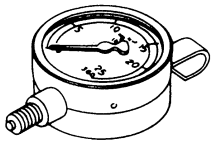
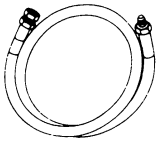
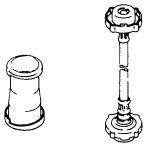
ENGINE LUBRICATION & COOLING SYSTEMS

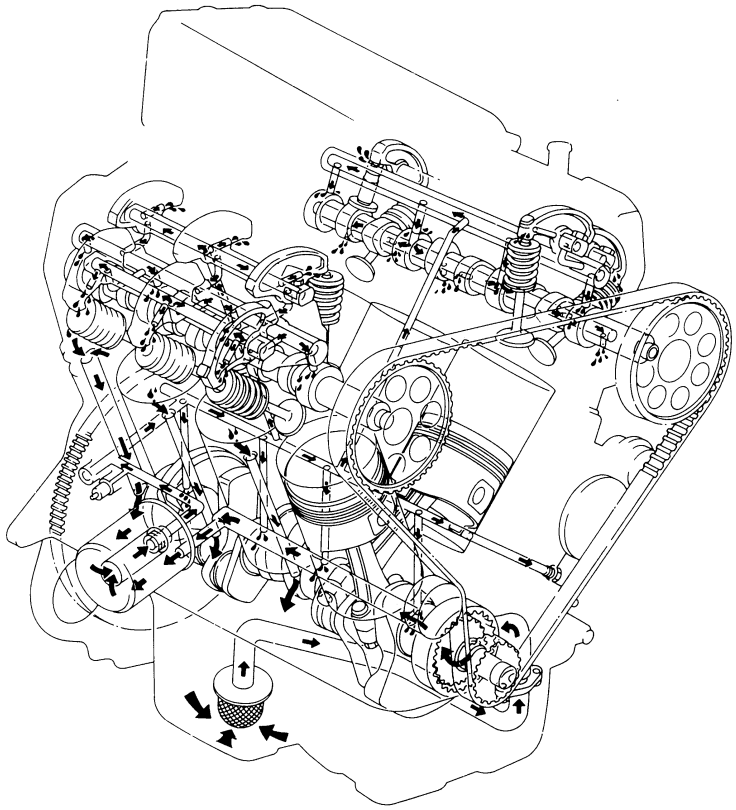
SECTION LC

CONTENTS

SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.) Tool name	Description	Engine application	
		VG30i	Z24i
ST25051001 (J25695-1) Oil pressure gauge		X	X
ST25052000 (J25695-2) Hose	 Adapting oil pressure gauge to cylinder block	X	X
EG17650301 (–) Radiator cap tester adapter	 Adapting radiator cap tester to radiator filler neck	X	X

