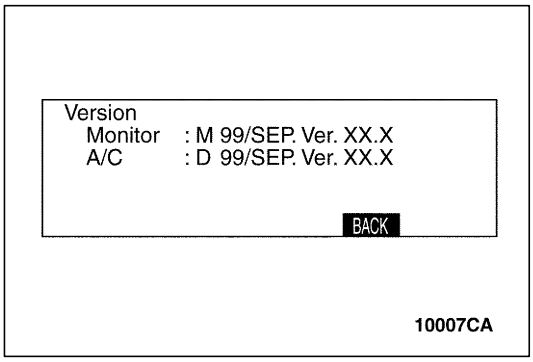


9. When function switch 1 (NEXT) is pressed at the previous screen, the displaying the message ”Automatic diagnosis finished.”

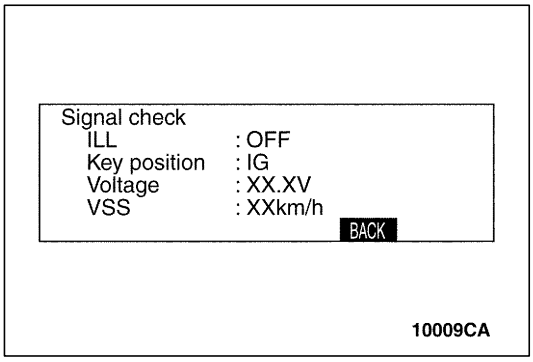


DIAGNOSIS MODE

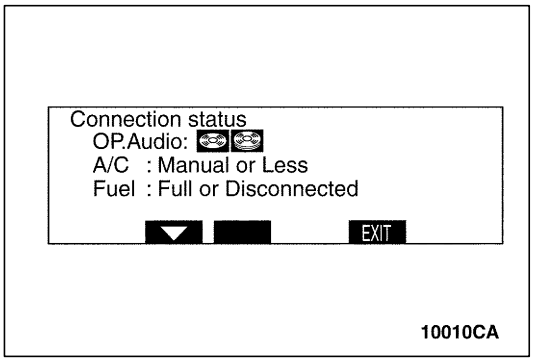
1. From the 1st menu of the service mode screen, press function switch 2 (DIAG) to display diagnosis mode.
2. The following displays appear when the various function switches are pressed.



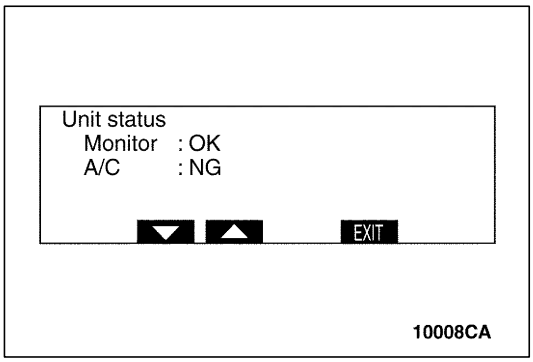
(1) When function switch 1 (VER) is pressed, the version of monitor and air conditioner is displayed.



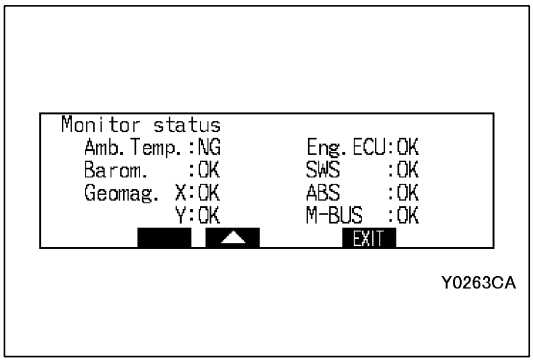
(2) When function switch 2 (VEHICLE) is pressed, the vehicle signal condition is displayed.



(3) When function switch 3 (COM) is pressed, the results are displayed after communication and wiring check is carried out.
If the audio system is recognized, the icon is displayed.
Air conditioner input (Automatic, Manual or without air conditioning) is displayed.
Fuel gauge input (OK, not connected or fuel tank full) is displayed.



- When function switch 1 (▼) at the previous screen, the status of unit is displayed.

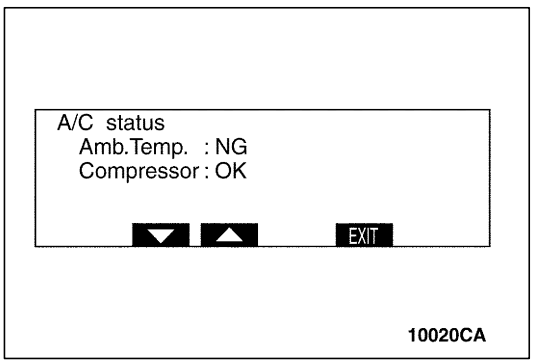


- When function switch 1 (▼) at the previous screen, the status of monitor is displayed.

Item	Display example	Contents or conditions
Ambient temperature	OK	–
Barometric pressure	OK	–
Geomagnetic sensor X direction, Y direction	OK	–
Engine-ECU, SWS, M-BUS	E1	Communication error
	E2	Open circuit or not connected

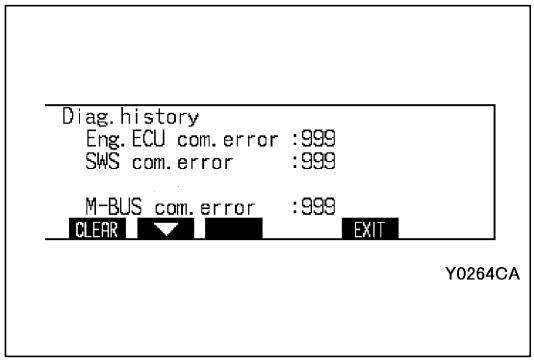
NOTE

For diesel vehicles, E2 is normally displayed for Engine-ECU. (meaning that it is not connected)



- When function switch 1 (▼) at the previous screen, the status of monitor is displayed. A/C related item list is displayed.
For vehicles without air conditioner or with a manual air conditioner, the version is not displayed.

Item	Display example
Ambient temperature sensor	NG
Compressor	OK

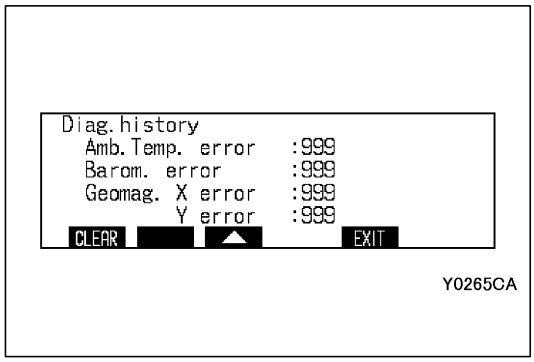


HISTORY MODE

(1) When function switch 3 (HISTORY) is pressed at the 1st menu of the service mode screen, the mode is switched to history mode.

Item	Display example	CONTENTS
Engine-ECU, SWS, M-BUS	000	No. of communication errors

- When function switch 1 (CLEAR) is pressed, the number of errors is erased.



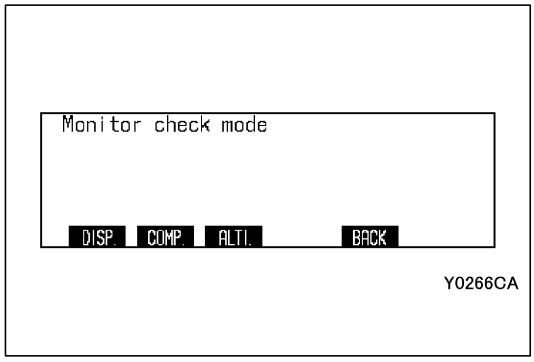
(2) When the function switch 2 (▼) is pressed, the mode is switched to the 2nd menu of history mode.

Item	Display example	CONTENTS
Amb.Temp, Barom, Geomag X.Y	000	No. of communication errors

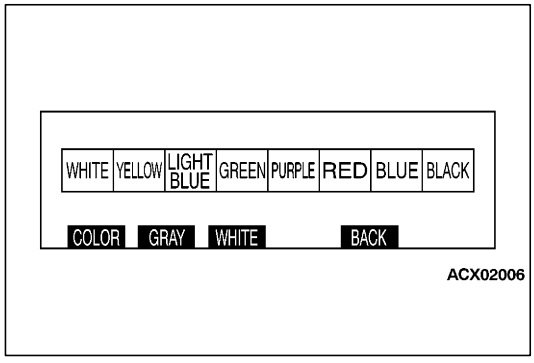
MONITOR CHECK MODE

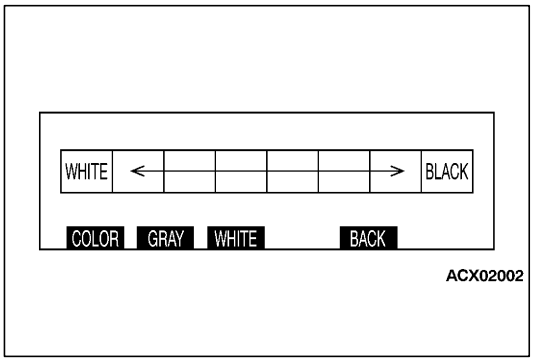
Display check mode

1. When function switch 1 (MONITOR) is pressed at the 2nd menu of the service mode screen, the mode is switched to monitor check mode.
   The following displays appear when the various function switches are pressed.

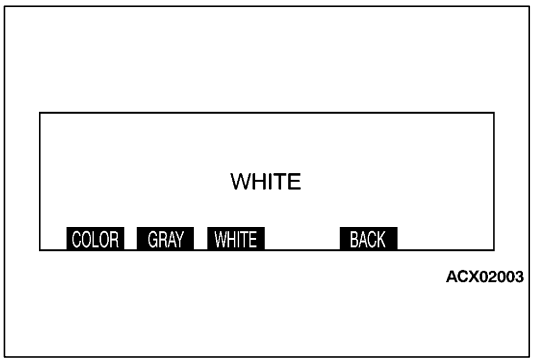


- When function switch 1 (DISP) is pressed, the color bar is displayed.

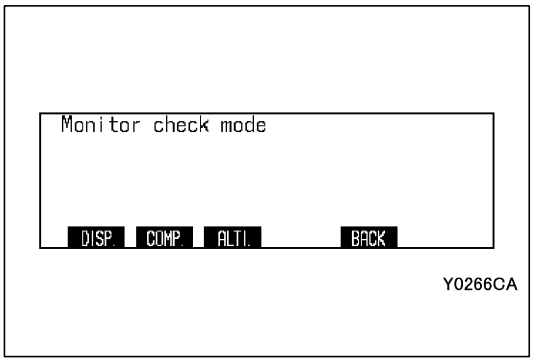




- When function switch 2 (GRAY) is pressed, the grey scale screen is displayed.

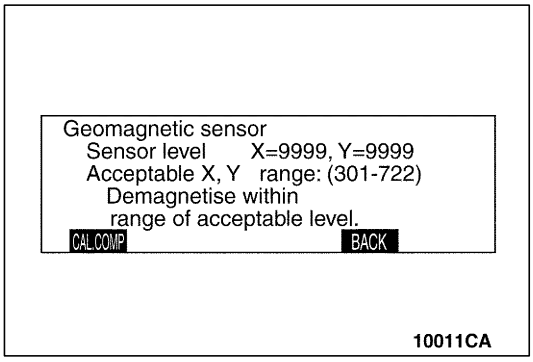


- When function switch 3 (WHITE) is pressed, the white screen is displayed.

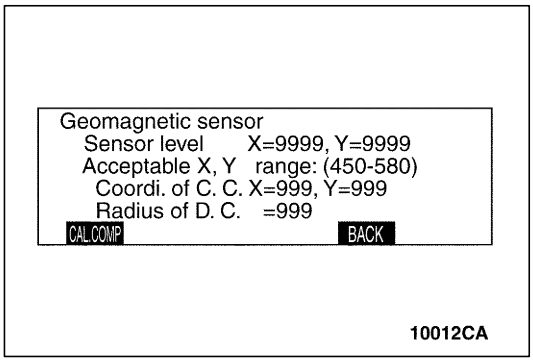


Geomagnetic check mode

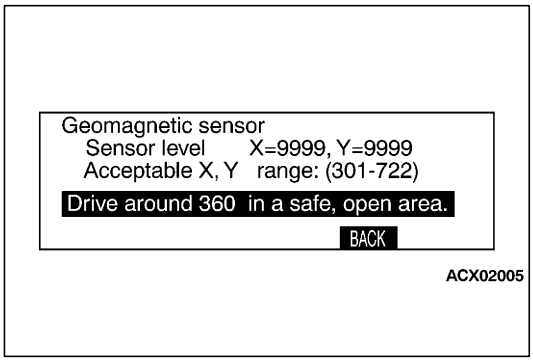
1. When function switch 1 (MONITOR) is pressed at the 2nd menu of the service mode screen, the mode is switched to monitor check mode.
   The following displays appear when the various function switches are pressed.



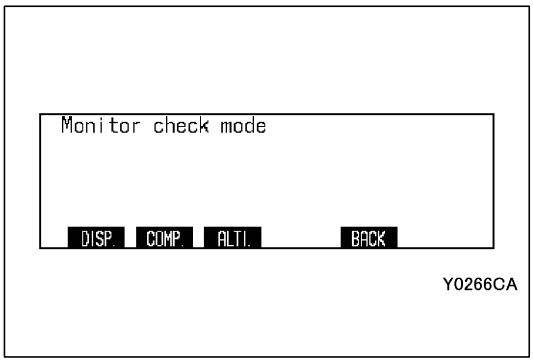
2. When function switch 2 (COMP) is pressed at the previous screen, the mode is switched to geomagnetic sensor mode.
   - At geomagnetic sensor mode, outputs in X- and Y-axes of the geomagnetic sensor, the circular bearing coordinate, and the radius are displayed.
     If both values of the sensor (X, Y) are outside the range between 450 and 580, there is a high possibility of geomagnetisation and the screen displays a message of degeomagnetisation request.
     For degeomagnetisation, refer to P.54A-15.



- If both values of the sensor (X, Y) are input within the range between 450 and 580 for one second or longer continuously, the axes are displayed.

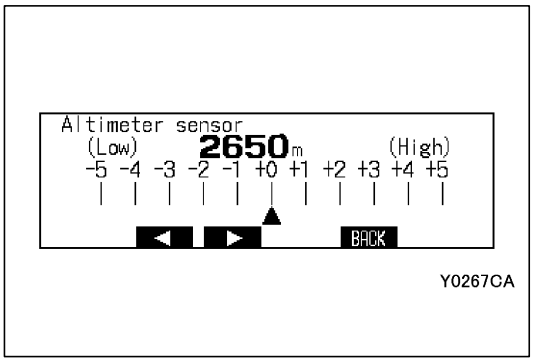


- When function switch 1 (CAL.COMP) is pressed at the previous screen, a message of rotation compensation is displayed.
  For the method of magnetization compensation by rotation, refer to P.54A-14.



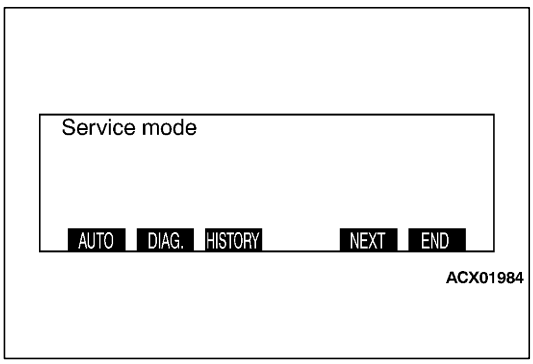
Altimeter adjust mode

When function switch 3 (ALTI) is pressed at the monitor check mode.
The following displays appear when the various function switches are pressed.



The altitude can be corrected as follows using the function keys.

- When function switch 2 (◀) is pressed, the altitude is corrected downwards, and after approximately 5 seconds, the calibration results are displayed in the altitude calibration column.
- When function switch 3 (▶) is pressed, the altitude is corrected upwards, and after approximately 5 seconds, the calibration results are displayed in the altitude calibration column.
- When ”ADJ” switch (BACK) is pressed, the mode is switched to monitor check mode screen.

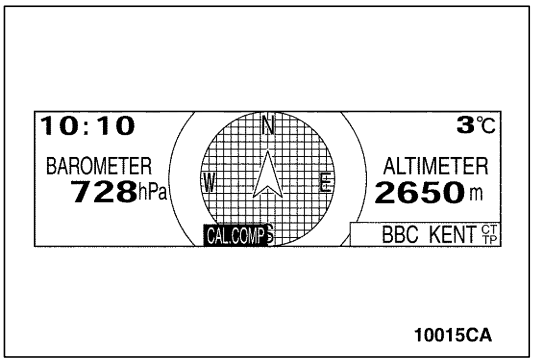


CANCELLING SERVICE MODE

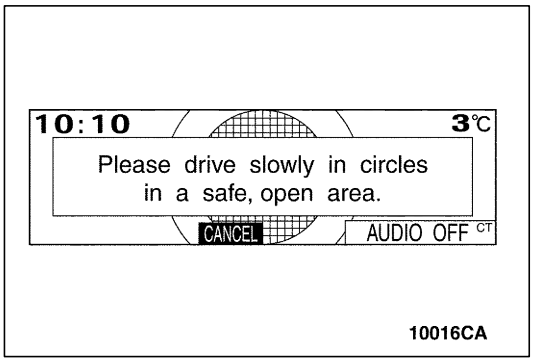
At the 1st menu of the service mode screen, press ”DISP” switch (END) , or turn the ignition switch to the ”LOCK” (OFF) position to cancel service mode.

MANUAL GEOMAGNETISATION CALIBRATION

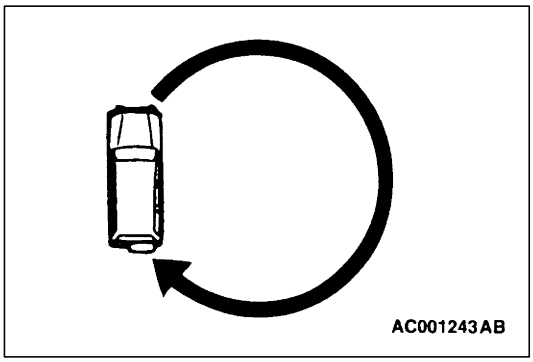
The RV meter automatically conducts geomagnetisation calibration by sampling direction data while the vehicle is normally driving. The calibration can be done manually at any time.



1. Press function switch 3 for three seconds or more during the environment information screen to call up the screen as shown in the illustration .

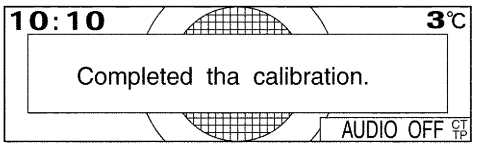


2. When function switch 3 (CAL.COMP) is pressed, a message of urging geomagnetisation calibration is displayed.



3. Drive around the vehicle.

   NOTE
   When driving around the vehicle to correct the sensor, select a safe and open area where there are no structures exist such as the high-tension line and the iron bridge that affect the geomagnetic sensor in circumference.



10017CA

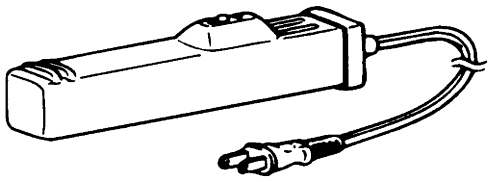
4. A message of completing geomagnetisation calibration is displayed.

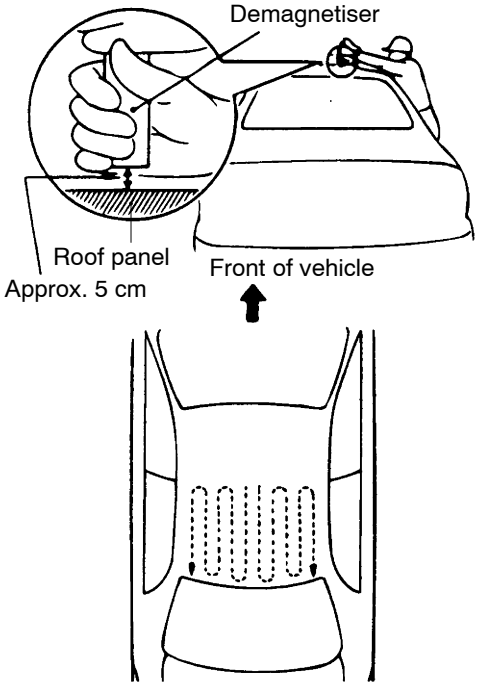
NOTE
If the following switches are pressed before completion of calibration, the system cancels calibration and use the previously corrected data.
- When pressing ”DISP” and ”ADJ” switches
- When pressing function switch 3 switch (CANCEL)
- When operating auto A/C and audio
- When turning the ignition switch to the “OFF” (LOCK)position

Degeomagnetisation and calibration method

1. Demagnetise the body using a commercial demagnetiser.

Example: Commercial demagnetiser


AC001246AB



AC001247

2. While keeping the distance between the tip of demagnetiser and the roof panel to approx. 5 cm, move the demagnetiser slowly with a sweeping manner on the rear-half surface of roof panel.

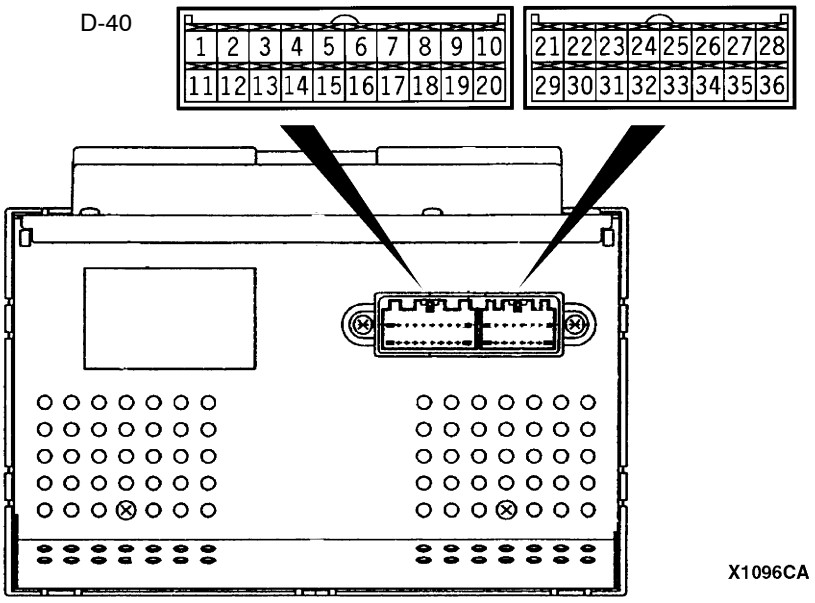
   Caution
   If the tip of demagnetiser touches the roof panel, the magnetising condition of body becomes worse to the contrary. Absolutely avoid this.

3. Slowly draw the demagnetiser apart from the body. Turn OFF the switch of demagnetiser when it is apart from the body more than 50 cm.

   Caution
   If the demagnetiser is turned OFF near the body or it is suddenly moved away from the body, the magnetising condition of body becomes worse to the contrary. Absolutely avoid these.

4. After degeomagnetisation, geomagnetisation calibration is carried out (Refer to P.54A-14.)

RV METER TERMINAL VOLTAGES



Terminal No.	Input/output	Signal symbol	Terminal voltage (V)	Harness problem		Trouble symptoms when there is a harness problem
				Open circuit	short-circuit	
4 - 1	–	–	–	–	–	–
5	Input	ISOK (MUT-II data signal)	Hi:System voltage Lo:0 - 1	Exists	Exists	Communication between the MUT-II and the engine-ECU <Diesel vehicles> or engine-A/T-ECU <petrol vehicles> is not possible.
6	Input/output	DATA (ETACS SWS data signal)	Hi:System voltage Lo:0 - 1	Exists	Exists	● Switch operating sound (buzzer) does not sound. ● Daytime/nighttime mode does not change in conjunction with the tail gate lamps. ● Indicators (buttons, illumination panel) do not illuminate.
7	Input/output	M-DATA(AUDIO) (M-BUS data signal)	Hi:4 - 5 Lo:0 - 1	Exists	Exists	● Audio information does not appear on the screen.
8	Input/output	M-CLOCK(AUDIO) M-BUS (C lock signal)	Hi:4 - 5 Lo:0 - 1	Exists	Exists	● Audio information does not appear on the screen.
9	Input/output	M-DATA(A/C) (M-BUS data signal)	Hi:4 - 5 Lo:0 - 1	Exists	Exists	● Air conditioner information does not appear on the screen. ● Ambient temperature is not displayed.
10	Input/output	M-CLOCK(A/C) M-BUS (C lock signal)	Hi:4 - 5 Lo:0 - 1	Exists	Exists	● Air conditioner information does not appear on the screen. ● Ambient temperature is not displayed.

Terminal No.	Input/output	Signal symbol	Terminal voltage (V)	Harness problem		Trouble symptoms when there is a harness problem
				Open circuit	short-circuit	
11 - 14	–	–	–	–	–	–
15	Input/output	K (engine K-LINE signal)	Hi: System voltage Lo:0 - 1	Exists	Exists	● Wiring communication error ● Communication between the engine-A/T-ECU <Petrol vehicles> is not possible. ● Abnormal driving information numerical display
16	–	–	–	–	–	–
17	Input/output	M-BUSY (AUDIO)	Hi:System voltage Lo:0 - 1	Exists	Exists	● Audio information does not appear on the screen.
18	–	SHIELD-EARTH (AUDIO)	–	–	–	–
19	Input/output	M-BUSY (A/C)	Hi:System voltage Lo:0 - 1	Exists	Exists	● Air conditioner information does not appear on the screen. ● Ambient temperature is not displayed.
20	–	SHIELD-EARTH	–	–	–	–
22 - 21	–	–	–	–	–	–
23	Input	Ambient temperature sensor	–	Exists	Exists	●Ambient temperature is not displayed.
24	Input	ILL + (Lighting switch)	Hi:System voltage Lo:0 - 1	Exists	Exists	Does not illuminate.
25	Input	ACC (ACC power supply)	System voltage	Exists	–	Screen does not appear. No operations are possible.
				–	Exists	Blown multi-purpose fuse
26	Input	+B	System voltage	Exists	–	Screen does not appear. No operations are possible.
				–	Exists	Blown multi-purpose fuse
27	Input	VSS (Vehicle speed pulse signal)	Hi:System voltage Lo:0 - 1	Exists	Exists	● Abnormal “Distance km after replacement” display in maintenance screen ● Switches which are not supposed to operate during driving do operate. (Example:clock adjustment screen, maintenance settings, etc.) ● Ambient temperature display is abnormally high.
28	–	Earth	–	Exists	–	Screen does not appear.

Terminal No.	Input/output	Signal symbol	Terminal voltage (V)	Harness problem		Trouble symptoms when there is a harness problem
				Open circuit	short-circuit	
29 - 30	–	–	–	–	–	–
31	–	EARTH (TEMP)	–	–	–	–
32	–	ILL - (illumination lamp adjustment signal)	–	Exists	Exists	Unable to adjust illumination lamp
33	Input	FUEL GAUGE	0 - 3	Exists	Exists	–
34 - 36	–	–	–	–	–	–

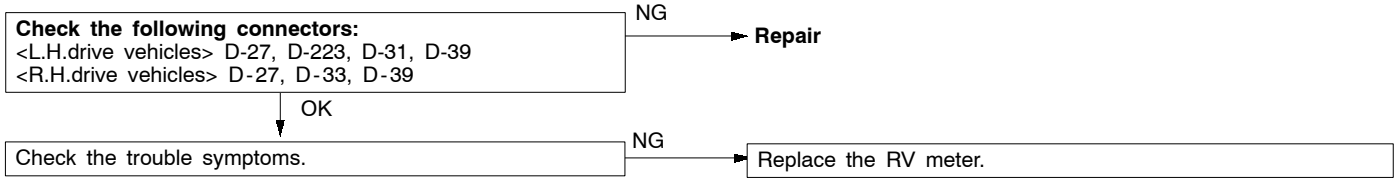
CHART CLASSIFIED BY TROUBLE SYMPTOMS

Related unit	Trouble Symptom	Inspection procedure No.	Reference page
Malfunction of RV meter	No system operations can be carried out.	1	54A-18
	System voltage drop warning screen appears.	2	54A-18
	Ambient temperature does not display normally.	3	54A-19
	Compass does not display normally.	4	54A-20
	Altimeter does not display normally.	5	54A-21
	Air conditioner information does not display normally.	6	54A-21
	Audio information does not display normally.	7	54A-22

INSPECTION PROCEDURES FOR EACH TROUBLE SYMPTOM

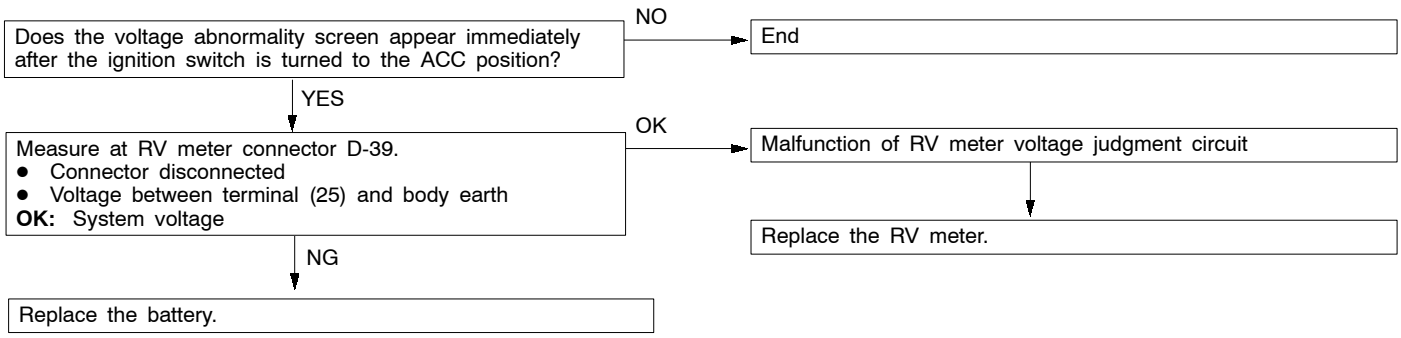
Inspection procedure 1

No system operations can be carried out.



Inspection procedure 2

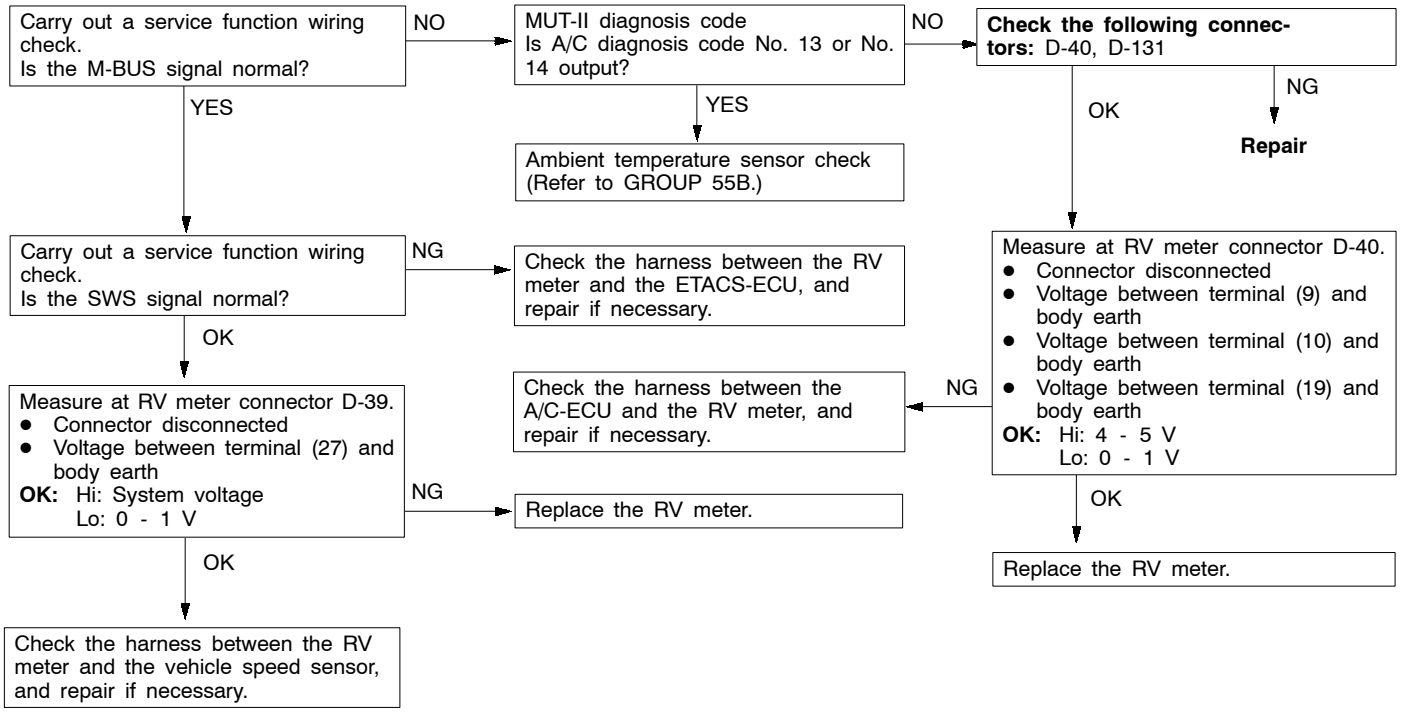
System voltage abnormality screen appears.



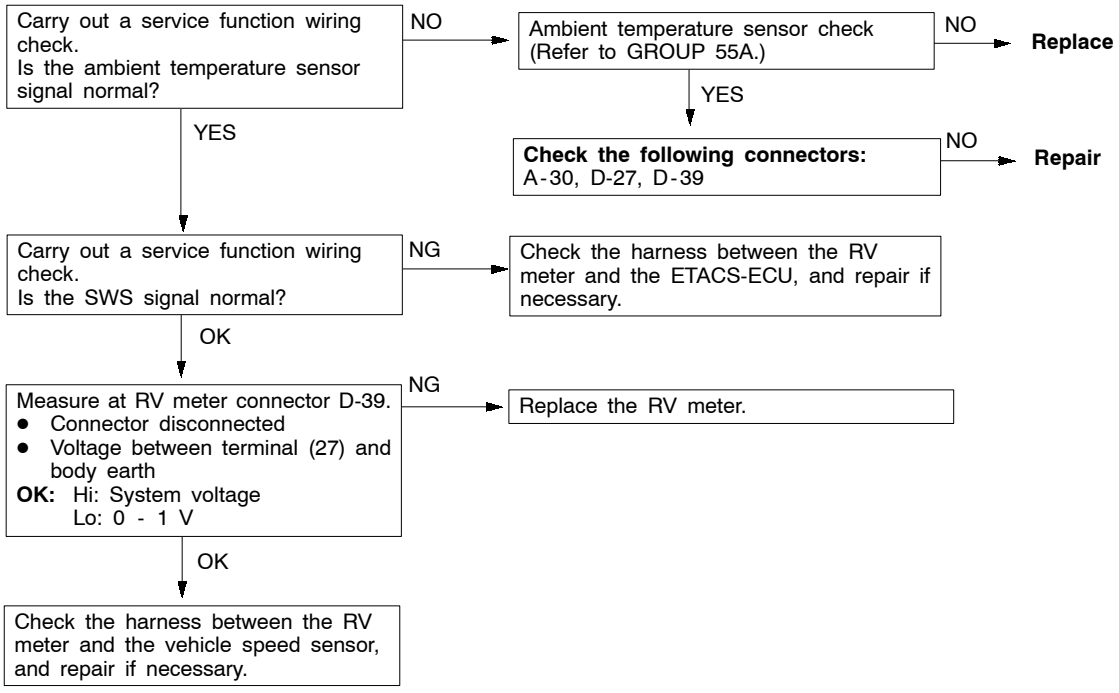
Inspection procedure 3

Ambient temperature does not display normally.

<Vehicles with automatic A/C>

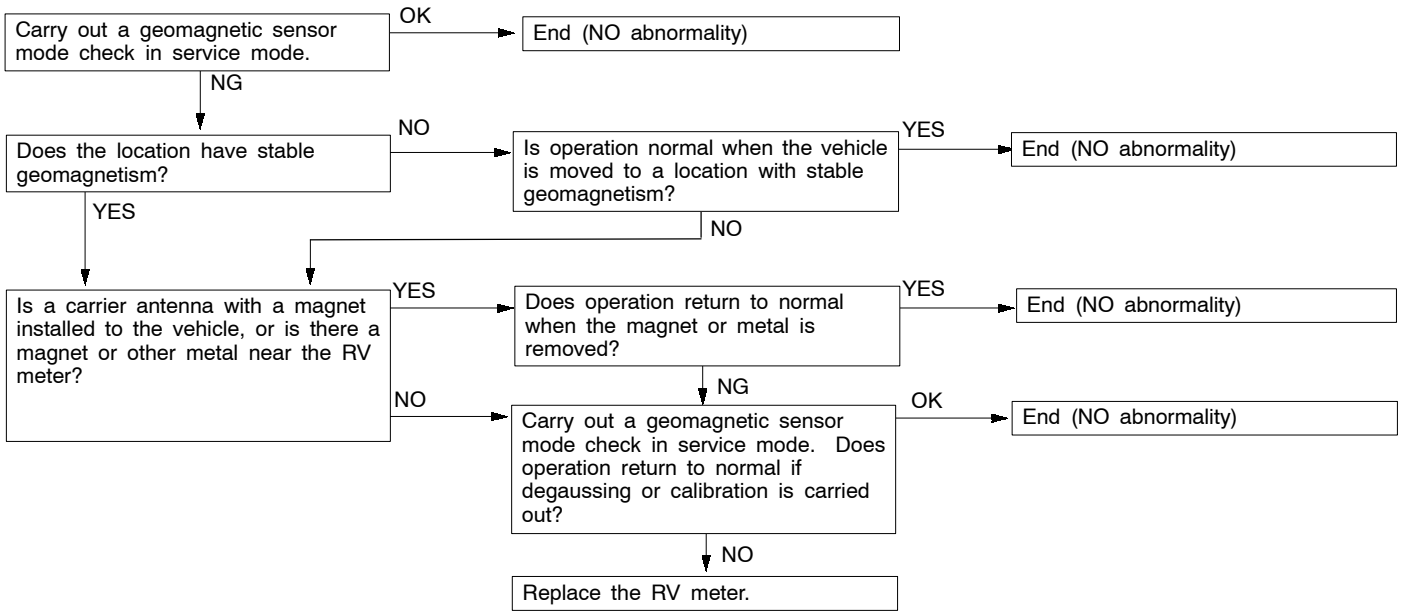


<Vehicles without automatic A/C>



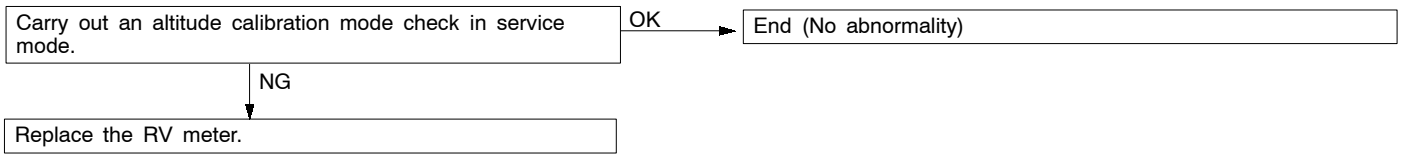
Inspection procedure 4

Compass does not display normally.



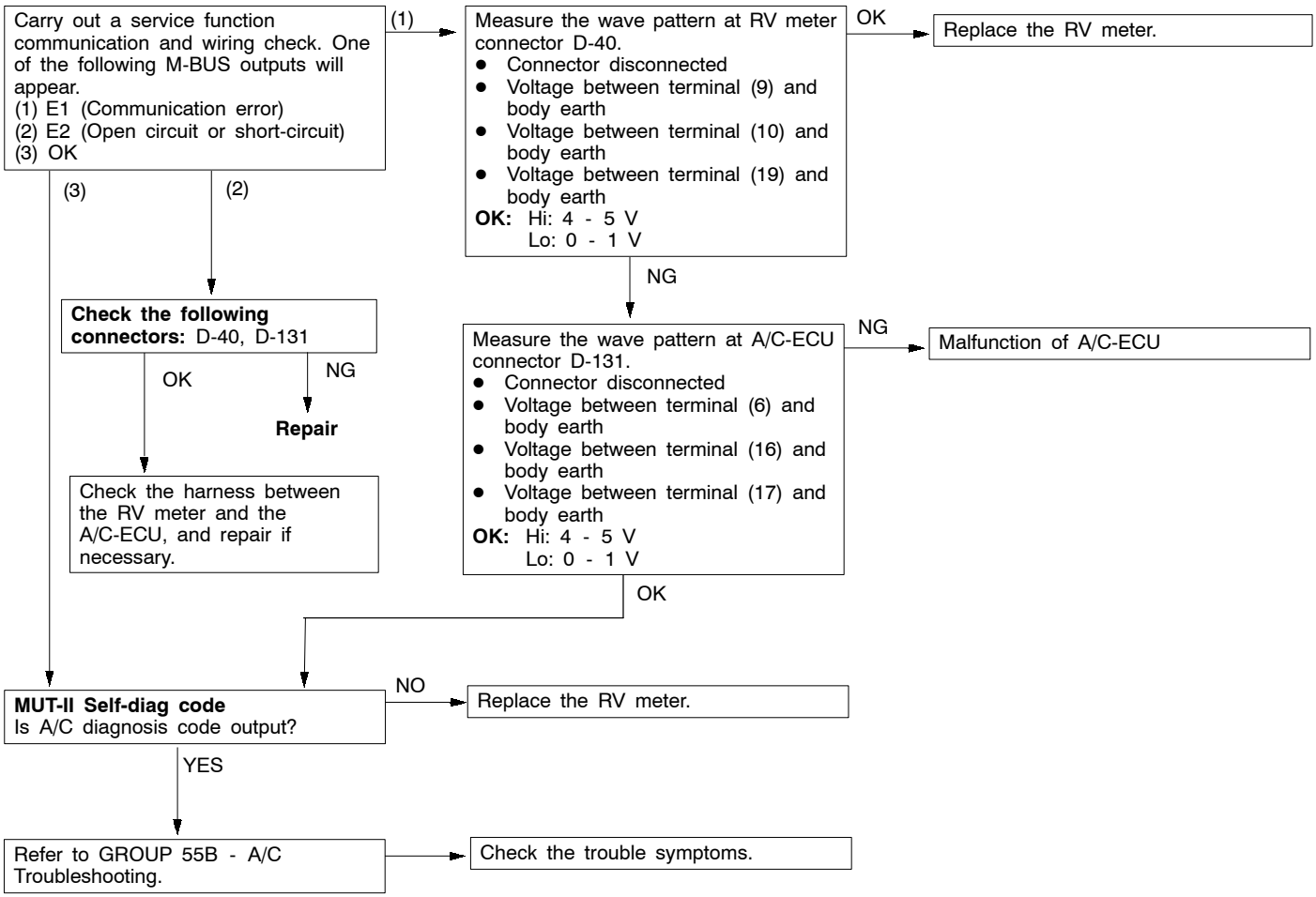
Inspection procedure 5

Altimeter does not display normally.



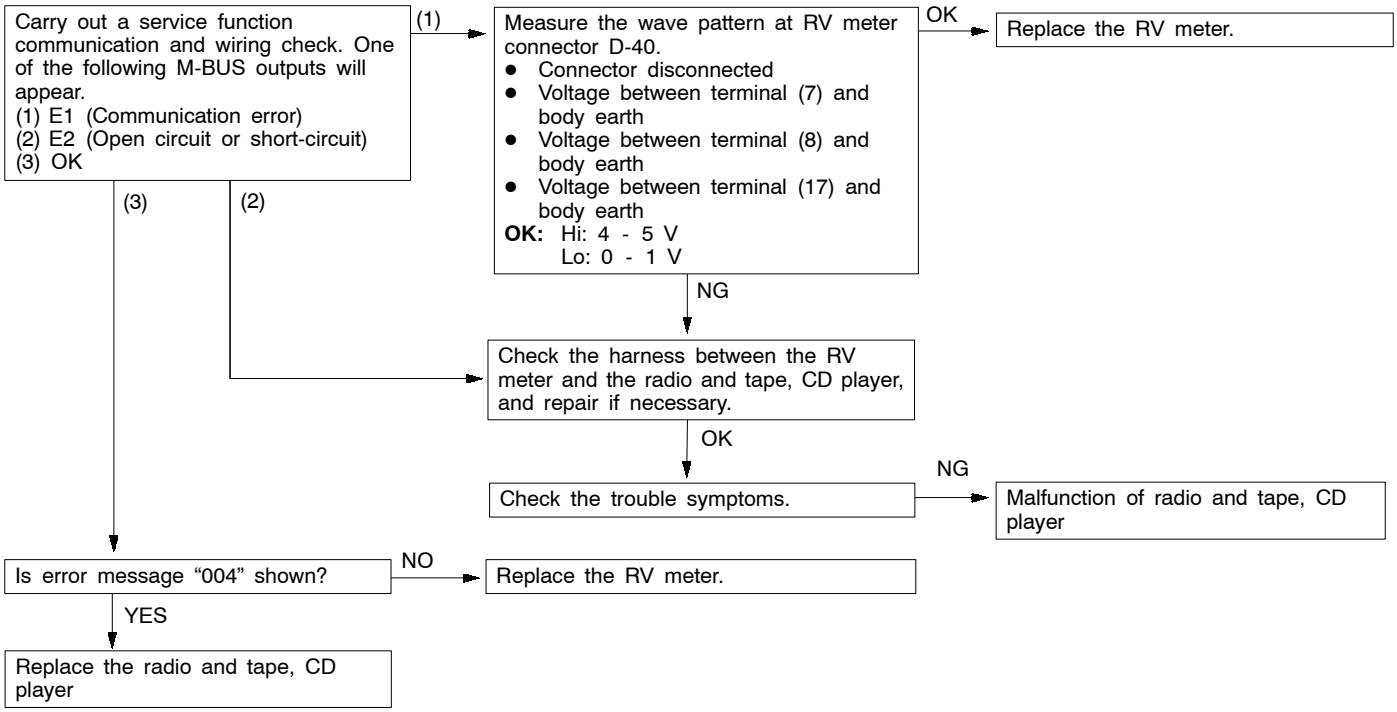
Inspection procedure 6

Air conditioner information does not display normally.



Inspection procedure 7

Audio information does not display normally.



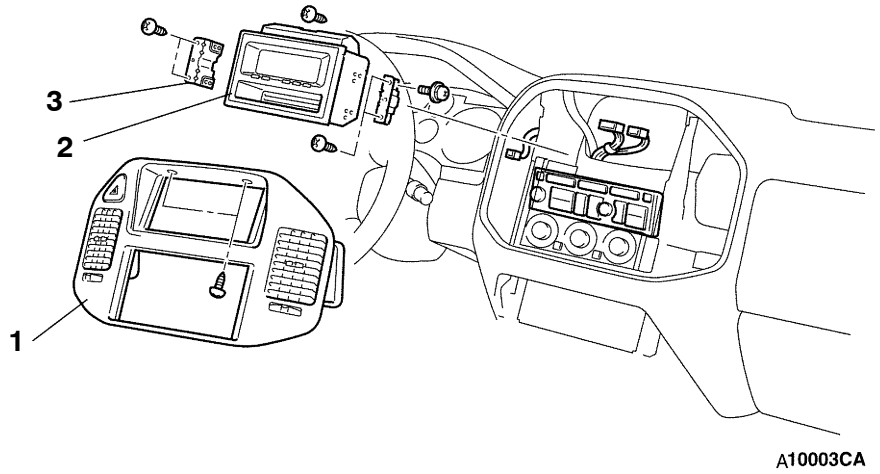
NOTE:

The contents of error messages shown in the audio display screen are as follows:

Error message	Location and cause of malfunction
EJECT	A magazine for CD changer is not inserted.
NO DISC	CD is not inserted.
ERROR 001	Program error in audio
ERROR 002	Error in CD disk
ERROR 003	Mechanical error in audio system
ERROR 004	Communication error in audio system and RV meter, power supply error in audio system, and other errors
ERROR HOT	Heat protection for audio system

RV METER

REMOVAL AND INSTALLATION



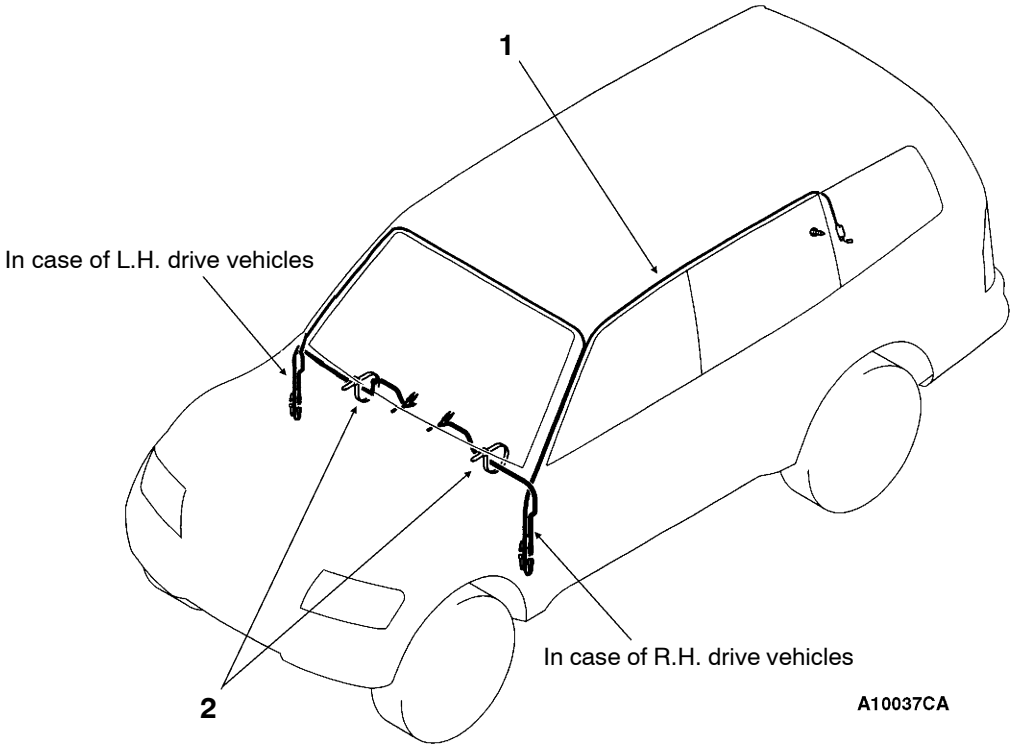
Removal steps

1. Center panel
   (Refer to GROUP 52A - Instrument Panel.)
2. RV meter
3. Bracket

GLASS ANTENNA

ANTENNA FEEDER CABLE

REMOVAL AND INSTALLATION



Removal steps

- Cowl side trim, front pillar, center pillar trim, quarter trim (Refer to GROUP 52A.)
- Head lining

1. Antenna feeder cable
- Instrument Panel (Refer to GROUP 52A)
2. Cable band

SMART WIRING SYSTEM (SWS)

Click on the applicable bookmark to selected the required model year.

SMART WIRING SYSTEM (SWS)

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Diagnosis Code Inspection Procedures 10

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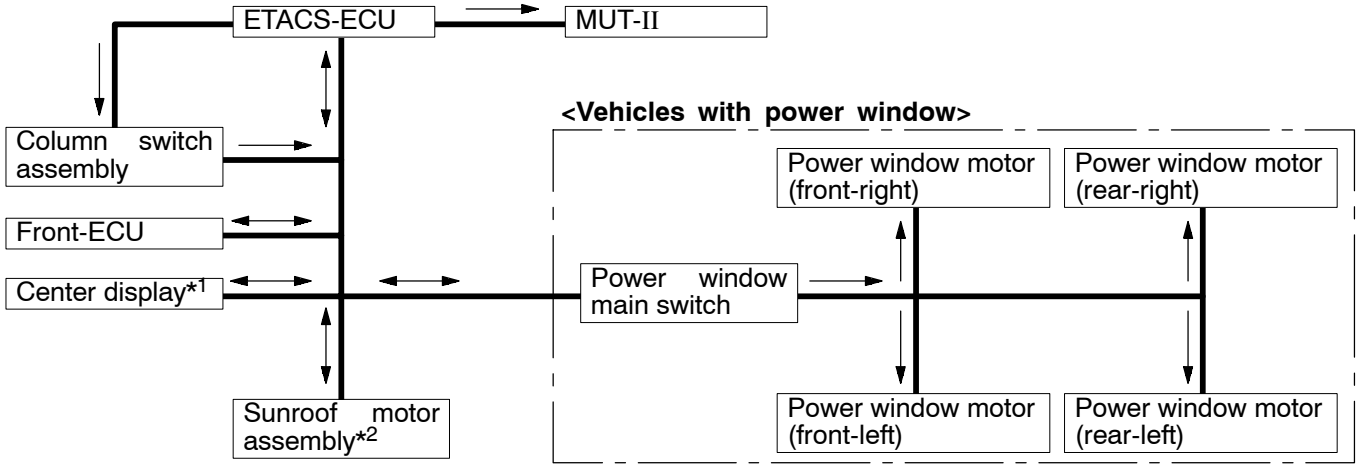
ON-VEHICLE SERVICE 60

Adjustment Procedures for SWS Function .. 60

GENERAL INFORMATION

COMMUNICATION LINE

Data lines for multiplex communication are connected between the front-ECU, ETACS-ECU, column switch assembly, sunroof motor assembly, center display, power window main switch, and power window motors as illustrated below.



NOTE
→ : Uni-directional communication line
↔ : Bi-directional communication line
*1: Vehicles with center display
*2: Vehicles with sunroof

OPERATION

BUZZER

Light Reminder Warning Buzzer Function

When the driver's door is opened with lighting switch in the ON (tail lamp switch or headlamp switch) position and ignition switch in the LOCK (OFF) or ACC position, the buzzer will sound continuously to remind the driver that the lamps (tail lamps or headlamps) are ON.
This function does not work if the lighting switched off through the headlamp automatic shutdown function. In addition, the ignition key reminder warning buzzer function has a priority over this function.

Center Display Operation Annunciation Function <Vehicles with Center Display>

On vehicles with center display, the buzzer (peeps) sounds when the operation switch of the audio and navigation system is pressed.

CENTRAL DOOR LOCKING SYSTEM <Vehicles with Central Door Locking System>

Central Door Locking System Operation

When the lock switch is turned ON after the unlock switch on the driver's door lock actuator switch is OFF, the ETACS-ECU gives a lock output for 0.5 second. When the unlock switch is turned ON after the lock switch on the driver's door lock actuator switch is OFF, the ETACS-ECU gives an unlock output for 0.5 second.
When the front passenger's door key or back door key is operated, the ETACS-ECU gives a lock or unlock output for 0.5 second.

Forgotten Key Prevention Function

If, with the key reminder switch OFF and the driver's door switch ON, the driver's door lock switch is turned ON after the door unlock switch in the front door lock actuator is turned OFF, the ETACS-ECU waits 0.3 second then give an unlock relay output for 0.5 second, there by preventing the doors from being locked. This operation prevents the ignition key from being locked inside the vehicle. This function takes precedence over the central door locking control function.

POWER WINDOWS

Power Windows Operation

A signal line dedicated for transmission of multiplex communication data is connected between the power window main switches and the power window motor-ECU.
Communication is uni-directional. The power window main switches have a transmitting circuit only, whereas the power window sub switches have a receiving circuit only.

Power Window Timer Function

With the ignition switch in the ON position, the power window relay and power window switch receipt permission signal (a SWS signal transmitted from the ETACS-ECU) 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.
If the driver's door is opened during timer operation, the receipt permission signal goes ON for additional 30 seconds. If the driver's door is subsequently closed during this period, the receipt permission signal goes OFF ten seconds after the receipt permission signal goes OFF.

KEYLESS ENTRY SYSTEM <Vehicles with Keyless Entry System>

Keyless Entry System Operation

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.

Keyless Entry Answerback Function

The keyless entry hazard answerable function facilitates confirmation of door locking and unlocking operations even in daylight. When a LOCK signal from the keyless entry transmitter is applied to the ETACS-ECU, all of the turn-signal lamps flash twice. When an UNLOCK signal from the keyless entry transmitter is applied to the ETACS-ECU, all of the turn-signal lamps flash four times. Note that an unlock switch has change from OFF to ON.

NOTE
The hazard answer back is enabled or disabled by the configuration function.

SUNROOF <Vehicles with Sunroof>

Sunroof Operation

All of the slide open/close, tilt up/down, and stop operations can be performed by a single switch. When the roof lid glass is tilted up, the sunshade opens approximately 98 mm in combined operation with the roof lid glass for better ventilation.
A jam preventing mechanism has been adopted. When a slide-close or tilt-down operation is blocked by an external force, the roof lid glass moves back and stops.

Sunroof Timer Function

When the ignition switch is turned from ON position to LOCK (OFF) or ACC position, the sunroof will be ready to work for 30 seconds.
If the driver's door is opened during the timer operation, the timer operates for another 30 seconds starting from that point. However, the timer operation discontinues if the door is closed during that period.

WINDSHIELD WIPER AND WASHER

Windshield Low-speed/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. Then the ETACS-ECU sends a signal to the front-ECU. The front-ECU determines the wiper operation interval and turns on the wiper signal relay. This causes the wiper auto stop relay to turn on. Then the wiper auto stop relay will turn off after the wipers reach the park position. This causes the wiper signal relay and then the wipers to turn off. If the wiper signal relay remains off for the wiper operation interval, the relay turns on again, causing the wipers to operate in intermittent mode.

Windshield Mist Wiper Operation

- If the windshield mist wiper switch of the column switch is turned to the ON position with the ignition switch at ACC or ON position, the mist wiper high-speed operation signal is sent to the front-ECU. This signal turns on the wiper speed switching relay, causing the wipers to work at high-speed while the mist switch is on.
- While the windshield mist wiper switch remains turned on when the intermittent mode is still working, the wipers work as the mist wiper. However, the wipers return to the intermittent mode again when the wiper auto stop signal turns on after the mist wiper switch is turned off.

Windshield Washer Operation

If the windshield washer switch of the column switch is turned to the ON position with the ignition switch at ACC or ON position, the windshield washer ON signal is sent to the front-ECU, causing the windshield wiper signal to turn on after 0.3 seconds. After the windshield washer switch signal turns off, the windshield wiper signal turns off in three seconds.
If the windshield wiper switch is turned to the ON position while the windshield wiper is at intermittent mode, the windshield washer works for that period when the windshield washer switch remains on. Then the wipers return to the intermittent mode.

REAR WIPER AND WASHER <Vehicles with 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 turns ON the rear wiper drive signal for three seconds (approx. two operations). 7.4 seconds later, the wiper begins the intermittent operation with 8 seconds' cycle.
If the shift lever <M/T> or 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 turns ON the rear wiper drive signal for three seconds (approx. two operations) to clear the rear field of view. 7.4 seconds later, the wiper returns to the intermittent operation with 8 seconds' cycle.

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 is in intermittent operation when the rear washer switch is turned ON, the rear wiper again continues the intermittent operation with 8 seconds' cycle from 7.4 seconds later since the rear drive signal is turned OFF.

HEADLAMP WASHER <Vehicles with Headlamp Washer>

If the headlamp washer switch at the steering column is placed in the ON position when the ignition switch is in the ACC or ON position and the headlamp switch is in the ON position, the headlamp washer drive signal is turned ON for 0.5 second.

IGNITION KEY HOLE ILLUMINATION LAMP

When the ignition switch is turned to LOCK (OFF) or ACC position with the driver's door opened, the ignition key hole illumination lamp is illuminated.
If the door is closed in that state, the lamp goes out after 30 seconds. Vehicles with keyless entry system, it illuminates for 30 seconds after the ignition key is removed. In either case the lamp goes out when the ignition switch is turned to ON position.

HEADLAMP

Headlamp Automatic Shutdown Function

If the ignition switch is turned to LOCK (OFF) or ACC position, when the headlamps are on, the headlamps will be switched off in three minutes. If the driver's door is opened within that three-minute period, the headlamps will be switched off automatically. This prevents the battery from discharged.
In addition, if the headlamps are turned on when the ignition switch is at LOCK (OFF) or ACC position, the headlamps will not be switched off.

Headlamp Dimmer Switch Automatic 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 <Vehicles with DRL>

If the ignition switch is turned to ON when the headlamps and tail lamps are off, the headlamps (low-beam) and tail lamps turn on.

FLASHER TIMER

Turn-signal Lamp

When the ignition switch is turned to ON position and turn-signal lamp switch is placed in the ON position for right or left turn signaling, the system generates turn-signal lamp drive signals (flashing signals).
The system also notifies of a blown turn-signal lamp bulb by shortening the flashing intervals of the corresponding indicator lamp.

Hazard Warning Lamp

The system detects a change from ON to OFF of the hazard lamp input signal and activates the hazard lamps if they are not in operation or deactivates the lamps if they are operating (reversal of state between activation and deactivation).

FRONT FOG LAMP <Vehicles with Front Fog Lamp>

If the front fog lamp switch is turned ON at the condition that the headlamp or the tail lamp is turned ON (including the illumination by the automatic lighting function), the front fog lamp is turned ON. Whenever the tail lamps are turned on at the next time, the front fog lamps will always be off regardless of the switch positions. In addition, if the tail lamp is switched off by the automatic lighting system, the front fog lamp will also be switched off. However, the front fog lamp will be illuminated when the tail lamp is switched on.

REAR FOG LAMP

If the fog lamp switch is turned ON when the headlamp or the front fog lamp is turned On, the rear fog lamp is switched ON and OFF alternatively.

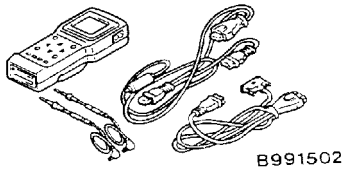
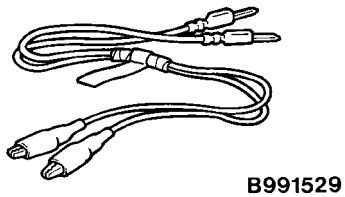
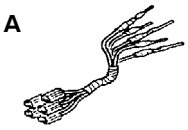
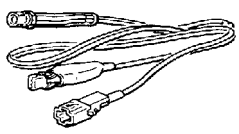
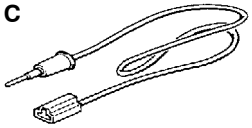
If the headlamp and the front fog lamp are turned OFF during lighting of the rear fog lamp, the rear fog lamp is turned OFF at the same time.

