
COOLING

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COOLANT INSPECTION

CO066-05

HINT:

Check the coolant level when the engine is cold.

1. CHECK ENGINE COOLANT LEVEL AT RADIATOR RESERVOIR

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

If low, check the leakage and add "Toyota Long Life Coolant" or equivalent up to between the "LOW" and "FULL" lines.

2. CHECK ENGINE COOLANT QUALITY

(a) Remove the radiator cap.

CAUTION:

To avoid the danger of being burned, do not remove the radiator cap and air release valve 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 scale around the radiator cap or water filler hole, and the coolant should be free from oil.

If excessively dirty, clean the coolant passages and replace the coolant.

(c) Reinstall the radiator cap.

REPLACEMENT

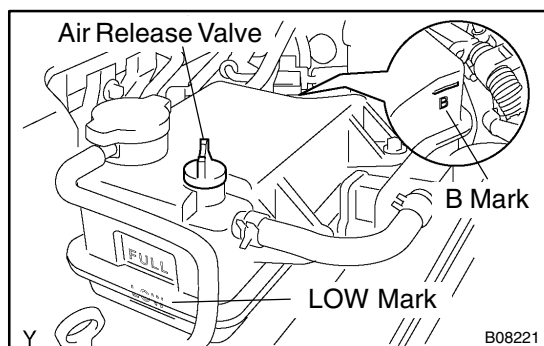
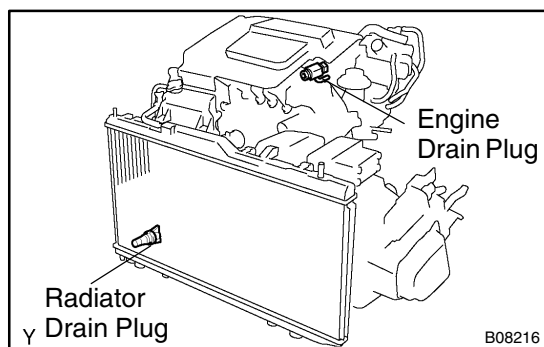
CAUTION:

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

1. DRAIN ENGINE COOLANT

- (a) Remove the radiator cap.
- (b) Loosen the radiator and engine drain plugs, and drain the coolant.
- (c) Close the drain plugs.

Torque: 13 N·m (130 kgf·cm, 9 ft·lbf) for engine



2. FILL ENGINE COOLANT

- (a) Turn the air release valve counterclockwise and pull it out.
- (b) Slowly fill the system with coolant up to B mark.
 - Use of improper coolants may damage engine cooling system.
 - Use "Toyota Long Life Coolant" or equivalent and mix it with plain water according to the manufacturer's directions.
 - Using of coolant which includes more than 50 % (freezing protection down to -35°C (-31°F) or 60 % (freezing protection down to -50°C (-58°F)) of ethylene-glycol is recommended but not more than 70 %.

NOTICE:

- Do not use an alcohol type coolant or plain water alone.
- The coolant should be mixed with plain water (preferably demineralized water or distilled water).

Capacity:

w/ Power heater	7.1 liter (7.5 US qts, 6.3 Imp. qts)
w/o Power heater	6.9 liter (7.3 US qts, 6.1 Imp. qts)

- (c) Close the air release valve and install the radiator cap securely.
- (d) Start the engine.

HINT:

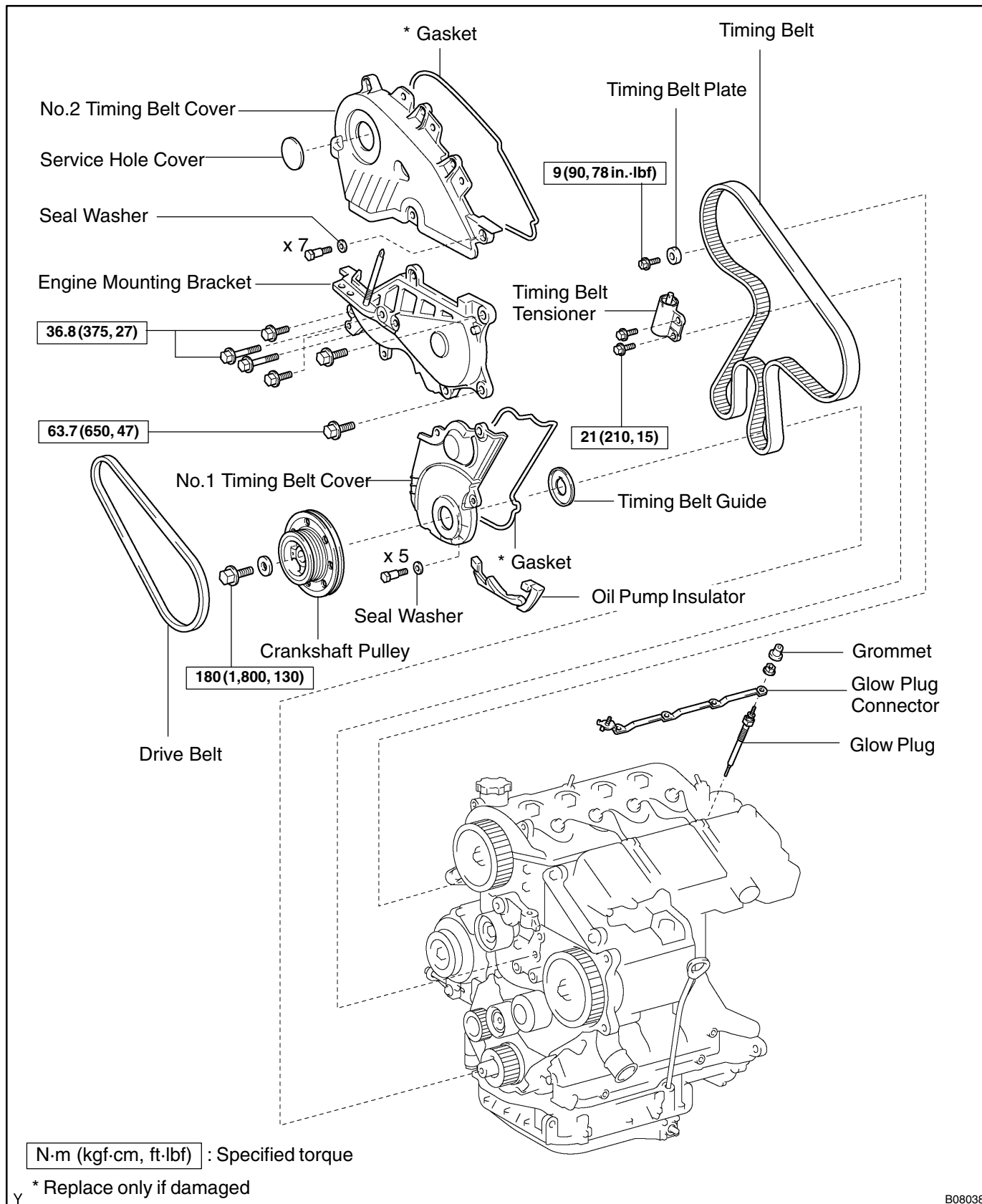
Warm up the engine with the speed of 2,000 rpm or more and continue doing it until the thermostat has open and the radiator reservoir has become hot.

- (e) Check the coolant level is above LOW mark.

