

CHARGING SYSTEM

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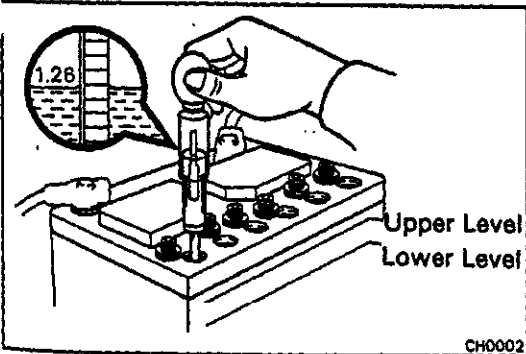
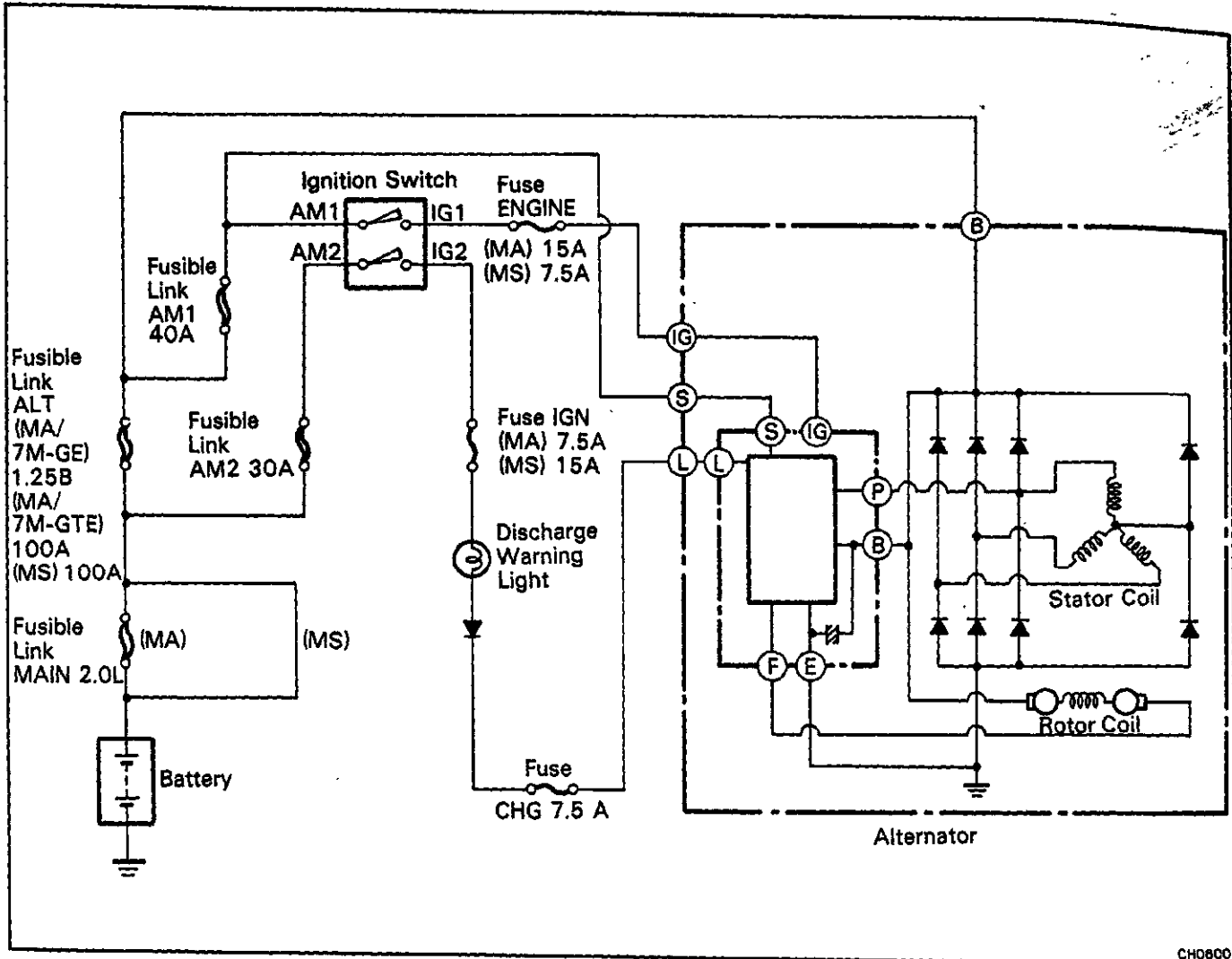
PRECAUTIONS

1. Check that the battery cables are connected to the correct terminals.
2. Disconnect the battery cables when the battery is given a quick charge.
3. Do not perform tests with a high voltage insulation resistance tester.
4. Never disconnect the battery while the engine is running.

TROUBLESHOOTING

Problem	Possible cause	Remedy	Page
Discharge warning light does not light with ignition ON and engine not running	Fuse blown Light burned out Wiring connection loose IC regulator faulty	Check "CHG" and "IGN" fuses Replace light Tighten loose connections Replace IC regulator	CH-7
Discharge warning light does not go out with engine running (battery requires frequent recharging)	Drive belt loose or worn Battery cables loose, corroded or worn Fuse blown Fusible link blown IC regulator or alternator faulty Wiring faulty	Adjust or replace drive belt Repair or replace cables Check "ENG" fuse Replace fusible link Check charging system Repair wiring	CH-4 CH-3

CHARGING SYSTEM CIRCUIT



CH0002

ON-VEHICLE INSPECTION

1. CHECK BATTERY SPECIFIC GRAVITY

- (a) Check the specific gravity of each cell.

Standard specific gravity

When fully charged at 20°C (68°F): 1.25 – 1.27

If not within specifications, charge the battery.

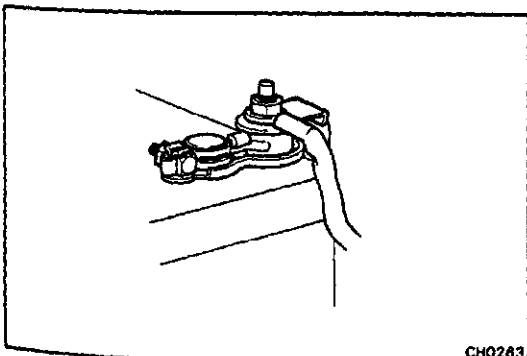
- (b) Check the electrolyte quantity of each cell.

If insufficient, refill with distilled (or purified) water.

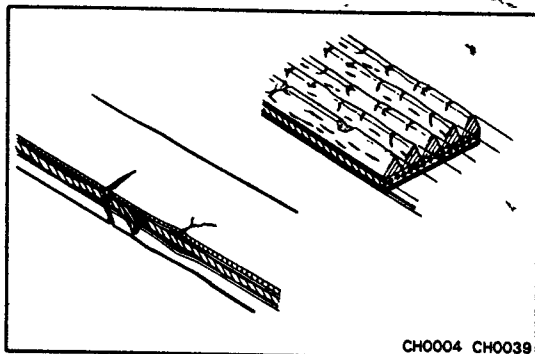
2. CHECK BATTERY TERMINALS, FUSIBLE LINKS AND FUSES

- (a) Check that the battery terminals are not loose or corroded.

- (b) Check the fusible links and fuses for continuity.



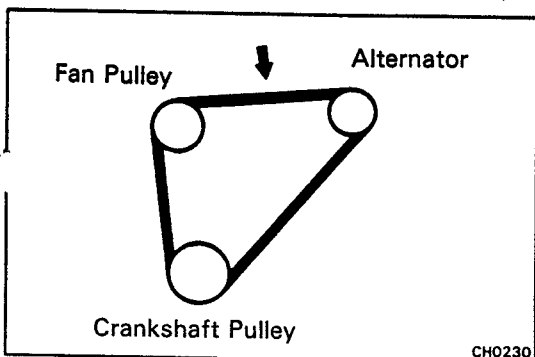
CH02A1



3. INSPECT DRIVE BELT

- (a) Visually check the belt for separation of the adhesive rubber above and below the core, separation from the belt side, severed core, separation of the rib from the adhesive rubber, cracking or separation of the ribs, torn or worn ribs or cracks in the inner ridges of the ribs.

If the belt has any of the above defects, replace it.



- (b) Check the drive belt deflection by pressing on the belt at the points indicated in the figure with 10 kg (22.0 lb, 98 N) of pressure.

Drive belt deflection:

New belt 10 – 12 mm (0.40 – 0.47 in.)

Used belt 15 – 17 mm (0.59 – 0.67 in.)

If necessary, adjust the drive belt deflection.

(Reference)

Using SST, check the drive belt tension.

SST A 09216-00020

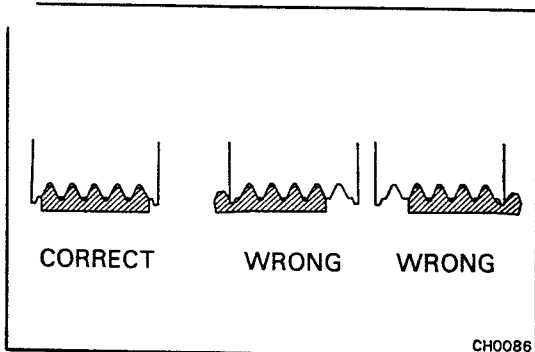
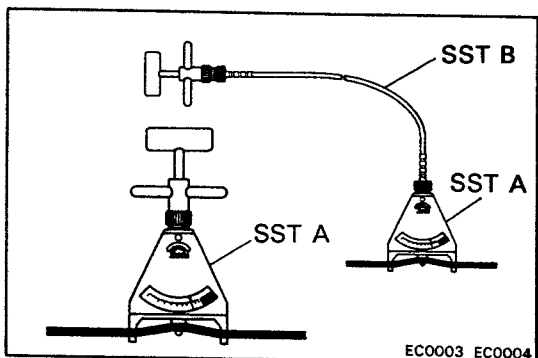
SST B 09216-00030

Drive belt tension:

New belt 70 – 80 kg

Used belt 30 – 45 kg

If necessary, adjust the drive belt tension.

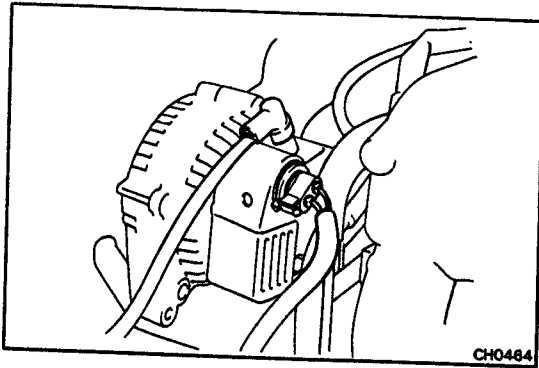


NOTE:

- "New belt" refers to a belt which has been used less than 5 minutes on a running engine.
- "Used belt" refers to a belt which has been used on a running engine for 5 minutes or more.
- After installing the drive belt, check that it fits properly in the ribbed grooves.
- Check with your hand to confirm that the belt has not slipped out of the groove on the bottom of the crank pulley.
- After installing the belt, run the engine for about 5 minutes and recheck the deflection or tension.

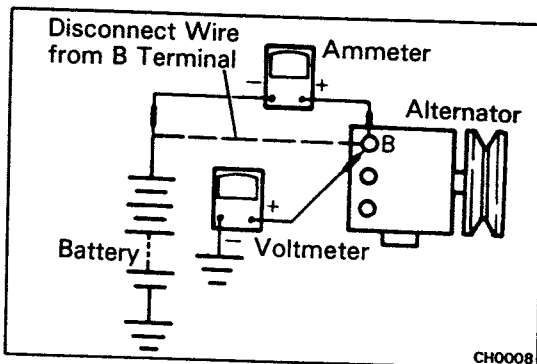
4. INSPECT FUSES FOR CONTINUITY

- CHG 7.5 A
- IGN 7.5 A
- ENGINE 15 A



5. **VISUALLY CHECK ALTERNATOR WIRING AND LISTEN FOR ABNORMAL NOISES**
 - (a) Check that the wiring is in good condition.
 - (b) Check that there are no abnormal noises from the alternator while the engine is running.
6. **CHECK DISCHARGE WARNING LIGHT CIRCUIT**
 - (a) Warm up the engine and turn it off.
 - (b) Turn off all accessories.
 - (c) Turn the ignition switch to "ON". Check that the charge light is lit.
 - (d) Start the engine. Check that the light goes out.

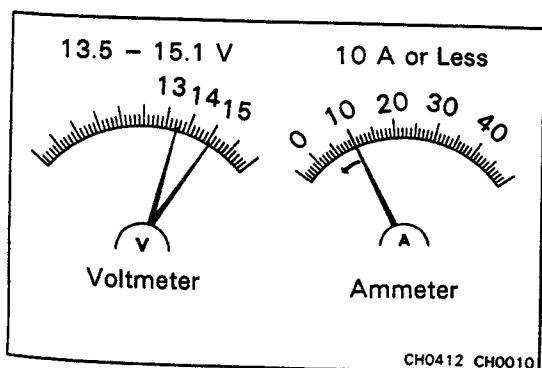
If the light does not operate as specified, troubleshoot the charge light circuit.



7. CHECK CHARGING CIRCUIT WITHOUT LOAD

NOTE: If a battery/ alternator tester is available, connect the tester to the charging circuit according to the manufacturer's instructions.

- (a) If a tester is not available, connect a voltmeter and ammeter to the charging circuit as follows:
 - Disconnect the wire from terminal B of the alternator and connect the wire to the negative (-) terminal of the ammeter.
 - Connect the test lead from the positive (+) terminal of the ammeter to terminal B of the alternator.
 - Connect the positive (+) lead of the voltmeter to terminal B of the alternator.
 - Ground the negative (-) lead of the voltmeter.

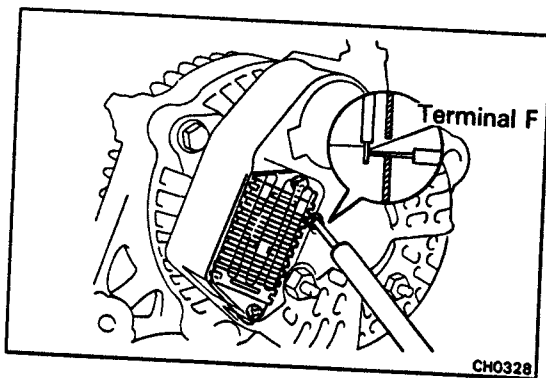


- (b) Check the charging circuit as follows:
With the engine running from idling to 2,000 rpm, check the reading on the ammeter and voltmeter.

Standard amperage: 10 A or less

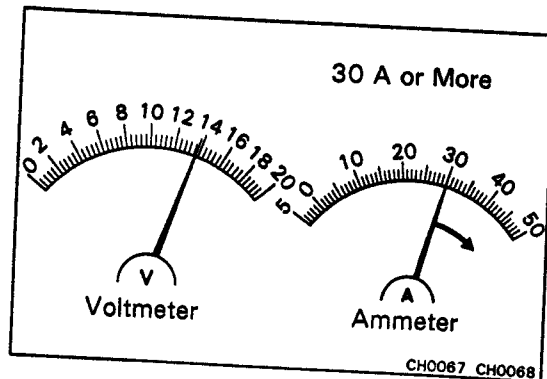
Standard voltage: 13.9 – 15.1 V at 25°C (77°F)
13.5 – 14.3 V at 115°C (239°F)

If the voltage reading is greater than standard voltage, replace the IC regulator.



If the voltage reading is less than standard voltage, check the IC regulator and alternator as follows:

- With terminal F grounded, start the engine and check the voltage reading of terminal B.
- If the voltage reading is more than standard voltage, replace the IC regulator.
- If the voltage reading is less than standard voltage, check the alternator.



8. CHECK CHARGING CIRCUIT WITH LOAD

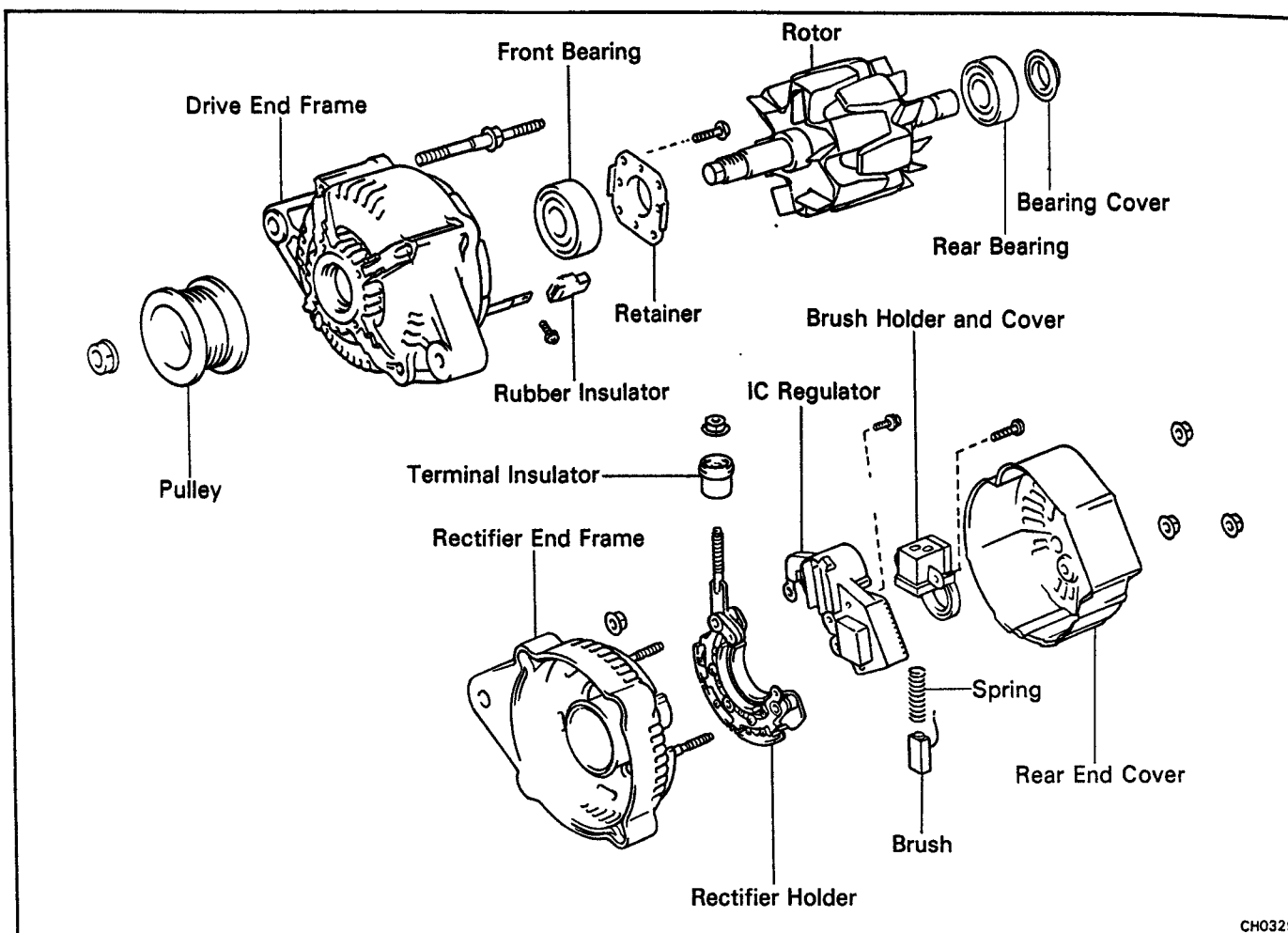
- (a) With the engine running at 2,000 rpm, turn on the high beam headlights and place the heater fan control switch on "HI".
- (b) Check the reading on the ammeter.

Standard amperage: 30 A or more

If the ammeter reading is less than 30 A, repair the alternator. (See pages CH-7)

NOTE: If the battery is fully charged, the indication will sometimes be less than 30 A.

ALTERNATOR COMPONENTS

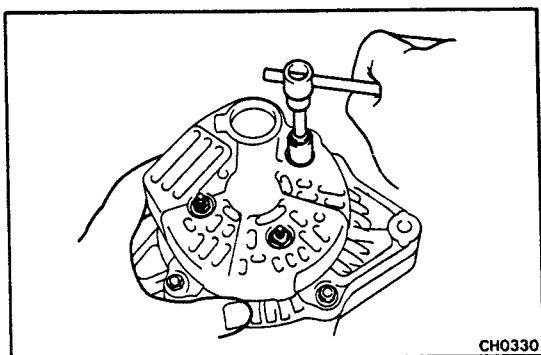


CH0329

DISASSEMBLY OF ALTERNATOR

1. REMOVE REAR END COVER

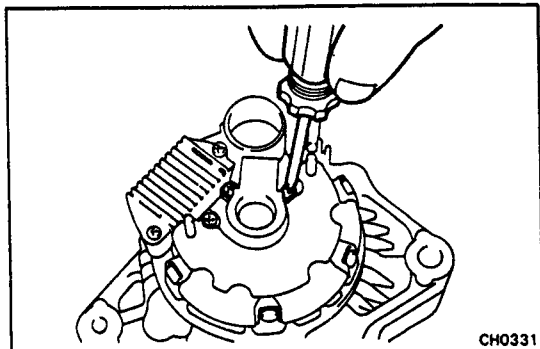
- Remove the nut and terminal insulator.
- Remove the three nuts and end cover.



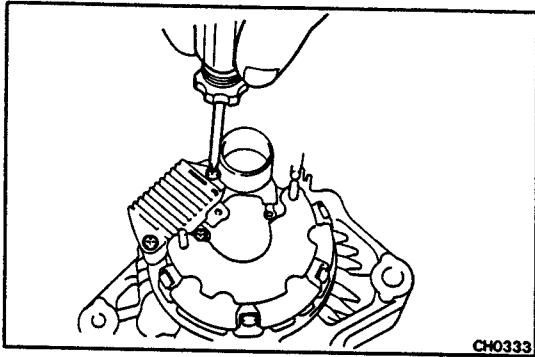
CH0330

2. REMOVE BRUSH HOLDER

Remove the two screws, brush holder and cover.

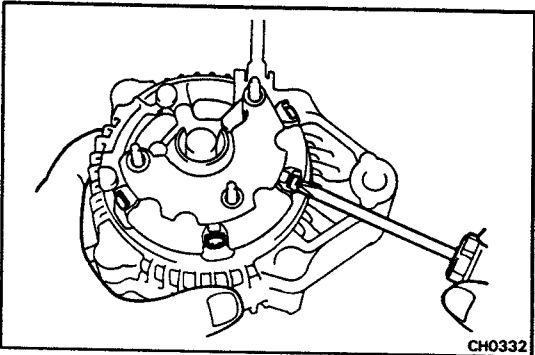


CH0331



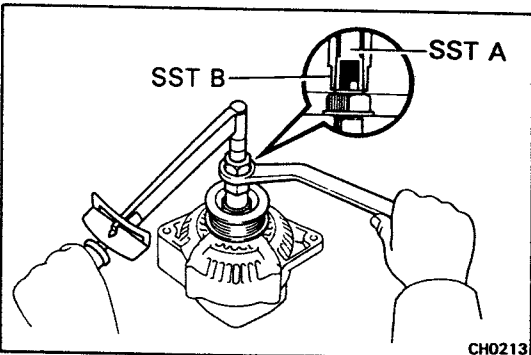
3. REMOVE IC REGULATOR

Remove the three screws and IC regulator.



4. REMOVE RECTIFIER HOLDER

- Remove the four screws and rectifier holder.
- Remove the four rubber insulators.



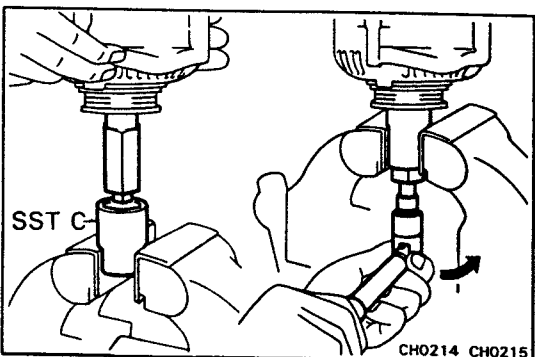
5. REMOVE PULLEY

- Hold SST A with a torque wrench, and tighten SST B clockwise to the specified torque.

SST 09820-63010

Torque: 400 kg-cm (29 ft-lb, 39 N·m)

- Check that SST A is secured to the rotor shaft.

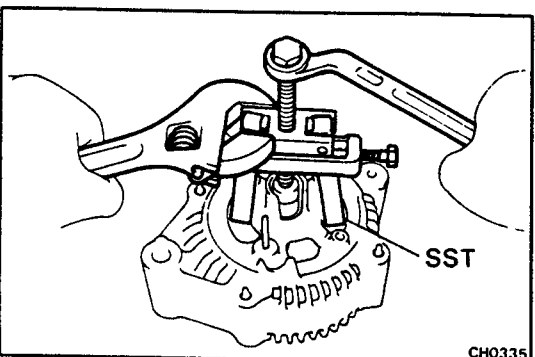


- As shown in the figure, mount SST C in a vise, and install the alternator to SST C.

- To loosen the pulley nut turn SST A in the direction shown in the figure.

CAUTION: To prevent damage to the rotor shaft, do not loosen the pulley nut more than one-half of a turn.

- Remove the alternator from SST C.
- Turn SST B and remove SSTs A and B.
- Remove the pulley nut and pulley.



6. REMOVE RECTIFIER END FRAME

- Remove the four nuts.
 - Using SST, remove the rectifier end frame.
- SST 09286-46011

7. REMOVE ROTOR FROM DRIVE END FRAME

INSPECTION AND REPAIR OF ALTERNATOR

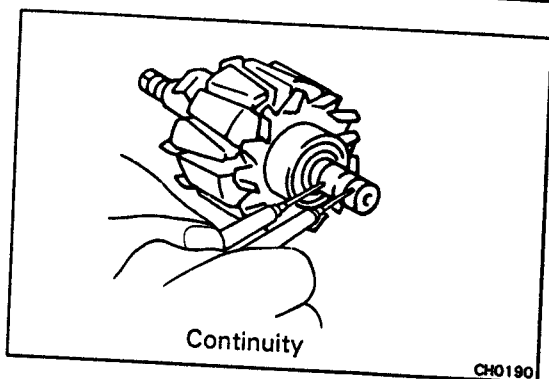
Rotor

1. INSPECT ROTOR FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the slip rings.

Standard resistance (cold): 2.8 – 3.0 Ω

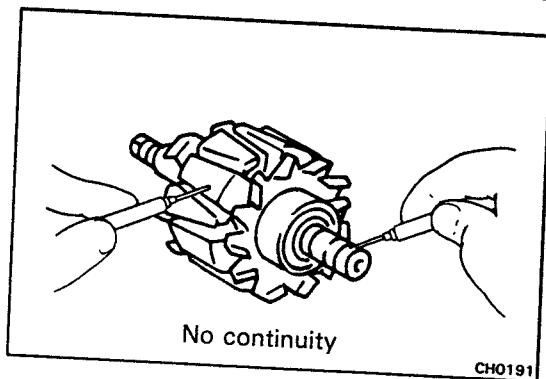
If there is no continuity, replace the rotor.



2. INSPECT ROTOR FOR GROUND

Using an ohmmeter, check that there is no continuity between the slip ring and the rotor.

If there is continuity, replace the rotor.



3. INSPECT SLIP RINGS

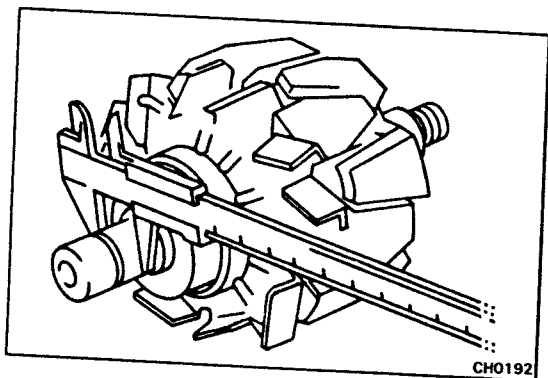
(a) Check that the slip rings are not rough or scored. If rough or scored, replace the rotor.

(b) Using calipers, measure the slip ring diameters.

Standard diameter: 14.2 – 14.4 mm
(0.559 – 0.567 in.)

Minimum diameter: 12.8 mm (0.504 in.)

If the diameter is less than minimum, replace the rotor.

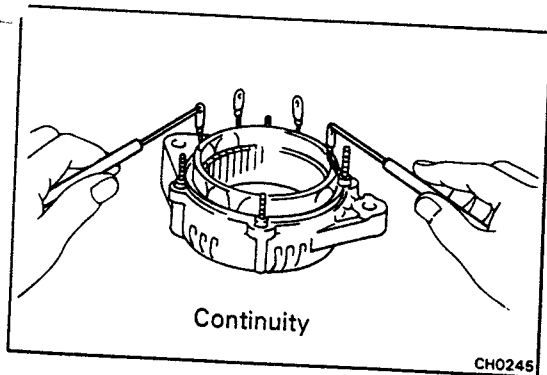


Stator

1. INSPECT STATOR FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the coil leads.

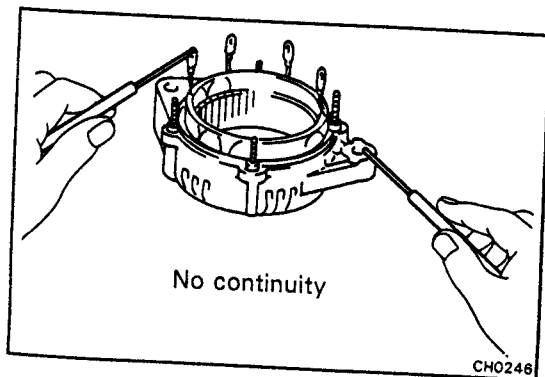
If there is no continuity, replace the drive end frame assembly.

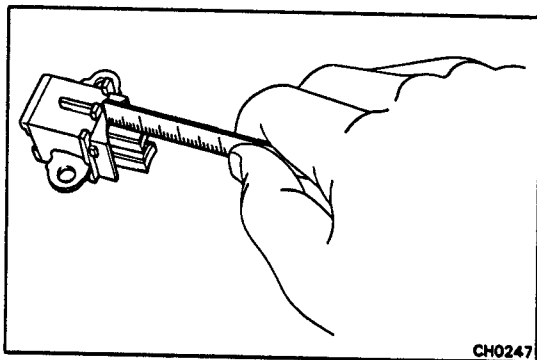


2. INSPECT STATOR FOR GROUND

Using an ohmmeter, check that there is no continuity between the coil leads and drive end frame.

If there is continuity, replace the drive end frame assembly.





Brushes

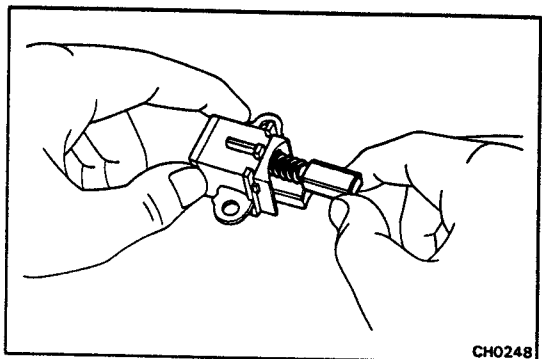
1. INSPECT EXPOSED BRUSH LENGTH

Using a scale, measure the exposed brush length.

Standard exposed length: 10.5 mm (0.413 in.)

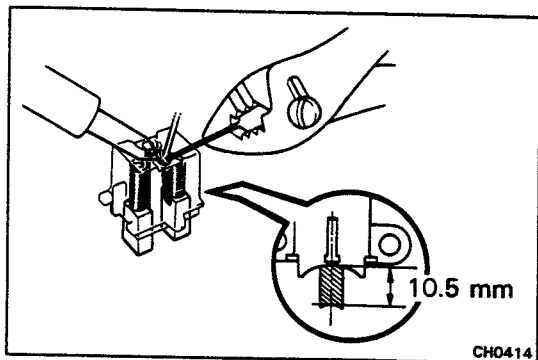
Minimum exposed length: 1.5 mm (0.059 in.)

If the exposed length is less than minimum, replace the brushes.



2. IF NECESSARY, REPLACE BRUSHES

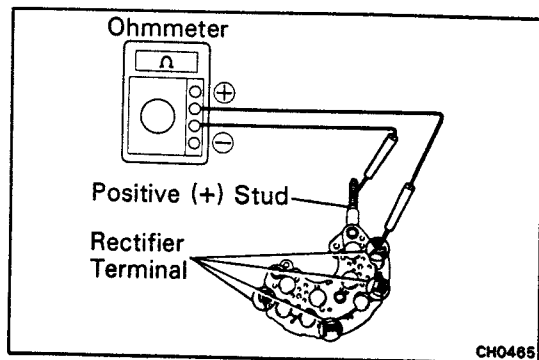
- (a) Unsolder and remove the brush and spring.
- (b) Run the wire of the brush through the hole in the brush holder, and insert the spring and brush into the brush holder.



- (c) Solder the brush wire to the brush holder at the exposed length.

Exposed length: 10.5 mm (0.413 in.)

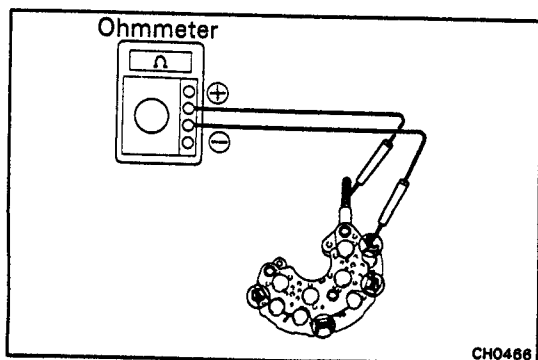
- (d) Check that the brush moves smoothly in the brush holder.
- (e) Cut off the excess wire.
- (f) Apply insulation paint to the soldered point.



Rectifiers (Rectifier Holder)

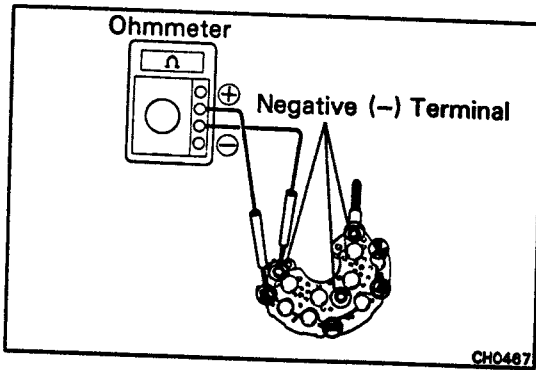
1. INSPECT POSITIVE SIDE RECTIFIER

- (a) Using an ohmmeter, connect one tester probe to the positive (+) stud and the other to each rectifier terminal.



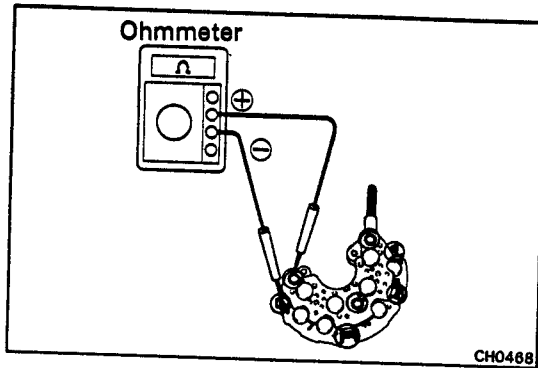
- (b) Reverse the polarity of the tester probes.
- (c) Check that one shows continuity and the other shows no continuity.

If not, replace the rectifier holder.



2. INSPECT NEGATIVE SIDE RECTIFIER

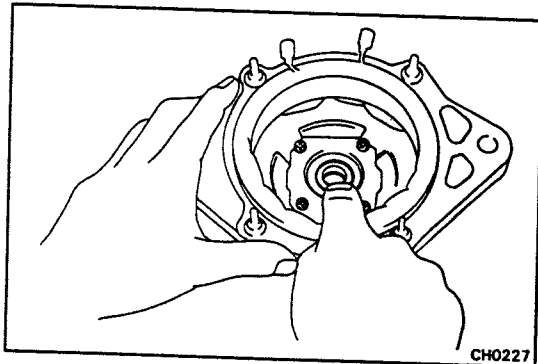
- (a) Connect one tester probe to each rectifier terminal and the other to each rectifier negative (-) terminal.



- (b) Reverse the polarity of the tester probes.

- (c) Check that one shows continuity and the other shows no continuity.

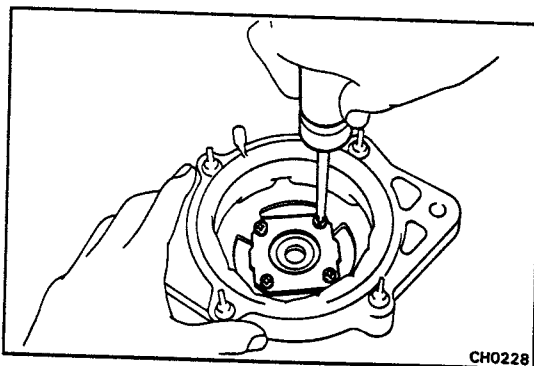
If not, replace the rectifier holder.



Bearings

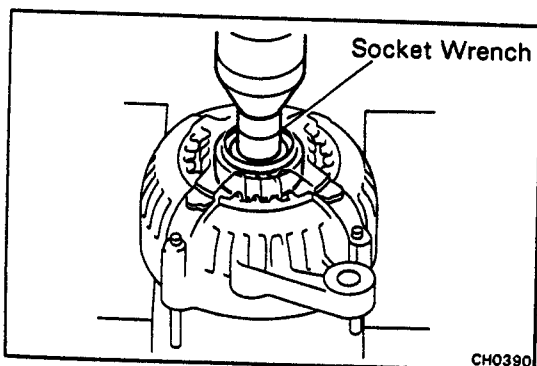
1. INSPECT FRONT BEARING

Check that the bearing is not rough or worn.

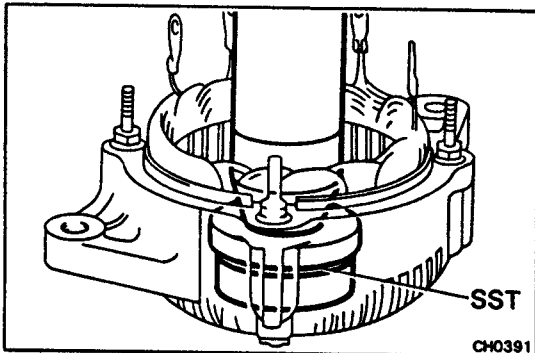


2. IF NECESSARY, REPLACE FRONT BEARING

- (a) Remove the four screws and bearing retainer.



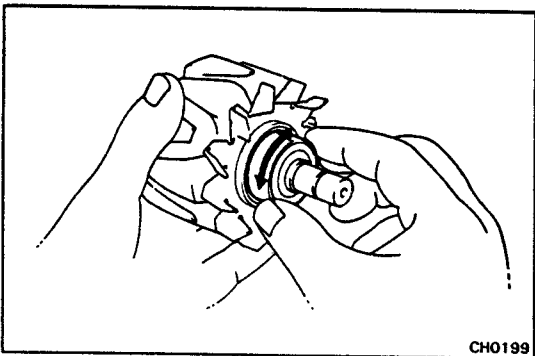
- (b) Using a press and socket wrench, press out the front bearing.



(c) Using SST and a press, press a new front bearing into the drive end frame.

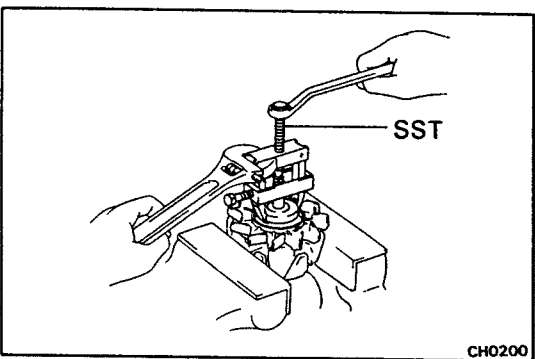
SST 09608-20012 (09608-00030)

(d) Install the bearing retainer with the four screws.



3. INSPECT REAR BEARING

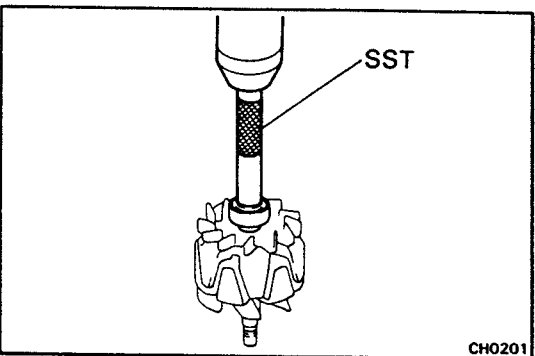
Check that the bearing is not rough or worn.



4. IF NECESSARY, REPLACE REAR BEARING

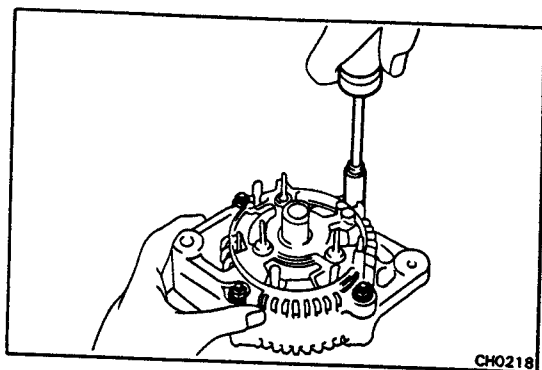
(a) Using SST, remove the bearing cover and bearing.

SST 09820-00021



(b) Using SST and a press, press in a new bearing and the bearing cover.

SST 09285-76010



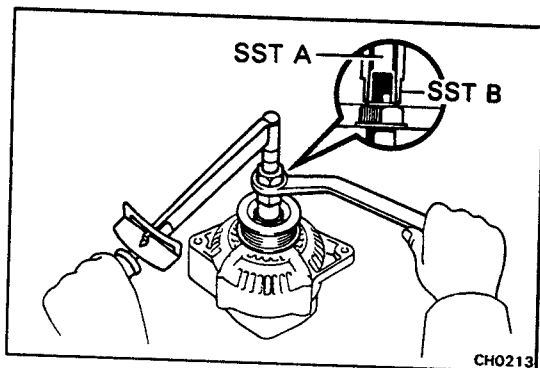
ASSEMBLY OF ALTERNATOR

(See page CH-7)

1. INSTALL ROTOR TO DRIVE END FRAME

2. INSTALL RECTIFIER END FRAME

- Using a plastic-faced hammer, lightly tap in the end frame.
- Install the four nuts.



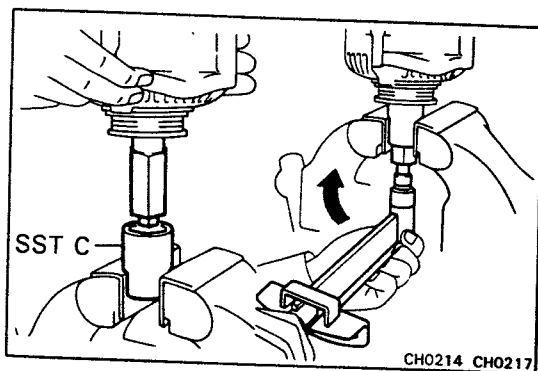
3. INSTALL PULLEY

- Install the pulley to the rotor shaft by tightening the pulley nut by hand.
- Hold SST A with a torque wrench, and tighten SST B clockwise to the specified torque.

SST 09820-63010

Torque: 400 kg-cm (29 ft-lb, 39 N·m)

- Check that SST A is secured to the pulley shaft.



- As shown in the figure, mount SST C in a vise, and install the alternator to SST C.

- To torque the pulley nut turn SST A in the direction shown in the figure.

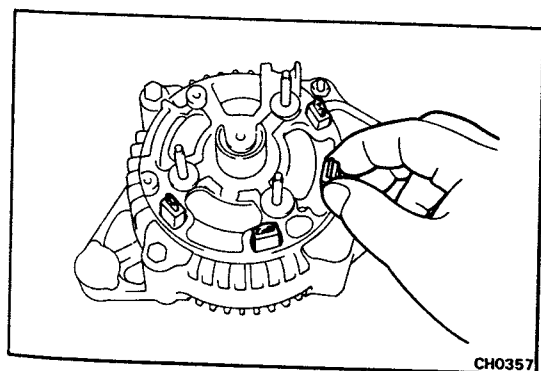
Torque: 1,125 kg-cm (81 ft-lb, 110 N·m)

- Remove the alternator from SST C.

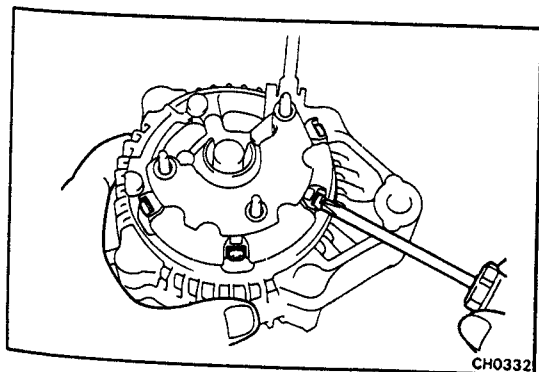
- Turn SST B and remove SSTs A and B.

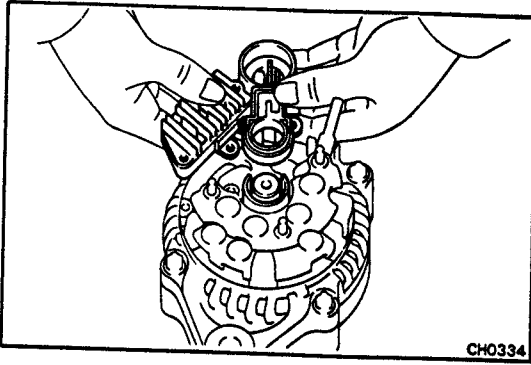
4. INSTALL RECTIFIER HOLDER

- Install the four rubber insulators on the lead wires.



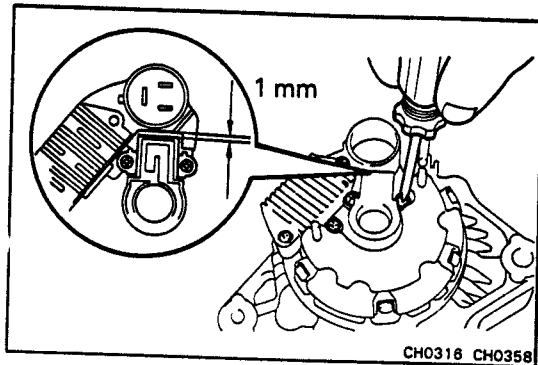
- Install the rectifier holder with the four screws.



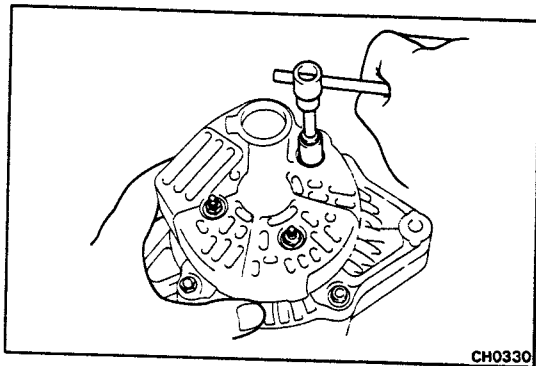
**5. INSTALL BRUSH HOLDER AND IC REGULATOR**

- (a) Place the brush holder.
- (b) Install the IC regulator and brush holder to the rear end frame horizontally as shown in the figure.

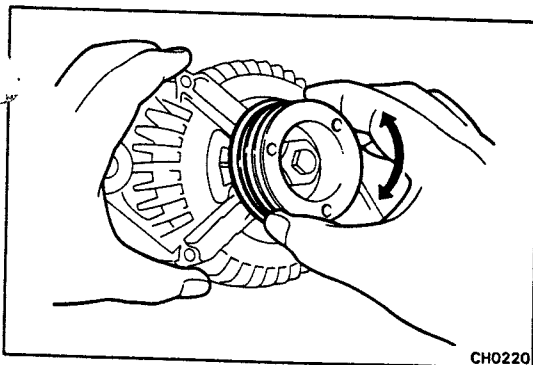
NOTE: Make sure the brush holder's cover doesn't slip to one side during installation.



- (c) Tighten the five screws until there is a clearance of at least 1 mm (0.04 in.) between the brush holder cover and connector.

**6. INSTALL REAR END COVER**

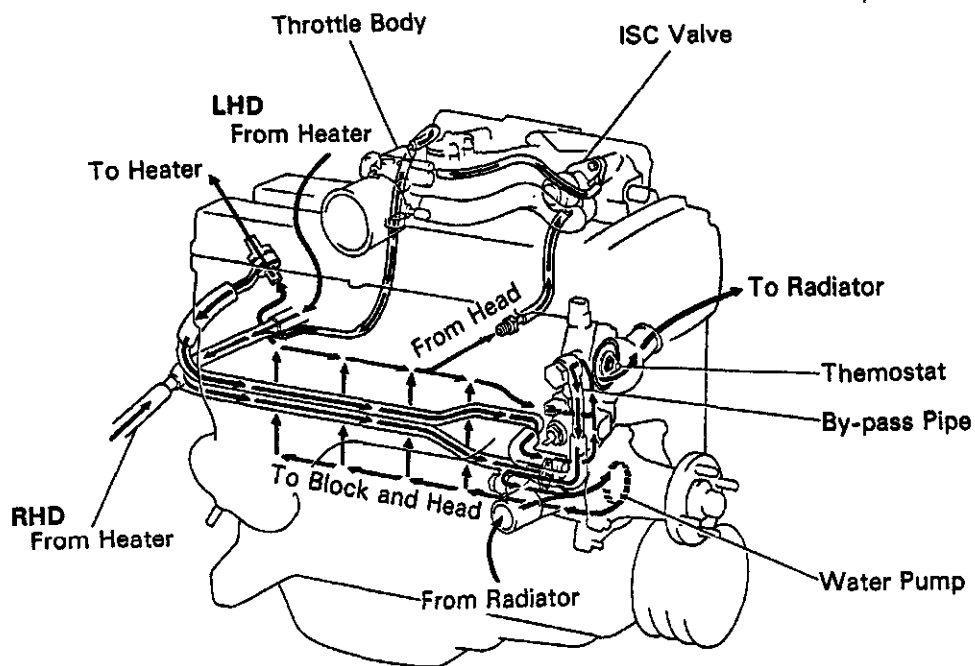
- (a) Install the end cover with the three nuts.
- (b) Install the terminal insulator with the nut.

**7. MAKE SURE ROTOR ROTATES SMOOTHLY**

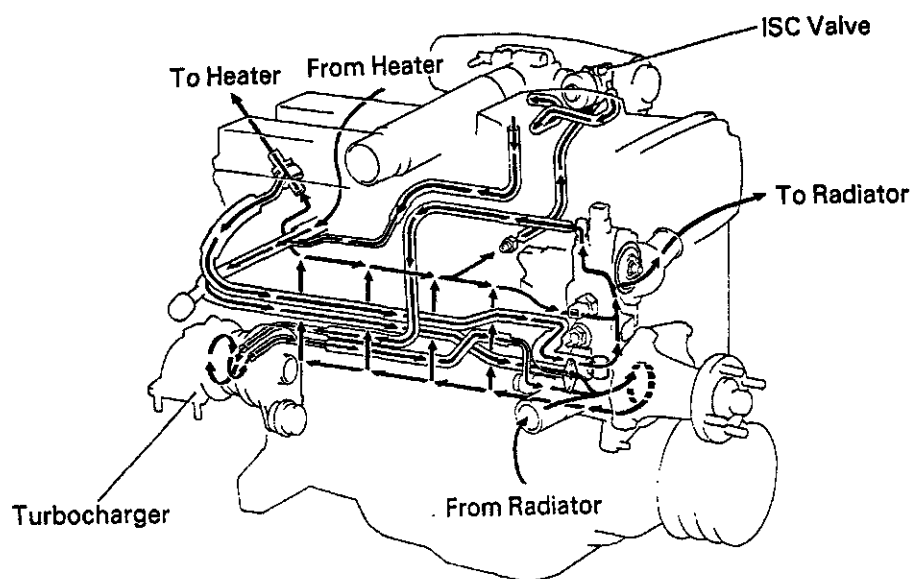
DESCRIPTION

This engine utilizes a pressurized water forced circulation cooling system which includes a thermostat equipped mounted on the outlet side.

7M-GE



7M-GTE



The cooling system is composed of the water jacket (inside the cylinder block and cylinder head), radiator, water pump, thermostat, cooling fan, hoses and other components.

Coolant which is heated in the water jacket is pumped to the radiator, through which a cooling fan blows air to cool the coolant as it passes through. Coolant which has been cooled is then sent back to the engine by the water pump, where it cools the engine.

The water jacket is a network of channels in the shell of the cylinder block and cylinder head through which coolant passes. It is designed to provide adequate cooling of the cylinders and combustion chambers which become the hottest during engine operation.

RADIATOR

The radiator performs the function of cooling the coolant which has passed through the water jacket and become hot, and is mounted in the front of the vehicle. The radiator consists of an upper tank and lower tank, and a core which connects the two tanks. The upper tank contains the inlet for coolant from the water jacket and the filter inlet. It also has a hose attached through which excess coolant or steam can flow. The lower tank contains the outlet for coolant and the drain cock. The core contains many tubes through which coolant flows from the upper tank to the lower tank as well as cooling fins which radiate heat away from the coolant in the tubes. The air sucked through the radiator by cooling fan, as well as the wind generated by the vehicle's travel, passes through the radiator, cooling it. Models with automatic transmission include an automatic transmission fluid cooler built into the lower tank of the radiator.

RADIATOR CAP

The radiator cap is a pressure type cap which seals the radiator, resulting in pressurization of the radiator as the coolant expands. The pressurization prevents the coolant from boiling even when the coolant temperature exceeds 100°C. A relief valve (pressurization valve) and a vacuum valve (negative pressure valve) are built into the radiator cap. The relief valve opens and lets steam escape through the overflow pipe when the pressure generated inside the cooling system exceeds the limit (coolant temperature: 110 – 120°C, (230 – 248°F), pressure; 0.3 – 1.0 kg/cm², (4.3 – 14.2 psi, 29.4 – 98.1 kPa). The vacuum valve opens to alleviate the vacuum which develops in the coolant system after the engine is stopped and the coolant temperature drops. The valve's opening allows the pressure in the cooling system to return to the coolant in the reservoir tank.

RESERVOIR TANK

The reservoir tank is used to catch coolant which overflows the cooling system as a result of volumetric expansion when the coolant is heated. The coolant in the reservoir tank returns to the radiator when the coolant temperature drops, thus keeping the radiator full at all times and avoiding needless coolant loss. Check the reservoir tank level to learn if the coolant needs to be replenished.

WATER PUMP

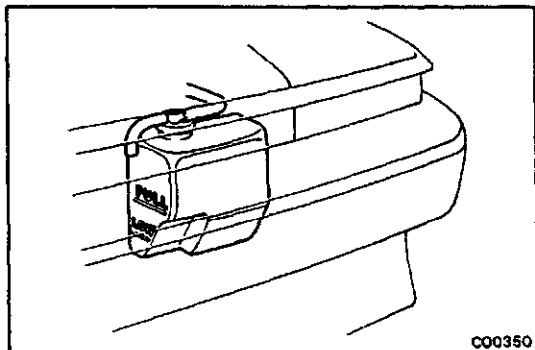
The water pump is used for forced circulation of coolant through the cooling system. It is mounted on the front of the cylinder block and driven by a V-ribbed belt.

THERMOSTAT

The thermostat has a wax type and is mounted in the water outlet housing. The thermostat includes a type of automatic valve operated by fluctuations in the coolant temperature. This valve closes when the coolant temperature drops, preventing the circulation of coolant through the engine and thus permitting the engine to warm up rapidly. The valve opens when the coolant temperature has risen, allowing the circulation of coolant. Wax inside the thermostat expands when heated and contracts when cooled. Heating the wax thus generates pressure which overpowers the force of the spring which keeps the valve closed, thus opening the valve. When the wax cools, its contraction causes the force of the spring to take effect once more, closing the valve. The thermostat in this engine operates at a temperature of 88°C (190°F).

TROUBLESHOOTING

Problem	Possible cause	Remedy	Page
Engine overheats	Alternator drive belt loose or missing	Adjust or replace belt	CH-4
	Dirt, leaves or insects in radiator or condenser	Clean radiator or condenser	
	Hoses, water pump, water outlet housing, radiator, heater, core plugs or head gasket leakage	Repair as necessary	
	Thermostat faulty	Check thermostat	CO-8
	Ignition timing retarded	Set timing	EM-17
	Fluid coupling faulty	Replace fluid coupling	CO-6
	Radiator hose plugged or rotted	Replace hose	
	Water pump faulty	Replace water pump	CO-6
	Radiator plugged or cap faulty	Check radiator	CO-9
	Cylinder head or block cracked or plugged	Repair as necessary	

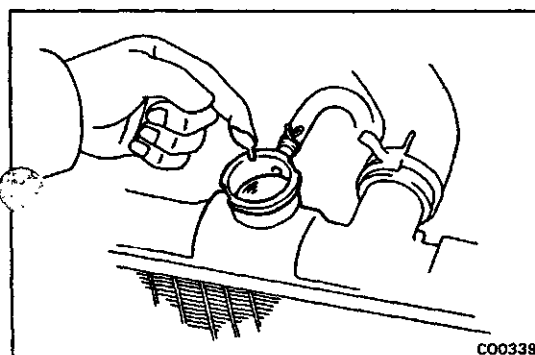


CHECK AND REPLACEMENT OF ENGINE COOLANT

1. CHECK ENGINE COOLANT LEVEL AT RESERVE TANK

The coolant level should be between the "LOW" and "FULL" lines.

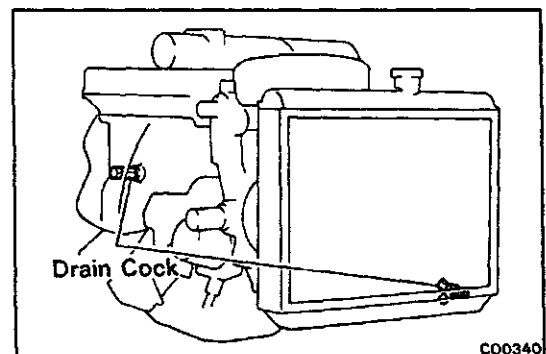
If low, check for leaks and add coolant up to the "FULL" line.



2. CHECK ENGINE COOLANT QUALITY

There should not be any excessive deposits of rust or scales around the radiator cap or radiator filler hole, and the coolant should also be free from oil.

If excessively dirty, replace the coolant.



3. REPLACE ENGINE COOLANT

- Remove the radiator cap.
- Drain the coolant from radiator and engine drain cocks. (Engine drain is at right rear of cylinder block.)
- Close the drain cocks.
- Fill system with coolant.

Use a good brand of ethylene-glycol base coolant, mixed according to manufacturer's directions.

Capacity:

MA

w/ Heater or air conditioner

M/T 8.1 liters (8.5 US qts, 7.1 Imp. qts)

A/T 8.0 liters (8.5 US qts, 7.0 Imp. qts)

w/o Heater or air conditioner

M/T 7.5 liters (7.9 US qts, 6.6 Imp. qts)

A/T 7.4 liters (7.8 US qts, 6.5 Imp. qts)

MS

w/ Heater or air conditioner

GCC Countries*

8.5 liters (9.0 US qts, 7.5 Imp. qts)

Others

7.8 liters (8.2 US qts, 6.7 Imp. qts)

w/o Heater or air conditioner

GCC Countries*

7.8 liters (8.2 US qts, 6.7 Imp. qts)

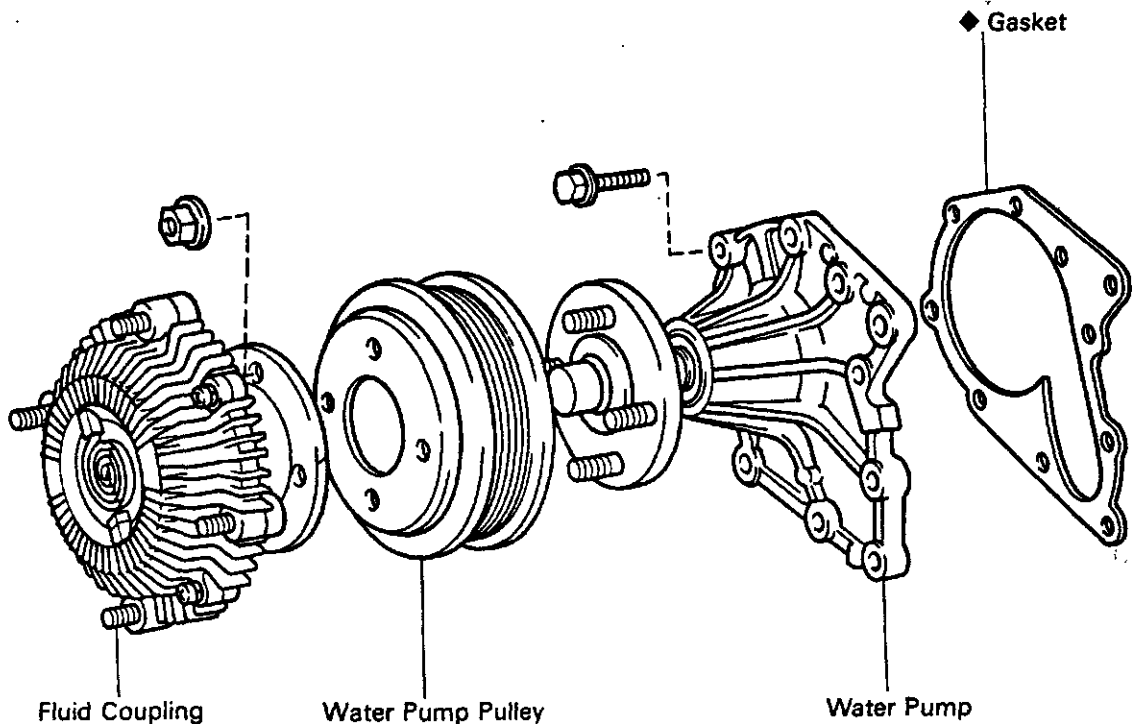
Others

7.1 liters (7.5 US qts, 6.2 Imp. qts)

- Install the radiator cap.
- Start the engine and check for leaks.
- Recheck the coolant level and refill as necessary.

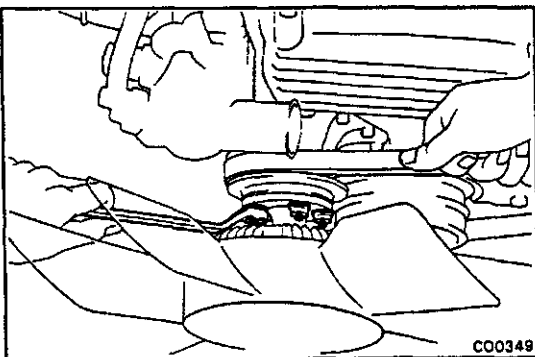
* GCC Countries: Saudi Arabia, Sultanate of Oman, Bahrain, United Arab Emirates, Qatar, Kuwait.

WATER PUMP COMPONENTS



◆ Non-reusable part

CO0341



REMOVAL OF WATER PUMP

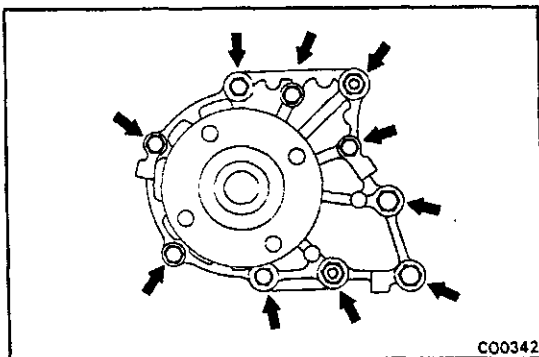
1. REMOVE ALTERNATOR DRIVE BELT, FLUID COUPLING AND WATER PUMP PULLEY

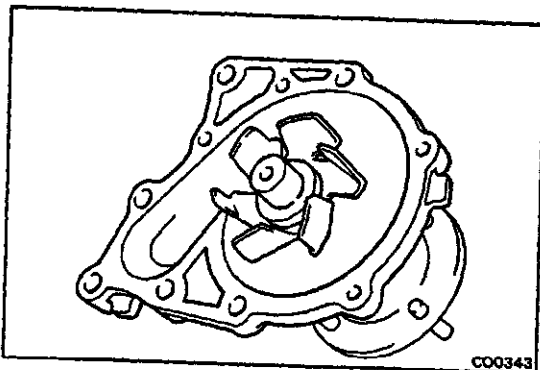
- Loosen the water pump pulley set nuts.
- Loosen the pivot bolt, adjusting bolt and nut, and remove the drive belt.
- Remove the four nuts, fluid coupling and water pump.
- Remove the fan from the fluid coupling.

2. REMOVE PS AIR PIPE

3. REMOVE WATER PUMP

Remove the eight bolts and two nuts, and remove water pump and gasket.





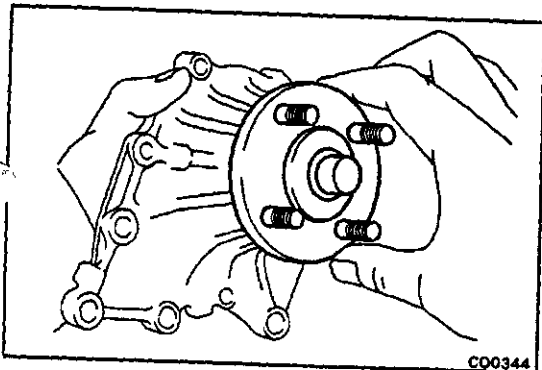
CO0343

INSPECTION OF WATER PUMP

1. INSPECT WATER PUMP BODY AND TIMING BELT CASE

Check the water pump body and timing belt case for cracks and damaged gasket surfaces.

If necessary, replace the water pump or timing belt case.

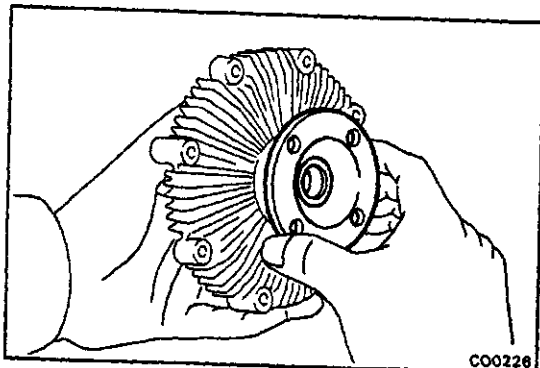


CO0344

2. INSPECT WATER PUMP BEARING

Turn the pulley and check that the water pump bearing moves smoothly and quietly.

If necessary, replace the water pump.

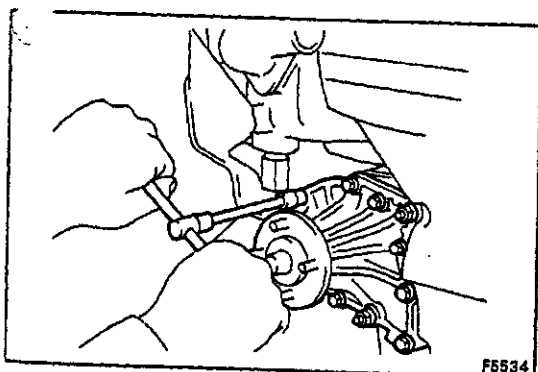


CO0226

3. INSPECT FLUID COUPLING

Check that the fluid coupling is not damaged and that no silicon oil leaks.

If necessary, replace the fluid coupling.



F5534

INSTALLATION OF WATER PUMP

(See page CO-6)

1. INSTALL WATER PUMP

Install water pump on new gasket with the eight bolts and two nuts.

Torque: 180 kg-cm (13 ft-lb, 18 N·m)

2. INSTALL PS AIR PIPE

3. INSTALL WATER PUMP PULLEY, FLUID COUPLING AND ALTERNATOR DRIVE BELT

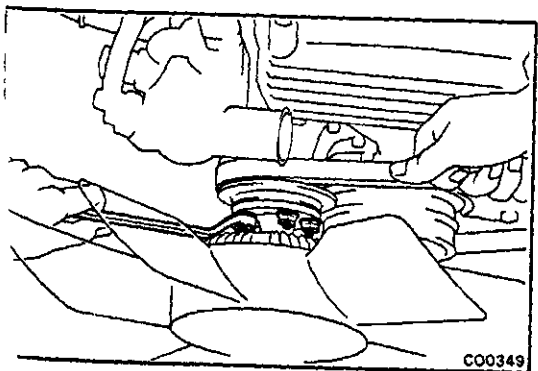
(a) Install the water pump pulley and fluid coupling with the four nuts.

(b) Place the drive belt on to each pulley.

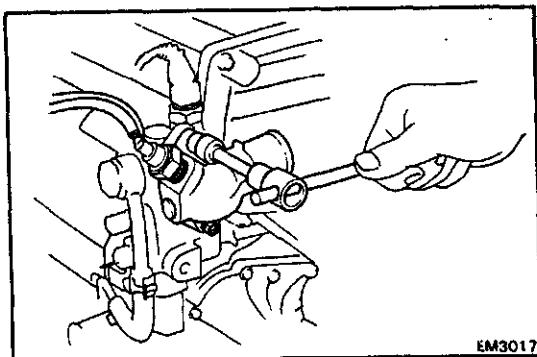
(c) Stretch the belt tight and tighten the four nuts.

4. ADJUST ALTERNATOR DRIVE BELT TENSION

(See page EM-36)



CO0349

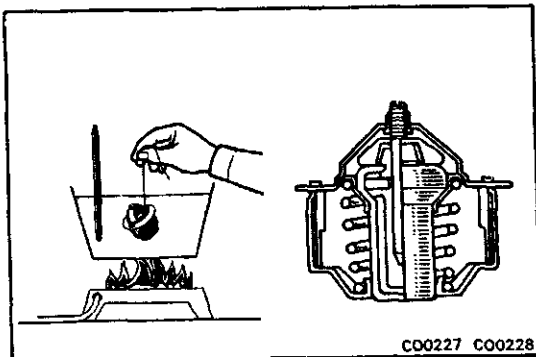


THERMOSTAT

REMOVAL OF THERMOSTAT

REMOVE WATER OUTLET AND THERMOSTAT

- Remove two bolts, water outlet and thermostat with gasket from the water outlet housing.
- Remove the gasket from the thermostat.



INSPECTION OF THERMOSTAT

NOTE: Thermostat is numbered according to the valve opening temperature.

- Immerse the thermostat in water and heat the water gradually.
- Check the valve opening temperature.

Valve opening temperature:

86 – 90°C (187 – 194°F)

If the valve opening temperature is not within specification, replace the thermostat.

- Check the valve lift.

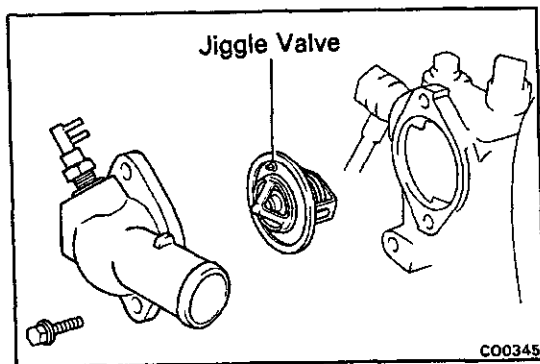
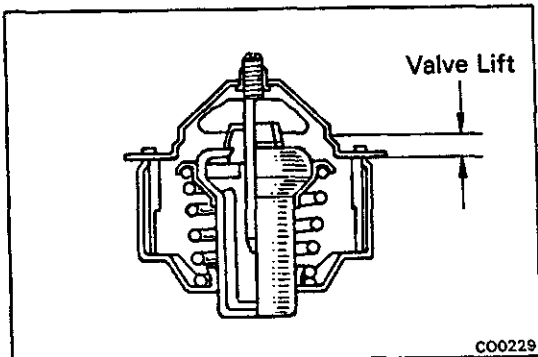
Valve lift:

8 mm (0.31 in.) or more at 100°C (212°F)

If the valve lift is less than specification, replace the thermostat.

- Check that the valve spring is tight when the thermostat is fully closed.

If necessary, replace the thermostat.



INSTALLATION OF THERMOSTAT

INSTALL THERMOSTAT AND WATER OUTLET

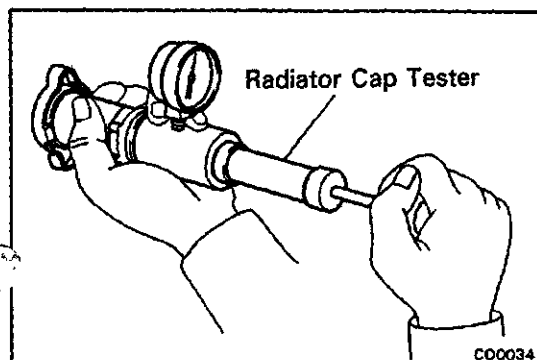
- Place a new gasket to the thermostat.
- Install the thermostat with the jiggle valve facing upward as shown in the illustration, and water outlet with the two bolts.

RADIATOR

CLEANING OF RADIATOR

Using water or steam cleaner, remove mud and dirt from the radiator core.

CAUTION: If using high-pressure type cleaner, be careful not to deform the fins of the radiator core. Keep a distance of more than 40 – 50 cm (15.75 – 19.69 in.) between the radiator core and cleaner nozzle when the cleaner nozzle pressure is 30 – 35 kg/cm² (427 – 498 psi, 2,942 – 3,432 kPa).



INSPECTION OF RADIATOR

1. CHECK RADIATOR CAP

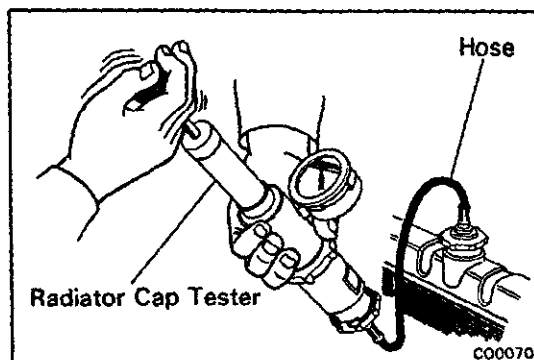
Using a radiator cap tester, pump tester until relief valve opens. Check that valve opens between 0.75 kg/cm² (10.7 psi, 74 kPa) and 1.05 kg/cm² (14.9 psi, 103 kPa). Check that pressure gauge does not drop rapidly when pressure on cap is below 0.6 kg/cm² (8.5 psi, 59 kPa).

If either check is not within limits, replace cap.

2. CHECK COOLING SYSTEM FOR LEAKS

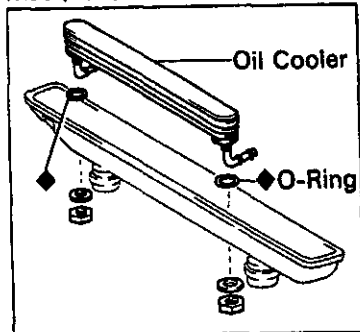
- Fill the radiator with coolant and attach a radiator cap tester.
- Warm up the engine.
- Pump it to 1.2 kg/cm² (17.1 psi, 118 kPa), check that pressure does not drop.

If the pressure drops, check for leaks from the hoses, radiator or water pump. If no external leaks are found, check the heater core, cylinder block and head.

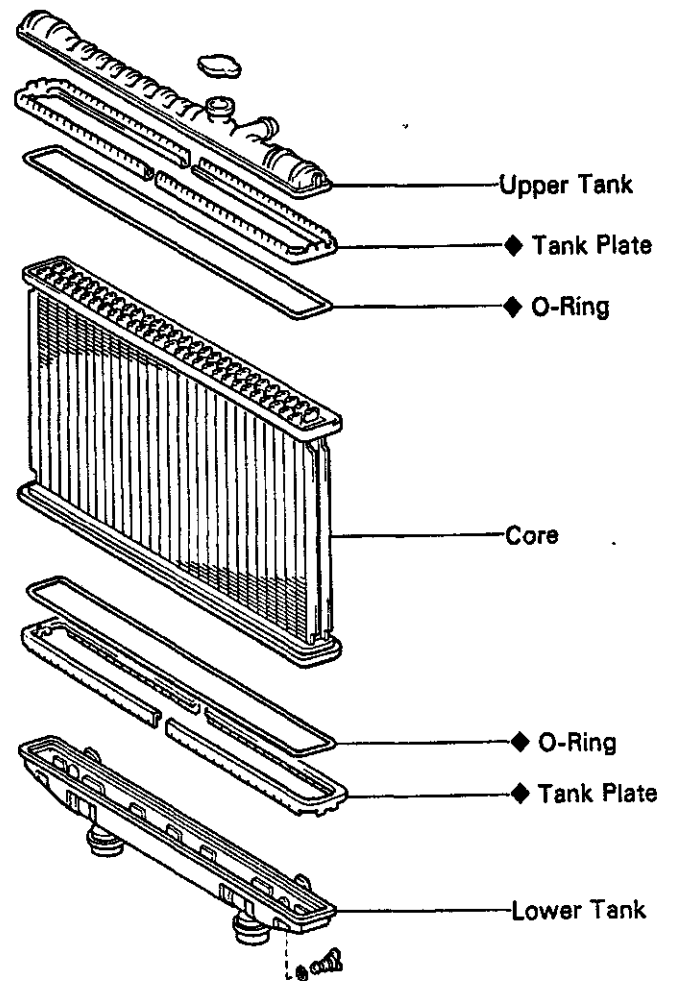
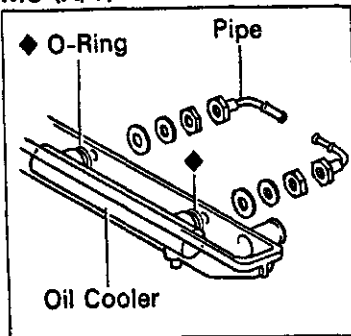


COMPONENTS

MA (A/T)



MS (A/T)



◆ Non-reusable part

CO05E

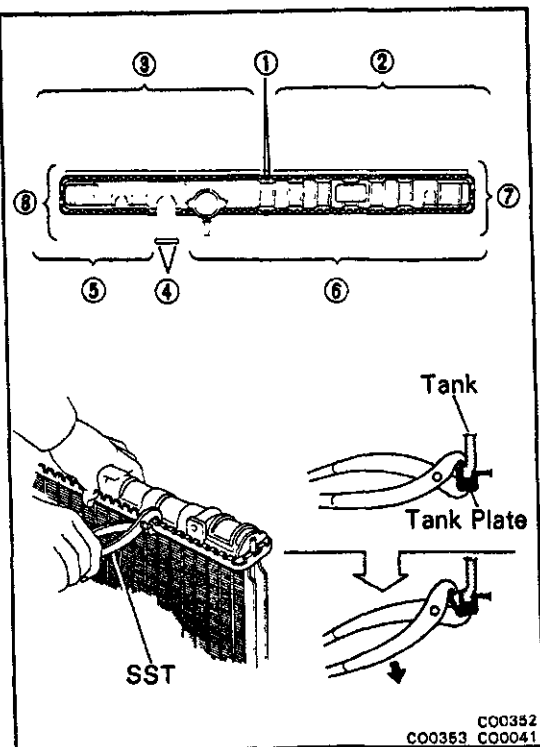
DISASSEMBLY OF RADIATOR

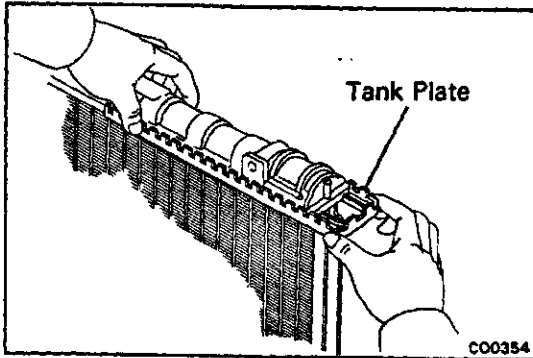
1. REMOVE TANK PLATE

- (a) Raise the claws of the tank plates with SST in the numerical order shown in the figure.

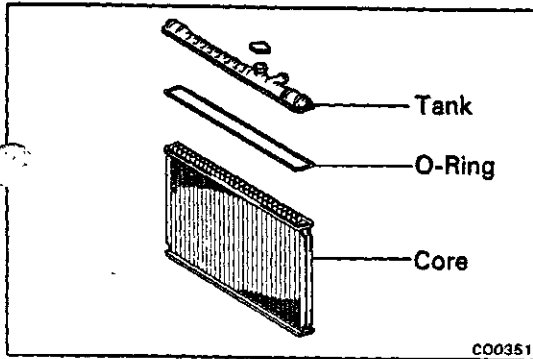
SST 09230-00010

NOTE: Be careful not to damage the core plate.

CO0352
CO0353 CO0041

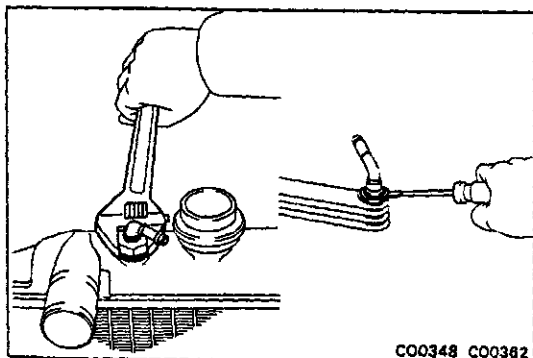


- (b) Pull the tank plates outward.



2. REMOVE TANK AND O-RING

- (a) Pull the tank upward.
(b) Remove the O-ring.



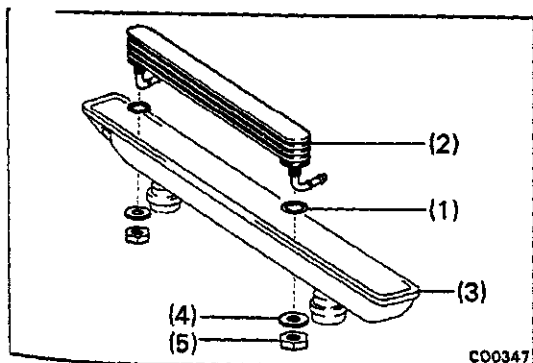
3. (A/T)

REMOVE OIL COOLER FROM LOWER TANK

- (a) (MS)
Remove the pipes.

NOTE: Make a note of the direction the pipes face.

- (b) Remove the nuts, plate washers and oil cooler.
(c) Remove the O-rings from the oil cooler.



ASSEMBLY OF RADIATOR

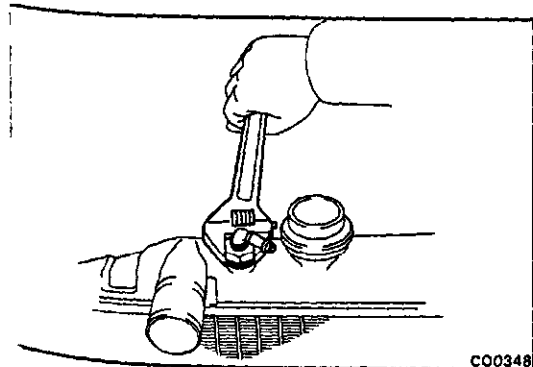
(See page CO-10)

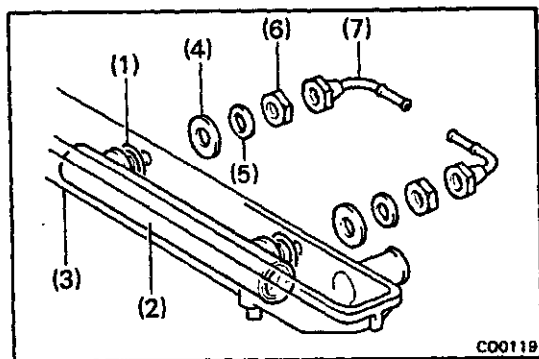
1. (MA with A/T)

INSTALL OIL COOLER TO LOWER TANK

- (a) Clean the O-ring contact surface of the lower tank and oil cooler.
(b) Install new O-rings (1) to the oil cooler (2).
(c) Install the oil cooler (2) with O-rings (1) to the lower tank (3).
(d) Install the plate washers (4), and nuts (5). Torque the nuts (5).

Torque: 220 kg-cm (16 ft-lb, 22 N·m)





(MS with A/T)

INSTALL OIL COOLER TO LOWER TANK

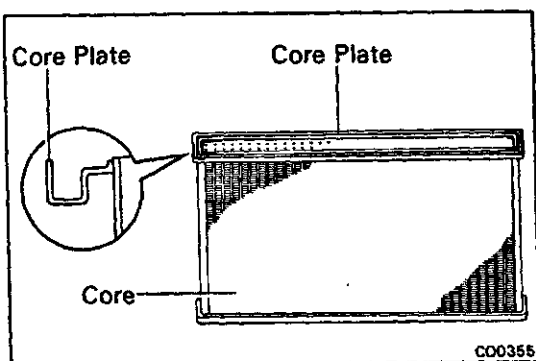
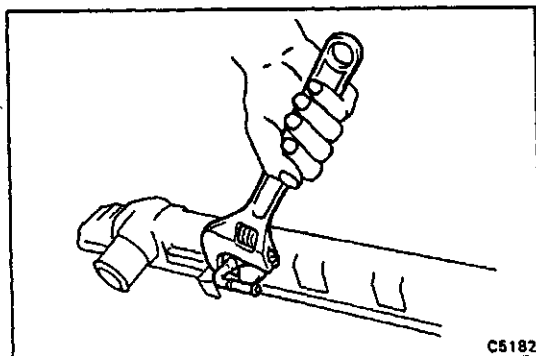
- (a) Clean the O-ring contact surface of the lower tank and oil cooler.
- (b) Install new O-rings (1) to the oil cooler (2).
- (c) Install the oil cooler (2) with the O-rings (1) to the lower tank (3).
- (d) Install the plate washers (4), spring washers (5) and nuts (6). Torque the nuts (6).

Torque: 220 kg-cm (16 ft-lb, 22 N-m)

- (e) Install the pipes (7).

Torque: 150 kg-cm (11 ft-lb, 15 N-m)

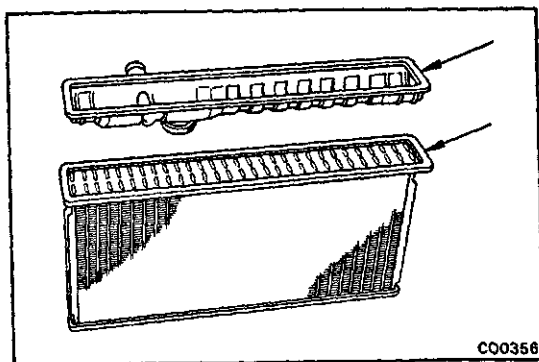
NOTE: Face the pipes in the same direction they were before disassembly.

**2. INSPECT CORE PLATE**

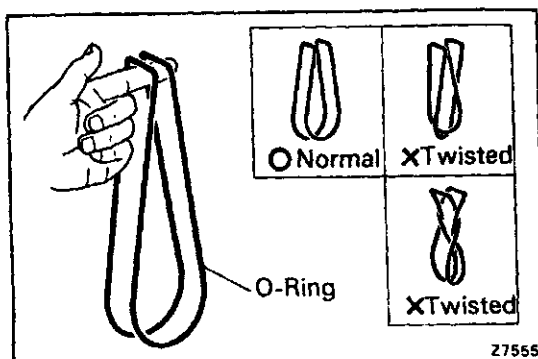
Inspect the core plate for damage.

NOTE:

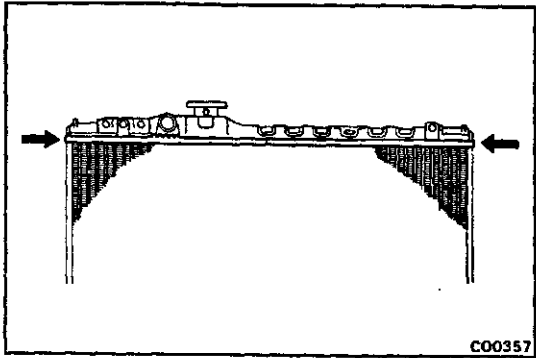
- If the sides of the core plate groove are deformed, reassembly of the tank will be impossible. Therefore, first correct any deformation with pliers.
- Water leakage will result if the bottom of the core plate groove is damaged or dented. Therefore, repair or replace if damaged.

**3. INSTALL NEW O-RING AND TANK****NOTE:**

- Clean the tank and core plate.

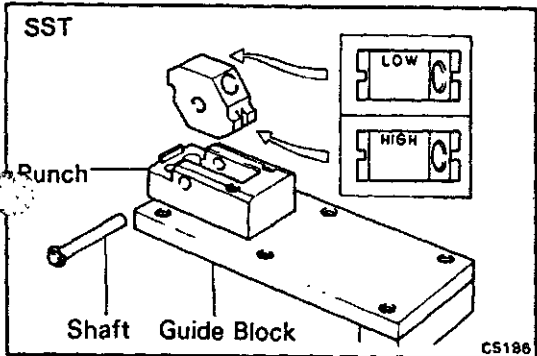


- Inspect the O-ring for twists.



4. INSTALL TANK PLATE

Insert the tank plates from both ends in the direction of the arrows. Insert to where the portions by the arrows contact with the tank.



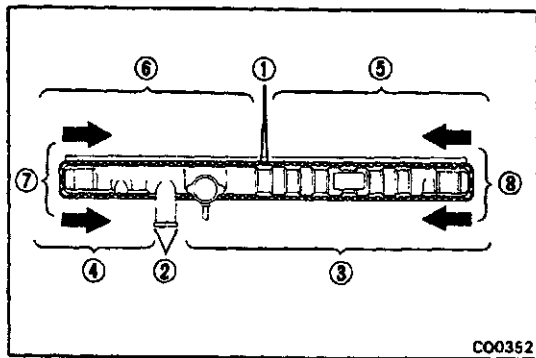
5. STAKE CLAW OF TANK PLATE

(a) Set the punch on SST to "LOW."

SST 09230-00010

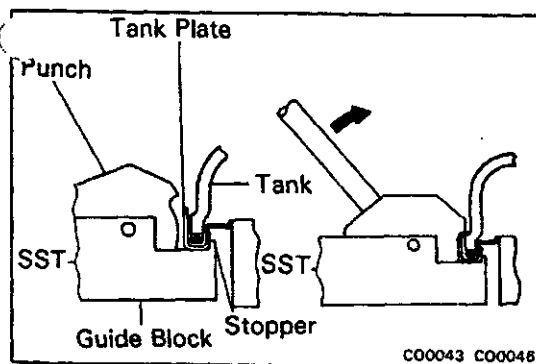
(b) Stake the claws of the tank plates with SST in the numerical order shown in the figure.

SST 09230-00010



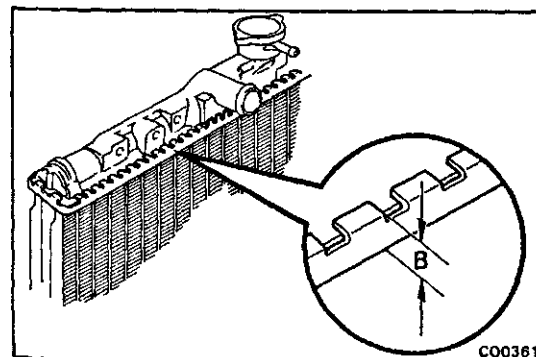
CAUTION: If the bottom of the core plate is staked with the SST on the guide block stopper, it may result in water leakage.

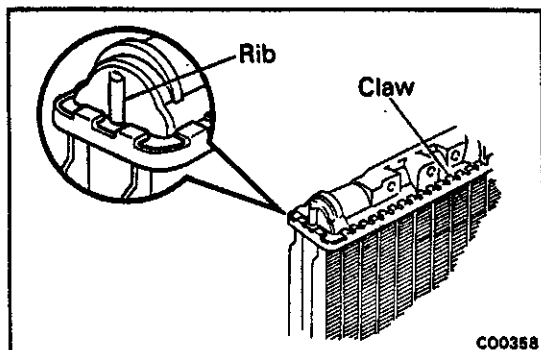
SST 09230-00010



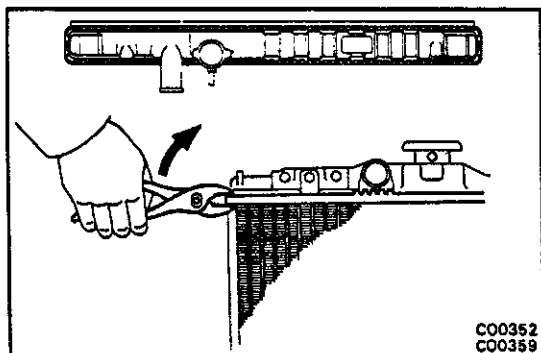
NOTE:

- Stake with just enough pressure to leave a mark on the claw. the staked plate height "B" should be as follows:
Plate height: 9.18 – 9.53 mm (0.3614 – 0.3752 in.)

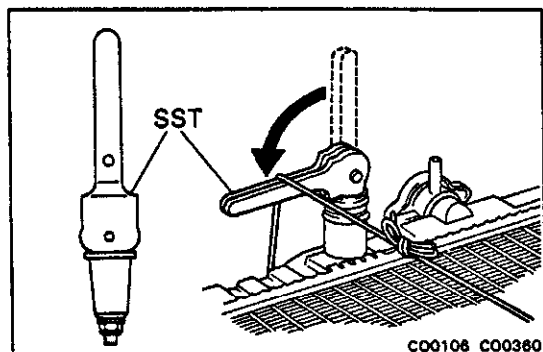




- Do not stake the areas protruding around the pipes, brackets or tank ribs.



- The points shown in the illustration cannot be staked with the SST. Use a pliers and be careful not to damage the core plate.



6. INSPECT FOR WATER LEAKS

- Tighten the drain plug.
- Plug the oil cooler pipes to prevent any water leakage into the oil cooler.
- Plug the inlet and outlet pipes of the radiator with SST.

SST 09230-00010

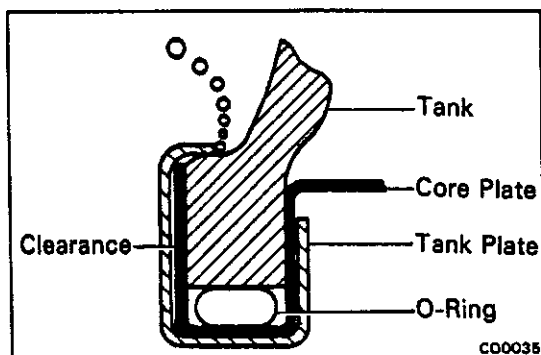
- Using a radiator cap tester, apply pressure to the radiator.

Test pressure: 1.5 kg/cm² (21 psi, 147 kPa)

- Inspect for water leaks.

NOTE: On radiator with resin tanks, there is a clearance between the core plate and tank plate where a minute amount of air will remain, giving the appearance of an air leak when the radiator is submerged in water.

Therefore, before performing the water leak test, first swish the radiator around in the water until all air bubbles disappear.



7. PAINT TANK PLATES

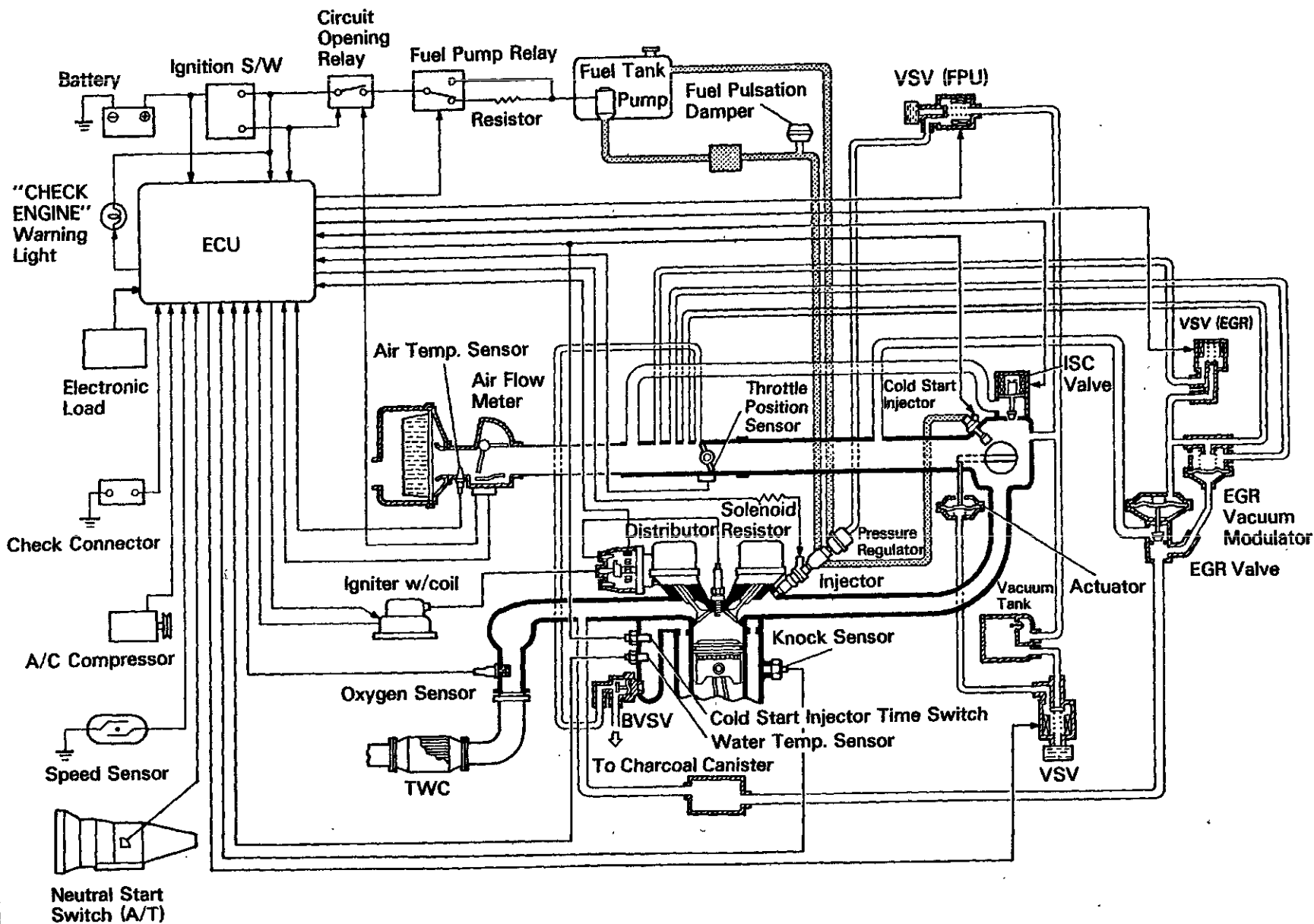
NOTE: If the water leak test checks out okay, allow the radiator to completely dry and then paint the tank plates.

EFI SYSTEM

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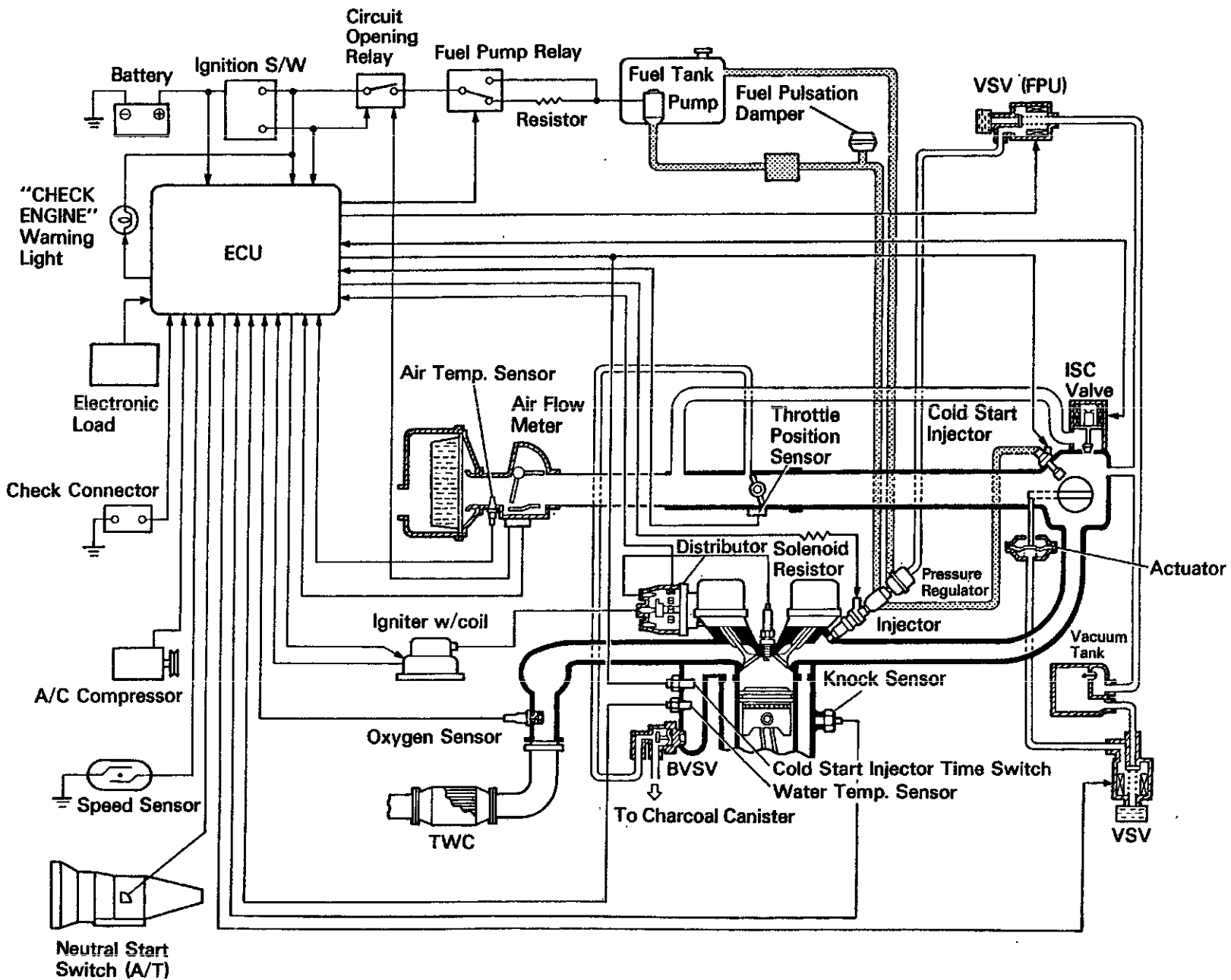
SYSTEM DESCRIPTION

7M-GE (Switzerland and Austria)



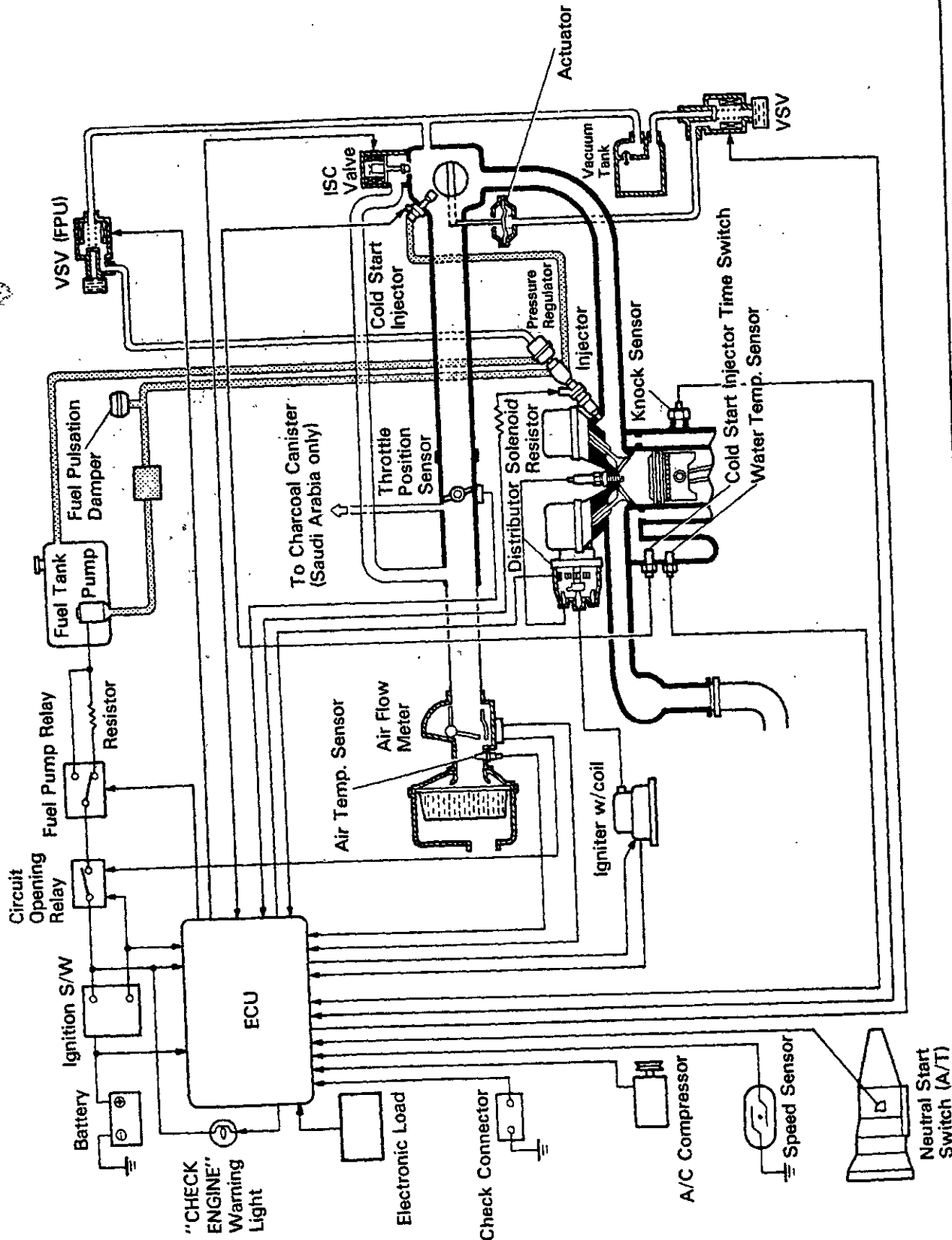
SYSTEM DESCRIPTION (Cont'd)

7M-GE (Australia)



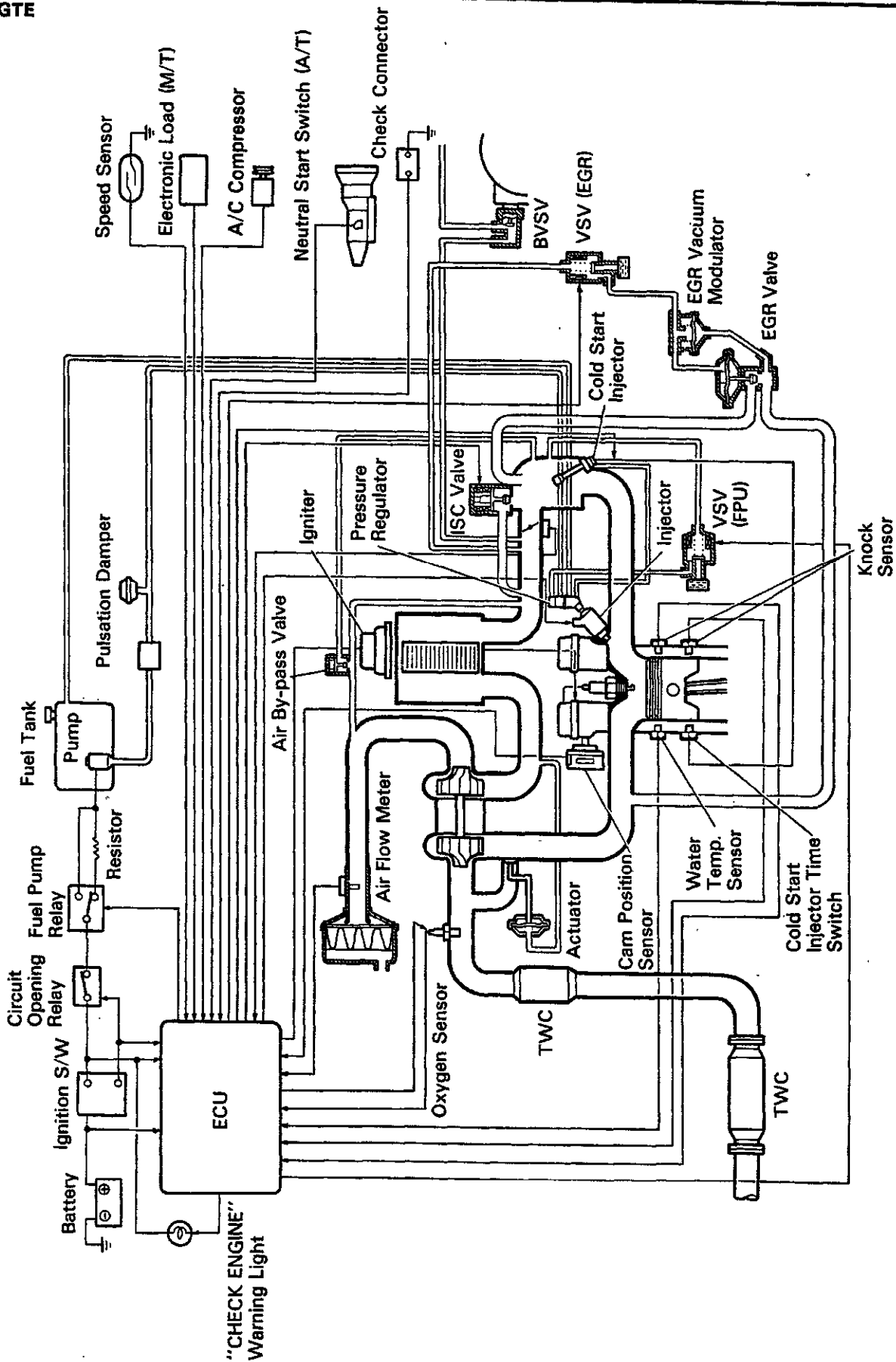
SYSTEM DESCRIPTION (Cont'd)

≡ (Others)



SYSTEM DESCRIPTION (Cont'd)

7M-GTE



The EFI system is composed of 3 basic sub systems; Fuel Induction, Air Induction and Electronic Control.

FUEL SYSTEM

An electric fuel pump supplies sufficient fuel, under a constant pressure, to the injectors. These injectors inject a metered quantity of fuel into the intake manifold in accordance with signals from the ECU (Electronic Control Unit).

AIR INDUCTION SYSTEM

The air induction system provides sufficient air for engine operation.

ELECTRONIC CONTROL SYSTEM

The 7M-GE, 7M-GTE engines are equipped with a Toyota Computer Control System (TCCS) which centrally controls the EFI, ESA, Diagnosis systems, etc. by means of an Electronic Control Unit (ECU — formerly EFI computer) employing a microcomputer.

By means of the ECU, the TCCS controls the following functions:

1. Electronic Fuel Injection (EFI)

The ECU receives signals from various sensors indicating changing engine operating conditions such as:

- Exhaust oxygen content (w/ TWC)
- Intake air volume
- Intake air temperature
- Coolant temperature
- Engine rpm
- Vehicle speed
- Acceleration/deceleration etc.

These signals are utilized by the ECU to determine the injection duration necessary for an optimum air-fuel ratio.

2. Electronic Spark Advance (ESA)

The ECU is programmed with data for optimum ignition timing under any and all operating conditions. Using data provided by sensors which monitor various engine functions (rpm, A/C signal, coolant temperature, etc.), the microcomputer (ECU) triggers the spark at precisely the right instant. (See IG section)

3. Idle Speed Control (ISC)

The ECU is programmed with target idling speed values to respond to different engine conditions (coolant temperature, air conditioner on/off, etc.). Sensors transmit signals to the ECU which control the flow of air through the bypass of the throttle valve and adjust idle speed to the target value. (See pages FI-53, 71, 108)

4. Diagnosis

The ECU detects any malfunctions or abnormalities in the sensor network and lights the "CHECK ENGINE" warning light on the instrument panel. At the same time, the trouble is identified and a diagnostic code is recorded by the ECU.

5. Fail-Safe Function

In the event of computer malfunction, a back-up circuit will take over to provide minimal drivability. Simultaneously, the "CHECK ENGINE" warning light will come on.

PRECAUTIONS

1. Before working on the fuel system, disconnect the negative terminal from the battery.

NOTE: Any diagnosis code retained by the computer will be erased when the battery terminal is removed.

Therefore, if necessary, read the diagnosis before removing the battery terminal.

2. Do not smoke or work near an open flame when working on the fuel system.
3. Keep gasoline off rubber or leather parts.

INSPECTION PRECAUTIONS

MAINTENANCE PRECAUTIONS

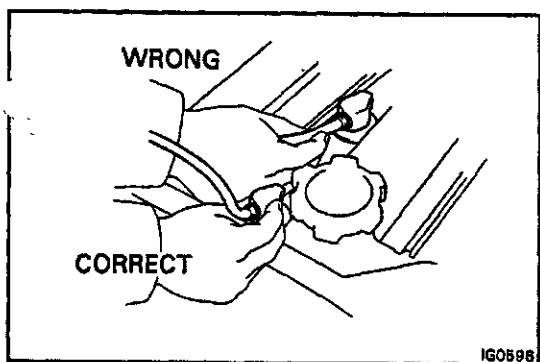
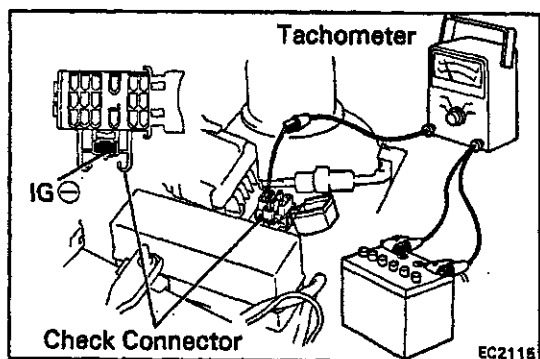
1. INSURE CORRECT ENGINE TUNE-UP
2. PRECAUTIONS WHEN CONNECTING GAUGE

- (a) Connect the tachometer test probe to the terminal IG $\ominus$ of check connector.

CHECK CONNECTOR LOCATION:

See pages FI-110, 111

- (b) Use the battery as the power source for the timing light, tachometer, etc.



3. IN EVENT OF ENGINE MISFIRE FOLLOWING PRECAUTIONS SHOULD BE TAKEN

- (a) Insure proper connection of battery terminals, etc.
- (b) Handle high tension cords carefully.
- (c) After repair work, insure that the ignition coil terminals and all other ignition system lines are reconnected securely.
- (d) When cleaning the engine compartment, be especially careful to protect the electrical system from water.

4. PRECAUTIONS WHEN HANDLING OXYGEN SENSOR (w/ TWC)

- (a) Do not allow oxygen sensor to drop or hit against an object.
- (b) Do not allow water to come into contact with the sensor or attempt to cool it.

IF VEHICLE IS EQUIPPED WITH MOBILE RADIO SYSTEM (HAM, CB, ETC)

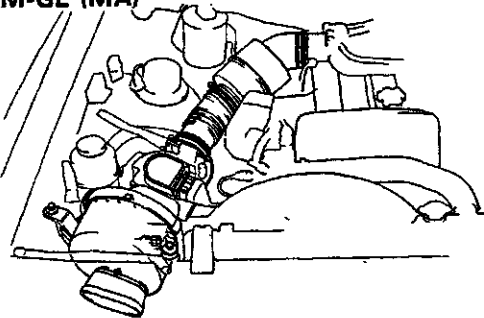
The ECU has been designed so that it will not be affected by outside interference.

However, if your vehicle is equipped with a CB radio transceiver, etc. (even one with about 10 W output), it may, at times, have an affect upon ECU operation, especially if the antenna and feeder are installed nearby.

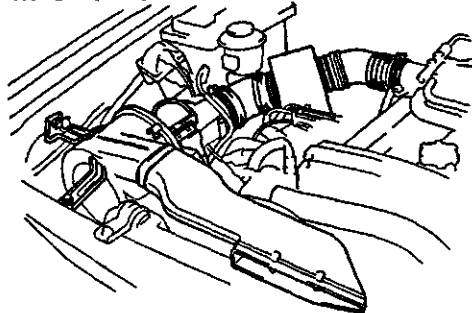
Therefore, observe the following precautions:

1. Install the antenna as far as possible from the ECU. The ECU is located behind the glove box (MA) or passenger's kick panel (MS), so the antenna should be installed in the rear of the vehicle.
2. Keep the antenna feeder as far away as possible from the ECU wires at least 20 cm (7.87 in.), and especially, do not wind them together.
3. Insure that the feeder and antenna are properly adjusted.
4. Do not equip your vehicle with a powerful mobile radio system.
5. Do not open the cover or the case of the ECU unless absolutely necessary. (If the IC terminals are touched, the IC may be destroyed by static electricity.)

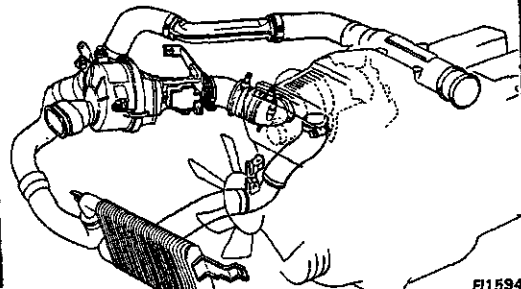
7M-GE (MA)



7M-GE (MS)



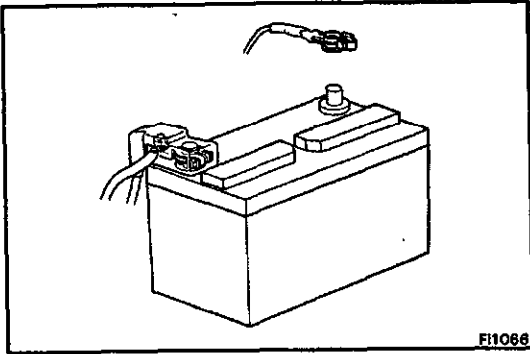
7M-GTE



FI1594

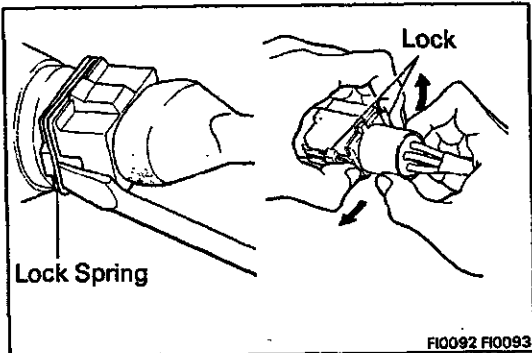
AIR INDUCTION SYSTEM

1. Separation the engine oil dipstick, oil filler cap, PCV hose, etc., may cause the engine to run out of tune.
2. Disconnection, looseness or cracks in the parts of the air induction system between the air flow meter and cylinder head will allow air suction and cause the engine to run out of tune.

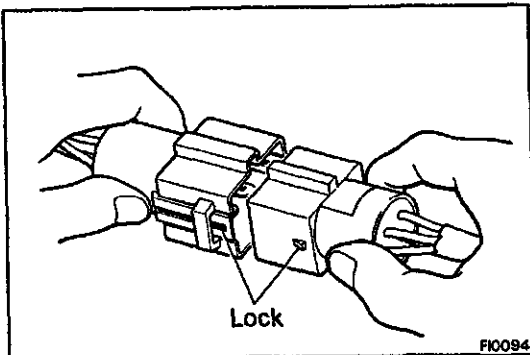


ELECTRONIC CONTROL SYSTEM

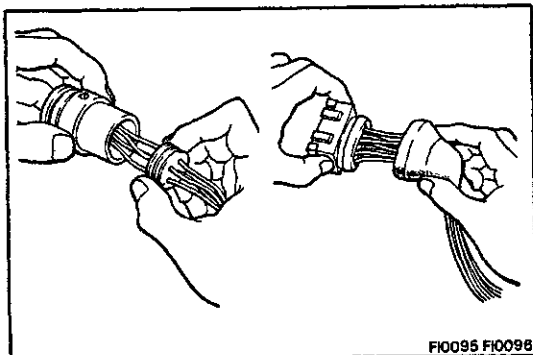
1. Before removing EFI wiring connectors, terminals, etc., first disconnect the power by either turning the ignition switch OFF or disconnecting the battery terminals.
2. When installing a battery, be especially careful not to incorrectly connect the positive and negative cables.
3. Do not permit parts to receive a severe impact during removal or installation. Handle all EFI parts carefully, especially the ECU.
4. Do not be careless during troubleshooting as there are numerous transistor circuits and even slight terminal contact can cause further troubles.
5. Do not open the ECU cover.
6. When inspecting during rainy weather, take care to prevent entry of water. Also, when washing the engine compartment, prevent water from getting on the EFI parts and wiring connectors.
7. Parts should be replaced as an assembly.



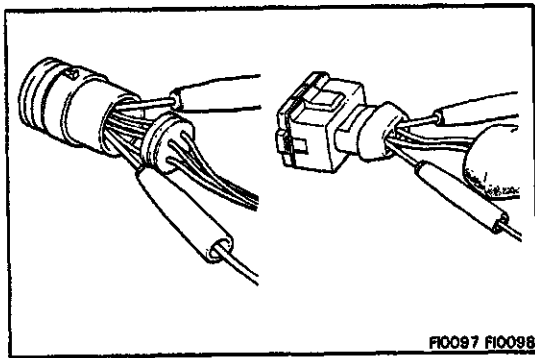
8. Care is required when pulling out the inserting wiring connectors.
 - (a) Release the lock and pull out the connector, pulling on the connectors.



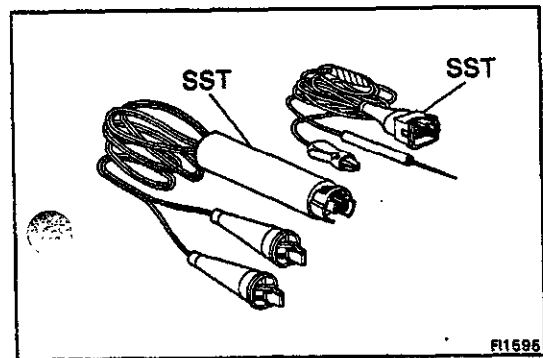
- (b) Fully insert the connector and insure that it is locked.



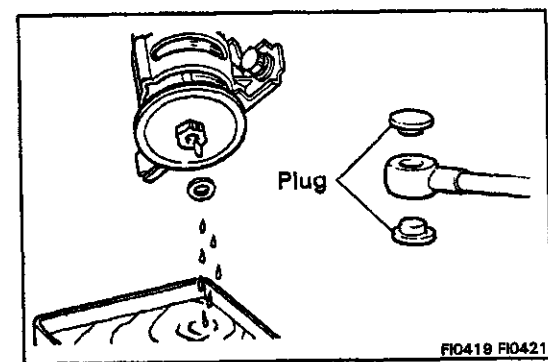
9. When inspecting a connector with a circuit tester.
 - (a) Carefully take out the water-proofing rubber if it is a water-proof type connector.



- (b) Insert the tester probe into the connector from the wiring side when checking the continuity, amperage or voltage.
- (c) Do not apply unnecessary force to the terminal.
- (d) After checking, install the water-proofing rubber on the connector securely.

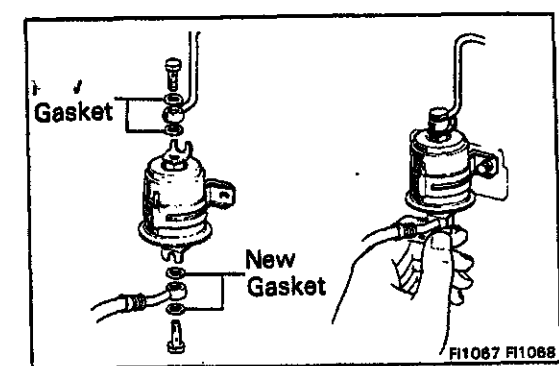


- 10. Use SST for inspection or test of the injector, cold start injector or its wiring connector.
SST 09842-30050 and 09842-30060

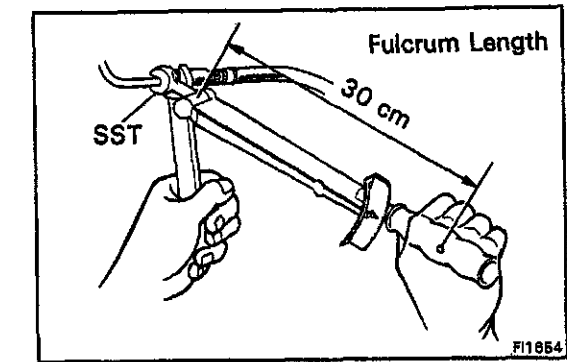


FUEL SYSTEM

- 1. When disconnecting the high fuel pressure line, a large amount of gasoline will spill out, so observe the following procedure.
 - (a) Put a container under the connection.
 - (b) Slowly loosen the connection.
 - (c) Disconnect the connection.
 - (d) Plug the connection with a rubber plug.

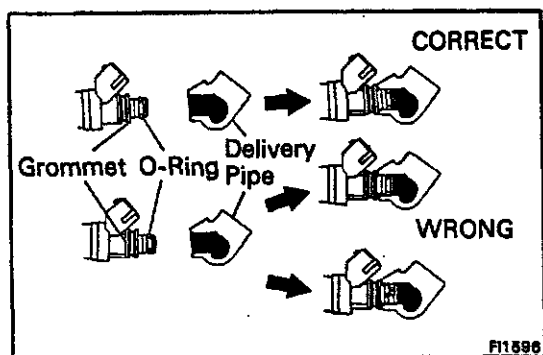


- 2. When connecting the flare nut or union bolt on the high pressure pipe union, observe the following procedure:
(Union bolt type)
 - (a) Always use a new gasket.
 - (b) Hand tighten the union bolt.
 - (c) Tighten the bolt to the specified torque.**Torque: 300 kg-cm (22 ft-lb, 29 N·m)**

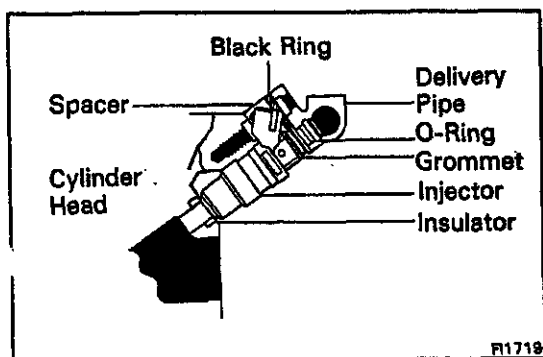


- (Flare nut type)
 - (a) Apply a thin coat of oil to the flare and tighten the flare nut.
 - (b) Then using SST, tighten the nut to the specified torque.

SST 09631-22020
Torque: 310 kg-cm (22 ft-lb, 30 N·m)
NOTE: Use a torque wrench with a fulcrum length of 30 cm (11.81 in.).

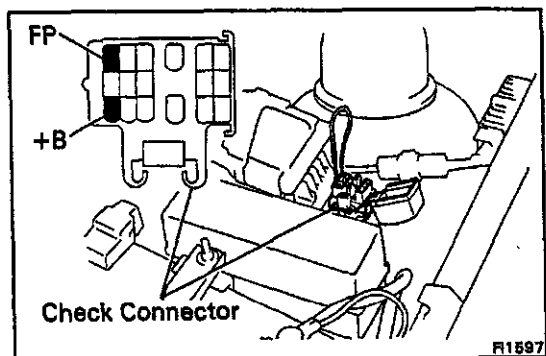


3. Observe the following precautions when removing and installing the injectors.
 - (a) Never reuse a O-ring.
 - (b) When placing an O-ring on the injector, use care care not to damage it in any way.
 - (c) Lubricate the O-ring with spindle oil or gasoline before installing - never use engine, gear or brake oil.



4. Install the injector to the delivery pipe and cylinder head as shown in the figure.

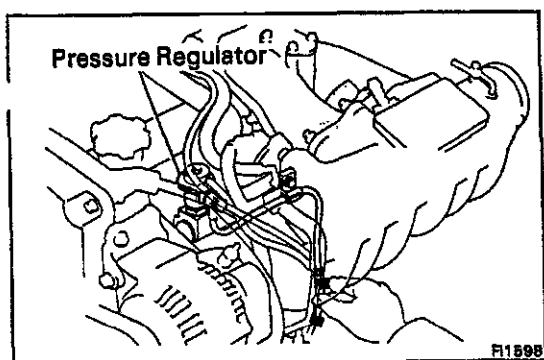
NOTE: Install the spacer with the black ring side facing upward.



5. Check that there are no fuel leaks after performing any maintenance on the fuel system.
 - (a) With engine stopped, turn the ignition switch ON.
 - (b) Short circuit the fuel pump check terminal +B and FP of the check connector with the service wire.

CHECK CONNECTOR LOCATION:

See pages FI-110, 111



- (c) When the fuel return hose is pinched, the pressure within the high pressure line will rise to about 4 kg/cm (57 psi, 392 kPa). In this state, check to see that there are no leaks from any part of the fuel system.

CAUTION: Always pinch the hose. Avoid bending as it may cause the hose to crack.

TROUBLESHOOTING

TROUBLESHOOTING HINTS

1. Engine troubles are usually not caused by the EFI system. When troubleshooting, always first check the condition of the other systems.

- (a) Electronic source

- Battery
- Fusible links
- Fuses

- (b) Body ground

- (c) Fuel supply

- Fuel leakage
- Fuel filter
- Fuel pump

- (d) Ignition system

- Spark plug
- High-tension cord
- Distributor (7M-GE) or cam position sensor (7M-GTE)
- Igniter and ignition coil

- (e) Air induction system

- Vacuum leaks

- (f) Emission control system

- PCV system
- EGR system (w/ EGR)

- (g) Others

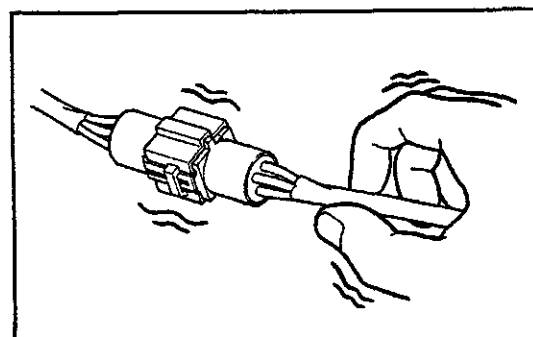
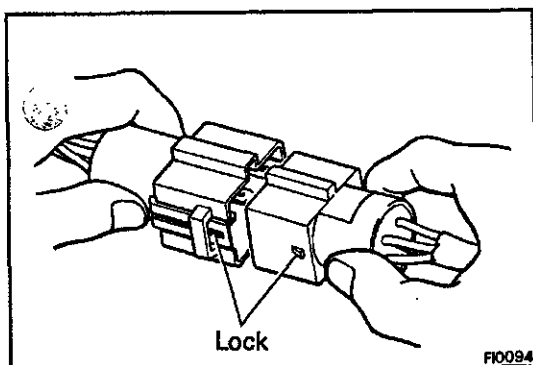
- Ignition timing (ESA system)
- Idle speed (ISC system)

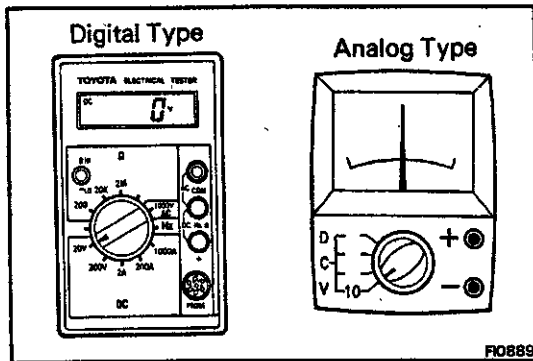
2. The most frequent cause of problems is simply a bad contact in wiring connectors. Always make sure that connections are secure.

When inspecting the connector, pay particular attention to the following points:

- (a) Check to see that the terminals are not bent.
 - (b) Check to see that the connector is pushed in completely and locked.
 - (c) Check to see that there is no signal change when the connector is slightly tapped or wiggled.

3. Sufficiently troubleshoot for other causes before replacing the ECU. The ECU is of high quality and it is expensive.

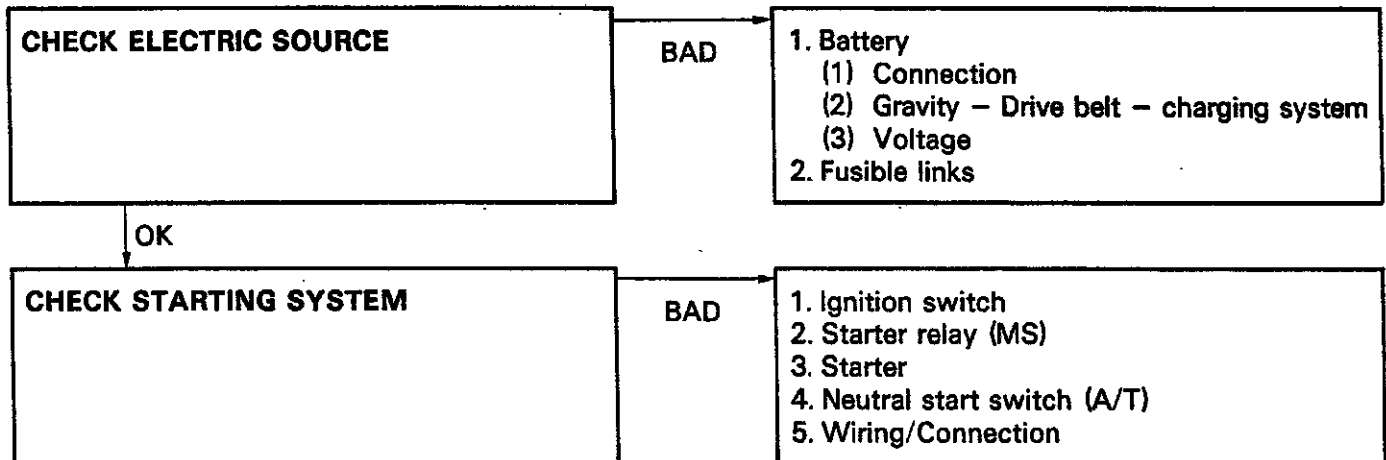


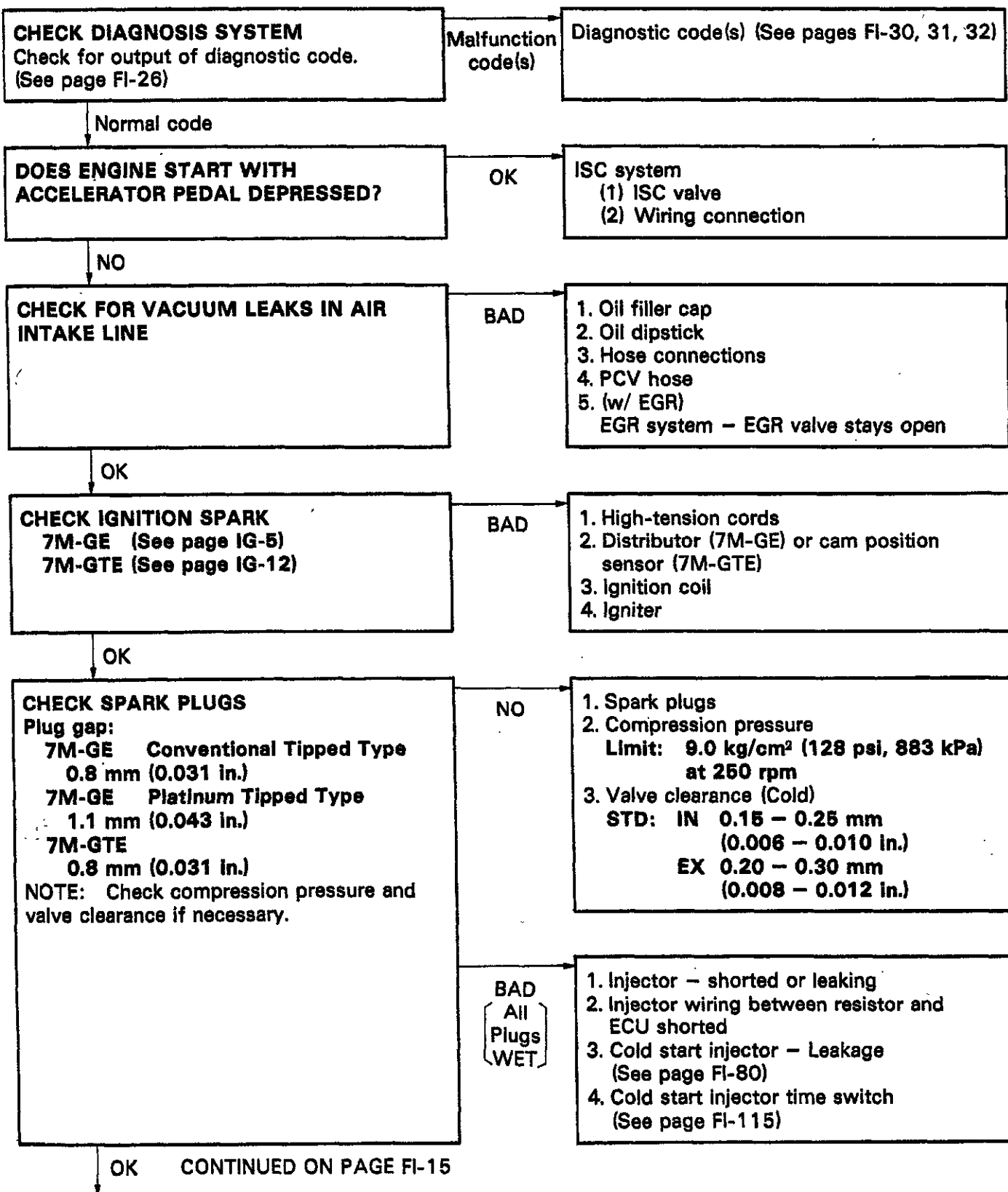


4. Use a volt/ohmmeter with high impedance (10 k.Ω/V minimum) for troubleshooting of the electrical circuit. (See pages FI-34, 57)

TROUBLESHOOTING PROCEDURES

SYMPTOM — DIFFICULT TO START OR NO START (ENGINE WILL NOT CRANK OR CRANKS SLOWLY)



SYMPTOM — DIFFICULT TO START OR NO START (CRANKS OK)

OK CONTINUED FROM PAGE FI-14

CHECK FUEL SUPPLY TO INJECTOR

1. Fuel in tank
2. Fuel pressure in fuel line
 - (1) Short terminals +B and FP of the check connector.
 - (2) You can feel fuel pressure in fuel return hose.
3. Check circuit opening relay (See page FI-113)

BAD

1. Fuel line — leakage — deformation
2. Fuse
3. Fuel pump (See page FI-73)
4. Fuel filter
5. Fuel pressure regulator (See page FI-84)
6. Circuit opening relay (See page FI-113)

OK

CHECK FUEL PUMP SWITCH IN AIR FLOW METER (7M-GE)

Check continuity between terminals FP and E1 with measuring plate of air flow meter open.

BAD

Air flow meter (See page FI-96)

OK

CHECK IGNITION TIMING

1. Short terminals T(MA) or TE1(MS) and E1 of the check connector.
2. Check ignition timing.
STD: 10° BTDC @ Idle
[w/ short circuited T(MA) or TE1(MS) — E1]

NO

Adjust ignition timing (See page EM-17)

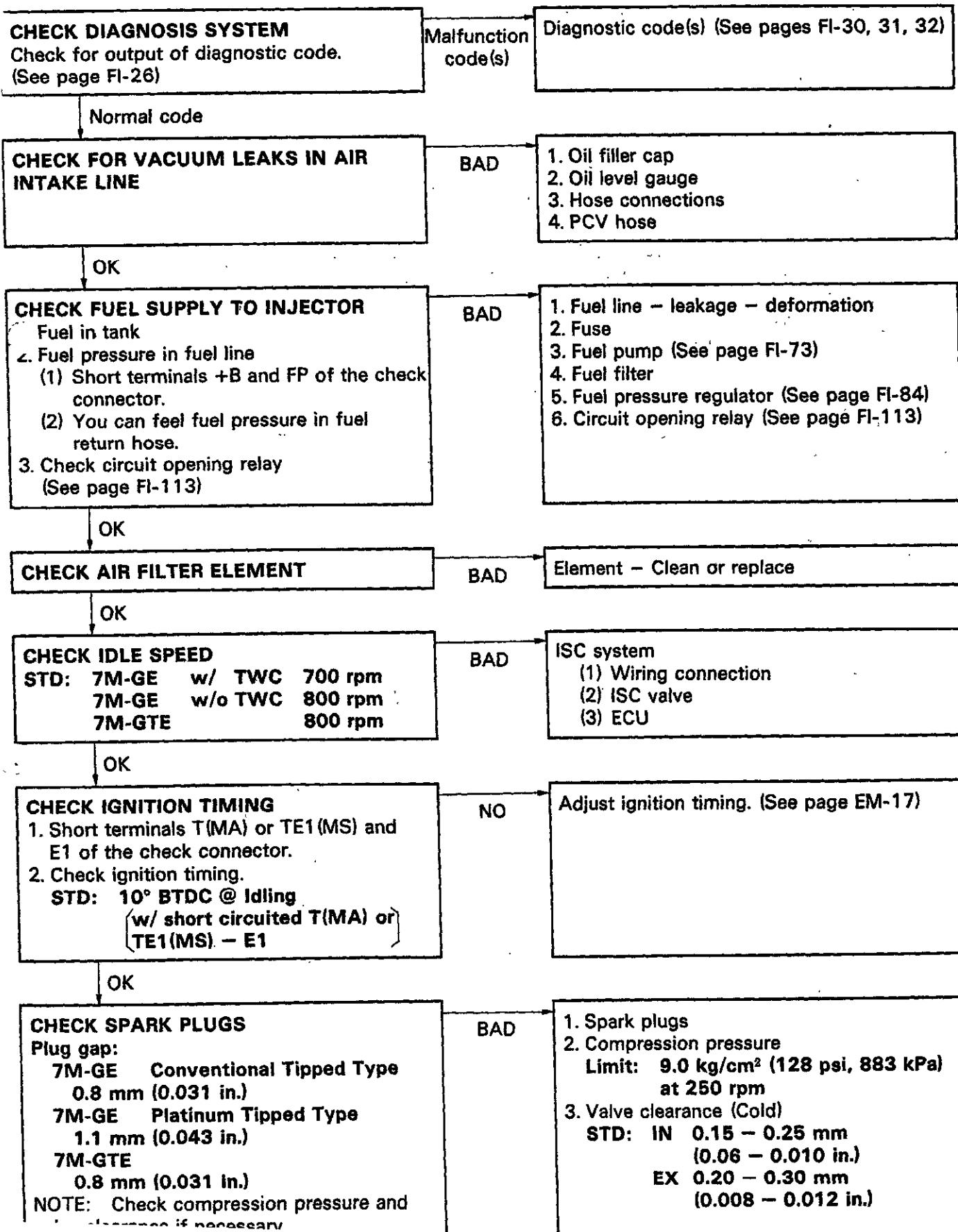
OK

CHECK EFI ELECTRONIC CIRCUIT USING VOLT/OHMMETER
(See pages FI-34, 57)

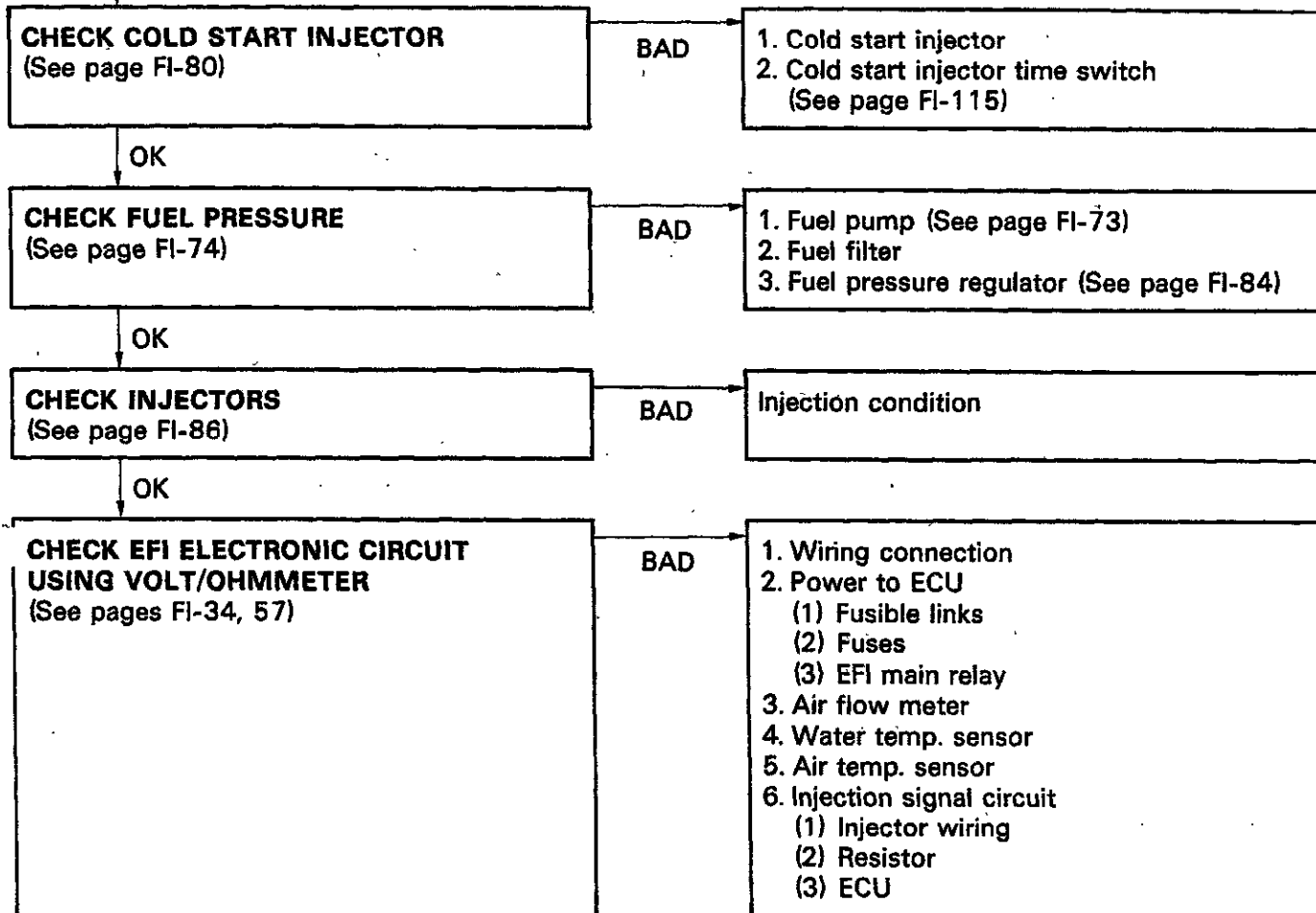
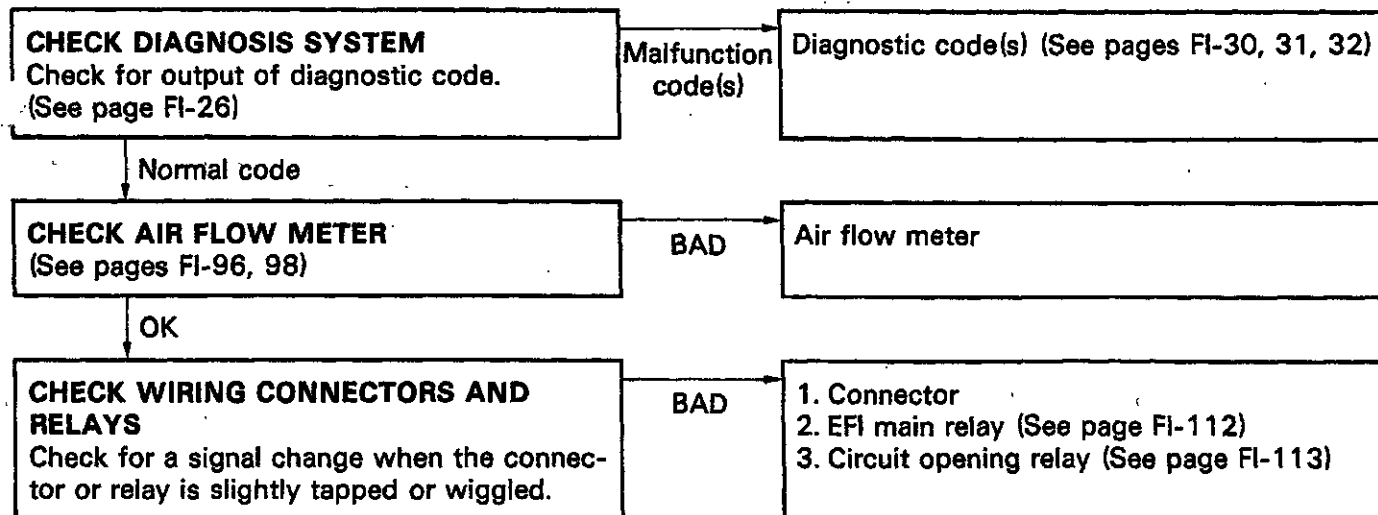
BAD

1. Wiring connection
2. Power to ECU
 - (1) Fusible links
 - (2) Fuses
 - (3) EFI main relay
3. Air flow meter
4. Water temp. sensor
5. Air temp. sensor
6. Injection signal circuit
 - (1) Injector wiring
 - (2) Resistor
 - (3) ECU

SYMPTOM — ENGINE OFTEN STALLS



OK CONTINUED FROM PAGE FI-16

**SYMPTOM — ENGINE SOMETIMES STALLS**

SYMPTOM — ROUGH IDLING AND/OR MISSING

CHECK DIAGNOSIS SYSTEM

Check for output of diagnostic code.
(See page FI-26)

Malfunction
code(s)

Diagnostic code(s) (See pages FI-30, 31, 32)

Normal code

CHECK FOR VACUUM LEAKS IN AIR
INTAKE LINE

BAD

1. Oil filler cap
2. Oil level gauge
3. Hose connections
4. PCV hose
5. EGR system — EGR valve stays open (EGR)

OK

CHECK AIR FILTER ELEMENT

BAD

Element — Clean or replace

OK

CHECK IDLE SPEED

STD: 7M-GE w/ TWC 700 rpm
7M-GE w/o TWC 800 rpm
7M-GTE 800 rpm

BAD

ISC system
(1) Wiring connection
(2) ISC valve
(3) ECU

OK

CHECK IGNITION TIMING

1. Short terminals T(MA) or TE1(MS) and E1 of the check connector.
2. Check ignition timing.

STD: 10° BTDC @ Idling

(w/ short circuited T(MA) or
TE1(MS) — E1)

NO

Adjust ignition timing. (See page EM-17)

OK

CHECK SPARK PLUGS

Plug gap:

7M-GE Conventional Tipped Type
0.8 mm (0.031 in.)

7M-GE Platinum Tipped Type
1.1 mm (0.043 in.)

7M-GTE
0.8 mm (0.031 in.)

NOTE: Check compression pressure and valve clearance if necessary.

BAD

1. Spark plugs
2. Compression pressure
Limit: 9.0 kg/cm² (128 psi, 883 kPa)
at 250 rpm
3. Valve clearance (Cold)
STD: IN 0.15 — 0.25 mm
(0.06 — 0.010 in.)
EX 0.20 — 0.30 mm
(0.008 — 0.012 in.)

OK CONTINUED ON PAGE FI-19

OK CONTINUED FROM PAGE FI-18

CHECK COLD START INJECTOR
(See page FI-80)

BAD

1. Cold start injector
2. Cold start injector time switch
(See page FI-115)

OK

CHECK FUEL PRESSURE
(See page FI-74)

BAD

1. Fuel pump (See page FI-73)
2. Fuel filter
3. Fuel pressure regulator (See page FI-84)

OK

CHECK INJECTORS
(See page FI-86)

BAD

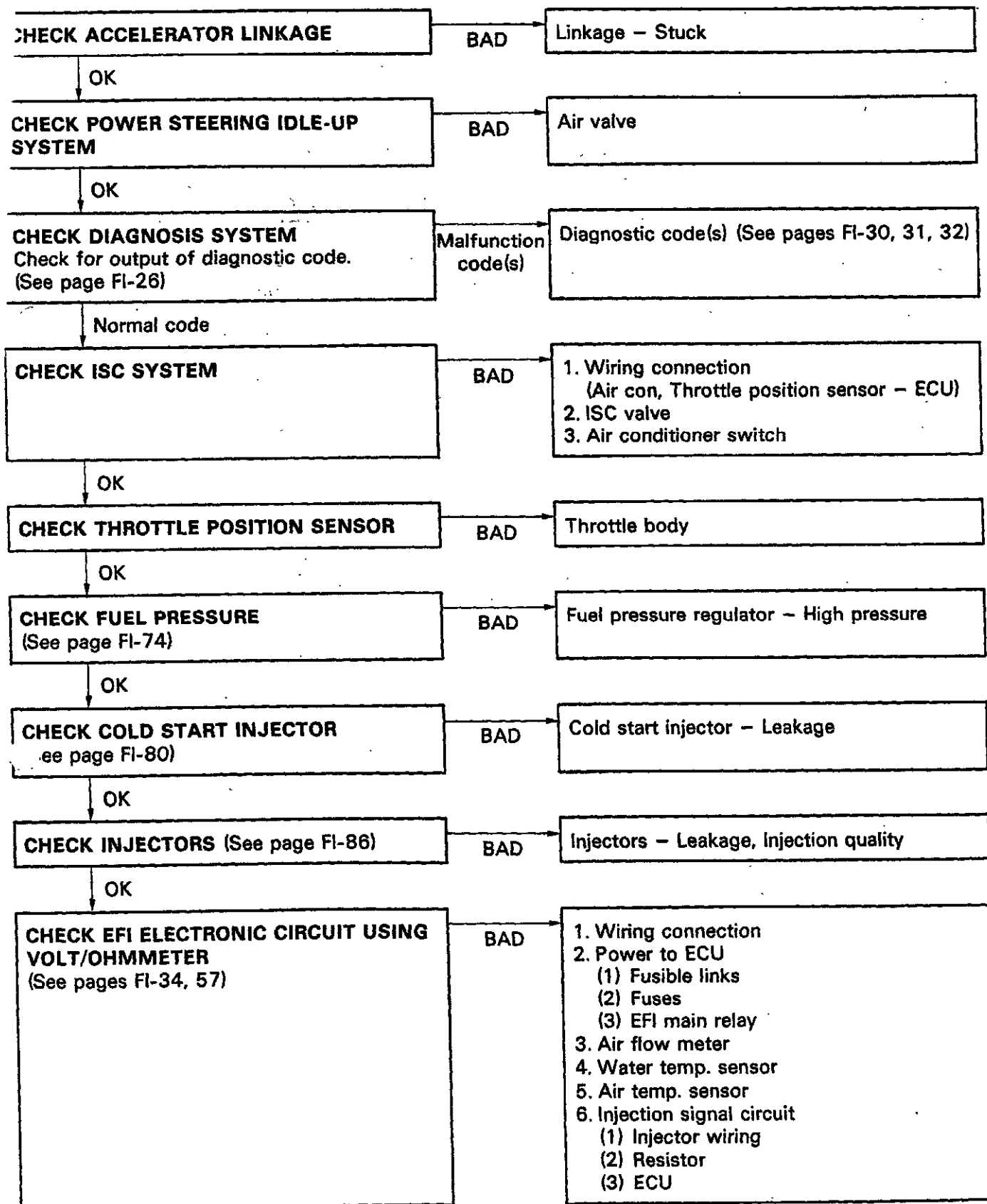
Injection condition

OK

**CHECK EFI ELECTRONIC CIRCUIT
USING VOLT/OHMMETER**
(See pages FI-34, 57)

BAD

1. Wiring connection
2. Power to ECU
 - (1) Fusible links
 - (2) Fuses
 - (3) EFI main relay
3. Air flow meter
4. Water temp. sensor
5. Air temp. sensor
6. Throttle position sensor
7. Injection signal circuit
 - (1) Injector wiring
 - (2) Resistor
 - (3) ECU

SYMPTOM — HIGH ENGINE IDLE SPEED (NO DROP)

SYMPTOM — ENGINE BACKFIRES-Lean Fuel Mixture**CHECK DIAGNOSIS SYSTEM**

Check for output of diagnostic code
(See page FI-26)

Malfunction
code(s)

Diagnostic code(s) (See pages FI-30, 31, 32)

Normal code

CHECK FOR VACUUM LEAKS IN AIR INTAKE LINE

BAD

1. Oil filler cap
2. Oil dipstick
3. Hose connections
4. PCV hose

OK

CHECK IGNITION TIMING

1. Short terminals T(MA) or TE1(MS) and E1 of the check connector.
2. Check ignition timing.
STD: 10° BTDC @ Idling
(w/ short circuited T(MA) or TE1(MS) — E1)

NO

Adjust ignition timing. (See page EM-17)

OK

CHECK COLD START INJECTOR
(See page FI-80)

BAD

1. Cold start injector
2. Cold start injector time switch
(See page FI-115)

OK

CHECK FUEL PRESSURE
(See page FI-74)

BAD

1. Fuel pump (See page FI-73)
2. Fuel filter
3. Fuel pressure regulator (See page FI-84)

OK

CHECK INJECTORS
(See page FI-86)

BAD

Injectors — Clogged

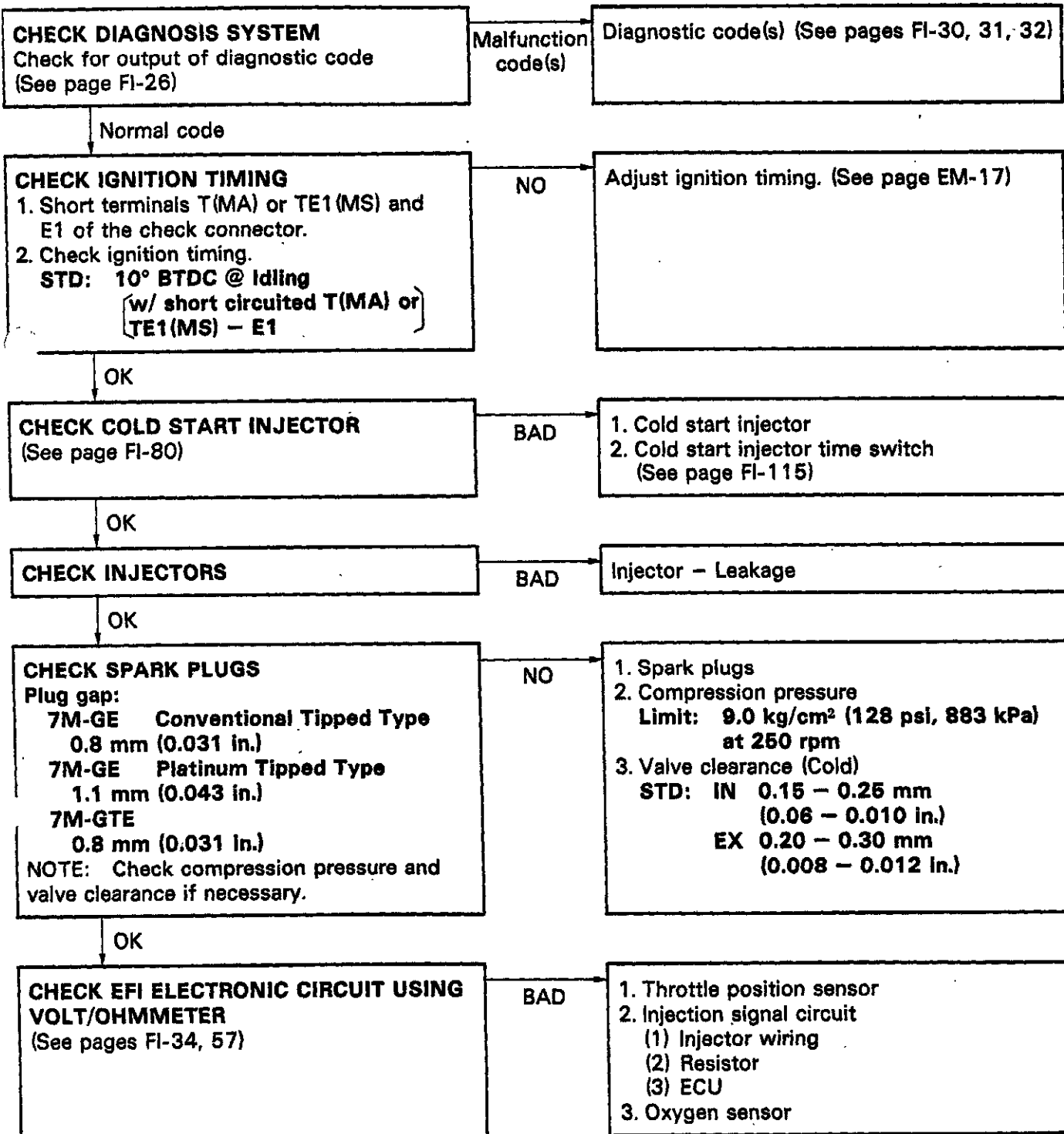
OK

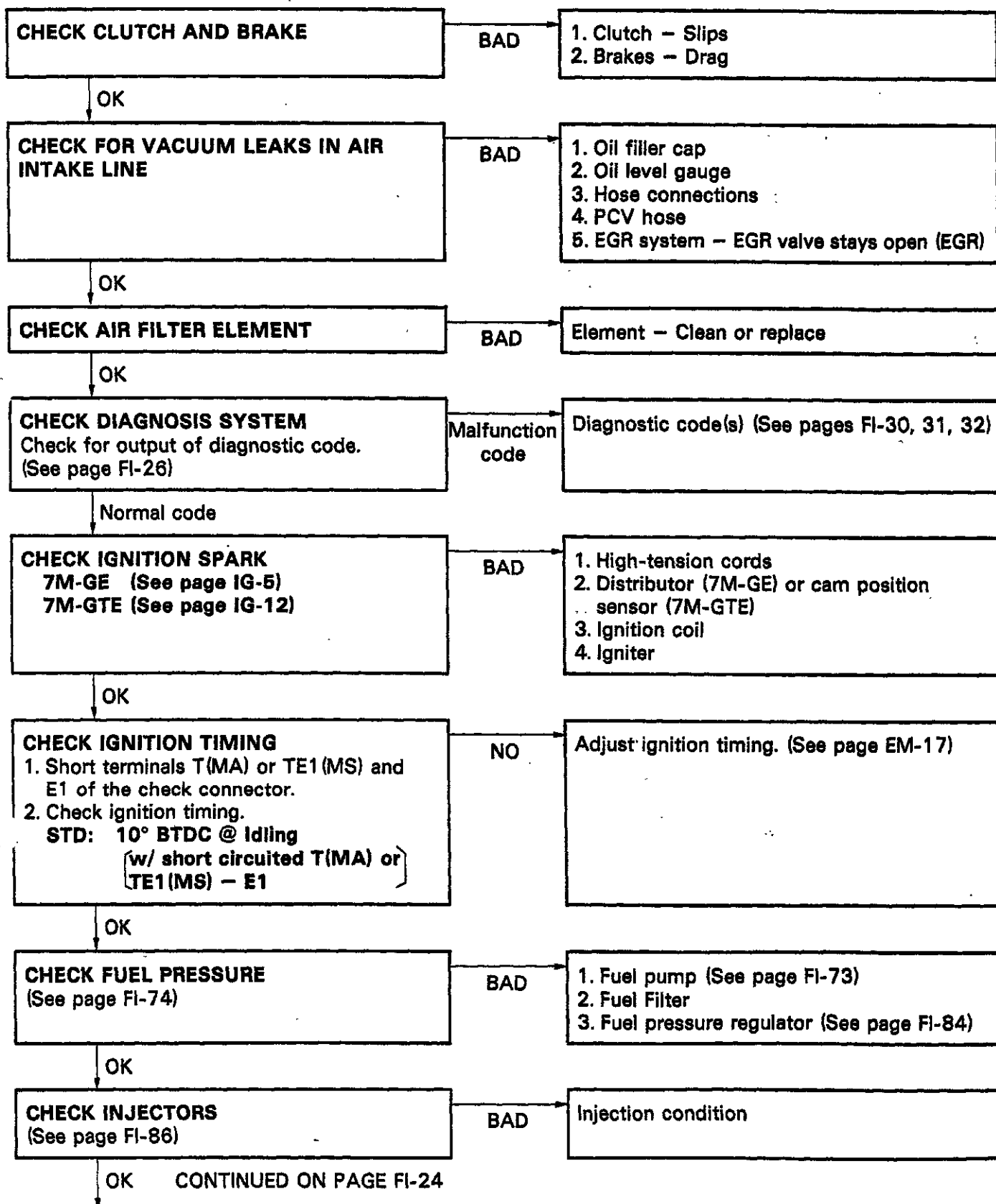
CHECK EFI ELECTRONIC CIRCUIT USING VOLT/OHMMETER
(See pages FI-34, 57)

BAD

1. Wiring connection
2. Power to ECU
 - (1) Fusible links
 - (2) Fuses
 - (3) EFI main relay
3. Air flow meter
4. Water temp. sensor
5. Air temp. sensor
6. Throttle position sensor
7. Injection signal circuit
 - (1) Injector wiring
 - (2) Resistor
 - (3) ECU
 - (4) Fuel cut signal
8. Oxygen sensor

SYMPTOM — MUFFLER EXPLOSION (AFTER FIRE) -Rich Fuel Mixture-Misfire



SYMPTOM — ENGINE HESITATES AND/OR POOR ACCELERATION

OK CONTINUED FROM PAGE FI-23

CHECK SPARK PLUGS**Plug gap:****7M-GE Conventional Tipped Type**

0.8 mm (0.031 in.)

