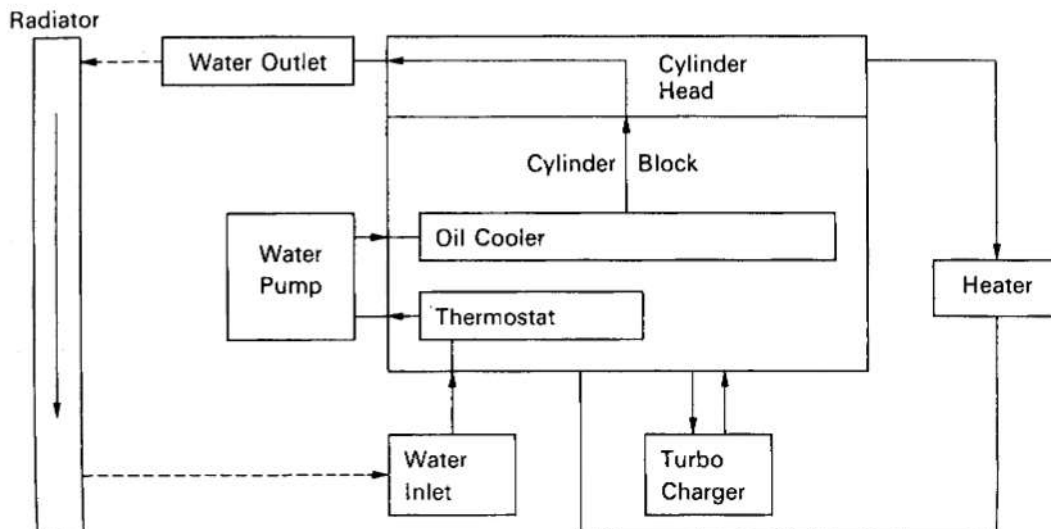
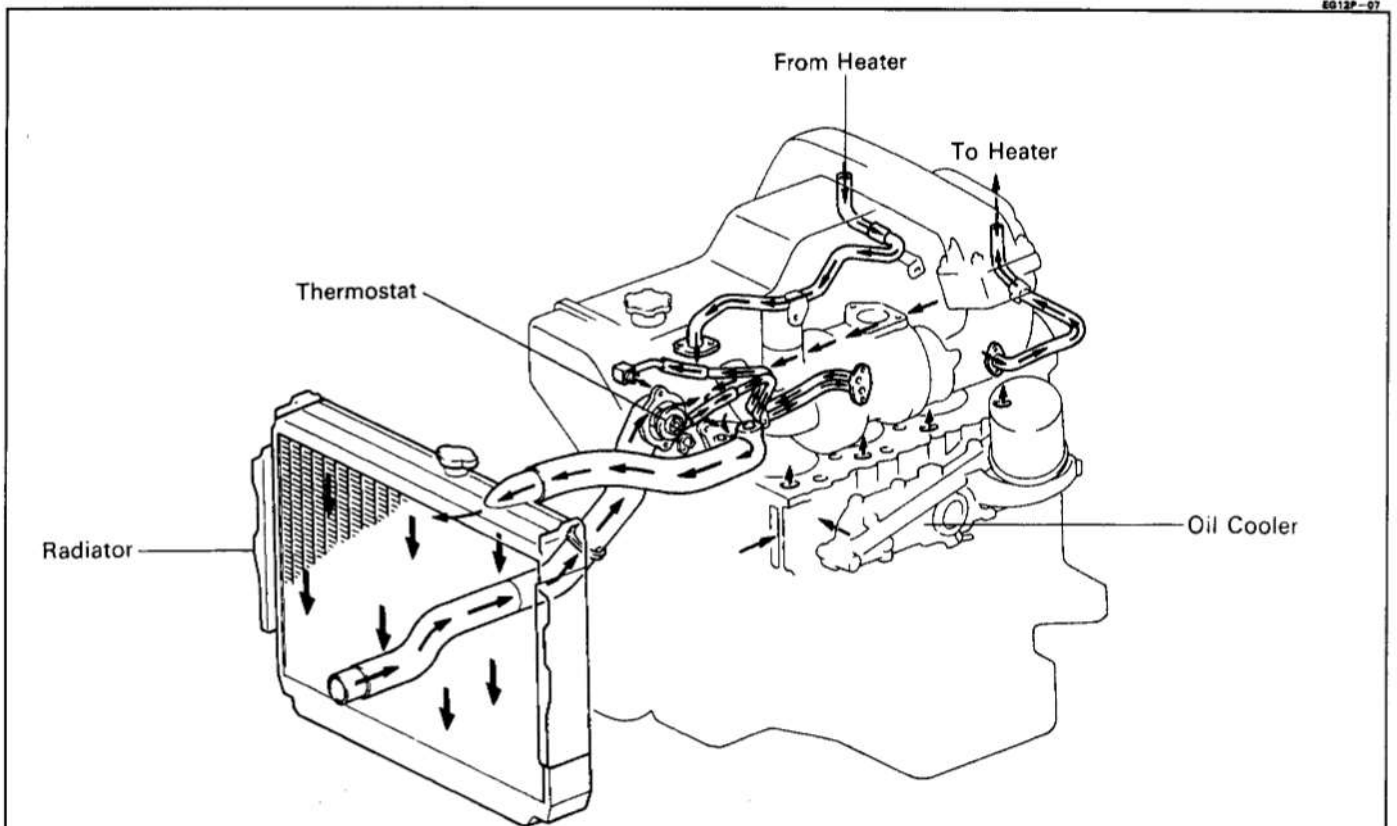


