

ENGINE ELECTRICAL

CONTENTS

E16AA--

CHARGING SYSTEM	2	SPECIFICATIONS	11
SPECIFICATIONS	2	Service specifications	11
General Specifications	2	Torque Specifications	11-1
Service Specifications	2	Lubricants	11-1
Torque Specifications	2-1	SPECIAL TOOLS	12
SPECIAL TOOLS	2-1	SERVICE ADJUSTMENT PROCEDURES ...	12
SERVICE ADJUSTMENT PROCEDURES ...	3	DISTRIBUTOR	16
ALTERNATOR	9	GLOW SYSTEM	18
STARTING SYSTEM	10	SPECIFICATIONS	18
SPECIFICATIONS	10	Service Specifications	18
General Specifications	10	Torque Specifications	18
Torque Specifications	10	Sealant and Adhesives	18
STARTER MOTOR	10	SERVICE ADJUSTMENT PROCEDURES ...	18
IGNITION SYSTEM	11	GLOW PLUG	25

CHARGING SYSTEM

SPECIFICATIONS

GENERAL SPECIFICATIONS

E16BA--

Vehicles for Europe

Items	Van						
	4G32 4G63 - 8 valve	4G63 - 8 valve (for cold climate zone)	4G63 - 16 valve	4D56	G63B G64B 4G63-8 valve (non-leaded petrol-powered vehicle) 4G64 4D56 (for cold climate zone) 4D56 (for 4WD vehicles)	4G63 - 8 valve (for cold climate zone - P13V only)	4G64 (for cold climate zone)
Nominal current A	Mini-bus						
	-	-	-	4G63 - 8 valve	4G63 - 8 valve (A/T) 4G64 4D56	4G63 - 8 valve (for cold climate zone) 4D56 (for 4WD vehicles)	4G64 (for cold climate zone)
	40	50	55	60	65	75	90

Vehicles for General Export

Items	Van	4G92	4G63 - 16 valve	4G33 4G32 4D56	4G33* 4G32*	-
	Mini-bus	-	-	-	4G33 4G32 4G63 - 8 valve (M/T)	4G33* 4G32* 4G36 - 8 Valve*
Nominal current A		50	55	60	65	75

*: for cold climate zone

Vehicles for Hong Kong

Items	4G33	4G92	4G64
Nominal current A	40	50	75

Vehicles for Australia

Items	Van	4G63 - 8 valve	4G63 - 16 valve 4G64 - 16 valve	-	4G64 - 8 valve	-	4D56
	Mini-bus	-	-	-	4G63 - 8 valve	4G64 - 8 valve (M/T)	4G64 - 8 valve (A/T)
Nominal current A		40	55	60 [Vehicles built up to September 1987] 65 [Vehicles built from October 1987]	65	75	60

SERVICE SPECIFICATIONS

E16BB--

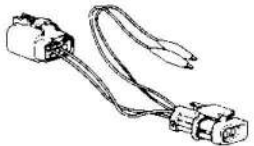
Items	Specifications
Standard value Voltage drop of alternator outlet line	V 0.2 or less
Limit Alternator output current	Over 70% of nominal output

TORQUE SPECIFICATIONS

Items	Nm	kgm	ft.lbs.
Alternator brace bolt			
Petrol-powered vehicles built up to May 1994	12–15	1.2–1.5	9–11
Diesel-powered vehicles and petrol-powered built from June 1994	20–25	2.0–2.5	14–18
Alternator support nut			
M8	20–25	2.0–2.5	14–18
M10	35–55	3.5–5.5	25–40
Oil tube eye bolt	14–19	1.4–1.9	10–14
Alternator brace attaching bolt	35–55	3.5–5.5	25–40
Alternator adjustment bolt	8–12	0.8–1.2	6–9

SPECIAL TOOLS

E16BF--

Tool (Number and name)	Use
MD998467 Alternator harness connector	Alternator (S, L terminal voltage) check
	

NOTES

SERVICE ADJUSTMENT PROCEDURES**1. ALTERNATOR OUTPUT LINE VOLTAGE DROP TEST**

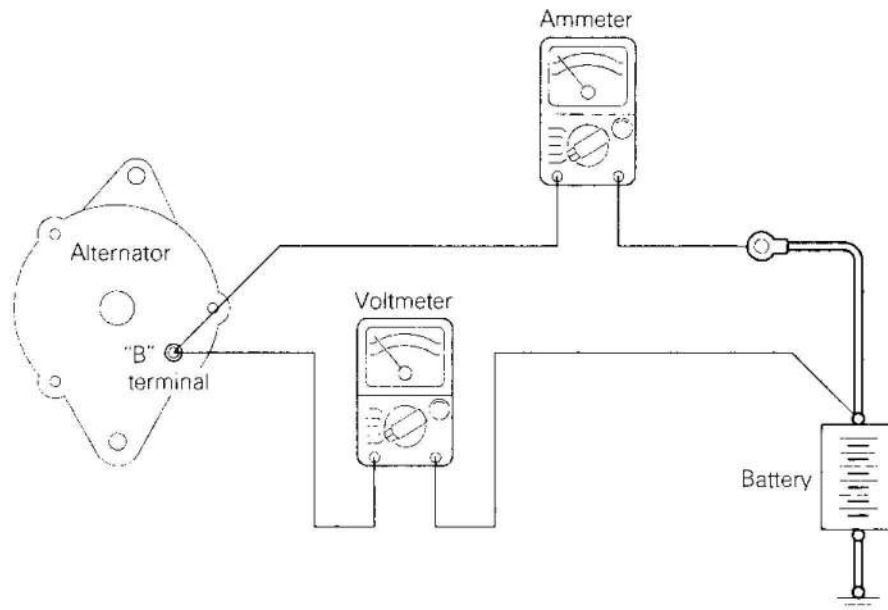
The purpose of this test is to determine whether the wiring connecting the alternator "B" terminal and the battery \oplus terminal (including the fusible link) is in a good condition or not.

- (1) Before carrying out the test, always be sure to check the following.
 - Alternator installation
 - Alternator drive belt tension (Refer to GROUP 11 – Engine Adjustment.)
 - Fusible link condition
 - Abnormal noise from the alternator while the engine is running
- (2) Turn the ignition switch to OFF.
- (3) Disconnect the battery \ominus cable.
- (4) Disconnect the alternator output wire from the alternator "B" terminal, and connect a DC test ammeter with a range of 0–100 A in series between the "B" terminal and the disconnected output wire. (Connect the \oplus lead of the ammeter to the "B" terminal, and then connect the \ominus lead of the ammeter to the disconnected output wire.)

NOTE

A clamp-type ammeter which enables measurements to be taken without disconnecting the alternator output wire should ideally be used. The reason for this is that if a vehicle in which the voltage may have dropped due to an imperfect connection at the alternator "B" terminal is being inspected, and so if the alternator "B" terminal is loosened and a test ammeter is connected, the connection will be complete at the time of connection and the possibility of finding problems will be reduced.

- (5) Connect a digital-type voltmeter between the alternator "B" terminal and the battery \oplus terminal. (Connect the \oplus lead of the voltmeter to the "B" terminal, and then connect the \ominus lead of the voltmeter to the battery \oplus terminal.)



6EN0892

- (6) Connect a tachometer. (Refer to GROUP 11 – Service Adjustment Procedures.)
- (7) Reconnect the battery (–) cable.
- (8) Leave the hood open.
- (9) Start the engine.
- (10) With the engine running at 2500 r/min, turn the headlamps and other lights on and off to adjust the alternator load so that the value indicated on the ammeter is slightly above 30 A.

Adjust the engine speed by gradually decreasing it until the value indicated on the ammeter is 30 A. Take a reading of the value indicated on the voltmeter at this time.

Limit value: 0.3 V or less

NOTE

If the alternator output is too high and the value indicated on the ammeter does not drop to 30 A, take a note of the reading on the voltmeter when the ammeter is at 40 A. The limit value in this case will be 0.4 V.

- (11) If the value indicated on the voltmeter is above the limit value, there is probably a malfunction of the alternator output wire, so check the wiring between the alternator "B" terminal and the battery ⊕ terminal.
If a terminal is not sufficiently tight or if the harness has become discoloured due to overheating, make the necessary repairs and then carry out a repeat test.
- (12) After testing is completed, run the engine at idle.
- (13) Turn off all lights and turn the ignition switch to OFF.
- (14) Disconnect the battery ⊖ cable.
- (15) Disconnect the test ammeter, voltmeter and tachometer.
- (16) Connect the alternator output wire to the alternator "B" terminal.
- (17) Reconnect the battery ⊖ cable.

2. OUTPUT CURRENT TEST

The purpose of this test is to determine whether the amount of current output from the alternator is normal or not.

(1) Before carrying out the output current test, always be sure to check the following.

- Alternator installation
- Battery condition (Refer to GROUP 54 – Battery.)

NOTE

The battery to be used for the current output test should be slightly discharged. The load in a fully-charged battery will be insufficient and it may not be possible to carry out the test correctly.

- Alternator drive belt tension (Refer to GROUP 11 – Engine Adjustment.)
- Fusible link condition
- Abnormal noise from the alternator while the engine is running

(2) Turn the ignition switch to OFF.

(3) Disconnect the battery \ominus cable.

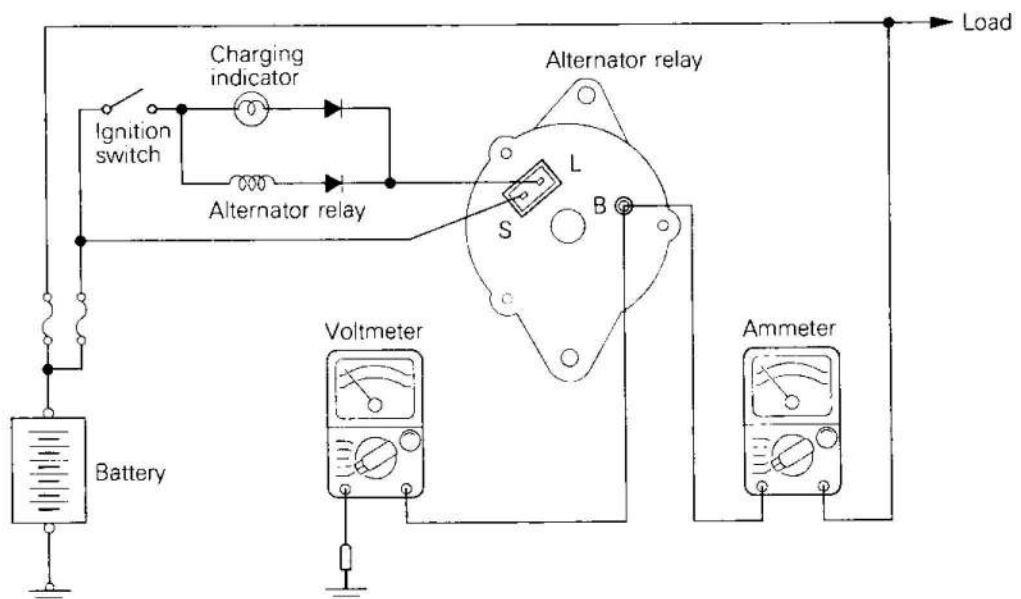
(4) Disconnect the alternator output wire from the alternator "B" terminal, and connect a DC test ammeter with a range of 0–100 A in series between the "B" terminal and the disconnected output wire. (Connect the \oplus lead of the ammeter to the "B" terminal, and then connect the \ominus lead of the ammeter to the disconnected output wire.)

Caution

Because high current will be flowing, all bolts and nuts of the connectors should be securely tightened. Using clips to make the connections should be absolutely avoided.

NOTE

A clamp-type ammeter which enables measurements to be taken without disconnecting the alternator output wire should ideally be used.



