

# COOLING AND LUBRICATION SYSTEM

## CONTENTS

<b>ENGINE COOLANT.....</b>	<b>6- 2</b>
<b>COOLING CIRCUIT.....</b>	<b>6- 3</b>
<b>COOLING CIRCUIT INSPECTION .....</b>	<b>6- 3</b>
<b>RADIATOR .....</b>	<b>6- 4</b>
<b>REMOVAL.....</b>	<b>6- 4</b>
<b>INSPECTION AND CLEANING .....</b>	<b>6- 6</b>
<b>INSTALLATION .....</b>	<b>6- 6</b>
<b>RADIATOR CAP.....</b>	<b>6- 7</b>
<b>INSPECTION.....</b>	<b>6- 7</b>
<b>WATER HOSE.....</b>	<b>6- 7</b>
<b>INSPECTION.....</b>	<b>6- 7</b>
<b>COOLING FAN .....</b>	<b>6- 8</b>
<b>INSPECTION.....</b>	<b>6- 8</b>
<b>REMOVAL.....</b>	<b>6- 8</b>
<b>INSTALLATION .....</b>	<b>6- 8</b>
<b>COOLING FAN THERMO-SWITCH .....</b>	<b>6- 9</b>
<b>REMOVAL.....</b>	<b>6- 9</b>
<b>INSPECTION.....</b>	<b>6- 9</b>
<b>INSTALLATION .....</b>	<b>6- 9</b>
<b>ECT SENSOR.....</b>	<b>6-10</b>
<b>REMOVAL.....</b>	<b>6-10</b>
<b>INSPECTION.....</b>	<b>6-10</b>
<b>INSTALLATION .....</b>	<b>6-11</b>
<b>THERMOSTAT CASE ASSEMBLY .....</b>	<b>6-12</b>
<b>REMOVAL.....</b>	<b>6-12</b>
<b>INSPECTION.....</b>	<b>6-12</b>
<b>INSTALLATION .....</b>	<b>6-13</b>
<b>WATER PUMP.....</b>	<b>6-14</b>
<b>REMOVAL AND DISASSEMBLY.....</b>	<b>6-14</b>
<b>INSPECTION.....</b>	<b>6-16</b>
<b>REASSEMBLY AND INSTALLATION .....</b>	<b>6-17</b>
<b>LUBRICATION SYSTEM.....</b>	<b>6-20</b>
<b>OIL PRESSURE .....</b>	<b>6-20</b>
<b>OIL FILTER .....</b>	<b>6-20</b>
<b>OIL PRESSURE REGULATOR .....</b>	<b>6-20</b>
<b>OIL STRAINER .....</b>	<b>6-20</b>
<b>OIL JET .....</b>	<b>6-20</b>

<i>OIL PUMP.....</i>	<i>6-20</i>
<i>OIL PRESSURE SWITCH .....</i>	<i>6-20</i>
<i>OIL COOLER .....</i>	<i>6-21</i>
<i>REMOVAL .....</i>	<i>6-21</i>
<i>INSPECTION AND CLEANING .....</i>	<i>6-21</i>
<i>INSTALLATION.....</i>	<i>6-22</i>
<i>ENGINE LUBRICATION FLOW CHART.....</i>	<i>6-23</i>
<i>ENGINE LUBRICATION CIRCUIT .....</i>	<i>6-24</i>

## 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  $-31^{\circ}\text{C}$  ( $-24^{\circ}\text{F}$ ).

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

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

### 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 60 % and more anti-freeze or 50 % and less. (Refer to below figure.)
- \* Do not use a radiator anti-leak additive.

50 % Engine coolant including reserve tank capacity

Anti-freeze	950 ml (2.01/1.67 US/Imp.pt)
Water	950 ml (2.01/1.67 US/Imp.pt)

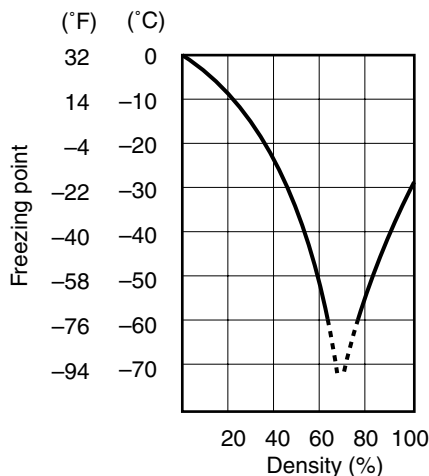


Fig.1 Engine coolant density-freezing point curve.

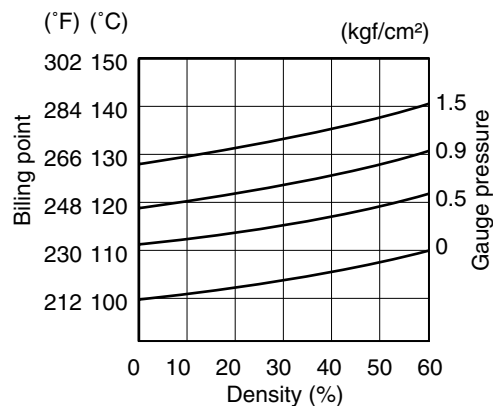
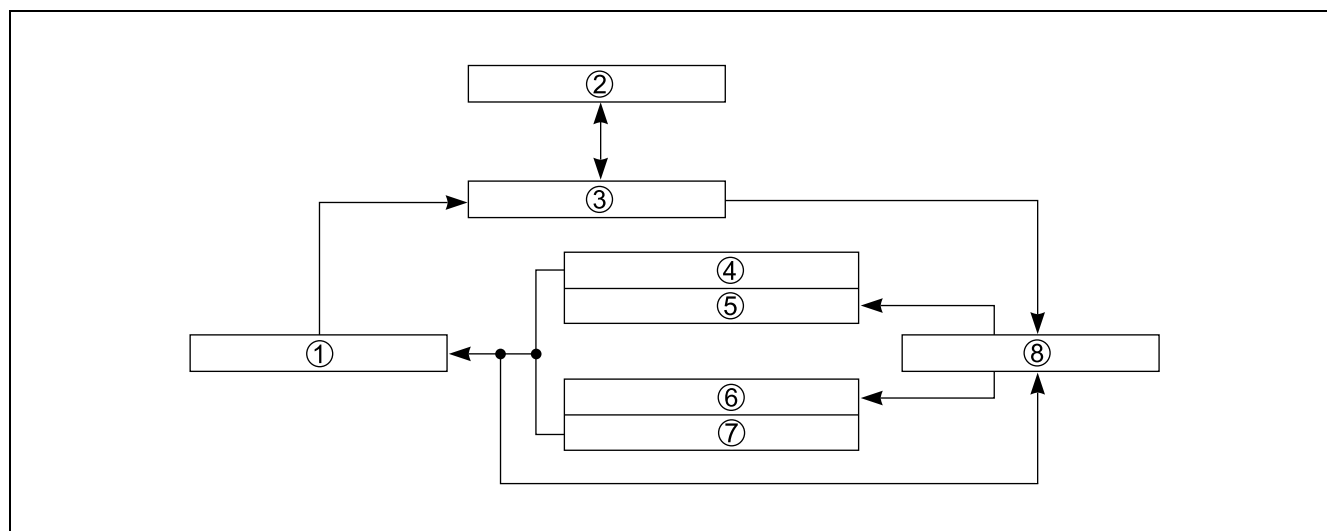


Fig.2 Engine coolant density-boiling point curve.

