

# COOLING AND LUBRICATION SYSTEM

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## ENGINE COOLANT

At the time of manufacture, the cooling system is filled with a 50:50 mixture of distilled water and ethylene glycol anti-freeze. This 50:50 mixture will provide the optimum corrosion protection and excellent heat protection, and will protect the cooling system from freezing at temperatures above  $-31\text{ }^{\circ}\text{C}$  ( $-24\text{ }^{\circ}\text{F}$ ).

If the motorcycle is to be exposed to temperatures below  $-31\text{ }^{\circ}\text{C}$  ( $-24\text{ }^{\circ}\text{F}$ ), this mixing ratio should be increased up to 55 % or 60 % according to the figure.

### CAUTION

- \* Use a high quality ethylene glycol base anti-freeze, mixed with distilled water. Do not mix an alcohol base anti-freeze and different brands of anti-freeze.
- \* Do not put in more than 60 % anti-freeze or less than 50 %. (Refer to the right figure.)
- \* Do not use a radiator anti-leak additive.

50 % engine coolant including reservoir tank capacity

|             |                              |
|-------------|------------------------------|
| Anti-freeze | 1 100 ml (2.3/1.9 US/lmp.pt) |
| Water       | 1 100 ml (2.3/1.9 US/lmp.pt) |

| Anti-freeze density | Freezing point  |
|---------------------|---|
| 50 %                | $-31\text{ }^{\circ}\text{C}$ ( $-24\text{ }^{\circ}\text{F}$ ) |
| 55 %                | $-40\text{ }^{\circ}\text{C}$ ( $-40\text{ }^{\circ}\text{F}$ ) |
| 60 %                | $-55\text{ }^{\circ}\text{C}$ ( $-67\text{ }^{\circ}\text{F}$ ) |

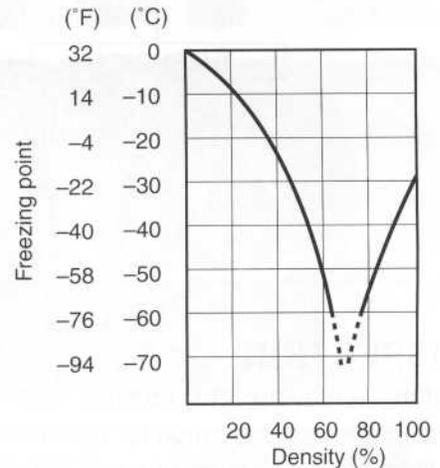


Fig.1 Engine coolant density-freezing point curve

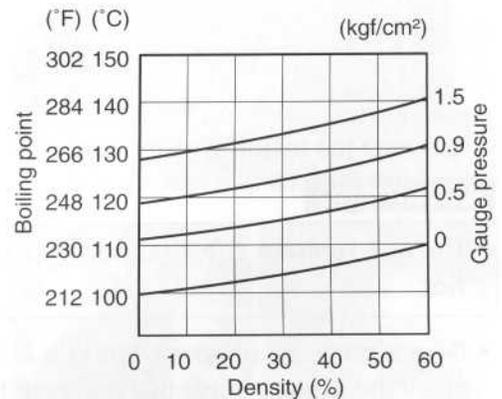
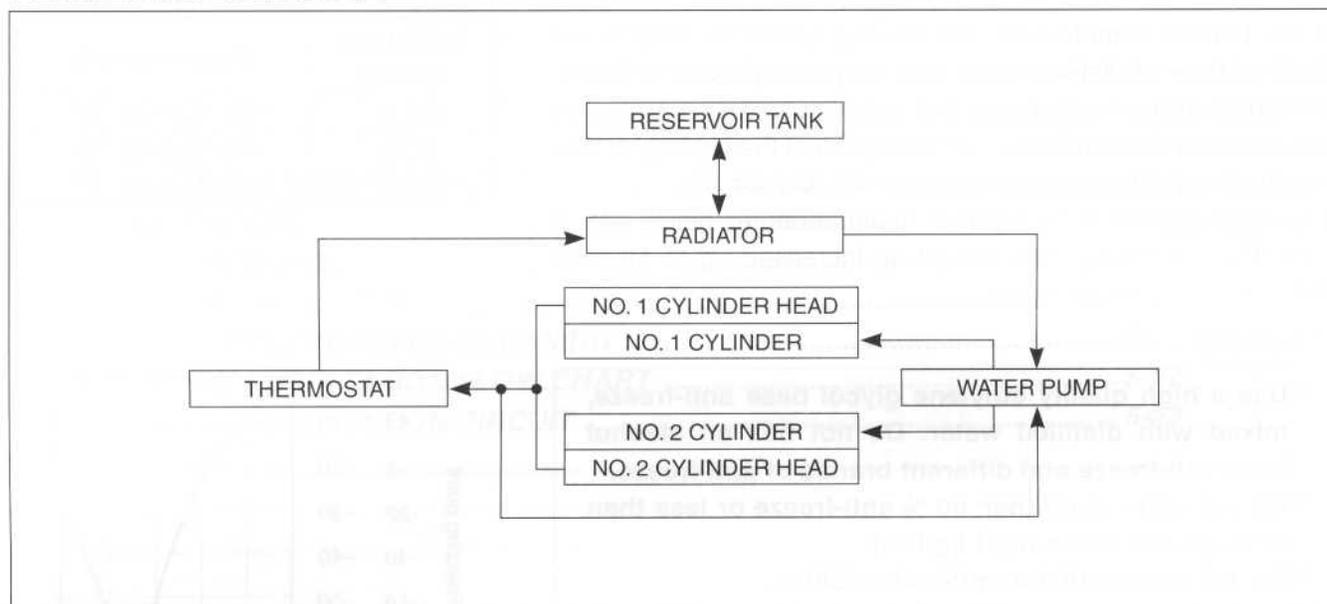


Fig.2 Engine coolant density-boiling point curve

### WARNING

- \* You can be injured by scalding fluid or steam if you open the radiator cap when the engine is hot. After the engine cools, wrap a thick cloth around cap and carefully remove the cap by turning it a quarter turn to allow pressure to escape and then turn the cap all the way off.
- \* The engine must be cool before servicing the cooling system.
- \* Coolant is harmful;
  - If it comes in contact with skin or eyes, flush with water.
  - If swallowed accidentally, induce vomiting and call physician immediately.
  - Keep it away from children.

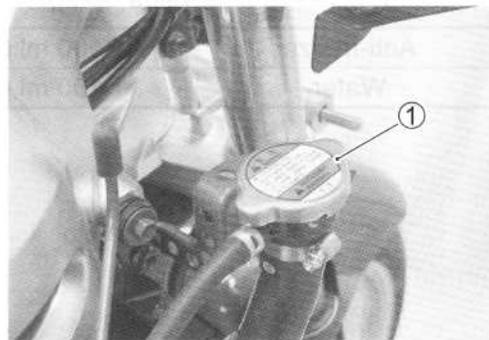
## COOLING CIRCUIT



## INSPECTION

Before removing the radiator and draining engine coolant, inspect the cooling circuit for tightness.

- Remove the body cowling. (☞ 6-6)
- Remove the radiator cap ①.



- Connect the tester ② to the filler.

