GENERAL

CONTENTS

NOTES

HOW TO USE THIS MANUAL

SCOPE OF MAINTENANCE, REPAIR AND SERVICING EXPLANATIONS

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

ON-VEHICLE SERVICE

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

INSPECTION

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

DEFINITION OF TERMS

STANDARD VALUE

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

LIMIT

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

REFERENCE VALUE

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

CAUTION

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

INDICATION OF TIGHTENING TORQUE

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

EXPLANATION OF MANUAL CONTENTS

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

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

Indicates (by symbols) where lubrication is necessary.

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

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

Classifications of Major Maintenance/Service Points

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

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

Symbols for Lubrication, Sealants and Adhesives

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

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

 : Sealant or adhesive

 : Brake fluid or automatic transmission fluid

 : Engine oil, gear oil or air conditioner compressor oil

 : Adhesive tape or butyl rubber tape

Indicates the group title.

Indicates the section title.

Indicates the group number.

Indicates the page number.

STEERING – Power Steering Oil Pump 37A-29

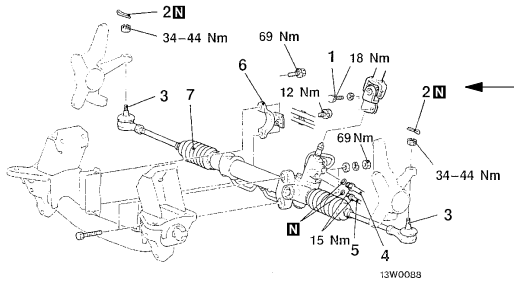
POWER STEERING GEAR BOX

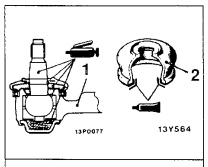
120000039

REMOVAL AND INSTALLATION

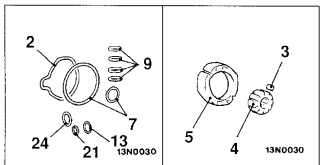
Pre-removal Operation
(1) Power Steering Fluid Draining (Refer to P. 37A-10.)
(2) Air Cleaner Assembly Removal
(3) Under Cover Removal (Refer to GROUP 42 – Under Cover.)

<2WD>





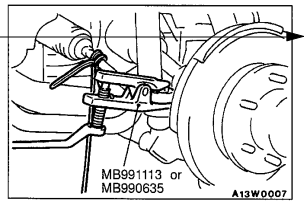
Sealant: 3M ATD Part No. 8661 or equivalent



Oil pump seal kit | Oil pump cartridge kit

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

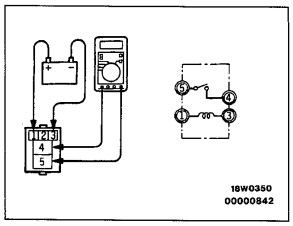
◀A▶ ◀B▶



REMOVAL SERVICE POINTS

◀A▶ TIE-ROD END DISCONNECTION

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

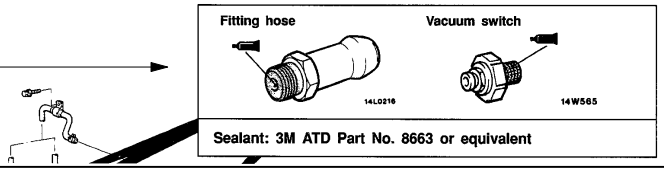


HEADLAMP RELAY CONTINUITY INSPECTION

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

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

Lubrication and sealing points



Sealant: 3M ATD Part No. 8663 or equivalent

00002471

Denotes non-reusable part.

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

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

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

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

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

HOW TO USE TROUBLESHOOTING/INSPECTION SERVICE POINTS

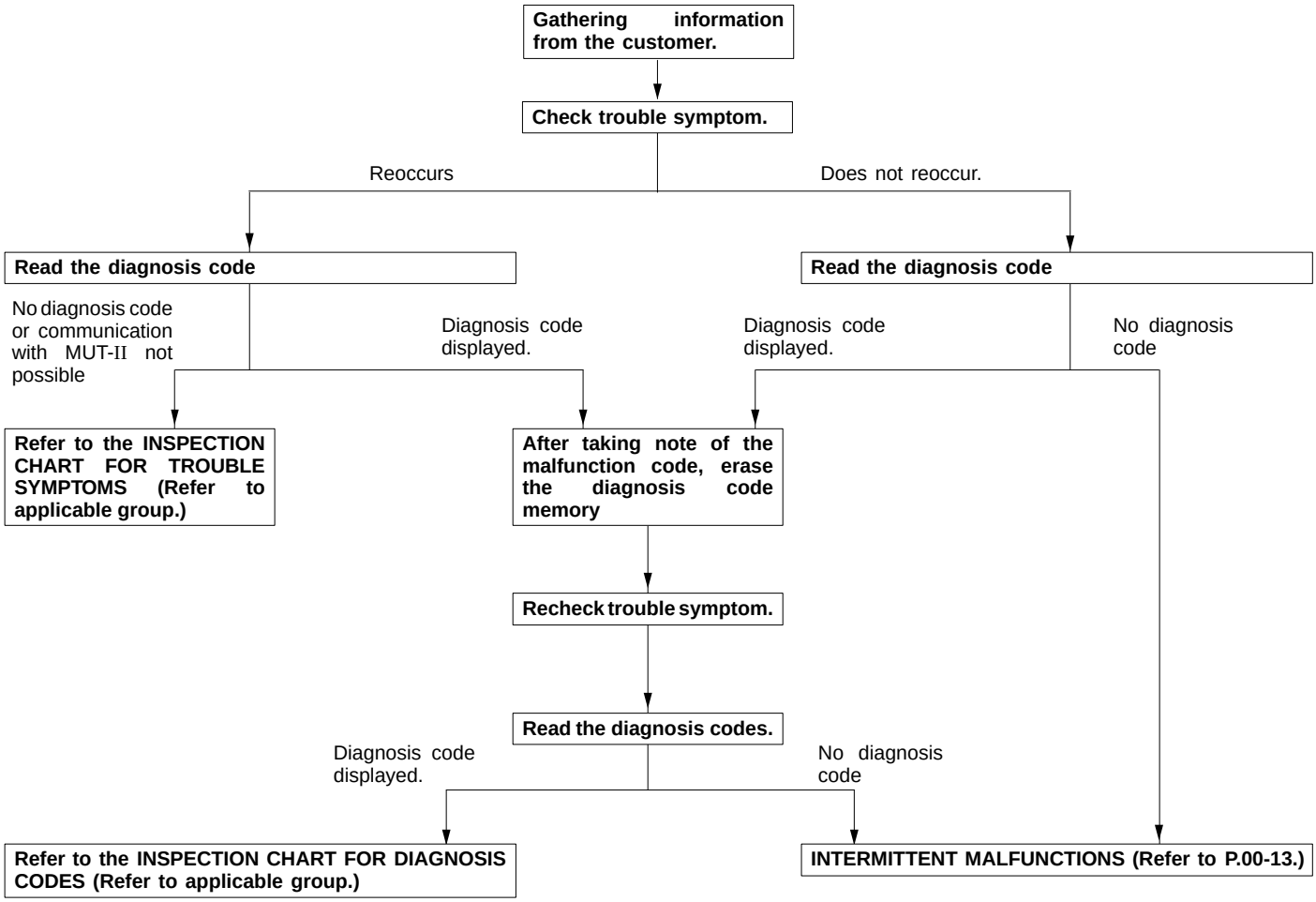
Troubleshooting of electronic control systems for which the MUT-II can be used follows the basic outline described below. Furthermore, even in systems for which the MUT-II cannot be used, part of these systems still follow this outline.

TROUBLESHOOTING CONTENTS

1. STANDARD FLOW OF DIAGNOSIS TROUBLESHOOTING

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

Diagnosis method



2. SYSTEM OPERATION AND SYMPTOM VERIFICATION TESTS

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

3. DIAGNOSIS FUNCTION

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

4. INSPECTION CHART FOR DIAGNOSIS CODES

5. INSPECTION PROCEDURE FOR DIAGNOSIS CODES

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

8. SERVICE DATA REFERENCE TABLE

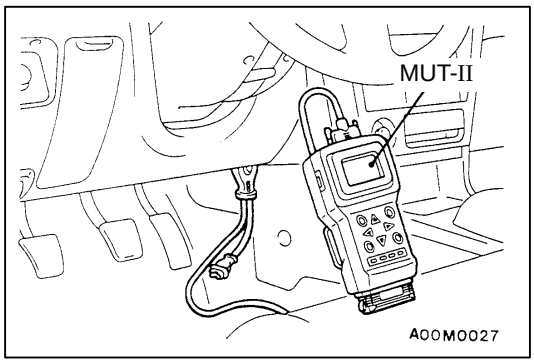
Inspection items and normal judgement values have been provided in this chart as reference information.

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.



