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SPACE RUNNER
SPACE WAGON

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	PYDE9802
WORKSHOP MANUAL	
ENGINE GROUP	PWEE□□□□ (Looseleaf edition)
ELECTRICAL WIRING	PHDE9802
BODY REPAIR MANUAL	PBDE9802
PARTS CATALOGUE	
SPACE RUNNER	B608V509A□
SPACE WAGON	B608W509A□

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.

EXPLANATION OF MANUAL CONTENTS

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

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

Indicates (by symbols) where lubrication is necessary.

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

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

Classifications of Major Maintenance/Service Points

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

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

Symbols for Lubrication, Sealants and Adhesives

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

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

 : Sealant or adhesive

 : Brake fluid or automatic transmission fluid

 : Engine oil, gear oil or air conditioner compressor oil

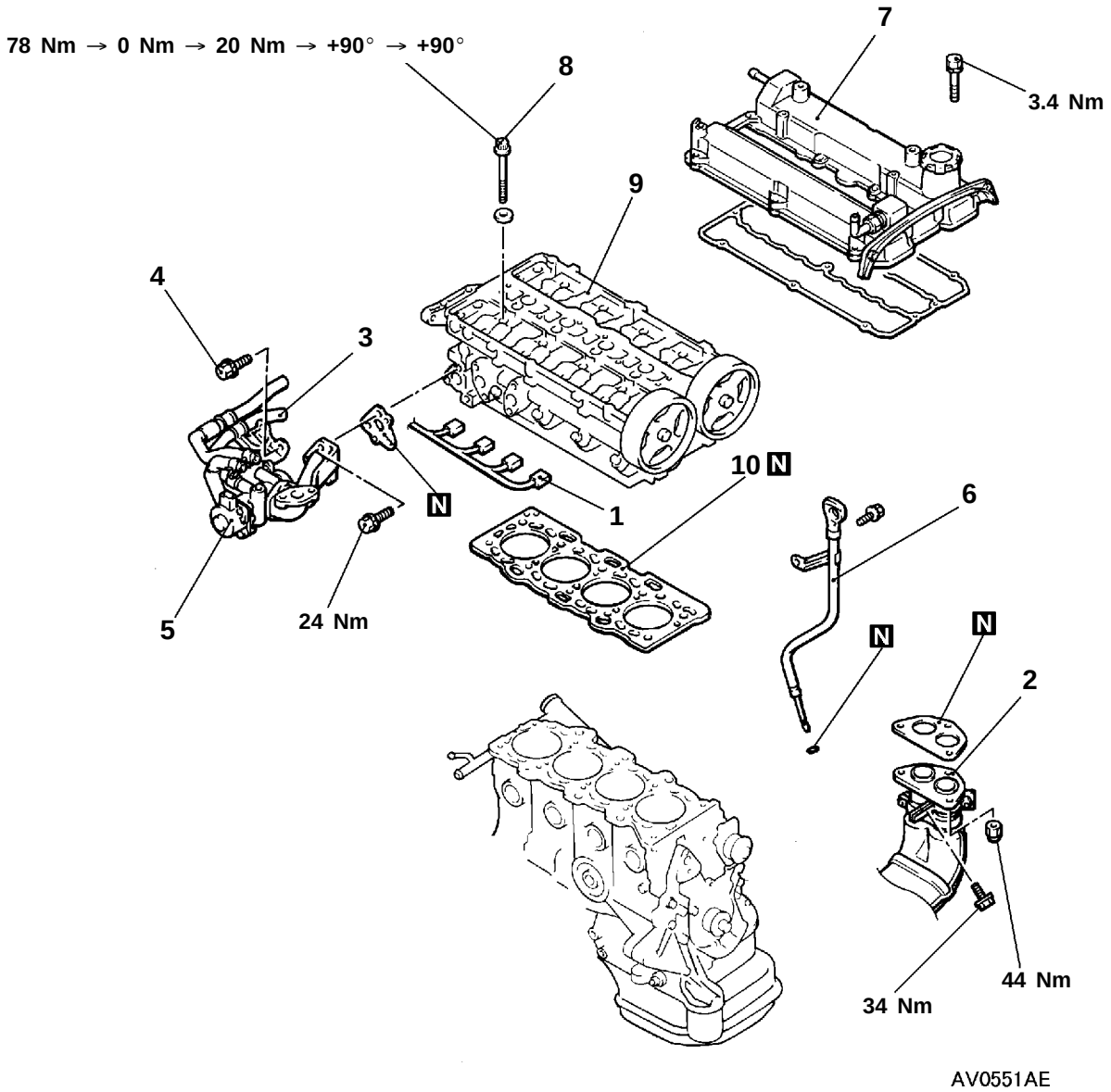
 : Adhesive tape or butyl rubber tape

CYLINDER HEAD GASKET

11200400542

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Fuel Discharge Prevention (Refer to GROUP 13A - On-vehicle Service.) <Pre-removal only>
- Engine Coolant Draining and Supplying (Refer to GROUP 14 - On-vehicle Service.)
- Engine Oil Draining and Supplying (Refer to GROUP 12 - On-vehicle Service.)
- Intake Manifold Removal and Installation (Refer to GROUP 15.)
- Fuel Pressure Regulator (High Pressure) and Fuel Pump (High Pressure) Removal and Installation (Refer to GROUP 13A.)
- Thermostat Case Assembly Removal and Installation (Refer to GROUP 14 - Water Hose and Pipe.)
- Timing Belt Removal and Installation (Refer to P.11A-30.)