ROOM LAMP <Vehicles with Keyless Entry System>

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 goes 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 100% and turned out approx. 30 seconds later. During that time (timer-controlled period), the room lamp goes 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 <Vehicles with keyless entry system>	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, vehicles with rear wiper and washer>	Shift lever moved to R position
Inhibitor switch (reverse) <A/T, vehicles with rear wiper and washer>	Selector lever moved to R position
Rear wiper motor auto-stop signal <Vehicles with rear wiper and washer>	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
Front passenger's or back door lock key cylinder switch <Vehicles with central door locking system>	Turn the key to the locked or unlock
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	Rotate the windshield intermittent wiper interval adjusting knob from FAST to SLOW when the ignition switch is in ON position (The ETACS-ECU sends a signal around the medium knob position)
	Windshield washer switch	Turned from OFF to ON
	Rear wiper switch <Vehicles with rear wiper and washer>	
	Rear washer switch <Vehicles with rear wiper and washer>	
	Headlamp washer switch <Vehicles with headlamp washer>	
Power window main switch	Any switch <Vehicles with power window>	Turned from OFF to ON
Transmitter	Any switch <Vehicles with keyless entry system>	Turned from OFF to ON
Sunroof switch	Any switch <Vehicles with sunroof>	Turned from OFF to ON
Center display	Any switch <Vehicles with center display>	Turned from OFF to ON

DIAGNOSIS CODE CHART

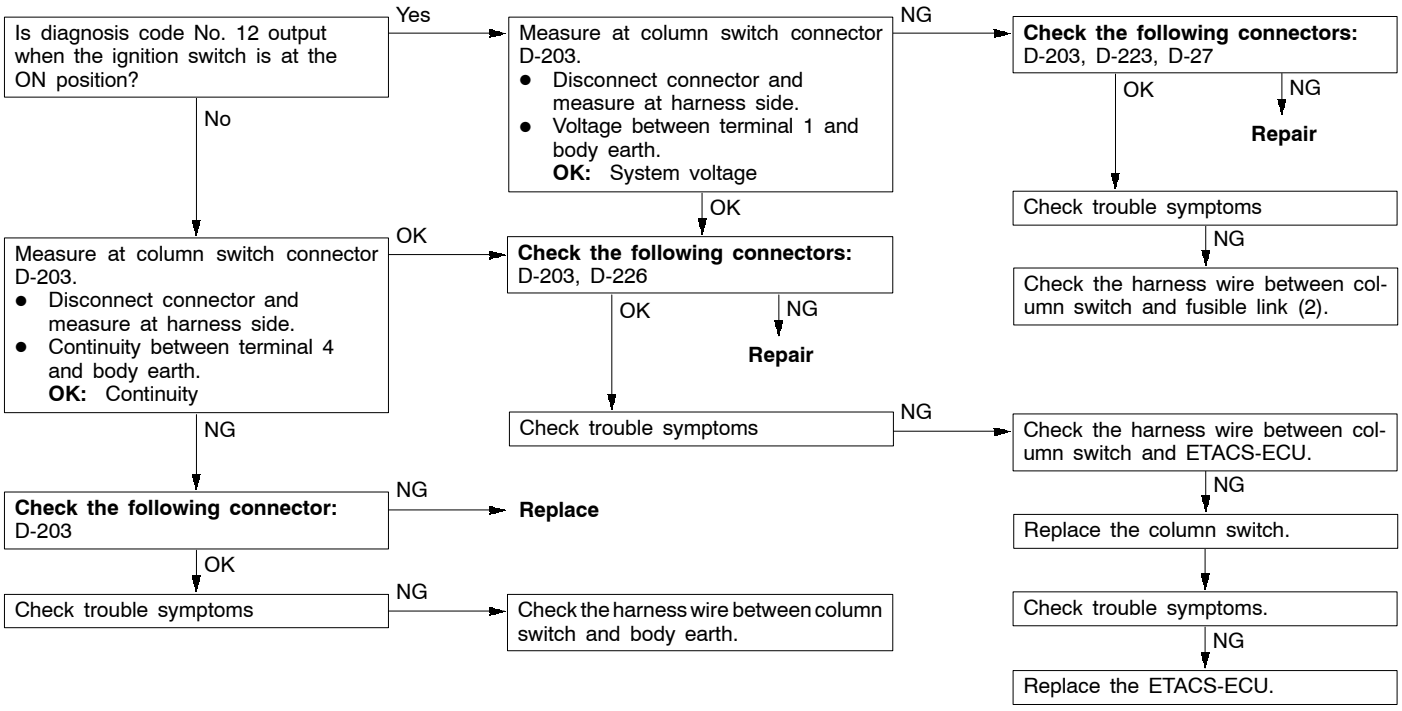
Code No.	Diagnosis item	Reference page
11	Failure concerning the ETACS-ECU	54B-10
12	Failure concerning the column switch or improper connecting with the ETACS-ECU	54B-10
13	Failure concerning the front-ECU	54B-11
21	Short circuit in communication line	54B-12

DIAGNOSIS CODE INSPECTION PROCEDURES

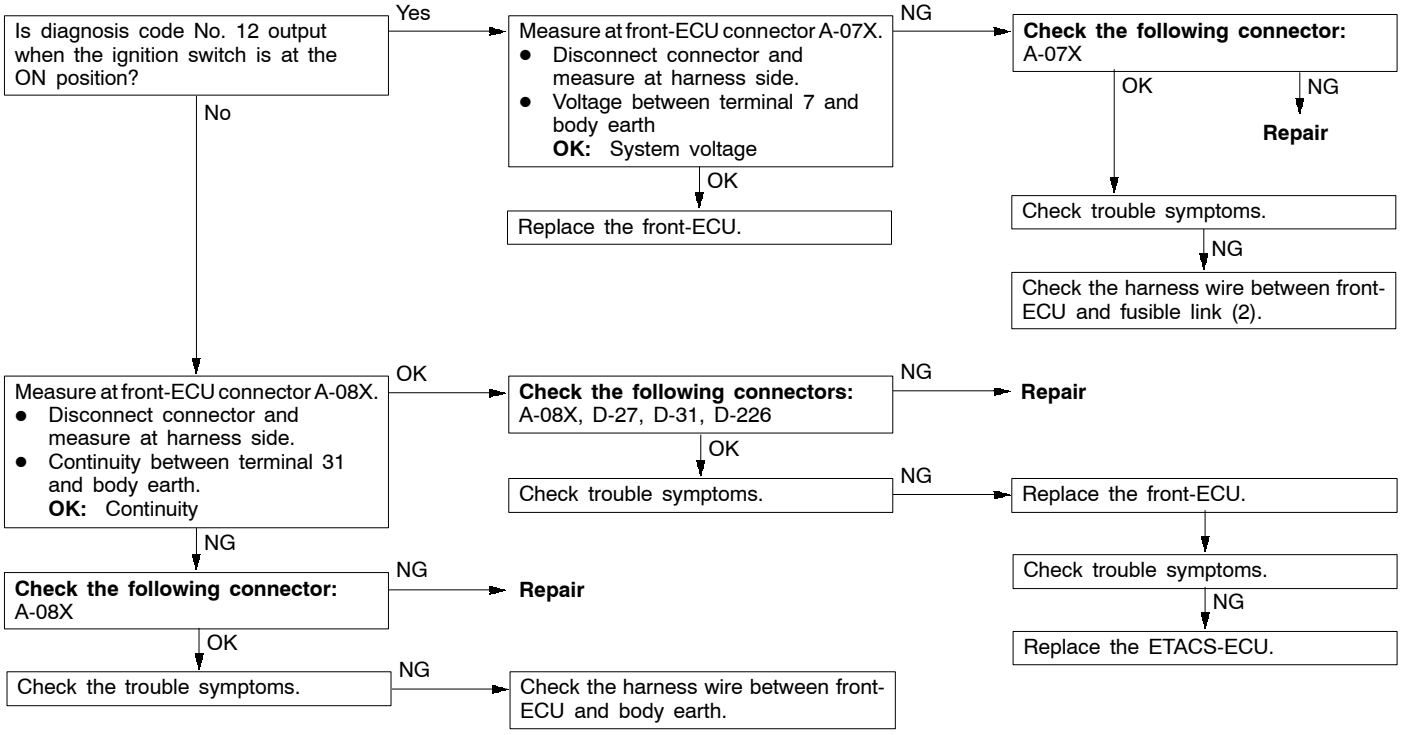
Code No.11 Failure concerning the ETACS-ECU	Probable cause
The ETACS-ECU monitors its own communication data, and sends a diagnosis code when an error takes place consecutive fifteen times in 0.6 second. The diagnosis code will be erased when the ETACS-ECU determines that its own communication data is sent consecutive 15 times in 0.6 second.	• Malfunction of ETACS-ECU

Replace the ETACS-ECU.

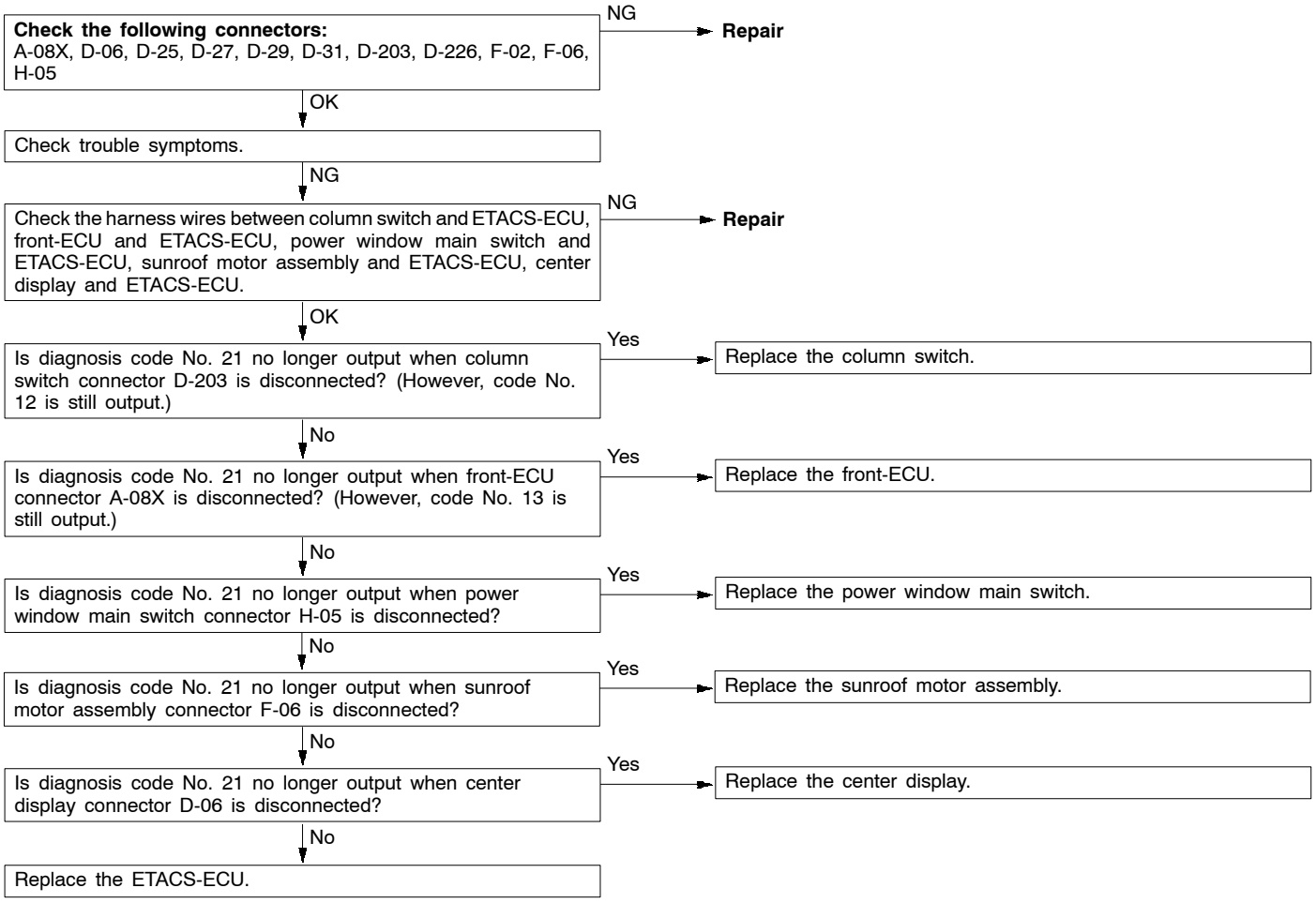
Code No.12 Failure concerning the column switch or improper connection with the ETACS-ECU	Probable cause
This diagnosis code is displayed when the column switch sends a signal regardless of the transmission request signal from the ETACS-ECU (three times or more in one second). The diagnosis code is erased 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 power window> • Malfunction of sunroof motor assembly <vehicles with sunroof> • Malfunction of center display <vehicles with 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-17
Buzzer	Light reminder warning buzzer function does not work normally.	B-1	54B-17
	Center display operation annunciation function does not work normally.	B-2	54B-18
Central door locking system	Central door locking system does not work normally.	C-1	54B-18
	Some doors does not lock or unlock.	C-2	54B-19
	Some functions of central locking system do not work.	C-3	54B-19
	Forgotten key prevention function does not work.	C-4	54B-20
Power window	Power window does not work at all.	D-1	54B-20
	Power window main switch can not operate driver's window.	D-2	54B-21
	Power window sub switch can not operate front passenger's or rear window.	D-3	54B-22
	Power window main switch can not operate front passenger's or rear window.	D-4	54B-23
	Power window timer function does not work normally.	D-5	54B-23
	When the glass is raised, it then lowers automatically.	D-6	54B-24
	The glass is not lowered when something is jammed in the window.	D-7	54B-24
	When the glass is fully raised, it then lowers automatically.	D-8	54B-24
Keyless entry system	Keyless entry system does not operate.	E-1	54B-24
	The room lamp and hazard warning lamps do not operate through the answerback function.	E-2	54B-25
	The encrypted code cannot be registered.	E-3	54B-25
Sunroof	Sunroof does not work at all.	F-1	54B-26
	Sunroof timer function does not work normally.	F-2	54B-27
	Safety mechanism does not function.	F-3	54B-27

Trouble symptom		Inspection procedure	Reference page
Windshield wiper and washer	Windshield wiper does not operate.	G-1	54B-28
	Windshield wiper does not stop at the predetermined park position.	G-2	54B-29
	Any of the windshield wiper switch positions is defective.	G-3	54B-29
	Windshield intermittent wiper interval cannot be adjusted.	G-4	54B-30
	Windshield washer does not work.	G-5	54B-30
Rear wiper and washer	Rear wiper does not work at all.	H-1	54B-31
	Rear wiper does not stop at the predetermined park position.	H-2	54B-31
	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.	H-3	54B-32
	Rear washer does not work.	H-4	54B-32
Headlamp washer	Headlamp washer does not work.	I-1	54B-33
Ignition key hole illumination lamp	Ignition key hole illumination lamp does not work normally.	J-1	54B-34
Headlamp, tail lamp	Tail lamp do not illuminate.	K-1	54B-34
	Headlamps (low-beam) do not illuminate.	K-2	54B-35
	Headlamps (high-beam) do not illuminate.	K-3	54B-35
	Headlamps do not illuminate when the passing switch is operated.	K-4	54B-36
	The headlamp automatic shutdown function does not work normally.	K-5	54B-36
	Headlamp dimmer switch automatic reset function does not work normally.	K-6	54B-37
	Daytime running lamp (DRL) function does not work.	K-7	54B-37
Flasher timer	Turn-signal lamp do not flash when the turn-signal lamp switch is turned on.	L-1	54B-37
	Hazard warning lamps do not flash when the hazard warning lamp switch is turned on.	L-2	54B-38
Front fog lamp	Front fog lamps do not illuminate when the front fog lamp switch is turned on.	M-1	54B-39
	Front fog lamp do not go out when the tail lamps are turned off while the front fog lamps are on.	M-2	54B-39

Trouble symptom		Inspection procedure	Reference page
Rear fog lamp	Rear fog lamp do not illuminate when the rear fog lamp switch is turned on.	N-1	54B-40
	Rear fog lamp do not go out when the headlamps and front fog lamps are turned off while the rear fog lamp is on.	N-2	54B-40
Room lamp	Room lamp does not illuminate.	O-1	54B-41
	Room lamp dimming function does not work normally.	O-2	54B-41
Center display	Center display does not work normally.	–	GROUP 54A – Center Display.

DEFECTS FOUND BY INPUT SIGNAL CHECK

If the input signal check finds a defect, follow the table below to check.

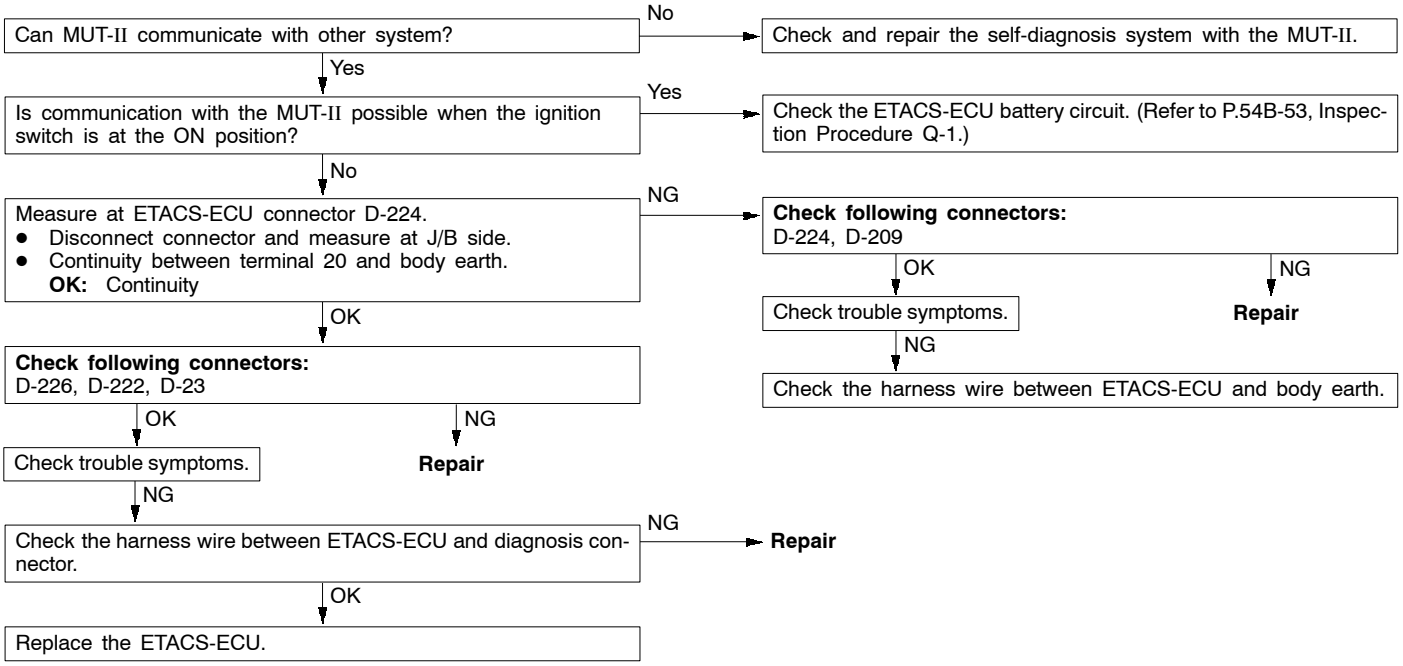
Trouble symptom	Inspection procedure	Reference page
Ignition switch (ACC) signal is not sent to the ETACS-ECU.	P-1	54B-42
Ignition switch (IG1) signal is not sent to the ETACS-ECU.	P-2	54B-42
Key reminder switch signal is not sent to the ETACS-ECU.	P-3	54B-43
Hazard warning lamp switch signal is not sent to the ETACS-ECU.	P-4	54B-43
Front fog lamp switch signal is not sent to the ETACS-ECU.	P-5	54B-44
Rear fog lamp switch signal is not sent to the ETACS-ECU.	P-6	54B-45
Back-up lamp switch signal is not sent to the ETACS-ECU. <M/T>	P-7	54B-45
Inhibitor switch (reverse) signal is not sent to the ETACS-ECU. <A/T>	P-8	54B-46
Rear wiper motor auto-stop signal is not sent to the ETACS-ECU.	P-9	54B-46
Driver's door switch signal is not sent to the ETACS-ECU.	P-10	54B-47
Door switches signal is not sent to the ETACS-ECU.		
Front passenger's or back door lock key cylinder switch signal is not sent to the ETACS-ECU.	P-11	54B-48
Driver's door lock actuator switch signal is not sent to the ETACS-ECU.	P-12	54B-48

Trouble symptom		Inspection procedure	Reference page
Column switch	Tail lamp switch signal is not sent to the ETACS-ECU.	P-13	54B-49
	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.	P-14	54B-50
	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.	P-15	54B-50
	Windshield washer switch signal is not sent to the ETACS-ECU.	P-14	54B-50
	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.	P-13	54B-49
Power window main switch	Any switch signal is not sent to the ETACS-ECU.	P-16	54B-51
Transmitter	Any switch signal is not sent to the ETACS-ECU.	P-17	54B-52
Sunroof switch	Any switch signal is not sent to the ETACS-ECU.	P-18	54B-52
Center display	Any switch signal is not sent to the ETACS-ECU.	P-19	54B-53

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

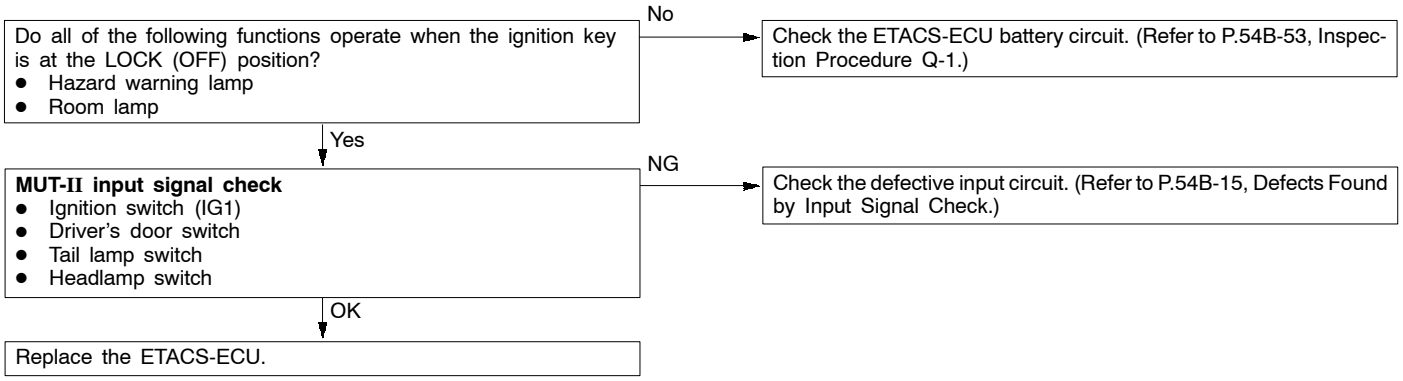
Inspection Procedure A-1

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



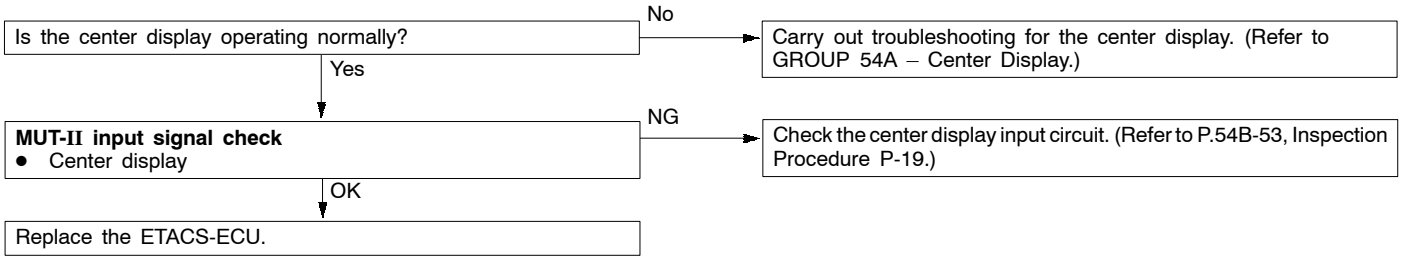
Inspection Procedure B-1

Buzzer: Light reminder warning buzzer function does not work normally.	Probable cause
The ETACS-ECU operates the light reminder warning buzzer function, based on input signals from the following switches: • 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



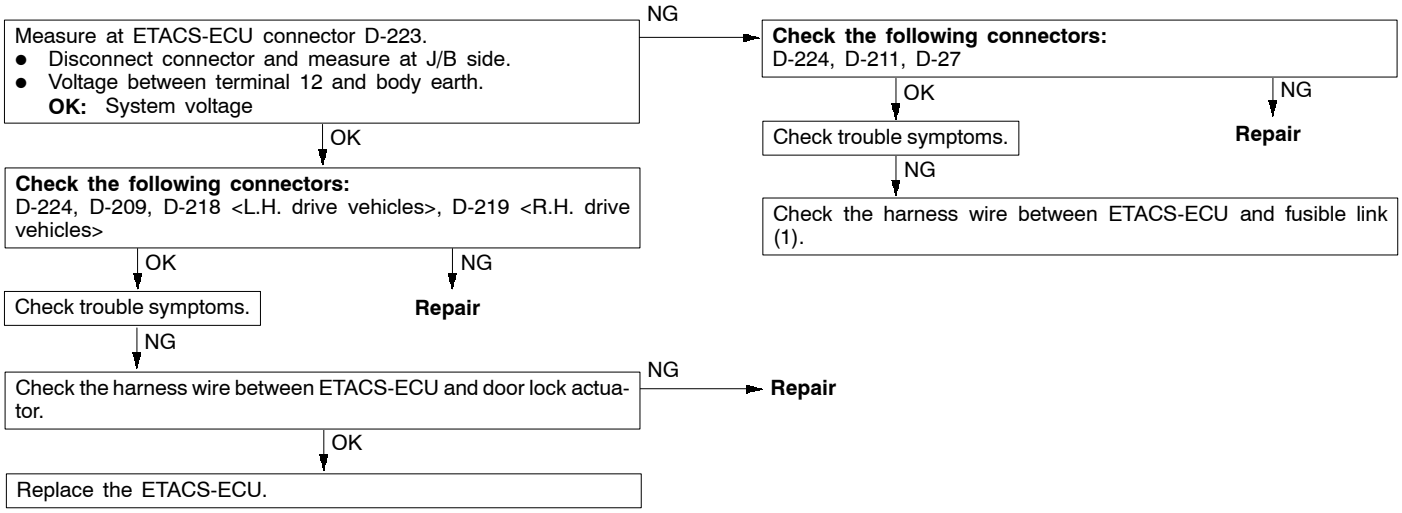
Inspection Procedure B-2

Buzzer: Center display operation annunciation function does not work normally.	Probable cause
If the center display is operating normally, the cause is probably a malfunction in the harness between the center display and the ETACS-ECU or in the ETACS-ECU itself.	• Malfunction of center display • Malfunction of ETACS-ECU • Malfunction of harness wire or connector



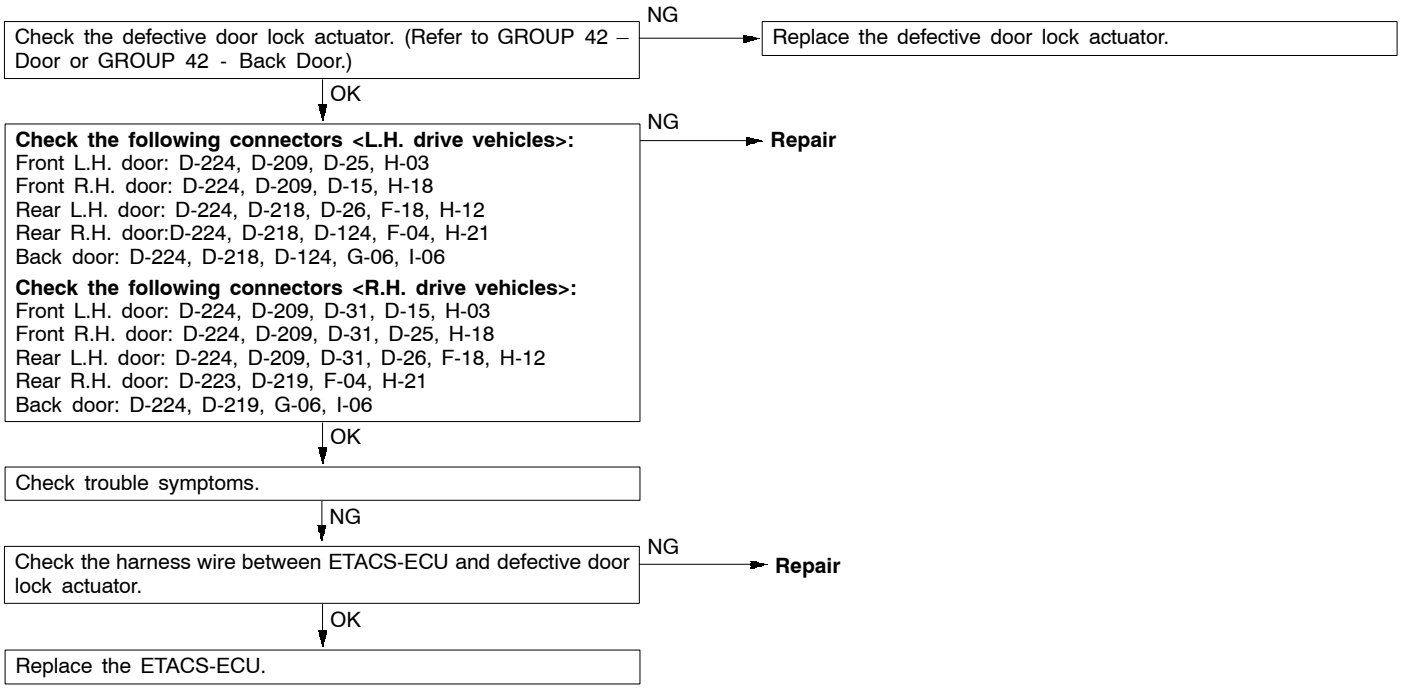
Inspection Procedure C-1

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



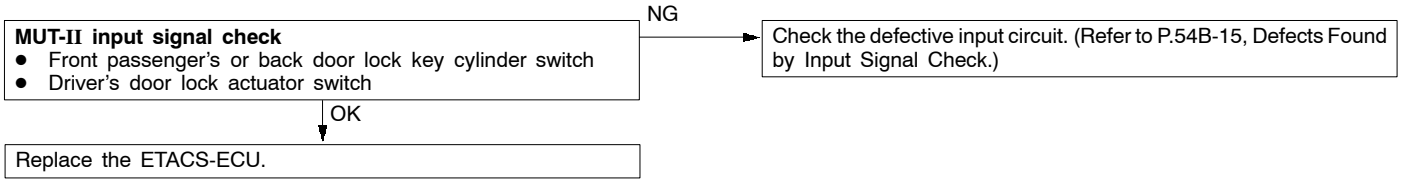
Inspection Procedure C-2

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, front passenger's, rear or back door lock actuator • Malfunction of ETACS-ECU • Malfunction of harness wire or connector



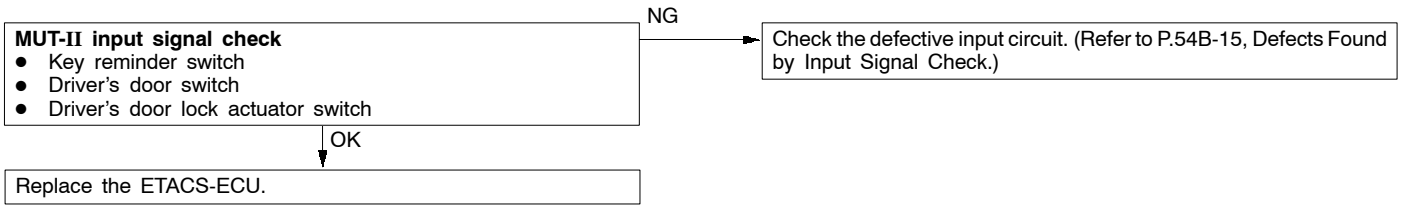
Inspection Procedure C-3

Central door locking system: Some functions of central locking system do not work.	Probable cause
The ETACS-ECU operates the central door locking system, based on input signals from the following switches: • Front passenger's or back door lock key cylinder switch • Driver's door lock actuator switch If the system does not work normally, a defect on the relevant circuit or the ETACS-ECU may be suspected.	• Malfunction of front passenger's or back door lock key cylinder switch • Malfunction of driver's door lock actuator switch • Malfunction of ETACS-ECU • Malfunction of harness wire or connector



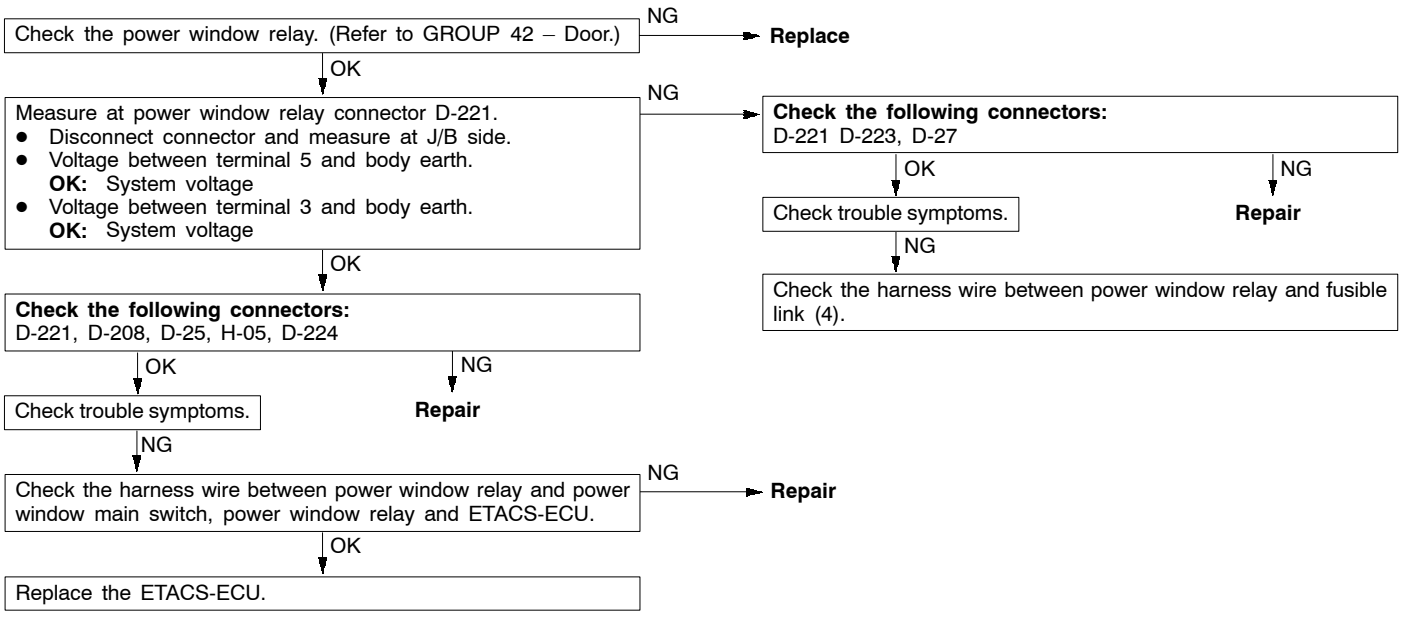
Inspection Procedure C-4

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



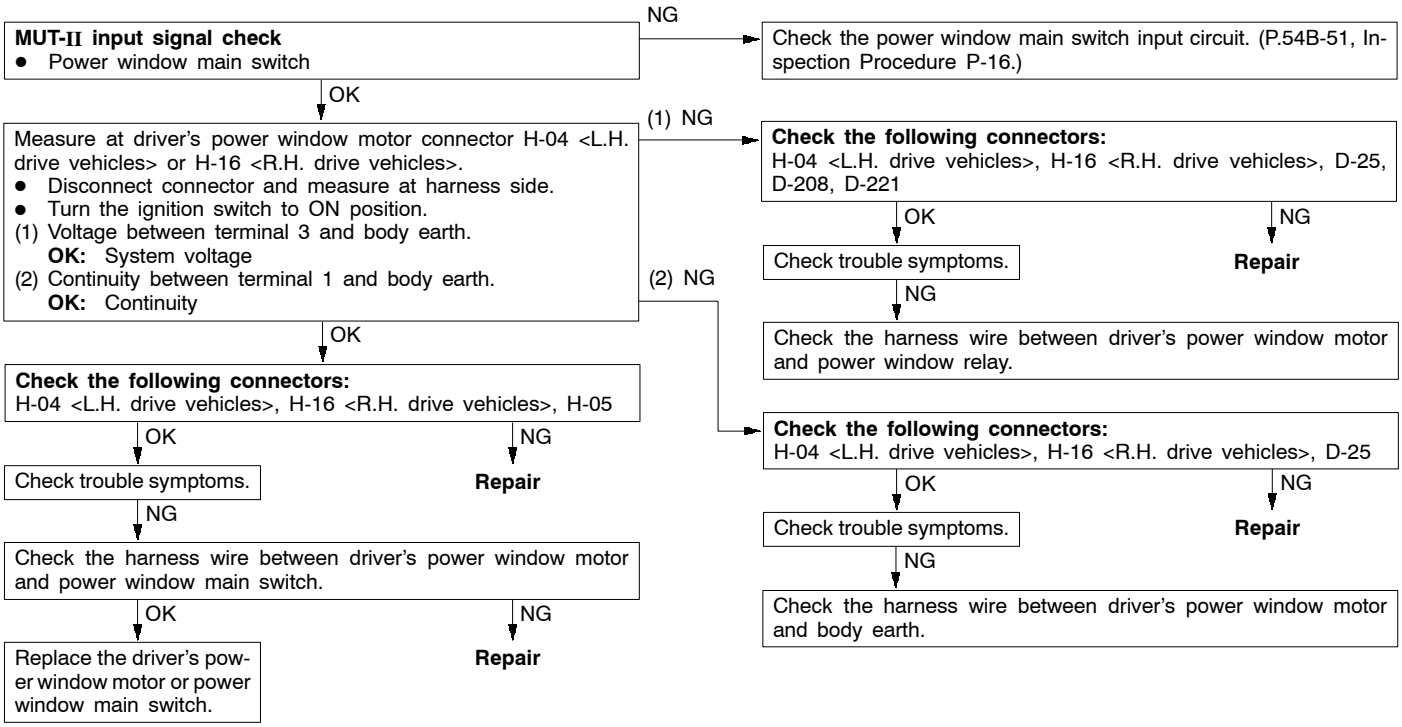
Inspection Procedure D-1

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



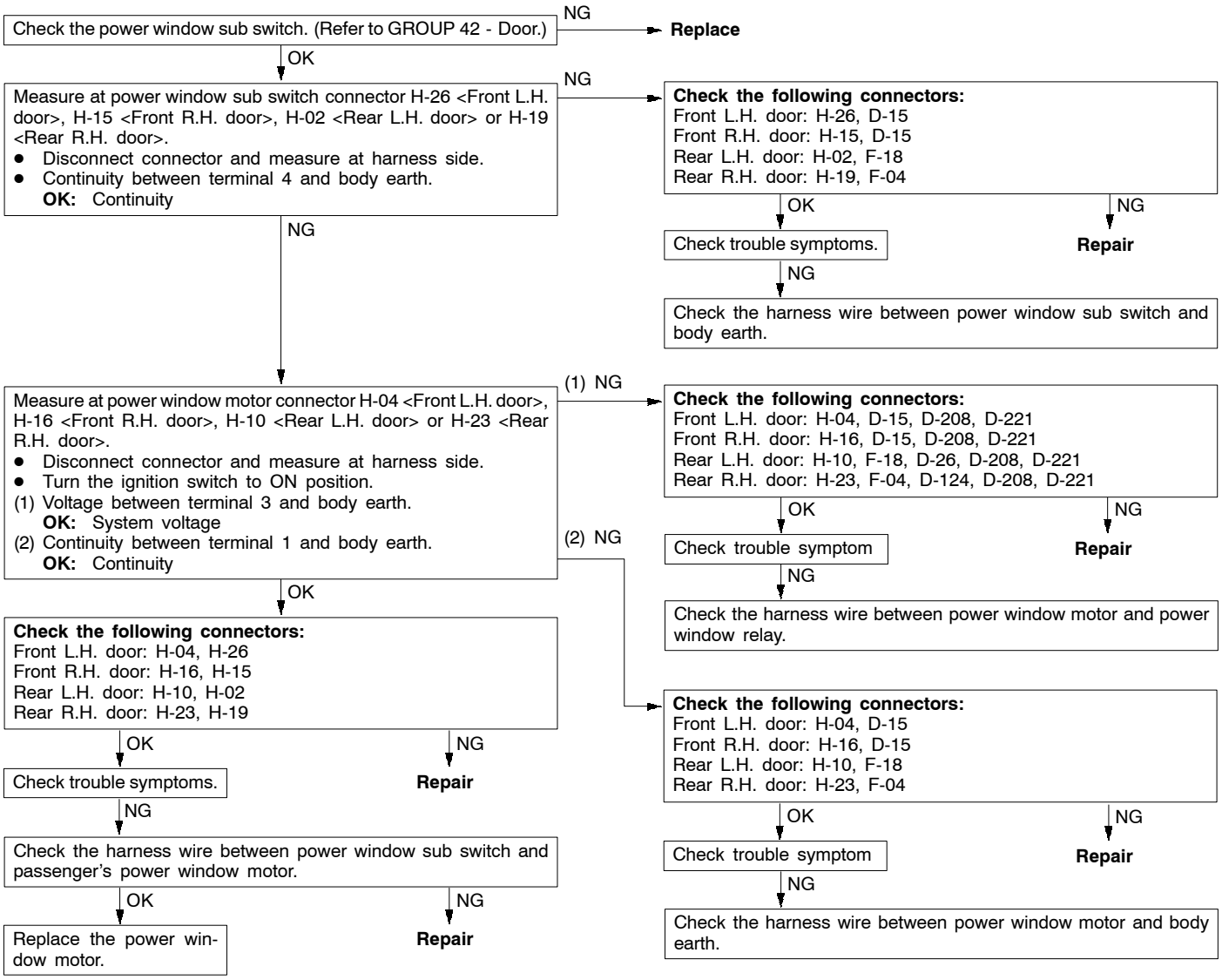
Inspection Procedure D-2

Power window: Power window main switch can not operate driver'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



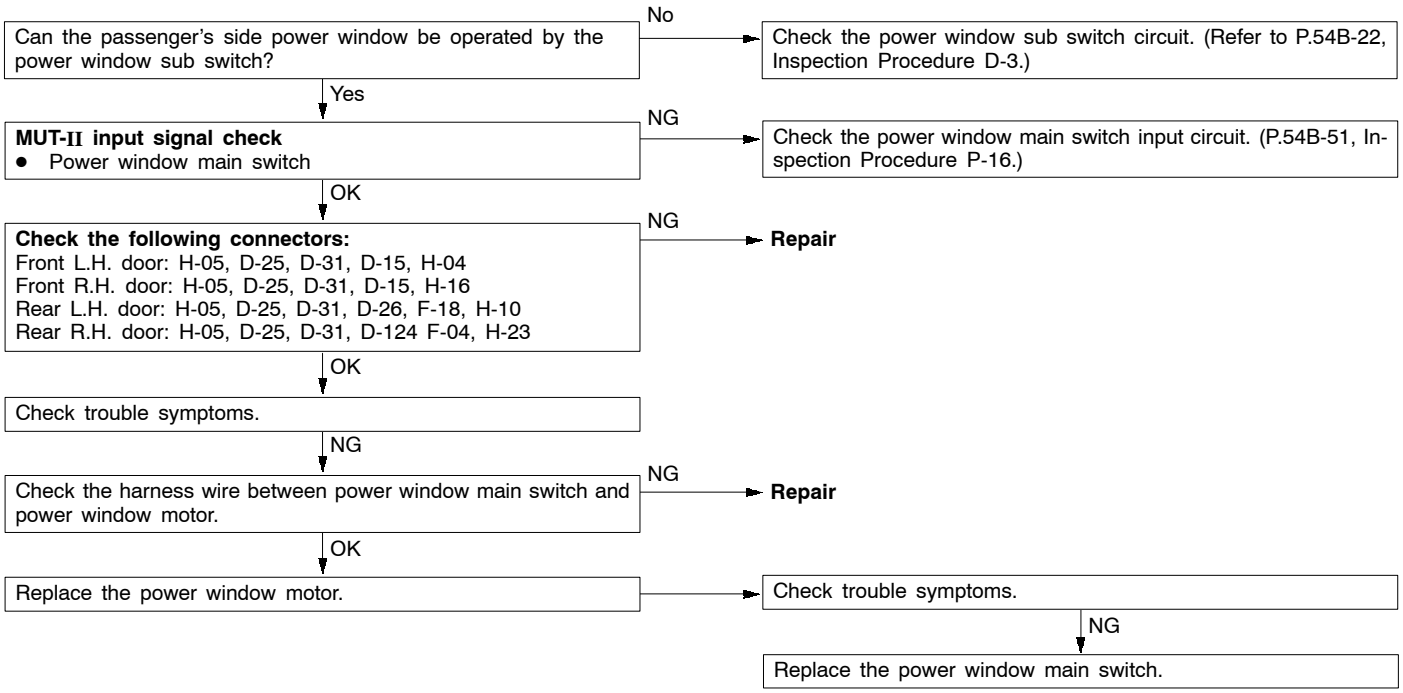
Inspection Procedure D-3

Power window: Power window sub switch can not operate front passenger's or rear window.	Probable cause
The cause is probably a malfunction of the power window sub switch or front passenger's or rear power window motor, or an abnormality in the power supply circuit.	• Malfunction of power window sub switch • Malfunction of front passenger's or rear power window motor • Malfunction of harness wire or connector



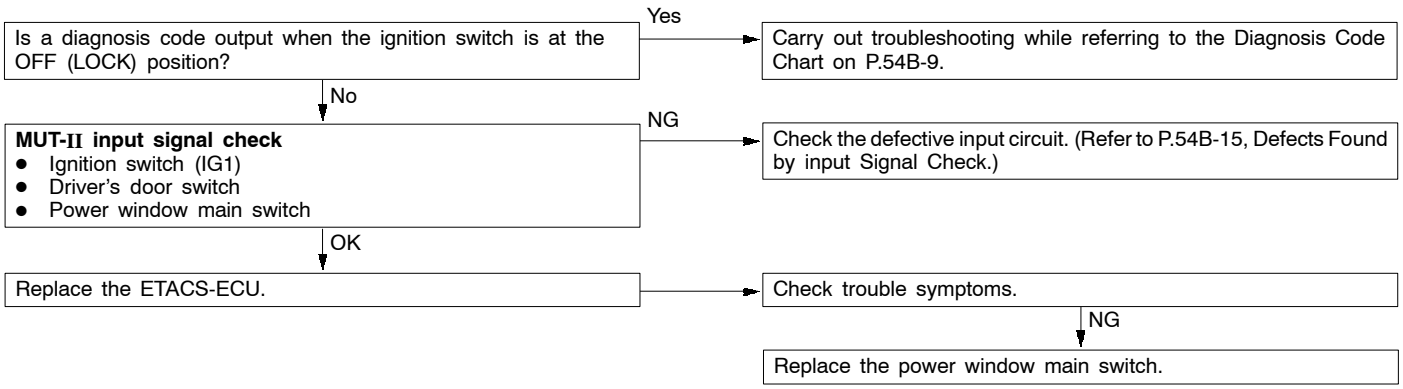
Inspection Procedure D-4

Power window: Power window main switch can not operate front passenger's or rear window.	Probable cause
The cause is probably a malfunction of the power window main switch or front passenger's or rear power window motor, or an abnormality in the power supply circuit.	• Malfunction of power window main switch • Malfunction of front passenger's or rear power window motor • Malfunction of harness wire or connector



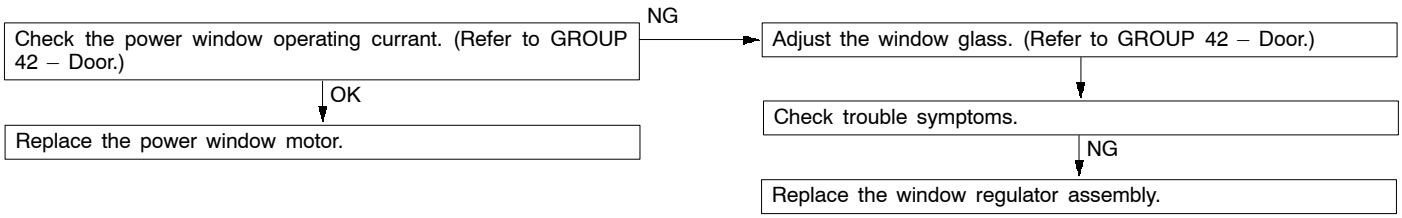
Inspection Procedure D-5

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, power window main switch or the ETACS-ECU may be suspected.	• Malfunction of driver's door switch • Malfunction of power window main 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



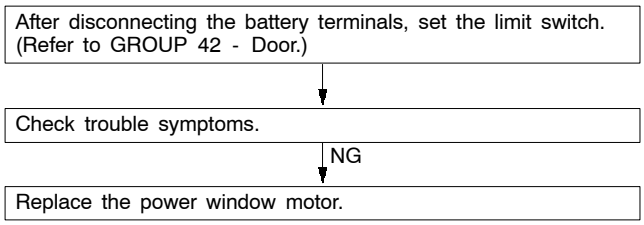
Inspection Procedure D-7

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.

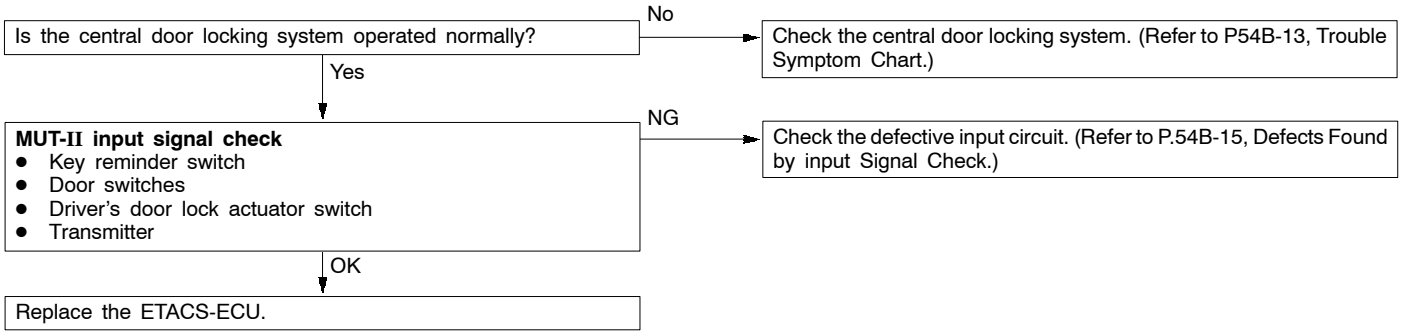
Inspection Procedure D-8

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



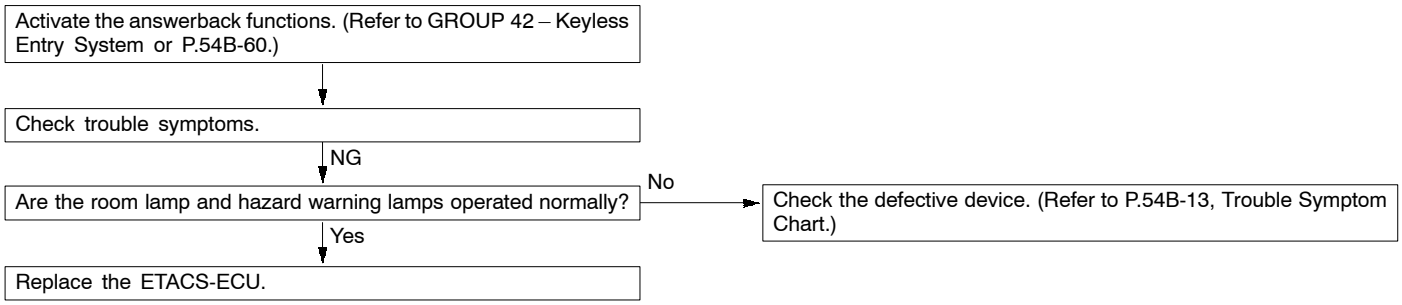
Inspection Procedure E-1

Keyless entry system: Keyless entry system does not operate.	Probable cause
The ETACS-ECU operates the keyless entry system, based on the input signals from the following switches: • Key reminder switch • Door switches • Driver's door lock actuator switch • Transmitter 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 door switches • Malfunction of driver's door lock actuator switch • Malfunction of transmitter • Malfunction of ETACS-ECU



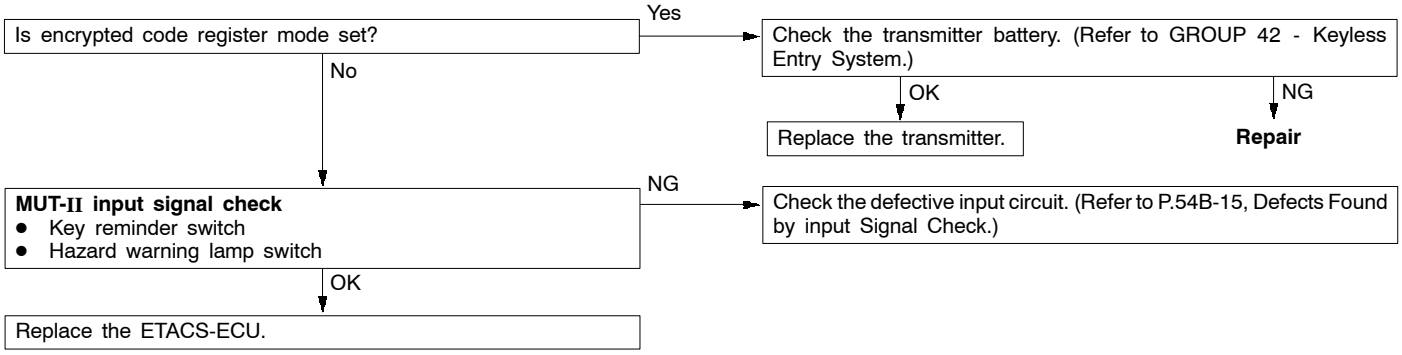
Inspection Procedure E-2

Keyless entry system: The room lamp and hazard warning lamps do not operate through the answerback function.	Probable cause
The hazard warning lamp answerback function can be selected by the driver's desire (can be deactivated). However, the room lamp answerback function can not be deactivated. if all of these device do not operate through the answerback function, the ETACS-ECU may be defective.	• Malfunction of turn-signal lamp • Malfunction of room lamp • Malfunction of ETACS-ECU • Malfunction of harness wire or connector



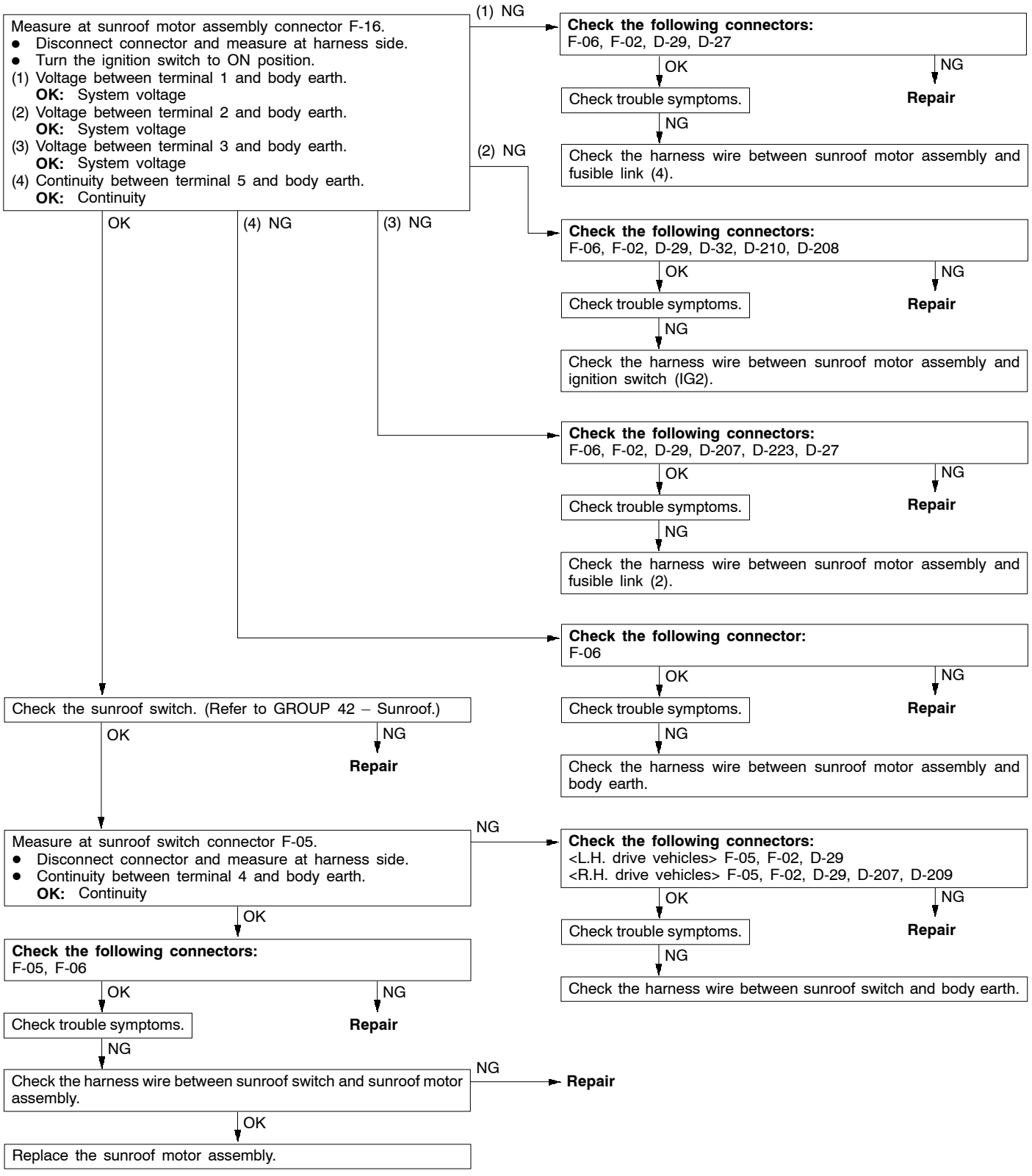
Inspection Procedure E-3

Keyless entry system: The encrypted code cannot be registered.	Probable cause
The ETACS-ECU actives the encrypted code register mode according to the following switch signals. • Key reminder switch • Hazard warning lamp switch If the encrypted code register mode is not set, the relevant input signal circuit or the ETACS-ECU may be defective. If a transmitter can not be registered although the encrypted code register mode is set, the transmitter or the ETACS-ECU may be defective.	• Malfunction of key reminder switch • Malfunction of hazard warning lamp switch • Malfunction of transmitter • Malfunction of ETACS-ECU • Malfunction of harness wire or connector



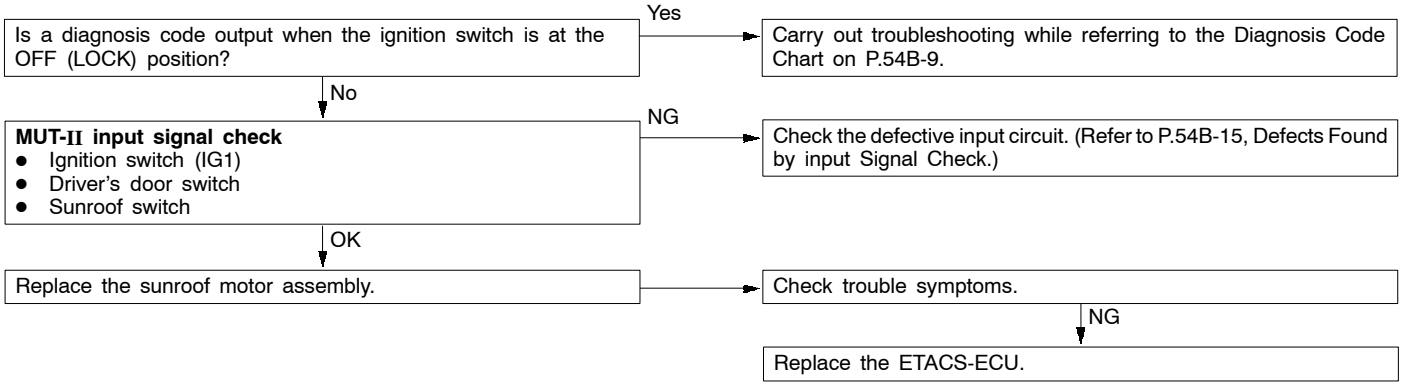
Inspection Procedure F-1

Sunroof: Sunroof does not work at all.	Probable cause
The power supply circuit of the sunroof motor assembly, the sunroof switch ground circuit, or the sunroof motor assembly may be defective.	• Malfunction of sunroof switch • Malfunction of sunroof motor assembly • Malfunction of harness wire or connector



Inspection Procedure F-2

Sunroof: Sunroof timer function does not work normally.	Probable cause
The sunroof motor assembly operates the sunroof 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, sunroof motor assembly or the ETACS-ECU may be suspected.	● Malfunction of driver's door switch ● Malfunction of sunroof motor assembly ● Malfunction of ETACS-ECU ● Malfunction of harness wire or connector



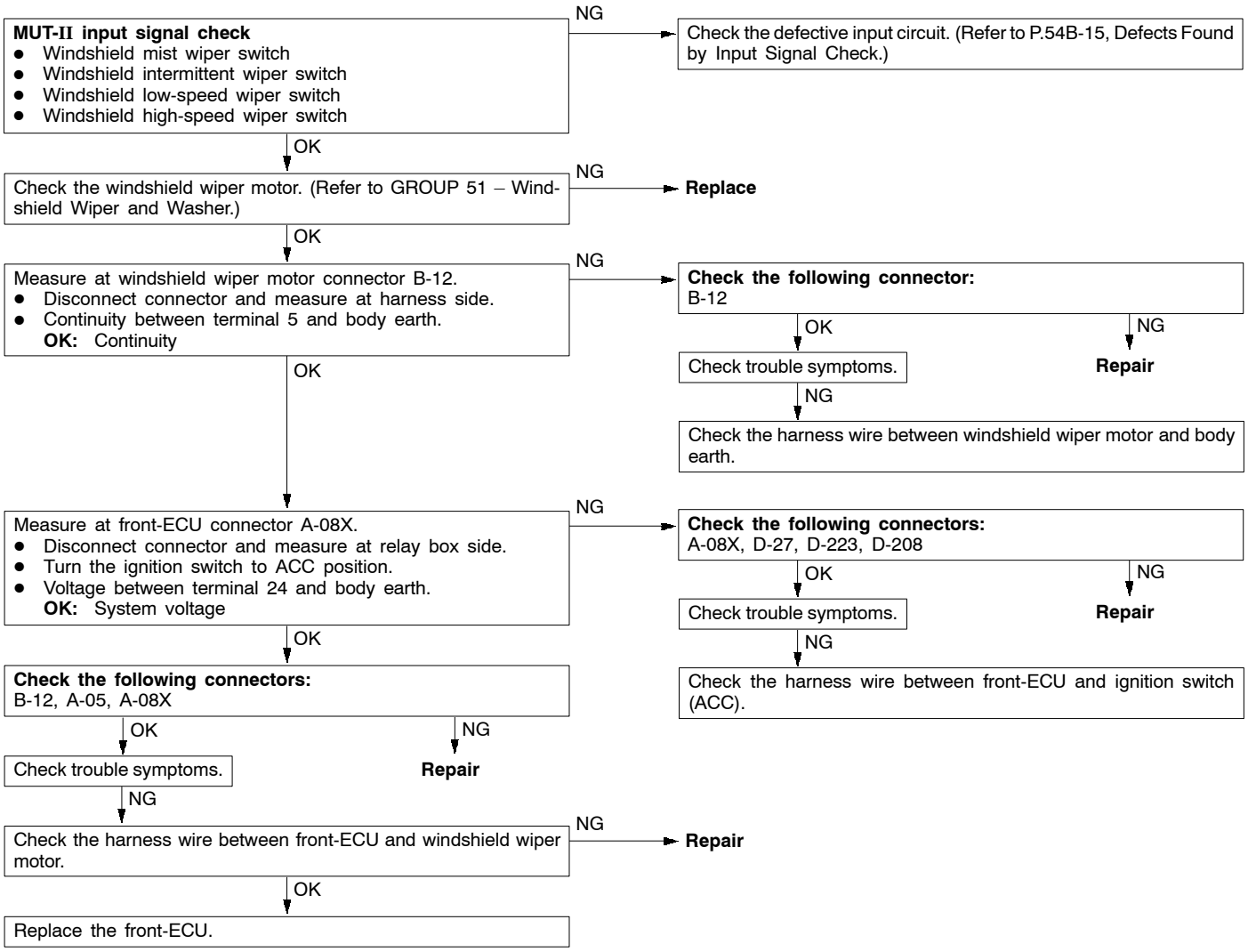
Inspection Procedure F-3

Sunroof: Safety mechanism does not work normally.	Probable cause
The sunroof motor assembly monitors load condition according to the current, which runs in the motor. If a predetermined current is exceeded, the sunroof motor reverses due to safety mechanism. If the sunroof motor does not reverse when an excessive load is applied, the sunroof motor assembly may be defective.	● Malfunction of sunroof motor assembly

Replace the sunroof motor assembly.