Lubrication Circuit

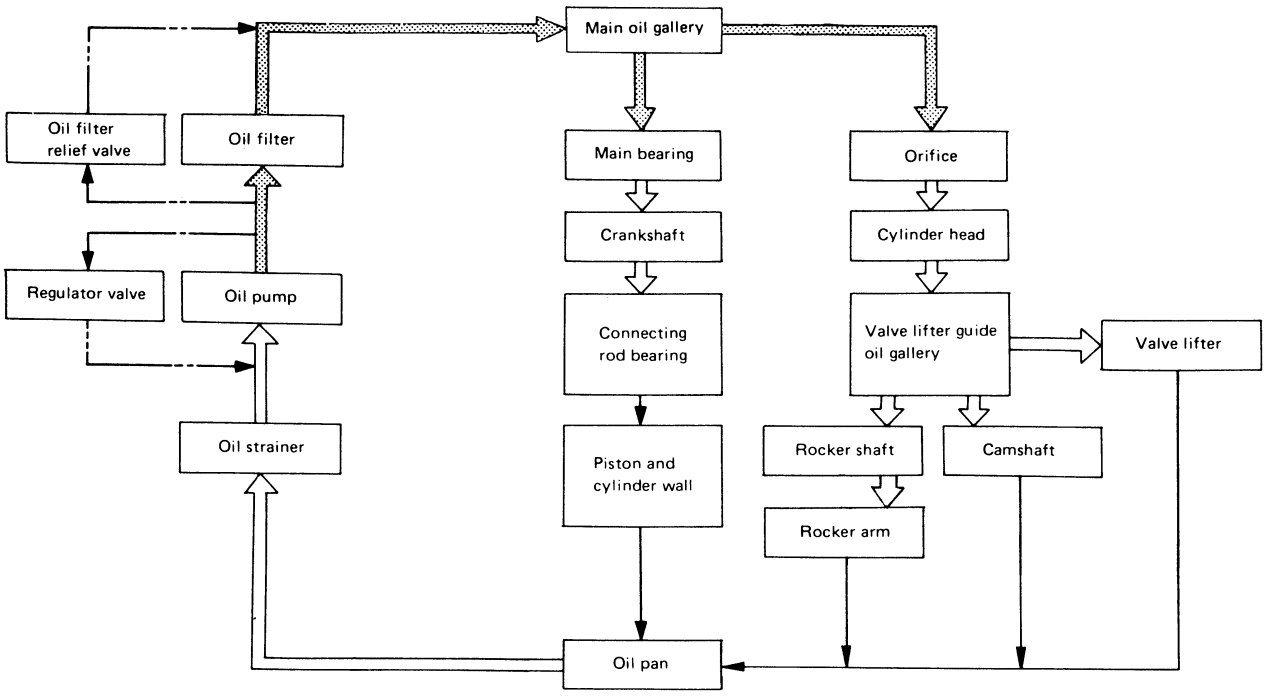


Note:

: Oil passage

: Oil gallery in cylinder block

: By-pass passage

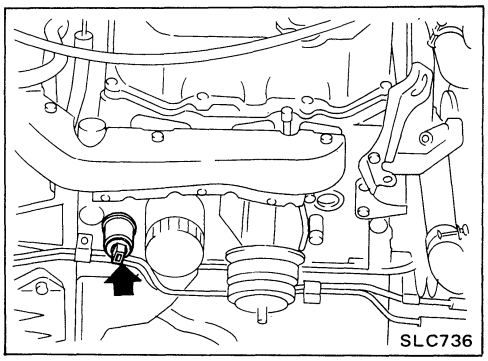


SLC725

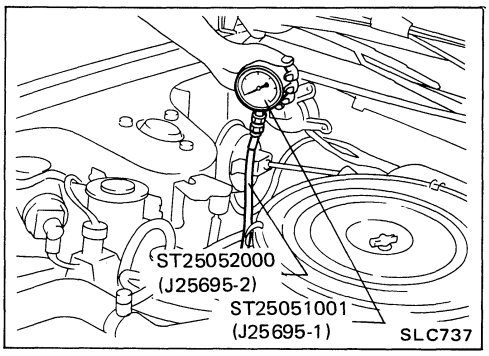
Oil Pressure Check

WARNING:

- **Be careful not to burn yourself, as the engine and oil may be hot.**
- **Oil pressure check should be done in "Neutral" gear position.**



1. Check oil level.
2. Remove oil pressure switch.



3. Install pressure gauge.
4. Start engine and warm it up to normal operating temperature, and then check oil pressure with engine running under no-load.

Engine rpm	Approximate discharge pressure kPa (kg/cm^2, psi)
Idle speed	More than 59 (0.6, 9)
3,200	363 - 461 (3.7 - 4.7, 53 - 67)

If difference is extreme, check oil passage and oil pump for oil leaks.

5. Install oil pressure switch.

Use proper liquid sealant.

Oil pressure switch:

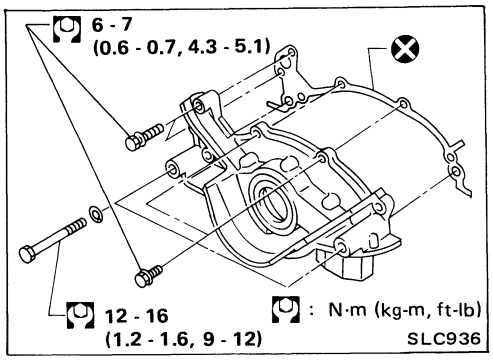
: 10 - 16 N·m

(1.0 - 1.6 kg-m, 7 - 12 ft-lb)