### ⚠ 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



- ① Thermostat    ② Reserve tank    ③ Radiator    ④ No.1 cylinder head    ⑤ No.1 cylinder  
⑥ No.2 cylinder    ⑦ No.2 cylinder head    ⑧ Water pump

## COOLING CIRCUIT INSPECTION

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

- Remove the cowling. (7-5)
- Remove the radiator cap ① and connect the radiator tester ② to the filler.

### ⚠ WARNING

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

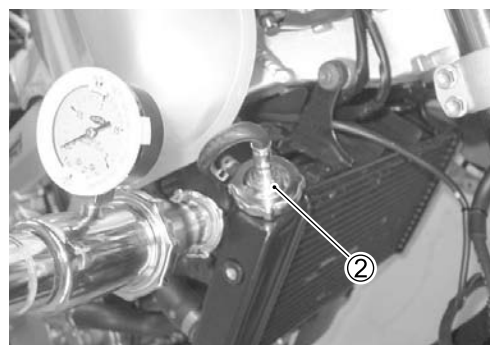
- Give a pressure of about 120 kPa (1.2 kgf/cm<sup>2</sup>, 17.0 psi) and see if the system holds this pressure for 10 seconds.
- If the pressure should fall during this 10-second interval, it means that there is a leaking point in the system. In such a case, inspect the entire system and replace the leaking component or part.

### ⚠ WARNING

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

### CAUTION

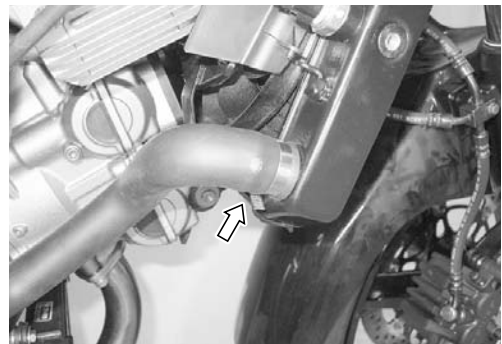
**Do not allow the pressure to exceed specified pressure, or the radiator can be damaged.**



## RADIATOR

### REMOVAL

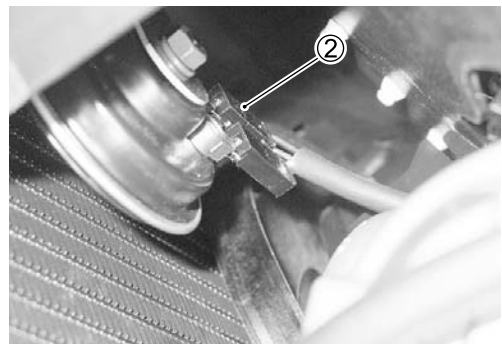
- Remove the cowling. (☞ 7-5)
- Drain the engine coolant. (☞ 2-18)
- Disconnect the right and left radiator hoses from the radiator.



- Disconnect the siphon hose ① from the radiator.



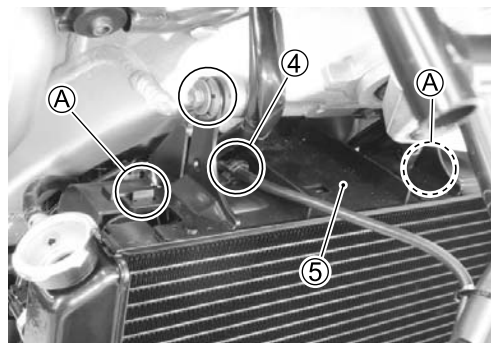
- Disconnect the horn lead wire coupler ②.



- Remove the radiator lower mounting bolt.
- Disconnect the cooling fan motor and thermo-switch lead wire coupler ③.



- Remove the radiator upper mounting bolt.
- Disconnect the speed sensor lead wire from the clamp ④.
- With the hooks A unlocked, remove the radiator from the radiator shroud ⑤.



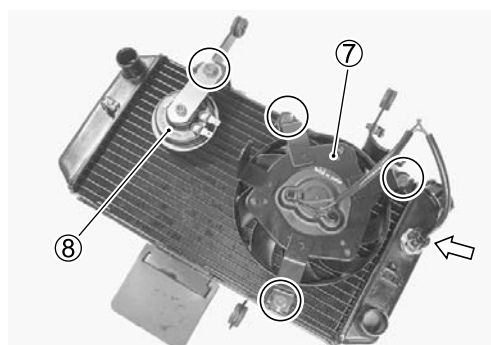
- Remove the cooling fan and thermo-switch lead wire coupler ⑥ from the radiator shroud.



- Remove the cooling fan ⑦.
- Disconnect the cooling fan thermo-switch lead wire coupler and remove the cooling fan thermo-switch.
- Remove the horn ⑧.

#### CAUTION

**When removing the horn ⑧, hold the nut by spanner to prevent the horn bracket distortion.**

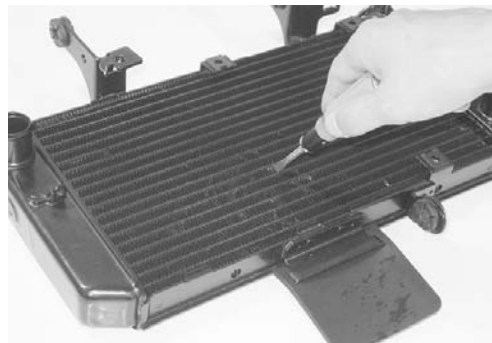


## INSPECTION AND CLEANING

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.



## INSTALLATION

- Install the radiator in the reverse order of removal.

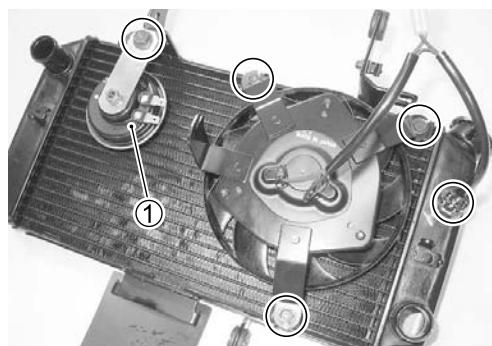
Pay attention to the following points :

- Install the cooling fan and horn ①.