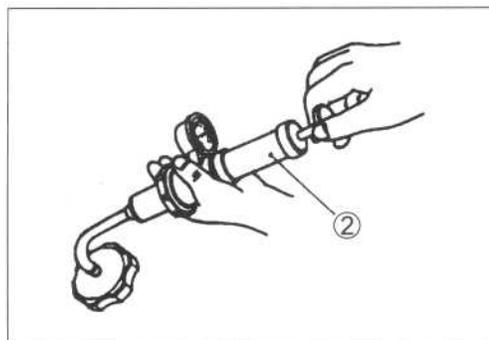
### ⚠ WARNING

**Do not remove the radiator cap when the engine is hot.**

- Give a pressure of about 110 kPa (1.1 kgf/cm<sup>2</sup>, 15.6 psi) and see if the system holds this pressure for 10 seconds.
- If the pressure should fall during this 10-second interval, it means that there is a leaking point in the system. In such a case, inspect the entire system and replace the leaking component or part.

### ⚠ WARNING

**When removing the radiator cap tester, put a rag on the filler to prevent spouting of engine coolant.**



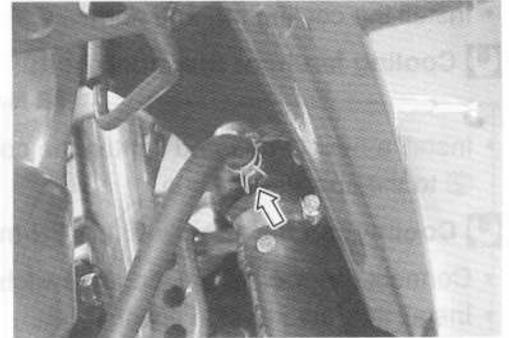
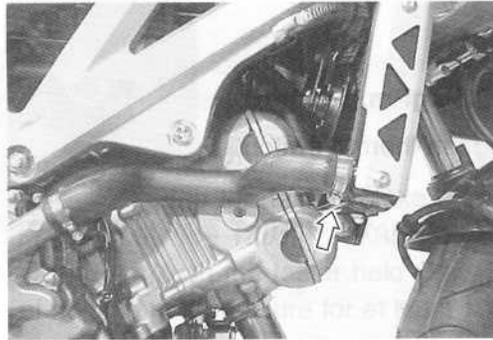
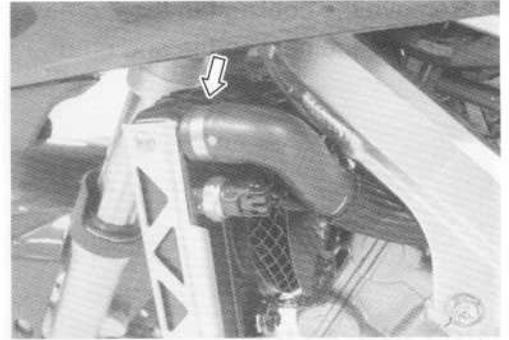
### CAUTION

**Do not allow the pressure to exceed the radiator cap release pressure, or the radiator can be damaged.**

## RADIATOR

### REMOVAL

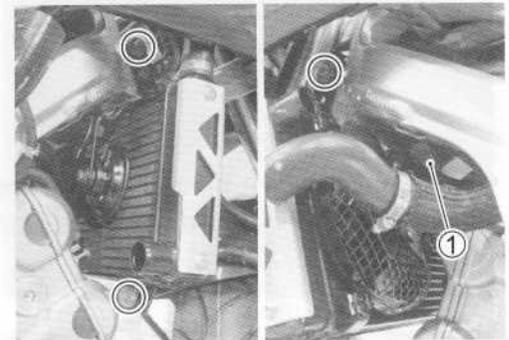
- Drain engine coolant. (☞ 2-19)
- Disconnect the radiator hoses from the radiator.
- Disconnect the siphon hose from the radiator.



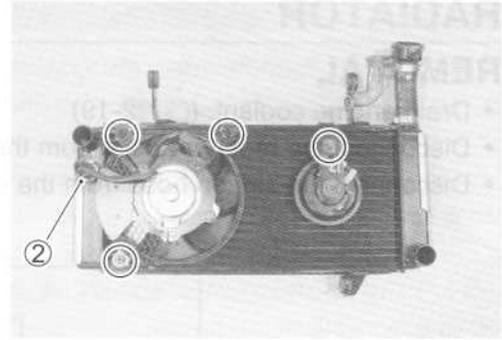
- Disconnect the horn lead wire coupler.



- Remove the radiator by removing its mounting bolts.
- Disconnect the cooling fan motor lead wire coupler ①.



- Remove the radiator side covers.
- Remove the cooling fan thermo-switch ②.
- Remove the cooling fan and horn.



## INSTALLATION

- Install the cooling fan and horn.

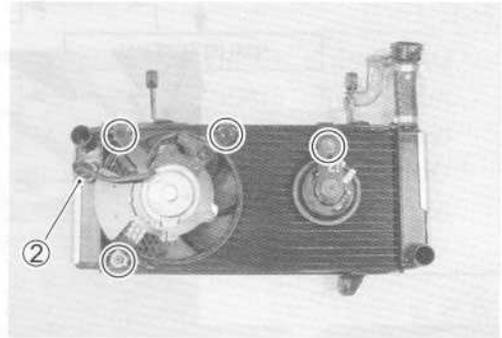
### Cooling fan/horn mounting bolt:

**8 N·m (0.8 kgf-m, 6.0 lb-ft)**

- Install a new O-ring and tighten the cooling fan thermo-switch ② to the specified torque.

### Cooling fan thermo-switch: 17 N·m (1.7 kgf-m, 12.5 lb-ft)

- Connect the cooling fan thermo-switch coupler.
- Install the radiator side covers.
- Install the radiator in the reverse order of removal.
- Pour engine coolant. ( 2-19)
- Bleed air from the cooling circuit. ( 2-20)

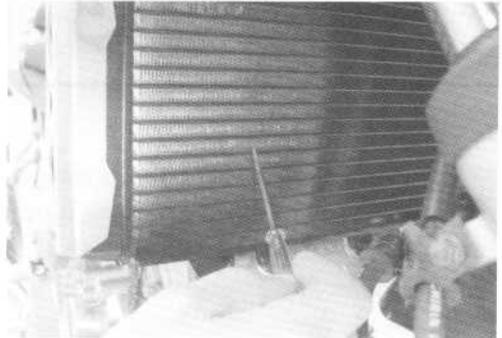


## INSPECTION AND CLEANING

- Road dirt or trash stuck to the fins must be removed.
- Use of compressed air is recommended for this cleaning.

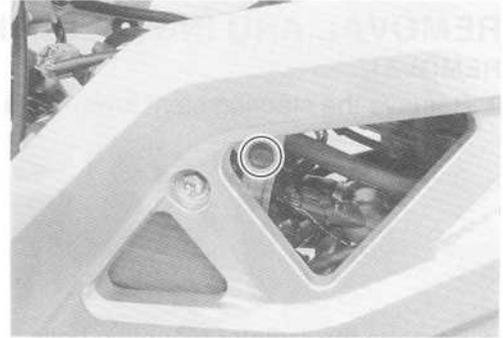


- Fins bent down or dented can be repaired by straightening them with the blade of a small screwdriver.



