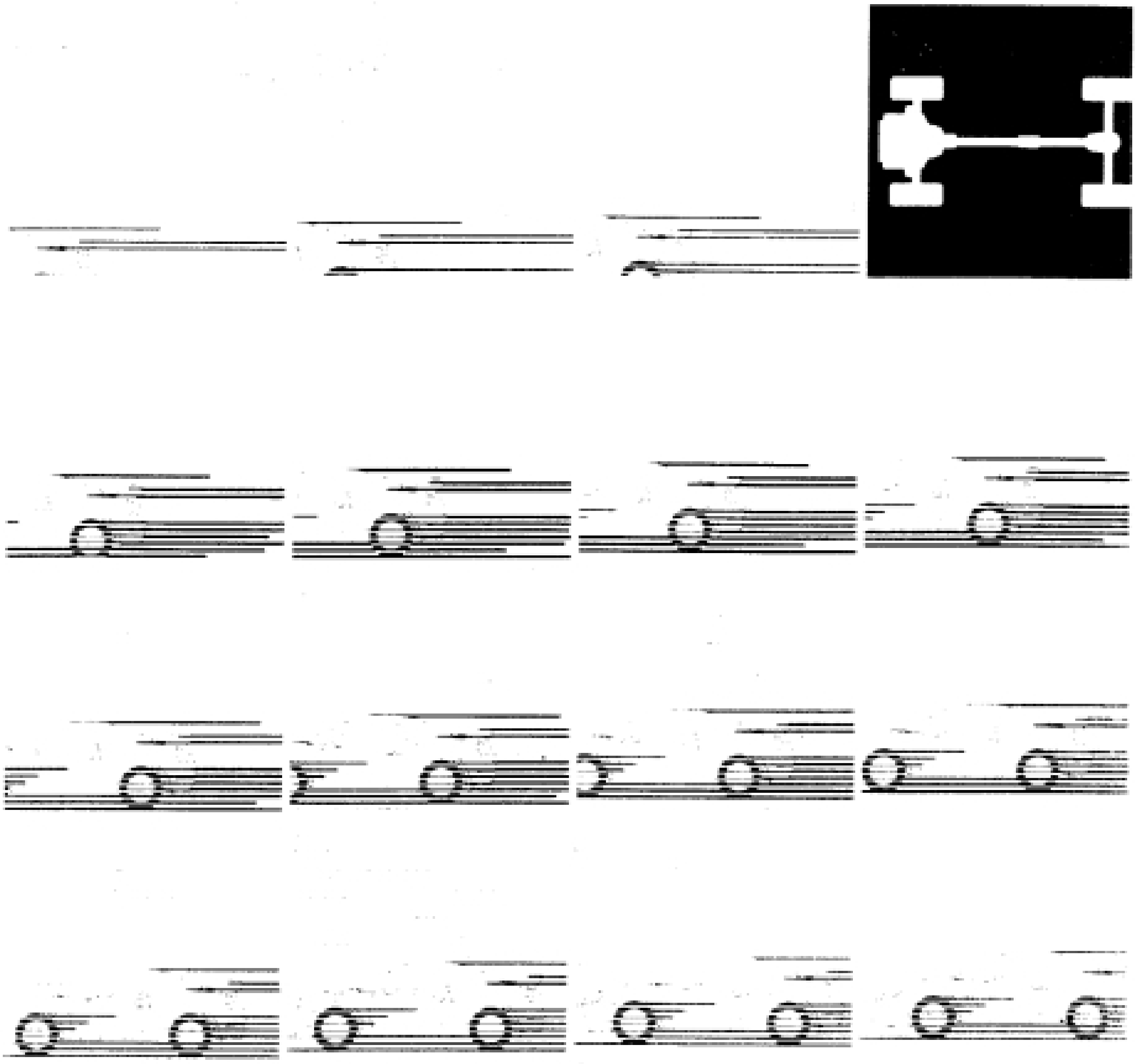
PART 1 of 2

MITSUBISHI
MOTORS

Workshop Manual

chassis

FTO '98



Pub. No. PWME9801

FTO

WORKSHOP MANUAL

FOREWORD

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

TECHNICAL INFORMATION MANUAL	PYME9801
WORKSHOP MANUAL	
ENGINE GROUP	PWEE9801
ELECTRICAL WIRING	PHME9801
BODY REPAIR MANUAL	PBME9801
PARTS CATALOGUE	B806G208A□

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

MITSUBISHI
MOTORS CORPORATION

Mar. 1998

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

WARNING!

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

(2) SRS components should not be subjected to heat over 93°C, so remove the SRS-ECU, air bag module (driver's side and front passenger's side) and clock spring before drying or baking the vehicle after painting.

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

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

NOTE

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

GENERAL

CONTENTS

HOW TO USE THIS MANUAL

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.

INDICATION OF DESTINATION

General Export and GCC are used for convenience to indicate destination.

NOTE
1. "General Export" means territories other than Europe, GCC, Australia, New Zealand, the U.S.A. and Canada.
2. "GCC" indicates countries that are members of the (Persian) Gulf Cooperation Council of nations.
3. In some instances, vehicles with other specifications may be shipped to some countries.

DEFINITION OF TERMS

STANDARD VALUE

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

LIMIT

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

REFERENCE VALUE

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

CAUTION

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

INDICATION OF TIGHTENING TORQUE

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

MODEL INDICATIONS

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

MPI: Indicates the multi-point injection, or engine equipped with the multi-point 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

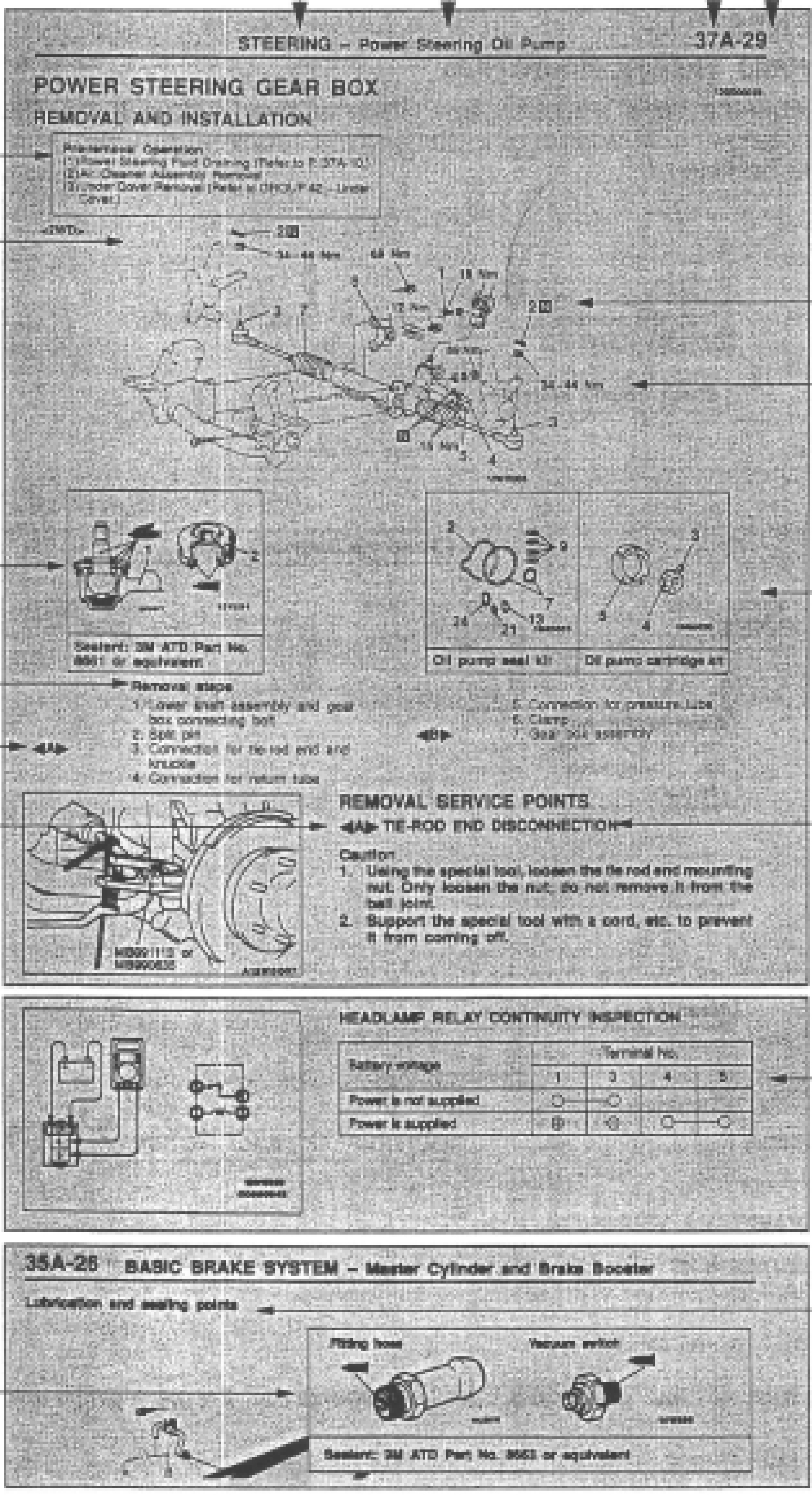
: Adhesive tape or butyl rubber tape

Indicates the group title.

Indicates the section title.

Indicates the group number.

Indicates the page number.



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.

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HOW TO USE TROUBLESHOOTING/INSPECTION SERVICE POINTS

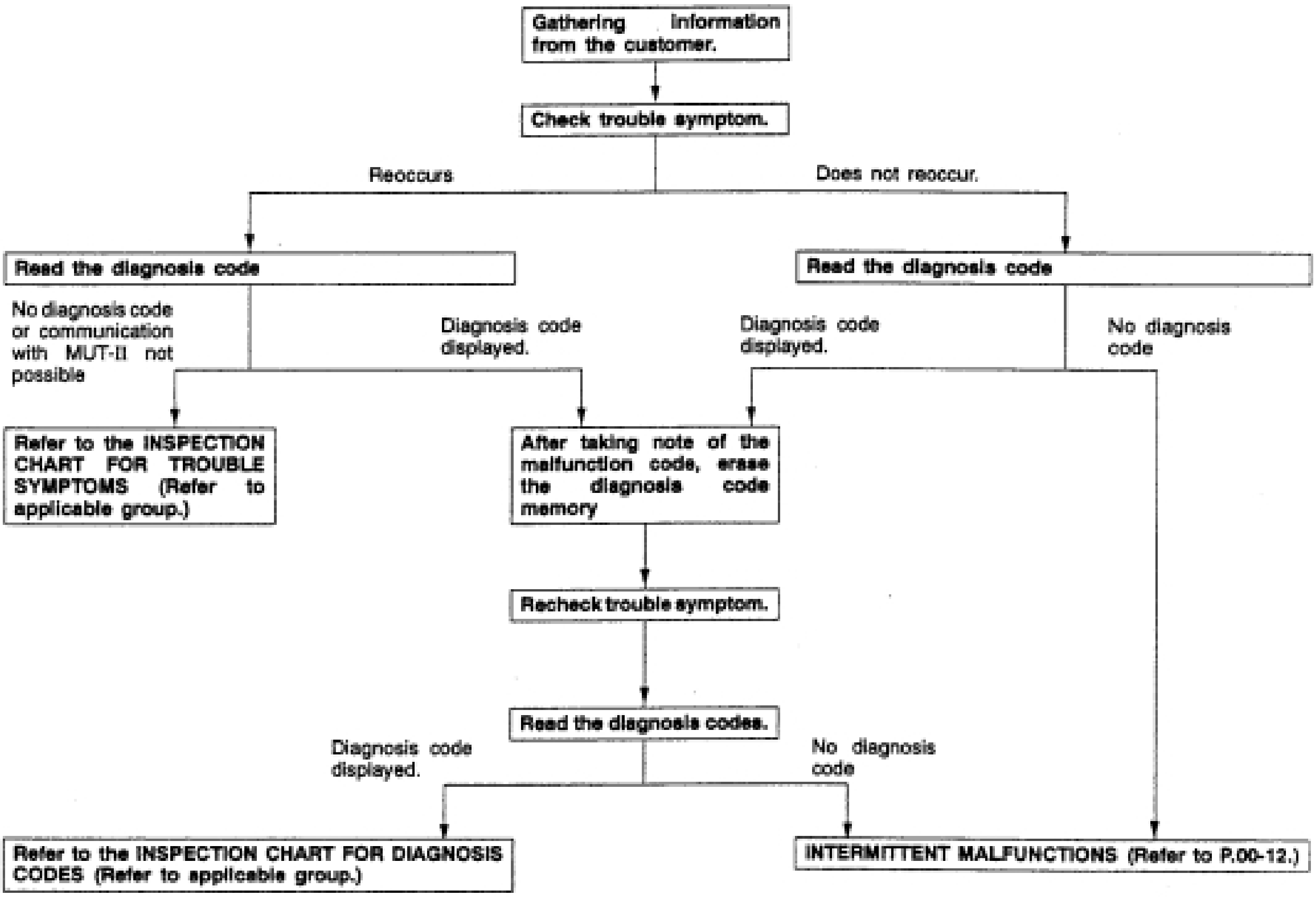
Troubleshooting of electronic control systems for which the MUT-II can be used follows the basic outline described below. Furthermore, even in systems for which the MUT-II cannot be used, part of these systems still follow this outline.

TROUBLESHOOTING CONTENTS

1. STANDARD FLOW OF DIAGNOSIS TROUBLESHOOTING

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

Diagnosis method



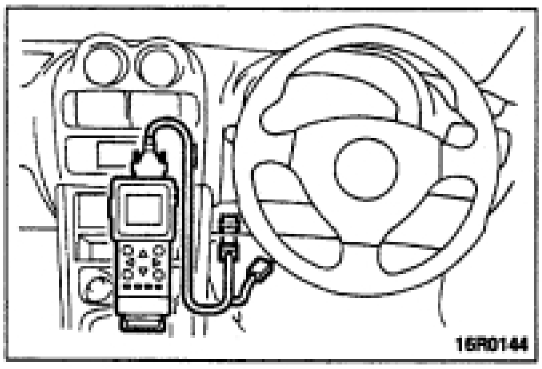
2. SYSTEM OPERATION AND SYMPTOM VERIFICATION TESTS

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

3. DIAGNOSIS FUNCTION

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

4. **INSPECTION CHART FOR DIAGNOSIS CODES**
5. **INSPECTION PROCEDURE FOR DIAGNOSIS CODES**
   Indicates the inspection procedures corresponding to each diagnosis code. (Refer to P.00-9 for how to read the inspection procedures.)
6. **INSPECTION CHART FOR TROUBLE SYMPTOMS**
   If there are trouble symptoms even though the results of inspection using the MUT-II show that all diagnosis codes are normal, inspection procedures for each trouble symptom will be found by means of this chart.
7. **INSPECTION PROCEDURE FOR TROUBLE SYMPTOM**
   Indicates the inspection procedures corresponding to each trouble symptoms classified in the Inspection Chart for Trouble Symptoms. (Refer to P.00-9 for how to read 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

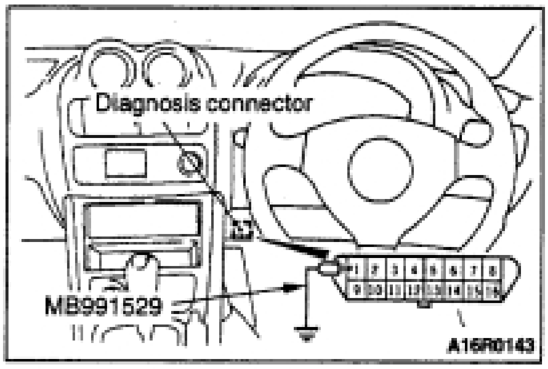
METHOD OF READING DIAGNOSIS CODES

WHEN USING THE MUT-II

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

Caution

Turn off the ignition switch 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. To check ABS system, remove the valve relay.

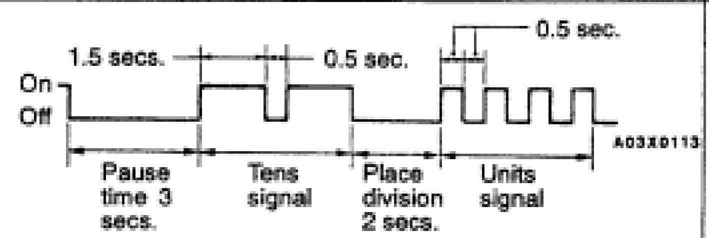
   NOTE
   That is because the valve relay is off and the warning lamp remains illuminated if there is a fault in the ABS system.
3. Turn off the ignition switch.
4. Read out a diagnosis code by observing how the warning lamp flashes.

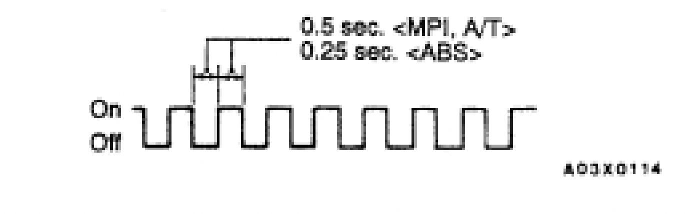
Applicable systems

System name	Warning lamp name
MPI	Engine warning lamp
A/T	Neutral position indicator lamp
ABS	ABS warning lamp
TCL	TCL-OFF indicator 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.

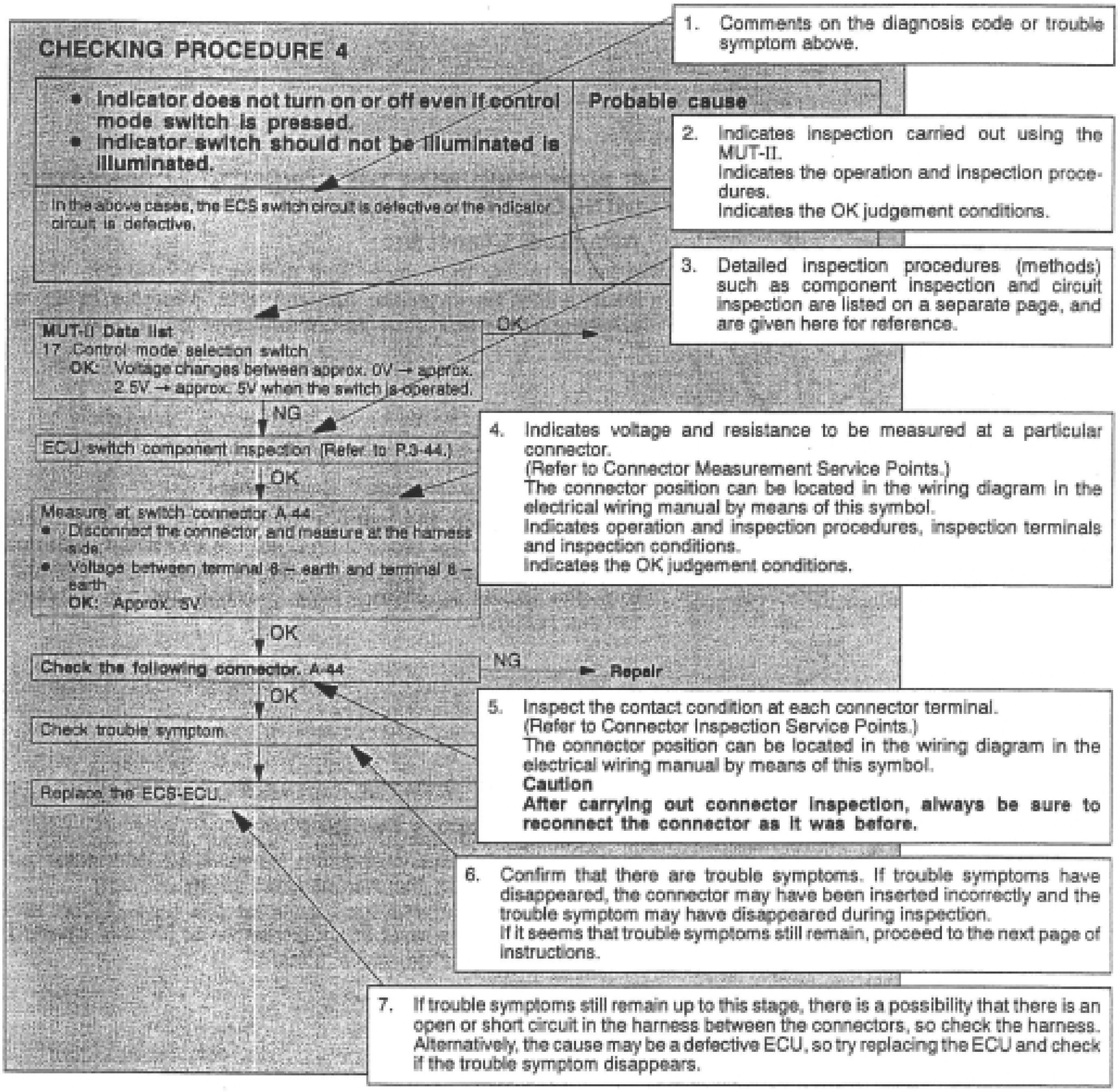
Caution
Turn off the ignition switch before connecting or disconnecting the MUT-II.

WHEN NOT USING THE MUT-II

(1) Turn the ignition switch to OFF.
(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.

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

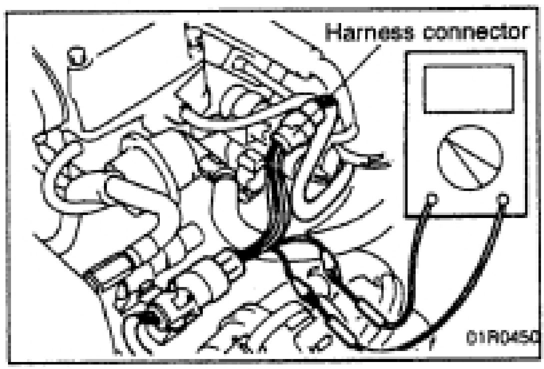
Check for an open or short circuit in the harness between the terminals which were defective according to the connector measurements. Carry out this inspection while referring to the electrical wiring manual. Here, "Check harness between power supply and terminal xx" also includes checking for blown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

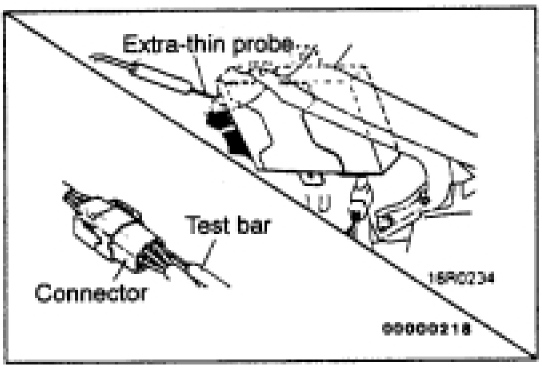
Turn the ignition switch to OFF when connecting disconnecting the connectors, and turn the ignition switch to ON when measuring if there are no instructions to be contrary.



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

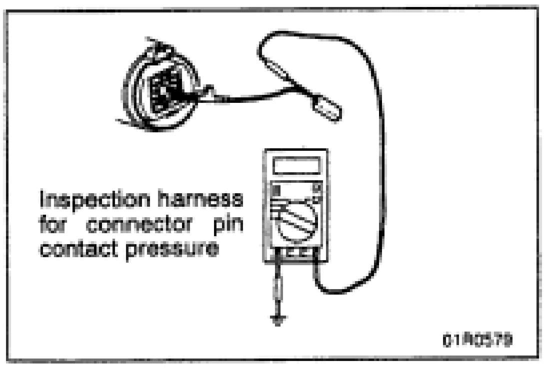
Waterproof Connectors

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

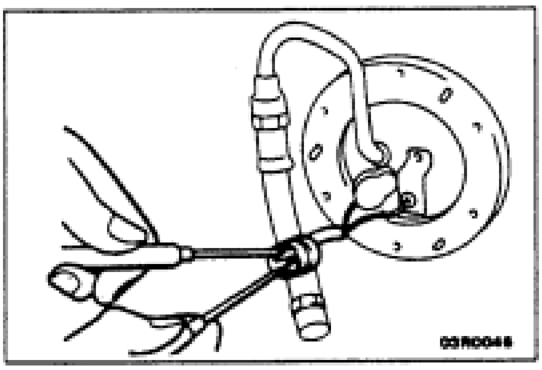
Check by inserting the test bar from the harness side. Note that if the connector (control unit, etc.) is too small to permit insertion of the test bar, it should not be forced; use a special tool (the extra-thin probe in the harness set for checking for this purpose.



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>

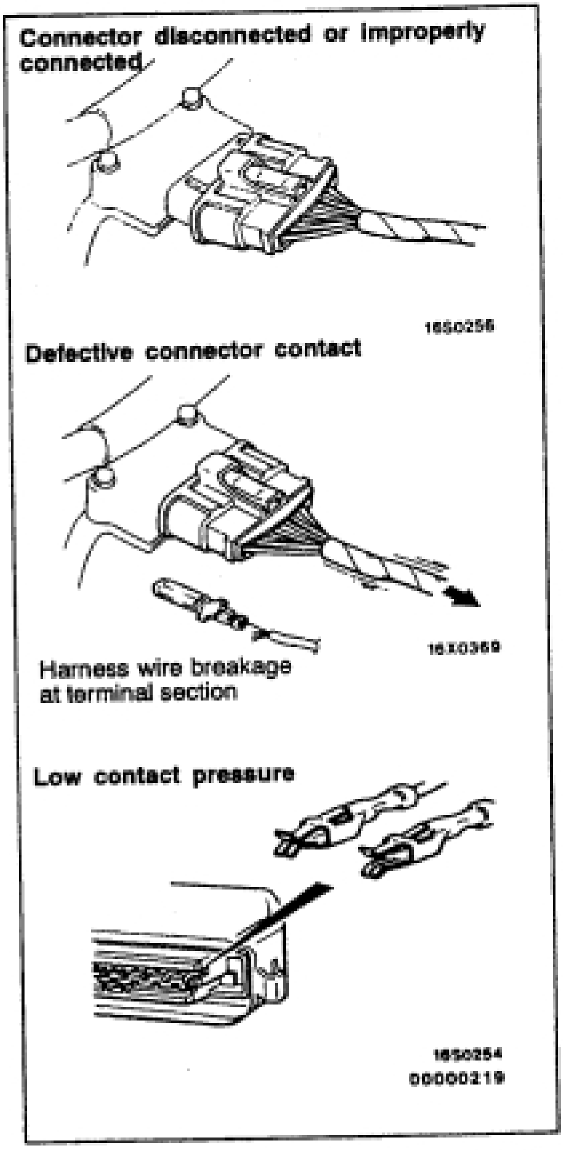
Touch the pin directly with the test bar.

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 INSPECTION

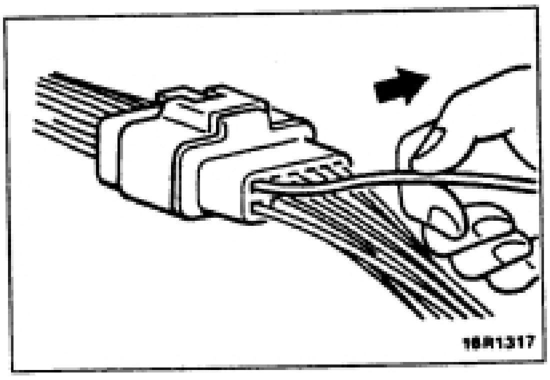
VISUAL INSPECTION

- 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



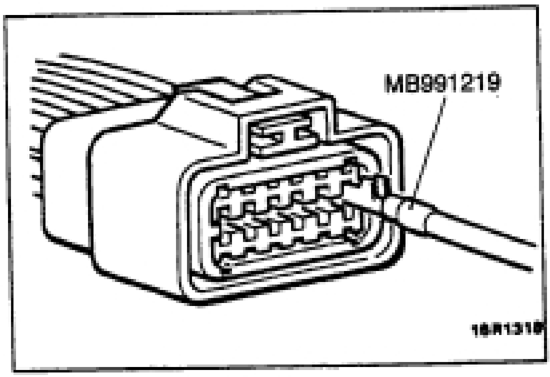
CONNECTOR PIN INSPECTION

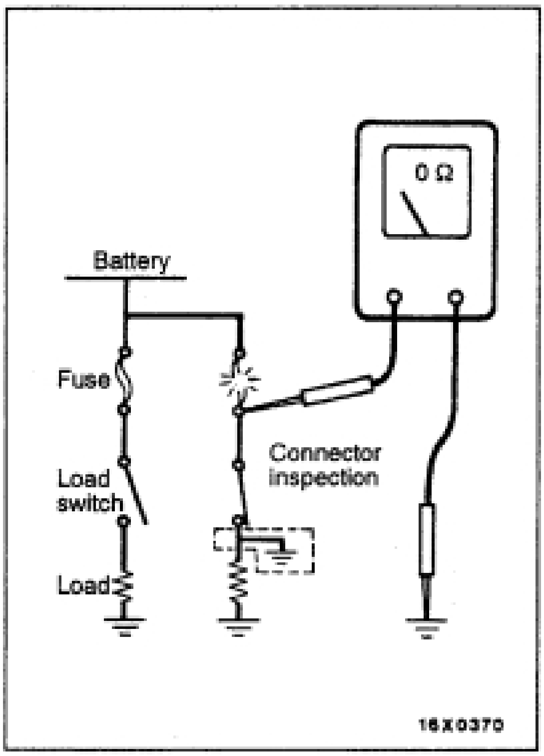
If the connector pin stopper is damaged, the terminal connections (male and female pins) will not be perfect even if the connector body is connected, and the pins may pull out of the reverse side of the connector. Therefore, gently pull the harnesses one by one to make sure that no pins pull out of the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



CONNECTOR ENGAGEMENT INSPECTION

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



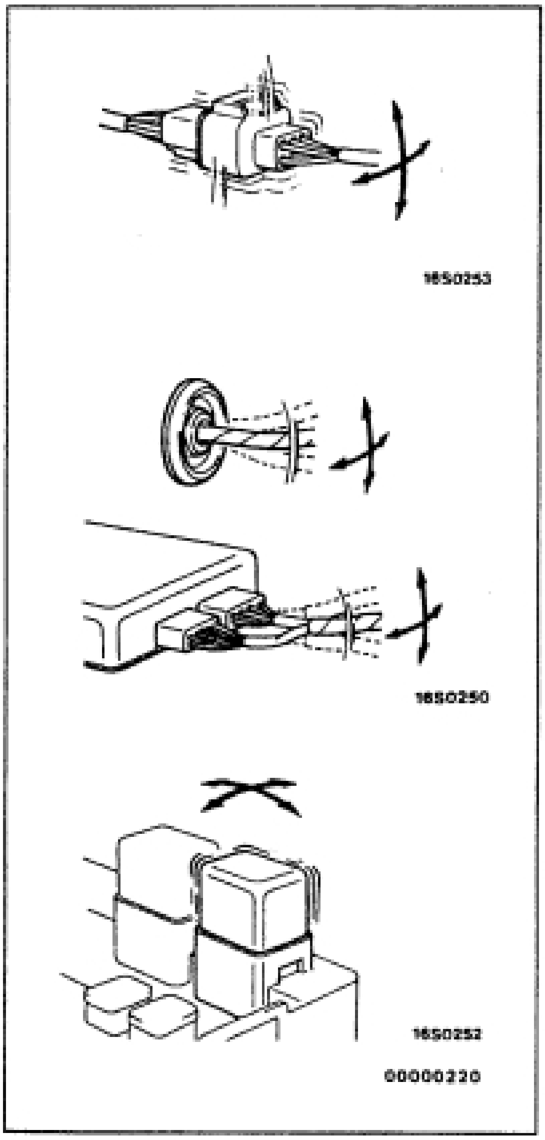


INSPECTION SERVICE POINTS FOR A BLOWN FUSE

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

The main causes of a short circuit are the following.

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



POINTS TO NOTE FOR INTERMITTENT MALFUNCTIONS

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

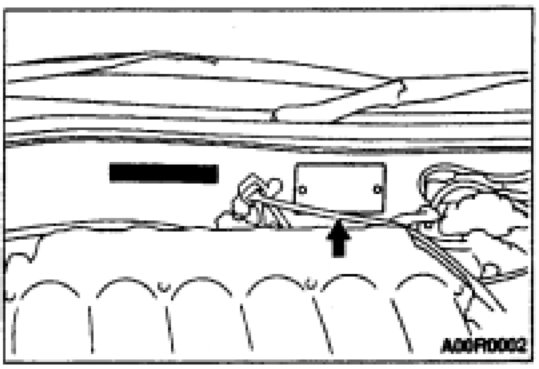
- Gently shake the connector up, down and to the left and right.
- Gently shake the wiring harness up, down and to the left and right.
- Gently rock each sensor and relay, etc. by hand.
- Gently shake the wiring harness at suspensions and other moving parts.

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

VEHICLE IDENTIFICATION

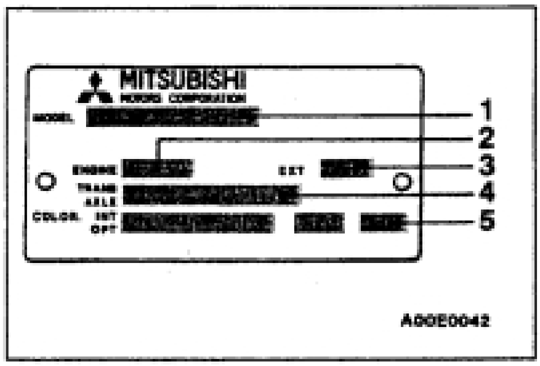
VEHICLE INFORMATION CODE PLATE

LOCATION



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

CODE PLATE DESCRIPTION



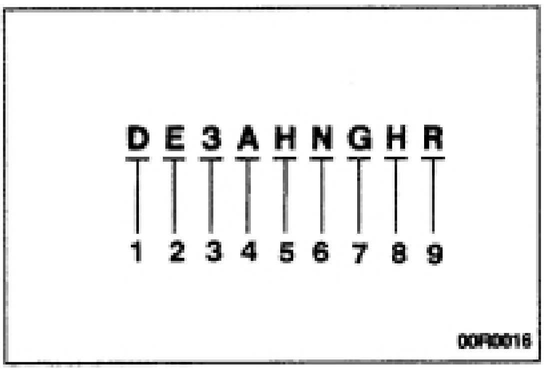
The plate shows model code, engine model, transmission model, and body colour code.

No.	Item	Contents	
1	MODEL	DE3A HNGHR	DE3A: Vehicle model
			HNGHR: Model series
2	ENGINE	6A12	Engine model
3	EXT	A26	Exterior code
4	TRANS AXLE	F5M42	Transmission code
5	COLOR INT OPT	A2630JD62	A26: Body colour code
			30J: Interior code
			D62: Equipment code

For monotone colour vehicles, the body colour code shall be indicated.

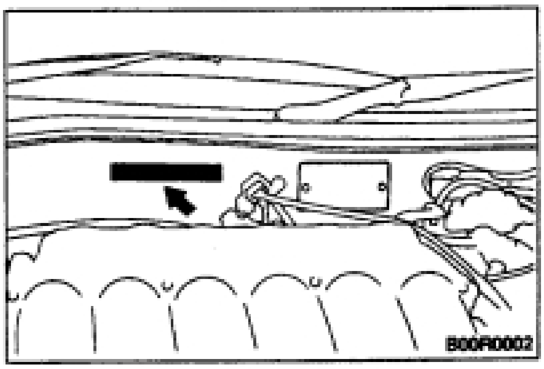
MODELS

Model code		Engine model	Transmission model	Fuel supply system
DE3A	HNGHR	6A12 <V6-MIVEC> (1,998 mℓ)	F5M42 (2WD-5M/T)	MPI
	HYGHR		F5A42 (2WD-5A/T)	



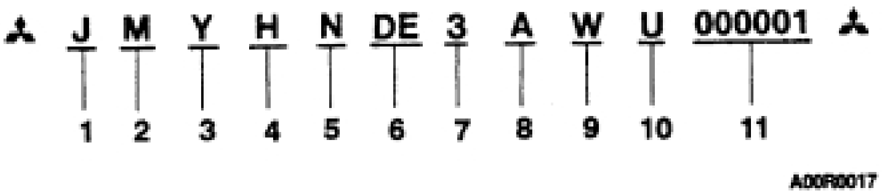
MODEL CODE

No.	Items	Contents
1	Vehicle line	D: FTO
2	Drive system	E: 2WD
3	Engine type	3: 1,998 mℓ petrol engine (6A12 <V6-MIVEC>)
4	Group	A: Passenger car
5	Body style	H: 2-door notchback coupe
6	Transmission type	N: 5-speed manual transmission Y: 5-speed automatic transmission
7	Vehicle grade	G: GPX
8	Specified engine feature	H: MPI-DOHC-MIVEC
9	Steering wheel location	R: Right hand

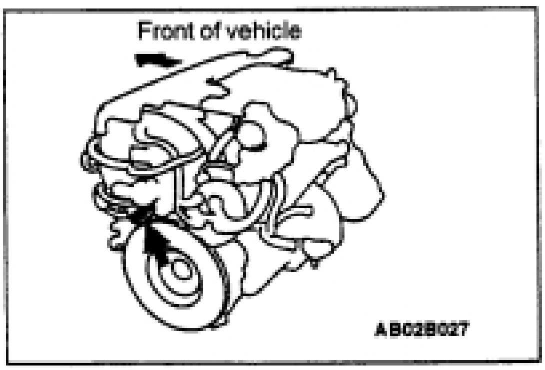


CHASSIS NUMBER

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	Y	For General Export
4	Body style	H	2-door notchback coupe
5	Transmission type	N	5-speed manual transmission
		Y	5-speed automatic transmission
6	Development order	DE	FTO
7	Engine	3	6A12: 1,998 mℓ petrol engine
8	Sort	A	Passenger car
9	Model year	W	1998
10	Plant	U	Mizushima Motor Vehicle Works
11	Serial number	–	–



ENGINE MODEL NUMBER

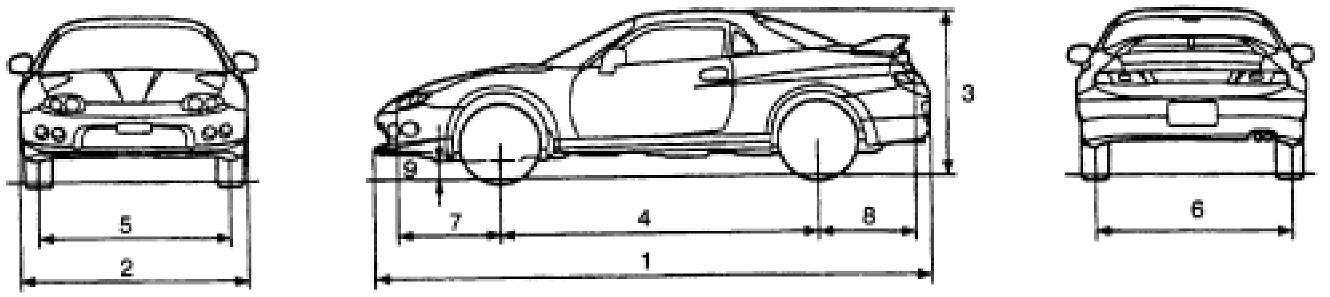
1. The engine model number is stamped at the cylinder block as shown in the following.

Engine model	Engine displacement mℓ
6A12	1998

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

Engine serial number	AA0201 to YY9999

MAJOR SPECIFICATIONS



Items			DE3AHNGHR	DE3AHYGHR
Vehicle dimensions mm	Overall length	1	4,365	4,365
	Overall width	2	1,735	1,735
	Overall height (unladen)	3	1,300, 1,305*	1,300 1,305*
	Wheelbase	4	2,500	2,500
	Track-front	5	1,490	1,490
	Track-rear	6	1,485	1,485
	Overhang-front	7	800	800
	Overhang-rear	8	795	795
	Ground clearance (unladen)	9	150	150
Vehicle weight kg	Kerb weight		1,200	1,240
	Max. gross vehicle weight		1,590	
	Max. axle weight rating-front		930	
	Max. axle weight rating-rear		660	
Seating capacity			4	
Engine	Model No.		6A12	
	Total displacement mℓ		1,998	
Transmission	Model No.		F5M42	F5A42
	Type		5-speed manual	5-speed automatic
Fuel system	Fuel supply system		MPI	

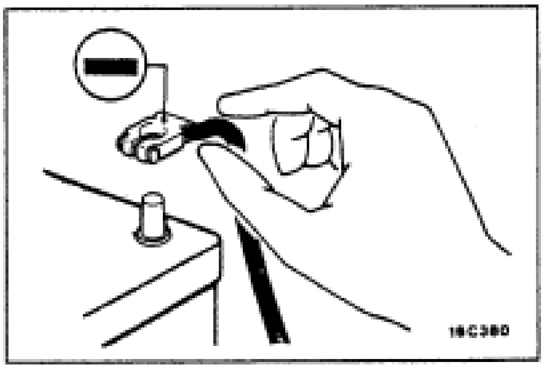
NOTE: * indicates vehicles equipped with sunroof.

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.
   - Sun visor
   - SRS air bag control unit (SRS-ECU)
   - Steering wheel
   - Steering gear and linkage
   - Air bag module (driver's side and front passenger's side)
   - Clock spring

   (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 and clock spring. If faulty replace them.
   (7) Whenever you finish servicing the SRS, check the SRS warning lamp operation to make sure that the system functions properly.
   (8) Be sure to deploy the air bag before disposing of the air bag 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 over 93°C, so remove the SRS components before drying or baking the vehicle after painting.
   After re-installing them, check the SRS warning lamp operation to make sure that the system functions properly.



SERVICING THE ELECTRICAL SYSTEM

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

Caution

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

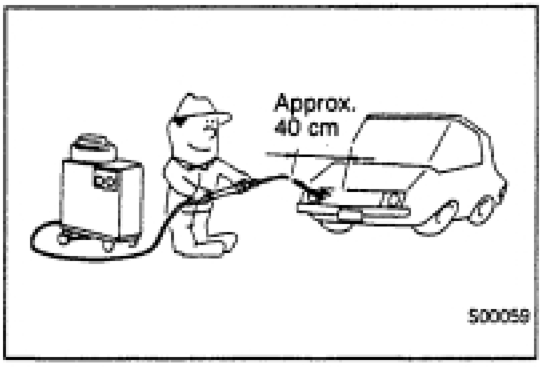
APPLICATION OF ANTI-CORROSION AGENTS AND UNDERCOATS

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

PRE-INSPECTION CONDITION

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

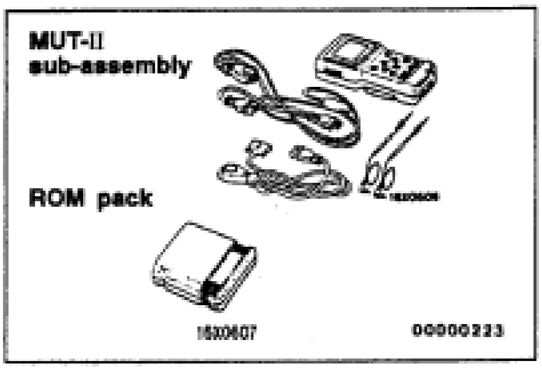
- Engine coolant temperature: 80–90°C
- Lamps, electric cooling fan and all accessories: OFF
- M/T: Neutral
- A/T: P range



VEHICLE WASHING

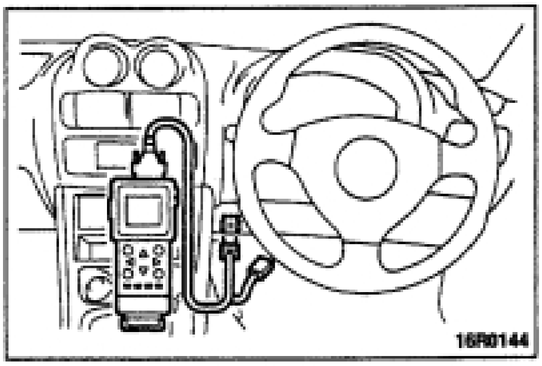
If high-pressure car-washing equipment or steam car-washing equipment is used to wash the vehicle, be sure to note the following information in order to avoid damage to plastic components, etc.

- 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 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 dermatitits. 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

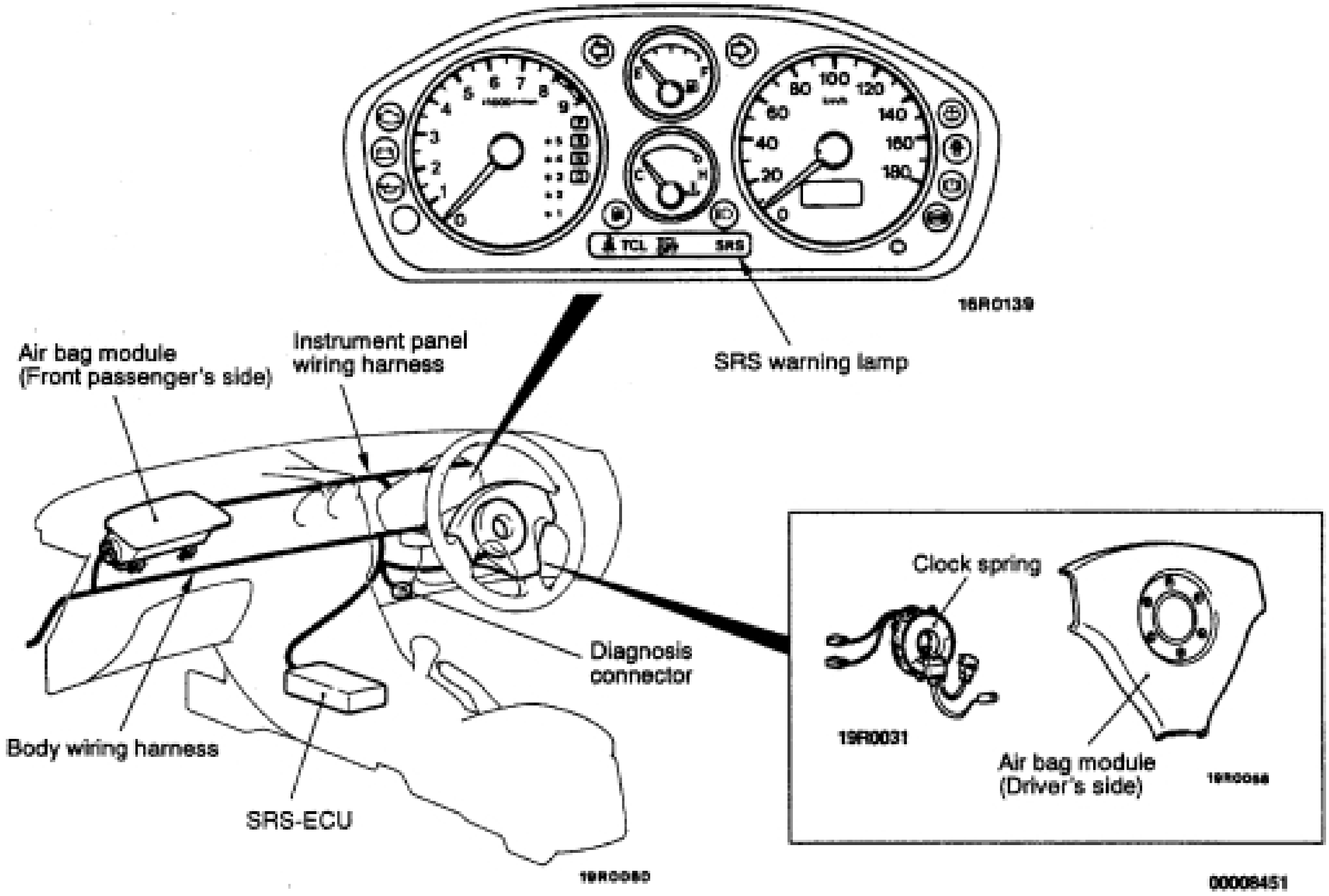
The most effective precaution is to adapt working practices which prevent, as far as practicable, the risk of skin contact with mineral oils, for example by using enclosed systems for handling used engine oil and by degreasing components, where practicable, before handling them.

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)

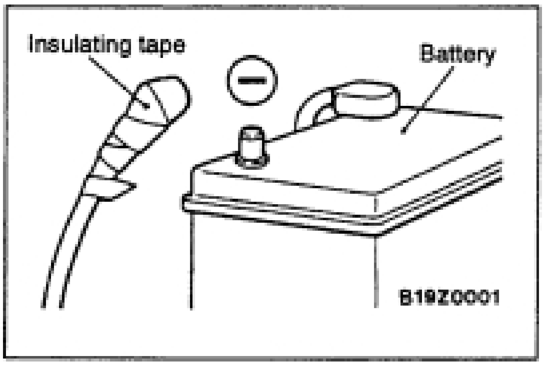
To improve safety, the SRS is equipped as standard parts. This system enhances collision safety by restraining the front passengers in case of an accident.
The SRS consists of two air bag modules, SRS air bag control unit (SRS-ECU), SRS warning lamp and clock spring. The air bags are located in the centre of the steering wheel, above the glove box. 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 warning lamp on the instrument panel indicates the operational status of the SRS. The clock spring is installed in the steering column.
Only authorized service personnel should do work on or around the SRS components. Those service personnel should read this manual carefully before starting any such work. Extreme care must be used when servicing the SRS to avoid injury to the service personnel (by inadvertent deployment of the air bags) or the driver (by rendering the SRS inoperative).



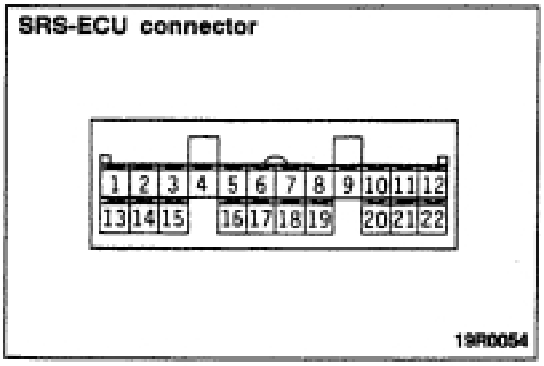
SRS SERVICE PRECAUTIONS

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

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 GROUP 52B.



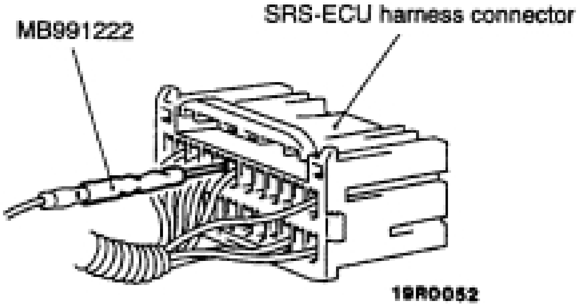
4. **After disconnecting the battery cable, wait 60 seconds or more before proceeding with the following work. The SRS system is designed to retain enough voltage to deploy the air bag for a short time even after the battery has been disconnected, so serious injury may result from unintended air bag deployment if work is done on the SRS system immediately after the battery cables are disconnected.**

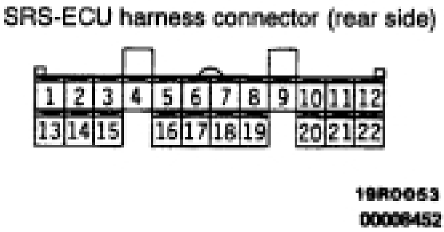


5. Do not attempt to repair the wiring harness connectors of the SRS. If any of the connectors are diagnosed as faulty, replace the wiring harness. If the wires are diagnosed as faulty, replace or repair the wiring harness according to the following table.

SRS-ECU harness connector, terminal number and colour	SRS-ECU Terminal No.	Destination of harness	Remedy
22, yellow	2, 14	Body wiring harness → Earth	Repair or replace each wiring harness.
	5	Body wiring harness → Junction block (Fuse No.8)	
	6	Body wiring harness → Diagnosis connector	
	12	Body wiring harness → Instrument panel wiring harness → SRS warning lamp	
	13, 22	Body wiring harness → Air bag module (Front passenger's side)	
	15, 20	Body wiring harness → Clock spring	Replace the clock spring, or repair or replace the body wiring harness.
	16	Body wiring harness → Instrument panel wiring harness → Junction block (Fuse No.4)	Repair or replace each wiring harness.

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





7. SRS components should not be subjected to heat over 93°C, so remove the SRS-ECU, air bag module (driver's side and front passenger's side), clock spring 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 OFF when the MUT-II is connected or disconnected.
10. If you have any questions about the SRS, please contact your local distributor.

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

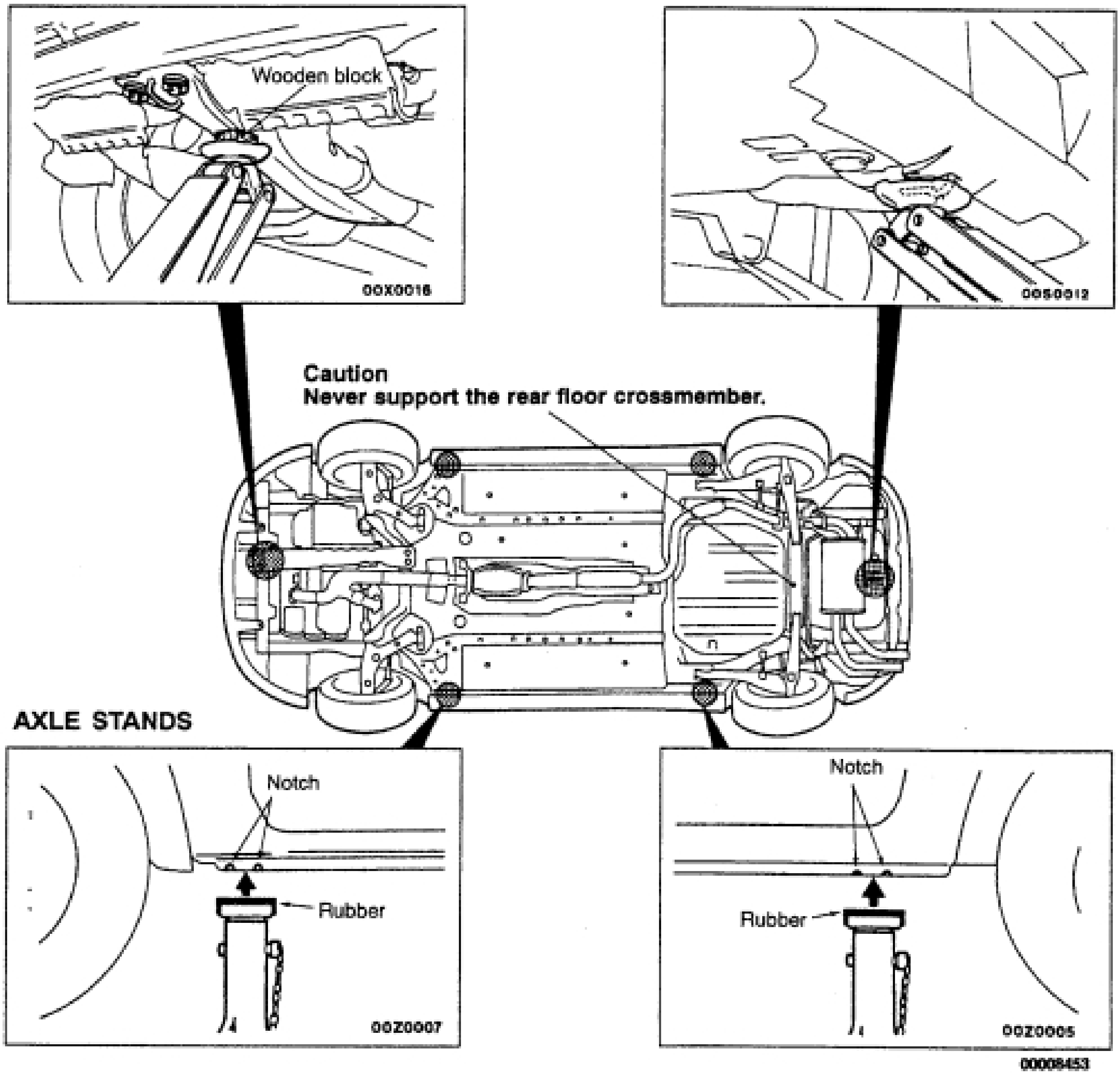
SUPPORT LOCATIONS FOR LIFTING AND JACKING

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 AND AXLE STANDS

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

GARAGE JACK

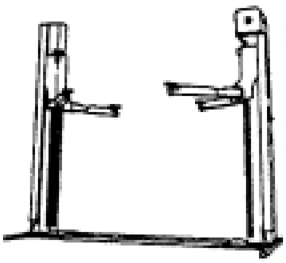


SUPPORT POSITIONS FOR A SINGLE-POST LIFT OR DOUBLE-POST LIFT

Caution

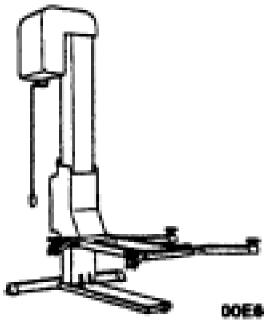
When service procedures require removing rear suspension, spare tyre and rear bumper, place additional weight on rear end of vehicle or anchor vehicle to hoist to prevent tipping of centre of gravity changes.

DOUBLE-POST LIFT



00E610

SINGLE-POST LIFT



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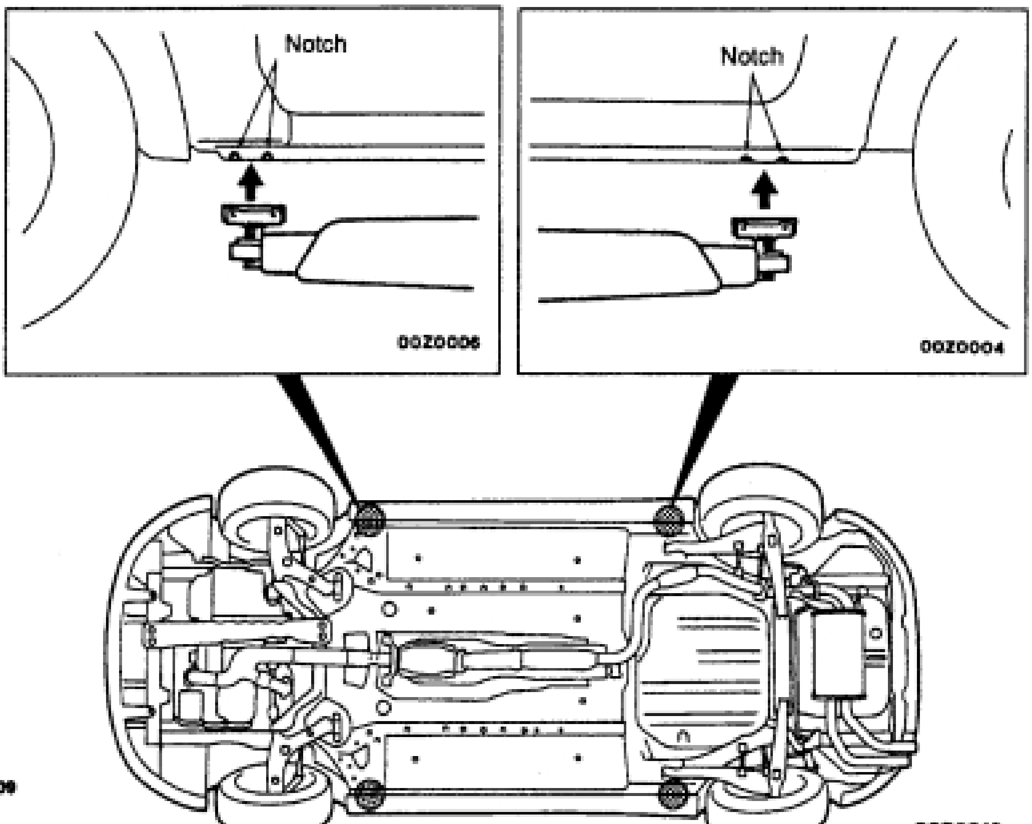

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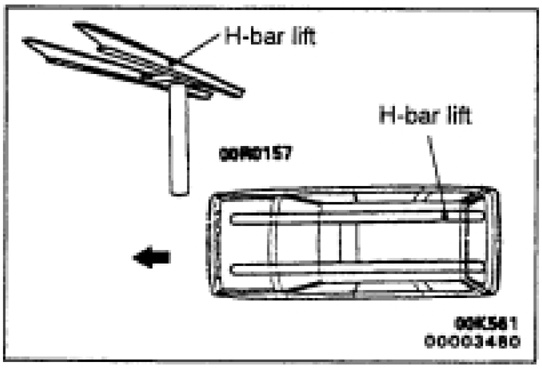
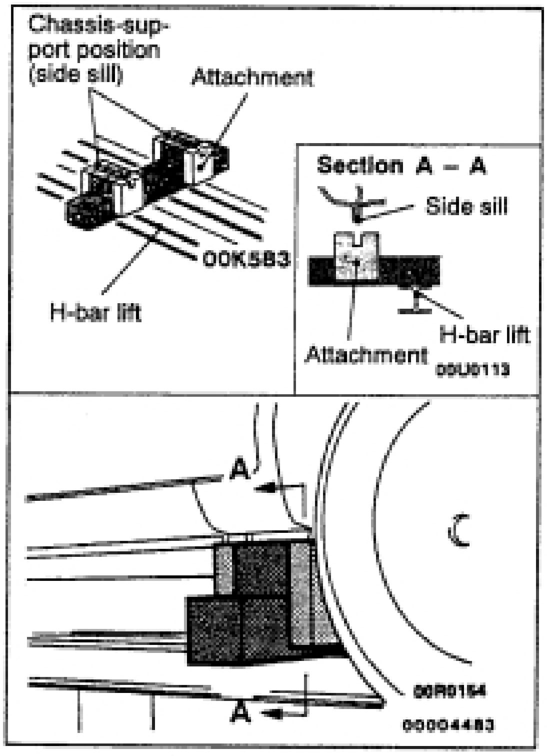


SUPPORT POSITIONS AND SUPPORT METHOD FOR AN H-BAR LIFT

Caution

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

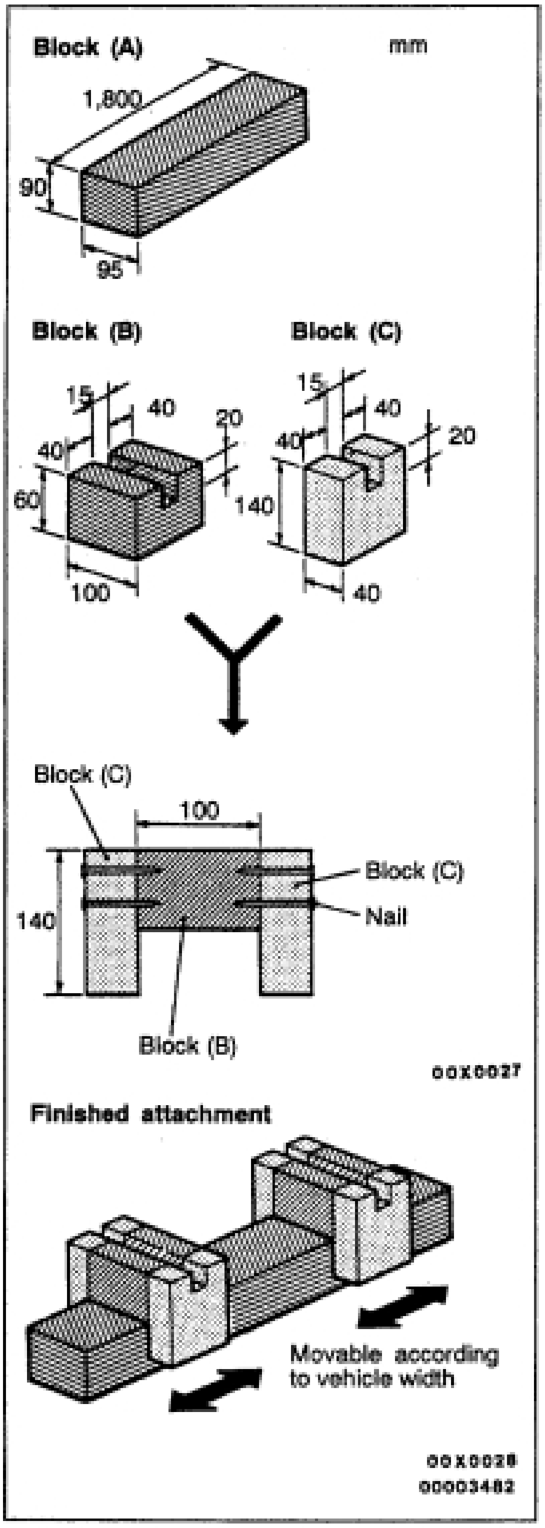
When H-bar lift is used to lift up vehicles, use of metallic attachment attached to the H-bar lift may cause damage to the suspension arm etc. Therefore, lift up the vehicle by the following procedure.



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

   Caution

   If support is at any location other than the designated positions, the body or suspension might be deformed or otherwise damaged, so care should be taken to support only at the correct (designated) positions.
3. Raise the H-bar lift to the height at which the vehicle is slightly raised and check to be sure that the vehicle is correctly and sufficiently secured; then raise the vehicle.



PREPARATION OF "ATTACHMENTS"

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

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

Caution
The wood selected for the blocks must be hard.

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

STANDARD PART/TIGHTENING-TORQUE TABLE

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

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

Standard bolt and nut tightening torque

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

Flange bolt and nut tightening torque

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

ENGINE

CONTENTS

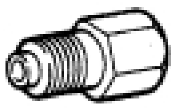
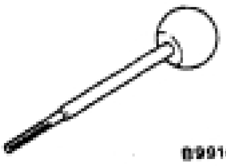
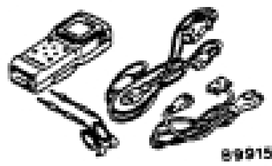
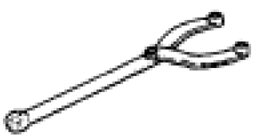
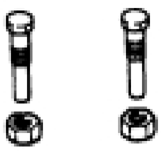
SERVICE SPECIFICATIONS

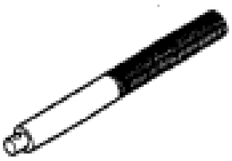
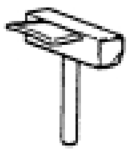
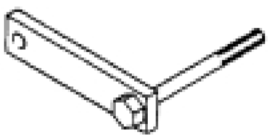
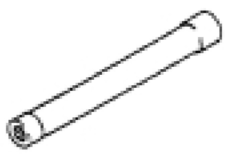
Items			Standard value	Limit
Alternator drive belt tension	Vibration frequency Hz	When checked	106 – 137	–
		When a used belt is installed	115 – 130	–
		When a new belt is installed	137 – 162	–
	Tension N	When checked	294–490	–
		When a used belt is installed	343–441	–
		When a new belt is installed	490–686	–
	Deflection (Reference value) mm	When checked	9.0–13.0	–
		When a used belt is installed	10.0–12.0	–
		When a new belt is installed	6.0–8.0	–
Power steering oil pump and A/C compressor drive belt tension	Vibration frequency Hz	When checked	143 – 169	–
		When a used belt is installed	150 – 163	–
		When a new belt is installed	180 – 202	–
	Tension N	When checked	490–686	–
		When a used belt is installed	539–637	–
		When a new belt is installed	789–980	–
	Deflection (Reference value) mm	When checked	4.4–5.2	–
		When a used belt is installed	4.6–5.0	–
		When a new belt is installed	3.4–4.0	–
Valve clearance (at cold) [value in ( ) indicates measured value at cam side] mm		Intake side	0.16 (0.10)	–
		Exhaust side	0.21 (0.13)	–
Basic ignition timing			5°	–
Idle speed r/min			700 ± 50	–
CO contents %			0.6 or less	–
Compression pressure (250 r/min) kPa			1226	Min. 1030
Compression pressure difference of all cylinder kPa			–	Max. 98
Intake manifold vacuum kPa			–	Min. 60
Cylinder head bolt shank length mm			–	96.4
Auto-tensioner push rod movement mm			Within 1	–
Timing belt tension torque Nm			3	–
Auto-tensioner rod protrusion amount mm			3.8 – 4.5	–

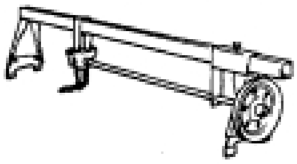
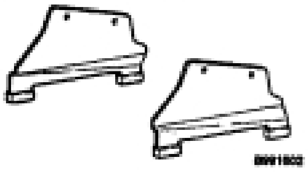
SEALANTS

Items	Specified sealants	Remarks
Oil pan	MITSUBISHI GENUINE PART MD970389 or equivalent	Semi-drying sealant
Flywheel bolt <M/T> or drive plate bolt <A/T>	3M ATD Part No.8660 or equivalent	Semi-drying sealant
Rocker cover, bearing cap, OCV holder, cam cap	3M Stud Locking 4170 or equivalent	–

SPECIAL TOOLS

Tool	Number	Name	Use
	MB991477	Valve adjusting socket	Adjustment of the valve clearance
 B991479	MB991479	Rocker arm piston checker	Adjustment of the valve clearance
	MB991668	Belt tension meter set	Drive belt tension measurement (used together with MUT-II)
 B991502	MB991502	MUT-II sub assembly	• Engine idle speed check • Basic ignition timing check • Drive belt tension measurement
	MB990767	End yoke holder	• Holding the camshaft sprocket • Holding the crankshaft pulley
	MD998719 or MD998754	Crankshaft pulley holder pin	
	MD998777	Camshaft oil seal adapter	Press-in of the camshaft oil seal (right bank side)

Tool	Number	Name	Use
	MD998713	Camshaft oil seal installer	• Press-in of the camshaft oil seal • Press-in of the circular packing
	MD998776	Crankshaft rear oil seal installer	Press-in of the crankshaft rear oil seal
	MB990938	Handle	Press-in of the crankshaft rear oil seal
	MD998767	Tension pulley socket wrench	Timing belt tension adjustment
	MD998717	Crankshaft front oil seal installer	Press-in of the crankshaft front oil seal
	MD998727	Oil pan remover	Removal of oil pan
	MD998781	Flywheel stopper	Securing the flywheel <M/T> or drive plate <A/T>
	MB991653	Cylinder head bolt wrench	Removal and installation of the cylinder head bolt
	MD998716	Crankshaft wrench	Turning of the crankshaft

Tool	Number	Name	Use
	GENERAL SERVICE TOOL MZ203827	Engine lifter	Supporting the engine assembly during removal and installation of the transmission
	MB991602	Foot assembly	
	MB991453	Engine hanger assembly	

ON-VEHICLE SERVICE

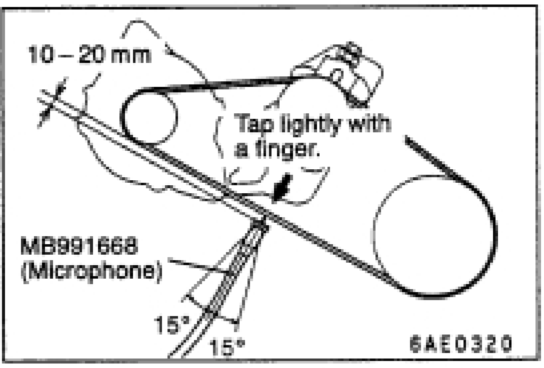
DRIVE BELT TENSION CHECK AND ADJUSTMENT

ALTERNATOR DRIVE BELT TENSION CHECK

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

Standard value:

Items	When checked	When a used belt is installed	When a new belt is installed
Vibration frequency Hz	106 – 137	115 – 130	137 – 162
Tension N	294 – 490	343 – 441	490 – 686
Deflection (Reference value) mm	9.0 – 13.0	10.0 – 12.0	6.0 – 8.0

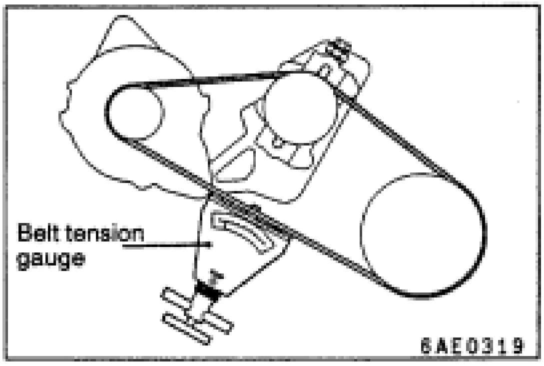


<When using the MUT-II>

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

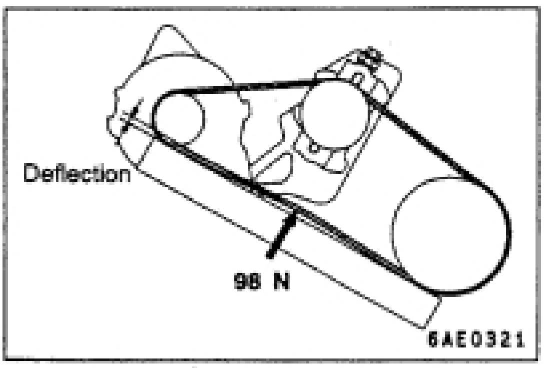
Caution

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



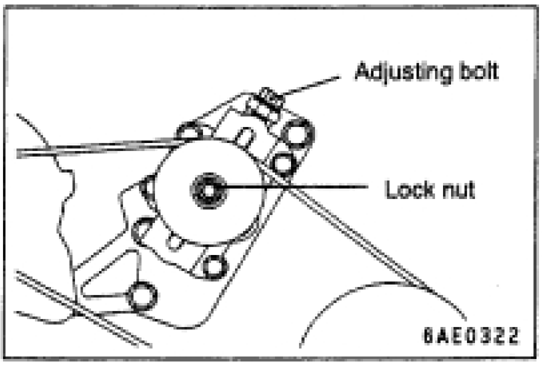
<When using a tension gauge>

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



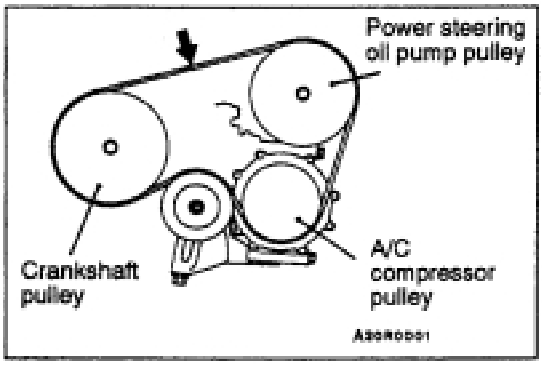
<Belt deflection check>

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



2. If outside the standard value, adjust the tension by the following procedure.
   (1) Loosen the lock nut.
   (2) Adjust the belt tension using adjusting bolt.
   (3) Tighten the lock nut.
   (4) Check the belt tension, and readjust if necessary.

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



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

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

   Standard value:

Items	When checked	When a used belt is installed	When a new belt is installed
Vibration frequency Hz	143 – 169	150 – 163	180 – 202
Tension N	490–686	539–637	784–980
Deflection mm	11.0–15.0	12.0–14.0	8.0–12.0

<When using the MUT-II>

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 range.

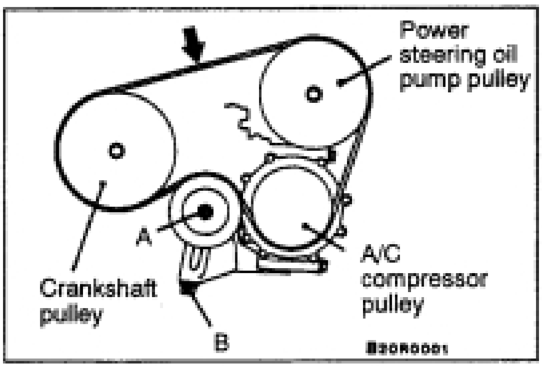
NOTE
Refer to P.11A-6 for details on the method of measuring the vibration frequency using the MUT-II.

<When using a tension gauge>

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

<Belt deflection check>

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

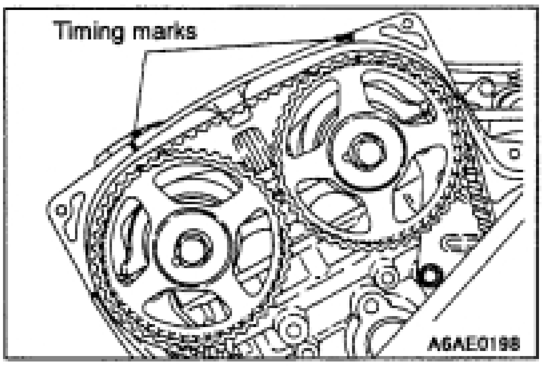


2. If outside the standard value, adjust by the following procedure.
   (1) Loosen the oil pump fixing nut A.
   (2) Adjust the amount of belt deflection using adjusting bolt B.
   (3) Tighten the fixing nut A
   Tightening torque: 49 Nm
   (4) Check the belt tension, and readjust if necessary.
   Caution
   Check after turning the crankshaft once or more clockwise (right turn).

VALVE CLEARANCE CHECK AND ADJUSTMENT

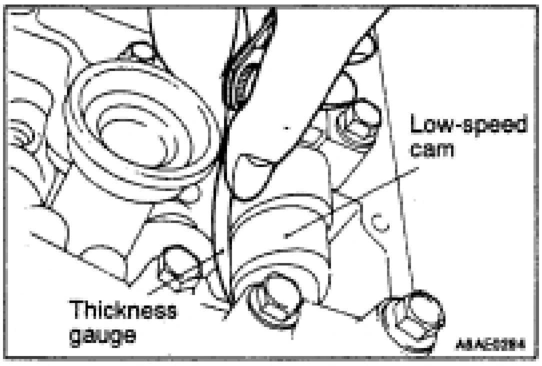
NOTE
Perform the check and adjustment when the engine is cold.

1. Remove the air intake plenum.
2. Remove all of the spark plugs.
3. Remove the timing belt upper cover.



4. Turn the crankshaft clockwise to align the timing marks on the camshaft sprockets. This sets the No.1 cylinder to top dead centre.
5. Remove the rocker cover.
6. Check the valve clearances of the valves indicated in the following table.

Cylinder No.	1	2	3	4	5	6
Intake valve	○					○
Exhaust valve	○	○				



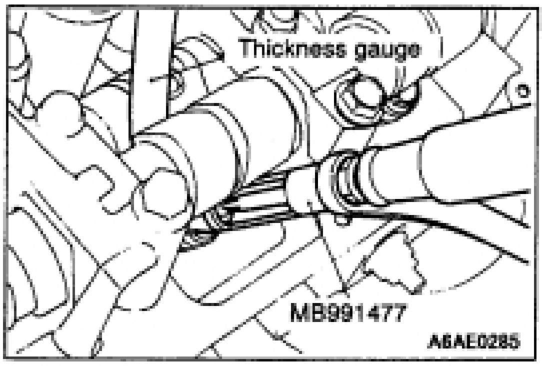
Checking method

Insert the thickness gauge into the clearance between the low-speed cam (narrower cam) and roller, and measure the clearance.

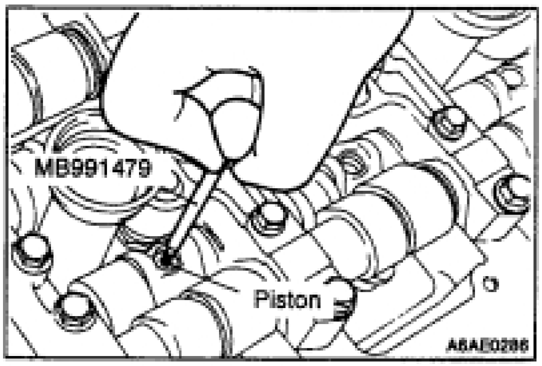
Standard value:
Intake valve 0.10 mm
Exhaust valve 0.13 mm

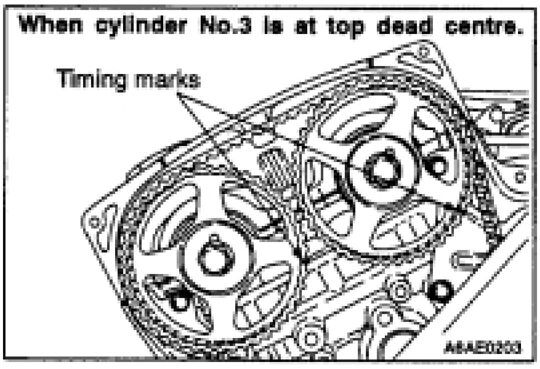
NOTE
If the above values are satisfied, the clearance at the valve side should be as follows:

Intake valve 0.16 mm
Exhaust valve 0.21 mm



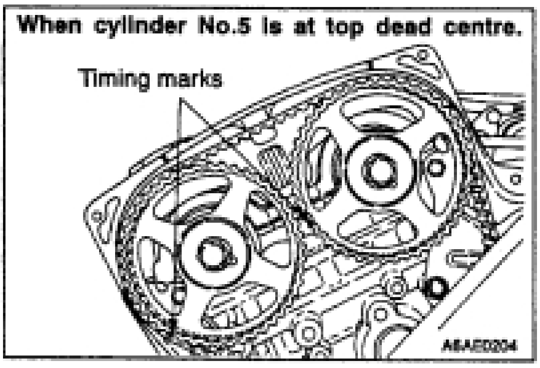
7. If the valve clearance deviates from the standard value, adjust by the following procedure.
   (1) Using the special tool, loosen the adjusting screw lock nut.
   (2) Insert the thickness gauge into the clearance between the low-speed cam (narrower cam) and roller.
   (3) Screw in one of the two adjusting screws until it contacts the valve (the screw begins to be tightened hard).
   (4) Screw in the other of the two adjusting screws until it contacts the valve (the screw begins to be tightened hard). Then tighten the lock nut.
   (5) Loosen the screw which has been screwed in at step (3) slightly (until the screw begins to turn freely), and screw in again until it contacts the valve (the screw begins to be tightened hard). Then tighten the lock nut.
   (6) Remove the thickness gauge.
   (7) Screw in the special tool into the piston top of the rocker arm 'H' (wider one), and check that the piston can be pulled up by hand.





8. Turn the crankshaft approx. 240° clockwise from the No.1 cylinder top dead centre. This sets the No.3 cylinder to top dead centre.
9. Check and adjust the valve clearances of the valves indicated in the following table, according to steps 6 and 7.

Cylinder No.	1	2	3	4	5	6
Intake valve		○	○			
Exhaust valve			○	○		



10. Turn the crankshaft approx.240° clockwise further from the top dead centre of the No.3 cylinder. This sets the No.5 cylinder to top dead centre.
11. Check and adjust the valve clearances of the valves indicated in the following table, according to steps 6 and 7.

Cylinder No.	1	2	3	4	5	6
Intake valve				○	○	
Exhaust valve					○	○

12. Install the rocker cover.
13. Install the timing belt upper cover.
14. Install the spark plugs.
15. Install the air intake plenum.

IGNITION TIMING CHECK

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Connect the MUT-II to the diagnosis connector.
3. Set up a timing light.
4. Start the engine and run at idle.
5. Check that engine idle speed is within the standard value.

   Standard value: approx. 700

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

   Standard value: 5° BTDC±3°

8. If the basic ignition timing is outside the standard value, inspect the MPI system while referring to GROUP 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. 10°BTDC

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

IDLE SPEED CHECK

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

   Standard value: 5° BTDC±3°

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

   Curb idle speed: 750 ± 100 r/min

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

6. If the idle speed is outside the standard value, check the MPI 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 OFF and connect the MUT-II to the diagnosis connector.
3. Check that the basic ignition timing is within the standard value.

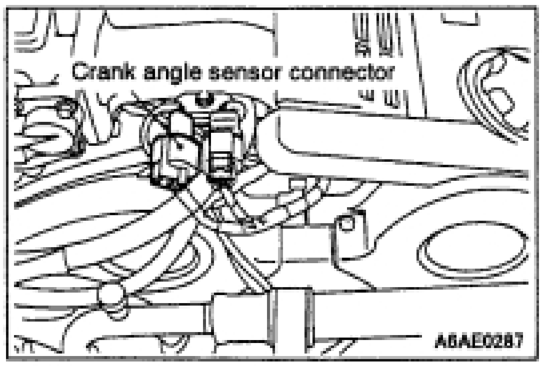
   Standard value: 5° BTDC±3°

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

   Standard value: 0.6% or less

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

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



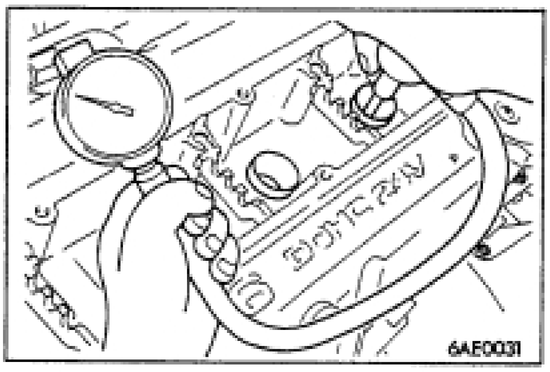
COMPRESSION PRESSURE CHECK

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

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

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

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



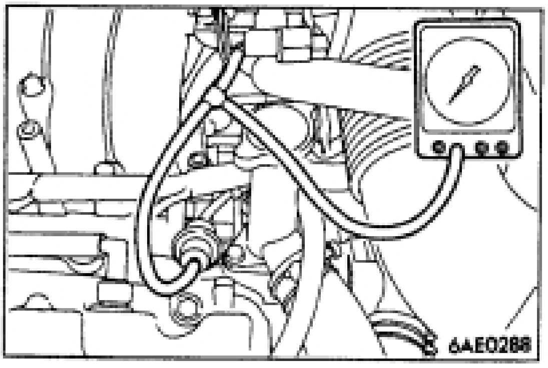
6. Set compression gauge to one of the spark plug holes.
7. Crank the engine with the throttle valve fully open and measure the compression pressure.

   Standard value (at engine speed of 250 r/min): 1226 kPa

   Limit (at engine speed of 250 r/min): min. 1030 kPa
8. Measure the compression pressure for all the cylinders, and check that the pressure differences of the cylinders are below the limit.

   Limit: max. 98 kPa
9. If there is a cylinder with compression or a compression difference that is outside the limit, pour a small amount of engine oil through the spark plug hole, and repeat the operations in steps from (6) to (8).
   (1) If the compression increases after oil is added, the cause of the malfunction is a worn or damaged piston ring and/or cylinder inner surface.
   (2) If the compression does not rise after oil is added, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket.
10. Connect the crank angle sensor connector.
11. Install the spark plugs and spark plug cables.
12. Use the MUT-II to erase the diagnosis codes.

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

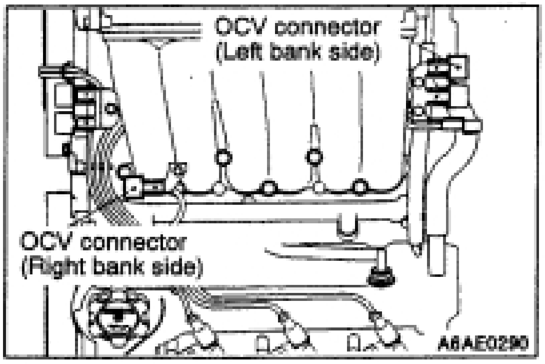


MANIFOLD VACUUM CHECK

1. Set the vehicle to the pre-inspection condition.
2. Set the engine tachometer or connect the MUT-II.
3. Check that the idle speed is within the standard value.

   NOTE
   When using the MUT-II, select the code No.22.
4. Connect the three-way union joint to the vacuum hose between the fuel pressure regulator and the air intake plenum, and connect a vacuum gauge.
5. Check the manifold vacuum at idle.

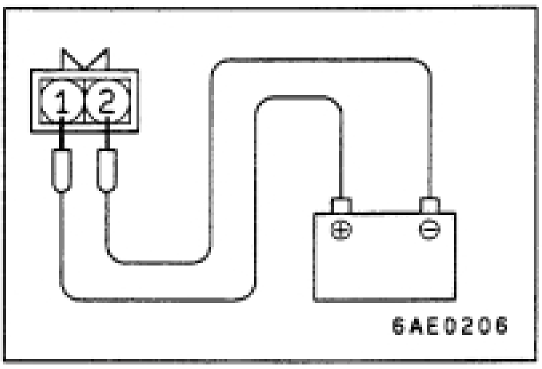
   Limit: 60 kPa



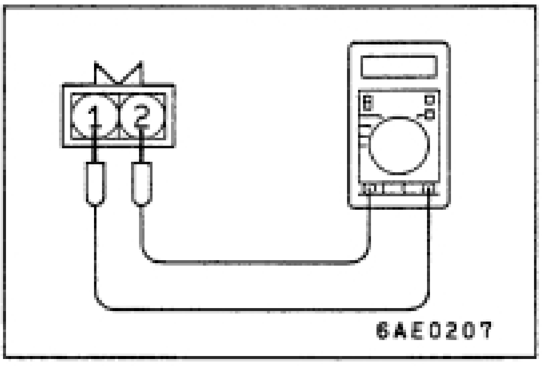
OIL CONTROL VALVE (OCV) CHECK

OPERATING SOUND CHECK

1. Disconnect the two OCV connectors.



2. When battery voltage is applied between terminals of the OCV-side connector, the operating sound of the OCV (for high-speed switching over) should be heard.



MEASUREMENT OF RESISTANCE BETWEEN TERMINALS

1. Disconnect the two OCV connectors.
2. Measure the resistance between terminal 1 and terminal 2 at the OCV connector side.

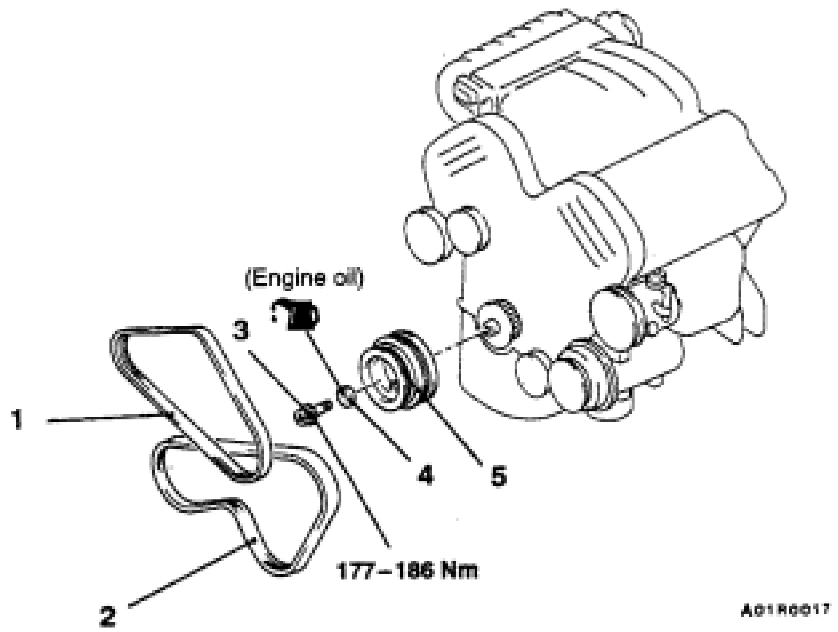
   Standard value: 6.0 – 7.5 Ω (at 20°C)

CRANKSHAFT PULLEY

REMOVAL AND INSTALLATION

Pre-removal Operation
Under Cover Removal

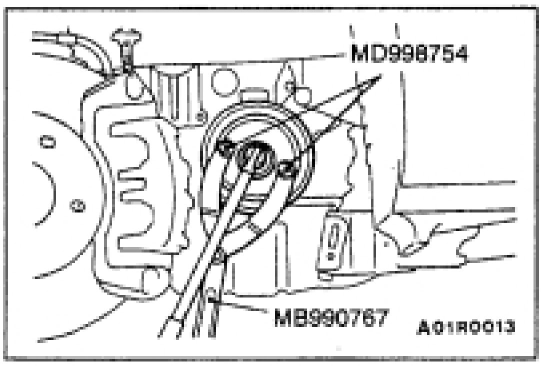
Post-installation Operation
• Under Cover Installation • Drive Belt Tension Adjustment (Refer to P.11A-5.)



Removal steps

1. Drive belt (Alternator)
2. Drive belt (Power steering oil pump, A/C compressor)

◀A▶ ▶A◀ 3. Crankshaft bolt
4. Washer
◀A▶ ▶A◀ 5. Crankshaft pulley



REMOVAL SERVICE POINT

◀A▶ CRANKSHAFT BOLT/CRANKSHAFT PULLEY REMOVAL

INSTALLATION SERVICE POINT

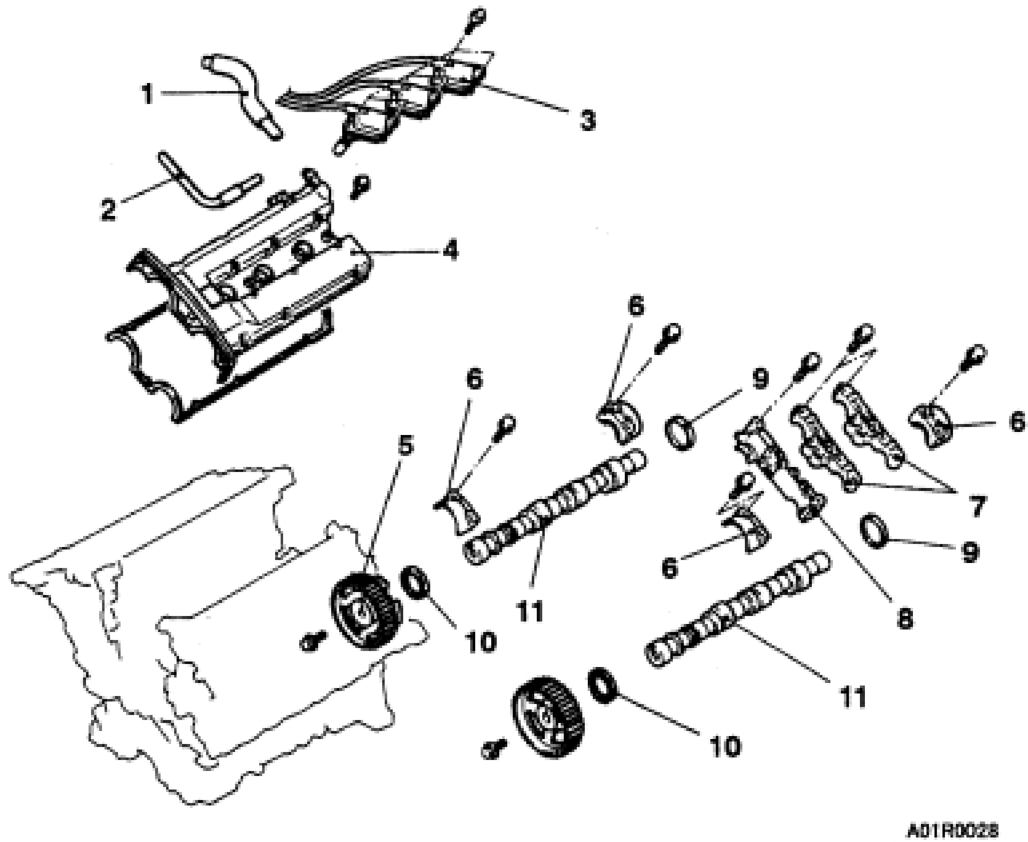
▶A◀ CRANKSHAFT BOLT/CRANKSHAFT PULLEY INSTALLATION

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

CAMSHAFT AND CAMSHAFT OIL SEAL

<Left bank side>

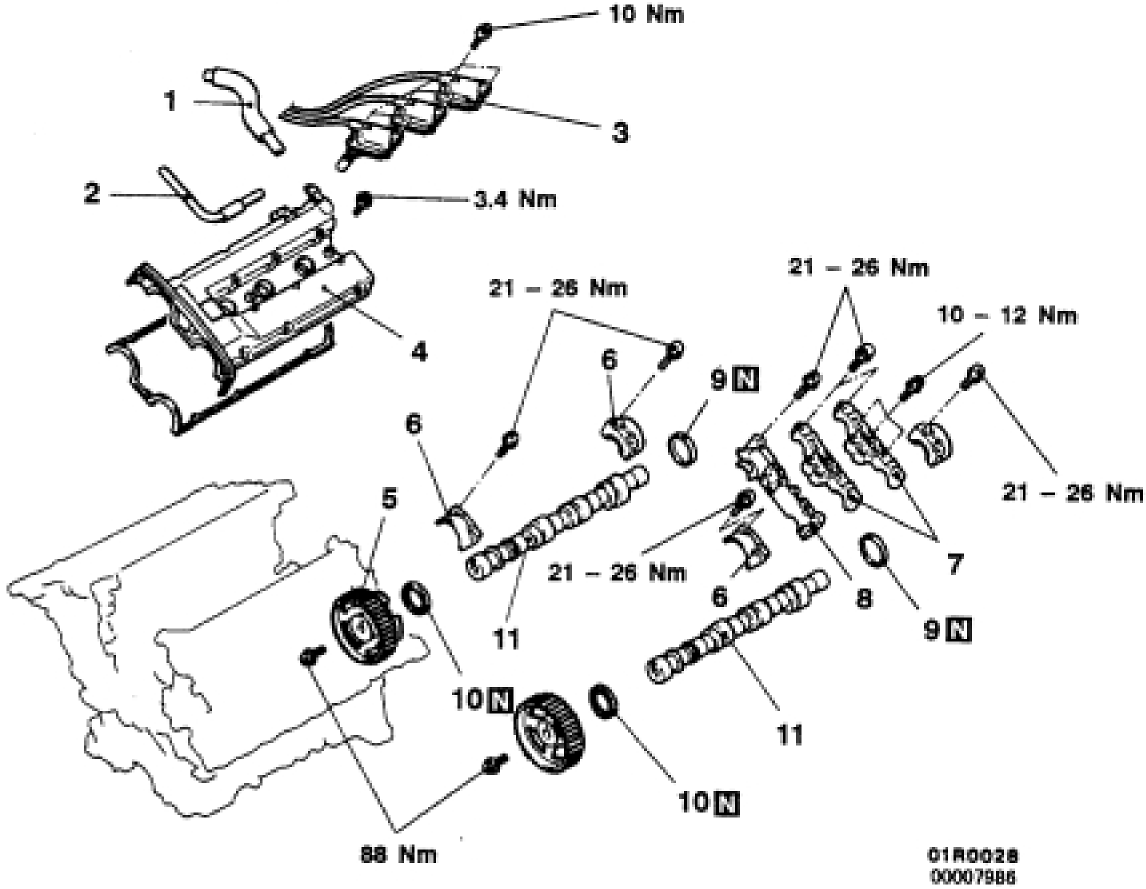
Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying (Refer to GROUP 14 – On-vehicle Service.)
- Air Cleaner Assembly Removal and Installation
- Timing Belt Removal and Installation (Refer to P.11A-29.)
- Fuel Discharge Prevention (Refer to GROUP 13A – On-vehicle Service.)



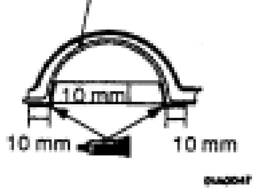
Removal steps (Left bank side)

1. Blow-by hose
2. PCV hose
3. Ignition coil assembly
4. Rocker cover
5. ◄A► Camshaft sprocket assembly
6. Cam caps, front and rear
7. Camshaft bearing cap, centre
8. OCV holder assembly
9. Circular packing
10. Camshaft oil seal
11. Camshaft

<Left bank side>



Rocker cover gasket



Sealant: 3M ATD Part No.8660 or equivalent

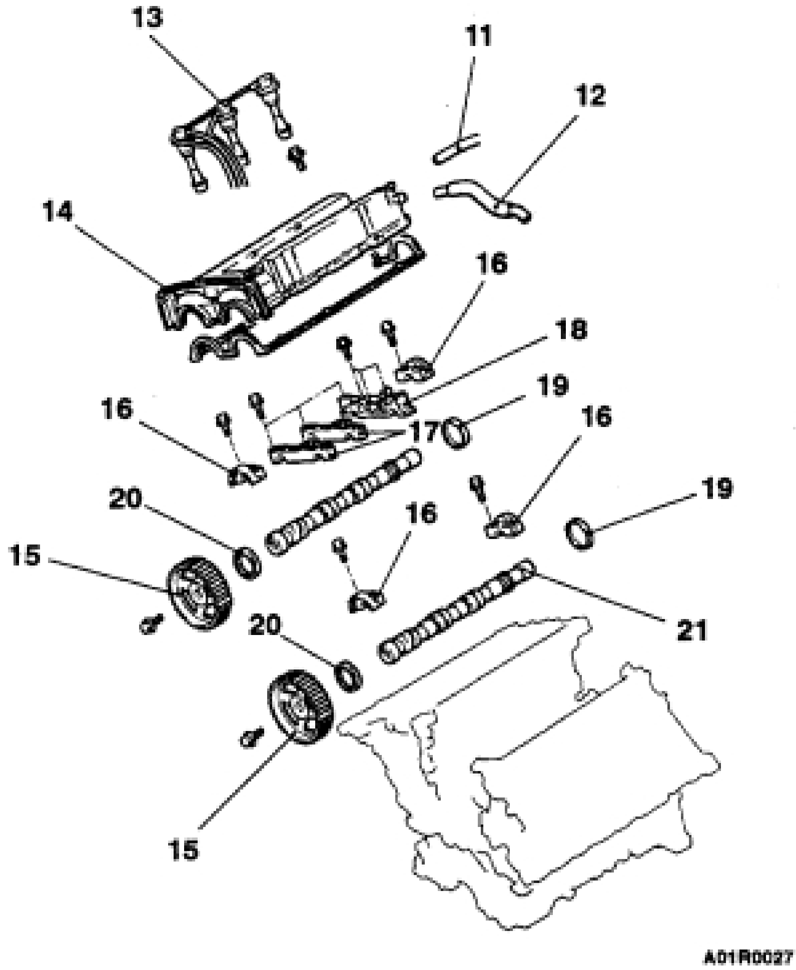
Apply engine oil to all moving parts prior to installation.

Installation steps (Left bank side)

- ▶A◀ 11. Camshaft
- ▶B◀ 8. OCV holder assembly
- ▶B◀ 7. Camshaft bearing cap
- ▶B◀ 6. Cam caps, front and rear
- ▶C◀ 10. Camshaft oil seal
- ▶D◀ 9. Circular packing
- ▶E◀ 5. Camshaft sprocket assembly
- 4. Rocker cover
- 3. Ignition coil assembly
- 2. PCV hose
- 1. Blow-by hose

<Right bank side>

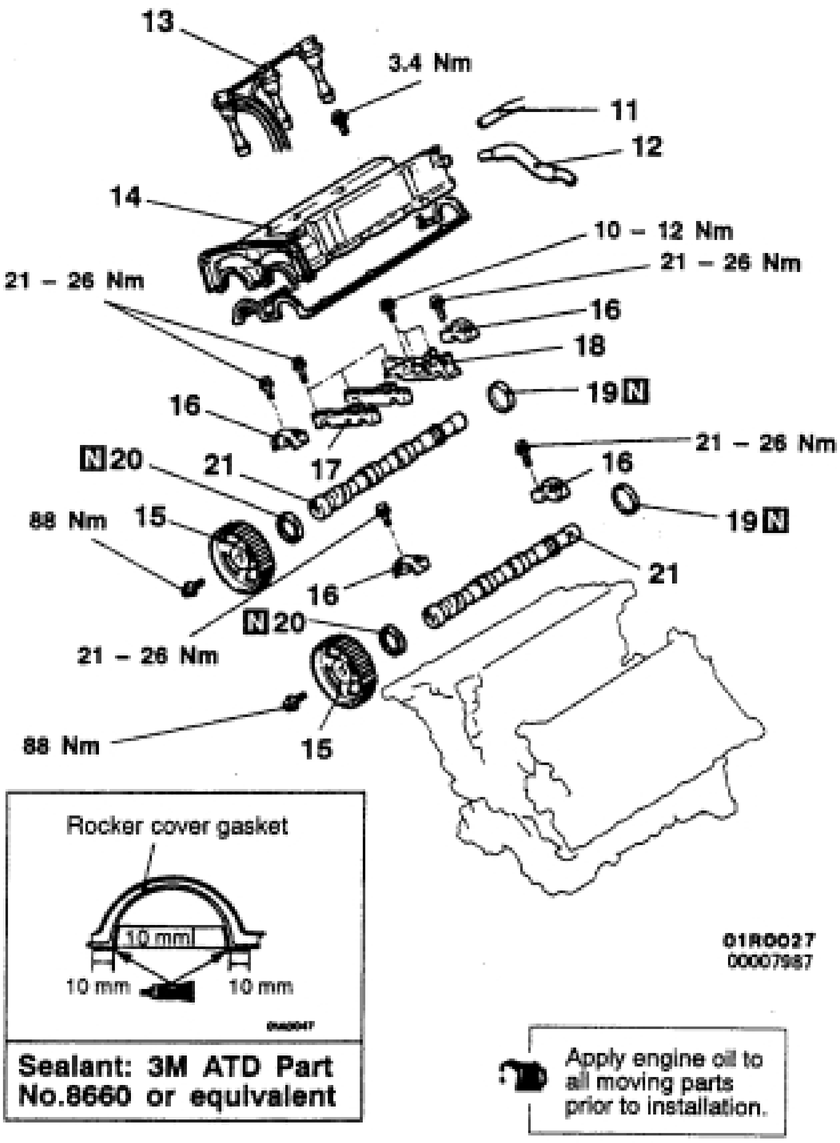
Pre-removal and Post-installation
- Engine Coolant Draining and Supplying (Refer to GROUP 14 – On-vehicle Service.)
- Air Cleaner Assembly Removal and Installation
- Air Intake Plenum Removal and Installation (Refer to GROUP 15 – Intake Manifold.)
- Timing Belt Removal and Installation (Refer to P.11A-29.)
- Camshaft Position Sensor Removal and Installation (Refer to GROUP 16.)