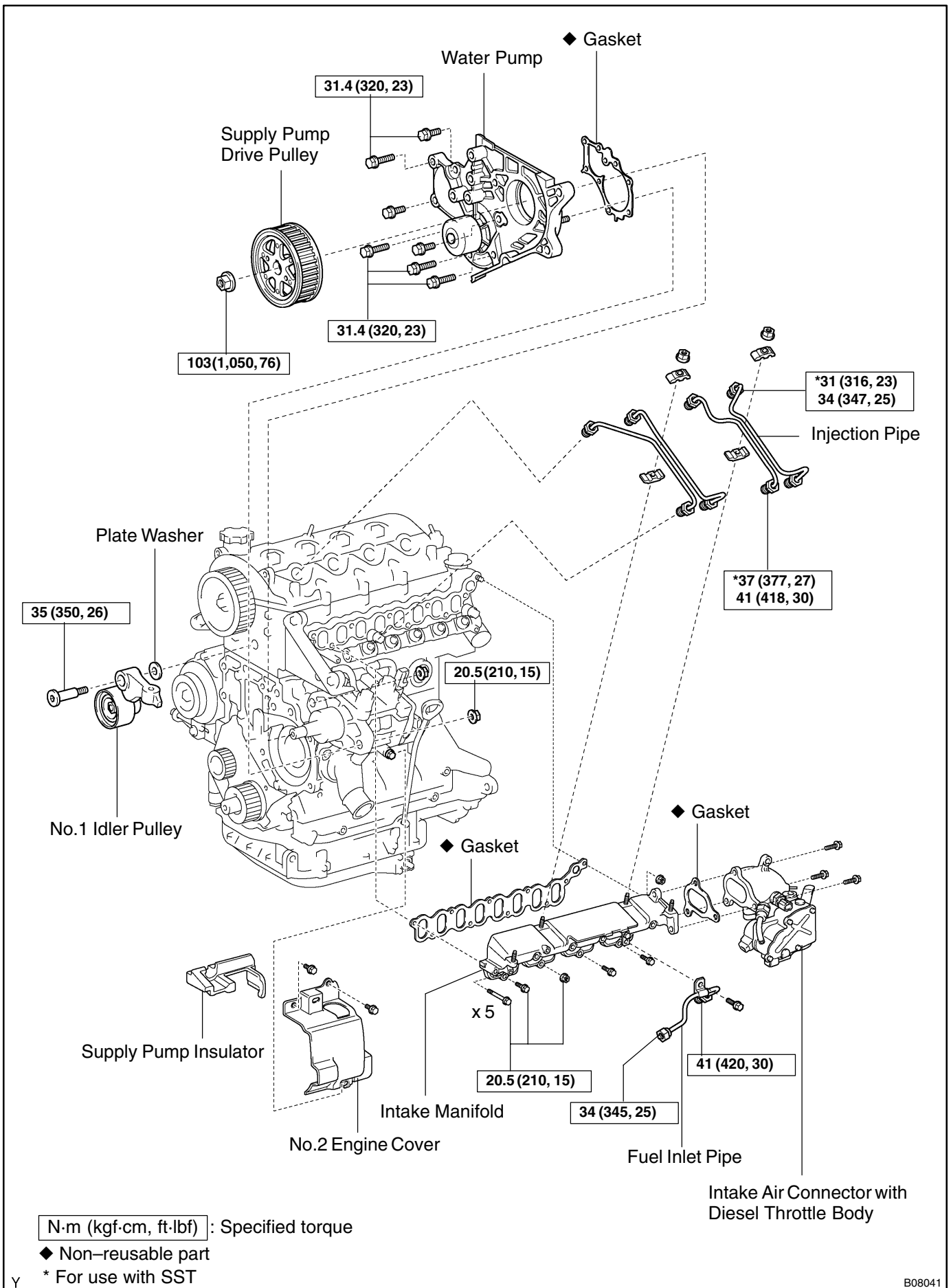
- (f) After the engine has become cold, check that the water level becomes below FULL line.
- 3. **CHECK ENGINE COOLANT FOR LEAK**
- 4. **CHECK ENGINE COOLANT SPECIFIC GRAVITY CORRECTLY**

WATER PUMP COMPONENTS

CO068-05



B08038

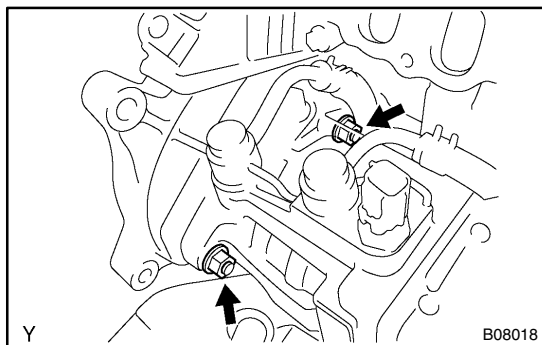


REMOVAL

NOTICE:

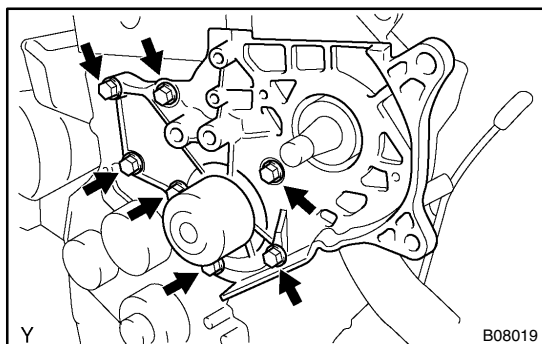
- Before removing the injection pipes and fuel inlet pipe, clean them up with a soft brush and compressed air.
- After removing the fuel inlet pipe and injection pipe, affix the gum tape on the supply pump, common rail and the whole injector installation area of the cylinder head cover for preventing dust from coming into them.

1. DRAIN ENGINE COOLANT
2. REMOVE TIMING BELT (See page EM-12)
3. REMOVE NO.1 IDLER AND SUPPLY PUMP DRIVE PULLEYS (See page EM-12)
4. REMOVE NO.2 ENGINE COVER (See page CO-10)
5. REMOVE SUPPLY PUMP INSULATOR
6. REMOVE FUEL INLET PIPE (See page FU-16)
7. REMOVE INJECTION PIPES (See page FU-6)
8. REMOVE INTAKE AIR CONNECTOR WITH DIESEL THROTTLE BODY (See page EM-28)
9. REMOVE INTAKE MANIFOLD (See page EM-28)

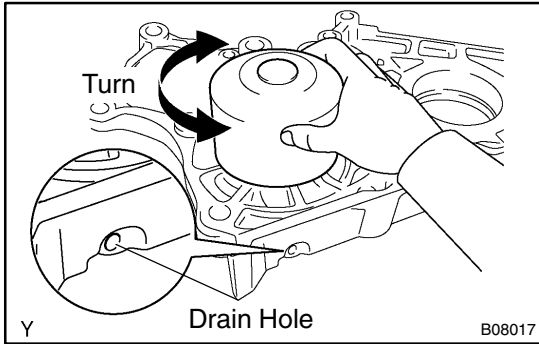


10. REMOVE WATER PUMP

- (a) Remove the 2 supply pump set nuts.



- (b) Remove the 7 bolts, water pump and gasket.



INSPECTION

1. INSPECT WATER PUMP

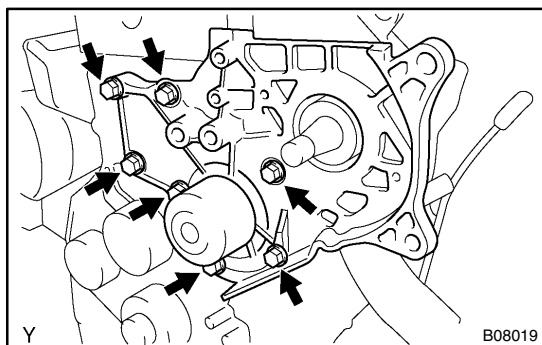
- (a) Visually check the drain hole for coolant leakage. If leakage is found, replace the water pump.
- (b) Turn the pulley, and check that the water pump bearing moves smoothly and quietly. If necessary, replace the water pump.

2. INSPECT TIMING BELT COMPONENTS (See page EM-11)

INSTALLATION

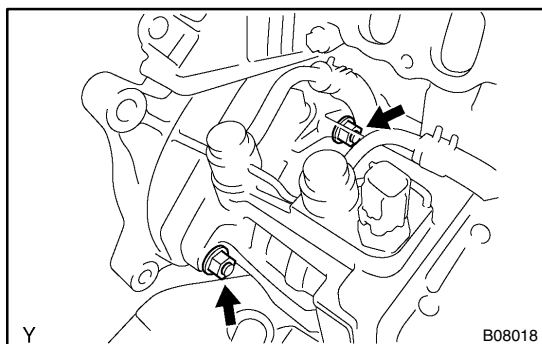
NOTICE:

In case of having the water pump replaced, must replace the fuel inlet pipe, too.