7M-GE Platinum Tipped Type

1.1 mm (0.043 in.)

7M-GTE

0.8 mm (0.031 in.)

NOTE: Check compression pressure and valve clearance if necessary.

BAD

1. Spark plugs
2. Compression pressure
Limit: 9.0 kg/cm² (128 psi, 883 kPa)
at 250 rpm
3. Valve clearance (Cold)
STD: IN 0.15 – 0.25 mm
(0.06 – 0.010 in.)
EX 0.20 – 0.30 mm
(0.008 – 0.012 in.)

OK

CHECK EFI ELECTRONIC CIRCUIT**USING VOLT/OHMMETER**

(See pages FI-34, 57)

BAD

1. Wiring connection
2. Power to ECU
 - (1) Fusible links
 - (2) Fuses
 - (3) EFI main relay
3. Air flow meter
4. Water temp. sensor
5. Air temp. sensor
6. Throttle position sensor
7. Injection signal circuit
 - (1) Injector wiring
 - (2) Resistor
 - (3) ECU

DIAGNOSIS SYSTEM

DESCRIPTION

(MA)

The ECU contains a built-in self-diagnosis system by which troubles with the engine signal network are detected and a "CHECK ENGINE" warning light on the instrument panel flashes.

By analyzing various signals as shown in the later table (See pages FI-30, 31) the Electronic Control Unit (ECU) detects system malfunctions which are related to the various operating parameter sensors or to the actuator. The ECU stores the failure until the diagnosis system is cleared by removing the EFI fuse with the ignition switch off.

A "CHECK ENGINE" warning light on the instrument panel informs the driver that a malfunction has been detected.

The light goes out automatically when the malfunction has been cleared.

The diagnostic code can be read by the number of the blinks of the "CHECK ENGINE" warning light when T and E1 are short-circuit.

(MS)

The ECU contains a built-in self-diagnosis system by which troubles with the engine signal network are detected and a "CHECK ENGINE" warning light on the instrument panel flashes.

By analyzing various signals as shown in the later table (See page FI-32) the Electronic Control Unit (ECU) detects system malfunctions which are related to the various operating parameter sensors or to the actuator. The ECU stores the failure until the diagnosis system is cleared by removing the EFI fuse with the ignition switch off.

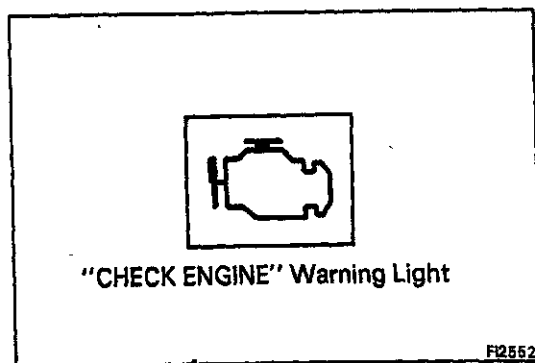
In the ECU, a test mode function has been added to the functions of the self-diagnosis system of the previous diagnosis mode (normal mode) for the purpose of detecting malfunctions such as poor contact which are difficult to detect in the normal mode. This function fills up the self-diagnosis system. The test mode can be implemented by the technician to follow the procedures of appropriate check terminal connection and operation described in later (See page FI-28).

In the normal mode, the self-diagnosis system monitors 14 items, indicated by the codes except for code No. 51 as shown in FI-32. A "CHECK ENGINE" warning light on the instrument panel informs the driver that a malfunction has been detected. The light goes out automatically when the malfunction has been cleared.

The diagnostic code can be read by the number of the blinks of the "CHECK ENGINE" warning light when TE1 and E1 are short-circuited.

In the test mode, seven items, indicated by code Nos. 13, 22, 24, 41, 42, 43, and 51, as shown in FI-32 are monitored. If a malfunction is detected in any one of the systems indicated by code Nos. 13, 22, 24, and 41 the ECU lights the "CHECK ENGINE" warning light to warn the technician that the malfunction has been detected. In this case, TE2 and E1 terminals on the check connector should be connected as shown later (See page FI-28)

In the test mode, for all seven conditions shown above in code Nos. 13 - 51, even if the malfunction is corrected, the malfunction is stored in the ECU memory while the ignition switch remains on. Also, when a malfunction occurs for the four conditions from code Nos. 13 - 41, the "CHECK ENGINE" warning light remains on. However, once the ignition switch is turned off, the ECU erases all of the malfunctions in the memory. The diagnostic mode (normal or test) and the output of the "CHECK ENGINE" warning light can be selected by the TE1, TE2 and E1 terminal connections on the check connector, as shown in the later.



"CHECK ENGINE" WARNING LIGHT CHECK

1. The "CHECK ENGINE" warning light will come on when the ignition switch is placed at ON and the engine is not running.
2. When the engine is started, the "CHECK ENGINE" warning light should go out.

If the light remains on, the diagnosis system has detected a malfunction or abnormality in the system.

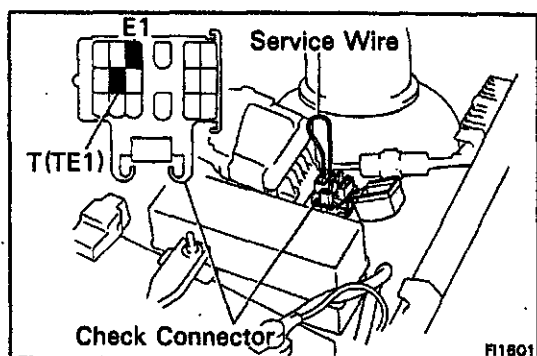
OUTPUT OF DIAGNOSIS CODES

(MA)

To obtain an output of diagnostic codes, proceed as follows:

1. Initial conditions
 - (a) Battery voltage about 11 volts
 - (b) Throttle valve fully closed (throttle position sensor IDL points closed)
 - (c) Transmission in neutral position
 - (d) Accessory switches OFF
2. Turn the ignition switch to ON. Do not start the engine.

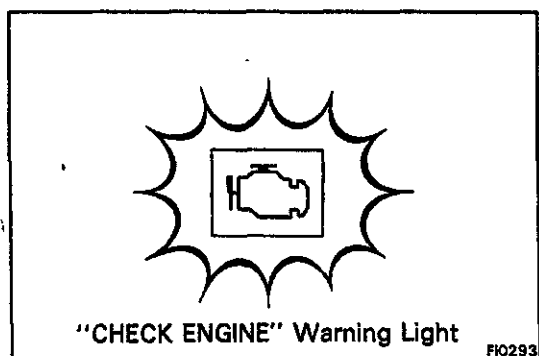
** 2 use this method*



3. Using a service wire, short terminals T(MA) or TE1(MS) and E1 of the check connector.

CHECK CONNECTOR LOCATION:
See pages FI-110, 111

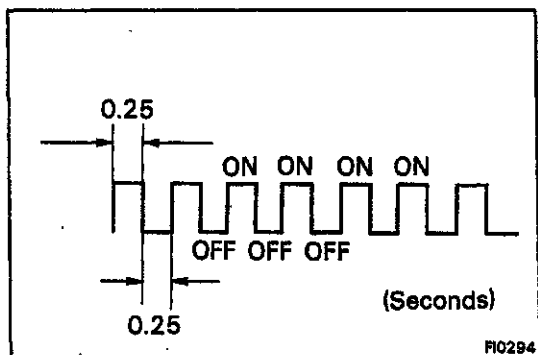
4. Read the diagnosis code as indicated by the number of flashes of the "CHECK ENGINE" warning light.



Diagnosis code (See pages FI-30, 31, 32)

(a) Normal System Operation

- The light will alternately blink on and off for 0.25 second intervals.

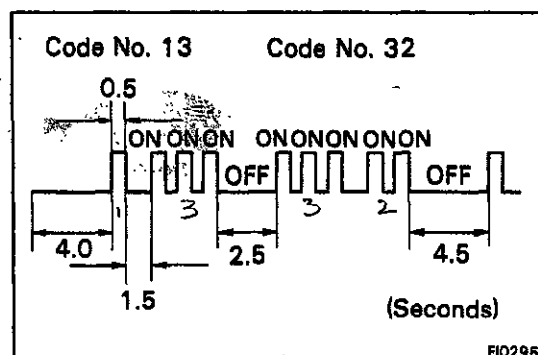


(b) Malfunction Code Indication

- The light will blink the number of times equal to the malfunction code indication with pauses as follows:
 1. Between the first digit and second digit, 1.5 seconds.
 2. Between code and code, 2.5 seconds.
 3. Before repeating all malfunction codes, 4.5 seconds.
- The diagnostic code series will be repeated as long as the "CHECK ENGINE" connector terminals T(TE1) and E1 are shorted.

NOTE: In event of a number of trouble codes, indication will begin from the small value and continue to the larger in order.

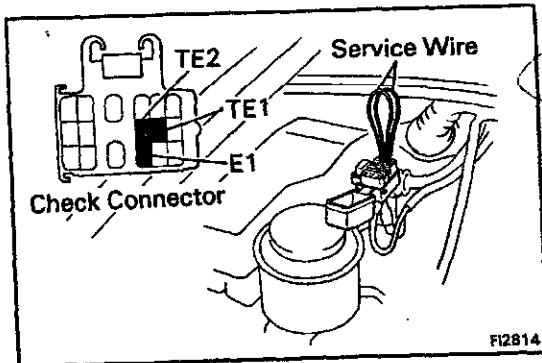
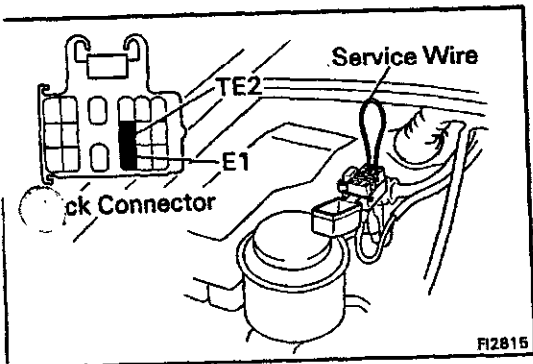
5. After the diagnosis check, remove the service wire.



(MS)

Normal mode
(See procedure MA)

car has to be driven



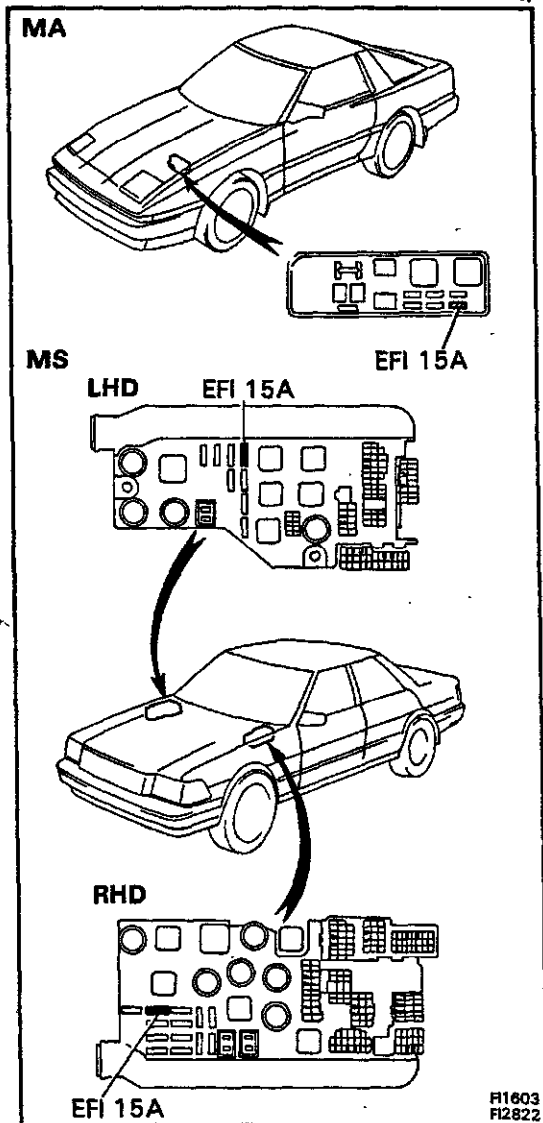
Test mode

To obtain an output of diagnostic codes, proceed as follows:

1. Initial conditions
 - (a) Battery voltage about 11 volts
 - (b) Throttle valve fully closed (throttle position sensor IDL points closed)
 - (c) Transmission in neutral position
 - (d) Accessory switches OFF
2. Using a service wire, short terminals TE2 and E1 of the check connector.
3. Start the engine and run the vehicle at a speed of 10 km/h (6 mph) or higher.
4. Simulate the conditions of the malfunction described by the user.
5. Using a service wire, short terminals TE1 and E1 of the check connector.

NOTE:

- The test mode will not start if terminals TE2 and E1 are connected after the ignition switch is turned on, or terminals TE2 and E1 are connected after terminals TE1 and E1 are connected.
 - The starter signal and vehicle speed signal will be diagnosed by the ECU as malfunctions, and codes No. 42, and 43 will be output, if the operation in 3. above is not performed.
6. Read the diagnosis code as indicated by the number of flashes of the "CHECK ENGINE" warning light.
(See page FI-27)
 7. After the diagnosis check, remove the service wires.



CANCELLING OUT DIAGNOSTIC CODE

1. After repair of the trouble area, the diagnostic code retained in memory by the ECU must be cancelled out by removing the EFI fuse 15A for 30 seconds or more, depending on ambient temperature (the lower the temperature, the longer the fuse must be left out) with the ignition switch off.

NOTE:

- Cancellation can also be done by removing the battery negative (-) terminal, but in this case other memory systems (clock etc.) will also be cancelled out.
 - If the diagnostic code is not cancelled out, it will be retained by the ECU and appear along with a new code in event of future trouble.
 - If it is necessary to work on engine components requiring removal of the battery terminal, a check must first be made to see if a diagnostic code has been recorded.
2. After cancellation, road test the vehicle to check that a "normal" code is now read on the "CHECK ENGINE" warning light.

If the same diagnostic code is still indicated, it means that the trouble area has not been repaired thoroughly.

DIAGNOSIS INDICATION

- (1) When 2 or more codes are indicated, the lowest number (code) will appear first.
However, no other code will appear along with code No. 11.
- (2) All detected diagnostic codes, except 51 and 53, will be retained in memory by the ECU from the time of detection until cancelled out.
- (3) Once the malfunction is cleared, the "CHECK ENGINE" warning light on the instrument panel will go out but the diagnostic code(s) remain stored in ECU memory (except for codes 51 and 53).

DIAGNOSTIC CODES (MA)

Code No.	Number of Check engine blinks	System	Diagnosis	Trouble area	See page
—	 FI1804	Normal	This appears when none of the other codes area identified.	—	—
11	 FI1805	ECU (+B)	Momentary interruption in power supply to ECU.	● Ignition switch circuit ● Ignition switch ● Main relay circuit ● Main relay ● ECU	FI-41
12	 FI1806	RPM Signal	No "NE" or "G" signal to ECU within 2 seconds after engine has been cranked.	● Distributor circuit ● Distributor ● Starter signal circuit ● ECU	IG-3
13	 FI1807	RPM Signal	No "NE" signal to ECU when engine speed is above 1,000 rpm.	● Distributor circuit ● Distributor ● ECU	IG-3
14	 FI1808	Ignition Signal	No "IGF" signal to ECU 6 – 8 times in succession.	● Ignition and ignition coil circuit ● Igniter and ignition coil ● ECU	FI-51
*1 21	 FI1809	Oxygen Sensor Signal	Detection of oxygen sensor deterioration.	● Oxygen sensor circuit ● Oxygen sensor ● ECU	FI-122
22	 FI1810	Water Temp. Sensor Signal	Open or short circuit in water temp. sensor signal.	● Water temp. sensor circuit ● Water temp. sensor ● ECU	FI-49
24	 FI1811	Intake Air Temp. Sensor Signal	Open or short circuit in intake air temp. sensor signal.	● Intake air temp. sensor circuit ● Intake air temp. sensor ● ECU	FI-48
31	 FI1812	Air-flow Meter Signal	(7M-GE) Open circuit in VC signal or short circuit between VS and E2 when idle contacts are closed. (7M-GTE) Open or Short circuit in air flow meter signal.	● Air flow meter circuit ● Air flow meter ● ECU	FI-44
32	 FI1813	(7M-GE) Air Flow Meter Signal	(7M-GE) Open circuit in E2 or short circuit between VC and VS.	● Air flow meter circuit ● Air flow meter ● ECU	FI-44
		(7M-GTE) HAC Sensor Signal	(7M-GTE) Open or short circuit in HAC sensor signal	● HAC sensor circuit ● HAC sensor ● ECU	FI-56
*2 34	 FI2818	Turbocharger Pressure	*3 Turbocharger pressure is abnormal.	● Turbocharger ● Air flow meter ● Intercooler system ● ECU	—
41	 FI1814	Throttle Position Sensor Signal	Open or short circuit in throttle position sensor signal.	● Throttle position sensor circuit ● Throttle position sensor ● ECU	FI-42

DIAGNOSTIC CODES (MA) (Cont'd)

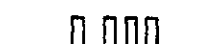
Code No.	Number of Check engine blinks	System	Diagnosis	Trouble area	See page
42	 FI1815	Vehicle Speed Sensor Signal	No "SPD" signal for 5 seconds when engine speed is between 2,500 rpm and 4,500 rpm and coolant temp. is below 80°C (176°F) except when racing the engine.	• Vehicle speed sensor circuit • Vehicle speed sensor • ECU	—
43	 FI1816	Starter Signal	No "STA" signal to ECU until engine speed reaches 800 rpm with vehicle not moving.	• Ignition switch circuit • Ignition switch • ECU	FI-50
52	 FI1818	Knock Sensor Signal	Open or short circuit in knock sensor signal.	• Knock sensor circuit • Knock sensor • ECU	—
53	 FI1819	Knock Control signal in ECU	Knock control in ECU faulty.	• ECU	—
51	 FI1817	Switch Signal	No "IDL" signal, "NSW" signal or "A/C" signal to ECU, with check terminals E1 and T shorted.	• A/C switch circuit • A/C switch • A/C amplifire • Neutral start switch circuit • Neutral start switch • Throttle position sensor circuit • Throttle position sensor • ECU	—

*1 w/ TWC vehicles only

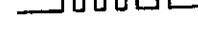
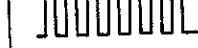
*2 7M-GTE only

*3 Abnormalities in the air flow meter may also be detected.

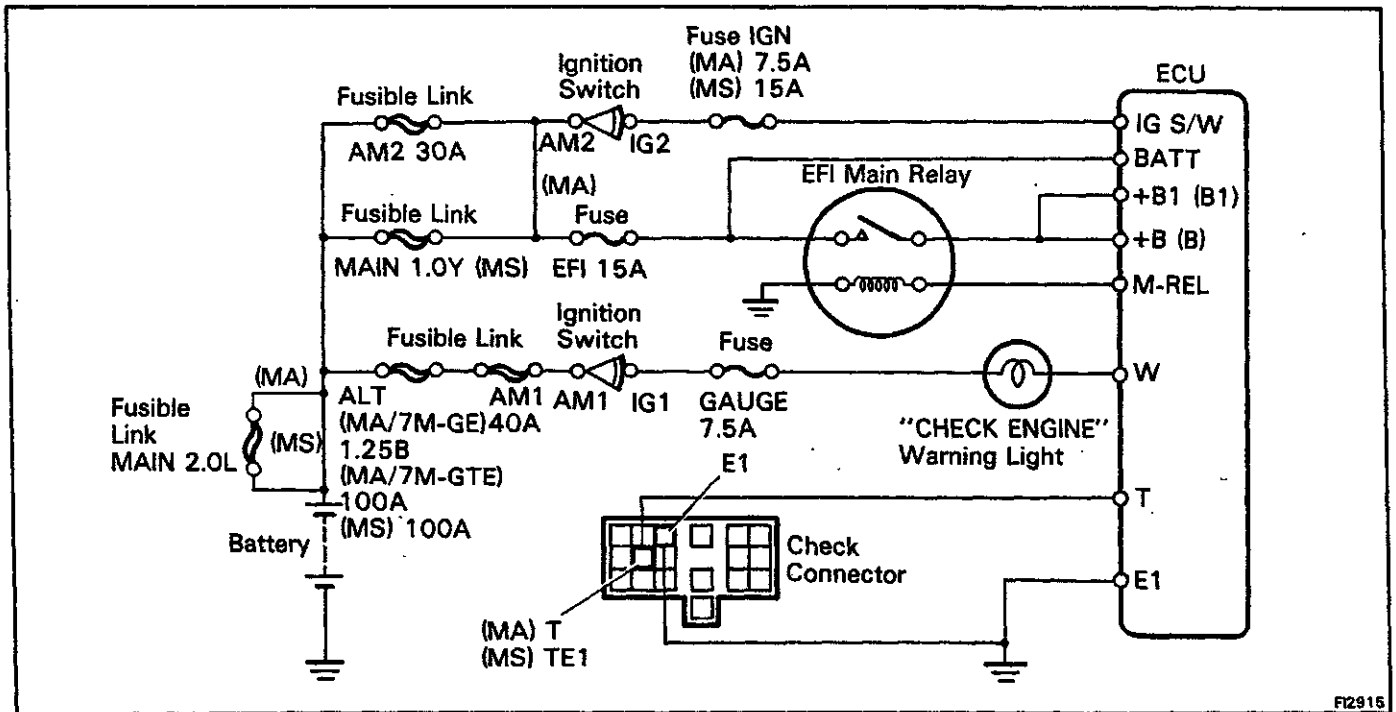
DIAGNOSTIC CODES (MS)

Code No.	Number of Check engine blinks	System	Diagnosis	Trouble area	See page
—	 FI1804	Normal	This appears when none of the other codes are identified.	—	—
11	 FI1805	ECU (B)	Momentary interruption in power supply to ECU.	• Ignition switch circuit • Ignition switch • Main relay circuit • Main relay • ECU	FI-62
12	 FI1806	RPM Signal	No "NE" or "G" signal to ECU within 2 seconds after engine has been cranked.	• Distributor circuit • Distributor • Starter signal circuit • ECU	IG-3
13	 FI1807	RPM Signal	No "NE" signal to ECU when engine speed is above 1,000 rpm.	• Distributor circuit • Distributor • ECU	IG-3
14	 FI1808	Ignition Signal	No "IGF" signal to ECU 6 – 8 times in succession.	• Igniter and ignition coil circuit • Igniter and ignition coil • ECU	FI-70

DIAGNOSTIC CODES (MS) (Cont'd)

Code No.	Number of Check engine blinks	System	Diagnosis	Trouble area	See page
22	 FI1610	Water Temp. Sensor Signal	Open or short circuit in water temp. sensor signal.	- Water temp. sensor circuit - Water temp. sensor - ECU	FI-68
24	 FI1611	Intake Air Temp. Sensor Signal	Open or short circuit in intake air temp. sensor signal.	- Intake air temp. sensor circuit - Intake air temp. sensor - ECU	FI-67
31	 FI1612	Air-flow Meter Signal	Open circuit in VC signal or short circuit between VS and E2 when idle contacts are closed.	- Air flow meter circuit - Air flow meter - ECU	FI-65
32	 FI1613	Air-flow Meter Signal	Open circuit in E2 or short circuit between VC and VS.	- Air flow meter circuit - Air flow meter - ECU	FI-65
41	 FI1614	Throttle Position Sensor Signal	Open or short circuit in throttle position sensor signal.	- Throttle position sensor circuit - Throttle position sensor - ECU	FI-63
42	 FI1615	Vehicle Speed Sensor Signal	No "SPD" signal for 5 seconds when engine speed is between 2,500 rpm and 4,500 rpm and coolant temp. is below 80°C (176°F) except when racing the engine.	- Vehicle speed sensor circuit - Vehicle speed sensor	—
43	 FI1616	Starter Signal	No "STA" signal to ECU until engine speed reaches 800 rpm with vehicle not moving.	- Ignition switch circuit - Ignition switch - ECU	FI-69
52	 FI1618	Knock Sensor Signal	Open or short circuit in knock sensor signal.	- Knock sensor circuit - Knock sensor - ECU	—
53	 FI1619	Knock Control signal in ECU	Knock control in ECU faulty.	ECU	—
72	 FI2811	A/C Compressor Relay Signal	Open or short circuit in A/C compressor relay signal.	- A/C compressor relay circuit - A/C compressor relay - ECU	—
51	 FI2811	Switch Signal	No "IDL" signal, "NSW" signal or "A/C" signal to ECU, with check terminals E1 and TE1 shorted.	- A/C switch circuit - A/C switch - A/C amplifire - Neutral start switch circuit - Neutral start switch - Throttle position sensor circuit - Throttle position sensor	—

INSPECTION OF DIAGNOSIS CIRCUIT



- ```

graph TD
 subgraph 1 [1.]
 Q1{Dose "CHECK ENGINE" warning light come on when ignition switch is at ON?}
 Q1 -- YES --> A1[System Normal]
 Q1 -- NO --> Q2{Does "CHECK ENGINE" warning light come on when ECU terminal W is grounded to the body?}
 Q2 -- YES --> A2[Check wiring between ECU terminal E1 and body ground.]
 Q2 -- NO --> A3[Check bulb, fuse and wiring between ECU and ignition switch.]
 A2 -- OK --> A4[Try another ECU]
 A2 -- BAD --> A5[Repair or replace]
 A3 -- BAD --> A6[Repair or replace.]
 end

 subgraph 2 [2.]
 Q3{Does "CHECK ENGINE" warning light go off when the engine is started?}
 Q3 -- YES --> A7[System Normal]
 Q3 -- NO --> Q4{Check wiring between ECU and "CHECK ENGINE" warning light.}
 Q4 -- BAD --> A8[Repair]
 Q4 -- OK --> Q5{Is there diagnostic code output when check connector terminals T(MA) or TE1(MS) and E1 are short circuited?}
 Q5 -- NO --> Q6{Check wiring between ECU terminal T and check connector terminal T(MA) or TE1(MS), and ECU terminal E1 and check connector terminal E1.}
 Q5 -- YES --> Q7{Does "CHECK ENGINE" warning light go out after repair according to malfunction code?}
 Q6 -- OK --> A9[Try another ECU.]
 Q6 -- NO --> A10[Further repair required.]
 Q7 -- YES --> A11[System OK]
 Q7 -- NO --> A10
 A11 --> A12[Cancel out diagnostic code.]
 end

```

## TROUBLESHOOTING WITH VOLT/OHMMETER (MA)

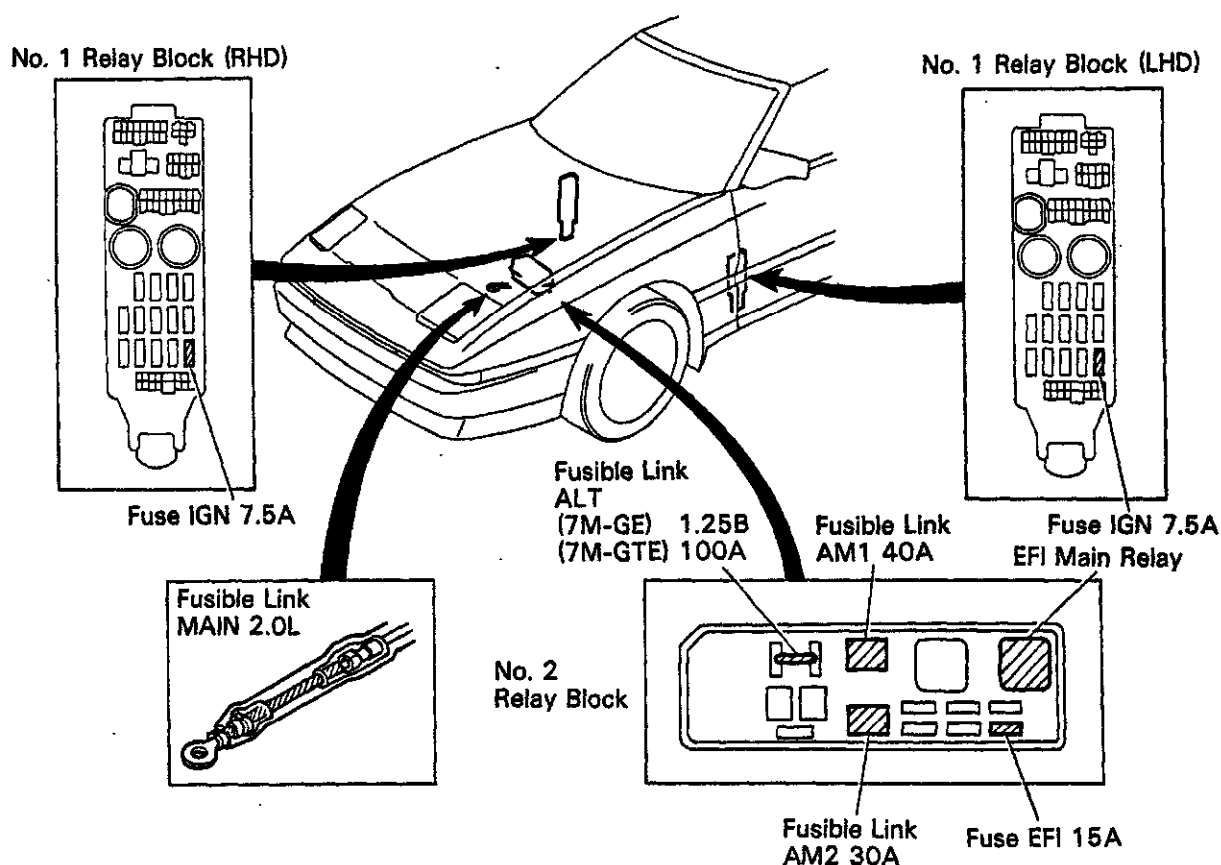
**NOTE:** The following troubleshooting procedures are designed for inspection of each separate system, and therefore the actual procedure may vary somewhat. However, troubleshooting should be performed referring to the inspection methods described in this manual.

Before beginning inspection, it is best to first make a simple check of the fuses, fusible links and the condition of the connectors.

The following troubleshooting procedures are based on the supposition that the trouble lies in either a short or open circuit in a component outside the computer or a short circuit within the computer.

If engine trouble occurs even though proper operating voltage is detected in the computer connector, then it can be assumed that the ECU is faulty and should be replaced.

### LOCATION OF FUSES AND FUSIBLE LINKS

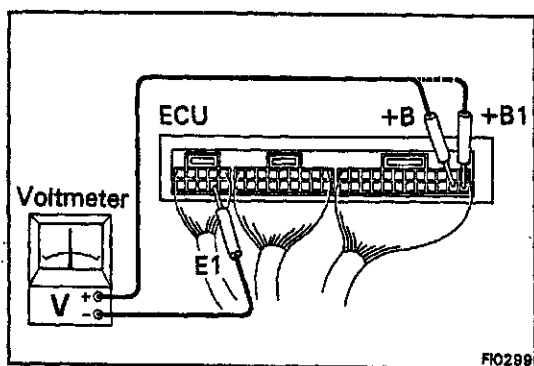


## EFI SYSTEM CHECK PROCEDURE

## NOTE:

- Perform all voltage measurements with the connectors connected.
- Verify that the battery voltage is 11V or above when the ignition switch is at "ON".

Using a voltmeter with high-impedance (10 k $\Omega$ /V minimum), measure the voltage at each terminal of the wiring connectors.



## Terminals of ECU (7M-GE)

| Symbol      | Terminal Name              | Symbol | Terminal Name            | Symbol | Terminal Name                              |
|-------------|----------------------------|--------|--------------------------|--------|--------------------------------------------|
| E01         | POWER GROUND               | T      | CHECK CONNECTOR          | L3     | ECT COMPUTER                               |
| E02         | POWER GROUND               | G2     | DISTRIBUTOR              | EGR    | VSV (EGR)                                  |
| No. 10      | INJECTOR (No. 1 and 4)     | VTA    | THROTTLE POSITION SENSOR | A/C    | A/C MAGNET SWITCH                          |
| No. 20      | INJECTOR (No. 2 and 6)     | NE     | DISTRIBUTOR              | SPD    | SPEEDOMETER                                |
| STA         | STARTER SWITCH             | IDL    | THROTTLE POSITION SENSOR | W      | WARNING LIGHT                              |
| No. 30      | INJECTOR (No. 3 and 5)     | IGT    | IGNITER                  | FPR    | FUEL PUMP RELAY                            |
| STJ         | COLD START INJECTOR        |        |                          | DFG    | DEFOGGER RELAY                             |
| E1          | COMPUTER GROUND            | IGF    | IGNITER                  | THA    | AIR TEMP. SENSOR                           |
| NSW         | NEUTRAL START SWITCH (A/T) |        |                          | ECT    | ECT COMPUTER                               |
| N/C         | *CLUTCH SWITCH (M/T)       | THW    | WATER TEMP. SENSOR       | VS     | AIR FLOW METER                             |
|             |                            | KNK    | KNOCK SENSOR             | LP     | HEADLIGHT RELAY                            |
| ISC 1       | ISC MOTOR NO. 1 COIL       | OX     | OXYGEN SENSOR            | VC     | THROTTLE POSITION SENSOR<br>AIR FLOW METER |
| ISC 3       | ISC MOTOR NO. 3 COIL       | E2     | SENSOR GROUND            |        |                                            |
| ISC 2       | ISC MOTOR NO. 2 COIL       | VSV 1  | VSV (AIR CONTROL)        | BATT   | BATTERY                                    |
| ISC 4       | ISC MOTOR NO. 4 COIL       | L1     | ECT COMPUTER             | +B     | EFI MAIN RELAY                             |
| G $\ominus$ | DISTRIBUTOR                | VSV2   | VSV (FPU)                | IG S/W | IGNITION SWITCH                            |
| VF          | CHECK CONNECTOR            | L2     | ECT COMPUTER             | +B1    | EFI MAIN RELAY                             |
| G1          | DISTRIBUTOR                | M-REL  | EFI MAIN RELAY (COIL)    |        |                                            |

## ECU Terminals

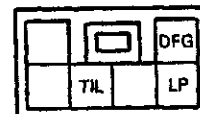
|     |        |        |     |            |       |       |             |    |     |     |     |     |     |    |       |       |       |     |     |     |     |    |    |      |        |
|-----|--------|--------|-----|------------|-------|-------|-------------|----|-----|-----|-----|-----|-----|----|-------|-------|-------|-----|-----|-----|-----|----|----|------|--------|
| E01 | No. 10 | STA    | STJ | NSW<br>N/C | ISC 1 | ISC 2 | G $\ominus$ | G1 | G2  | NE  | IGT | IGF | THW | OX | VSV 1 | VSV 2 | M-REL | EGR | SPD | FPR | THA | VS | VC | BATT | IG S/W |
| E02 | No. 20 | No. 30 | E1  |            | ISC 3 | ISC 4 | VF          | T  | VTA | IDL |     |     | KNK | E2 |       |       |       | A/C | W   | DFG |     | LP |    | +B   | +B1    |

## Terminals of ECU (7M-GTE)

| Symbol | Terminal Name              | Symbol | Terminal Name            | Symbol | Terminal Name                              |
|--------|----------------------------|--------|--------------------------|--------|--------------------------------------------|
| E01    | POWER GROUND               | G2     | CAM POSITION SENSOR      | A/C    | A/C MAGNETIC SWITCH                        |
| E02    | POWER GROUND               | VTA    | THROTTLE POSITION SENSOR | SPD    | SPEEDOMETER                                |
| No. 10 | INJECTOR (No. 1 and 4)     | NE     | CAM POSITION SENSOR      | W      | WARNING LIGHT                              |
| No. 20 | INJECTOR (No. 2 and 6)     | IDL    | THROTTLE POSITION SENSOR | FPR    | FUEL PUMP RELAY                            |
| STA    | STARTER SWITCH             | IGT    | IGNITER                  | OIL    | OIL PRESSURE SWITCH                        |
| No. 30 | INJECTOR (No. 3 and 5)     | IGdA   | IGNITER                  | THA    | AIR TEMP. SENSOR                           |
| STJ    | COLD START INJECTOR        | IGF    | IGNITER                  | ECT    | ECT COMPUTER                               |
| E1     | COMPUTER GROUND            | KNK1   | KNOCK SENSOR             | HAC    | ALTITUDE COMPENSATION SENSOR               |
| NSW    | NEUTRAL START SWITCH (A/T) | THW    | WATER TEMP. SENSOR       | FC     | CIRCUIT OPENING RELAY                      |
| N/C    | *CLUTCH SWITCH (M/T)       | KNK2   | KNOCK SENSOR             | VC     | THROTTLE POSITION SENSOR<br>AIR FLOW METER |
| IGdB   | IGNITER                    | OX     | OXYGEN SENSOR            | KS     | AIR FLOW METER                             |
| ISC 1  | ISC MOTOR NO. 1 COIL       | E2     | SENSOR GROUND            | BATT   | BATTERY                                    |
| ISC 3  | ISC MOTOR NO. 3 COIL       | VSV    | VSV (FPU)                | +B     | EFI MAIN RELAY                             |
| ISC 2  | ISC MOTOR NO. 2 COIL       | L1     | ECT COMPUTER             | IG S/W | IGNITION SWITCH                            |
| ISC 4  | ISC MOTOR NO. 4 COIL       | HT     | OXYGEN SENSOR            | +B1    | EFI MAIN RELAY                             |
| G ⊖    | CAM POSITION SENSOR        | L2     | ECT COMPUTER             | TIL    | TURBO INDICATOR                            |
| VF     | CHECK CONNECTOR            | M-REL  | EFI MAIN RELAY (COIL)    | DFG    | DEFOGGER RELAY                             |
| G1     | CAM POSITION SENSOR        | L3     | ECT COMPUTER             | LP     | HEADLIGHT RELAY                            |
| T      | CHECK CONNECTOR            | EGR    | VSV (EGR)                |        |                                            |

## ECU Terminals

|     |        |        |     |      |       |       |     |    |     |     |      |       |       |    |       |    |       |     |     |     |     |     |    |      |        |
|-----|--------|--------|-----|------|-------|-------|-----|----|-----|-----|------|-------|-------|----|-------|----|-------|-----|-----|-----|-----|-----|----|------|--------|
| E01 | No. 10 | STA    | STJ | NSW  | ISC 1 | ISC 2 | G ⊖ | G1 | G2  | NE  | IGT  | IGF   | THW   | OX | VSV 2 | HT | M-REL | EGR | SPD | FPR | THA | HAC | VC | BATT | IG S/W |
| E02 | No. 20 | No. 30 | E1  | IGdB | ISC 3 | ISC 4 | VF  | T  | VTA | IDL | IGdA | KNK 1 | KNK 2 | E2 | L1    | L2 | L3    | A/C | W   | OIL | ECT | FC  | KS | +B   | +B1    |



FI0574 FI1998

\*For cruise control

## Voltage at ECU Wiring Connectors (7M-GE)

| No. | Terminals                            | Condition                                                        |                                    | STD Voltage | See page |
|-----|--------------------------------------|------------------------------------------------------------------|------------------------------------|-------------|----------|
| 1   | BATT - E1                            | —                                                                |                                    | 10 - 14     | FI-39    |
|     | IG S/W - E1                          | Ignition S/W ON                                                  |                                    | 10 - 14     | FI-40    |
|     | M-REL - E1                           |                                                                  |                                    |             |          |
|     | +B (+B1) - E1                        |                                                                  |                                    |             | FI-41    |
| 2   | IDL - E2                             | Ignition S/W ON                                                  | Throttle valve open                | 10 - 14     | FI-42    |
|     | VC - E2                              |                                                                  | —                                  | 4 - 6       | FI-43    |
|     | VTA - E2                             |                                                                  | Throttle valve fully closed        | 0.1 - 1.0   |          |
|     |                                      |                                                                  | Throttle valve fully open          | 4 - 5       |          |
| 3   | VC - E2                              | Ignition S/W ON                                                  | —                                  | 4 - 6       | FI-44    |
|     | VS - E2                              |                                                                  | Measuring plate fully closed       | 4 - 5       |          |
|     |                                      |                                                                  | Measuring plate fully open         | 0.02 - 0.08 |          |
|     |                                      | Idling                                                           |                                    | 2 - 4       |          |
|     |                                      | 3,000 rpm                                                        |                                    | 0.3 - 1.0   |          |
| 5   | No. 10 E01<br>No. 20 -<br>No. 30 E02 | Ignition S/W ON                                                  |                                    | 9 - 14      | FI-47    |
| 6   | THA - E2                             | Ignition S/W ON                                                  | Intake air temperature 20°C (68°F) | 1 - 3       | FI-48    |
| 7   | THW - E2                             | Ignition S/W ON                                                  | Coolant temperature 80°C (176°F)   | 0.1 - 1.0   | FI-49    |
| 8   | STA - E1                             | Cranking                                                         |                                    | 6 - 14      | FI-50    |
| 9   | IGF, IGT - E1                        | Idling                                                           |                                    | 0.7 - 1.0   | FI-51    |
| 11  | ISC1<br>ISC4 - E1                    | Ignition S/W ON                                                  |                                    | 9 - 14      | FI-53    |
| 12  | W - E1                               | No trouble ("CHECK ENGINE" warning light off) and engine running |                                    | 8 - 14      | FI-54    |
| 13  | A/C - E1                             | Air conditioning ON                                              |                                    | 10 - 14     | FI-55    |

## ECU Terminals

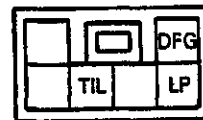
| E01 | No. 10 | STA    | STJ | NSW or N/C | ISC 1 | ISC 2 | G ⊖ | G1 | G2  | NE  | IGT | IGF | THW | OX | VSV 1 | VSV 2 | M-REL | EGR | SPD | FPR | THA | VS | VC | BATT | IG S/W |
|-----|--------|--------|-----|------------|-------|-------|-----|----|-----|-----|-----|-----|-----|----|-------|-------|-------|-----|-----|-----|-----|----|----|------|--------|
| E02 | No. 20 | No. 30 | E1  |            | ISC 3 | ISC 4 | VF  | T  | VTA | IDL |     |     | KNK | E2 |       |       |       | A/C | W   | DFG |     | LP |    | +B   | +B1    |

## Voltage at ECU Wiring Connectors (7M-GTE)

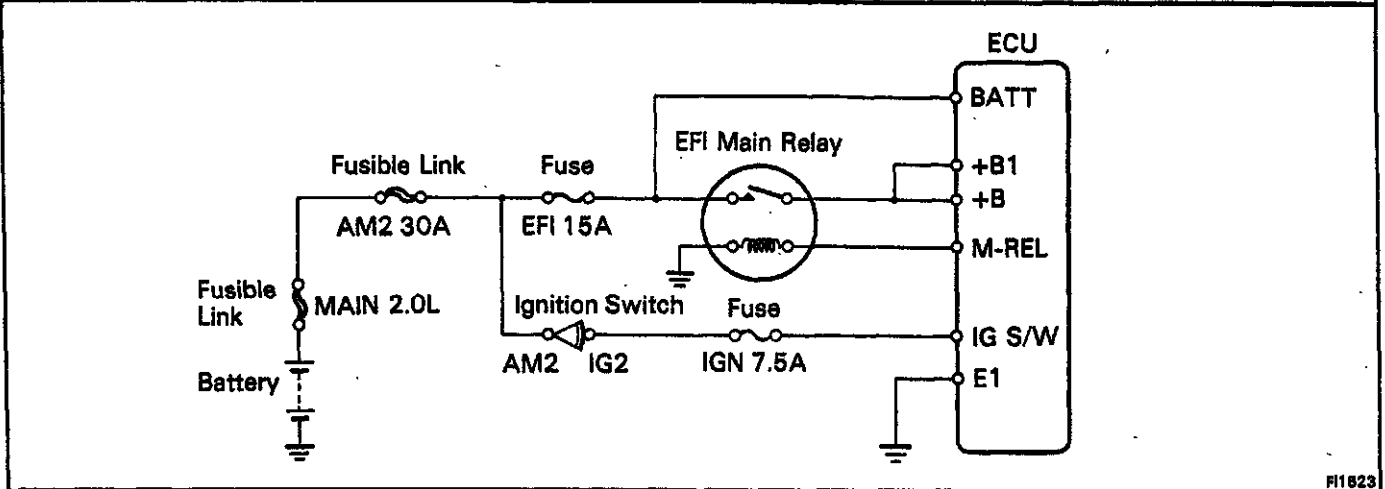
| No. | Terminals                            | Condition                                                        |                                    | STD Voltage | See page |
|-----|--------------------------------------|------------------------------------------------------------------|------------------------------------|-------------|----------|
| 1   | BATT - E1                            | —                                                                |                                    | 10 - 14     | FI-39    |
|     | IG S/W - E1                          | Ignition S/W ON                                                  |                                    | 10 - 14     | FI-40    |
|     | M-REL - E1                           |                                                                  |                                    |             |          |
|     | +B (+B1) - E1                        |                                                                  |                                    |             | FI-41    |
| 2   | IDL - E2                             | Ignition S/W ON                                                  | Throttle valve open                | 10 - 14     | FI-42    |
|     | VC - E2                              |                                                                  | —                                  | 4 - 6       | FI-43    |
|     | VTA - E2                             |                                                                  | Throttle valve fully closed        | 0.1 - 1.0   |          |
|     |                                      |                                                                  | Throttle valve fully open          | 4 - 5       |          |
| 4   | KS - Body ground                     | Ignition S/W ON                                                  |                                    | 4 - 6       | FI-45    |
|     |                                      | Cranking or running                                              |                                    | 2 - 4       |          |
|     | VC - Body ground                     | Ignition S/W ON                                                  |                                    | 4 - 6       | FI-46    |
| 5   | No. 10 E01<br>No. 20 -<br>No. 30 E02 | Ignition S/W ON                                                  |                                    | 9 - 14      | FI-47    |
| 6   | THA - E2                             | Ignition S/W ON                                                  | Intake air temperature 20°C (68°F) | 1 - 3       | FI-48    |
| 7   | THW - E2                             | Ignition S/W ON                                                  | Coolant temperature 80°C (176°F)   | 0.1 - 1.0   | FI-49    |
| 8   | STA - E1                             | Cranking                                                         |                                    | 6 - 14      | FI-50    |
| 9   | IGF, IGT - E1                        | Idling                                                           |                                    | 0.7 - 1.0   | FI-51    |
| 10  | IGdA, IGdB - E1                      | Idling                                                           |                                    | 1 - 3       | FI-52    |
| 11  | ISC1<br>ISC4 - E1                    | Ignition S/W ON                                                  |                                    | 9 - 14      | FI-53    |
| 12  | W - E1                               | No trouble ("CHECK ENGINE" warning light off) and engine running |                                    | 8 - 14      | FI-54    |
| 13  | A/C - E1                             | Air conditioning ON                                              |                                    | 10 - 14     | FI-55    |
| 14  | HAC - E2                             | Ignition S/W ON                                                  | 540 mmHg (21.26 in.Hg, 72.0 kPa)   | Approx. 2.8 | FI-56    |
|     |                                      |                                                                  | 750 mmHg (29.53 in.Hg, 100.0 kPa)  | Approx. 3.6 |          |

## ECU Terminals

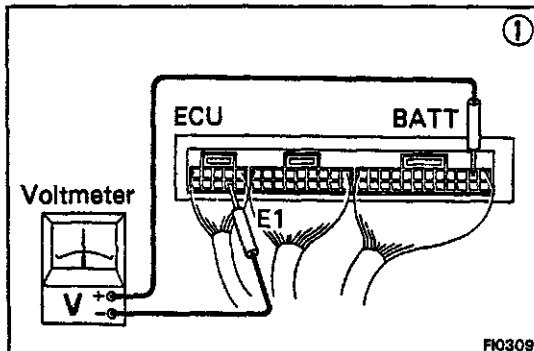
|     |        |        |     |            |       |       |    |    |     |     |      |       |       |    |       |    |       |     |     |     |     |     |    |      |        |
|-----|--------|--------|-----|------------|-------|-------|----|----|-----|-----|------|-------|-------|----|-------|----|-------|-----|-----|-----|-----|-----|----|------|--------|
| E01 | No. 10 | STA    | STJ | NSW or N/C | ISC 1 | ISC 2 | G0 | G1 | G2  | NE  | IGT  | IGF   | THW   | OX | VSV 2 | HT | M-REL | EGR | SPD | FPR | THA | HAC | VC | BATT | IG S/W |
| E02 | No. 20 | No. 30 | E1  | IGdB       | ISC 3 | ISC 4 | VF | T  | VTA | IDL | IGdA | KNK 1 | KNK 2 | E2 | L1    | L2 | L3    | A/C | W   | OIL | ECT | FC  | KS | +B   | +B1    |



| No. | Terminals     | Trouble    | Condition          | STD Voltage |
|-----|---------------|------------|--------------------|-------------|
| 1   | BATT — E1     | No voltage | —                  | 10 — 14 V   |
|     | IG S/W — E1   | No voltage | Ignition switch ON | 10 — 14 V   |
|     | M-REL — E1    | No voltage | Ignition switch ON | 10 — 14 V   |
|     | +B (+B1) — E1 | No voltage | Ignition switch ON | 10 — 14 V   |



FI1823



### • BATT — E1

① There is no voltage between ECU terminals BATT and E1.

② Check that there is voltage between ECU terminal BATT and body ground.

NO

OK

③ Check wiring between ECU terminal E1 and body ground.

OK

BAD

Try another ECU.

Replace or repair.

Check fuse and fusible link.

BAD

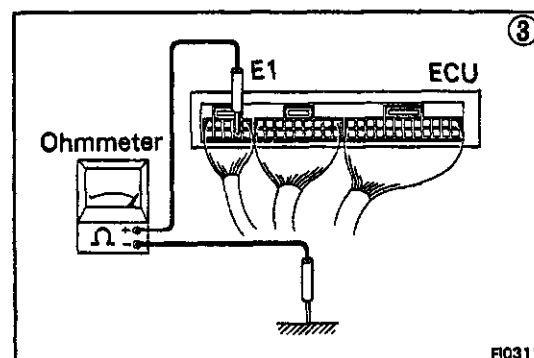
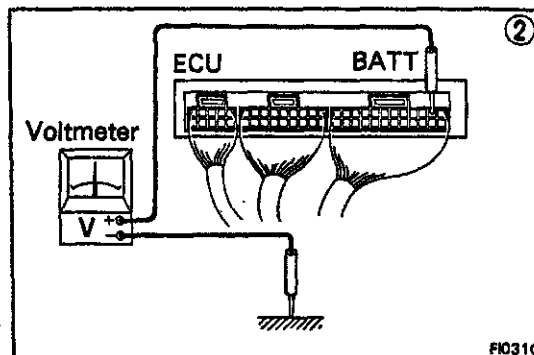
Replace.

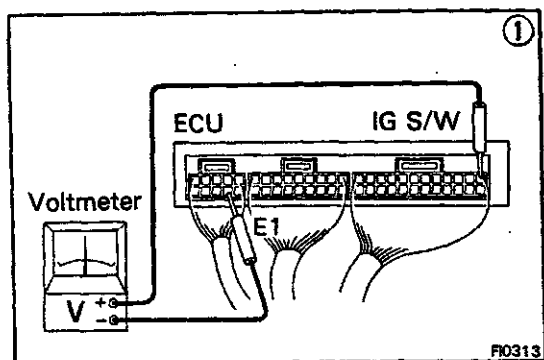
OK

Check wiring between ECU terminal and battery.

BAD

Repair or replace.





### • IG S/W — E1

① There is no voltage between ECU terminals IG S/W and E1. (IG S/W ON)

② Check that there is voltage between ECU terminal IG S/W and body ground. (IG S/W ON)

NO

OK

Check wiring between ECU terminal E1 and body ground.

OK

BAD

Try another ECU.

Replace or repair.

Check fuse, fusible links and ignition switch.

BAD

Repair or replace.

### • M-REL — E1

① There is no voltage between ECU terminals M-REL and E1. (IG S/W ON)

② Check that there is voltage between ECU terminal M-REL and body ground. (IG S/W ON)

NO

OK

Check wiring between ECU terminal E1 and body ground.

OK

BAD

Try another ECU.

Replace or repair.

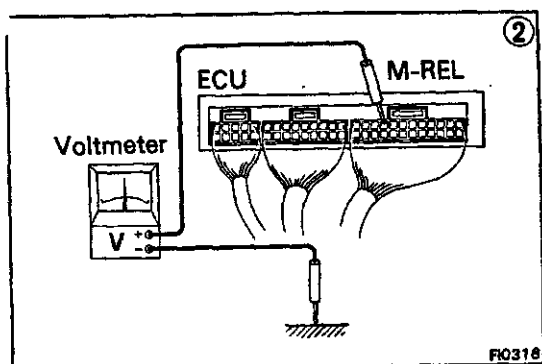
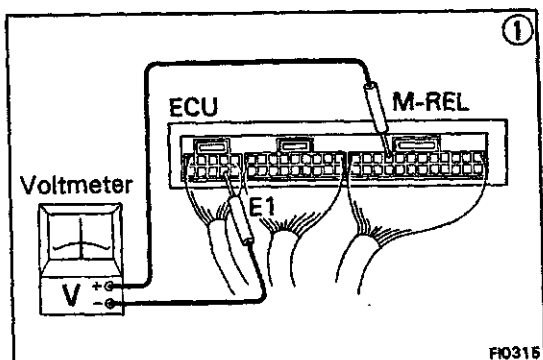
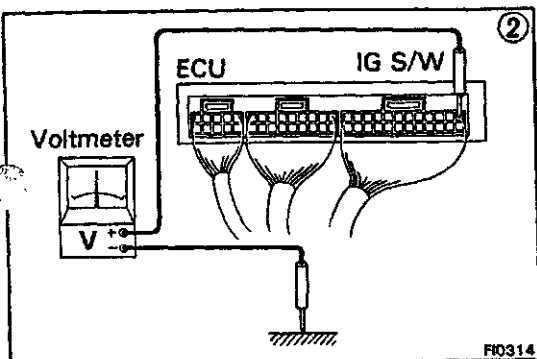
Check EFI main relay and wiring harness.

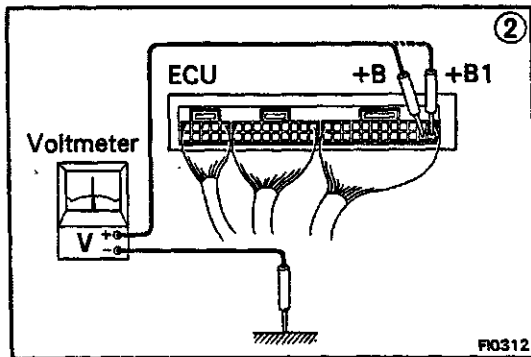
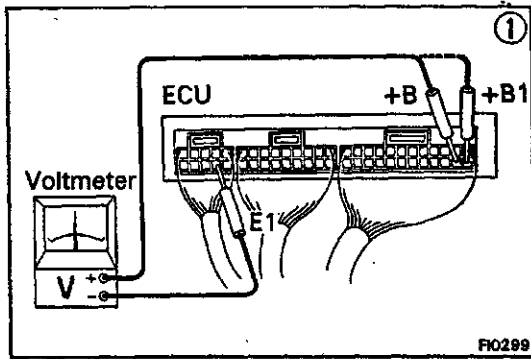
BAD

Replace.

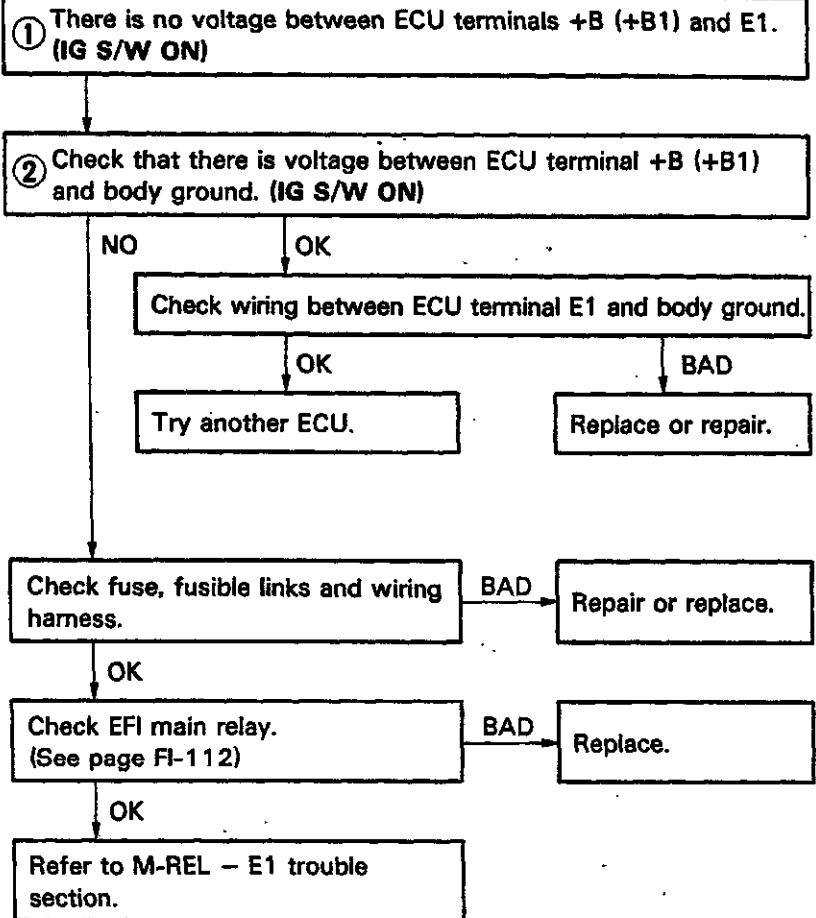
OK

Try another ECU.

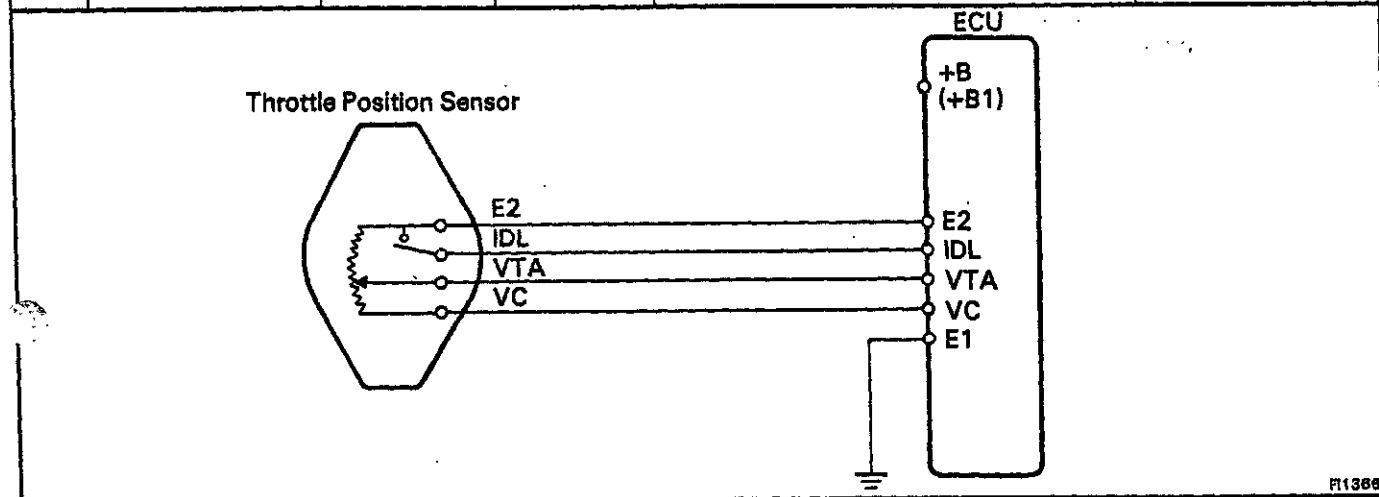




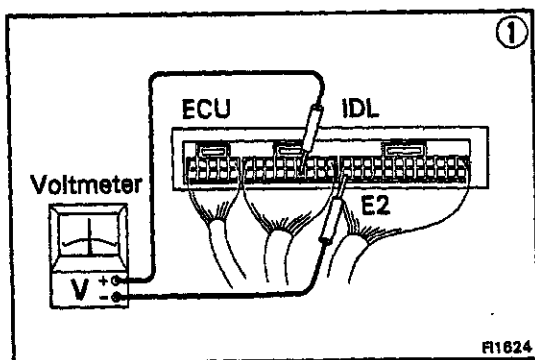
• +B (+B1) – E1



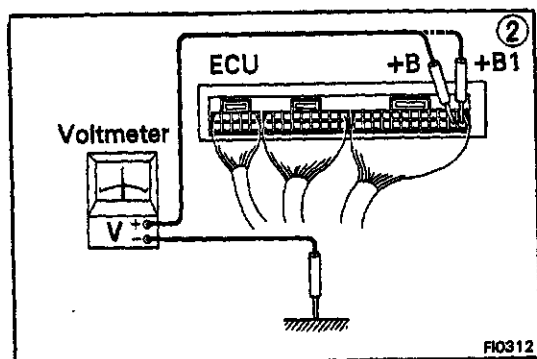
| No. | Terminals | Trouble    | Condition                   | STD Voltage |
|-----|-----------|------------|-----------------------------|-------------|
| 2   | IDL - E2  | No voltage | Throttle valve open         | 10 - 14 V   |
|     | VC - E2   |            | —                           | 4 - 6 V     |
|     | VTA - E2  |            | Throttle valve fully closed | 0.1 - 1.0 V |
|     | VTA - E2  |            | Throttle valve fully open   | 4 - 5 V     |



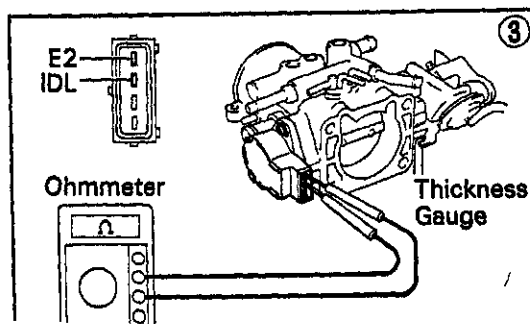
FI1388



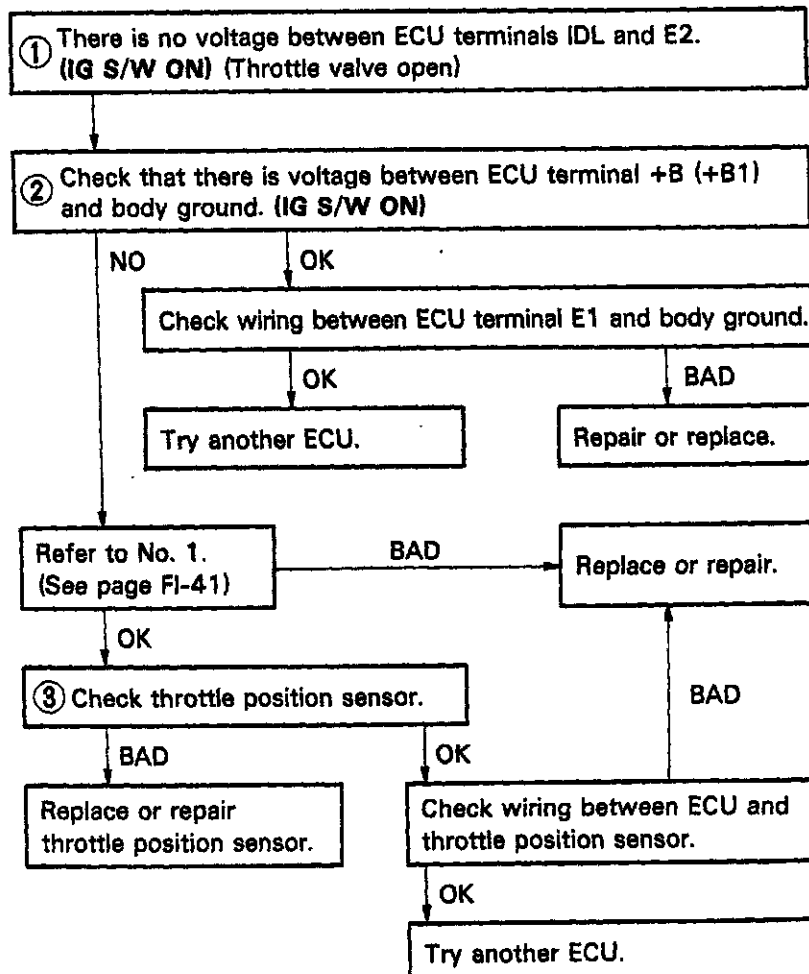
FI1824

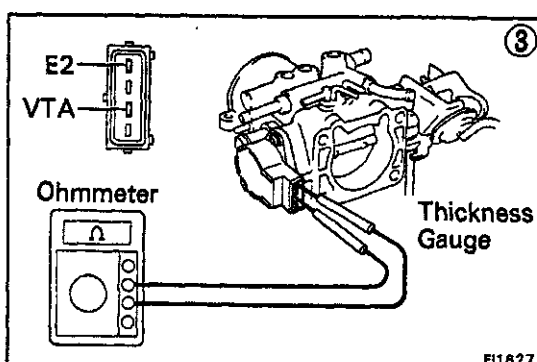
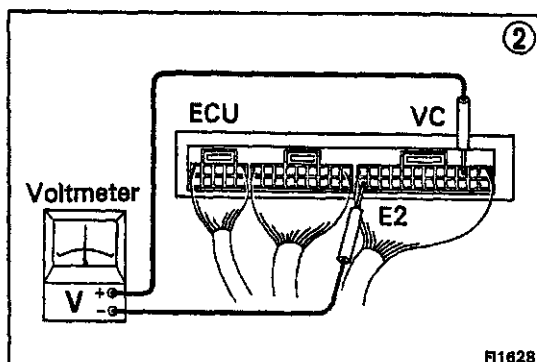
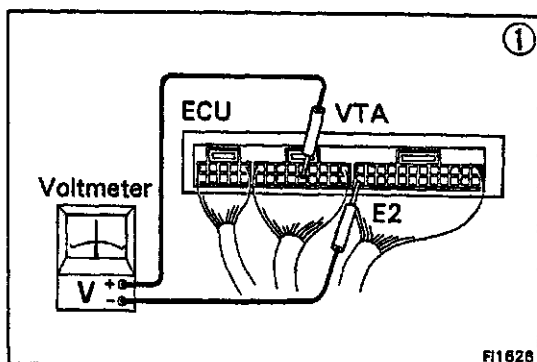
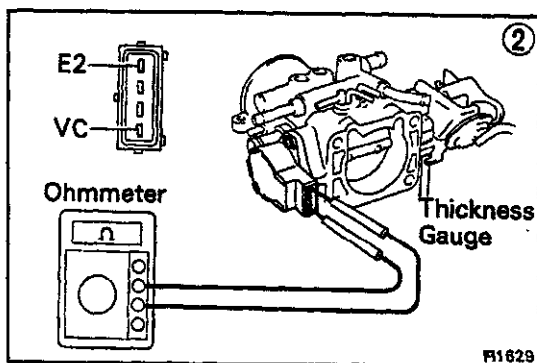
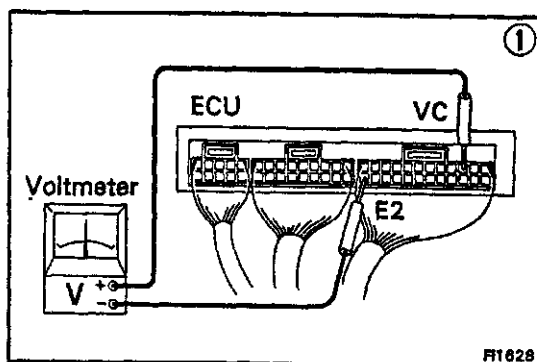


FI0312

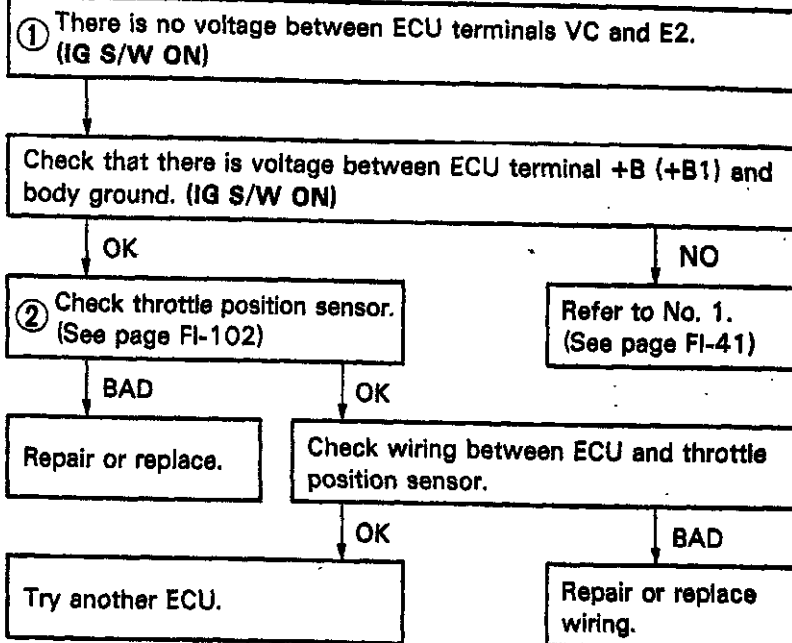


## • IDL - E2

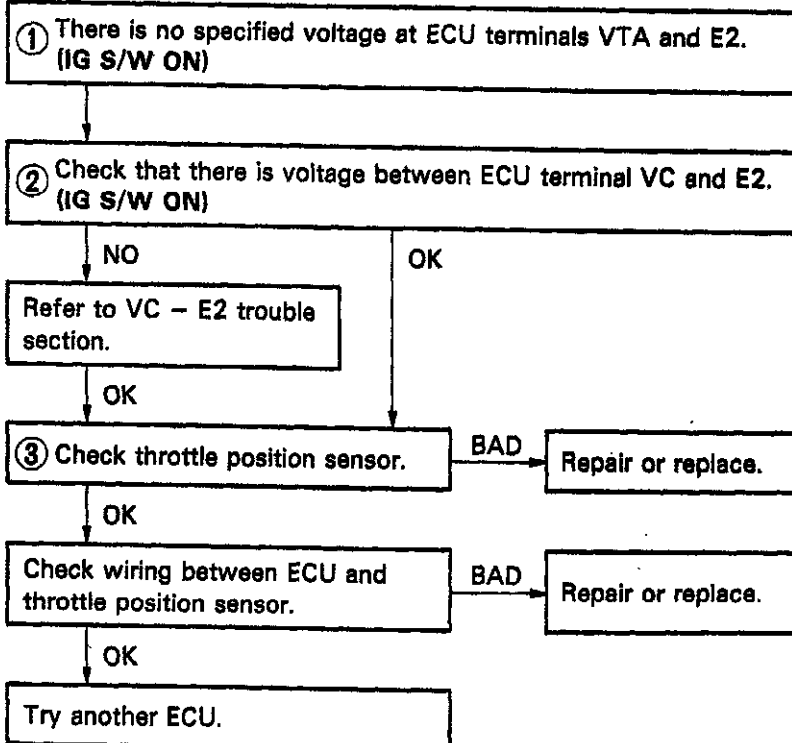




• VC — E2

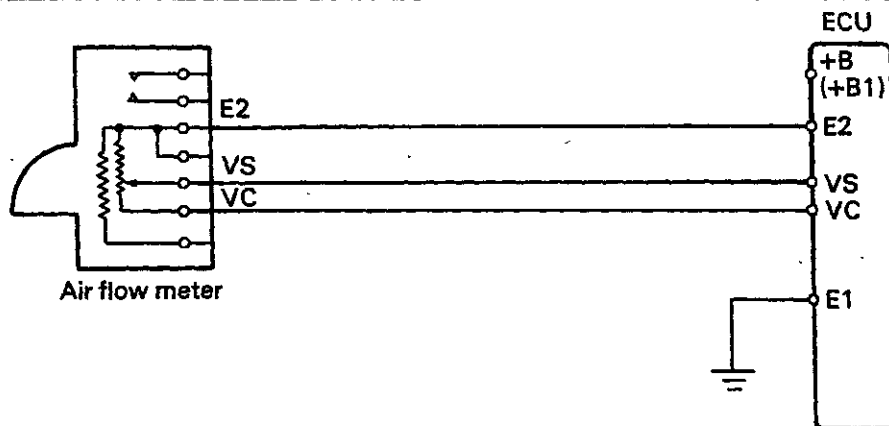


• VTA — E2

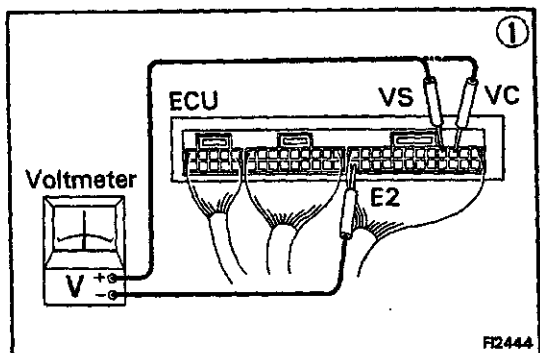


| No. | Terminals | Trouble    | Condition          |                              | STD Voltage   |
|-----|-----------|------------|--------------------|------------------------------|---------------|
| *3  | VC — E2   | No voltage | Ignition<br>S/W ON | —                            | 4 — 6 V       |
|     | VS — E2   |            |                    | Measuring plate fully closed | 4 — 5 V       |
|     | VS — E2   |            |                    | Measuring plate fully open   | 0.02 — 0.08 V |
|     | VS — E2   |            | Idling             | —                            | 2 — 4 V       |
|     | VS — E2   |            | 3,000 rpm          | —                            | 0.3 — 1.0 V   |

\*7M-GE only



FI1269



FI2444

① There is no voltage between ECU terminals VC or VS and E2. (IG S/W ON)

② Check that there is voltage between ECU terminal +B (+B1) and body ground. (IG S/W ON)

OK

NO

Refer to No. 1.  
(See page FI-41)

Check wiring between ECU terminal E1 and body ground.

OK

BAD

③ Check air flow meter.  
(See page FI-96)

BAD

Replace air flow  
meter.

OK

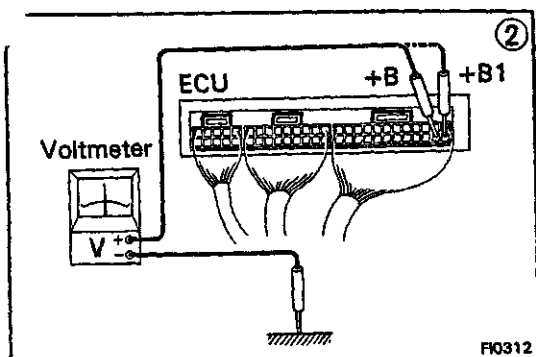
Check wiring between ECU and air  
flow meter.

Try another ECU.

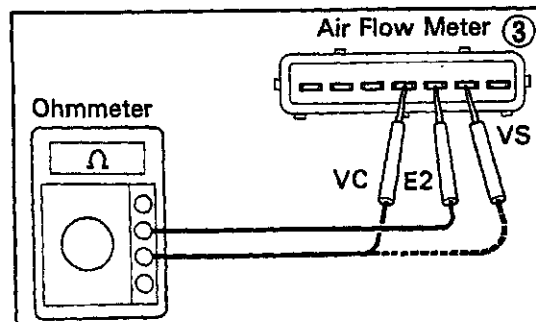
OK

BAD

Repair or replace.

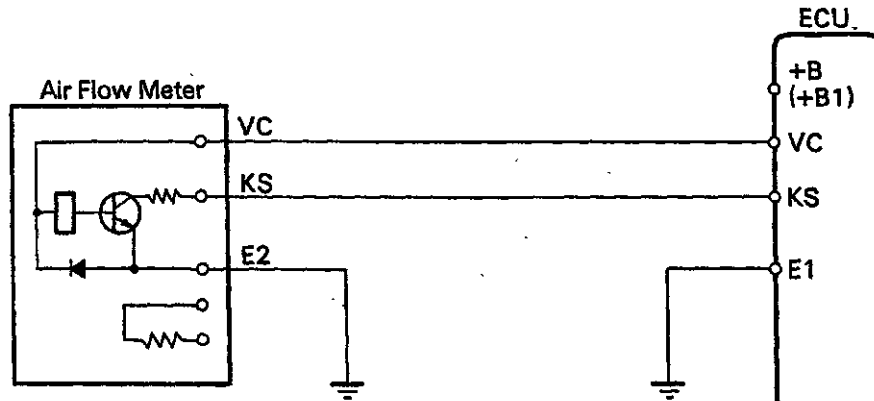


FI0312

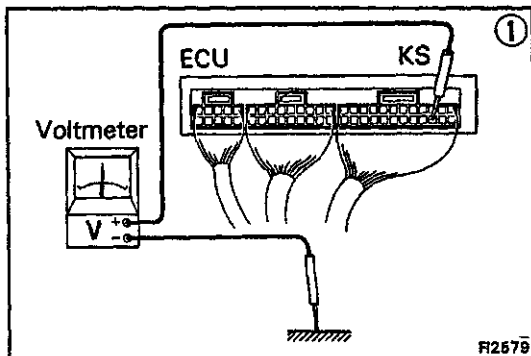


| No. | Terminals        | Trouble    | Condition           | STD Voltage |
|-----|------------------|------------|---------------------|-------------|
| *4  | KS — Body ground | No voltage | Ignition S/W ON     | 4 — 6 V     |
|     |                  |            | Cranking or running | 2 — 4 V     |
|     | VC — Body ground |            | Ignition S/W ON     | 4 — 6 V     |

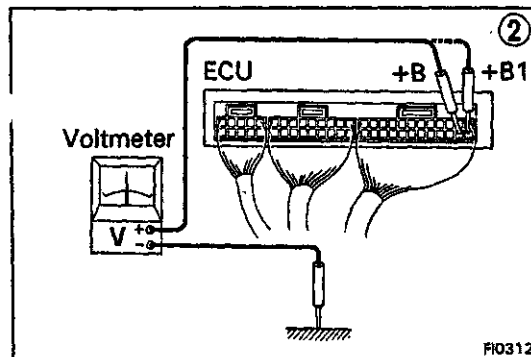
\*7M-GTE only



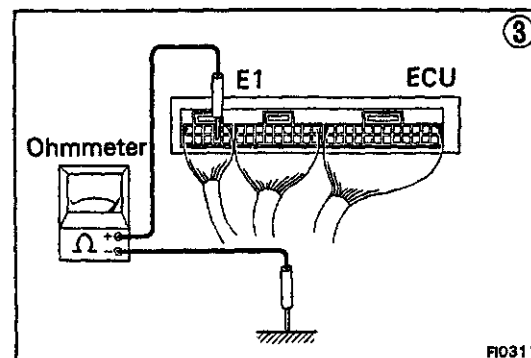
FI2560



FI2579



FI0312



FI0311

# • KS — Body ground

① There is no voltage between ECU terminals KS and body ground. (IG S/W ON)

② Check that there is voltage between ECU terminal +B (+B1) and body ground. (IG S/W ON)

OK

NO

Refer to No. 1.  
(See page FI-41)

③ Check wiring between ECU terminal E1 and body ground.

OK

BAD

Check air flow meter.  
(See page FI-98)

Repair or replace.

BAD

OK

Replace air flow meter.

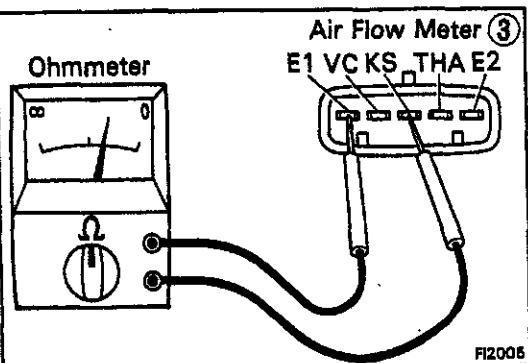
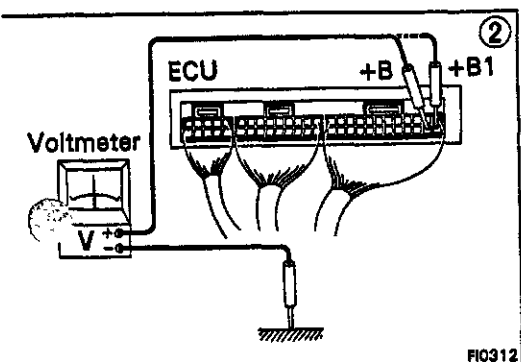
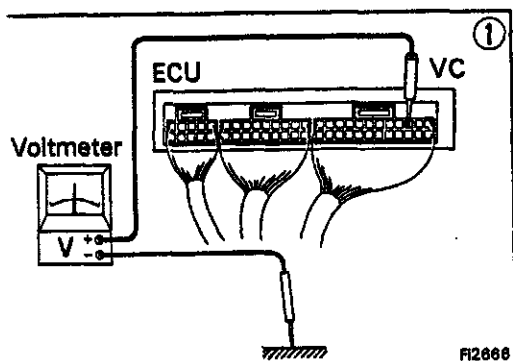
Check wiring between ECU and air flow meter.

OK

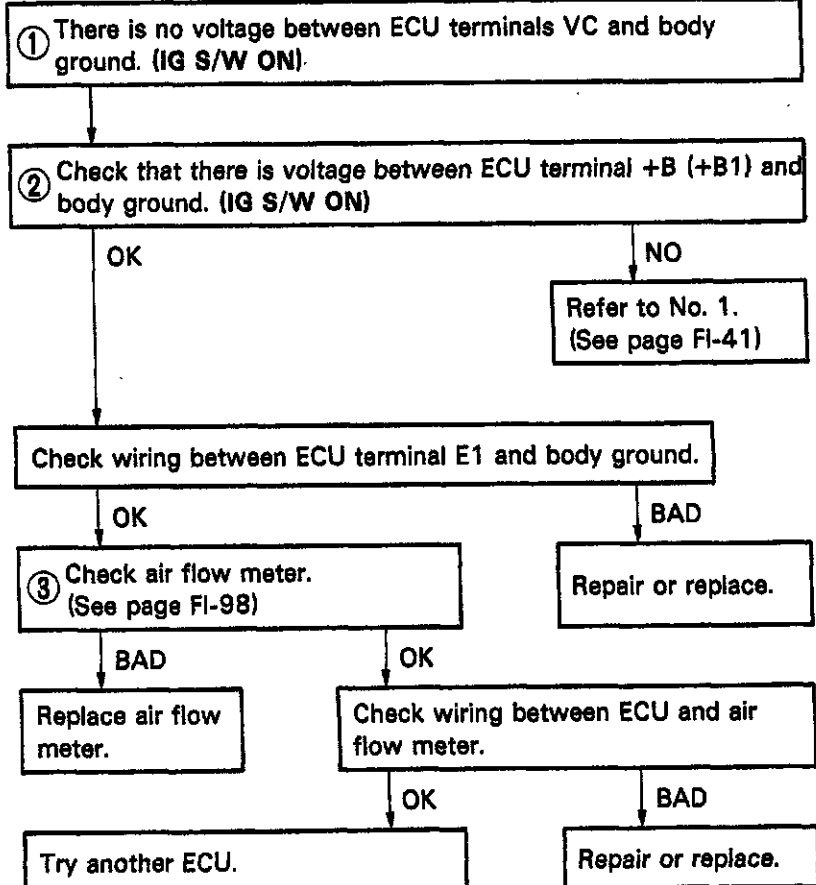
BAD

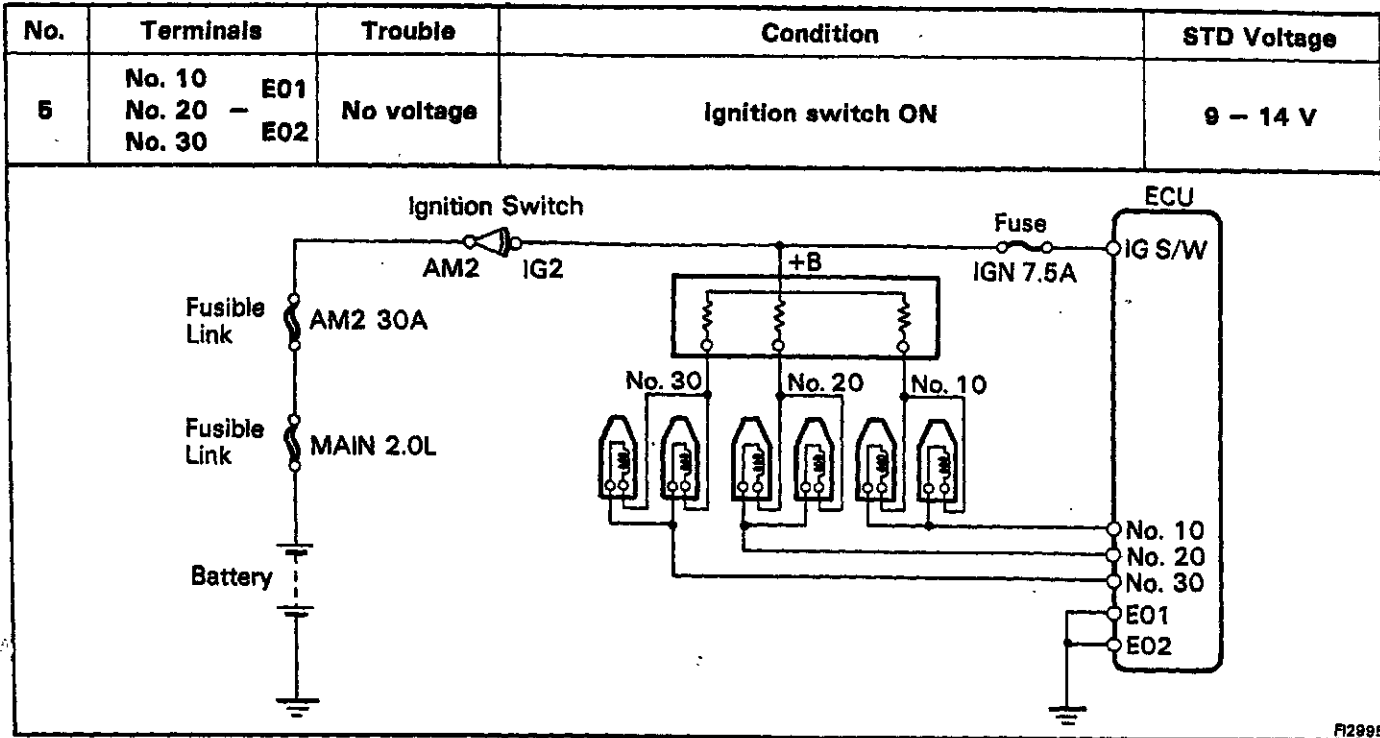
Try another ECU.

Repair or replace.

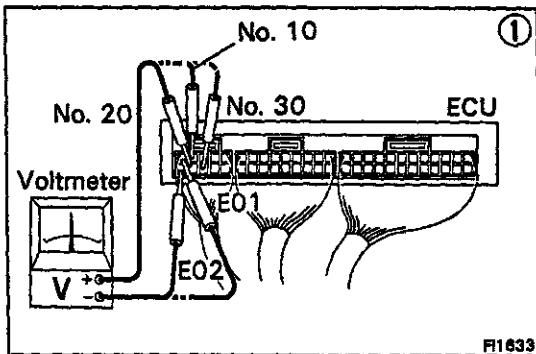


### • VC — Body ground

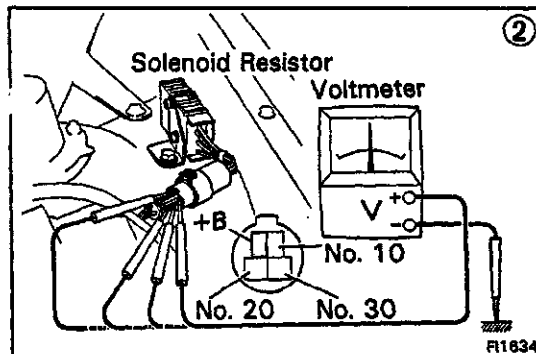




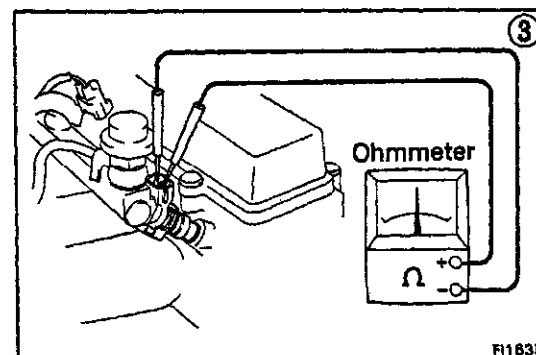
FI2995



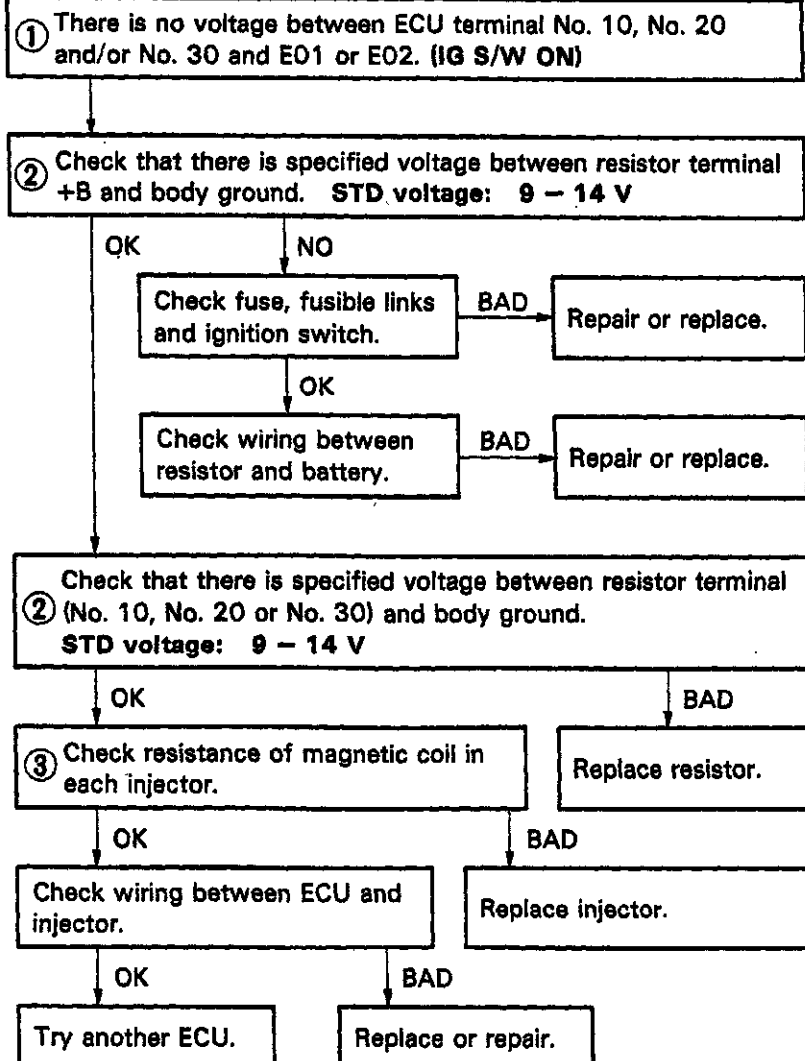
FI1633



FI1634

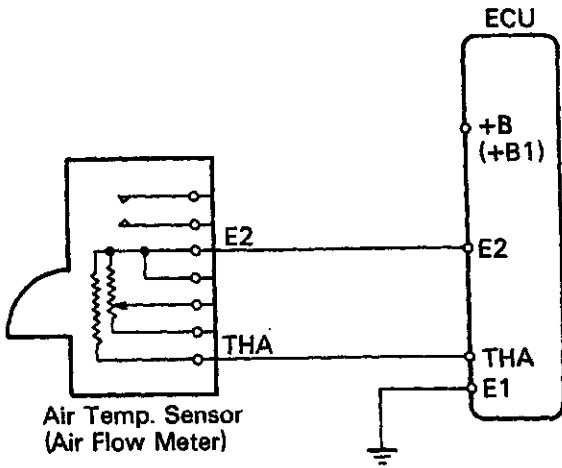
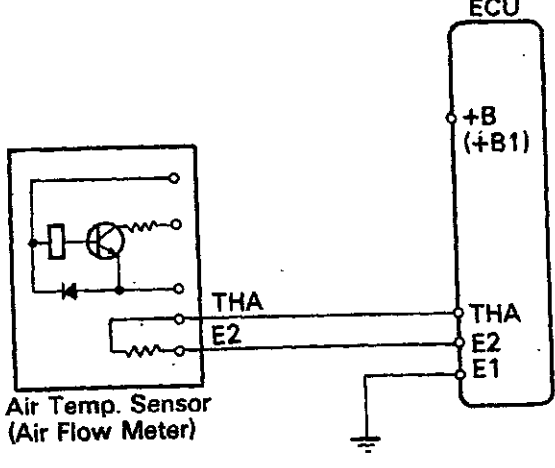


FI1635

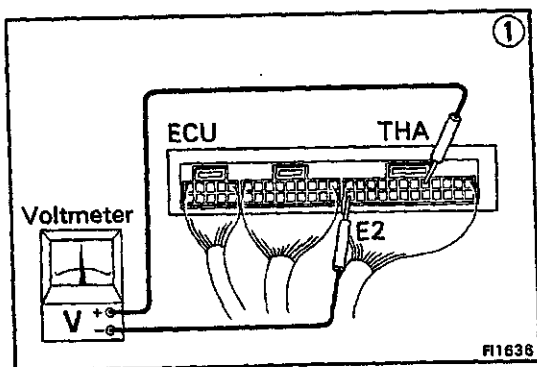


| No. | Terminals | Trouble    | Condition |                                    | STD Voltage |
|-----|-----------|------------|-----------|------------------------------------|-------------|
| 6   | THA — E2  | No voltage | IG S/W ON | Intake air temperature 20°C (68°F) | 1 — 3 V     |

|                                                                                                   |                                                                                                     |
|---------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| <b>7M-GE</b><br> | <b>7M-GTE</b><br> |
|---------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|

FI2665



① There is no voltage between ECU terminals THA and E2.  
(IG S/W ON)

Check that there is voltage between ECU terminal +B (+B1) and  
body ground. (IG S/W ON)

OK

NO

Refer to No. 1.  
(See page FI-41)

Check wiring between ECU terminal E1 and body ground.

OK

BAD

② Check air temp. sensor.  
(See pages FI-96, 98)

Repair or replace.

BAD

OK

Replace air flow  
meter.

Check wiring between ECU and air  
temp. sensor.

OK

BAD

Try another ECU.

Repair or replace.

7M-GE

Ohmmeter

Air Flow Meter

E2

THA

7M-GTE

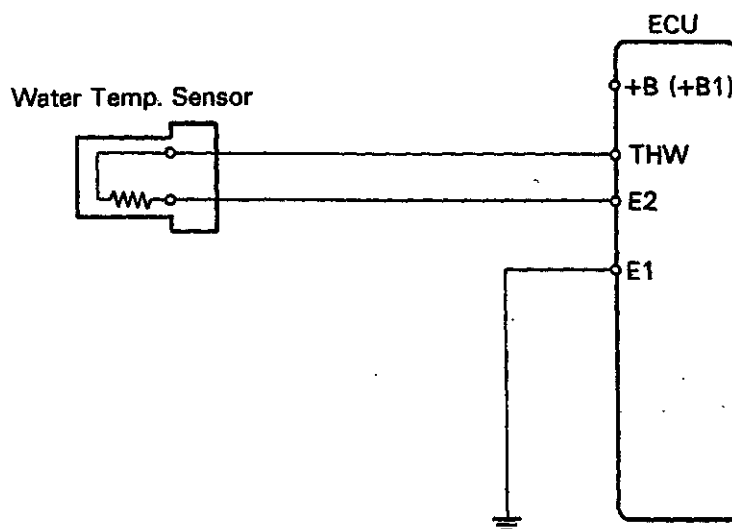
Ohmmeter

Air Flow Meter

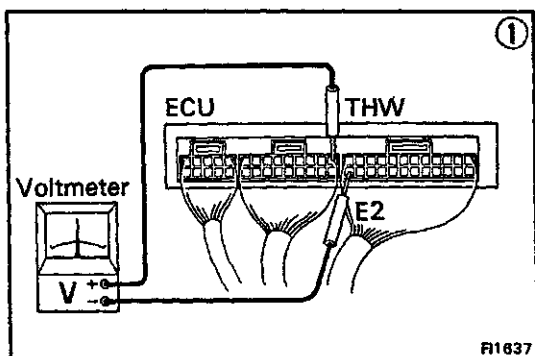
THA

E2

| No. | Terminals | Trouble    | Condition             |                                     | STD Voltage |
|-----|-----------|------------|-----------------------|-------------------------------------|-------------|
| 7   | THW — E2  | No voltage | Ignition switch<br>ON | Coolant temperature 80°C<br>(176°F) | 0.1 — 1.0 V |



FI0487



① There is no voltage between ECU terminals THW and E2.  
(IG S/W ON)

② Check that there is voltage between ECU terminal +B (+B1) and  
body ground. (IG S/W ON)

OK

NO

Refer to No. 1.  
(See page FI-41)

Check wiring between ECU terminal E1 and body ground.

OK

BAD

③ Check water temp. sensor.  
(See page FI-116)

Repair or replace.

BAD

OK

Replace water  
temp. sensor.

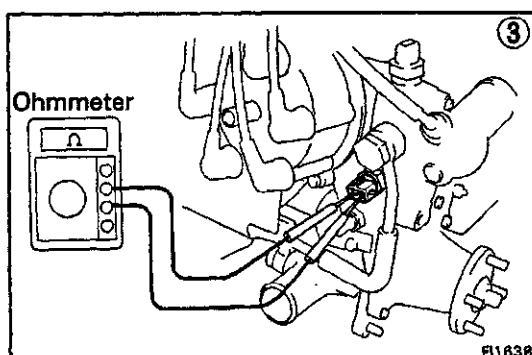
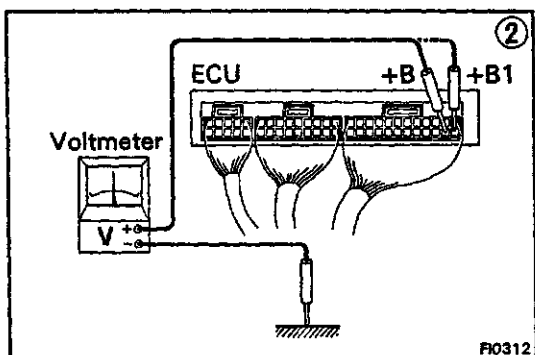
Check wiring between ECU and water  
temp. sensor.

OK

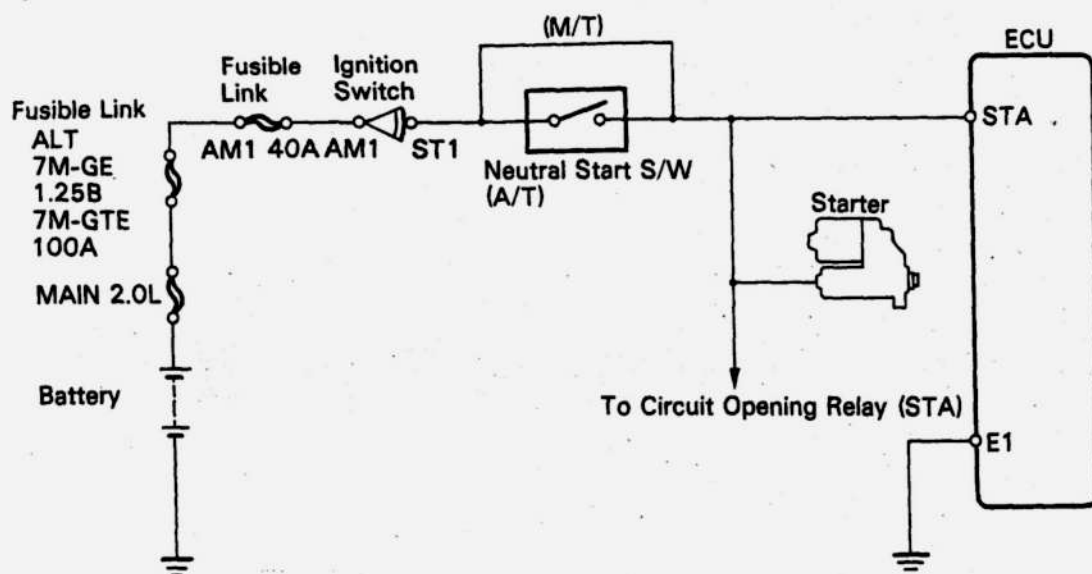
BAD

Try another ECU.

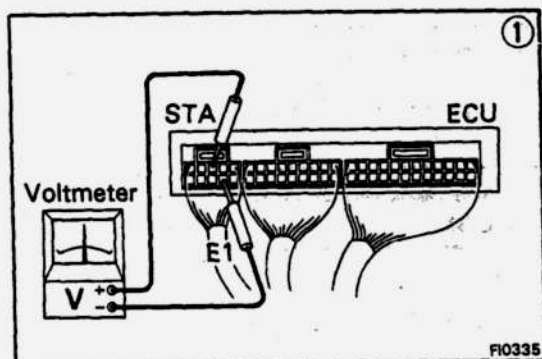
Repair or replace.



| No. | Terminals | Trouble    | Condition | STD Voltage |
|-----|-----------|------------|-----------|-------------|
| 8   | STA - E1  | No voltage | Cranking  | 6 - 14 V    |



FI1639



FI0335

① There is no voltage between ECU terminals STA and E1.  
(IG S/W START)

Check starter  
operation.

BAD

OK Check wiring between ECU terminal STA  
and ignition switch terminal ST1.

OK

BAD

Repair or replace.

② Check wiring between ECU terminal E1 and body  
ground.

OK

BAD

Try another ECU.

Repair or replace.

Check fusible links, battery, wiring,  
ignition switch and neutral start  
switch.

BAD

Repair or replace.

OK

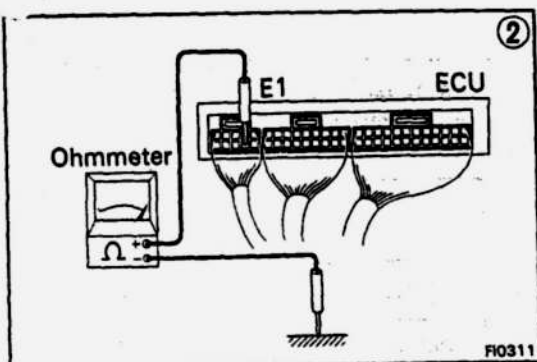
③ Check that there is voltage at STA (50) terminal of starter.  
(IG S/W START) STD voltage: 6 - 14 V

OK

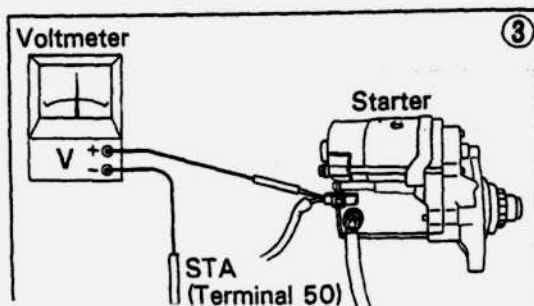
Check starter.

NO

Check wiring between ignition switch  
terminal ST1 and starter terminal STA (50).



FI0311

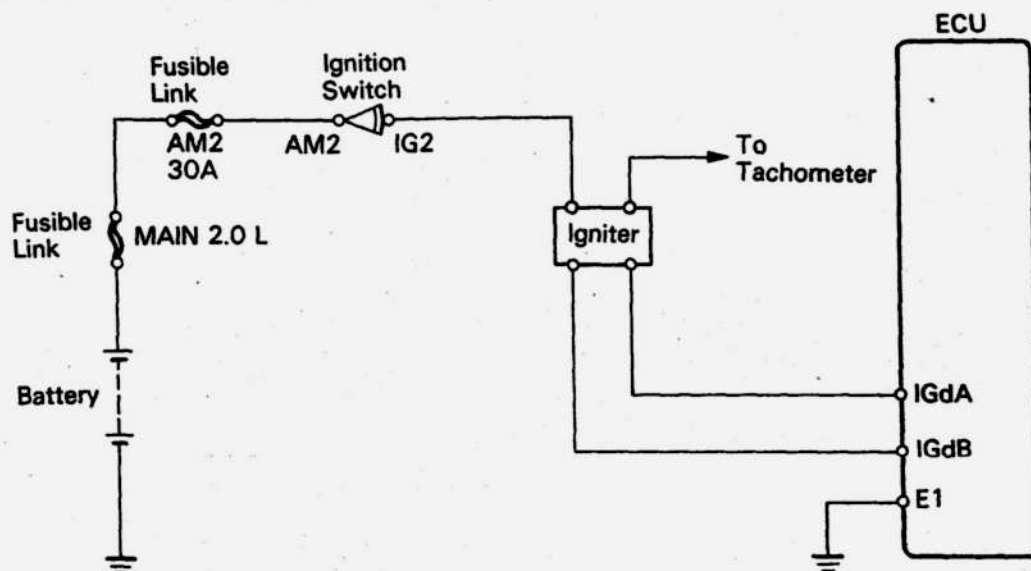


F11841

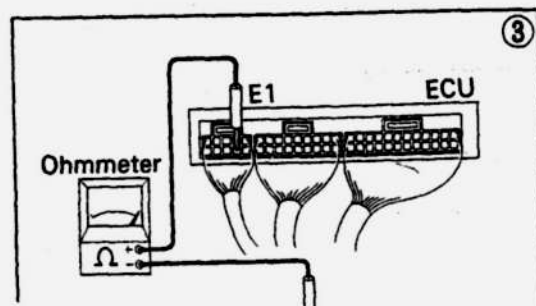
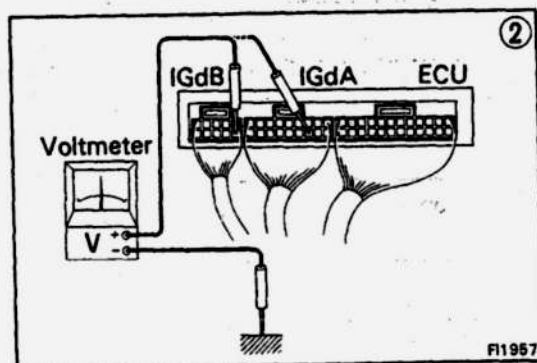
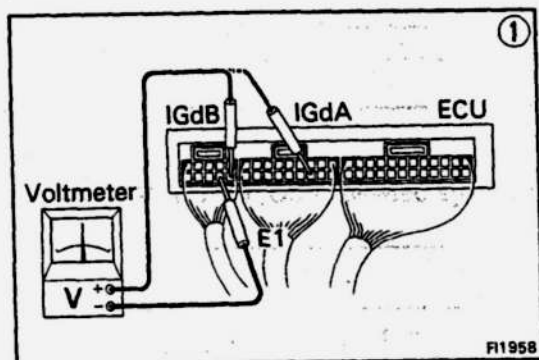
**Repair or replace.**

| No. | Terminals         | Trouble    | Condition | STD Voltage |
|-----|-------------------|------------|-----------|-------------|
| *10 | IGdA<br>IGdB — E1 | No voltage | Idling    | 1 — 3 V     |

\*7M-GTE only



FI1991



① There is no voltage between ECU terminals IGdA or IGdB and E1. (Idling)

② Check that there is voltage between ECU terminal IGdA or IGdB and body ground. (Idling)

NO OK

③ Check wiring between ECU terminal E1 and body ground.

BAD Repair or replace.

OK

Try another ECU.

Check fusible links and ignition switch.

BAD

Repair or replace.

OK

Check cam position sensor. (See page IG-18)

BAD

Repair or replace.

OK

Check wiring between ECU and battery.

BAD

Repair or replace.

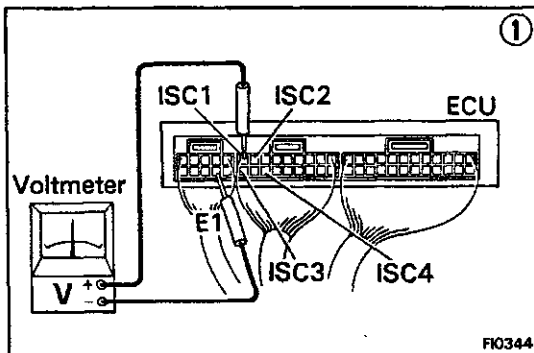
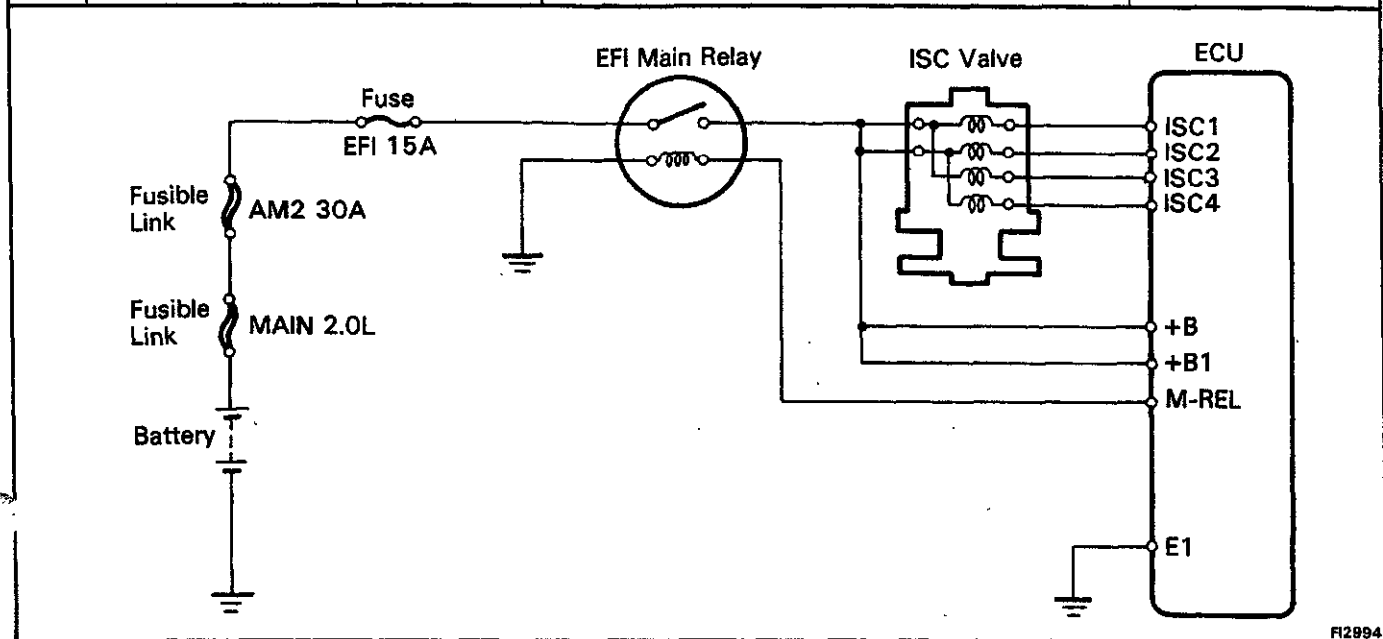
OK

Check igniter. (See page IG-17)

BAD

Repair or replace.

| No. | Terminals        | Trouble    | Condition          | STD Voltage |
|-----|------------------|------------|--------------------|-------------|
| 11  | ISC1 ~ ISC4 - E1 | No voltage | Ignition switch ON | 9 - 14 V    |



① There is no voltage between ECU terminals ISC1 ~ ISC4 and E1. (IG S/W ON)

② Check that there is voltage between ECU terminal +B (+B1) and body ground. (IG S/W ON)

OK

NO

Refer to No. 1.  
(See page FI-41)

Check wiring between ECU terminal E1 and body ground.

OK

BAD

③ Check ISC valve.  
(See page FI-108)

Repair or replace.

BAD

OK

Replace ISC valve.

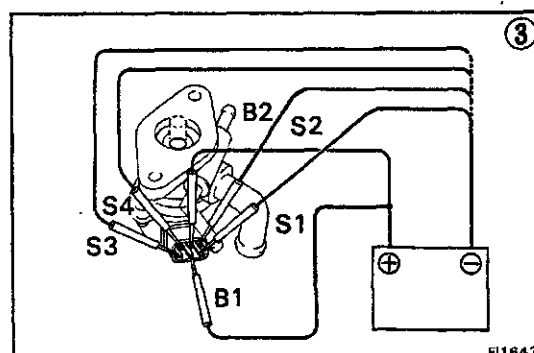
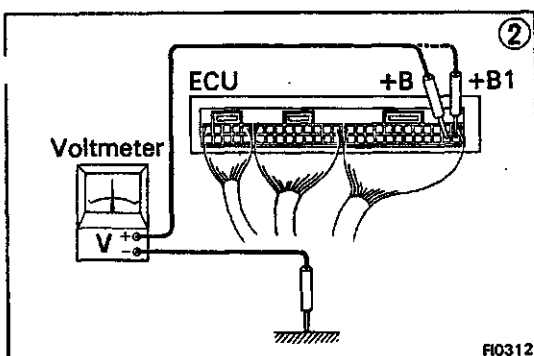
Check wiring between ECU and EFI main relay.

OK

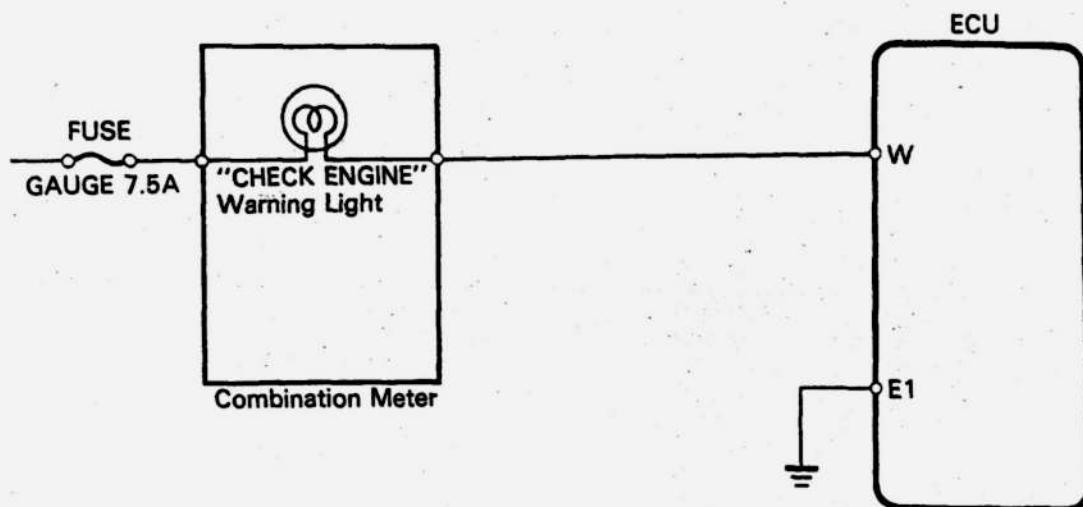
BAD

Try another ECU.

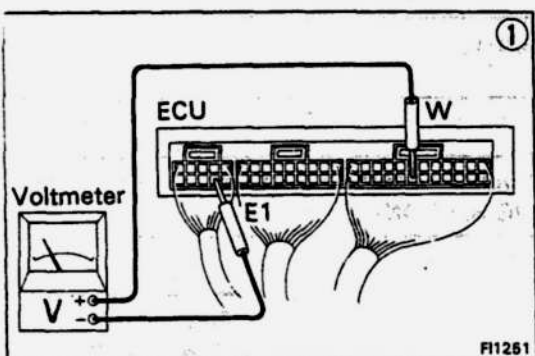
Repair or replace.



| Jo. | Terminals | Trouble    | Condition                                                        | STD Voltage |
|-----|-----------|------------|------------------------------------------------------------------|-------------|
| 12  | W - E1    | No voltage | No trouble ("CHECK" engine warning light off) and engine running | 8 - 14 V    |



FI0728



① There is no voltage between ECU terminals W and E1. (Idling)

② Check that there is voltage between ECU terminal W and body ground.

NO

OK

③ Check wiring between ECU terminal E1 and body ground.

OK

BAD

Try another ECU.

Repair or replace.

Check GAUGE fuse (7.5A) and "CHECK ENGINE" warning light.

OK

BAD

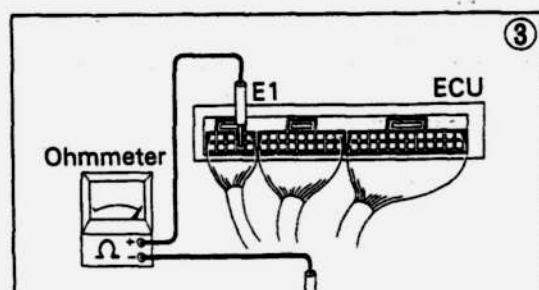
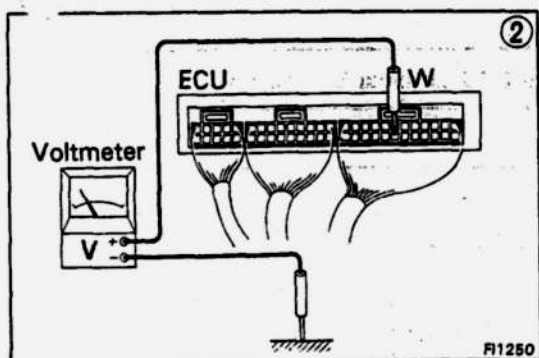
Repair or replace.

Fuse blows again

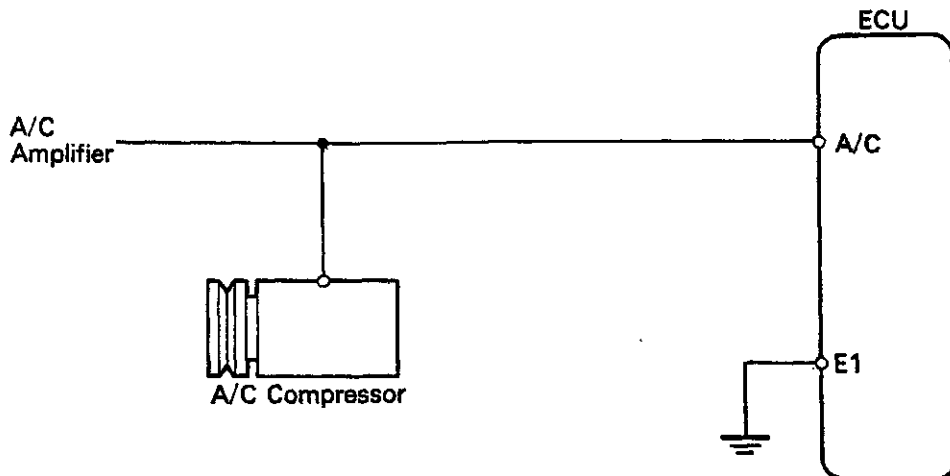
Check wiring between ECU terminal W and fuse.

BAD

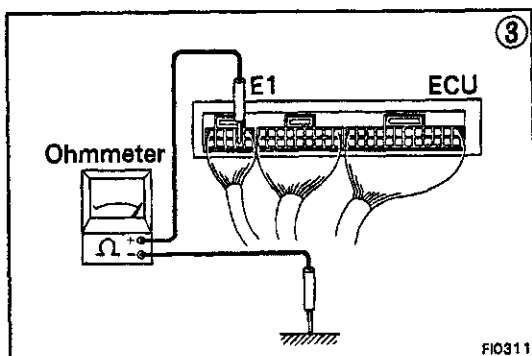
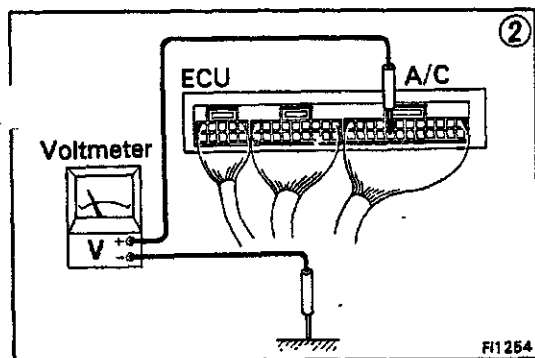
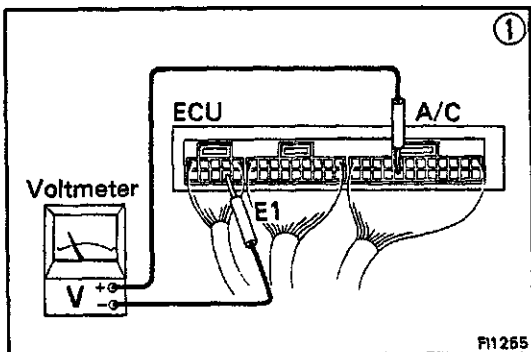
Repair or replace.



| No. | Terminals | Trouble    | Condition           | STD Voltage |
|-----|-----------|------------|---------------------|-------------|
| 13  | A/C — E1  | No voltage | Air conditioning ON | 10 — 14 V   |



F0822



① There is no voltage between ECU terminals A/C and E1.  
(Air conditioning ON)

② Check that there is voltage between ECU terminal A/C and body ground.

NO

OK

③ Check wiring between ECU terminal E1 and body ground.

OK

BAD

Try another ECU.

Repair or replace.

Check compressor running.

OK

BAD

Check wiring between ECU terminal A/C and amplifier.

BAD

Repair or replace.

Check that there is voltage between amplifier terminal and body ground.

BAD

Repair or replace.

OK

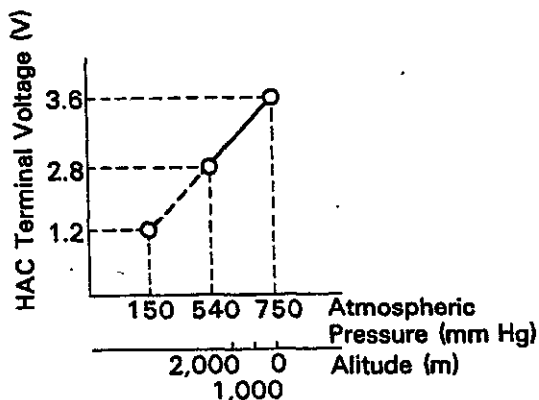
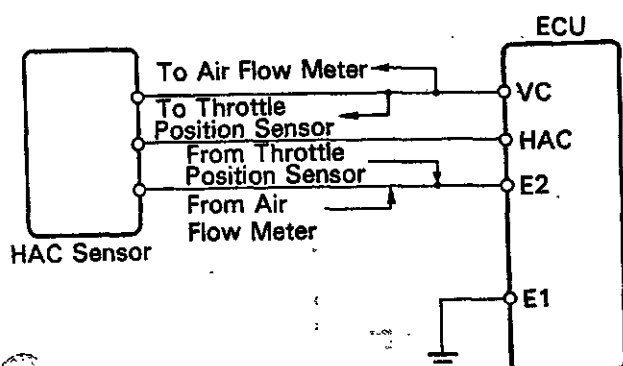
Check wiring between amplifier and ECU or compressor.

BAD

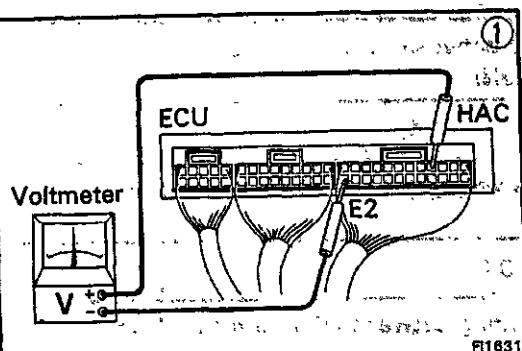
Repair or replace.

| o. | Terminals | Trouble    | Condition          | STD Voltage   |
|----|-----------|------------|--------------------|---------------|
| 4  | HAC — E2  | No voltage | Ignition<br>S/W ON | Approx. 2.8 V |
|    |           |            |                    | Approx. 3.6 V |

7M-GTE only



FI1995 FI1996



① There is no voltage between ECU terminal HAC and E2. (IG S/W ON)

② Check that there is voltage between ECU terminal VC and body ground. (IG S/W ON)

OK

NO

Refer to No. 2.  
(See page FI-43)

Check wiring between ECU terminal E1 and body ground.

OK

BAD

③ Check HAC sensor.  
(See page FI-121)

Repair or replace.

BAD

OK

Replace HAC  
sensor.

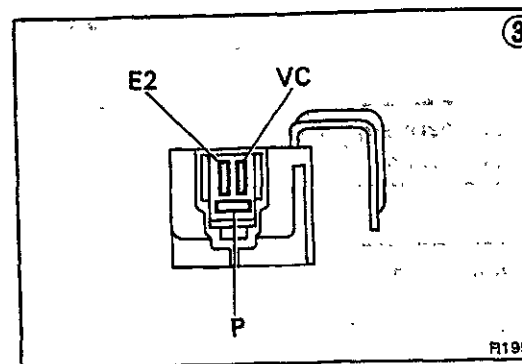
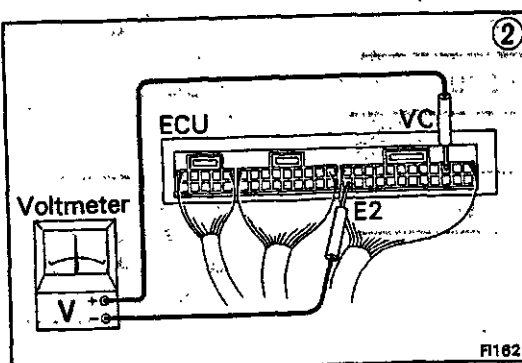
Check wiring between ECU and HAC  
sensor.

OK

BAD

Try another ECU.

Repair or replace.



## TROUBLESHOOTING WITH VOLT/OHMMETER (MS)

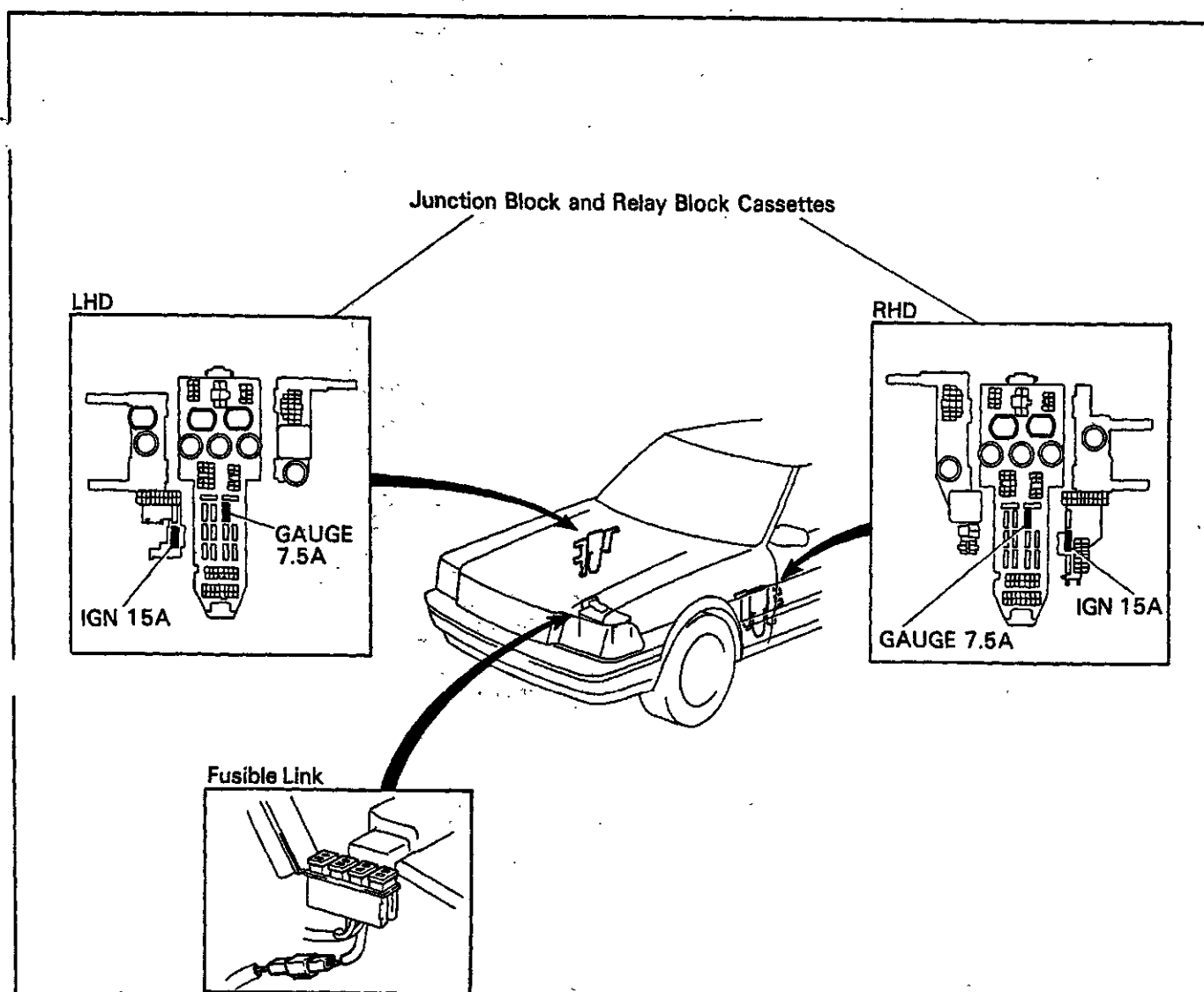
**NOTE:** The following troubleshooting procedures are designed for inspection of each separate system, and therefore the actual procedure may vary somewhat. However, troubleshooting should be performed referring to the inspection methods described in this manual.

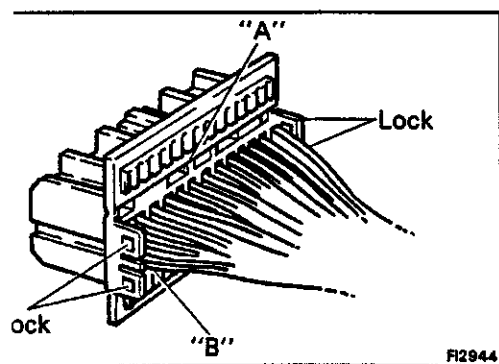
Before beginning inspection, it is best to first make a simple check of the fuses, fusible links and the condition of the connectors.

The following troubleshooting procedures are based on the supposition that the trouble lies in either a short or open circuit in a component outside the computer or a short circuit within the computer.

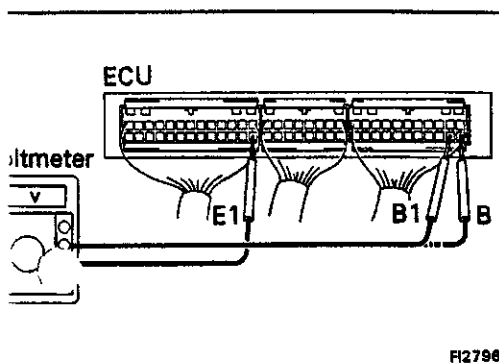
If engine trouble occurs even though proper operating voltage is detected in the computer connector, then it can be assumed that the ECU is faulty and should be replaced.

### LOCATION OF FUSES AND FUSIBLE LINKS





FI2944



FI2796

## EFI SYSTEM CHECK PROCEDURE

### PREPARATION

- Disconnect the connectors from the ECU.
- Remove the locks as shown in the illustration so that the tester probe(s) can easily come in.

**CAUTION:** Pay attention to sections "A" and "B" in the illustration which can be easily broken.

- Reconnect the connectors to the ECU.

### NOTE:

- Perform all voltage measurements with the connectors connected.
- Verify that the battery voltage is 11V or above when the ignition switch is at "ON".

Using a voltmeter with high-impedance (10 k $\Omega$ /V minimum), measure the voltage at each terminal of the wiring connectors.

### Terminals of ECU

| Symbol | Terminal Name                       | Symbol      | Terminal Name                              | Symbol | Terminal Name         |
|--------|-------------------------------------|-------------|--------------------------------------------|--------|-----------------------|
| E01    | POWER GROUND                        | NE          | DISTRIBUTOR                                | ACPS   | A/C PRESSURE SWITCH   |
| E02    | POWER GROUND                        | E1          | COMPUTER GROUND                            | SPD    | SPEEDOMETER           |
| No. 10 | INJECTOR (No. 1 and 4)              | VF          | CHECK CONNECTOR                            | ECT    | ECT COMPUTER          |
| No. 30 | INJECTOR (No. 3 and 5)              | G $\ominus$ | DISTRIBUTOR                                | ACR    | A/C COMPRESSOR        |
| No. 20 | INJECTOR (No. 2 and 6)              | TE2         | CHECK CONNECTOR                            | L1     | ECT COMPUTER          |
| ELS    | DEFOGGER SWITCH<br>HEADLIGHT SWITCH | TE1         | CHECK CONNECTOR                            | L2     | ECT COMPUTER          |
| FPU    | VSV (FPU)                           | KNK         | KNOCK SENSOR                               | FPR    | FUEL PUMP RELAY       |
| ACV    | VSV (A/R CONTROL)                   | THW         | WATER TEMP. SENSOR                         | L3     | ECT COMPUTER          |
| SC 1   | ISC MOTOR NO. 1 COIL                | IDL         | THROTTLE POSITION SENSOR                   | W      | WARNING LIGHT         |
| IGT    | IGNITER                             | THA         | AIR TEMP. SENSOR                           | M-REL  | EFI MAIN RELAY (COIL) |
| ISC2   | ISC MOTOR NO. 2 COIL                | VTA         | THROTTLE POSITION SENSOR                   | IG S/W | IGNITION SWITCH       |
| ISC3   | ISC MOTOR NO. 3 COIL                | VS          | AIR FLOW METER                             | B1     | EFI MAIN RELAY        |
| ISC4   | ISC MOTOR NO. 4 COIL                | VCC         | AIR FLOW METER<br>THROTTLE POSITION SENSOR | BATT   | BATTERY               |
| IGF    | IGNITER                             | E2          | SENSOR GROUND                              | B      | EFI MAIN RELAY        |
| G2     | DISTRIBUTOR                         | STA         | STARTER SWITCH                             |        |                       |
| G1     | DISTRIBUTOR                         | NSW         | NEUTRAL START SWITCH                       |        |                       |

### ECU Terminals

|                                                                                     |        |        |  |     |     |       |       |       |       |     |    |                                                                                     |    |     |  |     |     |                                                                                     |    |     |     |      |     |     |    |     |   |  |       |  |        |      |
|-------------------------------------------------------------------------------------|--------|--------|--|-----|-----|-------|-------|-------|-------|-----|----|-------------------------------------------------------------------------------------|----|-----|--|-----|-----|-------------------------------------------------------------------------------------|----|-----|-----|------|-----|-----|----|-----|---|--|-------|--|--------|------|
|  |        |        |  |     |     |       |       |       |       |     |    |  |    |     |  |     |     |  |    |     |     |      |     |     |    |     |   |  |       |  |        |      |
| E01                                                                                 | No. 10 | No. 20 |  | FPU | ACV | ISC 1 | ISC 2 | ISC 3 | ISC 4 | IGF | G2 | NE                                                                                  | VF | TE2 |  | KNK | THW | THA                                                                                 |    | VCC | STA | ACPS | SPD | ARC |    | FPR | W |  | M-REL |  | IG S/W | BATT |
| E02                                                                                 | No. 30 | ELS    |  |     |     | IGT   |       |       |       |     | G1 | E1                                                                                  | G⊖ | TE1 |  |     | IDL | VTA                                                                                 | VS | E2  | NSW |      | ECT | L1  | L2 | L3  |   |  |       |  | B1     | B    |

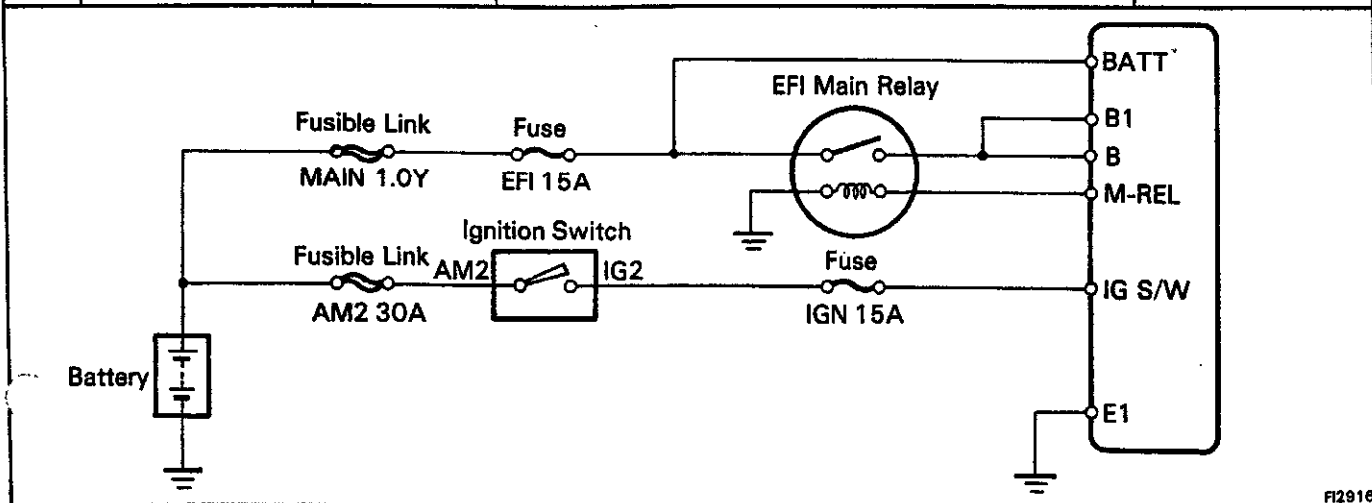
## Voltage at ECU Wiring Connectors

| No. | Terminals                            | Condition                                                        |                                    | STD Voltage | See page |
|-----|--------------------------------------|------------------------------------------------------------------|------------------------------------|-------------|----------|
| 1   | BATT - E1                            | —                                                                |                                    | 10 - 14     | FI-60    |
|     | IG S/W - E1                          | Ignition S/W ON                                                  |                                    | 10 - 14     | FI-61    |
|     | M-REL - E1                           |                                                                  |                                    |             | FI-62    |
|     | B (B1) - E1                          |                                                                  |                                    |             |          |
| 2   | IDL - E2                             | Ignition S/W ON                                                  | Throttle valve open                | 10 - 14     | FI-63    |
|     | VCC - E2                             |                                                                  | —                                  | 4 - 6       | FI-64    |
|     | VTA - E2                             |                                                                  | Throttle valve fully closed        | 0.1 - 1.0   |          |
|     |                                      |                                                                  | Throttle valve fully open          | 4 - 5       |          |
| 3   | VCC - E2                             | Ignition S/W ON                                                  | —                                  | 4 - 6       | FI-65    |
|     | VS - E2                              |                                                                  | Measuring plate fully closed       | 4 - 5       |          |
|     |                                      |                                                                  | Measuring plate fully open         | 0.02 - 0.08 |          |
|     |                                      | Idling                                                           |                                    | 2 - 4       |          |
|     |                                      | 3,000 rpm                                                        |                                    | 0.3 - 1.0   |          |
| 4   | No. 10 E01<br>No. 20 -<br>No. 30 E02 | Ignition S/W ON                                                  |                                    | 9 - 14      | FI-66    |
| 5   | THA - E2                             | Ignition S/W ON                                                  | Intake air temperature 20°C (68°F) | 1 - 3       | FI-67    |
| 6   | THW - E2                             | Ignition S/W ON                                                  | Coolant temperature 80°C (176°F)   | 0.1 - 1.0   | FI-68    |
| 7   | STA - E1                             | Cranking                                                         |                                    | 8 - 14      | FI-69    |
| 8   | IGF, IGT - E1                        | Idling                                                           |                                    | 0.7 - 1.0   | FI-70    |
| 9   | ISC1<br>ISC4 - E1                    | Ignition S/W ON                                                  |                                    | 9 - 14      | FI-71    |
| 10  | W - E1                               | No trouble ("CHECK ENGINE" warning light off) and engine running |                                    | 8 - 14      | FI-72    |

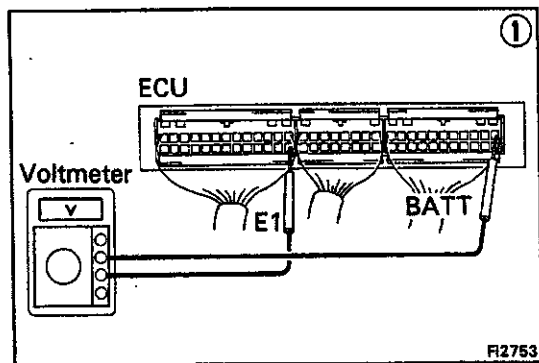
## ECU Terminals

|     |        |       |     |     |       |       |       |       |     |    |    |    |     |     |     |     |     |     |      |     |     |     |    |       |    |      |
|-----|--------|-------|-----|-----|-------|-------|-------|-------|-----|----|----|----|-----|-----|-----|-----|-----|-----|------|-----|-----|-----|----|-------|----|------|
| E01 | No. 10 | No. 2 | FPU | ACV | ISC 1 | ISC 2 | ISC 3 | ISC 4 | IGF | G2 | NE | VF | TE2 | KNK | THW | THA | VCC | STA | ACPS | SPD | ACR | FPR | W  | M-REL | IG | BATT |
| E02 | No. 30 | ELS   |     |     | IGT   |       |       |       |     | G1 | E1 | G⊖ | TE1 |     | IDL | VTA | VS  | E2  | NSW  | ECT | L1  | L2  | L3 |       | B1 | B    |

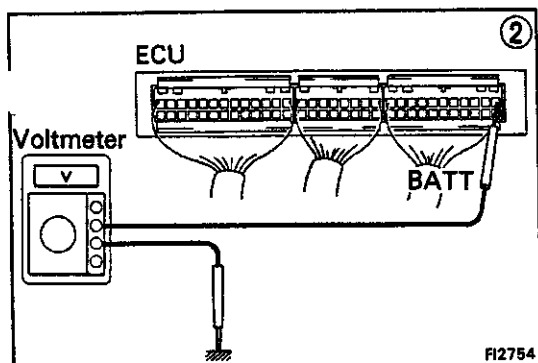
| No. | Terminals   | Trouble    | Condition..        | STD Voltage |
|-----|-------------|------------|--------------------|-------------|
| 1   | BATT — E1   | No voltage | —                  | 10 — 14 V   |
|     | IG S/W — E1 | No voltage | Ignition switch ON | 10 — 14 V   |
|     | M-REL — E1  | No voltage | Ignition switch ON | 10 — 14 V   |
|     | B (B1) — E1 | No voltage | Ignition switch ON | 10 — 14 V   |



FI2918

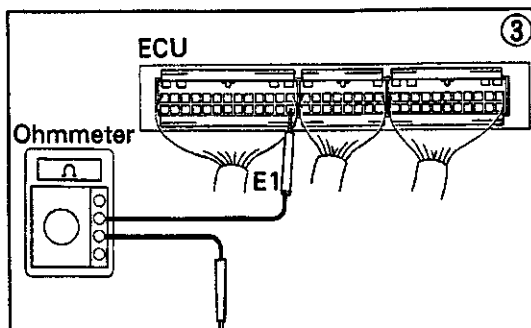
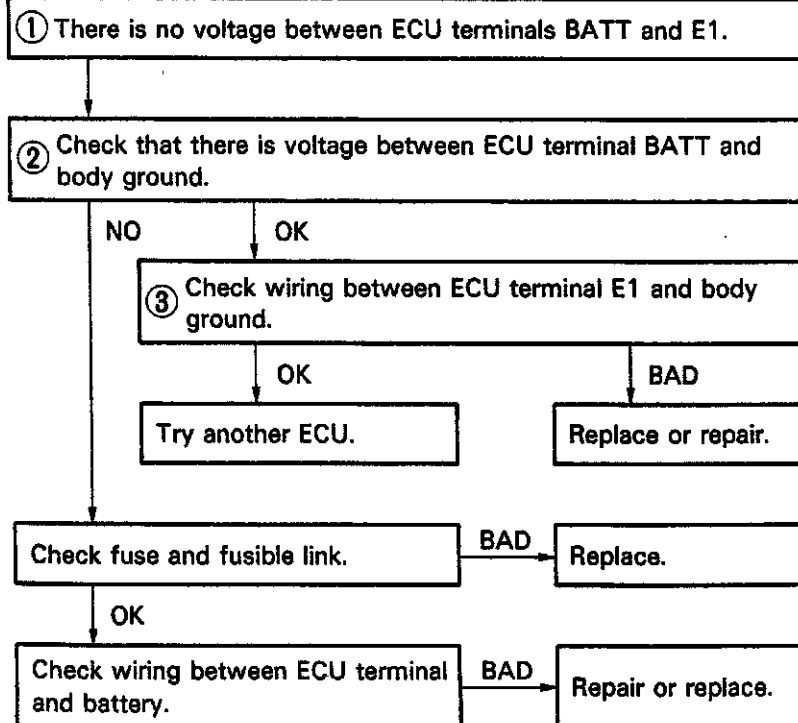


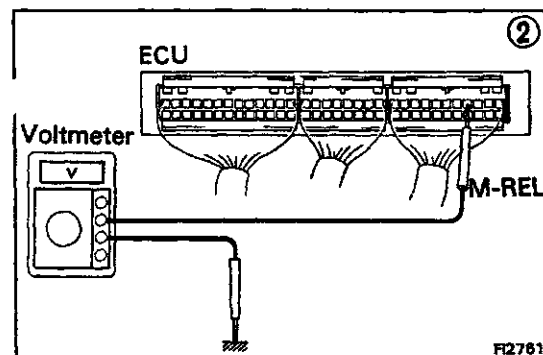
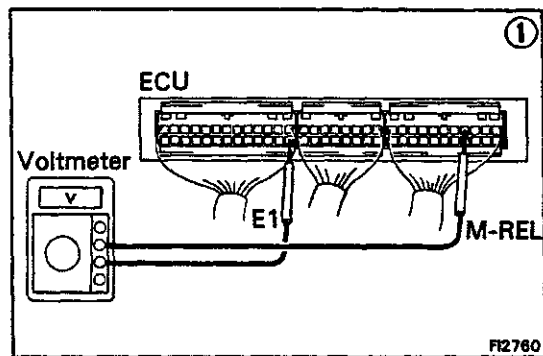
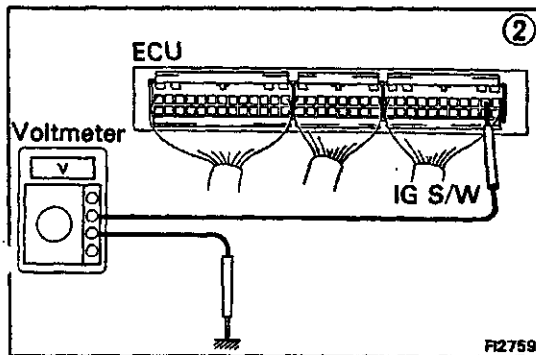
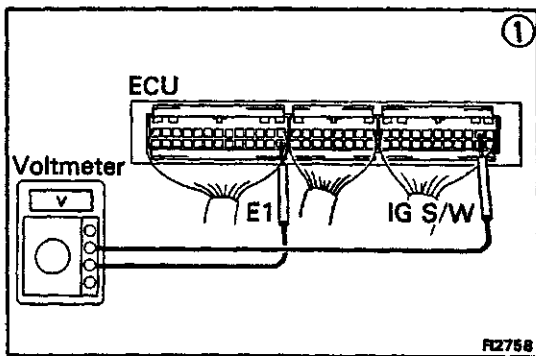
FI2753



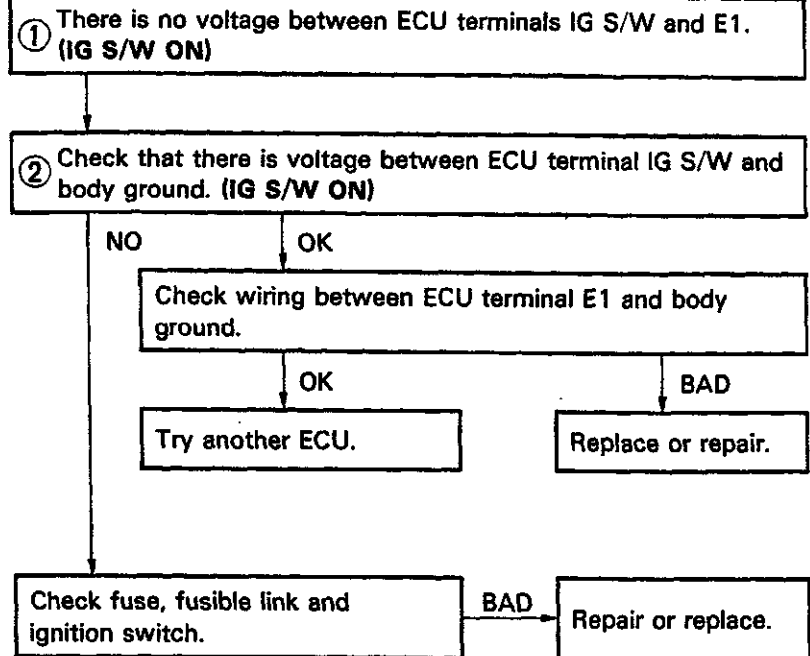
FI2754

### • BATT — E1

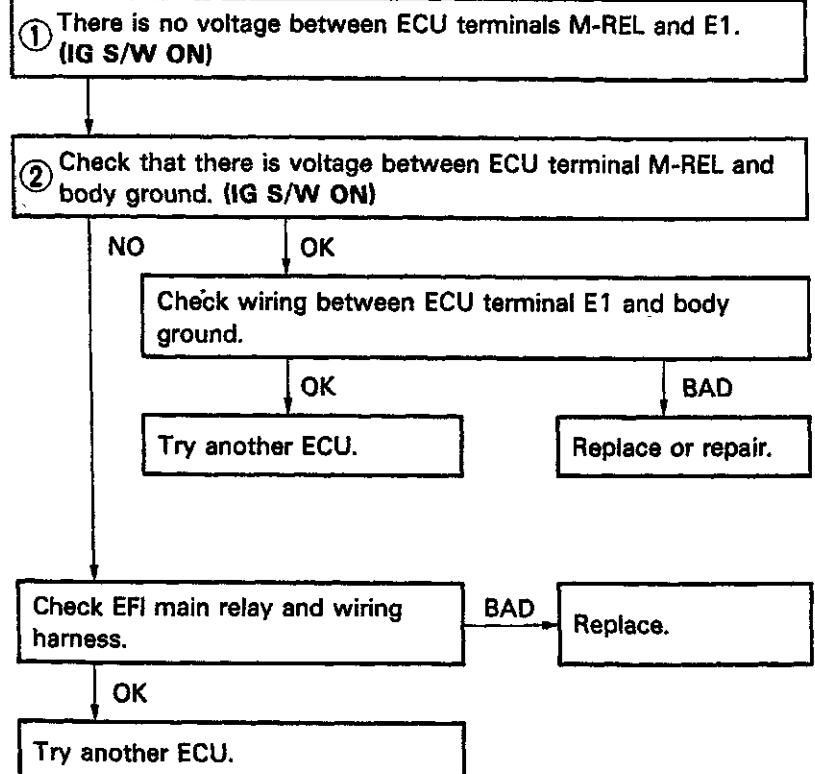


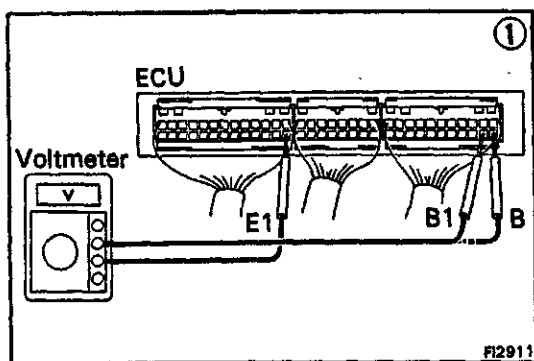


• IG S/W — E1



• M-REL — E1





### • B (B1) — E1

① There is no voltage between ECU terminals B (B1) and E1. (IG S/W ON)

② Check that there is voltage between ECU terminal B (B1) and body ground. (IG S/W ON)

NO

OK

Check wiring between ECU terminal E1 and body ground.

OK

BAD

Try another ECU.

Replace or repair.

Check fuse, fusible link and wiring harness.

BAD

Repair or replace.

OK

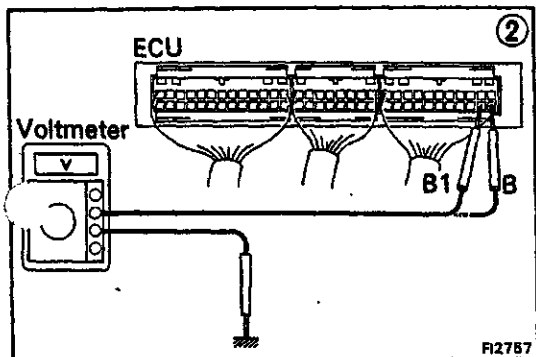
Check EFI main relay. (See page FI-112)

BAD

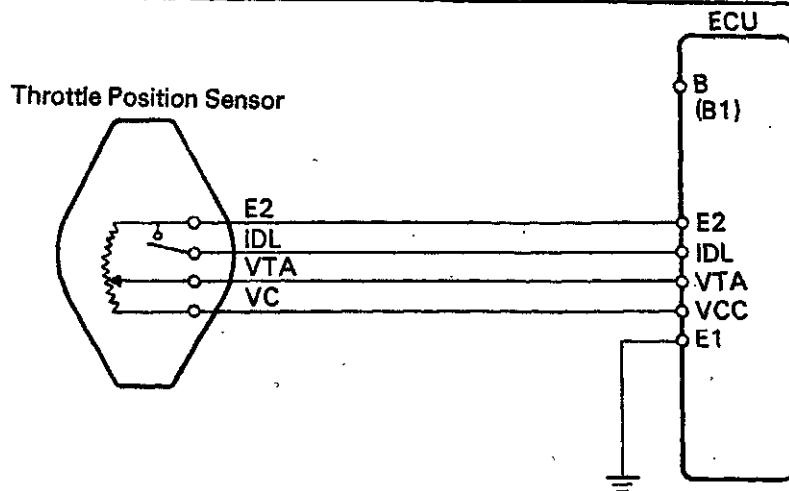
Replace.

