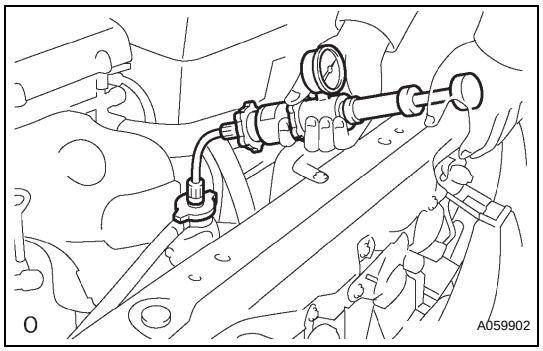
COOLING SYSTEM

ON-VEHICLE INSPECTION

1. INSPECT COOLING SYSTEM FOR LEAKS

CAUTION:

Do not remove the radiator cap while the engine and radiator are still hot. Pressurized, hot engine coolant and steam may be released and cause serious burns.



(a) Fill the radiator with coolant and attach the radiator cap tester.

(b) Warm up the engine.

(c) Using the radiator cap tester, increase the pressure inside the radiator to 118 kPa (1.2 kgf/cm ^{2}, 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.

2. CHECK ENGINE COOLANT LEVEL AT RESERVOIR

(a) The engine coolant level should be between the "LOW" and "FULL" lines when the engine is cold. If low, check for leaks and add "TOYOTA Super Long Life Coolant" or similar high quality ethylene glycol based non-silicate, non-amine, non-nitrite, and non-borate coolant with long-life hybrid organic acid technology up to the "FULL" line.

3. CHECK ENGINE COOLANT QUALITY

(a) Remove the radiator cap.
CAUTION:
Do not remove the radiator cap while the engine and radiator are still hot. Pressurized, hot engine coolant and steam may be released and cause serious burns.

(b) Check if there are any excessive deposits of rust or scale around the radiator cap and radiator filler hole. Also, the coolant should be free from oil.
HINT:
If excessively dirty, replace the coolant.

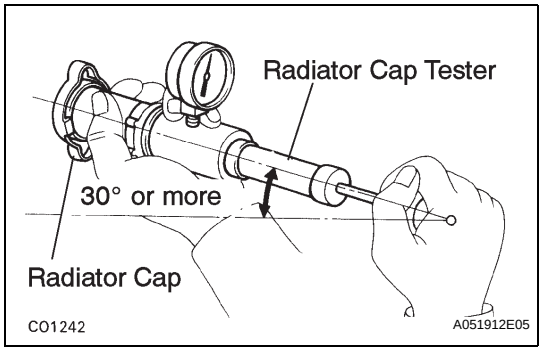
(c) Reinstall the radiator cap.

INSPECTION

1. INSPECT RADIATOR CAP SUB-ASSEMBLY

NOTICE:

- **If the reservoir cap is contaminated, 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 °C above the horizontal.**



(a) Using a radiator cap tester, slowly pump the tester and check that air is being released from the vacuum valve.

Pump speed:

1 push every 3 seconds or more

NOTICE:

Push the pump at a constant speed.

If air is not being released from the vacuum valve, replace the reservoir cap.

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

Pump speed:

1 push within 1 second

NOTICE:

The pump speed above should be followed for the first pump only. It will close the vacuum valve. Once the vacuum valve is closed, the pump speed can be reduced.

Standard opening pressure:

78 to 122 kPa (0.80 to 1.25 kgf/cm^2, 11.3 to 17.8 psi)

HINT:

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

CO

ON-VEHICLE INSPECTION

HINT:
The cooling fan may rotate when the ignition switch is turned from ACC to ON. This is normal.

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 ECT sensor, and check for disconnected connectors or wire breaks between the cooling fan relay and ECT sensor.
(c) Disconnect the ECT sensor connector.
(d) Check that the cooling fan rotates.
If not, check the fuses, cooling fan relay, ECM and cooling fan, and check for a short circuit between the cooling fan relay and ECT sensor.
(e) Reconnect ECT sensor connector.

2. CHECK COOLING FAN OPERATION WITH HIGH TEMPERATURE (Above 98°C (208°F))

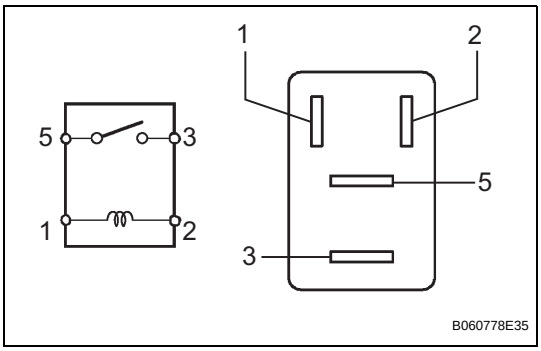
(a) Start the engine, and raise ECT to above 98°C (208°F).
(b) Check that the cooling fan rotates.
If not, replace the ECT sensor.

3. INSPECT COOLING FAN ASSEMBLY

(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:
4.9 to 8.5 A at 20°C (68°F)
If not, replace the cooling fan.
(d) Reconnect the cooling fan connector.

CO

INSPECTION

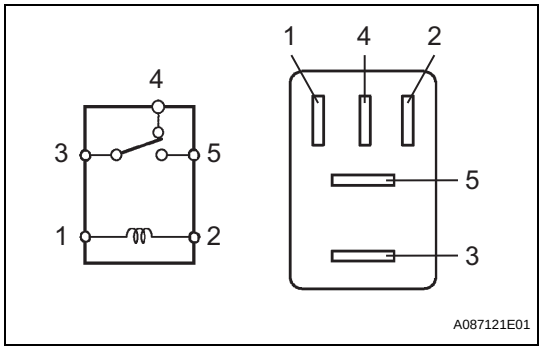


1. INSPECT FAN NO.1 AND FAN NO.3 RELAY

(a) Check the resistance of the relay.
Resistance

Tester Connection	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (when battery voltage is applied to terminals 1 and 2)

If the result is not as specified, replace the relay.



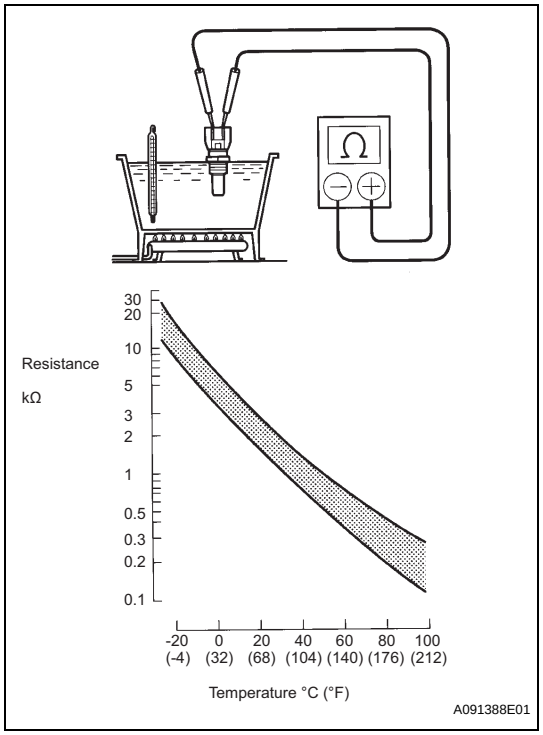
2. INSPECT FAN NO.2 RELAY

(a) Check the resistance of the relay.

Resistance

Tester Connection	Specified Condition
3 - 4	Below 1 Ω
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (when battery voltage is applied to terminals 1 and 2)

If the result is not as specified, replace the relay.



3. INSPECT ENGINE COOLANT TEMPERATURE SENSOR

(a) Check the resistance between terminals 1 and 2.