## RADIATOR RESERVOIR TANK REMOVAL AND INSTALLATION

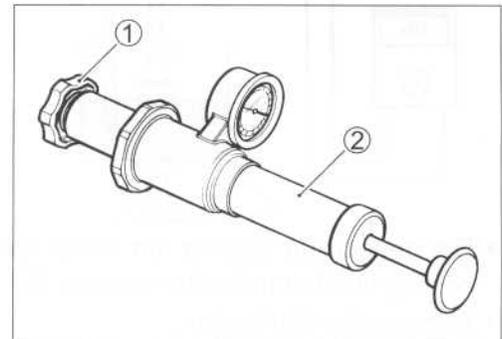
- Lift and support the fuel tank. (☞ 4-65)
- Disconnect the siphon hose from the radiator.
- Remove the reservoir tank by removing its mounting bolt.
- Drain engine coolant.
- Install the reservoir tank in the reverse order of removal.
- Fill the reservoir tank to the upper level.



## RADIATOR CAP

### INSPECTION

- Fit the cap ① to the radiator cap tester ②.
- Build up pressure slowly by operating the tester. Make sure that the pressure build-up stops at 95 – 125 kPa (0.95 – 1.25 kgf/cm<sup>2</sup>, 13.5 – 17.8 psi) and that, with the tester held standstill, the cap is capable of holding that pressure for at least 10 seconds.
- Replace the cap if it is found not to satisfy either of these two requirements.



### **DATA** Radiator cap valve opening pressure

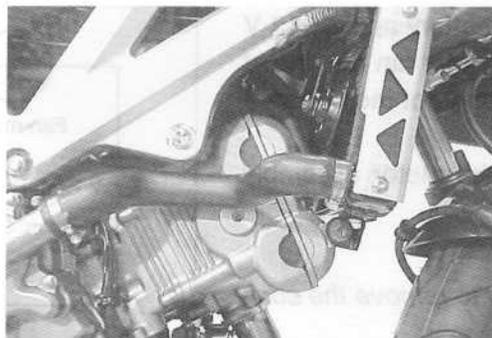
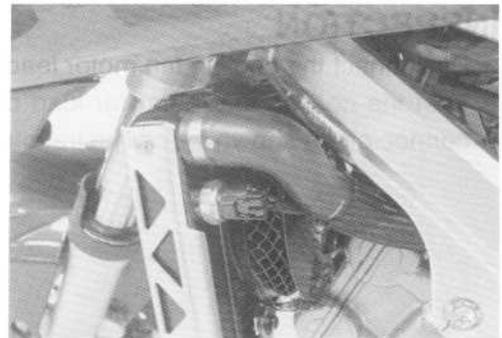
Standard:

95 – 125 kPa (0.95 – 1.25 kgf/cm<sup>2</sup>, 13.5 – 17.8 psi)

## WATER HOSE

### INSPECTION

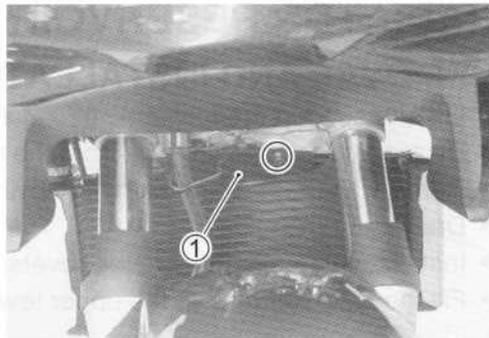
- Any water hose found in a cracked condition or flattened or water leaked must be replaced.
- Any leakage from the connecting section should be corrected by proper tightening.



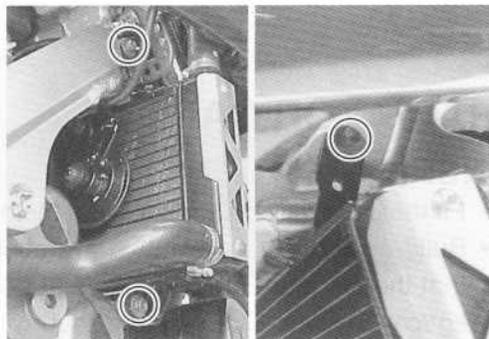
## COOLING FAN REMOVAL AND INSTALLATION

### REMOVAL

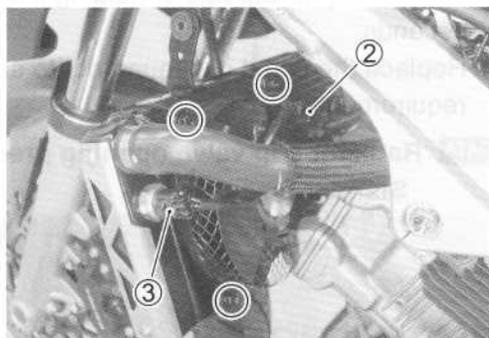
- Remove the steering stem lower plate ①.



- Remove the radiator mounting bolts.
- Move the radiator forward.



- Disconnect the cooling fan motor lead wire coupler ② and cooling fan thermo-switch coupler ③.
- Remove the cooling fan.



### INSTALLATION

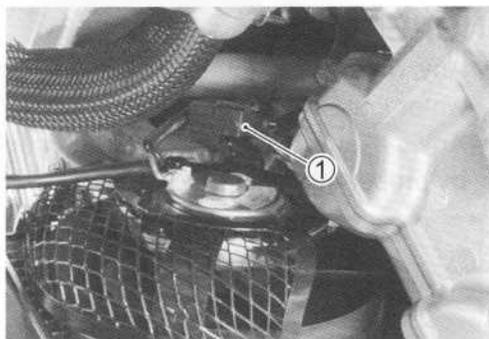
- Install the cooling fan and radiator in the reverse order of removal.

#### Cooling fan motor mounting bolt:

8 N·m (0.8 kgf-m, 6.0 lb-ft)

### INSPECTION

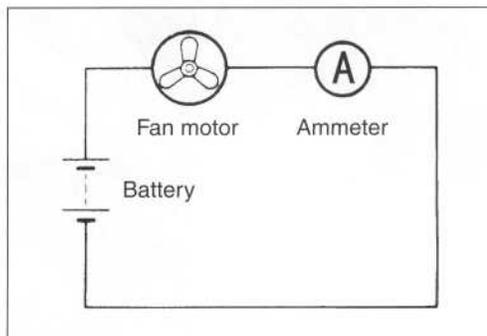
- Disconnect the cooling fan motor lead wire coupler ①.
- Test the cooling fan motor for load current with an ammeter connected as shown in the illustration.



- The voltmeter is for making sure that the battery applies 12 V to the motor. With the motor with electric motor fan running at full speed, the ammeter should be indicating not more than 5 amperes.
- If the fan motor does not turn, replace the motor assembly with a new one.

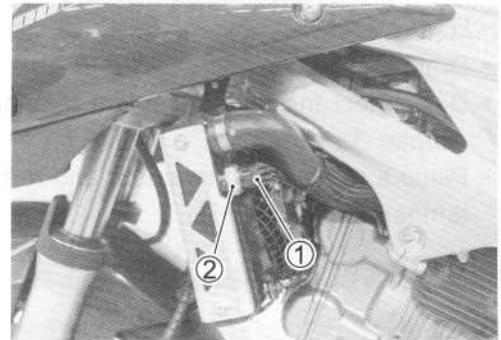
#### NOTE:

When making above test, it is not necessary to remove the cooling fan.