OK

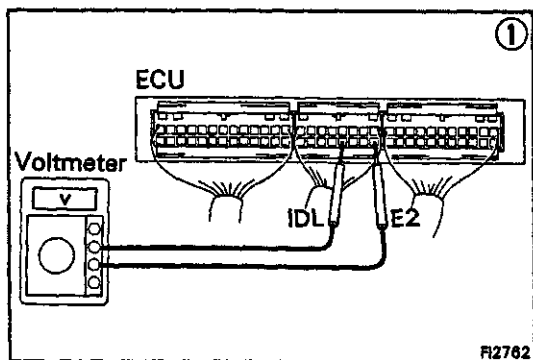
Refer to M-REL — E1 trouble section.



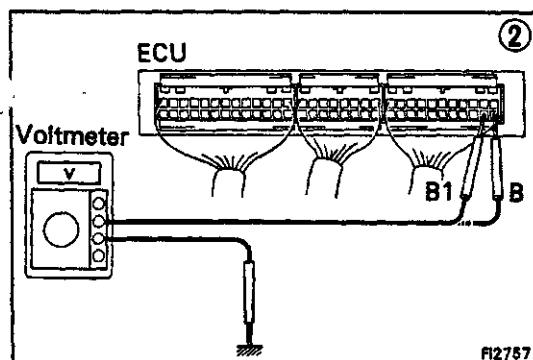
| No. | Terminals | Trouble    | Condition          |                             | STD Voltage |
|-----|-----------|------------|--------------------|-----------------------------|-------------|
| 2   | IDL — E2  | No voltage | Ignition switch ON | Throttle valve open         | 10 — 14 V   |
|     | VCC — E2  |            |                    | —                           | 4 — 6 V     |
|     | VTA — E2  |            |                    | Throttle valve fully closed | 0.1 — 1.0 V |
|     | VTA — E2  |            |                    | Throttle valve fully open   | 4 — 5 V     |



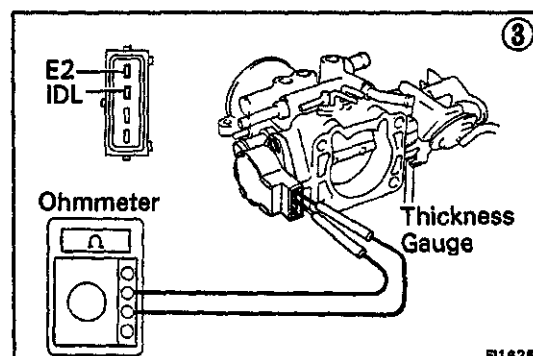
FI1366



FI2762

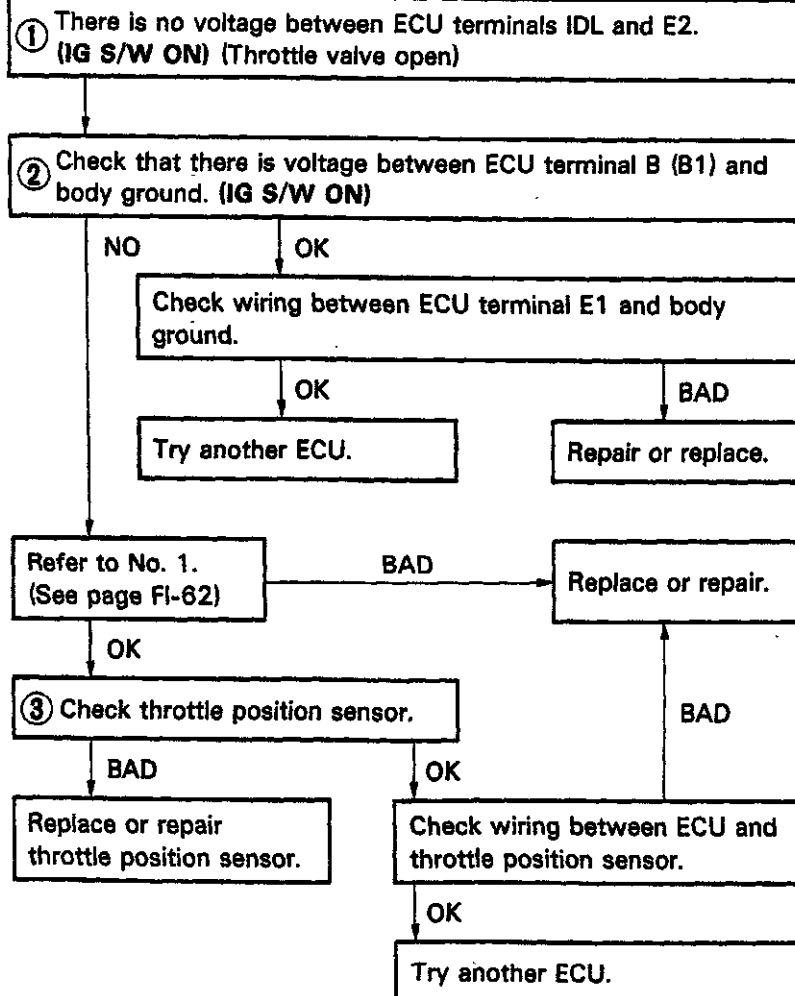


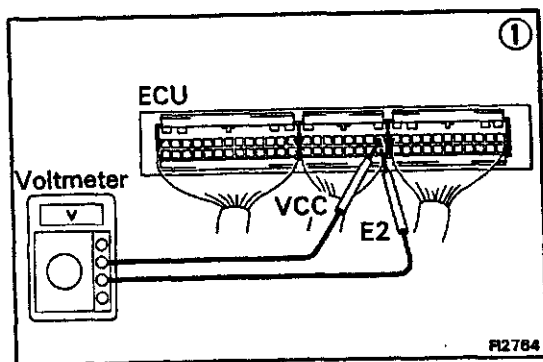
FI2767



FI1625

## • IDL — E2





### • VCC — E2

① There is no voltage between ECU terminals VCC and E2.  
(IG S/W ON)

Check that there is voltage between ECU terminal B (B1) and body ground. (IG S/W ON)

OK

NO

② Check throttle position sensor.  
(See page FI-102)

Refer to No. 1.  
(See page FI-62)

BAD

OK

Repair or replace.

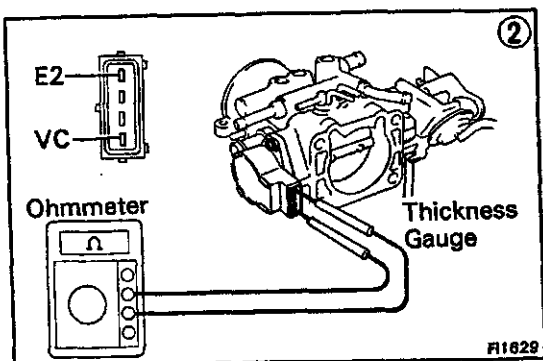
Check wiring between ECU and throttle position sensor.

OK

BAD

Try another ECU.

Repair or replace wiring.



### • VTA — E2

① There is no specified voltage at ECU terminals VTA and E2.  
(IG S/W ON)

② Check that there is voltage between ECU terminal VCC and E2.  
(IG S/W ON)

NO

OK

Refer to VCC — E2 trouble section.

OK

③ Check throttle position sensor.

BAD

Repair or replace.

OK

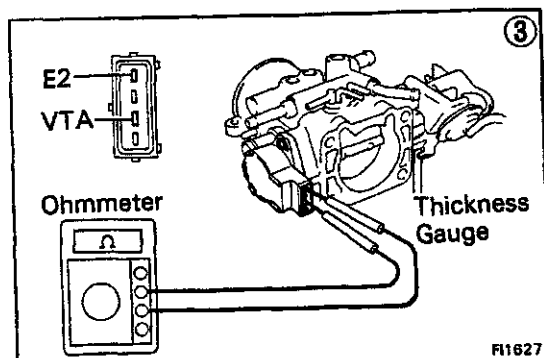
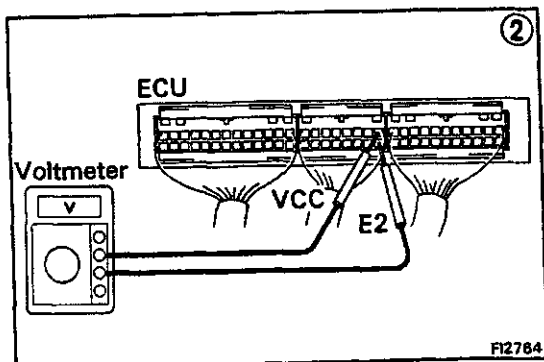
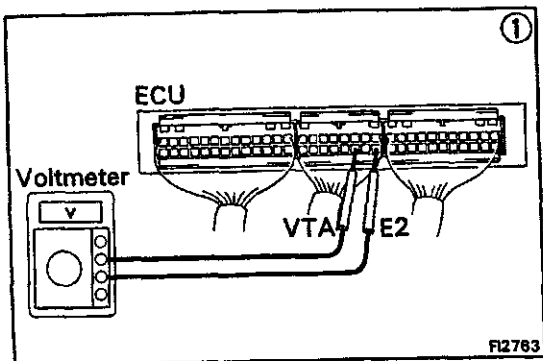
Check wiring between ECU and throttle position sensor.

BAD

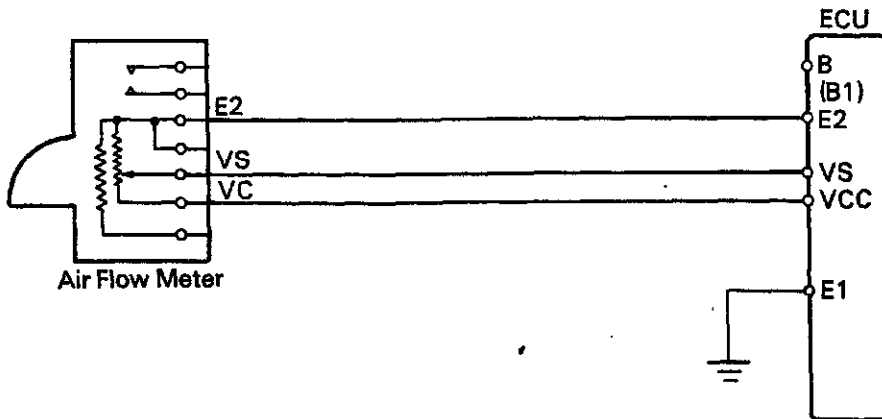
Repair or replace.

OK

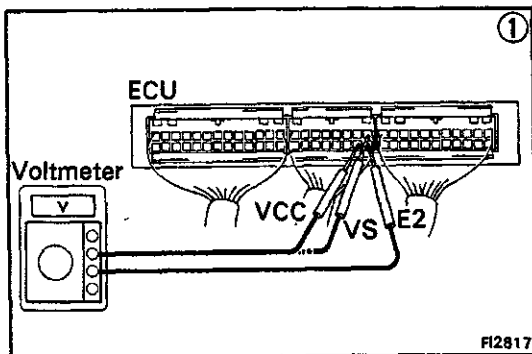
Try another ECU.



| No. | Terminals | Trouble    | Condition          |                              | STD Voltage   |
|-----|-----------|------------|--------------------|------------------------------|---------------|
| 3   | VCC — E2  | No voltage | Ignition<br>S/W ON | —                            | 4 — 6 V       |
|     | VS — E2   |            |                    | Measuring plate fully closed | 4 — 6 V       |
|     | VS — E2   |            |                    | Measuring plate fully open   | 0.02 — 0.08 V |
|     | VS — E2   |            | Idling             | —                            | 2 — 4 V       |
|     | VS — E2   |            | 3,000 rpm          | —                            | 0.3 — 1.0 V   |



FI1269



① There is no voltage between ECU terminals VCC or VS and E2. (IG S/W ON)

② Check that there is voltage between ECU terminal B (B1) and body ground. (IG S/W ON)

OK

NO

Refer to No. 1.  
(See page FI-62)

Check wiring between ECU terminal E1 and body ground.

OK

BAD

③ Check air flow meter.  
(See page FI-96)

Repair or replace.

BAD

OK

Replace air flow meter.

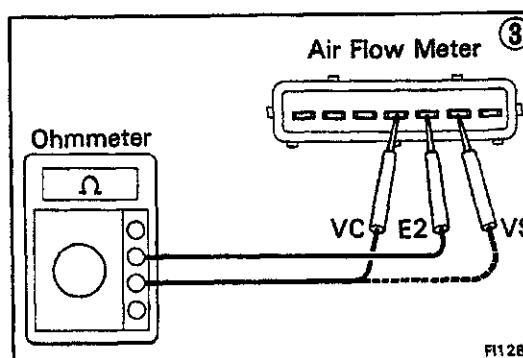
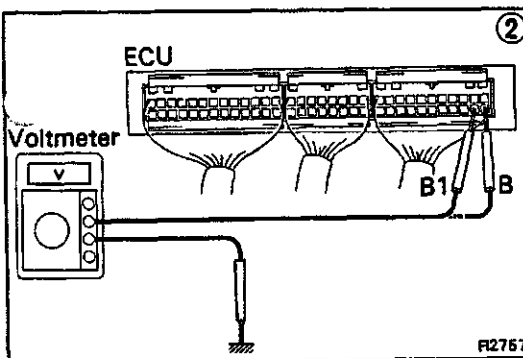
Check wiring between ECU and air flow meter.

OK

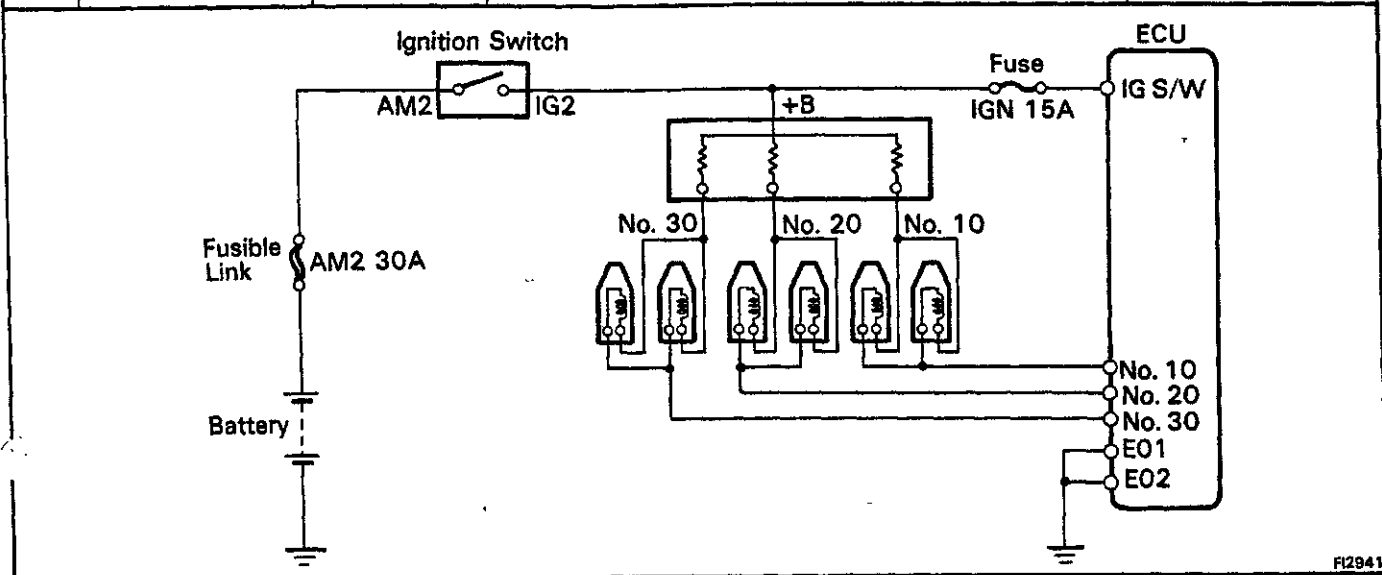
BAD

Try another ECU.

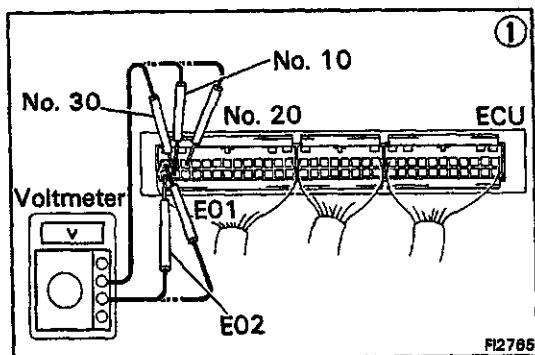
Repair or replace.



| No. | Terminals                              | Trouble    | Condition          | STD Voltage |
|-----|----------------------------------------|------------|--------------------|-------------|
| 4   | No. 10 — E01<br>No. 20 — E02<br>No. 30 | No voltage | Ignition switch ON | 9 – 14 V    |



FI2941



① There is no voltage between ECU terminal No. 10, No. 20 and/or No. 30 and E01 or E02. (IG S/W ON)

② Check that there is specified voltage between resistor terminal +B and body ground. STD voltage: 9 – 14 V

OK

NO

Check wiring between resistor and battery.

BAD

Repair or replace.

OK

Check wiring between resistor and battery.

BAD

Repair or replace.

② Check that there is specified voltage between resistor terminal (No. 10, No. 20 or No. 30) and body ground. STD voltage: 9 – 14 V

OK

BAD

③ Check resistance of magnetic coil in each injector.

Replace resistor.

OK

BAD

Check wiring between ECU and injector.

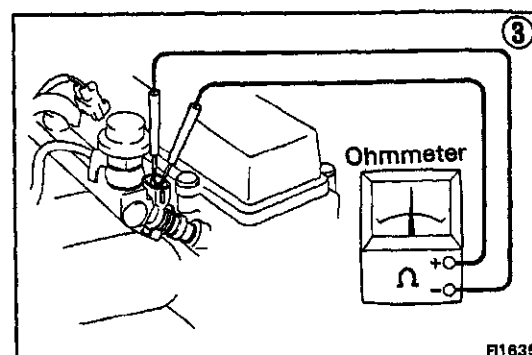
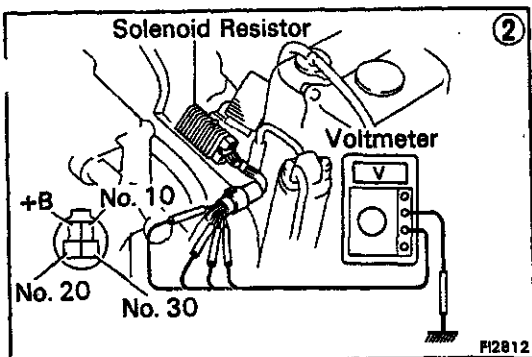
Replace injector.

OK

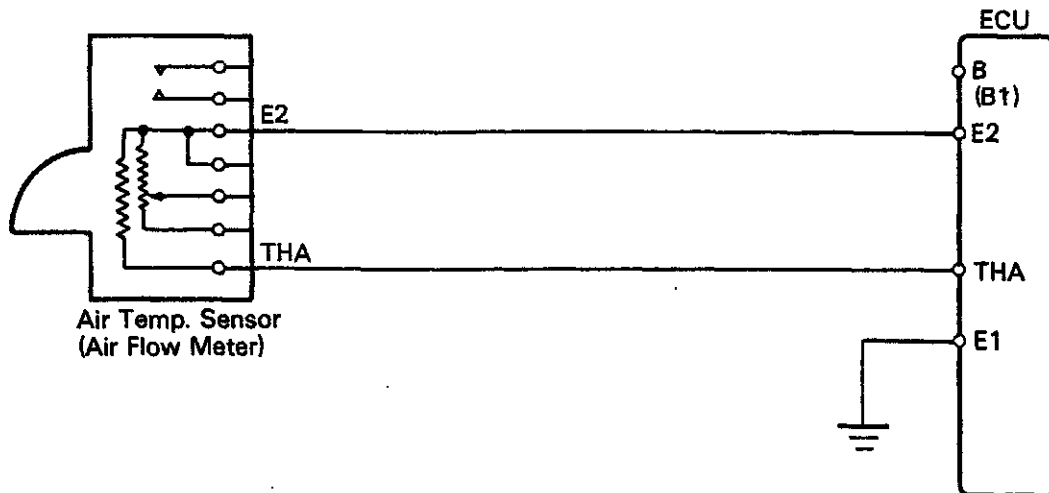
BAD

Try another ECU.

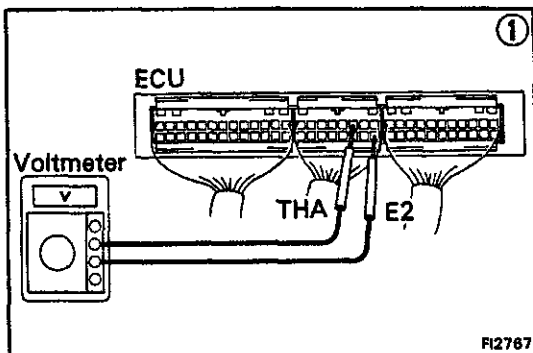
Replace or repair.



| No. | Terminals | Trouble    | Condition             |                                       | STD Voltage |
|-----|-----------|------------|-----------------------|---------------------------------------|-------------|
| 5   | THA — E2  | No voltage | Ignition switch<br>ON | Intake air temperature 20°C<br>(68°F) | 1 — 3 V     |



FI1272



① There is no voltage between ECU terminals THA and E2.  
(IG S/W ON)

② Check that there is voltage between ECU terminal B (B1) and  
body ground. (IG S/W ON)

OK

NO

Refer to No. 1.  
(See page FI-62)

Check wiring between ECU terminal E1 and body ground.

OK

BAD

③ Check air temp. sensor.  
(See page FI-96)

Repair or replace.

BAD

OK

Replace air flow  
meter.

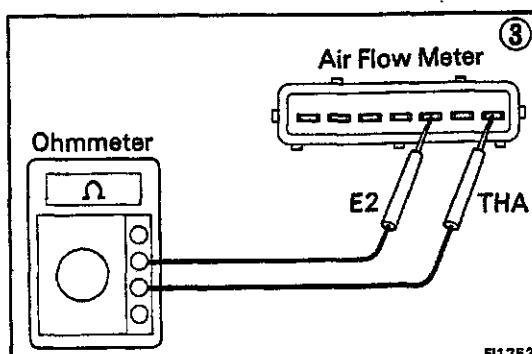
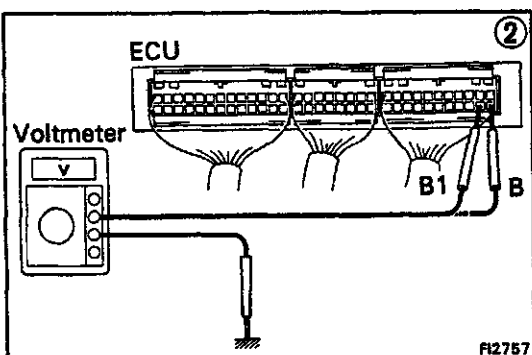
Check wiring between ECU and air  
temp. sensor.

OK

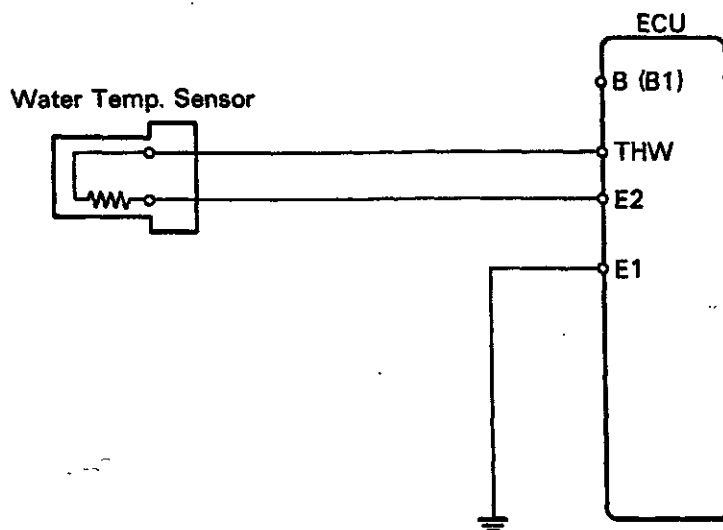
BAD

Try another ECU.

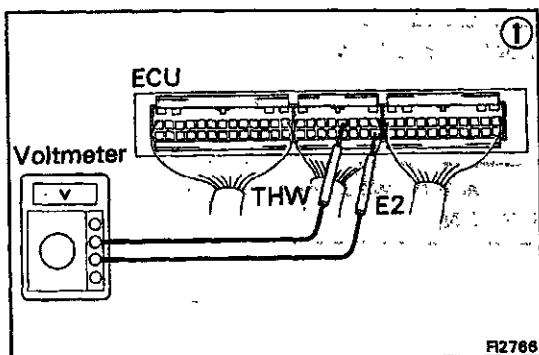
Repair or replace.



| No. | Terminals | Trouble    | Condition          |                                  | STD Voltage |
|-----|-----------|------------|--------------------|----------------------------------|-------------|
| 6   | THW — E2  | No voltage | Ignition switch ON | Coolant temperature 80°C (176°F) | 0.1 — 1.0 V |



FI0487



① There is no voltage between ECU terminals THW and E2. (IG S/W ON)

② Check that there is voltage between ECU terminal B (B1) and body ground. (IG S/W ON)

OK

NO

Refer to No. 1.  
(See page FI-62)

Check wiring between ECU terminal E1 and body ground.

OK

BAD

③ Check water temp. sensor.  
(See page FI-116)

Repair or replace.

BAD

OK

Replace water temp. sensor.

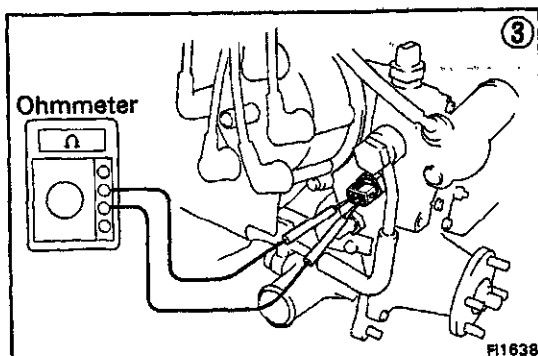
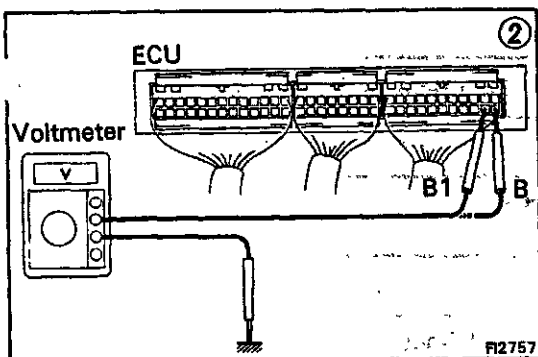
Check wiring between ECU and water temp. sensor.

OK

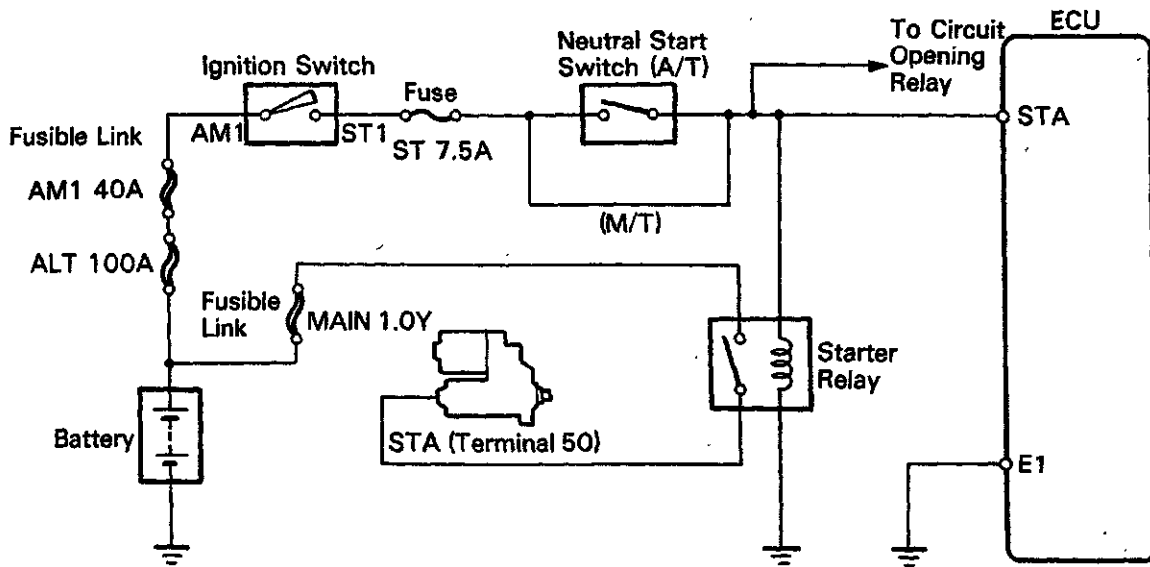
BAD

Try another ECU.

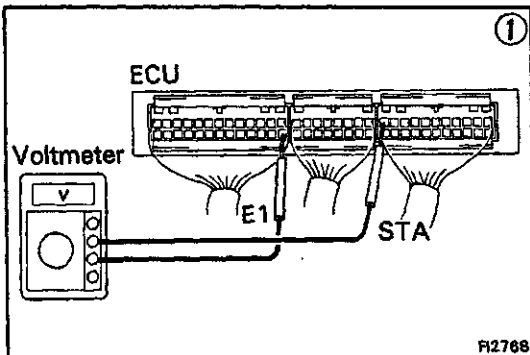
Repair or replace.



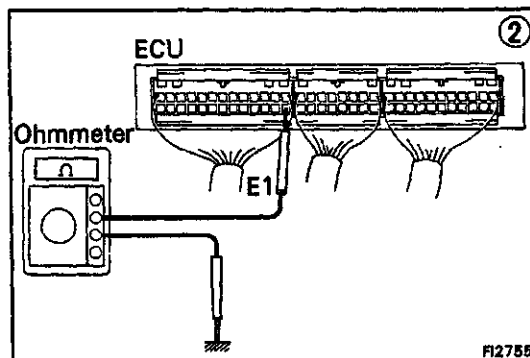
| No. | Terminals | Trouble    | Condition | STD Voltage |
|-----|-----------|------------|-----------|-------------|
| 7   | STA - E1  | No voltage | Cranking  | 6 - 14 V    |



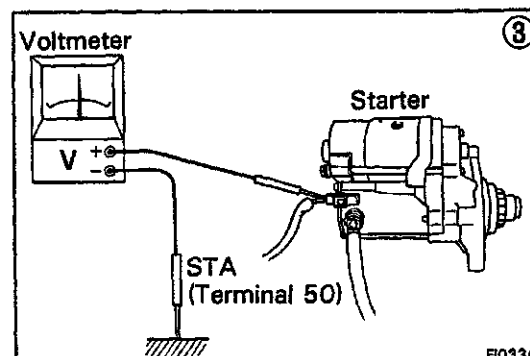
FI2943



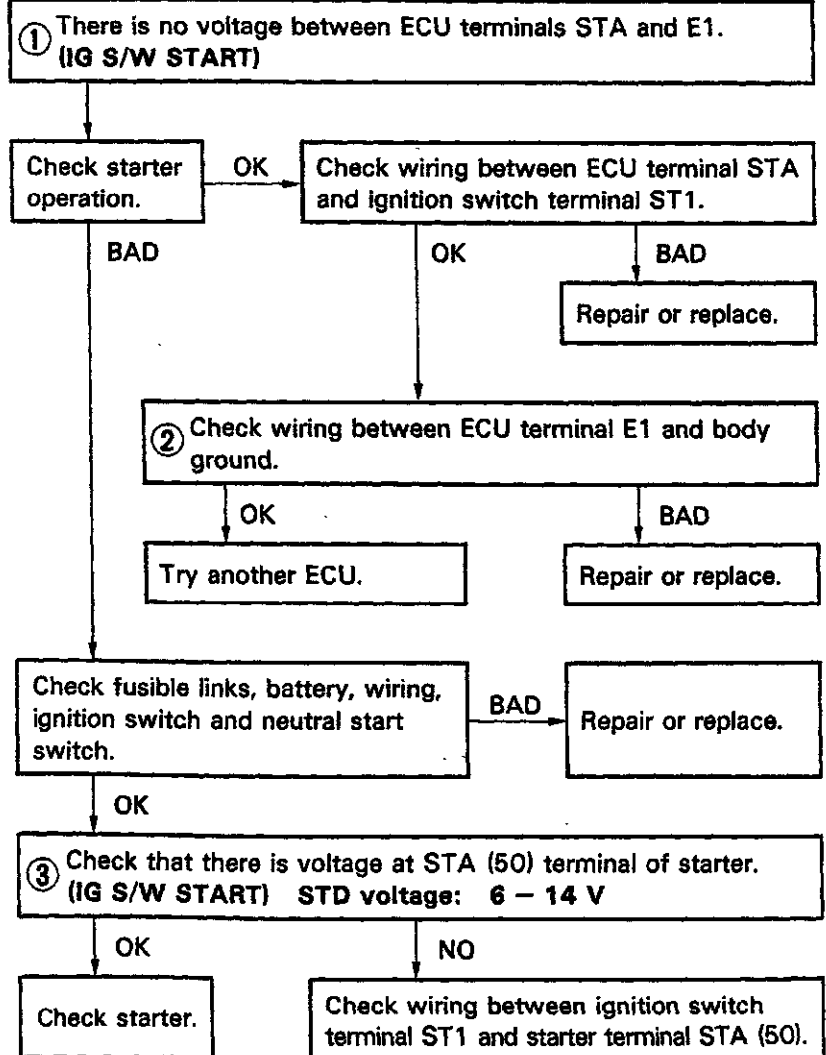
FI2768



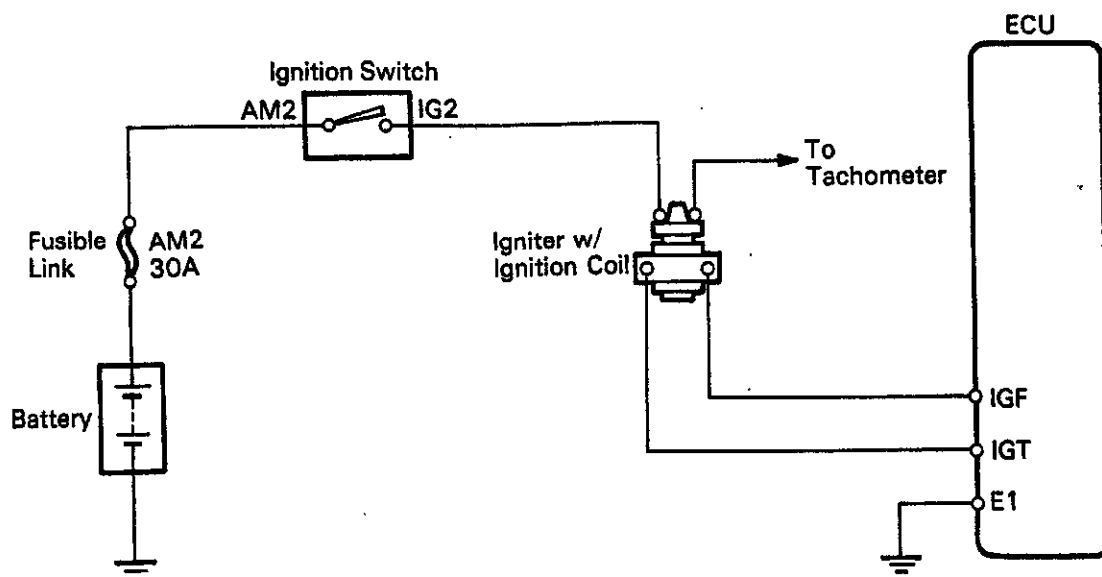
FI2755



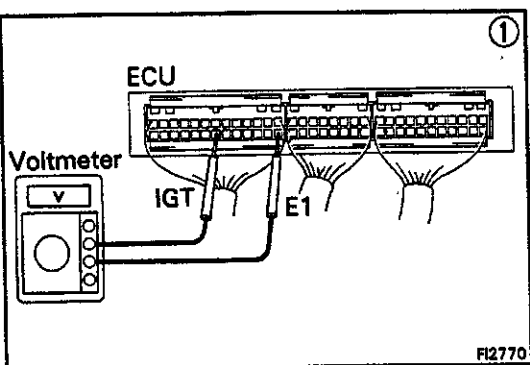
FI0336



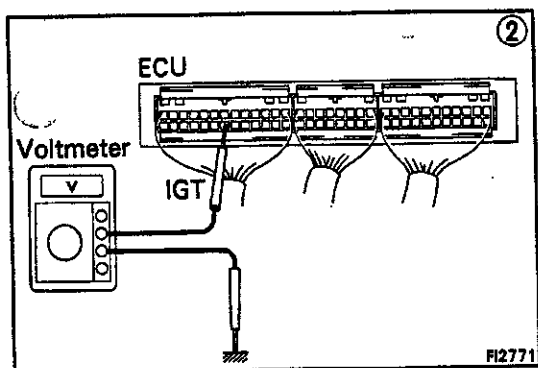
| No. | Terminals     | Trouble    | Condition | STD Voltage |
|-----|---------------|------------|-----------|-------------|
| 8   | IGT, IGF — E1 | No voltage | Idling    | 0.7 — 1.0 V |



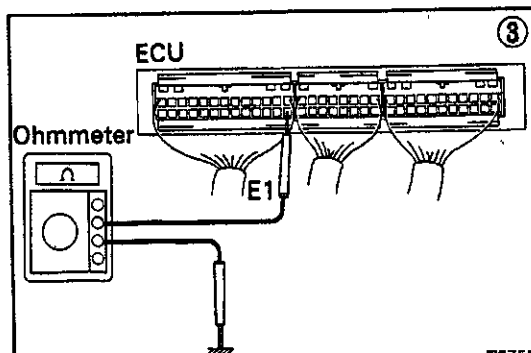
FI2438



FI2770



FI2771



① There is no voltage between ECU terminals IGT and E1. (Idling)

② Check that there is voltage between ECU terminal IGT and body ground. (Idling)

NO

OK

③ Check wiring between ECU terminal E1 and body ground.

BAD

Repair or replace.

OK

Try another ECU.

Check fusible link and ignition switch.

BAD

Repair or replace.

OK

Check distributor. (See page IG-11)

BAD

Repair or replace.

OK

Check wiring between ECU and battery.

BAD

Repair or replace.

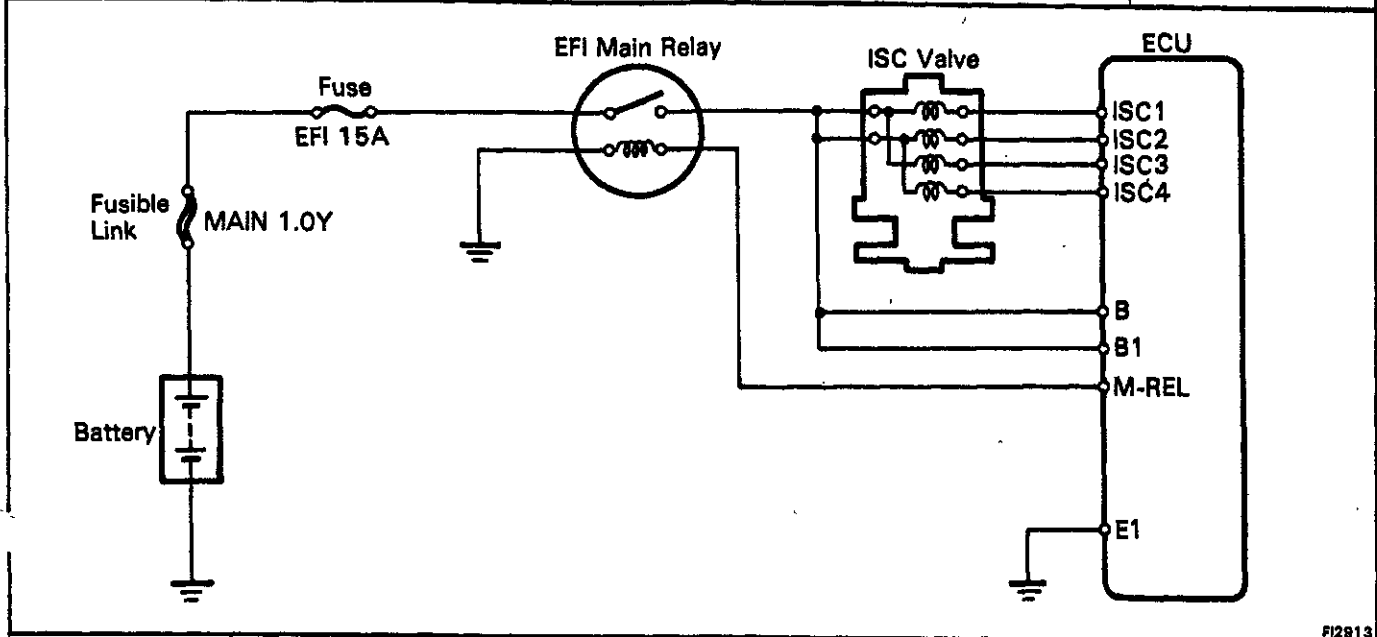
OK

Check igniter.

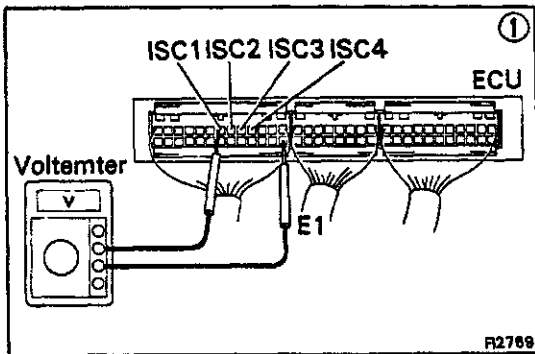
BAD

Repair or replace.

| No. | Terminals      | Trouble    | Condition          | STD Voltage |
|-----|----------------|------------|--------------------|-------------|
| 9   | ISC1~ISC4 — E1 | No voltage | Ignition switch ON | 9 — 14 V    |



FI2913



FI2769

① There is no voltage between ECU terminals ISC1 ~ ISC4 and E1. (IG S/W ON)

② Check that there is voltage between ECU terminal B (B1) and body ground. (IG S/W ON)

OK

NO

Refer to No. 1.  
(See page FI-62)

Check wiring between ECU terminal E1 and body ground.

OK

BAD

③ Check ISV valve.  
(See page FI-108)

BAD

OK

Replace ISC valve.

Repair or replace.

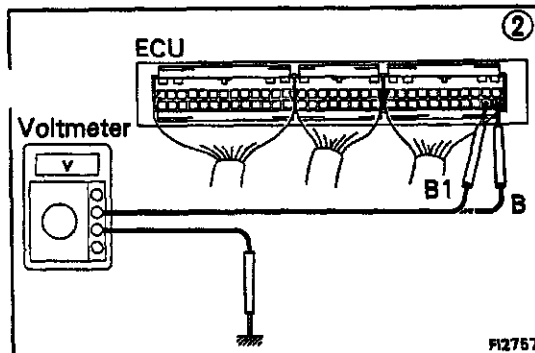
Check wiring between ECU and EFI main relay.

OK

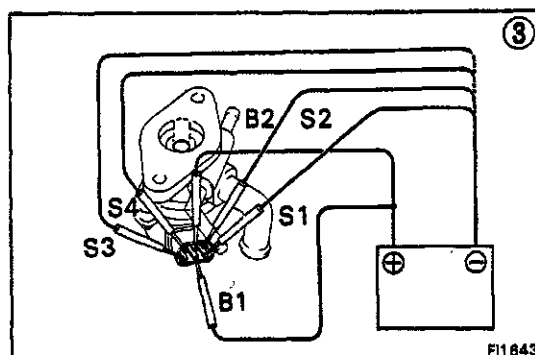
BAD

Try another ECU.

Repair or replace.

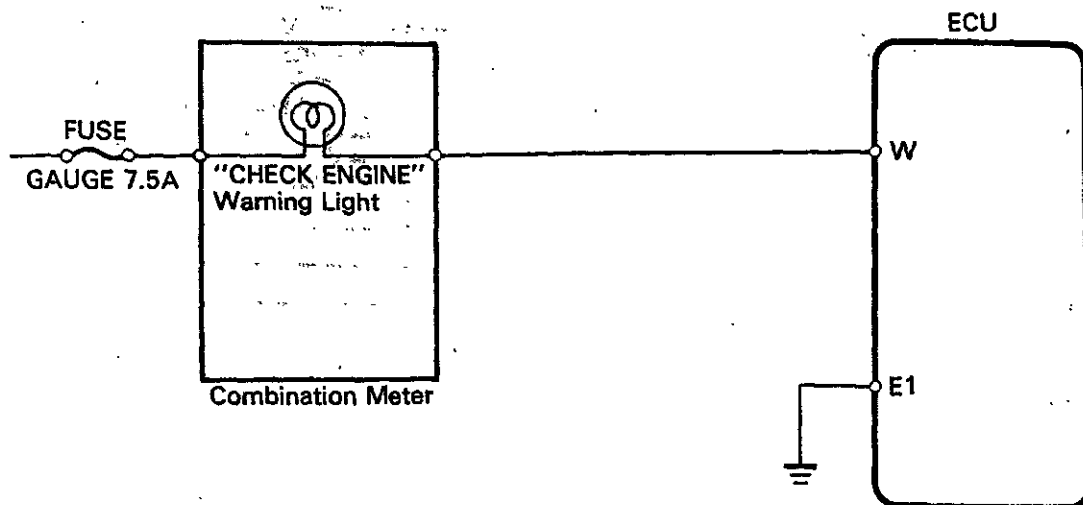


FI2757

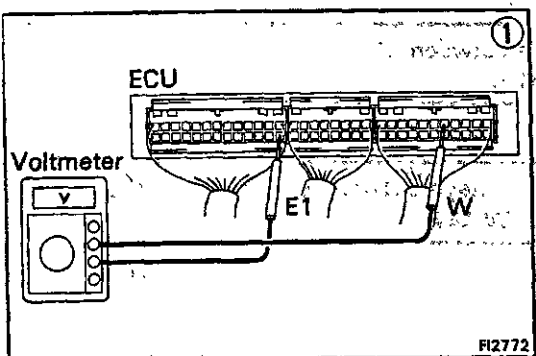


FI1643

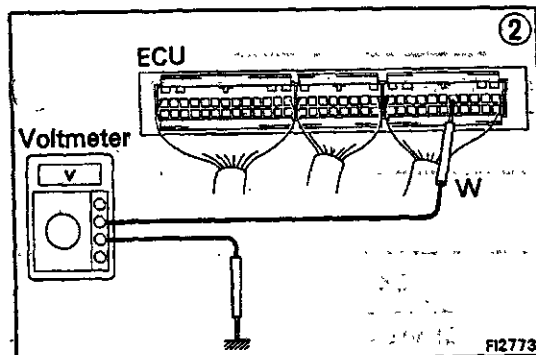
| No. | Terminals | Trouble    | Condition                                                       | STD Voltage |
|-----|-----------|------------|-----------------------------------------------------------------|-------------|
| 10  | W — E1    | No voltage | No trouble ("CHECK engine warning light off) and engine running | 8 — 14 V    |



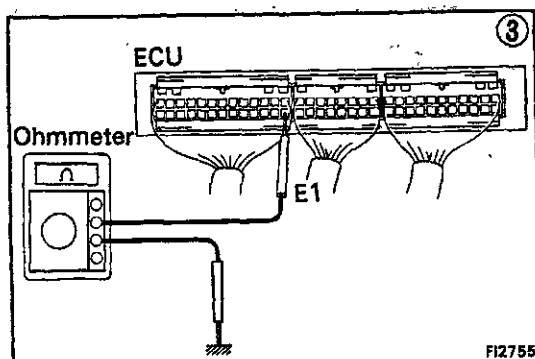
FI0728



FI2772



FI2773



FI2755

① There is no voltage between ECU terminals W and E1. (Idling)

② Check that there is voltage between ECU terminal W and body ground.

NO

OK

③ Check wiring between ECU terminal E1 and body ground.

OK

BAD

Try another ECU.

Repair or replace.

Check GAUGE fuse (7.5A) and "CHECK ENGINE" warning light.

OK

BAD

Repair or replace.

Fuse blows again

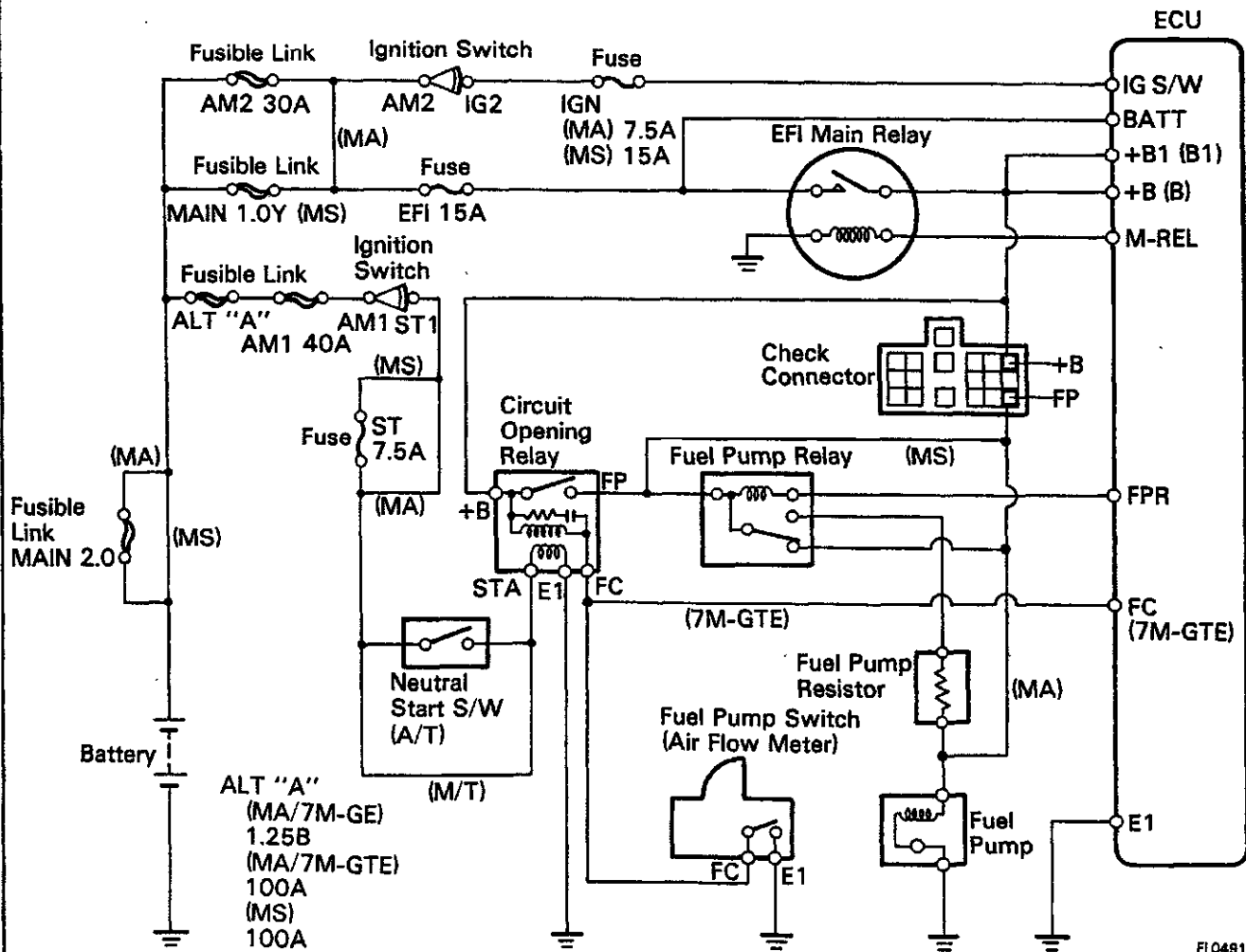
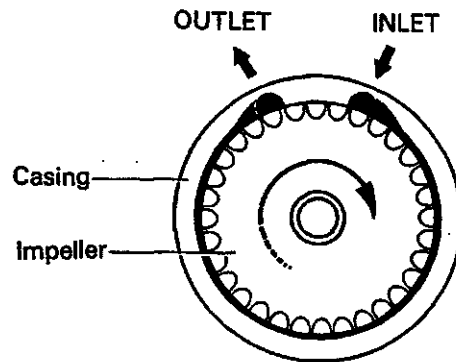
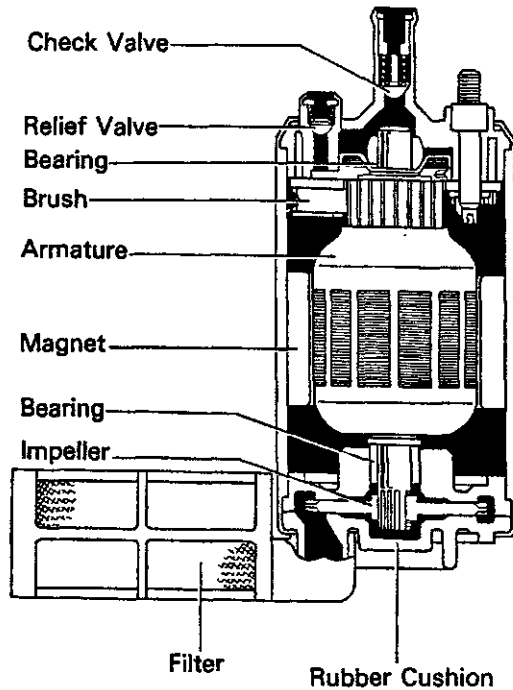
Check wiring between ECU terminal W and fuse.

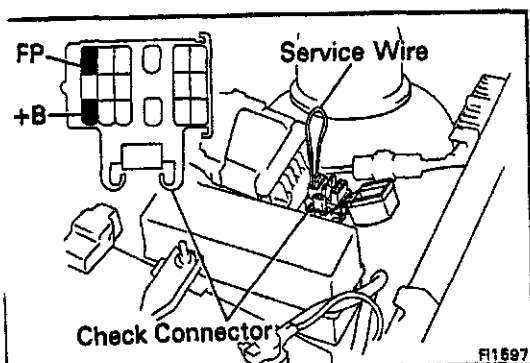
BAD

Repair or replace.

# FUEL SYSTEM

## Fuel Pump





## ON-VEHICLE INSPECTION

### 1. INSPECT FUEL PUMP OPERATION

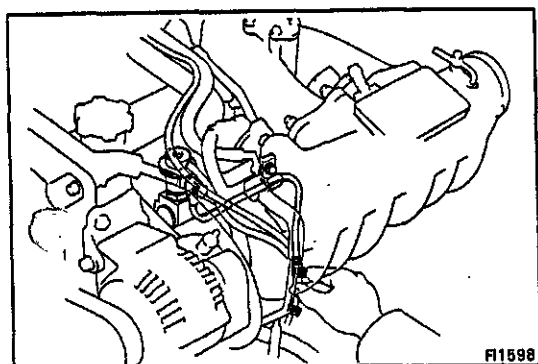
(a) Turn the ignition switch to ON.

**NOTE:** Do not start the engine.

(b) Using a service wire, short circuit the fuel pump check terminals +B and FP of the check connector.

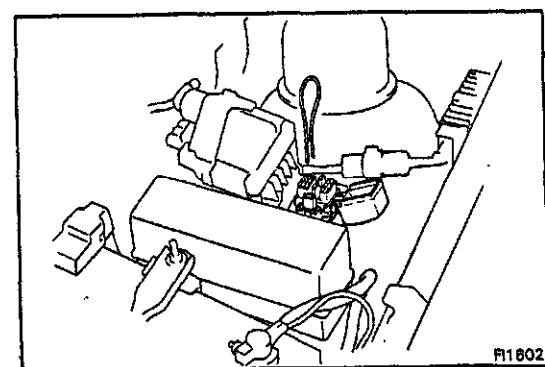
**CHECK CONNECTOR LOCATION:**

See pages FI-110, 111



(c) Check that there is pressure in the fuel return hose.

**NOTE:** At this time, you will hear fuel pressure noise.



(d) Remove the service wire.

(e) Turn the ignition switch OFF.

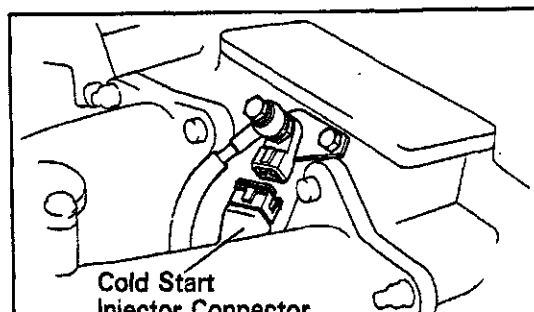
If there is no pressure, check the following parts.

- Fusible links
- Fuse
- EFI main relay
- Fuel pump
- Wiring connections

### 2. INSPECT FUEL PRESSURE

(a) Check that battery voltage is above 11 volts.

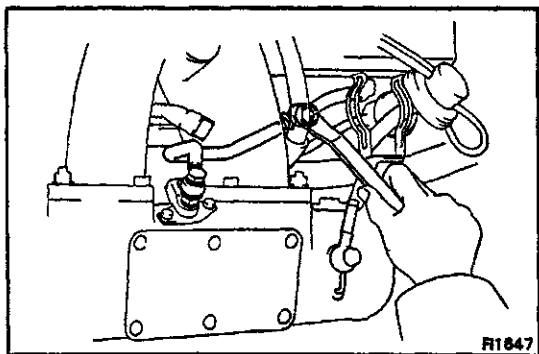
(b) Disconnect the cable from the negative (-) terminal of the battery.



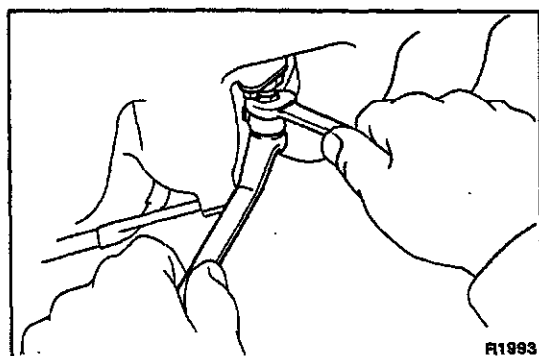
(c) Remove the cold start injector tube.

(7M-GE)

- Disconnect the wiring connector from the cold start injector.

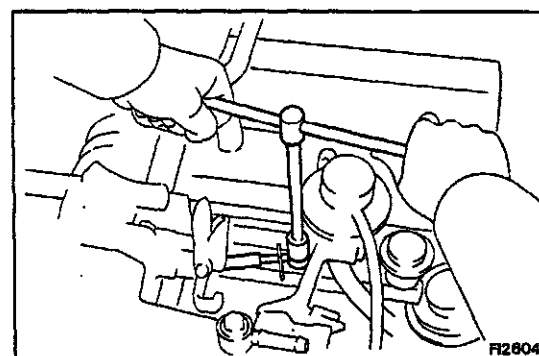


- Place a suitable container or shop towel under the cold start injector tube.
- Slowly loosen the union bolt of the cold start injector tube and remove the bolt and two gaskets from the delivery pipe.

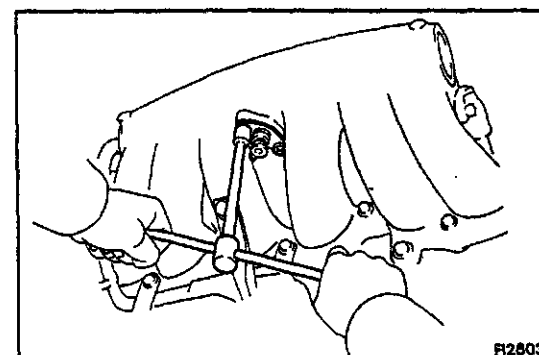


## (7M-GTE)

- Place a suitable container or shop towel under the cold start injector.
- Slowly loosen the union bolt of the cold start injector tube and remove the bolt and two gaskets from the cold start injector.

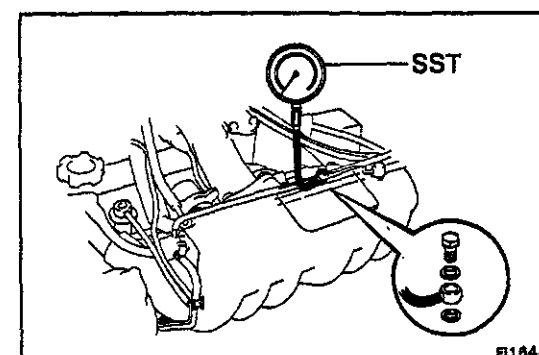


- Remove the union bolt, fuel tube and two gaskets.



- Remove the two bolts and disconnect the cold start injector with gasket.
- Disconnect the cold start injector connector.
- Install the gasket and cold start injector with the bolts.

**Torque: 55 kg-cm (48 in.-lb, 5.4 N·m)**

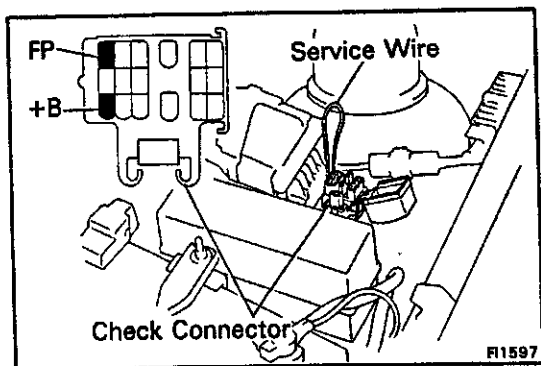


- (d) Install SST (pressure gauge) to the delivery pipe with new gaskets and union bolt, as shown in the figure.

**SST 09268-45012**

**Torque: 300 kg-cm (22 ft-lb, 29 N·m)**

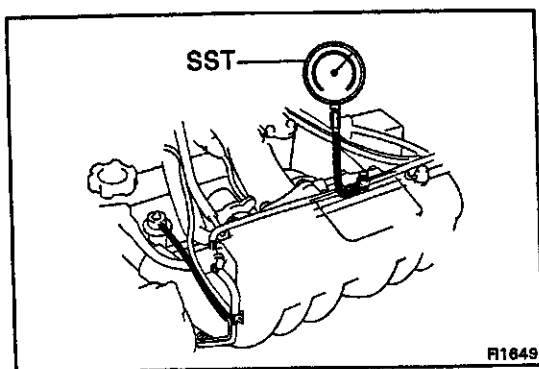
- (e) Wipe off any splattered gasoline.  
 (f) Reconnect the battery negative (–) cable.



- (g) Using a service wire, short circuit the fuel pump check terminals FP and +B of the check connector.

**CHECK CONNECTOR LOCATION:**

See pages FI-110, 111



- (h) Turn the ignition switch ON.

- (i) Measure the fuel pressure.

**Fuel pressure: 2.3 – 2.8 kg/cm<sup>2</sup>  
(33 – 40 psi, 226 – 275 kPa)**

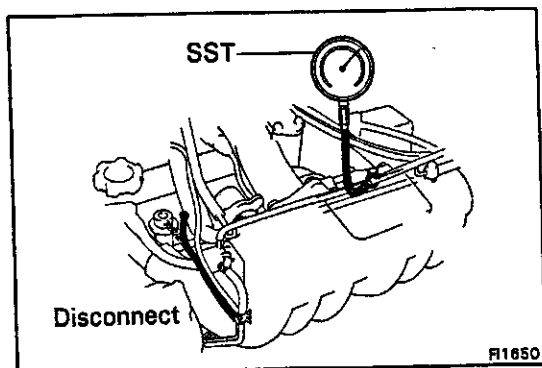
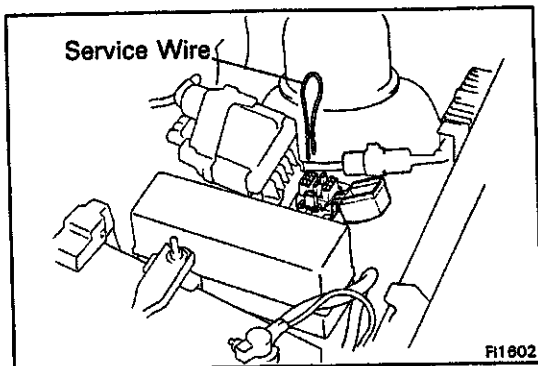
If pressure is high, replace the pressure regulator.

If pressure is low, check the following parts:

- Fuel hoses and connection
- Fuel pump
- Fuel filter
- Pressure regulator

- (j) Remove the service wire from the check connector.

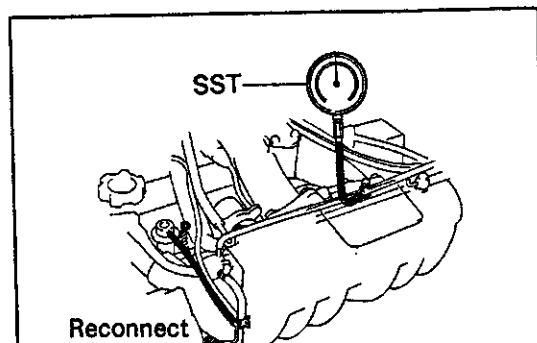
- (k) Start the engine.



- (l) Disconnect the vacuum sensing hose from the pressure regulator and plug hose end.

- (m) Measure the fuel pressure at idling.

**Fuel pressure: 2.3 – 2.8 kg/cm<sup>2</sup>  
(33 – 40 psi, 226 – 275 kPa)**



- (n) Reconnect the vacuum sensing hose to the pressure regulator.

- (o) Measure the fuel pressure at idling.

**Fuel pressure: 1.6 – 2.1 kg/cm<sup>2</sup>  
(23 – 30 psi, 157 – 206 kPa)**

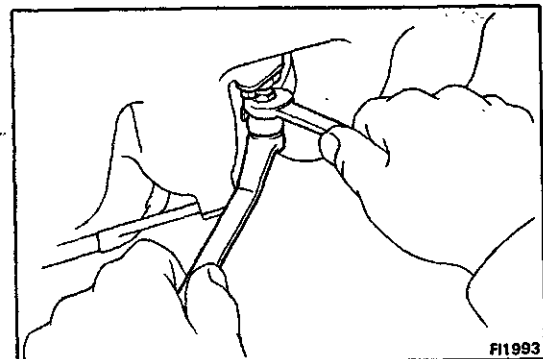
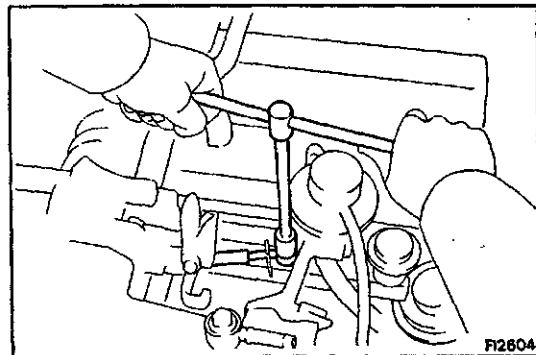
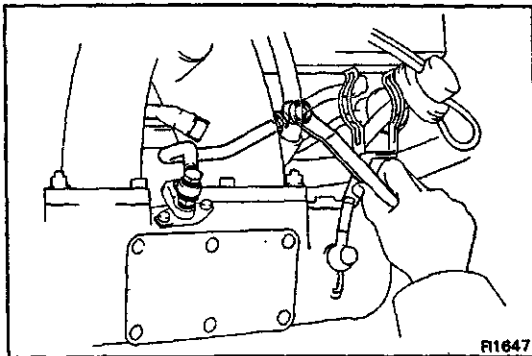
If pressure is not as specified, check the vacuum sensing hose and pressure regulator.

- (p) Stop the engine. Check that the fuel pressure remains above 1.5 kg/cm<sup>2</sup> (21 psi, 147 kPa) for 5 minutes after the engine is turned off.

If pressure is not as specified, check the fuel pump, pressure regulator and/or injectors.

- (q) After checking fuel pressure, disconnect the battery negative (–) cable and carefully remove the SST to prevent gasoline from splashing.

SST 09268-45012



- (r) Install cold start injector tube.

(7M-GE)

- Reconnect the cold start injector tube with new gaskets and union bolt to the delivery pipe.

**Torque: 300 kg-cm (22 ft-lb, 29 N·m)**

- Connect the wiring connector to the cold start injector.

(7M-GTE)

- Remove the two bolts and cold start injector with gasket.
- Connect the cold start injector connector.
- Install the cold start injector tube with new four gaskets and two union bolts.

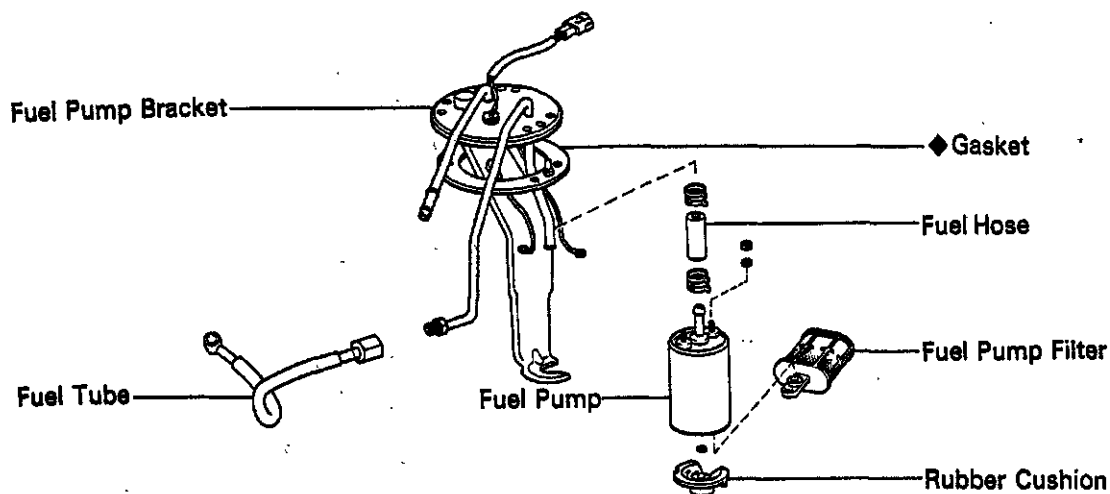
**Torque:**

|                                 |                                               |
|---------------------------------|-----------------------------------------------|
| <b>Delivery pipe side</b>       | <b>300 kg-cm</b><br><b>(22 ft-lb, 29 N·m)</b> |
| <b>Cold start injector side</b> | <b>180 kg-cm</b><br><b>(13 ft-lb, 18 N·m)</b> |

- (s) Check for fuel leakage.

## REMOVAL OF FUEL PUMP

MA



◆ Non-reusable part

FI1652

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY

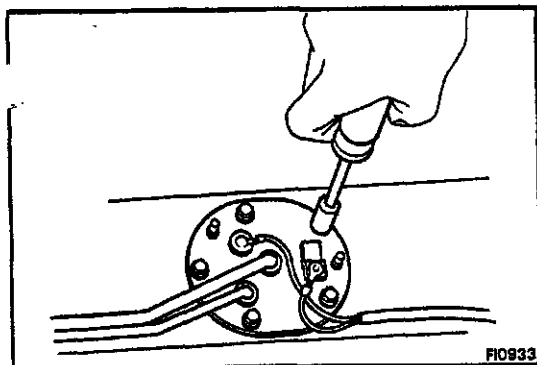
2. DRAIN GASOLINE FROM FUEL TANK

**WARNING:** Do not smoke or work near an open flame when working on the fuel pump.

3. REMOVE FUEL TANK

4. REMOVE FUEL PUMP BRACKET FROM FUEL TANK

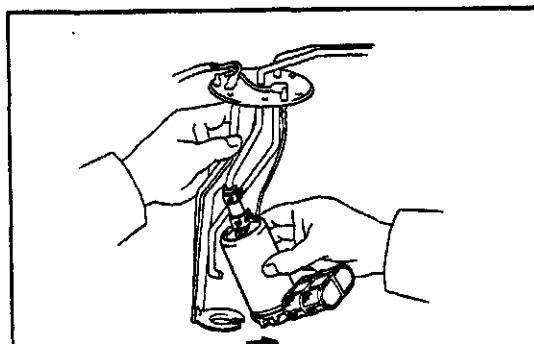
- (a) Remove the screws.
- (b) Pull out the fuel pump bracket.

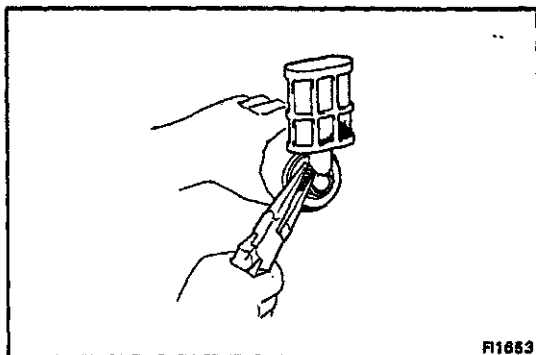


FI0933

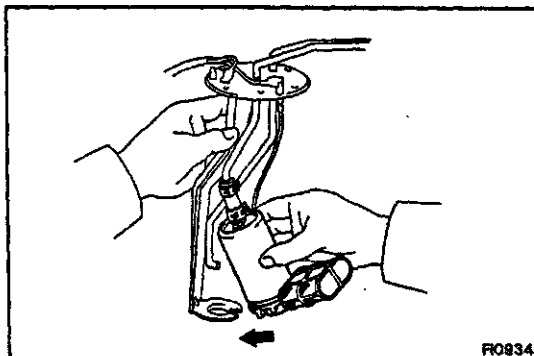
5. REMOVE FUEL PUMP FROM FUEL PUMP BRACKET

- (a) Remove the two nuts and disconnect the wires from the fuel pump.
- (b) Pull off the lower side of the fuel pump from the bracket.
- (c) Remove the fuel pump from the fuel hose.



**6. REMOVE FUEL PUMP FILTER FROM FUEL PUMP**

- (a) Remove the rubber cushion.
- (b) Using a small screwdriver, remove the clip.
- (c) Pull out the pump filter.

**INSTALLATION OF FUEL PUMP**

(See page FI-78)

**1. INSTALL FUEL PUMP FILTER TO FUEL PUMP**

- (a) Install the pump filter with the clip.
- (b) Install the rubber cushion.

**2. INSTALL FUEL PUMP TO FUEL PUMP BRACKET**

- (a) Insert the outlet port of the fuel pump into the fuel hose.
- (b) Push the lower side of the fuel pump and install the fuel pump.

**3. INSTALL FUEL PUMP BRACKET**

Install a new gasket and the pump bracket with the screws.

Torque: 35 kg-cm (30 in.-lb, 3.4 N·m)

**4. INSTALL FUEL TANK**

- (a) Apply a thin coat of oil to the flare and tighten the flare nut.
- (b) Then using SST, tighten the nut to the specified torque.

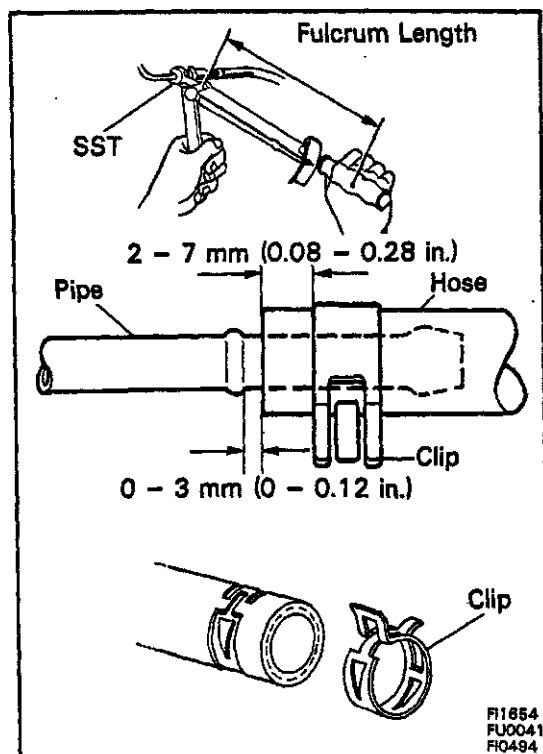
SST 09631-22020

Torque: 310 kg-cm (22 ft-lb, 30 N·m)

NOTE: Use a torque wrench with a fulcrum length 30 cm (11.81 in.).

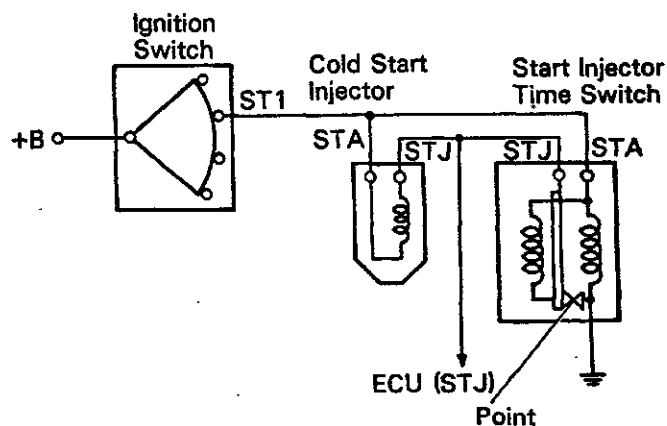
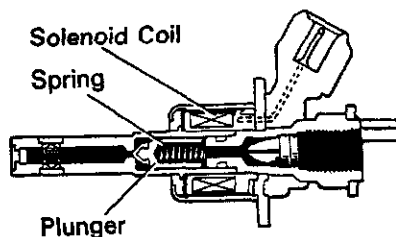
**CAUTION:**

- Tighten the fuel tank mounting bolts, etc. to the specified torque.
- Tighten the pipe union and flare nut (hose) to the specified torque.
- Push in the pipe and insert-type hose to the specified position, and install the clip to the specified location.
- If reusing the hose, reinstall the clip at the original location.

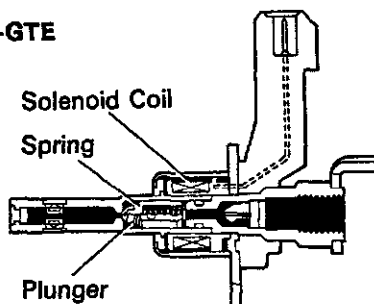
**5. REFILL GASOLINE****6. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**

## Cold Start Injector

### 7M-GE



### 7M-GTE



FI2981  
FI2980 FI2482

## ON-VEHICLE INSPECTION (7M-GE Only)

### INSPECT RESISTANCE OF COLD START INJECTOR

- Disconnect the cold start injector connector.
- Using an ohmmeter, measure the resistance of the injector.

**Resistance: 2 – 4  $\Omega$**

If the resistance is not as specified, replace the cold start injector.

- Connect the cold start injector connector.

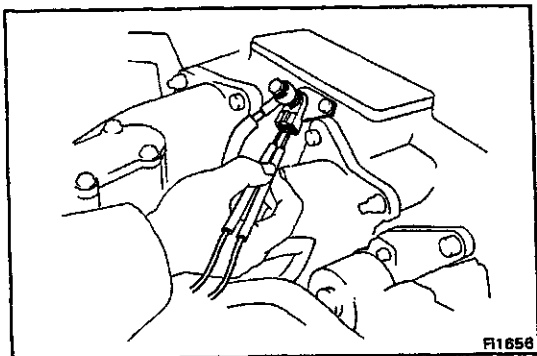
## REMOVAL OF COLD START INJECTOR

- DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**
- (7M-GE)  
DISCONNECT COLD START INJECTOR CONNECTOR**
- REMOVE COLD START INJECTOR TUBE (7M-GE)**

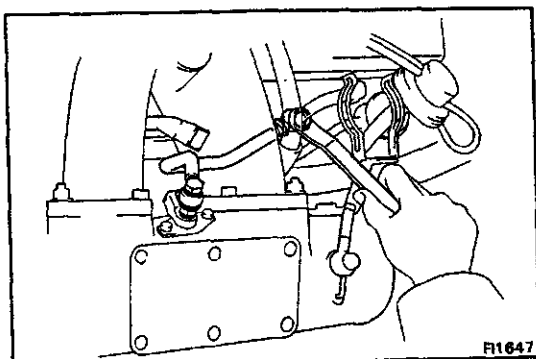
- Place a suitable container or shop towel under the cold start injector tube.
- Slowly loosen the two union bolts of the cold start injector tube and remove the bolts, four gaskets and injector tube.

### (7M-GTE)

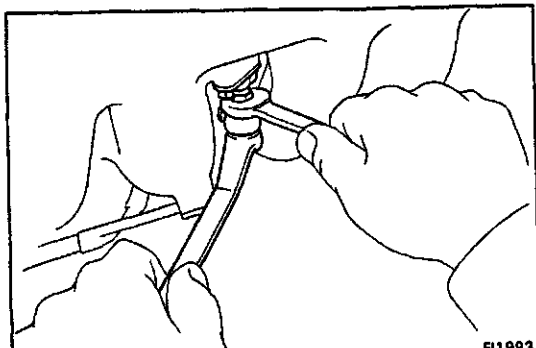
- Place a suitable container or shop towel under the cold start injector.
- Slowly loosen the union bolt of the cold start injector tube and remove the bolt and two gaskets from the cold start injector.



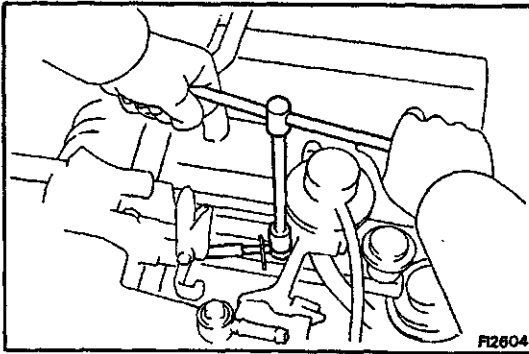
FI1658



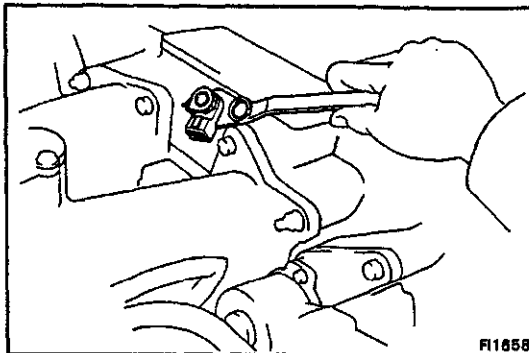
FI1647



FI1993

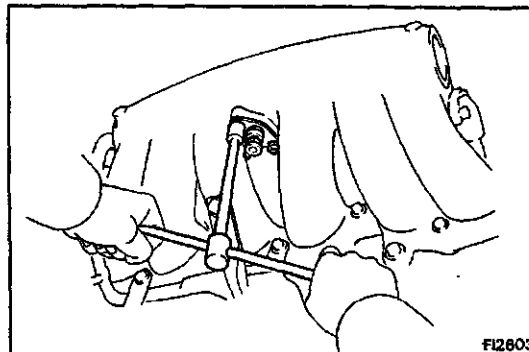


- (c) Remove the union bolt, fuel tube and two gaskets.



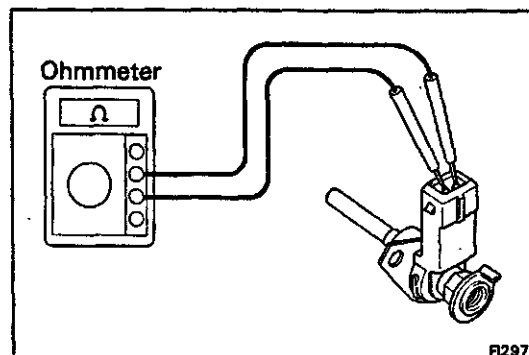
#### 4. REMOVE COLD START INJECTOR (7M-GE)

Remove the two bolts and cold start injector with the gasket.



#### (7M-GTE)

Remove the two bolts and cold start injector with the gasket, and disconnect the cold start injector connector.



### INSPECTION OF COLD START INJECTOR

#### 1. (7M-GTE) INSPECT RESISTANCE OF COLD START INJECTOR

Using an ohmmeter, check the resistance of the injector.

**Resistance: 2 – 4 Ω**

If the resistance is not as specified, replace the cold start injector.

#### 2. INSPECT INJECTION OF COLD START INJECTOR

**WARNING: Keep clear of sparks during the test.**

- (a) Install SST (two unions) to the injector and delivery pipe with new gaskets and the union bolts.

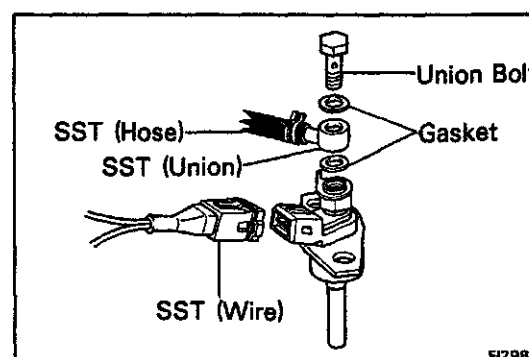
SST 09268-41045

- (b) Connect the SST (hose) to the unions.

SST 09268-41045

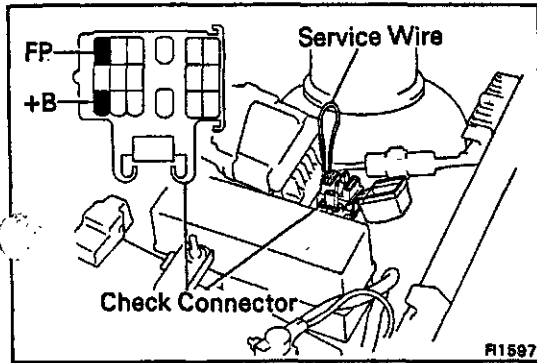
- (c) Connect the SST (wire) to the injector.

SST 09842-30050



- (d) Put a container under the injector.
- (e) Reconnect the battery negative (-) terminal.
- (f) Turn the ignition switch ON.

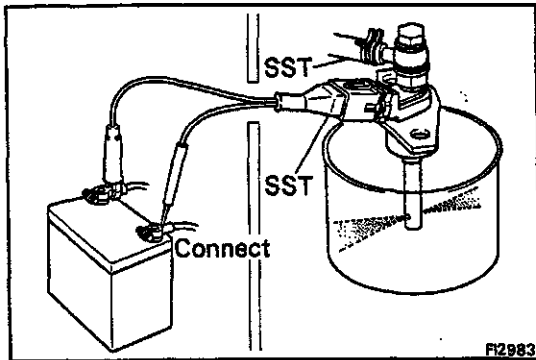
NOTE: Do not start the engine.



- (g) Using a service wire, short terminals +B and FP of the check connector.

CHECK CONNECTOR LOCATION:

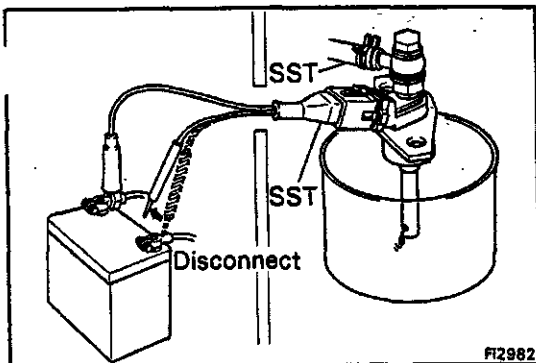
See pages FI-110, 111



- (h) Connect the test probes of the SST (wire) to the battery, and check that the fuel spray is as shown.

SST 09842-30050

**CAUTION:** Perform this check within the shortest possible time.



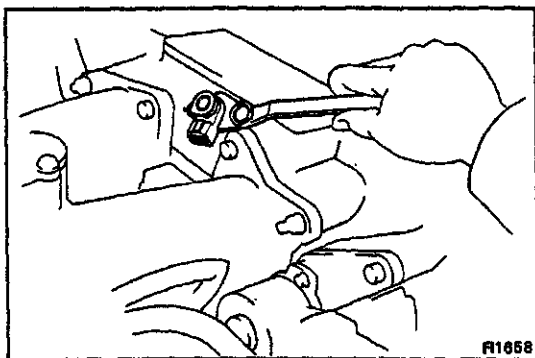
## 2. INSPECT LEAKAGE

- (a) In the condition above, disconnect the test probes of SST (wire) from the battery and check fuel leakage from the injector.

SST 09842-30050

**Fuel drop: One drop or less per minute**

- (b) Disconnect the battery negative (-) cable.
  - (c) Remove SST and the service wire.
- SST 09268-41045 and 09842-30050

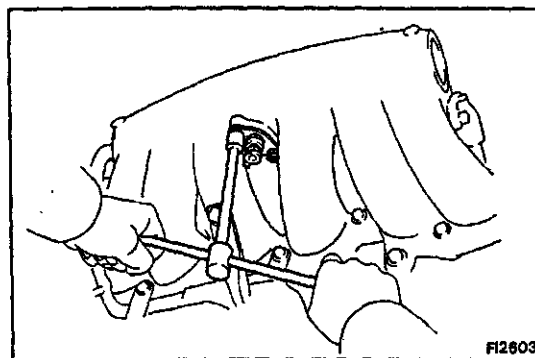


## INSTALLATION OF COLD START INJECTOR

### 1. INSTALL COLD START INJECTOR (7M-GE)

Install a new gasket and the cold start injector with the two bolts.

**Torque: 55 kg-cm (48 in.-lb, 5.4 N·m)**



(7M-GTE)

(a) Connect the connector to the cold start injector.

(b) Install a new gasket and the cold start injector with the two bolts.

**Torque: 55 kg-cm (48 in.-lb, 5.4 N·m)**

### 2. INSTALL COLD START INJECTOR TUBE

Using new gaskets, connect the cold start injector tube to the delivery pipe and cold start injector. Install the union bolts.

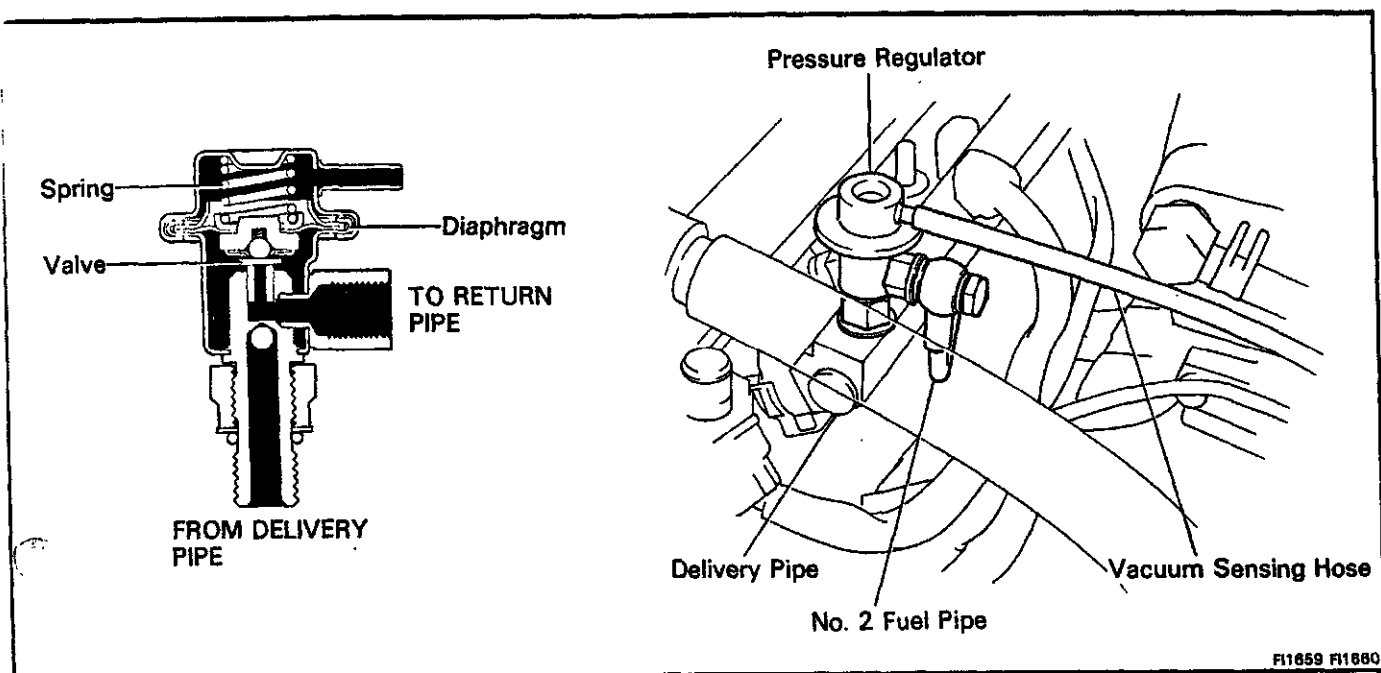
**Torque:**

**Delivery pipe side      300 kg-cm  
(22 ft-lb, 29 N·m)**

**Cold start injector side   180 kg-cm  
(13 ft-lb, 18 N·m)**

3. (7M-GE)  
CONNECT COLD START INJECTOR CONNECTOR
4. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY
5. CHECK FOR FUEL LEAKAGE

## Pressure Regulator



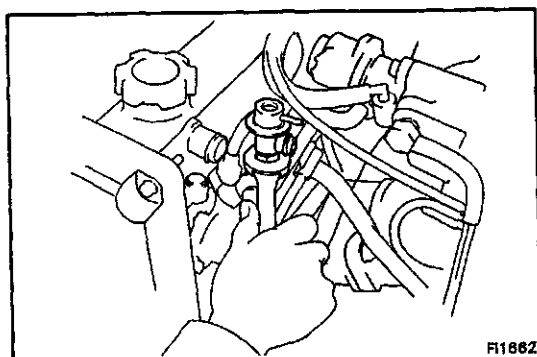
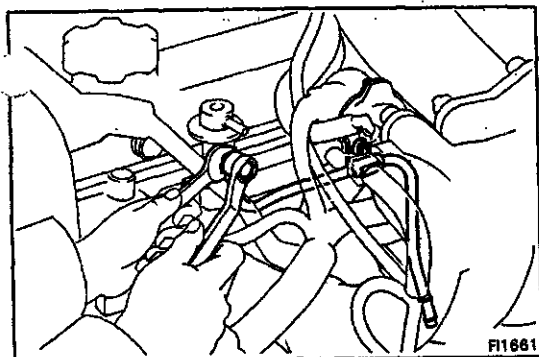
### ON-VEHICLE INSPECTION

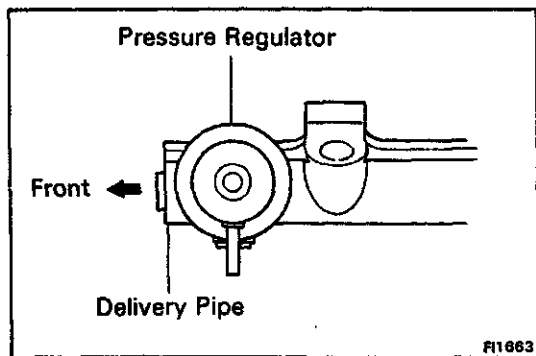
INSPECT FUEL PRESSURE (See page F1-74)

### REMOVAL OF PRESSURE REGULATOR

1. DISCONNECT PCV HOSE
2. DISCONNECT VACUUM SENSING HOSE
3. DISCONNECT NO.2 FUEL PIPE
  - (a) Place a suitable container or shop towel under the pressure regulator.
  - (b) Remove the union bolt and two gaskets.
  - (c) Remove the clamp bolt of the No.2 fuel pipe.
4. REMOVE PRESSURE REGULATOR
 

Loosen the lock nut, and remove the pressure regulator.





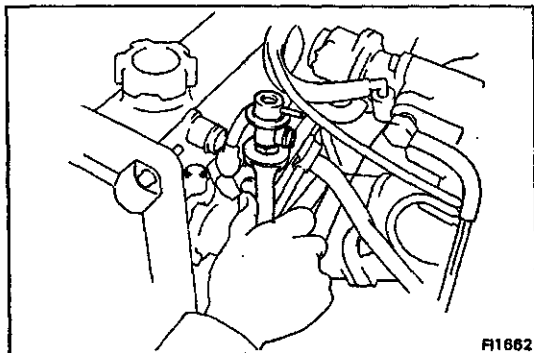
## INSTALLATION OF PRESSURE REGULATOR

### 1. INSTALL PRESSURE REGULATOR

- Fully loosen the lock nut of the pressure regulator.
- Thrust the pressure regulator completely into the delivery pipe by hand.
- Turn the pressure regulator counterclockwise until the outlet faces in the direction indicated in the figure.

- Torque the lock nut.

**Torque: 250 kg-cm (18 ft-lb, 25 N·m)**

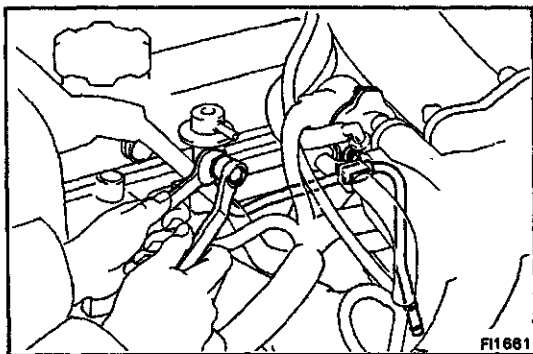


### 2. CONNECT NO. 2 FUEL PIPE

- Using new gaskets, connect the No. 2 fuel pipe to the pressure regulator. Install the union bolt.

**Torque: 250 kg-cm (18 ft-lb, 25 N·m)**

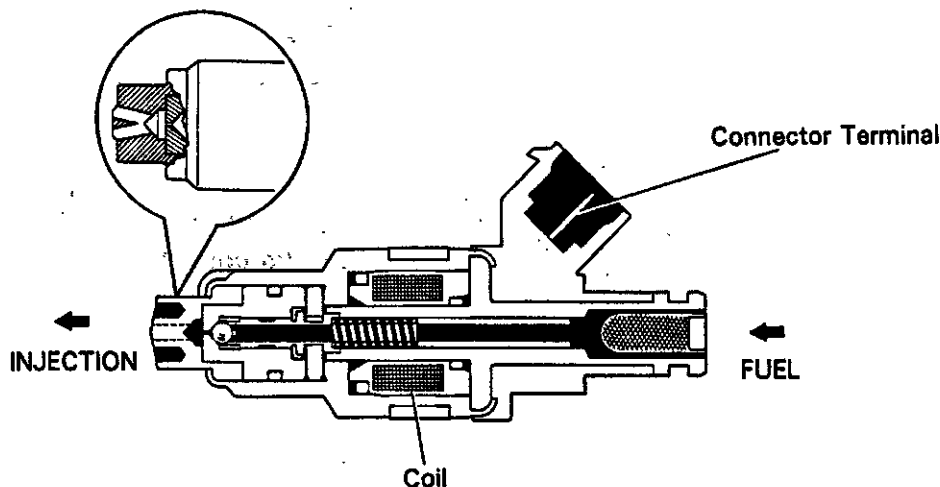
- Install the clamp bolt.



### 3. CONNECT VACUUM SENSING HOSE

### 4. CONNECT PCV HOSE

# Injectors



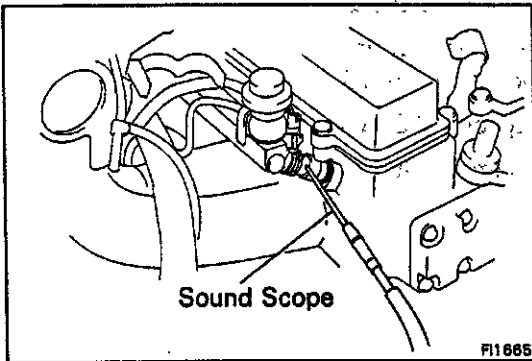
FI2581

## ON-VEHICLE INSPECTION

### 1. CHECK INJECTOR OPERATION

Check operation sound from each injector.

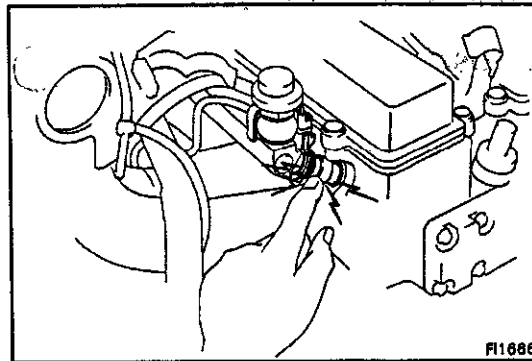
- (a) With the engine running or cranking, use a sound scope to check that there is normal operating noise in proportion to engine rpm.



FI1685

- (b) If you have no sound scope, you can check the injector transmission operation with your finger.

If no sound or an unusual sound is heard, check the wiring connector, injector, resistor or injection signal from the ECU.



FI1688

### 2. INSPECT RESISTANCE OF INJECTOR

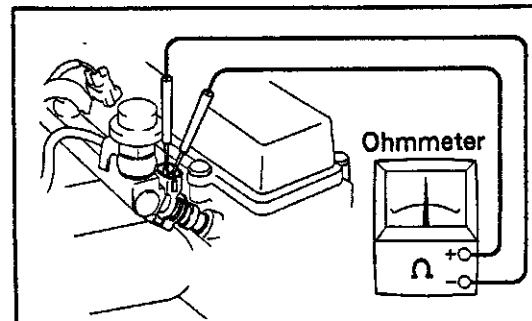
- (a) Disconnect the injector connector.
- (b) Using an ohmmeter, measure the resistance of both terminals.

Resistance:

7M-GE 1.8 – 3.4  $\Omega$

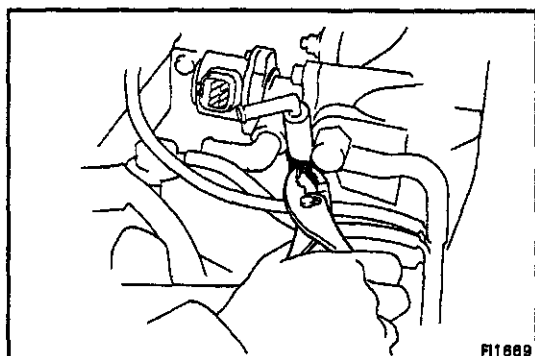
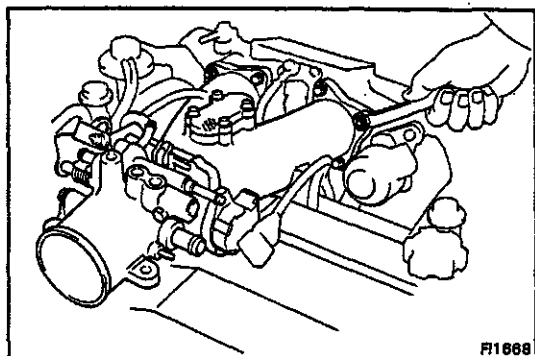
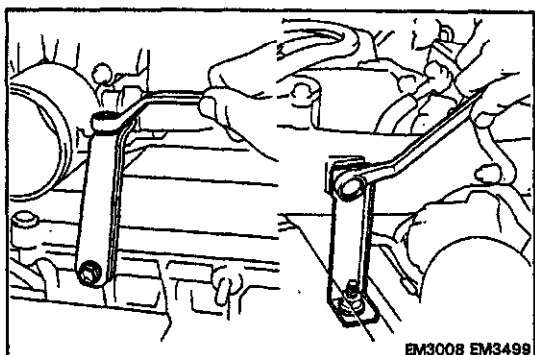
7M-GTE 2.0 – 3.8  $\Omega$

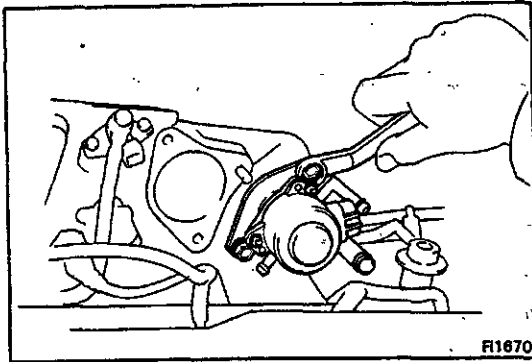
If the resistance is not as specified, replace the injector.



**REMOVAL OF INJECTOR**

1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**
2. **DRAIN COOLANT**
3. **DISCONNECT FOLLOWING HOSES:**
  - Water hoses from throttle body (7M-GE) or water by-pass pipe (7M-GTE)
  - Vacuum hoses from throttle body
  - ISC valve hoses from throttle body
  - Vacuum sensing hose from pressure regulator
4. **DISCONNECT FOLLOWING CONNECTORS:**
  - Throttle position sensor connector
  - ISC valve connector
  - (7M-GE)  
Cold start injector connector
5. **REMOVE AIR INTAKE CONNECTOR (7M-GE)**
  - (a) Disconnect the air cleaner hose from the throttle body.
  - (b) Remove the throttle body and air intake connector brackets.
  - (c) Remove the four bolts and two nuts, intake connector and gasket.  
(7M-GTE)  
(See steps 1 to 3 on page EM-12)
6. **(7M-GTE)  
REMOVE THROTTLE BODY (See page FI-104)**
7. **REMOVE ISC VALVE**
  - (a) Disconnect the No. 2 water by-pass hose from the ISC valve.

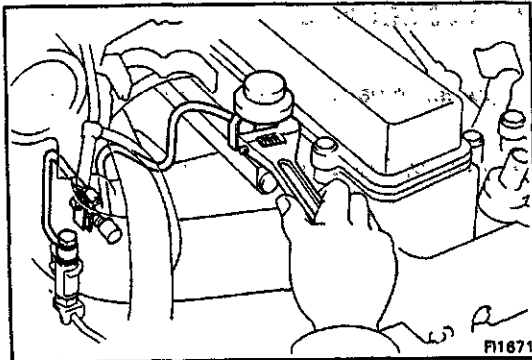




- (b) Remove the two bolts, ISC valve and gasket.

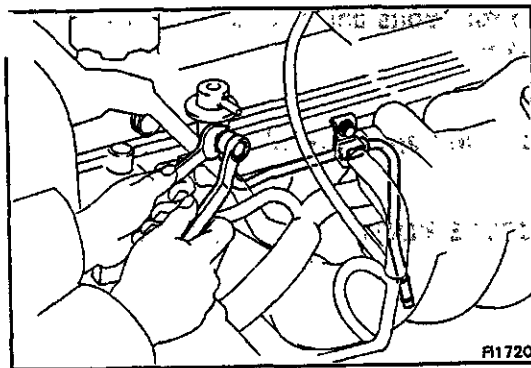
## 8. DISCONNECT INJECTOR CONNECTORS

## 9. DISCONNECT COLD START INJECTOR TUBE FROM DELIVERY PIPE (See page FI-80)



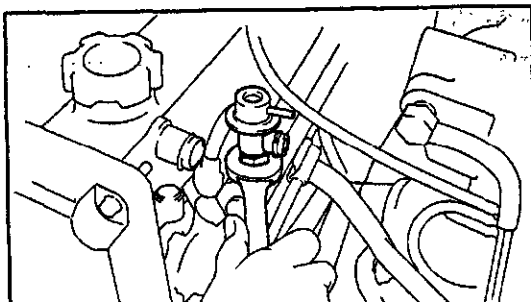
## 10. REMOVE NO.1 FUEL PIPE

- Remove the pulsation damper and two gaskets.
- Remove the union bolts and two gaskets from the fuel pipe support (MA) or fuel filter (MS).
- Remove the clamp bolt, No.1 fuel pipe and VSV (w/ EGR).



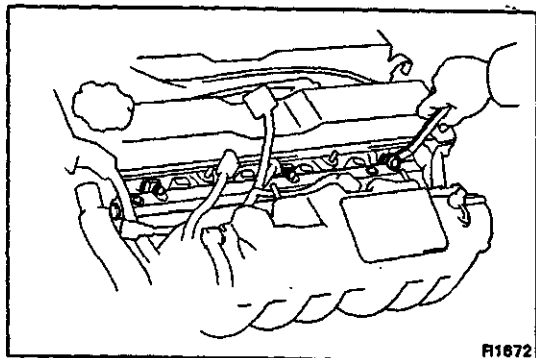
## 11. REMOVE NO.2 FUEL PIPE

- Remove the union bolt and two gaskets from the pressure regulator.
- Disconnect the fuel hose from the No.2 fuel pipe.
- Remove the clamp bolt and No.2 fuel pipe.



## 12. REMOVE PRESSURE REGULATOR

- Loosen the lock nut.
- Remove the pressure regulator and two gaskets.

**13. REMOVE DELIVERY PIPE**

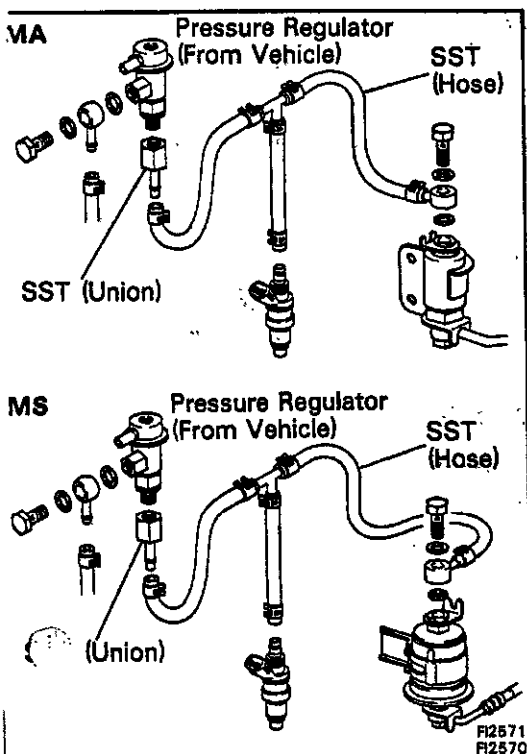
- (a) Remove the three bolts, and then remove the delivery pipe with injectors.

**CAUTION:** Be careful not to drop the injectors, when removing the delivery pipe.

- (b) Remove the six insulators and three spacers from the cylinder head.

**14. REMOVE INJECTORS**

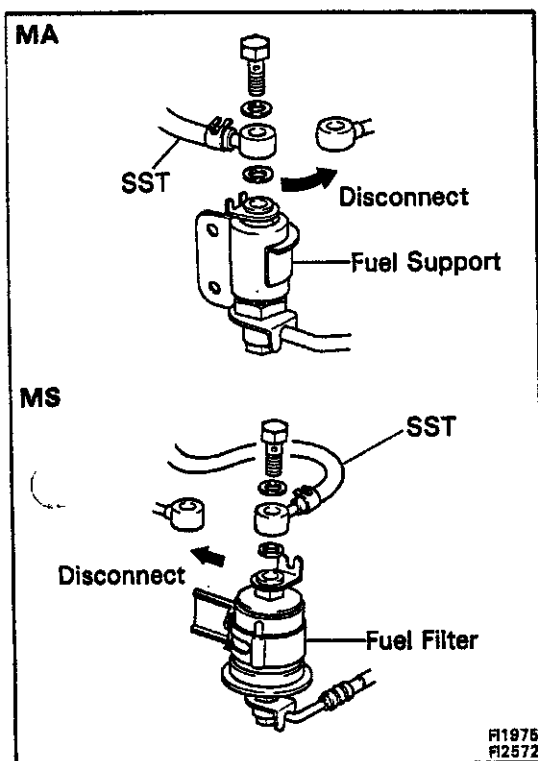
- (a) Pull out the injectors from the delivery pipe.
- (b) Remove the O-ring from the injector.



## INSPECTION OF INJECTOR

### 1. TEST INJECTION OF INJECTORS

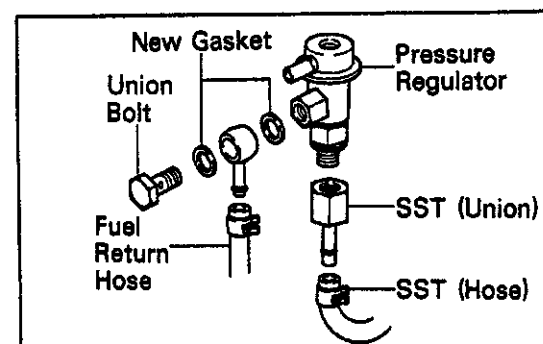
**WARNING:** Keep clear of sparks during the test.



- Disconnect the No. 1 fuel pipe from the fuel return pipe support (MA) or fuel filter (MS).
- Connect SST (hose) to the fuel pipe support (MA) or fuel filter (MS) outlet with SST (union), new gaskets and union bolt.

SST 09268-41045

**NOTE:** Use the vehicle's fuel support (MA) or fuel filter (MS).



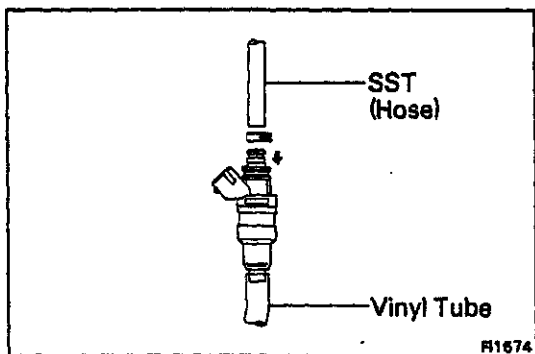
- Remove the pressure regulator (See page FI-84).

- Connect the fuel return hose to the pressure regulator with SST (union), new gasket and union bolt.

SST 09268-41045

- Connect SST (hose) to the pressure regulator with SST (union).

SST 09268-41045



(f) Connect the SST (hose) to the injector.

SST 09268-41045

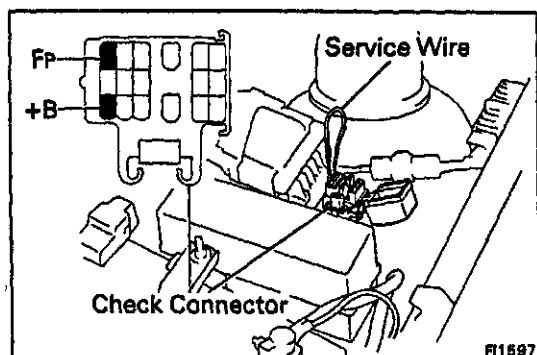
(g) Put the injector into the graduated cylinder.

NOTE: Install a suitable vinyl tube onto the injector to prevent gasoline from splashing out.

(h) Connect the battery cable.

(i) Turn the ignition switch ON.

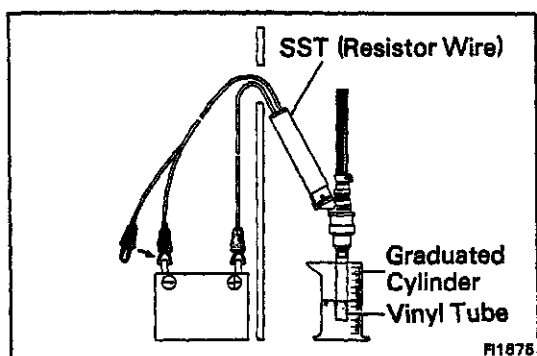
NOTE: Do not start the engine.



(j) Using a service wire, short circuit the fuel pump check terminals +B and Fp of the service connector.

CHECK CONNECTOR LOCATION:

See pages FI-110, 111



(k) Connect SST (resistor wire) to the injector and battery for 15 seconds and measure the injection volume with a graduated cylinder. Test each injector two or three times.

SST 09842-30060

Volume:

7M-GE

65 – 80 cc (4.0 – 4.9 cu in.) per 15 sec.

7M-GTE

101 – 114 cc (6.2 – 7.0 cu in.) per 15 sec.

Difference between each injector:

9 cc (0.5 cu in.) or less

If the injection volume is not as specified, replace the injector.

## 2. INSPECT LEAKAGE

(a) In the condition above, disconnect the test probes of SST (wire) from the battery and check for fuel leakage from the injector nozzle.

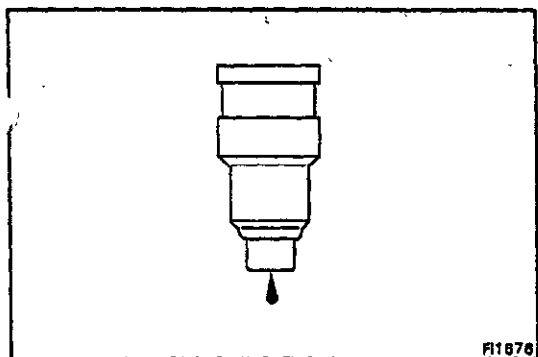
SST 09842-30060

Fuel drop: One drop or less per minute

(b) Disconnect the battery negative (–) cable.

(c) Remove the SST and service wire.

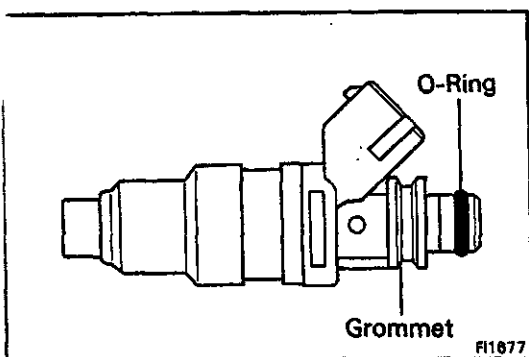
SST 09268-41045



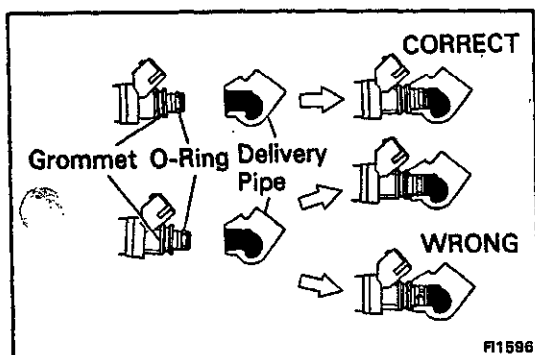
## INSTALLATION OF INJECTORS

### 1. INSTALL INJECTORS INTO DELIVERY PIPE

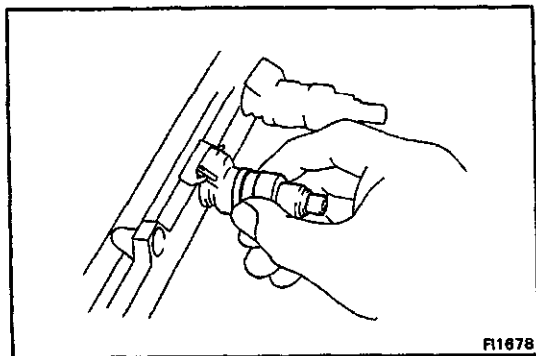
- (a) Install a new grommet to the injector.



- (b) Apply a light coat of gasoline to a O-ring and install it to the injector.

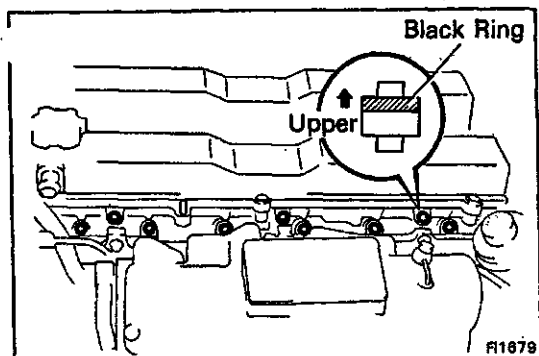


- (c) While turning the injector left and right, install it to the delivery pipe. Install the six injectors.



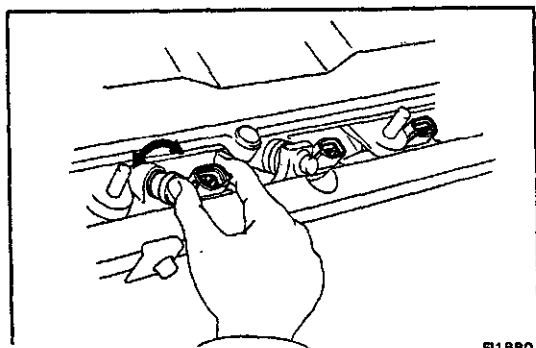
### 2. INSTALL DELIVERY PIPE WITH INJECTORS

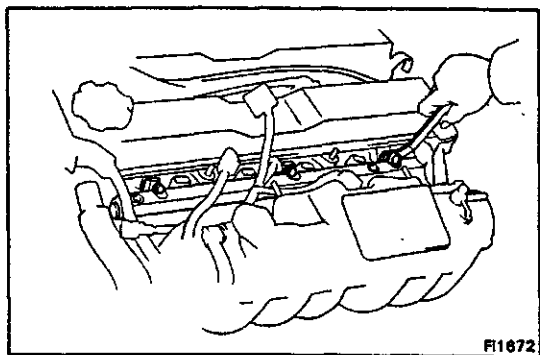
- (a) Install the six insulators into the injector hole of the cylinder head.
- (b) Install the black rings on the upper portion of each of the three spacers. Then install the spacers on the delivery pipe mounting hole of the cylinder head.



- (c) Place the injectors together with the delivery pipe on the cylinder head.
- (d) Check that the injectors rotate smoothly.

**NOTE:** If the injectors do not rotate smoothly, the probable cause is incorrect installation of O-rings. Replace O-rings.

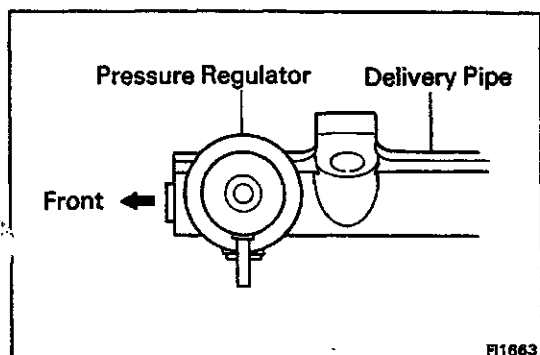




(e) Install the three spacers and bolts.

Torque the bolts.

**Torque: 180 kg-cm (13 ft-lb, 18 N·m)**



### 3. INSTALL PRESSURE REGULATOR

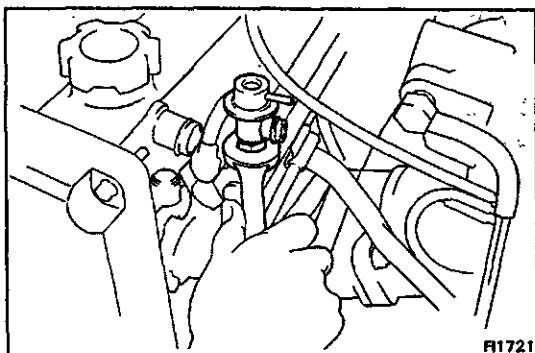
(a) Fully loosen the lock nut of the pressure regulator.

(b) Thrust the pressure regulator completely into the delivery pipe by hand.

(c) Turn the pressure regulator counterclockwise until the outlet faces in the direction indicated in the figure.

(d) Torque the lock nut.

**Torque: 250 kg-cm (18 ft-lb, 25 N·m)**



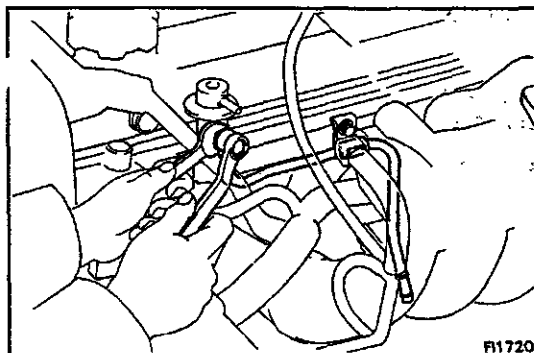
### 4. INSTALL NO. 2 FUEL PIPE

(a) Install the No. 2 fuel pipe and clamp bolt.

(b) Connect the fuel hose.

(c) Install the union bolt and new two gaskets to the pressure regulator. Torque the union bolt.

**Torque: 250 kg-cm (18 ft-lb, 25 N·m)**



### 5. INSTALL NO. 1 FUEL PIPE

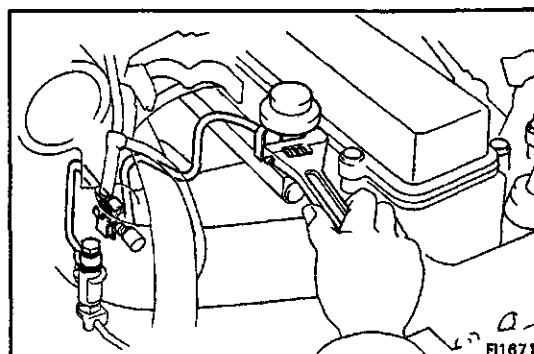
(a) Install the No. 1 fuel pipe, VSV (w/ EGR) and clamp bolt.

(b) Install the union bolt and two new gaskets to the fuel pipe support. Torque the union bolts.

**Torque: 300 kg-cm (22 ft-lb, 29 N·m)**

(c) Install the pulsation damper and two new gaskets. Torque the pulsation damper.

**Torque: 400 kg-cm (29 ft-lb, 39 N·m)**



**6. CONNECT INJECTOR CONNECTORS****7. CONNECT COLD START INJECTOR TUBE TO DELIVERY PIPE**  
(See page FI-83)**8. INSTALL ISC VALVE**

(a) Install a new gasket and ISC valve with the two bolts.

**Torque: 130 kg-cm (9 ft-lb, 13 N·m)**

(b) Connect No. 2 water by-pass hose to the ISC valve.

**9. (7M-GTE)  
INSTALL THROTTLE BODY**  
(See step 1 on page FI-106)**10. INSTALL AIR INTAKE CONNECTOR  
(7M-GE)**

(a) Install a new gasket and air intake connector with the four bolts and two nuts.

**Torque: 180 kg-cm (13 ft-lb, 18 N·m)**

(b) Install the air intake connector and throttle body brackets.

(c) Connect the air cleaner hose to the throttle body.

**(7M-GTE)  
(See page EM-14)**

7M-GTE only  
Check Valve  
Seal Washer

FI2006

FI1869

FI1868

**11. CONNECT FOLLOWING CONNECTORS:**

- Throttle position sensor connector
- ISC valve connector
- (7M-GE)  
Cold start injector connector

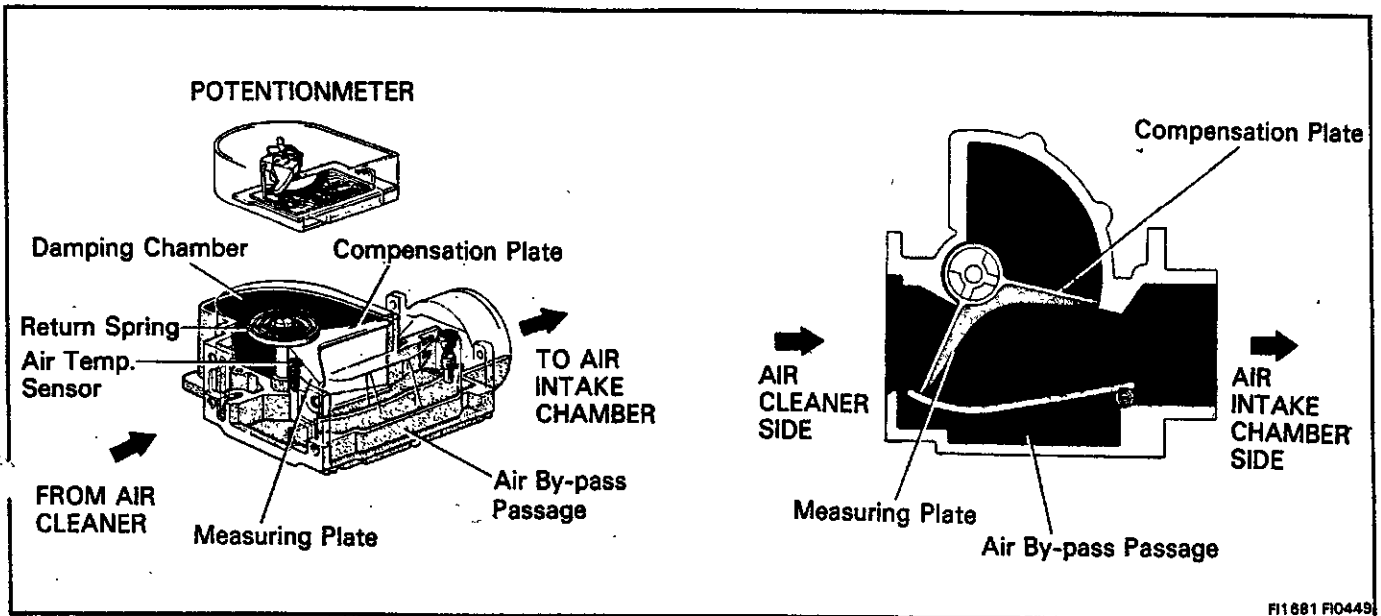
**12. CONNECT FOLLOWING HOSES:**

- Water hoses from throttle body (7M-GE) or water by-pass pipe (7M-GTE)
- Vacuum hoses from throttle body
- ISC valve hoses from throttle body
- Vacuum sensing hose from pressure regulator

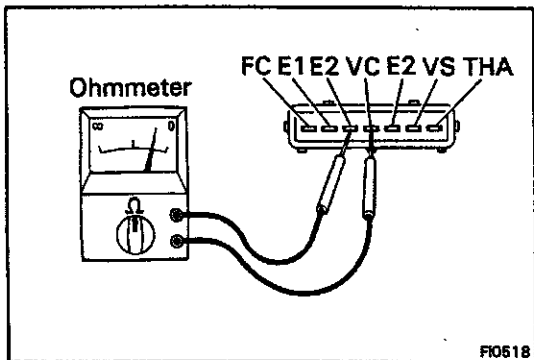
**13. REFILL COOLANT (See page CO-5)****14. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY****15. CHECK FOR FUEL LEAKAGE (See page FI-11)**

## AIR INDUCTION SYSTEM

### Air Flow Meter (7M-GE)



FI1681 FI0449



FI0518

## ON-VEHICLE INSPECTION

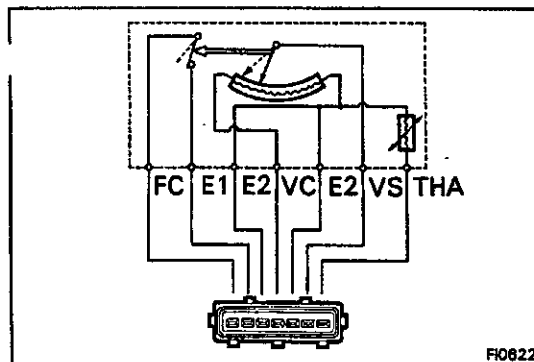
### INSPECT RESISTANCE OF AIR FLOW METER

- Disconnect the air flow meter connector.
- Using an ohmmeter, measure the resistance between each terminal.

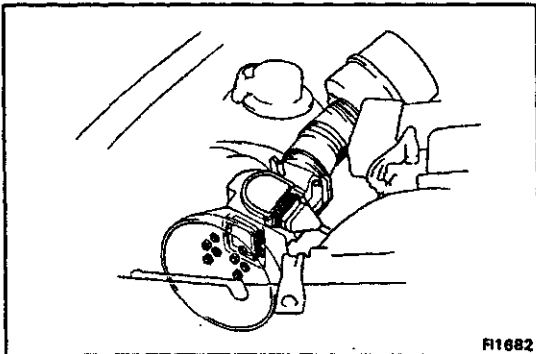
| Terminals | Resistance           | Temperature   |
|-----------|----------------------|---------------|
| VS - E2   | 20 - 600 $\Omega$    | -             |
| VC - E2   | 200 - 400 $\Omega$   | -             |
| THA - E2  | 10 - 20 K $\Omega$   | -20°C ( -4°F) |
|           | 4 - 7 K $\Omega$     | 0°C ( 32°F)   |
|           | 2 - 3 K $\Omega$     | 20°C ( 68°F)  |
|           | 0.9 - 1.3 K $\Omega$ | 40°C (104°F)  |
|           | 0.4 - 0.7 K $\Omega$ | 60°C (140°F)  |
| FC - E1   | Infinity             | -             |

If the resistance is not as specified, replace the air flow meter.

- Reconnect the air flow meter connector.



FI0622

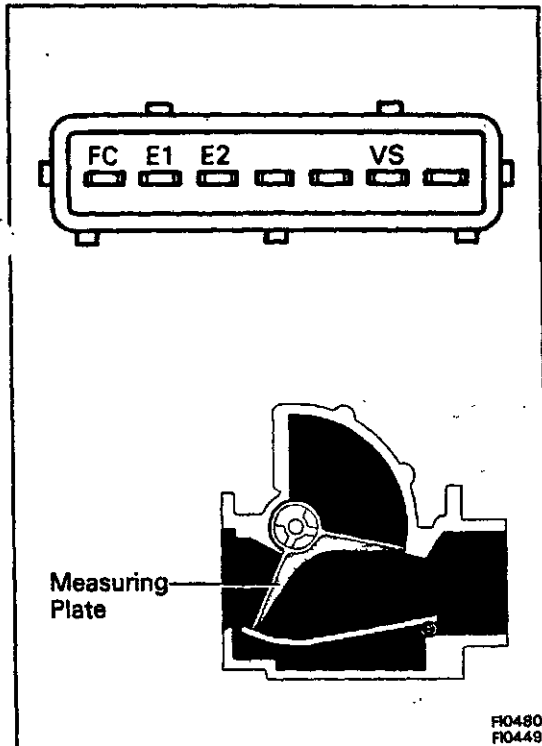


FI1882

## REMOVAL OF AIR FLOW METER

1. **DISCONNECT AIR FLOW METER CONNECTOR**
2. **DISCONNECT NO. 2 AIR CONNECTOR HOSE**
3. **REMOVE AIR CLEANER CAP**  
Remove the two bolts and cap.
4. **REMOVE AIR FLOW METER**

Pry off the lock plates, and remove the four nuts, and air flow meter.

FI0480  
FI0449

## INSPECTION OF AIR FLOW METER

### INSPECT RESISTANCE OF AIR FLOW METER

Using an ohmmeter, measure the resistance between each terminal by moving the measuring plate.

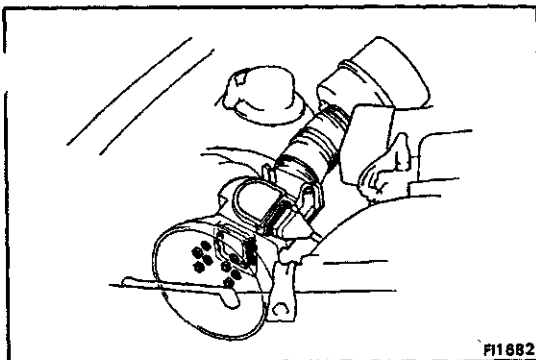
| Terminals | Resistance ( $\Omega$ ) | Measuring plate opening    |
|-----------|-------------------------|----------------------------|
| FC - E1   | Infinity                | Fully closed               |
|           | Zero                    | Other than closed position |
| VS - E2   | 20 - 600                | Fully closed               |
|           | 20 - 1,200              | Fully open                 |

NOTE: Resistance between terminals E2 and VS will change in a wave pattern as the measuring plate slowly opens.

If the resistance is not as specified, replace the air flow meter.

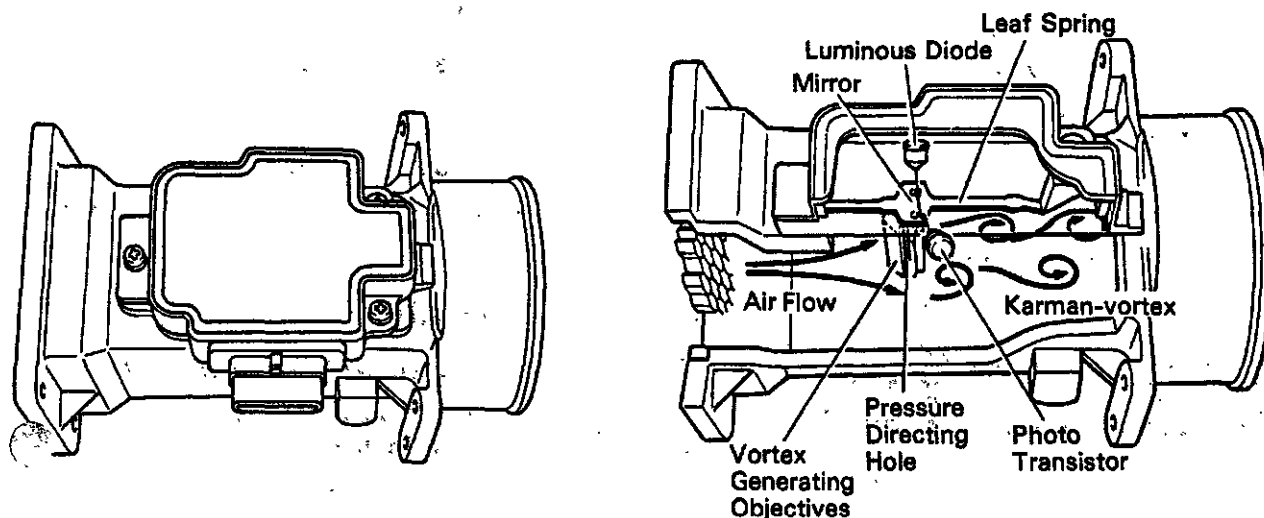
## INSTALLATION OF AIR FLOW METER

1. **INSTALL AIR FLOW METER**  
Install the air flow meter with the two lock plates and four nuts. Pry the lock plates on the nuts.
2. **INSTALL AIR CLEANER CAP**  
Install the cap with the two bolts.
3. **CONNECT NO. 2 AIR CONNECTOR HOSE**
4. **INSTALL AIR FLOW METER CONNECTOR**



FI1882

## Air Flow Meter (7M-GTE)



MS0001 R1877

### ON-VEHICLE INSPECTION

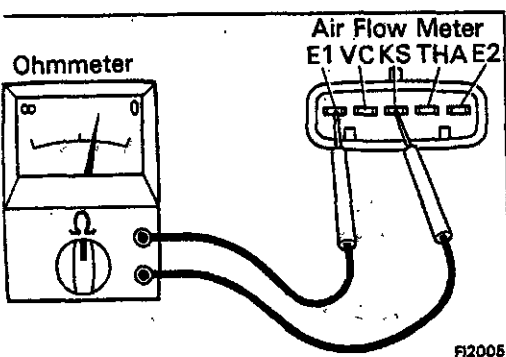
#### INSPECT RESISTANCE OF AIR FLOW METER

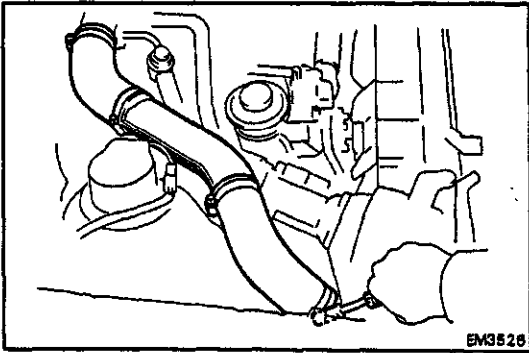
- Disconnect the air flow meter connector.
- Using an ohmmeter (analog type), measure the resistance between each terminal.

| Terminals | Resistance           | Temperature  |
|-----------|----------------------|--------------|
| KS → E1   | $\infty \Omega$      | —            |
| E1 → KS   | 5 – 10 k $\Omega$    |              |
| VS → E1   | 10 – 15 k $\Omega$   |              |
| E1 → VC   | 5 – 10 k $\Omega$    |              |
| THA – E2  | 10 – 20 k $\Omega$   | –20°C (–4°F) |
|           | 4 – 7 k $\Omega$     | 0°C (32°F)   |
|           | 2 – 3 k $\Omega$     | 20°C (68°F)  |
|           | 0.9 – 1.3 k $\Omega$ | 40°C (104°F) |
|           | 0.4 – 0.7 k $\Omega$ | 60°C (140°F) |

If the resistance is not as specified, replace the air flow meter.

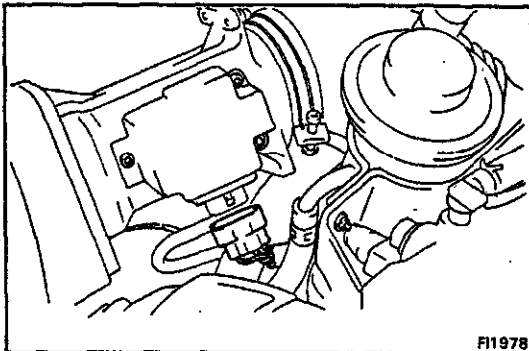
- Reconnect the air flow meter connector.





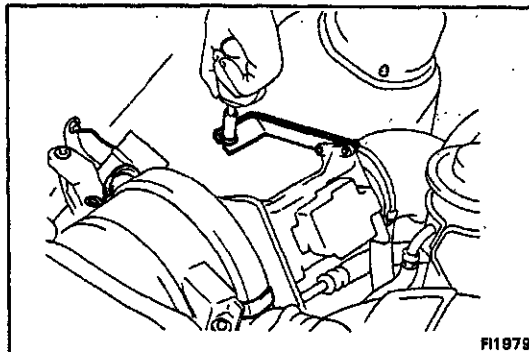
## REMOVAL OF AIR FLOW METER

1. REMOVE NO. 4 AIR CLEANER PIPE WITH NO. 1 AND NO. 2 AIR CLEANER HOSES

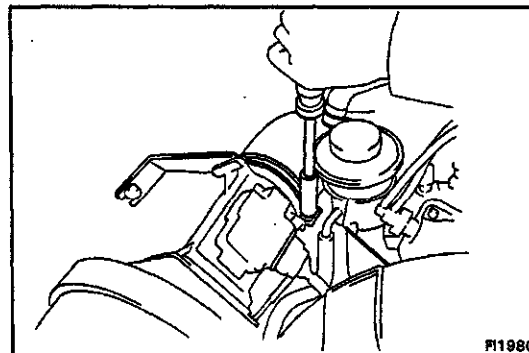


2. REMOVE AIR FLOW METER WITH AIR CLEANER CAP

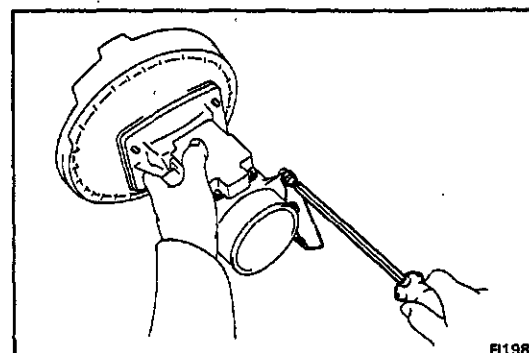
(a) Disconnect the connector.



(b) Remove the three clamps and bolt.

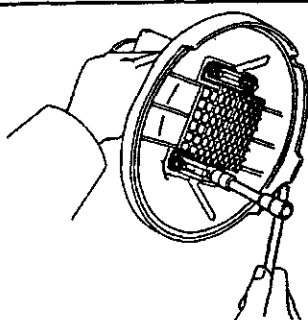


(c) Loosen the clamp and remove the air flow meter with air cleaner cap.



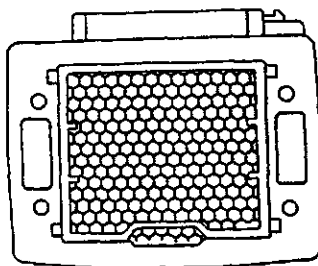
3. REMOVE AIR FLOW METER

(a) Remove the two screws and bracket.



FI1982

- (b) Pry off the lock plate.
- (c) Remove the four nuts, lock plates, No. 1 air cleaner cover and air cleaner cap.



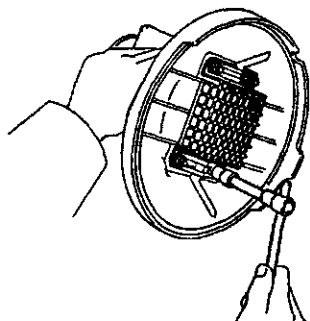
FI1983

## INSPECTION OF AIR FLOW METER

### INSPECT AIR FLOW METER

Check that the honey-combed mesh is neither deformed nor damaged.

If necessary, replace the air flow meter.



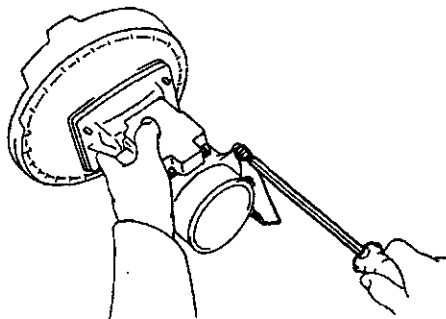
FI1982

## INSTALLATION OF AIR FLOW METER

### 1. INSTALL AIR FLOW METER

- (a) Install the air cleaner cap, No. 1 air cleaner cover and lock plates to the air flow meter with the four nuts.
- (b) Pry the lock plates on the nuts.

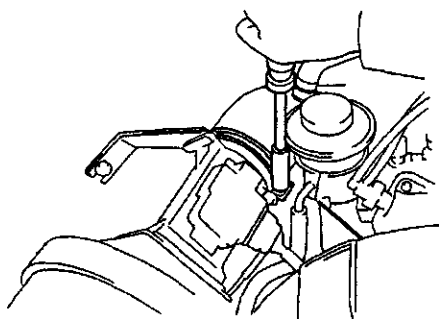
- (c) Install the bracket with the two screws.



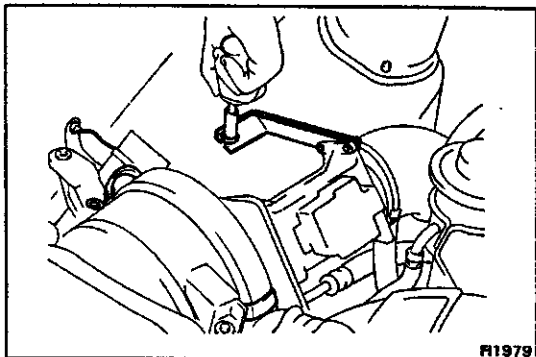
FI1981

### 2. INSTALL AIR FLOW METER WITH AIR CLEANER CAP

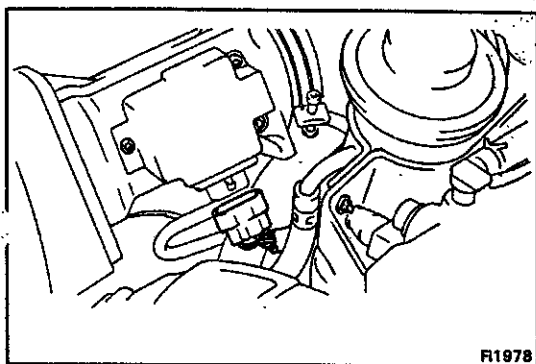
- (a) Install the air flow meter with air cleaner cap, and tighten the clamp.



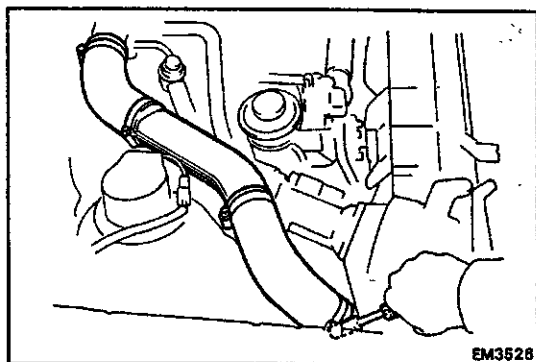
FI1980



(b) Install the bolt and clamps.

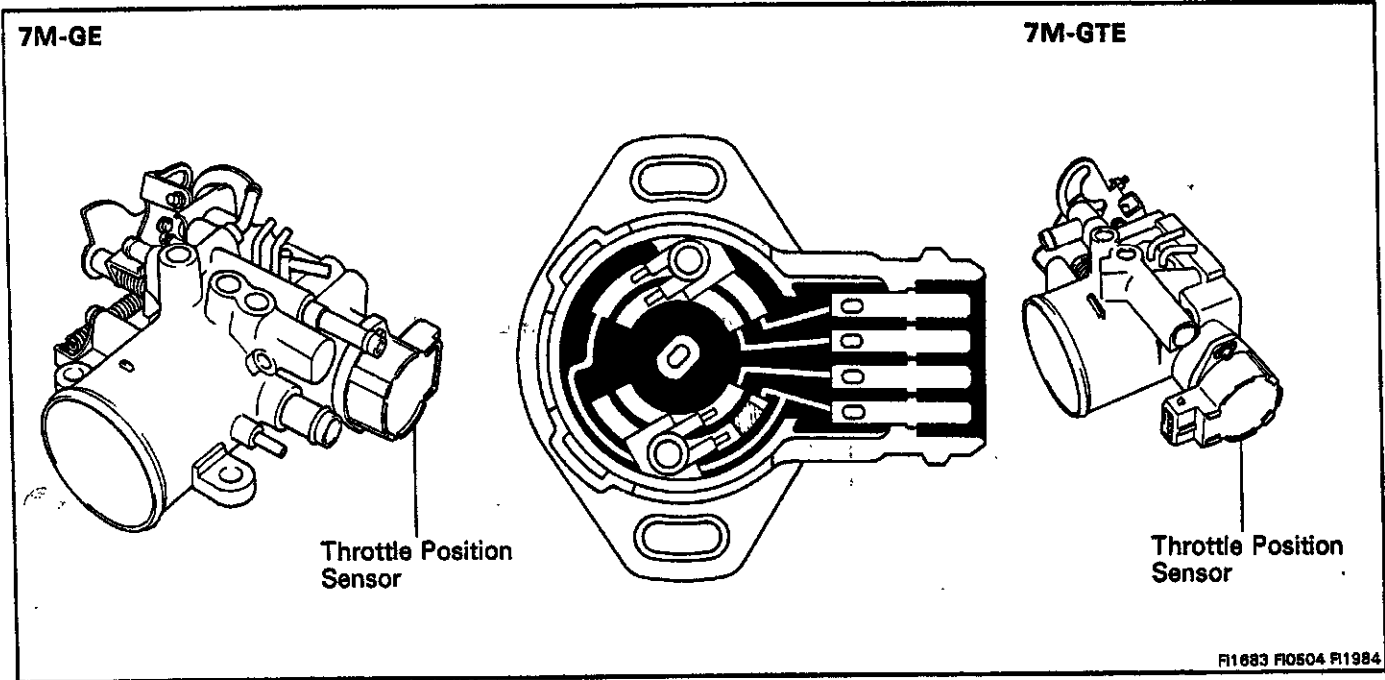


(c) Connect the connector.



**3. INSTALL NO. 4 AIR CLEANER PIPE WITH NO. 1 AND NO. 2 AIR CLEANER HOSES**

Throttle Body



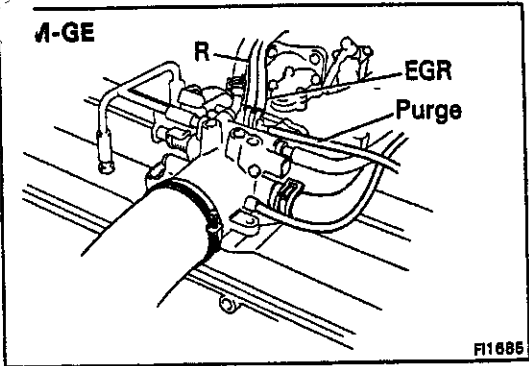
ON-VEHICLE INSPECTION

1. INSPECT THROTTLE BODY

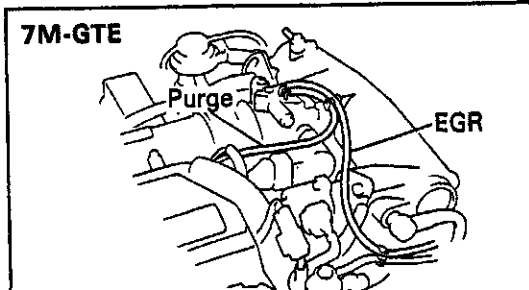
(a) Check that the throttle linkage moves smoothly.

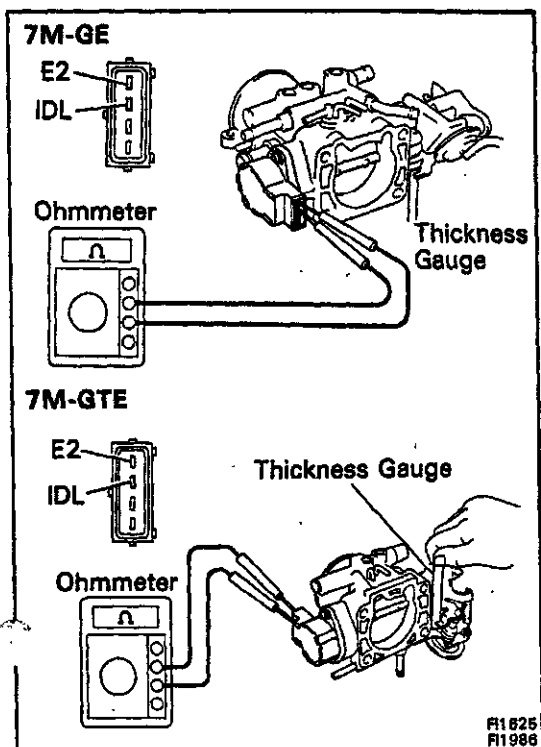
(b) Check the vacuum at each port.

- Start the engine.
- Check the vacuum with your finger.



| Port  | At Idling | Other than Idling |
|-------|-----------|-------------------|
| Purge | No vacuum | Vacuum            |
| EGR   | No vacuum | Vacuum            |
| R     | No vacuum | No vacuum         |

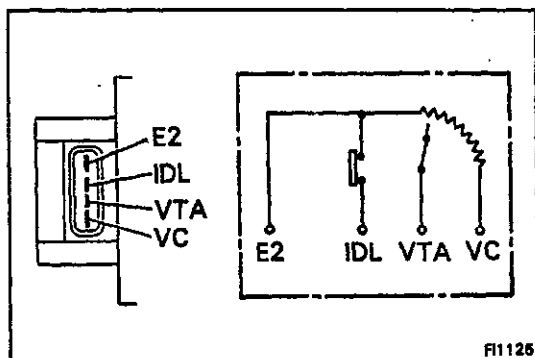


**2. INSPECT THROTTLE POSITION SENSOR**

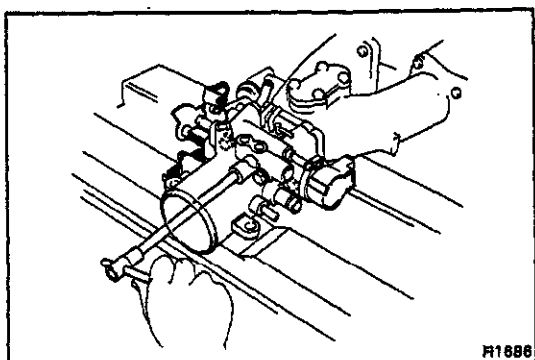
- Disconnect the connector from the sensor.
- Insert a thickness gauge between the throttle stop screw and stop lever.
- Using an ohmmeter, measure the resistance between each terminal.

| Clearance between lever and stop screw |                        | Between terminals | Resistance                  |
|----------------------------------------|------------------------|-------------------|-----------------------------|
| 7M-GE                                  | 7M-GTE                 |                   |                             |
| 0 mm (0 in.)                           |                        | VTA - E2          | 0.3 - 6.3 k $\Omega$        |
| 0.4 mm<br>(0.0157 in.)                 | 0.5 mm<br>(0.0197 in.) | IDL - E2          | Less than<br>2.3 k $\Omega$ |
| 0.75 mm<br>(0.0295 in.)                | 0.9 mm<br>(0.0354 in.) | IDL - E2          | $\infty$                    |
| Throttle valve fully opened position   |                        | VTA - E2          | 3.5 - 10.3 k $\Omega$       |
| -                                      |                        | VC - E2           | 4.25 - 8.25 k $\Omega$      |

- Reconnect the sensor connector.

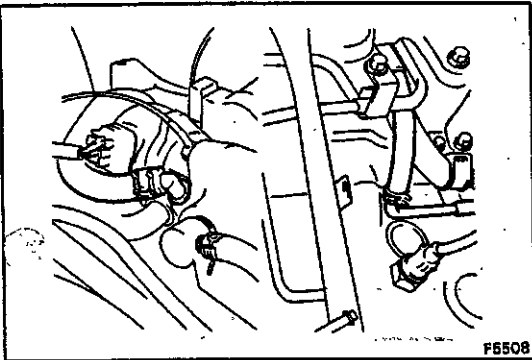
**REMOVAL OF THROTTLE BODY****(7M-GE)**

- DRAIN COOLANT FROM THROTTLE BODY**
- REMOVE ACCELERATOR CONNECTING ROD**
- DISCONNECT VACUUM HOSES**
- DISCONNECT NO. 2 AND NO. 3 WATER BY-PASS HOSES**
- DISCONNECT THROTTLE POSITION SENSOR CONNECTOR**
- DISCONNECT AIR CLEANER HOSE**
- REMOVE THROTTLE BODY BRACKET(S)**
- REMOVE THROTTLE BODY**  
Remove the four bolts and throttle body with the gasket.

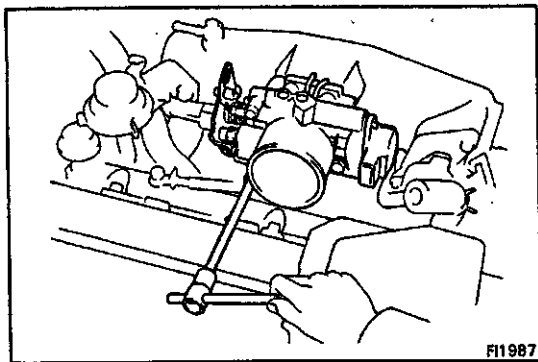


**(7M-GTE)**

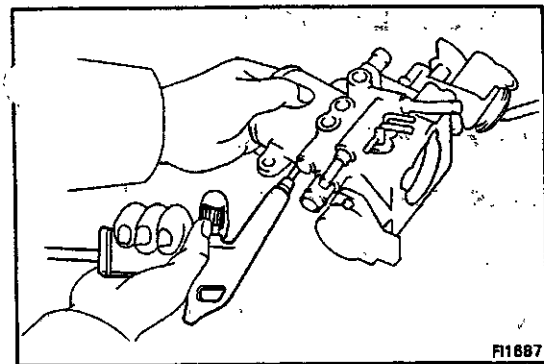
1. DRAIN COOLANT FROM THROTTLE BODY
2. DISCONNECT ACCELERATOR CONNECTING ROD
3. REMOVE AIR INTAKE CONNECTOR  
(See steps 1 to 3 on page EM-12)
4. DISCONNECT VACUUM HOSES
5. DISCONNECT THROTTLE POSITION SENSOR CONNECTOR



6. REMOVE THROTTLE BODY
  - (a) Disconnect the two water by-pass hoses from the ISC valve and water pipe.



- (b) Remove the four bolts, throttle body and gasket.
  - (c) Remove the two water by-pass hoses.



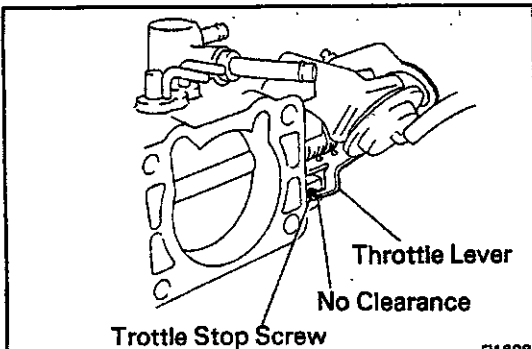
**INSPECTION OF THROTTLE BODY**

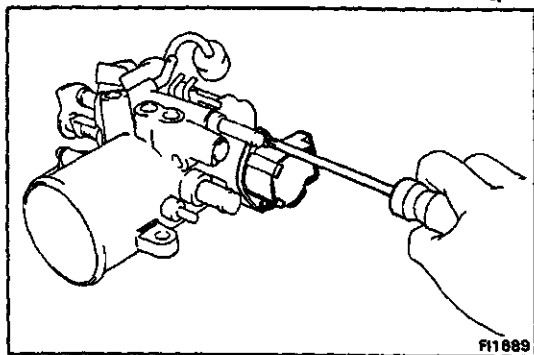
1. CLEAN THROTTLE BODY
  - (a) Using a soft brush and carburetor cleaner, clean the cast parts.
  - (d) Using compressed air, clean all passages and apertures.

