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# COOLING

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# COOLANT INSPECTION

CO04D-02

**HINT:**

Check the coolant level when the engine is cold.

**1. CHECK ENGINE COOLANT LEVEL AT RESERVOIR**

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

If low, check for leaks and add "Toyota Long Life Coolant" or equivalent 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 the radiator the cap 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 radiator filler hole, and the coolant should be free from oil.

If excessively dirty, replace the coolant.

(c) Reinstall the radiator cap.

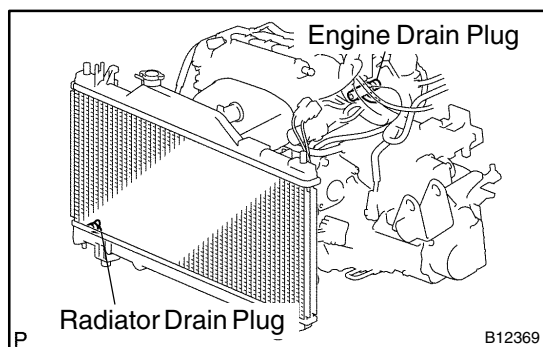
## REPLACEMENT

### 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.

#### 1. DRAIN ENGINE COOLANT

- (a) Remove the radiator cap.



- (b) Loosen the radiator drain plug (on the right side of the radiator lower tank) and engine drain plug (on the cylinder block), and drain the coolant.

- (c) Close the drain plugs.

**Torque: 8.0 N·m (80 kgf·cm, 69 in.-lbf) for engine**

#### 2. FILL ENGINE COOLANT

- (a) Slowly fill the system with coolant.
- 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  $-35^{\circ}\text{C}$  ( $-31^{\circ}\text{F}$ )] or 60 % [freezing protection down to  $-50^{\circ}\text{C}$  ( $-58^{\circ}\text{F}$ )] 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:

LHD	w/ Cold area specification	8.1 liters (8.5 US qts, 7.1 Imp. qts)
	w/o Cold area specification	7.4 liters (7.8 US qts, 6.5 Imp. qts)
RHD	w/ Cold area specification	8.3 liters (8.7 US qts, 7.3 Imp. qts)
	w/o Cold area specification	7.5 liters (7.9 US qts, 6.6 Imp. qts)

- (b) Reinstall the radiator cap.
- (c) Start the engine, and bleed the cooling system.
- (d) Refill the radiator reservoir with coolant until it reaches the "F" line.

#### 3. CHECK ENGINE COOLANT FOR LEAKS

#### 4. CHECK ENGINE COOLANT SPECIFIC GRAVITY CORRECTLY

## WATER PUMP ON-VEHICLE INSPECTION

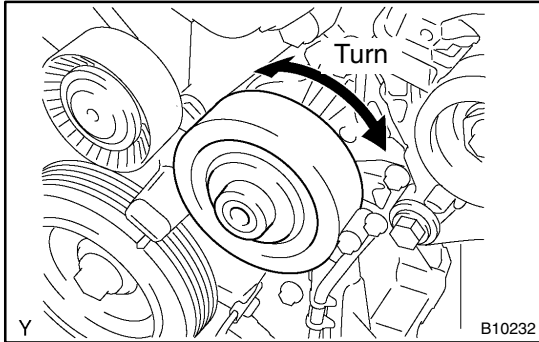
COOL-03

**NOTICE:**

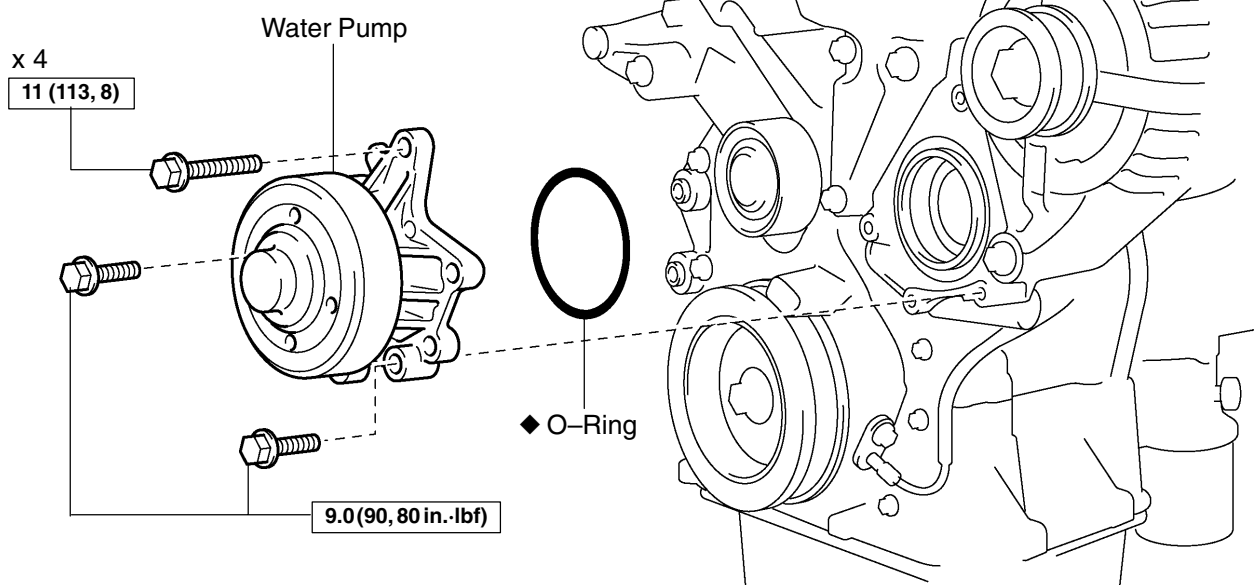
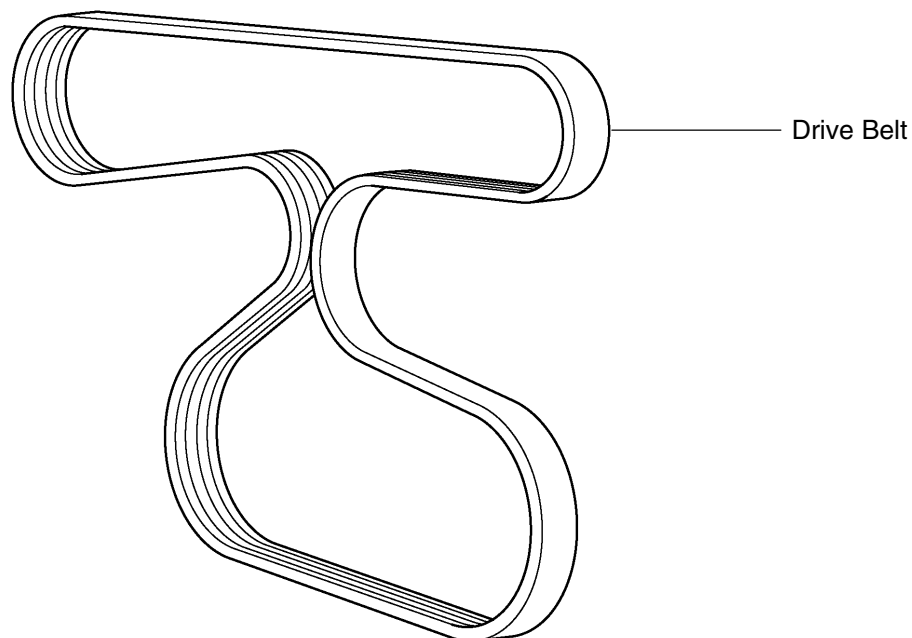
**Be sure to do checking when the engine coolant is charged.**

**INSPECT WATER PUMP**

- (a) Remove the drive belt (See page CH-1).
- (b) Turn the pulley, and check that the water pump bearing moves smoothly and quietly.  
If necessary, replace the water pump.
- (c) Reinstall the drive belt (See page CH-1).



