

SECTION LC

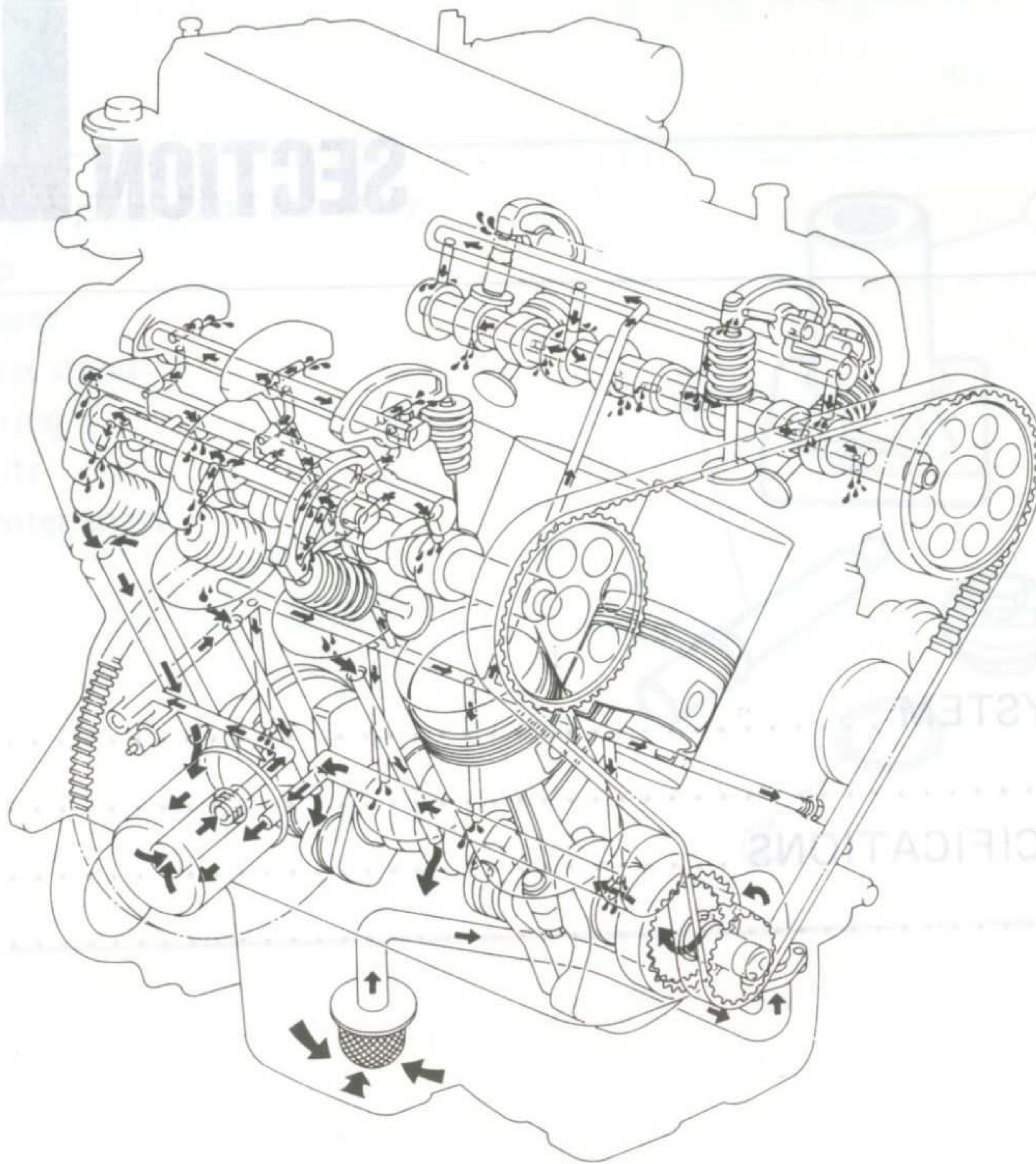
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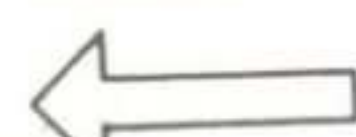
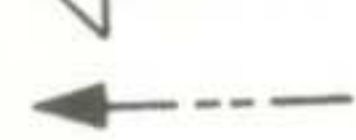
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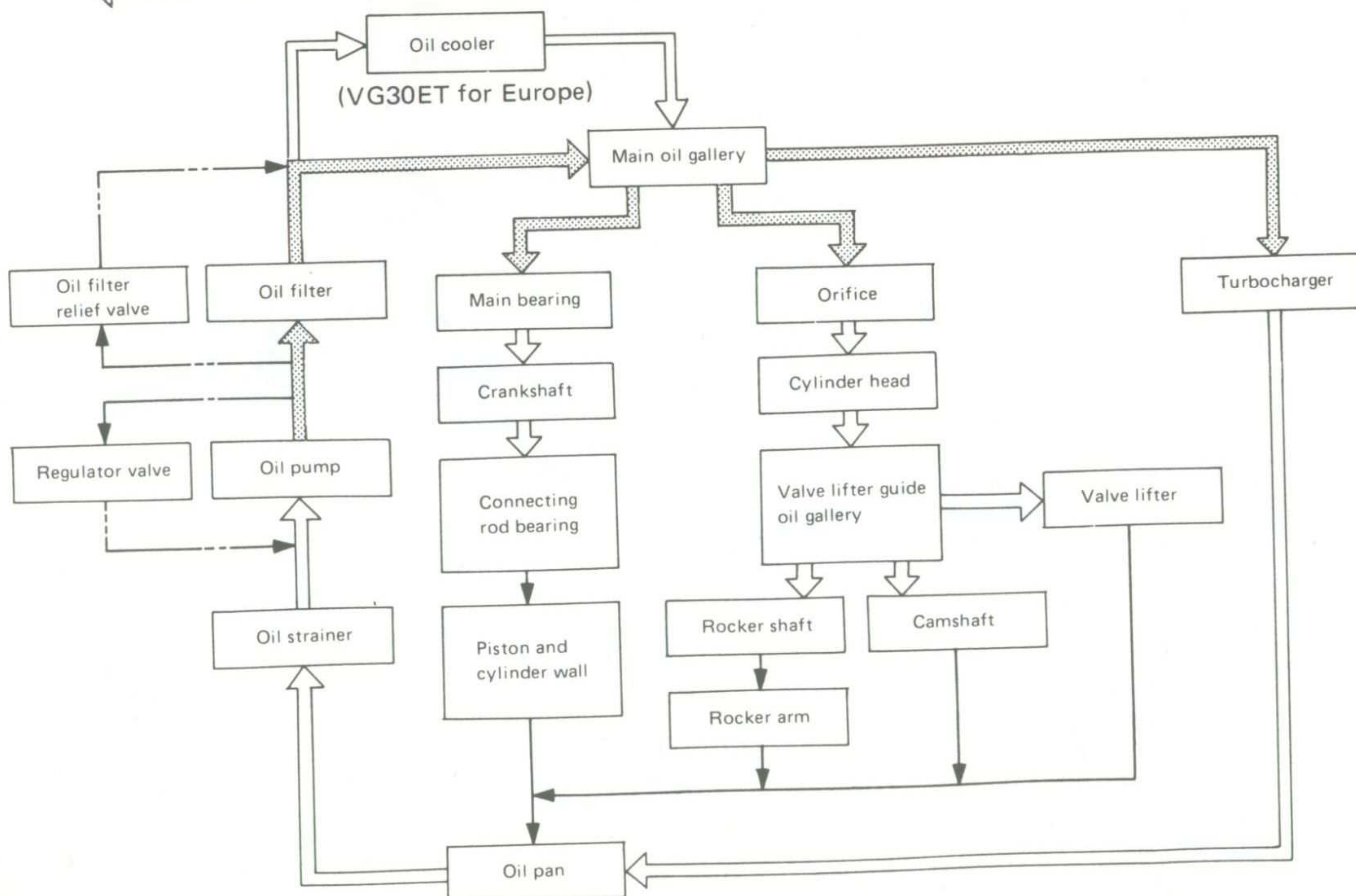
ENGINE LUBRICATION SYSTEM

Lubrication Circuit



Note:

-  : Oil passage
-  : Oil gallery in cylinder block
-  : By-pass passage



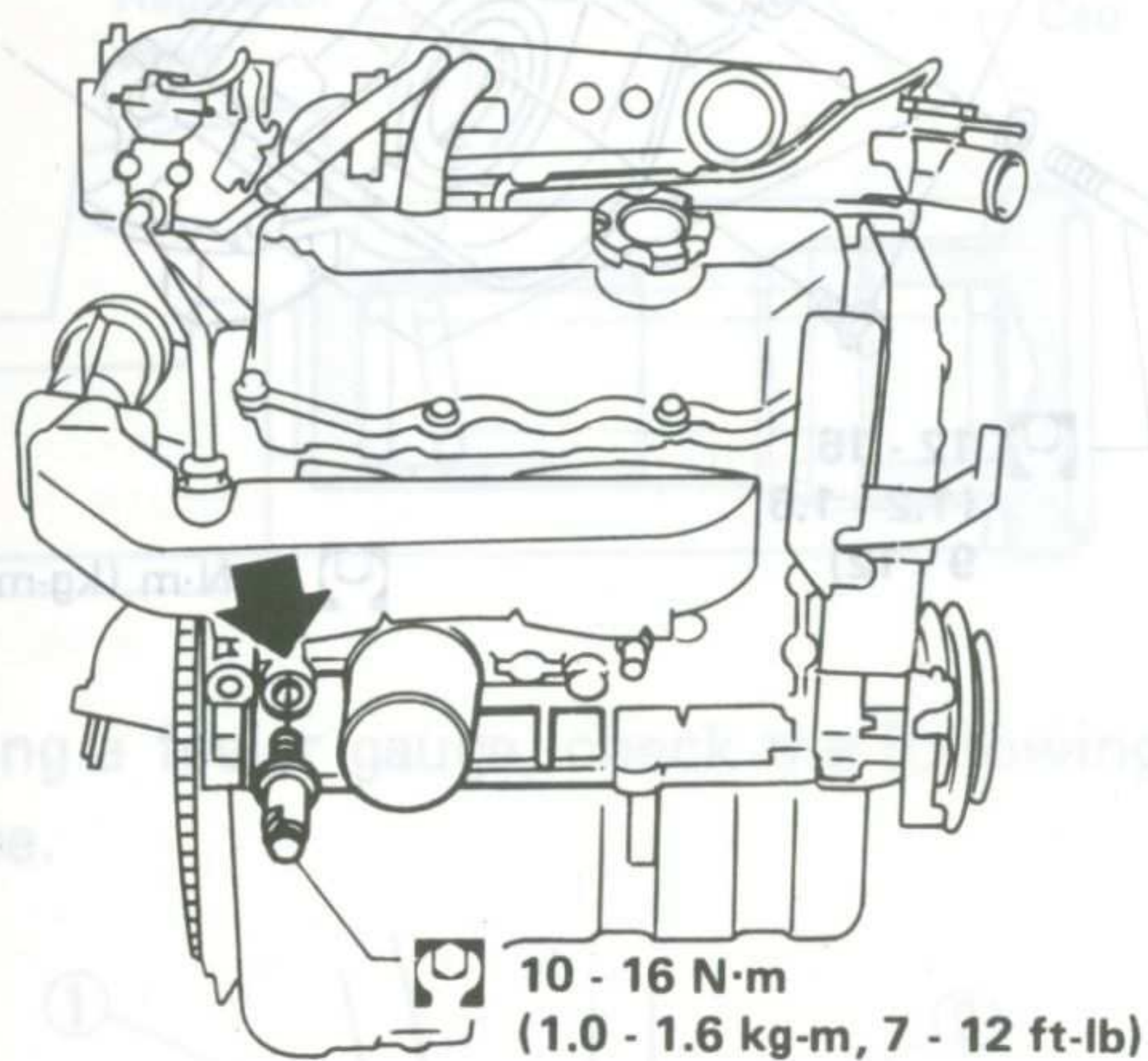
SLC696

ENGINE LUBRICATION SYSTEM

Oil Pressure Check (On-vehicle service)

Be careful not to burn yourself, as the engine and oil may be hot.

1. Warm up engine.
2. Stop engine and remove oil pressure switch.

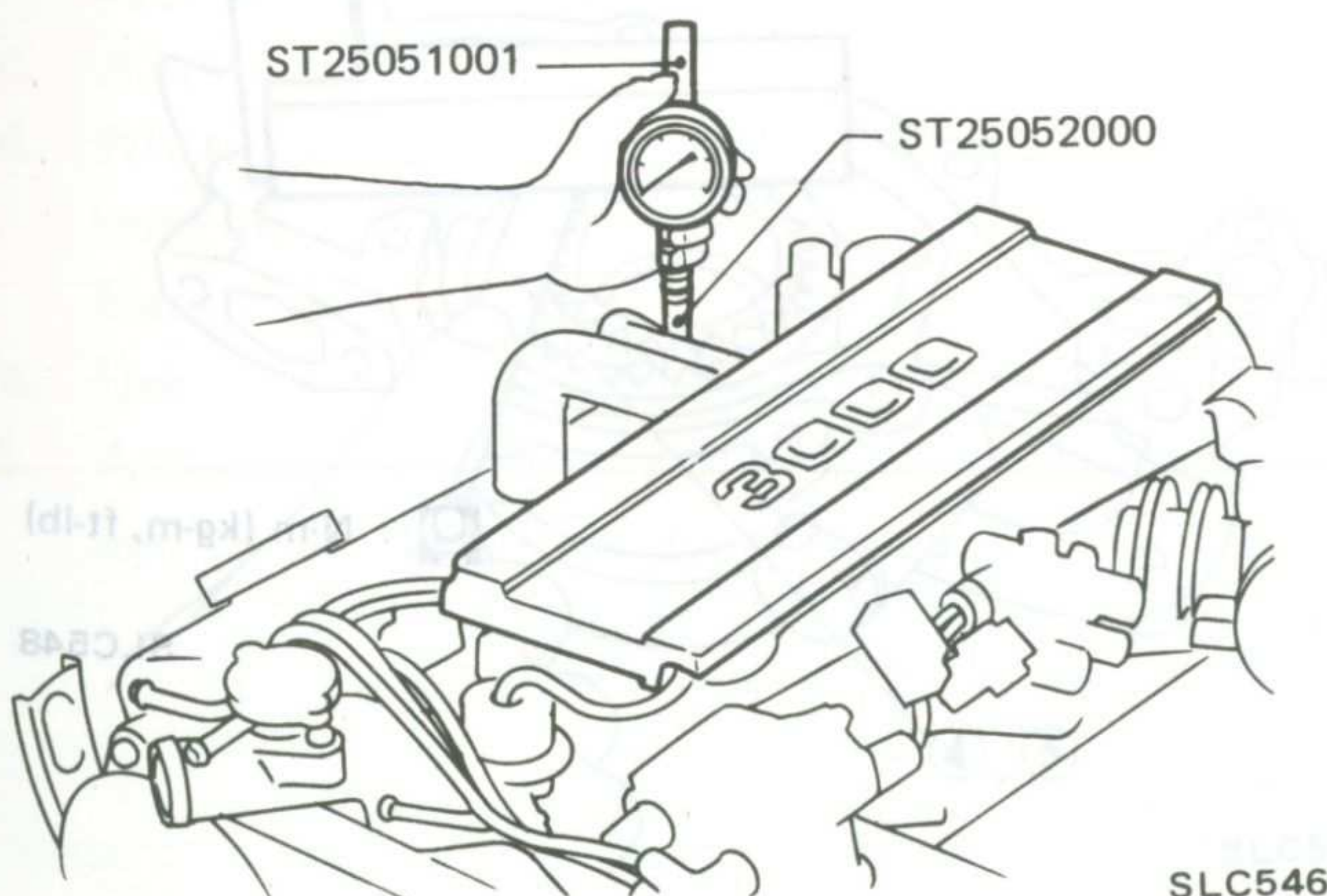


SLC545

3. Install pressure gauge.
4. Start engine and check oil pressure with engine running under no-load.

Engine rpm	Approximate discharge pressure kPa (bar, kg/cm ² , psi)
1,200	196 (2.0, 2, 28)
2,000	294 (2.9, 3, 43)
4,000	392 (3.9, 4, 57)

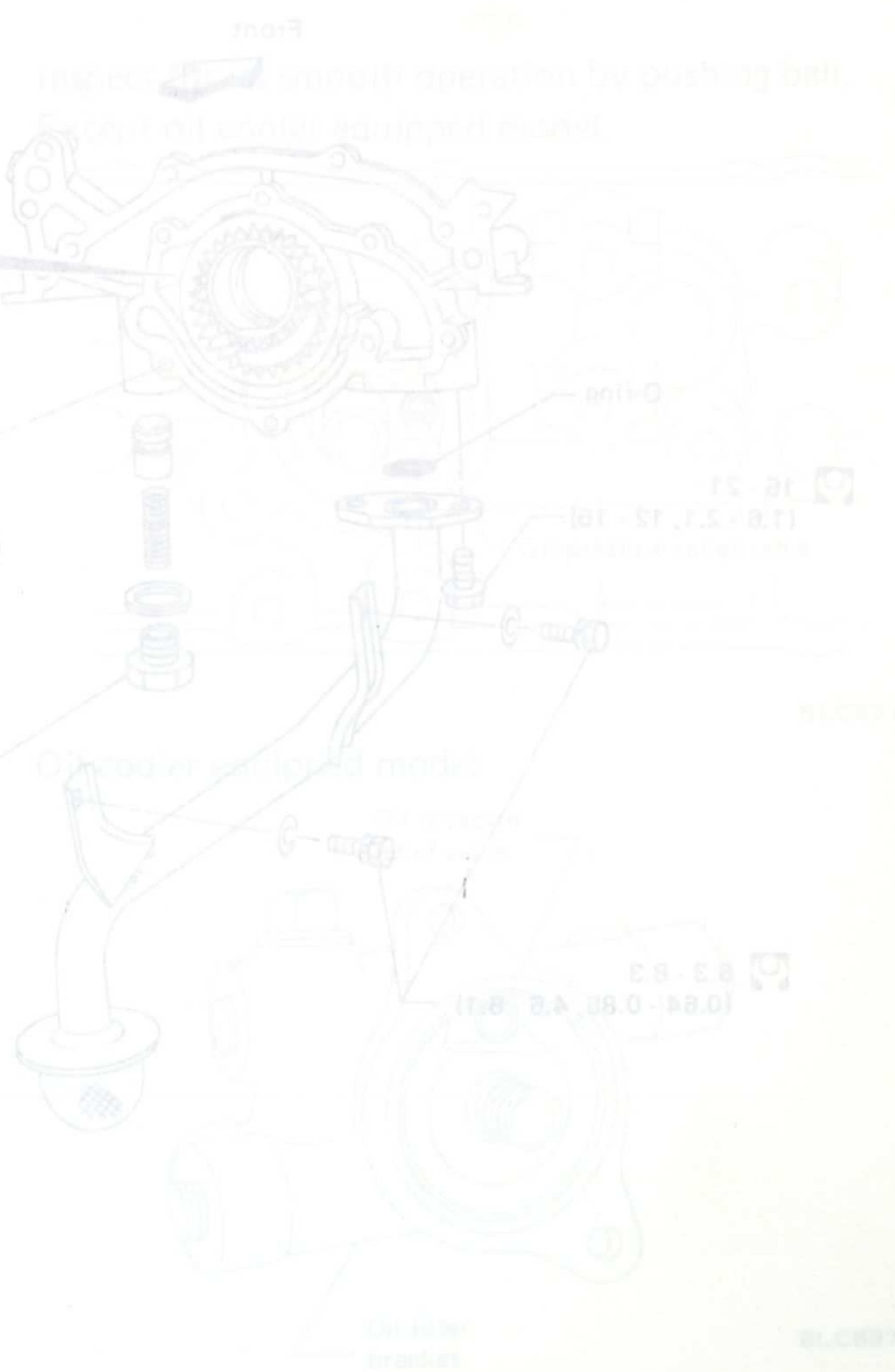
Oil pressure at 600 rpm (Idling) should be more than 78 kPa (0.78 bar, 0.8 kg/cm², 11 psi).