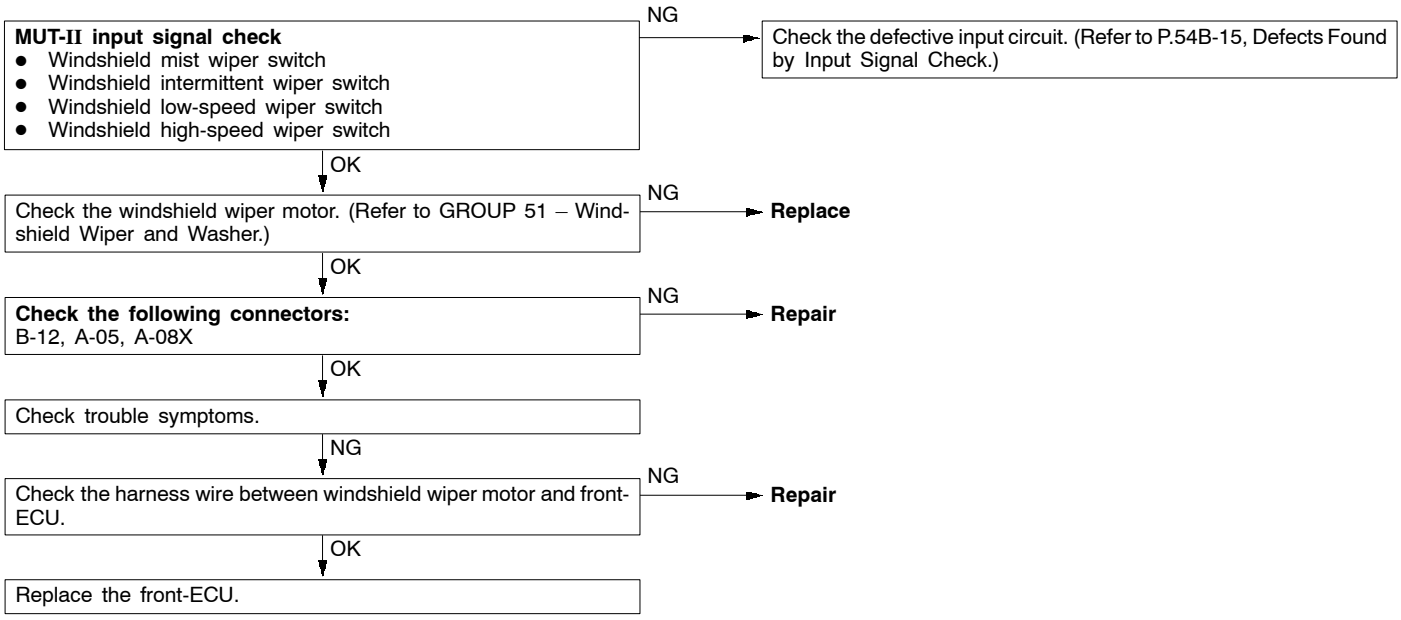
Inspection Procedure G-1

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



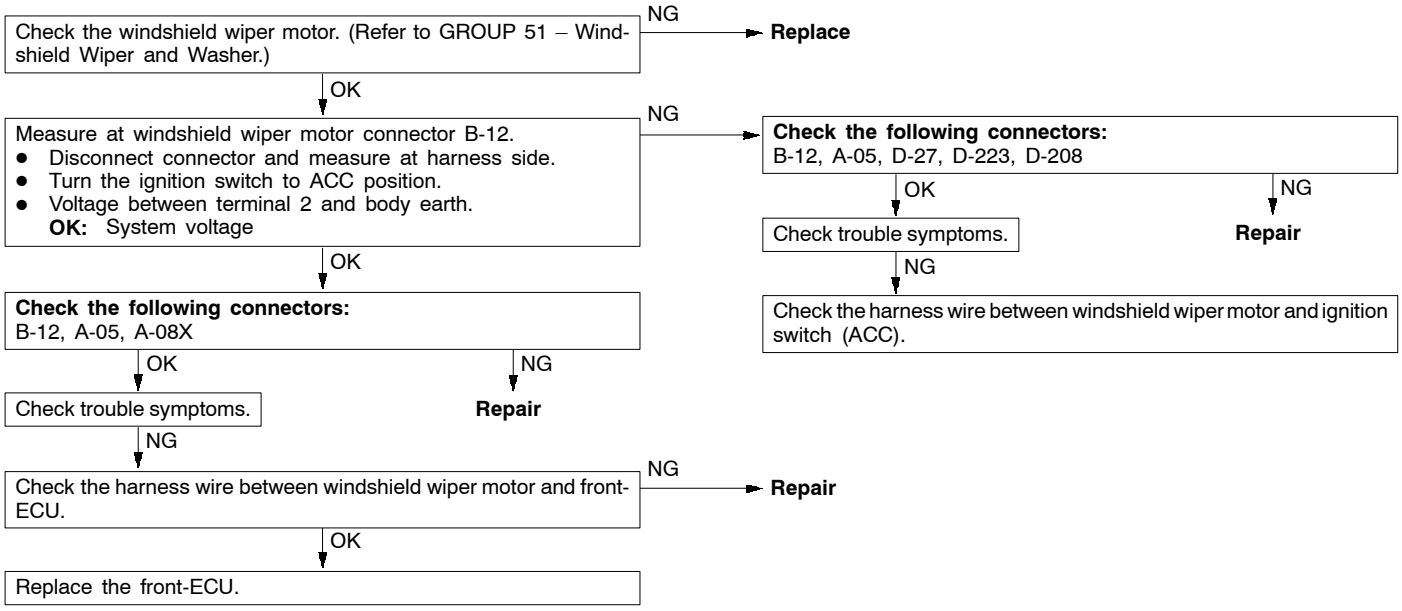
Inspection Procedure G-2

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



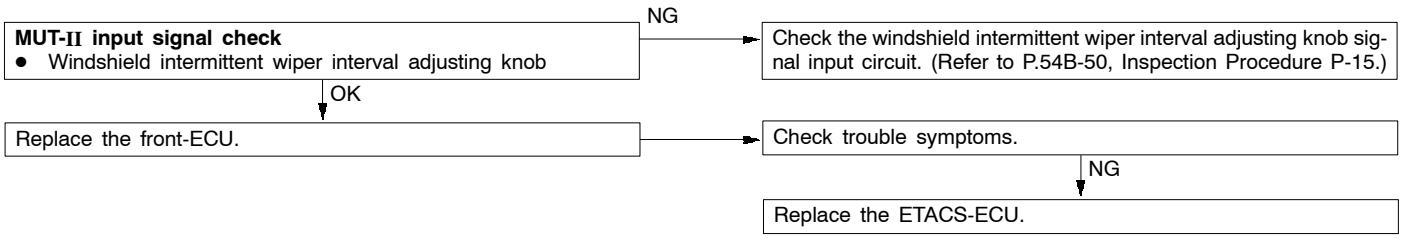
Inspection Procedure G-3

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



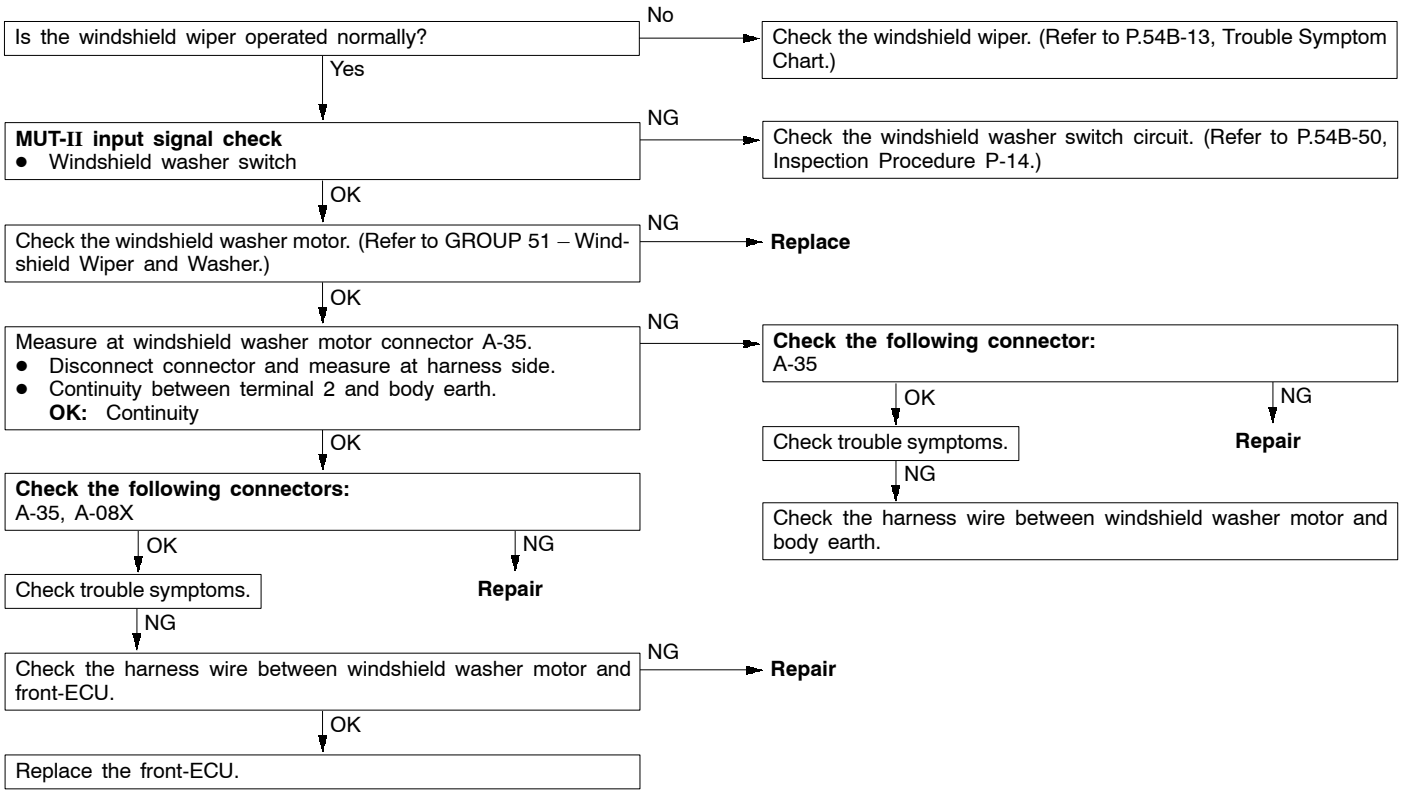
Inspection Procedure G-4

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



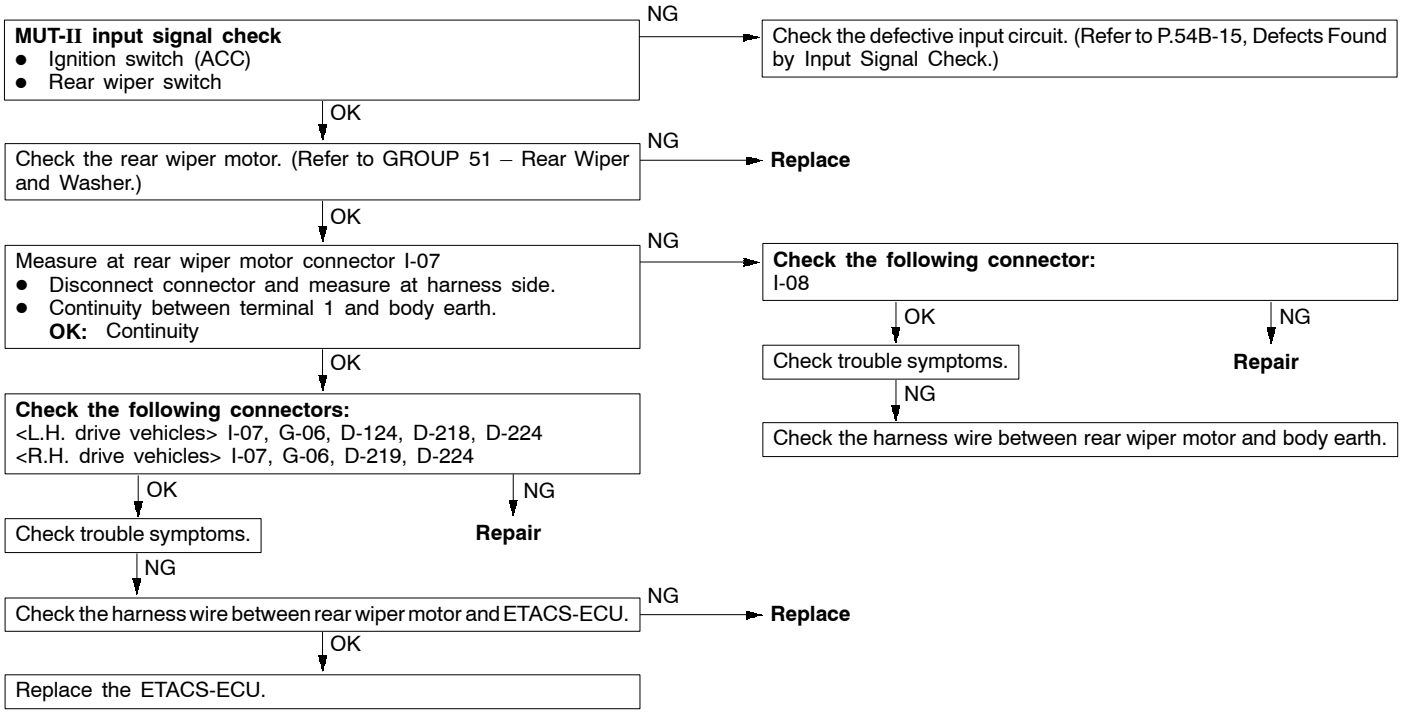
Inspection Procedure G-5

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



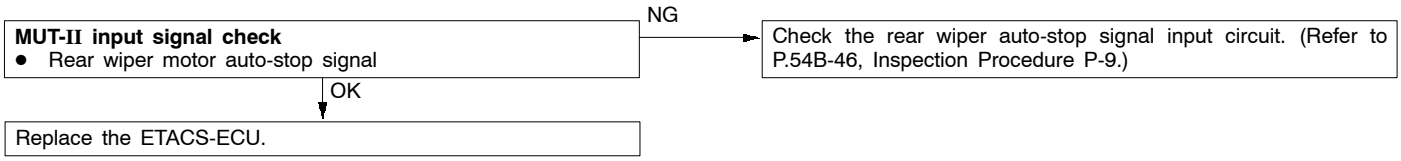
Inspection Procedure H-1

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



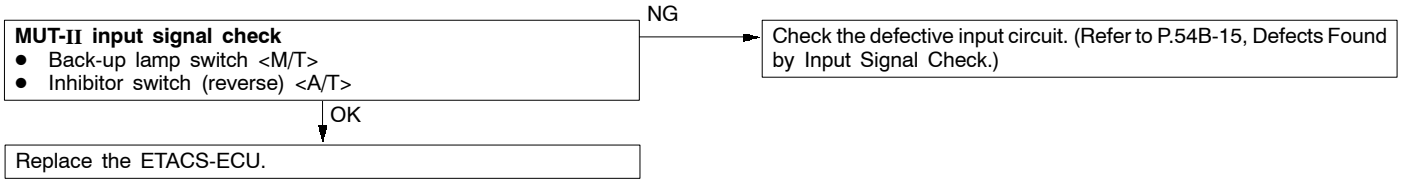
Inspection Procedure H-2

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



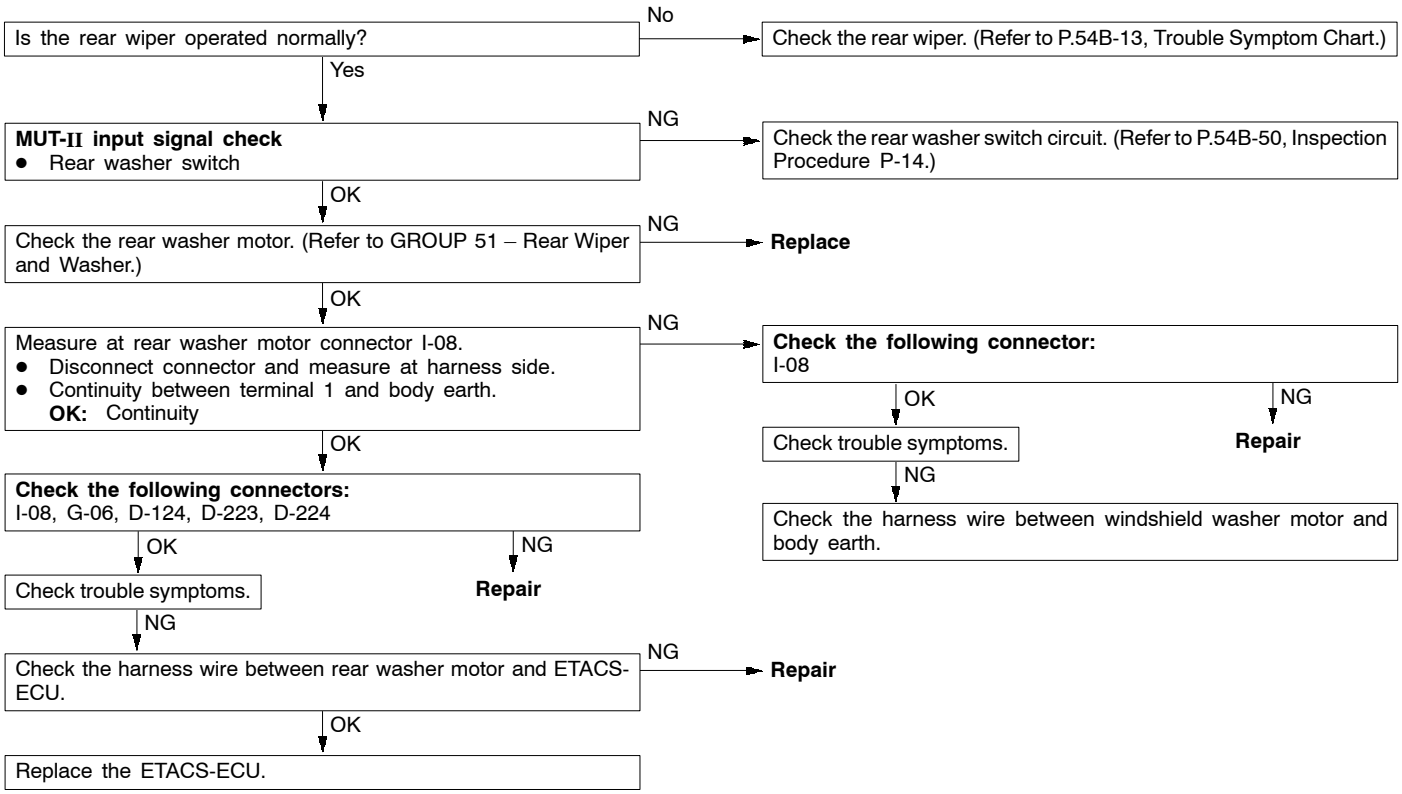
Inspection Procedure H-3

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



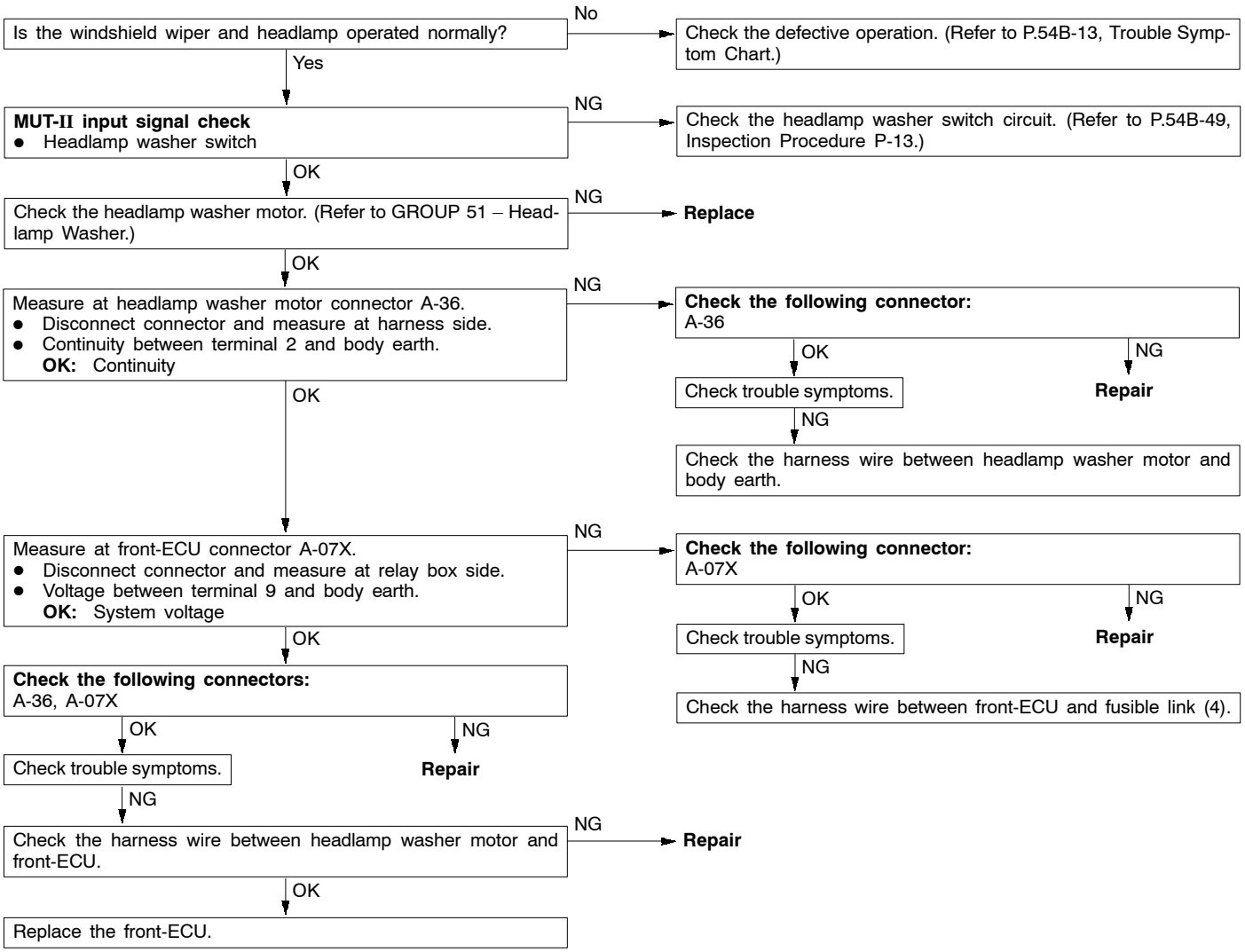
Inspection Procedure H-4

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



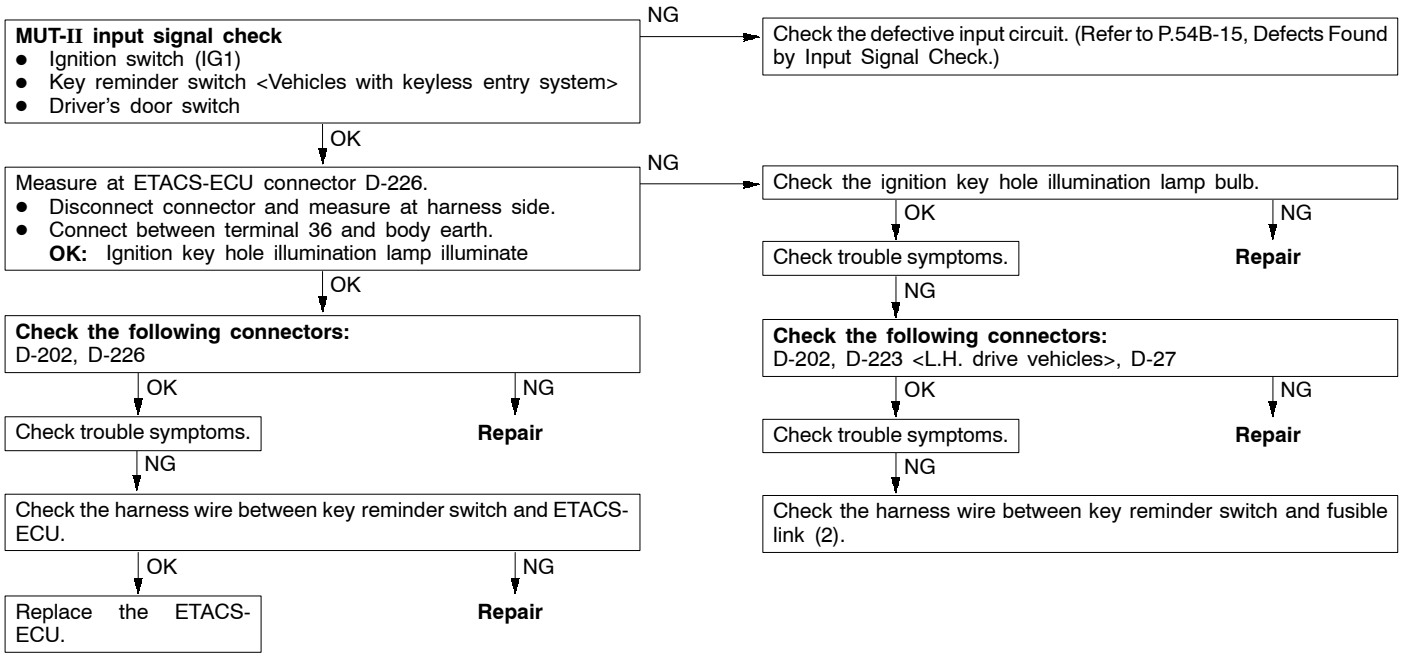
Inspection Procedure I-1

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



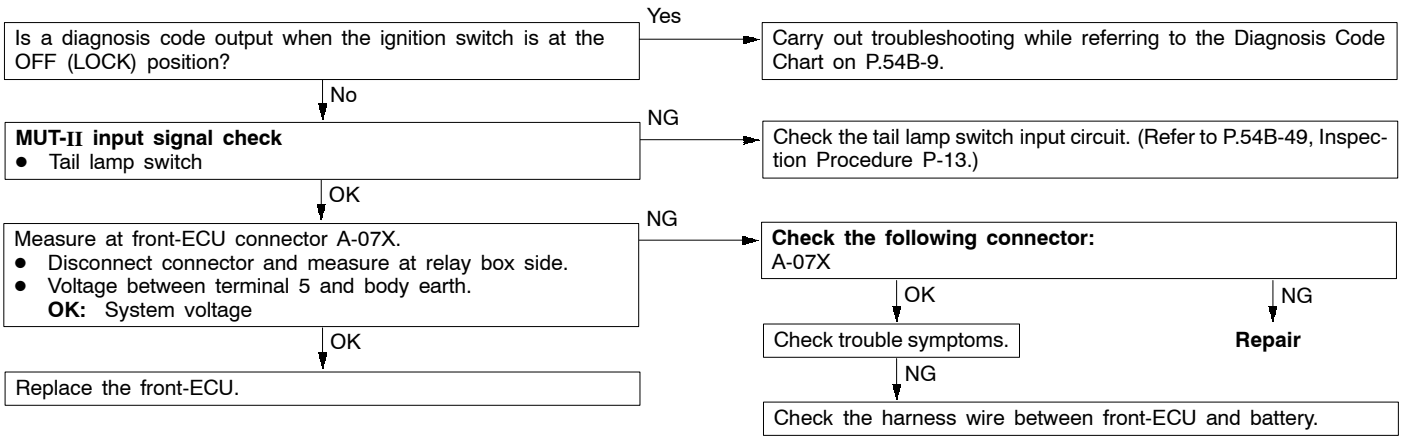
Inspection Procedure J-1

Ignition key hole illumination lamp: Ignition key hole illumination lamp does not work normally.	Probable cause
The ETACS-ECU operates the ignition key hole illumination lamp operation, based on input signals from the following switches: ● Ignition switch (IG1) ● Key reminder switch <Vehicles with keyless entry system> ● Driver's door switch If the ignition key hole illumination lamp does not work normally, the relevant input signal circuit, the combination meter or the ETACS-ECU may be defective.	● Malfunction of key reminder switch <Vehicles with keyless entry system> ● Malfunction of driver's door switch ● Malfunction of combination meter ● Malfunction of ETACS-ECU ● Malfunction of harness wire or connector



Inspection Procedure K-1

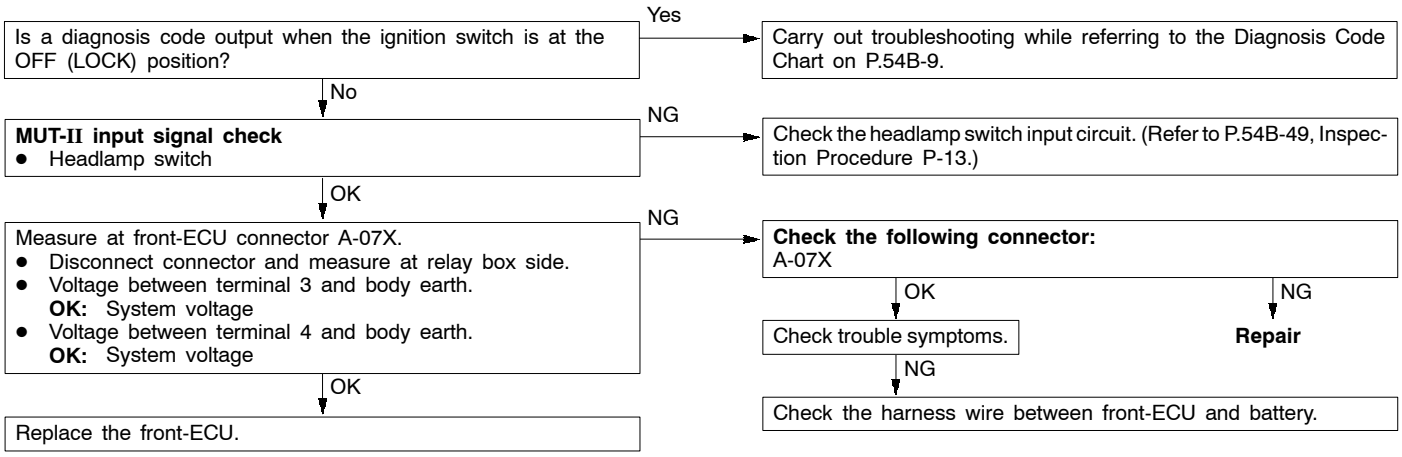
Headlamp, tail lamp: Tail lamp do not illuminate.	Probable cause
The column switch or the front-ECU may be defective.	● Malfunction of column switch ● Malfunction of front-ECU ● Malfunction of harness wire or connector



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 K-2

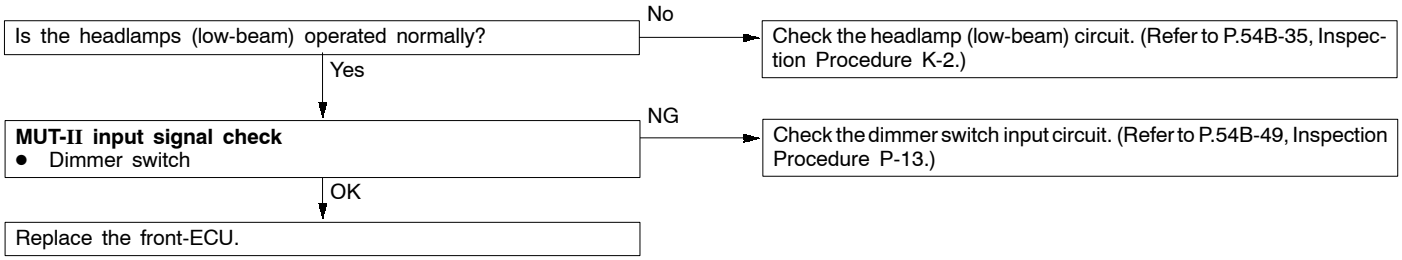
Headlamp, tail lamp: Headlamps (low-beam) do not illuminate.	Probable cause
The column switch or the front-ECU may be defective.	• Malfunction of column switch • Malfunction of front-ECU • Malfunction of harness wire or connector



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 K-3

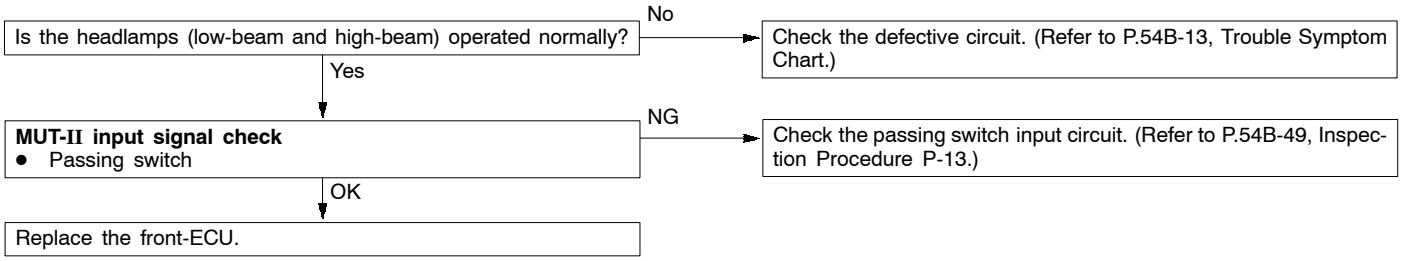
Headlamp, tail lamp: Headlamps (high-beam) do not illuminate.	Probable cause
The column switch or the front-ECU is suspected to be defective.	• Malfunction of column switch • Malfunction of front-ECU • Malfunction of harness wire or connector



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.

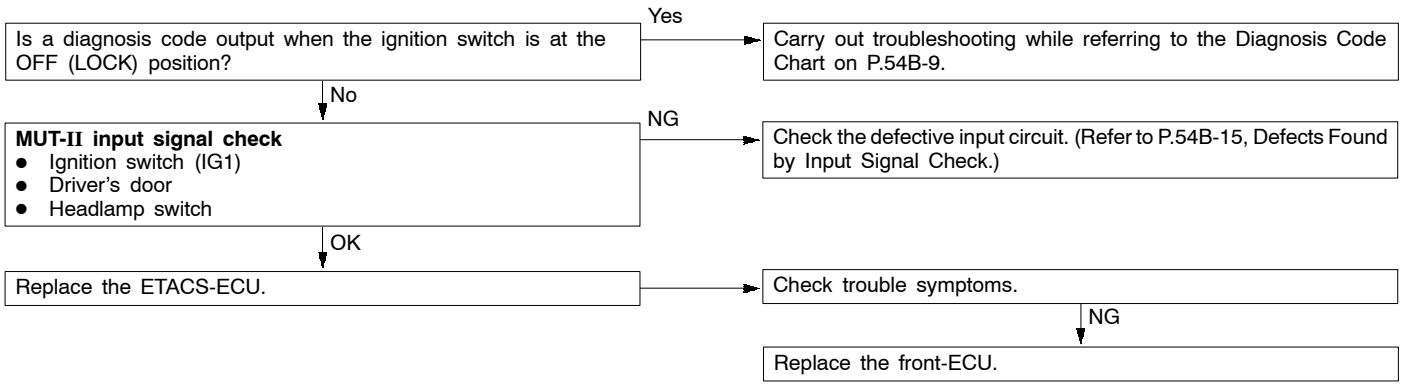
Inspection Procedure K-4

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 K-5

Headlamp, tail lamp: The headlamp automatic shutdown function does not work normally.	Probable cause
The ETACS-ECU operates the headlamp automatic shutdown function, based on the signals from the following switches • Ignition switch (IG1) • Driver's door switch • Headlamp switch If the head lamp automatic shutdown 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



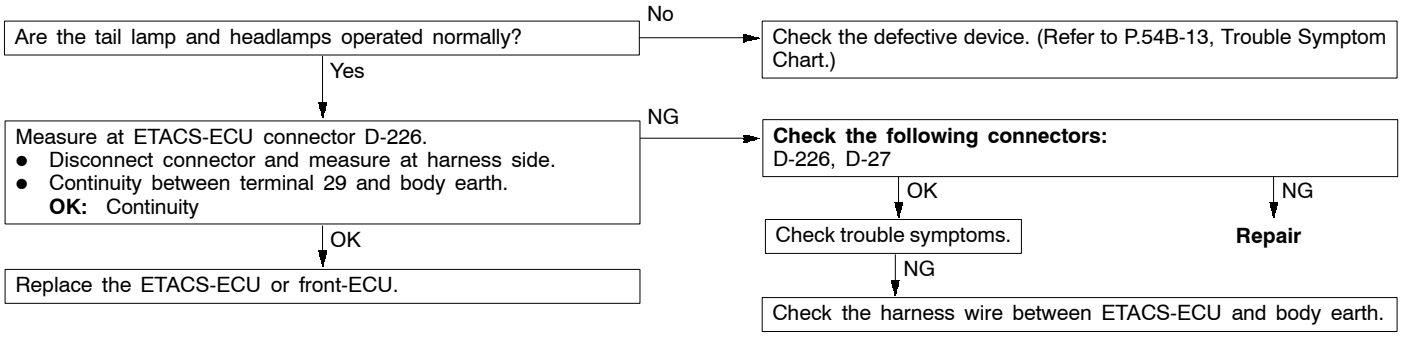
Inspection Procedure K-6

Headlamp, tail lamp: Headlamps dimmer switch automatic reset function does not work normally.	Probable cause
The headlamp dimmer switch automatic 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.

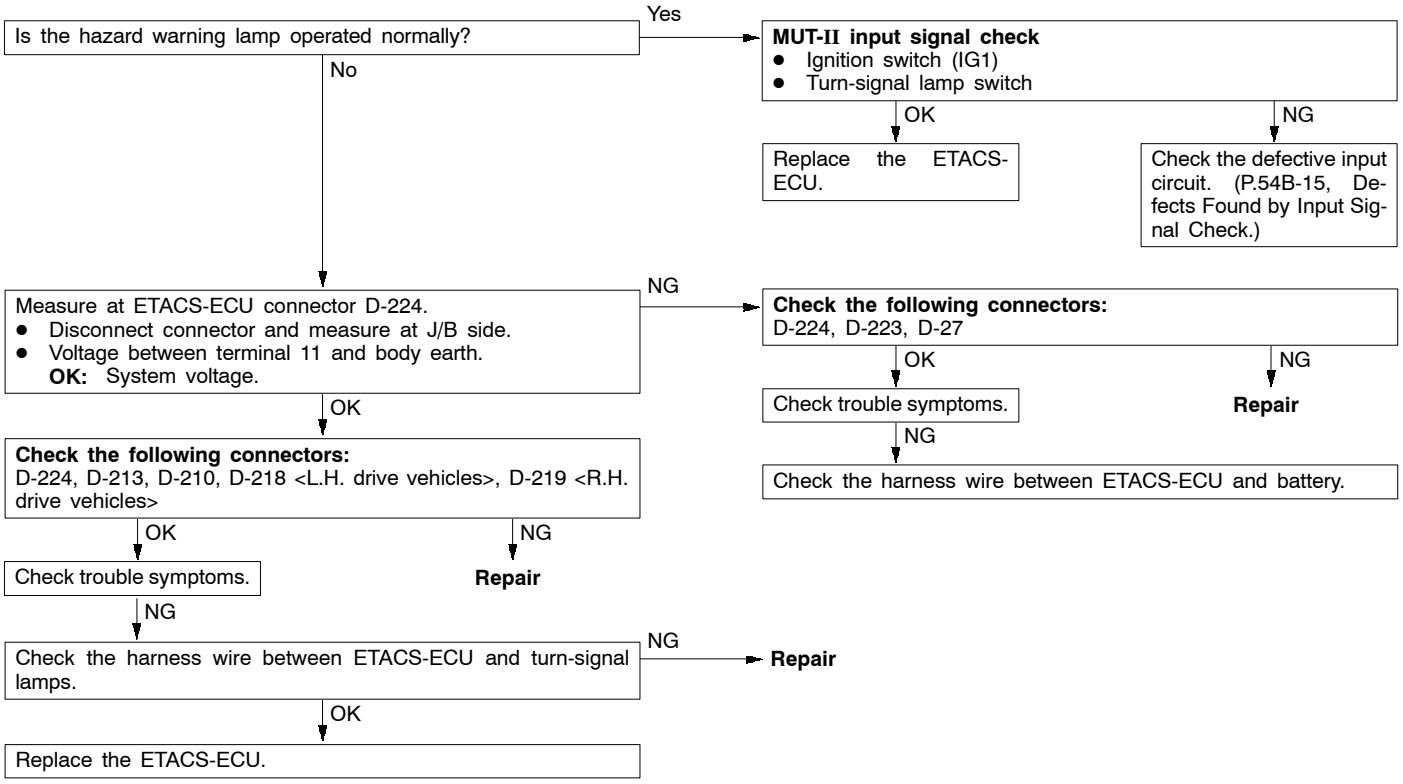
Inspection Procedure K-7

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 L-1

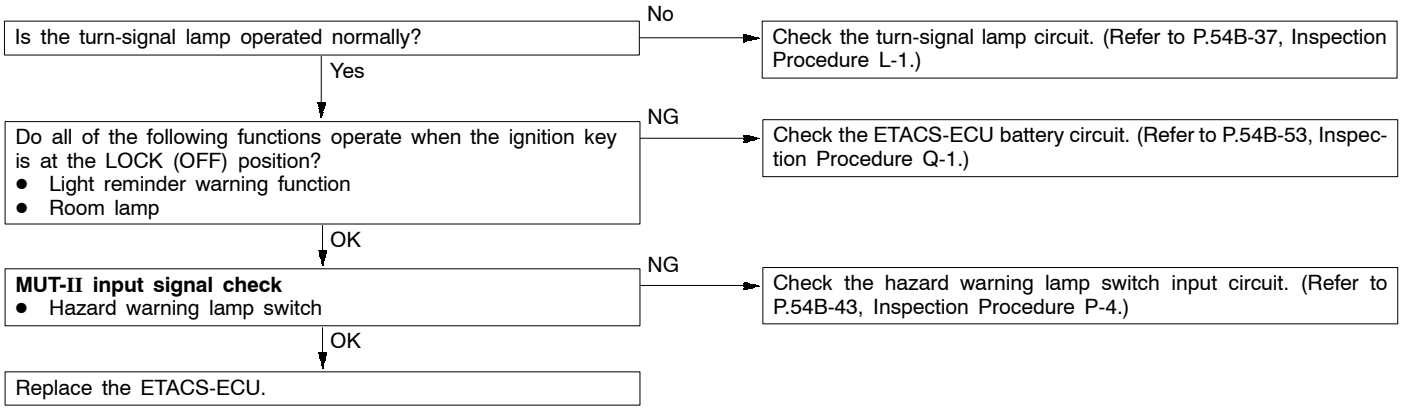
Flasher timer: Turn-signal lamp do not flash when the turn-signal lamp switch is turned on.	Probable cause
The ETACS-ECU makes the turn-signal lamps flash, based on the input signals from the following switches: • Ignition switch (IG1) • Turn-signal lamp switch If the turn-signal lamps do not flash normally, 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.

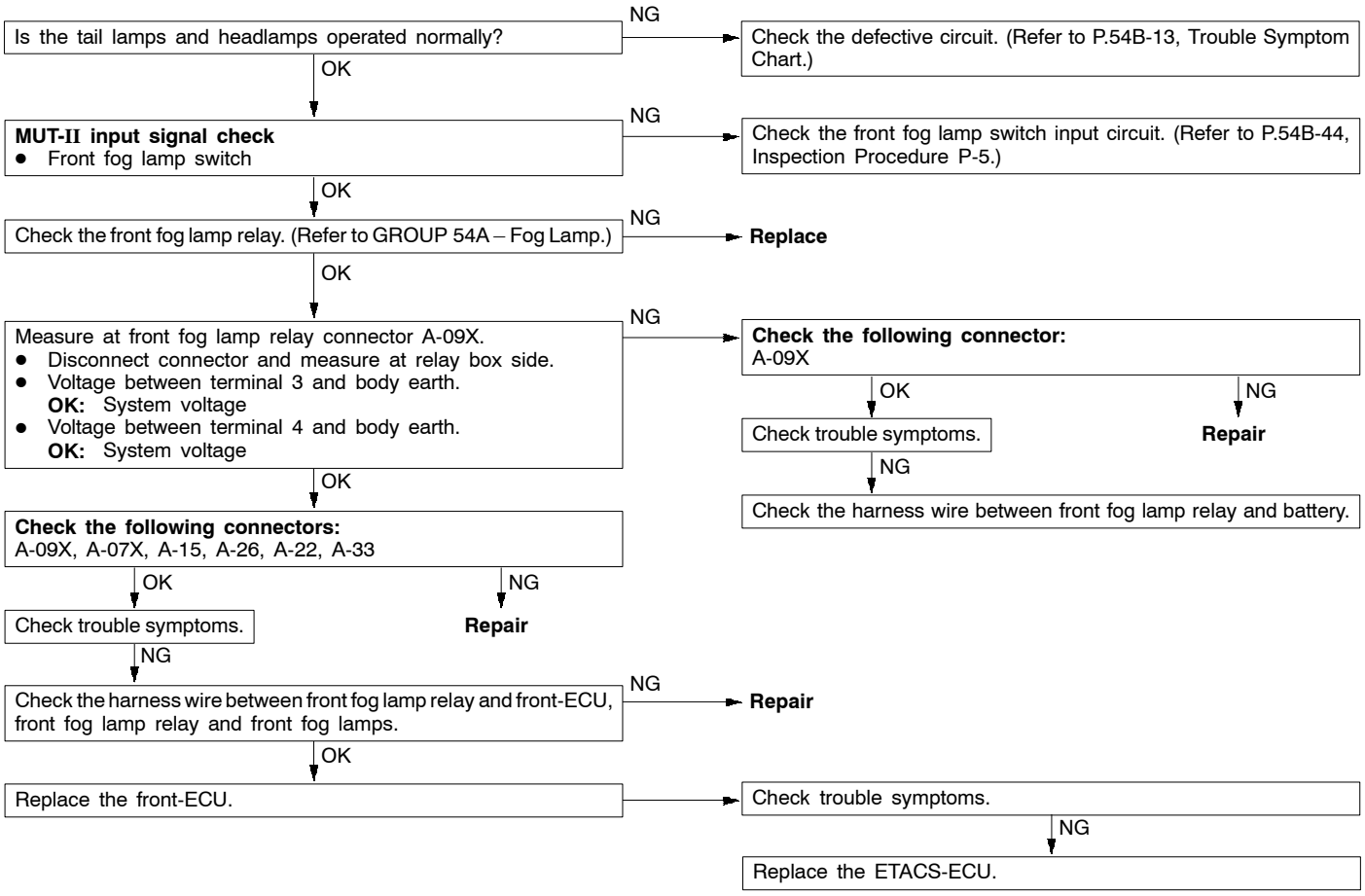
Inspection Procedure L-2

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.



Inspection Procedure M-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 and headlamps 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 front 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.

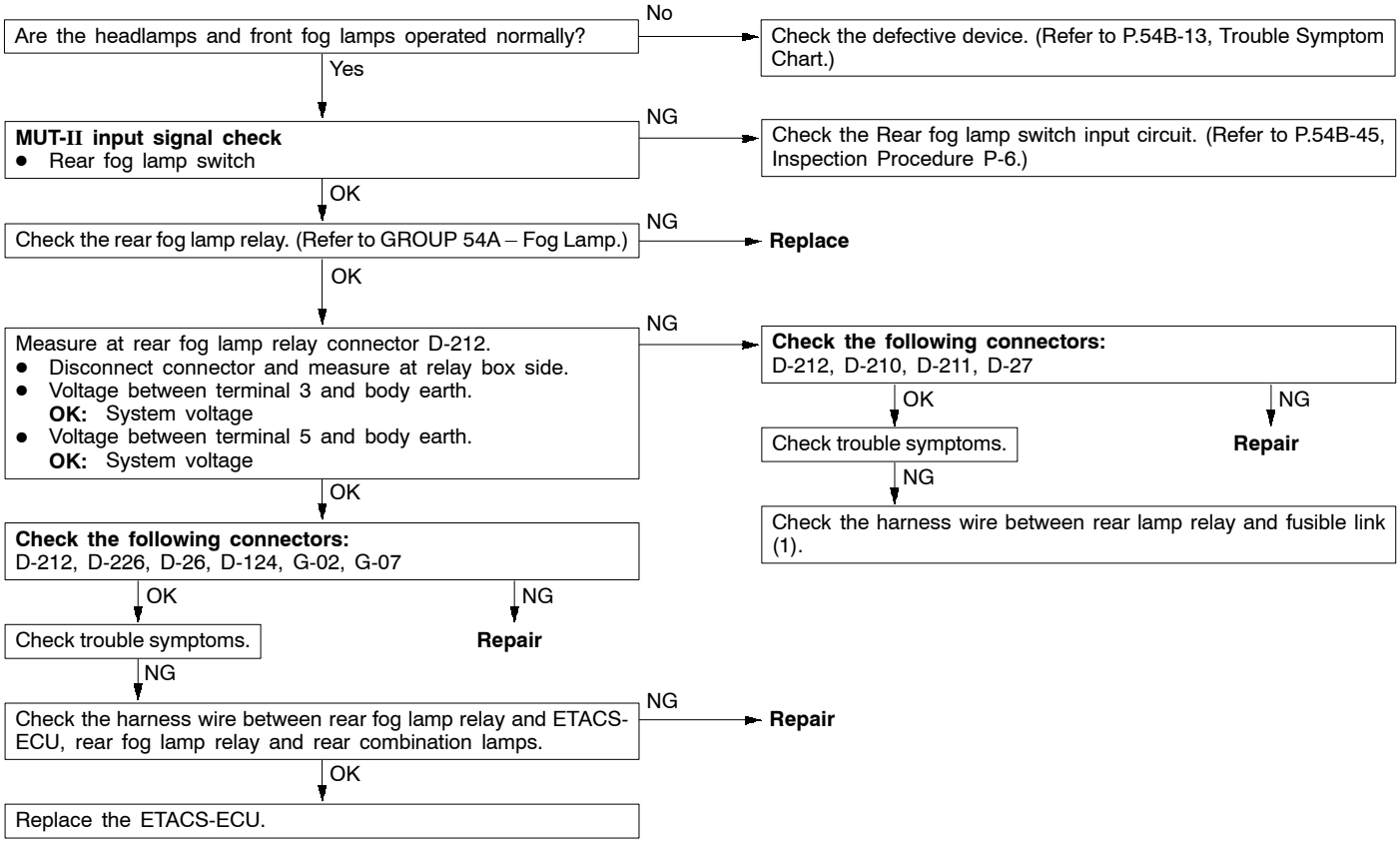
Inspection Procedure M-2

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 N-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 rear fog lamps 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.



NOTE
If only one of the rear fog lamp or rear fog lamp indicator lamp does not illuminate, the harness wire between the lamp and rear fog lamp relay may be defective or the lamp bulb may be burned out. In this case, check the rear fog lamp circuit.

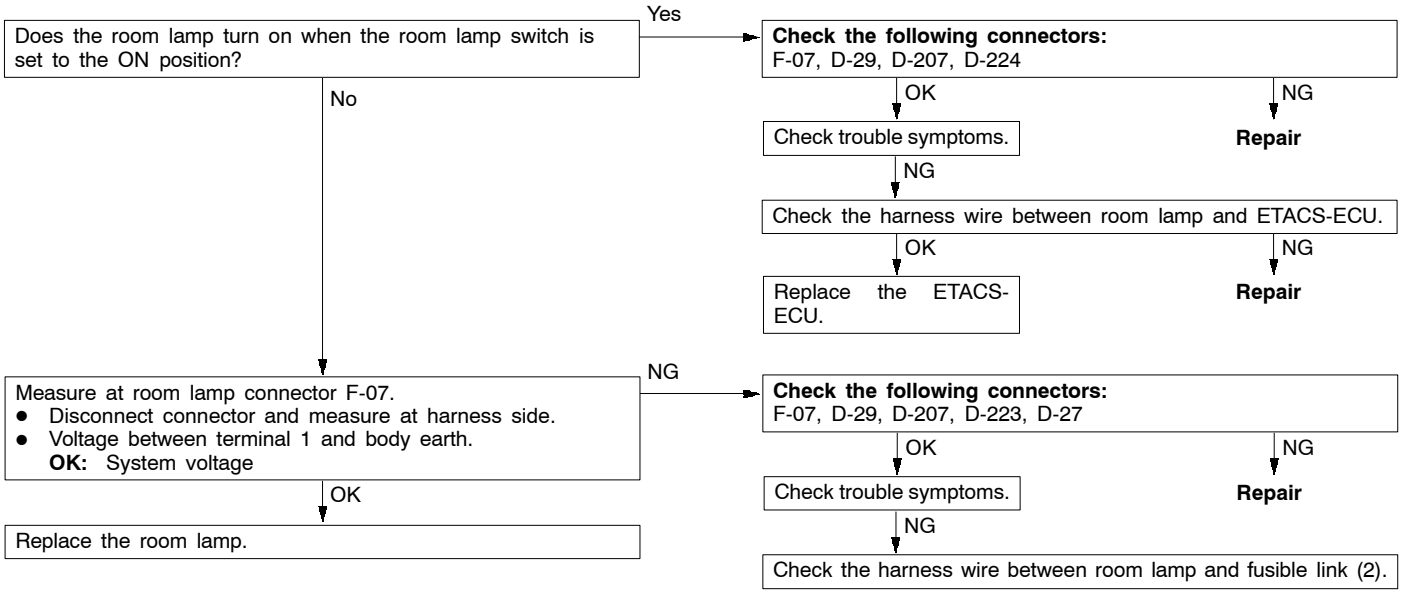
Inspection Procedure N-2

Rear fog lamp: Rear fog lamp do not go out when the headlamps and front fog 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.

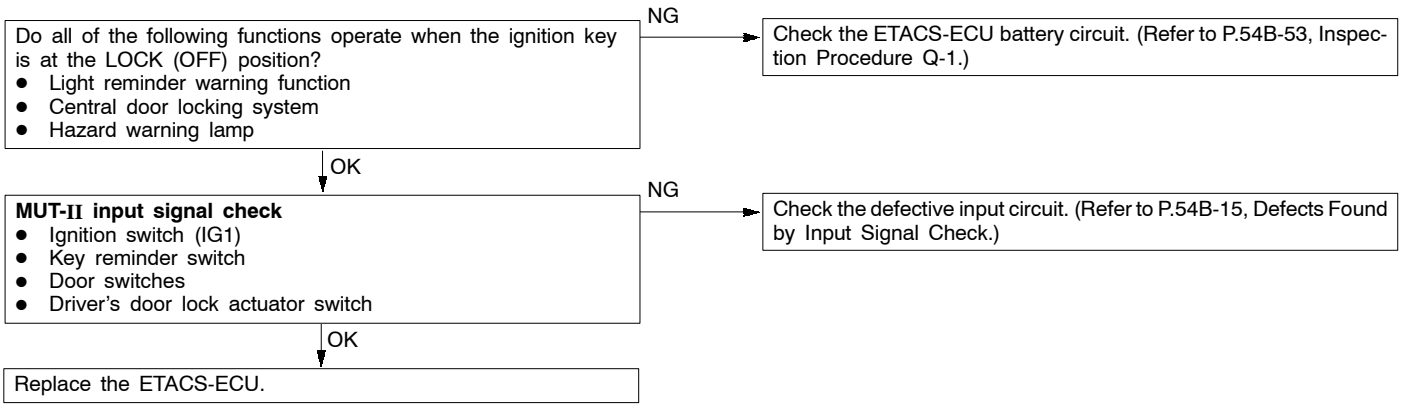
Inspection Procedure O-1

Room lamp: 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



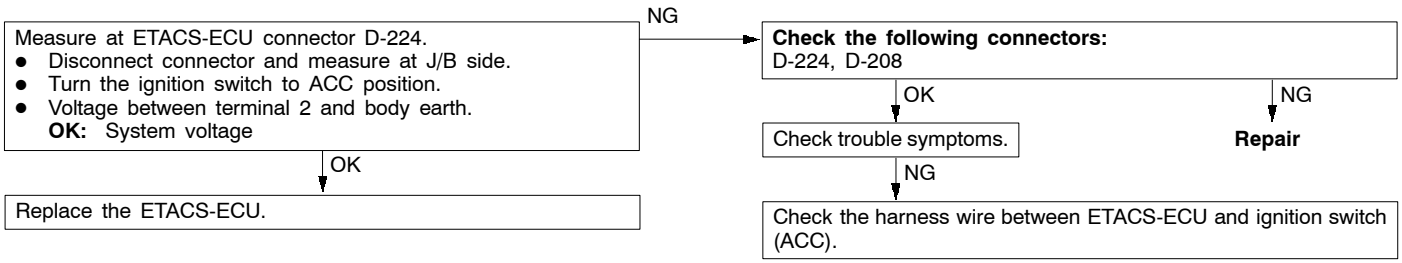
Inspection Procedure O-2

Room lamp: 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 • Door switches • Driver's door lock actuator switch 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



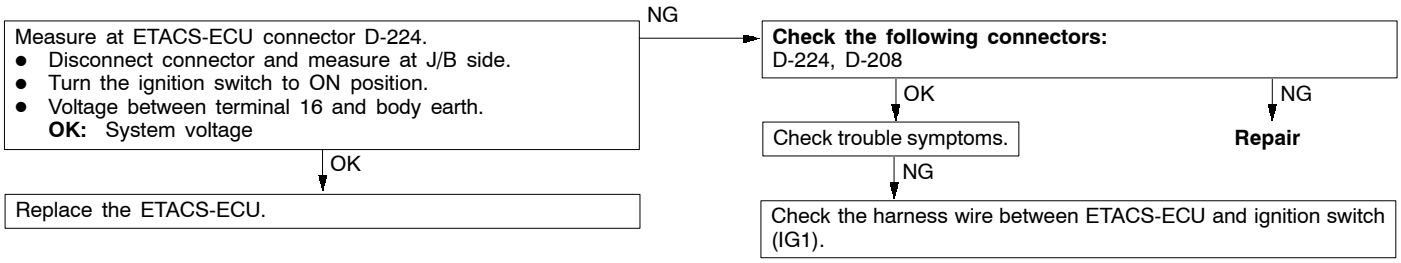
Inspection Procedure P-1

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	● Malfunction of ETACS-ECU ● Malfunction of harness wire or connector



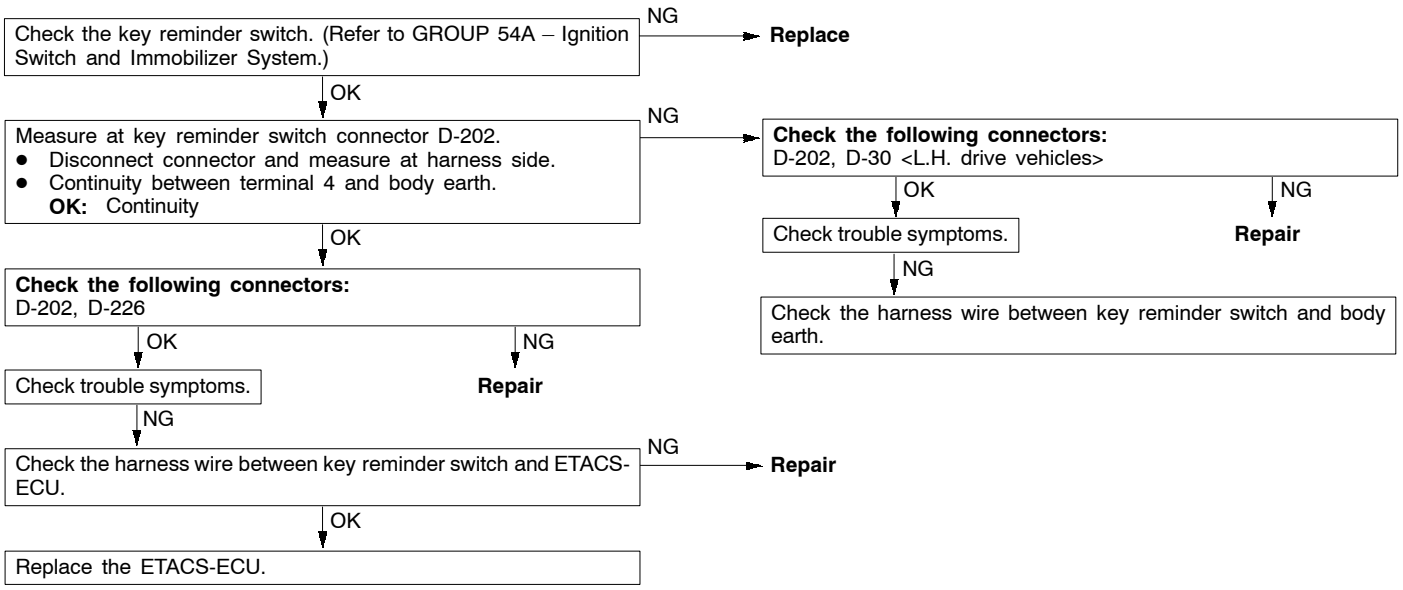
Inspection Procedure P-2

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 warning buzzer function ● Power window timer function ● Sunroof timer function ● Ignition key hole illumination lamp ● Headlamp automatic shutdown function ● Turn-signal lamp ● Room lamp dimming function	● Malfunction of ETACS-ECU ● Malfunction of harness wire or connector



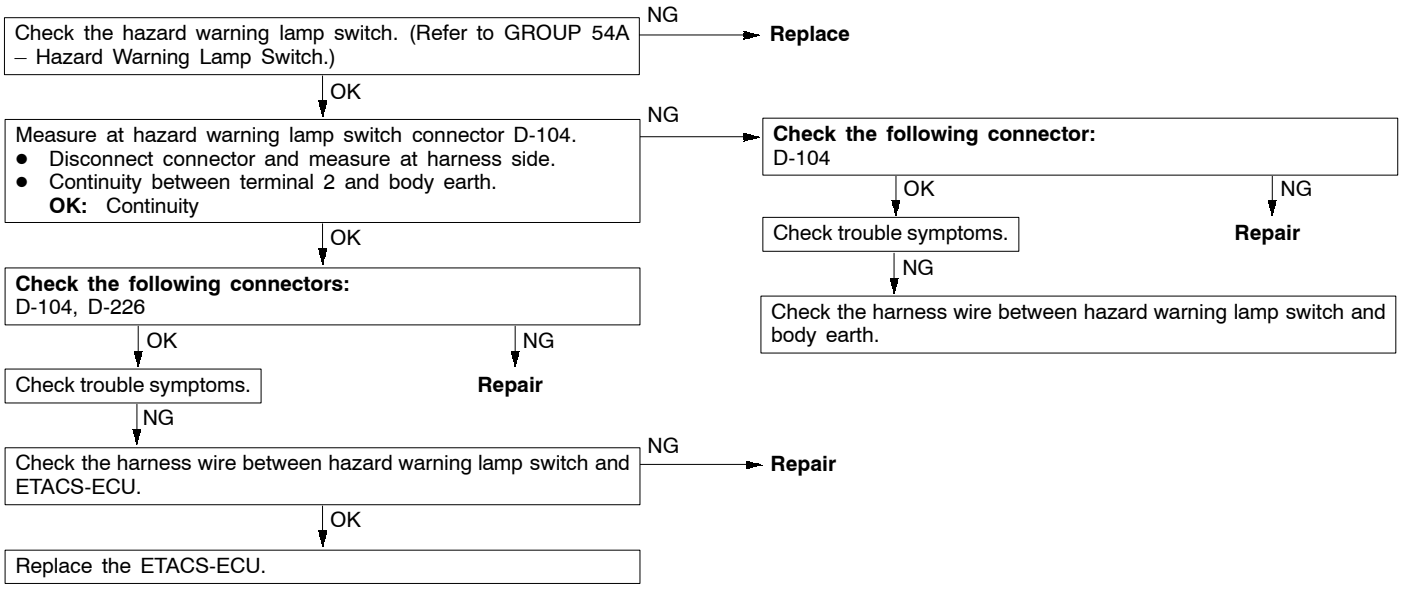
Inspection Procedure P-3

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 ● Keyless entry system ● Ignition key hole illuminaiton lamp ● Room lamp dimming function	● Malfunction of key reminder switch ● Malfunction of ETACS-ECU ● Malfunction of harness wire or connector



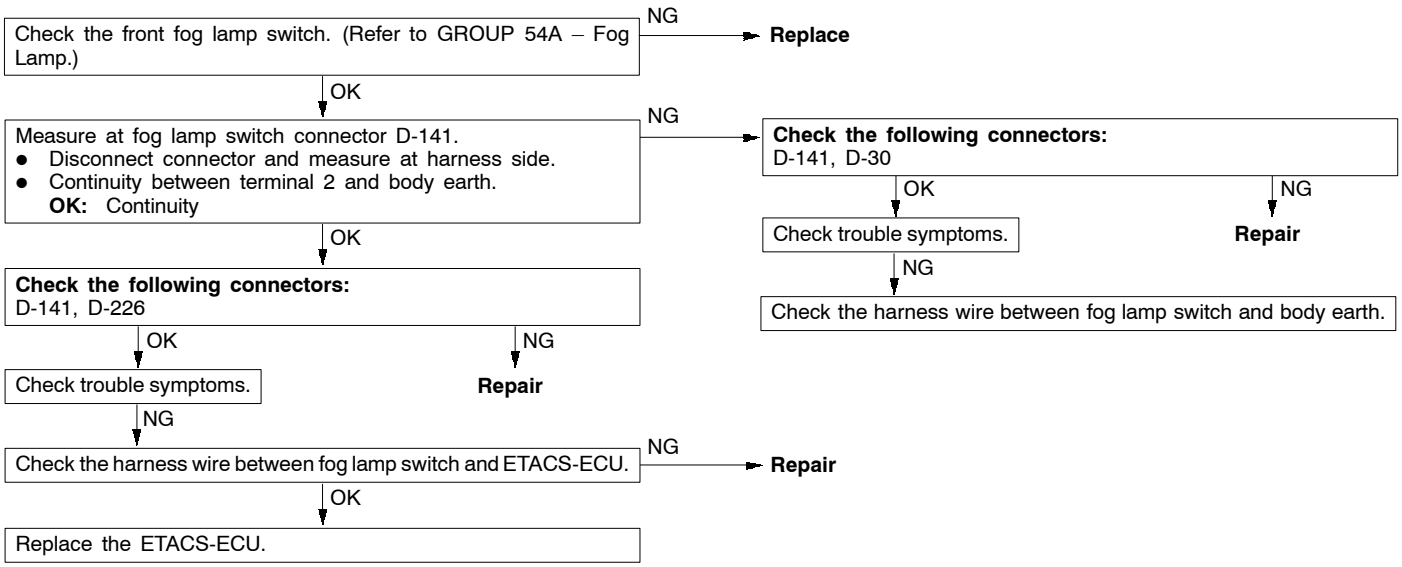
Inspection Procedure P-4

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)	● Malfunction of hazard warning lamp switch ● Malfunction of ETACS-ECU ● Malfunction of harness wire or connector