Removal steps

1. Injector harness connector
2. Front exhaust pipe connection
3. Water hose connection
4. Water pipe assembly mounting bolt
5. EGR valve and stay assembly
6. Engine oil level gauge
7. Rocker cover
◀A▶ ▶B◀ 8. Cylinder head bolt
9. Cylinder head assembly
▶A◀ 10. Cylinder head gasket

GENERAL INFORMATION

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

FUEL INJECTION CONTROL

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

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

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

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

IDLE AIR CONTROL

The idle speed is kept at the optimum speed by controlling the amount of air that bypasses the throttle valve in accordance with changes in idling conditions and engine load during idling. The engine-ECU drives the idle speed control (ISC) motor to keep the engine running at the pre-set idle target speed in accordance with the engine coolant temperature and air conditioner load. In addition, when the air conditioner switch is turned off and on while the engine is idling, the ISC motor operates to adjust the throttle valve bypass air amount in accordance with the engine load conditions in order to avoid fluctuations in the engine speed.

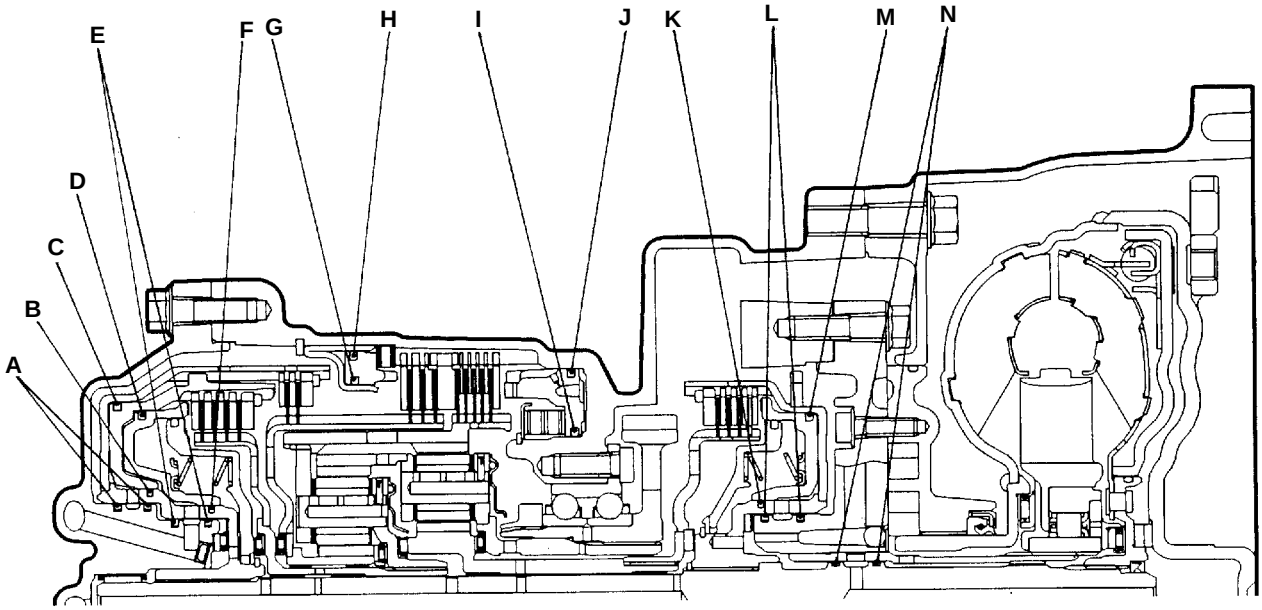
IGNITION TIMING CONTROL

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

SELF-DIAGNOSIS FUNCTION

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

OIL SEAL LAYOUT sub=04



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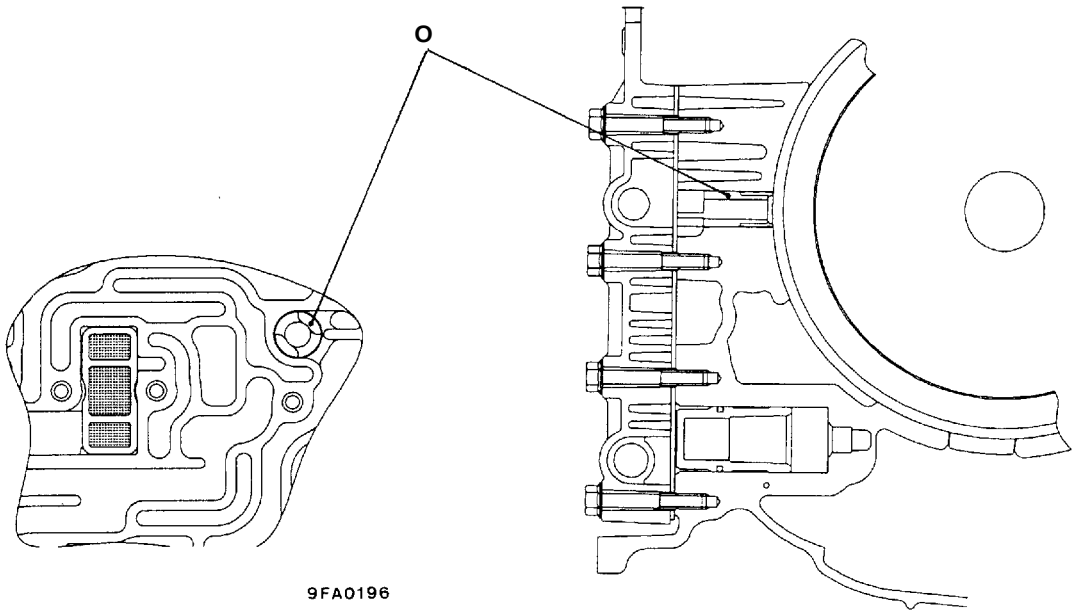