Resistance

Condition	Specified Condition
Approx. 20 °C (68 °F)	2.29 to 2.6 kΩ
Approx. 80 °C (176 °F)	0.300 to 0.327 kΩ

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

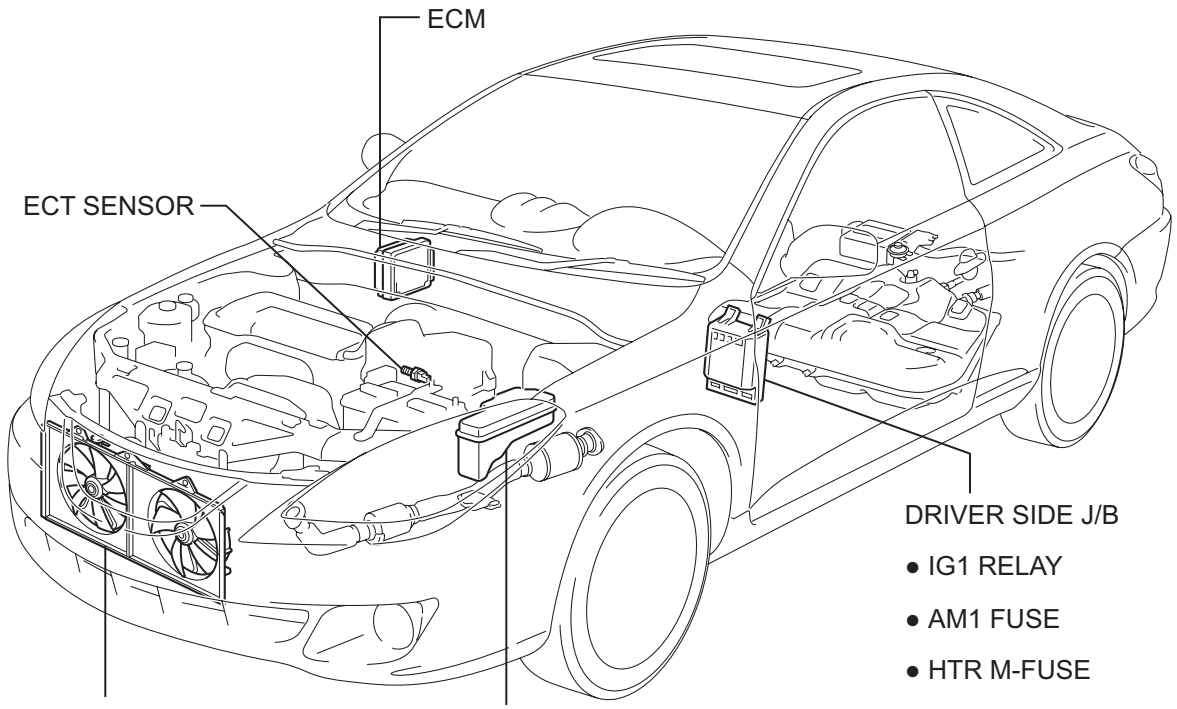
NOTICE:

When checking the ECT sensor in the water, the terminals should be kept dry. After the check, dry the sensor.

CO

COOLING FAN SYSTEM

PARTS LOCATION



C

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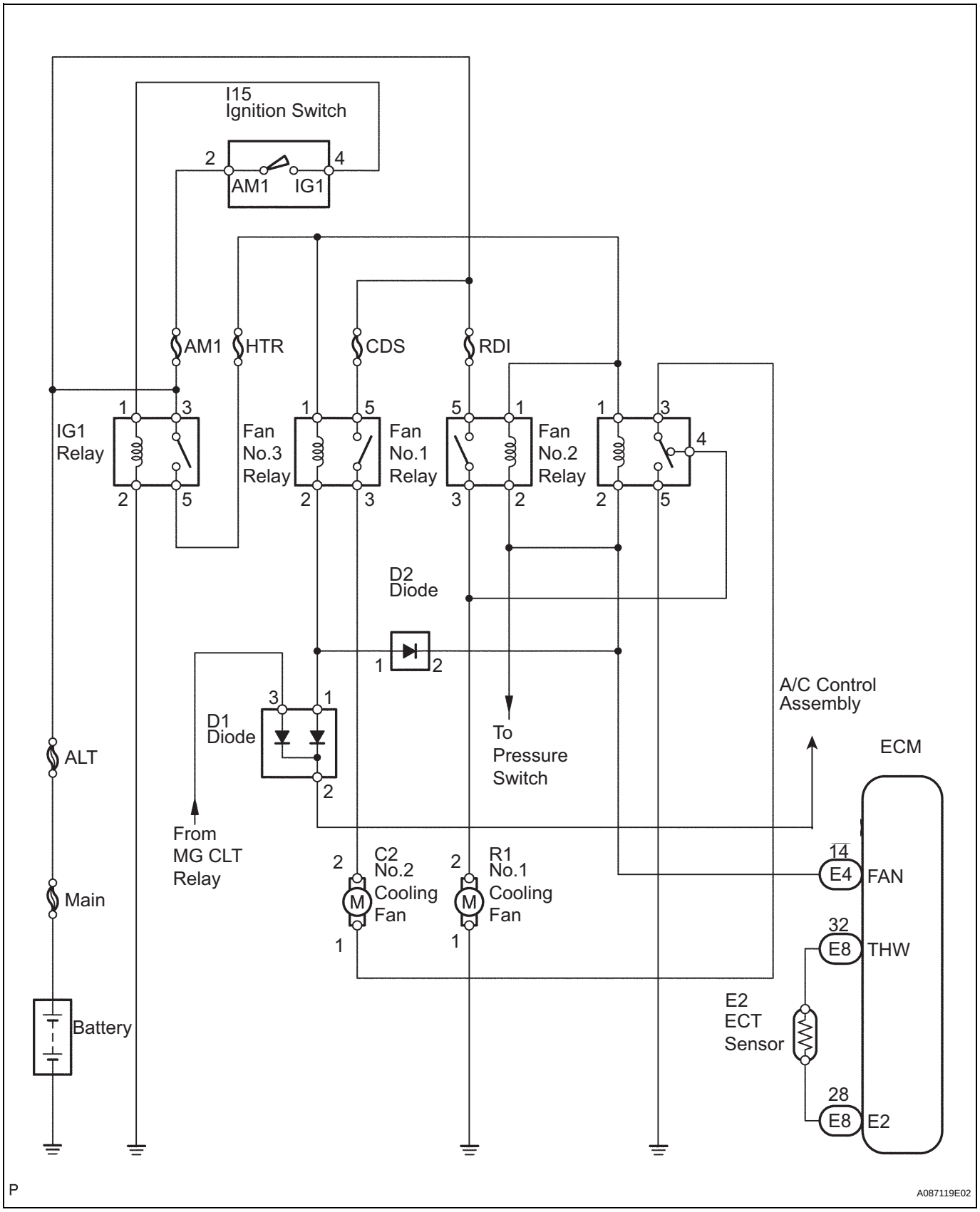
CO

SYSTEM DIAGRAM

The electric cooling fan system controls the fan motors using the Engine Coolant Temperature (ECT) sensor, and turns the 3 fan relays on and off according to the ECT and the air conditioner's operating condition.


I15
Ignition Switch
2
4
AM1
IG1
AM1
HTR
CDS
RDI
IG1
Relay
Fan
No.3
Relay
Fan
No.1
Relay
Fan
No.2
Relay
1
3
2
5
1
5
2
3
5
1
3
2
1
3
2
5
4
D2
Diode
1
2
D1
Diode
3
1
2
A/C Control
Assembly
ECM
To
Pressure
Switch
ALT
Main
Battery
From
MG CLT
Relay
2
C2
No.2
Cooling
Fan
M
1
2
R1
No.1
Cooling
Fan
M
1
14
E4
FAN
32
E8
THW
E2
ECT
Sensor
28
E8
E2
P
A087119E02

CO

COOLANT

REMOVAL

1. DRAIN ENGINE COOLANT

(a) Remove the radiator cap.