# COMPONENTS



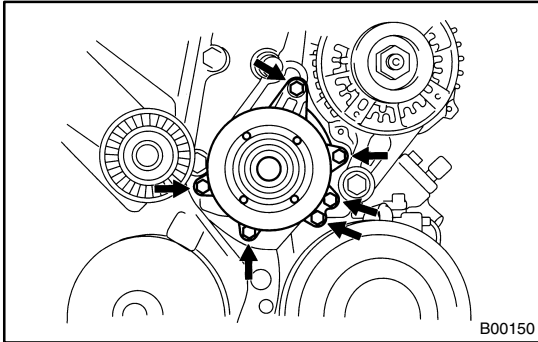
N·m (kgf·cm, ft·lbf) : Specified torque

◆ Non-reusable part

B08593

## REMOVAL

1. DRAIN ENGINE COOLANT (See page CO-2)
2. REMOVE DRIVE BELT (See page CH-1)



### 3. REMOVE WATER PUMP

- (a) Remove the 6 bolts, water pump and O-ring.
- (b) Clean up the engine coolant from the water chamber room.

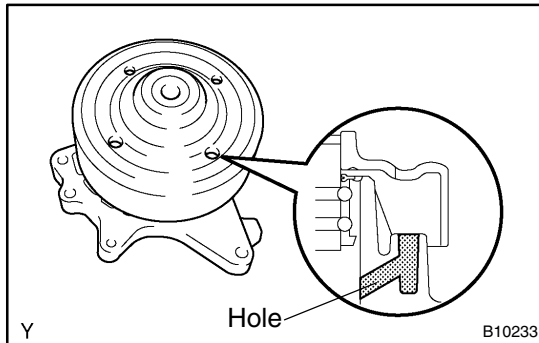
#### NOTICE:

**Do not remove the RH engine mounting bracket and alternator when the water pump alone is replaced.**

## INSPECTION

### NOTICE:

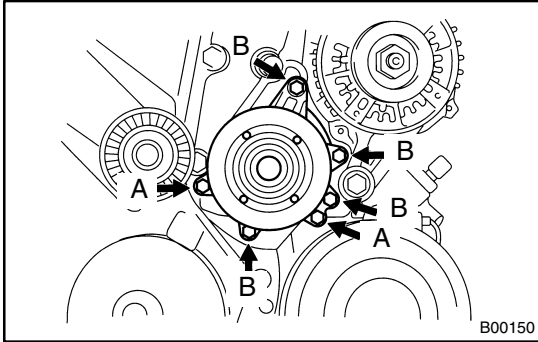
Never rotate the pulley in a condition with only a single unit of the water pump.



### INSPECT WATER PUMP

Visually check the drain hole for coolant leakage.  
If leakage is found, replace the water pump.





## INSTALLATION

### 1. INSTALL WATER PUMP

- Place a new O-ring on the timing chain cover.
- Install the water pump with the 6 bolts.

#### Torque:

**Bolt A:** 9.0 N·m (90 kgf·cm, 80 in.-lbf)

**Bolt B:** 11 N·m (113 kgf·cm, 8 ft·lbf)

#### HINT:

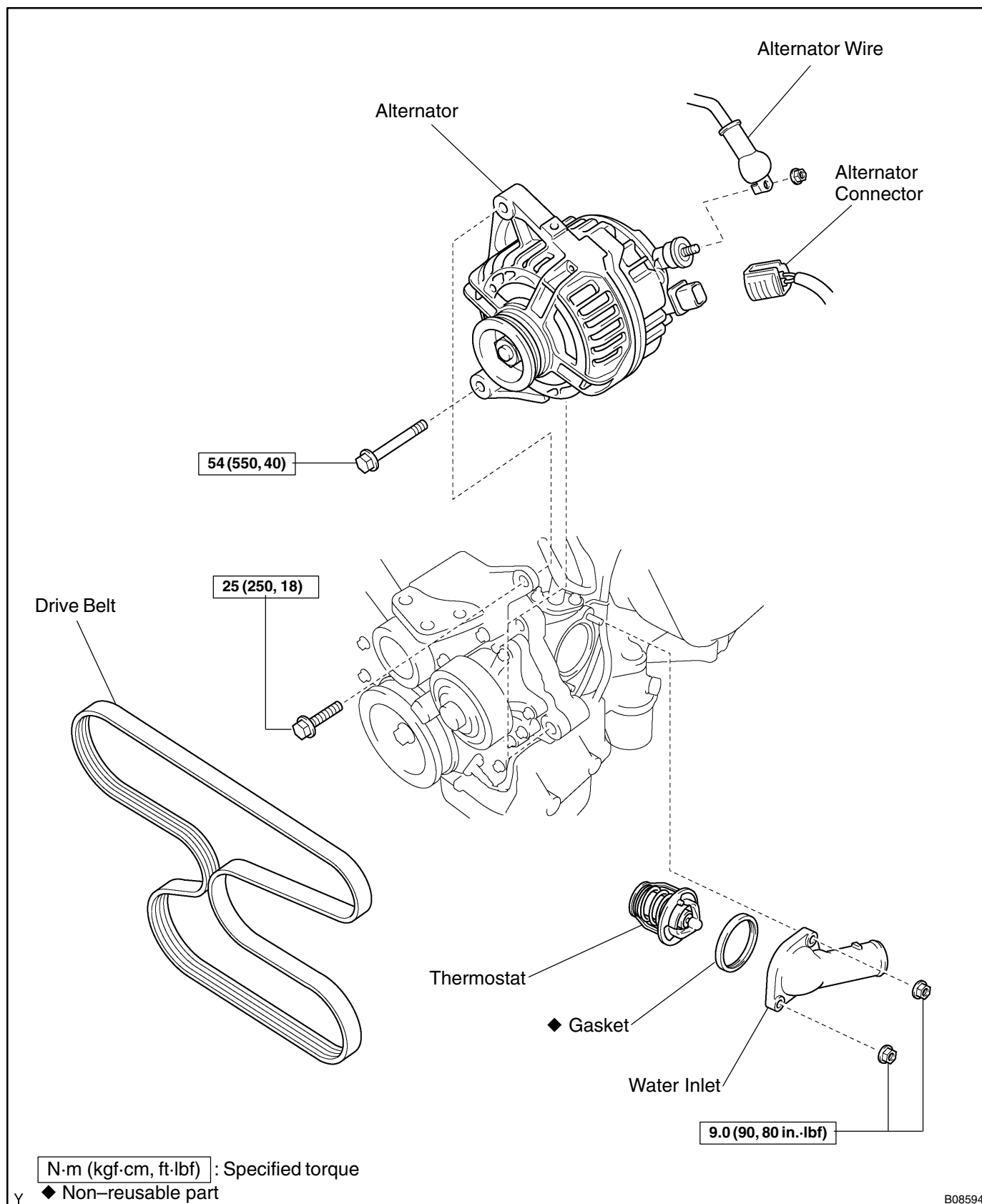
Each bolt length is indicated in the illustration.

Bolt "A"	30 mm (1.18 in.)
Bolt "B"	35 mm (1.38 in.)

- INSTALL DRIVE BELT (See page CH-1)
- FILL WITH ENGINE COOLANT (See page CO-2)
- START ENGINE AND CHECK FOR LEAKS
- RECHECK ENGINE COOLANT LEVEL

# THERMOSTAT COMPONENTS

C004J-14



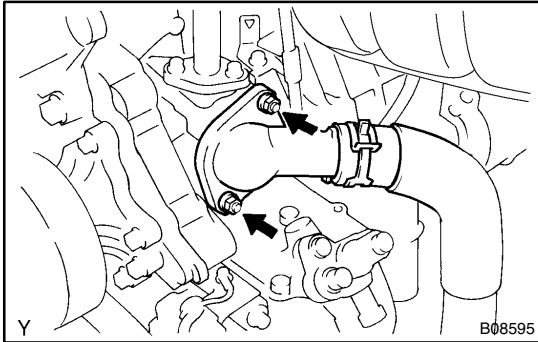
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## REMOVAL

### HINT:

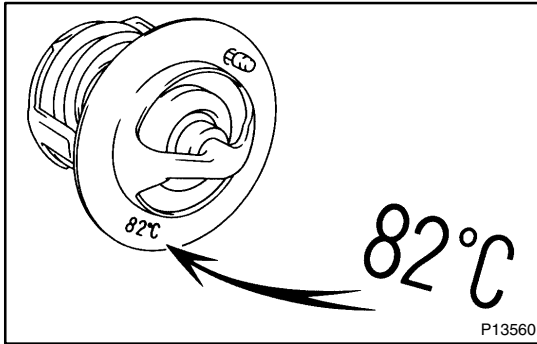
Removal of the thermostat would have an adverse effect, causing a lowering of cooling efficiency. Do not remove the thermostat, even if the engine tends to overheat.