**CAUTION:** To prevent deterioration, do not clean the throttle position sensor and dash pot.

**2. INSPECT THROTTLE VALVE**

Check that there is no clearance between the throttle stop screw and throttle lever when the throttle valve is fully closed.

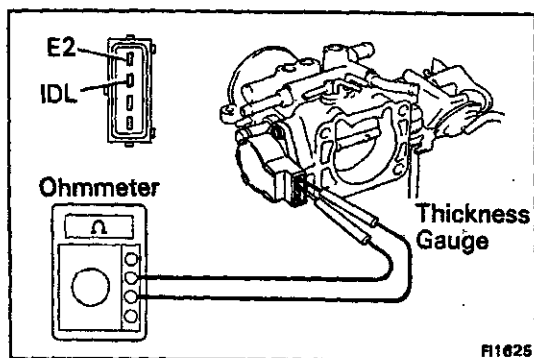




**3. INSPECT THROTTLE POSITION SENSOR**  
(See step 2 on page FI-103)

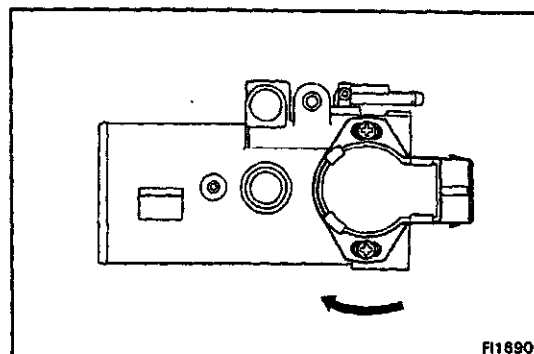
**4. IF NECESSARY, ADJUST THROTTLE POSITION SENSOR**

(a) Loosen the two screws of the sensor.

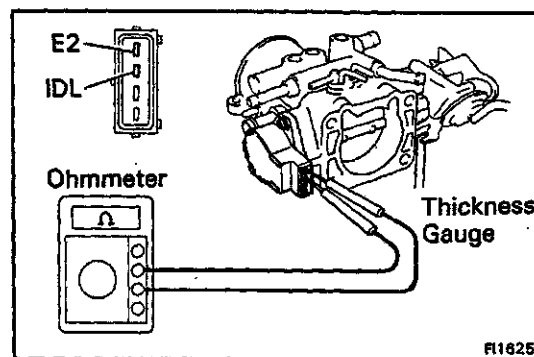


(b) Insert a 0.58 mm (0.0228 in.) (7M-GE) or 0.70 mm (0.0276 in.) (7M-GTE) thickness gauge, between the throttle stop screw and lever.

(c) Connect the test probe of an ohmmeter to terminals IDL and E.

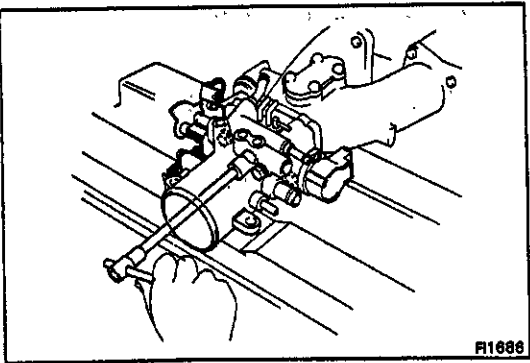


(d) Gradually turn the sensor clockwise until the ohmmeter deflects, and secure the sensor with the two screws.



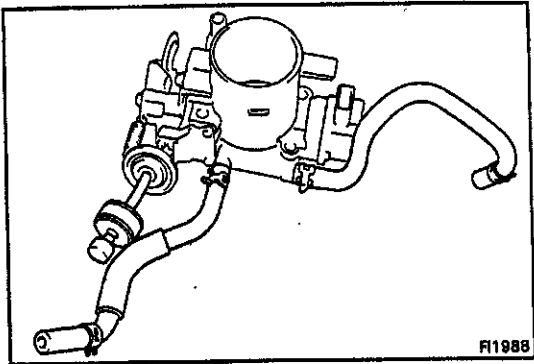
(e) Recheck the continuity between terminals IDL and E2.

| Clearance between lever and stop screw |                         | Continuity (IDL - E2) |
|----------------------------------------|-------------------------|-----------------------|
| 7M-GE                                  | 7M-GTE                  |                       |
| 0.40 mm<br>(0.0157 in.)                | 0.50 mm<br>(0.0197 in.) | Continuity            |
| 0.75 mm<br>(0.0295 in.)                | 0.90 mm<br>(0.0354 in.) | No continuity         |



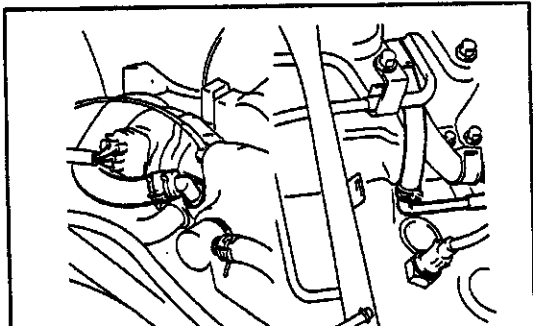
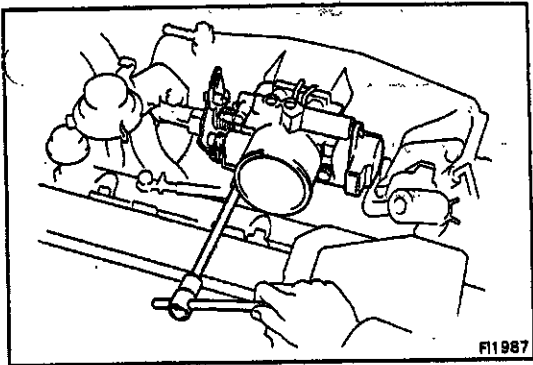
### INSTALLATION OF THROTTLE BODY (7M-GE)

1. **INSTALL THROTTLE BODY**  
Install the gasket and throttle body with the four bolts.  
Torque: 130 kg-cm (9 ft-lb, 13 N·m)
2. **CONNECT THROTTLE BODY BRACKET(S)**
3. **CONNECT AIR CLEANER HOSE**
4. **CONNECT THROTTLE POSITION SENSOR CONNECTOR**
5. **CONNECT VACUUM HOSES**
6. **CONNECT WATER HOSES**
7. **CONNECT ACCELERATOR CONNECTING ROD**
8. **REFILL WITH COOLANT**



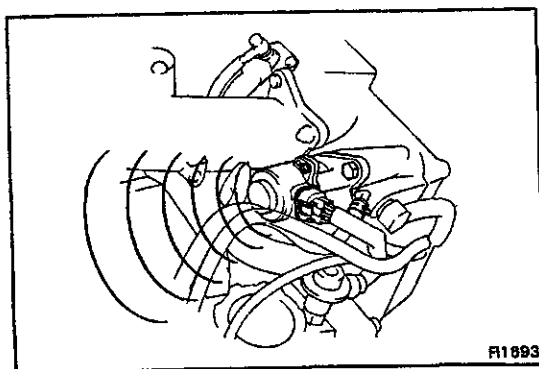
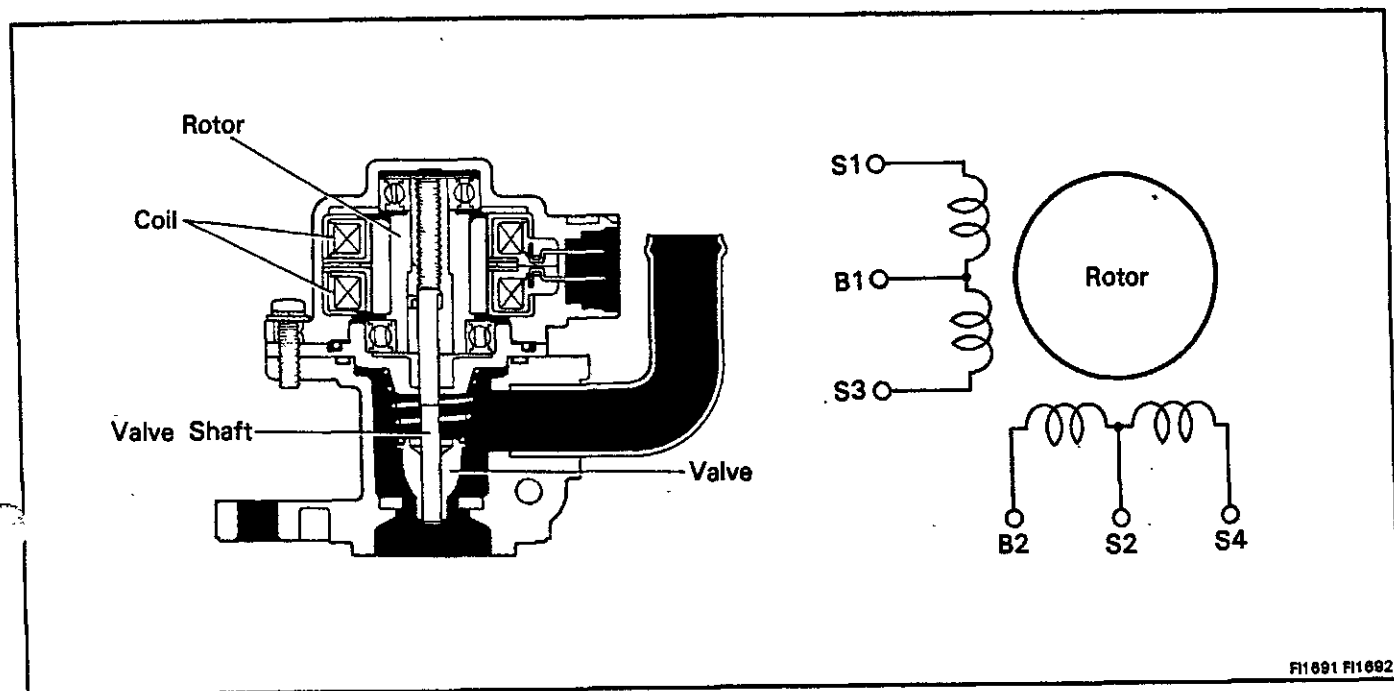
### (7M-GTE)

1. **INSTALL THROTTLE BODY**
  - (a) Install the two water by-pass hoses.
  - (b) Install a new gasket and throttle body with the four bolts.
  - (c) Connect the two water by-pass hoses to the ISC valve and water pipe.



- 2. CONNECT THROTTLE POSITION SENSOR CONNECTOR**
- 3. CONNECT VACUUM HOSES**
- 4. INSTALL AIR INTAKE CONNECTOR**  
(See steps 13 to 15 on page EM-14)
- 5. INSTALL ACCELERATOR CONNECTING ROD**
- 6. REFILL WITH COOLANT**

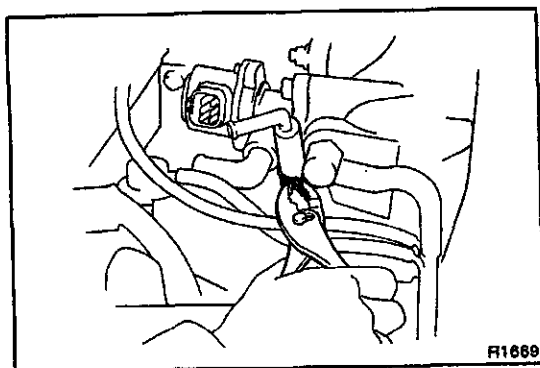
## Idle Speed Control (ISC) Valve



### ON-VEHICLE INSPECTION

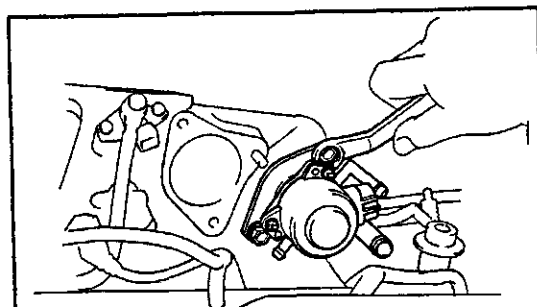
#### CHECK FOR OPERATING SOUND FROM ISC VALVE

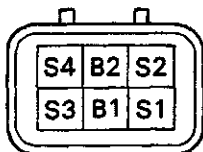
Check that there is a clicking sound immediately after stopping the engine.



### REMOVAL OF ISC VALVE

1. DRAIN COOLANT
2. DISCONNECT ISC VALVE CONNECTOR
3. DISCONNECT TWO WATER BY-PASS AND AIR HOSES FROM ISC VALVE
4. REMOVE ISC VALVE
  - (a) Remove the two bolts.
  - (b) Remove ISC valve and gasket.
  - (c) (7M-GTE)  
Remove the seal washer and check valve from the intake chamber.





FI1694

## INSPECTION OF ISC VALVE

### 1. INSPECT RESISTANCE OF ISC VALVE

Using an ohmmeter, measure the resistance between terminal B1 – S1 or S3 and B2 – S2 or S4.

Resistance: B1 – S1 or S3 10 – 30  $\Omega$

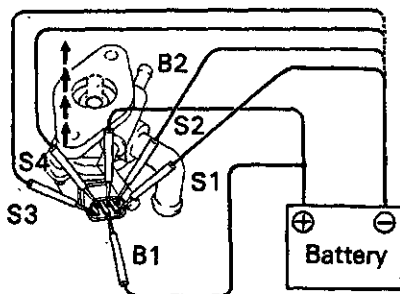
B2 – S2 or S4 10 – 30  $\Omega$

If resistance is not as specified, replace the ISC valve.

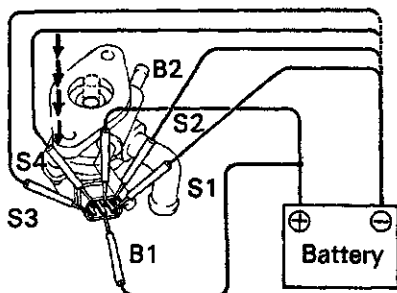
### 2. INSPECT OPERATION OF ISC VALVE

(a) Apply battery voltage to terminals B1 and B2 and while repeatedly grounding S1 – S2 – S3 – S4 – S1 in sequence, check that the valve moves toward the closed position.

(b) Apply battery voltage to terminals B1 and B2 and while repeatedly grounding S4 – S3 – S2 – S1 – S4 in sequence, check that the valve moves toward the open position.



FI1643



FI1643

## INSPECTION OF CHECK VALVE (7M-GTE only)

### INSPECT CHECK VALVE

Inspect the check valve for damage and the diaphragm for cracks.

If necessary, replace the check valve.

## INSTALLATION OF ISC VALVE

### 1. INSTALL ISC VALVE

(a) (7M-GTE)

Install the check valve and the seal washer as shown in the illustration, to the intake chamber.

(b) Install a new gasket to the intake manifold.

(c) Install the ISC valve with the two bolts and one nut.

Torque: 130 kg-cm (9 ft-lb, 13 N·m)

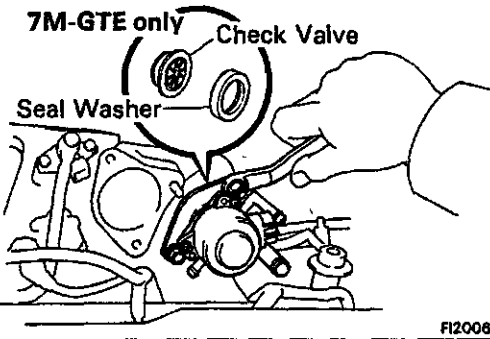
### 2. INSTALL AIR AND TWO WATER BY-PASS HOSES TO ISC VALVE

### 3. CONNECT ISC VALVE CONNECTOR

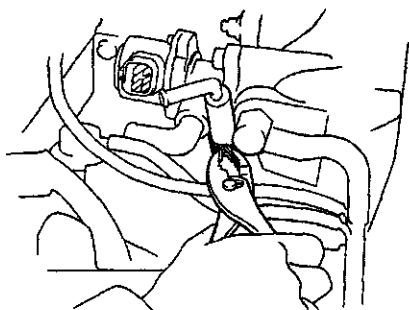
### 4. REFILL WITH COOLANT

7M-GTE only Check Valve

Seal Washer



FI2006



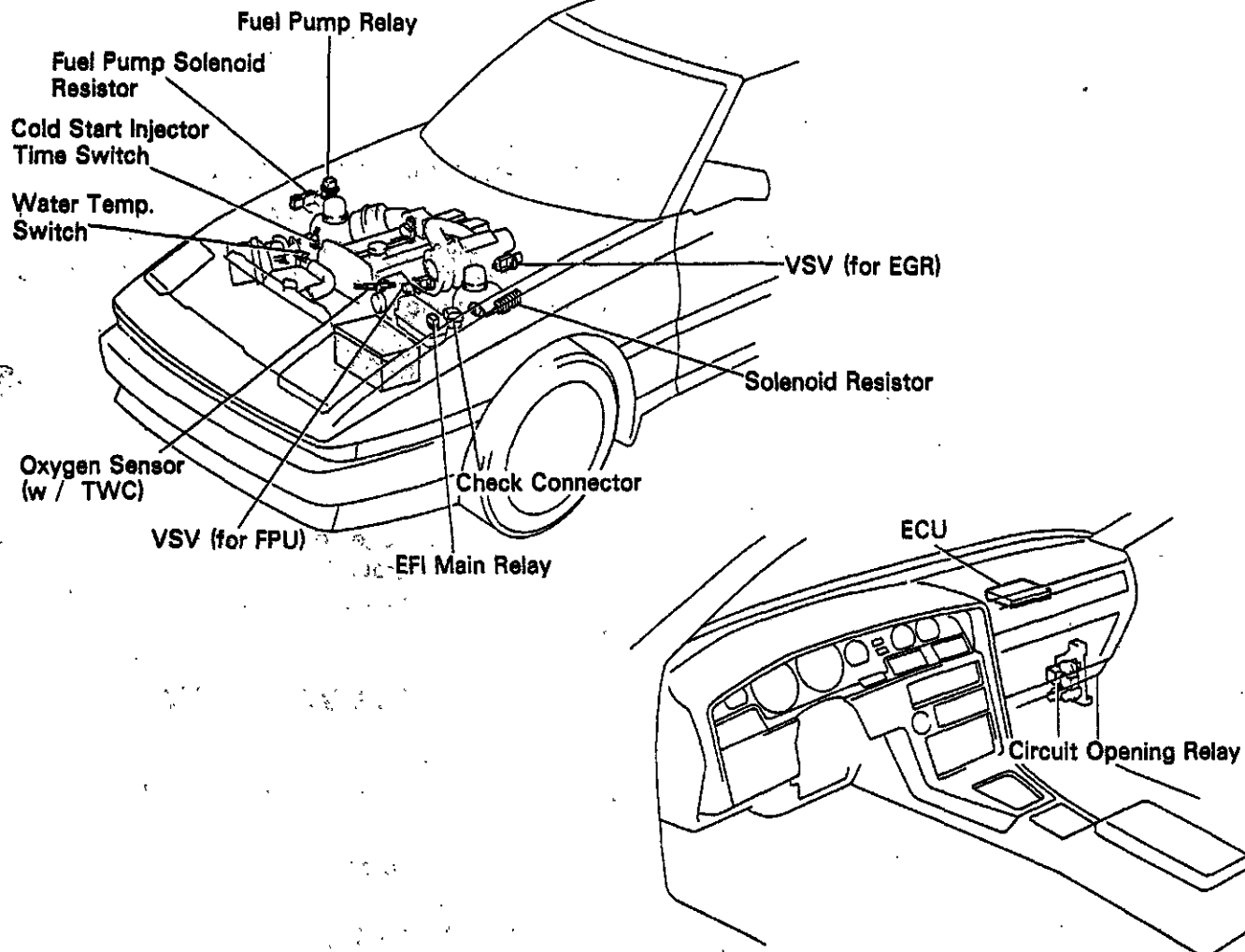
FI1669

## ELECTRONIC CONTROL SYSTEM

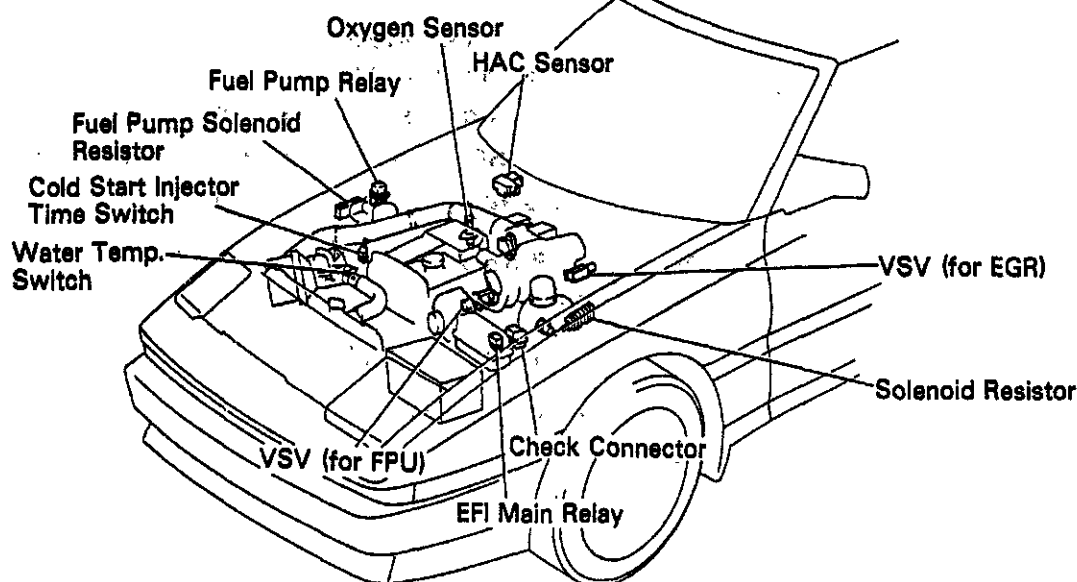
### Location of Electronic Control Parts

MA

7M-GE



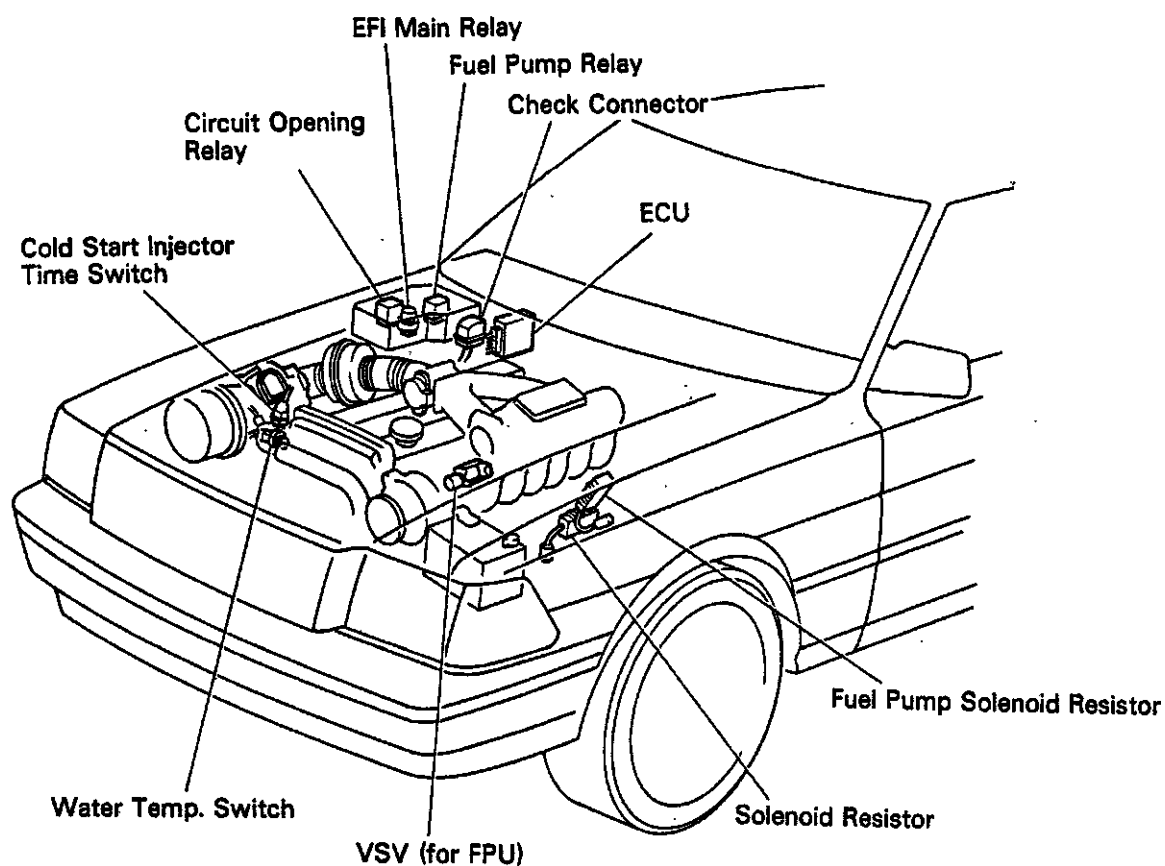
7M-GTE



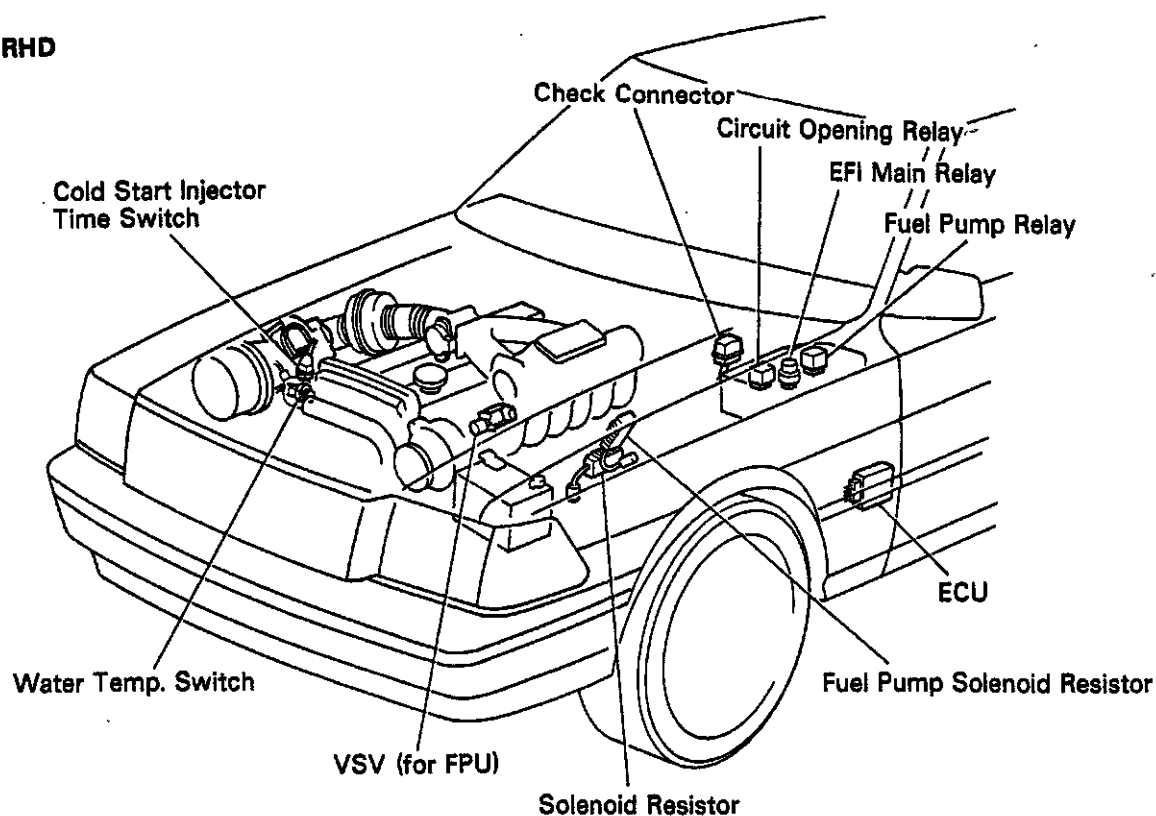
## Location of Electronic Control Parts (Cont'd)

MS

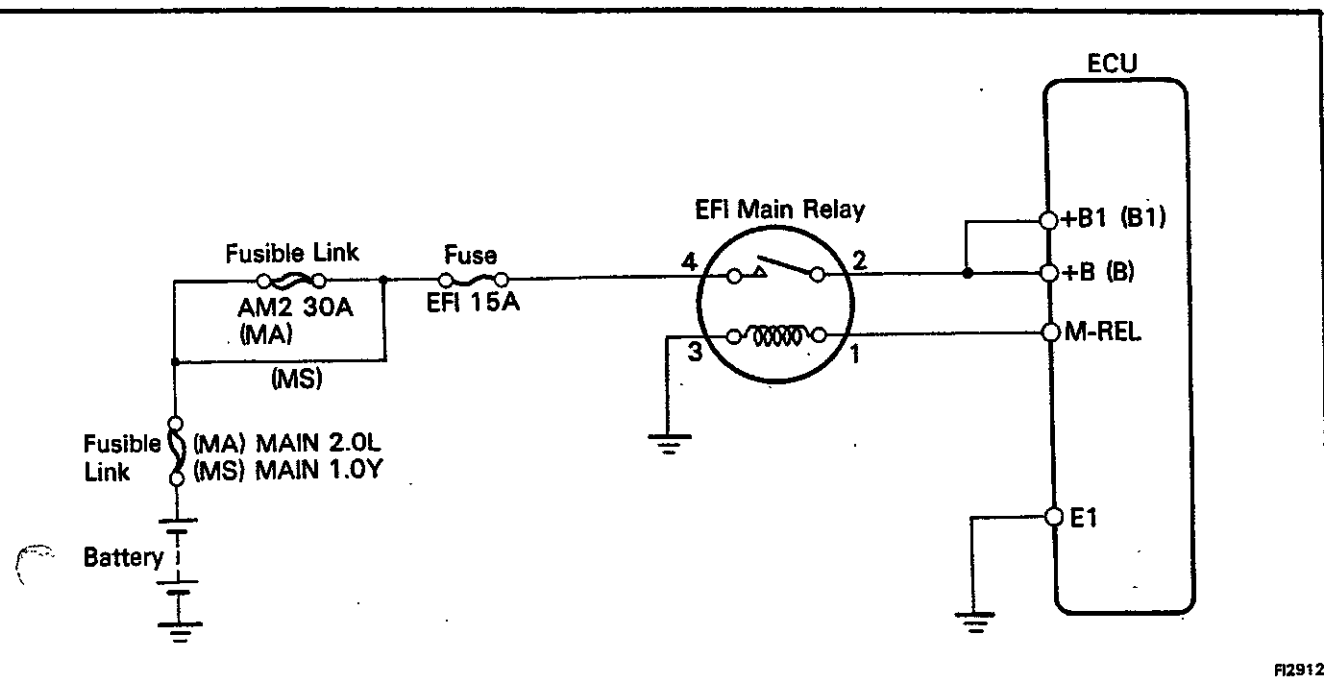
LHD



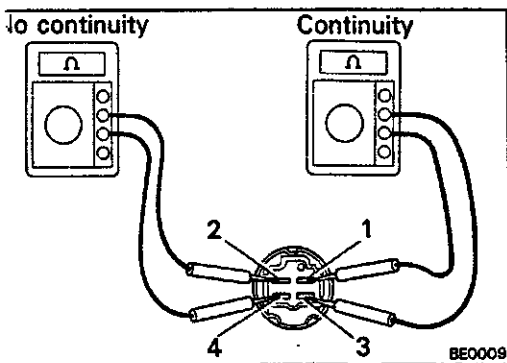
RHD



## EFI Main Relay



F12912



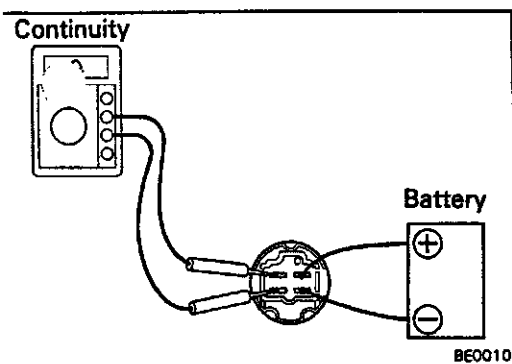
BE0009

### INSPECTION OF EFI MAIN RELAY

#### 1. INSPECT RELAY CONTINUITY

- Using an ohmmeter, check that there is continuity between terminals 1 and 3.
- Check that there is no continuity between terminals 2 and 4.

If continuity is not as specified, replace the relay.



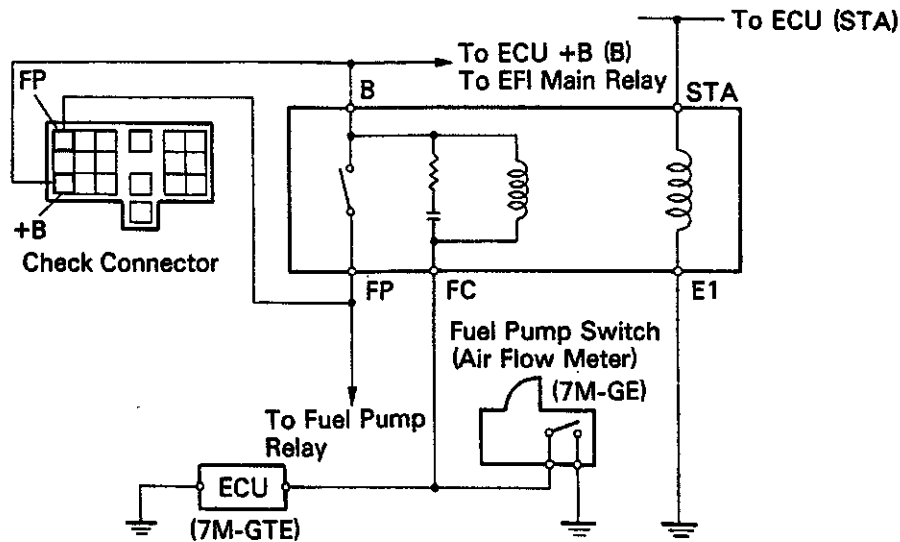
BE0010

#### 2. INSPECT RELAY OPERATION

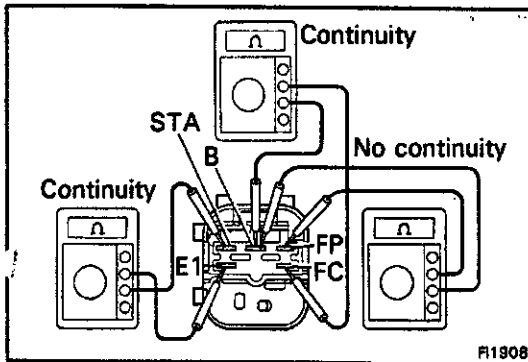
- Apply battery voltage across terminals 1 and 3.
- Check that there is continuity between terminals 2 and 4.

If operation is not as specified, replace the relay.

## Circuit Opening Relay



FI1992



FI1908

### INSPECTION OF CIRCUIT OPENING RELAY

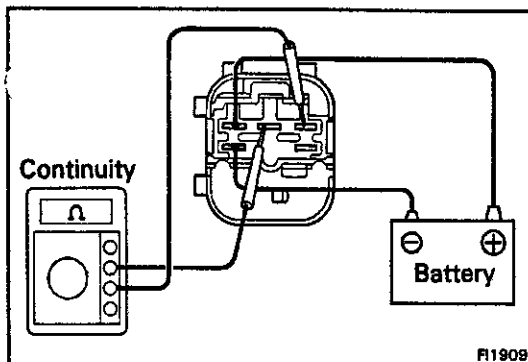
#### 1. INSPECT RELAY CONTINUITY

- Using an ohmmeter, check that there is continuity between terminals STA and E1.
- Check that there is continuity between terminals B and FC.
- Check that there is no continuity between terminals B and FP.

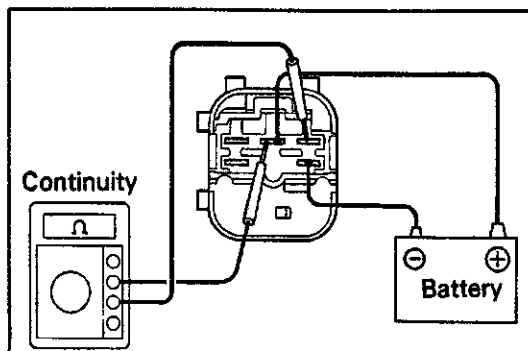
If continuity is not as specified, replace the relay.

#### 2. INSPECT RELAY OPERATION

- Apply battery voltage across terminals STA and E1.
- Using an ohmmeter, check that there is continuity between terminals B and FP.



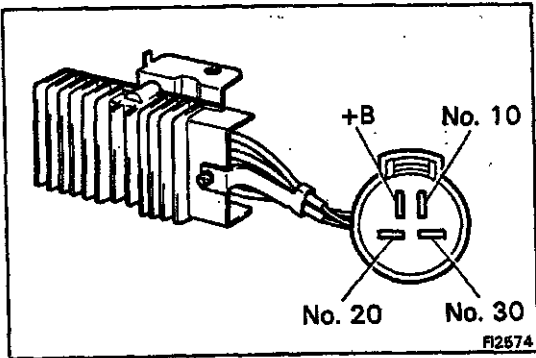
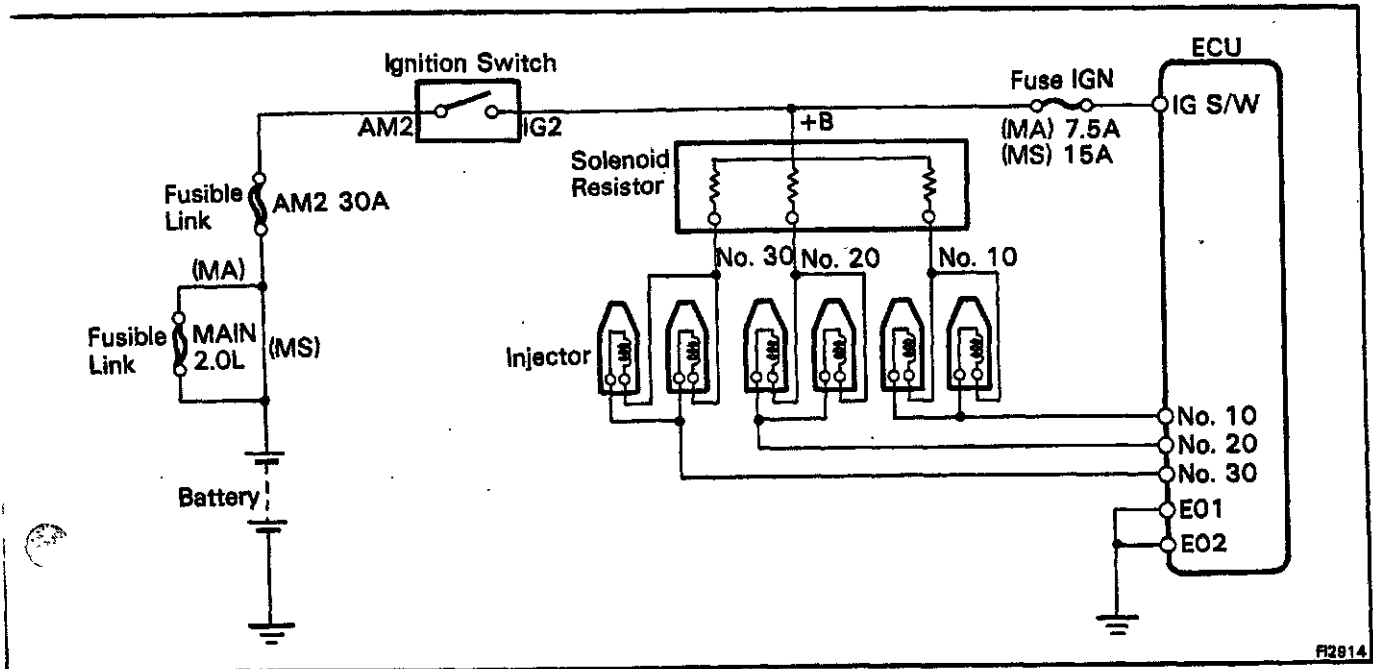
FI1908



- Apply battery voltage across terminals B and FC.
- Check that there is continuity between terminals B and FP.

If operation is not as specified, replace the relay.

## Solenoid Resistor



## INSPECTION OF SOLENOID RESISTOR

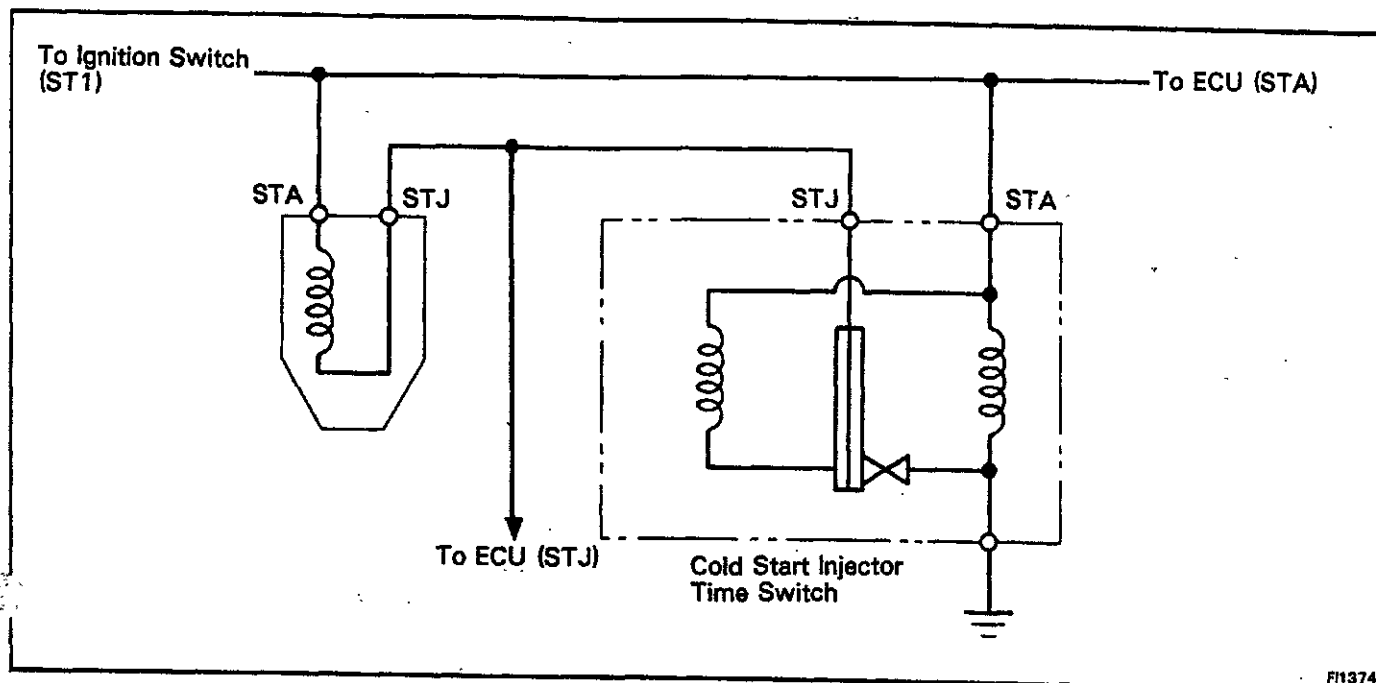
## INSPECT RESISTANCE OF SOLENOID RESISTOR

**Using an ohmmeter, measure the resistance between +B and other terminals.**

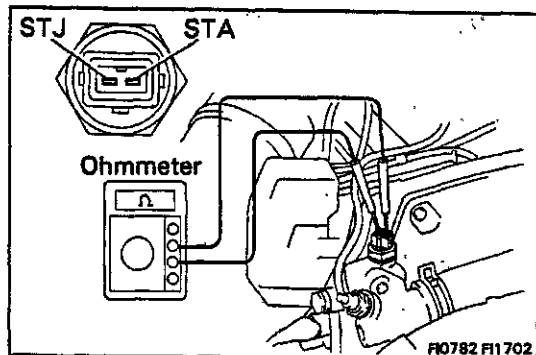
**Resistance: 3  $\Omega$  each**

**If the resistance is not as specified, replace the resistor.**

## Cold Start Injector Time Switch



FI1374



FI0782 FI1702

### INSPECTION OF COLD START INJECTOR TIME SWITCH

#### 1. INSPECT RESISTANCE OF COLD START INJECTOR TIME SWITCH

- Disconnect the connector.
- Using an ohmmeter, measure the resistance between each terminal.

##### Resistance:

##### w/ TWC

|           |                                       |
|-----------|---------------------------------------|
| STA - STJ | 25 - 50 $\Omega$ below<br>15°C (59°F) |
|           | 60 - 85 $\Omega$ above<br>30°C (86°F) |

|              |                  |
|--------------|------------------|
| STA - Ground | 25 - 85 $\Omega$ |
|--------------|------------------|

##### w/o TWC

|           |                                        |
|-----------|----------------------------------------|
| STA - STJ | 20 - 40 $\Omega$ below<br>30°C (86°F)  |
|           | 40 - 60 $\Omega$ above<br>40°C (104°F) |

|              |                  |
|--------------|------------------|
| STA - Ground | 20 - 80 $\Omega$ |
|--------------|------------------|

If the resistance is not as specified, replace the switch.

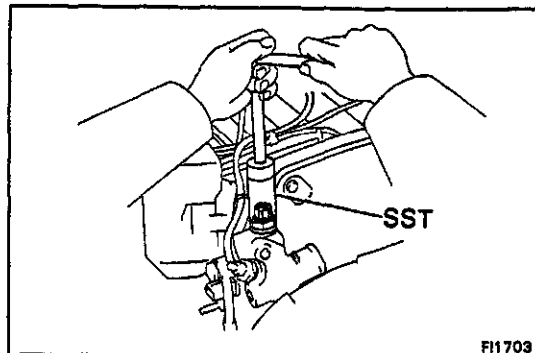
#### 2. IF NECESSARY, REPLACE COLD START INJECTION TIME SWITCH

- Drain the coolant.
- Using SST, replace the switch with a new gasket.

SST 09814-20010

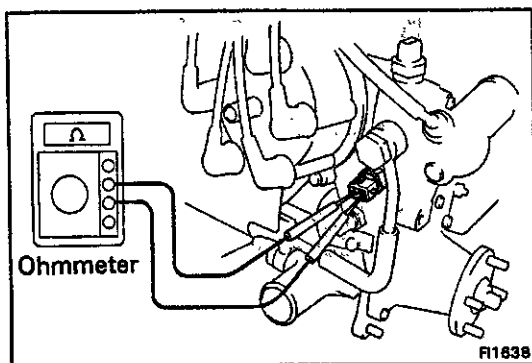
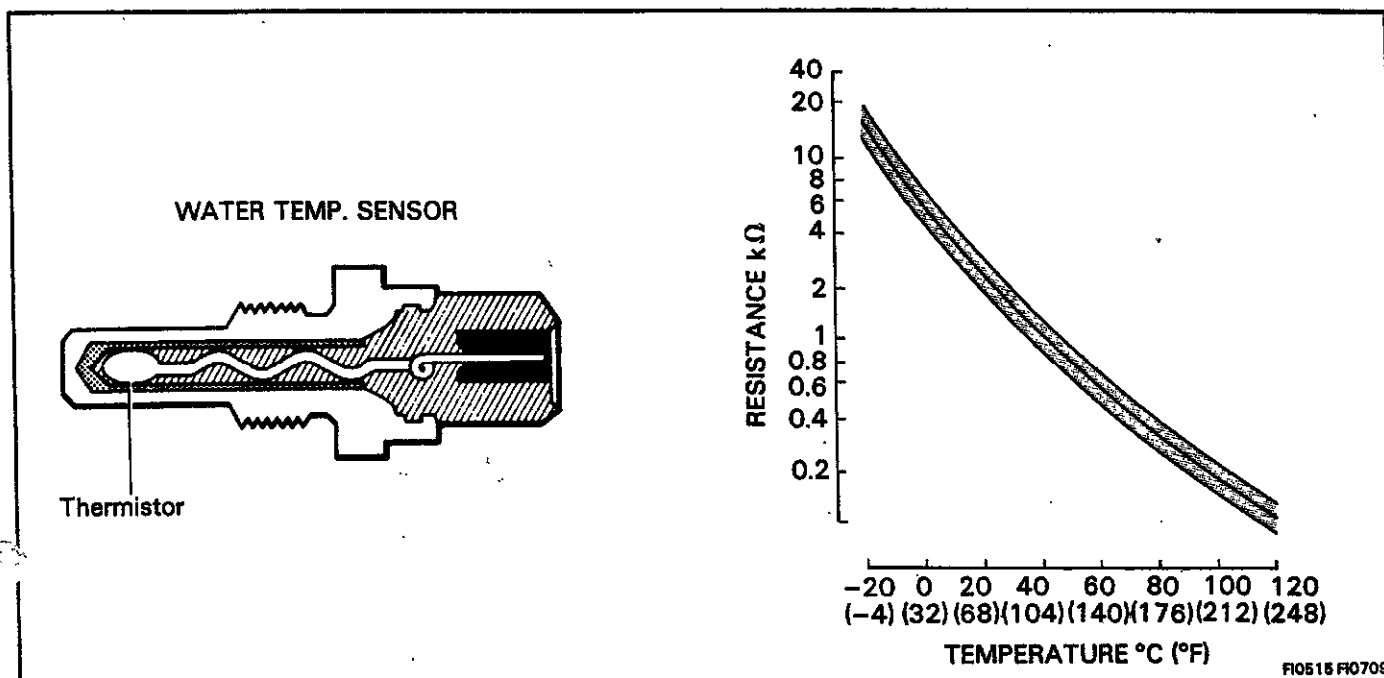
Torque: 300 kg-cm (22 ft-lb, 29 N-m)

- Refill with coolant.



FI1703

## Water Temperature Sensor



### INSPECTION OF WATER TEMPERATURE SENSOR

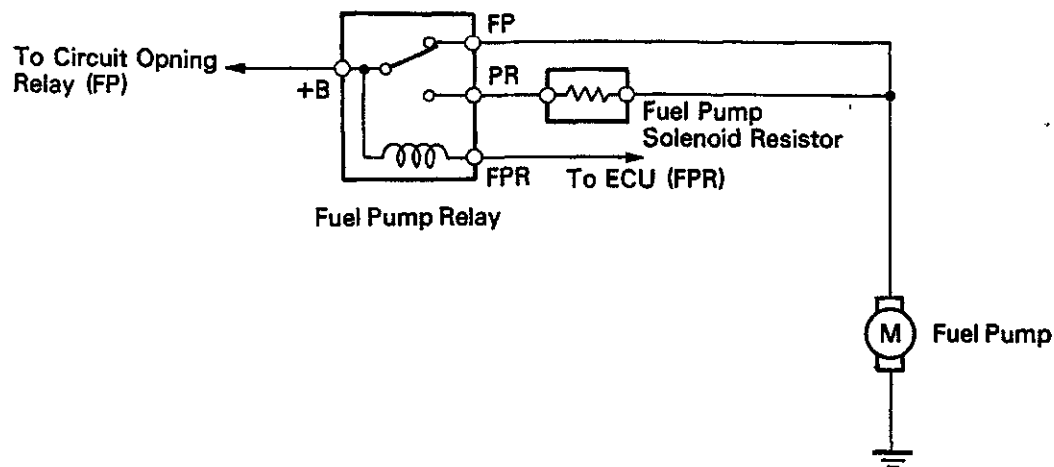
#### INSPECT RESISTANCE OF WATER TEMPERATURE SENSOR

Using an ohmmeter, measure the resistance between both terminals.

**Resistance:** Refer to chart.

If the resistance is not as specified, replace the water temperature sensor.

## Fuel Pump Relay and Resistor



FI1704

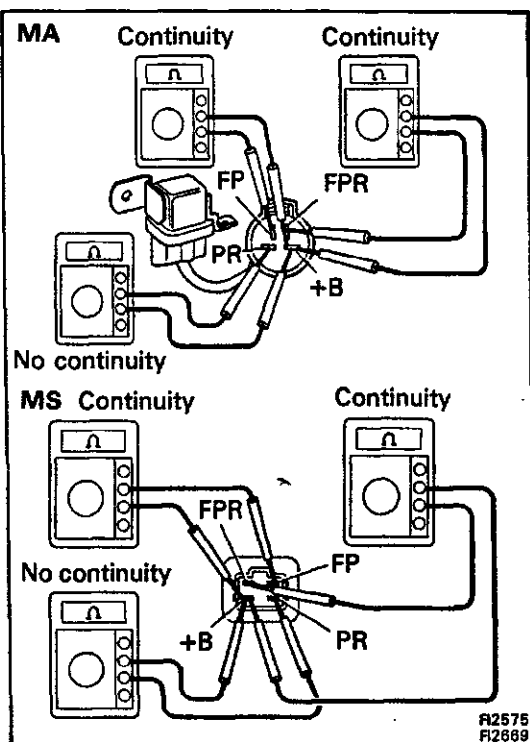
### INSPECTION OF PUMP RELAY AND RESISTOR

#### 1. INSPECT FUEL PUMP RELAY

##### A. Inspect Relay Continuity

- Using an ohmmeter, check that there is continuity between terminals +B and FP.
- Check that there is continuity between terminals +B and FPR.
- Check that there is no continuity between terminals +B and PR.

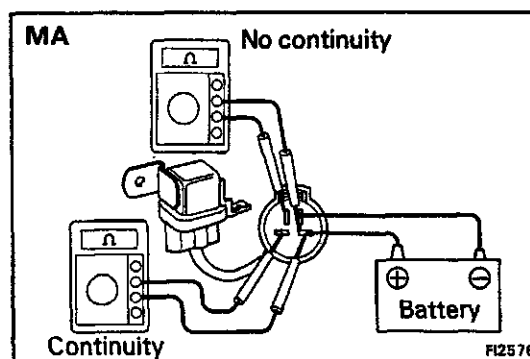
If continuity is not as specified, replace the relay.

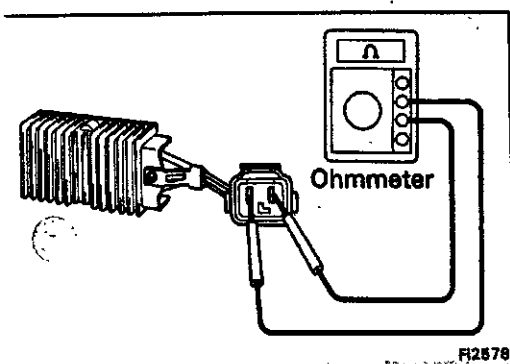
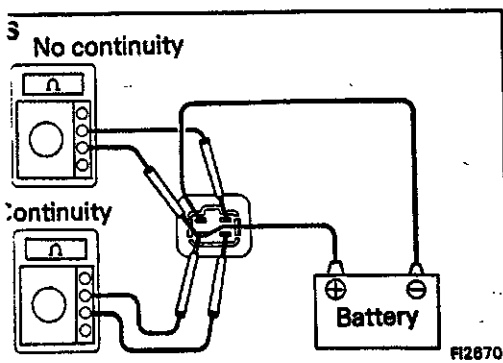


##### B. Inspect Relay Operation

- Apply battery voltage across terminals +B and FPR.
- Using an ohmmeter, check that there is continuity between terminals +B and PR.
- Check that there is no continuity between terminals B and FP.

If operation is not as described, replace the relay.





## 2. INSPECT FUEL PUMP RESISTOR

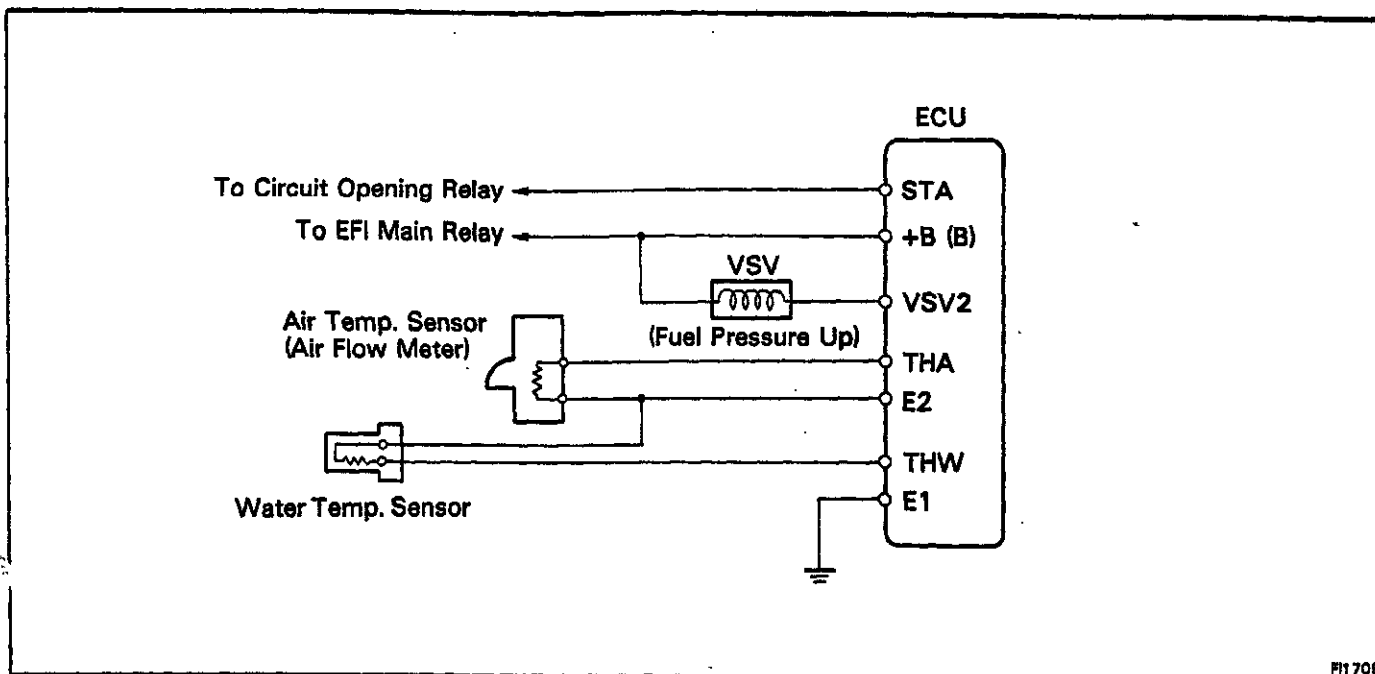
### Inspect Resistance of Fuel Pump Resistor

Using an ohmmeter, measure the resistance between both terminals.

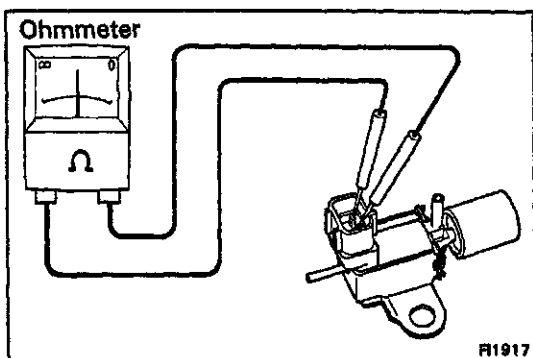
**Resistance:** Approx.  $0.7 \Omega$

If the resistance is not as specified, replace the fuel pump resistor.

## High Temperature Line Pressure Up System



FI1709



FI1917

### INSPECTION OF HIGH TEMPERATURE LINE PRESSURE UP SYSTEM

#### INSPECT VSV

##### A. Inspect VSV for Open Circuit

Using an ohmmeter, check that there is continuity between terminals.

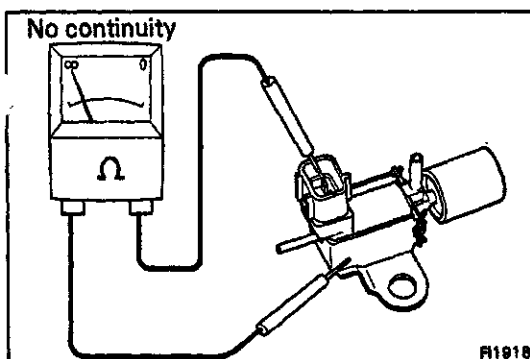
**Resistance: 30 – 50  $\Omega$**

If there is no continuity, replace the VSV.

##### B. Inspect VSV for Short Circuit

Using an ohmmeter, check that there is no continuity between each terminal and the body.

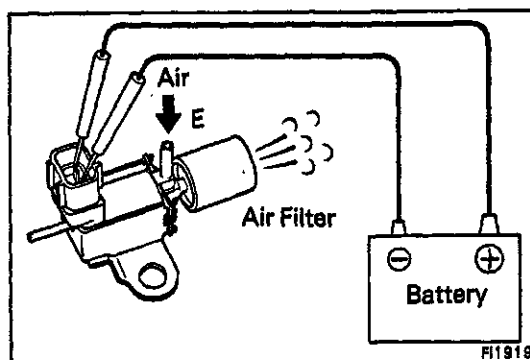
If there is continuity, replace the VSV.



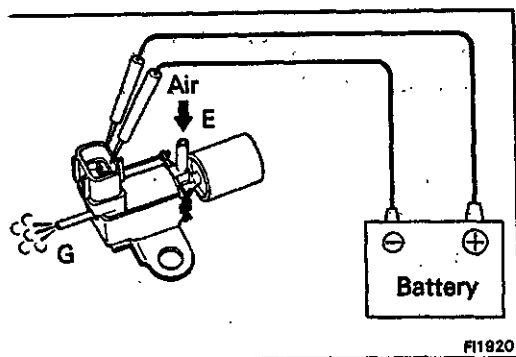
FI1918

##### C. Inspect VSV Operation

- Apply battery voltage across the terminals.
- Check that air flows from pipe E to air filter.

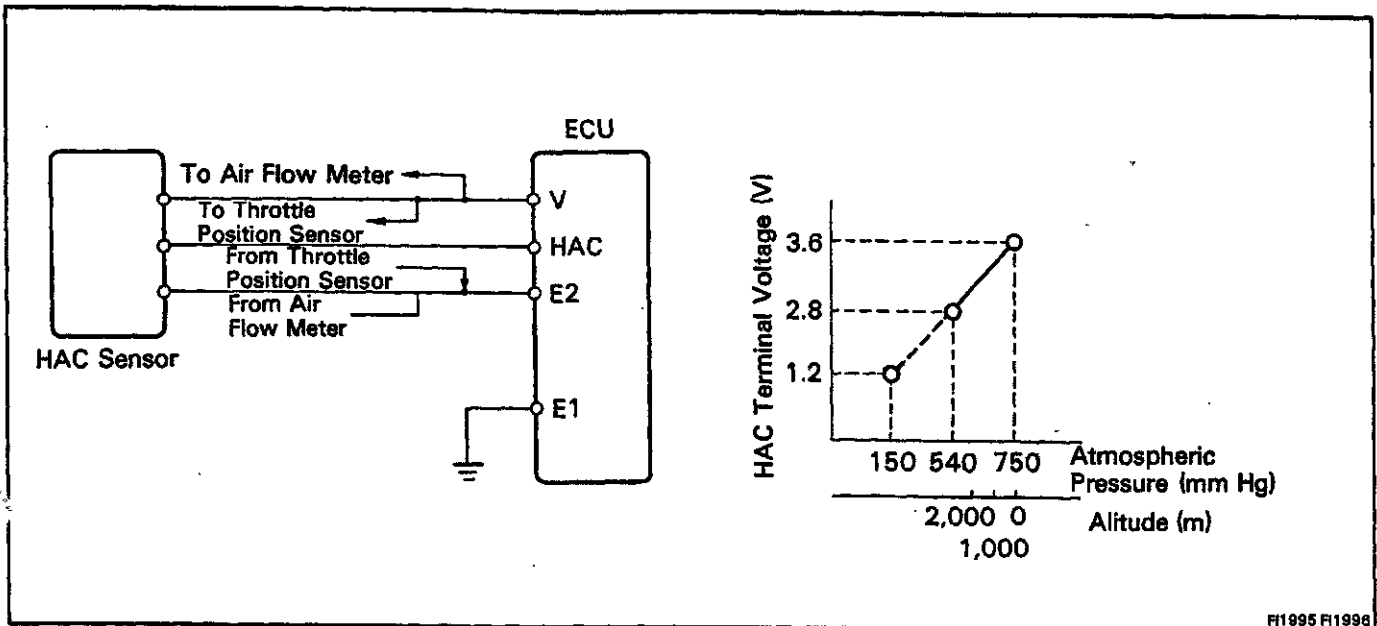


FI1919

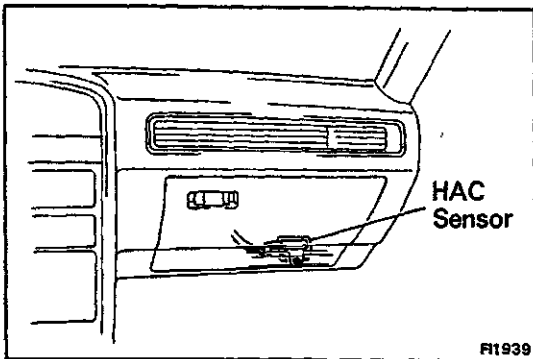


- (c) Disconnect the battery.
- (d) Check that air flows from the pipe E and pipe G.  
If operation is not as specified, replace the VSV.

## High Altitude Compensation (HAC) System (7M-GTE)



FI1995 FI1996



FI1939

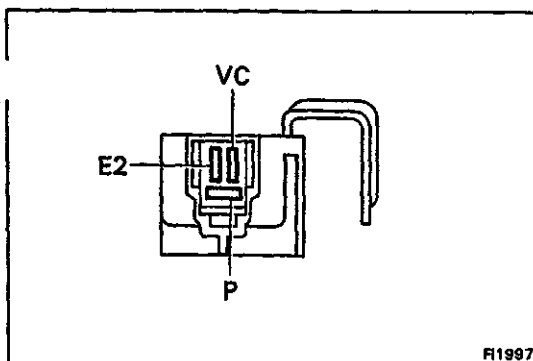
### INSPECTION OF HAC SENSOR

#### INSPECT RESISTANCE OF HAC SENSOR

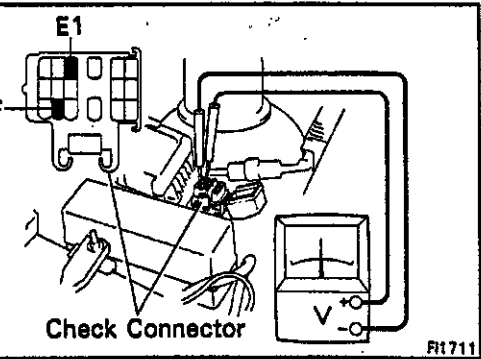
- Remove the glove box.
- Using an ohmmeter, measure the resistance between each terminal.

| Terminals | Resistance         |
|-----------|--------------------|
| VC - P    | 700 - 860 $\Omega$ |
| VC - E2   | 2.2 - 3.3 $\Omega$ |
| P - E2    | 2.9 - 4.2 $\Omega$ |

If the resistance is not as specified, replace the HAC sensor.



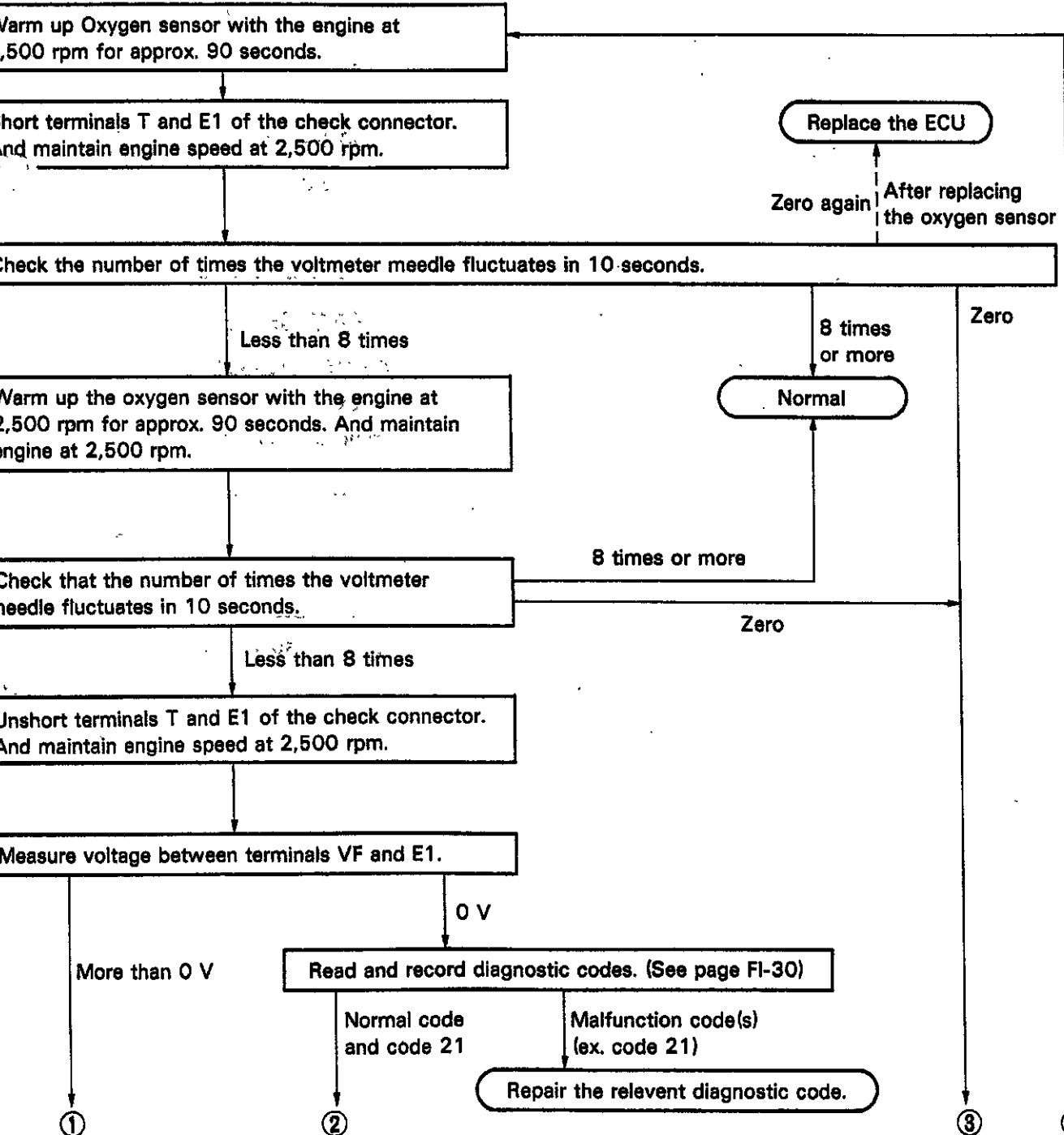
FI1997



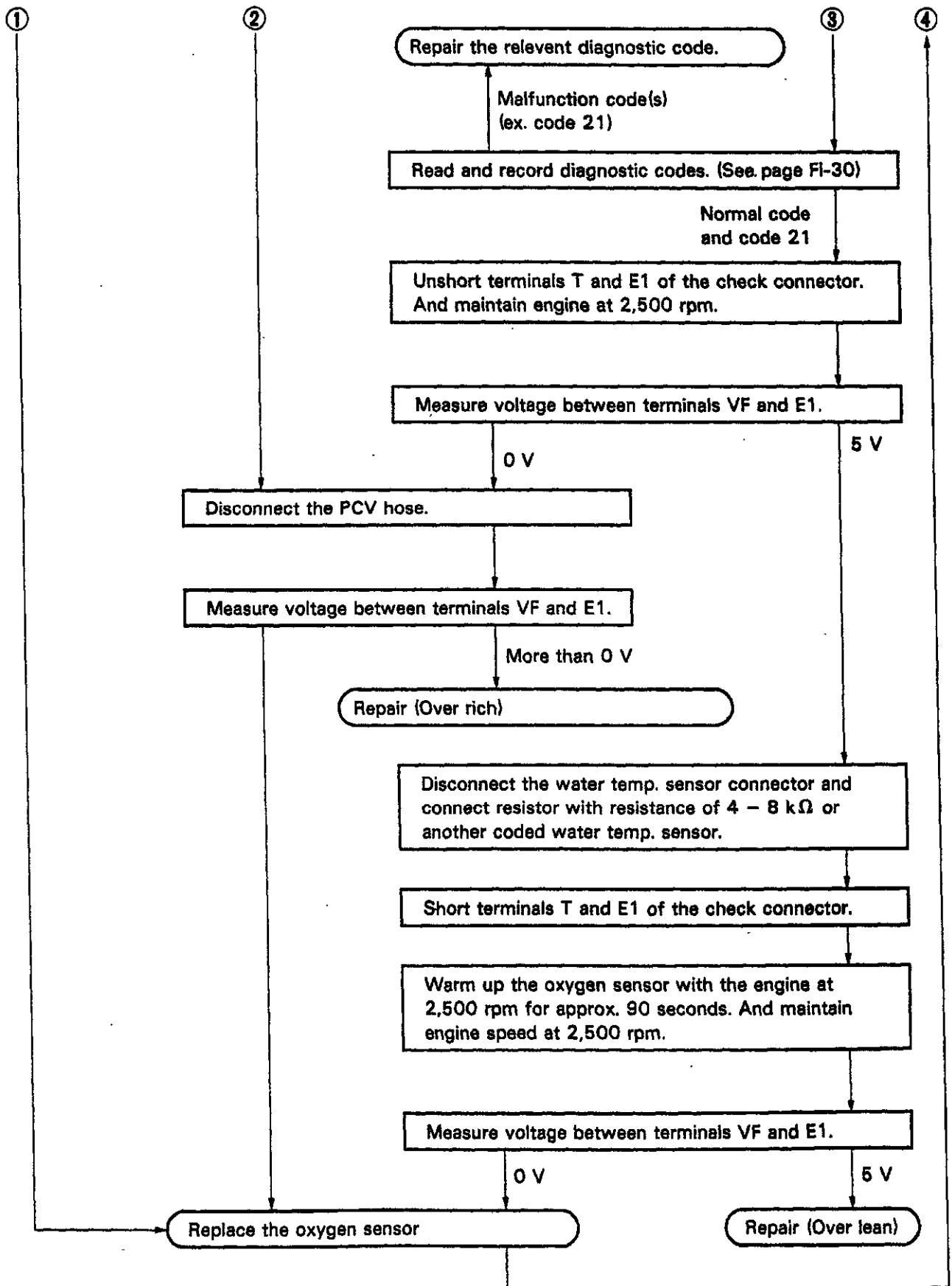
# Oxygen Sensor (w/ TWC)

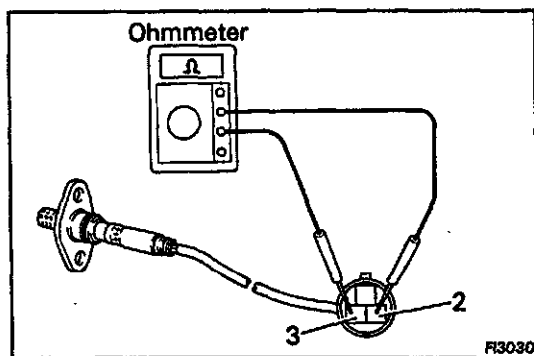
## INSPECTION OF OXYGEN SENSOR

- 1. **WARM UP ENGINE**  
Allow the engine to reach normal operating temperature.
- 2. **INSPECT FEEDBACK VOLTAGE (VF)**  
Connect the positive (+) probe of a voltmeter to terminals VF of the check connector, and negative (-) probe to terminal E1. Perform the test as follows.



CONTINUED FROM PAGE FI-122



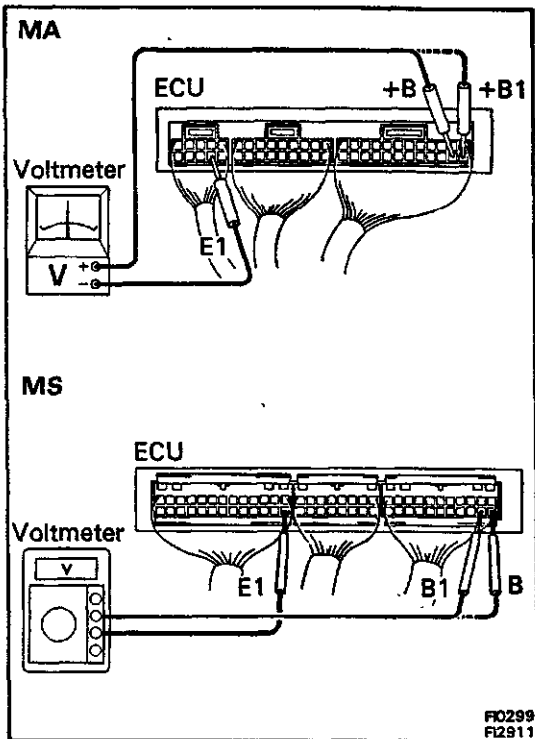


**3. (7M-GTE)  
INSPECT HEATER RESISTANCE OF OXYGEN  
SENSOR**

Using an ohmmeter, measure the resistance between the terminals 2 and 3.

**Resistance: 3.0 – 3.6  $\Omega$**

If the resistance is not as specified, replace the sensor.



## Electronic Controlled Unit (ECU)

### INSPECTION OF ECU

**NOTE:** The EFI circuit can be checked by measuring the resistance and voltage at the wiring connectors of the ECU.

1. (MS)  
**PREPARATION**  
(See page FI-58)
2. **INSPECT VOLTAGE OF ECU**

Check the voltage between each terminal of the wiring connectors.

- Turn the ignition switch ON.
- Measure the voltage at each terminal.

**NOTE:**

- Perform all voltage measurements with the connectors connected.
- Verify that the battery voltage is 11V or more when the ignition switch is ON.

### Voltage at ECU Wiring Connectors

| Terminals          | STD Voltage | Condition           |                                    |
|--------------------|-------------|---------------------|------------------------------------|
| BATT - E1          | 10 - 14     | —                   |                                    |
| IG S/W - E1        |             | Ignition S/W ON     |                                    |
| M-REL - E1         |             |                     |                                    |
| +B (+B1)<br>B (B1) |             |                     |                                    |
| IDL - E2           | 4 - 6       | Ignition S/W ON     | Throttle valve open                |
| VC (VCC) - E2      | 4 - 6       |                     | —                                  |
| VTA - E2           | 0.1 - 1.0   |                     | Throttle valve fully closed        |
|                    | 4 - 5       |                     | Throttle valve fully open          |
| *1VS - E2          | 4 - 5       | Ignition S/W ON     | Measuring plate fully closed       |
|                    | 0.02 - 0.08 |                     | Measuring plate fully open         |
|                    | 2 - 4       | Idling              |                                    |
|                    | 0.3 - 1.0   | 3,000 rpm           |                                    |
| *2KS - E2          | 4 - 6       | Ignition S/W ON     |                                    |
|                    | 2 - 4       | Cranking or running |                                    |
| VC - E2-           | 4 - 6       | Ignition S/W ON     |                                    |
| THA - E2           | 1 - 3       | Ignition S/W ON     | Intake air temperature 20°C (68°F) |
| THW - E2           | 0.1 - 1.0   | Ignition S/W ON     | Coolant temperature 80°C (176°F)   |

## Voltage at ECU Wiring Connectors (Cont'd)

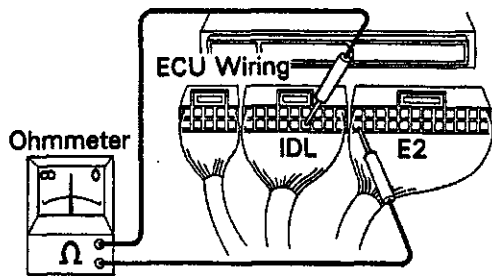
| Terminals                           | STD Voltage | Condition                                                         |                                       |
|-------------------------------------|-------------|-------------------------------------------------------------------|---------------------------------------|
| No. 10 E01<br>No. 20 -<br>No. 30 E2 | 9 - 14      | Ignition S/W ON                                                   |                                       |
| STA - E1                            | 6 - 14      | Cranking                                                          |                                       |
| ISC1<br>- E1<br>ISC4                | 9 - 14      | Ignition S/W ON                                                   |                                       |
| IGF, IGT - E1                       | 0.7 - 1.0   | Idling                                                            |                                       |
| *2IGdA, IGdB - E1                   | 1 - 3       | Idling                                                            |                                       |
| *2HAC - E2                          | Approx. 2.8 | Ignition S/W ON                                                   | 540 mm Hg (21.26 in.Hg, 72.0 kPa)     |
|                                     | Approx. 3.6 |                                                                   | 750 mm Hg (129.53 in.Hg, 100.0 kPa)   |
| W - E1                              | 9 - 14      | No trouble ("CHECK ENGINE" warning light off) and engine running. |                                       |
| *3A/C - E1                          | 10 - 14     | Air conditioning ON                                               |                                       |
| T - E1                              | 4 - 6       | Ignition S/W ON                                                   | Check connector T(TE1) - E1 not short |
|                                     | 0           |                                                                   | Check connector T(TE1) - E1 short     |
| *3NSW (A/T) - E1                    | 0           | Ignition S/W ON                                                   | Shift position P or N range           |
|                                     | 10 - 14     |                                                                   | Ex. P or N range                      |
| *3N/C (M/T) - E1                    | 0           | Ignition S/W ON                                                   | Clutch pedal not depressed            |
|                                     | 10 - 14     |                                                                   | Clutch pedal depressed                |
| *3DFG - E1                          | 10 - 14     | Ignition S/W ON                                                   | Defogger S/W OFF                      |
|                                     | 0           |                                                                   | Defogger S/W ON                       |
| *3LP - E1                           | 10 - 14     | Headlight S/W OFF                                                 |                                       |
|                                     | 0           | Headlight S/W ON                                                  |                                       |

\*1 7M-GE only

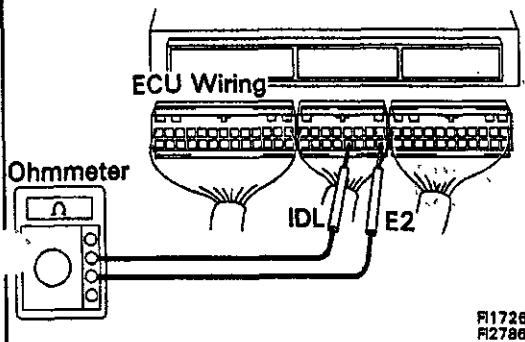
\*2 7M-GTE only

\*3 MA only

MA



MS

FI1726  
FI2788

## 3. INSPECT RESISTANCE OF ECU

## CAUTION:

- Do not touch the ECU terminals.
- The tester probe should be inserted into the wiring connector from the wiring side.

Check the resistance between each terminal of the wiring connectors.

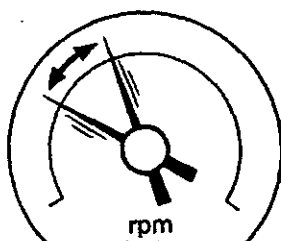
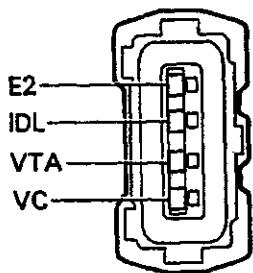
- Disconnect the wiring connectors from the ECU.
- Measure the resistance each terminal.

## Resistance of ECU Wiring Connectors

| Terminals                | Condition                          | Resistance ( $\Omega$ ) |
|--------------------------|------------------------------------|-------------------------|
| IDL - E2                 | Throttle valve open                | $\infty$                |
|                          | Throttle valve fully closed        | Less than 2,300         |
| VTA - E2                 | Throttle valve fully open          | 3,500 - 10,300          |
|                          | Throttle valve fully closed        | 300 - 6,300             |
| VC (VCC) - E2            | -                                  | 200 - 400               |
| *1VS - E2                | Measuring plate fully closed       | 20 - 600                |
|                          | Measuring plate fully open         | 20 - 1,200              |
| *2 KS $\rightarrow$ E2   | -                                  | $\infty$                |
| *2 E2 $\rightarrow$ KS   | -                                  | 5,000 - 10,000          |
| *2 VC $\rightarrow$ E2   | -                                  | 10,000 - 15,000         |
| *2 E2 $\rightarrow$ VC   | -                                  | 5,000 - 10,000          |
| THA - E2                 | Intake air temperature 20°C (68°F) | 2,000 - 3,000           |
| THW - E2                 | Coolant temperature 80°C (176°F)   | 200 - 400               |
| G1, G2 - G $\ominus$     | -                                  | 140 - 180               |
| NE - G $\ominus$         | -                                  |                         |
| ISC1, ISC2<br>ISC3, ISC4 | -                                  | 10 - 30                 |
| *2 HAC - E2              | -                                  | 2,900 - 4,200           |

\*1 7M-GE only

\*2 7M-GTE only



Tachometer

## Fuel Cut RPM

### INSPECTION OF FUEL CUT RPM

#### 1. WARM UP ENGINE

Allow the engine to reach normal operating temperature.

#### 2. INSPECT FUEL CUT RPM

- Disconnect the connector from the throttle position sensor.
- Short circuit terminals IDL and E1 on the wire connector side.
- Gradually raise the engine rpm and check that there is fluctuation the fuel cut and fuel return points.

NOTE: The vehicle should be stopped.

Fuel cut rpm: 1,800 rpm

Fuel return rpm: 1,200 rpm

# ENGINE MECHANICAL

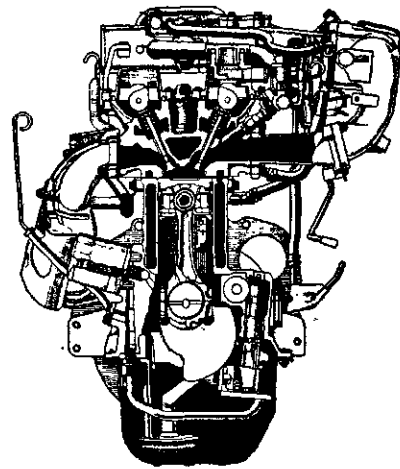
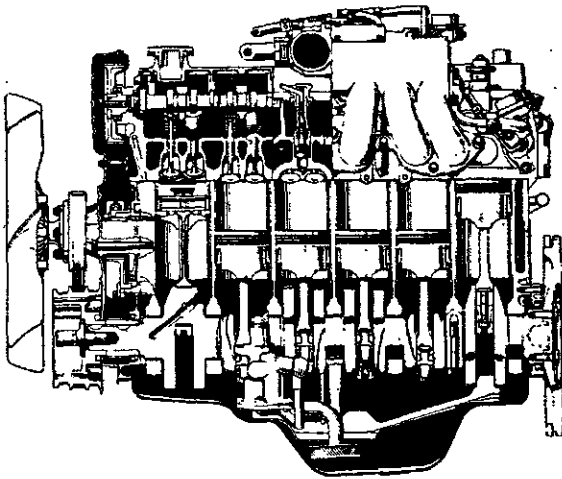
|                         | Page  |
|-------------------------|-------|
| DESCRIPTION .....       | EM-2  |
| TROUBLESHOOTING .....   | EM-4  |
| ENGINE TUNE-UP .....    | EM-7  |
| COMPRESSION CHECK ..... | EM-26 |
| TIMING BELT .....       | EM-28 |
| CYLINDER HEAD .....     | EM-37 |
| CYLINDER BLOCK .....    | EM-65 |

EN

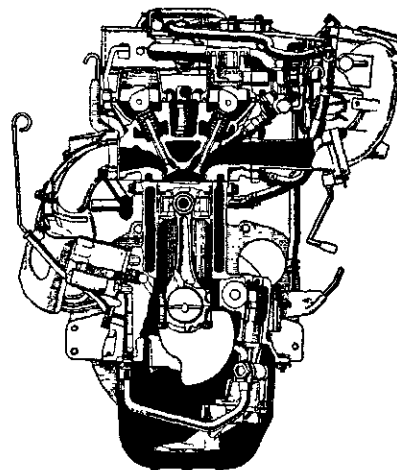
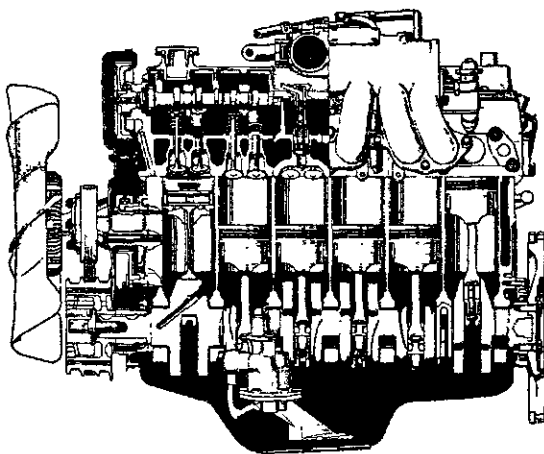
## DESCRIPTION

The 7M-GE and 7M-GTE engines are an in-line 6-cylinder 3.0 liter DOHC 24 valve engine.

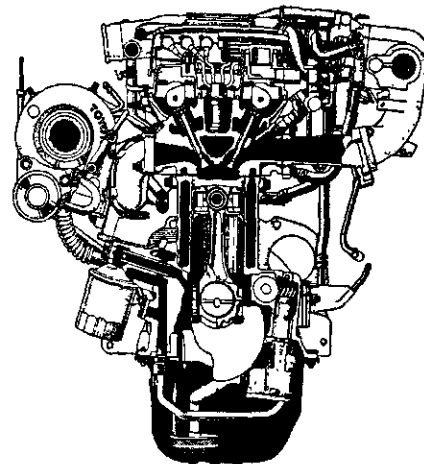
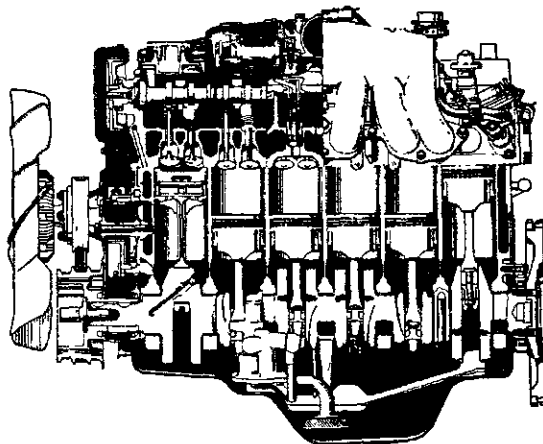
7M-GE (MA)



7M-GE (MS)



7M-GTE



The 7M-GE, 7M-GTE engines are an in-line 6-cylinder engine with the cylinders numbered 1-2-3-4-5-6 from the front. The crankshaft is supported by 7 bearings specified by the inside of the crankcase. These bearings are made of kelmet.

The crankshaft is integrated with 8 weights which are cast along with it for balancing. Oil holes are built into the crankshaft for supplying oil to the connecting rods, pistons and other components.

These engine's ignition order is 1-5-3-6-2-4. The cylinder head is made of aluminum alloy, with a cross flow type intake and exhaust layout and with pent roof type combustion chambers. The spark plugs are located in the center of the combustion chambers.

Exhaust and intake valves are equipped with irregular pitch springs with symmetrical ends made of oil tempered silicon chrome steel wire which are capable of following the valves even at high engine speeds.

Both the exhaust side cam shaft and the intake side cam shaft are driven by a single timing belt. The cam journal is supported at 7 places between the valve lifters of each cylinder and on the cylinder head of front end. Lubrication of the cam journal and cam is accomplished by oil being supplied through the oiler port in the center of the camshaft.

Adjustment of the valve clearance is done by means of an outer shim type system, in which valve adjusting shims are located above the valve lifters. This permits replacement of the shims without removal of the camshafts.

The resin timing belt cover is made in 2 pieces.

Pistons are made of highly temperature-resistant aluminum alloy, and depressions are built into the piston head to prevent interference with valves.

Piston pins are the full-floating type, with the pins fastened to neither the piston boss nor the connecting rods. Instead, snap rings are fitted on both ends of the pins, preventing the pins from falling out.

The No. 1 compression ring is made of stainless steel and the No. 2 compression ring is made of cast iron. The oil ring is made of a combination of stainless steel. The outer diameter of each piston ring is slightly larger than the diameter of the piston and the flexibility of the rings allows them to hug the cylinder walls when they are mounted on the piston. Compression rings No. 1 and No. 2 work to prevent the leakage of gas from the cylinder and the oil ring works to scrape oil off the cylinder walls to prevent it from entering the combustion chamber.

The cylinder block is made of cast iron. It has 6 cylinders which are approximately 1.6 times the length of the piston stroke. The top of the cylin-

ders is closed off by the cylinder head and the lower end of the cylinders becomes the crankcase, in which the crankshaft is installed. In addition, the cylinder block contains a water jacket, through which coolant is pumped to cool the cylinders.

The oil pan is bolted onto the bottom of the cylinder block. The oil pan is an oil reservoir made of pressed steel sheet. A dividing plate is included inside the oil pan to keep sufficient oil in the bottom of the pan even when the vehicle is tilted. This dividing plate also prevents the oil from making waves when the vehicle is stopped suddenly and thus shifting the oil away from the oil pump suction pipe.

## TROUBLESHOOTING

| Problem                                                | Possible cause                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Remedy                                                                                                                                                                                                                                                                                                               | Page                                                                                                                                                      |
|--------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Engine overheats                                       | Cooling system faulty<br>Incorrect ignition timing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Troubleshoot cooling system<br>Reset timing                                                                                                                                                                                                                                                                          | CO-4<br>EM-17                                                                                                                                             |
| Engine will not crank or cranks slowly                 | Starting system faulty                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Troubleshoot starting system                                                                                                                                                                                                                                                                                         | ST-2                                                                                                                                                      |
| Engine will not start/<br>hard to start<br>(cranks OK) | Vacuum leaks <ul style="list-style-type: none"> <li>● PCV hoses</li> <li>● (w/ EGR) EGR valve</li> <li>● Intake manifold</li> <li>● Air intake chamber</li> <li>● Throttle body</li> <li>● ISC valve</li> </ul> Pulling in air between air flow meter and throttle body<br>Ignition problems <ul style="list-style-type: none"> <li>● Ignition coil</li> <li>● Igniter</li> <li>● (7M-GE) Distributor (7M-GTE)</li> <li>● Cam position sensor</li> </ul> High-tension cord disconnected or broken<br>No fuel supply to injector <ul style="list-style-type: none"> <li>● No fuel in tank</li> <li>● Fuel pump not working</li> <li>● Fuel filter clogged</li> <li>● Fuel line clogged or leaking</li> </ul> EFI system problems<br>ISC system problem<br>Spark plugs faulty<br>Low compression | Repair as necessary<br><br><br><br><br><br><br><br><br><br><br>Repair as necessary<br>Perform spark test<br><br><br><br><br><br><br><br><br><br><br>Inspect cord<br>Troubleshoot EFI system<br><br><br><br><br><br><br><br><br><br><br>Repair as necessary<br>Check ISC system<br>Inspect plugs<br>Check compression | FI-96, 98<br>IG-5, 12<br><br><br><br><br><br><br><br><br><br><br>IG-6, 13<br>FI-12<br><br><br><br><br><br><br><br><br><br><br>FI-108<br>IG-7<br>EM-26, 27 |
| Rough idle, stalls or misses                           | Vacuum leaks <ul style="list-style-type: none"> <li>● PCV hoses</li> <li>● (w/ EGR) EGR valve</li> <li>● Intake manifold</li> <li>● Air intake chamber</li> <li>● Throttle body</li> <li>● ISC valve</li> </ul> Pulling in air between air flow meter and throttle body<br>Incorrect idle speed<br>Incorrect ignition timing<br>Ignition problems <ul style="list-style-type: none"> <li>● Ignition coil</li> <li>● Igniter</li> <li>● (7M-GE) Distributor (7M-GTE)</li> <li>● Cam position sensor</li> </ul> High-tension cord faulty<br>EFI system problems                                                                                                                                                                                                                                  | Repair as necessary<br><br><br><br><br><br><br><br><br><br><br>Check ISC system<br>Reset timing<br>Perform spark test<br><br><br><br><br><br><br><br><br><br><br>Inspect cord<br>Repair as necessary                                                                                                                 | FI-96, 98<br><br><br><br><br><br><br><br><br><br><br>FI-108<br>EM-17<br>IG-5, 12<br><br><br><br><br><br><br><br><br><br><br>IG-6, 13                      |

| <b>Problem</b>                                            | <b>Possible cause</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Remedy</b>                                                                                                                                                                                                                      | <b>Page</b>                                                                                                                                                 |
|-----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rough idle, stalls or misses (cont'd)                     | Spark plugs faulty<br>Engine overheats<br>Low compression                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Inspect plugs<br>Check cooling system<br>Check compression                                                                                                                                                                         | IG-7<br>CO-4<br>EM-26, 27                                                                                                                                   |
| Engine hesitates/<br>poor acceleration                    | Vacuum leaks <ul style="list-style-type: none"> <li>● PCV hoses</li> <li>● (w/ EGR) EGR valve</li> <li>● Intake manifold</li> <li>● Air intake chamber</li> <li>● Throttle body</li> <li>● ISC valve</li> </ul> Pulling in air between air flow meter and throttle body<br>Incorrect ignition timing<br>Emission control system problem (cold engine) <ul style="list-style-type: none"> <li>● (w/ EGR) EGR system always on</li> </ul> High-tension cord faulty<br>Fuel system clogged<br>Air cleaner clogged<br>EFI system problems<br>Spark plugs faulty<br>Engine overheats<br>Low compression | Repair as necessary<br><br><br><br><br><br>Reset timing<br><br><br>Check EGR system<br>Inspect cord<br>Check fuel system<br>Check air cleaner<br>Repair as necessary<br>Inspect plugs<br>Check cooling system<br>Check compression | <br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br>FI-96, 98<br>EM-17<br><br><br>IG-6, 1<br>FI-73<br>EM-7<br><br>IG-7<br>CO-4<br>EM-26, 27 |
| Engine diesels (runs after ignition switch is turned off) | EFI system problems                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Repair as necessary                                                                                                                                                                                                                |                                                                                                                                                             |
| Muffler explosion (after fire) on deceleration only       | Deceleration fuel cut system always off                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Check EFI (fuel cut) system                                                                                                                                                                                                        | FI-128                                                                                                                                                      |
| Muffler explosion (after fire) all the time               | Air cleaner clogged<br>EFI system problem<br>Incorrect ignition timing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Check air cleaner<br>Repair as necessary<br>Reset timing                                                                                                                                                                           | EM-7<br>EM-17                                                                                                                                               |
| Engine backfires                                          | Vacuum leak <ul style="list-style-type: none"> <li>● PCV hoses</li> <li>● (w/ EGR) EGR valve</li> <li>● Intake manifold</li> <li>● Air intake chamber</li> <li>● Throttle body</li> <li>● ISC valve</li> </ul> Pulling in air between air flow meter and throttle body<br>EFI system problem<br>Insufficient fuel flow<br>Incorrect ignition timing<br>Carbon deposits in combustion chambers                                                                                                                                                                                                      | Check hoses and repair as necessary<br><br><br>Repair as necessary<br><br>Repair as necessary<br>Troubleshoot fuel system<br>Reset timing<br>Inspect cylinder head                                                                 | <br><br><br><br><br><br><br>FI-96, 98<br><br><br>EM-17<br>EM-37                                                                                             |

**TROUBLESHOOTING (Cont'd)**

| <b>Problem</b>            | <b>Possible cause</b>                 | <b>Remedy</b>                    | <b>Page</b> |
|---------------------------|---------------------------------------|----------------------------------|-------------|
| Excessive oil consumption | Oil leak                              | Repair as necessary              |             |
|                           | PCV line clogged                      | Check PCV system                 |             |
|                           | Piston rings worn or damaged          | Check rings                      | EM-65       |
|                           | Valve stem and guide worn             | Check valves                     | EM-37       |
|                           | Valve stem seal worn                  | Check seals                      | EM-37       |
| Poor fuel economy         | Fuel leak                             | Repair as necessary              |             |
|                           | Air cleaner clogged                   | Check air cleaner                | EM-7        |
|                           | Incorrect ignition timing             | Reset timing                     | EM-17       |
|                           | EFI system problems                   | Repair as necessary              |             |
|                           | • Injector faulty                     |                                  |             |
|                           | • Deceleration fuel cut system faulty |                                  |             |
|                           | Idle speed too high                   | Check ISC system                 | FI-108      |
|                           | Spark plugs faulty                    | Inspect plugs                    | IG-7        |
|                           | EGR system always on                  | Check EGR system                 |             |
|                           | Low compression                       | Check compression                | EM-26, 27   |
|                           | Tires improperly inflated             | Inflate tires to proper pressure |             |
|                           | Clutch slips                          | Troubleshoot clutch              |             |
|                           | Brakes drag                           | Troubleshoot brakes              |             |
| Unpleasant odor           | Incorrect idle speed                  | Check ISC system                 | FI-108      |
|                           | Incorrect ignition timing             | Reset timing                     | EM-17       |
|                           | Vacuum leaks                          | Repair as necessary              |             |
|                           | • PCV hoses                           |                                  |             |
|                           | • (w/ EGR)                            |                                  |             |
|                           | EGR valve                             |                                  |             |
|                           | • Intake manifold                     |                                  |             |
|                           | • Air intake chamber                  |                                  |             |
|                           | • Throttle body                       |                                  |             |
|                           | EFI system problems                   | Repair as necessary              |             |

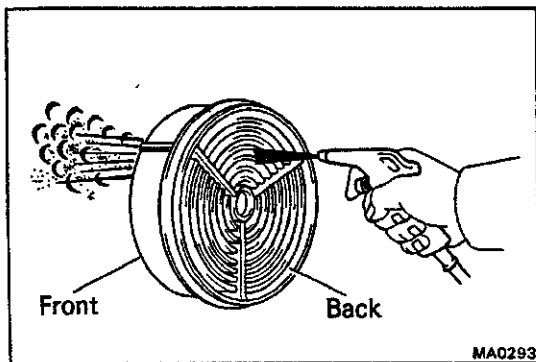
## ENGINE TUNE-UP

### INSPECTION OF ENGINE COOLANT

(See page CO-5)

### INSPECTION OF ENGINE OIL

(See page LU-5)



### INSPECTION OF AIR FILTER

- (a) Visually check that the air cleaner element is not excessively dirty, damaged or oily.
- (b) Clean the element with compressed air. First blow from back side thoroughly. Then blow off the front side of the element.

### INSPECTION OF BATTERY

(See page CH-3)

### INSPECTION OF HIGH-TENSION CORDS

(See pages IG-6, 13)

### INSPECTION OF SPARK PLUGS

(See pages IG-7 to 9)

### INSPECTION OF DRIVE BELT

(See page CH-4)

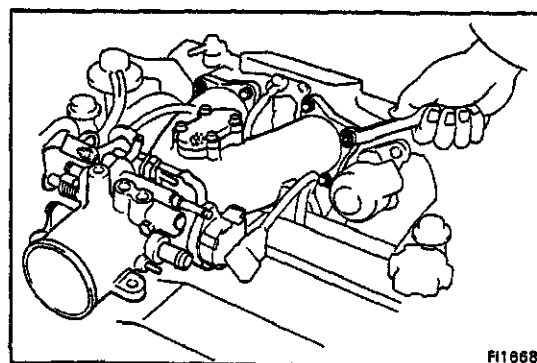
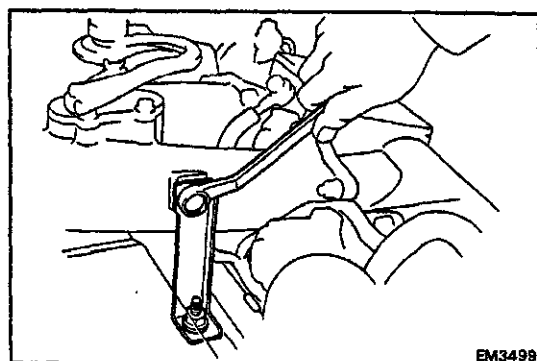
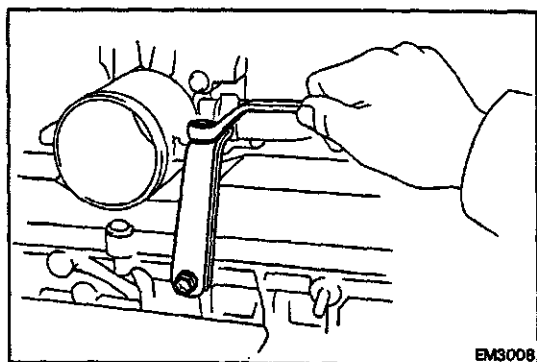
## INSPECTION AND ADJUSTMENT OF VALVE CLEARANCE

**NOTE:** Check and adjust the valve clearance while the engine is cold.

### (7M-GE)

#### 1. REMOVE AIR INTAKE CONNECTOR

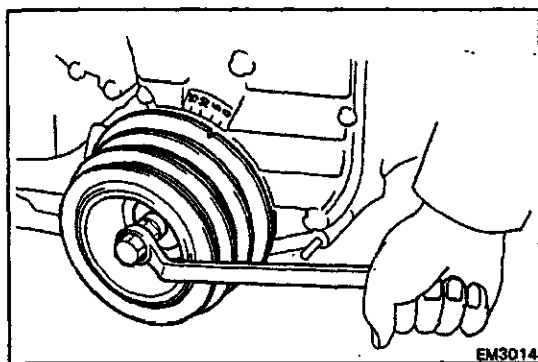
- (a) Remove the PCV pipe.
- (b) (ex. MS RHD)  
Disconnect the accelerator connecting rod.
- (c) Disconnect the water by-pass hoses from the throttle body.
- (d) Disconnect following hoses:
  - (w/ EGR)  
VSV hose(for EGR)
  - (w/ TWC)  
BVSV hose
  - (w/ EGR)  
EGR vacuum modulator hoses
  - No.7 air hose
- (e) Disconnect the throttle position sensor connector.
- (f) Remove the throttle body bracket(s).



- (g) Remove the air intake connector bracket mounting bolts.

- (h) Remove the four bolts, two nuts, air intake connector and gasket.

#### 2. REMOVE CYLINDER HEAD COVERS (See pages EM-59, 60)

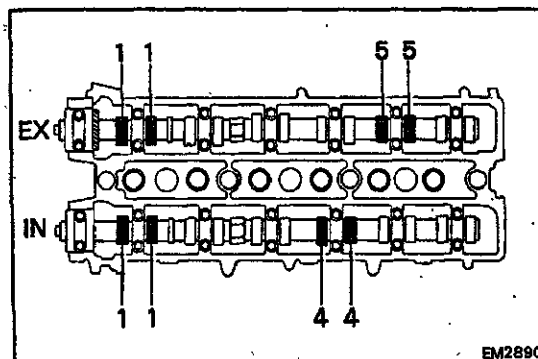


### 3. MEASURE VALVE CLEARANCE

#### (a) Set No.1 cylinder to TDC/compression.

- Turn the crankshaft pulley and align its groove with the "O" mark on the No.1 timing belt cover.
- Check that the valve lifters on the No.1 cylinder are loose and valve lifters on the No.6 cylinder are tight.

If not, turn the crankshaft pulley one complete revolution.

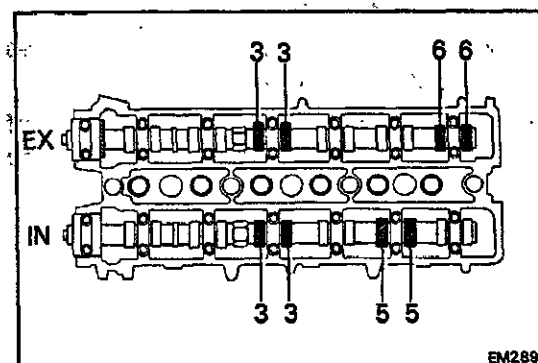


#### (b) Measure the clearance of No.1 (IN) and No.4 (IN) and No.1 (EX) and No.5 (EX) valves.

- Measure only those valves indicated in the figure.
- Record the measurements which are out of specification. They will be used later to determine the required replacement shims.

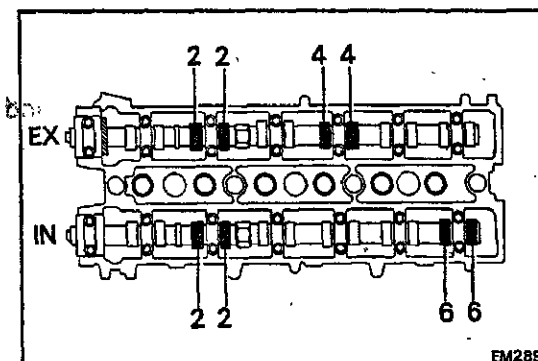
#### Valve clearance (Cold):

Intake 0.15 – 0.25 mm (0.0059 – 0.0098 in)  
Exhaust 0.20 – 0.30 mm (0.0079 – 0.0118 in)



#### (c) Turn the crankshaft pulley 2/3 revolution (240°) and measure the clearance of No.3 (IN) and No.5 (IN) and No.3 (EX) and No.6 (EX) valves.

- Check that the valve lifters on the No.3 cylinder are loose.
- Measure only those valves indicated in the figure.
- Record the measurements which are out of specification. They will be used later to determine the required replacement shims.



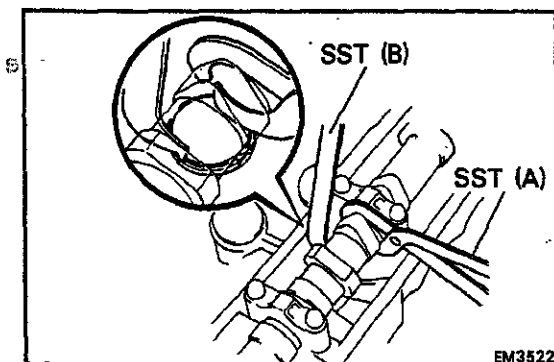
#### (d) Turn the crankshaft pulley 2/3 revolution (240°) and measure the clearance of No.2 (IN) and No.6 (IN) and No.2 (EX) and No.4 (EX) valves.

- Check that the valve lifters on the No.2 cylinder are loose.
- Measure only those valves indicated in the figure.
- Record the measurements which are out of specification. They will be used later to determine the required replacement shims.

### 4. ADJUST VALVE CLEARANCE

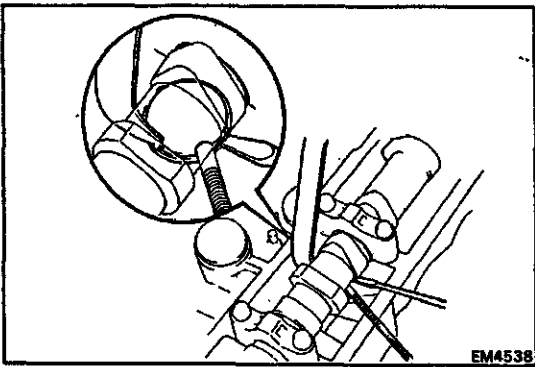
#### (a) Remove the adjusting shim.

- Turn the crankshaft pulley to position the lobe on the adjusting valve camshaft upward.
- Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter. Remove SST (A).

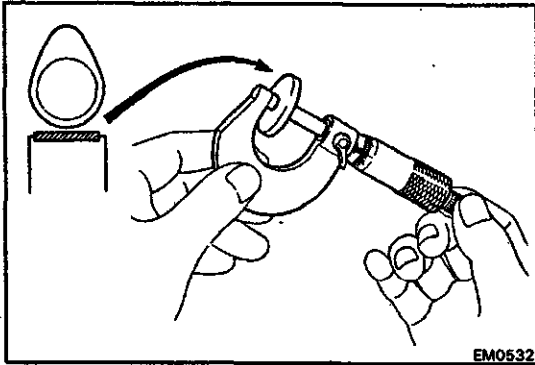


SST 09248-55010

NOTE: Before pressing down the valve lifter, position the notch toward the spark plug.



- Remove the adjusting shim with a small screwdriver and magnetic finger.



- (b) Determine the replacement shim size by using the following (Formula or Chart).

- Using a micrometer, measure the thickness of the shim which was removed.
- Calculate the thickness of the new shim so the valve clearance comes within specified value.

T ..... Thickness of shim used

A ..... Valve clearance measured

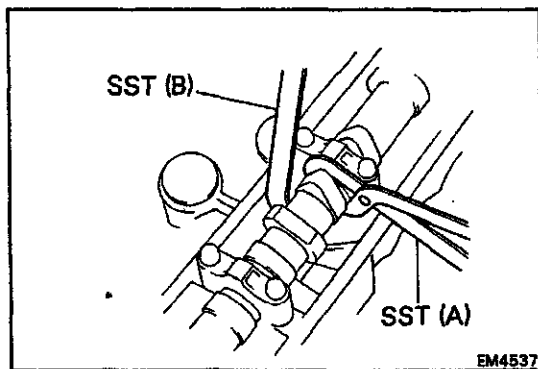
N ..... Thickness of shim new

Intake  $N = T + (A - 0.20 \text{ mm (0.0079 in.)})$

Exhaust  $N = T + (A - 0.25 \text{ mm (0.0098 in.)})$

- Select a new shim with a thickness as close as possible to the calculated value.

NOTE: Shims are available in 17 sizes, in increments of 0.050 mm (0.0020 in.), from 2.500 mm (0.0984 in.) to 3.300 mm (0.1299 in.).



- (c) Install a new adjusting shim.

- Place a new adjusting shim on the valve lifter.
- Using SST (A), press down the valve lifter and remove SST (B).

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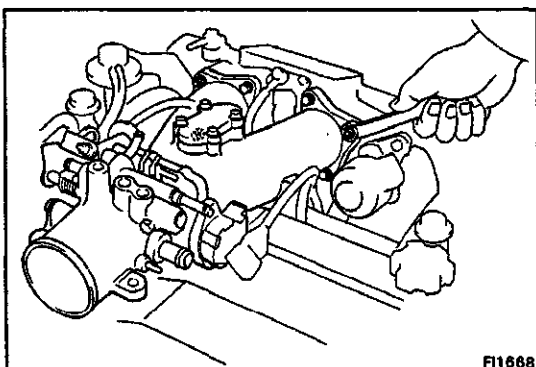
## 5. RECHECK VALVE CLEARANCE

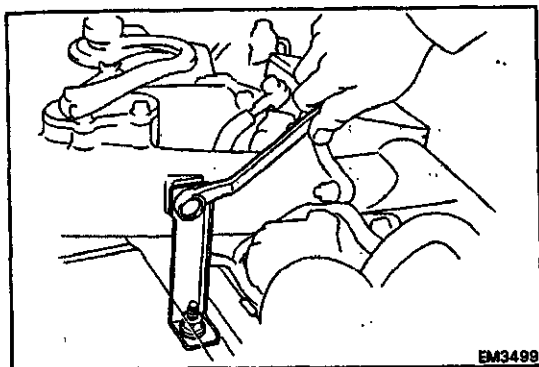
## 6. INSTALL CYLINDER HEAD COVERS (See pages EM-59, 60)

## 7. INSTALL AIR INTAKE CONNECTOR

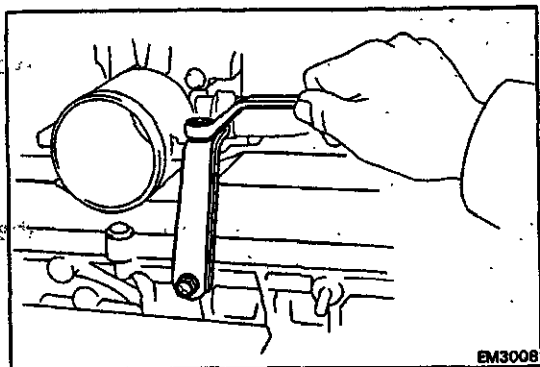
- (a) Install a new gasket and air intake connector with the four bolts and two nuts.

Torque: 180 kg-cm (13 ft-lb, 18 N·m)





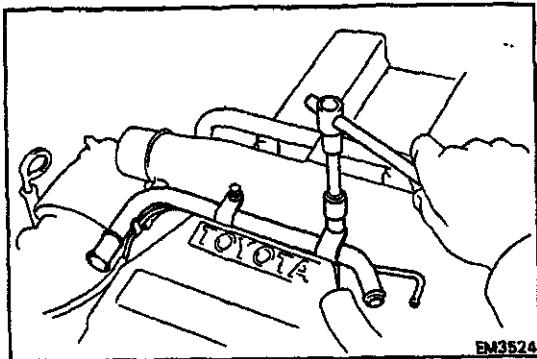
- (b) Install the air intake connector bracket mounting bolts.



- (c) Install the throttle body bracket(s).  
(d) Connect the throttle position sensor connector.  
(e) Connect following hoses:
  - No.7 air hose
  - (w/ EGR)  
EGR vacuum modulator hoses
  - (w/ TWC)  
BVSV hose
  - (w/ EGR)  
VSV hose (for EGR)(f) Connect the water by-pass hoses.  
(g) (ex. MS RHD)  
Connect the accelerator connecting rod.  
(h) Install the PCV pipe.

**(7M-GTE)****1. REMOVE ISC PIPE**

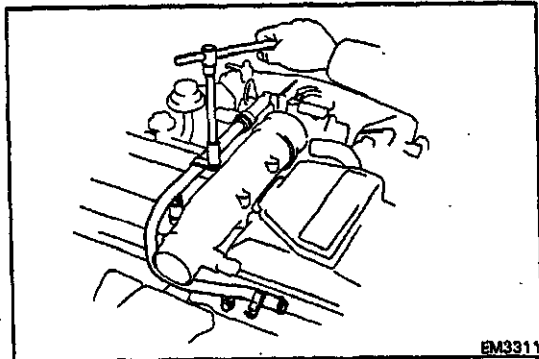
- (a) Disconnect the hoses from the ISC pipe.
- (b) Remove the two bolts and ISC pipe.



EM3524

**2. REMOVE PCV PIPE WITH HOSES**

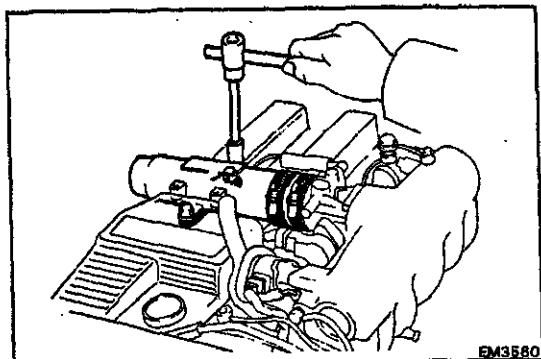
- (a) Disconnect the oxygen sensor wire from the two clamp.
- (b) Disconnect the No.4 PCV hose from the PCV pipe.
- (c) Remove the two bolts.
- (d) Disconnect the PCV pipe with hoses from the cylinder head covers and throttle body.



EM3311

**3. REMOVE INTAKE AIR CONNECTOR**

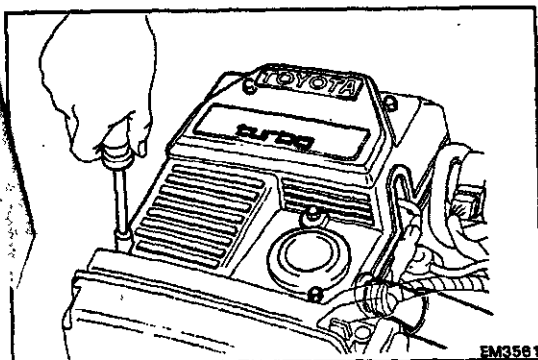
- (a) Disconnect the air valve hose from the intake air connector.
- (b) Loosen the clamp and remove the two bolts.
- (c) Remove the intake air connector.



EM3580

**4. REMOVE IGNITION COVER**

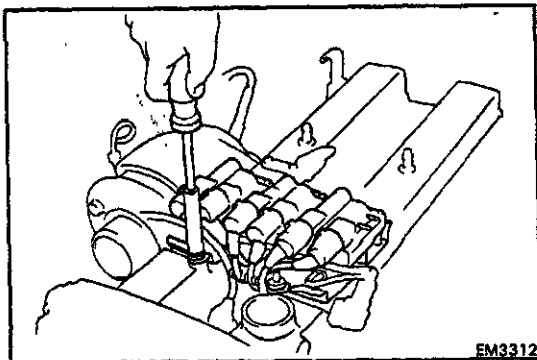
- (a) Remove the oil filler cap.
- (b) Remove the five nuts and ignition coil cover.



EM3581

**5. REMOVE IGNITION COIL WITH BRACKET**

- (a) Disconnect the connector and ground strap.
- (b) Remove the nut.
- (c) Remove the No.1 and No.2 high-tension cords from the ignition coil and clamp.
- (d) Remove the ignition coil with bracket and high-tension cords.
- (e) Remove the No.1 and No.2 high-tension cords from the spark plugs.



EM3312

**6. REMOVE CYLINDER HEAD COVERS**

- (a) Remove the accelerator link.
- (b) Disconnect the No.3 PCV hose.
- (c) Remove the cylinder head covers.

**7. MEASURE VALVE CLEARANCE**  
(See step 3 on page EM-9)**8. ADJUST VALVE CLEARANCE**  
(See step 4 on pages EM-9, 10)**9. RECHECK VALVE CLEARANCE****10. INSTALL CYLINDER HEAD COVERS**  
(See pages EM-59, 60)**11. INSTALL IGNITION COIL WITH BRACKET**

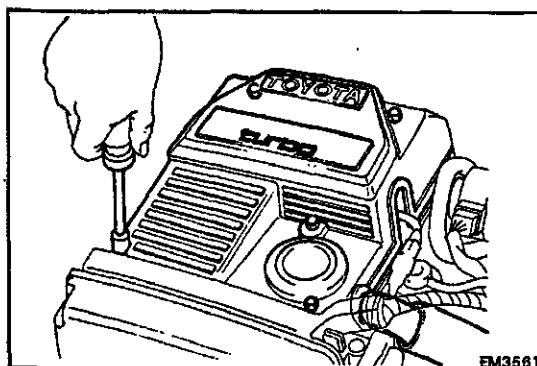
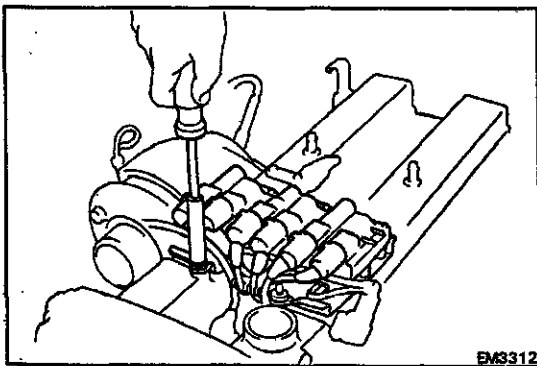
- (a) Install the No.1 and No.2 high-tension cords to spark plugs.
- (b) Install the ignition coil with bracket and high-tension cord. (See page IG-15)
- (c) Install the No.1 and No.2 high-tension cords to ignition coil and clamp.

- (d) Install and torque the nut.

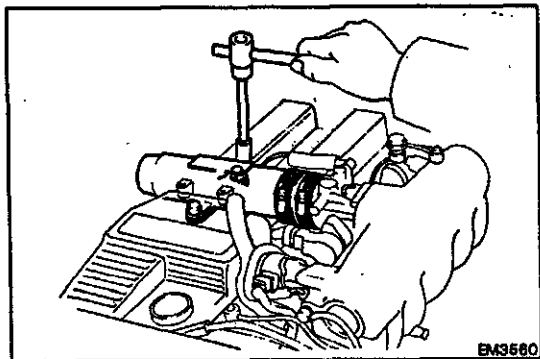
**Torque: 55 Kg-cm (48 in.-lb, 5.4 N·m)**

**NOTE:** Do not over tighten the nut.

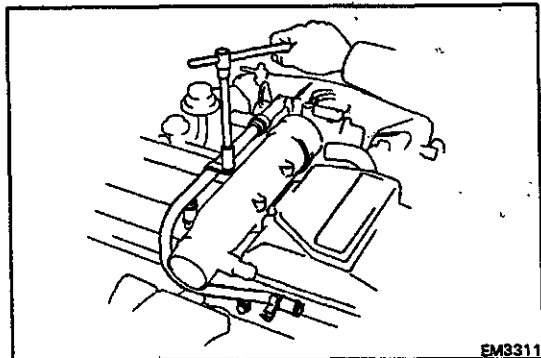
- (e) Connect the ground strap and connector.

**12. INSTALL IGNITION COIL COVER**

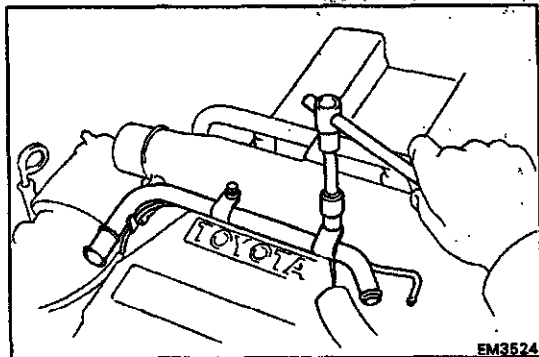
- (a) Install the ignition coil cover with the five nuts.
- (b) Install the oil filler cap.

**13. INSTALL INTAKE AIR CONNECTOR**

- (a) Install the intake air connector to throttle body.
- (b) Install and tighten the two nuts.
- (c) Tighten the clamp.
- (d) Connect the air valve hose to intake air connector.

**14. INSTALL PCV PIPE WITH HOSES**

- (a) Install the PCV pipe with hoses to the throttle body and cylinder head covers.
- (b) Install and tighten the two bolts.
- (c) Connect the No.4 PCV hose to the PCV pipe.
- (d) Connect the oxygen sensor wire to the two clamps.

**15. INSTALL ISC PIPE**

- (a) Install the ISC pipe with the two bolts.
- (b) Connect the hoses to the ISC pipe.

## Adjusting Shim Selection Using Chart

## INTAKE

Installed Shim Thickness (mm)

| Shim No. | Thickness      | Shim No. | Thickness      |
|----------|----------------|----------|----------------|
| 02       | 2.500 (0.0984) | 20       | 2.950 (0.1161) |
| 04       | 2.550 (0.1004) | 22       | 3.000 (0.1181) |
| 06       | 2.600 (0.1024) | 24       | 3.050 (0.1201) |
| 08       | 2.650 (0.1043) | 26       | 3.100 (0.1220) |
| 10       | 2.700 (0.1063) | 28       | 3.150 (0.1240) |
| 12       | 2.750 (0.1083) | 30       | 3.200 (0.1260) |
| 14       | 2.800 (0.1102) | 32       | 3.250 (0.1280) |
| 16       | 2.850 (0.1122) | 34       | 3.300 (0.1299) |
| 18       | 2.900 (0.1142) |          |                |

Intake valve clearance (cold):

0.15 – 0.25 mm (0.006 – 0.010 in.)

Example: A 2.800 mm shim is installed and the measured clearance is 0.450 mm  
 Replace the 2.800 mm shim with shim No. 24 (3.050 mm).

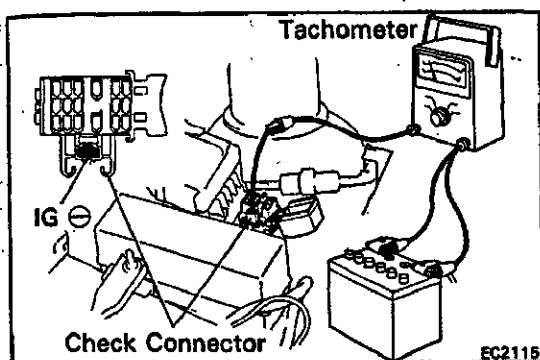
Shim thickness mm (in.)

| Shim No. | Thickness      | Shim No. | Thickness      |
|----------|----------------|----------|----------------|
| 02       | 2.500 (0.0984) | 20       | 2.950 (0.1161) |
| 04       | 2.550 (0.1004) | 22       | 3.000 (0.1181) |
| 06       | 2.600 (0.1024) | 24       | 3.050 (0.1201) |
| 08       | 2.650 (0.1043) | 26       | 3.100 (0.1220) |
| 10       | 2.700 (0.1063) | 28       | 3.150 (0.1240) |
| 12       | 2.750 (0.1083) | 30       | 3.200 (0.1260) |
| 14       | 2.800 (0.1102) | 32       | 3.250 (0.1280) |
| 16       | 2.850 (0.1122) | 34       | 3.300 (0.1299) |
| 18       | 2.900 (0.1142) |          |                |

## EXHAUST

[illegible]

**Example:** A 2.800 mm shim is installed and the measured clearance is 0.450 mm. Replace the 2.800 mm shim with shim No. 22 (3.000 mm).



## INSPECTION AND ADJUSTMENT OF IGNITION TIMING

### 1. WARM UP ENGINE

Allow the engine to reach normal operating temperature.

### 2. CONNECT TACHOMETER AND TIMING LIGHT TO ENGINE

Connect the tachometer positive terminal to the check connector terminal IG ⊖.

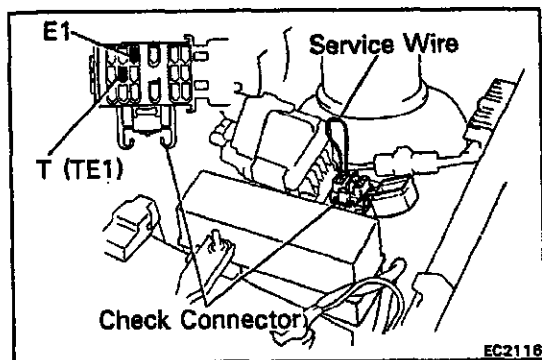
CHECK CONNECTOR LOCATION:

See pages FI-110, 111

#### CAUTION:

- Never allow the tachometer terminal to touch ground as it could result in damage to the igniter and/or ignition coil.
- As some tachometers are not compatible with this ignition system, we recommend that you confirm the compatibility of your unit before using.

NOTE (7M-GTE): Connect the timing light pickup to the No.6 cylinder high-tension cord.



### 3. CHECK IGNITION TIMING

- (a) Using a service wire, short terminals T(MA) or TE1(MS) and E1 of the check connector.

CHECK CONNECTOR LOCATION:

See pages FI-110, 111

- (b) Check the idle speed.

Idle speed:

|        |         |         |
|--------|---------|---------|
| 7M-GE  | w/ TWC  | 700 rpm |
|        | w/o TWC | 800 rpm |
| 7M-GTE |         | 800 rpm |

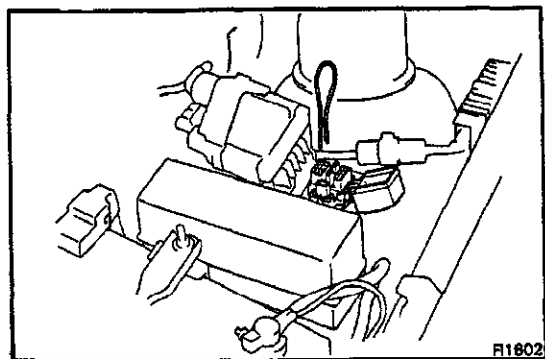
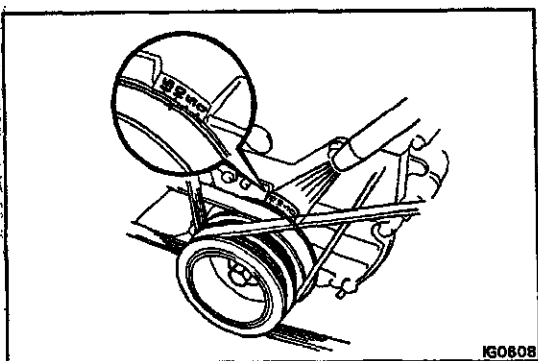
- (c) Using a timing light, check the ignition timing.

Ignition timing: 10° BTDC @ idle

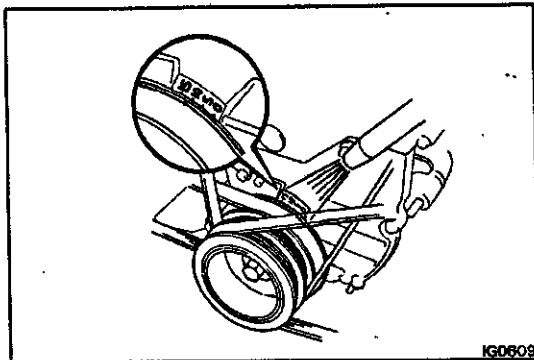
[w/ short-circuited T (TE1) and E1 and Transmission in "N" range]

If necessary, loosen the distributor (7M-GE) or cam position sensor (7M-GTE) bolt and turn the distributor (cam position sensor) to align the marks. Recheck the timing after tightening the distributor (cam position sensor).

Torque: 140 kg-cm (10 ft-lb, 14 N·m)



- (d) Unshort the check connector.

**4. FURTHER CHECK IGNITION TIMING**

Check that the ignition timing advances.

Ignition timing:

7M-GE 10 – 13° BTDC @ idle

7M-GTE More than 12° BTDC @ idle

**5. DISCONNECT TACHOMETER AND TIMING LIGHT FROM ENGINE**

## INSPECTION AND ADJUSTMENT OF IDLE MIXTURE (w/o TWC)

### 1. INITIAL CONDITIONS

- (a) Air cleaner installed
- (b) Normal engine operating temperature
- (c) All pipes and hoses of air intake system connected
- (d) All accessories switched off
- (e) All vacuum lines properly connected
- (f) EFI system wiring connectors fully plugged
- (g) Ignition timing set correctly
- (h) Transmission in N range

### 2. WARM UP ENGINE

Allow the engine to reach normal operating temperature.

### 3. CONNECT TACHOMETER TO ENGINE (See page EM-17)

### 4. CHECK IDLE SPEED

Idle speed: 800 rpm

### 5. INSPECT AND ADJUST IDLE CO CONCENTRATION

#### CAUTION:

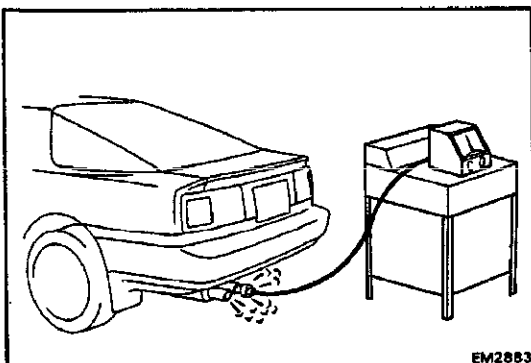
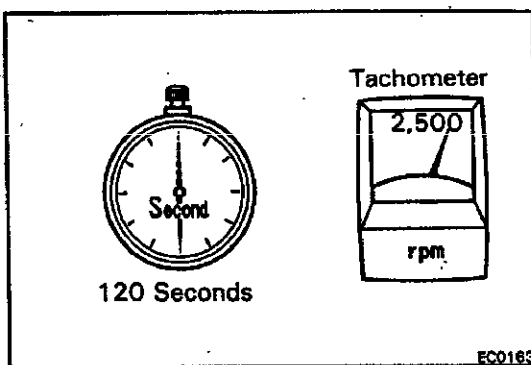
- Always use a CO meter when adjusting the idle mixture. It is not necessary to adjust with the idle mixture adjusting screw in most vehicles if they are in good condition. If a CO meter is not available, DO NOT ATTEMPT TO ADJUST WITH THE SCREW.
- If a CO meter is not available and it is absolutely necessary to adjust with the idle mixture adjusting screw, or if the air flow meter is replaced, use the alternative method.

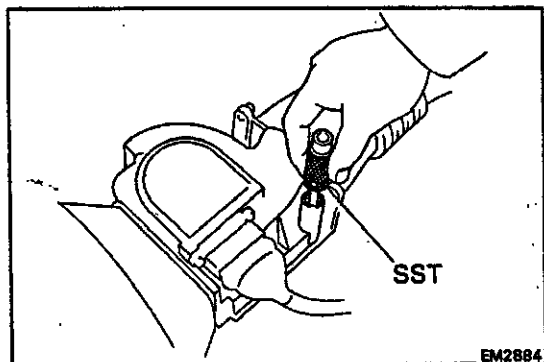
#### A. METHOD WITH CO METER

- (a) Check that the CO meter is properly calibrated.
- (b) Race the engine for approx. 120 seconds at approx. 2,500 rpm before measuring the concentration.
- (c) Wait 1 – 3 minutes after racing the engine to allow the concentration to stabilize.

- (d) Insert a testing probe at least 40 cm (1.3 ft) into the tailpipe, and measure the concentration with a short time.

Idle CO concentration:  $1.0 \pm 0.5 \%$





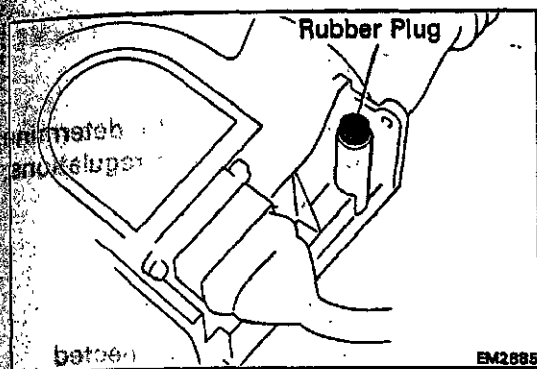
If the CO concentration is not as specified, adjust the idle mixture by turning the idle mixture adjusting screw with SST.

SST 09243-00020

- If the CO concentration is within specification, this adjustment is complete.
- If the CO concentration cannot be corrected by idle mixture adjustment, see the table below for other possible causes.

## Troubleshooting

| HC   | CO     | SYMPTOMS                                 | CAUSES                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------|--------|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| High | Normal | Rough idle                               | <ol style="list-style-type: none"> <li>Faulty ignition: <ul style="list-style-type: none"> <li>● Incorrect timing</li> <li>● Fouled, shorted or improperly gapped plugs</li> <li>● Open or crossed high-tension cords</li> <li>● Cracked distributor cap</li> </ul> </li> <li>Incorrect valve clearance</li> <li>Leaky EGR valve</li> <li>Leaky intake and exhaust valves</li> <li>Leaky cylinder</li> </ol>                                                            |
| High | Low    | Rough idle<br>(Fluctuating HC reading)   | <ol style="list-style-type: none"> <li>Vacuum leak: <ul style="list-style-type: none"> <li>● Vacuum hose</li> <li>● EGR valve</li> <li>● Intake manifold (Air intake chamber)</li> <li>● Throttle body</li> <li>● Cylinder head gasket</li> <li>● Brake booster line</li> </ul> </li> <li>Lean mixture causing misfire</li> </ol>                                                                                                                                       |
| High | High   | Rough idle<br>(Black smoke from exhaust) | <ol style="list-style-type: none"> <li>Restricted air filter</li> <li>Faulty EFI system: <ul style="list-style-type: none"> <li>● Faulty pressure regulator</li> <li>● Clogged fuel return line</li> <li>● Faulty air flow meter</li> <li>● Defective water temp. sensor</li> <li>● Defective air temp. sensor</li> <li>● Faulty ECU</li> <li>● Faulty injector</li> <li>● Faulty cold start injector</li> <li>● Faulty throttle position sensor</li> </ul> </li> </ol> |



- (e) Reinstall the rubber plug into the hole of the idle mixture adjusting screw.

## B. ALTERNATIVE METHOD

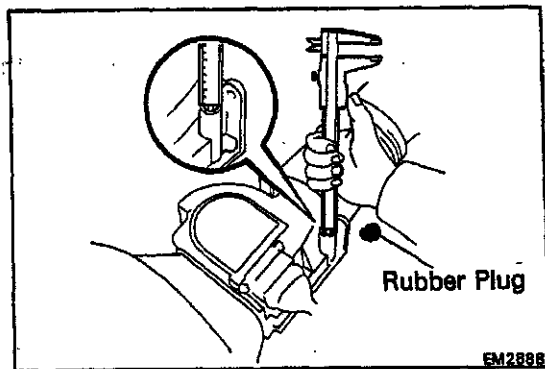
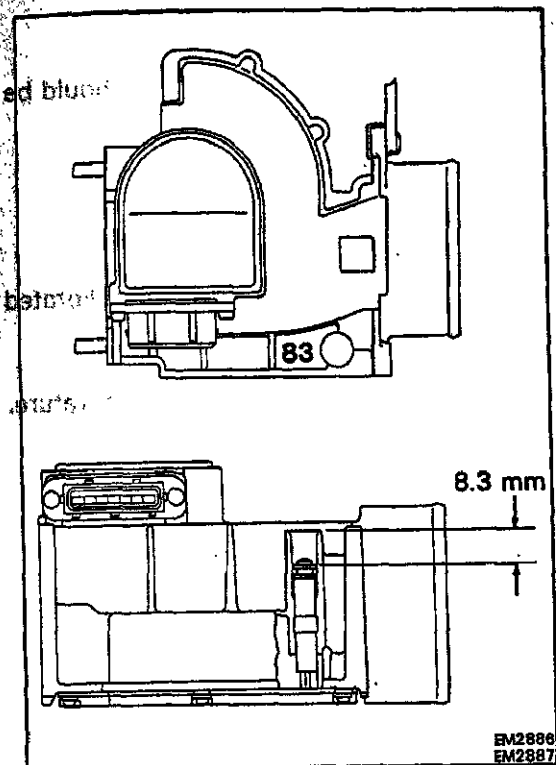
### NOTE:

- This method is to be used **ONLY** when it is absolutely necessary to adjust the idle mixture screw or if the air flow meter is replaced without the aid of a CO meter.
- The inscribed number shows the depth of the idle mixture screw positioned for presetting.

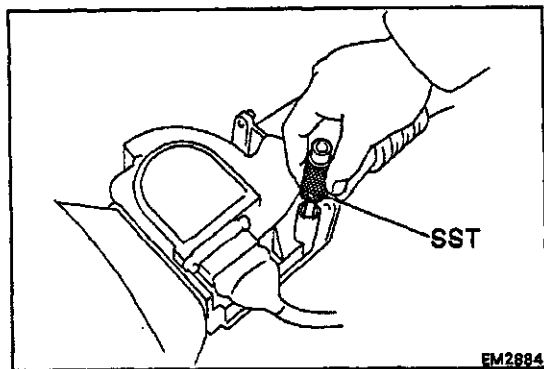
**Example:** Inscribed number depth  
83 → 8.3 mm (0.326 in.)

Depths over 10 mm with a decimal point are abbreviated.

**Example:** Inscribed number depth  
15 → 11.5 mm (0.453 in.)



- (a) Remove the rubber plug from the air flow meter.  
(b) Measure the depth of the idle mixture adjusting screw with vernier calipers.



- (c) Adjust the depth of idle mixture adjusting screw by turning the screw with SST.

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- (d) Reinstall the rubber plug into the hole of the idle mixture adjusting screw.

## INSPECTION OF IDLE HC/CO CONCENTRATION (w/ TWC)

**NOTE:** This check method is used only to determine whether or not the idle HC/CO complies with regulations.

### 1. INSTALL CONDITIONS

- (a) Air cleaner installed
- (b) Normal engine operating temperature
- (c) All pipes and hoses of intake system connected
- (d) All accessories switches off
- (e) All vacuum lines properly connected

**NOTE:** All vacuum hoses for EGR system etc. should be properly connected

- (f) EFI system wiring connectors fully plugged
- (g) Ignition timing set correctly
- (h) Transmission in "N" range
- (i) Tachometer and HC/CO meter at hand and calibrated

### 2. WARM UP ENGINE

Allow the engine to reach normal operating temperature.

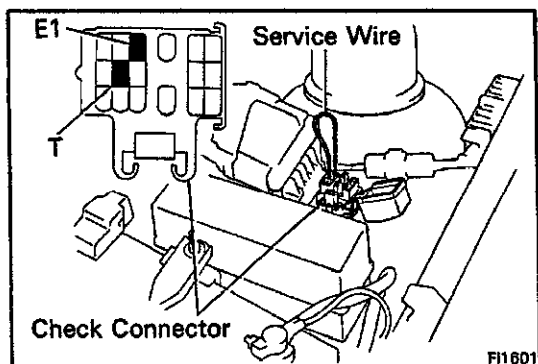
### 3. CONNECT TACHOMETER TO ENGINE

(See page EM-17)

### 4. CHECK IDLE SPEED

Idle speed:

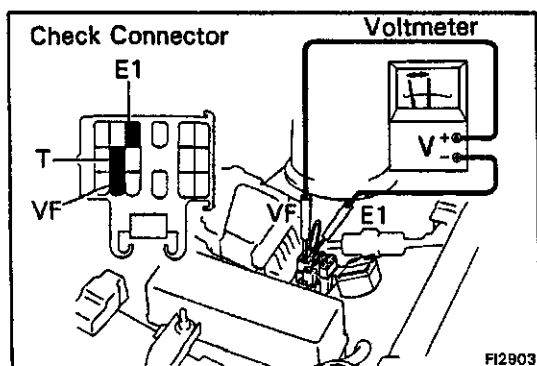
|        |         |
|--------|---------|
| 7M-GE  | 700 rpm |
| 7M-GTE | 800 rpm |



### 5. CHECK OXYGEN SENSOR OPERATION

- (a) Using a service wire, short terminals T and E1 of the check connector.

**CHECK CONNECTOR LOCATION:** See page FI-110



- (b) Connect the positive (+) probe of a voltmeter to terminal VF of the check connector, and negative (-) probe to terminal E1.
- (c) Hold the engine speed at 2,500 rpm for approx. 2 minutes.
- (d) Then, maintaining engine at 2,500 rpm, count how many times needle of voltmeter fluctuates between 0 and 5 V.

**Minimum needle fluctuation:**

**8 times for every 10 seconds**

If the fluctuation is less than minimum, check the air induction system for leakage. If necessary, see EFI SYSTEM.

6. RACE ENGINE AT 2,500 RPM APPROX. 2 MINUTES
7. INSERT TESTING PROBE OF HC/CO METER INTO TAIL PIPE AT 40 cm (1.3 ft)
8. MEASURE HC/CO CONCENTRATION AT IDLE

Wait at least one minute before measuring to allow the concentration to stabilize.

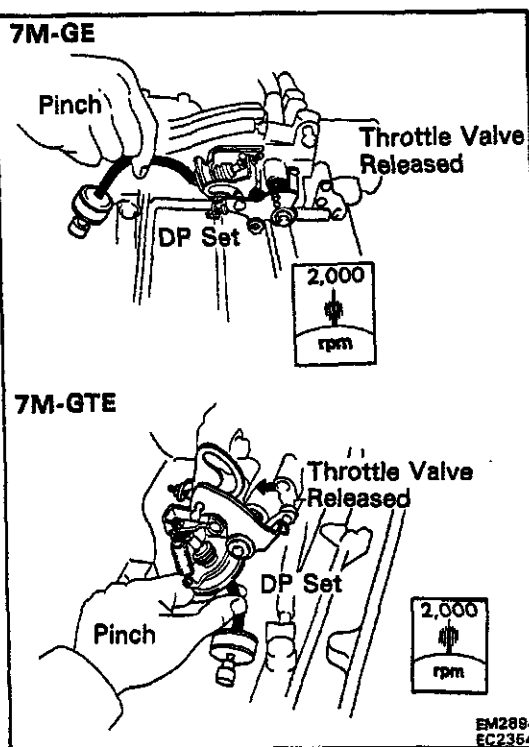
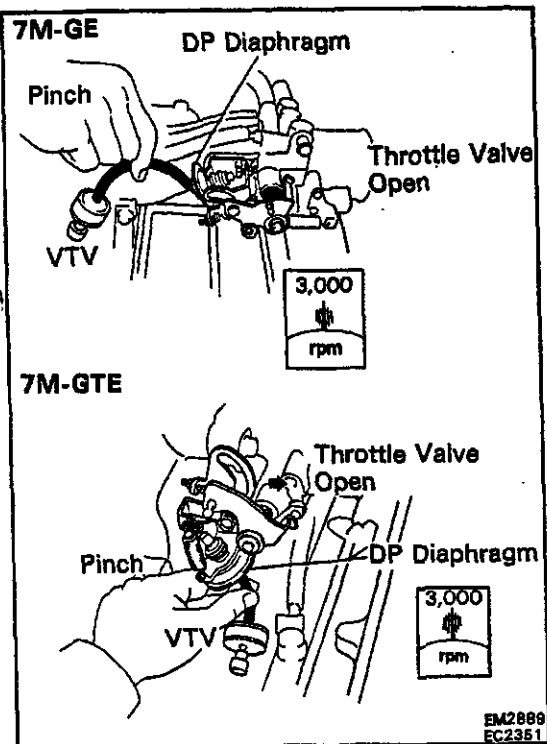
Complete the measuring within three minutes.

Idle CO concentration: 0 — 0.5 %

If the CO/HC concentration does not conform to your regulations, see the table in page EM-20 for possible causes.

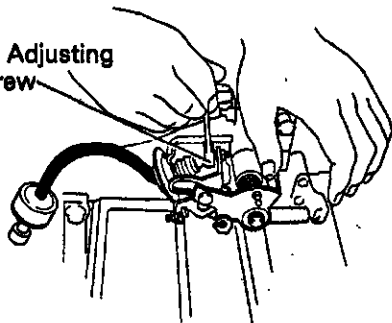
## INSPECTION AND ADJUSTMENT OF DASH POT (DP) SYSTEM

1. WARM UP ENGINE
2. CONNECT TACHOMETER TO ENGINE  
(See page EM-17)
3. CHECK IDLE SPEED
4. INSPECT AND ADJUST DP SETTING SPEED
  - (a) Maintain the engine speed at 3,000 rpm.
  - (b) Pinch the vacuum hose between the DP and VTV.

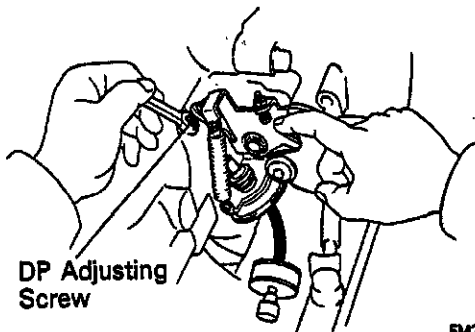


- (c) Release the throttle valve.
  - (d) Check that the DP is set.
- DP setting speed: 2,000 rpm**

## 7M-GE

DP Adjusting  
Screw

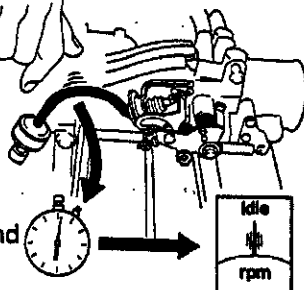
## 7M-GTE

DP Adjusting  
ScrewEM2896  
EC2352

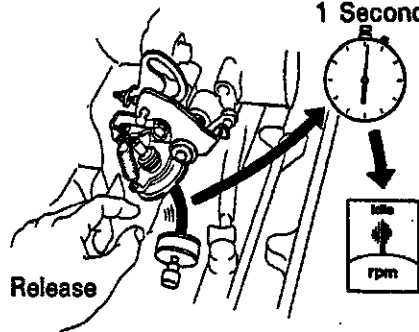
If not at specified speed, adjust with the DP adjusting screw.

## 7M-GE

Release

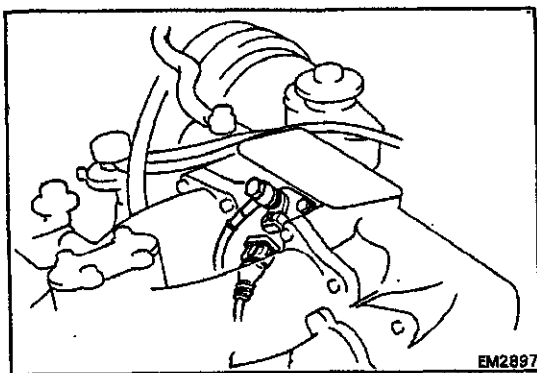
Approx.  
1 Second

## 7M-GTE

Approx.  
1 SecondEM2896  
EC2353

## 5. CHECK OPERATION OF VTV

- (a) Set the DP speed in the same procedure as above; (a) to (c).
- (b) Release the pinched hose and check that the engine returns to idle speed in approx. 1 second.



## COMPRESSION CHECK

**NOTE:** If there is lack of power, excessive oil consumption or poor fuel mileage, measure the cylinder compression pressure.

### (7M-GE)

1. **WARM UP ENGINE**
2. **DISCONNECT COLD START INJECTOR CONNECTOR**
3. **DISCONNECT SOLENOID RESISTOR CONNECTOR**
4. **DISCONNECT DISTRIBUTOR CONNECTOR**
5. **REMOVE THROTTLE BODY**
  - (a) Remove the PCV hose.
  - (b) Disconnect the water by-pass hoses and plug the hose end.
  - (c) Disconnect following hoses:
    - (w/ EGR)  
VSV hoses
    - (w/ TWC)  
BVSV hoses
    - (w/ EGR)  
EGR vacuum modulator hoses
    - No.7 air hose
  - (d) Disconnect the throttle position sensor connector.
  - (e) Remove the throttle body bracket(s).
  - (f) Remove the four bolts, throttle body and gasket.

### 6. REMOVE SPARK PLUGS (See page 1G-7)

### 7. CHECK CYLINDER COMPRESSION PRESSURE

- (a) Insert a compression gauge into the spark plug hole.
- (b) While cranking the engine with the starter motor, measure the compression pressure.

**NOTE:** Always use a fully charged battery to obtain an engine revolution of more than 250 rpm.

- (c) Repeat steps (a) through (b) for each cylinder.

**Compression pressure:**

11.0 kg/cm<sup>2</sup> (156 psi, 1,079 kPa) or more

**Minimum pressure:**

9.0 kg/cm<sup>2</sup> (128 psi, 883 kPa)

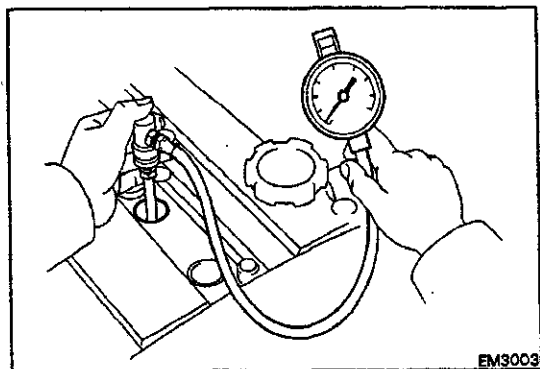
**Difference between each cylinder:**

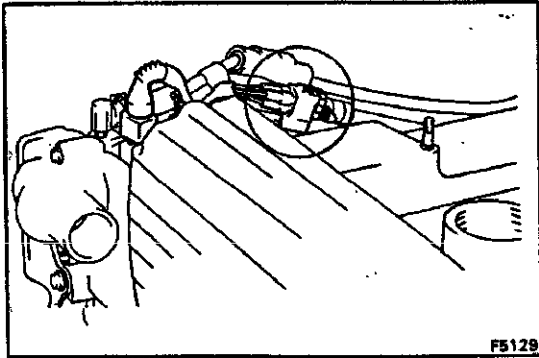
1.0 kg/cm<sup>2</sup> (14 psi, 98 kPa) or less

- (d) If cylinder compression in one or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through (b) for the cylinder with low compression.

- If adding oil helps the compression, chances are that the piston rings and/or cylinder bore are worn or damaged.

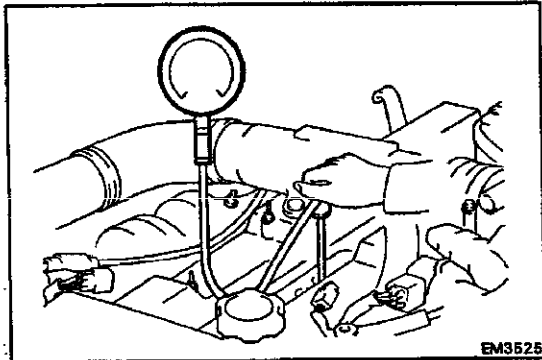
- If pressure stays low, a valve may be sticking or seating improperly, or there may be leakage past



**(7M-GTE)**

1. WARM UP ENGINE
2. DISCONNECT SOLENOID RESISTOR CONNECTOR
3. DISCONNECT CAM POSITION SENSOR CONNECTOR

4. REMOVE NO.1 AIR CLEANER HOSE
5. REMOVE PCV PIPE
6. REMOVE IGNITION COIL  
(See steps 4, 5 on page EM-12)
7. REMOVE SPARK PLUGS (See page IG-12)



8. CHECK CYLINDER COMPRESSION PRESSURE  
(See step 7 on page EM-26)

Compression pressure:

10.0 kg/cm<sup>2</sup> (142 psi, 981 kPa) or more

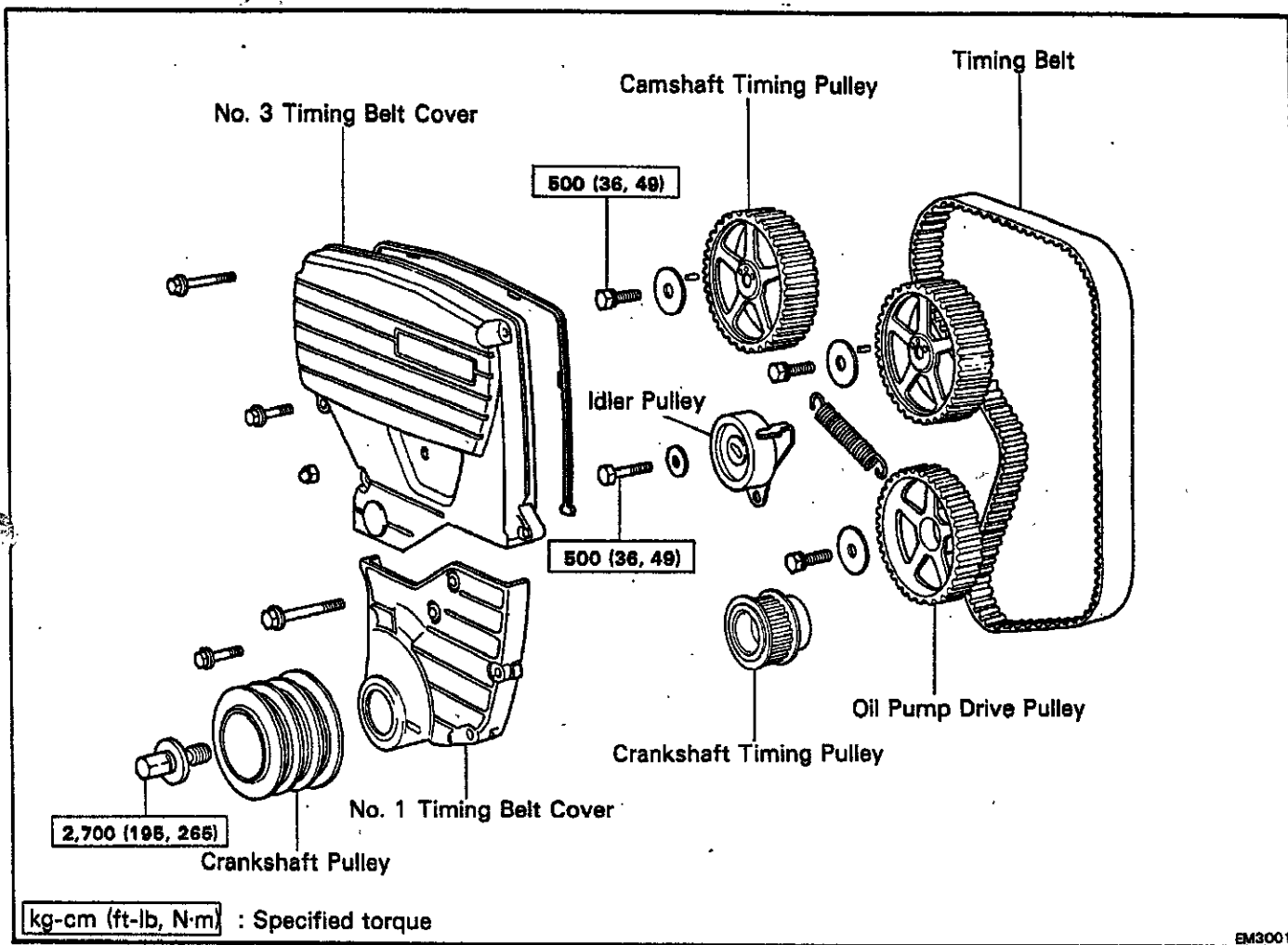
Minimum pressure:

9.0 kg/cm<sup>2</sup> (128 psi, 883 kPa)

Difference between each cylinder:

1.0 kg/cm<sup>2</sup> (14 psi, 98 kPa) or less

## TIMING BELT COMPONENTS



## REMOVAL OF TIMING BELT

### 1. REMOVE SPARK PLUGS

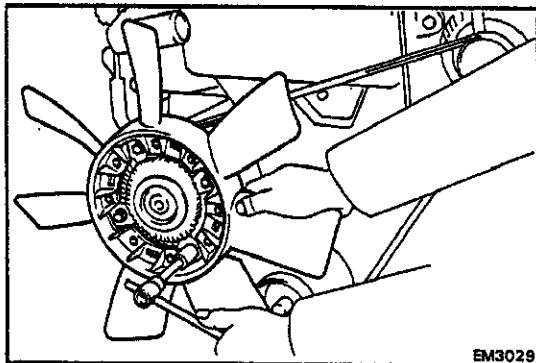
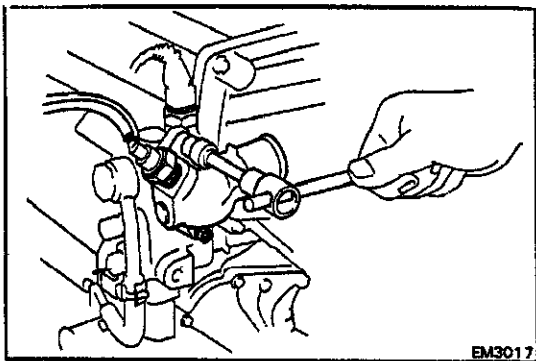
### 2. REMOVE WATER OUTLET

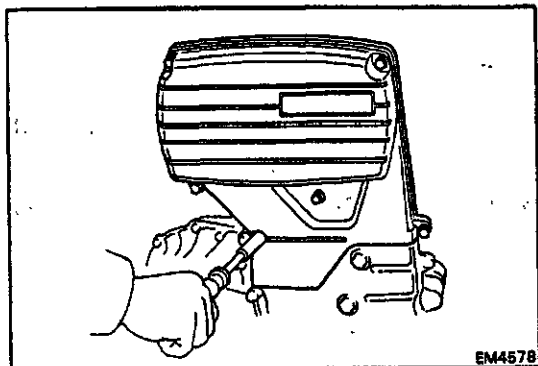
Remove the two bolts, water outlet and thermostat with gasket.