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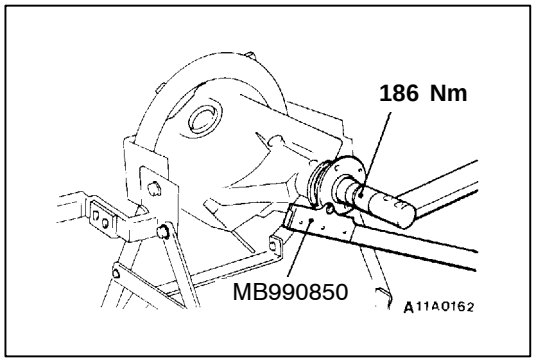
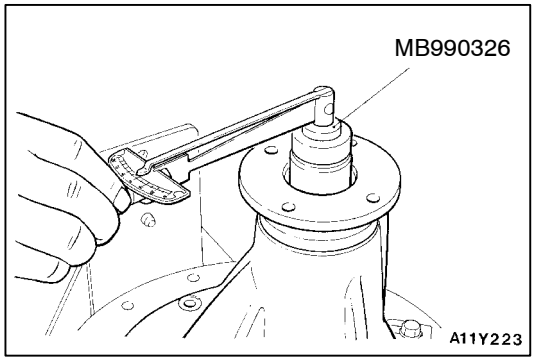


2. Tighten the companion flange to the specified torque by using special tools.



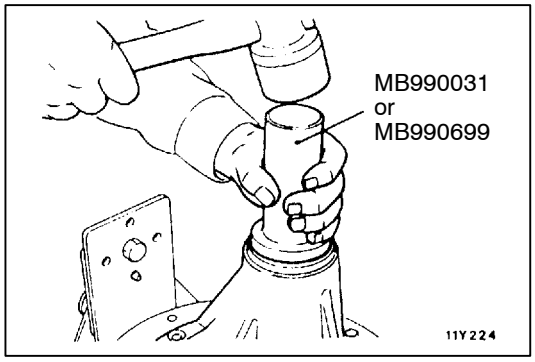
3. Measure the drive pinion turning torque (without the oil seal) by using the special tools.

Standard value:

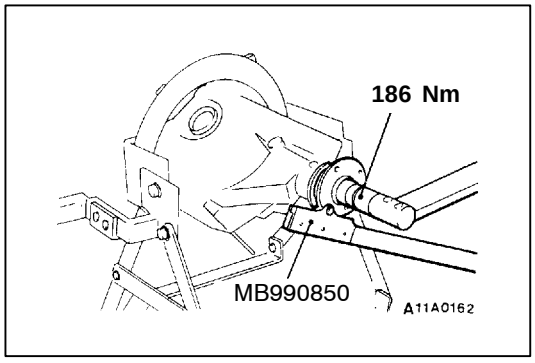
Bearing division	Bearing lubrication	Turning torque Nm
New	None (with anti-rust agent)	0.9 - 1.2 Nm
New or reusing	Gear oil applied	0.4 - 0.5 Nm

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

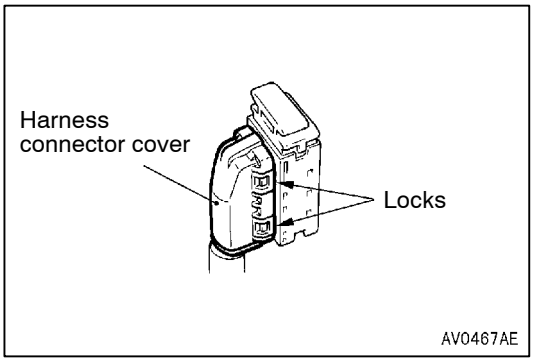
NOTE
When selecting the drive pinion front shims, if the number of shims is large, reduce the number of shims to a minimum by selecting the drive pinion spacers.



5. Remove the companion flange and drive pinion once again. Drive the oil seal into the gear carrier front lip by using the special tool.
6. Apply a thin coat of multipurpose grease to the companion flange contacting surface of the washer and oil seal contacting surface before installing drive pinion assembly.



7. Install the drive pinion assembly and companion flange with mating marks properly aligned, and tighten the companion flange self-locking nut to the specified torque by using special tools.



ON-VEHICLE SERVICE

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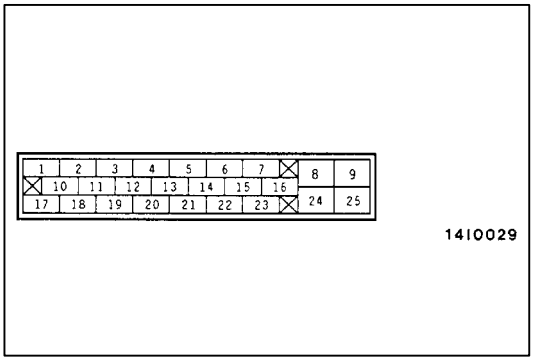
WHEEL SPEED SENSOR OUTPUT VOLTAGE CHECK

1. Lift up the vehicle and release the parking brake.
2. Remove the harness connector cover of the ABS-ECU and measure.



3. Rotate the wheel to be measured at approximately 1/2 - 1 rotation per second, and check the output voltage using a circuit tester or an oscilloscope.

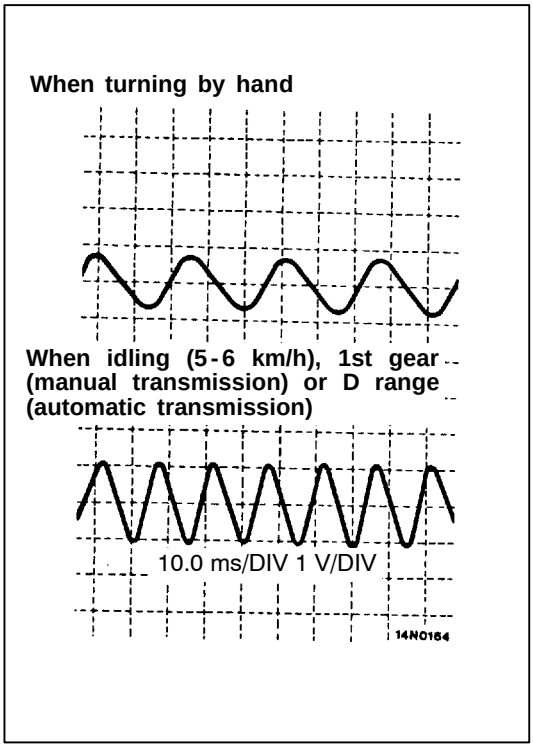
Wheel speed sensor	Front left	Front right	Rear left	Rear right
Terminal No.	1	19	5	23
	2	20	6	22