### Cooling fan/horn mounting bolt:

**8 N·m (0.8 kgf-m, 6.0 lb-ft)**

- Install the cooling fan thermo-switch. (☞ 6-8)
- Route the radiator hoses properly. (☞ 9-24)
- Install the drain plug with a new sealing washer and pour engine coolant. (☞ 2-18)
- Bleed air from the cooling circuit. (☞ 2-19)
- Install the cowl. (☞ 7-8)



## RADIATOR CAP

### INSPECTION

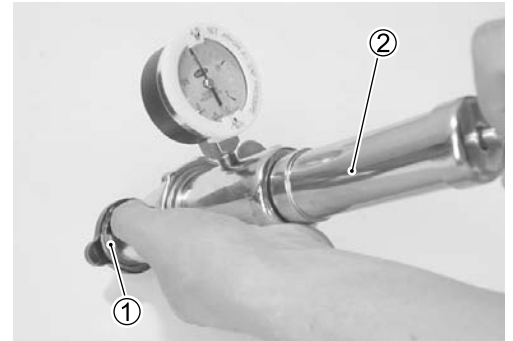
- Remove the radiator cap. (☞ 6-3)
- Fit the cap ① to the radiator cap tester ②.
- Build up pressure slowly by operating the tester. Make sure that the pressure build-up stops at 95 – 125 kPa (0.95 – 1.25 kgf/cm<sup>2</sup>, 13.5 – 17.8 psi) and that, with the tester held stand-still, the cap is capable of holding that pressure for at least 10 seconds.
- Replace the cap if it is found not to satisfy above 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)



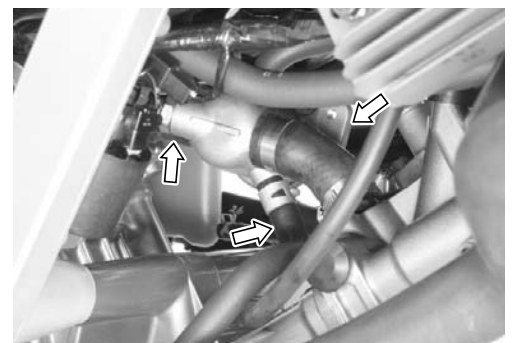
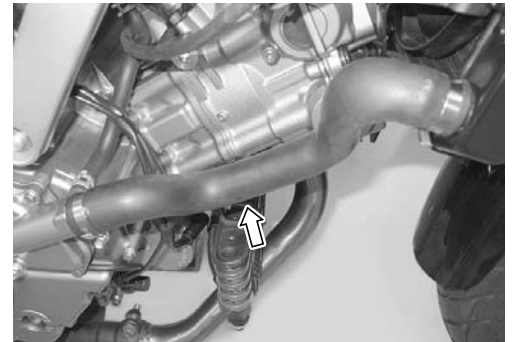
## WATER HOSE

### INSPECTION

- Remove the cowling. (☞ 7-5)

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.



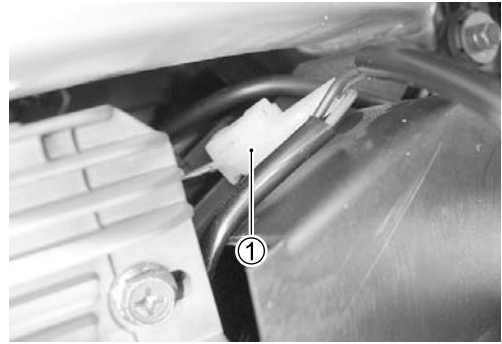


## COOLING FAN

### INSPECTION

- Remove the cowling. (☞ 7-5)
- Disconnect the cooling fan motor and thermo-switch lead wire coupler ①.

Test the cooling fan motor for load current with an ammeter connected as shown in the illustration.

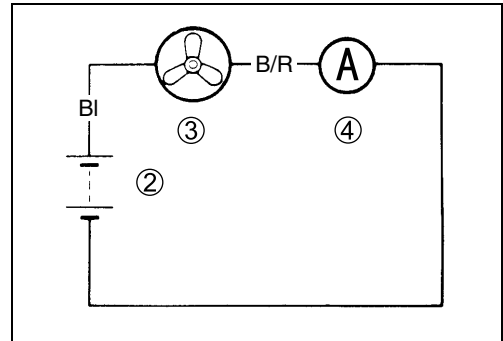


The voltmeter is for making sure that the battery ② applies 12 volts to the fan motor ③. With the fan motor with electric motor fan running at full speed, the ammeter ④ should be indicating not 5 amperes and more.

If the fan motor does not turn, replace the fan motor assembly with a new one.

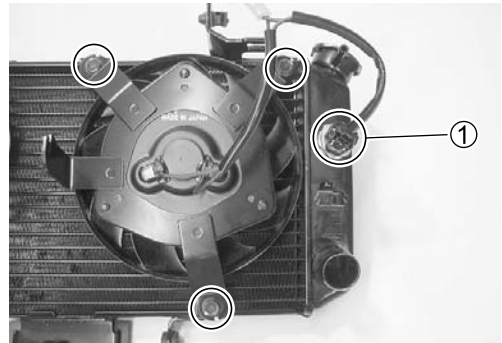
#### NOTE:

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



### REMOVAL

- Remove the cowling. (☞ 7-5)
- Drain the engine coolant. (☞ 2-18)
- Remove the radiator. (☞ 6-4)
- Disconnect the cooling fan thermo-switch coupler ①.
- Remove the cooling fan.



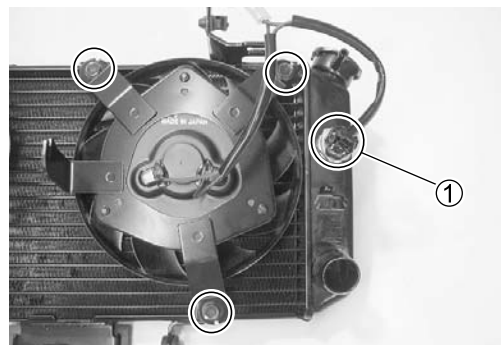
### INSTALLATION

- Install the cooling fan to the radiator.

#### Cooling fan motor mounting bolt:

**8 N·m (0.8 kgf-m, 6.0 lb-ft)**

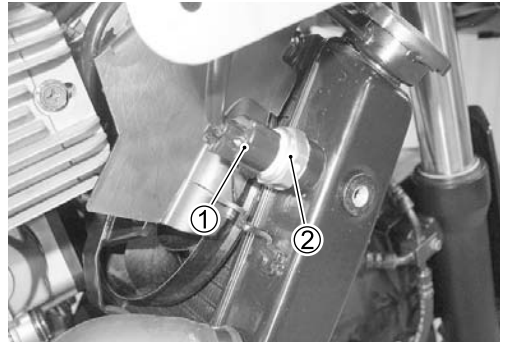
- Connect the cooling fan thermo-switch coupler ①.
- Install the radiator.
- Route the radiator hoses properly. (☞ 9-24)
- Pour engine coolant. (☞ 2-18)
- Bleed the air from the cooling circuit. (☞ 2-19)
- Install the cowling. (☞ 7-8)



## COOLING FAN THERMO-SWITCH

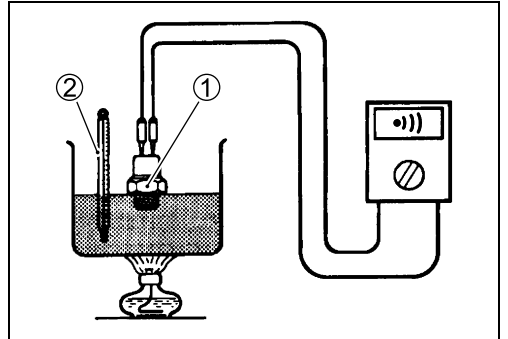
### REMOVAL

- Remove the cowling. (☞7-5)
- Drain the engine coolant. (☞2-18)
- Disconnect the cooling fan thermo-switch lead wire coupler ①.
- Remove the cooling fan thermo-switch ②.