SLC546

The above table shows data tested when SAE 10W-30 oil is used and oil temperature is between 77 and 83°C (171 and 181°F). Slight difference will be found because of oil viscosity or oil temperature. If difference is extreme, check oil passage and oil pump for oil leaks.

Oil Pressure Relief Valve Inspection



ENGINE LUBRICATION SYSTEM

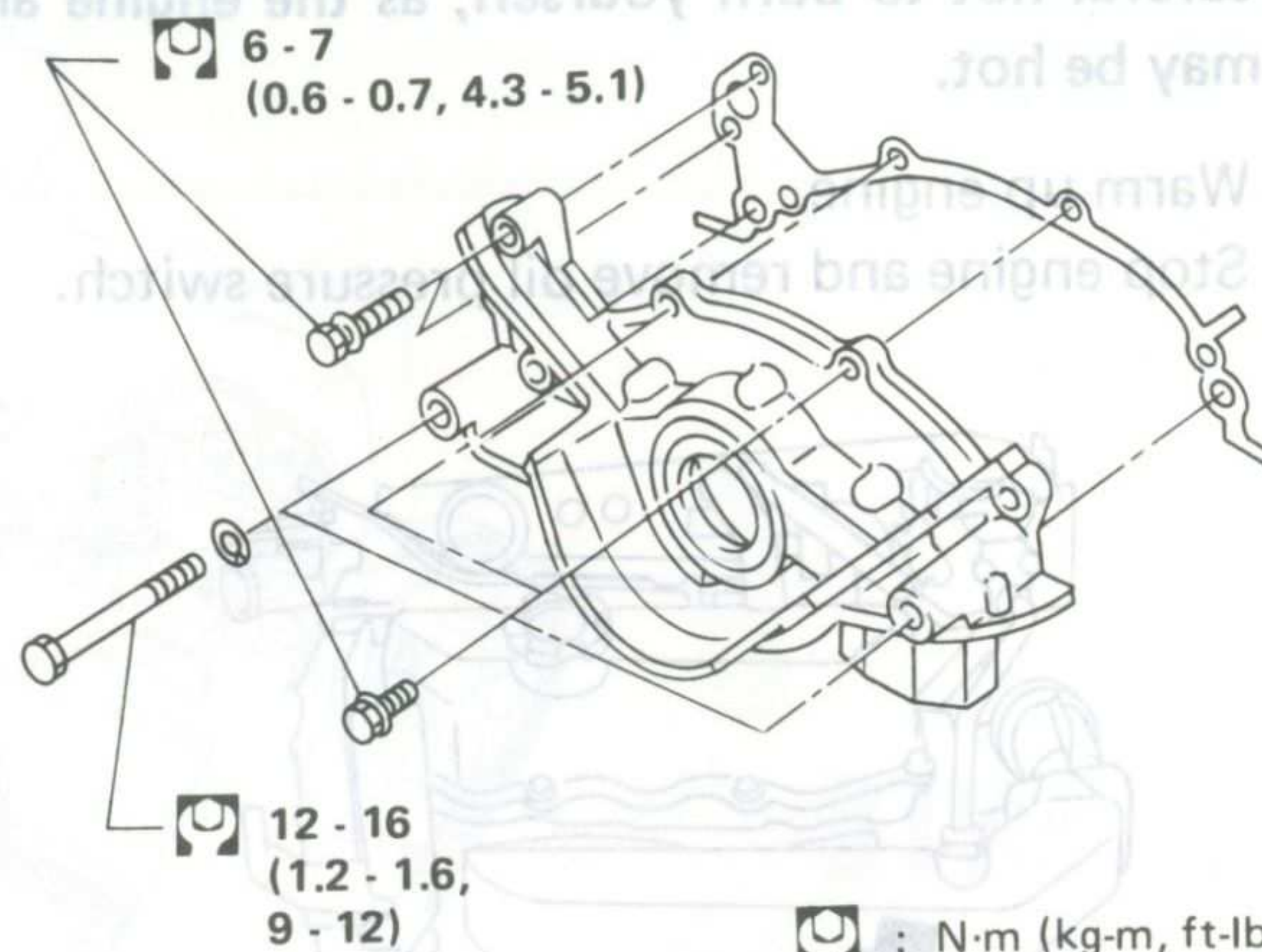
Disassembly and Assembly of Oil Pump

1. Drain oil.
2. Remove oil pan.
In case of on-vehicle service, refer to Oil Pan for removal in section EM.
3. Remove oil pump assembly.

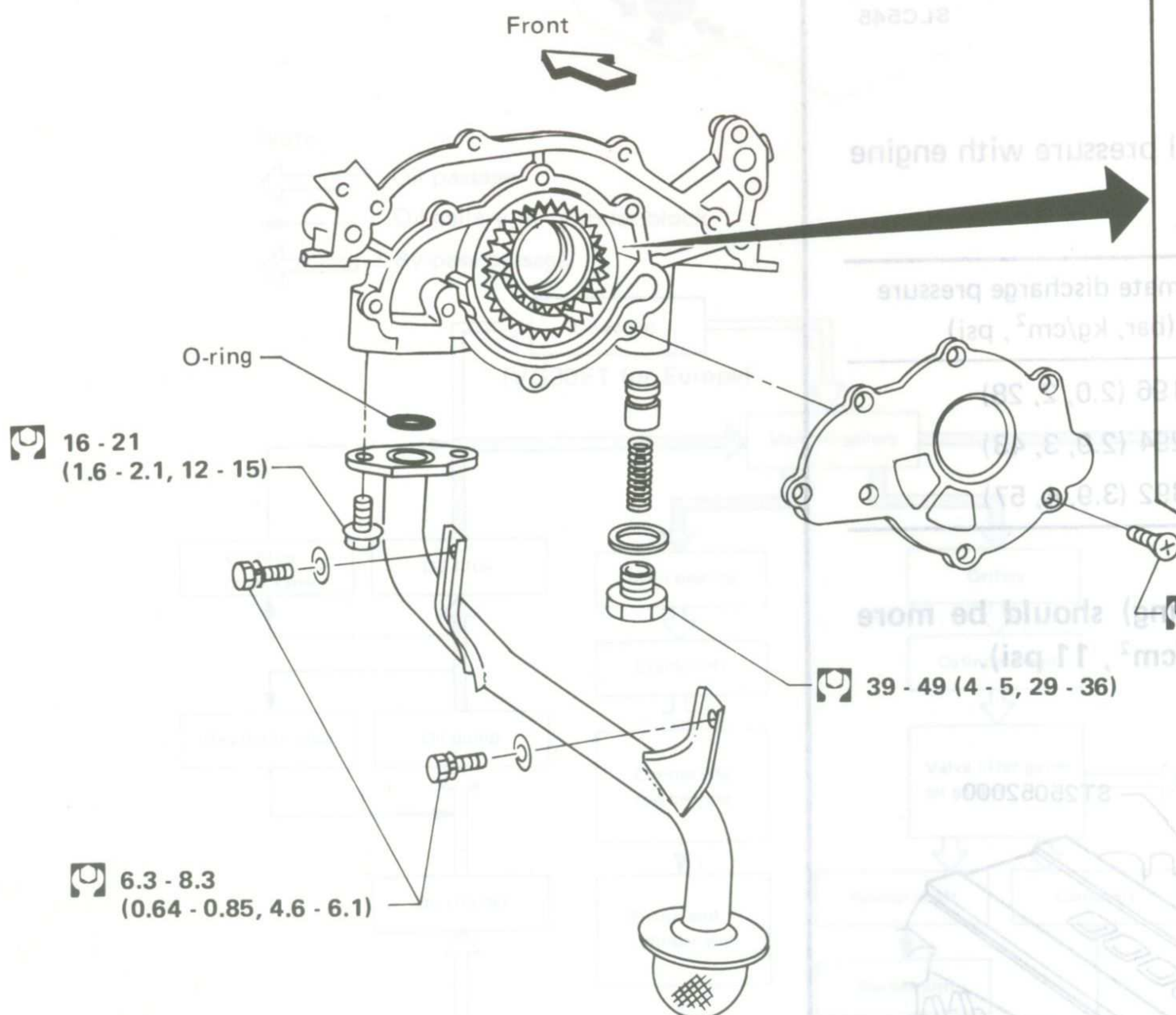
Always replace with new oil seal and gasket.

When installing oil pump, apply engine oil to inner and outer gear.

Be sure that O-ring is properly fitted on.



SLC547



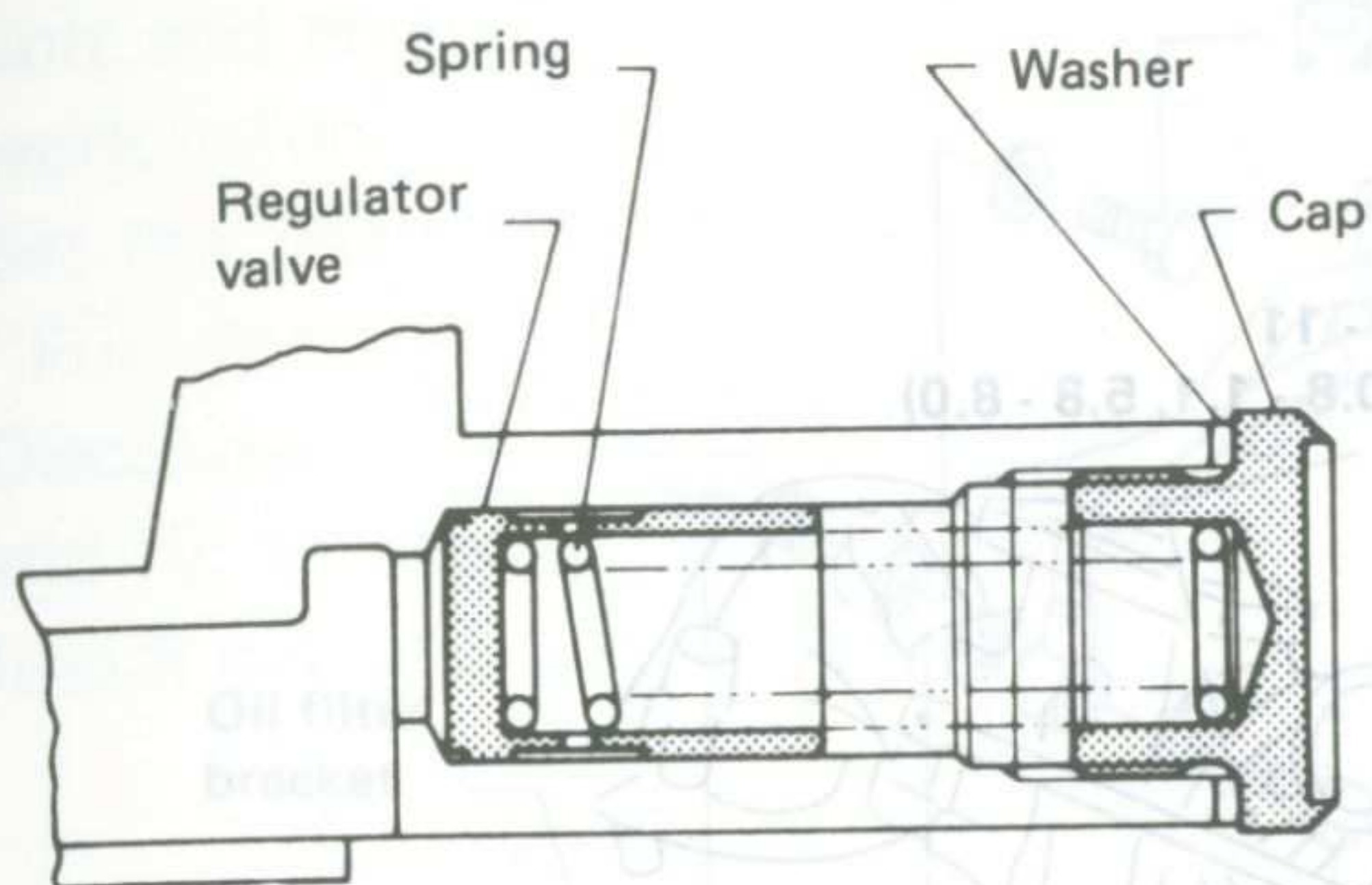
□ : N·m (kg-m, ft-lb)

SLC548

ENGINE LUBRICATION SYSTEM

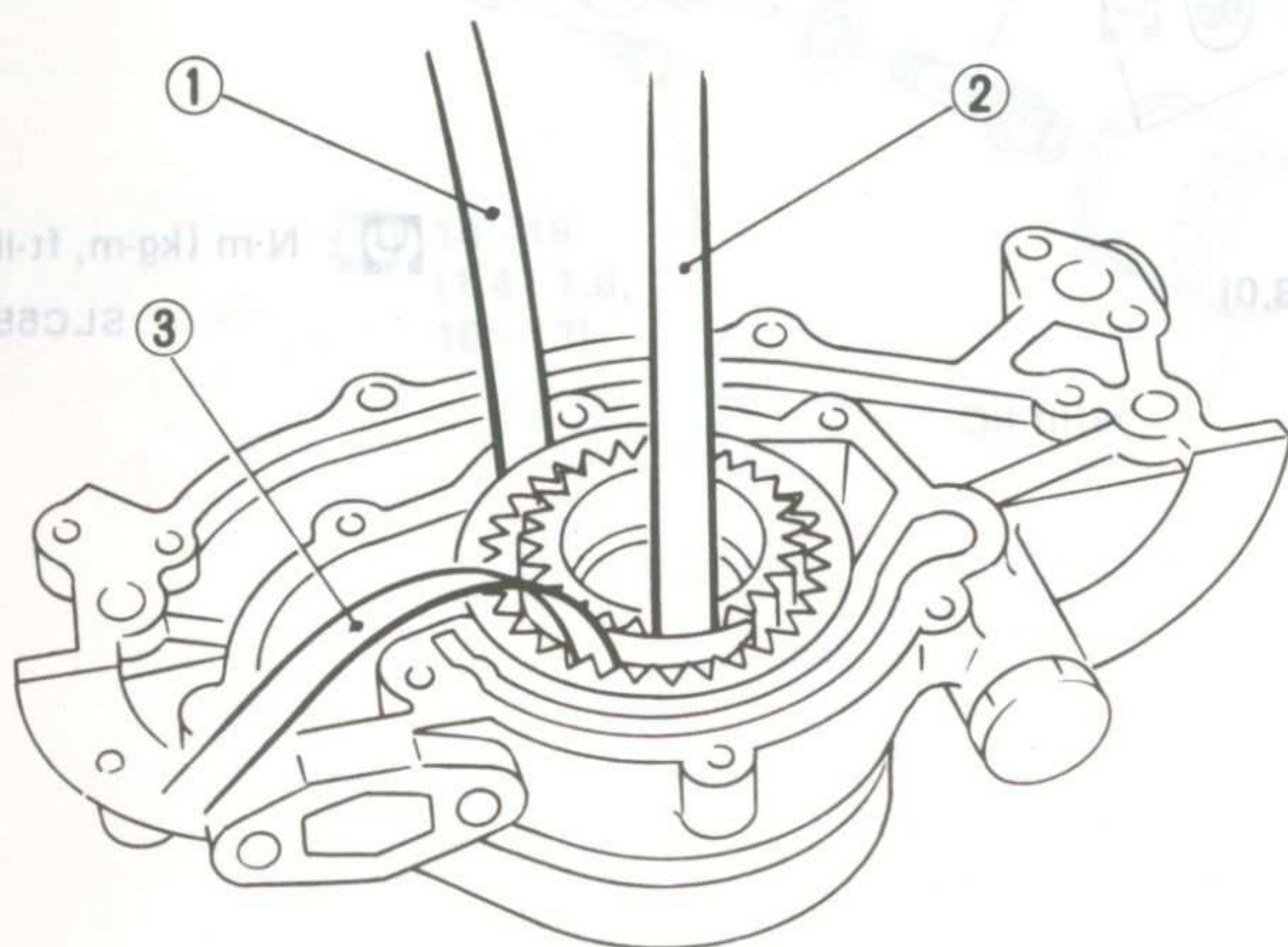
Oil Pump Inspection

1. Visually inspect components for wear and damage.
2. Check oil pressure regulator valve sliding surface and valve spring.