COOLING SYSTEM

DESCRIPTION

This engine utilizes a pressurized forced circulation cooling system which includes a thermostat equipped with a by pass valve mounted on the inlet side. EG12N-06

OPERATION



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

Coolant which is heated in the water jacket is pumped to the radiator, through which and 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 heated during engine operation.

RADIATOR

The radiator cools the coolant which has passed through the water jacket and become hot, and it 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 filler inlet. It also has a hose attached through which excess coolant or steam can flow. The lower tank has an outlet and drain cock for the coolant. The core contains many tubes through which coolant flows from the upper tank to the lower tank as well as to cooling fins which radiate heat away from the coolant in the tubes. The air sucked through the radiator by the cooling fan, as well as the wind generated by the vehicle's travel, passes through the radiator, cooling the coolant.

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 (212°F). 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; 29.4 – 98.1 kPa (0.3 – 1.0 kgf/cm², 4.3 – 14.2 psi). 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 coolant in the reservoir tank to return to the cooling system.

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 alternator drive belt.

THERMOSTAT

The thermostat has a wax type by pass valve and is mounted in the water inlet 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 82°C (180°F).

PREPARATION**SST (SPECIAL SERVICE TOOLS)**

EG12E-04

	09216-00020 Belt Tension Gauge	
	09216-00030 Belt Tension Gauge Cable	

EQUIPMENT

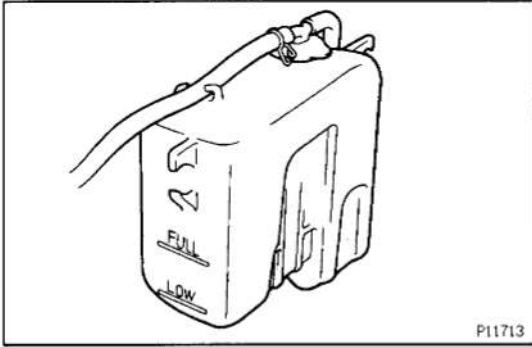
EG12W-05

Heater	
Radiator cap tester	
Thermometer	
Torque wrench	

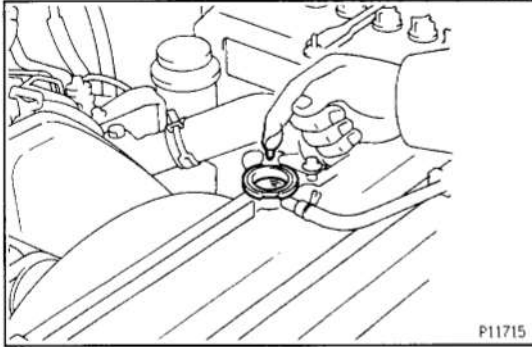
COOLANT

EG12X-05

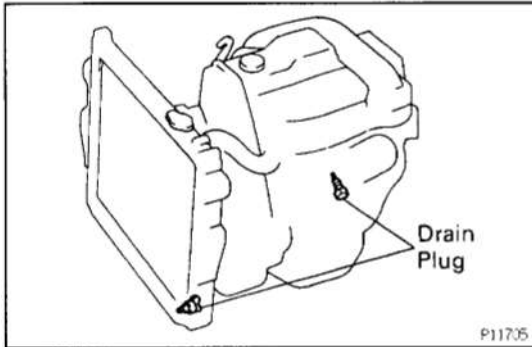
Item	Capacity	Classification
Engine coolant		Ethylene-glycol base
w/ Rear heater	11.0 liters (11.6 US qts, 9.7 imp. qts)	
w/o Rear heater	10.1 liters (10.7 US qts, 8.9 imp. qts)	



P11713



P11715



P11705

COOLANT CHECK AND REPLACEMENT

1. CHECK ENGINE COOLANT LEVEL AT RESERVOIR TANK

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

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

2. CHECK ENGINE COOLANT QUALITY

- (a) Remove the radiator cap.

CAUTION: To avoid the danger of being burned, do not remove it while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.

- (b) There should not be any excessive deposits of rust or scales around the radiator cap or radiator filler hole, and the coolant should be free from oil. If excessively dirty, replace the coolant.

- (c) Reinstall the radiator cap.

3. REPLACE ENGINE COOLANT

- (a) Remove the radiator cap.

CAUTION: To avoid the danger of being burned, do not remove it while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.

- (b) Drain the coolant from the radiator drain plug and engine drain plug. (The engine drain plug is on the left of engine block.)

- (c) Close the drain plugs.

Torque (Engine drain plug):

8 N·m (80 kgf·cm, 69 in.-lbf)

- (d) Slowly fill the system with coolant.