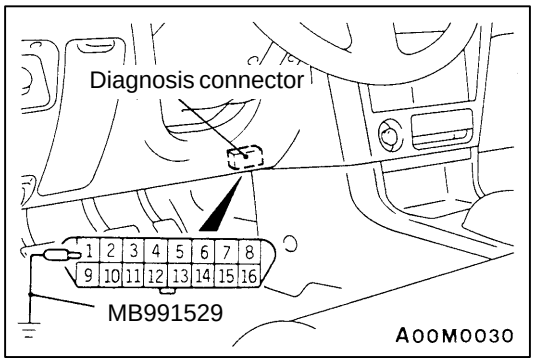
DIAGNOSIS FUNCTION

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

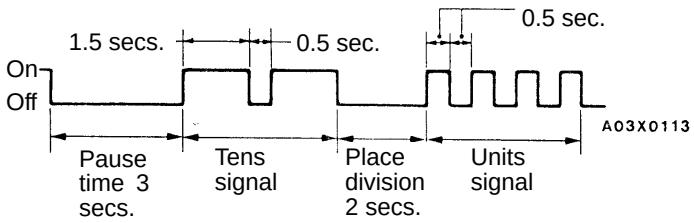
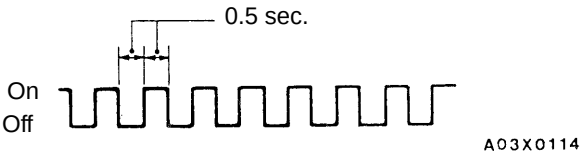
1. Use the special tool to earth No.1 terminal (diagnosis control terminal) of the diagnosis connector.
2. To check ABS system, remove the valve relay.

   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 on the ignition switch.
4. Read out a diagnosis code by observing how the warning lamp flashes.

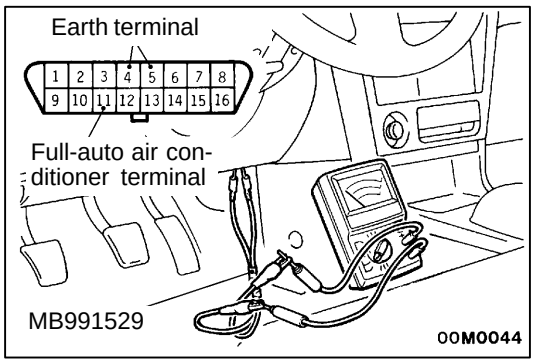
Applicable systems

System name	Warning lamp name
MPI	Engine warning lamp
AYC	AYC warning lamp
ABS	ABS warning lamp

Indication of diagnosis code by warning lamp

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

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



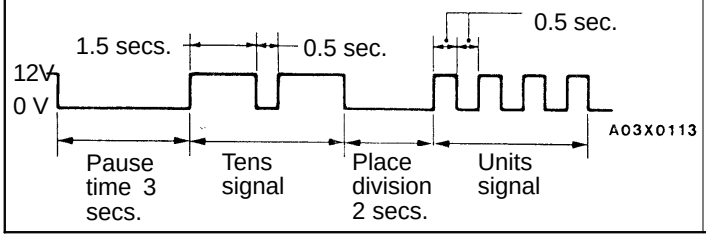
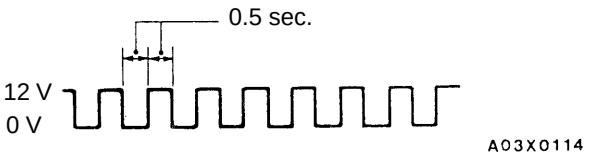
WHEN USING THE VOLTMETER

Use the special tool to connect the diagnosis output terminals and the earth terminal of the diagnosis connector to a voltmeter and take a reading of the diagnosis codes from the movement of the needle.

Voltmeter connection terminals

System name	Positive connection terminal	Negative connection terminal
Full-auto air conditioner	11	4 or 5

Diagnosis result display method when using a voltmeter

Example of diagnosis code voltage wave pattern for diagnosis code No. 24	Normal voltage wave pattern
	

METHOD OF ERASING DIAGNOSIS CODES

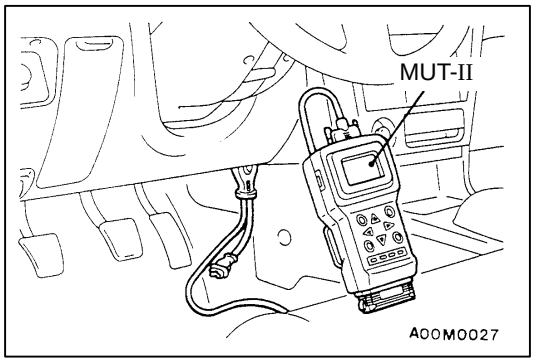
WHEN USING THE MUT-II

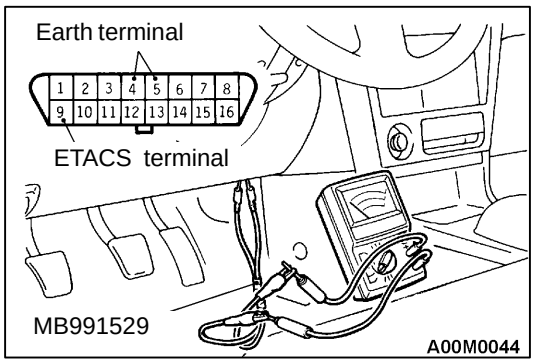
Connect the MUT-II to the diagnosis connector and erase the diagnosis code.

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.





INPUT SIGNAL INSPECTION POINTS <VEHICLES WITH ETACS-ECU>

WHEN USING THE MUT-II

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

Caution
The MUT-II should be connected or disconnected after turning the ignition switch to the OFF position.

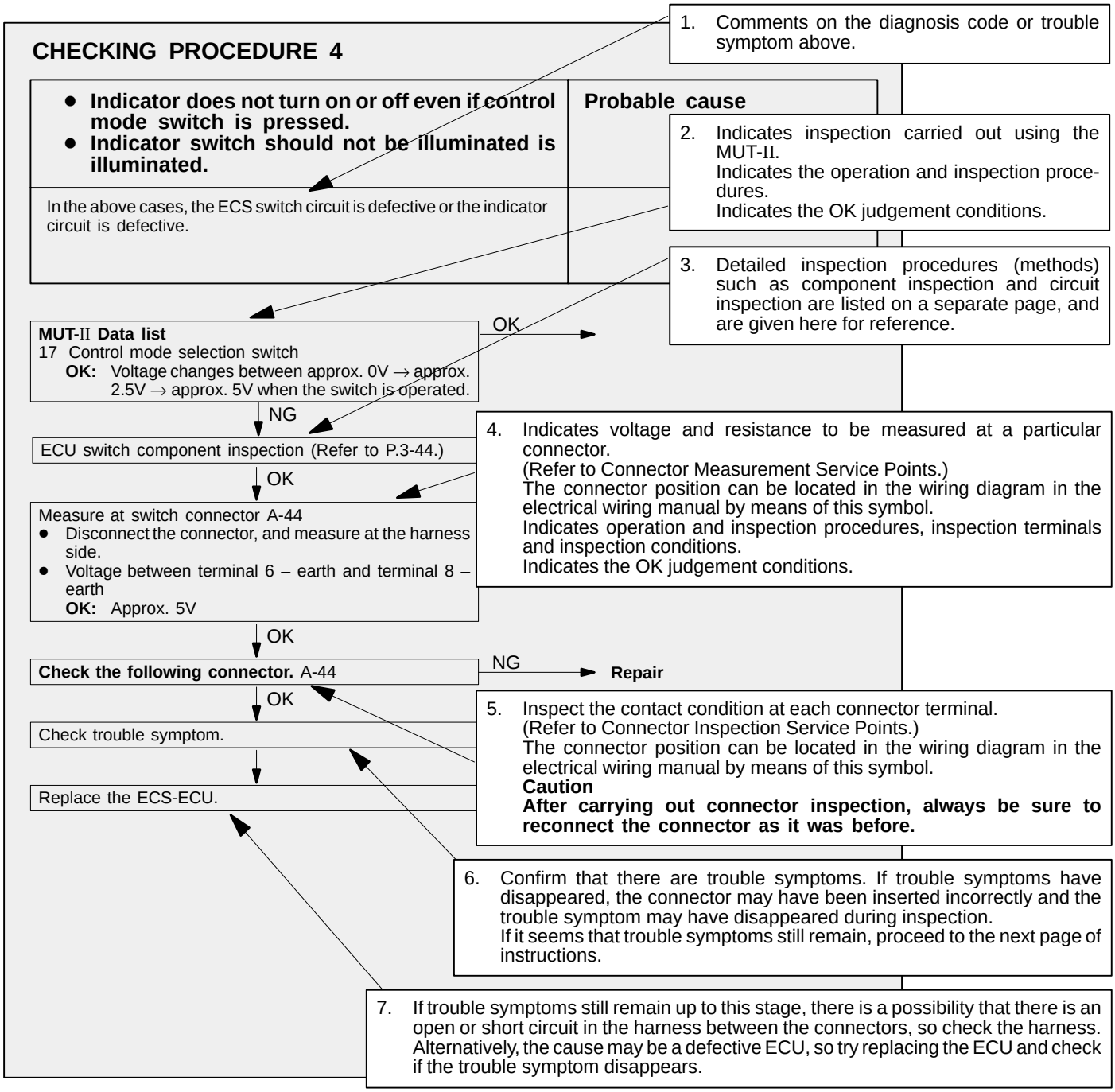
2. If buzzer of the MUT-II sounds once when the each switch is operated (ON/OFF), the ETACS-ECU input signal for that switch circuit system is normal.