## COOLING FAN THERMO-SWITCH REMOVAL

- Drain engine coolant. (☞ 2-19)
- Disconnect the cooling fan thermo-switch lead wire coupler ①.
- Remove the cooling fan thermo-switch ②.



## INSPECTION

- Check the cooling fan thermo-switch closing/opening temperature by testing it at a bench as shown in the figure. Connect the thermo-switch ① to the circuit tester and place it in oil contained in a pan, which is placed on a stove.
- Heat the oil to raise its temperature slowly and read the column thermometer ② when the switch closes or opens.

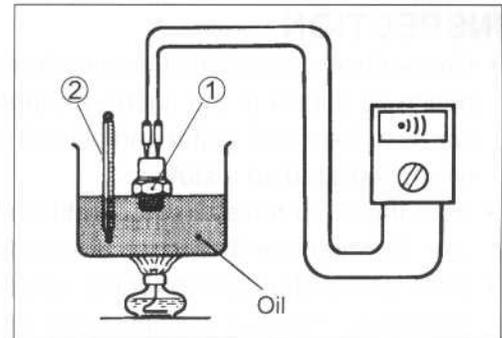
**DATA** Cooling fan thermo-switch operating temperature  
 Standard (OFF→ON): Approx. 105 °C (221 °F)  
 (ON→OFF): Approx. 100 °C (212 °F)

**TOOL** 09900-25008: Multi circuit tester set

**Tester knob indication: Continuity test (••••)**

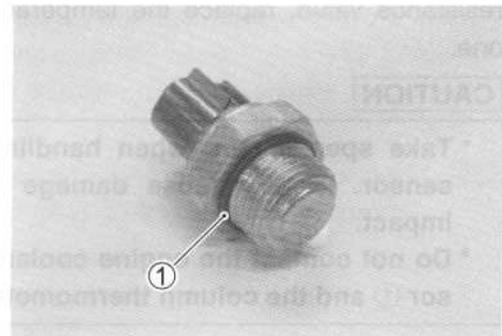
### CAUTION

- \* Take special care when handling the thermo-switch. It may cause damage if it gets a sharp impact.
- \* Do not contact the cooling fan thermo-switch ① and the column thermometer ② with a pan.



## INSTALLATION

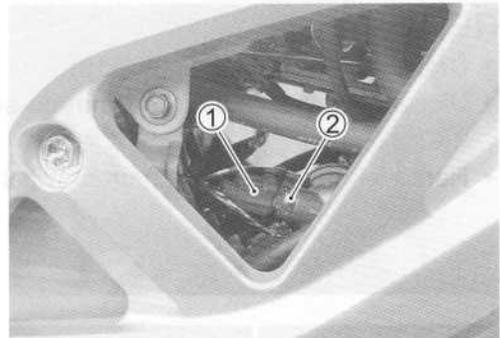
- Install a new O-ring ①.
  - Tighten the cooling fan thermo-switch to the specified torque.
- U** Cooling fan thermo-switch: 17 N·m (1.7 kgf·m, 12.5 lb·ft)
- Pour engine coolant. (☞ 2-19)
  - Bleed air from the cooling circuit. (☞ 2-20)



## ENGINE COOLANT TEMPERATURE SENSOR

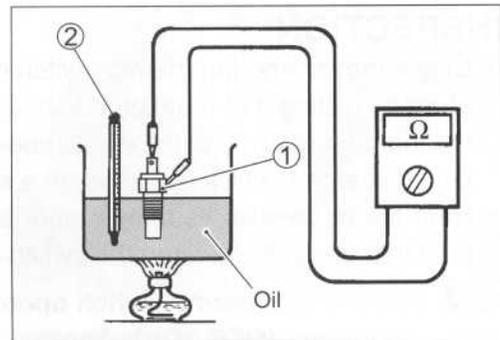
### REMOVAL

- Drain engine coolant. (☞ 2-19)
- Disconnect the engine coolant temperature sensor lead wire coupler ①.
- Place a rag under the sensor and remove the engine coolant temperature sensor ②.



### INSPECTION

- Check the engine coolant temperature sensor by testing it at a bench as shown in the figure. Connect the temperature sensor ① to the circuit tester and place it in oil contained in a pan, which is placed on a stove.
- Heat the oil to raise its temperature slowly and read the column thermometer ② and the ohmmeter.
- If the temperature sensor ohmic value does not change in the proportion indicated, replace it with a new one.



#### **DATA** Temperature sensor specification

| Temperature    | Standard resistance |
|----------------|---------------------|
| 20 °C (68 °F)  | Approx. 2.45 kΩ     |
| 40 °C (104 °F) | Approx. 1.15 kΩ     |
| 60 °C (140 °F) | Approx. 0.58 kΩ     |
| 80 °C (176 °F) | Approx. 0.32 kΩ     |

#### **TOOL** 09900-25008: Multi circuit tester set

#### **Tester knob indication: Resistance (Ω)**

If the resistance noted to show infinity or too much different resistance value, replace the temperature sensor with a new one.

#### **CAUTION**

- \* Take special care when handling the temperature sensor. It may cause damage if it gets a sharp impact.
- \* Do not contact the engine coolant temperature sensor ① and the column thermometer ② with a pan.

## INSTALLATION

- Install a new sealing washer ①.
- Tighten the engine coolant temperature sensor to the specified torque.

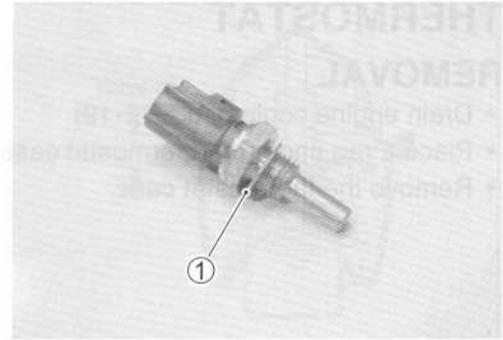
### Engine coolant temperature sensor:

18 N·m (1.8 kgf-m, 10.6 lb-ft)

### CAUTION

**Take special care when handling the temperature sensor. It may cause damage if it gets a sharp impact.**

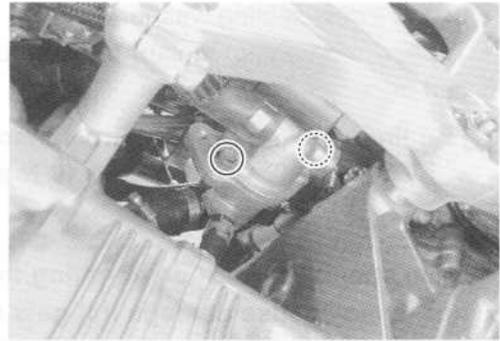
- Pour engine coolant. ( 2-19)
- Bleed air from the cooling circuit. ( 2-20)



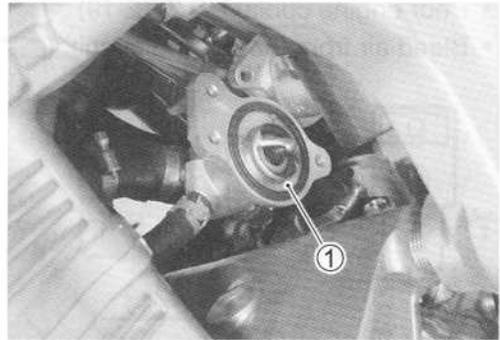
## THERMOSTAT

### REMOVAL

- Drain engine coolant. (☞ 2-19)
- Place a rag under the thermostat case.
- Remove the thermostat case.