- (5) Connect a voltmeter with a range of 0–20 V between the alternator "B" terminal and the earth. (Connect the ⊕ lead of the voltmeter to the "B" terminal, and then connect the ⊖ lead of the voltmeter to a secure earth.)
- (6) Connect a tachometer. (Refer to GROUP 11 – Service Adjustment Procedures.)
- (7) Reconnect the battery ⊖ cable.
- (8) Leave the hood open.
- (9) Check that the reading on the voltmeter is equal to the battery voltage.

NOTE

If the voltage is 0 V, the cause is probably an open circuit in the wire or fusible link between the alternator "B" terminal and the battery ⊕ terminal.

- (10) After turning the light switch on and turning on the headlamps, start the engine.
- (11) Immediately after setting the headlamps to high beam and turning the heater blower switch to HIGH, increase the engine speed to 2500 r/min and take a reading of the maximum output current value indicated on the ammeter.

Limit value: 70% of nominal output current

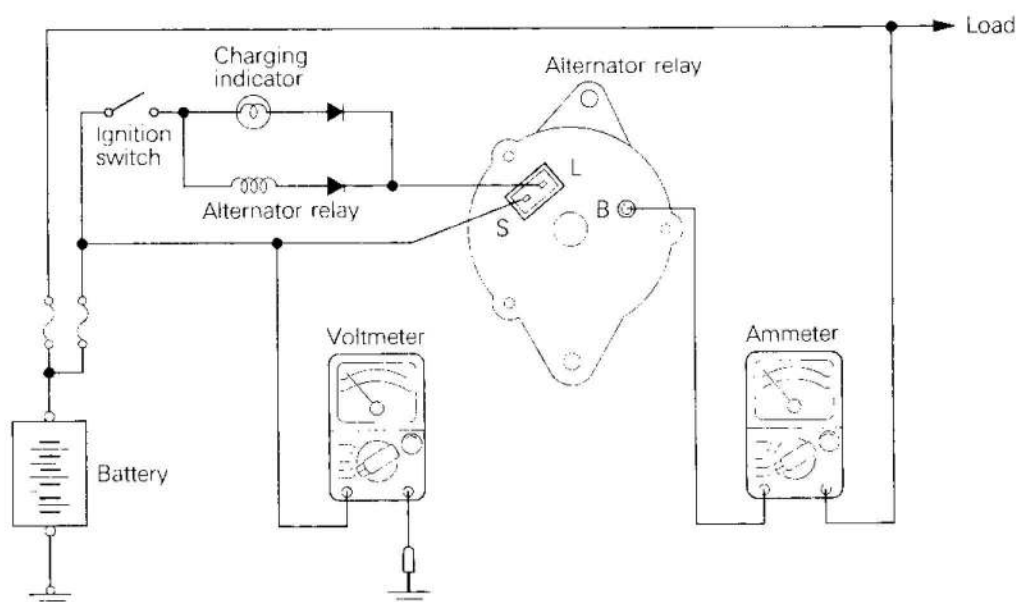
NOTE

- For the nominal output current, refer to GENERAL SPECIFICATIONS.
 - Because the current from the battery will soon drop after the engine is started, the above step should be carried out as quickly as possible in order to obtain the maximum current output value.
 - The current output value will change in accordance with the electrical load and the temperature of the alternator body.
 - If the electrical load is small while the test is being carried out, the required level of current may not be output even though the alternator is normal. In cases such as this, increase the electrical load by leaving the headlamps turned on for some time or by using the lighting system in another vehicle to discharge the battery, and then carry out a repeat test.
 - The required level of current also may not be output if the temperature of the alternator body or the ambient temperature is too high. In such cases as this, cool the alternator and then carry out a repeat test.
- (12) The reading on the ammeter should be above the limit value. If the reading is below the limit value and the alternator output wire is normal, remove the alternator from the engine and check the alternator.
 - (13) After completing the output current test, lower the engine speed to the idle speed.
 - (14) Turn the ignition switch to OFF.
 - (15) Disconnect the battery ⊖ cable.
 - (16) Disconnect the test ammeter, voltmeter and tachometer.
 - (17) Connect the alternator output wire to the alternator "B" terminal.
 - (18) Reconnect the battery ⊖ cable.

3. VOLTAGE REGULATION TEST

The purpose of this test is to determine whether the voltage regulator is correctly controlling the alternator output voltage.

- (1) Before carrying out the voltage regulation test, always be sure to check the following.
 - Alternator installation
 - Check that the battery installed in the vehicle is fully charged. (Refer to GROUP 54 – Battery.)
 - Alternator drive belt tension (Refer to GROUP 00 – Maintenance Service.)
 - Fusible link condition
 - Abnormal noise from the alternator while the engine is running.
- (2) Turn the ignition switch to OFF.
- (3) Disconnect the battery \ominus cable.
- (4) Connect a digital-type voltmeter between the alternator "S" terminal and the earth. (Connect the \oplus lead of the voltmeter to the "S" terminal, and then connect the \ominus lead of the voltmeter to a secure earth.)
- (5) Disconnect the alternator output wire from the alternator "B" terminal.
- (6) Connect a DC test ammeter with a range of 0–100 A in series between the "B" terminal and the disconnected output wire. (Connect the \oplus lead of the ammeter to the "B" terminal, and then connect the \ominus lead of the ammeter to the disconnected output wire.)



6EN0883

- (7) Connect a tachometer. (Refer to GROUP 11 – Service Adjustment Procedures.)
- (8) Reconnect the battery \ominus cable.

- (9) Turn the ignition switch to ON and check that the reading on the voltmeter is equal to the battery voltage.

NOTE

If the voltage is 0 V, the cause is probably an open circuit in the wire or fusible link between the alternator "S" terminal and the battery ⊕ terminal.

- (10) Check that all lights and accessories are off.
 (11) Start the engine.
 (12) Increase the engine speed to 2500 r/min.
 (13) Take a reading of the value indicated on the voltmeter when the current output by the alternator becomes 10 A or less.
 (14) If the voltage reading conforms to the value in the voltage regulation table, then the voltage regulator is operating normally.
 If the voltage is outside the standard value, there is a malfunction of the voltage regulator or of the alternator.

VOLTAGE REGULATION TABLE

Inspection terminal	Voltage regulator ambient temperature [°C (°F)]	Standard value (V)
"S" terminal	-20 (-4)	14.2–15.4
	20 (68)	13.9–14.9
	60 (140)	13.4–14.6
	80 (176)	13.1–14.5

- (15) After completing the test, lower the engine speed to the idle speed.
 (16) Turn the ignition switch to OFF.
 (17) Disconnect the battery ⊖ cable.
 (18) Disconnect the test ammeter, voltmeter and tachometer.
 (19) Connect the alternator output wire to the alternator "B" terminal.
 (20) Connect the battery ⊖ cable.

ALTERNATOR**REMOVAL AND INSTALLATION**

E16BHAA

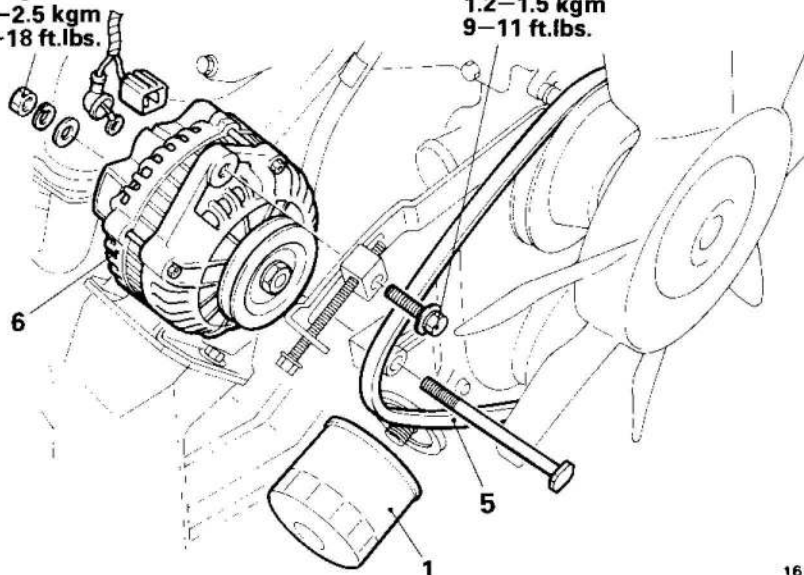
4G33, G33B, 4G32, G63B, 4G63 – 8 valve,
G64B, 4G64 – 8 valve

Removal steps

1. Oil filter
- ◆◆ 5. Alternator drive belt
6. Alternator

20–25 Nm
2.0–2.5 kgm
14–18 ft.lbs.

12–15 Nm
1.2–1.5 kgm
9–11 ft.lbs.

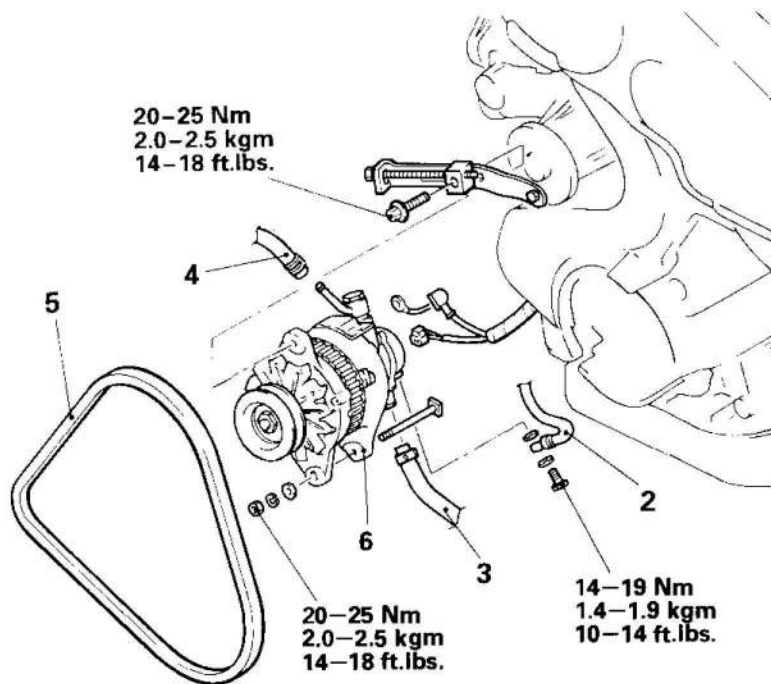


16G0231

4D56 <SINGLE BELT TYPE>**Removal steps**

2. Oil tube connection
3. Oil hose connection
4. Vacuum hose connection
- ◆◆ 5. Alternator drive belt
6. Alternator

20–25 Nm
2.0–2.5 kgm
14–18 ft.lbs.

**NOTE**

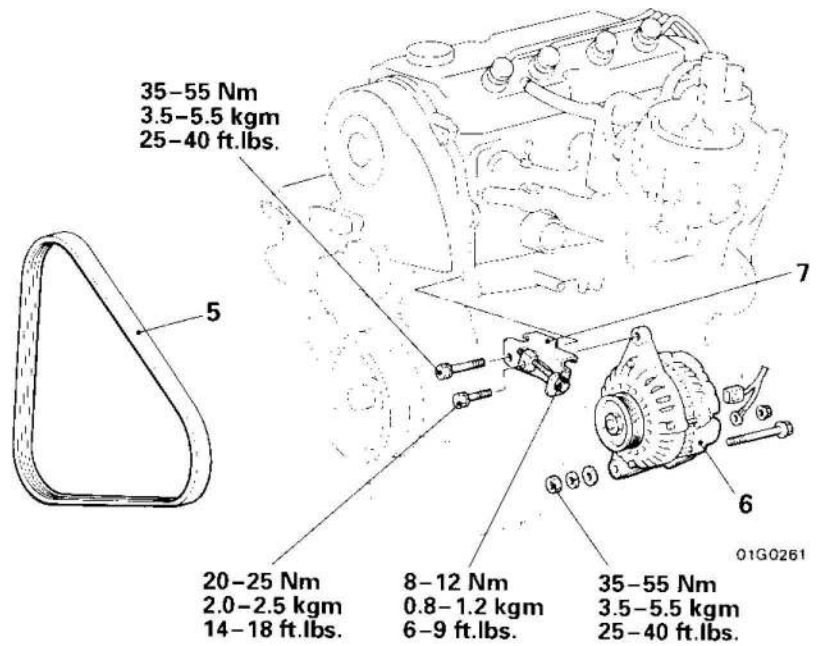
- (1) Reverse the removal procedures to reinstall.
(2) ◆◆: Refer to "Service Points of Installation".