Output voltage

When measuring with a circuit tester:
42 mV or more

When measuring with an oscilloscope:
120 mV p-p or more

4. The followings are suspected if the output voltage is lower than the value described above. Check the speed sensor, and replace if necessary.
   - Too large clearance between the pole piece of the speed sensor and ABS rotor
   - Faulty wheel speed sensor



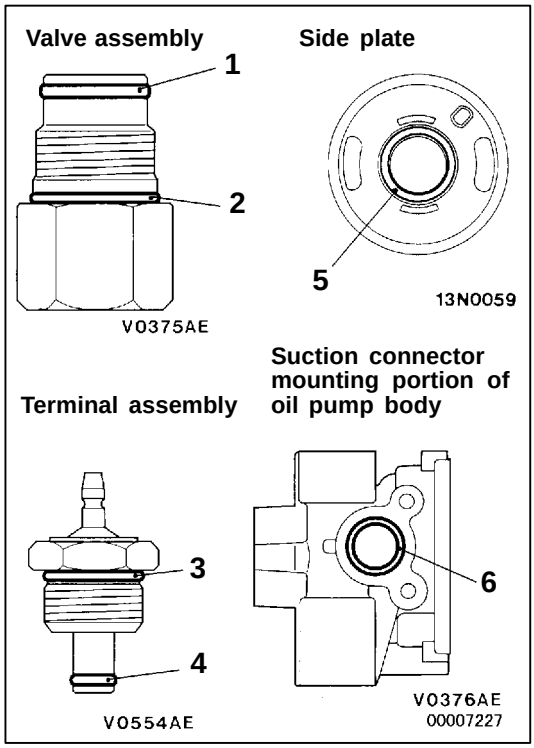
Inspecting Waveforms With An Oscilloscope

Use the following method to observe the output voltage waveform from each wheel sensor with an oscilloscope.

- Start the engine, and rotate the front wheels by engaging 1st gear (vehicles with manual transmission) or D range (vehicles with automatic transmission). Turn the rear wheels manually so that they rotate at a constant speed.

NOTE

1. Check the connection of the sensor harness and connector before using the oscilloscope.
2. The waveform measurements can also be taken while the vehicle is actually moving.
3. The output voltage will be small when the wheel speed is low, and similarly it will be large when the wheel speed is high.

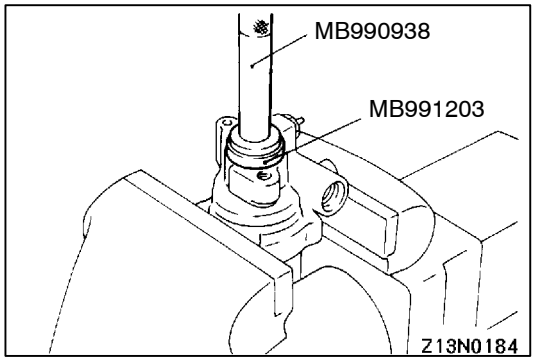


REASSEMBLY SERVICE POINTS

▶A◀ O-RINGS INSTALLATION

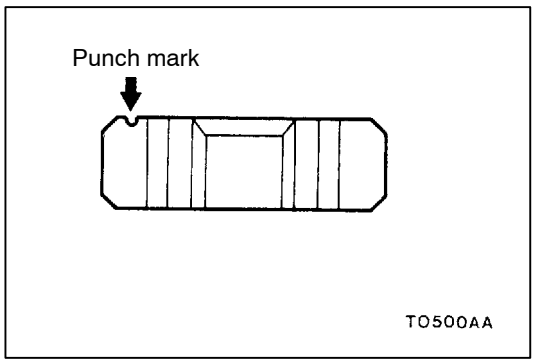
Apply the specified fluid on O-rings to install.

No.	I.D. × Width mm
1	15.8 × 1.9
2	21.0 × 1.9
3	14.8 × 2.4
4	14.8 × 1.9
5	3.8 × 1.9
6	15.8 × 2.4



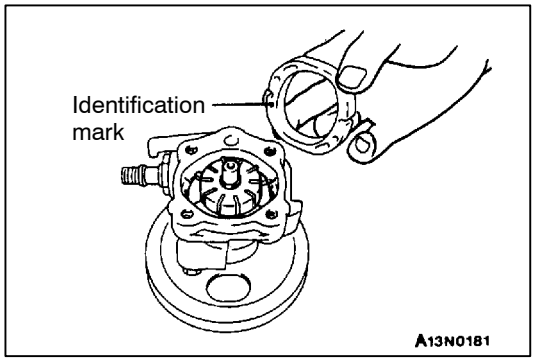
▶B◀ OIL SEAL INSTALLATION

Install the oil seal to the oil pump body with the special tools.



▶C◀ ROTOR INSTALLATION

Install the rotor with its punch mark towards the side plate.