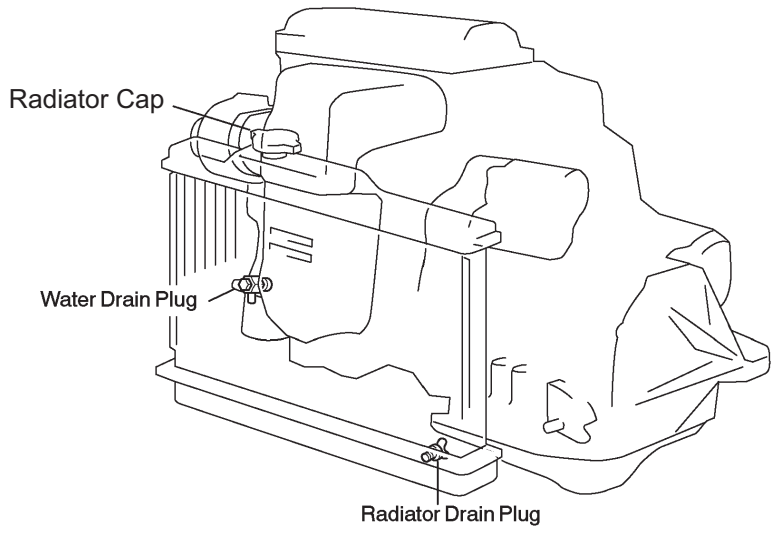
CAUTION:
Do not remove the radiator cap while the engine and radiator are still hot. Pressurized, hot engine coolant and steam may be released and cause serious burns.

(b) Drain engine coolant by loosening the radiator drain plug and the engine's water drain plug.

HINT:
Engine coolant inside the radiator is drained from the drain hole located on the bottom of the engine under cover.

(c) Tighten the cylinder block drain cock plugs.

Torque: 13 N*m (130 kgf*cm, 10 ft.*lbf)



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INSTALLATION

1. ADD ENGINE COOLANT

(a) Tighten the radiator drain plug.

(b) Add engine coolant into the radiator until it overflows.

Capacity:

6.2 liters (6.6 US qts, 5.4 Imp. qts)

HINT:

- Use of improper coolants may damage the engine cooling system.
- Use "TOYOTA Super Long Life Coolant" or similar high quality ethylene glycol based non-silicate, non-amine, non-nitrite, and non-borate coolant with long-life hybrid organic acid technology.
- New TOYOTA vehicles are filled with TOYOTA Super Long Life Coolant (color is pink, premixed ethylene-glycol concentration is approximately 50% and freezing temperature is -35 °C (-31 °F)). When replacing the coolant, TOYOTA Super Long Life Coolant is recommended.
- Observe the coolant level inside the radiator by pressing the inlet and outlet radiator hoses several times by hand. If the coolant level goes down, add the coolant.

NOTICE:

Do not use plain water alone.

(c) Pour coolant into the radiator reservoir tank until the coolant reaches the full line.

(d) Install the radiator cap.

(e) Start the engine and run the engine for 10 seconds.

(f) Remove the radiator cap after 10 seconds. Pour coolant if the coolant level is lower.

(g) Repeat (d) to (f) until the coolant level remains the same from steps (d) to (f).

HINT:

Perform the procedures above before the engine warms up. A warmed up engine causes the thermostat valve to open, and the air inside of the engine circulates between the radiator and the engine.

(h) Install the radiator cap.

(i) Warm up the engine until the thermostat valve begins to open.

HINT:

As the engine warms up, press the radiator inlet and outlet hose several times by hand.

(j) Stop the engine and wait until the coolant cools down to room temperature. If the coolant is below the full line, add coolant.

(k) Install the radiator cap and check the radiator reservoir tank coolant level. If it is below the full line, add coolant.

2. CHECK FOR ENGINE COOLANT LEAKS

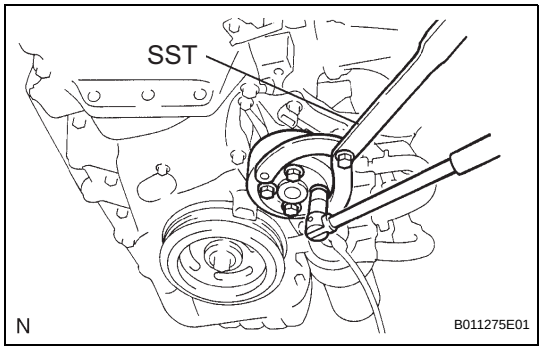
(a) Fill the radiator with coolant and attach a radiator cap tester.

(b) Pump it to 118 kPa (1.2 kgf/cm ^{2}, 17.1 psi) and check leakage.

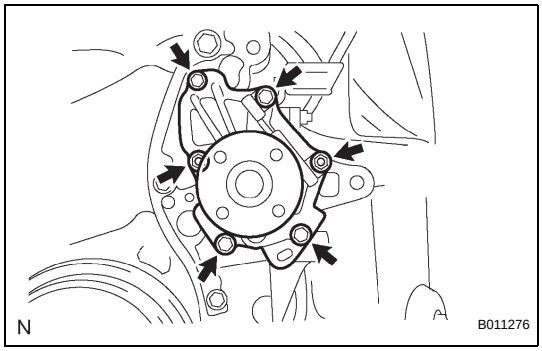
WATER PUMP

REMOVAL

1. **DRAIN ENGINE COOLANT**
2. **REMOVE FRONT WHEEL RH**
3. **REMOVE FRONT FENDER APRON SEAL RH**
4. **REMOVE ENGINE MOVING CONTROL ROD W/ BRACKET**
5. **REMOVE ENGINE MOUNTING STAY NO.2 RH**
6. **REMOVE ENGINE MOUNTING BRACKET NO.2 RH**
7. **REMOVE FAN AND GENERATOR V BELT**
8. **REMOVE GENERATOR ASSEMBLY**
9. **REMOVE WATER PUMP PULLEY**
   (a) Using SST, remove the 4 bolts and pump pulley.
   SST 09960-10010 (09962-01000, 09963-00700)
   (b) Disconnect the crankshaft position sensor wire harness clamp.



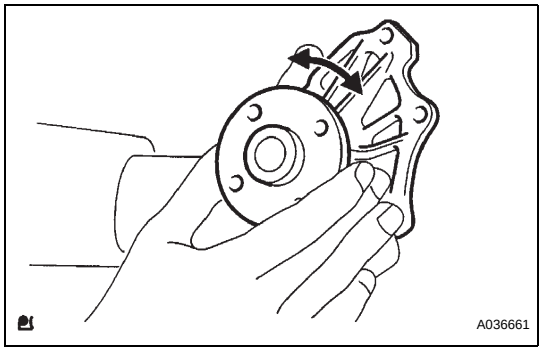
10. **REMOVE WATER PUMP ASSEMBLY**
    (a) Remove the 4 bolts, 2 nuts, bracket and water pump.



CO

INSPECTION

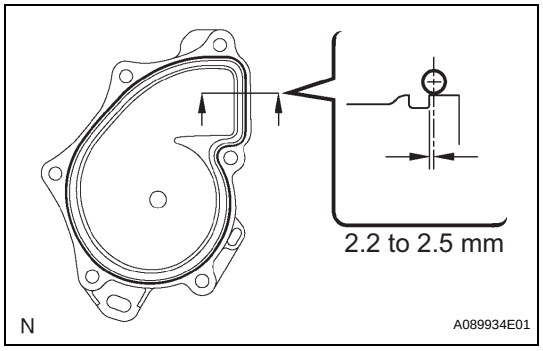
1. **INSPECT WATER PUMP ASSEMBLY**
   (a) Visually check the drain hole for coolant leakage.
   (b) Turn the pulley, and check that the water pump bearing moves smoothly and noiselessly.
   If the bearing moves roughly or noisily, replace the water pump.