1. INSTALL WATER PUMP

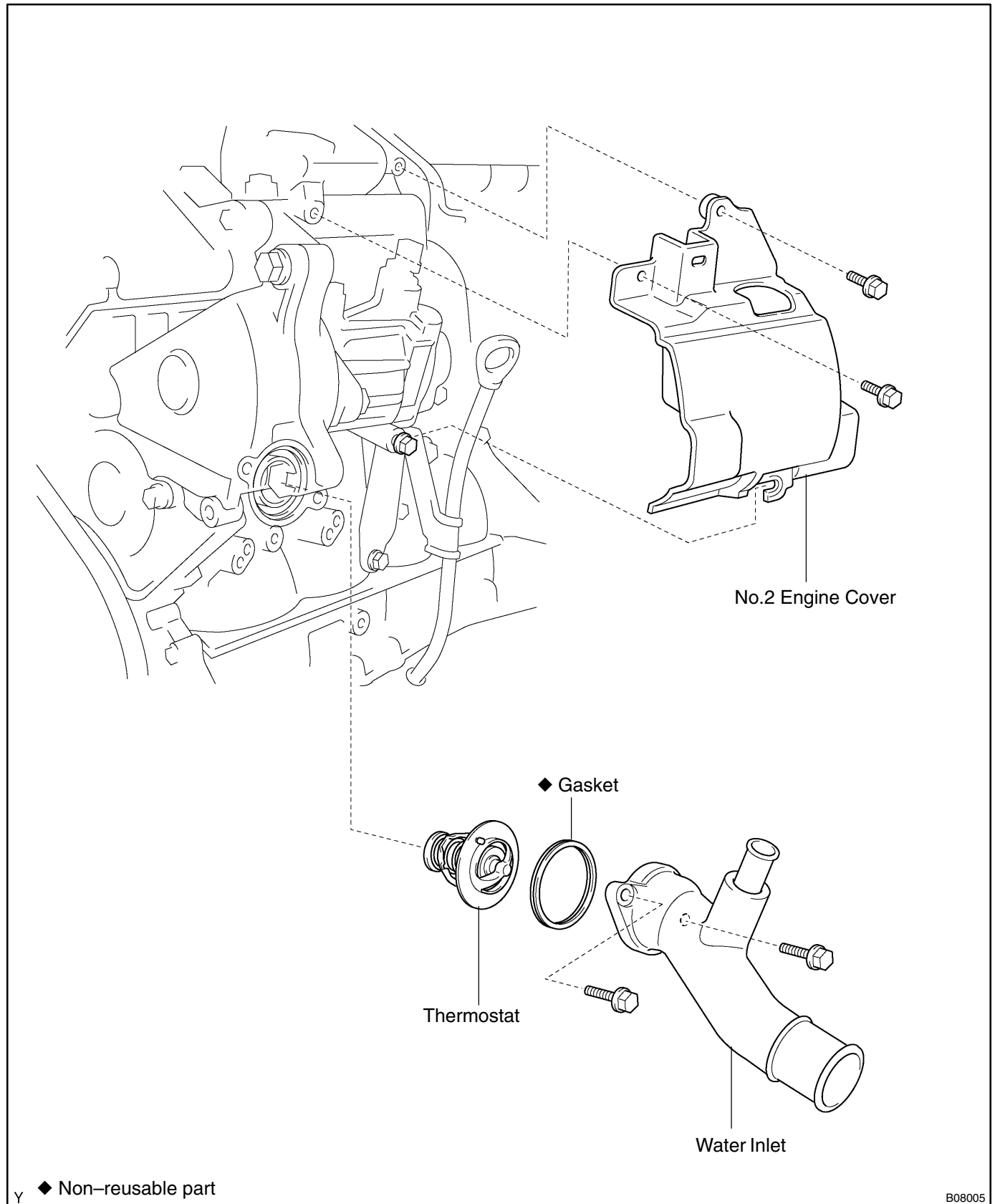
- (a) Install a new gasket and the water pump with the 7 bolts.
Torque: 31.4 N·m (320 kgf·cm, 23 ft·lbf)



- (b) Install the 2 supply pump set nuts.
Torque: 20.5 N·m (210 kgf·cm, 15 ft·lbf)
2. **INSTALL INTAKE MANIFOLD** (See page EM-46)
 3. **INSTALL INTAKE AIR CONNECTOR WITH DIESEL THROTTLE BODY** (See page EM-46)
 4. **INSTALL INJECTION PIPES** (See page FU-8)
 5. **INSTALL FUEL INLET PIPE** (See page FU-18)
 6. **INSTALL SUPPLY PUMP INSULATOR**
(See page FU-18)
 7. **INSTALL NO.2 ENGINE COVER**
 8. **INSTALL SUPPLY PUMP DRIVE AND NO.1 IDLER PULLEYS** (See page EM-18)
 9. **INSTALL TIMING BELT** (See page EM-18)
 10. **FILL WITH ENGINE COOLANT**
 11. **START ENGINE AND CHECK FOR COOLANT LEAK**

THERMOSTAT COMPONENTS

CO06C-05

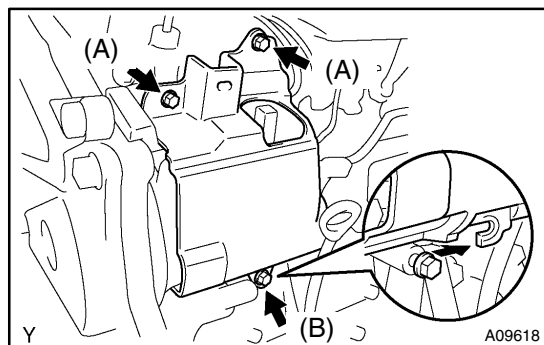


REMOVAL

HINT:

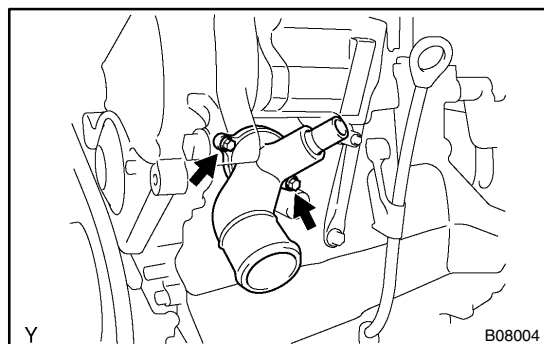
Removal of the thermostat would have an adverse effect, causing a decline in cooling efficiency. Do not remove the thermostat, even if the engine tends to overheat.

1. DRAIN ENGINE COOLANT



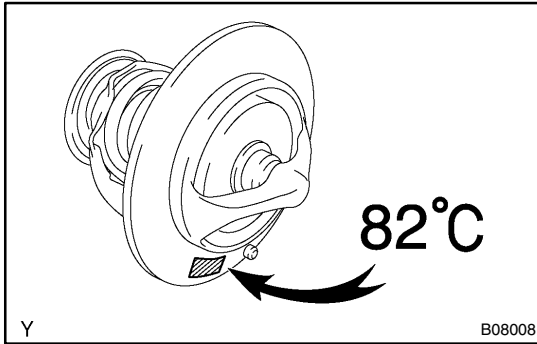
2. REMOVE NO.2 ENGINE COVER

- (a) Remove the 2 bolts (A).
- (b) Loosen the bolt (B) and remove the cover.



3. REMOVE WATER INLET AND THERMOSTAT

- (a) Remove the 2 bolts and water inlet from the cylinder block.
- (b) Remove the thermostat.
- (c) Remove the gasket from the thermostat.



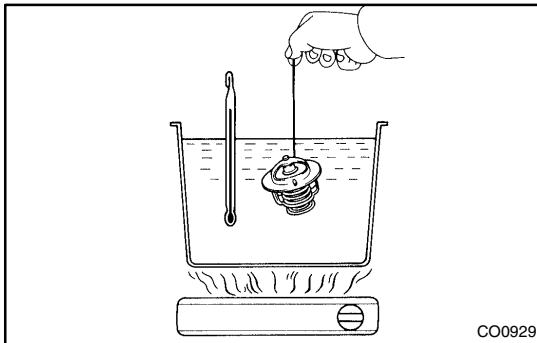
INSPECTION

INSPECT THERMOSTAT

HINT:

The thermostat is numbered with the valve opening temperature.

CO06E-05

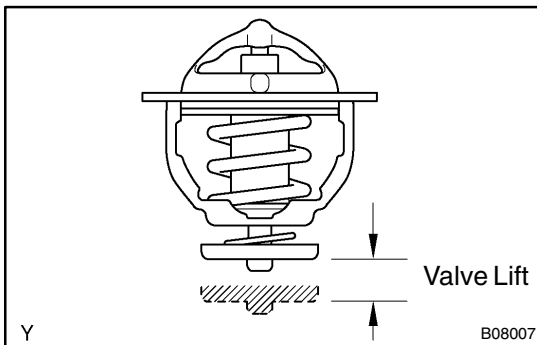


(a) Immerse the thermostat in water and gradually heat the water.

(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.



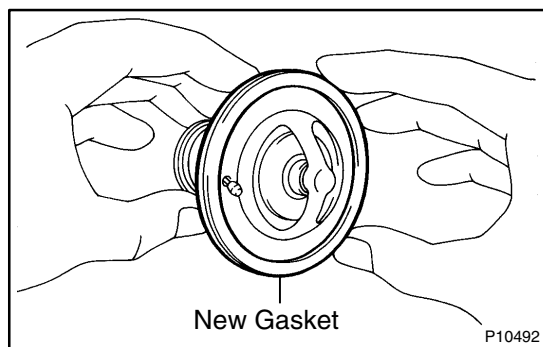
(c) Check the valve lift.

Valve lift: 8.5 mm (0.33 in.) or more at 95°C (203°F)

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

(d) Check that the valve is fully closed when the thermostat is at low temperature (below 40°C (104°F)).

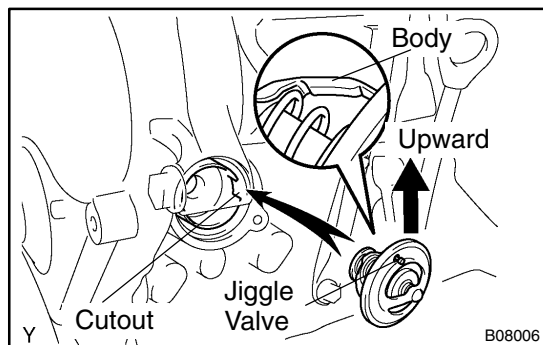
If not closed, replace the thermostat.



INSTALLATION

1. PLACE THERMOSTAT IN CYLINDER BLOCK

- (a) Install a new gasket to the thermostat.



- (b) Face the jiggle valve of the thermostat upward, and insert the thermostat body in the flange cutout on the cylinder block.