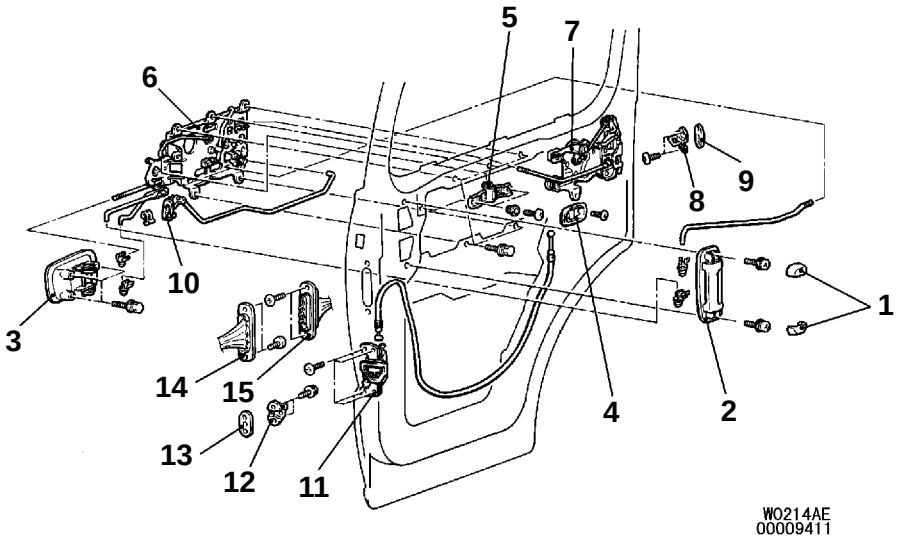
▶D◀ CAM RING INSTALLATION

Install the cam ring with its identification mark towards the side plate.

SLIDE DOOR HANDLE AND LATCH

REMOVAL AND INSTALLATION

Post-installation operation
- Door outside handle play check and adjustment (Refer to P.42-54.)
- Door inside handle play check and adjustment (Refer to P.42-54.)



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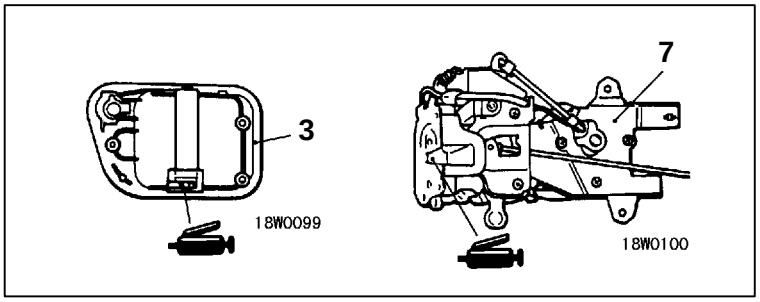


Slide door inside handle removal steps
- Slide door trim, upper (Refer to P.42-59.)

1. Slide door inside handle cover
2. Slide door inside handle

Slide door outside handle removal steps
- Slide door trim, upper (Refer to P.42-59.)

1. Slide door inside handle cover
2. Slide door inside handle
- Waterproof film, upper (Refer to P.42-59.)

3. Slide door outside handle

Slide door latch removal steps
- Slide door trim, upper and slide door trim, lower (Refer to P.42-59.)

1. Slide door inside handle cover
2. Slide door inside handle
- Waterproof film, upper (Refer to P.42-59.)

4. Inside lock knob cover
5. Inside lock knob
6. Slide door lock link assembly
- Waterproof film, lower (Refer to P.42-59.)

7. Slide door latch assembly
8. Striker
9. Shim

▶A◀ 10. Slide door child protection

11. Sub latch assembly
12. Striker
13. Shim

Contact switch removal steps

14. Contact switch (A)
- Slide door trim upper, slide door trim lower, waterproof film lower (Refer to P.42-59.)

15. Contact switch (B)

TROUBLESHOOTING

DIAGNOSIS FUNCTION

INPUT SIGNAL INSPECTION PROCEDURE

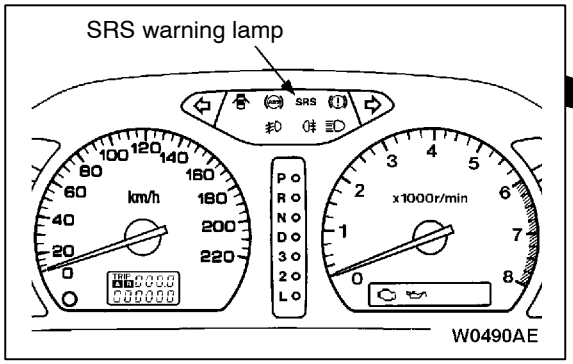
1. Connect the MUT-II or a voltmeter to the diagnosis connector to check input signal. (Refer to GROUP 00 - How to Use Troubleshooting/Inspection Service Points.)
2. The following input signals can be checked:
   Windshield wiper switch
   - LO
   - HI
   - INT
   - Variable intermittent switch
   - Mist