- Remove the thermostat ①.

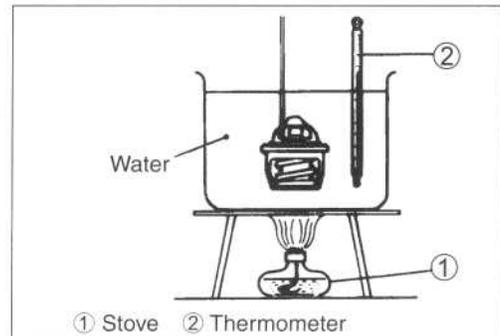
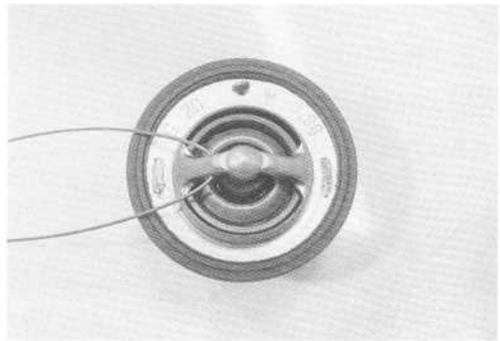


### INSPECTION

Inspect the thermostat pellet for signs of cracking.

Test the thermostat at a bench for control action in the following manner.

- Pass a string through the thermostat as shown in the photograph.
- Immerse the thermostat in water contained in a beaker as shown in the illustration. Note that the immersed thermostat is in suspension. Heat the water by placing the beaker on a stove and observe the rising temperature on a thermometer.
- Read the thermometer just when opening the thermostat. This reading, which is the temperature level at which the thermostat valve begins to open, should be within the standard value.



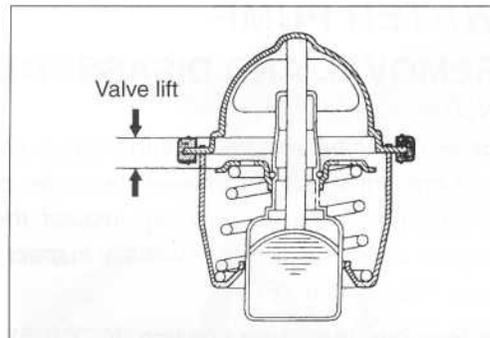
**DATA** Thermostat valve opening temperature  
Standard: Approx. 88 °C (190 °F)

- Keep on heating the water to raise its temperature.
- Just when the water temperature reaches specified value, the thermostat valve should have lifted by at least 8.0 mm (0.31 in).

**DATA** Thermostat valve lift

Standard: Over 8.0 mm at 100 °C (Over 0.31 in. at 212 °F)

- A thermostat failing to satisfy either of the two requirements (start-to-open temperature and valve lift) must be replaced.

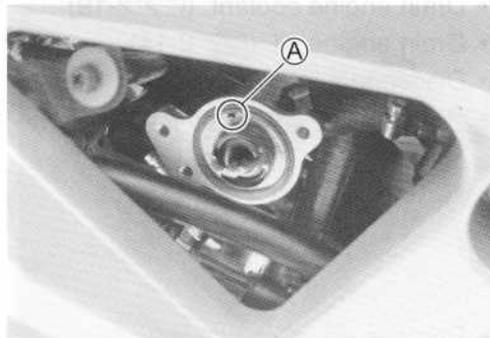


## INSTALLATION

- Install the thermostat.

**NOTE:**

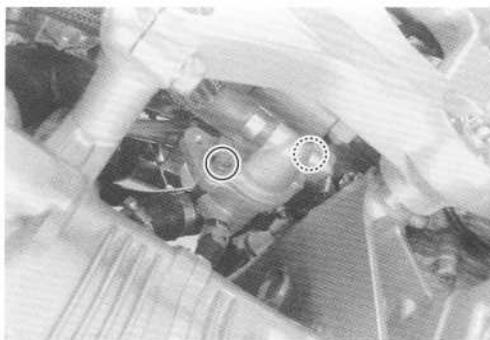
The jiggle valve **A** of the thermostat faces upside.



- Install the thermostat case.
- Tighten the thermostat case bolts to the specified torque.

**🔧** Thermostat case bolt: 10 N·m (1.0 kgf-m, 7.0 lb-ft)

- Pour engine coolant. (🔧 2-19)
- Bleed air from the cooling circuit. (🔧 2-20)



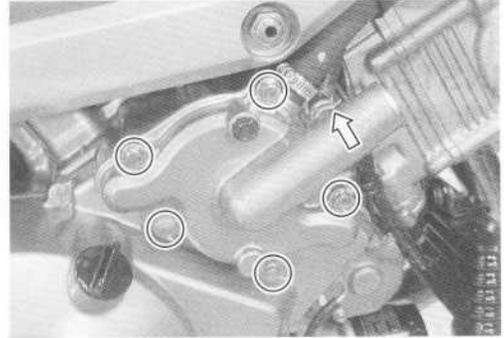
## WATER PUMP

### REMOVAL AND DISASSEMBLY

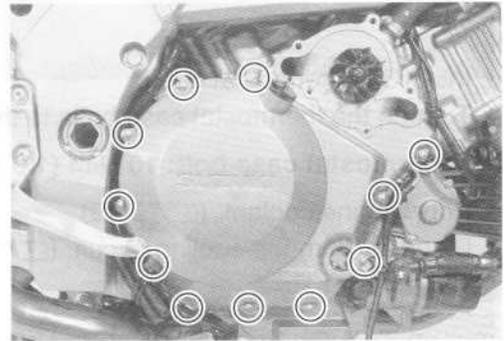
#### NOTE:

Before draining engine oil and engine coolant, inspect engine oil and coolant leakage between the water pump and clutch cover. If engine oil is leaking, visually inspect the oil seal and O-ring. If engine coolant is leaking, visually inspect the mechanical seal and seal ring. (☞ 5-15)

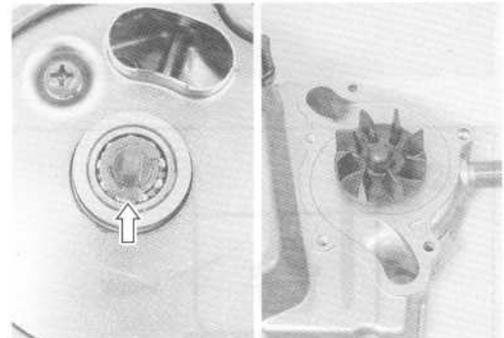
- Remove the under cowling. (☞ 6-5)
- Drain engine coolant. (☞ 2-19)
- Drain engine oil. (☞ 2-14)
- Disconnect the water hoses.
- Remove the water pump case.