2. INSTALL WATER INLET

Install the water inlet with the 2 bolts.

Torque: 8.8 N·m (90 kgf·cm, 78 in.-lbf)

3. INSTALL NO.2 ENGINE COVER

4. FILL WITH ENGINE COOLANT

5. START ENGINE AND CHECK FOR COOLANT LEAK

RADIATOR

ON-VEHICLE CLEANING

C006G-05

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

NOTICE:

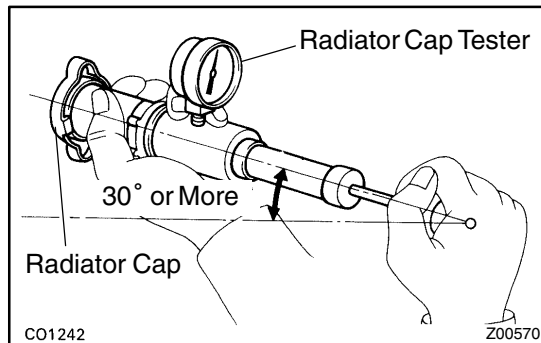
If using a high pressure type cleaner, be careful not to deform the fins of the radiator core. (i.e. Maintain a distance between the cleaner nozzle and radiator core.)

ON-VEHICLE INSPECTION

1. REMOVE RADIATOR CAP

CAUTION:

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



2. INSPECT RADIATOR CAP

NOTICE:

- If the radiator cap has contaminations, always rinse it with water.
 - Before using a radiator cap tester, wet the relief valve and pressure valve with engine coolant or water.
 - When performing steps (a) and (b) below, keep the tester at an angle of over 30° above the horizontal.
- (a) Using a radiator cap tester, slowly pump the tester and check if air is coming from the vacuum valve.

Pump speed: 1 push/(3 seconds or more)

NOTICE:

Push the pump at a constant speed.

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

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

Pump speed: 1 push within 1 second

NOTICE:

This pump speed is for the first pump only (in order to close the vacuum valve). After this, the pump speed can be reduced.

Standard opening pressure:

93.3 – 122.7 kPa (0.95 – 1.25 kgf/cm², 13.5 – 17.8 psi)

Minimum opening pressure:

78 kPa (0.8 kgf/cm², 11.4 psi)

HINT:

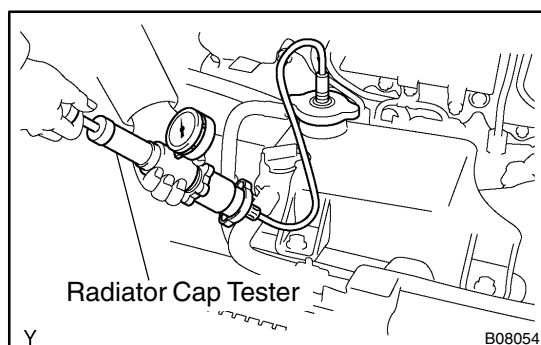
Use the tester's maximum reading as the opening pressure. If the opening pressure is less than minimum, replace the radiator cap.

3. INSPECT COOLING SYSTEM FOR LEAK

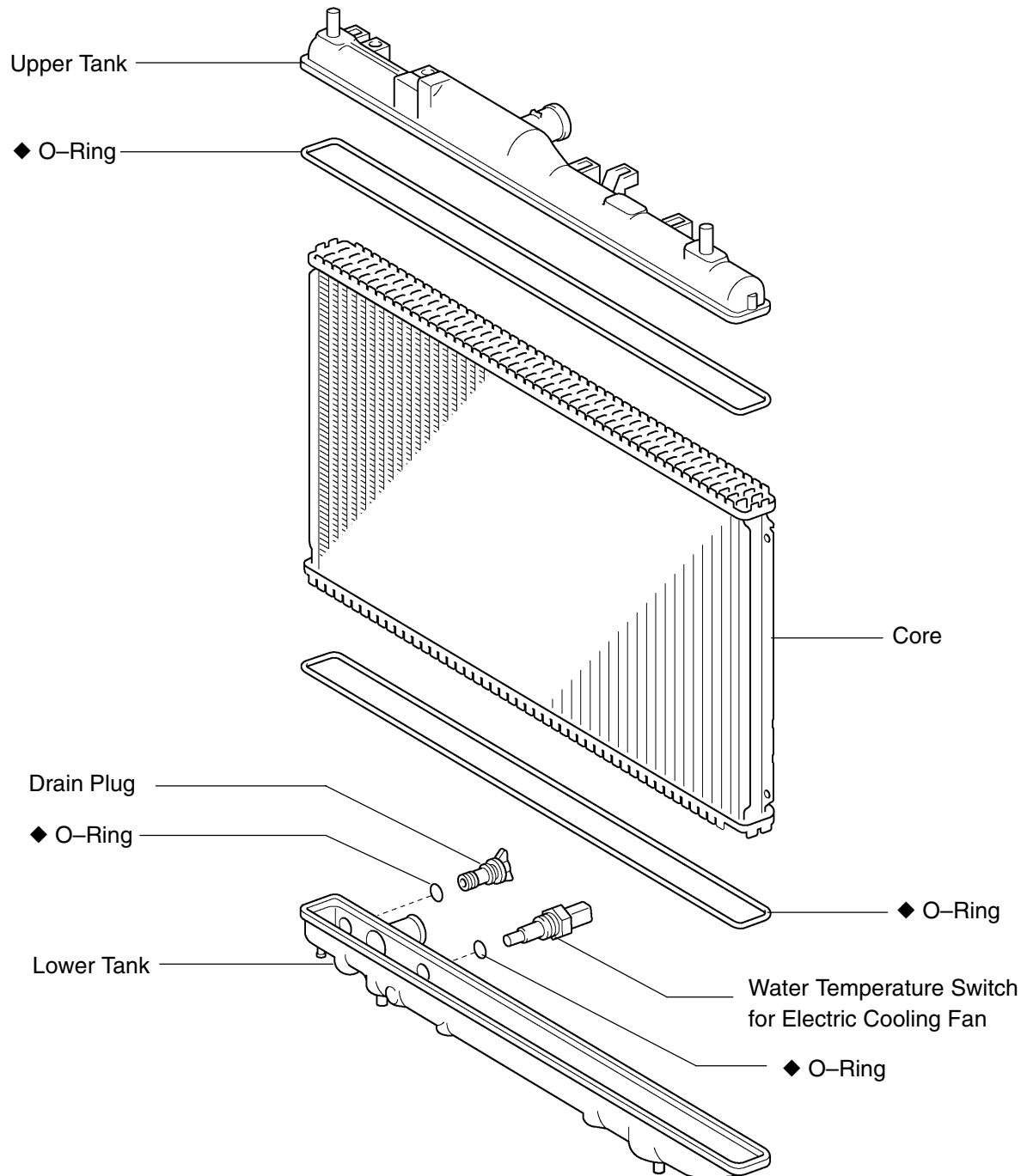
- (a) Fill the radiator with coolant, and attach a radiator cap tester.
- (b) Warm up the engine.
- (c) Pump it to 118 kPa (1.2 kgf/cm², 17.1 psi), and check that the pressure does not drop.

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

4. REINSTALL RADIATOR CAP



COMPONENTS



Y ◆ Non-reusable part

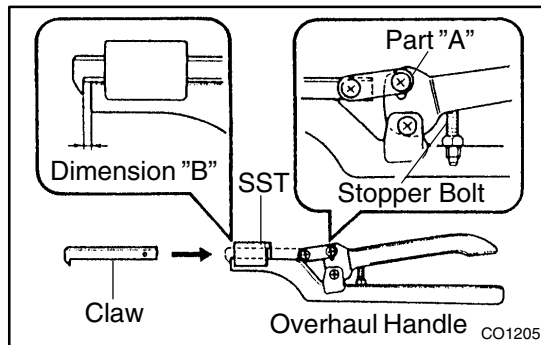
DISASSEMBLY

1. REMOVE DRAIN PLUG

- (a) Remove the drain plug.
- (b) Remove the O-ring.

2. REMOVE WATER TEMPERATURE SWITCH

- (a) Remove the water temperature switch.
- (b) Remove the O-ring.



3. ASSEMBLE SST

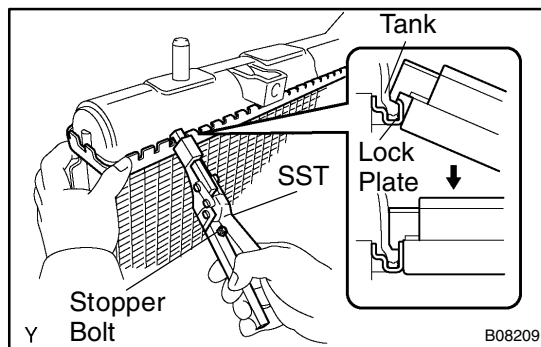
SST 09230-01010

- (a) Install the claw to the overhaul handle, inserting it in the hole in part "A" as shown in the diagram.
- (b) While gripping the handle, adjust the stopper bolt so that dimension "B" is as shown in the illustration.