Removal steps (Right bank side)

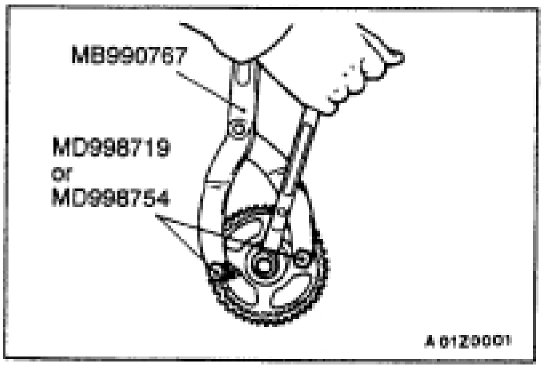
11. Breather hose
12. Blow-by hose
13. Spark plug cable assembly
14. Rocker cover
◀A▶ 15. Camshaft sprocket
16. Cam caps, front and rear
17. Camshaft bearing cap, centre
18. OCV holder assembly
19. Circular packing
20. Camshaft oil seal
21. Camshaft

<Right bank side>



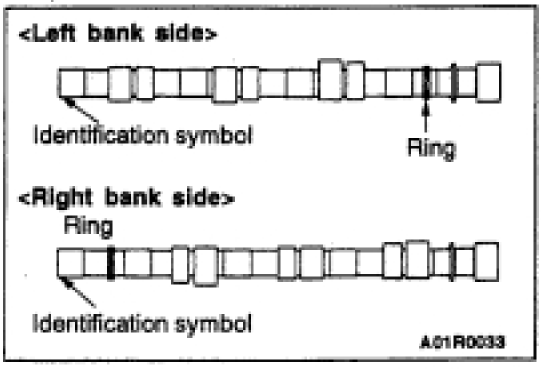
Installation steps (Right bank side)

- ▶A◀ 21. Camshaft
- ▶B◀ 18. OCV holder assembly
- ▶B◀ 17. Camshaft bearing cap
- ▶B◀ 16. Cam caps, front and rear
- ▶C◀ 20. Camshaft oil seal
- ▶D◀ 19. Circular packing
- ▶E◀ 15. Camshaft sprocket
- 14. Rocker cover
- 13. Spark plug cable assembly
- 12. Blow-by hose
- 11. Breather hose



REMOVAL SERVICE POINT

◀A▶ CAMSHAFT SPROCKET REMOVAL



INSTALLATION SERVICE POINTS

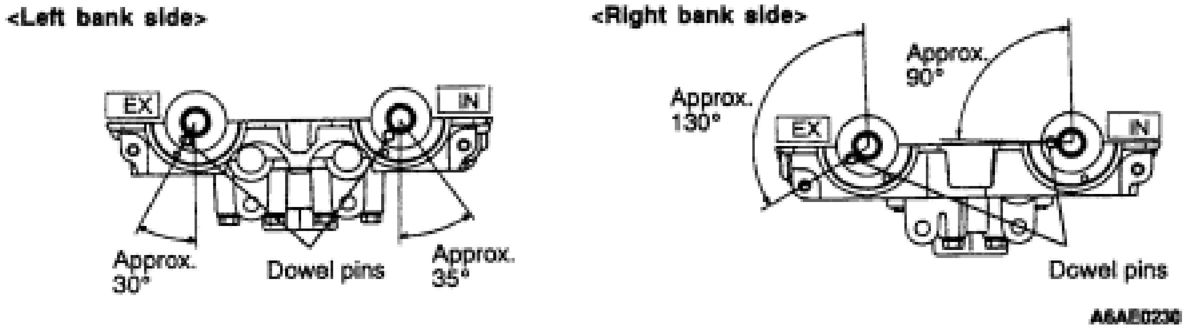
▶A◀ CAMSHAFT INSTALLATION

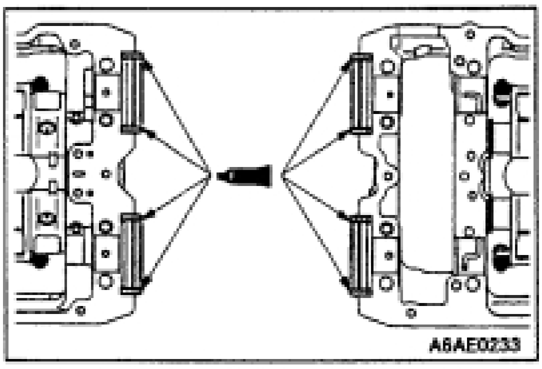
1. Check that the rocker arm is installed to the valve and lash adjuster correctly.
2. Apply engine oil to the journals and cams of the camshafts.
3. Install the camshafts to the cylinder head. Be careful not to confuse the intake camshaft with the exhaust one or left bank side with right bank side.

   NOTE
   It can be identified by the identification symbol on the camshaft rear end or the diameter of the ring whether a camshaft is for intake valves or exhaust valves.

Camshaft	Identification symbol	Ring diameter
Intake valve side	1	25 mm
Exhaust valve side	A	30 mm

4. Set the camshaft dowel pins in the positions shown in the illustration.



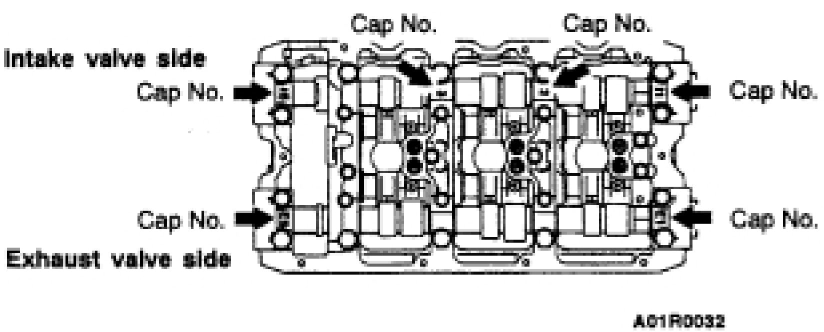


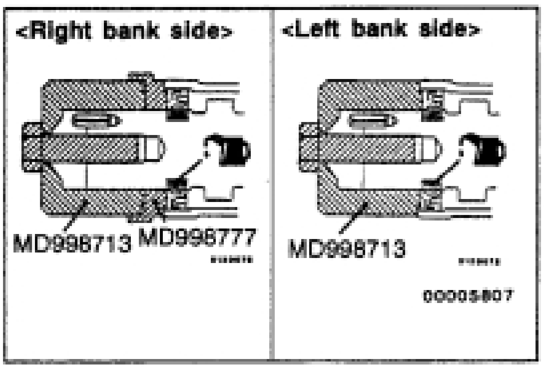
▶B◀ CAM CAP/CAMSHAFT BEARING CAP/OCV HOLDER ASSEMBLY INSTALLATION

1. Apply specified sealant to the camshaft holder in the positions shown in the illustration.

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

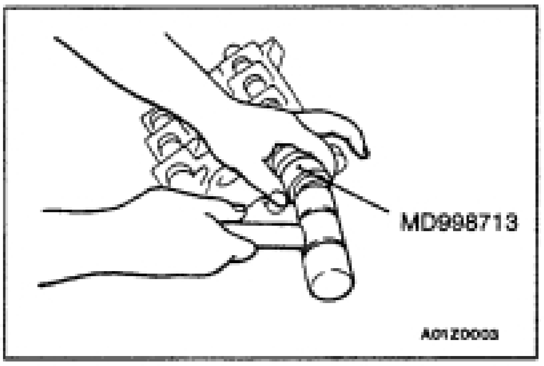
2. Install the camshaft bearing cap, cam cap and OCV holder assembly according to the "I" mark (stands for intake), the "E" mark (stands for exhaust), and the cap number.
3. Tighten the bolts in the shown sequence.





▶C◀ CAMSHAFT OIL SEAL INSTALLATION

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



▶D◀ CIRCULAR PACKING INSTALLATION

▶E◀ CAMSHAFT SPROCKET INSTALLATION

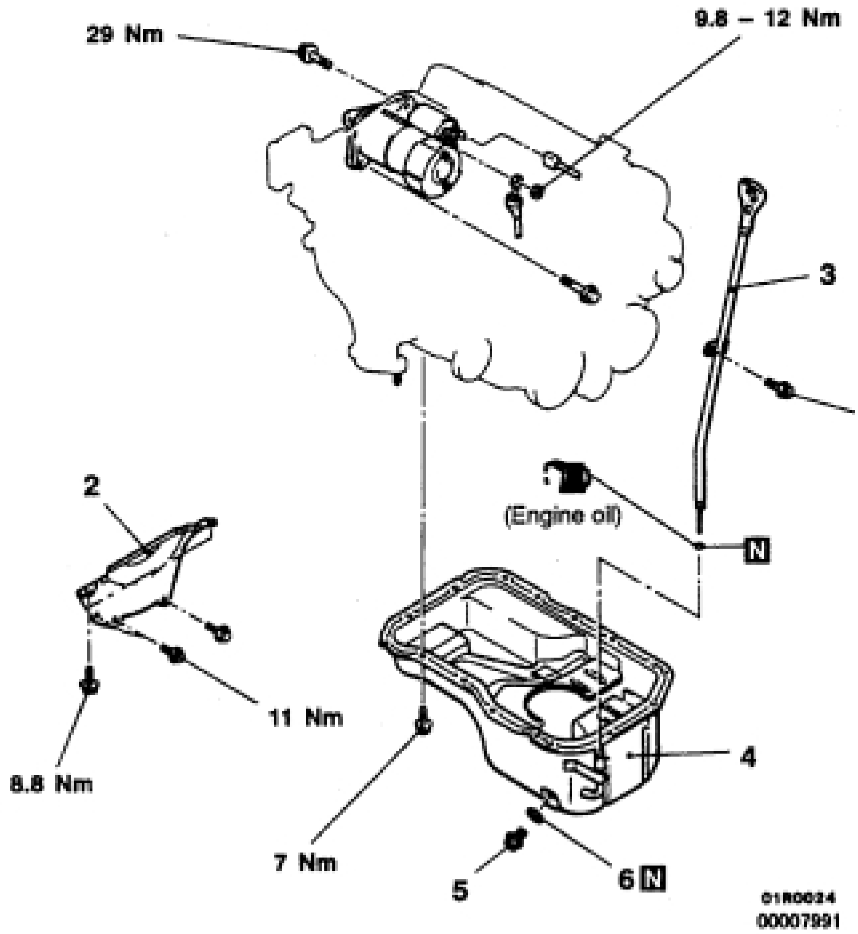
Use the special tool to stop the camshaft sprocket from turning in the same way as was done during removal, and then tighten the bolts to the specified torque.

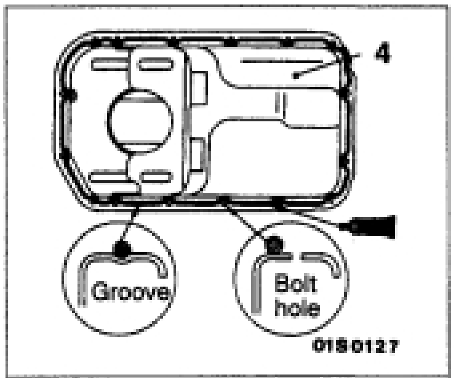
Tightening torque: 88 Nm

OIL PAN

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation	
• Under Cover Removal and Installation • Front Exhaust Pipe Removal and Installation (Refer to GROUP 15.)	• Engine Oil Draining and Supplying (Refer to GROUP 12 – On-vehicle Service.)



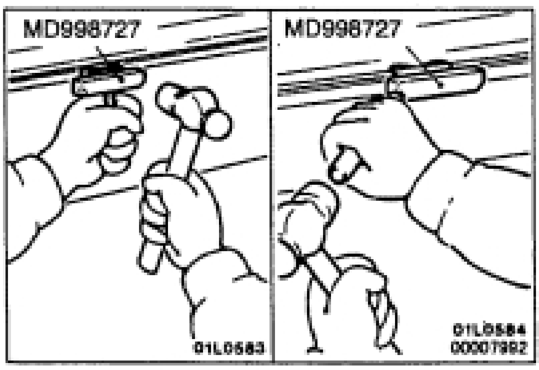


Sealant:
MITSUBISHI GENUINE PART MD970389 or equivalent

Removal steps

1. Starter motor
2. Bell housing cover
3. Engine oil level gauge assembly

◀A▶ 4. Oil pan
5. Drain plug
▶A◀ 6. Drain plug gasket



REMOVAL SERVICE POINT

◀A▶ OIL PAN REMOVAL

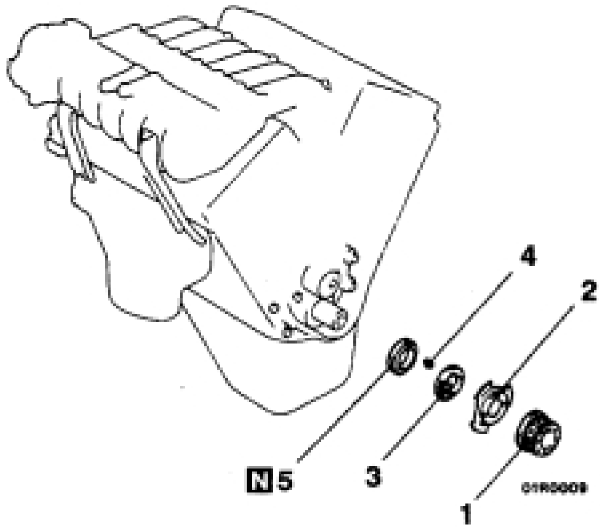
INSTALLATION SERVICE POINT

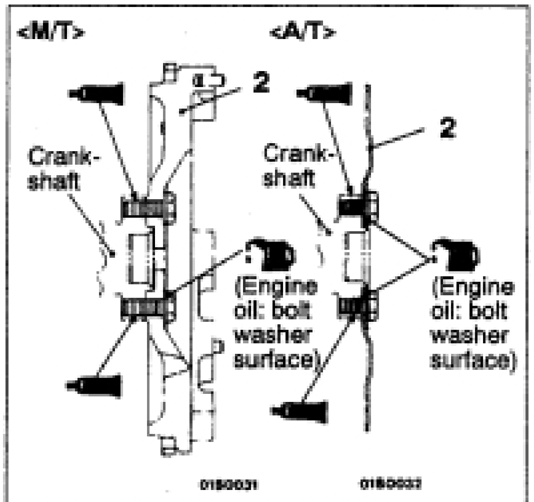
▶A◀ DRAIN PLUG GASKET INSTALLATION

Replace the drain plug gasket, being careful about its orientation. (Refer to GROUP 12.)

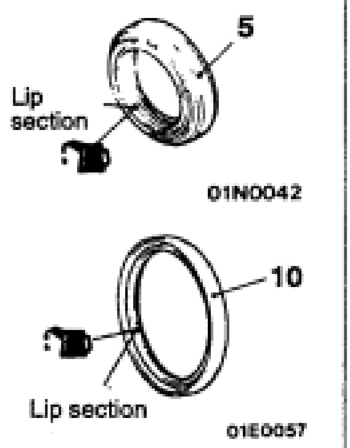
CRANKSHAFT OIL SEAL

REMOVAL AND INSTALLATION

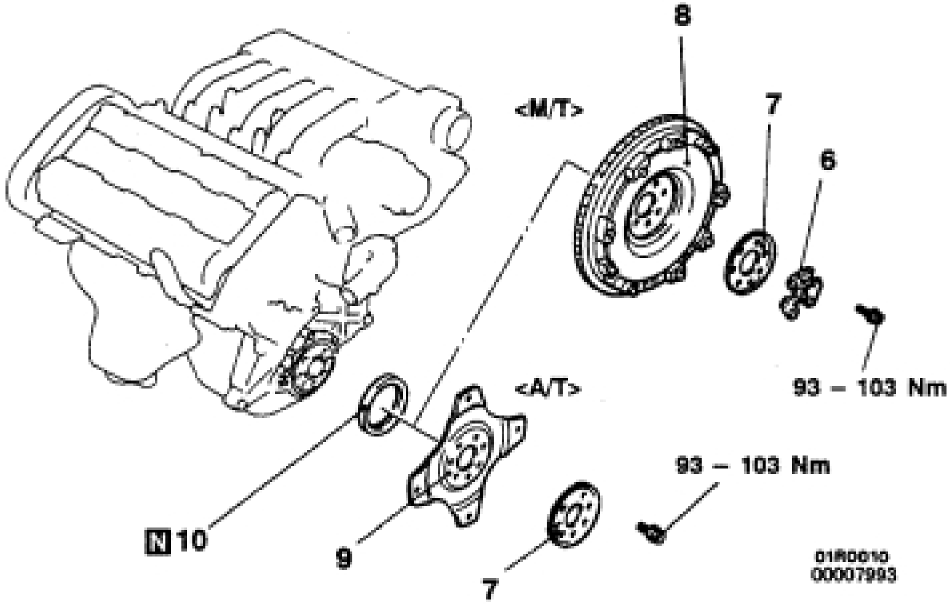




Sealant: 3M Stud Locking 4170 or equivalent



Engine oil



Crankshaft front oil seal removal steps

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

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

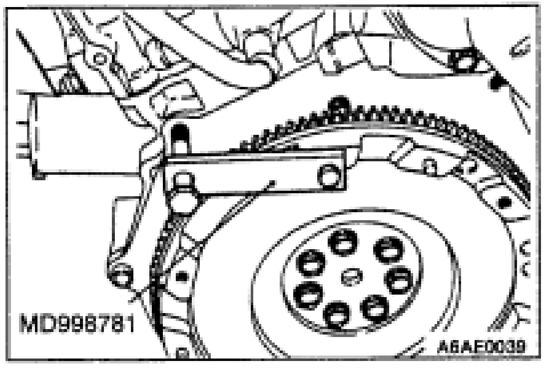
►C◄ 5. Crankshaft front oil seal

Crankshaft rear oil seal removal steps

- Oil pan (Refer to P.11A-21.)
- Transmission assembly (Refer to GROUP 22 or 23.)
- Clutch cover and disc <M/T>

6. Adapter plate
7. Plate

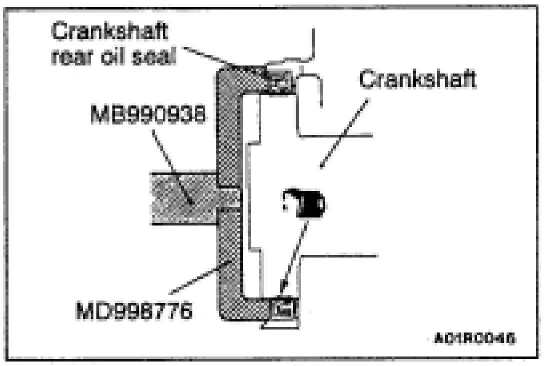
◄B► ►B◄ 8. Flywheel <M/T>
◄A► ►B◄ 9. Drive plate <A/T>
►A◄ 10. Crankshaft rear oil seal



REMOVAL SERVICE POINTS

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

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



INSTALLATION SERVICE POINTS

▶A◀ CRANKSHAFT REAR OIL SEAL INSTALLATION

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

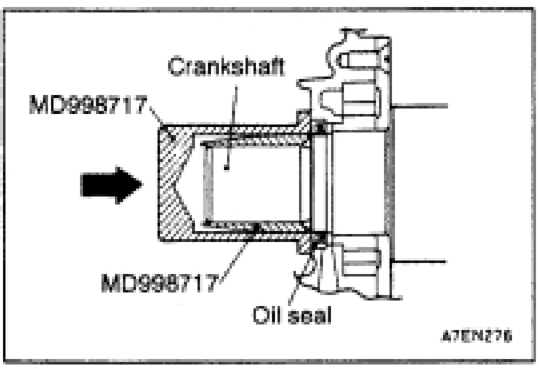
▶B◀ DRIVE PLATE <A/T>/FLYWHEEL <M/T> INSTALLATION

1. Clean off all sealant, oil and other substances which are adhering to the bolts, crankshaft thread holes and the flywheel <M/T> or drive plate <A/T>.
2. Apply oil to the seat surface of the flywheel <M/T> or drive plate <A/T> bolts.
3. Apply oil to the crankshaft thread holes.
4. Apply sealant to the thread of mounting bolts.

   Specified sealant: 3M Stud locking 4170 or equivalent

5. Use the special tool to hold the flywheel or drive plate in the same manner as removal, and tighten the bolt to the specified torque.

   Tightening torque: 93 – 103 Nm



▶C◀ CRANKSHAFT FRONT OIL SEAL INSTALLATION

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

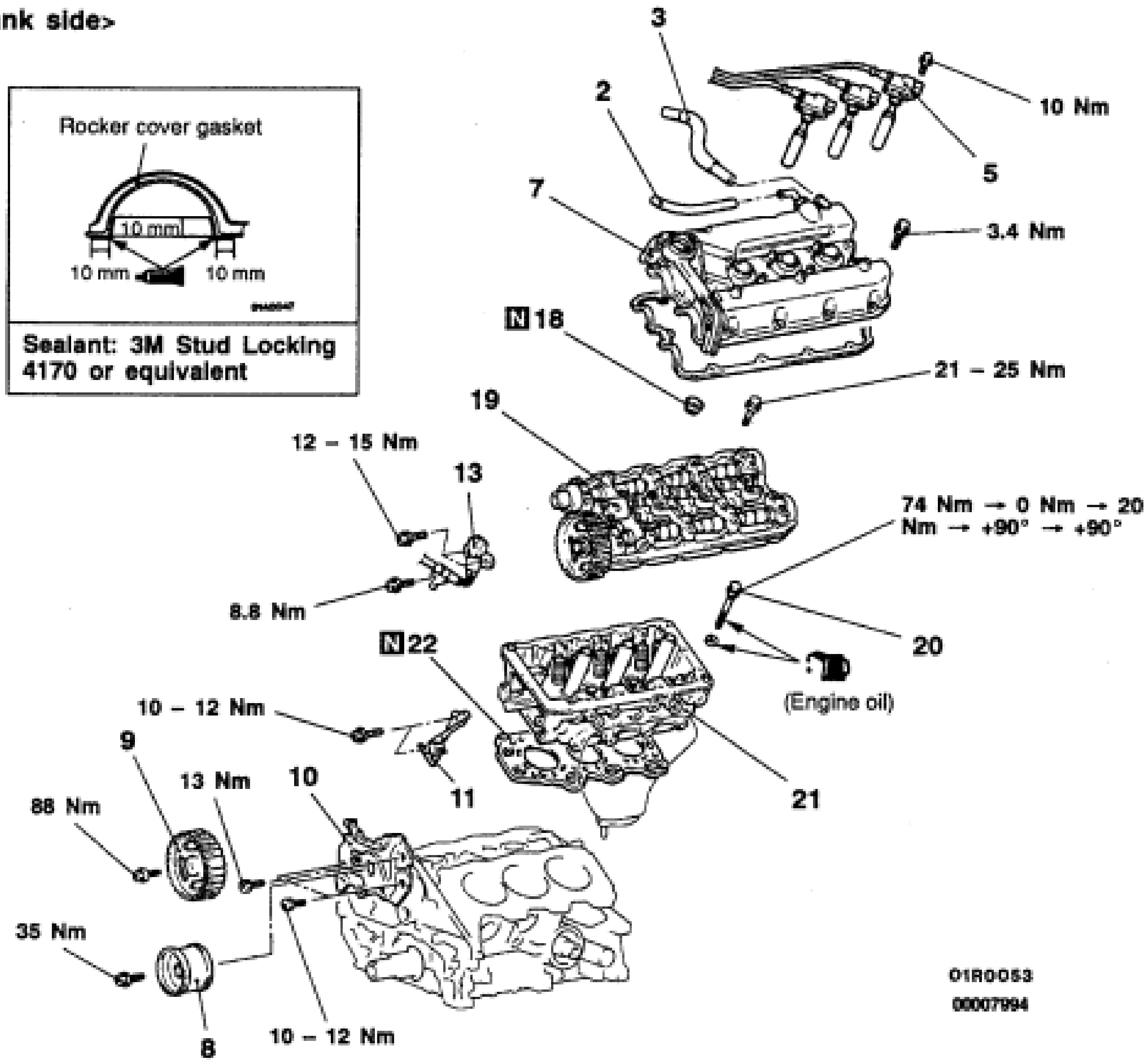
CYLINDER HEAD GASKET

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Fuel Discharge Prevention (Pre-removal operation)
- Engine Coolant Draining and Supplying
- Engine Oil Draining and Supplying
- Air Cleaner Cover and Air Intake Hose Removal and Installation
- Radiator Assembly Removal and Installation (Refer to GROUP 14.)
- Thermostat Case and Water Inlet Pipe Removal and Installation (Refer to GROUP 14 – Water Hose and Pipe.)
- Intake Manifold Removal and Installation (Refer to GROUP 15.)
- Front Exhaust Pipe Removal and Installation (Refer to GROUP 15.)
- Timing Belt Removal and Installation (Refer to P.11A-29.)

<Left bank side>



Removal steps

1. PCV hose
2. Blow-by hose
4. Ignition coil assembly
6. Rocker cover
7. Idler pulley

◀A▶ ▶D◀ 8. Camshaft sprocket (left bank, intake side)

9. Timing belt rear center cover
10. Timing belt rear left cover
12. Camshaft position sensor
15. Oil seal

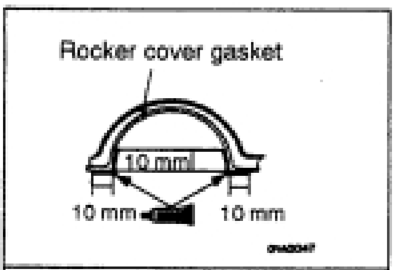
▶C◀ 16. Camshaft, camshaft holder assembly

◀B▶ ▶B◀ 17. Cylinder head bolt

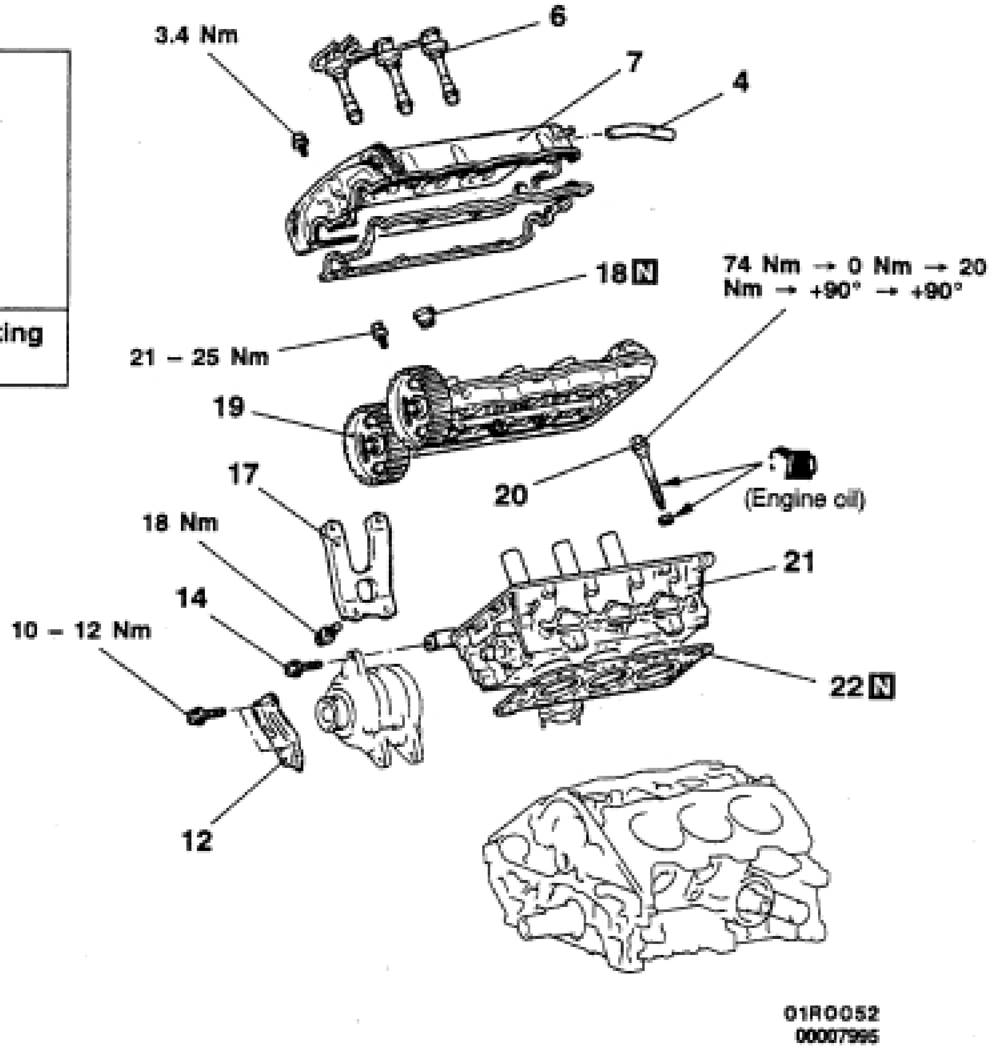
18. Cylinder head assembly

▶A◀ 19. Cylinder head gasket

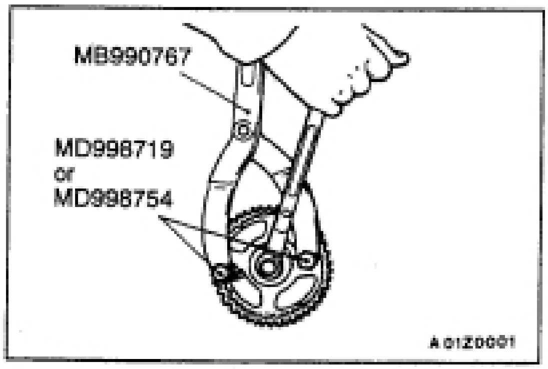
<Right bank side>



Sealant: 3M Stud Locking 4170 or equivalent

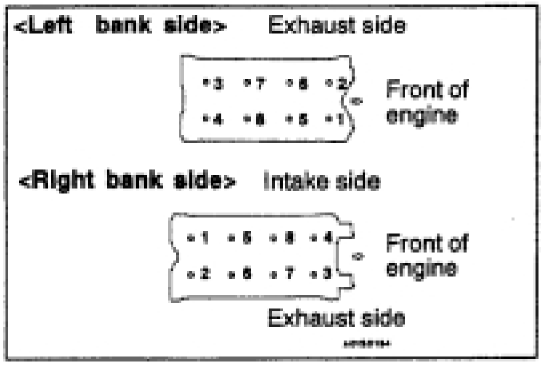


2. Blow-by hose
3. Breather hose
5. Spark plug cable assembly
6. Rocker cover
7. Idler pulley
◀A▶ ▶D◀ 8. Camshaft sprocket (left bank, intake side)
9. Timing belt rear center cover
11. Timing belt rear right cover
13. Alternator mounting bolt
14. Air intake plenum stay
15. Oil seal
▶C◀ 16. Camshaft and camshaft holder assembly
◀B▶ ▶B◀ 17. Cylinder head bolt
18. Cylinder head assembly
▶A◀ 19. Cylinder head gasket



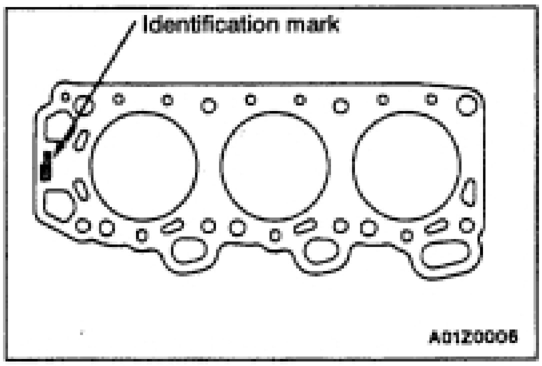
REMOVAL SERVICE POINTS

◀A▶ CAMSHAFT SPROCKET REMOVAL



◀B▶ CYLINDER HEAD BOLT REMOVAL

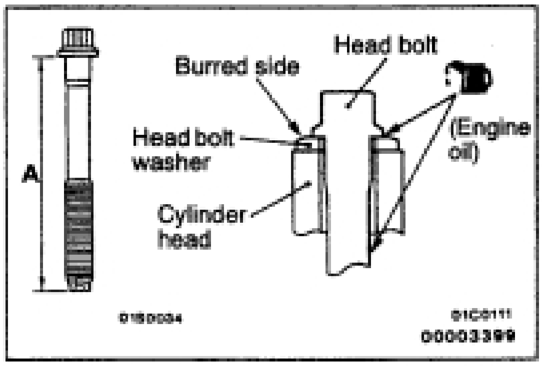
Loosen the bolts in 2 or 3 steps in order of the numbers shown in the illustration, and remove the cylinder head bolt.



INSTALLATION SERVICE POINTS

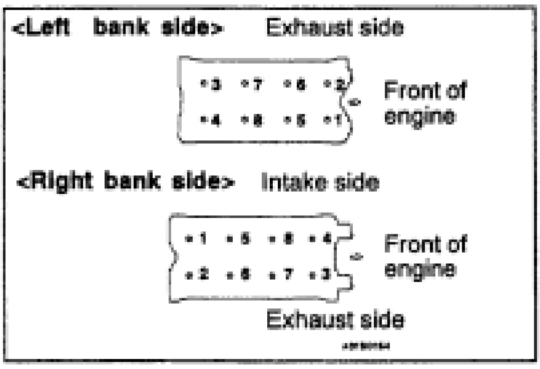
▶A◀ CYLINDER HEAD GASKET INSTALLATION

1. Wipe off all oil and grease from the gasket mounting surface.
2. Install the gasket to the cylinder block with the identification mark facing upwards.



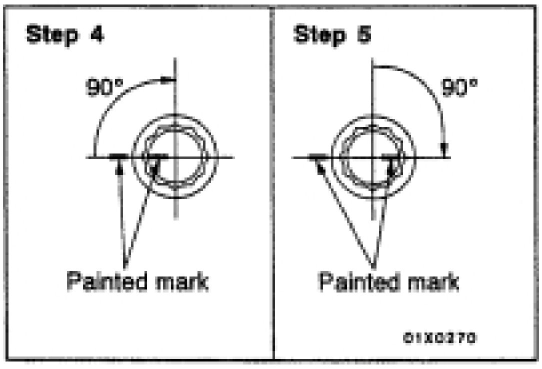
▶B◀ CYLINDER HEAD BOLT INSTALLATION

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



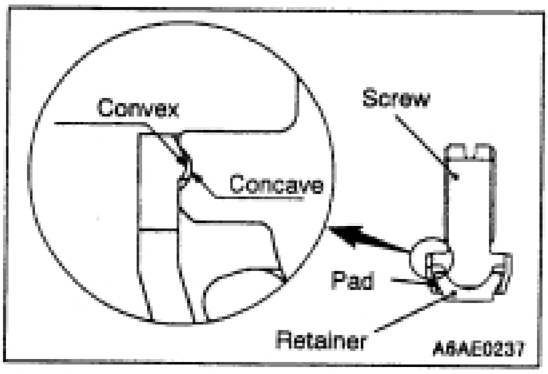
4. Tighten the bolts by the following procedure.

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



Caution

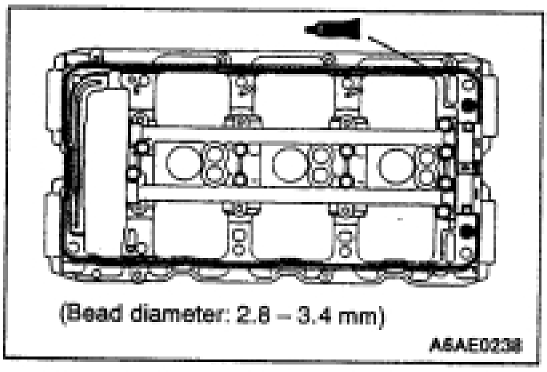
1. **Always make a tightening angle just 90°. If it is less than 90°, the head bolt will be loosened.**
2. **If it is more than 90°, remove the head bolt and repeat the procedure from step 1.**



▶C◀ CAMSHAFT AND CAMSHAFT HOLDER ASSEMBLY INSTALLATION

1. Check that the retainer of the adjusting screw is secured correctly.

   Caution
   Engage the convex part of the retainer with the concave part of the screw correctly, otherwise the pad may drop.



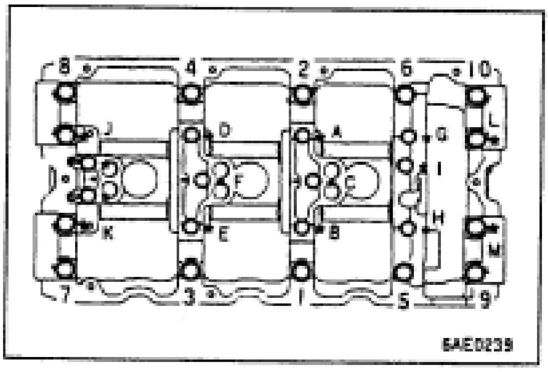
(Bead diameter: 2.8 – 3.4 mm)

2. Apply the specified sealant to the position shown in the illustration.

   Sealant: 3M Stud Locking 4170 or equivalent

3. While the sealant is wet (within 15 minutes), install the camshaft and camshaft holder assembly to the cylinder head.

   Caution
   Be careful not to apply the sealant to the other places than specified as the engine oil passage may be restricted.



4. Pull up the 'T' lever until the roller contacts the camshaft, and install the camshaft and camshaft holder assembly.
5. Tighten the bolts in the shown numerical order.
6. Check the tightening torques of the bolts marked by * in the shown alphabetical order.

▶D◀ CAMSHAFT SPROCKET INSTALLATION

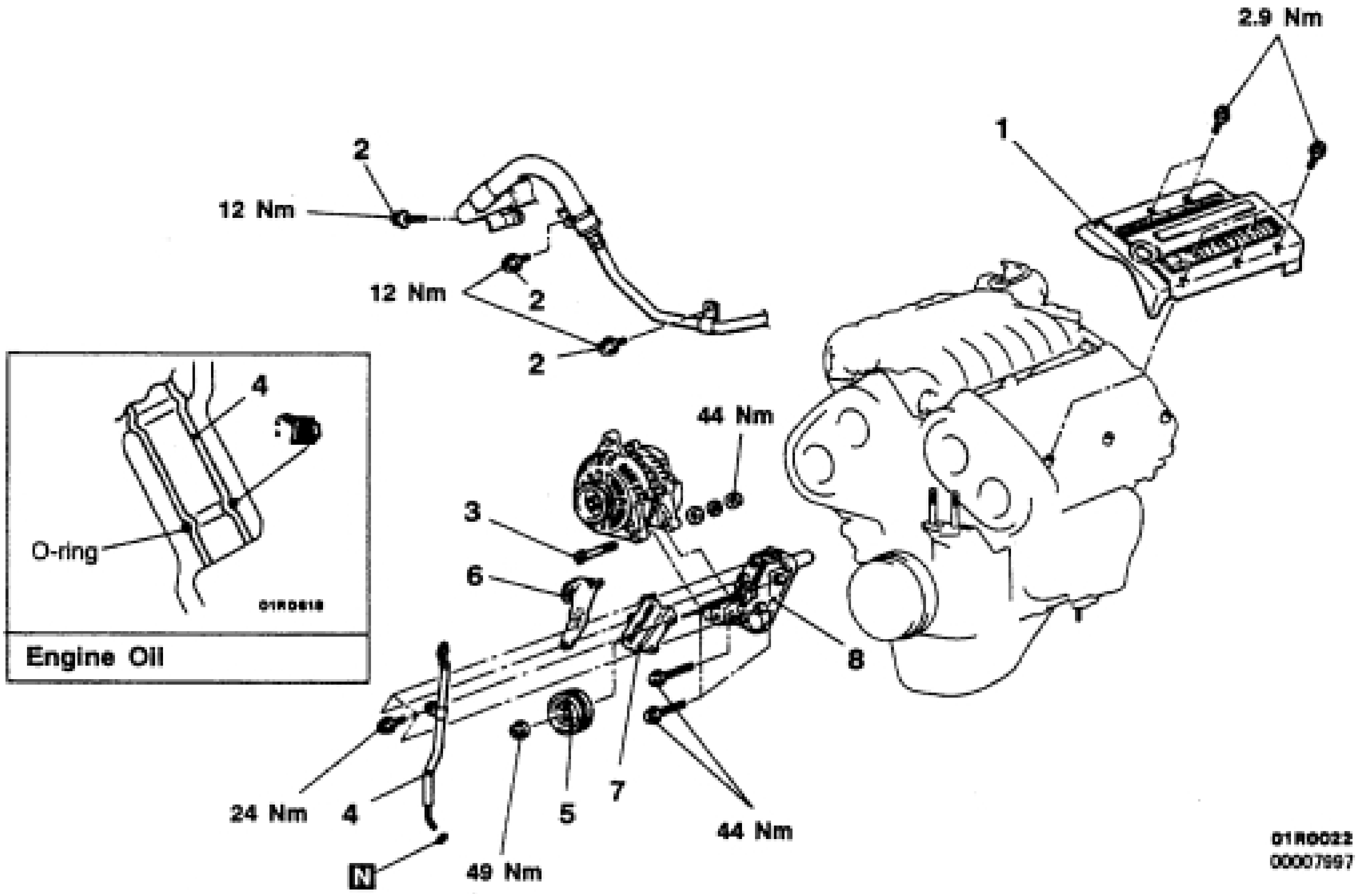
Use the special tool to hold the camshaft sprocket in the same way as removal, and tighten the bolts to the specified torque.

Tightening torque: 88 Nm

TIMING BELT

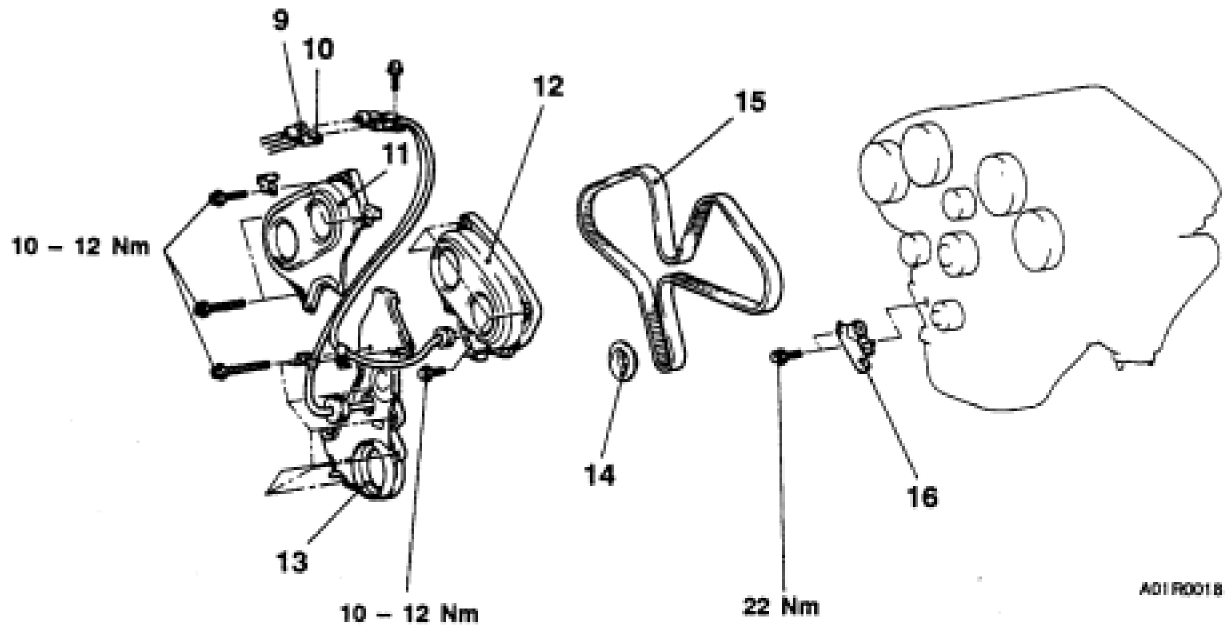
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Under Cover Removal and Installation
- Crankshaft Pulley Removal and Installation (Refer to P.11A-14)



Removal steps

1. Engine cover
2. Pressure pipe and hose clamp bolt
3. Alternator lower mounting bolt
4. Oil level gauge assembly ◀A▶
5. Tensioner pulley
6. Engine hanger
7. Tensioner bracket
8. Tension pulley bracket assembly



Removal steps

9. Crank angle sensor connector
10. Camshaft position sensor connector
11. Timing belt cover (front, upper right)
12. Timing belt cover (front, upper left)
13. Timing belt cover (lower)
14. Front flange

▶C◀ • Timing belt tension adjustment

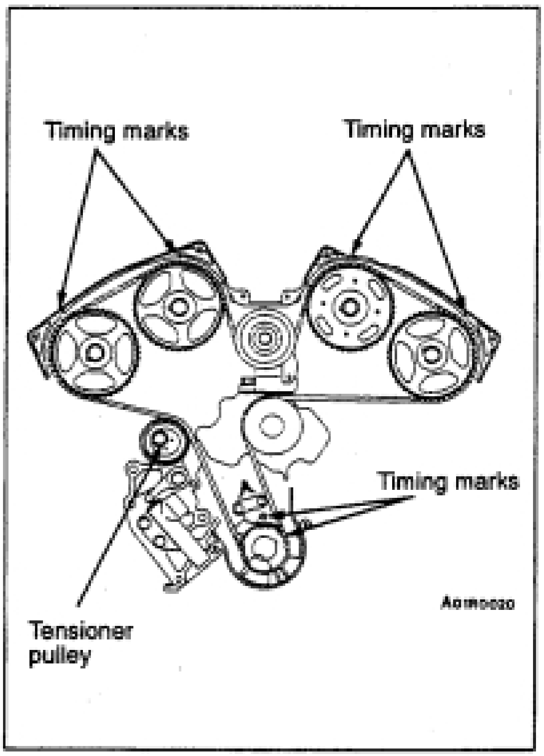
◀B▶ ▶B◀ 15. Timing belt

▶A◀ 16. Auto tensioner

REMOVAL SERVICE POINTS

◀A▶ TENSIONER PULLEY BRACKET REMOVAL

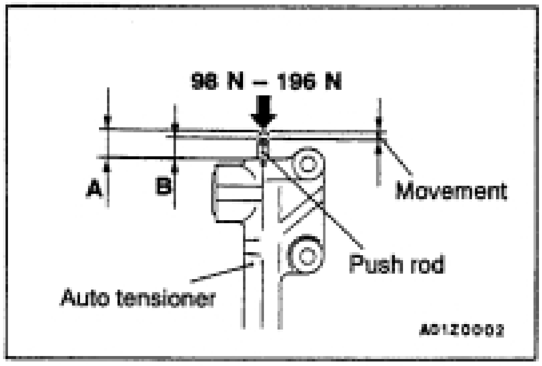
Loosen the upper side of the alternator, and then remove the tensioner pulley bracket.



◀B▶ TIMING BELT REMOVAL

1. Align each of the timing marks.
2. Loosen the centre bolt of the tension pulley and remove the timing belt.

   Caution
   If the timing belt is to be reused, use chalk to mark it with an arrow on its flat side indicating the turning direction.



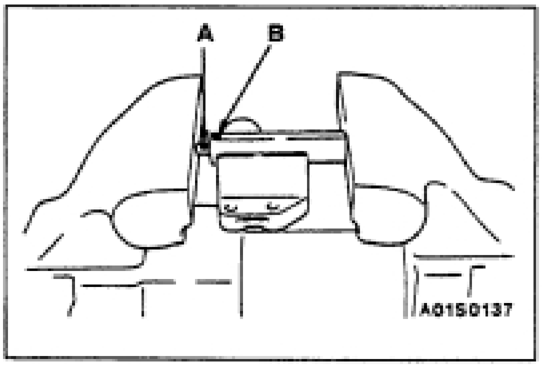
INSTALLATION SERVICE POINTS

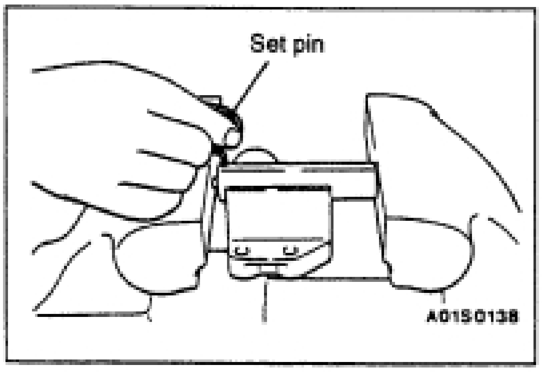
▶A◀ AUTO TENSIONER INSTALLATION

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

   Standard value: Within 1 mm
   A: Length when it is free (not pressed)
   B: Length when it is pressed
   A – B: Movement
2. If it is out of the standard value, replace the auto tensioner.
3. Use a press or vice to gently compress the auto tensioner push rod until pin hole A of the push rod and pin hole B of the tensioner cylinder are aligned.

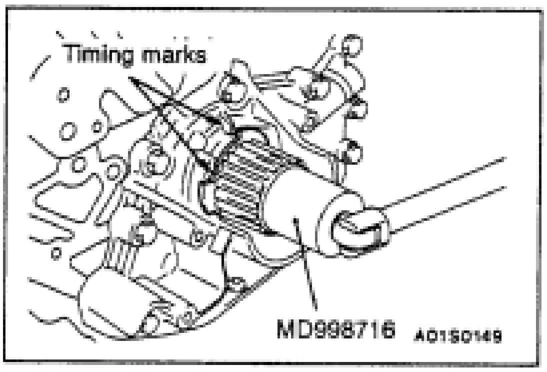
   Caution
   If the compression speed is too fast, the rod may become damaged, so be sure to carry out this operation slowly.





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

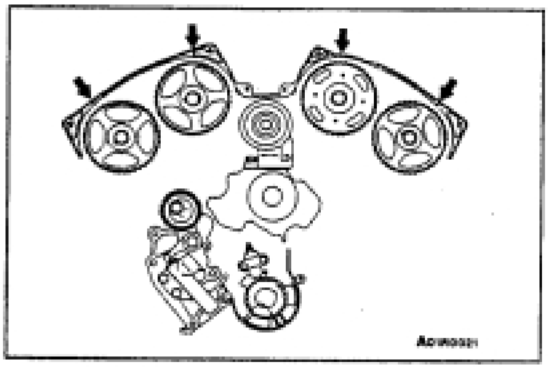
   NOTE
   When replacing the auto tensioner with a new part, the pin will be in the auto tensioner.
5. Install the auto tensioner to the engine.



▶B◀ TIMING BELT INSTALLATION

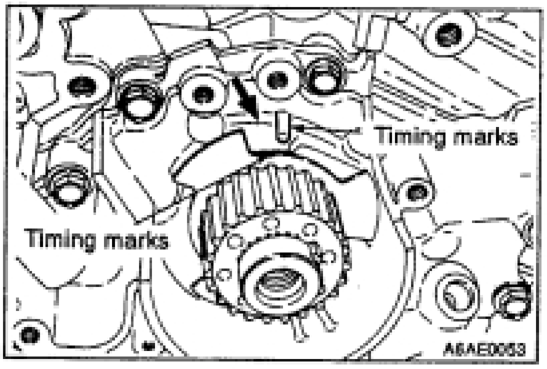
1. Turn the crankshaft sprocket timing mark forward by three teeth to move the piston slightly parts No.1 compression top dead centre.

   Caution
   If the camshaft is turned when the piston is at No.1 compression top dead centre, the valve will interfere with the piston.

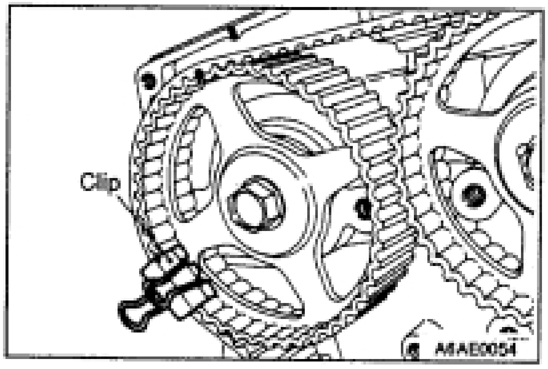


2. Align the camshaft sprocket timing marks.

   Caution
   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.



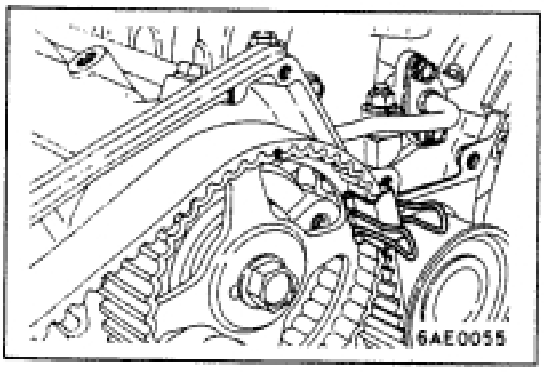
3. After aligning the crankshaft sprocket timing marks, turn the crankshaft one tooth anticlockwise.



4. Install the timing belt to the sprocket in the following order:

   Caution
   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.

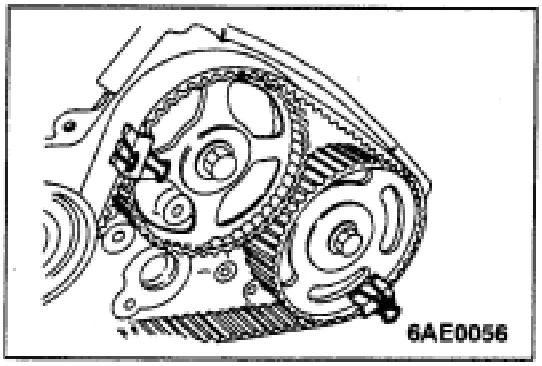
   (1) Align the timing marks of the left bank side exhaust camshaft sprocket, and clamp the timing belt with a clip.



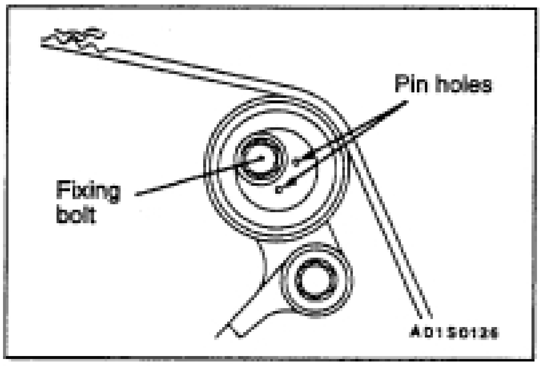
   (2) Align the timing marks of the intake camshaft sprocket, set the timing belt and clamp it with a clip at the position shown in the figure.

   Caution
   As the camshaft sprockets will turn easily, do not apply too much tension to the timing belt.

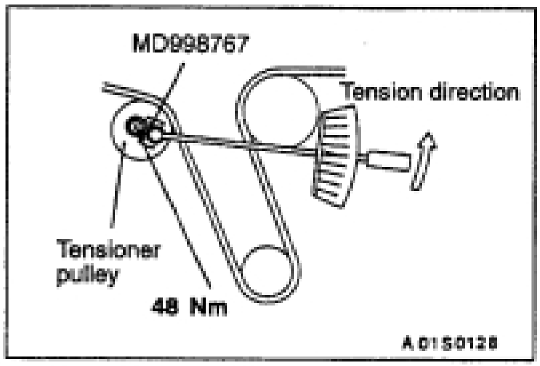
   (3) Set the timing belt onto the idler pulley.



(4) Check that the timing marks of the right bank side exhaust camshaft sprocket is aligned, and clamp the timing belt with a clip.
(5) Set the timing belt onto the water pump pulley.
(6) Set the timing belt onto the crankshaft sprocket.
(7) Set the timing belt onto the tensioner pulley.



5. Set the tensioner pulley so that the pin holes are at the bottom, press the tensioner pulley lightly against the timing belt, and then provisionally tighten the fixing bolt.
6. Check that all of the timing marks are aligned.
7. Remove all four of the clips.
8. Adjust the timing belt tension.

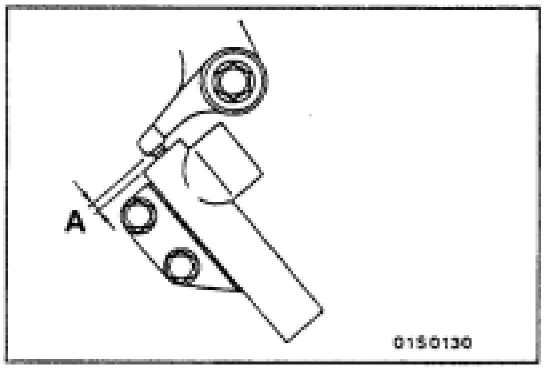


▶C◀ TIMING BELT TENSION ADJUSTMENT

1. After turning the crankshaft 1/4 of a revolution in the anticlockwise direction, turn it in the clockwise direction until the timing marks are aligned.
2. Loosen the tensioner pulley fixing bolt, and then use the special tool and a torque wrench to tighten the fixing bolt to the specified torque while applying tension to the timing belt.

   Standard value: 3 Nm <Timing belt tension torque>

   Caution
   When tightening the fixing bolt, make sure that the tensioner pulley does not turn with the bolt.



3. Turn the crankshaft two revolutions in the clockwise direction, and after leaving it for 5 minutes or more, check if the set pin of the auto tensioner can be removed and inserted easily.

   NOTE
   If the set pin cannot be inserted easily, the auto tensioner is good. Check if the amount of protrusion of the auto tensioner rod is within the standard value.

   Standard value (A): 3.8 – 4.5 mm

   If the amount of protrusion is outside the standard value, repeat the procedure in steps 1 to 3
4. Check to be sure that the timing marks of each sprocket are aligned.

ENGINE ASSEMBLY

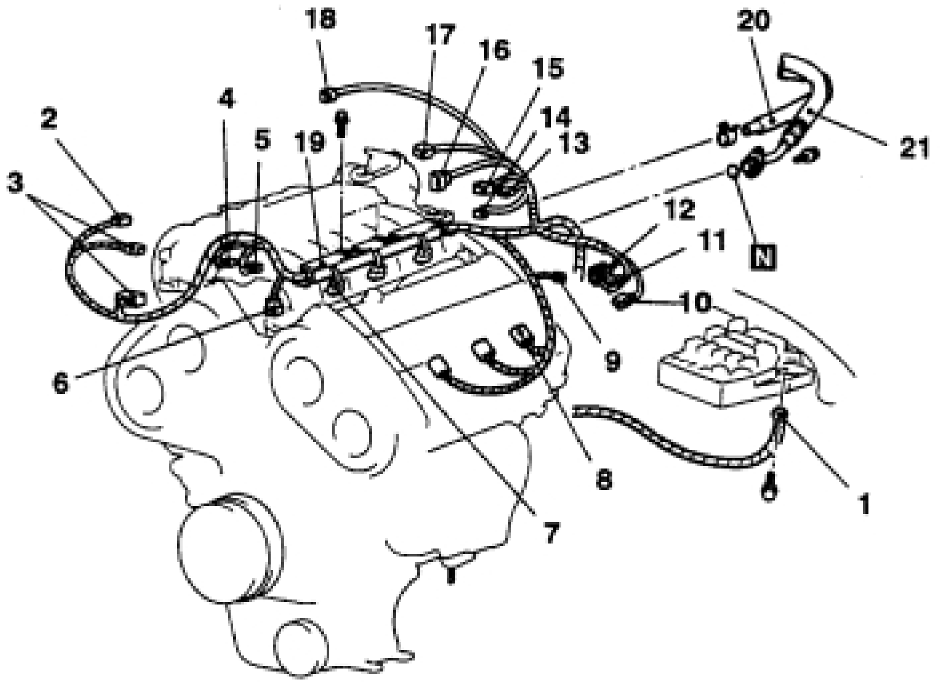
REMOVAL AND INSTALLATION

Caution

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

Pre-removal Operation
- Fuel Discharge Prevention
  (Refer to GROUP 13A – On-vehicle Service.)
- Hood and Hood Support Rod Removal
  (Refer to GROUP 42.)
- Air Cleaner Cover and Air Intake Hose Removal
- Radiator Removal (Refer to GROUP 14.)
- Front Exhaust Pipe Removal (Refer to GROUP 15.)
- Engine Coolant Draining
  (Refer to GROUP 14 – On-vehicle Service.)
- Transmission Assembly Removal
  (Refer to GROUP 22 or 23.)

Post-installation Operation
- Transmission Assembly Installation
  (Refer to GROUP 22 or 23.)
- Front Exhaust Pipe Installation
  (Refer to GROUP 15.)
- Radiator Installation (Refer to GROUP 14.)
- Air Cleaner Cover and Air Intake Hose Installation
- Hood and Hood Support Rod Installation
  (Refer to GROUP 42.)
- Accelerator Cable Adjustment
  (Refer to GROUP 13F – On-vehicle Service.)
- Engine Coolant Supplying
  (Refer to GROUP 14 – On-vehicle Service.)



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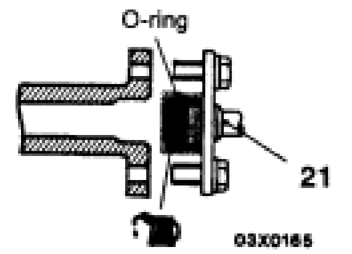
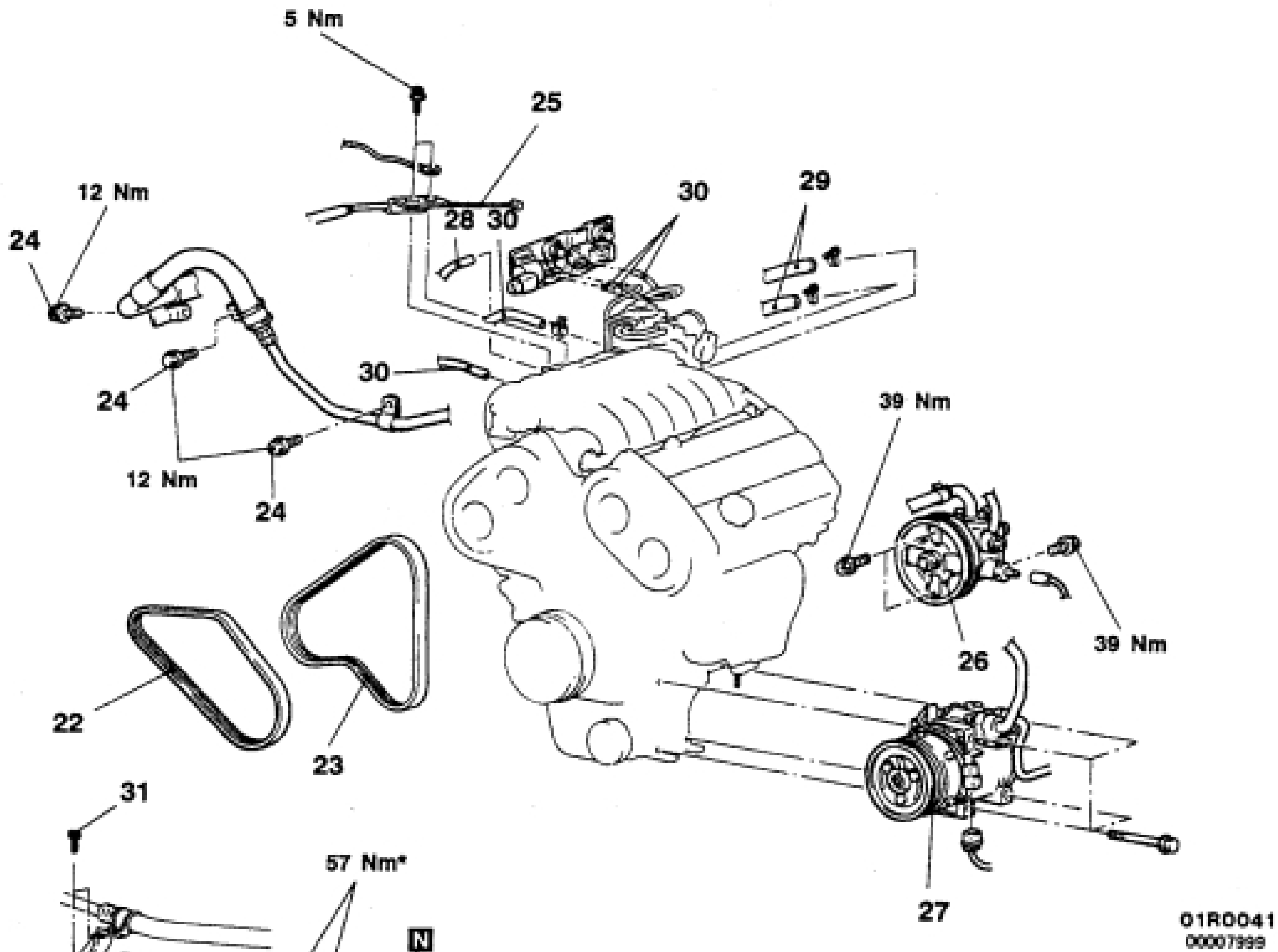


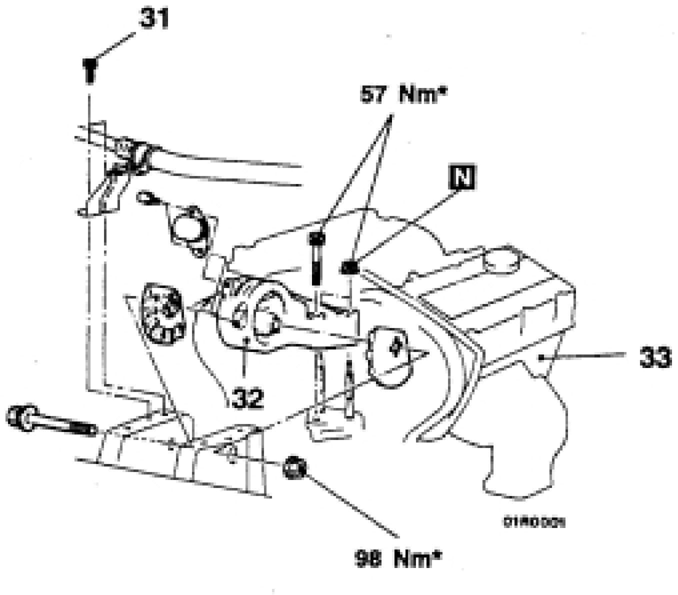
Engine oil

Removal steps

1. Battery wiring harness connection
2. Intake air temperature sensor connector
3. VIC servo motor connector
4. Crank angle sensor connector
5. Camshaft position sensor connector
6. Oil control valve connector (left bank side)
7. Injector connector
8. Ignition coil connector
9. Engine coolant temperature gauge connector
10. Engine coolant temperature sensor connector
11. Ignition failure sensor connector
12. Noise condenser connector
13. Knock sensor connector
14. Oil control valve connector (right bank side)
15. Injector harness connector
16. TPS connector
17. ISC motor connector
18. APS connector
19. Control wiring harness
20. Fuel return hose connection

►C◄ 21. High-pressure fuel hose connection





- Drive belt tension adjustment

22. Drive belt (Alternator)
23. Drive belt (Power steering oil pumpand A/C)
24. Clamp bolt (Power steering hose and pipe)
25. Accelerator cable connection
26. ◄A► Power steering oil pump assembly
27. ◄B► A/C compressor
28. Brake booster vacuum hose connection
29. Heater hose connection
30. Vacuum hose connection
31. A/C hose clamp mounting bolt
32. ◄C► ►B◄ Engine mount bracket
33. ◄D► ►A◄ Engine assembly

REMOVAL SERVICE POINTS

◀A▶ POWER STEERING OIL PUMP ASSEMBLY REMOVAL

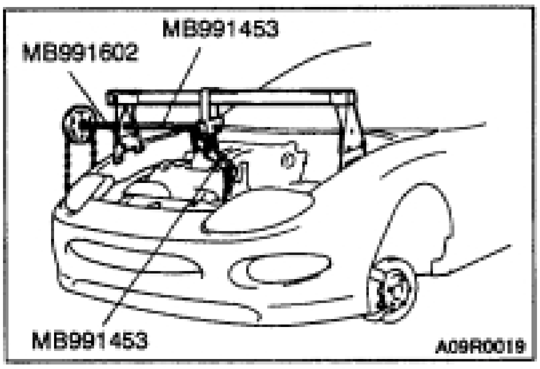
Remove the power steering oil pump assembly from the engine with the hose attached.

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.

◀B▶ A/C COMPRESSOR REMOVAL

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

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



◀C▶ ENGINE MOUNT BRACKET REMOVAL

1. Support the engine with a garage jack.
2. Remove the special tool which was attached when the transmission assembly was removed.
3. Hold the engine assembly with a chain block or similar tool.
4. Place a garage jack against the engine oil pan with a piece of wood in between, jack up the engine so that the weight of the engine is no longer being applied to the engine mount bracket, and then remove the engine mount bracket.

◀D▶ ENGINE ASSEMBLY REMOVAL

After checking that all cables, hoses and harness connectors, etc., are disconnected from the engine, lift the chain block slowly to remove the engine assembly upward from the engine compartment.

INSTALLATION SERVICE POINTS

▶A◀ ENGINE ASSEMBLY INSTALLATION

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

▶B◀ ENGINE MOUNT BRACKET INSTALLATION

1. Place a garage jack against the engine oil pan with a piece of wood in between, and install the engine mount bracket while adjusting the position of the engine.
2. Support the engine with the garage jack.
3. Remove the chain block and support the engine assembly with the special tool.

▶C◀ HIGH-PRESSURE FUEL HOSE INSTALLATION

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

   Caution

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

ENGINE LUBRICATION

CONTENTS

LUBRICANTS

Items		Specified Lubricant and Quantity
Engine oil (API classification)		SG or higher
Engine oil quantity ℓ	Oil filter	0.3
	Total	4.2

SPECIAL TOOL

Tool	Number	Name	Use
 B991396	MB991396	Oil filter wrench	Removal and installation of engine oil filter

ON-VEHICLE SERVICE

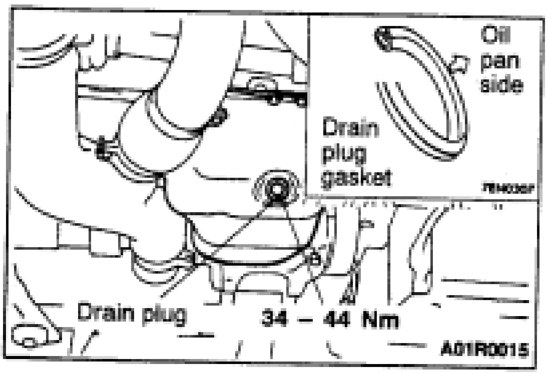
ENGINE OIL CHECK

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

ENGINE OIL REPLACEMENT

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

   Caution
   Use care as oil could be hot.

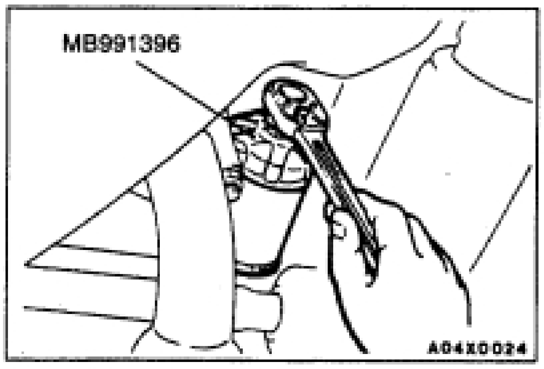


4. Install a new drain plug gasket so that it faces in the direction shown in the illustration, and then tighten the drain plug to the specified torque.

5. Refill with specified quantity of oil.

   Specified Engine Oil (API classification): SG or higher

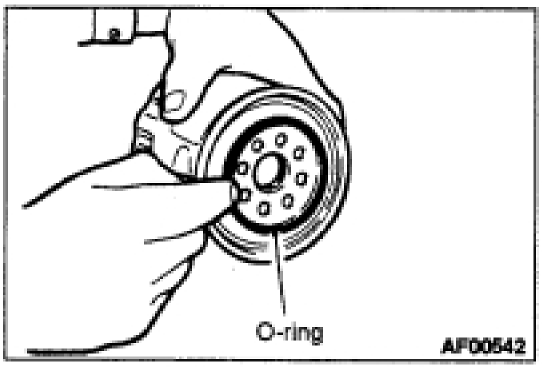
   Total quantity (Excludes volume inside oil filter): 3.9 ℓ
6. Install the engine oil filler cap.
7. Start the engine and run it for a few minutes.
8. Stop the engine and check the oil level.



OIL FILTER REPLACEMENT

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

   Caution
   Use care as oil could be hot.
4. Use the special tool to remove the engine oil filter.
5. Clean the filter bracket side mounting surface.



6. Apply a small amount of engine oil to the O-ring of the new oil filter.
7. Tighten the oil filter by hand. Once the O-ring of the oil filter is touching the flange, use the special tool to tighten the oil filter to 14 Nm (one turn).
8. Install the drain plug and refill engine oil. (Refer to Engine Oil Replacement on P.12-3.)
9. Race the engine 2 – 3 times, and check to be sure that no engine oil leaks from installation section of the oil filter.

NOTES

FUEL

CONTENTS

MULTIPOINT FUEL INJECTION (MPI)

CONTENTS

GENERAL INFORMATION

MULTIPOINT FUEL INJECTION SYSTEM DIAGRAM

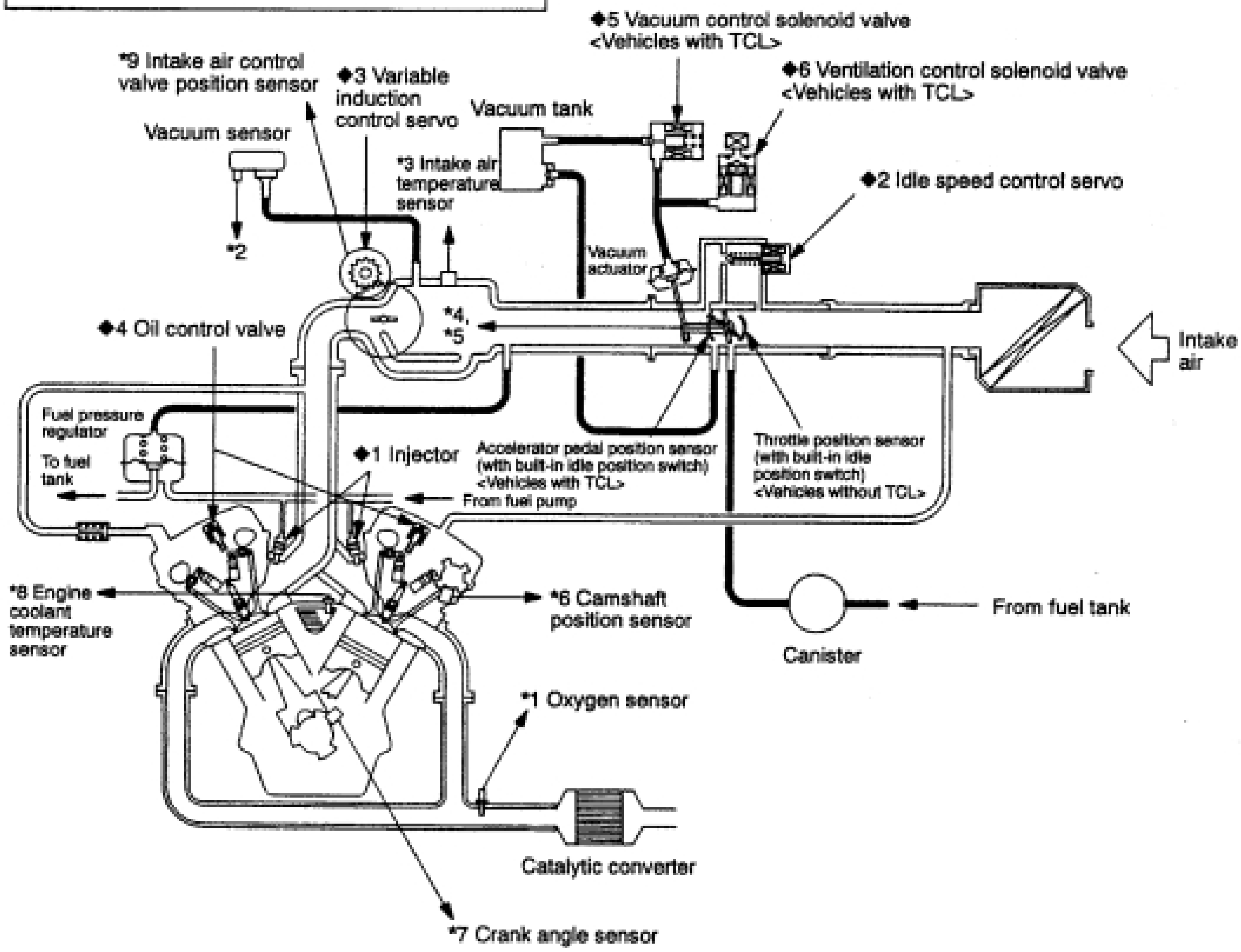
*1 Oxygen sensor
*2 Vacuum sensor
*3 Intake air temperature sensor
*4 Throttle position sensor
*5 Idle position switch
*6 Camshaft position sensor
*7 Crank angle sensor
*8 Engine coolant temperature sensor
*9 Intake air control valve position sensor

- Power supply voltage
- Detonation sensor
- Vehicle speed sensor
- A/C switch
- Inhibitor switch
- Power steering fluid pressure switch
- Ignition switch – ST
- Ignition switch – IG
- A/T-ECU
- TCL-ECU <TCL>

⇨ Engine-ECU ⇨

◆1 Injector
◆2 Idle speed control servo (stepper motor)
◆3 Variable induction control servo
◆4 Oil control valve
◆5 Vacuum control solenoid valve <TCL>
◆6 Ventilation control solenoid valve <TCL>

- Fuel pump relay
- Control relay
- A/C power relay
- Engine warning lamp
- Diagnosis signal
- Ignition coil
- A/T-ECU
- TCL-ECU <TCL>



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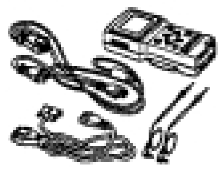
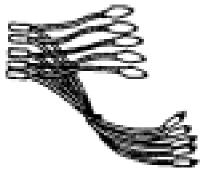
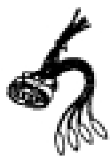
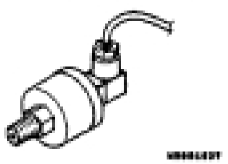
SERVICE SPECIFICATIONS

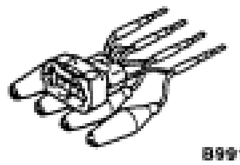
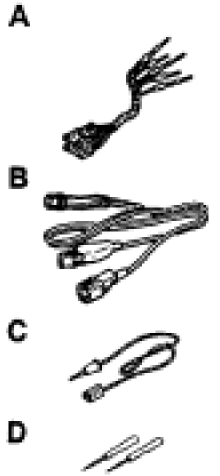
Items		Standard value
Basic idle speed r/min		700±50
Throttle position sensor adjusting voltage mV	Vehicles without TCL	400 – 1,000
	Vehicles with TCL	580 – 690
Throttle position sensor resistance kΩ		3.5 – 6.5
Accelerator pedal position sensor adjusting voltage <vehicles with TCL> mV		400 – 1,000
Accelerator pedal position sensor resistance <vehicles with TCL> kΩ		3.5 – 6.5
Idle speed control servo coil resistance Ω		28 – 33 (at 20°C)
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
Oxygen sensor output voltage V		0.6 – 1.0
Fuel pressure kPa	Vacuum hose disconnection	Approx. 324 – 343
	Vacuum hose connection	Approx. 265
Injector coil resistance Ω		13 – 16 (at 20°C)
Injector fuel leakage drop/min		1 or less
Ventilation control solenoid valve coil resistance <vehicles with TCL> Ω		36 – 44 (at 20°C)
Vacuum control solenoid valve coil resistance <vehicles with TCL> Ω		36 – 44 (at 20°C)

SEALANT

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

SPECIAL TOOLS

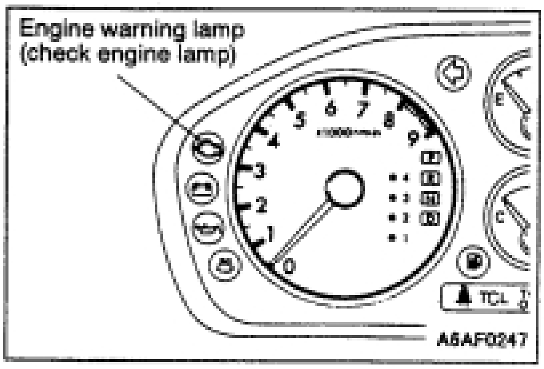
Tool	Number	Name	Use
	MB991502	MUT-II sub assembly	• Reading diagnosis code • MPI system inspection
	MB991348	Test harness set	• Measurement of voltage during troubleshooting • Inspection using an analyzer
	MB991519	Alternator harness connector	Measurement of voltage during troubleshooting
	MD998463	Test harness (6-pin, square)	• Inspection of idle speed control servo • Inspection using an analyzer
	MD998478	Test harness (3-pin, triangle)	• Measurement of voltage during troubleshooting • Inspection using an analyzer
	MD998709	Adaptor hose	Measurement of fuel pressure
	MD998742	Hose adaptor	
	MB991637	Fuel pressure gauge set	
	MB991529	Diagnosis code check harness	• Reading diagnosis code • Adjustment of basic idle speed

Tool	Number	Name	Use
 B991536	MB991536	Throttle position sensor adjustment check harness	• Adjustment of idle switch, throttle position sensor (TPS) and accelerator pedal position sensor (APS)
 MD998474	MD998474	Test harness (8-pin, square)	• Inspection using an analyzer
 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 engine-ECU terminal voltage • Inspection using an analyzer • Inspection of oxygen sensor

TROUBLESHOOTING

DIAGNOSIS TROUBLESHOOTING FLOW

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



DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

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

Engine warning lamp inspection items

Engine-ECU
Intake air temperature sensor
Throttle position sensor (TPS)
Engine coolant temperature sensor
Crank angle sensor
Camshaft position sensor
Vacuum sensor
Detonation sensor
Injector
Ignition coil, power transistor unit
Vacuum control solenoid valve <TCL>
Ventilation control solenoid valve <TCL>

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-ECU to DIAGNOSIS 2 mode using the MUT-II. Then carry out a road test.
2. Take a reading of the diagnosis code and repair the fault.
3. Turn the ignition switch "OFF" and then back to "ON" again.

   NOTE
   By turning the ignition switch "OFF", the engine-ECU will switch the diagnosis mode from diagnosis 2 mode to diagnosis 1 mode.
4. Erase the diagnosis code.

INSPECTION USING MUT-II DATA LIST AND ACTUATOR TESTING

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

FAIL-SAFE FUNCTION REFERENCE TABLE

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
Vacuum sensor	1. Uses the throttle position sensor signal and engine speed signal (crank angle sensor signal) to take reading of the basic injector drive time and basic ignition timing from the pre-set mapping. 2. Fixes the ISC servo in the appointed position so idle control is not performed.
Intake air temperature sensor	Controls as if the intake air temperature is 25°C.
Throttle position sensor (TPS)	No increase in fuel injection amount during acceleration due to the throttle position sensor signal.
Engine coolant temperature sensor	Controls as if the engine coolant temperature is 80°C. (This control continues until the ignition switch is turned off even after the sensor signal returns to normal.)
Camshaft position sensor	1. Injects fuel to all cylinders simultaneously. (However, after the ignition switch is turned to ON, the No. 1 cylinder top dead centre is not detected at all.) 2. Cuts off the fuel supply 4 seconds after a problem is detected. (However, after the ignition switch is turned to ON, the No.1 cylinder top dead centre is not detected at all.)
Detonation sensor	Switches the ignition timing from ignition timing for super petrol to ignition timing for standard petrol.
Ignition coil, power transistor	Cuts off the fuel supply to cylinders with an abnormal ignition.
Intake air control valve position sensor	Fully open the intake air control valve.
Communication wire with transmission control unit <A/T>	Ignition timing is not retarded during transmission gear shifting (overall engine and transmission control).
Alternator FR terminal	Does not control the output of the alternator according to an electrical load. (works as a normal alternator)

NOTE
When a problem is detected in the vacuum control solenoid valve, ventilation control solenoid valve, crank angle sensor or any of the above items, traction control is not performed <Vehicles with TCL>.

INSPECTION CHART FOR DIAGNOSIS CODES

Code No.	Diagnosis item	Reference page
13	Intake air temperature sensor system	13A-10
14	Throttle position sensor (TPS) system	13A-11
21	Engine coolant temperature sensor system	13A-12
22	Crank angle sensor system	13A-13
23	Camshaft position sensor system	13A-14
24	Vehicle speed sensor system	13A-15
31	Detonation sensor system	13A-16
32	Vacuum sensor system	13A-17
41	Injector system	13A-18
44	Ignition coil and power transistor unit system (No.1 and No.4 cylinders)	13A-19
52	Ignition coil and power transistor unit system (No.2 and No.5 cylinders)	13A-19
53	Ignition coil and power transistor unit system (No.3 and No.6 cylinders)	13A-19
61	Communication wire with A/T-ECU system	13A-20
62	Intake air control valve position sensor system	13A-21
64	Alternator FR terminal system	13A-22
71	Vacuum control solenoid valve system <Vehicles with TCL>	13A-23
72	Ventilation control solenoid valve system <Vehicles with TCL>	13A-24

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code No. 13 Intake air temperature sensor system	Probable cause
Range of Check • Ignition switch: ON • Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. Set conditions • Sensor output voltage is 4.6 V or more (corresponding to an intake air temperature of –45°C or less) for 4 seconds. or • Sensor output voltage is 0.2V or less (corresponding to an intake air temperature of 125°C or more) for 4 seconds.	• Malfunction of the intake air temperature sensor • Improper connector contact, open circuit or short-circuited harness wire of the intake air temperature sensor circuit • Malfunction of the engine-ECU

Check the intake air temperature sensor. (Refer to P.13A-85.)
- NG → **Replace**
- OK ↓

Measure at the air flow sensor connector A-04.
- Disconnect the connector, and measure at the harness side.
- Voltage between 1 and earth (Ignition switch: ON)
  OK: 4.5–4.9 V
- Continuity between 5 and earth
  OK: Continuity

- NG → **Check the following connectors:** B-35, B-76
  - NG → **Repair**
  - OK ↓ Check trouble symptom.
    - NG ↓ Check the harness wire between the engine-ECU and the intake air temperature sensor connector.
      - NG → **Repair**
      - OK ↓ Replace the engine-ECU.
- OK ↓

Check the following connector: A-04
- NG → **Repair**
- OK ↓

Check trouble symptom.
- NG → Replace the engine-ECU.

Code No. 14 Throttle position sensor (TPS) system	Probable cause
Range of Check • Ignition switch: ON • Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. Set conditions • The sensor output voltage is 0.2 V or less for 4 seconds.	• Malfunction of the throttle position sensor or maladjustment • Improper connector contact, open circuit or short-circuited harness wire of the throttle position sensor circuit • Improper "ON" state of idle position switch • Short circuit of the idle position switch signal line • Malfunction of the engine-ECU

MUT-II Data list
26 Idle position switch system
OK: With the throttle valve at the idle position: ON
With the throttle valve slightly open: OFF

NG → Check the idle position switch system. (Refer to P.13A-42, INSPECTION PROCEDURE 26.) <Vehicles without TCL> (Refer to P.13A-43, INSPECTION PROCEDURE 27.) <Vehicles with TCL>

↓ OK

Check the throttle position sensor. (Refer to P.13A-86.)

NG → **Replace**

↓ OK

Measure at the throttle position sensor connector A-07.
- Disconnect the connector, and measure at the harness side.
- Voltage between 4 and earth (Ignition switch: ON)
  OK: 4.8–5.2 V
- Continuity between 1 and earth
  OK: Continuity

NG → **Check the following connectors:** B-35, B-76

- NG → **Repair**
- ↓ OK
- Check trouble symptom.
- ↓ NG
- Check the harness wire between the engine-ECU and the throttle position sensor connector.
- NG → **Repair**
- ↓ OK
- Replace the engine-ECU.

↓ OK

Check the throttle position sensor output circuit. (Refer to P.13A-55, INSPECTION PROCEDURE 49.)

<table>
<tr><th>Code No. 21 Engine coolant temperature sensor system</th><th>Probable cause</th></tr>
<tr><td>Range of Check
• Ignition switch: ON
• Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts.
Set conditions
• Sensor output voltage is 4.6 V or more (corresponding to an engine coolant temperature of –45°C or less) for 4 seconds.
or
• Sensor output voltage is 0.1 V or less (corresponding to an engine coolant temperature of 140°C or more) for 4 seconds.</td><td rowspan="2">• Malfunction of the engine coolant temperature sensor
• Improper connector contact, open circuit or short-circuited harness wire of the engine coolant temperature sensor circuit
• Malfunction of the engine-ECU</td></tr>
<tr><td>Range of Check
• Ignition switch: ON
• Engine speed is approx. 50 r/min or more
Set conditions
• The sensor output voltage increases from 1.6 V or less (corresponding to an engine coolant temperature of 40°C or more) to 1.6 V or more (corresponding to an engine coolant temperature of 40°C or less).
• After this, the sensor output voltage is 1.6 V or more for 5 minutes.</td></tr>
</table>

Check the engine coolant temperature sensor. (Refer to P.13A-85.) —NG→ **Replace**

↓ OK

Measure at the engine coolant temperature sensor connector A-75.
- Disconnect the connector, and measure at the harness side.
- Voltage between 1 and earth (Ignition switch: ON)
  OK: 4.5–4.9 V
- Continuity between 2 and earth
  OK: Continuity

—NG→ **Check the following connectors:** B-35, B-76 —NG→ **Repair**

↓ OK

Check trouble symptom.

↓ NG

Check the harness wire between the engine-ECU and the engine coolant temperature sensor connector. —NG→ **Repair**

↓ OK

Replace the engine-ECU.

(From measurement) ↓ OK

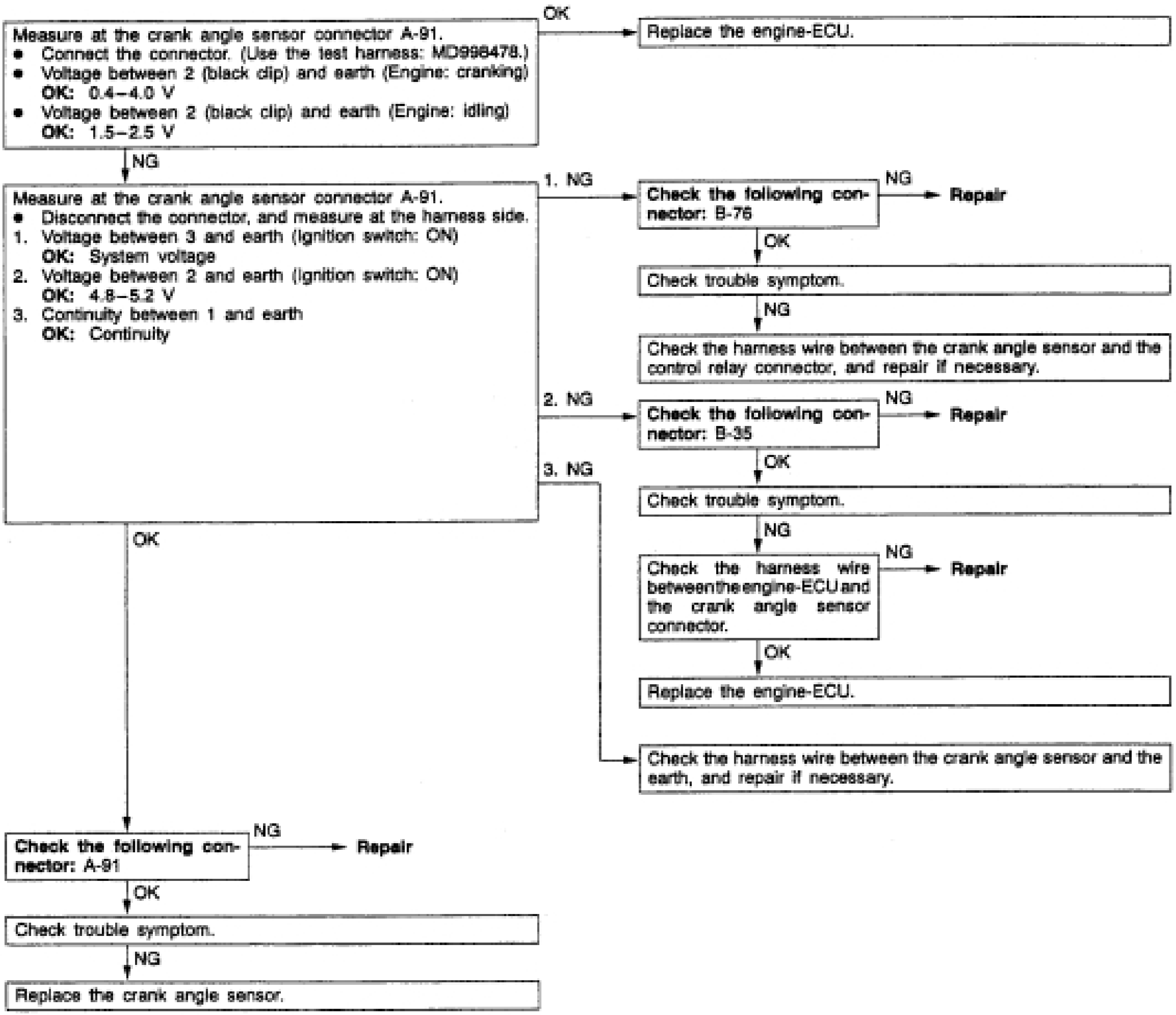
Check the following connector: A-75 —NG→ **Repair**

—OK→ Check trouble symptom.

↓ NG

Replace the engine-ECU.

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 • Improper connector contact, open circuit or short-circuited harness wire of the crank angle sensor • Malfunction of the engine-ECU



Code No.23 Camshaft position sensor system	Probable cause
Range of Check • Ignition switch: ON • Engine speed is approx. 50 r/min or more. Set conditions • Sensor output voltage does not change for 4 seconds (no pulse signal input.)	• Malfunction of the camshaft position sensor • Improper connector contact, open circuit or short-circuited harness wire of the camshaft position sensor circuit • Malfunction of the engine-ECU

Measure at the camshaft position sensor connector A-90.
- Connect the connector.
- Voltage between 2 and earth (Engine: cranking)
  OK: 0.4–3.0 V
- Voltage between 2 and earth (Engine: idling)
  OK: 1.5–2.0 V

OK → Replace the engine-ECU.

NG ↓

Measure at the camshaft position sensor connector A-90.
- Disconnect the connector, and measure at the harness side.

1. Voltage between 3 and earth (Ignition switch: ON)
   OK: System voltage
2. Voltage between 2 and earth (Ignition switch: ON)
   OK: 4.8–5.2 V
3. Continuity between 1 and earth
   OK: Continuity

1. NG → **Check the following connector:** B-76
- NG → **Repair**
- OK ↓ Check trouble symptom.
- NG ↓ Check the harness wire between the camshaft position sensor and the control relay connector, and repair if necessary.

2. NG → **Check the following connector:** B-35
- NG → **Repair**
- OK ↓ Check trouble symptom.
- NG ↓ Check the harness wire between the engine-ECU and the camshaft position sensor connector.
- NG → **Repair**
- OK ↓ Replace the engine-ECU.

3. NG → Check the harness wire between the camshaft position sensor and the earth, and repair if necessary.

OK ↓ **Check the following connector:** A-90
- NG → **Repair**
- OK ↓ Check trouble symptom.
- NG ↓ Replace the camshaft position sensor

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

Check the vehicle speed sensor
(Refer to GROUP 54 – Combination Meter.)
- NG → **Replace**
- OK ↓

Measure at the vehicle speed sensor connector A-06.
- 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
   (Ignition switch: ON)
   OK: 4.8 – 5.2 V
3. Continuity between 2 and earth
   OK: Continuity

OK ↓

Check the following connectors: A-06, B-35
- NG → **Repair**
- OK ↓

Check trouble symptom.
- NG ↓

Check the harness wire between the engine-ECU and the vehicle speed sensor.
- NG → **Repair**
- OK ↓

Replace the engine-ECU.

1. NG →

Check the following connectors: B-77, B-40, B-44
- NG → **Repair**
- OK ↓

Check trouble symptom.
- NG ↓

Check the harness wire between the ignition switch and the vehicle speed sensor.
- NG → **Repair**
- OK ↓

Check the ignition switch (Refer to GROUP 54 – Ignition switch.)

2. NG →

Check the following connector: B-35
- NG → **Repair**
- OK ↓

Check trouble symptom.
- NG ↓

Check the harness wire between the engine-ECU and the vehicle speed sensor.
- NG → **Repair**
- OK ↓

Replace the engine-ECU.

3. NG →

Check the harness wire between the vehicle speed sensor and the earth, and repair if necessary.

Code No. 31 Detonation sensor system	Probable cause
Range of Check • Ignition switch: ON • Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. • Engine speed is approx. 5,000 r/min or more Set conditions The change in the detonation sensor output voltage (detonation sensor peak voltage at each 1/3 revolution of the crankshaft) is less than 0.06 V for 200 times in succession.	• Malfunction of the detonation sensor • Improper connector contact, open circuit or short-circuited harness wire of the detonation sensor circuit • Malfunction of the engine-ECU

Measure at the detonation sensor connector A-19.
- Disconnect the connector and measure at the harness side.
- Continuity between 2 and earth

OK: Continuity

NG → Check the harness wire between the detonation sensor and earth, and repair if necessary.

OK → **Check the following connectors:** A-19, B-35

NG → **Repair**

OK → Check trouble symptom.

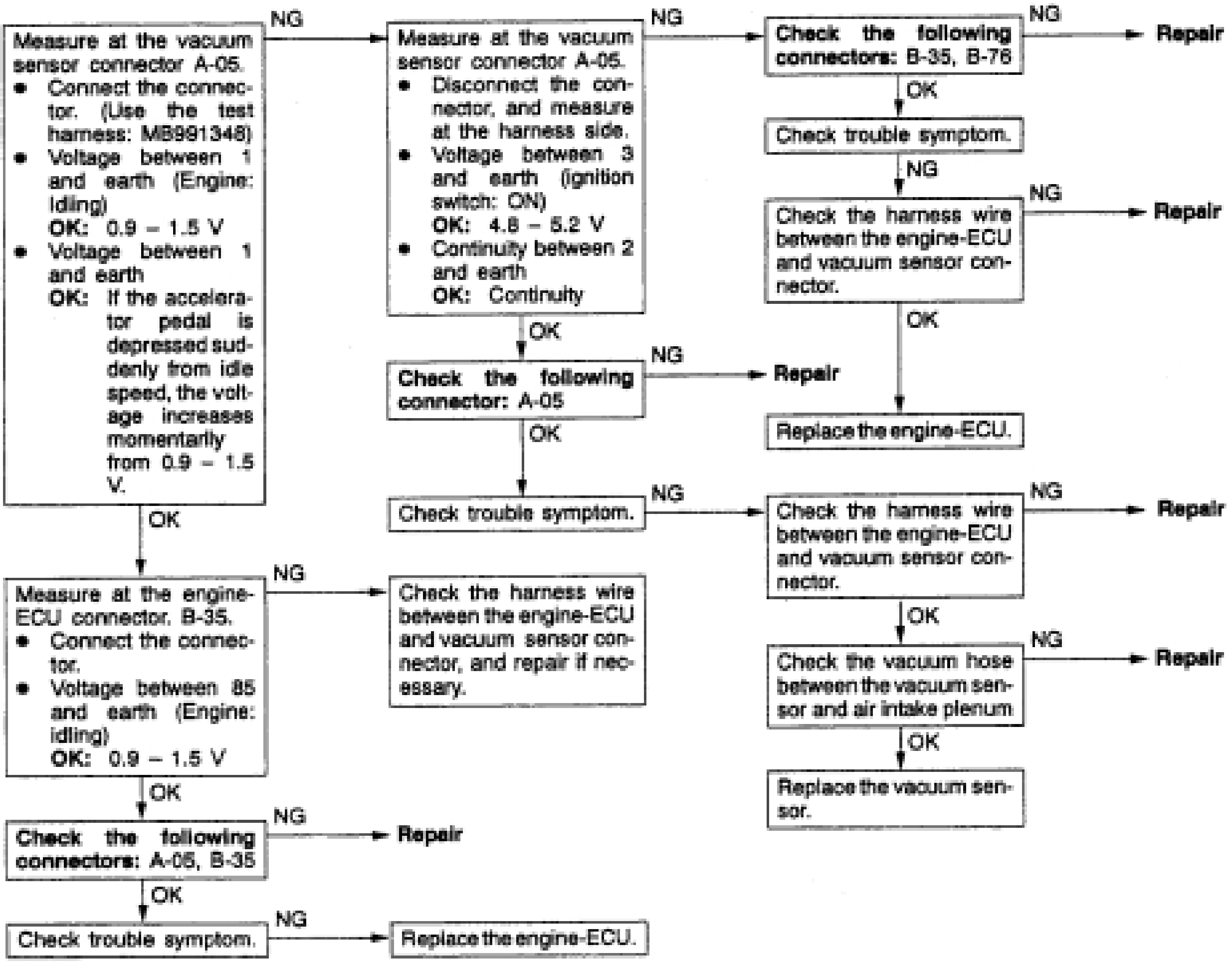
NG → Check the harness wire between the engine-ECU and the detonation sensor connector.

NG → **Repair**

OK → Replace the detonation sensor. → Check trouble symptom.

NG → Replace the engine-ECU.

Code No.32 Vacuum sensor system	Probable cause
Range of Check • Ignition switch: ON Set Conditions • The output voltage of the vacuum sensor is 4.5 V or more for 4 seconds. (This corresponds to the absolute manifold pressure of 115 kPa or more.)	• Malfunction of the vacuum sensor • Improper connector contact, open circuit or short-circuited harness wire of the vacuum sensor • Malfunction of the engine-ECU
Range of Check • The output voltage of the throttle position sensor is 1.25 V or more. or • The vehicle is stationary. Set Conditions • The output voltage of the vacuum sensor is 0.2 V or less for 4 seconds. (This corresponds to the absolute manifold pressure of 4.9 kPa or less.)	



Code No. 41 Injector system	Probable cause
Range of Check • Engine speed is approx. 50–1,000 r/min • The throttle position sensor output voltage is 1.15 V or less. • Actuator test by MUT-II is not carried out. Set conditions • Surge voltage of injector coil is not detected for 4 seconds.	• Malfunction of the injector • Improper connector contact, open circuit or short-circuited harness wire of the injector circuit • Malfunction of the engine-ECU

Check the injector. (Refer to P.13A-88.) —NG→ **Replace**

↓ OK

Measure at the injector connectors A-81, A-79, A-78.
(No.2, 4, 6 cylinder side)
- Disconnect the connector, and measure at the harness side.
- Voltage between 1 and earth (Ignition switch: ON)
  OK: System voltage

Measure at the injector intermediate connector A-18.
- Disconnect the connector, and measure at the harness side.
- Voltage between 8 and earth (Ignition switch: ON)
  OK: System voltage

—NG→ **Check the following connector:** B-76 —NG→ **Repair**

↓ OK

Check trouble symptom. —NG→ Check the harness wire between the control relay and the injector connector, and repair if necessary.

↓ OK (from injector connector measurement)

Check the injector control circuit. (Refer to P.13A-55, INSPECTION PROCEDURE 50.)

Code No. 44, 52, 53 Ignition coil and power transistor unit system	Probable cause
Range of Check • Engine speed is approx. 50–4,000 r/min • Engine is not cranking. Set conditions • The engine-ECU does not receive an ignition signal from one ignition coil for four seconds. However, the engine-ECU receives an ignition signal from the other coil(s).	• Malfunction of the ignition coil • Improper connector contact, open circuit or short-circuited harness wire of the ignition primary circuit • Malfunction of the ignition failure sensor • Malfunction of the engine-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 A-28, A-29, A-30.
- Disconnect the connector, and measure at the harness.