WHEN USING VOLTMETER

1. Use the special tool to connect a voltmeter between the earth terminal (No. 4 or 5) and the ETACS terminal (No. 9) of the diagnosis connector.
2. If the voltmeter indicator deflects once when the each switch is operated (ON/OFF), the ETACS-ECU input signal for that switch circuit system is normal.

HOW TO USE THE INSPECTION PROCEDURES

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



HARNESS INSPECTION

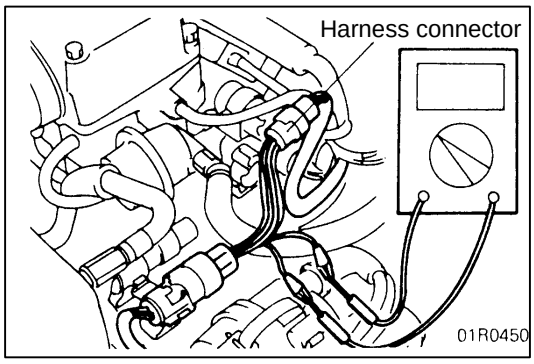
Check for an open or short circuit in the harness between the terminals which were defective according to the connector measurements. Carry out this inspection while referring to the electrical wiring manual. Here, “Check harness between power supply and terminal xx” also includes checking for blown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

MEASURES TO TAKE AFTER REPLACING THE ECU

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

CONNECTOR MEASUREMENT SERVICE POINTS

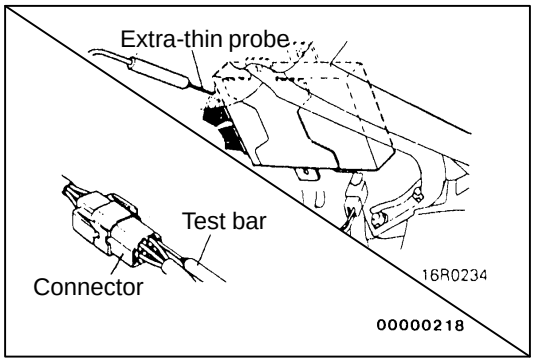
Turn the ignition switch to OFF when connecting disconnecting the connectors, and turn the ignition switch to ON when measuring if there are no instructions to be contrary.



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

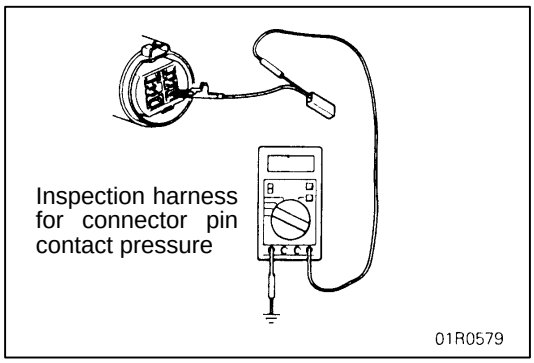
Waterproof Connectors

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



Ordinary (non-waterproof) Connectors

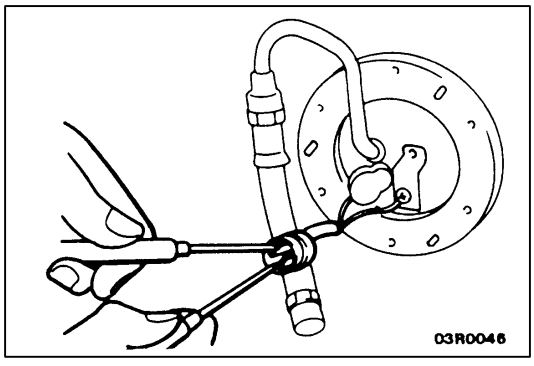
Check by inserting the test bar from the harness side. Note that if the connector (control unit, etc.) is too small to permit insertion of the test bar, it should not be forced; use a special tool (the extra-thin probe in the harness set for checking for this purpose.



IF INSPECTING WITH THE CONNECTOR DISCONNECTED

<When Inspecting a Female Pin>

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

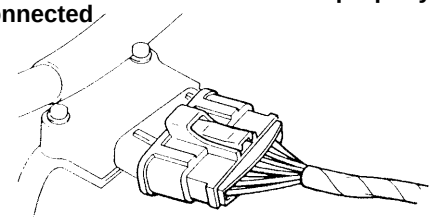


<When Inspecting a Male Pin>

Touch the pin directly with the test bar.

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

Connector disconnected or improperly connected



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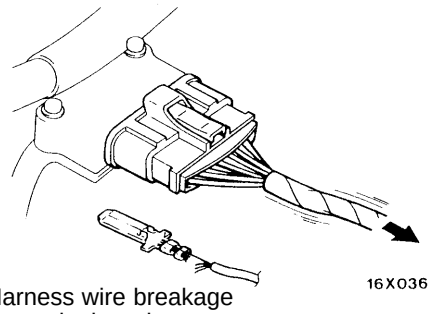
Defective connector contact



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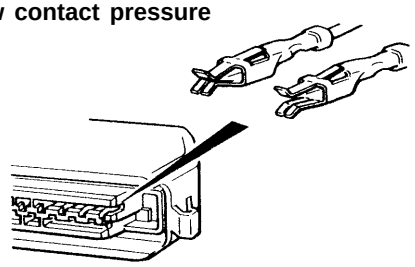
Harness wire breakage at terminal section

Low contact pressure



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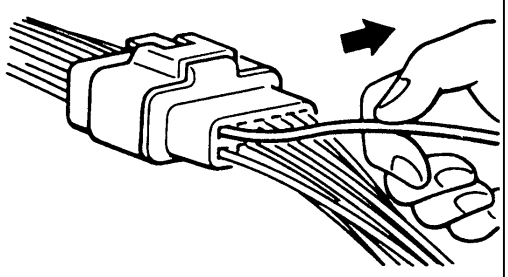
CONNECTOR INSPECTION

VISUAL INSPECTION

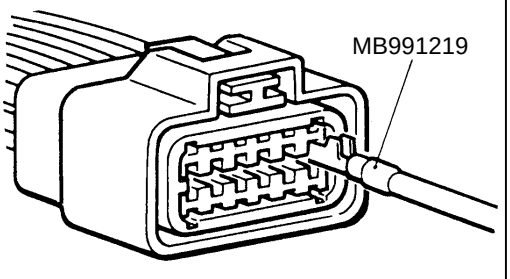
- Connector is disconnected or improperly connected
- Connector pins are pulled out
- Due to harness tension at terminal section
- Low contact pressure between male and female terminals
- Low connection pressure due to rusted terminals or foreign matter lodged in terminals



16R1317

CONNECTOR PIN INSPECTION

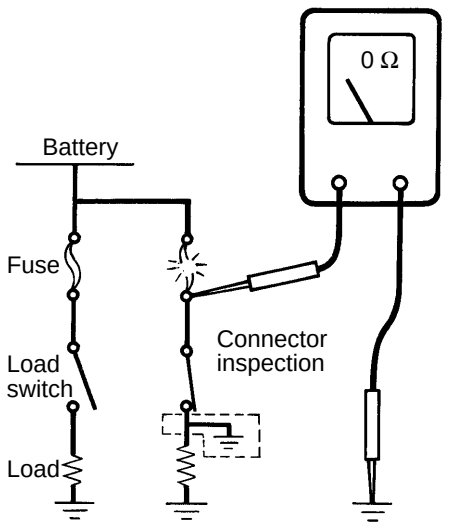
If the connector pin stopper is damaged, the terminal connections (male and female pins) will not be perfect even if the connector body is connected, and the pins may pull out of the reverse side of the connector. Therefore, gently pull the harnesses one by one to make sure that no pins pull out of the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



16R1318

CONNECTOR ENGAGEMENT INSPECTION

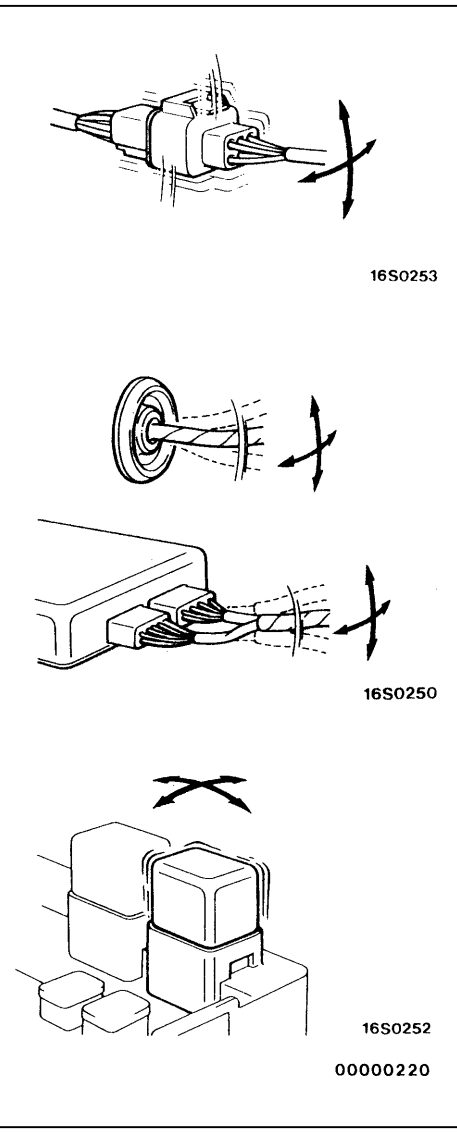
Use the special tool (connector pin connection pressure inspection harness of the inspection harness set) to inspect the engagement of the male pins and females pins. (Pin drawing force : 1 N or more)



INSPECTION SERVICE POINTS FOR A BLOWN FUSE

Remove the 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.