Dimension B: 0.2 – 0.3 mm (0.008 – 0.012 in)

NOTICE:

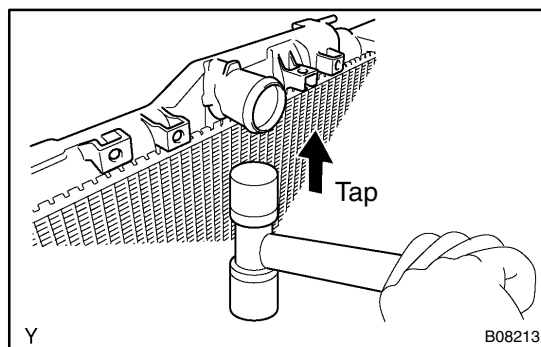
If this adjustment is not done the claw may be damaged.



4. UNCAULK LOCK PLATES

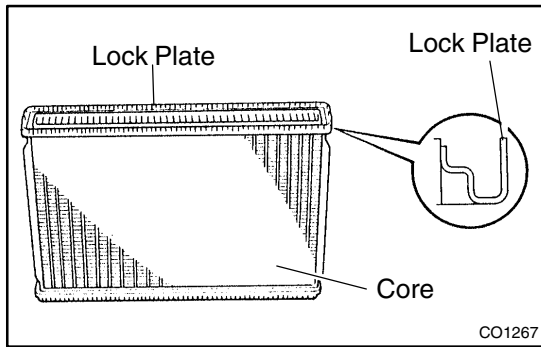
Using SST to release the caulking, squeeze the handle until stopped by the stopper bolt.

SST 09230-01010



5. REMOVE TANKS AND O-RINGS

Lightly tap the radiator inlet or outlet (or bracket of the radiator) with a soft-faced hammer, and remove the tank and the O-ring.



REASSEMBLY

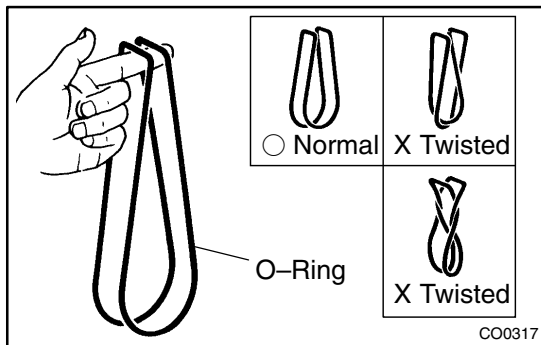
1. INSPECT LOCK PLATE FOR DAMAGE

HINT:

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

NOTICE:

The radiator can only be recaulked 2 times. After the 2nd time, the radiator core must be replaced.

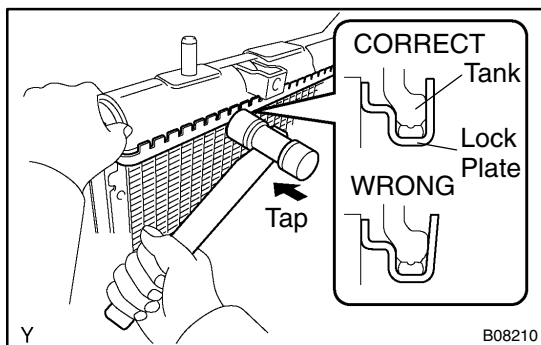


2. INSTALL NEW O-RINGS AND TANKS

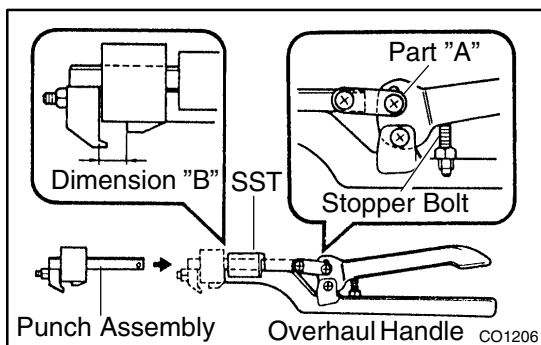
- (a) After checking that there are no foreign objects in the lock plate groove, install the new O-ring without twisting it.

HINT:

When cleaning the lock plate groove, lightly rub it with sand paper without scratching it.



- (b) Install the tank without damaging the O-ring.
(c) Tap the lock plate with a soft-faced hammer so that there is no gap between it and the tank.

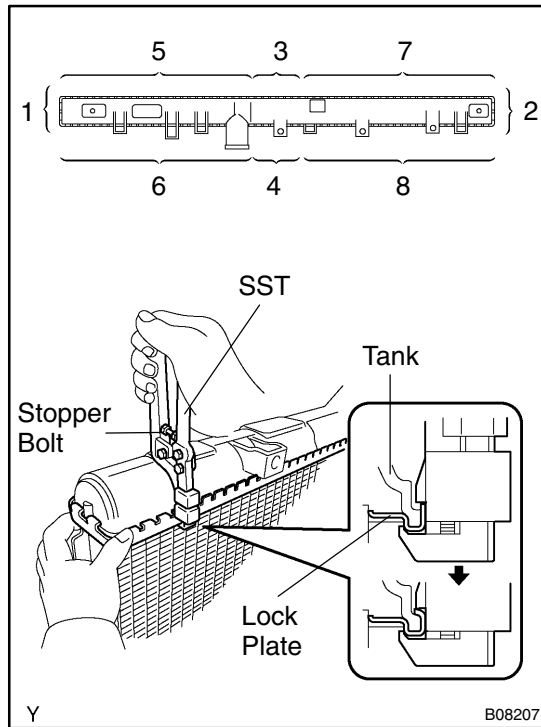


3. ASSEMBLE SST

SST 09230-01010, 09231-14010

- (a) Install the punch assembly to the overhaul handle, inserting it in the hole in part "A" as shown in the illustration.
(b) While gripping the handle, adjust the stopper bolt so that dimension "B" is as shown in the illustration.

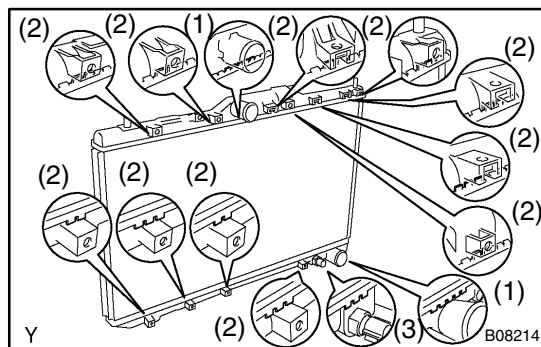
Dimension B: 8.4 mm (0.331 in.)



4. CAULK LOCK PLATE

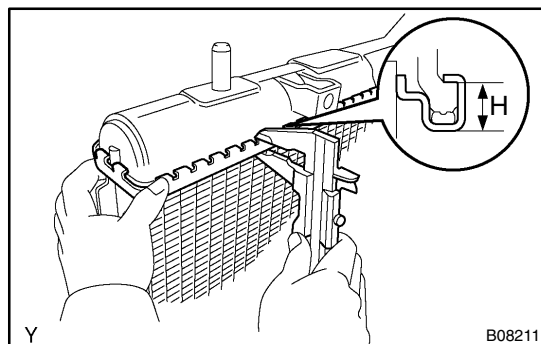
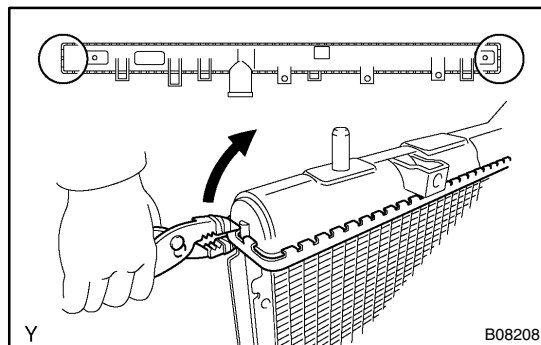
- (a) Lightly press SST against the lock plate in the order shown in the illustration. After repeating this a few times, fully caulk the lock plate by squeezing the handle until stopped by the stopper plate.

SST 09230-01010



HINT:

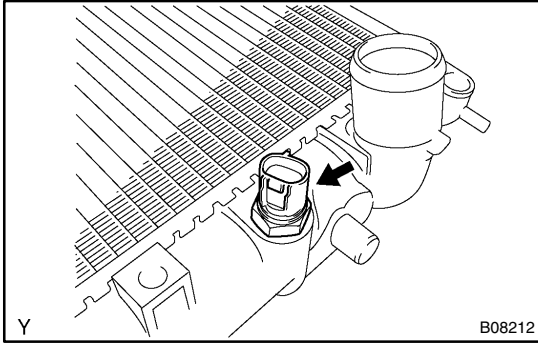
- Do not stake the areas protruding around the pipes (1), brackets (2) and flange (3).
- The points shown in the illustration cannot be staked with the SST. Use pliers or similar object and be careful not to damage the core plates.



- (b) Check the lock plate height (H) after completing the caulking.

