

ENGINE ELECTRICAL

CONTENTS

CHARGING SYSTEM	2	IGNITION SYSTEM	15
SPECIFICATIONS	2	SPECIFICATIONS	15
General Specifications	2	General Specifications	15
Service Specifications	3	Service Specifications	16-1
Torque Specifications	3	Torque Specifications	16-2
SPECIAL TOOL	4	SERVICE ADJUSTMENT PROCEDURES	17
SERVICE ADJUSTMENT PROCEDURES	4	DISTRIBUTOR	21
ALTERNATOR <PETROL-POWERED VEHICLES>	8	CRANK ANGLE SENSOR	23
ALTERNATOR <DIESEL-POWERED VEHICLES>	10	GLOW SYSTEM	24
STARTING SYSTEM	11	SPECIFICATIONS	24
SPECIFICATIONS	11	Service Specifications	24
General Specifications	11	Torque Specifications	24
Torque Specifications	12-1	Sealants and Adhesives	24
STARTER	13	SERVICE ADJUSTMENT PROCEDURES	24
		GLOW PLUG	29

CHARGING SYSTEM

SPECIFICATIONS

GENERAL SPECIFICATIONS

E168A--

ALTERNATOR

Vehicles for Europe

<4G13, 4G15, 4G16>

VEHICLES BUILT UP TO MAY 1990

Items	M/T (except MPI)	M/T (MPI)	A/T and cold climate zone
Type	Battery voltage sensing	Battery voltage sensing	Battery voltage sensing
Identification No.	A2T09291	A2T09392	A2T09493
Rated output V/A	12/60	12/65	12/75
Voltage regulator	Electronic built-in type	Electronic built-in type	Electronic built-in type

VEHICLES BUILT FROM JUNE 1990

Items	Carburettor	MPI	Cold climate zone and Carburettor-A/T
Type	Battery voltage sensing	Battery voltage sensing	Battery voltage sensing
Identification No.	A2T09291	A2T09392	A2T09493
Rated output V/A	12/60	12/65	12/75
Voltage regulator	Electronic built-in type	Electronic built-in type	Electronic built-in type

<4G37>

VEHICLES BUILT UP TO MAY 1990

Items	Standard	Cold climate zone
Type	Battery voltage sensing	Battery voltage sensing
Identification No.	A2T48791	A2T09792
Rated output V/A	12/65	12/75
Voltage regulator	Electronic built-in type	Electronic built-in type

VEHICLES BUILT FROM JUNE 1990

Items	Specification
Type	Battery voltage sensing
Identification No.	A2T09792
Rated output V/A	12/75
Voltage regulator	Electronic built-in type

<4G61, 4G67>

Items	Standard	Cold climate zone
Type	Battery voltage sensing	Battery voltage sensing
Identification No.	A3T03493	A3T03393
Rated output V/A	12/65	12/75
Voltage regulator	Electronic built-in type	Electronic built-in type

<4G92>

Items	Standard	Cold climate zone
Type	Battery voltage sensing	Battery voltage sensing
Identification No.	A2T40092	A2T38892
Rated output V/A	12/75	12/75
Voltage regulator	Electronic built-in type	Electronic built-in type

<4G93>

Items	Standard	Cold climate zone
Type	Battery voltage sensing	Battery voltage sensing
Identification No.	A2T40091	A2T38891
Rated output V/A	12/75	12/75
Voltage regulator	Electronic built-in type	Electronic built-in type

<4D65>

Items	Specifications
Type	Battery voltage sensing
Identification No.	A2T14376
Rated output V/A	12/65
Voltage regulator	Electronic built-in type

<4D68>

Items	Standard	Cold climate zone
Type	Battery voltage sensing	Battery voltage sensing
Identification No.	A2T38676	A3T11278
Rated output V/A	12/75	12/75
Voltage regulator	Electronic built-in type	Electronic built-in type

Vehicles for General Export

<4G13, 4G15>

VEHICLES BUILT UP TO APRIL 1989

Items	4G13 and 4G15 cold climate zone	M/T	A/T
Type	Battery voltage sensing	Battery voltage sensing	Battery voltage sensing
Identification No.	A2T09291	A2T09392	A2T09493
Rated output V/A	12/60	12/65	12/75
Voltage regulator	Electronic built-in type	Electronic built-in type	Electronic built-in type

VEHICLES BUILT FROM MAY 1989 UP TO MAY 1990

Items	4G13, 4G15 M/T and A/T cold climate zone	4G15 A/T, 4G15 GCC M/T and M/T (MPI)	4G15 GCC A/T and A/T (MPI)
Type	Battery voltage sensing	Battery voltage sensing	Battery voltage sensing
Identification No.	A2T09291	A2T09392	A2T09493
Rated output V/A	12/60	12/65	12/75
Voltage regulator	Electronic built-in type	Electronic built-in type	Electronic built-in type

VEHICLES BUILT FROM JUNE 1990

Items	Carburettor (except GCC)	Carburettor-GCC M/T and MPI-M/T	Carburettor-GCC A/T and MPI-A/T
Type	Battery voltage sensing	Battery voltage sensing	Battery voltage sensing
Identification No.	A2T09291	A2T09392	A2T09493
Rated output V/A	12/60	12/65	12/75
Voltage regulator	Electronic built-in type	Electronic built-in type	Electronic built-in type

<4G61, 4G67>

Items	Specifications
Type	Battery voltage sensing
Identification No.	A3T03493
Rated output V/A	12/65
Voltage regulator	Electronic built-in type

<4G92>

Items	Specifications
Type	Battery voltage sensing
Identification No.	A2T40092
Rated output V/A	12/75
Voltage regulator	Electronic built-in type

<4D65>

23TOM

Items	Specifications
Type	Battery voltage sensing
Identification No.	A2T14376
Rated output V/A	12/65
Voltage regulator	Electronic built-in type

Vehicles for Australia

<4G15>

Items	Carburettor	MPI	
		M/T	A/T
Type	Battery voltage sensing	Battery voltage sensing	Battery voltage sensing
Identification No.	A2T09291	A2T09392	A2T09493
Rated output V/A	12/60	12/65	12/75
Voltage regulator	Electronic built-in type	Electronic built-in type	Electronic built-in type

<4G61>

Items	Specifications
Type	Battery voltage sensing
Identification No.	A3T03493
Rated output V/A	12/65
Voltage regulator	Electronic built-in type

<4G92>

Items	Specifications
Type	Battery voltage sensing
Identification No.	A2T38892
Rated output V/A	12/75
Voltage regulator	Electronic built-in type

NOTES

<4065>

Item	Specification
Type	Battery voltage sensing
Identification No.	A2114312
Rated output, V/A	12/85
Voltage regulator	Electronic built-in type

Vehicles for Australia

<4012>

Item	Chassis	MPV
Type	Battery voltage sensing	Battery voltage sensing
Identification No.	A2103317	A2103312
Rated output, V/A	12/60	12/75
Voltage regulator	Electronic built-in type	Electronic built-in type

<4081>

Item	Specification
Type	Battery voltage sensing
Identification No.	A2103312
Rated output, V/A	12/60
Voltage regulator	Electronic built-in type

<4082>

Item	Specification
Type	Battery voltage sensing
Identification No.	A2103312
Rated output, V/A	12/60
Voltage regulator	Electronic built-in type

<4D65>

Items	Specifications
Type	Battery voltage sensing
Identification No.	A2T14376
Rated output V/A	12/65
Voltage regulator	Electronic built-in type

Vehicles for Australia

<4G15>

Items	Specifications
Type	Battery voltage sensing
Identification No.	A2T09291
Rated output V/A	12/60
Voltage regulator	Electronic built-in type

SERVICE SPECIFICATIONS

E16B8-

Items	Specifications
Standard value	
Alternator	
Regulated voltage	
Ambient temperature at voltage regulator V	
-20°C (-4°F)	14.2 – 15.4
20°C (68°F)	13.9 – 14.9
60°C (140°F)	13.4 – 14.6
80°C (176°F)	13.1 – 14.5
Limit	
Output current	70% of nominal output current

TORQUE SPECIFICATIONS

E16B8C-

Items	Nm	kgm	ft. lbs.
Alternator brace bolt	12 – 15	1.2 – 1.5	9 – 11
Alternator brace mounting bolt	20 – 27	2.0 – 2.7	14 – 20
Alternator pivot nut	20 – 25	2.0 – 2.5	14 – 18
Water pump pulley bolt	8 – 10	0.8 – 1.0	6 – 7
Alternator connector mounting nut	2.5 – 4.0	0.25 – 0.4	2 – 3
Battery holder	2 – 3	0.2 – 0.3	1.4 – 2.2
Eye bolt	14 – 19	1.4 – 1.9	10 – 14

SPECIAL TOOL

E16BF

Tool	Number	Name	Use
	MD998467	Alternator harness connector	Checking the alternator (S terminal voltage)

SERVICE ADJUSTMENT PROCEDURES

E16BGAC

INSPECTION

Check the following items before inspecting the voltage regulator adjusting voltage and the alternator output current.

- (1) Installation of alternator
- (2) Alternator drive belt tension
- (3) Battery specific gravity and voltage
- (4) Fusible link
- (5) Abnormal noise from alternator during operation

NOTE

1. Use a fully charged battery to obtain the standard value.
2. To check the alternator belt and battery, refer to GROUP 11 – Engine Adjustment.

VOLTAGE DROP TEST OF ALTERNATOR OUTPUT WIRE

The potential-fall method determines if the wiring, including the fusible link, between the alternator "B" terminal and battery (+) terminal is adequate or not.

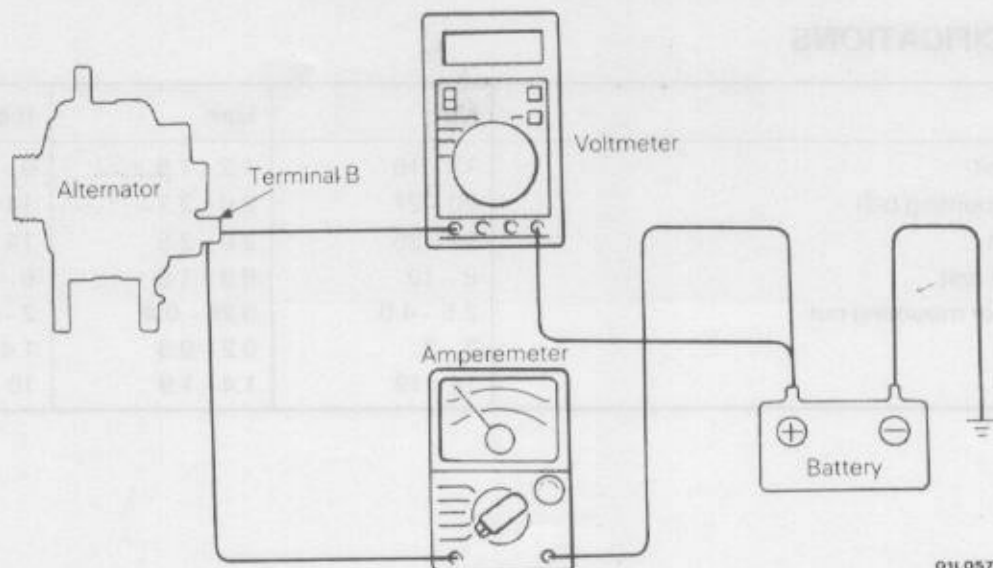
PREPARATION

- (1) Turn the ignition switch "OFF".
- (2) Remove the battery earth cable.
- (3) Disconnect the alternator output line from the alternator "B" terminal.
- (4) Connect 0 to 100A test DC ammeter in series between "B" terminal and the removed output line. Connect the (+) lead wire of the ammeter to the "B" terminal and the (-) lead wire to the removed output line.

NOTE

Use a magnetic flux ammeter which does not require removal of the harness. When checking a vehicle which may have output current drop due to an incomplete "B" terminal connection, the sudden connection of a test ammeter loosening the "B" terminal may prevent the problem from being discovered due to completion of the connection.

- (5) Connect a digital voltmeter to the alternator "B" terminal and battery (+) terminal. Connect the (+) lead wire of the voltmeter to the "B" terminal and the (-) lead wire to the battery (+) terminal.



01L0571

- (6) Connect the battery earth cable.

TEST

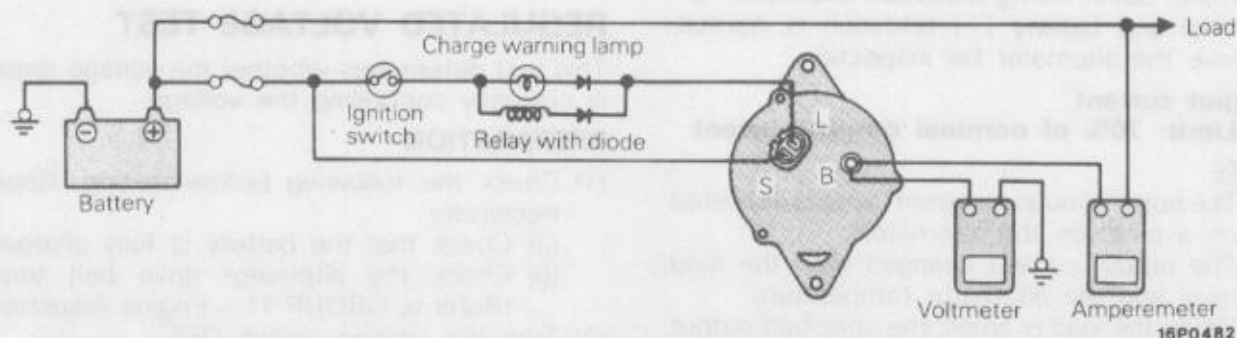
- (1) Start the engine.
- (2) Adjust the engine speed until the ammeter indicates 20A. (If the current is not 20A, turn on the position lamps to adjust.) Read the value on the voltmeter.

RESULT

- (1) Check that the value on voltmeter is within the standard value range.

Standard value: 0.2 V or less

- (2) When the value is larger than the standard value range, check for defective wiring between the alternator "B" terminal, fusible link, and battery (+) terminal. Repair loose contacts or discolored wires due to an overheated harness. Recheck.
- (3) After testing, turn off lamps and turn the ignition switch OFF.
- (4) Remove the battery earth cable.
- (5) Remove the ammeter and voltmeter.
- (6) Connect the alternator output line to the alternator "B" terminal.
- (7) Connect the battery earth cable.



OUTPUT CURRENT TEST

This test determines whether the alternator outputs current equivalent to the nominal output.

PREPARATION

- (1) Check the following items before testing. Repair if necessary.
 - (a) Check that the battery is in good condition.

NOTE
The battery to be used for this test should be slightly discharged.
A fully charged battery may not provide correct results due to insufficient load.
 - (b) Check the alternator drive belt tension.
- (2) Turn the ignition switch OFF.
- (3) Remove the battery earth cable.
- (4) Remove the alternator output line from the alternator "B" terminal.

- (5) Connect 0 to 100A test ammeter DC between "B" terminal and the removed output line in series.
Connect (+) lead wire to "B" terminal and (-) lead wire to the removed output line.

NOTE

Lock all high voltage connections firmly with nuts and bolts. Do not hold with a clip.

- (6) Connect 0 to 20V test voltmeter between the "B" terminal and earth.
Connect the voltmeter (+) lead wire to the alternator "B" terminal and (-) lead wire to earth.
- (7) Set up an engine tachometer.
Connect the battery earth cable.
- (8) Keep the engine hood open.

TEST

- (1) Check that the readings of the voltmeter and battery are the same.
0V is caused by a disconnected wire between the alternator "B" terminal and battery (+), a blown fusible link, or a defective earth.
- (2) With the headlamp switch ON, start the engine.
- (3) Set the headlamps at high beam and the heater blower switch at HIGH. Increase the engine speed to 2,500 r/min. and read the maximum output current on the ammeter.

NOTE

Read the maximum value quickly, as the charged current drops rapidly.

RESULT

- (1) The value on the ammeter should be over the limit value. If the value is under the limit and the alternator outlet wiring [between alternator "B" terminal and battery (+) terminal] is normal, remove the alternator for inspection.

Output current

Limit: 70% of nominal output current

NOTE

1. The nominal output current value is indicated on a plate on the alternator.
2. The output current changes with the load level and the alternator temperature.
When the load is small, the specified output current may not be obtained even though the alternator is normal. In this case, turn on the headlamps to discharge the battery, or use another vehicle's lamps to increase the load for recheck.
The specified value may not be obtained if the alternator or the ambient temperature is high. Allow the alternator to cool, and recheck.
- (2) After the output current test, lower the engine speed to idle. Turn the ignition switch OFF.
- (3) Remove the battery earth cable.
- (4) Remove the ammeter, voltmeter and the engine tachometer.
- (5) Connect an alternator output line to the alternator "B" terminal.

- (6) Connect the battery earth cable.