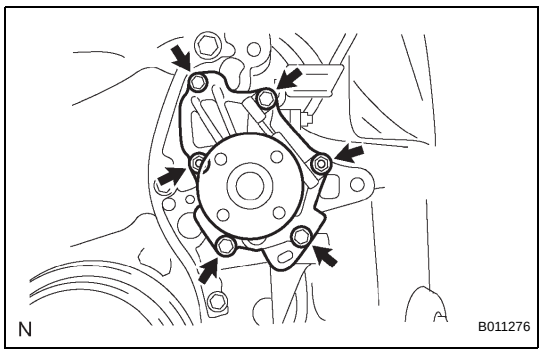
INSTALLATION

1. INSTALL WATER PUMP ASSEMBLY

(a) Remove any old packing (FIPG) material and be careful not to spill any oil on the contacting surfaces of the water pump and cylinder block.
HINT:
- Using a razor blade and gasket scraper, remove all the old packing (FIPG) materials from the gasket surfaces and sealing grooves.
- Thoroughly clean all components to remove all loose material.
- Using a non-residue solvent, clean both sealing surfaces.

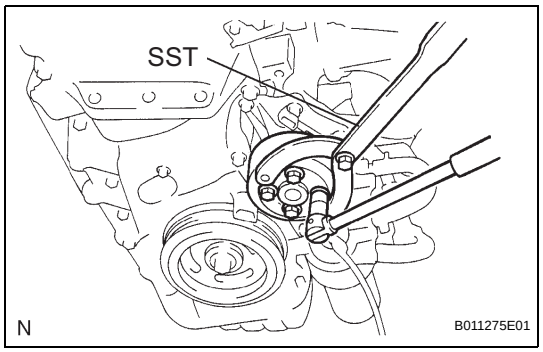


(b) Apply seal packing to the water pump as shown in the illustration.
Seal packing:
Part No. 08826-00080 or equivalent
HINT:
- Install a nozzle that has been cut to a 2.2 to 2.5 mm (0.09 to 0.10 in.) opening.
- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove the nozzle from the tube and reinstall cap.



(c) Install the water pump and bracket with the 4 bolts and 2 nuts.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

(d) Connect the crankshaft position sensor wire harness clamp.



2. INSTALL WATER PUMP PULLEY

(a) Using SST, install the pump pulley with the 4 bolts.
SST 09960-10010 (09962-01000, 09963-00700)
Torque: 26 N*m (265 kgf*cm, 19 in.*lbf)

3. INSTALL GENERATOR ASSEMBLY

4. INSTALL FAN AND GENERATOR V BELT

5. INSTALL ENGINE MOUNTING BRACKET NO.2 RH

6. INSTALL ENGINE MOVING CONTROL ROD W/ BRACKET

7. INSTALL ENGINE MOUNTING STAY NO.2 RH

8. INSTALL FRONT FENDER APRON SEAL RH

9. INSTALL FRONT WHEEL RH

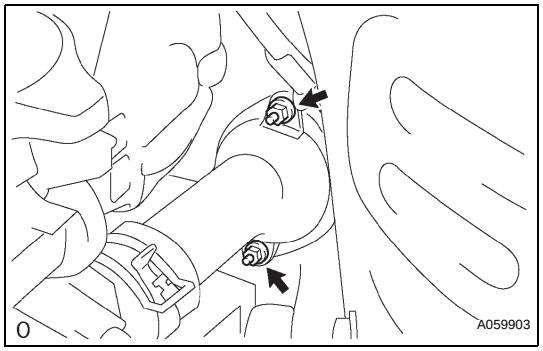
10. ADD ENGINE COOLANT

11. CHECK ENGINE COOLANT LEAKS

THERMOSTAT

REMOVAL

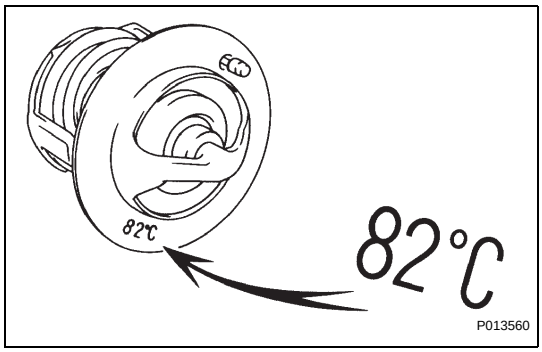
1. **DRAIN ENGINE COOLANT**
2. **REMOVE FAN AND GENERATOR V BELT**
3. **REMOVE GENERATOR ASSEMBLY**
4. **REMOVE RADIATOR HOSE INLET**
5. **REMOVE WATER INLET**
   (a) Remove the 2 nuts and disconnect the water inlet from the cylinder block.
6. **REMOVE THERMOSTAT**



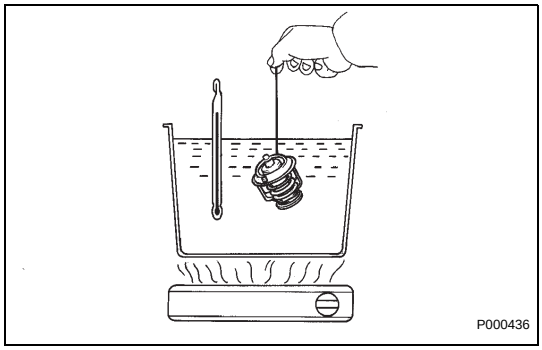
INSPECTION

1. INSPECT THERMOSTAT

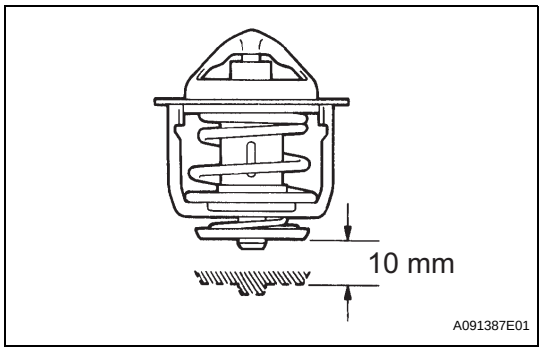
HINT:
The thermostat is numbered with the valve opening temperature.



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



(b) Check the valve opening temperature.
Valve opening temperature:
80 to 84 °C (176 to 183 °F)
If the valve opening temperature is not as specified, replace the thermostat.

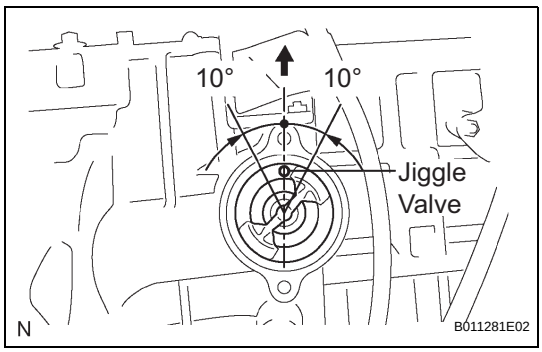


(c) Check the valve lift.
Valve lift:
10 mm (0.394 in.) or more at 95 °C (203 °F)
If the valve lift is not as specified, replace the thermostat.

(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.

CO

INSTALLATION



1. INSTALL THERMOSTAT

(a) Install a new gasket to the thermostat.

(b) Install the thermostat with the jiggle valve facing up.
HINT:
The jiggle valve may be set within 10° on either side of the prescribed position.