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 the 2 and earth
   OK: Continuity

1. NG → **Check the following connector:** A-65
   - NG → **Repair**
   - OK → Check trouble symptom.
     - NG → Check the harness wire between the ignition coil and ignition failure sensor connector, and repair if necessary.

2. NG → **Check the following connector:** B-32
   - NG → **Repair**
   - OK → Check trouble symptom.
     - NG → Check the harness wire between the engine-ECU and ignition coil connector.
       - OK → Replace the engine-ECU.
       - NG → **Repair**

3. NG → Check the harness wire between the ignition coil connector and earth, and repair if necessary.

OK ↓

Check the following connectors. A-28, A-29, A-30
- NG → **Repair**

Check trouble symptom.
- NG ↓

Check the ignition signal circuit. (Refer to P.13A-56, INSPECTION PROCEDURE 51.)

Code No. 61 Communication wire with A/T-ECU system	Probable cause
Range of Check • 60 seconds or more have passed immediately after engine was started. • Engine speed is approx. 50 r/min or more Set conditions The voltage of the torque reduction request signal from the A/T-ECU is LOW for 1.5 seconds or more.	• Malfunction of the harness wire and the connector • Malfunction of the engine-ECU • Malfunction of the A/T-ECU • Malfunction of the TCL-ECU <Vehicles with TCL>

<Vehicles without TCL>

Check the following connectors: B-29, B-34 — NG → **Repair**

↓ OK

Check trouble symptom.

↓ NG

Check the harness wire between the engine-ECU and the A/T-ECU connector. — OK → Replace the engine-ECU. → Check trouble symptom. → NG → Replace the A/T-ECU.

↓ NG

Repair

<Vehicles with TCL>

Check the following connectors: B-34, B-33, B-71, B-29, B-30, B-31 — NG → **Repair**

↓ OK

Check trouble symptom.

↓ NG

Check the harness wire between the engine-ECU and the TCL-ECU connector. — NG → **Repair**

↓ OK

Check the harness wire between the engine-ECU and the A/T-ECU connector. — OK → Replace the engine-ECU. → Check trouble symptom. → NG → Replace the TCL-ECU. → Check trouble symptom. → NG → Replace the A/T-ECU.

↓ NG

Repair

Code No.62 Intake air control valve position sensor system	Probable cause
Range of Check • 60 seconds or more have passed immediately after engine was started. • Engine speed is approx. 50 r/min or more. • Battery voltage is 10 V or more. Set conditions • The intake air control valve does not reach the target position even after the intake air control valve motor is driven several times. • A fault is detected in all of the four consecutive drives, which satisfy the Range of Check above.	• Malfunction of the intake air control valve position sensor • Improper connector contact, open circuit or short-circuited harness wire of the intake air control valve position sensor circuit • Malfunction of the intake air control servo motor (DC motor) • Improper connector contact, open circuit or short-circuited harness wire of the intake air control servo motor (DC motor) circuit • Malfunction of the engine-ECU

MUT-II Actuator test
11 Variable induction control servo
• Ignition switch: ON
OK: Operating sound of the intake air control valve can be heard.

NG → Check the variable induction control servo system. (Refer to P.13A-48, INSPECTION PROCEDURE 36.)

OK ↓

Measure at the intake air control valve position sensor connector A-02.
• Connect the connector. (Use the test harness: MB991348)
• Voltage between 2, 4 and earth
OK:
At idle condition:
0 – 1 V or 4.5 – 5.5 V
When raising gradually the engine speed to 5,000 r/min.:
4 or more (a moment)
At 5,000 r/min:
0 – 1 V or 4.5 – 5.5 V

OK ↓ Replace the engine-ECU.

NG → Measure at the intake air control valve position sensor connector A-02.
• Disconnect the connector, and measure at the harness side.
• Voltage between 1, 2, 4 and earth (Ignition switch: OK)
OK: 4.8 – 5.2 V
• Continuity between 3 and earth
OK: Continuity

OK ↓

Check the following connector:
A-02

NG → **Repair**

OK ↓ Check trouble symptom.

NG ↓ Replace the air intake plenum assembly.

NG → **Check the following connectors:**
B-33, B-35, B-76

NG → **Repair**

OK ↓ Check trouble symptom.

NG ↓ Check the harness wire between the engine-ECU and the intake air control valve position sensor connector.

NG → **Repair**

OK ↓ Replace the engine-ECU.

Code No. 64 Alternator FR Terminal System	Probable cause
Range of Check • Engine speed is approx. 50 r/min or more. Set condition • The alternator has send 4.5 V or more to the engine-ECU via the FR terminal for 20 seconds.	• Open circuit in alternator FR terminal circuit • Malfunction of the engine-ECU

Measure at the alternator connector A-83.
- Connect the connector. (Use the test harness: MB991519)
- Voltage between 4 (blue clip) and earth
  (Engine: Idling)
  (Radiator fan: Stopped)
  (Headlamp: OFF → ON)
  OK: Voltage drops by 0.2 – 3.5 V

OK → Replace the engine-ECU.

NG ↓

Measure at the alternator connector A-83.
- Disconnect the connector, and measure at the harness side.
- Voltage between 4 and earth
  (Ignition switch: ON)
  OK: 4.8 – 5.2 V

NG → **Check the following connector:** B-34
- NG → **Repair**
- OK ↓ Check trouble symptom.
- NG ↓ Check the harness wire between the engine-ECU and the alternator connector.
  - NG → **Repair**
  - OK ↓ Replace the engine-ECU.

OK ↓

Check the following connector: A-83

NG → **Repair**

OK ↓

Check trouble symptom.

NG ↓

Check the harness wire between the engine-ECU and the alternator connector.

NG → **Repair**

OK ↓

Replace the alternator.

Code No. 71 Vacuum control solenoid valve system <Vehicles with TCL>	Probable cause
Range of Check • Ignition switch: ON • Excluding 60 seconds immediately after the engine starts. • Battery voltage is 10 V or more. • Forced actuation by means of MUT-II is not being carried out. Set condition Solenoid valve drive or non-drive instruction and energized condition of solenoid coil are different.	• Malfunction of the vacuum control solenoid valve • Improper connector contact, open circuit or short-circuited harness wire of the vacuum control solenoid valve • Malfunction of the engine-ECU

Check the vacuum control solenoid valve. (Refer to P.13A-92.)
- NG → **Replace**
- OK ↓

Measure at the vacuum control solenoid valve connector A-44.
- Disconnect the connector and measure at the harness side.
- Voltage between 2 and earth (Ignition switch: ON)
  OK: System voltage

- NG → **Check the following connector:** B-76
  - NG → **Repair**
  - OK ↓ Check trouble symptom.
    - NG ↓ Check the harness wire between the vacuum control solenoid valve connector and the control relay connector, and repair if necessary.
- OK ↓

Measure at the engine-ECU connector B-33.
- Connect the connector.
- Voltage between 32 and earth (Ignition switch: ON)
  OK: System voltage

- NG → **Check the following connector:** A-44
  - NG → **Repair**
  - OK ↓ Check trouble symptom.
    - NG ↓ Check the harness wire between the engine-ECU and the vacuum control solenoid valve connector, and repair if necessary.
- OK ↓

Check the following connector: B-33
- NG → **Repair**
- OK ↓

Check trouble symptom.
- NG → Replace the engine-ECU.

Code No. 72 Ventilation control solenoid valve system <Vehicles with TCL>	Probable cause
Range of Check • Ignition switch: ON • Excluding 60 seconds immediately after the engine starts. • Battery voltage is 10 V or more. • Forced actuation by means of MUT-II is not being carried out. Set condition Solenoid valve drive or non-drive instruction and energized condition of solenoid coil are different.	• Malfunction of the ventilation control solenoid valve • Improper connector contact, open circuit or short-circuited harness wire of the ventilation control solenoid valve • Malfunction of the engine-ECU

Check the ventilation control solenoid valve. (Refer to P.13A-91.)

NG → **Replace**

OK ↓

Measure at the ventilation control solenoid valve connector A-46.
- Disconnect the connector and measure at the harness side.
- Voltage between 1 and earth (Ignition switch: ON)
  OK: System voltage

NG → **Check the following connector:** B-76

- NG → **Repair**
- OK ↓ Check trouble symptom.
- NG ↓ Check the harness wire between the control relay and the ventilation control solenoid valve connector, and repair if necessary.

OK ↓

Measure at the engine-ECU connector B-33.
- Connect the connector.
- Voltage between 31 and earth (Ignition switch: ON)
  OK: System voltage

NG → **Check the following connector:** A-46

- NG → **Repair**
- OK ↓ Check trouble symptom.
- NG ↓ Check the harness wire between the engine-ECU and the ventilation control solenoid valve connector, and repair if necessary.

OK ↓

Check the following connector: B-33

NG → **Repair**

OK ↓

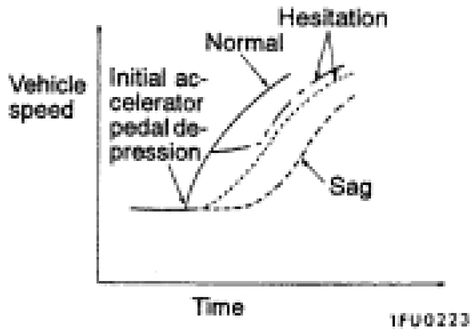
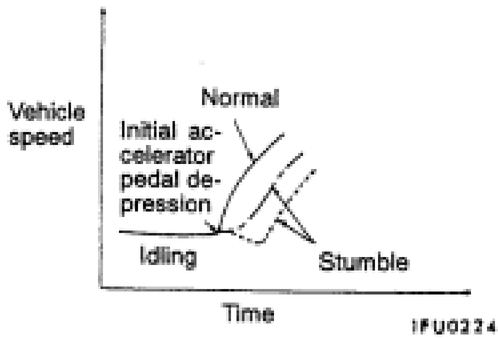
Check trouble symptom.

NG → Replace the engine-ECU.

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-27
	Communication with engine-ECU only is not possible.	2	13A-28
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-28
	The engine warning lamp remains illuminating and never goes out.	4	13A-29
Starting	No initial combustion (starting impossible)	5	13A-29
	Initial combustion but no complete combustion (starting impossible)	6	13A-30
	Long time to start (improper starting)	7	13A-31
Idling stability (Improper idling)	Unstable idling (Rough idling, hunting)	8	13A-31
	Idling speed is high. (Improper idling speed)	9	13A-32
	Idling speed is low. (Improper idling speed)	10	13A-33
Idling stability (Engine stalls)	When the engine is cold, it stalls at idling. (Die out)	11	13A-34
	When the engine becomes hot, it stalls at idling. (Die out)	12	13A-35
	The engine stalls when starting the car. (Pass out)	13	13A-36
	The engine stalls when decelerating.	14	13A-36
Driving	Hesitation, sag or stumble	15	13A-37
	The feeling of impact or vibration when accelerating	16	13A-37
	The feeling of impact or vibration when decelerating	17	13A-38
	Poor acceleration	18	13A-38
	Surge	19	13A-39
	Knocking	20	13A-39
Dieseling		21	13A-39
Too high CO and HC concentration when idling		22	13A-40
Low alternator output voltage (approx. 12.3 V)		23	13A-41

PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

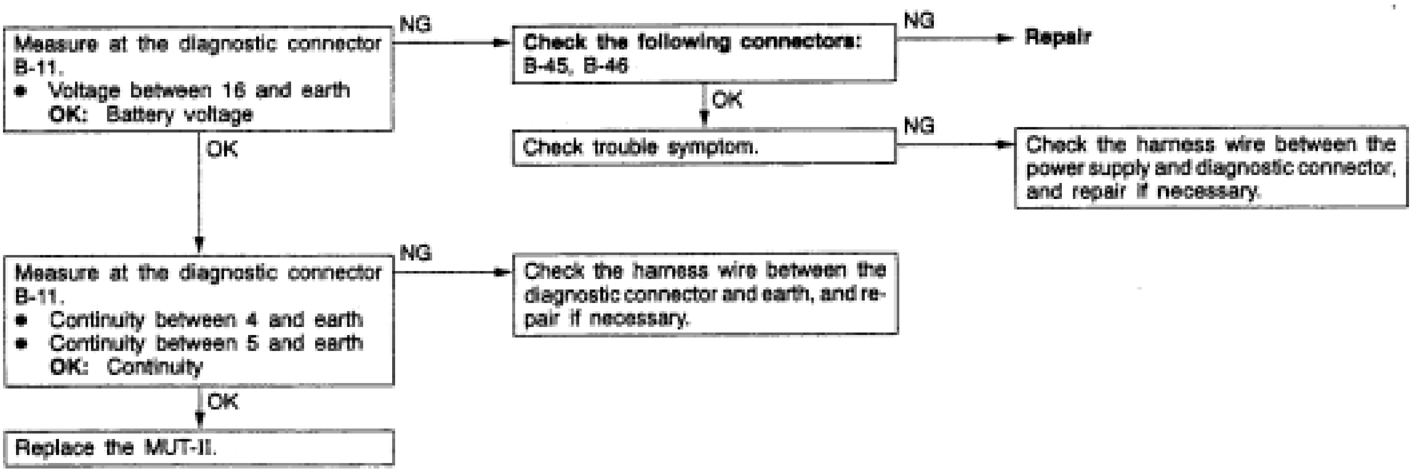
Items		Symptom
Starting	Won't start	The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.
	Fires up and dies	There is combustion within the cylinders, but then the engine soon stalls.
	Hard starting	Engine starts after cranking a while.
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	The engine speed does not rise.	The engine speed does not rise even after the accelerator pedal is depressed.
	Hesitation Sag	"Hesitation" is the delay in response of the vehicle speed (engine speed) that occurs when the accelerator is depressed in order to accelerate from the speed at which the vehicle is now traveling, or a temporary drop in vehicle speed (engine speed) during such acceleration. Serious hesitation is called "sag".  1FU0223
	Poor acceleration	Poor acceleration is inability to obtain an acceleration corresponding to the degree of throttle opening, even though acceleration is smooth, or the inability to reach maximum speed.
	Stumble	Engine speed increase is delayed when the accelerator pedal is initially depressed for acceleration.  1FU0224

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

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURE 1

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



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 engine-ECU and diagnosis connector

Check the following connector: B-34 — NG → **Repair**

↓ OK

Check trouble symptom.

↓ NG

Check the harness wire between engine-ECU and diagnosis connector. — NG → **Repair**

↓ OK

Check the engine-ECU power supply and earth circuit system. (Refer to P.13A-54, INSPECTION PROCEDURE 46.)

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

MUT-II Data list
16 Engine-ECU power supply voltage (Refer to P.13A-58.)
— NG → Check the engine-ECU power supply and earth circuit. (Refer to P.13A-54, INSPECTION PROCEDURE 46.)

↓ OK

Measure at the engine-ECU connector B-33.
- Disconnect the connector, and measure at the harness side.
- Earth the terminal No. 36.
  OK: The engine warning lamp illuminates.

— OK → **Check the following connector:** B-33 — NG → **Repair**
  ↓ OK
  Check trouble symptom.
  ↓ NG
  Replace the engine-ECU.

↓ NG

Check a burnt-out bulb. — NG → **Replace**

↓ OK

Measure at the combination meter connector C-06.
- Disconnect the connector, and measure at the harness side.
- Voltage between 33 and earth (Ignition switch: ON)
  OK: System voltage

— NG → Check the engine warning lamp power supply circuit, and repair if necessary.

↓ OK

Check the following connectors:
B-33, B-77, C-05
— NG → **Repair**

↓ OK

Check trouble symptom. — NG → Check the harness wire between combination meter and engine-ECU, and repair if necessary.

INSPECTION PROCEDURE 4

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

MUT-II Self-Diag code
Are diagnosis codes displayed?

Yes → Refer to P.13A-9, INSPECTION CHART FOR DIAGNOSIS CODES

↓ No

Measure at the combination meter connector C-05.
- Disconnect the connector, and measure at the harness side.
- Disconnect the engine-ECU connector
- Continuity between 11 and earth
  OK: No continuity

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

↓ OK

Replace the engine-ECU.

INSPECTION PROCEDURE 5

No initial combustion (starting impossible)	Probable cause
In cases such as the above, the cause is probably that a spark plug is defective, or that the supply of fuel to the combustion chamber is defective. In addition, foreign materials (water, kerosene, etc.) may be mixed with the fuel.	• Malfunction of the ignition system • Malfunction of the fuel pump system • Malfunction of the injectors • Malfunction of the engine-ECU • Foreign materials in fuel

Check battery voltage when cranking.
OK: 8 V or higher

NG → Check the battery. (Refer to GROUP 54 – Battery.)

↓ OK

MUT-II: Inspection of no initial combustion.
(Refer to P.13A-49, INSPECTION PROCEDURE 38.)

↓ OK

Can any sound be heard from the injectors when cranking?
(Using a sound scope, left bank)

NG → Check the injector system. (Refer to P.13A-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)

↓ OK

Ignition system: Inspection of no initial combustion.
(Refer to P.13A-49, INSPECTION PROCEDURE 39.)

↓ OK

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the injector operation sound at the right bank.
- Check if the injectors are clogged.
- Check if foreign materials (water, alcohol, etc.) got into fuel.
- Check the compression pressure.

INSPECTION PROCEDURE 6

Initial combustion but no complete combustion (starting impossible)	Probable cause
In such cases as the above, the cause is probably that the spark plugs are generating sparks but the sparks are weak, or the initial mixture for starting is not appropriate.	• Malfunction of the ignition system • Malfunction of the injector system • Foreign materials in fuel • Poor compression • Malfunction of the engine-ECU

Check battery voltage when cranking.
OK: 8 V or higher

NG → Check the battery. (Refer to GROUP 54 – Battery.)

OK ↓

MUT-II: Check if uncompleted combustion occurs.
(Refer to P.13A-49, INSPECTION PROCEDURE 40.)

OK ↓

Can any sound be heard from the injectors when cranking?
(Using a sound scope, left bank)

NG → Check the injector system. (Refer to P.13A-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)

OK ↓

Is starting good if the engine is cranked with the accelerator pedal slightly depressed?

Yes → Check ISC servo for operation sound.
(Refer to P.13A-90.)

- NG → Check the ISC servo system. (Refer to P.13A-47, INSPECTION PROCEDURE 35.)
- OK ↓
  - Clean the throttle valve area. (Refer to P.13A-75.)
  - Check and adjust the fixed SAS. (Refer to P.13A-80.)

No ↓

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 the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check if the injectors are clogged.
- Check the compression pressure.
- Check fuel lines for clogging.
- Check if foreign materials (water, alcohol, etc.) got into fuel.

INSPECTION PROCEDURE 7

In takes too long time to start. (Incorrect starting)	Probable cause
In cases such as the above, the cause is probably that the spark is weak and ignition is difficult, the initial mixture for starting is not appropriate, or sufficient compression pressure is not being obtained.	• Malfunction of the ignition system • Malfunction of the injector system • Inappropriate gasoline use • Poor compression

Check battery voltage when cranking
OK: 8 V or higher
- NG → Check the battery. (Refer to GROUP 54 – Battery.)
- OK ↓

MUT-II: Check if uncomplete combustion occurs. (Refer to P.13A-49, INSPECTION PROCEDURE 40.)
- OK ↓

Can any sound be heard from the injectors when cranking? (Using a sound scope, left bank)
- NG → Check the injector system. (Refer to P.13A-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)
- OK ↓

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 the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check if the injectors are clogged.
- Check the compression pressure.
- Check if foreign materials (water, alcohol, etc.) got into fuel.

INSPECTION PROCEDURE 8

Unstable idling (Rough idling, hunting)	Probable cause
In cases as the above, the cause is probably that the ignition system, air/fuel mixture, idle speed control (ISC) or compression pressure is defective. Because the range of possible causes is broad, inspection is narrowed down to simple items.	• Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the ISC system • Poor compression • Drawing air into exhaust system

Were the battery terminals disconnected?
- Yes → After warming-up, let the engine run at idling for 10 minutes.
- No ↓

MUT-II Self-Diag code
Are diagnosis codes displayed?
- Yes → Refer to P.13A-9, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

Does idling speed fluctuate excessively?
- Yes → Check if hunting occurs. (Refer to P.13A-50, INSPECTION PROCEDURE 41.)
- No ↓

Check the ISC servo for operation sound. (Refer to P.13A-90.)
- NG → Check the ISC servo system. (Refer to P.13A-47, INSPECTION PROCEDURE 35.)
- OK ↓

Check the injector for operation sound (left bank).
- NG → Check the injector system. (Refer to P.13A-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)
- OK ↓

MUT-II: Check if idling speed is unstable. (Refer to P.13A-50, INSPECTION PROCEDURE 42.)
- OK ↓

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

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the compression pressure.
- Check if foreign materials (water, alcohol, etc.) got into fuel.

INSPECTION PROCEDURE 9

Idling speed is high. (Improper idling speed)	Probable cause
In such cases as the above, the cause is probably that the intake air volume during idling is too great.	• Malfunction of the ISC servo system • Malfunction of the throttle body

MUT-II Self-Diag code
Are diagnosis codes displayed?

Yes → Refer to P.13A-9, INSPECTION CHART FOR DIAGNOSIS CODES.

No ↓

Check the ISC servo for operation sound. (Refer to P.13A-90.)

NG → Check the ISC servo system. (Refer to P.13A-47, INSPECTION PROCEDURE 35.)

OK ↓

MUT-II Data list
26 Idle position switch (Refer to P.13A-59.)

NG → Check the idle position switch system.
(Refer to P.13A-42, INSPECTION PROCEDURE 26.) <Vehicles without TCL>
(Refer to P.13A-43, INSPECTION PROCEDURE 27.) <Vehicles with TCL>

OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-58.)

NG → Check the engine coolant temperature sensor system. (Refer to P.13A-12, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)

OK ↓

MUT-II Data list
28 A/C switch (Refer to P.13A-59.)

NG → Check the A/C switch and A/C relay system. (Refer to P.13A-45, INSPECTION PROCEDURE 31.)

OK ↓

Basic idle speed adjustment (Refer to P.13A-80.)

↓

Check trouble symptom.

NG → Clean the throttle valve area. (Refer to P.13A-75.)

↓

Check and adjust the fixed SAS. (Refer to P.13A-80.)

INSPECTION PROCEDURE 10

Idling speed is low. (Improper idling speed)	Probable cause
In cases such as the above, the cause is probably that the intake air volume during idling is too small.	• Malfunction of the ISC servo system • Malfunction of the throttle body

MUT-II Self-Diag code
Are diagnosis codes displayed?
- Yes → Refer to P.13A-9, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

Check the ISC servo for operation sound. (Refer to P.13A-90.)
- NG → Check the ISC servo system. (Refer to P.13A-47, INSPECTION PROCEDURE 35.)
- OK ↓

MUT-II Data list
26 Idle position switch (Refer to P.13A-59.)
- NG → Check the idle position switch system. (Refer to P.13A-42, INSPECTION PROCEDURE 26.) <Vehicles without TCL> (Refer to P.13A-43, INSPECTION PROCEDURE 27.) <Vehicles with TCL>
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-58.)
- NG → Check the engine coolant temperature sensor system. (Refer to P.13A-12, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
- OK ↓

MUT-II Data list
29 Inhibitor switch (Refer to P.13A-59.)
- NG → Check the ignition switch ST and inhibitor switch system <A/T>. (Refer to P.13A-44, INSPECTION PROCEDURE 29.)
- OK ↓

Basic idle speed adjustment (Refer to P.13A-80.)
↓

Check trouble symptom.
- NG → Clean the throttle valve area. (Refer to P.13A-75.) → Check and adjust the fixed SAS. (Refer to P.13A-80.)

INSPECTION PROCEDURE 11

When the engine is cold, it stalls at idling. (Die out)	Probable cause
In such cases as the above, the cause is probably that the air/fuel mixture is inappropriate when the engine is cold, or that the intake air volume is insufficient.	• Malfunction of the ISC servo system • Malfunction of the throttle body • Malfunction of the injector system • Malfunction of the ignition system

- Were the battery terminals disconnected?
  - Yes → After warming-up, let the engine run at idling for 10 minutes.
  - No ↓
- **MUT-II Self-Diag code**
  Are diagnosis codes displayed?
  - Yes → Refer to P.13A-9, INSPECTION CHART FOR DIAGNOSIS CODES.
  - No ↓
- Does the engine stall right after the accelerator pedal is released?
  - Yes → Clean the throttle valve area. (Refer to P.13A-75.) → Check and adjust the fixed SAS. (Refer to P.13A-80.)
  - No ↓
- Is engine-idling stable after the warming-up?
  - No → Check if the unstable idling (Rough idling, hunting). (Refer to P.13A-31, INSPECTION PROCEDURE 8.)
  - Yes ↓
- Check the ISC servo for operation sound. (Refer to P.13A-90.)
  - NG → Check the ISC servo system. (Refer to P.13A-47, INSPECTION PROCEDURE 35.)
  - OK ↓
- Check the injector for operation sound (left bank).
  - NG → Check the injector system. (Refer to P.13A-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)
  - OK ↓
- **MUT-II Data list**
  26 Idle position switch (Refer to P.13A-59.)
  - NG → Check the idle position switch system. (Refer to P.13A-42, INSPECTION PROCEDURE 26.) <Vehicles without TCL> (Refer to P.13A-43, INSPECTION PROCEDURE 27.) <Vehicles with TCL>
  - OK ↓
- **MUT-II Data list**
  21 Engine coolant temperature sensor (Refer to P.13A-58.)
  - NG → Check the engine coolant temperature sensor system. (Refer to P.13A-12, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
  - OK ↓
- Check the fuel pressure. (Refer to P.13A-81.)
  - OK ↓
- Check the ignition timing. (Refer to GROUP 11A – On-vehicle Service.)
  - NG → Check that the crank angle sensor and timing belt cover are installed properly.
  - OK ↓
- Check the following items.
  - Check the ignition coil, spark plugs, spark plug cables.
  - Check the compression pressure.
  - Check the engine oil viscosity.

INSPECTION PROCEDURE 12

When the engine is hot, it stalls at idling. (Die out)	Probable cause
In such cases as the above, the cause is probably that ignition system, air/fuel mixture, idle speed control (ISC) or compression pressure is defective. In addition, if the engine suddenly stalls, the cause may also be a defective connector contact.	• Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the ISC system • Drawing air into intake system • Improper connector contact

Were the battery terminals disconnected?
- Yes → After warming-up, let the engine run at idling for 10 minutes.
- No ↓

MUT-II Self-Diag code
Are diagnosis codes displayed?
- Yes → Refer to P.13A-9, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

Check the ISC servo for operation sound. (Refer to P.13A-90.)
- NG → Check the ISC servo system. (Refer to P.13A-47, INSPECTION PROCEDURE 35.)
- OK ↓

Check the injector for operation sound (left bank).
- NG → Check the injector system. (Refer to P.13A-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)
- OK ↓

Does the engine stall right after the accelerator pedal is released?
- Yes → Clean the throttle valve area. (Refer to P.13A-75.) → Check and adjust the fixed SAS. (Refer to P.13A-80.)
- No ↓

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 drive signal
  - Primary and secondary ignition signal
  - Fuel pump drive signal
  - Engine-ECU power supply voltage
- Yes ↓

MUT-II: Engine stalling inspection when the engine is warm and idling. (Refer to P.13A-51, INSPECTION PROCEDURE 43.)
- OK ↓

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

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check if the injectors are clogged.
- Check the compression pressure.
- Check if foreign materials (water, alcohol, etc.) got into fuel.

INSPECTION PROCEDURE 13

The engine stalls when starting the car. (Pass out)	Probable cause
In cases such as the above, the cause is probably misfiring due to a weak spark, or an inappropriate air/fuel mixture when the accelerator pedal is depressed.	• Drawing air into intake system • Malfunction of the ignition system

MUT-II Self-Diag code
Are diagnosis codes displayed?

- Yes → Refer to P.13A-9, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

Check the following items.

- Check the ignition coil, spark plugs, spark plug cables.
- Check if air was drawn into the intake system.
  - Broken intake manifold gasket
  - Broken or disconnected vacuum hose
  - Improper operation of the PCV valve
  - Broken air intake hose

INSPECTION PROCEDURE 14

The engine stalls when decelerating.	Probable cause
In cases such as the above, the cause is probably that the intake air volume is insufficient due to a defective idle speed control (ISC) servo system.	• Malfunction of the ISC system

Were the battery terminals disconnected?

- Yes → After warming-up, let the engine run at idling for 10 minutes.
- No ↓

MUT-II Self-Diag code
Are diagnosis codes displayed?

- Yes → Refer to P.13A-9, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

MUT-II Data list
26 Idle position switch (Refer to P.13A-59.)

- NG → Check the idle position switch system.
  (Refer to P.13A-42, INSPECTION PROCEDURE 26.) <Vehicles without TCL>
  (Refer to P.13A-43, INSPECTION PROCEDURE 27.) <Vehicles with TCL>
- OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13A-58.)

- NG → Check the throttle position sensor system. (Refer to P.13A-11, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
- OK ↓

MUT-II Data list
45 ISC servo position

- Is the idle speed control (ISC) servo position drops to 0–2 steps when decelerating (engine r/min less than 1,000)?

- Yes → Check the vehicle speed sensor system. (Refer to P.13A-15, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 24.)
- No ↓

Check the following items.

- Check the ignition coil, spark plugs, spark plug cables.
- Clean the throttle valve area.
- Check and adjust the fixed SAS.

INSPECTION PROCEDURE 15

Hesitation, sag or stumble	Probable cause
In cases such as the above, the cause is probably that ignition system, air/fuel mixture or compression pressure is defective.	• Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the fuel supply system • Poor compression

MUT-II Self-Diag code
Are diagnosis codes displayed?

Yes → Refer to P.13A-9, INSPECTION CHART FOR DIAGNOSIS CODES.

No ↓

Check the injectors for operation sound (left bank).

NG → Check the injector system. (Refer to P.13A-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)

OK ↓

Check the ignition timing.
(Refer to GROUP 11A – On-vehicle Service.)

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

OK ↓

MUT-II: Check if hesitation, sag, stumble or poor acceleration occur.
(Refer to P.13A-52, INSPECTION PROCEDURE 44.)

OK ↓

Check the fuel pressure. (Refer to P.13A-81.)

OK ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the injector operating sound at the right bank.
- Check the operation vacuum of the traction control <TCL>.
- Check the operation of the throttle valve <TCL>.
- Check the vacuum tank and vacuum actuator <TCL>.
- Check the compression pressure.
- Check the fuel filter or fuel line for clogging.

INSPECTION PROCEDURE 16

The feeling of impact or vibration when accelerating	Probable cause
In cases such as the above, the cause is probably that there is an ignition leak accompanying the increase in the spark plug demand voltage during acceleration.	• Malfunction of the ignition system

MUT-II Self-Diag code
Are diagnosis codes displayed?

Yes → Refer to P.13A-9, INSPECTION CHART FOR DIAGNOSIS CODES.

No ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check for occurrence of ignition leak.

INSPECTION PROCEDURE 17

The feeling of impact or vibration when decelerating.	Probable cause
Malfunction of the ISC system is suspected.	• Malfunction of the ISC system

MUT-II Self-Diag code
Are diagnosis codes displayed?
- Yes → Refer to P.13A-9, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

Check the ISC servo for operation sound. (Refer to P.13A-90.)
- NG → Check the ISC servo system. (Refer to P.13A-47, INSPECTION PROCEDURE 35.)
- OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13A-58.)
- NG → Check the throttle position sensor system. (Refer to P.13A-11, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
- OK ↓

MUT-II Data list
26 Idle position switch (Refer to P.13A-59.)
- NG → Check the idle position switch system. (Refer to P.13A-42, INSPECTION PROCEDURE 26.) <Vehicles without TCL> (Refer to P.13A-43, INSPECTION PROCEDURE 27.) <Vehicles with TCL>
- OK ↓

Clean the throttle valve area. (Refer to P.13A-75.)

INSPECTION PROCEDURE 18

Poor acceleration	Probable cause
Defective ignition system, abnormal air-fuel ratio, poor compression pressure, etc. are suspected.	• Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the fuel supply system • Poor compression pressure • Clogged exhaust system

MUT-II Self-Diag code
Are diagnosis codes displayed?
- Yes → Refer to P.13A-9, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

Check the injectors for operation sound (left bank).
- NG → Check the injector system. (Refer to P.13A-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)
- OK ↓

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

MUT-II: Check if hesitation, sag, stumble or poor acceleration occur.
(Refer to P.13A-52, INSPECTION PROCEDURE 44.)
- OK ↓

Check the fuel pressure. (Refer to P.13A-81.)
- OK ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the injector operating sound at the rear bank.
- Check the operation vacuum of the traction control <TCL>.
- Check the operation of the throttle valve <TCL>.
- Check the vacuum tank and vacuum actuator <TCL>.
- Check the compression pressure.
- Check the fuel filter or fuel line for clogging.
- Broken air intake hose
- Clogged air cleaner
- Clogged exhaust system

INSPECTION PROCEDURE 19

Surge	Probable cause
Defective ignition system, abnormal air-fuel ratio, etc. are suspected.	• Malfunction of the ignition system • Malfunction of air-fuel ratio control system

MUT-II Self-Diag code
Are diagnosis codes displayed?

Yes → Refer to P.13A-9, INSPECTION CHART FOR DIAGNOSIS CODES.

No ↓

Check the injectors for operation sound (left bank).

NG → Check the injector system. (Refer to P.13A-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)

OK ↓

Check the ignition timing.
(Refer to GROUP 11A – On-vehicle Service.)

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

OK ↓

MUT-II: Check if surge occurs.
(Refer to P.13A-53, INSPECTION PROCEDURE 45.)

OK ↓

Check the fuel pressure. (Refer to P.13A-81.)

OK ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the injector operation sound at the right bank.

INSPECTION PROCEDURE 20

Knocking	Probable cause
In cases as the above, the cause is probably that the detonation control is defective or the heat value of the spark plug is inappropriate.	• Defective detonation sensor • Inappropriate heat value of the spark plug

MUT-II Self-Diag code
Are diagnosis codes displayed?

Yes → Refer to P.13A-9, INSPECTION CHART FOR DIAGNOSIS CODES.

No ↓

Does knocking occur when driving with the sensor disconnected?
At this time, use the MUT-II to check if the timing is retarded compared to when the detonation sensor connector is connected.

No → Check the detonation sensor system. (Refer to P.13A-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 31.)

Yes ↓

Check the following items.
- Spark plugs
- Check if foreign materials (water, alcohol, etc.) got into fuel.

INSPECTION PROCEDURE 21

Dieseling	Probable cause
Fuel leakage from injectors is suspected.	• Fuel leakage from injectors

Check the injectors for fuel leakage.

INSPECTION PROCEDURE 22

Too high CO and HC concentration when idling	Probable cause
Abnormal air-fuel ratio is suspected.	• Malfunction of the air-fuel ratio control system • Deteriorated catalyst

MUT-II Self-Diag code
Are diagnosis codes displayed?

Yes → Refer to P.13A-9, INSPECTION CHART FOR DIAGNOSIS CODES.

No ↓

Check the ignition timing.
(Refer to GROUP 11A – On-vehicle Service.)

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

OK ↓

MUT-II Data list
21 Engine coolant temperature sensor. (Refer to P.13A-58.)

NG → Check the engine coolant temperature sensor system. (Refer to P.13A-12, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)

OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-57.)

NG → Check the intake air temperature sensor system. (Refer to P.13A-10, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)

OK ↓

MUT-II Data list
11 Oxygen sensor
OK: 600–1,000 mV when racing suddenly

NG → Check the oxygen sensor system. (Refer to P.13A-46, INSPECTION PROCEDURE 33.)

OK ↓

MUT-II Data list
11 Oxygen sensor
OK: Repeat 0–400 mV and 600–1,000 mV alternately when idling.

OK → Replace the oxygen sensor. ↓ Check trouble symptom. NG ↓ (to "Check the following items.")

NG ↓

Check the fuel pressure. (Refer to P.13A-81.)

OK ↓

Check the following items.
- Check the injectors for operation sound.
- Check the injectors for fuel leakage.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the compression pressure.
- Check the positive crankcase ventilation system.
- Check the evaporative emission control system.

↓

Check the trouble symptom.

NG ↓

Replace the catalytic converter.

INSPECTION PROCEDURE 23

Low alternator output voltage (approx. 12.3 V)	Probable cause
The alternator may be defective, or malfunctions, which are listed in the right column, may be suspected.	• Malfunction of charging system • Short circuit in harness between alternator G terminal and engine-ECU • Malfunction of engine-ECU

Measure at the alternator connector side A-83.
- Connect the connector. (Use test harness: MB991519)
- Voltage between 1 (black clip) and earth (Engine: at idle) (Radiator fan: does not run) (Headlamp: OFF → ON)
  OK: Voltage rises by 0.2 – 3.5 V.

OK → Check the alternator. (Refer to GROUP 16 – Charging System.)

NG → Measure at the alternator connector A-83.
- Disconnect the connector, and measure at the harness side.
- Disconnect the engine-ECU connector.
- Continuity between 1 and earth
  OK: No continuity

NG → Check the harness wire between the alternator and the engine-ECU connector, and repair if necessary.

OK → Check the harness wire between the alternator and the engine-ECU connector.

NG → **Repair**

OK → Replace the engine-ECU.

INSPECTION PROCEDURE 24

Power supply system and ignition switch-IG system	Probable cause
When an ignition switch ON signal is input to the engine-ECU, the engine-ECU turns the control relay ON. This causes battery voltage to be supplied to the engine-ECU and injectors.	• Malfunction of the ignition switch • Malfunction of the control relay • Improper connector contact, open circuit or short-circuited harness wire • Disconnected engine-ECU earth wire • Malfunction of the engine-ECU

Check the control relay. (Refer to P.13A-85.)

NG → **Replace**

OK → Measure at the control relay connector B-72.
- Disconnect the connector, and measure at the harness side.
- Voltage between 4, 8 and earth
  OK: System voltage

OK → Check the engine-ECU power supply and earth circuit. (Refer to P.13A-54, INSPECTION PROCEDURE 46.)

NG → **Check the following connector: A-13**

NG → **Repair**

OK → Check trouble symptom.

NG → Check the harness wire between battery and control relay connector, and repair if necessary.

INSPECTION PROCEDURE 25

Fuel pump system	Probable cause
The engine-ECU turns the fuel pump relay ON when the engine is cranking or running, and this supplies power to drive the fuel pump.	• Malfunction of the fuel pump relay • Malfunction of the fuel pump • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU

Check the fuel pump operation. (Refer to P.13A-75.)
- NG → Check the fuel pump circuit. (Refer to P.13A-54, INSPECTION PROCEDURE 47.)
- OK ↓

Check the fuel pump relay. (Refer to P.13A-85.)
- NG → **Replace**
- OK ↓

Measure at the fuel pump relay connector B-73.
- Connect the connector.
- Voltage between 1 and earth
- MUT-II Actuator test: Fuel pump drive
  OK: System voltage

- NG → Check the fuel pump drive control circuit. (Refer to P.13A-55, INSPECTION PROCEDURE 48.)
- OK ↓

Check the harness wire between fuel pump relay connector and fuel pump drive terminal, and repair if necessary.

INSPECTION PROCEDURE 26

Idle position switch system <Vehicles without TCL>	Probable cause
The idle position switch inputs the condition of the accelerator pedal, i.e. whether it is depressed or released (HIGH/LOW), to the engine-ECU. The engine-ECU controls the idle speed control servo based on this input.	• Maladjustment of the accelerator pedal • Maladjustment of the fixed SAS • Maladjustment of the idle position switch and throttle position sensor • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU

Check the idle position switch. (Refer to P.13A-86.)
- NG → Replace the throttle position sensor.
- OK ↓

Measure at the throttle position sensor connector A-07.
- Disconnect the connector, and measure at the harness side.
- Voltage between 2 and earth (ignition switch: ON)
  OK: 4 V or higher
- Continuity between 1 and earth
  OK: Continuity

- NG → **Check the following connectors:** B-35, B-76
  - NG → **Repair**
  - OK ↓ Check trouble symptom.
  - NG ↓ Check the harness wire between engine-ECU and throttle position sensor connector.
    - OK ↓ Replace the engine-ECU.
    - NG ↓ **Repair**
- OK ↓

Check the following connector: A-07
- NG → **Repair**
- OK ↓

Check trouble symptom.
- NG ↓

Replace the engine-ECU.

INSPECTION PROCEDURE 27

Idle position switch system <Vehicles with TCL>	Probable cause
The idle position switch inputs the condition of the accelerator pedal, i.e. whether it is depressed or released (HIGH/LOW), to the engine-ECU. The engine-ECU controls the idle speed control servo based on this input.	• Maladjustment of the accelerator pedal • Maladjustment of the fixed SAS • Maladjustment of the idle position switch and accelerator pedal position sensor • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU

- Check the idle position switch. (Refer to P.13A-87.)
  - NG → Replace the accelerator pedal position sensor.
  - OK → Measure at the accelerator pedal position sensor connector A-08.
    - Disconnect the connector, and measure at the harness side.
    - Voltage between 3 and earth (Ignition switch: ON)
      OK: 4 V or higher
    - Continuity between 4 and earth
      OK: Continuity
    - NG → **Check the following connectors:** B-35, B-76
      - NG → **Repair**
      - OK → Check trouble symptom.
        - NG → Check the harness wire between engine-ECU and accelerator pedal position sensor connector.
          - OK → Replace the engine-ECU.
          - NG → **Repair**
    - OK → **Check the following connector:** A-08
      - NG → **Repair**
      - OK → Check trouble symptom.
        - NG → Replace the engine-ECU.

INSPECTION PROCEDURE 28

Ignition switch-ST system <M/T>	Probable cause
The ignition switch-ST inputs a HIGH signal to the engine-ECU while the engine is cranking. The engine-ECU controls fuel injection, etc. during starting based on this input.	• Malfunction of ignition switch • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU

- Measure at the engine-ECU connector B-35.
  - Disconnect the connector, and measure at the harness side.
  1. Voltage between 71 and earth (Ignition switch: START)
     OK: 8V or more
  2. Continuity between 91 and earth
     OK: Continuity
  - 1. NG → **Check the following connector:** B-36
    - NG → **Repair**
    - OK → Check trouble symptom.
      - NG → Check harness wire between the engine-ECU and ignition switch connector.
        - NG → **Repair**
        - OK → Check the ignition switch. (Refer to GROUP 54 – Ignition Switch.)
  - 2. NG → Check the harness wire between engine-ECU connector (terminal No. 91) and earth, and repair if necessary.
  - OK → **Check the following connector:** B-35
    - NG → **Repair**
    - OK → Check trouble symptom.
      - NG → Replace the engine-ECU.

INSPECTION PROCEDURE 29

Ignition switch-ST and inhibitor switch system <A/T>	Probable cause
• The ignition switch-ST inputs a HIGH signal to the engine-ECU while the engine is cranking. The engine-ECU controls fuel injection, etc. during starting based on this input. • The inhibitor switch inputs the condition of the select lever, i.e. whether it is in P or N range or in some other range, to the engine-ECU. The engine-ECU controls the idle speed control (ISC) servo based on this input.	• Malfunction of ignition switch • Malfunction of inhibitor switch • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU.

Check the inhibitor switch.
(Refer to GROUP 23A – On-vehicle Service.)
- NG → **Replace**
- OK ↓

Measure at the inhibitor switch connector A-74.
- Disconnect the connector, and measure at the harness side.

1. Voltage between 10 and earth (ignition switch: ON)
   OK: System voltage
2. Continuity between 9 and earth
   OK: Continuity
3. Voltage between 10 and earth
   - Ignition switch: START
   - Disconnect engine-ECU connector.

   OK: System voltage

OK ↓

Check the following connector: A-74
- NG → **Repair**
- OK ↓

Check trouble symptom.
- NG ↓

Check harness wire between engine-ECU and inhibitor switch connector.
- NG → **Repair**
- OK ↓

Replace the engine-ECU.

1\. NG ↓

Check harness wire between engine-ECU and inhibitor switch connector.
- NG → **Repair**
- OK ↓

Replace the engine-ECU.

2\. NG ↓

Check the following connector: A-12
- NG → **Repair**
- OK ↓

Check trouble symptom.
- NG ↓

Check harness wire between inhibitor switch connector and starter S terminal, and repair if necessary.

3\. NG ↓

Check the following connector: B-36
- NG → **Repair**
- OK ↓

Check trouble symptom.
- NG ↓

Check harness wire between inhibitor switch and ignition switch connector.
- NG → **Repair**
- OK ↓

Check the ignition switch.
(Refer to GROUP 54 – Ignition Switch.)

INSPECTION PROCEDURE 30

Power steering fluid pressure switch system	Probable cause
The presence or absence of power steering load is input to the engine-ECU. The engine-ECU controls the idle speed control (ISC) servo based on this input.	• Malfunction of power steering fluid pressure switch • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU

Check the power steering fluid pressure switch.
(Refer to GROUP 37A – On-vehicle Service.)
NG → **Replace**
OK ↓

Measure at the power steering fluid pressure switch connector A-33.
- Disconnect the connector, and measure at the harness side.
- Voltage between 1 and earth (Ignition switch: ON)
  OK: System voltage

NG → **Check the following connector:** A-13
- NG → **Repair**
- OK ↓ Check trouble symptom.
- NG ↓ Check harness wire between engine-ECU and power steering fluid pressure switch connector.
- NG → **Repair**
- OK ↓ Replace the engine-ECU.

OK ↓

Check the following connector: A-33
NG → **Repair**
OK ↓

Check trouble symptom.
NG ↓

Replace the engine-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-ECU, the engine-ECU carries out control of the idle speed control (ISC) servo, and also operates the A/C compressor magnetic clutch.	• Malfunction of A/C control system • Malfunction of A/C switch • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU

Check the A/C compressor relay.
(Refer to GROUP 55 – On-vehicle Service.)
NG → **Replace**
OK ↓

Measure at the engine-ECU connectors B-32, B-33.
- Disconnect the connector, and measure at the harness side.
- Voltage between 22 and earth, and 45 and earth
  (Ignition switch: ON)
  (A/C switch: ON)
  OK: System voltage
- Short the terminal 22 to earth
  (Ignition switch: ON, A/C switch: ON)
  OK: A/C compressor clutch turns on.

NG → Check the A/C system. (Refer to GROUP 55 – On-vehicle Service.)

OK → **Check the following connectors:** B-32, B-33
- NG → **Replace**
- OK ↓ Check trouble symptom.
- NG ↓ Replace the engine-ECU.

INSPECTION PROCEDURE 32

Fan motor relay system (Radiator fan, A/C condenser fan)	Probable cause
The power transistor inside the engine-ECU turns the fan motor relay on and off.	• Malfunction of fan motor relay • Malfunction of fan motor • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of engine-ECU

Measure at the engine-ECU connector B-32.
- Disconnect the connector, and measure at the harness side.
- Voltage between 21 and earth (Ignition switch: ON)
  OK: System voltage
- Short the terminal 21 to earth (Ignition switch: ON) (A/C switch: ON)
  OK: Radiator fan and condenser fan run

OK → **Check the following connector. B-32** — NG → **Repair**

OK → Check trouble symptom. — NG → Replace the engine-ECU.

NG →
- Check the radiator fan circuit.
- Check the A/C condenser fan circuit. (Refer to Electrical Wiring.)

INSPECTION PROCEDURE 33

Oxygen sensor system	Probable cause
If the CO or HC concentration is high, the malfunction(s) listed to the right may be present. • The oxygen sensor detects oxygen concentration in the exhaust gas, and converts the concentration to a voltage signal to send to the engine-ECU. • The engine-ECU controls the fuel injection amount according to this signal so that the air/fuel ratio can be close to the theoretical one.	• Malfunction of the oxygen sensor • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU

Check the oxygen sensor. (Refer to P.13A-87.) — NG → **Replace**

OK →

Measure at the oxygen sensor connector B-68.
- Disconnect the connector, and measure at the harness side.
1. Voltage between 3 and earth (Ignition switch: ON)
   OK: System voltage
2. Continuity between 2 and earth
   OK: Continuity
3. Continuity between 4 and earth
   OK: Continuity

1. NG → **Check the following connector: B-75** — NG → **Repair**
   OK → Check trouble symptom.
   NG → Check the harness wire between the oxygen sensor and the control relay connector, and repair if necessary.

2. NG → **Check the following connector: B-76** — NG → **Repair**
   OK → Check trouble symptom.
   NG → Check the harness wire between the engine-ECU and the oxygen sensor connector. — NG → **Repair**
   OK → Replace the engine-ECU.

3. NG → Check the harness wire between the oxygen sensor and the earth, and repair if necessary.

OK → **Check the following connector: B-68** — NG → **Repair**

OK → Check trouble symptom.

NG → Check the harness wire between the engine-ECU and the oxygen sensor connector. — NG → **Repair**

OK → Replace the engine-ECU.

INSPECTION PROCEDURE 34

Ignition circuit system	Probable cause
The engine-ECU interrupts the ignition coil primary current by turning the power transistor inside the engine-ECU ON and OFF.	• Malfunction of ignition switch. • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU

Measure at the distributor connectors A-28, A-29, A-30.
- Disconnect the connector and measure at the harness side.

1. Voltage between 1 and earth (Ignition switch: ON)
   OK: System voltage
2. Continuity between 2 and earth
   OK: Continuity

1. NG → **Check the following connectors:** A-65, B-36 — NG → **Repair**
- OK → Check trouble symptom.
- NG → Check the harness wire between ignition coil and ignition switch connector. — NG → **Repair**
- OK → Check the ignition switch. (Refer to GROUP 54 – Ignition Switch.)

2. NG → Check the harness wire between ignition coil connector and earth, and repair if necessary.

OK → **Check the following connectors:** A-28, A-29, A-30
- NG → **Repair**
- OK → Check trouble symptom.
- NG → Check ignition coil and power transistor unit circuit. (Refer to P.13A-19, INSPECTION PROCEDURE FOR DIAGNOSIS CODE Nos. 44, 52, 53.)

INSPECTION PROCEDURE 35

Idle speed control (ISC) servo (Stepper motor) system	Probable cause
The engine-ECU controls the intake air volume during idling by opening and closing the servo valve located in the bypass air passage.	• Malfunction of ISC servo • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU

Check the ISC servo (Refer to P.13A-90.) — NG → **Replace**

OK → Measure at the ISC servo connector A-09.
- Disconnect the connector and measure at the harness side.
- Voltage between 2 and earth, and 5 and earth (Ignition switch: ON)

OK: System voltage

NG → **Check the following connector:** B-76 — NG → **Repair**
- OK → Check trouble symptom.
- NG → Check the harness wire between control relay and ISC servo connector, and repair if necessary.

OK → Measure at the engine-ECU connector B-32.
- Disconnect the connector, measure at the harness side.
- Voltage between each of 4, 5, 17, 18 and earth (Ignition switch: ON)

OK: System voltage

NG → **Check the following connector:** A-09 — NG → **Repair**
- OK → Check trouble symptom.
- NG → Check harness wire between engine-ECU and ISC servo connector, and repair if necessary.

OK → **Check the following connector:** B-32 — NG → **Repair**

OK → Check trouble symptom. — NG → Replace the engine-ECU.

INSPECTION PROCEDURE 36

Variable induction control servo (DC motor) system	Probable cause
The engine-ECU opens or closes the intake air control valve by driving a direct motor.	• Malfunction of variable induction control servo • Improper connector contact, open circuit or short-circuited harness wire. • Malfunction of the engine-ECU

Check the variable induction control servo. (Refer to GROUP 15 – On-vehicle Service.) — NG → **Replace**

↓ OK

Check the following connectors: A-03, B-33 — NG → **Repair**

↓ OK

Check trouble symptom. — NG → Check the harness wire between the engine-ECU and variable induction control servo connector, and repair if necessary.

↓ OK

Replace the engine-ECU.

INSPECTION PROCEDURE 37

Oil control valve (valve timing switching) system	Probable cause
The engine-ECU switches the valve timing by controlling the solenoid valve, which is located on the cylinder head.	• Malfunction of oil control valve • Improper connector contact, open circuit or short-circuited harness wire. • Malfunction of the engine-ECU

Check the oil control valve. (Refer to GROUP 11A – On-vehicle Service.) — NG → **Replace**

↓ OK

Measure at the oil control valve (left) connector A-40.
- Disconnect the connector and measure at the harness side.
- Voltage between 1 and earth (ignition switch: ON)

OK: System voltage

— NG → Check the harness wire between control relay and oil control valve (left) connector, and repair if necessary.

↓ OK

Measure at the oil control valve (right) connector A-17.
- Disconnect the connector, and measure at the harness side.
- Voltage between 1 and earth. (Ignition switch: ON)

OK: System voltage

— NG → Check the harness wire between the control relay and oil control valve (right) connector, and repair of necessary.

↓ OK

Measure at the engine-ECU connector B-33.
- Connect the connector.
- Voltage between 34 and earth (right)
- Voltage between 6 and earth (left) (Ignition switch: ON)

OK: System voltage

— NG → **Check the following connectors:** A-17, A-40 — NG → **Repair**

↓ OK

Check trouble symptom.

↓ NG

Check the harness wire between engine-ECU and oil control valve connector, and repair if necessary.

↓ OK (from measurement at engine-ECU connector B-33)

Check the following connector: B-33 — NG → **Repair**

↓ OK

Check trouble symptom.

↓ NG

Replace the engine-ECU.

INSPECTION PROCEDURE 38

MUT-II: Inspection of no initial combustion

MUT-II Data list 16 Voltage of engine-ECU power source (Refer to P.13A-58.)	NG	Check the power supply and ignition switch-IG system. (Refer to P.13A-41, INSPECTION PROCEDURE 24.)
↓ OK		
Does the camshaft rotate at the engine cranking? (When oil filler cap is removed.)	No	Check timing belt for breakage.
↓ Yes		
MUT-II Self-Diag code Are diagnosis codes displayed?	Yes	Refer to P.13A-9, INSPECTION CHART FOR DIAGNOSIS CODES.
↓ No		
MUT-II Data list 22 Crank angle sensor **OK:** Cranking speed is displayed.	No	Check the crank angle sensor system. (Refer to P.13A-13, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 22.)
↓ OK		
MUT-II Actuator test 07 Fuel pump (Refer to P.13A-61.)	NG	Check the fuel pump system. (Refer to P.13A-42, INSPECTION PROCEDURE 25.)
↓ OK		
MUT-II Data list 21 Engine coolant temperature sensor (Refer to P.13A-58.)	NG	Check the engine coolant temperature sensor system. (Refer to P.13A-12, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)

INSPECTION PROCEDURE 39

Ignition system: Inspection of no initial combustion.

Measure at the ignition coil connectors A-28, A-29, A-30. • Connect the connectors (Use the test harness: MB991348). • Connect a primary voltage detection type engine tachometer to No.1 terminal of each connector in sequence. **OK:** The engine tachometer displays one-third of the actual cranking speed at all terminals.	NG	Check the ignition circuit system. (Refer to P.13A-47, INSPECTION PROCEDURE 34.)
↓ OK		
Check the ignition timing when cranking. **OK:** Approx. 5°BTDC	NG	Check the installation condition of crank angle sensor and timing belt cover.

INSPECTION PROCEDURE 40

MUT-II: Check if uncomplete combustion occurs.

MUT-II Self-Diag code Are diagnosis codes displayed?	Yes	Refer to P.13A-9, INSPECTION CHART FOR DIAGNOSIS CODE
↓ No		
MUT-II Actuator test 07 Fuel pump (Refer to P.13A-61.)	NG	Check the fuel pump system. (Refer to P.13A-42, INSPECTION PROCEDURE 25.)
↓ OK		
MUT-II Data list 21 Engine coolant temperature sensor (Refer to P.13A-58.)	NG	Check the engine coolant temperature sensor system. (Refer to P.13A-12, INSPECTION PROCEDURES FOR DIAGNOSIS CODE 21.)
↓ OK		
MUT-II Data list 18 Ignition switch-ST (Refer to P.13A-58.)	NG	Check the ignition switch-ST system <M/T>. (Refer to P.13A-43, INSPECTION PROCEDURE 28.) Check the ignition switch-ST and inhibitor switch system <A/T>. (Refer to P.13A-44, INSPECTION PROCEDURE 29.)

INSPECTION PROCEDURE 41

Check if hunting occurs.

Clean the throttle body. (Refer to P.13A-75.)

↓

Check and adjust the fixed SAS. (Refer to P.13A-80.)

↓

Check trouble symptom.

↓ NG

Inspect the intake of air into the air intake system
- Broken intake manifold gasket
- Broken air intake hose
- Broken vacuum hose
- Positive crankcase ventilation valve does not operate.

INSPECTION PROCEDURE 42

MUT-II: Check if idling speed is unstable.

MUT-II Data list
26 Idle position switch (Refer to P.13A-59.)

NG → Check the idle position switch system.
(Refer to P.13A-42, INSPECTION PROCEDURE 26.) <Vehicles without TCL>
(Refer to P.13A-43, INSPECTION PROCEDURE 27.) <Vehicles with TCL>

↓ OK

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-57.)

NG → Check the intake air temperature sensor system. (Refer to P.13A-10, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)

↓ OK

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-58.)

NG → Check the engine coolant temperature sensor system. (Refer to P.13A-12, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)

↓ OK

MUT-II Data list
11 Oxygen sensor
OK: 600–1,000 mV during sudden racing

NG → Check the oxygen sensor system. (Refer to P.13A-46, INSPECTION PROCEDURE 33.)

↓ OK

MUT-II Data list
11 Oxygen sensor
OK: Changes between 0–400 mV and 600–1,000 mV during idling

NG → Check the fuel pressure. (Refer to P.13A-81.)

OK →
1. Inspect the intake of air into the air intake system.
   - Broken intake manifold gasket
   - Broken vacuum hose
   - PCV valve does not operate.
   - Broken air intake hose
2. Check the injector for clog.

↓ OK

MUT-II Data list
27 Power steering fluid pressure switch (Refer to P.13A-59.)

NG → Check the power steering fluid pressure switch system. (Refer to P.13A-45, INSPECTION PROCEDURE 30.)

↓ OK

MUT-II Data list
28 A/C switch (Refer to P.13A-59.)

NG → Check the A/C switch and A/C relay system. (Refer to P.13A-45, INSPECTION PROCEDURE 31.)

↓ OK

MUT-II Data list
29 Inhibitor switch (Refer to P.13A-59.)

NG → Check the ignition switch-ST and inhibitor switch system <A/T>. (Refer to P.13A-44, INSPECTION PROCEDURE 29.)

↓ OK

MUT-II Data list
45 ISC Servo position (Refer to P.13A-60.)

NG → Adjust the basic idle speed. (Refer to P.13A-80.)

INSPECTION PROCEDURE 43

MUT-II: Engine stalling inspection when the engine is warmed up and idling.

MUT-II Data list
26 Idle position switch (Refer to P.13A-59.)
- NG → Check the idle position switch system. (Refer to P.13A-42, INSPECTION PROCEDURE 26.) <Vehicles without TCL> (Refer to P.13A-43, INSPECTION PROCEDURE 27.) <Vehicles with TCL>
- OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-57.)
- NG → Check the intake air temperature sensor system. (Refer to P.13A-10, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-58.)
- NG → Check the engine coolant temperature sensor system. (Refer to P.13A-12, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
- OK ↓

MUT-II Data list
11 Oxygen sensor
OK: 600 – 1,000 mV during sudden racing
- NG → Check the oxygen sensor system. (Refer to P.13A-46, INSPECTION PROCEDURE 33.)
- OK ↓

MUT-II Data list
11 Oxygen sensor
OK: Changes between 0 – 400 mV and 600 – 1,000 mV during idling
- NG → Check the fuel pressure. (Refer to P.13A-81.)
  - OK →
    1. Inspect the intake of air into the air intake system
       - Broken intake manifold gasket
       - Broken vacuum hose
       - PCV valve does not operate.
       - Broken air intake hose
    2. Check the injector for clog.
- OK ↓

MUT-II Data list
27 Power steering fluid pressure switch (Refer to P.13A-59.)
- NG → Check the power steering fluid pressure switch system. (Refer to P.13A-45, INSPECTION PROCEDURE 30.)
- OK ↓

MUT-II Data list
28 A/C switch (Refer to P.13A-59.)
- NG → Check the A/C switch and A/C relay system. (Refer to P.13A-45, INSPECTION PROCEDURE 31.)
- OK ↓

MUT-II Data list
29 Inhibitor switch (Refer to P.13A-59.)
- NG → Check the ignition switch-ST and inhibitor switch system <A/T>. (Refer to P.13A-44, INSPECTION PROCEDURE 29.)
- OK ↓

MUT-II Data list
45 ISC servo position (Refer to P.13A-60.)
- NG → Adjust the basic idle speed. (Refer to P.13A-80.)

INSPECTION PROCEDURE 44

MUT-II: Check if hesitation, sug, stumble or poor acceleration occurs.

MUT-II Data list
26 Idle position switch (Refer to P.13A-59.)

- NG → Check the idle position switch system. (Refer to P.13A-42, INSPECTION PROCEDURE 26.) <Vehicles without TCL> (Refer to P.13A-43, INSPECTION PROCEDURE 27.) <Vehicles with TCL>
- OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-57.)

- NG → Check the intake air temperature sensor system. (Refer to P.13A-10, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-58.)

- NG → Check the engine coolant temperature sensor system. (Refer to P.13A-12, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
- OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13A-58.)

- NG → Check the throttle position sensor system. (Refer to P.13A-11, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
- OK ↓

MUT-II Data list
11 Oxygen sensor
OK: 600 – 1,000 mV during sudden racing

- NG → Check the oxygen sensor system. (Refer to P.13A-46, INSPECTION PROCEDURE 33.)
- OK ↓

MUT-II Data list
11 Oxygen sensor
OK: Changes between 0 – 400 mV and 600 – 1,000 mV during idling

- NG → Check the fuel pressure. (Refer to P.13A-81.)
  - OK →
    1. Inspect the intake of air into the air intake system
       - Broken intake manifold gasket
       - Broken vacuum hose
       - PCV valve does not operate.
       - Broken air intake hose
    2. Check the injector for clog.
- OK ↓

MUT-II Actuator test
11 Variable induction control servo (Refer to P.13A-61.)

- NG → Check the variable induction control servo system. (Refer to P.13A-48, INSPECTION PROCEDURE 36.)
- OK ↓

MUT-II Actuator test
15 Vacuum control solenoid valve <Vehicles with TCL> (Refer to P.13A-62.)

- NG → Check the vacuum control solenoid valve system. (Refer to P.13A-23, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 71.)
- OK ↓

MUT-II Actuator test
16 Ventilation control solenoid valve <Vehicles with TCL> (Refer to P.13A-62.)

- NG → Check the ventilation control solenoid valve system. (Refer to P.13A-24, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 72.)
- OK ↓

MUT-II Actuator test
22 Oil control valve (Refer to P.13A-62.)

- NG → Check the oil control valve (valve timing switching) system. (Refer to P.13A-48, INSPECTION PROCEDURE 37.)

INSPECTION PROCEDURE 45

MUT-II: Check if surge occurs.

MUT-II Data list
26 Idle position switch (Refer to P.13A-59.)

- NG → Check the idle position switch system. (Refer to P.13A-42, INSPECTION PROCEDURE 26.) <Vehicles without TCL> (Refer to P.13A-43, INSPECTION PROCEDURE 27.) <Vehicles with TCL>
- OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-57.)

- NG → Check the intake air temperature sensor system. (Refer to P.13A-10, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-58.)

- NG → Check the engine coolant temperature sensor system. (Refer to P.13A-12, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
- OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13A-58.)

- NG → Check the throttle position sensor system. (Refer to P.13A-11, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
- OK ↓

MUT-II Data list
11 Oxygen sensor
OK: 600–1,000 mV during sudden racing

- NG → Check the oxygen sensor system. (Refer to P.13A-46, INSPECTION PROCEDURE 33.)
- OK ↓

MUT-II Data list
11 Oxygen sensor
OK: Changes between 0–400 mV and 600–1,000 mV during idling

- NG → Check the fuel pressure. (Refer to P.13A-81.)
  - OK →
    1. Inspect the intake of air into the air intake system
       - Broken intake manifold gasket
       - Broken vacuum hose
       - PCV valve does not operate.
       - Broken air intake hose
    2. Check the injector for clog.

INSPECTION PROCEDURE 46

Check the engine-ECU power supply and earth circuit.

Measure the engine-ECU connectors B-32, B-33, B-35.
- Disconnect the connector and measure at the harness side
1. Voltage between 82 and earth (Ignition switch: ON)
   OK: System voltage
2. Voltage between 38 and earth
   OK: System voltage
3. Voltage between 12, 25 and earth (Ignition switch: ON)
   OK: System voltage (when the terminal 38 is earthed)
4. Continuity between 13, 26 and earth
   OK: Continuity
5. Voltage between 80 and earth
   OK: System voltage

OK → **Check the following connectors:** B-32, B-33, B-35 (NG → **Repair**)
OK → Check trouble symptom.
NG → Replace the engine-ECU.

1. NG → **Check the following connector:** B-36 (NG → **Repair**)
OK → Check trouble symptom.
OK → Check the harness wire between engine-ECU and ignition switch connector. (NG → **Repair**)
OK → Check the ignition switch. (Refer to GROUP 54 – Ignition Switch.)

2, 3. NG → Check the harness wire between engine-ECU and control relay connector, and repair if necessary.

4. NG → Check the harness wire between engine-ECU and earth, and repair if necessary.

5. NG → **Check the following connectors:** B-36, B-45, B-46 (NG → **Repair**)
OK → Check trouble symptom
NG → Check the harness wire between engine-ECU and battery, and repair if necessary.

INSPECTION PROCEDURE 47

Check fuel pump circuit.

Measure at the fuel pump connector D-15.
- Disconnect the connector and measure at the harness side.
- Continuity between 1 and earth
  OK: Continuity

NG → **Check the following connector:** D-14 (NG → **Repair**)
OK → Check trouble symptom
NG → Check the harness wire between fuel pump and earth, and repair if necessary.

OK → **Check the following connectors:** B-36, D-14, D-17 (NG → **Repair**)
OK → Check trouble symptom.
NG → Check the harness wire between terminal for fuel pump drive and fuel pump connector. (NG → **Repair**)
OK → Replace the fuel pump.

INSPECTION PROCEDURE 48

Check the fuel pump drive control circuit.

Measure at the fuel pump relay connector B-73.
- Disconnect the connector and measure at the harness side.
- Voltage between 3, 4 and earth (Ignition switch: ON)
  OK: System voltage

NG → **Check the following connector:** B-36 — NG → **Repair**

OK → Check trouble symptom. — NG → Check the harness wire between fuel pump relay and ignition switch connector. — NG → **Repair**

OK → Check the ignition switch. (Refer to GROUP 54 – Ignition Switch.)

OK ↓

Measure at the engine-ECU connector B-32.
- Disconnect the connector and measure at the harness side.
- Voltage between 8 and earth (Ignition switch: ON)
  OK: System voltage

NG → **Check the following connector:** B-73 — NG → **Repair**

OK → Check trouble symptom. — NG → Check the harness wire between engine-ECU and fuel pump relay connector, and repair if necessary.

OK ↓

Check the following connector: B-32 — NG → **Repair**

OK → Check trouble symptom. — NG → Replace the engine-ECU.

INSPECTION PROCEDURE 49

Check throttle position sensor (TPS) output circuit.

Measure at the engine-ECU connector B-36.
- Connect the connector.
- Voltage between 84 and earth (Ignition switch: ON)
  OK: 0.3–1.0 V (Throttle valve at idle position)
  4.8–5.5 V (Throttle valve fully open)

NG → **Check the following connector:** A-07 — NG → **Repair**

OK → Check trouble symptom. — NG → Replace the engine-ECU.

OK ↓

Check the harness wire between engine-ECU and throttle position sensor connector, and repair if necessary.

INSPECTION PROCEDURE 50

Check injector control circuit

Measure at the engine-ECU connector B-32.
- Disconnect the connector and measure at the harness side.
- Voltage between 1, 2, 3, 14, 15, 16 and earth (Ignition switch: ON)
  OK: System voltage

NG → **Check the following connectors:** A-41, A-42, A-43, A-78, A-79, A-81 — NG → **Repair**

OK → Check trouble symptom. — NG → Check the harness between engine-ECU and injector connector, and repair if necessary.

OK ↓

Check the following connector: B-32 — NG → **Repair**

OK → Check trouble symptom. — NG → Replace the engine-ECU.

INSPECTION PROCEDURE 51

Check ignition signal circuit.

Measure at the ignition failure sensor connector A-65.
- 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 → An open or short circuit is present at any ignition signal output harness of the ignition failure sensor. Check and repair the harness.

2. NG → Check the harness wire between the ignition failure sensor and the earth, and repair if necessary.

OK ↓

Measure at the engine-ECU connector B-34.
- Connect the connector.
- Voltage between 58 and earth
  OK: 0.3 – 3.0 V

OK ↓

Replace the engine-ECU.

NG → **Check the following connectors:** A-65, B-34

NG → **Repair**

OK ↓

Check trouble symptom.

NG ↓

Check the harness wire between the engine-ECU and ignition failure sensor connector.

NG → **Repair**

OK ↓

Replace the ignition failure sensor.

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. The idle position switch normally turns off when the voltage of the throttle position sensor is 50 – 100 mV higher than the voltage at the idle position. If the throttle position switch turns back on after the throttle position sensor voltage has risen by 100 mV and the throttle valve has opened, the idle position switch and the throttle position sensor need to be adjusted.

*2. When the engine is stopped.

*3. The injector drive time represents the time when the cranking speed is at 250 r/min or below when the power supply voltage is 11 V.

*4. In a new vehicle [driven approximately 500 km or less], the injector drive time is sometimes 10% longer than the standard time.

*5. In a new vehicle [driven approximately 500 km or less], the step of the stepper motor is sometimes 30 steps greater than the standard value.

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 suddenly decelerated	200 mV or less	Procedure No.33	13A-46
			When engine is suddenly raced	600 – 1,000 mV		
		Engine:After having warmed up (The oxygen sensor signal is used to check the air/fuel mixture ratio, and control condition is also checked by the ECU.)	Engine is idling	400 mV or less (Changes) 600 – 1,000 mV		
			2,500 r/min			
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-10
			When intake air temperature is 0°C	0°C		
			When intake air temperature is 20°C	20°C		
			When intake air temperature is 40°C	40°C		
			When intake air temperature is 80°C	80°C		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
14	Throttle position sensor	Ignition switch: ON	Set to idle position	300 – 1,000 mV	Code No. 14	13A-11
			Gradually open	Increases in proportion to throttle opening angle		
			Open fully	4,500 – 5,500 mV		
16	Power supply voltage	Ignition switch: ON		System voltage	Procedure No. 24	13A-41
18	Cranking signal (ignition switch-ST)	Ignition switch: ON	Engine: Stopped	OFF	Procedure No. 28 <M/T> Procedure No. 29 <A/T>	13A-43 <M/T> 13A-44 <M/T>
			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-12
			When engine coolant temperature is 0°C	0°C		
			When engine coolant temperature is 20°C	20°C		
			When engine coolant temperature is 40°C	40°C		
			When engine coolant temperature is 80°C	80°C		
22	Crank angle sensor	• Engine: Cranking • Tachometer: Connected	Compare the engine speed readings on the tachometer and the MUT-II.	Accord	–	–
		• Engine: Idling • Idle position switch: ON	When engine coolant temperature is –20°C	1,275 – 1,475 r/min		
			When engine coolant temperature is 0°C	1,225 – 1,425 r/min		
			When engine coolant temperature is 20°C	1,100 – 1,300 r/min		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
22	Crank angle sensor	• Engine: Idling • Idle position switch: ON	When engine coolant temperature is 40°C	950 – 1,150 r/min	–	–
			When engine coolant temperature is 80°C	600 – 800 r/min		
26	Idle position switch	Ignition switch: ON (Check by operating accelerator pedal repeatedly)	Throttle valve: Set to idle position	ON	Procedure No.26 <Vehicles without TCL> Procedure No.27 <Vehicles with TCL>	13A-42 <Vehicles without TCL> 13A-43 <Vehicles with TCL>
			Throttle valve: Slightly open	OFF*1		
27	Power steering fluid pressure switch	Engine: Idling	Steering wheel stationary	OFF	Procedure No. 30	13A-45
			Steering wheel turning	ON		
28	A/C switch	Engine: Idling (when A/C switch is ON, A/C compressor should be operating.)	A/C switch: OFF	OFF	Procedure No. 31	13A-45
			A/C switch: ON	ON		
29	Inhibitor switch <A/T>	Ignition switch: ON	P or N	P or N	Procedure No. 29	13A-44
			D, 2, L or R	D, 2, L or R		
32	Vacuum sensor	• Engine coolant temperature: 80 – 95°C • Lights, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range) • Ignition switch: ON	When altitude is 0 m*2	101 kPa	Code No.32	13A-17
			When altitude is 600 m*2	95 kPa		
			When altitude is 1,200 m*2	88 kPa		
			When altitude is 1,800 m*2	81 kPa		
			Engine is idling	22.9 – 36.3 kPa		
			Engine is suddenly raced	Increase		
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.	–	–

<table>
<tr><th>Item No.</th><th>Inspection item</th><th colspan="2">Inspection contents</th><th>Normal condition</th><th>Inspection procedure No.</th><th>Reference page</th></tr>
<tr><td rowspan="6">41</td><td rowspan="3">Injectors *3</td><td rowspan="3">Engine: Cranking</td><td>When engine coolant temperature is 0°C (injection is carried out for all cylinders simultaneously)</td><td>65 – 96 ms</td><td rowspan="6">–</td><td rowspan="6">–</td></tr>
<tr><td>When engine coolant temperature is 20°C</td><td>32 – 47 ms</td></tr>
<tr><td>When engine coolant temperature is 80°C</td><td>5.8 – 8.6 ms</td></tr>
<tr><td rowspan="3">Injectors*4</td><td rowspan="3">• Engine coolant temperature: 80–95°C
• Lamps, electric cooling fan and all accessories: OFF
• Transmission: Neutral (A/T : P range)</td><td>Engine is idling</td><td>1.8 – 3.0 ms</td></tr>
<tr><td>2,500 r/min</td><td>1.7 – 2.9 ms</td></tr>
<tr><td>When engine is suddenly raced</td><td>Increases</td></tr>
<tr><td rowspan="2">44</td><td rowspan="2">Ignition advance</td><td rowspan="2">• Engine: After having warmed up
• Timing lamp is set. (The timing lamp is set in order to check actual ignition timing.)</td><td>Engine is idling</td><td>2 – 18°BTDC</td><td rowspan="2">–</td><td rowspan="2">–</td></tr>
<tr><td>2,500 r/min</td><td>22 – 42°BTDC</td></tr>
<tr><td rowspan="3">45</td><td rowspan="3">ISC (stepper) motor position *5</td><td rowspan="3">• Engine coolant temperature: 80 – 95°C
• Lamps, electric cooling fan and all accessories: OFF
• Transmission: Neutral (A/T : P range)
• Idle position switch: ON
• Engine: Idling
• When A/C switch is ON, A/C compressor should be operating</td><td>A/C switch: OFF</td><td>2 – 25 STEP</td><td rowspan="3">–</td><td rowspan="3">–</td></tr>
<tr><td>A/C switch: OFF → ON</td><td>Increases by 10 – 70 steps</td></tr>
<tr><td>• A/C switch: OFF
• Select lever: N range → D range</td><td>Increases by 5 – 50 steps</td></tr>
</table>

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
49	A/C relay	Engine: After having warmed up/Engine is idling	A/C switch: OFF	OFF (Compressor clutch is not operating)	Procedure No. 31	13A-45
			A/C switch: ON	ON (Compressor clutch is operating)		
62	Intake air control valve position sensor	Engine: Idling		0 STEP	Code No.62	13A-21
		Engine: 5,000 r/min or more		9 STEP		

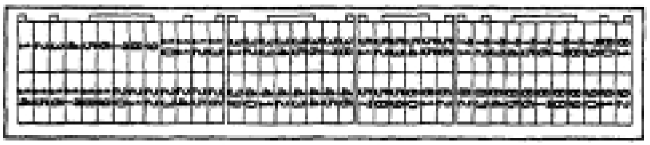
ACTUATOR TEST REFERENCE TABLE

Item No.	Inspection item	Drive contents	Inspection contents		Normal condition	Inspection procedure No.	Reference page
01	Injectors	Cut fuel to No. 1 injector	Engine: After having warmed up/ Engine is idling (Cut the fuel supply to each injector in turn and check cylinders which don't affect idling.)		Idling condition becomes different (becomes unstable).	Code No. 41	13A-18
02		Cut fuel to No. 2 injector					
03		Cut fuel to No. 3 injector					
04		Cut fuel to No. 4 injector					
05		Cut fuel to No. 5 injector					
06		Cut fuel to No. 6 injector					
07	Fuel pump	Fuel pump operates and fuel is recirculated.	• Engine: Cranking • Fuel pump: Forced driving Inspect according to both the above conditions.	Pinch the return hose with fingers to feel the pulse of the fuel being recirculated.	Pulse is felt.	Procedure No. 25	13A-42
				Listen near the fuel tank for the sound of fuel pump operation.	Sound of operation is heard.		
11	Variable induction control (VIC) servo	Solenoid valve turns from OFF to ON.	Ignition switch: ON		Sound of operation can be heard when VIC servo is driven.	Procedure No. 36	13A-48

Item No.	Inspection item	Drive contents	Inspection contents	Normal condition	Inspection procedure No.	Reference page
15	Vacuum control solenoid valve <Vehicles with TCL>	Solenoid valve turns from OFF to ON.	Ignition switch: ON	Sound of operation can be heard when solenoid valve is driven.	Code No. 71	13A-23
16	Ventilation control solenoid valve <Vehicles with TCL>	Solenoid valve turns from OFF to ON.	Ignition switch: ON	Sound of operation can be heard when solenoid valve is driven.	Code No. 72	13A-24
17	Basic ignition timing	Set to ignition timing adjustment mode	Engine: Idling Timing light is set	5°BTDC	–	–
21	Radiator fan and condenser fan	Drive the fan motor (radiator fan and condenser fan)	• Ignition switch: ON • A/C switch: ON	Radiator fan and condenser fan rotate	Procedure No. 32	13A-46
22	Oil control valve	Oil control valve turns from OFF to ON.	Engine: After having warmed up/Engine is idling	Engine stops, or idling becomes unstable.	Procedure No. 37	13A-48

CHECK AT THE ENGINE-ECU TERMINALS

Engine-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 11 – 14 V, momentarily drops slightly
14	No. 2 injector		
2	No. 3 injector		
15	No. 4 injector		
3	No. 5 injector		
16	No. 6 injector		

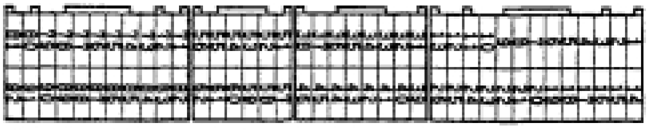
Terminal No.	Check item	Check condition (Engine condition)	Normal condition
4	Stepper motor coil <A1>	Engine: Soon after the warmed up engine is started	System voltage ↔ 0 V (Changes repeatedly)
17	Stepper motor coil <A2>		
5	Stepper motor coil <B1>		
18	Stepper motor coil <B2>		
8	Fuel pump relay	Ignition switch: ON	System voltage
		Engine: Idle speed	0 – 3V
10	Ignition coil – No.1, No.4 (Power transistor)	Engine speed: 3,000 r/min	0.3 – 3.0 V
11	Ignition coil – No.3, No.6 (Power transistor)		
23	Ignition coil – No.2, No.5 (Power transistor)		
12	Power supply	Ignition switch: ON	System voltage
25			
21	Fan motor relay	Engine: Idle speed When the radiator fan is not operating	System voltage
		When the radiator fan is operating	0 – 0.3 V
22	A/C relay	• Engine: Idle speed • A/C switch: OFF → ON (A/C compressor is operating)	System voltage or momentarily 6V or more → 0 – 3V
31	Ventilation control solenoid valve <Vehicles with TCL>	Ignition switch: ON	System voltage
32	Vacuum control solenoid valve <Vehicles with TCL>	Ignition switch: ON	System voltage
33	Intake air control valve position sensor No.2	Ignition switch: ON	0 – 1 V or 4.5 – 5.5 V
		Engine speed: rises from the idle speed to 5,000 r/min gradually.	0 – 1 V or 4.5 – 5.5 V → 1.5 – 4.0 V (a moment)
41	Intake air control valve position sensor No.1	Ignition switch: ON	0 – 1 V or 4.5 – 5.5 V
		Engine speed: rises from the idle speed to 5,000 r/min gradually.	0 – 1 V or 4.5 – 5.5 V → 1.5 – 4.0 V (a moment)
34	Oil control valve (right)	Ignition switch: ON	System voltage
		Engine: rises to 5,500 r/min or more after warmed up	0 – 1 V → approx. 8 V (after a few seconds)
35	Oil control valve (left)	Ignition switch: ON	System voltage
		Engine: rises to 5,500 r/min or more after warmed up	0 –1 V → approx. 8 V (after a few seconds)

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
36	Engine warning lamp	Ignition switch: OFF → ON		0 – 3V → 9 – 13V (After several seconds have elapsed)
37	Power steering fluid pressure switch	Engine: Idling after warming up	When steering wheel is stationary	System voltage
			When steering wheel is turned	0 – 3V
38	Control relay (Power supply)	Ignition switch: OFF		System voltage
		Ignition switch: ON		0 – 3V
39	Variable induction control (VIC) servo (closed)	Engine speed: reduces from 5,500 r/min to the idle speed gradually.		0 – 1 V → 4.0 V or more (a moment)
40	Variable induction control (VIC) servo (open)	Engine speed: rises from the idle speed to 5,000 r/min gradually.		0 – 1 V → 4.0 V or more (a moment)
45	A/C switch	Engine: Idle speed	Turn the A/C switch OFF	0 – 3V
			Turn the A/C switch ON (A/C compressor is operating)	System voltage
54	Alternator G terminal	• Engine: Warm, idle (radiator fan: OFF) • Headlamp: OFF to ON • Rear defogger switch: OFF to ON • Stop lamp: ON		Voltage rises by 0.2 – 3.5 V.
55	Alternator FR terminal	• Engine: Warm, idle (radiator fan: OFF) • Headlamp: OFF to ON • Rear defogger switch: OFF to ON • Stop lamp: ON		Voltage drops by 0.2 – 3.5 V.
58	Engine ignition signal	Engine speed: 3,000 r/min		0.3 – 3.0 V
71	Ignition switch – ST	Engine: Cranking		8V or more
72	Intake air temperature sensor	Ignition switch: ON	When intake air temperature is 0°C	3.2 – 3.8V
			When intake air temperature is 20°C	2.3 – 2.9V
			When intake air temperature is 40°C	1.5 – 2.1V
			When intake air temperature is 80°C	0.4 – 1.0V
76	Oxygen sensor	Engine: Running at 2,000 r/min after warmed up (Check using a digital type voltmeter)		0 ↔ 0.8V (Changes repeatedly)
80	Backup power supply	Ignition switch: OFF		System voltage

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
81	Sensor impressed voltage	Ignition switch: ON		4.5 – 5.5V
82	Ignition switch – IG	Ignition switch: ON		System voltage
83	Engine coolant temperature sensor	Ignition switch: ON	When engine coolant temperature is 0°C	3.2 – 3.8V
			When engine coolant temperature is 20°C	2.3 – 2.9V
			When engine coolant temperature is 40°C	1.3 – 1.9V
			When engine coolant temperature is 80°C	0.3 – 0.9V
84	Throttle position sensor	Ignition switch: ON	Set throttle valve to idle position	0.3 – 1.0V
			Fully open throttle valve	4.5 – 5.5V
85	Vacuum sensor	Ignition switch: ON	At altitude of 0 m	3.7 – 4.3V
			At altitude of 1,200 m	3.2 – 3.8V
		Engine: After having warmed up/Engine is idling		0.9 – 1.5V
		Engine: While engine is idling after having warmed up, suddenly depress the accelerator pedal.		From 0.9 – 1.5 V, momentarily rises
86	Vehicle speed sensor	• Ignition switch: ON • Move the vehicle slowly forward		0 ↔ 5V (Changes repeatedly)
87	Idle position switch	Ignition switch: ON	Set throttle valve to idle position	0 – 1V
			Slightly open throttle valve	4V or more
88	Camshaft position sensor	Engine: Cranking		0.4 – 3.0V
		Engine: Idle speed		0.5 – 2.0V
89	Crank angle sensor	Engine: Cranking		0.4 – 4.0V
		Engine: Idle speed		1.5 – 2.5V
91	Inhibitor switch <A/T>	Ignition switch: ON	Set selector lever to P or N	0 – 3V
			Set selector lever to Other than P or N	8 – 14V

CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

Engine-ECU Harness Side Connector Terminal Arrangement



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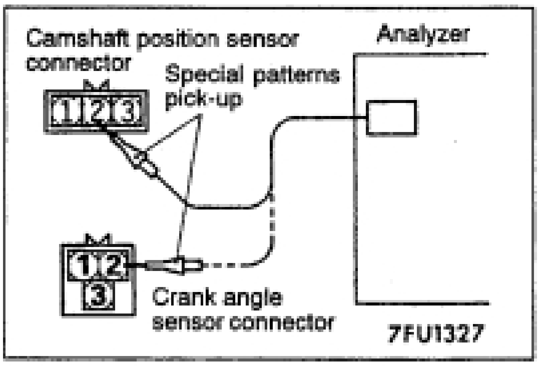
Terminal No.	Inspection item	Normal condition (Check condition)
1 – 12	No. 1 injector	13 – 16 Ω (At 20°C)
14 – 12	No. 2 injector	
2 – 12	No. 3 injector	
15 – 12	No. 4 injector	
3 – 12	No. 5 injector	
16 – 12	No. 6 injector	
4 – 12	Stepper motor coil (A1)	28 – 33 Ω (At 20°C)
17 – 12	Stepper motor coil (A2)	
5 – 12	Stepper motor coil (B1)	
18 – 12	Stepper motor coil (B2)	
13 – Body earth	Engine-ECU earth	Continuity (0 Ω)
26 – Body earth	Engine-ECU earth	
31 – 12	Ventilation control solenoid valve <Vehicles with TCL>	36 – 44 Ω (At 20 °C)
32 – 12	Vacuum control solenoid valve <Vehicles with TCL>	36 – 44 Ω (At 20 °C)
34 – 12	Oil control valve (right)	6.0 – 7.5 Ω (at 20°C)
35 – 12	Oil control valve (left)	
39 – 40	Variable induction control (VIC) servo	5 – 35 Ω (at 20°C)
72 – 92	Intake air temperature sensor	5.3 – 6.7 kΩ (When intake air temperature is 0°C)
		2.3 – 3.0 kΩ (When intake air temperature is 20°C)
		1.0 – 1.5 kΩ (When intake air temperature is 40°C)
		0.30 – 0.42 kΩ (When intake air temperature is 80°C)

Terminal No.	Inspection item	Normal condition (Check condition)
83 – 92	Engine coolant temperature sensor	5.1 – 6.5 kΩ (When coolant temperature is 0°C)
		2.1 – 2.7 kΩ (When coolant temperature is 20°C)
		0.9 – 1.3 kΩ (When coolant temperature is 40°C)
		0.26 – 0.36 kΩ (When coolant temperature is 80°C)
87 – 92	Idle position switch	Continuity (when throttle valve is at idle position)
		No continuity (when throttle valve is slightly open)
91 – Body earth	Inhibitor switch <A/T>	Continuity (when select lever is at P or N)
		No continuity (when select lever is at D, 2, L or R)



INSPECTION PROCEDURE USING AN ANALYZER

CAMSHAFT POSITION SENSOR AND CRANK ANGLE SENSOR

Measurement Method

1. Disconnect the camshaft position sensor connector and connect the special tool (test harness: MB991223) and jumper wire in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to camshaft position sensor terminal 2.
3. Disconnect the crank angle sensor connector and connect the special tool (test harness: MD998478) in between.
4. Connect the analyzer special patterns pickup to crank angle sensor terminal 2.

Alternate Method (Test harness not available)

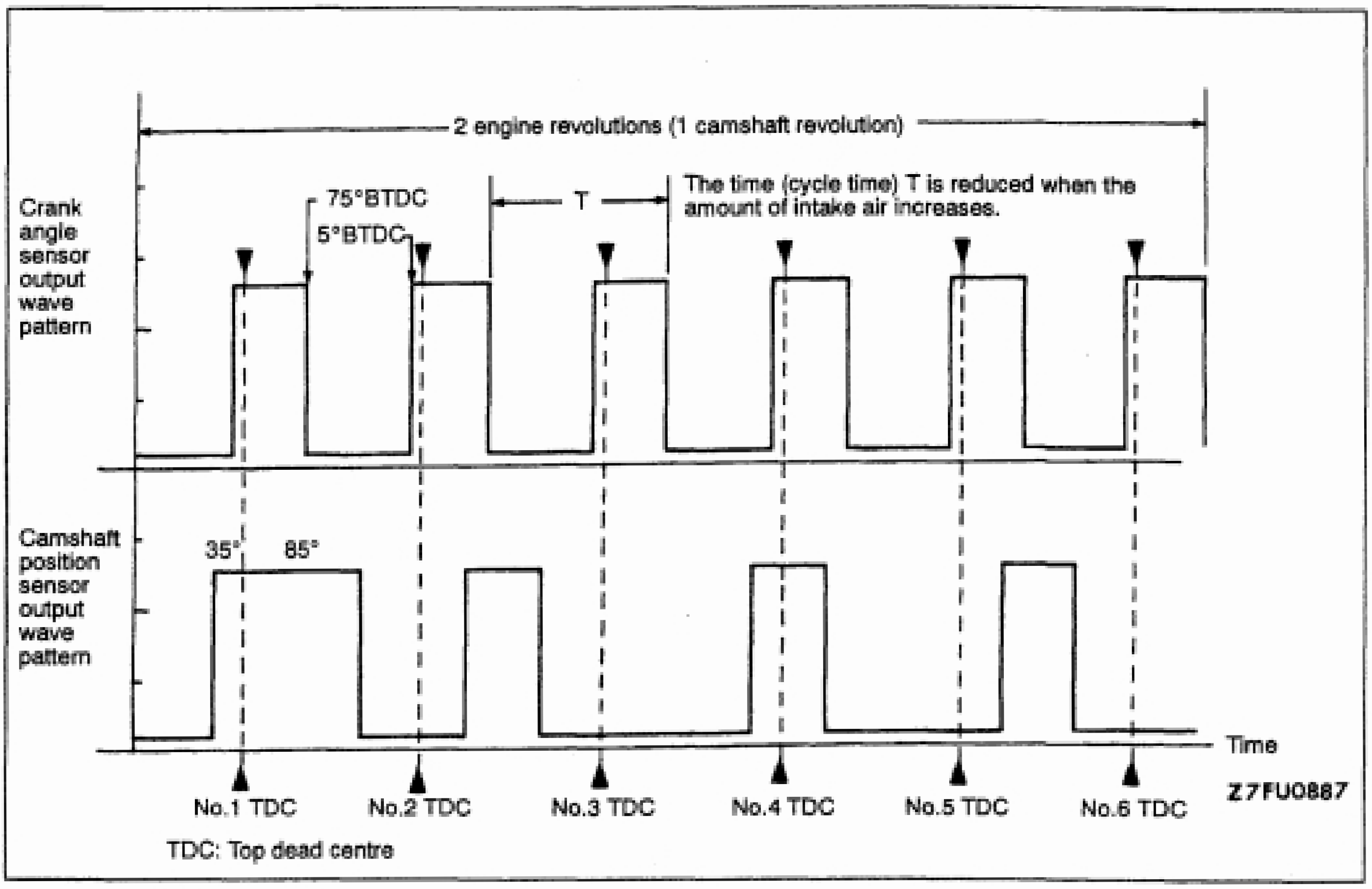
1. Connect the analyzer special patterns pickup to engine-ECU terminal 88. (When checking the camshaft position sensor signal wave pattern.)
2. Connect the analyzer special patterns pickup to engine-ECU terminal 89. (When checking the crank angle sensor signal wave pattern.)

Standard Wave Pattern

Observation conditions

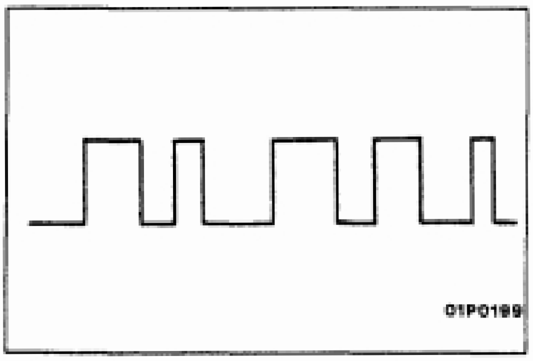
Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Idle speed

Standard wave pattern



Wave Pattern Observation Points

Check that cycle time T becomes shorter and the frequency increases when the engine speed is increased.



Examples of Abnormal Wave Patterns

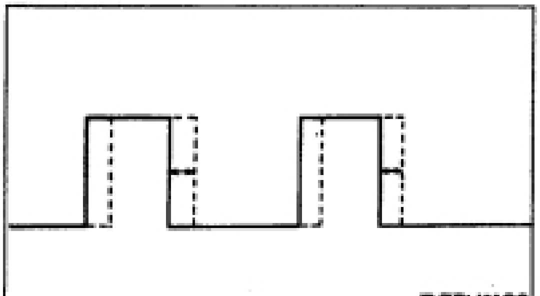
- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

  Rectangular wave pattern is output even when the engine is not started.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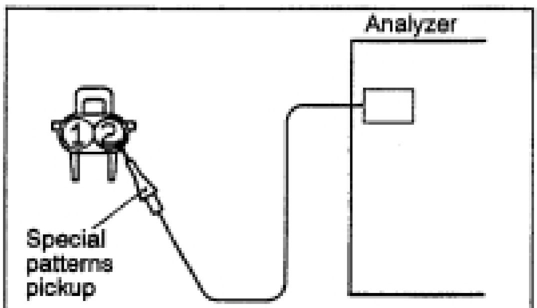
- Example 2

  Cause of problem

  Loose timing belt
  Abnormality in sensor disk

  Wave pattern characteristics

  Wave pattern is displaced to the left or right.



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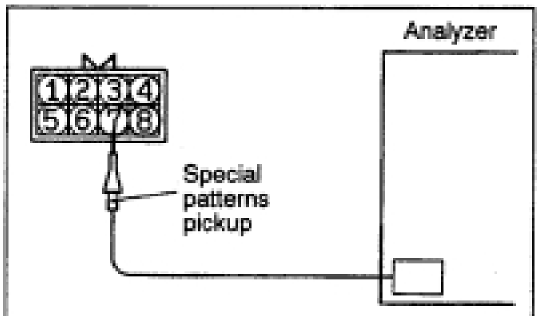
INJECTOR

Measurement Method

Measurement at the front bank (No.2, No.4, or No.6 cylinder)

1. Disconnect the injector connector, and then connect the special tool (test harness: MB991348) in between. (Both the power supply side and engine-ECU side should be connected.)
2. Connect the analyzer special patterns pickup to terminal 2 of the injector connector.



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Measurement at the rear bank (No.1, No.3, or No.5 cylinder)

1. Disconnect the injector intermediate harness connector, and connect the special tool (test harness: MD998474) in between.
2. Connect the probe of the analyzer to the following terminal: terminal 4 (the black clip of the special tool) when observing at the No.1 cylinder; terminal 7 (the white clip) when observing at the No.3 cylinder; terminal 8 (the blue clip) when observing at the No.5 cylinder

Alternate Method (Test harness not available)

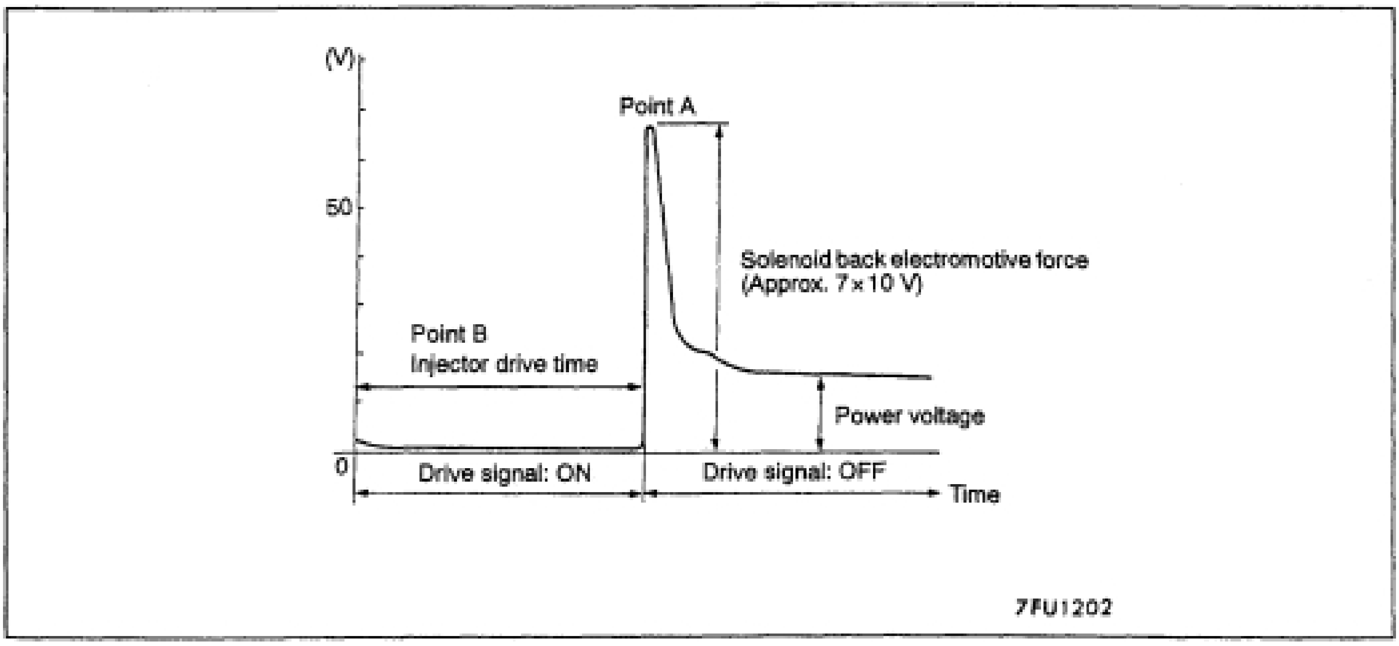
1. Connect the analyzer special patterns pickup to engine-ECU terminal 1. (When checking the No. 1 cylinder.)
2. Connect the analyzer special patterns pickup to engine-ECU terminal 14. (When checking the No. 2 cylinder.)
3. Connect the analyzer special patterns pickup to engine-ECU terminal 2. (When checking the No. 3 cylinder.)
4. Connect the analyzer special patterns pickup to engine-ECU terminal 15. (When checking the No. 4 cylinder.)
5. Connect the analyzer special patterns pickup to engine-ECU terminal 3. (When checking the No. 5 cylinder.)
6. Connect the analyzer special patterns pickup to engine-ECU terminal 16. (When checking the No. 6 cylinder.)

Standard Wave Pattern

Observation conditions

Function	Special patterns
Pattern height	Variable
Variable knob	Adjust while viewing the wave pattern
Pattern selector	Display
Engine r/min	Idle speed

Standard wave pattern

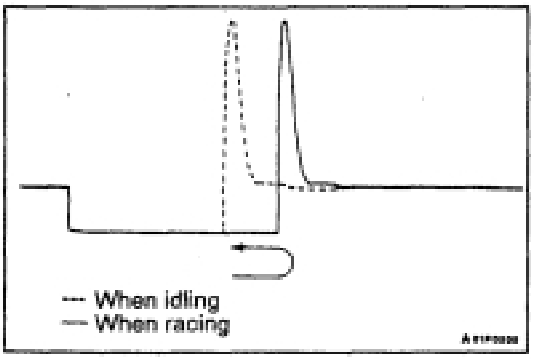


Wave Pattern Observation Points

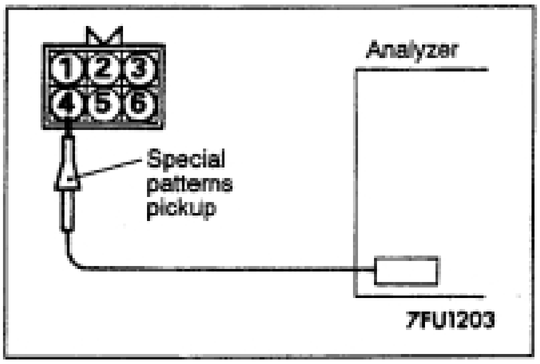
Point A: Height of solenoid back electromotive force

Contrast with standard wave pattern	Probable cause
Solenoid coil back electromotive force is low or doesn't appear at all.	Short in the injector solenoid

Point B: Injector drive time



- The injector drive time will be synchronized with the MUT-II tester display.
- When the engine is suddenly raced, the drive time will be greatly extended at first, but the drive time will soon match the engine speed.



IDLE SPEED CONTROL (ISC) SERVO (STEPPER MOTOR)

Measurement Method

1. Disconnect the ISC servo connector, and connect the special tool (test harness: MD998463) in between.
2. Connect the analyzer special patterns pickup to the ISC servo-side connector terminal 1 (red clip of special tool), terminal 3 (blue clip), terminal 4 (black clip) and terminal 6 (yellow clip) respectively.

Alternate Method (Test harness not available)

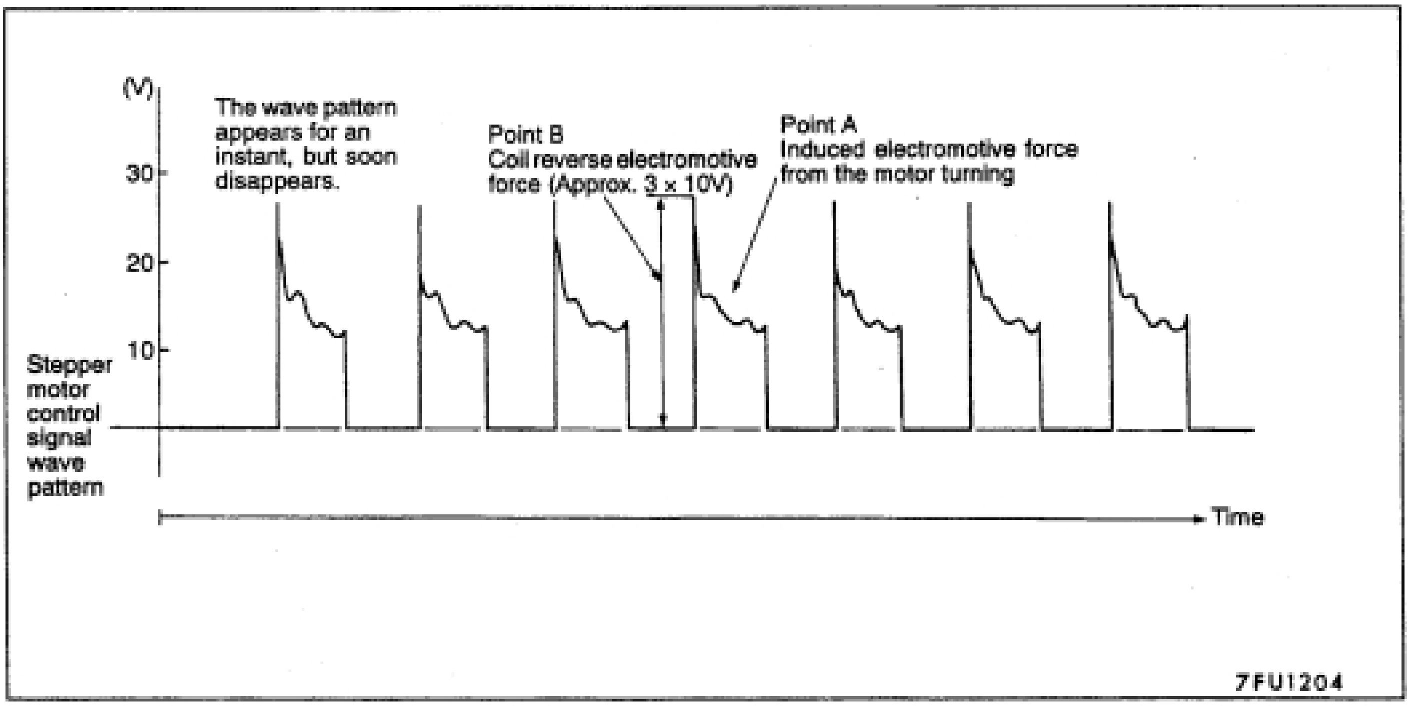
1. Connect the analyzer special patterns pickup to engine-ECU terminal 4, connection terminal 5, connection terminal 17, and connection terminal 18 respectively.