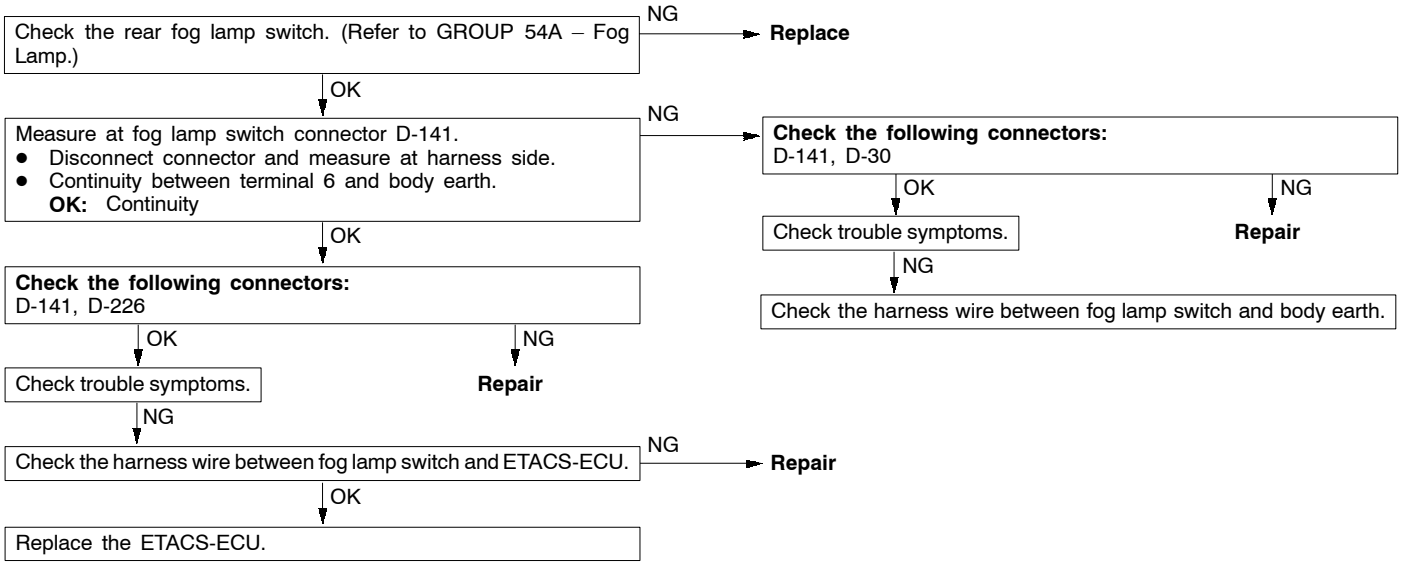
Inspection Procedure P-5

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



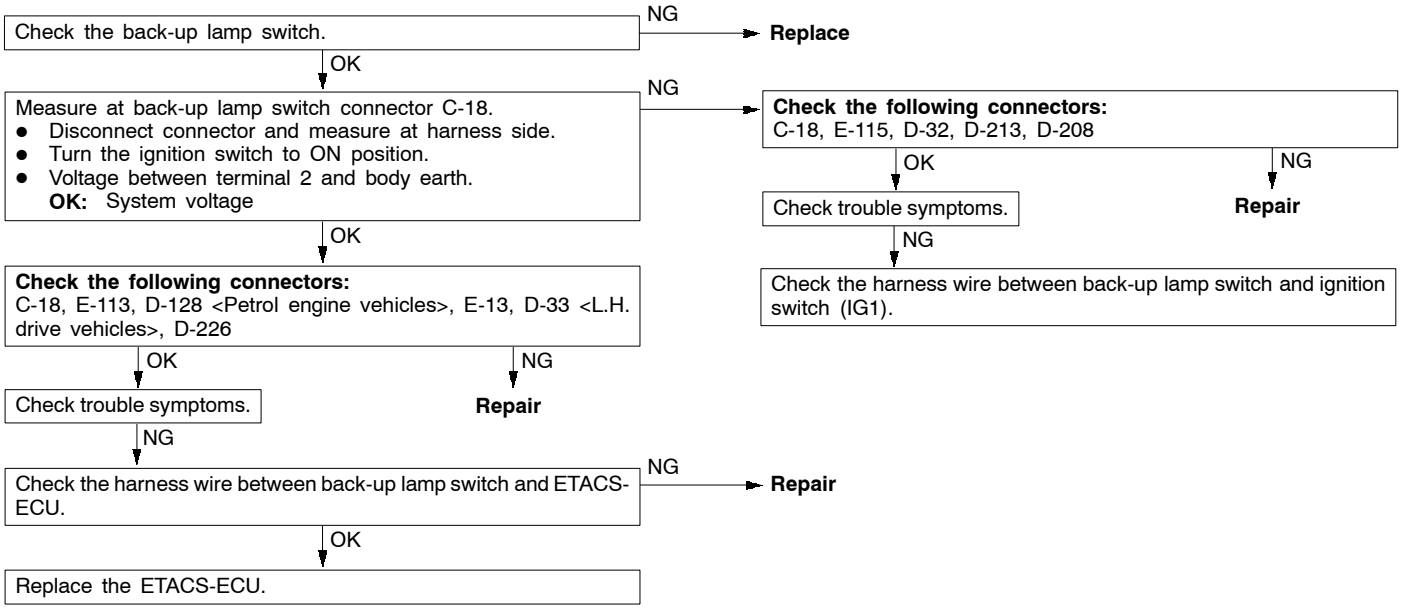
Inspection Procedure P-6

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



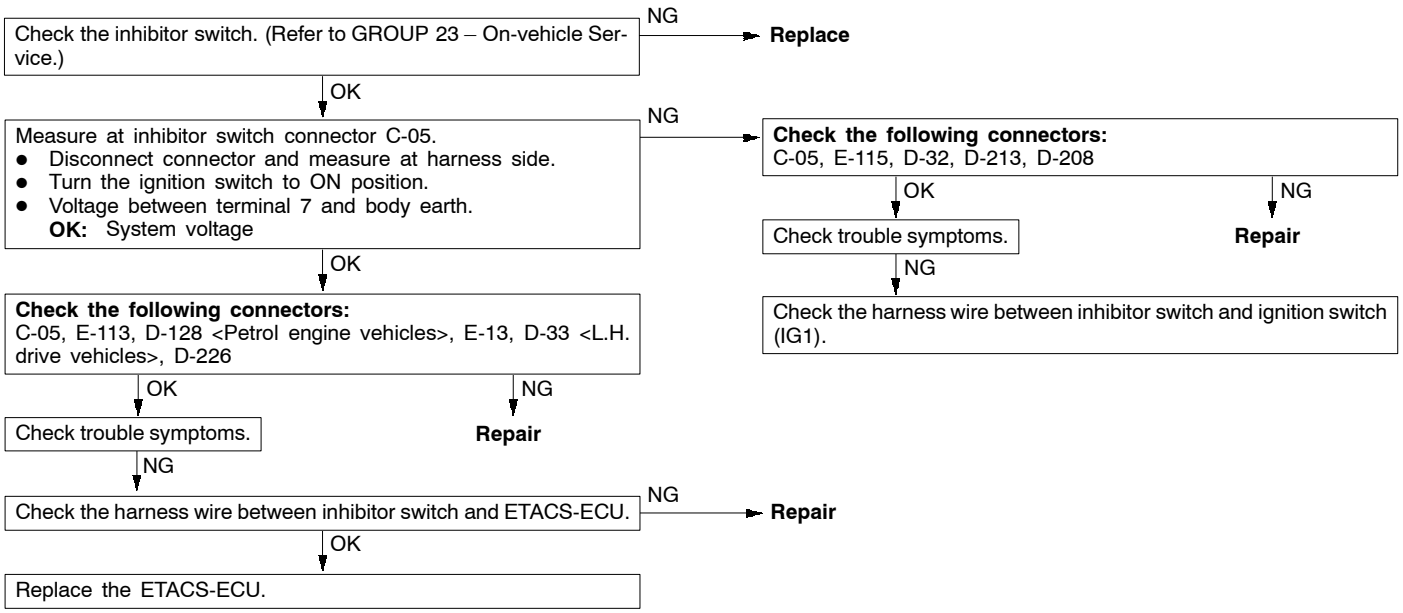
Inspection Procedure P-7

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



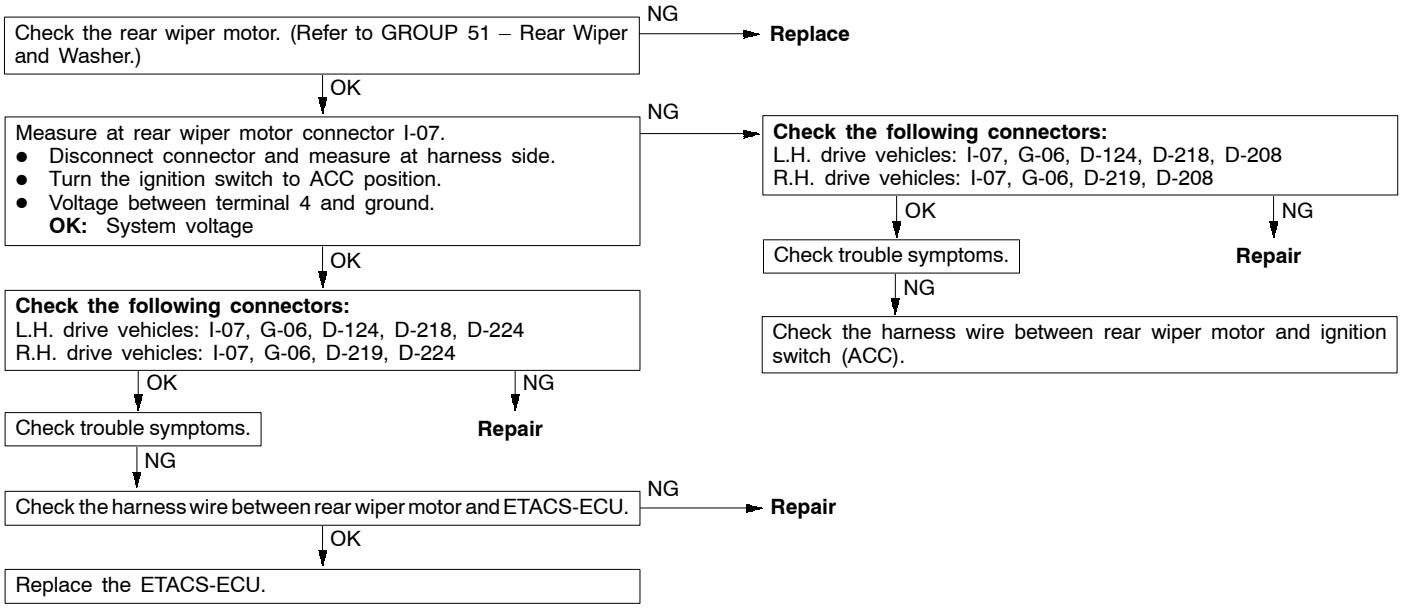
Inspection Procedure P-8

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



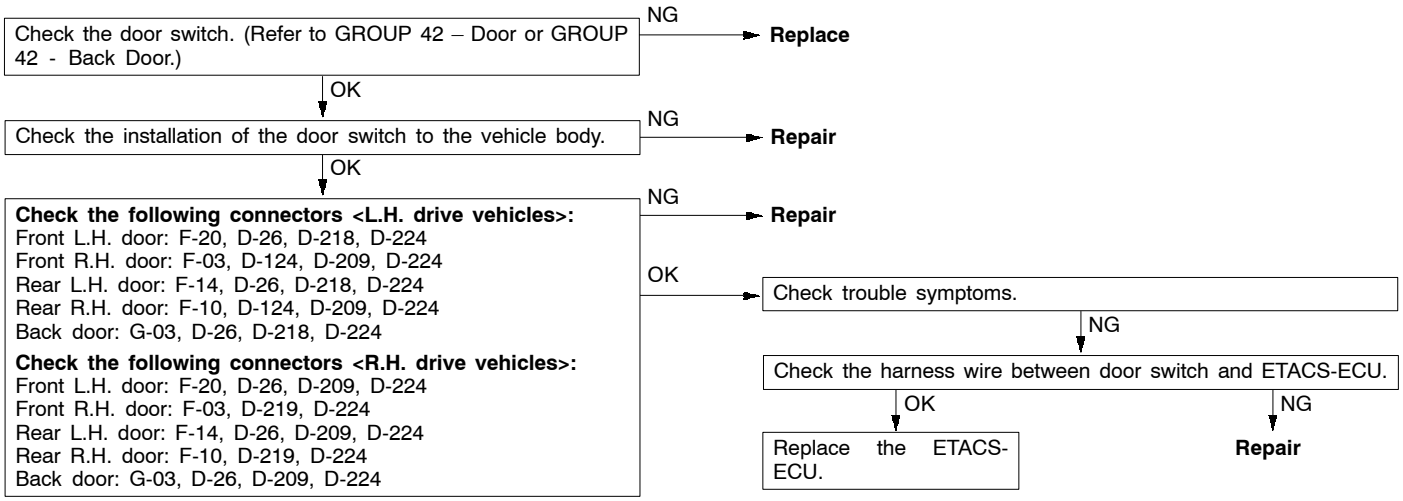
Inspection Procedure P-9

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



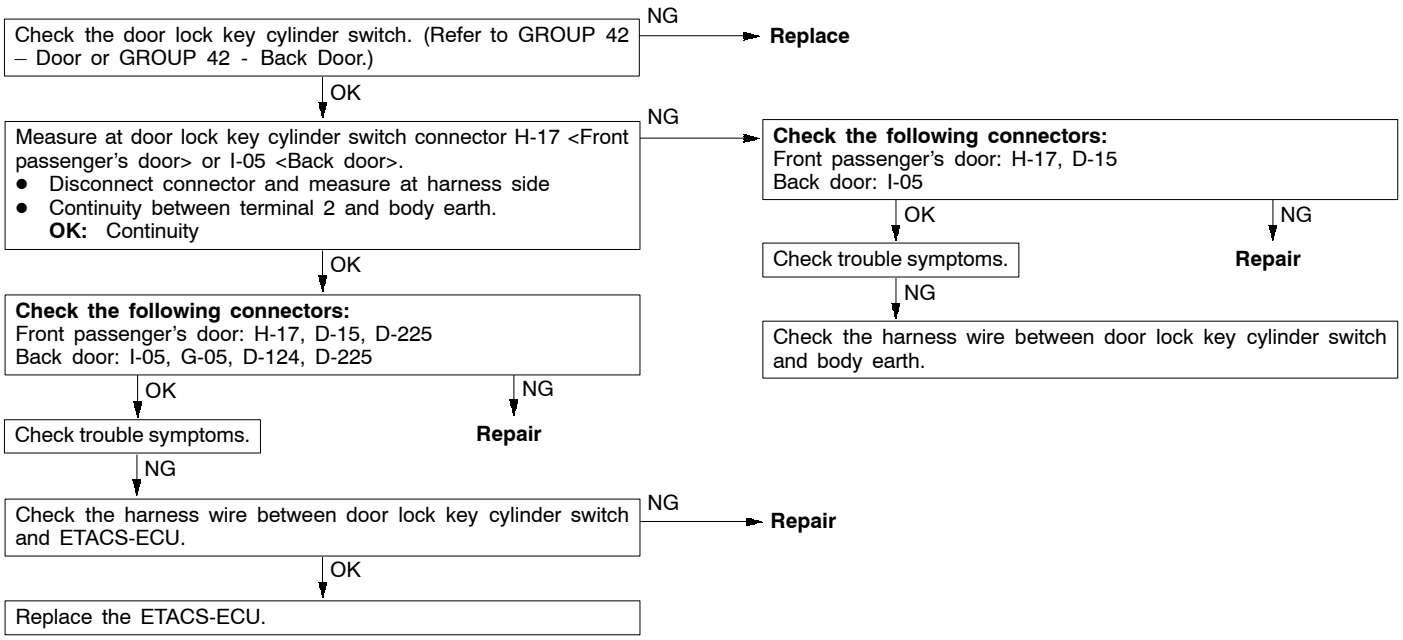
Inspection Procedure P-10

Driver's door switch signal is not sent to the ETACS-ECU. Door switches signal is not sent to the ETACS-ECU.	Probable cause
<Driver's door switch> The driver's door switch is used to operate the following functions. If the signal fails, these devices will not work normally. ● Light reminder warning buzzer function ● Forgotten key prevention function ● Power window timer function ● Ignition key hole illumination lamp ● Headlamp automatic shutdown 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 ● Room lamp dimming function	● Malfunction of driver's, front passenger's, rear or back door switch ● Malfunction of ETACS-ECU ● Malfunction of harness wire or connector



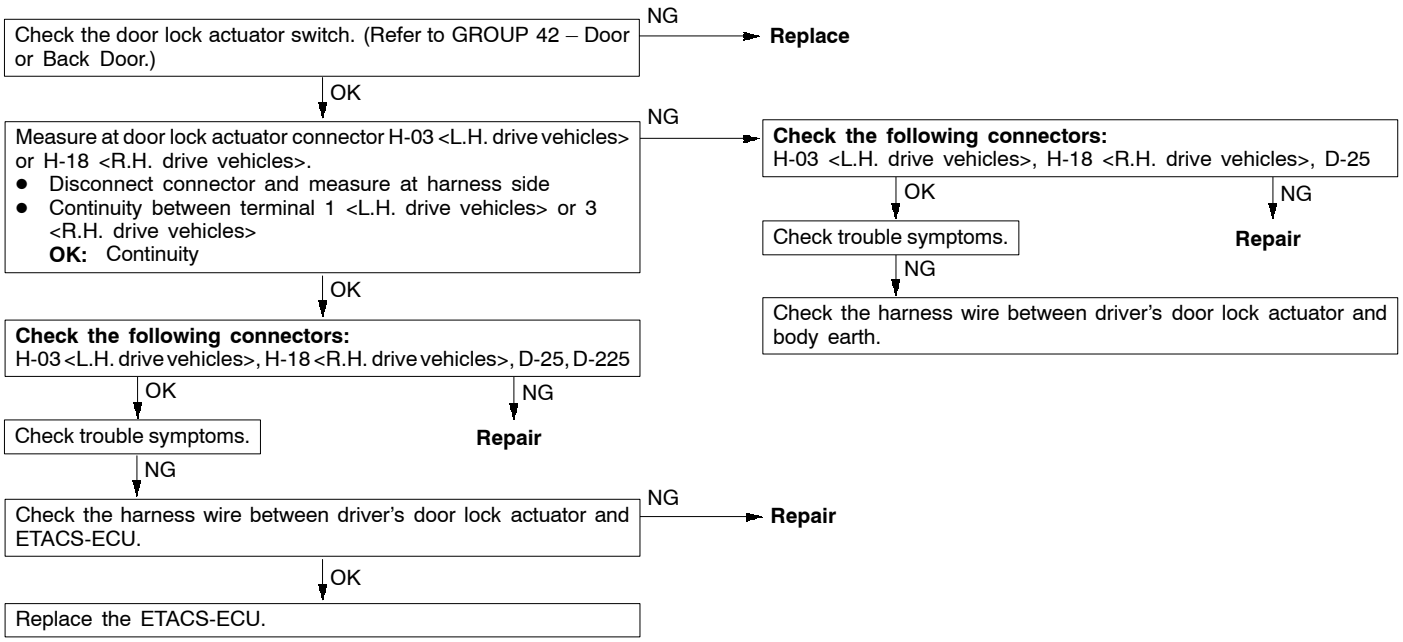
Inspection Procedure P-11

Front passenger's or back door lock key cylinder switch signal is not sent to the ETACS-ECU.	Probable cause
The front passenger's and back door lock key cylinder switch input signal is used to operate the central door locking system. If the signal fails, central door locking system will not work normally.	• Malfunction of front passenger's or back door lock key cylinder switch • Malfunction of ETACS-ECU • Malfunction of harness wire or connector



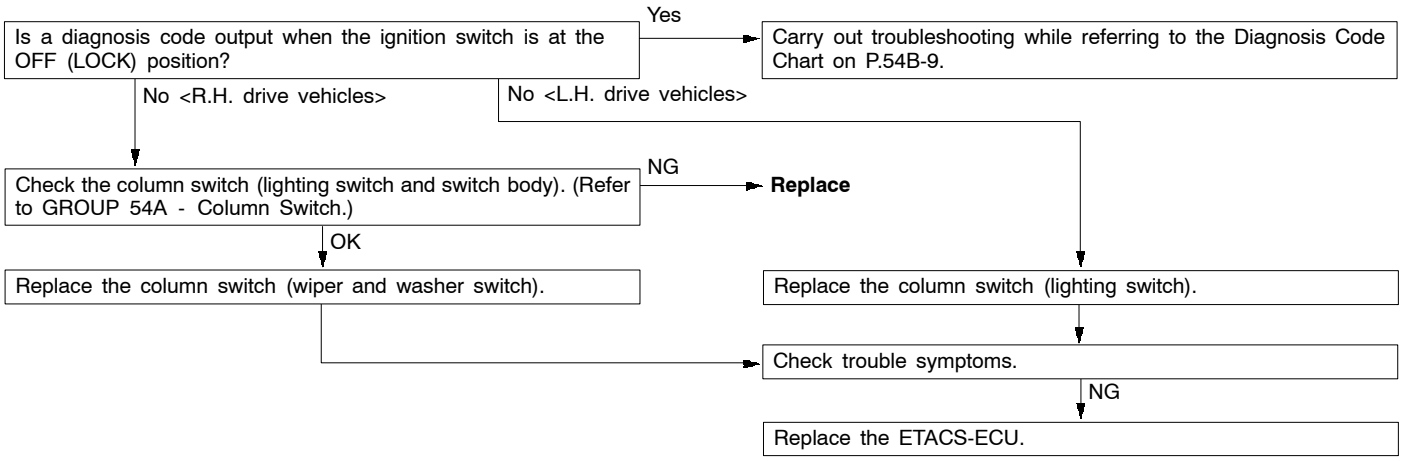
Inspection Procedure P-12

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 • Keyless entry system	• Malfunction of driver's door lock actuator • Malfunction of ETACS-ECU • Malfunction of harness wire or connector



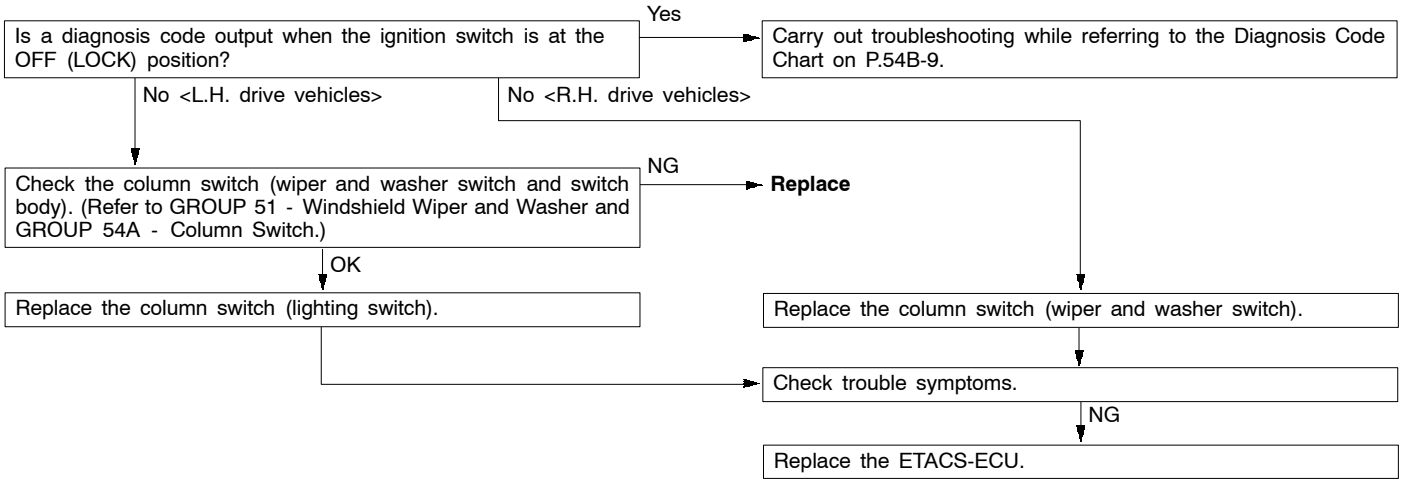
Inspection Procedure P-13

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.** ● **Headlamp washer switch is not sent to the ETACS-ECU.**	**Probable cause**
The column switch (lighting switch) is used to operate the following systems or functions. If the signal fails, these systems or function will not work normally. ● Headlamp washer ● Headlamp, tail lamp ● Turn-signal lamp ● Front fog lamp ● Rear fog lamp	● Malfunction of column switch ● Malfunction of ETACS-ECU



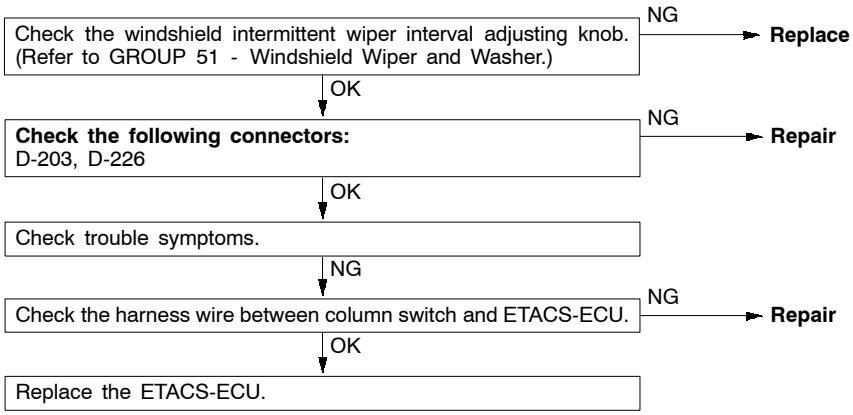
Inspection Procedure P-14

Column switch: ● **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.**	**Probable cause**
The column switch (wiper and washer switch) is used to operate the following systems or functions. If the signal fails, these systems or function will not work normally. ● Windshield wiper and washer ● Rear wiper and washer	● Malfunction of column switch ● Malfunction of ETACS-ECU



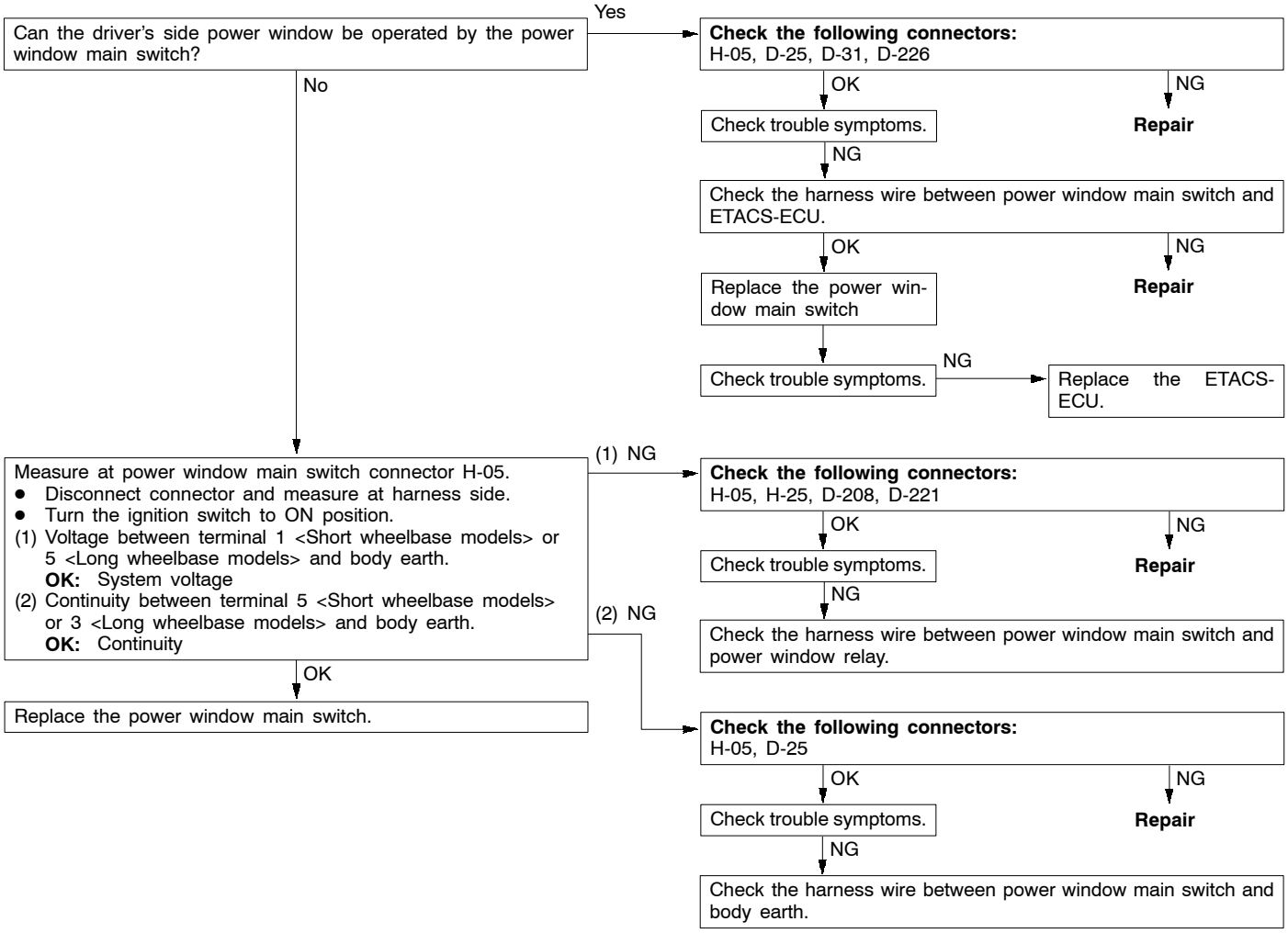
Inspection Procedure P-15

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



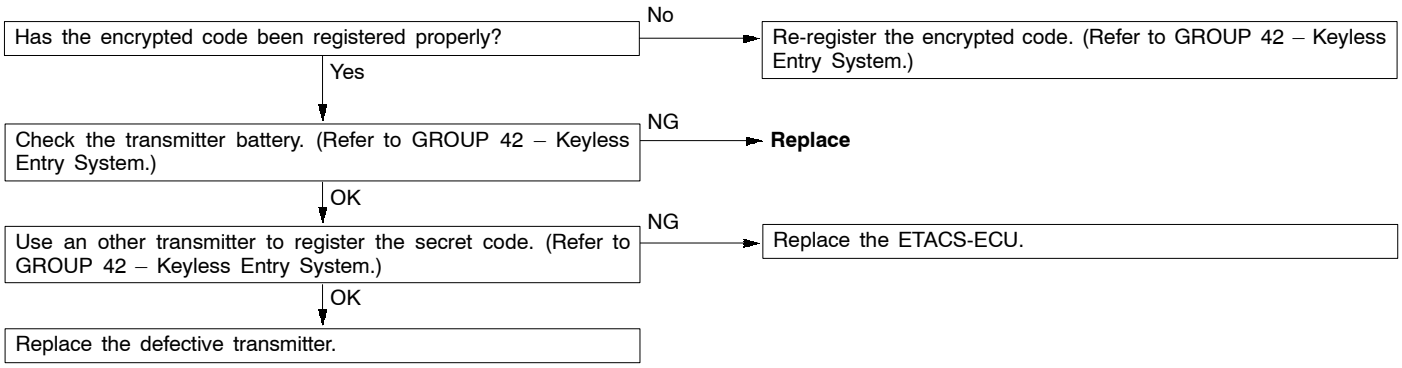
Inspection Procedure P-16

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



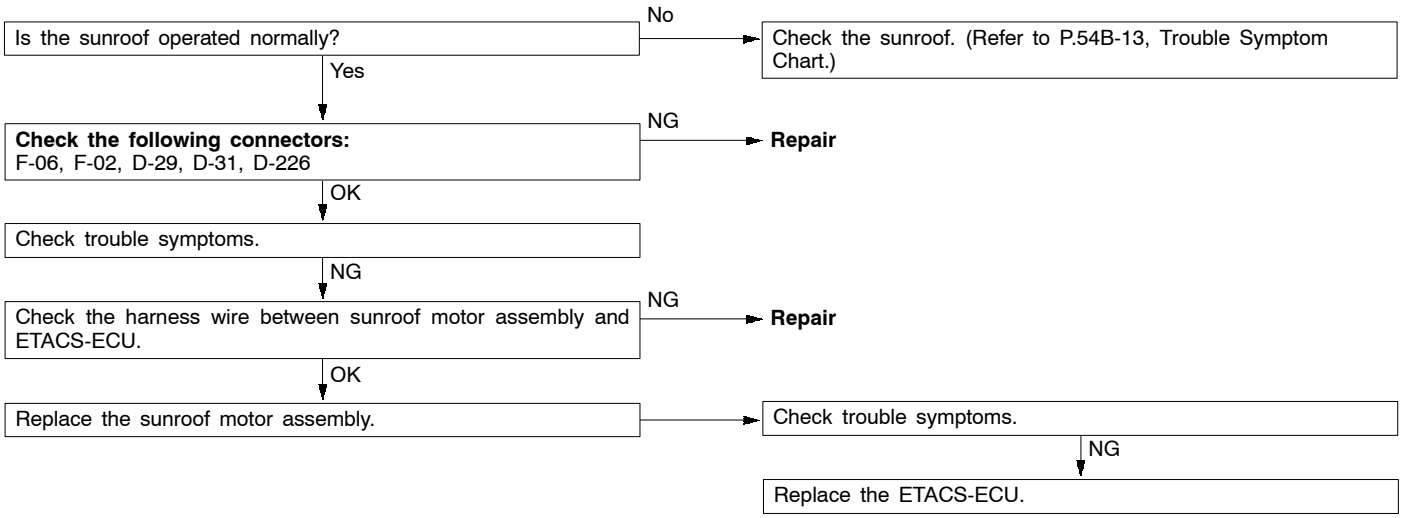
Inspection Procedure P-17

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



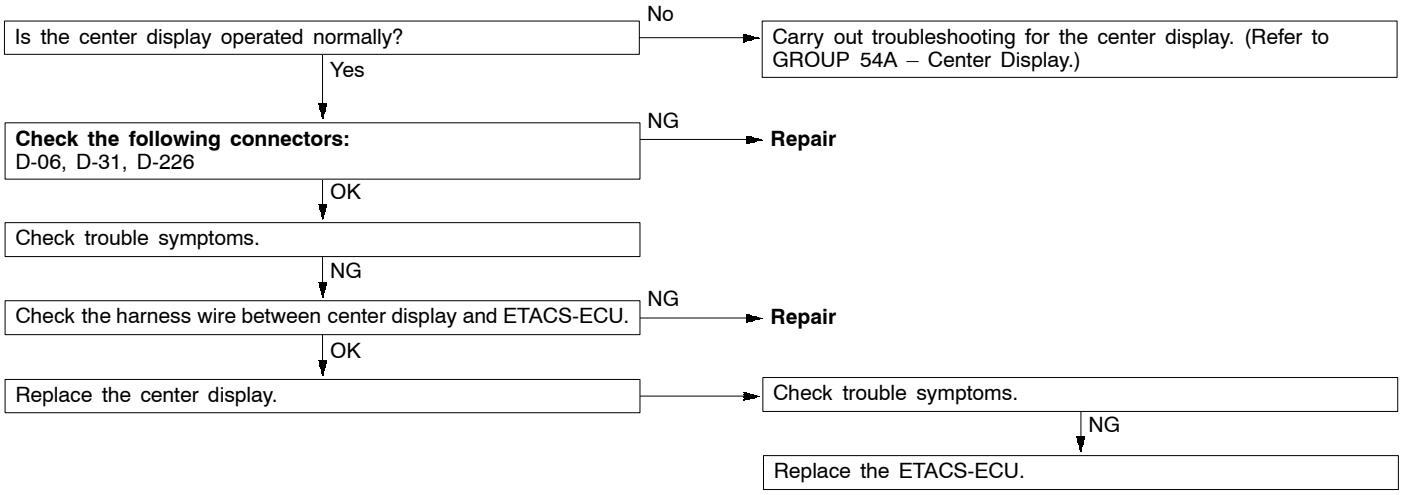
Inspection Procedure P-18

Sunroof switch: Any switch signal is not sent to the ETACS-ECU.	Probable cause
If there is a problem with communication between the sunroof motor assembly and the ETACS-ECU, the input signal check for the sunroof switch can no longer be carried out. In addition, the sunroof timer function will also stop working.	• Malfunction of sunroof switch • Malfunction of sunroof motor assembly • Malfunction of ETACS-ECU • Malfunction of harness wire or connector.



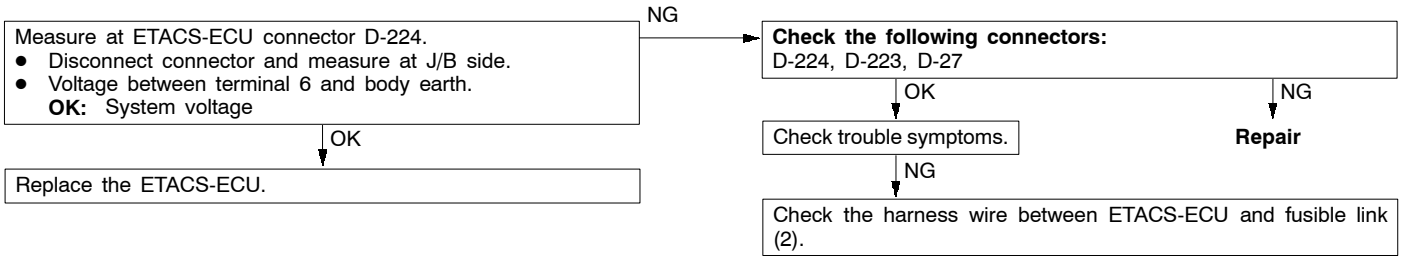
Inspection Procedure P-19

Center display: Any switch signal is not sent to the ETACS-ECU.	Probable cause
The cause is probably a malfunction of the center display or the ETACS-ECU.	• Malfunction of center display • Malfunction of ETACS-ECU • Malfunction of harness wire or connector.



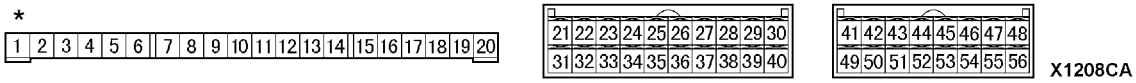
Inspection Procedure Q-1

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. • Ignition key reminder warning buzzer function • Central door lock ing system • Ignition key hole illumination lamp • Hazard warning lamp • Room lamp	• Malfunction of ETACS-ECU • Malfunction of harness wire or connector.



CHECK AT ECU TERMINALS

1. ETACS-ECU

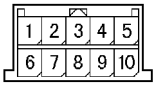


NOTE
*: Since the ETACS-ECU is directly mounted on the junction block and the measurement for connector of terminals No.1 to 20 is impossible, the values concerning these terminals are shown for reference only.

Terminal No.	Check items	Checking requirements	Normal condition
1	Rear wiper output	When rear wiper is operated	System voltage
2	Ignition switch (ACC) power supply	Ignition switch: ACC	System voltage
3	Rear washer output	When rear washer is operated	System voltage
4	Door lock output	When the door lock actuators are working to lock	System voltage
5	Rear wiper auto-stop signal input	When rear wiper is operated	System voltage
6	Battery power supply (for ECU)	Always	System voltage
7	Door switches signal input	Either door switch: ON (Door open)	0 V
8	Power window relay output	When power window can be operated	2 V or less
9	Driver's door switch signal input	Driver's door switch: ON (Driver's door open)	0 V
11	Battery power supply (for turn-signal lamp)	Always	System voltage
12	Battery power supply (for central door lock)	Always	System voltage
14	Turn-signal lamp (R.H.) output	When turn-signal lamp (L.H.) is lighted	System voltage
15	Turn-signal lamp (L.H.) output	When turn-signal lamp (R.H.) is lighted	System voltage
16	Ignition switch (IG1) power supply	Ignition switch: ON	System voltage
17	Door unlock output	When door lock actuators are working to unlock	System voltage
18	Room lamp output	When room lamp is lighted	2 V or less
20	Ground (for ECU)	Always	0 V
21	SWS communication line	Always	0 - 12 V (pulse signal)
22	Diagnosis indication selection input	When MUT-II is connected	0 V
23	Ground (for sensor)	Always	0 V
24	Front fog lamp switch signal input	Front fog lamp switch: ON	0 V
25	Rear fog lamp switch signal input	Rear fog lamp switch: ON	0 V

Terminal No.	Check items	Checking requirements	Normal condition
26	Key reminder switch signal input	Key reminder switch: ON (Ignition key removed)	0 V
27	Hazard warning lamp switch signal input	Hazard warning lamp switch: ON	0 V
29	Recognition line of daytime running lamp (DRL) <Vehicles with DRL>	Always	0 V
31	Data request signal output	Always	0 - 5 V (pulse signal)
34	Windshield intermittent wiper interval adjusting knob signal input	Ignition switch: ACC, Windshield intermittent wiper interval adjusting knob: FAST → SLOW	0 → 2.5 V
35	Back-up lamp switch signal input <M/T>	Ignition switch: ON, Shift lever: R	System voltage
	Inhibitor switch (reverse) signal input <A/T>	Ignition switch: ON, Selector lever: R	System voltage
36	Ignition key hole illumination lamp output	When ignition key hole illumination lamp is lighted	2 V or less
37	Diagnosis code or input signal check output	When diagnosis code is output	0 - 12 V (pulse signal)
		When input signal check is output	0, 12 V (When input pulse signal is changed)
40	Rear fog lamp relay output	When rear fog lamp is lighted	2 V or less
53	Front passenger's and back door lock key cylinder switch (LOCK) signal input	Front passenger's or back door lock key cylinder switch: LOCK	0 V
54	Front passenger's and back door lock key cylinder switch (UNLOCK) signal input	Front passenger's or back door lock switch: UNLOCK	0 V
55	Driver's door lock actuator switch (LOCK) signal input	Driver's door lock actuator switch: LOCK	0 V
56	Driver's door lock actuator switch (UNLOCK) signal input	Driver's door lock actuator switch: UNLCOK	0 V

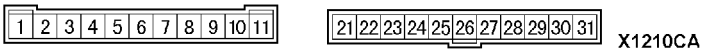
2. COLUMN SWITCH



X1209CA

Terminal No.	Check items	Checking requirements	Normal condition
1	Battery power supply	Always	System voltage
2	Data request signal input	Always	0 - 12 V (pulse signal)
3	SWS communication line	Always	0 - 5 V (pulse signal)
4	Ground	Always	0 V
6	Windshield intermittent wiper interval adjusting knob signal output	Ignition switch: ACC, Windshield intermittent wiper interval adjusting knob: FAST → SLOW	0 → 2.5 V
8	Windshield wiper switch backup output	Windshield low-speed wiper switch or windshield high-seed wiper switch: ON	0 V
9	Ignition switch (IG1) power supply	Ignition switch: ON	System voltage
10	Headlamp switch backup output	Headlamp switch: ON	0 V

3. FRONT-ECU



X1210CA

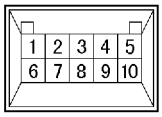
NOTE
Since the front-ECU is directly mounted on the relay box and measurement is impossible, these values are shown for reference.

Terminal No.	Check items	Checking requirements	Normal condition
1	Front fog lamp relay output	When front fog lamp is lighted	2 V or less
2	Headlamp (high-beam) output	When headlamp (high-beam) is lighted	System voltage
3, 4	Battery power supply (for headlamp)	Always	System voltage
5	Battery power supply (for tail lamp)	Always	System voltage
6	Headlamp (low-beam) output	When headlamp (low-beam) is lighted	System voltage
7	Battery power supply (for ECU)	Always	System voltage
8	Tail lamp output	When tail lamp is lighted	System voltage
9	Battery power supply (for headlamp washer)	Always	System voltage
11	Headlamp washer output	When headlamp washer is operated	System voltage
21	Windshield washer output	When windshield washer is operated	System voltage

Terminal No.	Check items	Checking requirements	Normal condition
22	SWS communication line	Always	0 - 12 V (pulse signal)
23	Windshield wiper auto-stop signal input	When windshield wiper is operated	System voltage
24	Ignition switch (ACC) power supply	Ignition switch: ACC	System voltage
25	Headlamp switch backup input	Headlamp switch: ON	0 V
26	Windshield wiper backup input	Windshield low-speed wiper switch or windshield high-speed wiper switch: ON	0 V
27	Windshield wiper (low-speed) output	When windshield wiper is operated (at low-speed)	System voltage
28	Windshield wiper (high-speed) output	When windshield wiper is operated (at high-speed)	System voltage
30	Ignition switch (IG2) power supply	Ignition switch: ON	System voltage
31	Ground	Always	0 V

4. POWER WINDOW MAIN SWITCH

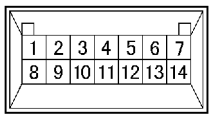
<Short wheelbase models>



X1211CA

Terminal No.	Check items	Checking requirements	Normal condition
1	Power supply	Power window relay: ON	System voltage
3	SWS communication line (between the main switch and the power window motor)	Power window relay: ON	0 - 12 V (pulse signal)
4	SWS communication line (between the main switch and the ETACS-ECU)	Always	0 - 12 V (pulse signal)
5	Ground	Always	0 V

<Long Wheelbase Models>



X1212CA

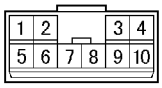
Terminal No.	Check items	Checking requirements	Normal condition
1	SWS communication line (between the main switch and the power window motor)	Power window relay: ON	0 - 12 V (pulse signal)
3	Ground	Always	0 V
5	Power supply	Power window relay: ON	System voltage
7	SWS communication line (between the main switch and the ETACS-ECU)	Always	0 - 12 V (pulse signal)

5. POWER WINDOW MOTOR

X1213CA

Terminal No.	Check items	Checking requirements	Normal condition
1	Ground	Always	0 V
2	Power window sub switch (DOWN) signal input <Except driver's door>	Power window sub switch: DOWN	0 V
3	Power supply	Power window relay: ON	System voltage
4	Power window sub switch (UP) signal input <Except driver's door>	Power window sub switch: UP	0 V
6	SWS communication line (between the power main switch and the power window motor)	Power window relay: ON	0 - 12 V (pulse signal)

6. SUNROOF MOTOR ASSEMBLY



X1214CA

Terminal No.	Check items	Checking requirements	Normal condition
1	Battery power supply (for motor)	Always	System voltage
2	Ignition switch (IG2) power supply	Ignition switch: ON	System voltage
3	Battery power supply (for ECU)	Always	System voltage
5	Ground	Always	0 V
6	Sunroof switch (CLOSE/DOWN) signal input	Sunroof switch: CLOSE/DOWN	0 V
7	Sunroof switch (UP) signal input	Sunroof switch: UP	0 V
8	Sunroof switch (OPEN) signal input	Sunroof switch: OPEN	0 V
6	SWS communication line	Always	0 - 12 V (pulse signal)

7. CENTER DISPLAY

Refer to GROUP 54A - Center Display.

ON-VEHICLE SERVICE

ADJUSTMENT PROCEDURES OF SWS FUNCTION

Through special operation of input switches, it is possible to disable and enable the functions listed below. Settings are retained even if the battery is disconnected.

- Keyless entry hazard answerback function
- Initialization of above mentioned functions

Configuration Mode Entry Conditions

1. Set each switch at the following condition.
   - Hazard warning lamp switch: OFF
   - Diagnosis control: ON (MUT-II connected or terminal 1 of diagnosis connector connected to earth)
   - Key reminder switch: OFF (ignition key inserted)
   - Ignition switch: LOCK (OFF)
   - Driver's door switch: OFF (driver's door closed)
2. When the windshield washer switch is continuously turned ON for more than 10 seconds, the buzzer integrated in the ETACS-ECU sounds once and the mode is switched to the configuration mode.

Configuration Mode Cancellation Conditions

The ETACS-ECU cancels the configuration mode when any of the conditions listed below is satisfied.

- Diagnosis control: OFF (MUT-II disconnected or terminal 1 of diagnosis connector disconnected from earth)
- Key reminder switch: ON (ignition key removed)
- Ignition switch: any position other than LOCK (OFF)
- Driver's door switch: ON (driver's door open)
- No configuration performed within three minutes of entry to configuration mode (If configuration is performed within first three minutes, monitoring continues for three minutes from that point.)

Configuration of Functions

Function	Configuration procedure
Keyless entry hazard answerback	If the transmitter's LOCK switch is turned ON twice within two seconds, the lock answerback function's enabled/disabled status is inverted. ● When function is enabled, buzzer sounds once (initial status). ● When function is disabled, buzzer sounds twice. If the transmitter's UNLOCK switch is turned ON twice within two seconds, the unlock answerback function's enabled/disabled status is inverted. ● When function is enabled, buzzer sounds once (initial status). ● When function is disabled, buzzer sounds twice.
Initialization of above mentioned functions	If the windshield washer switch is turned ON for more than 20 seconds, the buzzer sounds twice and all functions are initialized. (The configuration mode entry buzzer sounds after 10 seconds, but the switch must be kept ON for 20 seconds to achieve initialization.) IF the windshield washer switch ins kept ON for more than 20 seconds without prior entry of the configuration mode, the configuration mode is entered after 10 seconds and initialization does not take place.

HEATER, AIR CONDITIONER AND VENTILATION <MANUAL A/C>

Click on the applicable bookmark to selected the required model year.

HEATER, AIR CONDITIONER AND VENTILATION <MANUAL A/C>

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SERVICE SPECIFICATIONS

Item				Standard value
Idle speed r/min (N or P range)	Diesel	4D56		750 ± 100
		4M41		750 ± 50
Idle-up speed r/min (N or P range)	4D56			925 ± 25
	4M41	A/C	When the A/C is under low or medium load	800 ± 50
			When the A/C is under high load	1,000 ± 50
Water temperature switch °C	A/C cut-off		ON	108
			OFF	115
	Condenser fan		OFF	97
			ON	102
Resistor resistance (Front A/C) Ω	Between terminals 2 and 4			0.39 ± 7 %
	Between terminals 1 and 2			1.49 ± 7 %
	Between terminals 2 and 3			2.79 ± 7 %
Resistance of the rear air conditioner switch (temperature control switch) kΩ <except rear heater (floor console)>				0 - 3
Potentiometer for air mix damper kΩ <Rear heater>				1.2 - 4.8
Resistor resistance [Rear heater (front console)] Ω	Between terminals 1 and 6			4.9 ± 7 %
	Between terminals 1 and 3			1.25 ± 7 %
Resistor resistance [Rear heater (quarter trim), rear heater] Ω	Between terminals 1 and 6			4.9 ± 7 %
	Between terminals 1 and 3			1.25 ± 7 %
Idle-up solenoid valve resistance Ω				40
Air compressor air gap mm				0.35-0.65

LUBRICANTS

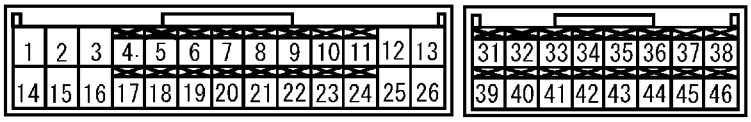
Item		Specified lubricants	Quantity
Compressor oil mL	Except for vehicles with rear cooler	DENSO OIL 8	120 ± 20
	Vehicles with rear cooler	DENSO OIL 8	140 ± 20
Pipe connections		DENSO OIL 8	As required
Refrigerant g	Except for vehicles with rear cooler	R134a (HFC-134a)	500 ± 20
	Vehicles with rear cooler	R134a (HFC-134a)	780 ± 20

TROUBLESHOOTING <Front heater, Front A/C>

Trouble symptom	Probable cause	Remedy	Reference page
The air conditioner does not work.	Malfunction of fuse	Replace the fuse.	–
	Malfunction of harness or connector	Repair the harness or connector.	–
	Refrigerant leak or overfilling of refrigerant	Replenish the refrigerant, repair the leak or take out some of the refrigerant.	–
	A/C compressor relay is defective.	Replace the A/C compressor relay.	55A-18
	The A/C compressor magnetic clutch is defective.	Replace the A/C compressor.	55A-10
	The dual pressure switch is defective.	Replace the dual-pressure switch.	55A-10
	The A/C switch is defective.	Replace the heater control assembly.	55A-24
	The blower switch is defective.	Replace the heater control assembly.	55A-24
	The air thermo sensor is defective.	Replace the automatic compressor-ECU and the air thermo sensor assembly.	55A-31
	The automatic compressor-ECU is defective.	Replace the automatic compressor-ECU and the air thermo sensor assembly.	55A-6
	The 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.	–
	The dual pressure switch is defective.	Replace the dual-pressure switch.	55A-10
	The condenser fan relay is defective.	Replace the condenser fan relay.	55A-18
	A/C compressor relay is defective.	Replace the A/C compressor relay.	55A-18
	The A/C compressor magnetic clutch is defective.	Replace the A/C compressor.	55A-10
When the A/C is operating, temperature inside the passenger compartment doesn't increase (warm air is not emitted).	Malfunction of the air thermo sensor	Replace the automatic compressor-ECU and the air thermo sensor assembly.	55A-31
The blower motor does not run.	Malfunction of fuse	Replace the fuse.	–
	Malfunction of harness or connector	Repair the harness or connector.	–
	The blower relay is defective.	Replace the blower relay.	55A-18
	The blower motor is defective.	Replace the blower motor.	55A-29
	The blower switch is defective.	Replace the heater control assembly.	55A-24
	Malfunction of the resistor	Replace the resistor.	55A-29
	The automatic compressor-ECU is defective.	Replace the automatic compressor-ECU and the air thermo sensor assembly.	55A-6

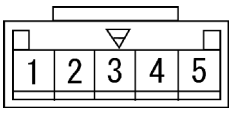
Trouble symptom	Probable cause	Remedy	Reference page
The blower motor does not stop running.	Malfunction of fuse	Replace the fuse.	–
	Malfunction of harness or connector	Repair the harness or connector.	–
	The blower switch is defective.	Replace the blower switch assembly.	55A-24
	Malfunction of the resistor	Replace the resistor.	55A-29
	The automatic compressor-ECU is defective.	Replace the automatic compressor-ECU and the air thermo sensor assembly.	55A-6
The inside/outside air changeover is impossible.	Malfunction of fuse	Replace the fuse.	–
	Malfunction of harness or connector	Repair the harness or connector.	–
	Malfunction of the inside/outside air changeover damper motor	Check the inside/outside air changeover damper motor.	55A-30
	The automatic compressor-ECU is defective.	Replace the automatic compressor-ECU and the air thermo sensor assembly.	55A-6

CHECK AT ENGINE-ECU TERMINALS <4M41>



Terminal No.	Check item	Check conditions	Normal condition
7	Input from the condenser fan relay (HI)	When the condenser fan stopped	0 V
		When the condenser fan is operating	System voltage
21	Input from the A/C compressor relay	When the A/C is off.	0 V
		When the A/C is in operation (When the compressor is operating)	System voltage
32	Input from dual pressure switch	Dual-pressure switch: OFF	0 V
		Dual-pressure switch: ON	System voltage
33	Automatic compressor-ECU	–	–

CHECK AT THE AUTOMATIC COMPRESSOR-ECU TERMINALS AND THE AIR THERMO SENSOR ASSEMBLY TERMINALS

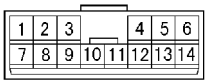


Terminal No.	Check item	Check conditions		Normal condition
2	Automatic compressor-ECU <4M41>	–		–
3	Earth	At all times		Continuity
4	Output to the dual-pressure switch	Dual-pressure switch: OFF		0 V
		Dual-pressure switch: ON		System voltage
5	Input from the A/C switch	Blower switch: LO	A/C switch: OFF	0 V
			A/C switch: ON	System voltage

TROUBLESHOOTING <Rear Heater, Rear Cooler>

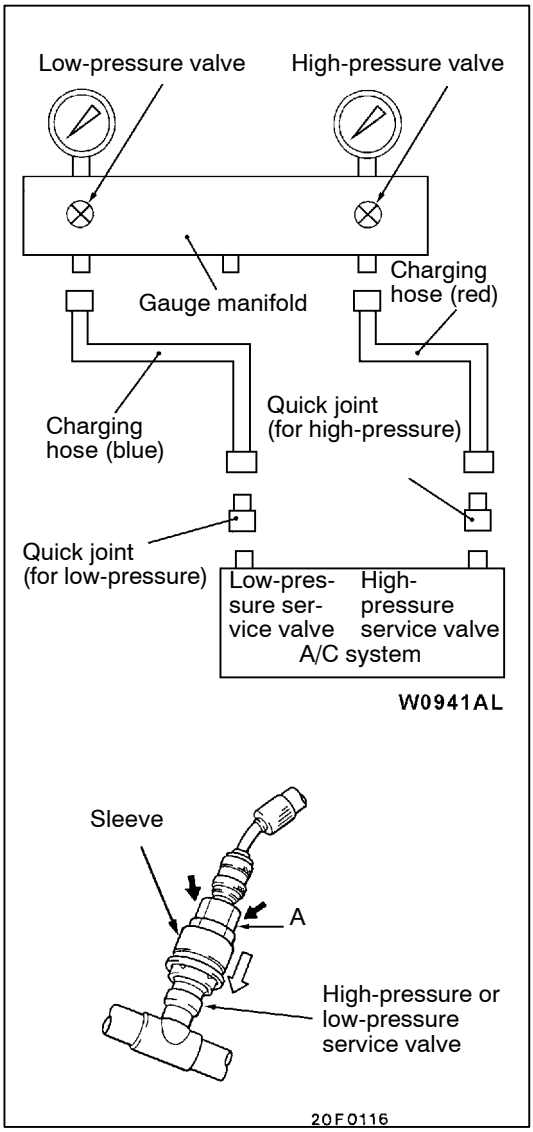
Trouble symptom	Probable causes	Remedy	Reference page
The rear cooler does not operate.	Malfunction of fuse	Replace the fuse.	–
	Malfunction of harness or connector	Repair the harness or connector.	–
	Refrigerant leak or overfilling of refrigerant	Replenish the refrigerant, repair the leak or take out some of the refrigerant.	–
	Malfunction of the rear A/C switch	Replace the rear A/C switch.	55A-32
	Malfunction of the front rear fan switch	Replace the front rear fan switch.	55A-33
	Malfunction of the air thermo sensor	Replace the air thermo sensor.	55A-39
	Malfunction of the rear blower relay	Replace the rear blower relay.	55A-18
	The rear blower motor is defective.	Replace the rear blower motor.	55A-40
	The rear cooler control unit is defective.	Replace the rear cooler control unit.	55A-34
When the rear cooler is operating, temperature inside the passenger compartment does not decrease(cool air is not emitted).	Refrigerant leak	Replenish the refrigerant and repair the leak.	–
When the rear heater is operating, temperature inside the passenger compartment does not increase(warm air is not emitted).	Malfunction of the air thermo sensor	Replace the air thermo sensor.	55A-39
The blower motor does not run.	Malfunction of fuse	Replace the fuse.	–
	Malfunction of harness or connector	Repair the harness or connector.	–
	Malfunction of the rear blower relay	Replace the blower relay.	55A-18
	The rear blower motor is defective.	Replace the blower motor.	55A-40
	Malfunction of the rear A/C switch	Replace the rear A/C switch.	55A-32
	Malfunction of the front rear fan switch	Replace the front rear fan switch.	55A-33
	Malfunction of the resistor	Replace the resistor.	55A-35
	The rear cooler control unit is defective.	Replace the rear cooler control unit.	55A-34
The blower motor does not stop running.	Malfunction of fuse	Replace the fuse.	–
	Malfunction of harness or connector	Repair the harness or connector.	–
	Malfunction of the rear A/C switch	Replace the rear A/C switch.	55A-32
	Malfunction of the front rear fan switch	Replace the front rear fan switch.	55A-33
	Malfunction of the resistor	Replace the resistor.	55A-35
	The rear cooler control unit is defective.	Replace the rear cooler control unit.	55A-34

CHECK AT THE REAR A/C CONTROL UNIT TERMINALS



X1136CA

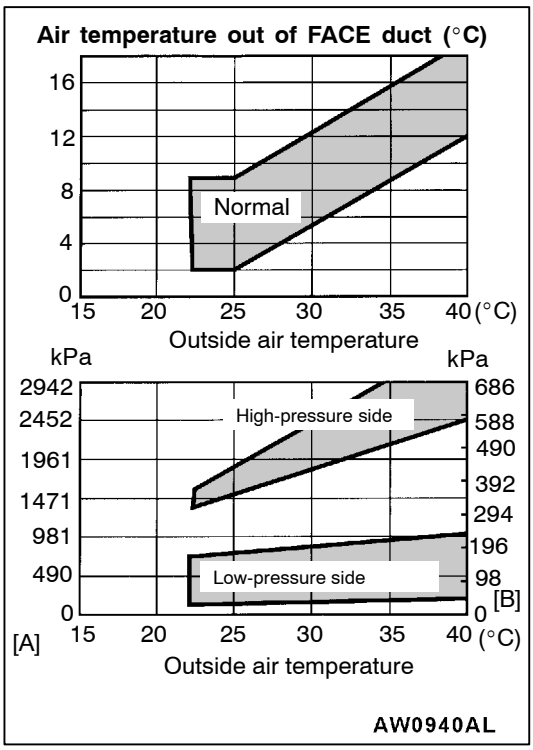
Terminal No.	Check item	Check conditions	Normal condition
1	Magnet valve	Magnet valve: OFF	System voltage
		Magnet valve: ON	Faint voltage (0.5 V)
2	Earth	At all times	Continuity
3	Input from temperature adjusting switch	Temperature adjusting switch: MAX. HOT	1 V
		Temperature adjusting switch: MAX. COOL	4 V
4	Power supply to potentiometer	At all times	5 V
5	Power supply to ignition switch (IG2)	Ignition switch: ON	System voltage
6	Electric motor for the air mix damper (MAX. COOL)	When the damper flap is moving to the MAX. COOL position.	10 V
		When the damper flap is moving to the MAX. HOT position.	Faint voltage (0.5 V)
7	Input from potentiometer for air mix damper	Air mix damper: MAX. HOT	1 V
		Air mix damper: MAX. COOL	4 V
8	Earth to sensor and potentiometer	At all times	0 V
9	Signal from air outlet changeover damper motor	Ignition switch: ON	0 – 12 V
10	Signal from air outlet changeover damper motor	Ignition switch: ON	0 – 12 V
11	Signal from air outlet changeover damper motor	Ignition switch: ON	0 – 12 V
12	Input from air thermo sensor	Sensor temperature: 25°C (1.5 k Ω)	2.2 V
13	Input from rear fan switch and front rear fan switch	Rear fan switch or front rear fan switch: ON	0 V
14	Electric motor for the air mix damper (MAX. HOT)	When the damper flap is moving to the MAX. COOL position.	Faint voltage (0.5 V)
		When the damper flap is moving to the MAX. HOT position.	10 V



ON-VEHICLE SERVICE

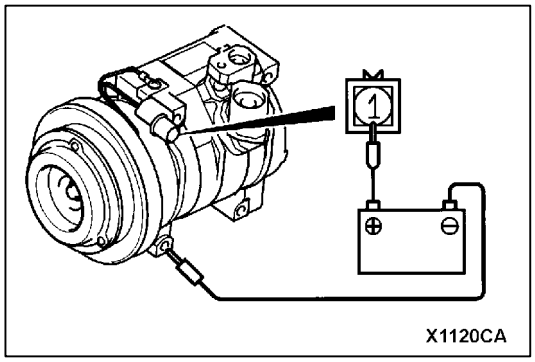
REFRIGERANT LEVEL TEST THROUGH PERFORMANCE TEST

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.55A-11.)

    NOTE
    In the graph below, see the following:
    [A]: Refrigerant pressure (high-pressure side)
    [B]: Refrigerant pressure (low-pressure side)



MAGNETIC CLUTCH TEST

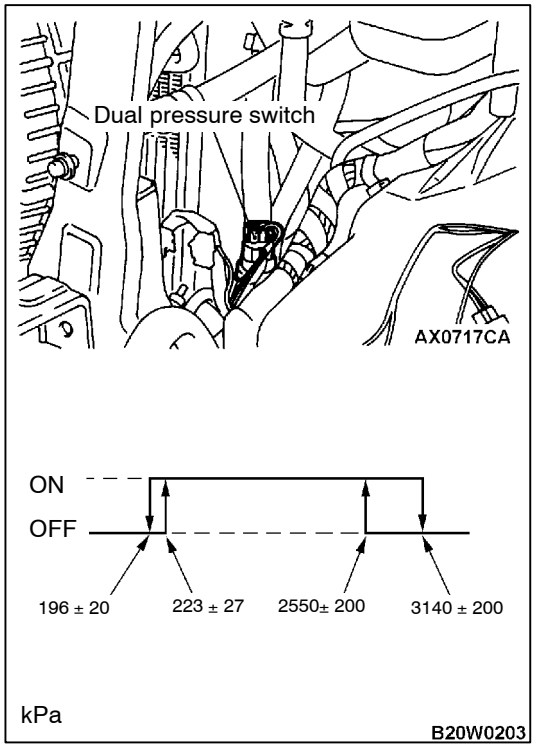
1. Disconnect the connector (1-pin) to the magnetic clutch.
2. Connect battery (+) voltage directly to the connector for the magnetic clutch.
3. If the magnetic clutch is normal, there will be “click”. If the pulley and armature do not make contact (‘click’), there is a malfunction.