NOTE

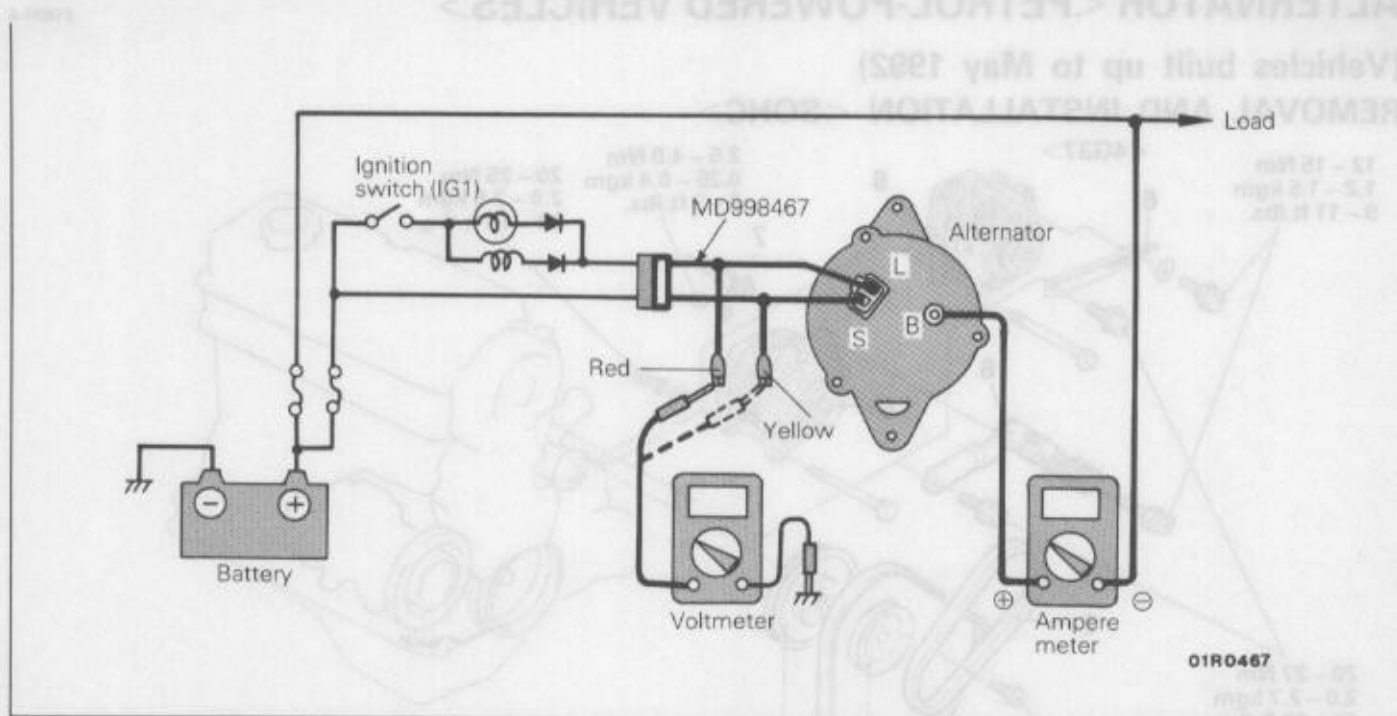
1. Having headlamps on when checking alternator output current increases the load. Standard current is generated at low speeds of the alternator. However, output current is stabilized when the alternator speed is about 4,000 r/min.
Therefore, the output current at 2,500 r/min. engine speed exceeds the standard value, and the alternator can be considered as near normal.
2. Alternator output current changes with the amount of load. Therefore, the standard output current may not be obtained due to a small load despite the charging system being normal. In this case, increase the load and recheck.

REGULATED VOLTAGE TEST

This test determines whether the voltage regulator is correctly controlling the voltage.

PREPARATION

- (1) Check the following before testing. Repair if necessary.
 - (a) Check that the battery is fully charged.
 - (b) Check the alternator drive belt tension. (Refer to GROUP 11 – Engine Adjustment.)
- (2) Turn the ignition switch OFF.
- (3) Remove the battery earth cable.
- (4) Connect a digital voltmeter between the alternator "L" terminal or "S" terminal and earth. Use the special tool and connect the voltmeter (+) lead wire to the "L" or "S" terminal. Connect the (-) lead wire to earth or the battery (-) terminal.
- (5) Remove the alternator outlet line from alternator "B" terminal.
- (6) Connect 0 to 100A test DC ammeter in series to the "B" terminal and removed outlet line. Connect the ammeter (+) lead wire to the "B" terminal and the (-) lead wire to removed outlet line.
- (7) Set up an engine tachometer.
Connect the battery earth cable.

**TEST**

- (1) Turn the ignition switch ON. Check that the voltmeter indicates a value within the following range:

Voltage: 2 – 5V**Battery voltage****"L" terminal****"S" terminal**

0V is caused by disconnected wire between the alternator "L" terminal, between the "S" terminal and the battery (+), or a blown fusible link.

- (2) Start the engine. All lamps and accessories should be OFF.
- (3) Set the engine speed at about 2,500 r/min. Read the voltmeter value when the alternator output current falls below 10A.

RESULT

- (1) When the voltage matches the voltage adjusting table, the voltage regulator operation is correct. Either the voltage regulator or the alternator is defective if the voltage value is not within the standard value range.

Voltage Adjusting Table

Voltage regulator ambient temperature °C (°F)	Regulating voltage V
-20 (-4)	14.2 – 15.4
20 (68)	13.9 – 14.9
60 (140)	13.4 – 14.6
80 (176)	13.1 – 14.5

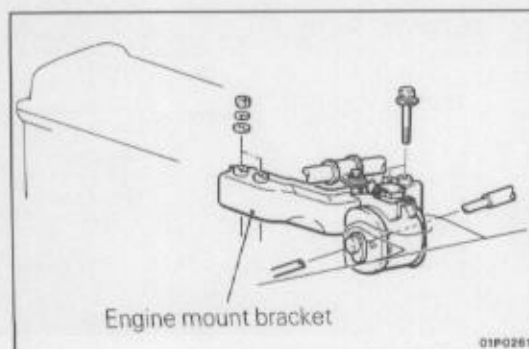
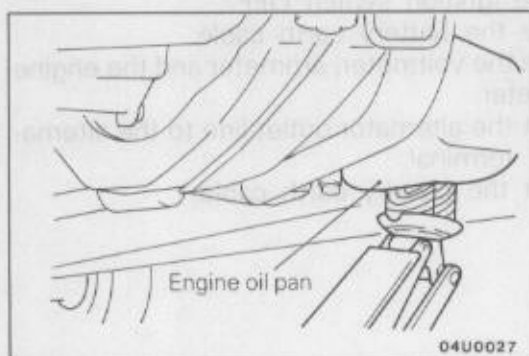
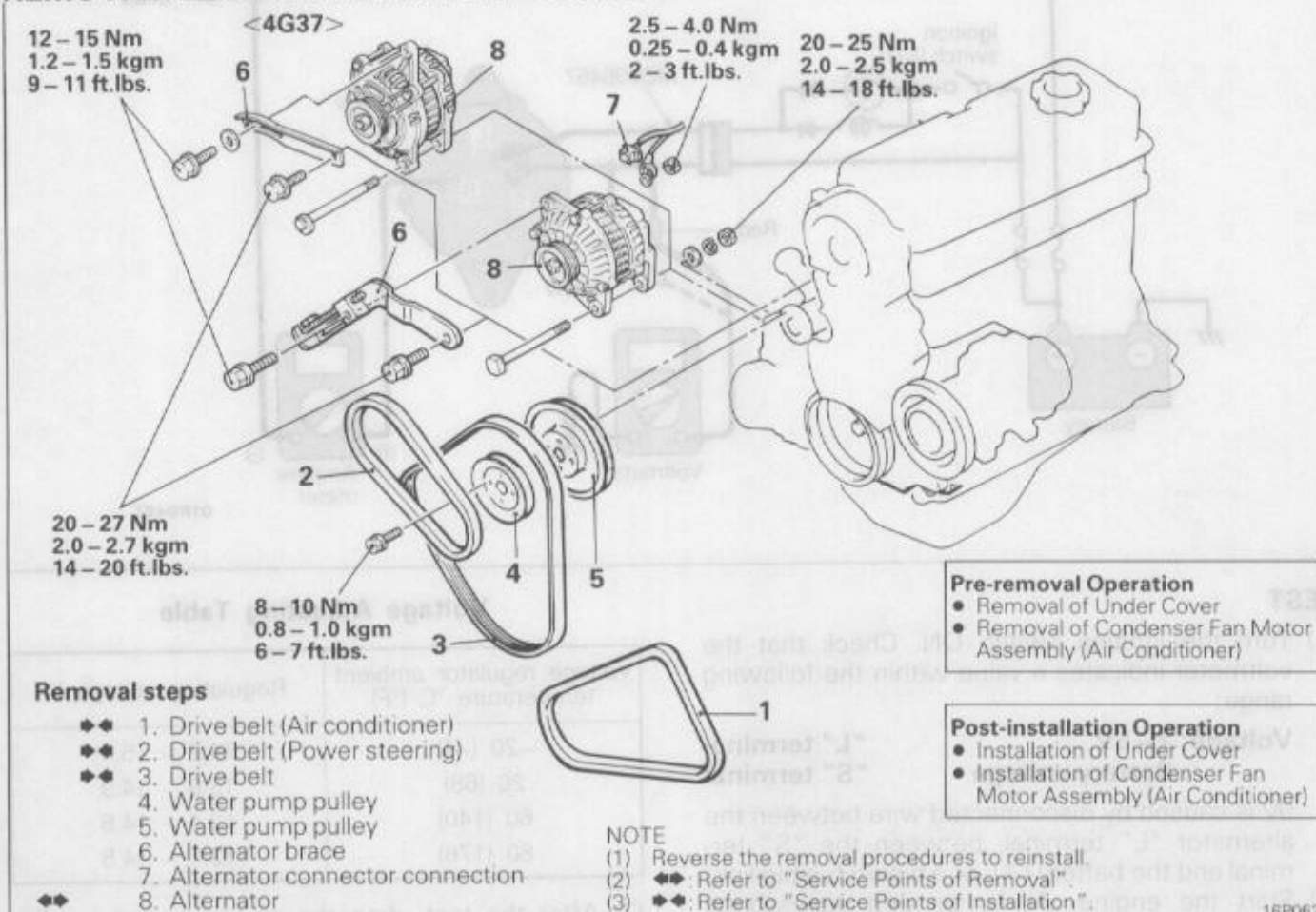
- (2) After the test, drop the engine speed to idle. Turn the ignition switch OFF.
- (3) Remove the battery earth cable.
- (4) Remove the voltmeter, ammeter and the engine tachometer.
- (5) Connect the alternator outlet line to the alternator "B" terminal.
- (6) Connect the battery earth cable.

ALTERNATOR <PETROL-POWERED VEHICLES>

E16BH-A

(Vehicles built up to May 1992)

REMOVAL AND INSTALLATION <SOHC>



SERVICE POINT OF REMOVAL

Vehicles built up to December

8. REMOVAL OF ALTERNATOR <4G37>

- (1) Jack up the vehicle after placing a wooden block between the jack and the engine's oil pan.

Caution

Jack up carefully, so as not to stress excessively the various parts.

- (2) Remove the engine mount bracket bolts and nuts shown in the illustration.
- (3) Lower the engine slowly using a jack and remove the alternator support bolt.
- (4) Remove the alternator.

SERVICE POINTS OF INSTALLATION

E16BHDA0

3. 2. 1. ADJUSTMENT OF DRIVE BELT TENSION

Refer to GROUP 11 – Engine Adjustment.

REMOVAL AND INSTALLATION <DOHC>

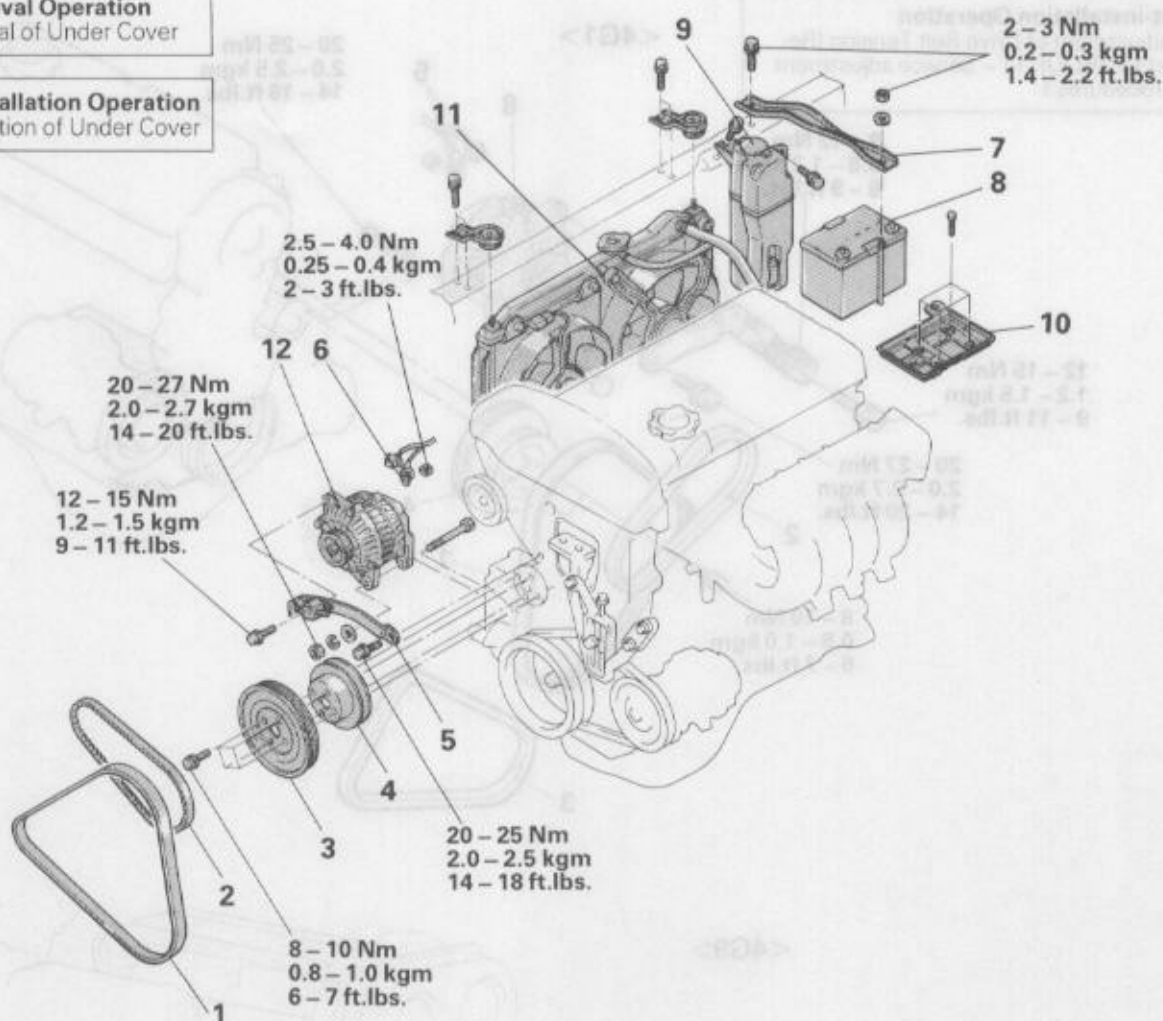
E16BH-B

Pre-removal Operation

- Removal of Under Cover

Post-installation Operation

- Installation of Under Cover

**Removal steps**

- ◆◆ 1. Drive belt
- ◆◆ 2. Drive belt (Power steering)
- 3. Water pump pulley
- 4. Water pump pulley
- 5. Alternator brace assembly
- 6. Alternator connector connection
- 7. Battery holder
- 8. Battery
- 9. Washer tank

- ◆◆ 10. Battery tray
- ◆◆ 11. Radiator
- ◆◆ 12. Alternator

NOTE

- (1) Reverse the removal procedures to reinstall.
- (2) ◆◆: Refer to "Service Points of Removal".
- (3) ◆◆: Refer to "Service Points of Installation".

16P0381



16P0215

SERVICE POINT OF REMOVAL

E16BHC80

11. REMOVAL OF RADIATOR

Remove the attaching bolts at the top of the radiator and lift the radiator vertically.

Caution

Do not disconnect the radiator hose.