Standard Wave Pattern

Observation conditions

Function	Special patterns
Pattern height	High
Pattern selector	Display
Engine condition	When the engine coolant temperature is 20°C or below, turn the ignition switch from 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



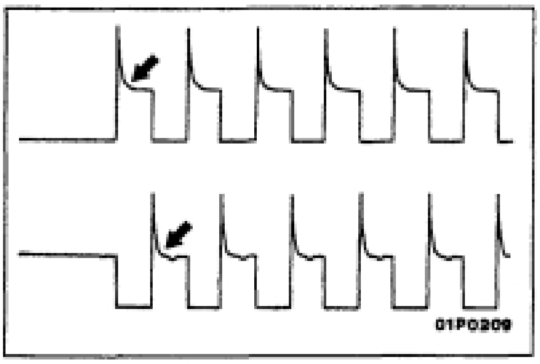
Wave Pattern Observation Points

Check that the standard wave pattern appears when the ISC 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

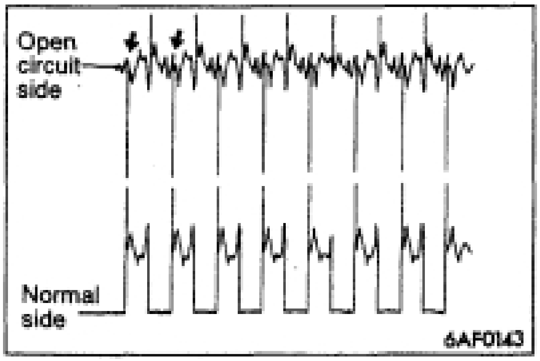
- Example 1

  Cause of problem

  Motor is malfunctioning. (Motor is not operating.)

  Wave pattern characteristics

  Induced electromotive force from the motor turning does not appear.



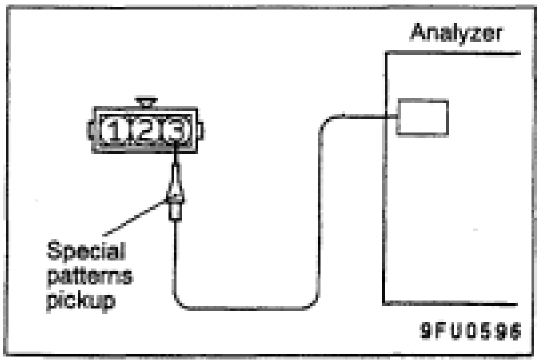
- Example 2

  Cause of problem

  Open circuit in the line between the ISC servo and the engine-ECU.

  Wave pattern characteristics

  Current is not supplied to the motor coil on the open circuit side. (Voltage does not drop to 0 V.)
  Furthermore, the induced electromotive force waveform at the normal side is slightly different from the normal waveform.



IGNITION COIL AND POWER TRANSISTOR

- Power transistor control signal

Measurement Method

1. Disconnect the ignition coil connector, and connect the special tool (test harness: MB991348) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to terminal 3 of each ignition coil connector in turn.

Alternate Method (Test harness not available)

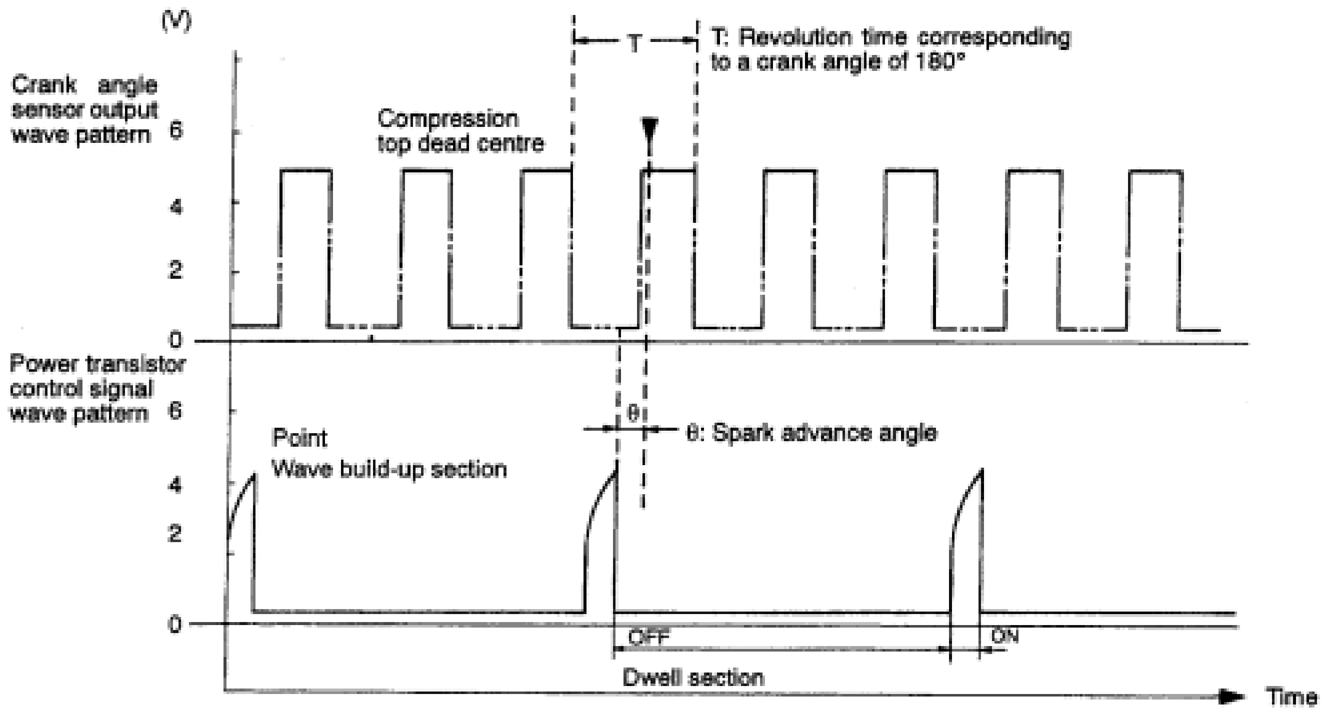
1. Connect the analyzer special patterns pickup to the engine-ECU terminal 10 (No.1, No.4), terminal 11 (No.3, No.6), terminal 23 (No.2, No.5) respectively.

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

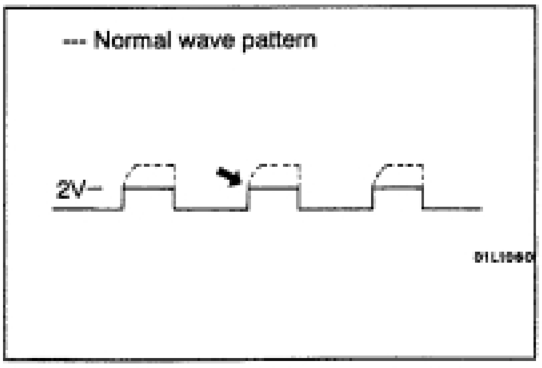


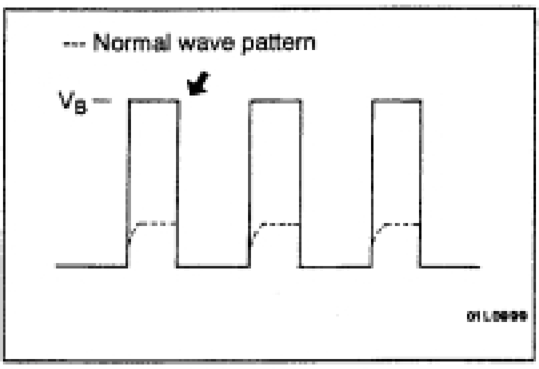
7FU1210

Wave Pattern Observation Points

Point: Condition of wave pattern build-up section and maximum voltage (Refer to abnormal wave pattern examples 1 and 2.)

Condition of wave pattern build-up section and maximum voltage	Probable cause
Rises from approx. 2 V to approx. 4.5 V at the top-right	Normal
2 V rectangular wave	Open-circuit in ignition primary circuit
Rectangular wave at power voltage	Power transistor malfunction





Examples of Abnormal Wave Patterns

- Example 1

  Wave pattern during engine cranking

  Cause of problem

  Open-circuit in ignition primary circuit

  Wave pattern characteristics

  Top-right part of the build-up section cannot be seen, and voltage value is approximately 2 V too low.

- Example 2

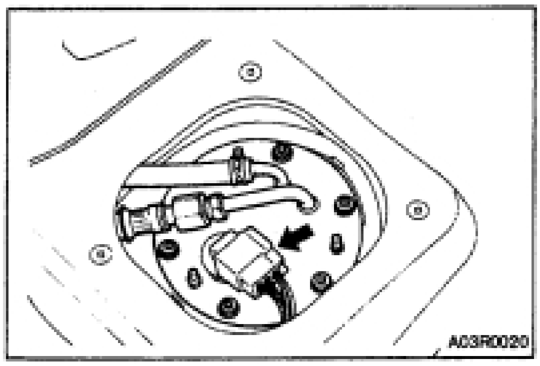
  Wave pattern during engine cranking

  Cause of problem

  Malfunction in power transistor

  Wave pattern characteristics

  Power voltage results when the power transistor is ON.

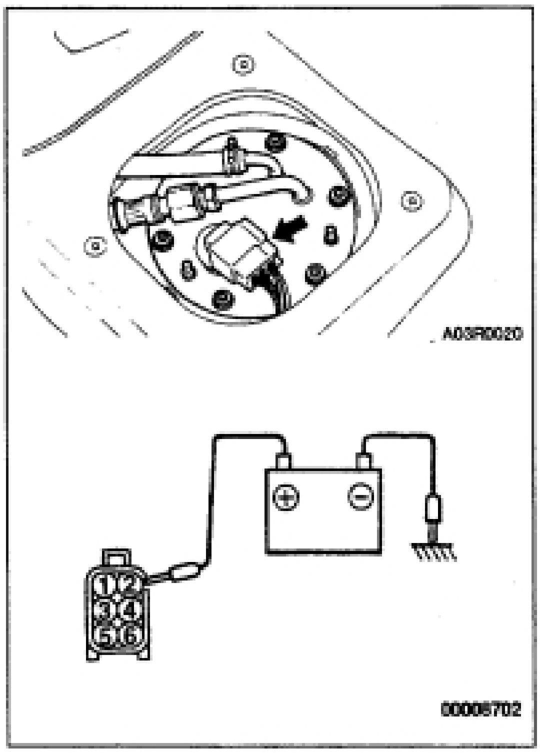


ON-VEHICLE SERVICE

FUEL PUMP CONNECTOR DISCONNECTION (HOW TO REDUCE THE FUEL PRESSURE)

When removing the fuel pipe, hose, etc., since fuel pressure in the fuel pipe line is high, do the following operation so as to release fuel pressure in the line and prevent fuel from running out.

1. Remove the rear seat cushion. (Refer to GROUP 52A.)
2. Remove the protector.
3. Disconnect the floor wiring harness and fuel wiring harness under the floor carpet.
4. After starting the engine and letting it run until it stops naturally, turn the ignition switch to OFF.
5. Connect the fuel wiring harness and floor wiring harness.
6. Install the rear seat cushion.



FUEL PUMP OPERATION CHECK

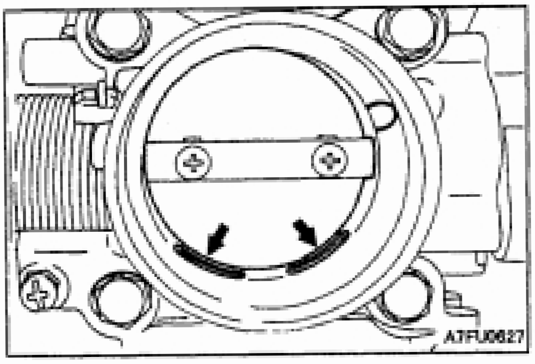
1. Check the operation of the fuel pump by using the MUT-II to force-drive the fuel pump.
2. If the fuel pump will not operate, check by using the following procedure, and if it is normal, check the drive circuit.
   (1) Turn the ignition switch to OFF.
   (2) Remove the rear seat.
   (3) Remove the protector.
   (4) Disconnect the connector of the fuel gauge and pipe assembly.
   (5) Check that the fuel pump operation sound can be heard when connecting the battery directly to the terminal No.2 of the fuel tank side connector.

   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.

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

THROTTLE BODY (THROTTLE VALVE AREA) CLEANING

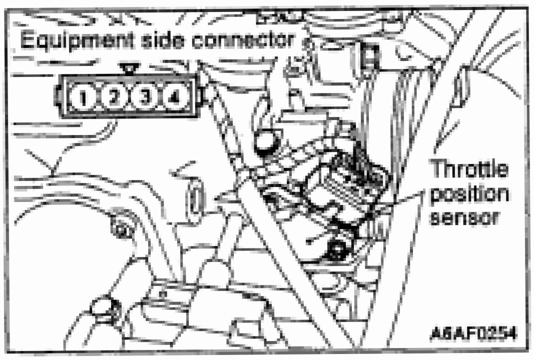
1. Start the engine and warm it up until the coolant is heated to 80°C or higher and then stop the engine.
2. Remove the air intake hose from the throttle body.



3. Plug the bypass passage inlet of the throttle body.

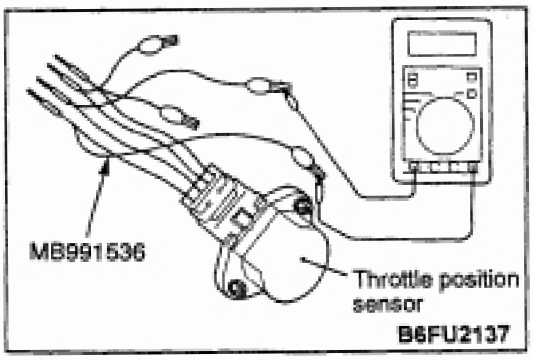
   Caution
   Do not allow cleaning solvent to enter the bypass passage.
4. Spray cleaning solvent into the valve through the throttle body intake port and leave it for about 5 minutes.
5. Start the engine, race it several times and idle it for about 1 minute. If the idling speed becomes unstable (or if the engine stalls) due to the bypass passage being plugged, slightly open the throttle valve to keep the engine running.
6. If the throttle valve deposits are not removed, repeat steps 4 and 5.
7. Unplug the bypass passage inlet.
8. Attach the air intake hose.
9. Use the MUT-II to erase the self-diagnosis code or disconnect the battery (–) cable from the battery for 10 seconds and then reconnect it.
10. Adjust the basic idle speed. (Refer to P.13A-80.)

    NOTE
    If the engine hunts while idling after adjustment of the basic idle speed, disconnect the (–) cable from the battery for 10 seconds or more, and then reconnect it and run the engine at idle for about 10 minutes.

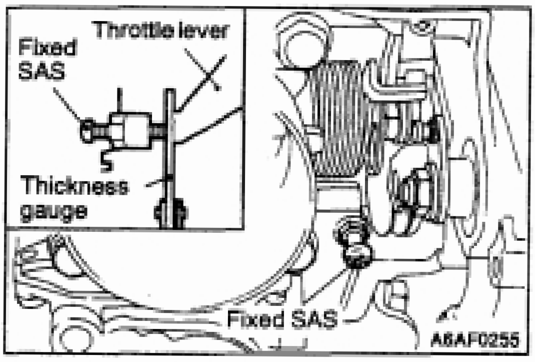


IDLE POSITION SWITCH AND THROTTLE POSITION SENSOR ADJUSTMENT <Vehicles without TCL>

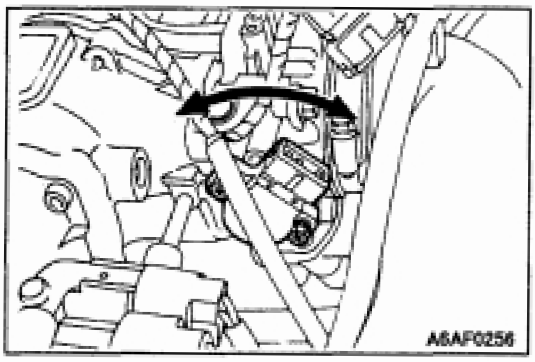
1. Connect the MUT-II to the diagnosis connector.



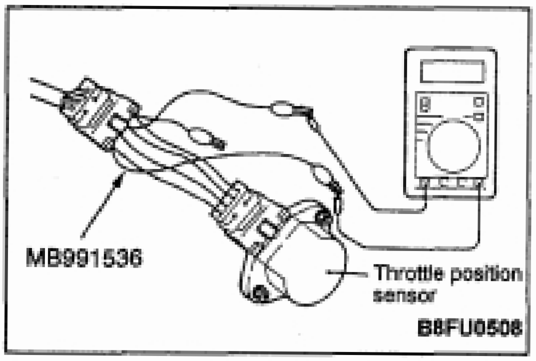
If the MUT-II is not used, follow the steps below.
(1) Disconnect the throttle position sensor connector.
(2) Connect the special tool (TPS test harness: MB991536) to the throttle position sensor connector.
(3) Connect an ohmmeter between the terminal No.2 (idle position switch: blue clip of special tool) and the terminal No.1 (sensor earth: red clip of special tool) of the throttle position sensor connector.



2. Insert a thickness gauge with a thickness of 0.65 mm between the fixed SAS and the throttle lever.
3. If the MUT-II is used, turn the ignition switch to ON (but do not start the engine).

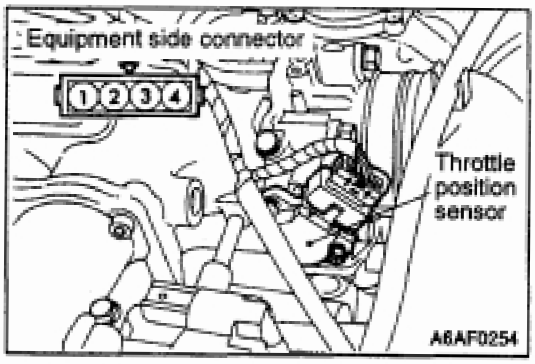


4. Loosen the throttle position sensor mounting bolt, and then turn the throttle position sensor clockwise as far as it will go.
5. Check that the idle position switch is ON at this position.
6. Slowly turn the throttle position sensor counterclockwise and find the point where the idle position switch turns off (no continuity between idle position switch terminal and sensor earth terminal).
   Securely tighten the throttle position sensor mounting bolt at this point.



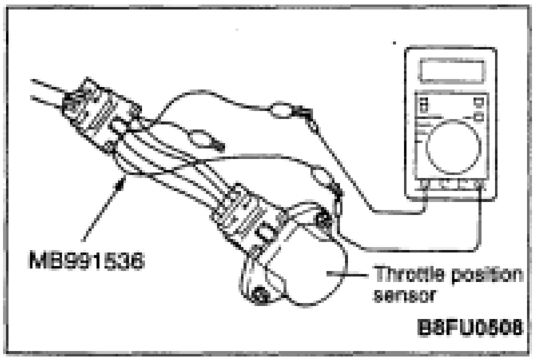
7. If the MUT-II is not used, follow the steps below.
   (1) Connect the released throttle position sensor harness-side connector to the special tool (Be careful not to confuse the terminal numbers).
   (2) Connect a digital voltmeter between the terminal No.3 (sensor output: yellow clip of special tool) and the terminal No.1 (sensor earth: red clip of special tool) of the throttle position sensor connector.
   (3) Turn the ignition switch to ON (but do not start the engine).
8. Check the throttle position sensor output voltage.

   Standard value: 400 – 1,000 mV
9. If there is a deviation from the standard value, check the throttle position sensor and the related harness.
10. Remove the thickness gauge.
11. Turn the ignition switch to OFF.
12. Disconnect the MUT-II. When the MUT-II is not used, remove the special tool and connect the throttle position sensor connector.



THROTTLE POSITION SENSOR ADJUSTMENT <Vehicles with TCL>

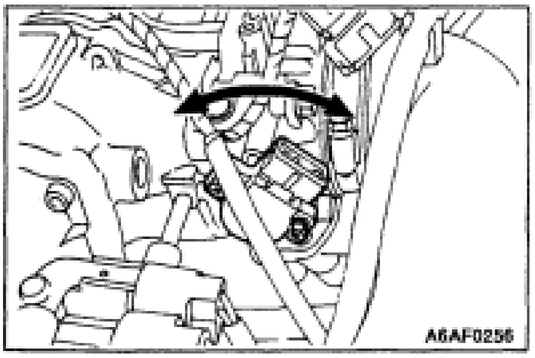
1. Connect the MUT-II to the diagnosis connector.
   If the MUT-II is not used, follow the steps below.
   (1) Disconnect the throttle position sensor connector, and connect the special tool (TPS test harness: MB991536) between the released connectors (Be careful not to confuse the terminal numbers).



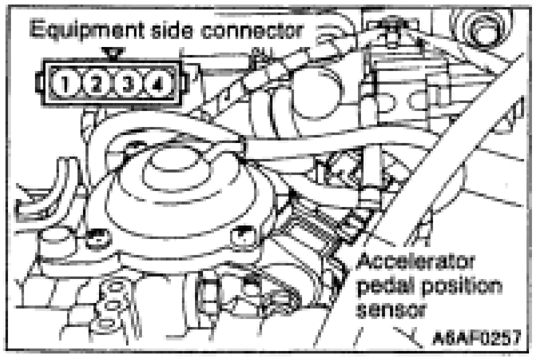
(2) Connect a digital voltmeter between the terminal No.3 (sensor output: yellow clip of special tool) and terminal No.1 (sensor earth: red clip of special tool) of the throttle position sensor connector.

2. Turn the ignition switch to ON (but do not start the engine).
3. Check the throttle position sensor output voltage.

Standard value: 580 – 690 mV

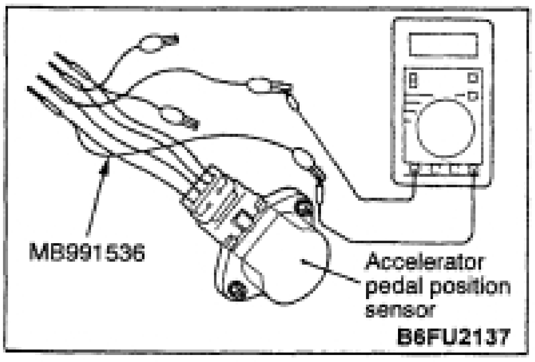


4. If the voltage is outside the standard value, adjust by loosening the throttle position sensor mounting bolts and turning the throttle position sensor body. After adjusting, tighten the bolts securely.
5. Turn the ignition switch to OFF.
6. Remove the MUT-II. If the MUT-II is not used, disconnect the special tool, and connect the throttle position sensor connector.
7. If a diagnosis code is output while adjusting the throttle position sensor, use the MUT-II to erase the diagnosis code or disconnect the battery (–) cable from the battery for 10 seconds and reconnect it, run the engine at idle for 10 minutes.

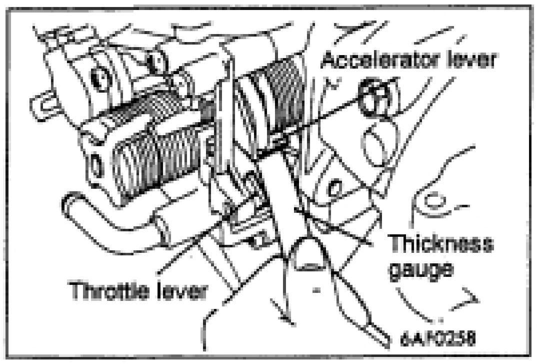


IDLE POSITION SWITCH AND ACCELERATOR PEDAL POSITION SENSOR ADJUSTMENT <Vehicle with TCL>

1. Connect the MUT-II to the diagnosis connector. If the MUT-II is not used, follow the steps below.
   (1) Disconnect the accelerator pedal position sensor connector.



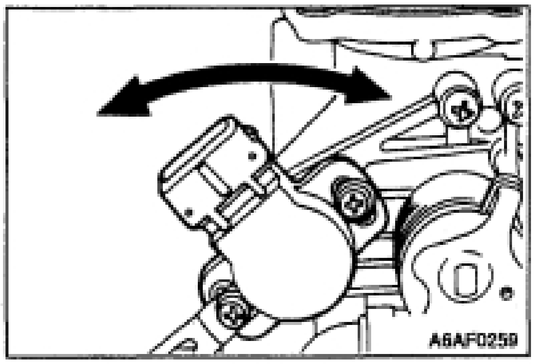
   (2) Connect the special tool (TPS test harness: MB991536) to the accelerator pedal position sensor connector (Do not connect it to the harness-side connector).
   (3) Connect an ohmmeter between the terminal No.3 (idle switch: yellow clip of special tool) and terminal No.4 (sensor earth: black clip of special tool) of the accelerator pedal position sensor connector.



2. Insert a thickness gauge with a thickness of 0.5 mm in between the accelerator lever and throttle lever to a depth of approximately 3 mm.

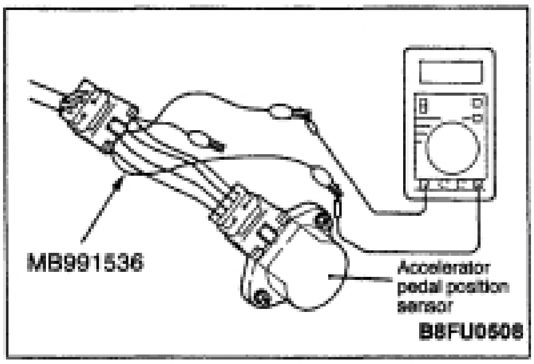
   NOTE
   If the thickness gauge is inserted more than 3 mm, the accelerator lever opening angle will become greater than the set opening angle, which will result in defective adjustment.

3. If the MUT-II is used, turn the ignition switch to ON (but do not start the engine).



4. Loosen the accelerator pedal position sensor mounting bolt, and then turn the accelerator pedal position sensor counterclockwise as far as it will go.
5. Check that the idle position switch is ON at this position. (There is continuity between terminals No.3 and No.4.)
6. Slowly turn the accelerator pedal position sensor clockwise and find the point where the idle position switch turns off (no continuity between terminal No.3 and No.4). Securely tighten the accelerator pedal position sensor mounting bolt at this point.

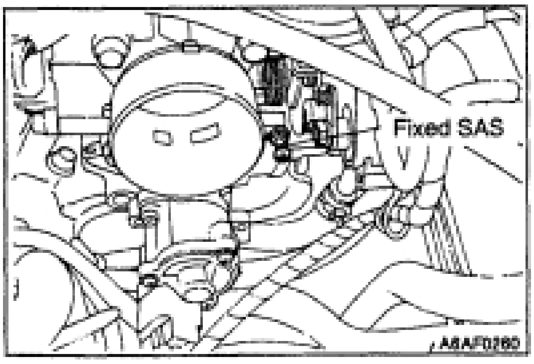
7. When using the MUT-II, select "Traction Control System" on the MUT-II.
   If the MUT-II is not used, follow the steps below.
   (1) Connect the released accelerator pedal position sensor harness-side connector to the special tool (Be careful not to confuse the terminal numbers).



   (2) Connect a digital voltmeter between the terminal No.2 (sensor output: blue clip of special tool) and terminal No.4 (sensor earth: black clip of special tool) of the accelerator pedal position sensor connector.
   (3) Turn the ignition switch to ON (but do not start the engine).
8. Check the accelerator pedal position sensor output voltage.

   Standard value: 400 – 1,000 mV

9. If the voltage is outside the standard value, check the accelerator pedal position sensor and related harnesses.
10. Remove the thickness gauge.
11. Turn the ignition switch to OFF.
12. Disconnect the MUT-II. When the MUT-II is not used, remove the special tool and connect the accelerator pedal position sensor connector.



FIXED SAS ADJUSTMENT

NOTE
1. The fixed SAS 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. Loosen the tension of the accelerator cable sufficiently.
2. Back out the fixed SAS lock nut.
3. Turn the fixed SAS counterclockwise until it is sufficiently backed out, and fully close the throttle valve.
4. Tighten the fixed SAS until the point where the throttle lever is touched (i.e., the point at which the throttle valve begins to open) is found.
   From that point, tighten the fixed SAS 1 turn.
5. While holding the fixed SAS so that it doesn't move, tighten the lock nut securely.
6. Adjust the tension of the accelerator cable. (Refer to GROUP 13B – On-vehicle Service.)
7. Adjust the basic idling speed.
8. Adjust the idle position switch and the throttle position sensor <vehicles without TCL> (P.13A-76), throttle position sensor <vehicles with TCL> (P.13A-77), idle position switch and accelerator pedal position sensor <vehicles with TCL> (P.13A-78).

BASIC IDLE SPEED ADJUSTMENT

NOTE
(1) The standard idling speed has been adjusted by the speed adjusting screw (SAS) by the manufacturer, and there should usually be no need for readjustment.
(2) If the adjustment has been changed by mistake, the idle speed may become too high or the idle speed may drop too low when loads from components such as the A/C are placed on the engine. If this occurs, adjust by the following procedure.
(3) The adjustment, if made, should be made after first confirming that the spark plugs, the injectors, the idle speed control servo, the compression pressure, etc., are all normal.

1. Before inspection and adjustment, set the vehicle to the pre-inspection condition.
2. Connect the MUT-II to the diagnosis connector (16-pin).
   NOTE
   When the MUT-II is connected, the diagnosis control terminal should be earthed.
3. Start the engine and run at idle.
4. Select the item No.30 of the MUT-II Actuator test.
   NOTE
   This holds the ISC servo at the basic step to adjust the basic idle speed.

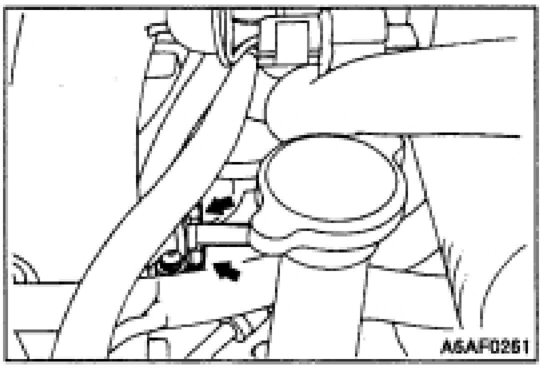
5. Check the idle speed.

   Standard value:
   700 ± 50 r/min

   NOTE
   (1) The engine speed may be 20 to 100 r/min lower than indicated above for a new vehicle [driven approximately 500 km or less], but no adjustment is necessary.
   (2) If the engine stalls or the engine speed is low even though the vehicle has been driven approximately 500 km or more, it is probable that deposits are adhered to the throttle valve, so clean it. (Refer to P.13A-75.)
6. If not within the standard value range, turn the speed adjusting screw (SAS) to make the necessary adjustment.

   NOTE
   If the idling speed is higher than the standard value range even when the SAS is fully closed, check whether or not there is any indication that the fixed SAS has been moved. If there is an indication that it has been moved, adjust the fixed SAS.
7. Press the MUT-II clear key, and release the ISC servo from the Actuator test mode.

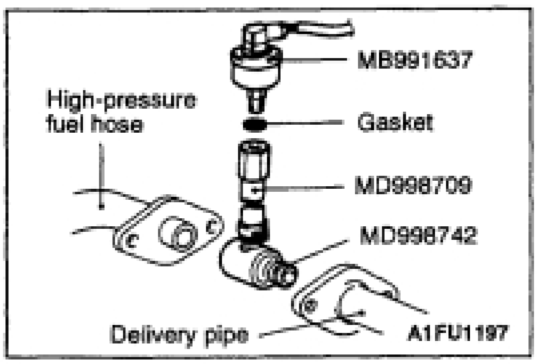
   NOTE
   Unless the ISC servo is released, the Actuator test mode will continue 27 minutes.
8. Switch OFF the ignition switch.
9. Disconnect the MUT-II.
10. Start the engine again and let it run at idle speed for about 10 minutes; check that the idling condition is normal.



FUEL PRESSURE TEST

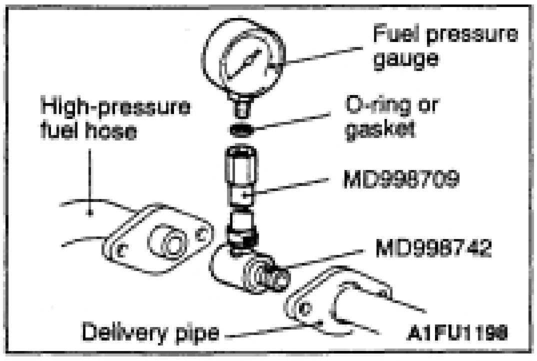
1. Release residual pressure from the fuel pipe line to prevent fuel gush out. (Refer to P.13A-75.)
2. Disconnect the high-pressure fuel hose at the delivery pipe side.

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

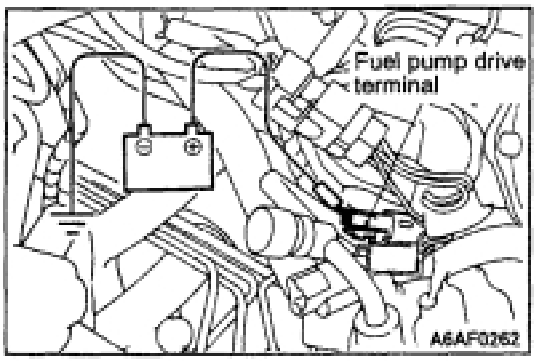


3. Replace the adapter of special tool for fuel pressure measurement.
4. Install the special tool for fuel pressure measurement.

<When the MUT-II is used>
(1) Install the special tool for fuel pressure measurement between the delivery pipe and the high-pressure fuel hose.
(2) Install the fuel pressure gauge set (special tool) to the special tool for fuel pressure measurement via the gasket.
(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.

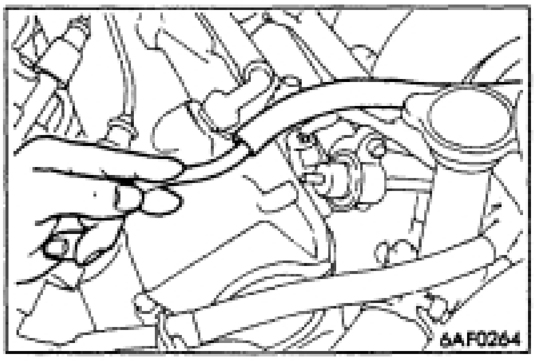


<When the MUT-II is not used>
(1) Install the fuel pressure gauge to the special tool for fuel pressure measurement via the suitable O-ring or gasket.
(2) Install the special tool, which was set in place in step (1) between the delivery pipe and the high-pressure hose.



5. Connect the fuel pump drive terminal to the battery (+) terminal using a jumper wire and drive the fuel pump. With the fuel pressure applied, check the fuel pressure gauge and special tool connections for leaks.
6. Disconnect the jumper wire from the fuel pump drive terminal to stop the fuel pump.
7. Start the engine and run at idle.
8. Measure fuel pressure while the engine is running at idle.

Standard value: Approx. 265 kPa



9. Disconnect the vacuum hose from the fuel pressure regulator and measure fuel pressure with the hose end closed by a finger.

Standard value: Approx. 324–343 kPa

10. Check to see that fuel pressure at idle does not drop even after the engine has been raced several times.
11. Racing the engine repeatedly, hold the fuel return hose lightly with fingers to feel that fuel pressure is present in the return hose.

NOTE
If the fuel flow rate is low, there will be no fuel pressure in the return hose.

12. If any of fuel pressure measured in steps 8 to 11 is out of specification, troubleshoot and repair according to the table below.

Symptom	Probable cause	Remedy
• Fuel pressure too low • Fuel pressure drops after racing • No fuel pressure in fuel return hose	Clogged fuel filter	Replace fuel filter
	Fuel leaking to return side due to poor fuel regulator valve seating or settled spring	Replace fuel pressure regulator
	Low fuel pump delivery pressure	Replace fuel pump
Fuel pressure too high	Binding valve in fuel pressure regulator	Replace fuel pressure regulator
	Clogged fuel return hose or pipe	Clean or replace hose or pipe
Same fuel pressure when vacuum hose is connected and when disconnected	Damaged vacuum hose or clogged nipple Fuel pressure control system faulty	Replace vacuum hose or clean nipple Check the fuel pressure control system.

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 injector	Replace injector
	Leaky fuel regulator valve seat	Replace fuel pressure regulator
Fuel pressure drops sharply immediately after engine is stopped	Check valve in fuel pump is held open	Replace fuel pump

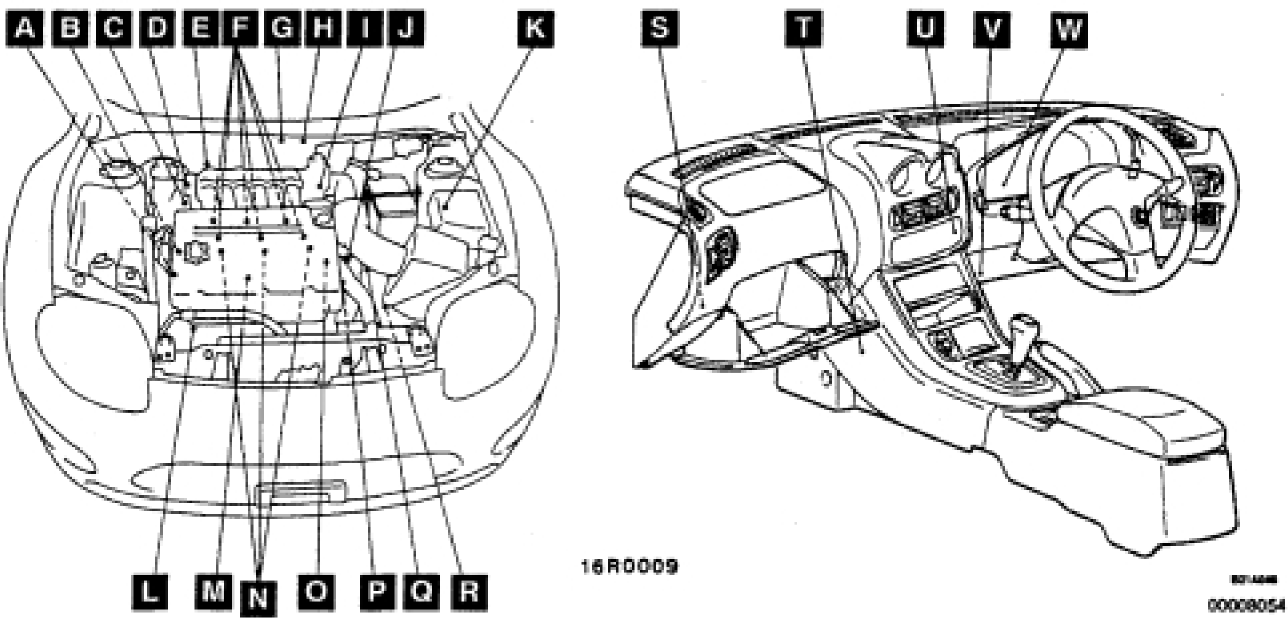
14. Release residual pressure from the fuel pipe line. (Refer to P.13A-75.)
15. Remove the special tool from the delivery pipe.

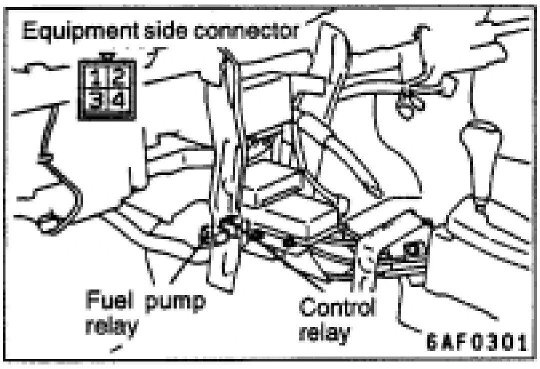
    Caution
    Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.
16. Replace the O-ring at the end of the high-pressure fuel hose with a new one. Furthermore, apply engine oil to the new O-ring before replacement.
17. Fit the high-pressure fuel hose over the delivery pipe and tighten the bolt to the specified torque.

    Tightening torque: 8.8 Nm
18. Check for fuel leaks.
    (1) Apply the battery voltage to the fuel pump drive terminal to drive the fuel pump.
    (2) Check the fuel line for leaks.

COMPONENT LOCATION

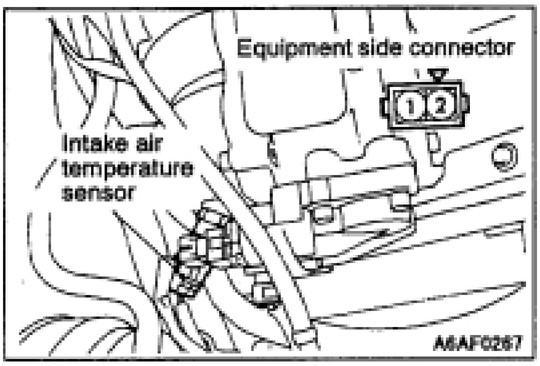
Name	Symbol	Name	Symbol
A/C relay	K	Inhibitor switch <A/T>	R
A/C switch	U	Injectors	F
Accelerator pedal position sensor (with idle position switch) <Vehicles with TCL>	I	Intake air temperature sensor	E
Camshaft position sensor	B	Oil control valve (left)	O
Control relay and fuel pump relay	T	Oil control valve (right)	C
Crank angle sensor	A	Oxygen sensor	X
Detonation sensor	M	Power steering fluid pressure switch	L
Diagnosis connector	V	Throttle position sensor <Vehicles with TCL>	I
Engine coolant temperature sensor	Q	Throttle position sensor (with idle position switch) <Vehicles without TCL>	I
Engine-ECU	S	Vacuum control solenoid valve <Vehicles with TCL>	H
Engine warning lamp (check engine lamp)	W	Vacuum sensor	G
Idle speed control servo (stepper motor)	I	Variable induction control servo	D
Ignition coils	N	Vehicle speed sensor	P
Ignition failure sensor	J	Ventilation control solenoid valve <Vehicles with TCL>	H





CONTROL RELAY AND FUEL PUMP RELAY CONTINUITY CHECK

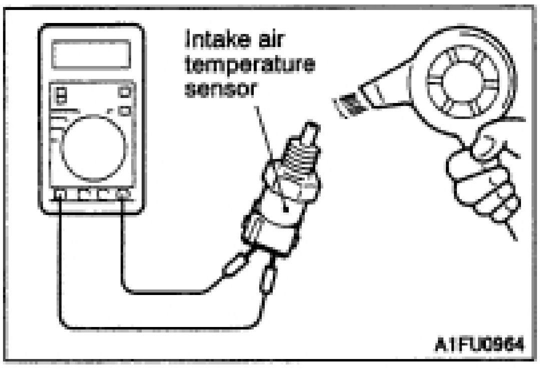
Battery voltage	Terminal No.			
	1	2	3	4
Not supplied		○	—	○
Supplied	○	—	○	
		⊖	—	⊕



INTAKE AIR TEMPERATURE SENSOR CHECK

1. Disconnect the intake air temperature sensor connector.
2. Measure resistance between terminals.

   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:

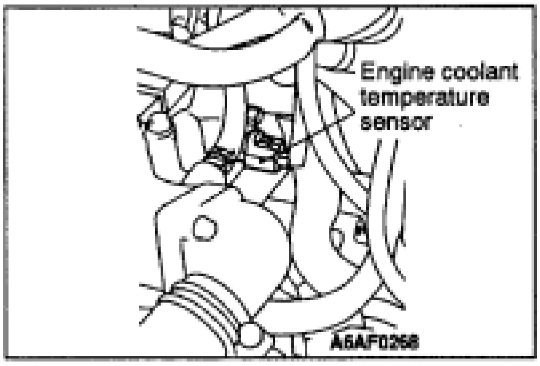
Temperature (°C)	Resistance (kΩ)
Higher	Smaller

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

   NOTE
   Replace the gasket at the same time.

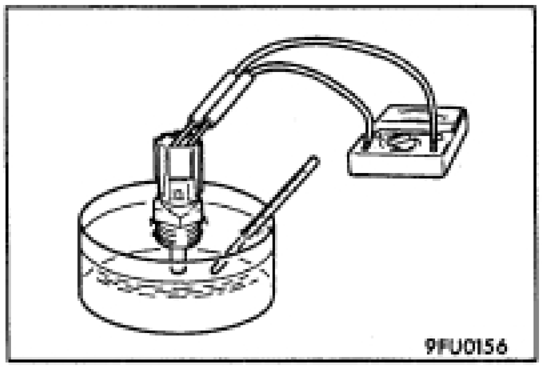
5. Tighten the intake air temperature sensor to the specified torque.

   Tightening torque: 11.8 – 14.7 Nm



ENGINE COOLANT TEMPERATURE SENSOR CHECK

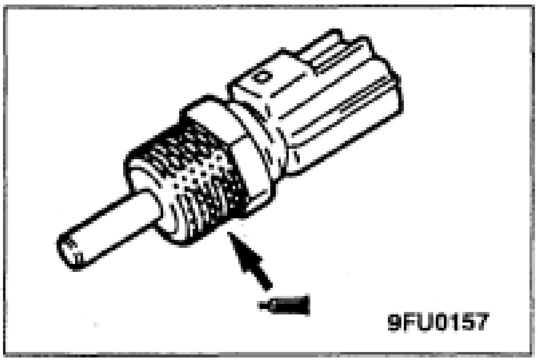
1. Remove the engine coolant temperature sensor.



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

   Standard value:
   2.1 – 2.7 kΩ (at 20°C)
   0.26 – 0.36 kΩ (at 80°C)

3. If the resistance deviates from the standard value greatly, replace the sensor.

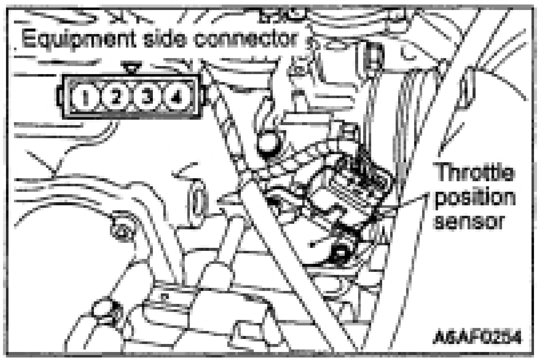


4. Apply sealant to threaded portion.

   Specified sealant:
   3M NUT Locking Part No.4171 or equivalent

5. Install the engine coolant temperature sensor and tighten it to the specified torque.

   Tightening torque: 29 Nm



THROTTLE POSITION SENSOR CHECK

1. Disconnect the throttle position sensor connector.
2. Measure the resistance between the throttle position sensor power supply terminal No.4 and the sensor earth terminal No.1.

   Standard value: 3.5 – 6.5 kΩ

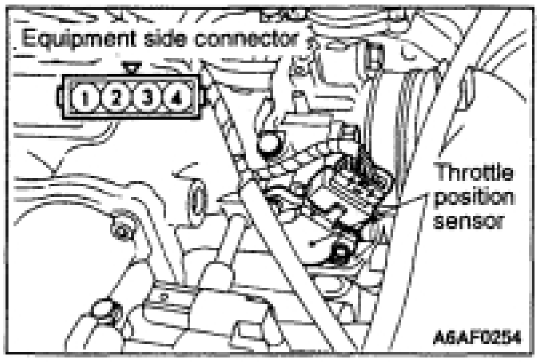
3. Measure the resistance between the throttle position sensor output terminal No.3 and the sensor earth terminal No.1.

   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 does not change smoothly, replace the throttle position sensor. Then adjust the throttle position sensor.

   NOTE
   For the throttle position sensor adjustment procedure, refer to P.13A-76 <Vehicles without TCL>, P.13A-77 <Vehicles with TCL>.



IDLE POSITION SWITCH CHECK <Vehicles without TCL>

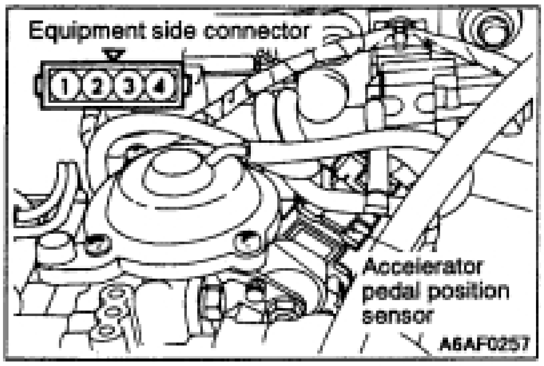
1. Disconnect the throttle position sensor connector.
2. Check the continuity between the throttle position sensor connector idle position switch terminal No.2 and the sensor earth terminal No.1.

   Normal condition:

Accelerator pedal	Continuity
Depressed	Non-conductive (∞ Ω)
Released	Conductive (0 Ω)

3. If out of specification, replace the throttle position sensor.

   NOTE
   After replacement, the idle position switch and throttle position sensor should be adjusted. (Refer to P.13A-76.)



IDLE POSITION SWITCH CHECK <Vehicles with TCL>

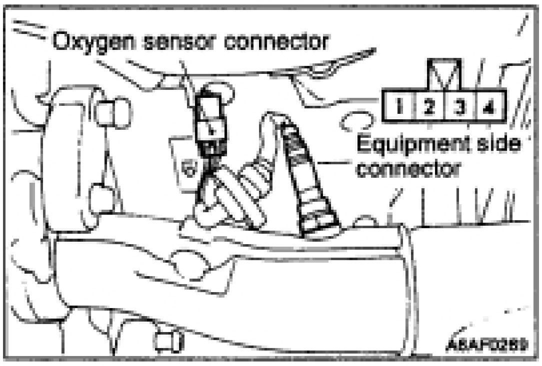
1. Disconnect the accelerator pedal position sensor connector.
2. Check the continuity between the accelerator pedal position sensor connector idle position switch terminal No. 3 and sensor earth terminal No. 4.

Normal condition:

Accelerator pedal	Continuity
Depressed	Non-conductive (∞ Ω)
Released	Conductive (0 Ω)

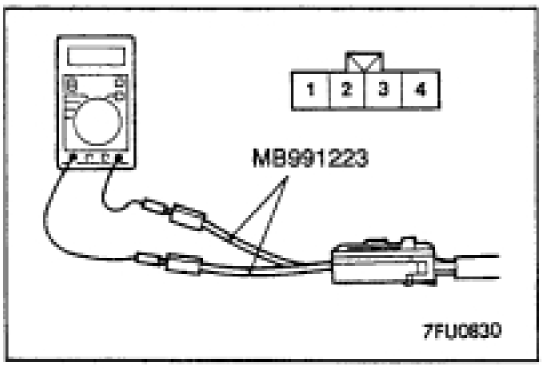
3. If out of specification, replace the accelerator pedal position sensor.

   NOTE
   After replacement, the idle position switch and accelerator pedal position sensor should be adjusted.
   (Refer to P.13A-78.)

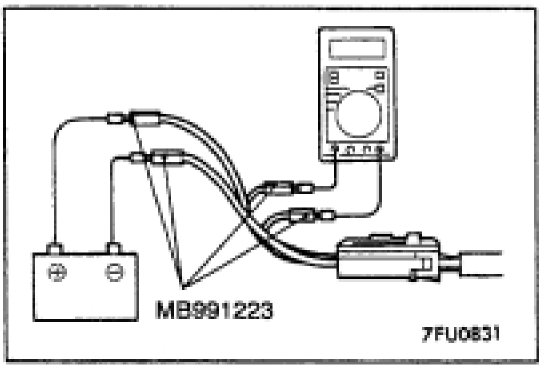


OXYGEN SENSOR CHECK

1. Disconnect the oxygen sensor connector and connect the special tool (test harness) to the connector on the oxygen sensor side.



2. Make sure that there is continuity (11 – 18 Ω at 20°C) between terminal 3 and terminal 4 on the oxygen sensor connector.
3. If there is no continuity, replace the oxygen sensor.



4. Warm up the engine until engine coolant is 80°C or higher.
5. Use the jumper wire to connect terminal 3 of the oxygen sensor connector to the battery (+) terminal and terminal 4 to the battery (–) terminal.

   Caution
   Be very careful when connecting the jumper wire; incorrect connection can damage the oxygen sensor.
6. Connect a digital voltmeter between terminal 1 and terminal 2.

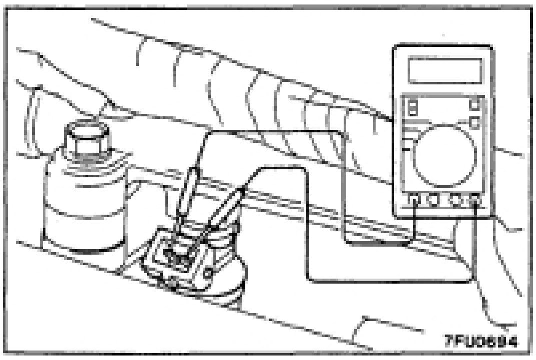
7. While repeatedly racing the engine, measure the oxygen sensor output voltage.

Standard value:

Engine	Oxygen sensor output voltage	Remarks
When racing the engine	0.6 – 1.0 V	If making the air/fuel ratio rich by racing the engine repeatedly, a normal oxygen sensor will output a voltage of 0.6 – 1.0 V.

8. If the sensor is defective, replace the oxygen sensor.

NOTE
For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Pipe and Main Muffler.



INJECTOR CHECK

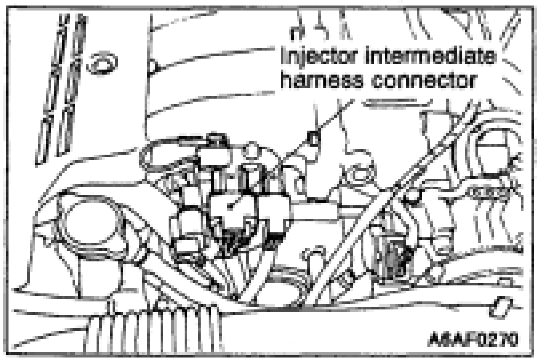
Measurement of Resistance between Terminals

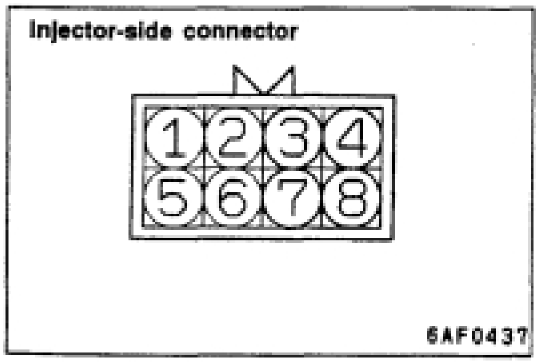
- Left bank side (No.2, No.4, No.6 cylinders)

1. Remove the injector connector.
2. Measure the resistance between terminals.

Standard value: 13 – 16 Ω (at 20°C)

3. Connect the injector connector.





- Right bank side (No.1, No.3, No.5 cylinders)

1. Disconnect the injector intermediate harness connectors.
2. Measure the resistance between terminals.

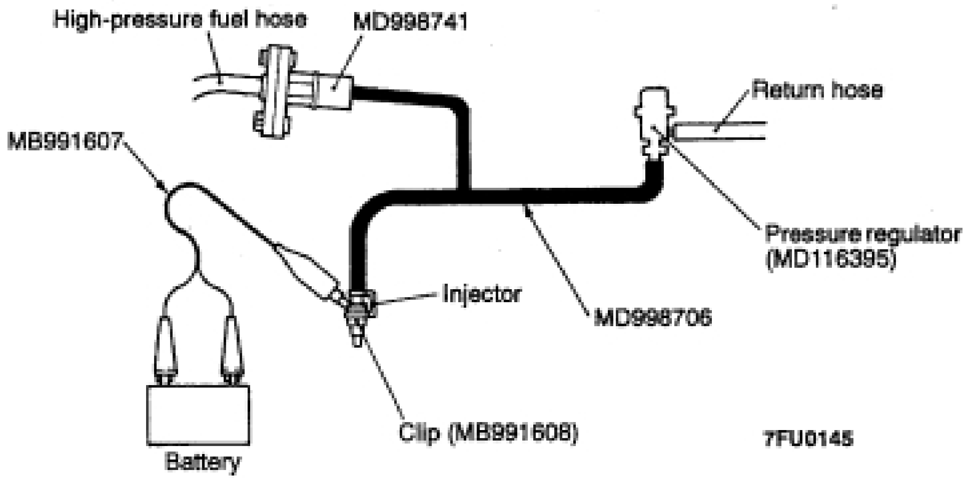
Standard value: 13 – 16 Ω (at 20°C)

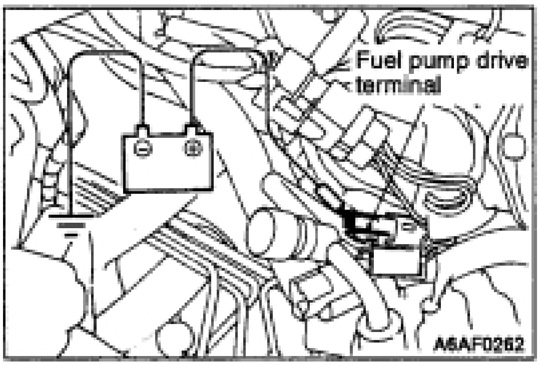
Injector	Measurement probe
No.1 cylinder	3 – 4
No.3 cylinder	3 – 7
No.5 cylinder	3 – 8

3. Connect the injector intermediate harness connector.

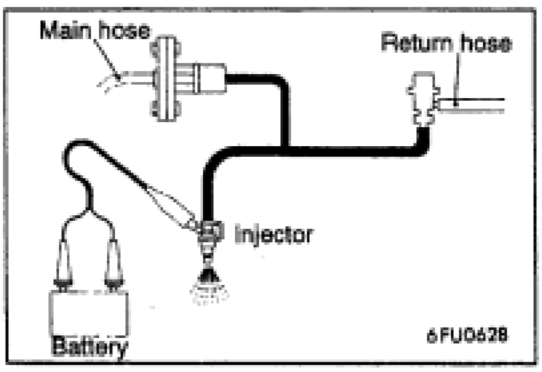
Checking the Injection Condition

1. Following the steps below, bleed out the residual pressure within the fuel pipe line to prevent flow of the fuel. (Refer to P.13A-75.)
2. Remove the injector.
3. Arrange the special tool (injector test set), adaptor, fuel pressure regulator and clips as shown in the illustration below.

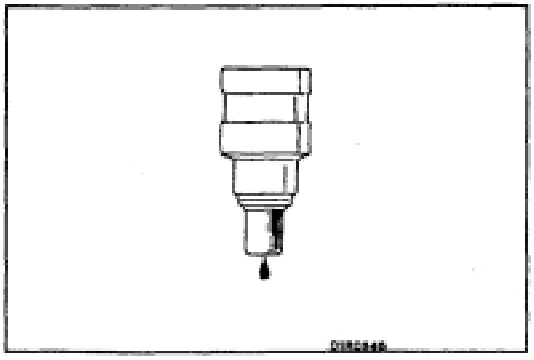




4. Apply battery voltage to fuel pump drive terminal, and activate the fuel pump.



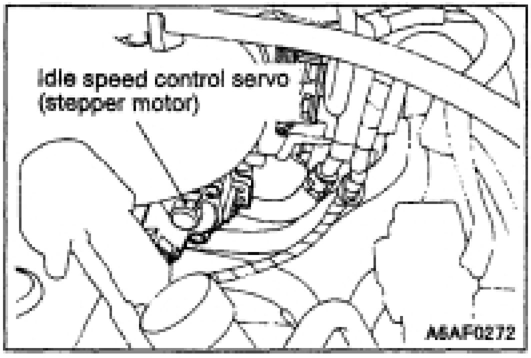
5. Activate the injector and check the atomized spray condition of the fuel.
   The condition can be considered satisfactory unless it is extremely poor.



6. Stop the actuation of the injector, and check for leakage from the injector's nozzle.

   Standard value: 1 drop or less per minute

7. Activate the injector without activating the fuel pump; then, when the spray emission of fuel from the injector stops, disconnect the special tool and restore it to its original condition.



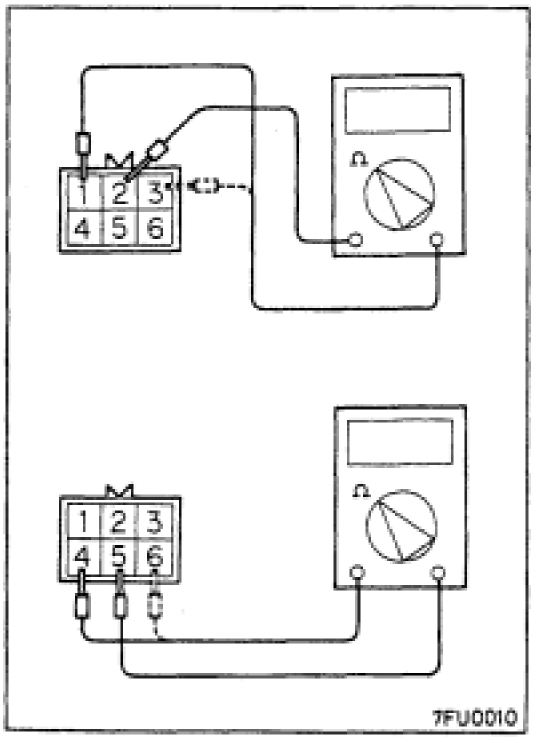
IDLE SPEED CONTROL (ISC) SERVO (STEPPER MOTOR) CHECK

Checking the Operation Sound

1. Check that the engine coolant temperature is 20°C or below.

   NOTE
   Disconnecting the engine coolant temperature sensor connector and connecting the harness-side of the connector to another engine coolant temperature sensor that is at 20°C or below is also okay.

2. Check that the operation sound of the stepper motor can be heard after the ignition is switched ON. (but without starting the motor.)
3. If the operation sound cannot be heard, check the stepper motor's activation circuit.
   If the circuit is normal, it is probable that there is a malfunction of the stepper motor or of the engine control unit.



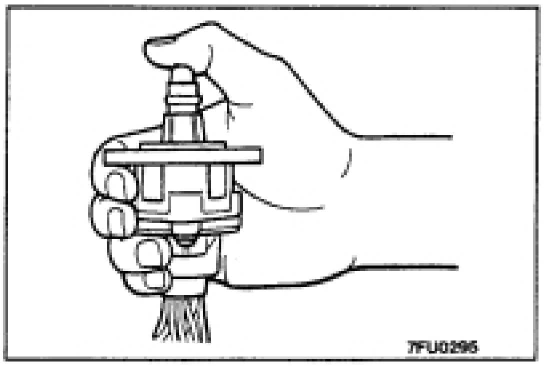
Checking the Coil Resistance

1. Disconnect the idle speed control servo connector and connect the special tool (test harness).
2. Measure the resistance between terminal 2 (white clip of the special tool) and either terminal 1 (red clip) or terminal 3 (blue clip) of the connector at the idle speed control servo side.

   Standard value: 28 – 33 Ω (at 20°C)

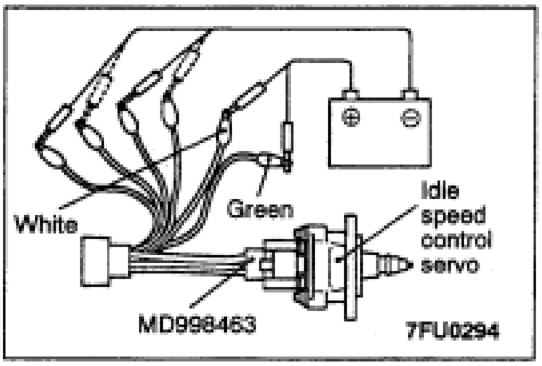
3. Measure the resistance between terminal 5 (green clip of the special tool) and either terminal 6 (yellow clip) or terminal 4 (black clip) of the connector at the idle speed control servo side.

   Standard value: 28 – 33 Ω (at 20°C)

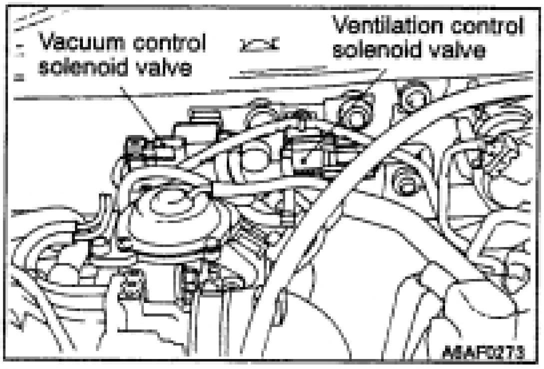


Operation Check

1. Remove the throttle body.
2. Remove the stepper motor.

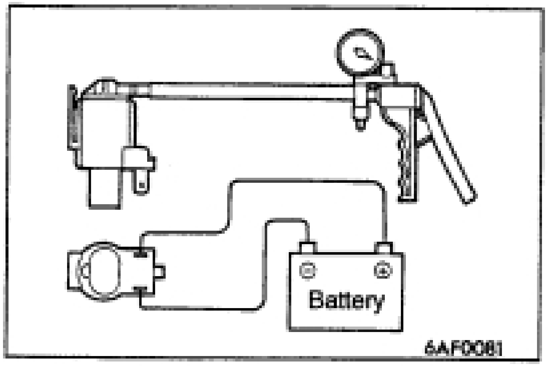


3. Connect the special tool (test harness) to the idle speed control servo connector.
4. Connect the positive (+) terminal of a power supply (approx. 6 V) to the white clip and the green clip.
5. With the idle speed control servo as shown in the illustration, connect the negative (–) terminal of the power supply to each clip as described in the following steps, and check whether or not a vibrating feeling (a feeling of very slight vibration of the stepper motor) is generated as a result of the activation of the stepper motor.
   (1) Connect the negative (–) terminal of the power supply to the red and black clip.
   (2) Connect the negative (–) terminal of the power supply to the blue and black clip.
   (3) Connect the negative (–) terminal of the power supply to the blue and yellow clip.
   (4) Connect the negative (–) terminal of the power supply to the red and yellow clip.
   (5) Connect the negative (–) terminal of the power supply to the red and black clip.
   (6) Repeat the tests in sequence from (5) to (1).
6. If, as a result of these tests, vibration is detected, the stepper motor can be considered to be normal.



VENTILATION CONTROL SOLENOID VALVE CHECK <Vehicles with TCL>

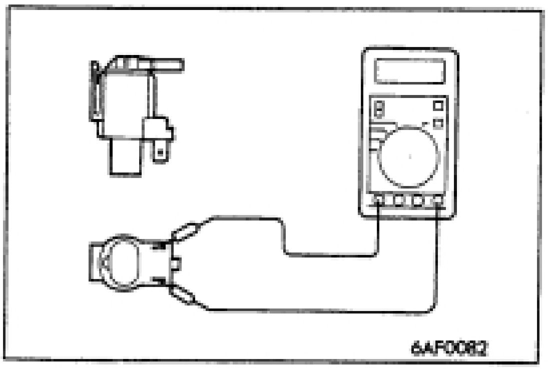
1. Disconnect the vacuum hose (green stripe) from the solenoid valve.
2. Disconnect the harness connector.



3. Connect a hand vacuum pump to the solenoid valve nipple.
4. Using a jumper wire, connect the solenoid valve terminal and the battery terminal.
5. Check the air-tightness by applying a vacuum when the jumper wire is disconnected/connected from/to the battery (–) terminal.

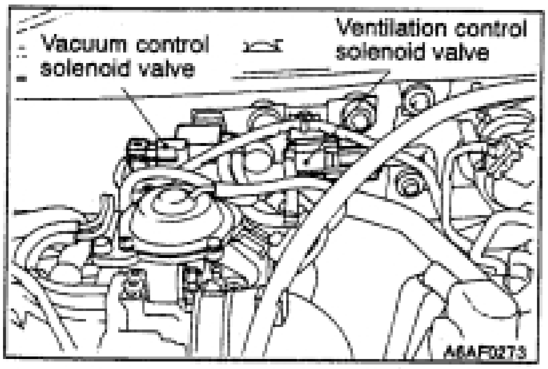
Normal condition:

Jumper wire	Normal condition
Disconnected	Vacuum leaks
Connected	Vacuum maintained



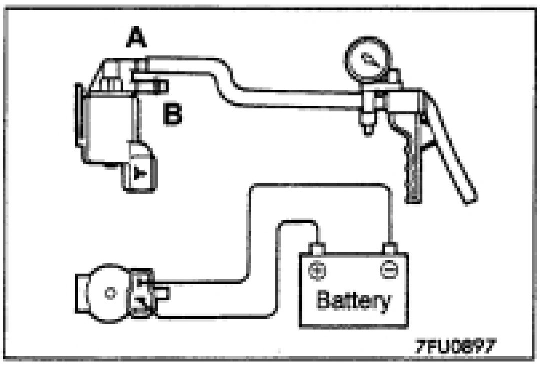
6. Measure the resistance between the terminals of the solenoid valve.

Standard value: 36 – 44 Ω (at 20°C)



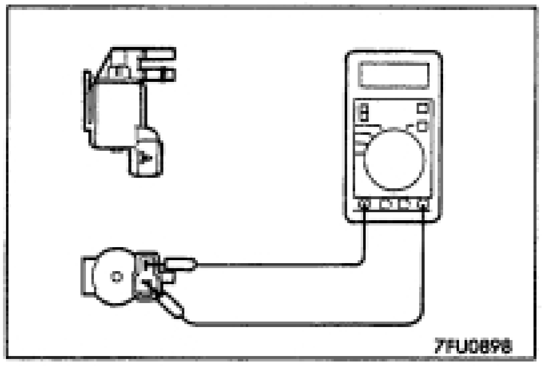
VACUUM CONTROL SOLENOID VALVE CHECK <Vehicles with TCL>

1. Disconnect the vacuum hose (blue stripe, green stripe) from the solenoid valve.
2. Disconnect the harness connector.



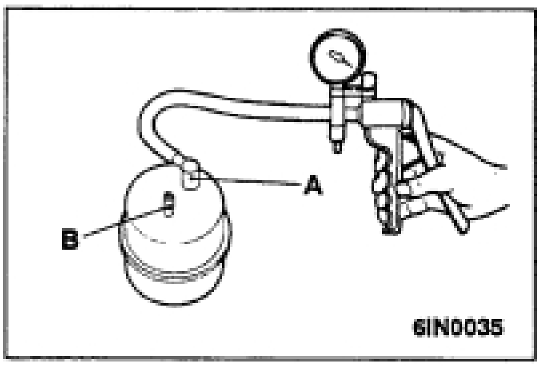
3. Connect a hand vacuum pump to the solenoid valve nipple A.
4. Using a jumper wire, connect the solenoid valve terminal and the battery terminal.
5. Check the air-tightness by applying a vacuum when the jumper wire is disconnected/connected from/to the battery (–) terminal.

Jumper wire	Nipple B	Normal condition
Connected	Open	Vacuum leaks
	Close	Vacuum maintained
Disconnected	Open	Vacuum maintained



6. Measure the resistance between the terminals of the solenoid valve.

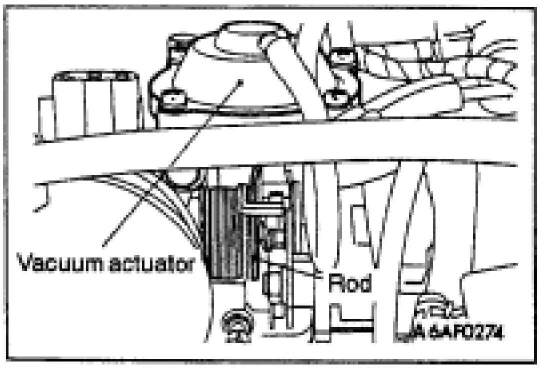
   Standard value: 36 – 44 Ω (at 20°C)



VACUUM TANK CHECK

<Vehicles with TCL>

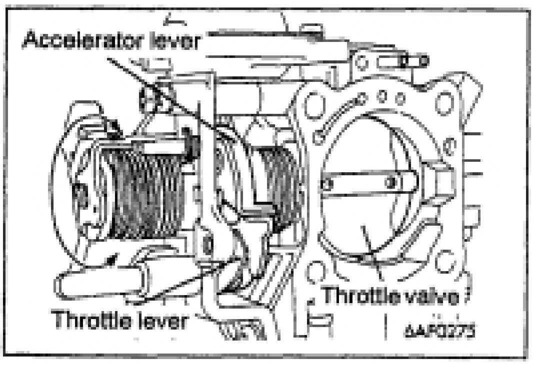
1. Connect a hand vacuum pump to vacuum tank A nipple, apply 67 kPa of vacuum and check that the vacuum is held.
2. Connect a hand vacuum pump to vacuum tank B nipple.
3. First, close A nipple with your finger and apply 67 kPa of vacuum. Then, check that the vacuum leaks immediately when you remove the finger blocking the nipple.



VACUUM ACTUATOR CHECK

<Vehicles with TCL>

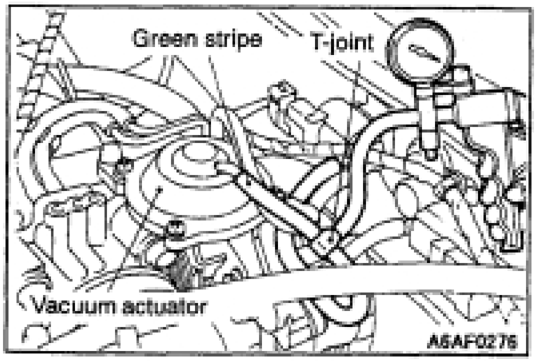
1. Remove the vacuum hose (green stripe) from the vacuum actuator and connect a hand vacuum pump to the vacuum actuator.
2. With the accelerator pedal depressed, check that the rod is pulled up and that vacuum is held when 27 kPa of vacuum is applied.



THROTTLE VALVE OPERATION CHECK

<Vehicles with TCL>

1. Check that the throttle valve opens and closes smoothly (throttle lever moves) according to the opening and closing of the accelerator lever.
2. If the throttle valve does not open and close smoothly, there might be a deposit on the throttle valve, so clean the throttle body. (Refer to P.13A-75.)



NEGATIVE PRESSURE CHECK DURING TRACTION CONTROL OPERATION

<Vehicles with TCL>

1. Disconnect the vacuum hose (green stripe) from the vacuum actuator, connect a hand vacuum pump between the actuator nipple and the vacuum hose via a T-joint. Set the hand vacuum pump near the driver's seat so that the negative pressure check can be carried out at the driver's seat.
2. Check the negative pressure during traction control operation.
   Inspection service points are the same as for the traction control operation inspection.
   (Refer to GROUP 13C or GROUP 23 – On-vehicle Service.)

   Normal condition:

Vehicle condition	Normal negative pressure when accelerator pedal is depressed
Vehicle is lifted up	20 kPa or more
Driving on a dry, sealed road surface	No change

NOTE
The traction control system function will stop 20 seconds after the accelerator pedal has been depressed, and negative pressure will gradually drop.

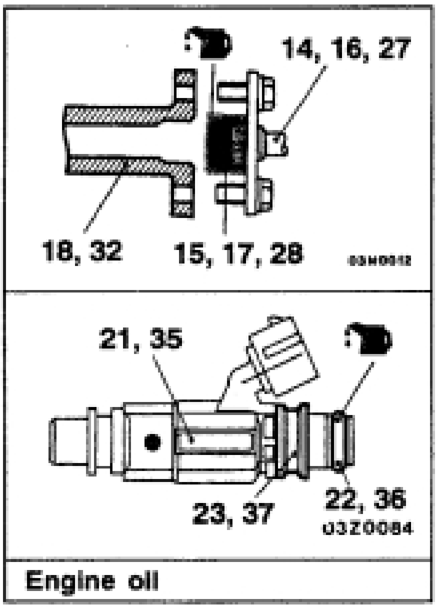
INJECTOR

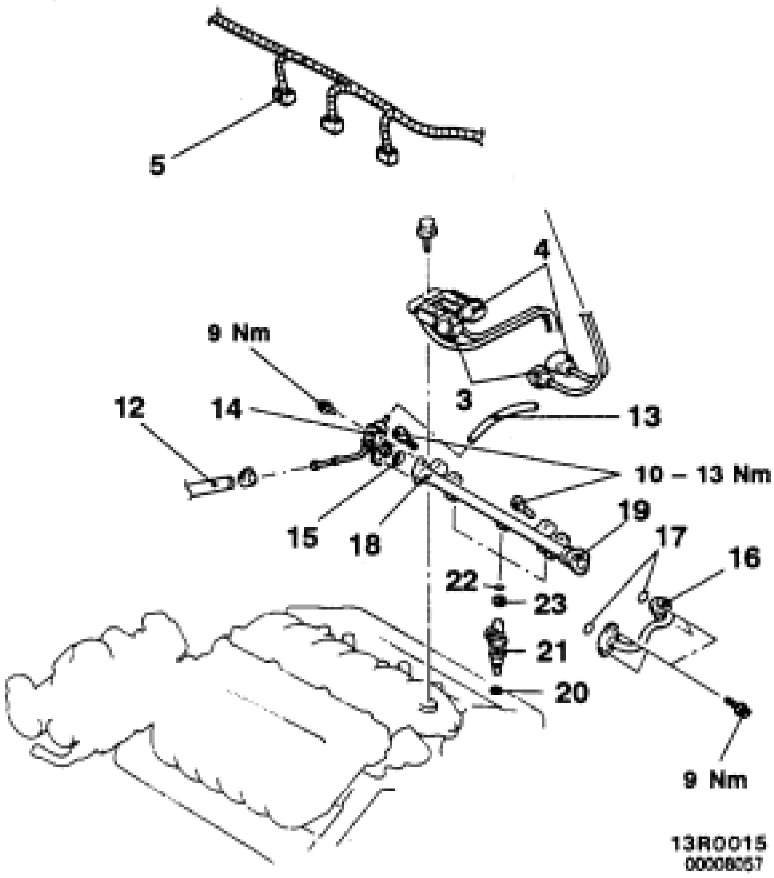
REMOVAL AND INSTALLATION

<Left bank>

Pre-removal Operation
- Fuel Discharge Prevention (Refer to P.13A-75.)
- Engine Cover Removal (Refer to GROUP 11A – Timing Belt.)

Post-installation Operation
- Engine Cover Installation (Refer to GROUP 11A – Timing Belt.)
- Accelerator Cable Adjustment
- Fuel Leakage Check





Removal steps

1. Variable induction control servo connector
3. Camshaft position sensor connector
4. Crank angle sensor connector
5. Injector connector
12. Fuel return hose connection
13. Vacuum hose connection

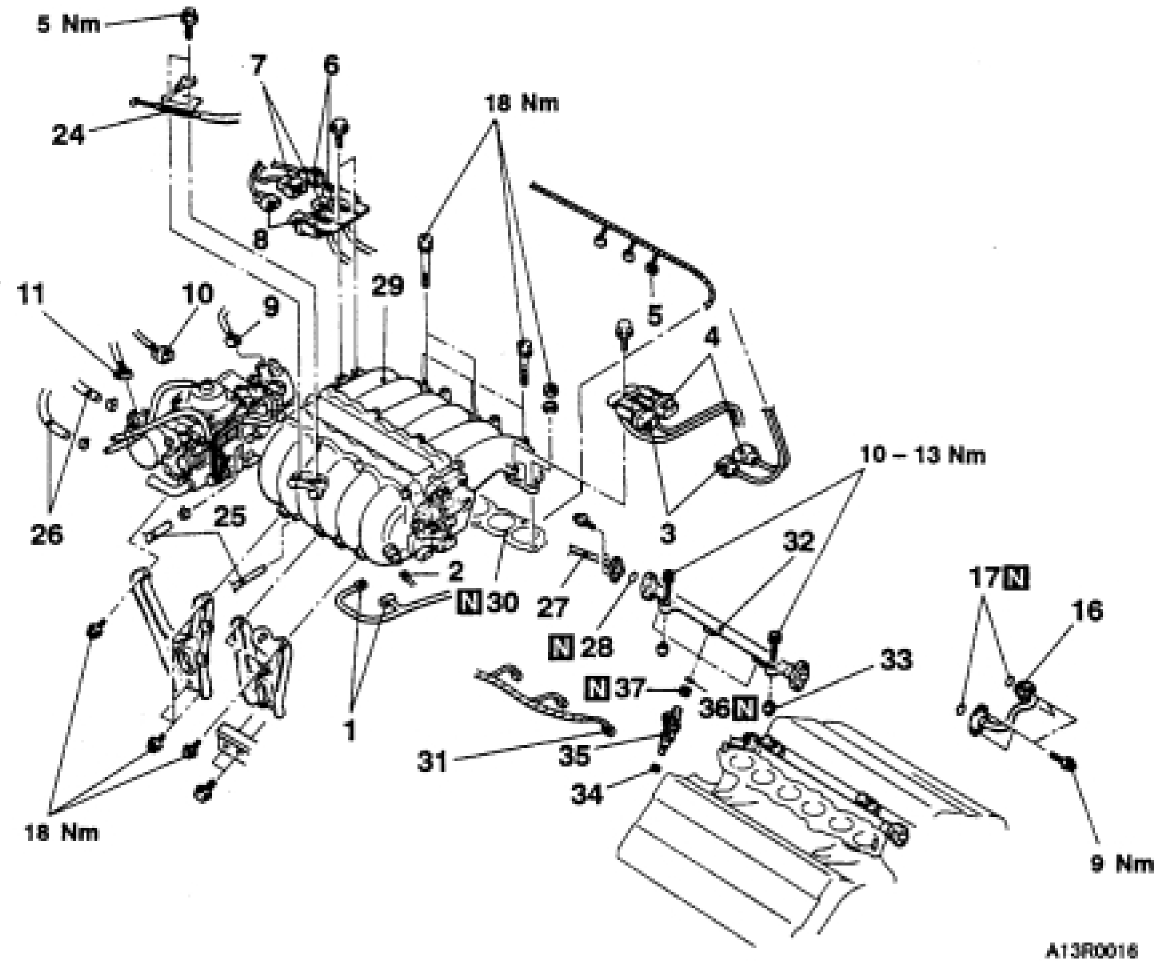
▶A◀ 14. Fuel pressure regulator
15. O-ring

▶A◀ 16. Fuel pipe assembly
17. O-ring

◀A▶ 18. Delivery pipe
19. Insulator
20. Insulator

▶A◀ 21. Injector
22. O-ring
23. Grommets

<Right bank>



Removal steps

1. Variable induction control servo connector
2. Intake air temperature sensor connector
3. Camshaft position sensor connector
4. Crank angle sensor connector
5. Injector connector
6. Detonation sensor connector
7. Injector harness connector
8. Oil control valve connector
9. Throttle position sensor connector
10. Idle speed control servo motor connector
11. Accelerator pedal position sensor connector
16. Fuel pipe assembly
17. O-ring
24. Accelerator cable
25. Brake booster vacuum hose connection
26. Engine coolant hose connection

▶A◀ 27. High-pressure fuel hose connection
28. O-ring
29. Air intake plenum and throttle body assembly
30. Gasket
31. Injector connector

◀A▶ 32. Delivery pipe
33. Insulator
34. Insulator

▶A◀ 35. Injector
36. O-ring
37. Grommets

REMOVAL SERVICE POINT

◀A▶ DELIVERY PIPE REMOVAL

Remove the delivery pipe (with the injectors attached to it).

Caution
Care must be taken, when removing the delivery pipe, not to drop the injector.

INSTALLATION SERVICE POINT

▶A◀ INJECTOR FUEL PRESSURE REGULATOR/ HIGH-PRESSURE FUEL HOSE INSTALLATION

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

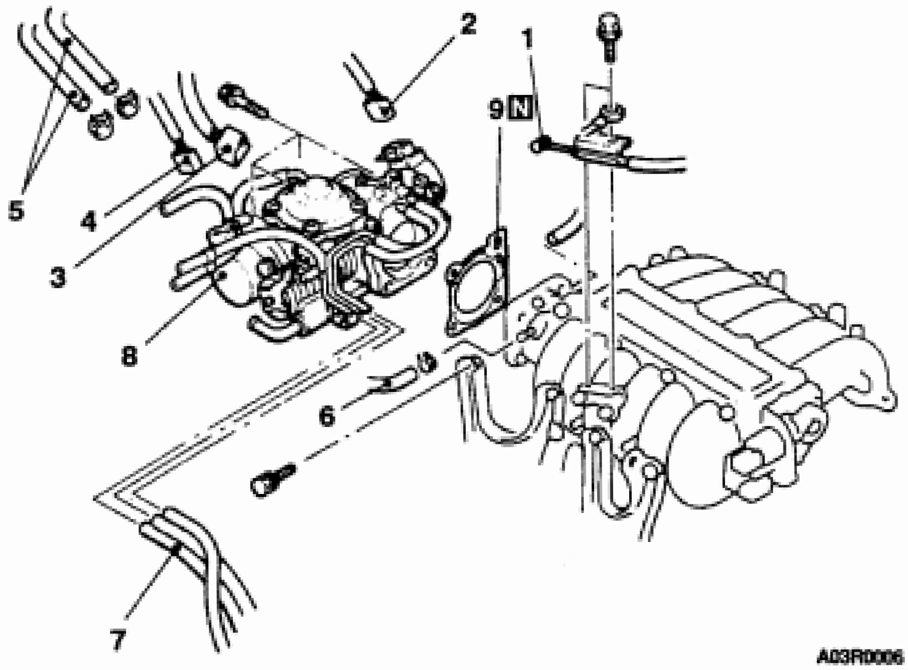
   Caution
   Be sure not to let engine oil in the delivery pipe.
2. While turning the injector, high-pressure fuel hose and fuel pressure regulator to the right and left, install them to the delivery pipe, while being careful not to damage the O-ring.
3. If they does not turn smoothly, the O-ring may be trapped, remove them and then re-insert them into the delivery pipe and check once again.
4. Tighten the high-pressure fuel hose to the standard torque, and tighten the fuel pressure regulator to the specified torque.

   Tightening torque:
   9 Nm (Fuel pressure regulator)

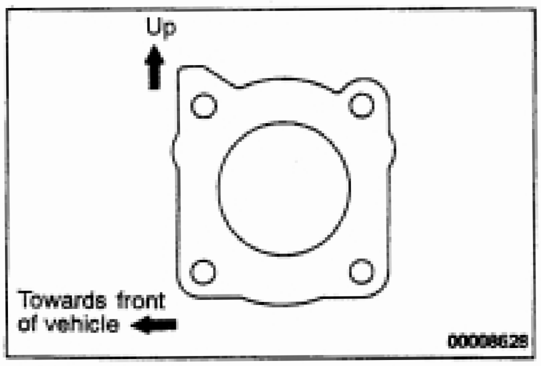
THROTTLE BODY

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying (Refer to GROUP 14 – On-vehicle Service.)
- Air Cleaner Removal and Installation



Removal steps
1. Accelerator cable connection
2. Throttle position sensor connector
3. Idle speed control servo connector
4. Accelerator pedal position sensor connector
5. Water hose connection
6. Brake booster vacuum hose connection
7. Vacuum hose connection
8. Throttle body
9. ►A◄ Throttle body gasket



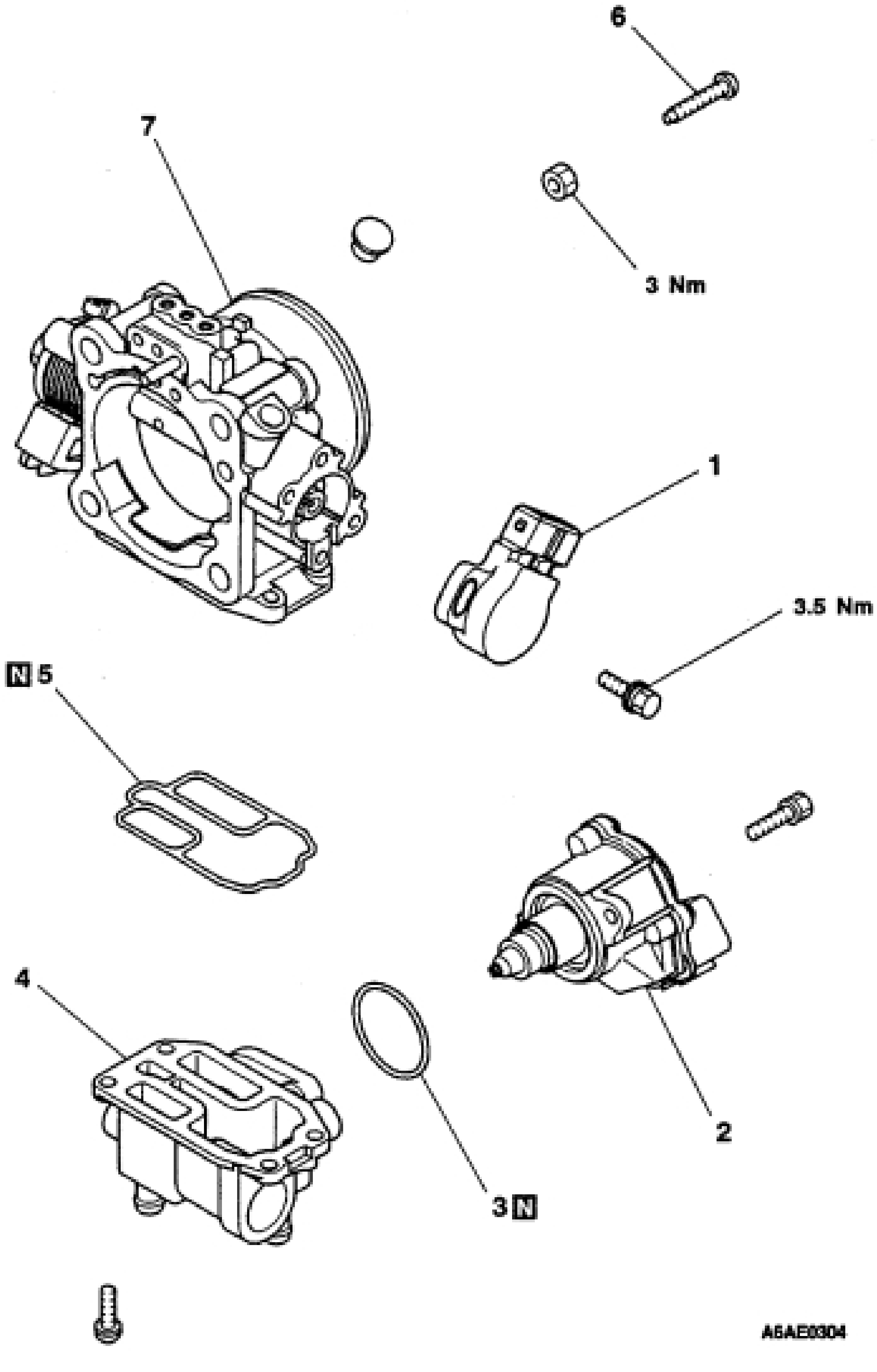
INSTALLATION SERVICE POINT

►A◄ THROTTLE BODY GASKET INSTALLATION

Place the gasket so that the projecting part is positioned as shown in the illustration, and then install it between the intake manifold and the throttle body.

DISASSEMBLY AND REASSEMBLY

<Vehicles without TCL>

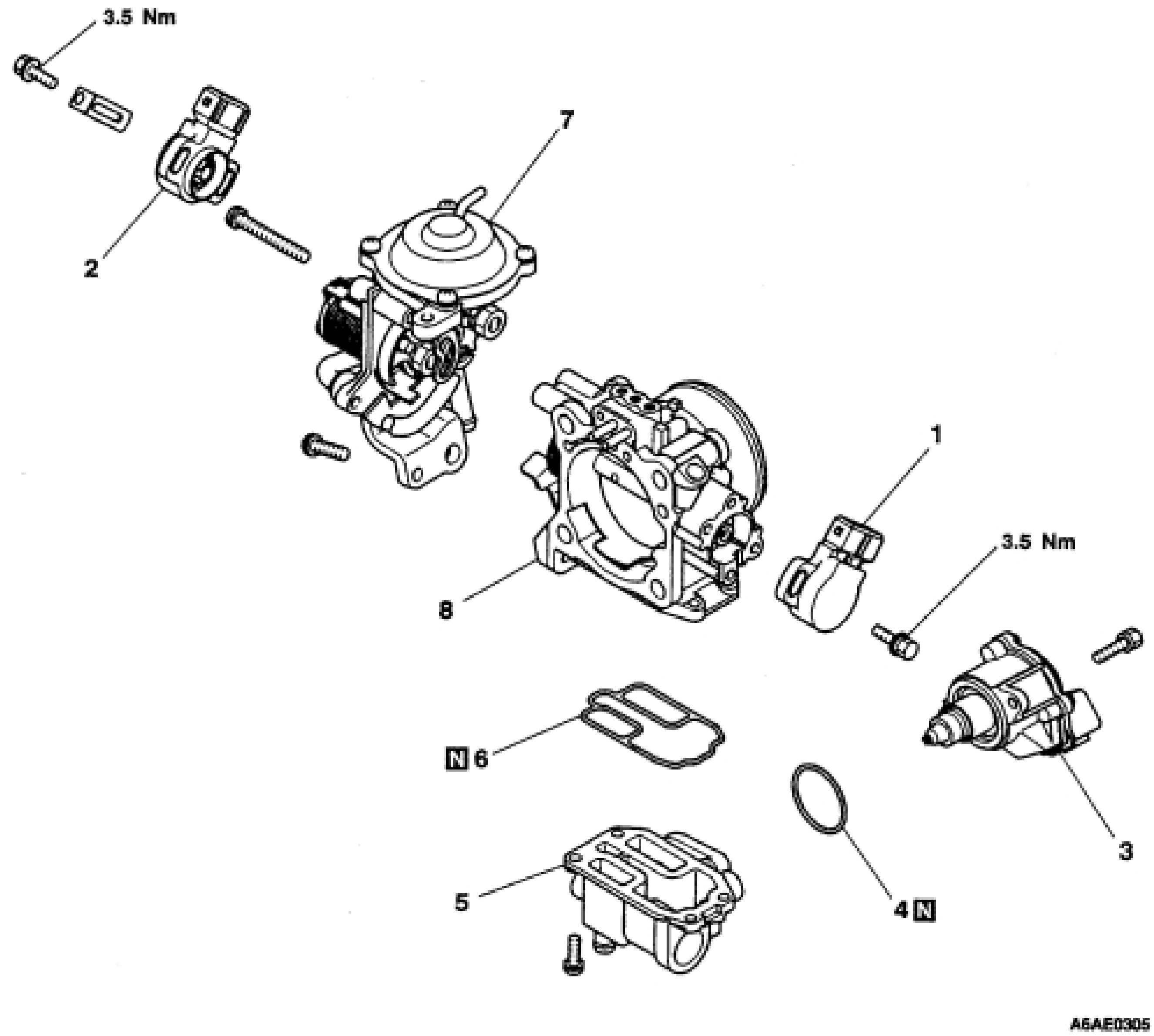


Disassembly steps

►B◄ 1. Throttle position sensor (TPS)
2. Idle speed control servo
3. O-ring
4. Fast idle air valve
5. O-ring
6. Fixed SAS
7. Throttle body

DISASSEMBLY AND REASSEMBLY

<Vehicles with TCL>



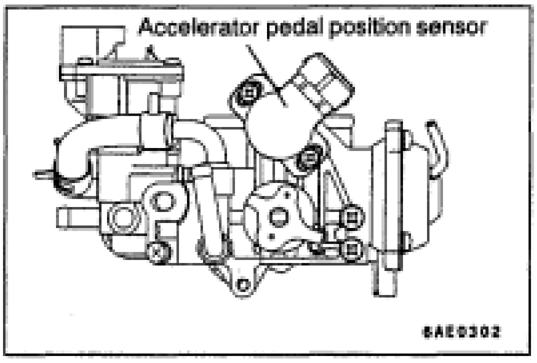
Disassembly steps

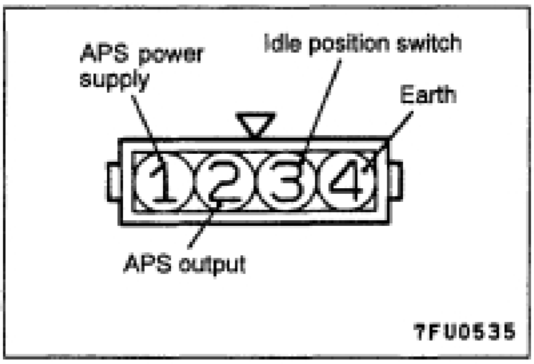
- ▶B◀ 1. Throttle position sensor (TPS)
- ▶A◀ 2. Accelerator pedal position sensor (APS)
- 3. Idle speed control servo
- 4. O-ring
- 5. Fast idle air valve
- 6. O-ring
- 7. Throttle lever
- 8. Throttle body

CLEANING THROTTLE BODY PARTS

1. Clean all throttle body parts.
   Do not use solvent to clean the following parts:
   - Throttle position sensor
   - Accelerator pedal position sensor
   - Idle speed control body assembly

   If these parts are immersed in solvent, their insulation will deteriorate.
   Wipe them with cloth only.
2. Check if the vacuum port or passage is clogged. Use compressed air to clean the vacuum passage.





REASSEMBLY SERVICE POINTS

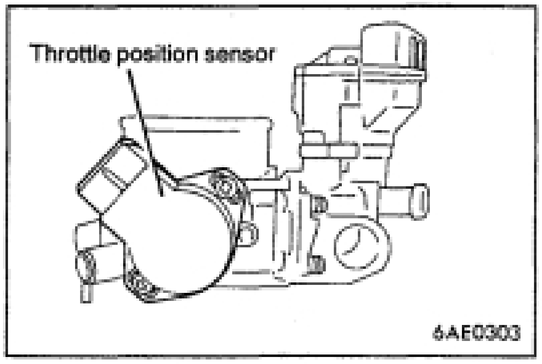
►A◄ ACCELERATOR PEDAL POSITION SENSOR (APS) INSTALLATION

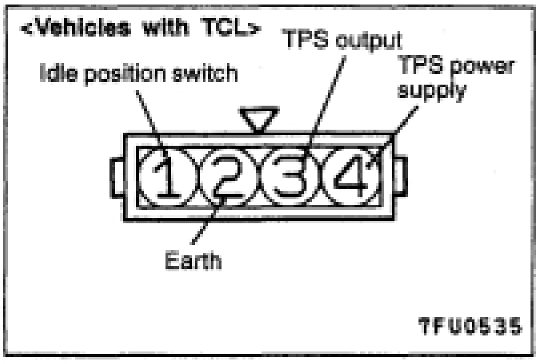
1. Install the APS so that it faces as shown in the illustration, and then tighten it with the screw.
2. Connect a multimeter between terminal (2) (APS output) and terminal (1) (APS power supply) of the APS connector, and check that the resistance increases gradually as the throttle valve is opened slowly to the fully-open position.
3. Check the continuity between terminal (3) (idle position switch) and terminal (4) (earth) of the APS connector when the throttle valve is fully closed and fully open.

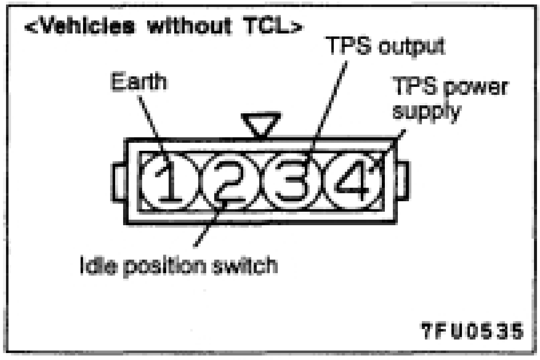
   Normal condition:

Throttle valve condition	Continuity
Fully closed	Continuity
Fully open	No continuity

   If there is no continuity when the throttle valve is fully closed, turn the APS body clockwise and then check again.
4. If there is an abnormality, replace the APS.







▶B◀ THROTTLE POSITION SENSOR (TPS) INSTALLATION

1. Install the TPS so that it faces as shown in the illustration, and then tighten it with the screw.
2. Connect a multimeter between terminal (4) (TPS power supply) and terminal (3) (TPS output) of the TPS connector, and check that the resistance increases gradually as the throttle valve is opened slowly to the fully-open position.
3. For vehicles without TCL, check the continuity between terminal (2) (idle position switch) and terminal (1) (earth) of the TPS connector when the throttle valve is fully closed and fully open.

   Normal condition:

Throttle valve condition	Continuity
Fully closed	Continuity
Fully open	No continuity

   If there is no continuity when the throttle valve is fully closed, turn the TPS body anti-clockwise and then check again.
4. If there is an abnormality, replace the TPS.

FUEL SUPPLY

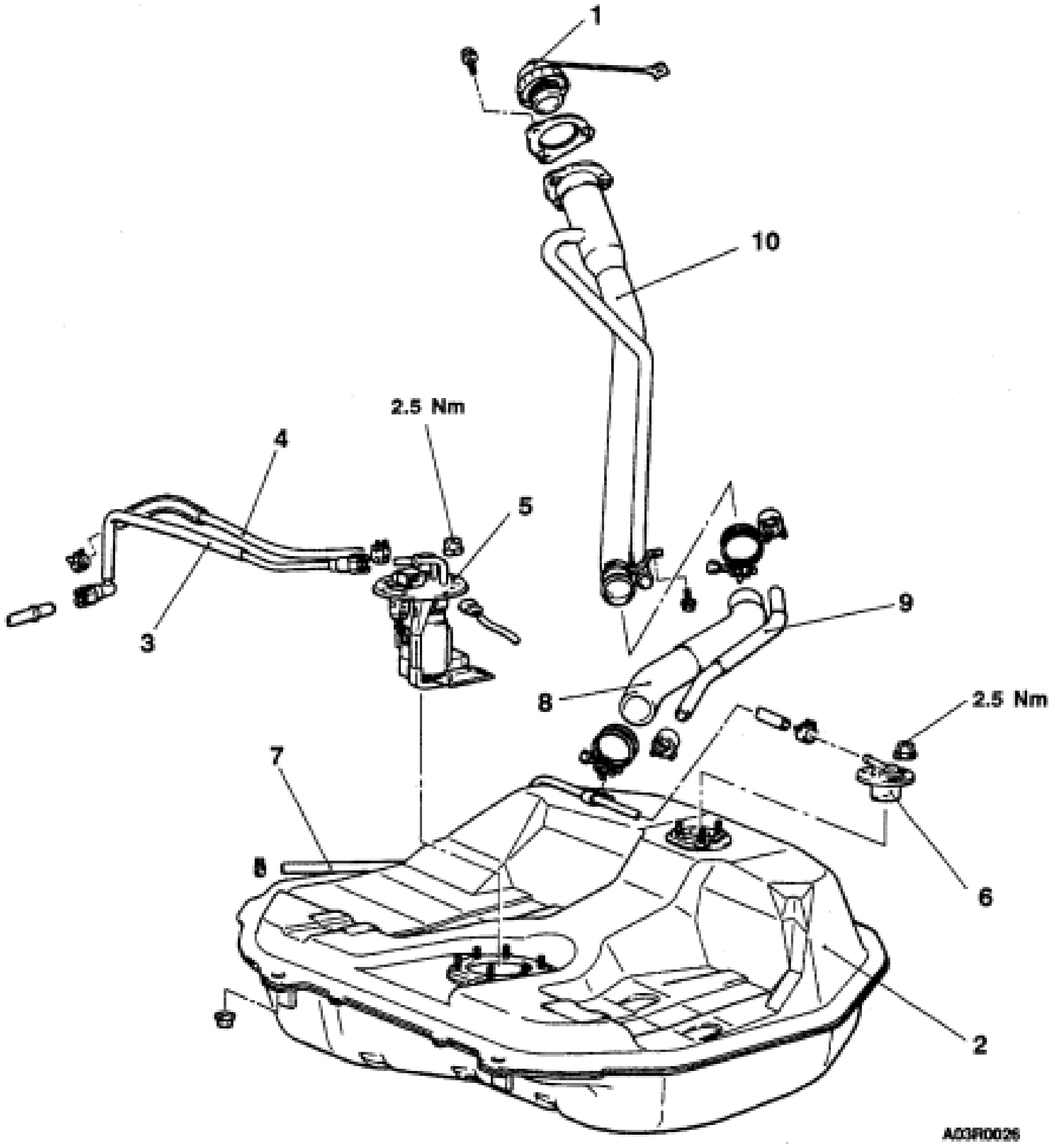
CONTENTS

FUEL TANK

REMOVAL AND INSTALLATION

Pre-removal Operation
- Draining Fuel
- Reduce the Inner Pressure of Fuel Line and Hose (Refer to GROUP 13A – On-vehicle Service.)