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.

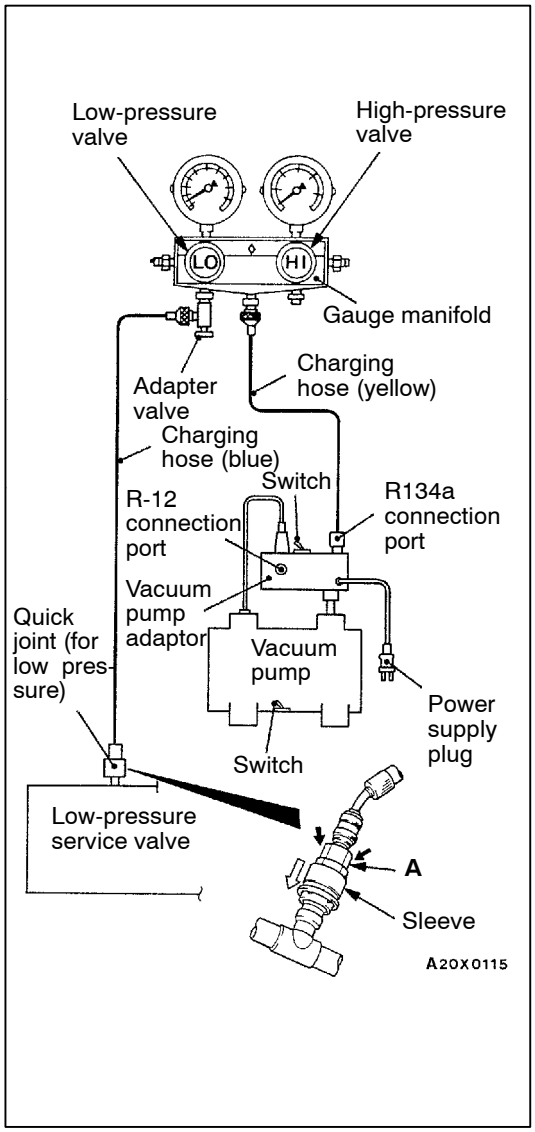
COMPRESSOR DRIVE BELT ADJUSTMENT

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.



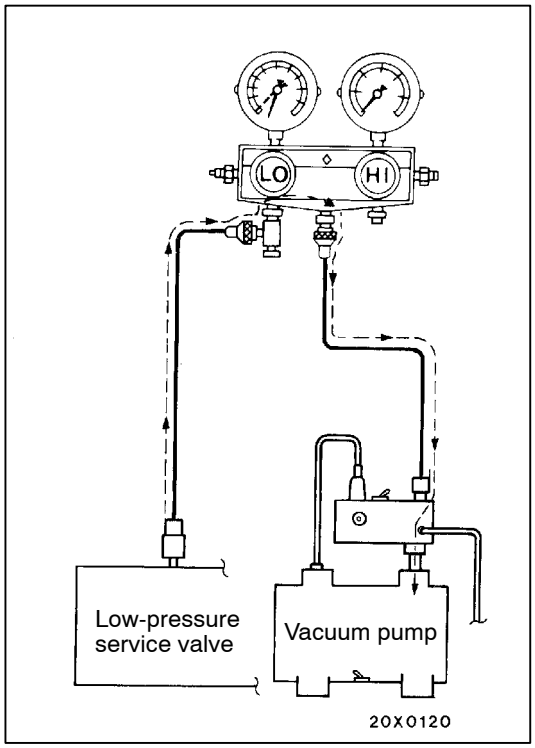
CHARGING

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 R134a.
   (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 R134a 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 R134a side to start the vacuum pump.

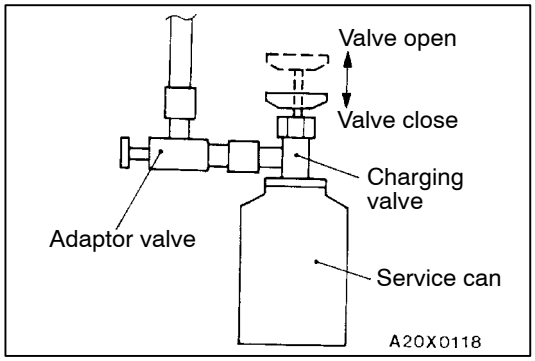
    Caution
    Do not operate the compressor for evacuation.

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.

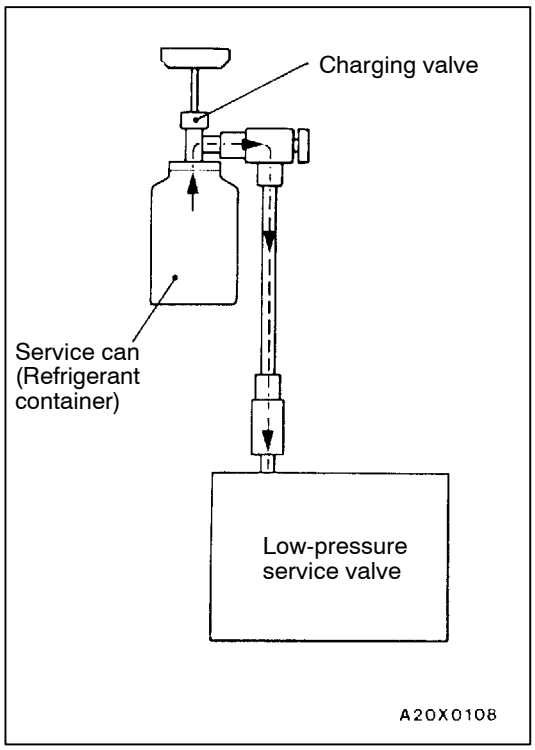
    Caution
    Do not operate the compressor in the vacuum condition; damage may occur.

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 R134a should be used.

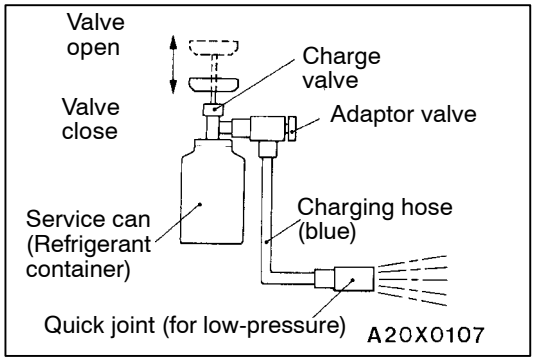
22. Start the engine.
23. Operate the A/C and set to the lowest temperature (MAX. COOL).

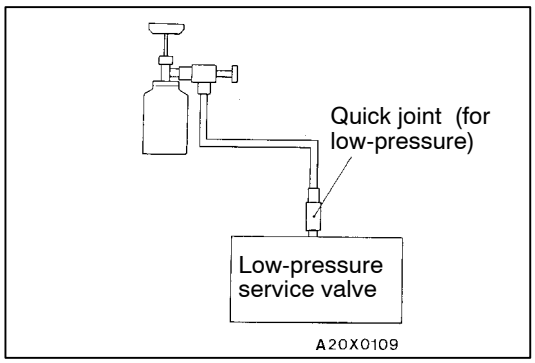
24. Fix the engine speed at 1,500 r/min.
25. Tighten the handle of the adaptor valve (valve open) to charge the required volume of refrigerant.

    Caution
    If the service can is inverted, liquid refrigerant may be drawn into the compressor damaging it by liquid compression. Keep the service can upright to ensure that refrigerant is charged in gas state.

26. After charging with refrigerant, turn the handle of the adaptor valve back all the way (valve closed).
27. Tighten the charging valve handle (valve closed). Remove the quick joint (for low-pressure) from the low-pressure service valve.

    NOTE
    If the service can is not emptied completely, keep the handles of the charging valve and adaptor valve closed for the next charging.

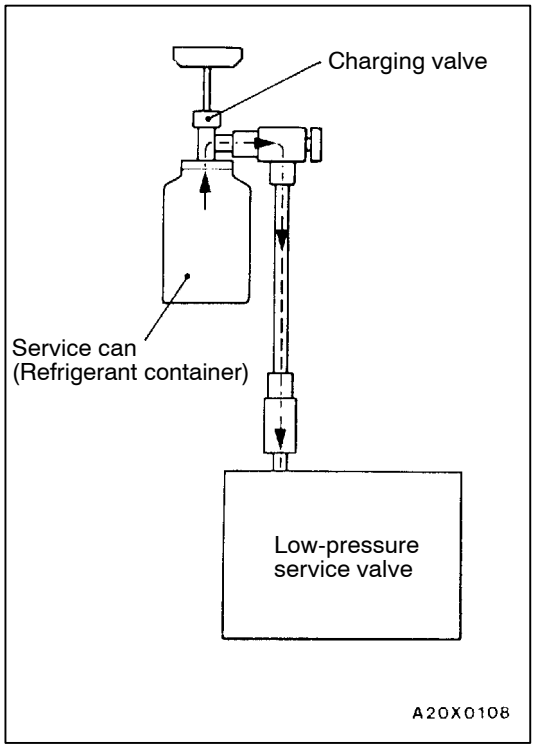




CORRECTING LOW REFRIGERANT LEVEL IN CASE THE SERVICE CAN IS USED.

1. Install the charge valve with the handle turned all the way back (valve open) to the service can.
2. Install the adaptor valve with the handle turned all the way back (valve close) to the charging valve.
3. Connect the charging hose (blue) to the adaptor valve.
4. Connect the charging hose (blue) to the quick joint (for low-pressure).
5. Tighten the handle of the charge valve (valve close), and pierce the service can.
6. Turn the handle of the adaptor valve to bleed the air.
7. Install the quick joint (for low-pressure) to the low-pressure service valve.

   NOTE
   The low-pressure service valve should be connected to the suction hose.

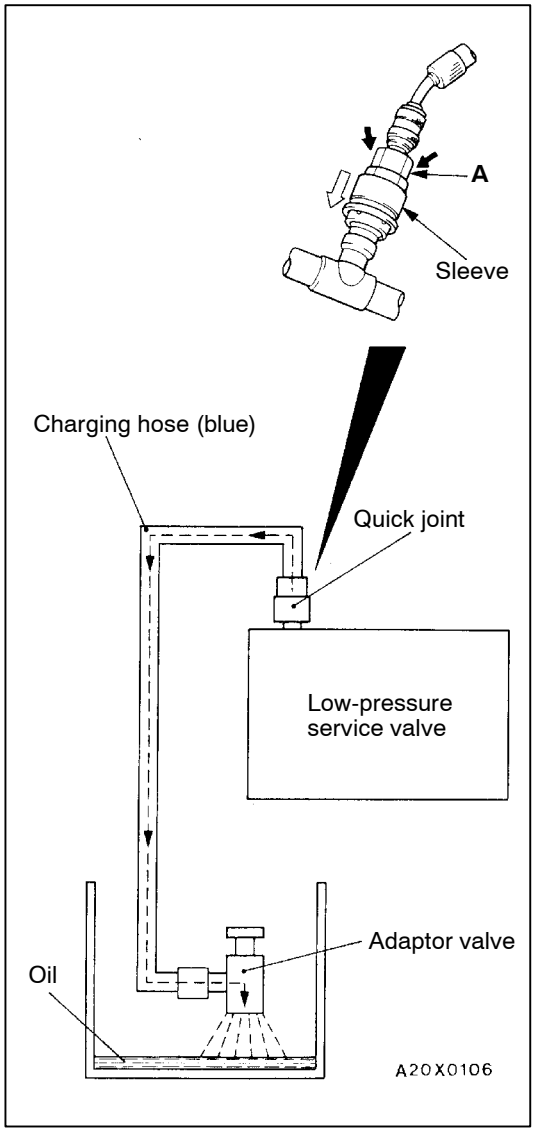


8. Start the engine.
9. Operate the air conditioner and set at the lowest temperature (MAX. COOL).
10. Fix the engine speed at 1,500 r/min.
11. Tighten the handle of the adaptor valve (valve open), and replenish refrigerant while checking the quantity through the sight glass.

    Caution
    If the service can is inverted, liquid refrigerant may be draw into the compressor damaging it by liquid compression. Keep the service can upright to ensure that refrigerant is changed in gas state.

12. After replenishing is completed, turn the handle of the adaptor valve all the way back (valve close), and remove the quick joint.

    NOTE
    When there is remainder of refrigerant in the service can, keep it for next use with the charge value and the valve of the adaptor valve being closed.



DISCHARGING SYSTEM

1. Run the engine at an engine speed of 1,200 - 1,500 r/min for approximately 5 minutes with the A/C operating to return to the oil.

   NOTE
   Returning the oil will be more effective if it is done while driving.

2. Stop the engine.
3. Connect the charging hose (blue) to the adaptor valve with its handle turned back all the way (valve closed).
4. Connect the quick joint to the charging hose (blue).
5. Install the quick joint to the low-pressure service valve.

   NOTE
   The low-pressure service valve should be connected to the suction hose.

   Caution
   To connect the quick joint, press section "A" firmly against the service valve until a click is heard.
   When connecting, run your hand along the hose while pressing to ensure that there are no bends in the hose.

6. Place the adaptor valve inside the container and discharge the refrigerant by opening the handle gradually so that oil does not gush out.

   NOTE
   Any oil remaining in the container should be returned to the A/C system.

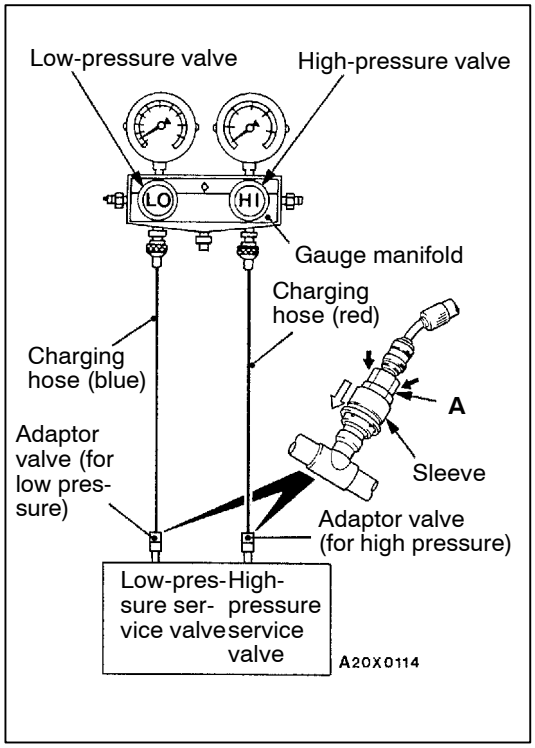
REFILLING OF OIL IN THE A/C SYSTEM

Too little oil will provide inadequate compressor lubrication and cause a compressor failure. Too much oil will increase discharge air temperature.
When a compressor is installed at the factory, it contains 120 mL of refrigerant oil. While the A/C system is in operation, the oil is carried through the entire system by the refrigerant. Some of this oil will be trapped and retained in various parts of the system.
When the following system components are changed, it is necessary to add oil to the system to replace the oil being removed with the component.

Compressor oil: DENSO OIL 8

Quantity

Condenser: 10 mL
Evaporator: 40 mL
Suction hose: 6.5 mL



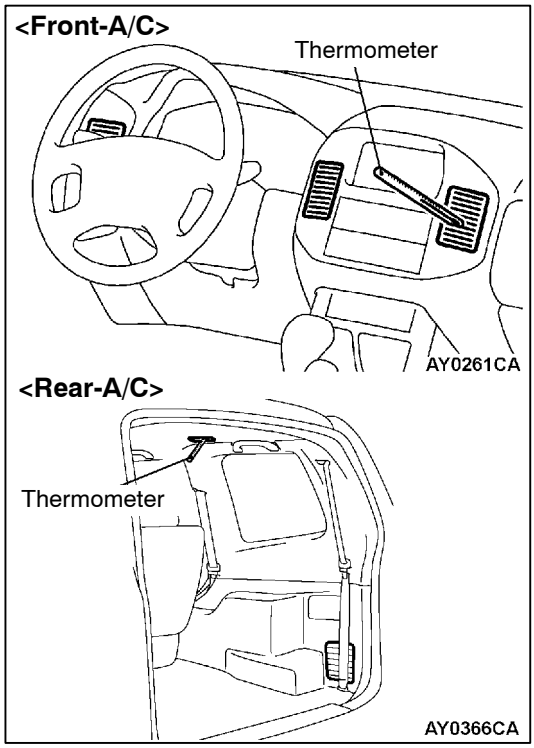
PERFORMANCE TEST

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:
   <Testing the front-A/C>
   - 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

   <Testing the rear-A/C>
   - The front A/C should be set as above.
   - A/C switch: A/C - ON position
   - Temperature control: Max. cooling 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
<Front-A/C test>

Garage ambient temperature °C	20	25	35	40
Discharge air temperature °C	3.5 - 5.5	3.5 - 5.5	4.5 - 6.5	5.5 - 7.5
Compressor high-pressure kPa	1,050 - 1,250	1,050 - 1,250	1,400 - 1,600	1,650 - 1,850
Compressor low-pressure kPa	120 - 140	120 - 140	130 - 150	160 - 180

Performance Temperature Chart
<Rear-A/C test>

Garage ambient temperature °C	20	25	35	40
Discharge air temperature °C	5.5 - 7.5	5.5 - 7.5	6.5 - 8.5	7.5 - 9.5
Compressor high-pressure kPa	1,150 - 1,350	1,150 - 1,350	1,500 - 1,700	1,750 - 1,950
Compressor low-pressure kPa	130 - 150	130 - 150	140 - 160	180 - 200

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

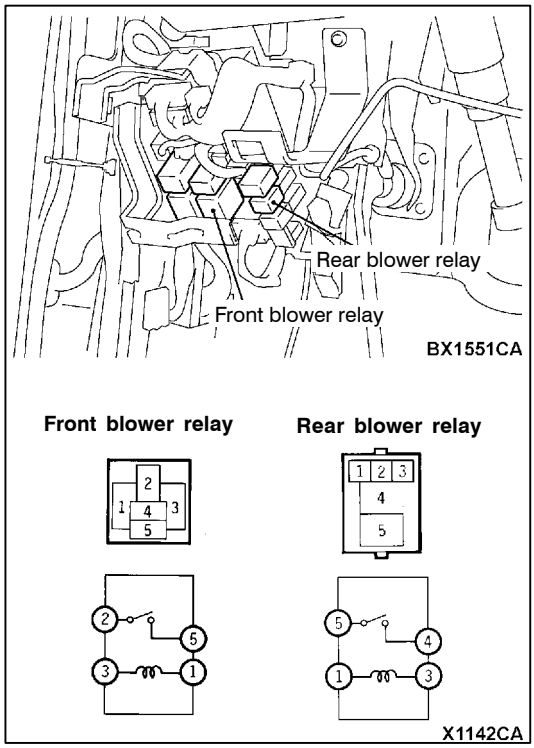
You must first know the conditions when the noise occurs. These conditions are: weather, vehicle speed, in gear or neutral, engine temperature or any other special conditions.
Noises that develop during A/C operation can often be misleading. For example: what sounds like a failed front bearing or connecting 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.

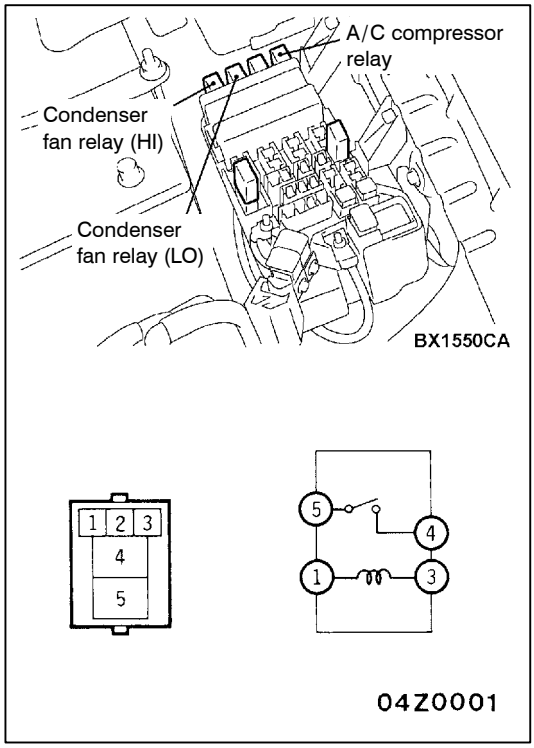
HANDLING TUBING AND FITTINGS

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.





FRONT BLOWER RELAY AND REAR BLOWER RELAY CONTINUITY CHECK <Vehicles with rear cooler>

FRONT BLOWER RELAY

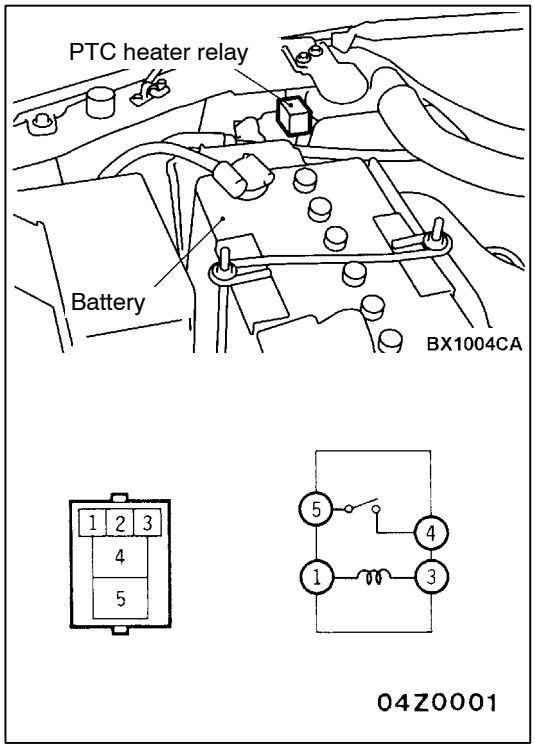
System voltage	Terminal No.			
	1	3	2	5
When current is not supplied	○	○		
When current is supplied	⊕	⊖	○	○

REAR BLOWER RELAY

System voltage	Terminal No.			
	1	3	4	5
When current is not supplied	○	○		
When current is supplied	⊕	⊖	○	○

CONTINUITY CHECK OF A/C COMPRESSOR RELAY AND CONDENSER FAN RELAY

System voltage	Terminal No.			
	1	3	4	5
When current is not supplied	○	○		
When current is supplied	⊕	⊖	○	○



PTC HEATER RELAY CONTINUITY CHECK <4M41>

System voltage	Terminal No.			
	1	3	2	5
When current is not supplied	○	○		
When current is supplied	⊕	⊖	○	○

NOTE
The PTC heater is located at the heater core.

IDLE-UP OPERATION CHECK <Diesel>

1. Set the vehicle in the pre-inspection condition:
2. Check that the idle speed is within the standard value.

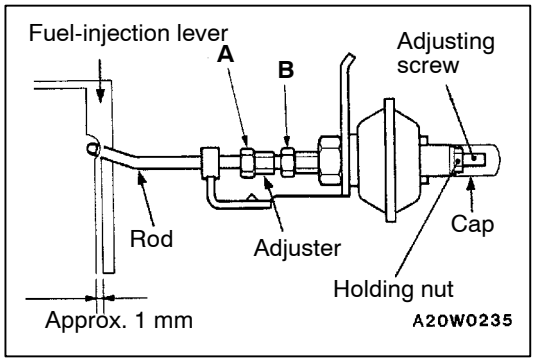
   Standard value:
   <4D56>750 ± 100 r/min
   <4M41>750 ± 50 r/min

   NOTE
   The idle speed is controlled by the engine-ECU and should not be adjusted.

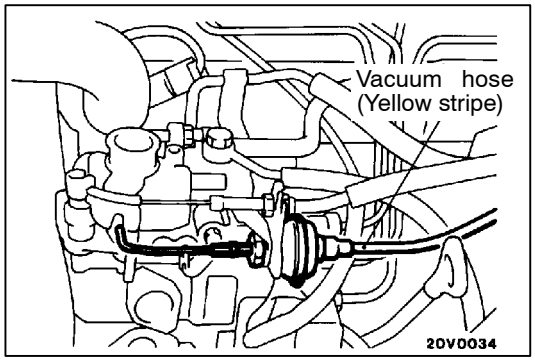
3. The idle speed should be within the standard value when the A/C switch is turned on and the A/C is operating.

   Standard value:
   <4D56> 925 ± 25 r/min
   <4M41: When the A/C is under low medium load>
   800 ± 50 r/min
   <4M41: When the A/C is under high load>
   1,000 ± 50 r/min

4. When the front A/C is set as follows, the idle speed should be within the standard value.
   Blower switch: ON
   Air outlet temperature: FOOT, FOOT/DEF, DEF
   Set temperature: MAX. HOT (32°C)
   Heat switch: ON

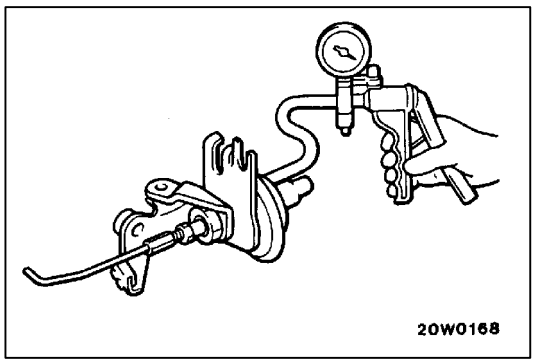


5. If there is a deviation of the idling speed from the standard value, adjust the idling speed by the following the procedures.<4D56>
   (1) Loosen nuts (A) and (B).
   (2) Adjust, by using the adjuster, so that the end of the vacuum actuator's rod is at the position indicated in the illustration.
   (3) Securely tighten nuts (A) and (B).
   (4) After activating the vacuum actuator, check to be sure that the rod and the lever do not contact when the activation is cancelled.
   (5) Remove the cap and loosen the nut for holding.
   (6) Adjust to the specified r/min by turning the adjusting screw.
   (7) Securely tighten the holding nut, and then attach the cap.



VACUUM ACTUATOR CHECK <Diesel-powered Vehicles>

1. Pull off the vacuum hose (yellow stripe) connected to the vacuum actuator.

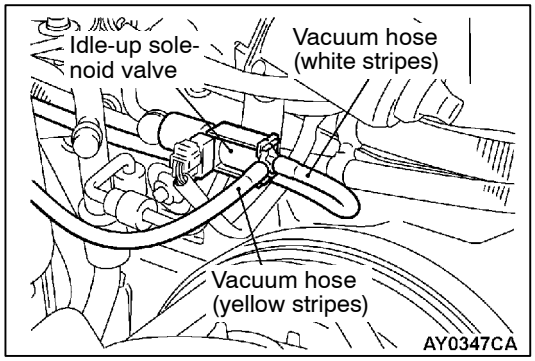


2. Connect a manual vacuum pump to the nipple of the vacuum actuator.
3. Check to be sure that the vacuum actuator rod starts to contact when 8 kPa of negative pressure is applied, and that the rod contracts to its full stroke when 12 kPa of negative pressure is applied.
4. Disconnect the manual vacuum pump from the vacuum actuator, and connect the vacuum hose (yellow stripe) to the vacuum actuator.

5. Start the engine and let it run at idle. Then cover the end of the vacuum hose (yellow stripe) with a finger and check the negative pressure when the A/C switch is turned on and off.

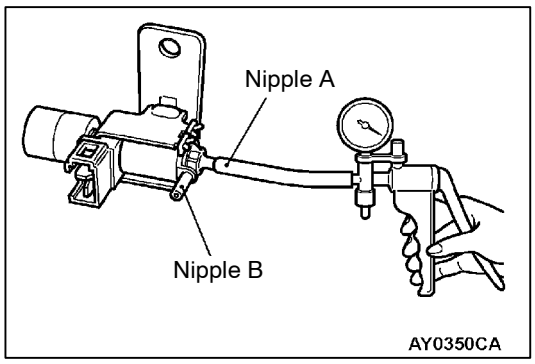
A/C switch	Negative pressure at hose end
OFF	NO
ON	YES

Caution
Be careful, when connecting the vacuum hose not to damage it.

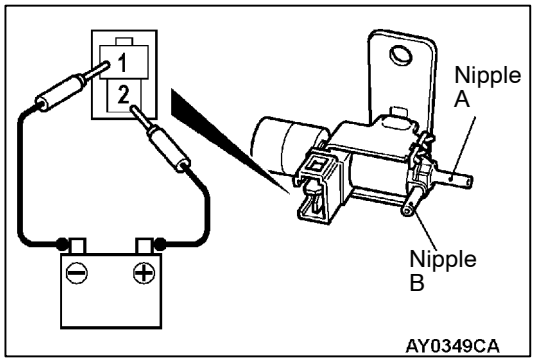


IDLE-UP SOLENOID VALVE CHECK <Diesel-powered vehicles>

1. Disconnect the vacuum hoses (white stripes, yellow stripes) from the solenoid valve.
2. Disconnect the harness connector.



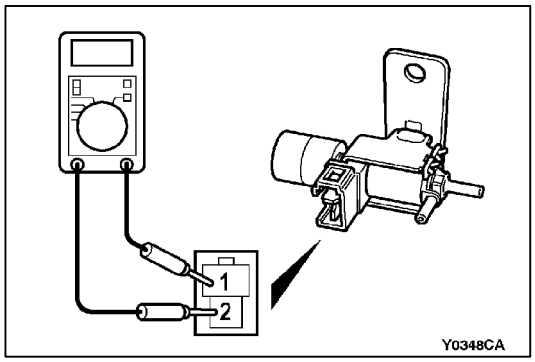
3. Connect a manual vacuum pump to the nipple A.



4. Check air-tightness by applying a vacuum with voltage applied directly from the battery to the solenoid valve terminal and without applying voltage.

Battery voltage	Nipple B	Vacuum condition
Applied	Open	Vacuum leaks from nipple B
	Blocked with finger *1	Vacuum is maintained
Not applied	Open	Vacuum is maintained
	Blocked with finger *2	

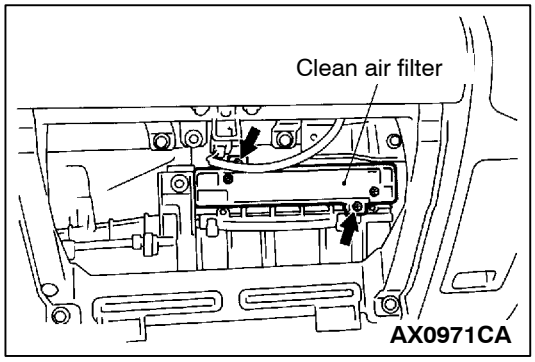
NOTE
In case of mark *1, a vacuum can be felt but in case of mark *2, a vacuum can not be felt.



5. Measure the resistance of the solenoid valve.

   Standard value: Approx. 40 Ω

6. When disconnecting the vacuum hose, always make a mark so that the hose can be reconnected at original position.

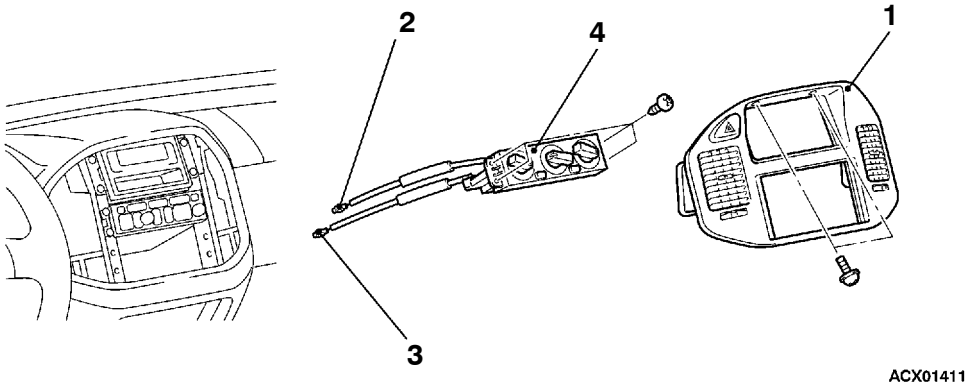


CLEAN AIR FILTER REPLACEMENT PROCEDURE

1. Remove the glove box. (Refer to GROUP 52A - Instrument Panel.)
2. Remove the two screws as shown, and replace the clean air filter.
3. Remove the clean air filter.
4. Install the glove box.

FRONT A/C

AIR CONDITIONER CONTROL PANEL ASSEMBLY AND A/C SWITCH REMOVAL AND INSTALLATION

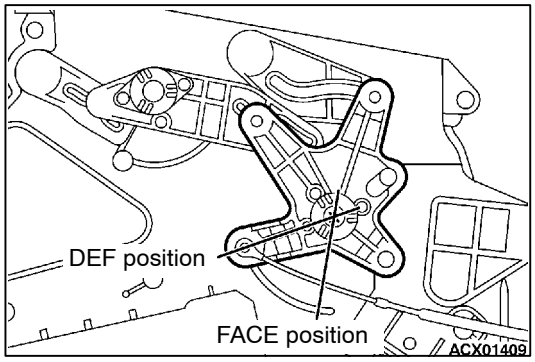


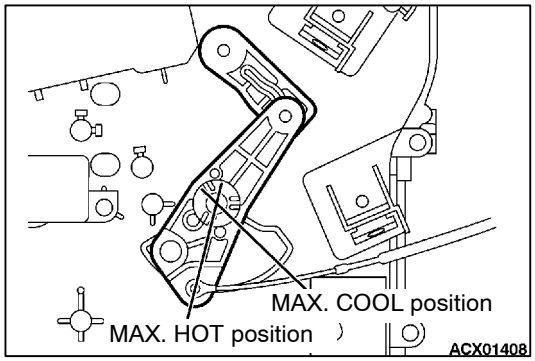
Removal steps

- Front floor console (Refer to GROUP 52A.)
- Lower panel (Refer to GROUP 52A - Instrument Panel.)
- Foot duct C
- Foot duct D

▶B◀
▶A◀

1. Center panel (Refer to GROUP 52A - Instrument Panel.)
2. Air mix damper cable connection
3. Air outlet changeover damper cable connection
4. Heater control assembly





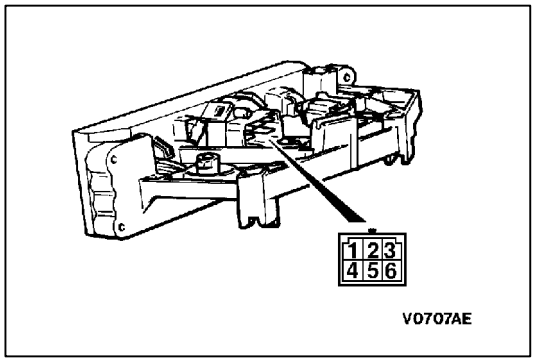
INSTALLATION SERVICE POINTS

▶A◀ AIR OUTLET CHANGEOVER DAMPER CABLE CONNECTION

1. Set the air outlet changeover knob of the heater control assembly to the DEF position.
2. Move the air outlet changeover damper lever to the DEF position (rotate the damper lever counterclockwise fully), and then connect the cable.

▶B◀ AIR MIX DAMPER DOOR CABLE CONNECTION

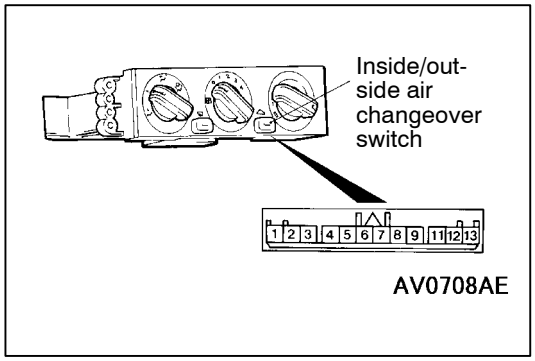
1. Turn the temperature adjusting knob of the heater control assembly to the HOT side fully.
2. Move the air mix door lever of the heater unit to the MAX. HOT position (rotate the damper lever clockwise fully), and then install the cable.



INSPECTION

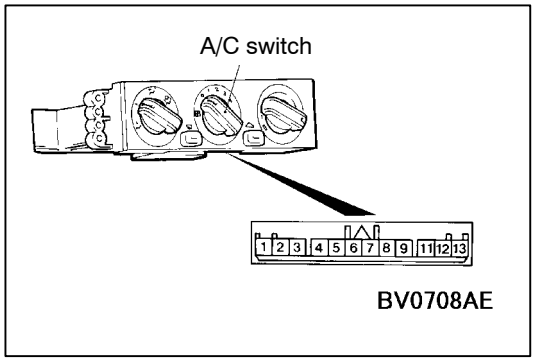
BLOWER SWITCH CONTINUITY CHECK

Switch position	Terminal No.				
	1	3	4	5	6
0 (OFF)					
1 (LO)		○		○	
2 (ML)	○	○			
3 (MH)		○			○
4 (HI)		○	○		



INSIDE/OUTSIDE AIR CHANGEOVER SWITCH CONTINUITY CHECK

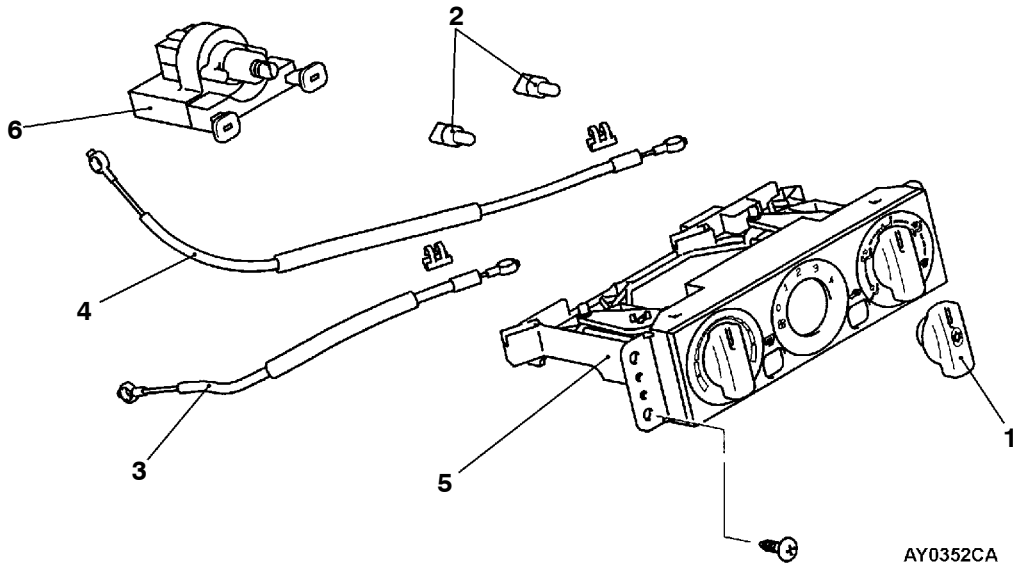
Switch position	Terminal No.						
	1	IND	3	4	5	8	9
When the switch is not pressed	○	○	○			○	ILL
When the switch is pressed				○	○		



A/C SWITCH CONTINUITY CHECK

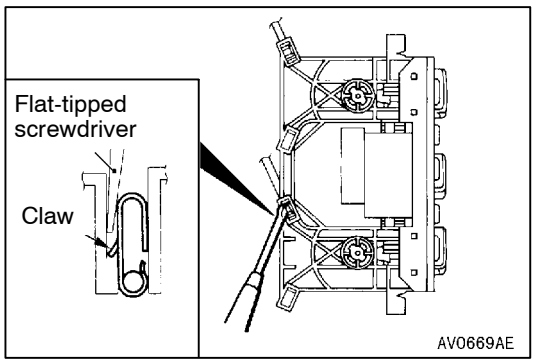
Switch position	Terminal No.						
	1	IND	7	5	6	8	9
OFF position	○	○	○			○	ILL
ON position				○	○		

DISASSEMBLY AND REASSEMBLY



Disassembly steps

1. Knob assembly
2. Bulb
◀A▶ 3. Air outlet changeover damper cable
◀A▶ 4. Air mix damper cable
5. Heater control panel
6. Blower switch assembly



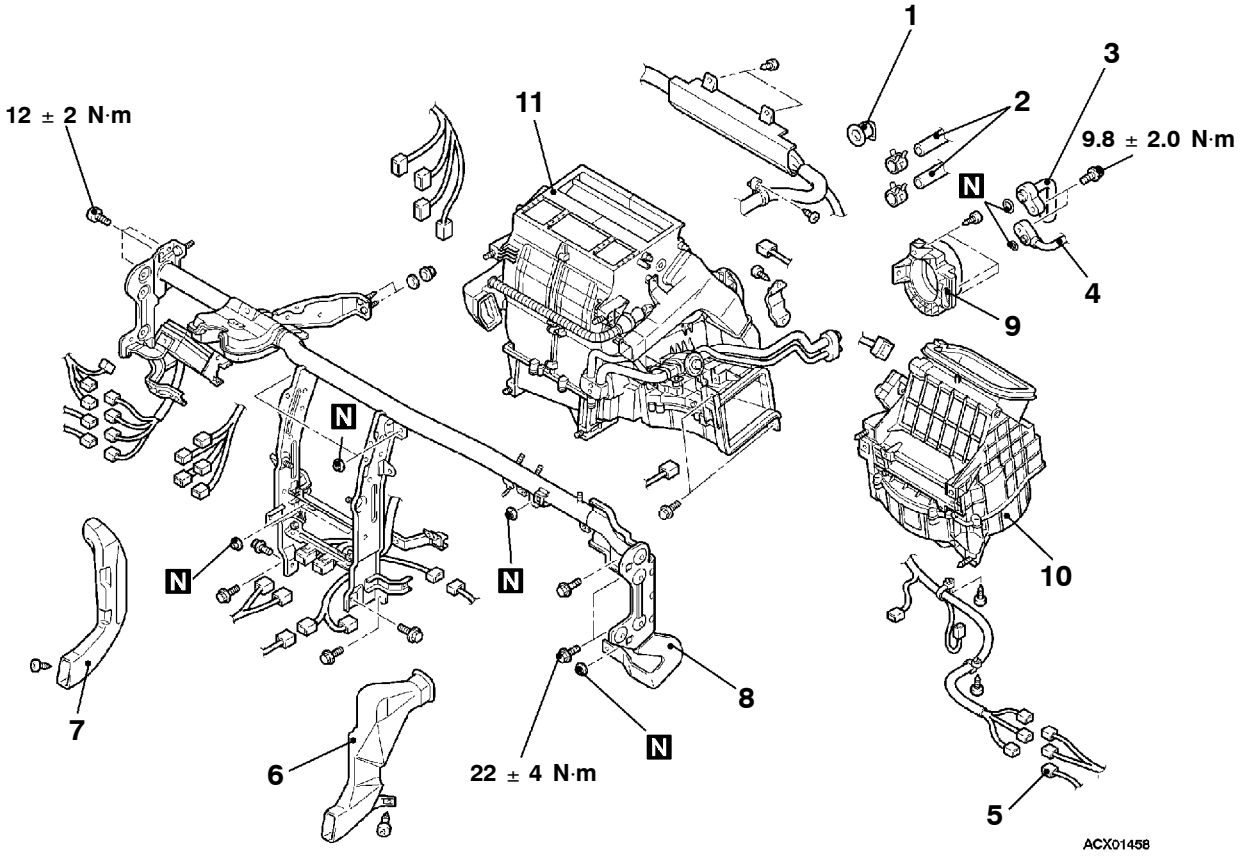
DISASSEMBLY SERVICE POINT

◀A▶ AIR OUTLET CHANGEOVER DAMPER CABLE /AIR MIX DAMPER CABLE DISCONNECTION

Insert a flat-tipped screwdriver into the clip through the inside of the control base, and then prise out the clip claw to disconnect the cables.

HEATER UNIT AND BLOWER ASSEMBLY REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations
- Refrigerant Discharge and Refilling (Refer to P.55A-9.)
- Engine Coolant Draining and Refilling (Refer to GROUP 14 - On-vehicle Service.)
- Instrument Panel Removal and Installation (Refer to GROUP 52A.)
- Bolt Securing Steering Column Shaft to Front Deck Crossmember (Refer to GROUP 37A – Steering Wheel and Shaft.)



Removal steps

1. Drain hose
2. Heater hose connection
◀A▶ 3. Suction flexible hose connection
◀A▶ 4. Liquid pipe A connection
5. Connectors
6. Foot duct B
7. Foot duct
8. Front crossmember assembly
9. Flange bracket
10. Blower assembly
11. Heater unit

REMOVAL SERVICE POINT

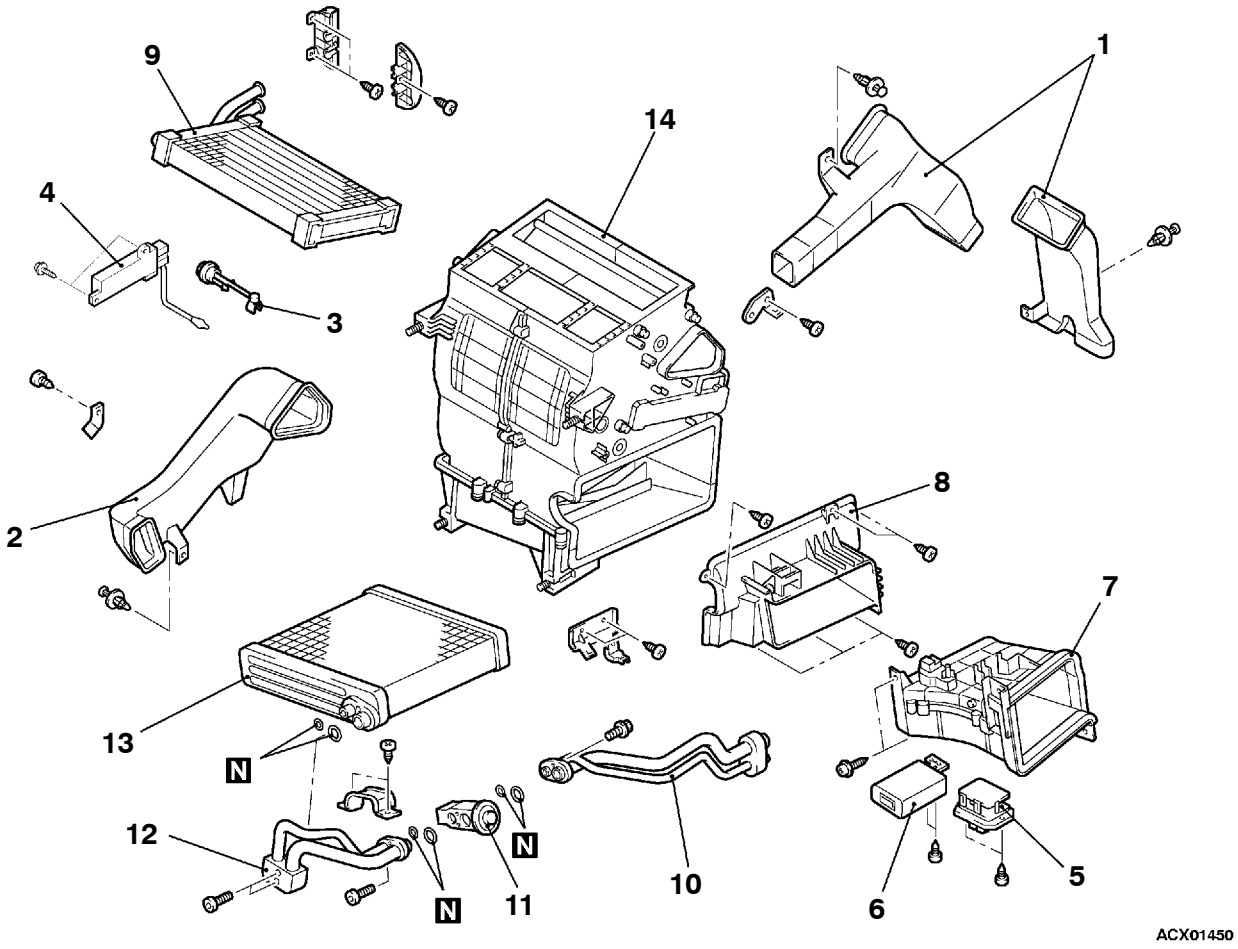
◀A▶ SUCTION FLEXIBLE HOSE/LIQUID PIPE A DISCONNECTION

Plug the disconnected hose nipple to prevent dust or foreign material from entering them.

Caution

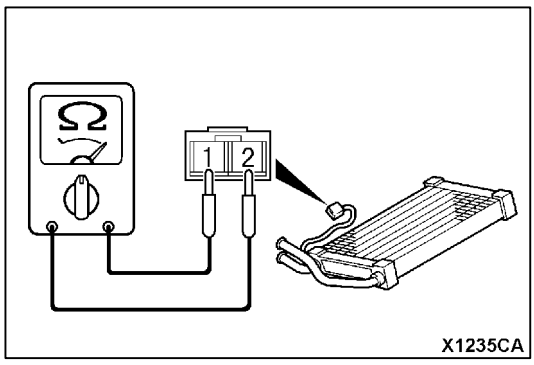
Use a plug, which air does not penetrate through. Compressor oil and receiver absorb moisture easily.

HEATER UNIT DISASSEMBLY AND REASSEMBLY



Disassembly steps

1. Foot duct A
2. Foot duct C
3. Air thermo sensor clip
4. Automatic compressor-ECU and air thermo sensor assembly
5. Aspirator hose
6. Blower linear controller
7. Rear A/C control unit <Vehicles with dual A/C>
8. Joint duct
9. Air duct sub-assembly
10. Heater core
11. Front pipe assembly
12. Expansion valve
13. Pipe
14. Evaporator
15. Case

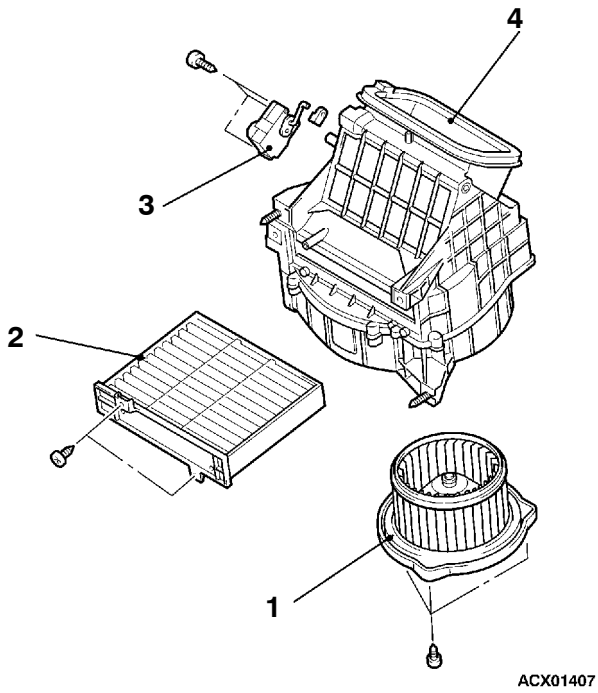


INSPECTION

PTC HEATER CHECK <4M41>

Continuity should be present between the terminals.

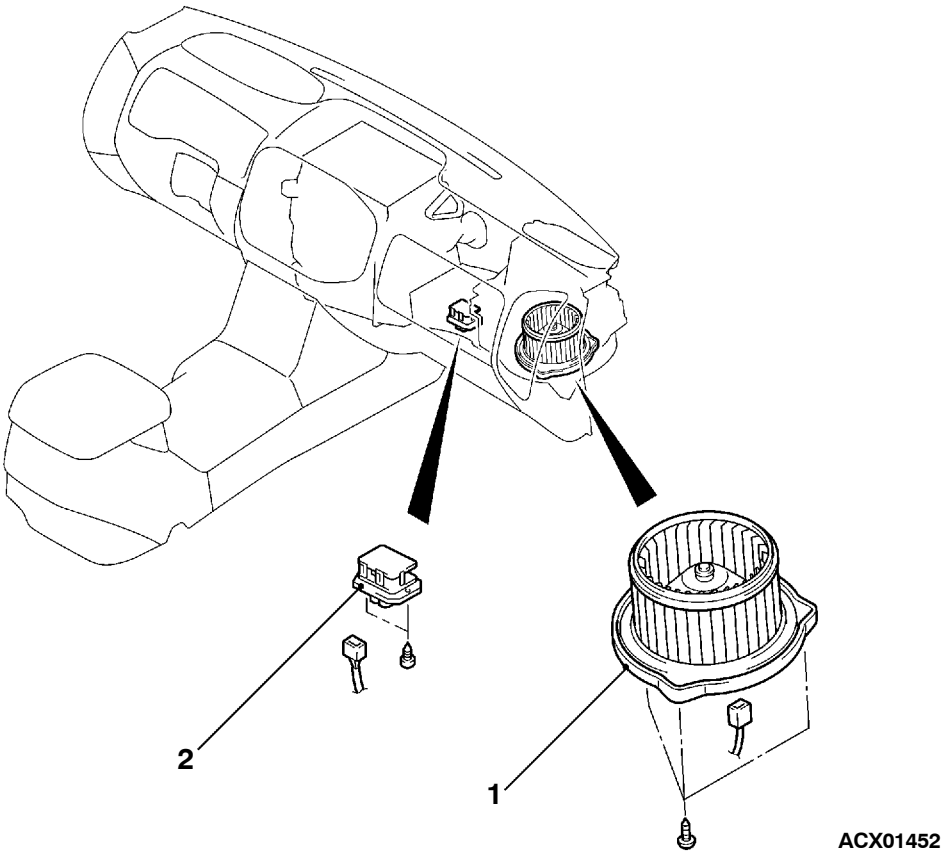
BLOWER ASSEMBLY DISASSEMBLY AND REASSEMBLY



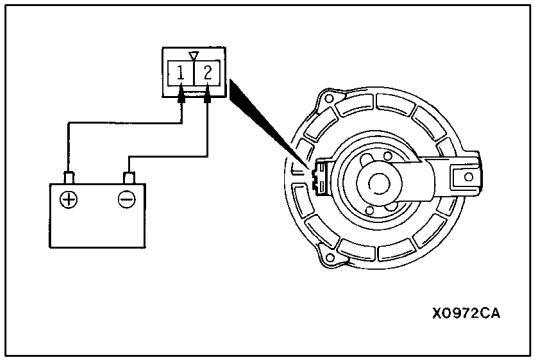
Disassembly steps

1. Blower motor
2. Clean air filter <Vehicles with clean air filter>
3. Inside/outside air changeover damper motor
4. Case

BLOWER MOTOR AND RESISTOR REMOVAL AND INSTALLATION



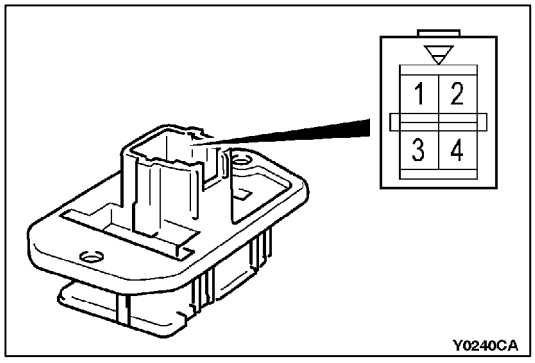
1. Blower motor
2. Resistor



INSPECTION

BLOWER MOTOR INSPECTION

The motor should run when battery voltage is applied between the terminals. In addition, any abnormal sound should not be heard from the motor.

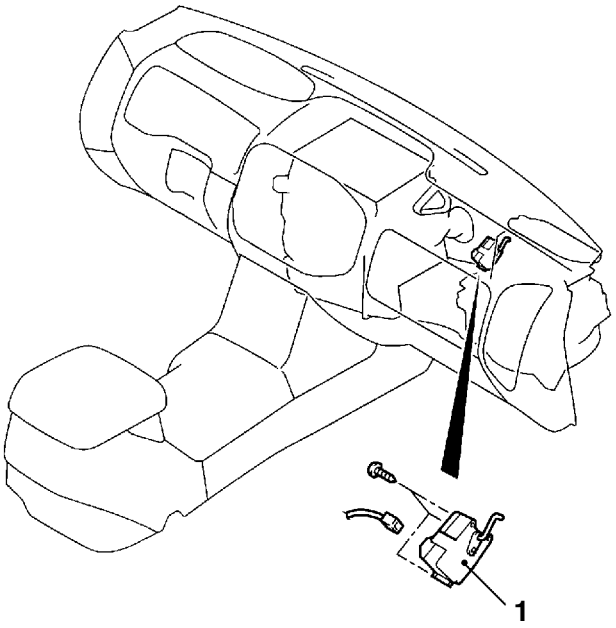


RESISTOR CHECK

Standard value:

Terminal to be measured	Standard value Ω
Between terminals No.3 and 2	2.79 ± 7 %
Between terminals No.1 and 2	1.49 ± 7 %
Between terminals No.2 and 4	0.39 ± 7 %

INSIDE/OUTSIDE AIR CHANGEOVER DAMPER MOTOR REMOVAL AND INSTALLATION



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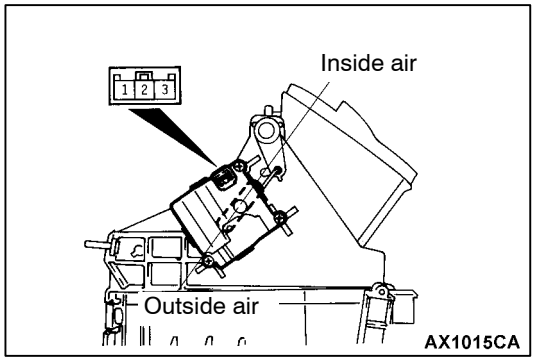
Removal steps

- Glove box (Refer to GROUP 52A – Instrument Panel.)

1. Inside/outside air changeover damper motor



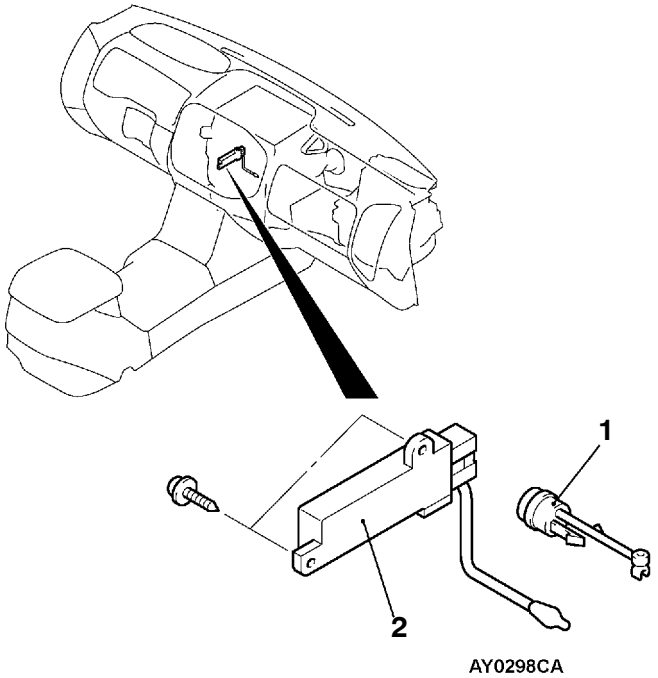
INSPECTION

INSIDE/OUTSIDE AIR CHANGEOVER DAMPER MOTOR CHECK

Battery terminal voltage			Lever operation
1	2	3	
⊕		⊖	Rotate to the inside air recirculation position.
⊕	⊖		Rotate to the outside air induction position.

Caution
If the lever reaches the stop position, disconnect the battery voltage.

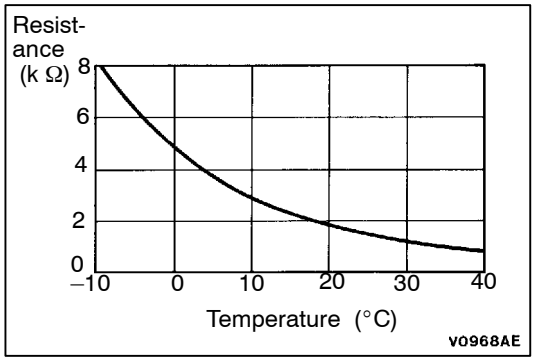
AUTOMATIC COMPRESSOR-ECU AND AIR THERMO SENSOR ASSEMBLY REMOVAL AND INSTALLATION



Removal steps

- Under cover (Refer to GROUP 52A – Instrument Panel.)

1. Air thermo sensor clip
2. Automatic compressor-ECU and air thermo sensor assembly



INSPECTION

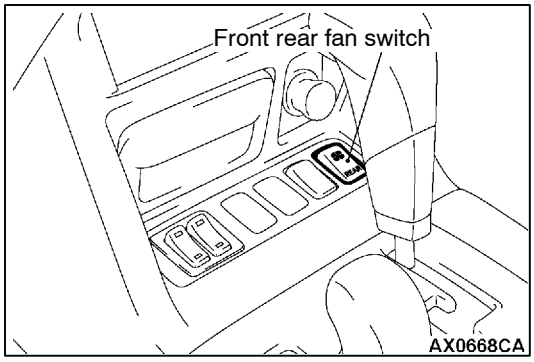
AIR THERMO SENSOR CHECK

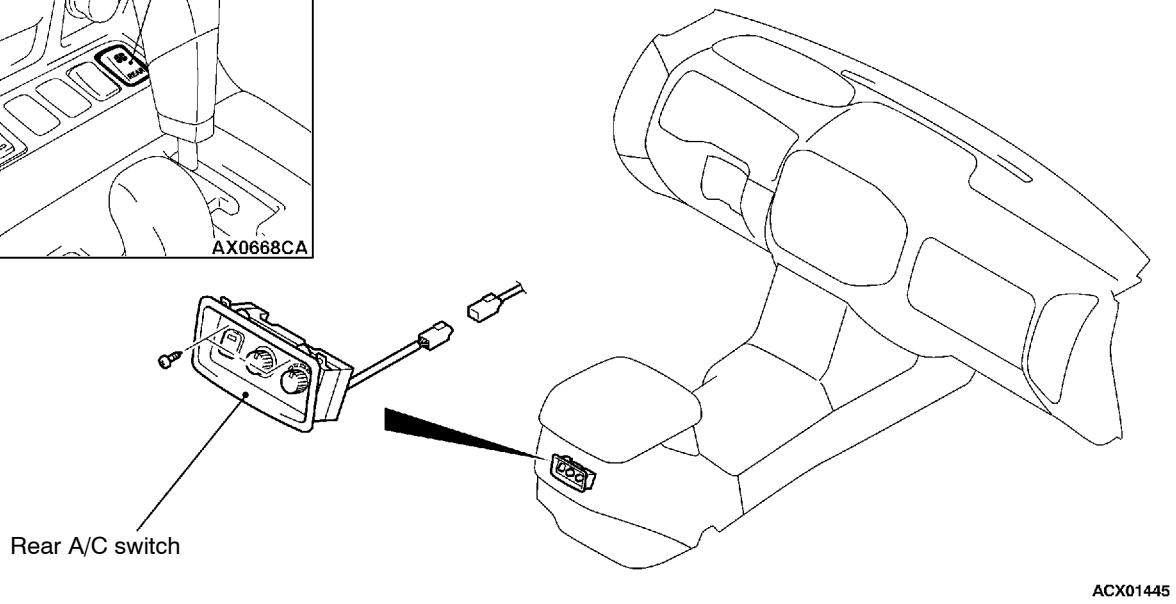
Measure the resistance between the sensor terminals under at least two temperatures. The resistance values should meet the left graph.

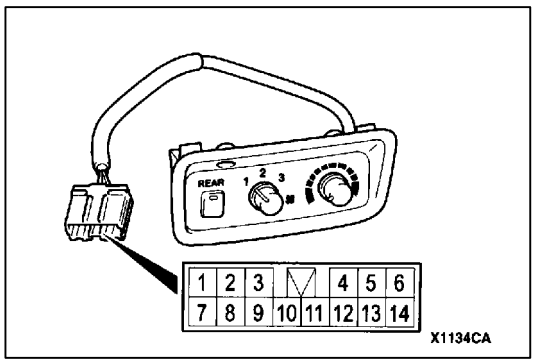
NOTE
The temperature should be within the shown range.

REAR HEATER AND REAR COOLER

REAR A/C SWITCH, FRONT REAR FAN SWITCH REMOVAL AND INSTALLATION







INSPECTION

CONTINUITY CHECK OF THE REAR A/C SWITCH

Air Volume Adjusting Switch Check

Switch position	Terminal No.			
	1	4	6	7
1	○	○		
2	○		○	
3	○			○

Rear Fan Switch Check

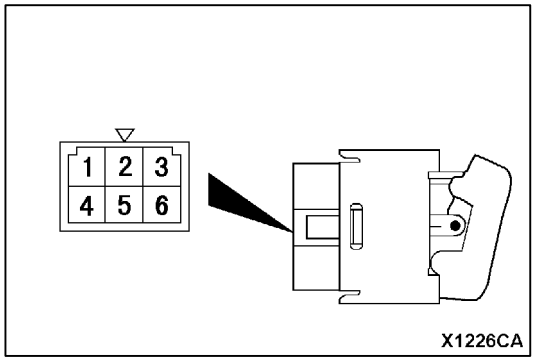
The rear fan switch toggles on and off.