SERVICE POINTS OF INSTALLATION

E16BHD8

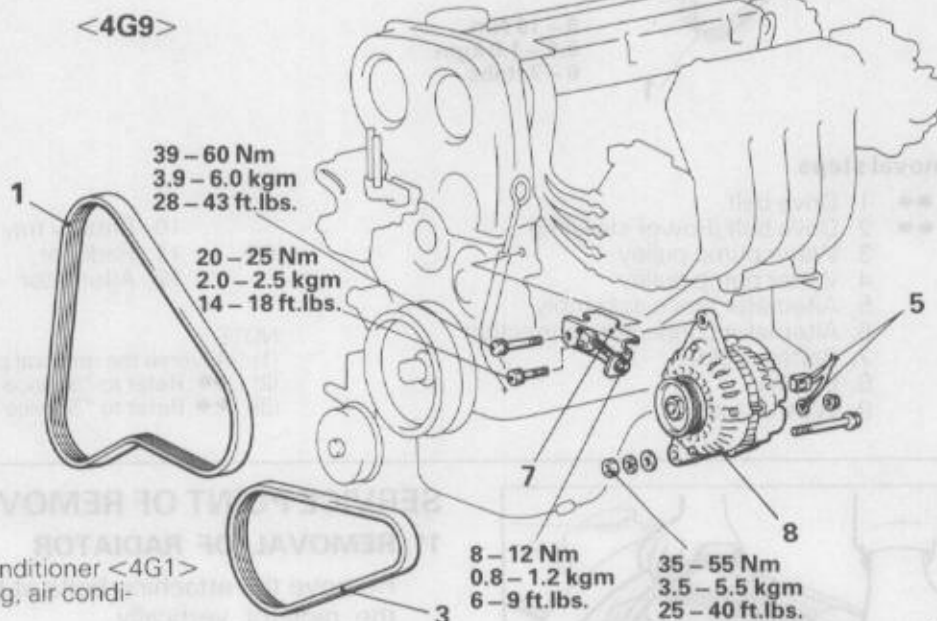
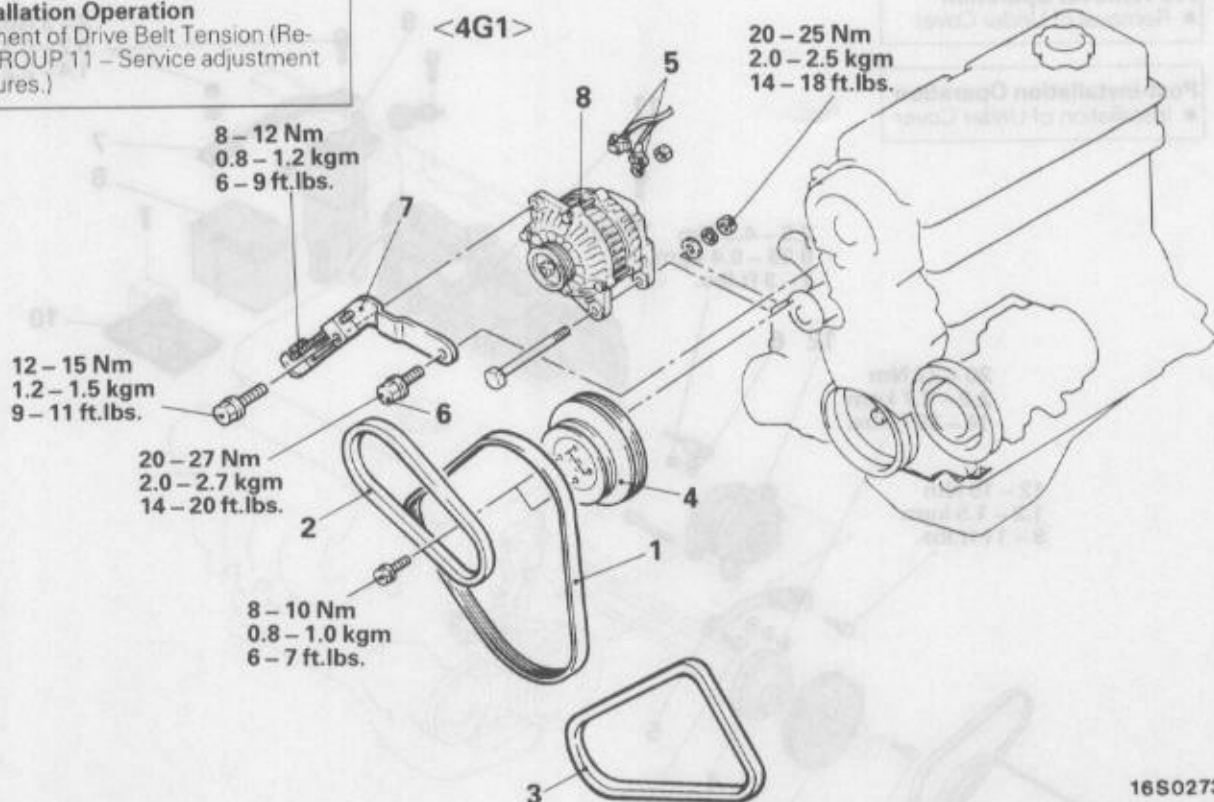
2. 1. ADJUSTMENT OF DRIVE BELT TENSION

Refer to GROUP 11 – Engine Adjustment.

(Vehicles built from June 1992)
REMOVAL AND INSTALLATION

Post-installation Operation

- Adjustment of Drive Belt Tension (Refer to GROUP 11 – Service adjustment Procedures.)

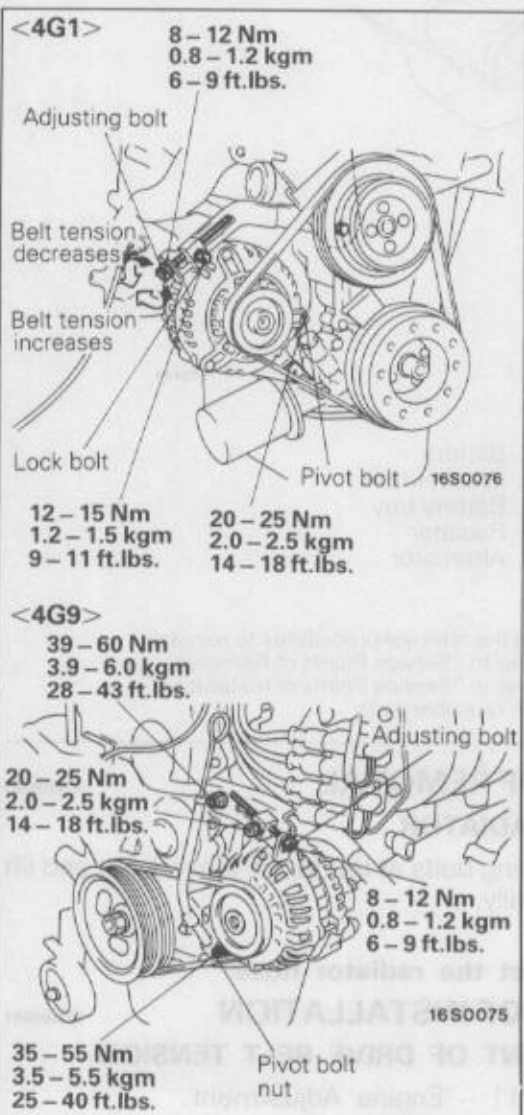
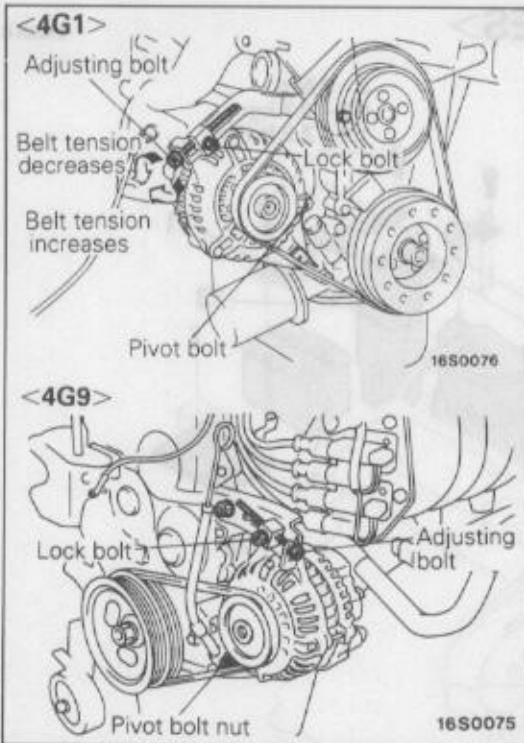


Removal steps

1. Drive belt (Air conditioner <4G1> or Power steering, air conditioner <4G9>)
2. Drive belt (Power steering)
3. Drive belt (Alternator)
4. Water pump pulley
5. Alternator connector
6. Alternator brace mounting bolt
7. Alternator brace
8. Alternator

NOTE

- (1) Reverse the removal procedures to reinstall.
- (2) ♦♦♦: Refer to "Service Points of Removal".
- (3) ♦♦♦: Refer to "Service Points of Installation".



SERVICE POINT OF REMOVAL

E16BHCF

3. REMOVAL OF DRIVE BELT (ALTERNATOR)

- (1) Loosen the pivot bolt nut and the lock bolt as shown in the illustration.
- (2) Loosen the adjusting bolt and lift it upwards.
- (3) Push the alternator towards the engine to remove the drive belt.

SERVICE POINTS OF INSTALLATION

E16BHDE

8. INSTALLATION OF ALTERNATOR / 7. ALTERNATOR BRACE / 3. DRIVE BELT (ALTERNATOR)

<4G1>

- (1) Install the alternator to the cylinder block and front case mounting boss with the pivot bolt, and provisionally tighten the nut to still allow the alternator to move smoothly.
- (2) Insert the alternator brace between the power steering oil pump bracket and the water pump, and tighten it to the specified torque.
- (3) Press the alternator body towards the engine, and provisionally tighten the alternator and alternator brace with the lock bolt.
- (4) Install the alternator drive belt and adjust the belt tension using the adjusting bolt. (Refer to GROUP 11 – Service Adjustment Procedures.)
- (5) After adjusting the belt tension, fully tighten the nut of the pivot bolt and the lock bolt to the specified torque, and then tighten the adjusting bolt to the specified torque.

<4G9>

- (1) Install the alternator to the front case mounting boss with the pivot bolt, and provisionally tighten the nut to still allow the alternator to move smoothly.
- (2) Install the alternator brace to the water pump, and tighten it to the specified torque.
- (3) Press the alternator body towards the engine, and provisionally tighten the alternator and alternator brace with the lock bolt.
- (4) Install the alternator drive belt and adjust the belt tension using the adjusting bolt. (Refer to GROUP 11 – Service Adjustment Procedures.)
- (5) After adjusting the belt tension, fully tighten the nut of the pivot bolt and the lock bolt to the specified torque, and then tighten the adjusting bolt to the specified torque.

ALTERNATOR <DIESEL-POWERED VEHICLES>

E16BH-C

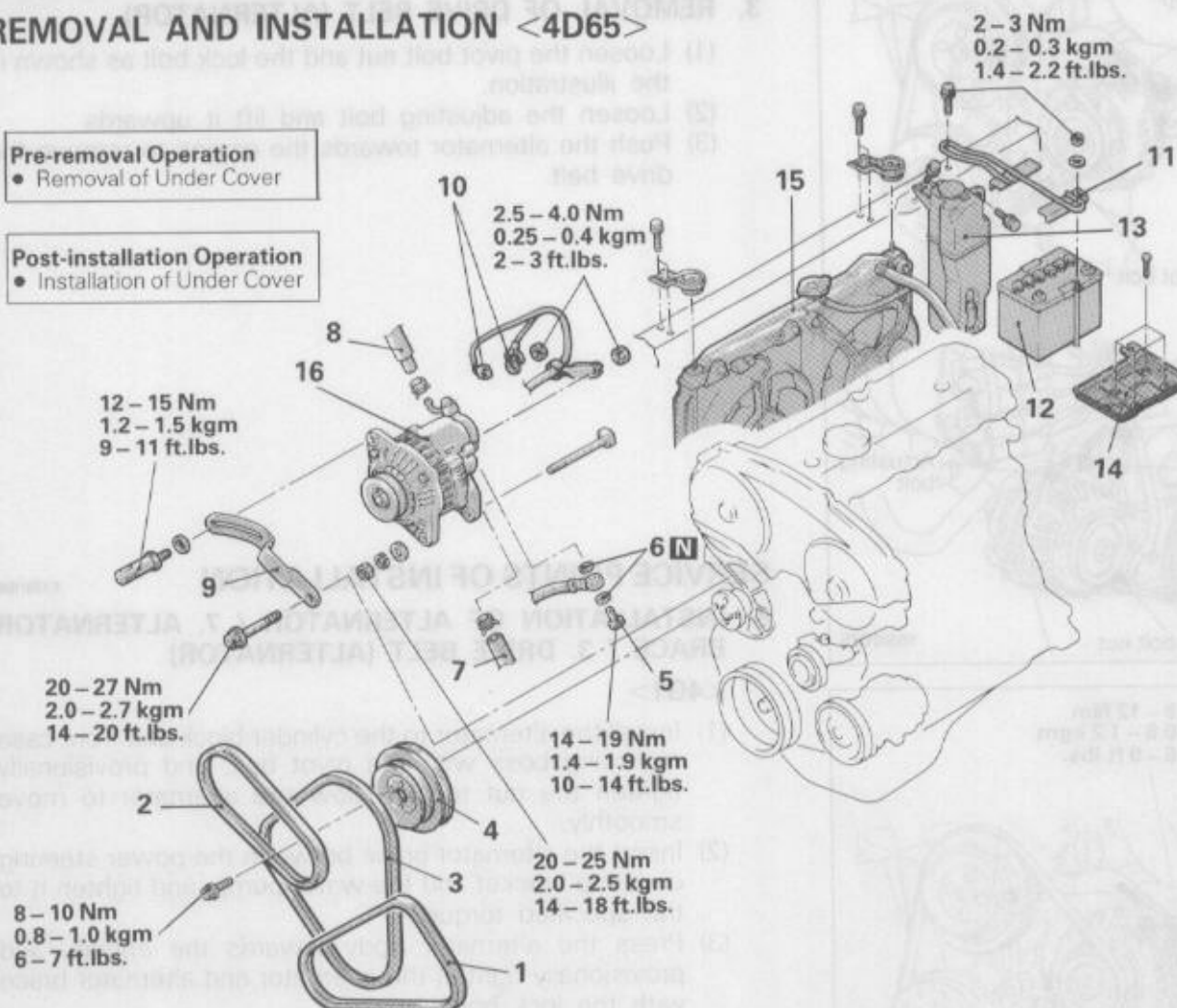
REMOVAL AND INSTALLATION <4D65>

Pre-removal Operation

- Removal of Under Cover

Post-installation Operation

- Installation of Under Cover



16P0449

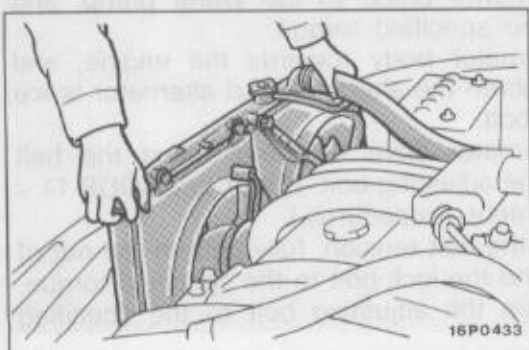
Removal steps

- ◆◆ 1. Drive belt (Air conditioner)
- ◆◆ 2. Drive belt (Power steering)
- ◆◆ 3. Drive belt
- ◆◆ 4. Water pump pulley
- ◆◆ 5. Eye bolt
- ◆◆ 6. Gasket
- ◆◆ 7. Oil hose connection
- ◆◆ 8. Vacuum hose connection
- ◆◆ 9. Alternator brace
- ◆◆ 10. Alternator connector connection
- ◆◆ 11. Battery holder

- ◆◆ 12. Battery
- ◆◆ 13. Washer tank
- ◆◆ 14. Battery tray
- ◆◆ 15. Radiator
- ◆◆ 16. Alternator

NOTE

- (1) Reverse the removal procedures to reinstall.
- (2) ◆◆: Refer to "Service Points of Removal".
- (3) ◆◆: Refer to "Service Points of Installation".
- (4) N: Non-reusable parts



16P0433

SERVICE POINT OF REMOVAL

E16BHC1

15. REMOVAL OF RADIATOR

Remove the attaching bolts at the top of the radiator and lift the radiator vertically.

Caution

Do not disconnect the radiator hose.

SERVICE POINTS OF INSTALLATION

E16BHDA1

3. 2. 1. ADJUSTMENT OF DRIVE BELT TENSION

Refer to GROUP 11 – Engine Adjustment.