- Use a good brand of ethylene–glycol base coolant and mix it according to the manufacturer's directions.
- Using coolant which includes more than 50 % ethylene–glycol (but not more than 70 %) is recommended.

NOTICE:

- Do not use a alcohol type coolant.
- The coolant should be mixed with demineralized water or distilled water.

Capacity:

(w/ Rear heater)

11.0 liters (11.6 US qts, 9.7 Imp. qts)

(w/o Rear heater)

10.1 liters (10.7 US qts, 8.9 Imp. qts)

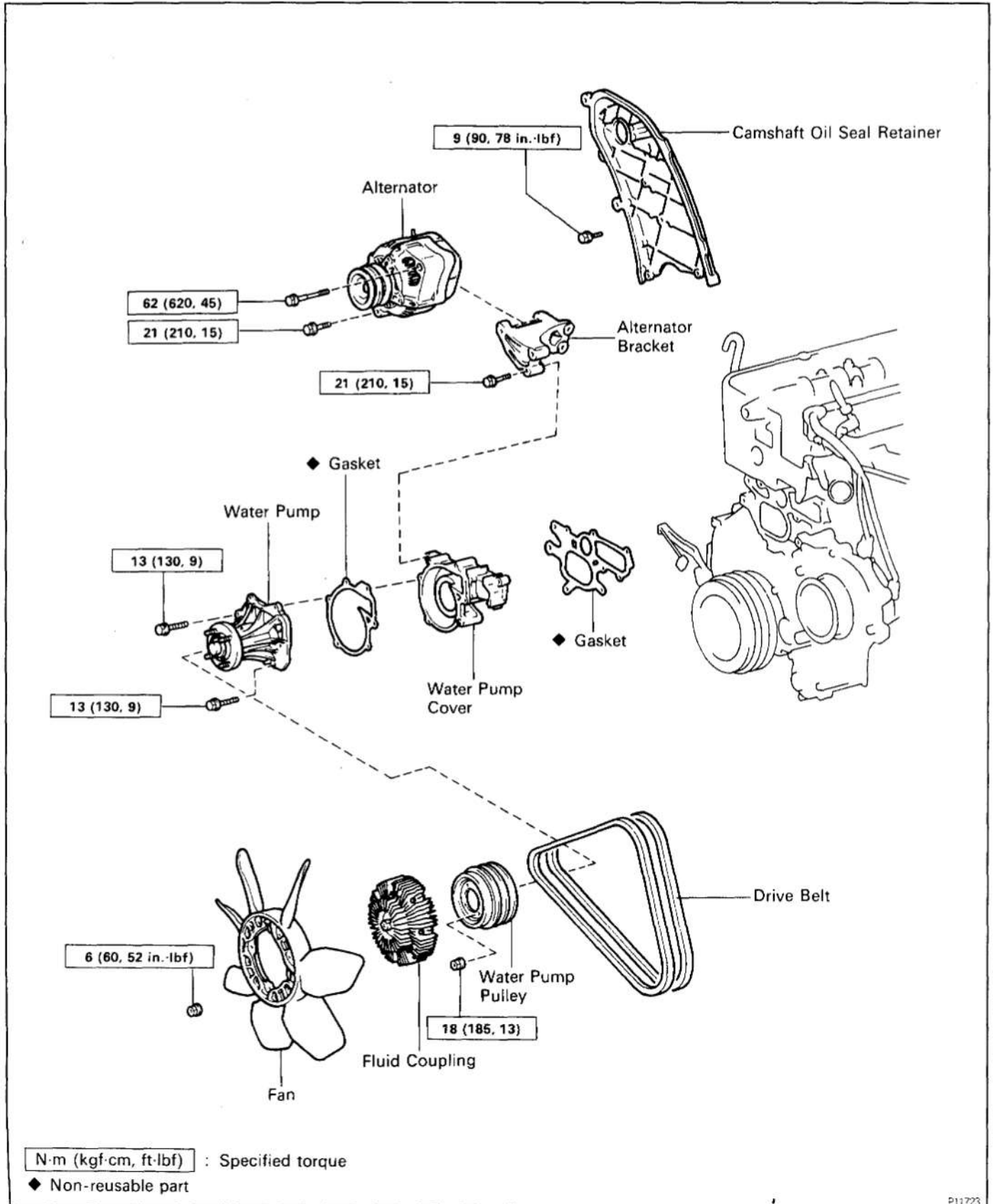
- (e) Reinstall the radiator cap.

- (f) Warm up the engine and check for leaks.

- (g) Recheck the coolant level and refill as necessary.