Switch position	Terminal No.							
	2	8	9	IND	12	10	ILL	11
OFF position		○	○	○	○	○	○	○
ON position	○	○	○	○	○	○	○	○

Temperature Adjusting Switch Check

Connect an ohmmeter between connector terminals No.3 and 5 as well as 5 and 13. The resistance values should change within the standard value range gradually when the temperature adjusting switch is operated.

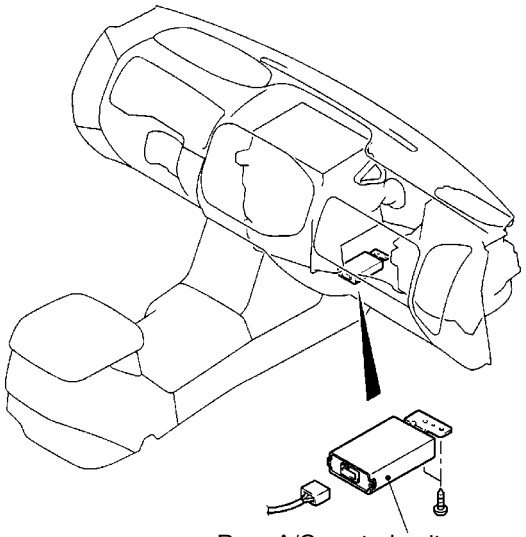
Standard value: 0 - 3 kΩ



Front Rear Fan Switch Continuity Check

Switch position	Terminal No.							
	1	2	IND	5	6	3	ILL	4
OFF position	○	○	○		○	○	○	○
ON position	○	○	○	○	○	○	○	○

REAR A/C CONTROL UNIT
REMOVAL AND INSTALLATION



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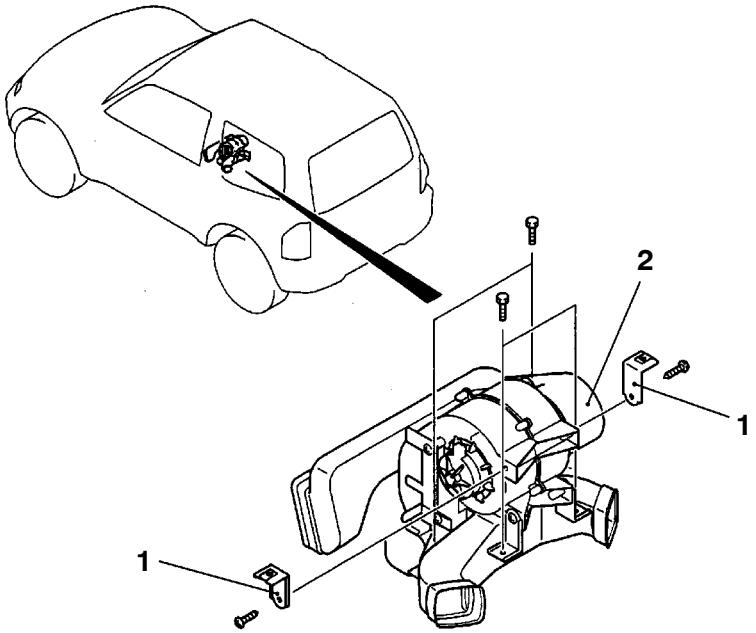
REAR HEATER UNIT <Floor console>
REMOVAL AND INSTALLATION



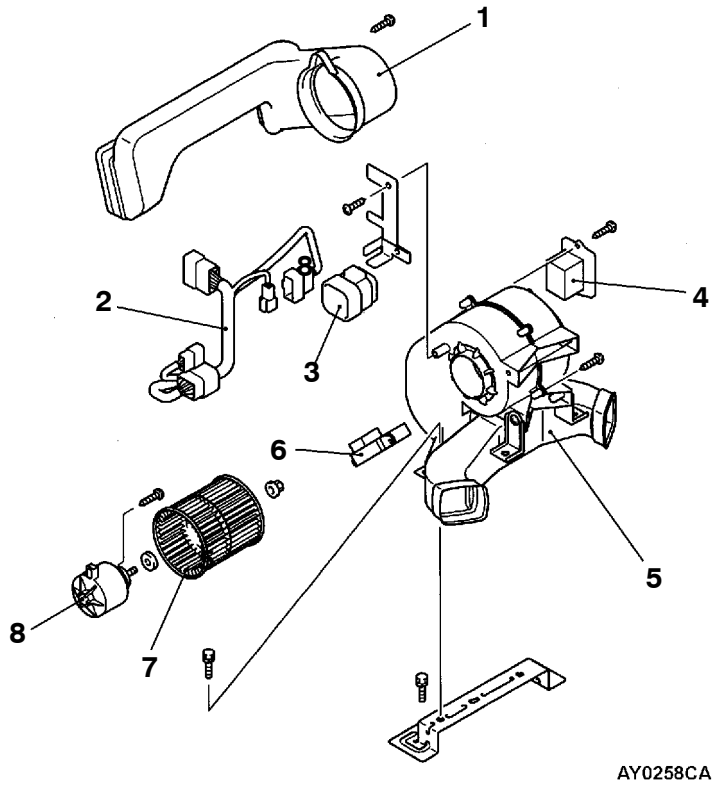
AY0259CA

Removal steps

- Front floor console
  (Refer to GROUP 52A.)

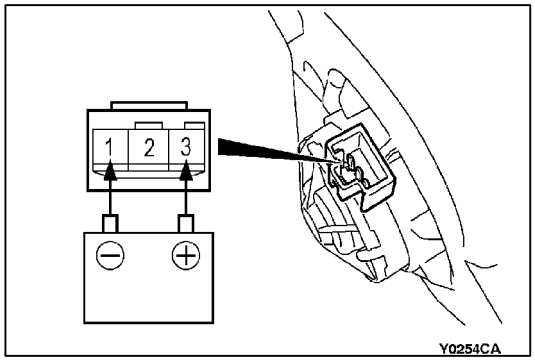
1. Upper bracket
2. Rear heater unit

REAR HEATER UNIT <FLOOR CONSOLE> DISASSEMBLY AND REASSEMBLY



Disassembly steps

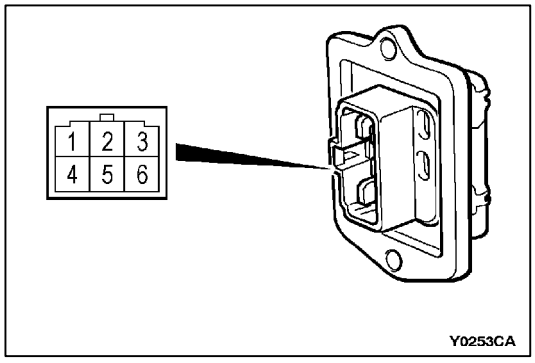
1. Rear inlet duct
2. Harness assembly
3. Relay
4. Resistor
5. Heater case
6. Heater core
7. Blower fan
8. Blower motor



INSPECTION

BLOWER MOTOR INSPECTION

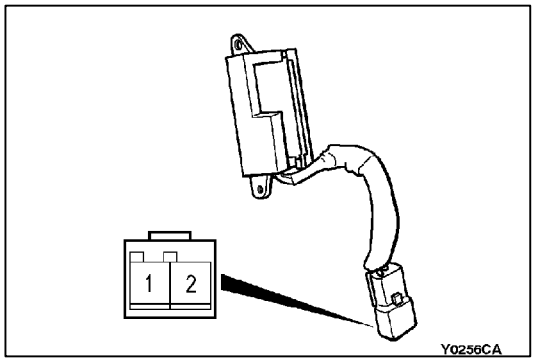
The motor should run when battery voltage is applied between the terminals. In addition, any abnormal sound should not be heard from the motor.



RESISTOR CHECK

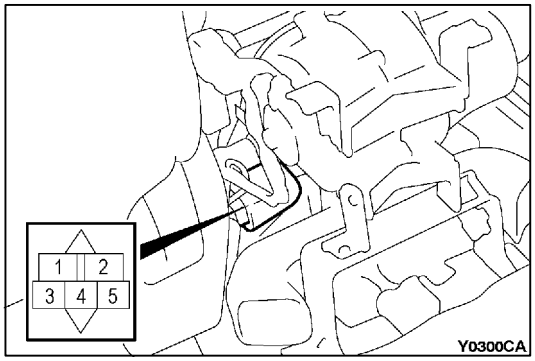
Standard value:

Terminal to be measured	Standard value Ω
Between terminals No.1 and 6	4.9 ± 7 %
Between terminals No.1 and 3	1.25 ± 7 %



PTC HEATER CHECK

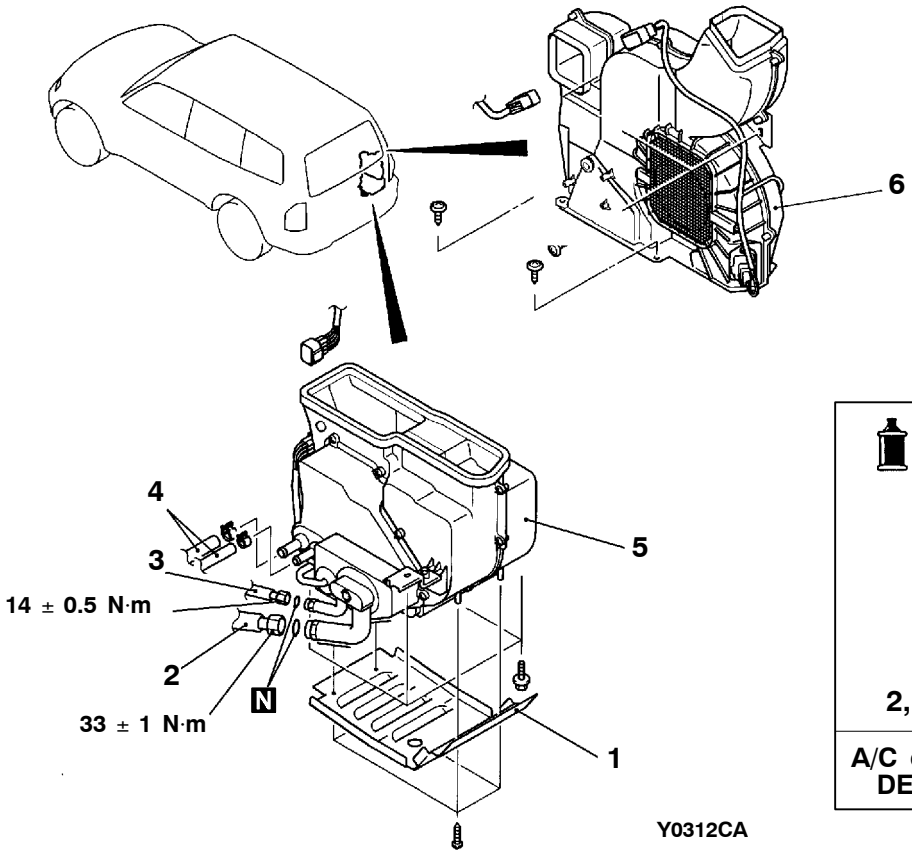
Continuity should be present between the terminals.

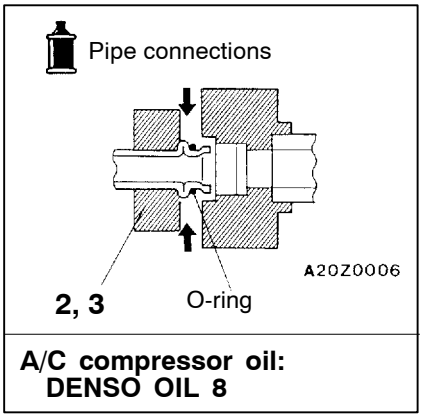


RELAY CONTINUITY CHECK

System voltage	Terminal No.			
	1	3	2	5
When current is not supplied	○	○		
When current is supplied	⊕	⊖	○	○

REAR HEATER UNIT AND REAR BLOWER ASSEMBLY <QUARTER TRIM> REMOVAL AND INSTALLATION





Rear heater unit removal steps

- Refrigerant discharge and refilling (Refer to P.55A-9.)
- Engine coolant draining and refilling (Refer to GROUP 14 - On-vehicle Service.)
- Rear mud guard (Refer to GROUP 51.)

1. Heater cover
2. Suction pipe C connection
3. Liquid pipe D connection
4. Heater hose connection
5. Rear heater unit

Rear blower assembly removal steps

- Upper quarter trim (RH), lower quarter trim (RH) (Refer to GROUP 52A – Trim.)
- Rear quarter duct, rear floor duct A mounting bolt, pillar duct mounting bolt (Refer to P.55A-55.)

6. Rear blower assembly

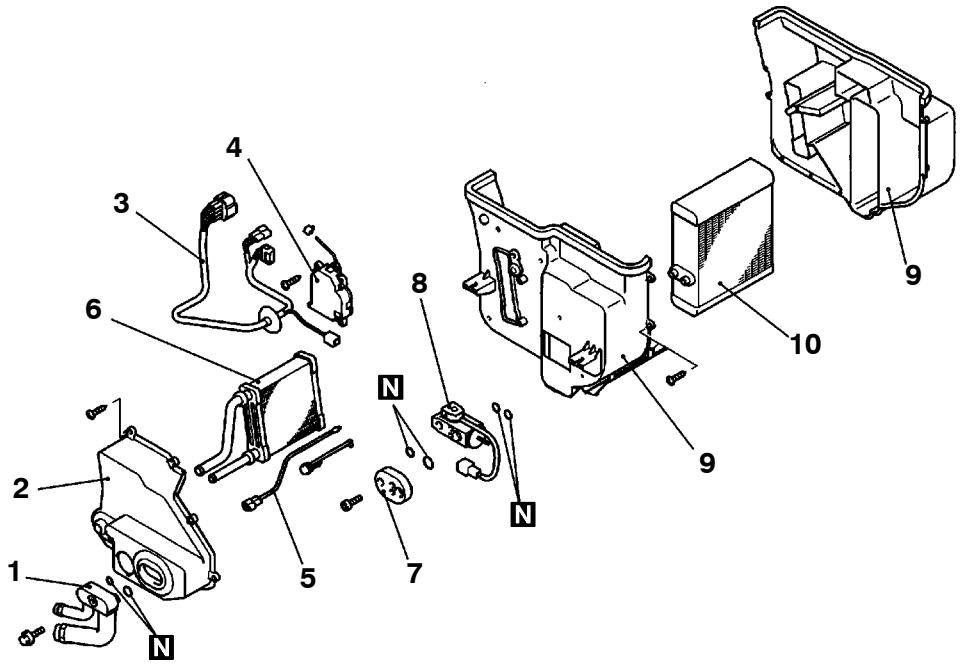
REMOVAL SERVICE POINTS

◀A▶ SUCTION PIPE C/LIQUID PIPE D DISCONNECTION

Plug the disconnected pipe and the rear heater unit nipples to prevent dust or foreign material from entering them.

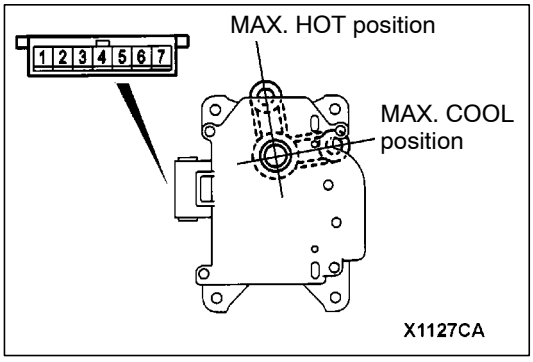
Caution
Use a plug, which air does not penetrate through. Compressor oil and receiver absorb moisture easily.

REAR HEATER UNIT DISASSEMBLY AND REASSEMBLY



Disassembly steps

1. Tube accessory assembly
2. Heater cover
3. Harness assembly
4. Electric motor for the air mix damper <Vehicles with rear heater>
5. Air thermo sensor <Vehicles with rear cooler>
6. Heater core <Vehicles with rear heater>
7. Connector tube <Vehicles with rear cooler>
8. Expansion valve <Vehicles with rear cooler>
9. Heater case
10. Evaporator <Vehicles with rear cooler>



INSPECTION

AIR MIX DAMPER MOTOR CHECK

Motor Check

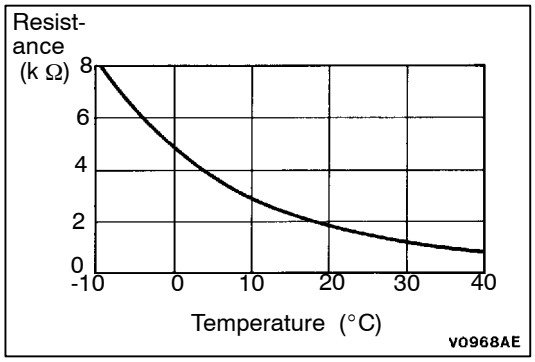
Battery connection terminal		Lever operation
1	2	
⊕	⊖	Rotate to the COOL position.
⊖	⊕	Rotate to the HOT position.

Caution
If the lever reaches the stop position, disconnect the battery voltage.

Potentiometer Check

When the resistances between terminals 3 and 5 as well as terminals 3 and 7 are measured at the previous check, the resistance value should change gradually within the standard value.

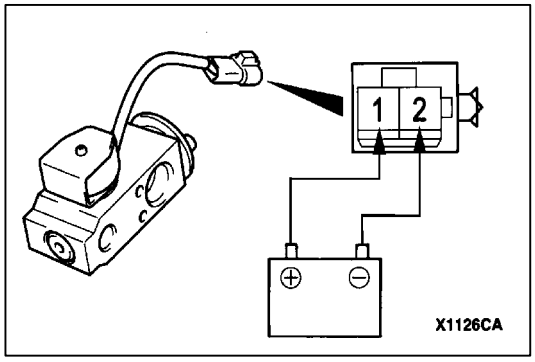
Standard value: 1.2 - 4.8 kΩ



Air Thermo Sensor Check

Measure the resistance between the sensor terminals under at least two temperatures. The resistance values should meet the left graph.

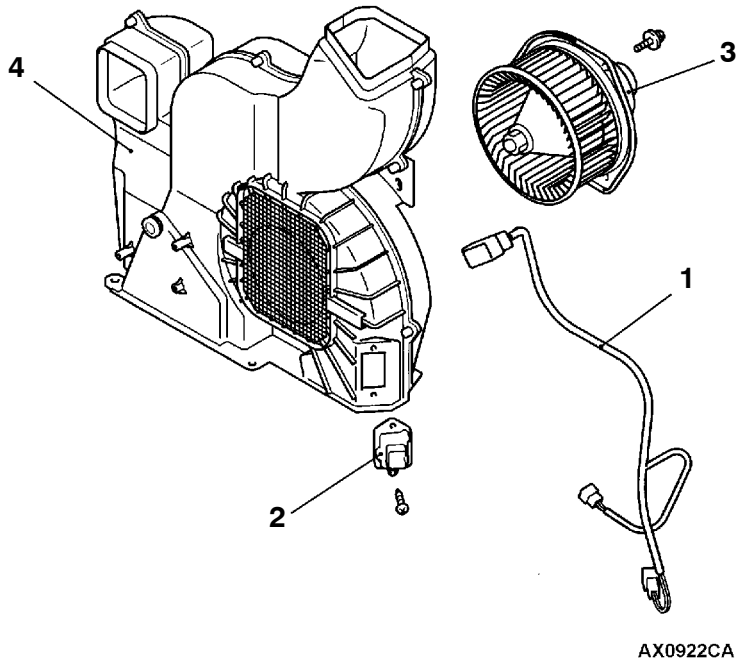
NOTE
The temperature should be within the shown range.



Expansion Valve (Magnet Valve) Check

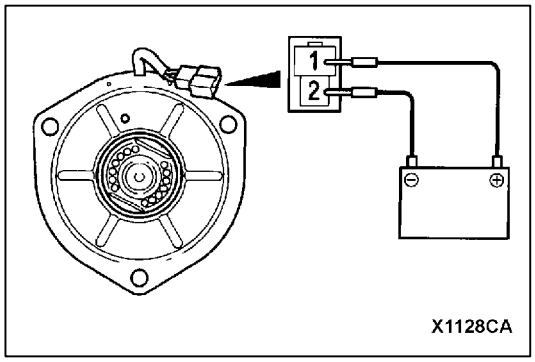
When battery voltage is applied to the magnetic valve terminal No.1 and No.2 terminal is earthed, operating sound should be heard from the magnetic valve.

REAR BLOWER ASSEMBLY DISASSEMBLY AND REASSEMBLY



Disassembly steps

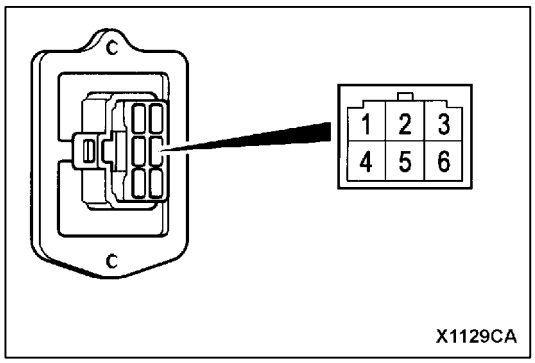
1. Harness assembly
2. Resistor
3. Blower motor assembly
4. Case



INSPECTION

BLOWER MOTOR CHECK

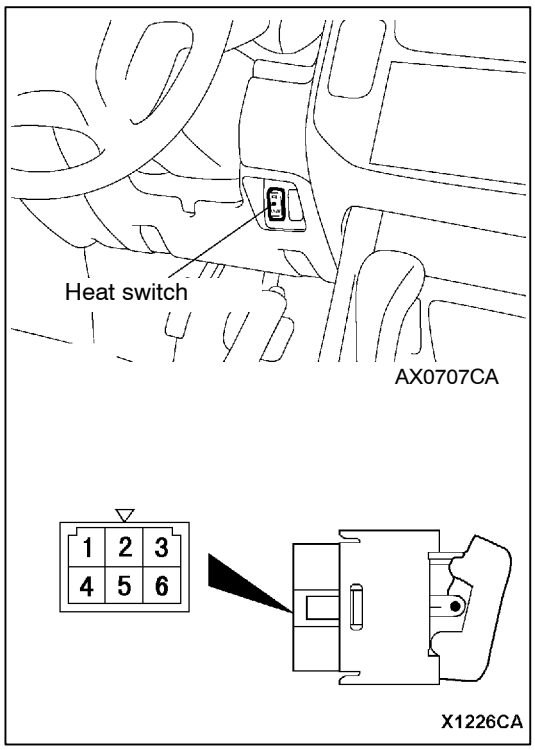
The motor should run when battery voltage is applied between the terminals. In addition, any abnormal sound should not be heard from the motor.



RESISTOR CHECK

Standard value:

Terminal to be measured	Standard value Ω
Between terminals No.1 and 6	4.9 ± 7%
Between terminals No.1 and 3	1.25 ± 7%



HEAT SWITCH <4M41>

INSPECTION

HEAT SWITCH CHECK

Switch position	Terminal No.						
	1	2	IND	6	3	ILL	4
OFF position	○		○	○	○	○	○
ON position	○	○	○	○	○	○	○

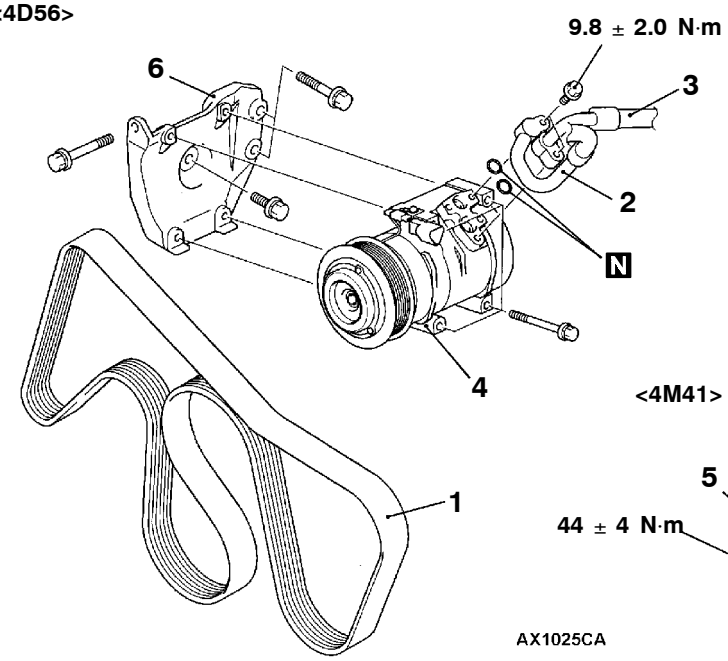
COMPRESSOR

REMOVAL AND INSTALLATION

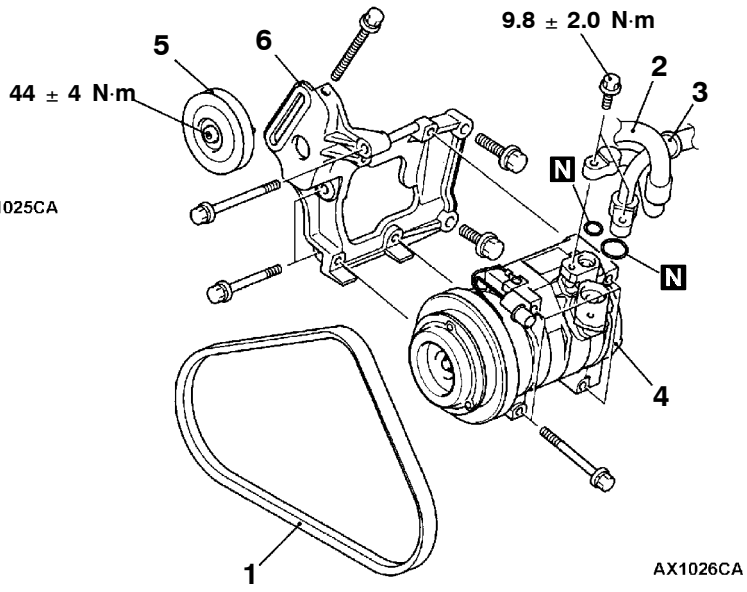
Pre-removal Operations
- Refrigerant Discharge (Refer to P.55A-9.)
- Air Duct A Removal (Refer to GROUP 15 – Air Cleaner.)
- Condense Tank Removal (Refer to GROUP 14 – Radiator.)

Post-installation Operations
- Refrigerant Charge (Refer to P.55A-9.)
- Condense Tank Installation (Refer to GROUP 14 – Radiator.)
- Air Duct A Installation (Refer to GROUP 15 – Air Cleaner.)
- Drive Belt Tension Check (Refer to GROUP 11A, B - On-vehicle Service.)

<4D56>

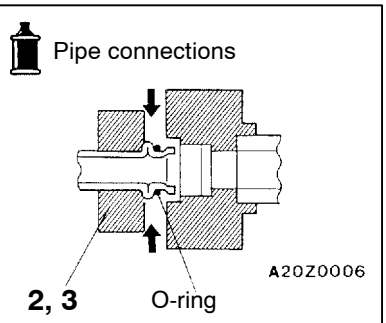


<4M41>



AX1025CA

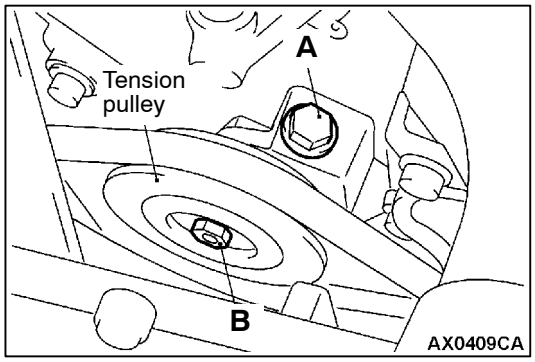
AX1026CA



A/C compressor oil:
DENSO OIL 8

Removal steps

◀A▶ 1. Drive belt
◀B▶ 2. Discharge flexible hose connection
◀B▶ 3. Suction flexible hose connection
◀C▶ ▶A◀ 4. Compressor
5. Tension pulley assembly
6. Compressor bracket



REMOVAL SERVICE POINTS

◀A▶ DRIVE BELT REMOVAL

Loosen tension pulley mounting bolt A and adjusting bolt B in that order, and then remove the drive belt.

Caution
If the drive belt is reused, mark an arrow indicating rotation direction (clockwise direction) on the belt surface with a chalk.

◀B▶ DISCHARGE FLEXIBLE HOSE/SUCTION FLEXIBLE HOSE DISCONNECTION

Plug the disconnect hoses and the compressor nipples to prevent dust or foreign material from entering them.

Caution
Use a plug, which air does not penetrate through. Compressor oil and receiver absorb moisture easily.

◀C▶ COMPRESSOR REMOVAL

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.

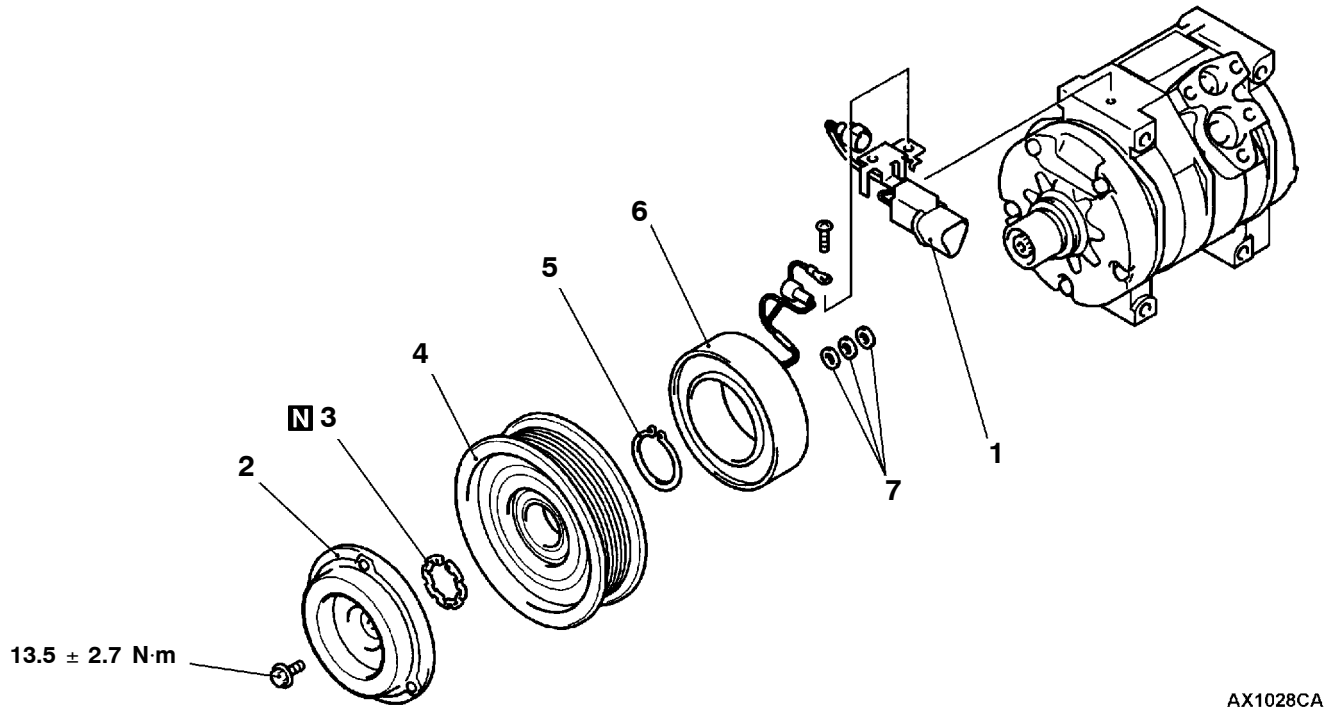
1. Measure the amount of oil within the removed compressor. (X mL)
2. Drain (from the new compressor) the amount of oil calculated according to the following formula, and then install the new compressor.

   Except vehicles with rear cooler:
   120 mL – X mL = Y mL

   Vehicles with rear cooler, dual A/C:
   140 mL – X mL = Y mL

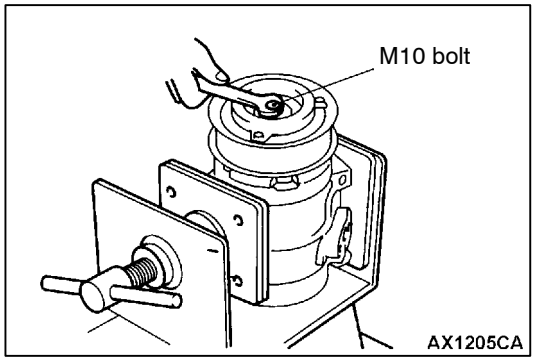
   NOTE
   (1) The above amounts (120 mL and 140 mL) indicate the factory-charged amount inside a new compressor.
   (2) Y mL indicates the amount of oil in the refrigerant line, the condenser, the evaporator, etc.

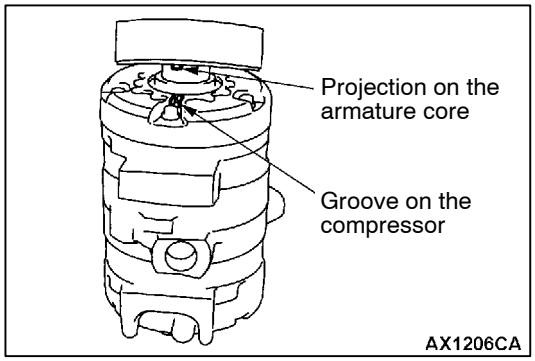
DISASSEMBLY AND REASSEMBLY



Disassembly steps

- ▶C◀ ● Air gap adjustment
- 1. Connector
- ◀A▶ 2. Armature
- ▶B◀ 3. Snap ring
- 4. Rotor
- 5. Snap ring
- ▶A◀ 6. Field core
- 7. Washer





DISASSEMBLY SERVICE POINT

◀A▶ ARMATURE REMOVAL

1. Remove the armature mounting bolt.
2. Tighten the M10 bolt in the armature bolt hole to disengage the shaft from the armature serration.

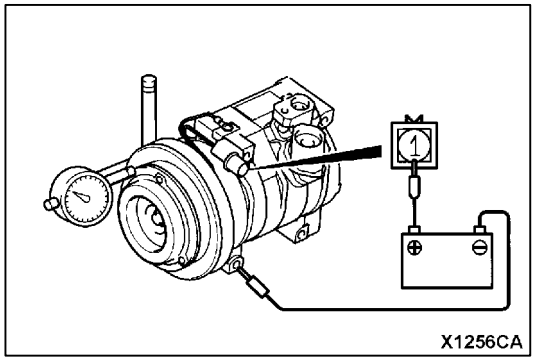
ASSEMBLY SERVICE POINT

▶A◀ FIELD CORE INSTALLATION

Align the compressor groove with the field core projection to install the field core.

▶B◀ SNAP RING INSTALLATION

Be careful not to expand the snap ring excessively. If the inside diameter of the snap ring exceeds 30.5 mm due to excessive expansion, replace it.



▶C◀ AIR GAP ADJUSTMENT

Apply battery voltage to the magnetic clutch, and check that the clutch air gap is within the standard value.
If not within the standard value, use a washer to adjust the air gap.

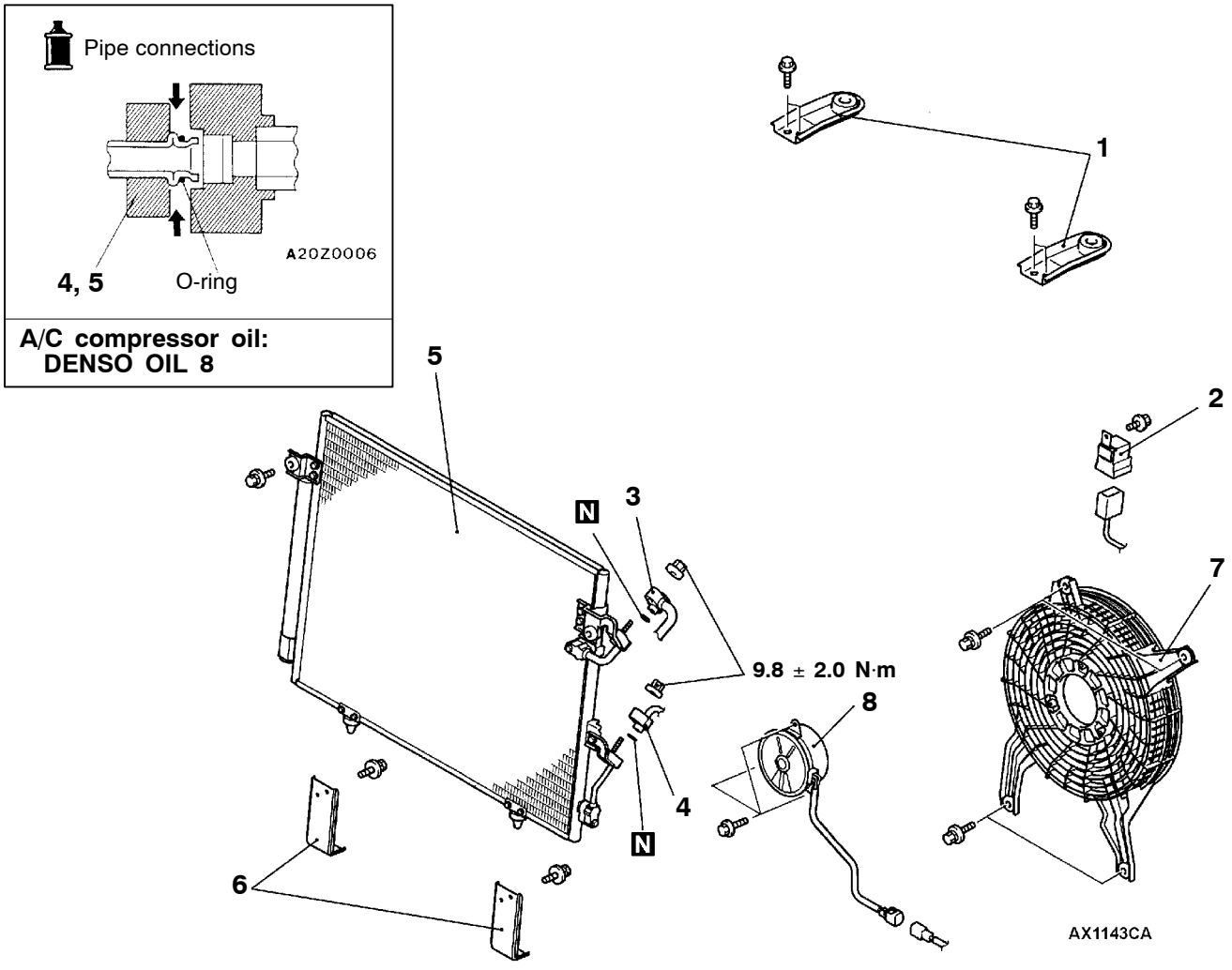
Standard value: 0.35 - 0.65 mm

NOTE
The washers are available in three thicknesses (0.1 mm, 0.3 mm, 0.5 mm).

CONDENSER ASSEMBLY AND CONDENSER FAN

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations
- Refrigerant Discharge and Refilling (Refer to P.55-9.)
- Radiator Grille and Skid Plate Removal and Installation (Refer to GROUP 51 – Front Bumper.)
- Air Duct A Removal and Installation (Refer to GROUP 15 – Air Cleaner.)
- Condenser Tank Removal and Installation (Refer to GROUP 14 - Radiator.)
- Oil Reservoir Mounting Bolt Removal and Installation (Refer to GROUP 37 – Oil Line.)



Condenser assembly removal steps
1. Radiator bracket
2. PTC heater relay <4M41>
3. Discharge flexible hose connection
4. Liquid pipe A connection
5. Condenser
6. Condenser bracket

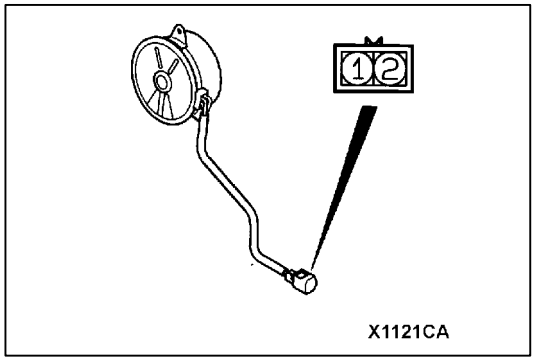
Condenser fan removal steps
7. Condenser fan assembly
8. Motor assembly

REMOVAL SERVICE POINT

◀A▶ DISCHARGE FLEXIBLE HOSE/LIQUID PIPE A DISCONNECTION

Plug the disconnected hoses, pipes and the condenser nipples to prevent system contamination.

Caution
Use a plug, which air does not penetrate through. Compressor oil and receiver absorb moisture easily.



INSPECTION

MOTOR ASSEMBLY CHECK

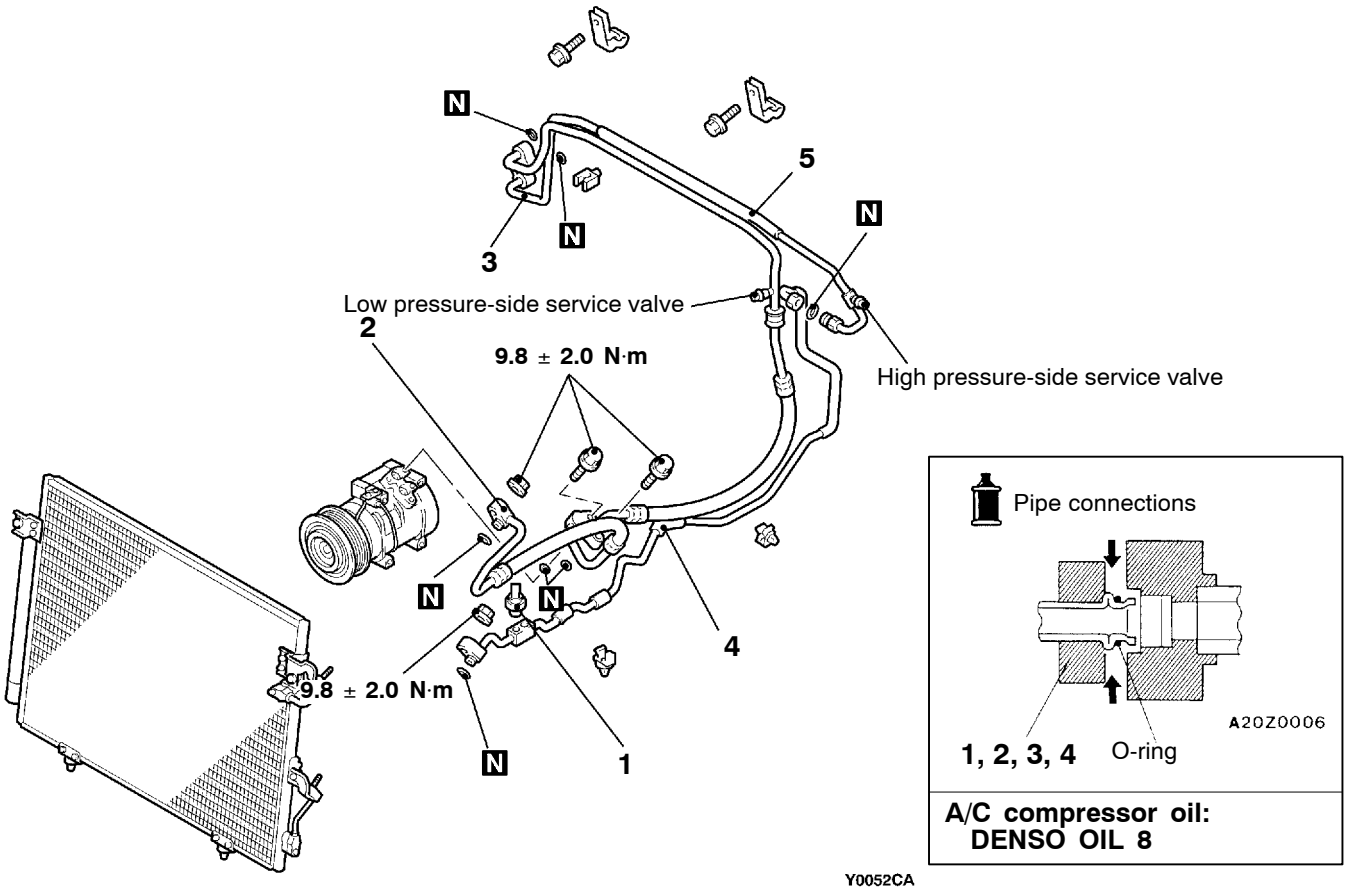
Battery connection terminal		Motor operation
1	2	
⊕	⊖	Turns

REFRIGERANT LINE

REMOVAL AND INSTALLATION
<L.H. drive vehicles>

Pre-removal and Post-installation Operations
- Refrigerant Discharge and Refilling (Refer to P.55-9.)
- Condense Tank Removal and Installation (Refer to GROUP 14 – Radiator.)
- Engine Cover Removal
- Battery, Battery Tray Removal and Installation

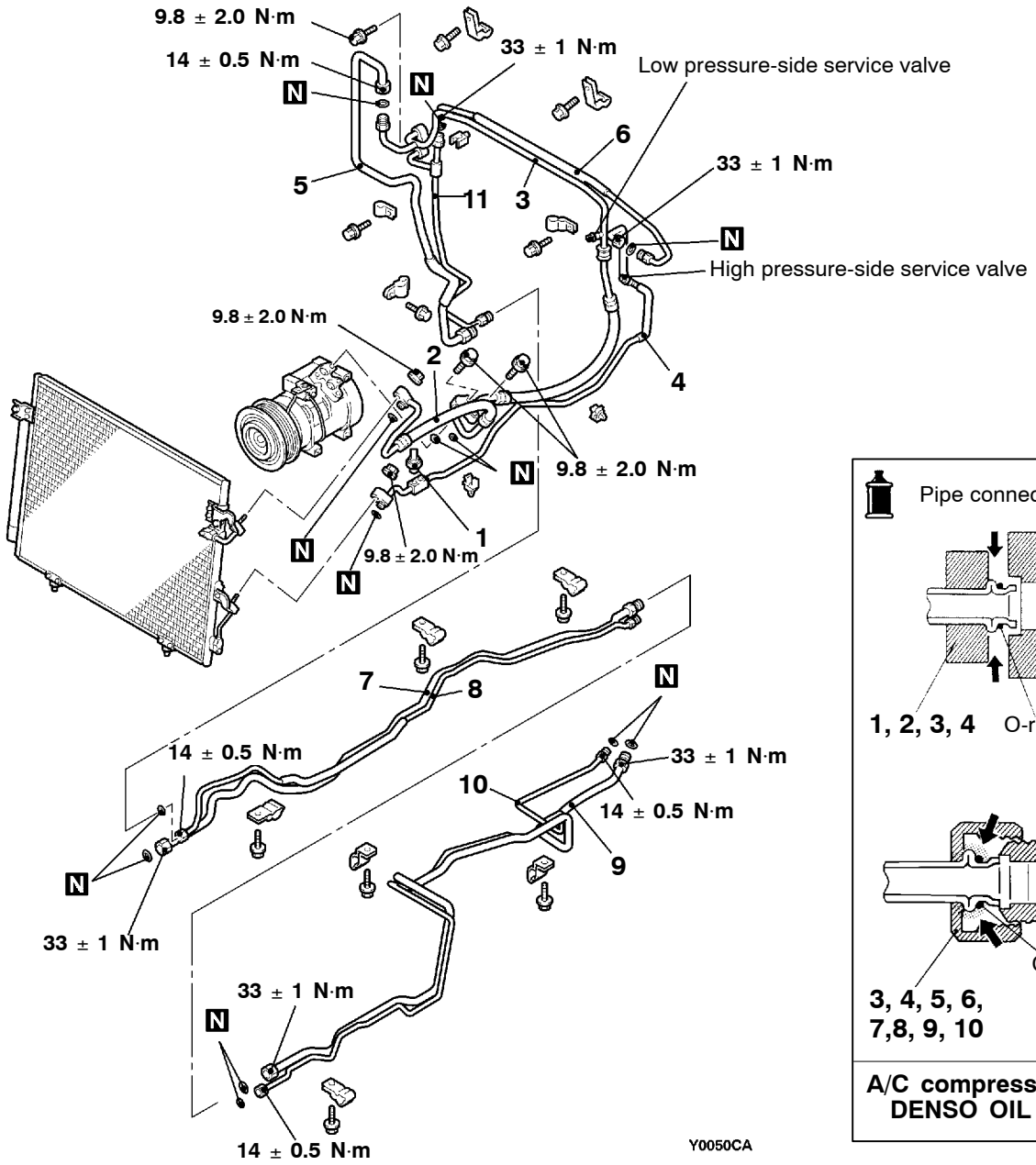
<Single A/C>

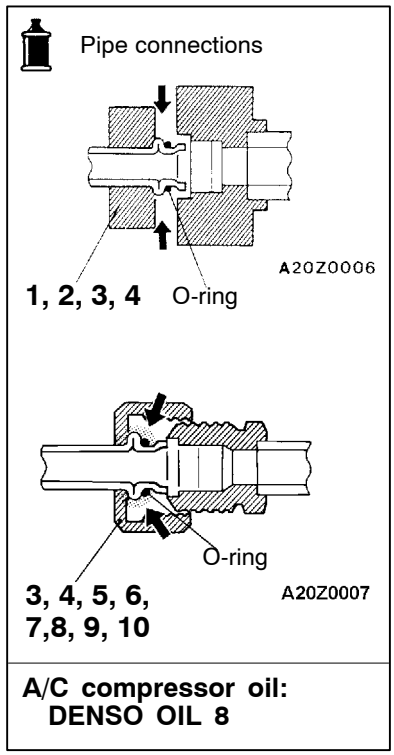


Removal steps

1. Dual pressure switch
◀A▶ 2. Discharge flexible hose
◀A▶ 3. Suction flexible hose
◀A▶ 4. Liquid pipe A
5. Liquid pipe B

<Dual A/C>





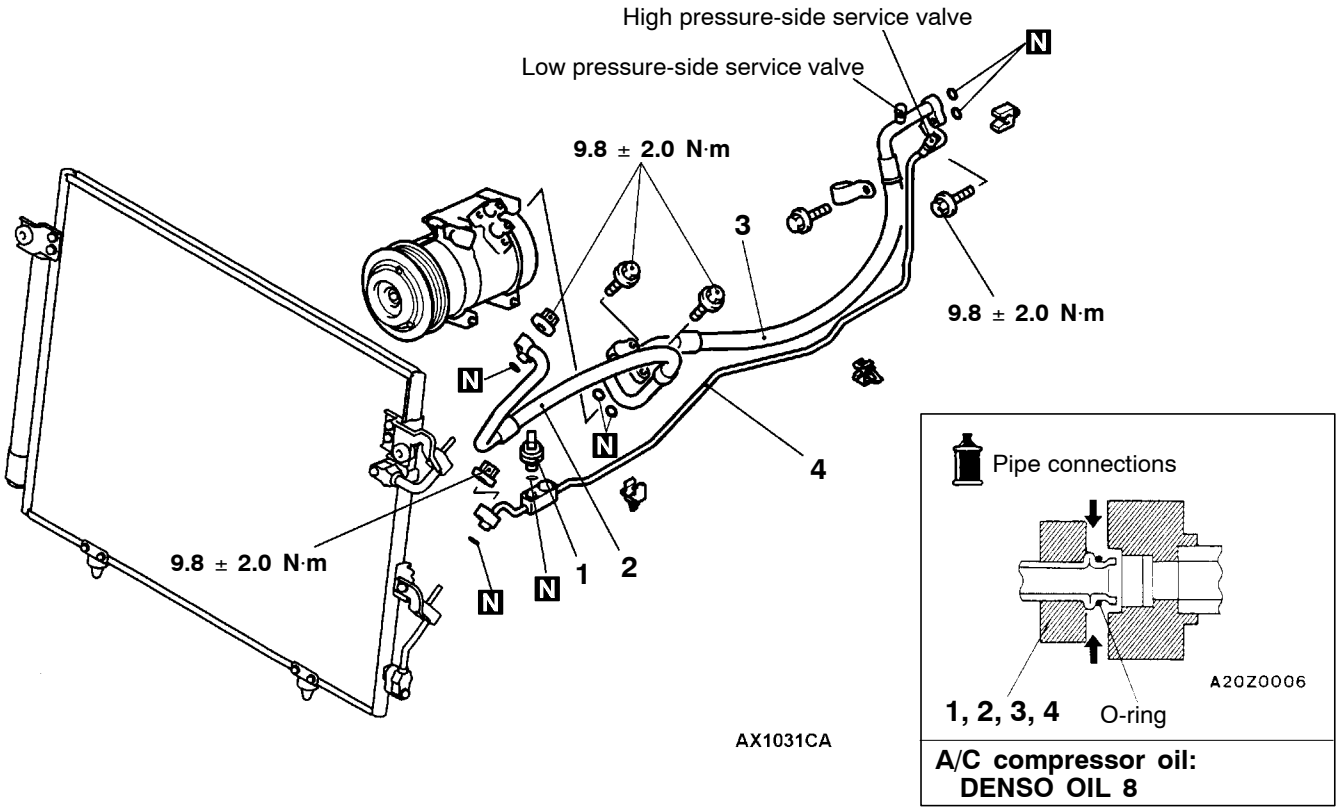
Removal steps

- 1. Dual pressure switch
- ◀A▶ 2. Discharge flexible hose
- ◀A▶ 3. Suction flexible hose
- ◀A▶ 4. Liquid pie A
- ◀A▶ 5. Suction pipe A
- ◀A▶ 6. Liquid pipe B
- ◀A▶ 7. Suction pipe B
- ◀A▶ 8. Liquid pipe C
- ◀A▶ 9. Suction pipe C
- ◀A▶ 10. Liquid pipe D
- ◀A▶ 11. Liquid pipe E

<R.H. drive vehicles>

Pre-removal and Post-installation Operations
- Refrigerant Discharge and Refilling (Refer to P.55-9.)
- Condense Tank Removal and Installation (Refer to GROUP 14 – Radiator.)
- Engine Cover Removal
- Battery, Battery Tray Removal and Installation

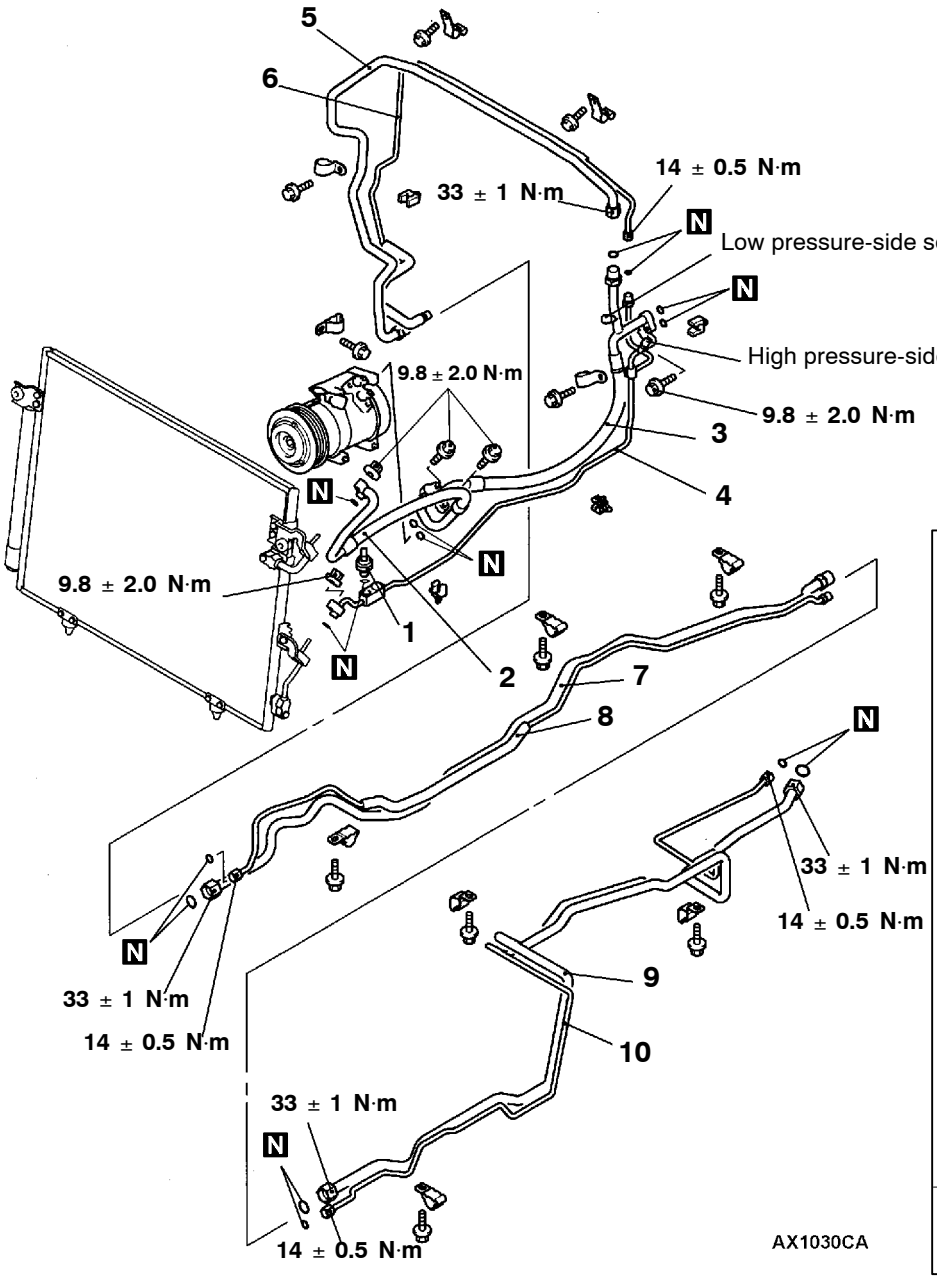
<Single A/C>

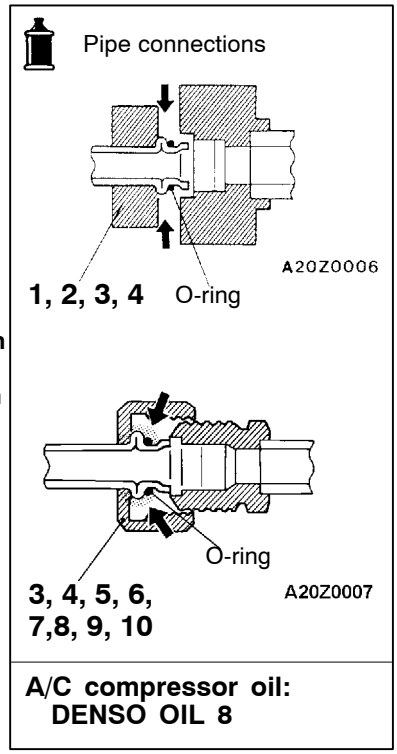


Removal steps

1. Dual pressure switch
◀A▶ 2. Discharge flexible hose
◀A▶ 3. Suction flexible hose
◀A▶ 4. Liquid pipe A

<Dual A/C>





Removal steps

◀A▶ 1. Dual pressure switch
◀A▶ 2. Discharge flexible hose
◀A▶ 3. Suction flexible hose
◀A▶ 4. Liquid pie A
◀A▶ 5. Suction pipe A
◀A▶ 6. Liquid pipe B
◀A▶ 7. Suction pipe B
◀A▶ 8. Liquid pipe C
◀A▶ 9. Suction pipe C
◀A▶ 10. Liquid pipe D

REMOVAL SERVICE POINT

◀A▶ HOSE/PIPE DISCONNECTION

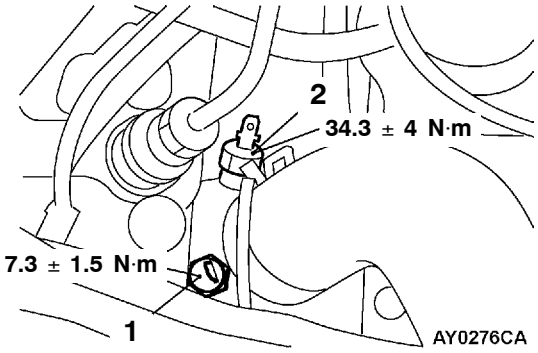
Plug the condenser, the compressor and the heater unit nipples to prevent system contamination.

Caution
Use a plug, which air does not penetrate through. Compressor oil and receiver absorb moisture easily.

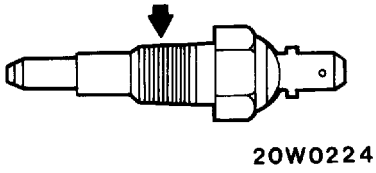
ENGINE COOLANT TEMPERATURE SWITCH<4D56>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Coolant Refilling (Refer to GROUP 14 - On-vehicle Service.)
- Intercooler Removal and Installation <Vehicles with intercooler> (Refer to GROUP 15.)

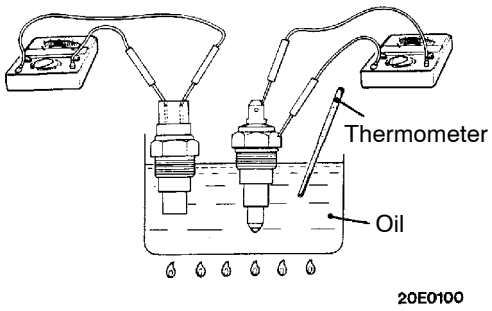


(Threaded portion)



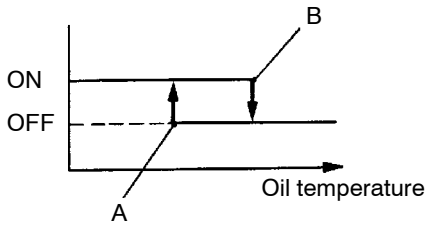
Sealant:
3M Nut Locking Part No. 4171 or equivalent

1. Engine coolant temperature switch (for A/C cut-off)
2. Engine coolant temperature switch (for condenser fan)



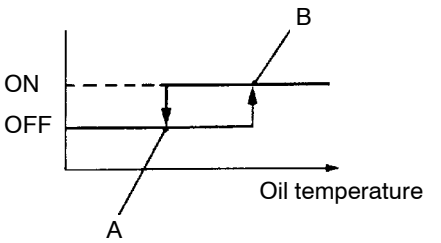
20E0100

<For A/C cut-off>



20W0237

<For condenser fan>



20W0204
00000585

INSPECTION

ENGINE COOLANT TEMPERATURE SWITCH CONTINUITY CHECK

1. Dip the engine coolant temperature switch in oil and heat the oil with a gas burner or similar item.

   Caution
   Do not heat any more than is necessary.

2. Check the continuity with a circuit tester as the temperature of the oil changes, and the condition is normal if the continuity is within the following ranges.

   Standard value:

Engine coolant temperature switch	Temperature	Continuity
For A/C cut-off	Less than 108 °C (Temperature at point A)	ON (Continuity)
	More than 115 °C (Temperature at point B)	OFF (No continuity)
For condenser fan	Less than 97 °C (Temperature at point A)	OFF (No continuity)
	More than 102 °C (Temperature at point B)	ON (Continuity)

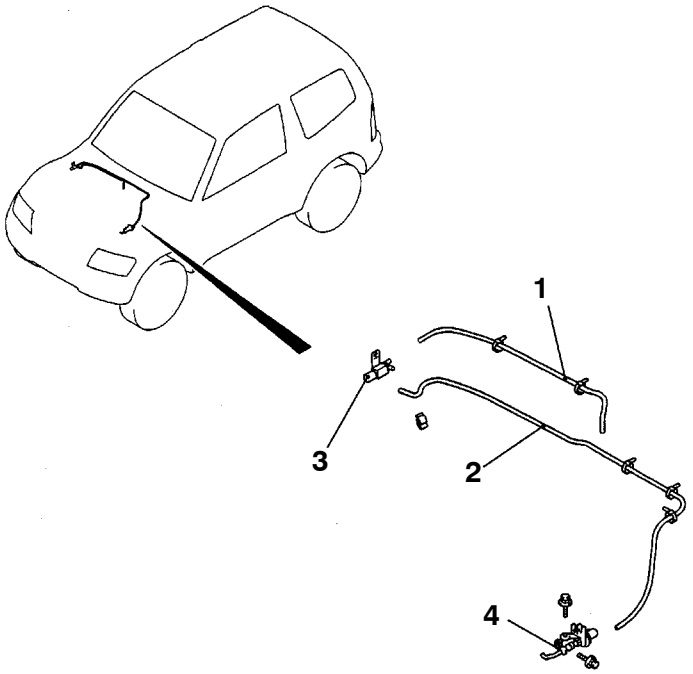
IDLE-UP SYSTEM <Diesel-powered Vehicles>

REMOVAL AND INSTALLATION

Pre-removal Operation
Intercooler Removal <Vehicle with intercooler> (Refer to GROUP 15.)