PWME8802-F

REVISED

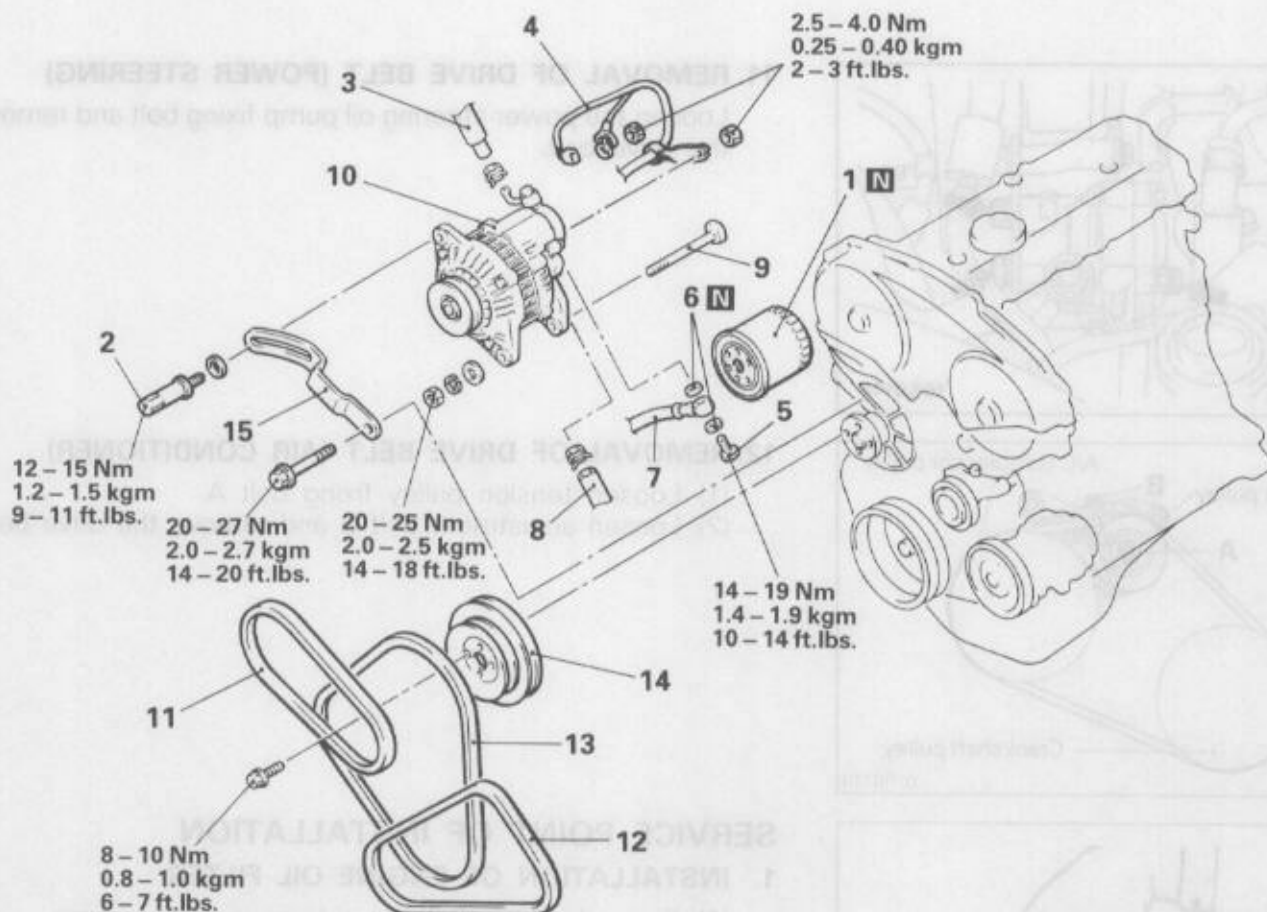
REMOVAL AND INSTALLATION <4D68>

Pre-removal Operation

- Draining Engine Oil

Post-installation Operation

- Supplying Engine Oil
- Adjustment of Drive Belt Tension (Refer to GROUP 11 – Service Adjustment Procedures.)



16S0112

Removal steps

- ◆◆ 1. Engine oil filter
2. Alternator brace bolt
3. Brake booster vacuum hose connection
4. Alternator connector
5. Eye bolt
6. Gasket
7. Oil hose assembly connection
8. Oil hose connection
9. Alternator mount bolt
- ◆◆ 10. Alternator
- ◆◆ 11. Drive belt (Power steering)
- ◆◆ 12. Drive belt (Air conditioner)
13. Drive belt (Alternator)
14. Water pump pulley
15. Alternator brace

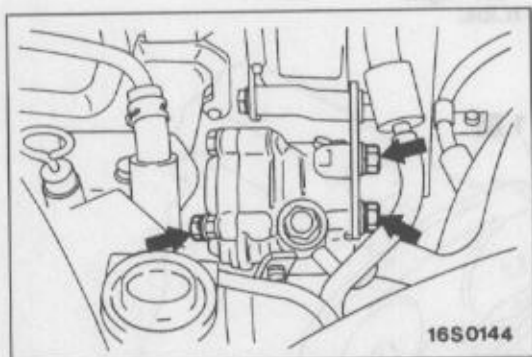
NOTE

- (1) Reverse the removal procedures to reinstall.
- (2) ◆◆: Refer to "Service Points of Removal".
- (3) ◆◆: Refer to "Service Points of Installation".
- (4) **N**: Non-reusable parts

SERVICE POINTS OF REMOVAL

10. REMOVAL OF ALTERNATOR

- (1) Remove the engine oil filter and check to be sure that there is enough space to take out the alternator.
- (2) Remove the alternator from the bottom of the engine compartment.

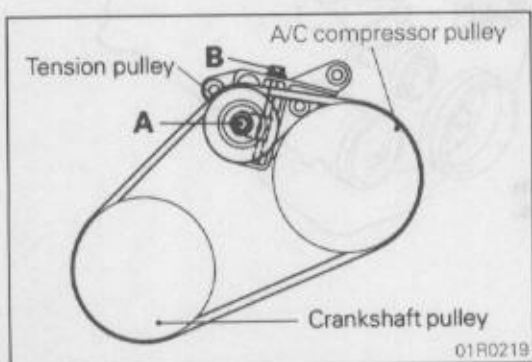


11. REMOVAL OF DRIVE BELT (POWER STEERING)

Loosen the power steering oil pump fixing bolt and remove the drive belt.

12. REMOVAL OF DRIVE BELT (AIR CONDITIONER)

- (1) Loosen tension pulley fixing bolt A.
- (2) Loosen adjustment bolt B and remove the drive belt.



SERVICE POINT OF INSTALLATION

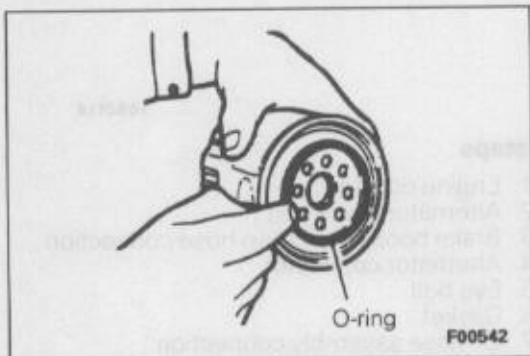
1. INSTALLATION OF ENGINE OIL FILTER

- (1) Clean the filter bracket side mounting surface.
- (2) Apply a small amount of engine oil to the O-ring of the new oil filter.
- (3) Turn the oil filter by hand to install.

NOTE

Tightening torque 18–22 Nm (1.8–2.2 kgm, 13–16 ft.lbs.)

- (4) Fill with engine oil.
- (5) Race the engine 2–3 times, and check to be sure that no engine oil leaks from the installation section of the oil filter.



STARTING SYSTEM

SPECIFICATIONS

GENERAL SPECIFICATIONS

STARTER

Vehicles for Europe

<4G13, 4G15, 4G16>

VEHICLES BUILT UP TO MAY 1990

Items	M/T	A/T and cold climate zone
Type	Direct drive	Direct drive
Identification No.	M3T32592* ¹ , M3T32593* ²	M3T41081* ¹ , M3T41083* ²
Rated output kW/V	0.7/12	0.9/12
No. of pinion teeth	8	8

VEHICLES BUILT FROM JUNE 1990

Items	M/T	A/T-carburettor and Cold climate zone	A/T-MPI
Type	Direct drive	Direct drive	Direct drive
Identification No.	M3T32593	M3T41083	M3T42781
Rated output kW/V	0.7/12	0.9/12	0.9/12
No. of pinion teeth	8	8	8

<4G37>

Items	Standard	Cold climate zone
Type	Direct drive	Direct drive
Identification No.	M3T32592* ¹ , M3T32593* ²	M3T41081* ¹ , M3T41083* ²
Rated output kW/V	0.7/12	0.9/12
No. of pinion teeth	8	8

<4G61, 4G67>

Items	4G61 standard	4G61 cold climate zone and 4G67
Type	Direct drive	Reduction drive
Identification No.	M3T41081* ¹ , M3T41083* ²	M1T70481
Rated output kW/V	0.9/12	1.2/12
No. of pinion teeth	8	8

<4G9>

Items	M/T	A/T-Standard	A/T-Cold climate zone
Type	Direct drive	Direct drive	Direct drive
Identification No.	M3T43381	M3T43481	M0T70381
Rated output kW/V	0.9/12	0.9/12	1.0/12
No. of pinion teeth	8	8	8

NOTE

*1: Vehicles built up to Mar. 1990

*2: Vehicles built from Apr. 1990

<4D65>

Items	Standard	Cold climate zone
Type	Reduction drive	Reduction drive
Identification No.	M2T57271	M2T60172
Rated output kW/V	2.0/12	2.2/12
No. of pinion teeth	10	13

<4D68>

Items	Standard	Cold climate zone
Type	Reduction drive	Reduction drive
Identification No.	M2T57273	M2T62971
Rated output kW/V	2.0/12	2.2/12
No. of pinion teeth	10	10

Vehicles for General Export

<4G13, 4G15>

VEHICLES BUILT UP TO MAY 1990

Items	M/T	A/T and cold climate zone
Type	Direct drive	Direct drive
Identification No.	M3T32592 ^{*1} , M3T32593 ^{*2}	M3T41081 ^{*1} , M3T41083 ^{*2}
Rated output kW/V	0.7/12	0.9/12
No. of pinion teeth	8	8

VEHICLES BUILT FROM JUNE 1990

Items	M/T and 4G13-cold climate zone	A/T-carburettor and 4G15-cold climate zone	A/T-MPI
Type	Direct drive	Direct drive	Direct drive
Identification No.	M3T32593	M3T41083	M3T42781
Rated output kW/V	0.7/12	0.9/12	0.9/12
No. of pinion teeth	8	8	8

<4G61, 4G67>

Items	4G61	4G67 ^{*2}
Type	Direct drive	Reduction drive
Identification No.	M3T41081 ^{*1} , M3T41083 ^{*2}	M3T70481
Rated output kW/V	0.9/12	1.2/12
No. of pinion teeth	8	8

NOTE

^{*1}: Vehicles built up to Mar. 1990^{*2}: Vehicles built from Apr. 1990

<4G9>

Items	M/T	A/T
Type	Direct drive	Direct drive
Identification No.	M3T43381	M3T43481
Rated output kW/V	0.9/12	0.9/12
No. of pinion teeth	8	8

<4D65>

Items	Standard	Cold climate zone
Type	Reduction drive	Reduction drive
Identification No.	M2T57271	M2T60172
Rated output kW/V	2.0/12	2.2/12
No. of pinion teeth	10	13

Vehicles for Australia

<4G15>

VEHICLES BUILT UP TO MAY 1990

Items	M/T	A/T
Type	Direct drive	Direct drive
Identification No.	M3T32592* ¹ , M3T32593* ²	M3T41081* ¹ , M3T41083* ²
Rated output kW/V	0.7/12	0.9/12
No. of pinion teeth	8	8

VEHICLES BUILT FROM JUNE 1990

Items	M/T	A/T-carburettor	A/T-MPI
Type	Direct drive	Direct drive	Direct drive
Identification No.	M3T32593	M3T41083	M3T42781
Rated output kW/V	0.7/12	0.9/12	0.9/12
No. of pinion teeth	8	8	8

<4G61>

Items	Specification
Type	Direct drive
Identification No.	M3T41083
Rated output kW/V	0.9/12
No. of pinion teeth	8

NOTE

*1: Vehicles built up to Mar. 1990

*2: Vehicles built from Apr. 1990

<4G9>

Items	M/T	A/T
Type	Direct drive	Direct drive
Identification No.	M3T43381	M3T43481
Rated output kW/V	0.9/12	0.9/12
No. of pinion teeth	8	8

TORQUE SPECIFICATIONS

E16CC -

Items	Nm	kgm	ft.lbs.
Starter mounting bolt	27 – 34	2.7 – 3.4	20 – 25
Starter connector mounting nut	10 – 16	1.0 – 1.6	7 – 12
Intake manifold stay	18 – 25	1.8 – 2.5	13 – 18
Air cleaner			
Mounting bolt	8 – 10	0.8 – 1.0	6 – 7
Mounting nut	8 – 9	0.8 – 0.9	6 – 7

NOTE
 *1: Vehicles built up to Mar. 1992
 *2: Vehicles built from Apr. 1992

STARTER**REMOVAL AND INSTALLATION <PETROL-POWERED VEHICLES>**

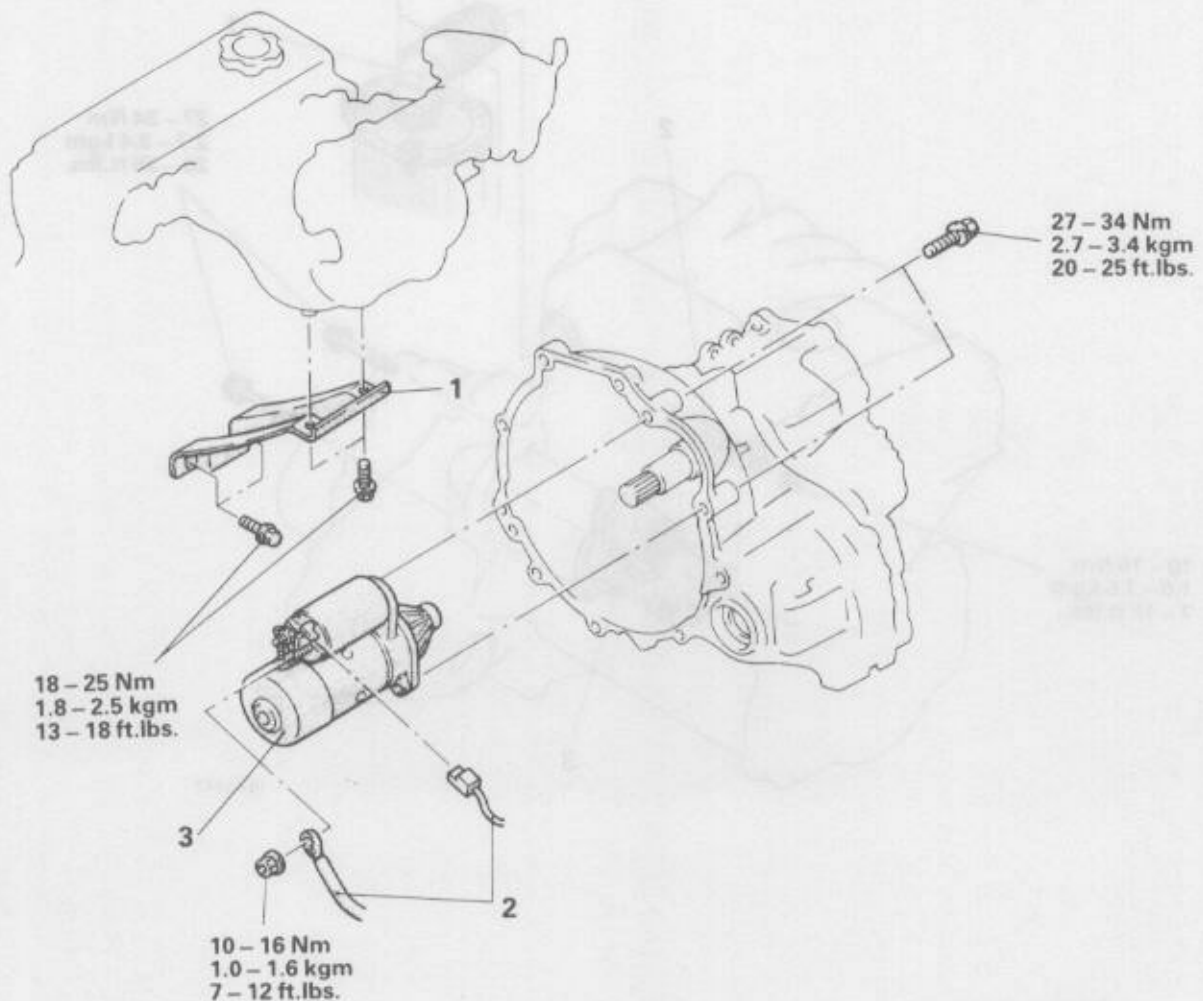
E16C1-A

Pre-removal Operation

- Removal of Air Cleaner <MPI>
(Refer to GROUP 15 – Air Cleaner.)

Post-installation Operation

- Installation of Air Cleaner <MPI>
(Refer to GROUP 15 – Air Cleaner.)