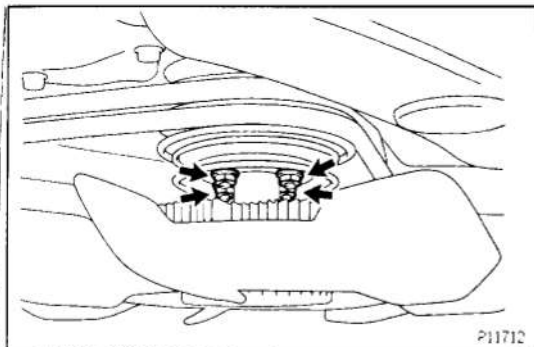
WATER PUMP COMPONENTS FOR REMOVAL AND INSTALLATION

EG162-03



N·m (kgf·cm, ft·lbf) : Specified torque

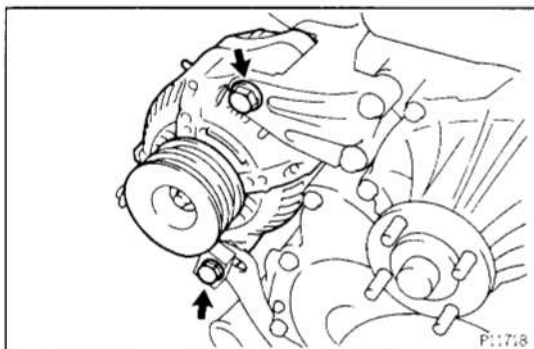
◆ Non-reusable part



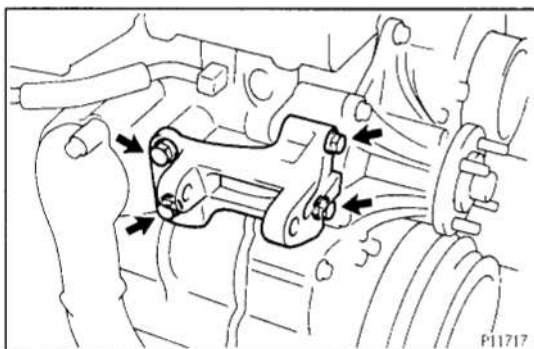
WATER PUMP REMOVAL

(See Components for Removal and Installation)

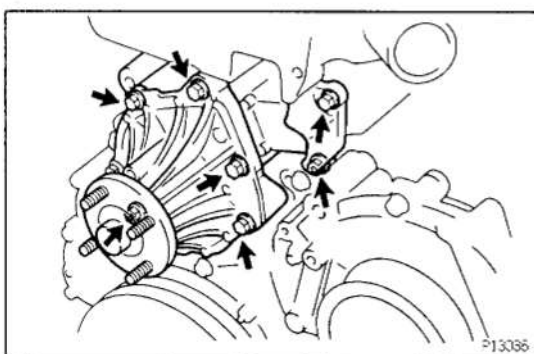
1. DRAIN ENGINE COOLANT
2. REMOVE DRIVE BELT, FAN AND WATER PUMP PULLEY
 - (a) Stretch the belt tight and loosen the 4 pump pulley set nuts.
 - (b) Loosen the pivot bolt and adjusting lock bolt.
 - (c) Loosen the adjusting bolt, and remove the drive belt.
 - (d) Remove the 4 nuts, fan and fluid coupling assembly and pulley.
3. REMOVE TIMING BELT AND IDLER PULLEY
(See step 1 to 9 on pages EG-32 to 33)
4. REMOVE NO.1 CAMSHAFT TIMING PULLEY
(See step 10 on page EG-34)
5. REMOVE CAMSHAFT OIL SEAL RETAINER
(See step 3 on page EG-41)



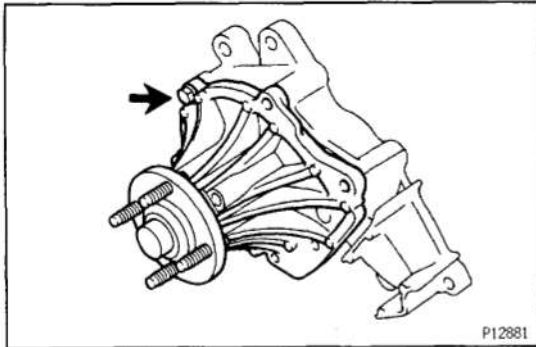
6. REMOVE WATER PUMP
 - (a) Remove the lock bolt and pivot bolt and alternator.



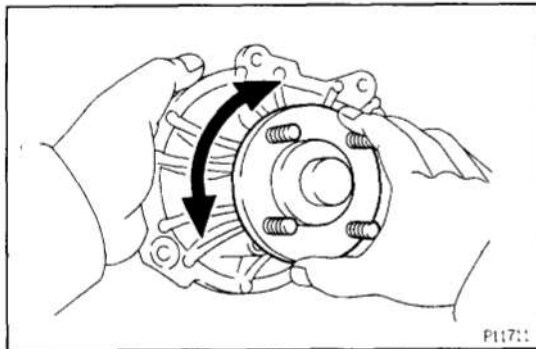
- (b) Remove the 4 bolts and alternator bracket.



- (c) Remove the 5 bolts, 2 nuts, water pump and gasket.



- (d) Remove the bolt, water pump cover and gasket.