16G0230

4G92

Removal steps

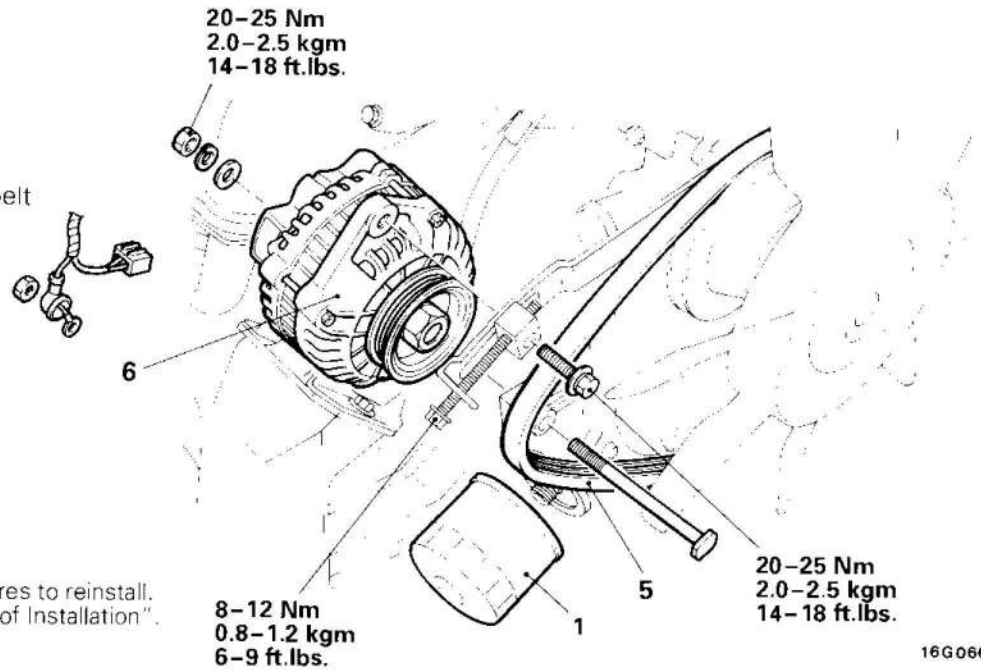
- ◆◆ 5. Alternator drive belt
- 6. Alternator
- 7. Alternator brace



4G63, 4G64 – 16 valve

Removal steps

- 1. Oil filter
- ◆◆ 5. Alternator drive belt
- 6. Alternator



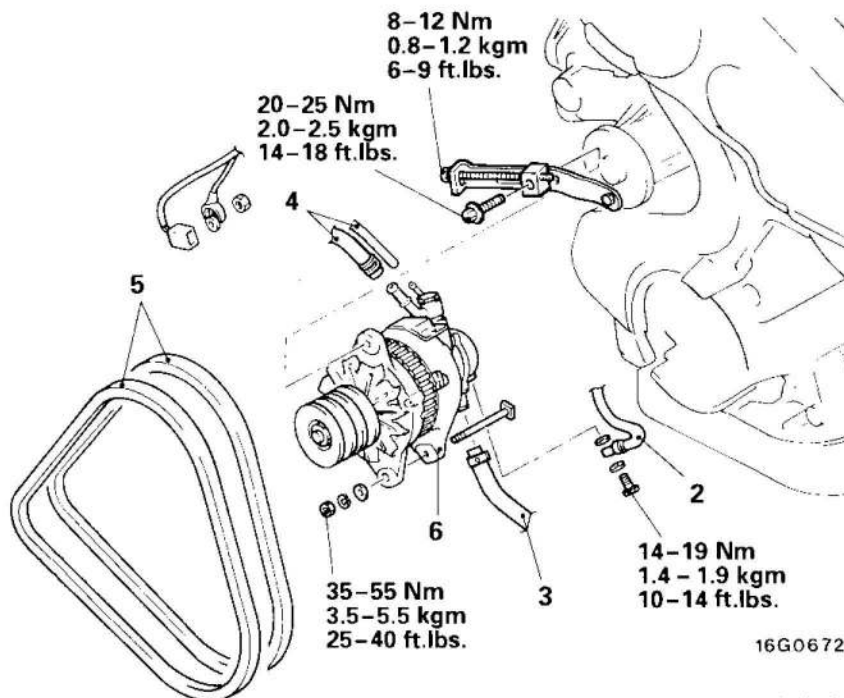
NOTE

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

4D56 – 2WD <DOUBLE BELT TYPE>

Removal steps

- 2. Oil tube connection
- 3. Oil hose connection
- 4. Vacuum hose connection
- ◆◆ 5. Alternator drive belt
- 6. Alternator

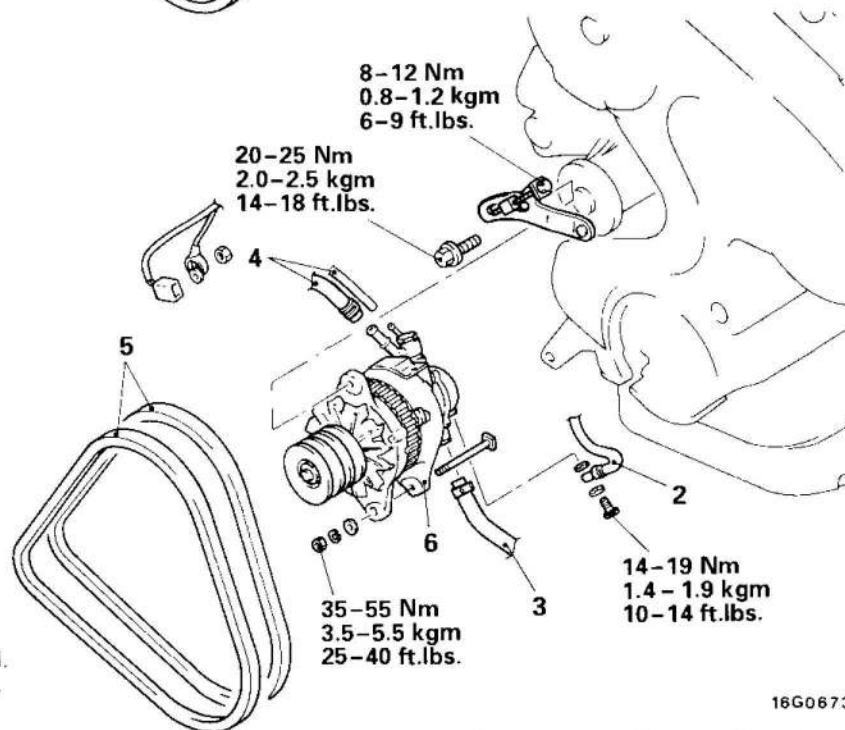


16G0672

4D56 – 4WD <DOUBLE BELT TYPE>

Removal steps

- 2. Oil tube connection
- 3. Oil hose connection
- 4. Vacuum hose connection
- ◆◆ 5. Alternator drive belt
- 6. Alternator



16G0673

NOTE

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

SERVICE POINTS OF INSTALLATION

5. ADJUSTMENT OF ALTERNATOR DRIVE BELT

When adjusting belt tension, refer to GROUP 11 ENGINE—Adjustment of V-belt Deflection.

STARTING SYSTEM

SPECIFICATIONS

GENERAL SPECIFICATIONS

E16CA--

Vehicles for Europe

Items	4G32	4G32 (for cold climate zone) 4G63 4G64 G63B G64B	4G63 (A/T and cold climate zone) 4G64 (for cold climate zone)	4D56	4D56 (for cold climate zone)
Nominal output kW	0.7	0.9	1.2	2.0	2.2

Vehicles for General Export

Items	4G33 4G32	4G33 (for cold climate zone) 4G32 (for cold climate zone) 4G92 4G63 (M/T)	4G63 (M/T for cold climate zone and A/T) 4G64	4D56 (M/T)	4D56 (M/T for cold climate zone and A/T)
Nominal output kW	0.7	0.9	1.2	2.0	2.2

Vehicles for Australia

Items	4G63, 4G64		4D56	
	M/T	A/T	M/T	A/T
Nominal output kW	0.9	1.2	2.0	2.2

TORQUE SPECIFICATIONS

E16CC--

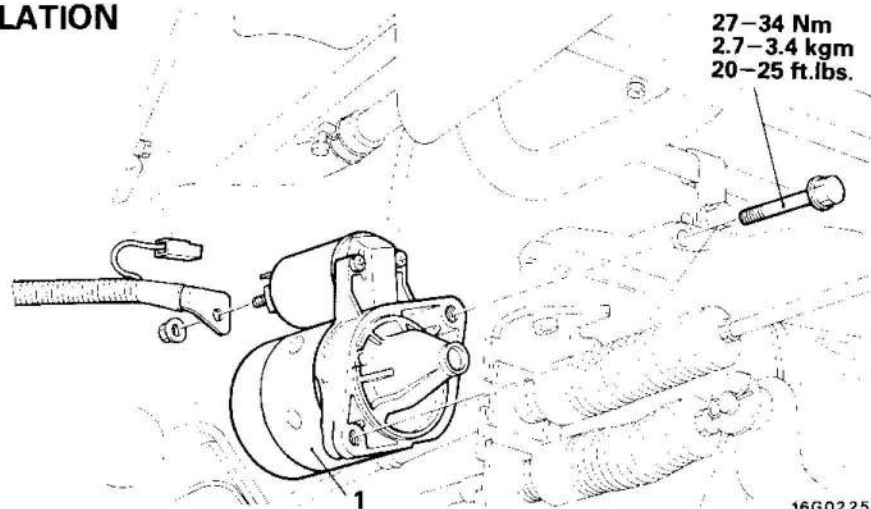
Items	Nm	kgm	ft.lbs.
Starter motor mounting bolts	27-34	2.7-3.4	20-25

STARTER MOTOR

REMOVAL AND INSTALLATION

E16CIAA

1. Starter motor



IGNITION SYSTEM**SPECIFICATIONS****SERVICE SPECIFICATIONS**

E16DB--

Vehicles for Europe

Items		4G32, 4G63 – 8 valve	4G63 – 8 valve (non- leaded pet- rol-powered vehicle), G63B	4G63 – 16 valve (Carburettor)	4G63 – 16 valve (MPI)	4G64, G64B
Standard value						
Ignition coil						
Resistance of built-out resistor	Ω	1.22–1.49	1.22–1.49	–	–	–
Primary coil resistance	Ω	1.08–1.32	1.08–1.32	1.08–1.32	0.67–0.81	0.72–0.88
Secondary coil resistance	kΩ	12.75–17.25	22.1–29.9	22.1–29.9	11.3–15.3	10.29–13.92
No. 1 cylinder TDC sensor						
Output voltage	V	–	–	–	–	0.2–1.2
Crank angle sensor						
Output voltage	V	–	–	–	–	1.8–2.5