Oil Pump

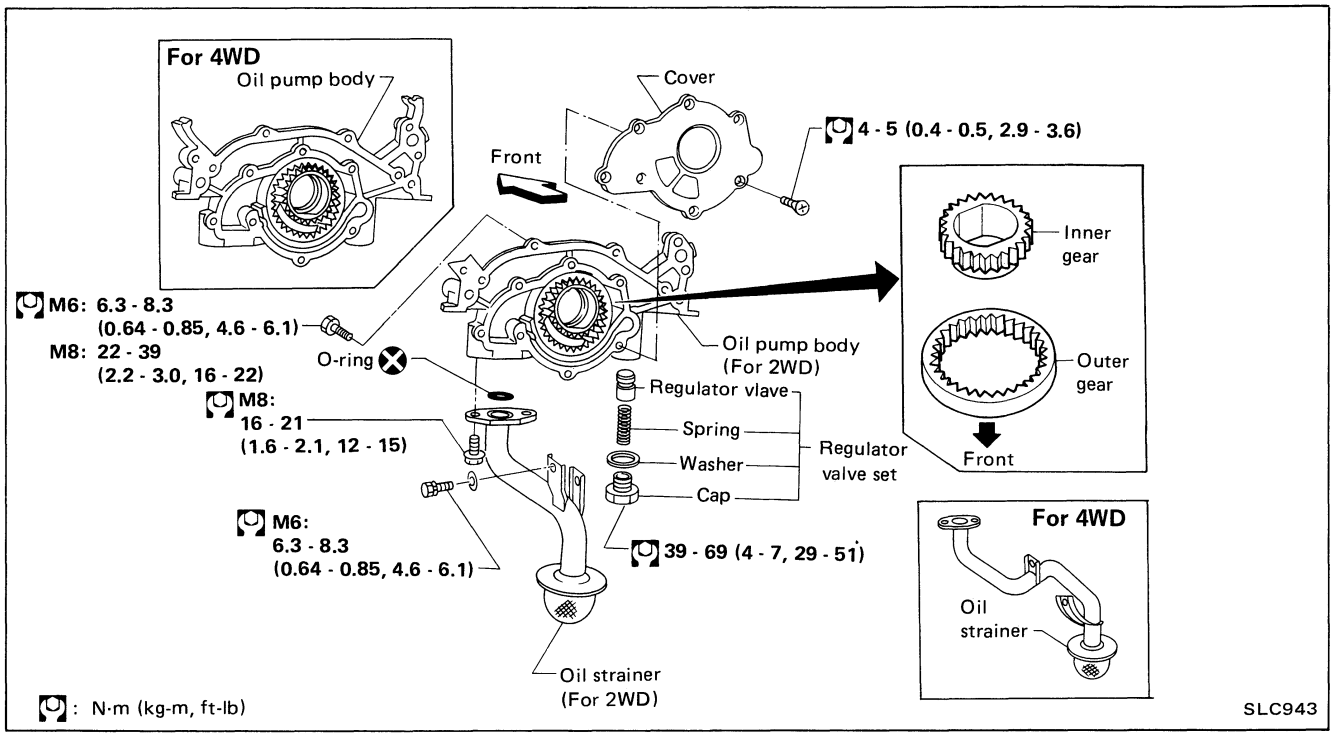
REMOVAL

1. Drain oil.
2. Remove oil pan.



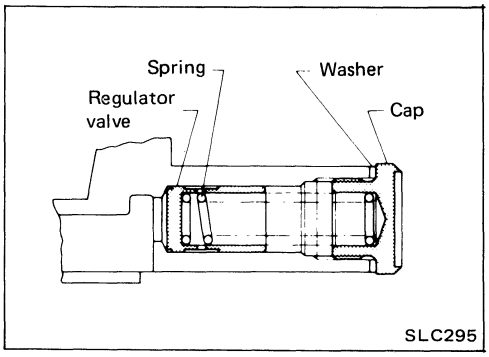
3. Remove oil pump assembly.

DISASSEMBLY AND ASSEMBLY



- **When installing oil pump, apply engine oil to inner and outer gear.**
- **Be sure that O-ring is properly fitted on.**

Oil Pump (Cont'd)

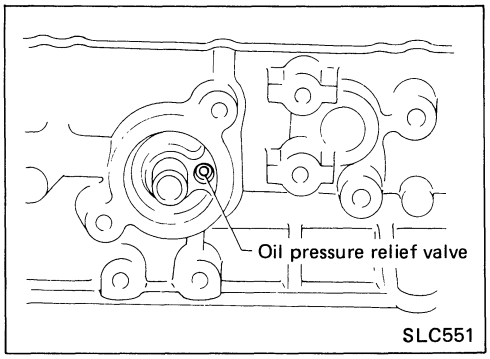


SLC295

REGULATOR VALVE INSPECTION

1. Visually inspect components for wear and damage.
2. Check oil pressure regulator valve sliding surface and valve spring.
3. Coat regulator valve with engine oil and check that it falls smoothly into the valve hole by its own weight.

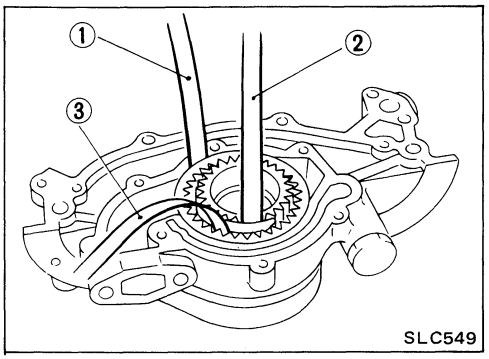
If damaged, replace regulator valve set or oil pump assembly.



SLC551

OIL PRESSURE RELIEF VALVE INSPECTION

Inspect oil pressure relief valve for movement, cracks and breaks by pushing the ball. If replacement is necessary, remove valve by prying it out with a screwdriver.
Install a new valve in place by tapping it.