**Removal steps**

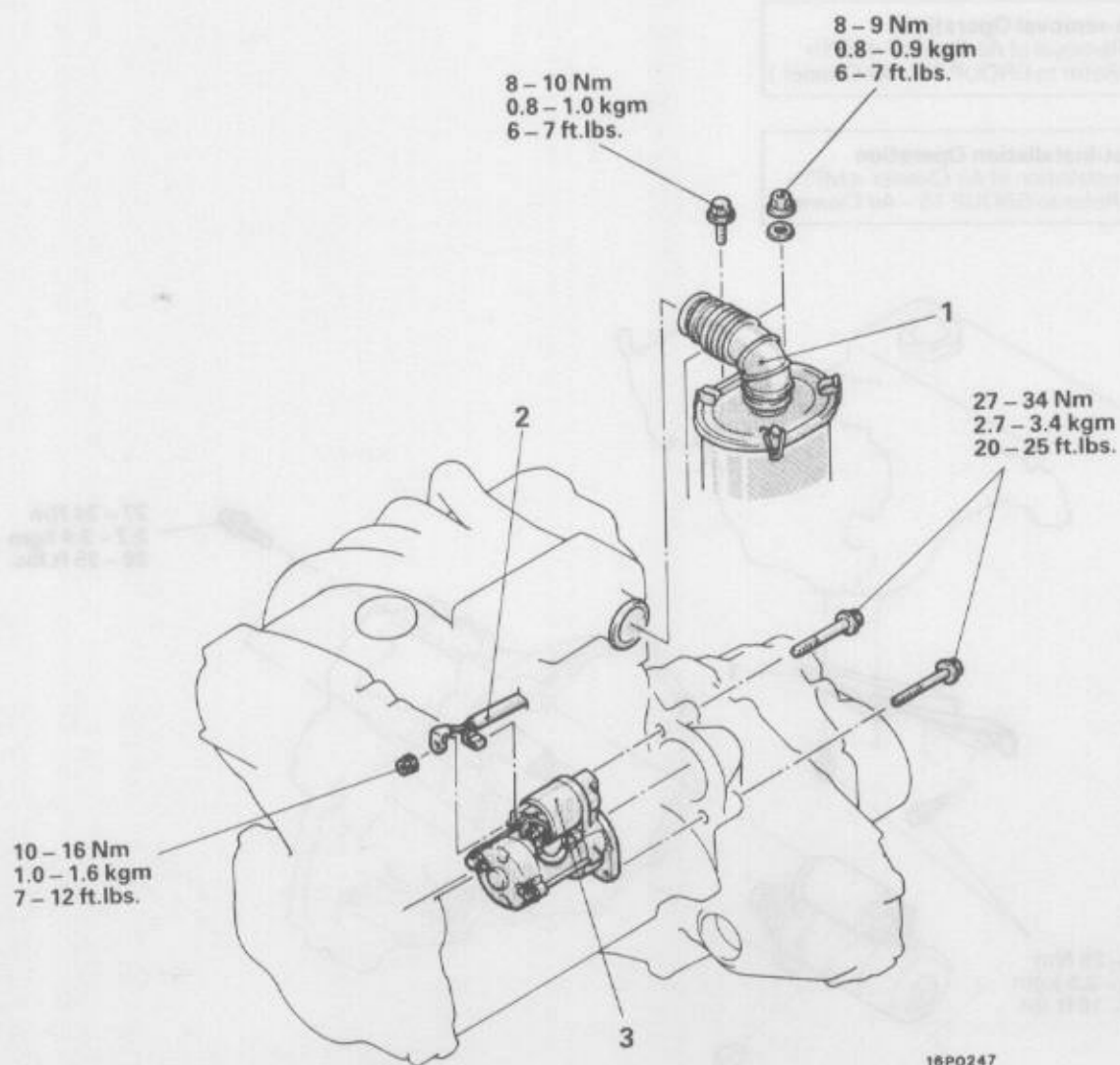
1. Intake manifold stay <SOHC-MPI>
2. Starter connector connection
3. Starter

NOTE

Reverse the removal procedures to reinstall.

REMOVAL AND INSTALLATION <DIESEL-POWERED VEHICLES>

E16CI-8

**Removal steps**

1. Air cleaner <Air conditioner>
2. Starter connector connection
3. Starter

NOTE

Reverse the removal procedures to reinstall.

IGNITION SYSTEM

SPECIFICATIONS

GENERAL SPECIFICATIONS

DISTRIBUTOR

Vehicles for Europe

VEHICLES BUILT UP TO MAY 1990

Engine	4G13, 4G16- conventional carburettor	4G13-FBC	4G15- conventional carburettor	4G15-MPI, 4G37
Items				
Type	Contact pointless	Contact pointless	Contact pointless	Contact pointless
Identification No.	T3T62995	T3T62682	T3T62996	T3T64173
Advance mechanism	Centrifugal + vacuum	Centrifugal + vacuum	Centrifugal + vacuum	Electronic
Firing order	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2

VEHICLES BUILT FROM JUNE 1990

Engine	4G13- conventional carburettor	4G15- conventional carburettor	4G13, 4G15-MPI	4G37	4G92
Items					
Type	Contact pointless with built-in ignition coil	Contact pointless with built-in ignition coil	Contact pointless with built-in ignition coil	Contact pointless	Contact pointless with built-in ignition coil
Identification No.	T6T87371	T6T87372	T6T57171	T2T53371	T6T57671A
Advance mechanism	Centrifugal + vacuum	Centrifugal + vacuum	Electronic	Electronic	Electronic
Firing order	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2

Vehicles for General Export

VEHICLES BUILT UP TO MAY 1990

Engine	4G13	4G15-conventional carburettor	4G15-MPI
Items			
Type	Contact pointless	Contact pointless	Contact pointless
Identification No.	T3T62995	T3T62996	T3T64173
Advance mechanism	Centrifugal + vacuum	Centrifugal + vacuum	Electronic
Firing order	1-3-4-2	1-3-4-2	1-3-4-2

VEHICLES BUILT FROM JUNE 1990

Engine	4G13 (except GCC)	4G13-GCC	4G15-conven- tional carburettor (except GCC, Hong Kong and Singapore)	4G15-GCC, Hong Kong and Singapore	4G15-MPI	4G92
Items						
Type	Contact pointless with built-in ignition coil	Contact pointless with built-in ignition coil	Contact pointless with built-in ignition coil	Contact pointless with built-in ignition coil	Contact pointless with built-in ignition coil	Contact pointless with built-in ignition coil
Identification No.	T6T87075	T6T87373	T6T87073	T6T87372	T6T57171	T6T57671A
Advance mechanism	Centrifugal + vacuum	Centrifugal + vacuum	Centrifugal + vacuum	Centrifugal + vacuum	Electronic	Electronic
Firing order	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2

Vehicles for Australia

VEHICLES BUILT UP TO MAY 1990

Items \ Engine	4G15-conventional carburettor	4G15-MPI
Type	Contact pointless	Contact pointless
Identification No.	T3T62994	T3T64173
Advance mechanism	Centrifugal + vacuum	Electronic
Firing order	1-3-4-2	1-3-4-2

VEHICLES BUILT FROM JUNE 1990

Items \ Engine	4G15-conventional carburettor	4G15-MPI	4G92
Type	Contact pointless with built-in ignition coil	Contact pointless with built-in ignition coil	Contact pointless with built-in ignition coil
Identification No.	T6T87372	T6T57171	T6T57671A
Advance mechanism	Centrifugal + vacuum	Electronic	Electronic
Firing order	1-3-4-2	1-3-4-2	1-3-4-2

CRANK ANGLE SENSOR

Items \ Engine	4G61, 4G67	4G93
Type	Contact pointless	Contact pointless
Identification No.	T1T49072 ^{*1} , T1T49073 ^{*2} , T1T49571 ^{*3}	T1T49771A
Advance mechanism	Electronic	Electronic

NOTE

^{*1}: Vehicles built up to April 1989^{*2}: Vehicles built from May 1989 up to May 1990^{*3}: Vehicles built from June 1990

IGNITION COIL

Items \ Engine	4G13*, 4G16, 4G15-conventional carburettor*	4G15-MPI*, 4G37	4G61, 4G67
Type	Molded single-coil type with external resistor	Molded single-coil type	Molded dual-coil type
Identification No.	F-100	F-088	F-089

NOTE

^{*}: Vehicles built up to May 1990

SERVICE SPECIFICATIONS**DISTRIBUTOR**

VEHICLES BUILT UP TO MAY 1990

Identification No.	Centrifugal timing advance crank angle/engine speed r/min.			Vacuum characteristics crank angle/vacuum mmHg (in.Hg)		
	Initial	Middle	Final	Initial	Middle	Final
T3T62682	0/1,500	5/2,500	16/6,000	0/80 (3.15)	6/150 (5.19)	23/280 (11.02)
T3T62994	0/1,600	6/3,600	14/6,000	0/80 (3.15)	10/150 (5.19)	20/300 (11.81)
T3T62995	0/1,500	5/2,500	16/6,000	0/100 (3.94)	4.4/150 (5.19)	15/300 (11.81)
T3T62996	0/1,600	6/3,800	14/6,000	0/130 (5.12)	7/200 (7.87)	15/300 (11.81)

VEHICLES BUILT FROM JUNE 1990

Identification No.	Centrifugal timing advance crank angle/engine speed r/min.			Vacuum characteristics crank angle/vacuum mmHg (in.Hg)		
	Initial	Middle	Final	Initial	Middle	Final
T6T87073	0/1,500	6/2,600	12/5,500	0/120 (4.72)	10.5/250 (9.84)	20/410 (16.14)
T6T87371	0/1,500	7/2,800	15/5,800	0/115 (4.53)	8/220 (8.66)	14/300 (11.81)
T6T87372	0/1,500	6/2,600	12/5,500	0/120 (4.72)	10.5/250 (9.84)	20/410 (16.14)
T6T87075	0/1,500	7/2,800	15/5,800	0/120 (4.72)	10.5/250 (9.84)	20/410 (16.14)
T6T87373	0/1,500	7/2,800	15/5,800	0/120 (4.72)	10.5/250 (9.84)	20/410 (16.14)

IGNITION COIL

Except 4G13, 4G15 – VEHICLES BUILT FROM JUNE 1990

Items	Type	F-100	F-088	F-089
Primary coil resistance Ω		1.08 – 1.32	0.72 – 0.88	0.77 – 0.95
Secondary coil resistance $k\Omega$		22.10 – 29.90	10.29 – 13.92	10.3 – 13.9
External resistor resistance Ω		1.22 – 1.49	–	–

4G13, 4G15 – VEHICLES BUILT FROM JUNE 1990, 4G92 AND 4G93

Items	Type	4G13, 4G15, 4G92	4G93
Primary coil resistance Ω		0.9 – 1.2	0.70 – 0.86
Secondary coil resistance $k\Omega$		20 – 29	11.3 – 15.3

TORQUE SPECIFICATIONS

E16DC--

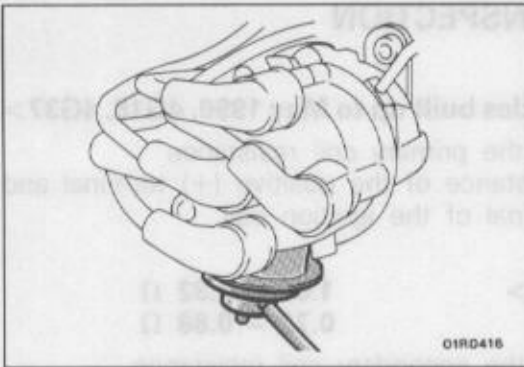
Items	Nm	kgm	ft.lbs.
Distributor mounting nut	10–13	1.0–1.3	7–9
Throttle body stay nut	15–22	1.5–2.2	11–16
Crank angle sensor nut	10–13	1.0–1.3	7–9

12.5	1.25	12.5	1.25	12.5	1.25	12.5	1.25
12.5	1.25	12.5	1.25	12.5	1.25	12.5	1.25
12.5	1.25	12.5	1.25	12.5	1.25	12.5	1.25
12.5	1.25	12.5	1.25	12.5	1.25	12.5	1.25
12.5	1.25	12.5	1.25	12.5	1.25	12.5	1.25
12.5	1.25	12.5	1.25	12.5	1.25	12.5	1.25
12.5	1.25	12.5	1.25	12.5	1.25	12.5	1.25
12.5	1.25	12.5	1.25	12.5	1.25	12.5	1.25
12.5	1.25	12.5	1.25	12.5	1.25	12.5	1.25
12.5	1.25	12.5	1.25	12.5	1.25	12.5	1.25

Classification	Initial	1st/2nd	3rd/4th	5th/6th	7th/8th	9th/10th	11th/12th
12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5

Classification	Initial	1st/2nd	3rd/4th	5th/6th	7th/8th	9th/10th	11th/12th
12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5

Classification	Initial	1st/2nd	3rd/4th	5th/6th	7th/8th	9th/10th	11th/12th
12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5



SERVICE ADJUSTMENT PROCEDURES

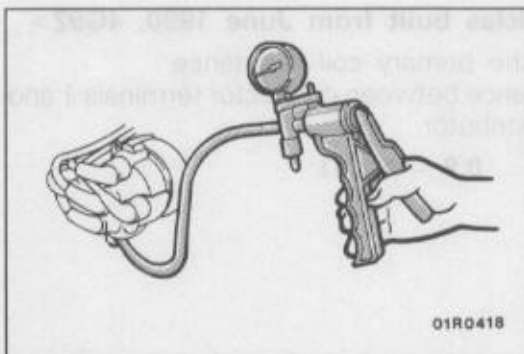
E16DGAJ

CENTRIFUGAL ADVANCE CONTROL DEVICE INSPECTION

- (1) Start the engine and run it at idle.
- (2) Disconnect the vacuum hose from the vacuum controller. Plug the disconnected vacuum hose.
- (3) Increase the engine speed gradually and check the advance. It is normal if the ignition timing advances smoothly as the speed increases.

Symptom	Possible cause
Excessive advance	Worn or damaged governor spring
Start-up advance too sudden	Damaged spring
Inadequate advance or excessive hysteresis	Malfunction of governor weight or cam

- (4) If any of the above symptoms occur, disassemble the distributor and check it.



VACUUM ADVANCE CONTROL DEVICE INSPECTION

- (1) Start the engine and run it at idle.
- (2) Disconnect the vacuum hose from the vacuum controller. Plug the disconnected vacuum hose. Connect a vacuum pump to the nipple.

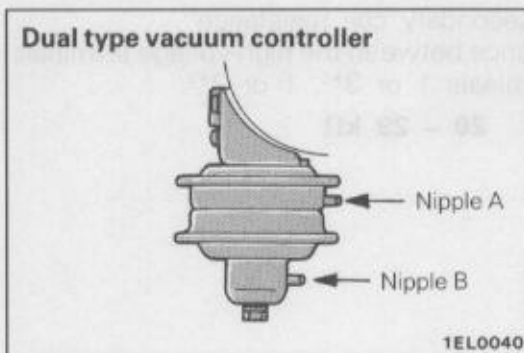
NOTE

For the dual type vacuum controller used in 4G13-FBC engines, application of a vacuum to nipple B (for cold advance control) will cause a maximum advance of 5°.

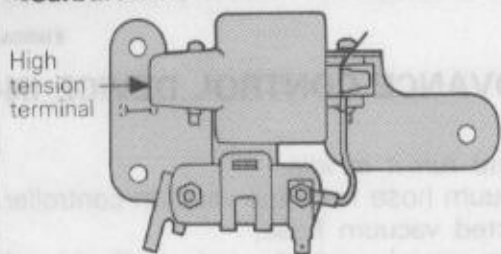
- (3) Increase the vacuum of the vacuum pump gradually and check the advance. It is normal if the ignition timing advances smoothly as the vacuum increases.

Symptom	Possible cause
Excessive advance	Worn or damaged vacuum controller spring
Start-up advance too sudden	Damaged spring
Inadequate advance or excessive hysteresis	Breaker base malfunction
Not advancing	Damaged diaphragm

- (4) If any of the above symptoms occur, disassemble the distributor and check it.

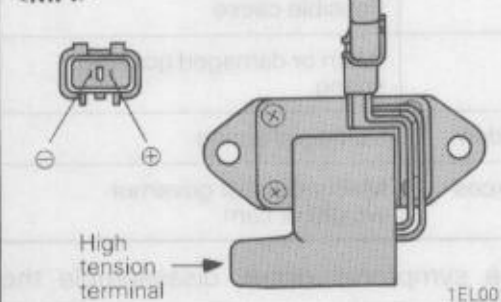


<Carburettor>



1EL0041

<MPI>



1EL0010

IGNITION COIL INSPECTION

SINGLE-COIL TYPE

<4G13, 4G15 – Vehicles built up to May 1990, 4G16, 4G37>

- (1) Measurement of the primary coil resistance
Measure the resistance of the positive (+) terminal and negative (-) terminal of the ignition coil.