1. **DRAIN ENGINE COOLANT (See page CO-2)**
2. **REMOVE DRIVE BELT AND ALTERNATOR (See page CH-1)**



3. **REMOVE WATER INLET AND THERMOSTAT**

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

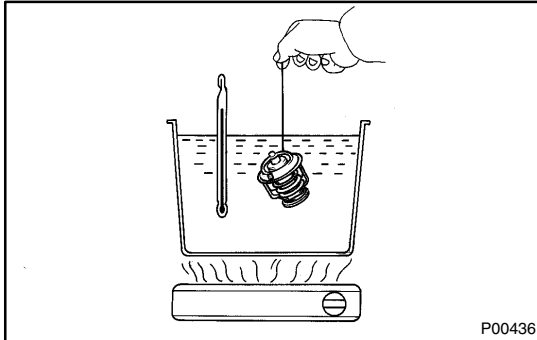


## INSPECTION

### INSPECT THERMOSTAT

#### HINT:

The thermostat is numbered with the valve opening temperature.

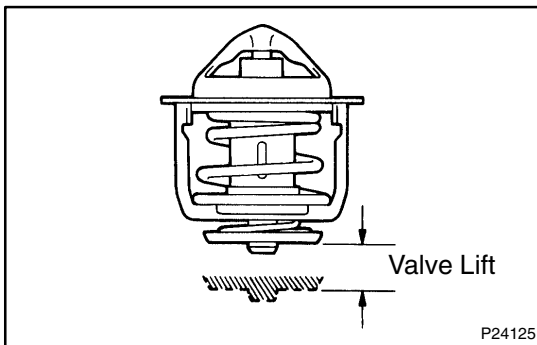


(a) Immerse the thermostat in water and gradually heat the water.

(b) Check the valve opening temperature.

**Valve opening temperature: 80 – 84 °C (176 – 183.2 °F)**

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



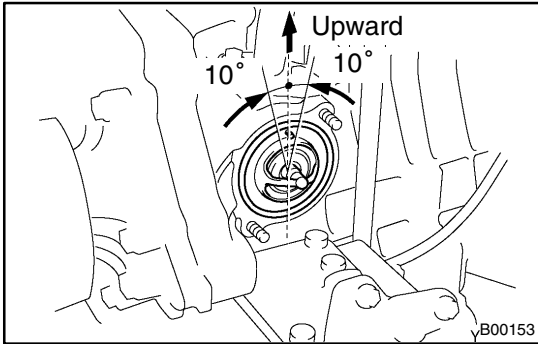
(c) Check the valve lift.

**Valve lift: 10 mm (0.39 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 temperatures (below 40 °C (104 °F)).

If not closed, replace the thermostat.



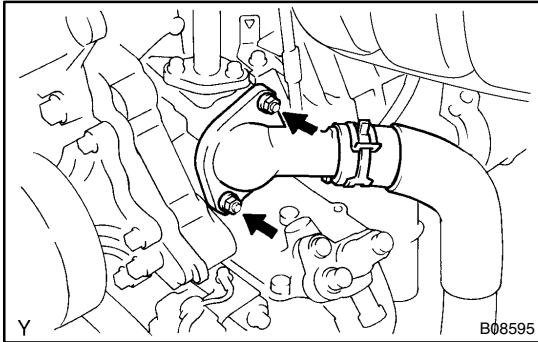
## INSTALLATION

### 1. PLACE THERMOSTAT IN CYLINDER BLOCK

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

#### HINT:

The jiggle valve may be set within 10° of either side of the prescribed position.



### 2. INSTALL WATER INLET

Install the water inlet with the 2 nuts.

**Torque: 9.0 N·m (90 kgf·cm, 80 in·lbf)**

3. **INSTALL ALTERNATOR AND DRIVE BELT (See page EM-18)**
4. **FILL WITH ENGINE COOLANT (See page CO-2)**
5. **START ENGINE AND CHECK FOR LEAKS**
6. **RECHECK ENGINE COOLANT LEVEL**

## RADIATOR ON-VEHICLE CLEANING

CO04N-01

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

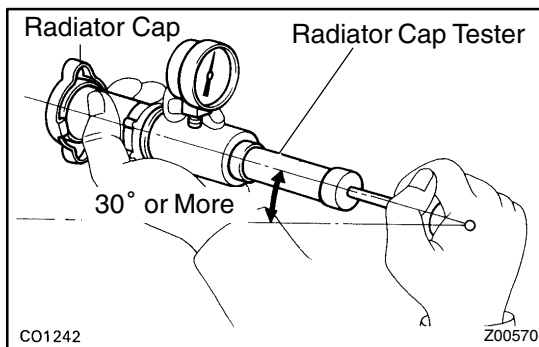
#### CAUTION:

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 radiator cap 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 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:**

**74 – 103 kPa (0.75 – 1.05 kgf/cm<sup>2</sup>, 10.7 – 14.9 psi)**

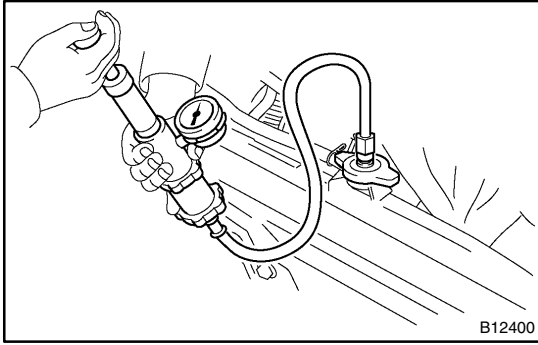
**Minimum opening pressure:**

**59 kPa (0.6 kgf/cm<sup>2</sup>, 8.5 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 LEAKS**

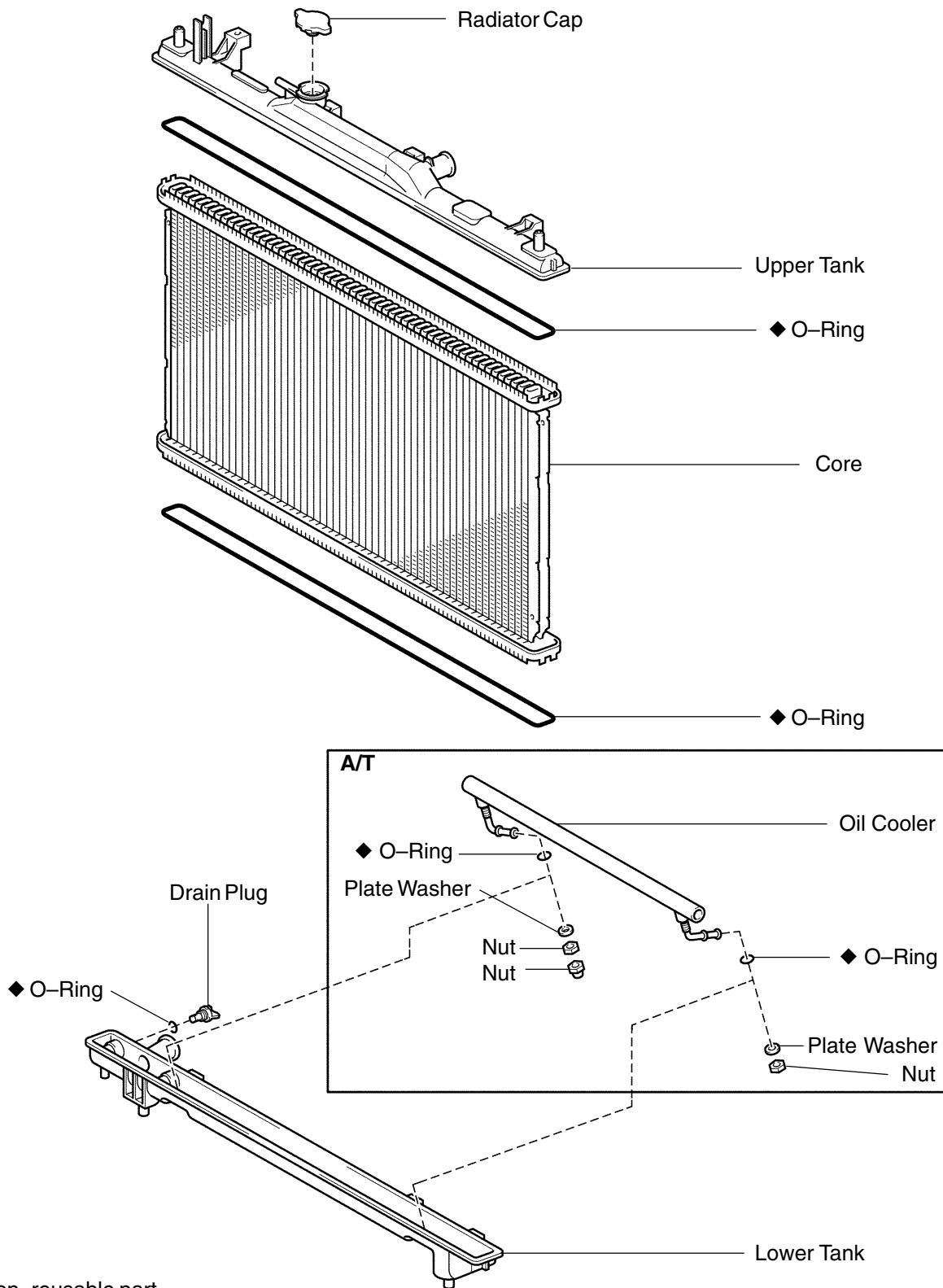
- (a) Fill the radiator with coolant and attach a radiator cap tester.
- (b) Warm up the engine.
- (c) Pump it to 118 kPa (1.2 kgf/cm<sup>2</sup>, 17.1 psi), and check that the pressure does not drop.