MODELS

<LANCER EVOLUTION-IV>

Model code	Class code	Model year	Grade	Engine model	Transmission model	Fuel supply system
E-CN9A	SNDF	’97	RS	4G63 (2,000-DOHC – 16 valves-intercooler turbo)	W5M51 (4WD-5M/T)	Electronically controlled fuel injection (MPI)
	SRGF	’97	GSR			

Applicable serial numbers

E-CN9A: CN9A – 0000001 ∽

<LANCER EVOLUTION-V>

Model code	Class code	Model year	Grade	Engine model	Transmission model	Fuel supply system
GF-CP9A	SNDF	’98	EVOLUTION-V RS	4G63 (2,000-DOHC – 16 valves-intercooler turbo)	W5M51 (4WD-5M/T)	MPI
	SNGF	’98	EVOLUTION-V GSR			

Applicable serial numbers

GF-CP9A: CP9A – 0000001 ∽

<LANCER EVOLUTION-VI>

Model code	Class code	Model year	Grade	Engine model	Transmission model	Fuel supply system
GF-CP9A	SNDF	’99	EVOLUTION-VI RS	4G63 (2,000-DOHC – 16 valves-intercooler turbo)	W5M51 (4WD-5M/T)	MPI
	SNGF	’99	EVOLUTION-VI GSR			

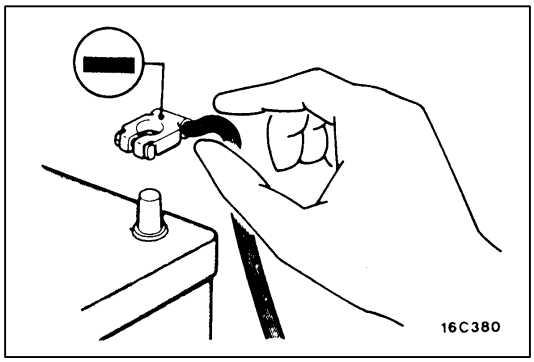
Applicable serial numbers

GF-CP9A: CP9A – 0100001 ∽

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) Always use the designated special tools and test equipment.
   (3) 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.
   (4) Never attempt to disassemble or repair the SRS components. (SRS air bag control unit, air bag module and clock spring.) If faulty, replace it.
   (5) Warnings labels must be needed when servicing and handling SRS components. Warning labels are located in the following locations.
      - Sun visor
      - Glove box
      - SRS air bag control unit
      - Steering wheel
      - Steering gear and linkage
      - Air bag module
      - Clock spring
   (6) 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 upwards.
   (7) Be sure to deploy the air bag before disposing of air bag module or disposing of a vehicle equipped with an air bag. (Refer to GROUP 52B – Air Bag Module Disposal Procedures.)
   (8) Whenever you finish servicing the SRS, check the SRS warning lamp operation to make sure that the system functions properly.
2. Observe the following when carrying out operations on place 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.)

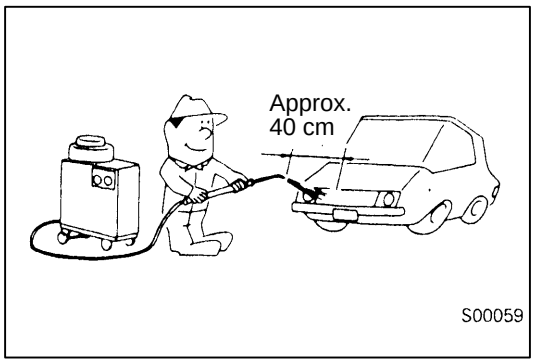
APPLICATION OF ANTI-CORROSION AGENTS AND UNDERCOATS

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.

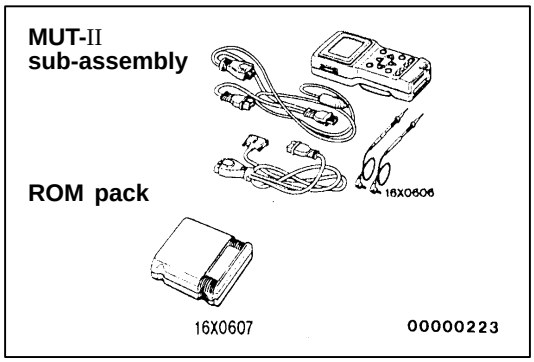
- Engine coolant temperature: 80–90°C
- Lamps, electric cooling fan and all accessories: OFF
- M/T: Neutral



VEHICLE WASHING

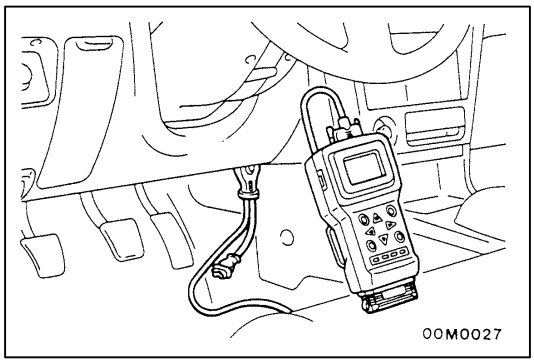
If high-pressure car-washing equipment or steam car-washing equipment is used to wash the vehicle, be sure to note the following information in order to avoid damage to plastic components, etc.

- 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 INSTRUCTION MANUAL for instructions on handling the MUT-II.



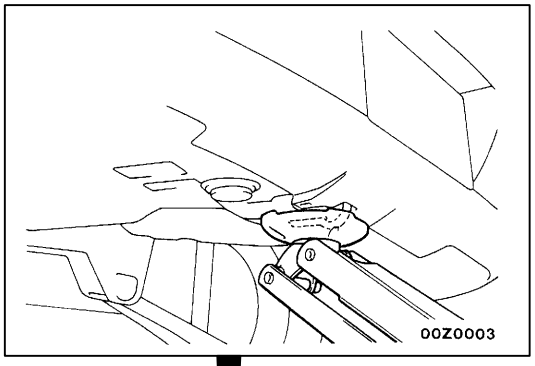
Connect the MUT-II to the diagnosis connector as shown in the illustration.

Caution
Connection and disconnection of the MUT-II should always be made with the ignition switch in the OFF position.

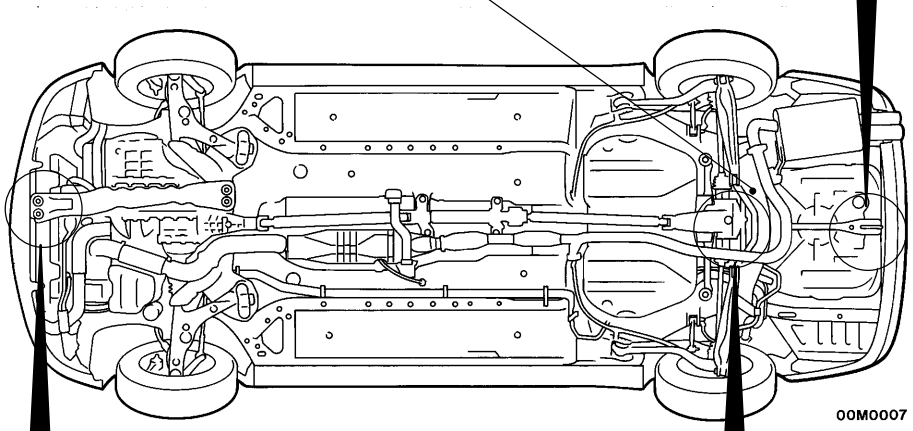
SUPPORT LOCATIONS FOR LIFTING AND JACKING

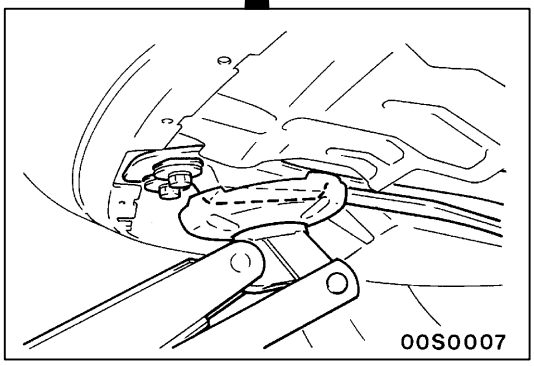
GARAGE JACK

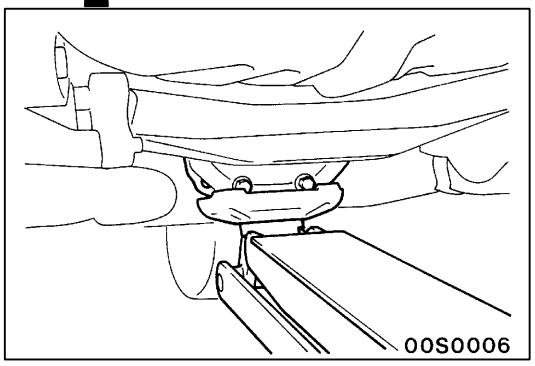
Caution
Do not support the vehicles at locations other than specified supporting points. Neglecting this will cause damage, etc.