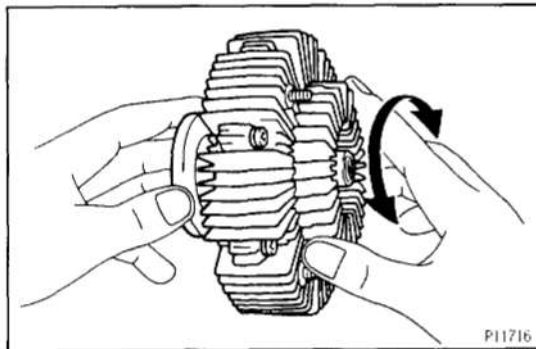
WATER PUMP INSPECTION

EG355-01

1. INSPECT WATER PUMP

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

If necessary, replace the water pump.



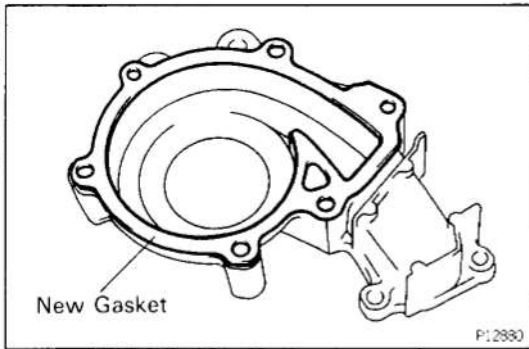
2. INSPECT FLUID COUPLING

Check the fluid coupling for damage and silicon oil leakage.

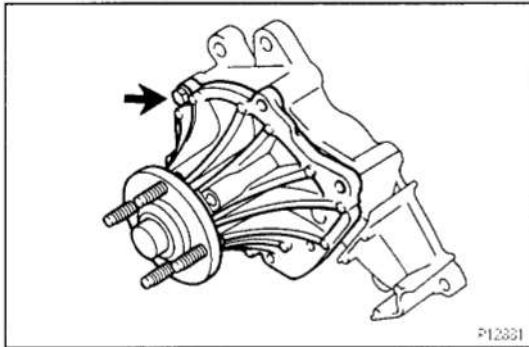
If necessary, replace the fluid coupling.

WATER PUMP INSTALLATION**(See Components for Removal and Installation)****1. INSTALL WATER PUMP ASSEMBLY**

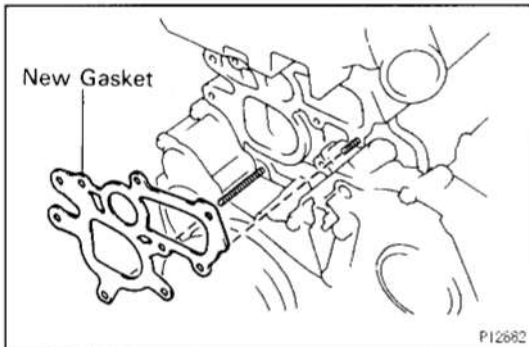
(a) Install a new gasket to the water pump cover.



(b) Temporarily install the water pump and water pump cover with the bolt.

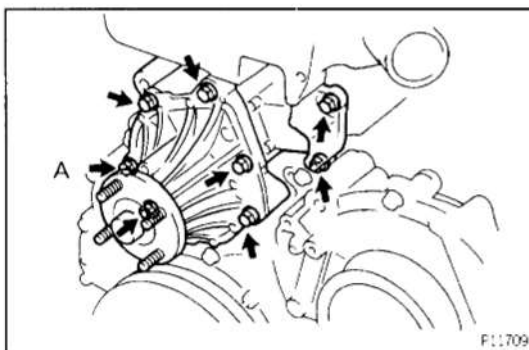


(c) Place a new gasket in position on the cylinder head.

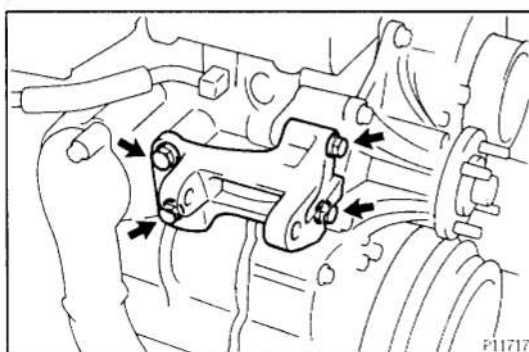


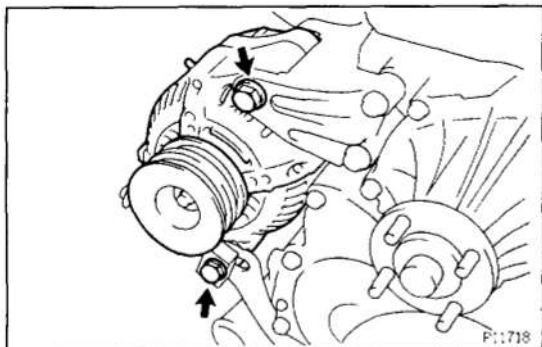
(d) Temporarily install the water pump with the 5 bolts and 2 nuts.

(e) Tighten the bolts and nuts.

Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)

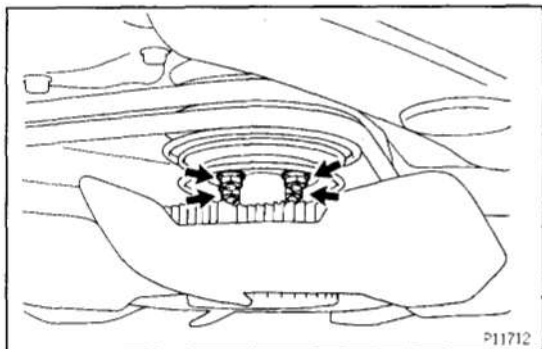
(f) Install the alternator bracket with the 4 bolts.

Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)



- (g) Install the alternator with the pivot bolt and lock bolt.
 Torque: 21 N·m (210 kgf·cm, 15 ft·lbf) for Lock bolt
 Torque: 62 N·m (620 kgf·cm, 45 ft·lbf) for Pivot bolt

2. **INSTALL CAMSHAFT OIL SEAL RETAINER**
 (See step 7 on page EG-56)
3. **INSTALL NO.1 CAMSHAFT TIMING PULLEY**
 (See step 1 on page EG-36)
4. **INSTALL IDLER PULLEY AND TIMING BELT**
 (See steps 2 to 11 on pages EG-36 to 39)

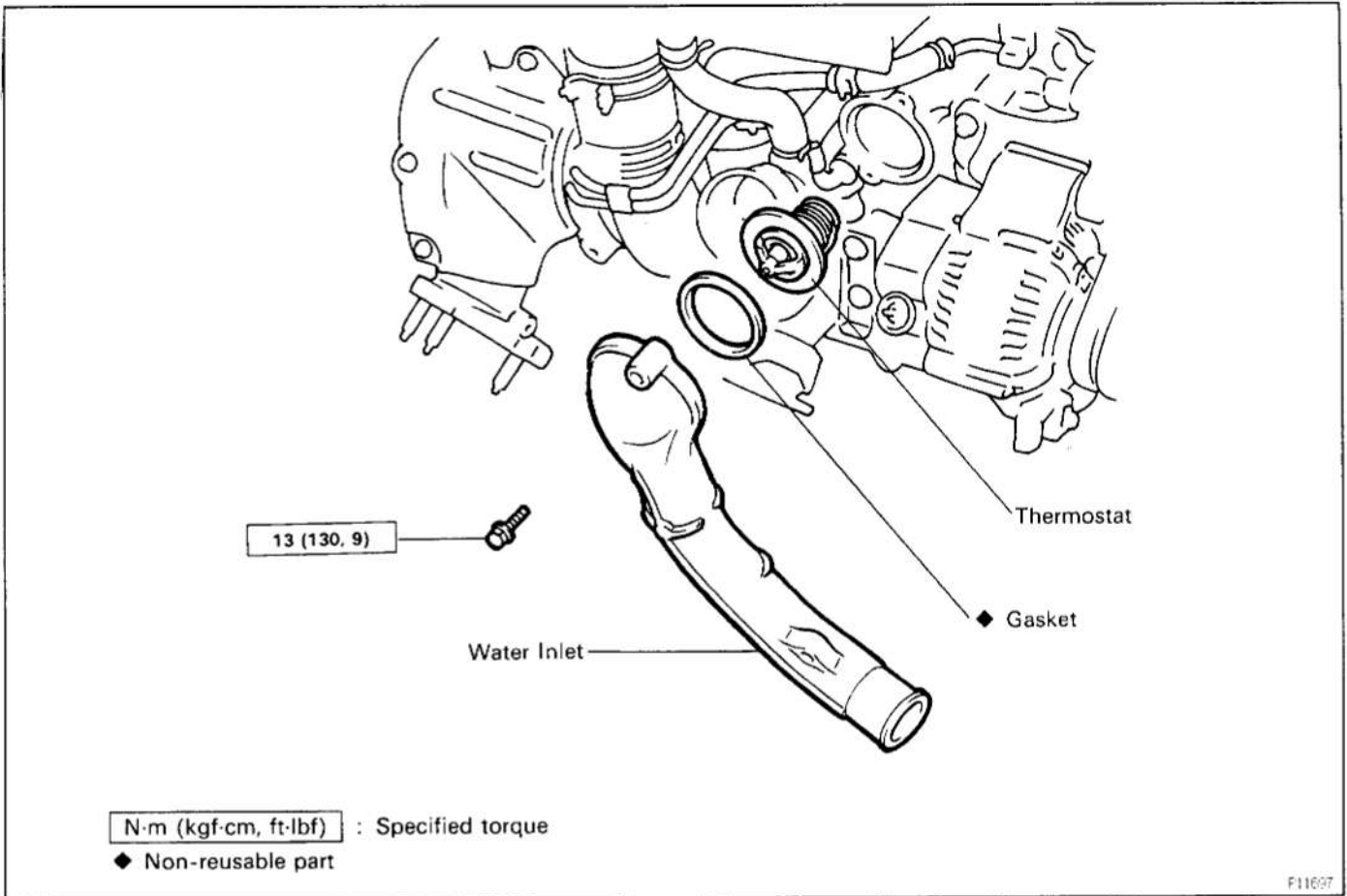


5. **INSTALL WATER PUMP PULLEY, FAN AND DRIVE BELT**
 - (a) Install the pump pulley, the fluid fan and coupling assembly with the 4 nuts.
 - (b) Place the drive belt on each pulley.
 - (c) Stretch the belt tight and torque the 4 nuts.
 Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)
 - (d) Adjust the drive belt deflection.
 (See step 3 on page CH-5)