Plate height (H): 7.40 – 7.80 mm (0.2913 – 0.3071 in.)

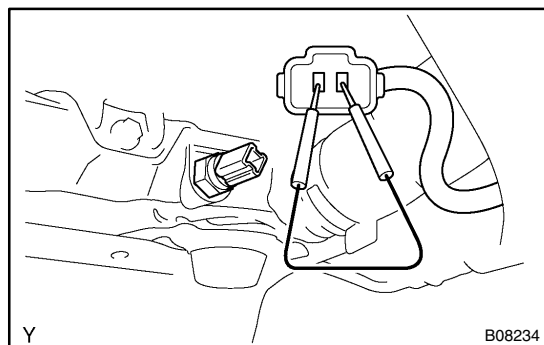
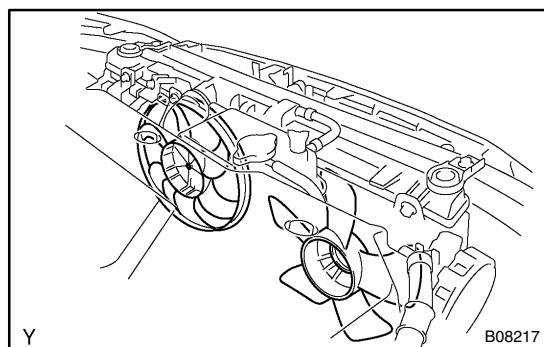
If not within the specified height, adjust the stopper bolt of the handle again and caulk again.

**5. INSTALL WATER TEMPERATURE SWITCH**

- (a) Install a new O-ring to the water temperature switch.
- (b) Install the water temperature switch.

6. INSTALL DRAIN PLUG

- (a) Install a new O-ring to the drain plug.
- (b) Install the drain plug.



ELECTRIC COOLING FAN ON-VEHICLE INSPECTION

CO0VJ-01

1. CHECK COOLING FAN OPERATION WITH LOW TEMPERATURE (Below 83°C (181°F))

- Turn the ignition switch ON.
- Check that the cooling fan stops.

- Disconnect the water temperature switch connector.
 - Connect the terminals on the water temperature switch connector.
 - Check that the cooling fan rotates.
- If not, check the fuse, cooling fan relay, cooling fan, and check for a open circuit between the cooling fan relay and water temperature switch.
- Reconnect the water temperature switch connector.

2. CHECK COOLING FAN OPERATION WITH HIGH TEMPERATURE (Above 93°C (199°F))

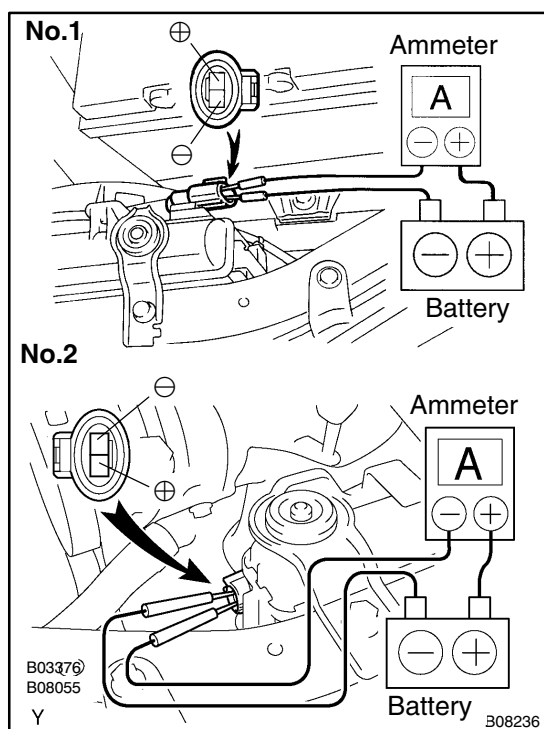
- Start the engine, and raise coolant temperature to above 93°C (199°F).

HINT:

Coolant temperature is the detected value by the water temperature switch on the radiator lower tank.

- Check that the cooling fan rotates.

If not, replace the water temperature switch.



3. INSPECT COOLING FANS

- Disconnect the cooling fan connector.
- Connect battery and ammeter to the cooling fan connector.
- Check that the cooling fan rotates smoothly, and check the reading on the ammeter.

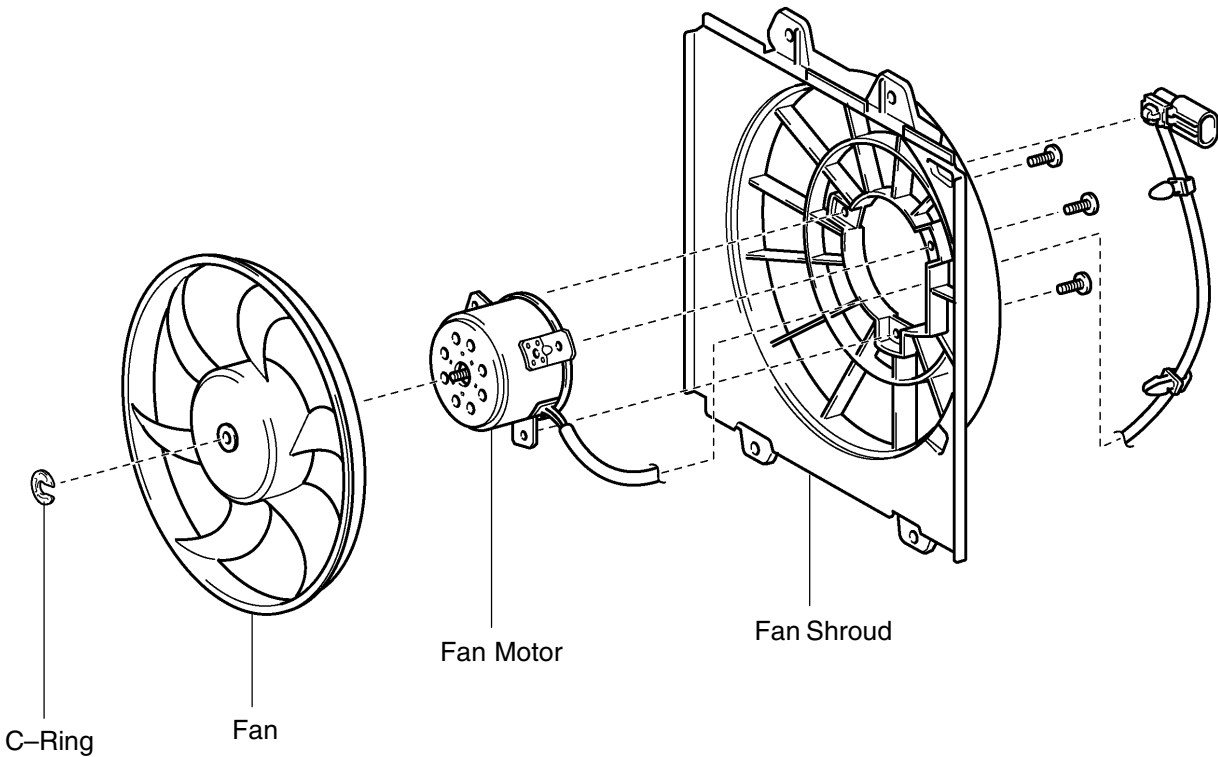
Standard amperage:

No.1	At 20°C (68°F)	Approx. 13.2 A
No.2	At 20°C (68°F)	Approx. 9.8 A

- Reconnect the cooling fan connector.