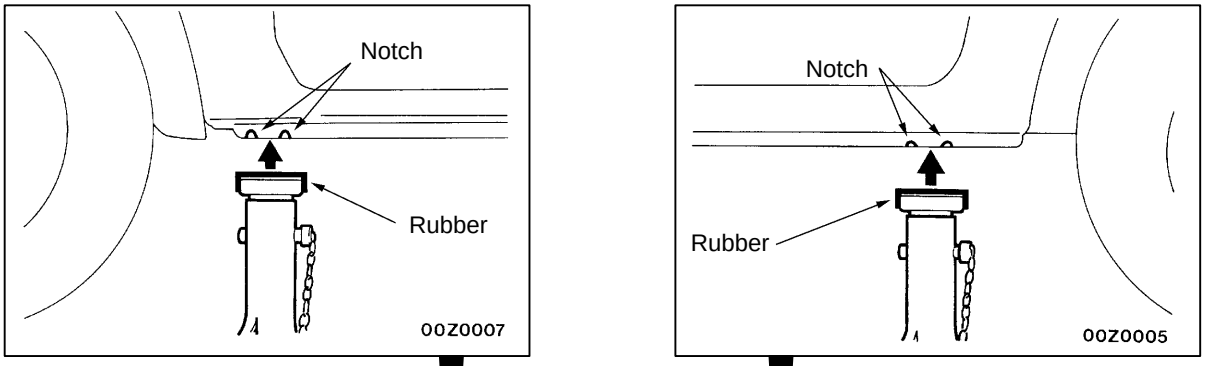
Caution
Never support the rear floor crossmember.

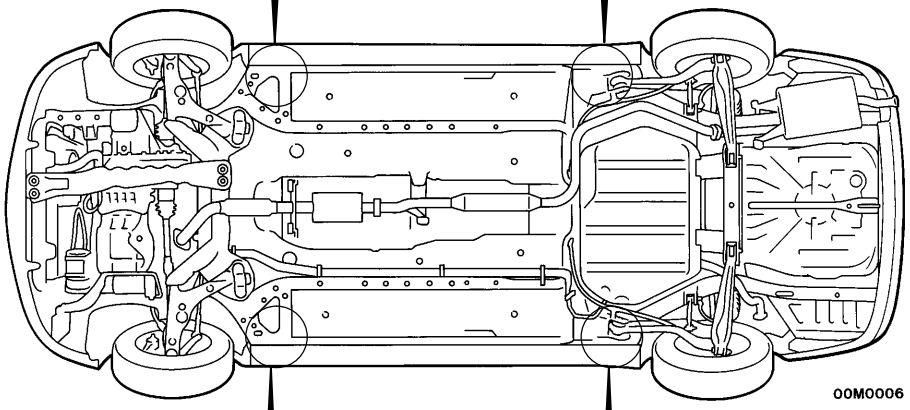




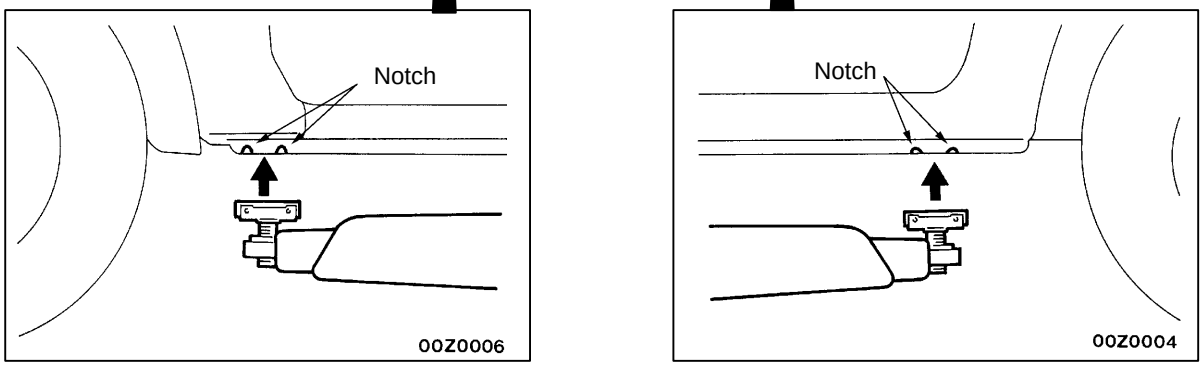


AXLE STANDS

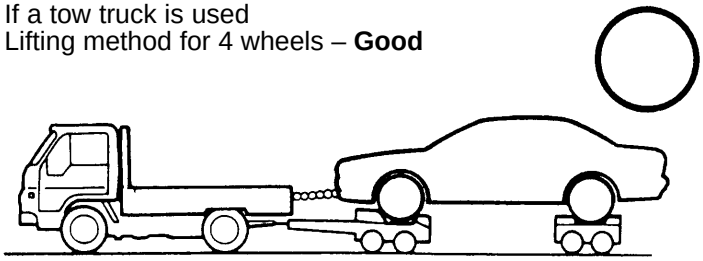
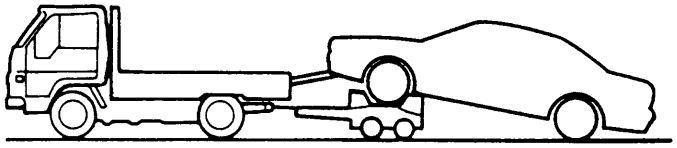
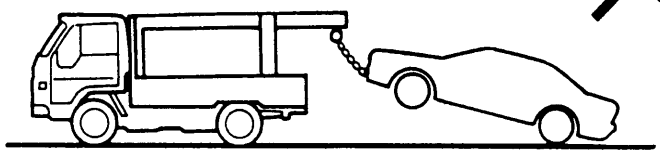
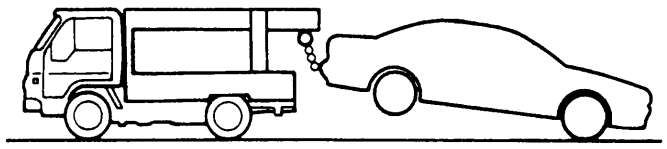
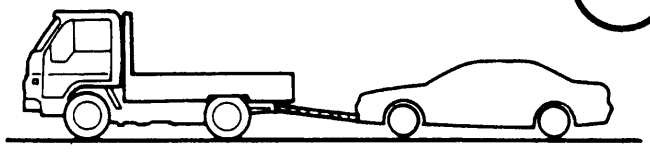


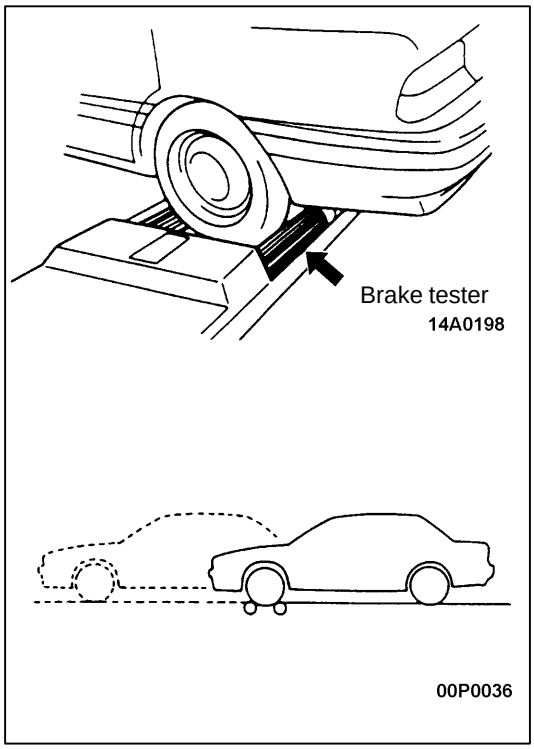


SINGLE-POST AND DOUBLE-POST LIFT



SPECIAL HANDLING INSTRUMENTS FOR TOWING

Towing methods	Remarks
If a tow truck is used Lifting method for 4 wheels – **Good**  00N0028	• For 4WD models, the basic principle is that all four wheels are to be raised before towing. • The shift lever should be set to 1st gear and the parking brake should be applied.
Front wheels lifted – **No good**  00N0030	• The vehicle must not be towed by placing only its front wheels or only the rear wheels on a rolling dolly, because to do so will result in deterioration of the viscous coupling and result in the viscous coupling causing the vehicle to jump forward suddenly.
Front wheels lifted – **No good**  00N0026	• If only the front wheels or only the rear wheels are lifted for towing, the bumper will be damaged. In addition, lifting of the rear wheels causes the oil to flow forward, and may result in heat damage to the rear bushing of the transfer, and so should never be done.
Rear wheels lifted – **No good**  00N0029	
Towing by rope or cable – **Good**  00N0027	• The front and rear wheels must rotate normally. • Both running and driving systems must function normally. • The shift lever must be set to the neutral position and the ignition key must be set to “ACC”.



BRAKE TEST

In order to stabilize the viscous coupling's dragging force, the brake test should always be conducted after the speedometer test.

FRONT WHEEL MEASUREMENTS

1. Place the front wheels on the brake tester.
2. Perform the brake test.

   Caution
   The rear wheels should remain on the ground.