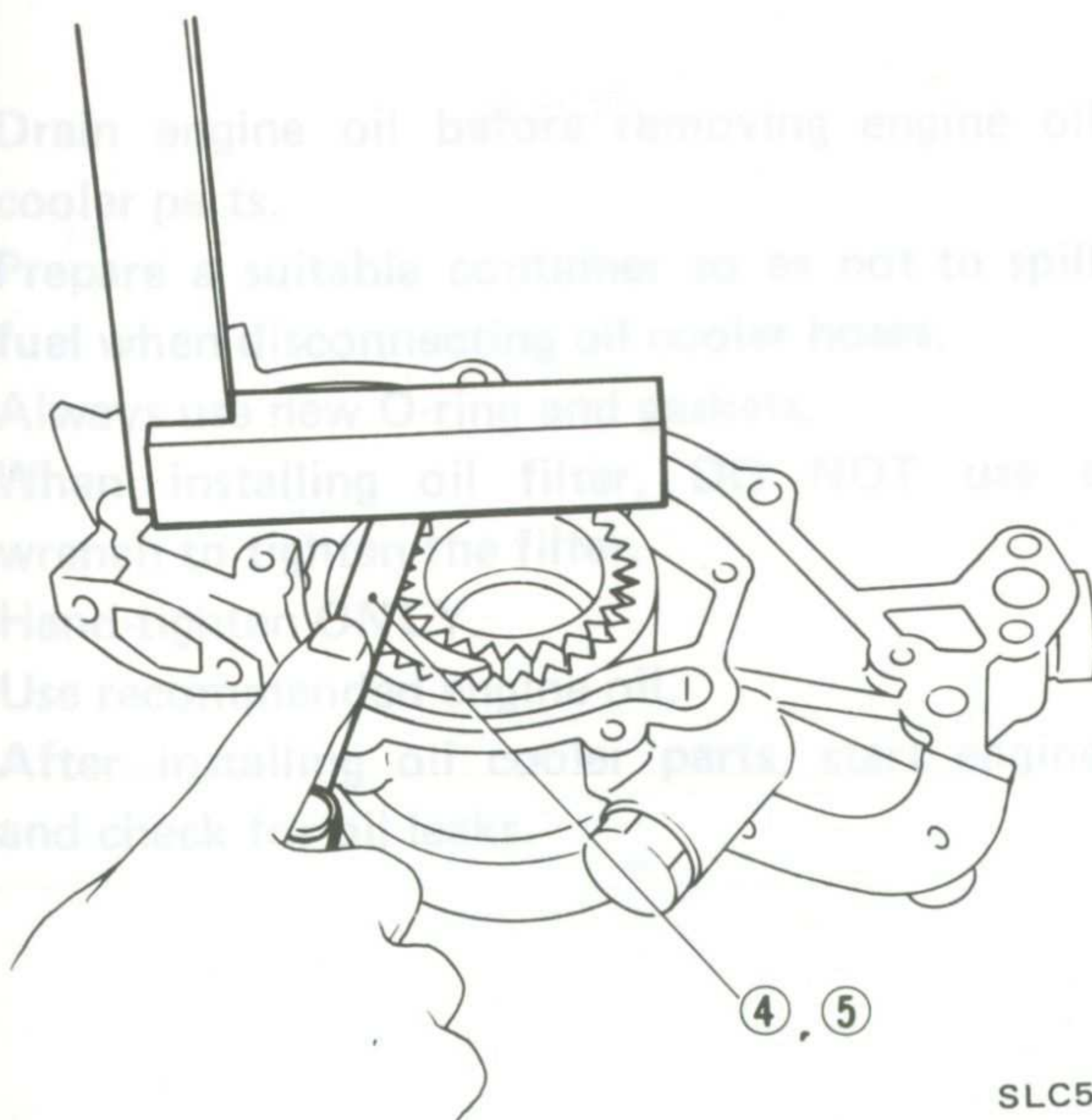


SLC295

3. Using a feeler gauge, check the following clearance.



SLC549



SLC550

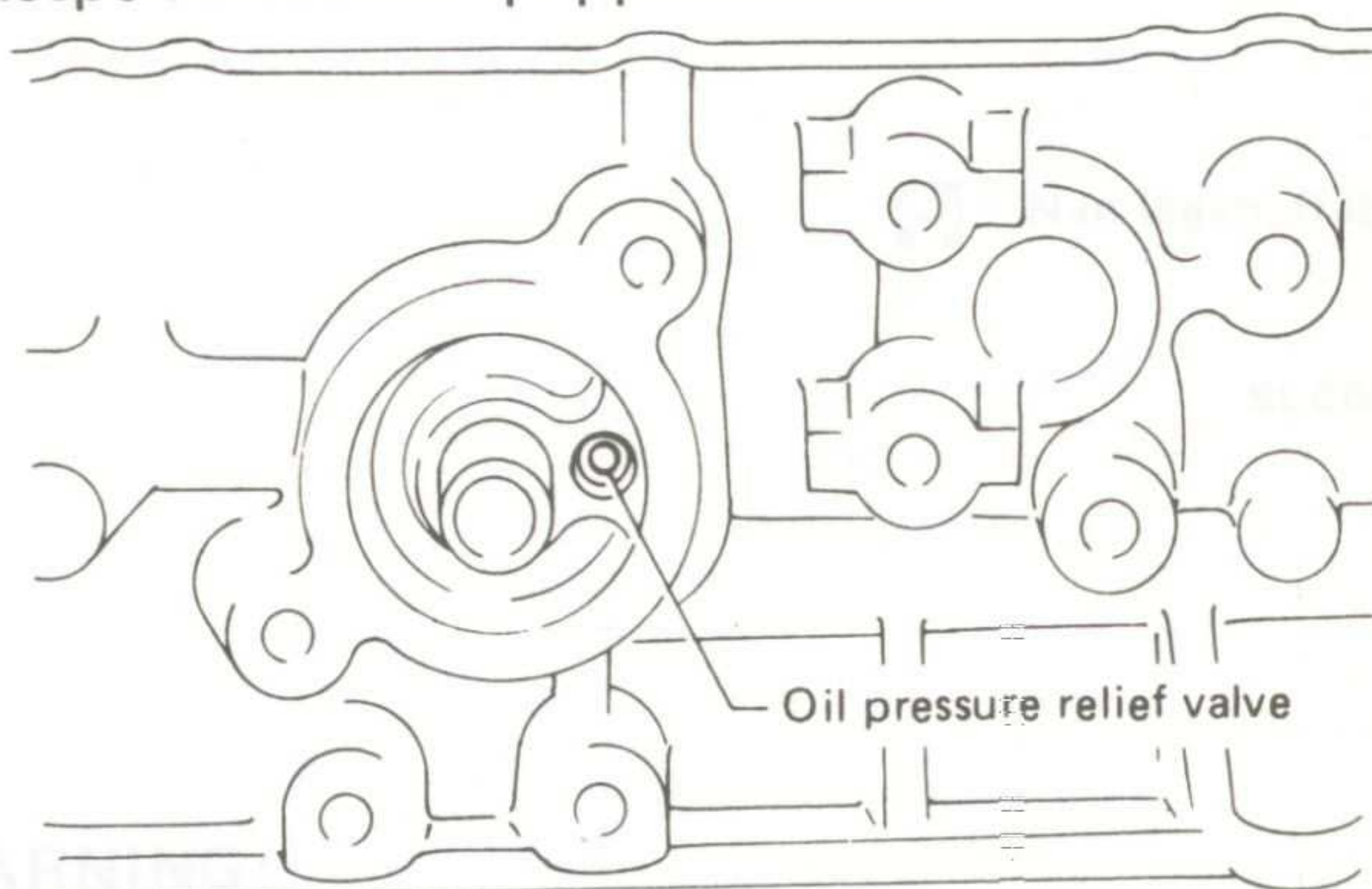
If it exceeds the limit, replace gear set or entire oil pump assembly.

Unit: mm (in)

Body to outer gear clearance ①	0.11 - 0.20 (0.0043 - 0.0079)
Inner gear to crescent clearance ②	0.12 - 0.23 (0.0047 - 0.0091)
Outer gear to crescent clearance ③	0.21 - 0.32 (0.0083 - 0.0126)
Housing to inner gear clearance ④	0.05 - 0.09 (0.0020 - 0.0035)
Housing to outer gear clearance ⑤	0.05 - 0.11 (0.0020 - 0.0043)

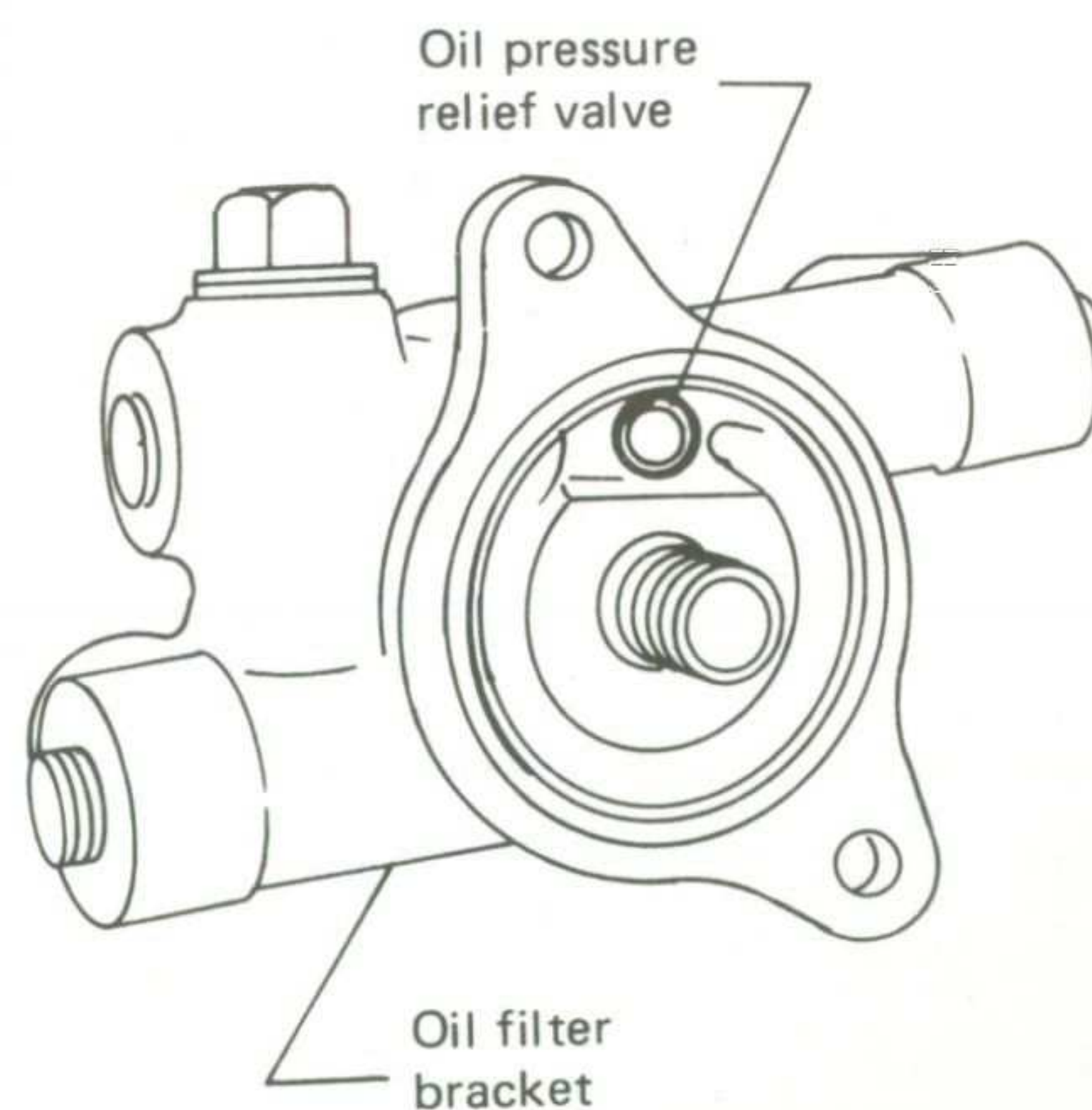
Oil Pressure Relief Valve Inspection

Inspect for its smooth operation by pushing ball. Except oil cooler equipped model.



SLC551

Oil cooler equipped model



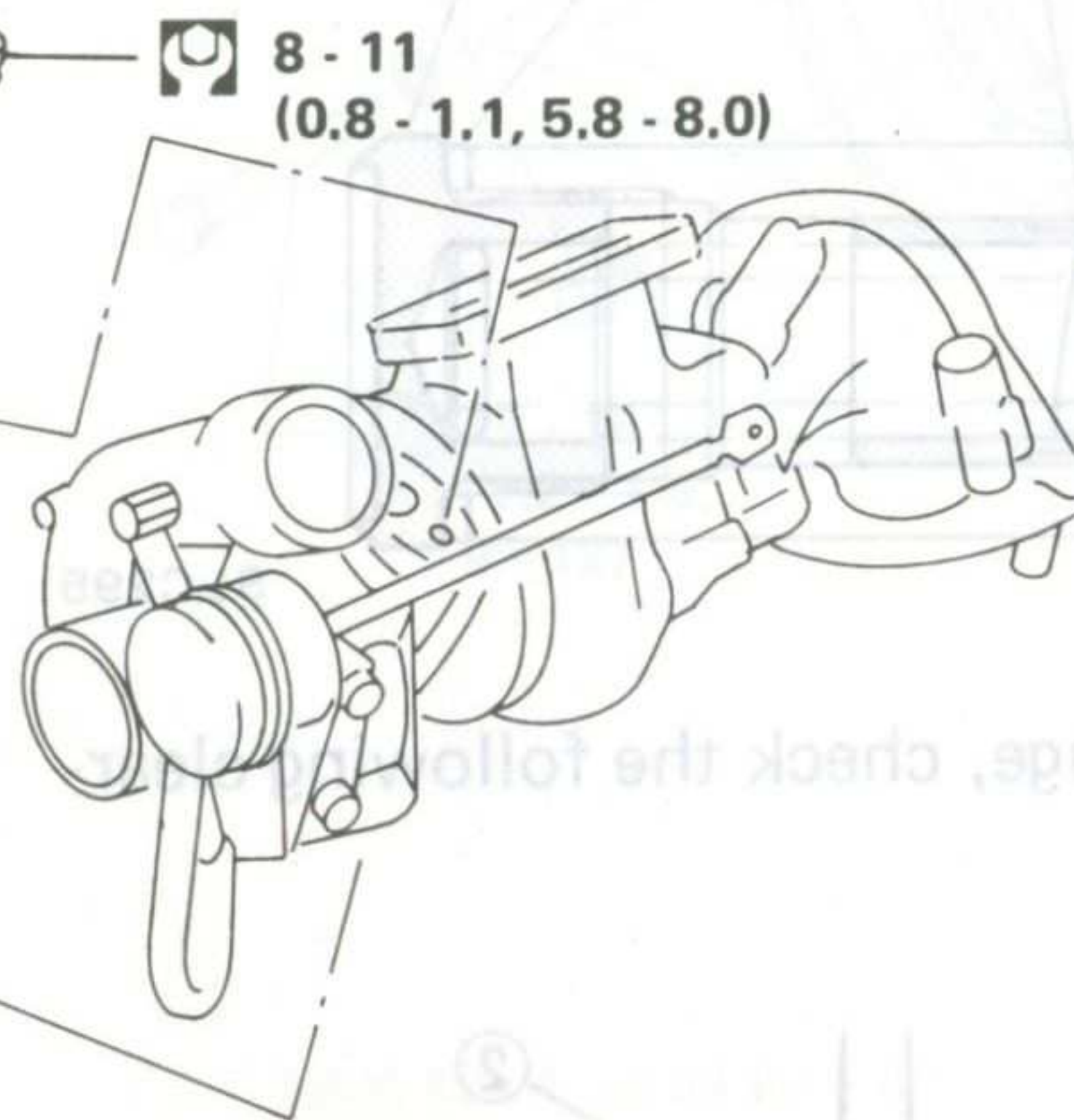
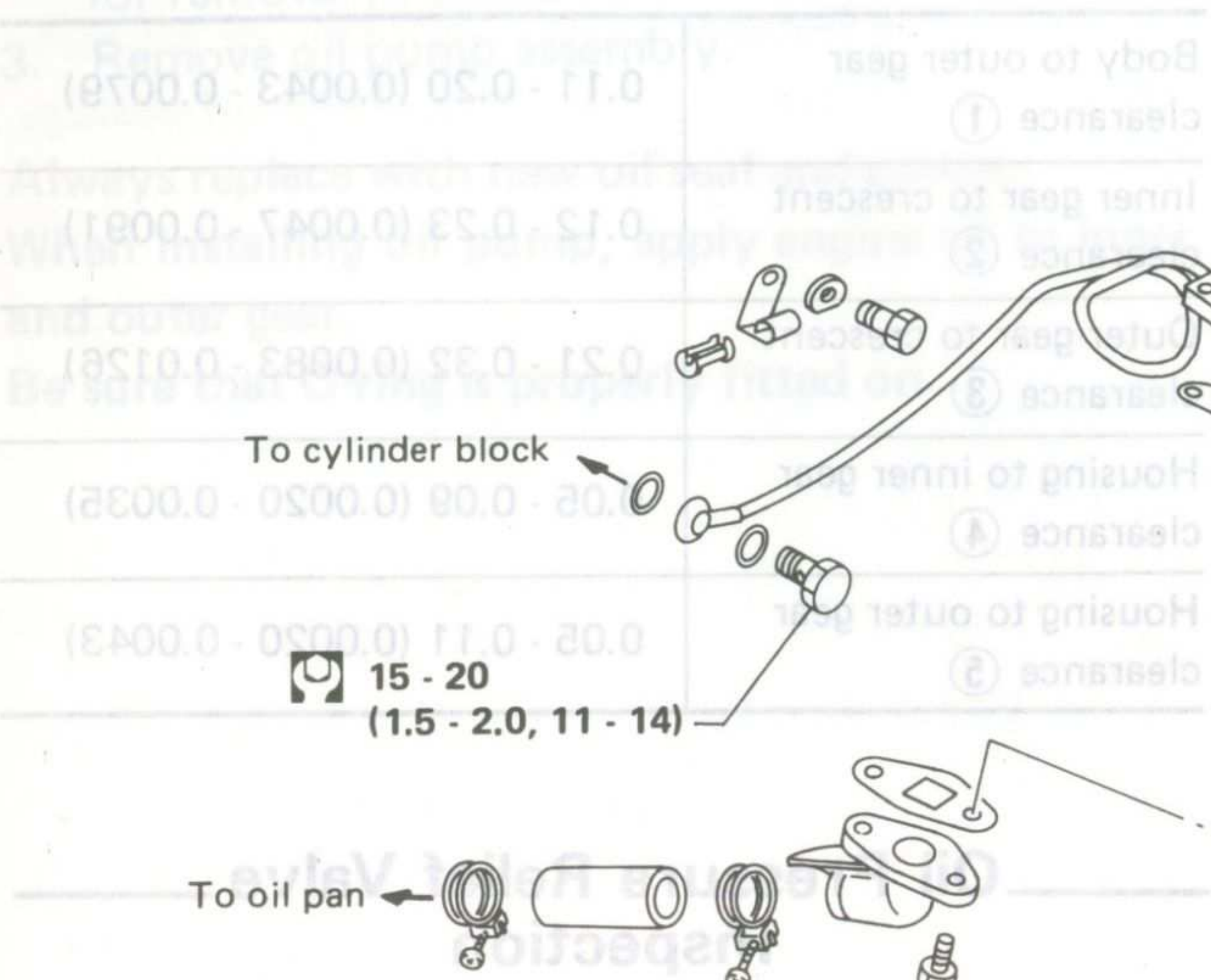
SLC697

ENGINE LUBRICATION SYSTEM

Lubricating Oil Passage for Turbocharger

Always replace with new gasket.

After installation, run engine for a few minutes and check for leaks.