### INSPECTION

- Check the thermo-switch closing or opening temperatures by testing it at the bench as shown in the figure. Connect the thermo-switch ① to a circuit tester and place it in the 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.



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

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

**DATA** Cooling fan thermo-switch operating temperature  
 Standard (OFF→ON): Approx. 98 °C (208 °F)  
 (ON→OFF): Approx. 92 °C (198 °F)

### CAUTION

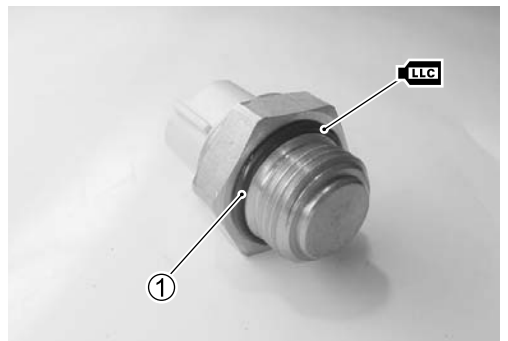
- \* Take special care when handling the thermo-switch. It may cause damage if it gets a sharp impact.
- \* Do not contact the cooling fan thermo-switch ① and the column thermometer ② with a pan.

### INSTALLATION

- Install a new O-ring ① and apply engine coolant to the O-ring.
- 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)

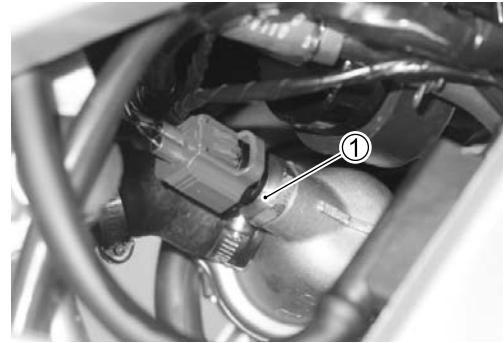
- Pour engine coolant. (☞2-18)
- Bleed air from the cooling circuit. (☞2-19)
- Install the cowling. (☞7-8)



## ECT SENSOR

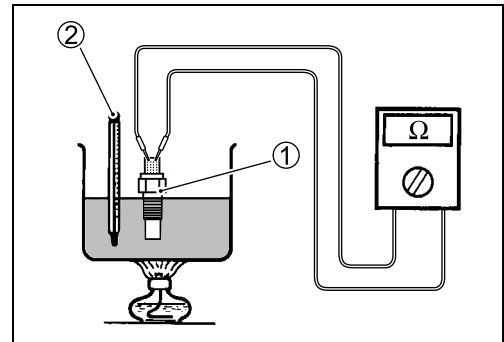
### REMOVAL

- Drain the engine coolant. (☞ 2-18)
- Disconnect the ECT sensor lead wire coupler.
- Place a rag under the ECT sensor and remove the ECT sensor ①.



### INSPECTION

- Check the ECT sensor by testing it at the bench as shown in the figure. Connect the ECT sensor ① to a circuit tester and place it in the WATER contained in a pan, which is placed on a stove.
- Heat the water to raise its temperature slowly and read the column thermometer ② and the ohmmeter.
- If the ECT 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. 1.148 kΩ
60 °C (140 °F)	Approx. 0.587 kΩ
80 °C (176 °F)	Approx. 0.322 kΩ

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

#### **CAUTION**

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



## INSTALLATION

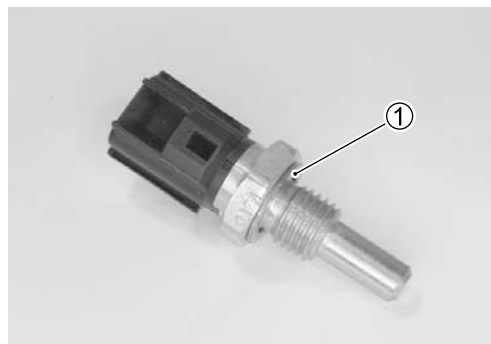
- Install a new sealing washer ①.
- Tighten the ECT sensor to the specified torque.

 **ECT sensor: 19 N·m (1.9 kgf-m, 13.5 lb-ft)**

### CAUTION

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

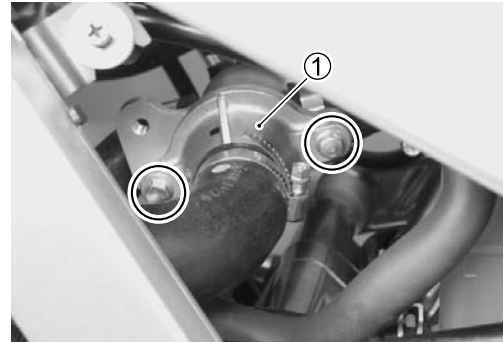
- Pour engine coolant. ( 2-18)
- Bleed air from the cooling circuit. ( 2-19)



## THERMOSTAT CASE ASSEMBLY

### REMOVAL

- Drain the engine coolant. (☞ 2-18)
- Place a rag under the thermostat case.
- Remove the thermostat case cap ①.



- Remove the thermostat ②.

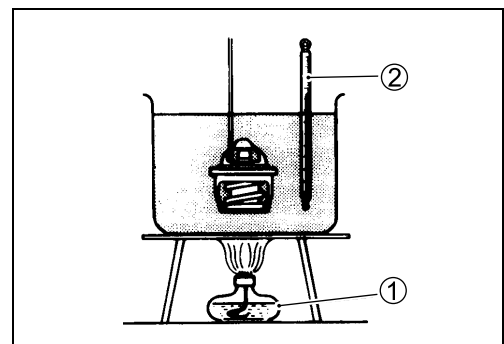
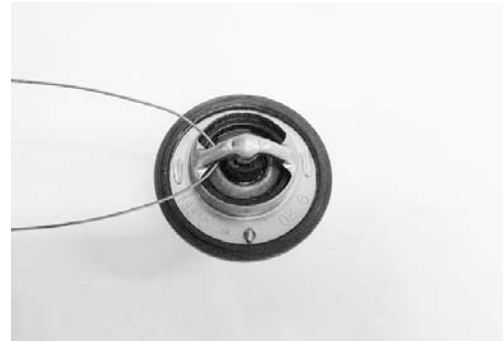


### INSPECTION

Inspect the thermostat pellet for signs of cracking.