3. If the brake dragging force exceeds the specified value, jack up the vehicle and manually rotate each wheel to check the rotation condition of each wheel.

   NOTE
   If the brake dragging force exceeds the specified value, the cause may be the effect of the viscous coupling's dragging force, so jack up the front wheels and check the rotation condition of the wheels in this state for no effect by the viscous coupling's dragging force.

REAR WHEEL MEASUREMENTS

After placing the rear wheels on the brake tester, follow the same procedures as for the front wheel measurements.

TIGHTENING TORQUE

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

GENERAL INFORMATION

Descriptions			Specifications
Type			In-line OHV, SOHC
Number of cylinders			4
Combustion chamber			Pentroof + curved top piston type
Total displacement dm^3			1,997
Cylinder bore mm			85.0
Piston stroke mm			88.0
Compression ratio			8.8
Valve timing	Intake valve	Opens (BTDC)	21°
		Closes (ABDC)	59°
	Exhaust valve	Opens (BBDC)	58°
		Closes (ATDC)	18°
Lubrication system			Pressure feed, full-flow filtration
Oil pump type			Involute gear type

SPECIFICATIONS

SERVICE SPECIFICATIONS

Items		Standard value	Limit
Timing belt			
Auto-tensioner rod projection length mm		12	–
Auto-tensioner rod pushed-in amount [when pushed with a force of 98 – 196 N] mm		1.0 or less	–
Rocker arms and camshaft			
Camshaft cam height mm	Intake	35.79	35.29
	Exhaust	35.49	34.99
Camshaft journal outer diameter mm		26	–
Cylinder head and valves			
Cylinder head flatness of gasket surface mm		Less than 0.05	0.2
Cylinder head grinding limit of gasket surface mm Total resurfacing depth of both cylinder head and cylinder block		–	0.2
Cylinder head overall height mm		131.9 – 132.1	–
Cylinder head bolt shank length mm		–	Maximum 99.4
Valve thickness of valve head (margin) mm	Intake	1.0	0.5
	Exhaust	1.5	1.0
Overall valve length mm	Intake	109.5	109.0
	Exhaust	109.7	109.2
Valve thickness to valve guide clearance mm	Intake	0.02 – 0.05	0.10
	Exhaust	0.05 – 0.09	0.15
Valve face angle		45° – 45.5°	–
Valve spring free length mm		48.3	47.3
Valve spring load/installed height N/mm		294/40.0	–
Valve spring out-of-squareness		1.5° or less	Maximum 4°
Valve seat contact width mm		0.9 – 1.3	–
Valve guide inner diameter mm		6.6	–
Valve guide projection from cylinder head upper surface mm		20.5	–
Valve stem projection mm	Intake	49.20	49.70
	Exhaust	48.40	48.90
Oversize rework dimensions of valve guide hole mm	0.05 O.S.	12.05 – 12.07	–
	0.25 O.S.	12.25 – 11.27	–
	0.50 O.S.	12.50 – 12.52	–

Items		Standard value	Limit
Intake oversize rework dimensions of valve guide hole mm	0.3 O.S.	35.30 – 35.33	–
	0.6 O.S.	35.60 – 35.63	–
Exhaust oversize rework dimensions of valve guide hole mm	0.3 O.S.	33.30 – 33.33	–
	0.6 O.S.	33.60 – 33.63	–
Front case and oil pan			
Oil pump side clearance mm	Drive gear	0.08 – 0.14	–
	Driven gear	0.06 – 0.12	–
Oil pressure at curb idle speed kPa [Oil temperature is 75 to 90°C]		78 or more	–
Piston and connecting rod			
Piston outer diameter mm		85.0	–
Piston ring side clearance mm	No. 1 ring	0.04 – 0.075	–
	No. 2 ring	0.02 – 0.06	–
Piston ring end gap mm	No. 1 ring	0.25 – 0.35	0.8
	No. 2 ring	0.40 – 0.55	0.8
	Oil ring	0.10 – 0.40	1.0
Piston pin outer diameter mm		21.0	–
Piston pin press-in load N (Room temperature)		7,350 – 17,200	–
Crankshaft pin oil clearance mm		0.02 – 0.05	0.1
Connecting rod big end side clearance mm		0.10 – 0.25	0.4
Crankshaft and flywheel			
Crankshaft end play mm		0.05 – 0.25	0.40
Crankshaft journal outer diameter mm		57.0	–
Crankshaft pin outer diameter mm		44.0	–
Crankshaft journal oil clearance mm		0.02 – 0.04	0.1
Bearing cap bolt shank length mm		–	Maximum 71.1
Piston to cylinder clearance mm		0.02 – 0.04	–
Cylinder block grinding limit of gasket surface mm Total resurfacing depth of both cylinder head and cylinder block		–	0.2
Cylinder block overall height mm		284	–
Cylinder block inner diameter mm		85.0	–
Cylinder block cylinder mm		0.01	–
Turbocharger			
Waste gate actuator operation check kPa		100	113.3

Items	Standard value	Limit
Alternator		
Rotor coil resistance Ω	Approx. 3 – 5	–
Protrusion length of brush mm	–	2
Starter motor		
Commutator runout mm	0.05	0.1
Commutator outer diameter mm	32.0	31.4
Commutator undercut mm	0.5	–

TORQUE SPECIFICATIONS

Items	Nm
Alternator and ignition system	
Oil level gauge guide	13
Water pump pulley	9
Alternator brace (Alternator side)	21
Alternator brace (Tightened with water pump)	23
Alternator pivot bolt	44
Crankshaft pulley	25
Center cover	3
Spark plug	25
Ignition coil	10
Timing belt	
Timing belt cover (Flange bolt)	11
Timing belt cover (Washer bolt)	9
Power steering pump bracket	49
Tensioner pulley	49
Tensioner arm	24
Auto tensioner	24
Idler pulley	48
Crank angle sensor	9
Oil pump sprocket	54
Camshaft bolt	118
Tensioner “B”	19
Counterbalance shaft sprocket	45

Items	Nm
Rocker cover	3.5
Engine support bracket	49
Camshaft sprocket bolt	88
Timing belt rear right cover	11
Timing belt rear left upper cover	11
Fuel and emission control parts	
Throttle body	18
Fuel pressure regulator	9
Delivery pipe	11
Vacuum tank bracket	9
Solenoid valve bracket	9
Solenoid valve	9
Vacuum hose and vacuum pipe	11
Secondary air intake manifold	
Heat protector	13
Vacuum hose and vacuum pipe	11
Air pipe (Heat protector side)	13
Air pipe (Cam position sensor side)	11
Air pipe (Eye bolt)	49
Air pipe (Control valve side)	24
Air control valve	21
Air control valve bracket	24
Intake manifold stay	30
Intake manifold (M8)	19
Intake manifold (M10)	35
Exhaust manifold	
Engine hanger	12
Heat protector (Turbocharger side)	14
Oxygen sensor	54
Exhaust fitting bolt	59
Exhaust fitting nut	59
Air outlet fitting	19

Items	Nm
OIl return pipe (Turbocharger side)	9
Oil return pipe (Oil pan side – Head mark 7)	9
Oil return pipe (Oil pan side – Head mark 10)	13
Oil pipe	11
Oil pipe eye bolt (Cylinder head side)	16
Oil pipe eye bolt (Turbocharger side)	30
Water pipe	11
Water pipe eye bolt	41
Exhaust manifold (M8)	29
Exhaust manifold (M10)	49
Exhaust manifold (Turbocharger side)	59
Water pump and water hose	
Water temperature sensor	29
Water temperature gauge unit	11
Water inlet fitting	24
Water outlet fitting (M6)	10
Water outlet fitting (M8)	13
Thermostat housing	24
Thermostat housing (Clamp)	11
Water inlet pipe (Cylinder block)	13
Water inlet pipe (Outlet fitting)	10
Water pump	14
Knock sensor	22
Rocker arms and camshaft	
Camshaft position sensor	9
Camshaft position sensor cover	10
Camshaft position sensing cylinder	21
Camshaft position sensing support	13
Camshaft bearing cap	20
Oil delivery body	11
Cylinder head and valves	
Cylinder head bolt [Tighten to 78 Nm and then completely before tightening to final torque specification]	20 → 90° + 90°

Items	Nm
Front case and oil pan	
Drain plug	39
Oil pan	7
Oil screen	19
Buffle plate	22
Oil pressure switch	10
Oil cooler by-pass valve	54
Relief plug	44
Plug	24
Front case	24
Oil pump cover (Screw)	10
Oil pump cover (Bolt)	16
Piston and connecting rods	
Connecting rod nut	20 + 90° to 94°
Crankshaft and flywheel	
Flywheel bolt	132
Rear plate	11
Bell housing cover	9
Oil seal case	11
Beam bearing cap bolt	25 + 90°
Check valve	32
Throttle body	
Throttle position sensor	3.5
Idle speed control body assembly	3.5
Turbocharger	
Waste gate actuator	11

NEW TIGHTENING METHOD – BY USE OF BOLTS TO BE TIGHTENED IN PLASTIC AREA

A new type of bolts, to be tightened in plastic area, is currently used some parts of the engine. The tightening method for the bolts is different from the conventional one. Be sure to observe the method described in the text when tightening the bolts.
Service limits are provided for the bolts. Make sure that the service limits described in the text are strictly observed.