### 3. (with A/C) REMOVE A/C BELT

### 4. REMOVE FAN AND ALTERNATOR DRIVE BELT

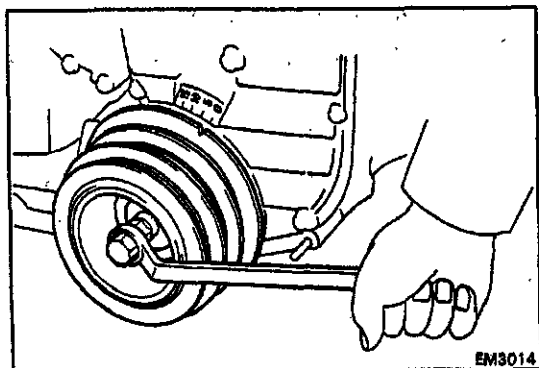
### 5. REMOVE PS BELT





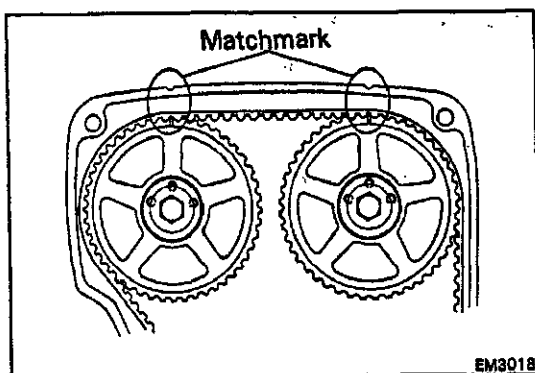
## 6. REMOVE NO.3 TIMING BELT COVER

Remove the five bolts, nut and No.3 timing belt cover with the gasket.



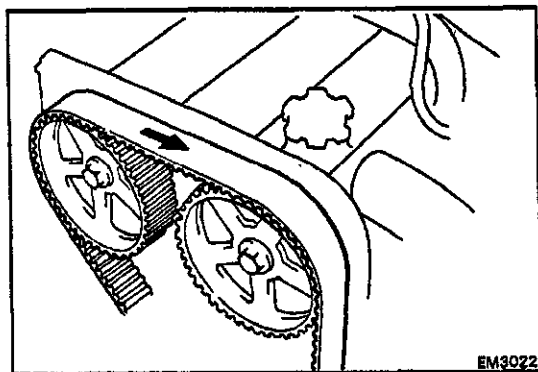
## 7. SET NO.1 CYLINDER TO TDC/COMPRESSION

- (a) Turn the crankshaft pulley and align its groove with the "0" mark on the No.1 timing belt cover.



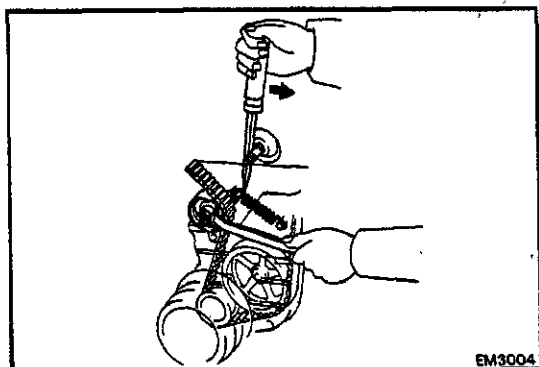
- (b) Check that the matchmarks on the camshaft timing pulleys and No.2 timing belt cover are aligned.

If not, turn the crankshaft pulley one complete revolution.

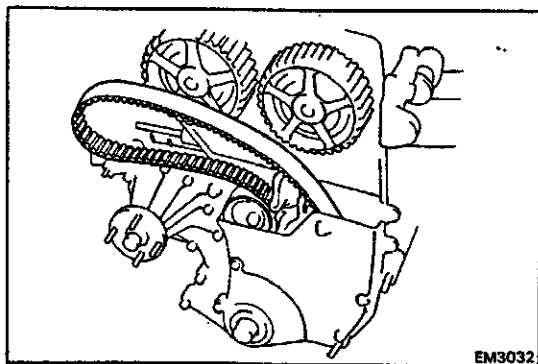


## 8. REMOVE TIMING BELT FROM CAMSHAFT TIMING PULLEYS

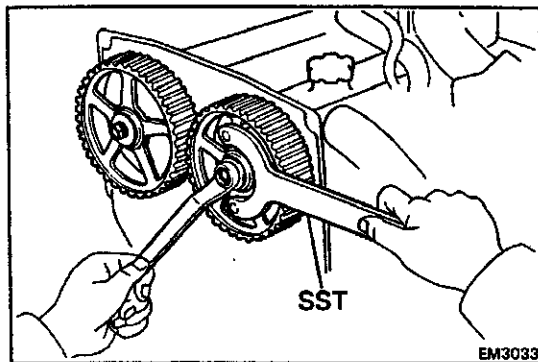
NOTE: If reusing the timing belt, draw a direction arrow on the belt (in direction of engine revolution).



- (a) Loosen the idler pulley bolt and shift it left as far as it will go with a screwdriver and wrench.
- (b) Temporarily tighten the set bolt and then relieve the timing belt tension.
- (c) Remove the belt from the camshaft timing pulley.

**NOTE:**

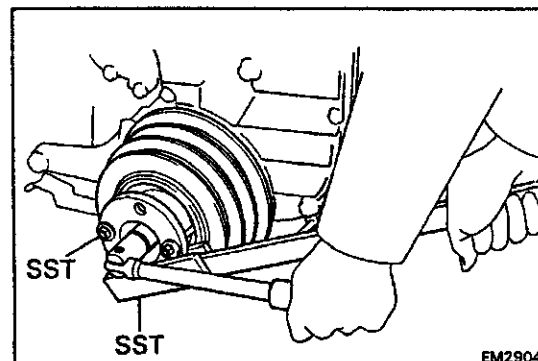
- Support the belt so the meshing of the crankshaft timing pulley and timing belt does not shift.
- Be careful not to drop anything inside the timing belt cover.
- Do not allow the belt to come into contact with oil, water and dust.

**9. REMOVE CAMSHAFT TIMING PULLEYS**

Using SST to hold the pulley, remove the pulley bolt, timing pulley and match pin.

SST 09278-54012

**CAUTION:** Do not make use of the timing belt tension when removing and installing the pulley set bolts.

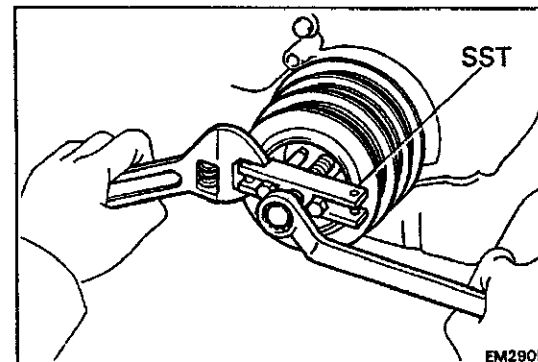
**10. REMOVE CRANKSHAFT PULLEY**

- (a) Using SST to hold the crankshaft pulley, loosen the pulley bolt.

SST MA 09213-70010 and 09330-00021

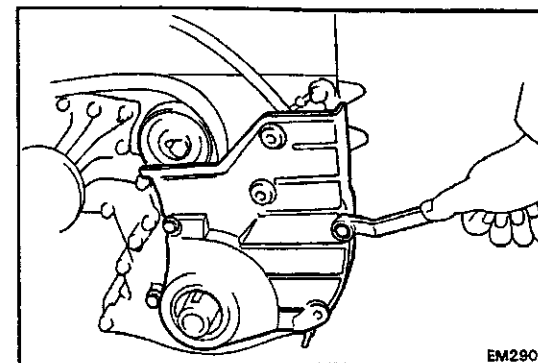
MS 09213-54014 and 09330-00021

- (b) Remove SST and pulley bolt.



- (c) Using SST, remove the pulley.

SST 09213-31021

**11. REMOVE PS AIR PIPE****12. REMOVE NO.1 TIMING BELT COVER**

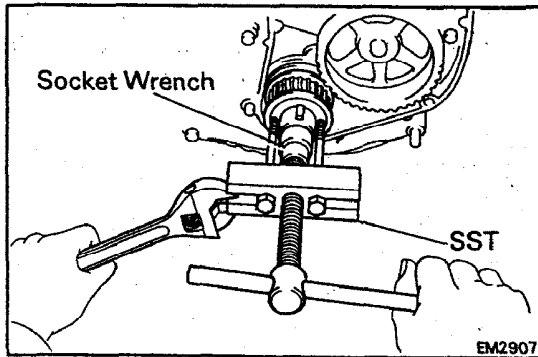
(with A/C)

Remove the nine bolts, nut, A/C idler pulley bracket, compressor bracket and No.1 timing belt cover.

(without A/C)

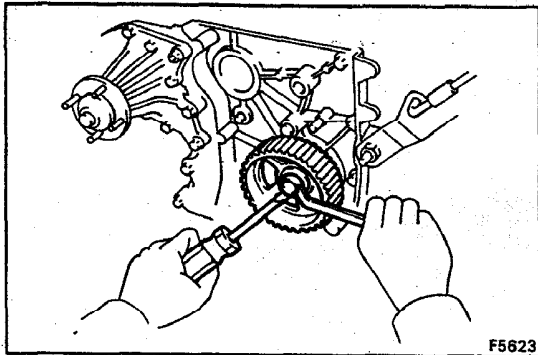
Remove the six bolts, No.1 timing belt cover.

**13. REMOVE TIMING BELT****14. REMOVE IDLER PULLEY AND TENSION SPRING**

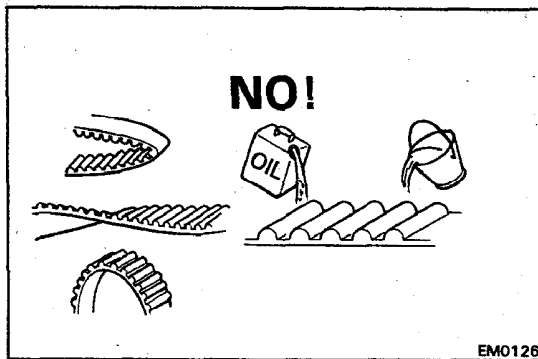
**15. REMOVE CRANKSHAFT TIMING PULLEY**

Using SST and a socket wrench, remove the crankshaft timing pulley.

SST 09213-60017

**16. REMOVE OIL PUMP DRIVE PULLEY**

Using a screwdriver to hold the pulley, remove the pulley bolt and pulley.

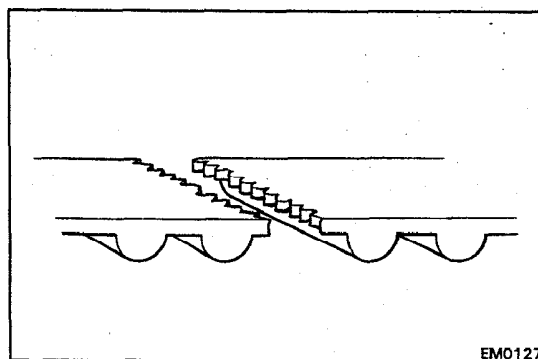
**INSPECTION OF COMPONENTS****1. INSPECT TIMING BELT****CAUTION:**

- Do not bend, twist or turn the belt inside out.
- Do not allow the belt to come into contact with oil, water or steam.
- Do not utilize belt tension when installing or removing the set bolt of the camshaft timing pulley.

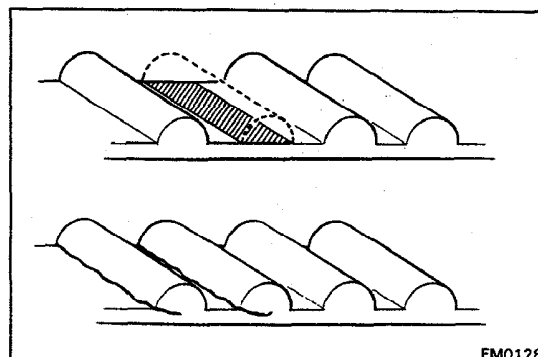
If there are defects as shown in the figures. Check the following points and replace the timing belt if necessary.

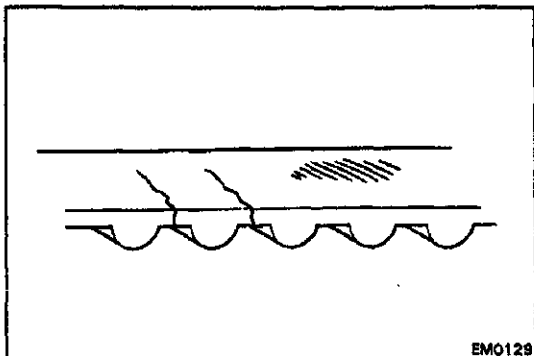
**(a) Premature parting**

- Check for proper installation.
- Check the timing belt cover gasket for damage and proper installation.

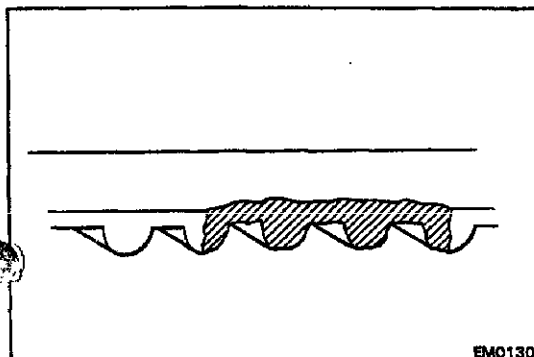


- (b)** If the belt teeth are cracked or damaged, check to see if the camshaft is locked.

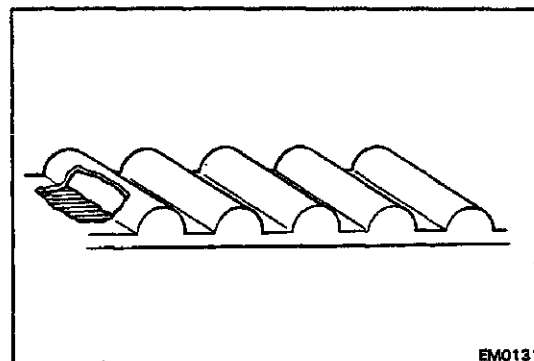




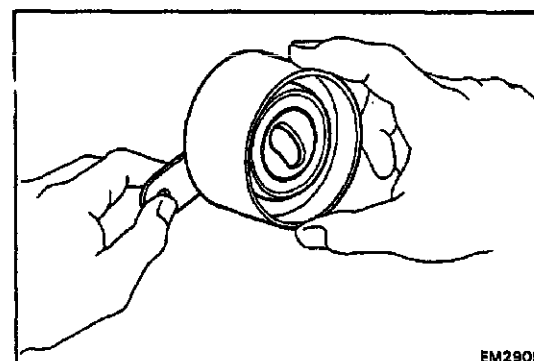
- (c) If there is noticeable wear or cracks on the belt face, check to see if there are nicks on one side of the idler pulley lock.



- (d) If there is wear or damage on only one side of the belt, check the belt guide and the alignment of each pulley.



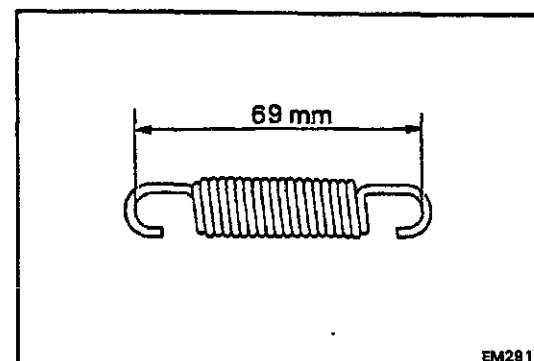
- (e) If there is noticeable wear on the belt teeth, check the timing belt cover gasket for damage and check for foreign materials on the pulley teeth.



## 2. INSPECT IDLER PULLEY

Check the turning smoothness of the timing belt idler pulley.

If necessary, replace the idler pulley.

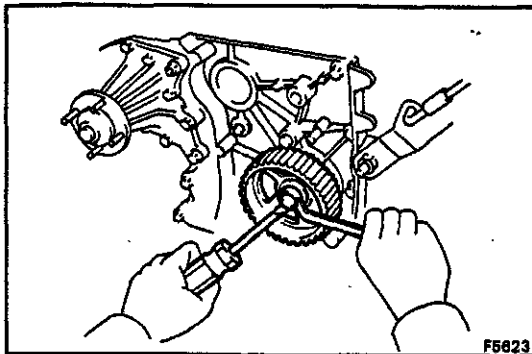


## 3. INSPECT TENSION SPRING

Check the free length of the spring.

**Free length: 69 mm (2.72 in.)**

If not as specified, replace the spring.



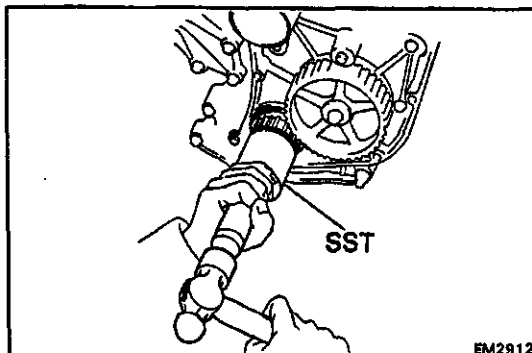
## INSTALLATION OF TIMING BELT

(See page EM-28)

### 1. INSTALL OIL PUMP PULLEY

Using a screwdriver to hold the pulley, install and torque the pulley bolt.

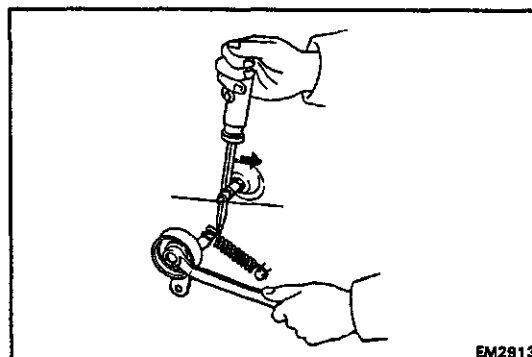
Torque: 220 kg-cm (16 ft-lb, 22 N·m)



### 2. INSTALL CRANKSHAFT TIMING PULLEY

Using SST and a hammer, drive in the pulley.

SST 09214-60010

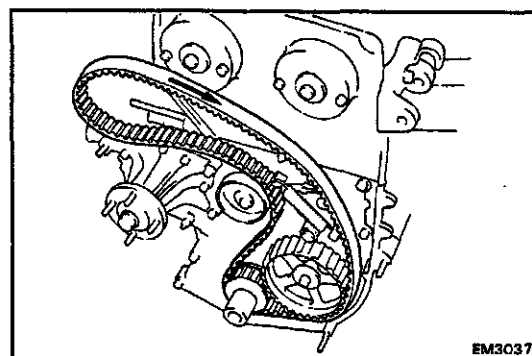


### 3. TEMPORARILY INSTALL IDLER PULLEY AND TENSION SPRING

(a) Install the idler pulley and tension spring.

(b) Pry the pulley toward the left as far as it will go and temporarily tighten it.

NOTE: Remove any oil or water on the idler pulley and keep it clean.

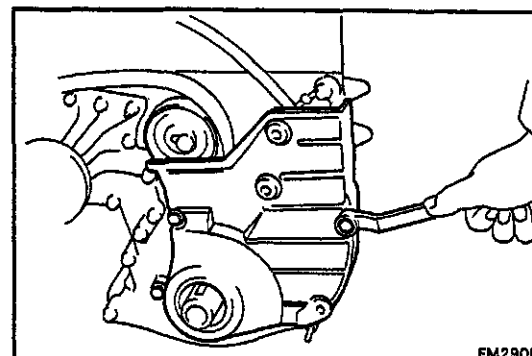


### 4. TEMPORARILY INSTALL TIMING BELT

**CAUTION:** The engine should be cold.

NOTE: If reusing the timing belt, install it with the rotation direction mark pointing in the same direction as before disassembly.

Install the timing belt on the crankshaft timing pulley, oil pump drive pulley and idler pulley.



### 5. INSTALL NO.1 TIMING BELT COVER

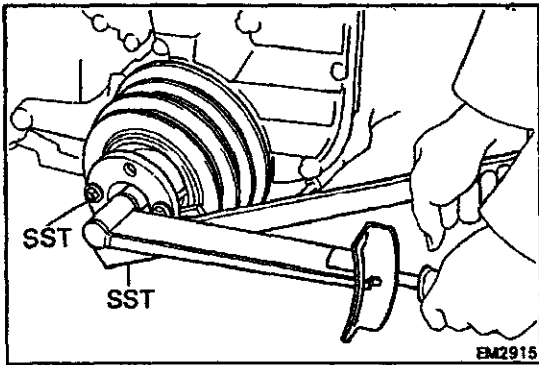
(with A/C)

Install the No.1 timing belt cover, A/C compressor bracket and idler pulley bracket with the nine bolts and nut.

(without A/C)

Install the No.1 timing belt cover with the six bolts.

### 6. INSTALL PS AIR PIPE



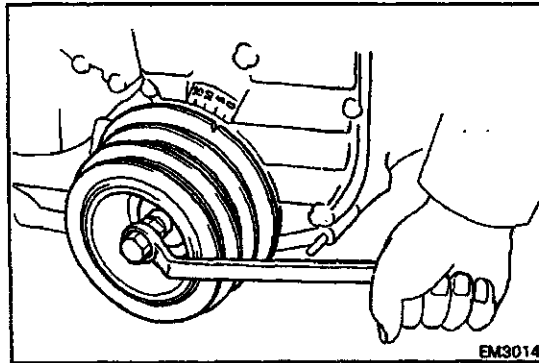
## 7. INSTALL CRANKSHAFT PULLEY

- Align the pulley set key with the key groove of the pulley.
- Install the pulley.
- Using SST to hold the crankshaft pulley, install and torque the pulley bolt.

SST MA 09213-70010 and 09330-00021

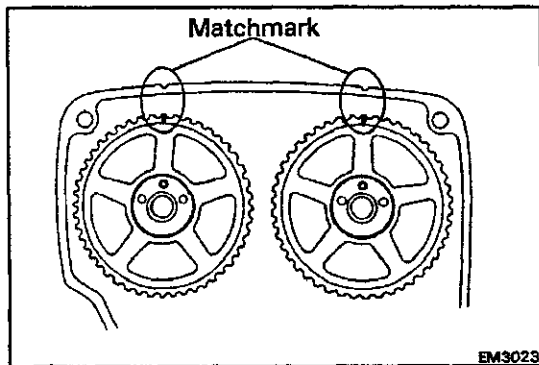
MS 09213-54014 and 09330-00021

**Torque: 2,700 kg-cm (195 ft-lb, 265 N·m)**



## 8. SET NO.1 CYLINDER TO TDC/COMPRESSION OF CRANKSHAFT

Turn the crankshaft pulley and align its groove with the "O" mark on the No.1 timing belt cover.



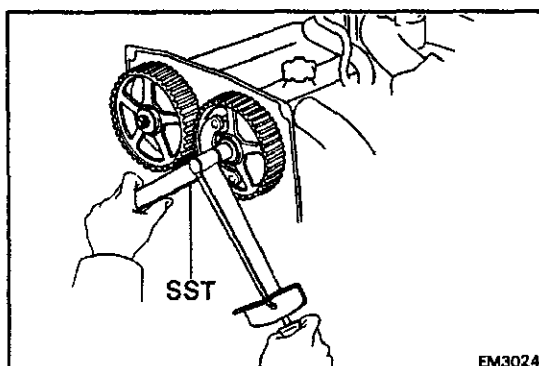
## 9. INSTALL CAMSHAFT TIMING PULLEYS

- Align the timing pulley matchmark with the No.2 timing belt cover matchmark.
- Install the timing pulley.
- Install the pin into the middle hole.

### NOTE:

- When replacing the camshaft or the camshaft timing pulley:  
Align the center holes of the camshaft and timing pulleys, as shown in the illustration and insert the straight pin.
- When reusing the camshaft or camshaft timing pulleys:  
Check that the straight pin hole position is in the same position it was at disassembly, insert the straight pin.

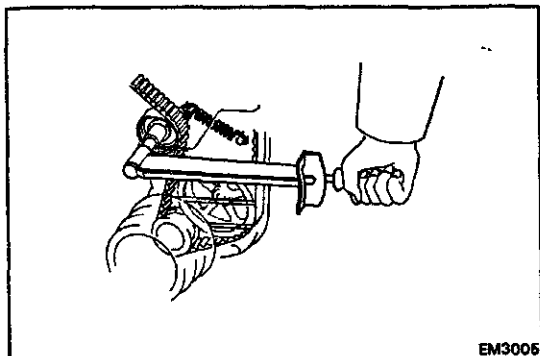
- Install the pulley bolt.



- Using SST to hold the pulley, torque the pulley bolt.  
SST 09278-54012

**Torque: 500 kg-cm (36 ft-lb, 49 N·m)**

- Check that the matchmarks on the camshaft timing pulley are aligned with those on the No.2 timing belt cover.



EM3005

**10. INSTALL TIMING BELT**

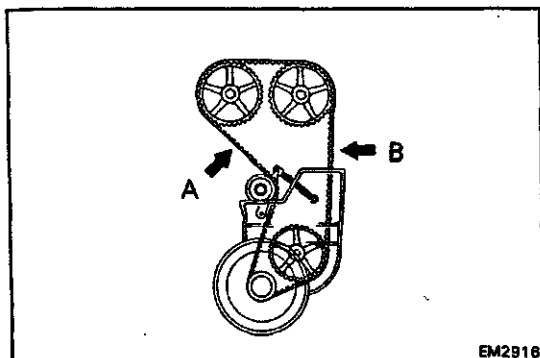
- (a) Install the timing belt to the IN side and EX side.
- (b) Loosen the idler pulley bolt, and torque the idler pulley bolt.

**Torque: 500 kg-cm (36 ft-lb, 49 N·m)**

**NOTE:** Make sure that the timing belt tension at A is equal to that at B.

If not, readjust with the idler pulley.

- (c) Turn the crankshaft pulley two revolutions clockwise from TDC to TDC.
- (d) Check that the matchmark on the camshaft timing pulley are aligned with those on the No.2 timing belt cover.

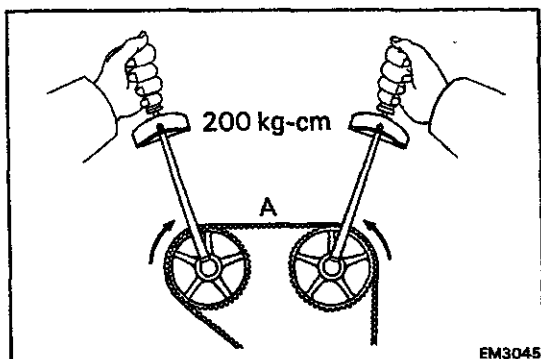


EM2916

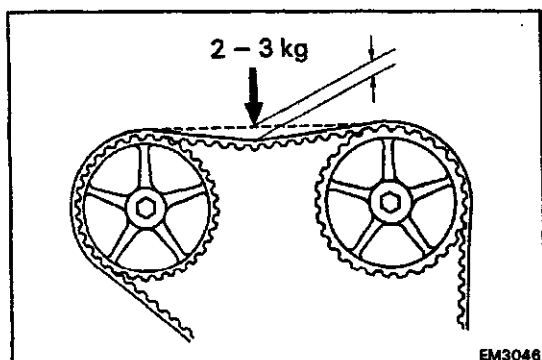
**11. CHECK TIMING BELT TENSION**

- (a) Turn both the intake and exhaust camshaft pulleys inward at the same time to slacken the timing belt at position A.

**Turning torque: 200 kg-cm (14 ft-lb, 20 N·m)**



EM3045



EM3046

- (b) Measure the timing belt deflection as shown.

**Belt deflection at 2 - 3 kg (4.4 - 6.6 lb, 20 - 29 N):**

**Cold Used belt 5 - 7 mm (0.20 - 0.28 in.)**

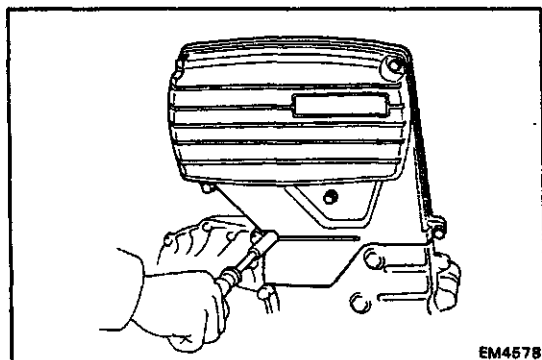
**New belt 4 - 6 mm (0.16 - 0.24 in.)**

**Hot (Reference) 3 - 5 mm (0.12 - 0.20 in.)**

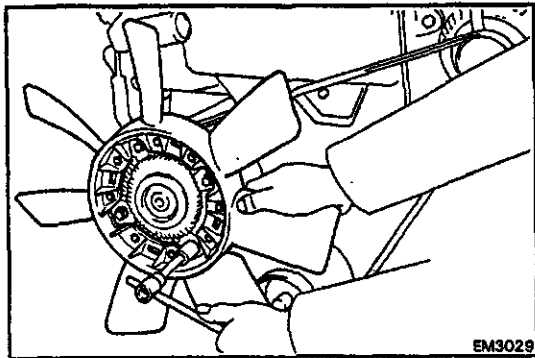
If the measurement is not within specification, adjust by the idler pulley.

**12. INSTALL NO.3 TIMING BELT COVER**

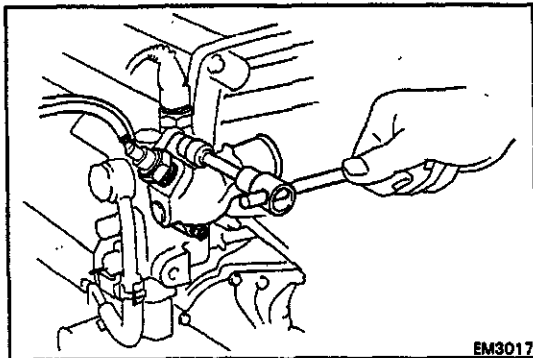
Install a gasket and the belt cover with the five bolts and nut.

**13. INSTALL PS BELT**

EM4578

**14. INSTALL ALTERNATOR DRIVE BELT AND FAN**

Torque: Fan 55 kg-cm (48 in.-lb, 5.4 N-m)  
 Adjusting bolt 130 kg-cm (9 ft-lb, 13 N-m)

**15. (with A/C)  
INSTALL A/C BELT****16. INSTALL WATER OUTLET**

Install the thermostat with a new gasket and water outlet with the two bolts.

**17. INSTALL SPARK PLUGS  
(See page IG-7)****18. ADJUST DRIVE BELTS**

Install and adjust the drive belts.

Drive belt deflection with 10 kg or 22 lb:

**New belt**

|      |     |                              |
|------|-----|------------------------------|
| A    | 10  | — 12 mm (0.39 — 0.47 in.)    |
| B    | 7   | — 8 mm (0.28 — 0.31 in.)     |
| C MA | 7   | — 9.5 mm (0.28 — 0.374 in.)  |
| MS   | 7.5 | — 9.5 mm (0.295 — 0.374 in.) |

**Used belt**

|      |      |                            |
|------|------|----------------------------|
| A    | 15   | — 17 mm (0.59 — 0.67 in.)  |
| B    | 9    | — 11 mm (0.35 — 0.43 in.)  |
| C MA | 10.5 | — 12 mm (0.413 — 0.47 in.) |
| MS   | 10   | — 13 mm (0.39 — 0.51 in.)  |

**(Reference)**

Using SST, check the drive belt tension.

SST A 09216-00020

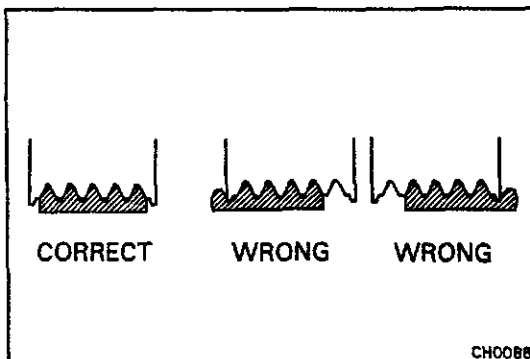
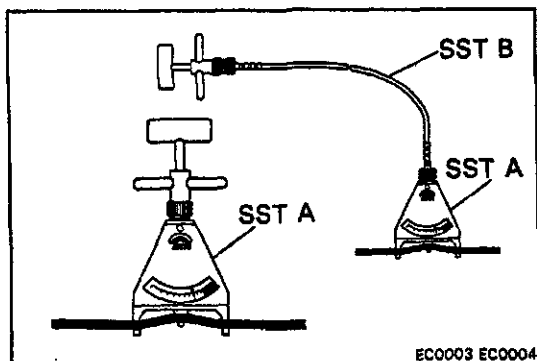
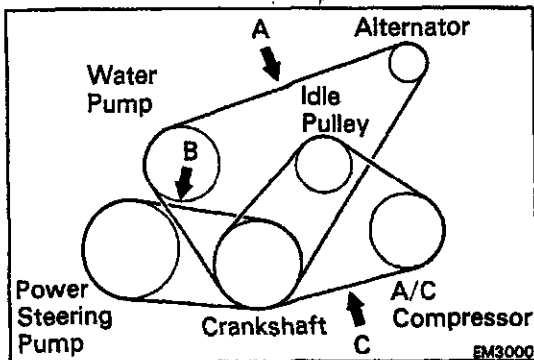
SST B 09216-00030

**Drive belt tension:**

|           |   |            |
|-----------|---|------------|
| New belt  | A | 70 — 80 kg |
|           | B | 55 — 65 kg |
|           | C | 53 — 77 kg |
| Used belt | A | 30 — 45 kg |
|           | B | 25 — 40 kg |
|           | C | 30 — 40 kg |

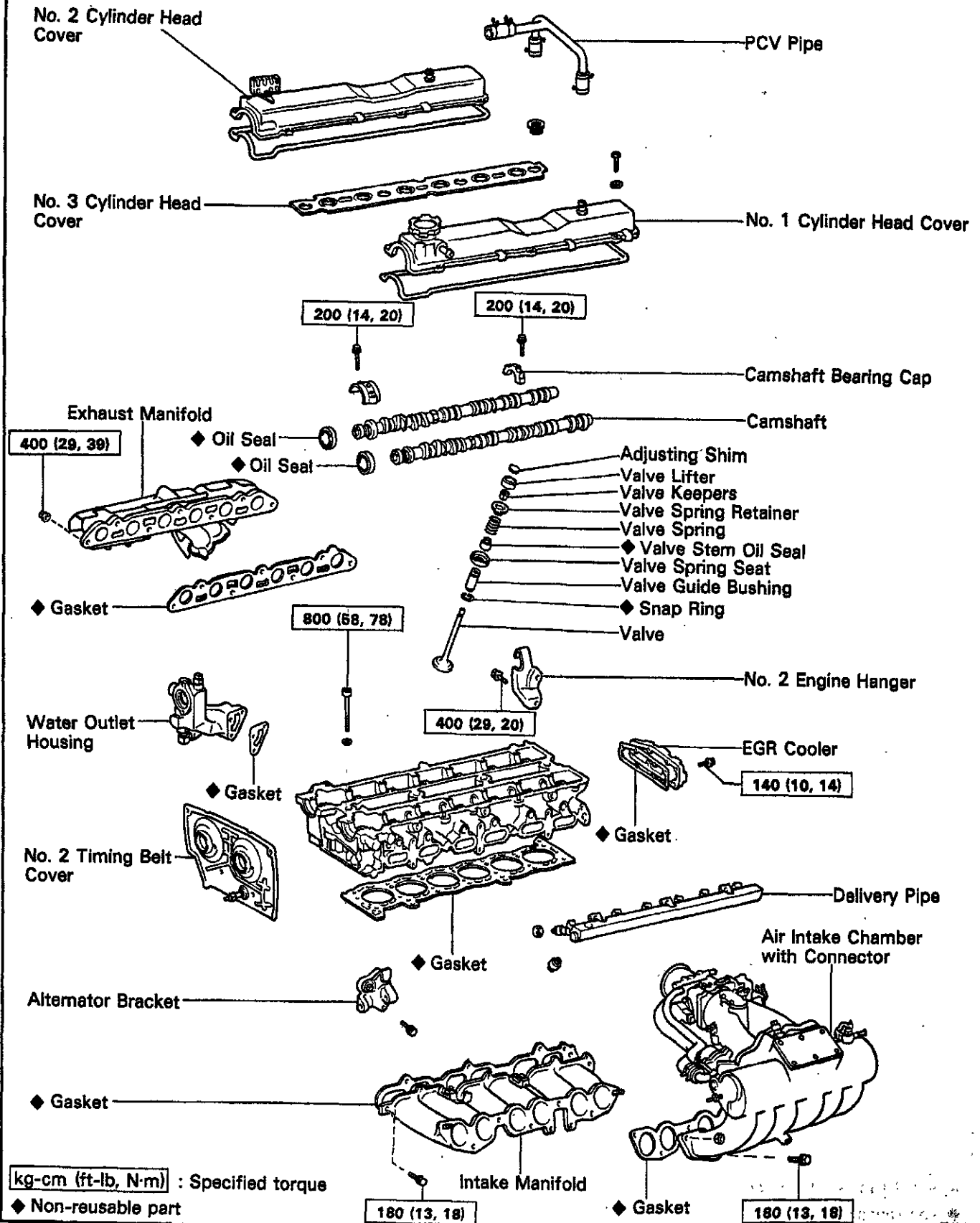
**NOTE:**

- "New belt" refers to a belt which has been used less than 5 minutes on a running engine.
- "Used belt" refers to a belt which has been used on a running engine for 5 minutes or more.
- After installing the drive belt, check that it fits properly in the ribbed grooves.
- Check by hand to confirm that the belt has not slipped out of the groove on the bottom of the crank pulley.
- After installing the belt, run the engine for approx. 5 minutes and then recheck the deflection.



# CYLINDER HEAD COMPONENTS

7M-GE



## 7M-GTE

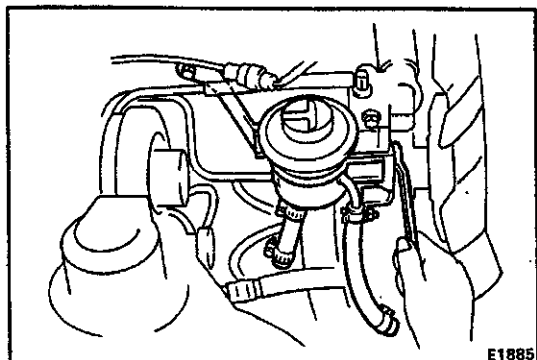


**REMOVAL OF CYLINDER HEAD**

(See pages EM-37, 38)

**1. REMOVE ALTERNATOR**

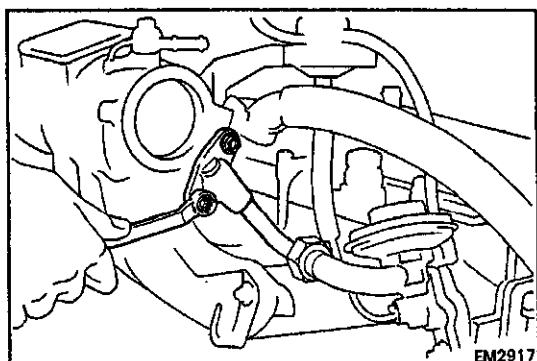
- (a) Disconnect the No.3 PCV hose.
- (b) Remove the drive belt.
- (c) Remove the alternator and adjusting bar.

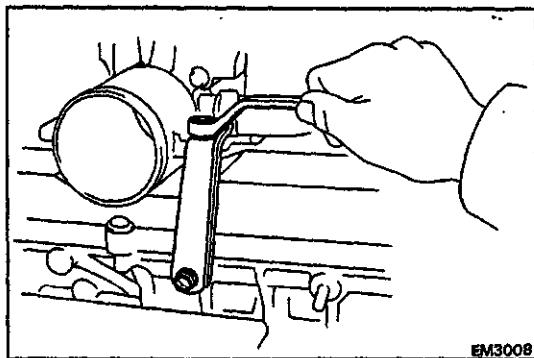
**2. (7M-GTE)****REMOVE PS RESERVOIR TANK**

Remove the two bolts, nut and reservoir tank with bracket.

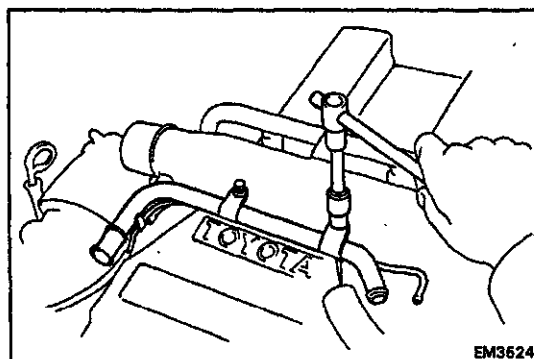
**3. (7M-GTE)****REMOVE CAM POSITION SENSOR****4. REMOVE AIR INTAKE CHAMBER WITH CONNECTOR**

- (a) Remove the PCV pipe.
- (b) Disconnect following connectors:
  - (7M-GE)  
Cold start injector connector
  - Throttle position sensor connector
  - ISC valve connector
- (c) Disconnect following hoses:
  - BVSV hose from throttle body
  - EGR hoses from throttle body
  - Vacuum transmitting pipe hose from intake chamber
  - Pressure regulator hose
  - VSV (for fuel pressure up) hoses
  - (7M-GE)  
Diaphragm hose
- (d) Disconnect following hoses:
  - (7M-GTE)  
Auxiliary air pipe hose from vacuum transmitting pipe hose
  - No.1 water by-pass hose from ISC valve
  - (7M-GE)  
No.3 water by-pass hose from throttle body
  - (7M-GTE)  
No.3 water by-pass hose from water by-pass pipe
- (e) (w/ EGR)  
Remove the EGR pipe mounting bolts.
- (f) Remove the manifold stay mounting bolts.

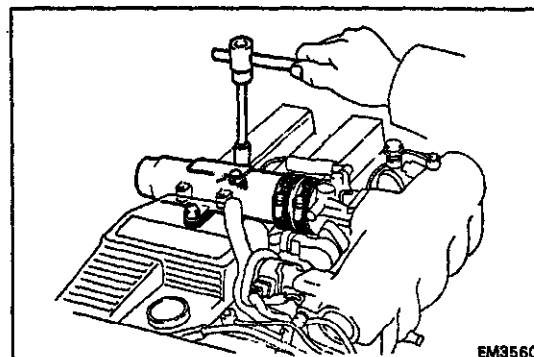




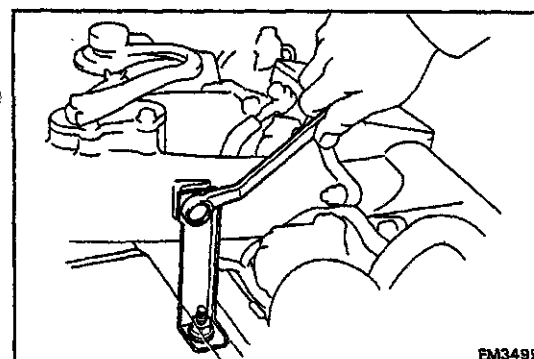
- (g) (7M-GE)  
Remove the throttle body bracket(s).



- (7M-GTE)  
Remove the ISC pipe.



- (h) (7M-GTE)  
Remove the air intake connector mounting bolt.

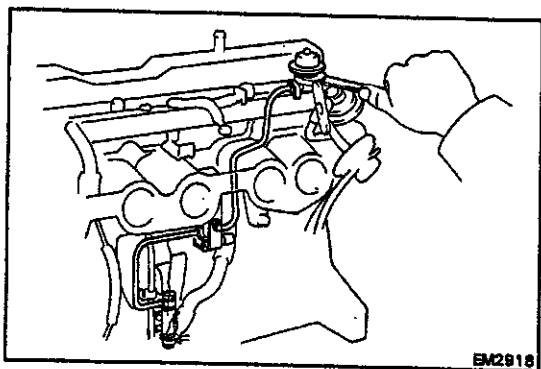
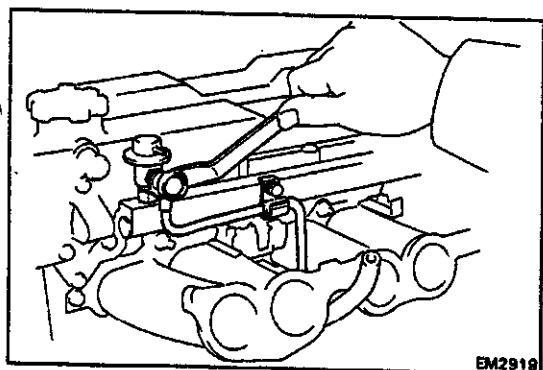


- (i) (7M-GE)  
Remove the air intake connector bracket mounting bolts.
- (j) Remove the cold start injector tube.
- (k) Remove the EGR vacuum modulator from the bracket.
- (l) Disconnect the engine wire from the clamps of intake chamber.
- (m) Remove the two nuts, five bolts, vacuum transmitting pipes and intake chamber with connector and gasket.
- (n) (7M-GTE)  
Disconnect the cold start injector connector.

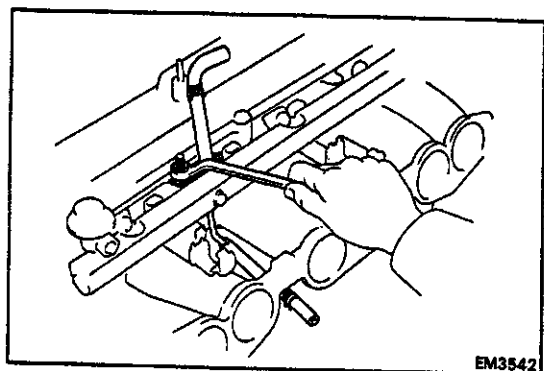
**5. (7M-GTE)  
REMOVE IGNITION COIL WITH BRACKET  
(See steps 5 and 6 on pages EM-12, 13)**

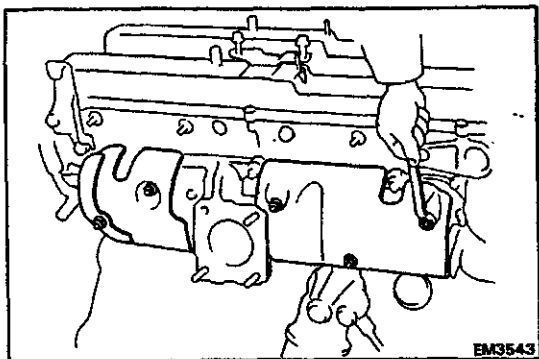
**6. REMOVE ENGINE WIRE**

- (a) Disconnect following wires:
- (w/ TWC)
    - Oxygen sensor connector
  - Oil pressure sender gauge connector
  - Water temp. sensor connector
  - Water temp. sender gauge connector
  - Cold start injector time switch connector
  - Distributor connector
  - Injector connectors
  - Three VSV connectors
  - Knock sensor connectors
  - Ground strap from intake manifold
- (b) Remove the engine wire from the each clamps.

**7. REMOVE PULSATION DAMPER, VSV AND NO.1 FUEL PIPE****8. REMOVE NO.2 FUEL PIPE**

- (a) Disconnect the fuel hose from the No.2 fuel pipe.
- (b) Remove the bolt, union bolt, No.2 fuel pipe and gaskets.

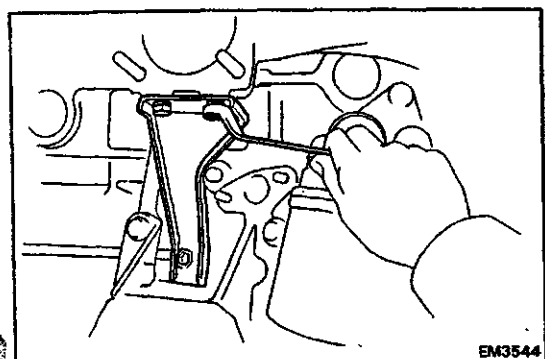
**9. (7M-GTE)  
REMOVE AUXILIARY AIR PIPE****10. (7M-GE)  
REMOVE HIGH-TENSION CORDS AND DISTRIBUTOR****11. (7M-GE)  
REMOVE OIL DIPSTICK****12. (7M-GTE)  
REMOVE TURBOCHARGER**  
(See steps 5 to 7 and 9 to 15 on pages TC-10 to 12)



### 13. REMOVE EXHAUST MANIFOLD

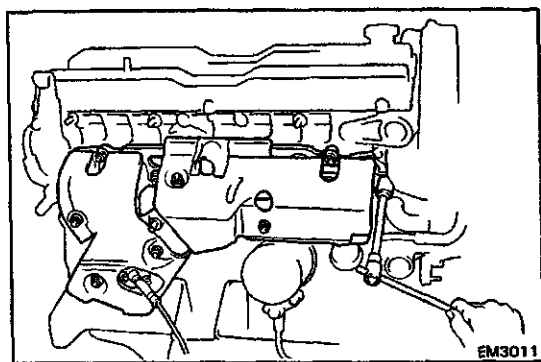
(a) (7M-GTE)

Remove the five nuts and heat insulators.

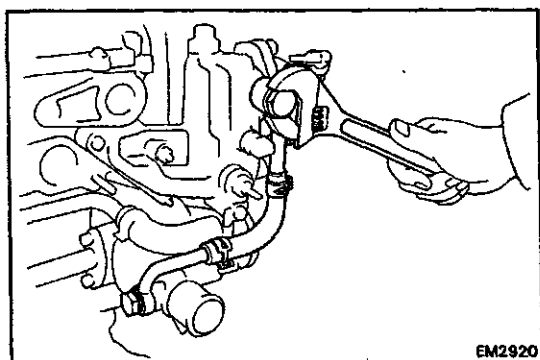


(b) (7M-GTE)

Remove the three bolts and exhaust manifold stay.



(c) Remove the seven nuts, exhaust manifold and gasket.

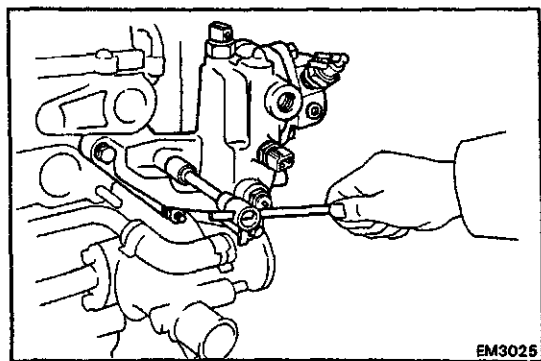


### 14. REMOVE WATER OUTLET HOUSING

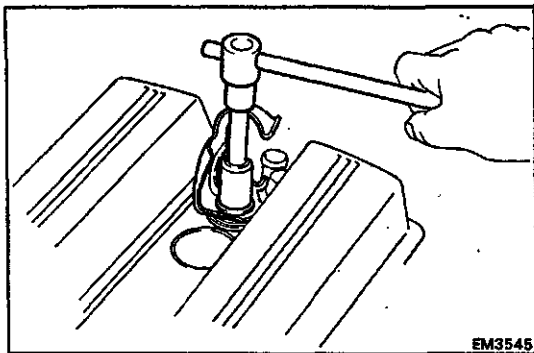
(a) (7M-GE)

Remove the union bolts, union with No.4 water by-pass hose and gaskets.

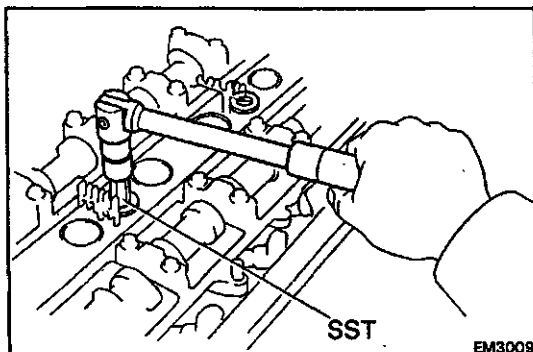
(b) Disconnect the No.6 water by-pass hose from the water by-pass pipe.



(c) Remove the bolt, two nuts, water outlet housing and gasket.

**15. REMOVE CYLINDER HEAD COVERS**

- (a) (LHD)  
Remove the accelerator link.
- (b) (MA)  
Remove the heater hose clamp.
- (c) Remove the No.1 and No.2 cylinder head covers.



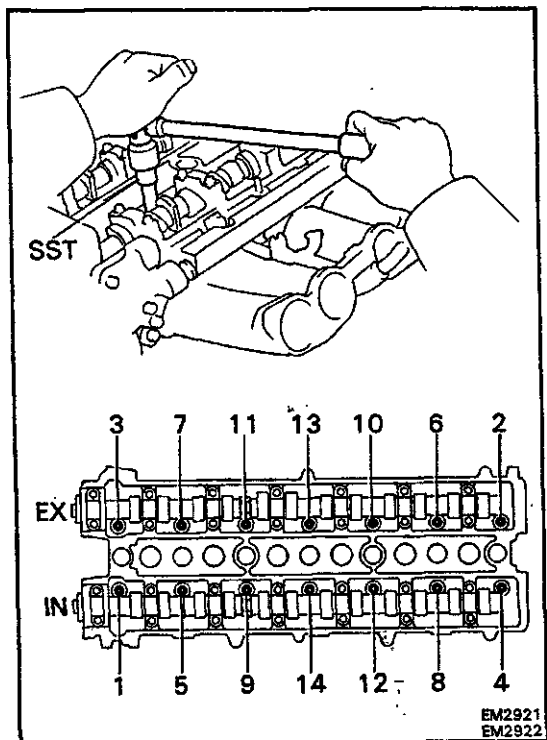
- (d) Using SST, remove the No.3 cylinder head cover.  
SST 09923-00010

**16. REMOVE SPARK PLUGS**

(See page IG-7)

**17. REMOVE TIMING BELT AND CAMSHAFT TIMING PULLEYS**

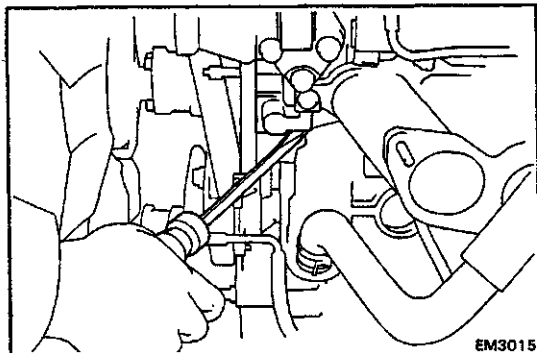
(See steps 4 and 6 to 9 on pages EM-28 to 30)

**18. REMOVE CYLINDER HEAD**

- (a) Using SST, uniformly loosen and remove the cylinder head bolts in several passes, in the sequence shown.

SST 09043-38100

**CAUTION:** Head warpage or cracking could result from removing in incorrect order.



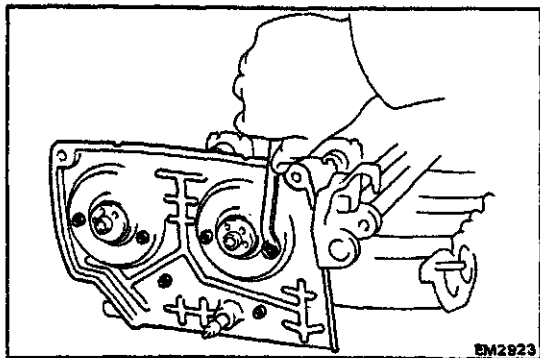
- (b) Lift the cylinder head from the dowels on the cylinder block.

- (c) Place the head on wooden blocks on a bench.

If the cylinder head is difficult to lift off, pry with a screwdriver between the cylinder head and block projection.

**CAUTION:**

- Be careful not to damage the cylinder head and block surface on the cylinder and head gasket side.
- Be careful not to damage the VSV.

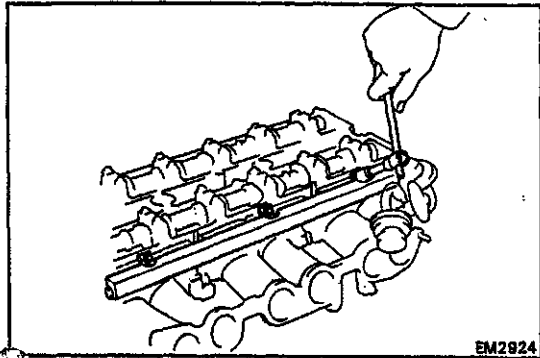


## DISASSEMBLY OF CYLINDER HEAD

(See pages EM-37, 38)

1. REMOVE NO.2 TIMING BELT COVER

2. REMOVE ALTERNATOR BRACKET

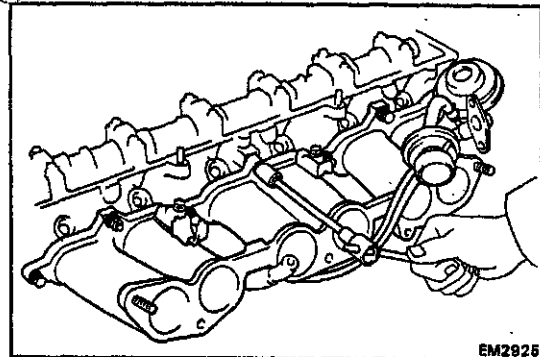


3. REMOVE DELIVERY PIPE WITH INJECTORS

(a) Remove the three bolts, and then remove the delivery pipe with the injectors.

NOTE: When removing the delivery pipe, be careful not to drop the injectors.

(b) Remove the six insulators and three spacers from the cylinder head.



4. REMOVE INTAKE MANIFOLD

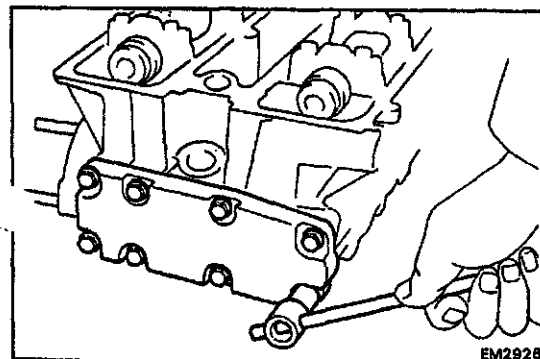
(w/ EGR)

Remove the four nuts, seven bolts, EGR valve, VSV, intake manifold and gasket.

(w/o EGR)

Remove the four nuts, seven bolts, VSV, intake manifold and gasket.

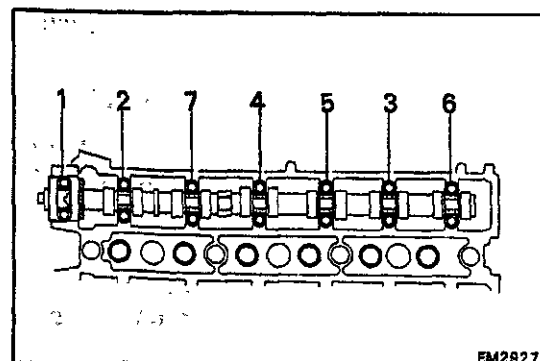
5. REMOVE NO.2 ENGINE HANGER AND GROUND STRAP



6. REMOVE HEATER UNION

7. (w/ EGR)

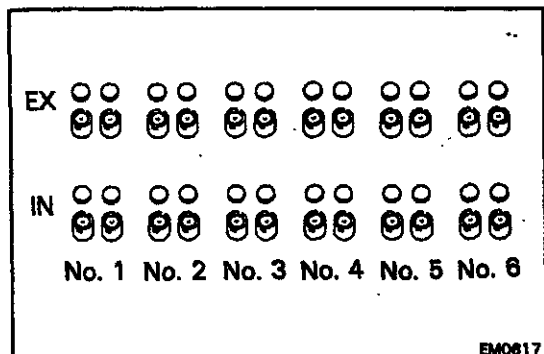
REMOVE EGR COOLER



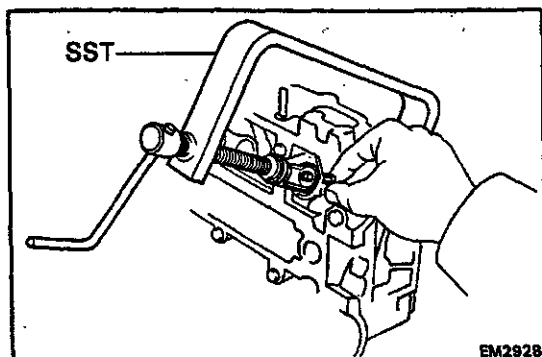
8. REMOVE BEARING CAPS AND CAMSHAFTS

(a) Uniformly loosen and remove the bearing cap bolts in several passes, in the sequence shown.

(b) Remove the camshaft bearing caps, oil seal and camshaft.

**9. REMOVE VALVE LIFTERS WITH SHIMS**

Arrange the valve lifters and shims in order.

**10. REMOVE VALVES**

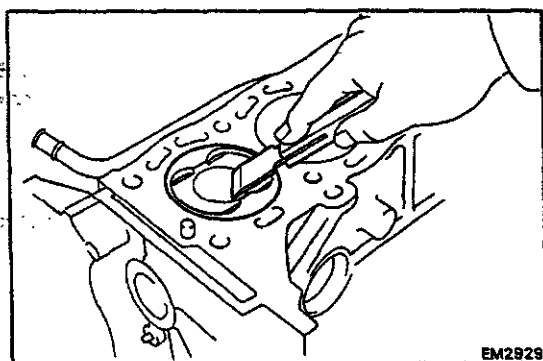
- (a) Using SST, press the valve spring and remove the two keepers.

SST 09202-70010

- (b) Remove the spring retainer, valve spring, seat and valve.

- (c) Pry out the oil seal.

**NOTE:** Arrange the valves, seats, valve springs and retainers in order.

**INSPECTION, CLEANING AND REPAIR OF CYLINDER HEAD COMPONENTS****1. CLEAN TOP OF PISTONS AND TOP OF CYLINDER BLOCK**

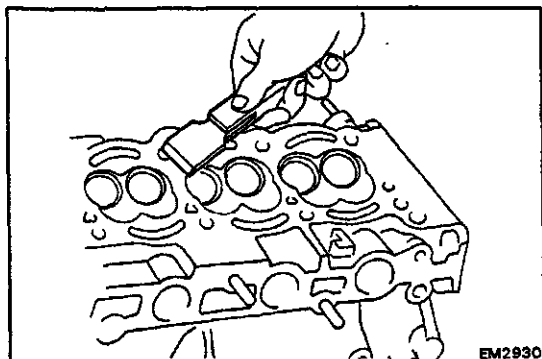
- (a) Turn the crankshaft and bring each piston to top dead center. Using a gasket scraper, remove all the carbon from the piston tops.
- (b) Using a gasket scraper, remove all gasket material from the top of the block. Blow carbon and oil from the bolt holes.

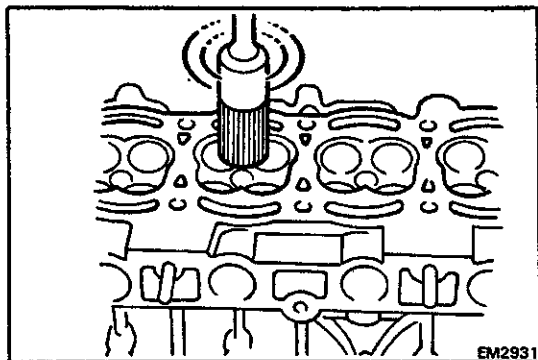
**WARNING:** Protect your eyes when using high pressure air.

**2. REMOVE GASKET MATERIAL**

Using a gasket scraper, remove all gasket material from the head and manifold surfaces.

**CAUTION:** Be careful not to scratch the surfaces.

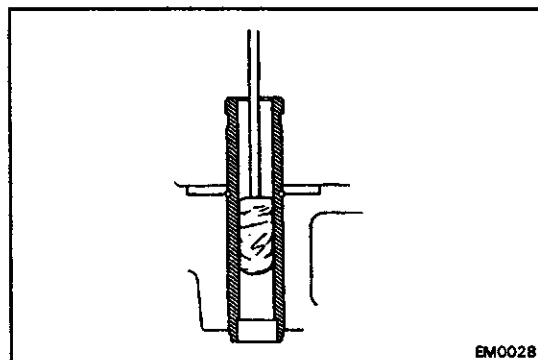




### 3. CLEAN COMBUSTION CHAMBER

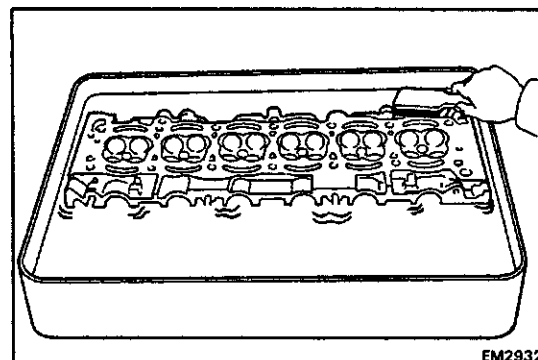
Using a wire brush, remove all the carbon from the combustion chambers.

**CAUTION:** Be careful not to scratch the head gasket contact surface.



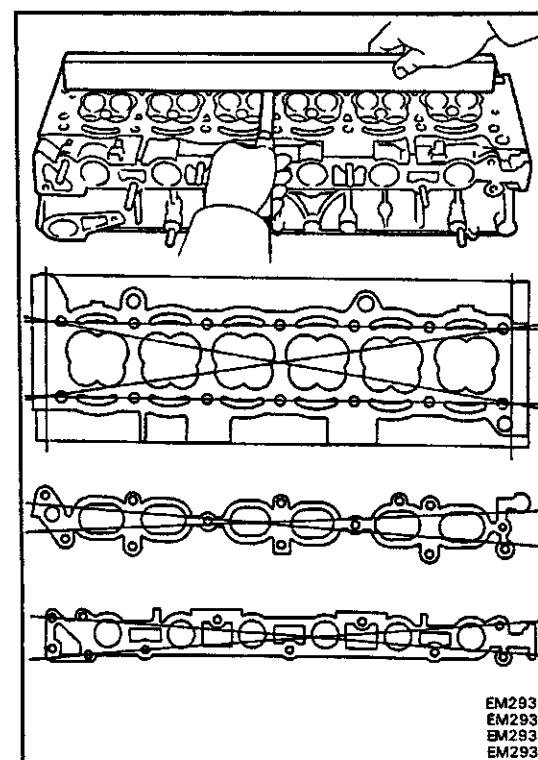
### 4. CLEAN VALVE GUIDE BUSHINGS

Using a valve guide brush and solvent, clean all the valve guide bushings.



### 5. CLEAN CYLINDER HEAD

Using a soft brush and solvent, thoroughly clean the head.

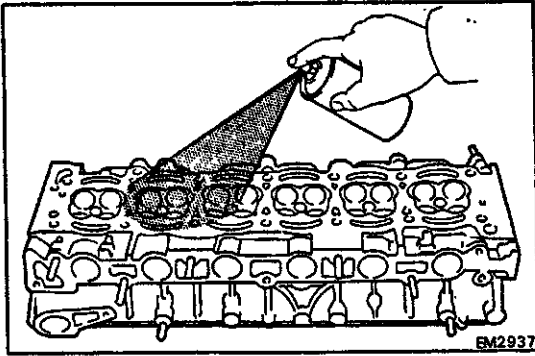


### 6. INSPECT CYLINDER HEAD FOR FLATNESS

Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder block and manifold for warpage.

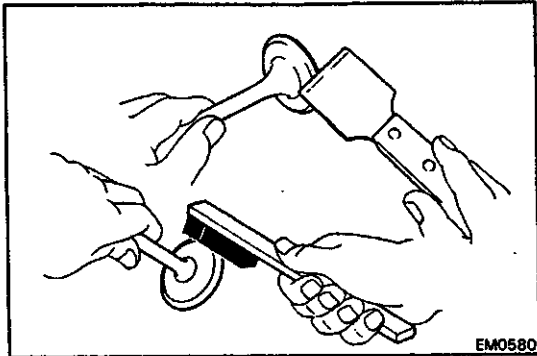
**Maximum warpage:** 0.10 mm (0.0039 in.)

If warpage is greater than maximum, replace the cylinder head.

**7. INSPECT CYLINDER HEAD FOR CRACKS**

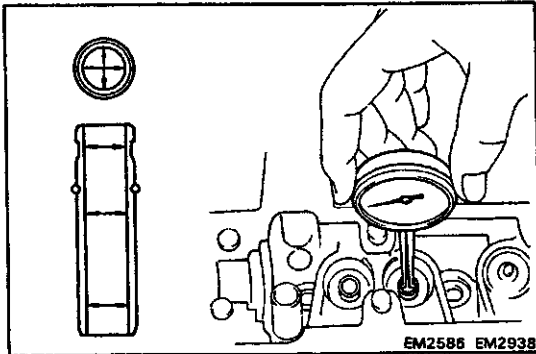
Using a dye penetrant, check the combustion chamber, intake and exhaust ports, head surface and the top of the head for cracks.

If cracked, replace the head.

**8. CLEAN VALVES**

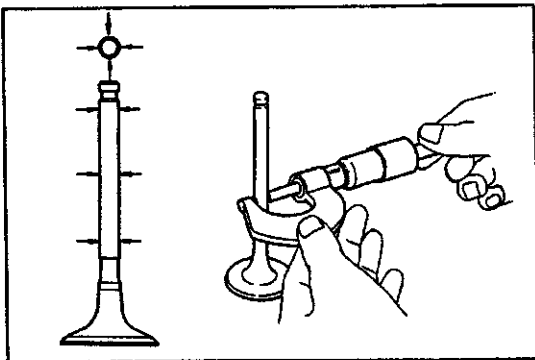
(a) Use a gasket scraper to chip any carbon from the valve head.

(b) Using a wire brush, thoroughly clean the valve.

**9. INSPECT VALVE STEMS AND GUIDE BUSHINGS**

(a) Using a caliper gauge, measure the inside diameter of the valve guide.

**Guide inside diameter:** 6.010 – 6.030 mm  
(0.2366 – 0.2374 in.)



(b) Using a micrometer, measure the diameter of the valve stem.

**Stem diameter:**

**Intake** 5.970 – 5.985 mm  
(0.2350 – 0.2356 in.)

**Exhaust** 5.965 – 5.980 mm  
(0.2348 – 0.2354 in.)

(c) Subtract the valve stem diameter measurement from the valve guide bushing inside diameter measurement.

**Standard stem oil clearance:**

**Intake** 0.025 – 0.060 mm  
(0.0010 – 0.0024 in.)

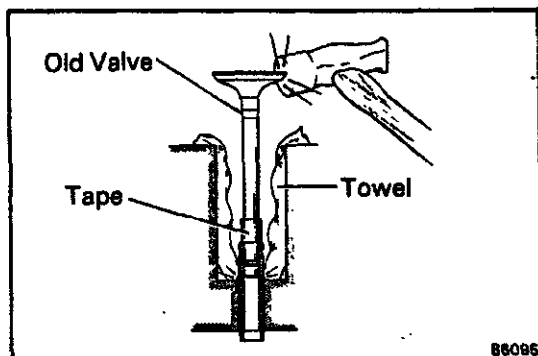
**Exhaust** 0.030 – 0.065 mm  
(0.0012 – 0.0026 in.)

**Maximum stem oil clearance:**

**Intake** 0.08 mm (0.0031 in.)

**Exhaust** 0.10 mm (0.0039 in.)

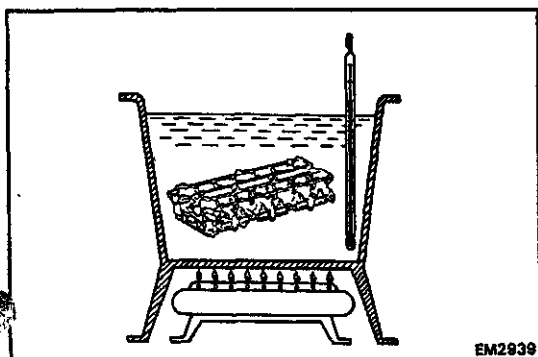
If the clearance is greater than maximum, replace the valve and guide bushing.



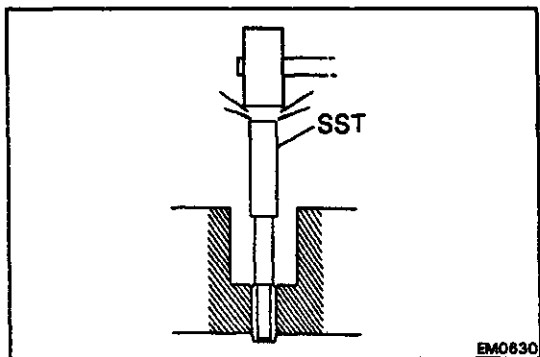
# 10. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

- (a) Insert an old valve wrapped with tape into the valve guide bushing and break off the valve guide bushing by hitting it with a hammer.

**CAUTION:** Be careful not to damage the lifter hole.

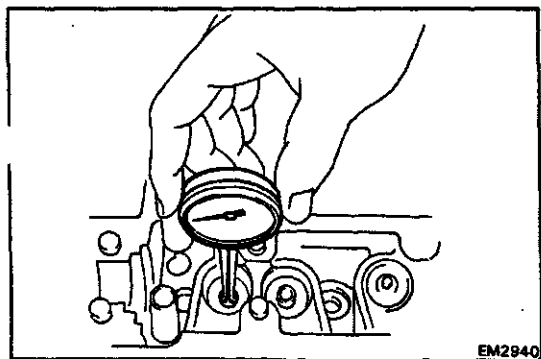


- (b) Gradually heat the cylinder head to approx. 90°C (194°F).



- (c) Using SST and hammer, drive out valve guide bushing.

SST 09201-70010



- (d) Using a caliper gauge, measure the valve guide bore of the cylinder head.

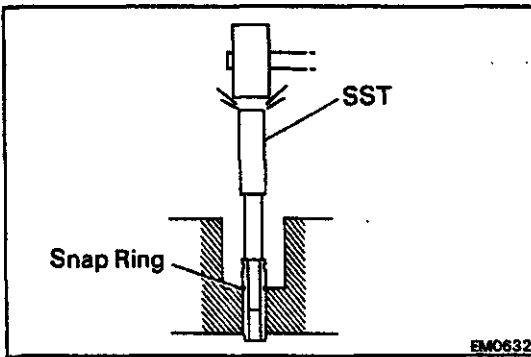
Both intake and exhaust

| Bushing bore mm (in.)                | Bushing size |
|--------------------------------------|--------------|
| 11.000 – 11.027<br>(0.4331 – 0.4341) | Use STD      |
| Over 11.027<br>(0.4341)              | Use O/S 0.05 |

- (e) Select a new valve guide bushing.

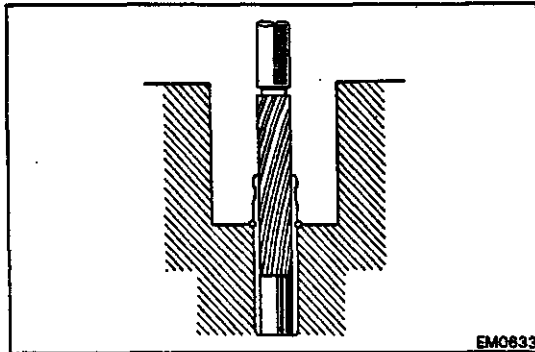
If the valve guide bushing bore of the cylinder head is more than 11.027 mm (0.4341 in.), machine the bore to the following dimensions.

**Rebored valve guide bushing bore dimension:**  
11.050 – 11.077 mm (0.4350 – 0.4361 in.)

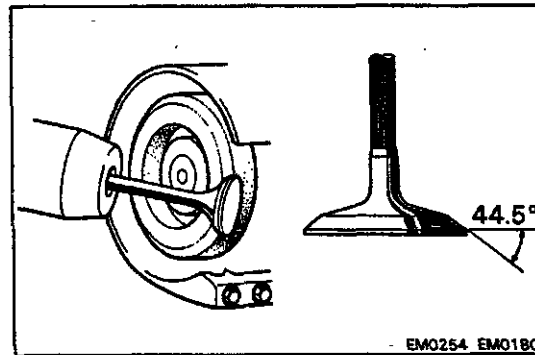


- (f) Gradually heat the cylinder head to approx. 90°C (194°F).
- (g) Using SST and hammer, drive in a new valve guide bushing until the snap ring makes contact with the cylinder head.

SST 09201-70010



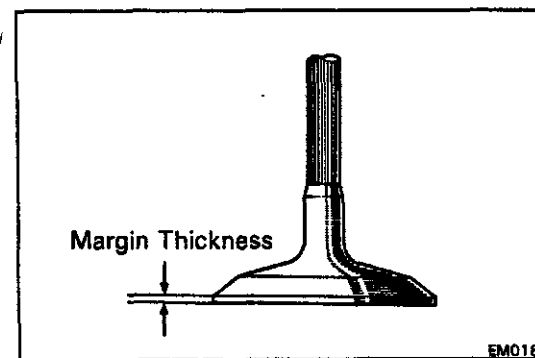
- (h) Using a sharp 6 mm (0.23 in.) reamer, ream the valve guide bushing to obtain standard specified clearance (See page EM-47) between the valve guide bushing and new valve.



## 11. INSPECT AND GRIND VALVES

- (a) Grind the valve only enough to remove pits and carbon.
- (b) Check that the valve are ground to the correct valve face angle.

Valve face angle: 44.5°

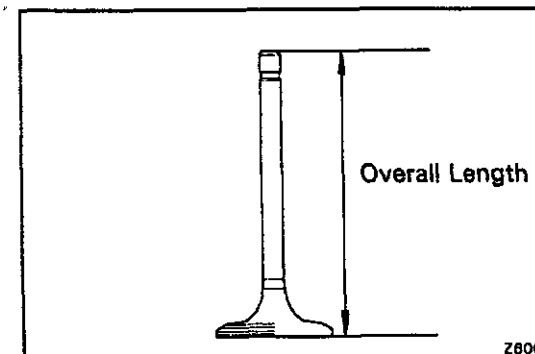


- (c) Check the valve head margin thickness.

Standard margin thickness: 1.3 mm (0.051 in.)

Minimum margin thickness: 0.5 mm (0.020 in.)

If the valve head margin thickness is less than minimum, replace the valve.

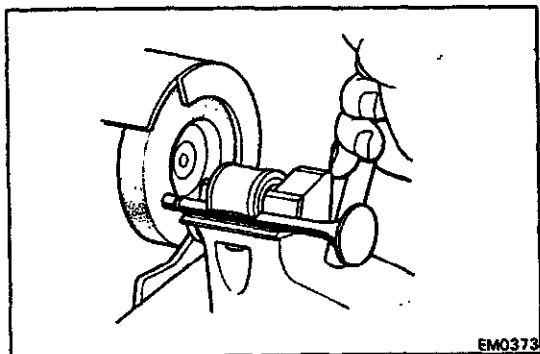


- (d) Check the valve overall length.

Standard overall length: 98.15 mm (3.8642 in.)

Minimum overall length: 97.75 mm (3.8484 in.)

If the valve overall length is less than minimum, replace the valve.

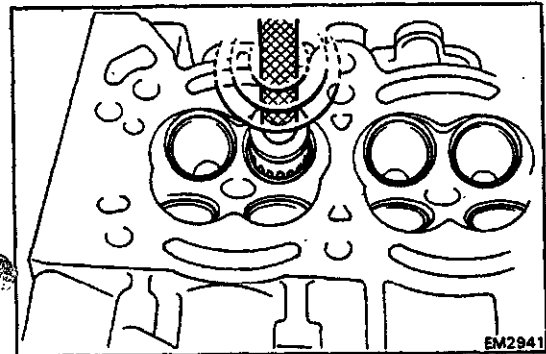


(e) Check the surface of the valve stem tip for wear. If the valve stem tip is worn, regrind it with grinder or replace the valve if necessary.

**CAUTION:** Do not grind off more than minimum over-all length (See page EM-49).

## 12. INSPECT AND CLEAN VALVE SEATS

(a) Using a 45° carbide cutter, resurface the valve seats. Remove only enough metal to clean the seats.



(b) Check the valve seating position. Apply a thin coat of prussian blue (or white lead) to the valve face. Install the valve. Lightly press the valve against the seat. Do not rotate the valve.

(c) Check the valve face and seat for the following:

- If blue appears 360° around the face, the valve is concentric. If not, replace the valve.

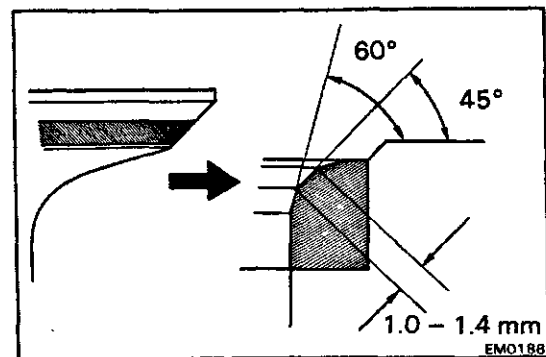
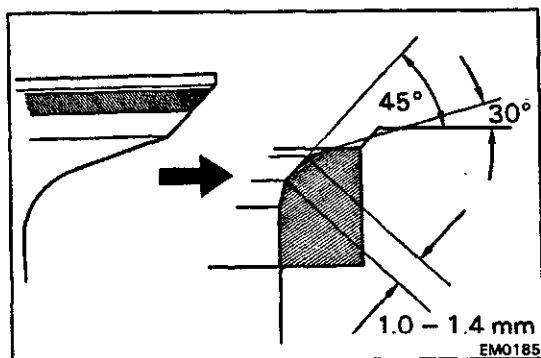
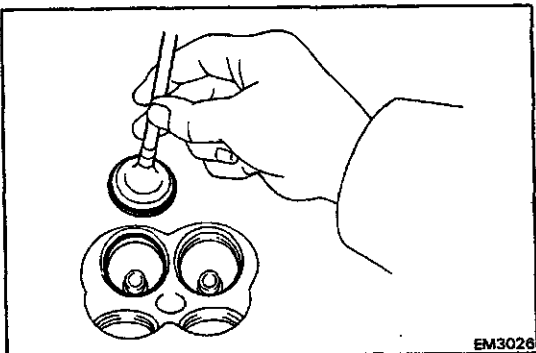
- If blue appears 360° around the valve seat, the guide and seat are concentric. If not, resurface the seat.

- Check that the seat contact is on the middle of the valve face with the following width.

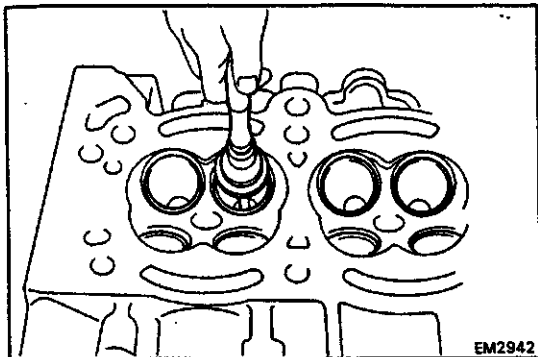
**1.0 – 1.4 mm (0.039 – 0.055 in.)**

If not, correct the valve seat as follows:

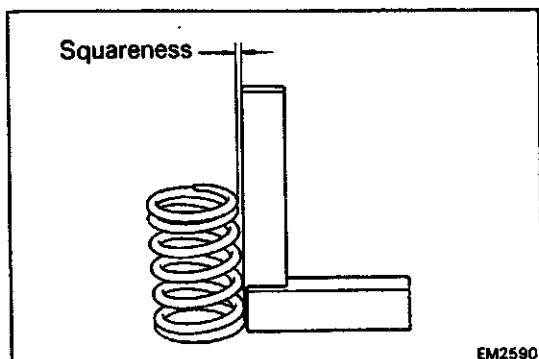
- If seating is too high on the valve face use 30° and 45° cutters to correct the seat.



- If seating is too low on the valve face, use 60°, and 45° cutters to correct the seat.



- (d) Hand-lap the valve and valve seat with an abrasive compound.

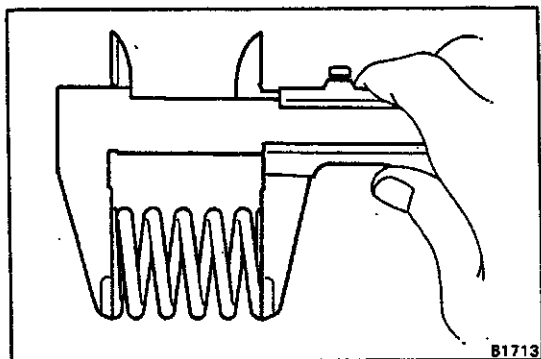


### 13. INSPECT VALVE SPRINGS

- (a) Using a steel square, measure the squareness of the valve springs.

**Maximum squareness: 1.5 mm (0.059 in.)**

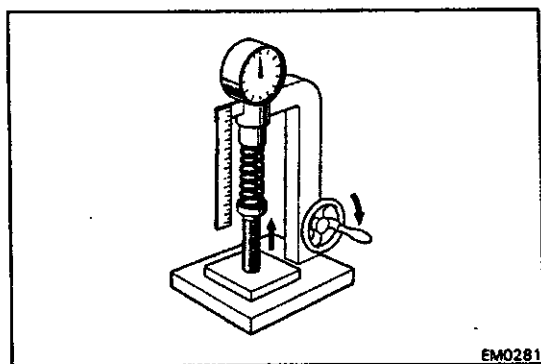
If squareness is greater than maximum, replace the valve spring.



- (b) Using calipers, measure the free length of the valve spring.

**Free length: 41.64 mm (1.6394 in.)**

If the free length is not within specification, replace the valve spring.

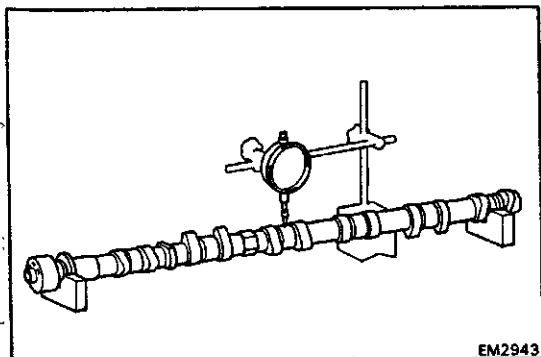


- (c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

**Installed tension:**

**16.0 kg (35 lb, 157 N) at 35.0 mm (1.378 in.)**

If the installed tension is not as specified, replace the valve spring.

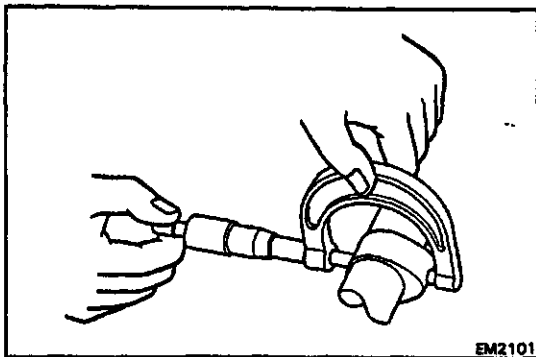


### 14. INSPECT CAMSHAFT AND BEARING CAPS

- (a) Place the camshaft on V-blocks and, using a dial gauge, measure the circle runout at the center journal.

**Maximum circle runout: 0.03 mm (0.0012 in.)**

If the circle runout is greater than maximum, replace the camshaft.



EM2101

(b) Using a micrometer, measure the cam lobe height.

**Standard cam lobe height:**

**Intake**

|        |    |                       |
|--------|----|-----------------------|
| 7M-GE  | MA | 38.36 mm (1.5102 in.) |
|        | MS | 38.16 mm (1.5024 in.) |
| 7M-GTE |    | 38.35 mm (1.5098 in.) |

**Exhaust**

|        |    |                       |
|--------|----|-----------------------|
| 7M-GE  | MA | 38.36 mm (1.5102 in.) |
|        | MS | 38.35 mm (1.5098 in.) |
| 7M-GTE |    | 38.35 mm (1.5098 in.) |

**Minimum cam lobe height:**

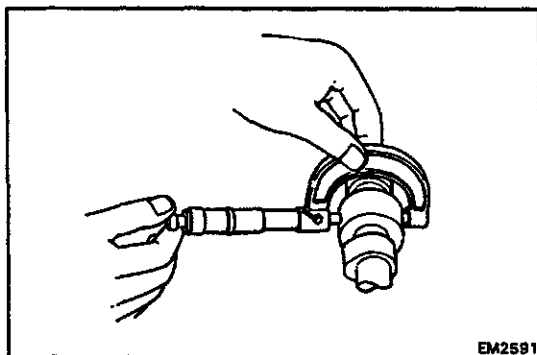
**Intake**

|        |    |                       |
|--------|----|-----------------------|
| 7M-GE  | MS | 37.85 mm (1.4905 in.) |
| Others |    | 38.00 mm (1.4961 in.) |

**Exhaust**

38.00 mm (1.4961 in.)

If the cam lobe height is less than minimum, replace the camshaft.



EM2591

(c) Using a micrometer, measure the journal diameter.

**Standard diameter:**

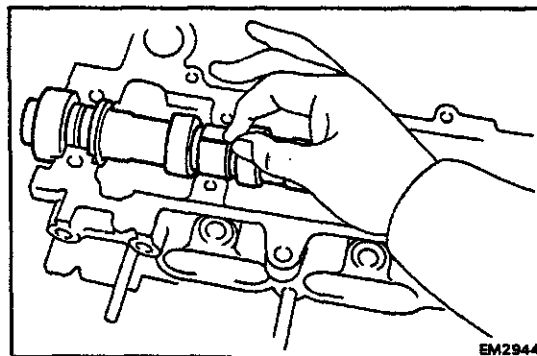
**No.1**

26.949 – 26.965 mm (1.0610 – 1.0616 in.)

**No.2 – No.7**

26.888 – 26.975 mm (1.0586 – 1.0620 in.)

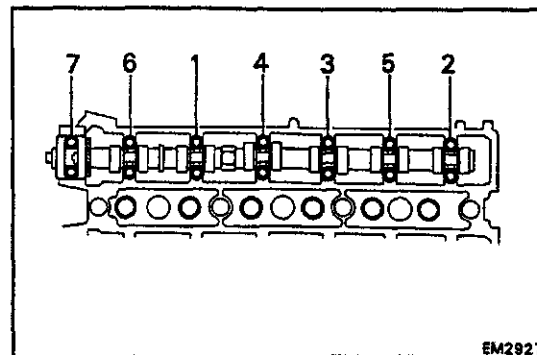
If the journal diameter is less than specified, replace the camshaft.



EM2944

## 15. INSPECT CAMSHAFT OIL CLEARANCE

- Clean the bearing caps and camshaft journal.
- Place the camshaft in the cylinder head.
- Lay a strip of plastigage across each journal.



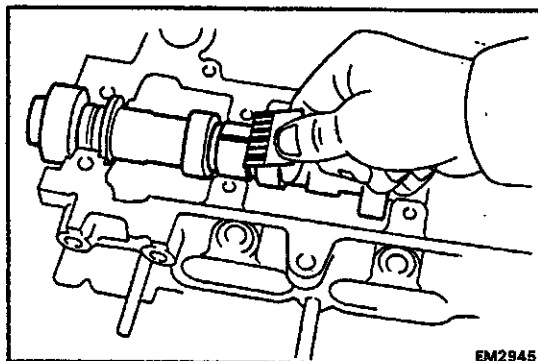
EM2927

- Place the bearing caps with the top of the number on the cap pointing toward the front and in numerical order from the front side.
- Install and torque the cap bolts gradually in the sequence shown in the figure.

**Torque:** 200 kg-cm (14 ft-lb, 20 N·m)

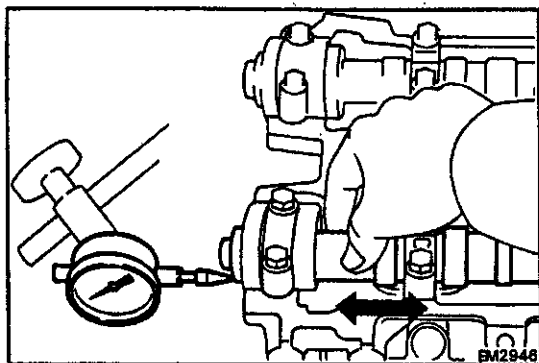
**NOTE:** Do not turn the camshaft while the plastigage is in place.

- Remove the caps and measure the plastigage at its widest point.

**Standard oil clearance:****No.1****0.035 – 0.072 mm (0.0014 – 0.0028 in.)****No.2 – No.7****0.025 – 0.093 mm (0.0010 – 0.0037 in.)****Maximum oil clearance: 0.13 mm (0.0051 in.)**

If clearance is greater than maximum, replace the cylinder head and/or camshaft.

- (g) Clean out the pieces of plastigage from the bearing caps and journals.

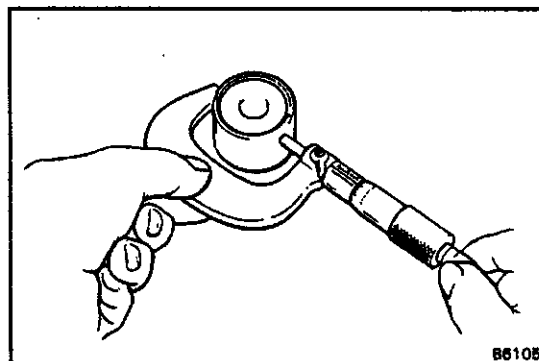
**16. INSPECT CAMSHAFT THRUST CLEARANCE**

- (a) Clean and install the camshaft and bearing caps.  
 (b) Using a dial gauge, measure the thrust clearance while moving the camshaft back and forth.

**Standard thrust clearance: 0.08 – 0.19 mm  
 (0.0031 – 0.0075 in.)**

**Maximum thrust clearance: 0.30 mm (0.0118 in.)**

If clearance is greater than maximum, replace the camshaft and/or cylinder head.

**17. INSPECT VALVE LIFTER OIL CLEARANCE**

- (a) Using a micrometer, measure the diameter of the valve lifter.

**Valve lifter diameter: 27.975 – 27.985 mm  
 (1.1014 – 1.1018 in.)**

- (b) Using a dial indicator, measure the inside diameter of the cylinder head bore.

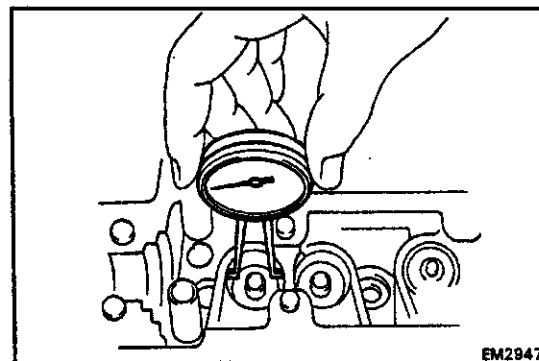
**Lifter bore diameter: 28.000 – 28.021 mm  
 (1.1024 – 1.1032 in.)**

- (c) Subtract the valve lifter measurement from the cylinder head bore.

**Standard oil clearance: 0.015 – 0.046 mm  
 (0.0006 – 0.0018 in.)**

**Maximum oil clearance: 0.1 mm (0.004 in.)**

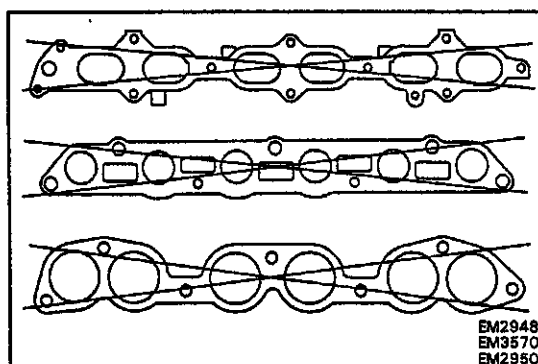
If clearance is greater than maximum, replace the cylinder head and/or valve lifter.

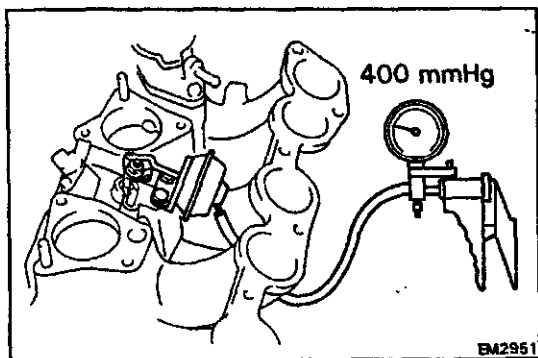
**18. INSPECT INTAKE, EXHAUST MANIFOLD AND INTAKE CHAMBER**

Using a precision straight edge and feeler gauge, check the surfaces contacting the cylinder head or intake manifold for warpage.

**Maximum warpage:**

|                  |        |                      |
|------------------|--------|----------------------|
| Intake manifold  |        | 0.10 mm (0.0039 in.) |
| Exhaust manifold | 7M-GE  | 0.75 mm (0.0295 in.) |
|                  | 7M-GTE | 0.50 mm (0.0197 in.) |
| Intake chamber   |        | 0.10 mm (0.0039 in.) |





## INSPECTION OF INTAKE AIR CONTROL SYSTEM (7M-GE only)

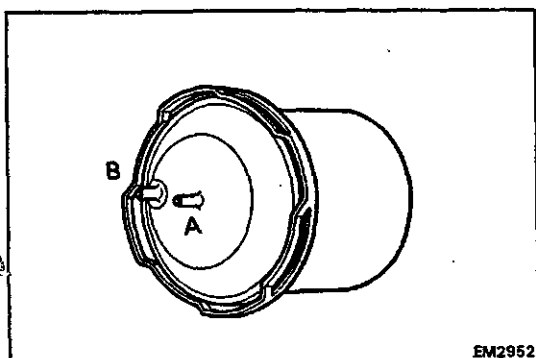
### 1. CHECK AIR CONTROL VALVE OPERATION

With 400 mmHg (15.75 in.Hg, 53.3 kPa) of vacuum applied to the actuator, check that the control valve moves smoothly to the fully closed position.

If not adjust with the adjusting screw.

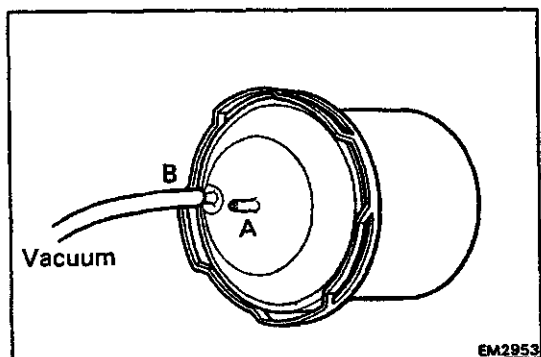
### 2. CHECK VACUUM TANK BY BLOWING AIR INTO EACH PIPE

- Check that air flows from pipe B to A.
- Check that air does not flow from pipe A to B.



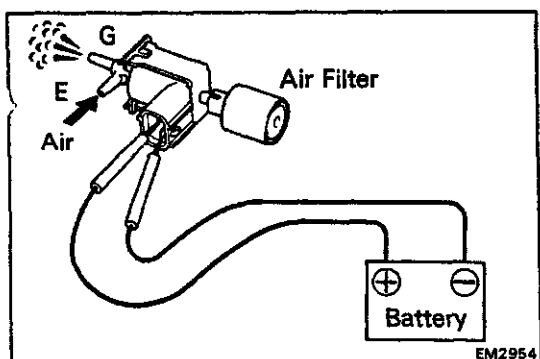
- Apply 500 mmHg (19.69 in.Hg, 66.7 kPa) of vacuum to pipe B and check that there is no change in vacuum after one minute.

If there is a change, replace the vacuum tank.



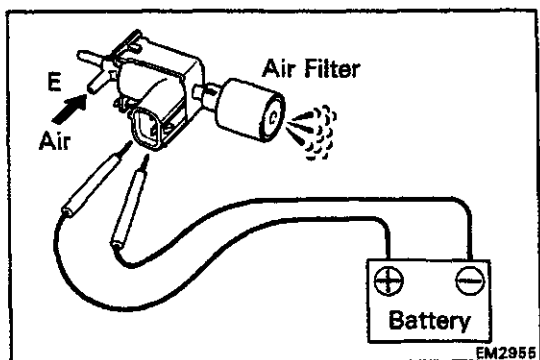
### 3. CHECK VACUUM CIRCUIT CONTINUITY IN THE VSV BY BLOWING AIR INTO PIPE

- Connect the VSV terminals to the battery terminals as illustrated.
- Blow into pipe E and check that air comes out of the pipe G.



- Disconnect the battery.
- Blow into pipe E and check that air comes out of the air filter.

If a problem is found, replace the VSV.

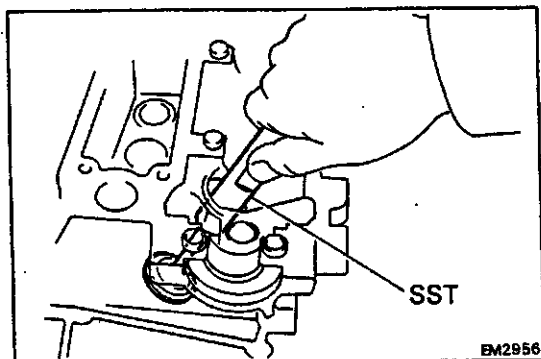


**ASSEMBLY OF CYLINDER HEAD**

(See pages EM-37, 38)

**NOTE:**

- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets and oil seals with new ones.

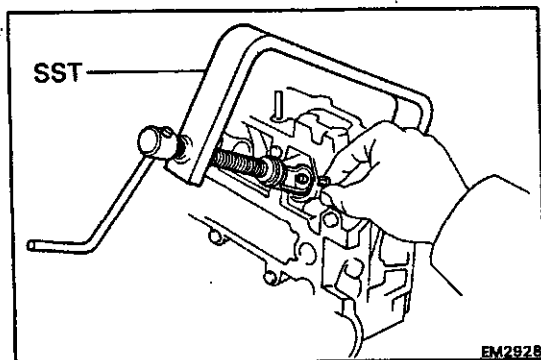
**1. INSTALL VALVES**

- Insert the valves in the cylinder head valve guide bushing. Make sure the valves are installed in the correct order.

- Using SST, install new oil seals on the valve guide bushings.

SST 09201-41020

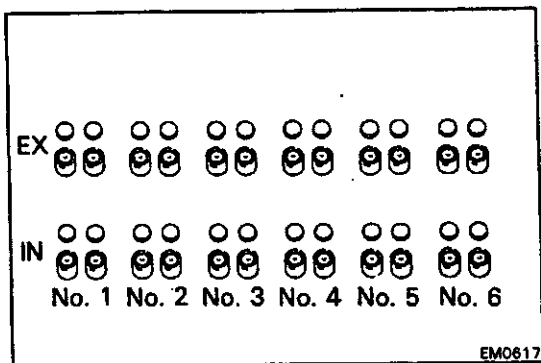
- Install spring seats, springs and spring retainers.



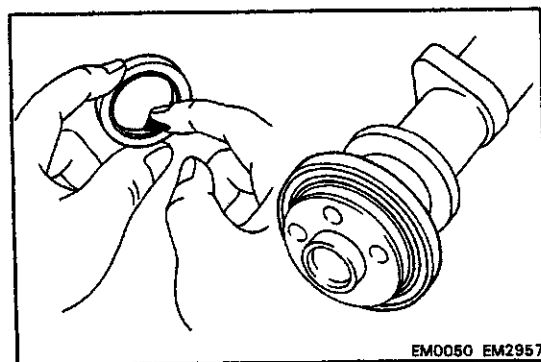
- Using SST, compress the valve retainers and place two keepers around the valve stem.

SST 09202-70010

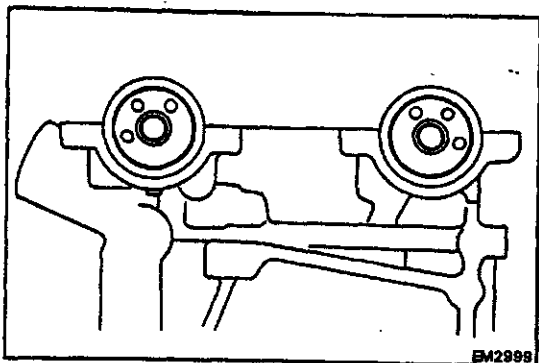
- Tap the stem lightly to assure proper fit.

**2. INSTALL VALVE LIFTERS WITH SHIMS**

Make sure the valve lifters with their shims are installed in the correct order.

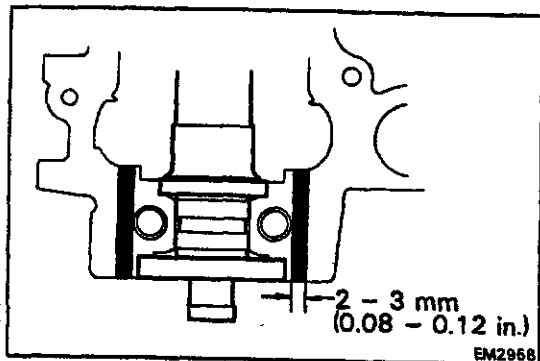
**3. INSTALL CAMSHAFTS AND OIL SEALS**

- Apply engine oil to the lip of a new oil seal.
- Install the oil seal to the camshaft.



- (c) Coat all bearing journals with engine oil.
- (d) Place the camshafts on the cylinder head as shown in the figure.

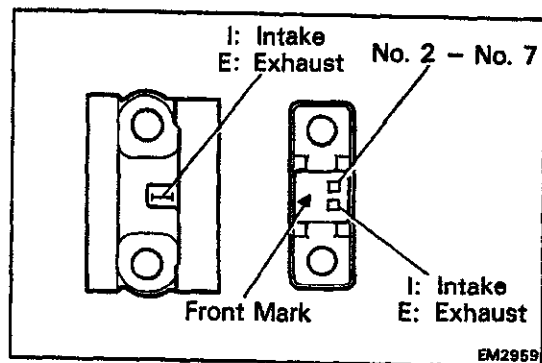
NOTE: The exhaust camshaft has a distributor (7M-GE) or cam position sensor (7M-GTE) drive gear.



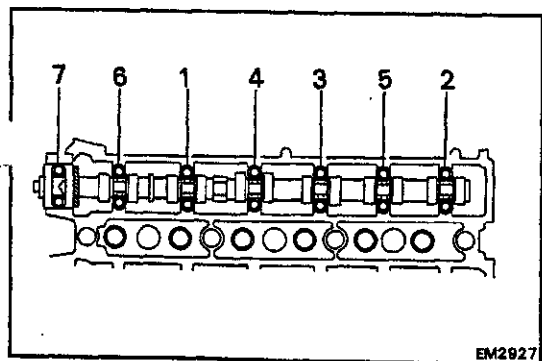
- (e) Apply seal packing to the areas indicated in the figure.

**Seal packing:** Part No.08826-00080 or equivalent

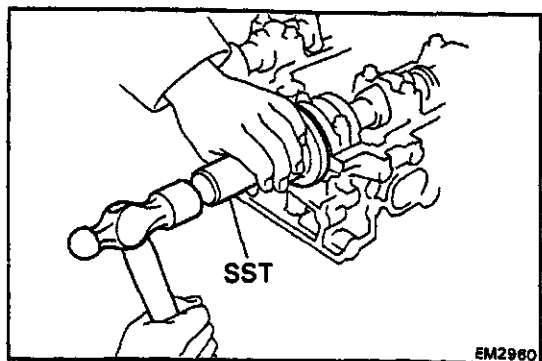
NOTE: Install the No.1 bearing cap immediately after applying the seal packing.



- (f) Place bearing caps on each journal with the front marks pointing toward the front.



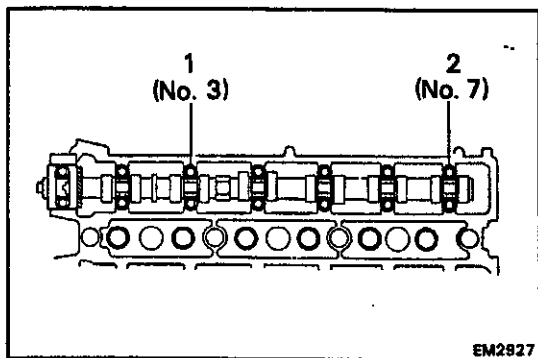
- (g) Tighten each bearing cap bolt a little at a time and in the sequence shown in the figure.



- (h) Using SST, drive in a new camshaft oil seal.

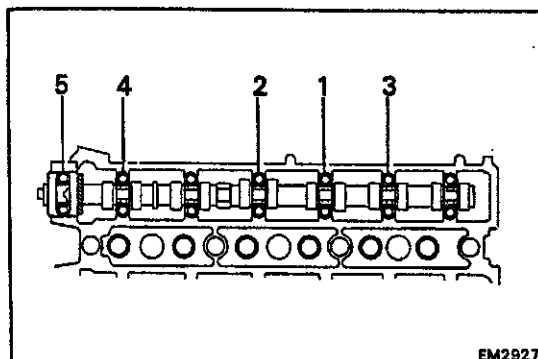
SST 09223-50010

NOTE: Be careful not to install the oil seal slantwise.



- (i) Tighten the No.3 and No.7 bearing cap bolts a little at a time and in the sequence shown in the figure.

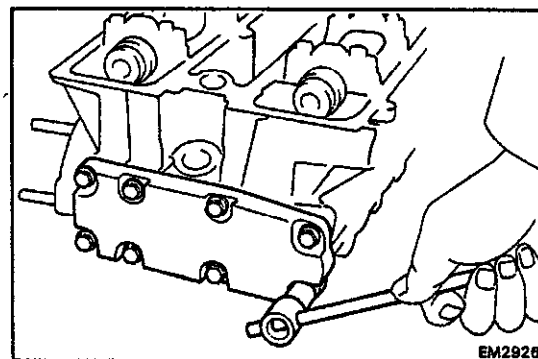
**Torque: 200 kg-cm (14 ft-lb, 20 N·m)**



- (j) Torque each bearing cap bolt a little at a time and in the sequence shown in the figure.

**Torque: 200 kg-cm (14 ft-lb, 20 N·m)**

- (k) Check the camshaft thrust clearance.



#### 4. (w/ EGR)

##### **INSTALL EGR COOLER**

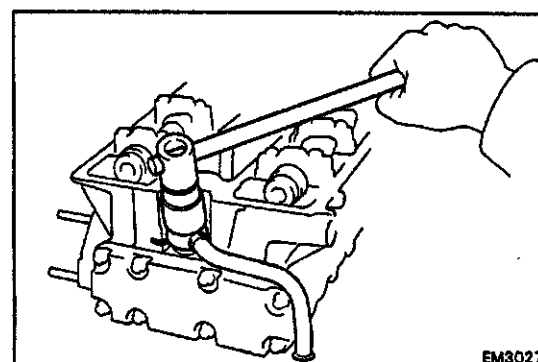
Install a new gasket and EGR cooler with the eight bolts.

**Torque: 140 kg-cm (10 ft-lb, 14 N·m)**

#### (w/o EGR)

##### **INSTALL EGR HOLE PLATE**

Install a new gasket and EGR hole plate with the two bolts.



#### 5. **INSTALL HEATER UNION**

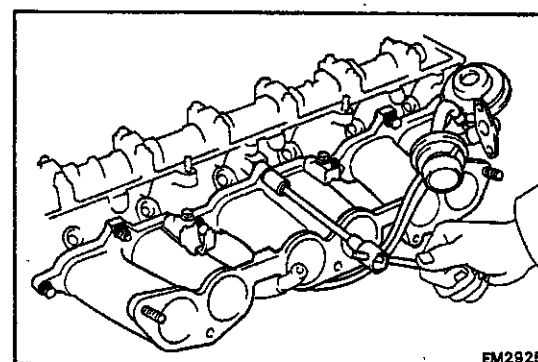
- (a) Install a new gasket, union, another gasket and union bolt to the cylinder head.

- (b) Torque the union bolt.

**Torque: 600 kg-cm (43 ft-lb, 59 N·m)**

#### 6. **INSTALL NO.2 ENGINE HANGER AND GROUND STRAP**

**Torque: 400 kg-cm (29 ft-lb, 39 N·m)**



#### 7. **INSTALL INTAKE MANIFOLD**

- (a) Position a new gasket on the cylinder head.

- (b) (w/ EGR)

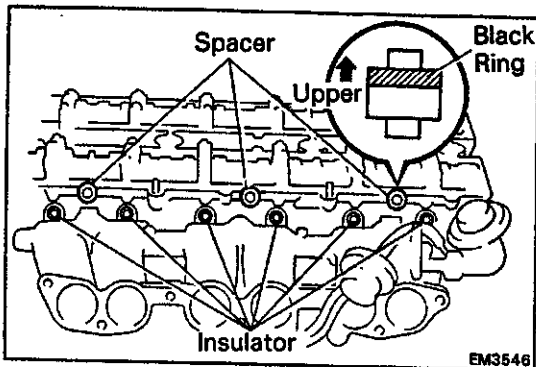
- Install the intake manifold and VSV with the two nuts and seven bolts.
- Install the EGR valve with the two nuts.
- Torque the bolts and nuts.

**Torque: 180 kg-cm (13 ft-lb, 18 N·m)**

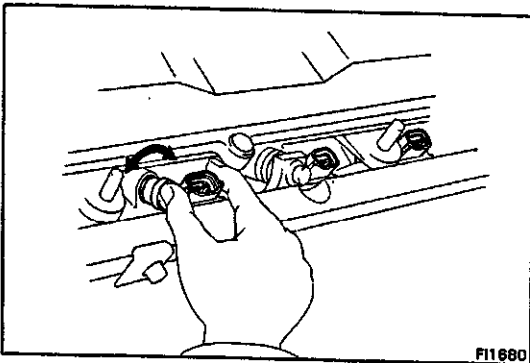
(w/o EGR)

- Install the intake manifold four nuts and seven bolts.
- Torque the bolts and nuts.

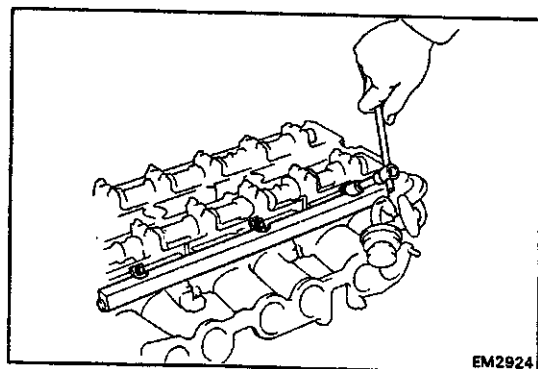
Torque: 180 kg-cm (13 ft-lb, 18 N·m)

**8. INSTALL DELIVERY PIPE WITH INJECTORS**

- Install the six insulators into the injector hole of the cylinder head.
- Install the black rings on the upper portion of each of the three spacers. Then install the spacers on the delivery pipe mounting holes of the cylinder head.



- Place the injectors together with delivery pipe on the cylinder head.
- Make sure that the injectors rotate smoothly.



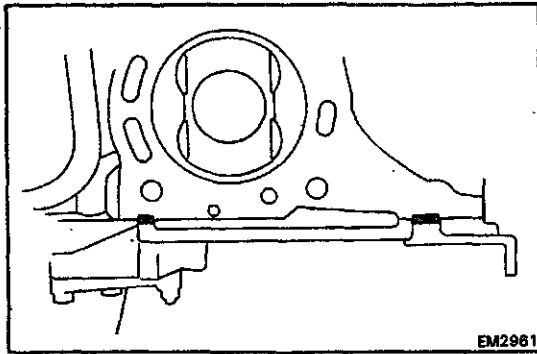
- Install the three thinner spacers and bolts. Torque the bolts.

Torque: 180 kg-cm (13 ft-lb, 18 N·m)

**9. INSTALL ALTERNATOR BRACKET**

Torque: 400 kg-cm (29 ft-lb, 39 N·m)

**10. INSTALL NO.2 TIMING BELT COVER**



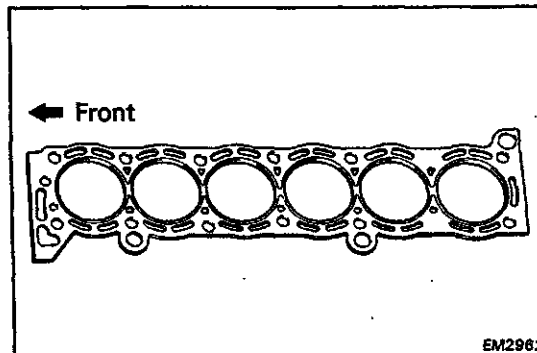
## INSTALLATION OF CYLINDER HEAD

(See pages EM-37, 38)

### 1. INSTALL CYLINDER HEAD

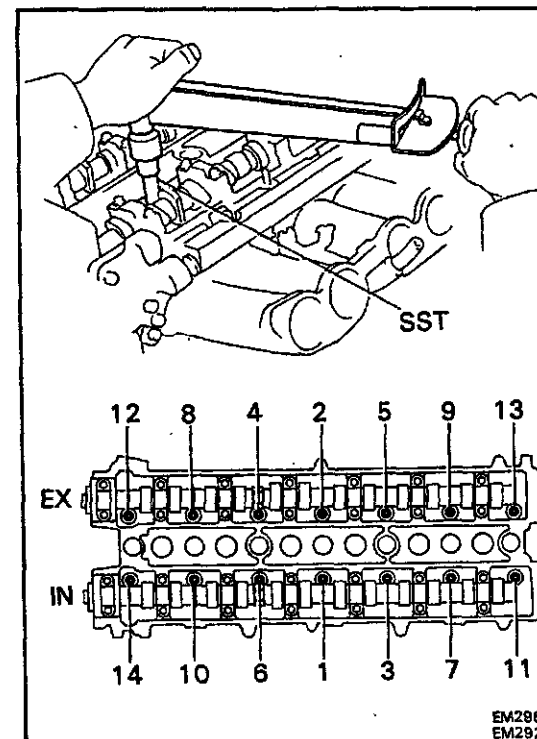
(a) Apply seal packing to the two locations shown.

Seal packing: Part No. 08826-00080 or equivalent



(b) Place a new cylinder head gasket on the cylinder block.

**CAUTION:** Be careful of the installation direction.



(c) Place the cylinder head on the cylinder head gasket, and connect the No.5 water by-pass hose to the union.

(d) Apply a light coat of the engine oil on the threads and under the cylinder head bolts.

(e) Using SST, install and uniformly tighten the fourteen cylinder head bolts in several passes and in the sequence shown.

SST 09043-38100

Torque: 800 kg-cm (58 ft-lb, 78 N·m)

### 2. INSTALL CAMSHAFT TIMING PULLEYS AND TIMING BELT

(See steps 8 to 12 and 14 on pages EM-34 to 36)

### 3. INSTALL SPARK PLUGS

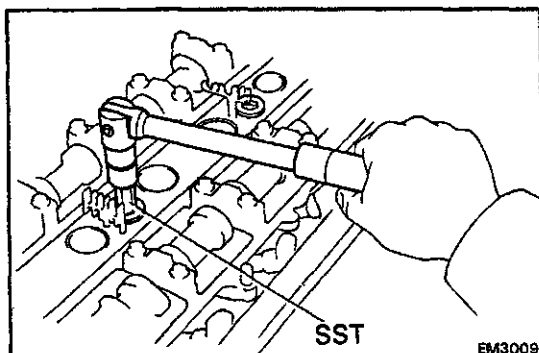
(See page IG-7)

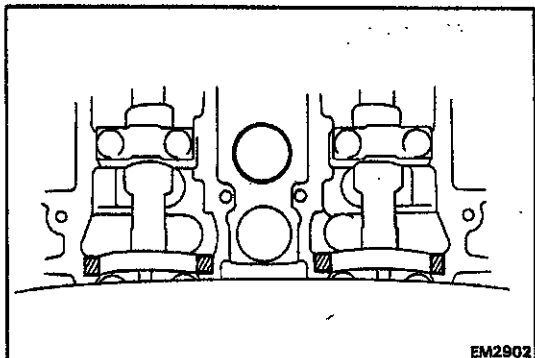
### 4. INSTALL CYLINDER HEAD COVERS

(a) Using SST, install the No.3 cylinder head cover and heater hose clamp.

SST 09923-00010

Torque: 180 kg-cm (13 ft-lb, 18 N·m)



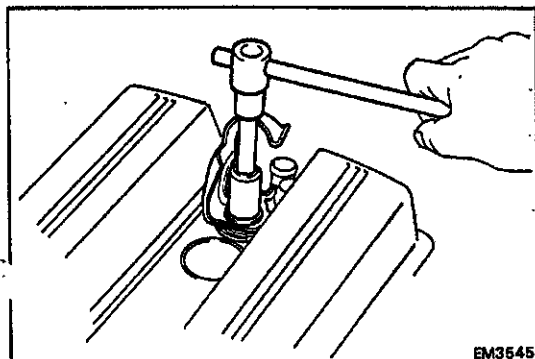


- (b) Apply seal packing to the cylinder head as shown in the figure.

Seal packing: Part No.08826-00080 or equivalent

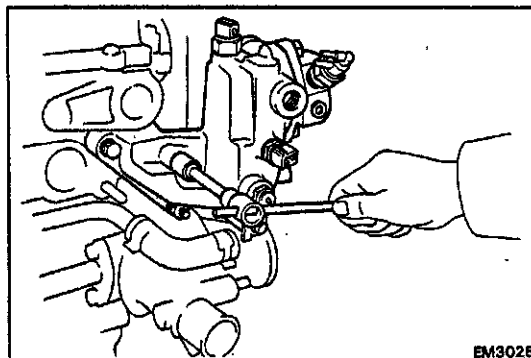
- (c) Install the No.1 and No.2 cylinder head covers.

Torque: 25 kg-cm (22 in.-lb, 2.5 N·m)



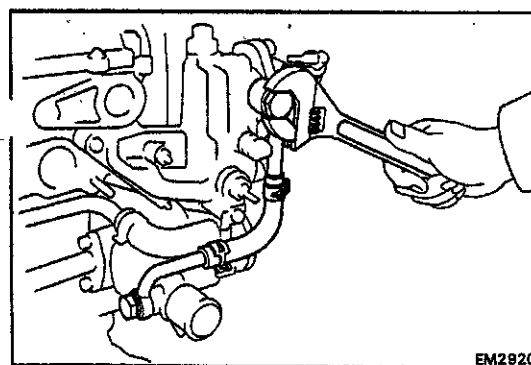
- (d) (MA)  
Install the heater hose clamp.

- (e) (7M-GTE)  
Install the accelerator link.

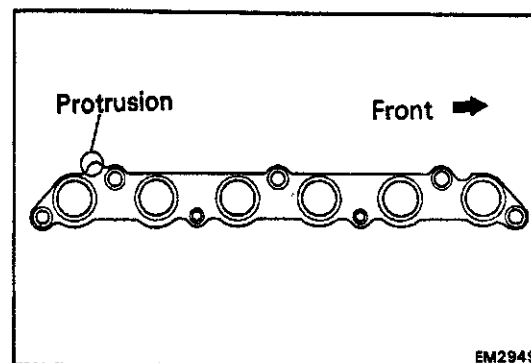


## 5. INSTALL WATER OUTLET HOUSING

- (a) Install a new gasket and water outlet housing with the bolt and two nuts.  
(b) Connect the No.6 water by-pass hose.

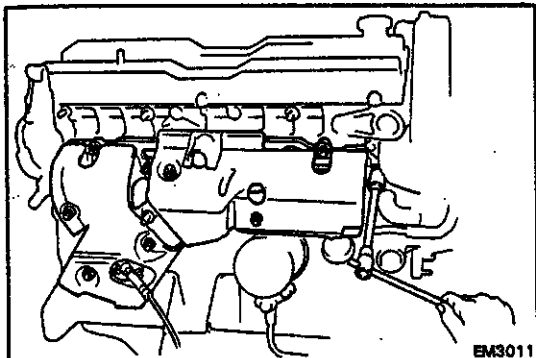


- (c) (7M-GE)  
Install a new gasket, union, another gasket and union bolt to the water outlet housing.



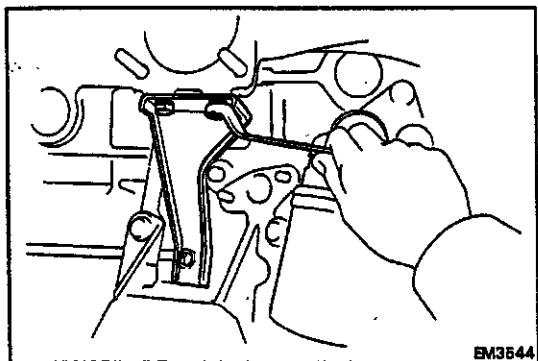
## 6. INSTALL EXHAUST MANIFOLD

- (a) Face a new exhaust gasket so the protrusion is facing the rear and install on the cylinder head.



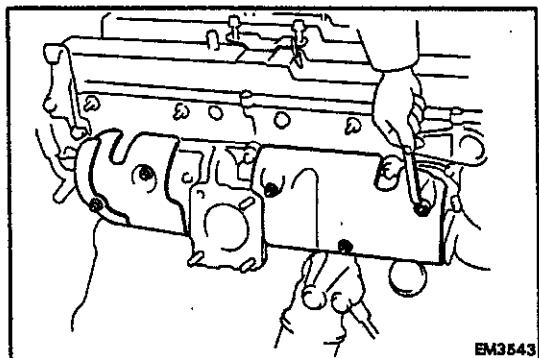
(b) Install the exhaust manifold with the seven nuts.

**Torque: 400 kg-cm (29 ft-lb, 39 N·m)**



(c) (7M-GTE)

Install the exhaust manifold stay with the three bolts.



(d) (7M-GTE)

Install the heat insulators with the five bolts.

7. (7M-GTE)

**INSTALL TURBOCHARGER**

(See steps 4 to 8 and 10 to 12 on pages TC-15 to 17)

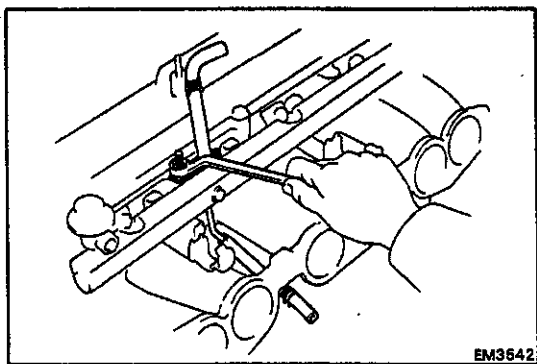
8. (7M-GE)

**INSTALL OIL DIPSTICK**

9. (7M-GE)

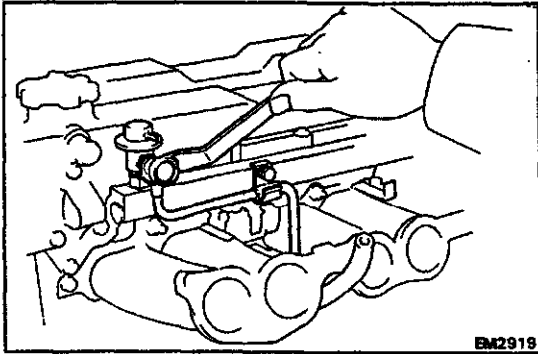
**INSTALL DISTRIBUTOR AND HIGH-TENSION CORDS**

(See page IG-22)



10. (7M-GTE)

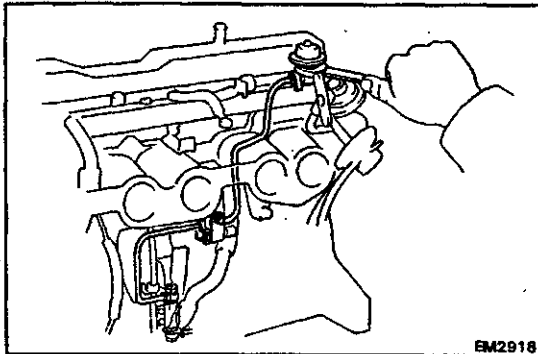
**INSTALL AUXILIARY AIR PIPE**

**11. INSTALL NO.2 FUEL PIPE**

- (a) Install a new gasket, No.2 fuel pipe, another gasket and union bolt to the pressure regulator.

**Torque: 250 kg-cm (18 ft-lb, 25 N·m)**

- (b) Install the No.2 fuel pipe to the delivery pipe with the bolt.

**12. INSTALL NO.1 FUEL PIPE AND PULSATION DAMPER**

- (a) Install a new gasket, No.1 fuel pipe, another gasket and pulsation damper to the delivery pipe.

**Torque: 400 kg-cm (29 ft-lb, 39 N·m)**

- (b) Install the No.1 fuel pipe and VSV to the intake manifold.

- (c) Connect the No.1 fuel pipe to the fuel support (MA) or fuel filter (MS).

**13. INSTALL ENGINE WIRE**

- (a) Install the engine wire to the each clamps.
- (b) Connect following wires:
- Three VSV connectors
  - Knock sensor connector
  - Ground strap to intake manifold
  - Injector connectors
  - Distributor connector
  - Cold start injector time switch connector
  - Water temp. sender gauge connector
  - Water temp. sensor connector
  - Oil pressure sender gauge connector
  - (w/ TWC)  
Oxygen sensor connector

**14. (7M-GTE)**

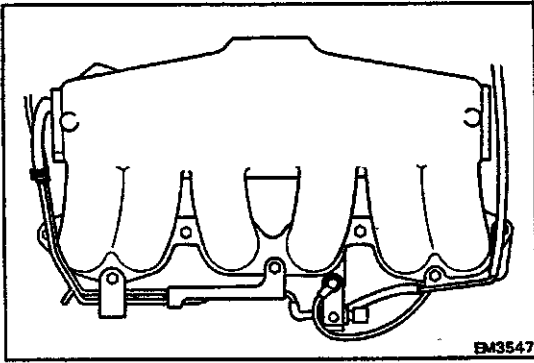
**INSTALL IGNITION COIL WITH BRACKET**  
(See steps 11, 12 on page EM-13)

**15. INSTALL AIR INTAKE CHAMBER WITH CONNECTOR**

- (a) Position a new gasket on the intake manifold.

- (b) (7M-GTE)

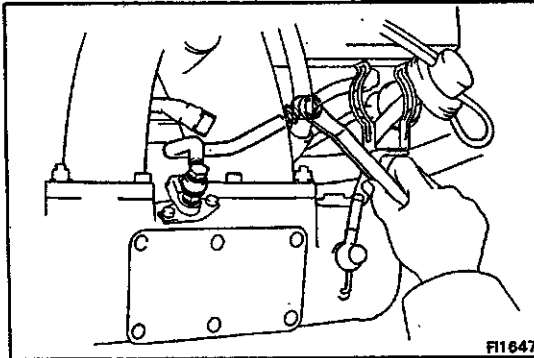
Connect the cold start injector connector



- (c) Install the intake chamber with connector and vacuum transmitting pipes with the two nuts and five bolts.

**Torque: 180 kg-cm (13 ft-lb, 18 N·m)**

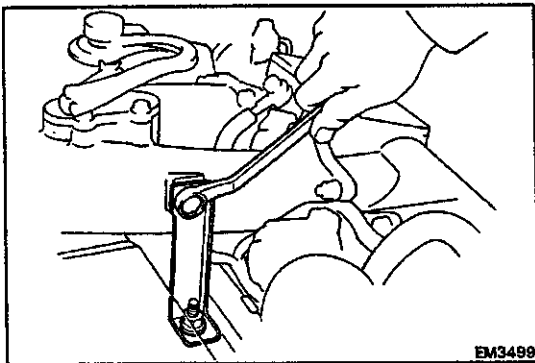
- (d) Connect the engine wire to the clamps of the intake chamber.



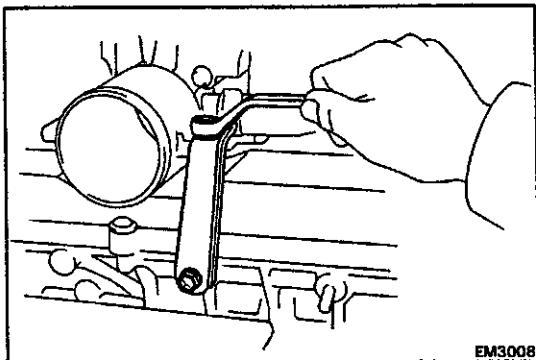
- (e) Install new gaskets and cold start injector tube.

**Torque: To delivery pipe**  
**300 kg-cm (22 ft-lb, 29 N·m)**  
**To cold start injector**  
**180 kg-cm (13 ft-lb, 18 N·m)**

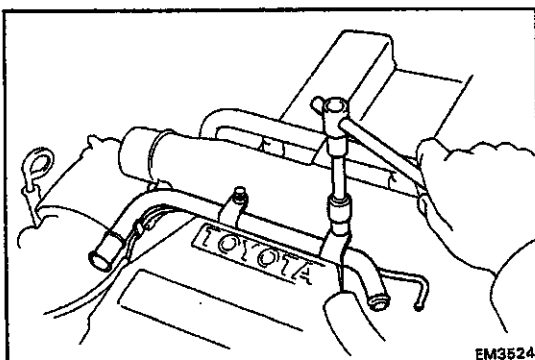
- (f) (w/ EGR)  
 Install the EGR vacuum modulator to the bracket.



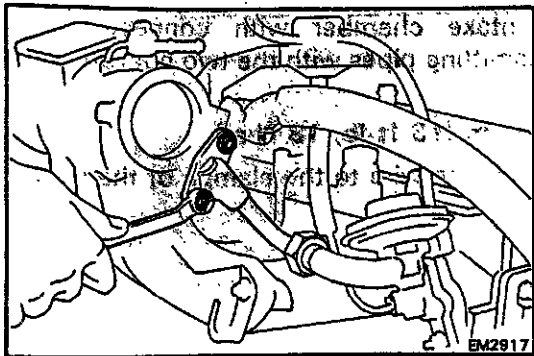
- (g) (7M-GE)  
 Install the air intake connector bracket mounting bolts.



- (h) (7M-GE)  
 Install the throttle body bracket(s).

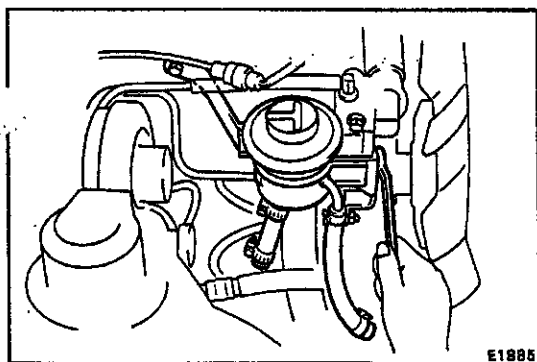


- (i) (7M-GTE)  
 Install the ISC pipe and connect the hoses.



- (j) Install the EGR pipe mounting bolts.
- (k) Install the manifold stay mounting bolt.
- (l) Connect following hoses:
  - (7M-GE)  
No.3 water by-pass hose to throttle body (7M-GTE)
  - Auxiliary air pipe hose to vacuum transmitting pipe
  - No.1 water by-pass hose to ISC valve
- (m) Connect following hoses:
  - (7M-GE)  
Diaphragm hose
  - VSV(for fuel pressure up)hoses
  - Pressure regulator hose
  - EGR hoses to throttle body and vacuum transmitting pipe.
  - Vacuum transmitting pipe hose to intake chamber
  - BVSV hose to throttle body
- (n) Connect following wires:
  - ISC valve connector
  - Throttle position sensor connector
  - (7M-GE)  
Cold start injector connector.
- (o) Install the PCV pipe.

**16. (7M-GTE)**  
**INSTALL CAM POSITION SENSOR**  
 (See steps 1, 2 on page IG-26)

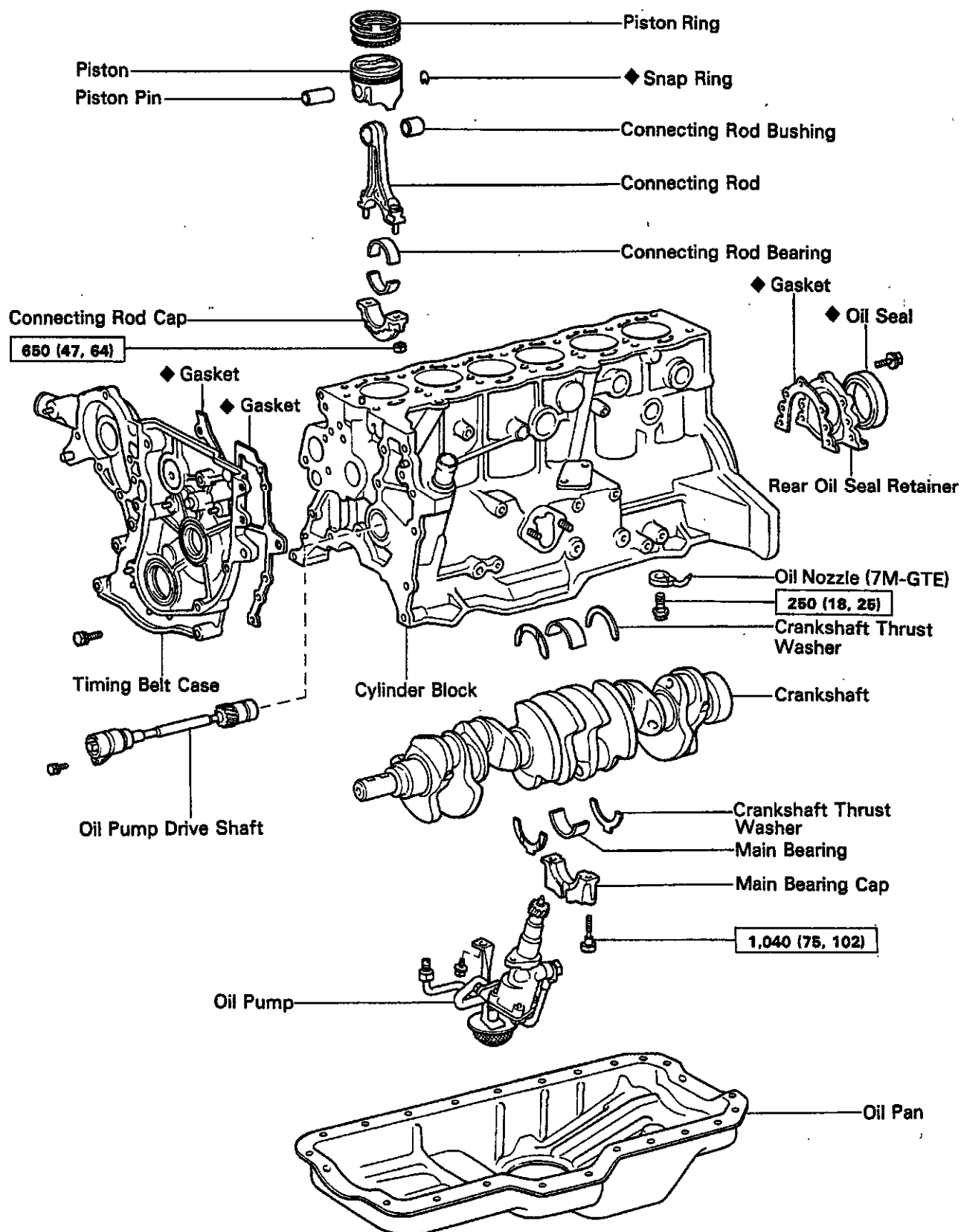


**17. (7M-GTE)**  
**INSTALL PS RESERVOIR TANK**  
 Install the PS reservoir tank with bracket.

**18. INSTALL ALTERNATOR AND ADJUSTING BAR**

- (a) Install the alternator and adjusting bar.
- (b) Install the drive belt.  
(See page EM-36)
- (c) Connect the No.3 PCV pipe.

# CYLINDER BLOCK COMPONENTS



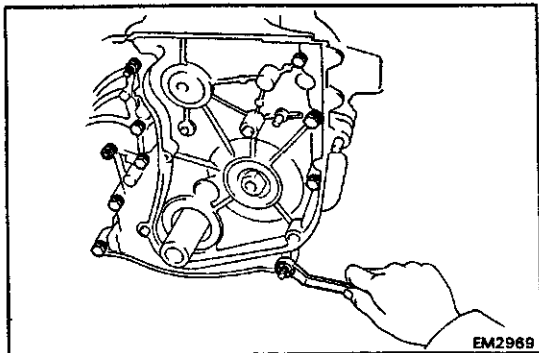
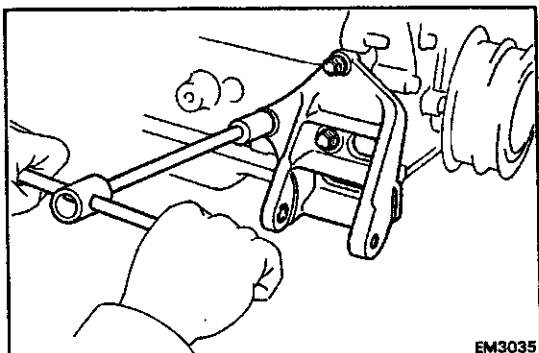
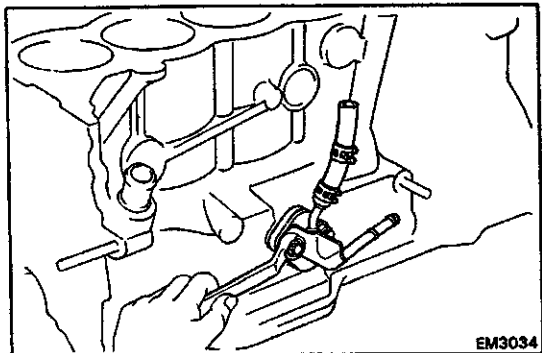
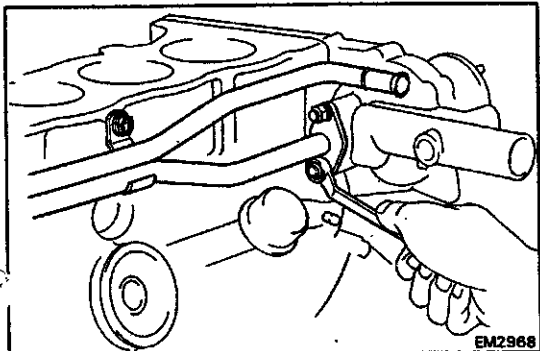
kg-cm (ft-lb, N·m) : Specified torque

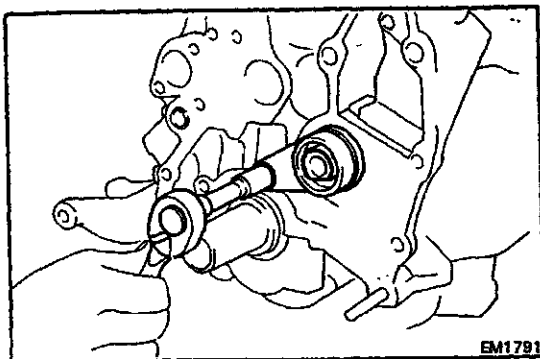
◆ Non-reusable part

**DISASSEMBLY OF CYLINDER BLOCK**

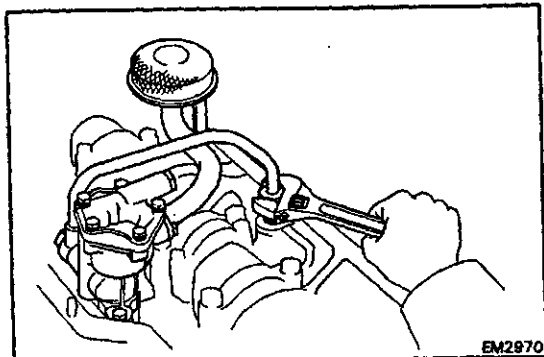
(See page EM-65)

1. **REMOVE FLYWHEEL OR DRIVE PLATE AND REAR END PLATE**
2. **INSTALL ENGINE STAND FOR DISASSEMBLY**
3. **REMOVE TIMING BELT**  
(See steps 2 to 8 and 10 to 18 on pages EM-28 to 31)
4. **REMOVE CYLINDER HEAD**  
(See steps 1 to 15 and 18 on pages EM-39 to 43)
5. **REMOVE WATER BY-PASS PIPE AND HOSES**
  - (a) Remove the two nuts from the timing belt case.
  - (b) Remove the three bolts from the cylinder block and the water by-pass pipe and hose with gasket.
6. **REMOVE GROUND STRAP FROM CYLINDER BLOCK**
7. (7M-GE)  
**REMOVE VACUUM CONTROL VALVE SET**
8. **REMOVE FUEL RETURN PIPE SUPPORT**  
Remove the two nuts, fuel pipe support and insulator.
9. **REMOVE ENGINE MOUNTING BRACKETS**
10. (7M-GE)  
**REMOVE OIL FILTER**  
(See page LU-6)  
(7M-GTE)  
**REMOVE OIL FILTER BRACKET**  
(See step 1 on page LU-18)
11. (7M-GE w/ Oil cooler)  
**REMOVE OIL HOLE COVER PLATE**  
(7M-GE w/o Oil cooler)  
**REMOVE OIL HOLE COVER PLATE**
12. **REMOVE PS PUMP BRACKET**
13. **REMOVE OIL PAN**  
(See page LU-9)
14. **REMOVE TIMING BELT CASE WITH WATER PUMP**  
Remove the seven bolts and three nuts, and remove the timing belt case and gaskets.

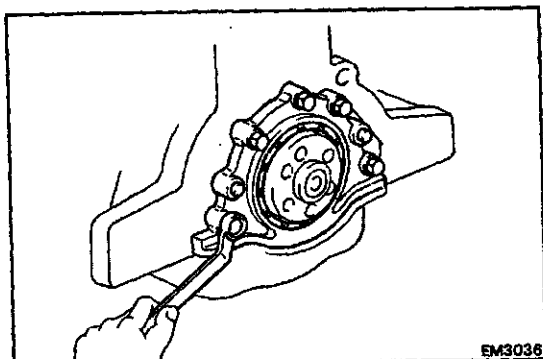


**15. REMOVE OIL PUMP DRIVE SHAFT**

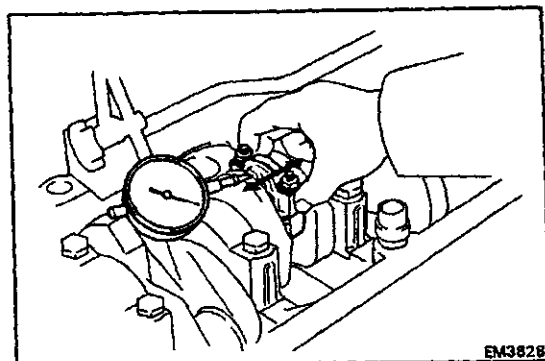
- (a) Remove the bolt and oil pump drive shaft.
- (b) While turning oil pump drive shaft, slowly pull out so as not to damage the bearing.

**16. REMOVE OIL PUMP**

- (a) Loosen the union nut.
- (b) Remove the two bolts and oil pump.

**17. REMOVE REAR OIL SEAL RETAINER**

Remove the five bolts, rear oil seal retainer and gasket.

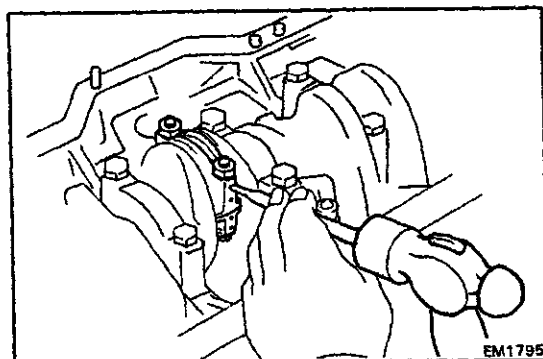
**18. CHECK CONNECTING ROD THRUST CLEARANCE**

Using a dial indicator, measure the thrust clearance while moving the rod back and forth.

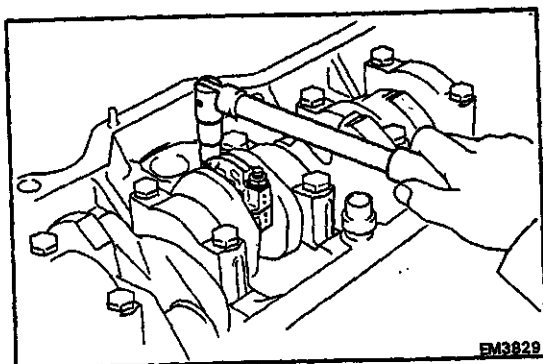
**Standard thrust clearance:** 0.160 – 0.296 mm  
(0.0063 – 0.0117 in.)

**Maximum thrust clearance:** 0.3 mm (0.012 in.)

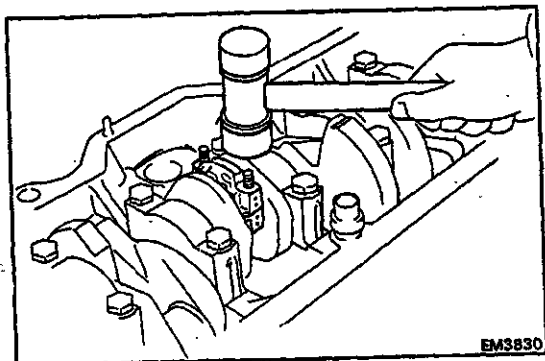
If clearance is greater than maximum, replace the connecting rod assembly. If necessary, replace the crankshaft.

**19. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE**

- (a) Using a punch or numbering stamp, place the matchmarks on the rod and cap to ensure correct reassembly.

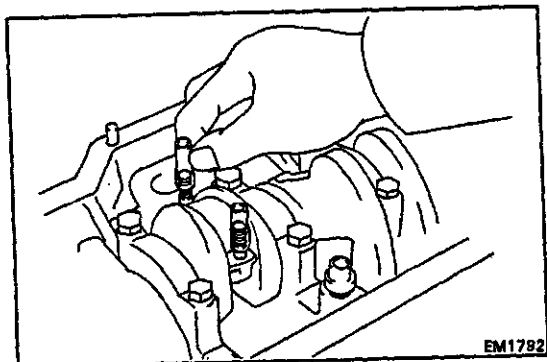


(b) Remove the connecting rod cap nuts.

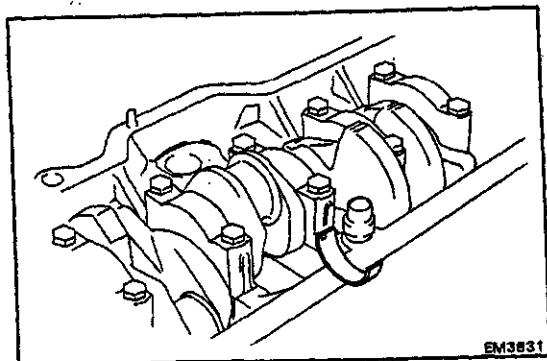


(c) Using a plastic-faced hammer, lightly tap the connecting rod bolts and lift off the connecting rod cap.

NOTE: Keep the lower bearing inserted with the connecting rod cap.



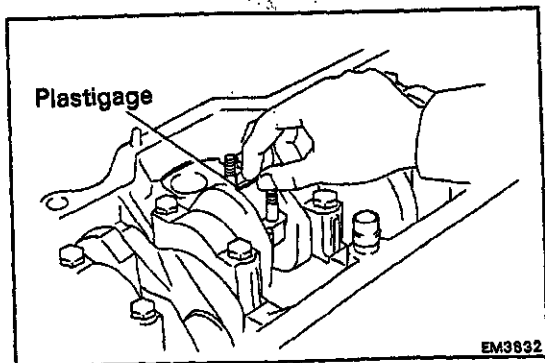
(d) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.



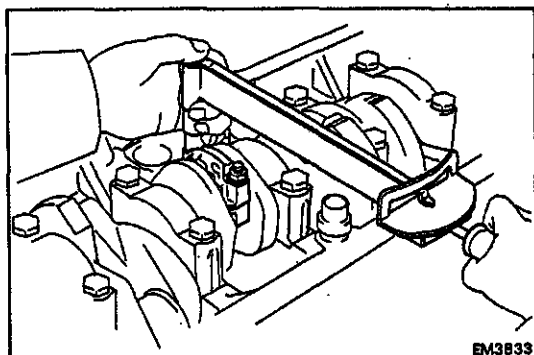
(e) Clean the crank pin and bearing.

(f) Check the crank pin and bearing for pitting and scratches.

If the crank pin or bearing are damaged, replace the bearings. If necessary, grind or replace the crankshaft.



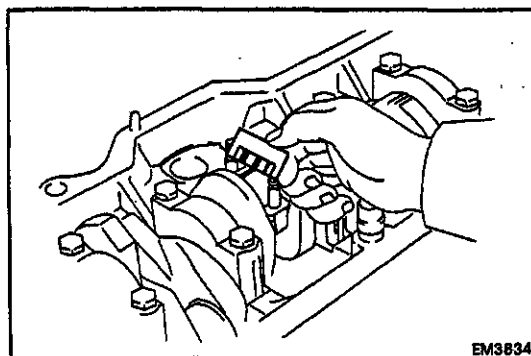
(g) Lay a strip of Plastigage across the crank pin.



- (h) Install the connecting rod cap.  
(See step 7 on page EM-90)

**Torque: 650 kg-cm (47 ft-lb, 64 N·m)**

**NOTE:** Do not turn the crankshaft.



- (i) Remove the connecting rod cap.

- (j) Measure the Plastigage at its widest point.

**Standard oil clearance: 0.021 – 0.053 mm  
(0.0008 – 0.0021 in.)**

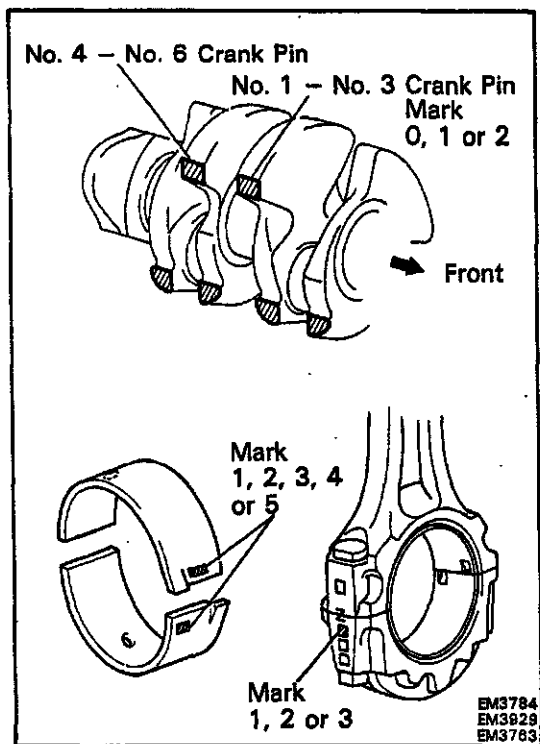
**Maximum oil clearance: 0.07 mm (0.0028 in.)**

If the oil clearance is greater than maximum, replace the bearings. If necessary, grind or replace the crankshaft.

**Undersized bearing: U/S 0.25**

- (k) Completely remove the plastigage.

**NOTE:** If using a standard size bearing, replace with one having the same number. If the number of the bearing cannot be determined, select a bearing from the table below according to the numbers imprinted on the connecting rod cap and crankshaft. There are five sizes of standard bearings, marked "1", "2", "3", "4" and "5".

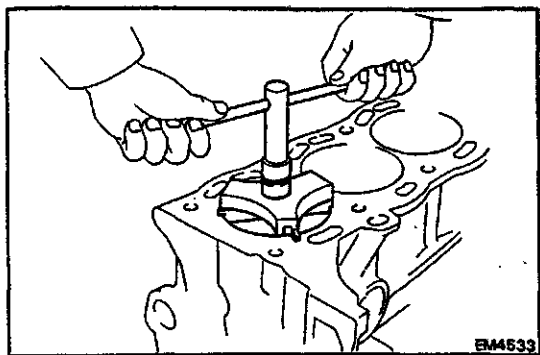


|            | Number marked |   |   |   |   |   |   |   |   |
|------------|---------------|---|---|---|---|---|---|---|---|
| Rod cap    | 1             | 1 | 2 | 1 | 2 | 3 | 2 | 3 | 3 |
| Crankshaft | 0             | 1 | 0 | 2 | 1 | 0 | 2 | 1 | 2 |
| Bearing    | 1             | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 5 |

**Example:** Rod cap "2", Crankshaft "1" = Bearing "3"

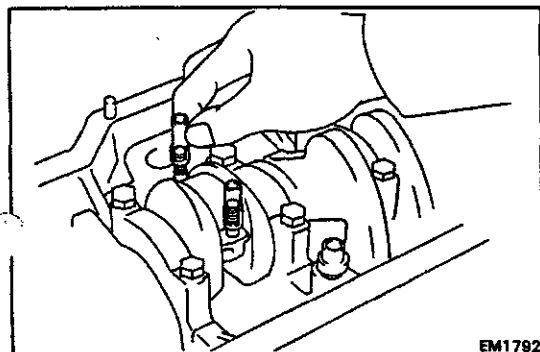
**(Reference)**

| Mark        | Big End Inner Diameter               | Crank Pin Diameter                   | mm (in.)                           |
|-------------|--------------------------------------|--------------------------------------|------------------------------------|
|             |                                      |                                      | Bearing Center Wall Thickness      |
| 0           | —                                    | 51.993 – 52.000<br>(2.0470 – 2/0472) | —                                  |
| 1           | 55.015 – 55.025<br>(2.1659 – 2.1663) | 51.985 – 51.992<br>(2.0446 – 2.0469) | 1.490 – 1.495<br>(0.0587 – 0.0589) |
| 2           | 55.026 – 55.035<br>(2.1664 – 2.1667) | 51.976 – 51.984<br>(2.0463 – 2.0466) | 1.496 – 1.500<br>(0.0589 – 0.0591) |
| 3           | 55.036 – 55.045<br>(2.1668 – 2.1671) | —                                    | 1.501 – 1.505<br>(0.0591 – 0.0593) |
| 4           | —                                    | —                                    | 1.506 – 1.510<br>(0.0593 – 0.0594) |
| 5           | —                                    | —                                    | 1.511 – 1.515<br>(0.0595 – 0.0596) |
| U/S<br>0.25 | 55.015 – 55.045<br>(2.1659 – 2.1671) | 51.725 – 51.735<br>(2.0364 – 2.0368) | 1.622 – 1.632<br>(0.0639 – 0.0643) |



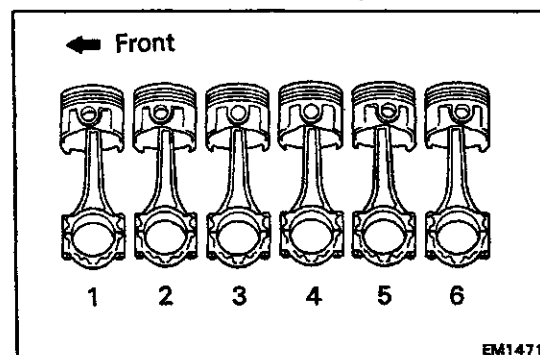
## 20. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

(a) Remove all the carbon from the top of the cylinder.