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

- Pass a string between flange, as shown in the photograph.
- Immerse the thermostat in the 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 ① and observe the rising temperature on a thermometer ②.
- 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.



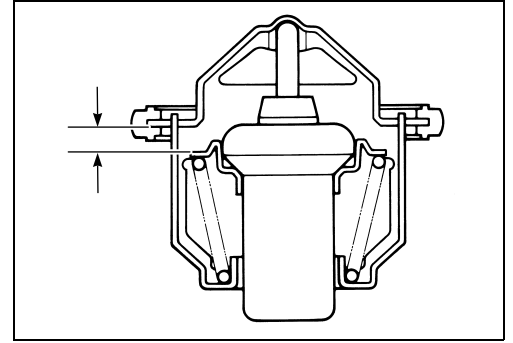
**DATA** Thermostat valve opening temperature  
Standard: Approx. 88 °C (190 °F)

- 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.

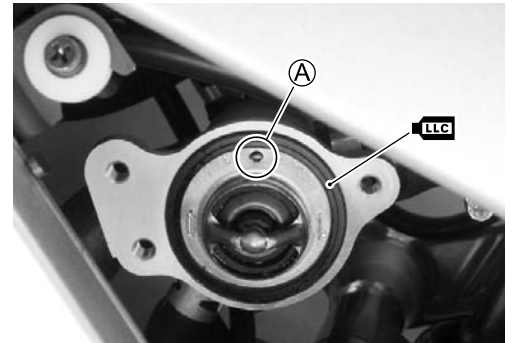


## INSTALLATION

- Apply engine coolant to the rubber seal on the thermostat.
- Install the thermostat.

#### **NOTE:**

*The jiggle valve ① of the thermostat faces upside.*



- Install the thermostat case cap ①.

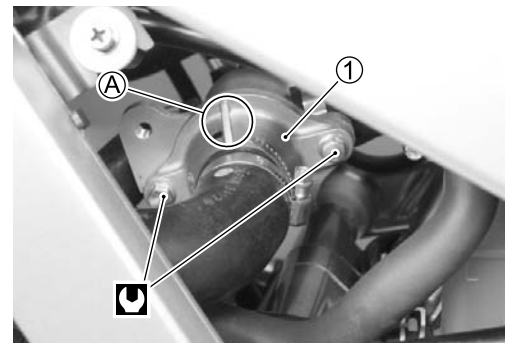
#### **NOTE:**

*The rib ① of the thermostat case cap should be faced upward.*

- 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. (🔧 2-18)
- Bleed air from the cooling circuit. (🔧 2-19)



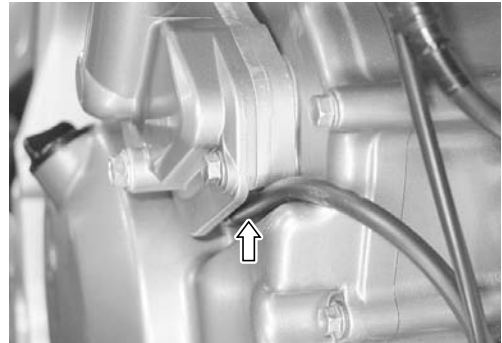
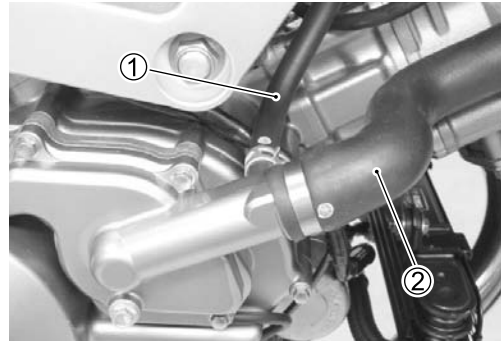
## WATER PUMP

### REMOVAL AND DISASSEMBLY

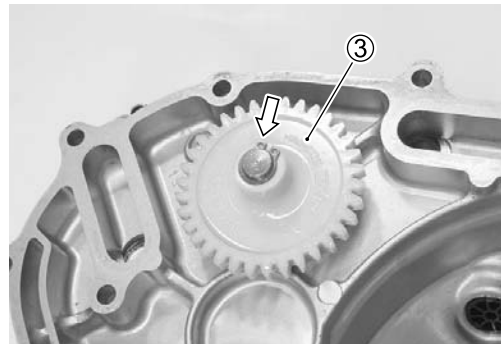
- Drain the engine coolant. (🔧 2-18)
- Drain the engine oil. (🔧 2-13)
- Disconnect the water hoses ①, ②.
- Remove the water pump case and clutch cover. (🔧 3-27)

#### NOTE:

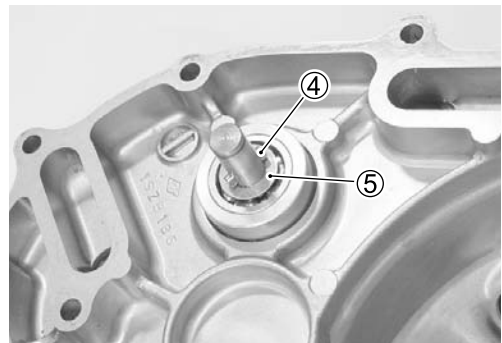
*Before draining engine oil and engine coolant, inspect engine oil and coolant leakage between the water pump and clutch cover. If engine oil is leaking, visually inspect the oil seal and O-ring. If engine coolant is leaking, visually inspect the mechanical seal and seal ring. (🔧 6-16)*



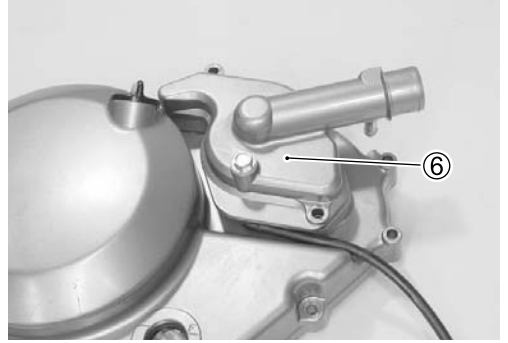
- Remove the snap ring and water pump driven gear ③.



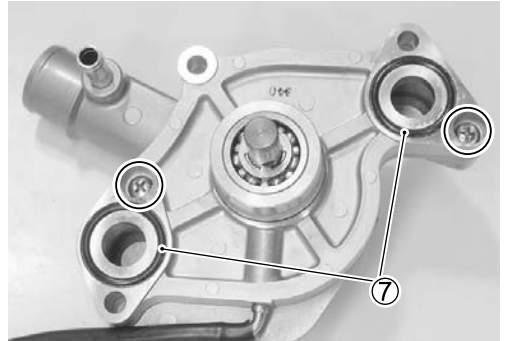
- Remove the pin ④ and washer ⑤.