Vehicles for General Export

Items		4G32, 4G33, 4G63 – 8 valve	4G63 – 16 valve (Carburettor), 4G92	4G63 – 16 valve (MPI)
Standard value				
Ignition coil				
Resistance of built-out resistor	Ω	1.35–1.65	–	–
Primary coil resistance	Ω	1.17–1.43	1.08–1.32	0.67–0.81
Secondary coil resistance	kΩ	11.05–14.95	22.1–29.9	11.3–15.3

Vehicles for Hong Kong

Items		4G33	4G92	4G64
Standard value				
Ignition coil				
Resistance of built-out resistor	Ω	1.22–1.49	–	–
Primary coil resistance	Ω	1.08–1.32	1.08–1.32	0.72–0.88
Secondary coil resistance	kΩ	12.75–17.25	22.1–29.9	10.29–13.92
No. 1 cylinder TDC sensor				
Output voltage	V	–	–	0.2–1.2
Crank angle sensor				
Output voltage	V	–	–	1.8–2.5

Vehicles for Australia

Items		4G63 - 8 valve	4G63 - 16 valve	4G64 - 8 valve	4G64 - 16 valve
Standard value					
Ignition coil					
Resistance of built-out resistor	Ω	1.22-1.49	-	-	-
Primary coil resistance	Ω	1.08-1.32	1.08-1.32	0.72-0.88	0.67-0.81
Secondary coil resistance	k Ω	12.75-17.25	22.1-29.9	10.29-13.92	11.3-15.3
No. 1 cylinder TDC sensor					
Output voltage	V	-	-	0.2-1.2	-
Crank angle sensor					
Output voltage	V	-	-	1.8-2.5	-

TORQUE SPECIFICATIONS

E16DC--

Items	Nm	kgm	ft.lbs.
Distributor mounting nut	10-13	1.0-1.3	7-9
Water outlet fitting attaching bolt	17-20	1.7-2.0	12-14
Timing belt upper cover attaching bolt			
4G92	8-12	0.8-1.2	6-9
4G63, 4G64	10-12	1.0-1.2	7-9
Distributor attaching bolt	10-15	1.0-1.5	7-11
Distributor bracket attaching bolt			
M6	4-6	0.4-0.6	3-4
M8	19-28	1.9-2.8	14-20
Camshaft sprocket spacer attaching bolt	8-12	0.8-1.2	6-9

LUBRICANTS

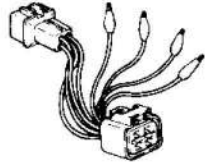
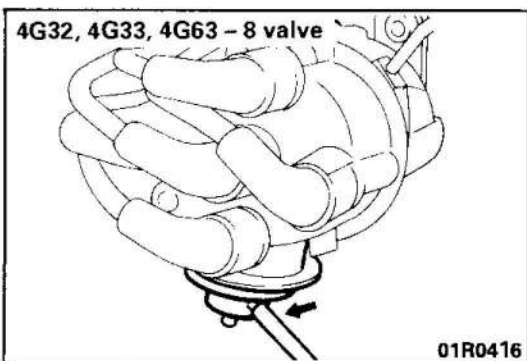
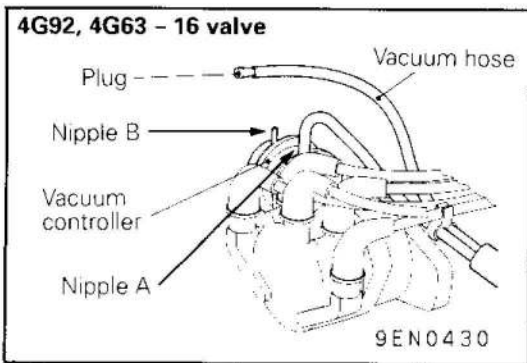
Items	Specified lubricant	Quantity
Distributor coupling	Multipurpose grease SAE J310, NLGI No. 3	2g

NOTE

SPECIAL TOOLS

E16DF--

Tool (Number and name)	Use
MD998464 Harness connector (4P, square)	Crank angle sensor check

SERVICE ADJUSTMENT PROCEDURES

INSPECTION OF CENTRIFUGAL TIMING CONTROL DEVICE

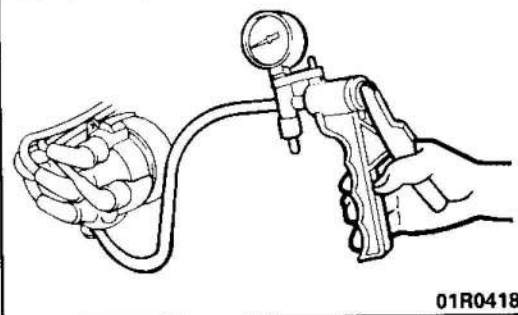
E16DGAA

- (1) Connect a timing light.
- (2) Disconnect the vacuum hose from nipple (B) of the vacuum controller and plug the hose. <Dual diaphragm type only>
- (3) Start engine and run at idle.
- (4) Remove vacuum hose from vacuum controller.
- (5) Increase engine speed gradually and check advance.
It is normal if advances smoothly according with increased speed.

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

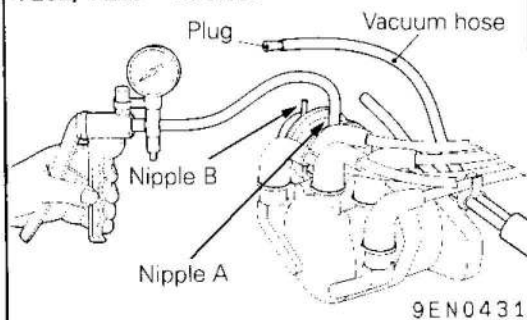
- (6) For the above symptoms, disassemble distributor and check.

4G32, 4G33, 4G63 – 8 valve, G63B



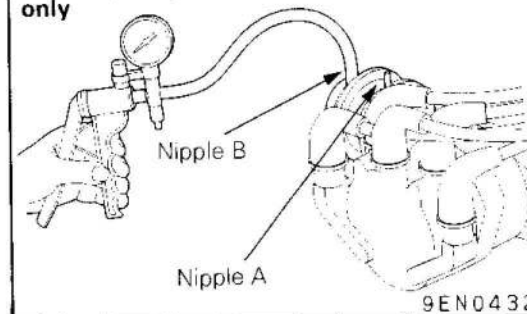
01R0418

4G92, 4G63 – 16 valve



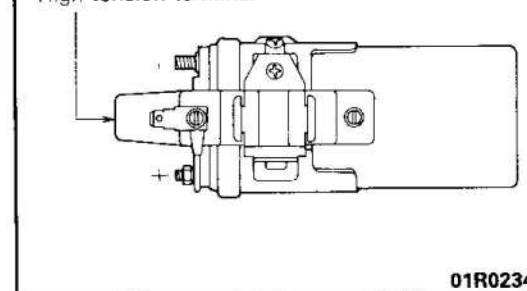
9EN0431

Dual diaphragm type only



9EN0432

High tension terminal



01R0234

INSPECTION OF VACUUM TIMING CONTROL DEVICE

- (1) Connect a timing light.
- (2) Disconnect the vacuum hose from nipple (B) of the vacuum controller and plug the hose. <Dual diaphragm type only>
- (3) Start engine and run at idle.
- (4) Remove vacuum hose from vacuum controller. Connect vacuum pump to nipple.
- (5) <Dual diaphragm type only>
Connect the vacuum hose to nipple (B) of the vacuum controller and check the advance angle when the negative pressure indicated in the table below is applied.

	Negative pressure	Advance angle
4G92	Approx. 250 mmHg (9.8 in.Hg)	Approx. 10°
4G63	Approx. 90 mmHg (3.5 in.Hg)	Approx. 8°

- (6) Add vacuum on vacuum pump gradually and check advance. It is normal if advancing smoothly with increased negative pressure.

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

- (7) For the above symptoms, disassemble distributor and check.

INSPECTION OF IGNITION COIL

With ohmmeter, check that the resistance of the built-out resistor, the primary coil resistance (between ignition coil (+) and (-) terminals), and the secondary coil resistance (between ignition coil (+) terminal and high tension terminal) are within the standard value.

Standard value:

Vehicles for Europe (4G32, 4G63 – 8 valve, G63B)

Vehicles for Hong Kong built from July 1991

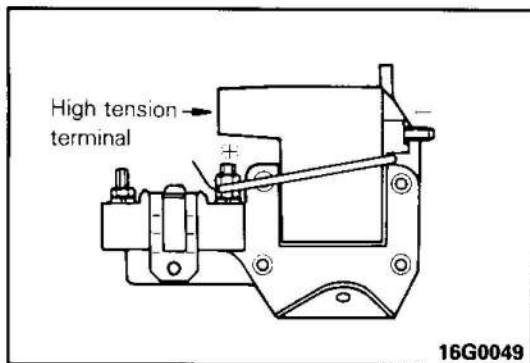
(4G33)

Vehicles for Australia (4G63 – 8 valve)

Built-out resistor	1.22–1.49 Ω
Primary coil	1.08–1.32 Ω
Secondary coil	12.75–17.25 kΩ

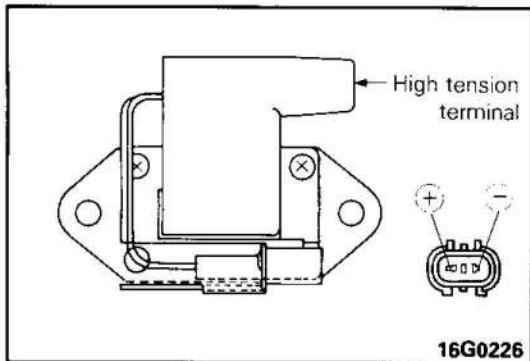
Vehicles for General Export (4G32, 4G33, 4G63 – 8 valve)

Built-out resistor	1.35–1.65 Ω
Primary coil	1.17–1.43 Ω
Secondary coil	11.05–14.95 kΩ



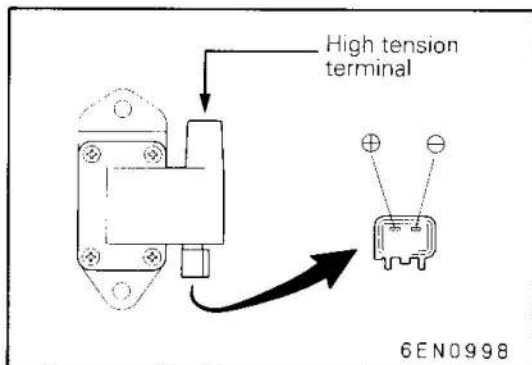
Vehicles for Europe [4G63 – 8 valve
(nonleaded petrol-powered vehicle)]

Built-out resistor	1.22–1.49 Ω
Primary coil	1.08–1.32 Ω
Secondary coil	22.1–29.9 k Ω