Standard value:<Carburettor> 1.08 – 1.32 Ω <MPI> 0.72 – 0.88 Ω

- (2) Measurement of the secondary coil resistance
Measure the resistance between the ignition coil's positive (+) terminal and the high tension terminal.

Standard value:<Carburettor> 22.10 – 29.90 k Ω <MPI> 10.29 – 13.92 k Ω

- (3) Measure the resistance of the external resistor.

Standard value:<Carburettor> 1.22 – 1.49 Ω

<Carburettor>



High tension terminal

Ignition coil

1EL0056

<4G13, 4G15 – Vehicles built from June 1990, 4G92>

- (1) Measurement of the primary coil resistance
Measure the resistance between connector terminals 1 and 3*¹, 2*² of the distributor.

Standard value: 0.9 – 1.2 Ω

NOTE

*¹: Carburettor*²: MPI

<MPI>

High tension terminal



1EL0057

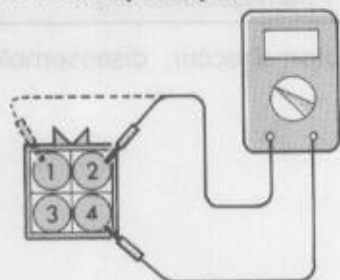
- (2) Measurement of secondary coil resistance
Measure the resistance between the high-voltage terminals and connector terminals 1 or 3*¹, 1 or 2*².

Standard value: 20 – 29 k Ω

NOTE

*¹: Carburettor*²: MPI

Vehicles built up to April 1989



6EL0039

DUAL-COIL TYPE <4G61, 4G67>

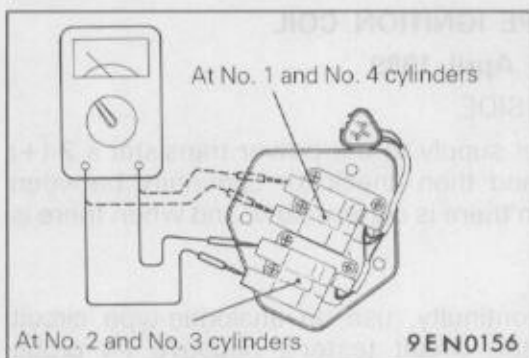
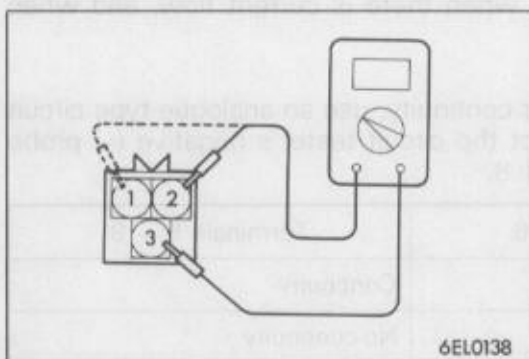
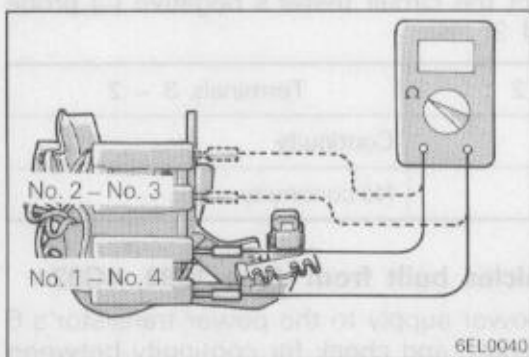
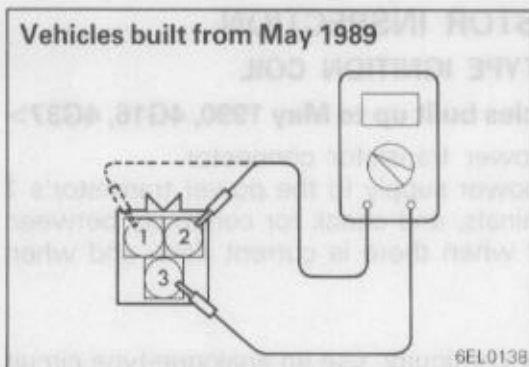
- (1) Measurement of the primary coil resistance.
(2) Measure the resistance between connector terminals 4*¹, 3*² and 2 (the coils at the No. 1 and No. 4 cylinder sides) of the ignition coil, and between terminals 4*¹, 3*² and 1 (the coils at the No. 2 and No. 3 cylinder sides).

Standard value: 0.77 – 0.95 Ω

NOTE

*¹: Vehicles built up to April 1989*²: Vehicles built from May 1989

Vehicles built from May 1989



- (3) Measurement of secondary coil resistance.
- (4) Measure the resistance between the high-voltage terminals for the No. 1 and No. 4 cylinders, and between the high-voltage terminals for the No. 2 and No. 3 cylinders.

Standard value range: 10.3 – 13.9 k Ω

Caution

When measuring the resistance of the secondary coil, be sure to disconnect the connector of the ignition coil.

<4G93>

- (1) Measurement of the primary coil resistance.
Measure the resistance between connector terminals 3 and 2 (the coils at the No. 1 and No. 4 cylinder sides) of the ignition coil, and between terminals 3 and 1 (the coils at the No. 2 and No. 3 cylinder sides).

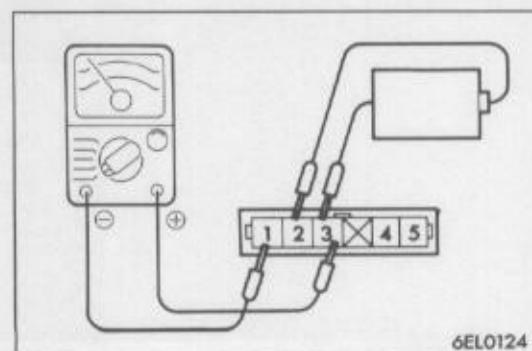
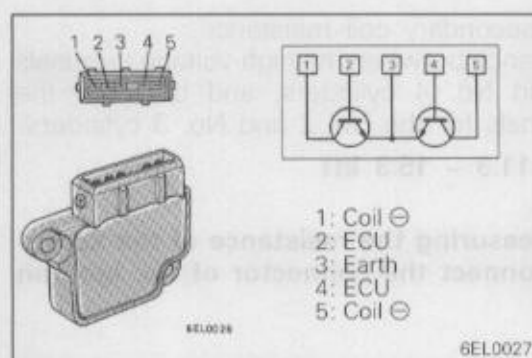
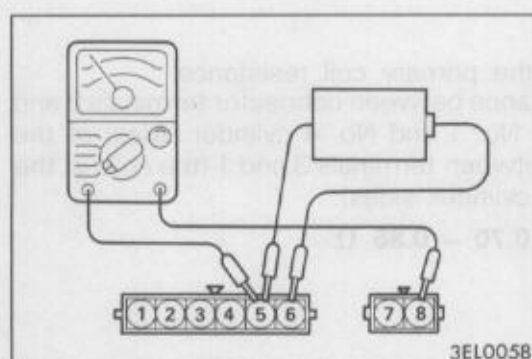
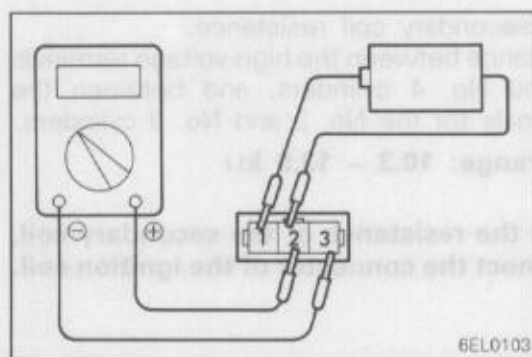
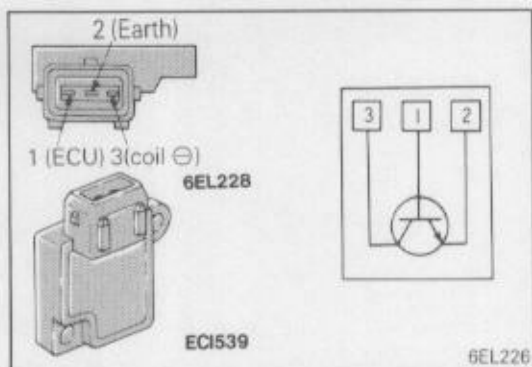
Standard value: 0.70 – 0.86 Ω

- (2) Measurement of secondary coil resistance.
Measure the resistance between the high-voltage terminals for the No. 1 and No. 4 cylinders, and between the high-voltage terminals for the No. 2 and No. 3 cylinders.

Standard value: 11.3 – 15.3 k Ω

Caution

Be sure, when measuring the resistance of the secondary coil, to disconnect the connector of the ignition coil.



POWER TRANSISTOR INSPECTION

FOR SINGLE-COIL TYPE IGNITION COIL

<4G13, 4G15 – Vehicles built up to May 1990, 4G16, 4G37>

- (1) Disconnect the power transistor connector.
- (2) Connect a 1.5 V power supply to the power transistor's 1 (+) and 2 ($-$) terminals, and check for continuity between terminals 3 and 2 when there is current flow, and when there is not.

NOTE

When checking for continuity, use an analogue-type circuit tester, and connect the circuit tester's negative ($-$) probe (black) to terminal 3.

Terminals 1 – 2	Terminals 3 – 2
Current flow	Continuity
No current flow	No continuity

<4G13, 4G15 – Vehicles built from June 1990, 4G92>

- (1) Connect a 1.5 V power supply to the power transistor's 6 (+) and 5 ($-$) terminals, and check for continuity between terminals 5 and 8 when there is current flow, and when there is not.

NOTE

When checking for continuity, use an analogue-type circuit tester, and connect the circuit tester's negative ($-$) probe (black) to terminal 8.

Terminals 5 – 6	Terminals 5 – 8
Current flow	Continuity
No current flow	No continuity

FOR DUAL-COIL TYPE IGNITION COIL

Vehicles built up to April 1989

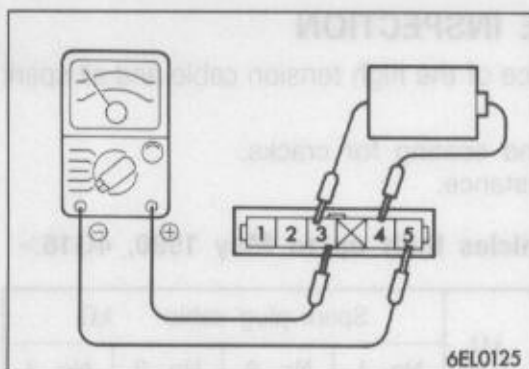
No. 1 – No. 4 COIL SIDE

Connect a 1.5 V power supply to the power transistor's 2 (+) and 3 ($-$) terminals, and then check for continuity between terminals 1 and 3 when there is current flow, and when there is not.

NOTE

When checking for continuity, use an analogue-type circuit tester, and connect the circuit tester's negative ($-$) probe (black) to terminal 1.

Terminals 2 – 3	Terminals 1 – 3
Current flow	Continuity
No current flow	No continuity



No. 2 – No. 3 COIL SIDE

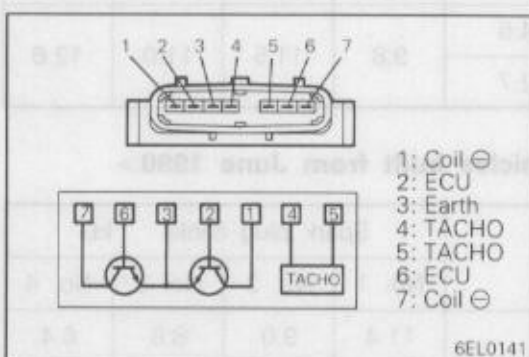
Connect a 1.5 V power supply to the power transistor's 4 (+) and 3 (–) terminals, and then check for continuity between terminals 3 and 5 when there is current flow, and when there is not.

Terminals 3 – 4	Terminals 3 – 5
Current flow	Continuity
No current flow	No continuity

NOTE

When checking for continuity, use an analogue-type circuit tester, and connect the circuit tester's negative (–) probe (black) to terminal 5.

Vehicles built from May 1989

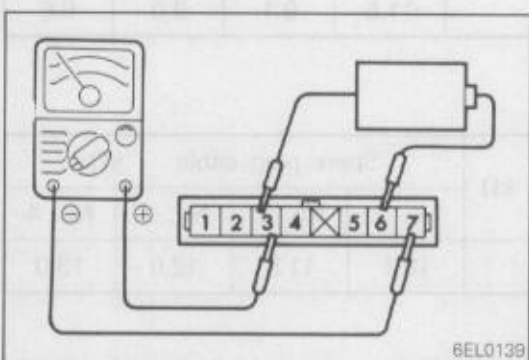


No. 1 – No. 4 COIL SIDE

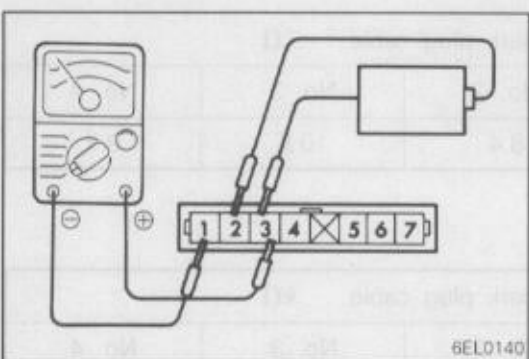
Connect a 1.5 V power supply to the power transistor's 6 (+) and 3 (–) terminals, and then check for continuity between terminals 7 and 3 when there is current flow, and when there is not.

NOTE

When checking for continuity, use an analogue-type circuit tester, and connect the circuit tester's negative (–) probe (black) to terminal 7.



Terminals 6 – 3	Terminals 7 – 3
Current flow	Continuity
No current flow	No continuity



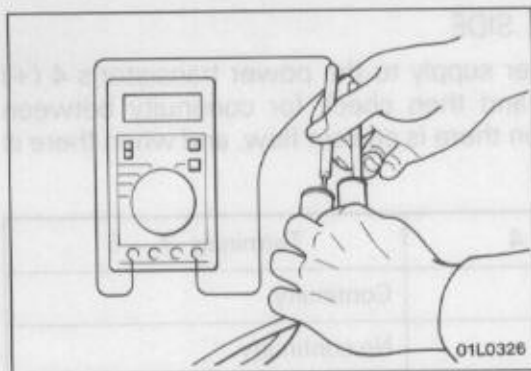
No. 2 – No. 3 COIL SIDE

Connect a 1.5 V power supply to the power transistor's 2 (+) and 3 (–) terminals, and then check for continuity between terminals 1 and 3 when there is current flow, and when there is not.

Terminals 2 – 3	Terminals 1 – 3
Current flow	Continuity
No current flow	No continuity

NOTE

When checking for continuity, use an analogue-type circuit tester, and connect the circuit tester's negative (–) probe (black) to terminal 1.



RESISTIVE CODE INSPECTION

Measure the resistance of the high tension cable and all spark plug leads.

- (1) Check the cap and coating for cracks.
- (2) Measure the resistance.

<4G13, 4G15 – Vehicles built up to May 1990, 4G16>

High tension cable	kΩ	Spark plug cable kΩ			
		No. 1	No. 2	No. 3	No. 4
Carburettor	4.5	9.8	11.5	11.0	12.6
MPI	2.7				

<4G13, 4G15 – Vehicles built from June 1990>

Items	Spark plug cable kΩ			
	No. 1	No. 2	No. 3	No. 4
Carburettor	11.4	9.0	8.8	6.4
MPI	11.5	9.1	9.0	6.6

<4G37>

High tension cable	kΩ	Spark plug cable kΩ			
		No. 1	No. 2	No. 3	No. 4
3.6		10.1	11.5	12.0	13.0

<4G61, 4G67>

Spark plug cable kΩ			
No. 1	No. 2	No. 3	No. 4
5.8	8.4	10.6	9.7

<4G92>

Spark plug cable kΩ			
No. 1	No. 2	No. 3	No. 4
12.6	11.7	9.4	8.5

<4G93>

Spark plug cable kΩ			
No. 1	No. 2	No. 3	No. 4
6.7	8.6	10.4	10.7

CHECKING THE DETONATION SENSOR

Check the detonation sensor circuit if self-diagnosis output pattern code No. 31 is displayed.

NOTE

For information concerning the self-diagnosis output pattern codes, refer to GROUP 13 – Service Adjustment Procedures.

NOTES

CHECKING THE DETONATION SENSOR

Check the detonation sensor circuit if self-diagnostic output pattern code No. 31 is displayed.

NOTE

For information concerning the self-diagnostic output pattern codes, refer to GROUP 13 - Service Adjustment Procedures.