2. INSTALL WATER INLET

(a) Install the water inlet with the 2 nuts.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

3. INSTALL RADIATOR HOSE INLET

4. INSTALL GENERATOR ASSEMBLY

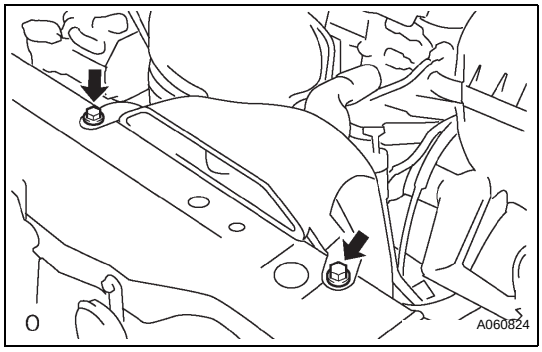
5. INSTALL FAN AND GENERATOR V BELT

6. ADD ENGINE COOLANT

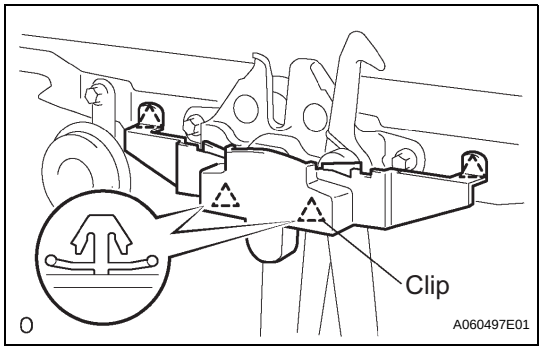
7. CHECK ENGINE COOLANT LEAKS

REMOVAL

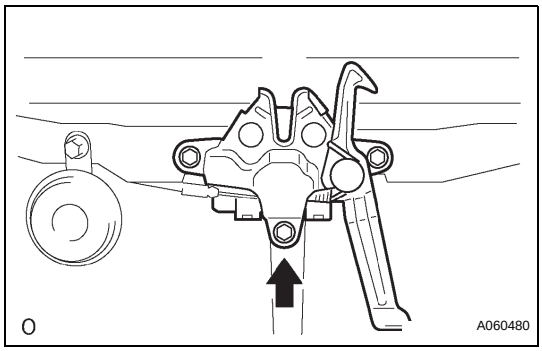
1. **DRAIN ENGINE COOLANT**
2. **REMOVE RADIATOR RESERVE TANK HOSE OR PIPE**
3. **REMOVE RADIATOR HOSE INLET**
4. **REMOVE RADIATOR HOSE OUTLET**
5. **ADJUST OIL COOLER OUTLET HOSE NO.2 (A/T)**
6. **REMOVE OIL COOLER OUTLET HOSE NO.3 (A/T)**
7. **REMOVE AIR CLEANER INLET ASSEMBLY**
   (a) Remove the 2 bolts and air cleaner inlet.
8. **REMOVE RADIATOR SUPPORT UPPER**
   (a) Disconnect the 2 horn connectors.



   (b) Remove the hood lock release lever cover.



   (c) Remove the bolt shown in the illustration.
   (d) Remove the 4 bolts and radiator support.



9. **REMOVE RADIATOR ASSEMBLY**
   (a) Disconnect the fan motor connector.
   (b) Remove the radiator from the body.
10. **REMOVE RADIATOR SUPPORT LOWER**
11. **REMOVE FAN ASSEMBLY**
    (a) Remove the 3 bolts and fan from the radiator.

CO

DISASSEMBLY

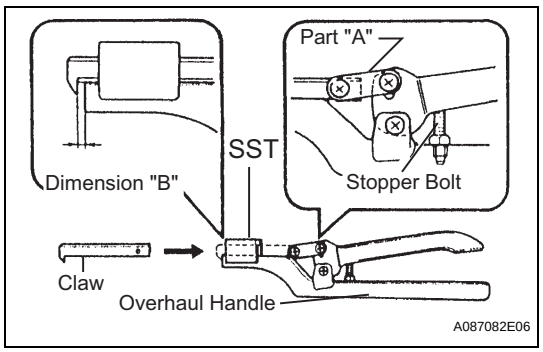
1. REMOVE DRAIN PLUG

(a) Remove the drain plug.

(b) Remove the O-ring.

2. ASSEMBLE SST

SST 09230-01010 (09231-01010, 09231-01030)



(a) Install the claw 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.

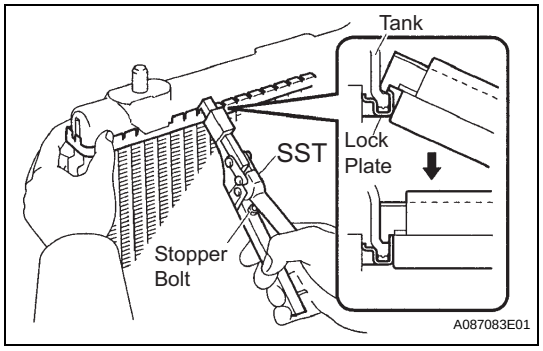
Dimension B:

0.2 to 0.3 mm (0.008 to 0.012 in.)

NOTICE:

If the stopper bolt is not adjusted, the claw may be damaged.

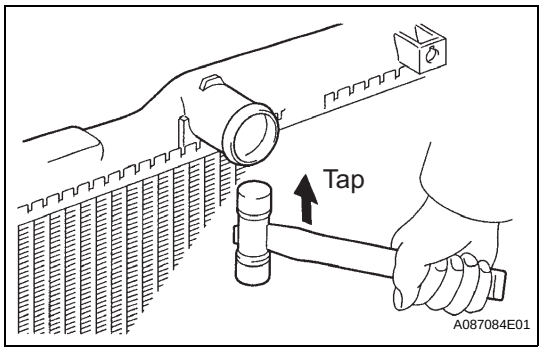
3. REMOVE UNCAULK LOCK PLATE



(a) Using SST to release the caulking, grip the handle until stopped by the stopper bolt.

SST 09230-01010 (09231-01010, 09231-01030)

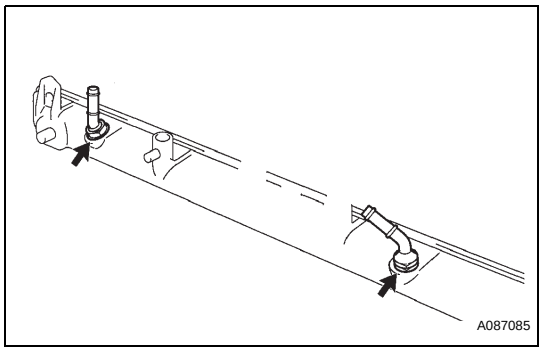
4. REMOVE RADIATOR TANK UPPER AND TANK LOWER



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

(b) Remove the O-ring.

5. REMOVE OIL COOLER ASSEMBLY (for Automatic Transaxle)



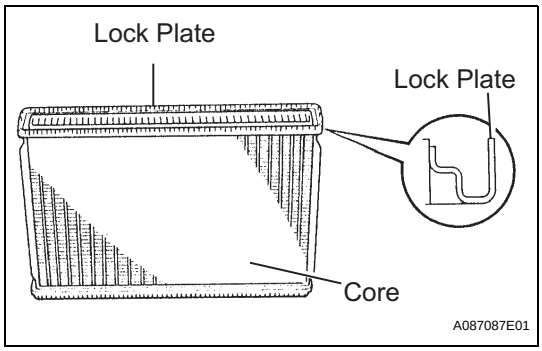
(a) Remove the cooler pipe.

(b) Loosen the 2 nuts and 2 plate washers.

(c) Remove the oil cooler.

(d) Remove the 2 O-rings from the oil cooler.

CO

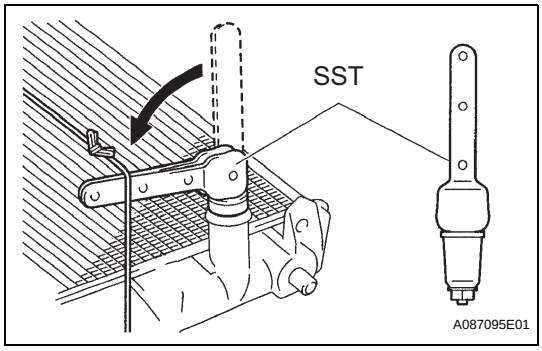


INSPECTION

1. INSPECT LOCK PLATE FOR DAMAGE

(a) 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 the lock plate groove's shape with pliers or a similar object, if necessary.
- Water leakage will result if the bottom of the lock plate groove is damaged or dented. Repair or replace if necessary.