- Areas where the bolts are in use:
  (1) Cylinder head bolts
  (2) Main bearing cap bolts
  (3) Connecting rod cap bolts
- Tightening method
  After tightening the bolts to the specified torque, tighten them another 90° or 180° (twice 90°). The tightening method varies on different areas. Observe the tightening method described in the text.

SEALANTS

Item	Specified sealant	Quantity
Engine support bracket bolt	3M™ AAD Part No. 8672 or equivalent	As required
Semi-circular packing	3M™ AAD Part No. 8672 or equivalent	As required
Rocker cover	3M™ AAD Part No. 8672 or equivalent	As required
Oil return pipe gasket	3M™ AAD Part No. 8731 or equivalent	As required
Thermostat housing	Mitsubishi Genuine Part No. MD970389 or equivalent	As required
Water outlet fitting	Mitsubishi Genuine Part No. MD970389 or equivalent	As required
Engine coolant temperature gauge unit	3M™ AAD Part No. 8672 or equivalent	As required
Engine coolant temperature sensor	3M™ AAD Part No. 8731 or equivalent	As required
Cam position sensor support	Mitsubishi Genuine Part No. MD970389 or equivalent	As required
Oil pressure switch	3M™ AAD Part No. 8672 or equivalent	As required
Oil pan	Mitsubishi Genuine Part No. MD970389 or equivalent	As required
Oil seal case	Mitsubishi Genuine Part No. MD970389 or equivalent	As required

FORM-IN-PLACE GASKET

The engine has several areas where the form-in-place gasket (FIPG) is in use. To ensure that the gasket fully serves its purpose, it is necessary to observe some precautions when applying the gasket. Bead size, continuity and location are of paramount importance. Too thin a bead could cause leaks. Too thick a bead, on the other hand, could be squeezed out of location, causing blocking or narrowing of the fluid feed line. To eliminate the possibility of leaks from a joint, therefore, it is absolutely necessary to apply the gasket evenly without a break, while observing the correct bead size.
The FIPG used in the engine is a room temperature vulcanisation (RTV) type and is supplied in a 100-gram tube (Part No. MD970389). Since the RTV hardens as it reacts with the moisture in the atmospheric air, it is normally used in the metallic flange areas. The FIPG, Part No. MD970389, can be used for sealing both engine oil and coolant, while Part No. MD997110 can only be used for engine oil sealing.

Disassembly

The parts assembled with the FIPG can be easily disassembled without use of a special method. In some cases, however, the sealant between the joined surfaces may have to be broken by lightly striking with a mallet or similar tool. A flat and thin gasket scraper may be lightly hammered in between the joined surfaces. In this case, however, care must be taken to prevent damage to the joined surfaces. For removal of the oil pan, the special tool “Oil Pan Remover” (MD998727) is available. Be sure to use the special tool to remove the oil pan.

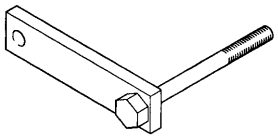
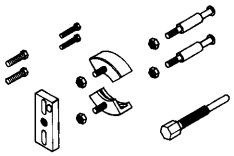
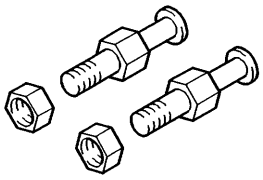
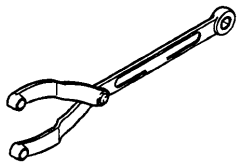
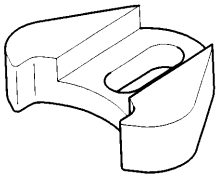
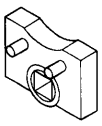
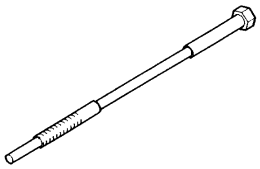
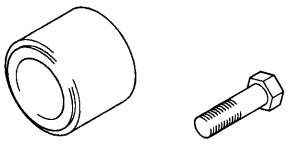
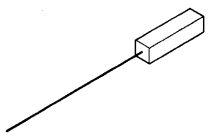
Surface Preparation

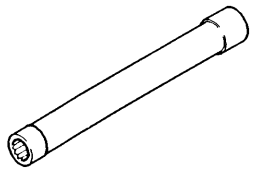
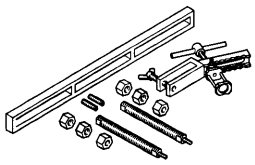
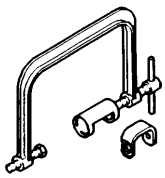
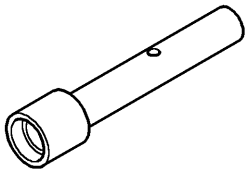
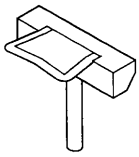
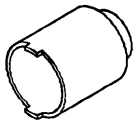
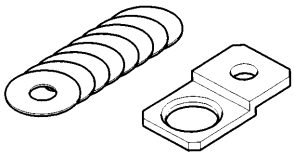
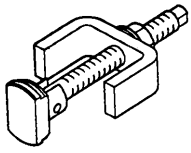
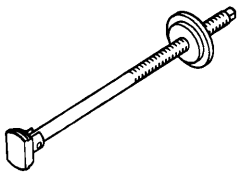
Thoroughly remove all substances deposited on the gasket application surfaces, using a gasket scraper or wire brush. Check to ensure that the surfaces to which the FIPG is to be applied is flat. Make sure that there are no oils, greases and foreign substances deposited on the application surfaces. Do not forget to remove the old sealant remained in the bolt holes.

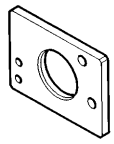
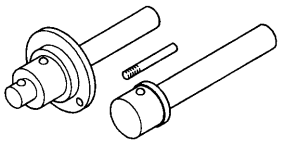
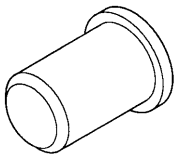
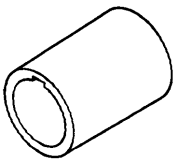
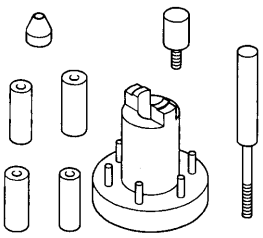
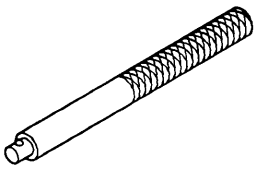
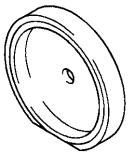
Form-in-Place Gasket Application

When assembling parts with the FIPG, you must observe some precautions, but the procedures is very simple as in the case of a conventional precut gasket.
Applied FIPG bead should be of the specified size and without breaks. Also be sure to encircle the bolt hole circumference with a completely continuous bead. The FIPG can be wiped away unless it is hardened. While the FIPG is still moist (in less than 15 minutes), mount the parts in position. When the parts are mounted, make sure that the gasket is applied to the required area only. In addition, do not apply any oil or water to the sealing locations or start the engine until a sufficient amount of time (about one hour) has passed after installation is completed.
The FIPG application procedure may vary on different areas. Observe the procedure described in the text when applying the FIPG.