4G64 – 8 valve and G64B engine

Primary coil	0.72–0.88 Ω
Secondary coil	10.29–13.92 k Ω

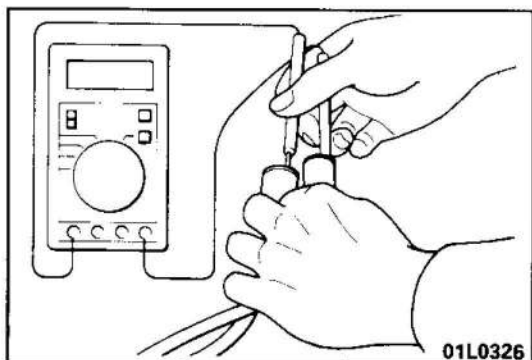


4G63 – 16 valve (Carburettor), 4G92

Primary coil	1.08–1.32 Ω
Secondary coil	22.1–29.9 k Ω

4G63 – 16 valve (MPI), 4G64 – 16 valve

Primary coil	0.67–0.81 Ω
Secondary coil	11.3–15.3 k Ω

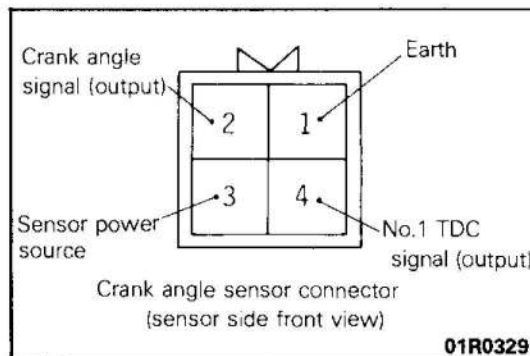
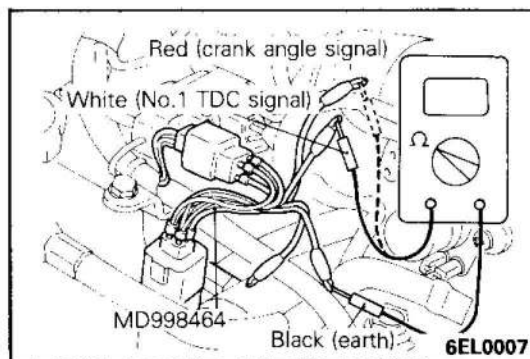
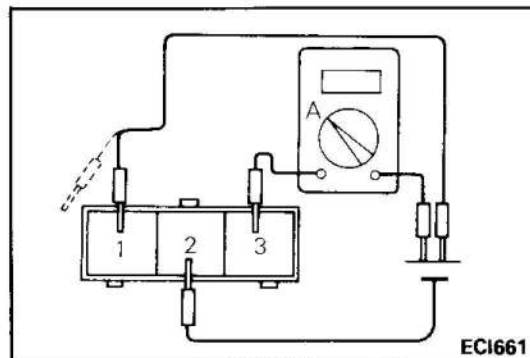
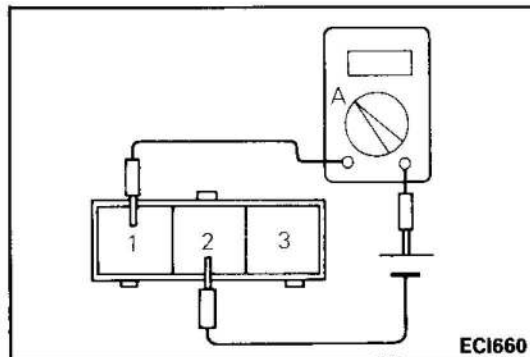
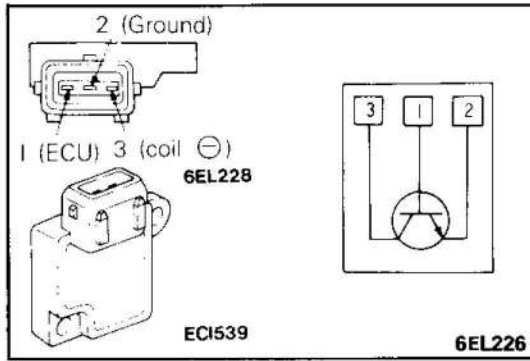


INSPECTION OF RESISTIVE CODE

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

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

Limit: Max. 22 k Ω



INSPECTION OF POWER TRANSISTOR

- (1) Detach the power transistor connector.
- (2) Check to be sure that electricity flows when a voltage of 1.5 V (one dry cell) is applied between power transistor terminals ①-②.
- (3) Check whether or not electricity flows when a voltage of 1.5 V (one dry cell) is applied between power transistor terminals ③-②.

Terminal ① voltage	Between terminals ③-②
When applied (solid line)	Electricity flows
When discontinued (broken line)	No electricity flows

INSPECTION OF CRANK ANGLE SENSOR

1. Disconnect crank angle sensor connector.
2. Connect special tool (harness connector) between disconnected connectors.
3. Measure the output voltage between terminal 2 and 1 (crank angle signal), and 4 and 1 (No.1 TDC signal) when engine is cranking.

Standard value:

- 2 (red, crank angle signal) – 1 (black, earth) **1.8–2.5 V**
- 4 (white, No.1 TDC signal) – 1 (black, earth) **0.2–1.2 V (needle runout)**

4. When using oscilloscope, connect same as 3. Check output waveform and voltage.

Standard value: 5 V **0**

5. If not within the standard value, check sensor power source and earth circuit. When they are normal, disassemble distributor and check.

DISTRIBUTOR

<Vehicles built up to May 1994>

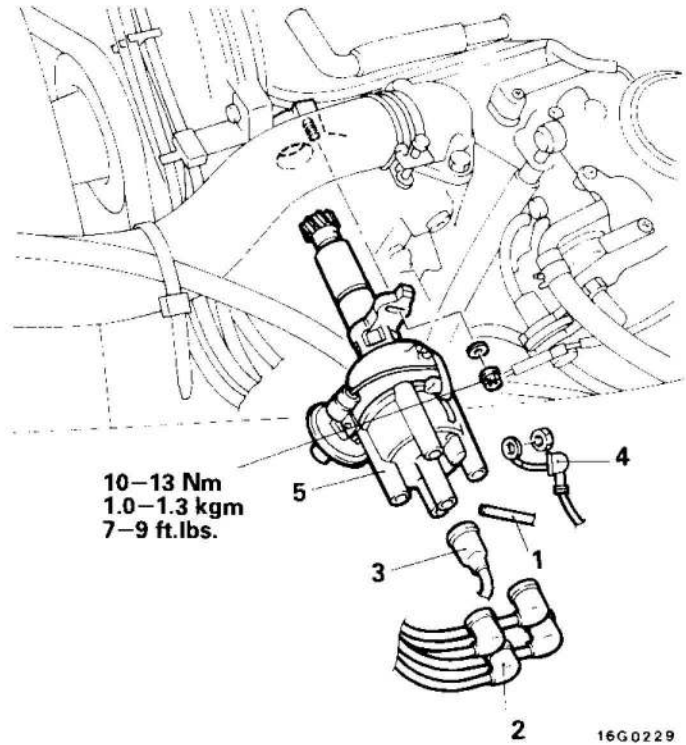
REMOVAL AND INSTALLATION CONVENTIONAL CARBURETTOR AND F.B.C.

Post-installation Operation

- Adjustment of ignition timing
(Refer to GROUP 11 ENGINE –
Service Adjustment Procedures)

Removal steps

1. Vacuum hose connection
2. Spark plug cable connection
3. High tension cable connection
4. Connector connection
- ◆◆ 5. Distributor



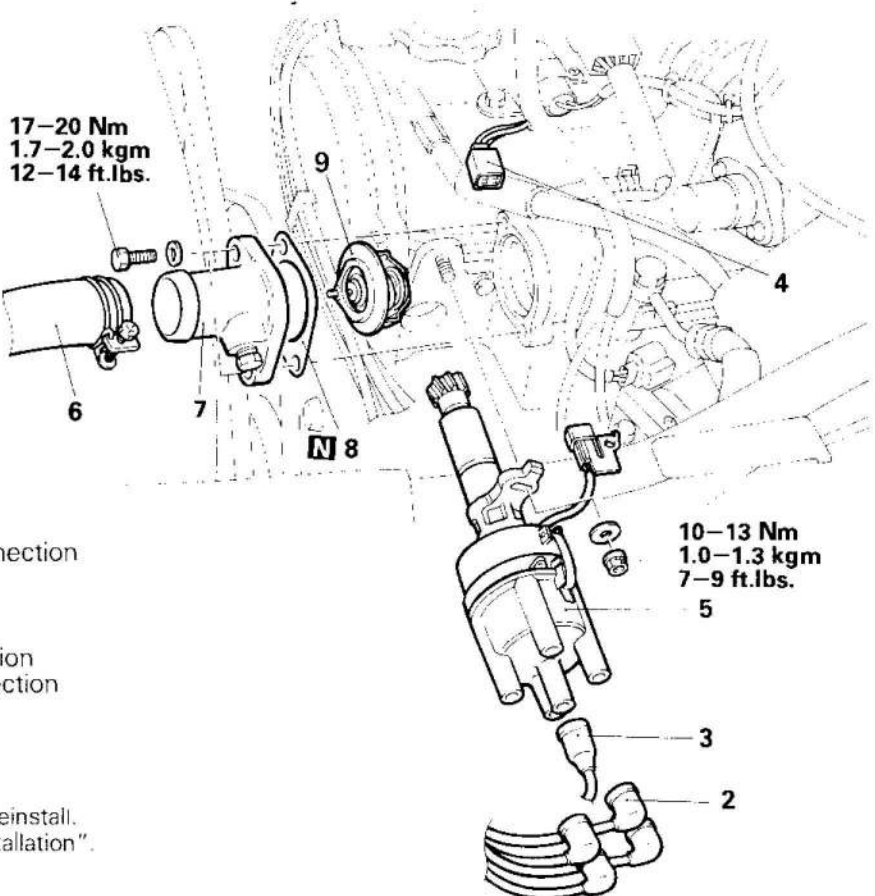
M.P.I.

Pre-removal Operation

- Drainage of coolant

Post-installation Operation

- Filling of coolant
- Adjustment of ignition timing
(Refer to GROUP 11 ENGINE –
Service Adjustment Procedures)

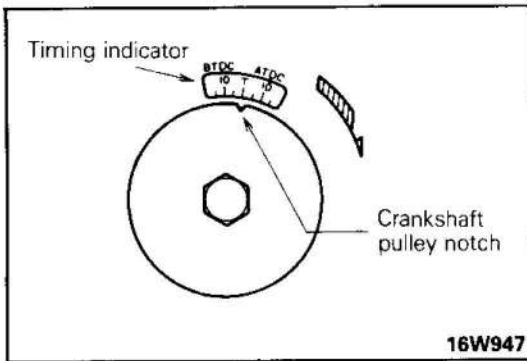


Removal steps

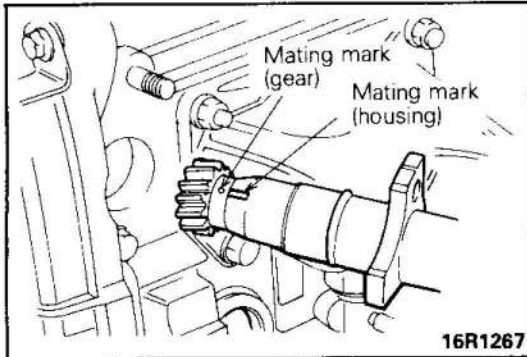
6. Radiator upper hose connection
7. Water outlet fitting
8. Gasket
9. Thermostat
2. Spark plug cable connection
3. High tension cable connection
4. Connector connection
- ◆◆ 5. Distributor

NOTE

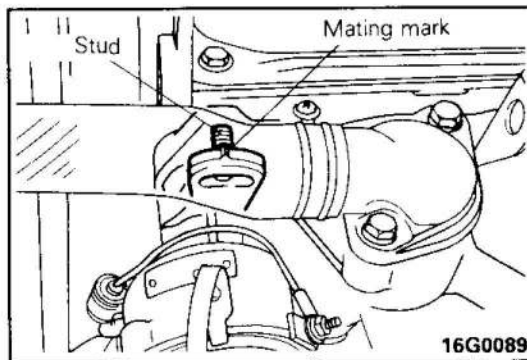
- (1) Reverse the removal procedures to reinstall.
- (2) ◆◆: Refer to "Service Points of Installation".

**SERVICE POINTS OF INSTALLATION****5. INSTALLATION OF DISTRIBUTOR**

- (1) Rotate crankshaft and match crankshaft pulley notch and timing indicator "T" mark.
- (2) Check that No.1 cylinder is at the compression dead point. (Refer to GROUP 11 ENGINE—Engine Inspection)



- (3) Match mating marks on distributor housing and gear.