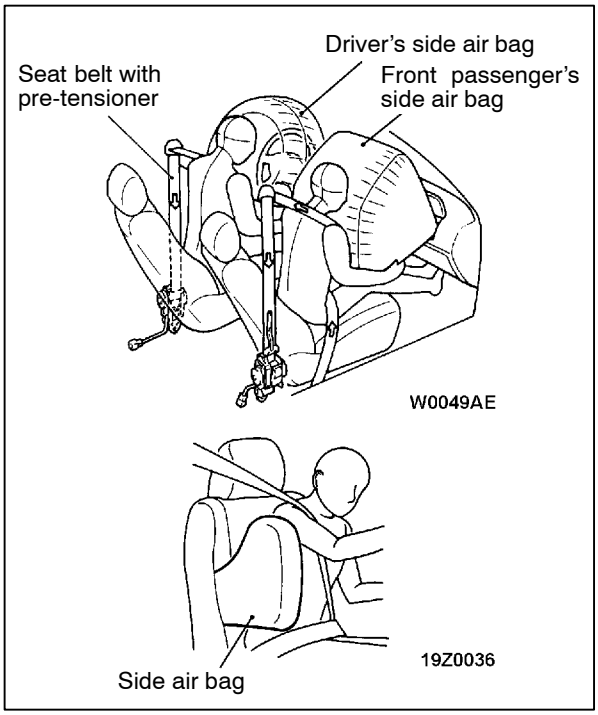
   Windshield washer switch

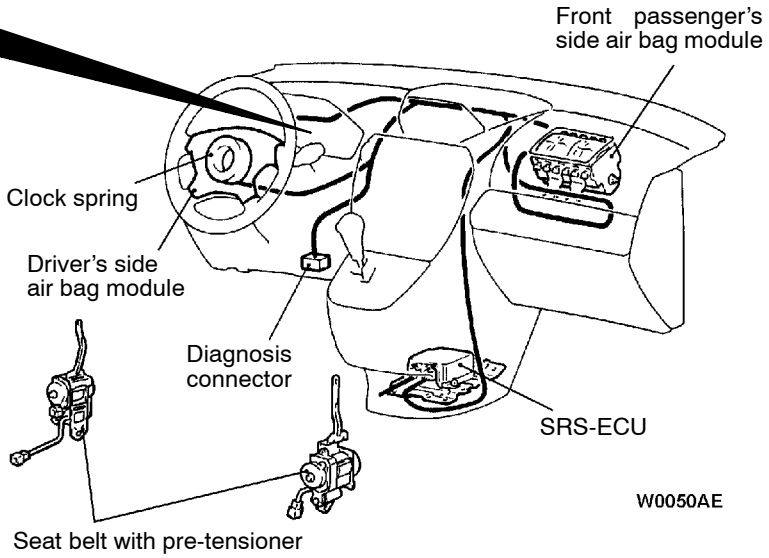
   NOTE
   If all the input signals cannot be check by using the MUT-II, the diagnosis circuit may be defective.

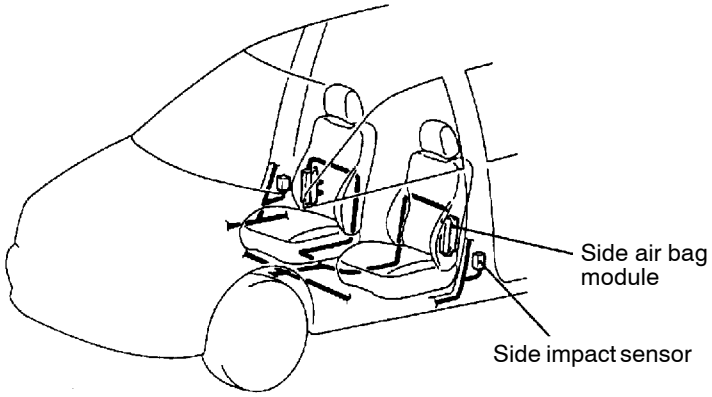
INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom	Inspection procedure	Reference page
Communication with the MUT-II is impossible.	Refer to GROUP 54 - SWS.	
When the wiper switch is set to “LO” position, the wipers do not operates at “LO” mode.	1	51-25
When the wiper switch is set to “HI” position, the wipers do not operates at “LO” mode instead of “HI” mode.	2	51-26
When the wiper switch is set to “INT” position, the wipers do not operate intermittently. (However, the wipers operate normally when the switch is set to “LO” or “HI” position.)	3	51-26
The wipers do not stop when the wiper switch is turned off during the low wiper speed.	4	51-27
The operating interval of the wipers does not change when the variable intermittent wiper switch is operated during constant vehicle speed.	5	51-27
The washers do not operate when the washer switch is operated.	6	51-28
The wipers do not operate when the washer switch is operated (However, the washer operates normally.)	7	51-29

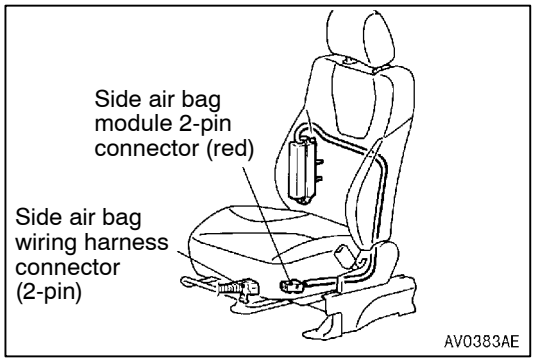

SRS warning lamp
SRS
km/h
x1000r/min
P
R
N
D
3
2
L
W0490AE


Driver's side air bag
Seat belt with pre-tensioner
Front passenger's side air bag
W0049AE
Side air bag
19Z0036


Front passenger's side air bag module
Clock spring
Driver's side air bag module
Diagnosis connector
SRS-ECU
W0050AE
Seat belt with pre-tensioner


Side air bag module
Side impact sensor
V0012AJ

00009238

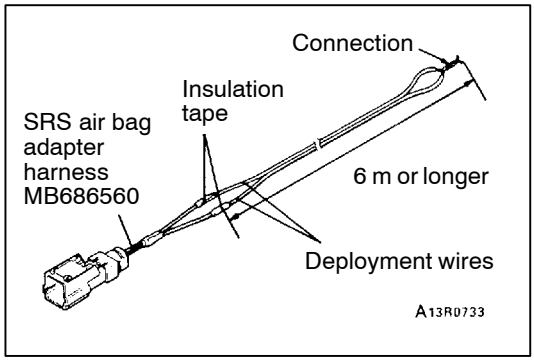


Side air bag module

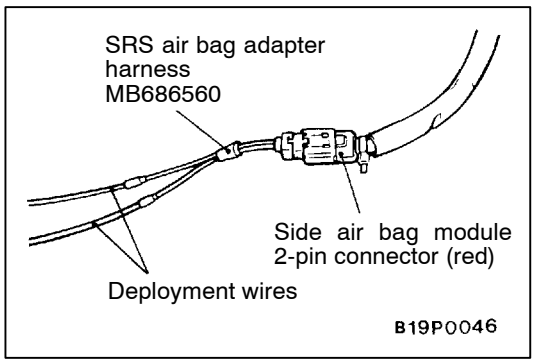
(1) Remove the connection between the side air bag module 2-pin connector (red) and the side air bag wiring harness connector (2-pin).