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

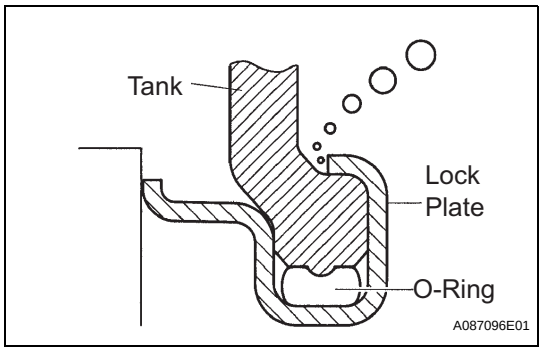


2. INSPECT FOR WATER LEAKS

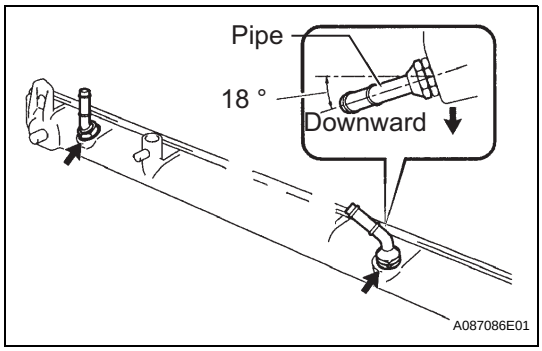
(a) Plug the inlet and outlet pipes of the radiator with SST.
SST 09230-01010

(b) Using a radiator cap tester, apply pressure to the radiator.
Test pressure:
177 kPa (1.8 kgf/cm ^{2}, 26 psi)

(c) Submerge the radiator in water.



(d) Inspect for leaks.
HINT:
On radiators with resin tanks, there is 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 air bubbles disappear.



REASSEMBLY

1. INSTALL OIL COOLER ASSEMBLY (for Automatic Transaxle)

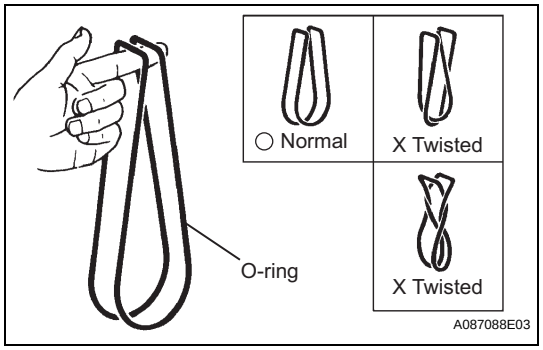
(a) Clean the O-ring contact surface of the lower tank and oil cooler.

(b) Install 2 new O-rings to the oil cooler.

(c) Install the oil cooler to the lower tank with the 2 plate washers and nuts.
Torque: 8.3 N*m (85 kgf*cm, 73 in.*lbf)

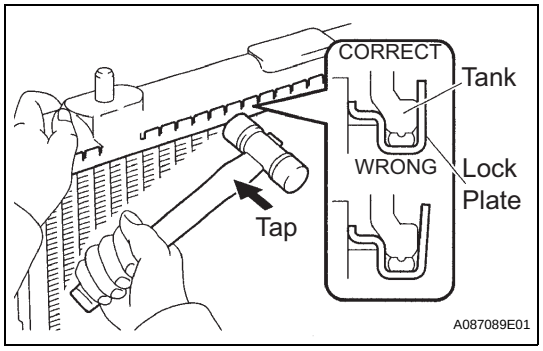
(d) Install the cooler pipe in the direction indicated in the illustration.
Torque: 14.7 N*m (150 kgf*cm, 11 in.*lbf)

CO



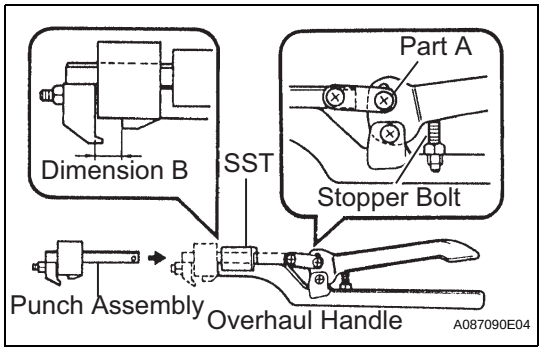
2. INSTALL RADIATOR TANK UPPER AND TANK LOWER

(a) After checking that there are no foreign objects in the lock plate groove, install a 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 the lock plate and the tank.

3. ASSEMBLY SST
SST 09230-01010, 09231-14010

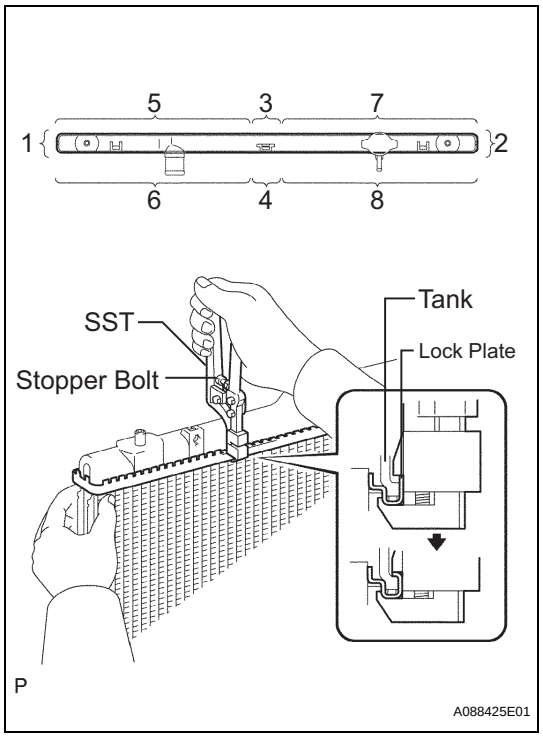


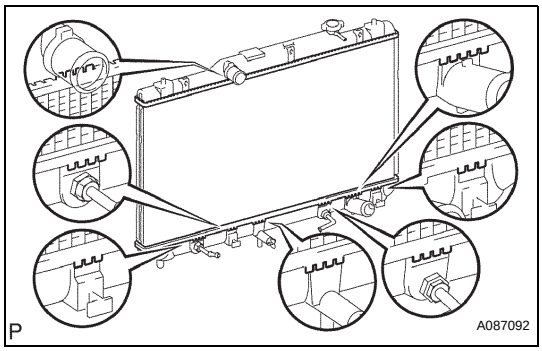
(a) Install the punch assembly to the overhaul handle, inserting it in the hole in part A as shown in the illustration.
(b) While gripping the handle, adjust the stopper bolt so that dimension B is as shown in the illustration.
Dimension B:
8.4 mm (0.331 in)

CO

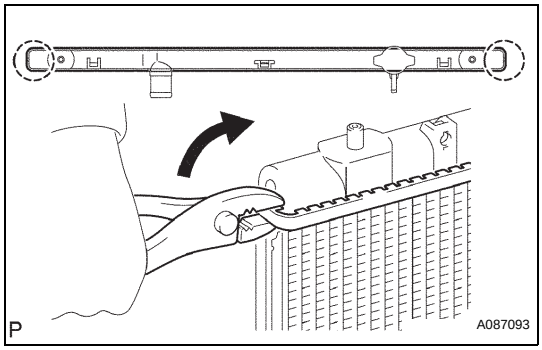
4. CAULK LOCK PLATE

(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 gripping the handle until stopped by the stopper plate.
SST 09230-01010

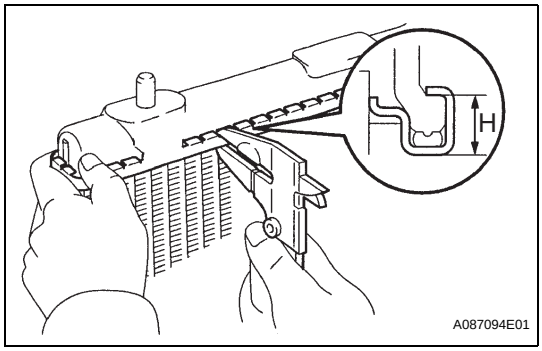




(b) Check the pipes, brackets or tank ribs.
HINT:
Do not tap the areas protruding around the pipes, brackets or tank ribs.