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.

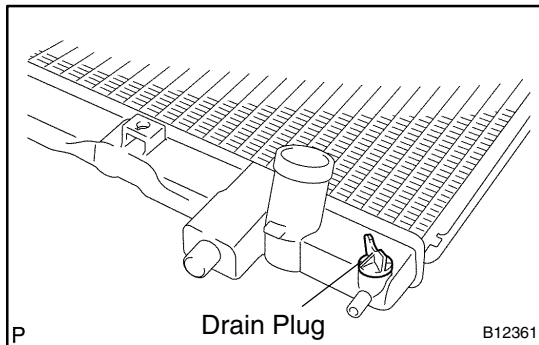
**4. REINSTALL RADIATOR CAP**



## COMPONENTS



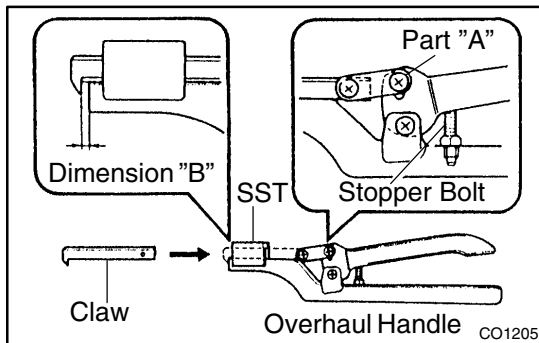
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## DISASSEMBLY

### 1. REMOVE DRAIN PLUG

- Remove the drain plug.
- Remove the O-ring from the drain plug.



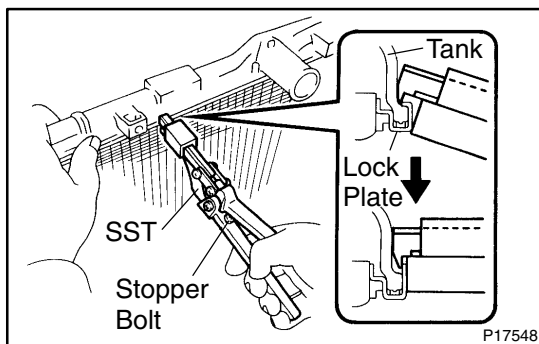
### 2. ASSEMBLE SST

SST 09230-01010

- Install the claw to the overhaul handle, inserting it in the hole in part "A" as shown in the diagram.
- While gripping the handle, adjust the stopper bolts so that dimension "B" shown in the diagram is 0.2 – 0.3 mm (0.008 – 0.012 in.).

#### NOTICE:

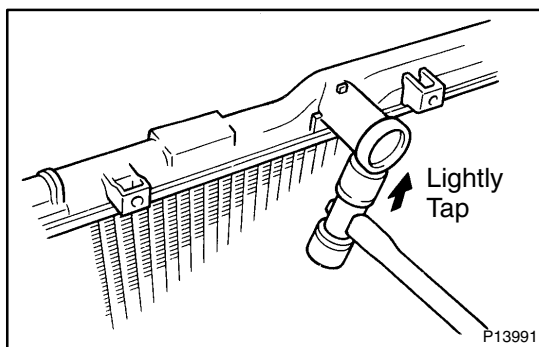
If this adjustment is not done the claw may be damaged.



### 3. UNCAULK LOCK PLATES

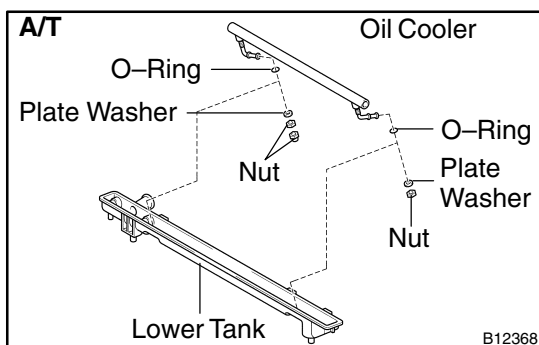
Using SST to release the caulking, squeeze the handle until stopped by the stopper bolts.

SST 09230-01010



### 4. REMOVE TANKS AND O-RINGS

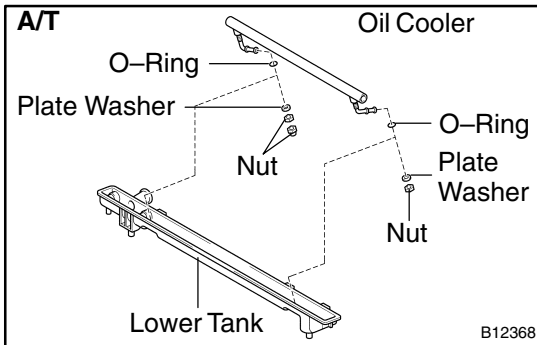
Lightly tap the bracket of the radiator (or radiator inlet or outlet) with a soft-faced hammer, and remove the tank and O-ring.



### 5. A/T:

#### REMOVE OIL COOLER FROM LOWER TANK

- Remove the 3 nuts and 2 plate washers.
- Remove the oil cooler and 2 O-rings.



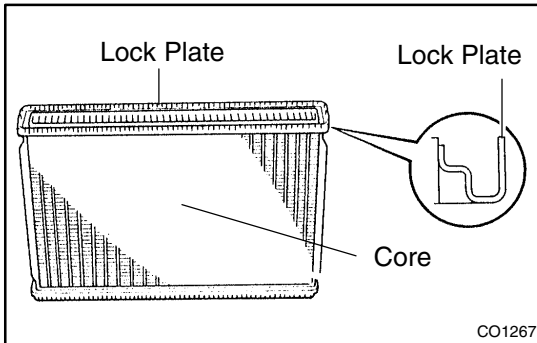
## REASSEMBLY

### 1. A/T:

#### INSTALL OIL COOLER TO LOWER TANK

- Install 2 new O-rings to the oil cooler.
- Install the oil cooler to the lower tank with the 2 plate washers and 2 nuts.

**Torque: 8.3 N·m (85 kgf·cm, 74 in.-lbf)**



### 2. INSPECT LOCK PLATE

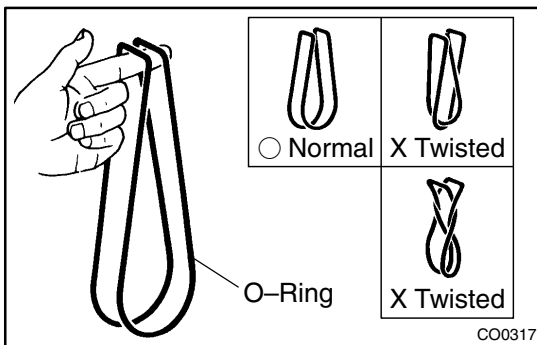
Inspect the lock plate for damage.

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.