COMPONENTS

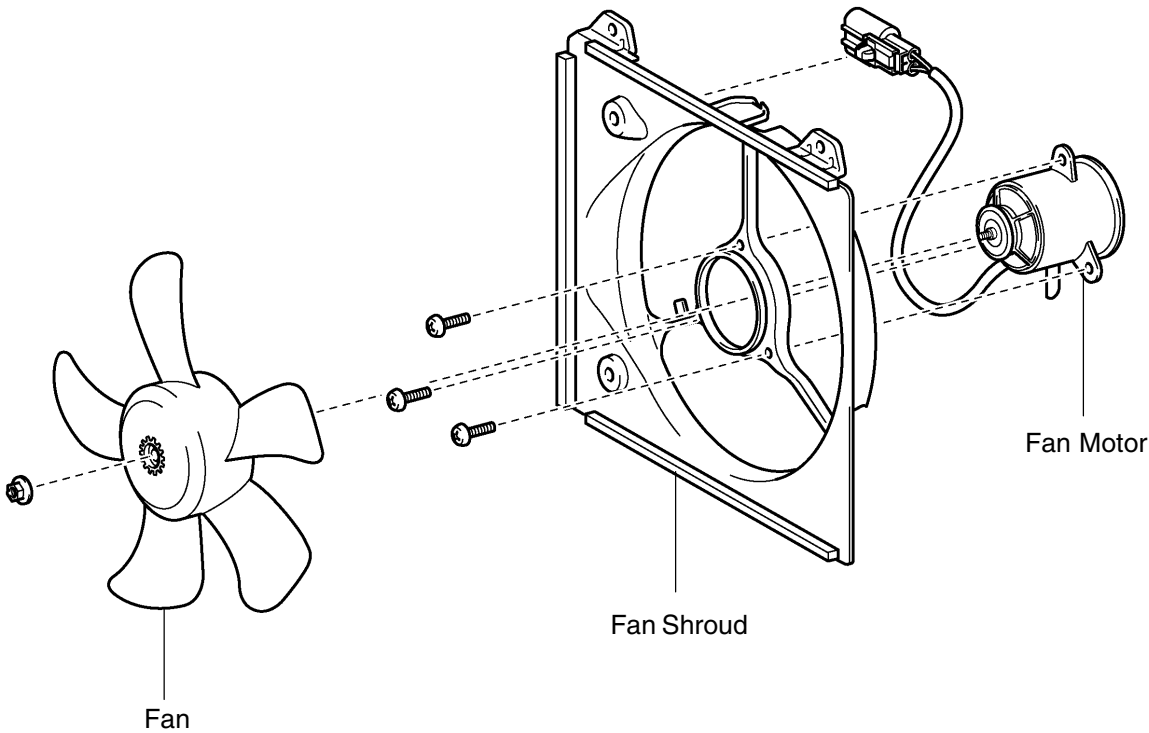
No.1 Cooling Fan



Y

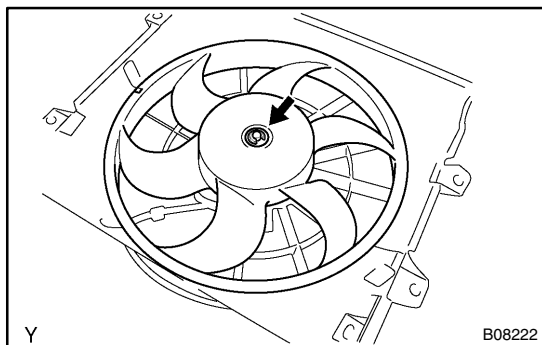
B08230

No.2 Cooling Fan



Y

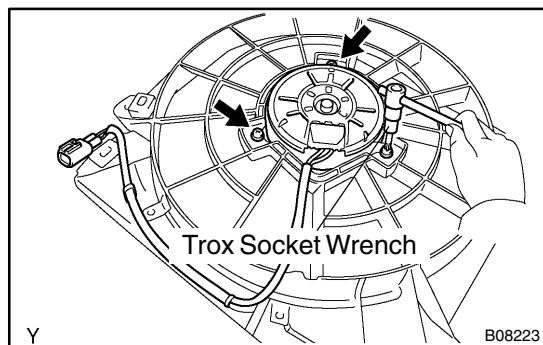
B08229



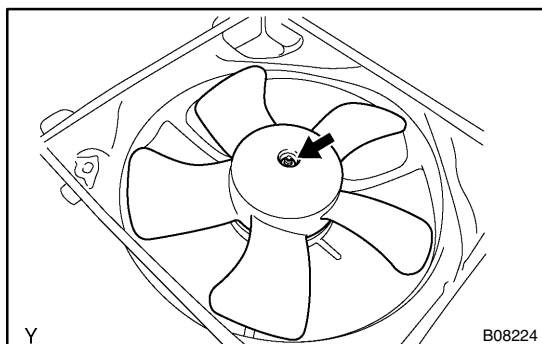
DISASSEMBLY

1. REMOVE NO.1 COOLING FAN

- (a) Remove the C-ring and fan.
- (b) Disconnect the lead wire and connector holder from the fan shroud.

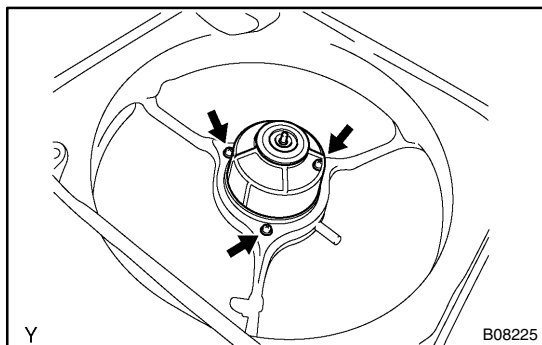


- (c) Using a trox socket wrench (T20), remove the 3 screws and fan motor.

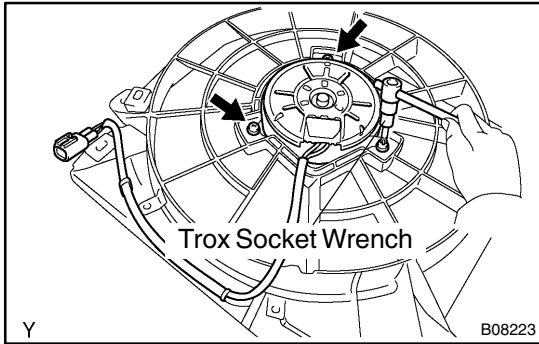


2. REMOVE NO.2 COOLING FAN

- (a) Remove the nut and fan.
- (b) Disconnect the lead wire and connector holder from the fan shroud.



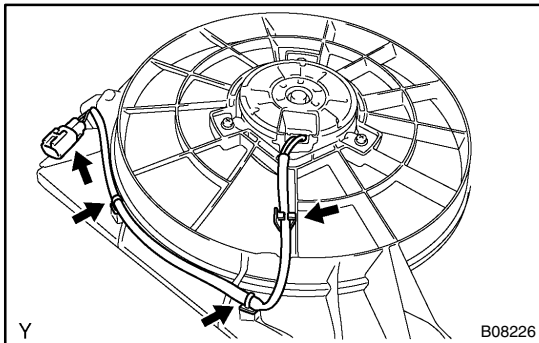
- (c) Remove the 3 screws and fan motor.



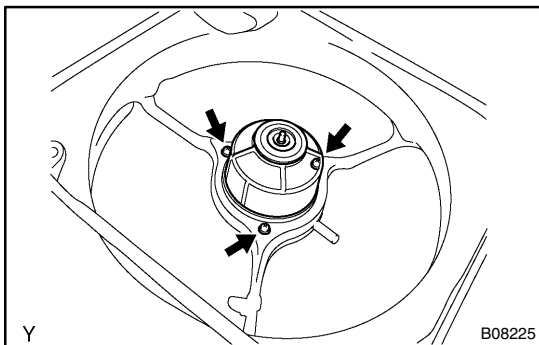
REASSEMBLY

1. INSTALL NO.1 FAN MOTOR

- (a) Using a trox socket wrench (T20), install the fan motor with the 3 screws.

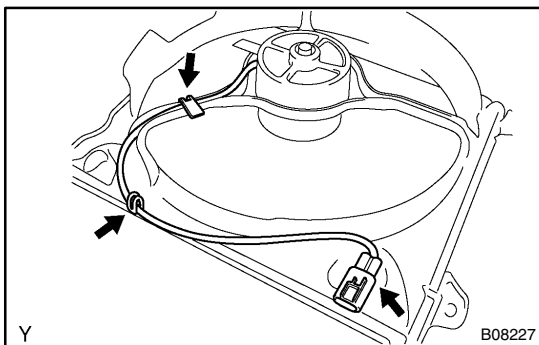


- (b) Connect the lead wire and connector holder to the fan shroud.
(c) Install the fan with the C-ring.



2. INSTALL NO.2 FAN MOTOR

- (a) Install the fan motor with the 3 screws.

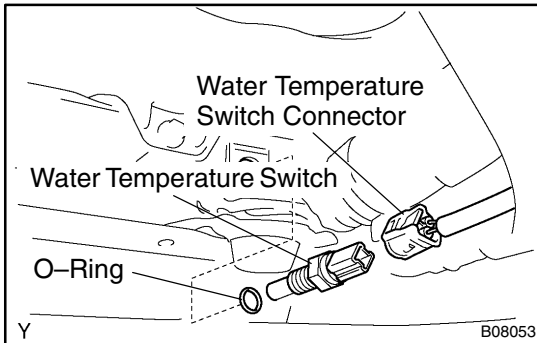


- (b) Connect the lead wire and connector holder to the fan shroud.
(c) Install the fan with the nut.

WATER TEMPERATURE SWITCH INSPECTION

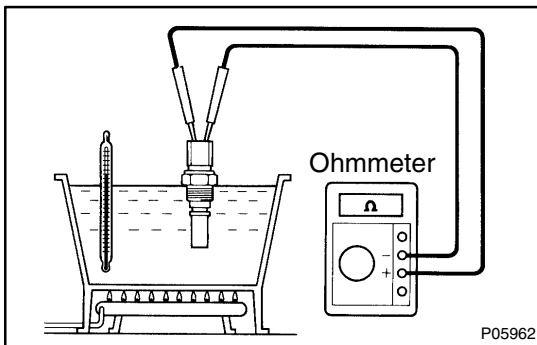
C00AJ-04

1. REMOVE ENGINE UNDER COVER
2. DRAIN ENGINE COOLANT



3. REMOVE WATER TEMPERATURE SWITCH

- (a) Disconnect the connector.
- (b) Remove the water temperature switch.
- (c) Remove the O-ring from the water temperature switch.