6. **FILL WITH ENGINE COOLANT**
7. **START ENGINE AND CHECK FOR COOLANT LEAKS**

THERMOSTAT COMPONENTS FOR REMOVAL AND INSTALLATION

EG13D-09



THERMOSTAT REMOVAL

EG367-01

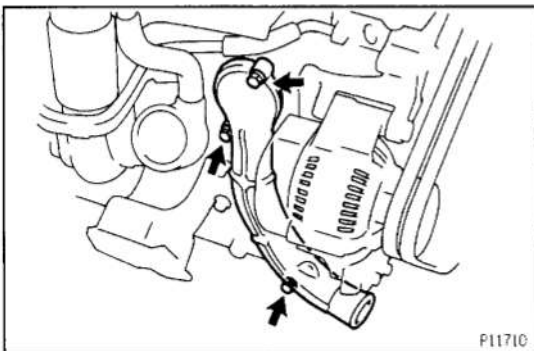
(See Components for Removal and Installation)

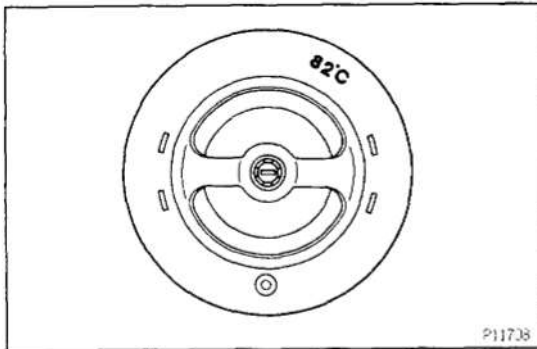
HINT: Removal of the thermostat would have an adverse effect, causing a lowering of cooling efficiency. Do not remove the thermostat, even if the engine tends to overheat.

1. DRAIN ENGINE COOLANT

2. REMOVE WATER INLET AND THERMOSTAT

- (a) Remove the 3 bolts and water inlet from the cylinder block.
- (b) Remove the thermostat.
- (c) Remove the gasket from the thermostat.

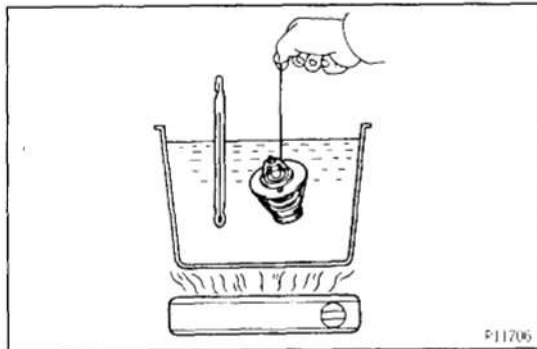




THERMOSTAT INSPECTION

INSPECT THERMOSTAT

HINT: The thermostat is numbered with the valve opening temperature.



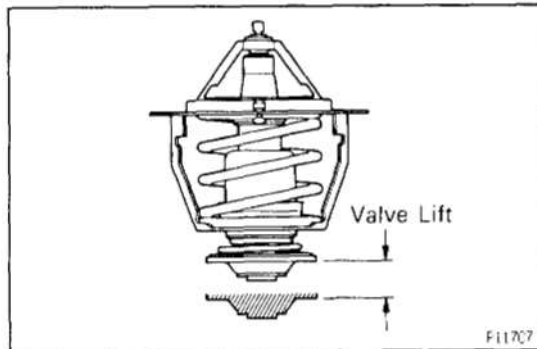
(a) Immerse the thermostat in water and gradually heat the water.

(b) Check the valve opening temperature.

Valve opening temperature:

80 – 84°C (176 – 183°F)

If the valve opening temperature is not as specified, replace the thermostat.



(c) Check the valve lift.

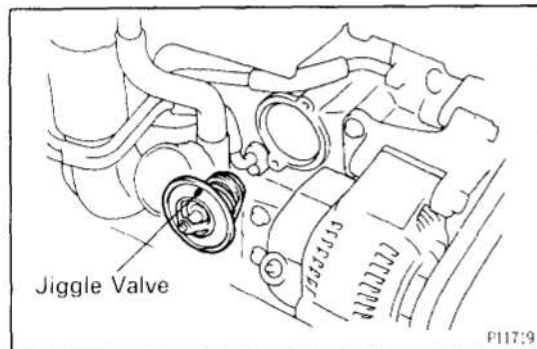
Valve lift:

8 mm (0.31 in.) or more at 95°C (203°F)

If the valve lift is not as specified, replace the thermostat.

(d) Check that the valve spring is tight when the thermostat is fully closed.

If not closed, replace the thermostat.