- (4) Match mating mark on distributor flange to the center of distributor stud, install to engine.

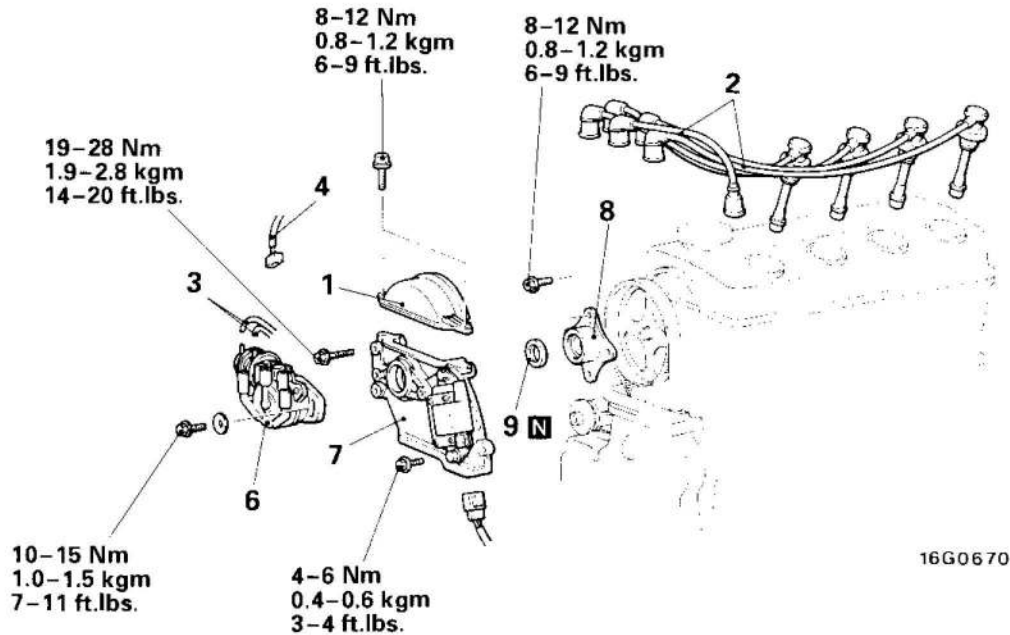
<Vehicles built from June 1994>

REMOVAL AND INSTALLATION

Post-installation Operation

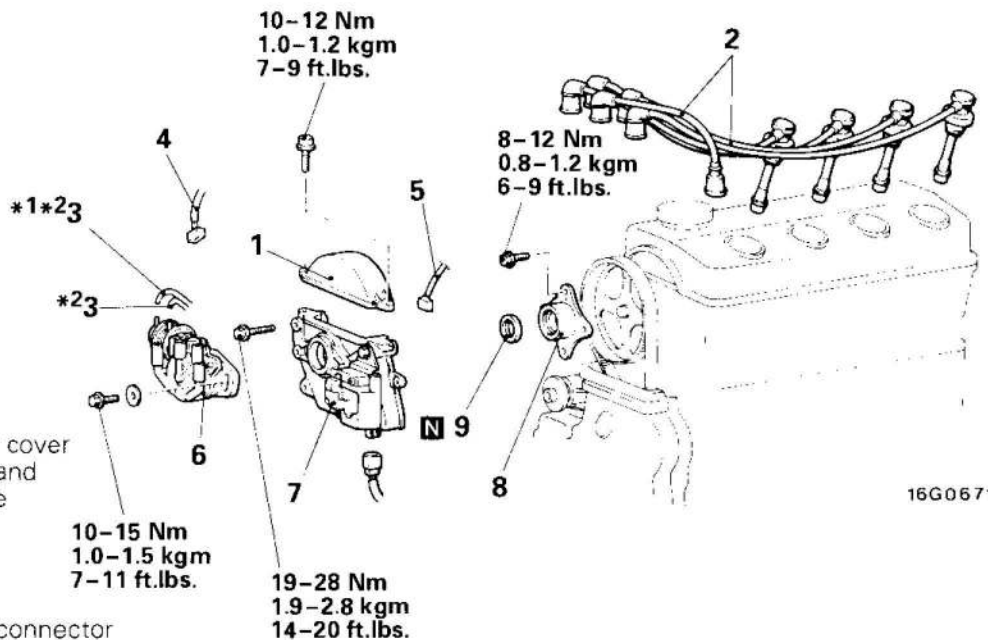
- Adjustment of ignition timing
(Refer to GROUP 11 ENGINE – Service Adjustment Procedures.)

4G92



16G0670

4G63, 4G64



16G0671

Removal steps

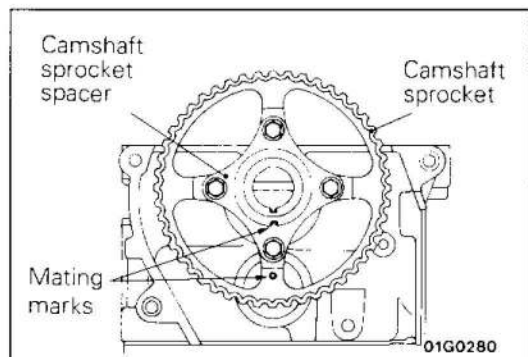
1. Timing belt upper cover
2. Spark plug cable and high-tension cable
3. Vacuum hose connection
4. Distributor connector
5. Power transistor connector <MPI>
- ◆◆ 6. Distributor assembly
- ◆◆ 7. Distributor bracket
- ◆◆ 8. Camshaft sprocket sensor
- ◆◆ 9. Oil seal

NOTE

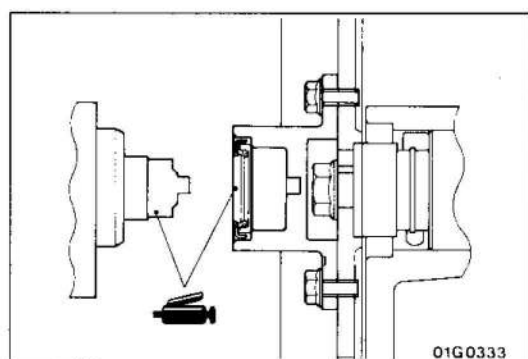
- (1) Reverse the removal procedures to reinstall.
- (2) ◆◆ : Refer to "Service Points of Installation".
- (3) *1: Vehicles with high altitude compensation system
- (4) *2: Vehicles without MPI

SERVICE POINTS OF INSTALLATION**9. INSTALLATION OF OIL SEAL**

Use a box wrench or similar tool to tap in the oil seal until it is flush with the camshaft sprocket spacer.

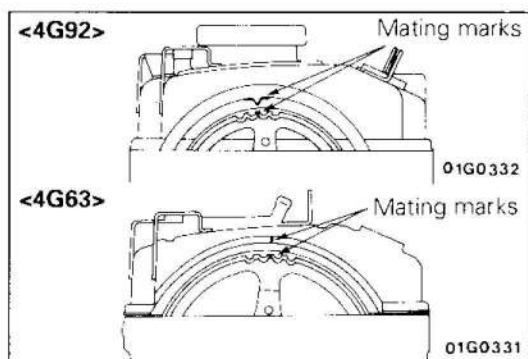
**8. INSTALLATION OF CAMSHAFT SPROCKET SPACER**

Install so that the mating marks on the camshaft sprocket spacer and the camshaft sprocket are aligned as shown in the illustration.

**6. INSTALLATION OF DISTRIBUTOR ASSEMBLY**

(1) Apply 2 g of grease in the places shown in the illustration.

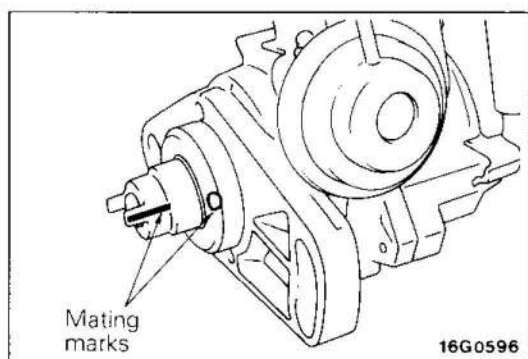
Specified grease: Multipurpose grease SAE J310, NGLI No. 3



(2) Turn the crankshaft clockwise to set the No. 1 cylinder to the compression top dead centre position.

NOTE

If the mating marks on the camshaft sprocket and rocker cover are aligned, the cylinder will be at the compression top dead centre position.



(3) Align the mating marks on the distributor housing and the coupling.

(4) Install the distributor to the engine while aligning the stud bolt fixing the distributor with the slot in the distributor mounting flange.

GLOW SYSTEM

SPECIFICATIONS

SERVICE SPECIFICATIONS

E16EB--

Items		Standard value
Engine coolant temperature sensor resistance [at 20°C (68°F)]	kΩ	2.92–3.58
Dropping resistance [at 20°C (68°F)] – Super quick glow system	mΩ	150
Glow plug resistance [at 20°C (68°F)]	mΩ	
Automatic glow plug		250
Super quick glow plug		235
Self-regulating glow system		
Metal		1000
Ceramic		500

TORQUE SPECIFICATIONS

E16EC--

Items	Nm	kgm	ft.lbs
Water temperature sensor	8–10	0.8–1.0	6–7
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	Remarks
Engine coolant temperature sensor	3M Nut Locking Part No.4171 or equivalent	Drying sealant

SERVICE ADJUSTMENT PROCEDURES

INSPECTION OF GLOW SYSTEM OPERATION

E16EGAA

AUTO GLOW SYSTEM

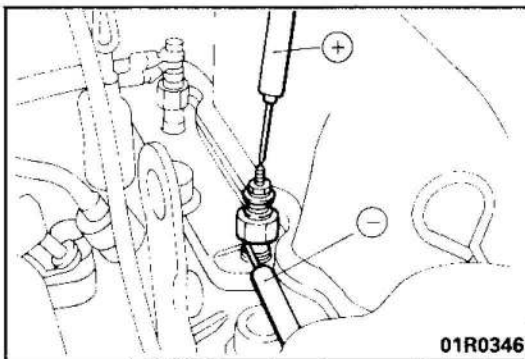
Conditions before inspection:

- Battery voltage: 12V
- (1) Connect voltmeter between glow plug plate and plug body (earth).
 - (2) Check indicated value on voltmeter with ignition switch ON.
 - (3) Check that preheat indication lamp lights for about 6 seconds and indicates battery voltage (about 9V or over) for about 36 seconds immediately after ignition switch is turned on. [At cooling water temperature 20°C (68°F)]

NOTE

Continuity time varies depending upon cooling water temperature.

- (4) After checking (3), set ignition switch at START position.
- (5) The system is normal if battery voltage (about 9V or over) is generated for about 6 seconds during engine cranking and after start operation. [at cooling water temperature 20°C (68°F)]
- (6) When the voltage or continuity time is not normal, check the terminal voltage in glow control unit, and single parts.



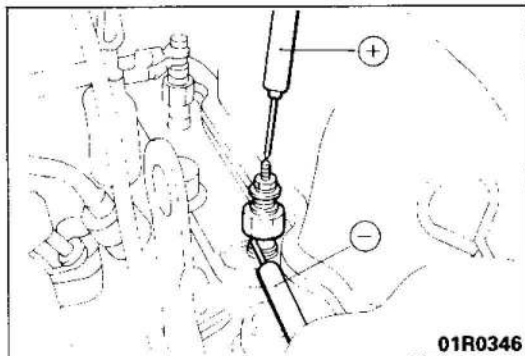
SUPER QUICK GLOW SYSTEM

Conditions before inspection:

- Battery voltage: 12V
- Cooling water temperature: 30°C (86°F) or under. (Or disconnect water temperature sensor connector)

Caution

When water temperature sensor is disconnected, reconnect after inspection.