E16DH-

DISTRIBUTOR

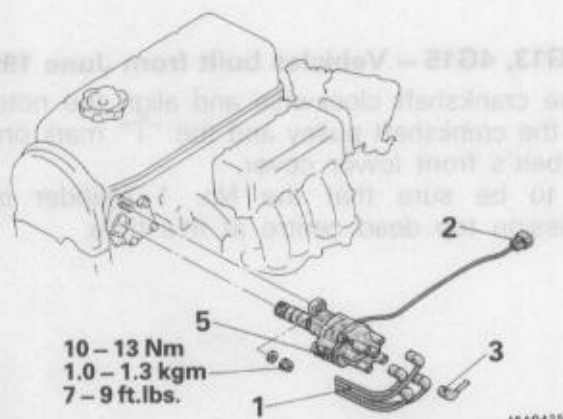
REMOVAL AND INSTALLATION

Post-installation Operation

- Engine Adjustment
(Refer to GROUP 11 – Engine Adjustment.)

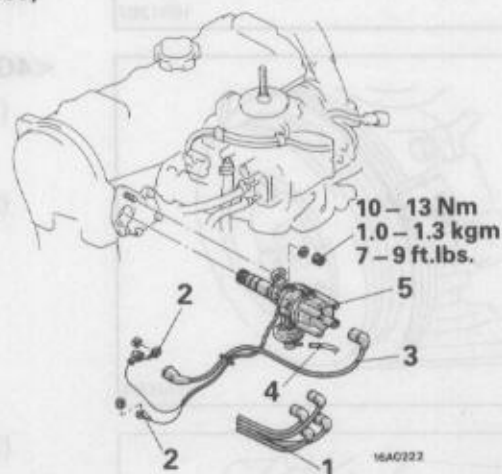
<MPI>

(4G15 – Vehicles built up to May 1990 and 4G37)



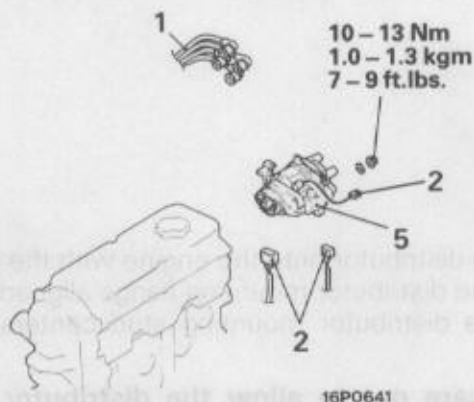
<Carburettor>

(4G16 and 4G13, 4G15 – Vehicles built up to May 1990)



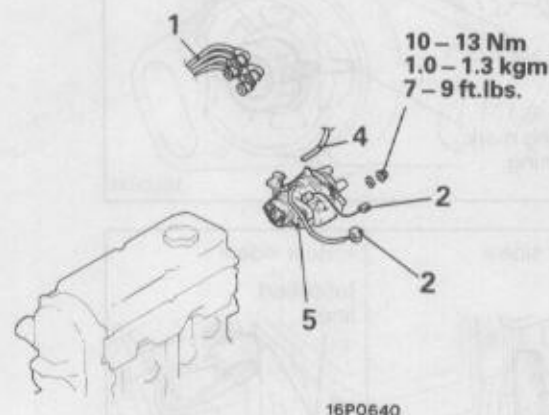
<MPI>

(4G13, 4G92 and 4G15 – Vehicles built from June 1990)



<Carburettor>

(4G13, 4G15 – Vehicles built from June 1990)

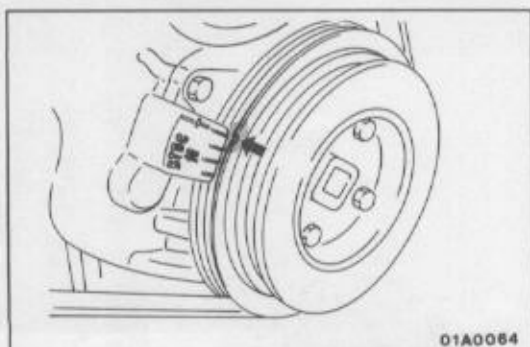


Removal steps

1. Spark plug cable connection
2. Distributor connector connection
3. Connection of the high tension cable
4. Vacuum hose connection <Carburettor>
5. Distributor

NOTE

- (1) Reverse the removal procedures to reinstall.
- (2) ♦♦: Refer to "Service Points of Installation"



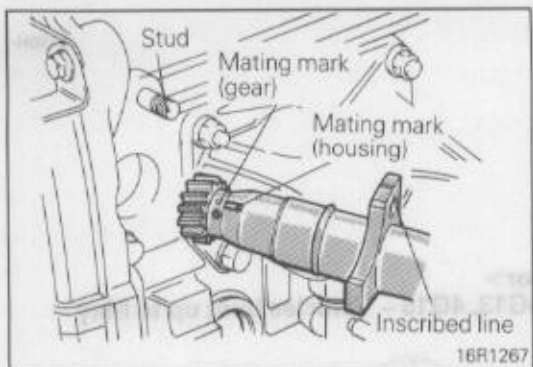
SERVICE POINT OF INSTALLATION

E16DHCA

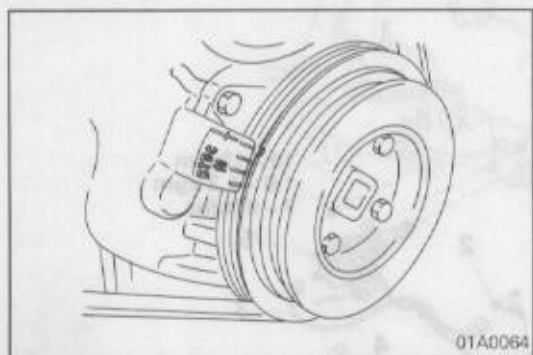
5. INSTALLATION OF DISTRIBUTOR

<Except 4G92 and 4G13, 4G15 – Vehicles built from June 1990>

- (1) Turn the crankshaft clockwise and align the notched part of the crankshaft pulley and the "T" mark on the timing belt's front lower cover.
- (2) Check to be sure that the No. 1 cylinder is at compression top dead centre at this time.

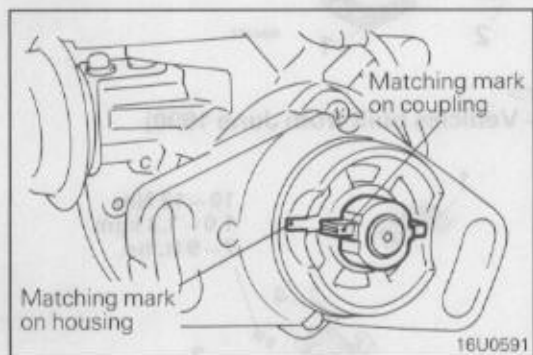


- (3) Align the mating mark of the distributor housing and the mating mark of the gear.
- (4) Install with the inscribed line (on the installation flange of the distributor) aligned with the centre of the distributor installation stud.

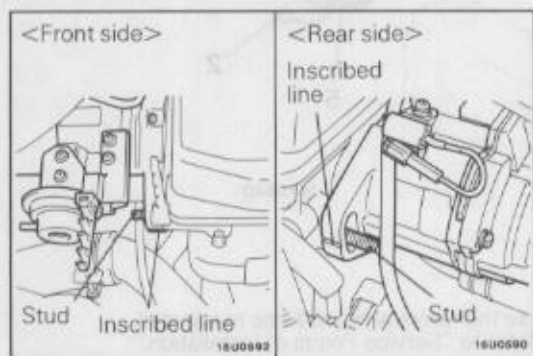


<4G92 and 4G13, 4G15 – Vehicles built from June 1990>

- (1) Turn the crankshaft clockwise and align the notched part of the crankshaft pulley and the "T" mark on the timing belt's front lower cover.
- (2) Check to be sure that the No. 1 cylinder is at compression top dead centre at this time.



- (3) Align the matching mark (notch) on the distributor housing with that (notch) on the coupling.

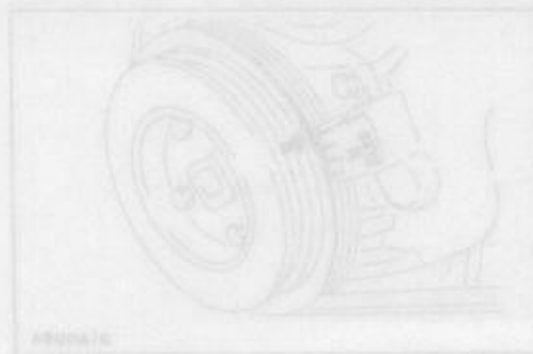


- (4) Install the distributor onto the engine with the inscribed lines of the distributor mounting flange aligned with the respective distributor mounting stud centers.

Caution

- Use care not to allow the distributor to turn when tightening the mounting flange nuts.

- (5) Confirm that the ignition timing conforms with the standard value.

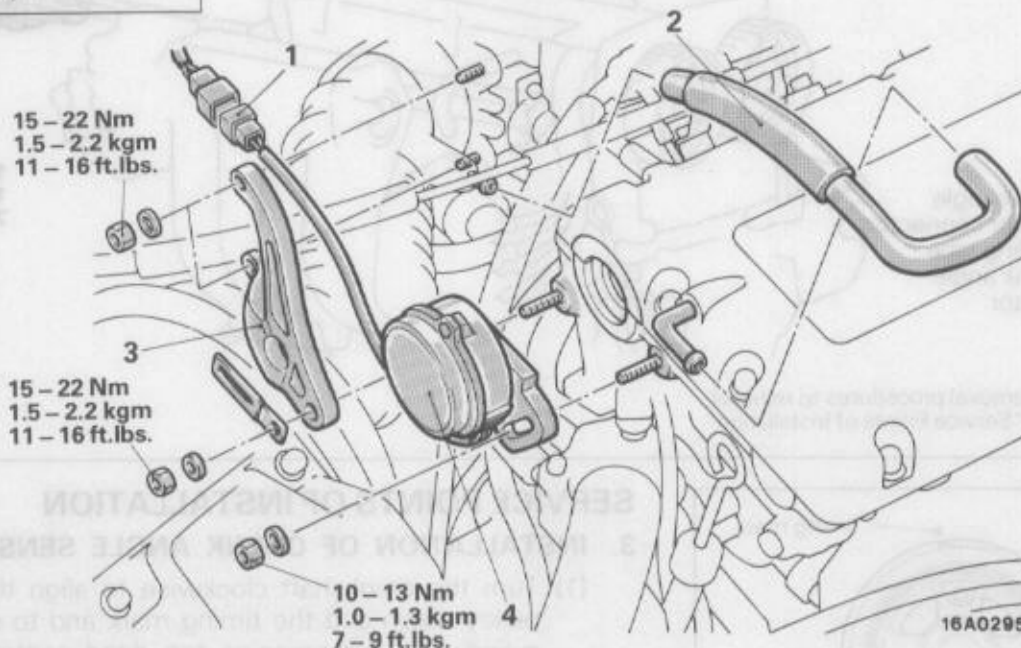


CRANK ANGLE SENSOR

REMOVAL AND INSTALLATION <4G61, 4G67>

Post-installation Operation

- Engine Adjustment
(Refer to GROUP 11 – Engine Adjustment.)

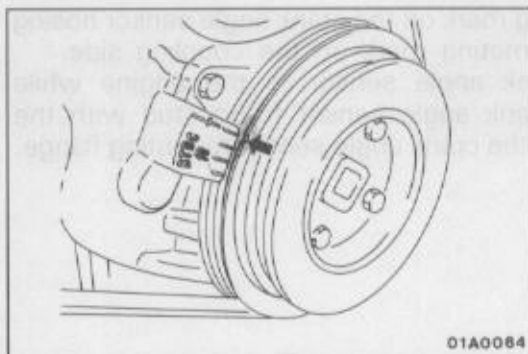


Removal steps

1. Crank angle sensor connector connection
2. Breather hose
3. Throttle body stay
- ◆◆ 4. Crank angle sensor

NOTE

- (1) Reverse the removal procedures to reinstall.
- (2) ◆◆: Refer to "Service Points of Installation".

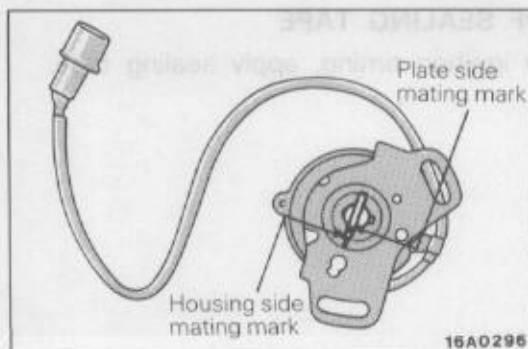


SERVICE POINT OF INSTALLATION

E16DLAA

4. INSTALLATION OF CRANK ANGLE SENSOR

- (1) Turn the crankshaft clockwise and align the notched part of the crankshaft pulley and the "T" mark on the timing belt's front lower cover.
- (2) Check to be sure that the No. 1 cylinder is at compression top dead centre at this time.



- (3) Align the mating mark (punched mark) at the housing side of the crank angle sensor with the mating mark (notched) at the plate side.
- (4) Install the crank angle sensor on the engine.

Caution

When tightening the installation nut of the crank angle sensor, make sure that the crank angle sensor does not turn.

REMOVAL AND INSTALLATION <4G93>

Post-installation Operation

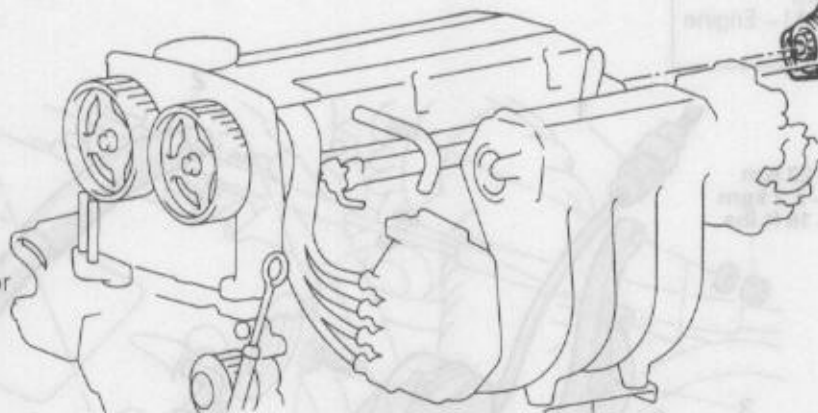
- Engine Adjustment
(Refer to GROUP 11 – Service Adjustment Procedures.)

Removal steps

1. Crank angle sensor connector
2. Sealing tape
3. Crank angle sensor

NOTE

- (1) Reverse the removal procedures to reinstall.
- (2) ♦♦: Refer to "Service Points of Installation"



16S0117

SERVICE POINTS OF INSTALLATION

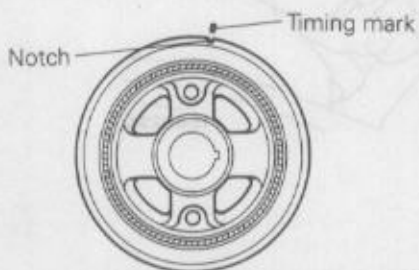
E16DLAB

3. INSTALLATION OF CRANK ANGLE SENSOR

- (1) Turn the crankshaft clockwise to align the crankshaft pulley notch and the timing mark and to set the No. 1 cylinder to compression top dead centre.

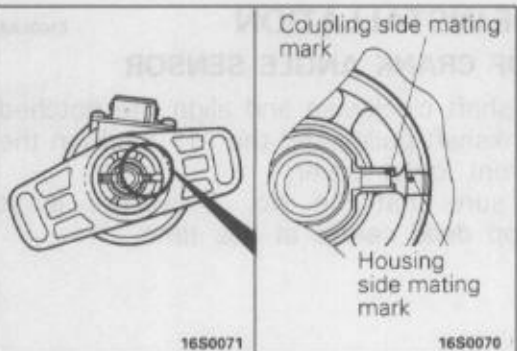
Caution

Take note that when the timing mark and the notch are aligned, the No. 4 cylinder will also be at compression top dead centre.



16S0072

- (2) Align the mating mark on the crank angle sensor housing side with the mating mark on the coupling side.
- (3) Install the crank angle sensor to the engine while aligning the crank angle sensor fixing stud with the oblong hole on the crank angle sensor mounting flange.



2. INSTALLATION OF SEALING TAPE

After adjusting the ignition timing, apply sealing tape.

16-24 GLOW SYSTEM - Specifications / Service Adjustment Procedures

GLOW SYSTEM

SPECIFICATIONS

SERVICE SPECIFICATIONS

Item	Specifications
Standard value	
Engine coolant temperature sensor resistance at 20°C (68°F) ±1%	2.93 - 3.89
Throttle position sensor resistance at 20°C (68°F) ±1%	155 - 165
Glow plug resistance at 20°C (68°F) ±1%	2.50

TORQUE SPECIFICATIONS

Item	mm	kgm	ft.lbf
Engine coolant temperature sensor	30 - 40	3 - 4	22 - 28
Glow plug	15 - 20	1.5 - 2.0	11 - 14
Glow plug plate attaching nut	1 - 1.5	0.1 - 0.15	0.7 - 1.1

SEALANTS AND ADHESIVES

Item	Specifications
Engine coolant temperature sensor	Sealant (Mitsubishi Part No. 9200-10-000)
	Sealant (Mitsubishi Part No. 9200-10-000)

SERVICE ADJUSTMENT PROCEDURES

GLOW SYSTEM OPERATION INSPECTION

- Check the battery voltage. (12 V)
- Check the engine coolant temperature sensor connection.
- Check the glow plug resistance.