**NOTICE:**

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



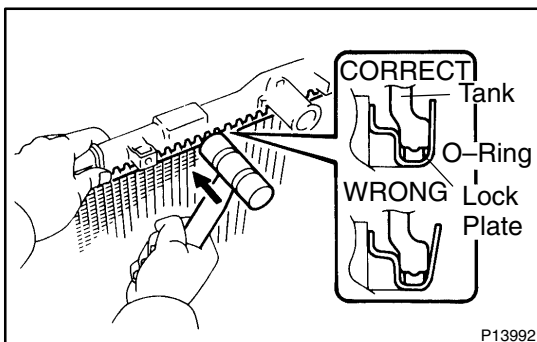
### 3. INSTALL NEW O-RINGS AND TANKS

- After checking that there are no foreign objects in the lock plate groove, install 2 new O-rings without twisting them.

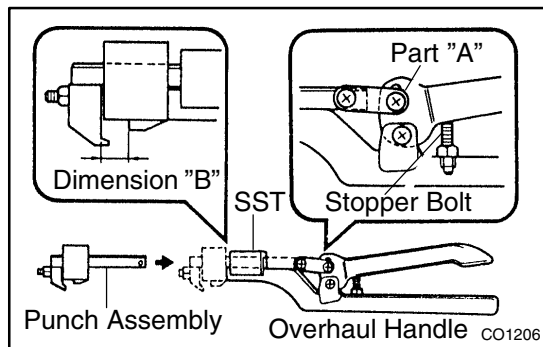
HINT:

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

- Install the tank without damaging the O-ring.



- Tap the lock plate with a soft-faced hammer so that there is no gap between it and the tank.

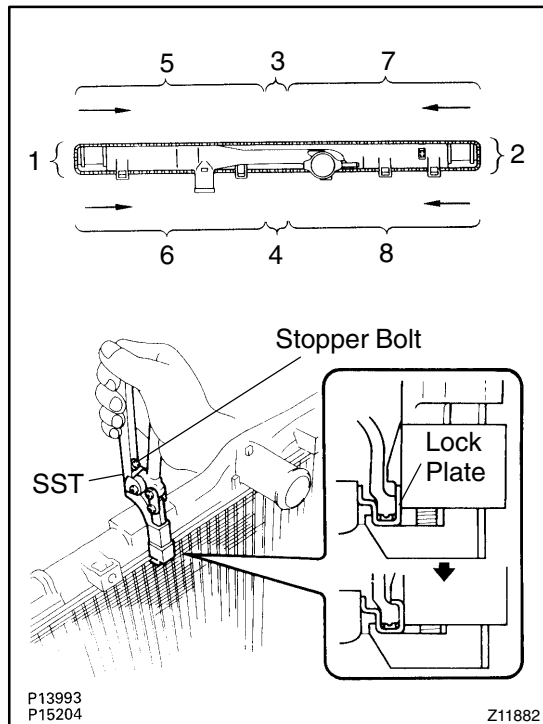


#### 4. ASSEMBLE SST

SST 09230-01010, 09231-14010

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

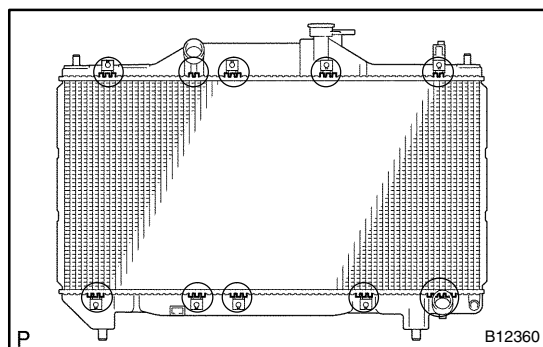
**Dimension: 8.4 mm (0.331 in.)**



#### 5. CAULK LOCK PLATE

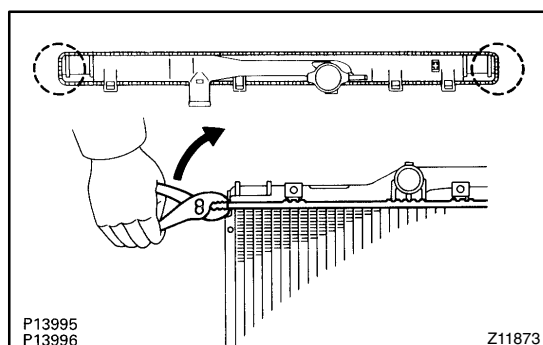
- Lightly press SST against the lock plate in the order shown in the illustration. After repeating this a few times, fully caulk the lock plate by squeezing the handle until touch by the stopper bolt.

SST 09230-01010

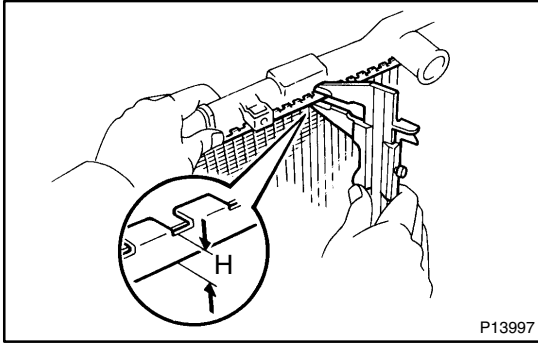


#### HINT:

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



- The points shown in the illustration cannot be staked with SST. Use pliers or similar object and be careful not to damage the core plates.



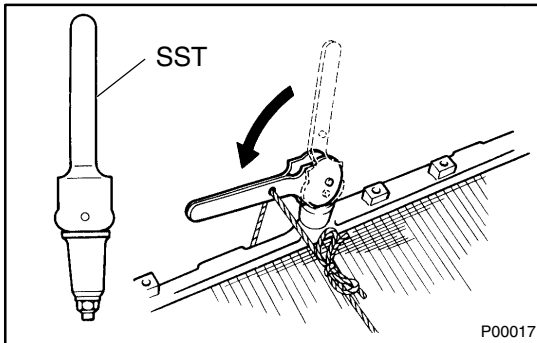
- (b) Check the lock plate height (H) after completing the caulking.

**Plate height: 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.

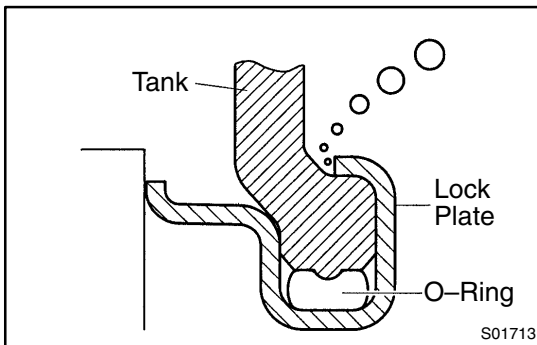
#### 6. INSTALL DRAIN PLUG

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



#### 7. INSPECT FOR WATER LEAKS

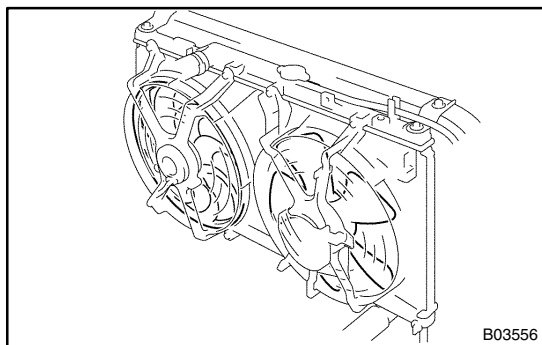
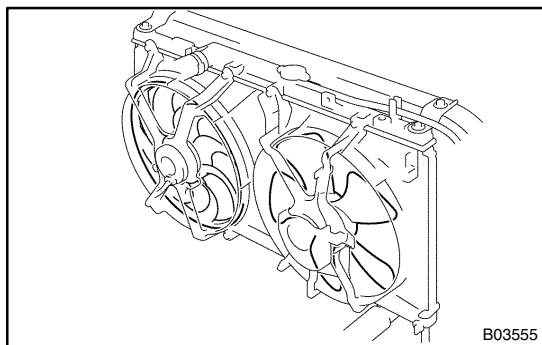
- (a) Tighten the drain plug.
- (b) Plug the inlet and outlet pipes of the radiator with SST.  
SST 09230-01010
- (c) Using a radiator cap tester, apply pressure to the radiator.  
**Test pressure: 177 kPa (1.8 kgf/cm<sup>2</sup>, 26 psi)**
- (d) Submerge the radiator in water.