(c) Check the core plates.
HINT:
The dotted circles shown in the illustration and parts of the oil cooler near the dotted circles (A/T) cannot be tapped with the SST. Use pliers or similar objects and be careful not to damage the core plates.



(d) Check the lock plate height (H) after completing the caulking.
Plate height (H):
7.40 to 7.80 mm (0.2913 to 0.3071 in.)
If not within the specified height, adjust the stopper bolt of the handle again and caulk again.

5. INSTALL DRAIN PLUG

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

INSTALLATION

1. INSTALL FAN ASSEMBLY

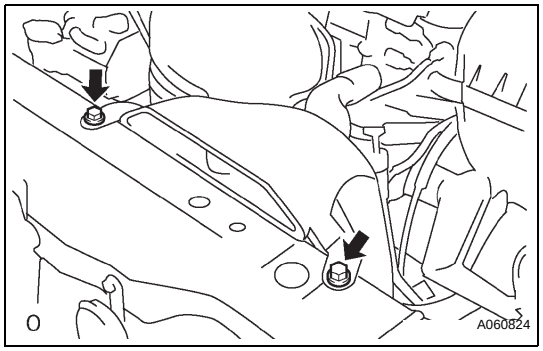
(a) Install the fan to the radiator with the 3 bolts.
Torque: 5.0 N*m (51 kgf*cm, 44 in.*lbf)

2. INSTALL RADIATOR ASSEMBLY

(a) Install the radiator to the body.
(b) Connect the fan motor connector.

3. INSTALL RADIATOR SUPPORT UPPER

(a) Install the radiator support with the 4 bolts.
Torque: 14 N*m (142 kgf*cm, 10 in.*lbf)
(b) Connect the 2 horn connectors.



4. INSTALL AIR CLEANER INLET ASSEMBLY

(a) Install the air cleaner inlet with the 2 bolts.
Torque: 5.0 N*m (51 kgf*cm, 44 in.*lbf)