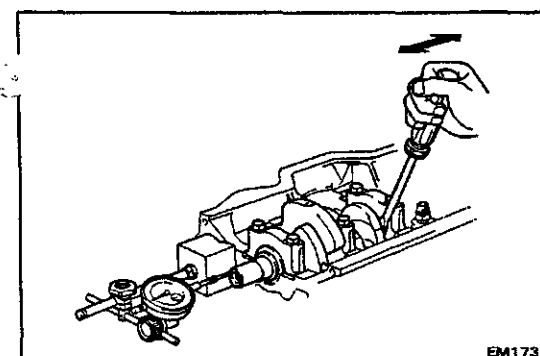
(b) Cover the rod bolts with a short piece of hose to protect the crankshaft from damage.

(c) Push the piston, connecting rod assembly and the upper bearing through the top of the cylinder block.



### NOTE:

- Keep the bearing insert with the connecting rod and cap.
- Arrange the piston and connecting rod assemblies in order.



## 21. CHECK CRANKSHAFT THRUST CLEARANCE

Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

**Standard thrust clearance:** 0.05 – 0.25 mm  
(0.0020 – 0.0098 in.)

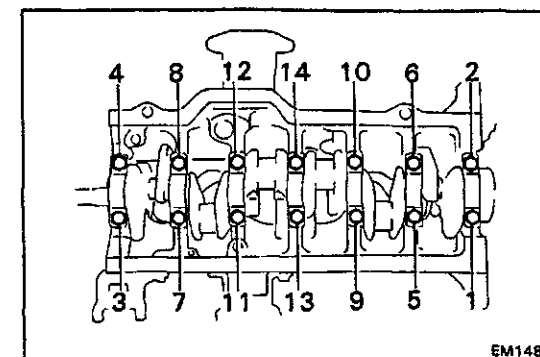
**Maximum thrust clearance:** 0.30 mm (0.0118 in.)

If the clearance is greater than maximum, replace the thrust washers as a set.

### Thrust washer thickness:

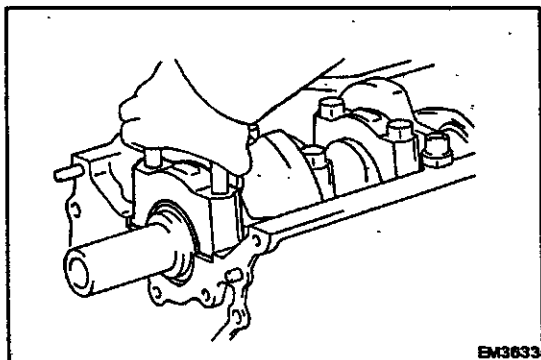
**STD size** 2.925 – 2.975 mm  
(0.1152 – 0.1171 in.)

**O/S 0.125** 2.988 – 3.038 mm  
(0.1176 – 0.1196 in.)



## 22. REMOVE MAIN BEARING CAPS AND CHECK OIL CLEARANCE

(a) Uniformly loosen and remove the main bearing cap bolts in several passes, in the sequence shown.



- (b) Using the removed main bearing cap bolts, wiggle the cap back and forth, and remove the caps, lower bearings and lower thrust washers (No. 4 cap only).

## NOTE:

- Keep the lower bearing inserted with the cap.
- Arrange the caps and lower thrust washers in correct order.

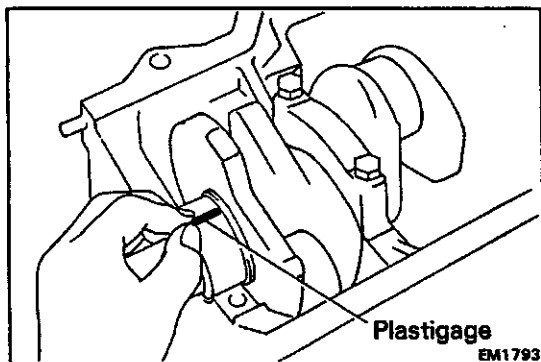
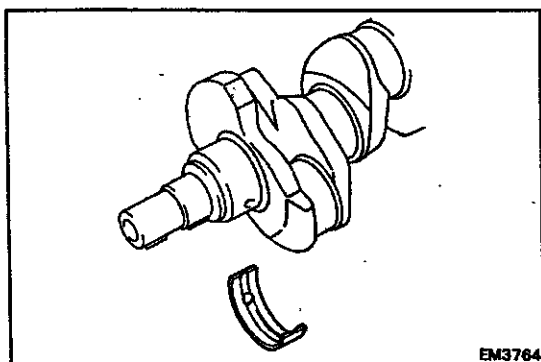
- (c) Lift out the crankshaft.

NOTE: Keep the upper bearings and upper thrust washers insert with the cylinder block.

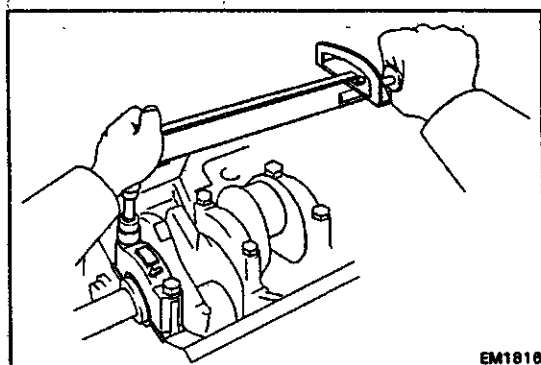
- (d) Clean each journal and bearing.

- (e) Check each journal and bearing for pitting and scratches.

If the journal or bearing is damaged, replace the bearings. If necessary, grind or replace the crankshaft.



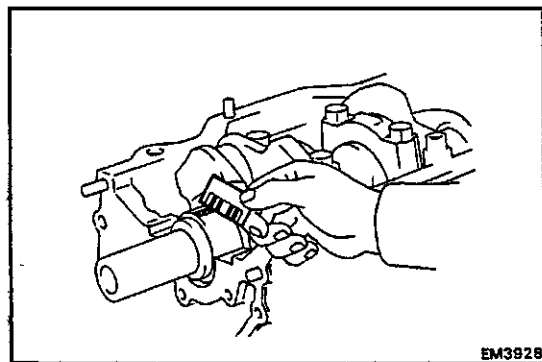
- (f) Place the crankshaft on the cylinder block.  
(g) Lay a strip of Plastigage across each journal.



- (h) Install the main bearing caps. (See step 5 on page EM-89)

**Torque: 1,040 kg-cm (75 ft-lb, 102 N-m)**

NOTE: Do not turn the crankshaft.



- (i) Remove the main bearing caps.

- (j) Measure the Plastigage at its widest point.

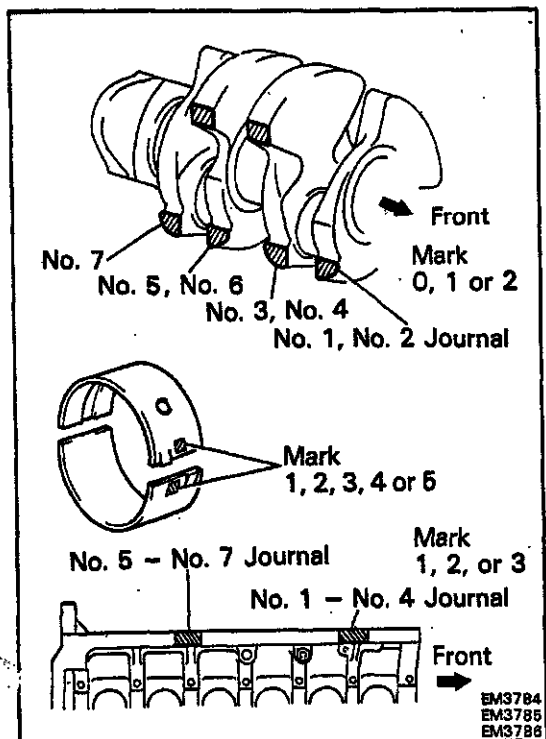
**Standard oil clearance: 0.030 – 0.048 mm (0.0012 – 0.0019 in.)**

**Maximum oil clearance: 0.07 mm (0.0028 in.)**

If the oil clearance is greater than maximum, replace the bearings. If necessary, replace the crankshaft.

**Under size bearing: U/S 0.25**

- (k) Completely remove the Plastigage.



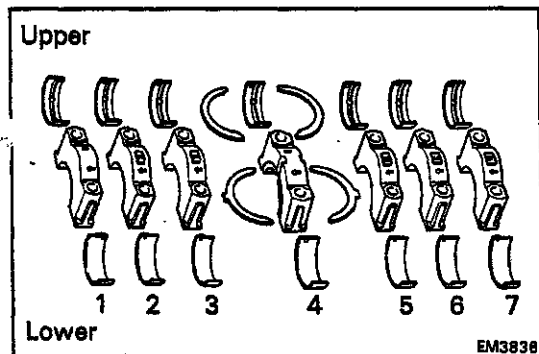
**NOTE:** If using a standard size bearing, replace with one having the same number. If the number of the bearing cannot be determined, select a bearing from the table below according to the numbers imprinted on the cylinder block and crankshaft.

There are five sizes of standard bearings, marked "1", "2", "3", "4" and "5".

|                | Number marked |   |   |   |   |   |   |   |   |
|----------------|---------------|---|---|---|---|---|---|---|---|
| Cylinder Block | 1             | 1 | 2 | 1 | 2 | 3 | 2 | 3 | 3 |
| Crankshaft     | 0             | 1 | 0 | 2 | 1 | 0 | 2 | 1 | 2 |
| Bearing        | 1             | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 5 |

Example: Cylinder Block "2", Crankshaft "1" = Bearing "3"  
(Reference)

|             |                                      |                                      |                                    | mm (in.) |
|-------------|--------------------------------------|--------------------------------------|------------------------------------|----------|
| Mark        | Cylinder Block Main Journal Bore     | Main Journal Diameter                | Bearing Center Wall Thickness      |          |
| 0           | —                                    | 60.007 – 60.012<br>(2.3625 – 2.3627) | —                                  |          |
| 1           | 64.024 – 64.030<br>(2.5206 – 2.5209) | 60.001 – 60.006<br>(2.3622 – 2.3624) | 1.988 – 1.991<br>(0.0783 – 0.0784) |          |
| 2           | 64.031 – 64.036<br>(2.5209 – 2.5211) | 59.994 – 60.000<br>(2.3620 – 2.3622) | 1.992 – 1.994<br>(0.0784 – 0.0785) |          |
| 3           | 64.037 – 64.042<br>(2.5211 – 2.5213) | —                                    | 1.995 – 1.997<br>(0.0785 – 0.0786) |          |
| 4           | —                                    | —                                    | 1.998 – 2.000<br>(0.0787 – 0.0787) |          |
| 5           | —                                    | —                                    | 2.001 – 2.003<br>(0.0788 – 0.0789) |          |
| U/S<br>0.25 | 64.022 – 64.046<br>(2.5205 – 2.5215) | 59.730 – 59.740<br>(2.3516 – 2.3520) | 2.123 – 2.133<br>(0.0836 – 0.0840) |          |



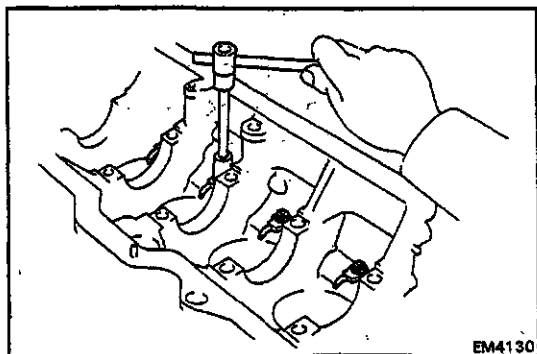
## 23. REMOVE CRANKSHAFT

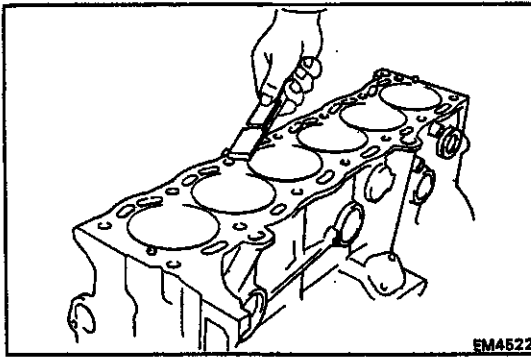
- Lift out the crankshaft.
- Remove the upper bearings and upper thrust washers.

### NOTE:

- Arrange the caps, bearings and thrust washers in correct order.
- The pilot bearing in the crankshaft rear end is permanently lubricated and requires no cleaning or lubrication.

## 24. (7M-GTE) REMOVE OIL NOZZLES





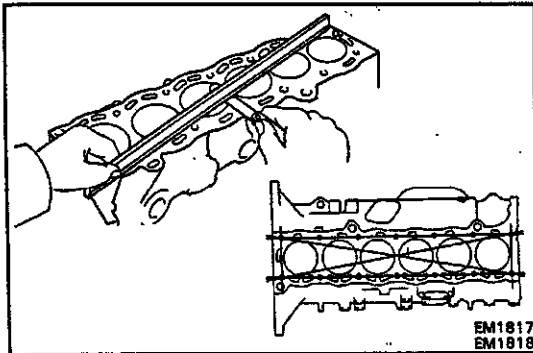
## INSPECTION OF CYLINDER BLOCK

### 1. REMOVE GASKET MATERIAL

Using a gasket scraper, remove all the gasket material from the cylinder block surface.

### 2. CLEAN CYLINDER BLOCK

Using a soft brush and solvent, clean the block.

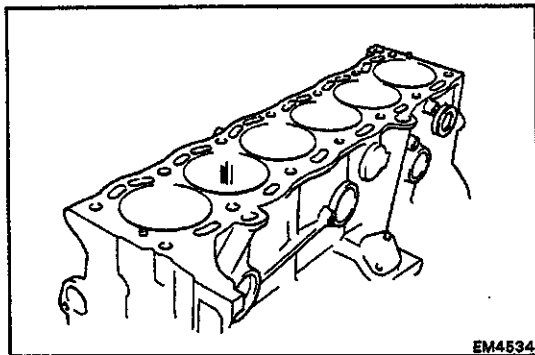


### 3. INSPECT TOP OF CYLINDER BLOCK FOR FLATNESS

Using a precision straight edge and thickness gauge, measure the surfaces contacting the cylinder head gasket for warpage.

**Maximum warpage: 0.05 mm (0.0020 in.)**

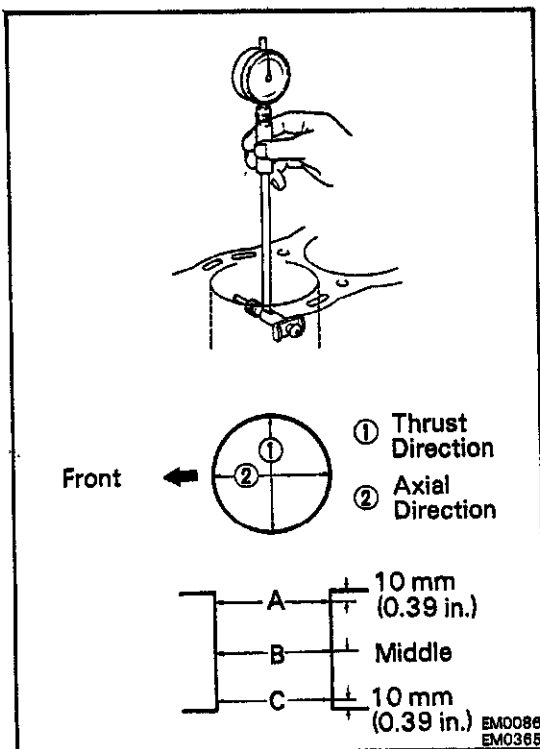
If warpage is greater than maximum, replace the cylinder block.



### 4. INSPECT CYLINDERS FOR VERTICAL SCRATCHES

Visually check the cylinder for vertical scratches.

If deep scratches are present, rebore all six cylinders. If necessary, replace the cylinder block.



### 5. INSPECT CYLINDER BORE DIAMETER

Using a cylinder gauge, measure the cylinder bore diameter at positions A, B and C in the thrust and axial directions.

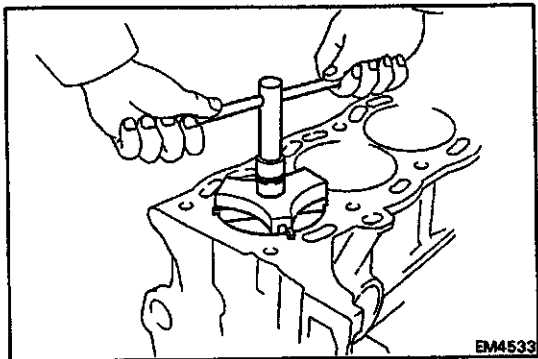
**Standard diameter:**

**STD size 82.99 – 83.04 mm  
(3.2673 – 3.2693 in.)**

**Maximum diameter:**

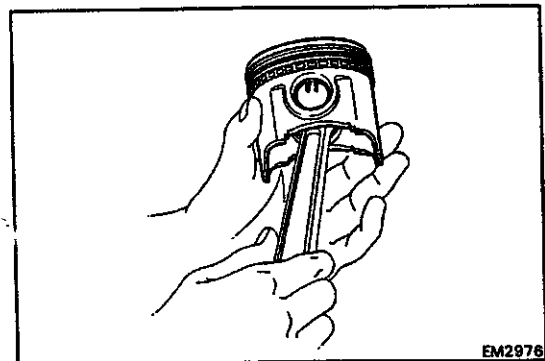
**STD size 83.24 mm (3.2772 in.)  
O/S 0.50 83.74 mm (3.2968 in.)**

If the diameter is greater than maximum, rebore all six cylinders. If necessary, replace the cylinder block.



## 6. REMOVE CYLINDER RIDGES

If the wear is less than 0.2 mm (0.008 in.), use a ridge reamer to machine the top of the cylinder.

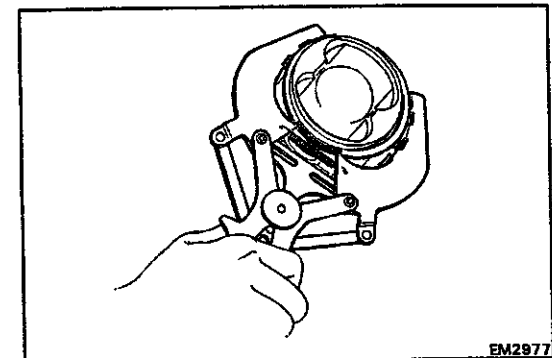


## DISASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES

(See page EM-65)

### 1. CHECK FIT BETWEEN PISTON AND PIN

Try to move the piston back and forth on the piston pin. If any movement is felt, replace the piston and pin as a set.

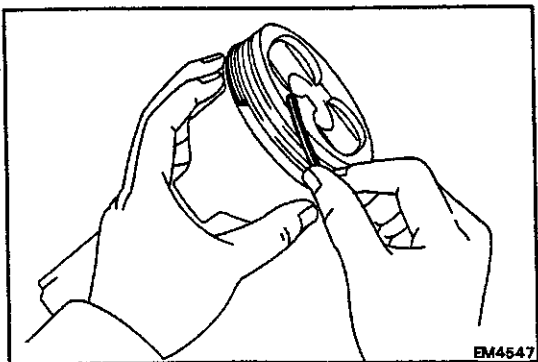


### 2. REMOVE PISTON RINGS

(a) Using a piston ring expander, remove the compression rings.

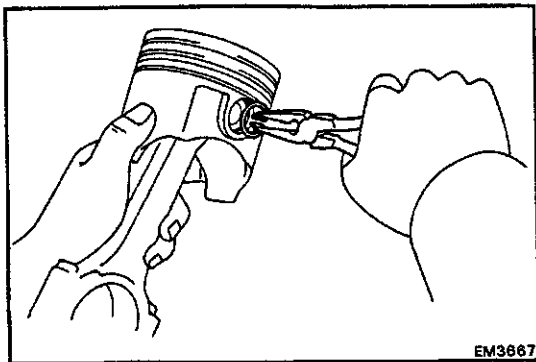
(b) Remove the two side rails and oil ring expander by hand.

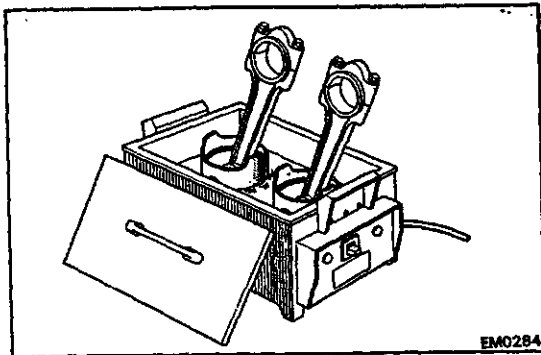
NOTE: Arrange the rings in correct order.



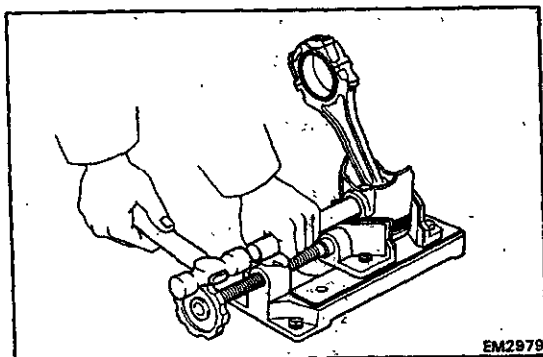
### 3. DISCONNECT CONNECTING ROD FROM PISTON

(a) Using needle-nose pliers, remove the snap rings from the piston.

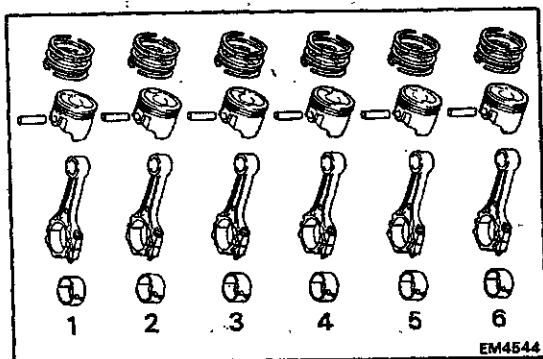




(b) Gradually heat the piston to approx. 60°C (140°F).



(c) Using a plastic-faced hammer and brass bar, lightly tap out the piston pin and remove the connecting rod.

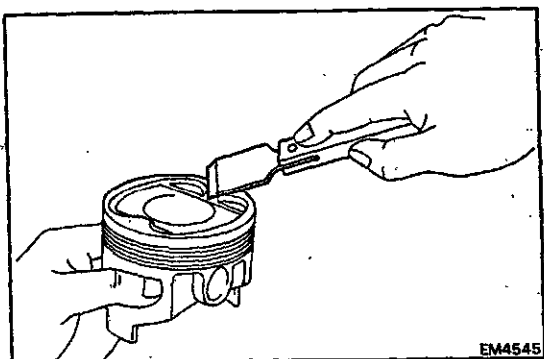


#### NOTE:

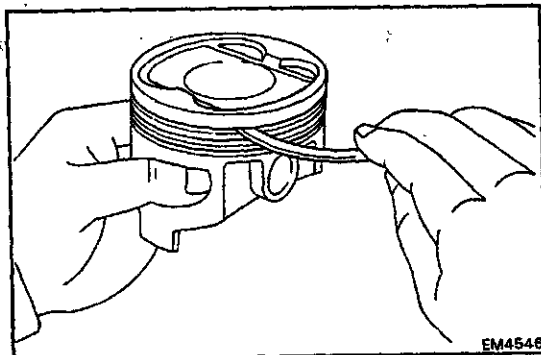
- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods and bearings in correct order.

## INSPECTION OF PISTON AND CONNECTING ROD ASSEMBLIES

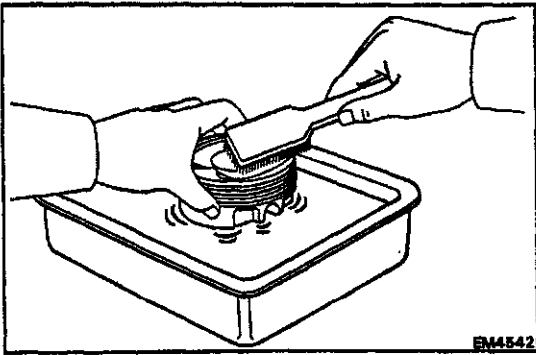
### 1. CLEAN PISTONS



(a) Using a gasket scraper, remove the carbon from the piston top.

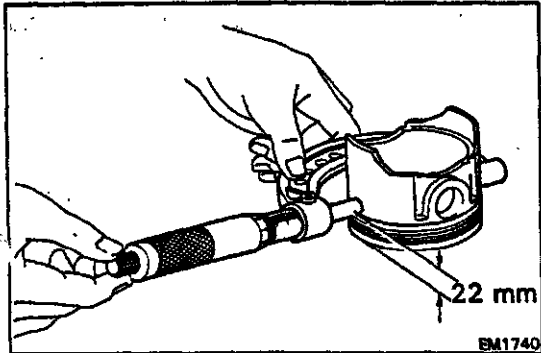


(b) Using a groove cleaning tool or broken ring, clean the ring grooves.



- (c) Using a soft brush and solvent, thoroughly clean the piston.

**CAUTION:** Do not damage the piston.



## 2. INSPECT PISTON DIAMETER AND OIL CLEARANCE

- (a) Using a micrometer, measure the piston diameter at a right angle to the piston pin hole center line, 22 mm (0.87 in.) from the piston head.

**Standard diameter:**

**7M-GE STD size** 82.90 – 82.95 mm  
(3.2638 – 3.2658 in.)

**O/S 0.50** 83.40 – 83.45 mm  
(3.2835 – 3.2854 in.)

**7M-GTE STD size** 82.91 – 82.96 mm  
(3.2642 – 3.2661 in.)

**O/S 0.50** 83.41 – 83.46 mm  
(3.2839 – 3.2858 in.)

- (b) Measure the cylinder bore diameter in thrust directions.

(See step 5 on page EM-73)

- (c) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

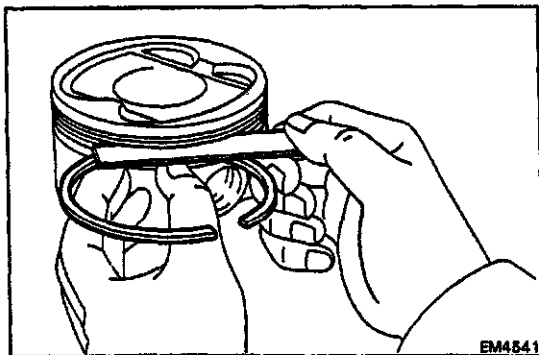
**Standard oil clearance:**

**7M-GE** 0.08 – 0.10 mm (0.0031 – 0.0039 in.)

**7M-GTE** 0.07 – 0.09 mm (0.0028 – 0.0035 in.)

**Maximum oil clearance:** 0.13 mm (0.0051 in.)

If the oil clearance is greater than maximum, replace the piston. If necessary, rebore all six cylinders and replace all six pistons. If necessary, replace the cylinder block.



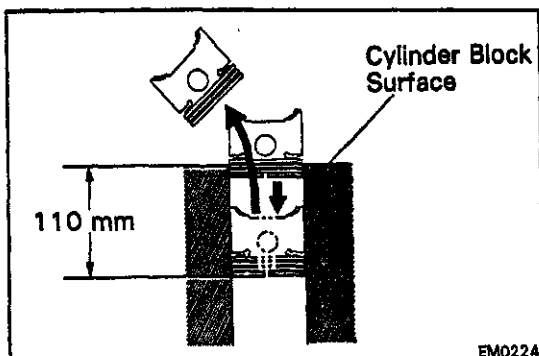
## 3. INSPECT CLEARANCE BETWEEN WALL OF RING GROOVE AND NEW PISTON RING

Using a thickness gauge, measure the clearance between new piston ring and the wall of the piston ring groove.

**Ring groove clearance:** No. 1 0.03 – 0.07 mm  
(0.0012 – 0.0028 in.)

No. 2 0.02 – 0.06 mm  
(0.0008 – 0.0024 in.)

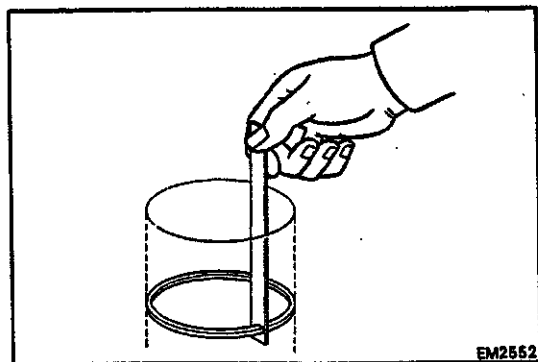
If the clearance is not within specification, replace the piston.



## 4. INSPECT PISTON RING END GAP

- (a) Insert the piston ring into the cylinder bore.

- (b) Using a piston, push the piston ring a little beyond the bottom of the ring travel.  
(110 mm (4.33 in.) from top surface of cylinder block)



(c) Using a thickness gauge, measure the end gap.

Standard end gap:

No. 1

7M-GE (w/o TWC) and 7M-GTE

0.29 – 0.44 mm (0.0114 – 0.0173 in.)

7M-GE (w/ TWC)

0.23 – 0.38 mm (0.0091 – 0.0150 in.)

No. 2 0.25 – 0.53 mm (0.0098 – 0.0209 in.)

Oil (Side rail)

7M-GE (w/o TWC) and 7M-GTE

0.10 – 0.44 mm (0.0039 – 0.0173 in.)

7M-GE (w/ TWC)

0.10 – 0.40 mm (0.0039 – 0.0157 in.)

Maximum end gap:

No. 1

7M-GE (w/o TWC) and 7M-GTE

0.74 mm (0.0291 in.)

7M-GE (w/ TWC)

0.68 mm (0.0268 in.)

No. 2 1.13 mm (0.0445 in.)

Oil (Side rail)

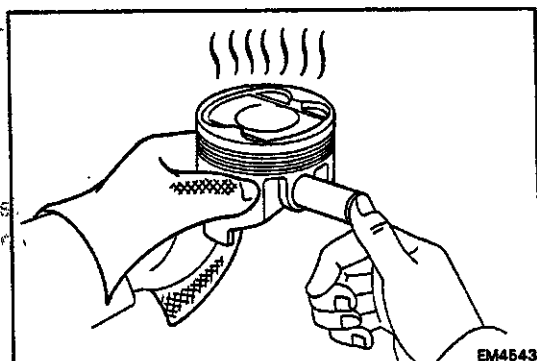
7M-GE (w/o TWC) and 7M-GTE

1.04 mm (0.0409 in.)

7M-GE (w/ TWC)

1.00 mm (0.0394 in.)

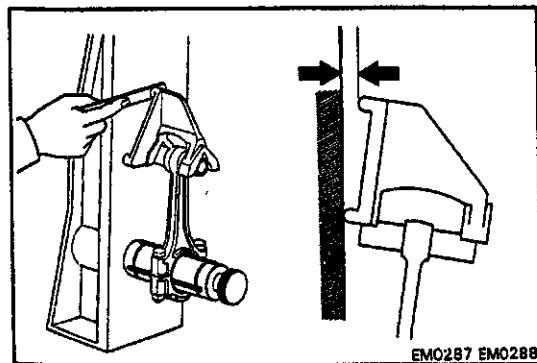
If the gap is greater than maximum, replace the piston ring. If the gap is greater than maximum, even with a new piston ring, rebore the cylinder and use an O/S piston ring.



## 5. CHECK PISTON PIN FIT

At 60°C (140°F) you should be able to push the pin into the piston with your thumb.

If the pin can be installed at a lower temperature, replace the piston.



## 6. INSPECT CONNECTING RODS

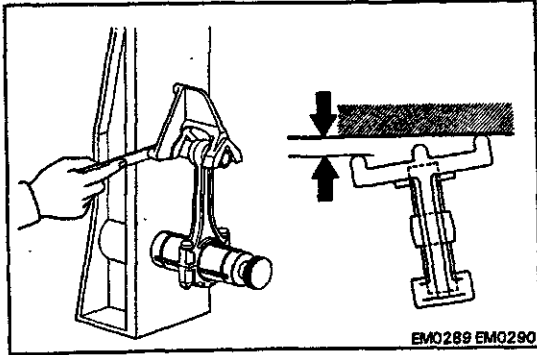
(a) Using a rod aligner and thickness gauge, check the connecting rod alignment.

● Check for bend.

Maximum bend:

0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

If bend is greater than maximum, replace the connecting rod assembly.

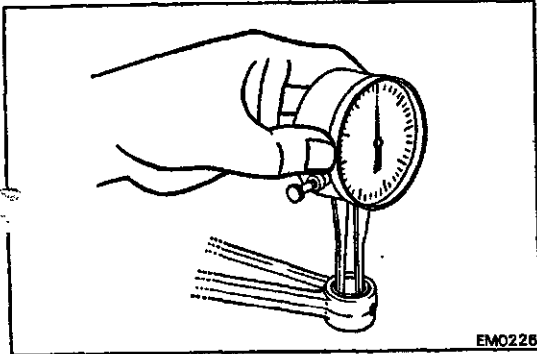


- Check for twist.

**Maximum twist:**

**0.15 mm (0.0059 in.) per 100 mm (3.94 in.)**

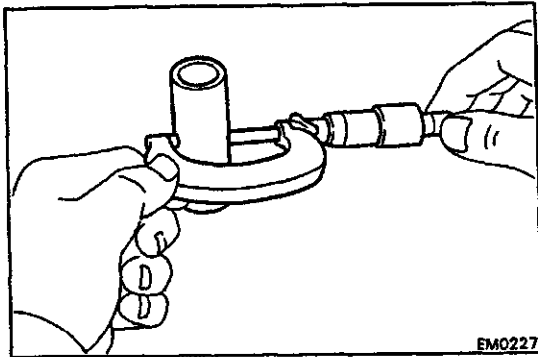
If twist is greater than maximum, replace the connecting rod assembly.



- (b) Inspect the oil clearance between the rod bushing and piston pin.

- Using a caliper gauge, measure the inside diameter of the connecting rod bushing.

**Bushing inside diameter: 22.005 – 22.017 mm  
(0.8663 – 0.8668 in.)**



- Using a micrometer, measure the piston pin diameter.

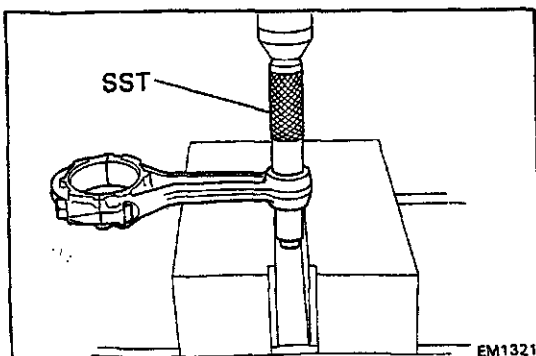
**Piston pin diameter: 21.996 – 22.009 mm  
(0.8660 – 0.8665 in.)**

- Subtract the piston pin diameter measurement from the bushing inside diameter measurement.

**Standard oil clearance: 0.005 – 0.011 mm  
(0.0002 – 0.0004 in.)**

**Maximum oil clearance: 0.02 mm (0.0008 in.)**

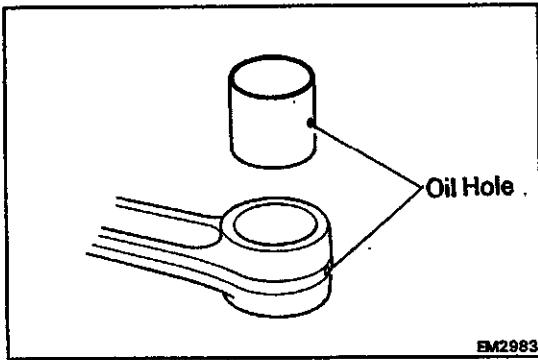
If the oil clearance is greater than maximum, replace the bushing. If necessary, replace the piston and piston pin assembly.



## 7. IF NECESSARY, REPLACE CONNECTING ROD BUSHINGS

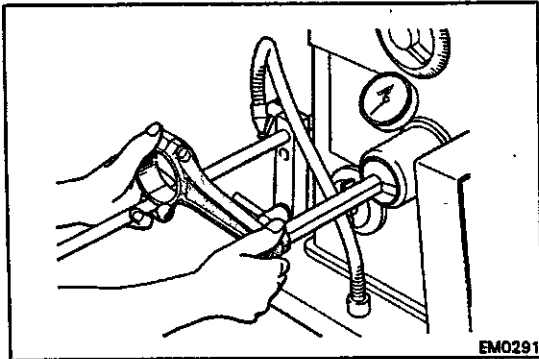
- (a) Using SST and a press, press out the bushing.

SST 09222-30010

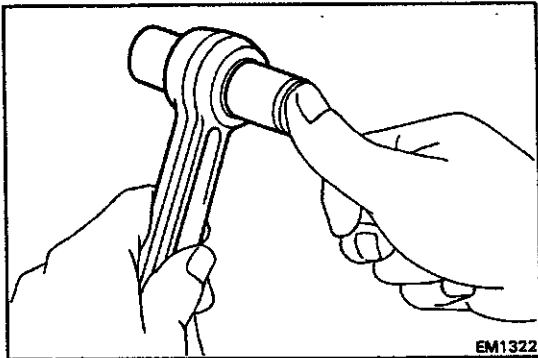


(b) Align the oil holes of a new bushing and connecting rod.

(c) Using SST and a press, press in the bushing.  
SST 09222-30010



(d) Using a pin hole grinder, hone the bushing to obtain the specified clearance between the bushing and piston pin.



(e) Check the piston pin fit at normal room temperature. Coat the piston pin with engine oil and push it into the connecting rod with your thumb.

## BORING OF CYLINDERS

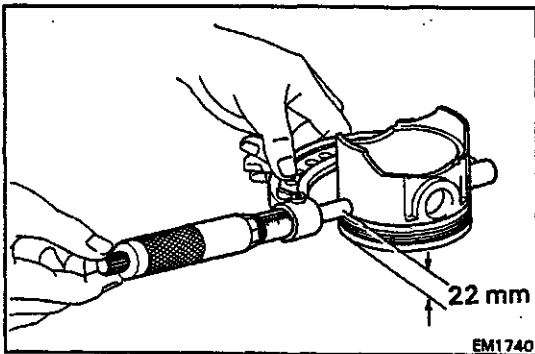
### NOTE:

- Bore all six cylinders for the oversized piston outside diameter.
- Replace the piston rings with ones to match the oversized pistons.

### 1. SELECT OVERSIZED PISTON

Oversized piston diameter:

|          |        |                                           |
|----------|--------|-------------------------------------------|
| O/S 0.50 | 7M-GE  | 83.40 – 83.45 mm<br>(3.2835 – 3.2854 in.) |
|          | 7M-GTE | 83.41 – 83.46 mm<br>(3.2839 – 3.2858 in.) |



### 2. CALCULATE AMOUNT TO BORE CYLINDER

- Using a micrometer, measure the piston diameter at a right angle to the piston pin hole center line, 22 mm (0.87 in.) from the piston head.
- Calculate the amount each cylinder is to be rebored as follows:

$$\text{Size to be rebored} = P + C - H$$

P = Piston diameter

C = Piston clearance

$$\text{7M-GE } 0.08 - 0.10 \text{ mm} \\ (0.0020 - 0.0028 \text{ in.})$$

$$\text{7M-GTE } 0.07 - 0.09 \text{ mm} \\ (0.0028 - 0.0035 \text{ in.})$$

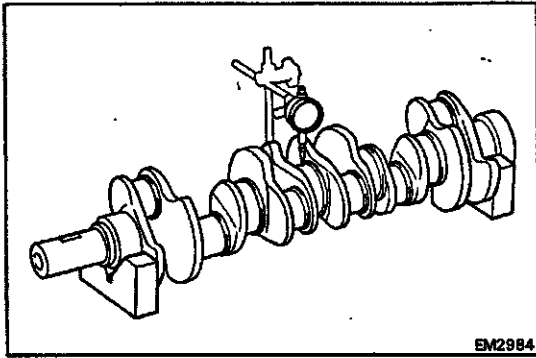
H = Allowance for honing

$$0.02 \text{ mm (0.0008 in.) or less}$$

### 3. BORE AND HONE CYLINDERS TO CALCULATED DIMENSIONS

Maximum honing: 0.02 mm (0.0008 in.)

**CAUTION:** Excess honing will destroy the finished roundness.



## INSPECTION OF CRANKSHAFT

### 1. INSPECT CRANKSHAFT FOR RUNOUT

- (a) Place the crankshaft on V-blocks.
- (b) Using a dial indicator, measure the circle runout at the center journal.

**Maximum circle runout: 0.06 mm (0.0024 in.)**

If the circle runout is greater than maximum, replace the crankshaft.

**NOTE:** Use a long spindle on the dial gauge.

### 2. INSPECT MAIN JOURNALS AND CRANK PINS

- (a) Using a micrometer, measure the diameter of each main journal and crank pin.

**Journal diameter:**

**STD size 59.994 – 60.012 mm**  
(2.3620 – 2.3627 in.)

**U/S 0.25 59.730 – 59.740 mm**  
(2.3516 – 2.3520 in.)

**Crank pin diameter:**

**STD size 51.976 – 52.000 mm**  
(2.0463 – 2.0472 in.)

**U/S 0.25 51.725 – 51.735 mm**  
(2.0364 – 2.0368 in.)

If the diameter is not within specification, check the oil clearance. If necessary, grind or replace the crankshaft.

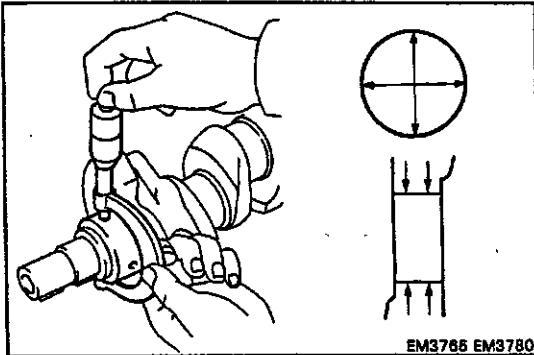
- (b) Check each main journal and crank pin for taper and out-of-round as shown.

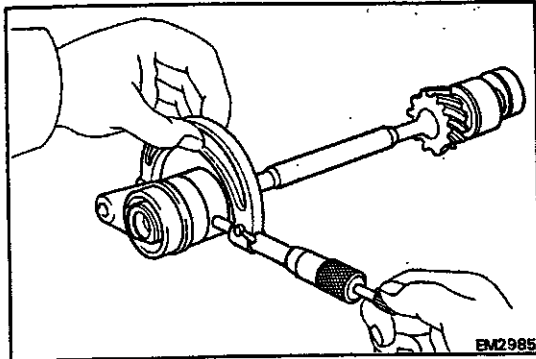
**Maximum taper and out-of-round: 0.02 mm**  
(0.0008 in.)

If taper or out-of-round is greater than maximum, replace the crankshaft.

### 3. IF NECESSARY, GRIND AND HONE MAIN JOURNALS AND/OR CRANK PINS

Grind and hone the main journals and/or crank pins to the finished undersized diameter (See procedure step 2). Install new main journal and/or crank pin undersized bearings.





## INSPECTION AND REPAIR OF OIL PUMP DRIVE SHAFT, BEARINGS AND BUSHING

### 1. INSPECT OIL PUMP DRIVE SHAFT

- (a) Using a micrometer, measure the journal diameter of pump drive shaft.

Standard journal diameter:

Front 40.959 – 40.975 mm  
(1.6126 – 1.6132 in.)

Rear 32.959 – 32.975 mm  
(1.2976 – 1.2982 in.)

- (b) Using a cylinder gauge, measure the inside diameter of the pump drive shaft bearing.

Bearing inside diameter:

Front 41.000 – 41.025 mm  
(1.6142 – 1.6152 in.)

Rear 33.000 – 33.025 mm  
(1.2992 – 1.3002 in.)

- (c) Subtract the journal diameter measurement from the bearing inside diameter measurement.

Standard oil clearance: 0.025 – 0.066 mm  
(0.0010 – 0.0026 in.)

Maximum oil clearance: 0.08 mm (0.0031 in.)

If the clearance is greater than maximum, replace the bearing. If necessary, replace the drive shaft.

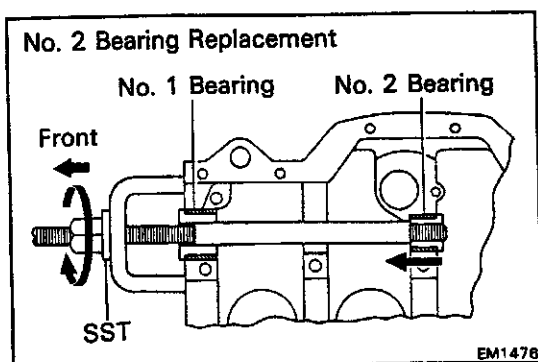
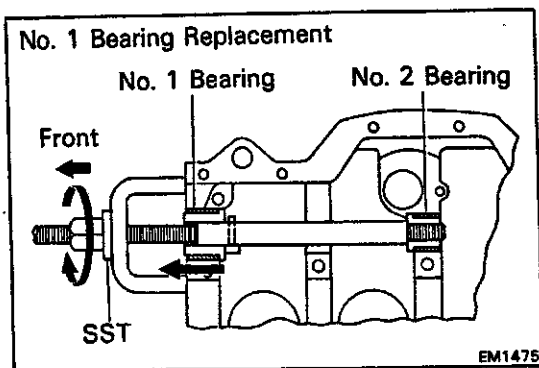
### 2. IF NECESSARY, REPLACE OIL PUMP DRIVE SHAFT BEARING

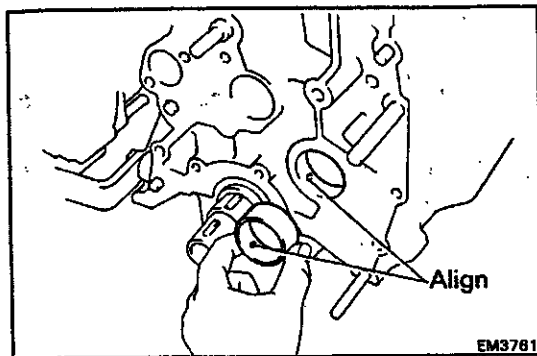
- (a) Using SST, replace the No. 1 bearing by using No. 2 bearing as a guide.

SST 09215-00100 (09215-00120, 09215-00130, 09215-00140, 09215-00160, 09215-00210, 09215-00220)

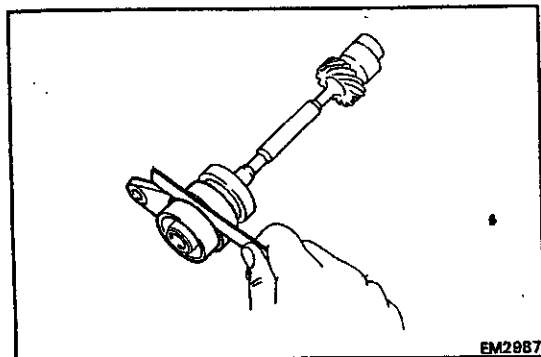
- (b) Using SST, replace the No. 2 bearing by using the No. 1 bearing as a guide.

SST 09215-00100 (09215-00120, 09215-00130, 09215-00140, 09215-00210, 09215-00220)





**CAUTION:** When inserting the bearings, align each oil hole.



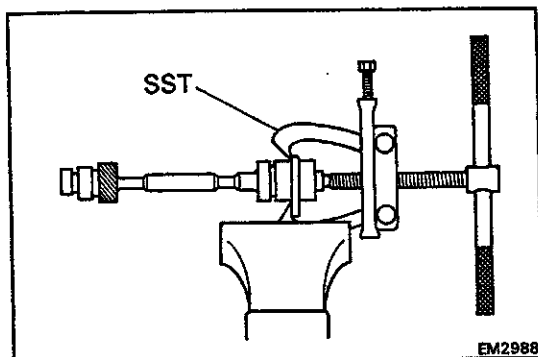
### 3. INSPECT OIL PUMP DRIVE SHAFT THRUST CLEARANCE

Using a thickness gauge, measure the drive shaft thrust clearance between the thrust plate and collar.

**Standard thrust clearance:** 0.06 – 0.13 mm  
(0.0024 – 0.0051 in.)

**Maximum thrust clearance:** 0.30 mm (0.0118 in.)

If clearance is greater than maximum, replace the thrust plate and/or collar.



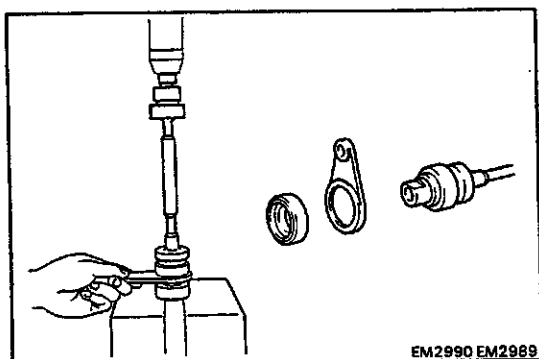
### 4. IF NECESSARY, REPLACE THRUST PLATE AND COLLAR

(a) Using SST, remove the thrust plate and collar.

SST 09950-20017

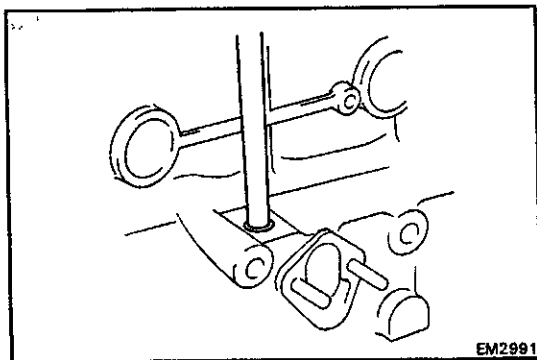
(b) Install the thrust plate and collar in the direction as shown.

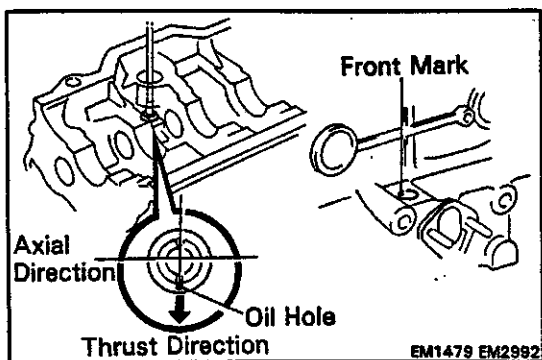
(c) Using a press, install the thrust plate and collar.



### 5. IF NECESSARY, REPLACE OIL PUMP GUIDE BUSHING

(a) Drive out the bushing from the outer side of the block.





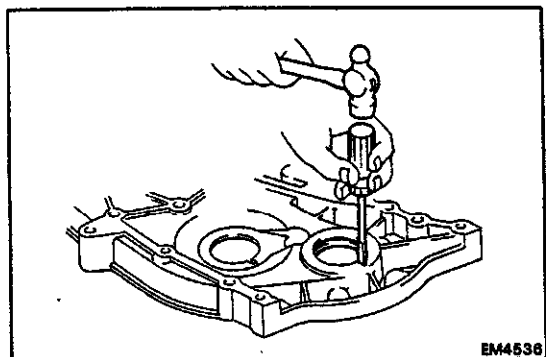
- (b) Drive in the bushing from the inside of the block with a suitable tool.

NOTE: The oil hole should be positioned toward the crankshaft side.

- (c) Make sure the front mark of bushing is positioned toward the front of block.

## REPLACEMENT OF OIL SEALS

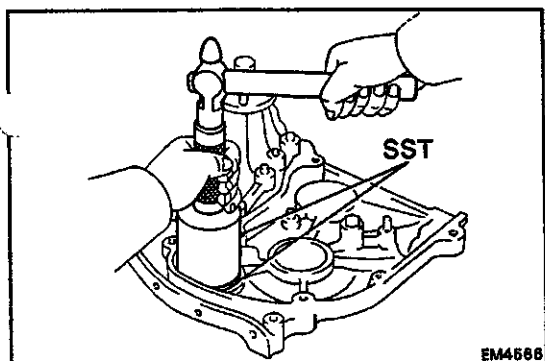
NOTE: There are two methods (A and B) of oil seal replacement.



### 1. REPLACE CRANKSHAFT FRONT OIL SEAL

- A. If the timing case is removed from the cylinder block:

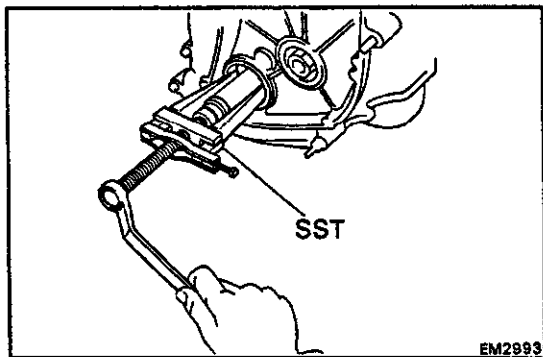
- (a) Using a screwdriver and hammer, tap out the oil seal.



- (b) Using SST and a hammer, tap in a new oil seal.

SST 09214-60010 and 09506-35010

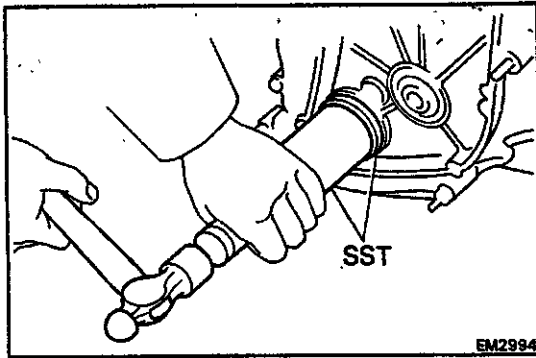
- (c) Apply MP grease to the oil seal lip.



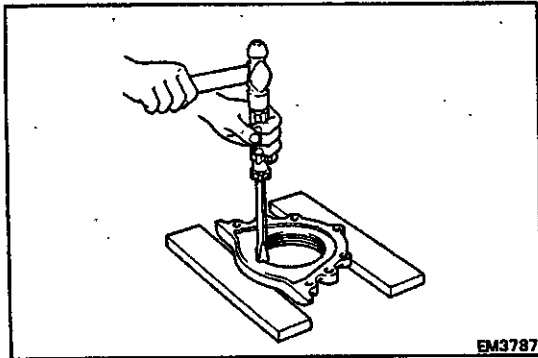
- B. If the timing case is installed to the cylinder block:

- (a) Using SST, remove the oil seal.

SST 09308-55010



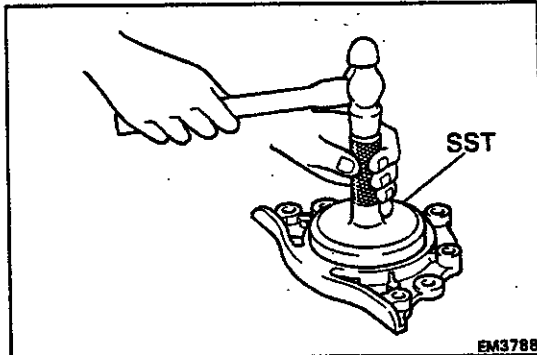
- (b) Apply MP grease to a new oil seal lip.
- (c) Using SST and a hammer, tap in the oil seal.  
SST 09214-60010 and 09506-35010



## 2. REPLACE CRANKSHAFT REAR OIL SEAL

### A. If the rear oil seal retainer is removed from the cylinder block:

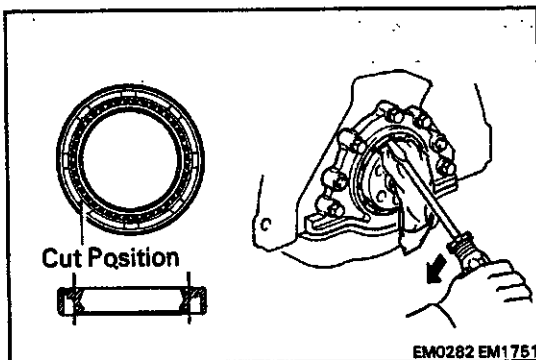
- (a) Using a screwdriver and hammer, tap out the oil seal.



- (b) Using SST and a hammer, tap in a new oil seal.

SST 09223-41020

- (c) Apply MP grease to the oil seal lip.

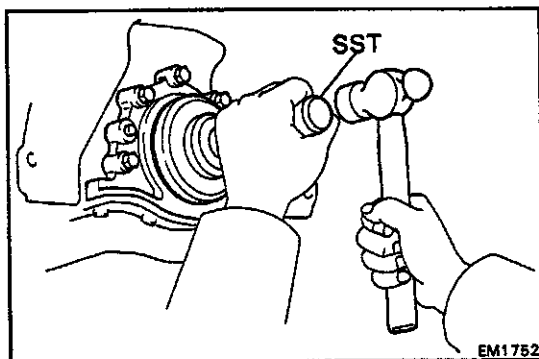


### B. If the rear oil seal retainer is installed to the cylinder block:

- (a) Using a knife, cut off the lip of the oil seal as shown.
- (b) Using a screwdriver, pry out the oil seal.

**CAUTION:** Be careful not to damage the crankshaft. Tape the screwdriver tip.

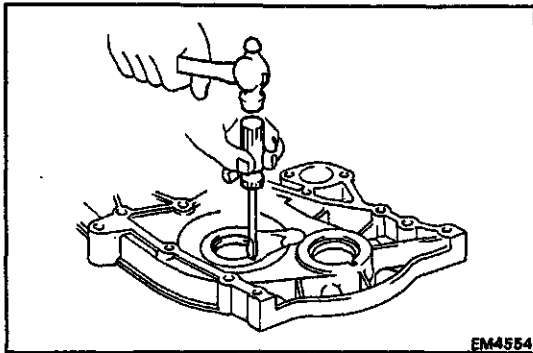
- (c) Check the oil seal lip contact surface of the crankshaft for cracks or damage.



- (d) Apply MP grease to a new oil seal lip.

- (e) Using SST and a hammer, tap in the oil seal.

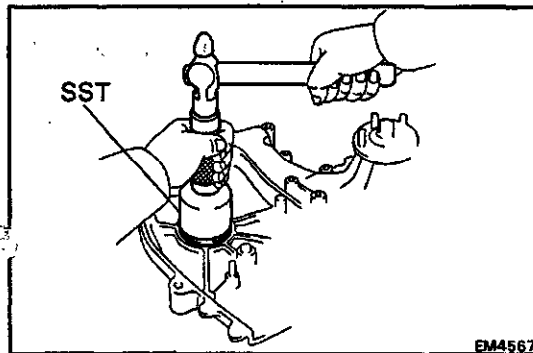
SST 09223-41020



### 3. REPLACE PUMP DRIVE SHAFT OIL SEAL

A. If the timing belt case is removed from the cylinder block:

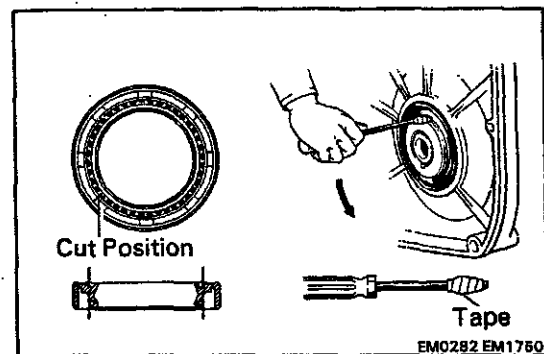
(a) Using a screwdriver and hammer, tap out the oil seal.



(b) Using SST and a hammer, tap in a new oil seal.

SST 09214-41010

(c) Apply MP grease to the oil seal lip.



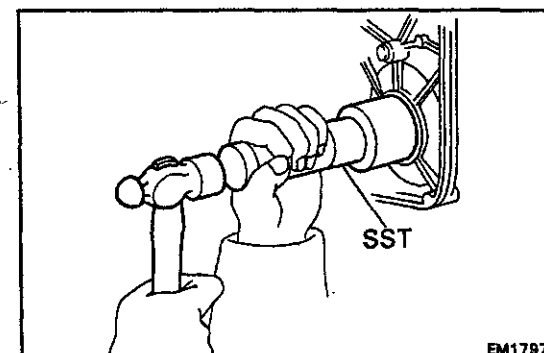
B. If the timing belt case is installed to the cylinder block:

(a) Using a knife, cut off the lip of the oil seal as shown.

(b) Using a screwdriver, pry out the oil seal.

**CAUTION:** Be careful not to damage the crankshaft. Tape the screwdriver tip.

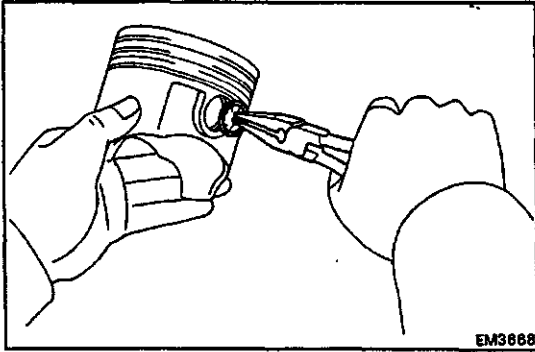
(c) Check the oil seal lip contact surface of the pump drive shaft for cracks or damage.



(d) Apply MP grease to a new oil seal lip.

(e) Using SST and a hammer, tap in the oil seal.

SST 09214-41010

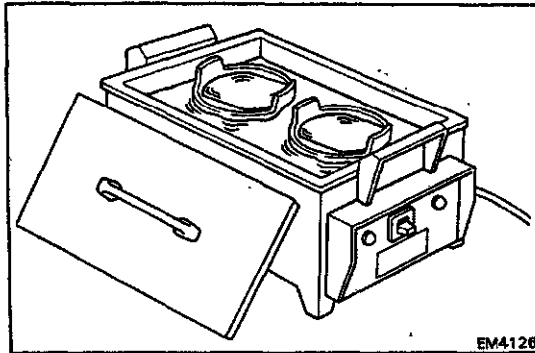


## ASSEMBLY OF PISTON AND CONNECTING ROD

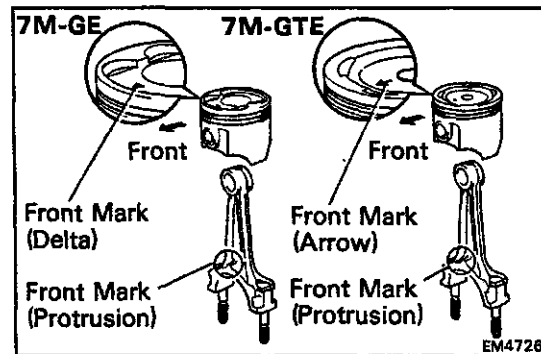
(See page EM-65)

### 1. ASSEMBLE PISTON AND CONNECTING ROD

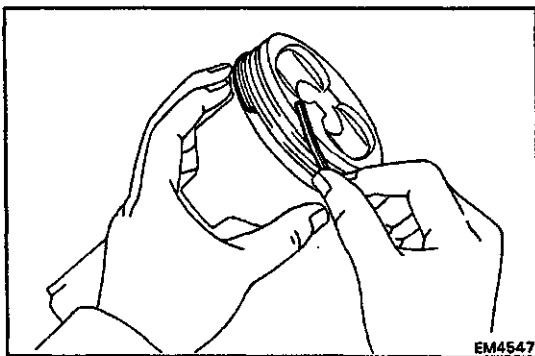
- (a) Install a new snap ring on one side of the piston pin hole.



- (b) Gradually heat the piston to approx. 60°C (140°F).

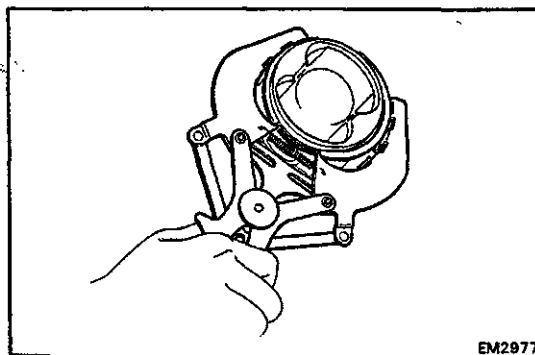


- (c) Coat the piston pin with engine oil.
- (d) Align the front marks of the piston and the connecting rod, and push in the piston pin with your thumb.
- (e) Install a new snap ring on the other side of the pin hole.

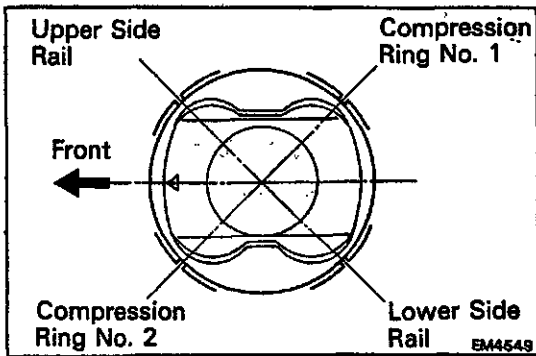


### 2. INSTALL PISTON RINGS

- (a) Install the oil ring expander and two side rails by hand.

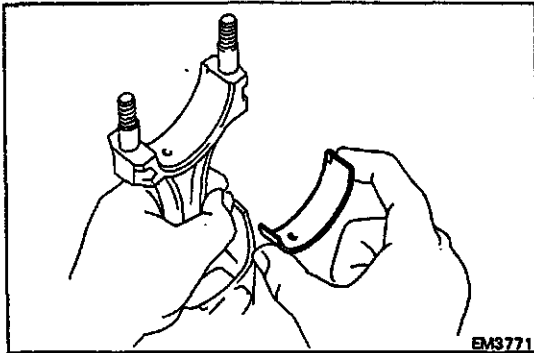


- (b) Using a piston ring expander, install the two compression rings with the code mark facing upward.



- (c) Position the piston rings so that the ring ends are as shown.

**CAUTION:** Do not align the ends.



### 3. INSTALL BEARINGS

- (a) Align the bearing claw with the claw groove of the connecting rod or connecting rod cap.  
(b) Install the bearing in the connecting rod and rod cap.

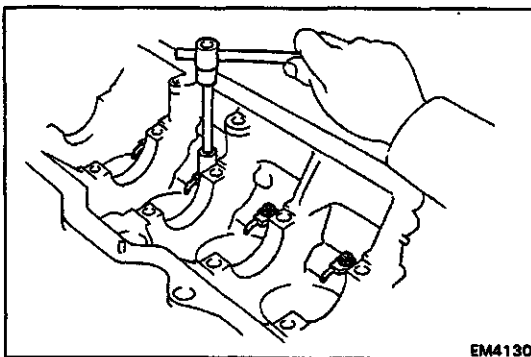
**CAUTION:** Install the bearings with the oil hole in the connecting rod.

## ASSEMBLY OF CYLINDER BLOCK

(See page EM-65)

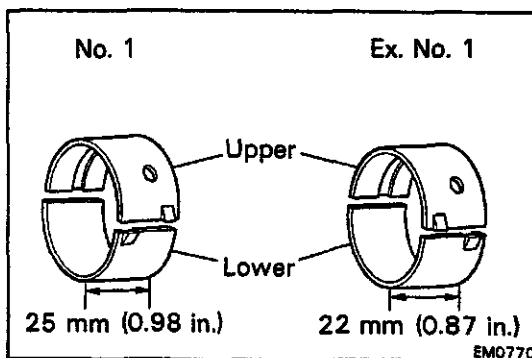
### NOTE:

- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new parts.



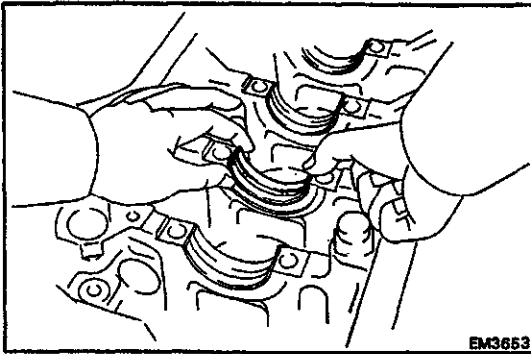
### 1. (7M-GTE) INSTALL OIL NOZZLES

**Torque:** 250 kg-cm (18 ft-lb, 25 N·m)



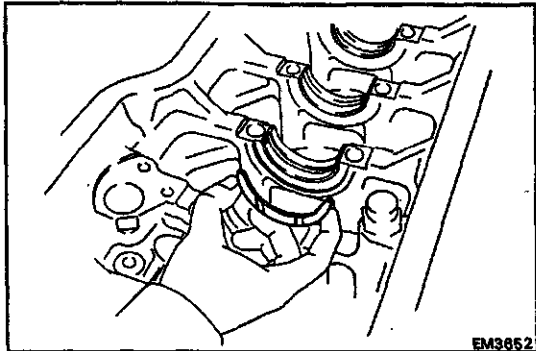
### 2. INSTALL MAIN BEARINGS

**NOTE:** Different the bearing are used for the No. 1 and ex. No. 1.



- (a) Align the bearing claw with the the claw groove of the main bearing cap or cylinder block.
- (b) Install the bearing in the cylinder block and bearing caps.

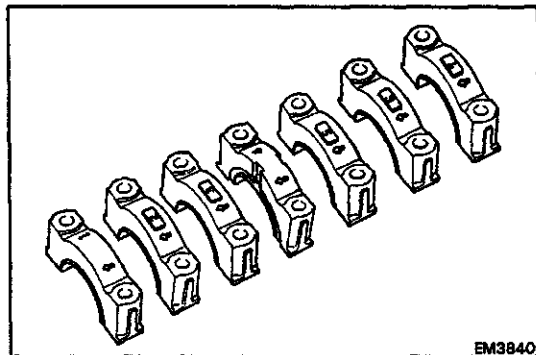
**CAUTION:** Install the bearing with the oil hole in the block.



### 3. INSTALL UPPER THRUST WASHERS

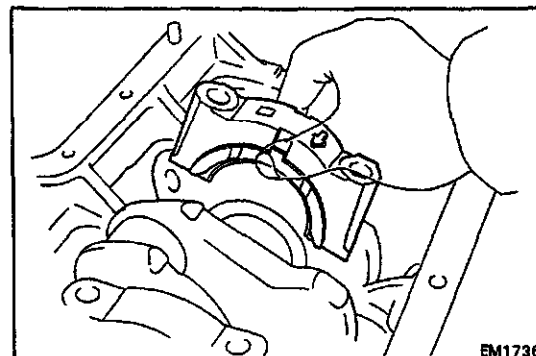
Install the thrust washers under the No. 4 main journal position of the block with the oil grooves facing outward.

### 4. PLACE CRANKSHAFT ON CYLINDER BLOCK

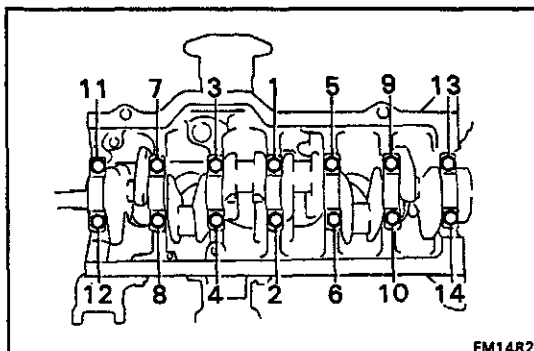


### 5. INSTALL MAIN BEARING CAPS AND LOWER THRUST WASHERS

**NOTE:** Each bearing cap has a number and front mark.



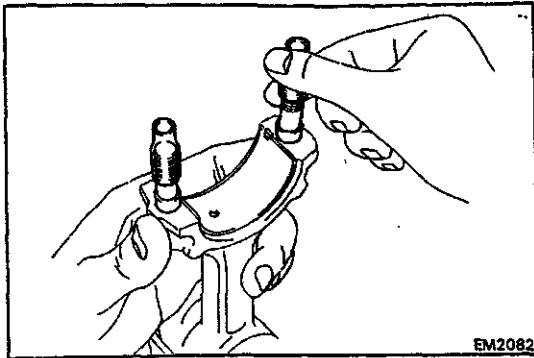
- (a) Install the thrust washers on the No. 4 bearing cap with the grooves facing outward.



- (b) Install the bearing caps in numbered order with arrows facing forward.
- (c) Install and uniformly tighten the fourteen cap bolts in several passes, in the sequence shown.

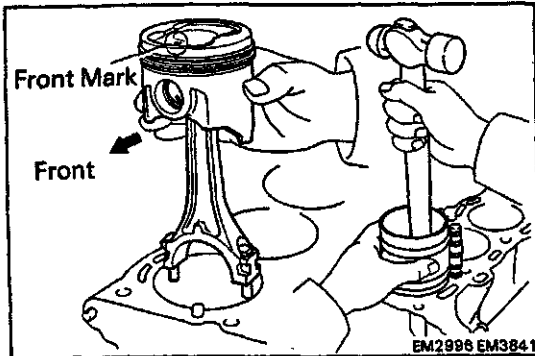
**Torque:** 1,040 kg-cm (75 ft-lb, 102 N·m)

- (d) Check that the crankshaft turns smoothly.
- (e) Check the crankshaft thrust clearance.  
(See step 21 on page EM-70)

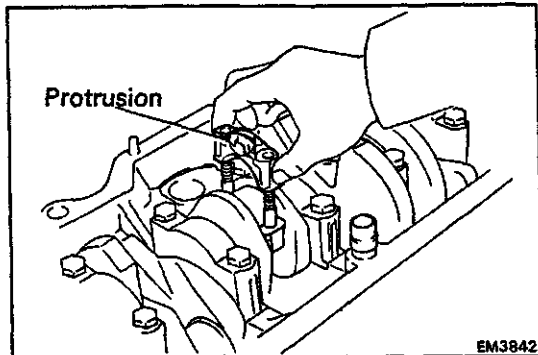


## 6. INSTALL PISTON AND CONNECTING ROD ASSEMBLIES

- (a) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.

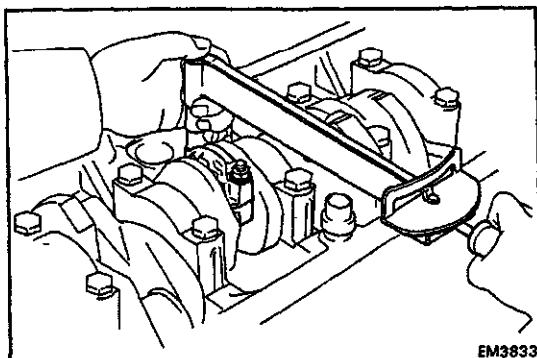


- (b) Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark (delta for 7M-GE and arrow for 7M-GTE) of the piston facing forward.



## 7. INSTALL CONNECTING ROD CAPS

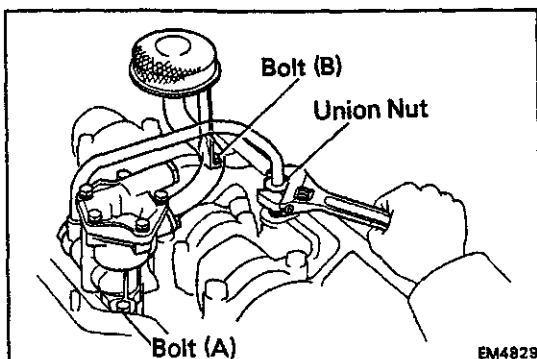
- (a) Match the numbered cap with the numbered connecting rod.
- (b) Install the cap with the protrusion facing forward.



- (c) Install and alternately tighten the cap nuts in several passes.

**Torque: 650 kg-cm (47 ft-lb, 64 N·m)**

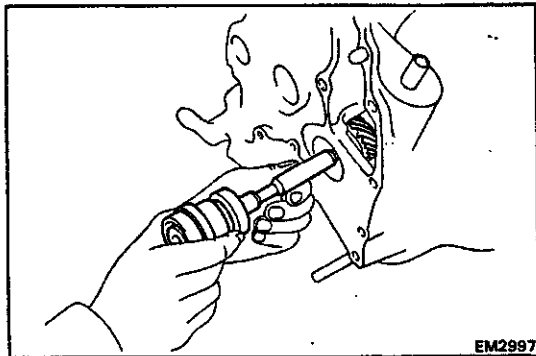
- (d) Check that the crankshaft turns smoothly.
- (e) Check the connecting rod thrust clearance.  
(See step 18 on page EM-67)



## 8. INSTALL OIL PUMP ASSEMBLY

- (a) Clean the oil pump.
- (b) Install the oil pump with the two bolts and union nut.  
Torque the bolt and union nut.

**Torque:** Bolt (A) 220 kg-cm (16 ft-lb, 22 N·m)  
Bolt (B) 60 kg-cm (52 in.-lb, 5.9 N·m)  
Union nut 350 kg-cm (25 ft-lb, 34 N·m)

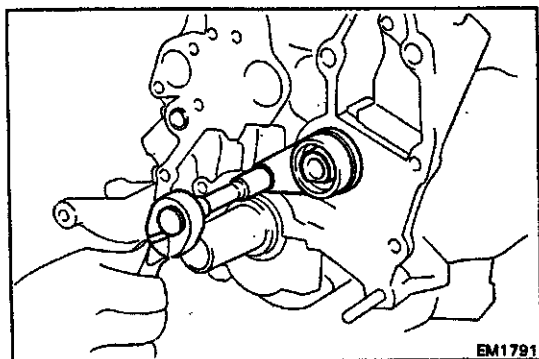


## 9. INSTALL OIL PUMP DRIVE SHAFT

- (a) While turning the drive shaft, insert slowly to avoid damaging the drive shaft bearing.

- (b) Install the bolt.

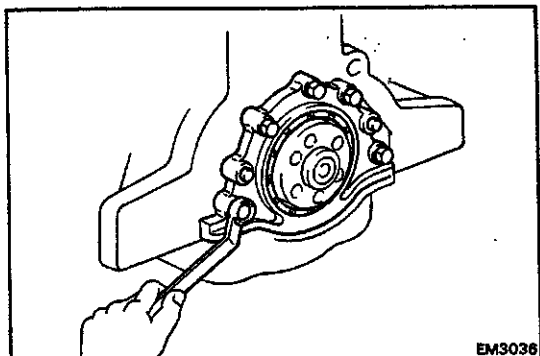
**Torque: 145 kg-cm (10 ft-lb, 14 N·m)**



## 10. INSTALL REAR OIL SEAL RETAINER

Install a new gasket and rear oil seal retainer with the five bolts.

**Torque: 130 kg-cm (9 ft-lb, 13 N·m)**

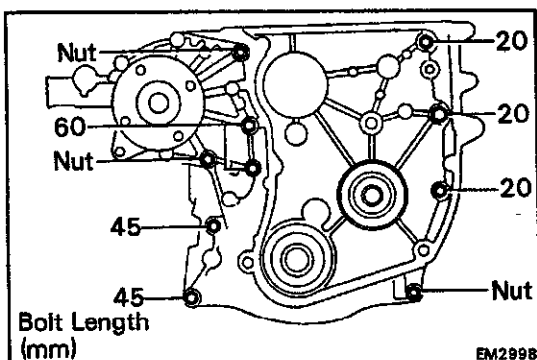


## 11. INSTALL TIMING BELT CASE WITH WATER PUMP

- (a) Position new gaskets on the cylinder block.  
 (b) Apply sealant to two or three threads of the 10 mm bolt end.

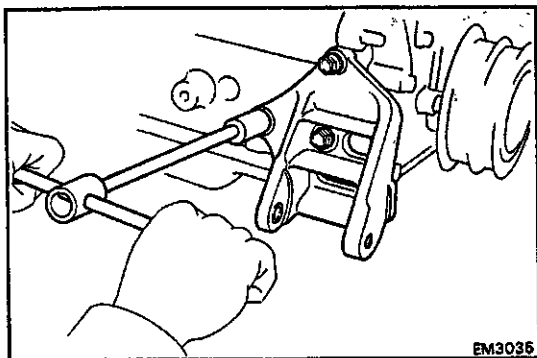
**Sealant: Part No. 08833-00070, THREE BOND 1324 or equivalent**

- (c) Install the timing belt case with the seven bolts and three nuts.



## 12. INSTALL OIL PAN (See page LU-14)

## 13. INSTALL PS PUMP BRACKET



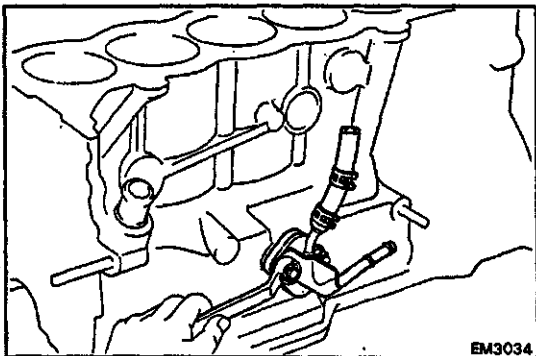
**14. (7M-GE w/ Oil Cooler)  
INSTALL OIL REGULATOR**

Install a new gasket and oil regulator with the two bolts.

**(7M-GE w/o Oil Cooler and 7M-GTE)  
INSTALL OIL HOLE COVER PLATE**

Install a new gasket and oil hole cover plate with the two bolts.

**15. (7M-GE)  
INSTALL NEW OIL FILTER  
(See page LU-6)**



EM3034

**16. INSTALL ENGINE MOUNTING BRACKETS**

**17. INSTALL FUEL RETURN PIPE SUPPORT**

Install a new insulator and fuel pipe support with the two nuts.

**Torque: 130 kg-cm (89 ft-lb, 13 N·m)**

**18. (7M-GE)  
INSTALL VACUUM CONTROL VALVE SET**

**19. INSTALL GROUND STRAP TO CYLINDER BLOCK**

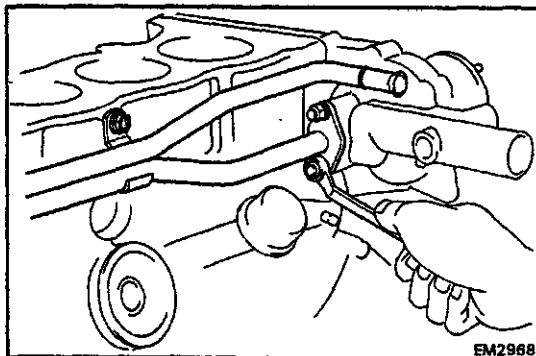
**20. INSTALL WATER BY-PASS PIPE**

(a) Install a new gasket and water by-pass pipe to the timing belt case with the two nuts.

**Torque: 140 kg-cm (10 ft-lb, 14 N·m)**

(b) Install the water by-pass pipe to the cylinder block with the three bolts.

**Torque: 130 kg-cm (9 ft-lb, 13 N·m)**



EM2968

**21. INSTALL CYLINDER HEAD  
(See steps 1 and 4 to 18 on pages EM-59 to 64)**

**22. INSTALL TIMING BELT  
(See step 1 to 8 and 10 to 15 on pages EM-33 to 36)**

**23. REMOVE ENGINE STAND**

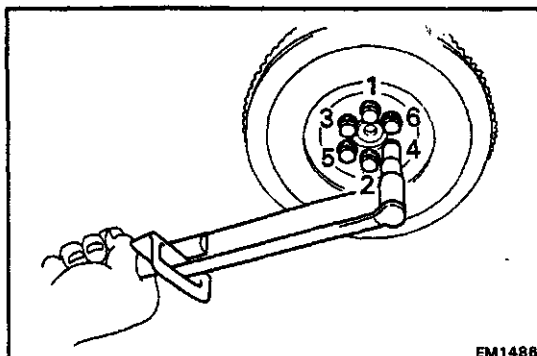
**24. INSTALL REAR END PLATE  
Torque: 130 kg-cm (9 ft-lb, 13 N·m)**

**25. INSTALL FLYWHEEL OR DRIVE PLATE ON  
CRANKSHAFT**

(a) Install the flywheel or drive plate on crankshaft.

(b) Install and uniformly tighten the bolts in several passes, in the sequence shown.

**Torque: 750 kg-cm (54 ft-lb, 74 N·m)**



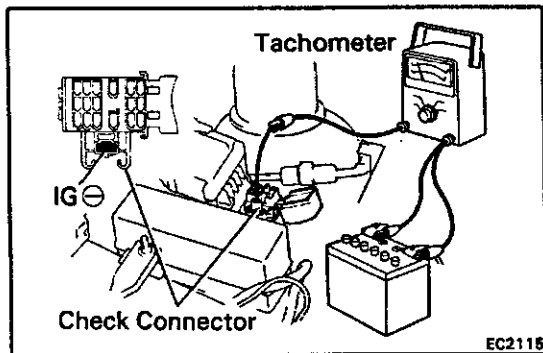
EM1488

# IGNITION SYSTEM

|                                      | Page  |
|--------------------------------------|-------|
| PRECAUTIONS .....                    | IG-2  |
| TROUBLESHOOTING .....                | IG-3  |
| IGNITION SYSTEM CIRCUIT .....        | IG-4  |
| ON-VEHICLE INSPECTION (7M-GE) .....  | IG-5  |
| ON-VEHICLE INSPECTION (7M-GTE) ..... | IG-12 |
| DISTRIBUTOR (7M-GE) .....            | IG-19 |
| CAM POSITION SENSOR (7M-GTE) .....   | IG-23 |

## PRECAUTIONS

1. Do not leave the ignition switch on for more than 10 minutes if the engine does not start.



2. When a tachometer is connected to the system, connect the tachometer test probe to the check connector terminal IG  $\ominus$ .

CHECK CONNECTOR LOCATION:  
See pages FI-110, 111

3. As some tachometers are not compatible with this ignition system, we recommended that you confirm the compatibility of your unit before using.
4. NEVER allow the tachometer terminals to touch ground as it could result in damage to the igniter and/or ignition coil.
5. Do not disconnect the battery while the engine is running.
6. Make sure that the igniter is properly grounded to the body.

## TROUBLESHOOTING

| Problem                                                | Possible causes                                                                                                                                                                                                                                                                                        | Remedy                                                                                                                                                                                 | Page                                                                                      |
|--------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| Engine will not start/<br>hard to start<br>(cranks OK) | Incorrect ignition timing<br>Ignition problems <ul style="list-style-type: none"> <li>● Ignition coil</li> <li>● (7M-GTE)<br/>Igniter</li> <li>● (7M-GE)<br/>Distributor<br/>(7M-GTE)<br/>Cam position sensor</li> <li>● High-tension cords</li> </ul> Ignition wiring disconnected<br>or broken       | Reset timing<br><br>Inspect coil<br><br>Inspect igniter<br><br>Inspect distributor<br><br>Inspect cam position sensor<br>Inspect high-tension cords<br>Inspect wiring                  | EM-17<br><br>IG-10 or 14<br><br>IG-17<br><br>IG-11<br><br>IG-18<br>IG-6 or 13             |
| Rough idle or stalls                                   | Spark plugs faulty<br>Ignition wiring faulty<br>Incorrect ignition timing<br>Ignition problems <ul style="list-style-type: none"> <li>● Ignition coil</li> <li>● (7M-GTE)<br/>Igniter</li> <li>● (7M-GE)<br/>Distributor<br/>(7M-GTE)<br/>Cam position sensor</li> <li>● High-tension cords</li> </ul> | Inspect plugs<br>Inspect wiring<br>Reset timing<br><br>Inspect coil<br><br>Inspect igniter<br><br>Inspect distributor<br><br>Inspect cam position sensor<br>Inspect high-tension cords | IG-7<br><br>EM-17<br><br>IG-10 or 14<br><br>IG-17<br><br>IG-11<br><br>IG-18<br>IG-6 or 13 |
| Engine hesitates/<br>poor acceleration                 | Spark plugs faulty<br>Ignition wiring faulty<br>Incorrect ignition timing                                                                                                                                                                                                                              | Inspect plugs<br>Inspect wiring<br>Reset timing                                                                                                                                        | IG-7<br><br>EM-17                                                                         |
| Muffler explosion<br>(after fire) all the<br>time      | Incorrect ignition timing                                                                                                                                                                                                                                                                              | Reset timing                                                                                                                                                                           | EM-17                                                                                     |
| Engine backfires                                       | Incorrect ignition timing                                                                                                                                                                                                                                                                              | Reset timing                                                                                                                                                                           | EM-17                                                                                     |
| Poor fuel economy                                      | Spark plugs faulty<br>Incorrect ignition timing                                                                                                                                                                                                                                                        | Inspect plugs<br>Reset timing                                                                                                                                                          | IG-7<br>EM-17                                                                             |
| Engine overheats                                       | Incorrect ignition timing                                                                                                                                                                                                                                                                              | Reset timing                                                                                                                                                                           | EM-17                                                                                     |

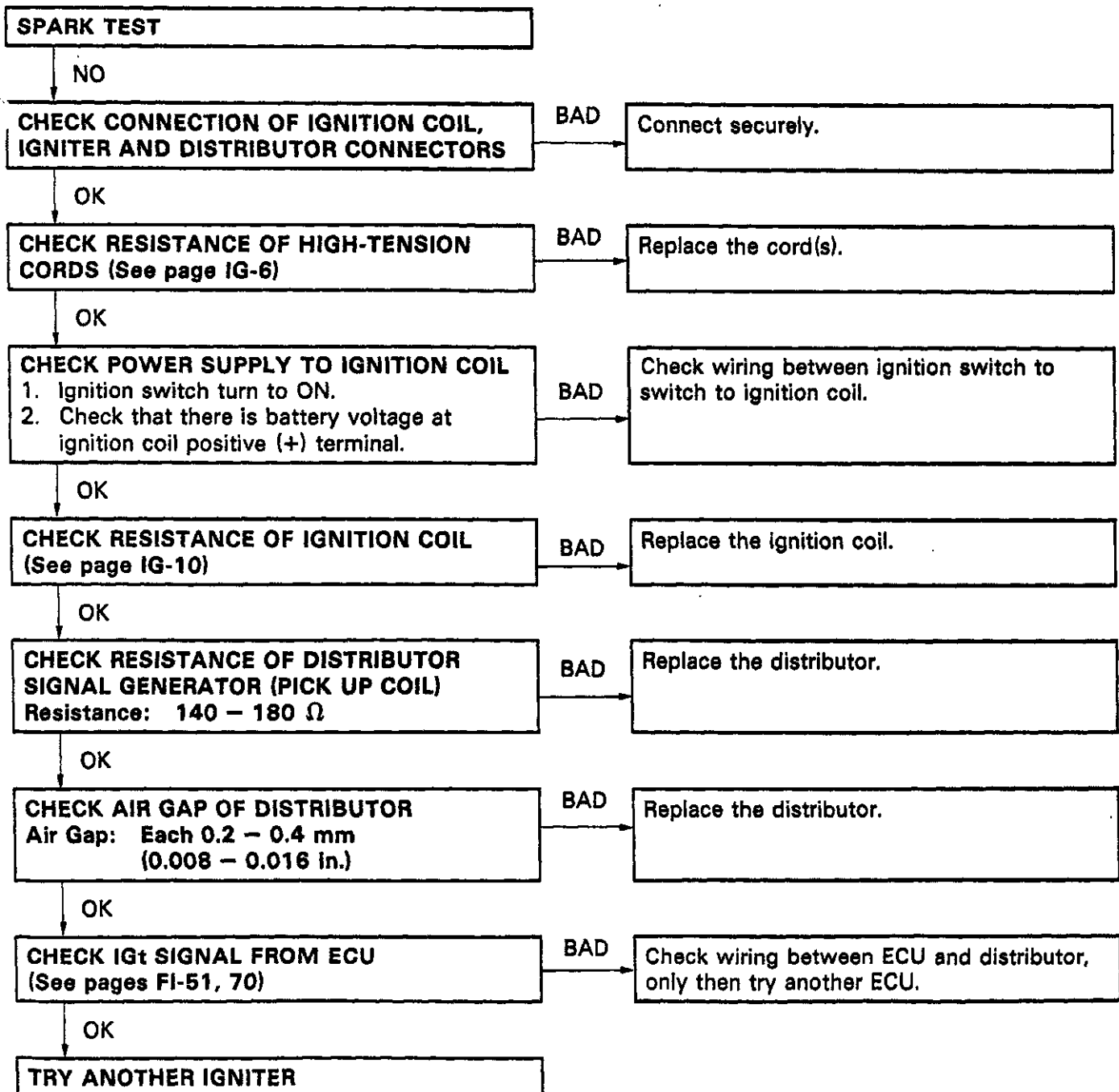
The ECU is programmed with data for optimum ignition timing under any and all operating conditions. Using data provided by sensors which monitor various engine functions (rpm, intake air volume, eng. temperature, etc.) the microcomputer (ECU) triggers the spark at precisely the right instant.

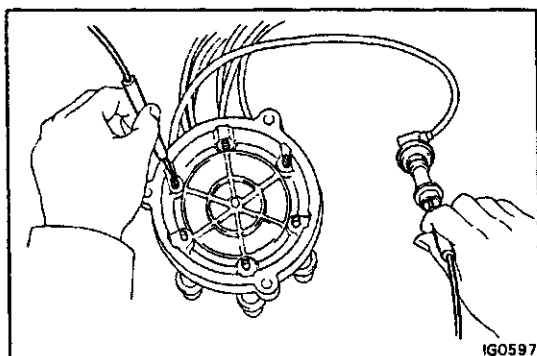
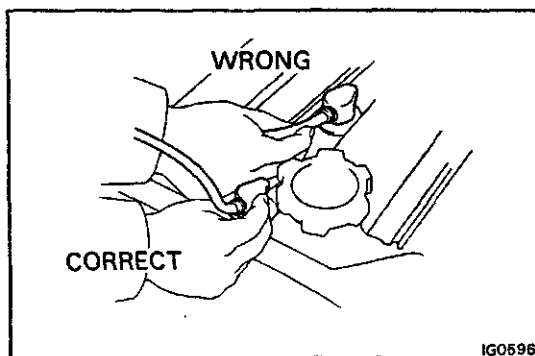
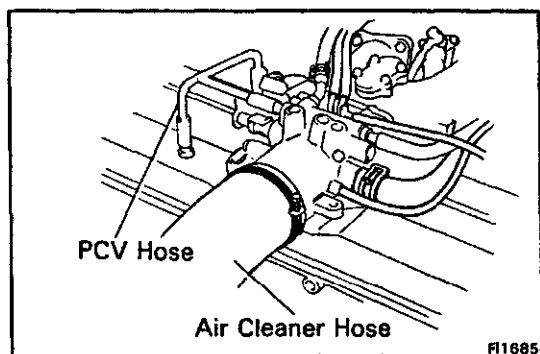
**ON-VEHICLE INSPECTION (7M-GE)****SPARK TEST****CHECK THAT SPARK OCCURS**

- (a) Disconnect high-tension cord from the distributor.
- (b) Hold the end about 12.5 mm (0.49 in.) from body of vehicle.
- (c) See if spark occurs while engine is being cranked.

NOTE: To prevent gasoline from being injected from injectors during this test, crank the engine for no more than 1-2 seconds at a time.

If the spark does not occur, perform the test as follows:





## INSPECTION OF HIGH-TENSION CORDS

### 1. REMOVE HIGH-TENSION CORDS

- (a) Disconnect the throttle body.
  - Disconnect the air cleaner hose.
  - Remove the throttle body bracket.
  - Disconnect the throttle cables or accelerator connecting rod.
  - Disconnect the PCV hose.
  - Remove the four bolts and pick up the throttle body.
- (b) Carefully remove the high-tension cords by their rubber boots from the spark plugs.

**CAUTION:** Pulling on or bending the cords may damage the conductor inside.

### 2. INSPECT HIGH-TENSION CORD RESISTANCE

Using an ohmmeter, measure the resistance without disconnecting the cap.

**Maximum resistance: 25 k $\Omega$  per cord**

If resistance exceeds maximum, check the terminals.

If necessary, replace the high-tension cord and/or distributor cap.

### 3. INSTALL HIGH-TENSION CORDS

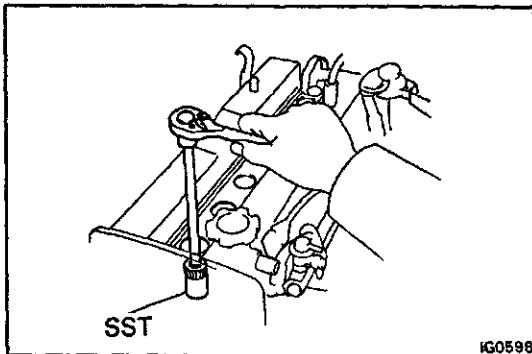
- (a) Install high-tension cords.
- (b) Install the throttle body.
  - Install the throttle body with the four bolts.
  - Connect the PCV hose.
  - Connect the throttle cables or accelerator connecting rod.
  - Install the throttle body bracket.
  - Connect the air cleaner hose.

## INSPECTION OF SPARK PLUGS (Conventional Tipped Type Spark Plug)

### 1. REMOVE SPARK PLUGS

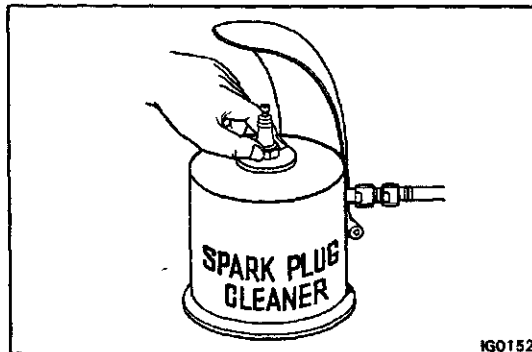
- (a) Remove the high-tension cords.  
(See page IG-6)

- (b) Using SST, remove the spark plug.  
SST 09155-16100



### 2. CLEAN SPARK PLUGS

Using a spark plug cleaner or wire brush, clean the spark plug.



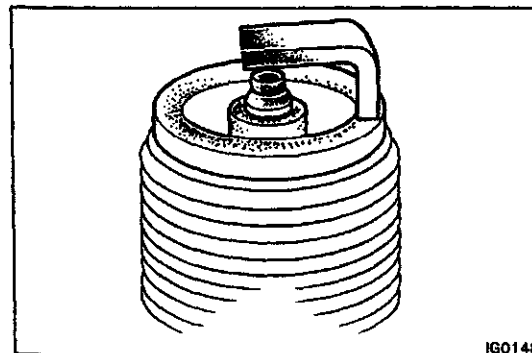
### 3. VISUALLY INSPECT SPARK PLUGS

Check the spark plug for electrode wear, threads damage and insulator damage.

If abnormal, replace the plugs.

Recommended spark plugs:

ND Q20R-U  
NGK BCPR6EY



### 4. ADJUST ELECTRODE GAP

Carefully bend the outer electrode to obtain the correct electrode gap.

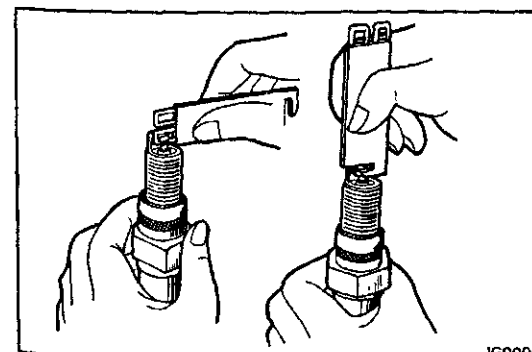
Correct electrode gap: 0.8 mm (0.031 in.)

### 5. INSTALL SPARK PLUGS

- (a) Using SST, install and torque the spark plug.

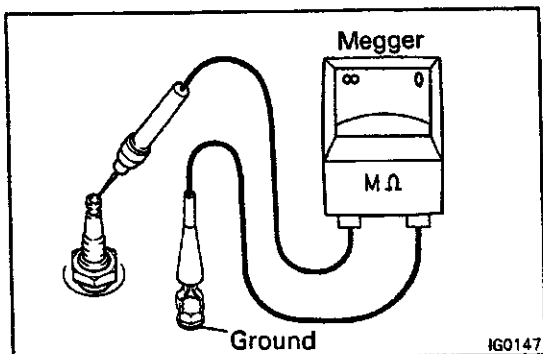
SST 09155-16100

Torque: 180 kg-cm (13 ft-lb, 18 N·m)



**(Platinum Tipped Type Spark Plug)****CAUTION:**

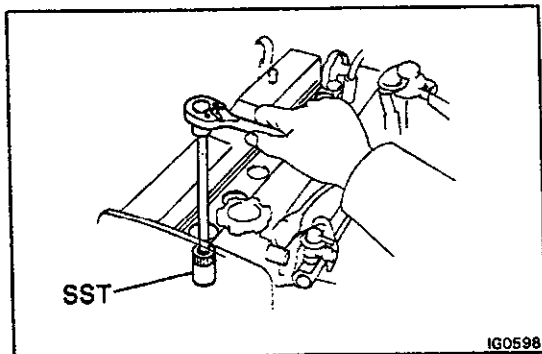
- Never use a wire brush for cleaning.
- Never attempt to adjust gap on used plug.
- Spark plugs should be replaced every 60,000 miles (100,000 km).

**1. INSPECT ELECTRODE**

(a) If using a megger (insulation resistance meter):

- Remove the high-tension cords. (See page IG-6)
- Measure the insulation resistance.

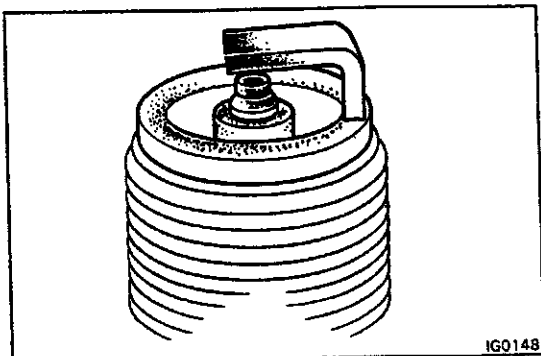
**Correct insulation resistance: 10 MΩ or more**  
If less than 10 MΩ, proceed to step 2.



(b) If not a megger:

- Quickly race the engine to 4,000 rpm five times.
- Using SST, remove the spark plug. (See procedure below)

SST 09155-16100



- Visually inspect the spark plugs.

If the electrode is dry ..... Okay

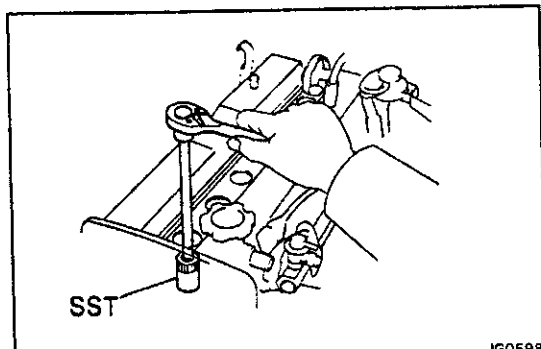
If the electrode is wet ..... Proceed to step 3

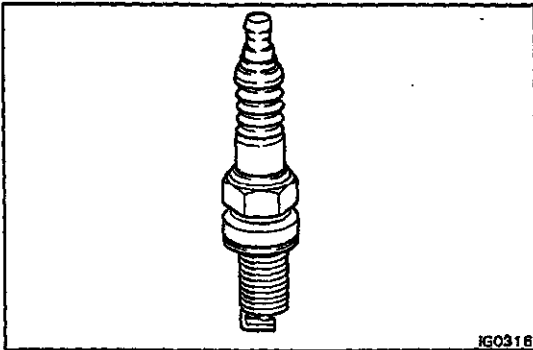
**2. REMOVE SPARK PLUGS**

(a) Remove the high-tension cords. (See page IG-6)

(b) Using SST, remove the spark plug.

SST 09155-16100





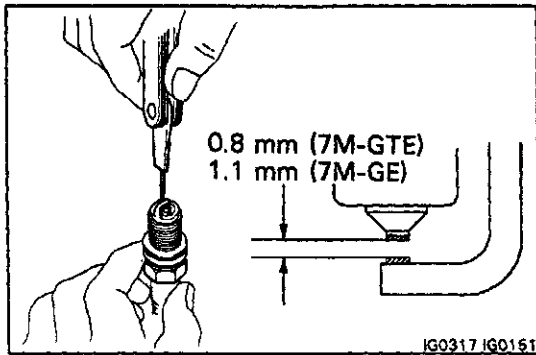
### 3. VISUALLY INSPECT SPARK PLUGS

Check the spark plug for thread or insulator damage.

If abnormal, replace the plug.

Recommended spark plugs:

|        |     |            |
|--------|-----|------------|
| 7M-GE  | ND  | PQ16R      |
|        | NGK | BCPR5EP11  |
| 7M-GTE | ND  | PQ20R-P8   |
|        | NGK | BCPR6EP-N8 |



### 4. INSPECT ELECTRODE GAP

Maximum electrode gap:

7M-GE 1.3 mm (0.051 in.)

7M-GTE 1.0 mm (0.039 in.)

If the gap is greater than maximum, replace the plug.

Correct electrode gap of new plug:

7M-GE 1.1 mm (0.043 in.)

7M-GTE 0.8 mm (0.031 in.)

If adjusting the gap of a new plug, bend only the base of the ground electrode, do not touch the tip.



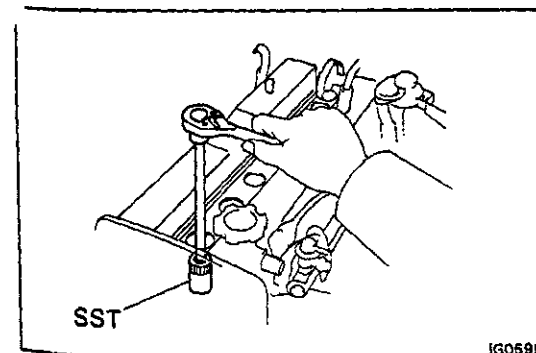
### 5. CLEAN SPARK PLUGS

If the electrode has traces of wet carbon, allow it to dry and then clean with a spark plug cleaner.

Air pressure: Below 6 kg/cm<sup>2</sup> (85 psi, 588 kPa)

Duration: 20 seconds or less

NOTE: If there are traces of oil, remove it with gasoline before using the spark plug cleaner.



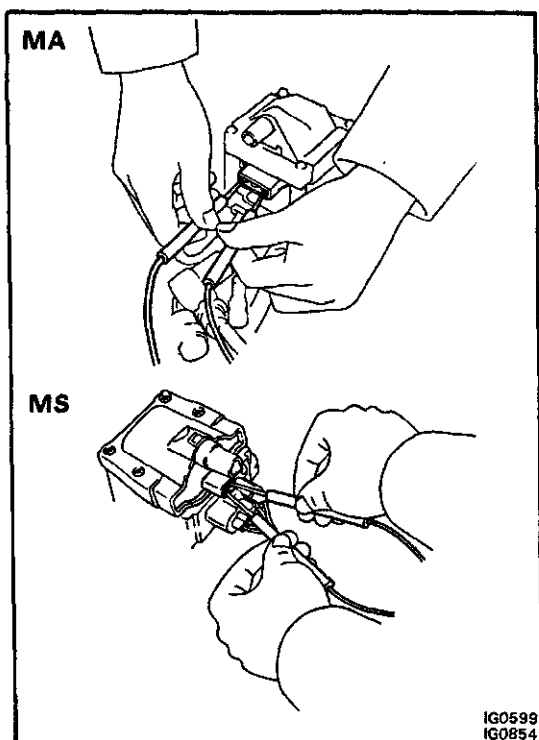
### 6. INSTALL SPARK PLUGS

(a) Using SST, install and torque the spark plug.

SST 09155-16100

Torque: 180 kg-cm (13 ft-lb, 18 N·m)

(b) Install the high-tension cords.



## INSPECTION OF IGNITION COIL

### 1. DISCONNECT HIGH-TENSION CORD (See page IG-6)

### 2. INSPECT PRIMARY COIL RESISTANCE

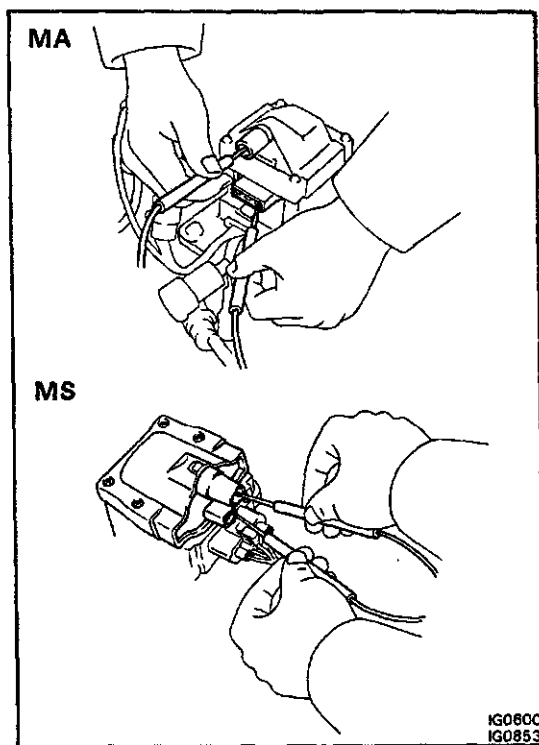
Using an ohmmeter, measure the resistance between the positive (+) and negative (-) terminals.

Primary coil resistance (cold):

MA 0.24 – 0.30  $\Omega$

MS 0.41 – 0.50  $\Omega$

If the resistance is not as specified, replace the ignition coil.



### 3. INSPECT SECONDARY COIL RESISTANCE

Using an ohmmeter, measure the resistance between the positive (+) terminal and high-tension terminal.

Secondary coil resistance (cold):

MA 9.2 – 12.4 k $\Omega$

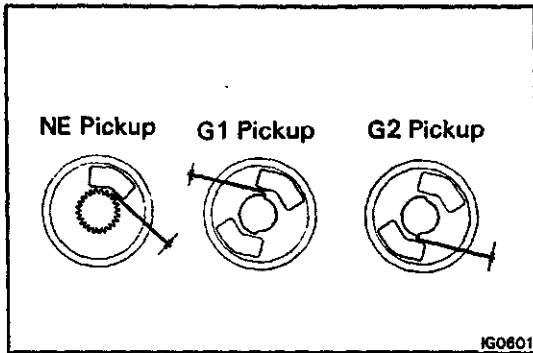
MS 10.2 – 13.8 k $\Omega$

If the resistance is not as specified, replace the ignition coil.

### 4. RECONNECT HIGH-TENSION CORD (See page IG-6)

## INSPECTION OF IGNITER

(See procedure IG-5)



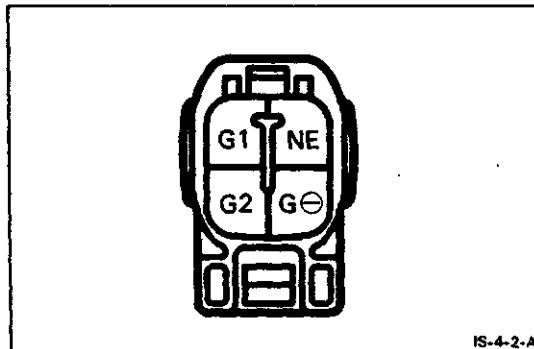
## INSPECTION OF DISTRIBUTOR

### 1. INSPECT AIR GAPS

Using a thickness gauge, measure the gap between the signal rotor and pickup coil projection.

**Air gap:** 0.2 – 0.4 mm (0.008 – 0.016 in.)

If the gap is not as specified, replace the distributor.



### 2. INSPECT PICKUP COILS

Using an ohmmeter, check resistance of the pickup coil.

**G1 pickup coil resistance:**

G1 – G ⊖ 140 – 180 Ω

**G2 pickup coil resistance:**

G2 – G ⊖ 140 – 180 Ω

**NE pickup coil resistance:**

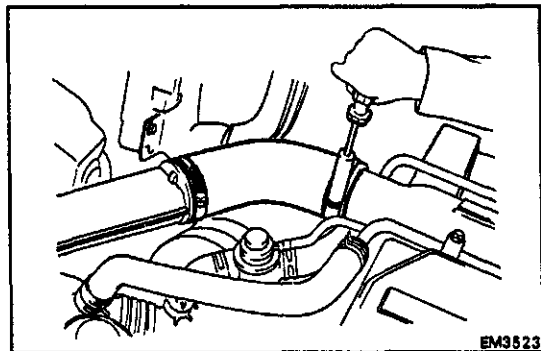
NE – G ⊖ 140 – 180 Ω

If the resistance is not as specified, replace the distributor.

## ON-VEHICLE INSPECTION (7M-GTE)

### SPARK TEST

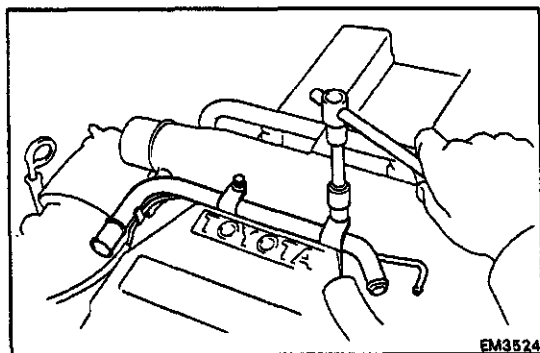
**NOTE:** Perform this test to check that voltage is coming from the ignition coil to spark plug.



**1. DISCONNECT NO.1 AIR CLEANER HOSE**

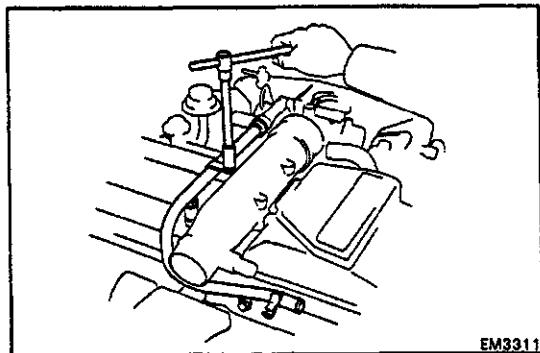
**2. DISCONNECT FOLLOWING CABLES AND ROD:**

- (a) Accelerator link w/ cable
- (b) Accelerator rod
- (c) (A/T)  
Throttle cable



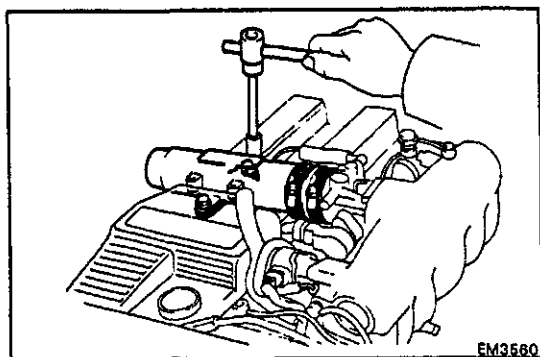
**3. REMOVE ISC PIPE**

- (a) Disconnect the six hoses from ISC pipe.
- (b) Remove the two bolts and ISC pipe.



**4. REMOVE PCV PIPE WITH HOSES**

- (a) Remove the oxygen sensor wire from two clamps.
- (b) Disconnect the No.4 PCV hose from the PCV pipe.
- (c) Remove the two bolts.
- (d) Disconnect the PCV pipe with hoses from the cylinder head covers and throttle body.

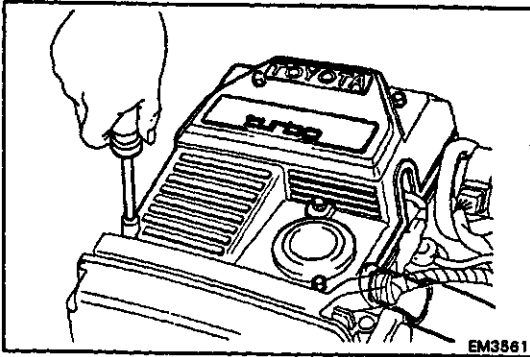


**5. REMOVE INTAKE AIR CONNECTOR**

- (a) Disconnect the air valve hose from the intake air connector.
- (b) Loosen the clamp and remove the two bolts.
- (c) Remove the intake air connector.

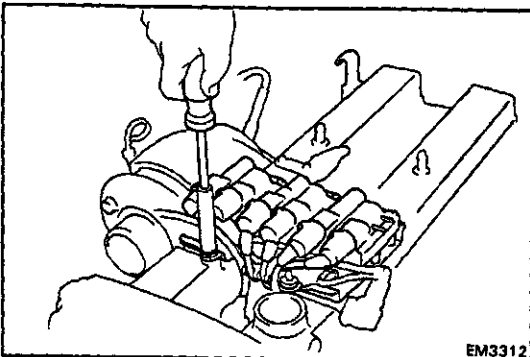
## IGNITION SYSTEM — On-Vehicle Inspection (7M-GTE)

13



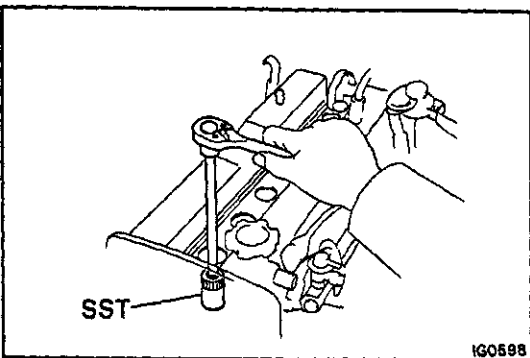
### 6. REMOVE IGNITION COIL COVER

- (a) Remove the oil filler cap.
- (b) Remove the five nuts and ignition coil cover.



### 7. REMOVE IGNITION COIL WITH BRACKET

- (a) Remove the nut.
- (b) Disconnect the No.1 and No.2 high-tension cords from the ignition coil and clamp.
- (c) Remove the ignition coil with bracket and high-tension cords.
- (d) Remove the No.1 and No.2 high-tension cords from the spark plugs.

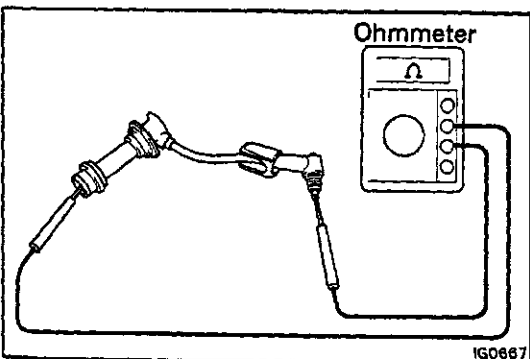


### 8. REMOVE SPARK PLUGS

Using SST, remove the spark plug.  
SST 09155-16100

### 9. PERFORM SPARK TEST

- (a) Install the oil filler cap.
- (b) Install the spark plugs to each high-tension cord.
- (c) Ground the spark plug.
- (d) Disconnect the solenoid resistor and cold start injector connectors.
- (e) See if spark occurs while engine is being cranked.



## INSPECTION OF HIGH-TENSION CORDS

### INSPECT HIGH-TENSION CORD RESISTANCE

Using an ohmmeter, measure the resistance.

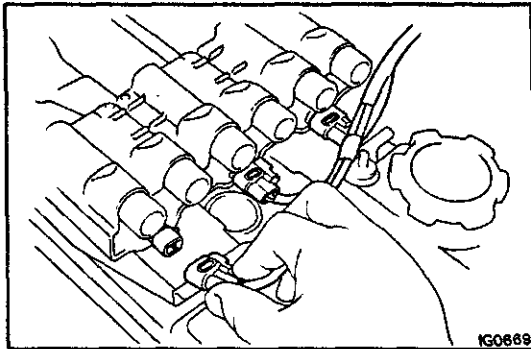
**Maximum resistance: 25 k $\Omega$  per cord**

If resistance exceeds maximum, check the terminals.

If necessary, replace the high-tension cord.

## INSPECTION OF SPARK PLUGS

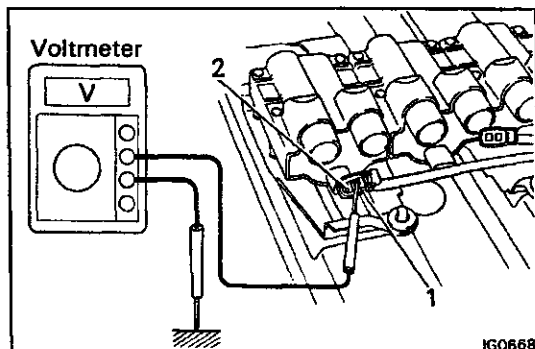
(See pages IG-7, 8)



## INSPECTION OF IGNITION COIL -

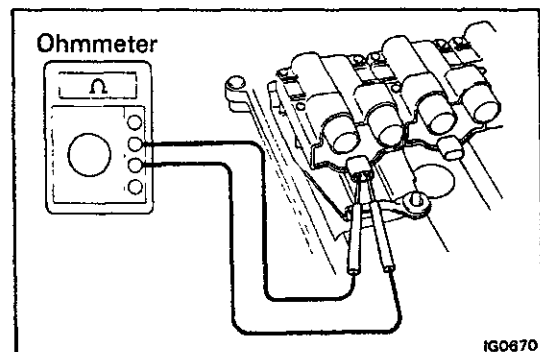
### 1. INSPECT POWER SOURCE LINE

- Disconnect the high-tension cord from the ignition coil.
- Disconnect the ignition coil connectors.
- Turn the ignition switch ON.



- Using a voltmeter, measure the voltage between terminal 1 and body ground.

**Voltage: Approx. 12 V**

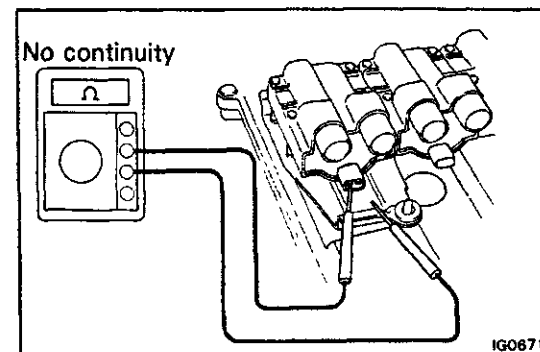


### 2. INSPECT PRIMARY COIL RESISTANCE

Using an ohmmeter, measure the resistance between the positive (+) and negative (−) terminals.

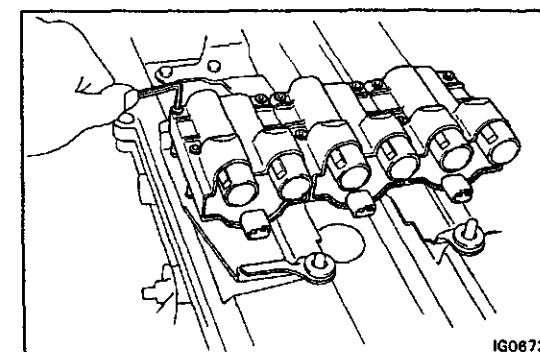
**Primary coil resistance (cold): 0.3 – 0.5 Ω**

**NOTE:** Because is inside the coil, it is impossible to measure secondary coil resistance.



### 3. INSPECT IGNITION COIL GROUND

Using an ohmmeter, check that there is no continuity between the ignition coil terminal and body ground.

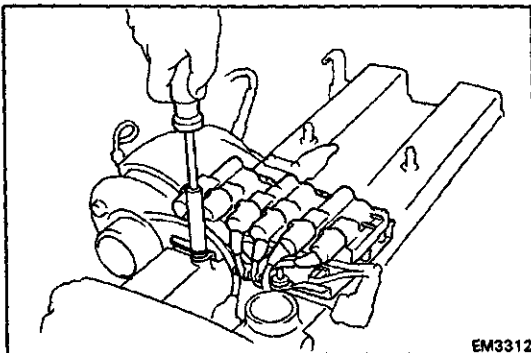
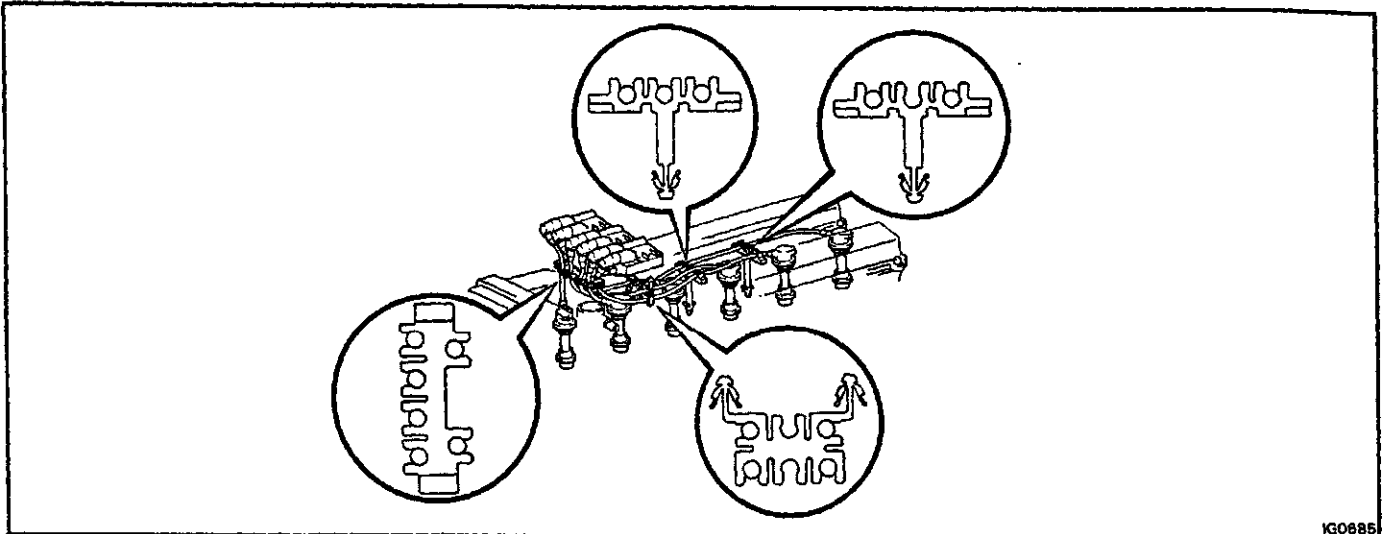


### 4. IF NECESSARY, REPLACE IGNITION COIL

Using a hexagon key wrench 3 mm (0.12 in.), replace the ignition coil.

### 5. INSTALL IGNITION COIL WITH BRACKET

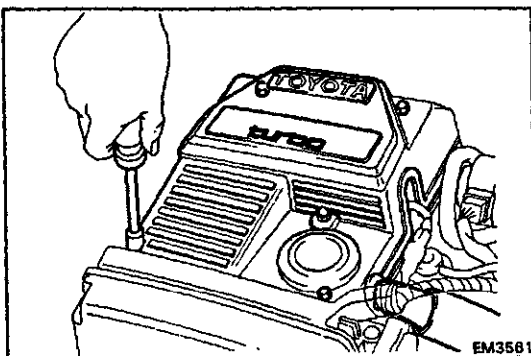
- (a) Connect the ignition coil connector.
- (b) Install the high-tension cords as shown in the illustration; No.5 and No.6, No.3 and No.4, and No.1 and No.2.



- (c) Install and torque the nut.

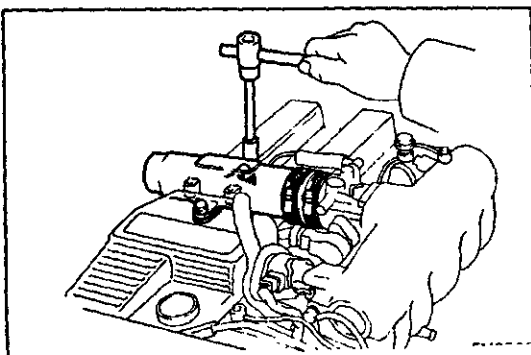
**Torque: 55 kg-cm (48 in.-lb, 5.4 N·m)**

**CAUTION: Do not over tighten the nut.**



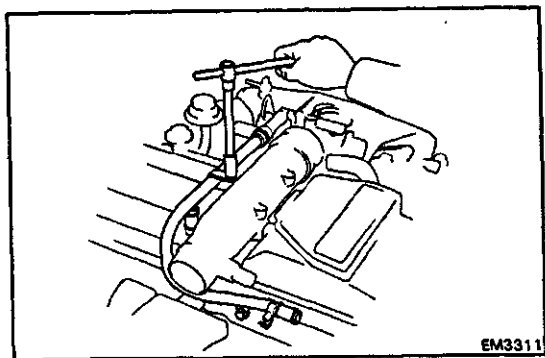
### 6. INSTALL IGNITION COIL COVER

- (a) Remove the oil filler cap.
- (b) Install the ignition coil cover with the five nuts.
- (c) Install the oil filler cap.

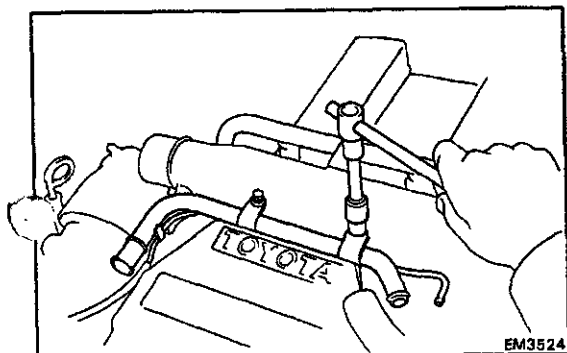


### 7. INSTALL INTAKE AIR CONNECTOR

- (a) Install the intake air connector.
- (b) Install and tighten the two bolts.
- (c) Tighten the clamp.
- (d) Connect the air valve hose.

**8. INSTALL PCV PIPE WITH HOSES**

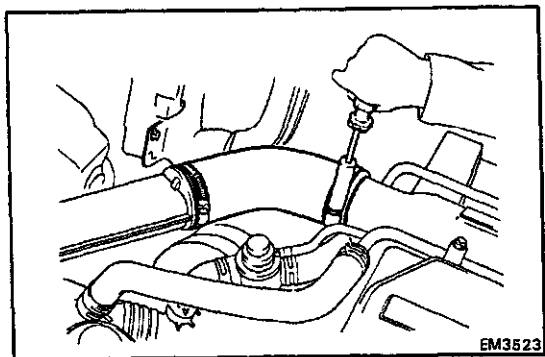
- (a) Install the PCV pipe with hoses to throttle body and cylinder head cover.
- (b) Install and tighten the two bolts.
- (c) Connect the No.4 PCV hose.
- (d) Install the oxygen sensor wire to the two PCV pipe clamps.

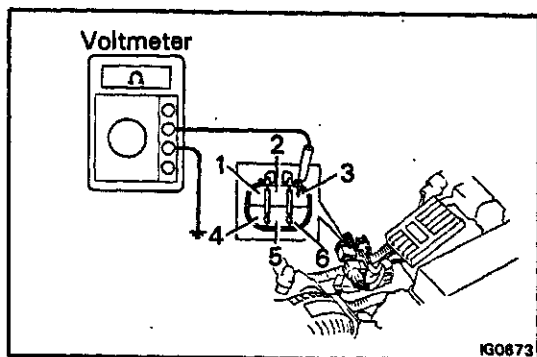
**9. INSTALL ISC PIPE**

- (a) Install the ISC pipe with the two bolts.
- (b) Connect the six hoses to ISC pipe.

**10. CONNECT FOLLOWING CABLES AND ROD:**

- (a) (A/T)  
Throttle cable
- (b) Accelerator rod
- (c) Accelerator link w/ cable

**11. CONNECT NO.1 AIR CLEANER HOSE**



## INSPECTION OF IGNITER

### 1. CHECK POWER SOURCE LINE VOLTAGE

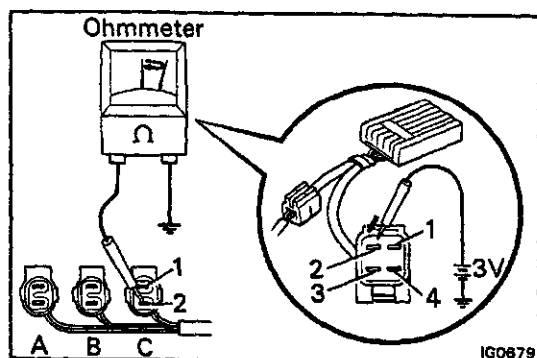
- Disconnect the connector 6-P.
- Turn the ignition switch ON.
- Using a voltmeter, connect the positive (+) probe to the terminal 3 of harness side and negative (-) probe to the body ground.

Voltage: Approx. 12 V

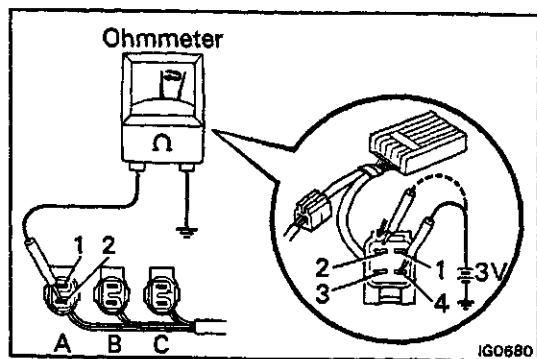
- Connect the connector 6-P.

### 2. CHECK POWER TRANSISTOR IN IGNITER

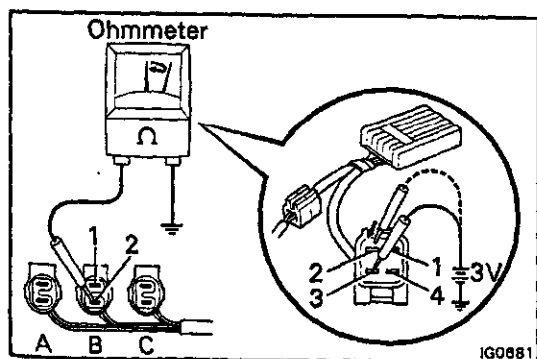
- Disconnect the connector 4-P.
- Disconnect each ignition coil from its connector.
- Turn the ignition switch ON.



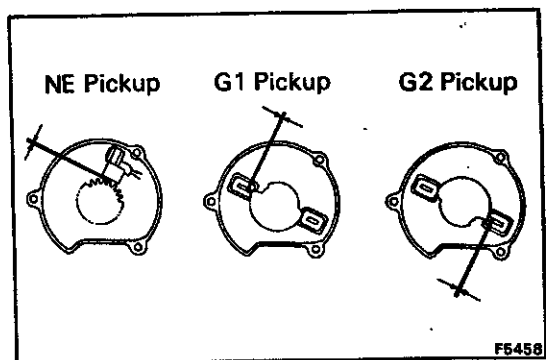
- Using an ohmmeter, connect terminal 2 of the ignition coil C and body ground.
- Using a 3 V dry cell battery, apply voltage to terminal 2 of the connector 4-P. As voltage is applied, check that there is momentary continuity.



- Using an ohmmeter, connect terminal 2 of the ignition coil A and body ground.
- Using a 3 V dry cell battery, apply voltage to terminal 4 of the connector 4-P.
- With terminal 4 connected apply voltage to terminal 2 of connector 4-P. As you apply voltage, check that there is momentary continuity.



- Using an ohmmeter, connect terminal 2 of the ignition coil B and body ground.
- Using a 3 V dry cell battery, apply voltage to terminal 3 of the connector 4-P.
- With terminal 3 connected apply voltage to terminal 2 of connector 4-P. As you apply voltage, check that there is momentary continuity.



## INSPECTION OF CAM POSITION SENSOR

### 1. INSPECT AIR GAP

Using a thickness gauge, measure the gap between the signal rotor and pickup coil projection.

**Air gap: 0.2 – 0.4 mm (0.008 – 0.016 in.)**

If the gap is not within specification, replace the cam position sensor.

### 2. INSPECT PICKUP COILS

Using an ohmmeter, check resistance of the pickup coil.

**G1 pickup coil resistance:**

**G1 – G $\ominus$  140 – 180  $\Omega$**

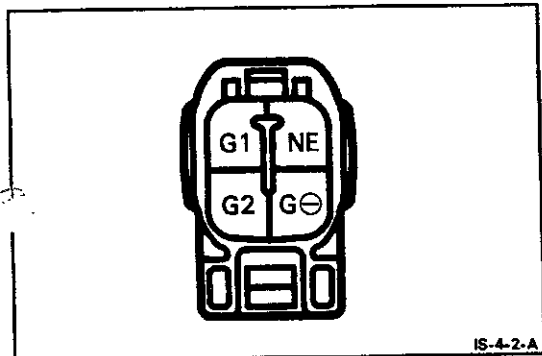
**G2 pickup coil resistance:**

**G2 – G $\ominus$  140 – 180  $\Omega$**

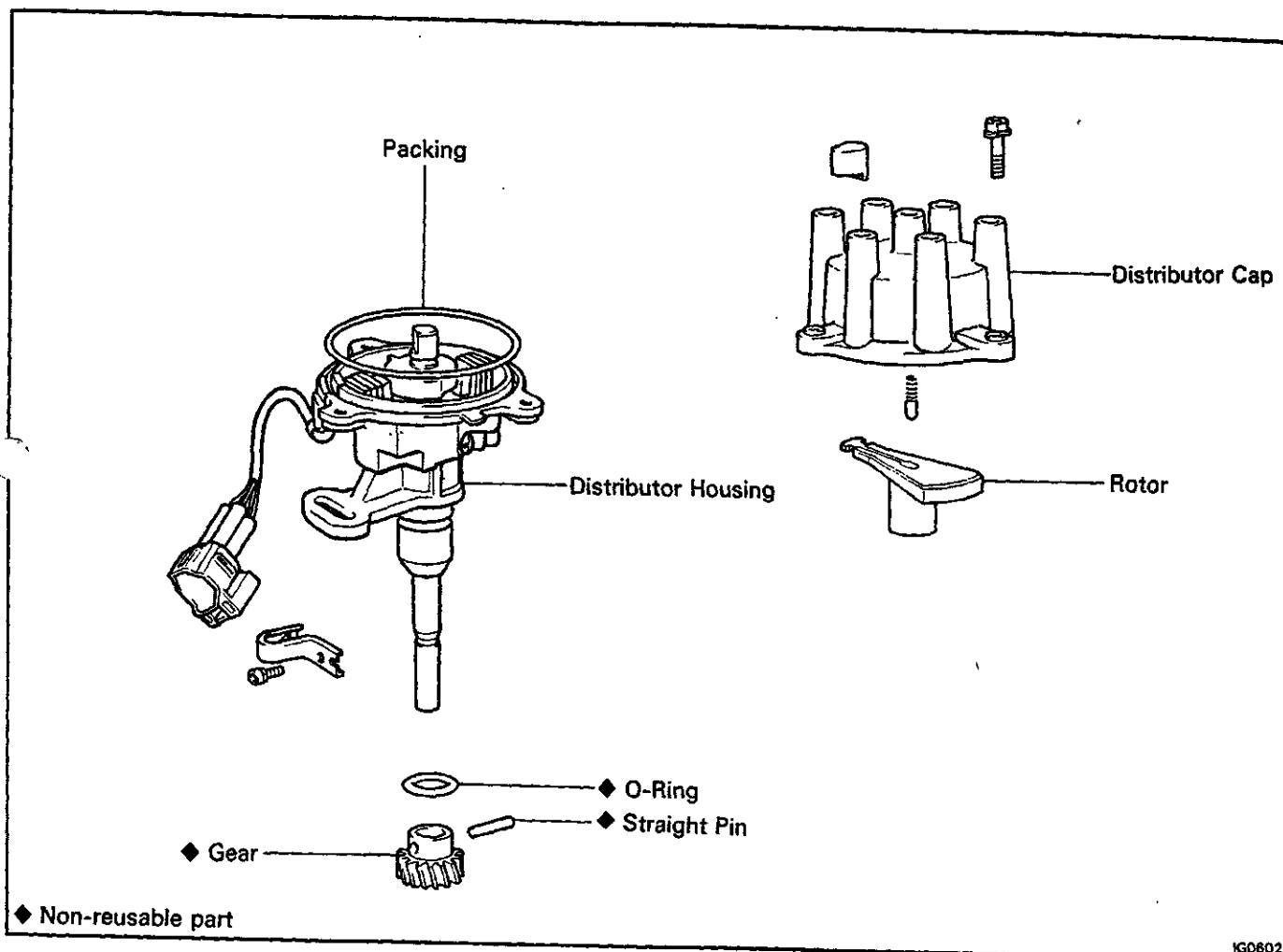
**NE pickup coil resistance:**

**NE – G $\ominus$  140 – 180  $\Omega$**

If the resistance is not as specified, replace the cam position sensor.



## DISTRIBUTOR (7M-GE) COMPONENTS



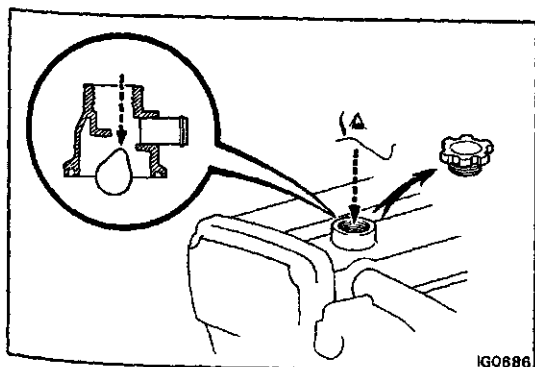
IG0602

## REMOVAL OF DISTRIBUTOR

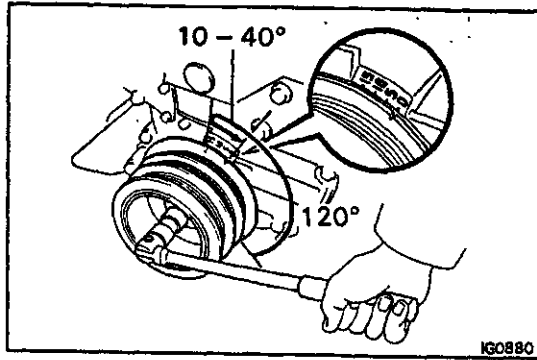
1. **DISCONNECT HIGH-TENSION CORDS FROM DISTRIBUTOR CAP**
2. **DISCONNECT DISTRIBUTOR CONNECTOR**
3. **REMOVE DISTRIBUTOR CAP AND PACKING**

### 4. **SET NO.1 CYLINDER TO TDC/COMPRESSION**

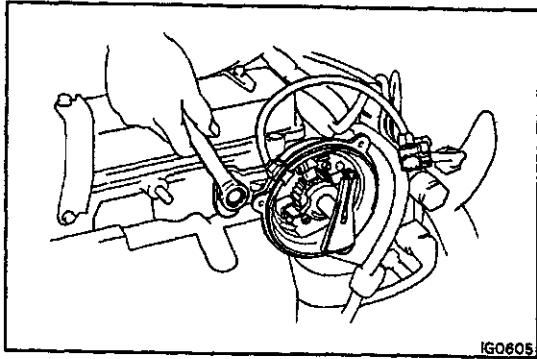
- (a) Remove the oil filler cap.
- (b) Look through oil filler hole and turn the crankshaft clockwise until the cam nose can be seen.



IG0886

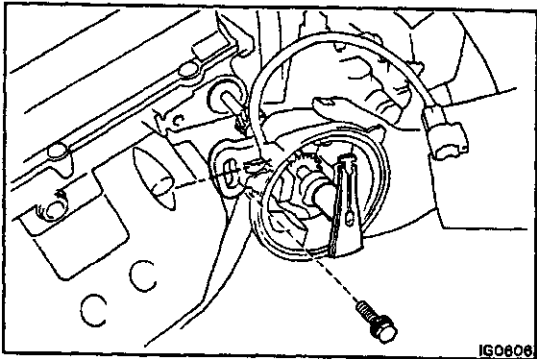


- (c) Turn the crankshaft counterclockwise approximate 120°.
- (d) Turn the crankshaft again approximately 10° to 40° clockwise so that the timing belt cover TDC mark and the crankshaft pulley TDC mark are aligned.

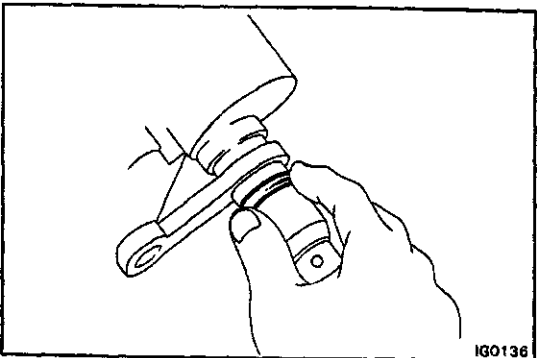


## 5. REMOVE DISTRIBUTOR

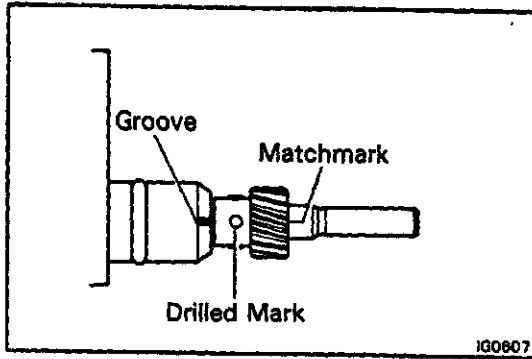
- (a) Remove the hold-down bolt,



- (b) Pull out the distributor from the cylinder head.



## 6. REMOVE O-RING



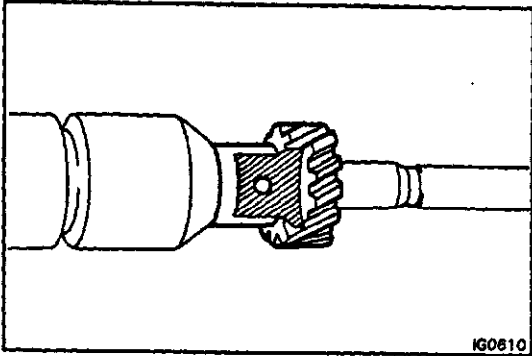
## REPLACEMENT OF DISTRIBUTOR DRIVEN GEAR

### 1. GRIND DRIVEN GEAR AND PIN

- Align the drilled mark on the driven gear with the groove of the housing.
- Place a matchmark on the distributor shaft that aligns with the groove of the housing.

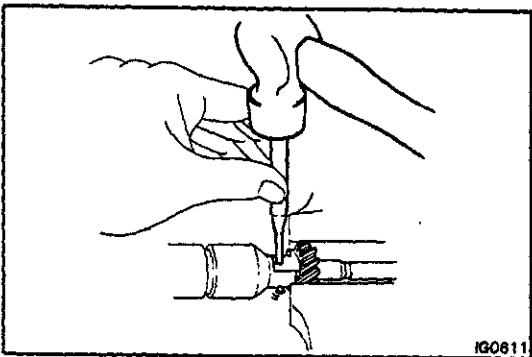
(c) Using a grinding wheel, grind the gear and pin.

**CAUTION:** Be careful not to damage the shaft.



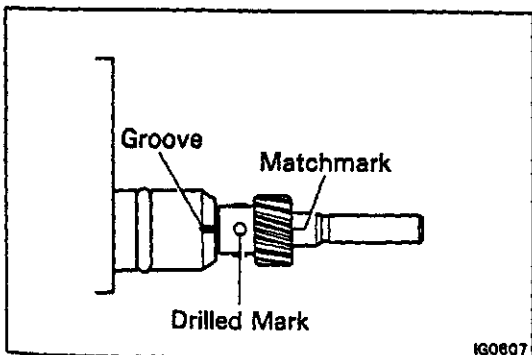
### 2. REMOVE PIN AND DRIVEN GEAR

- Using a punch and hammer, drive out the pin.
- Remove the driven gear and discard it.

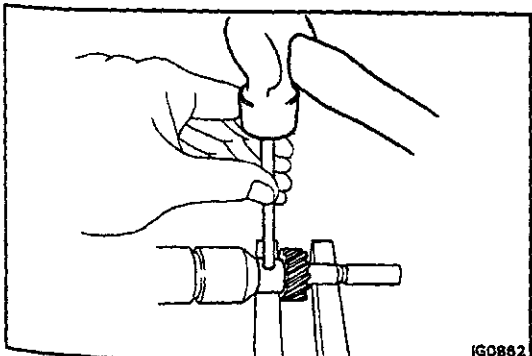


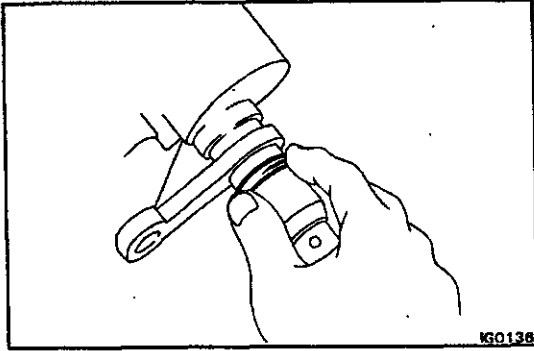
### 3. INSTALL NEW DRIVEN GEAR AND PIN

- Align the matchmark with the groove of the housing.
- Align the drilled mark on the new driven gear with the groove of the housing.



- Using a punch and hammer, peen both ends of the pin.





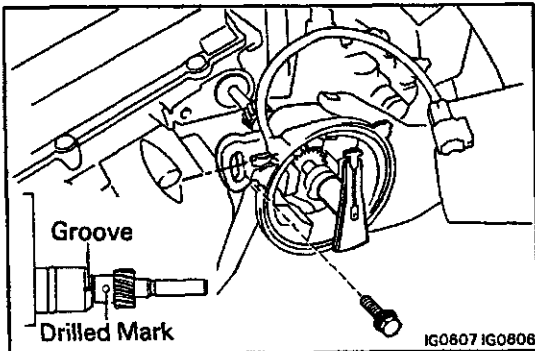
## INSTALLATION OF DISTRIBUTOR

### 1. CHECK NO.1 CYLINDER TO TDC/COMPRESSION

### 2. INSTALL DISTRIBUTOR

(a) Install a new O-ring to the distributor.

NOTE: Always use a new O-ring when installing the distributor.



(b) Align the drilled mark on the driven gear with the groove of the housing.

(c) Insert the distributor, aligning the center of the flange with that of the bolt hole on the cylinder head.

(d) Lightly tighten the hold-down bolt.

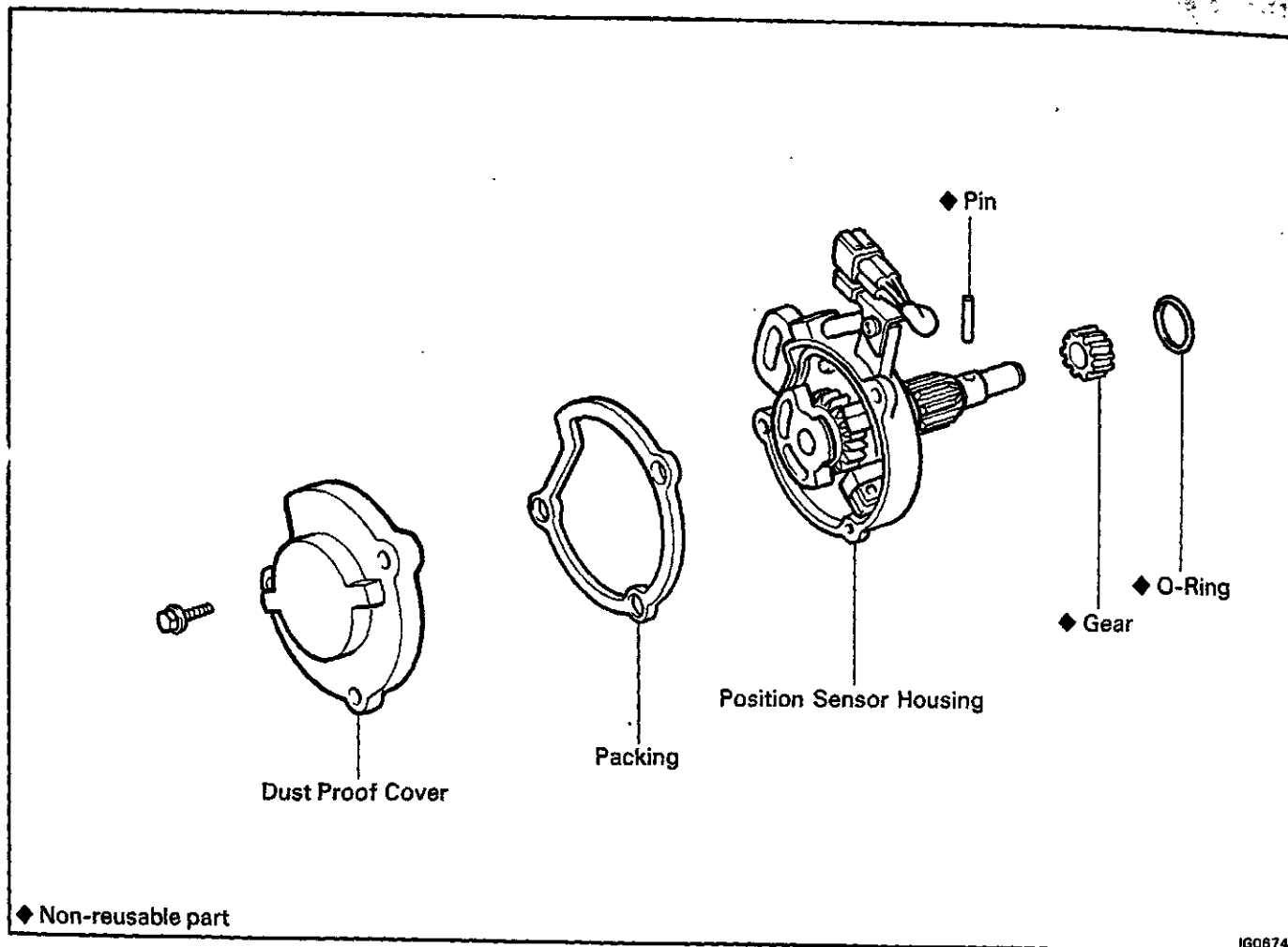
### 3. INSTALL DISTRIBUTOR CAP

### 4. CONNECT DISTRIBUTOR CONNECTOR

### 5. CONNECT HIGH-TENSION CORDS TO DISTRIBUTOR CAP

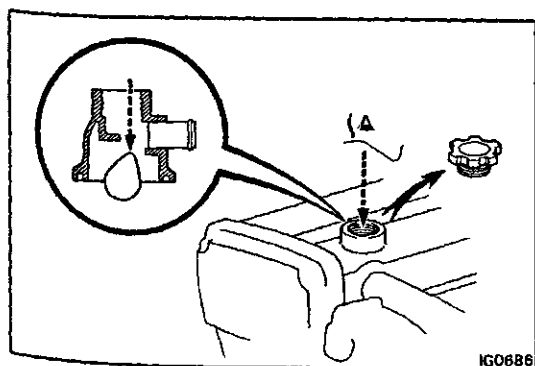
### 6. ADJUST IGNITION TIMING (See page EM-17)

## CAM POSITION SENSOR (7M-GTE) COMPONENTS



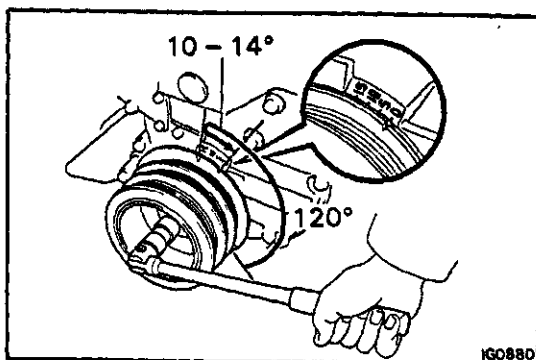
## REMOVAL OF CAM POSITION SENSOR

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY
2. DISCONNECT CAM POSITION SENSOR CONNECTOR

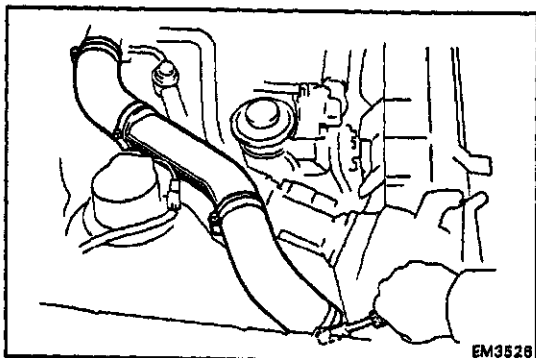


## 3. SET NO.1 CYLINDER TO TDC/COMPRESSION

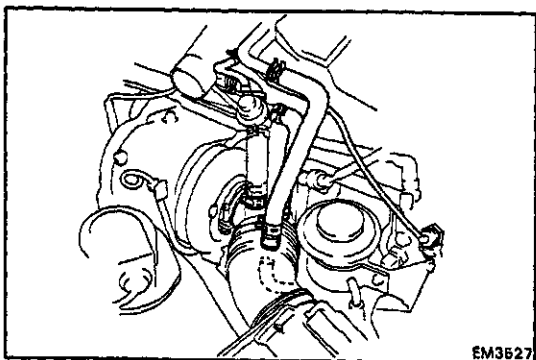
- (a) Remove the oil filler cap.
- (b) Look through oil filler hole and turn the crankshaft clockwise until the cam nose can be seen.



- (c) Turn the crankshaft counterclockwise approximately 120°.
- (d) Turn the crankshaft again approximately 10° to 40° clockwise so that the timing belt cover TDC mark and the crankshaft pulley TDC mark are aligned.

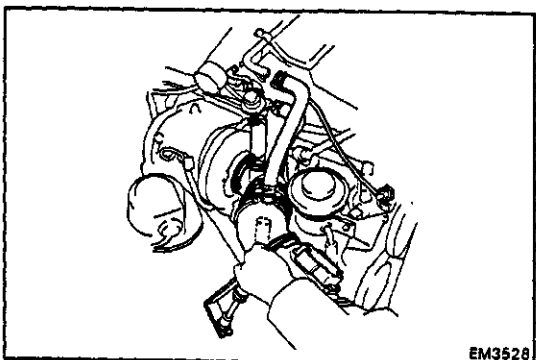


#### 4. REMOVE NO.4 AIR CLEANER PIPE WITH NO.1 AND NO.2 AIR CLEANER HOSES

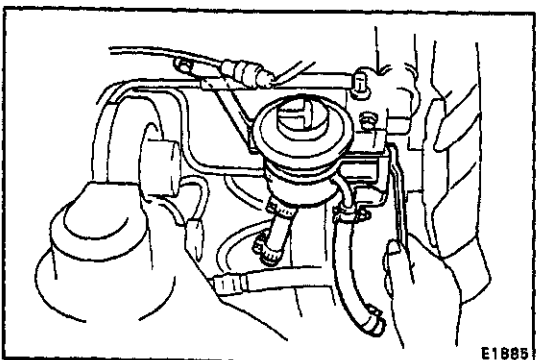


#### 5. REMOVE NO.7 AIR CLEANER HOSE WITH AIR FLOW METER AND AIR CLEANER CAP

- (a) Disconnect the three air hoses and PCV hose.
- (b) Disconnect the air flow meter connector.
- (c) Disconnect the PS idle up air hose.