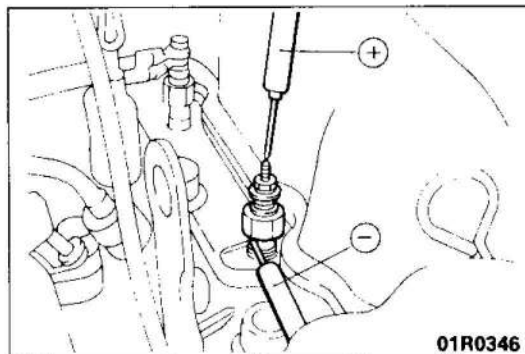


- (1) Connect voltmeter between glow plug plate and plug body (earth).
- (2) Check indicated value on voltmeter when ignition switch is turned ON.
- (3) Check that battery voltage (about 9V or over) is indicated for about 3 seconds (when glow plug is cool) immediately after ignition switch is turned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

NOTE

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

- (4) After checking above, set ignition switch at START position.
- (5) The system is normal when battery voltage [approximately 9V (4V or higher for vehicles without turbocharger for Switzerland built from November, 1990)] is generated for about 30 seconds (150 seconds for vehicles without turbocharger for Switzerland built from November, 1990) during engine cranking and after operation.
- (6) When the voltage or continuity time is abnormal, check terminal voltage in glow control unit or single parts to determine defective parts.

**SELF-REGULATING GLOW SYSTEM**

Conditions before inspection:

- Battery voltage: 12V
- (1) Connect voltmeter between glow plug plate and plug body (earth).
 - (2) Check indicated value on voltmeter with ignition switch ON.
 - (3) Immediately after the ignition switch is turned ON, if the glow indicator lamp illuminates after approximately 11 seconds (for metal type) or after approximately 7 seconds (for ceramic type) and if battery voltage is indicated after approximately 4 seconds (for metal type) or after 1.5 seconds (for ceramic type), then the system is normal [when engine coolant temperature is 20°C (68°F)].

NOTE

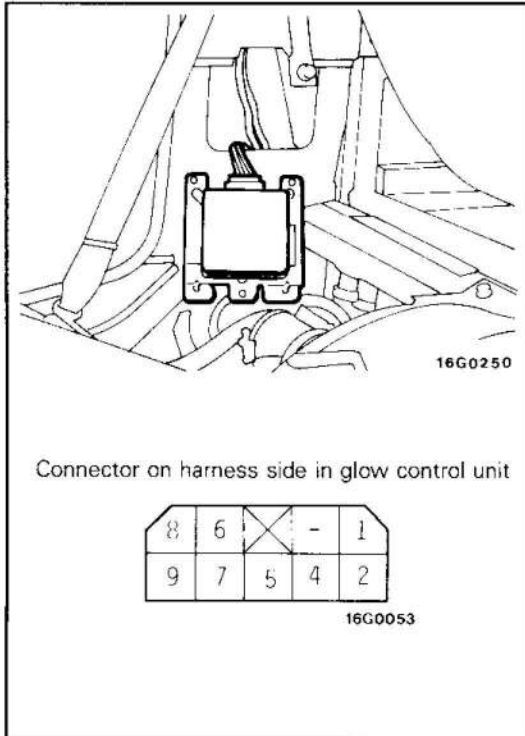
Continuity time varies depending upon cooling water temperature.

- (4) After checking (3), set ignition switch at START position.
- (5) While the engine is cranking or after the engine is started, if battery voltage is generated for approximately 30 seconds (for metal type) or for 180 seconds (for ceramic type), then the system is normal [when engine coolant temperature is 20° (68°F)].

NOTE

The afterglow operates when the engine coolant temperature is 60°C (140°F) or less. In addition, the afterglow stops once the engine coolant temperature rises above 60°C (140°F).

- (6) When the voltage or continuity time is not normal, check the terminal voltage in glow control unit, and single parts.



**INSPECTION OF GLOW CONTROL UNIT
AUTO GLOW SYSTEM**

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

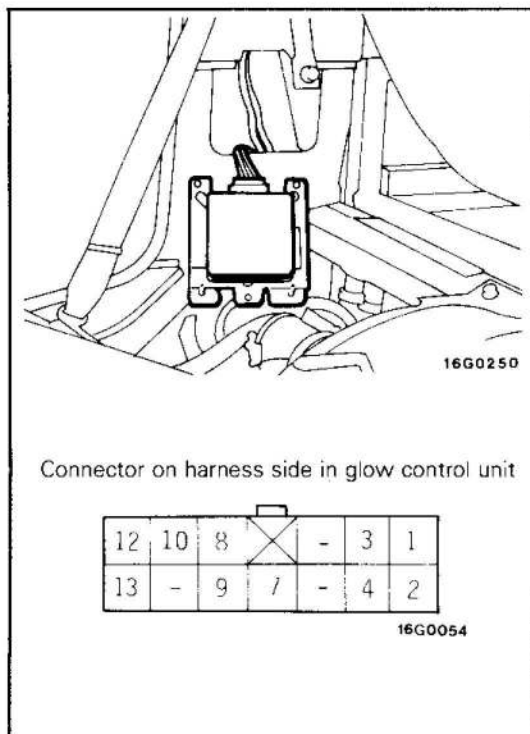
NOTES

(1) Check with glow control unit connector connected.

Terminal	Connect area or measuring part	Measuring item	Tester connection	Check conditions	Standard value
2	Glow plug relay	Voltage	2-earth	Ignition switch ON	Indicates battery voltage for about 30 seconds after ON.

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

Terminal	Connect area or measuring part	Measuring item	Tester connection	Check condition	Standard value
1	Ignition switch (IG ¹ power source)	Voltage	1-earth	Ignition switch ON	Battery voltage
2	Glow plug relay coil	Resistance	2-earth	Constantly	About 20 Ω [at 20° (68°F)]
3	Vacant terminal	—	—	—	—
4	Ignition switch	Voltage	4-earth	During engine cranking	Battery voltage
5	Control unit earth	Continuity	5-earth	Constantly	Continuity
6	Preheat indication lamp	Voltage	6-earth	Constantly	Battery voltage
7	Start indication lamp	Voltage	7-earth	Constantly	Battery voltage
8	Alternator L terminal	Voltage	8-earth	Ignition switch ON	1-4 V
9	Water temperature sensor	Resistance	9-earth	-20°C (-4°F)	24.8±2.5 kΩ
				0°C (32°F)	8.6 kΩ
				20°C (68°F)	3.3 kΩ
				40°C (104°F)	1.5 kΩ



SUPER QUICK GLOW SYSTEM

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

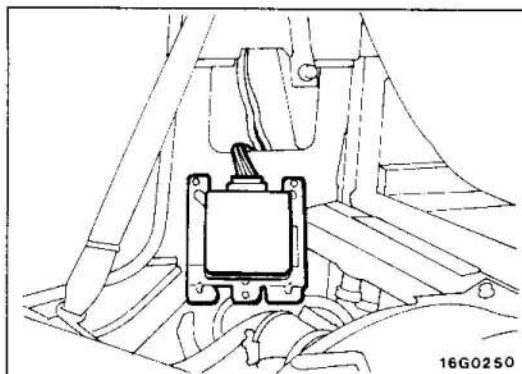
(1) Check with glow control unit connector connected.

Terminal	Connect area or measuring part	Measuring item	Tester connection	Check conditions	Standard value
2	Glow plug relay (1)	Voltage	2-earth	Ignition switch OFF ON (when glow plug is cool)	Indicates battery voltage for about 3 seconds after ON.
4	Glow plug relay (2)	Voltage	4-earth	Ignition switch OFF ON (when glow plug is cool)	Indicates battery voltage for about 3 seconds after ON.
				During engine cranking	About 8–10 battery voltage

* Read voltage measurement quickly.

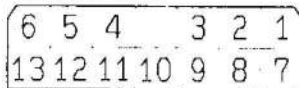
(2) Remove glow control unit connector. Check with harness side connector.

Terminal	Connect area or measuring part	Measuring item	Tester connection	Check condition	Standard value
1	Ignition switch (IG ¹ power source)	Voltage	1-earth	Ignition switch ON	Battery voltage (about 12 V)
2	Glow plug relay (1) coil	Resistance	2-earth	Constantly	About 20 Ω [at 20° (68°F)]
3	Ignition switch (ST power source)	Voltage	3-earth	During engine cranking	Battery voltage (8–10 V)
4	Glow plug relay (2) coil	Resistance	4-earth	Constantly	About 20 Ω [at 20°C (68°F)]
5	Vacant terminal	–	–	–	–
6	Vacant terminal	–	–	–	–
7	Glow plug (Terminal voltage measuring)	Continuity	7-earth	Constantly	Continuity (0 Ω)
8			8–10		
9			9-earth		
10			8-earth	Constantly [at 20°C (68°F)]	Continuity (about 50 mΩ)
11	Vacant terminal	–	–	–	–
12	Alternator L terminal	Voltage	12-earth	Ignition switch ON	1–4 V
13	Water 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)	3.3 kΩ
				40°C (104°F)	1.5 kΩ

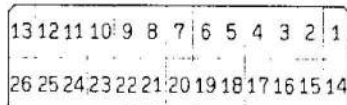


Connector on harness side in glow control unit

Vehicles without EGR



Vehicles with EGR



DEN0067

SELF-REGULATING GLOW SYSTEM

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

(1) Check with glow control unit connector connected.

Terminal	Connect area or measuring part	Measuring item	Tester connection	Check conditions	Standard value
7 14*	Glow plug relay	Voltage	7 – earth 14 – earth*	Ignition switch ON	Immediately after the ignition switch is turned ON, battery voltage is indicated for approximately 11 seconds (for metal type) or 7 seconds (for ceramic type)

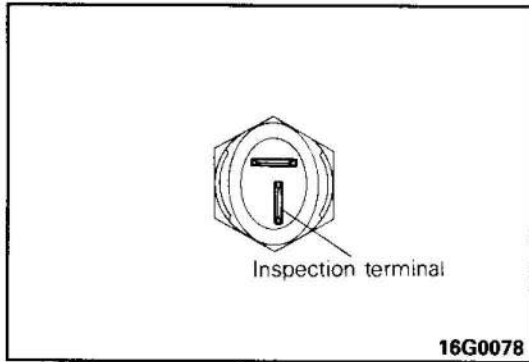
(2) Remove glow control unit connector. Check with harness side connector.

Terminal	Connect area or measuring part	Measuring item	Tester connection	Check conditions	Standard value
1	Ignition switch (IG1 power source)	Voltage	1 – earth	Ignition switch ON	Battery voltage
13 5*	Water temperature sensor	Resistance	13 – earth 5 – earth*	-20°C (-4°F)	24.8 ± 2.5 kΩ
				0°C (32°F)	8.6 kΩ
				20°C (68°F)	3.3 kΩ
				40°C (104°F)	1.5 kΩ
2 12*	Ignition switch	Voltage	2 – earth 12 – earth*	During engine cranking	Battery voltage
10 13 or 26*	Control unit earth	Continuity	10 – earth 13 or 26 – earth*	Constantly	Continuity
7 14*	Glow plug relay coil	Resistance	7 – earth 14 – earth*	Constantly	About 20Ω [at 20°C (68°F)]
3 17*	Preheat indication lamp	Voltage	3 – earth 17 – earth*	Constantly	Battery voltage
6 23*	Alternator L terminal	Voltage	6 – earth 23 – earth*	Ignition switch ON	1 – 4V

NOTE

* Vehicles with EGR

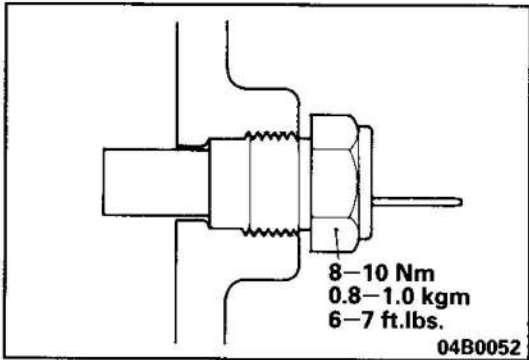
NOTES



INSPECTION OF WATER TEMPERATURE SENSOR

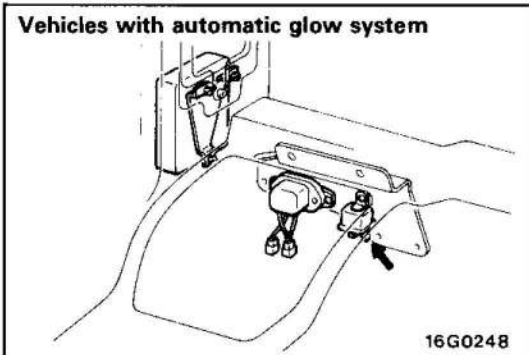
- (1) Remove water temperature sensor from intake manifold.
- (2) Check that water temperature sensor resistance is within the standard value.