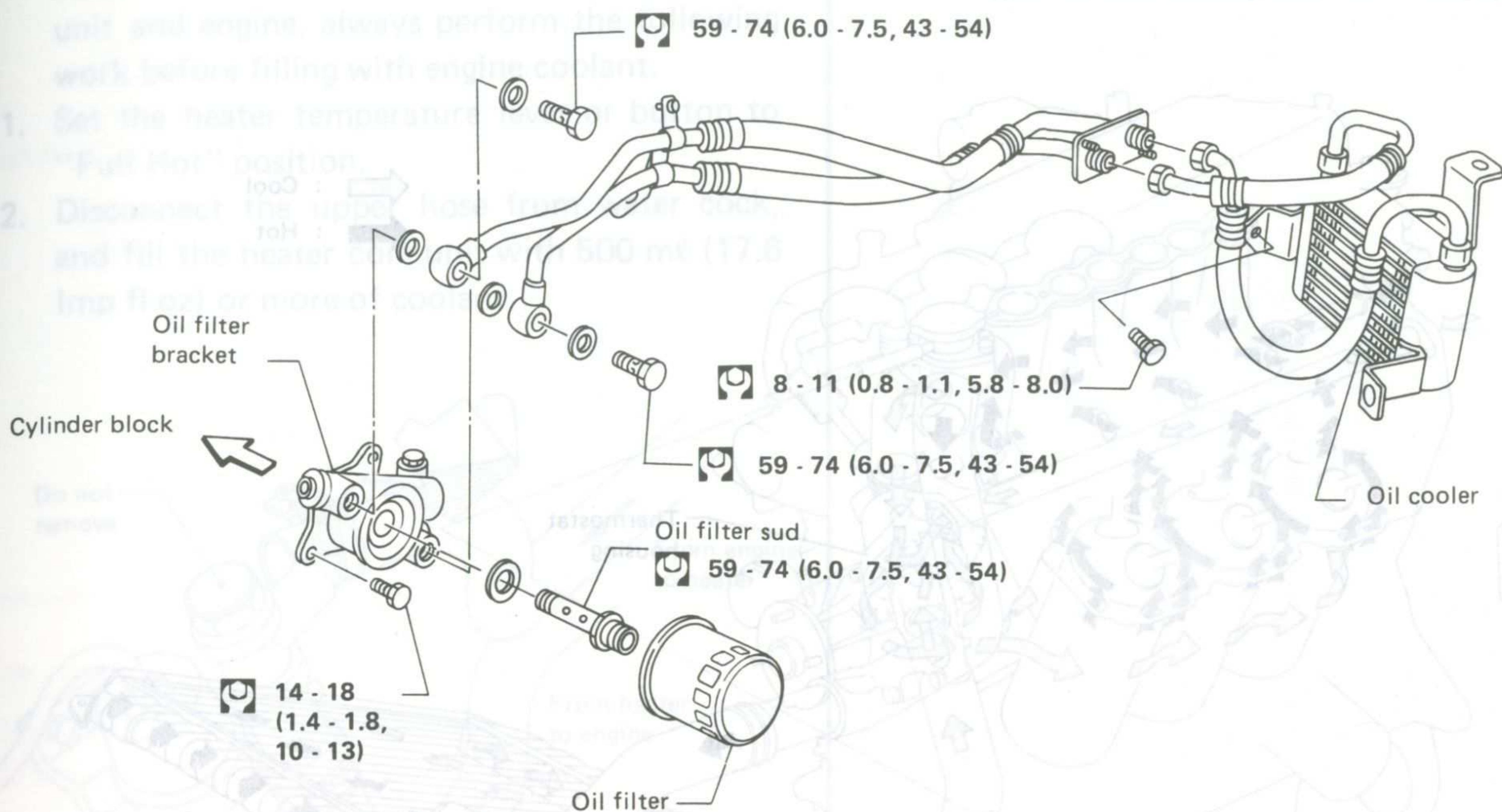


: N·m (kg-m, ft-lb)

SLC552

ENGINE LUBRICATION SYSTEM

Engine Oil Cooler



: N·m (kg-m, ft-lb)

SLC698

- Drain engine oil before removing engine oil cooler parts.
- Prepare a suitable container so as not to spill fuel when disconnecting oil cooler hoses.
- Always use new O-ring and gaskets.
- When installing oil filter, **DO NOT** use a wrench to tighten the filter. Hand-tighten **ONLY**.
- Use recommended engine oil.
- After installing oil cooler parts, start engine and check for oil leaks.

WARNING:

Be careful not to burn yourself as engine oil is hot.

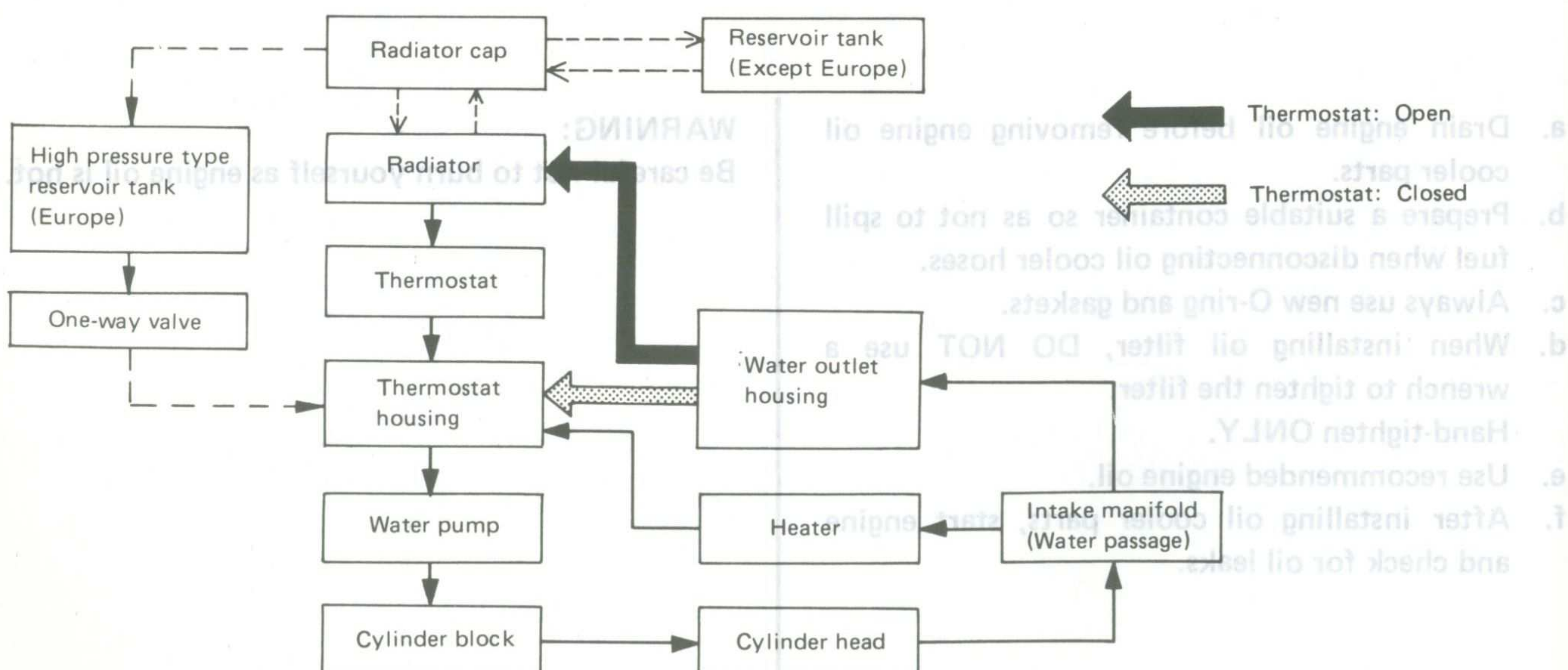
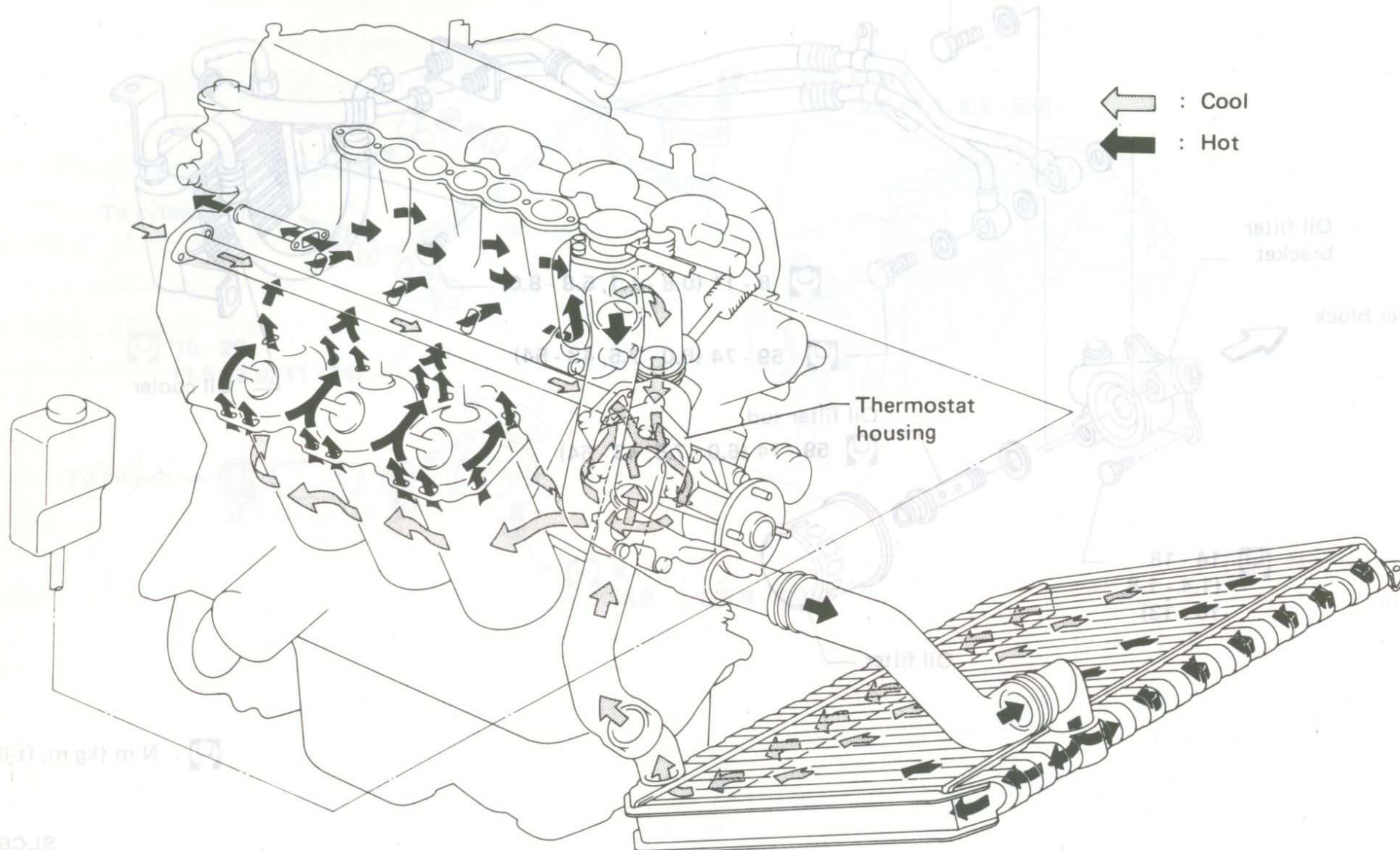
COOLING SYSTEM

Cooling Circuit

To avoid danger of being scalded, never attempt to drain coolant when engine is hot.

If it is necessary to remove radiator cap when radiator is hot, turn cap slowly counterclockwise to the first stop. After all pressure in the cooling system is released, turn cap past the stop and remove it.

Always replace with new gasket and O-ring.

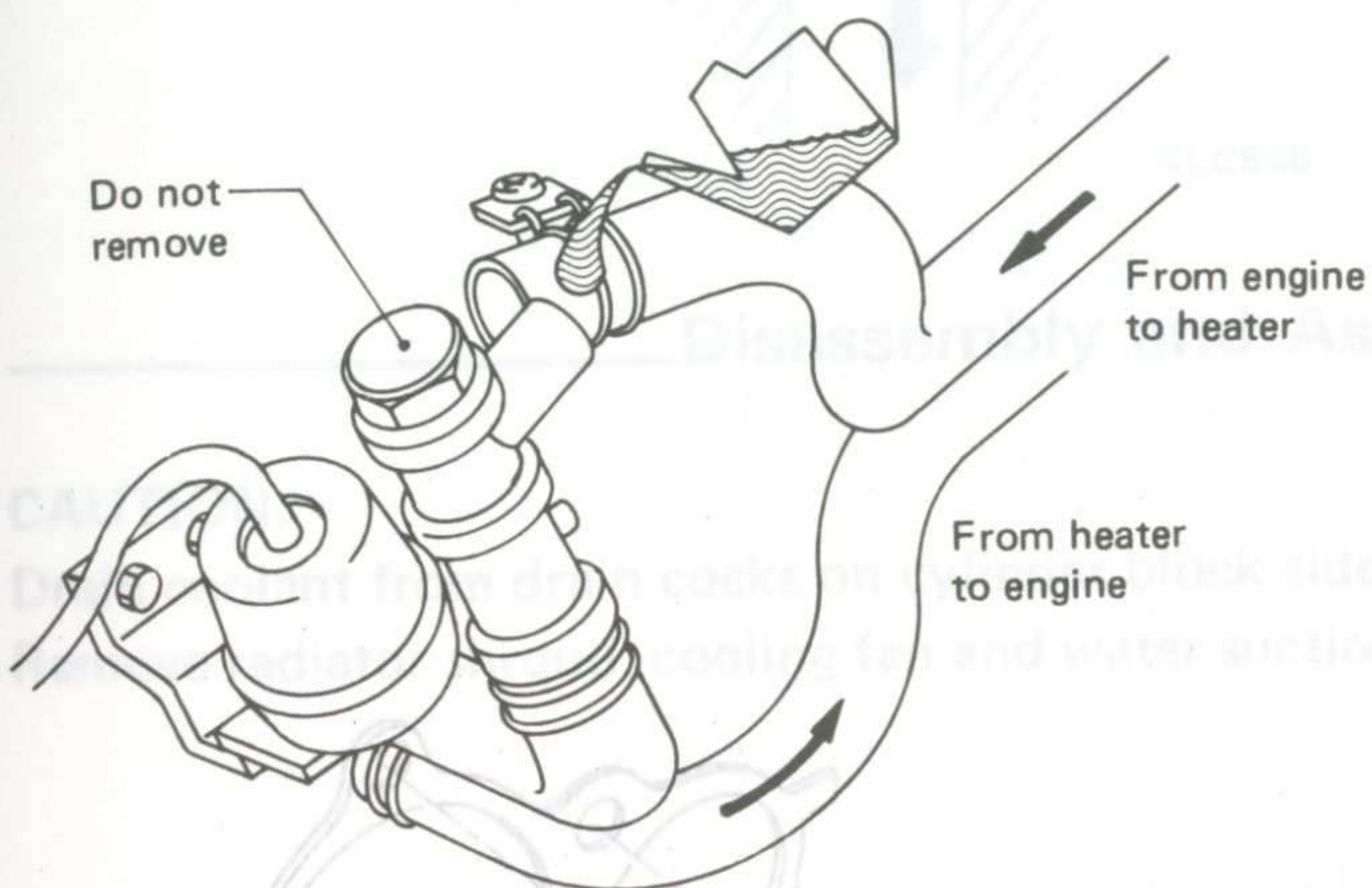


SLC703

COOLING SYSTEM

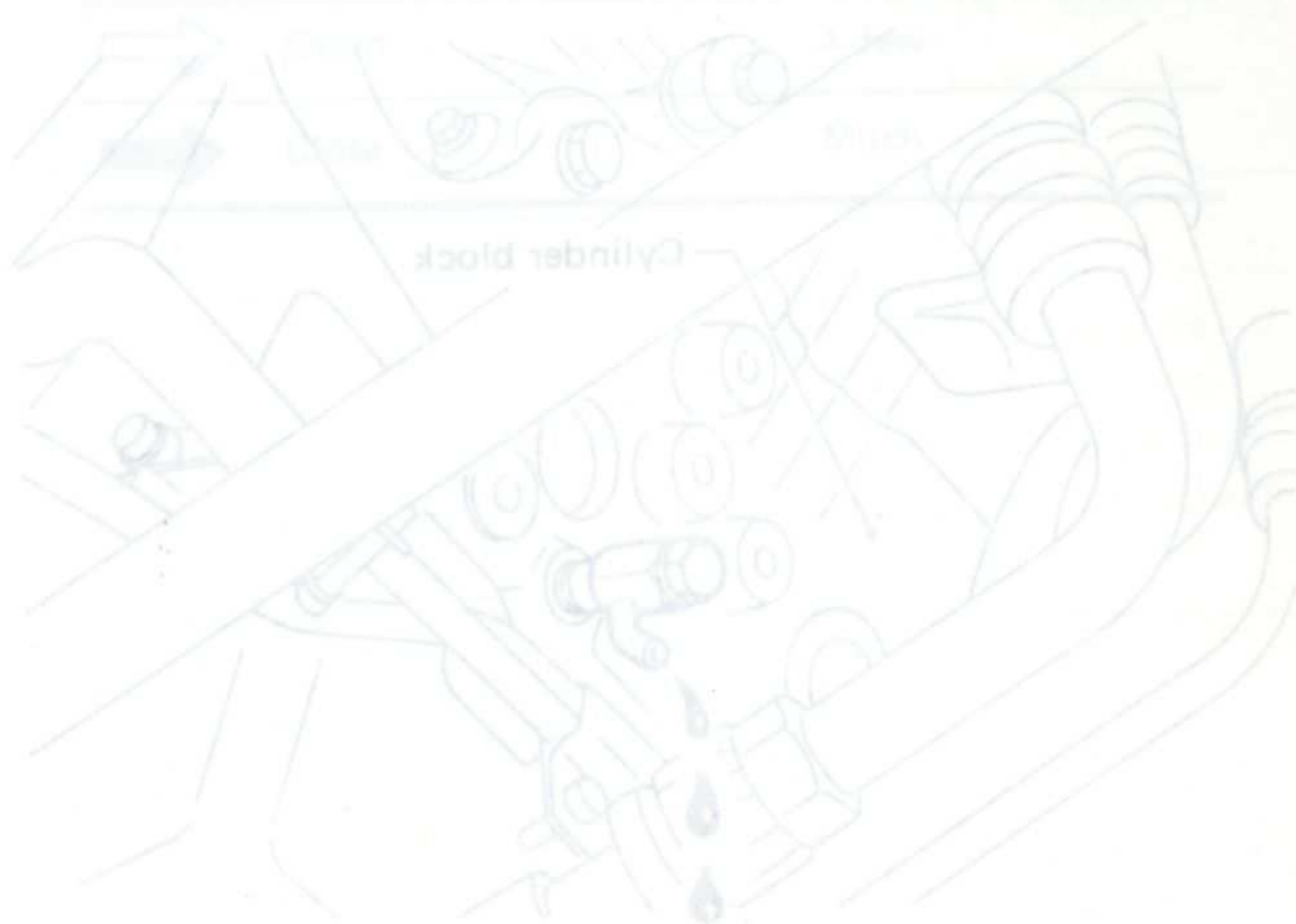
Changing Engine Coolant

- Refer to Changing Engine Coolant in section MA.
- If the hoses connecting engine and heater have been disconnected to dismount heater core unit and engine, always perform the following work before filling with engine coolant.
 1. Set the heater temperature lever or button to "Full Hot" position.
 2. Disconnect the upper hose from water cock, and fill the heater core unit with 500 ml (17.6 Imp fl oz) or more of coolant.