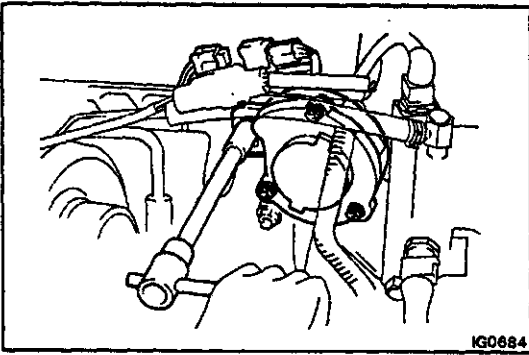


- (d) Loosen the clamps and remove the bolt.
- (e) Remove the No.2 air cleaner hose with air flow meter and air cleaner cap.



#### 6. REMOVE PS RESERVOIR TANK

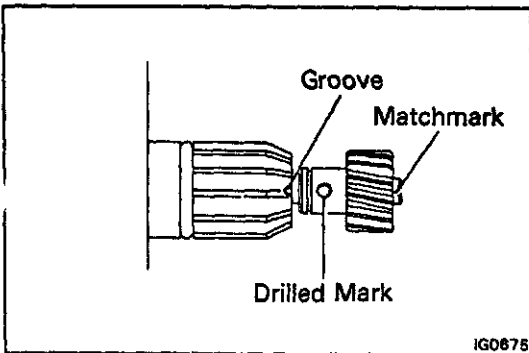
Remove the two bolts, nut and reservoir tank with bracket.



**7. REMOVE CAM POSITION SENSOR**

- (a) Remove the hold-down bolt.
- (b) Pull out the cam position sensor from the cylinder head.

**8. REMOVE O-RING**



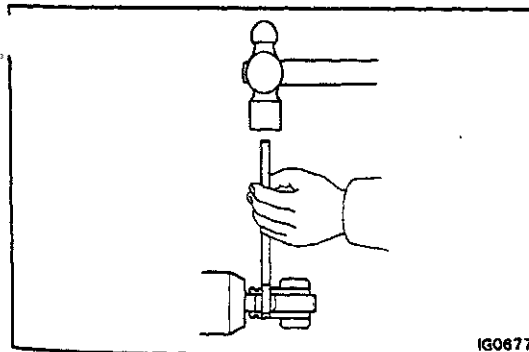
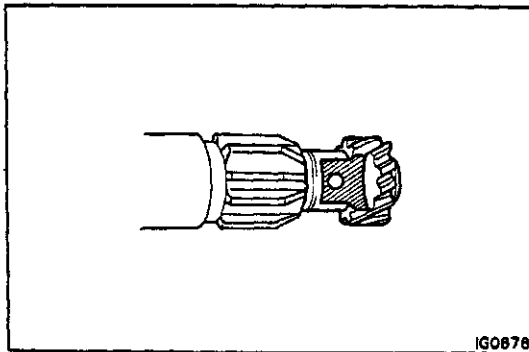
**REPLACEMENT OF CAM POSITION SENSOR DRIVEN GEAR**

**1. GRIND DRIVEN GEAR AND PIN**

- (a) Align the drilled mark on the driven gear with the groove of the housing.
- (b) Place a matchmark on the cam position shaft that aligns with the groove of the housing.

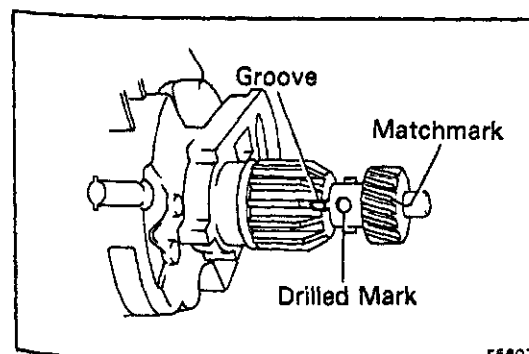
(c) Using a grinding wheel, grind the gear and pin.

**CAUTION:** Be careful not to damage the shaft.



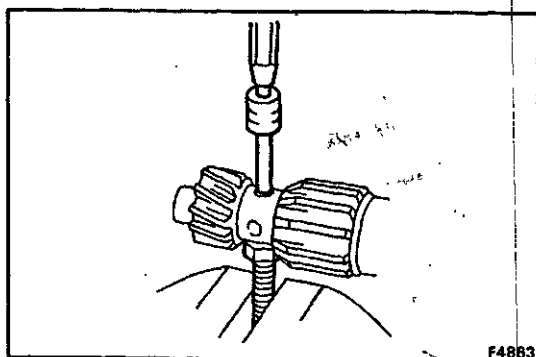
**2. REMOVE PIN AND DRIVEN GEAR**

- (a) Using a punch and hammer, drive out the pin.
- (b) Remove the driven gear and discard it.



**3. INSTALL NEW DRIVEN GEAR AND PIN**

- (a) Align the matchmark with the groove of the housing.
- (b) Align the drilled mark on the new driven gear with the groove of the housing.



F4883

- (c) Using a punch and hammer, peen both ends of the pin.

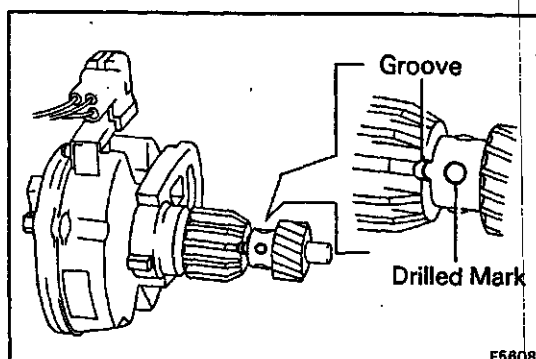
## INSTALLATION OF CAM POSITION SENSOR

### 1. CHECK NO.1 CYLINDER TO TDC/COMPRESSION

### 2. INSTALL CAM POSITION SENSOR

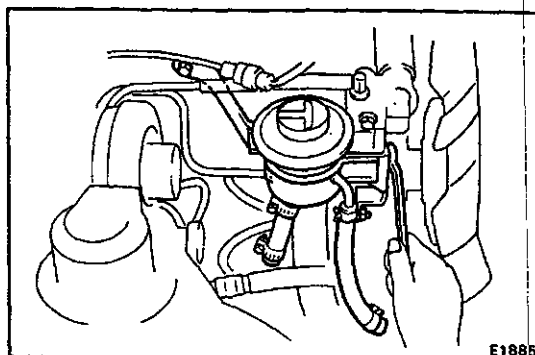
- (a) Install a new O-ring to the cam position sensor.

NOTE: Always use a new O-ring when installing the cam position sensor.



F5608

- (b) Align the drilled mark on the driven gear with the groove of the housing.
- (c) Insert the cam position sensor, aligning the center of the flange with that of the bolt hole on the cylinder head.
- (d) Lightly tighten the hold-down bolt.



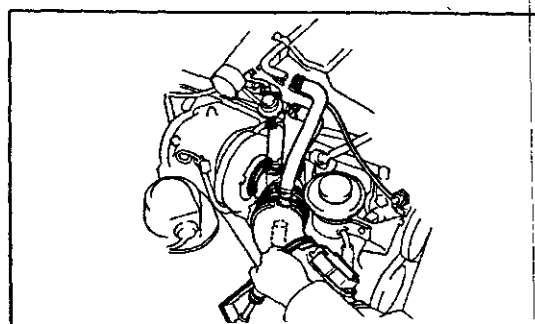
E1885

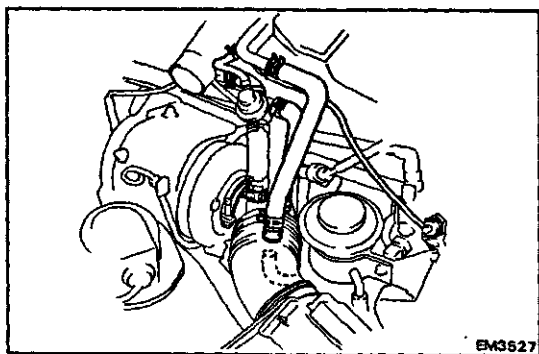
### 3. INSTALL PS RESERVOIR TANK

Install the PS reservoir tank with bracket with the two bolts and nut.

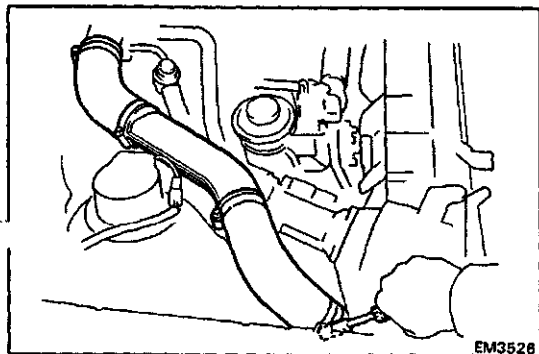
### 4. INSTALL NO.7 AIR CLEANER HOSE WITH AIR FLOW METER AND AIR CLEANER CAP

- (a) Install the No.7 air cleaner hose with air flow meter and air cleaner cap.
- (b) Install the bolt and tighten the clamps.





- (c) Connect the PS idle up air hose.
- (d) Connect the air flow meter connector.
- (e) Connect the PCV hose and three air hoses.



- 5. INSTALL NO.4 AIR CLEANER PIPE WITH NO.1 AND NO.2 AIR CLEANER HOSES**
- 6. CONNECT CAM POSITION SENSOR CONNECTOR**

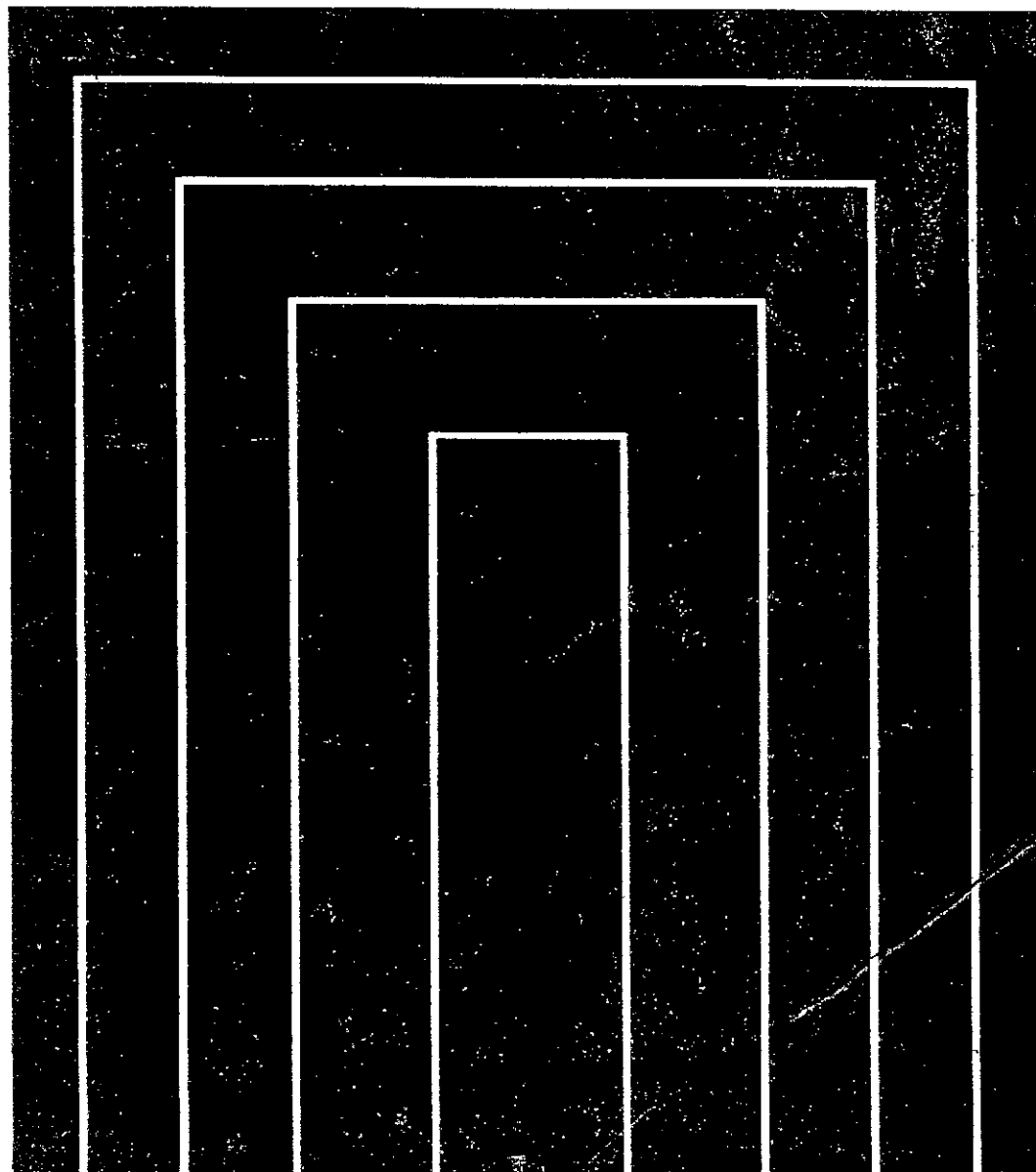
- 7. WARM UP ENGINE**  
Allow the engine to reach normal operating temperature.
- 8. ADJUST IGNITION TIMING (See page EM-17)**

# TOYOTA

## 7M-GE, 7M-GTE ENGINE

### REPAIR MANUAL

Aug., 1987



# TOYOTA 7M-GE, 7M-GTE ENGINE REPAIR MANUAL

|                                     |    |
|-------------------------------------|----|
| INTRODUCTION                        | IN |
| ✓ ENGINE MECHANICAL                 | EM |
| ✓ TURBOCHARGER SYSTEM               | TC |
| ✓ EFI SYSTEM                        | F  |
| COOLING SYSTEM                      | CO |
| LUBRICATION SYSTEM                  | LU |
| IGNITION SYSTEM                     | IG |
| STARTING SYSTEM                     | ST |
| CHARGING SYSTEM                     | CH |
| SERVICE SPECIFICATIONS              | A  |
| STANDARD BOLT TORQUE SPECIFICATIONS | B  |
| SST AND SSM                         | C  |

# INTRODUCTION

|                                                                       | Page |
|-----------------------------------------------------------------------|------|
| HOW TO USE THIS MANUAL .....                                          | IN-2 |
| IDENTIFICATION INFORMATION .....                                      | IN-4 |
| GENERAL REPAIR INSTRUCTIONS .....                                     | IN-4 |
| PRECAUTIONS FOR VEHICLES EQUIPPED WITH<br>A CATALYTIC CONVERTER ..... | IN-6 |
| ABBREVIATIONS USED IN THIS MANUAL .....                               | IN-7 |

IN

## HOW TO USE THIS MANUAL

To assist you in finding your way through this manual, the Section Title and major heading are given at the top of every page.

An **INDEX** is provided on the 1st page of each section to guide you to the item to be repaired.

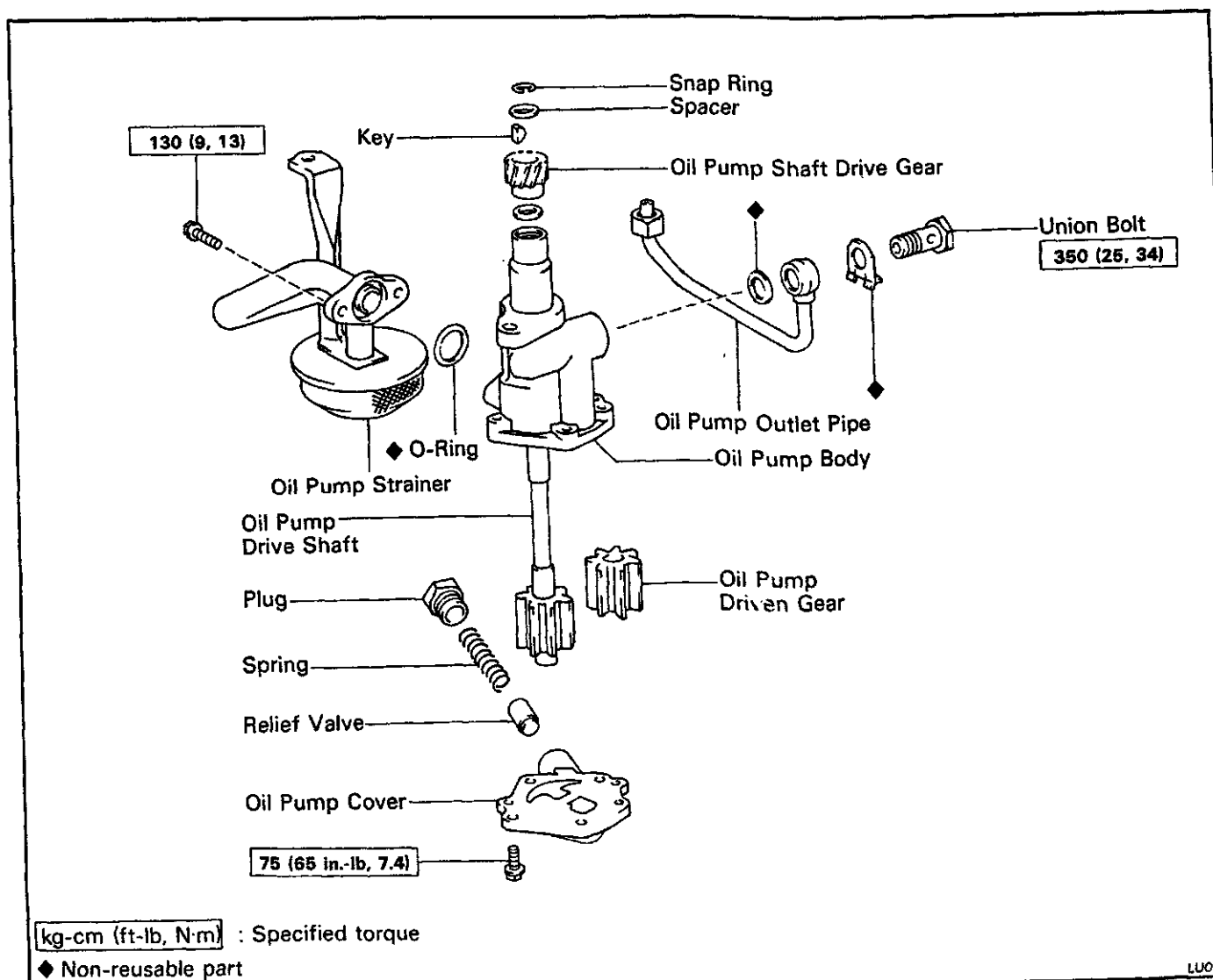
At the beginning of each section, **PRECAUTIONS** are given that pertain to *all* repair operations contained in that section. *Read these precautions before starting any repair task.*

**TROUBLESHOOTING** tables are included for each system to help you diagnose the system problem and find the cause. The repair for each possible cause is referenced in the remedy column to quickly lead you to the solution.

## REPAIR PROCEDURES

Most repair operations begin with an overview illustration. It identifies the components and shows how the parts fit together.

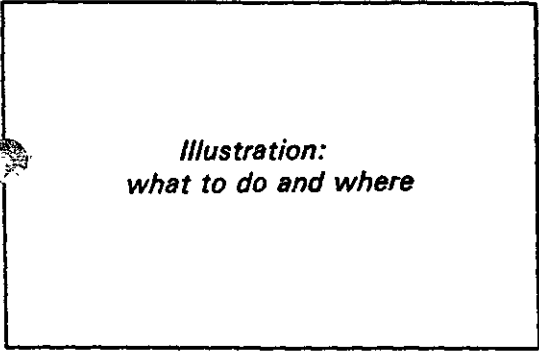
Example:



The procedures are presented in a step-by-step format:

- The illustration shows *what* to do and *where* to do it.
- The task heading tells *what* to do.
- The detailed text tells *how* to perform the task and gives other information such as specifications and warnings.

Example:



*Illustration:*  
*what to do and where*

*Task heading: what to do*

## 2. IF NECESSARY, REPLACE DRIVE SHAFT BEARING

Using SST, replace the No.1 bearing by using No. 2 bearing as a guide.

SST 09215-00100 (09215-00120, 09215-00150,  
09215-00160, 09215-00210, 09214-00220)

*Set part No.*

*Component part No.*

*Detail text: how to do it*

- (i) Tighten the No. 3 and No. 7 bearing cap bolt a little at a time and in the sequence shown in the figure.

**Torque: 500 kg-cm (36 ft-lb, 49 N·m)**

*Specification*

This format provides the experienced technician with a FAST TRACK to the information needed. The upper case task heading can be read at a glance and only when necessary, the text below it provides detailed information. Important specifications and warnings always stand out in bold type.

## REFERENCES

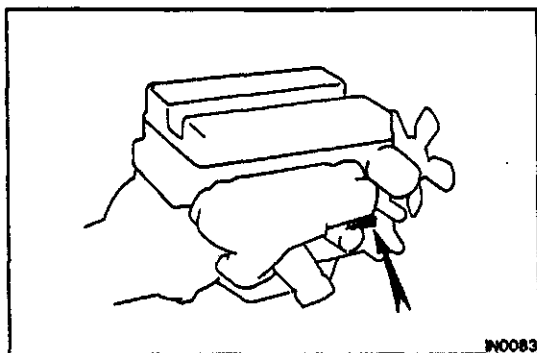
References have been kept to a minimum. However, when they are required you are given the page to go to.

## SPECIFICATIONS

Specifications are presented in bold type throughout the text in the applicable step. You never have to leave the procedure to look up your specifications. All specifications are also found in Appendix A, Specifications, for quick reference.

## WARNINGS, CAUTIONS, NOTES:

- **WARNINGS** are presented in bold type, and indicate there is a possibility of injury to you or other people.
- **CAUTIONS** are also presented in bold type, and indicate the possibility of damage to the components being repaired.
- **NOTES** are separated from the text but do not appear in bold type. They provide additional information to help you efficiently perform the repair.



## IDENTIFICATION INFORMATION

### ENGINE SERIAL NUMBER

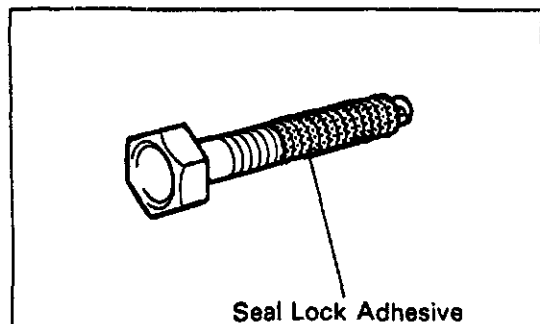
The engine serial number is stamped on the right side of the cylinder block.

## GENERAL REPAIR INSTRUCTIONS

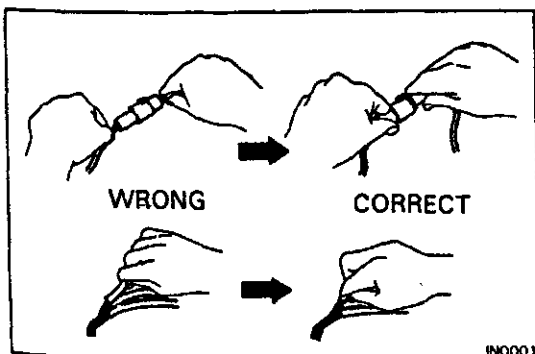
1. Use fender, seat and floor covers to keep the vehicle clean and prevent damage.
2. During disassembly, keep parts in order to facilitate reassembly.
3. Observe the following:
  - (a) Before performing electrical work, disconnect the negative (–) cable from the battery terminal.
  - (b) If it is necessary to disconnect the battery for inspection or repair, always disconnect the cable from the negative (–) terminal which is grounded to the vehicle body.
  - (c) To prevent damage to the battery terminal post, loosen the terminal nut and raise the cable straight up without twisting or prying it.
  - (d) Clean the battery terminal posts and cable terminals with a shop rag. Do not scrape them with a file or other abrasive object.
  - (e) Install the cable terminal to the battery post with the nut loose, and tighten the nut after installation. Do not use a hammer to tap the terminal onto the post.
  - (f) Be sure the cover for the positive (+) terminal is properly in place.
4. Check hose and wiring connectors to make sure that they are secure and correct.
5. Non-reusable parts
  - (a) Always replace cotter pins gaskets, O-rings, oil seals, etc. with new ones.
  - (b) Non-reusable parts are indicated in the component illustrations by the "◆" symbol.
6. Precoated Parts
 

Precoated parts are the bolts, nuts, etc. which are coated with a seal lock adhesive at the factory.

  - (a) If a precoated part is retightened, loosened or caused to move in any way, it must be recoated with the specified adhesive.



- (b) Recoating of Precoated Parts
    - (1) Clean off the old adhesive from the part's threads.
    - (2) Dry with compressed air.
    - (3) Apply the specified seal lock adhesive to the part's threads.
  - (c) Precoated parts are indicated in the component illustrations by the "★" symbol.
7. When necessary, use a sealer or gaskets to prevent leaks.
  8. Carefully observe all specifications for bolt torques. Always use a torque wrench.
  9. Use of special service tools (SST) and special service materials (SSM) may be required, depending on the nature of the repair. Be sure to use SST and SSM where specified and follow the proper work procedure. A list of SST and SSM can be found at the back of this manual.
  10. When replacing fuses, be sure the new fuse is the correct amperage. DO NOT exceed the fuse amp rating or use one of a lower rating.
  11. Care must be taken when jacking up and supporting the vehicle. Be sure to lift and support the vehicle at the proper locations.
    - (a) If the vehicle is to be jacked up only at the front or rear end, be sure to block the wheels in order to ensure safety.
    - (b) After the vehicle is jacked up, be sure to support it on stands. It is extremely dangerous to do any work on the vehicle raised on a jack alone, even for a small job that can be finished quickly.
  12. Observe the following precautions to avoid damaging the parts:
    - (a) Do not open the cover or the case of the ECU unless absolutely necessary. (If the IC terminals are touched, the IC may be destroyed by static electricity.)
    - (b) Be careful not to drop electrical components, such as sensors or relays. If they are dropped on a hard floor, they should be replaced and not reused.
    - (c) When disconnecting vacuum hoses, pull on the end of the hose, not the middle.
    - (d) When separating electrical connectors, pull on the connector itself, not the wires.



# LUBRICATION SYSTEM

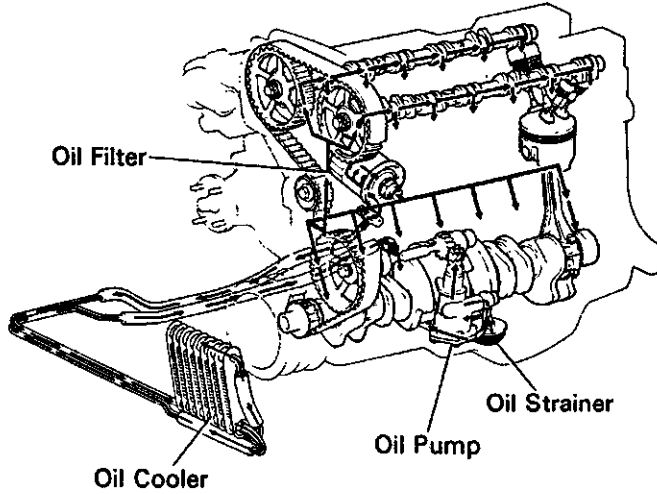
|                                                         | Page  |
|---------------------------------------------------------|-------|
| DESCRIPTION .....                                       | LU-2  |
| TROUBLESHOOTING .....                                   | LU-4  |
| OIL PRESSURE CHECK .....                                | LU-5  |
| REPLACEMENT OF ENGINE OIL<br>AND OIL FILTER .....       | LU-6  |
| OIL PUMP .....                                          | LU-8  |
| OIL COOLER AND OIL PRESSURE<br>REGULATOR (7M-GE) .....  | LU-15 |
| OIL COOLER AND OIL PRESSURE<br>REGULATOR (7M-GTE) ..... | LU-18 |

**LU**

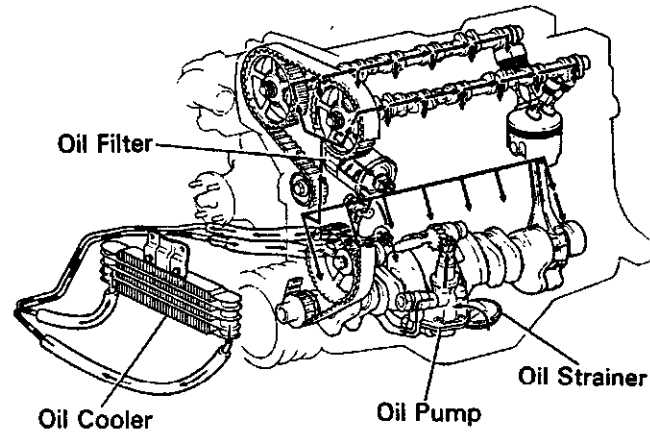
## DESCRIPTION

A fully pressurized, fully filtered lubrication system has been adopted for this engine.

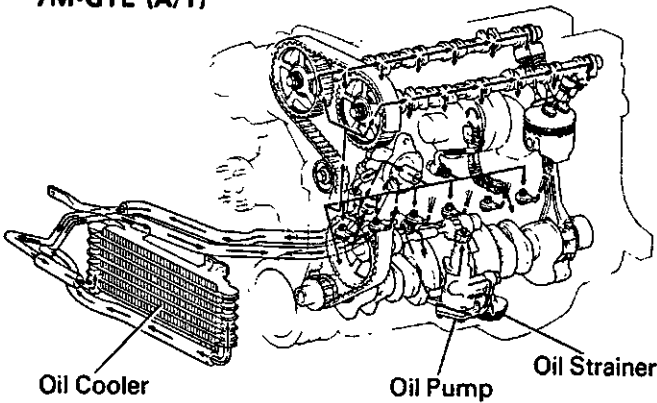
**7M-GE (MA)**



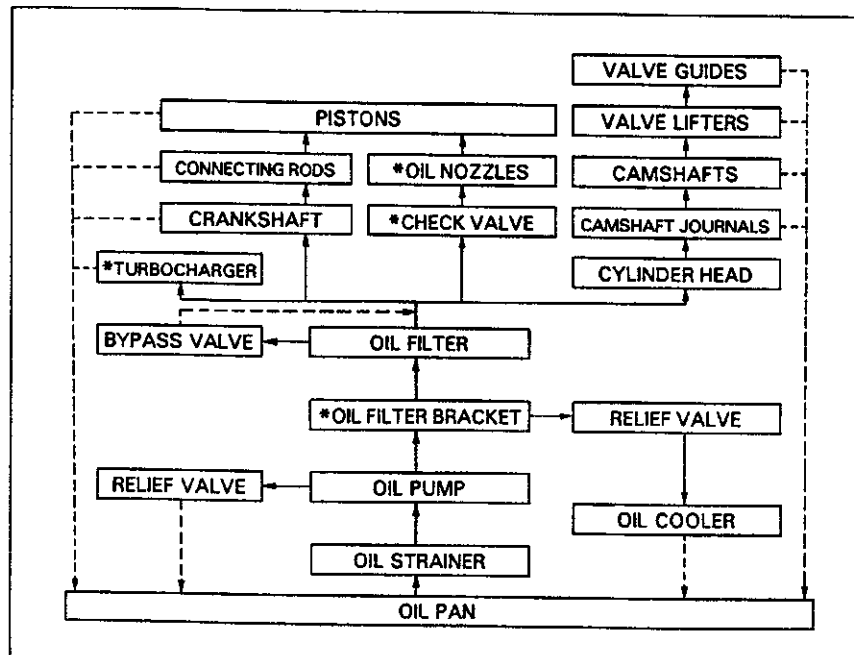
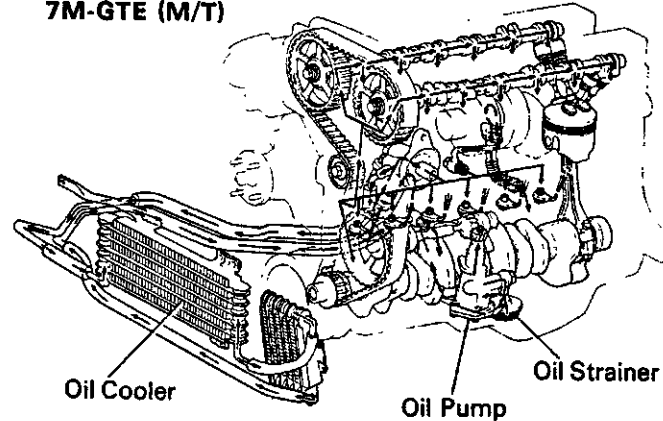
**7M-GE (MS)**



**7M-GTE (A/T)**



**7M-GTE (M/T)**



\*7M-GTE only

A pressure feeding lubrication system has been adopted to supply oil to the moving parts of this engine. The lubrication system consists of an oil pan, oil pump, oil filter and other external parts which supply oil to the moving parts in the engine block. The oil circuit is shown in the illustration at the top of the previous page. Oil from the oil pan is pumped up by the oil pump. After it passes through the oil filter, it is fed through the various oil holes in the crankshaft and cylinder block. After passing through the cylinder block and performing its lubricating function, the oil is returned by gravity to the oil pan. A dipstick on the side of the cylinder block is provided to check the oil level.

### **OIL PUMP**

The oil pump pumps up oil from the oil pan and sends it under pressure to the various parts of the engine. An oil strainer is mounted in front of the inlet to the oil pump. The oil pump itself is a gear pump, which uses a drive gear and driven gear inside the pump body. When the drive gear rotates, the driven gear rotates in the opposite direction. When the gear teeth disengage oil is drawn in, and when the gear teeth engage oil is discharged.

### **OIL PRESSURE REGULATOR**

At high engine speeds, the engine oil supplied by the oil pump exceeds the capacity of the engine to utilize it. For that reason, the oil pressure regulator works to prevent an oversupply of oil. During normal oil supply, a coil spring and valve keep the bypass closed, but when too much oil is being fed, the pressure becomes extremely high, overpowering the force of the spring and opening the valves. This allows the excess oil to flow through the valve and return to the oil pan.

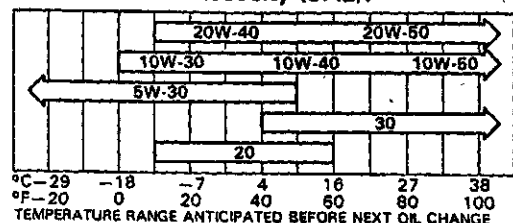
### **OIL FILTER**

The oil filter is a full flow type filter with a built-in paper filter element. Particles of metal from wear, airborne dirt, carbon and other impurities can get in the oil during use and could cause accelerated wear or siezing if allowed to circulate through the engine. The oil filter, integrated into the oil line, removes these impurities as the oil passes through it. The filter is mounted outside the engine to simplify replacement of the filter element. A relief valve is also included ahead of the filter element to relieve the high oil pressure in case the filter element becomes clogged with impurities. The relief valve opens when the oil pressure overpowers the force of the spring. Oil passing through the relief valve bypasses the oil filter and flows directly into the main oil hole in the engine.

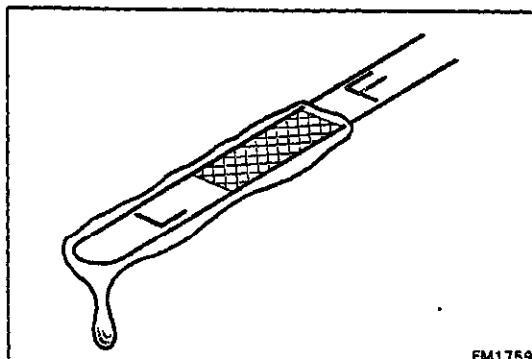
## TROUBLESHOOTING

| Problem           | Possible cause                                                                                                                                                       | Remedy                                                                                                                                          | Page                                           |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
| Oil leakage       | Cylinder head, cylinder block or oil pump body damaged or cracked<br>Oil seal faulty<br>Gasket faulty                                                                | Repair as necessary<br>Replace oil seal<br>Replace gasket                                                                                       | EM-84                                          |
| Low oil pressure  | Oil leakage<br>Relief valve faulty<br>Oil pump faulty<br>Engine oil poor quality<br>Crankshaft bearing faulty<br>Connecting rod bearing faulty<br>Oil filter clogged | Repair as necessary<br>Repair relief valve<br>Repair oil pump<br>Replace engine oil<br>Replace bearing<br>Replace bearing<br>Replace oil filter | LU-8<br>LU-8<br>LU-6<br>EM-65<br>EM-65<br>LU-8 |
| High oil pressure | Relief valve faulty                                                                                                                                                  | Repair relief valve                                                                                                                             | LU-8                                           |

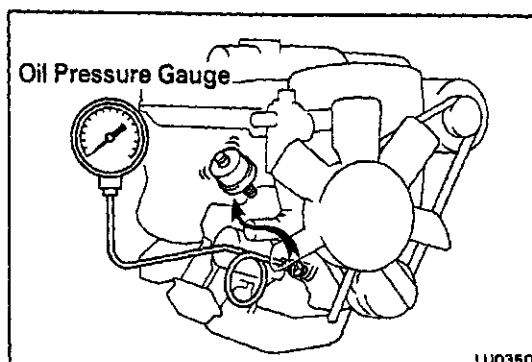
## Recommended Viscosity (SAE):



LU0310



EM1759



LU0350

## OIL PRESSURE CHECK

## 1. CHECK ENGINE OIL QUALITY

Check the oil for deterioration, entry of water, discoloring or thinning.

If oil quality is poor, replace the oil.

Europe (7M-GE) and Australia

Use API grade SE, SF or better and recommended viscosity oil.

Europe (7M-GTE)

Use API grade SF or better and recommended viscosity oil.

Others

Use API grade SC, SD, SE, SF or better and recommended viscosity oil.

## 2. CHECK ENGINE OIL LEVEL

The oil level should be between the "L" and "F" marks on the dipstick.

If low, check for leakage and add oil up to the "F" mark.

## 3. REMOVE OIL PRESSURE SENDER GAUGE

## 4. INSTALL OIL PRESSURE GAUGE

## 5. START ENGINE

Start engine and warm it up to normal operating temperature.

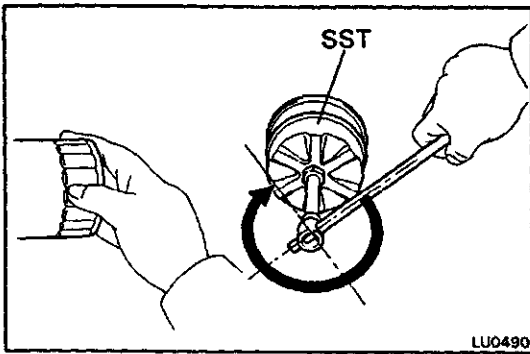
## 6. MEASURE OIL PRESSURE

Oil pressure:

At idle 0.3 kg/cm<sup>2</sup> (4.3 psi, 29 kPa)  
or more

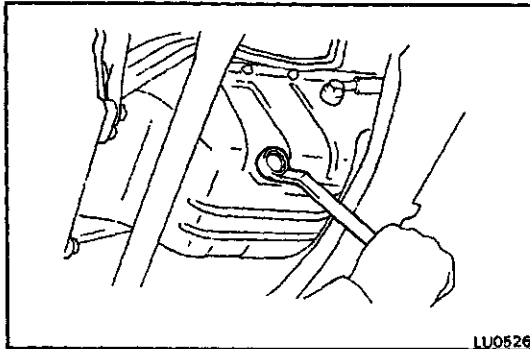
At 3,000 rpm 2.5 – 5.0 kg/cm<sup>2</sup>  
(36 – 71 psi, 245 – 490 kPa)

NOTE: Check for oil leakage after reinstalling the oil pressure sender gauge.



- (d) Lightly screw in the oil filter to where you feel resistance.
- (e) Then, using SST, tighten the oil filter an extra 3/4 turn.

SST 09228-07500



### 3. FILL WITH ENGINE OIL

- (a) Clean and install the oil drain plug with a new gasket.

**Torque: 350 kg-cm (25 ft-lb, 34 N·m)**

- (b) Fill the engine with new oil.

**Oil capacity:**

**Dry fill**

**7M-GE MA (GCC Countries\*)**

5.0 liters (5.3 US qts, 4.4 Imp. qts)

**7M-GE MA (Others)**

4.9 liters (5.2 US qts, 4.3 Imp. qts)

**7M-GE MS**

5.3 liters (5.6 US qts, 4.7 Imp. qts)

**7M-GTE (A/T)**

5.0 liters (5.3 US qts, 4.4 Imp. qts)

**7M-GTE (M/T)**

5.1 liters (5.4 US qts, 4.5 Imp. qts)

**Drain and refill**

**w/o oil filter change**

**MA**

3.9 liters (4.1 US qts, 3.4 Imp. qts)

**MS**

4.1 liters (4.3 US qts, 3.6 Imp. qts)

**w/ oil filter change**

**MA**

4.2 liters (4.4 US qts, 3.7 Imp. qts)

**MS**

4.4 liters (4.7 US qts, 3.9 Imp. qts)

### 4. START ENGINE AND CHECK FOR LEAKS

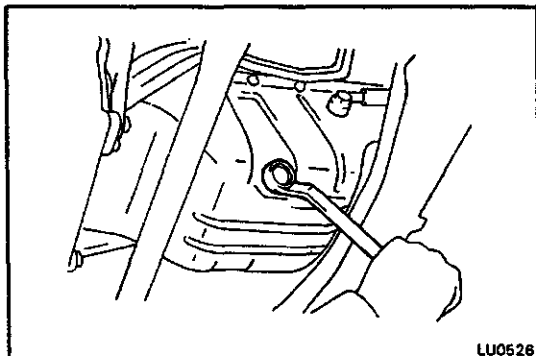
### 5. RECHECK ENGINE OIL LEVEL (See page LU-5)

\* GCC Countries: Saudi Arabia, Sultanate of Oman, Bahrain, United Arab Emirates, Qatar, Kuwait.

## REPLACEMENT OF ENGINE OIL AND OIL FILTER

### 1. DRAIN ENGINE OIL

- (a) Remove the oil filler cap.
- (b) Remove the oil drain plug and drain the oil into a container.

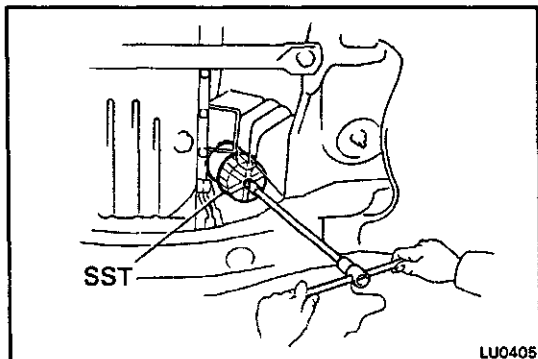


LU0526

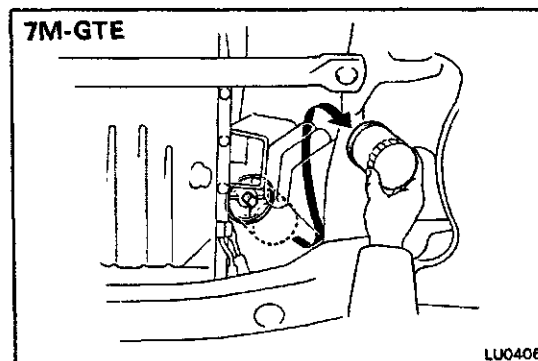
### 2. REPLACE OIL FILTER

- (a) Using SST, remove the oil filter (located on right side of the engine block).

SST 09228-07500



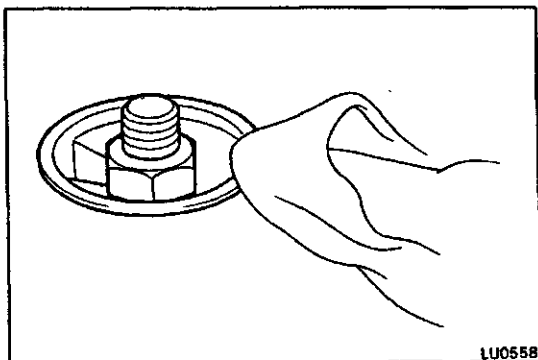
LU0405



LU0406

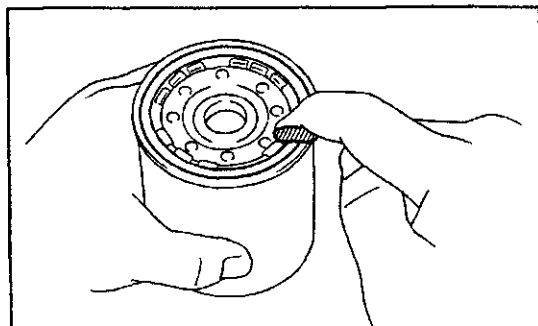
**NOTE (7M-GTE):** Remove the oil filter taking it over the engine mounting bracket and down between the bracket and No. 1 suspension crossmember.

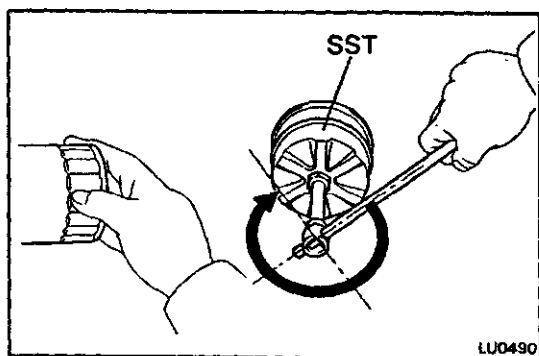
- (b) Clean and check the oil filter installation surface.



LU0558

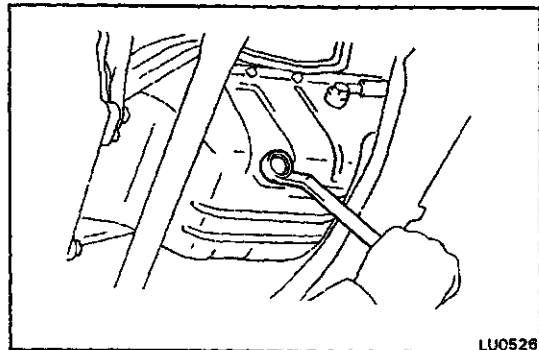
- (c) Apply clean engine oil to the gasket of the new oil filter.





- (d) Lightly screw in the oil filter to where you feel resistance.
- (e) Then, using SST, tighten the oil filter an extra 3/4 turn.

SST 09228-07500



### 3. FILL WITH ENGINE OIL

- (a) Clean and install the oil drain plug with a new gasket.

**Torque: 350 kg-cm (25 ft-lb, 34 N·m)**

- (b) Fill the engine with new oil.

**Oil capacity:**

**Dry fill**

**7M-GE MA (GCC Countries\*)**

5.0 liters (5.3 US qts, 4.4 Imp. qts)

**7M-GE MA (Others)**

4.9 liters (5.2 US qts, 4.3 Imp. qts)

**7M-GE MS**

5.3 liters (5.6 US qts, 4.7 Imp. qts)

**7M-GTE (A/T)**

5.0 liters (5.3 US qts, 4.4 Imp. qts)

**7M-GTE (M/T)**

5.1 liters (5.4 US qts, 4.5 Imp. qts)

**Drain and refill**

**w/o oil filter change**

**MA**

3.9 liters (4.1 US qts, 3.4 Imp. qts)

**MS**

4.1 liters (4.3 US qts, 3.6 Imp. qts)

**w/ oil filter change**

**MA**

4.2 liters (4.4 US qts, 3.7 Imp. qts)

**MS**

4.4 liters (4.7 US qts, 3.9 Imp. qts)

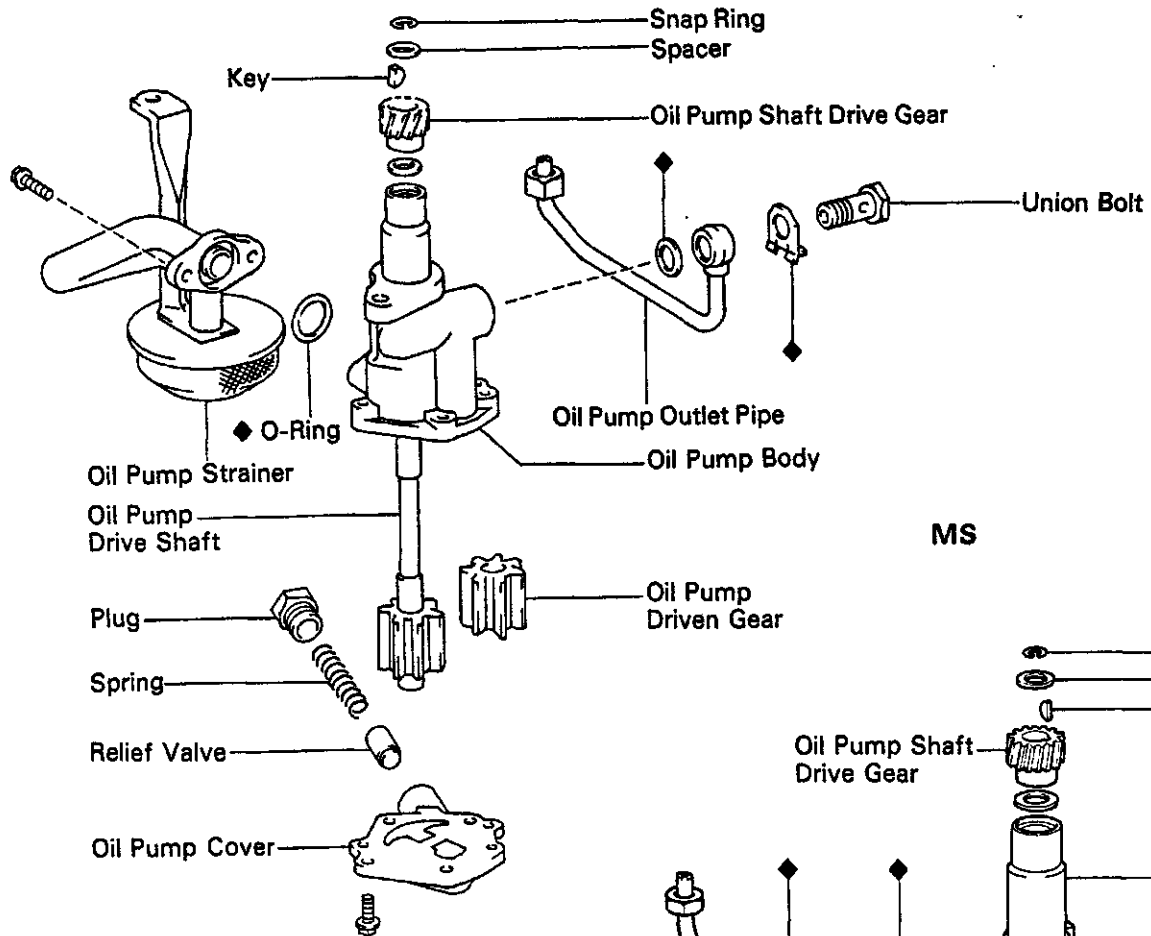
### 4. START ENGINE AND CHECK FOR LEAKS

### 5. RECHECK ENGINE OIL LEVEL (See page LU-5)

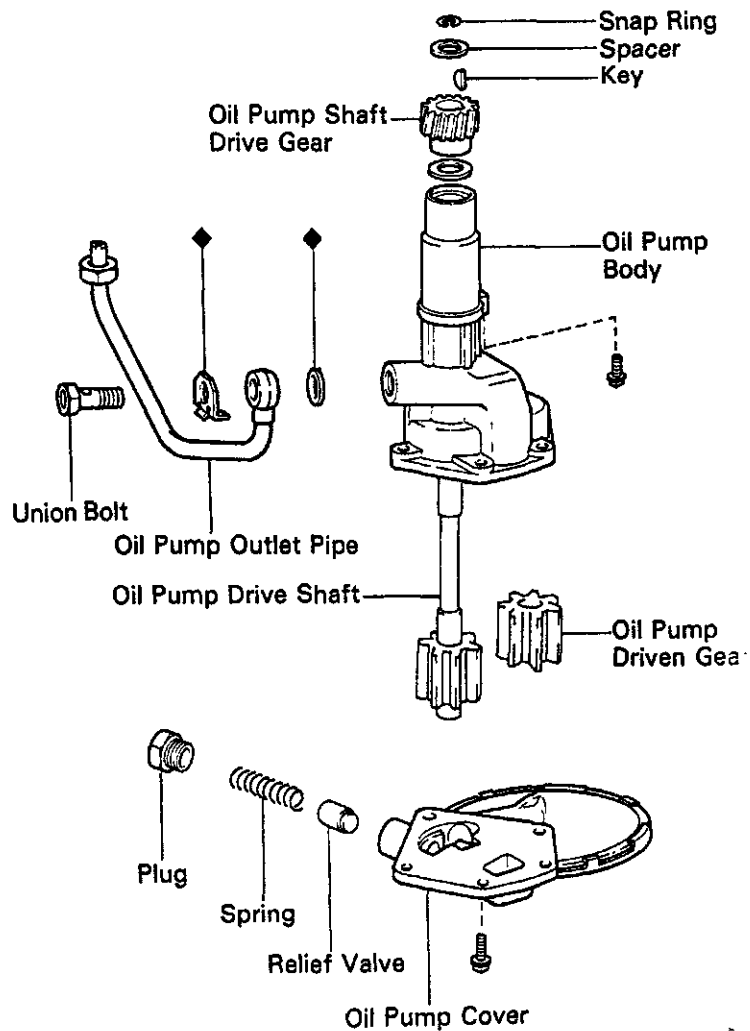
\* GCC Countries: Saudi Arabia, Sultanate of Oman, Bahrain, United Arab Emirates, Qatar, Kuwait.

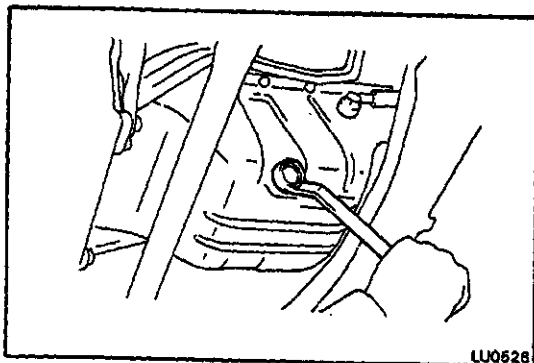
# OIL PUMP COMPONENTS

MA



MS



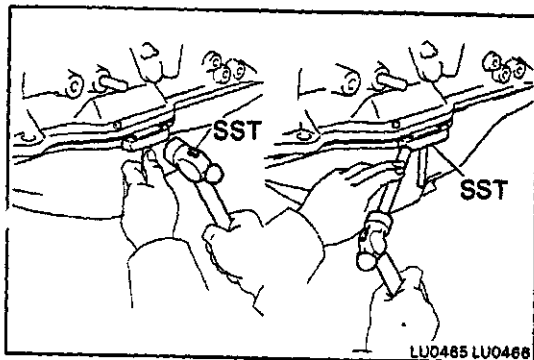


## REMOVAL OF OIL PUMP

(See page LU-8)

### 1. DRAIN ENGINE OIL

- (a) Remove the oil filler cap.
- (b) Remove the oil drain plug and drain the oil into a container.

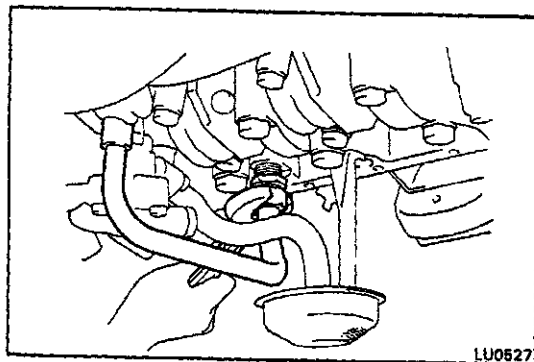


### 2. REMOVE OIL PAN

- (a) Remove the dipstick.
- (b) Remove the bolts and nuts.
- (c) Insert the blade of SST between the cylinder block and oil pan, cut off applied sealer and then remove the oil pan.

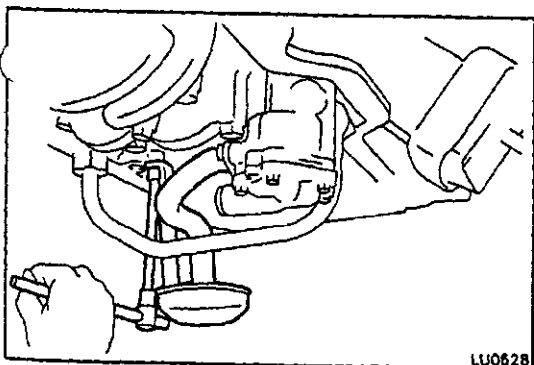
SST 09032-00100

**CAUTION:** Be careful not to damage the oil pan flange.

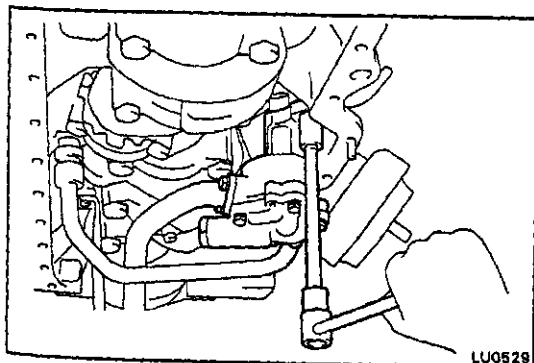


### 3. REMOVE OIL PUMP

- (a) Loosen the union nut of the oil pump outlet pipe.



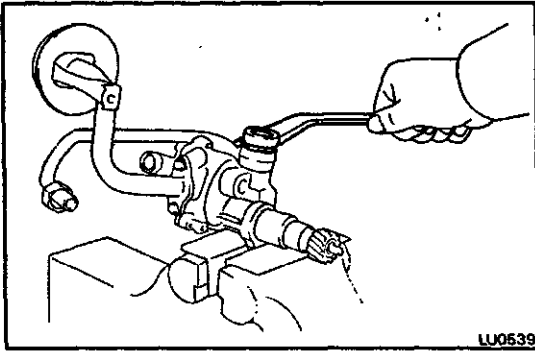
- (b) (MA)  
Remove the mount bolt of the oil pump strainer stay.



- (c) Remove the bolt and oil pump.

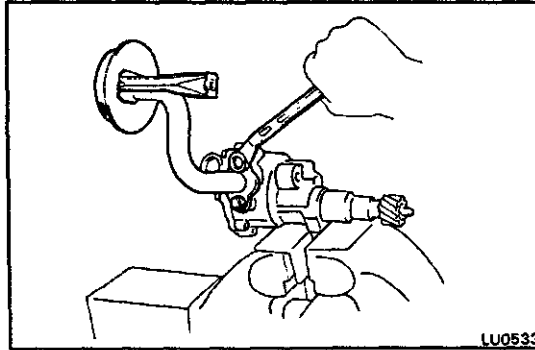
## DISASSEMBLY OF OIL PUMP

(See page LU-8)



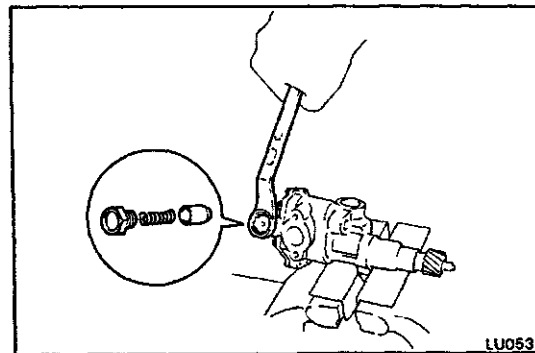
### 1. REMOVE OIL PUMP OUTLET PIPE

- (a) Unstake the lock washer.
- (b) Remove the union bolt, lock washer, oil pump outlet pipe and gasket.



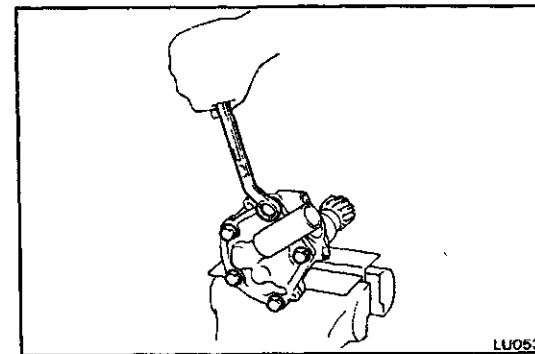
### 2. (MA) REMOVE OIL PUMP STRAINER

Remove the two bolts, oil pump strainer and O-ring.



### 3. REMOVE RELIEF VALVE

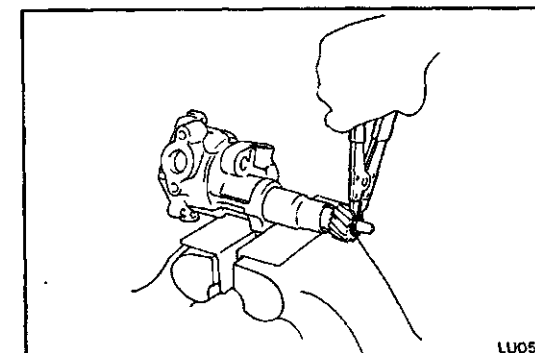
Unscrew the relief valve plug, and remove the spring and relief valve.



### 4. REMOVE OIL PUMP COVER

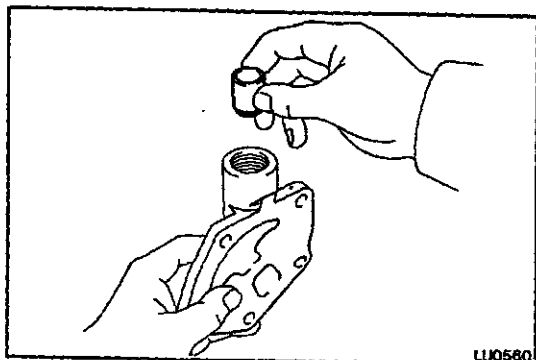
Remove the five bolts and oil pump cover.

### 5. REMOVE OIL PUMP DRIVEN GEAR



### 6. REMOVE OIL PUMP DRIVE SHAFT

Using snap ring pliers, remove the snap ring, spacer, shaft drive gear, key and oil pump drive shaft.

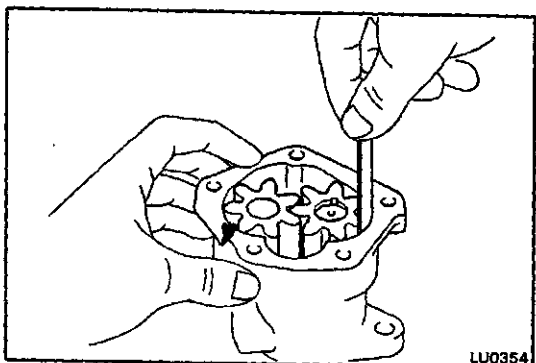


## INSPECTION OF OIL PUMP

### 1. INSPECT RELIEF VALVE

Coat the valve with engine oil and check that it falls smoothly into the valve hole by its own weight.

If it does not, replace the relief valve. If necessary, replace the oil pump assembly.



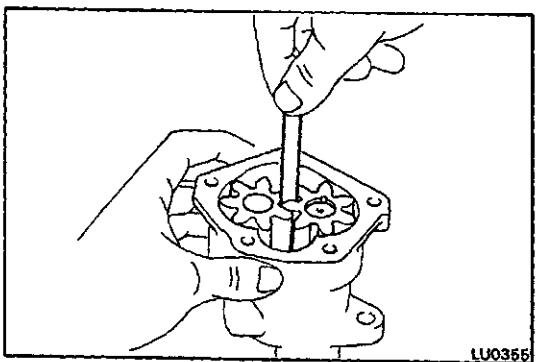
### 2. INSPECT BODY CLEARANCE

Using a thickness gauge, measure the clearance between the driven gear and pump body.

**Standard clearance:** 0.105 – 0.175 mm  
(0.0041 – 0.0069 in.)

**Maximum clearance:** 0.2 mm (0.008 in.)

If the clearance is greater than maximum, replace the gear or oil pump assembly.



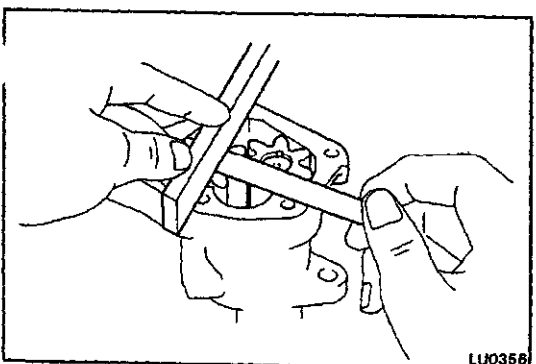
### 3. INSPECT GEAR BACKLASH

Using a thickness gauge, measure the backlash as shown in several places.

**Standard backlash:** 0.5 – 0.6 mm  
(0.020 – 0.024 in.)

**Maximum backlash:** 0.9 mm (0.035 in.)

If the backlash is greater than maximum, replace the oil pump drive shaft and driven gear.



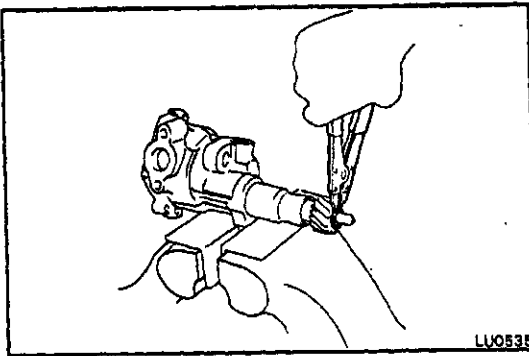
### 4. INSPECT SIDE CLEARANCE

Using a thickness gauge and precision straight edge, measure the clearance between the gears and precision straight edge.

**Standard clearance:** 0.03 – 0.09 mm  
(0.0012 – 0.0035 in.)

**Maximum clearance:** 0.15 mm (0.0059 in.)

If the clearance is greater than maximum, replace the drive shaft and driven gear. If necessary, the oil pump assembly.



## ASSEMBLY AND OPERATION CHECK OF OIL PUMP

(See page LU-8)

### 1. INSTALL OIL PUMP DRIVE SHAFT

Install the oil pump drive shaft, key, shaft drive gear, spacer, and using snap ring pliers, install the snap ring.

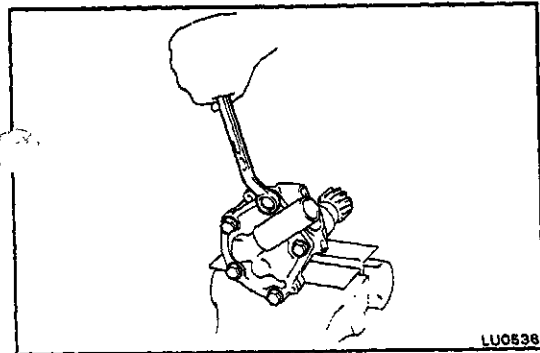
### 2. INSTALL OIL PUMP DRIVEN GEAR

### 3. INSTALL OIL PUMP COVER

Install the oil pump cover with the five bolts.

Torque the bolts.

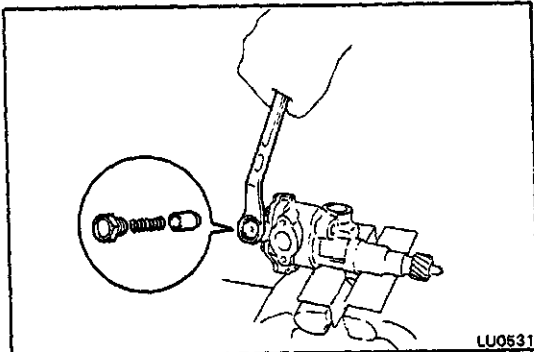
Torque: 75 kg-cm (65 in.-lb, 7.4 N·m)



### 4. INSTALL RELIEF VALVE

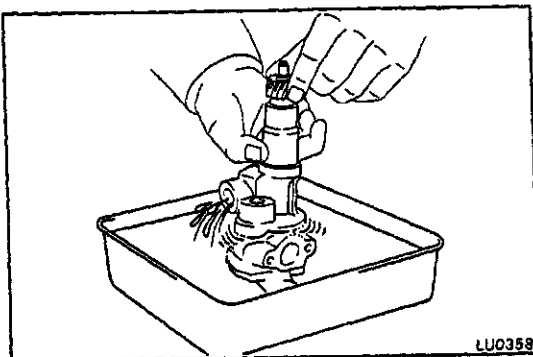
Install the relief valve and spring with the relief valve plug. Torque the plug.

Torque: 375 kg-cm (27 ft-lb, 37 N·m)

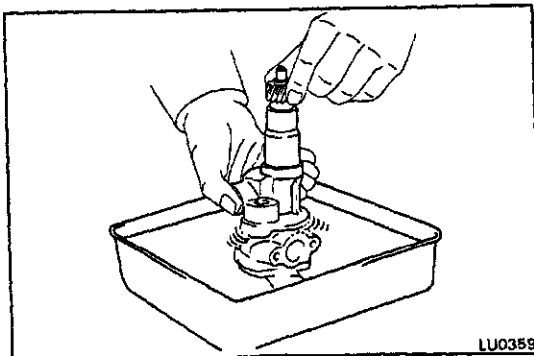


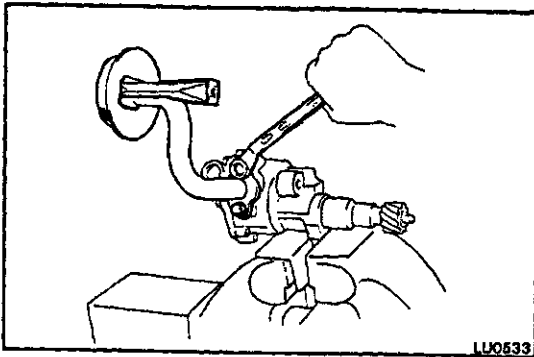
### 5. CHECK PUMP OPERATION

- (a) Immerse the suction end of the pump into clean engine oil and turn the shaft counterclockwise. Oil should come out of the discharge hole.



- (b) Close the discharge hole with your thumb, and turn the shaft as before. The shaft should be difficult to turn.

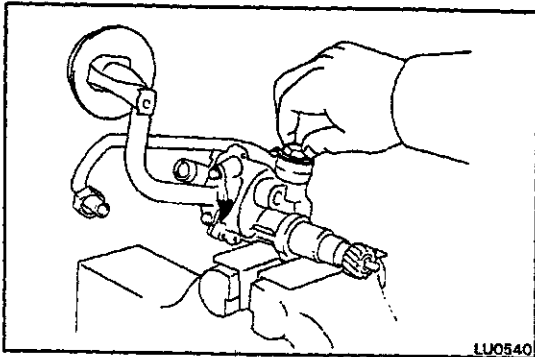




**6. (MA) INSTALL OIL PUMP STRAINER**

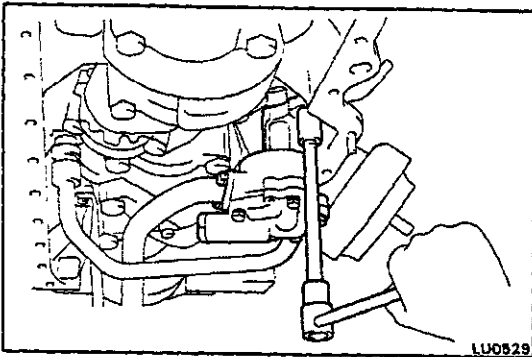
- (a) Install a new O-ring to oil pump strainer.
- (b) Install the oil pump strainer with the two bolts.

**Torque: 130 kg-cm (9 ft-lb, 13 N·m)**



**7. INSTALL OIL PUMP OUTLET PIPE**

Install the oil pump outlet pipe with a new lock washer, gasket and the union bolt. Finger tighten the union bolt.



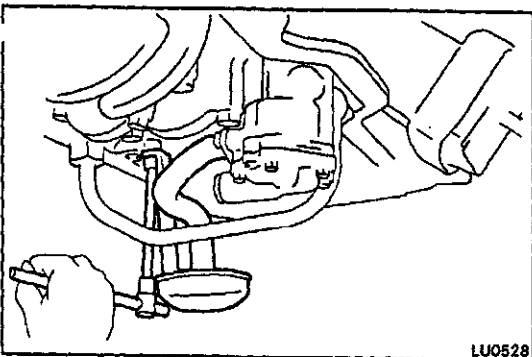
**INSTALLATION OF OIL PUMP**

(See page LU-8)

**1. INSTALL OIL PUMP**

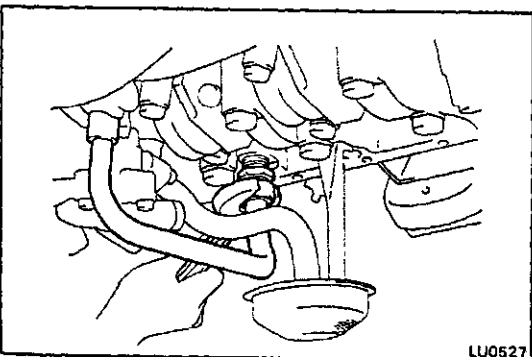
- (a) Install the oil pump with the bolt. Torque the bolt.

**Torque: 220 kg-cm (16 ft-lb, 22 N·m)**



- (b) Install the mount bolt holding the oil pump strainer stay to block.

**Torque: 60 kg-cm (52 in.-lb, 6.9 N·m)**



- (c) Connect the outlet pipe with the union bolt. Torque the union bolt and nut.

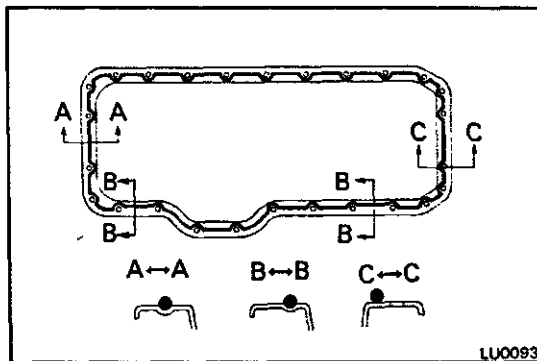
**Torque: 350 kg-cm (25 ft-lb, 34 N·m)**

- (d) Stake the lock washer.

**2. INSTALL OIL PAN**

- (a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the oil pan and cylinder block.
- Using a razor blade and gasket scraper, remove all the packing (FIPG) material from the gasket surfaces.
  - Thoroughly clean all components to remove all the loose material.
  - Clean both sealing surfaces with a non-residue solvent.

**CAUTION:** Do not use a solvent which will affect the painted surfaces.



- (b) Apply seal packing to the oil pan as shown in the figure.

**Seal packing: Part No. 08826-00080 or equivalent**

- Install a nozzle that has been cut to a 5 mm (0.20 in.) opening.

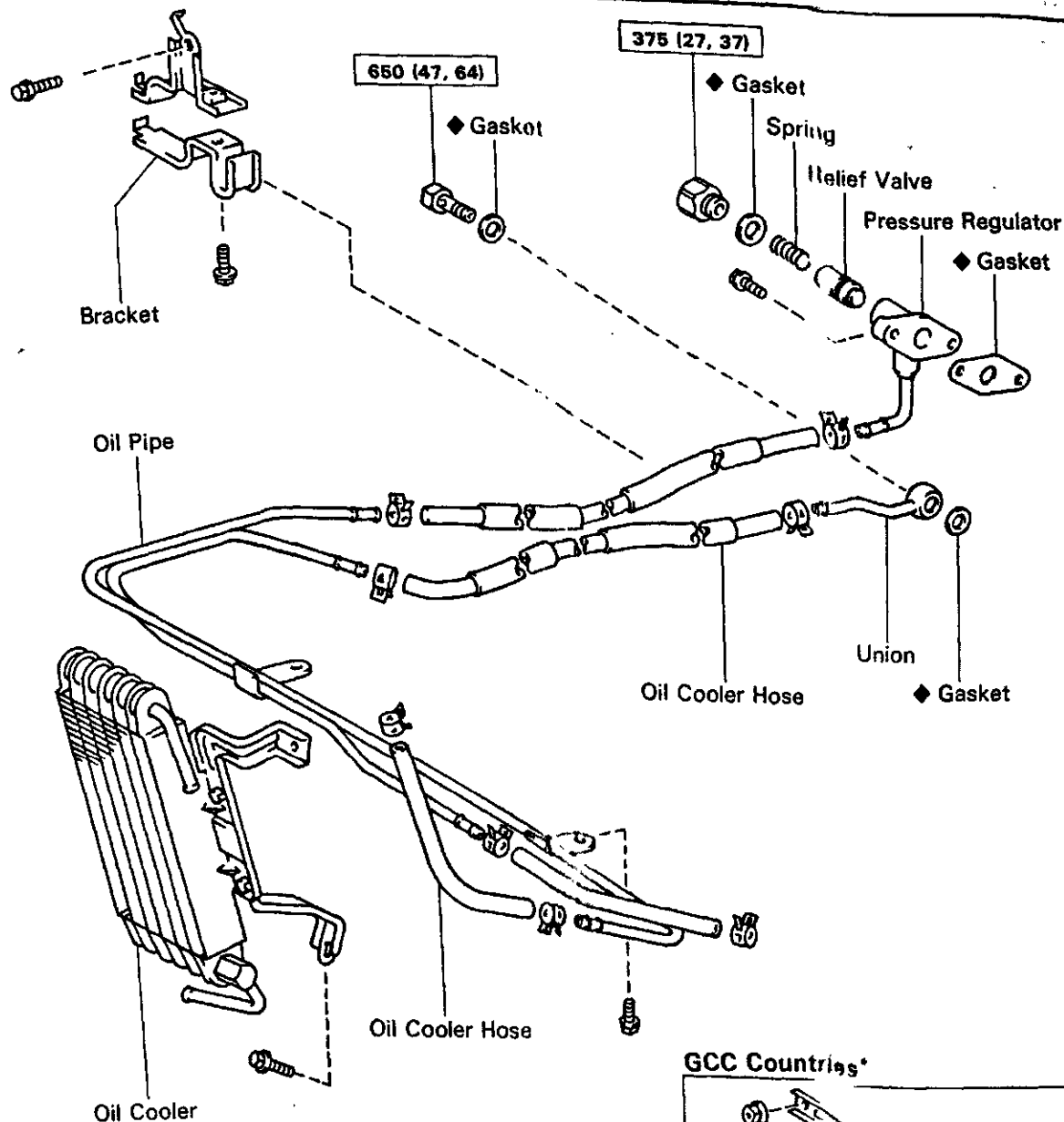
- (c) Install the oil pan with the bolts and nuts.

**Torque: 130 kg-cm (9 ft-lb, 13 N·m)**

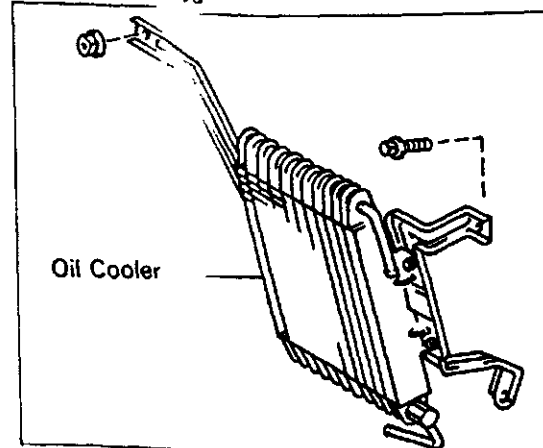
- 3. FILL WITH ENGINE OIL (See step 3 on page LU-7)**
- 4. START ENGINE AND CHECK FOR LEAKS**
- 5. RECHECK OIL LEVEL (See step 2 on page LU-5)**

# OIL COOLER AND OIL PRESSURE REGULATOR (7M-GE) COMPONENTS

MA



GCC Countries\*



[kg-cm (ft-lb, N·m)] : Specified torque

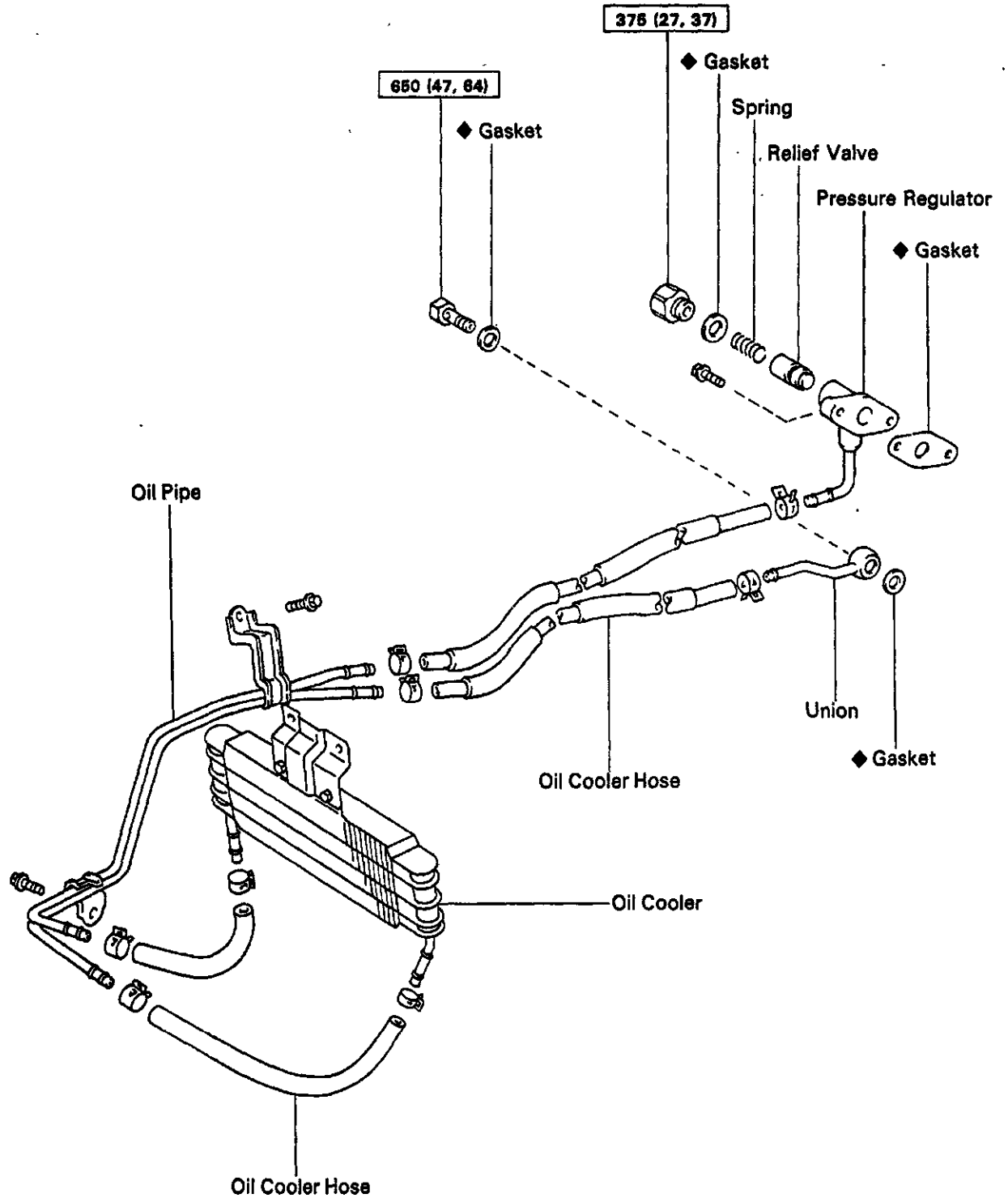
◆ Non-reusable part

\* GCC Countries: Saudi Arabia, Sultanate of Oman, Bahrain, United Arab Emirates, Qatar, Kuwait

LU0543

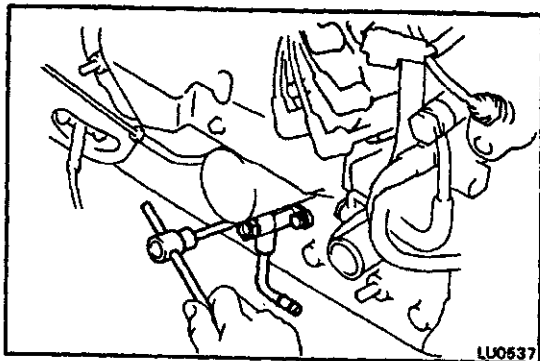
# COMPONENTS (Cont'd)

MS



[kg-cm (ft-lb, N-m)] : Specified torque

◆ Non-reusable part



## REMOVAL AND DISASSEMBLY OF OIL PRESSURE REGULATOR

(See pages LU-15, 16)

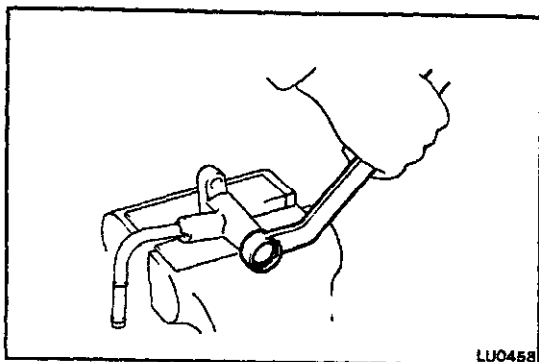
### 1. DISCONNECT OIL HOSE

### 2. REMOVE OIL PRESSURE REGULATOR

Remove the two bolts, oil pressure regulator and gasket.

### 3. REMOVE RELIEF VALVE

Unscrew the plug, and remove the spring, relief valve and gasket.

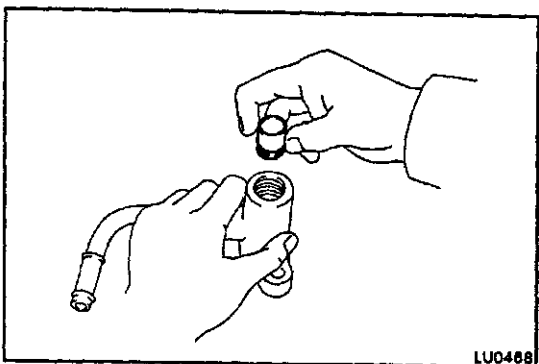


## INSPECTION OF OIL PRESSURE REGULATOR

### INSPECT RELIEF VALVE

Coat the valve with engine oil and check that it falls smoothly into the valve hole by its own weight.

If it does not, replace the relief valve. If necessary, replace the oil pressure regulator assembly.



## ASSEMBLY AND INSTALLATION OF OIL PRESSURE REGULATOR

(See pages LU-15, 16)

### 1. INSTALL RELIEF VALVE

Install the relief valve and spring with the plug and a new gasket. Torque the plug.

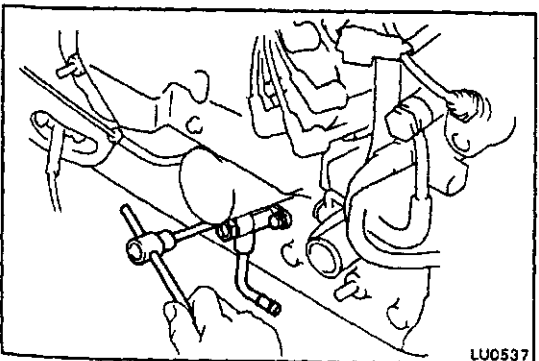
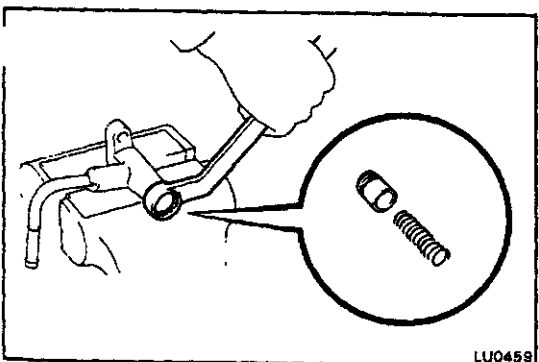
Torque: 375 kg-cm (27 ft-lb, 37 N·m)

### 2. INSTALL OIL PRESSURE REGULATOR

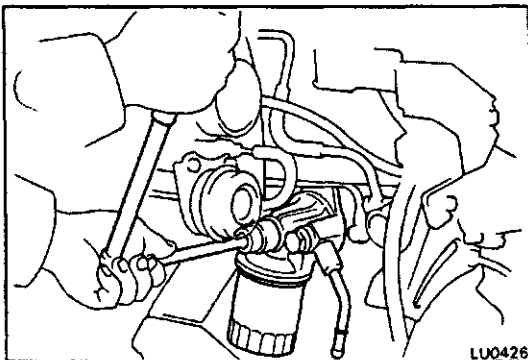
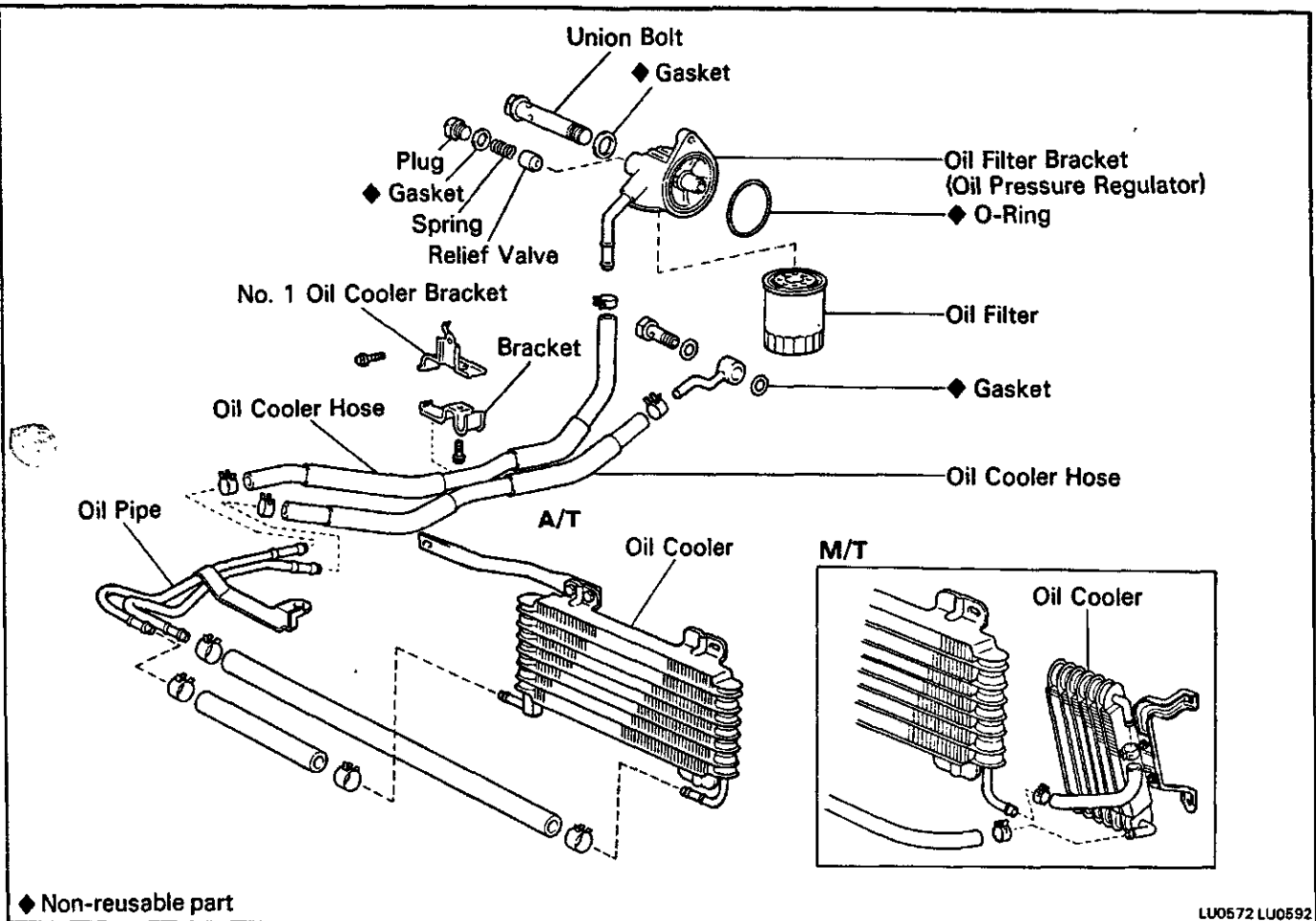
Install the oil pressure regulator with the two bolts. Torque the bolts.

Torque: 145 kg-cm (10 ft-lb, 14 N·m)

### 3. CONNECT OIL HOSE



# OIL COOLER AND OIL PRESSURE REGULATOR (7M-GTE) COMPONENTS



## REMOVAL AND DISASSEMBLY OF OIL FILTER BRACKET

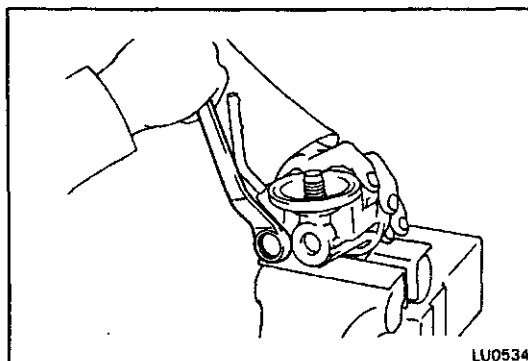
### 1. REMOVE OIL FILTER BRACKET

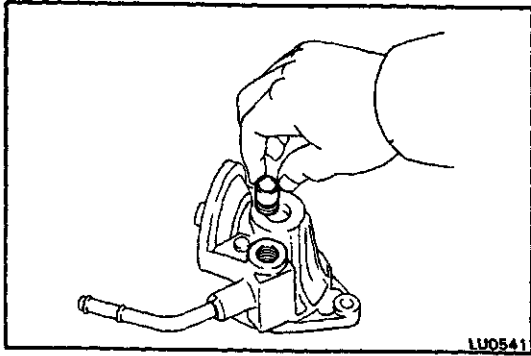
Remove the union bolt, gasket, oil filter bracket and O-ring.

### 2. REMOVE OIL FILTER (See page LU-6)

### 3. REMOVE RELIEF VALVE

Unscrew the plug, and remove the spring, relief valve and gasket.

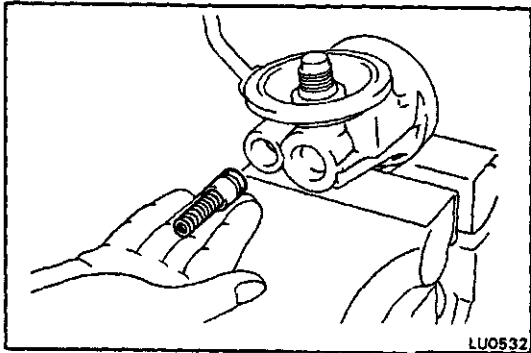




## INSPECTION OF RELIEF VALVE

Coat the valve with engine oil and check that it falls smoothly into the valve hole by its own weight.

If it does not, replace the relief valve. If necessary, replace the oil filter bracket assembly.

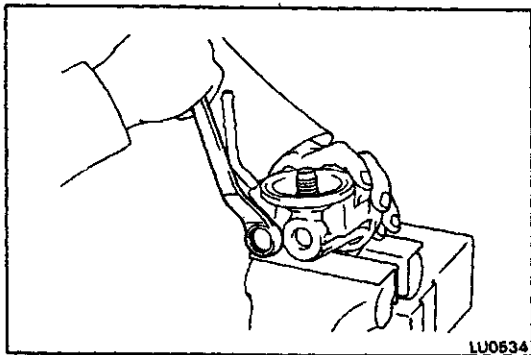


## ASSEMBLY AND INSTALLATION OF OIL FILTER BRACKET

(See page LU-18)

### 1. INSTALL RELIEF VALVE

(a) Install the relief valve and spring.

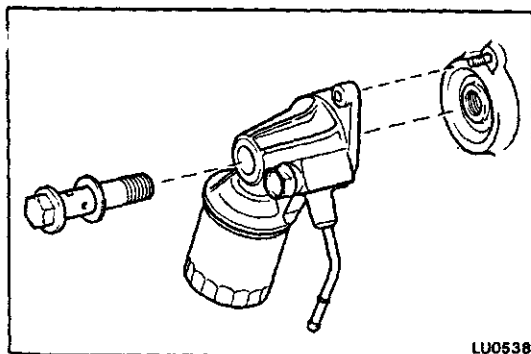


(b) Install and torque the plug with a new gasket.

Torque: 375 kg-cm (27 ft-lb, 37 N·m)

### 2. INSTALL OIL FILTER

(See page LU-6)

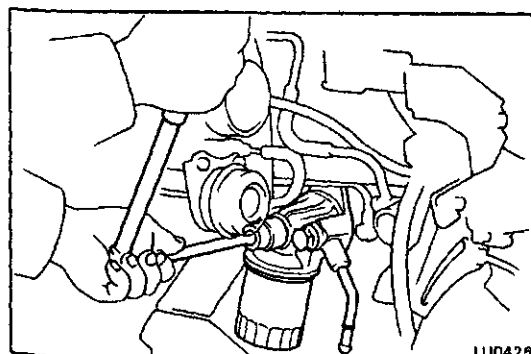


### 3. INSTALL OIL FILTER BRACKET

(a) Install a new O-ring to bracket.

(b) Install a new gasket to union bolt.

(c) Put the oil filter bracket hole over the cylinder block stud bolt and install the oil filter bracket with the union bolt.



(d) Torque the union bolt.

Torque: 500 kg-cm (36 ft-lb, 49 N·m)

# SERVICE SPECIFICATIONS

|                           | Page |
|---------------------------|------|
| ENGINE MECHANICAL .....   | A-2  |
| TURBOCHARGER SYSTEM ..... | A-7  |
| EFI SYSTEM .....          | A-7  |
| COOLING SYSTEM .....      | A-11 |
| LUBRICATION SYSTEM .....  | A-11 |
| IGNITION SYSTEM .....     | A-12 |
| STARTING SYSTEM .....     | A-13 |
| CHARGING SYSTEM .....     | A-13 |

# ENGINE MECHANICAL

## Specifications

| Drive belt deflection or tension |           |     | w/ 10 kg (22.1 lb, 98 N)                      |                   | w/ SST (Reference) |
|----------------------------------|-----------|-----|-----------------------------------------------|-------------------|--------------------|
| Water Pump — Alternator          | New belt  |     | 10 — 12 mm                                    | 0.39 — 0.47 in.   | 70 — 80 kg         |
|                                  | Used belt |     | 15 — 17 mm                                    | 0.59 — 0.67 in.   | 30 — 45 kg         |
| Crankshaft — PS pump             | New belt  |     | 7 — 8 mm                                      | 0.28 — 0.31 in.   | 55 — 65 kg         |
|                                  | Used belt |     | 9 — 11 mm                                     | 0.35 — 0.43 in.   | 25 — 40 kg         |
| Crankshaft — A/C compressor      | New belt  | MA  | 7 — 9.5 mm                                    | 0.28 — 0.374 in.  | 53 — 77 kg         |
|                                  |           | MS  | 7.5 — 9.5 mm                                  | 0.295 — 0.374 in. | 53 — 77 kg         |
|                                  | Used belt | MA  | 10.5 — 12 mm                                  | 0.413 — 0.47 in.  | 30 — 40 kg         |
|                                  |           | MS  | 10 — 13 mm                                    | 0.39 — 0.51 in.   | 30 — 40 kg         |
| Engine coolant capacity          |           |     |                                               |                   |                    |
| MA                               |           |     |                                               |                   |                    |
| w/ Heater or air con.            | M/T       |     | 8.1 liters                                    | 8.5 US qts        | 7.1 Imp. qts       |
|                                  | A/T       |     | 8.0 liters                                    | 8.5 US qts        | 7.0 Imp. qts       |
| w/o Heater or air con.           | M/T       |     | 7.5 liters                                    | 7.9 US qts        | 6.6 Imp. qts       |
|                                  | A/T       |     | 7.4 liters                                    | 7.8 US qts        | 6.5 Imp. qts       |
| MS (GCC Countries*)              |           |     |                                               |                   |                    |
| w/ Heater or air con.            |           |     | 8.5 liters                                    | 9.0 US qts        | 7.5 Imp. qts       |
| w/o Heater or air con.           |           |     | 7.8 liters                                    | 8.2 US qts        | 6.9 Imp. qts       |
| MS (Others)                      |           |     |                                               |                   |                    |
| w/ Heater or air con.            |           |     | 7.8 liters                                    | 8.2 US qts        | 6.9 Imp. qts       |
| w/o Heater or air con.           |           |     | 7.1 liters                                    | 7.5 US qts        | 6.2 Imp. qts       |
| Engine oil capacity              |           |     |                                               |                   |                    |
| Dry fill                         |           |     |                                               |                   |                    |
| 7M-GE MA (GCC Countries*)        |           |     | 5.0 liters                                    | 5.3 US qts        | 4.4 Imp. qts       |
| 7M-GE MA (Others)                |           |     | 4.9 liters                                    | 5.2 US qts        | 4.3 Imp. qts       |
| 7M-GE MS                         |           |     | 5.3 liters                                    | 5.6 US qts        | 4.7 Imp. qts       |
| 7M-GTE (M/T)                     |           |     | 5.1 liters                                    | 5.4 US qts        | 4.5 Imp. qts       |
| 7M-GTE (A/T)                     |           |     | 5.0 liters                                    | 5.3 US qts        | 4.4 Imp. qts       |
| Drain and refill                 |           |     |                                               |                   |                    |
| w/o Oil filter change            |           |     |                                               |                   |                    |
| MA                               |           |     | 3.9 liters                                    | 4.1 US qts        | 3.4 Imp. qts       |
| MS                               |           |     | 4.1 liters                                    | 4.3 US qts        | 3.6 Imp. qts       |
| w/ Oil filter change             |           |     |                                               |                   |                    |
| MA                               |           |     | 4.2 liters                                    | 4.4 US qts        | 3.7 Imp. qts       |
| MS                               |           |     | 4.4 liters                                    | 4.7 US qts        | 3.9 Imp. qts       |
| Battery specific gravity         |           |     | 1.25 — 1.27 when fully charged at 20°C (68°F) |                   |                    |
| High-tension cord resistance     |           |     | 25 kΩ per cord                                |                   |                    |
| Spark plug                       |           |     |                                               |                   |                    |
| Conventional tipped type         |           |     |                                               |                   |                    |
| Type                             |           | ND  | Q20R-U                                        |                   |                    |
|                                  |           | NGK | BCPR6EY                                       |                   |                    |
| Air gap                          |           |     | 0.8 mm                                        | 0.031 in.         |                    |
| Platinum tipped type             |           |     |                                               |                   |                    |
| Type                             | 7M-GE     | ND  | PQ16R                                         |                   |                    |
|                                  |           | NGK | BCPR5EP11                                     |                   |                    |
|                                  | 7M-GTE    | ND  | PQ20R-P8                                      |                   |                    |
|                                  |           | NGK | BCPR6EP-N8                                    |                   |                    |
| Air gap                          | 7M-GE     |     | 1.1 mm                                        | 0.043 in.         |                    |
|                                  | 7M-GTE    |     | 0.8 mm                                        | 0.031 in.         |                    |

\* GCC Countries: Saudi Arabia, Sultanate of Oman, Bahrain, United Arab Emirates, Qatar, Kuwait.

## Specifications (Cont'd)

|                                                |                                     |                                      |         |                                                                 |                     |           |
|------------------------------------------------|-------------------------------------|--------------------------------------|---------|-----------------------------------------------------------------|---------------------|-----------|
| Ignition timing                                |                                     | T/M in N range                       |         | 10°BTDC @ idle<br>[w/ Terminals T (TE1) and E1 short-circuited] |                     |           |
| Firing order                                   |                                     |                                      |         | 1 - 5 - 3 - 6 - 2 - 4                                           |                     |           |
| Valve clearance (cold)                         |                                     | Intake                               |         | 0.15 - 0.25 mm                                                  | 0.0059 - 0.0098 in. |           |
|                                                |                                     | Exhaust                              |         | 0.20 - 0.30 mm                                                  | 0.0079 - 0.0188 in. |           |
| Idle speed                                     | 7M-GE                               | w/o TWC                              |         | 800 rpm                                                         |                     |           |
|                                                |                                     | w/ TWC                               |         | 700 rpm                                                         |                     |           |
| Idle CO concentration                          | 7M-GTE                              |                                      |         | 800 rpm                                                         |                     |           |
|                                                |                                     | w/o TWC                              |         | 1.0 ± 0.5 %                                                     |                     |           |
|                                                |                                     | w/ TWC                               |         | 0 - 0.5 %                                                       |                     |           |
| Dash pot setting speed                         |                                     |                                      |         | 2,000 rpm                                                       |                     |           |
| Intake manifold vacuum at idle speed           |                                     |                                      |         | 440 mmHg (17.32 in.Hg, 130 kPa) or more                         |                     |           |
| Compression pressure at 250 rpm                |                                     | 7M-GE                                | STD     | 11.0 kg/cm²                                                     | 156 psi             | 1,079 kPa |
|                                                |                                     |                                      | Limit   | 9.0 kg/cm²                                                      | 128 psi             | 883 kPa   |
|                                                |                                     | 7M-GTE                               | STD     | 10.0 kg/cm²                                                     | 142 psi             | 981 kPa   |
|                                                |                                     |                                      | Limit   | 9.0 kg/cm²                                                      | 128 psi             | 883 kPa   |
| Differential of pressure between each cylinder |                                     |                                      |         | 1.0 kg/cm² (14 psi, 98 kPa) or less                             |                     |           |
| Cylinder head                                  | Warpage                             | Cylinder block side                  | Limit   | 0.10 mm                                                         | 0.0039 in.          |           |
|                                                |                                     | Intake manifold side                 | Limit   | 0.10 mm                                                         | 0.0039 in.          |           |
|                                                |                                     | Exhaust manifold side                | Limit   | 0.10 mm                                                         | 0.0039 in.          |           |
|                                                | Valve guide bore                    | STD                                  |         | 11.000 - 11.027 mm                                              | 0.4331 - 0.4341 in. |           |
|                                                |                                     | O/S 0.05                             |         | 11.050 - 11.077 mm                                              | 0.4350 - 0.4361 in. |           |
|                                                | Valve seat                          | Refacing angle                       |         |                                                                 | 30°, 45°, 60°       |           |
| Contacting angle                               |                                     |                                      |         | 45°                                                             |                     |           |
| Contacting width                               |                                     |                                      |         | 1.0 - 1.4 mm                                                    | 0.039 - 0.055 in.   |           |
| Valve guide bushing                            | Inside diameter                     |                                      |         | 6.010 - 6.030 mm                                                | 0.2366 - 0.2374 in. |           |
|                                                | Outside diameter                    | STD                                  |         | 11.033 - 11.044 mm                                              | 0.4344 - 0.4348 in. |           |
|                                                |                                     | O/S 0.05                             |         | 11.083 - 11.094 mm                                              | 0.4363 - 0.4368 in. |           |
|                                                |                                     | Replacing temp. (Cylinder head side) |         | 90°C                                                            | 194°F               |           |
| Valve                                          | Valve overall length                | STD                                  |         | 98.15 mm                                                        | 3.8642 in.          |           |
|                                                |                                     | Limit                                |         | 97.75 mm                                                        | 3.8484 in.          |           |
|                                                | Valve face angle                    |                                      |         |                                                                 | 44.5°               |           |
|                                                | Stem diameter                       | Intake                               |         | 5.970 - 5.985 mm                                                | 0.2350 - 0.2356 in. |           |
|                                                |                                     | Exhaust                              |         | 5.965 - 5.980 mm                                                | 0.2348 - 0.2354 in. |           |
|                                                | Stem oil clearance                  | STD                                  | Intake  | 0.025 - 0.060 mm                                                | 0.0010 - 0.0024 in. |           |
|                                                |                                     |                                      | Exhaust | 0.030 - 0.065 mm                                                | 0.0012 - 0.0026 in. |           |
|                                                |                                     | Limit                                | Intake  | 0.08 mm                                                         | 0.0031 in.          |           |
|                                                |                                     |                                      | Exhaust | 0.10 mm                                                         | 0.0039 in.          |           |
|                                                | Valve margin thickness              | STD                                  |         | 1.3 mm                                                          | 0.051 in.           |           |
| Limit                                          |                                     |                                      | 0.5 mm  | 0.020 in.                                                       |                     |           |
| Valve spring                                   | Free length                         |                                      |         | 41.64 mm                                                        | 1.6394 in.          |           |
|                                                | Installed height                    |                                      |         | 35 mm                                                           | 1.378 in.           |           |
|                                                | Installed load at 35 mm (1.378 in.) |                                      |         | 16 kg                                                           | 35 lb               | 157 N     |
|                                                |                                     | STD                                  |         | 1.5 mm                                                          | 0.059 in.           |           |
| Squareness                                     |                                     | Limit                                |         |                                                                 |                     |           |
| Valve lifter                                   | Lifter diameter                     | STD                                  |         | 27.975 - 27.985 mm                                              | 1.1014 - 1.1018 in. |           |
|                                                | Oil clearance                       | STD                                  |         | 0.015 - 0.046 mm                                                | 0.0006 - 0.0018 in. |           |
|                                                |                                     | Limit                                |         | 0.10 mm                                                         | 0.0039 in.          |           |

## Specifications (Cont'd)

|                                             |                                  |               |          |                    |                     |
|---------------------------------------------|----------------------------------|---------------|----------|--------------------|---------------------|
| Intake, exhaust manifold and intake chamber | Warpage                          |               |          |                    |                     |
|                                             | Intake                           |               | Limit    | 0.10 mm            | 0.0039 in.          |
|                                             | Exhaust                          | 7M-GE         | Limit    | 0.75 mm            | 0.0295 in.          |
|                                             |                                  | 7M-GTE        | Limit    | 0.50 mm            | 0.0197 in.          |
|                                             | Intake chamber                   |               | Limit    | 0.10 mm            | 0.0039 in.          |
| Camshaft                                    | Thrust clearance                 |               | STD      | 0.08 – 0.19 mm     | 0.0031 – 0.0075 in. |
|                                             |                                  |               | Limit    | 0.30 mm            | 0.0118 in.          |
|                                             | Journal oil clearance            |               |          |                    |                     |
|                                             |                                  | No. 1         | STD      | 0.035 – 0.072 mm   | 0.0014 – 0.0028 in. |
|                                             |                                  |               | Limit    | 0.13 mm            | 0.0051 in.          |
|                                             |                                  | No. 2 – No. 7 | STD      | 0.025 – 0.093 mm   | 0.0010 – 0.0037 in. |
|                                             |                                  |               | Limit    | 0.13 mm            | 0.0051 in.          |
|                                             | Journal diameter                 | No. 1         | STD      | 26.949 – 26.965 mm | 1.0610 – 1.0616 in. |
|                                             |                                  | No. 2 – No. 7 | STD      | 26.888 – 26.975 mm | 1.0586 – 1.0620 in. |
|                                             | Circle runout                    |               | Limit    | 0.03 mm            | 0.0012 in.          |
|                                             | Cam lobe height                  |               |          |                    |                     |
|                                             | Intake                           | 7M-GE (MA)    | STD      | 38.36 mm           | 1.5102 in.          |
|                                             |                                  |               | Limit    | 38.00 mm           | 1.4961 in.          |
|                                             |                                  | 7M-GE (MS)    | STD      | 38.16 mm           | 1.5024 in.          |
|                                             |                                  |               | Limit    | 37.85 mm           | 1.4901 in.          |
|                                             |                                  | 7M-GTE        | STD      | 38.35 mm           | 1.5098 in.          |
|                                             |                                  |               | Limit    | 38.00 mm           | 1.4961 in.          |
|                                             | Exhaust                          | 7M-GE (MA)    | STD      | 38.36 mm           | 1.5102 in.          |
|                                             |                                  |               | Limit    | 38.00 mm           | 1.4961 in.          |
|                                             |                                  | Others        | STD      | 38.35 mm           | 1.5098 in.          |
|                                             |                                  |               | Limit    | 38.00 mm           | 1.4961 in.          |
| Idler pulley tension spring                 | Free length                      |               |          | 69 mm              | 2.72 in.            |
| Cylinder block                              | Cylinder head surface warpage    |               | Limit    | 0.05 mm            | 0.0020 in.          |
|                                             | Cylinder bore                    | STD           | STD      | 82.99 – 83.04 mm   | 3.2673 – 3.2693 in. |
|                                             |                                  |               | Limit    | 83.24 mm           | 3.2772 in.          |
|                                             |                                  | O/S 0.50      | Limit    | 83.74 mm           | 3.2968 in.          |
|                                             | Cylinder block main journal bore |               |          |                    |                     |
|                                             |                                  | STD           | Mark 1   | 64.024 – 64.030 mm | 2.5206 – 2.5209 in. |
|                                             |                                  |               | Mark 2   | 64.031 – 64.036 mm | 2.5209 – 2.5211 in. |
|                                             |                                  |               | Mark 3   | 64.037 – 64.042 mm | 2.5211 – 2.5213 in. |
|                                             |                                  | U/S 0.25      |          | 64.022 – 64.046 mm | 2.5205 – 2.5215 in. |
| Piston and piston ring                      | Piston diameter                  | 7M-GE         | STD      | 82.90 – 82.95 mm   | 3.2638 – 3.2658 in. |
|                                             |                                  |               | O/S 0.50 | 83.40 – 83.45 mm   | 3.2835 – 3.2854 in. |
|                                             |                                  | 7M-GTE        | STD      | 82.91 – 82.96 mm   | 3.2642 – 3.2661 in. |
|                                             |                                  |               | O/S 0.50 | 83.41 – 83.46 mm   | 3.2839 – 3.2858 in. |
|                                             | Piston oil clearance             | 7M-GE         | STD      | 0.08 – 0.10 mm     | 0.0031 – 0.0039 in. |
|                                             |                                  |               | Limit    | 0.13 mm            | 0.0051 in.          |
|                                             |                                  | 7M-GTE        | STD      | 0.07 – 0.09 mm     | 0.0028 – 0.0035 in. |
|                                             |                                  |               | Limit    | 0.13 mm            | 0.0051 in.          |
|                                             | Piston ring end gap              |               |          |                    |                     |
|                                             | 7M-GE (w/o TWC) and 7M-GTE       |               |          |                    |                     |
|                                             |                                  | No. 1         | STD      | 0.29 – 0.44 mm     | 0.0114 – 0.0173 in. |
|                                             |                                  |               | Limit    | 0.74 mm            | 0.0291 in.          |
|                                             |                                  | No. 2         | STD      | 0.25 – 0.53 mm     | 0.0098 – 0.0209 in. |
|                                             |                                  |               | Limit    | 1.13 mm            | 0.0445 in.          |
|                                             | Oil                              |               | STD      | 0.10 – 0.44 mm     | 0.0039 – 0.0173 in. |
|                                             |                                  |               | Limit    | 1.04 mm            | 0.0409 in.          |

## Specifications (Cont'd)

|                                 |                                              |           |                    |                     |  |
|---------------------------------|----------------------------------------------|-----------|--------------------|---------------------|--|
| Piston and piston ring (Cont'd) | 7M-GE (w/ TWC)                               |           |                    |                     |  |
|                                 | No. 1                                        | STD       | 0.23 – 0.38 mm     | 0.0091 – 0.0150 in. |  |
|                                 |                                              | Limit     | 0.68 mm            | 0.0268 in.          |  |
|                                 | No. 2                                        | STD       | 0.25 – 0.53 mm     | 0.0098 – 0.0209 in. |  |
|                                 |                                              | Limit     | 1.13 mm            | 0.0051 in.          |  |
|                                 | Oil                                          | STD       | 0.10 – 0.40 mm     | 0.0039 – 0.0157 in. |  |
|                                 |                                              | Limit     | 1.00 mm            | 0.0394 in.          |  |
|                                 | Piston ring groove clearance                 |           |                    |                     |  |
|                                 | No. 1                                        | Limit     | 0.03 – 0.07 mm     | 0.0012 – 0.0028 in. |  |
|                                 | No. 2                                        | Limit     | 0.02 – 0.06 mm     | 0.0008 – 0.0024 in. |  |
| Connecting rod and bearing      | Thrust clearance                             | STD       | 0.160 – 0.296 mm   | 0.0063 – 0.0117 in. |  |
|                                 |                                              | Limit     | 0.3 mm             | 0.012 in.           |  |
|                                 | Big end inner diameter                       |           |                    |                     |  |
|                                 | STD                                          | Mark 1    | 55.015 – 55.025 mm | 2.1659 – 2.1663 in. |  |
|                                 |                                              | Mark 2    | 55.026 – 55.035 mm | 2.1664 – 2.1667 in. |  |
|                                 |                                              | Mark 3    | 55.036 – 55.045 mm | 2.1668 – 2.1671 in. |  |
|                                 | U/S 0.25                                     |           | 55.015 – 55.045 mm | 2.1659 – 2.1671 in. |  |
|                                 | Connecting rod bearing center wall thickness |           |                    |                     |  |
|                                 | STD                                          | Mark 1    | 1.490 – 1.495 mm   | 0.0587 – 0.0589 in. |  |
|                                 |                                              | Mark 2    | 1.496 – 1.500 mm   | 0.0589 – 0.0591 in. |  |
|                                 |                                              | Mark 3    | 1.501 – 1.505 mm   | 0.0591 – 0.0593 in. |  |
|                                 |                                              | Mark 4    | 1.506 – 1.510 mm   | 0.0593 – 0.0594 in. |  |
|                                 |                                              | Mark 5    | 1.511 – 1.515 mm   | 0.0595 – 0.0596 in. |  |
|                                 | U/S 0.25                                     |           | 1.622 – 1.632 mm   | 0.0639 – 0.0643 in. |  |
|                                 | Bearing oil clearance                        | STD       | 0.021 – 0.053 mm   | 0.0008 – 0.0021 in. |  |
|                                 |                                              | Limit     | 0.07 mm            | 0.0028 in.          |  |
|                                 | Busing inside diameter                       |           | 22.005 – 22.017 mm | 0.8663 – 0.8668 in. |  |
|                                 | Piston pin oil clearance                     | STD       | 0.005 – 0.011 mm   | 0.0002 – 0.0004 in. |  |
|                                 |                                              | Limit     | 0.02 mm            | 0.0008 in.          |  |
|                                 | Piston pin diameter                          |           | 21.996 – 22.009 mm | 0.8660 – 0.8665 in. |  |
| Crankshaft and bearing          | Rod bend                                     | Limit     | 0.05 mm            | 0.0020 in.          |  |
|                                 | Rod twist                                    | Limit     | 0.15 mm            | 0.0059 in.          |  |
|                                 | Thrust clearance                             | STD       | 0.05 – 0.25 mm     | 0.0020 – 0.0098 in. |  |
|                                 |                                              | Limit     | 0.30 mm            | 0.0118 in.          |  |
|                                 | Thrust washer thickness                      | STD       | 2.925 – 2.975 mm   | 0.1152 – 0.1171 in. |  |
|                                 |                                              | O/S 0.125 | 2.988 – 3.038 mm   | 0.1176 – 0.1196 in. |  |
|                                 | Main journal oil clearance                   | STD       | 0.030 – 0.048 mm   | 0.0012 – 0.0019 in. |  |
|                                 |                                              | Limit     | 0.07 mm            | 0.0028 in.          |  |
|                                 | Main journal diameter                        |           |                    |                     |  |
|                                 | STD                                          | Mark 0    | 60.007 – 60.012 mm | 2.3625 – 2.3627 in. |  |
|                                 |                                              | Mark 1    | 60.001 – 60.006 mm | 2.3622 – 2.3624 in. |  |
|                                 |                                              | Mark 2    | 59.994 – 60.000 mm | 2.3620 – 2.3622 in. |  |
|                                 | U/S 0.25                                     |           | 59.730 – 59.740 mm | 2.3516 – 2.3520 in. |  |
|                                 | Main bearing center wall thickness           |           |                    |                     |  |
|                                 | STD                                          | Mark 1    | 1.988 – 1.991 mm   | 0.0783 – 0.0784 in. |  |
|                                 |                                              | Mark 2    | 1.992 – 1.994 mm   | 0.0784 – 0.0785 in. |  |
|                                 |                                              | Mark 3    | 1.995 – 1.997 mm   | 0.0785 – 0.0786 in. |  |
|                                 |                                              | Mark 4    | 1.998 – 2.000 mm   | 0.0787 – 0.0787 in. |  |
|                                 |                                              | Mark 5    | 2.001 – 2.003 mm   | 0.0788 – 0.0789 in. |  |
|                                 | U/S 0.25                                     |           | 2.123 – 2.133 mm   | 0.0836 – 0.0840 in. |  |

## Specifications (Cont'd)

|                                 |                                     |       |        |                    |                     |
|---------------------------------|-------------------------------------|-------|--------|--------------------|---------------------|
| Crankshaft and bearing (Cont'd) | Crank pin diameter                  | STD   | Mark 0 | 51.993 – 52.000 mm | 2.0470 – 2.0472 in. |
|                                 |                                     |       | Mark 1 | 51.985 – 51.992 mm | 2.0466 – 2.0469 in. |
|                                 |                                     |       | Mark 2 | 51.976 – 51.984 mm | 2.0463 – 2.0466 in. |
|                                 | U/S 0.25                            |       |        | 51.725 – 51.735 mm | 2.0364 – 2.0368 in. |
|                                 | Circle runout                       |       | Limit  | 0.06 mm            | 0.0024 in.          |
|                                 | Main journal taper and out-of-round |       | Limit  | 0.02 mm            | 0.0008 in.          |
| Pump drive shaft                | Thrust clearance                    | STD   |        | 0.06 – 0.13 mm     | 0.0024 – 0.0051 in. |
|                                 |                                     | Limit |        | 0.30 mm            | 0.0118 in.          |
|                                 | Oil clearance                       | STD   |        | 0.025 – 0.066 mm   | 0.0010 – 0.0026 in. |
|                                 |                                     | Limit |        | 0.08 mm            | 0.0031 in.          |
|                                 | Journal diameter                    | Front |        | 40.959 – 40.975 mm | 1.6126 – 1.6132 in. |
|                                 |                                     | Rear  |        | 32.959 – 32.975 mm | 1.2976 – 1.2982 in. |

## Torque Specifications

| Part tightened                                      | kg-cm | ft-lb     | N-m |
|-----------------------------------------------------|-------|-----------|-----|
| Camshaft timing pulley x Camshaft                   | 500   | 36        | 49  |
| Oil pump drive pulley x Oil pump drive shaft        | 220   | 16        | 22  |
| Crankshaft x Crank pulley                           | 2,700 | 195       | 265 |
| Crankshaft x Flywheel                               | 750   | 54        | 74  |
| Crankshaft x Drive plate                            | 750   | 54        | 74  |
| Air intake chamber x Intake manifold                | 180   | 13        | 18  |
| Air intake chamber x Air intake connector (7M-GE)   | 180   | 13        | 18  |
| Throttle body x Air intake connector                | 130   | 9         | 13  |
| Cylinder head x No. 1 and No. 2 cylinder head cover | 25    | 22 in.-lb | 2.5 |
| Cylinder head x No. 3 cylinder head cover           | 180   | 13        | 18  |
| Cylinder head x Cylinder block                      | 800   | 58        | 78  |
| Cylinder head x Spark plug                          | 180   | 13        | 18  |
| Cylinder head x No. 2 engine hanger                 | 400   | 29        | 39  |
| Cylinder head x Heat union                          | 600   | 43        | 59  |
| Cylinder head x EGR cooler                          | 140   | 10        | 14  |
| Cylinder head x Camshaft bearing cap                | 200   | 14        | 20  |
| Cylinder head x Intake manifold                     | 180   | 13        | 18  |
| Cylinder head x Delivery pipe                       | 180   | 13        | 18  |
| Cylinder head x Exhaust manifold                    | 400   | 29        | 39  |
| Cylinder head x Distributor (7M-GE)                 | 140   | 10        | 14  |
| Cylinder head x Cam position sensor (7M-GTE)        | 140   | 10        | 14  |
| Connecting rod cap x Connecting rod                 | 650   | 47        | 64  |
| Cylinder block x Main bearing cap                   | 1,040 | 75        | 102 |
| Cylinder block x Oil nozzle                         | 250   | 18        | 25  |
| Cylinder block x Timing belt case x Idler pulley    | 500   | 36        | 49  |
| Cylinder block x Oil pump drive shaft thrust plate  | 145   | 11        | 14  |

**TURBOCHARGER SYSTEM****Specifications**

|              |                          |     |     |                                                                |
|--------------|--------------------------|-----|-----|----------------------------------------------------------------|
| Turbocharger | Turbocharging pressure   | M/T | STD | 0.39 – 0.53 kg/cm <sup>2</sup><br>(5.5 – 7.5 psi, 38 – 52 kPa) |
|              |                          | A/T | STD | 0.34 – 0.42 kg/cm <sup>2</sup><br>(4.8 – 6.0 psi, 33 – 41 kPa) |
|              | Bearing shaft axial play |     | STD | 0.13 mm (0.0051 in.) or less                                   |

**Torque specifications**

| Part tightened                              | kg-cm. | ft-lb     | N·m |
|---------------------------------------------|--------|-----------|-----|
| Turbocharger x Turbin outlet elbow          | 440    | 32        | 43  |
| Oil pipe x Turbocharger                     | 130    | 9         | 13  |
| Water pipe x Turbocharger                   | 75     | 65 in.-lb | 7.4 |
| Oil pipe x Cylinder block (Bolt)            | 350    | 25        | 34  |
| Oil pipe x Cylinder block (Nut)             | 130    | 9         | 13  |
| Turbocharger stay x Turbocharger            | 810    | 59        | 79  |
| Turbocharger stay x Engine mounting bracket | 590    | 43        | 58  |
| Turbocharger x Exhaust manifold             | 450    | 33        | 44  |
| Front exhaust pipe x Turbocharger           | 630    | 46        | 62  |

**EFI SYSTEM****Specifications**

|                          |                                        |                            |                                                        |                  |
|--------------------------|----------------------------------------|----------------------------|--------------------------------------------------------|------------------|
| Fuel pressure regulator  | Fuel pressure                          | at No vacuum               | 2.3 – 2.8 kg/cm <sup>2</sup><br>(33 – 40 psi, 275 kPa) |                  |
| Cold start injector      | Resistance                             |                            | 2 – 4 Ω                                                |                  |
|                          | Fuel leakage                           |                            | One drop or less per minute                            |                  |
| Injector                 | Resistance                             | 7M-GE                      | 1.8 – 3.4 Ω                                            |                  |
|                          |                                        | 7M-GTE                     | 2.0 – 3.8 Ω                                            |                  |
|                          | Injection volume                       | 7M-GE                      | 65 – 80 cc (4.0 – 4.9 cu in.) per 15 sec.              |                  |
|                          |                                        | 7M-GTE                     | 101 – 114 cc (6.2 – 7.0 cu in.) per 15 sec.            |                  |
|                          | Difference between each injector       |                            | 9 cc (0.5 cu in.) or less                              |                  |
|                          | Fuel leakage                           |                            | One drop or less per minute                            |                  |
| Throttle position sensor | Clearance between stop screw and lever |                            | Between terminals                                      | Resistance       |
|                          | 7M-GE                                  | 7M-GTE                     |                                                        |                  |
|                          | 0 mm (0 in.)                           |                            | VTA – E2                                               | 0.3 – 6.3 kΩ     |
|                          | 0.40 mm (0.0157 in.)                   | 0.5 mm (0.0197 in.)        | IDL – E2                                               | Less than 2.3 kΩ |
|                          | 0.75 mm (0.0295 in.)                   | 0.9 mm (0.0354 in.)        | IDL – E2                                               | ∞                |
|                          | Throttle valve fully opened position   |                            | VTA – E2                                               | 3.5 – 10.3 kΩ    |
|                          |                                        |                            | VC – E2                                                | 4.25 – 8.25 kΩ   |
| ISC valve                | Resistance                             | B1 – S1 or S3              | 10 – 30 Ω                                              |                  |
|                          |                                        | B2 – S2 or S4              | 10 – 30 Ω                                              |                  |
| Solenoid resistor        | Resistance                             | No. 10<br>+B – }<br>No. 30 | 3 Ω each                                               |                  |

## Specifications (Cont'd)

|                                 |                                                                                    |                              |              |                 |                                |
|---------------------------------|------------------------------------------------------------------------------------|------------------------------|--------------|-----------------|--------------------------------|
| Cold start injector time switch | Resistance                                                                         | w/ TWC                       | STA – STJ    | 25 – 50 Ω       | below 15°C (59°F)              |
|                                 |                                                                                    |                              |              | 60 – 85 Ω       | above 30°C (86°F)              |
|                                 |                                                                                    |                              | STA – Ground | 25 – 85 Ω       | –                              |
|                                 | Resistance                                                                         | w/o TWC                      | STA – STJ    | 20 – 40 Ω       | below 30°C (86°F)              |
|                                 |                                                                                    |                              | STA – Ground | 40 – 60 Ω       | above 40°C (104°F)             |
|                                 |                                                                                    |                              |              | 20 – 80 Ω       | –                              |
| Fuel pump Resistor              | Resistance                                                                         | Approx. 0.7 Ω                |              |                 |                                |
| VSV (FPU)                       | Resistance                                                                         | 30 – 50 Ω                    |              |                 |                                |
| Air flow meter                  | Resistance                                                                         | 7M-GE                        | E2 – VS      | 20 – 600 Ω      | (Measuring plate fully closed) |
|                                 |                                                                                    |                              |              | 20 – 1,200 Ω    | (Measuring plate fully open)   |
|                                 |                                                                                    |                              | E2 – VC      | 200 – 400 Ω     |                                |
|                                 |                                                                                    |                              | E1 – FC      | Infinity        | (Measuring plate fully closed) |
|                                 |                                                                                    |                              |              | Zero            | (Other than closed position)   |
|                                 |                                                                                    |                              | E2 – THA     | 10 – 20 kΩ      | at –20°C (–4°F)                |
|                                 |                                                                                    |                              |              | 4 – 7 kΩ        | at 0°C (32°F)                  |
|                                 |                                                                                    |                              |              | 2 – 3 kΩ        | at 20°C (68°F)                 |
|                                 |                                                                                    |                              |              | 0.9 – 1.3 kΩ    | at 40°C (104°F)                |
|                                 |                                                                                    |                              |              | 0.4 – 0.7 kΩ    | at 60°C (140°F)                |
|                                 | 7M-GTE                                                                             | KS → E1                      | ∞            |                 |                                |
|                                 |                                                                                    | E1 → KS                      | 5 – 10 kΩ    |                 |                                |
|                                 |                                                                                    | VC → E1                      | 10 – 15 kΩ   |                 |                                |
|                                 |                                                                                    | E1 → VC                      | 5 – 10 kΩ    |                 |                                |
|                                 |                                                                                    | E2 – THA                     | 10 – 20 kΩ   | at –20°C (–4°F) |                                |
|                                 |                                                                                    |                              | 4 – 7 kΩ     | at 0°C (32°F)   |                                |
|                                 |                                                                                    |                              | 2 – 3 kΩ     | at 20°C (68°F)  |                                |
|                                 |                                                                                    |                              | 0.9 – 1.3 kΩ | at 40°C (104°F) |                                |
|                                 |                                                                                    |                              | 0.4 – 0.7 kΩ | at 60°C (140°F) |                                |
| Water temp. sensor              | Resistance                                                                         | 10 – 20 kΩ at –20°C (–4°F)   |              |                 |                                |
|                                 |                                                                                    | 4 – 7 kΩ at 0°C (32°F)       |              |                 |                                |
|                                 |                                                                                    | 2 – 3 kΩ at 20°C (68°F)      |              |                 |                                |
|                                 |                                                                                    | 0.9 – 1.3 kΩ at 40°C (104°F) |              |                 |                                |
|                                 |                                                                                    | 0.4 – 0.7 kΩ at 60°C (140°F) |              |                 |                                |
|                                 |                                                                                    | 0.2 – 0.4 kΩ at 80°C (176°F) |              |                 |                                |
| ECU                             | NOTE:                                                                              |                              |              |                 |                                |
|                                 | ● Perform all voltage and resistance measurements with the computer connected.     |                              |              |                 |                                |
|                                 | ● Verify that the battery voltage is 11 V or above with the ignition switch is ON. |                              |              |                 |                                |
|                                 | Voltage                                                                            |                              |              |                 |                                |
|                                 | Terminals                                                                          | Condition                    |              |                 | STD voltage (V)                |
|                                 | BATT – E1                                                                          | –                            |              |                 | 10 – 14                        |
|                                 | IG S/W – E1                                                                        | Ignition S/W ON              |              |                 |                                |
| M-REL – E1                      |                                                                                    |                              |              |                 |                                |
| +B (+B1) – E1<br>B (B1)         |                                                                                    |                              |              |                 |                                |

## Specifications (Cont'd)

| ECU (Cont'd) | Terminals                                | Condition                                                        |                                        | STD voltage (V) |
|--------------|------------------------------------------|------------------------------------------------------------------|----------------------------------------|-----------------|
|              | IDL - E2                                 | Ignition S/W ON                                                  | Throttle valve open                    | 10 - 14         |
|              | VC (VCC) - E2                            |                                                                  |                                        | 4 - 6           |
|              | VTA - E2                                 |                                                                  | Throttle valve fully closed            | 0.1 - 1.0       |
|              |                                          |                                                                  | Throttle valve fully open              | 4 - 5           |
|              | *1VS - E2                                | Ignition S/W ON                                                  | Measuring plate fully closed           | 4 - 5           |
|              |                                          |                                                                  | Measuring plate fully open             | 0.02 - 0.08     |
|              |                                          | Idling                                                           |                                        | 2 - 4           |
|              |                                          | 3,000 rpm                                                        |                                        | 0.3 - 1.0       |
|              | *2KS - E2                                | Ignition S/W ON                                                  |                                        | 4 - 6           |
|              |                                          | Cranking or running                                              |                                        | 2 - 4           |
|              | VC - E2                                  | Ignition S/W ON                                                  |                                        | 4 - 6           |
|              | THA - E2                                 | Ignition S/W ON                                                  | Intake air temperature 20°C (68°F)     | 1 - 3           |
|              | THW - E2                                 | Ignition S/W ON                                                  | Coolant temperature 80°C (176°F)       | 0.1 - 1.0       |
|              | No. 10 E01<br>No. 20 - E02<br>No. 30 E02 | Ignition S/W ON                                                  |                                        | 9 - 14          |
|              | STA - E1                                 | Cranking                                                         |                                        | 6 - 14          |
|              | ISC1<br>ISC4 - E1                        | Ignition S/W ON                                                  |                                        | 9 - 14          |
|              | IGF, IGT - E1                            | Idling                                                           |                                        | 0.7 - 1.0       |
|              | *2IGdA, IGdB - E1                        | Idling                                                           |                                        | 1 - 3           |
|              | *2HAC - E2                               | Ignition S/W ON                                                  | 540 mmHg (21.26 in.Hg, 72.0 kPa)       | Approx. 2.8     |
|              |                                          |                                                                  | 750 mmHg (129.53 in.Hg, 100.0 kPa)     | Approx. 3.6     |
|              | W - E1                                   | No trouble ("CHECK ENGINE" warning light off) and engine running |                                        | 9 - 4           |
|              | *3A/C - E1                               | Air conditioning ON                                              |                                        | 10 - 14         |
|              | T - E1                                   | Ignition S/W ON                                                  | Check connector T (TE1) - E1 not short | 4 - 6           |
|              |                                          |                                                                  | Check connector T (TE1) - E1 short     | 0               |
|              | *3NSW (A/T) - E1                         | Ignition S/W ON                                                  | Shift position P or N range            | 0               |
|              |                                          |                                                                  | Ex. P or N range                       | 10 - 14         |
|              | *3N/C (M/T) - E1                         | Ignition S/W ON                                                  | Clutch pedal not depressed             | 0               |
|              |                                          |                                                                  | Clutch pedal depressed                 | 10 - 14         |
|              | *3DFG - E1                               | Ignition S/W ON                                                  | Defogger S/W OFF                       | 10 - 14         |
|              |                                          |                                                                  | Defogger S/W ON                        | 0               |
|              | *3LP - E1                                | Headlight S/W OFF                                                |                                        | 10 - 14         |
|              |                                          | Headlight S/W ON                                                 |                                        | 0               |

\*1 7M-GE only

## Specifications (Cont'd)

| ECU (Cont'd)                  | Resistance      |                                    |                         |
|-------------------------------|-----------------|------------------------------------|-------------------------|
|                               | Terminals       | Condition                          | Resistance ( $\Omega$ ) |
| IDLE — E2                     |                 | Throttle valve open                | $\infty$                |
|                               |                 | Throttle valve fully closed        | Less than 2,300         |
| VTA — E2                      |                 | Throttle valve fully open          | 3,500 — 10,300          |
|                               |                 | Throttle valve fully closed        | 300 — 6,300             |
| VC (VCC) — E2                 |                 | —                                  | 200 — 400               |
| * <sup>1</sup> VS — E2        |                 | Measuring plate fully closed       | 20 — 600                |
|                               |                 | Measuring plate fully open         | 20 — 1,200              |
| * <sup>2</sup> KS → E1        |                 | —                                  | $\infty$                |
| * <sup>2</sup> E1 → KS        |                 | —                                  | 5,000 — 10,000          |
| * <sup>2</sup> VC → E1        |                 | —                                  | 10,000 — 15,000         |
| * <sup>2</sup> E1 → VC        |                 | —                                  | 5,000 — 10,000          |
| THA — E2                      |                 | Intake air temperature 20°C (68°F) | 2,000 — 3,000           |
| THW — E2                      |                 | Coolant temperature 80°C (176°F)   | 200 — 400               |
| G1, G2 — G —                  |                 | —                                  | 140 — 180               |
| NE — G —                      |                 | —                                  |                         |
| ISC1, ISC2 — +B<br>ISC3, ISC4 |                 | —                                  | 10 — 30                 |
| * <sup>2</sup> HAC — E2       |                 | —                                  | 2,900 — 4,200           |
| Fuel cut rpm                  | Fuel cut rpm    |                                    | 1,800 rpm               |
|                               | Fuel return rpm |                                    | 1,200 rpm               |

\*<sup>1</sup> 7M-GE only\*<sup>2</sup> 7M-GTE only

## Torque Specifications

| Part tightened                       | kg-cm | ft-lb     | N-m |
|--------------------------------------|-------|-----------|-----|
| Fuel pump x Fuel tank                | 35    | 30 in.-lb | 3.4 |
| Cold start injector x Intake chamber | 55    | 48 in.-lb | 5.4 |
| Pressure regulator x Delivery pipe   | 250   | 18        | 25  |
| No. 2 fuel pipe x Pressure regulator | 250   | 18        | 25  |
| Pulsation damper x Delivery pipe     | 400   | 29        | 39  |

## Torque Specifications (Cont'd)

| Part tightened                                 | kg-cm | ft-lb | N-m |
|------------------------------------------------|-------|-------|-----|
| Cold start injector tube x Delivery pipe       | 300   | 22    | 29  |
| Cold start injector tube x Cold start injector | 180   | 13    | 18  |
| No. 1 fuel pipe x Fuel pipe support            | 300   | 22    | 29  |
| ISC valve x Intake chamber                     | 130   | 9     | 13  |
| Air intake connector x Intake chamber          | 180   | 13    | 18  |
| Throttle body x Air intake connector           | 130   | 9     | 13  |

## COOLING SYSTEM

## Specifications

|                         |                               |                            |                                                                   |
|-------------------------|-------------------------------|----------------------------|-------------------------------------------------------------------|
| Engine coolant capacity |                               | See page A-2               |                                                                   |
| Thermostat              | Valve opening temperature     | 86 – 90°C      187 – 194°F |                                                                   |
|                         | Valve lift at 100°C (212°F)   | 8 mm (0.31 in.) or more    |                                                                   |
| Radiator                | Relief valve opening pressure | STD                        | 0.75 – 1.05 kg/cm <sup>2</sup><br>(10.7 – 14.9 psi, 74 – 103 kPa) |
|                         |                               | Limit                      | 0.6 kg/cm <sup>2</sup> 8.5 psi      59 kPa                        |

## Torque Specifications

| Part tightened                      | kg-cm | ft-lb     | N-m |
|-------------------------------------|-------|-----------|-----|
| Drain plug                          | 300   | 22        | 29  |
| Water outlet x Water outlet housing | 65    | 56 in.-lb | 6.4 |
| Water pump x Cylinder block         | 180   | 13        | 18  |

## LUBRICATION SYSTEM

## Specifications

|                     |                               |                                                        |                  |
|---------------------|-------------------------------|--------------------------------------------------------|------------------|
| Engine oil capacity |                               | See page A-2                                           |                  |
| Oil pressure        | at idle speed<br>at 3,000 rpm | 0.3 kg/cm <sup>2</sup> (4.3 psi, 29 kPa) or more       |                  |
|                     |                               | 2.5 – 5.0 kg/cm <sup>2</sup> 36 – 71 psi 245 – 490 kPa |                  |
| Oil pump            | Body clearance                | STD                                                    | 0.105 – 0.175 mm |
|                     |                               | Limit                                                  | 0.2 mm           |
|                     | Side clearance                | STD                                                    | 0.03 – 0.09 mm   |
|                     |                               | Limit                                                  | 0.15 mm          |
|                     | Gear backlash                 | STD                                                    | 0.5 – 0.6 mm     |
|                     |                               | Limit                                                  | 0.9 mm           |

## Torque Specifications

| Part tightened                                       | kg-cm | ft-lb     | N-m |
|------------------------------------------------------|-------|-----------|-----|
| Engine oil drain plug                                | 350   | 25        | 34  |
| Oil pump cover x Oil pump body                       | 75    | 65 in.-lb | 7.4 |
| Relief valve x Oil pump cover                        | 375   | 27        | 37  |
| Oil pump strainer x Oil pump body (MA only)          | 130   | 9         | 13  |
| Oil pump x Cylinder block                            | 220   | 16        | 22  |
| Oil pump strainer x Cylinder block (MA only)         | 60    | 52 in.-lb | 5.9 |
| Oil pump outlet pipe x Oil pump                      | 350   | 25        | 34  |
| Oil pump outlet pipe x Union                         | 350   | 25        | 34  |
| Oil pan x Cylinder block                             | 130   | 9         | 13  |
| Oil pressure regulator x Cylinder block (7M-GE only) | 145   | 10        | 14  |
| Oil pressure regulator plug                          | 375   | 27        | 37  |
| Oil filter bracket x Cylinder block                  | 500   | 36        | 49  |

## IGNITION SYSTEM

|                                                     |                           |                     |                                                                                                                                          |                                   |
|-----------------------------------------------------|---------------------------|---------------------|------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| Ignition timing                                     |                           |                     | 10° BTDC @ idle<br>[w/ Terminals T (TE1) and E1 short-circuit]                                                                           |                                   |
| Firing order                                        |                           |                     | 1 - 5 - 3 - 6 - 2 - 4                                                                                                                    |                                   |
| High-tension cord                                   | Resistance                | Limit               | 25 k $\Omega$ per cord                                                                                                                   |                                   |
| Spark plug                                          | Conventional tipped type  |                     | Q20R-U<br>BCPR6EY<br>0.8 mm<br>0.031 in.                                                                                                 |                                   |
|                                                     | Type                      | ND<br>NGK           |                                                                                                                                          |                                   |
|                                                     | Air gap                   |                     |                                                                                                                                          |                                   |
|                                                     | Platinum tipped type      |                     | PQ16R<br>BCPR5EP11<br>PQ20R-P8<br>BCPR6EP-N8<br>1.1 mm<br>0.043 in.<br>1.3 mm<br>0.051 in.<br>0.8 mm<br>0.031 in.<br>1.0 mm<br>0.039 in. |                                   |
|                                                     | Type                      | 7M-GE ND<br>NGK     |                                                                                                                                          |                                   |
|                                                     |                           | 7M-GTE ND<br>NGK    |                                                                                                                                          |                                   |
|                                                     | Air gap                   | 7M-GE STD<br>Limit  |                                                                                                                                          |                                   |
|                                                     |                           | 7M-GTE STD<br>Limit |                                                                                                                                          |                                   |
| Ignition coil                                       | Primary coil resistance   |                     | at cold<br>MA<br>MS<br>0.24 - 0.30 $\Omega$<br>0.41 - 0.50 $\Omega$<br>0.3 - 0.5 $\Omega$                                                |                                   |
|                                                     |                           | 7M-GE               |                                                                                                                                          |                                   |
|                                                     |                           | 7M-GTE              |                                                                                                                                          |                                   |
|                                                     | Secondary coil resistance |                     | 9.2 - 12.4 k $\Omega$<br>10.2 - 13.8 k $\Omega$                                                                                          |                                   |
|                                                     |                           | 7M-GE MA<br>MS      |                                                                                                                                          |                                   |
| Distributor (7M-GE) or can position sensor (7M-GTE) | Air gap                   | NE, G1 and G2       | Pickups                                                                                                                                  | 0.2 - 0.4 mm<br>0.008 - 0.016 in. |
|                                                     | Pickup coil resistance    | NE, G1 and G2       | Pickups                                                                                                                                  | 140 - 180 $\Omega$                |

## STARTING SYSTEM

| Starter               | Rated voltage and output power |        | 12 V 1.0 kW               |            | 12 V 1.4 kW       |           |
|-----------------------|--------------------------------|--------|---------------------------|------------|-------------------|-----------|
|                       |                                |        | 90 A or less at 11.5 V    |            | ←                 |           |
|                       | No-load characteristic         | Ampere | 3,000 rpm or more         |            | 3,500 rpm or more |           |
|                       |                                | rpm    |                           |            |                   |           |
| Brush                 | Length                         | STD    | 13.5 mm                   | 0.531 in.  | 15.5 mm           | 0.610 in. |
|                       |                                | Limit  | 8.5 mm                    | 0.335 in.  | 10.0 mm           | 0.394 in. |
| Spring installed load |                                | STD    | 1,785 – 2,415 g           |            |                   |           |
|                       |                                |        | (3.9 – 5.3 lb, 17 – 24 N) |            | ↑                 |           |
|                       |                                | Limit  | 1.2 kg                    | 2.6 lb     | 12 N              | ↑         |
|                       |                                |        |                           |            |                   |           |
| Commutator            | Outer diameter                 | STD    | 30 mm                     | 1.18 in.   | ↑                 |           |
|                       |                                | Limit  | 29 mm                     | 1.14 in.   | ↑                 |           |
|                       | Undercut depth                 | STD    | 0.6 mm                    | 0.024 in.  | ↑                 |           |
|                       |                                | Limit  | 0.2 mm                    | 0.008 in.  | ↑                 |           |
|                       | Circuit runout                 | Limit  | 0.05 mm                   | 0.0020 in. | ↑                 |           |
|                       |                                |        |                           |            |                   |           |

## CHARGING SYSTEM

|                                                            |                       |                                      |
|------------------------------------------------------------|-----------------------|--------------------------------------|
| Drive belt tension                                         |                       | See page A-2                         |
| Battery specific gravity when fully charged at 20°C (68°F) |                       | 1.25 – 1.27                          |
| Alternator                                                 | Rated output          | 12 V 70 A                            |
|                                                            | Rotor coil resistance | 2.8 – 3.0 Ω                          |
|                                                            | Slip ring diameter    | STD 14.2 – 14.4 mm 0.559 – 0.567 in. |
|                                                            |                       | Limit 12.8 mm 0.504 in.              |
|                                                            | Brush exposed length  | STD 10.5 mm 0.413 in.                |
| Alternator regulator (IC)                                  | Regulating voltage    | at 25°C (77°F) 13.9 – 15.1 V         |
|                                                            |                       | at 115°C (239°F) 13.5 – 14.3 V       |

# SST AND SSM

|                                       | Page |
|---------------------------------------|------|
| SST (SPECIAL SERVICE TOOLS) .....     | C-2  |
| SSM (SPECIAL SERVICE MATERIALS) ..... | C-5  |

SST (SPECIAL SERVICE TOOLS)

NOTE: Classification  
A = SST required for vehicle inspections and minor repairs and multipurpose SST.  
B = SST required for major repairs involving disassembly of components.  
C = SST required for rather special, less frequent work not of classifiable as either A or B.

| Section | Classification | Part Name | Part No.    | Illustration                                                                          | EM | TC | FI | CO | LU | IG | ST | CH | Note                                          |
|---------|----------------|-----------|-------------|---------------------------------------------------------------------------------------|----|----|----|----|----|----|----|----|-----------------------------------------------|
|         |                |           | 09032-00100 |    |    |    |    |    |    |    |    |    | A<br>(Oil Pan Seal Cutter)                    |
|         |                |           | 09043-38100 |    |    |    |    |    |    |    |    |    | A<br>(Hexagon 10 mm Wrench)                   |
|         |                |           | 09155-18100 |    |    |    |    |    |    |    |    |    | A<br>(Spark Plug Wrench)                      |
|         |                |           | 09201-41020 |    |    |    |    |    |    |    |    |    | B<br>(Valve Stem Oil Seal Replacer)           |
|         |                |           | 09201-70010 |    |    |    |    |    |    |    |    |    | B<br>(Valve Guide Bushing Remover & Replacer) |
|         |                |           | 09202-70010 |   |    |    |    |    |    |    |    |    | A<br>(Valve Spring Compressor)                |
|         |                |           | 09213-31021 |  |    |    |    |    |    |    |    |    | A<br>(Crankshaft Pulley Puller)               |
|         |                |           | 09213-54014 |  |    |    |    |    |    |    |    |    | A<br>(Crankshaft Pulley Puller)               |
|         |                |           | 09213-50017 |  |    |    |    |    |    |    |    |    | A<br>(Crankshaft Pulley & Gear Pulley Set)    |
|         |                |           | 09213-70010 |  |    |    |    |    |    |    |    |    | A<br>(Crankshaft Pulley Holding Tool)         |
|         |                |           | 09214-41010 |  |    |    |    |    |    |    |    |    | B<br>(Crankshaft Damper & Gear Replacer)      |
|         |                |           |             |                                                                                       |    |    |    |    |    |    |    |    | * Starter front bearing for 1.4 kW only       |
|         |                |           |             |                                                                                       |    |    |    |    |    |    |    |    | MS                                            |
|         |                |           |             |                                                                                       |    |    |    |    |    |    |    |    | MA                                            |
|         |                |           |             |                                                                                       |    |    |    |    |    |    |    |    | Oil pump oil seal                             |

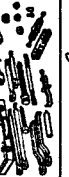
SST (SPECIAL SERVICE TOOLS) (Cont'd)

| Section | Classification | Part Name | Part No.    | Illustration                                                                         | EM | TC | FI | CO | LU | IG | ST | CH | Note                                             |
|---------|----------------|-----------|-------------|--------------------------------------------------------------------------------------|----|----|----|----|----|----|----|----|--------------------------------------------------|
|         |                |           | 09214-90010 |     |    |    |    |    |    |    |    |    | B<br>(Crankshaft Pulley & Gear Replacer)         |
|         |                |           | 09215-00109 |     |    |    |    |    |    |    |    |    | C<br>(Crankshaft Bearing Remover & Replacer Set) |
|         |                |           | 09215-00120 |     |    |    |    |    |    |    |    |    | •<br>(Gate "A")                                  |
|         |                |           | 09215-00130 |     |    |    |    |    |    |    |    |    | •<br>(Bolt)                                      |
|         |                |           | 09215-00140 |     |    |    |    |    |    |    |    |    | •<br>(Nut)                                       |
|         |                |           | 09215-00160 |     |    |    |    |    |    |    |    |    | •<br>(Pin)                                       |
|         |                |           | 09215-00210 |     |    |    |    |    |    |    |    |    | •<br>(Remover & Replacer)                        |
|         |                |           | 09215-00220 |     |    |    |    |    |    |    |    |    | •<br>(Remover & Replacer)                        |
|         |                |           | 09216-00020 |    |    |    |    |    |    |    |    |    | A<br>(Belt Tension Gauge)                        |
|         |                |           | 09216-00030 |   |    |    |    |    |    |    |    |    | A<br>(Belt Tension Cable)                        |
|         |                |           | 09222-30010 |  |    |    |    |    |    |    |    |    | B<br>(Connecting Rod Bushing Remover & Replacer) |
|         |                |           | 09223-41020 |   |    |    |    |    |    |    |    |    | B<br>(Crankshaft Rear Oil Seal Replacer)         |
|         |                |           | 09223-50010 |   |    |    |    |    |    |    |    |    | B<br>(Crankshaft Front Oil Seal Replacer)        |
|         |                |           | 09228-07500 |   |    |    |    |    |    |    |    |    | A<br>(Oil Filter Wrench)                         |
|         |                |           |             |                                                                                      |    |    |    |    |    |    |    |    | Camshaft oil seal                                |

SST (SPECIAL SERVICE TOOLS) (Cont'd)

| Section                                                                               |                                                                  |   |   |   |  |   |   |   |   |   |                                                                   |
|---------------------------------------------------------------------------------------|------------------------------------------------------------------|---|---|---|--|---|---|---|---|---|-------------------------------------------------------------------|
| Classification                                                                        |                                                                  |   |   |   |  |   |   |   |   |   |                                                                   |
| Part Name                                                                             |                                                                  |   |   |   |  |   |   |   |   |   |                                                                   |
| Part No.                                                                              |                                                                  |   |   |   |  |   |   |   |   |   |                                                                   |
| Illustration                                                                          |                                                                  |   |   |   |  |   |   |   |   |   |                                                                   |
|    | 09230-00010<br>(Radiator Service Tool Set)                       | B | ● |   |  |   |   |   |   |   |                                                                   |
|    | 09243-00020<br>(Idle Adjusting Screw Wrench)                     | A | ● |   |  |   |   |   |   |   |                                                                   |
|    | 09248-55010<br>(Valve Clearance Adjusting Tool Set)              | A | ● |   |  |   |   |   |   |   |                                                                   |
|    | 09266-41045<br>(Injection Measuring Tool Set)                    | B |   | ● |  |   |   |   |   |   |                                                                   |
|    | 09266-45012<br>(EFI Fuel Pressure Gauge)                         | A |   | ● |  |   |   |   |   |   |                                                                   |
|    | 09276-54012<br>(Drive Shaft Holding Tool)                        | A | ● |   |  |   |   |   |   |   | Camshaft timing pulley                                            |
|    | 09285-76010<br>(Injection Pump Camshaft Bearing Cone Replacer)   | C |   |   |  | ● | ● | ● | ● | ● | *1 Starter front bearing for 1.0 kW only<br>*2 Rotor rear bearing |
|    | 09286-46011<br>(Injection Pump Spline Shaft Puller)              | C |   |   |  |   |   |   | ● | ● | *1 Starter bearing<br>*2 Rectifier and frame                      |
|   | 09306-55010<br>(Oil Seal Puller)                                 | A | ● |   |  |   |   |   |   |   |                                                                   |
|  | 09330-00021<br>(Companion Flange Holding Tool)                   | A | ● |   |  |   |   |   |   |   |                                                                   |
|  | 09504-35010<br>(Differential Drive Pinion Rear Bearing Replacer) | B | ● |   |  |   |   |   |   |   | Crankshaft front oil seal                                         |
|  | 09606-20012<br>(Front Hub & Drive Pinion Bearing Tool Set)       | B |   |   |  |   |   |   |   | ● |                                                                   |
|  | (Replacer)                                                       |   |   |   |  |   |   |   |   | ● | Rotor front bearing                                               |
|  | 09631-22020<br>(Power Steering Hose Nut 14 x 17 Wrench Set)      | A |   | ● |  |   |   |   |   |   | Fuel line flare nut                                               |

SST (SPECIAL SERVICE TOOLS) (Cont'd)

| Section                                                                            |                                                       |   |   |   |  |  |  |  |  |   |                                 |
|------------------------------------------------------------------------------------|-------------------------------------------------------|---|---|---|--|--|--|--|--|---|---------------------------------|
| Classification                                                                     |                                                       |   |   |   |  |  |  |  |  |   |                                 |
| Part Name                                                                          |                                                       |   |   |   |  |  |  |  |  |   |                                 |
| Part No.                                                                           |                                                       |   |   |   |  |  |  |  |  |   |                                 |
| Illustration                                                                       |                                                       |   |   |   |  |  |  |  |  |   |                                 |
|  | 09814-20010<br>(Outer Rear View Mirror Wrench)        | C |   | ● |  |  |  |  |  |   | Cold start injector time switch |
|  | 09820-00021<br>(Alternator Rear Bearing Puller)       | B |   |   |  |  |  |  |  | ● |                                 |
|  | 09820-83010<br>(Alternator Pulley Set Nut Wrench Set) | B |   |   |  |  |  |  |  | ● |                                 |
|  | 09842-30060<br>(Wiring "A" EFI Inspection)            | B |   | ● |  |  |  |  |  |   |                                 |
|  | 09842-30060<br>(Wiring "E" EFI Inspection)            | B |   | ● |  |  |  |  |  |   |                                 |
|  | 09823-00018<br>(Hexagon Wrench)                       | B | ● |   |  |  |  |  |  |   |                                 |
|  | 09950-20017<br>(Universal Puller)                     | B | ● |   |  |  |  |  |  |   |                                 |
|  | 09992-00241<br>(Turbocharger Pressure Gauge)          | C |   | ● |  |  |  |  |  |   | 7M-GTE                          |

SSM (SPECIAL SERVICE MATERIALS)

| Part Name                                    |  | Part No.    |  | Sec. |  | Use etc.                                                                                                                                                               |  |
|----------------------------------------------|--|-------------|--|------|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Seal packing or equivalent                   |  | 08826-00080 |  | EM   |  | Over the space between the timing belt case and cylinder block<br>Cylinder head x No. 1 and No. 2<br>Cylinder head cover<br>Cylinder head x No. 1 camshaft bearing cap |  |
| Adhesive 1324, Three bond 1324 or equivalent |  | 08833-00070 |  | LU   |  | Engine oil pan                                                                                                                                                         |  |
|                                              |  |             |  | EM   |  | Timing belt case mounting bolt (10 mm)                                                                                                                                 |  |

# STARTING SYSTEM

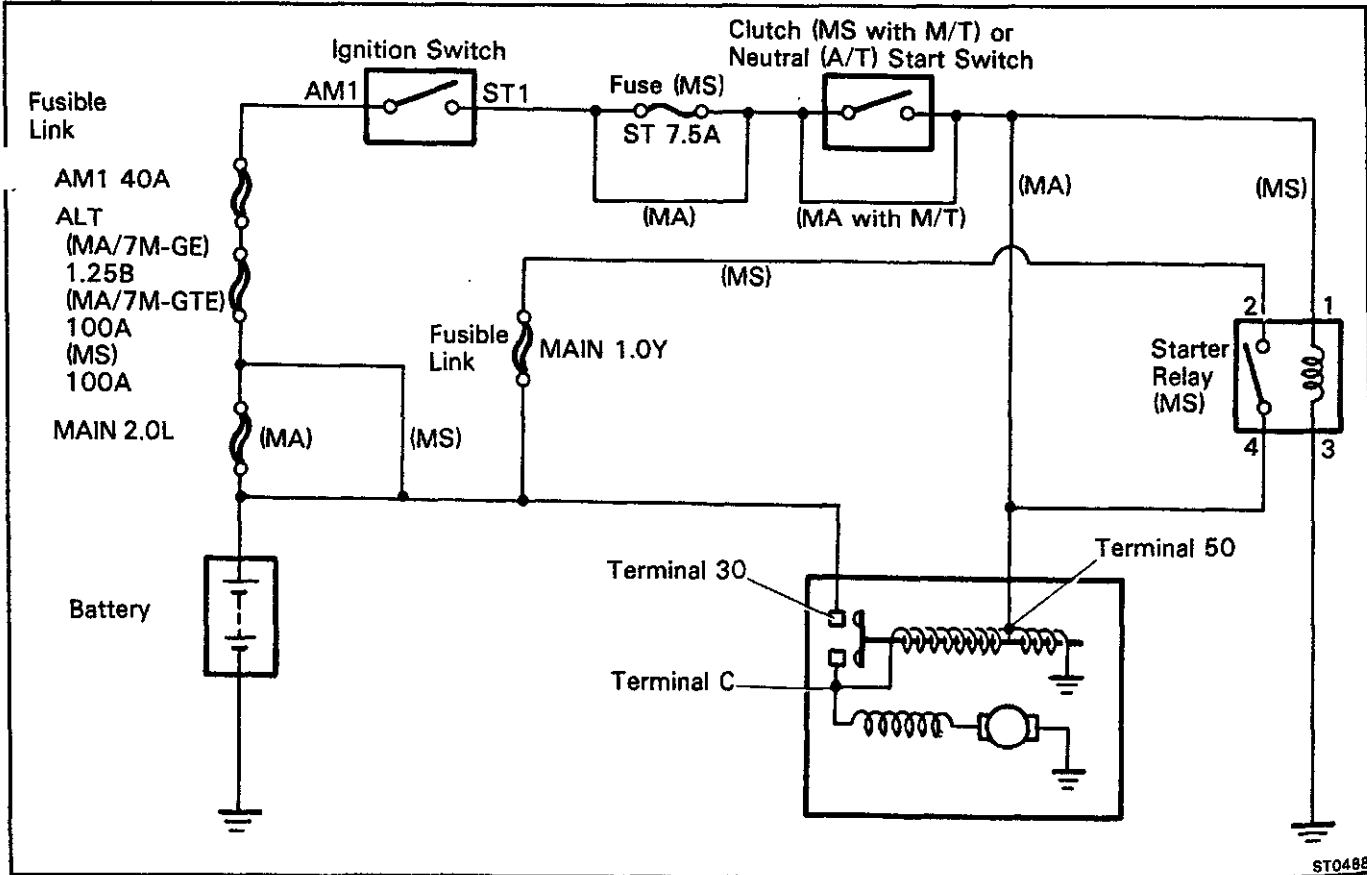
|                               | Page  |
|-------------------------------|-------|
| TROUBLESHOOTING .....         | ST-2  |
| STARTING SYSTEM CIRCUIT ..... | ST-2  |
| STARTER .....                 | ST-3  |
| STARTER RELAY (MS) .....      | ST-13 |

**ST**

TROUBLESHOOTING

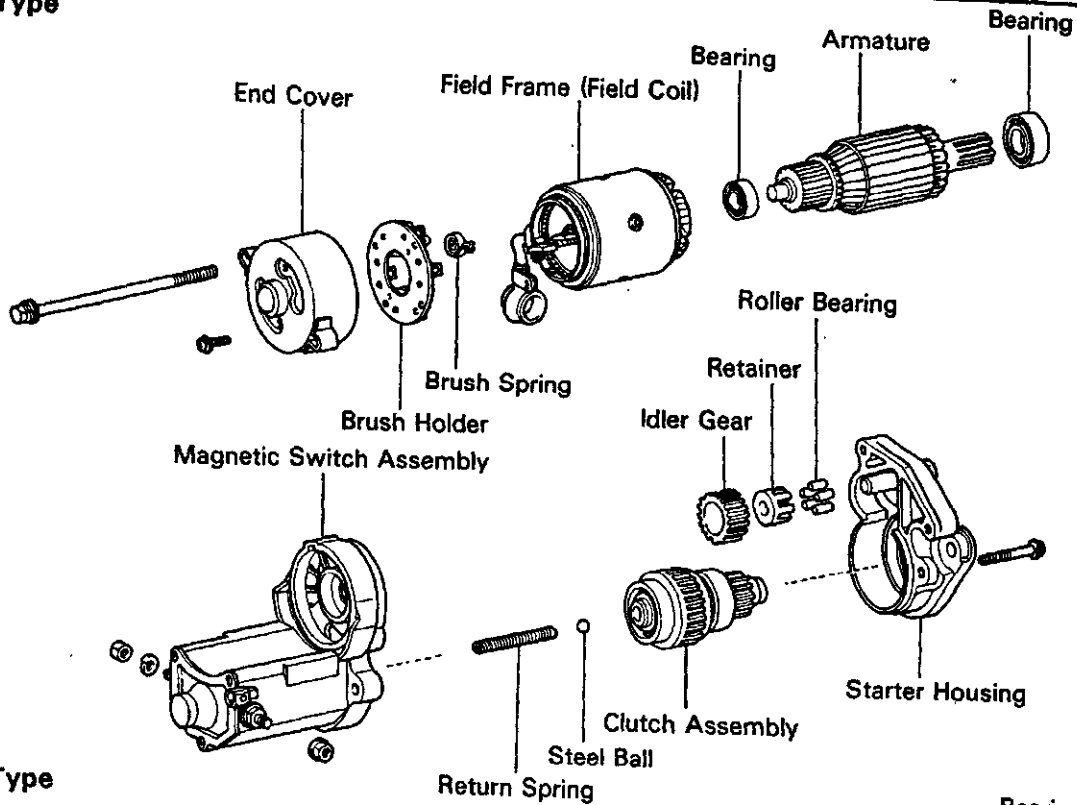
| Problem                               | Possible cause                                                                                                                                                                       | Remedy                                                                                                                                   | Page |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|------|
| Engine will not crank                 | Battery charge low                                                                                                                                                                   | Check battery specific gravity<br>Charge or replace battery                                                                              | CH-3 |
|                                       | Battery cables loose, corroded or worn<br>Neutral start switch faulty (A/T only)<br>Fusible link blown<br>Starter relay faulty (MS only)<br>Starter faulty<br>Ignition switch faulty | Repair or replace cables<br>Replace switch<br>Replace fusible link<br>Replace starter relay<br>Repair starter<br>Replace ignition switch | ST-3 |
| Engine cranks slowly                  | Battery charge low                                                                                                                                                                   | Check battery specific gravity<br>Charge or replace battery                                                                              | CH-3 |
|                                       | Battery cables loose, corroded or worn<br>Starter faulty                                                                                                                             | Repair or replace cables<br>Repair starter                                                                                               | ST-3 |
| Starter keeps running                 | Starter faulty<br>Ignition switch faulty<br>Short in wiring                                                                                                                          | Repair starter<br>Replace ignition switch<br>Repair wiring                                                                               | ST-3 |
|                                       |                                                                                                                                                                                      |                                                                                                                                          |      |
| Starter spins – engine will not crank | Pinion gear teeth broken or faulty starter<br>Flywheel teeth broken                                                                                                                  | Repair starter<br>Replace flywheel                                                                                                       | ST-3 |
|                                       |                                                                                                                                                                                      |                                                                                                                                          |      |

STARTING SYSTEM CIRCUIT

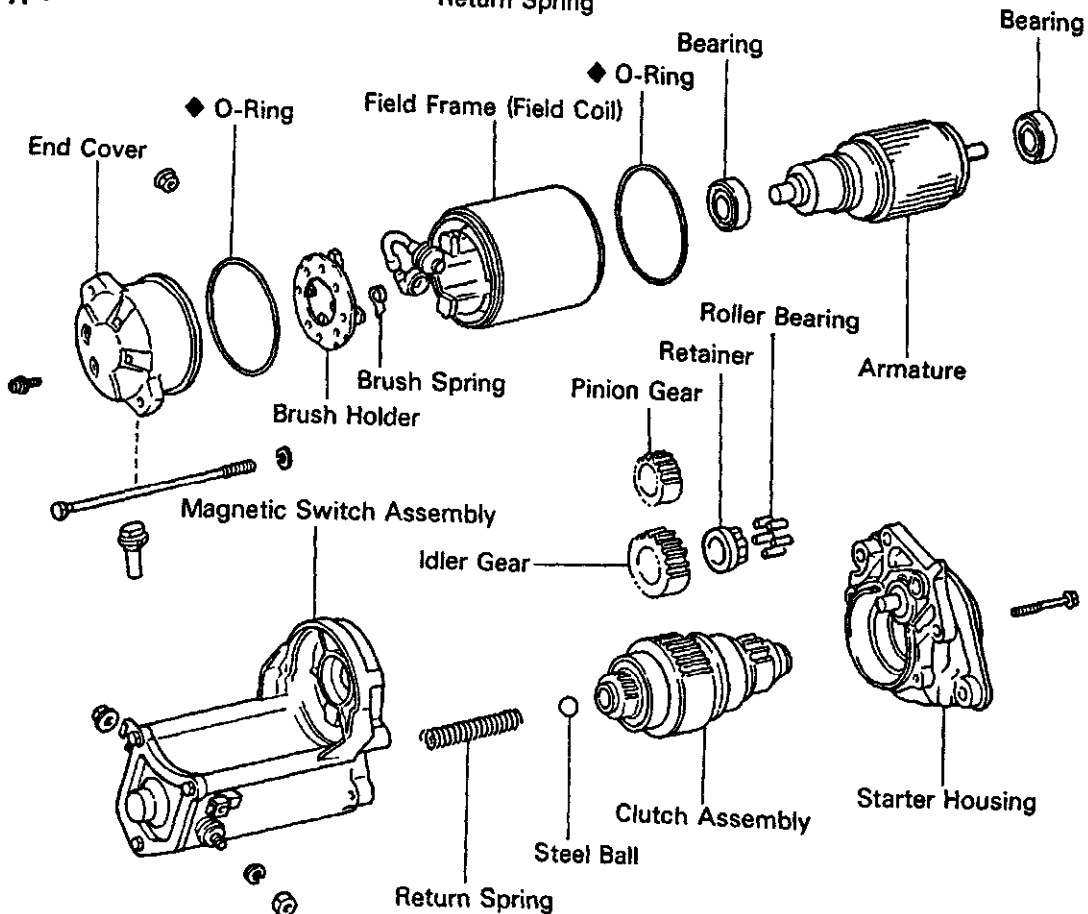


# STARTER COMPONENTS

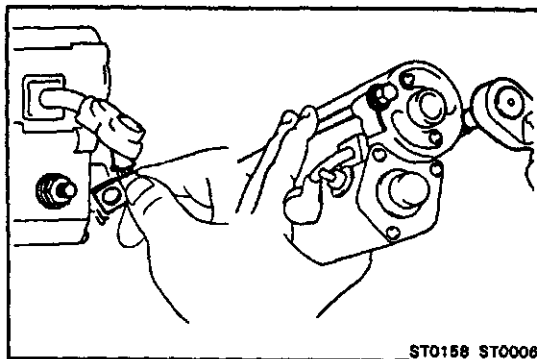
## 1.0 kW Type



## 1.4 kW Type



◆ Non-reusable part

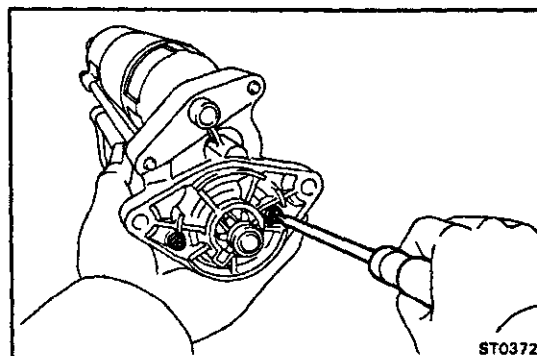


## DISASSEMBLY OF STARTER

(See page ST-3)

### 1. REMOVE FIELD FRAME WITH ARMATURE FROM MAGNETIC SWITCH ASSEMBLY

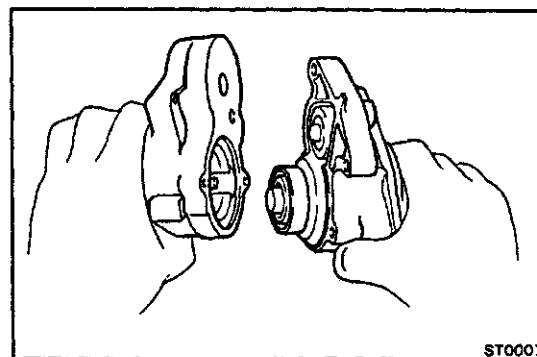
- (a) Remove the nut, and disconnect the lead wire from the magnetic switch terminal.
- (b) Remove the two through bolts. Pull out the field frame with the armature from the magnetic switch assembly.
- (c) Remove the O-ring. (1.4 kw type only)



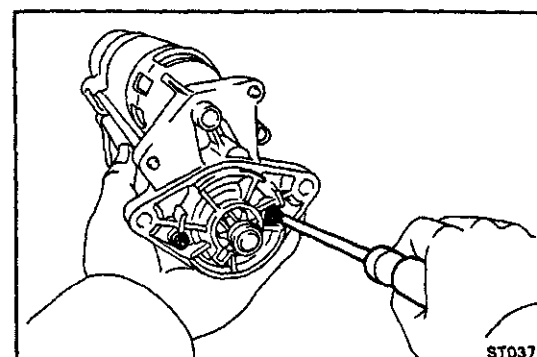
### 2. REMOVE STARTER HOUSING FROM MAGNETIC SWITCH ASSEMBLY

(1.0 kW type)

- (a) Remove the two screws

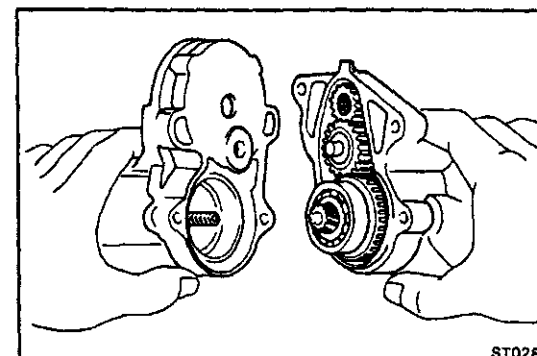


- (b) Remove the starter housing with the idler gear, bearing and clutch assembly.