Caution
If the engine coolant temperature sensor is disconnected, reconnect it after inspection.

- (1) Connect a voltmeter between the glow plug plate and ground (battery).
- (2) Check the voltage reading on the voltmeter when the ignition switch is turned ON.
- (3) Check that the voltmeter indicates a battery voltage (about 9 V or over) for about 5 seconds when glow plug is cold immediately after the ignition switch is turned ON.

NOTE
Continuously monitor voltage depending upon the glow plug temperature and battery voltage.



Fig. 16-24 Glow System - Glow Plug Plate Connection

GLOW SYSTEM

SPECIFICATIONS

SERVICE SPECIFICATIONS

E16EB-

Items	Specifications
Standard value	
Engine coolant temperature sensor resistance [at 20°C (68°F)] kΩ	2.93 – 3.58
Dropping resistor resistance [at 20°C (68°F)] mΩ	155 – 165
Glow plug resistance [at 20°C (68°F)] mΩ	235

TORQUE SPECIFICATIONS

E16EC-

Items	Nm	kgm	ft.lbs.
Engine coolant temperature sensor	30 – 40	3 – 4	22 – 28
Glow plug	15 – 20	1.5 – 2.0	11 – 14
Glow plug plate attaching nut	1 – 1.5	0.1 – 0.15	0.7 – 1.1

SEALANTS AND ADHESIVES

E16EE-

Items	Specified sealant and adhesive
Engine coolant temperature sensor	3M Adhesive Nut Locking 4171 or equivalent

SERVICE ADJUSTMENT PROCEDURES

GLOW SYSTEM OPERATION INSPECTION

E16EGAD

Conditions before inspection:

- Battery voltage: 12 V
- Cooling water temperature: 55°C (131°F) or lower. (Or disconnect the engine coolant temperature sensor connector)

Caution

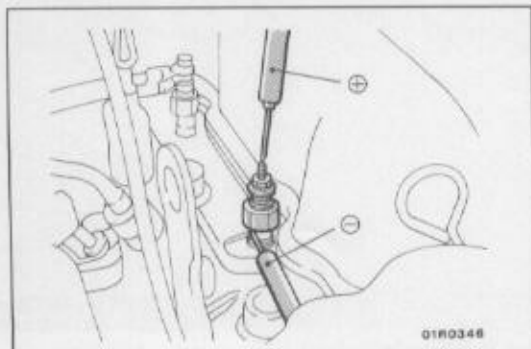
If the engine coolant temperature sensor is disconnected, reconnect it after inspection.

- (1) Connect a voltmeter between the glow plug plate and plug body (earth).
- (2) Check the voltage reading on the voltmeter when the ignition switch is turned ON.
- (3) Check that the voltmeter indicates a battery voltage (about 9 V or over) for about 3 seconds (when glow plug is cool) immediately after the ignition switch is turned ON.

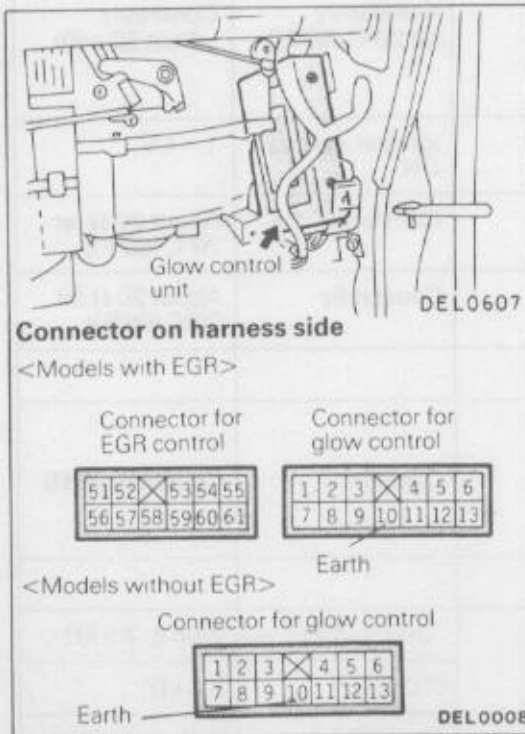
NOTE

Continuity time varies depending upon the glow plug temperature and battery voltage.

PWME8802



- (4) After checking the above, set ignition switch at the START position.
- (5) The system is normal if battery voltage (about 9 V or over) is generated for about 180 seconds during engine cranking and after operation.
- (6) When the voltage or continuity time is abnormal, check the terminal voltage in glow control unit or individual parts to determine which parts are defective.



GLOW CONTROL UNIT INSPECTION

Check the terminal voltage in glow control unit and continuity on the harness side.

- (1) Check with the glow control unit connector connected.

Ter- minal	Connection area or measured part	Measured item	Tester connec- tion	Check condi- tions	Standard value
7	Glow plug relay (1)	Voltage	7-earth	Ignition switch OFF ON (when glow plug is cool)	Indicates bat- tery voltage for about 3 sec- onds after ON
8	Glow plug relay (2)	Voltage	8-earth	Ignition switch OFF ON (when glow plug is cool)	Indicates bat- tery voltage for about 3 sec- onds after ON
				During engine cranking	About 12 battery voltage

* Read the voltage reading, quickly.

(2) Remove the glow control unit connector. Check with the harness side connector.

Terminal	Connection area or measured part	Measured item	Tester connection	Check condition	Standard value
1	Ignition switch (IG1 power supply)	Voltage	1-earth	Ignition switch ON	Battery voltage (about 12 V)
2	Ignition switch (ST power supply)	Voltage	2-earth	During engine cranking	Battery voltage (8 – 10 V)
3	Vacant terminal	—	—	—	—
4	Glow plug (constant-current positive terminal)	Resistance	4-earth	Constantly [at 20°C (68°F)]	Continuity (about 50 mΩ)
5	Glow plug (voltage positive terminal)		5-earth		
6	Alternator L terminal	Voltage	6-earth	Ignition switch ON	1 – 4 V
7	Glow plug relay (1) coil	Resistance	7-earth	Constantly	About 20 Ω [at 20°C (68°F)]
8	Glow plug relay (2) coil	Resistance	8-earth	Constantly	About 20 Ω [at 20°C (68°F)]
9	Vacant terminal	—	—	—	—
10	Glow plug (constant-current negative terminal)	Resistance	10-earth	Constantly	Continuity (0 Ω)
11	Glow plug (voltage negative terminal)		10 – 11 11 earth		
12	Vacant terminal	—	—	—	—
13	Engine coolant temperature sensor	Resistance	13-earth	–20°C (–4°F)	24.8 ± 2.5 kΩ
				0°C (32°F)	8.6 kΩ
				20°C (68°F)	3.25 ± 0.33 kΩ
				40°C (104°F)	1.5 kΩ

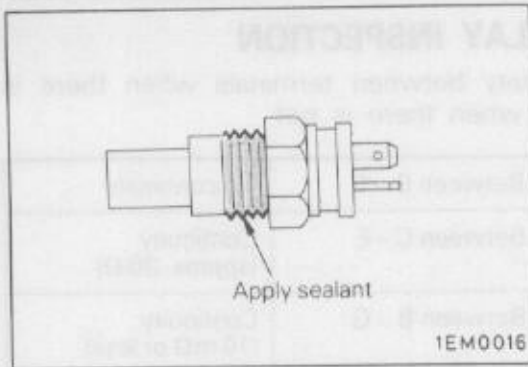


16G0078

ENGINE COOLANT TEMPERATURE SENSOR INSPECTION

- (1) Remove the engine coolant temperature sensor from the cylinder head.
- (2) Check that the engine coolant temperature sensor resistance is within the standard value range.

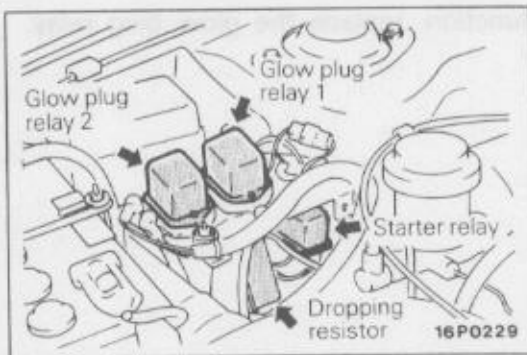
Standard value range: 2.92 – 3.58 kΩ [at 20°C (68°F)]



- (3) Apply sealant to the threaded portion.

Specified adhesive: 3M Adhesive Nut Locking 4171 or equivalent

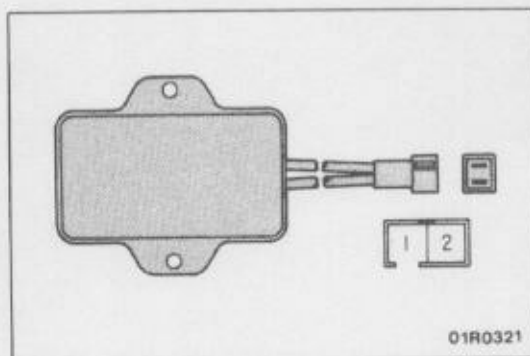
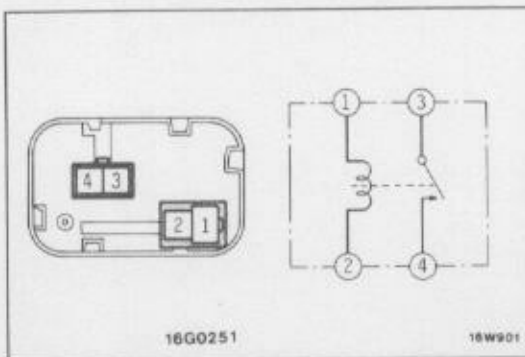
- (4) Install the engine coolant temperature sensor and tighten it to the specified torque.



STARTER RELAY INSPECTION

- (1) Remove the starter relay.
 (2) Connect the battery power supply to terminal 1. Check the continuity between the terminals with terminal 2 earthed.

With power	Between terminals 3 and 4	Continuity
Without power	Between terminals 1 and 2	Continuity
	Between terminals 3 and 4	No continuity

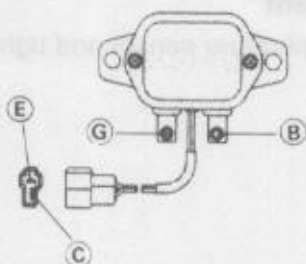


DROPPING RESISTOR INSPECTION

Disconnect the connector of the dropping resistor and measure the resistance between resistor side connector terminals.

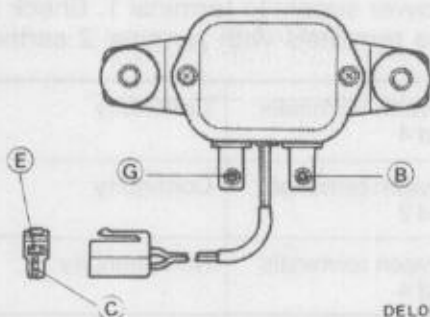
Standard value: 155 – 165 mΩ

Glow plug relay (No. 1)

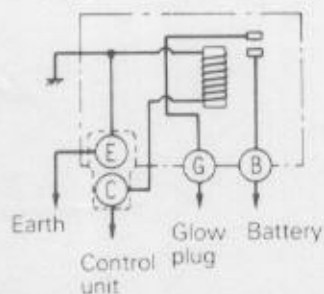


01R0320

Glow plug relay (No. 2)



DELO007



01R0335

GLOW PLUG RELAY INSPECTION

(1) Check for continuity between terminals when there is current flow and when there is not.

While no current is flowing	Between B – G	No continuity
	Between C – E	Continuity (approx. 20 Ω)
While current is flowing	Between B – G	Continuity (10 m Ω or less)

(2) If there is a malfunction, replace the glow plug relay.

GLOW PLUG

E16EH-

REMOVAL AND INSTALLATION

Pre-removal Operation

- Removal of Intake Manifold (A)
(Refer to GROUP 15 – Intake and Exhaust Manifold.)

Post-installation Operation

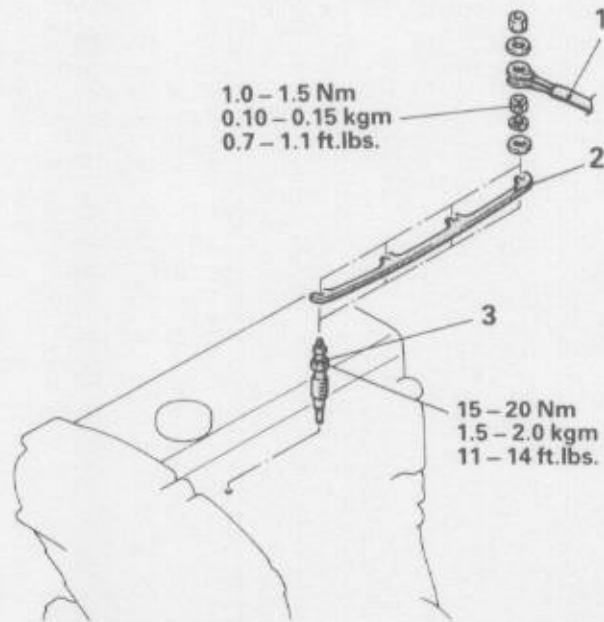
- Installation of Intake Manifold (A)
(Refer to GROUP 15 – Intake and Exhaust Manifold.)

Removal steps

1. Connector connection
2. Glow plug plate
- ◆◆◆ 3. Glow plug

NOTE

- (1) Reverse the removal procedures to reinstall.
- (2) ◆◆: Refer to "Service Points of Removal"
- (3) ◆◆◆: Refer to "Service Points of Installation"



16P024B

SERVICE POINT OF REMOVAL

E16EHBA

3. REMOVAL OF GLOW PLUG

Remove the glow plug by hand after loosening it most of the way with a tool as its ceramic part is fragile.

INSPECTION

E16EHCA

- Check for rust on the glow plug plate.
- Check the glow plug for damage.

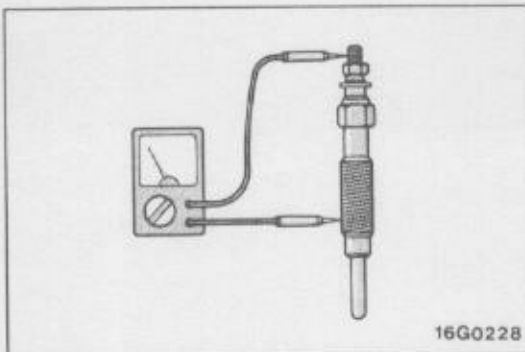
INSPECTION OF GLOW PLUG

Check the resistance between the glow plug (Nos. 1 – 4) terminals and body.

Standard value: 235 mΩ [at 20°C (68°F)]

Caution

1. Remove oil from the plug before measuring as the glow plug resistance is very small.
2. Do not use a plug if it has been dropped from a height of 10 cm (4 in.) or more.



16G0228

SERVICE POINT OF INSTALLATION

E16EHDA

3. INSTALLATION OF GLOW PLUG

First screw in the glow plug by hand before tightening it with a tool as its ceramic part is fragile.

GLOW PLUG

REMOVAL AND INSTALLATION

Pre-removal Operation
 1. Remove the glow plug from the glow plug holder.
 2. Inspect the glow plug for damage.

Post-installation Operation
 1. Install the glow plug in the glow plug holder.
 2. Check for proper operation.

Removal steps:

1. Remove the glow plug from the glow plug holder.
2. Inspect the glow plug for damage.
3. Check for proper operation.

NOTE:

1. Do not use a glow plug that is damaged or worn.
2. Do not use a glow plug that is not the correct type for the engine.
3. Do not use a glow plug that is not the correct size for the glow plug holder.



SERVICE POINT OF REMOVAL

3. REMOVAL OF GLOW PLUG

Remove the glow plug by hand after loosening it with a
 1/2" hex key. Do not use a tool as the removal can damage the glow plug.

INSPECTION

- Check for rust on the glow plug holder.
- Check the glow plug for damage.

INSPECTION OF GLOW PLUG

Check the resistance between the glow plug holder and the glow plug body.

Standard value: 200 mΩ (at 20°C (68°F))

CAUTION:

1. Remove oil from the glow plug before measuring its resistance. If the glow plug resistance is very small, it may be damaged.
2. Do not use a glow plug if it has been damaged from a spark plug or if it is not the correct type.

SERVICE POINT OF INSTALLATION

3. INSTALLATION OF GLOW PLUG

First screw in the glow plug by hand before tightening it with a 1/2" hex key as the removal can damage the glow plug.