4. INSPECT WATER TEMPERATURE SWITCH

- (a) Using an ohmmeter, check that there is continuity between the terminals when the coolant temperature is above 93°C (199°F).

If there is no continuity, replace the switch.

- (b) Using an ohmmeter, check that there is no continuity between the terminals when the coolant temperature is below 83°C (181°F).

If there is continuity, replace the switch.

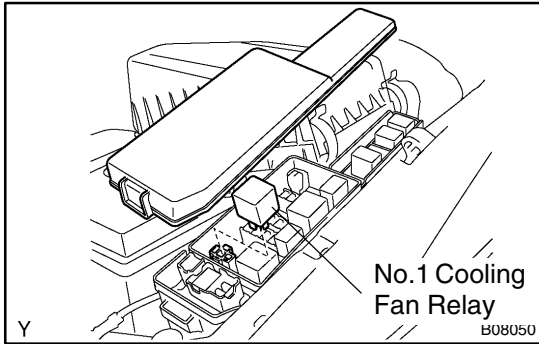
5. REINSTALL WATER TEMPERATURE SWITCH

- (a) Install a new O-ring to the water temperature switch.
- (b) Install the water temperature switch.
- (c) Connect the connector.

6. REINSTALL ENGINE UNDER COVER

7. REFILL WITH ENGINE COOLANT

8. START ENGINE AND CHECK FOR COOLANT LEAK

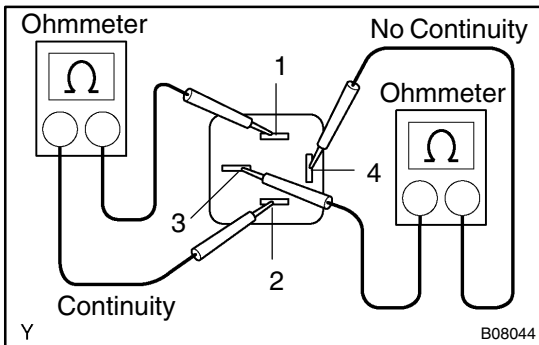


COOLING FAN RELAY INSPECTION

CO0BB-03

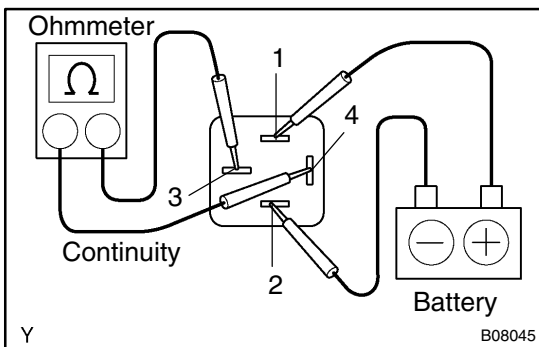
1. INSPECT NO.1 COOLING FAN RELAY

- Remove the relay box cover.
- Remove the No.1 cooling fan relay. (Marking: FAN NO.1)

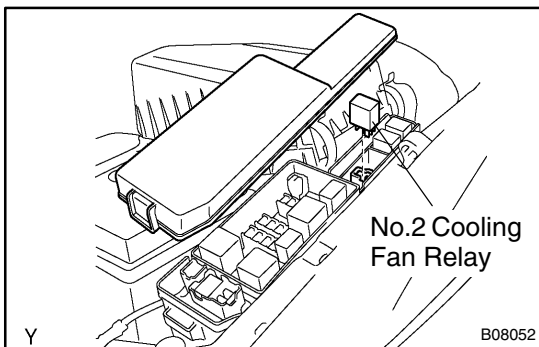


- Inspect the No.1 cooling fan relay continuity.
 - Using an ohmmeter, check that there is continuity between terminals 1 and 2.
 If there is no continuity, replace the relay.
 - Check that there is no continuity between terminals 3 and 4.

If there is continuity, replace the relay.

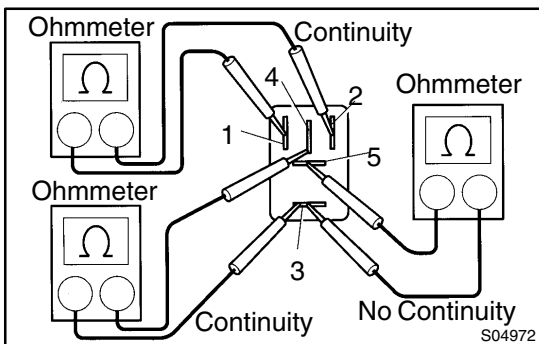


- Inspect the No.1 cooling fan relay operation.
 - Apply battery positive voltage across terminals 1 and 2.
 - Using an ohmmeter, check that there is continuity between terminals 3 and 4.
 If there is no continuity, replace the relay.
- Reinstall the No.1 cooling fan relay.

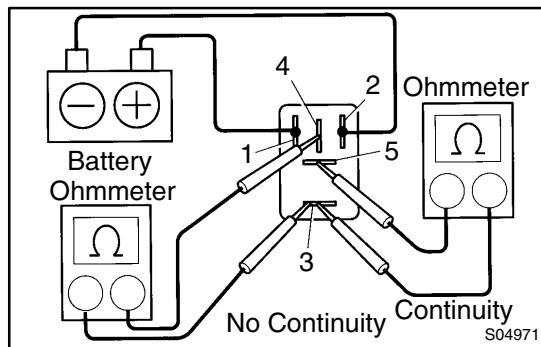


2. INSPECT NO.2 COOLING FAN RELAY

- Remove the relay box cover.
- Remove the No.2 cooling fan relay. (Marking: FAN NO.2)



- Inspect the No.2 cooling fan relay continuity.
 - Using an ohmmeter, check that there is continuity between terminals 1 and 2.
 If there is no continuity, replace the relay.
 - Check that there is continuity between terminals 3 and 4.
 If there is no continuity, replace the relay.
 - Check that there is no continuity between terminals 3 and 5.
 If there is continuity, replace the relay.



(d) Inspect the No.2 cooling fan relay operation.

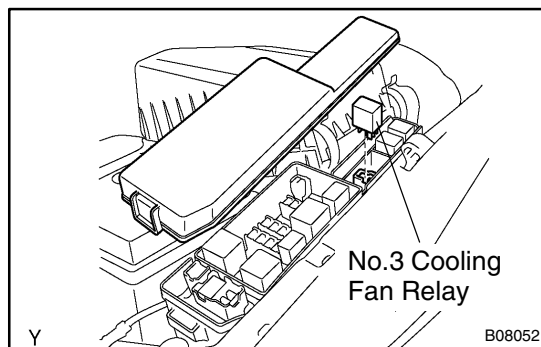
- (1) Apply battery positive voltage across terminals 1 and 2.
- (2) Using an ohmmeter, check that there is no continuity between terminals 3 and 4.

If there is continuity, replace the relay.

- (3) Check that there is continuity between terminals 3 and 5.

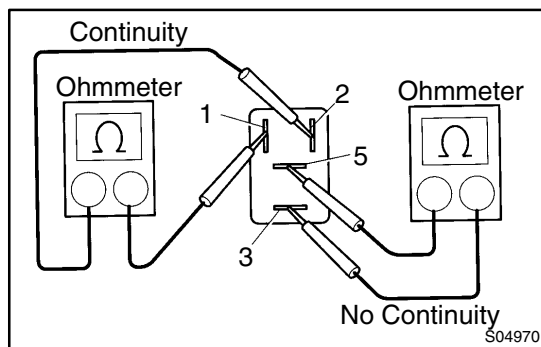
If there is no continuity, replace the relay.

- (e) Reinstall the No.2 cooling fan relay.
- (f) Reinstall the relay box cover.



3. INSPECT NO.3 COOLING FAN RELAY

- (a) Remove the relay box cover.
- (b) Remove the No.3 cooling fan relay. (Marking: FAN NO.3)



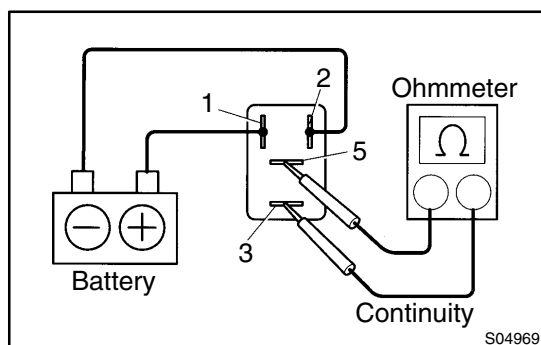
(c) Inspect the No.3 cooling fan relay continuity.

- (1) Using an ohmmeter, check that there is continuity between terminals 1 and 2.

If there is no continuity, replace the relay.

- (2) Check that there is no continuity between terminals 3 and 5.

If there is continuity, replace the relay.



(d) Inspect the No.3 cooling fan relay operation.

- (1) Apply battery positive voltage across terminals 1 and 2.
- (2) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

If there is no continuity, replace the relay.

- (e) Reinstall the No.3 cooling fan relay.