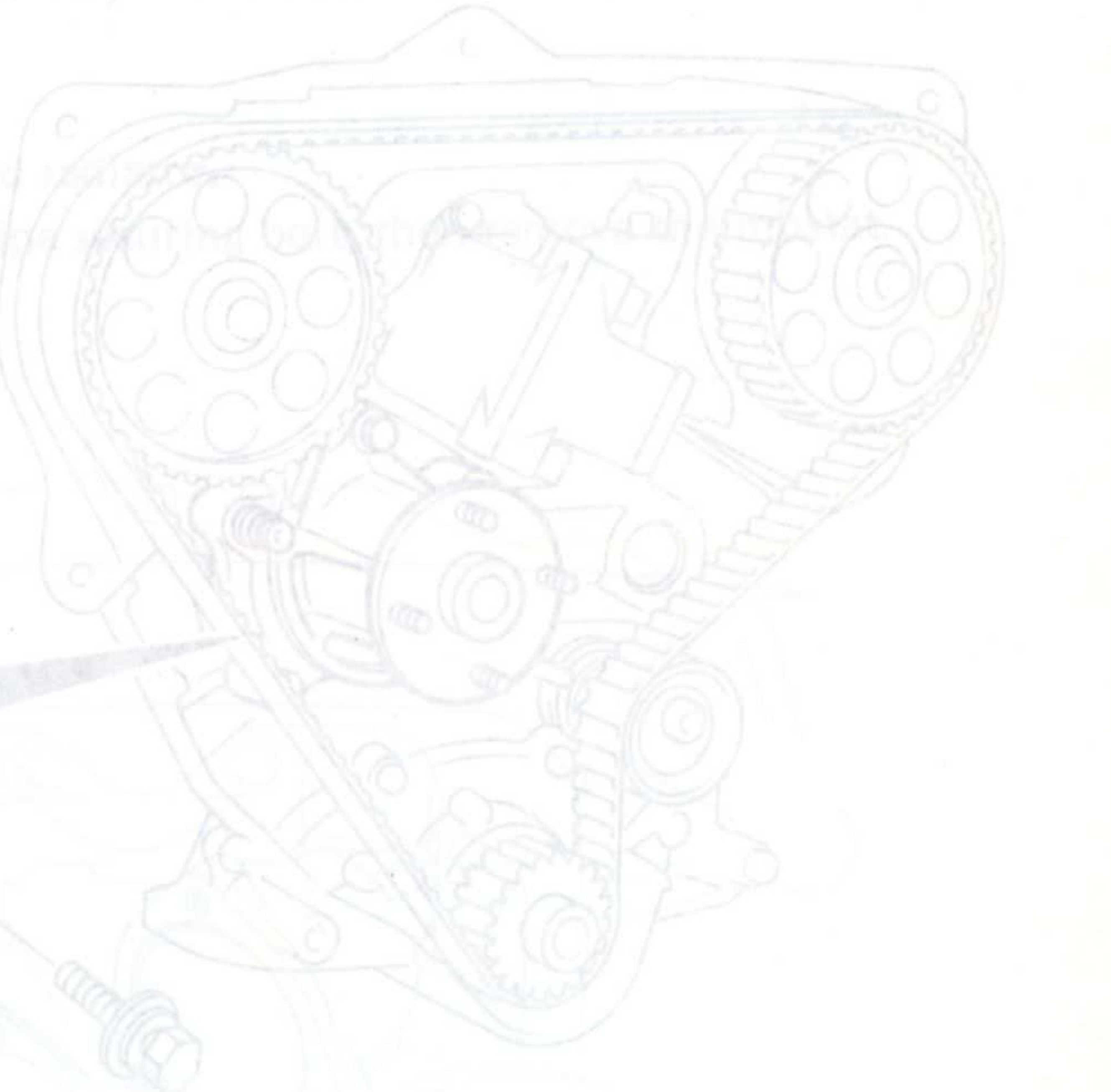


3. Connect the hoses.

Drain coolant from right side drain cocks on cylinder block and radiator.



Assembly of Thermostat

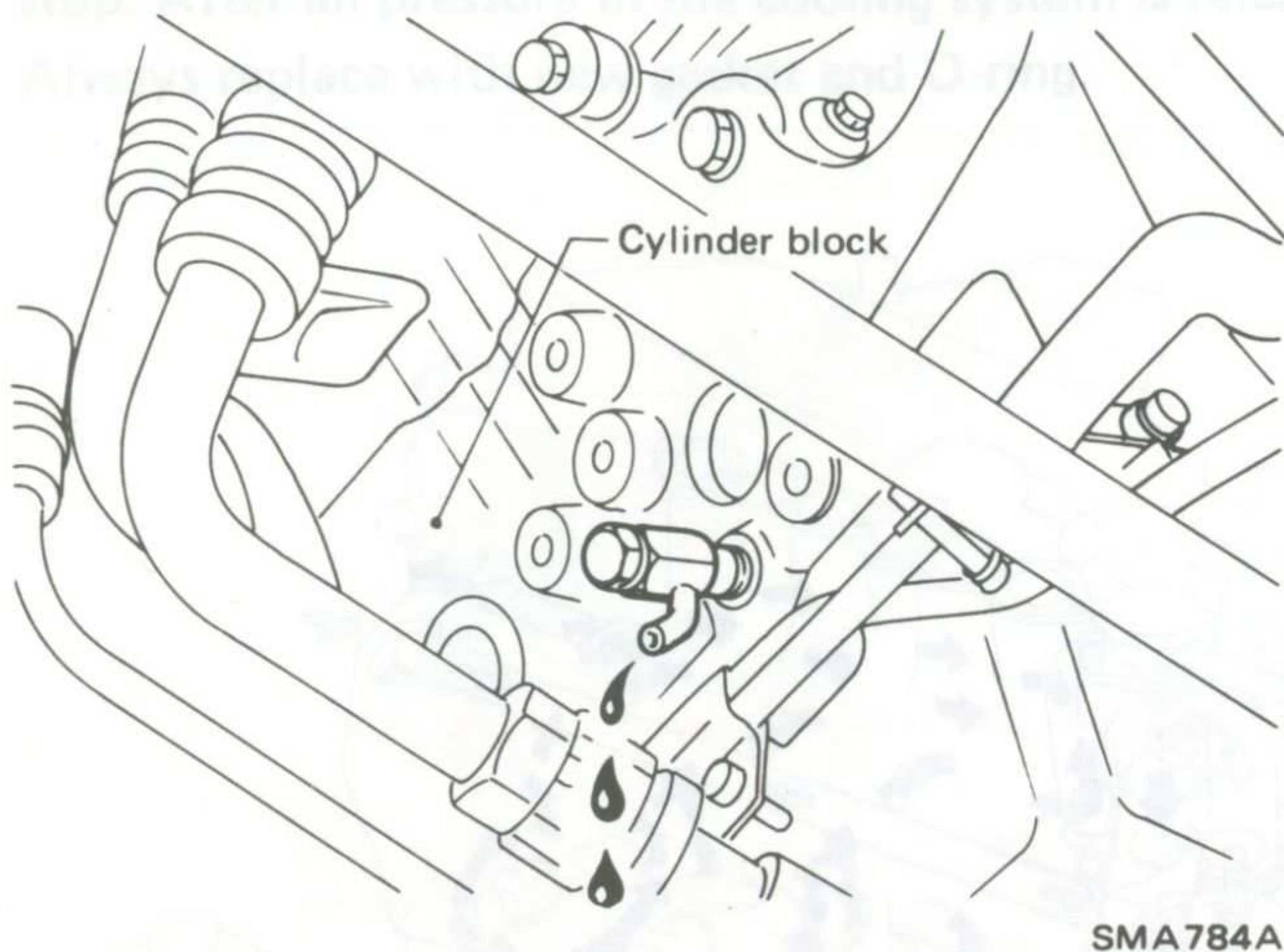


Water pump can not be disassembled and should be replaced as a unit.
Always replace with new gasket.
To avoid deforming timing cover, make sure there is adequate clearance between cover and hose clamp.
After installing water pump, connect hose and clamp securely, then check for leaks using cap tester.

COOLING SYSTEM

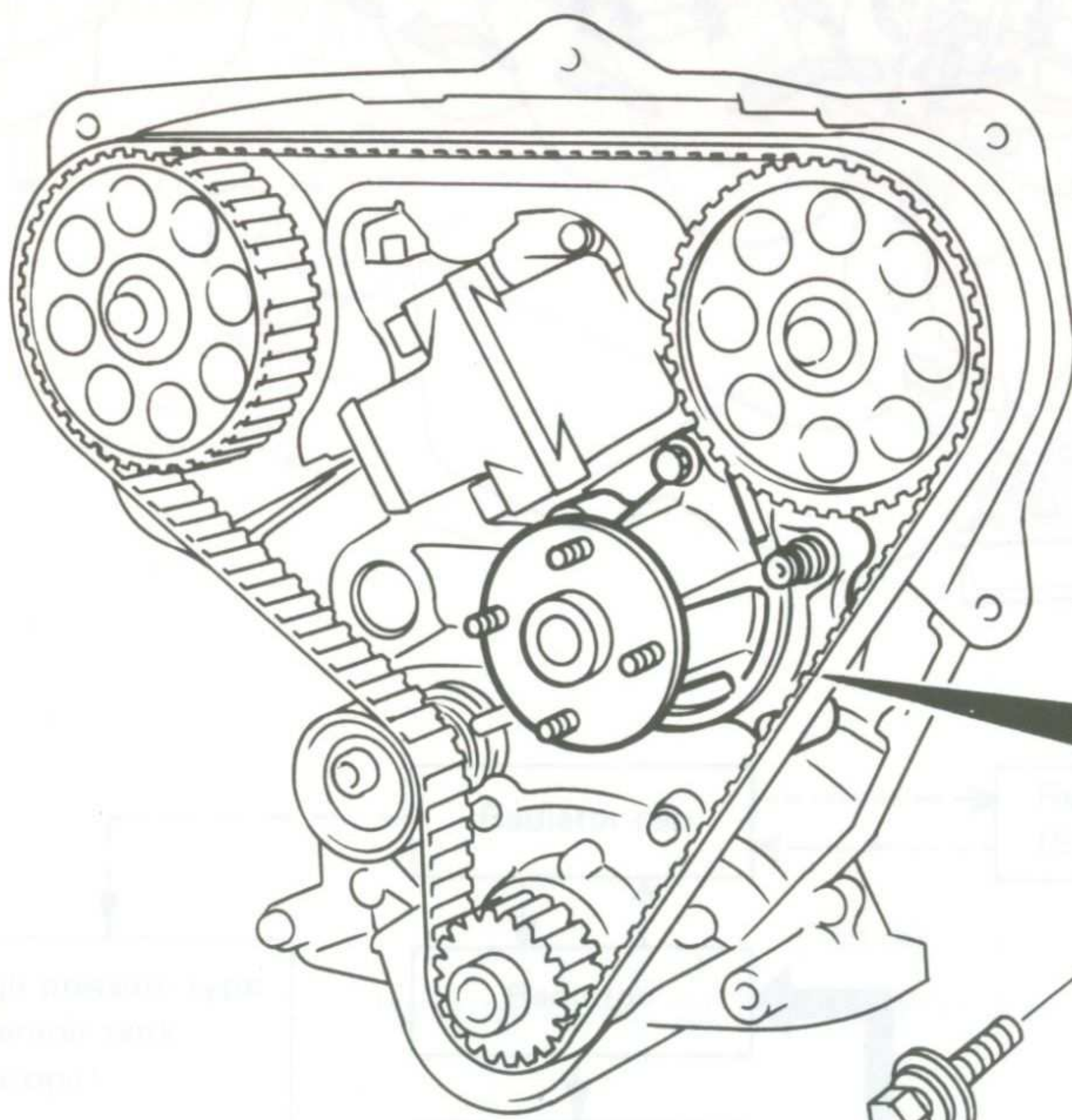
Water Pump Removal and Installation (On-vehicle service)

Drain coolant from right side drain cocks on cylinder block and radiator.



CAUTION:

When removing water pump assembly, be careful not to get coolant on timing belt.

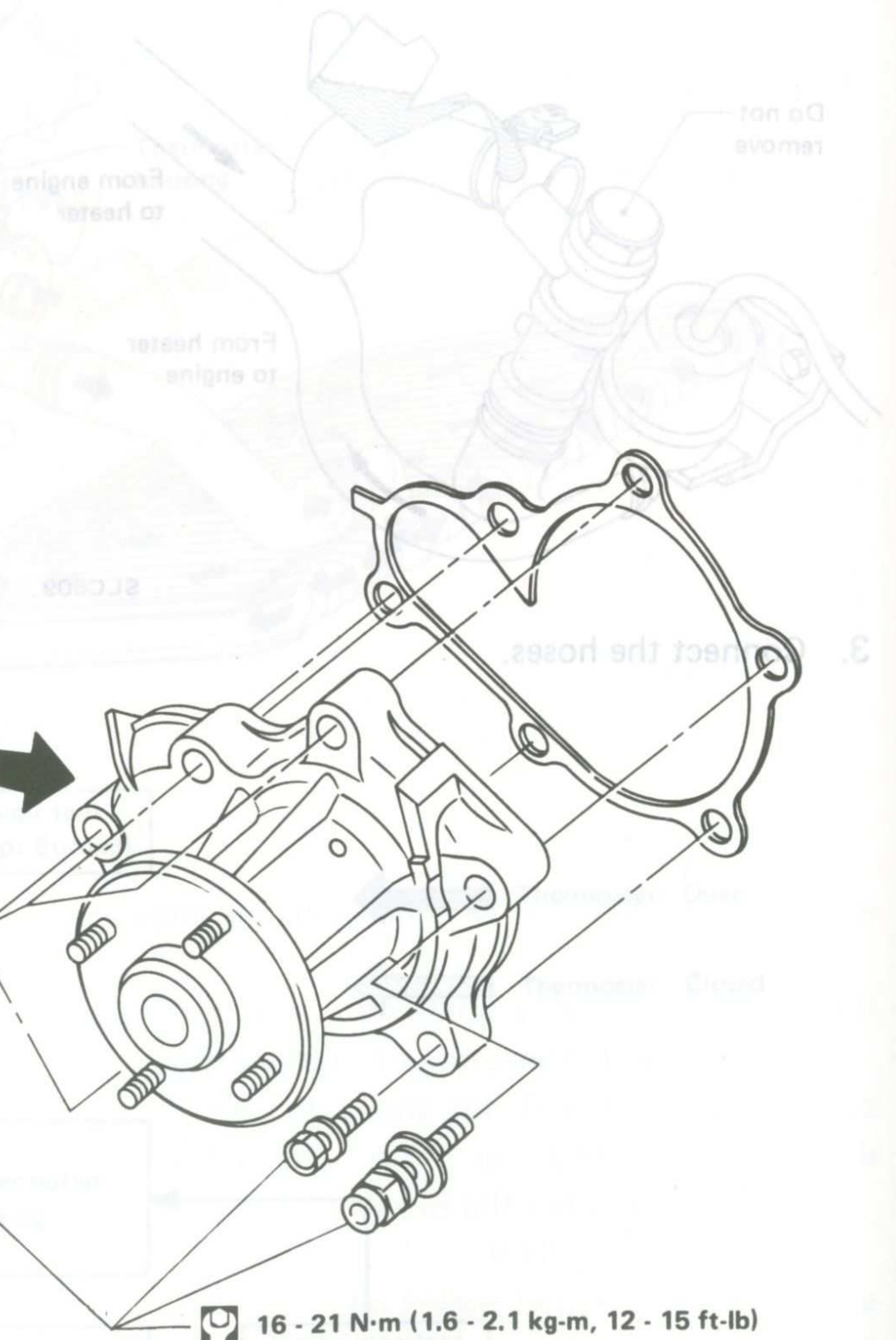


Water pump can not be disassembled and should be replaced as a unit.

Always replace with new gasket.

To avoid deforming timing cover, make sure there is adequate clearance between cover and hose clamp.

After installing water pump, connect hose and clamp securely, then check for leaks using cap tester.



16 - 21 N·m (1.6 - 2.1 kg-m, 12 - 15 ft-lb)

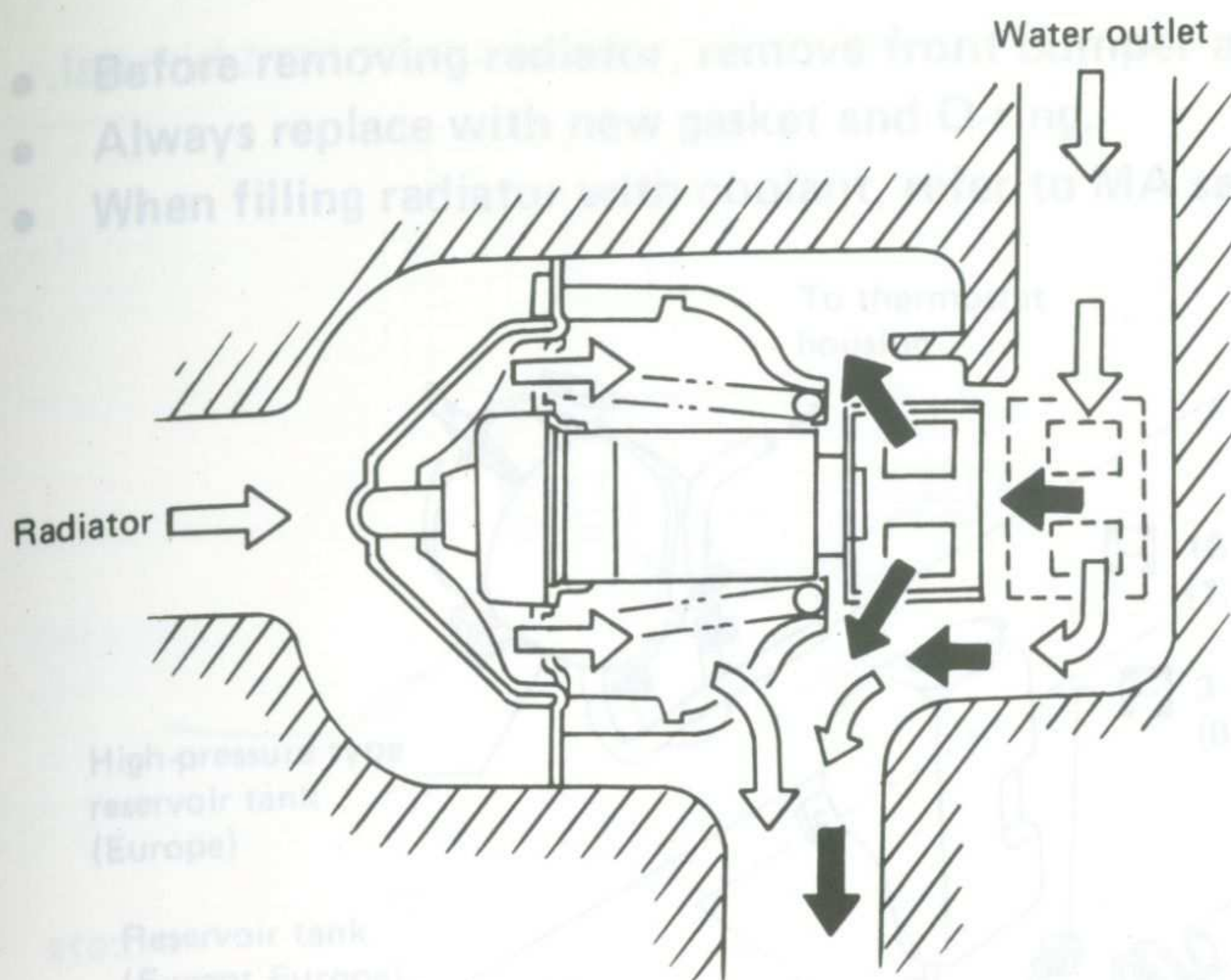
SLC554

Inspection

Check for excessive end play and rough operation.