Post-installation Operation
- Refilling Fuel.
- Checking for Fuel Leaks

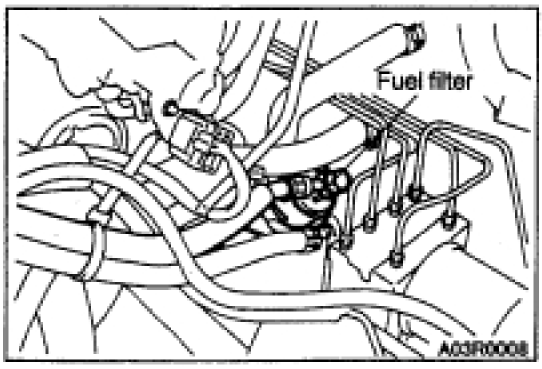


Removal steps

1. Fuel filler cap
2. Fuel tank

▶A◀ 3. High-pressure tube

4. Return hose
5. Fuel gauge unit and pump assembly
6. Valve assembly
7. Vapour hose
8. Filler hose
9. Leveling hose
10. Fuel filler neck assembly

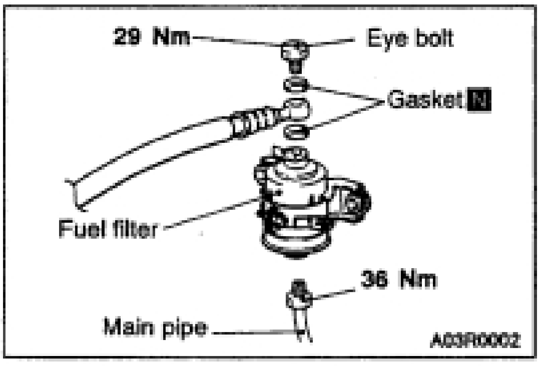


INSPECTION

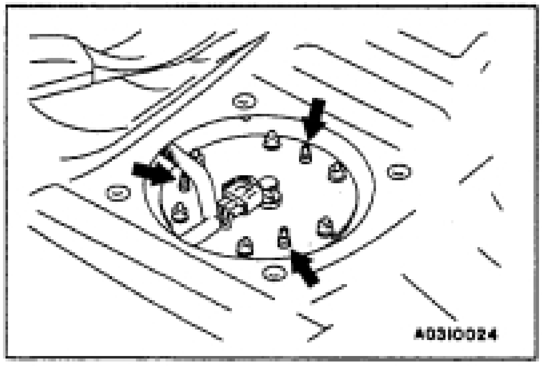
FUEL FILTER REPLACEMENT

1. Bleed the residual pressure from inside the fuel line. (Refer to GROUP 13A – On-vehicle Service.)
2. Remove the air intake hose and battery.
3. Hold the fuel filter with a spanner and remove the eye bolt. Then remove the high-pressure tube.

   Caution
   As there will be some pressure remaining in the fuel pipe line, cover it with a rag to prevent fuel from spraying out.



4. Hold the fuel filter with a spanner and loosen the flare nut. Then disconnect the main pipe connection.
5. Remove the fuel filter.
6. When installing the fuel filter, use a new gasket, and tighten the flare nut of the high-pressure tube and the main pipe to the specified torque.
7. After installation, check that there are no fuel leaks.
   (1) Apply battery voltage to the fuel pump drive terminal to operate the fuel pump. (Refer to GROUP 13A – On-vehicle Service.)
   (2) Check for leaks when fuel pressure is applied.



FUEL GAUGE UNIT AND PUMP ASSEMBLY REPLACEMENT

1. Remove the rear seat cushion. (Refer to GROUP 52A.)
2. Remove the protector.
3. Disconnect the connector from the fuel gauge unit and pump assembly and remove the high-pressure tube and return hose.
4. Remove the mounting nut, and then remove the fuel gauge unit and pump assembly.
5. When the fuel gauge unit and pump assembly is installed, insert it into the fuel tank while tilting the float toward the left.

   NOTE
   The fuel tank includes a reservoir cup. If the fuel gauge and pump assembly is inserted with the float tilted toward the right, the fuel gauge unit and pump assembly will contact the reservoir cup.

6. Install the new fuel gauge unit and pump assembly, align the projections on the packing (indicated by arrows in the illustration) with the holes in the fuel gauge unit and pump assembly.

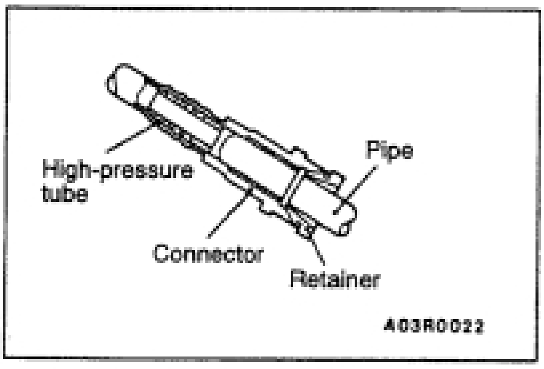
7. Tighten the mounting nut to the specified torque.

   Tightening torque: 2.5 Nm

8. Connect the connector and install the high-pressure tube and return hose.
9. Install the protector.
10. Install the rear seat cushion. (Refer to GROUP 52A.)

FUEL GAUGE UNIT CHECK

Refer to GROUP 54 – Combination Meter.



INSTALLATION SERVICE POINT

▶A◀ HIGH-PRESSURE TUBE INSTALLATION

1. Insert the high-pressure tube connector to the pipe until the retainer goes over the pipe spool.
2. After inserting, pull the high-pressure tube slightly in the direction A shown in the figure to confirm that the connector is engaged firmly.

ACCELERATOR CABLE AND PEDAL

SERVICE SPECIFICATIONS

Items	Standard value
Accelerator cable play mm	1–2
Engine idle speed r/min (N or P for A/T)	700±50

ON-VEHICLE SERVICE

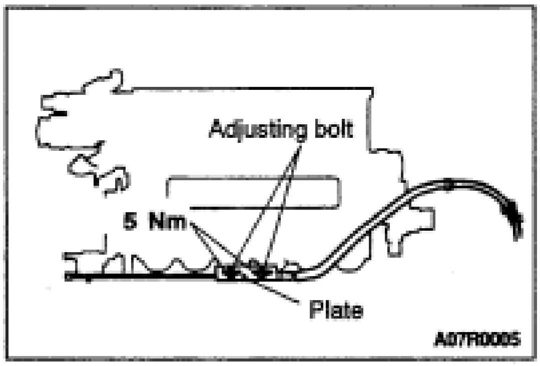
ACCELERATOR CABLE CHECK AND ADJUSTMENT

1. Turn A/C and lamps OFF.
   Inspect and adjust no at idle.
2. Warm engine until it is stabilized at idle.
3. Confirm that idle speed is at the standard value.

   Standard value: 700±50 r/min

4. Stop engine (ignition switch OFF).
5. Confirm there are no sharp bends in accelerator cable.
6. Check inner cable for correct play.

   Standard value: 1–2 mm

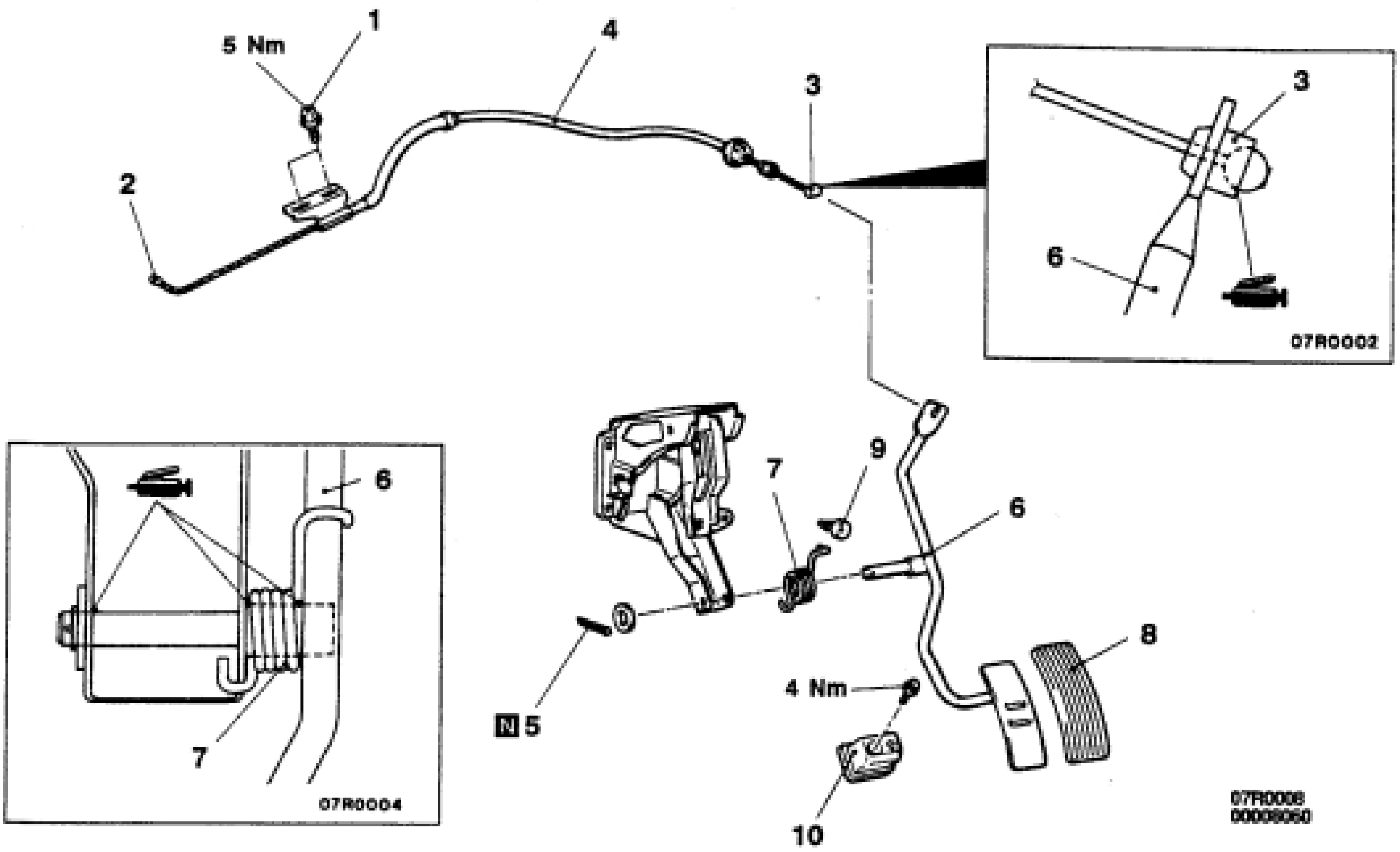


7. If there is too much play or no play, adjust play by the following procedures.
   (1) Loosen the adjusting bolt to release the cable.
   (2) Move the plate until the inner cable play is at the standard value, and then tighten the adjusting bolt to the specifide torque.

ACCELERATOR CABLE AND PEDAL

REMOVAL AND INSTALLATION

Post-installation Operation
Adjusting the Accelerator Cable (Refer to P.13B-5.)



Removal steps

1. Adjusting bolt
2. Inner cable connection (throttle body side)
3. Inner cable connection (accelerator pedal side)
4. Accelerator cable
5. Split pin
6. Accelerator pedal
7. Return spring
8. Pedal pad
9. Stopper
10. Accelerator pedal stopper

TRACTION CONTROL SYSTEM (TCL)

CONTENTS

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.

(4) If the component marked by an asterisk (*) is removed and installed, be careful not to bump it against the SRS system components.

TROUBLESHOOTING

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING

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

NOTE
Before carrying out trouble diagnosis, check to be sure that all of the following items are normal.

- Is the standard steering wheel being used, and has it been correctly installed to the straight-ahead position on the steering shaft?
- Are the size, specifications, air pressure, balance and wear conditions of the tyres and wheels normal?
- Is the wheel alignment normal?
- Have any other modifications been made to the engine or suspension which could conceivably have an effect on the TCL system?

DIAGNOSTIC FUNCTION

METHOD OF READING THE DIAGNOSIS CODES

Use the MUT-II or the voltmeter to read the diagnosis codes.
(Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.)

METHOD OF ERASING THE 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	APS circuit system	13C-4
12	APS or TPS circuit system	13C-5
13	TPS circuit system	13C-6
23	Stop lamp switch circuit system	13C-6
24	TCL switch circuit system	13C-7
26	Ignition switch (IG2) circuit system	13C-7
27	TCL-ECU power supply voltage circuit (engine control relay circuit) system	13C-8
31	Front right wheel speed sensor circuit system	13C-8
32	Front left wheel speed sensor circuit system	13C-8
33	Rear right wheel speed sensor circuit system	13C-9
34	Rear left wheel speed sensor circuit system	13C-9
35	Rear wheel speed sensor circuit system (1)	13C-9
36	Rear wheel speed sensor circuit system (2)	13C-9
41	Steering wheel sensor (ST-1) circuit system (open circuit)	13C-10
42	Steering wheel sensor (ST-2) circuit system (open circuit)	13C-10
43	Steering wheel sensor (ST-N) circuit system (open circuit)	13C-10
44	Steering wheel sensor circuit system (short circuit)	13C-11
45	Steering wheel sensor (ST-N) circuit system (short circuit)	13C-11
71	Engine-ECU communication circuit system	13C-12
72	Engine-ECU circuit system	GROUP 13A – Troubleshooting
73		
74	A/T-ECU communication circuit system	13C-12
76	ABS circuit system	13C-13

INSPECTION PROCEDURES FOR DIAGNOSIS CODES

Code No. 11 APS circuit system	Probable cause
This diagnosis code is output if the APS output voltage is less than 0.2 V due to an open circuit or other malfunction in the APS circuit. The APS power supply and earth are supplied from the engine-ECU, and the output signal is used by the A/T-ECU and auto-cruise control-ECU as well as by the TCL-ECU.	• Malfunction of APS • Malfunction of TCL-ECU • Malfunction of harness or connector

MUT-II Data list
11 APS output Open and close the throttle lever.
OK: Changes smoothly between 400 mV – 5,000 mV

- OK → **Check the following connectors:** B-71, A-08
  - NG → **Repair**
  - OK → Check trouble symptom.
    - NG → Replace the TCL-ECU.
- NG → Measure the voltage at APS connector A-08.
  - Ignition switch: ON
  - Disconnect the APS connector and measure at harness side.
  - Measure at the harness side.
  - Between terminal (1) and body earth

  OK: 4.8–5.2 V

  - NG → **Check the following connectors:** A-08, B-35
    - NG → **Repair**
    - OK → Check trouble symptom.
      - NG → Check the harness between the APS and the engine-ECU, and repair if necessary.
        - NG → **Repair**
        - OK → Replace the TCL-ECU.
  - OK → Measure the resistance at APS connector A-08.
    - Disconnect the APS connector.
    - Measure the resistance at the sensor side.
    - Between terminals (2) and (4), and terminals (1) and (2)
    - Move the accelerator lever.

      OK: Changes smoothly from 0 Ω to 5 kΩ.

    - NG → **Replace the APS.**
    - OK → Measure the voltage at TCL-ECU connector B-71.
      - Ignition switch: ON
      - Disconnect the TCL-ECU connector and measure at the harness side.
      - Between terminal (38) and body earth

      OK: 0.2 V or more

      - NG → **Check the following connectors:** B-71, A-08
        - NG → **Repair**
        - OK → Check trouble symptom.
          - NG → Check the harness between the APS and the TCL-ECU, and repair if necessary.
      - OK → **Check the following connectors:** B-71, A-08
        - NG → **Repair**
        - OK → Check trouble symptom.
          - NG → Replace the TCL-ECU.

Code No. 12 APS or TPS circuit system	Probable cause
This diagnosis code is output if the APS opening angle is 20° or greater than the TPS opening angle because of a short in the APS, an open circuit in the TPS or sticking of the vacuum actuator. As this detection condition can be applicable during throttle control, trouble diagnosis is invalid at this time.	• Malfunciton of APS • Malfunction of TPS • Malfunction of TCL-ECU • Malfunction of engine-ECU • Malfunction of harness or connector • Malfunction of vacuum actuator

MUT-II Data list
13 TPS output
Open and close the throttle lever.
OK: Changes smoothly between 400 mV – 5,000 mV

OK → Measure the resistance at APS connector A-08.
- Disconnect the APS connector.
- Measure the resistance at the sensor side.
- Between terminals (2) and (4), and terminals (1) and (2)
- Move the accelerator lever.
  OK: Changes smoothly from 0 Ω to 5 kΩ.

NG → **Replace the APS.**

OK → **Check the following connectors:** A-08, B-71

NG → **Repair**

OK → Check trouble symptom.

NG → Check the harness between the APS and the TCL-ECU, and repair if necessary.

NG → **Repair**

OK → Replace the TCL-ECU

NG (MUT-II Data list) → Vacuum actuator operation inspection (Refer to GROUP 13A – On-vehicle Service.)

NG → **Replace**

OK → Measure the voltage at TPS connector A-07.
- Ignition switch: ON
- Disconnect the TPS connector and measure at the harness side.
- Between terminal (4) and body earth

OK: 4.8 – 5.2 V

NG → **Check the following connectors:** A-07, B-35

NG → **Repair**

OK → Check trouble symptom.

NG → Check the harness between the TPS and the engine-ECU, and repair if necessary.

NG → **Repair**

OK → Replace the engine-ECU.

OK → Measure the resistance at TPS connector A-07.
- Disconnect the TPS connector.
- Measure the resistance at the sensor side.
- Between terminals (1) and (3), and terminals (3) and (4)
- Move the accelerator lever.
  OK: Changes smoothly from 0 Ω to 5 kΩ.

NG → **Replace the TPS.**

OK → Measure the voltage at engine-ECU connector B-35.
- Ignition switch: ON
- Connect the engine-ECU connector and measure at the harness side.
- Between terminal (84) and body earth

Move the accelerator lever
OK Changes smoothly from 0 V to 5 V.

NG → **Check the following connectors:** A-07, B-35

NG → **Repair**

OK → Check trouble symptom.

NG → Check the harness between the TPS and the engine-ECU, and repair if necessary.

OK → Replace the engine-ECU.

Code No.13 TPS circuit system	Probable cause
This diagnosis code is output if the TPS opening angle is 20° or greater than the APS opening angle because of a short in the TPS or an open circuit in the APS. If there is an open circuit in the APS, diagnosis code No. 11 is output at the same time. Accordingly, if only diagnosis code No. 13 is output, the cause is probably an abnormality in the TPS circuit system.	• Malfunction of APS • Malfunction of TPS • Malfunction of harness or connector • Malfunction of engine-ECU

MUT-II Self-Diag code
Is TCL diagnosis code No. 11 output?

Yes → Code No. 11 APS circuit system (Refer to P.13C-4.)

No ↓

Measure the resistance at TPS connector A-07.
- Disconnect the TPS connector and measure at the sensor side.
- Between terminals (1) and (3), (3) and (4)
- Move the accelerator lever.

OK Changes smoothly from 0 Ω to 5 kΩ.

NG ↓ Replace the TPS.

OK → **Check the following connectors:**
A-07, B-35

NG → **Repair**

OK ↓ Check trouble symptom.

NG ↓ Check the harness between the TPS and the engine-ECU, and repair if necessary.

Code No. 23 Stop lamp switch circuit system	Probable cause
This diagnosis code is output if the stop lamp switch remains ON for a continuous period of 15 minutes or more, or for a continuous period of 1 minute or more when driving at a speed of 10 km/h or more, because of a short circuit or defective adjustment of the stop lamp switch. This diagnosis code No. may also occur while driving in traffic jams or if the foot is resting on the brake pedal with driving.	• Malfunction of stop lamp switch • Malfunction of harness or connector • Malfunction of TCL-ECU

Measure the continuity at the stop lamp switch connector B-22.
- Disconnect the connector and measure at the switch side.
- Between terminals (1) – (2)

OK: Continuity when the brake pedal is depressed
No continuity when the brake pedal is released

OK → **Check the following connectors:**
B-22, B-14, B-37, B-70

NG → **Repair**

OK ↓ Check trouble symptom.

NG ↓ Inspect the harness between stop lamp switch and the TCL-ECU.

NG → **Repair**

OK ↓ Replace the TCL-ECU.

NG ↓ Stop lamp switch installation check (Refer to GROUP 35A – On-vehicle Service.)

OK → Replace the stop lamp switch.

NG ↓ Stop lamp switch adjustment (Refer to GROUP 35A – On-vehicle Service.)

Code No. 24 TCL switch circuit system	Probable cause
This diagnosis code is output if signals are input simultaneously from both the TCL-OFF and TCL-ON positions because of a short circuit in the TCL switch circuit.	• Malfunction of the TCL switch • Malfunction of harness or connector • Malfunction of TCL-ECU

Measure the continuity at TCL switch connector C-10.
- Disconnect the connector and measure at the switch side.
- Between terminals (2) – (3) and (3) – (6)

OK: No continuity

NG → Replace the TCL switch.

OK ↓

Check the following connectors:
C-10, B-77, B-70

NG → **Repair**

OK ↓

Check trouble symptom.

NG ↓

Check the harness between the TCL switch and the TCL-ECU.

NG → **Repair**

OK ↓

Replace the TCL-ECU.

Code No. 26 Ignition switch (IG2) circuit system	Probable cause
This diagnosis code is output if the IG2 power supply is not distributed, even though the engine speed is 450 r/min or more.	• Malfunction of harness or connector • Malfunction of TCL-ECU

Measure the voltage at TCL-ECU connector B-70.
- Ignition switch : ON
- Disconnect the TCL-ECU connector and measure at the harness side.
- Between terminal (5) and body earth

  OK: System voltage

OK → **Check the following connector:**
B-70

NG → **Repair**

OK ↓

Check trouble symptom.

NG ↓

Replace the TCL-ECU.

NG ↓

Check the following connectors:
B-44, B-43, B-37, B-70

NG → **Repair**

OK ↓

Check trouble symptom.

NG ↓

Check the harness between the ignition switch and the TCL-ECU, and repair if necessary.

Code No. 27 TCL-ECU power supply voltage circuit (engine control relay circuit) system	Probable cause
This diagnosis code is output if the TCL-ECU power supply voltage (engine control relay supply voltage) is lower than the specified value. If the voltage returns to the specified value or greater, the diagnosis code is erased.	• Malfunction of control relay • Malfunction of harness or connector • Malfunction of TCL-ECU

Measure the voltage at TCL-ECU connector B-71
- Engine: idling
- Disconnect the TCL-ECU connector and measure at the harness side.
- Between terminal (45) and body earth

OK: 10 V or more

OK → **Check the following connector:** B-71
- OK → Check trouble symptom.
  - NG → Replace the TCL-ECU.

NG → **Check the following connectors:** B-72, B-71
- NG → **Repair**
- OK → Check trouble symptom.
  - NG → Check the harness between the control relay and the TCL-ECU.
    - NG → **Repair**
    - OK → Engine control relay inspection (Refer to GROUP 13A – On-vehicle Service.)

Code No. 31 Front right wheel speed sensor circuit system Code No. 32 Front left wheel speed sensor circuit system	Probable cause
These diagnosis codes are output if a pulse (from the front wheels) indicates that the difference between the front wheels and the rear wheels is 8km/h or more because of an open or short circuit in a wheel speed sensor or a malfunction of sensor.	• Malfunction of front wheel speed sensor • Malfunction of harness or connector • Malfunction of TCL-ECU • Malfunction of ABS-ECU

NOTE
When these diagnosis codes are output, erase the diagnosis code memory after carrying out repairs, and then carry out a road test at 20 km/h or more and check to be sure that the diagnosis codes are not output again.

Is the ABS warning lamp illuminated, or is an ABS diagnosis code output?
- Yes → Carry out ABS troubleshooting (Refer to GROUP 35B – Trouble-shooting.)
- No → Measure at TCL-ECU connectors B-70, B-71.
  - Measure at the ECU side with the connector disconnected.
  - Voltage between terminal (40) and body earth
  - Voltage between terminal (41) and body earth

  OK: 4.8 – 5.2 V
  - NG → Replace the TCL-ECU.
  - OK → **Check the following connectors:** B-70, B-71, B-52, B-53
    - NG → **Repair**
    - OK → Check trouble symptom.
      - NG → Check the harness connectors between the ABS-ECU and the TCL-ECU, and repair if necessary.

Code No. 33 Rear right wheel speed sensor circuit system Code No. 34 Rear left wheel speed sensor circuit system	Probable cause
These diagnosis codes are output if a pulse (from the wheels on one side of rear) indicates that the difference between the left wheel and the right wheel is 8km/h or more because of an open or short circuit in a wheel speed sensor or a defective sensor.	• Malfunction of rear wheel speed sensor • Malfunction of harness or connector • Malfunction of TCL-ECU • Malfunction of ABS-ECU

NOTE
When these diagnosis codes are output, erase the diagnosis code memory after carrying out repairs, and then carry out a road test at 20 km/h or more and check to be sure that the diagnosis codes are not output again.

Is the ABS warning lamp illuminated, or is an ABS diagnosis code output?
- Yes → Carry out ABS troubleshooting (Refer to GROUP 35B – Troubleshooting.)
- No ↓

Measure at TCL-ECU connector B-70, B-71.
- Measure at the ECU side with the connector disconnected.
- Voltage between terminal (42) and body earth
- Voltage between terminal (43) and body earth

OK: 4.8–5.2 V
- NG → Replace the TCL-ECU.
- OK ↓

Check the following connectors:
B-70, B-71, B-52, B-53
- NG → **Repair**
- OK ↓

Check trouble symptom.
- NG → Check the harness connectors between the ABS-ECU and the TCL-ECU, and repair if necessary.

Code No. 35 Rear wheel speed sensor circuit system (1) Code No. 36 Rear wheel speed sensor circuit system (2)	Probable cause
Diagnosis code No. 35 is output if the pulse signal from a rear wheel sensor is momentarily interrupted (0.02 sec.) because of a transient open circuit in a rear wheel speed sensor. Diagnosis code No. 36 is output if a rear wheel speed sensor abnormality is judged when the turning speed of both rear wheels is 0 km/h for 20 seconds or more while TCL is operating.	• Malfunction of rear wheel speed sensor • Malfunction of harness or connector • Malfunction of ABS-ECU • Malfunction of TCL-ECU

NOTE
(1) If the front wheels only are turning while the rear wheels are stationary (wheel slip), the TCL-OFF indicator will start flashing after 20 seconds, and the system will be isolated.
(2) When these diagnosis codes are output, erase the diagnosis code memory after carrying out repairs, and then carry out a road test at 20 km/h or more and check to be sure that the diagnosis codes are not output again.

Is a diagnosis code output from the ABS-ECU?
- Yes → Carry out ABS troubleshooting (Refer to GROUP 35B – Troubleshooting.)
- No ↓

MUT-II Data list
33, 34 Wheel speed sensor
Accelerate from a stationary position.
OK: Vehicle speeds displayed on the speedometer and MUT-II are identical.
- OK → Replace the TCL-ECU.
- NG ↓

Check the following connectors:
B-70, B-71, B-52, B-53
- NG → **Repair**
- OK ↓

Check trouble symptom.
- NG → Check the harness connectors between the ABS-ECU and the TCL-ECU, and repair if necessary.

Code No. 41 Steering wheel sensor (ST-1) circuit system (open circuit) Code No. 42 Steering wheel sensor (ST-2) circuit system (open circuit) Code No. 43 Steering wheel sensor (ST-N) circuit system (open circuit)	Probable cause
These diagnosis codes are output if there is an open circuit in the output wire of the steering wheel sensor circuit.	• Malfunction of harness or connector • Malfunction of steering wheel sensor • Malfunction of TCL-ECU

Measure at TCL-ECU connectors B-70, B-71.
- Connector connected
- Voltage between terminals (2), (10) and (11) and the body earth
  OK: Changes between approx. 3 V and approx. 0.5 V when the steering wheel is turned

OK / NG: Stays at 0V without changing → **Check the following connectors:** B-70, B-71
- NG → **Repair**
- OK → Check trouble symptom.
  - NG → Replace the TCL-ECU.

NG: Stays at 4 V or more without changing → Measure at steering wheel sensor connector B-58.
- Disconnect the connector and measure at the harness side.
- Continuity between terminal (3) and body earth
  OK: Continuity

NG → **Check the following connectors:** B-58, B-14
- NG → **Repair**
- OK → Check trouble symptom.
  - NG → Check the harness between the steering wheel sensor and the body earth, and repair if necessary.

OK → **Check the following connectors:** B-58, B-37
- NG → **Repair**
- OK → Check trouble symptom.
  - NG → Inspect the harness between the steering wheel sensor and the TCL-ECU.
    - NG → **Repair**
    - OK → Replace the steering wheel sensor.

NG: Changes between 4 V or more and approx. 0.5 V → Replace the steering wheel sensor.

Code No. 44 Steering wheel sensor circuit system (short circuit)	Probable cause
This diagnosis code is output when no steering angle signal is output because there is a short-circuit in either steering wheel sensor ST-1 or steering wheel sensor ST-2 when the speed averages output by the left and right rear wheel speed sensors are 10 km/h or more.	• Malfunction of harness or connector • Malfunction of steering wheel sensor • Malfunction of TCL-ECU

Measure at TCL-ECU connectors B-70, B-71.
- Connector connected
- Voltage between terminals (2) and (10) and the body earth
  OK: Changes between approx. 3 V and approx. 0.5 V when the steering wheel is turned

OK → **Check the following connectors:** B-70, B-71
- NG → **Repair**
- OK → Check trouble symptom.
  - NG → Replace the TCL-ECU.

NG → Check the harness between the steering wheel sensor and the TCL-ECU.
- NG → **Repair**
- OK → Measure at steering wheel sensor connector B-58.
  - Disconnect the connector and measure at the harness side.
  - Voltage between terminal (2) and body earth
    OK: System voltage

NG → **Check the following connectors:** B-58, B-45
- NG → **Repair**
- OK → Check trouble symptom.
  - NG → Check the harness between the steering wheel sensor and the ignition switch, and repair if necessary.

OK → **Check the following connector:** B-58
- NG → **Repair**
- OK → Replace the steering wheel sensor.

Code No. 45 Steering wheel sensor (ST-N) circuit system (short circuit)	Probable cause
This diagnosis code is output if it is considered that there is an abnormality in the steering wheel sensor (ST-N) circuit system when the straight-ahead position is continuously detected even though the steering wheel is turned 20° or more.	• Malfunction of steering wheel sensor • Malfunction of harness or connector • Malfunction of TCL-ECU

Measure at TCL-ECU connector B-70.
- Ignition switch: ON
- Connector connected
- Voltage between terminals (11) and the body earth
  OK: Changes between approx. 3V and approx. 0.5 V when the steering wheel is turned

OK → **Check the following connector:** B-70
- NG → **Repair**
- OK → Check trouble symptom.
  - NG → Replace the TCL-ECU.

NG → Check the harness between the steering wheel sensor and the TCL-ECU.
- NG → **Repair**
- OK → **Check the following connector:** B-58
  - NG → **Repair**
  - OK → Replace the steering wheel sensor.

Code No. 71 Engine-ECU communication circuit system	Probable cause
This diagnosis code is output if an error is detected in the communication contents because of an open or short circuit in the serial communication circuit between the TCL-ECU and the engine-ECU, a malfunction of ECU and a defective shielding of the shield wire.	• Malfunction of harness or connector • Malfunction of TCL-ECU • Malfunction of engine-ECU

Check the following connectors:
B-71, B-34
- NG → **Repair**
- OK ↓

Check trouble symptom.
- NG ↓

Check the harness between the TCL-ECU and the engine-ECU.
- NG → **Repair**
- OK ↓

Replace the TCL-ECU.
↓

Check trouble symptom.
- NG → Replace the engine-ECU.

Code No. 74 A/T-ECU communication circuit system	Probable cause
This diagnosis code is output if an error is detected in the communication contents because of an open or short circuit in the serial communication circuit between the TCL-ECU and the A/T-ECU, a malfunction of ECU and a defective shielding of the shield wire.	• Malfunction of harness or connector • Malfunction of TCL-ECU • Malfunction of A/T-ECU

Check the following connectors:
B-70, B-29
- NG → **Repair**
- OK ↓

Check trouble symptom.
- NG ↓

Check the harness between the TCL-ECU and the A/T-ECU.
- NG → **Repair**
- OK ↓

Replace the TCL-ECU.
↓

Check trouble symptom.
- NG → Replace the A/T-ECU.

Code No. 76 ABS circuit system	Probable cause
This diagnosis code is output if the ABS-ECU detects the system abnormality (when ABS warning lamp illumination is controlled).	• Malfunction of harness or connector • Malfunction of TCL-ECU • Malfunction of ABS-ECU

Is the ABS warning lamp illuminated, or is an ABS diagnosis code output? — Yes → Carry out ABS troubleshooting. (Refer to GROUP 35B – Troubleshooting.)

↓ No

Check the following connectors: B-71, B-53 — NG → Repair

↓ OK

Check trouble symptom.

↓ NG

Check the harness between the ABS-ECU and the TCL-ECU. — NG → Repair

↓ OK

Replace the TCL-ECU.

↓

Check trouble symptom. — NG → Replace the ABS-ECU.

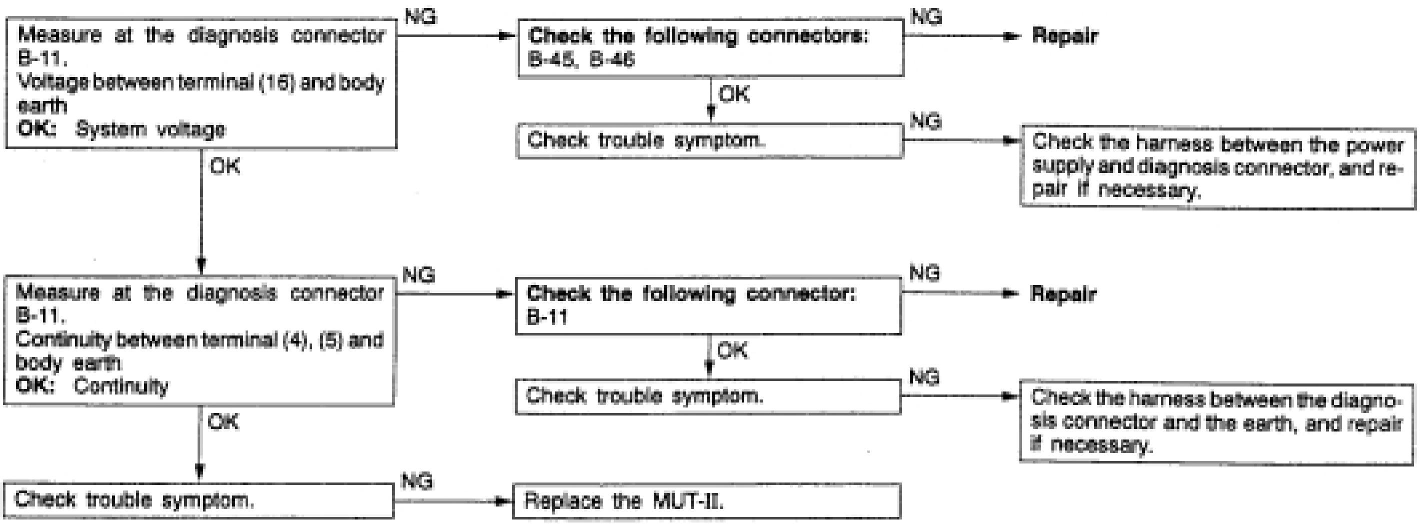
INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.	Reference page
Communication with the MUT-II is not possible.	Communication with all systems is not possible.	1	13C-14
	Communication with TCL-ECU only is not possible.	2	13C-15
Malfunction of TCL indicator lamp display	None of the TCL indicator lamps (TCL OFF, TCL) illuminate when the ignition switch is ON.	3	13C-16
	One of the TCL indicator lamps does not illuminate when the ignition switch is ON (Another lamp does illuminate).	4	13C-16
	TCL OFF indicator lamp remains illuminated even after the engine is started.	5	13C-17
	TCL OFF indicator lamp flashes after the engine is started.		
	TCL remains illuminated even after the engine is started.	6	13C-17
	TCL OFF indicator lamp does not illuminate even if the TCL switch is continuously pressed to the OFF side while the engine is idling.	7	13C-18
Malfunction of TCL operation	TCL illuminates in the TCL operation range, but torque is not reduced.	8	13C-18
Poor starting Poor acceleration	Engine output is reduced in the TCL non-operation range (TCL indicator lamp does not illuminate) and starting and acceleration performance is poor.		

INSPECTION PROCEDURES FOR TROUBLE SYMPTOMS

Inspection Procedure 1

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



Inspection Procedure 2

Communication with the MUT-II is not possible. (Communication with TCL-ECU only is not possible.)	Probable cause
If the MUT-II cannot communicate with the TCL-ECU only, the cause is probably an abnormality in the TCL diagnosis line or in the TCL-ECU power supply line.	• Malfunction of harness or connector • Malfunction of engine control relay • Malfunction of TCL-ECU

Measure at diagnosis connector B-11 and TCL-ECU connector B-71.
- Disconnect the connector and measure at the harness side.
- Continuity between the following terminals
  OK: Continuity
  TCL-ECU side 21 – Diagnosis connector side 1
  TCL-ECU side 34 – Diagnosis connector side 7

NG → **Check the following connectors:** B-11, B-37, B-71
- NG → **Repair**
- OK → Check trouble symptoms.
  - NG → Check the harness between the TCL-ECU and diagnosis connector, and repair if necessary.

OK ↓

Measure at TCL-ECU connector B-71.
- Disconnect the connector and measure at the harness side.
- Engine: idling
- Voltage between (45) and body earth
  OK: 10 V or more

NG → **Check the following connectors:** B-72, B-71
- NG → **Repair**
- OK → Check trouble symptoms.
  - NG → Check the harness between the engine control relay and TCL-ECU.
    - OK → Check the engine control relay. (Refer to GROUP 13A – On-vehicle Service.)
    - NG → **Repair**

OK ↓

Measure at TCL-ECU connectors B-70, B-71.
- Disconnect the connector and measure at the harness side.
- Continuity between (1), (33), (46) and body earth
  OK: Continuity

NG → Check the harness between the TCL-ECU and the earth, and repair if necessary.

OK ↓

Check the following connectors: B-70, B-71

NG → **Repair**

OK ↓

Check trouble symptoms.

NG → Replace the TCL-ECU.

Inspection Procedure 3

None of the TCL indicator lamps (TCL OFF, TCL) illuminate when the ignition switch is ON.	Probable cause
The main cause is an open circuit in the indicator circuit because of a burnt-out indicator lamp bulb.	• Malfunction of harness or connector • Malfunction of TCL-ECU • Malfunction of indicator lamp bulb

- Do other warning lamps illuminate when the ignition switch is at ON position?
  - No → **Check the following connectors:** B-77, C-06, C-04, B-45, B-44
    - NG → **Repair**
    - OK → Check trouble symptom.
      - NG → Check the harness between the combination meter and the junction block, and repair if necessary.
  - Yes → **Check the following connector:** B-77
    - NG → **Repair**
    - OK → Check trouble symptom.
      - NG → Check the harness between the combination meter and the TCL-ECU.
        - NG → **Repair**
        - OK → Check if a TCL indicator lamp bulb is burnt out.
          - NG → Replace the lamp bulb.
          - OK → Replace the TCL-ECU.

Inspection Procedure 4

One of the TCL indicator lamps does not illuminate when the ignition switch is ON.	Probable cause
Because the TCL indicators utilise shared power supply circuits, if one of the indicator lamps is illuminated, the power supply circuit can be judged to be normal.	• Open circuit in indicator lamp power supply circuit. • Burnt-out indicator lamp bulb

- Is the bulb of the non-illuminated indicator lamp normal?
  - No → Replace the lamp bulb.
  - Yes → Measure at the TCL-ECU connector B-70.
    - • Disconnect the connector and measure at the harness side.
    - 1. Voltage between terminal (15) and body earth
    - 2. Voltage between terminal (16) and body earth
    - **OK:** System voltage
    - OK → Replace the TCL-ECU.
    - 1. NG → **Check the following connector:** B-70
      - NG → **Repair**
      - OK → Check the harness wire between the engine control relay and the TCL-ECU, and repair if necessary.
    - 2. NG → **Check the following connectors:** B-70, B-77, C-06
      - NG → **Repair**
      - OK → Check trouble symptom
        - NG → Check the harness between the combination meter and the TCL-ECU, and repair if necessary.

Inspection Procedure 5

• TCL OFF indicator lamp remains illuminated even after the engine is started. • TCL OFF indicator lamp flashes after the engine is started.	Probable cause
The TCL-OFF indicator is also used as a system warning indicator. If there is a system abnormality, this indicator will illuminate or flash.	• Malfunction of other system related to the TCL • Malfunction of harness or connector

Is the diagnosis code normal? (Is communication with the MUT-II possible?)
- No → To trouble symptom inspection procedure 1 (Refer to P.13C-14.)
- Yes ↓

Does the TCL OFF indicator lamp switch off when TCL-ECU connector B-70 is disconnected?
- Yes → Replace the TCL-ECU.
- No ↓

Check the following connectors: C-06, B-77, B-70
- OK → Check trouble symptom. → NG → Check the harness between the combination meter and the TCL-ECU, and repair if necessary.
- NG ↓ **Repair**

Inspection Procedure 6

TCL indicator lamp remains illuminated even after the engine is started.	Probable cause
The TCL indicator lamp only illuminates while the engine is running if the TCL is operating.	• Malfunction of TCL indicator power supply circuit • Malfunction of TCL-ECU • Malfunction of harness or connector

Does the TCL indicator remain illuminated when TCL-ECU connector B-70 is disconnected and the ignition switch is turned to ON?
- No → Replace the TCL-ECU.
- Yes ↓

Check the following connectors: C-06, B-77, B-70
- OK → Check trouble symptom. → NG → Check the harness between the combination meter and the TCL-ECU, and repair if necessary.
- NG ↓ **Repair**

Inspection Procedure 7

TCL OFF indicator lamp does not illuminate even if the TCL switch is continuously pressed to the OFF side while the engine is idling.	**Probable cause**
If the indicator lamp does not illuminate when the switch is operated, there is a malfunction in the switch, switch circuit or in the TCL-ECU.	• Malfunction of harness or connector • Malfunction of TCL switch • Malfunction of TCL-ECU

MUT-II Data list
- 25 TCL OFF switch
- Press the TCL switch continuously to the OFF side while the engine is idling.
  OK: ON is displayed

OK → Replace the TCL-ECU.

NG ↓

Check the following connectors:
B-70, B-77, C-10, B-19, B-14

NG → **Repair**

OK ↓

Check trouble symptom

NG → Check the harnesses between the TCL-ECU and the TCL switch, and between the TCL switch and the body earth.

NG → **Repair**

OK ↓

TCL switch component inspection (Refer to P.13C-25.)

Inspection Procedure 8

• **TCL illuminates in the TCL operation range, but torque is not reduced.** • **Engine output is reduced in the TCL non-operation range (TCL indicator lamp does not illuminate) and starting and acceleration performance is poor.**	**Probable cause**
In cases such as the above, the electrical system is normal, and the cause is probably an abnormality in the mechanical system (vacuum actuator).	• Malfunction of vacuum solenoid valve • Malfunction of ventilation solenoid valve • Malfunction of vacuum actuator • Incorrect vacuum hose connector • Malfunction of throttle link • Malfunction of vacuum tank • Blocked air cleaner element

As the cause is probably a malfunction of the vacuum actuator system, carry out inspection of the following items in order.

- Vacuum solenoid valve operation inspection (Refer to GROUP 13A – On-vehicle Service.)
- Ventilation solenoid valve operation inspection (Refer to GROUP 13A – On-vehicle Service.)
- Disconnected or mis-connected vacuum hose inspection (Refer to GROUP 13A – On-vehicle Service.)
- Throttle link operation inspection (Refer to GROUP 13A – On-vehicle Service.)
- Vacuum tank inspection (Refer to GROUP 13A – On-vehicle Service.)
- Air cleaner element blockage inspection

DATA LIST REFERENCE TABLE

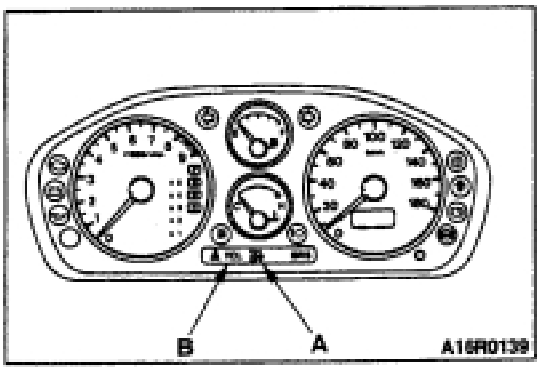
No.	Check item	Check condition		Normal condition
11	APS	Accelerator pedal position Engine stop Selector lever position: P	Fully closed	400–1,000 mV
			Depressed	Gradually rises from the above value
			Fully open	4,500–5,000 mV
13	TPS	Accelerator pedal position Engine stop Selector lever position: P	Fully closed	400–1,000 mV
			Depressed	Gradually rises from the above value
			Fully open	4,500–5,000 mV
15	Inhibitor switch	Ignition switch: ON Engine stop	Selector lever: P position	P
			Selector lever: R position	R
			Selector lever: N position	N
			Selector lever: D position	D
16	Shift position	Selector lever position: SPORT mode	Driving at constant speed of 10 km/h in 1 range	1st
			Driving at constant speed of 30 km/h in 2 range	2nd
			Driving at constant speed of 50 km/h in 3 range	3rd
			Driving at constant speed of 70 km/h in 4 range	4th
21	Idle switch	Accelerator pedal position Ignition switch: ON	Depressed	OFF
			Released	ON
22	Ignition switch	Ignition switch: ON		ON
		Ignition switch: OFF		OFF
23	Stop lamp switch	Brake pedal position Ignition switch: ON	Depressed	ON
			Released	OFF
24	TCL ON switch	TCL ON switch operation Ignition switch : ON	Pressed	ON
			Released	OFF
25	TCL OFF switch	TCL OFF switch operation Ignition switch: ON	Pressed	ON
			Released	OFF

No.	Check item	Check condition		Normal condition
27	ECU power supply voltage	Ignition switch: ON		System voltage
31	Front right wheel speed sensor	Engine running Selector lever position: D	Vehicle stopped	0 km/h
			Driving at 40 km/h	40 km/h
32	Front left wheel speed sensor	Engine running Selector lever position: D	Vehicle stopped	0 km/h
			Driving at 40 km/h	40 km/h
33	Rear right wheel speed sensor	Engine running Selector lever position: D	Vehicle stopped	0 km/h
			Driving at 40 km/h	40 km/h
34	Rear left wheel speed sensor	Engine running Selector lever position: D	Vehicle stopped	0 km/h
			Driving at 40 km/h	40 km/h
40	Engine speed	Ignition switch: ON	Engine: idling	Engine speeds displayed on the MUT-II and tachometer are identical.
44	Steering angle	Steering wheel position Ignition switch: ON	Turned 90° to the right	R 90 deg
			Turned 90° to the left	L 90 deg
45	Steering straight-ahead point learning	Steering wheel position Ignition switch: ON	Immediately after ignition switch is ON	OFF
			Immediately after city driving	ON
51	Slip control	TCL switch: ON Driving on low frictional resistance road	TCL indicator lamp illuminated	ON
			TCL indicator lamp switched off	OFF
52	Trace control	TCL switch: ON Driving on winding road	TCL indicator lamp illuminated	ON
			TCL indicator lamp switched off	OFF
74	Steering wheel sensor (ST-N)	Steering wheel position Engine idling	Neutral position	LOW
			Steering wheel turned 90° from neutral position	HIGH
75	Steering wheel sensor (ST-1)	Steering wheel position Ignition switch: ON	Steering wheel turned slowly to left	HIGH and LOW display alternately
76	Steering wheel sensor (ST-2)	Steering wheel position Ignition switch: ON	Steering wheel turned slowly to right	HIGH and LOW display alternately
81	Engine model	Ignition switch: ON		6A12
82	Valve type	Ignition switch: ON		DOHC
83	Aspiration type	Ignition switch: ON		N/A
84	Engine classification	Ignition switch: ON		MIVEC

CHECK AT ECU TERMINALS

Terminal No.	Check item	Measurement condition	Normal condition
2	Diagnosis control	When MUT-II is connected	0 V
3	TCL ON switch	Ignition switch: ON TCL switch: Pressed to ON side	0 – 2 V
		Ignition switch: ON TCL switch: Released	Battery voltage
4	Engine-ECU data communication	Engine: Idling	Other than 0 V
7	Earth	Ignition switch: ON	0 V
8	Diagnosis data input	When MUT-II is connected	Serial communication with MUT-II
		When MUT-II is not connected	1 V or less
9	TCL OFF switch	Ignition switch: ON TCL switch: Pressed to OFF side	0 – 2 V
		Ignition switch: ON TCL switch: Released	Battery voltage
10	Engine-ECU data communication	Engine: Idling	Other than 0 V
11	Wheel speed sensor input (rear left wheel)	Engine: Idling, Vehicle slowly moving forward	Flashes between 0 V and approx. 5 V
12	Steering wheel sensor (ST-1) input	Ignition switch: ON Steering wheel turned slowly	Flashes between 0 V and approx. 3 V
21	TCL-OFF indicator	Ignition switch: ON Indicator: Extinguished	Battery voltage
		Ignition switch: ON Indicator: Illuminated	0 – 2 V
22	TCL indicator	Ignition switch: ON Indicator: Illuminated	0 – 2 V
		Ignition switch: ON Indicator: Extinguished	Battery voltage
24	Wheel speed sensor input (front left wheel)	Engine: Idling, Vehicle slowly moving forward	Flashes between 0 V and approx. 5 V
25	Wheel speed sensor input (front right wheel)	Engine: Idling, Vehicle slowly moving forward	Flashes between 0 V and approx. 5 V
27	Stop lamp switch input	Ignition switch: ON Brake pedal depressed	10 – 12 V
		Ignition switch: ON Brake pedal released	0 – 2 V
29	A/T-ECU data communication	Engine: Idling	Other than 0 V
30	ECU power supply	Ignition switch: ON	Battery voltage

Terminal No.	Check item	Measurement condition	Normal condition
31	Earth	Ignition switch: ON	0 V
32	Ignition switch IG2	Ignition switch: ON	Battery voltage
33	Steering wheel sensor (ST-2) input	Ignition switch: ON Steering wheel turned slowly.	Flashes between 0 V and approx. 3 V
34	Steering wheel sensor (ST-N) input	Engine: Idling Steering wheel in straight-ahead position	0.5 V or less
		Engine: Idling Steering wheel turned 90° from straight-ahead position	2.5 – 3.5 V
36	Wheel speed sensor input (rear right wheel)	Engine: Idling, Vehicle slowly moving forward	Flashes between 0 V and approx. 5 V
38	APS output	Ignition switch: ON Accelerator pedal fully depressed	4.5 – 5.5 V
		Ignition switch: ON Accelerator pedal released	0.4 – 1.0 V
39	ABS fail signal	During ABS fail	0 – 2 V
		When ABS is normal	10 – 16 V
40	A/T-ECU data communication	Engine: Idling	Other than 0 V
41	ECU back-up power supply	Ignition switch: OFF	Battery voltage
42	Earth	Ignition switch: ON	0 V



ON-VEHICLE SERVICE

SYSTEM CHECK USING THE TCL INDICATOR LAMPS

Press the TCL switch and check if each TCL indicator lamp illuminates or switches off.

TCL switch mode	Inspection conditions	TCL OFF indicator (A)	TCL indicator (B)
Switch does not operate	Turn the ignition switch to the ON position.	O	O
	Start the engine.	×	×
TCL OFF mode	Engine is idling.	O	–
TCL ON mode	Drive the vehicle at 30 km/h for 2 minutes or more.	No illumination	–

NOTE
O: illuminated, X: extinguished, – : not relevant

Caution
If a different result is obtained when checking, refer to the "Troubleshooting" section for remedy.

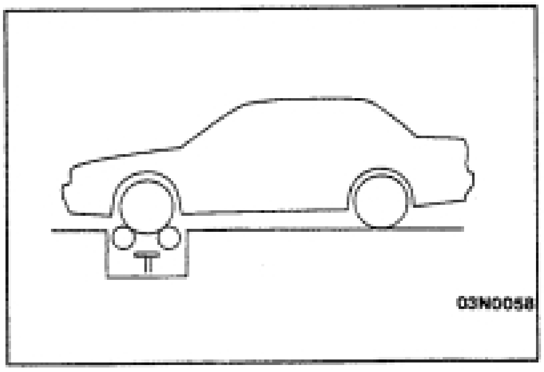
TCL OPERATION CHECK

<When using the MUT-II>

1. Connect the MUT-II to the diagnosis connector.
2. Move the selector lever to P range <A/T>, or move the shift lever to the neutral position <M/T>.
3. Start the engine.
4. Turn the TCL switch to ON.
5. Operate the MUT-II to start the actuator test (item No. 05) and fully depress the accelerator pedal at the same time. Check that the engine speed is kept down to 3,000 r/min at this time.

   Caution
   The actuator test should only be carried out for 3 seconds.
   Because the engine speed will increase once the actuator test is stopped, the accelerator pedal should be released quickly after it has been depressed.

   NOTE
   The TCL-ECU will output a "request torque: 0" signal to the engine-ECU for 3 seconds while the actuator test is being carried out, and the TCL OFF indicator will illuminate during this time.



<When not using the MUT-II>

1. Turn the TCL switch to ON.
2. Place the front wheels onto a speedometer tester or a chassis dynamo and start the engine. (The front wheels may also be jacked up.)
3. Move the shift lever to 1st position <M/T> or the selector lever to D range <A/T>.
4. Check to be sure that the engine speed is restrained when the accelerator pedal is depressed.

NOTE
If the following symptoms occur when the accelerator pedal is depressed, refer to "Troubleshooting".
(1) If the TCL indicator lamp does not illuminate.
(2) If the TCL indicator lamp illuminates but the engine is not restrained.

Caution
Inspection should be completed within 20 seconds after the accelerator pedal was depressed. If it takes longer than 20 seconds, the TCL system function will stop and the engine speed will gradually increase.

STOP LAMP SWITCH CHECK

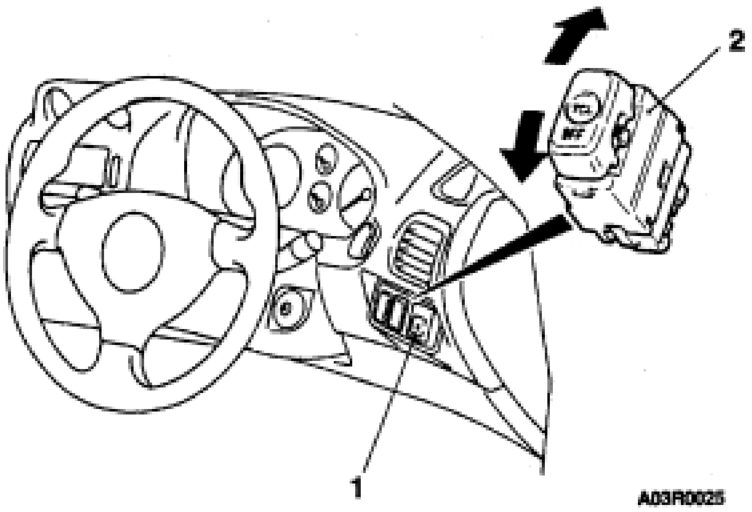
Refer to GROUP 35A – On-vehicle Service.

WHEEL SPEED SENSOR CHECK

Refer to GROUP 35B – On-vehicle Service.

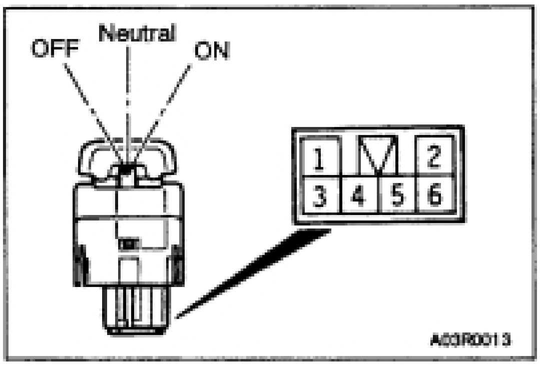
TCL SWITCH

REMOVAL AND INSTALLATION



Removal steps

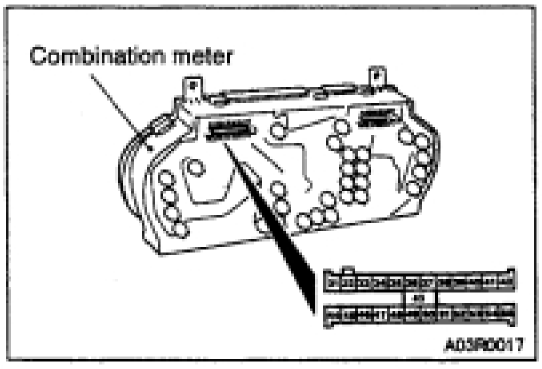
1. Instrument panel switch
2. TCL switch



INSPECTION

TCL SWITCH CONTINUITY CHECK

Switch position	Terminal No.						
	1	2	3	6	4	–	5
ON			○	○	○	lamp	○
Neutral							
OFF		○	○				



TCL INDICATOR LAMP CONTINUITY CHECK

1. Remove the combination meter. (Refer to GROUP 54 – Combination Meter.)
2. Check the continuity between each terminals.

Indicator lamp	Terminal No.			
	33		40	41
TCL	○	lamp	○	
TCL OFF	○	lamp		○

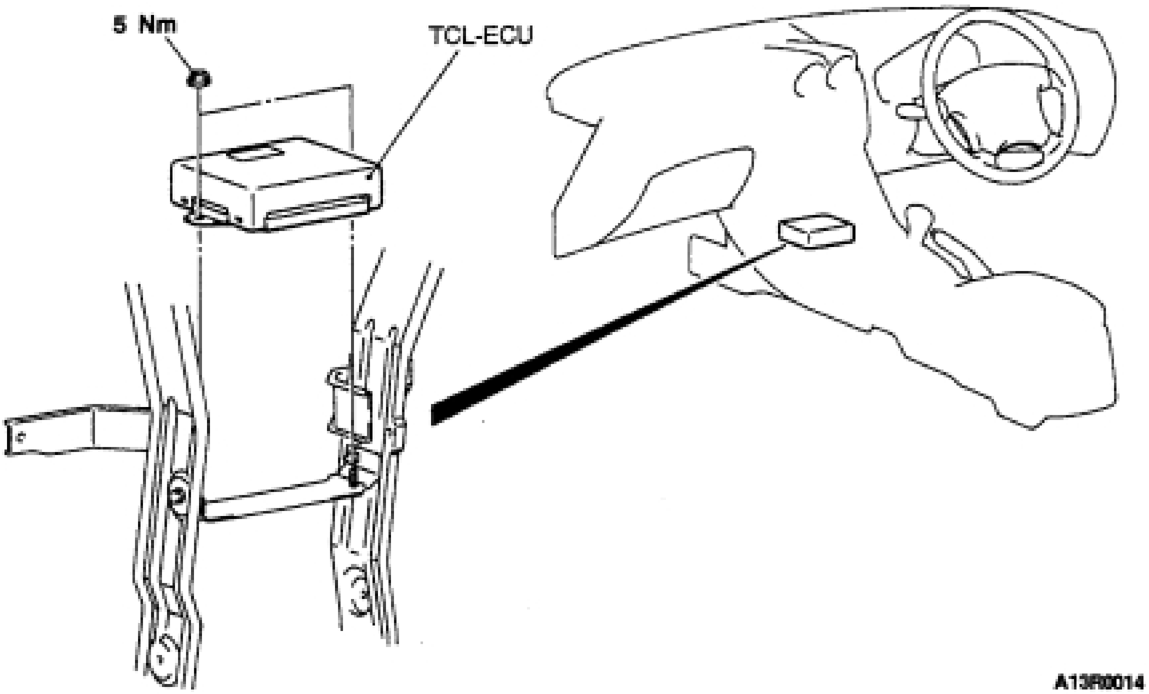
3. If there is no continuity, replace the indicator lamp.

TCL-ECU

REMOVAL AND INSTALLATION

Caution
Be careful not to subject the SRS-ECU to any shocks during removal and installation of the TCL-ECU.

Pre-removal and Post-installation Operation
- Radio and Tape Player or Radio Plug Removal and Installation (Refer to GROUP 54.)



ENGINE COOLING

CONTENTS

SERVICE SPECIFICATIONS

Items		Standard value	Limit
Radiator cap opening pressure kPa		74 – 103	64
Range of coolant antifreeze concentration of radiator %		30 – 60	–
Thermostat	Valve opening temperature of thermostat °C	82 ± 1.5	–
	Full-opening temperature of thermostat °C	95	–
	Valve lift (at 95°C) mm	8.5 or more	–

LUBRICANT

Items	Quantity ℓ
HIGH QUALITY ETHYLENE GLYCOL ANTIFREEZE COOLANT	6.5

SEALANTS

Items	Specified sealant	Remarks
Cylinder block drain plug	3M Nut Locking Part No. 4171 or equivalent	Drying sealant
Water pump	Mitsubishi Genuine Parts No. MD970389 or equivalent	Semi-drying sealant

ON-VEHICLE SERVICE

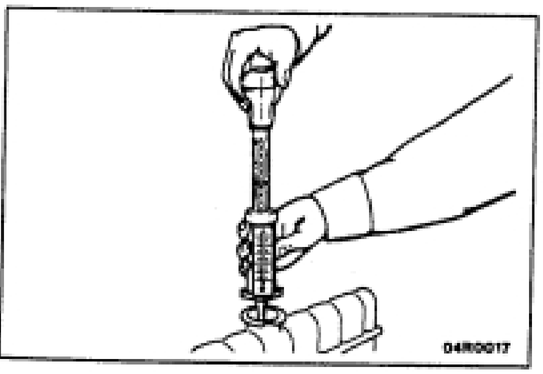
RADIATOR CAP OPENING PRESSURE CHECK

Standard value: 74 – 103 kPa

Limit: 64 kPa

ENGINE COOLANT LEVEL CHECK

1. Confirm that the condense tank coolant level is between "FULL" and "LOW".
2. Check that there is no foreign matter in the coolant.



CONCENTRATION MEASUREMENT

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

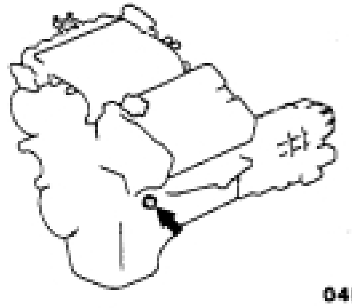
Caution

If the concentration of the antifreeze is below 30 %, the anti-corrosion property will be adversely affected. In addition, if the concentration is above 60 %, both the anti-freezing and engine cooling properties will decrease, affecting the engine adversely. For these reasons, be sure to maintain the concentration level within the specified range.

ENGINE COOLANT REPLACEMENT

1. Drain the engine coolant by removing the drain plug and then the radiator cap.
2. Remove the drain plug from the cylinder block to drain the engine coolant.

Left bank

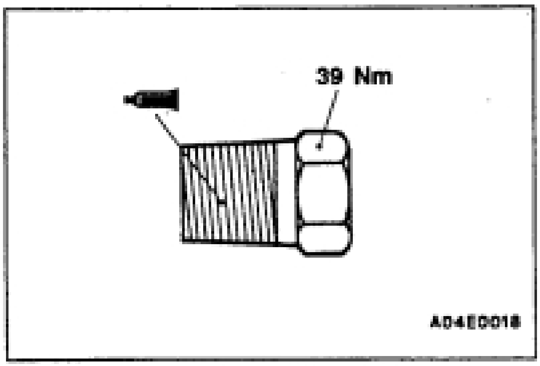


04R0008

Right bank

04R0013
00008061

3. Remove the reserve tank to drain the engine coolant.
4. When the engine coolant has drained, pour in water from the radiator cap to clean the engine coolant line.



5. Coat the thread of the cylinder block drain plug with the specified sealant and tighten to the specified torque.

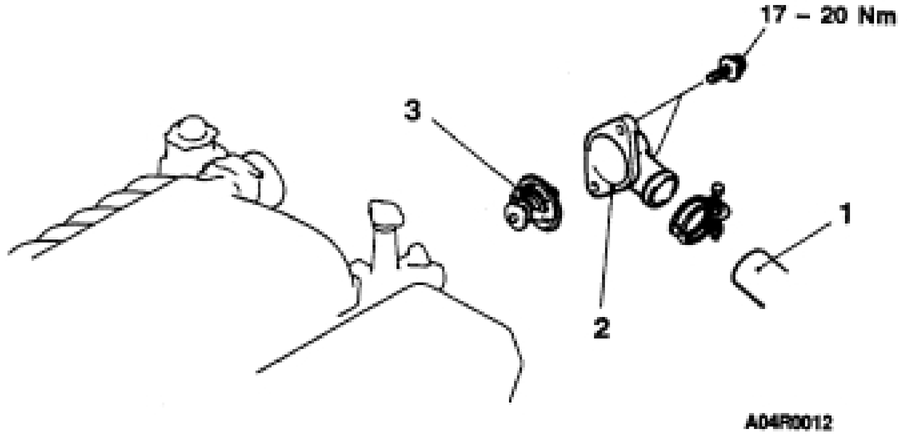
   Specified sealant:
   3M Nut Locking Part No. 4171 or equivalent
6. Securely tighten the radiator drain plug.
7. Install the reserve tank.
8. Slowly pour the engine coolant into the mouth of the radiator until the radiator is full, and pour also into the reserve tank up to the FULL line.

   Quantity: 6.5 ℓ
9. Install the radiator cap securely.
10. Start the engine and warm the engine until the thermostat opens.
11. After the thermostat opens, race the engine several times, and then stop the engine.
12. Cool down the engine. 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.

THERMOSTAT

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying (Refer to P.14-3.)
- Air Cleaner Cover and Air Intake Hose Assembly Removal and Installation.



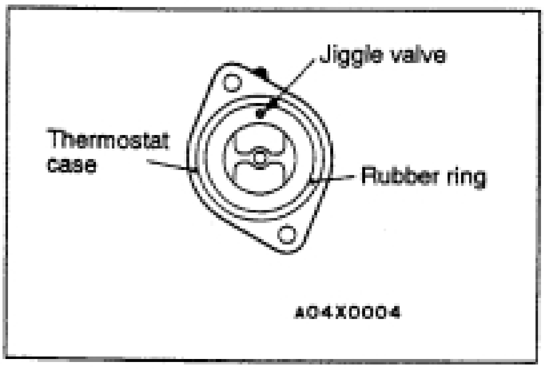
Removal steps

◀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.



INSTALLATION SERVICE POINTS

▶A◀ THERMOSTAT INSTALLATION

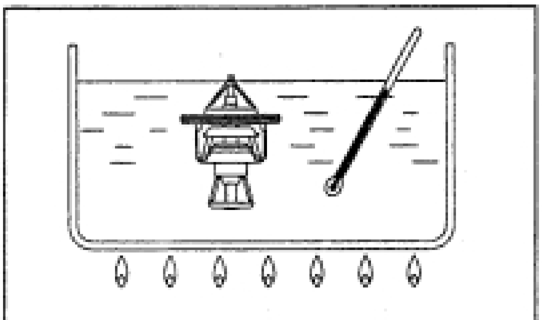
Install the thermostat so that the jiggle valve is facing straight up.

Caution

Make absolutely sure that no oil is adhering to the rubber ring of the thermostat. In addition, be careful not to fold over or scratch the rubber ring when inserting. If the rubber ring is damaged, replace the thermostat.

▶B◀ RADIATOR LOWER 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.



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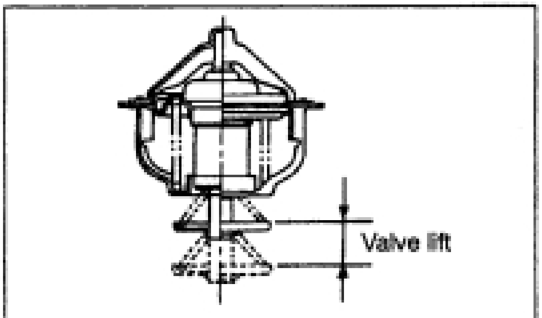
INSPECTION

THERMOSTAT CHECK

1. Immerse the thermostat in water, and heat the water while stirring. Check the thermostat valve opening temperature.

   Standard value:

   Valve opening temperature: 82±1.5°C



804N0004

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

   Standard value:

   Full-opening temperature: 95°C

   Amount of valve lift: 8.5 mm or more

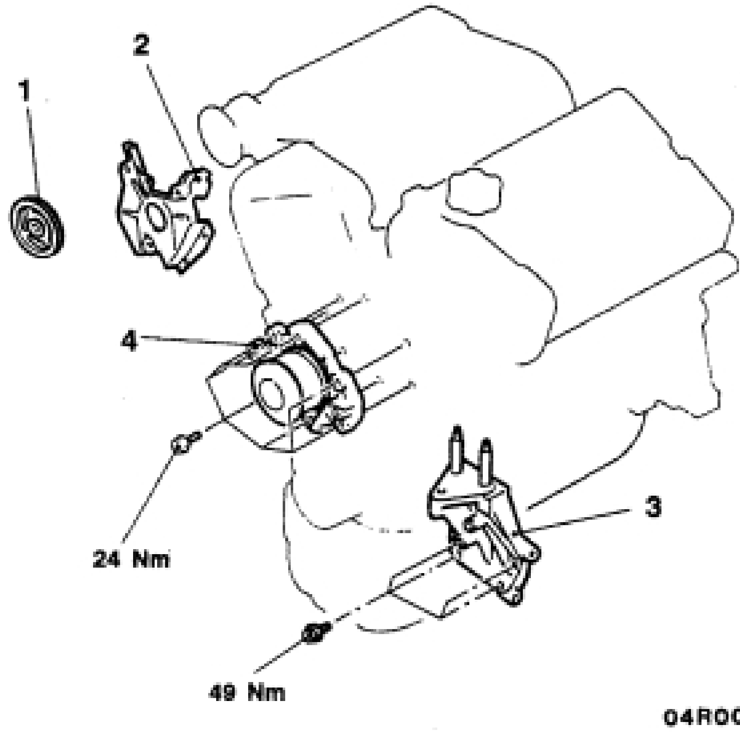
   NOTE

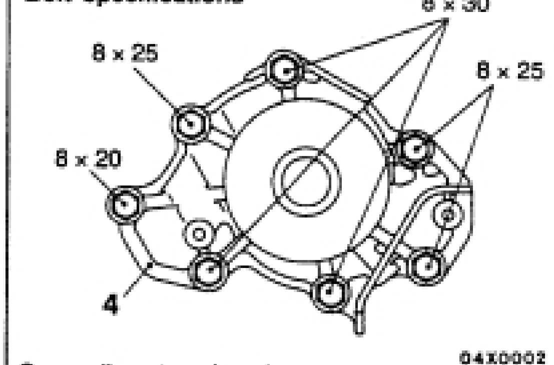
   Measure the valve height when the thermostat is fully closed, and use this measurement to calculate the valve height when the thermostat is fully open.

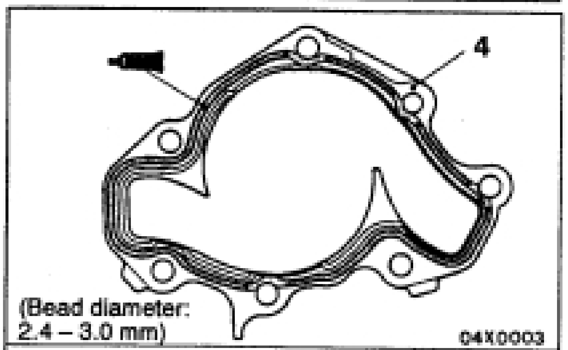
WATER PUMP

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying (Refer to P.14-3.)
- Power Steering Oil Pump Bracket Removal and Installation (Refer to GROUP 37A – Oil Pump.)
- A/C Compressor Bracket Removal and Installation (Refer to GROUP 55 – Compressor and Tensioner Pulley.)
- Timing Belt Removal and Installation (Refer to GROUP 11A.)
- Engine Mount Bracket Removal and Installation (Refer to GROUP 32.)







Sealant:
Mitsubishi Genuine Part No. MD970389 or equivalent

Removal steps

1. Camshaft sprocket (Refer to GROUP 11A – Cylinder Head Gasket.)
2. Timing belt rear center cover (GROUP 11A – Cylinder Head Gasket.)
3. Engine support bracket

▶A◀ 4. Water pump

INSTALLATION SERVICE POINT

▶A◀ WATER PUMP INSTALLATION

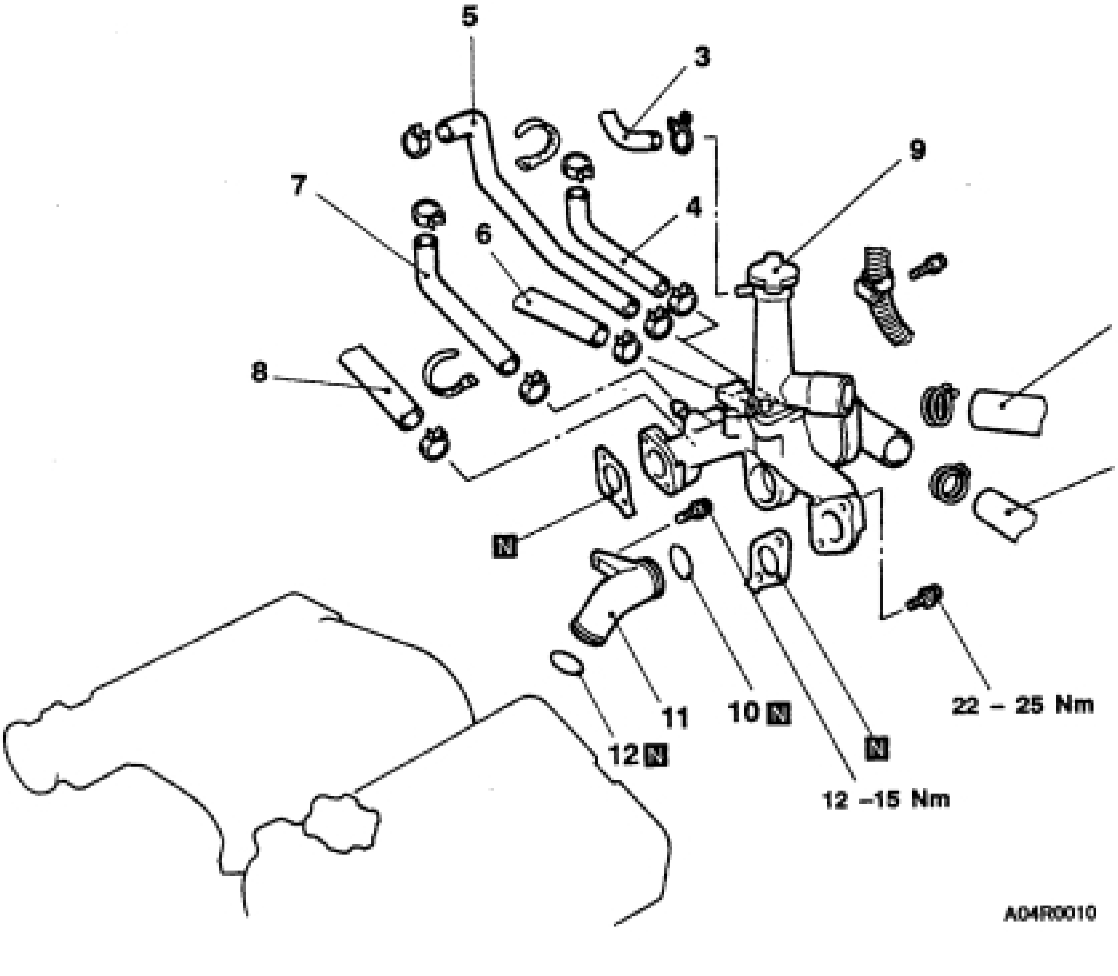
1. Squeeze out the sealant from the gasket surface completely with a gasket scraper or wire brush.
2. Apply a continuous bead of the specified sealant. Be careful not to apply the sealant to the places other than the specified places.

   Specified Sealant:
   Mitsubishi Genuine Part No.MD970389 or equivalent
3. Install the water pump within 15 minutes (while the sealant is still wet).

WATER HOSE AND WATER PIPE

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Suppling (Refer to P.14-3.)
- Air Cleaner cover and Air Intake Hose Assembly Removal and Installation



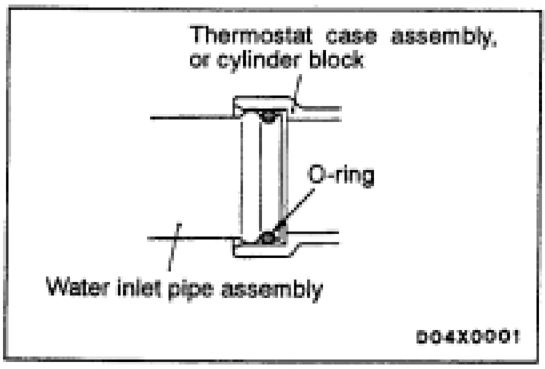
Removal steps

◀A▶ ▶B◀ 1. Radiator upper hose connection
◀A▶ ▶B◀ 2. Radiator lower hose connection
3. Overflow hose
4. Water hose <Vehicle without TCL>
5. Water hose <Vehicle with TCL>
6. Heater hose connection
7. Water hose
8. Heater hose connection
9. Thermostat case assembly
▶A◀ 10. O-ring
11. Water inlet pipe assembly
▶A◀ 12. O-ring

REMOVAL SERVICE POINT

◀A▶ RADIATOR UPPER HOSE/RADIATOR LOWER HOSE DISCONNECTION

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



INSTALLATION SERVICE POINTS

▶A◀ O-RING INSTALLATION

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

▶B◀ RADIATOR LOWER HOSE/RADIATOR UPPER HOSE CONNECTION

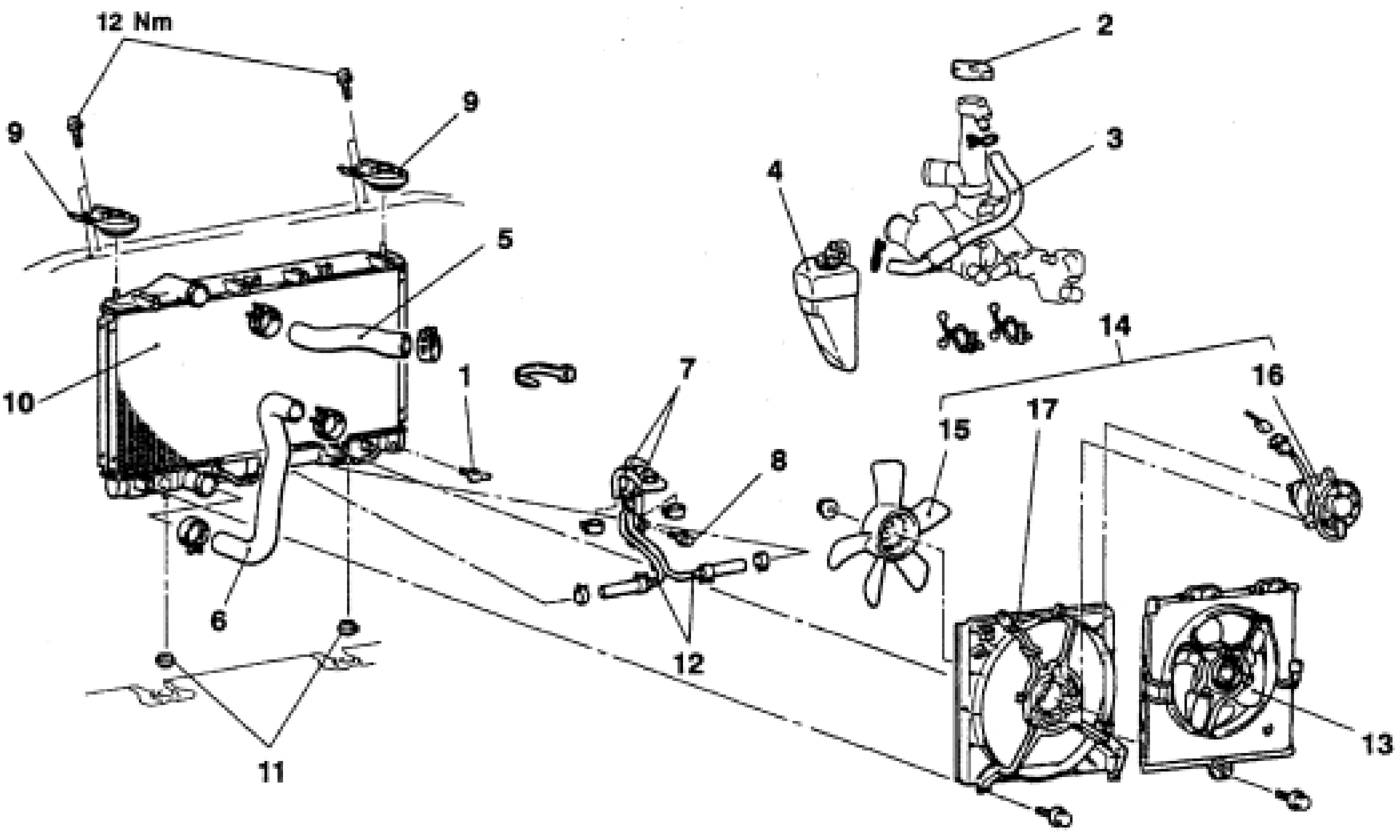
1. Insert each hose as far as the projection of the water inlet fitting or water outlet fitting.
2. Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.

RADIATOR

REMOVAL AND INSTALLATION

Pre-removal operation
- Engine Coolant Draining (Refer to P.14-3.)
- Air Cleaner cover and Air Intake Hose Assembly Removal

Post-installation Operation
- Engine Coolant Supplying (Refer to P.14-3.)
- A/T Fluid Supplying and Checking (Refer to GROUP 23 – On-vehicle Service.)
- Air Cleaner cover and Air Intake Hose Assembly Installation



Removal steps

1. Drain plug
2. Radiator cap
3. Overflow hose
4. Reserve tank
5. ◄A► ►A◄ Radiator upper hose
6. ◄A► ►A◄ Radiator lower hose
7. ◄B► Transmission fluid cooler hose connection <A/T>
8. Bolt <A/T>
9. Upper insulator
10. Radiator assembly
11. Lower insulator
12. ◄B► Transmission fluid cooler hose and pipe assembly <A/T>
13. Condenser fan motor assembly
14. Radiator fan motor assembly
15. Fan
16. Radiator fan motor
17. Shroud

REMOVAL SERVICE POINTS

◀A▶ RADIATOR UPPER HOSE/RADIATOR LOWER HOSE DISCONNECTION

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

◀B▶ TRANSMISSION FLUID COOLER HOSE AND PIPE ASSEMBLY REMOVAL

After disconnecting the hoses from the radiator and the transmission, piug all of the pipes and hoses to prevent dirt and other foreign objects from getting inside.

INSTALLATION SERVICE POINT

▶A◀ RADIATOR LOWER HOSE/RADIATOR UPPER HOSE CONNECTION

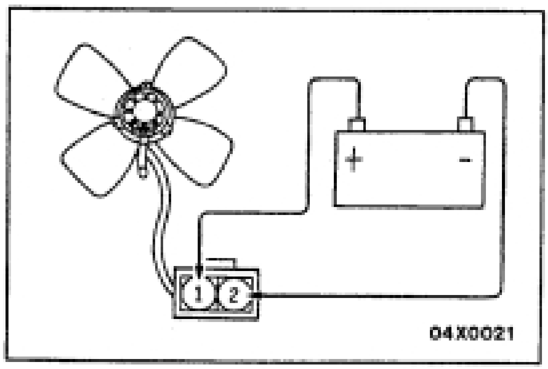
1. Insert each hose as far as the projection of the water inlet fitting or water outlet fitting.
2. Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.

Caution

Always position the hoses and clamps at their original positions in order to prevent the coolant leakage.

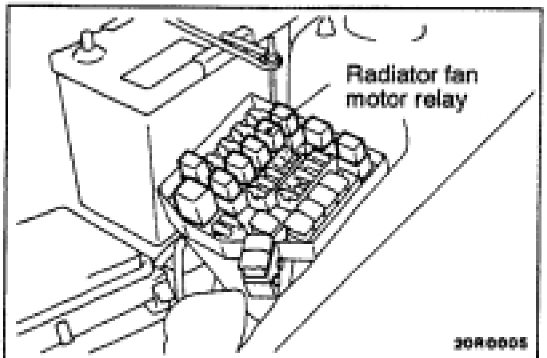
INSPECTION

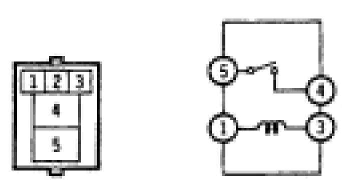
RADIATOR FAN MOTOR CHECK



Check that the radiator fan operates when applying the battery voltage between the terminals 1 and 2 of the radiator fan motor connector.

POWER RELAY CONTINUITY CHECK





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

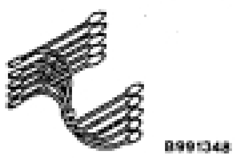
INTAKE AND EXHAUST

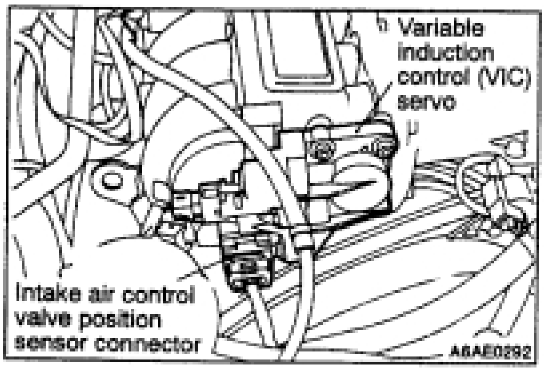
CONTENTS

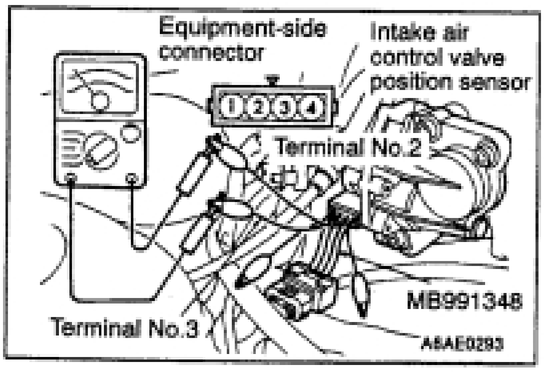
SERVICE SPECIFICATIONS

Items		Standard value	Limit
Valve position sensor terminal voltage (between terminals No.2 and No.3, and between terminals No.4 and No.3) V	Idling	0 – 1 or 4.5 – 5.5	–
	Gradually rise the engine speed up to 5,000 r/min	1.5 – 4.0 (a moment)	–
	5,000 r/min	0.1 or 4.5 – 5.5	–
VIC servo coil continuity	Between terminals No.1 and No.2	Continuity (Approx. 5 – 35Ω: at 20°C)	–
Air intake plenum, intake manifold mounting face distortion		0.15 mm or less	0.2 mm

SPECIAL TOOL

Tool	Number	Name	Use
 B991348	MB991348	Test harness set	Variable induction control system check (Intake air control valve position sensor connector connection)





ON-VEHICLE SERVICE

VARIABLE INDUCTION CONTROL SYSTEM CHECK

SYSTEM CHECK

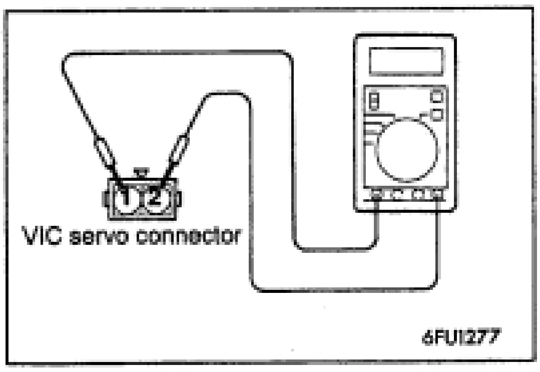
1. Disconnect the intake air control valve position sensor connector.
2. Connect the special tool (test harness set) between the disconnected connectors. (All of the terminals should be connected.)
3. Connect the voltmeter between the terminals No.2 and No.3 of the intake air control valve position sensor, then measure the voltage. Also, measure the voltage between the terminals No.4 and No.3 by the same manner.

Standard value:

Engine condition	Voltage (V)
Idling	0 – 1 or 4.5 – 5.5
Gradually rise the engine speed up to 5,000 r/min	1.5 – 4.0 (a moment)

Engine condition	Voltage (V)
5,000 r/min	0 – 1 or 4.5 – 5.5

4. If the voltage is not within the standard value, check the intake air control valve position sensor, variable induction control (VIC) servo and its related harness.

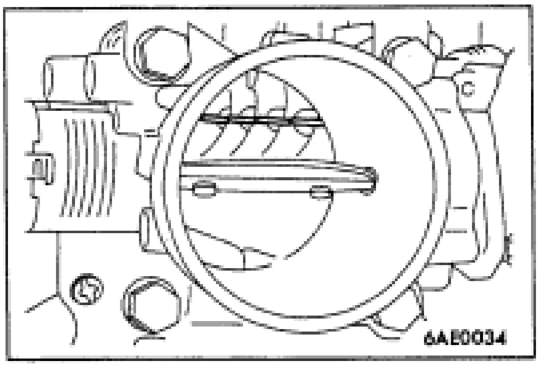


VARIABLE INDUCTION CONTROL (VIC) SERVO CHECK

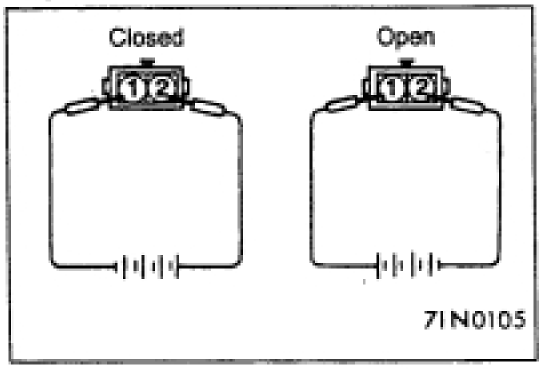
1. Disconnect the VIC servo connector.
2. Remove the air intake hose from the throttle body.
3. Check continuity of VIC servo coil.

Standard value:

Terminal	Continuity
Between No.1 and No.2	Continuity (Approx. 5 – 35 Ω: at 20°C)



4. Fully open the throttle valve.



5. Apply a voltage to the VIC servo connector terminals, and check that the control valve of the VIC servo operates smoothly.

Caution
The voltage should be DC 6V or less. If a high voltage is applied, the VIC servo gear may lock.

6. Replace the air intake plenum assembly if there is no continuity or the control valve does not operate smoothly.

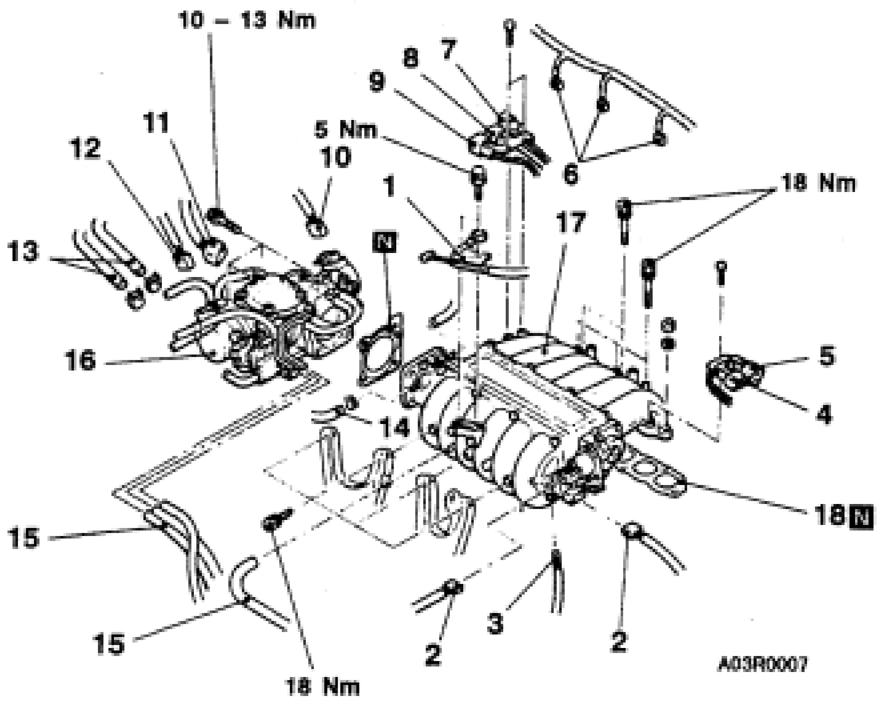
7. Install the air intake hose.
8. Connect the VIC servo connector.

INTAKE MANIFOLD

REMOVAL AND INSTALLATION

Pre-removal Operation
- Engine Coolant Draining
  (Refer to GROUP 14 – On-vehicle Service.)
- Fuel Discharge Prevention
  (Refer to GROUP 13A – On-vehicle Service.)
- Air Cleaner Removal

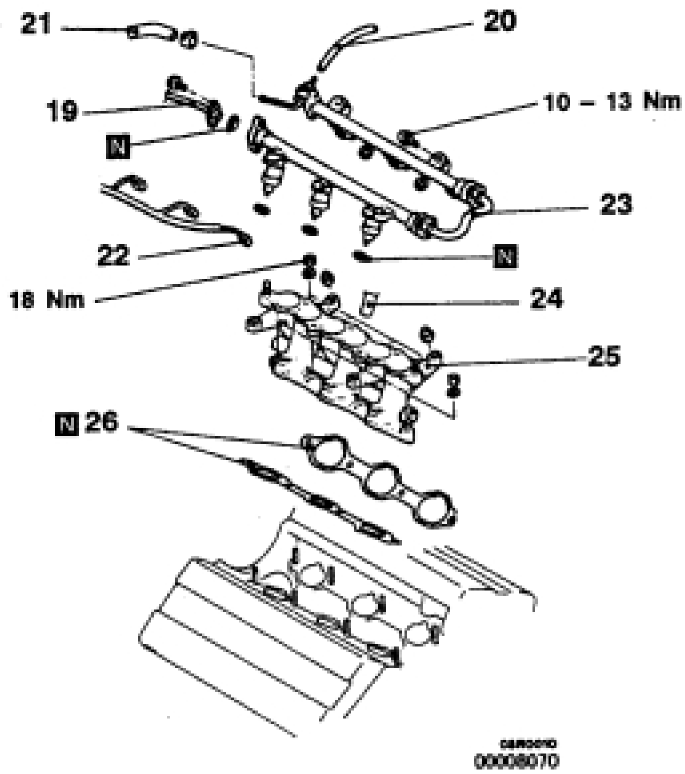
Post-installation Operation
- Engine Coolant Supplying
  (Refer to GROUP 14 – On-vehicle Service.)
- Accelerator Cable Adjustment
  (Refer to GROUP 13B – On-vehicle Service.)
- Air Cleaner Installation

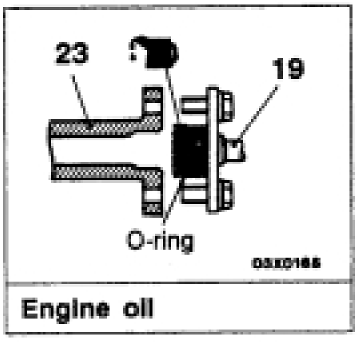


Removal steps

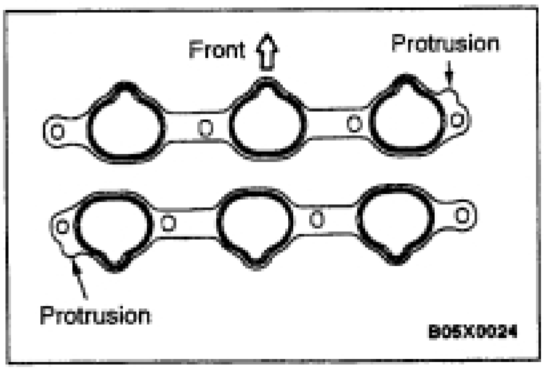
1. Accelerator cable
2. VIC servo motor connector
3. Air temperature sensor connector
4. Camshaft position sensor connector
5. Crank angle sensor connector
6. Injector connector
7. Detonation sensor connector
8. Injector harness connector
9. Oil control valve connector
10. TPS connector
11. ISC servo motor connector
12. APS connector
13. Engine coolant hose connection
14. Brake booster vacuum hose connection
15. Vacuum hose
16. Throttle body
17. Air intake plenum

►C◄ 18. Air intake plenum gasket





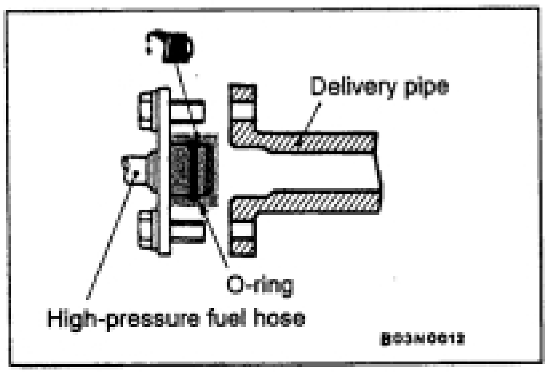
▶B◀ 19. Fuel high-pressure hose connection
20. Vacuum hose connection
21. Fuel return hose connection
22. Injector connector
23. Delivery pipe (with injector)
24. PCV hose connection
25. Intake manifold
▶A◀ 26. Intake manifold gasket



INSTALLATION SERVICE POINTS

▶A◀ INTAKE MANIFOLD GASKET INSTALLATION

Install gasket with its protrusion in the position illustrated.



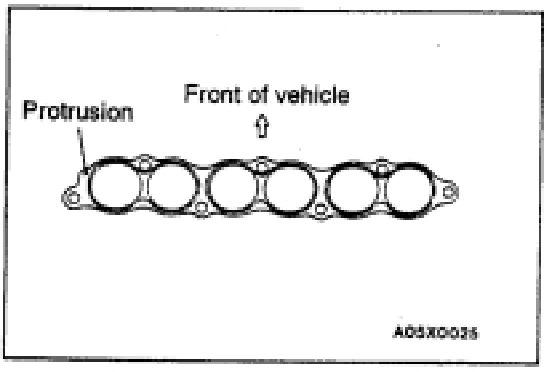
▶B◀ HIGH-PRESSURE FUEL HOSE INSTALLATION

1. When connecting the high-pressure fuel hose to the delivery pipe, apply a small amount of new engine oil to the O-ring and then insert the high-pressure fuel hose, being careful not to damage the O-ring.

   Caution
   Be careful not to let any engine oil get into the delivery pipe.

2. While turning the high-pressure fuel hose to the left and right, install it to the delivery pipe.

3. Check to be sure that the injector turns smoothly.
   If it does not turn smoothly, the O-ring may be trapped, remove the high-pressure fuel hose and then re-insert it into the delivery pipe and check once again.
4. Tighten the mounting bolts to the specified torque.



▶C◀ AIR INTAKE PLENUM GASKET INSTALLATION

Install the gasket with its protrusion in the position illustrated.

INSPECTION

Check the following points; replace the part if a problem is found.

AIR INTAKE PLENUM, INTAKE MANIFOLD CHECK

1. Check for damage or cracking of any part, and replace the defective parts.
2. Check for obstruction of the negative pressure (vacuum) outlet port, and clean if necessary.
3. Using a straight edge and thickness gauge, check for distortion of the cylinder head installation surface.

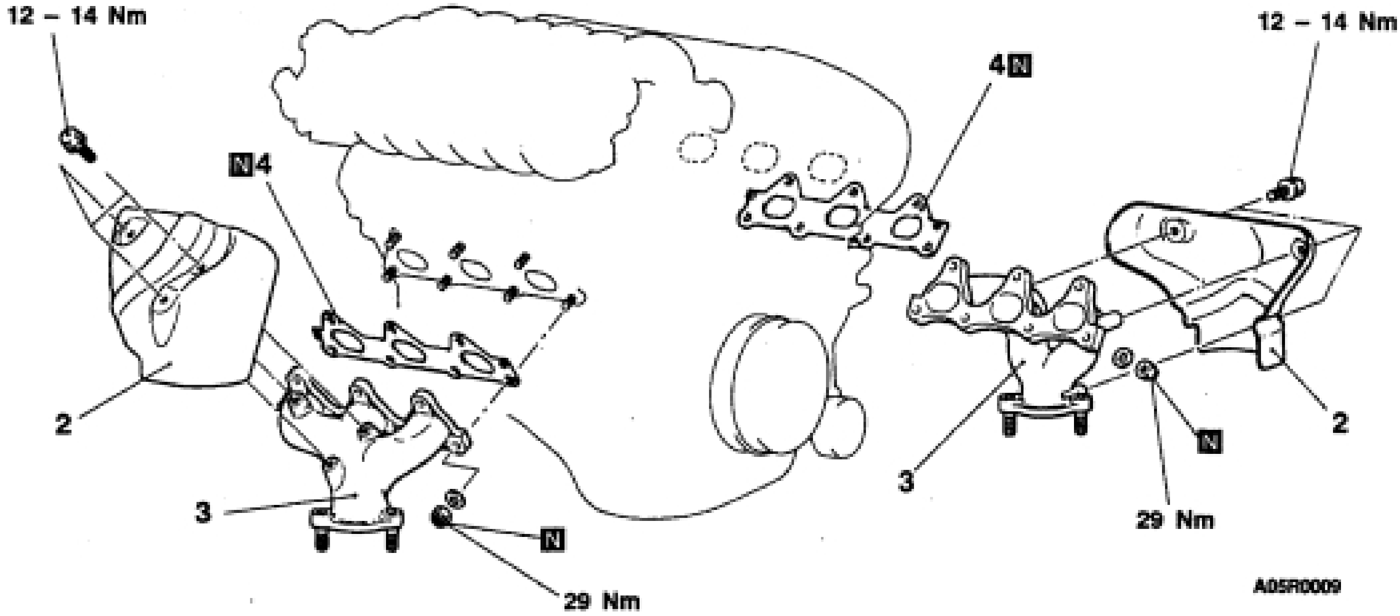
   Standard value: 0.15 mm or less

   Limit: 0.20 mm

EXHAUST MANIFOLD

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Front Exhaust Pipe Removal and Installation (Refer to P.15-22.)