- (e) Inspect for leaks.

#### HINT:

On radiators with resin tanks, there is a clearance between the tank and lock 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 doing the water leak test, first swish the radiator around in the water until all bubbles disappear.



## ELECTRIC COOLING FAN ON-VEHICLE INSPECTION

CO150-01

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

- (a) Turn the ignition switch ON.
- (b) Check that the cooling fan stops.

If not, check the cooling fan relay and water temperature sensor, and check for a separated connector or severed wire between the cooling fan relay and water temperature sensor.

- (c) Disconnect the water temperature sensor connector.
- (d) Check that the cooling fan rotates.

If not, check the fuses, cooling fan relay, engine ECU and cooling fan, and check for a short circuit between the cooling fan relay and water temperature sensor.

- (e) Reconnect the water temperature sensor connector.

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

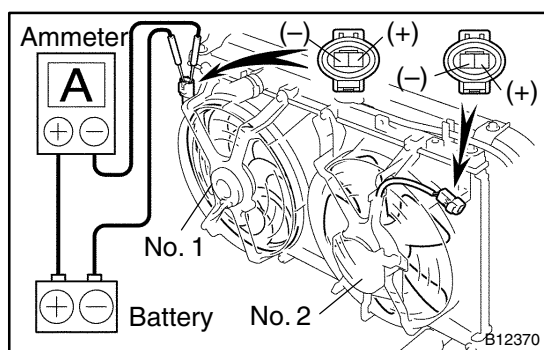
- (a) Start the engine, and raise coolant temperature to above 100°C (212°F).

#### HINT:

Coolant temperature is the detected value by the water temperature sensor on the water outlet.

- (b) Check that the cooling fan rotates.

If not, replace the water temperature sensor.



### 3. INSPECT COOLING FANS

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

#### Standard amperage at 20°C (68°F):

No. 1	BOSCH made	4.8 A
	DENSO made	5.0 – 7.0 A
No. 2		4.2 – 7.8 A

- (d) Reconnect the cooling fan connector.

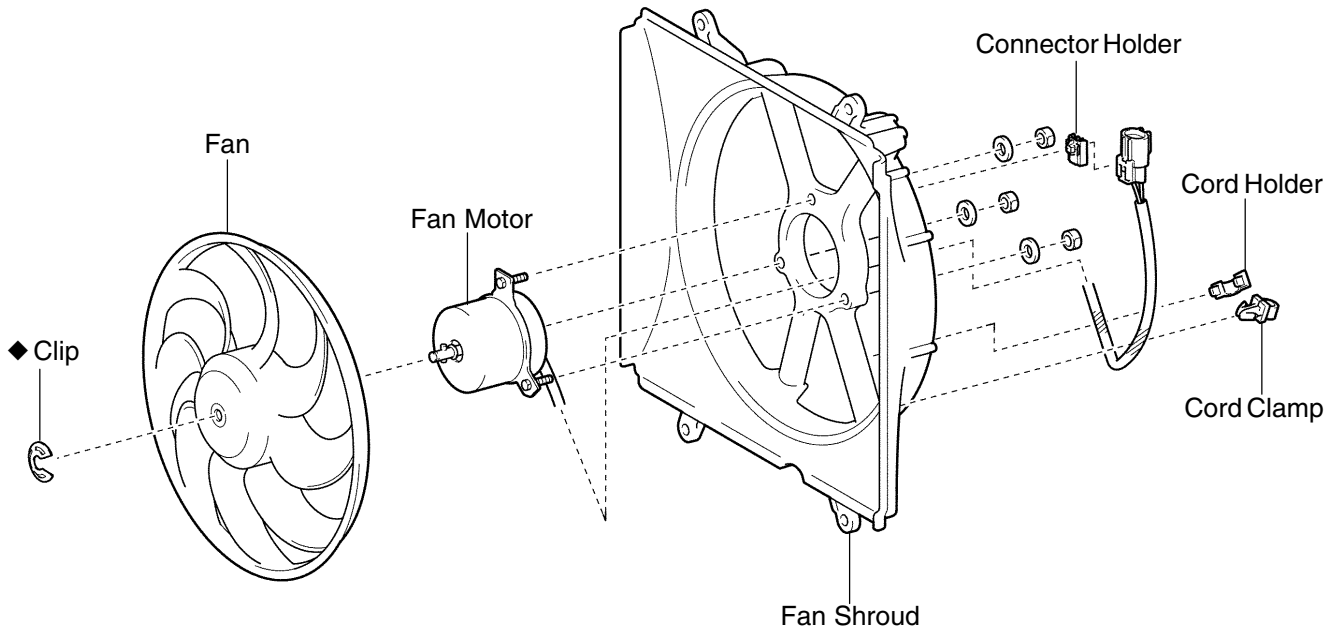
### 4. INSPECT WATER TEMPERATURE SENSOR (See page FI-50)

### 5. INSPECT ENGINE ECU

Check the voltage between ECU terminals FAN and E1.  
(See page DI-20)