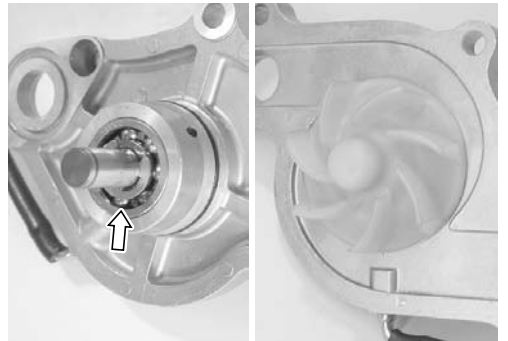
- Remove the water pump ⑥ from the clutch cover.



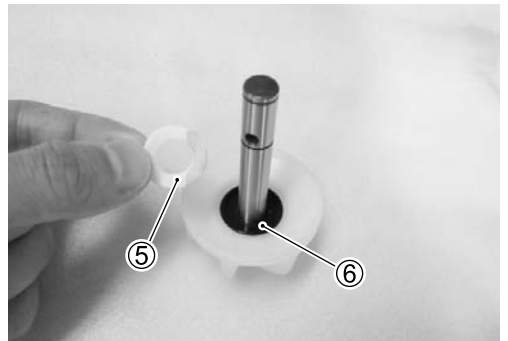
- Remove the screws and separate the water pump.
- Remove the O-rings ⑦.



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



- Remove the mechanical seal ring ⑤ and rubber seal ⑥ from the impeller.





- Remove the bearings with the special tool.

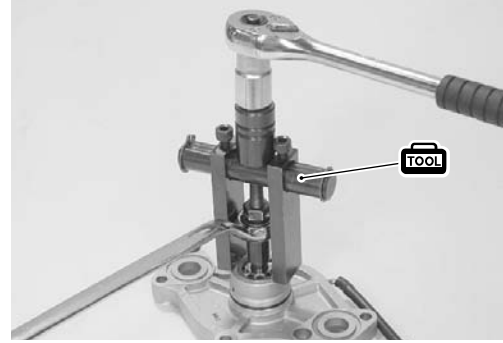
 **09921-20240: Bearing remover set (10 mm)**

**NOTE:**

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

**CAUTION**

**The removed bearings must be replaced with the new ones.**



- Remove the mechanical seal and oil seal with the special tool.

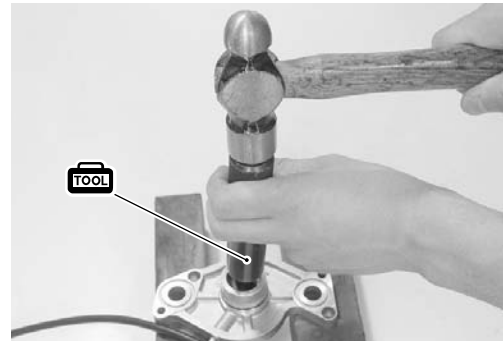
 **09913-70210: Bearing installer set ( $\phi$  20 mm)**

**NOTE:**

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

**CAUTION**

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



## INSPECTION

### BEARING

Inspect the play of the bearing by hand while it is in the water pump case.

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 oil leakage.

**BEARING CASE**

Visually inspect the bearing case for damage.

Replace the water pump body if necessary.

**REASSEMBLY AND INSTALLATION**

- Install the oil seal with the special tool.

 **09913-70210: Bearing installer set ( $\phi$  22 mm)**

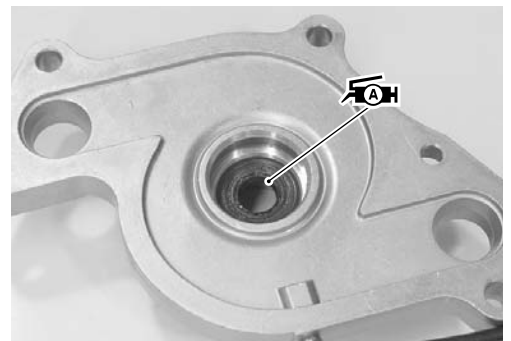
**NOTE:**

*The stamped mark on the oil seal faces impeller side.*



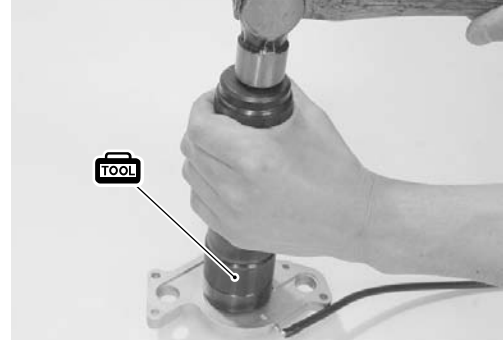
- Apply a small quantity of the SUZUKI SUPER GREASE to the oil seal lip.

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



- Install the new mechanical seal with the special tool.

 **09913-70210: Bearing installer set ( $\phi$  25 mm)**

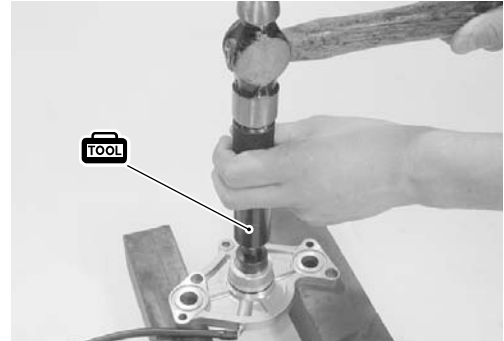


- Install the new bearings with the special tool.

 **09913-70210: Bearing installer set ( $\phi$  25 mm)**

**NOTE:**

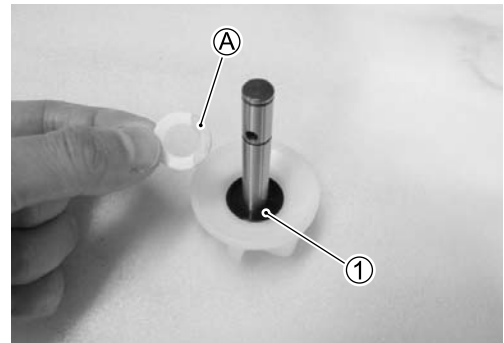
*The stamped mark on the bearing faces to the crankcase side.*



- 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:**

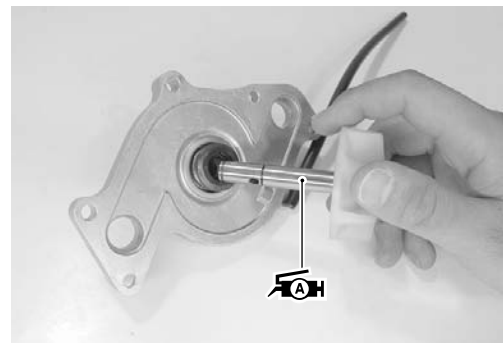
*The paint marked side ① of the mechanical seal ring faces to the impeller.*



- Apply SUZUKI SUPER GREASE to the impeller shaft.