Caution
The side air bag modules for both the driver's side and passenger's side should be deployed.

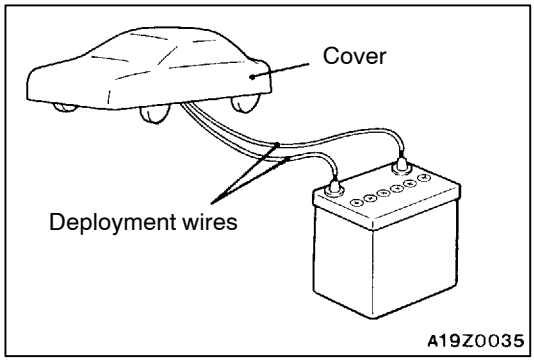
NOTE
If the side air bag module connector is disconnected from the body wiring harness, both electrodes of the side air bag module connector will be automatically shorted to prevent unintended deployment of the side air bag due to static electricity, etc.



(2) Connect two wires, each six meters or longer, to the two leads of SRS air bag adapter harness and cover the connections with insulation tape. The other ends of the two wires should be connected to each other (short-circuited), to prevent sudden unexpected deployment of the side air bag.



(3) Connect the side air bag module 2-pin connector (red) to SRS air bag adapter harness and pass the deployment wires out of the vehicle.



(4) Fully close all door windows, close the doors and place a cover over the vehicle to minimize the amount of noise.

Caution
If the glass is damaged, it may break, so the car must be covered.

INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptoms	Inspection procedure	Reference page
The lighting monitor buzzer does not sound under the following conditions while tail lamps or headlamps illuminate. ● When the ignition switch is turned to OFF position and the driver's side door is open.	1	54-30
The headlamps and tail lamps do not switch off automatically when removing the ignition key and opening the driver's side door while tail lamps or headlamps illuminate. (However, the lighting monitor buzzer sounds.)	2	54-31
The headlamps do not change to high beam or low beam.	3	54-31
The headlamps do not illuminate when the passing switch is operated.	4	54-32
Headlamp angle does not change when the headlamp leveling switch is operated.	5	54-33
The headlamps do not illuminate when the vehicle is in the following condition and the ignition switch is at the ON position. However, the headlamps illuminate when the lighting switch is turned to the HEAD position. <Vehicles with daytime running lamp system> ● Lighting switch: OFF ● Passing switch: OFF	6	54-34
The headlamps do not switch off when the vehicle is in the following condition and the lighting switch is turned to the TAIL position. <Vehicles with daytime running lamp system> ● Ignition switch: OFF ● Passing switch: OFF		
The fog lamps do not illuminate when the fog lamp switch is turned on while tail lamps or headlamps illuminate.	7	54-35
The fog lamps do not switch off when the lighting switch is turned off while fog lamps illuminate.		
The fog lamps do not switch off when the tail lamps switch off by the automatic headlamp switch-off function while fog lamps illuminate.		
The turn signal lamps do not flash.	8	54-35
The hazard warning lamps do not flash.	9	54-36

(2) If the above is not the problem, check the connections of the related harness connectors. If a malfunctioning location is discovered, repair it and then re-check the trouble symptoms.
(3) If there are no abnormalities in the harness connections, check the harnesses themselves. If there are no abnormalities in the harnesses, replace the relevant unit. Make a note of any error codes and service function data generated at this time.

NOTE
If the cause of the problem seems to be related to system communication, carry out troubleshooting.

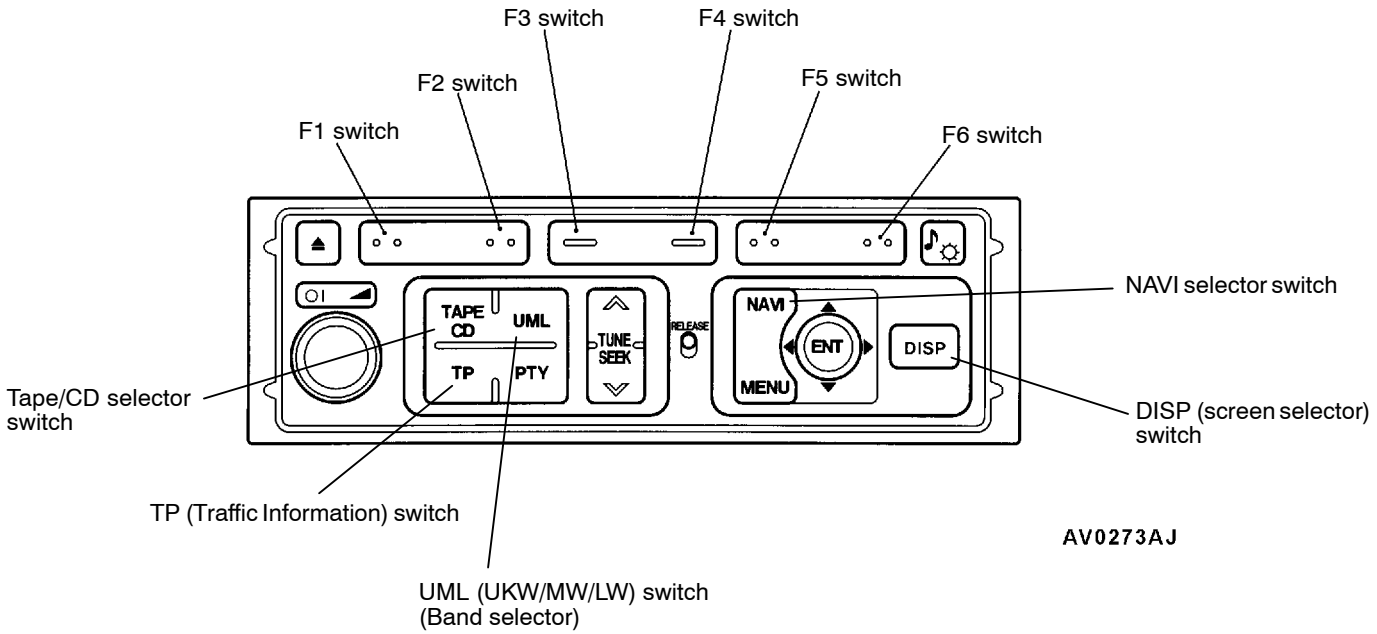
3. Notes on trouble diagnosis when only specific functions are abnormal