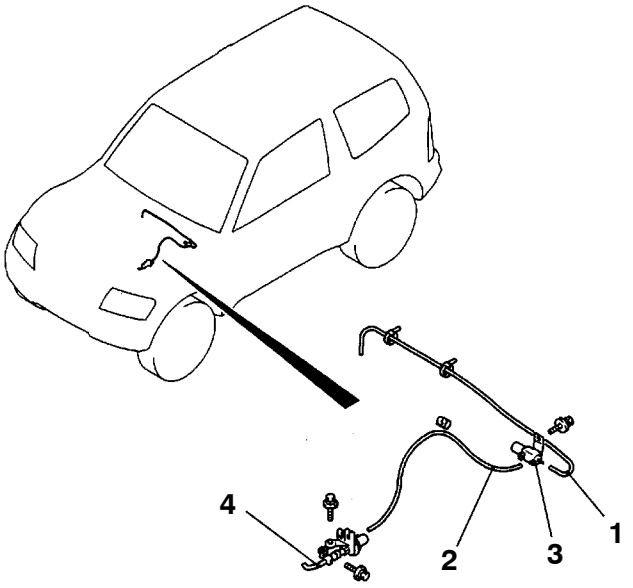
Post-installation Operation
- Accelerator Cable Adjustment (Refer to GROUP 17 - On-vehicle Service.)
- Throttle Cable Adjustment <A/T> (Refer to GROUP 23 - On-vehicle Service.)
- Intercooler Installation <Vehicles with intercooler> (Refer to GROUP 15.)
- Idle-up Operation Check (Refer to P. 55-16.)

<R.H. drive vehicles>



AY0277CA

<L.H. drive vehicles>



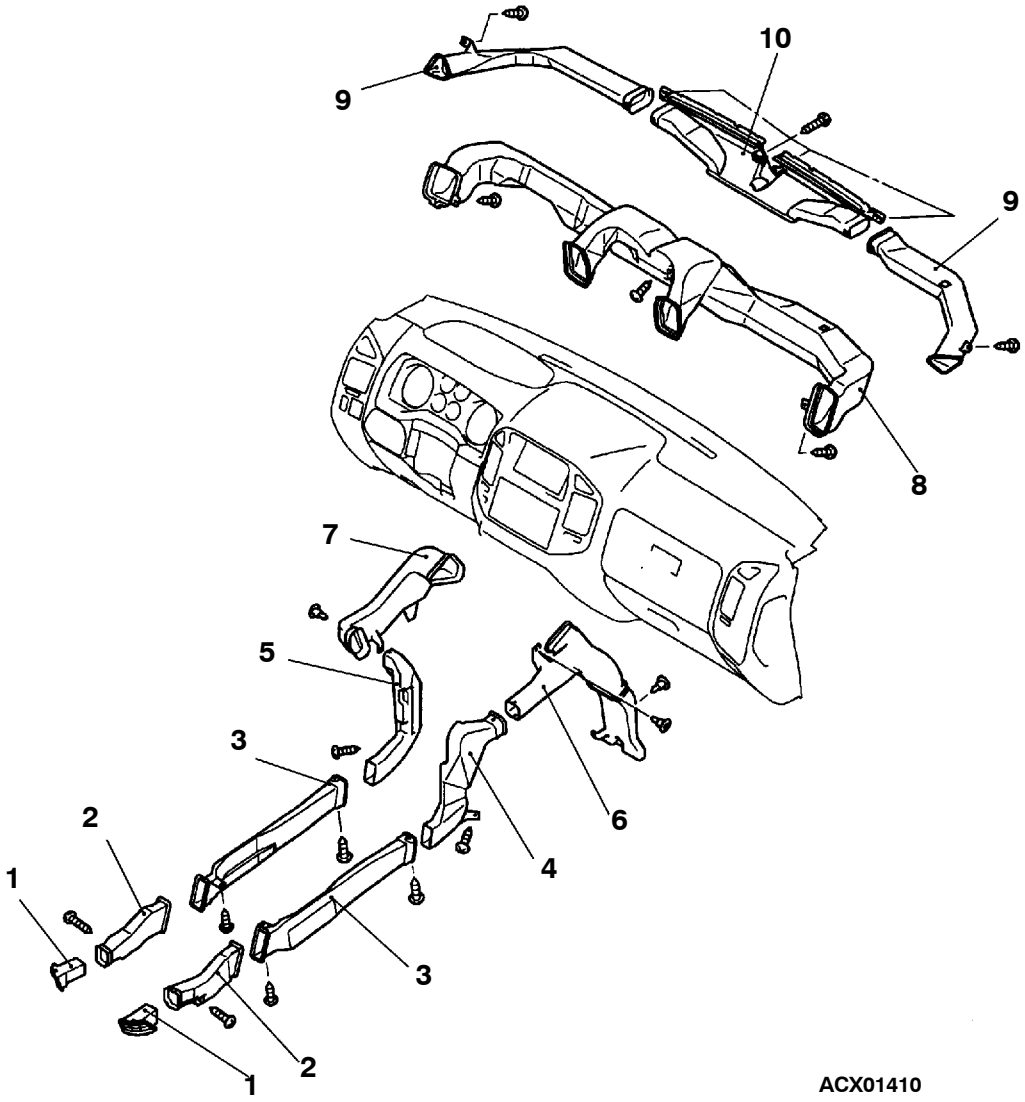
AY0275CA

Idle-up solenoid valve removal steps
1. Vacuum hose (white stripe) connection
2. Vacuum hose (yellow stripe) connection
3. Idle-up solenoid valve
4. Solenoid valve bracket B
5. Solenoid valve bracket A

Vacuum actuator assembly removal steps
2. Vacuum hose (yellow stripe) connection
6. Accelerator cable connection
7. Split pin <A/T>
8. Throttle cable connection <A/T>
9. Vacuum hose (blue stripe) <Vehicles with ABS>
10. Vacuum actuator assembly

DUCTS

FRONT A/C DUCT
REMOVAL AND INSTALLATION



ACX01410

Rear heater duct removal steps

- Front floor console and rear floor console (Refer to GROUP 52A.)

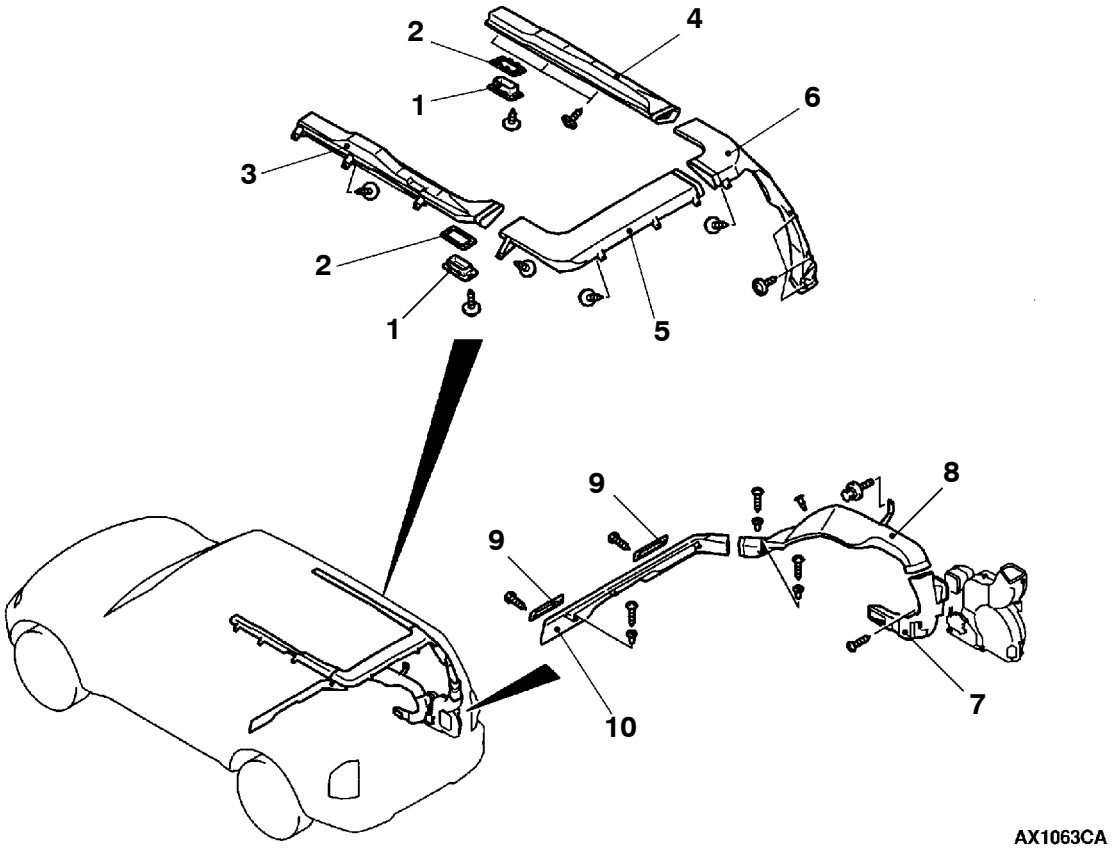
1. Foot grille
2. Rear heater duct B
3. Rear heater duct A

Defroster nozzle, distribution duct and foot duct removal steps

- Instrument panel (Refer to GROUP 52A.)

4. Foot duct B
5. Foot duct D
6. Foot duct A
7. Foot duct C
8. Distribution duct
9. Side defroster duct
10. Defroster nozzle assembly

REAR A/C DUCT
REMOVAL AND INSTALLATION



Rear roof duct removal steps

- Upper quarter trim (R.H.)
  (Refer to GROUP 52–Trims.)

1. Air outlet assembly
2. Retainer
- Head lining

3. Roof duct (L.H.)
4. Roof duct (R.H.)
5. Rear roof duct
6. Pillar duct

Rear floor duct removal steps

- Upper quarter trim (R.H.), lower quarter trim (R.H.)
  (Refer to GROUP 52 – Trims.)

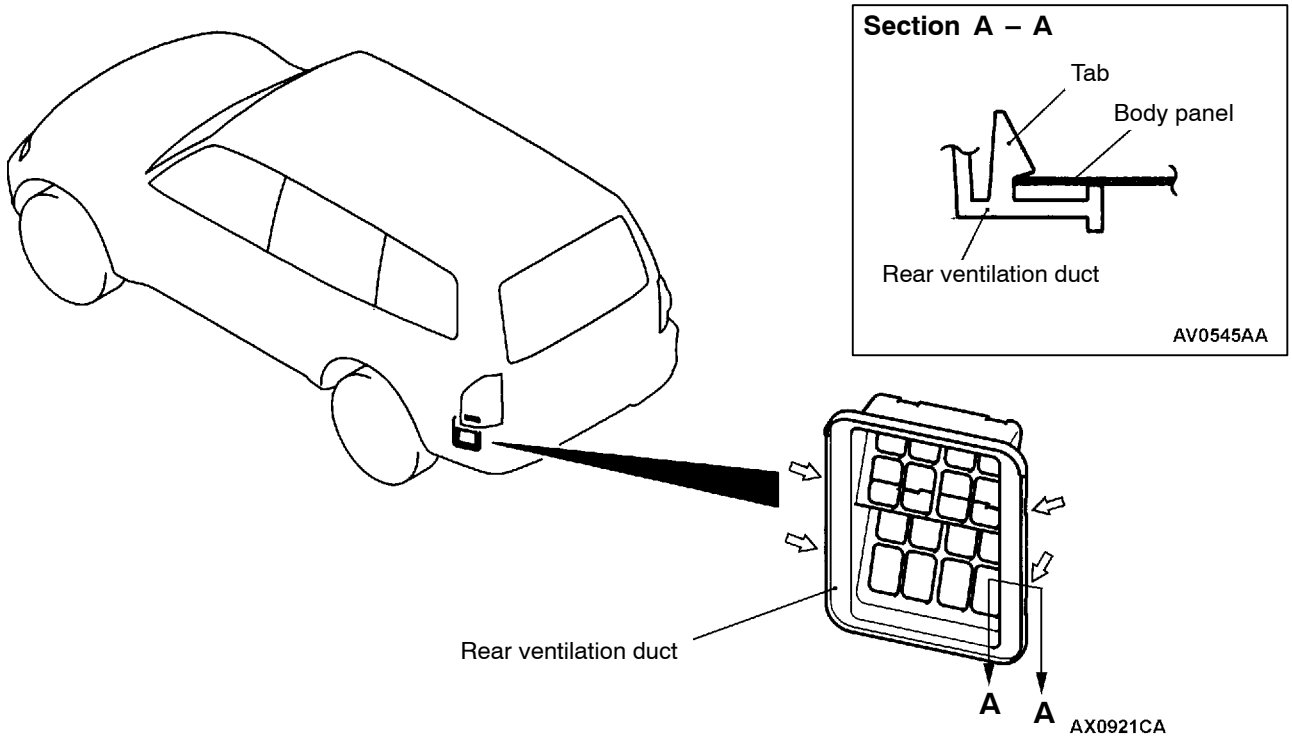
7. Rear quarter duct
8. Rear floor duct A
9. Rear heater grille
- Floor carpet

10. Rear floor duct B

VENTILATION

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations
Rear Bumper Removal and Installation (Refer to GROUP 51.)



NOTE
⇦: indicates the tab positions.

HEATER, AIR CONDITIONER AND VENTILATION <AUTOMATIC A/C>

Click on the applicable bookmark to selected the required model year.

HEATER, AIR CONDITIONER AND VENTILATION <AUTOMATIC A/C>

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REFRIGERANT LINE 31

COMPRESSOR 33

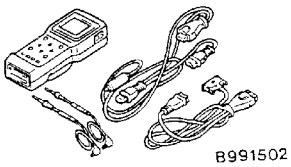
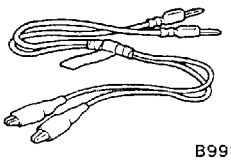
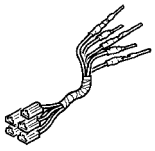
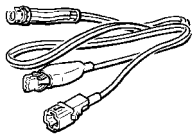
SERVICE SPECIFICATIONS

Item			Standard value
Resistance value of the potentiometer for the air mix damper (front A/C) kΩ			Approx. 0.96 - 5.76
Resistance value of the potentiometer for the air outlet changeover damper (front A/C) kΩ			Approx. 0.96 - 5.76
Resistance of the rear air conditioner switch (temperature control switch) <except rear heater (floor console)> kΩ			0 - 3
Resistance of the potentiometer for the air mix damper <Rear heater, dual A/C> kΩ			1.2 - 4.8
Resistance value of the resistor (rear A/C) Ω	Between terminals 1 and 6		4.9 ± 7 %
	Between terminals 1 and 3		1.25 ± 7%
Air compressor air gap mm			0.35 - 0.65
Idle speed r/min (N or P range)	Petrol		600 ± 50
Idle-up speed r/min (N or P range)	Petrol	When the A/C is under low load	700 ± 50
		When the A/C is under medium load	800 ± 50
		When the A/C is under high load	1,000 ± 50

LUBRICANTS

Item		Brand	Quantity
Compressor oil ml	Single A/C <except vehicles with rear cooler>	DENSO OIL 8	120 ± 20
	Single air conditioner <vehicles with rear cooler>, dual air conditioner	DENSO OIL 8	140 ± 20
Pipe connections		DENSO OIL 8	As required
Refrigerant g	Single A/C <except vehicles with rear cooler>	R134a (HFC-134a)	500 ± 20
	Single air conditioner <vehicles with rear cooler>, dual air conditioner	R134a (HFC-134a)	780 ± 20

SPECIAL TOOLS

Tools	No.	Name	Application
 B991502	MB991502	MUT-II sub assembly	Front A/C check
 B991529	MB991529	Diagnosis code checking harness	Check of the full-automatic air conditioner by using a voltmeter
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	Continuity check and voltage measurement at harnesses or connector A: For checking connector pin contact pressure B: For checking the power supply circuit C: For checking the power supply circuit D: For connecting commercial tester

TROUBLESHOOTING <FRONT A/C>

DIAGNOSIS TROUBLESHOOTING FLOW

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

DIAGNOSIS FUNCTION

METHOD OF READING DIAGNOSIS CODES

Connect the MUT-II to the 16-pin diagnosis connector.
(Refer to GROUP 00 - How to Use Troubleshooting/Inspection Service Points.)

METHOD OF ERASING DIAGNOSIS CODES

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

INSPECTION CHART FOR DIAGNOSIS CODES

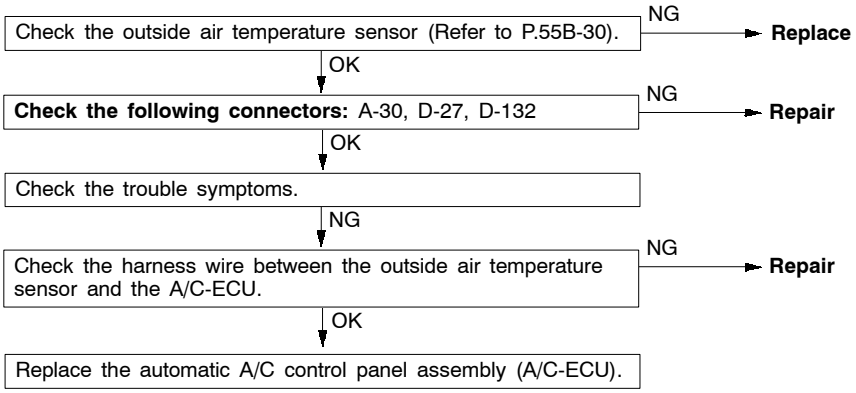
Code No.	Diagnosis item	Reference page
11	Inside air temperature sensor system (open circuit)	55B-4
12	Inside air temperature sensor system (short circuit)	55B-4
13	Outside air temperature sensor system (open circuit)	55B-4
14	Outside air temperature sensor system (short circuit)	55B-4
15	Heater water temperature sensor system (open circuit)	55B-5
16	Heater water temperature sensor system (short circuit)	55B-5
21	Air thermo sensor system (open circuit)	55B-5
22	Air thermo sensor system (short circuit)	55B-5
31	Potentiometer system for the air mix damper	55B-6
32	Potentiometer system for the air outlet changeover damper	55B-7

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

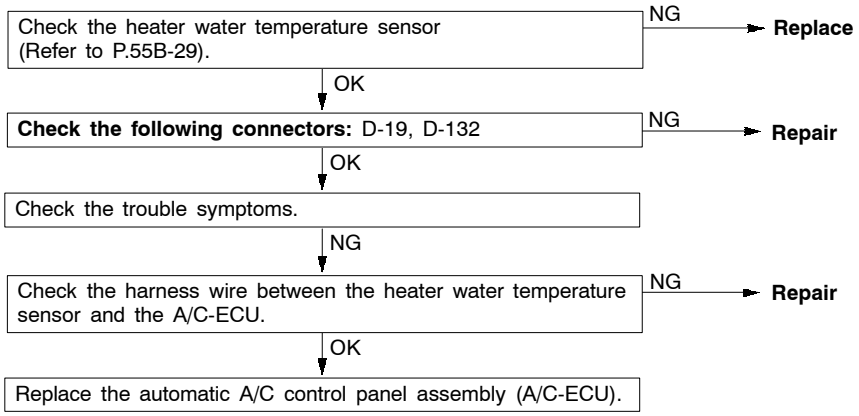
Code No.11, 12 Inside air temperature sensor system	Probable cause
Code No.11 is set when the inside air temperature circuit inside the A/C-ECU is open. Meanwhile, code No.12 is set when it is short.	Malfunction of the A/C-ECU

Replace the automatic A/C control panel assembly (A/C-ECU).

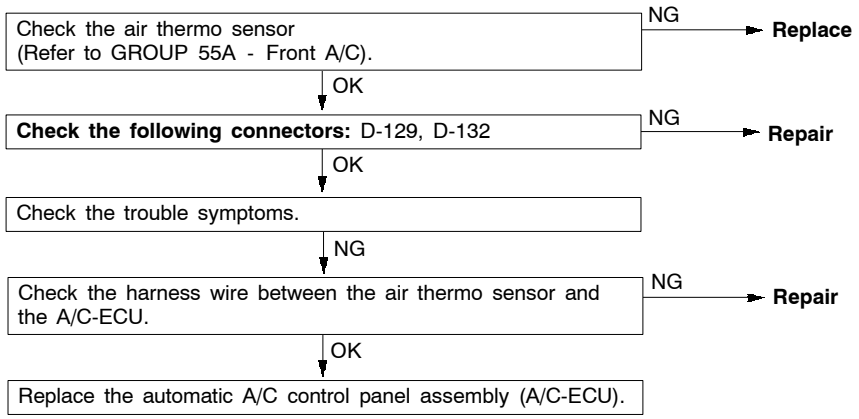
Code No.13, 14 Outside air temperature sensor system	Probable cause
Code No.13 is set when the outside air temperature sensor circuit is open. Meanwhile, code No.14 is set when it is short.	• Malfunction of the outside air temperature sensor • Malfunction of connector or harness • Malfunction of the A/C-ECU



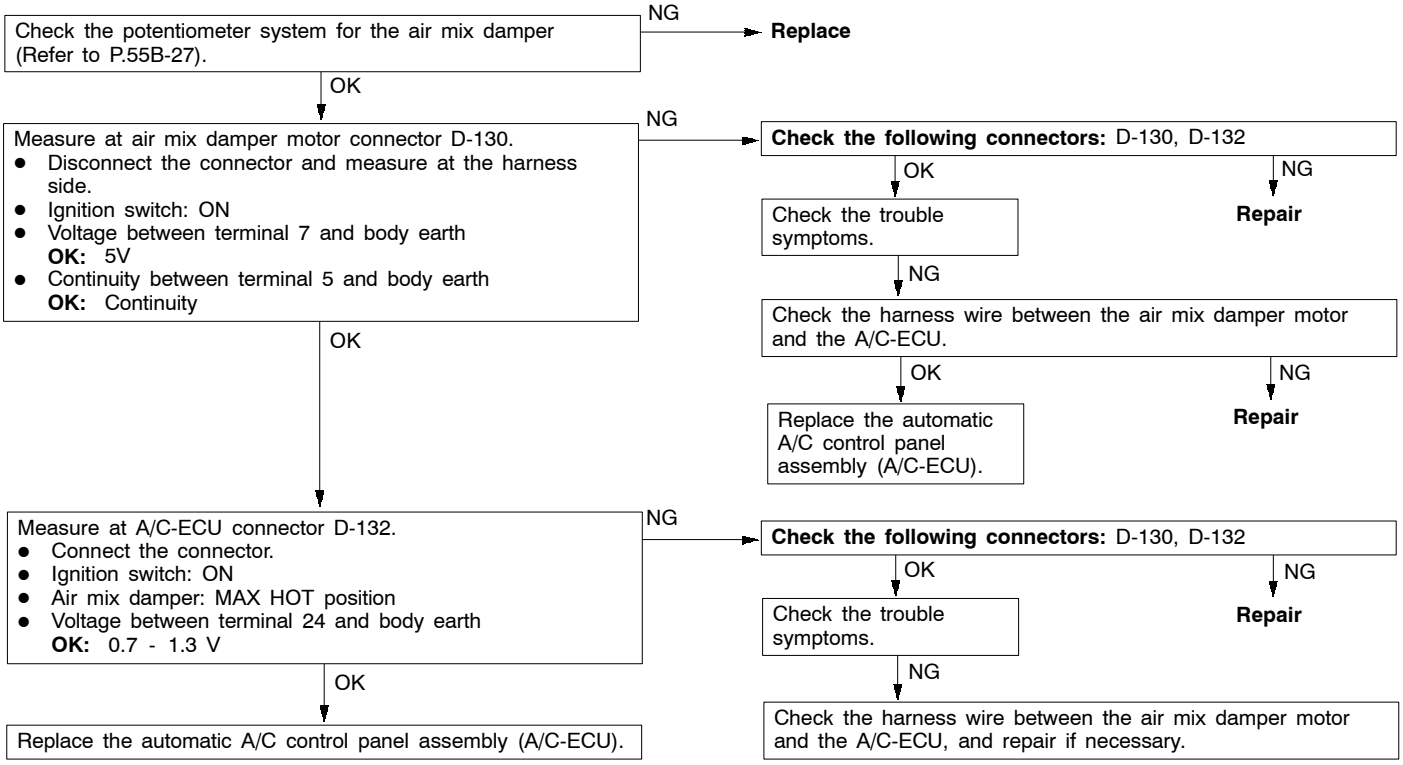
Code No.15, 16 Heater water temperature sensor system	Probable cause
Code No.15 is output when the heater water temperature sensor circuit is open. Code No.16 is output when that circuit is short.	● Malfunction of the heater water temperature sensor ● Malfunction of connector or harness ● Malfunction of the A/C-ECU



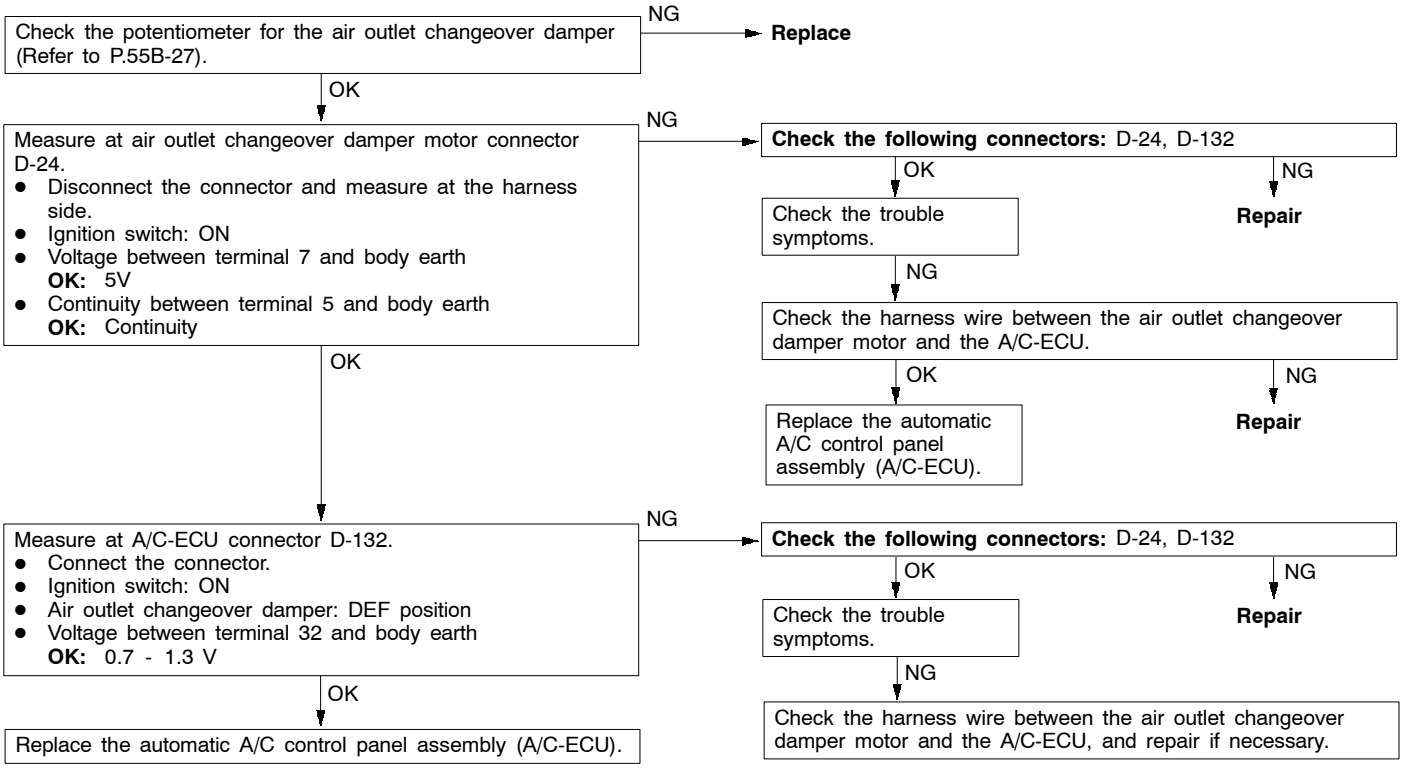
Code No.21, 22 Air thermo sensor system	Probable cause
Code No.21 is set when the air thermo sensor circuit is open. Meanwhile, code No.22 is set when it is short.	● Malfunction of the air thermo sensor ● Malfunction of connector or harness ● Malfunction of the A/C-ECU



Code No.31 Potentiometer system for the air mix damper	Probable cause
This diagnosis code is set when the potentiometer for the air mix damper does not send any signal to the A/C-ECU due to short or open circuit.	• Malfunction of the potentiometer system for the air mix damper • Malfunction of connector or harness • Malfunction of the A/C-ECU



Code No.32 Potentiometer system for the air outlet changeover damper	Probable cause
This diagnosis code is set when the potentiometer for the air outlet changeover damper does not send any signal to the A/C-ECU due to open or short circuit.	• Malfunction of the potentiometer for the air outlet changeover damper • Malfunction of connector or harness • Malfunction of the A/C-ECU



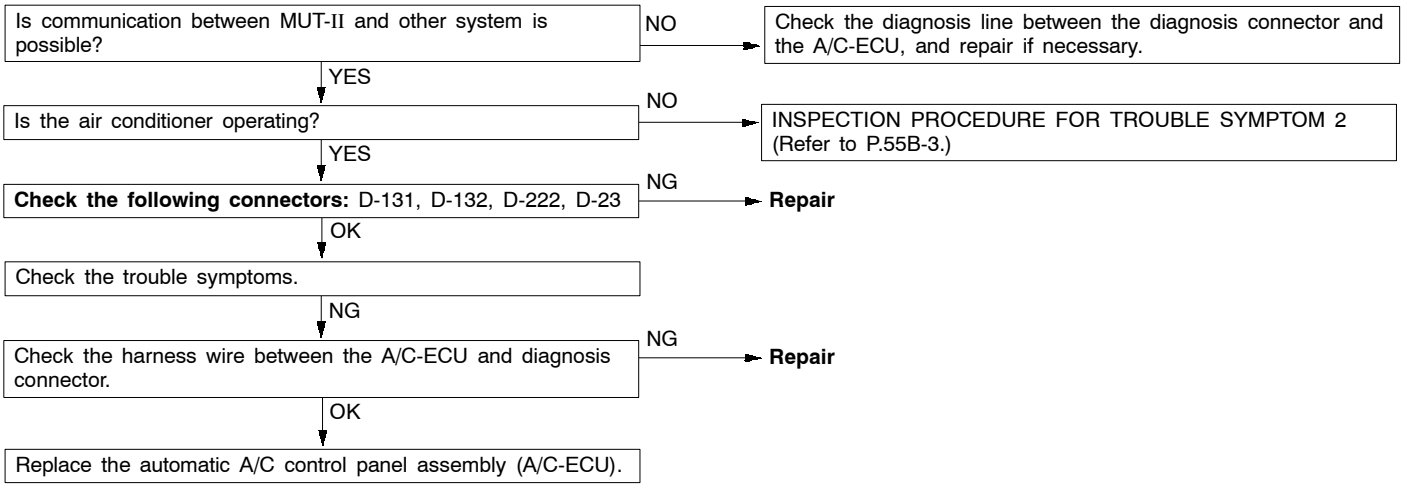
INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom	Inspection procedure No.	Reference page
Communication with MUT-II is impossible.	1	55B-8
The air conditioner does not operate at all.	2	55B-9
The air conditioner display does not appear on the center display screen.	3	55B-9
A/C outlet air temperature can not be set.	4	55B-10
The blower does not operate.	5	55B-11
The blower air volume can not be changed.	6	55B-12
Air outlet vent cannot be changed.	7	55B-12
Inside/outside air changeover is not possible.	8	55B-13
The rear defogger does not operate.	9	55B-14
The condenser fan does not operate <except 4D56>.	10	55B-15
The condenser fan does not operate <4D56>.	11	55B-16

INSPECTION PROCEDURES FOR TROUBLE SYMPTOMS

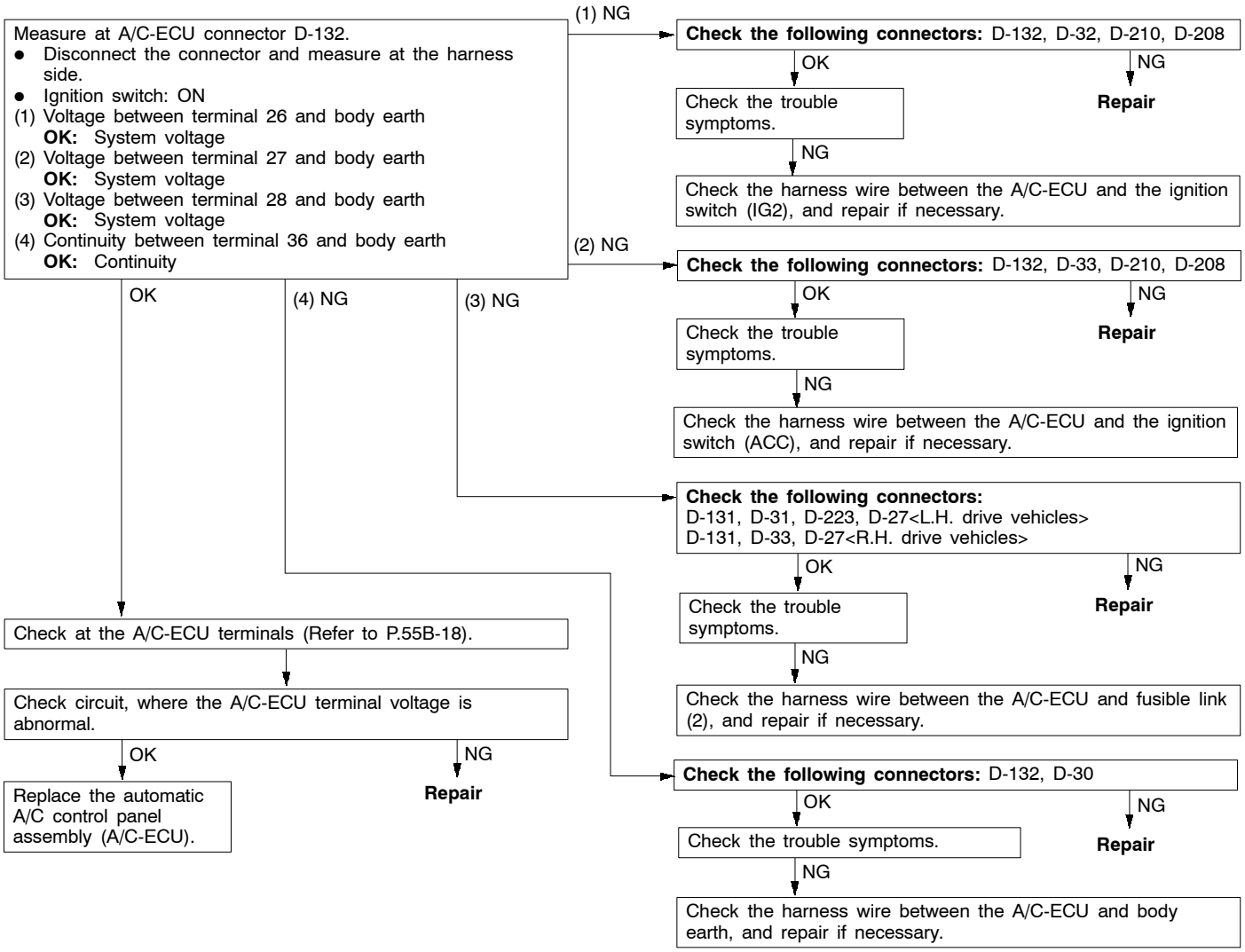
Inspection procedure 1

Communication with the MUT-II is not possible.	Probable cause
If communication with all other systems is not possible, there is a high possibility that there is a malfunction of the diagnosis line. If only the A/C system can not communicate with the MUT-II, the diagnosis line between the diagnosis connector and the A/C-ECU may be defective.	• Malfunction of harness or connector • Malfunction of the A/C-ECU



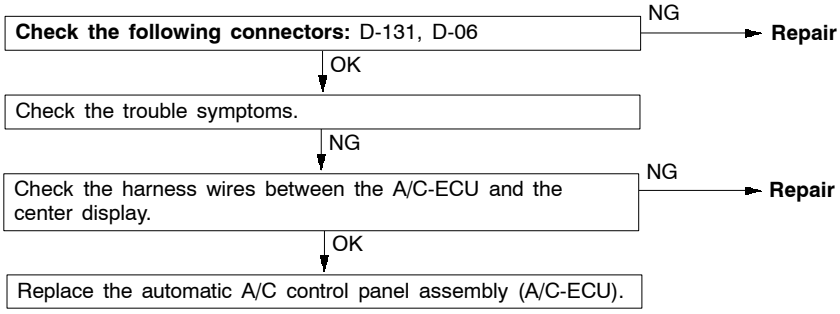
Inspection procedure 2

The air conditioner does not operate at all.	Probable cause
The power supply system (including earth) for the A/C-ECU may be defective. In addition, the A/C-ECU may be inoperative due to a defective harness (such as short).	• Malfunction of harness or connector • Malfunction of the A/C-ECU



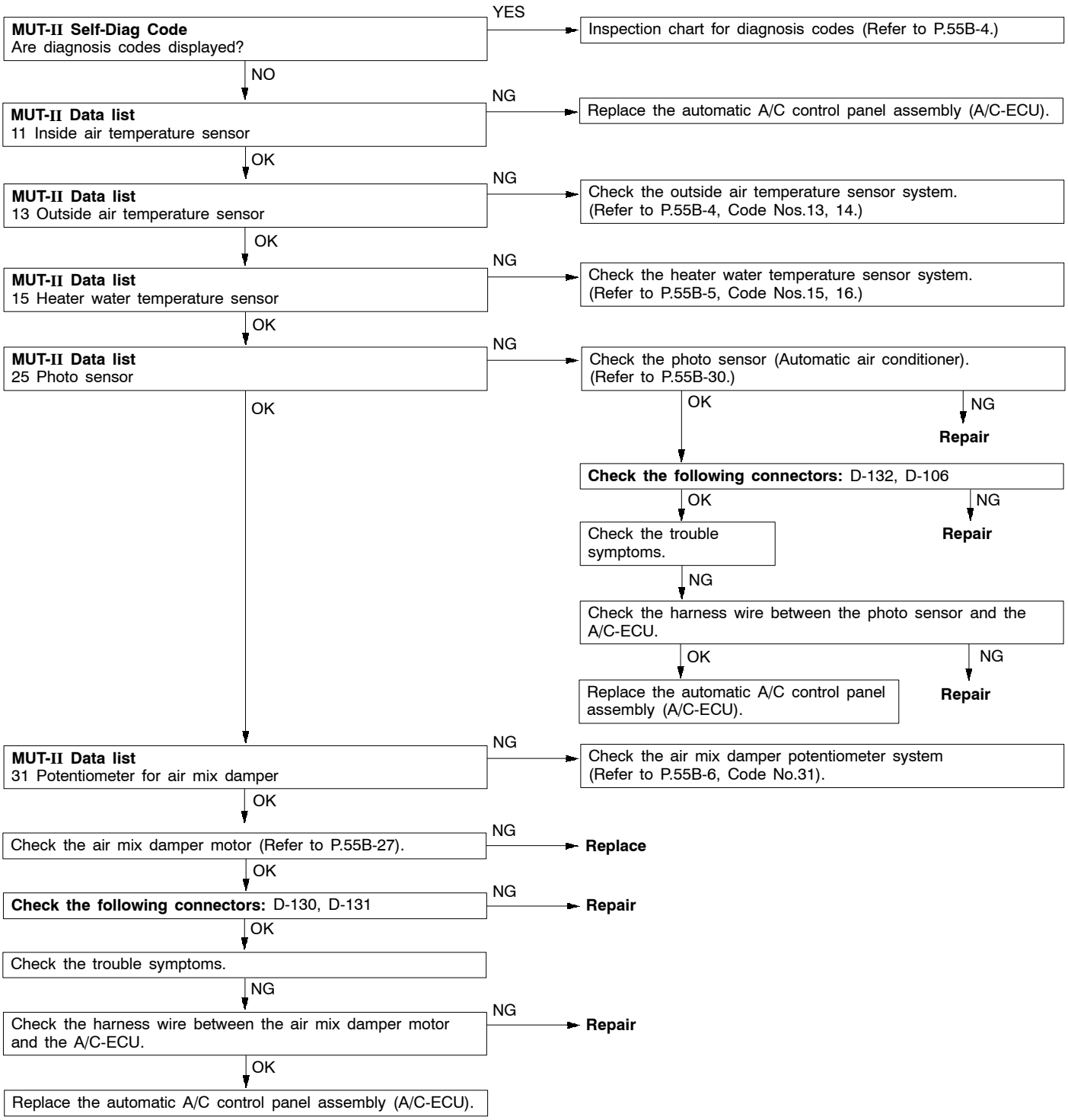
Inspection procedure 3

The air conditioner display does not appear on the center display screen.	Probable cause
Check the harness wires between the A/C-ECU and the center display, and repair if necessary.	• Malfunction of harness or connector • Malfunction of the A/C-ECU



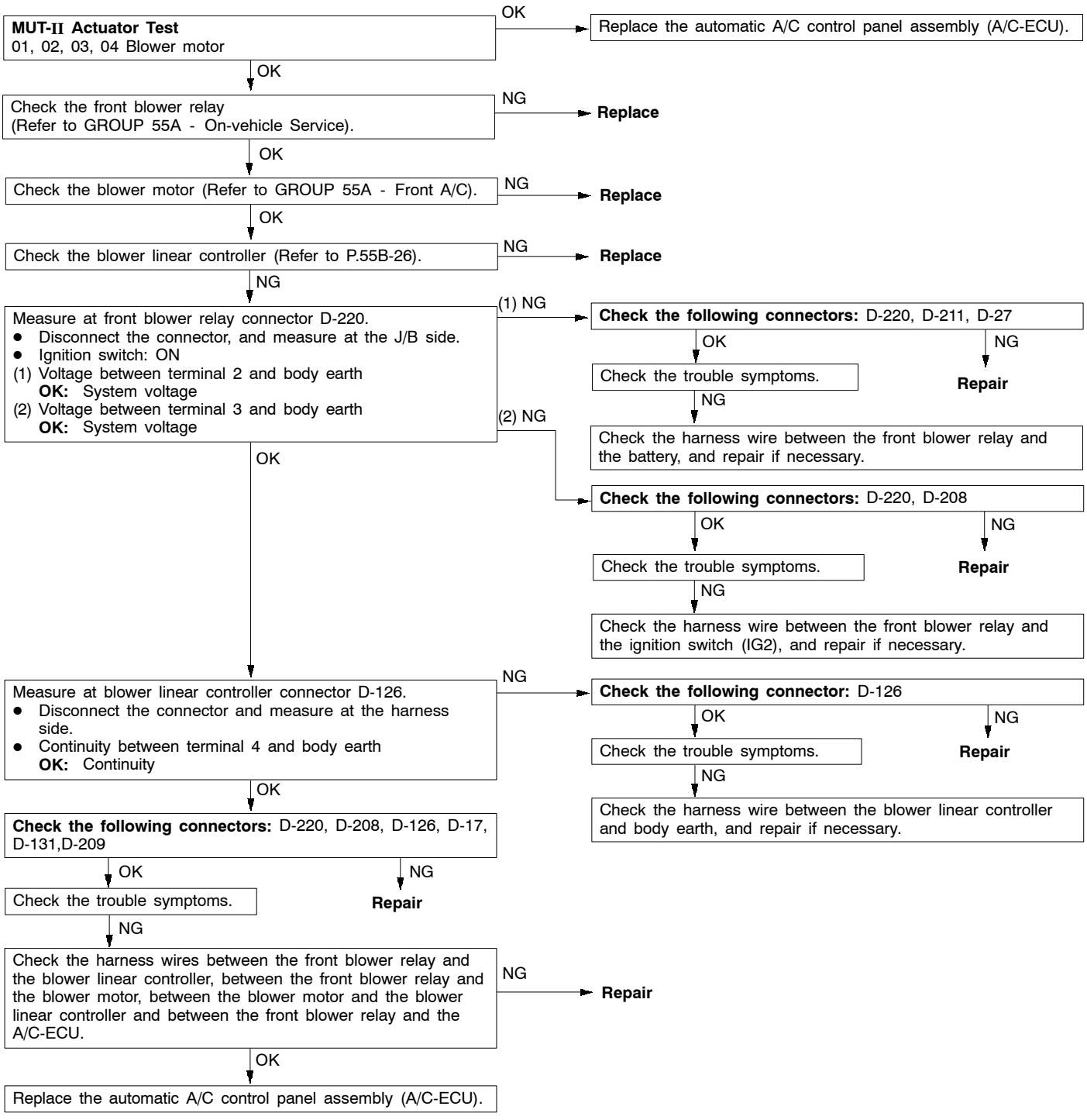
Inspection procedure 4

A/C outlet air temperature can not be set.	Probable cause
If the air outlet temperature can not be changed after a A/C temperature is set, sensor(s) or the air mix damper may be defective.	• Malfunction of the inside air temperature sensor • Malfunction of the outside air temperature sensor • Malfunction of the heater water temperature sensor • Malfunction of the photo sensor • Malfunction of the electric motor for the air mix damper • Malfunction of harness or connector • Malfunction of the A/C-ECU



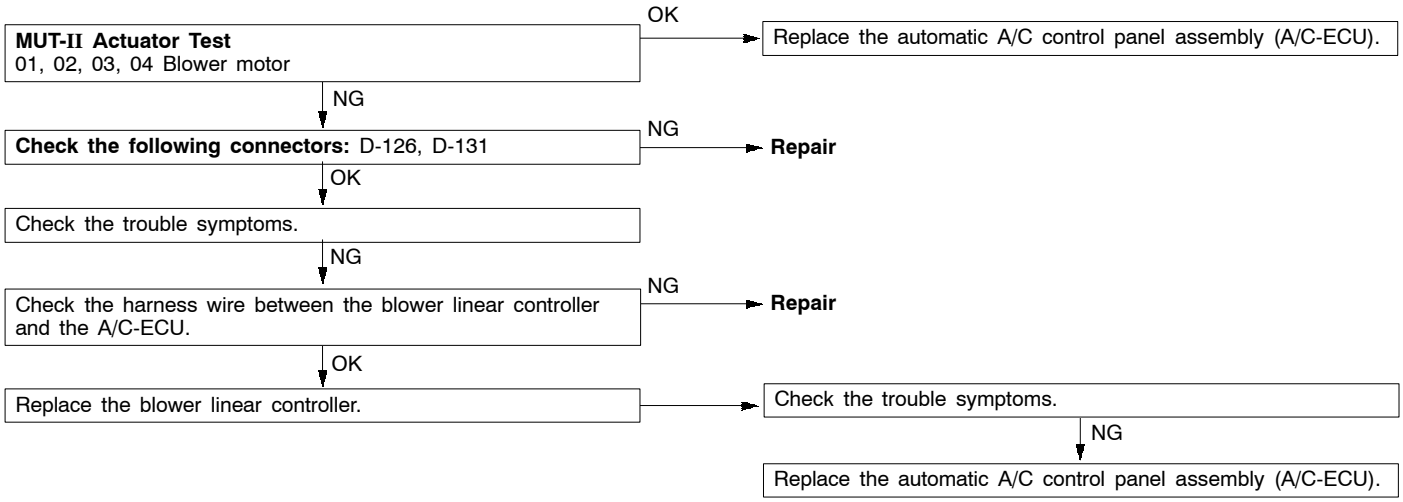
Inspection procedure 5

The blower does not operate.	Probable cause
If no air comes out of the blower even though the blower switch is on, the cause is probably a malfunction of the front blower relay circuit.	• Malfunction of the front blower relay • Malfunction of the blower linear controller • Malfunction of the blower motor • Malfunction of harness or connector • Malfunction of the A/C-ECU



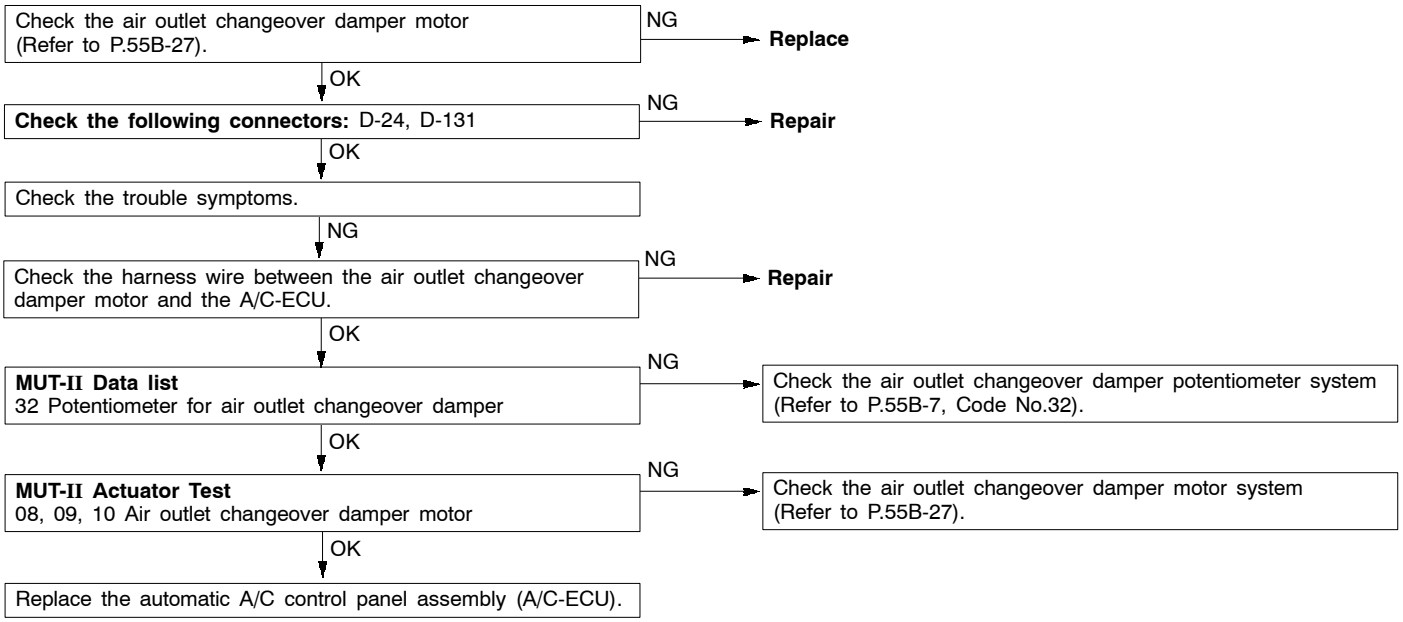
Inspection procedure 6

The blower air volume can not be changed.	Probable cause
If the air volume can not be controlled, the blower linear controller circuit may be defective.	• Malfunction of the blower linear controller • Malfunction of harness or connector • Malfunction of the A/C-ECU



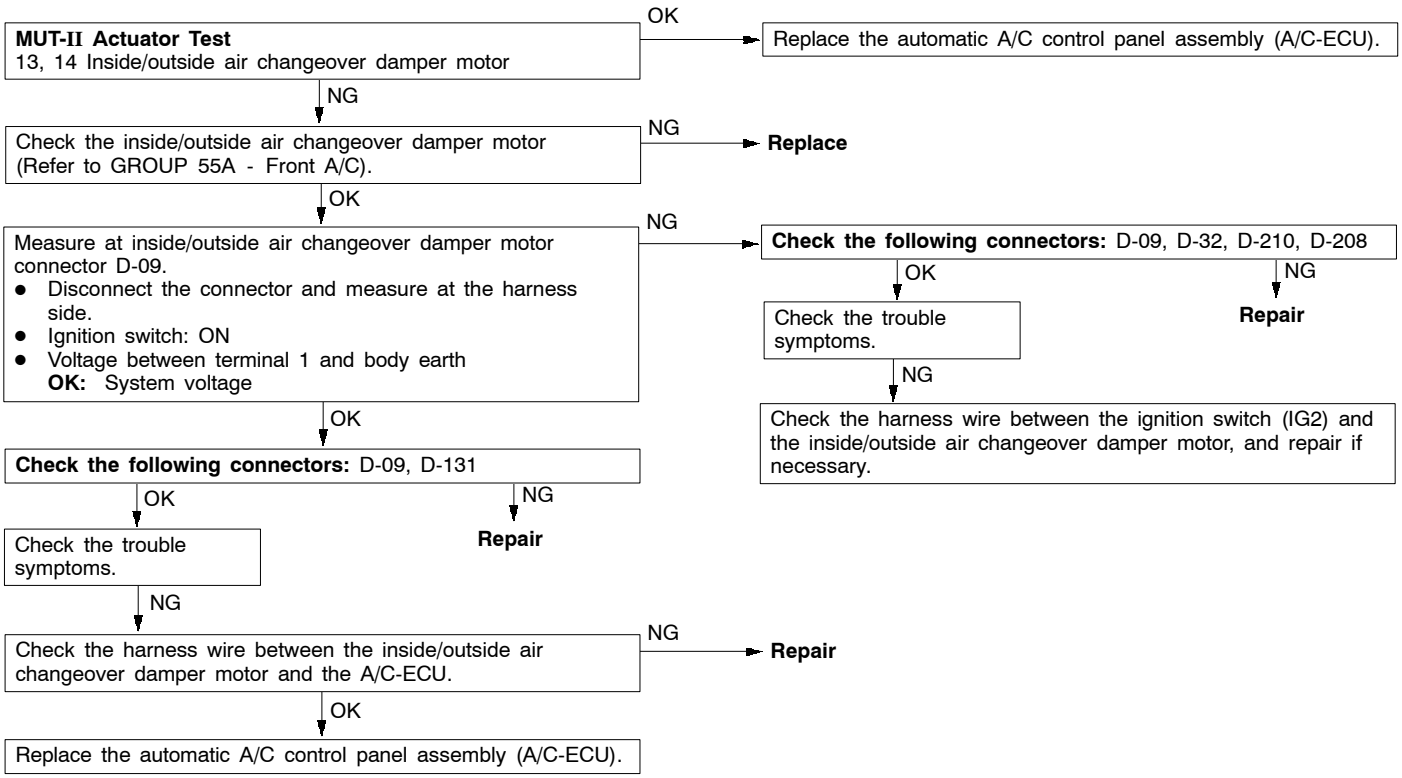
Inspection procedure 7

Air outlet vent cannot be changed.	Probable cause
When the air outlet vents cannot be changed even if the changeover switch is operated, the air outlet changeover damper motor circuit may be defective.	• Malfunction of the electric motor for the air outlet changeover damper • Malfunction of harness or connector • Malfunction of the A/C-ECU



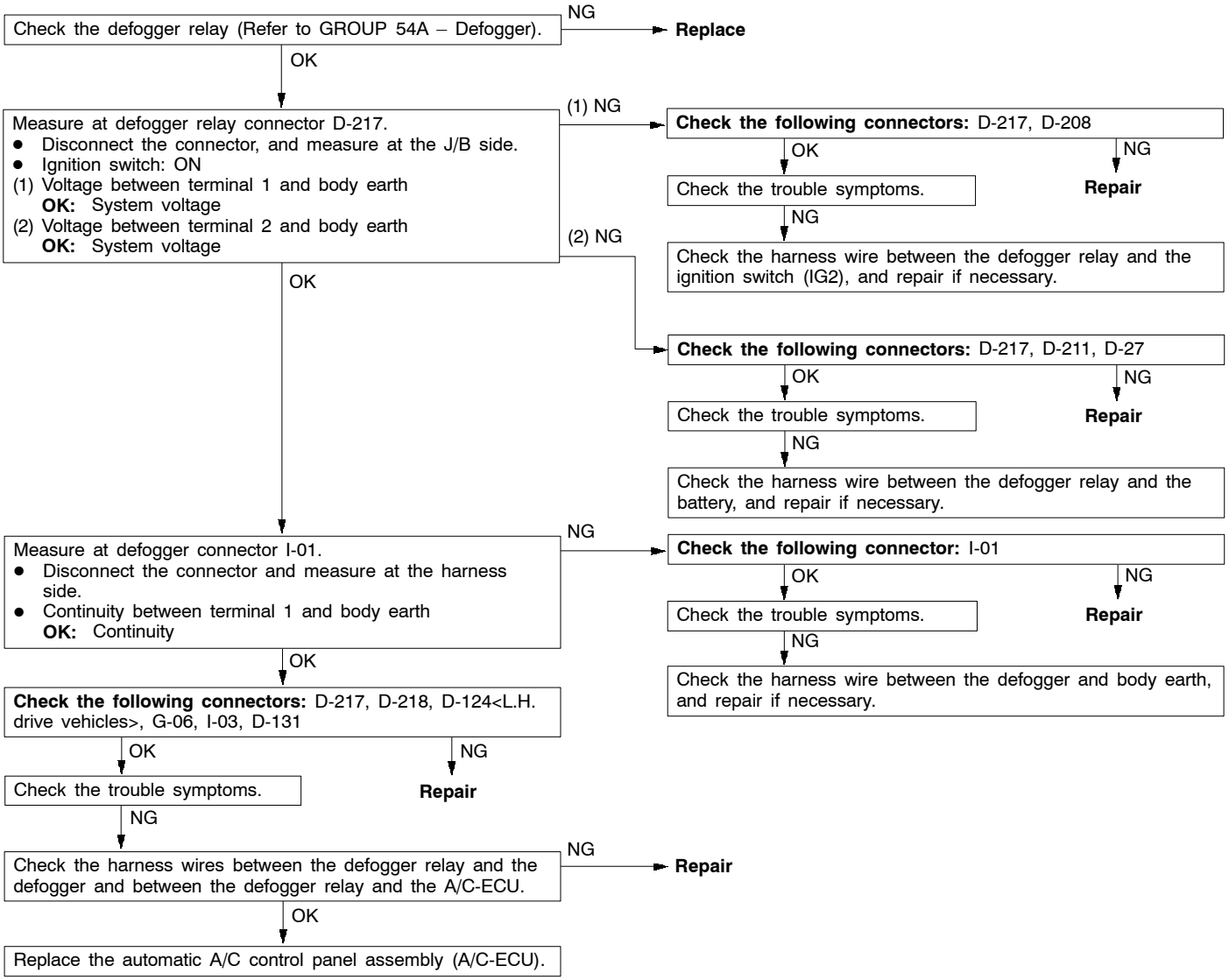
Inspection procedure 8

Inside/outside air changeover is not possible.	Probable cause
When inside air cannot be changed to outside air or vice versa even if its changeover switch is on, the inside/outside air changeover damper motor system may be defective.	• Malfunction of the inside/outside air changeover damper motor • Malfunction of harness or connector • Malfunction of the A/C-ECU



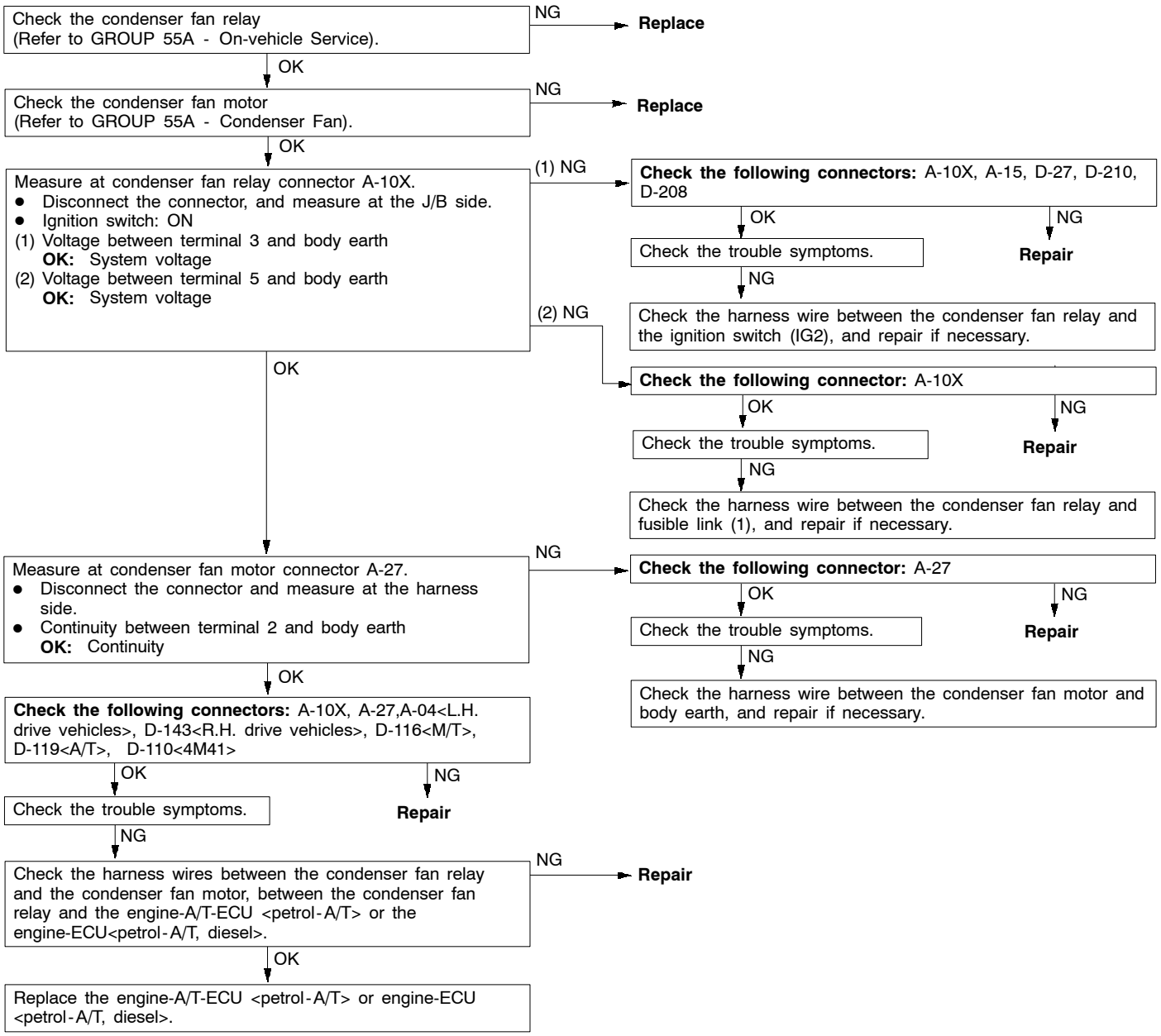
Inspection procedure 9

The rear defogger does not operate.	Probable cause
When the rear defogger does not operate even if the rear defogger switch is on (the defogger remains on for twenty minutes due to a timer function), the rear defogger relay system may be defective.	• Malfunction of the defogger relay • Malfunction of harness or connector • Malfunction of the A/C-ECU



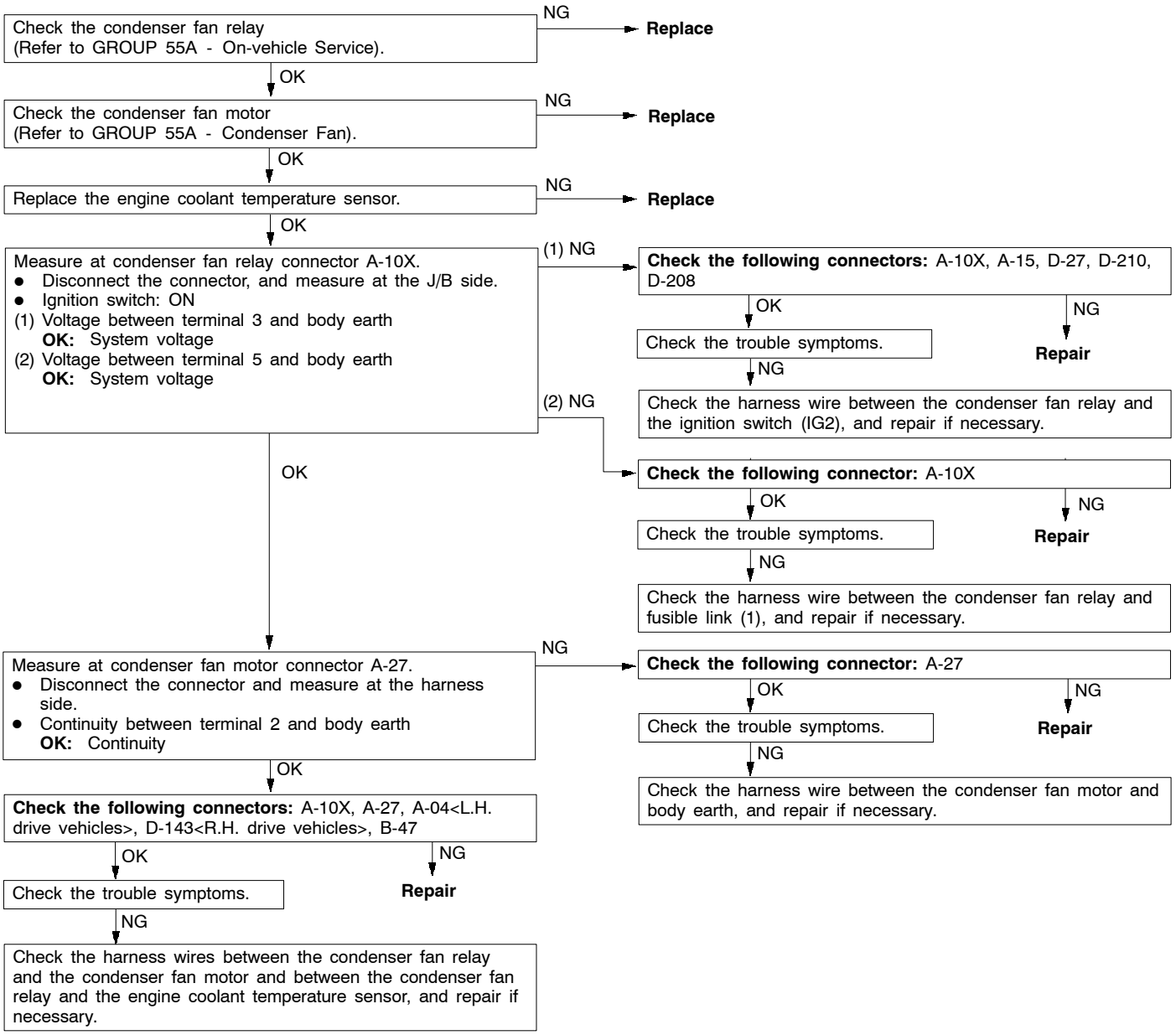
Inspection procedure 10

The condenser fan does not operate <except 4D56>.	Probable cause
If the condenser fan does not operate, the condenser fan relay or motor may be defective.	• Malfunction of the condenser fan relay • Malfunction of harness or connector • Malfunction of the engine-A/T-ECU <petrol> or engine-ECU <diesel>



Inspection procedure 11

The condenser fan does not operate <4D56>.	Probable cause
If the condenser fan does not operate, the condenser fan relay or motor may be defective.	• Malfunction of the condenser fan relay • Malfunction of harness or connector • Malfunction of the engine-A/T-ECU <petrol> or engine-ECU <diesel>



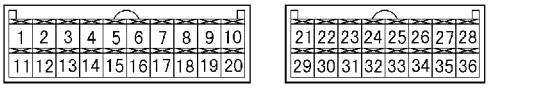
DATA LIST REFERENCE TABLE

Item No.	Check item	Inspection contents	
11	Inside air temperature sensor	Ignition switch: ON	Inside air temperature and temperature displayed on the MUT-II are identical.
13	Outside air temperature sensor	Ignition switch: ON	Outside air temperature and temperature displayed on the MUT-II are identical.
15	Heater water temperature sensor	Ignition switch: ON	Heater core surface temperature and temperature displayed on the MUT-II are identical.
21	Air thermo sensor	Ignition switch: ON	Evaporator outlet temperature and temperature displayed on the MUT-II are identical.
25	Photo sensor	Ignition switch: ON	Amount of incident light is proportional to voltage displayed on the MUT-II.
31	Potentiometer for the air mix damper	Ignition switch: ON Damper position: MAX HOT	Opening angle: Approximately 100%
		Ignition switch: ON Damper position: MAX COOL	Opening angle: Approximately 0%
32	Potentiometer for the air outlet changeover damper	Ignition switch: ON Damper position: FACE	Opening angle: Approximately 0%
		Ignition switch: ON Damper position: FOOT	Opening angle: Approximately 60%
		Ignition switch: ON Damper position: FOOT/DEF	Opening angle: Approximately 80%
		Ignition switch: ON Damper position: DEF	Opening angle: Approximately 100%

ACTUATOR TEST TABLE

Item No.	Check item	Drive Contents
01	Blower motor	Stopped
02		Low speed
03		Medium speed
04		High speed
05	Electric motor for the air mix damper	Opening angle: Approximately 0%
06		Opening angle: Approximately 50%
07		Opening angle: Approximately 100%
08	Electric motor for the air outlet changeover damper	FACE
09		FOOT
10		DEF
11	Compressor ON/OFF	OFF
12		ON
13	Inside/outside air changeover damper motor	Outside air
14		Inside air

CHECK AT A/C-ECU TERMINALS



W0763AU

Terminal No.	Check item	Check conditions	Normal condition
1	Electric motor for the air mix damper (MAX COOL)	When the damper flap is moving to the MAX COOL position.	10 V
		When the damper flap is moving to the MAX HOT position.	Faint voltage (0.5 V)
2	Electric motor for the air outlet changeover damper (FACE)	When the damper flap is moving to the FACE position.	10 V
		When the damper flap is moving to the DEF position.	Faint voltage (0.5 V)
3	Inside/outside air changeover damper motor (Inside air)	When the damper flap is moving to the inside air recirculation position.	Faint voltage (0.5 V)
		When the damper flap is moving to the the outside air induction position.	10 V (when the motor is stopped)
4	Inside/outside air changeover damper motor (Outside air)	When the damper flap is moving to the inside air recirculation position.	10 V (when the motor is stopped)
		When the damper flap is moving to the the outside air induction position.	Faint voltage (0.5 V)
5	Input signal from dual pressure switch	Dual pressure switch: OFF	0 V
		Dual pressure switch: ON	System voltage
6	Multi center display unit communication line	Ignition switch: ON	Hi: 4 - 5 V Lo: 0 - 1 V
7	Output to the engine-A/T-ECU <petrol> or engine-ECU <diesel>.	When the A/C is off.	0 V
		When the A/C is in operation (When compressor is operating)	System voltage
9	Input from lock sensor <petrol>	When the compressor is operating	0 - 0.75 V (pulse signal)
10	Output to blower linear controller	When the blower is operating	0 - 3.5 V (Effective alternating voltage)
11	Electric motor for the air mix damper (MAX HOT)	When the damper flap is moving to the MAX COOL position.	Faint voltage (0.5 V)
		When the damper flap is moving to the MAX HOT position.	10 V
12	Electric motor for the air outlet changeover damper (DEF)	When the damper flap is moving to the FACE position.	Faint voltage (0.5 V)
		When the damper flap is moving to the DEF position.	10 V
13	Engine-ECU <Diesel for cold zone>	Blower switch: ON Air outlet temperature: FOOT, FOOT/DEF, DEF Set temperature: MAX HOT (32°C)	System voltage
14	Blower relay	When the blower is stopped	System voltage
		When the blower is operating	0 V

Terminal No.	Check item	Check conditions	Normal condition
15	Rear defogger	Rear defogger: OFF	System voltage
		Rear defogger: ON	1.5 V or less
16	Multi center display unit communication line	Ignition switch: ON	Hi: 4 - 5 V Lo: 0 - 1 V
17	Multi center display unit communication line	Ignition switch: ON	Hi: 4 - 5 V Lo: 0 - 1 V
18	Multi center display unit communication line shield	At all times	0 V
19	Diagnosis output	Ignition switch: ON	A voltmeter needle fluctuates between 0 and 12 V.
20	Input from A/C compressor relay	When the A/C is off.	0 V
		When the A/C is in operation (When compressor is operating)	System voltage
21	Power supply to potentiometer	At all times	5 V
22	Input from outside air temperature sensor	Sensor temperature: 25°C (1.7 kΩ)	1.9 V
23	Input from heater water temperature sensor	Sensor temperature: 25°C (5 kΩ)	2.8 V
24	Input from potentiometer for air mix damper	When the damper flap is moving to the MAX HOT position.	0.7 - 1.3 V
25	Power supply to illumination	Lighting switch: ON	System voltage
26	Power supply to ignition switch (IG2)	Ignition switch: ON	System voltage
27	Power supply to ignition switch (ACC)	Ignition switch: ACC	System voltage
28	Backup power supply	At all times	System voltage
29	Earth to sensor and potentiometer	At all times	0 V
30	Input from air thermo sensor	Sensor temperature: 25°C (1.5 kΩ)	2.2 V
31	Photo sensor (+)	During 800 kcal/m^2 - h	1 V
32	Input from potentiometer for the air outlet changeover damper	When the damper flap is moving to the DEF position.	0.7 - 1.3 V
33	Diagnosis input	Ignition switch: ON	0 V
34	Compressor lock signal (ignition signal)	Engine speed: 3 000 r/min	0.3 - 3.0
35	Illumination earth	At all times	Continuity
36	Earth	At all times	Continuity

CHECK AT ENGINE-A/T-ECU OR ENGINE-ECU TERMINALS

Refer to GROUP 13A – Troubleshooting <petrol> or GROUP 13B – Troubleshooting <diesel>.