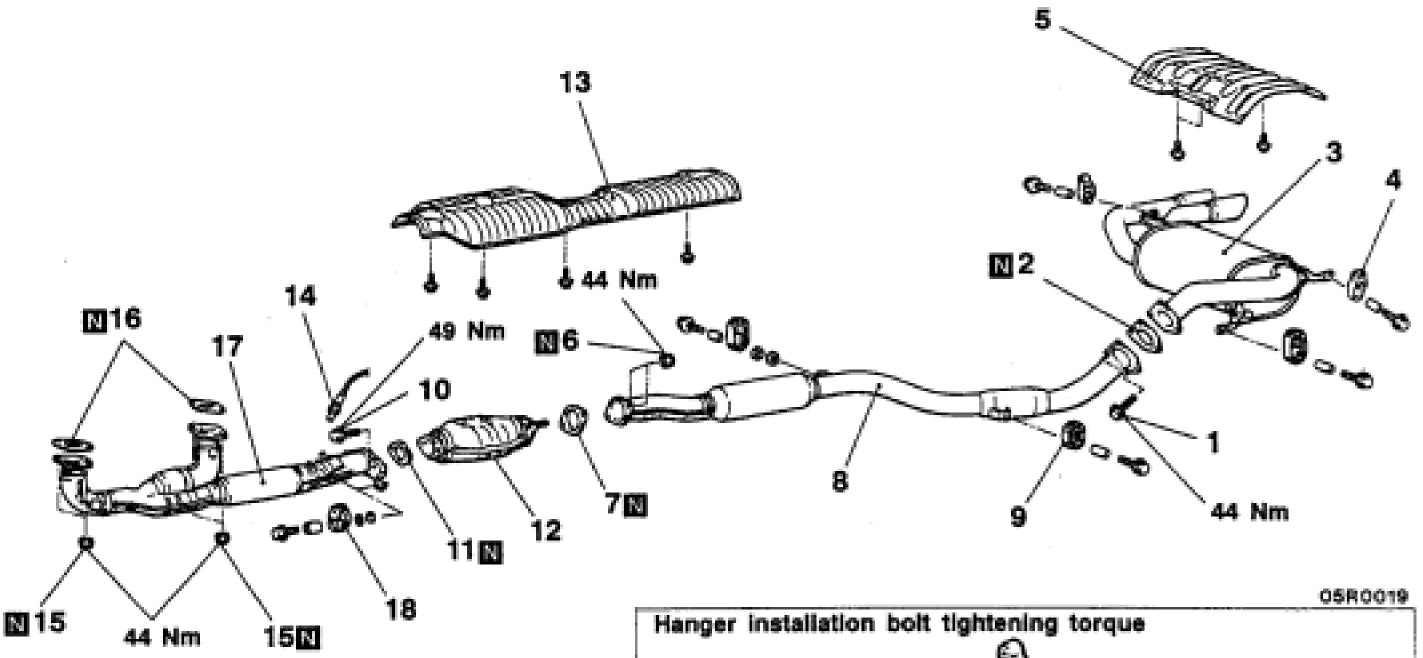
Removal steps

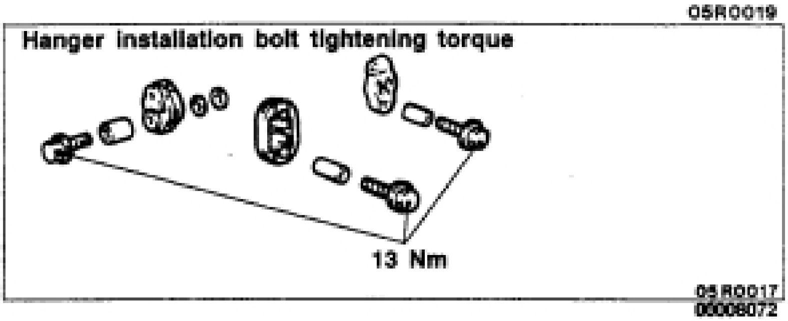
1. Exhaust manifold bracket A
2. Heat protector
3. Exhaust manifold
4. Exhaust manifold gasket

EXHAUST PIPE AND MAIN MUFFLER

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Under Cover Removal and Installation





Main muffler removal steps
1. Bolt
2. Gasket
3. Main muffler assembly
4. Hanger
5. Rear floor heat protector panel

Center exhaust pipe removal steps
1. Bolt
2. Gasket
6. Self locking nuts
7. Gasket
8. Center exhaust pipe
9. Hanger
10. Bolt
11. Gasket
12. Catalytic converter
13. Front floor heat protector panel

Front exhaust pipe removal steps
10. Bolt
11. Gasket
14. Oxygen sensor
15. Self locking nuts
16. Gasket
17. Front exhaust pipe
18. Hanger

ENGINE ELECTRICAL

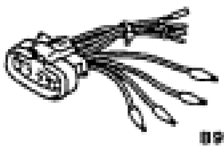
CONTENTS

CHARGING SYSTEM

SERVICE SPECIFICATIONS

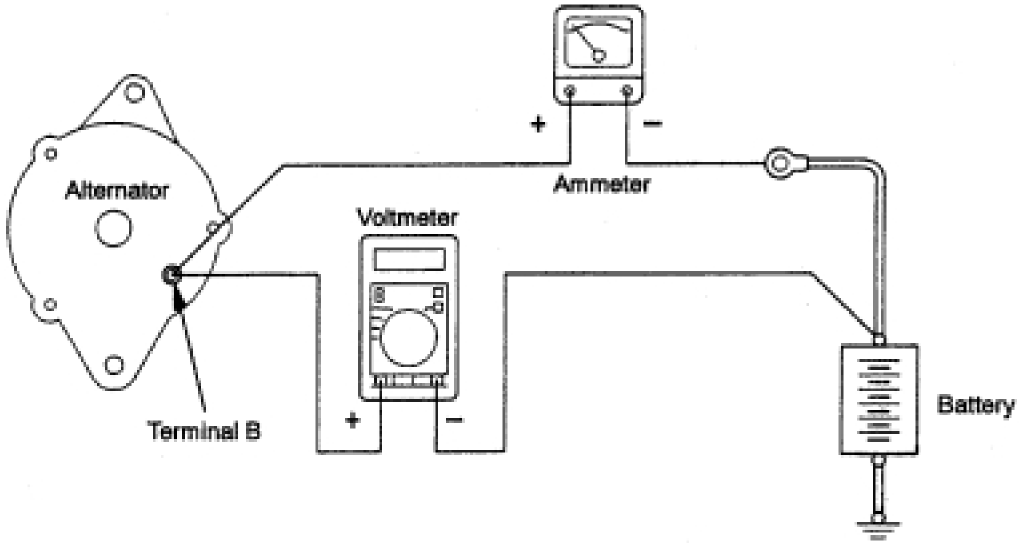
Items	Limit	Remark
Alternator output line voltage drop V	max. 0.3	–
Alternator output current A	70% of normal output current	The nominal output current is labelled on the alternator.

SPECIAL TOOL

Tool	Number	Name	Use
 B991519	MB991519	Alternator test harness	Checking the alternator (S terminal voltage) (4-pin connector)

ON-VEHICLE SERVICE

ALTERNATOR OUTPUT LINE VOLTAGE DROP TEST



This test determines whether the wiring from the alternator "B" terminal to the battery (+) terminal (including the fusible line) is in a good condition or not.

(1) Always be sure to check the following before the test.
- Alternator installation
- Alternator drive belt tension (Refer to GROUP11A – On-vehicle Service.)
- 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 0–100 A in series between the "B" terminal and the disconnected output wire. (Connect the (+) lead of the ammeter to the "B" terminal, and then connect the (–) lead of the ammeter to the disconnected output wire.)

NOTE
An inductive-type ammeter which enables measurements to be taken without disconnecting the alternator output wire should be recommended. Using this equipment will lessen the possibility of a voltage drop caused by a loose "B" terminal connection.

(5) Connect a digital-type voltmeter between the alternator "B" terminal and the battery (+) terminal. (Connect the (+) lead of the voltmeter to the "B" terminal and the connect the (–) lead of the voltmeter to the battery (+) cable.)

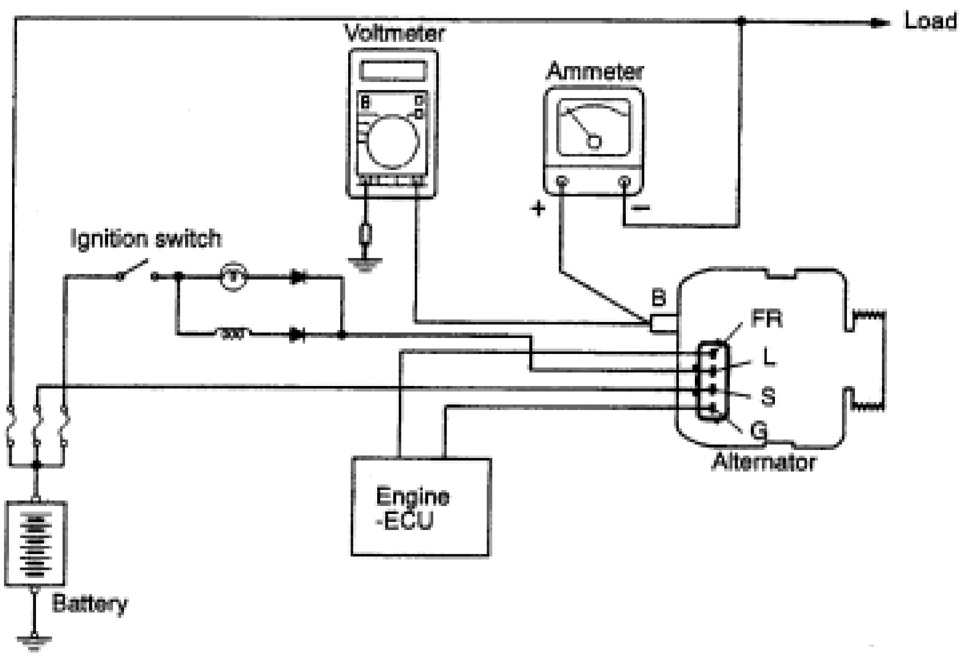
(6) Connect a tachometer.
(Refer to GROUP 11A – On-vehicle Service.)
(7) Reconnect the negative battery cable.
(8) Leave the hood open.
(9) Start the engine.
(10) With the engine running at 2,500 r/min, turn the headlamps and other lamps on and off to adjust the alternator load so that the value displayed 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) Disconnect the negative battery cable.
(15) Disconnect the ammeter, voltmeter and tachometer.
(16) Connect the alternator output wire to the alternator "B" terminal.
(17) Connect the negative battery cable.

OUTPUT CURRENT TEST



6AE0411

This test determines whether the alternator output current is normal.

(1) Before the test, always be sure to check the following.
- Alternator installation
- Battery (Refer to GROUP 54.)

  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 (Refer to GROUP 11A – On-vehicle Service.)
- 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 a tachometer.
(Refer to GROUP 11A – On-vehicle Service.)
(7) Connect the negative battery cable.
(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.

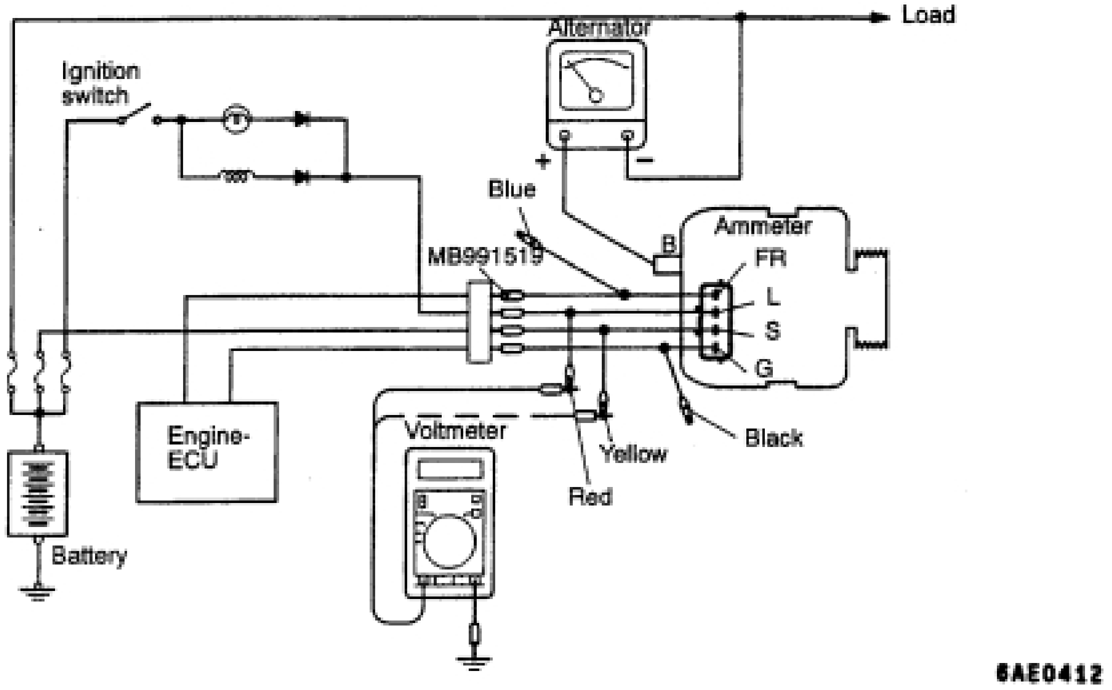
(10) Turn the light switch on to turn on headlamps and then start the engine.
(11) Immediately after setting the headlamps to high beam and turning the heater blower switch to the high revolution position, increase the engine speed to 2,500 r/min and read the maximum current output value displayed on the ammeter.

Limit: 70% of normal current output

NOTE
- The nominal output current is labelled on the alternator.
- 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) Disconnect the negative battery cable.
(16) Disconnect the ammeter, voltmeter and tachometer.
(17) Connect the alternator output wire to the alternator "B" terminal.
(18) Connect the negative battery cable.

REGULATED VOLTAGE TEST



This test determines whether the voltage regulator is correctly controlling the alternator output voltage.

(1) Always be sure to check the following before the test.
- Alternator installation
- Check that the battery installed in the vehicle is fully charged. (Refer to GROUP 54 – Battery.)
- Alternator drive belt tension (Refer to GROUP 11A – On-vehicle Service.)
- Fusible link
- Abnormal noise from the alternator while the engine is running

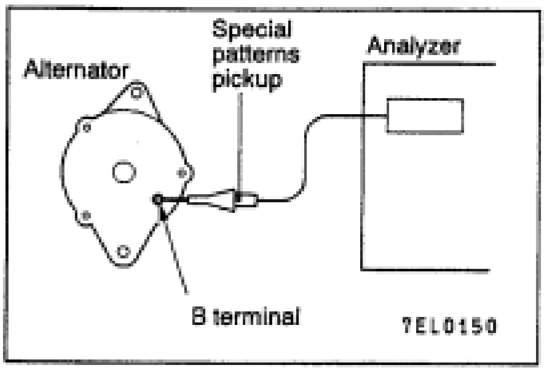
(2) Turn the ignition switch to the OFF position.
(3) Disconnect the negative battery cable.
(4) Use the special tool (Alternator test harness: MB991519) to connect a digital voltmeter between the alternator S terminal and earth. (Connect the (+) lead of the voltmeter to the "S" terminal, and then connect the lead of the voltmeter to a secure earth.)
(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) Connect a tachometer. (Refer to GROUP 11A – On-vehicle Service.)
(8) Reconnect the negative battery cable.
(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) Disconnect the negative battery cable.
(18) Disconnect the ammeter, voltmeter and tachometer.
(19) Connect the alternator output wire to the alternator "B" terminal.
(20) Connect the negative battery cable.

Voltage Regulation Table
Standard value:

Inspection terminal	Voltage regulator ambient temperature °C	Voltage V
Terminal "S"	–20	14.2–15.4
	20	13.9–14.9
	60	13.4–14.6
	80	13.1–14.5



WAVEFORM CHECK USING AN ANALYZER

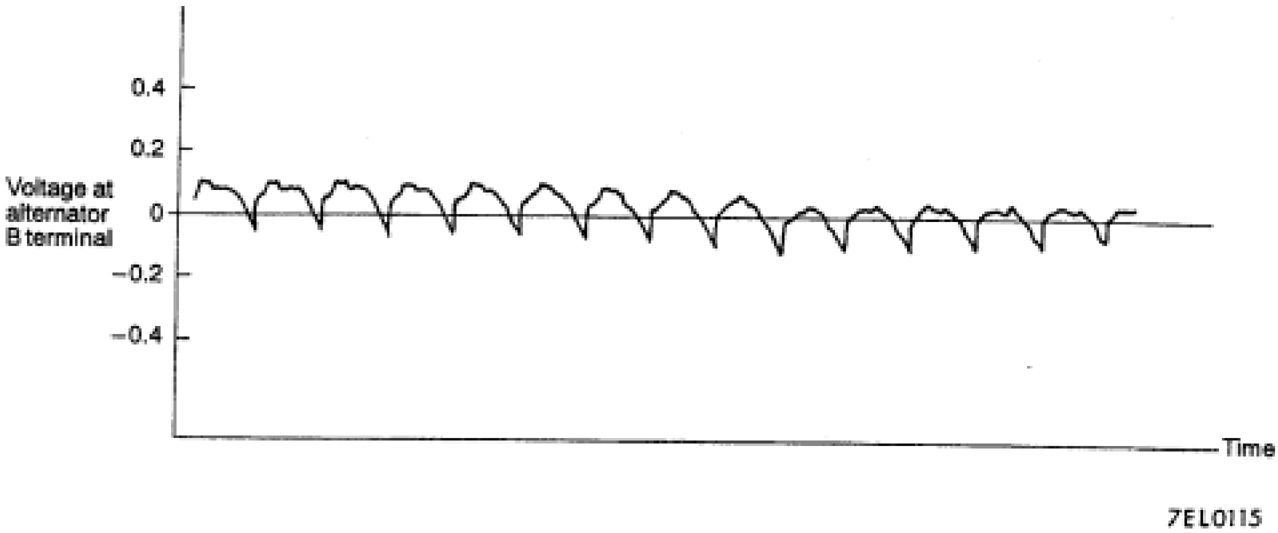
MEASUREMENT METHOD

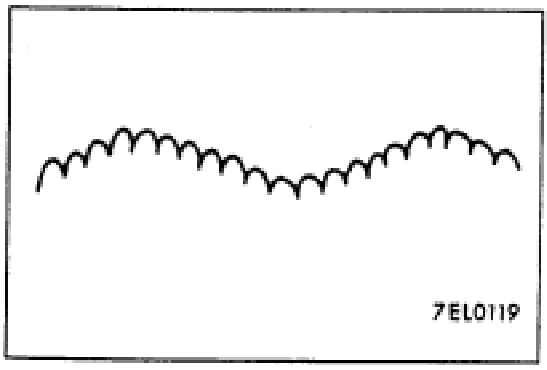
Connect the analyzer special patterns pick-up to the alternator B terminal.

STANDARD WAVEFORM

Observation Conditions

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



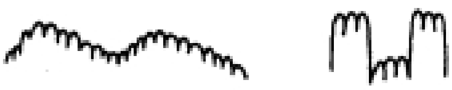
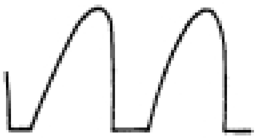


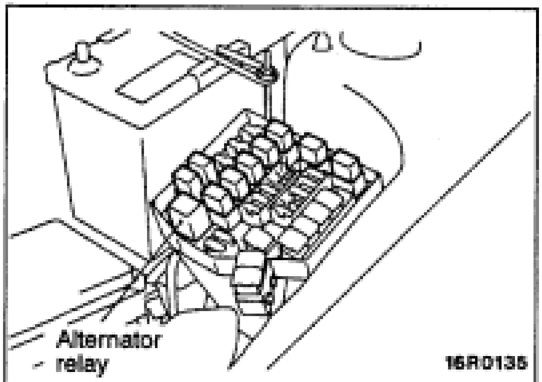
NOTE
The voltage waveform of the alternator B terminal can undulate as shown at left. This waveform is produced when the regulator operates according to fluctuations in the alternator load (current), and is normal for the alternator.
In addition, when the voltage waveform reaches an excessively high value (approx. 2 V or higher at idle), it often indicates an open circuit due to a brown fuse between alternator B terminal and battery, but not a defective alternator.

EXAMPLES OF ABNORMAL WAVEFORMS

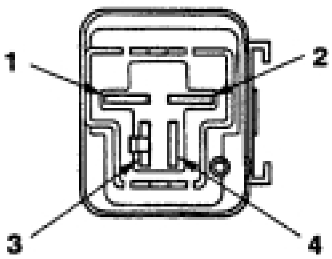
NOTE

1. The size of the waveform patterns differs largely, depending on the adjustment of the variable knob on the analyzer.
2. Identification of abnormal waveforms is easier when there is a large output current (regulator is not operating). (Waveforms can be observed when the headlamps are illuminated.)
3. Check the conditions of the charging warning lamp (illuminated/not illuminated). Also, check the charging system totally.

Abnormal waveforms	Problem cause	Abnormal waveforms	Problem cause
Example 1  A7EL0120	• Open diode	Example 4  A7EL0123	• Short in stator coil
Example 2  A7EL0121	• Short in diode	Example 5  A7EL0124 At this time, the charging warning lamp is illuminated.	• Open supple-mentary diode
Example 3  A7EL0122	• Broken wire in stator coil		



16R0135



16S0148
00008463

ALTERNATOR RELAY CONTINUITY CHECK

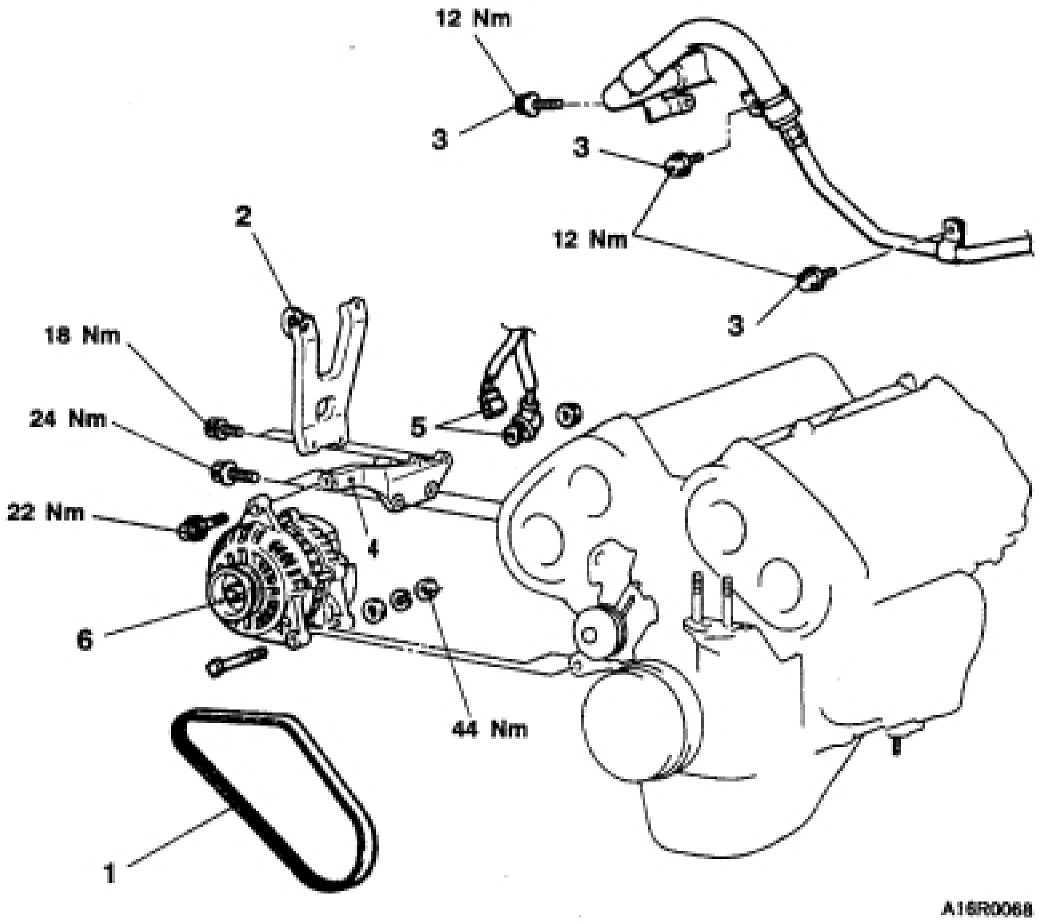
1. Remove the alternator relay from the relay box inside the engine compartment.
2. Set the analogue-type circuit tester to the Ω range and check that there is continuity when the (+) terminal of the tester is connected to terminal 4 of the alternator relay and the (–) terminal is connected to terminal 2.
3. Next, check that there is no continuity when the (+) terminal is connected to terminal 2 and the (–) terminal is connected to terminal 4.
4. If the continuity checks in steps 2 and 3 show a defect, replace the alternator relay.

ALTERNATOR

REMOVAL AND INSTALLATION

Pre-removal Operation
- Air Intake Plenum Removal
  (Refer to GROUP 15 – Intake Manifold.)
- Clutch Master Cylinder and Clutch Hose Bracket Removal <M/T>
  (Refer to GROUP 21 – Clutch Control.)

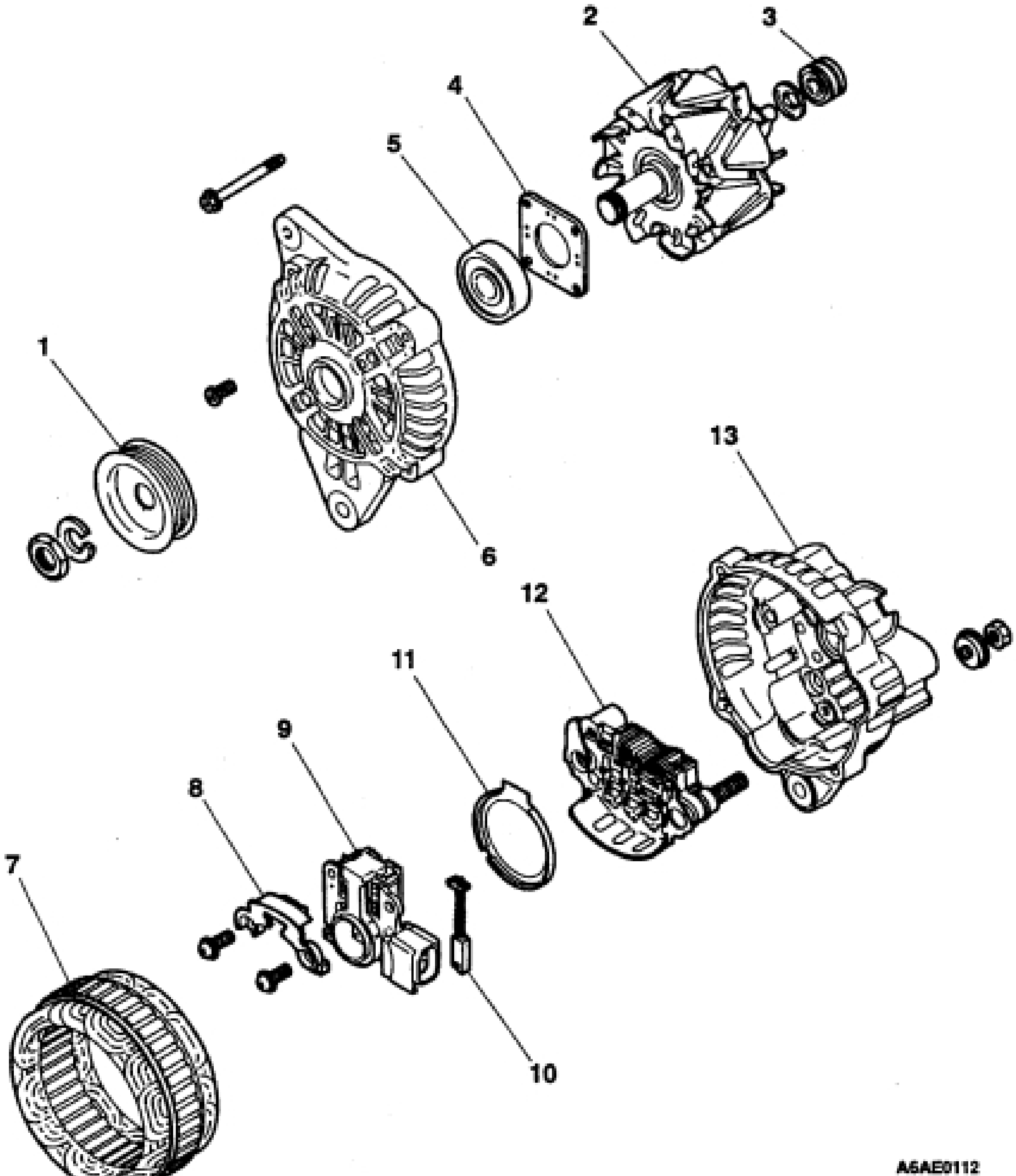
Post-installation Operation
- Clutch Master Cylinder and Clutch Hose Bracket Installation <M/T>
  (Refer to GROUP 21 – Clutch Control.)
- Air Intake Plenum Installation
  (Refer to GROUP 15 – Intake Manifold.)
- Drive Belt Adjustment
  (Refer to GROUP 11A – On-vehicle Service.)



Removal steps

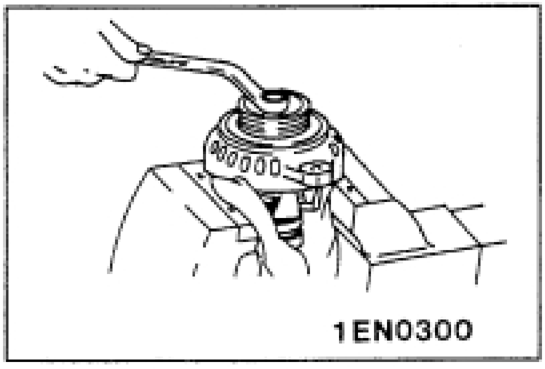
1. Drive belt (Alternator)
2. Air intake plenum stay
3. Oil pressure hose and pipe clamp bolt
4. Alternator bracket
5. Alternator connector
6. Alternator

DISASSEMBLY AND REASSEMBLY



Disassembly steps

◄A► 1. Alternator pulley
►B◄ 2. Rotor
3. Rear bearing
4. Bearing retainer
5. Front bearing
◄B► 6. Front bracket
◄C► 7. Stator
8. Plate
◄C► ►A◄ 9. Regulator assembly
10. Brush
11. Slinger
12. Rectifier
13. Rear bracket

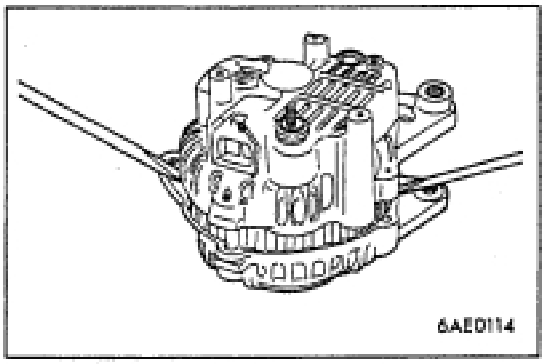


DISASSEMBLY SERVICE POINTS

◀A▶ ALTERNATOR PULLEY REMOVAL

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

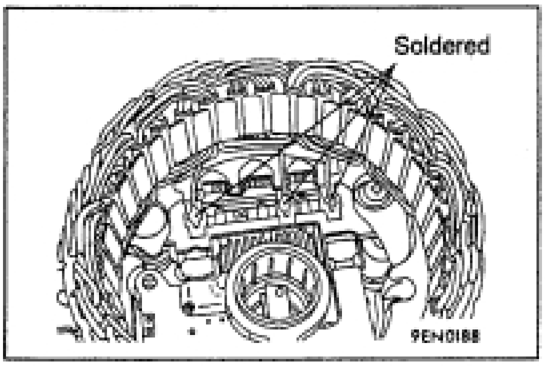
Caution
Use care so that the rotor is not damaged.



◀B▶ FRONT BRACKET REMOVAL

Insert a flat tip screwdriver, etc., in the clearance between the front bracket and stator core, to pry open and separate the stator and front bracket.

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



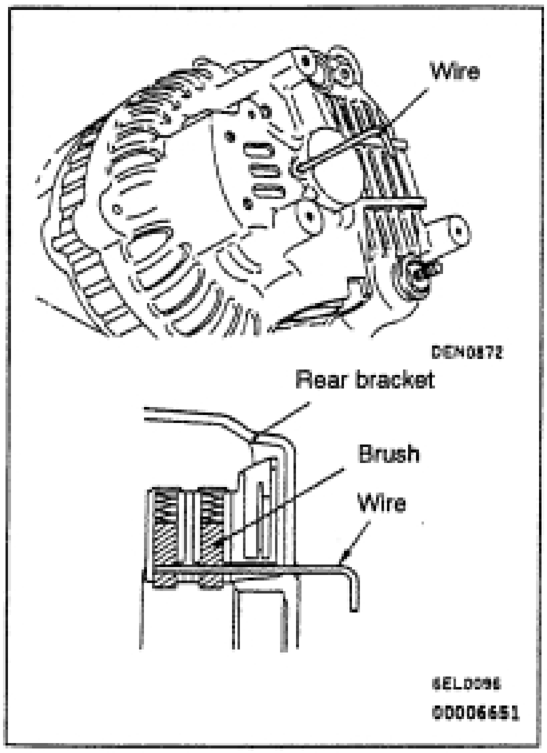
◀C▶ STATOR/REGULATOR ASSEMBLY REMOVAL

(1) When removing the stator, remove the stator lead wire soldered onto the main diode of the rectifier.
(2) When removing the rectifier from the regulator assembly, remove the soldered sections of the rectifier.

Caution
1. **Use care to make sure that the heat of the soldering iron is not transmitted to the diodes for a long period.**
2. **Use care that no undue force is exerted to the lead wires of the diodes.**

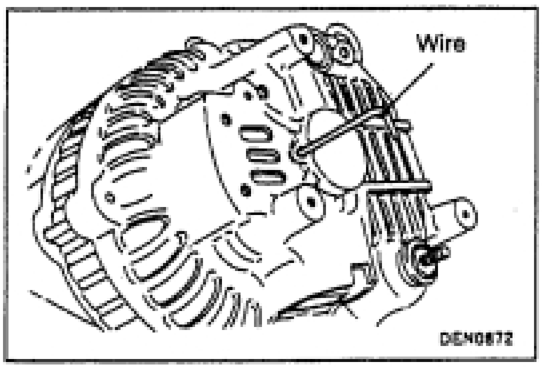
REASSEMBLY SERVICE POINTS

▶A◀ REGULATOR ASSEMBLY INSTALLATION



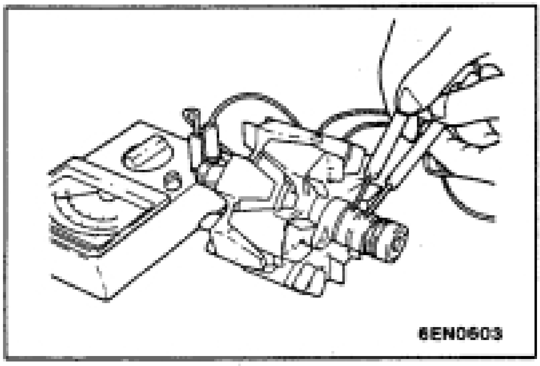
After installing the regulator assembly, insert a wire into the hole provided on the rear bracket while pressing in the brush to fix the brush.

NOTE
The brush is fixed when a wire is inserted, making rotor installation easier.



▶B◀ ROTOR INSTALLATION

After installing the rotor, remove the wire used to fix the brush.

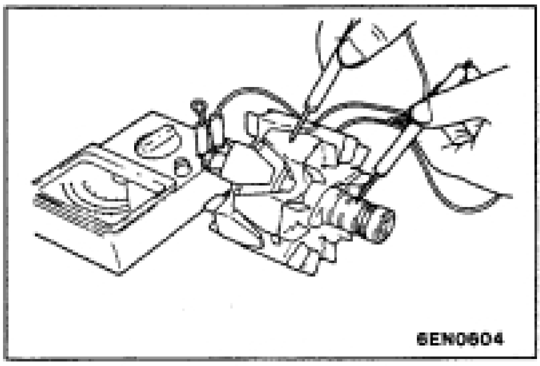


INSPECTION

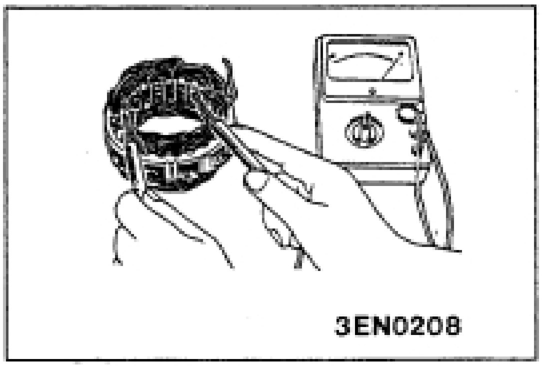
ROTOR CHECK

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

   Standard value: 3 – 5 Ω

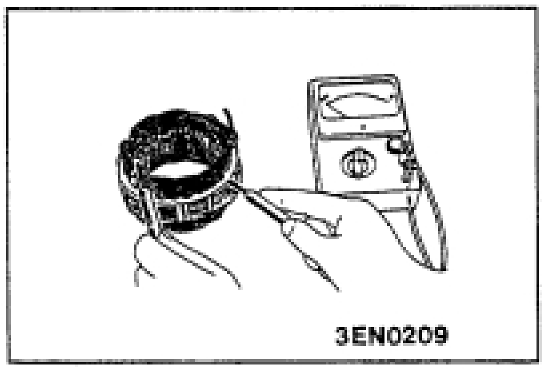


2. Check the continuity between the slip ring and core, and if there is continuity, replace the rotor.



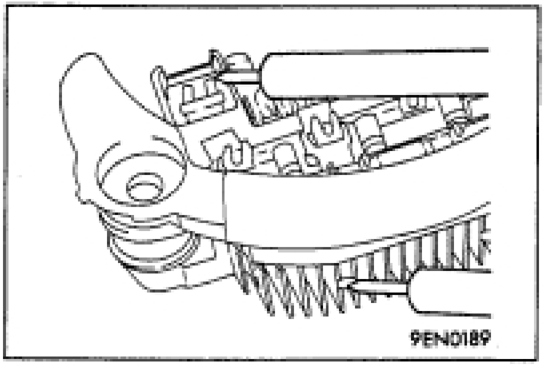
STATOR CHECK

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

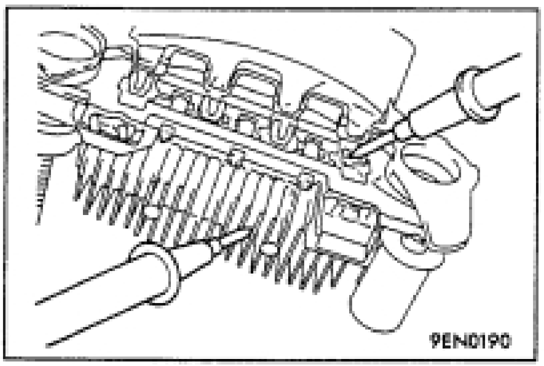


2. Check the continuity between the coil and core, and if there is continuity, replace the stator.

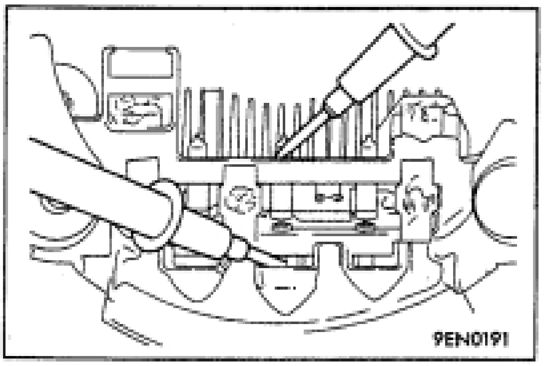
RECTIFIER CHECK



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

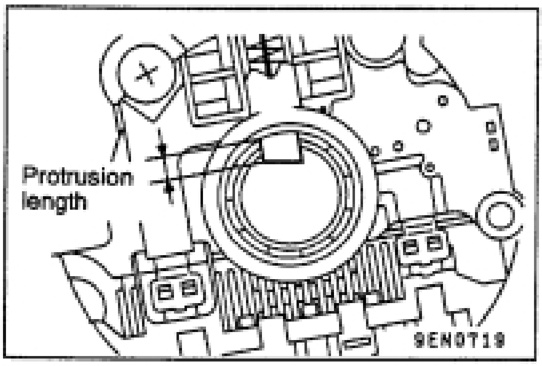


2. Inspect the (–) heat sink by checking the continuity between the (–) heat sink and stator coil lead wire connection terminal using a tester probe.
   If there is a continuity at both, the diode is short circuited, so replace the rectifier.

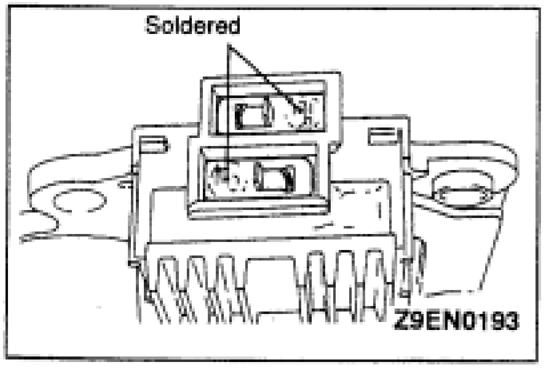


3. Check the diode trio by connecting an ohmmeter to both ends of each diode and check the continuity of the three diodes.
   If there is a continuity at both ends, or if there is no continuity, the diode is damaged so replace the rectifier.

BRUSH CHECK



1. Measure the length of the brush protrusion shown in the illustration, and replace the brush if the measured value is below the limit value.
   Limit: 2 mm or less

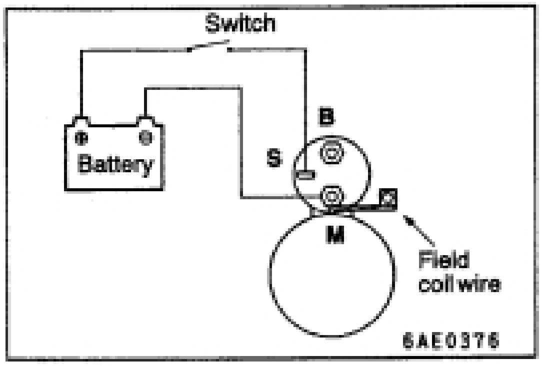


2. The brush can be removed if the solder of the brush lead wire is removed.
3. When installing a new brush, insert the brush into the holder as shown in the illustration, and then solder the lead wires.

STARTING SYSTEM

SERVICE SPECIFICATIONS

Items	Standard value	Limit
Pinion gap mm	0.5 – 2.0	–
Commutator outer diameter mm	29.4	28.8
Commutator runout mm	–	0.05
Commutator undercut mm	0.5	0.2



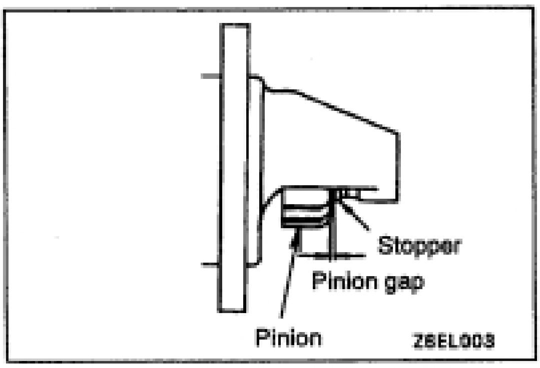
STARTER MOTOR

INSPECTION

PINION GAP ADJUSTMENT

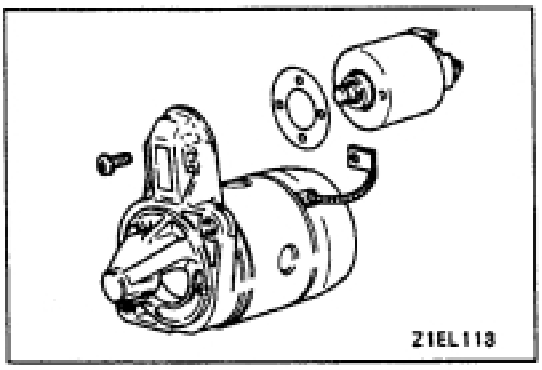
1. Disconnect field coil wire from M-terminal of magnetic switch.
2. Connect a 12V battery between S-terminal and M-terminal.
3. Set switch to "ON", and pinion will move out.

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

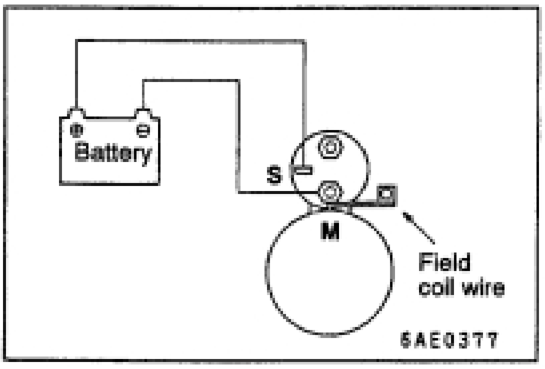


4. Check pinion to stopper clearance (pinion gap) with a thickness gauge.

   Pinion gap: 0.5–2.0 mm



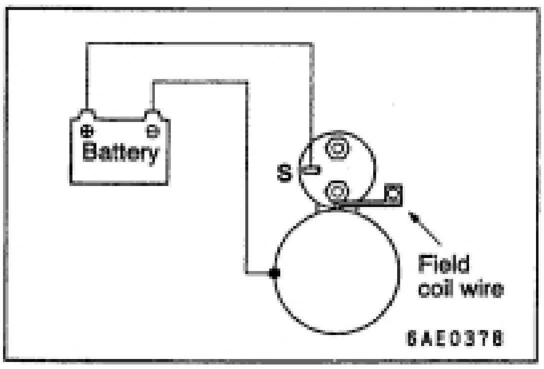
5. If pinion gap is out of specification, adjust by adding or removing gaskets between magnetic switch and front bracket.



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.

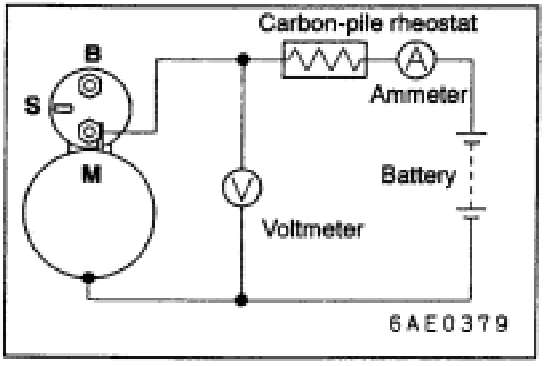
   Caution
   This test must be performed quickly (in less than 10 seconds) to prevent coil from burning.
3. If pinion moves out, then pull-in coil is good. If it doesn't, replace magnetic switch.



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.

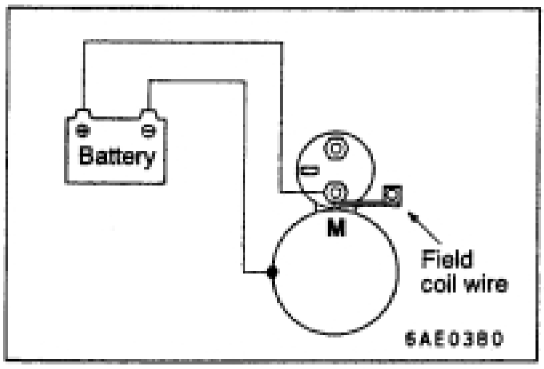
   Caution
   This test must be performed quickly (in less than 10 seconds) to prevent coil from burning.
3. Manually pull out the pinion as far as the pinion stopper position.
4. If pinion remains out, everything is in order. If pinion moves in, hold-in circuit is open. Replace magnetic switch.



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



MAGNETIC SWITCH RETURN TEST

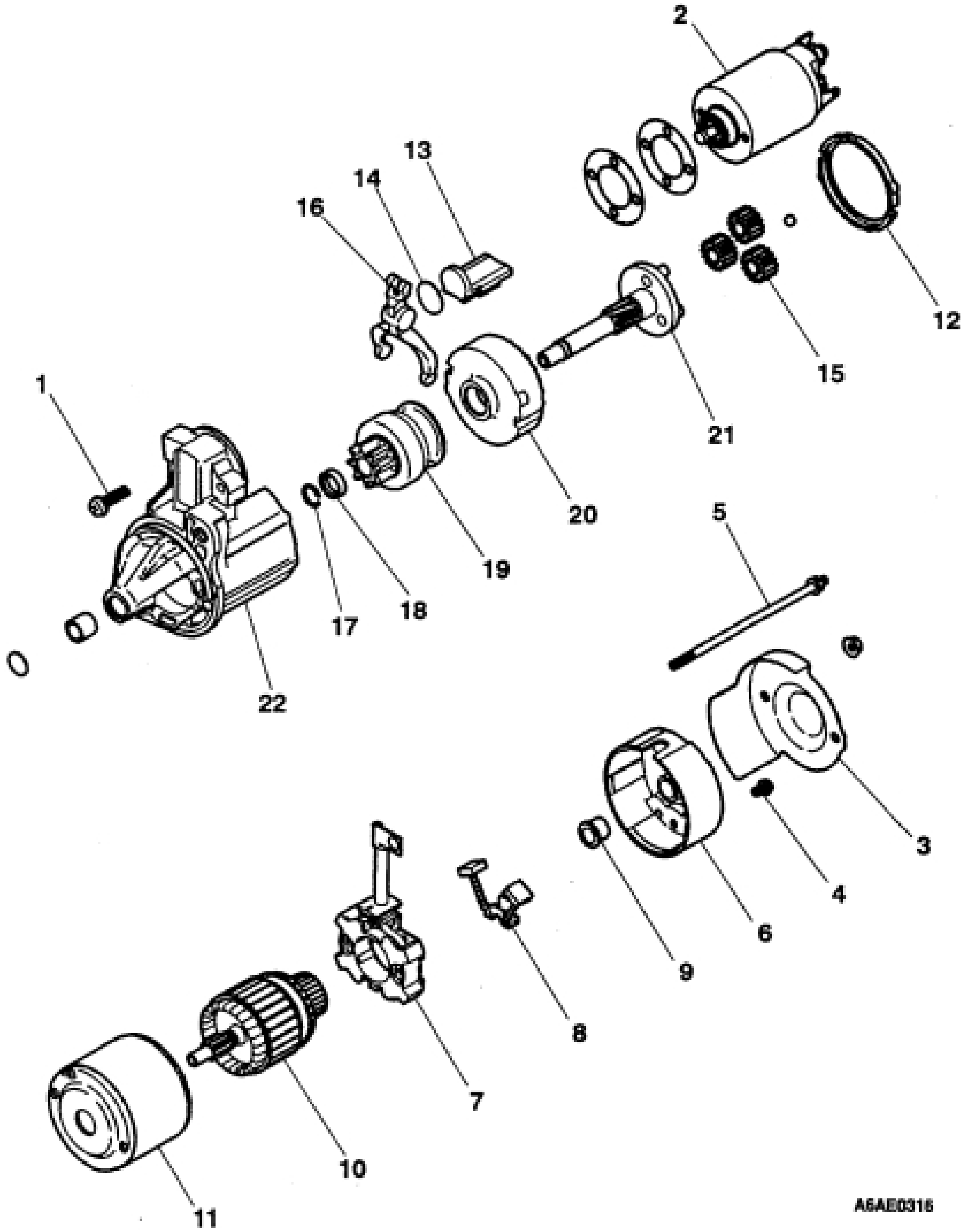
1. Disconnect field coil wire from M-terminal of magnetic switch.
2. Connect a 12V battery between M-terminal and body.

   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.

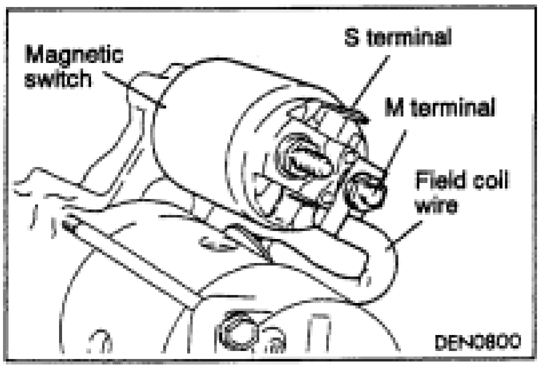
   Caution
   Be careful not to get your fingers caught when pulling out the pinion.

DISASSEMBLY AND REASSEMBLY



Disassembly steps

	1. Screw		12. Packing A
◄A►	2. Magnetic switch		13. Packing B
	3. Starter cover		14. Plate
	4. Screw		15. Planetary gear
	5. Through bolt		16. Lever
	6. Rear bracket	◄C► ►A◄	17. Snap ring
	7. Brush holder	◄C► ►A◄	18. Stop ring
	8. Brush		19. Overrunning clutch
	9. Rear bearing		20. Internal gear
◄B►	10. Armature		21. Planetary gear holder
	11. Yoke assembly		22. Front bracket



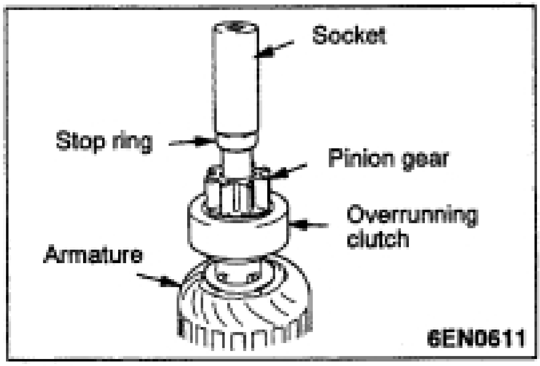
DISASSEMBLY SERVICE POINTS

◀A▶ MAGNETIC SWITCH REMOVAL

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

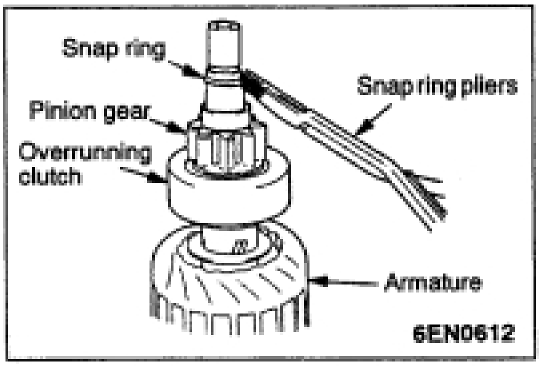
◀B▶ ARMATURE REMOVAL

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



◀C▶ SNAP RING/STOP RING REMOVAL

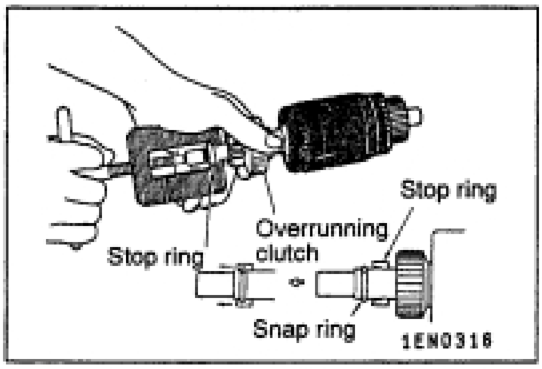
1. Using an appropriate wrench socket, push the stop ring toward the overrunning clutch.



2. Remove the snap ring with snap ring pliers and then remove the stop ring and overrunning clutch.

STARTER MOTOR PARTS CLEANING

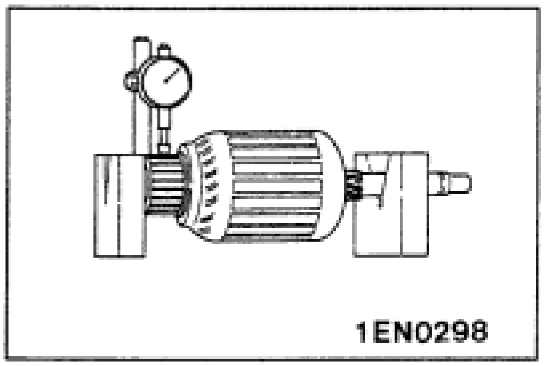
1. Do not immerse the parts in cleaning solvent. Immersing the yoke and field coil assembly and/or armature will damage insulation. Wipe these parts with a cloth only.
2. Do not immerse the drive unit in cleaning solvent. The overrunning clutch is pre-lubricated at the factory and solvent will wash lubrication from clutch.
3. The drive unit may be cleaned with a brush moistened with cleaning solvent and wiped dry with a cloth.



REASSEMBLY SERVICE POINTS

▶A◀ STOP RING/SNAP RING INSTALLATION

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



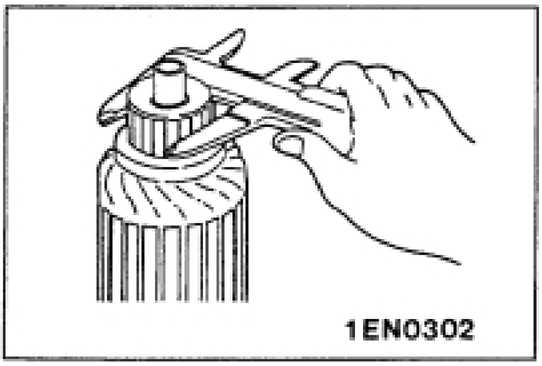
INSPECTION

COMMUTATOR

1. Place the armature in a pair of "V" blocks and check the runout with a dial indicator.

   Standard value: 0.05 mm

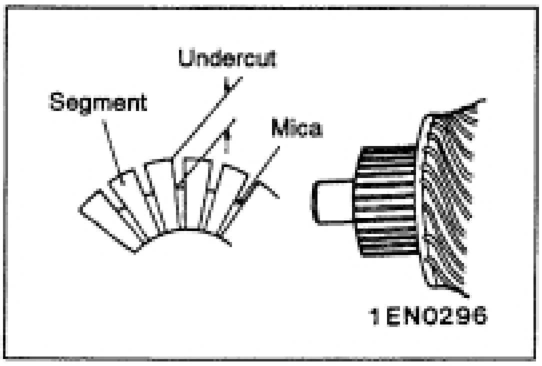
   Limit: 0.1 mm



2. Measure the commutator outer diameter.

   Standard value: 29.4 mm

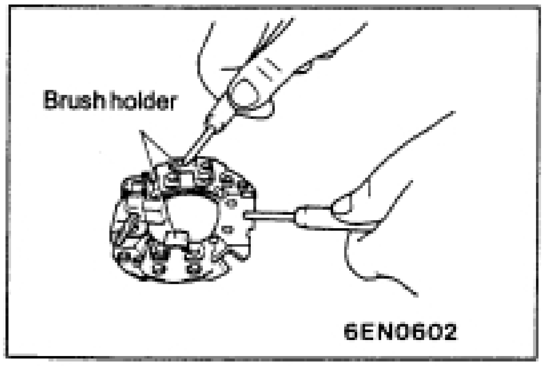
   Limit: 28.8 mm



3. Check the undercut depth between segments.

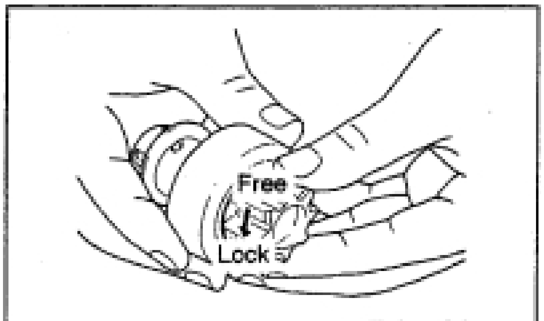
   Standard value: 0.5 mm

   Limit: 0.2 mm



BRUSH HOLDER

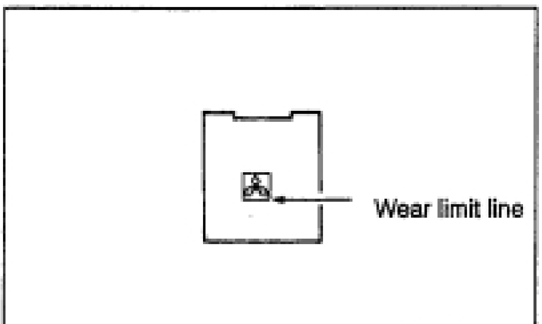
Check the continuity between brush holder plate and brush holder.
If there is no continuity, the brush holder is in order.



1EN0293

OVERRUNING CLUTCH

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

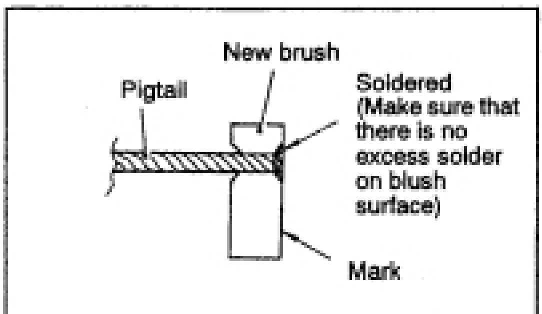


1EN0292

BRUSH

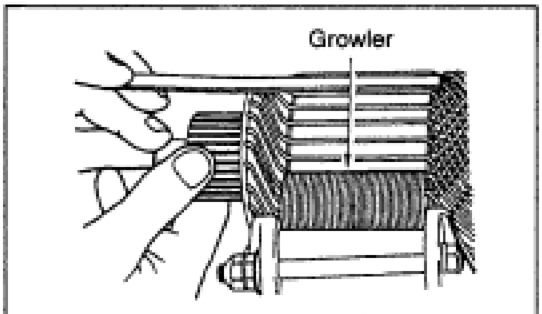
1. Check the brush for roughness of the surface that contacts the commutator and check the brush length.

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



1EN0295

3. When removing a worn brush by breaking with pliers, use care to prevent damage to the pigtail.
4. Polish the pigtail end for secure soldering.
5. Insert the pigtail into the hole of a new brush and solder. Make sure that there is no excess solder on the brush surface.

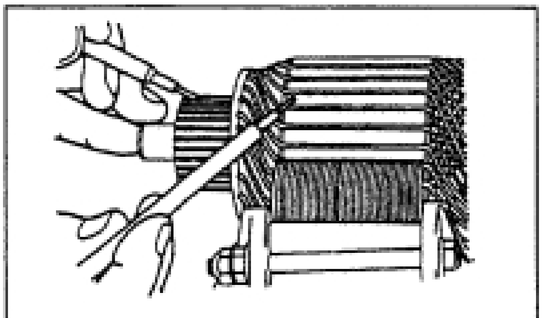


6EN0600

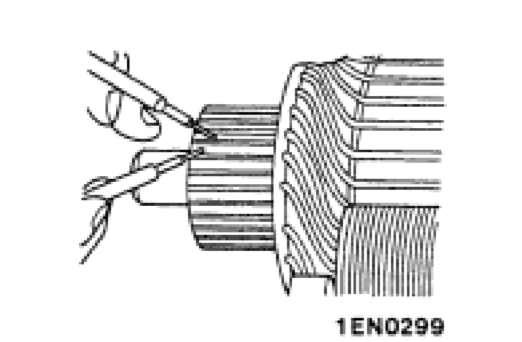
ARMATURE COIL SHORT-CIRCUIT TEST

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

   Caution
   Clean the armature surface thoroughly before checking.


6EN0601

3. Check the insulation between each commutator segment and armature coil core.
   If there is no continuity, the insulation is in order.



ARMATURE COIL OPEN-CIRCUIT INSPECTION

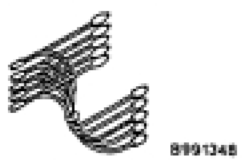
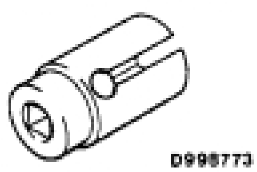
Check the continuity between segments. If there is continuity, the coil is in order.

IGNITION SYSTEM

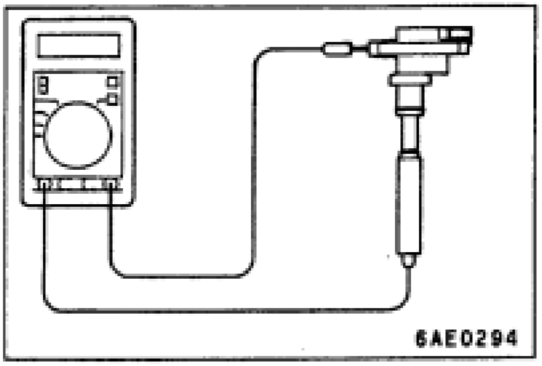
SERVICE SPECIFICATIONS

Items	Standard Value	Limit	Remark
Ignition secondary coil resistance kΩ	17 – 25	–	–
Ignition failure sensor resistance Ω	0.1 or less	–	–
Spark plug cable resistance kΩ	–	max.22	–
Spark plug gap mm	0.7 – 0.8	–	Left bank
	0.7 – 0.8	1.1	Right bank

SPECIAL TOOLS

Tool	Number	Name	Use
	MB991348	Test harness set	Ignition primary voltage check
	MD998773	Detonation sensor wrench	Detonation sensor removal and installation

ON-VEHICLE SERVICE



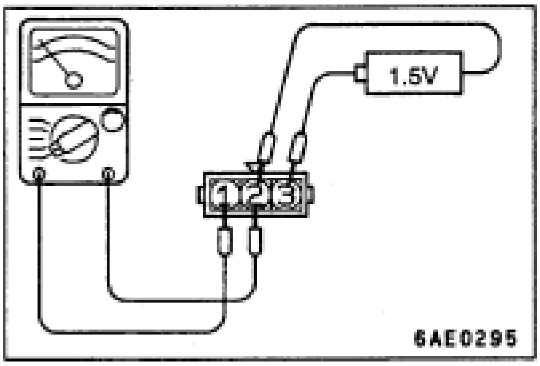
IGNITION COIL (WITH BUILT-IN POWER TRANSISTOR) CHECK

Check by following procedure, and replace if there is a malfunction.

SECONDARY COIL RESISTANCE CHECK

Measure the resistance between the high-voltage terminals of the ignition coil.

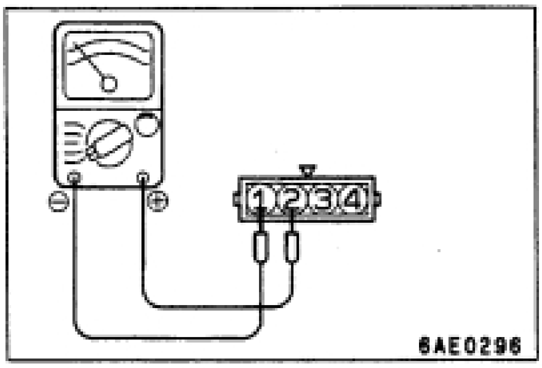
Standard value: 17 – 25 kΩ



PRIMARY COIL AND POWER TRANSISTOR CONTINUITY CHECK

NOTE
An analogue-type circuit tester should be used. Connect the positive (+) prove (red) of the circuit tester to terminal 2, and negative (–) prove (black) of the circuit tester to terminal 1.
Check the continuity between terminals 1 and 2 when current is flowing and not flowing.

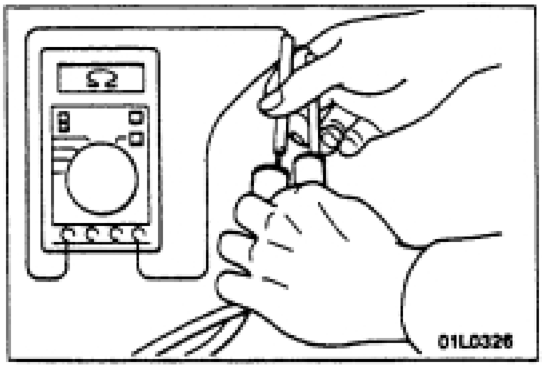
Voltage: 1.5 V	Terminal No.		
	1	2	3
When current is flowing	○	⊖ ○	⊕
When current is not flowing			



IGNITION FAILURE SENSOR CHECK

Use an analogue-type circuit tester to check the continuity between terminals 1 and 2, and that the resistance is within the standard value.

Standard value: 0.1 Ω or less



SPARK PLUG CABLE CHECK

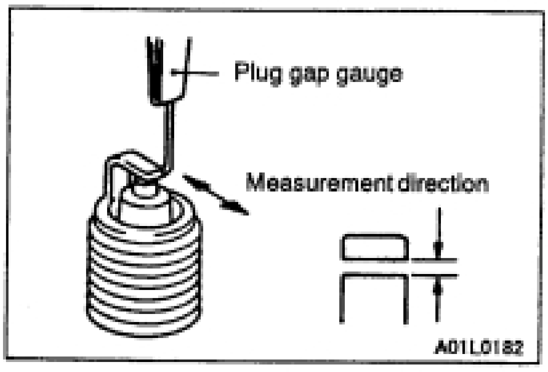
Measure the resistance of each spark plug cables.

Limit: max. 22 kΩ

SPARK PLUG CHECK, CLEANING AND REPLACEMENT

<Left bank>

1. Check for burned out electrode or damaged insulator. Check for even burning.
2. Remove carbon deposits with wire brush or plug cleaner.



3. Use a plug gap gauge to check that the plug gap is within the standard value range.

Standard value:

Maker	Model	Standard value (mm)
NGK	BKR7EKC-N	0.7 – 0.8

<Right bank>

Check the plug gap. If the gap exceeds the limit, replace the plug.

Standard value, limit:

Maker	Model	Standard value (mm)	Limit (mm)
NGK	PFR7M	0.7 – 0.8	1.1

Caution
(1) Do not adjust the gap of a platinum plug.
(2) If a platinum plug is cleaned, a platinum tip may be damaged. Therefore, if the plug needs to be cleaned due to deposits, clean the plug within 20 seconds with a plug cleaner only. Do not use a wire brush.

CAMSHAFT POSITION SENSOR CHECK

Refer to GROUP 13A – Troubleshooting.

CRANK ANGLE SENSOR CHECK

Refer to GROUP 13A – Troubleshooting.

DETONATION SENSOR CHECK

Check the detonation sensor circuit if self-diagnosis code No.31 is shown.

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

WAVEFORM CHECK USING AN ANALYZER

Ignition Secondary Voltage Waveform Check

MEASUREMENT METHOD

1. Clamp the secondary pickup around a spark plug cable.

   NOTE

   (1) The peak of the ignition voltage will be reversed when the spark plug cables of No.4, No.5, No.6 cylinders are clamped and when the spark plug cables of No.1, No.2 and No.3 cylinders are clamped.

   (2) Because of the two-cylinder simultaneous ignition system, the waves for two cylinder in each group appear during wave observation (No.1 cylinder-No.4 cylinder, No.2 cylinder-No.5 cylinder, No.3-cylinder-No.6 cylinder). However, wave observation is carried out for the cylinder with the spark plug cable clamped by the secondary pickup.

2. Clamp the spark plug cable with the Trigger pickup.

   NOTE

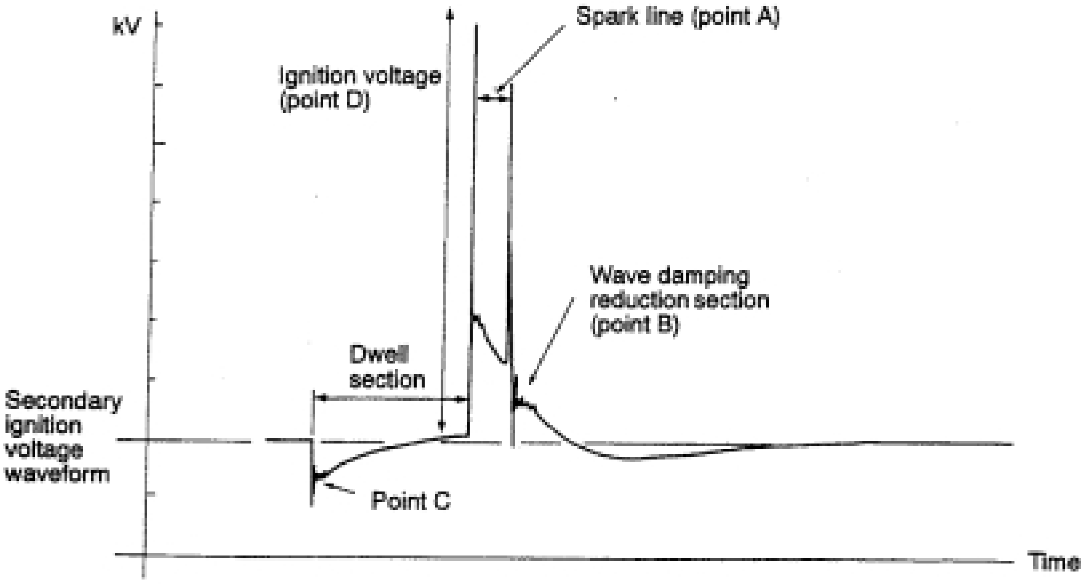
   (1) Clamp the spark plug cable for the No.1, No.2 or No.3 cylinder of the same group with the cylinder that is clamped with the secondary pickup.

   (2) It can be difficult to identify which cylinder waveform is displayed, but the waveform of the cylinder which is clamped with the secondary pickup will be stable, so this can be used as a reference for identification.

STANDARD WAVEFORM

Observation Conditions

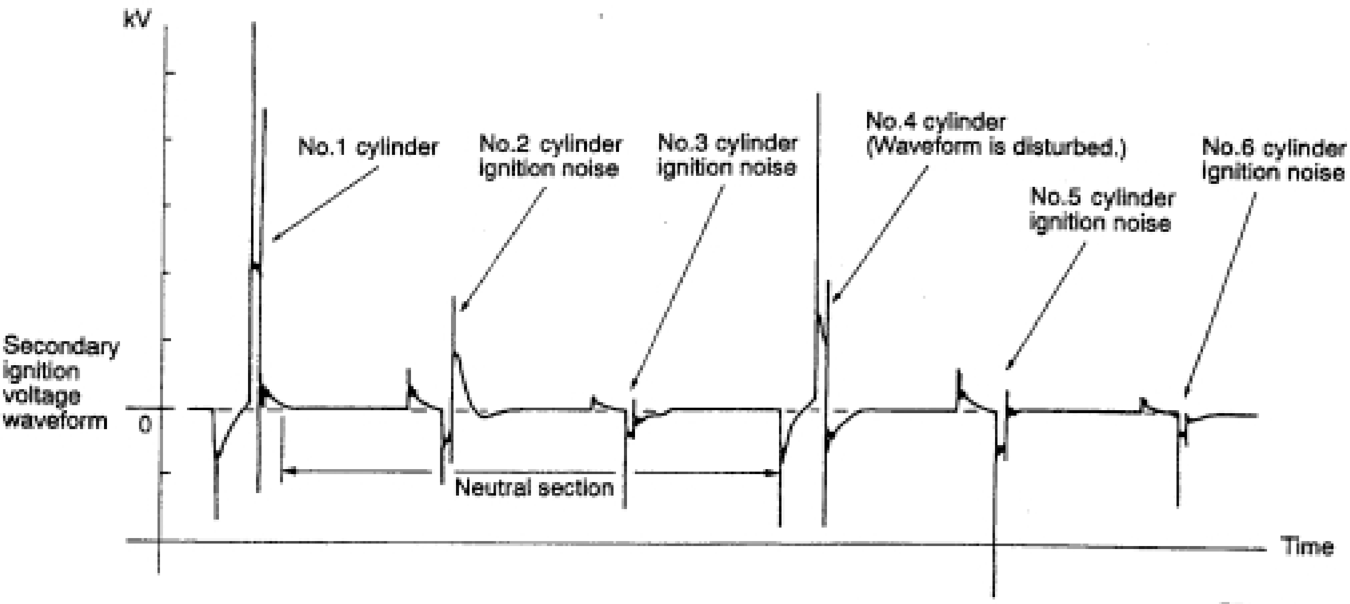
Function	Secondary
Pattern height	High (or Low)
Pattern selector	Raster
Engine revolutions	Curb idle speed



7EL0147

Observation Condition (The only change from above condition is the pattern selector.)

Pattern selector	Display



7EL0148

WAVEFORM OBSERVATION POINTS

Point A: The height, length and slope of the spark line show the following trends (Refer to abnormal waveform examples, 1, 2, 3 and 4).

Spark line		Plug gap	Condition of electrode	Compression force	Concentration of air mixture	Ignition timing	Spark plug cable
Length	Long	Small	Normal	Low	Rich	Advanced	Leak
	Short	Large	Large wear	High	Lean	Retarded	High resistance
Height	High	Large	Large wear	High	Lean	Retarded	High resistance
	Low	Small	Normal	Low	Rich	Advanced	Leak
Slope		Large	Plug is fouled	–	–	–	–

Point B: Number of vibration in reduction vibration section (Refer to abnormal waveform example 5)

Number of vibrations	Coil and condenser
Three or more	Normal
Except above	Abnormal

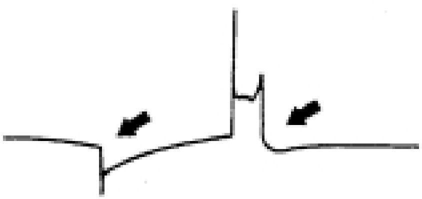
Point C: Number of vibrations at beginning of dwell section (Refer to abnormal waveform example 5)

Number of vibrations	Coil
5–6 or higher	Normal
Except above	Abnormal

Point D: Ignition voltage height (distribution per each cylinder) shows the following trends.

Ignition voltage	Plug gap	Condition of electrode	Compression force	Concentration of air mixture	Ignition timing	Spark plug cable
High	Large	Large wear	High	Lean	Retarded	High resistance
Low	Small	Normal	Low	Rich	Advanced	Leak

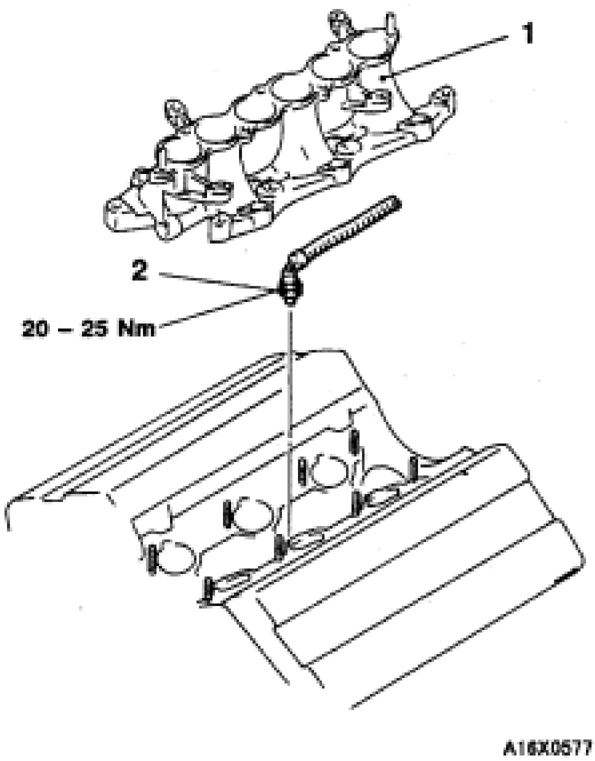
EXAMPLES OF ABNORMAL WAVEFORMS

Abnormal waveform	Wave characteristics	Cause of problem
Example 1  01P0215	Spark line is high and short.	Spark plug gap is too large.
Example 2  01P0216	Spark line is low and long, and is sloping. Also, the second half of the spark line is distorted. This could be a result of misfiring.	Spark plug gap is too small.
Example 3  01P0217	Spark line is low and long, and is sloping. However, there is almost no spark line distortion.	Spark plug gap is fouled.
Example 4  01P0218	Spark line is high and short. Difficult to distinguish between this and abnormal waveform example 1.	Spark plug cable is nearly falling off. (Causing a dual ignition)
Example 5  01P0219	No waves in wave damping section.	Layer short in ignition coil

DETONATION SENSOR

REMOVAL AND INSTALLATION

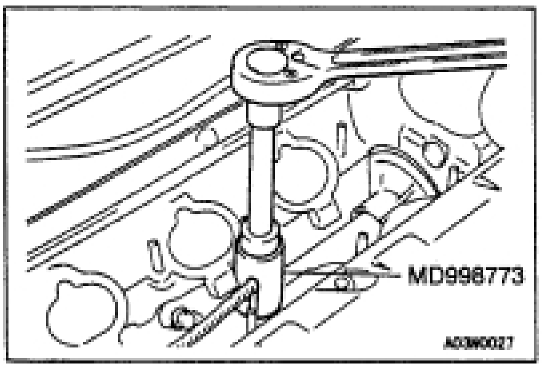
Pre-removal Operation	Post-installation Operation
Fuel Discharge Prevention (Refer to GROUP 13A – On-vehicle Service.)	• Accelerator Cable adjustment (Refer to GROUP 13B – On-vehicle Service.) • Fuel Leakage Check



Removal steps

1. Intake manifold
   (Refer to GROUP 15.)

◀A▶ ▶A◀ 2. Detonation sensor



REMOVAL SERVICE POINT

◀A▶ DETONATION SENSOR REMOVAL

INSTALLATION SERVICE POINT

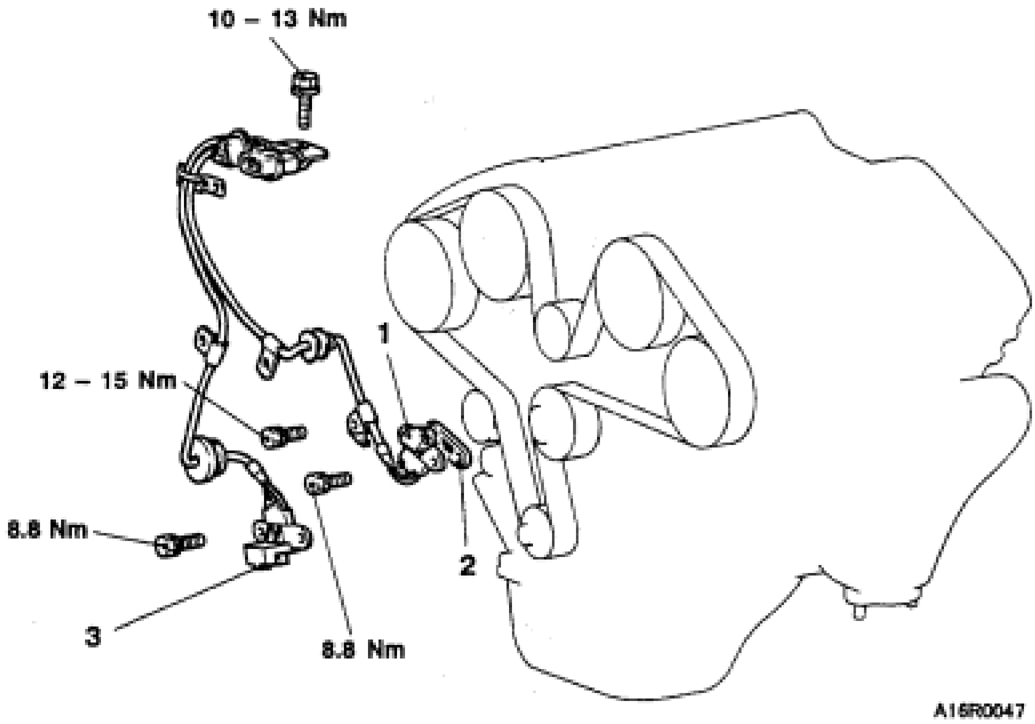
▶A◀ DETONATION SENSOR INSTALLATION

Always observe the specified tightening torque, otherwise the engine control will be influenced.

CAMSHAFT POSITION SENSOR AND CRANK ANGLE SENSOR

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Timing Belt Cover Removal and Installation
(Refer to GROUP 11A – Timing Belt.)



Removal steps

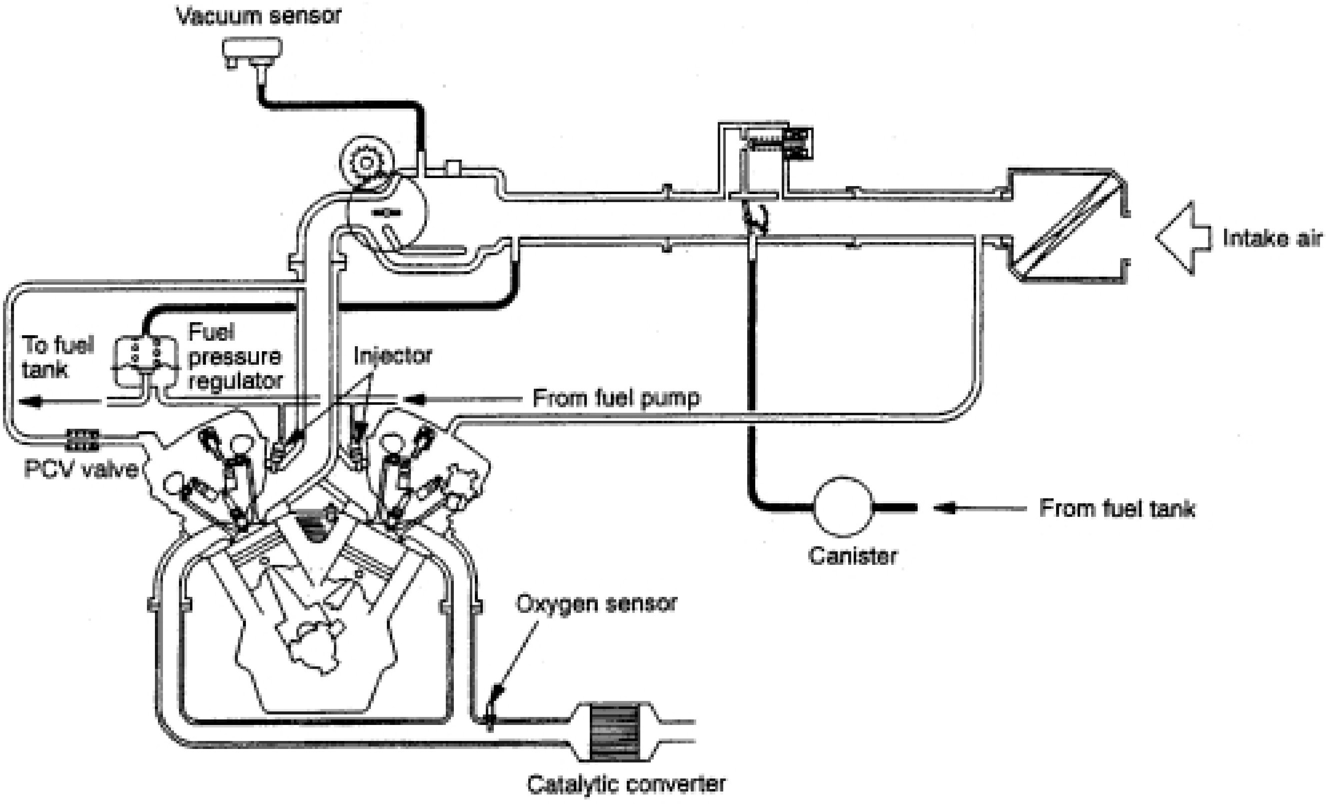
1. Camshaft position sensor
2. Spacer
3. Crank angle sensor

EMISSION CONTROL

CONTENTS

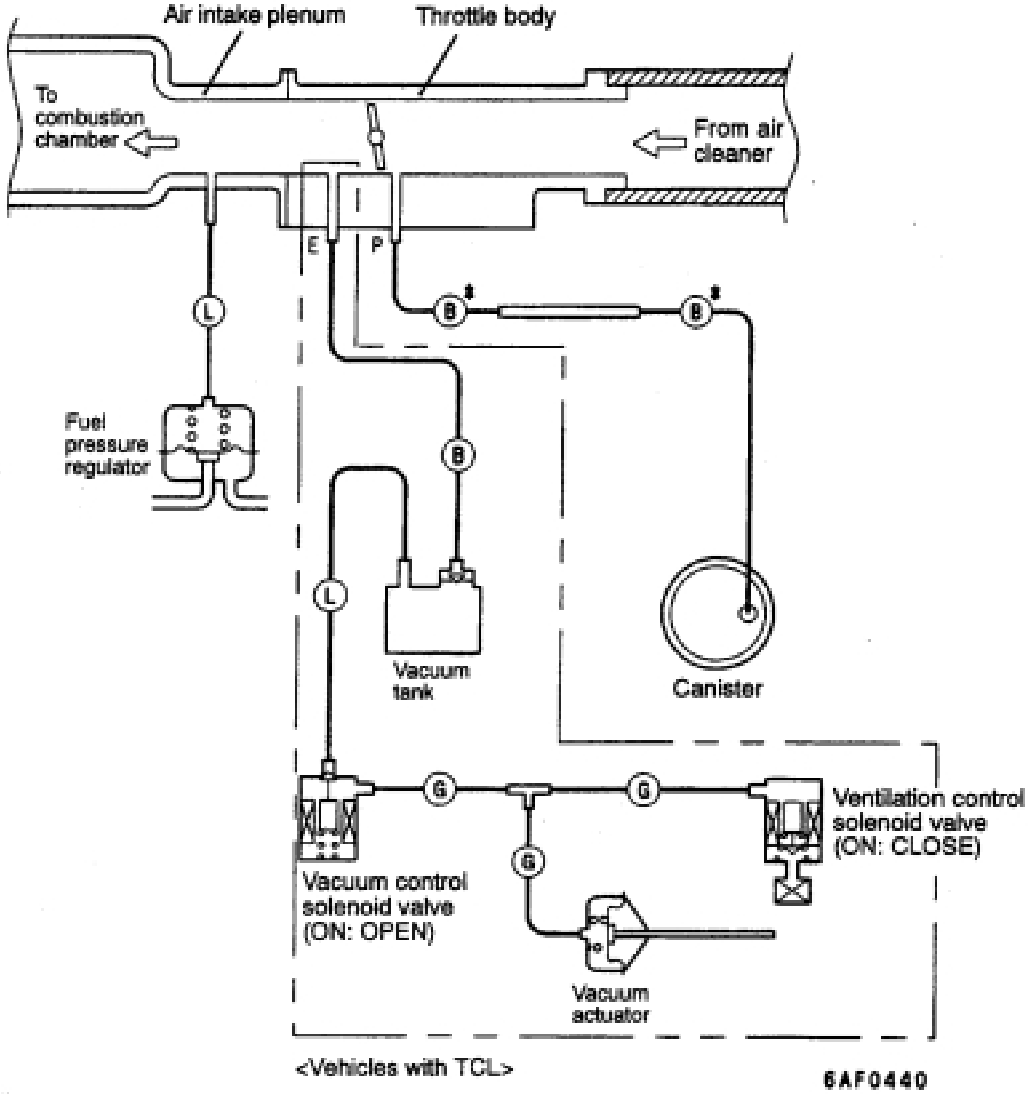
ON-VEHICLE SERVICE

SYSTEM DIAGRAM



6AF0439

VACUUM CIRCUIT DIAGRAM



Vacuum hose colour
B: Black
G: Green
L: Light blue
Y: Yellow

*: Red for vehicles with TCL

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.

EMISSION CONTROL DEVICE REFERENCE TABLE

Parts	Air/fuel ratio control system	Blow-by gas re-circula-tion sys-tem	Evapo-rative emis-sion control system	Over-heat warning system	Catalyt-ic con-verter	Refer-ence page
Engine-ECU	○					–
Oxygen sensor	○					*
Vacuum sensor	○					*
Intake air temperature sensor	○					*
Coolant temperature sensor	○					*
Throttle position sensor	○					*
Idle position switch	○					*
Crank angle sensor	○					*
Camshaft position sensor	○					*
Injector	○					*
Positive crank case ventilation (PCV) valve		○				17-5
Canister			○			17-7
Catalytic convertor					○	17-7

NOTE
*: Refer to GROUP 13A – On-vehicle Service.

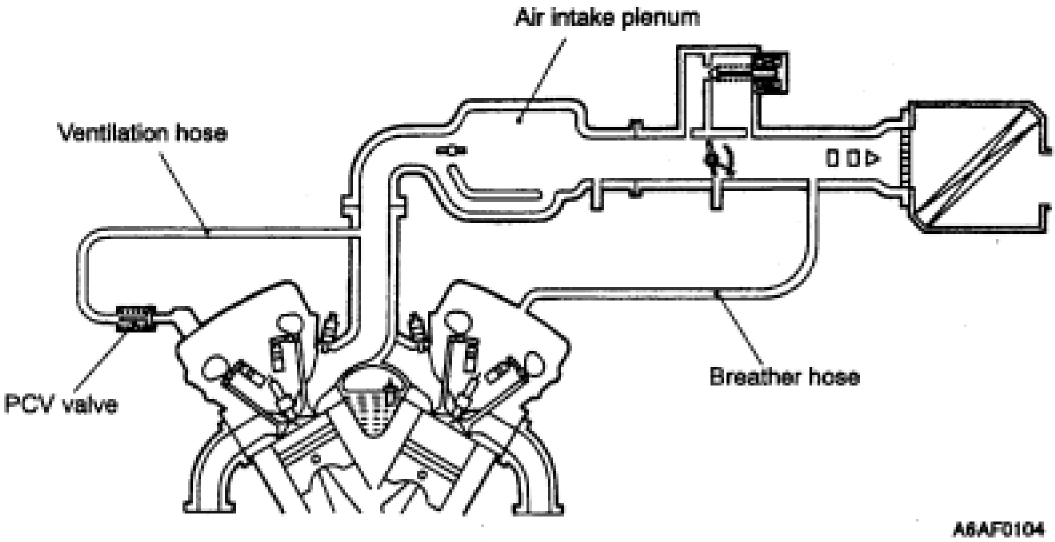
EMISSION CONTROL SYSTEM CHECK

Caution
Check each system after engine adjustment.

AIR/FUEL RATIO CONTROL SYSTEM CHECK (MPI)

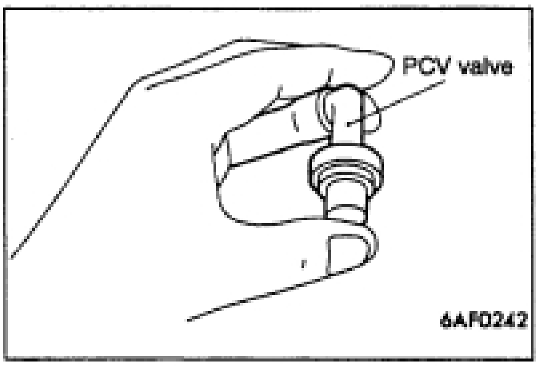
Refer to GROUP 13A – On-vehicle Service.

BLOW-BY GAS RECIRCULATION SYSTEM



POSITIVE CRANKCASE VENTILATION SYSTEM CHECK

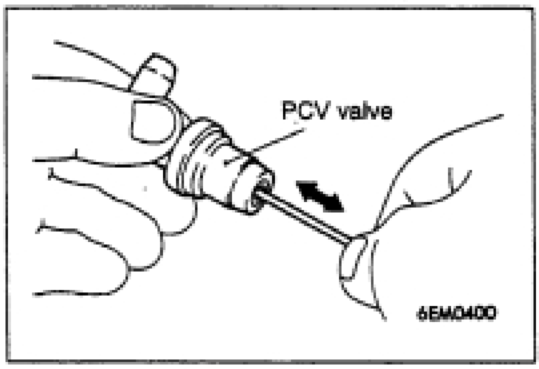
1. Remove the ventilation hose from the PCV valve.
2. Remove the PCV valve from the rocker cover.
3. Reinstall the PCV valve at the ventilation hose.
4. Start the engine and run at idle.



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

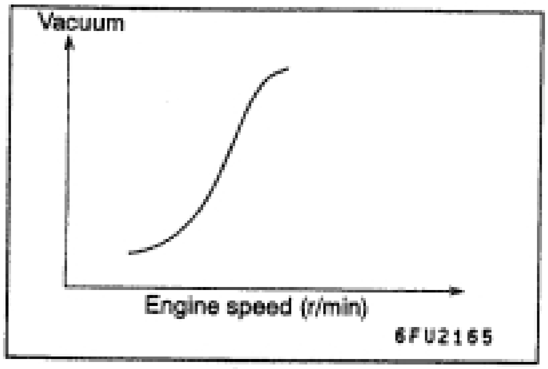


1. Insert a thin rod into the PCV valve from the side shown in the illustration (rocker cover installation side), and move the rod back and forth to check that the plunger moves.
2. If the plunger does not move, there is clogging in the PCV valve. In this case, clean or replace the PCV valve.

EVAPORATIVE EMISSION CONTROL SYSTEM

PURGE PORT VACUUM CHECK

1. Disconnect the vacuum hose (vehicles with TCL: red stripe, vehicles without TCL: black stripe) from the throttle body purge vacuum nipple and connect a hand vacuum pump to the nipple.

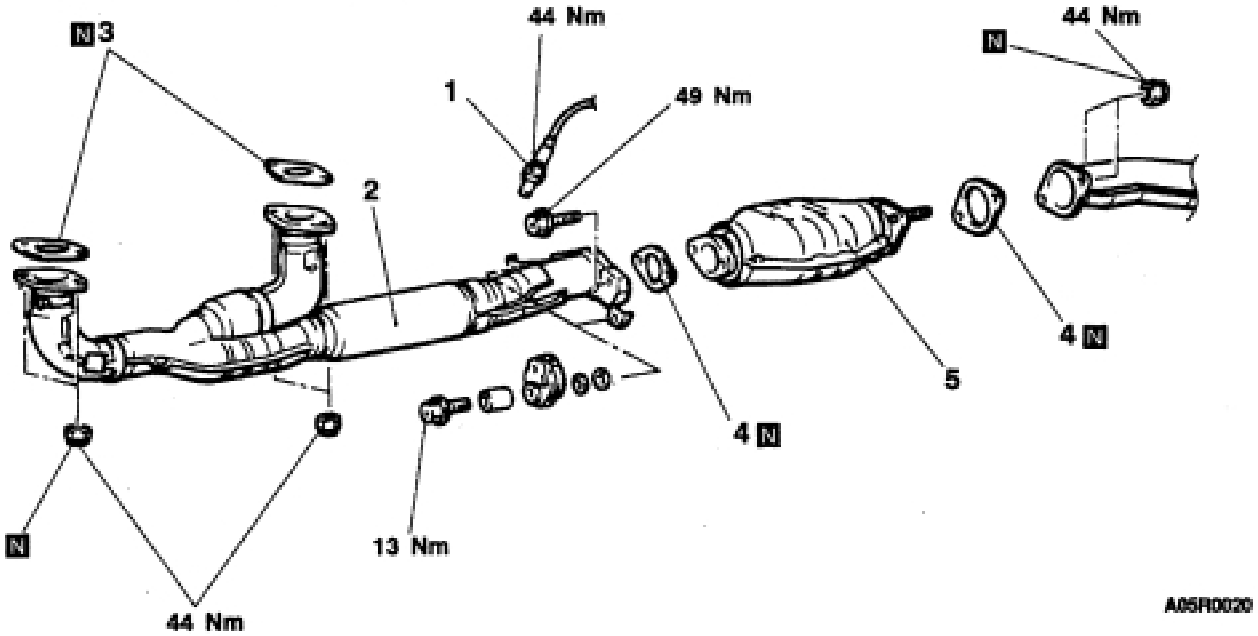


2. Start the engine and check that, after raising the engine speed by racing the engine, purge vacuum raises according to engine speed.

   NOTE
   If there is a problem with the change in vacuum, the throttle body purge port may be clogged and require cleaning.

CATALYTIC CONVERTER

REMOVAL AND INSTALLATION

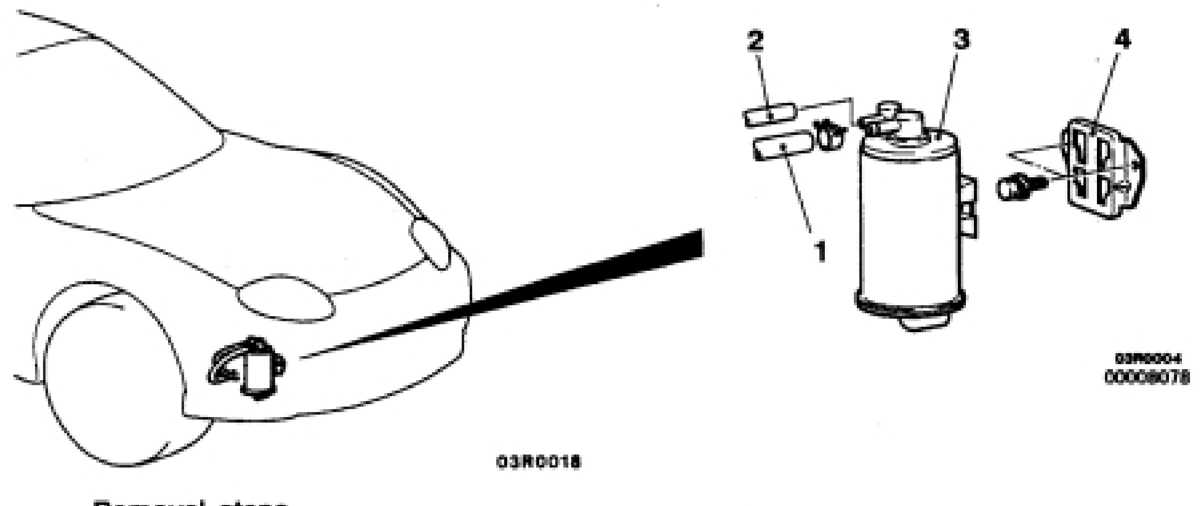


Removal steps

1. Oxygen sensor
2. Front exhaust pipe
3. Gasket
4. Gasket
5. Catalytic converter

CANISTER

REMOVAL AND INSTALLATION



Removal steps

1. Vapor hose
2. Purge hose
3. Canister
4. Canister bracket

NOTES

CLUTCH

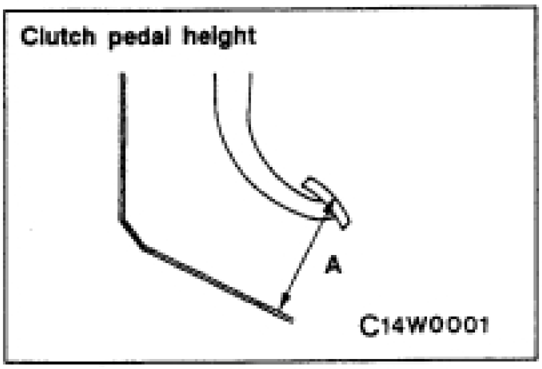
CONTENTS

SERVICE SPECIFICATIONS

Items	Standard value
Clutch pedal height mm	193.5 – 196.5
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	70 or more

LUBRICANTS

Items	Specified lubricants	Quantity
Clutch fluid	Brake fluid DOT3 or DOT4	As required
Push rod assembly	Rubber grease	
Boot		
Release cylinder push rod	MITSUBISHI genuine grease Part No. 0101011	

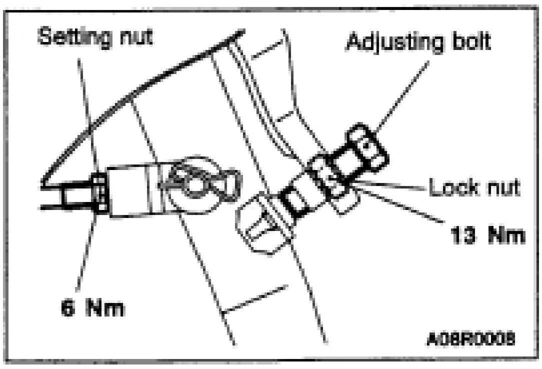


ON-VEHICLE SERVICE

CLUTCH PEDAL INSPECTION AND ADJUSTMENT

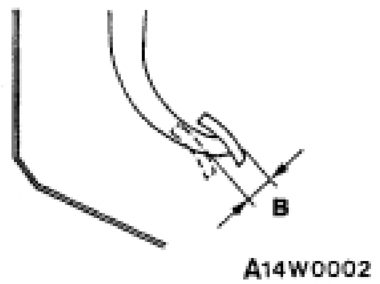
1. Turn up the carpet, etc. under the clutch pedal.
2. Measure the clutch pedal height.

   Standard value (A): 193.5 – 196.5 mm



3. If the height of the clutch pedal is outside the standard value, loosen the lock nut and adjust the pedal height to the standard value using the adjusting bolt.

Clutch pedal clevis pin play



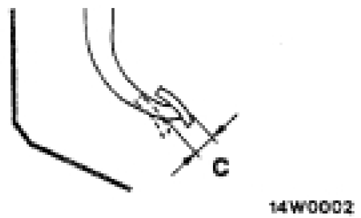
4. Measure the clutch pedal clevis pin play.

   Standard value (B): 1 – 3 mm

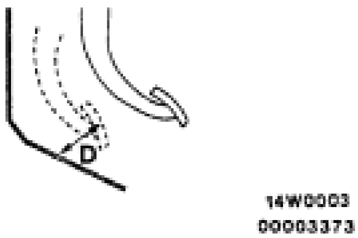
5. If the clutch pedal clevis pin play is not within the standard value, turn the push rod to adjust the play and use the setting nut to fix the push rod.

   Caution
   Do not push in the master cylinder push rod at this time.

Clutch pedal free play



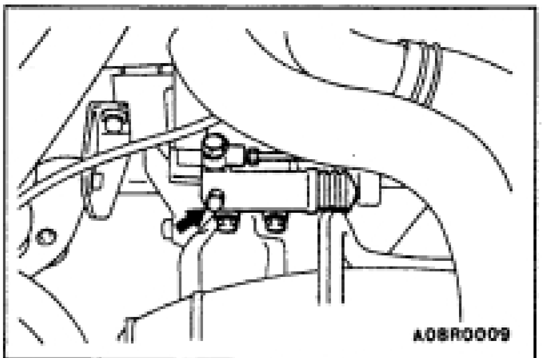
Distance between the clutch pedal and the toeboard when the clutch is disengaged



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): 70 mm or more

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 or clutch. Bleed the air, or disassemble and inspect the master cylinder or clutch.
8. Turn back the carpet, etc.



BLEEDING

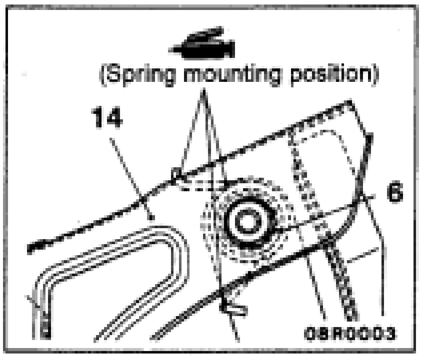
Specified fluid: Brake fluid DOT 3 or DOT 4

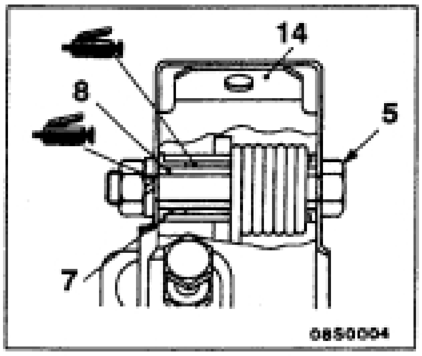
Caution
Use the specified brake fluid. Avoid using a mixture of the specified fluid and other fluid.