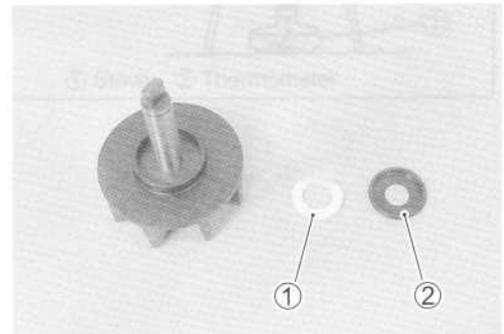
- Remove the clutch cover.



- Remove the E-ring from the impeller shaft.
- Remove the impeller.



- Remove the mechanical seal ring ① and the rubber seal ② from the impeller.



- Remove the bearings with the special tool and proper bars.

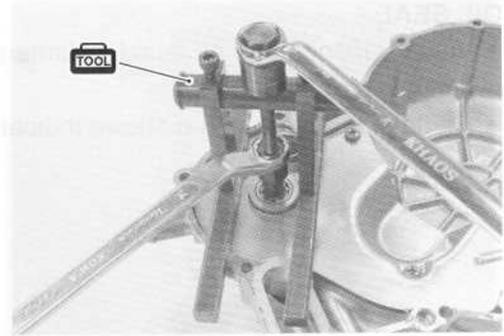
**TOOL 09921-20240: Bearing remover set**

**NOTE:**

*If there is no abnormal noise, bearing removal is not necessary.*

**CAUTION**

**The removed bearing must be replaced with a new one.**



- Remove the mechanical seal using the special tool.

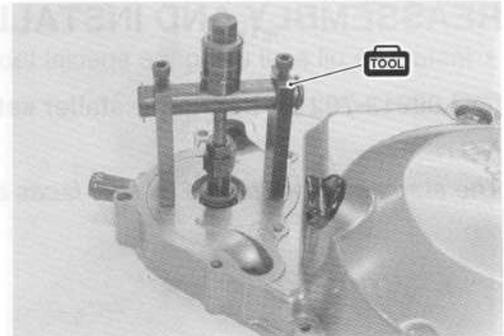
**TOOL 09921-20240: Bearing remover set**

**NOTE:**

*If there is no abnormal condition, the mechanical seal removal is not necessary.*

**CAUTION**

**The removed mechanical seal must be replaced with a new one.**



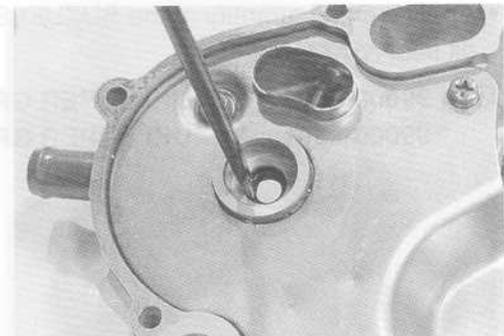
- Remove the oil seal using a suitable bar.

**NOTE:**

*If there is no abnormal condition, the oil seal removal is not necessary.*

**CAUTION**

**The removed oil seal must be replaced with a new one.**



## INSPECTION AND CLEANING

### BEARING

- Inspect the play of the bearings by hand while they are in the clutch cover.
- Rotate the inner race by hand to inspect for abnormal noise and smooth rotation.
- Replace the bearing if there is anything unusual.



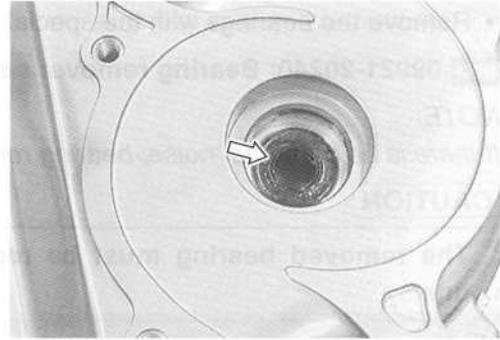
### MECHANICAL SEAL

- Visually inspect the mechanical seal for damage, with particular attention given to the sealing face.
- Replace the mechanical seal that shows indications of leakage. Also replace the seal ring if necessary.



### OIL SEAL

- Visually inspect the oil seal for damage, with particular attention given to the lip.
- Replace the oil seal that shows indications of leakage.



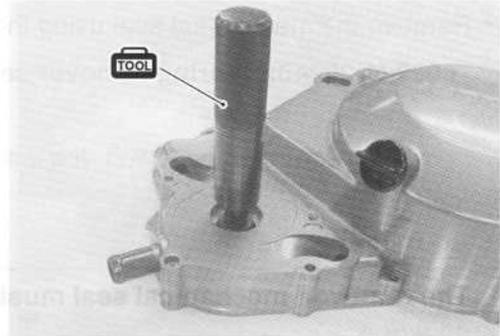
### REASSEMBLY AND INSTALLATION

- Install the oil seal using the special tool.

**TOOL** 09913-70210: Bearing installer set

**NOTE:**

*The stamped mark on the oil seal faces outside.*



- Apply a small quantity of the SUZUKI SUPER GREASE to the oil seal lip.

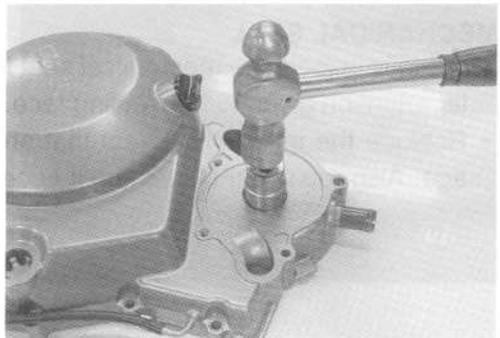
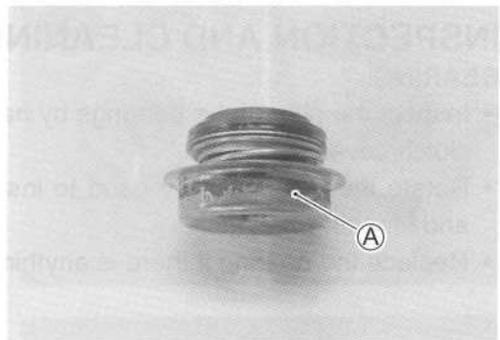
**AH** 99000-25030: SUZUKI SUPER GREASE "A" (USA)  
99000-25010: SUZUKI SUPER GREASE "A" (Others)



- Install the new mechanical seal using a suitable size socket wrench.

**NOTE:**

*On the new mechanical seal, the sealer (A) has been applied.*

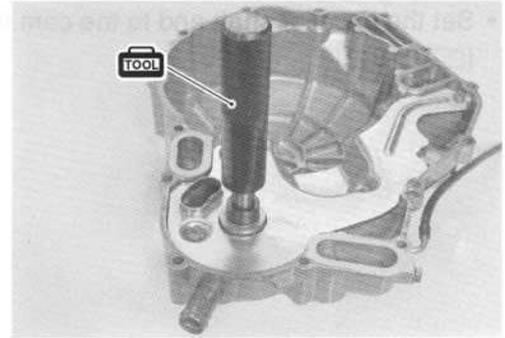


- Install the new bearing using the special tool.

**TOOL** 09913-70210: Bearing installer set

**NOTE:**

The stamped mark on the bearing faces crankcase side.