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

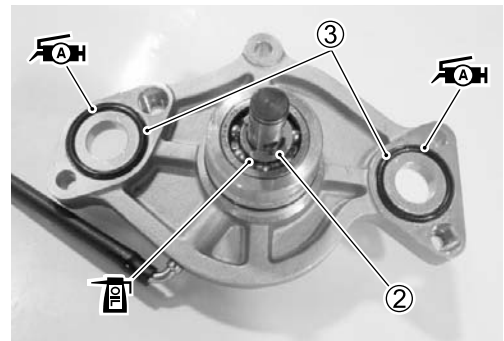
- Install the impeller to the water pump body.



- Fix the impeller shaft with the E-ring ②.
- Apply SUZUKI SUPER GREASE to the O-rings.

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

- Install new O-rings ③.
- Fill the bearing with engine oil until engine oil comes out from the hole of the bearing housing.

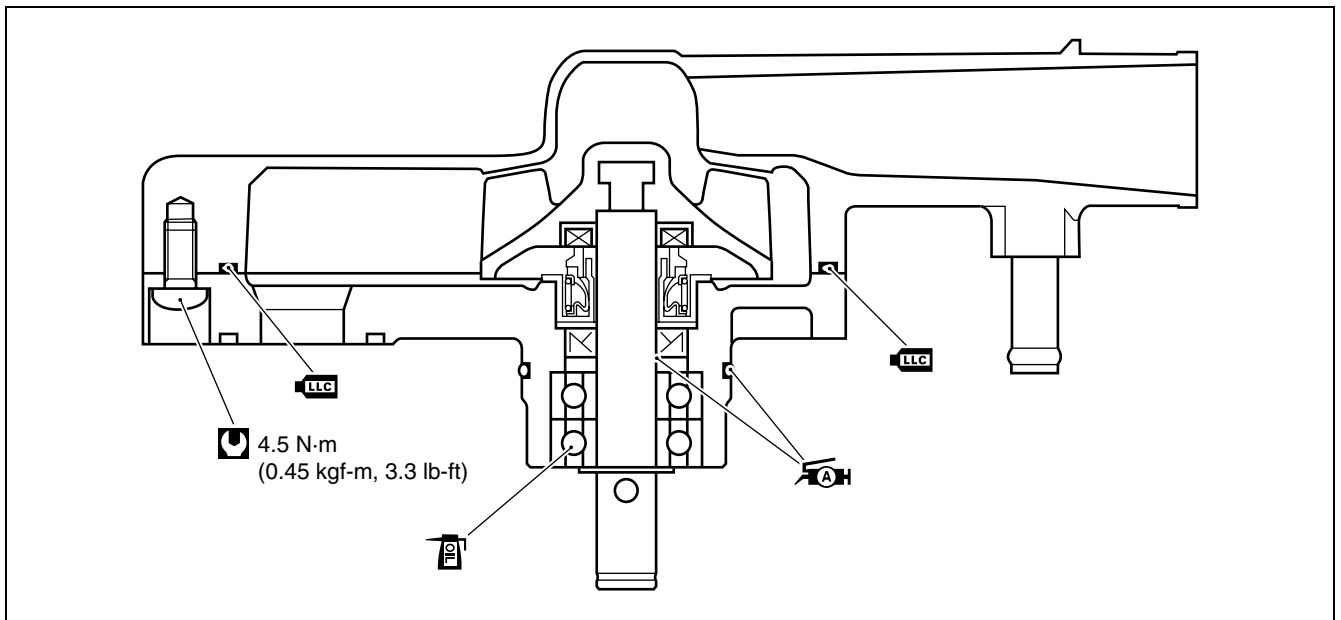
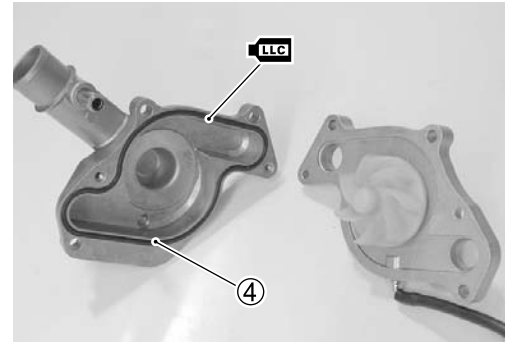


- Apply engine coolant to the O-ring ④.
- Install a new O-ring.

**CAUTION**


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

- Connect the water hoses.
- Pour engine coolant. (☞ 2-18)
- Pour engine oil. (☞ 2-14)




## **LUBRICATION SYSTEM**


### **OIL PRESSURE**

 2-31


### **OIL FILTER**

 2-14


### **OIL PRESSURE REGULATOR**

 3-57


### **OIL STRAINER**

 3-58


### **OIL JET**

 3-49, -59, -60 and -96

### **OIL PUMP**

 3-81 and -89

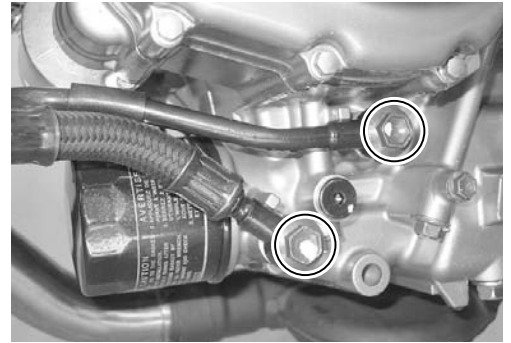
### **OIL PRESSURE SWITCH**

 3-58 and 8-34

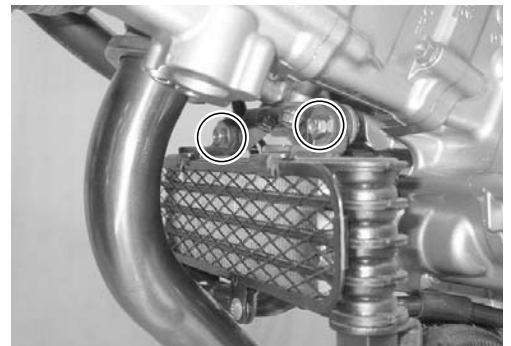
## OIL COOLER

### REMOVAL

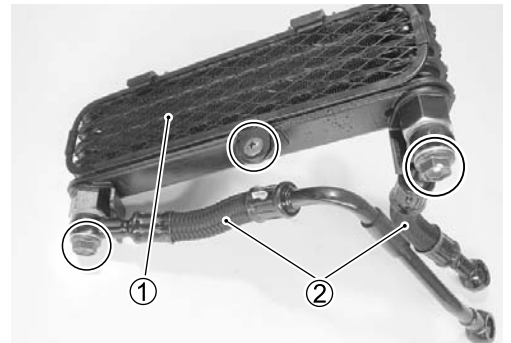
- Drain the engine oil. (☞ 2-13)
- Disconnect the oil cooler hoses.