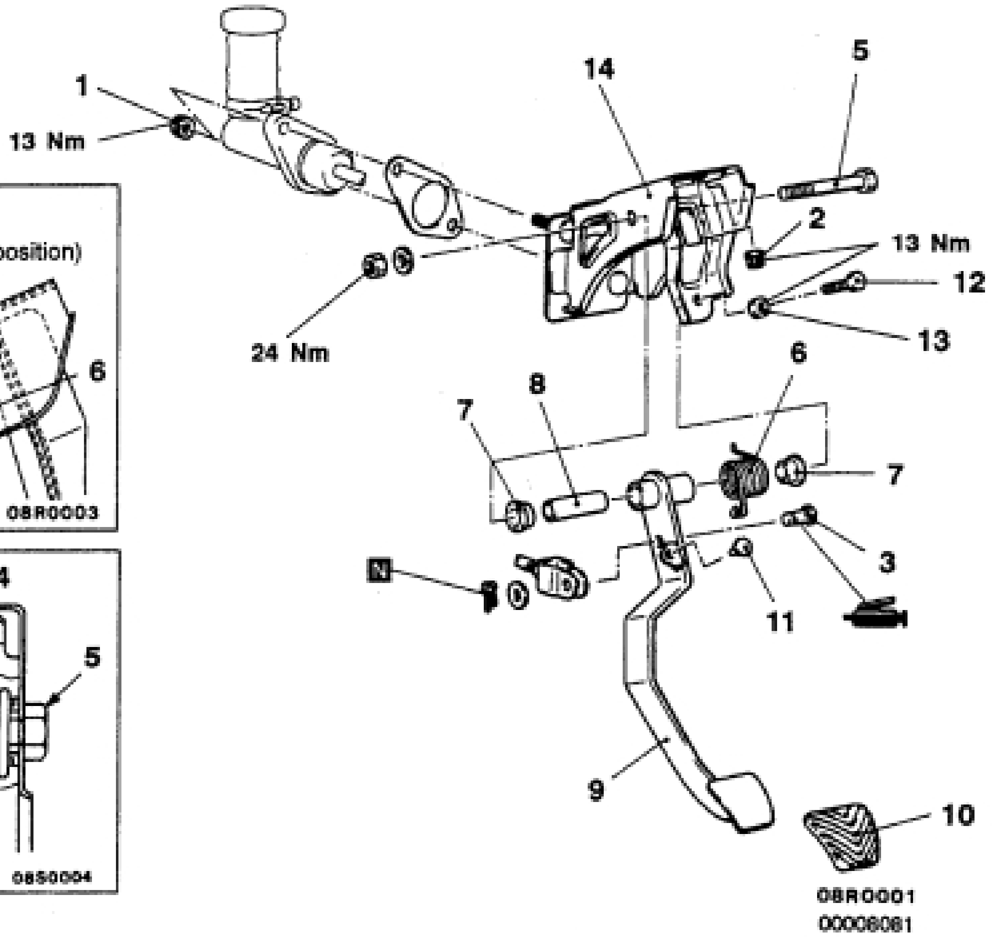
CLUTCH PEDAL

REMOVAL AND INSTALLATION

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







Removal steps

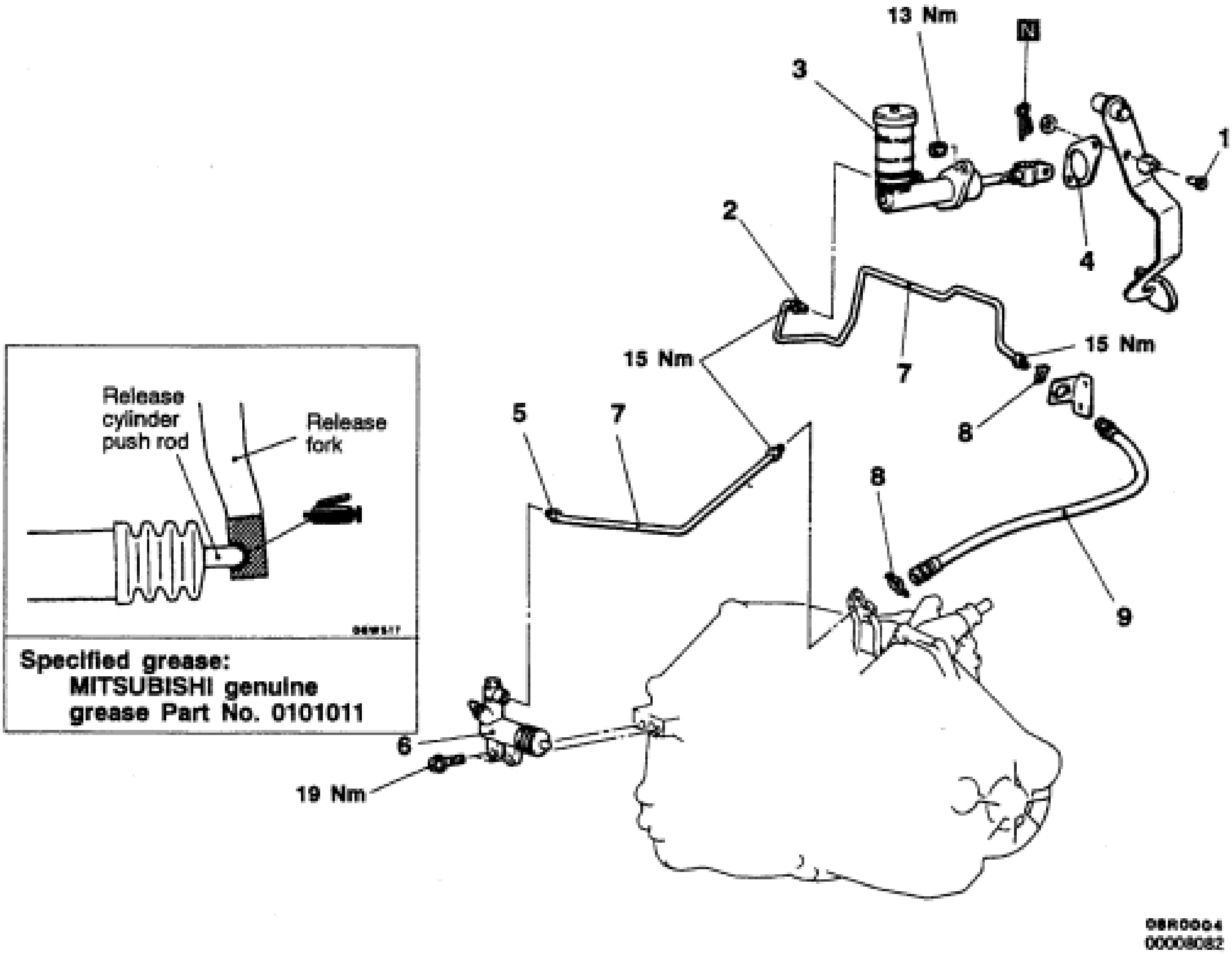
1. Clutch master cylinder mounting nut
2. Master cylinder member mounting nut
3. Clevis pin
4. Pedal support member and clutch pedal assembly
5. Bolt
6. Clutch return spring
7. Clutch pedal bushing
8. Pipe
9. Clutch pedal
10. Pedal pad
11. Stopper
12. Adjusting bolt
13. Lock nut
14. Master cylinder member assembly

CLUTCH CONTROL

REMOVAL AND INSTALLTION

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)



Clutch master cylinder removal steps
1. Clevis pin
2. Clutch pipe connection
3. Clutch master cylinder
4. Sealer

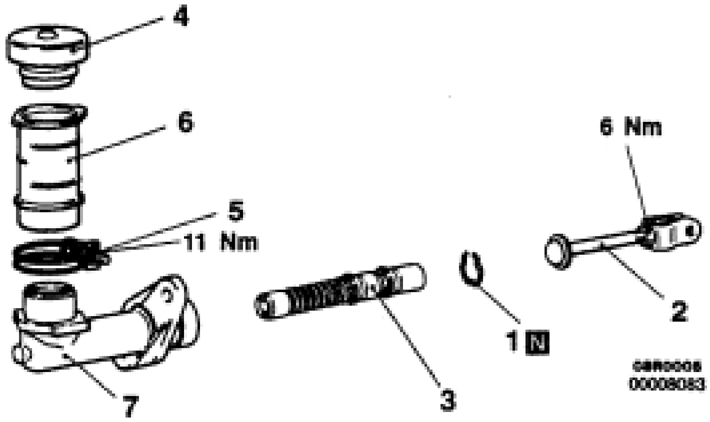
Clutch master cylinder removal steps
5. Clutch pipe connection
6. Clutch release cylinder

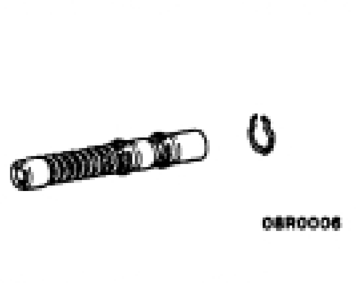
Clutch line removal steps
7. Clutch pipe
8. Hose clip
9. Clutch hose

DISASSEMBLY AND REASSEMBLY

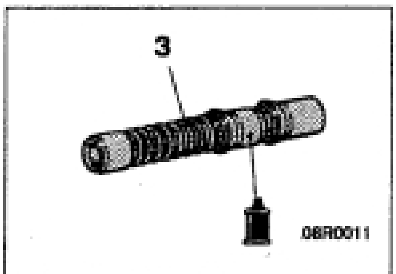
CLUTCH MASTER CYLINDER

Caution
Do not disassemble piston assembly.

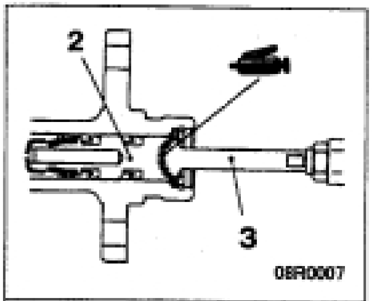




Piston repair kit



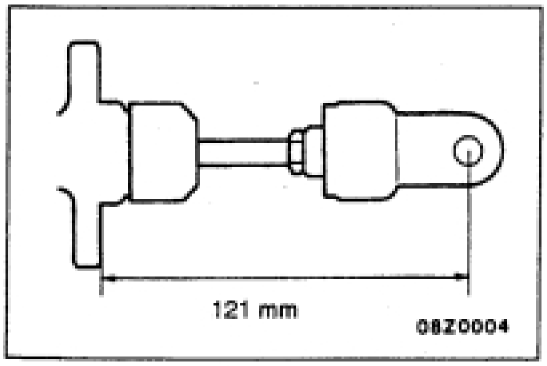
Clutch fluid:
Brake fluid DOT3 or DOT4



Grease: Rubber grease

Dsassembly steps

1. Piston stopper ring
2. ▶A◀ Push rod assembly
3. Piston assembly
4. Reservoir cap
5. Reservoir band
6. Reservoir tank
7. Clutch 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

CONTENTS

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

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.

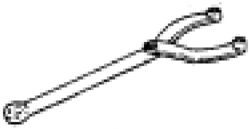
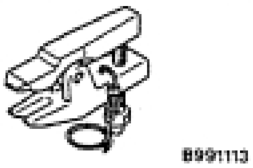
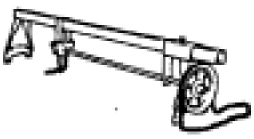
NOTE

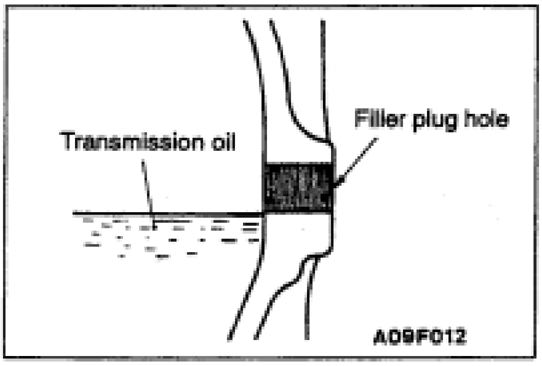
The SRS includes the following components: SRS-ECU, SRS warning lamp, air bag module, clock spring and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents by an asterisk (*).

LUBRICANT

Item	Specified lubricant	Quantity ℓ
Transmission oil	Hypoid gear oil SAE 75W – 90 or 75W – 85W conforming to API GL-4	2.2

SPECIAL TOOLS

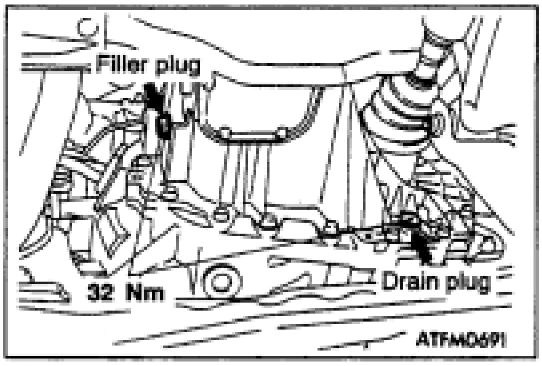
Tool	Number	Name	Use
	MB990767	End yoke holder	Fixing the hub
 B991113	MB990635 or MB991113	Steering linkage puller	Tie rod end and lower arm disconnection
 Z203827	GENERAL SERVICE TOOL MZ203827	Engine lifter	Supporting the engine assembly during removal and installation of the transmission
	MB991602	Foot assembly	
 B991453	MB991453	Engine hanger	



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.



TRANSMISSION OIL REPLACEMENT

(1) Remove the drain plug to drain oil.
(2) Tighten the drain plug to the specified torque.
(3) Remove the filler plug and fill with specified oil till the level comes to the lower portion of filler plug hole.

Transmission oil

Specified oil:

Hypoid gear oil SAE 75W – 90 or 75W – 85W conforming to API GL-4

Quantity: 2.2 ℓ

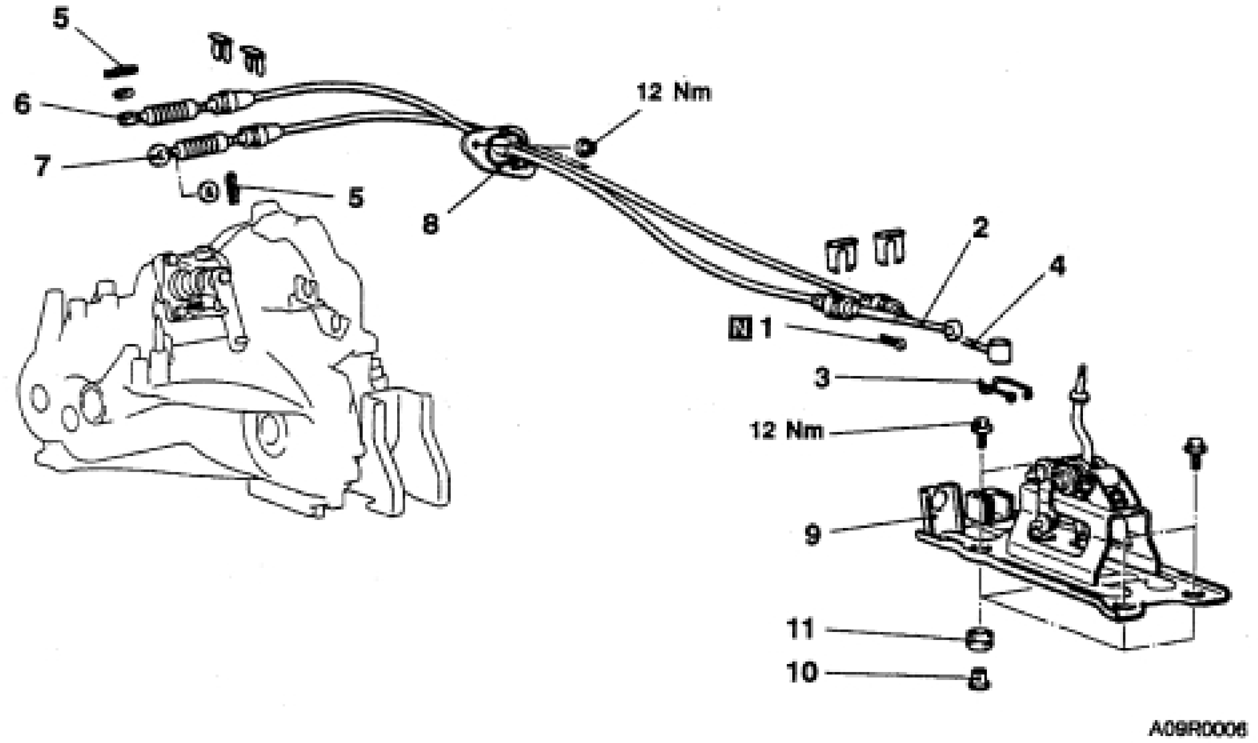
(4) Tighten the filler plug to the specified torque.

TRANSMISSION CONTROL

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Air Cleaner Assembly Removal and Installation
- Floor Console Box Removal and Installation (Refer to GROUP 52A.)

Caution: SRS
Be careful not to subject the SRS-ECU to any shocks during removal and installation of the shift cable and select cable assembly.

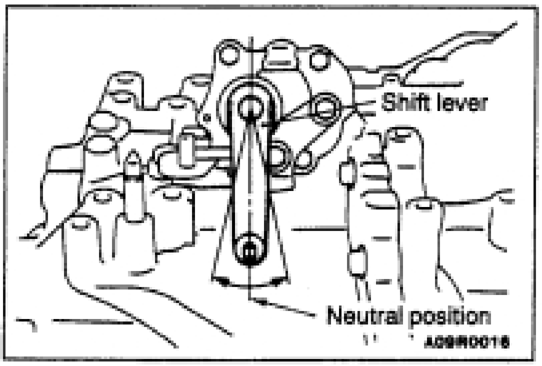


Shift cable and select cable assembly removal steps

1. Split pin
2. ▶A◀ Select cable connection (passenger compartment side)
3. Clip
4. Shift cable connection (passenger compartment side)
5. Snap pin
6. ▶A◀ Select cable connection (Transmission side)
7. ▶A◀ Shift cable connection (Transmission side)
8. ▶A◀ Shift cable and select cable assembly

Shift lever assembly removal steps

1. Split pin
2. ▶A◀ Select cable connection (passenger compartment side)
3. Clip
4. Shift cable connection (passenger compartment side)
9. Shift lever assembly
10. Distance piece
11. Bushing



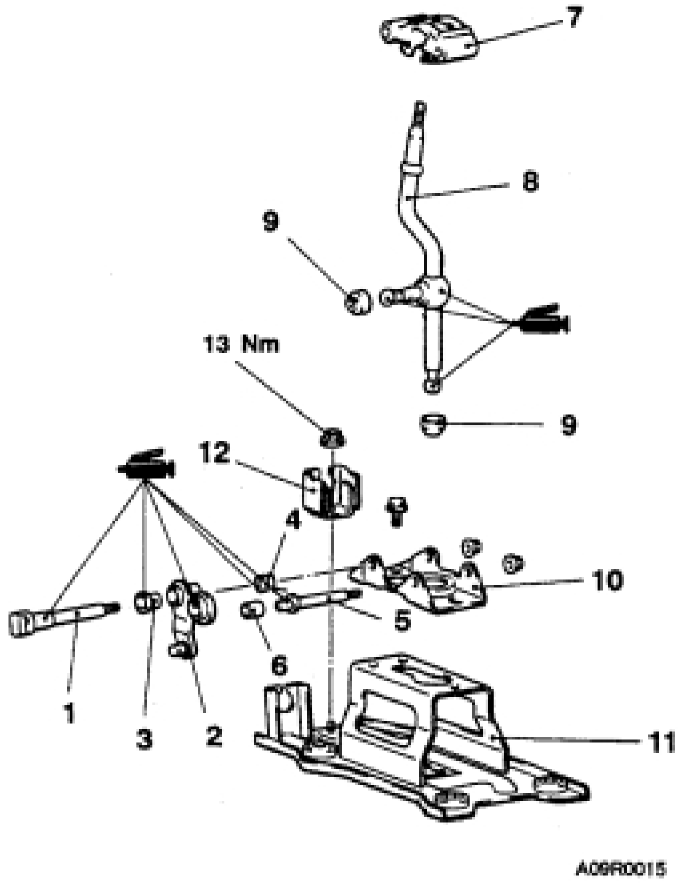
INSTALLATION SERVICE POINTS

▶A◀ SHIFT CABLE AND SELECT CABLE ASSEMBLY/ SHIFT CABLE CONNECTION/SELECT CABLE CONNECTION

(1) Set the transmission side shift lever and the passenger compartment side shift lever to the neutral position.

(2) For the transmission side, face the white and yellow paint marks on the shift and select cable ends to the snap pins, and install the cables.
(3) For the passenger compartment side, face the flange surface of the resin bushing on the select cable end to the split pin, and install the cable.
(4) Move the shift lever to all positions and check that the operation is smooth.

SHIFT LEVER ASSEMBLY DISASSEMBLY AND REASSEMBLY



Disassembly steps

1. Bell crank shaft
2. Crank
3. Bushing
4. Torsion spring
5. Spring stopper
6. Cushion
7. Shift lever ball sheet
8. Shift lever sub assembly
9. Shift lever bushing
10. Shift lever control retainer
11. Bracket assembly
12. Cable bracket

TRANSMISSION ASSEMBLY

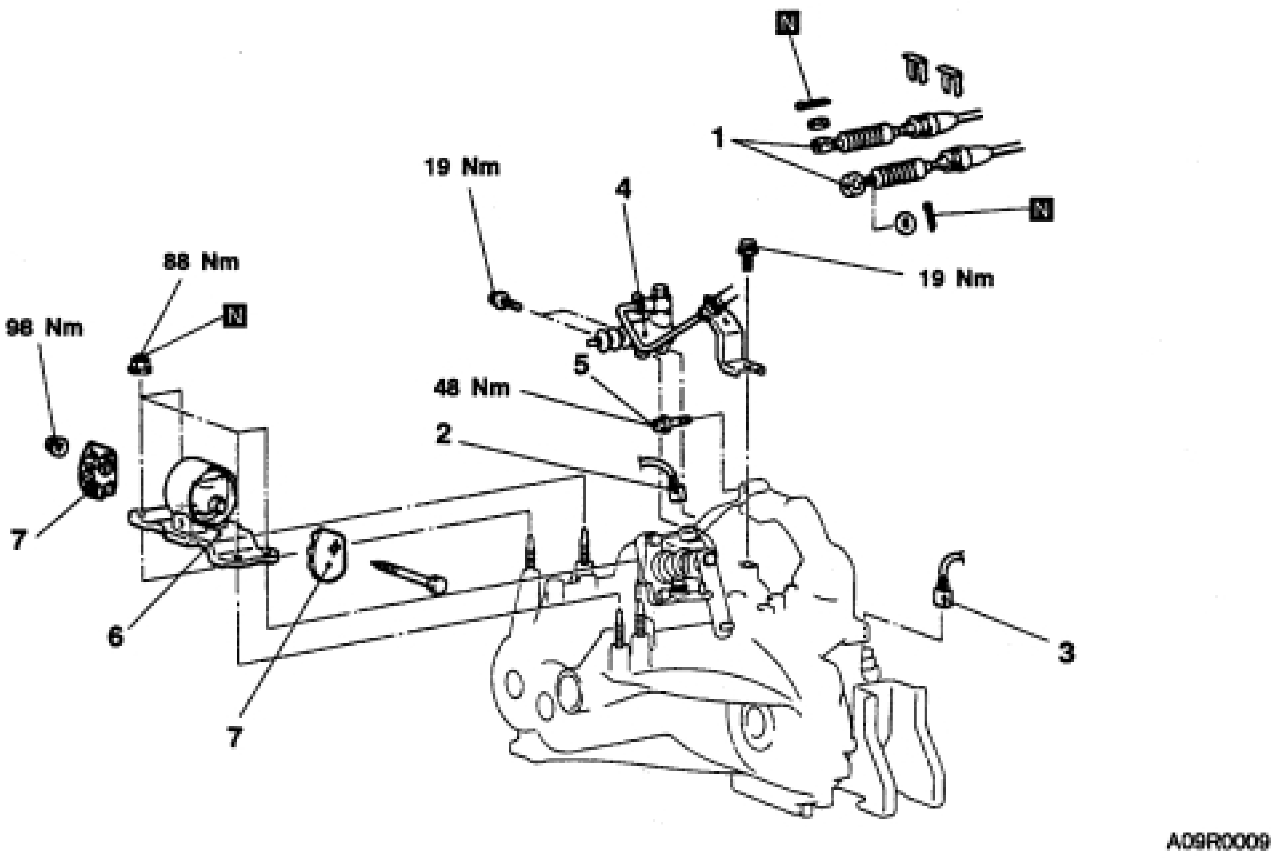
REMOVAL AND INSTALLATION

Caution

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

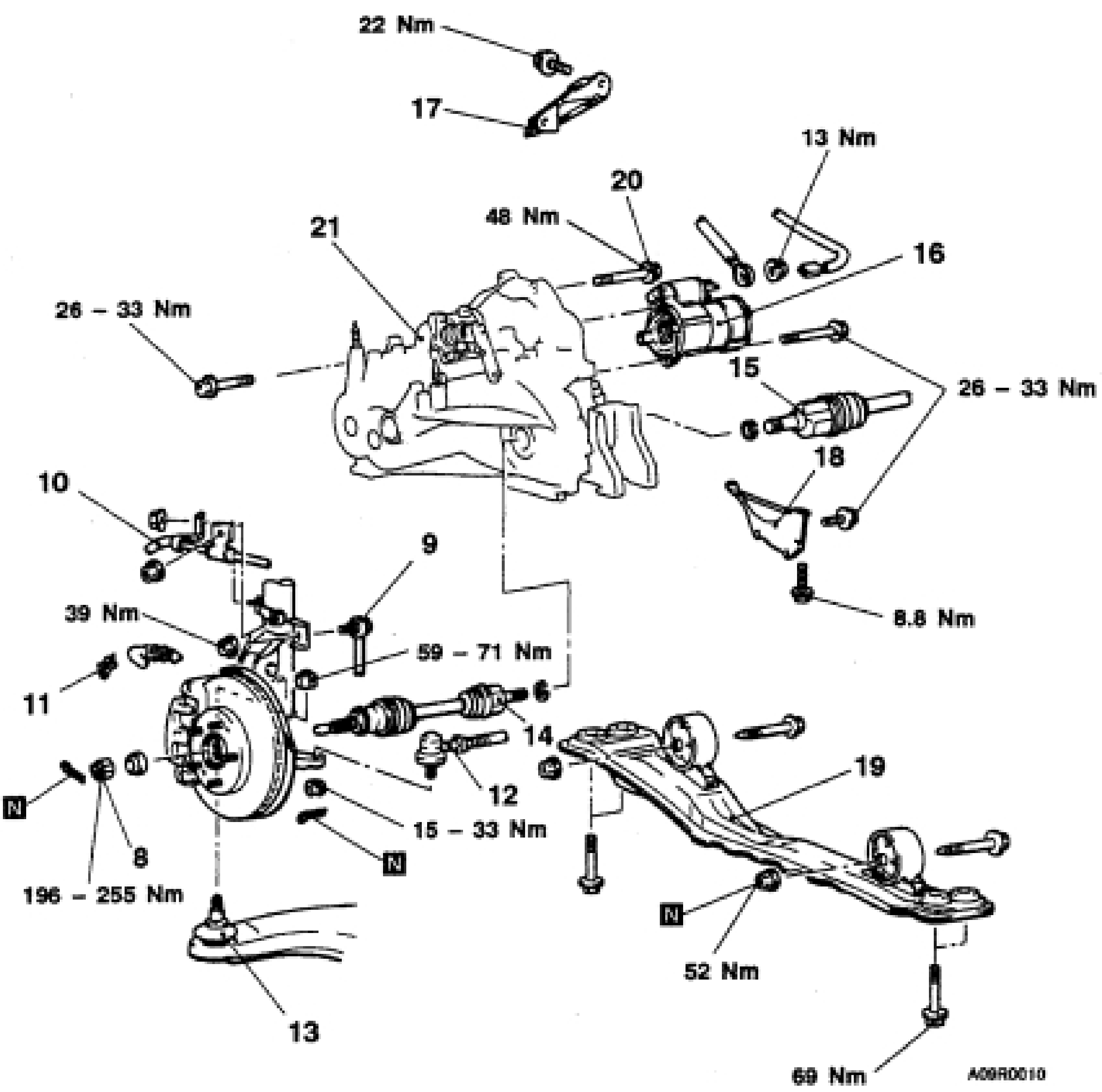
Pre-removal Operation
- Transmission Oil Draining (Refer to P.22-3.)
- Under Cover Removal
- Battery and Battery Tray Removal
- Air Cleaner Assembly Removal
- Front Exhaust Pipe Removal (Refer to GROUP 15.)
- Engine Cover Removal (Refer to GROUP 11A – Timing Belt.)

Post-installation Operation
- Engine Cover Installation (Refer to GROUP 11A – Timing Belt.)
- Air Cleaner Assembly Installation
- Battery and Battery Tray Installation
- Under Cover Installation
- Transmission Oil Supplying (Refer to P.22-3.)
- Front Exhaust Pipe Installation (Refer to GROUP 15.)
- Shift Lever Operation Check
- Speedometer Operation Check



Removal steps

1. Shift and select cable connection
2. Backup lamp switch connector
3. Vehicle speed sensor connector
◄A► 4. Clutch release cylinder connection
5. Transmission assembly upper part coupling bolts
◄B► 6. Transmission mount bracket
►B◄ 7. Transmission mount stopper
◄C► • Engine assembly supporting



Lifting up of the vehicle

◀D▶ ▶A◀ 8. Drive shaft nut <LH>
9. Stabilizer link connection
10. Speed sensor clamp
11. Brake hose clamp
◀E▶ 12. Tie rod end connection
◀E▶ 13. Lower arm ball joint connection
14. Drive shaft <LH> (Refer to GROUP 26.)

◀F▶ 15. Drive shaft <RH> connection
16. Starter motor
17. Oil filter cover
18. Bell housing cover
19. Centermember assembly
20. Transmission assembly lower part coupling bolts
◀G▶ 21. Transmission assembly

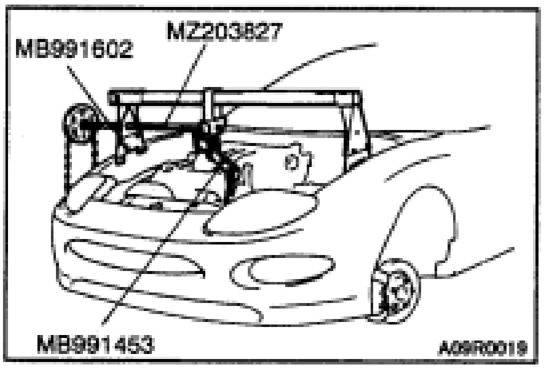
REMOVAL SERVICE POINTS

◀A▶ CLUTCH RELEASE CYLINDER REMOVAL

Remove the clutch release cylinder without disconnecting the oil line connection, and fix it on the vehicle body.

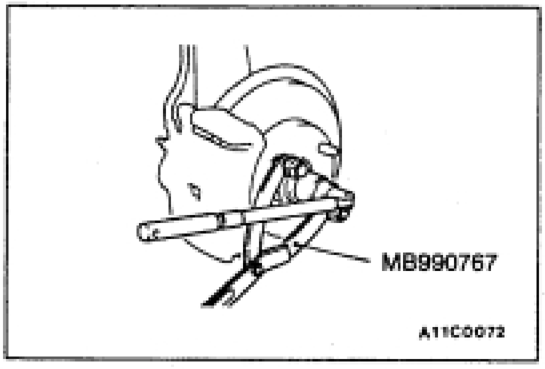
◀B▶ TRANSMISSION MOUNT BRACKET REMOVAL

Jack up the transmission assembly gently with a garage jack, and then remove the transmission mount bracket.



◀C▶ ENGINE ASSEMBLY SUPPORTING

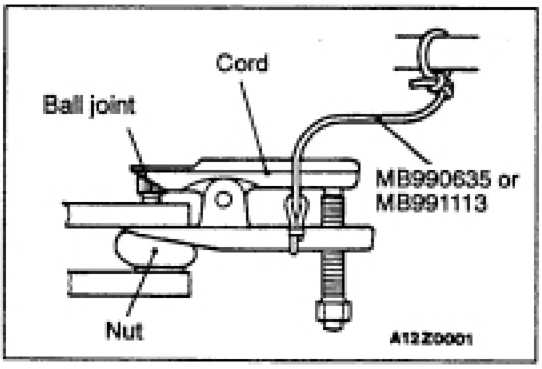
Set the special tool to the vehicle to support the engine assembly.



◀D▶ DRIVE SHAFT NUT <LH> REMOVAL

Caution

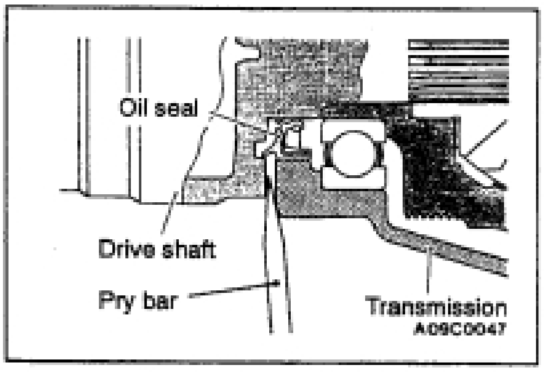
While the drive shaft nut is loosened, do not apply the vehicle weight to the wheel bearing.



◀E▶ TIE ROD END/LOWER ARM BALL JOINT DISCONNECTION

Caution

1. **Use the special tool to 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. not to let it come off.**



◀F▶ DRIVE SHAFT <RH> DISCONNECTION

(1) Insert a pry bar between the transmission case and the drive shaft as shown to remove the drive shaft.

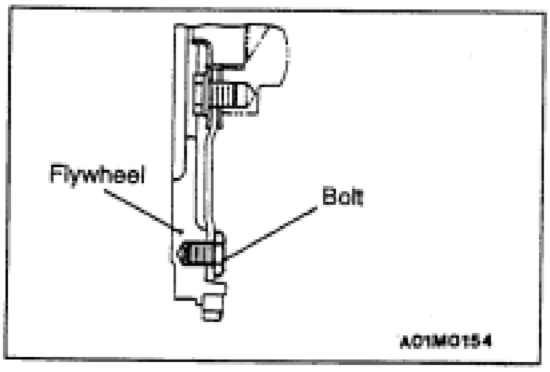
NOTE
Remove the drive shaft together with the hub and knuckle.

Caution

1. **Always use a pry bar, or the TJ will be damaged.**

2. Do not insert the pry bar too deeply, otherwise the oil seal may be damaged.

(2) Suspend the removed drive shaft with a wire so that there are no sharp bends in any of the joints.
(3) Use a shop towel to cover the transmission case not to let foreign material get into it.

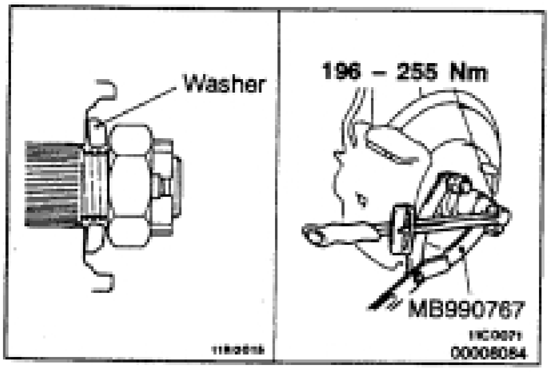


◀G▶ TRANSMISSION ASSEMBLY REMOVAL

1. Support the transmission assembly with a transmission jack.
2. Remove the transmission assembly lower part coupling bolts, and lower the transmission assembly to remove.

   Caution

   Do not remove the flywheel mounting bolt shown in the illustration. If this bolt is removed, the flywheel will become out of balance and damaged.



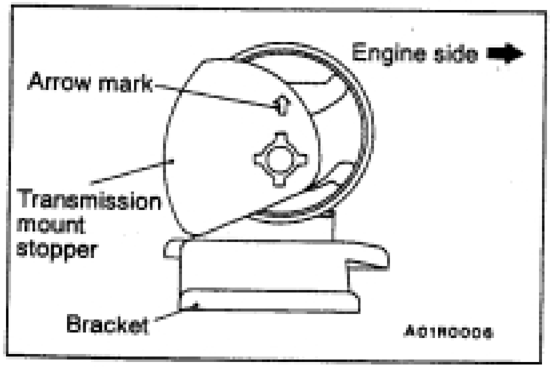
INSTALLATION SERVICE POINTS

▶A◀ DRIVE SHAFT NUT <LH> INSTALLATION

1. Install the drive shaft washer as shown in the illustration.
2. Using the special tool, tighten the drive shaft nut to the specified torque.

   Caution

   Before the drive shaft nut is tightened to the specified torque, do not apply the vehicle weight to the wheel bearing.
3. If the split pin is not aligned with the bolt pin hole, tighten the nut further within 255 Nm. Then when the nearest bolt pin hole is aligned, insert the split pin into the hole and secure it.



▶B◀ TRANSMISSION MOUNT STOPPER INSTALLATION

Install the transmission mount stopper so that the arrow points as show in the illustration.

AUTOMATIC TRANSMISSION

CONTENTS

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

WARNING!

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

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

NOTE

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

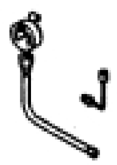
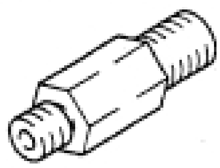
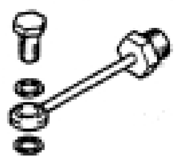
SERVICE SPECIFICATIONS

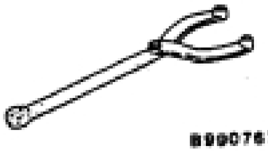
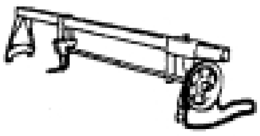
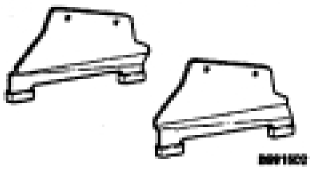
Items		Standard value
Input shaft speed sensor resistance (at 20°C) Ω		330 – 390
Output shaft speed sensor resistance (at 20°C) Ω		330 – 390
Oil temperature sensor kΩ	at 0°C	16.7 – 20.5
	at 100°C	0.57 – 0.69
Resistance of damper clutch control solenoid valve coil (at 20°C) Ω		2.7 – 3.4
Resistance of Low-Reverse solenoid valve coil (at 20°C) Ω		2.7 – 3.4
Resistance of second solenoid valve coil (at 20°C) Ω		2.7 – 3.4
Resistance of underdrive solenoid valve coil (at 20°C) Ω		2.7 – 3.4
Resistance of overdrive solenoid valve coil (at 20°C) Ω		2.7 – 3.4
Resistance of reduction solenoid valve coil (at 20°C) Ω		2.7 – 3.4
Stall speed r/min		2,100 – 2,600

LUBRICANTS

Items	Specified lubricant	Quantity ℓ
Transmission fluid	DIA QUEEN ATF SP II, DIA QUEEN ATF SP II M or equivalent	7.8

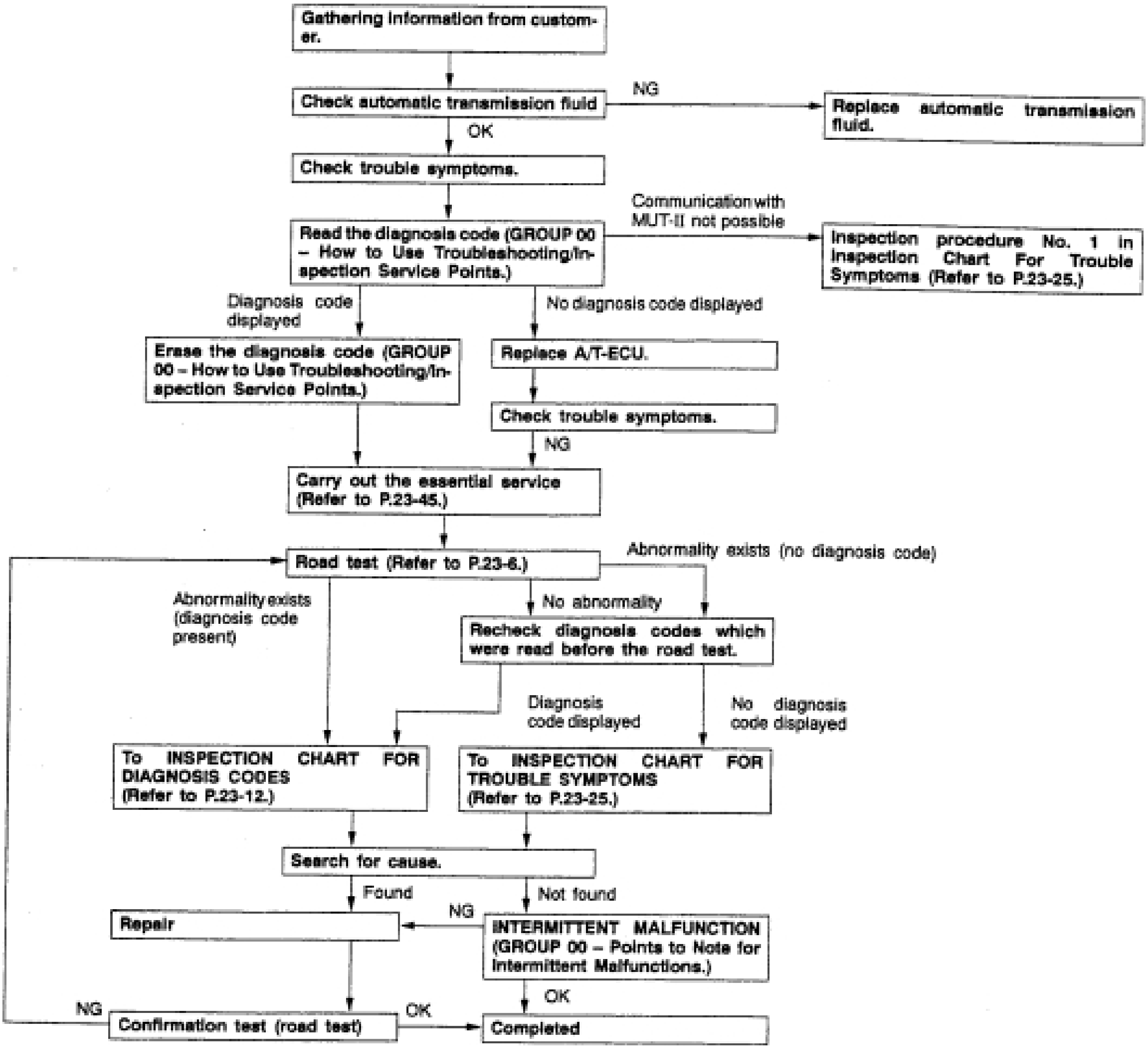
SPECIAL TOOLS

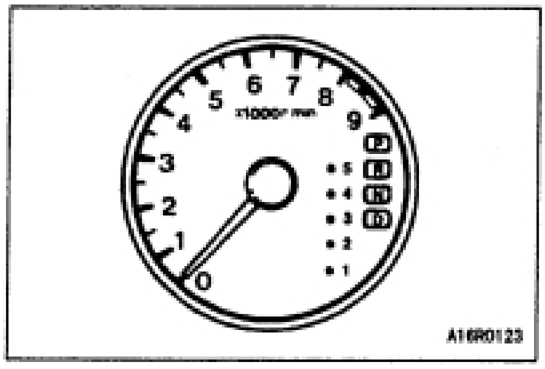
Tool	Number	Name	Use
	MB991502	MUT-II sub assembly	Checking of the diagnosis code
	MD998330 (including MD998331)	Oil pressure gauge (2,942 kPa)	Measurement of oil pressure
	MD998332 MD998268	Adapter	
	MD998900	Adapter	

Tool	Number	Name	Use
 B990767	MB990767	End yoke holder	Fixing the hub
 B991113	MB990635 or MB991113	Steering linkage puller	Tie rod end and lower arm disconnection
 Z203827	GENERAL SERVICE TOOL MZ203827	Engine lifter	Supporting the engine assembly during removal and installation of the transmission
	MB991602	Foot assembly	
 B991453	MB991453	Engine hanger assembly	Supporting the engine assembly during removal and installation of the transmission

TROUBLESHOOTING <A/T>

STANDARD FLOW OF DIAGNOSIS TROUBLESHOOTING





DIAGNOSIS FUNCTION

1. N range lamp

The N range lamp flashes at a frequency of approximately 1 Hz if there is an abnormality in any of the items in the table below which are related to the A/T system. Check the diagnosis code output if the N range lamp is flashing at a frequency of approximately 1 Hz.

N range lamp flashing items

Input shaft speed sensor
Output shaft speed sensor
Each solenoid valve
Out of phase at each shift point
A/T control relay system

Caution

If the N range lamp is flashing at a frequency of approximately 2 Hz (faster than at 1 Hz), it means that the automatic transmission fluid temperature is too high. Stop the vehicle in a safe place and wait until the N range lamp switches off.

2. Method of reading the diagnosis code

Use the MUT-II or the N range lamp to take a reading of the diagnosis codes. (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.)

ROAD TEST

No.	State prior to test and operation	Test and operation	Judgement value	Check item	Diag-nosis code No.	Inspection item if there is an abnormality
1	Ignition switch: OFF	Ignition switch (1) ON	Data list No. 54 (1) Battery voltage [mV]	Control relay	54	A/T Control relay
2	Ignition switch: ON Engine: Stopped 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 position (1) D (1st gear) (2) Select sport mode (1st gear) (3) Upshift and hold the selector lever (2nd gear) (4) Downshift and hold the selector lever (1st gear)	Date 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	–	Shift switch assembly system
		Accelerator pedal (1) Released (2) Half depressed (3) Depressed	Data list No. 11 (1) 400 – 1,000 mV (2) Gradually rises from (1) (3) 4,500 – 5,000 mV	Throttle position sensor <Vehicles without TCL> Accelerator pedal position sensor <Vehicles with TCL>	11 12 14	Throttle position sensor system <Vehicles without TCL> Accelerator pedal position sensor system <Vehicles with TCL>
		Brake pedal (1) Depressed (2) Released	Data list No. 26 (1) ON (2) OFF	Stop lamp switch	26	Stop lamp switch system
3	Ignition switch: ST Engine: Stopped	Starting test with lever P or N range	Starting should be possible	Starting possible or impossible	–	Starting impossible
4	Warming up	Drive for 15 minutes or more so that the automatic fluid temperature becomes 70 – 90°C.	Data list No. 15 Gradually rises to 70 – 90°C	Oil temperature sensor	15	Oil temperature sensor system

No.	State prior to test and operation	Test and operation	Judgement value	Check item	Diag-nosis code No.	Inspection item if there is an abnormality
5	Engine: Idling Selector lever position: N	Brake pedal (Retest) (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) Released (2) Half depressed	Data list No. 64 (1) ON (2) OFF	Idle position switch	–	Idle position switch system
			Data list No. 21 (1) 800 – 900 rpm Gradually rises from (1)	Crank angle sensor	21	Crank angle sensor system
			Data list No. 58 (2) Data changes	Communication with engine-ECU <Vehicles without TCL> Communication with TCL-ECU <Vehicles with TCL>	51	Serial communication system
		Selector lever position (1) N → D (2) N → R	Should be no abnormal shifting shocks Time lag should be within 2 seconds	Malfunction when starting	–	Engine stalling during shifting
					–	Shocks when changing from N to D and large time lag
					–	Shocks when changing from N to R and large time lag
					–	Shocks when changing from N to D,N to R and large time lag
				Driving impossible	–	Does not move forward
					–	Does not reverse
					–	Does not move (forward or reverse)

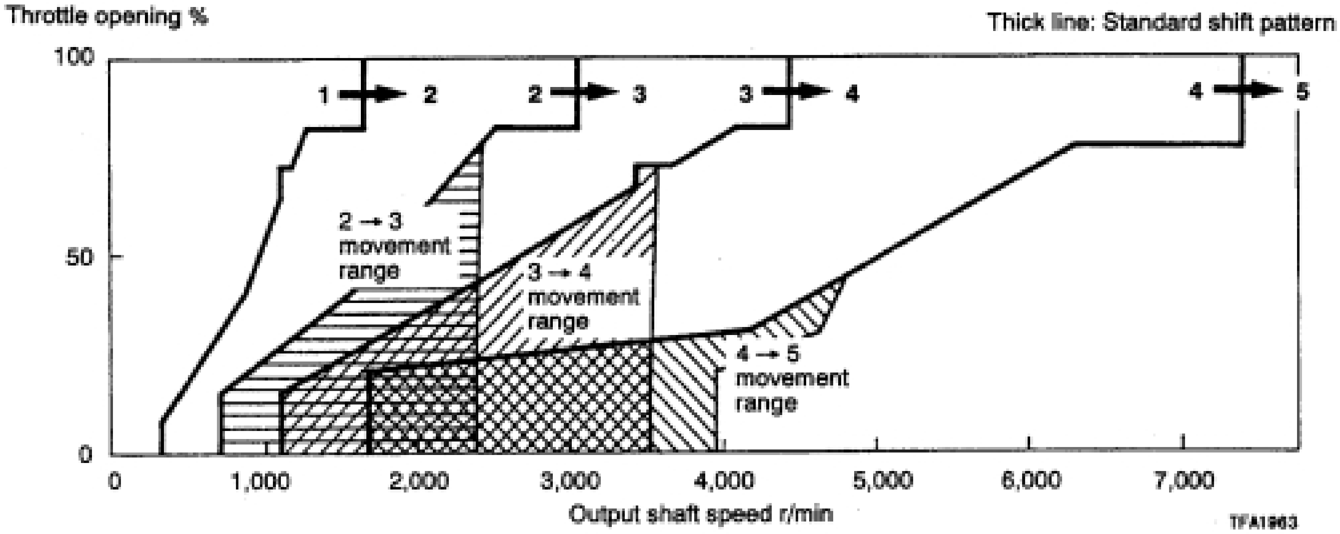
No.	State prior to test and operation	Test and operation	Judgement value	Check item	Diagnosis code No.	Inspection item if there is an abnormality
6	Selector lever position: Sport mode	Shift position and vehicle speed (1) Idling in 1 position (Vehicle stopped) (2) Driving at constant speed of 10 km/h in 1 position (3) Driving at constant speed of 30 km/h in 2 position (4) Driving at 50 km/h in 3 position (5) Driving at constant speed of 50 km/h in 4 position (6) Driving at constant speed of 70 km/h in 5 position (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) 0 %, (6) 0 %	Low and reverse solenoid valve (LR solenoid valve)	31	Low and reverse solenoid valve system
			Data list No. 32 (2) 0 %, (3) 0 %, (4) 0 %, (5) 0 %, (6) 100 %	Underdrive solenoid valve (UD solenoid valve)	32	Underdrive solenoid valve system
			Data list No. 33 (2)100 %, (3) 0 %, (4) 100 %, (5) 100 %, (6) 0 %	Second solenoid valve (2ND solenoid valve)	33	Second solenoid valve system
			Data list No. 34 (2) 100 %, (3) 100 %,(4) 0 %, (5) 0 %, (6) 0 %	Overdrive solenoid valve (OD solenoid valve)	34	Overdrive solenoid valve system
			Data list No.35 (2) 0 %, (3) 0 %, (4) 0 %, (5) 100 %, (6) 100 %	Reduction solenoid valve (RED solenoid valve)	35	Reduction 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) 1,500 – 1,700 rpm	Input shaft speed sensor	22	Input shaft speed sensor system
			Data list No. 23 (5) 1,500 – 1,700 rpm	Output shaft speed sensor	23	Output shaft speed sensor system
			Data list No. 36 (4) 0 % (5) Approx. 70 – 90 %	Damper clutch control solenoid valve (DCC solenoid valve)	36 52	Damper clutch control solenoid valve system
			Data list No. 52 (4) Approx. 100 – 300 rpm (5) Approx. 0 – 10 rpm			

No.	State prior to test and operation	Test and operation	Judgement value	Check item	Diag-nosis code No.	Inspection item if there is an abnormality
7	Use the MUT-II to stop the INVECS-II function. Selector lever position: D	Monitor data list No. 11, 23, and 63 with the MUT-II. (1) Accelerate to 5th gear at a throttle position sensor output of 1.5V (accelerator opening angle of 30 %). (2) Gently decelerate to a standstill. (3) Accelerate to 5th gear at a throttle position sensor output of 2.5 V (accelerator opening angle of 50%). (4) While driving at 60 km/h in 5th gear, select sport mode, shift down to 4th gear. (5) While driving at 40 km/h in 4th gear, shift down to 3rd gear. (6) While driving at 30 km/h in 3rd gear, shift down to 2nd gear. (7) While driving at 20 km/h in 2nd gear, shift down to 1st gear.	For (1), (2) and (3), the reading should be the same as the specified output shaft speed and no abnormal shocks should occur. For (4), (5), (6) and (7), downshifting should occur immediately after the shifting operation is made.	Malfunction when shifting	–	Shocks and running up
				Displaced shifting points	–	All points
					–	Some points
				Does not shift	–	No diagnosis code
					22	Input shaft speed sensor system
					23	Output shaft speed sensor system
				Does not shift from 1st to 2nd or 2nd to 1st	31	Low and reverse solenoid valve system
					33	Second solenoid valve system
					41	1st gear ratio is not specified
					42	2nd gear ratio is not specified
				Does not shift from 2nd to 3rd or 3rd to 2nd	33	Second solenoid valve system
					34	Overdrive solenoid valve system
					42	2nd gear ratio is not specified
					43	3rd gear ratio is not specified
				Does not shift from 3rd to 4th or 4th to 3rd	31	Low and reverse solenoid valve system
					35	Reduction solenoid valve system
					43	3rd gear ratio is not specified
					44	4th gear ratio is not specified

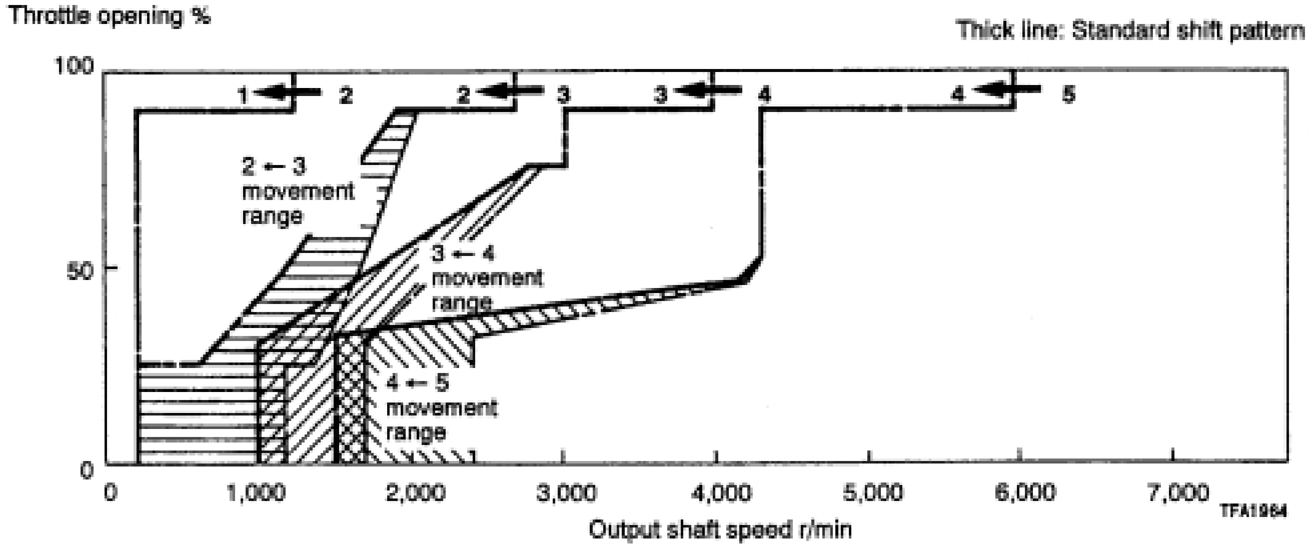
No.	State prior to test and operation	Test and operation	Judgement value	Check item	Diag-nosis code No.	Inspection item if there is an abnormality
7	Use the MUT-II to stop the INVECS-II function. Selector lever position: D	Monitor data list No. 11, 23, and 63 with the MUT-II. (1) Accelerate to 5th gear at a throttle position sensor output of 1.5V (accelerator opening angle of 30 %). (2) Gently decelerate to a standstill. (3) Accelerate to 5th gear at a throttle position sensor output of 2.5 V (accelerator opening angle of 50%). (4) While driving at 60 km/h in 5th gear, select sport mode, shift down to 4th gear. (5) While driving at 40 km/h in 4th gear, shift down to 3rd gear. (6) While driving at 30 km/h in 3rd gear, shift down to 2nd gear. (7) While driving at 20 km/h in 2nd gear, shift down to 1st gear.	For (1), (2) and (3), the reading should be the same as the specified output shaft speed and no abnormal shocks should occur. For (4), (5), (6) and (7), downshifting should occur immediately after the shifting operation is made.	Does not shift from 4th to 5th or 5th to 4th	32	Underdrive solenoid valve system
					33	Second solenoid valve system
					44	4th gear ratio is not specified
					45	5th gear ratio is not specified
8	Selector lever position: N (Carry out on a flat and straight road.)	Monitor data list No. 22 and No. 23 with the MUT-II. (1) Move selector lever to R range, drive at constant speed of 10 km/h.	The ratio between data list No. 22 and No. 23 should be the same as the gear ratio when reversing.	Does not shift	22	Input shaft speed sensor system
					23	Output shaft speed sensor system
					46	Reverse gear ratio is not specified

SHIFT PATTERN

UPSHIFT PATTERN



DOWNSHIFT PATTERN



INSPECTION CHART FOR DIAGNOSIS CODE

Code	Diagnosis item		Reference page
11	Throttle position sensor system <Vehicles without TCL> Accelerator pedal position sensor system <Vehicles with TCL>	Short circuit	23-13
12		Open circuit	23-13
14		Sensor maladjustment	23-13
15	Oil temperature sensor system	Open circuit	23-13
21	Crank angle sensor system	Open circuit	23-14
22	Input shaft speed sensor system	Short circuit/open circuit	23-14
23	Output shaft speed sensor system	Short circuit/open circuit	23-15
26	Stop lamp switch system	Short circuit	23-15
31	Low and reverse solenoid valve system	Short circuit/open circuit	23-16
32	Underdrive solenoid valve system	Short circuit/open circuit	23-16
33	Second solenoid valve system	Short circuit/open circuit	23-16
34	Overdrive solenoid valve system	Short circuit/open circuit	23-16
35	Reduction solenoid valve system	Short circuit/open circuit	23-16
36	Damper control clutch solenoid valve system	Short circuit/open circuit	23-16
41	1st gear ratio does not meet the specification		23-17
42	2st gear ratio does not meet the specification		23-18
43	3rd gear ratio does not meet the specification		23-19
44	4th gear ratio does not meet the specification		23-20
45	5th gear ratio does not meet the specification		23-21
46	Reverse gear ratio does not meet the specification		23-22
51	Abnormal communication with engine-ECU <Vehicles without TCL> Abnormal communication with TCL-ECU <Vehicles with TCL>		23-23
52	Damper control clutch solenoid valve system	Defective system	23-16
54	A/T Control relay system	Short circuit to earth/ open circuit	23-23
56	N range lamp system	Short circuit to earth	23-24
71	Malfunction of A/T-ECU		23-24

INSPECTION PROCEDURES FOR DIAGNOSIS CODES

Code No. 11, 12, 14 Throttle position sensor system <Vehicles without TCL>, accelerator pedal position sensor <Vehicles with TCL>	Probable cause
If the TPS or APS output voltage is 4.8 V or higher when the engine is idling, the output is judged to be too high and diagnosis code No. 11 is output. If the TPS or APS output voltage is 0.2 V or lower at times other than when the engine is idling, the output is judged to be too low and diagnosis code No. 12 is output. If the TPS or APS output voltage is 0.2 V or lower or if it is 1.2 V or higher when the engine is idling, the TPS or APS adjustment is judged to be incorrect and diagnosis code No. 14 is output.	• Malfunction of the throttle position sensor <Vehicles without TCL> • Malfunction of the accelerator pedal position sensor <Vehicles with TCL> • Malfunction of connector • Malfunction of the A/T-ECU

Throttle position sensor check <Vehicles without TCL>
Accelerator pedal position sensor check<Vehicles with TCL>
(Refer to GROUP 13A – On-vehicle Service.) — NG → **Replace**

↓ OK

Check the following connectors:
A-07 <Vehicles without TCL>, A-08 <Vehicles with TCL>, B-30 — NG → **Repair**

↓ OK

Harness check
- Between throttle position sensor and A/T-ECU <Vehicles without TCL>
- Between accelerator pedal position sensor and A/T-ECU <Vehicles with TCL>

— NG → **Repair**

↓ OK

Check the trouble symptoms. — NG → Replace the A/T-ECU.

Code No. 15 Oil temperature sensor system	Probale cause
If the oil temperature sensor output voltage is 2.6 V or more even after driving for 10 minutes or more (if the oil temperature does not increase), it is judged that there is an open circuit in the oil temperature sensor and diagnosis code No. 15 is output.	• Malfunction of the oil temperature sensor • Malfunction of connector • Malfunction of the A/T-ECU

Oil temperature sensor check (Refer to P.23-53.) — NG → **Replace**

↓ OK

Check the follwing connectors: A-25, B-30 — NG → **Repair**

↓ OK

Harness check
- Between oil temperature sensor and A/T-ECU

— NG → **Repair**

↓ OK

Check the trouble symptoms. — NG → Replace the A/T-ECU.

Code No. 21 Crank angle sensor system	Probable cause
If no output pulse is detected from the crank angle sensor for 5 seconds or more while driving at 25 km/h or more, it is judged that there is an open circuit in the crank angle sensor and diagnosis code No. 21 is output.	• Malfunction of the crank angle sensor • Malfunction of connector • Malfunction of the A/T-ECU

Check the follwing connectors: A-91, B-30 — NG → **Repair**

↓ OK

Harness check
• Between crank angle sensor and A/T-ECU — NG → **Repair**

↓ OK

Crank angle sensor system check
(Refer to GROUP 13A – Troubleshooting.) — NG → **Replace**

↓ OK

Check the trouble symptoms. — NG → Replace the A/T-ECU.

Code No. 22 Input shaft speed sensor system	Probable cause
If no output pulse is detected from the input shaft speed sensor for 1 second or more while driving in 3rd or 4th gear at a speed of 30 km/h or more, there is judged to be an open circuit or short-circuit in the input shaft speed sensor and diagnosis code No. 22 is output. If diagnosis code No. 22 is output four times, the transmission is locked into 3rd gear (D range) or 2nd gear (downshifting in sport mode) as a fail-safe measure, and the N range lamp flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of connector • Malfunction of A/T-ECU

★: Refer to the Transmission Workshop Manual.

Measure at the input shaft speed sensor connector A-73.
• Disconnect the connector and measure at the harness side.
(1) Voltage between 3 and earth (Ignition switch: ON)
OK: Battery voltage
(2) Voltage between 2 and earth (Ignition switch: ON)
OK: approx. 5 V
(3) Continuity between 1 and earth
OK: Continuity

— NG → **Check the following connectors:** A-73, B-30, B-36, B-43, B-44 — NG → **Repair**

↓ OK

Check the following harness:
• Between the input shaft speed sensor and the ignition switch
• Between the input shaft speed sensor and A/T-ECU — NG → **Repair**

↓ OK

Check the trouble symptoms. — NG → Replace the A/T-ECU.

↓ OK (from the first measurement)

Measure output waveform of the input shaft speed sensor.
(using an oscilloscope)
• Engine: 2,000 r/min (approx. 50 km/h)
• Transmission: 3rd gear (Voltage)
OK: Conforms to the waveform shown at page 23-43 (Inspection procedure using an oscilloscope). There is no noise in the output waveform.

— NG → Replace the input shaft speed sensor.

↓

Check the trouble symptoms. — NG → A/T overhaul ★
• Replace the underdrive clutch retainer.

↓

Check the trouble symptoms.

↓ NG

Eliminate the cause of the noise.

↓ OK (from the waveform measurement)

Check the trouble symptoms. — NG → Replace the A/T-ECU.

Code No. 23 Output shaft speed sensor system	Probable cause
If the output from the output shaft speed sensor is continuously 50% lower than the vehicle speed for 1 second or more while driving in 3rd or 4th gear at a speed of 30 km/h or more, there is judged to be an open circuit or short-circuit in the output shaft speed sensor and diagnosis code No. 23 is output. If diagnosis code No. 23 is output four times, the transmission is locked into 3rd gear (D range) or 2nd gear (downshifting in sport mode) as a fail-safe measure, and the N range lamp flashes at a frequency of 1 Hz.	• Malfunction of the output shaft speed sensor • Malfunction of the transfer drive gear or driven gear • Malfunction of connector • Malfunction of the A/T-ECU

★: Refer to the Transmission Workshop Manual.

Measure at the output shaft speed sensor connector A-72.
- Disconnect the connector and measure at the harness side.

(1) Voltage between 3 and earth (Ignition switch: ON)
OK: Battery voltage
(2) Voltage between 2 and earth (Ignition switch: ON)
OK: approx. 5 V
(3) Continuity between 1 and earth
OK: Continuity

→ NG → **Check the following connectors:** A-02, B-30, B-36, B-43, B-44 → NG → **Repair**
↓ OK
Check the following harness:
- Between the output shaft speed sensor and the ignition switch
- Between the output shaft speed sensor and A/T-ECU

→ NG → **Repair**
↓ OK
Check the trouble symptoms. → NG → Replace the A/T-ECU.

↓ OK

Measure output waveform of the output shaft speed sensor.
(using an oscilloscope)
- Engine: 2,000 r/min (approx. 50 km/h)
- Transmission: 3rd gear

(Voltage)
OK: Conforms to the waveform shown at page 23-43 (Inspection procedure using an oscilloscope). There is no noise in the output waveform.

→ NG → Replace the output shaft speed sensor.
↓
Check the trouble symptoms. → NG → A/T overhaul ★
- Replace the transfer drive gear and driven gear.

↓
Check the trouble symptoms.
↓ NG
Eliminate the cause of the noise.

↓ OK
Check the trouble symptoms. → NG → Replace the A/T-ECU.

Code No. 26 Stop lamp switch system	Probable cause
If the stop lamp switch is on for 5 minutes or more while driving, it is judged that there is a short circuit in the stop lamp switch and diagnosis code No. 26 is output.	• Malfunction of the stop lamp switch • Malfunction of connector • Malfunction of the A/T-ECU

Stop lamp switch check (Refer to GROUP 35A – Brake Pedal.) → NG → **Replace**
↓ OK
Check the following connectors: B-22, B-29, B-14, B-38 → NG → **Repair**
↓ OK
Harness check
- Between stop lamp switch and A/T-ECU

→ NG → **Repair**
↓ OK
Check the trouble symptoms. → NG → Replace the A/T-ECU.

Code No. 31 Low and reverse solenoid valve system Code No. 32 Underdrive solenoid valve system Code No. 33 Second solenoid valve system Code No. 34 Overdrive solenoid valve system Code No. 35 Reduction solenoid valve system	Probable cause
If the resistance value for a solenoid valve is too large or too small, it is judged that there is a short-circuit or an open circuit in the solenoid valve and the respective diagnosis code is output. The transmission is locked into 3rd gear as a fail-safe measure, and the N range lamp flashes at a frequency of 1 Hz.	• Malfunction of solenoid valve • Malfunction of connector • Malfunction of the A/T-ECU

- Solenoid valve check (Refer to P.23-54.) — NG → **Replace**
  - OK ↓
- **Check the following connectors:** A-25, B-29, B-31 — NG → **Repair**
  - OK ↓
- Harness check
  - Between solenoid valve and A/T-ECU — NG → **Repair**
  - OK ↓
- Replace the solenoid valve.
  - ↓
- Check the trouble symptoms. — NG → Replace the A/T-ECU.

Code No. 36, 52 Damper clutch control solenoid valve system	Probable cause
If the resistance value for the damper clutch control solenoid valve is too large or too small, it is judged that there is a short-circuit or an open circuit in the damper clutch control solenoid valve and diagnosis code No. 36 is output. If the drive duty rate for the damper clutch control solenoid valve is 100 % for a continuous period of 4 seconds or more, it is judged that there is an abnormality in the damper clutch control system and diagnosis code No. 52 is output. When diagnosis code No. 36 is output, the transmission is locked into 3rd gear as a fail-safe measure, and the N range lamp flashes at a frequency of 1 Hz.	• Malfunction of the damper clutch control solenoid valve • Malfunction of connector • Malfunction of the A/T-ECU

- Damper clutch control solenoid valve check (Refer to P.23-54.) — NG → **Replace**
  - OK ↓
- **Check the following connectors:** A-25, B-31 — NG → **Repair**
  - OK ↓
- Harness check
  - Between damper clutch control solenoid valve and A/T-ECU — NG → **Repair**
  - OK ↓
- Replace the damper clutch control solenoid valve.
  - ↓
- Check the trouble symptoms. — NG → Replace the A/T-ECU.

Code No. 41 1st gear ratio does not meet the specification	Probable cause
If the output from the output shaft speed sensor multiplied by the 1st gear ratio is not the same as the output from the input shaft speed sensor after shifting to 1st gear has been completed, diagnosis code No. 41 is output. If diagnosis code No. 41 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range lamp flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of the low and reverse brake system • Malfunction of the underdrive clutch system • Noise generated • Malfunction of the direct planately carrier • Malfunction of the reduction brake system

★: Refer to the Transmission Workshop Manual.

MUT-II Self-Diag code
Is the diagnosis code No. 22 output?

Yes → Code No. 22 Input shaft speed sensor system check (Refer to P.23-14.)

No ↓

MUT-II Self-Diag code
Is the diagnosis code No. 23 output?

Yes → Code No. 23 Output shaft speed sensor system check (Refer to P.23-15.)

No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Disconnect the connector A-73 and measure voltage between 1 and 2 at the input shaft speed sensor.
- Engine: 2,000 r/min (approx. 50 km/h)
- Selector lever position: D (3rd gear)

(Voltage)
OK: A waveform such as the one shown on P.23-43 (Inspection Procedure Using an Oscilloscope) is output (flashing is 1.0 V or more) and there is no noise appearing in the waveform.

NG → Replace the input shaft speed sensor.
↓
Check the trouble symptoms.
NG ↓
A/T overhaul ★
- Replace the underdrive clutch retainer.

↓
Check the trouble symptoms.
NG ↓
Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Disconnect the connector A-72 and measure voltage between 1 and 2 at the output shaft speed sensor.
- Engine: 2,000 r/min (approx. 50 km/h)
- Selector lever position: D (3rd gear)

(Voltage)
OK: A waveform such as the one shown on P.23-43 (Inspection Procedure Using an Oscilloscope) is output (flashing is 1.0 V or more) and there is no noise appearing in the waveform.

NG → Replace the output shaft speed sensor.
↓
Check the trouble symptoms.
NG ↓
A/T overhaul ★
- Replace the direct planatery carrier

↓
Check the trouble symptoms.
NG ↓
Eliminate the cause of the noise.

OK ↓

A/T overhaul ★
- Underdrive clutch system check
- Low and reverse brake system check
- Reduction brake system check

Code No. 42 2nd gear ratio does not meet the specification	Probable cause
If the output from the output shaft speed sensor multiplied by the 2nd gear ratio is not the same as the output from the input shaft speed sensor after shifting to 2nd gear has been completed, diagnosis code No. 42 is output. If diagnosis code No. 42 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range lamp flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of the second brake system • Malfunction of the underdrive clutch system • Noise generated • Malfunction of the direct planately carrier • Malfunction of the reduction brake system

★: Refer to the Transmission Workshop Manual.

MUT-II Self-Diag code
Is the diagnosis code No. 22 output?

Yes → Code No. 22 Input shaft speed sensor system check (Refer to P.23-14.)

No ↓

MUT-II Self-Diag code
Is the diagnosis code No. 23 output?

Yes → Code No. 23 Output shaft speed sensor system check (Refer to P.23-15.)

No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Disconnect the connector A-73 and measure voltage between 1 and 2 at the input shaft speed sensor.
- Engine: 2,000 r/min (approx. 50 km/h)
- Selector lever position: D (3rd gear)

(Voltage)
OK: A waveform such as the one shown on P.23-43 (Inspection Procedure Using an Oscilloscope) is output (flaishing is 1.0 V or more) and there is no noise appearing in the waveform.

NG → Replace the input shaft speed sensor. ↓ Check the trouble symptoms. NG ↓ A/T overhaul ★
- Replace the underdrive clutch retainer.

↓ Check the trouble symptoms. NG ↓ Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Disconnect the connector A-72 and measure voltage between 1 and 2 at the output shaft speed sensor.
- Engine: 2,000 r/min (approx. 50 km/h)
- Selector lever position: D (3rd gear)

(Voltage)
OK: A waveform such as the one shown on P.23-43 (Inspection Procedure Using an Oscilloscope) is output (flaishing is1.0 V or more) and there is no noise appearing in the waveform.

NG → Replace the output shaft speed sensor. ↓ Check the trouble symptoms. NG ↓ A/T overhaul ★
- Replace the direct planately carrier

↓ Check the trouble symptoms. NG ↓ Eliminate the cause of the noise.

OK ↓

A/T overhaul ★
- Underdrive clutch system check
- Second brake system check
- Reduction brake system check

Code No. 43 3rd gear ratio does not meet the specification	Probable cause
If the output from the output shaft speed sensor multiplied by the 3rd gear ratio is not the same as the output from the input shaft speed sensor after shifting to 3rd gear has been completed, diagnosis code No. 43 is output. If diagnosis code No. 43 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range lamp flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of the underdrive clutch system • Malfunction of the overdrive clutch system • Noise generated • Malfunction of the direct planately carrier • Malfunction of the reduction brake system

★: Refer to the Transmission Workshop Manual.

MUT-II Self-Diag code
Is the diagnosis code No. 22 output?

Yes → Code No. 22 Input shaft speed sensor system check (Refer to P.23-14.)

No ↓

MUT-II Self-Diag code
Is the diagnosis code No. 23 output?

Yes → Code No. 23 Output shaft speed sensor system check (Refer to P.23-15.)

No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Disconnect the connector A-73 and measure voltage between 1 and 2 at the input shaft speed sensor.
- Engine: 2,000 r/min (approx. 50 km/h)
- Selector lever position: D (3rd gear)

(Voltage)
OK: A waveform such as the one shown on P.23-43 (Inspection Procedure Using an Oscilloscope) is output (flalshing is 1.0 V or more) and there is no noise appearing in the waveform.

NG → Replace the input shaft speed sensor. ↓ Check the trouble symptoms. NG ↓ A/T overhaul ★ • Replace the underdrive clutch retainer. ↓ Check the trouble symptoms. NG ↓ Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Disconnect the connector A-72 and measure voltage between 1 and 2 at the output shaft speed sensor.
- Engine: 2,000 r/min (approx. 50 km/h)
- Selector lever position: D (3rd gear)

(Voltage)
OK: A waveform such as the one shown on P.23-43 (Inspection Procedure Using an Oscilloscope) is output (flalshing is 1.0 V or more) and there is no noise appearing in the waveform.

NG → Replace the output shaft speed sensor. ↓ Check the trouble symptoms. NG ↓ A/T overhaul ★ • Replace the direct planatery carrier ↓ Check the trouble symptoms. NG ↓ Eliminate the cause of the noise.

OK ↓

A/T overhaul ★
- Underdrive clutch system check
- Second brake system check
- Reduction brake system check

Code No. 44 4th gear ratio does not meet the specification	Probable cause
If the output from the output shaft speed sensor multiplied by the 4th gear ratio is not the same as the output from the input shaft speed sensor after shifting to 4th gear has been completed, diagnosis code No. 44 is output. If diagnosis code No. 44 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range lamp flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of the underdrive clutch system • Noise generated • Malfunction of the direct planetely carrier • Malfunction of the direct clutch system

★: Refer to the Transmission Workshop Manual.

MUT-II Self-Diag code
Is the diagnosis code No. 22 output?

- Yes → Code No. 22 Input shaft speed sensor system check (Refer to P.23-14.)
- No ↓

MUT-II Self-Diag code
Is the diagnosis code No. 23 output?

- Yes → Code No. 23 Output shaft speed sensor system check (Refer to P.23-15.)
- No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Disconnect the connector A-73 and measure voltage between 1 and 2 at the input shaft speed sensor.
- Engine: 2,000 r/min (approx. 50 km/h)
- Selector lever position: D (3rd gear)

(Voltage)
OK: A waveform such as the one shown on P.23-43 (Inspection Procedure Using an Oscilloscope) is output (flashing is 1.0 V or more) and there is no noise appearing in the waveform.

- NG → Replace the input shaft speed sensor. ↓ Check the trouble symptoms. → NG ↓ A/T overhaul ★ • Replace the underdrive clutch retainer. ↓ Check the trouble symptoms. → NG ↓ Eliminate the cause of the noise.
- OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Disconnect the connector A-72 and measure voltage between 1 and 2 at the output shaft speed sensor.
- Engine: 2,000 r/min (approx. 50 km/h)
- Selector lever position: D (3rd gear)

(Voltage)
OK: A waveform such as the one shown on P.23-43 (Inspection Procedure Using an Oscilloscope) is output (flashing is 1.0 V or more) and there is no noise appearing in the waveform.

- NG → Replace the output shaft speed sensor. ↓ Check the trouble symptoms. → NG ↓ A/T overhaul ★ • Replace the direct planetaly carrier ↓ Check the trouble symptoms. → NG ↓ Eliminate the cause of the noise.
- OK ↓

A/T overhaul ★
- Overdrive clutch system check
- Underdrive clutch system check
- Direct clutch system check

Code No. 45 5th gear ratio does not meet the specification	Probable cause
If the output from the output shaft speed sensor multiplied by the 5th gear ratio is not the same as the output from the input shaft speed sensor after shifting to 5th gear has been completed, diagnosis code No. 45 is output. If diagnosis code No. 45 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range lamp flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of the second brake system • Malfunction of the overdrive clutch system • Noise generated • Malfunction of the direct planately carrier • Malfunction of the direct clutch system

★: Refer to the Transmission Workshop Manual.

MUT-II Self-Diag code
Is the diagnosis code No. 22 output?

Yes → Code No. 22 Input shaft speed sensor system check (Refer to P.23-14.)

No

MUT-II Self-Diag code
Is the diagnosis code No. 23 output?

Yes → Code No. 23 Output shaft speed sensor system check (Refer to P.23-15.)

No

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Disconnect the connector A-73 and measure voltage between 1 and 2 at the input shaft speed sensor.
- Engine: 2,000 r/min (approx. 50 km/h)
- Selector lever position: D (3rd gear)

(Voltage)
OK: A waveform such as the one shown on P.23-43 (Inspection Procedure Using an Oscilloscope) is output (flashing is 1.0 V or more) and there is no noise appearing in the waveform.

NG → Replace the input shaft speed sensor.
→ Check the trouble symptoms.
NG → A/T overhaul ★
- Replace the underdrive clutch retainer.

→ Check the trouble symptoms.
NG → Eliminate the cause of the noise.

OK

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Disconnect the connector A-72 and measure voltage between 1 and 2 at the output shaft speed sensor.
- Engine: 2,000 r/min (approx. 50 km/h)
- Selector lever position: D (3rd gear)

(Voltage)
OK: A waveform such as the one shown on P.23-43 (Inspection Procedure Using an Oscilloscope) is output (flaishing is 1.0 V or more) and there is no noise appearing in the waveform.

NG → Replace the output shaft speed sensor.
→ Check the trouble symptoms.
NG → A/T overhaul ★
- Replace the direct planetary carrier.

→ Check the trouble symptoms.
NG → Eliminate the cause of the noise.

OK

A/T overhaul ★
- Second brake system check
- Overdrive clutch system check
- Direct clutch system check

Code No. 46 Reverse gear ratio does not meet the specification	Probable cause
If the output from the output shaft speed sensor multiplied by the reverse gear ratio is not the same as the output from the input shaft speed sensor after shifting to reverse gear has been completed, diagnosis code No. 46 is output. If diagnosis code No. 46 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range lamp flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of the low and reverse brake system • Malfunction of the reverse clutch system • Noise generated • Malfunction of the direct planetary carrier. • Malfunction of the reduction brake system

★: Refer to the Transmission Workshop Manual.

MUT-II Self-Diag code
Is the diagnosis code No. 22 output?

Yes → Code No. 22 Input shaft speed sensor system check (Refer to P.23-14.)

No ↓

MUT-II Self-Diag code
Is the diagnosis code No. 23 output?

Yes → Code No. 23 Output shaft speed sensor system check (Refer to P.23-15.)

No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Disconnect the connector A-73 and measure voltage between 1 and 2 at the input shaft speed sensor.
- Engine: 2,000 r/min (approx. 50 km/h)
- Selector lever position: D (3rd gear)

(Voltage)
OK: A waveform such as the one shown on P.23-43 (Inspection Procedure Using an Oscilloscope) is output (flaishing is 1.0 V or more) and there is no noise appearing in the waveform.

NG → Replace the input shaft speed sensor. ↓ Check the trouble symptoms. NG ↓
A/T overhaul ★
- Replace the underdrive clutch retainer.

↓ Check the trouble symptoms. NG ↓ Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Disconnect the connector A-72 and measure voltage between 1 and 2 at the output shaft speed sensor.
- Engine: 2,000 r/min (approx. 50 km/h)
- Selector lever position: D (3rd gear)

(Voltage)
OK: A waveform such as the one shown on P.23-43 (Inspection Procedure Using an Oscilloscope) is output (flaishing is 1.0 V or more) there is no noise appearing in the waveform.

NG → Replace the output shaft speed sensor. ↓ Check the trouble symptoms. NG ↓
A/T overhaul ★
- Replace the direct planetary carrier.

↓ Check the trouble symptoms. NG ↓ Eliminate the cause of the noise.

OK ↓

A/T overhaul ★
- Low and reverse brake system check
- Reverse clutch system check
- Direct clutch system check

Code No. 51 Abnormal communication with engine-ECU <Vehicles without TCL> Abnormal communication with TCL-ECU <Vehicles with TCL>	Probable cause
If normal communication is not possible for a continuous period of 1 second or more when the ignition switch is at the ON position, the battery voltage is 10 V or more and the engine speed is 450 r/min or more, diagnosis code No. 51 is output. Diagnosis code No. 51 is also output if the data being received is abnormal for a continuous period of 4 seconds under the same conditions.	• Malfunction of connector • Malfunction of the engine-ECU <Vehicles without TCL> • Malfunction of the TCL-ECU <Vehicles with TCL> • Malfunction of the A/T-ECU

MUT-II Self-Diag code
- Is the diagnosis code No.61 output? <Vehicles without TCL>
- Is the diagnosis code No.74 output? <Vehicles with TCL>

No → Check the trouble symptoms.
NG → Replace the engine-ECU <Vehicles without TCL>. Replace the TCL-ECU <Vehicles with TCL>.
→ Check the trouble symptoms.
NG → Replace the A/T-ECU.

Yes → **Check the following connectors:**
- B-29, B-34 <Vehicles without TCL>
- B-29, B-71 <Vehicles with TCL>

NG → **Repair**
OK → Harness check
- Between engine-ECU and A/T-ECU <Vehicles without TCL>
- Between TCL-ECU and A/T-ECU <Vehicles with TCL>

NG → **Repair**
OK → Check the trouble symptoms.
NG → Replace the engine-ECU. <Vehicles without TCL> Replace the TCL-ECU. <Vehicles with TCL>
→ Check the trouble symptoms.
NG → Replace the A/T-ECU.

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 has been turned ON, it is judged that there is an open circuit or a short-circuit in the A/T control relay earth and diagnosis code No. 54 is output. Then the transmission is locked into 3rd gear as a fail-safe measure, and the N range lamp flashes at a frequency of 1 Hz.	• Malfunction of the A/T control relay • Malfunction of connector • Malfunction of the A/T-ECU

Check the A/T control relay. (Refer to P.23-53.)
NG → **Replace**
OK → **Check the following connectors:** A-13, B-75, B-29, B-31
NG → **Repair**
OK → Harness check
- Between A/T control relay and body earth
- Between A/T control relay and battery
- Between A/T control relay and A/T-ECU

NG → **Repair**
OK → Check the trouble symptoms.
NG → Replace the A/T-ECU.

Code No. 56 N range lamp system	Probable cause
If the N range signal is off after an N range lamp illumination instruction (ON instruction) has been given, it is judged that there is a short-circuit in the N range lamp earth and diagnosis code No. 56 is output.	• Malfunction of the N range lamp bulb • Malfunction of connector • Malfunction of the A/T-ECU

Check the N range lamp bulb (Refer to GROUP 52A – Instrument Panel.) — NG → **Replace**

↓ OK

Check the following connectors: C-05, B-29, B-78 — NG → **Repair**

↓ OK

Harness check
- Between N range lamp bulb and A/T-ECU

— NG → **Repair**

↓ OK

Check the trouble symptoms. — NG → Replace the A/T-ECU.

Code No. 71 Malfunction of A/T-ECU	Probale cause
There is an abnormality in the A/T-ECU. The transmission is locked into 3rd gear as a fail-safe measure.	• Malfunction of the A/T-ECU

Replace the A/T-ECU.

INSPECTION CHART FOR TROUBLE SYMPTOMS

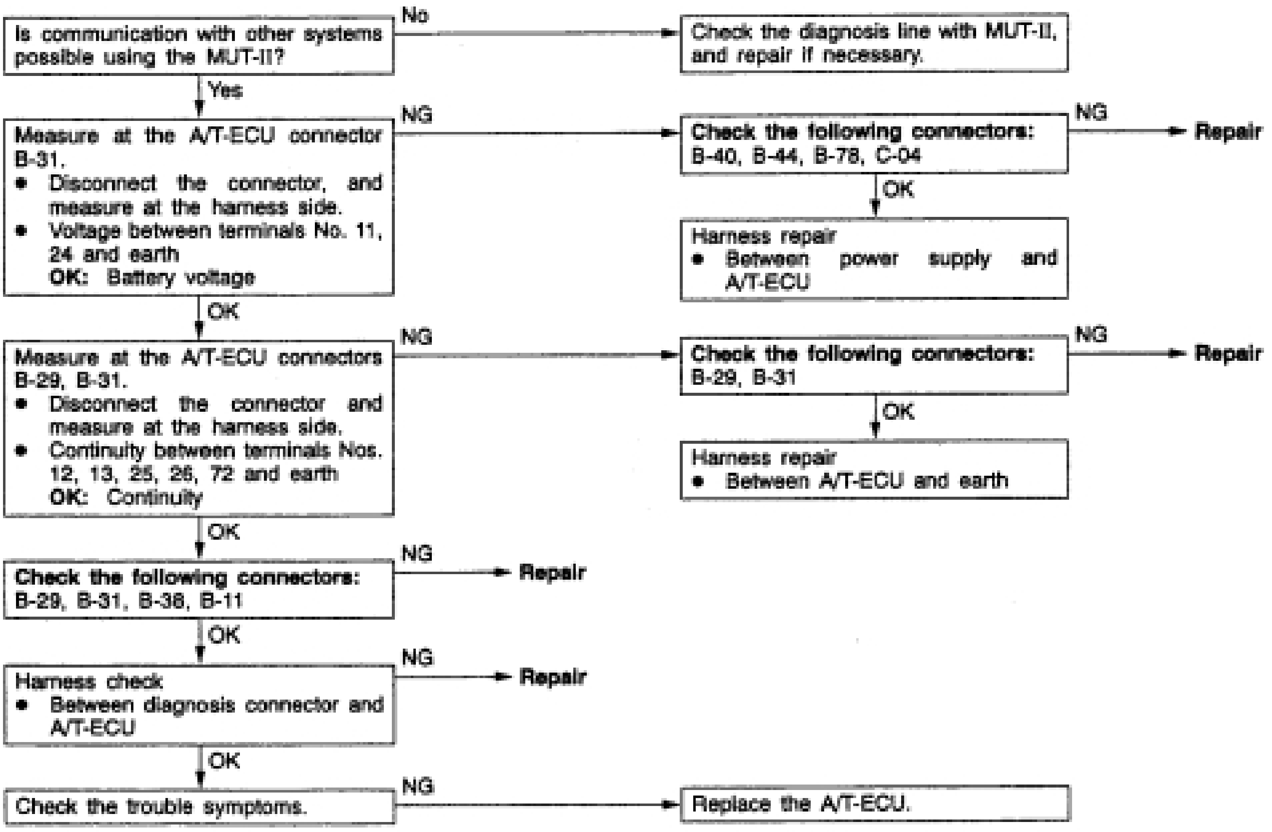
Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is not possible		1	23-25
Driving impossible	Starting impossible	2	23-26
	Does not move forward	3	23-26
	Does not reverse	4	23-27
	Does not move (forward or reverse)	5	23-27
Malfunction when starting	Engine stalling when shifting	6	23-28
	Shocks when changing from N to D and large time lag	7	23-28
	Shocks when changing from N to R and large time lag	8	23-29
	Shocks when changing from N to D, N to R and large time lag	9	23-30
Malfunction when shifting	Shocks and running up	10	23-30
Displaced shifting points	All points	11	23-31
	Some points	12	23-32
Does not shift	No diagnosis codes	13	23-32
Malfunction while driving	Poor acceleration	14	23-33
	Vibration	15	23-33
Inhibitor switch system		16	23-34

Trouble symptom	Inspection procedure No.	Reference page
Shift switch assembly system	17	23-34
Idle position switch system	18	23-35
Dual pressure switch system	19	23-35
Vehicle speed sensor system	20	23-36

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURE 1

Communication with MUT-II is not possible	Probable cause
If communication with the MUT-II is not possible, the cause is probably a defective diagnosis line or the A/T-ECU is not functioning.	• Malfunction of diagnosis line • Malfunction of connector • Malfunction of the A/T-ECU



INSPECTION PROCEDURE 2

Starting impossible	Probable cause
Starting is not possible when the selector lever is in P or N range.In such cases, the cause is probably a defective engine system, torque converter or oil pump.	• Malfunction of the engine system • Malfunction of the torque converter • Malfunction of the oil pump

★: Refer to the Transmission Workshop Manual.

- Inhibitor switch system check (Refer to P.23-34, INSPECTION PROCEDURE 16.)
  - NG → **Repair, replace**
  - OK ↓
- Check the transmission control cable assembly.
  - NG → **Repair, replace**
  - OK ↓
- Check the engine system.
  - Control system, ignition system, fuel system, main engine system
  - NG → **Repair, replace**
  - OK ↓
- Torque converter check
  - Check for incorrect installation (inserted at an angle, etc.) and for damaged splines.
  - NG → Repair if possible. If the splines are damaged and repairs are not possible, replace the torque converter assembly.
  - OK ↓
- Repaice the oil pump assembly. ★ (The oil pump cannot be disassembled.)

INSPECTION PROCEDURE 3

Does not move (forward)	Probable cause
If the vehicle does not move forward when the selector lever is shifted from N to D, sport mode 1st or sport mode 2nd while the engine is idling, the cause is probably abnormal line pressure or a malfunction of the underdrive clutch or valve body.	• Abnormal line pressure • Malfunction of the underdrive solenoid valve • Malfunction of the underdrive clutch • Malfunction of the valve body

★: Refer to the Transmission Workshop Manual.

- **MUT-II Actuator test**
  - No. 2 Underdrive solenoid valve
    OK: Sound of operation can be heard.
  - NG → Replace the solenoid valve. ★
  - OK ↓
- Hydraulic pressure test (Refer to P.23-56.)
  - Measure the hydraulic pressure for each element when in sport mode 1st.
    Standard value: Refer to P.23-57.
  - NG → Valve body disassembly, cleaning and reassembly ★
    - Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
    - If the damage cannot be repaired, replace the valve body assembly.
  - OK ↓
- Underdrive clutch system check ★
  - Remove the transmission assembly, valve body cover and valve body.
  - Pistons should operate and pressure should be maintained when air is blown through the underdrive clutch oil hole in the transmission case.
  - OK → Valve body disassembly, cleaning and reassembly ★
  - NG → Underdrive clutch check ★
    - Check for burning of the facing, defective piston seal rings and interference at the retainer.

INSPECTION PROCEDURE 4

Does not reverse	Probable cause
If the vehicle does not reverse when the selector lever is shifted from N to R range while the engine is idling, the cause is probably abnormal pressure in the reverse clutch or low and reverse brake or a malfunction of the reverse clutch, low and reverse brake or valve body.	• Abnormal reverse clutch pressure • Abnormal low and reverse brake pressure • Malfunction of the low and reverse solenoid valve • Malfunction of the reverse clutch • Malfunction of the low and reverse brake • Malfunction of the valve body

★: Refer to the Transmission Workshop Manual.

MUT-II Actuator test
- No. 1 Low and reverse solenoid valve
  OK: Sound of operation can be heard.

NG → Replace the low and reverse solenoid valve. ★

↓ OK

Hydraulic pressure check (Refer to P.23-56.)
- Measure the reverse clutch pressure in R range.
  Standard value: Refer to P.23-57.

NG → Valve body disassembly, cleaning and reassembly ★

↓ OK

Hydraulic pressure check (Refer to P.23-56.)
- Measure the low and reverse brake pressure in R range.
  Standard value: Refer to P.23-57.

NG → Valve body disassembly, cleaning and reassembly ★
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

↓ OK

Reverse clutch system and low and reverse brake system check ★
- Remove the transmission assembly, valve body cover and valve body.
- Pistons should operate and pressure should be maintained when air is blown through the reverse clutch oil hole and the low reverse brake oil hole in the transmission case.

OK → Valve body disassembly, cleaning and reassembly ★

NG → Reverse clutch and low and reverse brake check ★
- Check for burning of the facing, defective piston seal rings and interference at the retainer.

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 shifted to any position while the engine is idling, the cause is probably abnormal line pressure, or a malfunction of the power train, oil pump or valve body.	• Abnormal line pressure • Malfunction of power train • Malfunction of the oil pump • Malfunction of the valve body

★: Refer to the Transmission Workshop Manual.

Hydraulic pressure check (Refer to P.23-56.)
- Measure the hydraulic pressure for each element when driving in sport mode 1st gear, 2nd gear and R range.
  Standard value: Refer to P.23-57.

OK → Power train check ★
- Disassemble the transmission, check the condition of the planetary carrier, output shaft and differential, etc.

↓ NG

Replace the oil pump assembly. ★
(The oil pump cannot be disassembled.)

NG → Valve body disassembly, cleaning and reassembly ★
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

INSPECTION PROCEDURE 6

Engine stalling when shifting	Probable cause
If the engine stalls when the selector lever is shifted from N to D or R range while the engine is idling, the cause is probably a malfunction of the engine system, damper clutch solenoid valve, valve body or torque converter (damper clutch malfunction).	• Malfunction of the engine system • Malfunction of the damper clutch control solenoid valve • Malfunction of the valve body • Malfunction of the torque converter (Malfuction of the damper clutch)

★: Refer to the Transmission Workshop Manual.

Engine system check
- Check the control system, ignition system, fuel system and main system.

NG → **Repair, replace**

OK ↓

Replace the damper clutch control solenoid valve.

↓

Valve body disassembly, cleaning and reassembly ★
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

NG → Repalce the torque converter.

INSPECTION PROCEDURE 7

Shocks when changing from N to D and large time lag	Probable cause
If abnormal shocks or a time lag of 2 seconds or more occur when the selector lever is shifted from N to D range while the engine is idling, the cause is probably abnormal underdrive clutch pressure or a malfunction of the underdrive clutch, valve body or idle position switch.	• Abnormal underdrive clutch pressure • Malfunction of the underdrive solenoid valve • Malfunction of the underdrive clutch • Malfunction of the valve body • Malfunction of the idle position switch

★: Refer to the Transmission Workshop Manual.

MUT-II Actuator test
- No. 2 Underdrive solenoid valve
  OK: Sound of operation can be heard.

NG → Replace the underdrive solenoid valve. ★

OK ↓

When does the shock occur?

When starting → Shocks sometimes occur
- No → Valve body disassembly, cleaning and reassembly ★
- Yes ↓

MUT-II Data list
- No. 64 Idle position switch
  OK: Turns from on to off when the accelerator pedal is slightly depressed from the fully closed position.

OK → Valve body disassembly, cleaning and reassembly ★

NG ↓

- INSPECTION PROCEDURE 18, Idle position switch system check (Refer to P.23-35.)

When shifting ↓

Hydraulic pressure test (Refer to P.23-56.)
- Measure the underdrive clutch pressure when shifting from N to D.
  Standard value: Refer to P.23-57.

NG → Valve body disassembly, cleaning and reassembly ★

OK ↓

Underdrive clutch system check ★
- Remove the transmission assembly, valve body cover and valve body.
- Pistons should operate and pressure should be maintained when air is blown through the underdrive clutch oil hole in the transmission case.

OK → Valve body disassembly, cleaning and reassembly ★

NG ↓

Underdrive clutch check ★
- Check for burning of the facing, defective piston seal rings and interference at the retainer.

Valve body disassembly, cleaning and reassembly ★
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

INSPECTION PROCEDURE 8

Shocks when changing from N to R and large time lag	Probable cause
If abnormal shocks or a time lag of 2 seconds or more occurs when the selector lever is shifted from N to R range while the engine is idling, the cause is probably abnormal reverse clutch pressure or low and reverse brake pressure, or a malfunction of the reverse clutch, low and reverse brake, valve body or idle position switch.	• Abnormal reverse clutch pressure • Abnormal low and reverse brake pressure • Malfunction of the low and reverse solenoid valve • Malfunction of the reverse clutch • Malfunction of the low and reverse brake • Malfunction of the valve body • Malfunction of the idle position switch

★: Refer to the Transmission Workshop Manual.

MUT-II Actuator test
- No. 1 Low and reverse solenoid valve
  OK: Sound of operation can be heard.

NG → Replace the low and reverse solenoid valve. ★

OK ↓

When does the shock occur?

When starting → Shocks sometimes occur

- No → Valve body disassembly, cleaning and reassembly ★
- Yes ↓

MUT-II Data list
- No. 64 Idle position switch
  OK: Turns from on to off when the accelerator pedal is slightly depressed from the fully closed position.

OK → Valve body disassembly, cleaning and reassembly ★

NG ↓

- INSPECTION PROCEDURE 18, Idle position switch system check (Refer to P.23-35.)

When shifting ↓

Hydraulic pressure test (Refer to P.23-56.)
- Measure the reverse clutch pressure in R range.
  Standard value: Refer to P.23-57.

NG → Valve body disassembly, cleaning and reassembly ★

OK ↓

Hydraulic pressure test (Refer to P.23-56.)
- Measure the low and reverse brake pressure in R range.
  Standard value: Refer to P.23-57.

NG → Valve body disassembly, cleaning and reassembly ★

OK ↓

Reverse clutch system and low reverse brake system check ★
- Remove the transmission assembly, valve body cover and valve body.
- Pistons should operate and pressure should be maintained when air is blown through the reverse clutch oil hole and low and reverse brake oil hole in the transmission case.

OK → Valve body disassembly, cleaning and reassembly ★
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

NG ↓

Reverse clutch and low reverse brake check ★
- Check for burning of the facing, defective piston seal rings and interference at the retainer.

INSPECTION PROCEDURE 9

Shocks when changing from N to D, N to R and large time lag	Probable cause
If abnormal shocks or a time lag of 2 seconds or more occur when the selector lever is shifted from N to D range and from N to R range 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 the oil pump • Malfunction of the valve body

★: Refer to the Transmission Workshop Manual.

Hydraulic pressure test (Refer to P.23-56.)
- Measure the hydraulic pressure for each element when driving in sport mode 1st gear, 2nd gear and R range.
  Standard value: Refer to P.23-57.

NG → Adjust the line pressure. (Refer to P.23-63.)
- NG → When does the shock occur?

OK ↓

When does the shock occur?

When starting → Valve body disassembly, cleaning and reassembly ★
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

When shifting ↓

Replace the oil pump assembly. ★
(The oil pump cannot be disassembled.)

INSPECTION PROCEDURE 10

Shocks and running up	Probable cause
If shocks occur when driving due to upshifting or downshifting and 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 each solenoid valve • Malfunction of the oil pump • Malfunction of the valve body • Malfunction of each brake or each clutch

★: Refer to the Transmission Workshop Manual.

MUT-II Actuator test
- No. 1 Low and reverse solenoid valve
- No. 2 Underdrive solenoid valve
- No. 3 Second solenoid valve
- No. 4 Overdrive solenoid valve
- No. 5 Reduction solenoid valve
  OK: Sound of operation can be heard.

NG → Replace the solenoid valve.

OK ↓

Adjust the line pressure. (Refer to P.23-63.)

NG → Replace the oil pump assembly. ★
(The oil pump cannot be disassembled.)
- NG → Valve body disassembly, cleaning and reassembly ★
  - Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
  - If the damage cannot be repaired, replace the valve body assembly.

OK ↓

Clutch and brake check ★
- Check for burning of the facing, defective piston seal rings and interference at the retainer.

INSPECTION PROCEDURE 11

All points (Displaced shifting points)	Probable cause
If all shift points are displaced while driving, the cause is probably a malfunction of the output shaft speed sensor, TPS/APS or of a solenoid valve.	• Malfunction of the output shaft speed sensor • Malfunction of the TPS/APS • Malfunction of each solenoid valve • Abnormal line pressure • Malfunction of the valve body • Malfunction of the A/T-ECU

★: Refer to the Transmission Workshop Manual.

MUT-II Data list
- No. 23 Output shaft speed sensor
  OK: Increases in proportion to vehicle speed.

NG → Code No. 23, Output shaft speed sensor system check (Refer to P.23-15.)

↓ OK

MUT-II Data list
- No. 11 TPS/APS
  OK: Increases in proportion to accelerator pedal opening angle

NG → Code No. 11, 12, 14, TPS/APS system check (Refer to P.23-13.)

↓ OK

MUT-II Data list
- No. 31 Low and reverse solenoid valve duty %
- No. 32 Underdrive solenoid valve duty %
- No. 33 Second solenoid valve duty %
- No. 34 Overdrive solenoid valve duty %
- No. 35 Reduction solenoid valve duty %
  OK: Refer to the table below.

NG → Replace the solenoid valve. ★ → NG → Repalce the A/T-ECU.

↓ OK

Adjust the line pressure. (Refer to P.23-63.)

NG → Valve body disassembly, cleaning and reassembly ★
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

	No. 31	No. 32	No. 33	No. 34	No. 35
Driving at constant speed in 1st gear	0 %	0 %	100 %	100 %	0 %
Driving at constant speed in 2nd gear	100 %	0 %	0 %	100 %	0 %
Driving at constant speed in 3rd gear	100 %	0 %	100 %	0 %	0 %
Driving at constant speed in 4th gear	0 %	0 %	100 %	0 %	100 %
Driving at constant speed in 5th gear	0 %	100 %	0 %	0 %	100 %

INSPECTION PROCEDURE 12

Some points (Displaced shifting points)	Probable cause
If some of the shift points are displaced while driving, the cause is probably a malfunction of the valve body, or it is related to control and is not an abnormality.	• Malfunction of the valve body

★: Refer to the Transmission Workshop Manual.

INVECS-II CANCEL COMMAND
- Use the MUT-II to stop the INVECS-II function.

Does standard shifting occur normally?
- No → Does the problem occur only when the automatictransmissionfluidtemperature is 35°C or lower or 120°C or higher?
  - No → Valve body disassembly, cleaning and reassembly ★
    - Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
    - If the damage cannot be repaired, replace the valve body assembly.
  - Yes → It is related to control and is not an abnormality.
- Yes → It is related to control and is not an abnormality.

INSPECTION PROCEDURE 13

No diagnosis codes (Does not shift)	Probable cause
If shifting does not occur while driving and no diagnosis codes are output, the cause is probably a malfunction of the inhibitor switch, sport mode switch, or A/T-ECU.	• Malfunction of the inhibitor switch • Malfunction of the sport mode switch • Malfunction of the A/T-ECU

Does the transmission remain in 3rd gear with selector lever in position D ?
- No → MUT-II Data list
- Yes → Is backup power being supplied to the A/T-ECU?
  - No → Power supply circuit check
  - Yes → Is power being supplied to the A/T-ECU?
    - Yes → MUT-II Data list
    - No → Power supply circuit check

MUT-II Data list
- No. 61 Inhibitor switch
  OK: A/T-ECU input signal and selector lever position should match.

NG → • INSPECTION PROCEDURE 16, Inhibitor switch system check. (Refer to P.23-34.)

OK ↓

MUT-II Data list
- No.67 shift switch assembly select switch
- No.68 shift switch assembly upshift switch
- No.69 shift switch assembly downshift switch
  OK: A/T-ECU input signal and selector lever position should match.

NG → • INSPECTION PROCEDURE 17, Shift switch assembly system check (Refer to P.23-34.)

OK ↓

Replace the A/T-ECU.

Power supply circuit check
- Pay particular attention to open circuits in the harnesses, poor connector connections and open circuits in fuses.
- If there is a blown fuse, investigate why a short-circuit has occurred and then replace the fuse.

INSPECTION PROCEDURE 14

Poor acceleration	Probable cause
If acceleration is poor even if downshifting occurs while driving, the cause is probably a malfunction of the engine system or of a brake or clutch.	• Malfunction of the engine system • Malfunction of the brake or clutch

★: Refer to the Transmission Workshop Manual.