COOLING SYSTEM

Description of Thermostat (Bottom by-pass coolant flow)



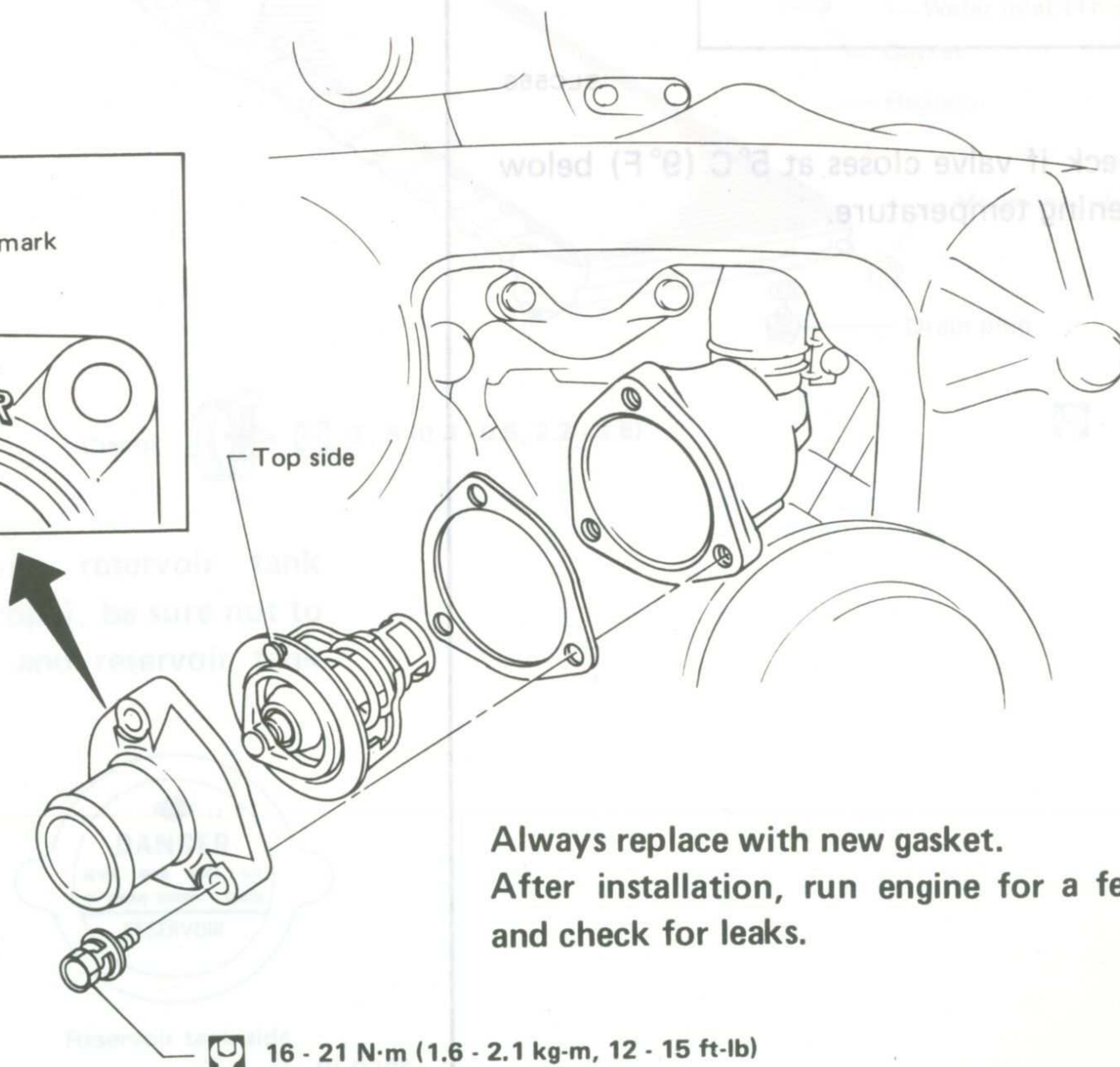
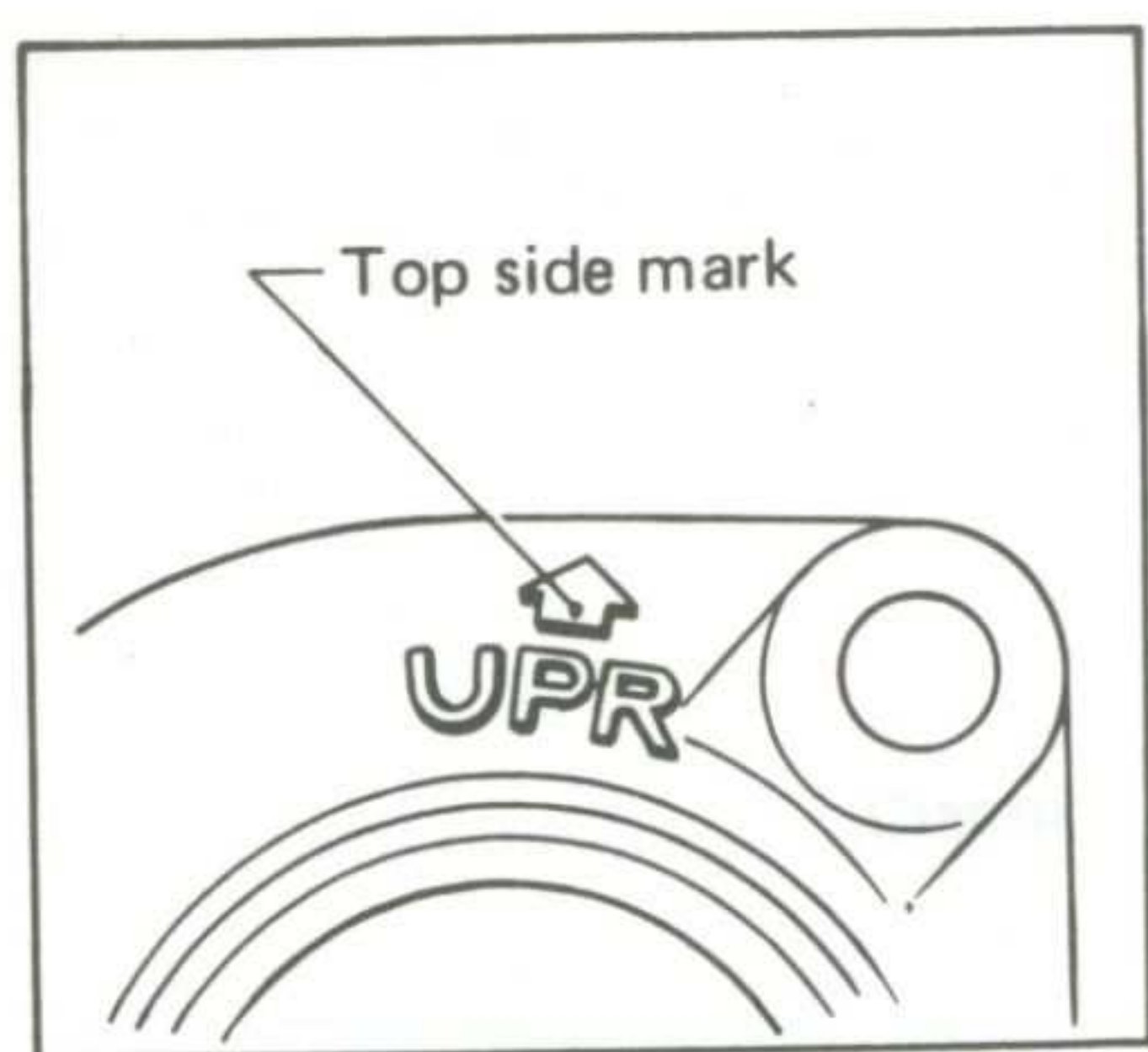
Thermostat	Coolant flow out through water outlet
→ Open	A few
→ Close	Much

Disassembly and Assembly of Thermostat

CAUTION:

Drain coolant from drain cocks on cylinder block side and radiator.

Remove radiator shroud, cooling fan and water suction pipe securing bolt, then remove thermostat.



Always replace with new gasket.

After installation, run engine for a few minutes, and check for leaks.

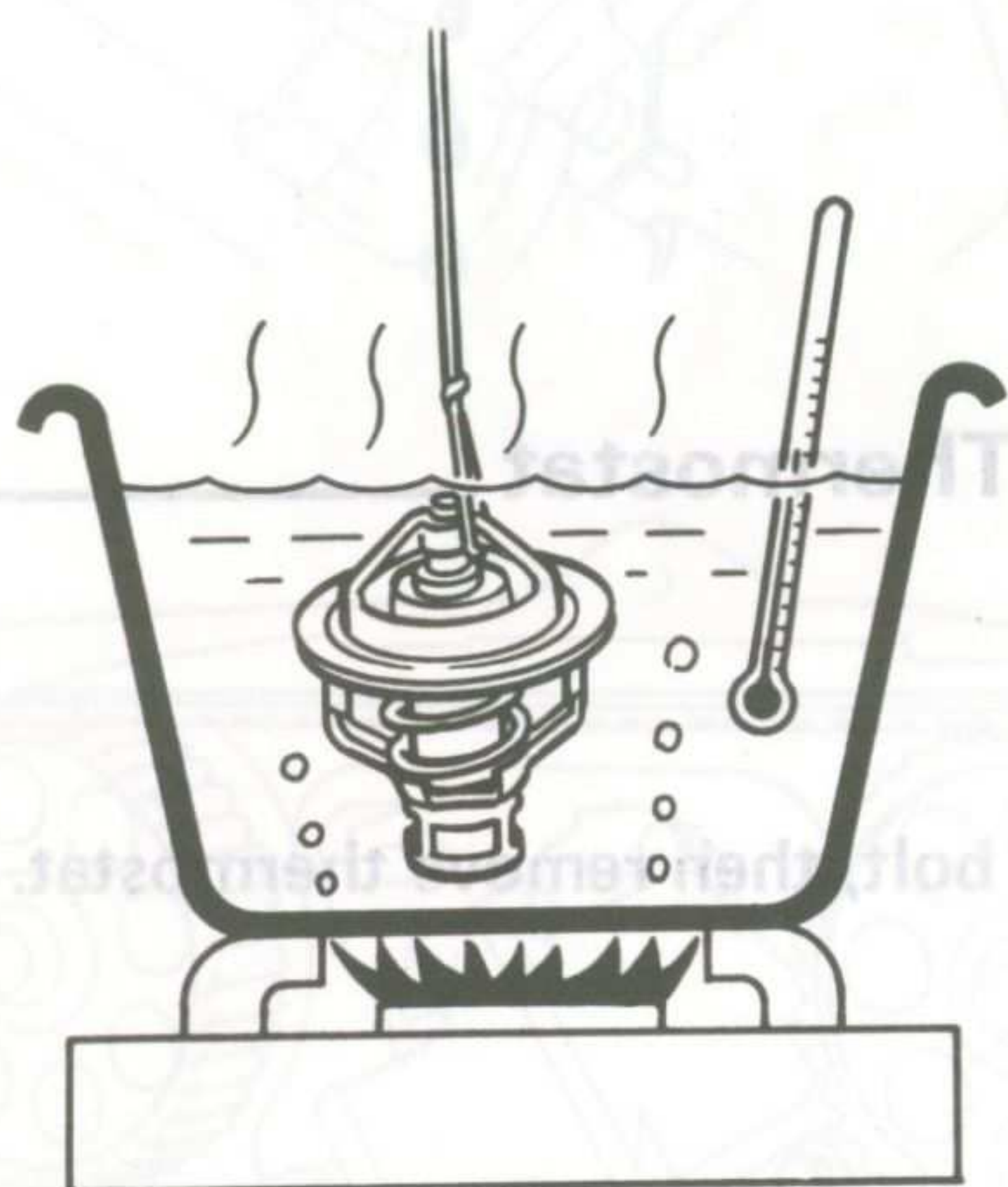
SLC555

COOLING SYSTEM

Inspection of Thermostat

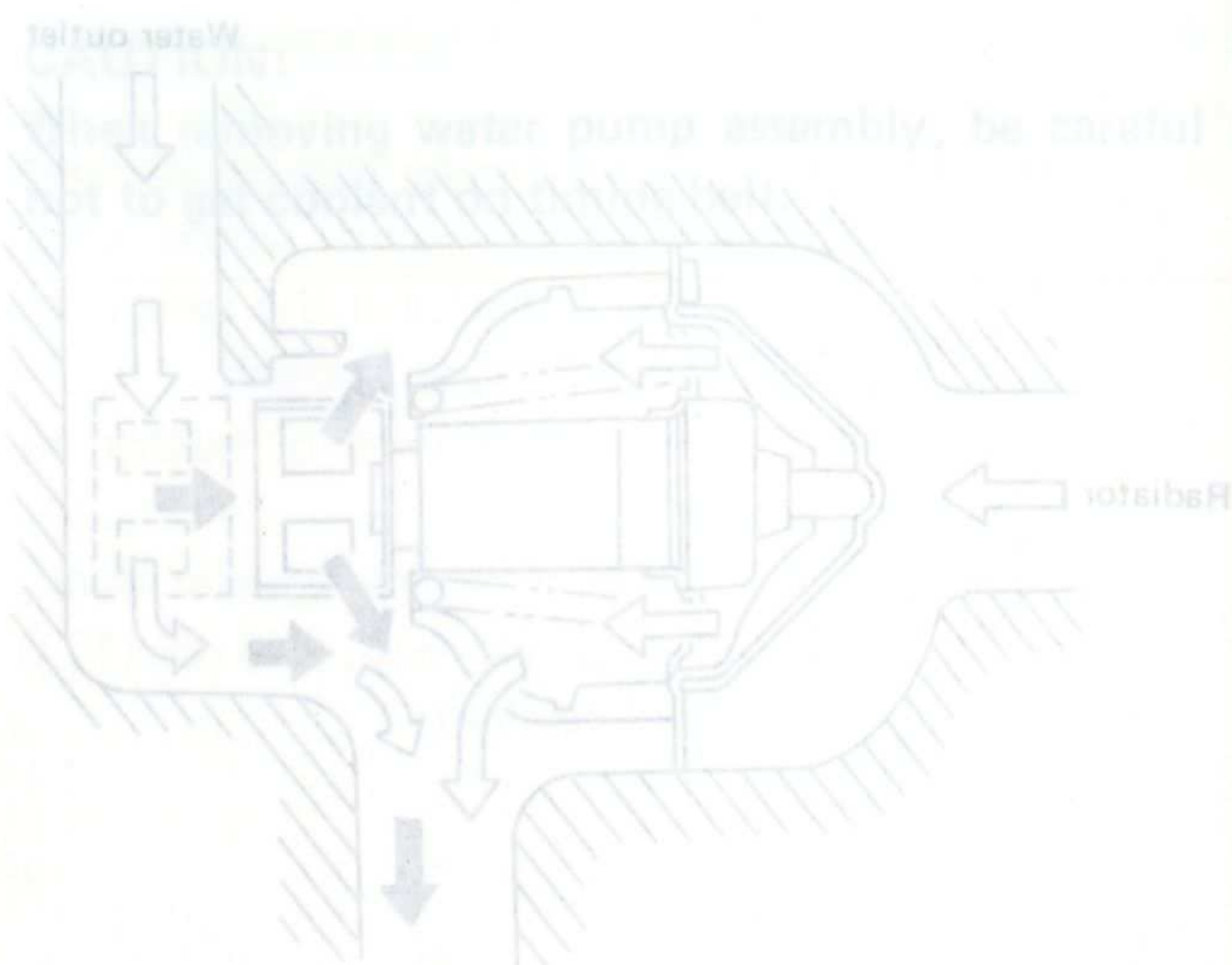
1. Check for valve seating condition at ordinary temperatures. It should seat tightly.
2. Check valve opening temperature and maximum valve lift.

	Standard
Valve opening temperature °C (°F)	76.5 (170)
Maximum valve lift mm/°C (in/°F)	10/90 (0.39/194)



SLC556

3. Then check if valve closes at 5°C (9°F) below valve opening temperature.



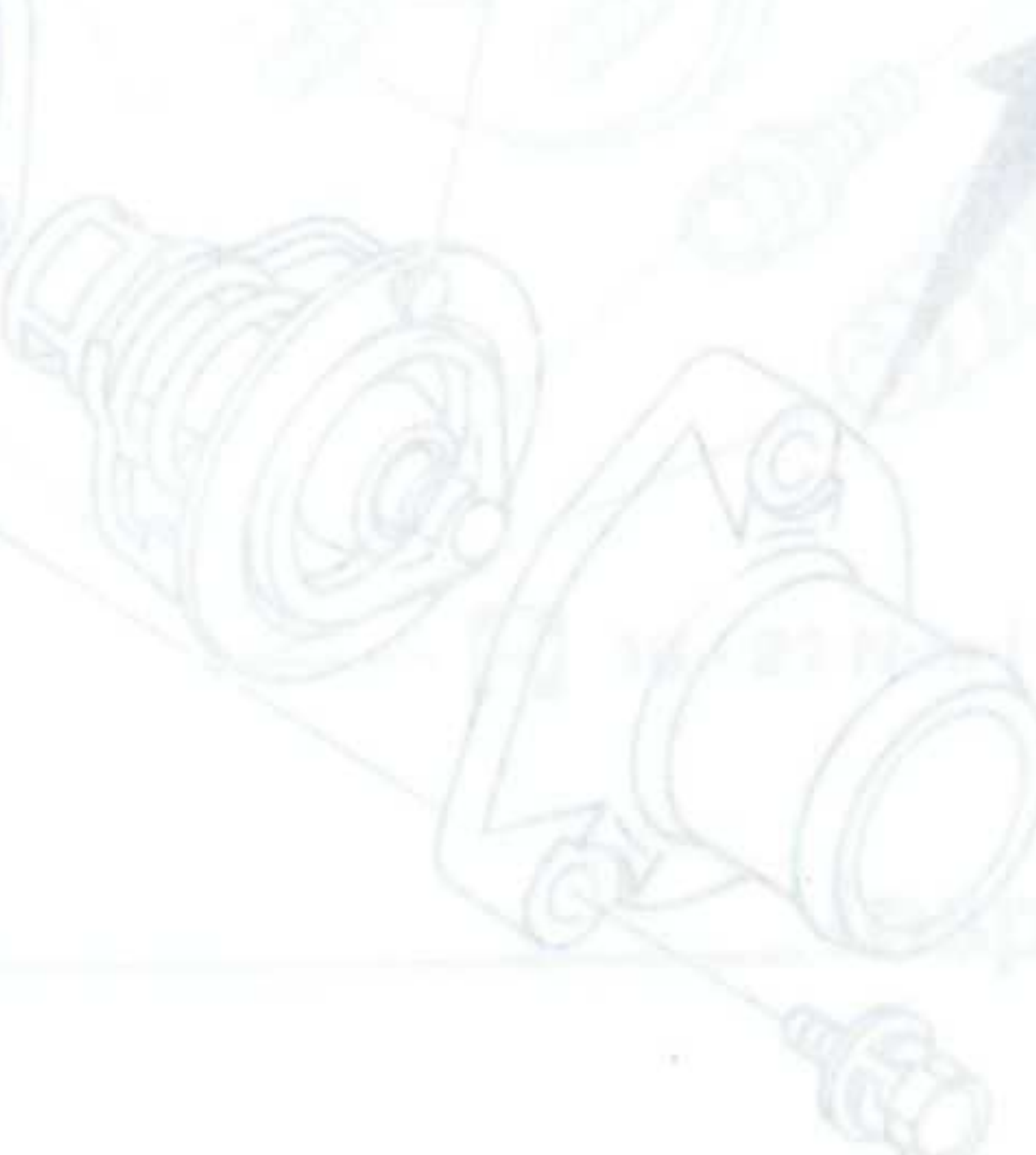
SLC556

CAUTION:

Remove radiator shroud, cooling fan and water suction pipe securing bolts. Drain coolant from drain cocks on cylinder block side and radiator.