- Remove the oil cooler.



- Remove the oil cooler fin guard net ①.
- Remove the oil hoses ②.



### 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.

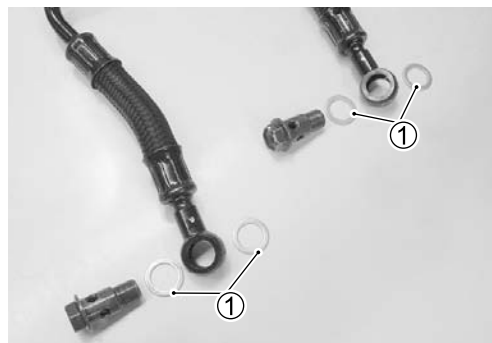


## INSTALLATION

- Install the new gasket washers ①.

### CAUTION

**Use the new gasket washers to prevent engine oil leakage.**



- Connect the oil hoses.
- Install the oil cooler.

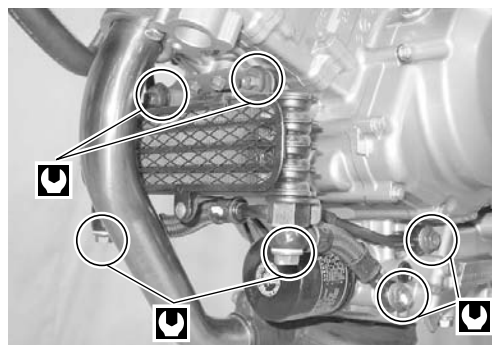
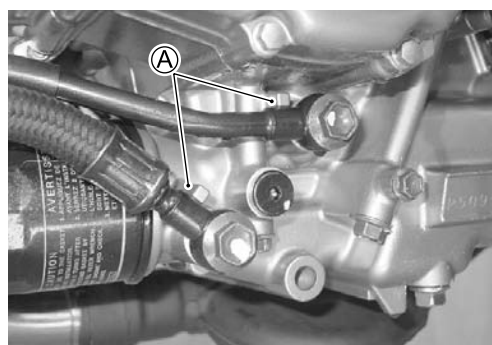
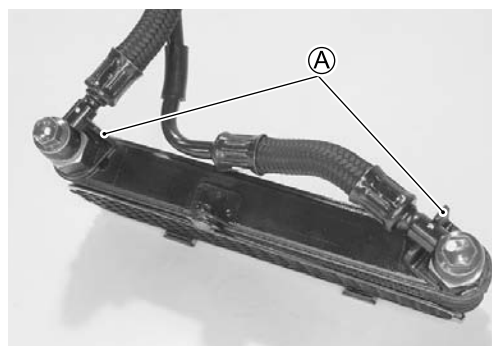
 **Oil cooler mounting bolt: 10 N·m (1.0 kgf-m, 7.0 lb-ft)**

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

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

### CAUTION

**The oil cooler hoses should be contacted with the stoppers A.**

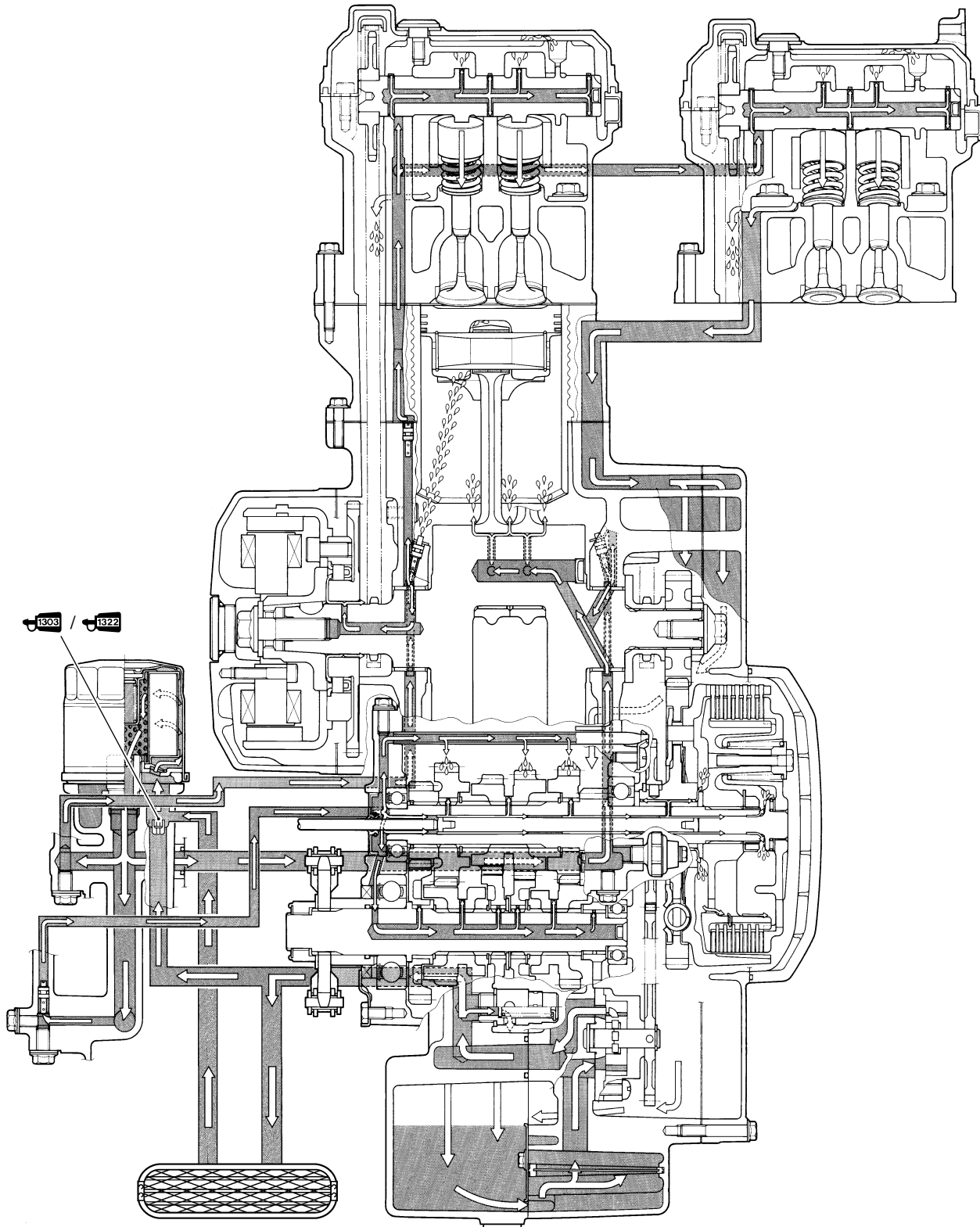






## ENGINE LUBRICATION CIRCUIT

### FRONT CYLINDER



## REAR CYLINDER