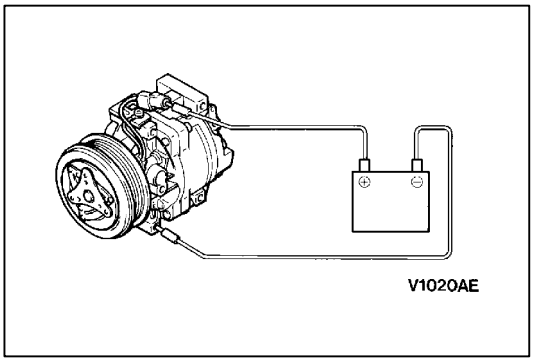
(1) If only certain functions are showing an abnormality, use the audio checking function of the service functions to check the hardware switches.
(2) If the switch functions are normal, check the connections of the related harness connectors. If a malfunctioning location is discovered, repair it and then re-check the trouble symptoms.
(3) If there are no abnormalities in the harness connections, check the harnesses themselves. If there are no abnormalities in the harnesses, replace the unit which controls that function.

4. Notes on trouble diagnosis of the navigation function

(1) The vehicle positioning accuracy of the navigation function is limited because of the principle of operation which it uses. Because of this, the system may be operating normally even though customers might be reporting a problem.
Before carrying out troubleshooting, get as much information as possible from the customer regarding things such as usage conditions and driving locations. If it is possible to judge from this that the problem is not caused by a system abnormality, explain the principle of operation used by the navigation function and how to utilize it effectively.
(2) If you find that there is a system abnormality, check according to the Inspection Chart Classified by Trouble Symptoms in the Troubleshooting section.

MULTI CENTER DISPLAY CONTROL PANEL





INSPECTION

55200850310

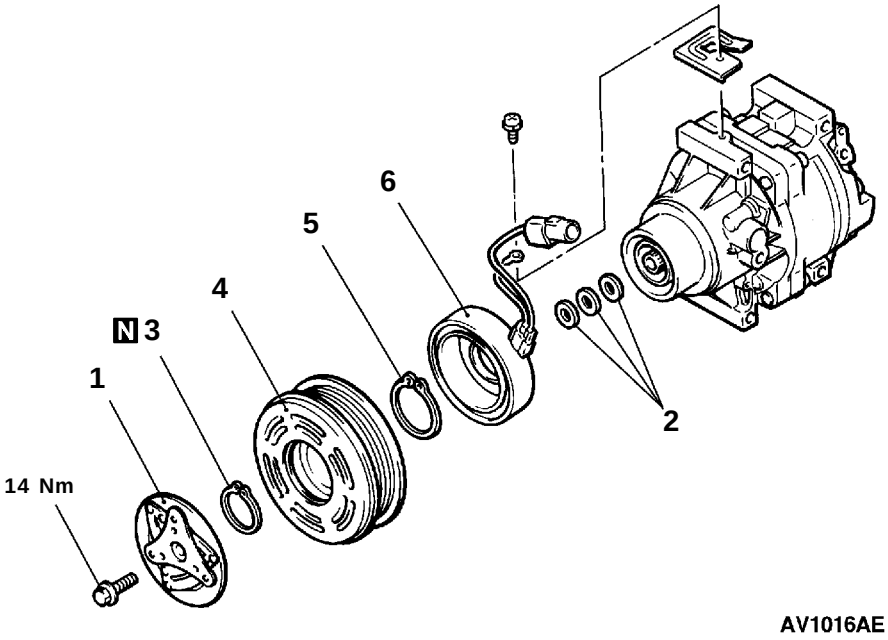
COMPRESSOR MAGNETIC CLUTCH OPERATION INSPECTION

Connect the battery (+) terminal to the compressor side terminal, and earth the battery (-) terminal to the body of the compressor. The condition is normal if the sound of the magnetic clutch (click) can be heard.

MAGNETIC CLUTCH

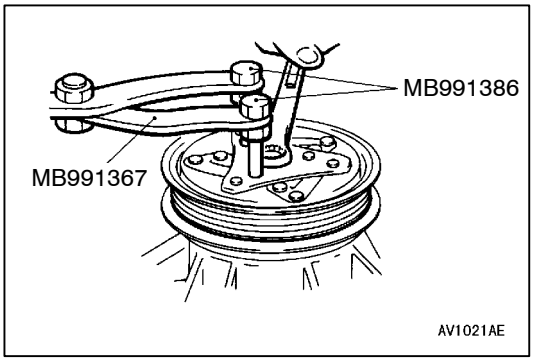
55200460346

DISASSEMBLY AND REASSEMBLY



Magnetic clutch disassembly steps

- ▶B◀ ● Air gap adjustment
- ◀A▶ 1. Armature plate
- 2. Shims
- ▶A◀ 3. Snap ring
- 4. Rotor
- 5. Snap ring
- 6. Clutch coil



DISASSEMBLY SERVICE POINT

◀A▶ ARMATURE PLATE REMOVAL