Top side

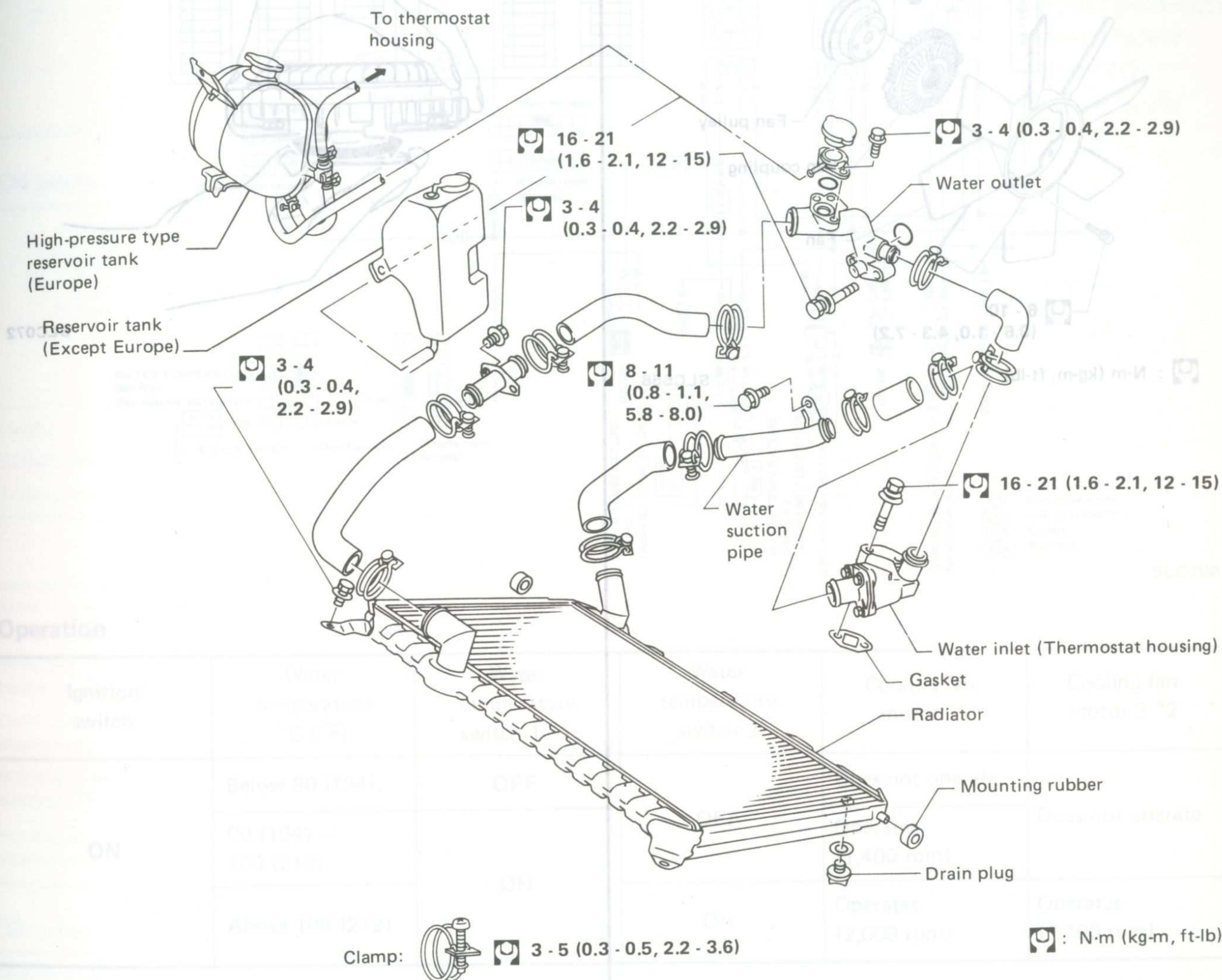


Check for excessive air and high operation.

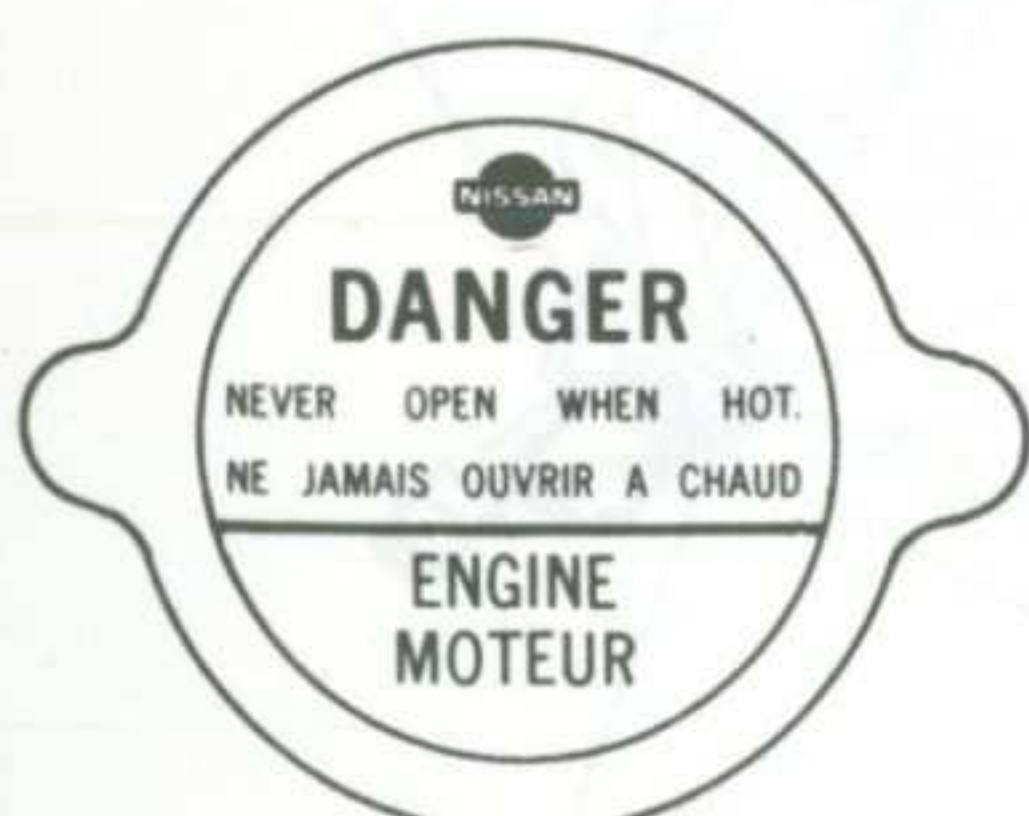
COOLING SYSTEM

Removal and Installation of Radiator

- Before removing radiator, remove front bumper assembly.
- Always replace with new gasket and O-ring.
- When filling radiator with coolant, refer to MA section.



- On high-pressure type reservoir tank equipped models (Europe), be sure not to mix up radiator cap and reservoir tank cap.



Engine side



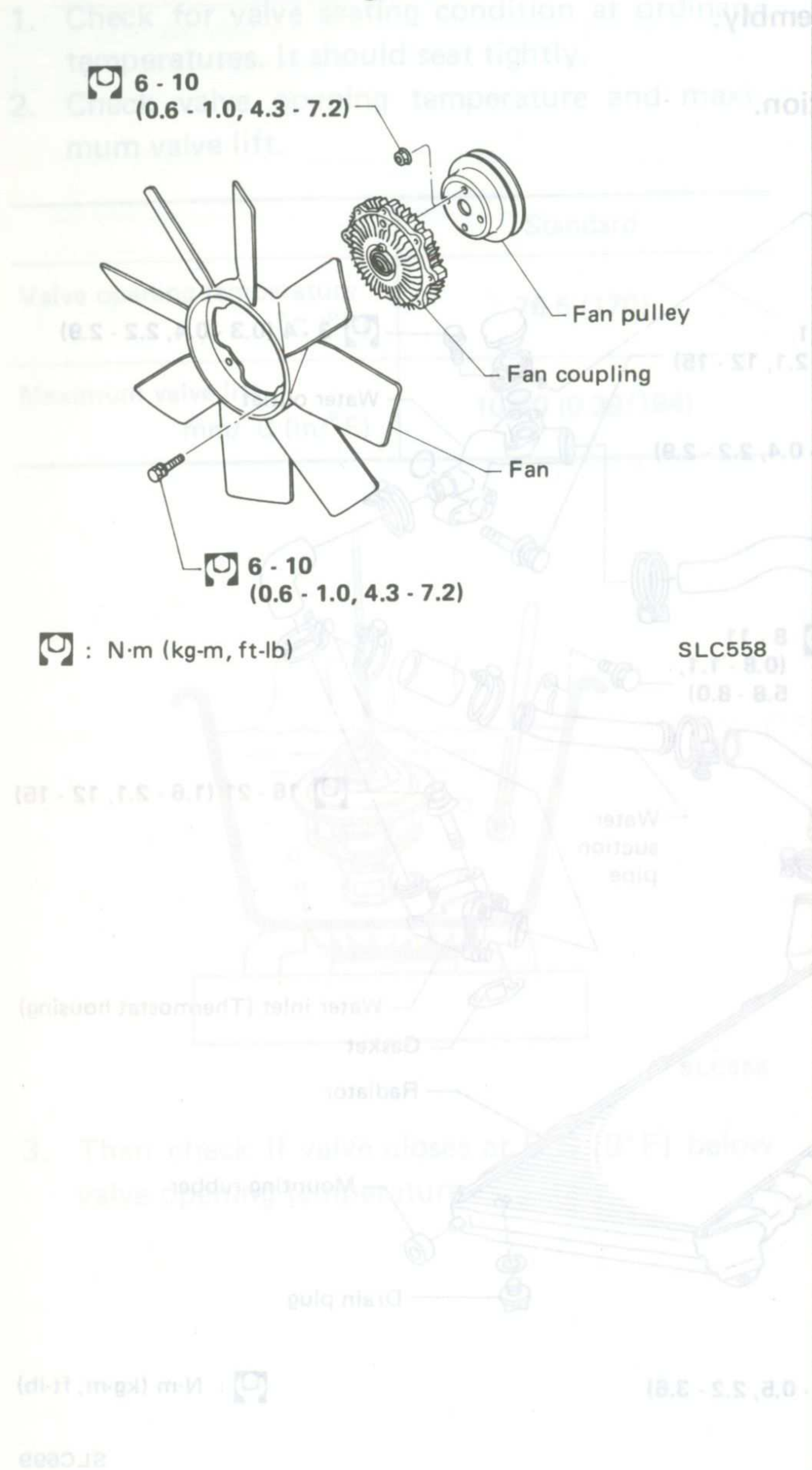
Reservoir tank side

SLC705

SLC699

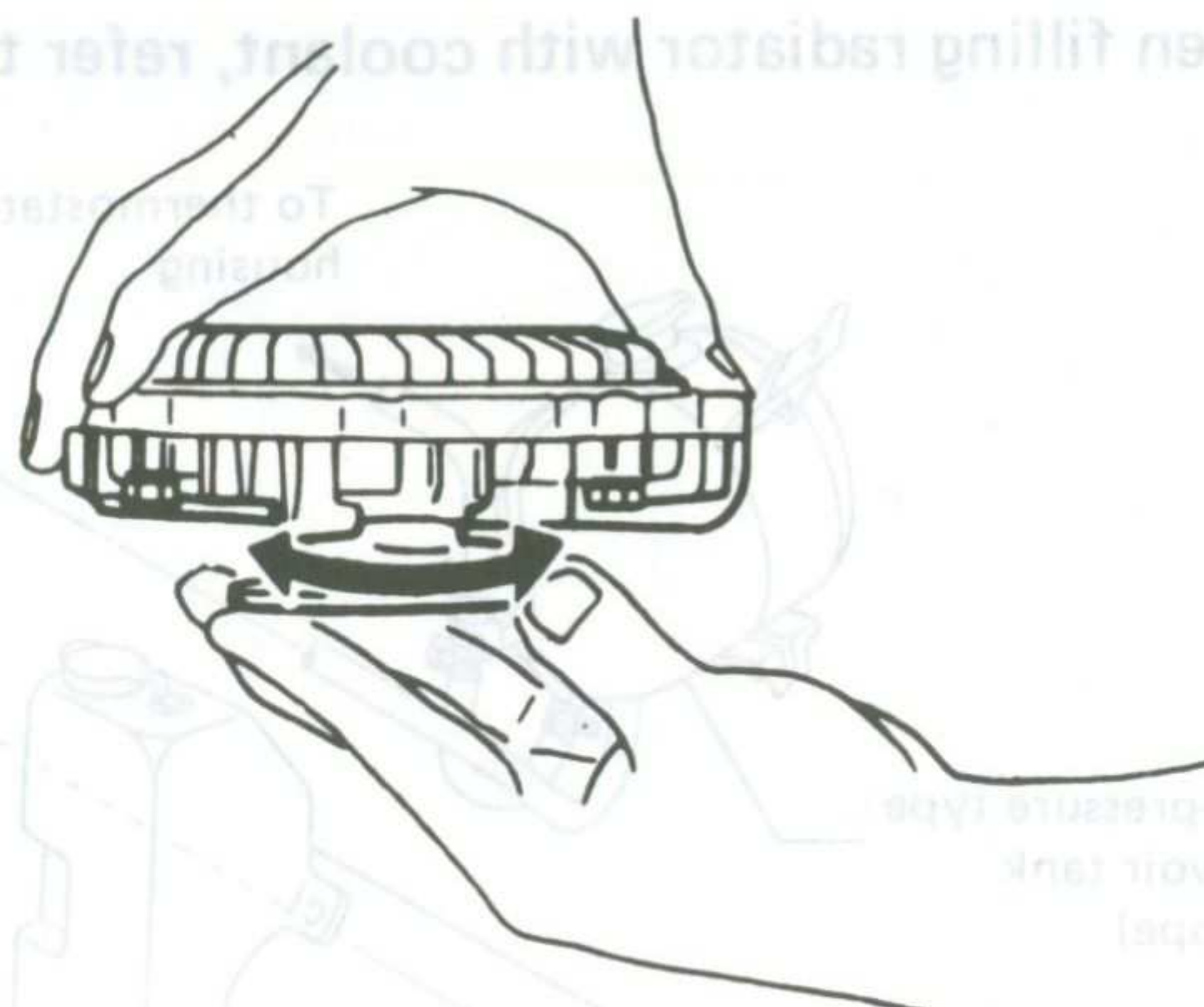
COOLING SYSTEM

Disassembly and Assembly of Cooling Fan



Inspection of Cooling Fan

Check fan coupling for oil leakage or bent bimetal.



SLC072



On high-pressure type reservoir tank equipped models (Europe), be sure not to mix up radiator cap and reservoir tank cap.