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



- (3) After checking, apply specified sealant to engine coolant temperature sensor screw area to install intake manifold.

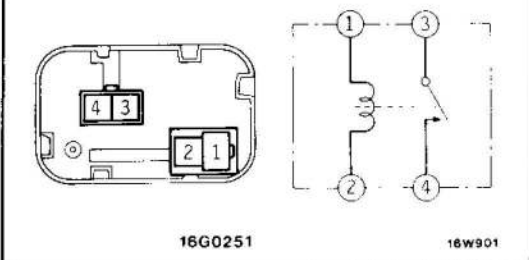
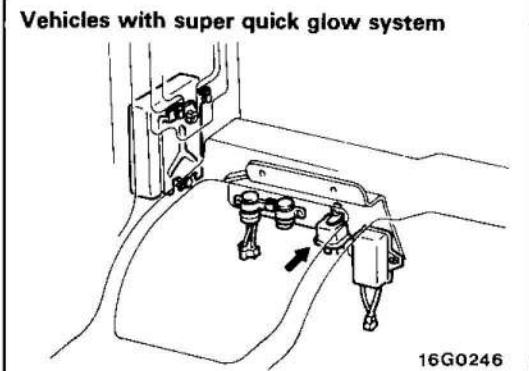
Specified sealant: 3M Nut Locking Part No.4171 or equivalent

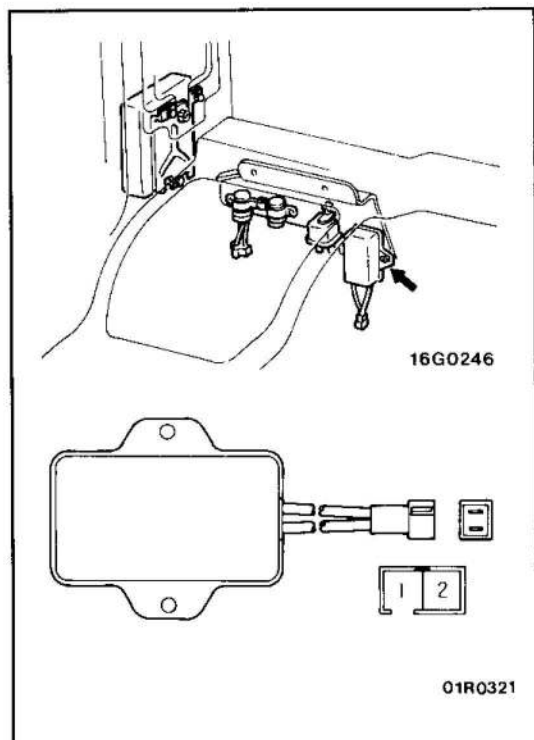


INSPECTION OF STARTER RELAY

- (1) Remove starter relay from relay bracket.
- (2) Connect battery power source to terminal ①. Check continuity between 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

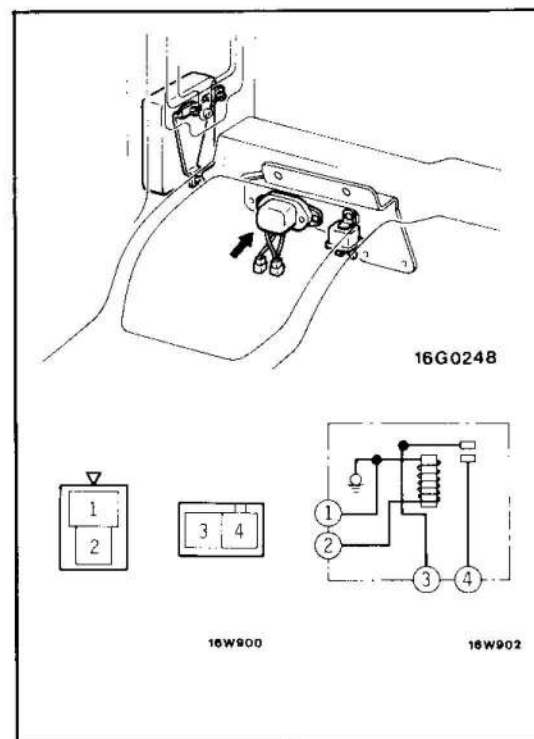




INSPECTION OF DROPPING RESISTOR—SUPER QUICK GLOW SYSTEM

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

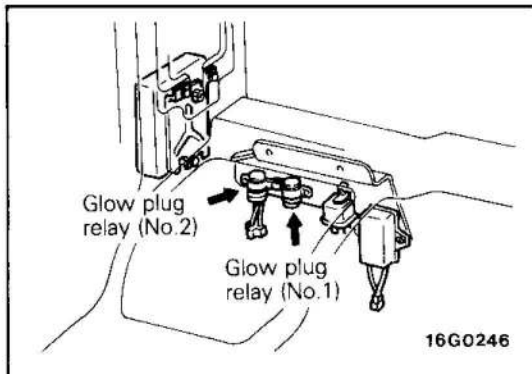
Standard value: 150 mΩ



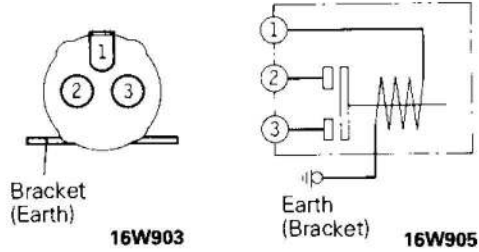
**INSPECTION OF GLOW PLUG RELAY
AUTO GLOW SYSTEM**

- (1) Remove glow plug relay from relay bracket.
- (2) Connect battery power source to terminal 2 . Check continuity between terminals with terminal 1 earthed.

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

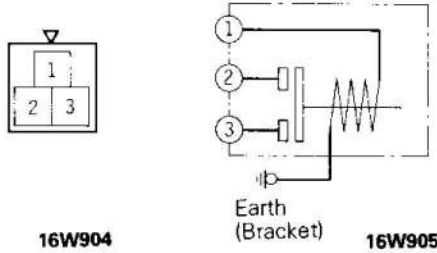


Glow plug relay (No. 1)

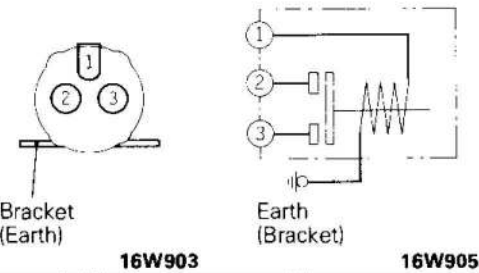


Glow plug relay (No. 2)

[Vehicles built up to June 1989]



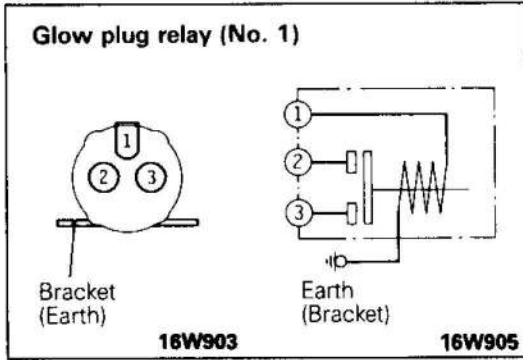
[Vehicles built from July 1989]



SUPER QUICK GLOW SYSTEM

- (1) Remove glow plug relay from relay bracket.
- (2) Connect battery power source to terminal ①. Check continuity between terminals with bracket earthed.

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



SELF-REGULATING GLOW SYSTEM

- (1) Remove glow plug relay from relay bracket.
- (2) Connect battery power source to terminal ①. Check continuity between terminals with bracket earthed.

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

NOTES

GLOW PLUG**REMOVAL AND INSTALLATION****Removal steps**

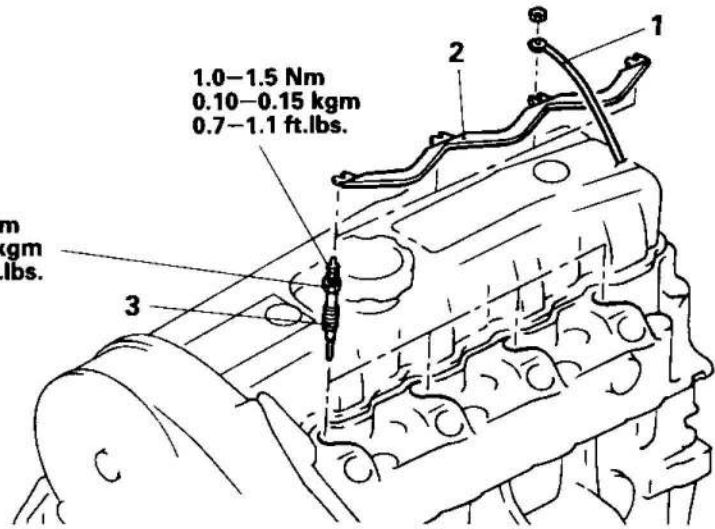
1. Connector
2. Glow plug plate
- ◆◆◆◆ 3. Glow plug

NOTE

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

15–20 Nm
1.5–2.0 kgm
11–14 ft.lbs.

1.0–1.5 Nm
0.10–0.15 kgm
0.7–1.1 ft.lbs.



16B0084

SERVICE POINTS OF REMOVAL**3. REMOVAL OF GLOW PLUG**

Remove super quick glow plug by hand after loosening with tool as its ceramic part is fragile.

INSPECTION

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

INSPECTION OF GLOW PLUG

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

Standard value:

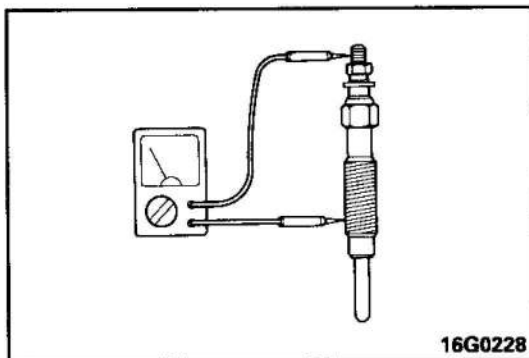
Automatic glow plug:	250 mΩ [at 20°C (68°F)]
Super quick glow plug:	235 mΩ [at 20°C (68°F)]
Self-regulating glow system	
Metal type glow plug	1000 mΩ
[at 20°C (68°F)]	
Ceramic type glow plug	500 mΩ
[at 20°C (68°F)]	

Caution

Remove oil from plug before measuring as glow plug resistance is very small.

SERVICE POINTS OF INSTALLATION**3. INSTALLATION OF GLOW PLUG**

Tighten super quick glow plug with tool after screwing in by hand as its ceramic part is fragile.



16G0228

NOTES