## COMPONENTS

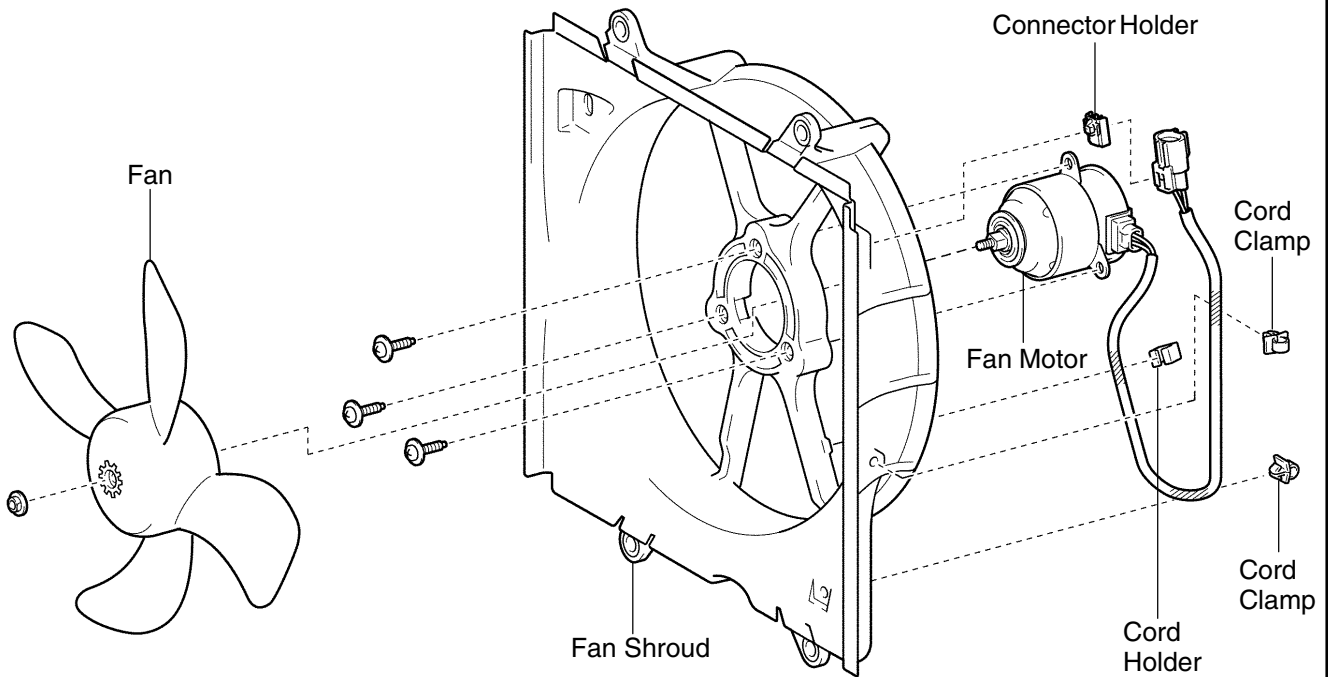
### BOSCH Made



P ◆ Non-reusable part

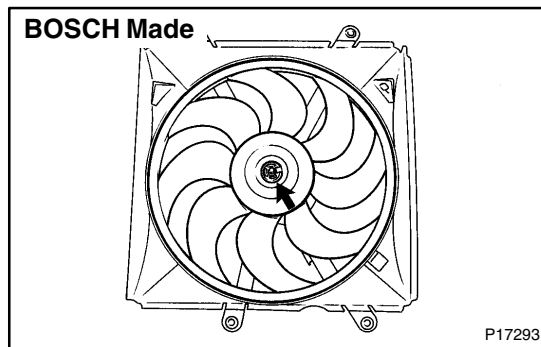
B12362

### DENSO Made



P

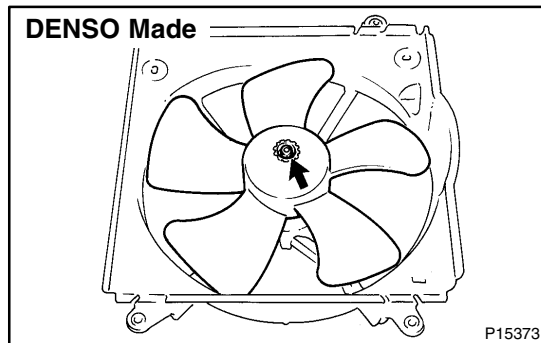
B12363



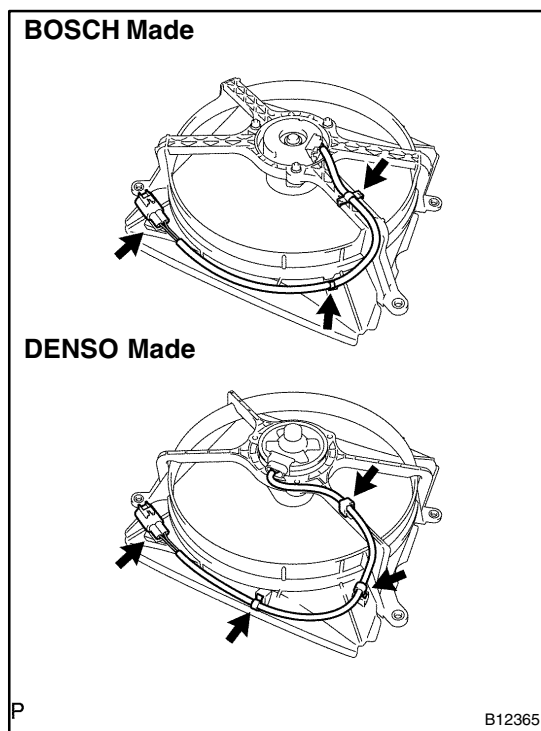
## DISASSEMBLY

### 1. REMOVE FAN

- (a) BOSCH made:  
Remove the C-ring and fan.

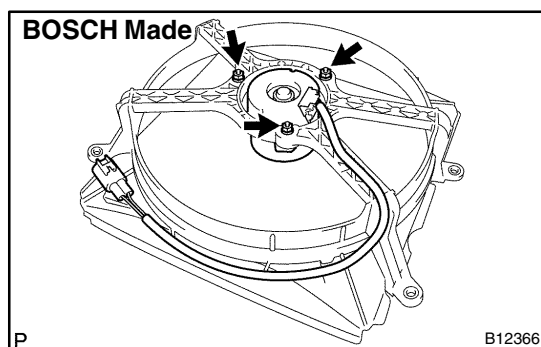


- (b) DENSO made:  
Remove the nut and fan.



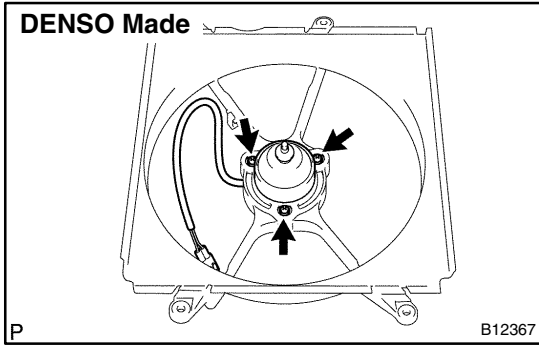
### 2. REMOVE FAN MOTOR

- (a) Remove the cord holder.  
(b) Disconnect the wire from the fan shroud.  
(c) Remove the connector holder from the connector.  
(d) BOSCH made:  
Remove the cord clamp from the wire.  
(e) DENSO made:  
Remove the 2 cord clamps from the wire.

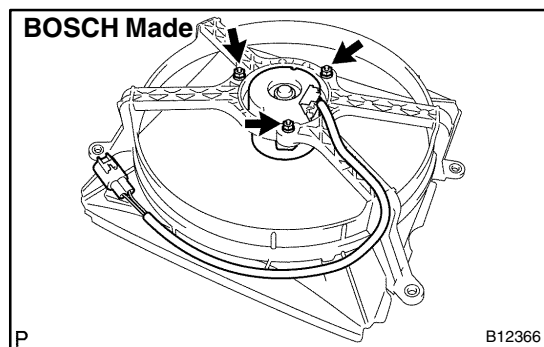


- (f) BOSCH made:  
Remove the 3 nuts, 3 washers and fan motor.





- (g) DENSO made:  
Remove the 3 screws and fan motor.

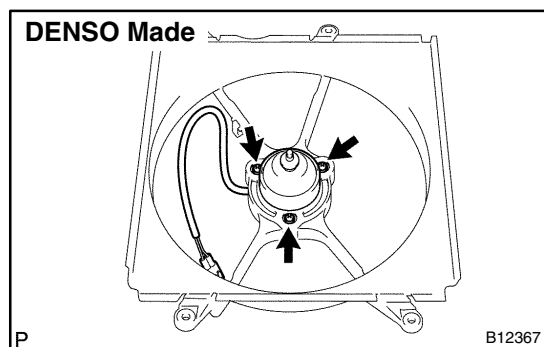


## REASSEMBLY

### 1. INSTALL FAN MOTOR

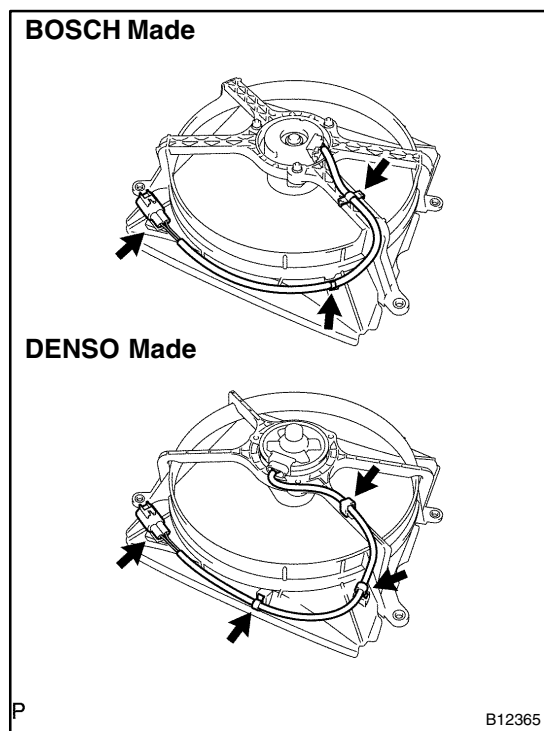
#### (a) BOSCH made:

Install the fan motor and 3 washers with the 3 nuts.



#### (b) DENSO made:

Install the fan motor with the 3 screws.



#### (c) BOSCH made:

Install the cord clamp to the wire.

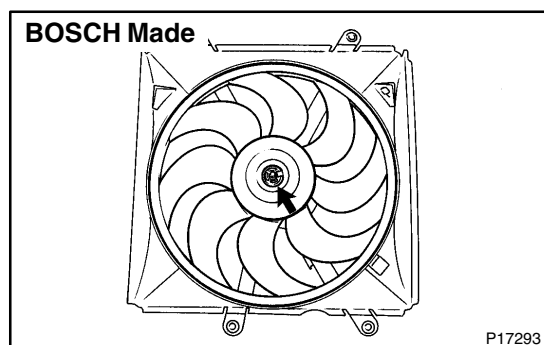
#### (d) DENSO made:

Install the 2 cord clamps to the wire.