- Engine system check
  - Check the control system, ignition system, fuel system and main system.
  - NG → **Replace, repair**
  - OK ↓
- Brake or clutch check ★
  - Check for burning of the facing, defective piston seal rings and interference at the retainer.

INSPECTION PROCEDURE 15

Vibration	Probable cause
If vibration occurs when driving at constant speed or when accelerating and deceleration in top range, the cause is probably abnormal damper clutch pressure or a malfunction of the engine system, damper clutch control solenoid valve, torque converter or valve body.	• Abnormal damper clutch pressure • Malfunction of the engine system • Malfunction of the damper clutch control solenoid valve • Malfunction of the torque converter • Malfunction of the valve body

★: Refer to the Transmission Workshop Manual.

- **MUT-II Actuator test**
  - No. 6 Damper clutch control solenoid valve
    OK: Sound of operation can be heard.
  - NG → Replace the damper clutch control solenoid valve. ★
  - OK ↓
- Does the problem occur even when the oil temperature sensor connector is disconnected?
  - Yes → Engine system check
    - Check the control system, ignition system, fuel system and main system.
  - No ↓
- Hydraulic pressure test (Refer to P.23-56.)
  - Measure the damper clutch pressure.
    Standard value: Refer to P.23-57.
  - NG → Valve body disassembly, cleaning and reassembly ★
    - Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
    - If the damage cannot be repaired, replace the valve body assembly.
  - OK ↓
- Replace the torque converter assembly.

INSPECTION PROCEDURE 16

Inhibitor switch system	Probable cause
The cause is probably a malfunction of the inhibitor switch circuit or ignition switch circuit	• Malfunction of the inhibitor switch • Malfunction of the ignition switch • Malfunction of connector • Malfunction of the A/T-ECU

- Inhibitor switch check (Refer to P.23-49.)
  - NG → **Replace**
  - OK ↓
- Check the voltage of the inhibitor switch connector A-74.
  - Disconnect the connector and measure at the harness side.
  - Voltage between terminal No. 8 and earth
  - **OK:** Battery voltage
  - NG → **Check the following connectors:** A-74, B-36, B-43, B-44
    - NG → **Repair**
    - OK ↓
    - Harness check
      - Between inhibitor switch and ignition switch
      - NG → **Repair**
    - OK ↓
    - Check the trouble symptoms.
    - NG ↓
    - Ignition switch check (Refer to GROUP54 – Ignition Switch.)
  - OK ↓
- **Check the following connectors:** A-74, B-29
  - NG → **Repair**
  - OK ↓
- Harness check
  - Between inhibitor switch and A/T-ECU connector
  - NG → **Repair**
  - OK ↓
- Check the trouble symptoms.
  - NG → Repalce the A/T-ECU.

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 a defective A/T-ECU.	• Malfunction of the inhibitor switch • Malfunction of the shift switch assembly select switch • Malfunction of the shift switch assembly upshift switch • Malfunction of the shift switch assembly downshift switch • Malfunction of connector • Malfunction of the A/T-ECU

- Inhibitor switch check (Refer to P.23-49.)
  - NG → INSPECTION PROCEDURE 16, Inhibitor switch system check (Refer to P.23-34.)
  - OK ↓
- Shift switch assembly check (Refer to P.23-67.)
  - NG → **Replace**
  - OK ↓
- **Check the following connectors:** B-67, B-29
  - NG → **Repair**
  - OK ↓
- Harness check
  - Between shift switch assembly and A/T-ECU
  - NG → **Repair**
  - OK ↓
- Check the trouble symptoms.
  - NG → Replace the A/T-ECU.

INSPECTION PROCEDURE 18

Idle position switch system	Probable cause
The cause is probably a defective idle position switch circuit or a defective A/T-ECU.	• Malfunction of the idle position switch • Malfunction of connector • Malfunction of the A/T-ECU

Idle position switch check
(Refer to GROUP 13A – On-vehicle Service.)
NG → Replace the TPS or APS.
↓ OK

Check the following connectors:
A-07, B-30 <Vehicles without TCL>, A-08, B-30 <Vehicles with TCL>
NG → **Repair**
↓ OK

Harness check
• Between idle position switch and A/T-ECU
NG → **Repair**
↓ OK

Check the trouble symptoms.
NG → Replace the A/T-ECU.

INSPECTION PROCEDURE 19

Dual pressure switch system	Probable cause
The cause is probably a defective dual pressure switch circuit or a defective A/T-ECU.	• Malfunction of the dual pressure switch • Malfunction of connector • Malfunction of A/C system • Malfunction of the A/T-ECU

Dual pressure switch check (Refer to GROUP 55 – On-vehicle service.)
NG → **Replace**
↓ OK

Check the voltage of the A/T-ECU connector B-31.
• Disconnect the connector and check at the harness side.
• Ignition switch: ON
• A/C switch: ON
• Voltage between terminal No. 10 and earth
OK: Battery voltage

↓ NG

A/C system check (Refer to GROUP 55 – Troubleshooting.)

OK →

Check the following connectors:
B-31, A-11
NG → **Repair**
↓ OK

Check the trouble symptoms.
↓ NG

Check the A/C system. (Refer to GROUP 55 – Troubleshooting.)
NG → **Repair**
↓ OK

Replace the A/T-ECU.

INSPECTION PROCEDURE 20

Vehicle speed sensor system	Probable cause
The cause is probably a defective vehicle speed sensor circuit or a defective A/T-ECU.	• Malfunction of the vehicle speed sensor • Malfunction of connector • Malfunction of the A/T-ECU

Check the vehicle speed sensor.
(Refer to GROUP 54 – Combination Meters.)

- NG → **Replace**
- OK ↓

Measure at the vehicle speed sensor connector A-10.
- Disconnect the connector, and measure at the harness side.

1. Voltage between 1 and earth (Ignition switch: ON)
   OK: Battery voltage
2. Voltage between 3 and earth (Ignition switch: ON)
   OK: 4.8 – 5.2 V
3. Continuity between 2 and earth
   OK: Continuity

OK ↓

Check the following connectors:
A-06, B-29

- NG → **Repair**
- OK ↓

Check trouble symptom.

NG ↓

Check the harness wire between the A/T-ECU and the vehicle speed sensor connector.

- NG → **Repair**
- OK ↓

Replace the A/T-ECU.

1. NG →

Check the following connectors:
B-40, B-44, B-77

- NG → **Repair**
- OK ↓

Check trouble symptom.

NG ↓

Check the harness wire between the vehicle speed sensor and ignition switch connector.

- NG → **Repair**
- OK ↓

Check the ignition switch. (Refer to GROUP 54 – Ignition switch.)

2. NG →

Check the following connector: B-29

- NG → **Repair**
- OK ↓

Check trouble symptom.

NG ↓

Check the harness wire between the A/T-ECU and the vehicle speed sensor connector.

- NG → **Repair**
- OK ↓

Replace the A/T-ECU.

3. NG →

Check the harness wire between the vehicle speed sensor and the earth, and repair if necessary.

DATA LIST REFERENCE TABLE

Item No.	Check item	Check requirement		Normal value
11	Throttle position sensor <Vehicles without TCL> Accelerator pedal position sensor <Vehicles with TCL>	Engine: Stopped Selector lever position: P	Accelerator pedal: Released	400 – 1,000 mV
			Accelerator pedal: Halfly depressed	Gradually rises from the above value
			Accelerator pedal: Depressed	4,500 – 5,000 mV
15	Oil temperature sensor	Warming up	Drive for 15 minutes or more so that the automatic transmission fluid temperature becomes 70 – 90 °C.	Gradually rises to 70 – 90 °C
21	Crank angle sensor	Engine: Idling Selector lever position: P	Accelerator pedal: Released	800 – 900 rpm
			Accelerator pedal: Halfly depressed	Gradually rises from the above value
22	Input shaft speed sensor	Selector lever position: Sport mode	Driving at constant speed of 50 km/h in 3rd gear	1,900 – 2,100 rpm
23	Output shaft speed sensor	Selector lever position: Sport mode	Driving at constant speed of 50 km/h in 3rd gear	1,900 – 2,100 rpm
26	Stop lamp switch	Ignition switch: ON Engine: Stopped	Brake pedal: Depressed	ON
			Brake pedal: Released	OFF
29	Vehicle speed sensor	Selector lever position: Sport mode	Idling with 1st gear (Vehicle stopped)	0 km/h
			Driving at constant speed of 50 km/h in 3rd gear	50 km/h
31	Low and reverse solenoid valve duty %	Selector lever position: Sport mode	Driving at constant speed in 1st gear	No. 31: 0 %, No. 32: 0 %, No. 33: 100 %, No. 34: 100%, No. 35: 0%
32	Underdrive solenoid valve duty %		Driving at constant speed in 2nd gear	No. 31: 100 %, No. 32: 0 %, No. 33: 0 %, No. 34: 100%, No. 35: 0%
33	Second solenoid valve duty %		Driving at constant speed gear in 3rd gear	No. 31: 100 %, No. 32: 0 %, No. 33: 100 %, No. 34: 0%, No. 35: 0%
34	Overdrive solenoid valve duty %		Driving at constant speed gear in 4th gear	No. 31: 0 %, No. 32: 0 %, No. 33: 100 %, No. 34: 0%, No. 35: 100%
35	Reduction solenoid valve duty %		Driving at constant speed in 5th gear	No. 31: 0 %, No. 32: 100 %, No. 33: 0 %, No. 34: 0%, No. 35: 100%

Item No.	Check item	Check requirement		Normal value
36	Damper clutch control solenoid valve duty %	Selector lever position: Sport mode	Driving at 50 km/h in 3rd gear with accelerator released	0 %
			Driving at constant speed of 70 km/h in 3rd gear	Approx. 70 – 90 %
52	Amount of damper clutch slippage	Selector lever position: Sport mode	Driving at constant speed of 50 km/h in 3rd gear	Approx. 100 – 300 rpm
			Driving at constant speed of 70 km/h in 3rd gear	Approx. 0 – 10 rpm
54	Control relay output voltage	Ignition switch : OFF	Ignition switch: ON	Battery voltage (mV)
58	Intake manifold vacuum	Selector lever position: Sport mode	N range with accelerator pedal released → depressed.	Date changes
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 constant speed of 10 km/h in 1st gear	1st
			Driving at constant speed of 30 km/h in 2nd gear	2nd
			Driving at constant speed of 50 km/h in 3rd gear	3rd
			Driving at constant speed of 50 km/h in 4th gear	4th
			Driving at constant speed of 70 km/h in 5th gear	5th
64	Idle position switch	Engine: Idling Selector lever position: N	Accelerator pedal: Released	ON
			Accelerator pedal: Halfly depressed	OFF
65	Dual pressure switch	Engine: Idling Selector lever position: N	A/C switch: ON	ON
			A/C switch: OFF	OFF

Item No.	Check item	Check requirement	Normal value
67	Shift switch assembly select switch	Ignition switch: ON Engine: Stopped	Selector lever position: D Data list No.67: OFF, Data list No.68: OFF, Data list No.69: OFF Selector lever operation: Select sport mode Data list No.67: ON, Data list No.68: OFF, Data list No.69: OFF Selector lever operation: Upshift and hold the selector lever Data list No.67: ON, Data list No.68: ON, Data list No.69: OFF Selector lever operation: Downshift and hold the selector lever Data list No.67: ON, Data list No.68: OFF, Data list No.69: ON
68	Shift switch assembly upshift switch		
69	Shift switch assembly downshift switch		

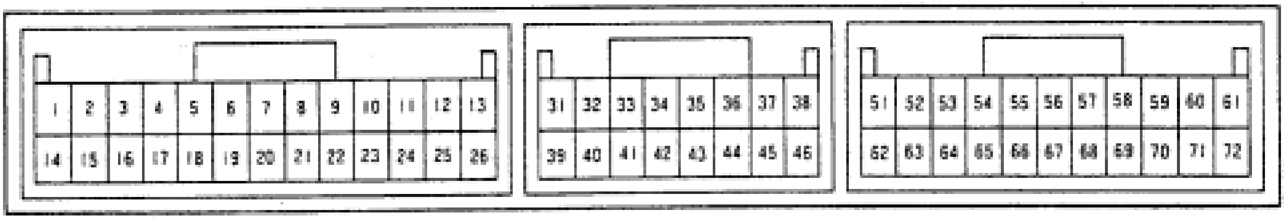
ACTUATOR TEST JUDGEMENT VALUE

Item No.	Check item	Test content	Check requirement	Normal value
1	Low reverse solenoid valve	Drive the solenoid valve specified by the MUT-II at 50 % duty for 5 seconds. No other solenoid valve should be energised.	Ignition switch: ON Selector lever position: P Engine: 0 r/min Vehicle speed: 0 km/h (Vehicle stopped) Throttle (Accelerator) opening voltage: Less than 0 V Idle switch: ON	The operation sound should be audible when the solenoid valve is driven.
2	Underdrive solenoid valve			
3	Second solenoid valve			
4	Overdrive solenoid valve			
5	Reduction solenoid valve			
6	Damper clutch control solenoid valve			
7	1st indicator lamp	Illuminate each indicator lamp for three seconds according to the signal from the MUT-II.		Shift indicator lamp illuminates.
8	2nd indicator lamp			
9	3rd indicator lamp			
10	4th indicator lamp			
11	5th indicator lamp			
12	A/T control relay	Control relay is OFF for 3 seconds.		Data list No. 54 (1) During test: 0 mV (2) Normal: Battery voltage [mV]

INVECS-II CANCEL COMMAND

Item No.	Item	Content	Remarks
14	INVECS-II	Stop the INVECS-II control and change gears according to the standard shift pattern.	Use this function when carrying out procedure 7 in the road tests.

CHECK AT A/T-ECU TERMINALS



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Terminal No.	Check item	Check requirement	Standard value
1	Underdrive solenoid valve	Selector lever position: Sport mode (1st gear)	Battery voltage
		Selector lever position: P	Approx.7 – 9 V
2	Solenoid valve power supply	Ignition switch: OFF	0 V
		Ignition switch: ON	Battery voltage
3	Solenoid valve power supply	Ignition switch: OFF	0 V
		Ignition switch: ON	Battery voltage
4	Shift indicator lamp (1st)	Gear: 1st gear	Battery voltage
		Gear: Other than above	0 V
5	Shift indicator lamp (3rd)	Gear: 3rd gear	Battery voltage
		Gear: Other than above	0 V
6	Shift indicator lamp (5th)	Gear: 5th gear	Battery voltage
		Gear: Other than above	0 V
10	A/C compressor load signal	A/C switch: OFF	0 V
		A/C switch: ON	Battery voltage
11	Power supply	Ignition switch: OFF	0 V
		Ignition switch: ON	Battery voltage
12	Earth	Always	0 V
13	Earth	Always	0 V
14	Overdrive solenoid valve	Selector lever position: Sport mode (3rd gear)	Battery voltage
		Selector lever position: P	Approx. 7 – 9 V
15	Damper clutch control solenoid valve	Selector lever position: Sport mode (1st gear)	Battery voltage
		Selector lever position: Sport mode (50 km/h in 4th gear)	Other than battery voltage

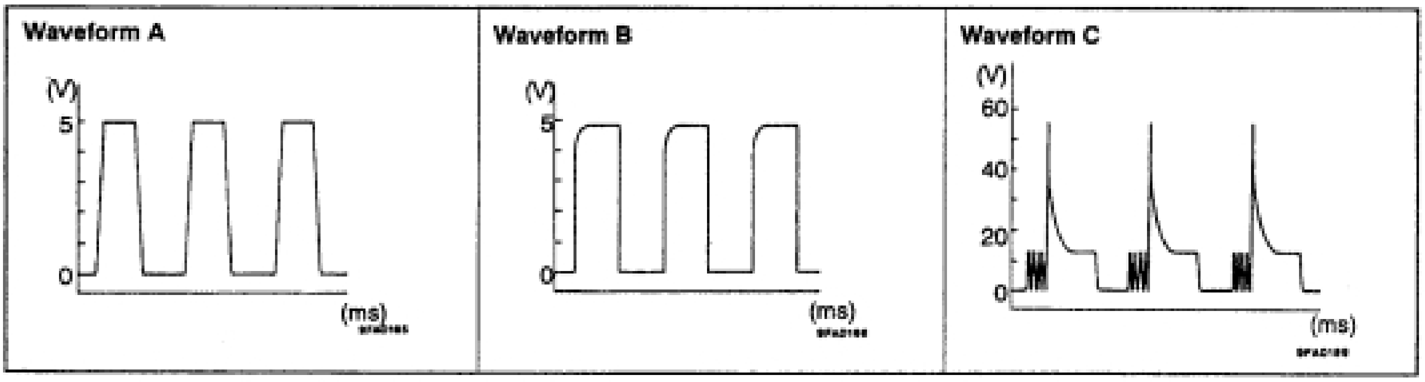
Terminal No.	Check item	Check requirement	Standard value
16	Second solenoid valve	Selector lever position: Sport mode (2nd gear)	Battery voltage
		Selector lever position: P	Approx. 7 – 9 V
17	Shift indicator lamp (2nd)	Gear: 2nd gear	Battery voltage
		Gear: Other than above	0 V
18	Shift indicator lamp (4th)	Gear: 4th gear	Battery voltage
		Gear: Other than above	0 V
21	Engine-ECU torque reduction request signal <Vehicles with TCL>	Ignition switch: ON (except during shifting)	4 – 5 V
23	Diagnosis control	–	–
24	Power supply	Ignition switch: OFF	0 V
		Ignition switch: ON	Battery voltage
25	Earth	Always	0 V
26	Earth	Always	0 V
31	Input shaft speed sensor	Measure between terminal No. 31 and No. 43 by an oscilloscope. Engine: 2,000 r/min Selector lever position: Sport mode (3rd gear)	Refer to P.23-43, Oscilloscope inspection procedure.
32	Output shaft speed sensor	Measure between terminal No. 32 and No. 43 by an oscilloscope. Engine: 2,000 r/min Selector lever position: Sport mode (3rd gear)	Refer to P.23-43, Oscilloscope inspection procedure.
33	Crank angle sensor	Engine: Idling	2.0 – 2.4 V
36	Idle position switch	Engine: Idling	0 V
		Engine: Other than idling	5 V
38	Back up power suuply	Always	Battery voltage
43	Sensor earth	Always	0 V
44	Oil temperature sensor	ATF temperature: 25 °C	3.8 – 4.0 V
		ATF temperature: 80 °C	2.3 – 2.5 V
45	Throttle position sensor (TPS) Accelerator pedal position sensor (APS)	Accelerator pedal: Released (Engine stopped)	0.5 – 1.0 V
		Accelerator pedal: Depressed (Engine stopped)	4.5 – 5.0 V
51	Reduction solenoid valve	Selector lever position: D (1st gear)	Battery voltage
		Selector lever position: D (5th gear)	Approx. 7 – 9 V

Terminal No.	Check item	Check requirement	Standard value
53	Communication with engine-ECU <Vehicles without TCL>	Engine: Idling Selector lever position: D	Other than 0 V
	Communication with TCL-ECU <Vehicles with TCL>		
54	Communication with engine-ECU <Vehicles without TCL>	Engine: Idling Selector lever position: D	Other than 0 V
	Communication with TCL-ECU <Vehicles with TCL>		
55	Inhibitor switch P	Selector lever position: P	Battery voltage
		Selector lever position: Other than above	0 V
56	Inhibitor switch N	Selector lever position: N	Battery voltage
		Selector lever position: Other than above	0 V
57	Select switch	Selector lever position: Sport mode	Battery voltage
		Selector lever position: Other than above	0 V
58	Downshift switch	Selector lever: Downshift in sport mode, and hold the selector lever	Battery voltage
		Selector lever: Other than above	0 V
59	Stop lamp switch	Brake pedal: Depressed	Battery voltage
		Brake pedal: Released	0 V
62	Low and reverse solenoid valve	Selector lever position: Sport mode (1st gear)	Battery voltage
		Selector lever position: Sport mode (2nd gear)	Approx. 7 – 9 V
63	Diagnosis output	Normal (No diagnosis code output)	0 → 5 V flashing
66	Inhibitor switch R	Selector lever position: R	Battery voltage
		Selector lever position: Other than above	0 V
67	Inhibitor switch D	Selector lever position: D	Battery voltage
		Selector lever position: Other than above	0 V
68	Upshift switch	Selector lever: Upshift in sport mode, and hold the selector lever	Battery voltage
		Selector lever: Other than above	0 V
69	Vehicle speed sensor	When stopped	0 V
		Move forward slowly	0 → 5 V flashing
71	A/T control relay	Ignition switch: OFF	0 V
		Ignition switch: ON	Battery voltage
72	Earth	Ignition switch: ON	0 V

OSCILLOSCOPE INSPECTION PROCEDURE

Check item	Check requirement		Normal condition (Waveform sample)
Crank angle sensor	Selector lever position: N	Idling (Vehicle stopped)	Waveform A
Input shaft speed sensor	Selector lever position: Sport mode	Driving at constant speed of 50 km/h in 3rd gear	Waveform B
Output shaft speed sensor			
Vehicle speed sensor			
Low reverse solenoid valve	Ignition switch: ON Selector lever position: P Engine: 0 r/min Vehicle speed: 0 km/h (Vehicle stopped) Throttle (Accelerator) opening angle: Less than 1 V Idle switch: ON	Force drive each solenoid valve (Actuator test)	Waveform C
Underdrive solenoid valve			
Second solenoid valve			
Overdrive solenoid valve			
Reduction solenoide valve			
Damper clutch control solenoid valve			

Waveform sample



TROUBLESHOOTING <AUTOMATIC TRANSMISSION ERRONEOUS OPERATION PREVENTION MECHANISM>

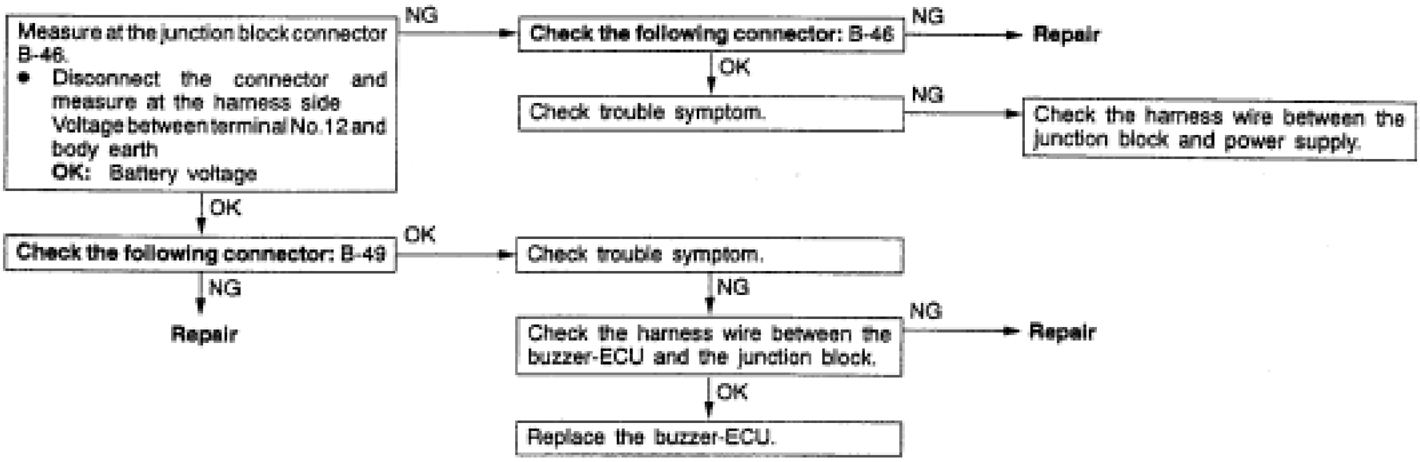
INSPECTION CHART FOR TROUBLE SYMPTOMS

Problem	Inspection Procedure No.	Reference page
When the selector lever is moved to R, the backup lamp lights up, but the buzzer does not operate.	1	23-44
When the selector lever is moved to R, the backup lamp does not light up and neither does the buzzer operate.	2	23-44

INSPECTION CHART FOR TROUBLE SYMPTOMS

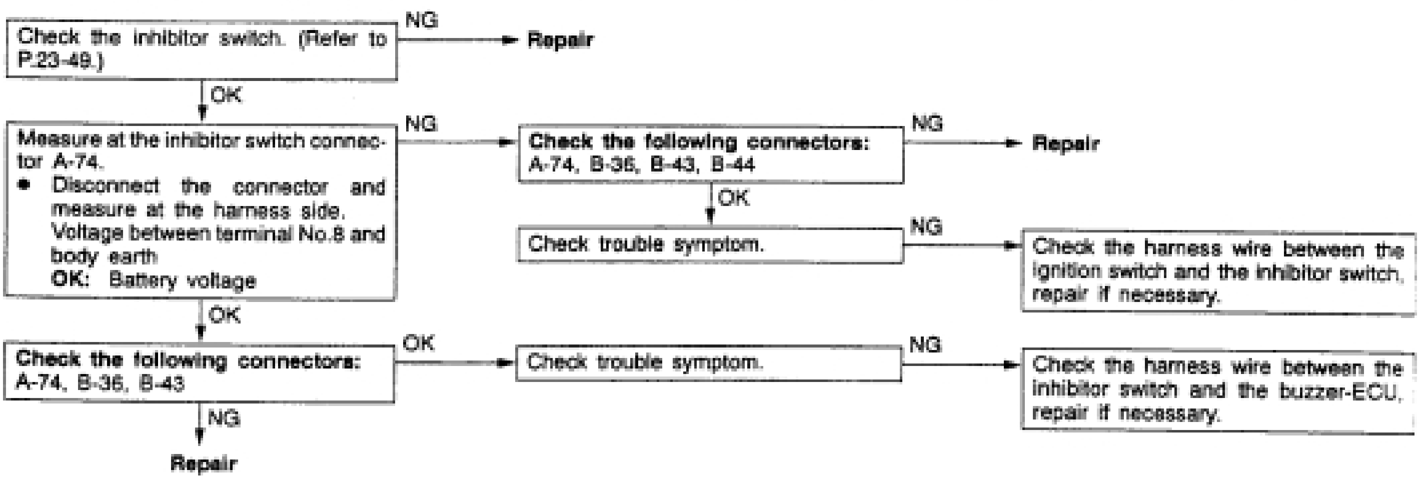
INSPECTION PROCEDURE 1

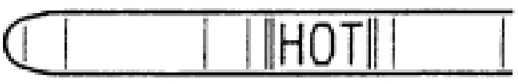
When the selector lever is moved to R, the backup lamp lights up, but the buzzer does not operate.	Probable cause
The input circuit from the inhibitor switch to the buzzer-ECU may be faulty or the buzzer-ECU may be defective. Also the ignition switch input circuit may be defective.	• Malfunction of the harness or connector • Malfunction of the buzzer-ECU



INSPECTION PROCEDURE 2

When the selector lever is moved to R, the backup lamp does not light up and neither does the buzzer operate.	Probable cause
The inhibitor switch circuit or the ignition switch input circuit may be defective.	• Malfunction of the inhibitor switch • Malfunction of the fuse • Malfunction of harness or connector





TFA1334

ON-VEHICLE SERVICE

ESSENTIAL SERVICE

AUTOMATIC TRANSMISSION FLUID CHECK

Caution
When the transmission has been replaced or overhauled, or driving has been carried out under the severe condition, the transmission fluid cooler line flushing should always be carried out and also, the transmission fluid and oil filters (special filters for transmission only) should always be replaced.

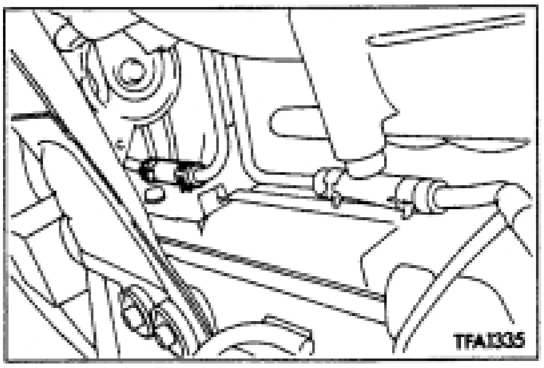
1. Drive the vehicle until the fluid temperature rises to the normal temperature (70–80°C).
2. Park the vehicle on a level surface.
3. Move the selector lever through all positions to fill the torque converter and the hydraulic circuits with fluid, and then move the selector lever to the N position.
4. After wiping off any dirt around the oil level gauge, remove the oil level gauge and check the condition of the fluid.

   NOTE
   If the fluid smells as if it is burning, it means that the fluid has been contaminated by the particles from the bushes and friction materials, a transmission overhaul and flushing the cooler line may be necessary.
5. Check that the fluid level is at the HOT mark on the oil level gauge. If the fluid level is lower than this, pour in more fluid until the level reaches the HOT mark.

   Automatic transmission fluid:

   Dia Queen ATF SP II, ATF SP II M or equivalent

   NOTE
   If the fluid level is low, the oil pump will draw in air along with the fluid, which will cause bubbles to form inside the hydraulic circuit. This will in turn cause the hydraulic pressure to drop, which will result in late shifting and slipping of the clutches and brakes.
   If there is too much fluid, the gears can churn it up into foam and cause the same conditions that can occur with low fluid levels.
   In either case, air bubbles can cause overheating and oxidation of the fluid which can interfere with normal valve, clutch, and brake operation. Foaming can also result in fluid escaping from the transmission vent, in which case it may be mistaken for a leak.
6. Securely insert the oil level gauge.



AUTOMATIC TRANSMISSION FLUID REPLACEMENT

Caution
When the transmission has been replaced or overhauled, the transmission fluid cooler line flushing should always be carried out before installing the transmission fluid cooler hose.

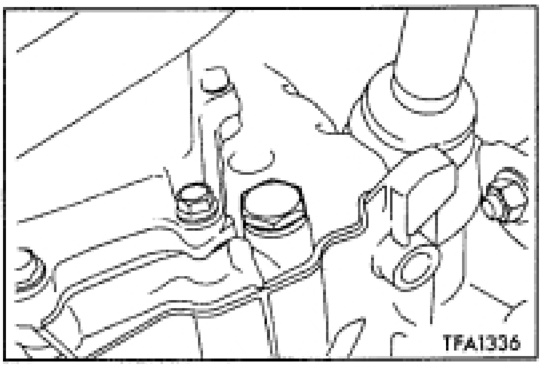
If you have a fluid changer, use this changer to replace the fluid. If you do not have a fluid changer, replace the fluid by the following procedure.

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

   Running conditions: N range with engine idling

   Caution
   The engine should be stopped within one minute after it is started. If the fluid has all drained out before then, the engine should be stopped at that point.

   Discharge volume: Approx. 3.5 ℓ



3. Remove the drain plug from the bottom of the transmission case to drain the fluid.

   Discharge volume: Approx. 2.0 ℓ
4. Replace the oil filters. (Refer to P.23-48)
5. Install the drain plug via a new gasket, and tighten it to the specified torque.

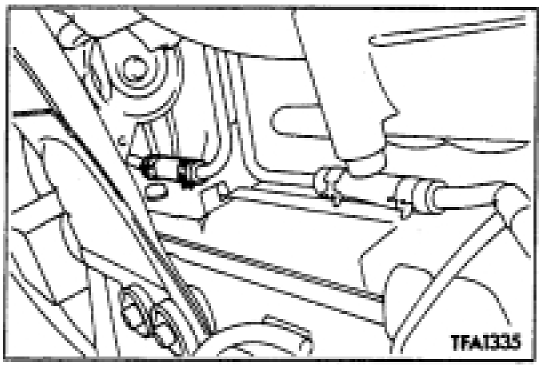
   Tightening torque: 32 Nm
6. Pour the new fluid in through the oil filler tube.

   Adding volume: Approx. 5.5 ℓ

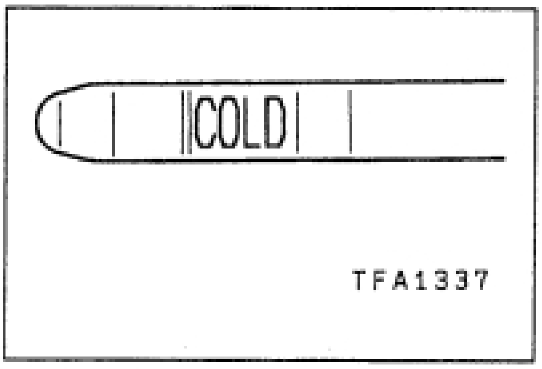
   Caution
   Stop pouring if the full volume (5.5 ℓ) of fluid cannot be poured in.
7. Repeat the procedure in step 2.

   NOTE
   Drain the fluid from the cooler hose 7 ℓ at least in steps 2 and 6. Then drain the fluid a little and check the fluid for dirt.
   If it has been contaminated, repeat the steps 6 and 7.
8. Pour the new fluid in through the oil filler tube.

   Adding volume: Approx. 3.5 ℓ



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

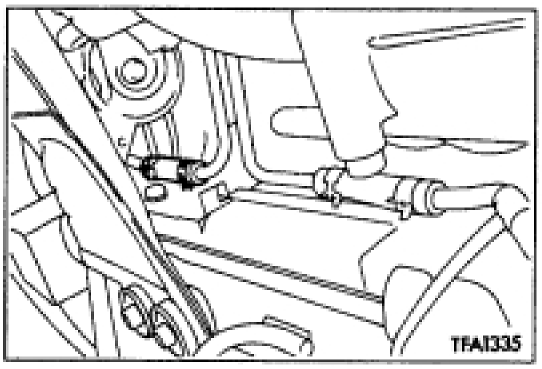


12. Check that the fluid level is at the COLD mark on the oil level gauge. If the level is lower than this, pour in more fluid.
13. Drive the vehicle until the fluid temperature rises to the normal temperature (70 – 80°C), and then check the fluid level again.
    The fluid level must be at the HOT mark.

    NOTE
    The COLD level is for reference only; the HOT level should be regarded as the standard level.
14. Firmly insert the oil level gauge into the oil filler tube.

AUTOMATIC TRANSMISSION FLUID COOLER LINE FLUSHING

Caution
When the transmission has been replaced or overhauled, or automatic transmission fluid is contaminated, the transmission fluid cooler line flushing should always be carried out.



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

   Running conditions: N range with engine idling

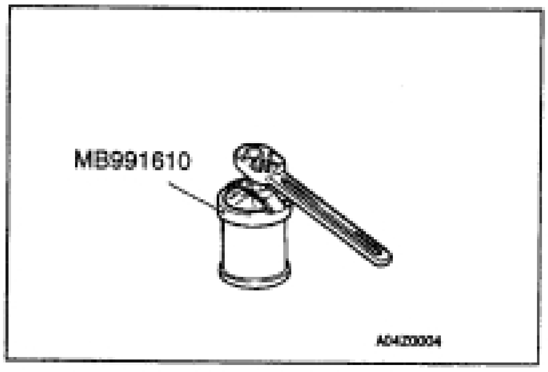
   Caution
   The engine should be stopped within one minute after it is started. If the fluid has all drained out before then, the engine should be stopped at that point.

   Discharge volume: Approx. 3.5 ℓ
3. Pour the new fluid in through the oil filler tube.

   Adding volume: Approx. 3.5 ℓ

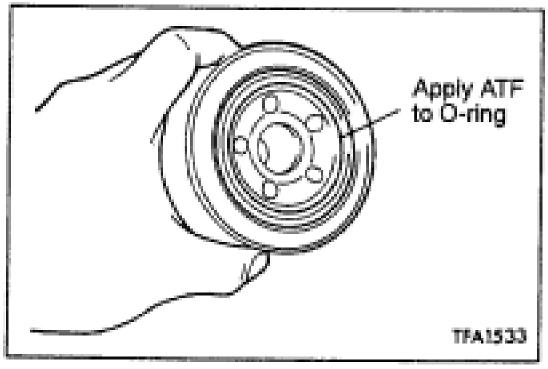
   Caution
   Stop pouring if the 3.5 ℓ of fluid cannot be poured in.
4. Repeat the procedure in step 2.

   NOTE
   Drain the fluid from the cooler hose 7 ℓ at least in step 2. Then drain the fluid a little and check the fluid for dirt.
   If it has been contaminated, repeat the steps 3 and 4.
5. Follow the automatic transmission fluid replacement procedure from the step 3.



OIL FILTER REPLACEMENT

1. Use the special tool (MB991610) to remove the automatic transmission oil filter.
2. Clean the filter bracket side mounting surface.



3. Apply a small amount of automatic transmission fluid to the O-ring of the new oil filter.
4. Use the special tool (MB991610) to install the automatic transmission oil filter.

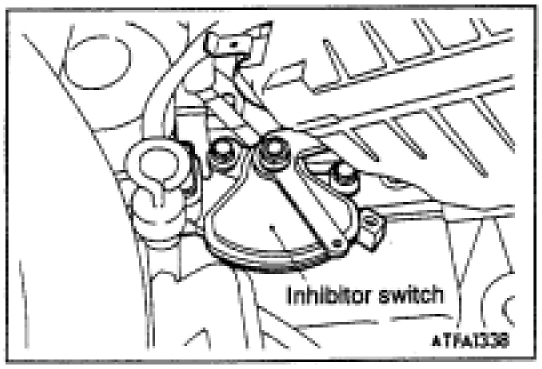
   NOTE
   Tightening torque: 12 Nm
5. Check the quantity of the automatic transmission fluid. (Refer to P.23-45.)

THROTTLE POSITION SENSOR ADJUSTMENT <Vehicles without TCL>

Refer to GROUP 13A – On-vehicle Service.

ACCELERATOR PEDAL POSITION SENSOR ADJUSTMENT <Vehicles with TCL>

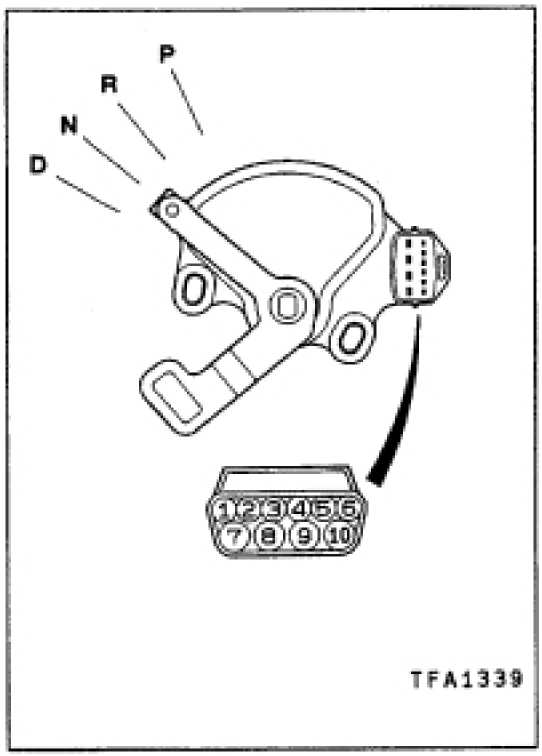
Refer to GROUP 13A – On-vehicle Service.

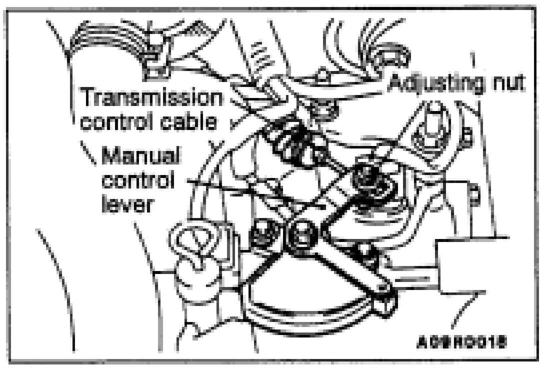


INHIBITOR SWITCH CONTINUITY CHECK

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

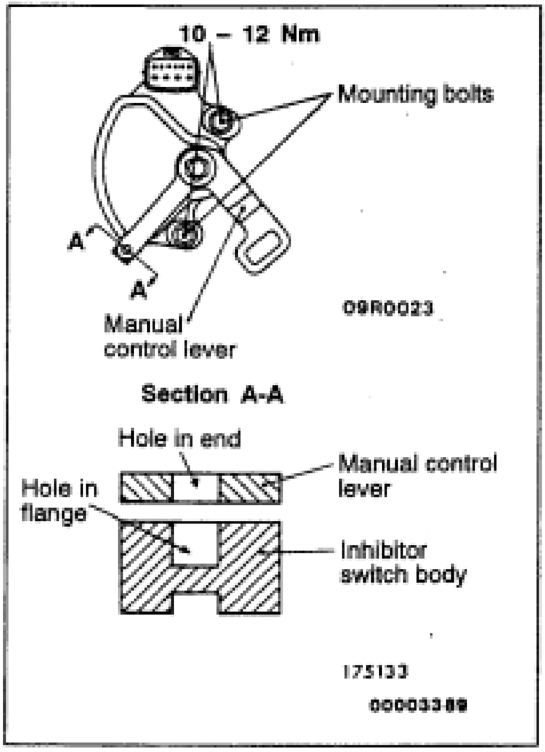
NOTE
The inhibitor switch has seven positions, but four positions indicated above are used.





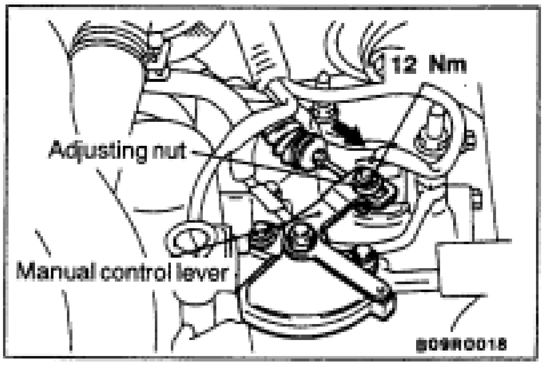
INHIBITOR SWITCH AND CONTROL CABLE ADJUSTMENT

1. Set the selector lever to the "N" position.
2. Loosen the control cable to manual control lever coupling nut to free the cable and lever.
3. Set the manual control lever to the neutral position.



4. Loosen the inhibitor switch body mounting bolts and turn the inhibitor switch body so the hole in the end of the manual control lever and the hole (cross section A-A in the figure on the left) in the flange of the inhibitor switch body flange are aligned.
5. Tighten the inhibitor switch body mounting bolts to the specified torque.

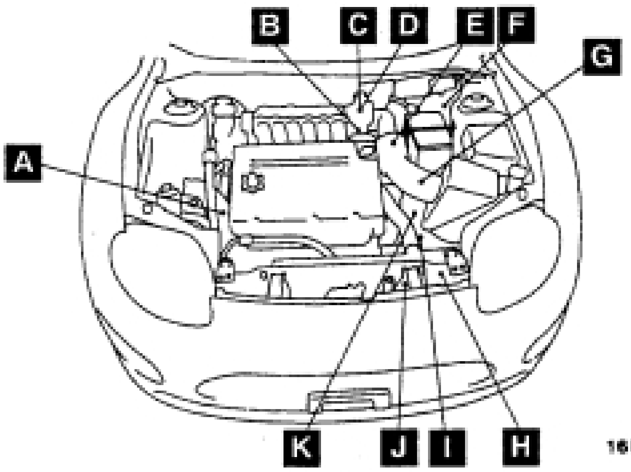
Caution
Be careful at this time that the position of the switch body is not changed.



6. Gently pull the transmission control cable in the direction of the arrow, and then tighten the adjusting nut.
7. Check that the selector lever is in the "N" position.
8. Check that the manual control lever on the transmission side operates and functions correctly corresponding to each position of the selector lever.

A/T CONTROL COMPONENT LOCATION

Name	Symbol	Name	Symbol
Accelerator position sensor <Vehicles with TCL>	C	Oil temperature sensor	J
A/T control relay	T	Output shaft speed sensor	G
A/T-ECU	S	Select switch	O
Crank angle sensor	A	Shift indicator lamp	L
Diagnosis connector	N	Solenoid valve	H
Downshift switch	P	Stop lamp switch	M
Dual pressure switch	F	TCL-ECU	R
Engine-ECU	U	Throttle position sensor <Vehicles without TCL>	B
Idle position switch	D	Upshift switch	Q
Inhibitor switch	I	Vehicle speed sensor	E
Input shaft speed sensor	K		



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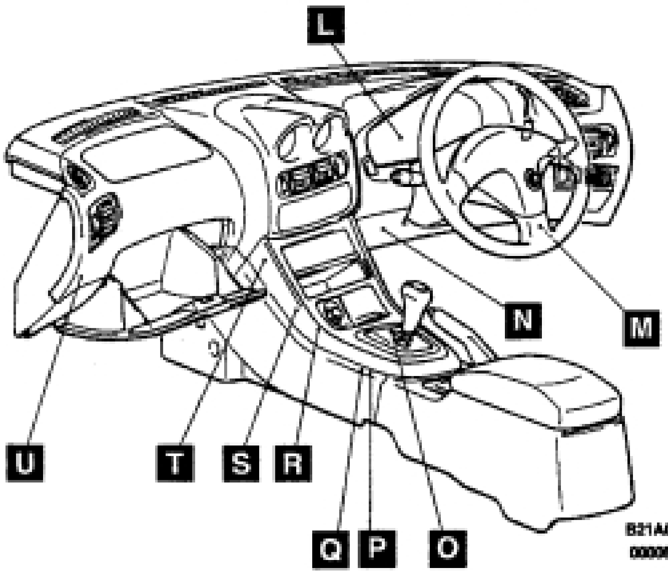

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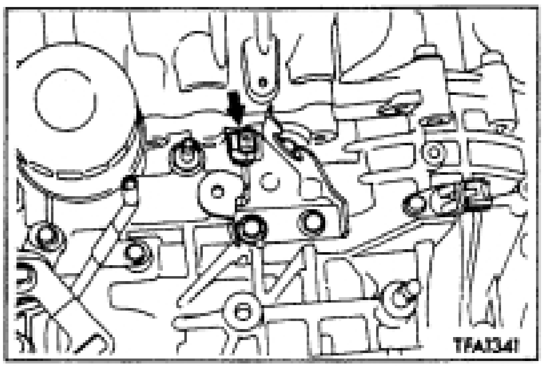
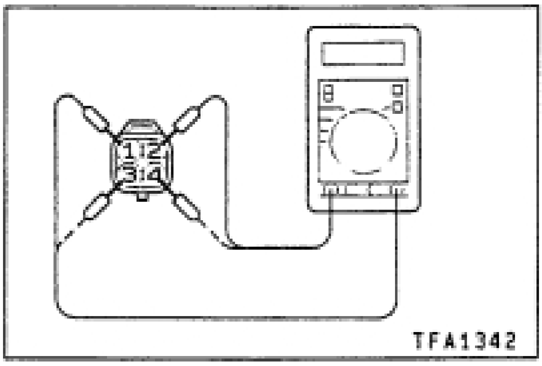
A/T CONTROL COMPONENT CHECK

INPUT SHAFT SPEED SENSOR CHECK



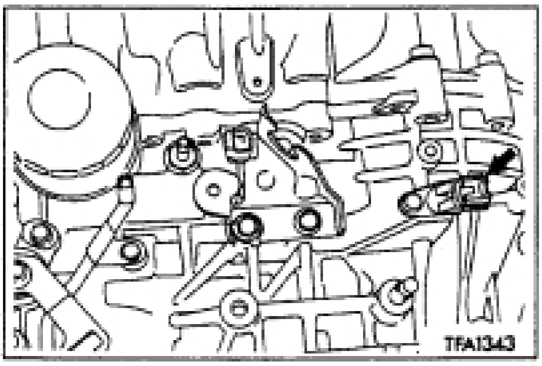
1. Disconnect the input shaft speed sensor connector.



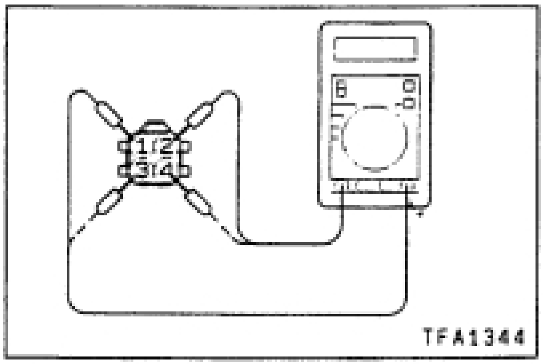
2. Measure the resistance between the terminals No.1 and No.2 of the input shaft speed sensor-side connector.

   Standard value: 330 – 390 Ω (at 20°C)
3. Check that there is continuity between the terminals No.1 and No.3, and between the terminals No.2 and No.4 of the input shaft speed sensor-side connector.
4. If the input shaft speed sensor is faulty, replace it.

OUTPUT SHAFT SPEED SENSOR CHECK



1. Disconnect the output shaft speed sensor connector.



2. Measure the resistance between the terminals No.1 and No.2 of the output shaft speed sensor-side connector.

   Standard value: 330 – 390 Ω (at 20°C)
3. Check that there is continuity between the terminals No.1 and No.3, and between the terminals No.2 and No.4 of the output shaft speed sensor-side connector.
4. If the output shaft speed sensor is faulty, replace it.

CRANK ANGLE SENSOR CHECK

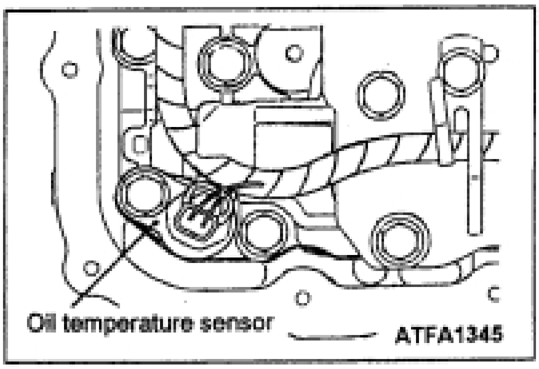
Refer to GROUP 13A – Troubleshooting.

THROTTLE POSITION SENSOR CHECK <Vehicles without TCL>

Refer to GROUP 13A – On-vehicle Service.

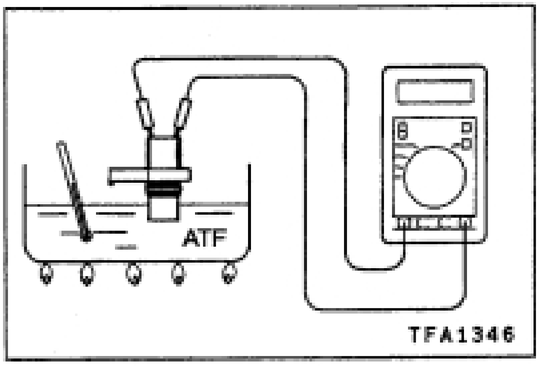
ACCELERATOR PEDAL POSITION SENSOR CHECK <Vehicles with TCL>

Refer to GROUP 13A – On-vehicle Service.



OIL TEMPERATURE SENSOR CHECK

1. Remove the oil temperature sensor.



2. Measure the resistance between terminals No. 1 and No. 2 of the oil temperature sensor connector.

   Standard value:

Oil temperature (°C)	Resistance (kΩ)
0	16.7–20.5
100	0.57–0.69

3. If the resistance is outside the standard valve, replace the oil temperature sensor.

INHIBITOR SWITCH CHECK

Refer to P.23A-49.

STOP LAMP SWITCH CHECK

Refer to GROUP 35A – Brake Pedal.

VEHICLE SPEED SENSOR CHECK

Refer to GROUP 54 – On-vehicle Service.

DUAL POSITION PRESSURE SWITCH CHECK

Refer to GROUP 55 – On-vehicle Service.

IDLE POSITION SWITCH CHECK

Refer to GROUP 13A – On-vehicle Service.

SELECT SWITCH CHECK

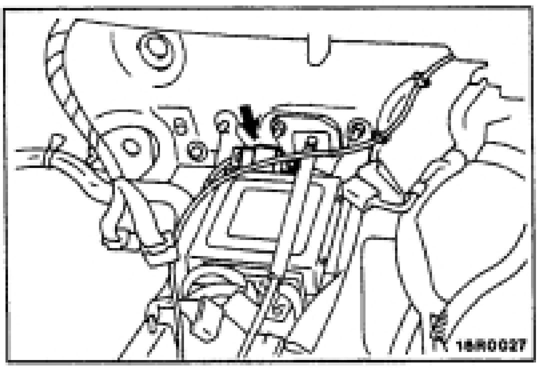
Refer to P.23-67.

UPSHIFT SWITCH CHECK

Refer to P.23-67.

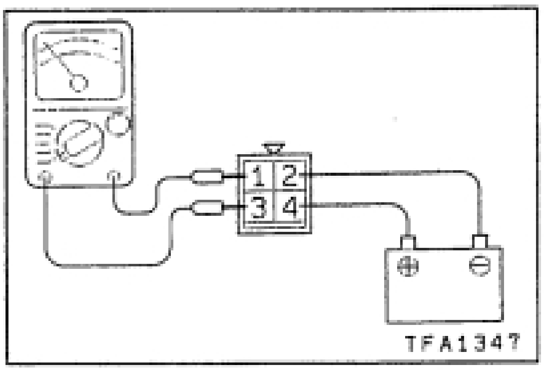
DOWNSHIFT SWITCH CHECK

Refer to P.23-67.



A/T CONTROL RELAY CHECK

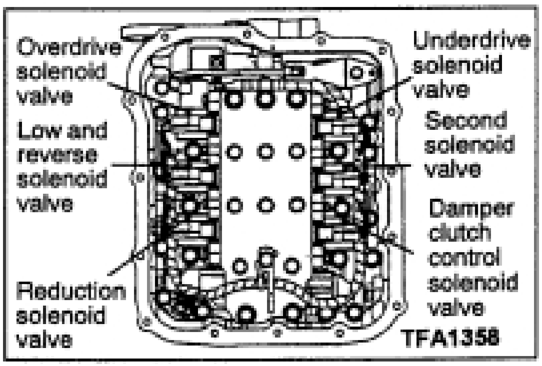
1. Remove the A/T control relay.



2. Use jumper wires to connect A/T control relay terminal 2 to the battery (–) terminal and terminal 4 to the battery (+) terminal.
3. Check the continuity between terminal 1 and terminal 3 of the A/T control relay when the jumper wires are connected to and disconnected from the battery.

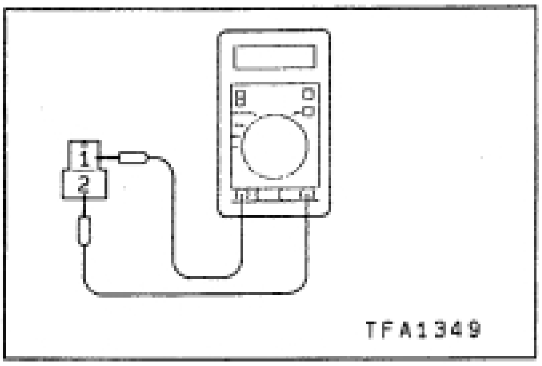
Jumper wire	Continuity between terminals No. 1 and No. 3
Connected	Continuity
Disconnected	No continuity

4. If there is a problem, replace the A/T control relay.



SOLENOID VALVE CHECK

1. Remove the valve body cover.
2. Disconnect the connectors of each solenoid valve.

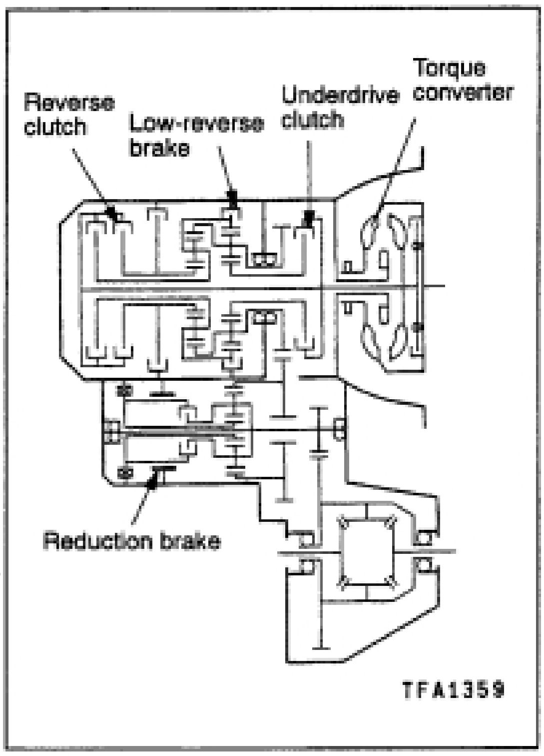


3. Measure the resistance between terminals 1 and 2 of each solenoid valve.

Standard value:

Name	Resistance
Damper clutch control solenoid valve	2.7 – 3.4 Ω (at 20°C)
Low and reverse solenoid valve	
Second solenoid valve	
Underdrive solenoid valve	
Overdrive solenoid valve	
Reduction solenoid valve	

4. If the resistance is outside the standard value, replace the solenoid valve.



TORQUE CONVERTER STALL TEST

This test measures the maximum engine speed when the selector lever is at the D or R position and the torque converter stalls to test the operation of the torque converter operation and the holding performance of the clutches and brakes in the transmission.

Caution

Do not let anybody stand in front of or behind the vehicle while this test is being carried out.

1. Check the automatic transmission fluid level and temperature and the engine coolant temperature.
   - Fluid level: At the HOT mark on the oil level gauge
   - Fluid temperature: 80 – 100°C
   - Engine coolant temperature: 80 – 100°C
2. Check both rear wheels (left and right).
3. Pull the parking brake lever on, with the brake pedal fully depressed.
4. Start the engine.
5. Move the selector lever to the D position, fully depress the accelerator pedal and take a reading of the maximum engine speed at this time.

   Caution

   (1) The throttle should not be left fully open for any more than eight 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 1,000 r/min to let the automatic transmission fluid cool down before carrying out subsequent tests.

   Standard value

   Stall speed: 2,100 – 2,600 r/min
6. Move the selector lever to the R position and carry out the same test again.

   Standard value

   Stall speed: 2,100 – 2,600 r/min

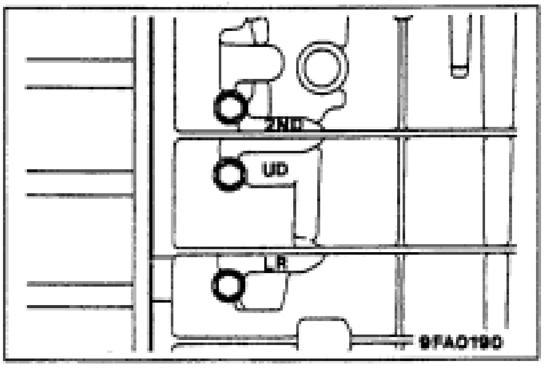
TORQUE CONVERTER STALL TEST JUDGEMENT RESULTS

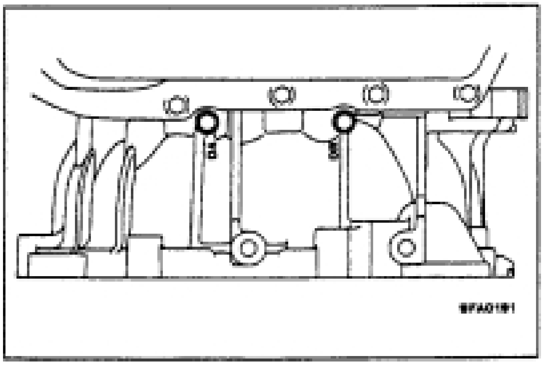
a. Stall speed is too high in both D and R ranges
   - Low line pressure
   - Low & reverse brake slippage

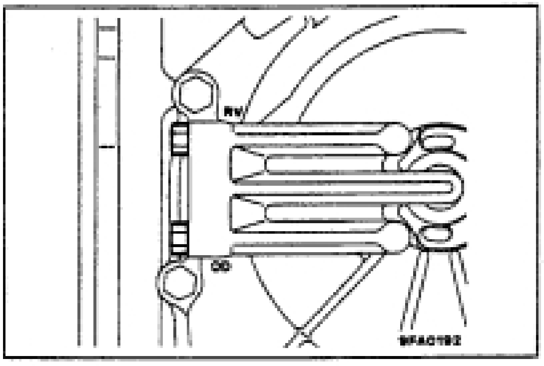
b. Stall speed is too high in D range only
   - Underdrive clutch slippage

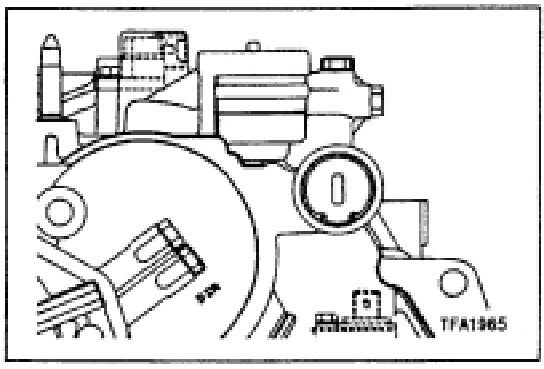
c. Stall speed is too high in R range only
   - Reverse clutch slippage
   - Reduction brake slippage

d. Stall speed too low in both D and R ranges
   - Malfunction of torque converter
   - Insufficient engine output









HYDRAULIC PRESSURE TEST

1. Warm up the engine until the automatic transmission fluid temperature is 80 – 100°C.
2. Jack up the vehicle so that the wheels are free to turn.
3. Connect the special tools (2,942 kPa oil pressure gauge [MD998330]) and adapter [MD998332, MD998900, MD998268 (for RED and DIR pressure)] to each pressure discharge port.

   NOTE
   2ND: Second brake pressure port
   UD: Underdrive clutch pressure port
   LR: Low and reverse brake pressure port
   DR: Torque converter pressure port
   DA: Damper clutch apply pressure port
   RV: Reverse clutch pressure port
   OD: Overdrive clutch pressure port
   RED: Reduction brake pressure port
   DIR: Direct clutch pressure port
4. Measure the hydraulic pressure at each port under the conditions given in the standard hydraulic pressure table, and check that the measured values are within the standard value ranges.
5. If a value is outside the standard range, correct the problem while referring to the hydraulic pressure test diagnosis table.

STANDARD HYDRAULIC PRESSURE TEST

Measurement condition			Standard hydraulic pressure kPa							
Selector lever position	Shift position	Engine speed (r/min)	Under-drive clutch pressure	Reverse clutch pressure	Over-drive clutch pressure	Direct clutch pressure	Low and reverse brake pressure	Second brake pressure	Reduc-tion brake pressure	Torque converter pressure
P	–	2,500	–	–	–	–	310 – 390	–	310 – 390	310 – 390
R	Re-verse	2,500	–	1,320 – 1,720	–	–	1,320 – 1,720	–	1,320 – 1,720	500 – 700
N	–	2,500	–	–	–	–	310 – 390	–	310 – 390	310 – 390
D	1st gear	2,500	1,010 – 1,050	–	–	–	1,010 – 1,050	–	1,010 – 1,050	500 – 700
	2nd gear	2,500	1,010 – 1,050	–	–	–	–	1,010 – 1,050	1,010 – 1,050	500 – 700
	3rd gear	2,500	590 – 690	–	590 – 690	–	–	–	590 – 690	450 – 650
	4th gear	2,500	590 – 690	–	590 – 690	590 – 690	–	–	–	450 – 650
	5th gear	2,500	–	–	590 – 690	590 – 690	–	590 – 690	–	450 – 650

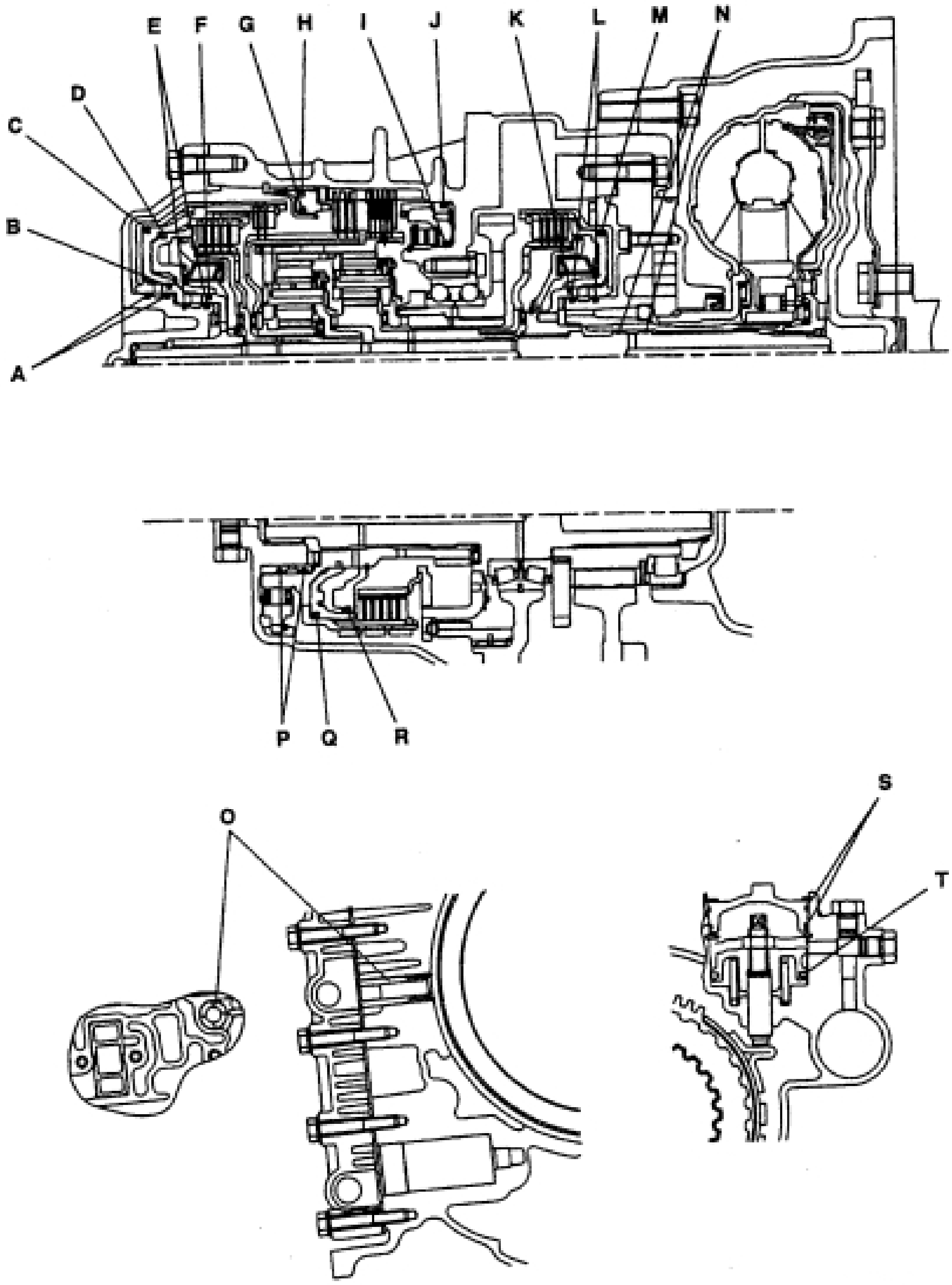
HYDRAULIC PRESSURE TEST DIAGNOSIS TABLE

Trouble symptom	Probable cause
All hydraulic pressures are high.	Malfunction of the regulator valve
All hydraulic pressures are low.	Malfunction of the oil pump
	Clogged internal oil filter
	Clogged external oil filter
	Clogged oil cooler
	Malfunction of the regulator valve
	Malfunction of the relief valve
	Incorrect valve body installation
Hydraulic pressure is abnormal in "R" range only.	Malfunction of the regulator valve
Hydraulic pressure is abnormal in "3" or "4" range only.	Malfunction of the regulator valve
	Malfunction of the switch valve
Only underdrive hydraulic pressure is abnormal.	Malfunction of the oil seal K
	Malfunction of the oil seal L
	Malfunction of the oil seal M
	Malfunction of the underdrive solenoid valve
	Malfunction of the underdrive pressure control valve
	Malfunction of check ball
	Clogged orifice
	Incorrect valve body installation
Only reverse clutch hydraulic pressure is abnormal.	Malfunction of the oil seal A
	Malfunction of the oil seal B
	Malfunction of the oil seal C
	Malfunction of check ball
	Clogged orifice
	Incorrect valve body installation
Only overdrive hydraulic pressure is abnormal.	Malfunction of the oil seal D
	Malfunction of the oil seal E
	Malfunction of the oil seal F
	Malfunction of the overdrive solenoid valve
	Malfunction of the overdrive pressure control valve
	Malfunction check ball
	Clogged orifice
	Incorrect valve body installation

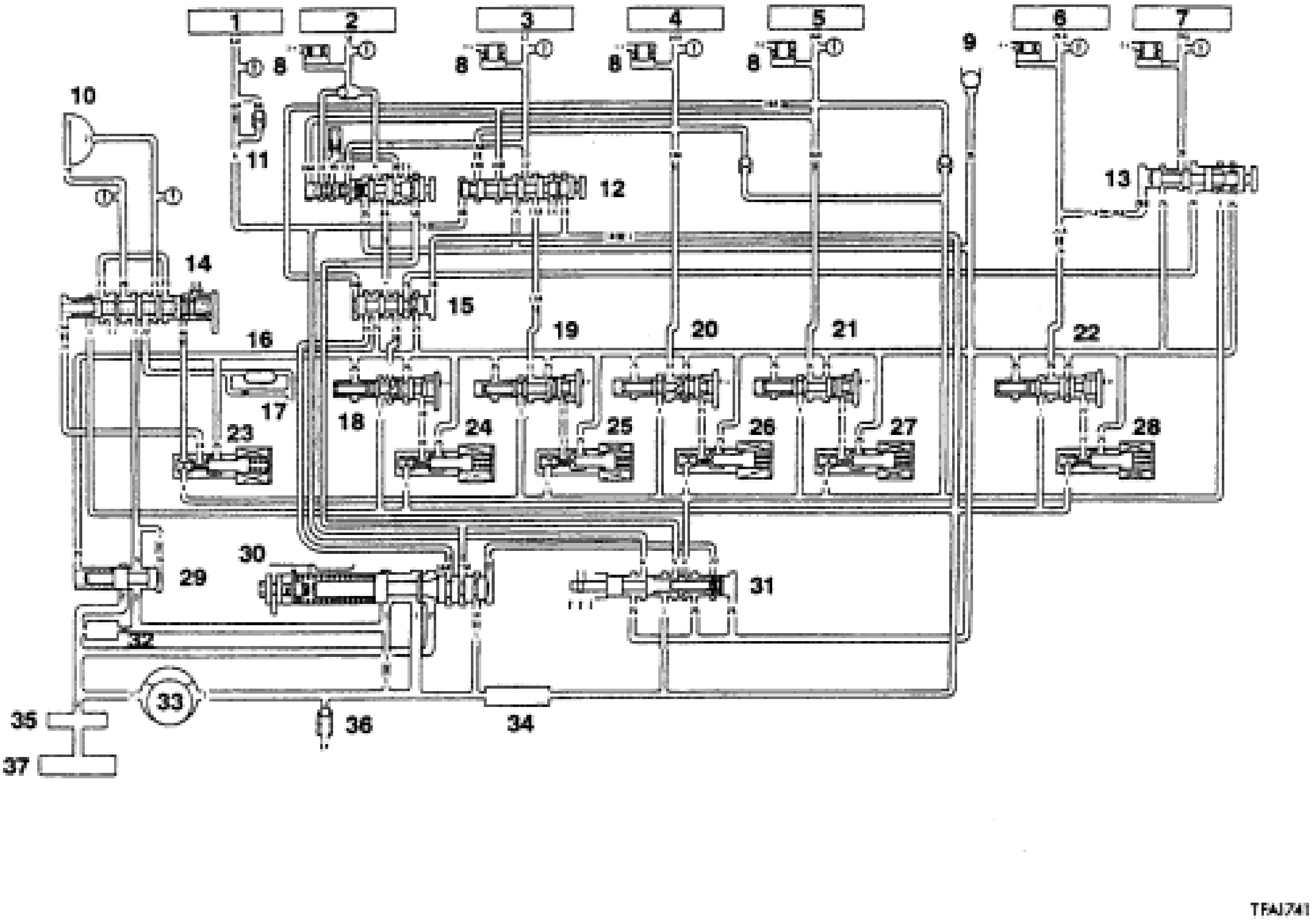
Trouble symptom	Probable cause
Only direct clutch hydraulic pressure is abnormal.	Malfunction of the oil seal P
	Malfunction of the oil seal Q
	Malfunction of the oil seal R
	Malfunction of the low and reverse solenoid valve
	Malfunction of the low and reverse pressure control valve
	Malfunction of switch valve
	Malfunction of fail-safe valve C
	Clogged orifice
	Incorrect valve body installation
Only low and reverse hydraulic pressure is abnormal.	Malfunction of the oil seal I
	Malfunction of the oil seal J
	Malfunction of the low and reverse solenoid valve
	Malfunction of the low and reverse pressure control valve
	Malfunction of the switch valve
	Malfunction of the fail safe valve A
	Malfunction of check ball
	Clogged orifice
	Incorrect valve body installation
Only second hydraulic pressure is abnormal.	Malfunction of the oil seal G
	Malfunction of the oil seal H
	Malfunction of the oil seal O
	Malfunction of the second solenoid valve
	Malfunction of the second pressure control valve
	Malfunction of the fail safe valve B
	Clogged orifice
	Incorrect valve body installation
Only reduction brake hydraulic pressure is abnormal.	Malfunction of the oil seal S
	Malfunction of the oil seal T
	Malfunction of the reduction solenoid valve
	Malfunction of the reduction pressure control valve
	Clogged orifice
	Incorrect valve body installation

Trouble symptom	Probable cause
Only torque converter pressure is abnormal.	Malfunction of the oil cooler
	Malfunction of the oil seal N
	Malfunction of the damper clutch control solenoid valve
	Malfunction of the damper clutch control valve
	Malfunction of the torque converter pressure control valve
	Clogged orifice
	Incorrect valve body installation
Pressure applied to non operating element.	Incorrect transmission control cable adjustment
	Malfunction of the manual valve
	Incorrect valve body installation

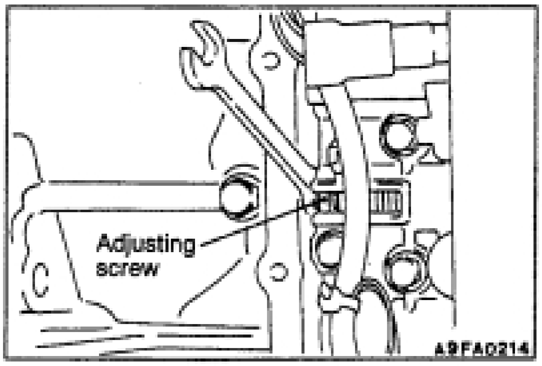
OIL SEAL LAYOUT



HYDRAULIC CIRCUIT
PARKING AND NEUTRAL



1. Reverse clutch
2. Low-reverse brake
3. Second brake
4. Underdrive clutch
5. Overdrive clutch
6. Reduction brake clutch
7. Direct 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 valve
15. Switch valve
16. Automatic transmission fluid cooler
17. Lubrication
18. Low-reverse pressure control valve
19. Second pressure control valve
20. Underdrive pressure control valve
21. Overdrive pressure control valve
22. Reduction pressure control valve
23. Damper clutch control solenoid valve
24. Low-reverse solenoid valve
25. Second solenoid valve
26. Underdrive solenoid valve
27. Overdrive solenoid valve
28. Reduction solenoid valve
29. Torque converter pressure control valve
30. Regulator valve
31. Manual valve
32. Oil filter
33. Oil pump
34. Oil strainer
35. Oil filter (Built in type)
36. Relief valve
37. Oil pan



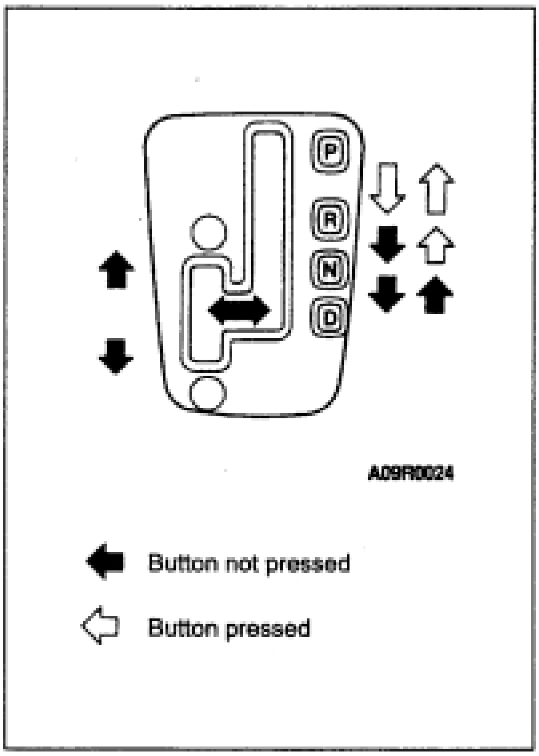
LINE PRESSURE ADJUSTMENT

1. Discharge the automatic transmission fluid, and then remove the valve body cover.
2. Turn the adjusting screw shown in the illustration at left to adjust the underdrive pressure to the standard value. The pressure increases when the screw is turned to the left.

   NOTE
   When adjusting the underdrive pressure, adjust to the middle of the standard value range.

   Standard value: 1,010 – 1,050 kPa

   Change in pressure for each turn of the adjusting screw: 35 kPa
3. Install the valve body cover, and pour in the standard volume of automatic transmission fluid.
4. Carry out a hydraulic pressure test. (Refer to P.23-56.) Readjust the line pressure if necessary.



SELECTOR LEVER OPERATION CHECK

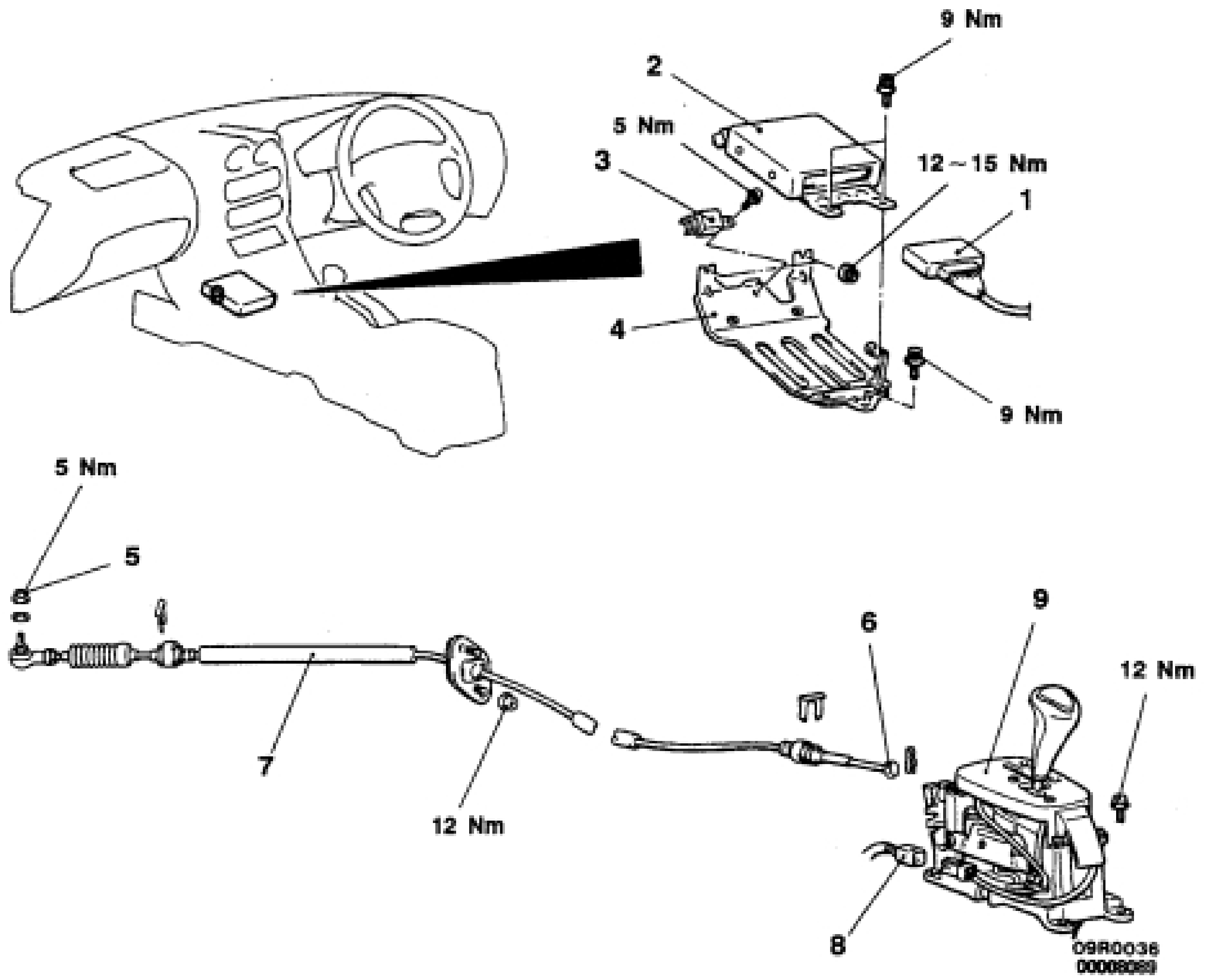
1. Apply the parking brake, and shift the selector lever to each range and check that lever moves smoothly and is controlled.
2. Check if the engine starts when the selector lever is at "N" or "P" position, and does not start at the other positions.
3. Start the engine and release the parking brake. Check if the vehicle moves forward when the selector lever is moved to "D" position, sport mode 1st or 2nd position, and moves backward when moved to "R" position.
4. Stop the engine. Turn the ignition switch to "ON", and check if the backup lamp illuminates and the buzzer sounds when the selector lever is moved to "R" position.

TRANSMISSION CONTROL

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Air Cleaner Assembly Removal and Installation
- Floor Console Box Removal and Installation (Refer to GROUP 52A.)

Caution: SRS
Be careful not to subject the SRS-ECU to any shocks during removal and installation of the transmission control cable and selector lever assembly.



Transmission control cable removal steps

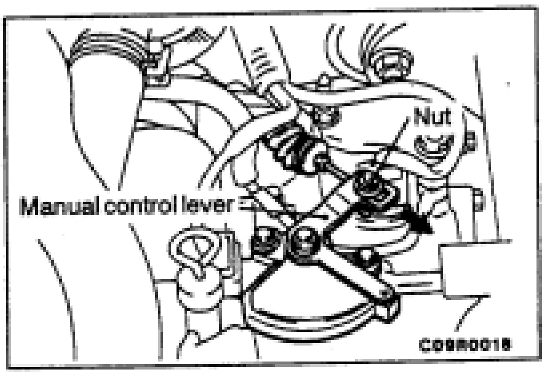
1. Harness connector
2. A/T-ECU
3. Control relay
4. ECU bracket

▶A◀ 5. Nut

6. Transmission control cable connection
7. Transmission control cable assembly

Selector lever assembly removal steps

6. Transmission control cable connection
8. Wiring harness connector
9. Selector lever assembly

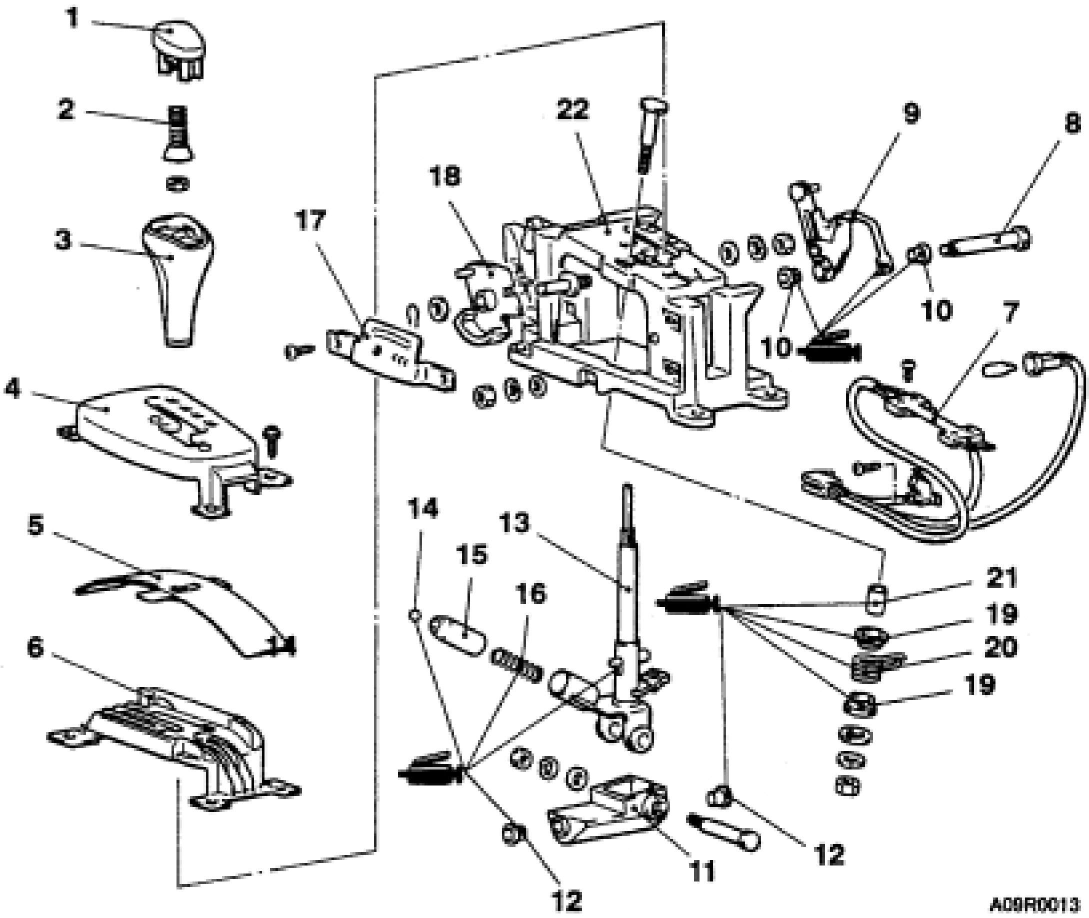


INSTALLATION SERVICE POINT

▶A◀ NUT INSTALLATION

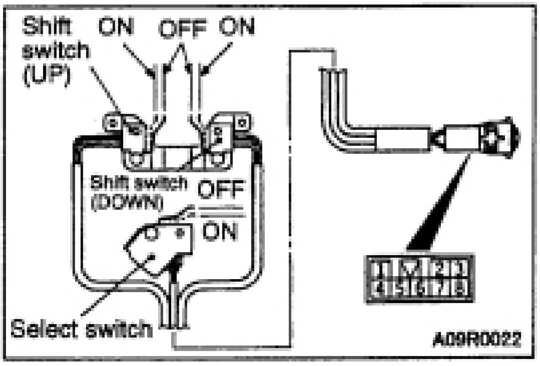
1. Move the selector lever and the manual control lever in the "N" position.
2. Loosen the adjusting nut, gently pull the transmission control cable in the direction of the arrow and tighten the nut.

SELECTOR LEVER ASSEMBLY
DISASSEMBLY AND REASSEMBLY



Disassembly steps

1. Push button
2. Spring
3. Shift knob
4. Upper panel
5. Slider
6. Lower panel
7. Shift switch assembly
8. Bolt
9. Arm assembly
10. Bushing
11. Lever case
12. Bushing
13. Lever assembly
14. Ball
15. Lever guide
16. Spring
17. Plate
18. Lock cam
19. Bushing
20. Spring
21. Spacer
22. Bracket



INSPECTION

SHIFT SWITCH ASSEMBLY CONTINUITY CHECK

Switch position		Terminal No.				
		4	5	6	7	8
Shift switch (UP)	ON					
	OFF		○	○		
Shift switch (DOWN)	ON					
	OFF	○	○			
Select switch	ON		○			○
	OFF		○		○	

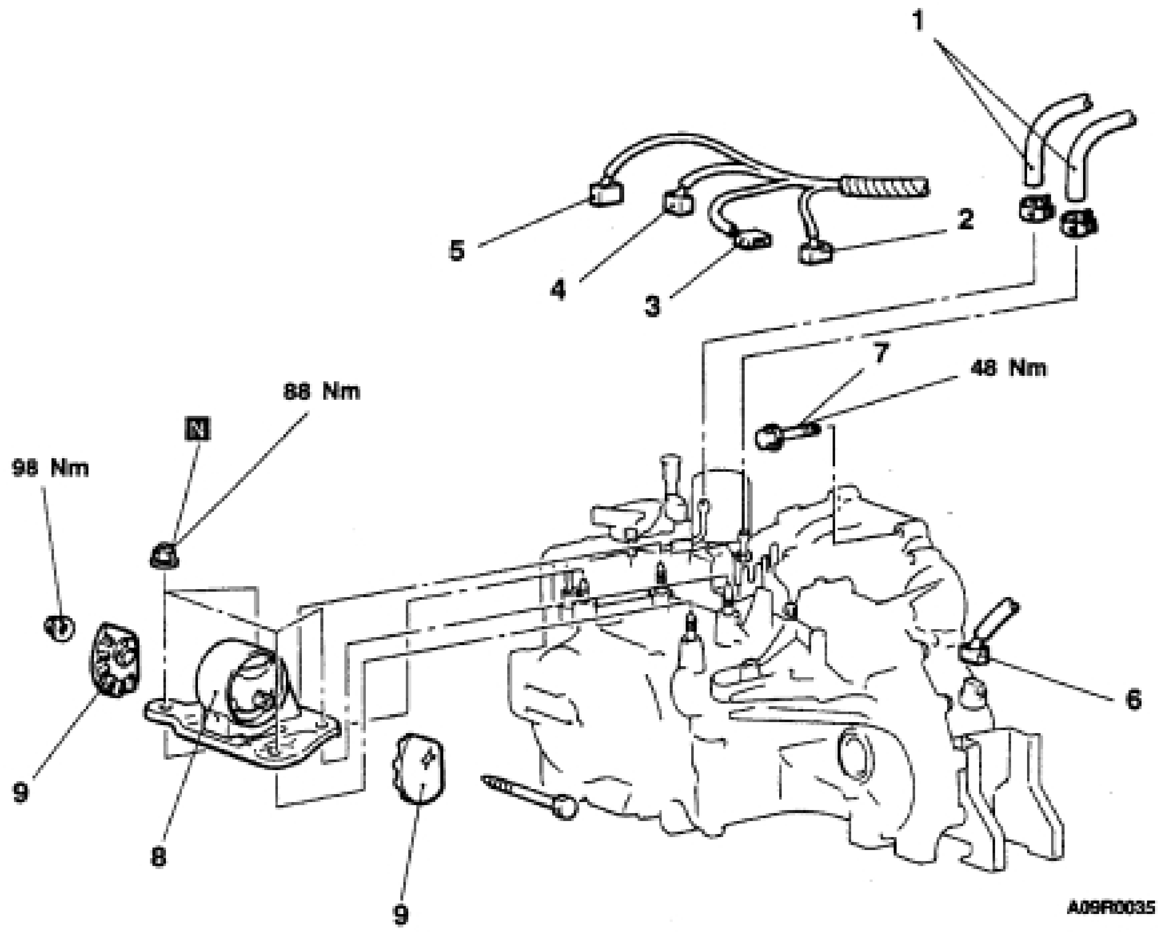
TRANSMISSION ASSEMBLY

REMOVAL AND INSTALLATION

Caution
Mounting locations marked by * should be provisionally tightened, and then fully tightened when the body is supporting the full weight of the engine.

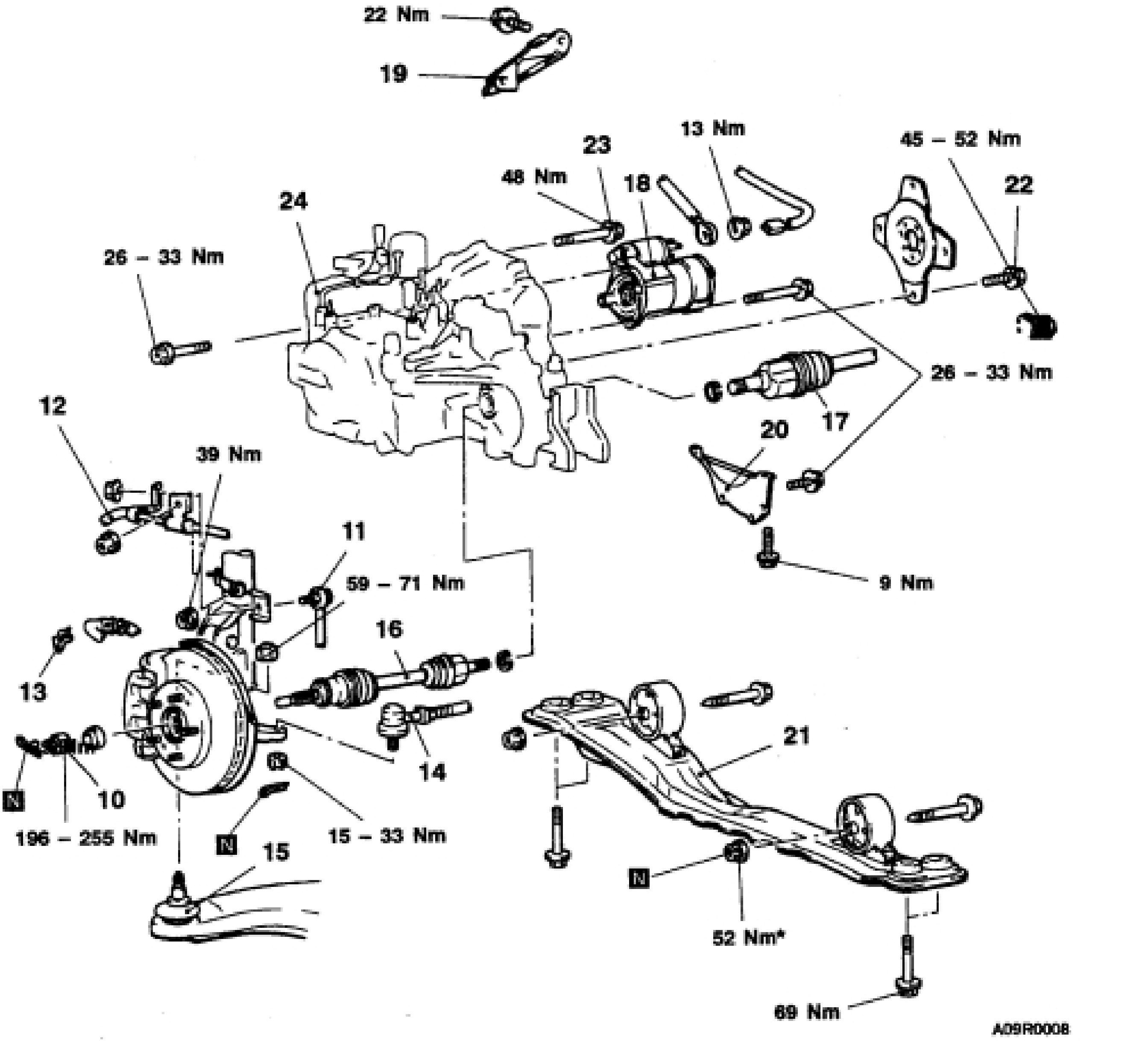
Pre-removal Operation
- Transmission Fluid Draining (Refer to P.23-46.)
- Under Cover Removal
- Battery and Battery Tray Removal
- Air Cleaner Assembly Removal
- Front Exhaust Pipe Removal (Refer to GROUP 15.)
- Engine Cover Removal (Refer to GROUP 11A – Timing Belt.)

Post-installation Operation
- Engine Cover Installation (Refer to GROUP 11A – Timing Belt.)
- Front Exhaust Pipe Installation (Refer to GROUP 15.)
- Air Cleaner Assembly Installation
- Battery and Battery Tray Installation
- Under Cover Installation
- Transmission Fluid Supplying (Refer to P.23-46.)
- Selector Lever Operation Check
- Speedometer Operation Check



Removal steps
- Transmission control cable connection (Refer to P.23-64.)
1. Transmission fluid cooler hoses connection
2. Pulse generator "A" connector
3. Pulse generator "B" connector
4. Inhibitor switch connector
5. A/T control solenoid valve assembly connector
6. Vehicle speed sensor connector
7. Transmission assembly upper part coupling bolts

◀A▶ 8. Transmission mount bracket
▶C◀ 9. Transmission mount stopper
◀B▶ • Engine assembly supporting



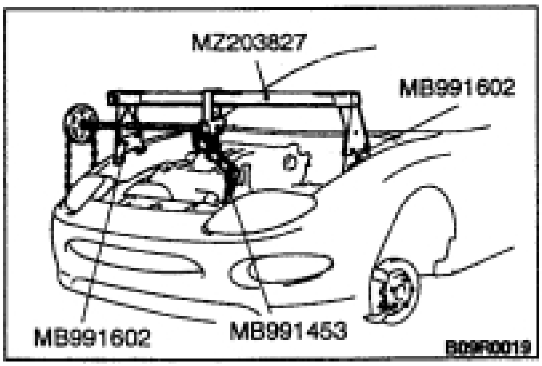
Lifting up of the vehicle

◀C▶ ▶B◀ 10. Drive shaft nut <L.H.>
11. Stabilizer link connection
12. Speed sensor clamp
13. Brake hose clamp
◀D▶ 14. Tie rod end connection
◀D▶ 15. Lower arm ball joint connection
16. Drive shaft <L.H.> (Refer to GROUP 26.)
◀E▶ 17. Drive shaft <R.H.> connection
18. Starter
19. Oil filter cover
20. Bell housing cover
21. Centermember assembly
◀F▶ 22. Drive plate bolts
◀F▶ 23. Transmission assembly lower part coupling bolts
◀F▶ ▶A◀ 24. Transmission assembly

REMOVAL SERVICE POINTS

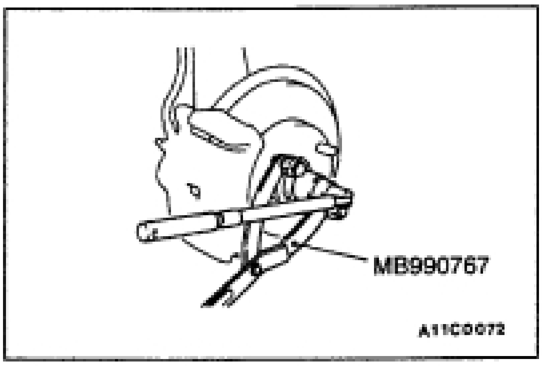
◀A▶ TRANSMISSION MOUNT BRACKET REMOVAL

Jack up the transmission assembly gently with a garage jack, and then remove the transmission mount bracket.



◀B▶ ENGINE ASSEMBLY SUPPORTING

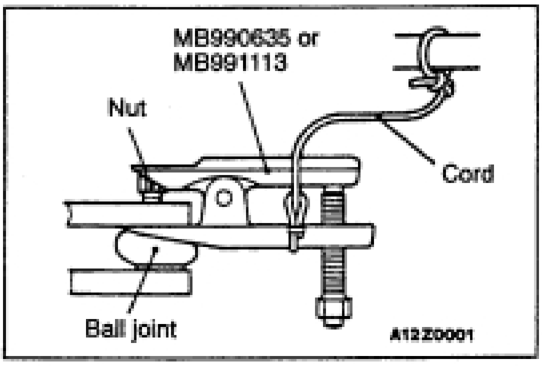
Set the special tool to the vehicle to support the engine assembly.



◀C▶ DRIVE SHAFT NUT <L.H.> REMOVAL

Caution

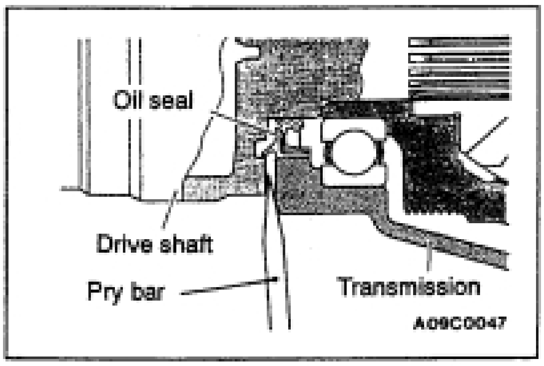
Do not apply the vehicle weight to the wheel bearing while the drive shaft nut is loosened.



◀D▶ TIE ROD END /LOWER ARM BALL JOINT DISCONNECTION

Caution

1. **Use the special tool to 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. not to let it come off.**



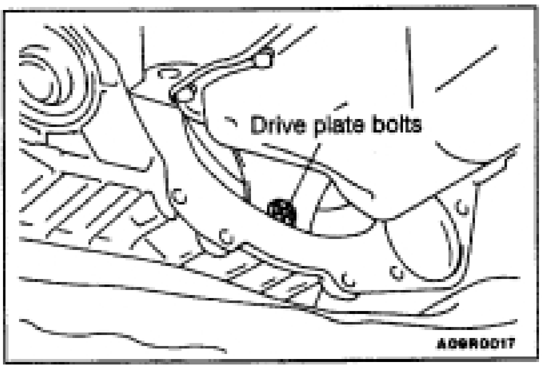
◀E▶ DRIVE SHAFT <R.H.> DISCONNECTION

1. Insert a pry bar between the transmission case and the drive shaft as shown to remove the drive shaft.

   NOTE
   Remove the drive shaft together with the hub and knuckle.

   Caution
   (1) Always use a pry bar, or the TJ will be damaged.
   (2) Do not insert the pry bar too deeply, otherwise the oil seal may be damaged.

2. Suspend the removed drive shaft with a wire so that there are no sharp bends in any of the joints.
3. Use a shop towel to cover the transmission case not to let foreign material get into it.

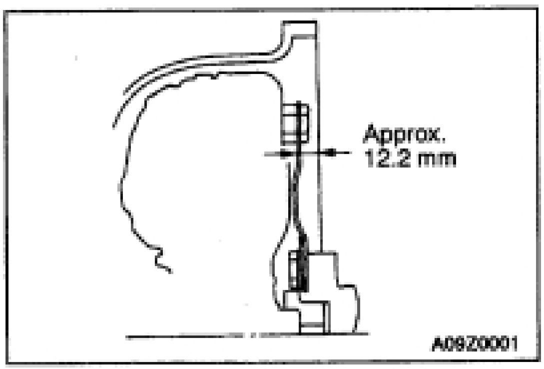


◀F▶ DRIVE PLATE BOLT/TRANSMISSION ASSEMBLY LOWER PART COUPLING BOLTS/TRANSMISSION ASSEMBLY REMOVAL

1. Support the transmission assembly by using a transmission jack.
2. Remove the drive plate bolts while turning the crank shaft.
3. Press in the torque converter to the transmission side so that the torque converter does not remain on the engine side.
4. Remove the transmission assembly lower part coupling bolts and lower the transmission assembly.

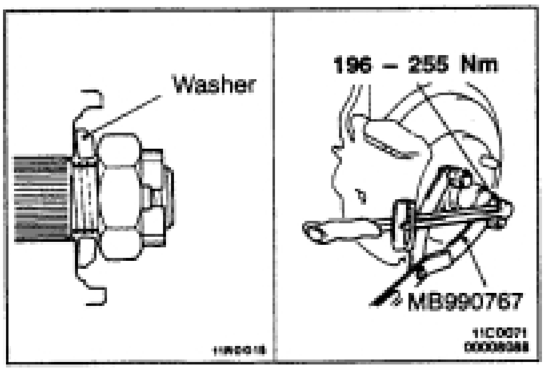
INSTALLATION SERVICE POINTS

▶A◀ TRANSMISSION ASSEMBLY INSTALLATION



After securely inserting the torque converter into the transmission side so that the value shown in the illustration will be obtained, install the transmission assembly to the engine.

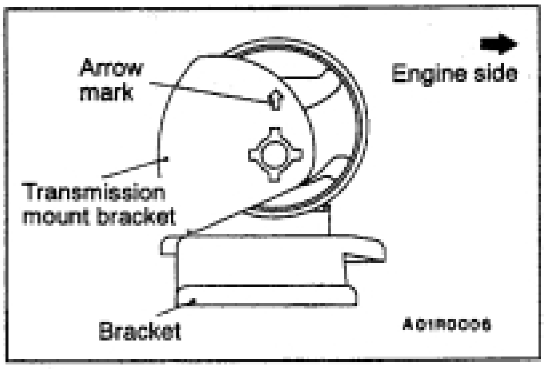
▶B◀ DRIVE SHAFT NUT <L.H.> INSTALLATION



1. Install the drive shaft washer as shown in the illustration.
2. Using the special tool, tighten the drive shaft nut to the specified torque.

   Caution
   Before tightening the drive shaft nut to the specified torque, do not apply the vehicle weight to the wheel bearing.

3. If the split pin is not aligned with the bolt pin hole, tighten the nut further within 255 Nm. Then when the nearest bolt pin hole is aligned, insert the split pin into the hole and secure it.



▶C◀ TRANSMISSION MOUNT STOPPER INSTALLATION

Install the transmission mount stopper so that the arrow points as shown in the illustration.