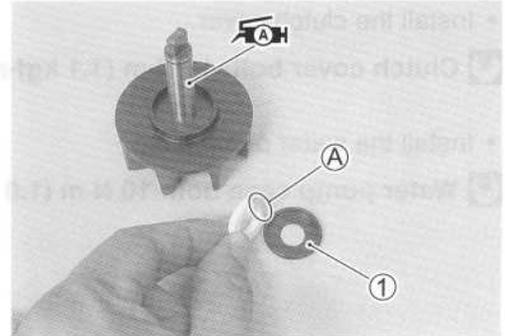
- Apply SUZUKI SUPER GREASE to the impeller shaft.

**AH** 99000-25030: SUZUKI SUPER GREASE "A" (USA)  
99000-25010: SUZUKI SUPER GREASE "A" (Others)

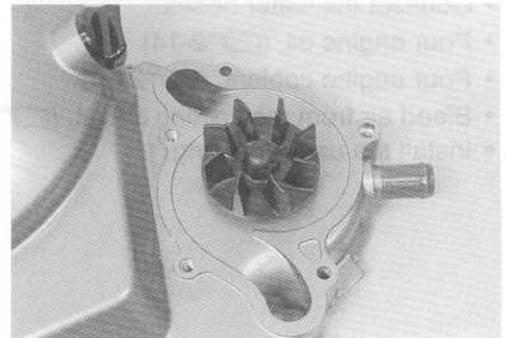
- Install the rubber seal ① into the impeller.
- After wiping off the oily or greasy matter from the mechanical seal ring, install it into the impeller.

**NOTE:**

The paint marked side **A** of the mechanical seal ring faces the impeller.



- Install the impeller to the clutch cover.



- Fix the impeller shaft with the E-ring securely.



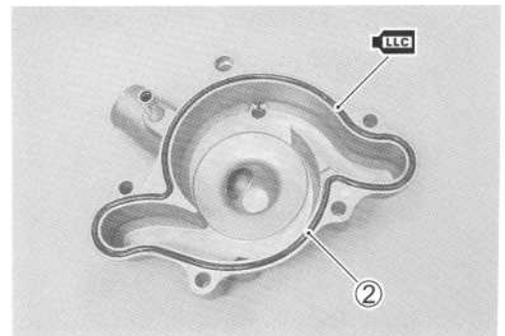
- Install a new O-ring ②.

**NOTE:**

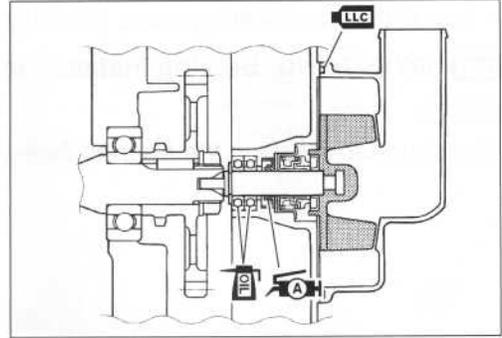
Apply engine coolant to the O-ring ②.

**CAUTION**

Use a new O-ring to prevent engine coolant leakage.



- Set the impeller shaft end to the cam drive idle shaft.  
( 3-91)

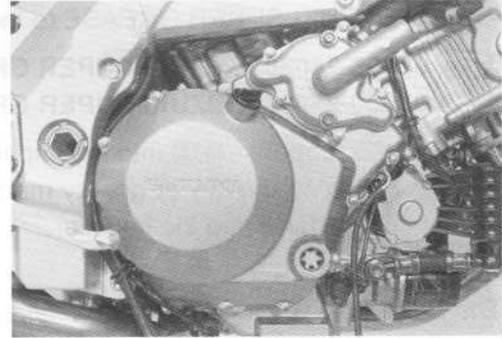


- Install the clutch cover.

 **Clutch cover bolt: 11 N·m (1.1 kgf-m, 8.0 lb-ft)**

- Install the water pump case.

 **Water pump case bolt: 10 N·m (1.0 kgf-m, 7.3 lb-ft)**



- Connect the water hoses.
- Pour engine oil. ( 2-14)
- Pour engine coolant. ( 2-19)
- Bleed air from the cooling circuit. ( 2-20)
- Install the under cowling.

## LUBRICATION SYSTEM

### OIL PRESSURE

☞ 2-32

### OIL FILTER

☞ 2-15

### OIL PRESSURE REGULATOR

☞ 3-67

### OIL STRAINER

☞ 3-28 and -85

### OIL JET

☞ 3-68, -69 and -95

### OIL PUMP

☞ 3-66 and -67

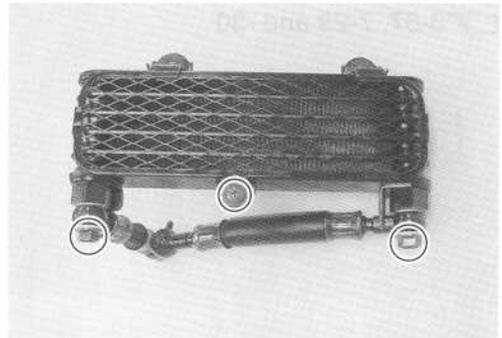
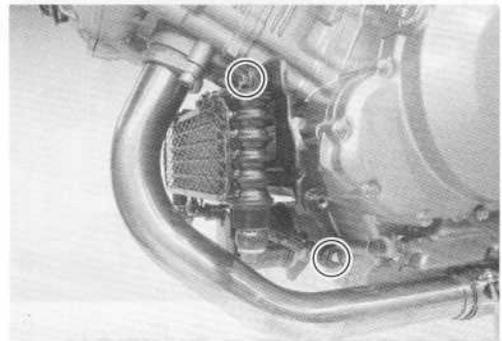
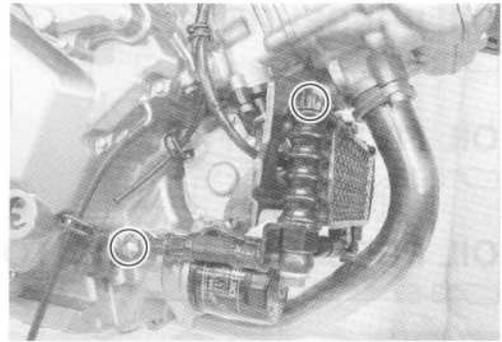
### OIL PRESSURE SWITCH

☞ 3-67, 7-29 and -30

## OIL COOLER

### REMOVAL

- Remove the under cowling. (☞ 6-5)
- Drain engine oil. (☞ 2-14)
- Disconnect the oil cooler hoses.
- Remove the oil cooler.



- Remove the oil cooler fin guard net.
- Remove the oil hoses.

## INSTALLATION

- Install new gasket washers ①.

### CAUTION

Use new gasket washers to prevent engine oil leakage.