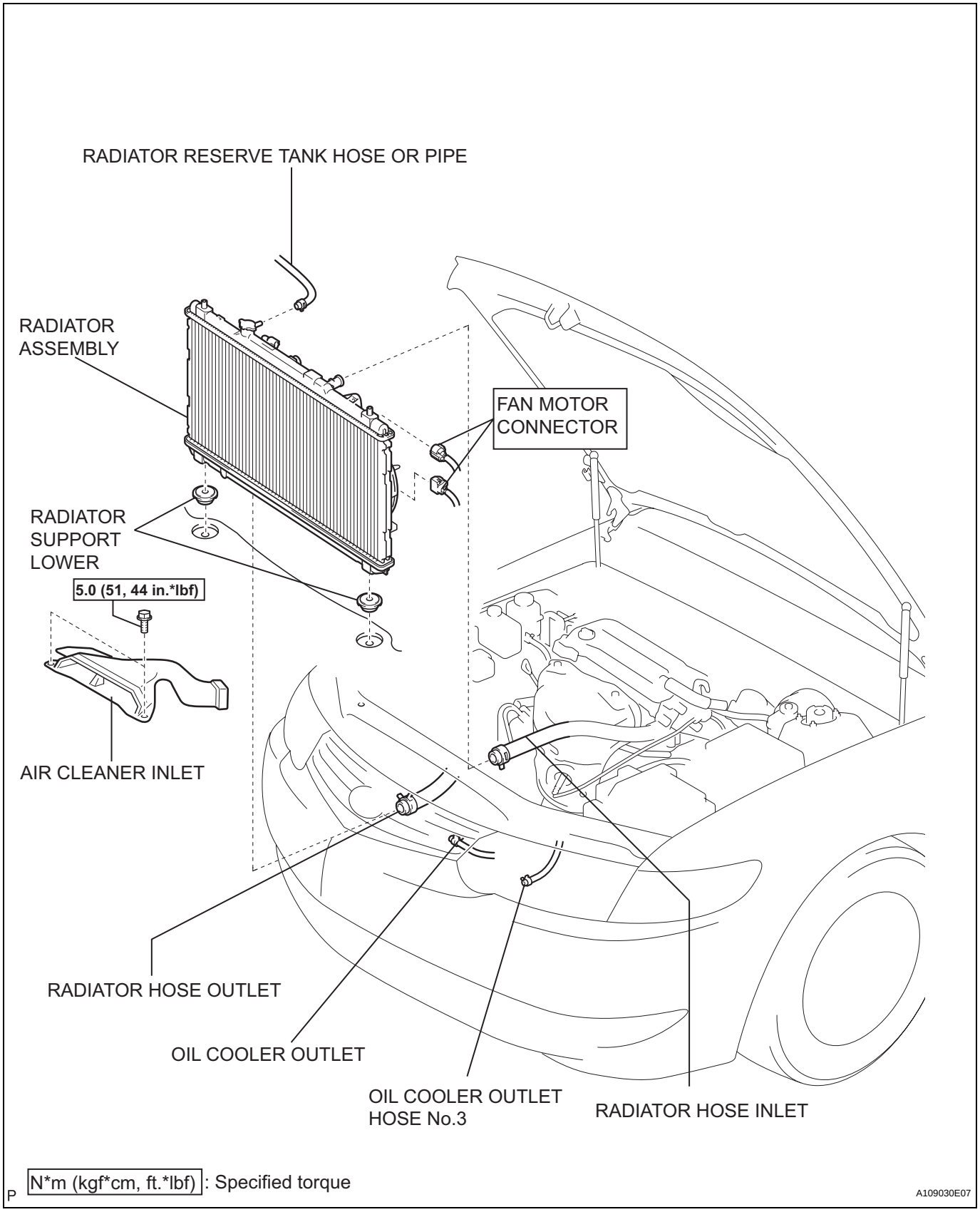
5. ADJUST HOOD SUB-ASSEMBLY

6. ADD ENGINE COOLANT

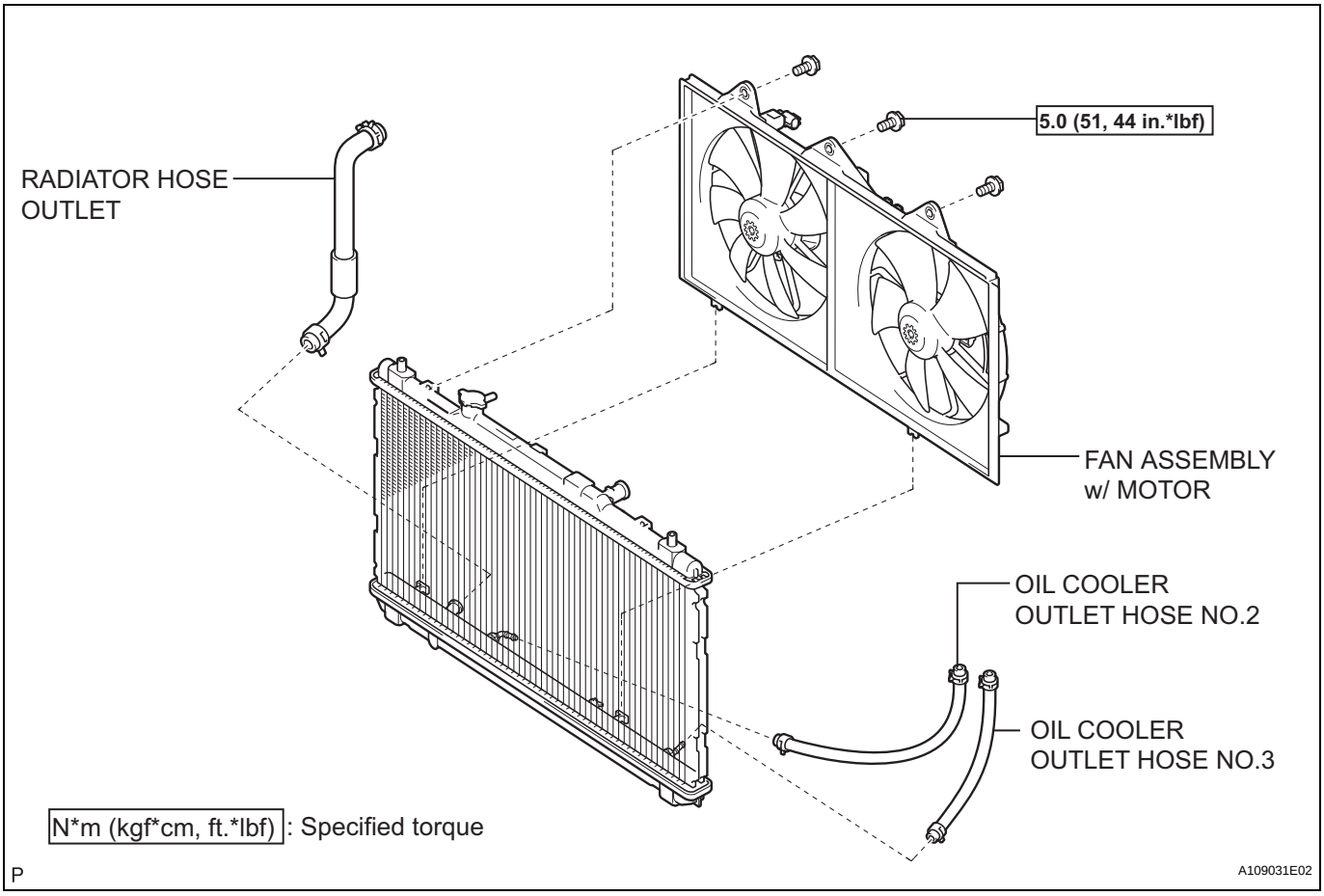
7. CHECK ENGINE COOLANT LEAKS

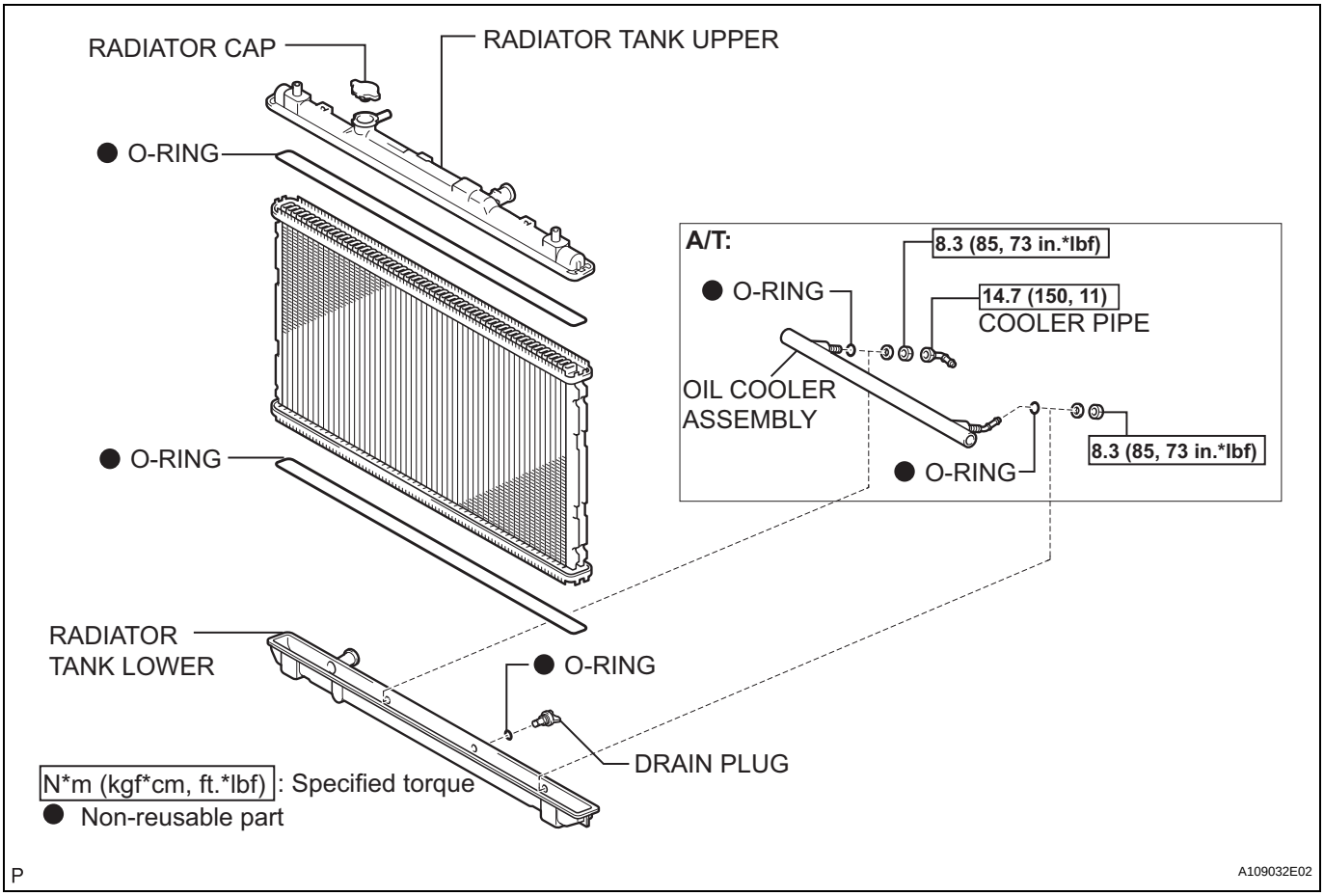
RADIATOR

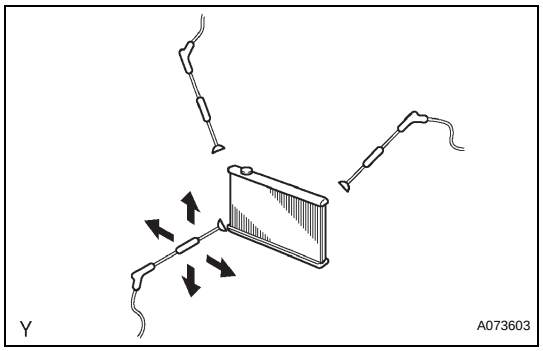
COMPONENTS



CO


RADIATOR HOSE OUTLET
5.0 (51, 44 in.*lbf)
FAN ASSEMBLY w/ MOTOR
OIL COOLER OUTLET HOSE NO.2
OIL COOLER OUTLET HOSE NO.3
N*m (kgf*cm, ft.*lbf) : Specified torque
P
A109031E02


RADIATOR CAP
RADIATOR TANK UPPER
● O-RING
● O-RING
A/T:
8.3 (85, 73 in.*lbf)
● O-RING
14.7 (150, 11)
COOLER PIPE
OIL COOLER ASSEMBLY
8.3 (85, 73 in.*lbf)
● O-RING
RADIATOR TANK LOWER
● O-RING
DRAIN PLUG
N*m (kgf*cm, ft.*lbf) : Specified torque
● Non-reusable part
P
A109032E02



ON-VEHICLE CLEANING

1. INSPECT FINS BLOCKAGE

(a) If the fins are clogged, wash them with water or a steam cleaner. Dry with compressed air.

Standard

Injection Distance	Injection Pressures
300 mm (11.81 in.)	2,942 to 4,903 kPa (30 to 50 kg/cm ^{2}, 427 to 711 psi)
500 mm (19.69 in.)	4,903 to 7,845 kPa (50 to 80 kg/cm ^{2}, 711 to 1,138 psi)

NOTICE:

- **If the distance between the steam cleaner and the core is too close, the fins may become damaged. Keep the following injection distance.**
- **If the fins are bent, straighten them with a screwdriver or pliers.**
- **Never apply water directly onto the electronic components.**