#### (e) Install the connector holder to the connector.

#### (f) Connect the wire to the fan shroud.

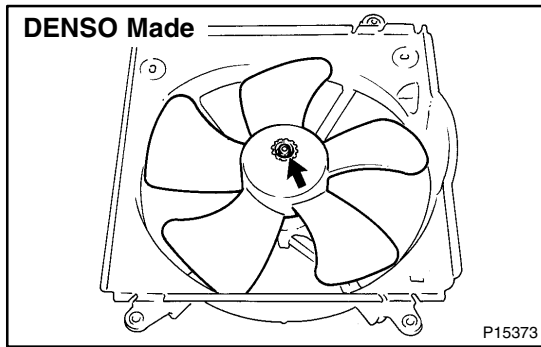
#### (g) Install the cord holder.



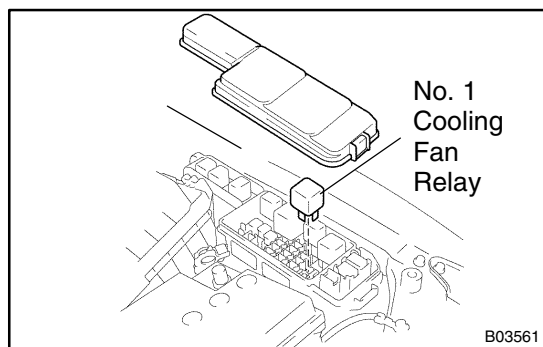
### 2. INSTALL FAN

#### (a) BOSCH made:

Install the fan with a new C-ring.



- (b) DENSO made:  
Install the fan with the nut.

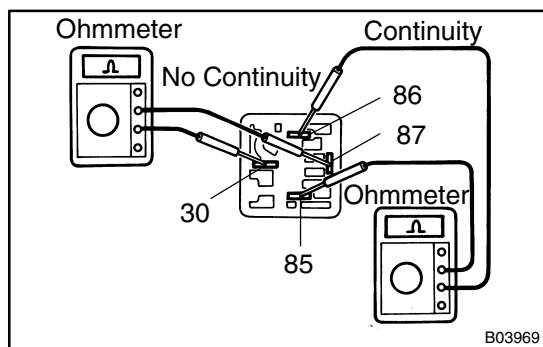


## COOLING FAN RELAY INSPECTION

CO054-09

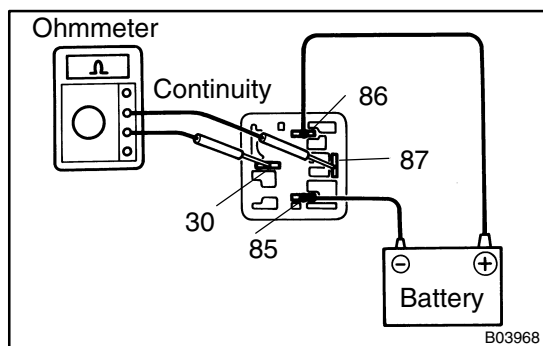
### 1. INSPECT NO. 1 COOLING FAN RELAY

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

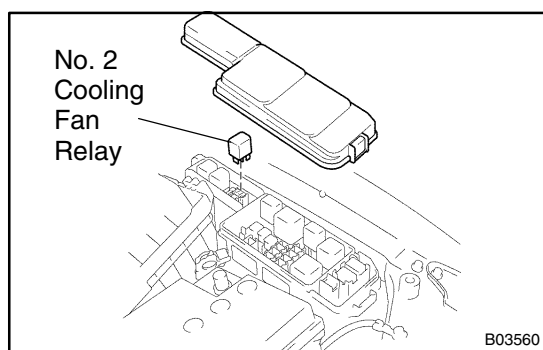


- Inspect the No. 1 cooling fan relay continuity.
  - Using an ohmmeter, check that there is continuity between terminals 86 and 85.
 If there is no continuity, replace the relay.
  - Check that there is no continuity between terminals 30 and 87.

If there is continuity, replace the relay.

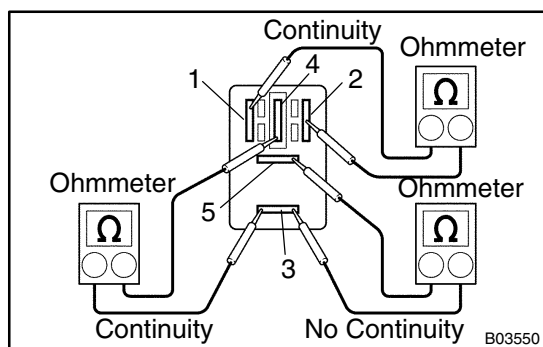


- Inspect the No. 1 cooling fan relay operation.
  - Apply battery voltage across terminals 86 and 85.
  - Using an ohmmeter, check that there is continuity between terminals 30 and 87.
 If there is no continuity, replace the relay.
- Reinstall the No. 1 cooling fan relay.
- Reinstall the relay box cover.



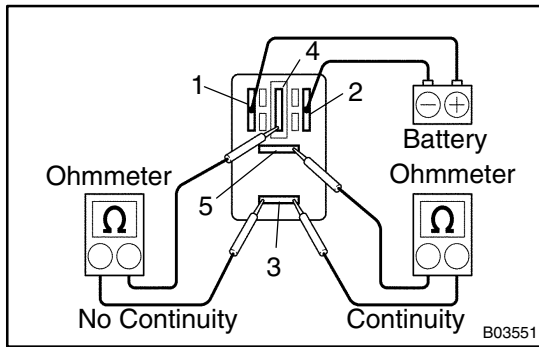
### 2. INSPECT NO. 2 COOLING FAN RELAY

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

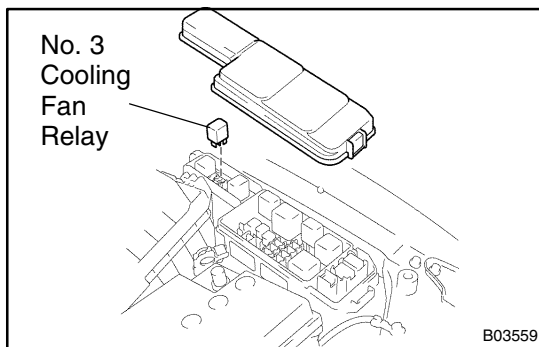


- Inspect the No. 2 cooling fan relay continuity.
  - Using an ohmmeter, check that there is continuity between terminals 1 and 2.
 If there is no continuity, replace the relay.
  - Check that there is continuity between terminals 3 and 4.
 If there is no continuity, replace the relay.
  - Check that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

If there is continuity, replace the relay.

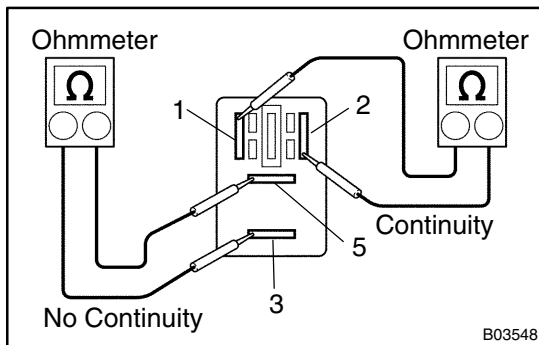


- (d) Inspect the No. 2 cooling fan relay operation.
- (1) Apply battery voltage across terminals 1 and 2.
  - (2) Using an ohmmeter, check that there is no continuity between terminals 3 and 4.
- If there is continuity, replace the relay.
- (3) Using an ohmmeter, check that there is continuity between terminals 3 and 5.
- If there is no continuity, replace the relay.
- (e) Reinstall the No. 2 cooling fan relay.
  - (f) Reinstall the relay box cover.

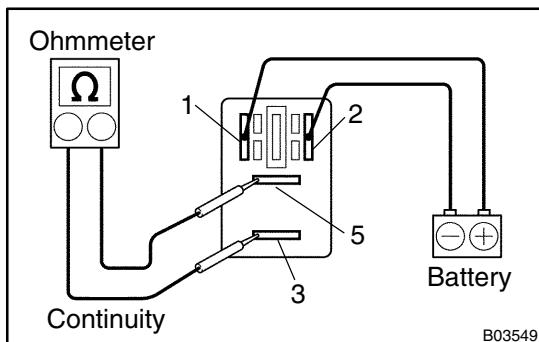


### 3. INSPECT NO. 3 COOLING FAN RELAY

- (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 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.
  - (f) Reinstall the relay box cover.