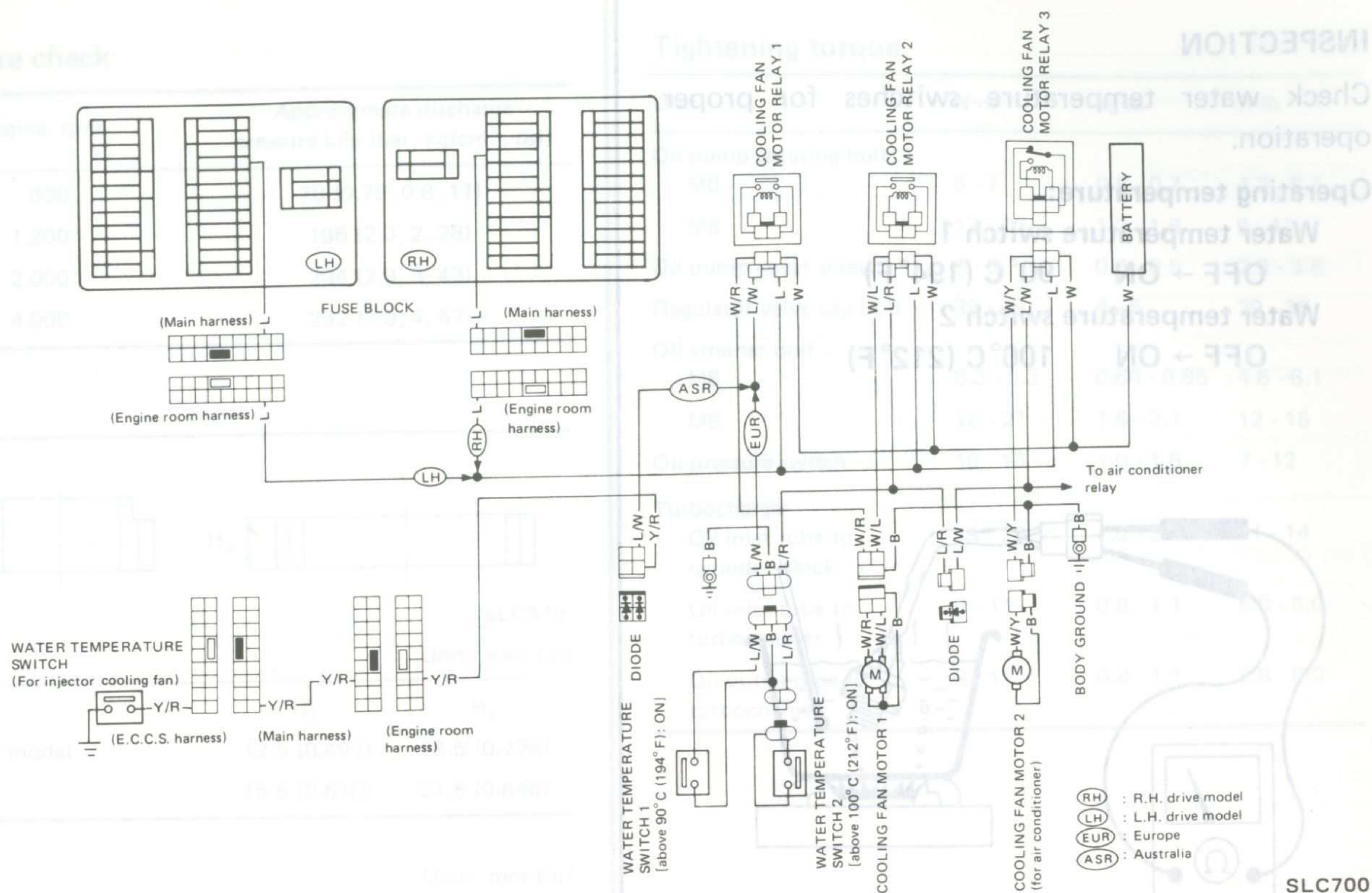
Reservoir tank side
SLC708



Engine side

COOLING SYSTEM

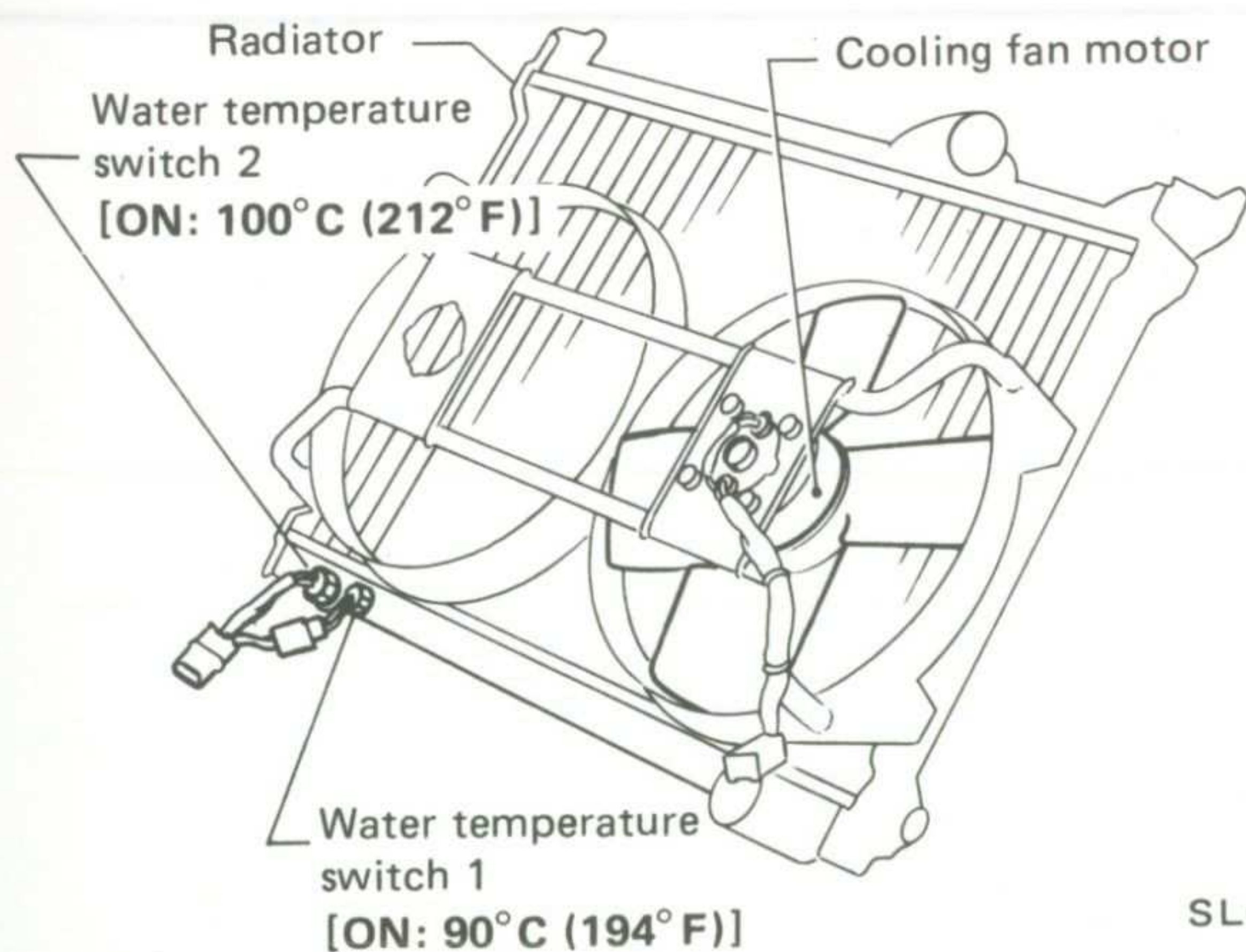
Electric Cooling Fan



SLC700

Operation

Ignition switch	Water temperature °C (°F)	Water temperature switch 1 *1	Water temperature switch 2	Cooling fan motor 1	Cooling fan motor 2 *2
ON	Below 90 (194)	OFF	OFF	Does not operate	Does not operate
	90 (194) – 100 (212)	ON		Operates (1,400 rpm)	
	Above 100 (212)		ON	Operates (2,000 rpm)	Operates (1,700 rpm)



SLC701

- *1 On Australia models, temperature switch for injector cooling fan is used instead of water temperature switch 1. The switch is installed on intake manifold and starts to actuate at 100°C (212°F), which is equivalent to a radiator coolant temperature of 90°C (194°F).
- *2 Cooling fan motor 2 operates when air conditioner switch is turned to ON regardless of water temperature.

COOLING SYSTEM

Electric Cooling Fan (Cont'd)

INSPECTION

Check water temperature switches for proper operation.

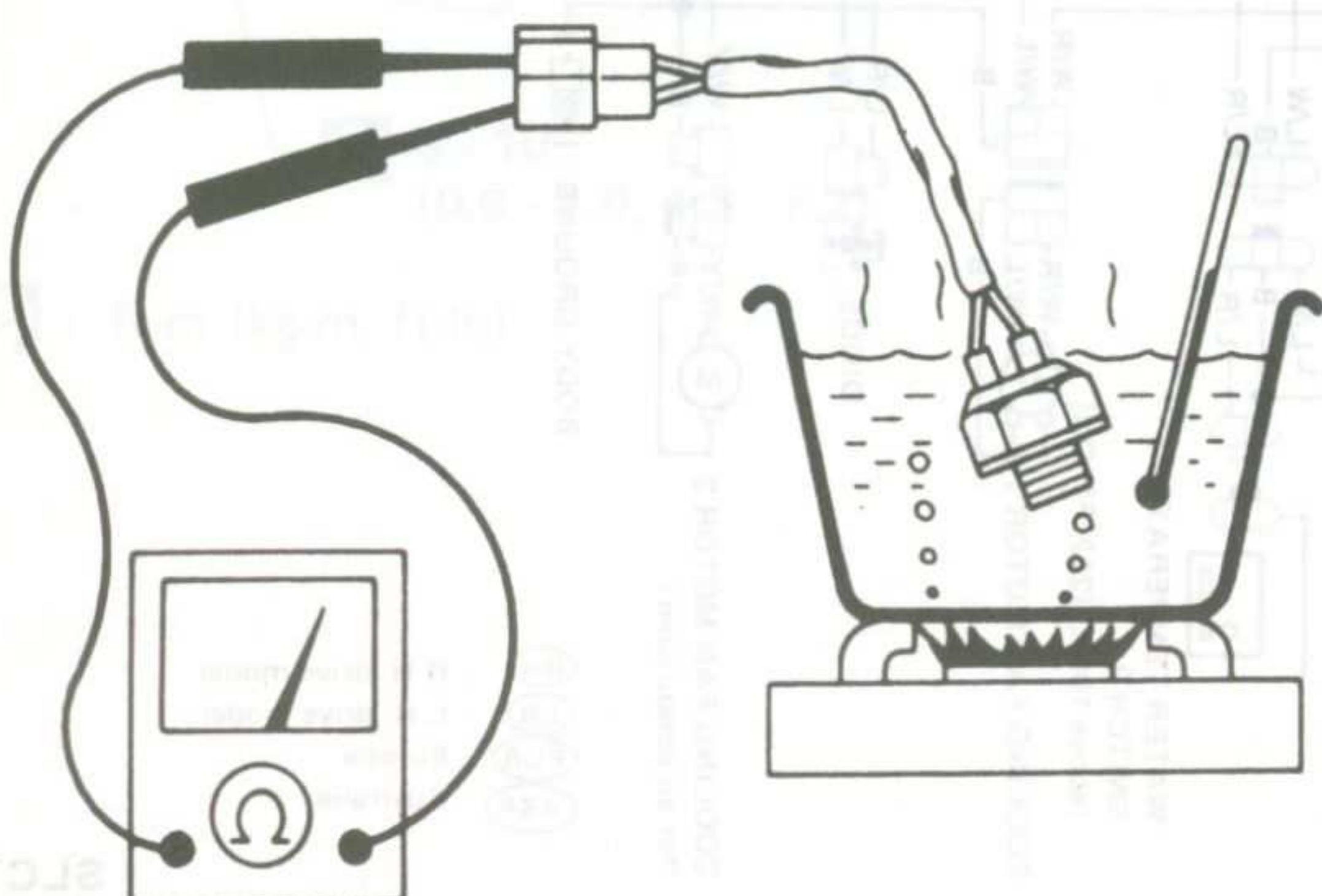
Operating temperature:

Water temperature switch 1

OFF → ON 90°C (194°F)

Water temperature switch 2

OFF → ON 100°C (212°F)

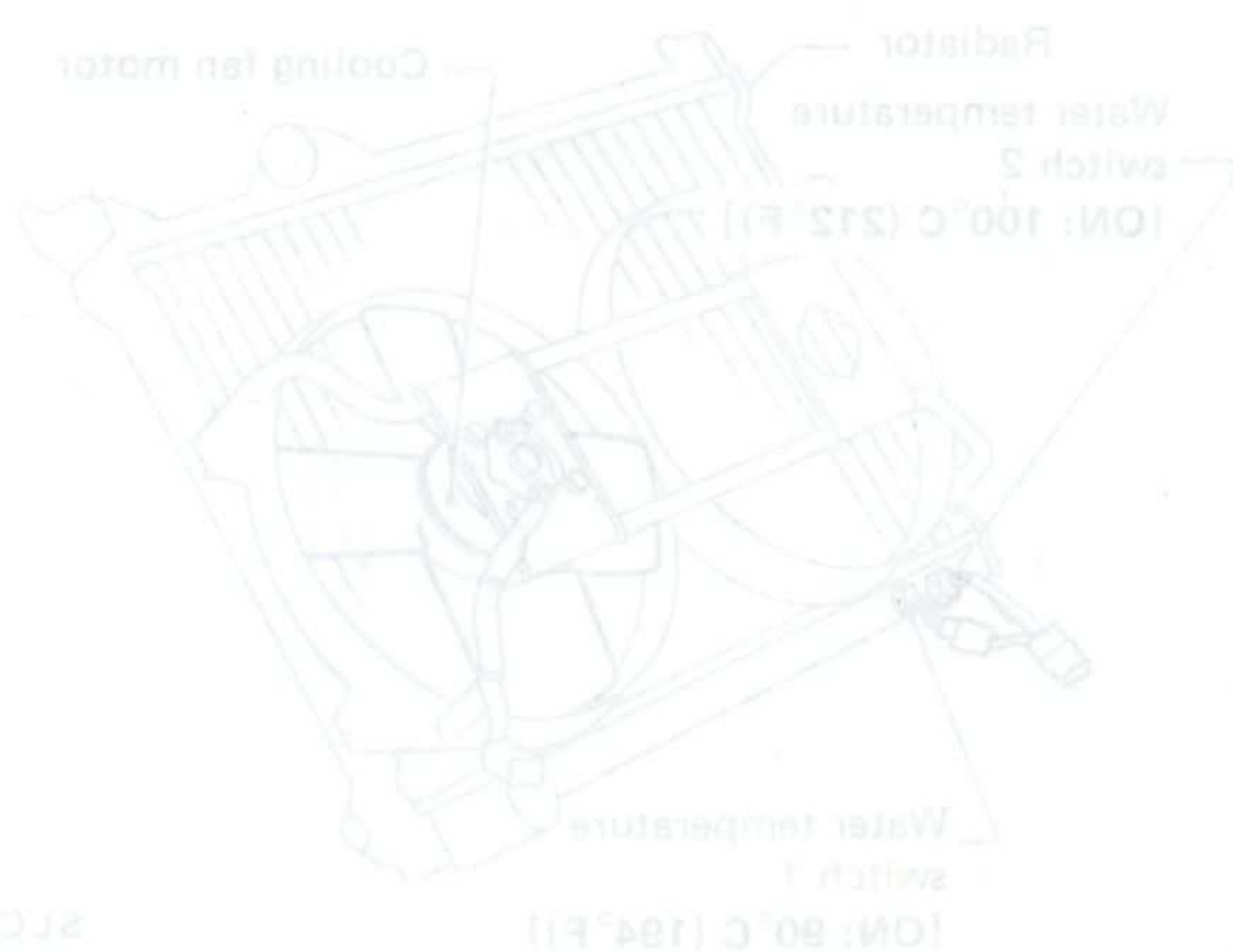


SLC463

Ignition switch	Water temperature °C (°F)	Water temperature switch 1 *1	Water temperature switch 2	Cooling fan motor 1	Cooling fan motor 2 *
ON	Below 90 (194)	OFF	OFF	Does not operate	Does not operate
	90 (194) - 100 (212)	ON	ON	Operates (1,400 rpm)	Operates (1,700 rpm)
	Above 100 (212)			Operates (1,700 rpm)	Operates (1,700 rpm)

*1 On Australia models, temperature switch for injector cooling fan is used instead of water temperature switch. The switch is installed on intake manifold and starts to actuate at 100°C (212°F), which is equivalent to a radiator coolant temperature of 90°C (194°F).

*2 Cooling fan motor 2 operates when air conditioner switch is turned to ON regardless of water temperature.



SLC767

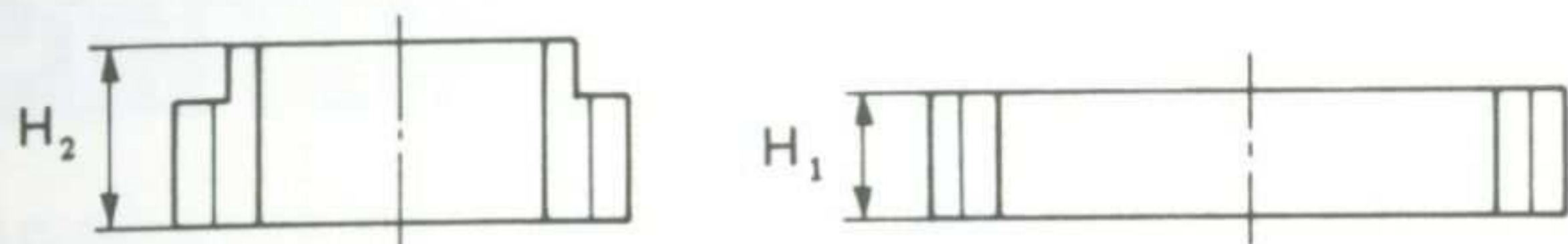
SERVICE DATA AND SPECIFICATIONS

Engine Lubrication System

Oil pressure check

Engine rpm	Approximate discharge pressure kPa (bar, kg/cm ² , psi)
600	78 (0.78, 0.8, 11)
1,200	196 (2.0, 2, 28)
2,000	294 (2.9, 3, 43)
4,000	392 (3.9, 4, 57)

Oil pump



SLC573

Unit: mm (in)

Height	H ₁	H ₂
Except turbo model	12.5 (0.492)	18.5 (0.728)
Turbo model	15.5 (0.610)	21.5 (0.846)

Unit: mm (in)

Body to outer gear clearance ①	0.11 - 0.20 (0.0043 - 0.0079)
Inner gear to crescent clearance ②	0.12 - 0.23 (0.0047 - 0.0091)
Outer gear to crescent clearance ③	0.21 - 0.32 (0.0083 - 0.0126)
Housing to inner gear clearance ④	0.05 - 0.09 (0.0020 - 0.0035)
Housing to outer gear clearance ⑤	0.05 - 0.11 (0.0020 - 0.0043)

Oil pressure regulator valve

Opening pressure	373 - 412 (3.73 - 4.12,
kPa (bar, kg/cm ² , psi)/rpm	3.8 - 4.2, 54 - 60)/2,000

Tightening torque

Unit	N·m	kg-m	ft-lb
Oil pump securing bolt			
M6	6 - 7	0.6 - 0.7	4.3 - 5.1
M8	12 - 16	1.2 - 1.6	9 - 12
Oil pump cover screw	4 - 5	0.4 - 0.5	2.9 - 3.6
Regulator valve cap bolt	39 - 49	4 - 5	29 - 36
Oil strainer bolt			
M6	6.3 - 8.3	0.64 - 0.85	4.6 - 6.1
M8	16 - 21	1.6 - 2.1	12 - 15
Oil pressure switch	10 - 16	1.0 - 1.6	7 - 12
Turbocharger			
Oil inlet tube to cylinder block	15 - 20	1.5 - 2.0	11 - 14
Oil inlet tube to turbocharger	8 - 11	0.8 - 1.1	5.8 - 8.0
Oil outlet pipe to turbocharger	8 - 11	0.8 - 1.1	5.8 - 8.0

SERVICE DATA AND SPECIFICATIONS

Engine Cooling System

Radiator

Unit: kPa (bar, kg/cm², psi)

Cap relief pressure	59 - 98 (0.59 - 0.98, 0.6 - 1.0, 9 - 14)
Leakage test pressure	157 (1.57, 1.6, 23)

Thermostat

Standard

Valve opening temperature	76.5 (170)
°C (°F)	
Maximum valve lift	10/90 (0.39/194)
mm/°C (in/°F)	

Fan coupling

Cut off point	rpm	
Low	Except turbo model	750
	Turbo model	950
High	Except turbo model	2,450
	Turbo model	2,700
Low → High temperature	°C (°F)	60 - 70 (140 - 158)

Temperature switch (Turbocharged model)

Operating temperature

OFF → ON	°C (°F)	100 (212)
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Tightening torque

Unit	N·m	kg·m	ft·lb
Water pump securing bolt	16 - 21	1.6 - 2.1	12 - 15
Thermostat housing securing bolt	16 - 21	1.6 - 2.1	12 - 15
Water inlet securing bolt	16 - 21	1.6 - 2.1	12 - 15
Water outlet securing bolt	16 - 21	1.6 - 2.1	12 - 15
Coolant filler housing bolt	3 - 4	0.3 - 0.4	2.2 - 2.9
Radiator securing bolt	3 - 4	0.3 - 0.4	2.2 - 2.9
Radiator hose clamp	3 - 5	0.3 - 0.5	2.2 - 3.6
Cooling fan securing bolt	5.9 - 8.3	0.6 - 0.85	4.3 - 6.1
Fan coupling securing bolt	5.9 - 8.3	0.6 - 0.85	4.3 - 6.1

Oil pressure check

Engine rpm	Approximate discharge pressure kPa (bar, kg/cm ² , psi)
600	78 (0.78, 0.8, 11)
1,500	198 (2.0, 2.2, 28)
2,000	294 (3.0, 3.2, 43)
4,000	392 (4.0, 4.2, 57)

Oil pump



Height	Unit: mm (in)
Except turbo model	152 (6.0)
Turbo model	152 (6.0)

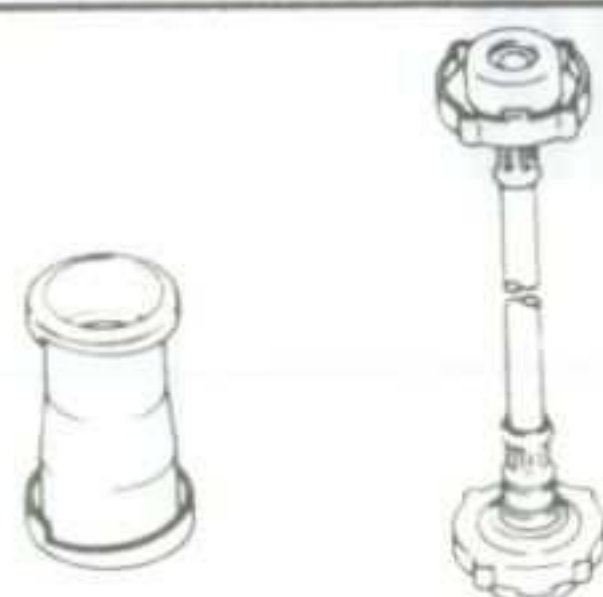
Unit: mm (in)	Height
0.11 - 0.20 (0.0043 - 0.0079)	Body to outer gear clearance (1)
0.13 - 0.23 (0.0051 - 0.0091)	Inner gear to crescent clearance (2)
0.21 - 0.32 (0.0083 - 0.0126)	Outer gear to crescent clearance (3)
0.02 - 0.08 (0.0020 - 0.0031)	Housing to inner gear clearance (4)
0.02 - 0.11 (0.0020 - 0.0043)	Housing to outer gear clearance (5)

Oil pressure regulator valve

Opening pressure	Unit: kPa (bar, kg/cm ² , psi)
373 - 412 (3.73 - 4.12)	
2.8 - 4.2 (0.28 - 0.42)	

SPECIAL SERVICE TOOL

Tool number	Tool name
EG17650301	Radiator cap tester adapter



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