SPECIAL TOOLS

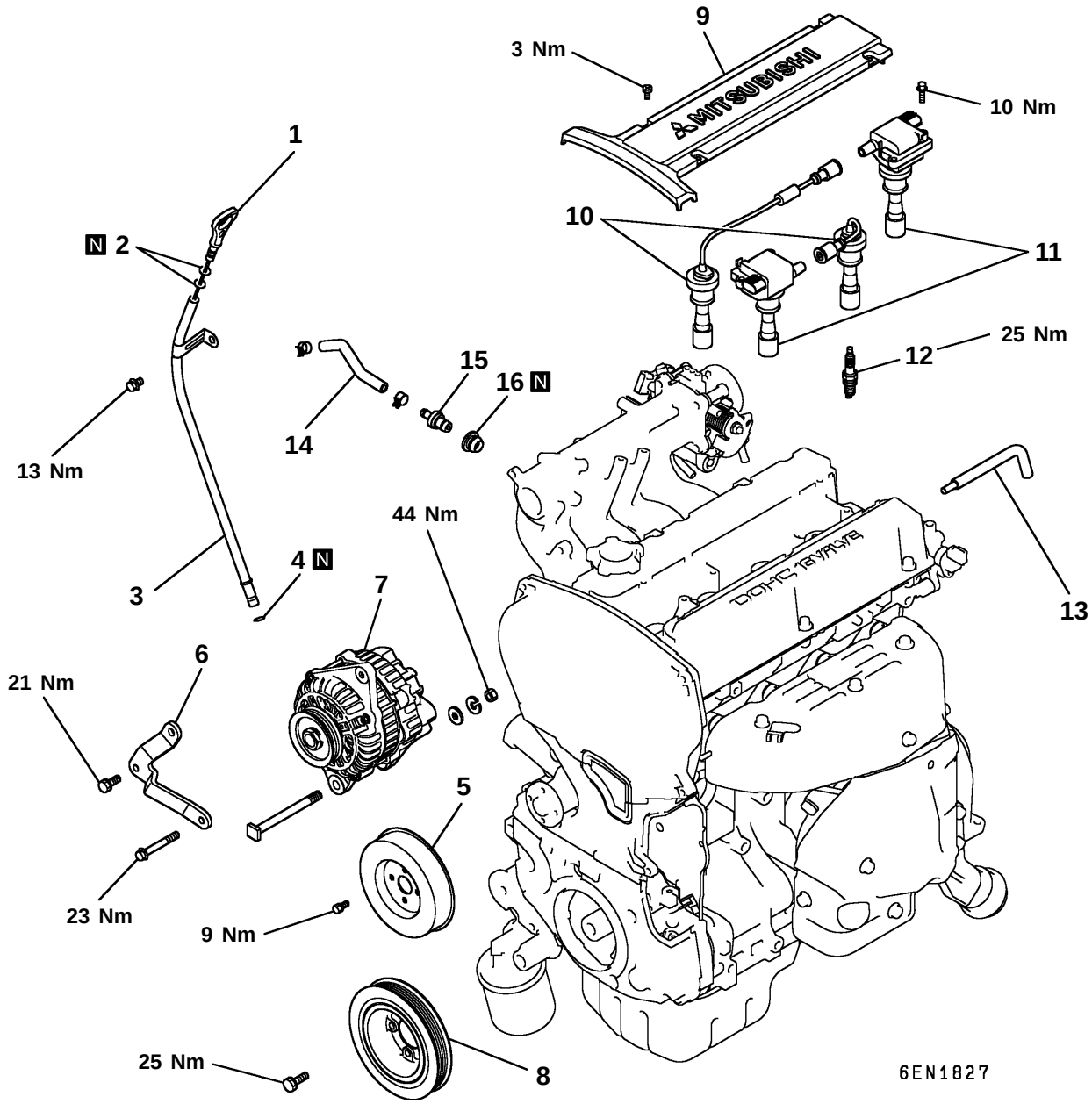
Tool	Number	Name	Use
	MD998781	Flywheel stopper	Holding of flywheel and drive plate
	MD998778	Crankshaft sprocket puller	Removal of crankshaft sprocket
	MD998719	Pulley holder pin	Holding camshaft sprocket
	MB990767	Crankshaft pulley holder	
	MD998785	Sprocket stopper	Holding silent shaft sprocket
	MD998767	Tensioner puller socket wrench	Adjustment of timing belt tension
	MD998738	Set screw	
	MD998713	Camshaft oil seal installer	Installation of camshaft oil seal
	MD998442	Lash adjuster wire	Air bleeding of lash adjuster

Tool	Number	Name	Use
	MB991654	Cylinder head bolt wrench (12)	Removal and installation of cylinder head bolt
	MD998772	Valve spring compressor	Removal and installation of valve and related parts
	MD998735	Valve spring compressor	
	MD998737	Valve stem seal installer	Installation of valve stem seal
	MD998727	Oil pan remover	Removal of oil pan
	MD998162	Plug wrench	Removal and installation of front case cap plug Use with MD998783.
	MD998783	Plug wrench retainer	Removal and installation of front case cap plug
	MD998371	Silent shaft bearing puller	Removal of counterbalance shaft front bearing
	MD998372	Silent shaft bearing puller	Removal of counterbalance shaft rear bearing

Tool	Number	Name	Use
	MB991603	Silent shaft bearing puller stopper	Guide stopper for removal and installation of counterbalance shaft rear bearing Use with MD998372.
	MD998705	Silent shaft bearing installer	Installation of counterbalance shaft front and rear bearing
	MD998375	Crankshaft front seal installer	Installation of crankshaft front oil seal
	MD998285	Crankshaft front oil seal guide	Guide for installation of crankshaft front oil seal Use with MD998375.
	MD998780	Piston setting tool	Removal and installation of piston pin
	MB990938	Handle	Installation of crankshaft rear oil seal
	MD998776	Crankshaft rear oil seal installer	

ALTERNATOR AND IGNITION SYSTEM

REMOVAL AND INSTALLATION

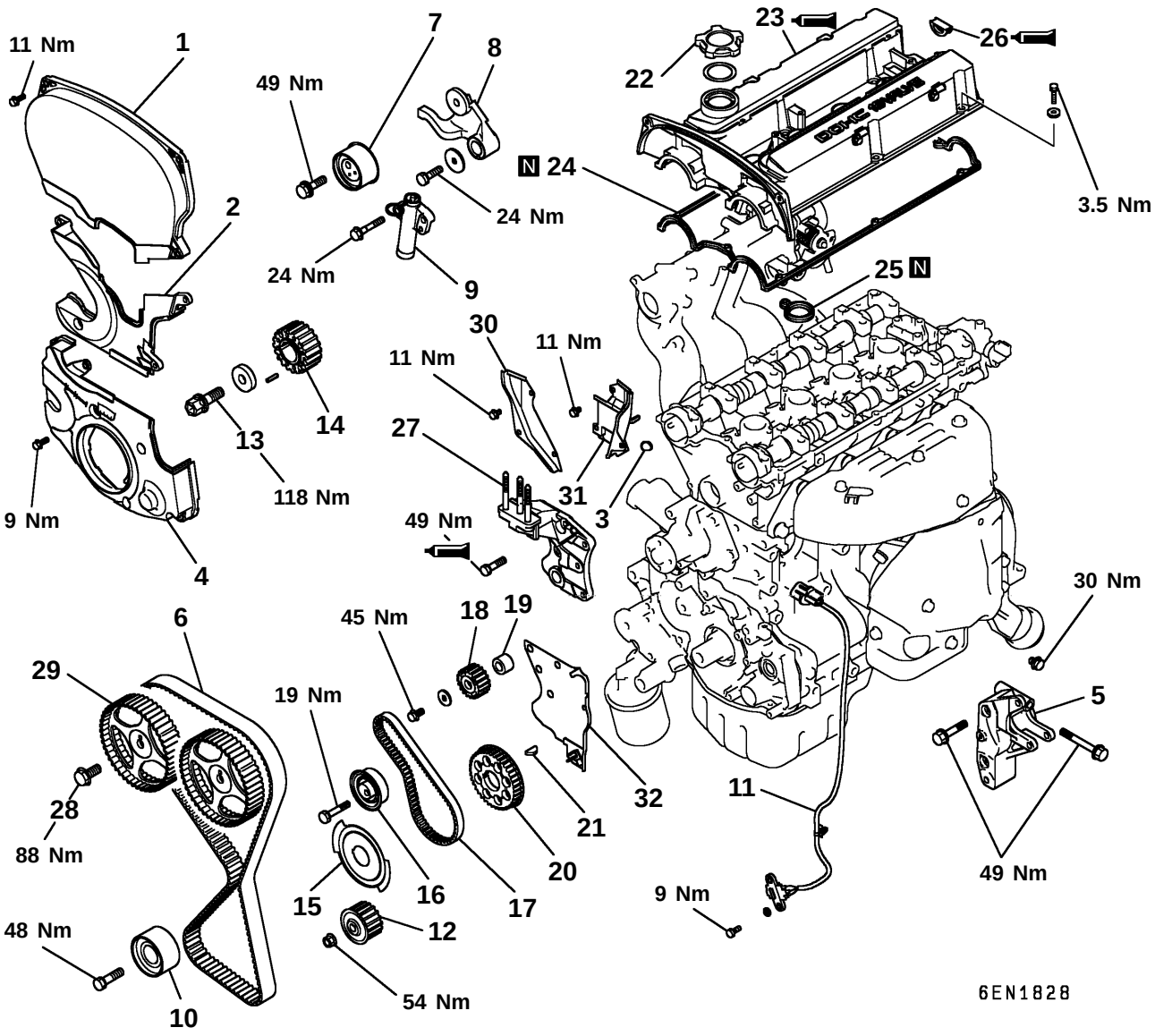


Removal steps

1. Oil level gauge
2. O-ring
3. Oil level gauge guide
4. O-ring
5. Water pump pulley
6. Alternator brace
7. Alternator
8. Crankshaft pulley
9. Center cover
10. Spark plug cable
11. Ignition coil
12. Spark plug
13. Breather hose
14. PCV hose
15. PCV valve
16. PCV valve gasket

TIMING BELT

REMOVAL AND INSTALLATION



Removal steps

1. Timing belt front upper cover
2. Timing belt front center cover
3. Rubber plug
4. Timing belt front lower cover
5. Power steering pump bracket
◀A▶ ▶L◀ 6. Timing belt
▶K◀ 7. Tensioner pulley
8. Tensioner arm
▶J◀ 9. Auto tensioner
10. Idler pulley
11. Crank angle sensor
◀B▶ ▶I◀ 12. Oil pump sprocket
◀C▶ ▶H◀ 13. Crankshaft sprocket bolt
◀D▶ 14. Crankshaft sprocket
15. Crankshaft sensing blade
16. Tensioner B
◀E▶ ▶G◀ 17. Timing belt B
◀F▶ ▶F◀ 18. Counterbalance shaft sprocket
▶E◀ 19. Crankshaft spacer
◀G▶ 20. Crankshaft sprocket B
21. Crankshaft key
22. Oil filler cap
▶D◀ 23. Rocker cover
24. Rocker cover gasket A
25. Rocker cover gasket B
▶C◀ 26. Semi-circular packing
▶B◀ 27. Engine support bracket
◀H▶ ▶A◀ 28. Camshaft sprocket bolt
29. Camshaft sprocket
30. Timing belt rear right cover
31. Timing belt rear left upper cover
32. Timing belt rear left lower cover