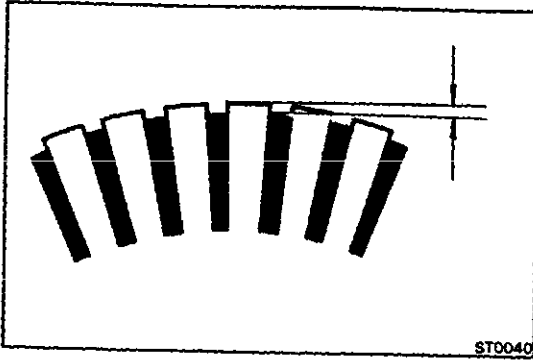


(1.4 kW type)

- (a) Remove the two screws



- (b) Remove the starter housing with the pinion gear, idler gear, bearing and clutch assembly.



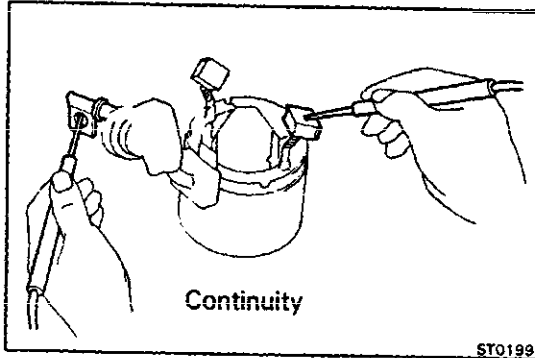
#### 4. INSPECT UNDERCUT DEPTH OF SEGMENT

Check that the undercut depth is clean and free of foreign materials. Smooth out the edge.

Standard undercut depth: 0.6 mm (0.024 in.)

Minimum undercut depth: 0.2 mm (0.008 in.)

If the undercut depth is less than minimum, correct it with a hacksaw blade.

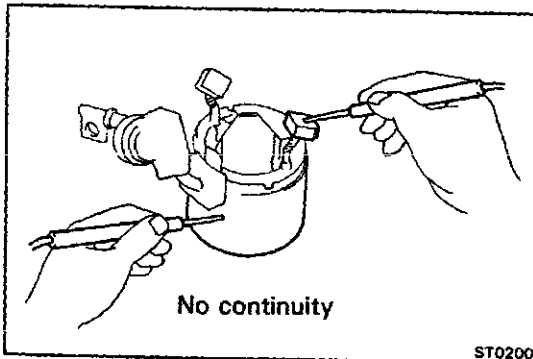


#### Field Frame (Field Coil)

##### 1. INSPECT FIELD COIL FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the lead wire and field coil brush lead.

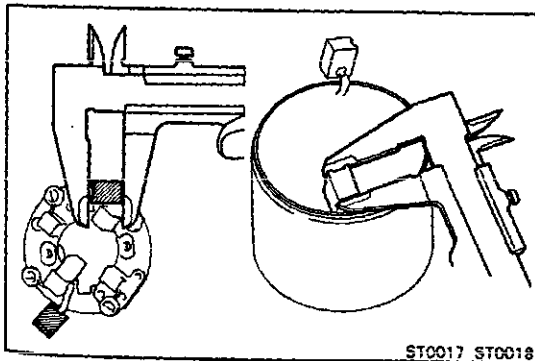
If there is no continuity, replace the field frame.



##### 2. INSPECT THAT FIELD COIL IS NOT GROUNDED

Using an ohmmeter, check that there is no continuity between the field coil end and field frame.

If there is continuity, repair or replace the field frame.



#### Brushes

##### INSPECT BRUSH LENGTH

Using vernier calipers, measure the brush length.

Standard length:

1.0 kW type 13.5 mm (0.531 in.)

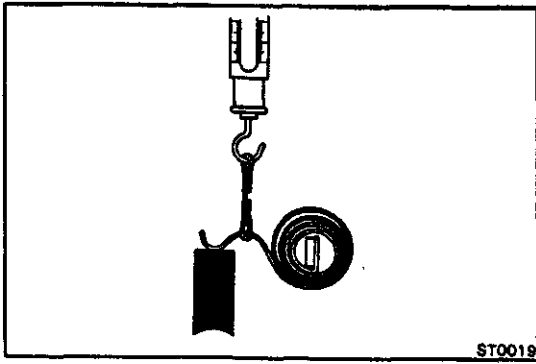
1.4 kW type 15.5 mm (0.610 in.)

Minimum length:

1.0 kW type 8.5 mm (0.335 in.)

1.4 kW type 10.0 mm (0.394 in.)

If the length is less than minimum, replace the brush holder and field frame.



## Brush Springs

### INSPECT BRUSH SPRING LOAD

Take the pull scale reading the instant the brush spring separates from the brush.

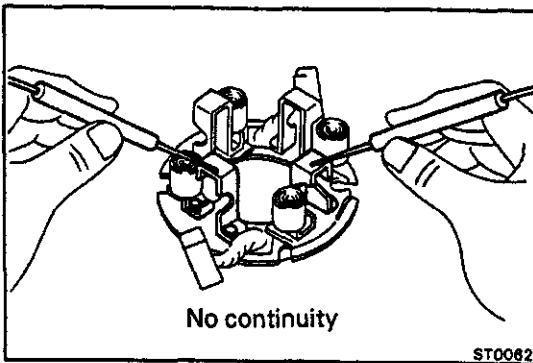
**Standard installed load:**

1.785 – 2.415 kg (3.9 – 5.3 lb, 18 – 24 N)

**Minimum installed load:**

1.2 kg (2.6 lb, 12 N)

If the installed load is less than minimum, replace the brush springs.



## Brush Holder

### INSPECT INSULATION OF BRUSH HOLDER

Using an ohmmeter, check that there is no continuity between the positive (+) and negative (–) brush holders.

If there is continuity, repair or replace the brush holder.

## Clutch and Gears

### 1. INSPECT GEAR TEETH

Check the gear teeth on the pinion gear, idler gear and clutch assembly for wear or damage.

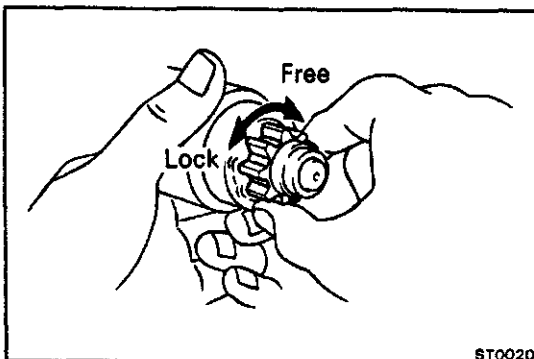
If damaged, replace the gear or clutch assembly.

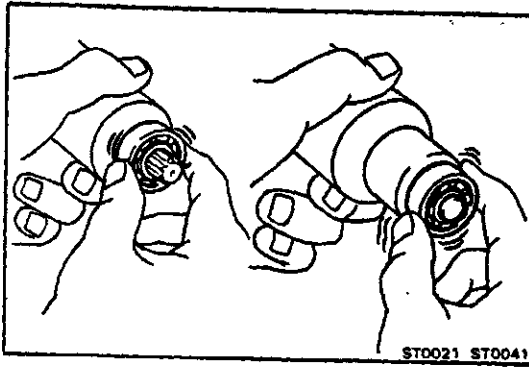
If damaged, also check the flywheel ring gear for wear or damage.

### 2. INSPECT CLUTCH

Rotate the clutch pinion gear clockwise and check that it turns freely. Try to rotate the clutch pinion gear counterclockwise and check that it locks.

If necessary, replace the clutch assembly.

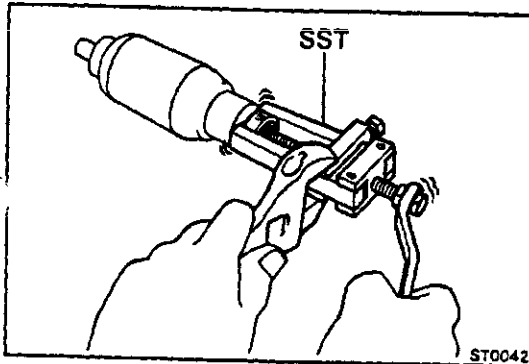




## Bearings

### 1. INSPECT BEARINGS

Turn each bearing by hand while applying inward force. If resistance is felt or if the bearing sticks, replace the bearing.



### 2. IF NECESSARY, REPLACE BEARINGS

(a) Using SST, remove the bearing.

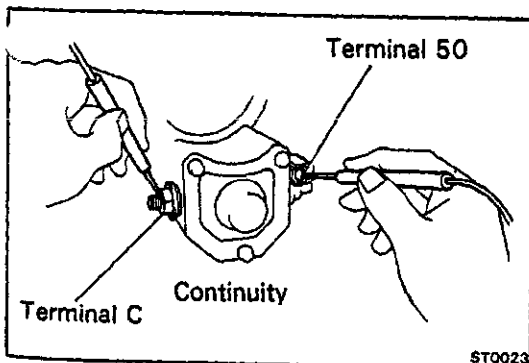
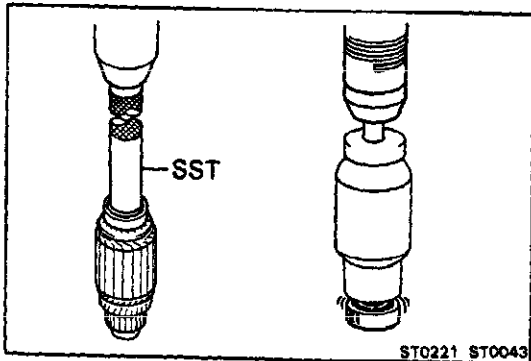
SST 09286-46011

(b) Using SST and a press, press in a new front bearing.

SST 1.0 kw type 09285-76010

1.4 kw type 09201-41020

(c) Using a press, press in a new rear bearing.

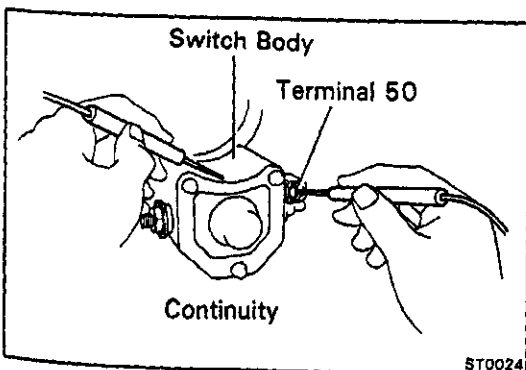


## Magnetic Switch

### 1. PERFORM PULL-IN COIL OPEN CIRCUIT TEST

Using an ohmmeter, check that there is continuity between terminal 50 and C.

If there is no continuity, replace the magnetic switch assembly.



### 2. PERFORM HOLD-IN COIL OPEN CIRCUIT TEST

Using an ohmmeter, check that there is continuity between terminal 50 and the switch body.

If there is no continuity, replace the magnetic switch assembly.

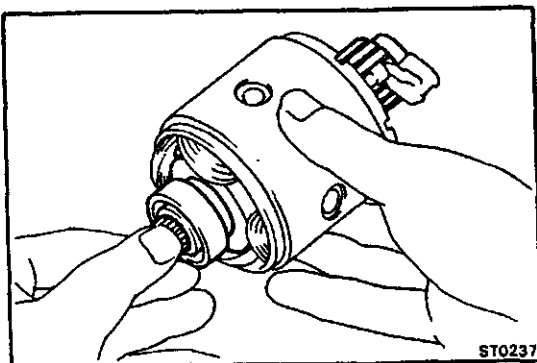
## ASSEMBLY OF STARTER

(See page ST-3)

**NOTE:** Use high-temperature grease to lubricate the bearings and gears when assembling the starter.

### 1. PLACE ARMATURE INTO FIELD FRAME

Apply grease to the armature bearings and insert the armature into the field frame.



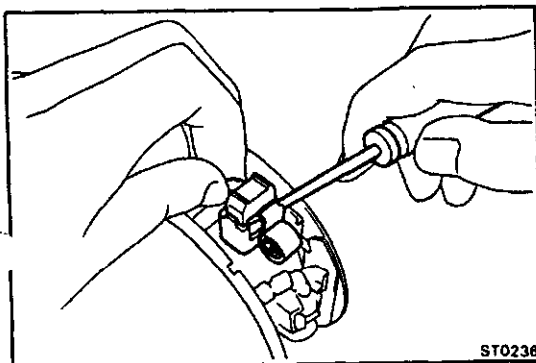
ST0237

### 2. INSTALL BRUSH HOLDER

- (a) Using a screwdriver, hold the brush spring back, and connect the brush into the brush holder. Connect the four brushes.

**NOTE:** Check that the positive (+) lead wires are not grounded.

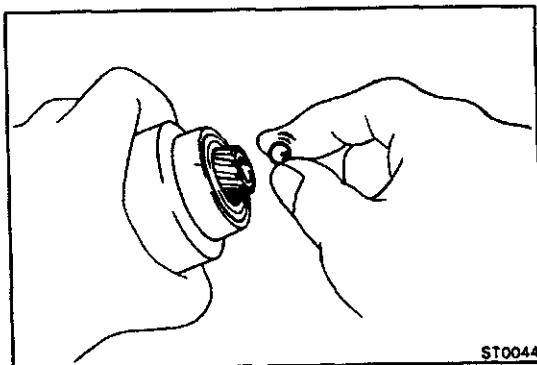
- (b) Place a new O-ring on the field frame.(1.4 kW type only)
- (c) Install the end cover to the field frame.



ST0238

### 3. INSERT STEEL BALL INTO CLUTCH SHAFT HOLE

- (a) Apply grease to the steel ball.
- (b) Insert the steel ball into the clutch shaft hole.

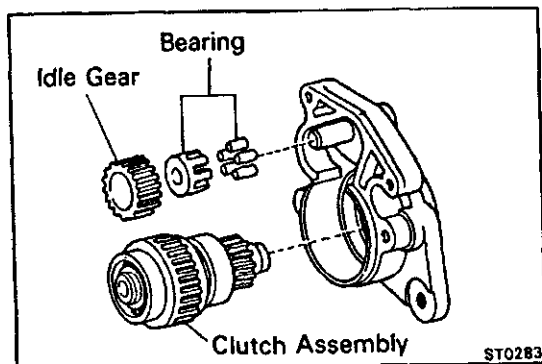


ST0044

### 4. INSTALL GEARS AND CLUTCH ASSEMBLY

(1.0 kW type)

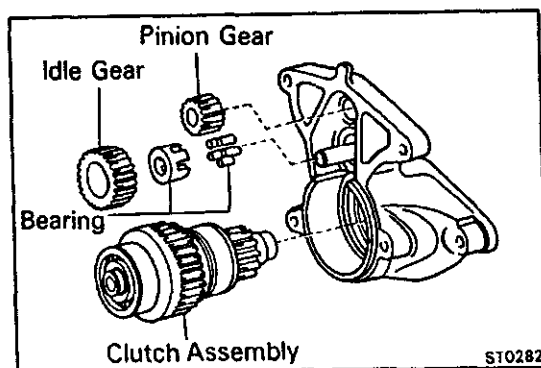
- (a) Apply grease to the gear and clutch assembly.
- (b) Place the clutch assembly, idler gear and bearing in the starter housing.



ST0283

(1.4 kW type)

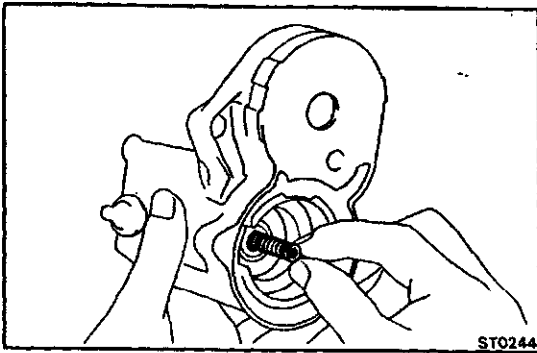
- (a) Apply grease to the gears and clutch assembly.
- (b) Place the clutch assembly, idler gear, bearing and pinion gear in the starter housing.



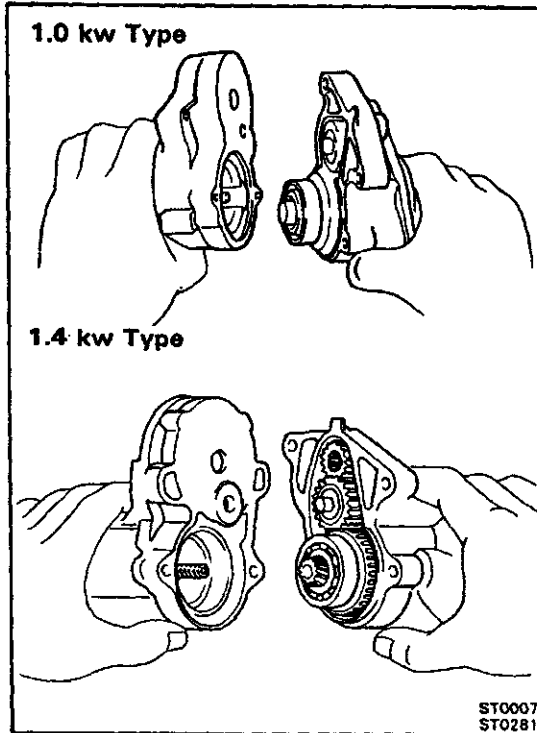
ST0282

**5. INSTALL STARTER HOUSING**

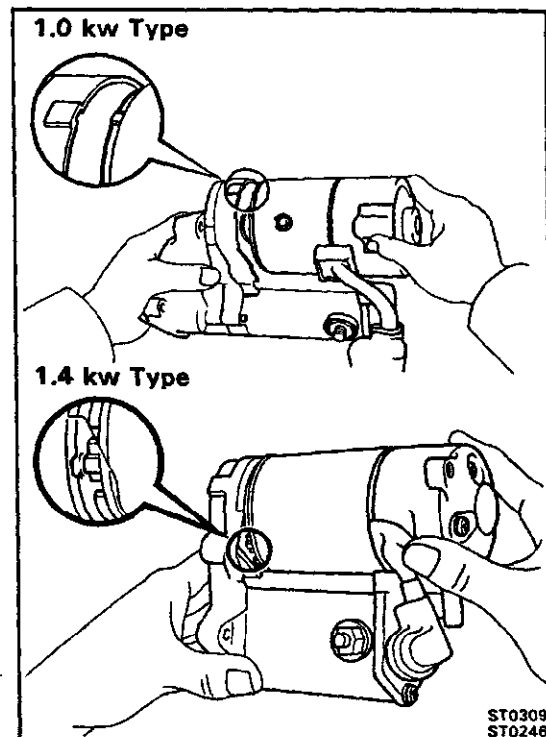
- (a) Apply grease to the return spring.
- (b) Insert the return spring into the magnetic switch hole.

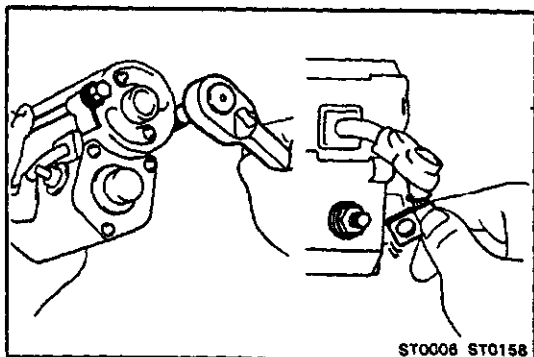


- (c) Place the starter housing on the magnetic switch and insert the two screws.

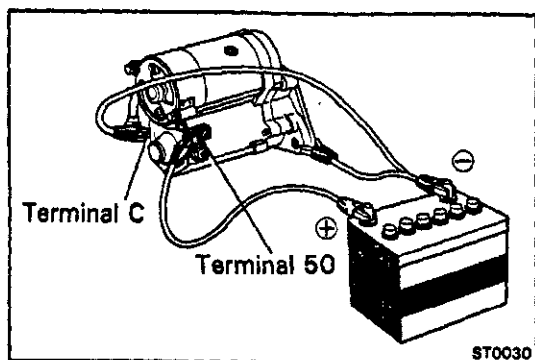
**6. INSTALL FIELD FRAME WITH ARMATURE TO MAGNETIC SWITCH ASSEMBLY**

- (a) Place a new O-ring on the field frame. (1.4 kW type only)
- (b) Align the protrusion of the field frame with the cutout of the magnetic switch.





- (c) Install the two through bolts.
- (d) Connect the lead wire to the magnetic switch terminal C, and install the nut.



## PERFORMANCE TEST OF STARTER

**CAUTION:** These tests must be performed within 3 to 5 seconds to avoid burning out the coil.

### 1. PERFORM PULL-IN TEST

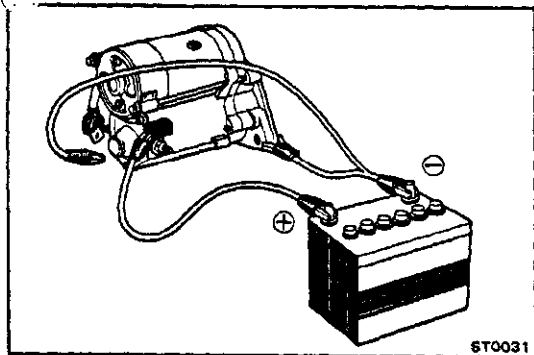
- (a) Disconnect the field coil lead wire from terminal C.
- (b) Connect the battery to the magnetic switch as shown. Check that the clutch pinion gear moves outward.

If the clutch pinion gear does not move, replace the magnetic switch assembly.

### 2. PERFORM HOLD-IN TEST

While connected as above with the clutch pinion gear out, disconnect the negative (–) lead from terminal C. Check that the pinion gear remains out.

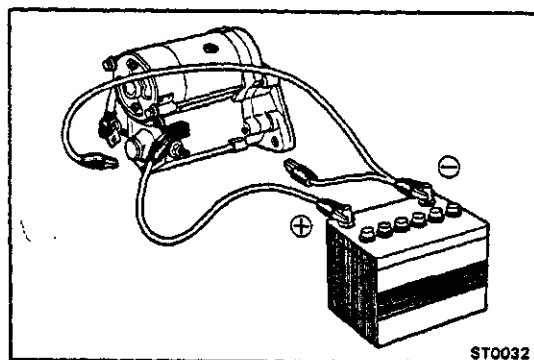
If the clutch pinion gear returns inward, replace the magnetic switch assembly.



### 3. INSPECT CLUTCH PINION GEAR RETURN

Disconnect the negative (–) lead from the switch body. Check that the clutch pinion gear returns inward.

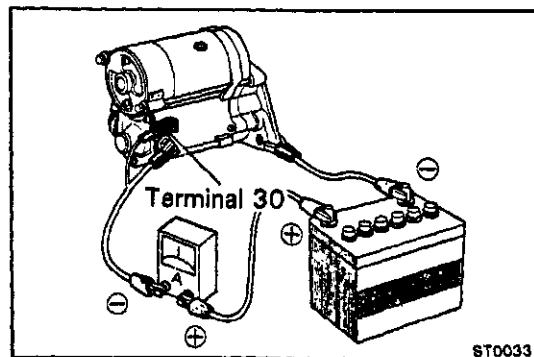
If the clutch pinion gear does not return, replace the magnetic switch assembly.



### 4. PERFORM NO-LOAD PERFORMANCE TEST

- (a) Connect the battery and ammeter to the starter as shown.
- (b) Check that the starter rotates smoothly and steadily with the pinion gear moving out. Check that the ammeter reads the specified current.

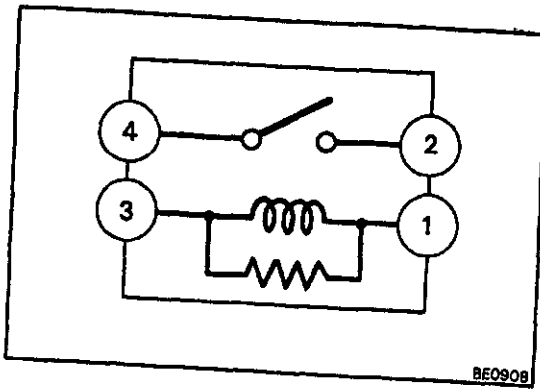
**Specified current: 90A or less at 11.5 V**



## STARTER RELAY (MS)

### INSPECTION OF STARTER RELAY

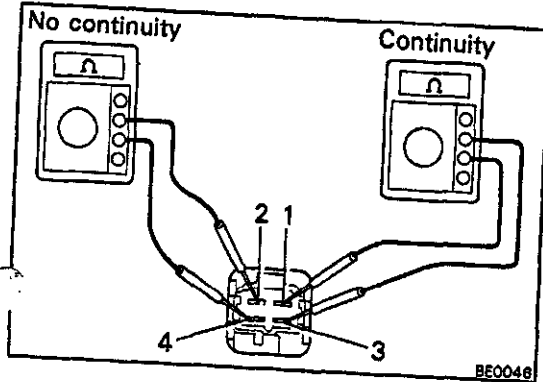
LOCATION: In the No. 2 relay block of the engine compartment.



#### 1. INSPECT RELAY CONTINUITY

- Using an ohmmeter, check that there is continuity between terminals 1 and 3.
- Check that there is no continuity between terminals 2 and 4.

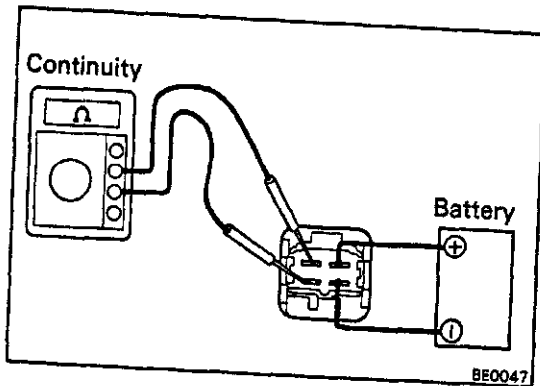
If continuity is not as specified, replace the relay.



#### 2. INSPECT RELAY OPERATION

- Apply battery voltage across terminals 1 and 3.
- Using an ohmmeter, check that there is continuity between terminals 2 and 4.

If operation is not as specified, replace the relay.

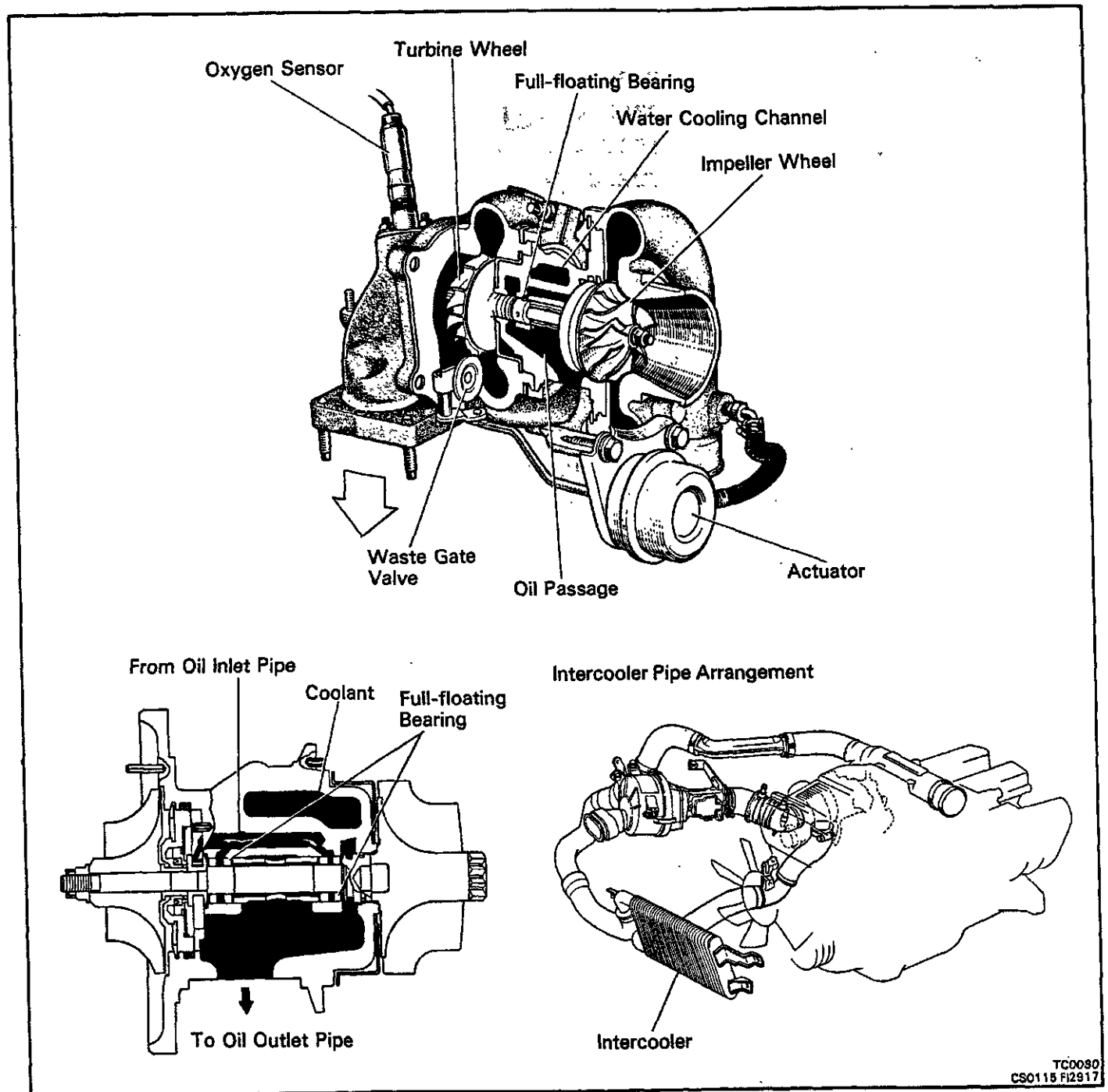


# TURBOCHARGER SYSTEM

|                       | Page |
|-----------------------|------|
| DESCRIPTION .....     | TC-2 |
| PRECAUTIONS .....     | TC-4 |
| TROUBLESHOOTING ..... | TC-5 |
| TURBOCHARGER .....    | TC-7 |

**T**

## DESCRIPTION



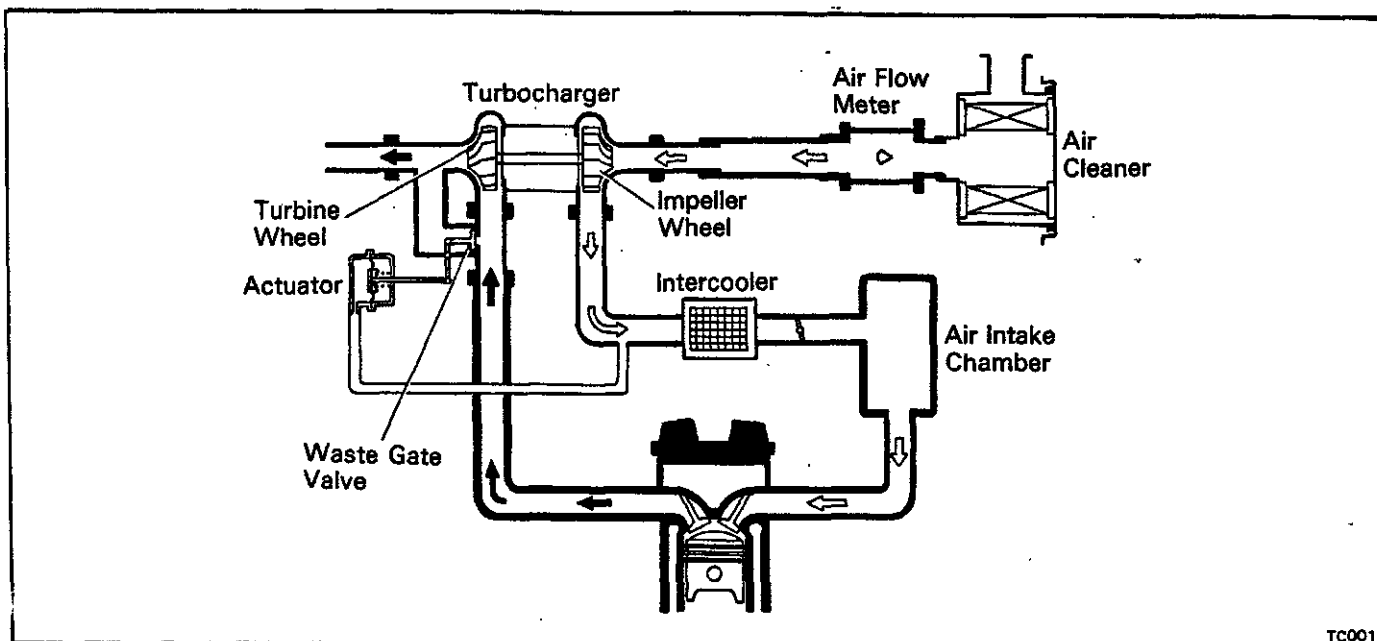
TC0090  
CS0115 FI2917

The turbocharger is a device which increases engine output by sending a greater amount of air-fuel mixture to the engine than under normal conditions. Engine output depends upon the amount of the air-fuel mixture ignited per unit of time. Therefore, to increase engine output, the most effective method is to send a greater amount of air-fuel mixture into the cylinder.

In other words, by installing a special turbocharger and providing more air-fuel mixture

than usual, engine output can be increased by increasing the average combustion pressure without increasing the engine speed.

Superchargers are either turbocharger type (using exhaust gas to turn the turbine) or supercharger type (using the engine crankshaft, etc. to mechanically turn the pump, etc.). For the Supra 7M-GTE engine, the turbocharger type has been adopted.



## Operation of the Turbocharger

Exhaust gas acts on the turbine wheel inside the turbine housing, causing it to revolve. When the turbine wheel revolves, the impeller wheel which is located on the same shaft also revolves, compressing the intake air which has passed through the air flow meter from the air cleaner. When expelled from the compressor housing the compressed air is supplied to the cylinders. When the engine speed increases, the exhaust gas volume increases and the turbine wheel revolutions increase (approx. 20,000 rpm – 110,000 rpm), thus the turbocharged air pressure grows greater and engine output increases.

## Intercooler

The intercooler cools the turbocharged air (intake air) put out by the turbocharger, thereby increasing the air density. As the air intake efficiency increases, the gas temperature in the combustion chamber falls and the occurrence of knocking is suppressed, giving an increase in engine output.

The Supra 7M-GTE intercooler is an air cooling type located at the front of the vehicle, utilizing the vehicle windstream to cool the turbocharged air.

## Waste Gate Valve

Although on the one hand high output is achieved by turbocharging, if the turbocharged air pressure becomes too high, knocking occurs and on the contrary, a reduction in engine output is caused. If the turbocharged air pressure exceeds the prescribed air pressure, the flow of exhaust gas bypasses the turbine, controlling turbine wheel revolutions and turbocharge air pressure. This bypass valve which controls the quantity of exhaust gas flowing to the turbine is called the waste gate valve.

When the supercharged air pressure exceeds the prescribed pressure, the actuator operates, the waste gate valve opens and part of the exhaust gas by-passes the turbine. This causes a drop in the turbine revolution rate and controls the supercharged air within the prescribed limits.

## PRECAUTIONS

1. Do not stop the engine immediately after pulling a trailer or high speed or uphill driving. Idle the engine 20 – 120 seconds, depending on the severity of the driving condition.
2. Avoid sudden racing or acceleration immediately after starting a cold engine.
3. If the engine is run with the air cleaner removed, foreign material entering will damage the wheels which run at extremely high speed.
4. If the turbocharger is defective and must be replaced, first check for the cause of the defect in reference to the following items and replace parts if necessary:
  - Engine oil level and quality
  - Conditions under which the turbocharger was used
  - Oil lines leading to the turbocharger

5. Use caution when removing and reinstalling the turbocharger assembly. Do not drop it or bang it against anything or grasp it by easily-deformed parts, such as the actuator or rod, when moving it.

6. Before removing the turbocharger, plug the intake and exhaust ports and oil inlet to prevent entry of dirt or other foreign material.

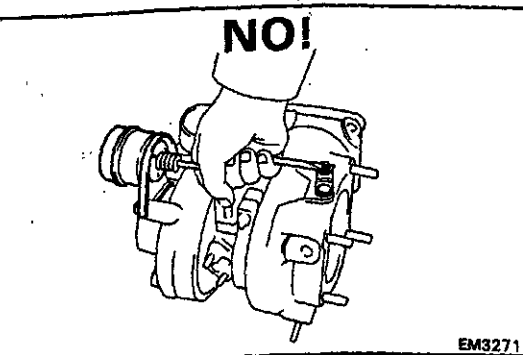
7. If replacing the turbocharger, check for accumulation of sludge particles in the oil pipes and, if necessary, replace the oil pipes.

8. Completely remove the gasket adhered to the lubrication oil pipe flange and turbocharger oil flange.

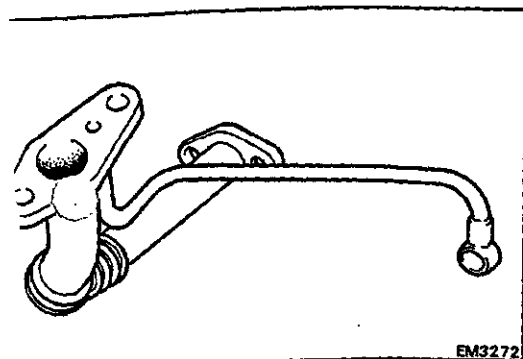
9. If replacing bolts or nuts, do so only with the specified new ones to guard against breakage or deformation.

10. If replacing the turbocharger, put 20 cc (1.2 cu in.) of oil into the turbocharger oil inlet and turn the impeller wheel by hand to spread oil to the bearing.

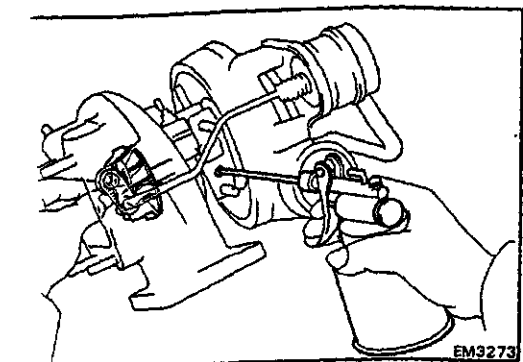
11. If overhauling or replacing the engine, cut the fuel supply after reassembly and crank the engine for 30 seconds to distribute oil throughout the engine. Then allow the engine to idle for 60 seconds.



EM3271



EM3272



EM3273

## TROUBLESHOOTING

NOTE: Before troubleshooting the turbocharger, first check the engine itself. (Valve clearance, engine compression, ignition timing etc.)

### INSUFFICIENT ACCELERATION, LACK OF POWER OR EXCESSIVE FUEL CONSUMPTION

#### (Possible Cause)

#### (Check Procedure and Correction Method)

#### 1. TURBOCHARGING PRESSURE TOO LOW

Check turbocharging pressure. (See page TC-8)

Turbocharging pressure:

M/T 0.39 — 0.53 kg/cm<sup>2</sup>  
(5.5 — 7.5 psi, 38 — 52 kPa)

A/T 0.34 — 0.42 kg/cm<sup>2</sup>  
(4.8 — 6.0 psi, 33 — 41 kPa)

If the pressure is below specification, begin diagnosis from item 2.

#### 2. RESTRICTED INTAKE AIR SYSTEM

Check intake air system, and repair or replace parts as necessary. (See page TC-7)

#### 3. LEAK IN INTAKE AIR SYSTEM

Check intake air system, and repair or replace parts as necessary. (See page TC-7)

#### 4. RESTRICTED EXHAUST SYSTEM

Check exhaust system, and repair or replace parts as necessary. (See page TC-7)

#### 5. LEAK IN EXHAUST SYSTEM

Check exhaust system, and repair or replace parts as necessary. (See page TC-7)

#### 6. ERRATIC TURBOCHARGER OPERATION

Check rotation of impeller wheel. If it does not turn or turns with a heavy drag, replace the turbocharger assembly.

Check axial play of bearing shaft. (See page TC-14)

Axial play: 0.13 mm (0.0051 in.) or less

If not within specification, replace the turbocharger assembly.

**ABNORMAL NOISE****(Possible Cause)****(Check Procedure and Correction Method)****1. TURBOCHARGER INSULATOR  
RESONANCE**

Check for loose, improperly installed or deformed insulator mount bolts and nuts, and repair or replace as necessary.

**2. EXHAUST PIPE LEAKING OR  
VIBRATING**

Check for exhaust pipe deformation, loose mount bolts or a damaged gasket, and repair or replace as necessary.

**3. ERRATIC TURBOCHARGER  
OPERATION**

Refer to item 6 of INSUFFICIENT ACCELERATION, LACK OF POWER OF EXCESSIVE FUEL CONSUMPTION

**EXCESSIVE OIL CONSUMPTION OR WHITE EXHAUST****(Possible Cause)****(Check Procedure and Correction Method)****FAULTY TURBOCHARGER OIL SEAL**

Check for oil leakage in exhaust system.

- Remove the turbine elbow from the turbocharger and check for excessive carbon deposits on the turbine wheel. Excessive carbon deposits would indicate a faulty turbocharger.

Check for oil leakage in intake air system.

- Check for axial play in impeller wheel, and replace the turbocharger if necessary.  
(See page TC-14)

**Axial play:** 0.13 mm (0.0051 in.) or less

**CAUTION:** Do not mistakenly diagnose ordinary oil mist from the PCV in the blow by gas as an oil leak from the turbocharger.

# TURBOCHARGER

## ON-VEHICLE INSPECTION OF TURBOCHARGER

### 1. INSPECT INTAKE AIR SYSTEM

Check for leakage or clogging between the air cleaner and turbocharger inlet and between the turbocharger outlet and cylinder head.

- Clogged air cleaner .... Clean or replace the element
- Hoses collapsed or deformed .... Repair or replace
- Leakage from connections .... Check each connection and repair
- Cracks in components .... Check and replace

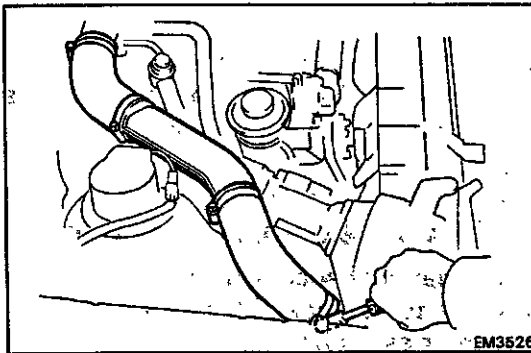
### 2. INSPECT EXHAUST SYSTEM

Check for leakage or clogging between the cylinder head and turbocharger inlet and between the turbocharger outlet and exhaust pipe.

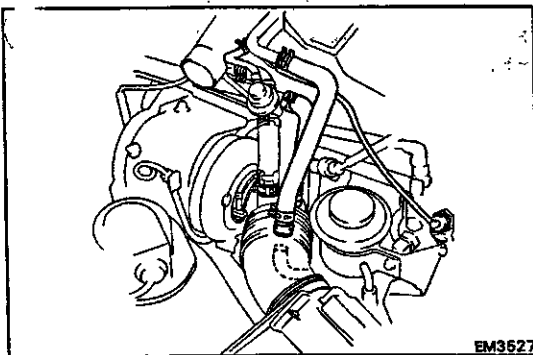
- Deformed components .... Repair or replace
- Foreign material in passages .... Remove
- Leakage from components .... Repair or replace
- Cracks in components .... Check and replace

### 3. INSPECT OPERATION OF ACTUATOR AND WASTE GATE VALVE

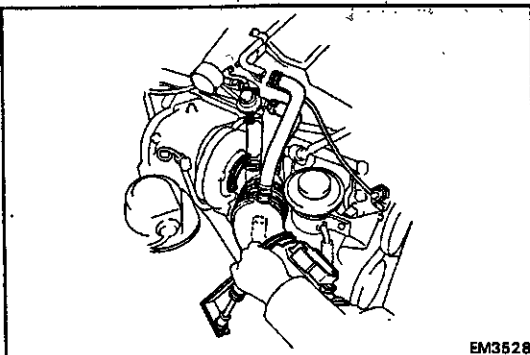
- (a) Remove the No.4 air cleaner pipe with No.1 and No.2 air cleaner hoses.

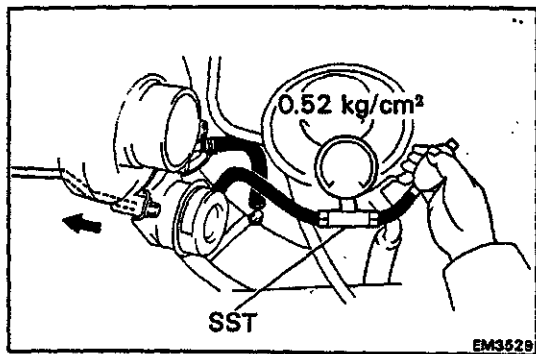


- (b) Disconnect the air hoses.
- (c) Disconnect the air flow meter connector.



- (d) Loosen the clamps and remove the bolt.
- (e) Remove the No.7 air cleaner hose with air flow meter and air cleaner cap.
- (f) Disconnect the PS idle up air hose.





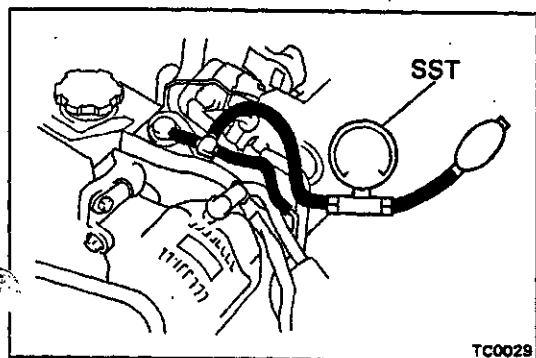
(g) Disconnect the actuator hose.

(h) Using SST (turbocharger pressure gauge), apply approx. 0.52 kg/cm² (7.4 psi, 51 kPa) of pressure to the actuator and check that the rod moves.

SST 09992-00241

If the rod does not move, replace the turbocharger assembly.

**CAUTION:** Never apply more than 0.8 kg/cm² (11.4 psi 78 kPa) of pressure to the actuator.



#### 4. CHECK TURBOCHARGING PRESSURE

(a) Install SST (turbocharger pressure gauge) to the pressure regulator with a three way.

SST 09992-00241

(b) (M/T models)

Accelerate the vehicle with the throttle valve fully open after driving at 3-speed at 1,000 rpm. Measure the turbocharging pressure when the engine speed is over 2,500 rpm.

**Standard pressure:** 0.39 — 0.53 kg/cm²  
(5.5 — 7.5 psi, 38 — 52 kPa)

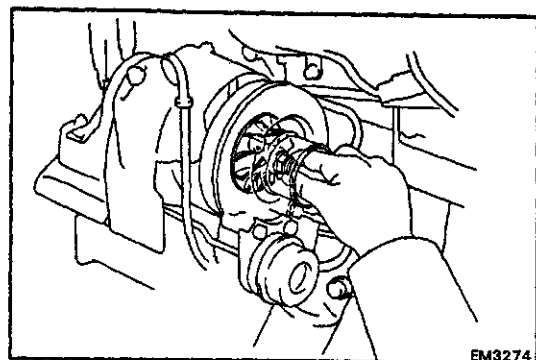
(c) (A/T models)

From a stationary state accelerate the vehicle in "L" range with the throttle valve fully open. Measure the turbocharging pressure when the engine speed is over 3,500 rpm.

**Standard pressure:** 0.34 — 0.42 kg/cm²  
(4.8 — 6.0 psi, 33 — 41 kPa)

If the pressure is less than that specified, check the intake air and exhaust systems for leakage. If there is no leakage, replace the turbocharger assembly.

If the pressure is above specification, check if the actuator hose is disconnected or cracked. If not, replace the turbocharger assembly.



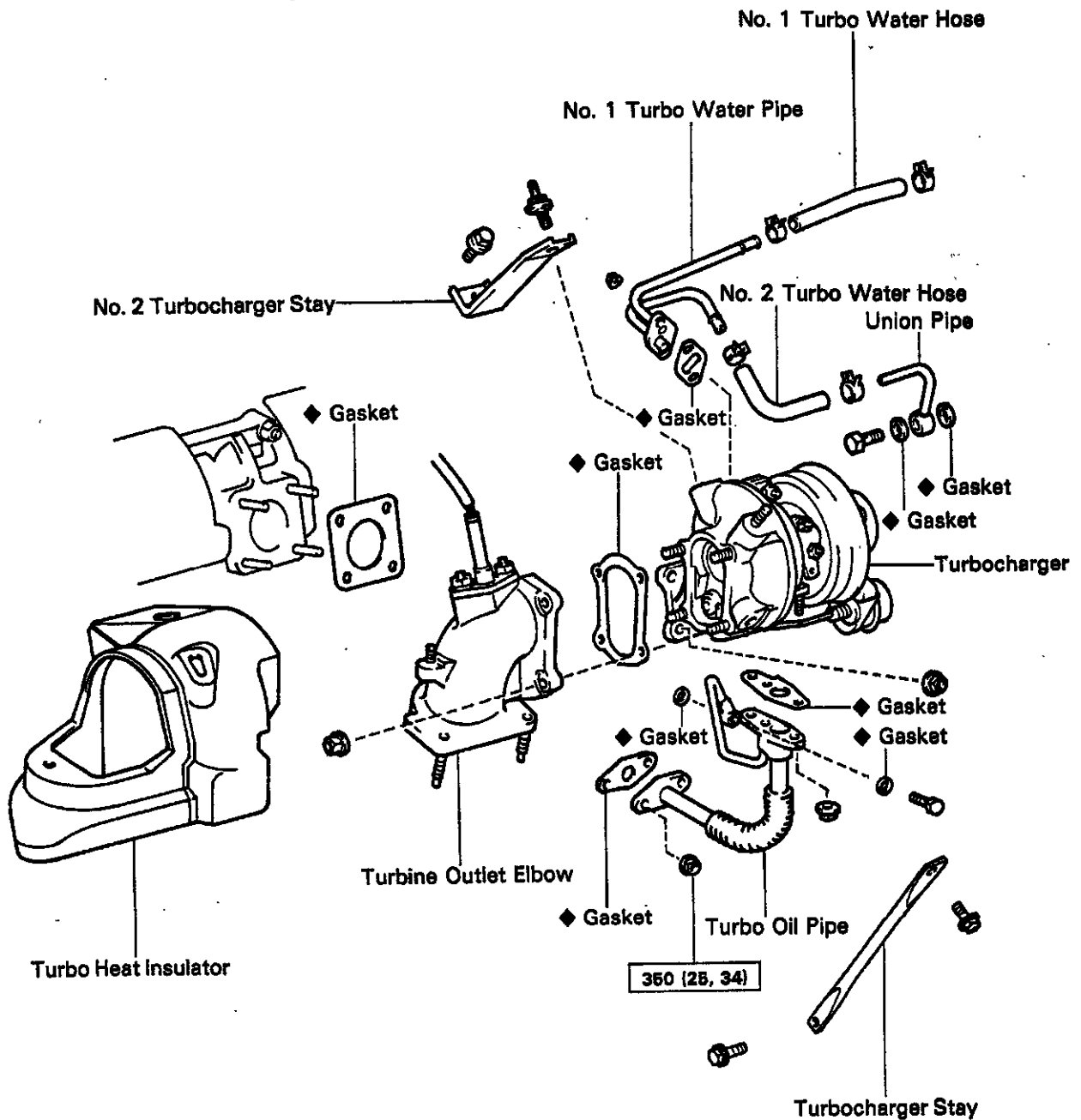
#### 5. INSPECT IMPELLER WHEEL ROTATION

Grasp the edge of the impeller wheel and turn it.

Check that it turns smoothly.

If it does not turn or if it turns with a drag, replace the turbocharger assembly.

## COMPONENTS



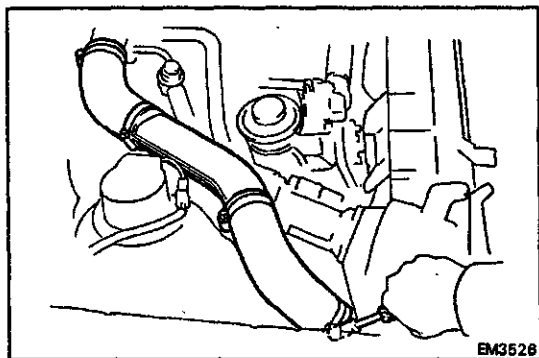
kg-cm (ft-lb, N-m) : Specified torque

◆ Non-reusable part

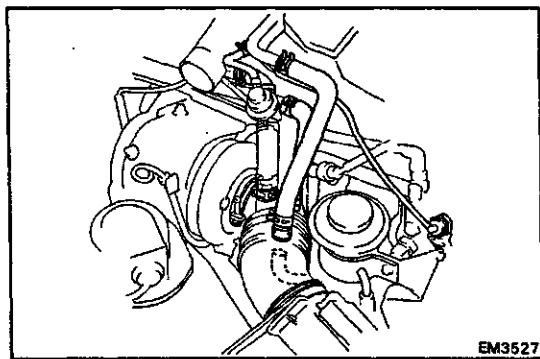
**REMOVAL OF TURBOCHARGER**

(See page TC-9).

1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**
2. **DRAIN COOLANT**

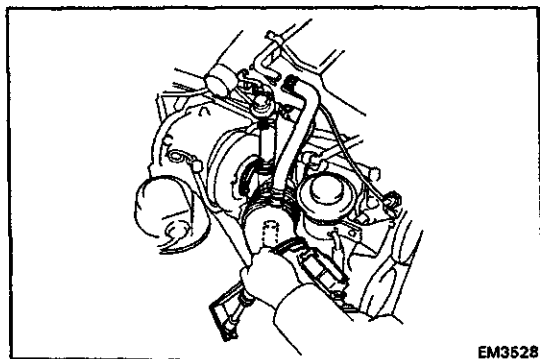


3. **REMOVE NO.4 AIR CLEANER PIPE WITH NO.1 AND NO.2 AIR CLEANER HOSES**

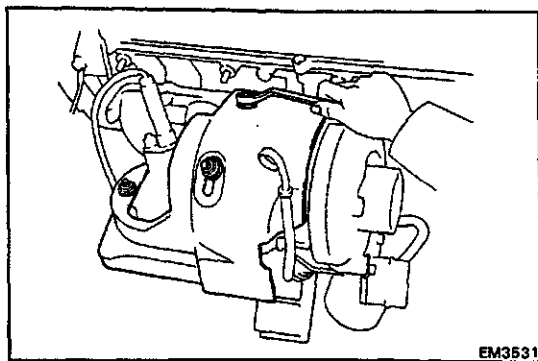


4. **REMOVE NO.7 AIR CLEANER HOSE WITH AIR FLOW METER AND AIR CLEANER CAP**

- (a) Disconnect the three air hoses and PCV hose.
- (b) Disconnect the air flow meter connector.
- (c) Disconnect the PS idle up air hose.

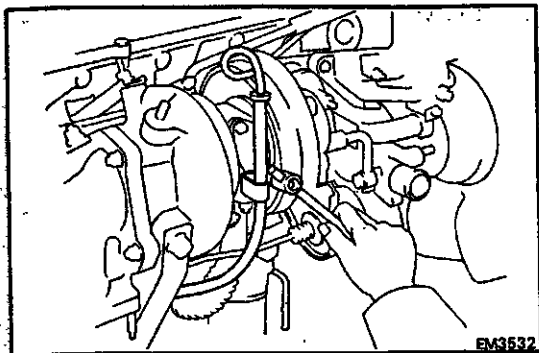


- (d) Loosen the clamps and remove the bolt.
- (e) Remove the No.7 air cleaner hose with air flow meter and air cleaner cap.

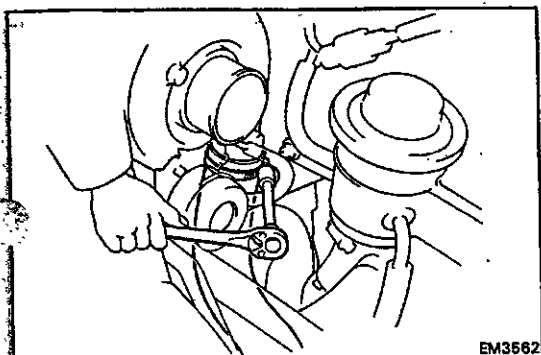


5. **REMOVE TURBO HEAT INSULATOR**

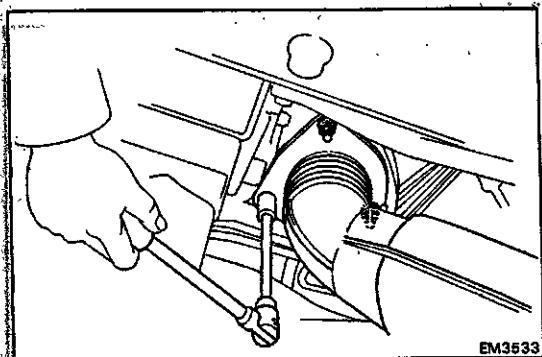
- (a) Disconnect the oxygen sensor connector.
- (b) Remove the three nuts, plate washer and turbo heat insulator.

**6. REMOVE OIL DIPSTICK GUIDE**

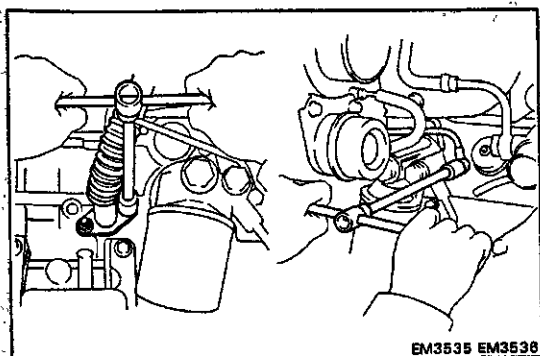
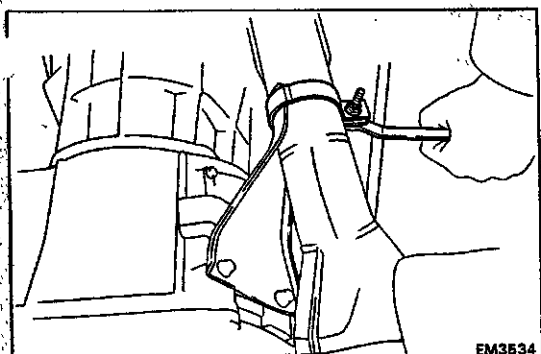
- (a) Remove the oil dipstick.
- (b) Remove the bolt and oil dipstick guide.
- (c) Remove the O-ring from the oil dipstick guide.

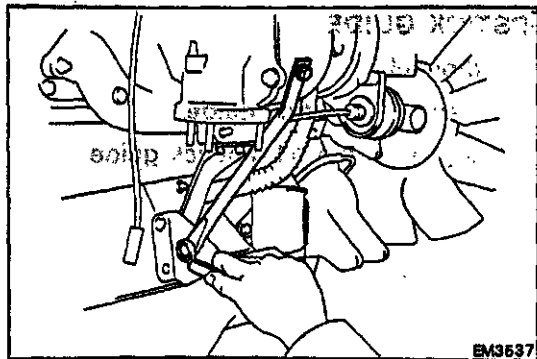
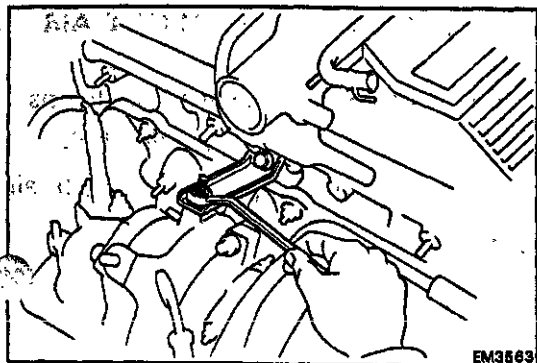
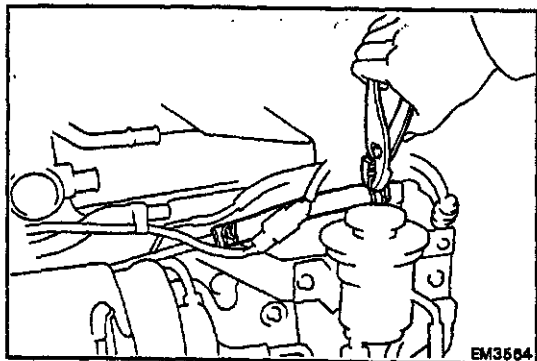
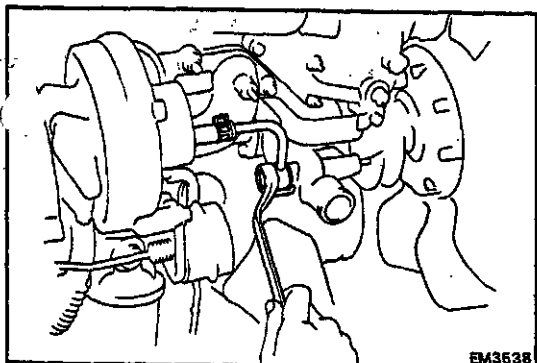
**7. REMOVE NO.1 AIR CLEANER PIPE WITH NO.6 AIR CLEANER HOSE**

- (a) Loosen the No.5 and No.6 air cleaner hose clamps.
- (b) Remove the No.1 air cleaner pipe mounting bolt.
- (c) Remove the No.1 air cleaner pipe with No.6 air cleaner hose.

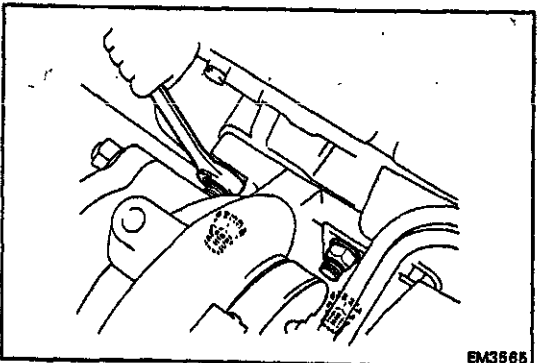
**8. DISCONNECT FRONT EXHAUST PIPE**

- (a) Remove the three nuts.
- (b) Remove the front exhaust pipe clamp.
- (c) Disconnect the front exhaust pipe from the exhaust manifold.
- (d) Remove the gasket.

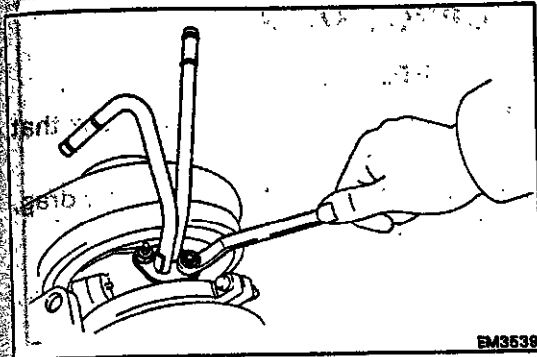
**9. REMOVE TURBO OIL PIPE MOUNTING NUTS****10. REMOVE TURBO OIL PIPE MOUNTING UNION BOLT**

**11. REMOVE TURBOCHARGER STAY****12. REMOVE NO.2 TURBOCHARGER STAY****13. DISCONNECT NO.1 TURBO WATER HOSE FROM WATER OUTLET HOUSING****14. DISCONNECT UNION PIPE**

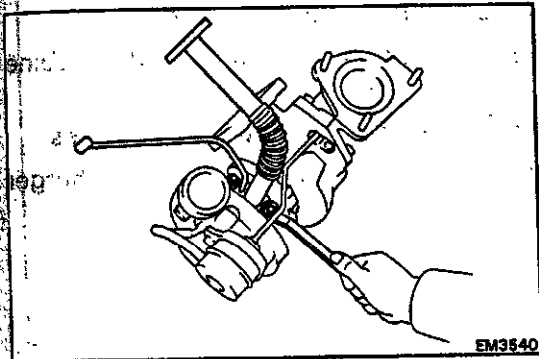
Remove the union bolt and gaskets.

**15. REMOVE TURBOCHARGER**

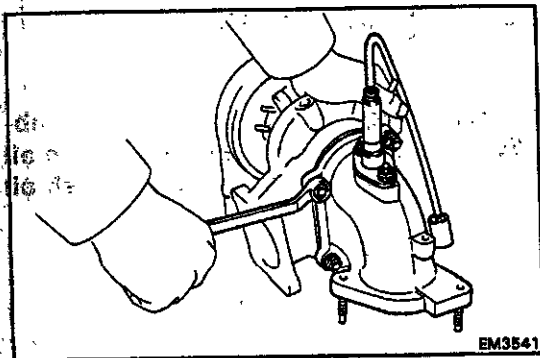
Remove the four nuts, turbocharger and gasket.

**16. REMOVE NO.1 TURBO WATER PIPE**

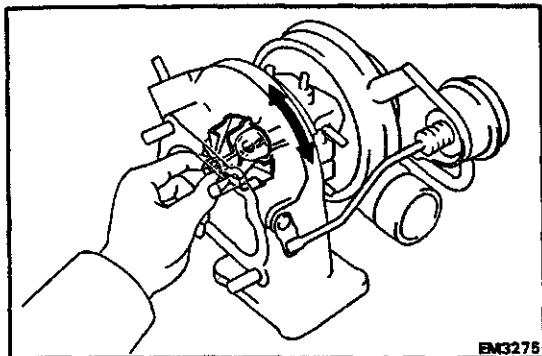
Remove the two nuts, No.1 turbo water pipe and gasket.

**17. REMOVE TURBO OIL PIPE**

Remove the two nuts, turbo oil pipe and gasket.

**18. REMOVE TURBINE OUTLET ELBOW**

Remove the four nuts, turbine outlet elbow and gasket.

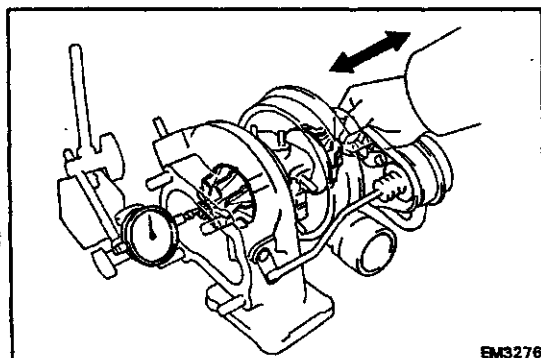


## INSPECTION OF TURBOCHARGER

### 1. INSPECT IMPELLER WHEEL ROTATION

Grasp the edge of the turbine wheel and turn it. Check that the impeller wheel turns smoothly.

If the impeller wheel does not turn or if it turns with a drag, replace the turbocharger assembly.

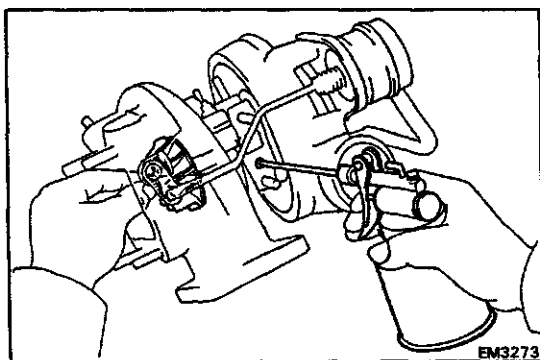


### 2. INSPECT AXIAL PLAY OF SHAFT BEARING

Insert a dial gauge into the intake side hole the turbine wheel edge by and check the axial play.

**Standard clearance: 0.13 mm (0.0051 in.) or less**

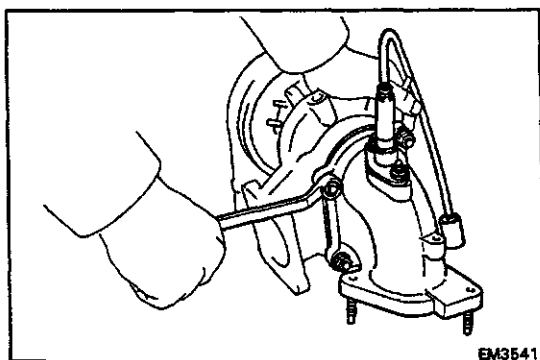
If not within specification, replace the turbocharger assembly.



## INSTALLATION OF TURBOCHARGER

(See page TC-9)

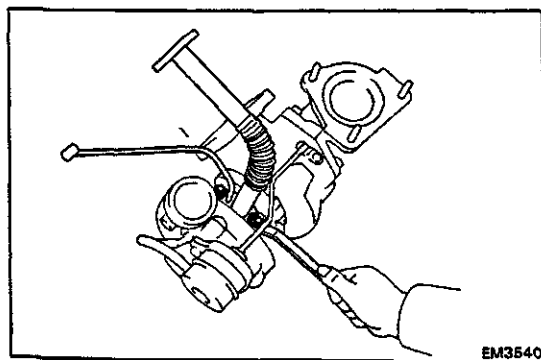
**CAUTION:** After replacing the turbocharger assembly, pour approx. 20 cc (1.2 cu in.) of new oil into the oil inlet and turn the impeller wheel by hand to splash oil on the bearing.



### 1. INSTALL TURBINE OUTLET ELBOW

Install a new gasket and the turbine outlet elbow with the four nuts.

**Torque: 440 kg-cm (32 ft-lb, 43 N-m)**



### 2. INSTALL TURBO OIL PIPE

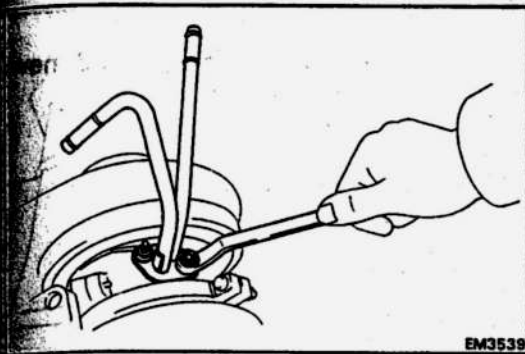
Install a new gasket and the turbo oil pipe with the two nuts.

**Torque: 130 kg-cm (9 ft-lb, 13 N-m)**

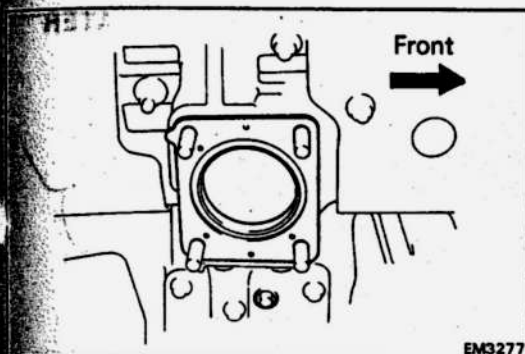
**3. INSTALL NO.1 TURBO WATER PIPE**

Install a new gasket and the No.1 turbo water pipe with the two nuts.

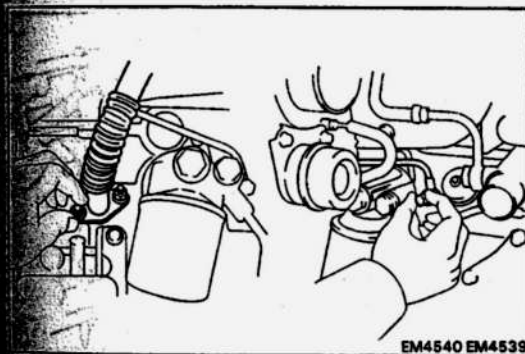
**Torque: 75 kg-cm (65 in.-lb, 7.4 N·m)**

**4. INSTALL TURBOCHARGER**

- (a) Face the new gasket so the protrusion is facing the rear and install on the exhaust manifold.
- (b) Place a new gasket on the oil return hole of the cylinder block.

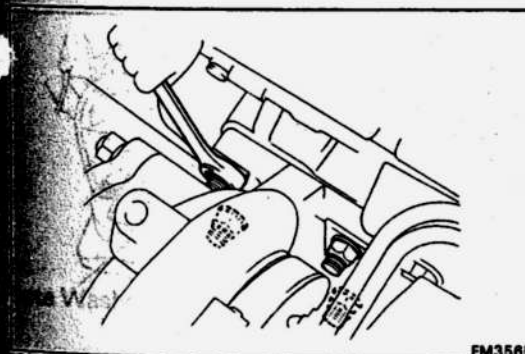


- (c) Install the turbocharger through the turbocharger stud bolts and turbo oil pipe stud bolts.
- (d) Temporarily install the four nuts holding the exhaust manifold and turbocharger.
- (e) Temporarily install the turbo oil pipe flange nuts.
- (f) Temporarily install the union bolt with two new gaskets.



- (g) Torque the turbocharger mounting nuts.

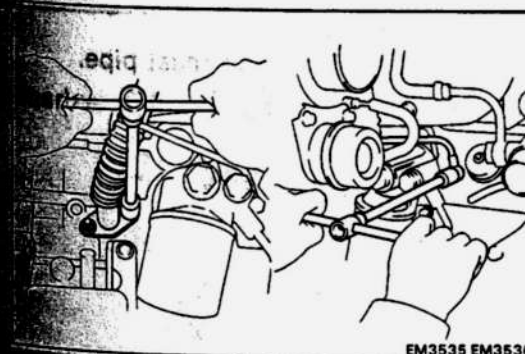
**Torque: 450 kg-cm (33 ft-lb, 44 N·m)**

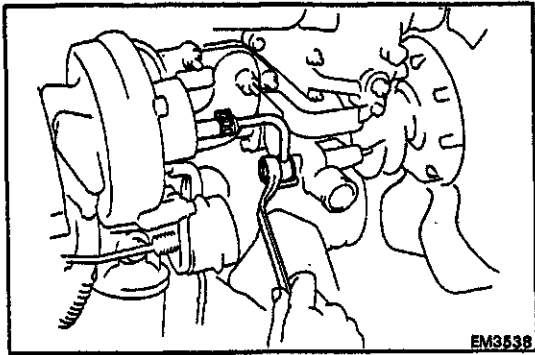


- (h) Torque the turbo oil pipe union bolt and flange nuts.

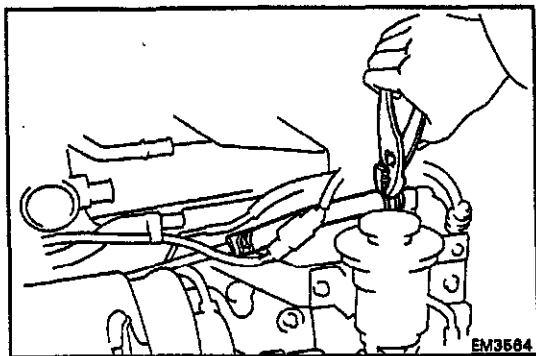
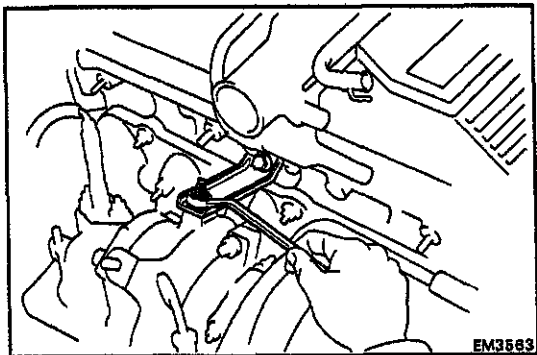
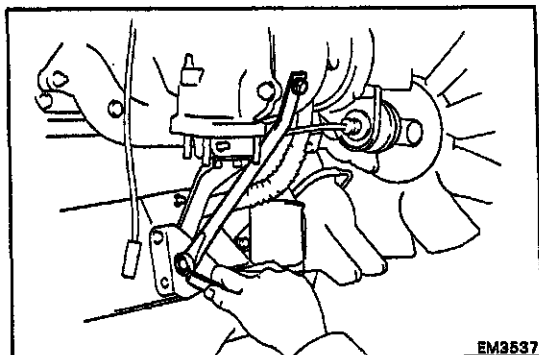
**Torque: Bolt 350 kg-cm (25 ft-lb, 34 N·m)**

**Nut 130 kg-cm (9 ft-lb, 13 N·m)**



**5. CONNECT UNION PIPE**

Connect the union pipe with the union bolt and new gaskets.

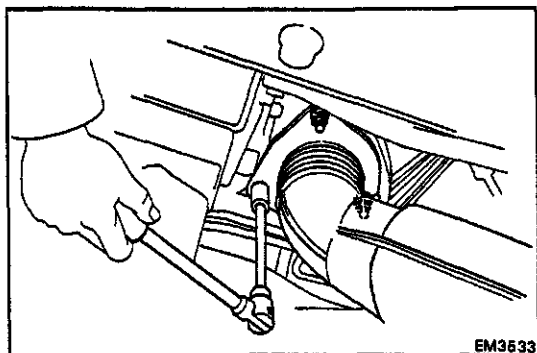
**6. CONNECT NO.1 TURBO WATER HOSE TO WATER OUTLET HOUSING****7. INSTALL NO.2 TURBOCHARGER STAY****8. INSTALL TURBOCHARGER STAY****Torque:**

To turbocharger

810 kg-cm (59 ft-lb, 79 N·m)

To engine mounting bracket

590 kg-cm (43 ft-lb, 58 N·m)

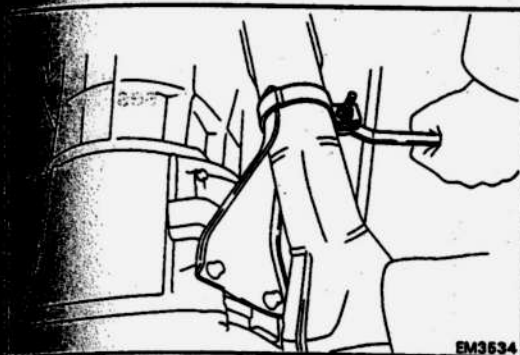
**9. CONNECT FRONT EXHAUST PIPE**

(a) Install a new gasket to the front exhaust pipe.

(b) Connect the front exhaust pipe to the exhaust manifold with three new nuts.

Torque: 630 kg-cm (46 ft-lb, 62 N·m)

- (c) Install the front exhaust pipe clamp.



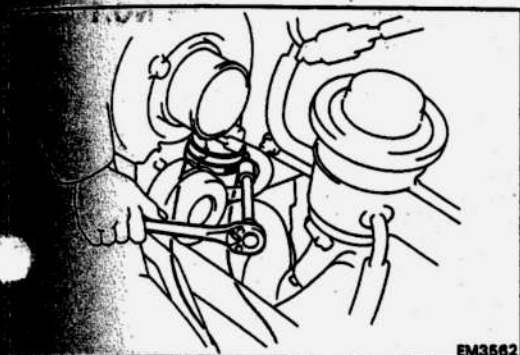
EM3534

**10. INSTALL NO.1 AIR CLEANER PIPE WITH NO.6 AIR CLEANER HOSE**

- (a) Install the No.1 air cleaner pipe with No.6 air cleaner hose to the No.5 air cleaner hose and turbocharger.  
 (b) Connect the No.1 air cleaner pipe to bracket with the bolt.

**Torque: 130 kg-cm (9 ft-lb, 13 N·m)**

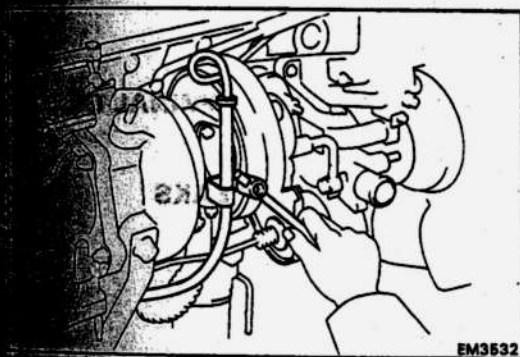
- (c) Tighten the No.5 and No.6 air hose clamps.



EM3562

**11. INSTALL OIL DIPSTICK GUIDE**

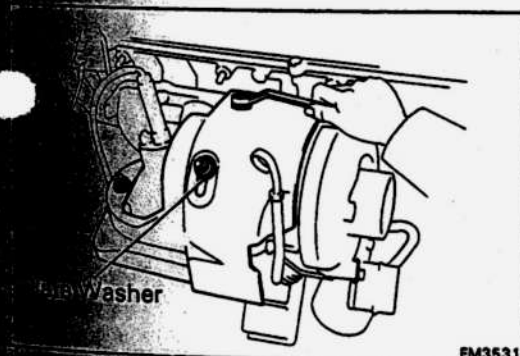
- (a) Install a new O-ring to the oil dipstick guide.  
 (b) Insert the oil dipstick guide to the No.2 oil dipstick guide.  
 (c) Connect the oil dipstick guide to the turbocharger with the bolt.  
 (d) Install the oil dipstick.



EM3532

**12. INSTALL TURBO HEAT INSULATOR**

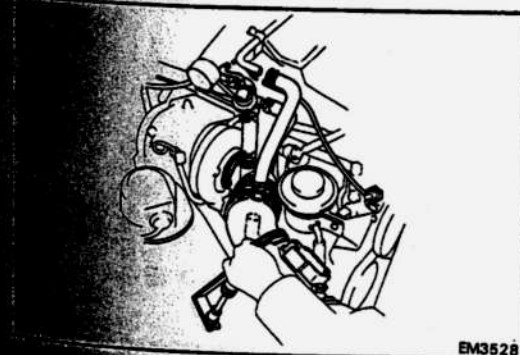
- (a) Install the turbo heat insulator and plate washer with the three nuts.  
 (b) Connect oxygen sensor connector.



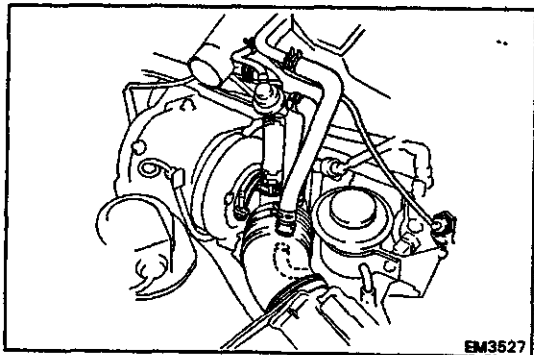
EM3531

**13. INSTALL NO.7 AIR CLEANER HOSE WITH AIR FLOW METER AND AIR CLEANER CAP**

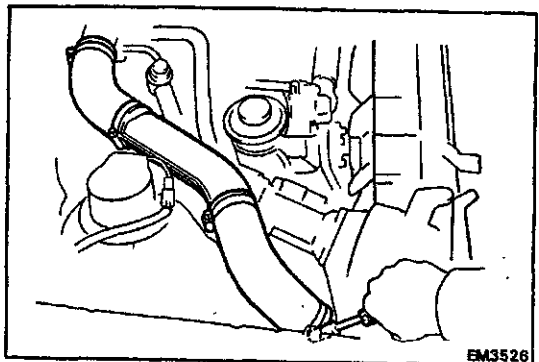
- (a) Install the No.7 air cleaner hose with air flow meter and air cleaner cap.  
 (b) Install the bolt and tighten the clamps.



EM3528



- (c) Connect the PS idle up air hose.
- (d) Connect the air flow meter connector.
- (e) Connect the PCV hose and three air hoses.



**14. INSTALL NO.4 AIR CLEANER PIPE WITH NO.1 AND NO.2 AIR CLEANER HOSES**

**15. FILL WITH COOLANT**  
(See page CO-5)

**16. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**

**17. START ENGINE AND CHECK FOR LEAKS**

# NEW CAR FEATURES

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**Introduction**

**IN**

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**New Model Highlights**

**MH**

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**Technical Description**

**TD**

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**Appendix**

**AP**

# DIFFERENTIAL .

## LSD (Limited-Slip Differential)

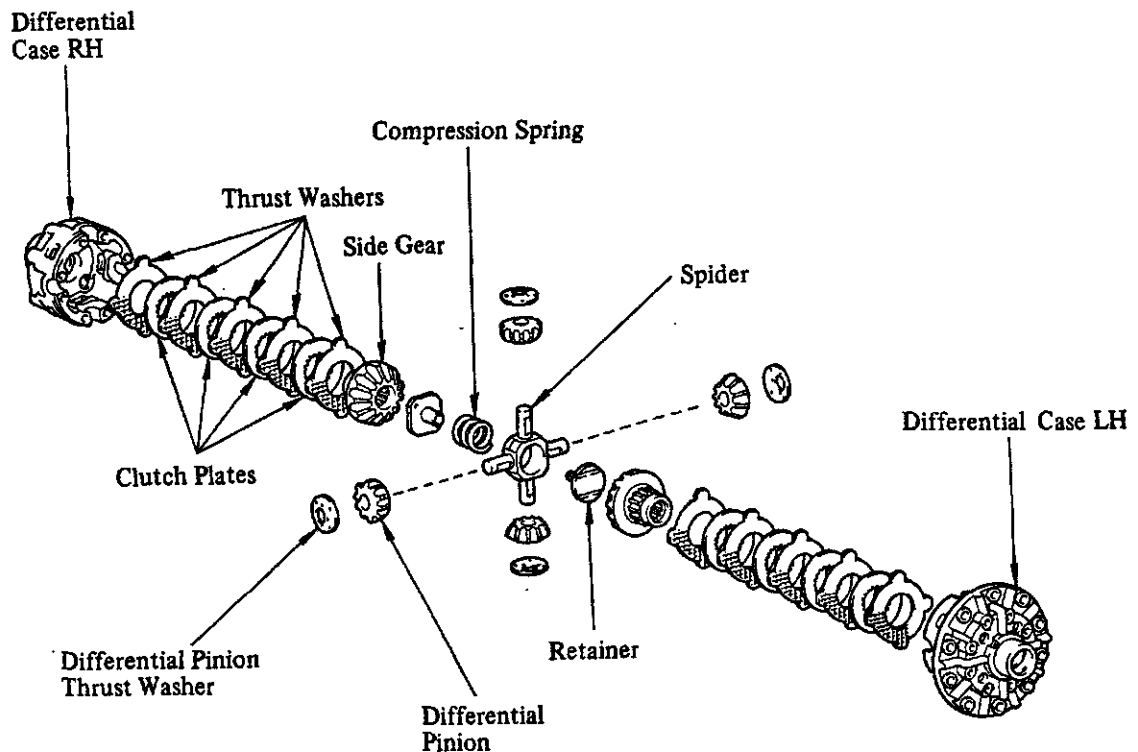
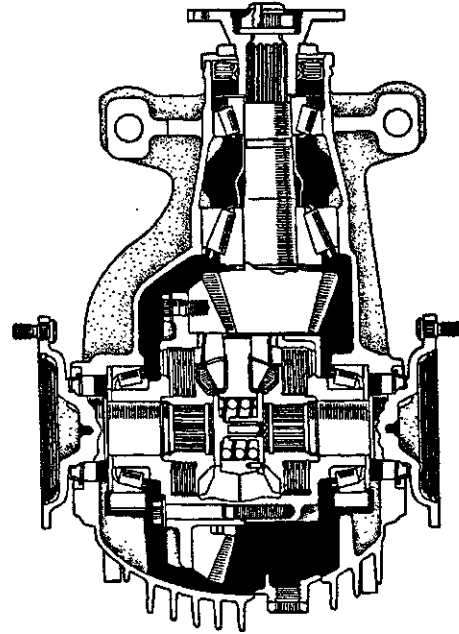
### CONSTRUCTION

Thrust washers and clutch plates are mounted, in alternating sequence, between the side gears and the differential case.

Four projections of the thrust washers fit into the guide grooves of the differential case, and the clutch plates are splined to the side gears.

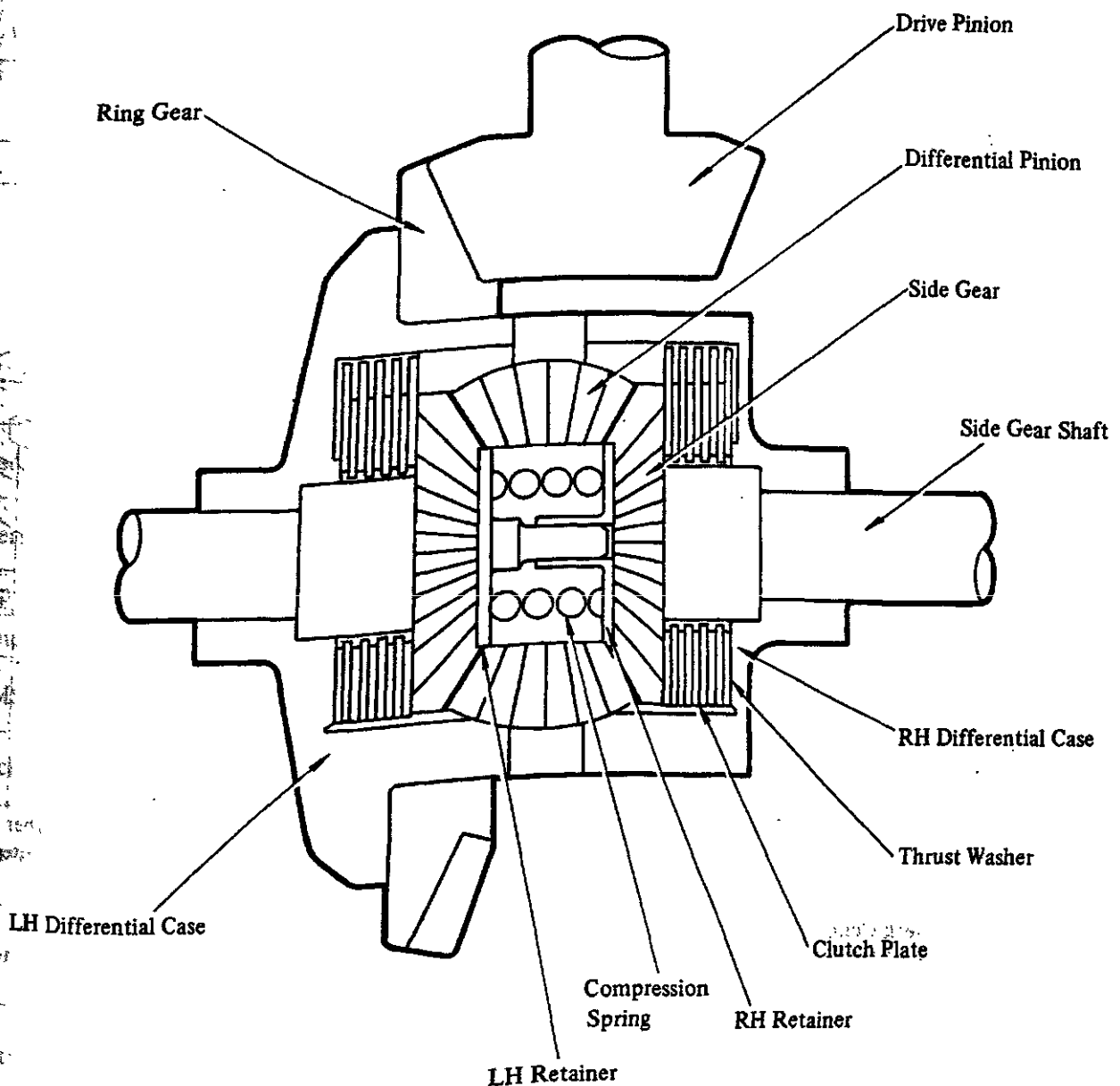
A barrel shaped compression spring is fitted between the left and right side gears to keep the thrust washers pressed up against the clutch plates via the retainers and side gears.

This means, in effect, that the side gears are kept pressed against the differential case (via the thrust washers and clutch plates) by the spring.



## OPERATION

If there is a large difference in the rates at which the left and right wheels turn (as, for example, when the vehicle is cornering) a corresponding difference is produced in the rates at which the side gears and differential case turn. This difference would result in slippage between the thrust washers and clutch plates. Since these are pushed together by the spring, friction torque is created between the thrust washers and clutch plates (that is, between their surfaces, which are in direct contact with each other). This torque attempts to make the differential case and side gears rotate as a unit. This is called the "limited slip effect".



# SUSPENSION

## TEMS (For Australia Only)

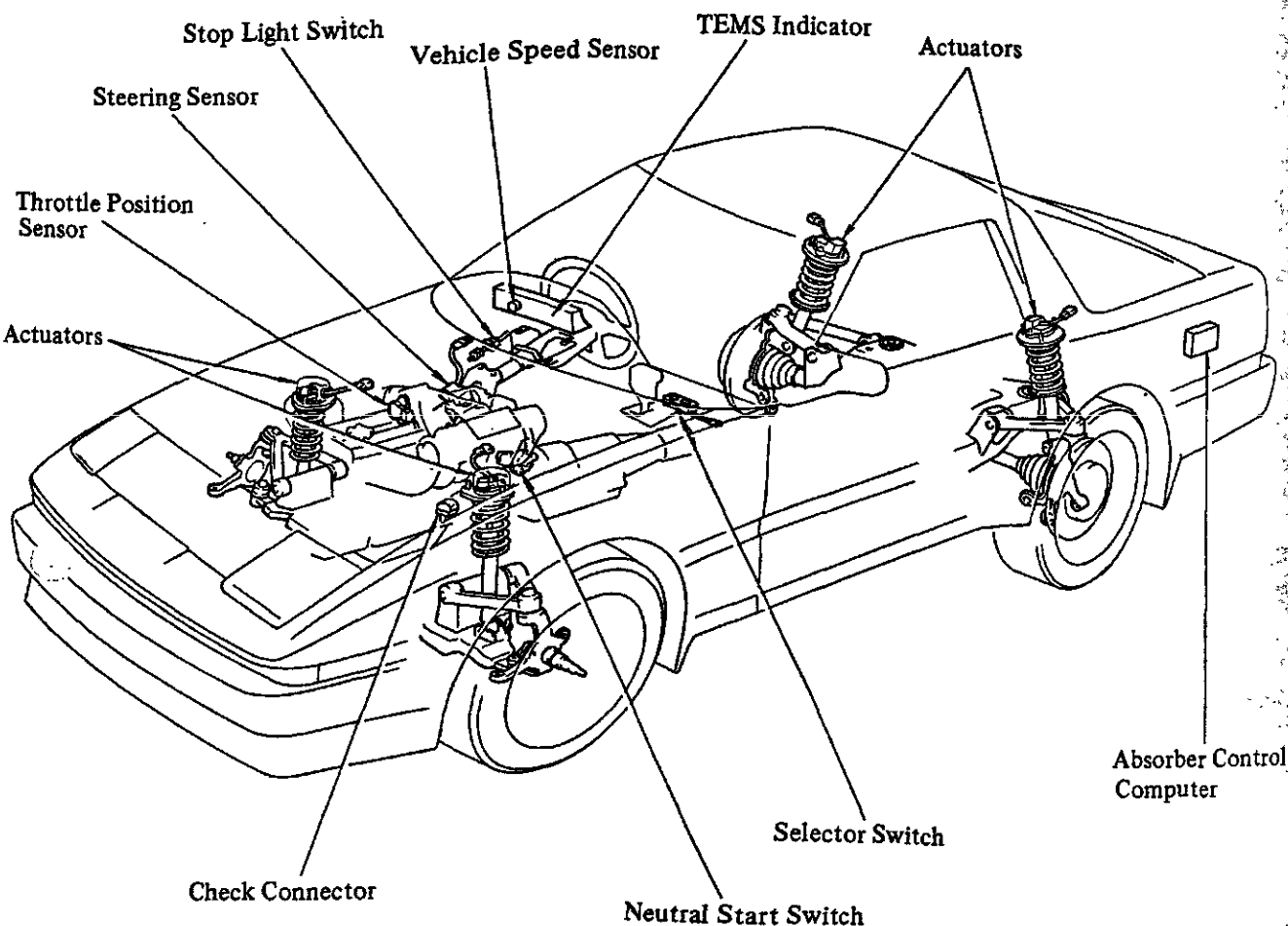
TEMS stands for the Toyota Electronic Modulated Suspension.

This is a system in which the damping force of the 4 shock absorbers is changed automatically depending on the driving conditions and which delivers superb riding comfort and better driving stability.

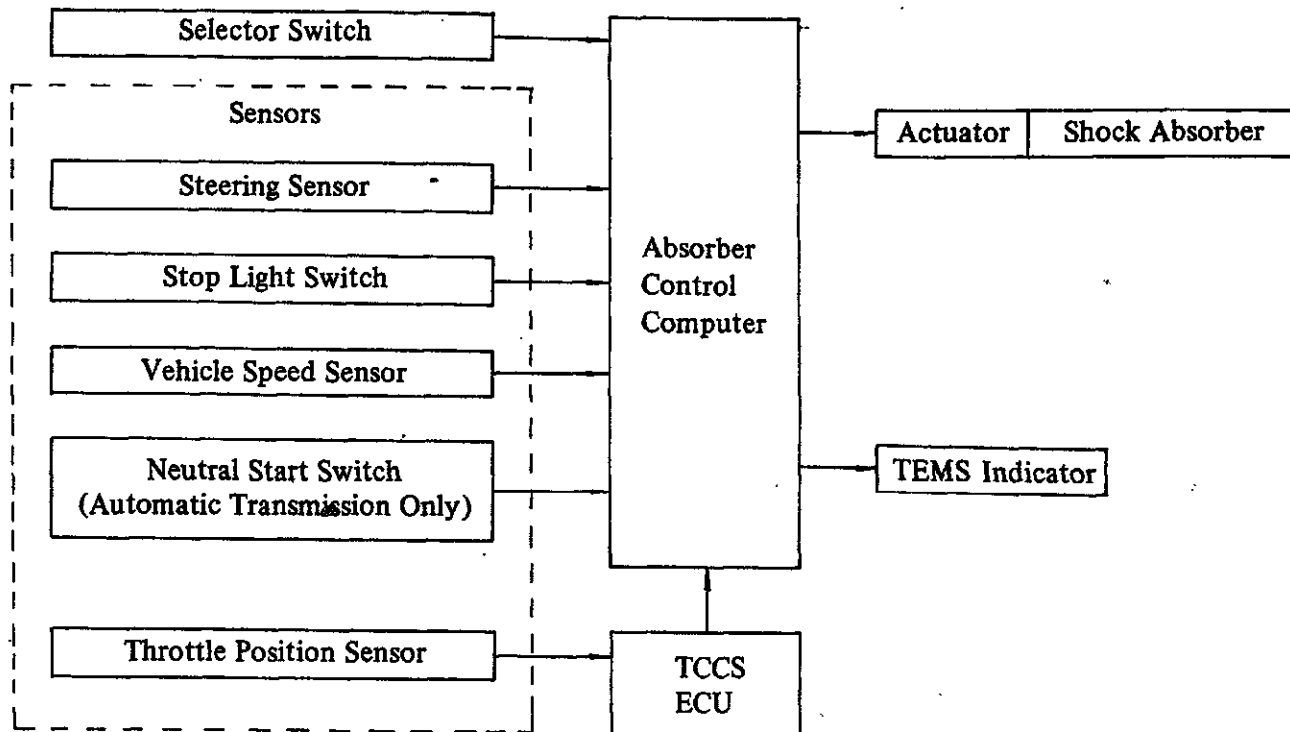
The shock absorbers' damping force changes in 3 stages.

Also, the driver can select 2 modes. A diagnosis system and fail-safe function are also included.

## LOCATION OF SYSTEM COMPONENTS

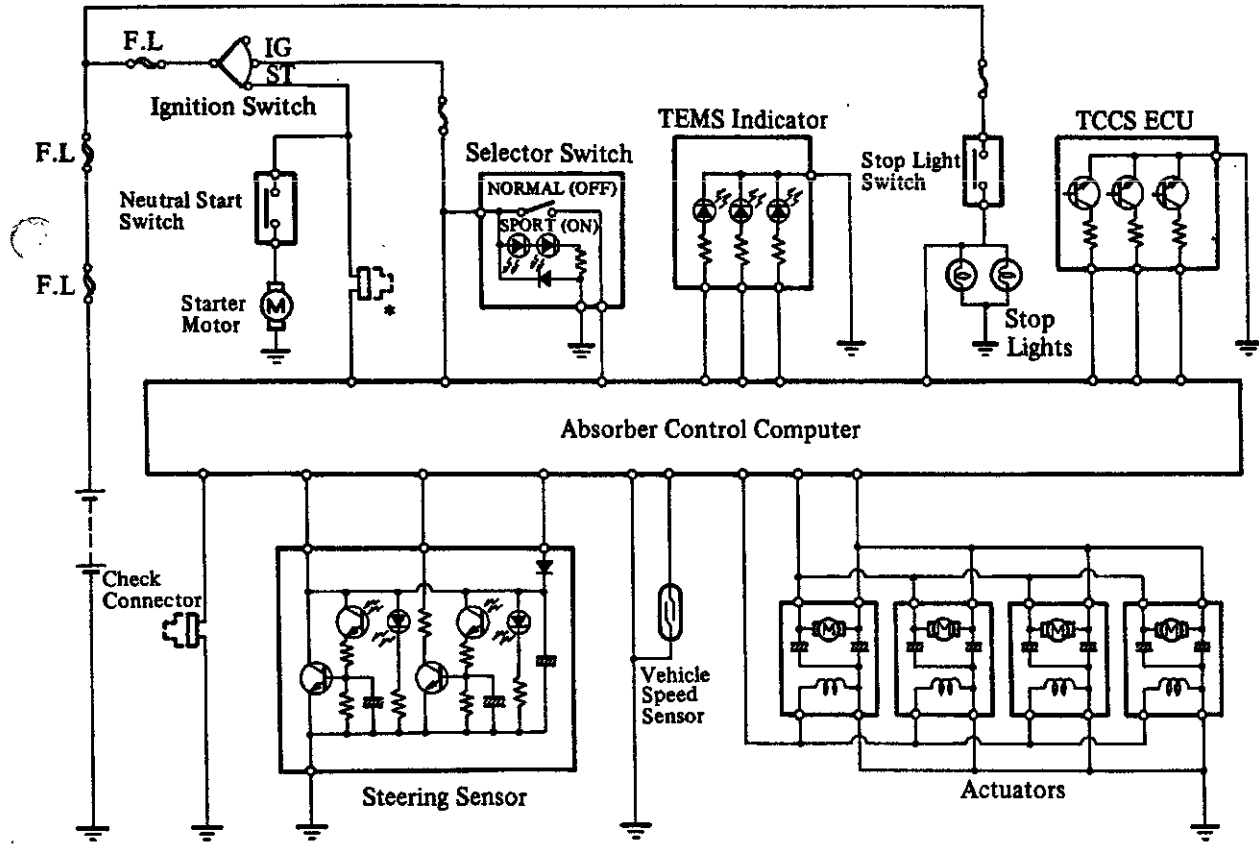


## FUNCTION OF COMPONENTS



| Component                                          | Function                                                                                                                        |
|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Selector Switch                                    | There are 2 buttons, "Normal" and "Sport", by which the driver selects the damping force mode.                                  |
| Steering Sensor                                    | This detects the direction in which the steering wheel is turned and the turning angle.                                         |
| Stop Light Switch                                  | This sends a braking signal to the computer.                                                                                    |
| Vehicle Speed Sensor                               | This sends a vehicle speed signal to the computer.                                                                              |
| TEMS Indicator                                     | This indicates the damping force conditions of the shock absorbers.                                                             |
| Shock Absorber                                     | These shock absorbers have a built-in rotary valve which changes the damping force in 3 stages.                                 |
| Actuator                                           | By a signal from the computer, the actuator drives the shock absorber control rod (rotary valve) and changes the damping force. |
| Absorber Control Computer                          | This computer uses signals from each sensor and controls the shock absorber damping force according to the mode selected.       |
| Throttle Position Sensor                           | This detects the throttle valve opening angle and sends signals to the absorber control computer through the TCCS ECU.          |
| Neutral Start Switch (Automatic Transmission only) | This sends signals to the computer that the shift position is the "N" or "P" range.                                             |

WIRING DIAGRAM



\* M/T— Open  
A/T— Short

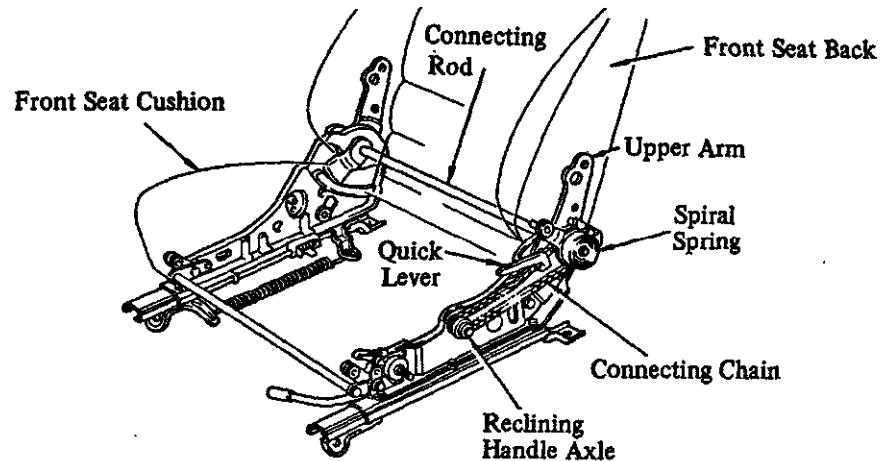
## FRONT SEAT

### STEPLESS RECLINING ADJUSTER SYSTEM

#### 1. Description

A stepless reclining adjuster system was adopted in which the reclining angle of the front seats (driver and passenger) can be steplessly adjusted.

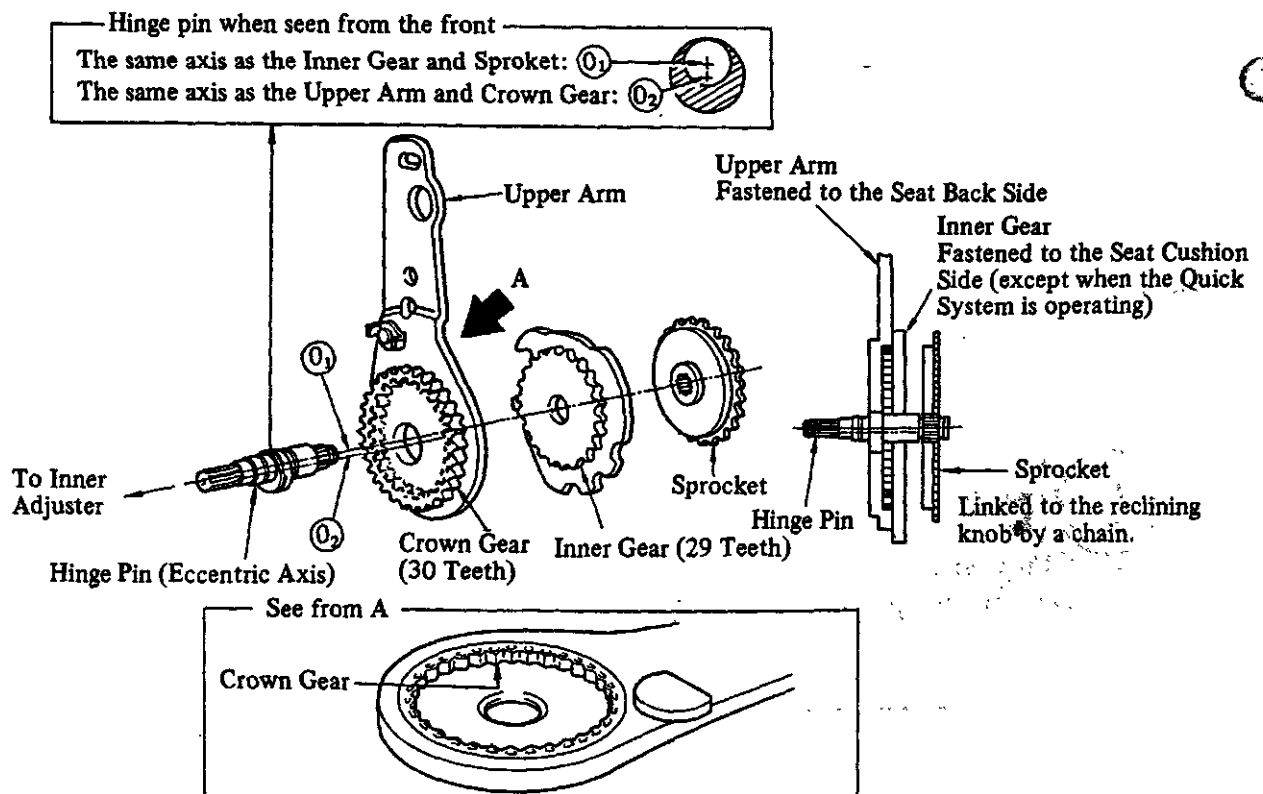
Also, a Quick System was adopted in which the seat can be reclined forward or backward with one touch by operating the Quick Lever.



#### 2. Construction and Operation

##### STEPLESS RECLINING ADJUSTMENT

##### 1) Construction



## 2) Operation

- If the reclining adjuster knob is turned, the sprocket, which is linked to the knob by a chain, and the hinge pin, which is linked to the sprocket by serrations, are turned.
- As the hinge pin rotates it raises the upper arm by sliding it against the inner gear.
- Since the inner gear is fastened to the seat cushion side, (except when the Quick System is operating), center  $O_2$  of the upper arm crown gear fastened to the seat back turns with center  $O_1$  of the inner gear as its axis.
- Therefore, the upper arm crown gear turns around the inner gear by the turning of the hinge pin. Furthermore, when the hinge pin has made  $N$  turns, the reclining angle of the seat back can be expressed by the flowing formula.

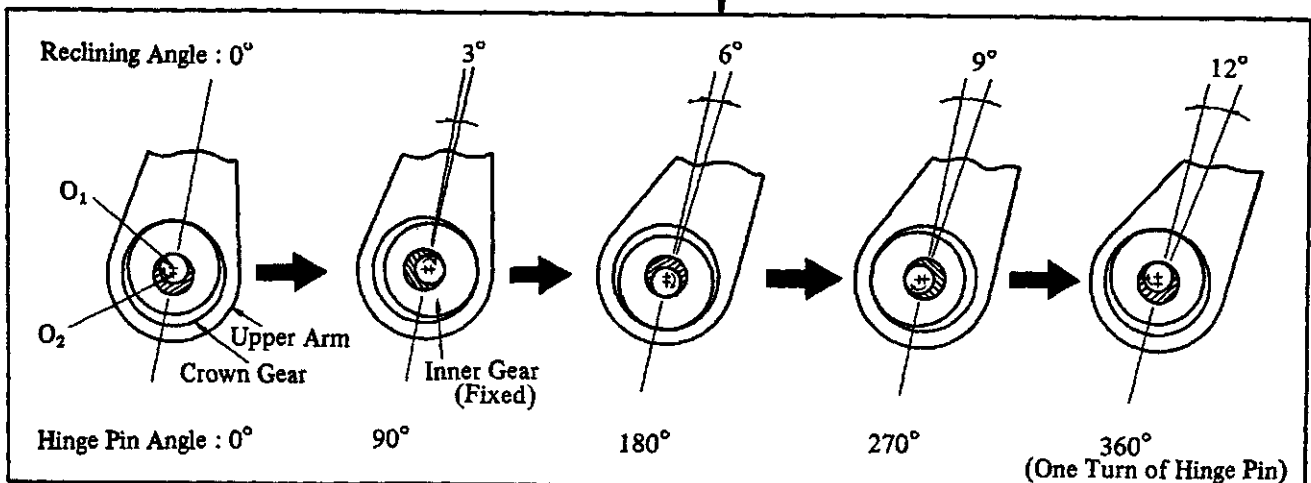
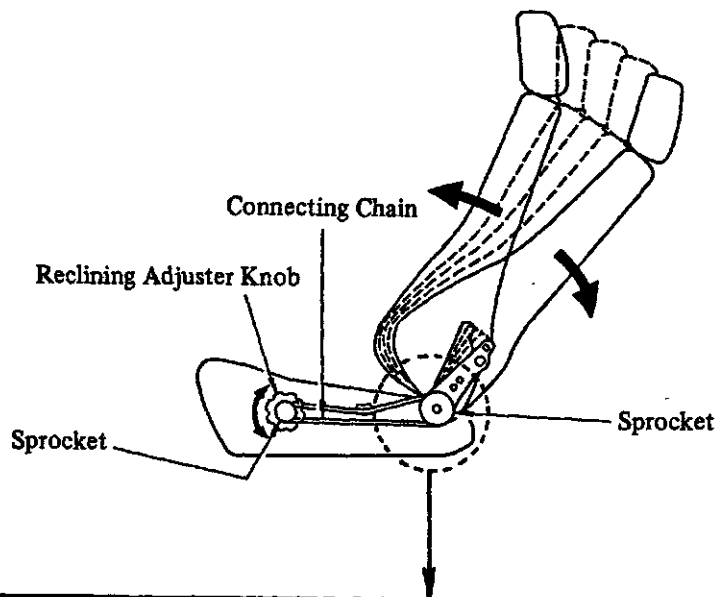
$$\alpha = N \times \frac{Z_2 - Z_1}{Z_2} \times 360^\circ$$

$\alpha$  : Reclining Angle,  $N$  : No. of Turns of Hinge Pin

$Z_1$  : No. of Inner Gear Teeth (29)

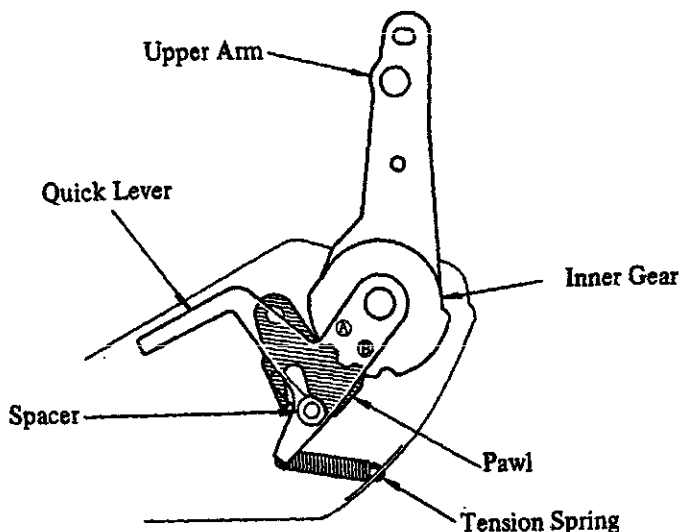
$Z_2$  : No. of Crown Gear Teeth (30)

Therefore,  $\alpha = 12^\circ \times N$  and one turn of the hinge pin reclines the seat back  $12^\circ$ .



## Normal Position

Figure below shows the state where the seat back is locked in the normal position. At this time, the pawl is engaged in the latch on the outer circumference of the inner gear (A, B). Moreover, the quick lever which moves as one with the upper arm is pressed by the tension spring on the back surface of the pawl and the pawl is locked with the latch of the inner gear. Furthermore, in the normal position, the seat back can be steplessly reclined.

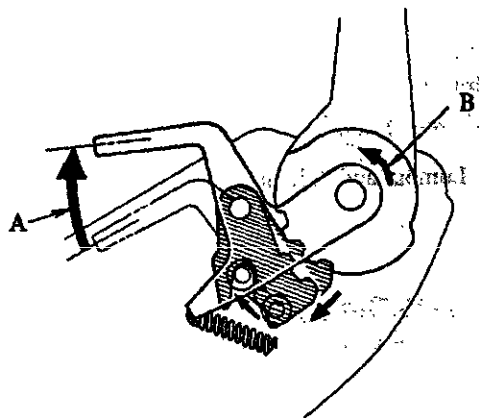
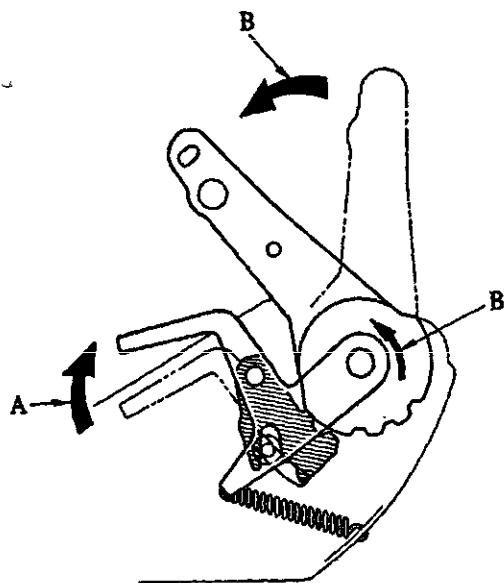


## Forward Reclining Position

The figure below shows the seat back reclining forward. The quick lever is operated in direction A with the seat back in the normal position. At this time, the spacer releases from the pawl and the force of the pawl pressing on the latch is removed.

Therefore, with the hinge pin as the axis, the upper arm and the inner gear become one and the seat back reclines forward. (Direction B)

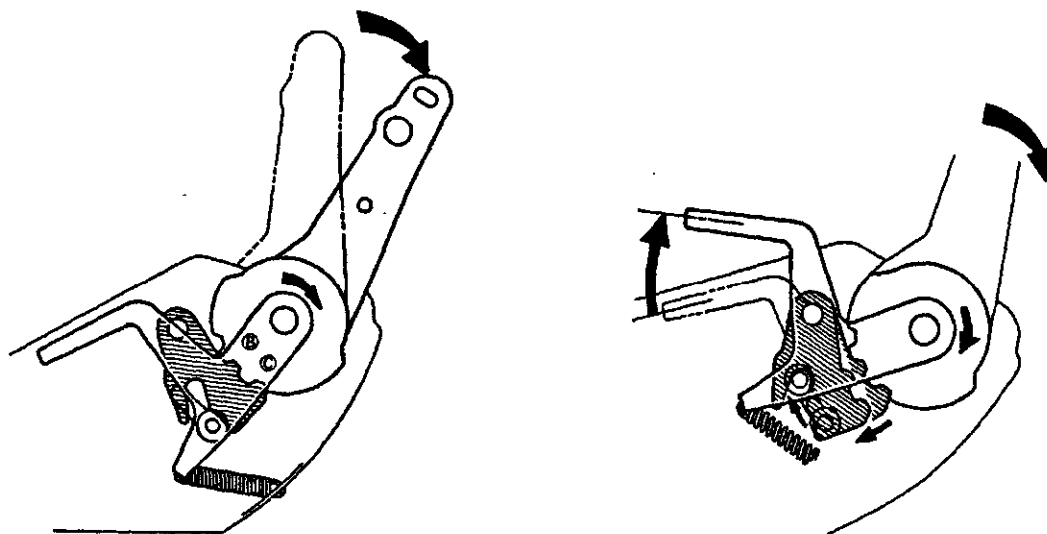
Also, even if the seat back returns to the normal position, it will return to the originally set reclining position.



### 3. Backward Reclining Lock Position

The figure below shows the seat back reclined backward.

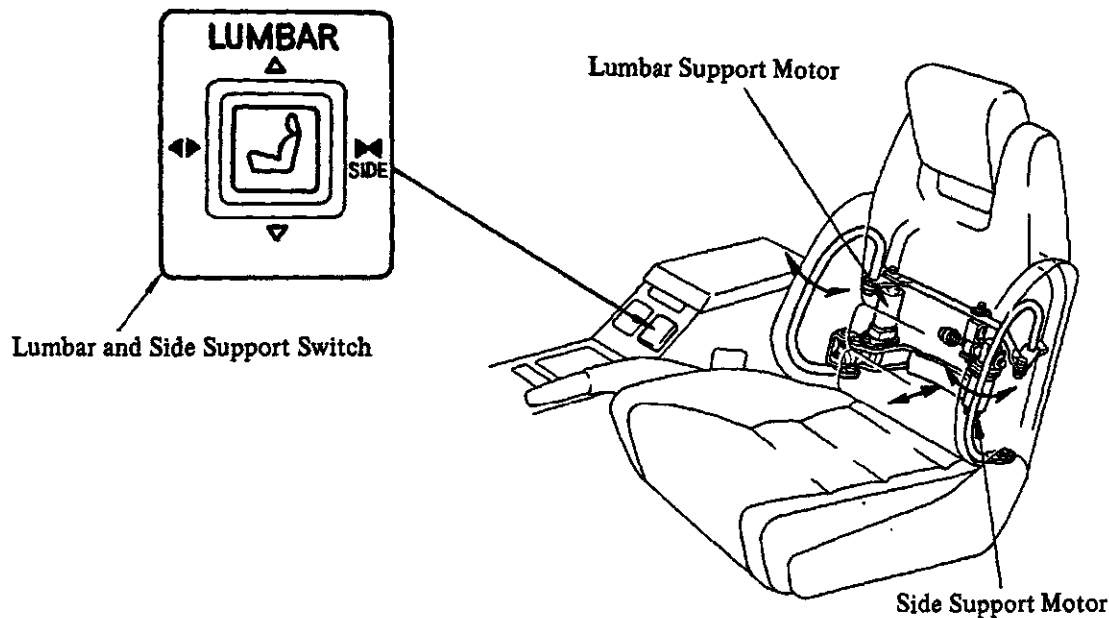
As with forward reclining, the quick lever is operated and the pawl releases from the latch of the inner gear. Next the seat back reclines and the pawl is locked with the latch (B, C) of the inner gear. Further, in the backward reclining lock position, stepless reclining of the seat back can be done. Also, even if the seat back is returned to the normal position, it will return to the originally set reclining position.



## POWER SIDE SUPPORT AND POWER LUMBAR SUPPORT

### 1. Description

The previous manual side support and lumbar support systems have been changed to electrical systems to improve their manipulability.

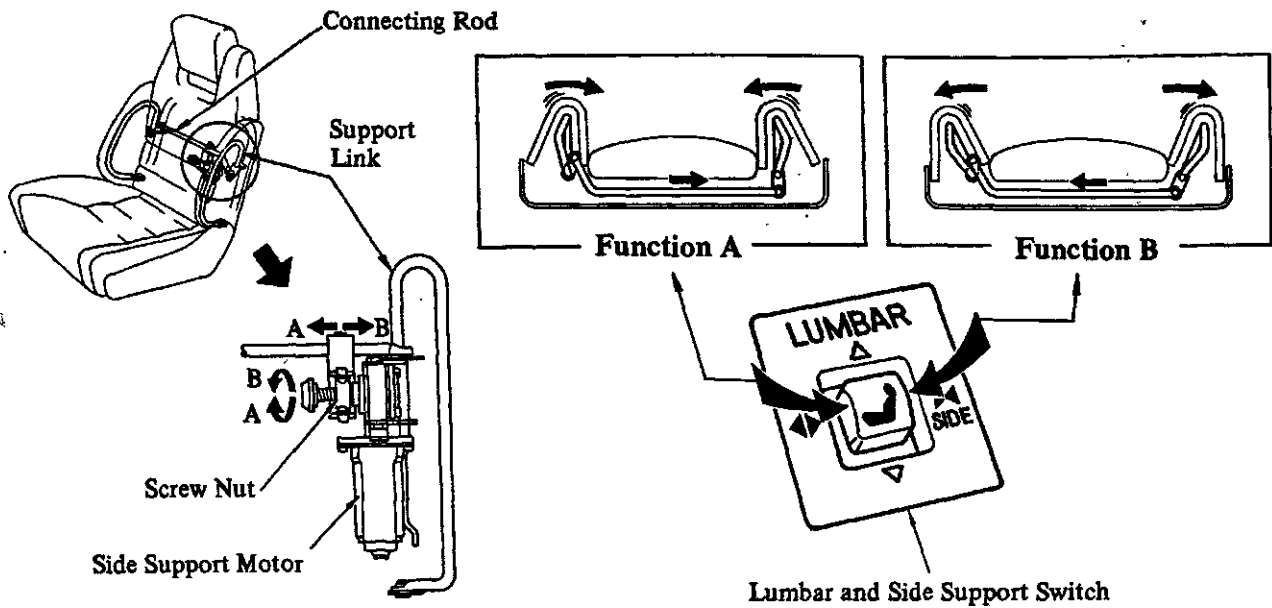


## 2. Construction and Operation

### POWER SIDE SUPPORT ADJUSTMENT

Previously, by turning the adjustment knob on the side of the seat, the support link was moved to carry out side support adjustment.

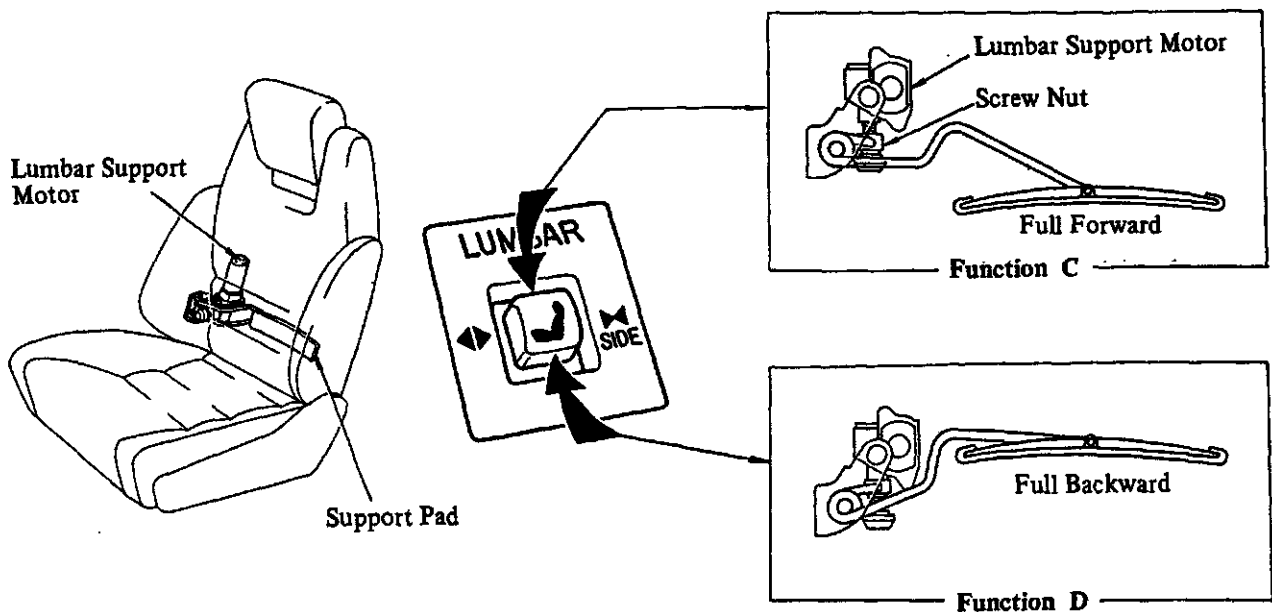
As opposed to this, with the power side support adjustment system, a connecting rod connected to a screw nut on the side support motor is moved left or right, moving the support link and adjusting the side support.



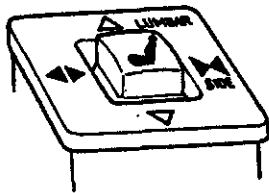
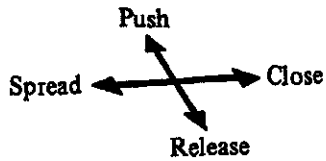
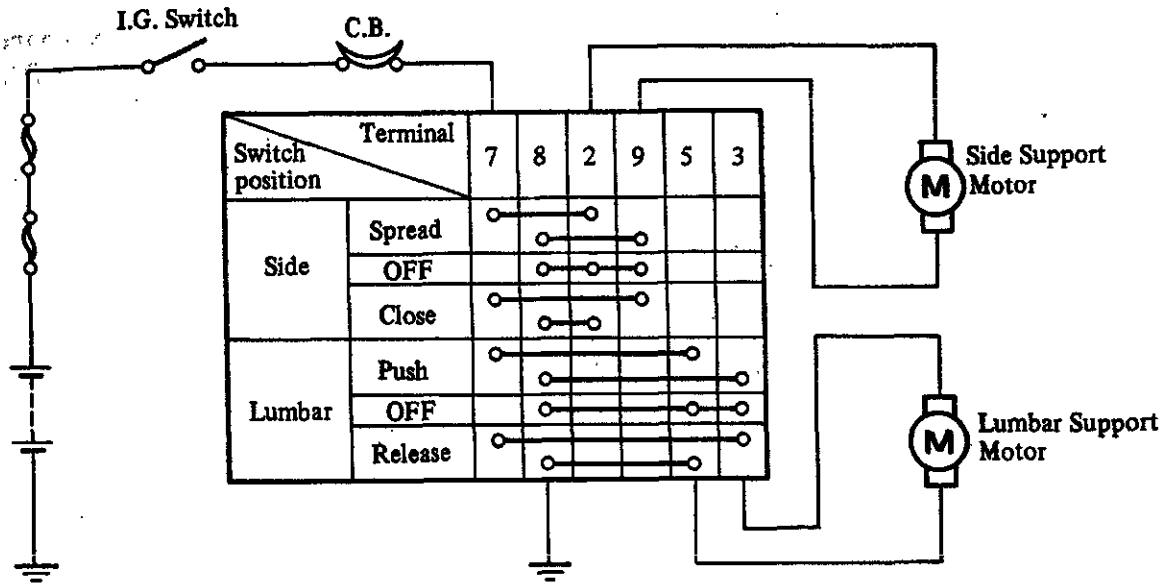
### POWER LUMBAR SUPPORT ADJUSTMENT

Previously, lumbar support adjustment was accomplished by moving a lever on the side of the seat which moved the support pad linked to the torsion bar forward or backward.

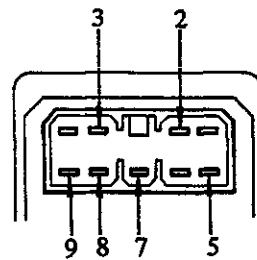
Now however, with power lumbar support adjustment, the screw nut on the lumbar support motor is moved and the torsion bar linked to it moves the support pad forward or backward, making stepless adjustment possible.



### 3. System Circuit

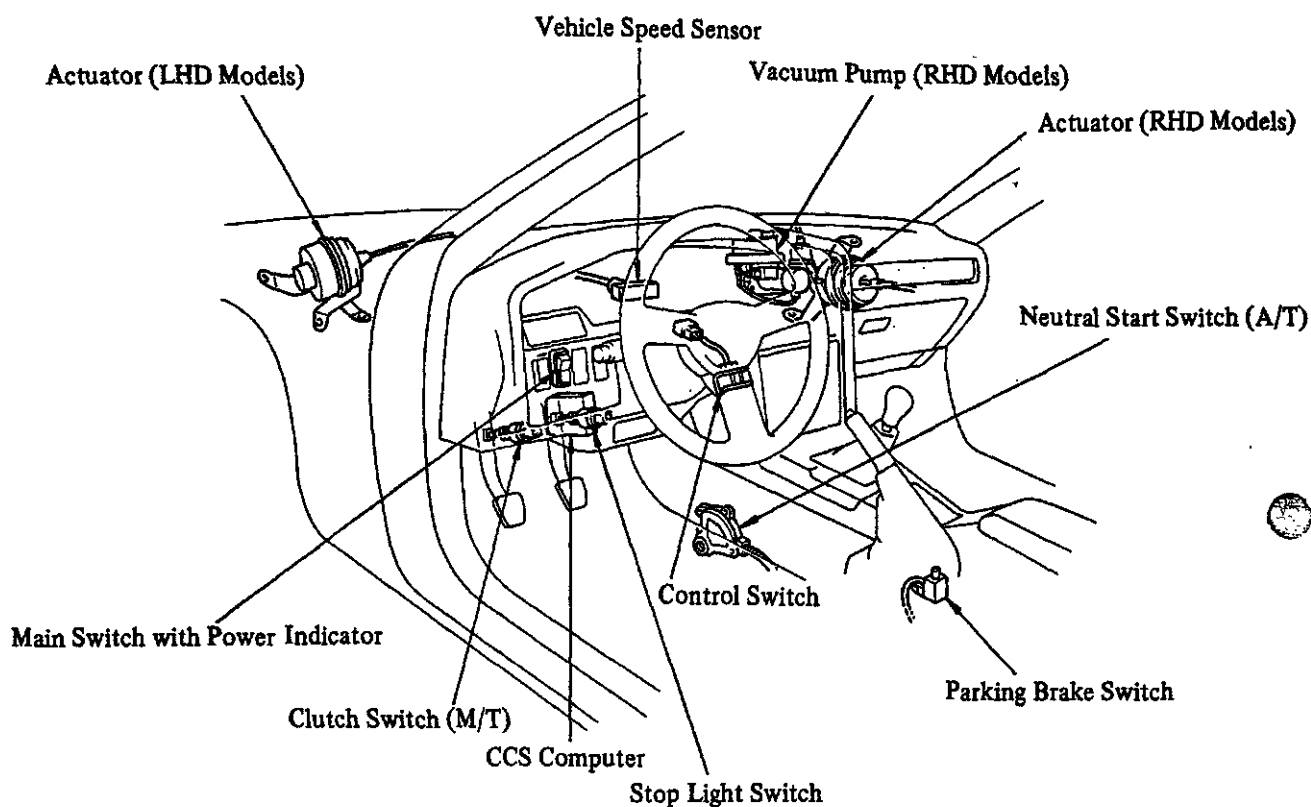


Lumbar and Side Support Switch



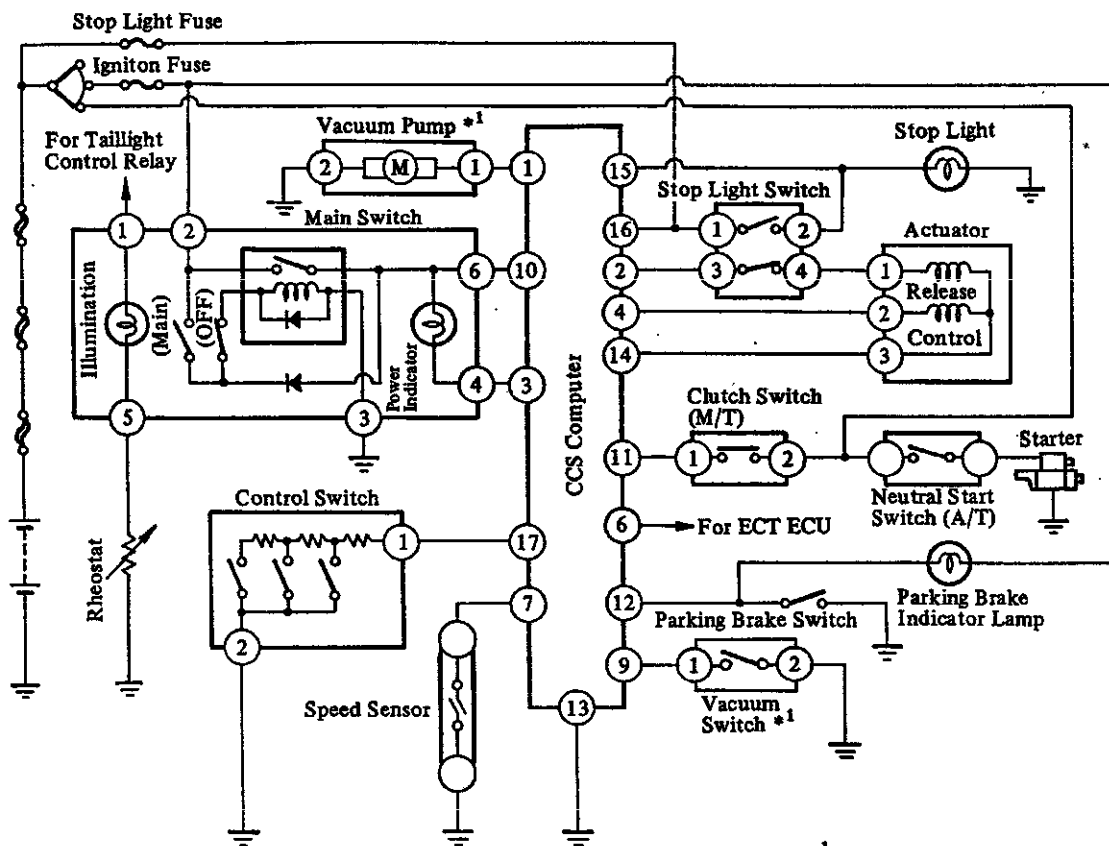
Connector for Lumbar and Side Support Switch

## CRUISE CONTROL SYSTEM (CCS)



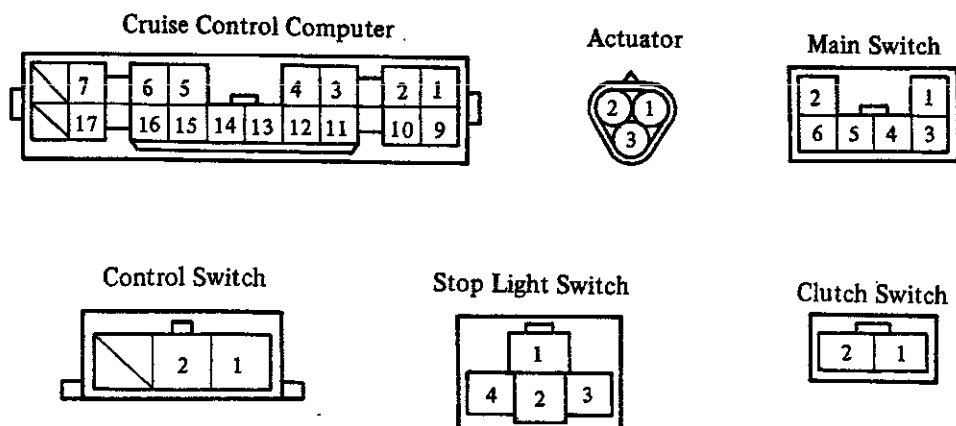
| COMPONENT                        | FUNCTION                                                                                                                                                     |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Vehicle Speed Sensor             | This is mounted on the speedometer driven gear and produces pulse signals. The cruise control computer detects vehicle speed by sensing the pulse frequency. |
| CCS Computer                     | Receives signals from each sensor and controls total CCS functioning.                                                                                        |
| Actuator                         | This is controlled by the CCS computer, to increase or decrease the throttle valve opening angle.                                                            |
| Control Switch                   | This is used to control the CCS when setting the vehicle at a desired cruising speed or resetting it at another cruising speed, and to cancel the CCS.       |
| Main Switch with Power Indicator | This is used to connect the CCS to the power source. Lights up when the main switch is ON, indicating that power is being supplied in the system.            |
| Stop Light Switch                | Output CCS release signals                                                                                                                                   |
| Parking Brake Switch             |                                                                                                                                                              |
| Clutch Switch (M/T)              |                                                                                                                                                              |
| Neutral Start Switch (A/T)       |                                                                                                                                                              |
| Vacuum Pump (RHD Models)         | Supplies extra vacuum to the actuator when the vacuum in the manifold is not sufficient.                                                                     |

## WIRING DIAGRAM



\*1: Models with RHD

## MAJOR CONNECTORS

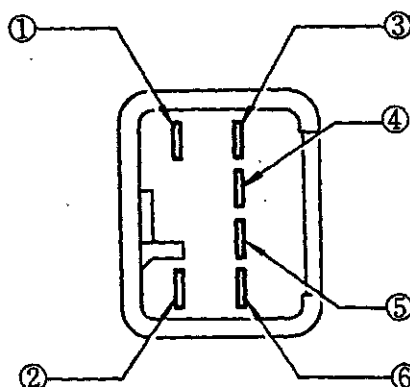
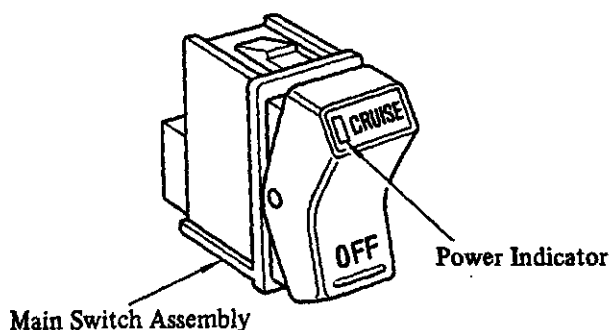


## OPERATION

- The construction and operation of the cruise control system is the same as previous systems. (Basically, it is the same as that on the 1986 Celica ST 162 Series.)

### Main Switch

- Even though the Main Switch is in the ON position, if the Ignition Switch is turned off, the Main Switch goes off at the same time. When the Ignition Switch is turned on again, the Main Switch remains off.

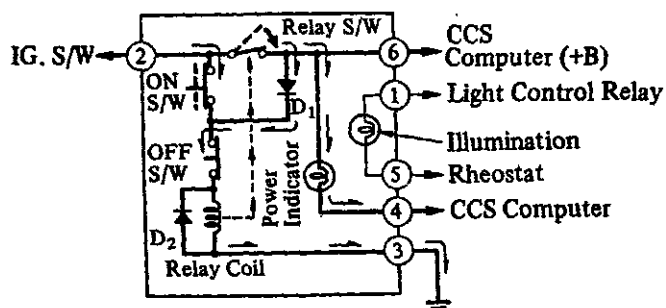


Connector for Main Switch

## OPERATION

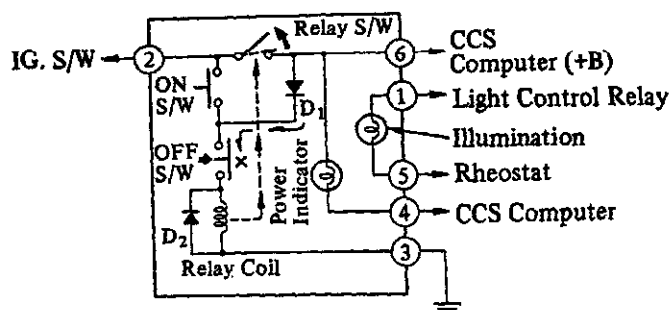
### 1) Main Switch ON

- With the Ignition Switch ON, if the Main Switch is turned ON, Terminal ③ is grounded by Terminal ② through the On Switch, Off Switch and Relay Coil.
- The Relay Switch goes on and current flows to Terminal ⑥.
- Also, since current is flowing through the Relay Coil through  $D_1$ , even if the Relay Switch is separated from the On switch, it remains ON. (Self-hold Circuit)
- The Power Indicator Lamp Lights up.



### 2) Main Switch OFF

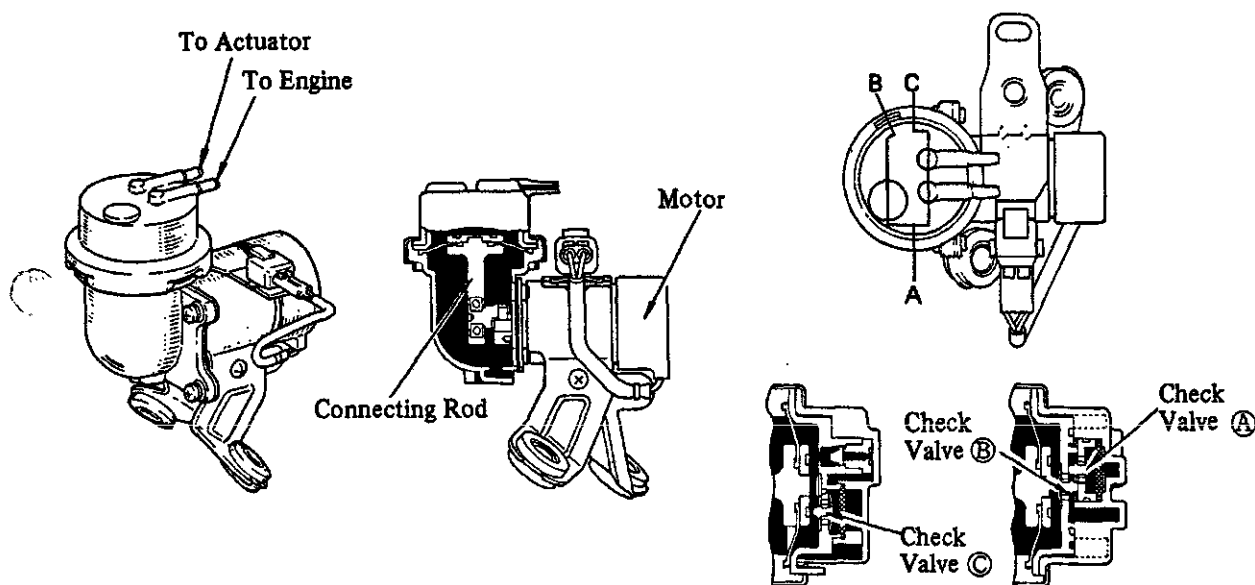
- When the Main Switch is ON, if the Off Switch is pressed, the current flowing from  $D_1$  is cut off and the flow of current to the Relay Coil is stopped, causing the Main Switch goes off.
- Also, when the Ignition Switch is turned OFF, the Relay Coil is no longer charged and the Main Switch goes off.



## 2. Vacuum Pump (Models with RHD)

### CONSTRUCTION

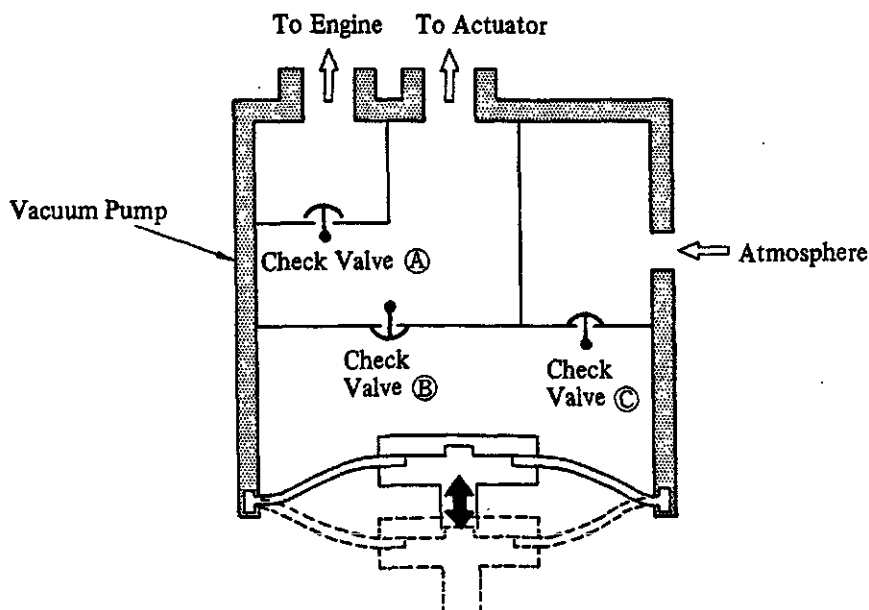
The vacuum pump is located between the vacuum outlet of the engine and the vacuum circuit of the actuator, and supplies extra vacuum to the actuator when the vacuum in the manifold is not sufficient (as when the vehicle is climbing a hill or during full acceleration).



A-B Cross Section    A-C Cross Section

### OPERATION

Check valve ① is normally kept open due to vacuum in the manifold, and supplies vacuum to the actuator. When manifold vacuum is low, the computer sends a signal to turn the vacuum pump on. As a result, vacuum is supplied to the actuator through check valve ②.



### 3. Vacuum Switch

This switch detects vacuum in the intake manifold.

It turns on when this vacuum is 170 mmHg or lower, and sends an ON signal to the computer.