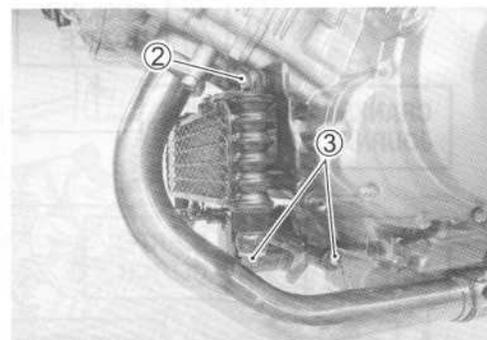
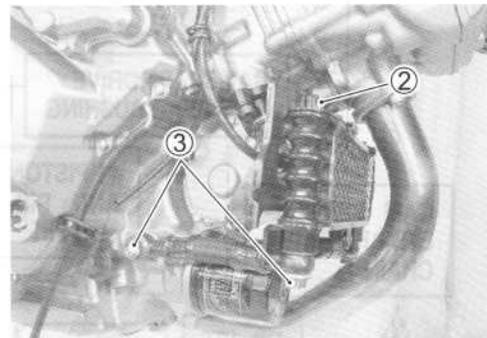
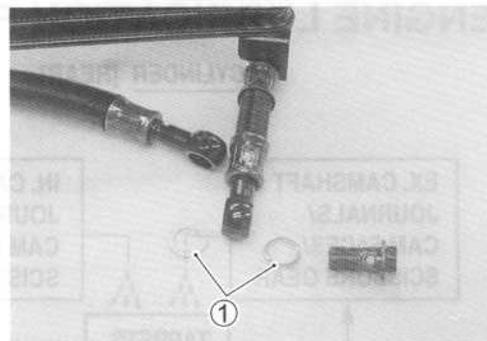
- Install the oil cooler.
- Tighten the oil cooler mounting bolts ② to the specified torque.

#### Oil cooler mounting bolt: 10 N·m (1.0 kgf-m, 7.3 lb-ft)

- Tighten the oil cooler hose union bolts ③ to the specified torque.

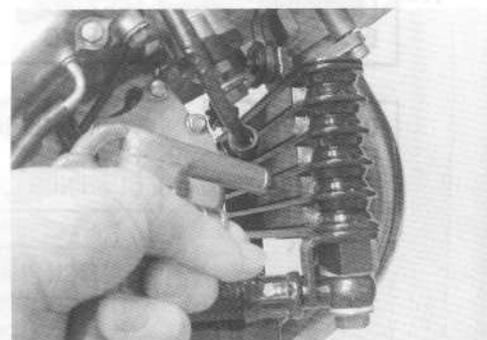
#### Oil cooler hose union bolt: 23 N·m (2.3 kgf-m, 16.5 lb-ft)

- Install the under cowling.

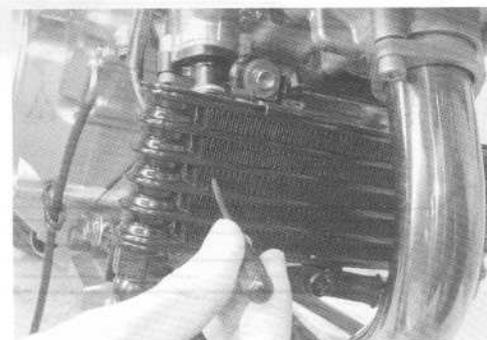


## INSPECTION AND CLEANING

- Inspect the oil cooler and hose joints for oil leakage. If any defect are found, replace the oil cooler and oil hoses with the new ones.
- Road dirt or trash stuck to the fins must be removed.
- Use of compressed air is recommended for this cleaning.



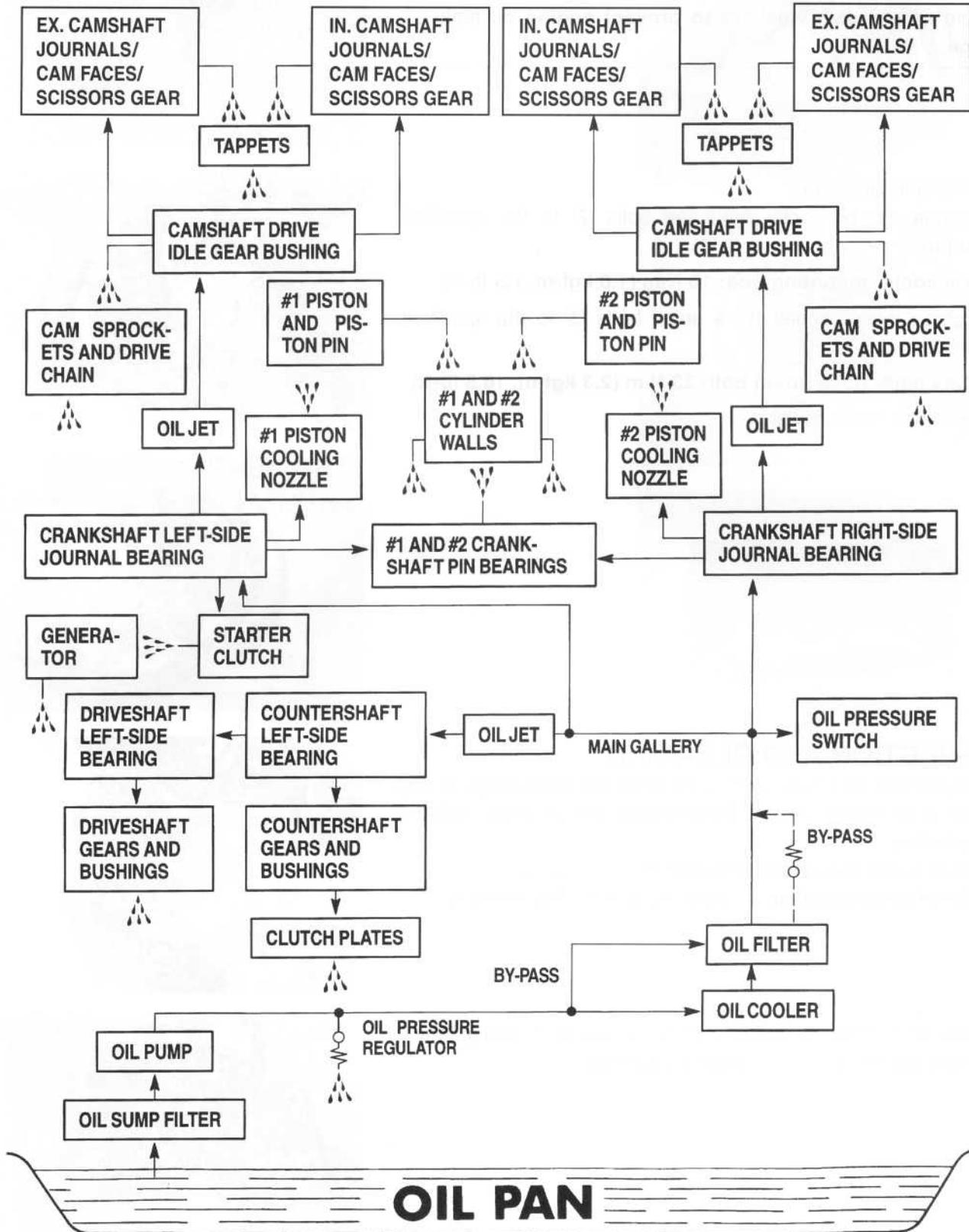
- Fins bent down or dented can be repaired by straightening them with the blade of a small screwdriver.



# ENGINE LUBRICATION FLOW CHART

#2 CYLINDER [REAR]

#2 CYLINDER [FRONT]



# ENGINE LUBRICATION CIRCUIT