TROUBLESHOOTING <REAR A/C>

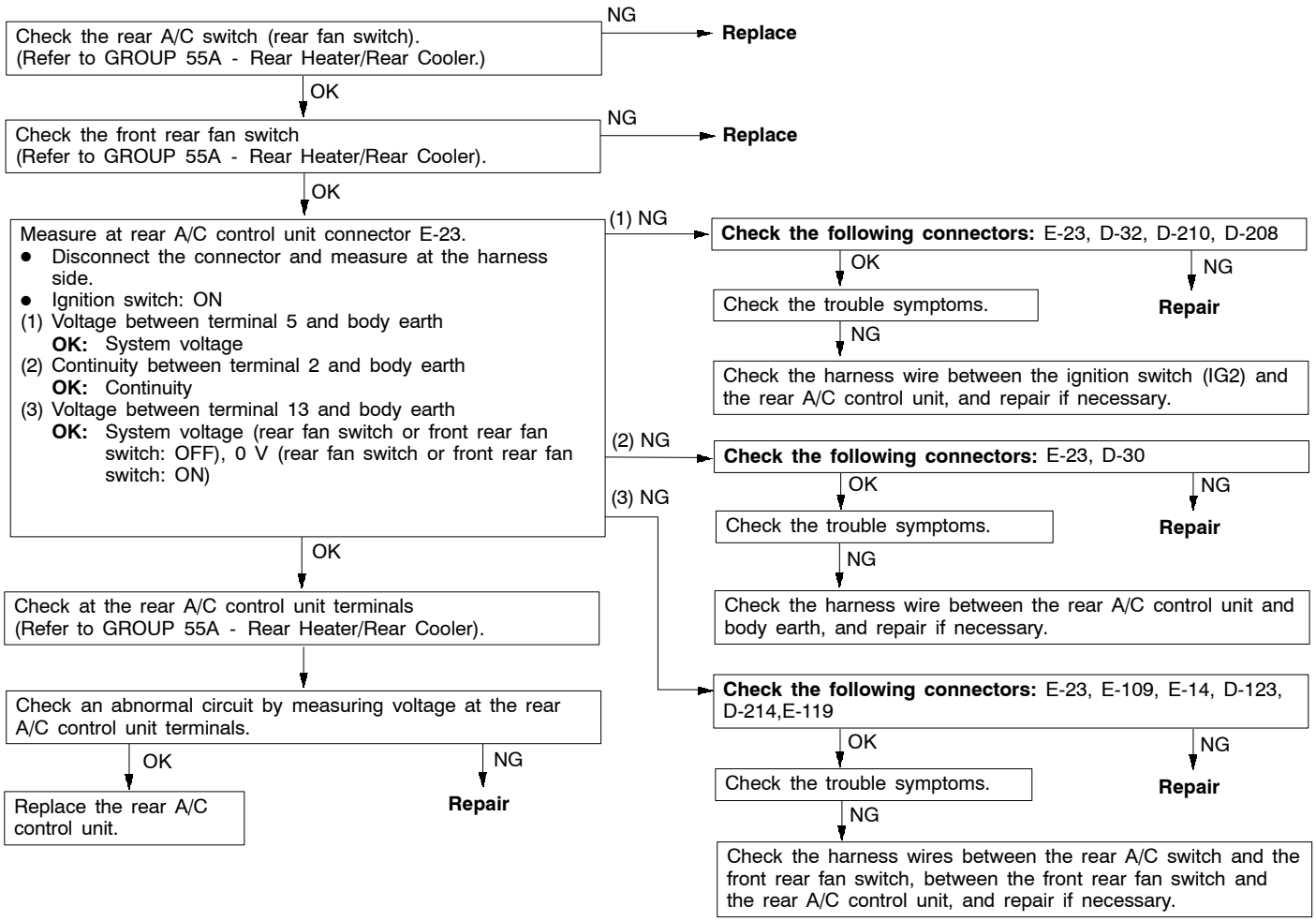
INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom	Inspection procedure No.	Reference page
The rear A/C does not operate at all.	1	55B-20
The rear A/C outlet air temperature can not be set.	2	55B-21
The rear blower does not operate.	3	55B-22
Rear blower air volume can not be changed.	4	55B-23
Air outlet vents can not be changed in proportion to the temperature adjusting switch.	5	55B-23

INSPECTION PROCEDURES FOR TROUBLE SYMPTOMS

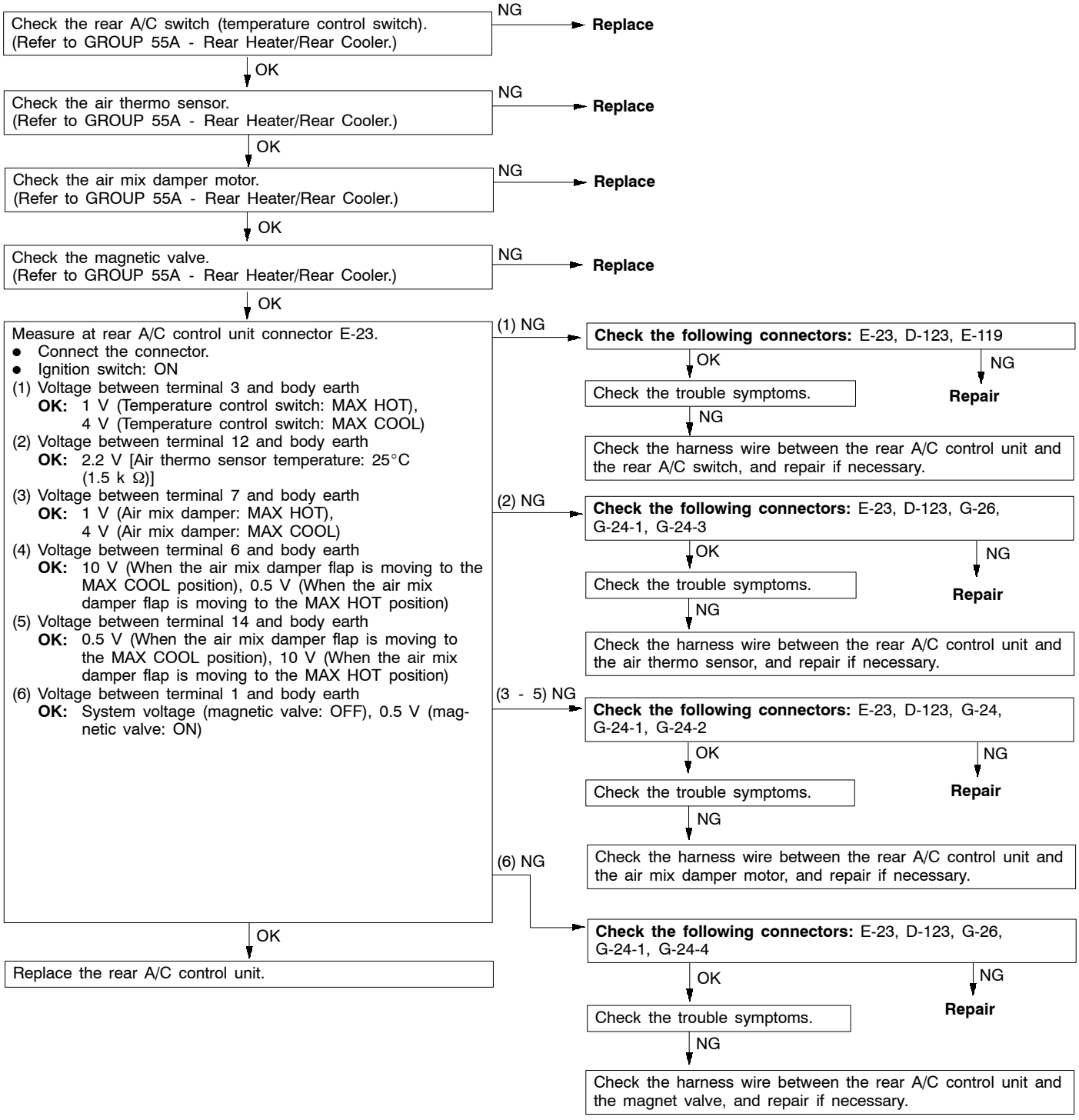
Inspection procedure 1

The rear A/C does not operate at all.	Probable cause
The rear fan switch or front rear fan switch circuit, or the power supply system (including earth) for the rear A/C control unit may be defective. Besides that, the rear A/C control unit may not be operating correctly due to a defective harness (such as short circuit).	• Malfunction of the rear fan switch • Malfunction of the front rear fan switch • Malfunction of harness or connector • Malfunction of the rear A/C control unit



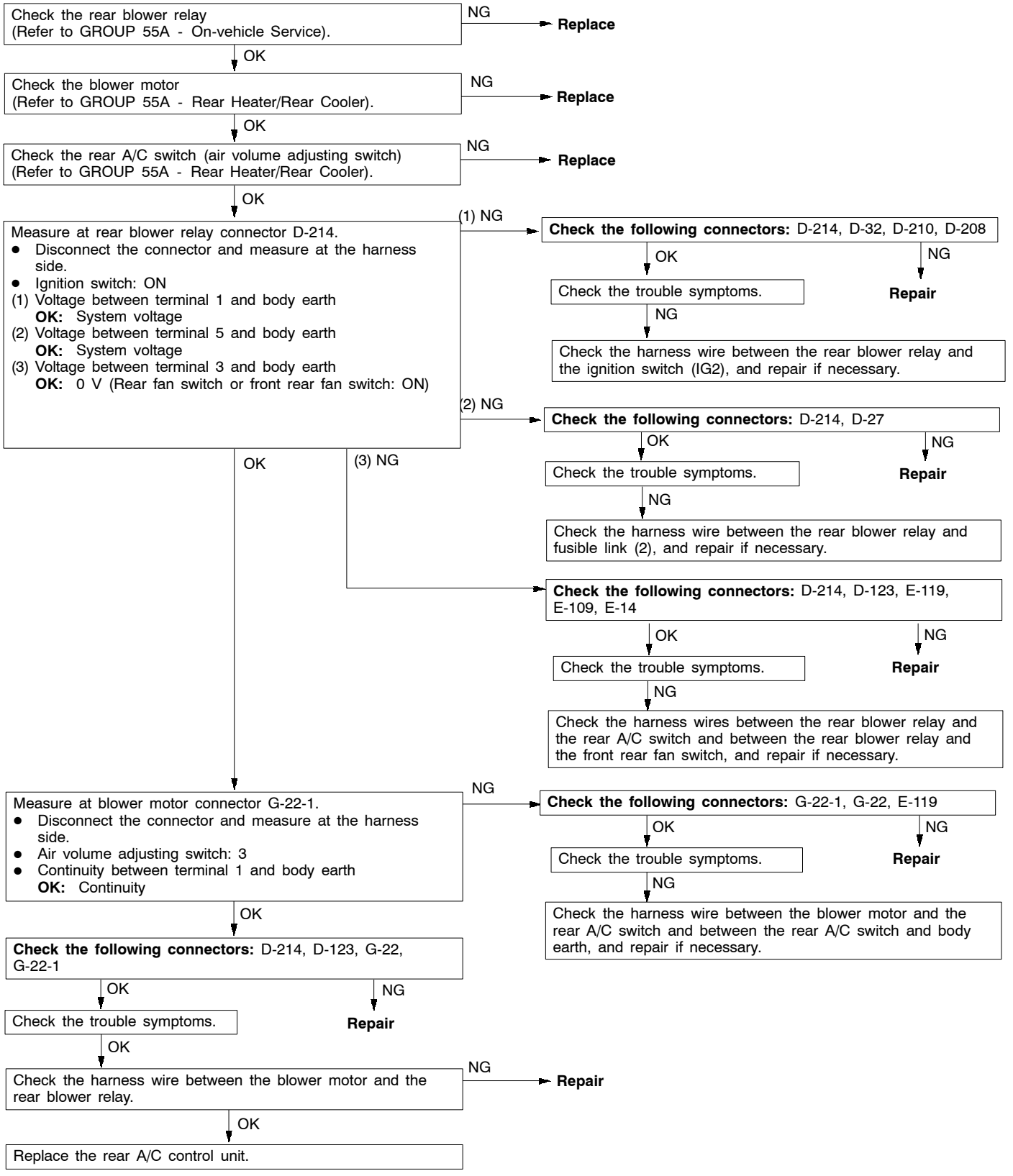
Inspection procedure 2

The rear A/C outlet air temperature can not be set.	Probable cause
If the air outlet temperature can not be changed after a temperature control switch is operated,the temperature control switch, the air thermo sensor, the magnet valve or the air mix damper maybe defective.	• Malfunction of the rear A/C switch • Malfunction of the air thermo sensor • Magnet valve • Malfunction of the electric motor for the air mix damper • Malfunction of harness or connector • Malfunction of the rear A/C control unit



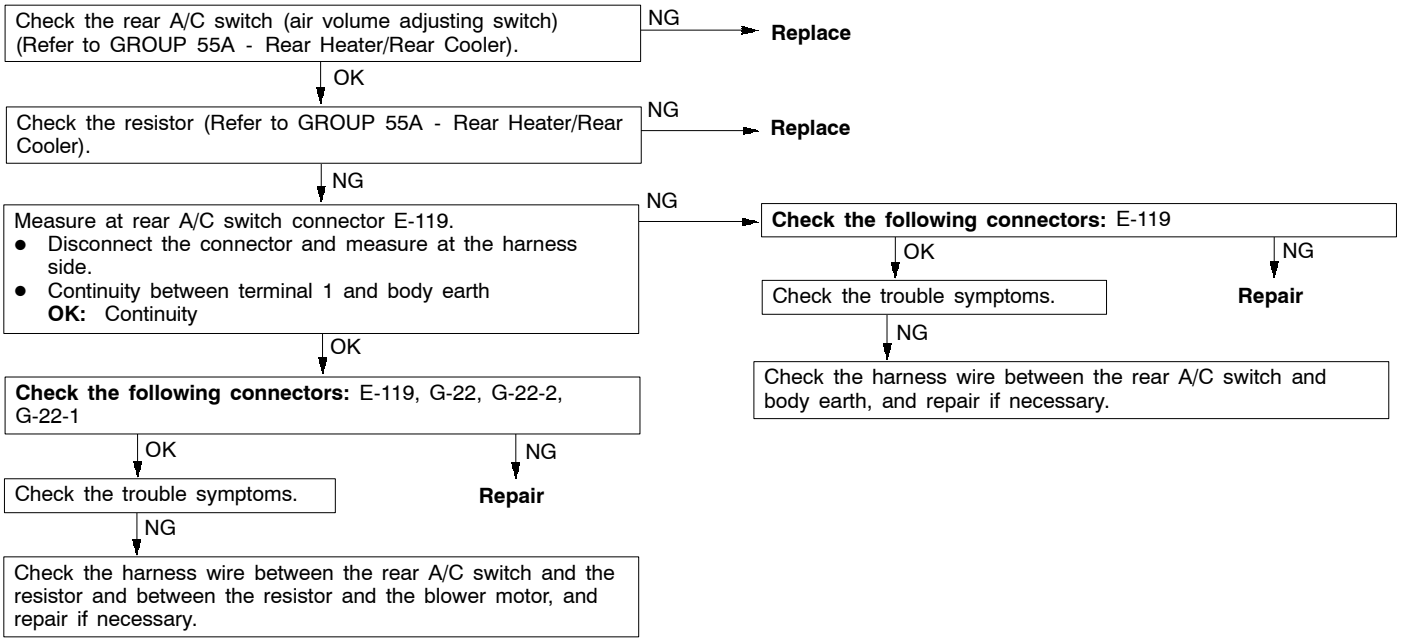
Inspection procedure 3

The rear blower does not operate.	Probable cause
If no air comes out of the air vents even if the rear fan switch or the front rear fan switch is turned on, the rear blower relay circuit may be defective.	• Malfunction of the rear blower relay • Malfunction of the blower motor • Malfunction of the rear A/C switch • Malfunction of harness or connector



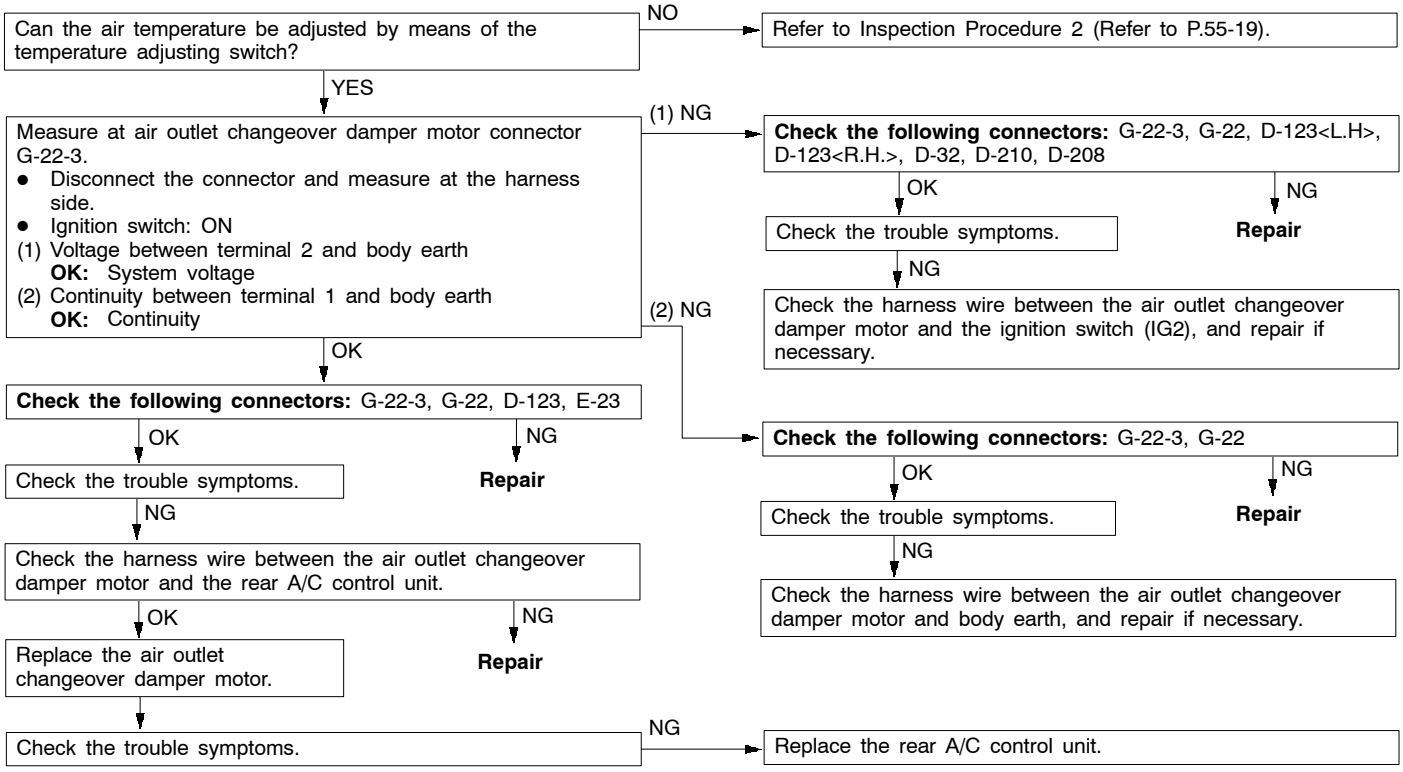
Inspection procedure 4

The rear blower air volume can not be changed.	Probable cause
If the air volume can not be controlled, the air volume adjusting switch or the resistor may be defective.	• Malfunction of the rear A/C switch • Malfunction of the resistor • Malfunction of harness or connector

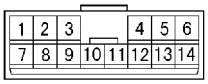


Inspection procedure 5

Air outlet vents can not be changed in proportion to the temperature adjusting switch.	Probable cause
If the air outlet temperature can not be changed after a temperature control switch is operated, the air outlet changeover damper may be defective.	• Malfunction of the electric motor for the air outlet changeover damper • Malfunction of harness or connector • Malfunction of the rear A/C control unit



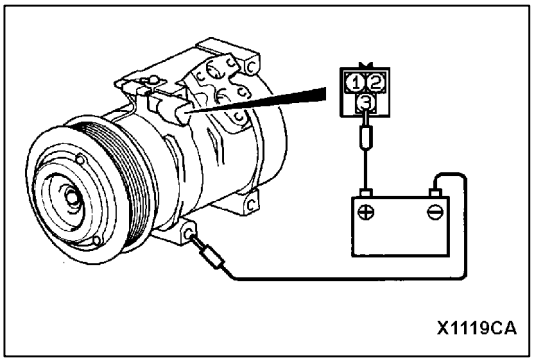
CHECK AT REAR A/C CONTROL UNIT TERMINALS



X1136CA

Terminal No.	Check item	Check conditions	Normal condition
1	Magnet valve	Magnet valve: OFF	System voltage
		Magnet valve: ON	Faint voltage (0.5 V)
2	Earth	At all times	Continuity
3	Input from temperature adjusting switch	Temperature adjusting switch: MAX HOT	1 V
		Temperature adjusting switch: MAX COOL	4 V
4	Power supply to potentiometer	At all times	5 V
5	Power supply to ignition switch (IG2)	Ignition switch: ON	System voltage
6	Electric motor for the air mix damper (MAX COOL)	When the damper flap is moving to the MAX COOL position.	10 V
		When the damper flap is moving to the MAX HOT position.	Faint voltage (0.5 V)
7	Input from potentiometer for air mix damper	Air mix damper: MAX HOT	1 V
		Air mix damper: MAX COOL	4 V
8	Earth to sensor and potentiometer	At all times	0 V
9	Signal from air outlet changeover damper motor	Ignition switch: ON	0 - 12 V
10	Signal from air outlet changeover damper motor	Ignition switch: ON	0 - 12 V
11	Signal from air outlet changeover damper motor	Ignition switch: ON	0 - 12 V
12	Input from air thermo sensor	Sensor temperature: 25°C (1.5 kΩ)	2.2 V
13	Input from rear fan switch and front rear fan switch	Rear fan switch or front rear fan switch: ON	0 V
14	Electric motor for the air mix damper (MAX HOT)	When the damper flap is moving to the MAX COOL position.	Faint voltage (0.5 V)
		When the damper flap is moving to the MAX HOT position.	10 V

ON-VEHICLE SERVICE



X1119CA

MAGNETIC CLUTCH TEST

1. Disconnect the connector (3-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.

IDLE UP OPERATION CHECK <Petrol>

1. Set the vehicle in the following condition:
2. Check that the idle speed is within the standard value.

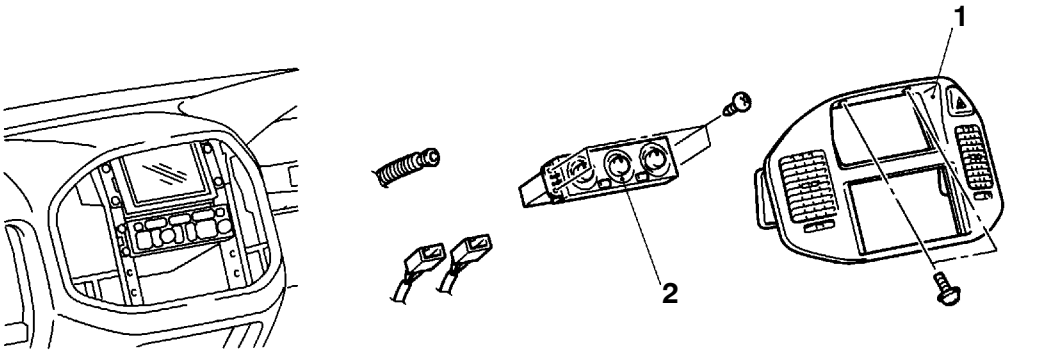
   Standard value: 700 ± 50 r/min

   NOTE
   (1) The idle speed is controlled by the ISC system and should not be adjusted.
   (2) Run the engine at idle, and wait for at least two minutes before the check.
3. The idle speed should be within the standard value when the A/C switch is turned on and the A/C is operating.

   Standard value:
   <While the A/C is under low load>
   700 ± 50 r/min
   <While the A/C is under medium load>
   800 ± 50 r/min
   <While the A/C is under high load>
   1,000 ± 50 r/min

FRONT A/C

AUTOMATIC A/C CONTROL PANEL ASSEMBLY (A/C-ECU) REMOVAL AND INSTALLATION

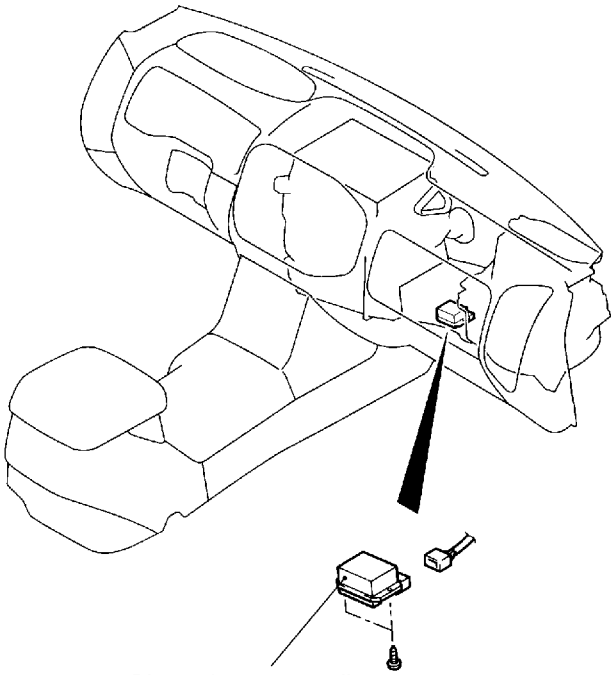


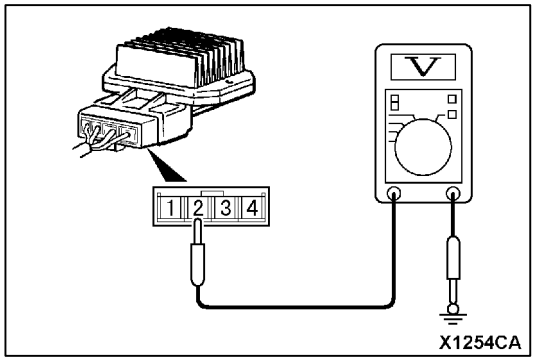
AX1027CA

Removal steps

1. Center panel (Refer to GROUP 52A - Instrument Panel.)
2. Automatic A/C control panel assembly (A/C-ECU)

BLOWER LINEAR CONTROLLER REMOVAL AND INSTALLATION





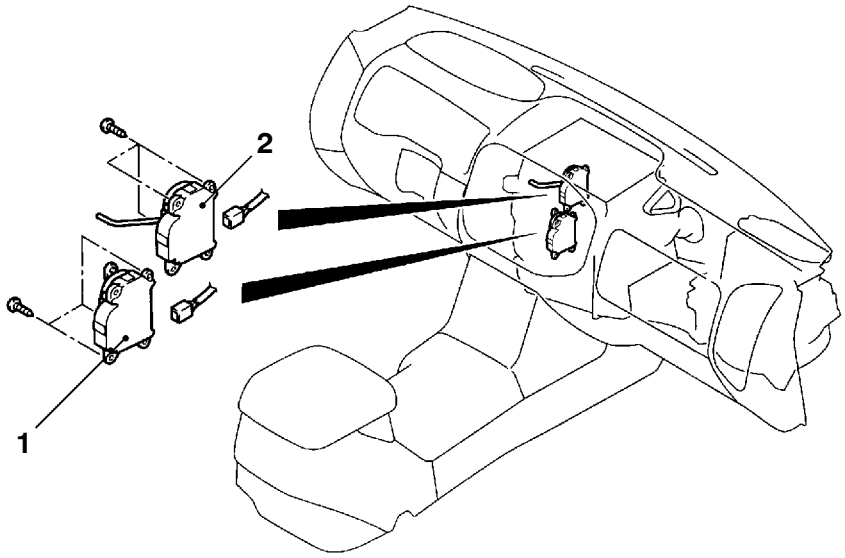
INSPECTION

BLOWER LINEAR CONTROLLER INSPECTION

When the connector is connected and the ignition switch is turned ON, the voltage at terminal 2 should meet the following table.

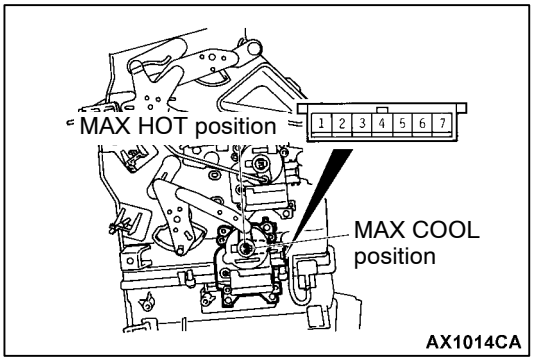
Blower switch position	Voltage at terminal No.2 V
Low speed	4.0
Medium speed	7.9
High speed	13.7

AIR MIX DAMPER MOTOR AND AIR OUTLET CHANGEOVER DAMPER MOTOR REMOVAL AND INSTALLATION



Removal steps
- Under cover (Refer to GROUP 52A – Instrument Panel.)

1. Electric motor for the air mix damper
2. Electric motor for the air outlet changeover damper



INSPECTION

AIR MIX DAMPER MOTOR INSPECTION

Motor check

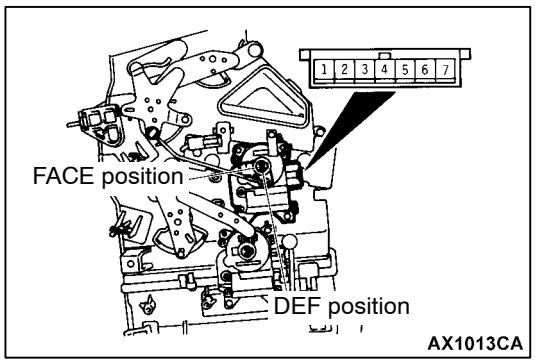
Battery connection terminal		Lever operation
1	2	
⊕	⊖	Rotate to the HOT position.
⊖	⊕	Rotate to the COOL position.

Caution
If the lever reaches the stop position, disconnect the battery voltage.

Potentiometer check

When the resistances between terminals 3 and 5 as well as terminals 3 and 7 are measured at the previous check, the resistance value should change gradually within the standard value.

Standard value: Approximately 0.96 - 5.76 kΩ



AIR OUTLET CHANGEOVER DAMPER MOTOR CHECK

Motor check

Battery connection terminal		Lever operation
1	2	
⊕	⊖	Rotate to the DEF position.
⊖	⊕	Rotate to the FACE position.

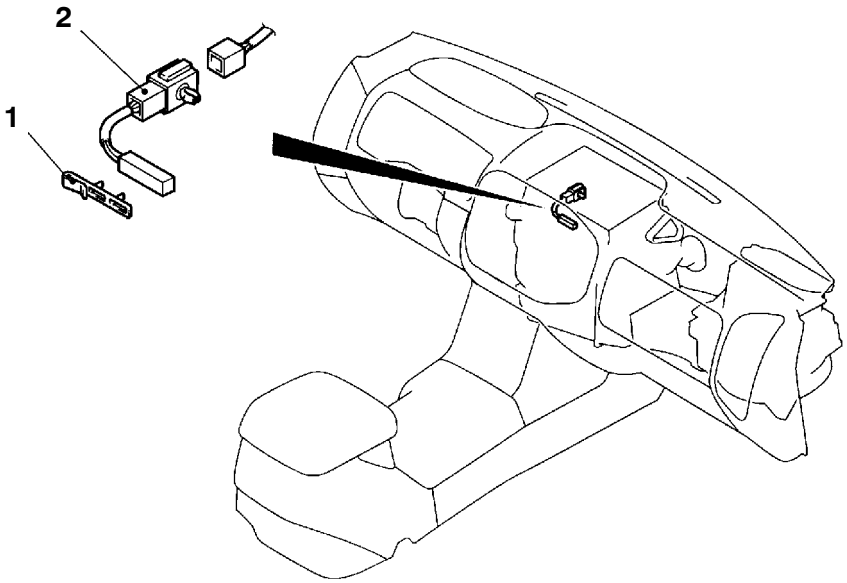
Caution
If the lever reaches the stop position, disconnect the battery voltage.

Potentiometer check

When the resistances between terminals 3 and 5 as well as terminals 3 and 7 are measured at the previous check, the resistance value should change gradually within the standard value.

Standard value: Approximately 0.96 - 5.76 kΩ

HEATER WATER TEMPERATURE SENSOR REMOVAL AND INSTALLATION



Removal steps

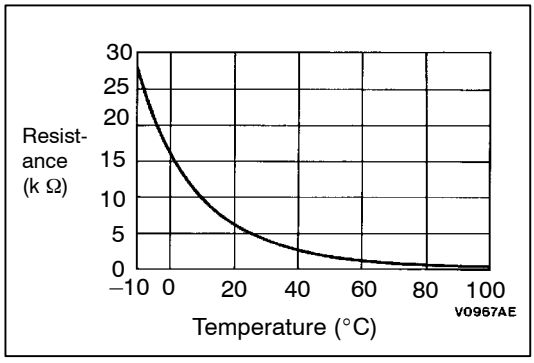
- Under cover (Refer to GROUP 52A – Instrument Panel.)

▶A◀ 1. Heater water temperature sensor clip
▶A◀ 2. Heater water temperature sensor

INSTALLATION SERVICE POINTS

▶A◀ HEATER WATER TEMPERATURE SENSOR CLIP INSTALLATION

Insert the heater water temperature sensor into the mounting hole on the heater unit, and secure the sensor with the clip.



INSPECTION

HEATER WATER TEMPERATURE SENSOR CHECK

Measure the resistance between the sensor terminals under at least two temperatures. The resistance values should meet the left graph.

NOTE
The temperature should be within the shown range.

PHOTO SENSOR

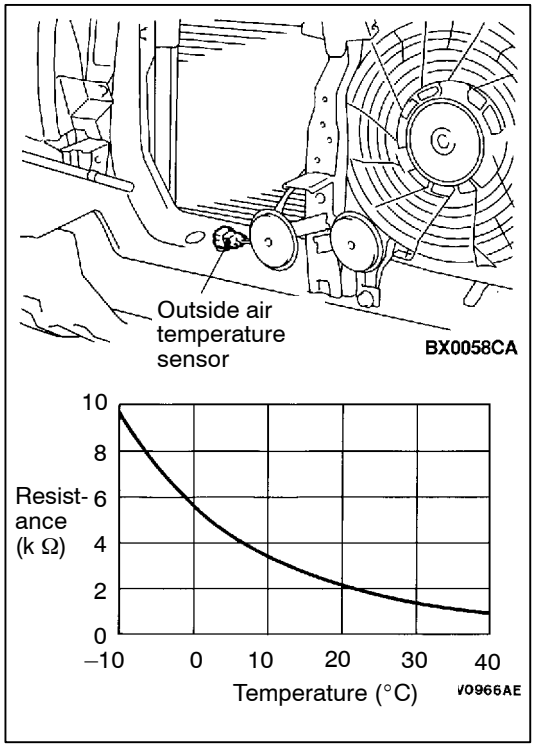
REMOVAL AND INSTALLATION

(Refer to GROUP 54A – Headlamp.)

INSPECTION

PHOTO SENSOR CHECK

The blower speed should drop when the light-receiving section of the photo sensor is covered with your hand. If not, replace the photo sensor.



OUTSIDE AIR TEMPERATURE SENSOR

INSPECTION

OUTSIDE AIR TEMPERATURE SENSOR CHECK

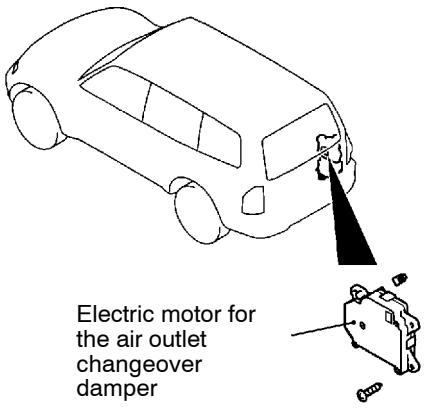
Measure the resistance between the sensor terminals under at least two temperatures. The resistance values should meet the left graph.

NOTE
The temperature should be within the shown range.

REAR A/C

ELECTRIC MOTOR FOR THE AIR OUTLET CHANGEOVER DAMPER

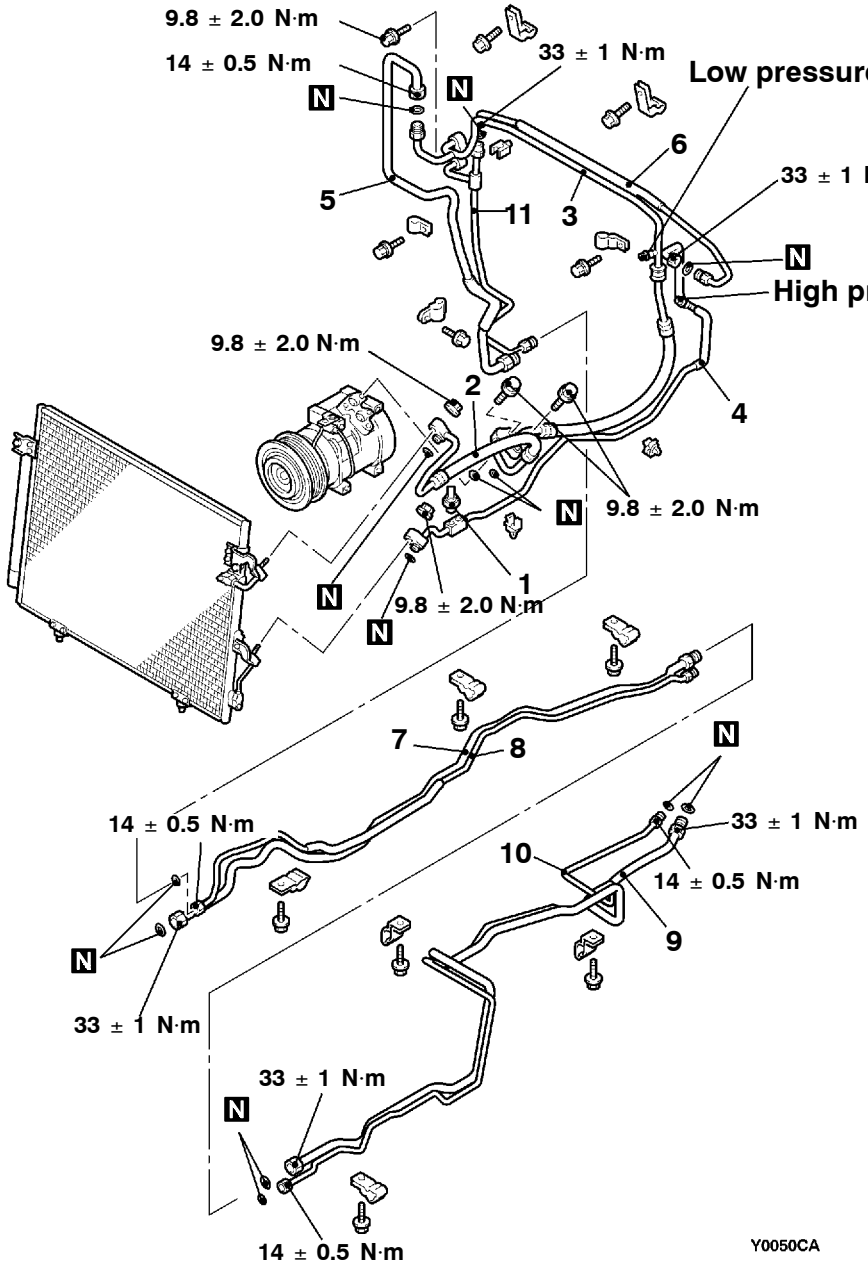
REMOVAL AND INSTALLATION

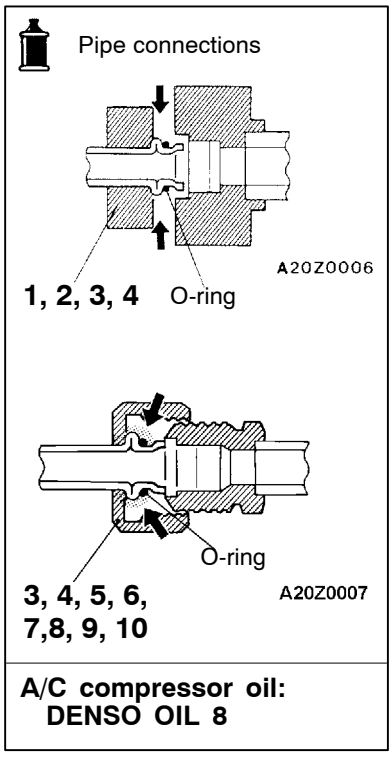


REFRIGERANT LINE <PETROL>

REMOVAL AND INSTALLATION <L.H. drive vehicles>

Dual A/C





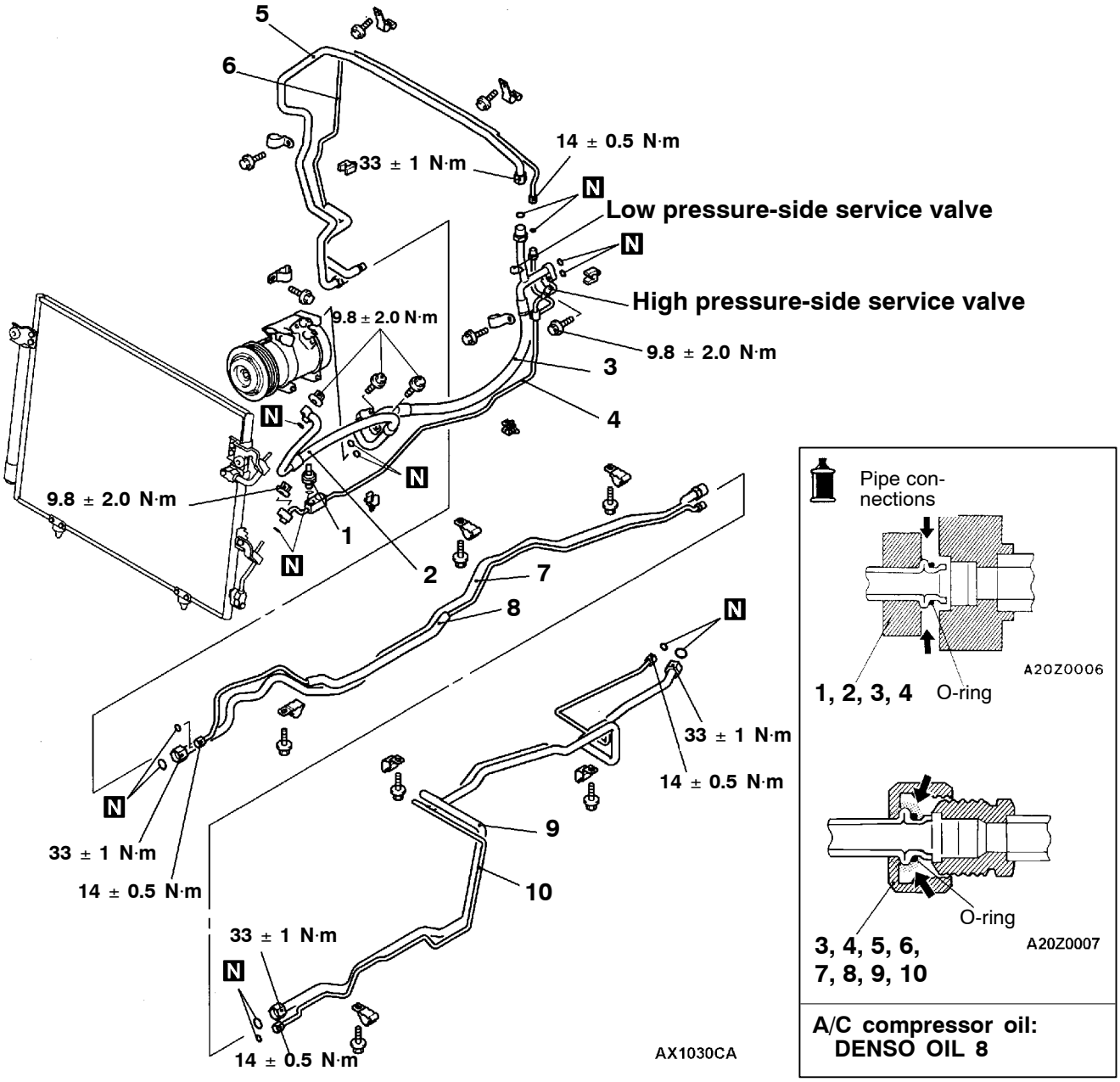
A/C compressor oil: DENSO OIL 8

Removal steps

- ◀A▶ 1. Dual pressure switch
- ◀A▶ 2. Discharge flexible hose
- ◀A▶ 3. Suction flexible hose
- ◀A▶ 4. Liquid pipe A
- ◀A▶ 5. Suction pipe A
- ◀A▶ 6. Liquid pipe B
- ◀A▶ 7. Suction pipe B
- ◀A▶ 8. Liquid pipe C
- ◀A▶ 9. Suction pipe C
- ◀A▶ 10. Liquid pipe D
- ◀A▶ 11. Liquid pipe E

<R.H. drive vehicles>

Dual A/C



Removal steps

1. Dual pressure switch
◀A▶ 2. Discharge flexible hose
◀A▶ 3. Suction flexible hose
◀A▶ 4. Liquid pipe A
◀A▶ 5. Suction pipe A
◀A▶ 6. Liquid pipe B
◀A▶ 7. Suction pipe B
◀A▶ 8. Liquid pipe C
◀A▶ 9. Suction pipe C
◀A▶ 10. Liquid pipe D

REMOVAL SERVICE POINT

◀A▶ HOSE/PIPE DISCONNECTION

Plug the condenser, the compressor and the heater unit nipples to prevent system contamination.

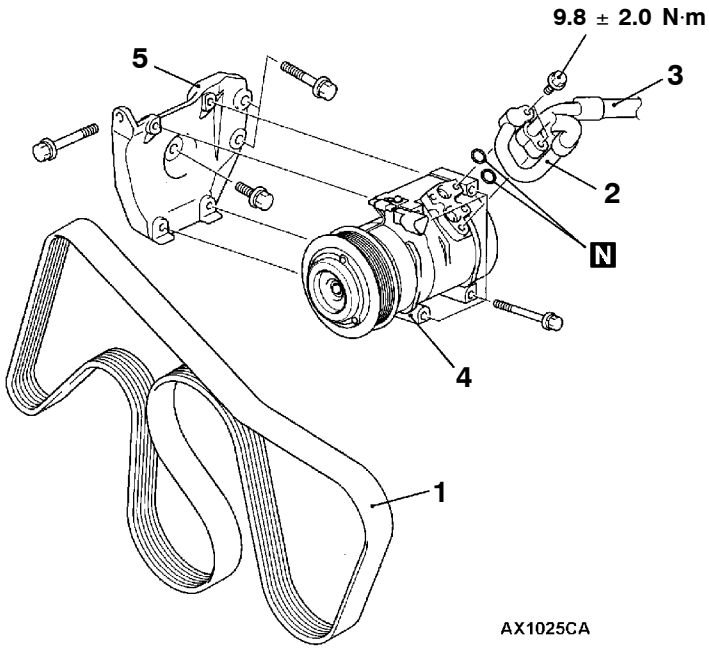
Caution
Use a plug, which air does not penetrate through. Compressor oil and receiver absorb moisture easily.

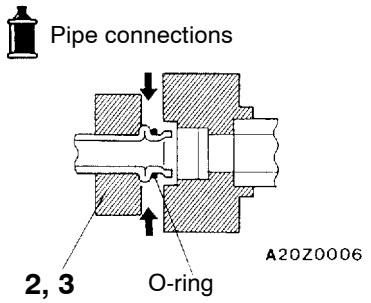
COMPRESSOR <petrol>

REMOVAL AND INSTALLATION

Pre-removal Operations
Refrigerant discharge
(Refer to GROUP-55A - On-vehicle Service.)

Post-installation Operations
- Refrigerant charge
  (Refer to GROUP-55A - On-vehicle Service.)
- Drive belt tension check
  (Refer to GROUP 11A, B - On-vehicle Service.)

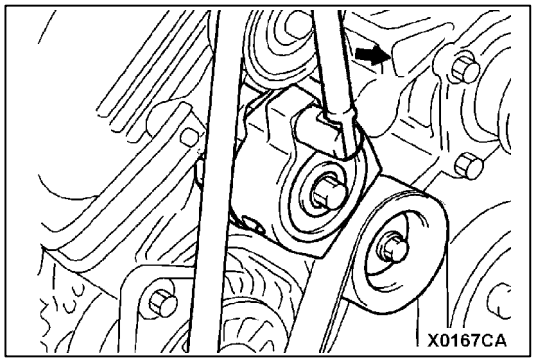




A/C compressor oil:
DENSO OIL 8

Removal steps

◀A▶ 1. Drive belt
◀B▶ 2. Discharge flexible hose connection
◀B▶ 3. Suction flexible hose connection
◀C▶ ▶A◀ 4. Compressor
5. Compressor bracket



REMOVAL SERVICE POINTS

◀A▶ DRIVE BELT REMOVAL

Engage a socket wrench with the service square hole on the automatic tensioner, move the wrench to the shown direction to loosen the drive belt.

Caution
If the drive belt is reused, mark an arrow indicating rotation direction (clockwise direction) on the belt surface with a chalk.

◀B▶ DISCHARGE FLEXIBLE HOSE/SUCTION FLEXIBLE HOSE DISCONNECTION

Plug the disconnect hoses and the compressor nipples to prevent dust or foreign material from entering them.

Caution
Use a plug, which air does not penetrate through. Compressor oil and receiver absorb moisture easily.

◀C▶ COMPRESSOR REMOVAL

Be careful not to spill the compressor oil.

INSTALLATION SERVICE POINT

▶A◀ COMPRESSOR INSTALLATION

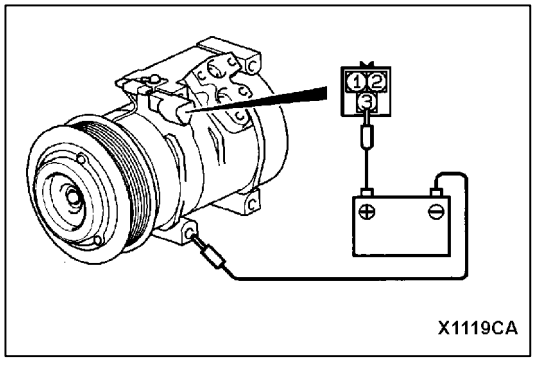
If a new compressor is installed, first adjust the amount of oil according to the procedures described below, and then install the compressor.

1. Measure the amount of oil within the removed compressor. (X ml)
2. Drain (from the new compressor) the amount of oil calculated according to the following formula, and then install the new compressor.

   Single A/C <except vehicles with rear cooler>:
   120 ml − X ml = Y ml

   Single A/C <Vehicles with rear cooler>, dual A/C:
   140 ml – X ml = Y ml

   NOTE
   (1) The above amounts (120 ml and 140 ml) indicate the factory-charged amount inside a new compressor.
   (2) Y ml indicates the amount of oil in the refrigerant line, the condenser, the evaporator, etc.

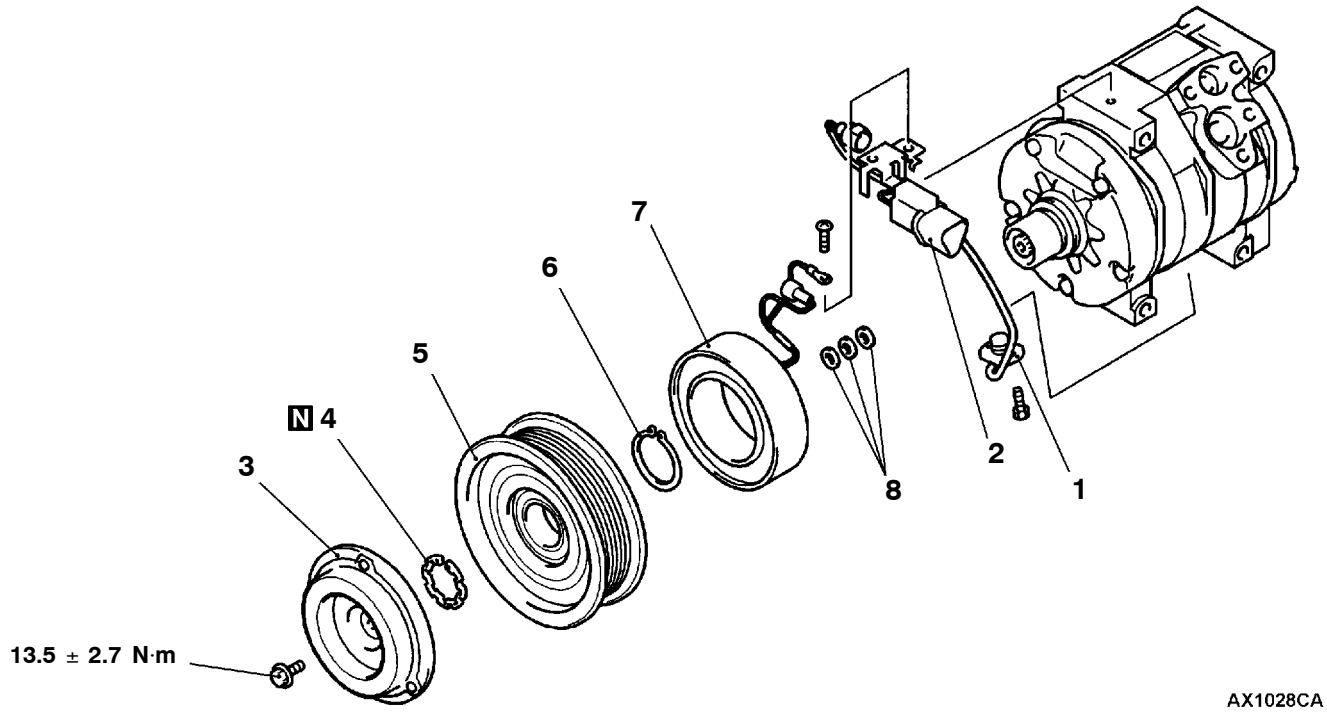


INSPECTION

COMPRESSOR MAGNETIC CLUTCH OPERATION INSPECTION

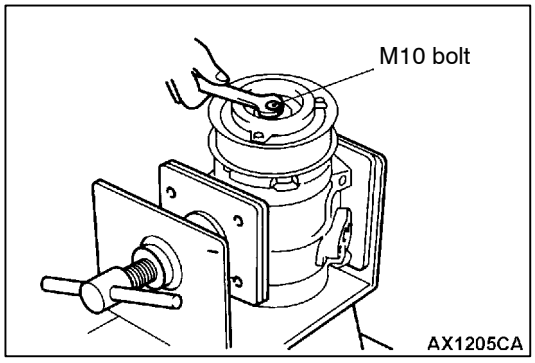
Connect the positive battery cable to compressor connector terminal No.3 or No.1 and negative battery cable to the compressor housing (earth).The magnetic clutch should click.

DISASSEMBLY AND REASSEMBLY



Disassembly steps

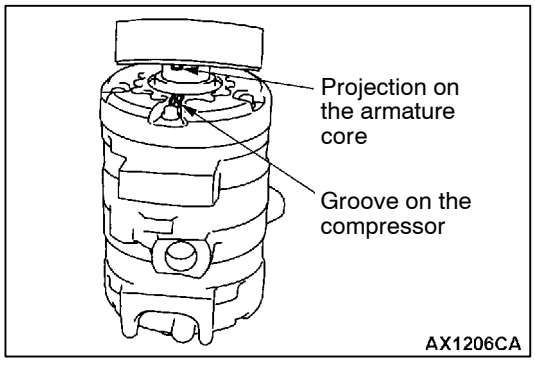
▶C◀ ● Air gap adjustment
1. Lock sensor
2. Connector
◀A▶ 3. Armature
▶B◀ 4. Snap ring
5. Rotor
6. Snap ring
▶A◀ 7. Field core
8. Washer



DISASSEMBLY SERVICE POINT

◀A▶ ARMATURE REMOVAL

1. Remove the armature mounting bolt.
2. Tighten the M10 bolt in the armature bolt hole to disengage the shaft from the armature serration.



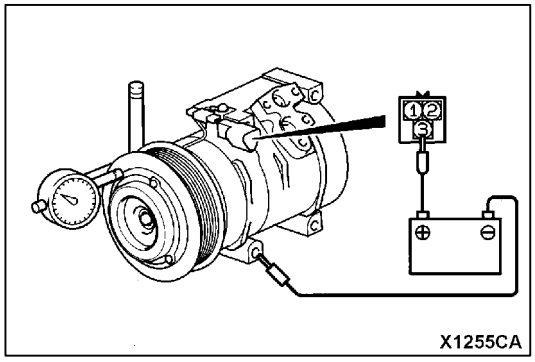
REASSEMBLY SERVICE POINTS

▶A◀ FIELD CORE INSTALLATION

Align the compressor groove with the field core projection to install the field core.

▶B◀ SNAP RING INSTALLATION

Be careful not to expand the snap ring excessively. If the inside diameter of the snap ring exceeds 30.5 mm due to excessive expansion, replace it.



▶C◀ AIR GAP ADJUSTMENT

Apply battery voltage to the magnetic clutch, and check that the clutch air gap is within the standard value. If not within the standard value, adjust it by using washers.

Standard value: 0.35 - 0.65 mm

NOTE
The washers are available in three thicknesses (0.1 mm, 0.3 mm, 0.5 mm).