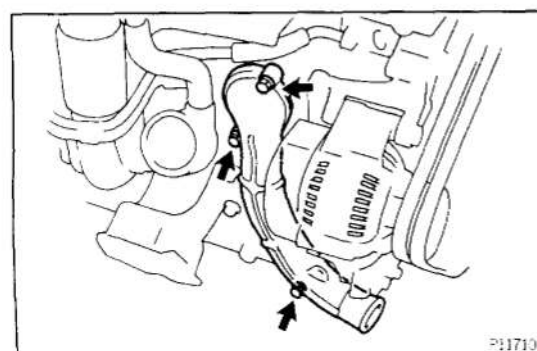


THERMOSTAT INSTALLATION

(See Components for Removal and Installation)

1. PLACE THERMOSTAT IN CYLINDER BLOCK

- (a) Install a new gasket to the thermostat.
- (b) Install the thermostat with the jiggle valve upward.



2. INSTALL WATER INLET TO CYLINDER BLOCK

Install the water inlet with the 3 bolts.

Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)

NOTICE: Torque the 2 upper bolts first.

3. FILL WITH ENGINE COOLANT

4. START ENGINE AND CHECK FOR COOLANT LEAKS

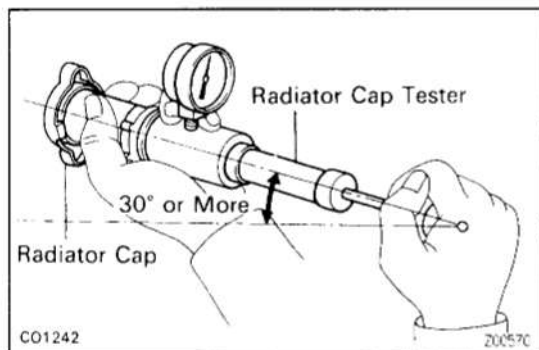
RADIATOR

RADIATOR CLEANING

EG13L-03

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

NOTICE: If using a high pressure type cleaner, be careful not to deform the fins of the radiator core. If the cleaner nozzle pressure is 2,942 – 3,432 kPa (30 – 35 kgf/cm², 427 – 498 psi), keep a distance of at least 40 – 50 cm (15.75 – 19.69 in.) between the radiator core and cleaner nozzle.



RADIATOR INSPECTION

EG359-01

1. REMOVE RADIATOR CAP

CAUTION: To avoid the danger of being burned, do not remove it while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.

2. INSPECT RADIATOR CAP

NOTICE: When performing steps (a) and (b) below, keep the radiator pump tester at an angle of over 30° above the horizontal.

- (a) Using a radiator cap tester, slowly pump the tester and check that air is coming from the relief valve.

Pump speed:

1 push/3 seconds or more

NOTICE: Push the pump at a constant speed.

If air is not coming from the relief valve, replace the radiator cap.

- (b) Pump the tester several times and measure the relief valve opening pressure.

Pump speed:

1st time

1 push/1 second or less

2nd time or more

Any speed

Standard opening pressure:

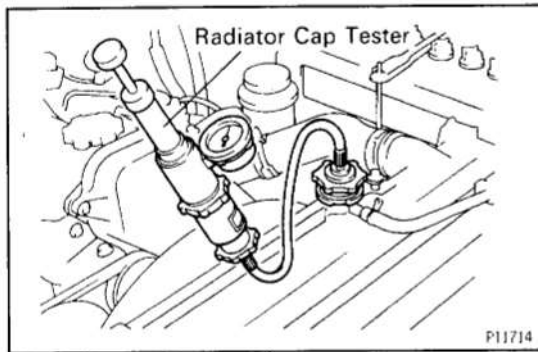
74 — 103 kPa

(0.75 — 1.05 kgf/cm², 10.7 — 14.9 psi)

Minimum opening pressure:

59 kPa (0.6 kgf/cm², 8.5 psi)

If the opening pressure is less than minimum, replace the radiator cap.



3. INSPECT COOLING SYSTEM FOR LEAKS

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

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

4. REINSTALL RADIATOR CAP

SERVICE SPECIFICATIONS**SERVICE DATA**

EG07L-0F

Thermostat	Valve opening temperature	80 — 84°C (176 — 183°F)
	Valve lift (at 95°C (203°F))	8 mm (0.31 in.) or more
Radiator cap	Relief valve opening pressure (STD)	74 — 103 kPa (0.75 — 1.05 kgf/cm ² , 10.7 — 14.9 psi)
	Relief valve opening pressure (Limit)	59 kPa (0.6 kgf/cm ² , 8.5 psi)

TORQUE SPECIFICATIONS

EG07M-0H

Part tightened		N-m	kgf-cm	ft-lbf
Cylinder block x Drain plug		8	80	69 in.-lbf
Water pump x Cylinder block		13	130	9
Alternator bracket x Cylinder block		21	210	15
Alternator x Alternator bracket	Lock bolt	21	210	15
	Pivot bolt	62	620	45
Fan x Water pump pulley		18	185	13
Water inlet x Cylinder block		13	130	9