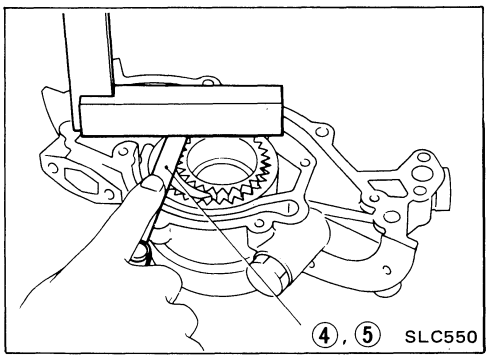
SLC549

OIL PUMP INSPECTION

Using a feeler gauge, check the following clearance.

Unit: mm (in)

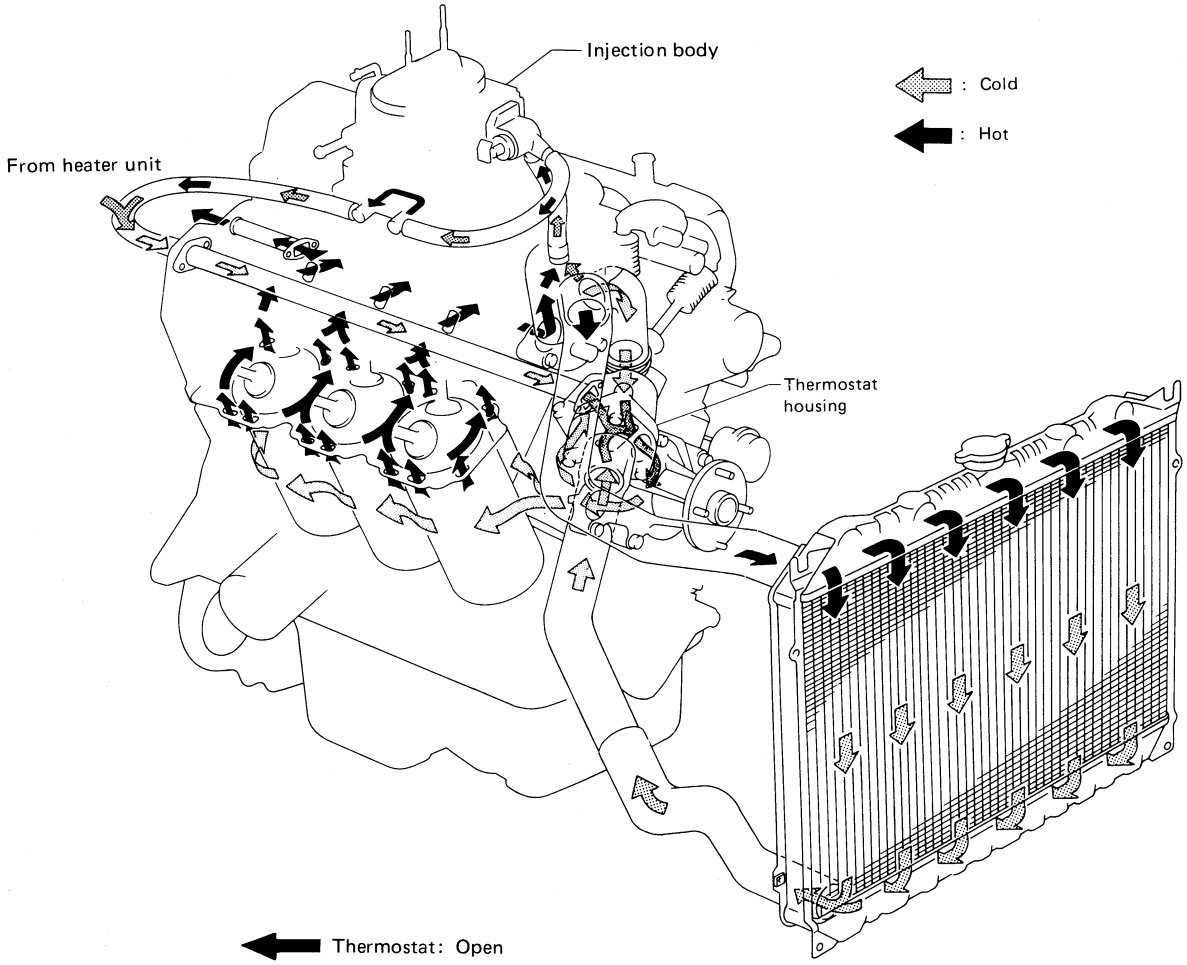
Body to outer gear clearance ①	0.11 - 0.20 (0.0043 - 0.0079)
Innter gear to crescent clearance ②	0.12 - 0.23 (0.0047 - 0.0091)
Outer gear to crescent clearance ③	0.21 - 0.32 (0.0083 - 0.0126)
Housing to inner gear clearance ④	0.05 - 0.09 (0.0020 - 0.0035)
Housing to outer gear clearance ⑤	0.05 - 0.11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

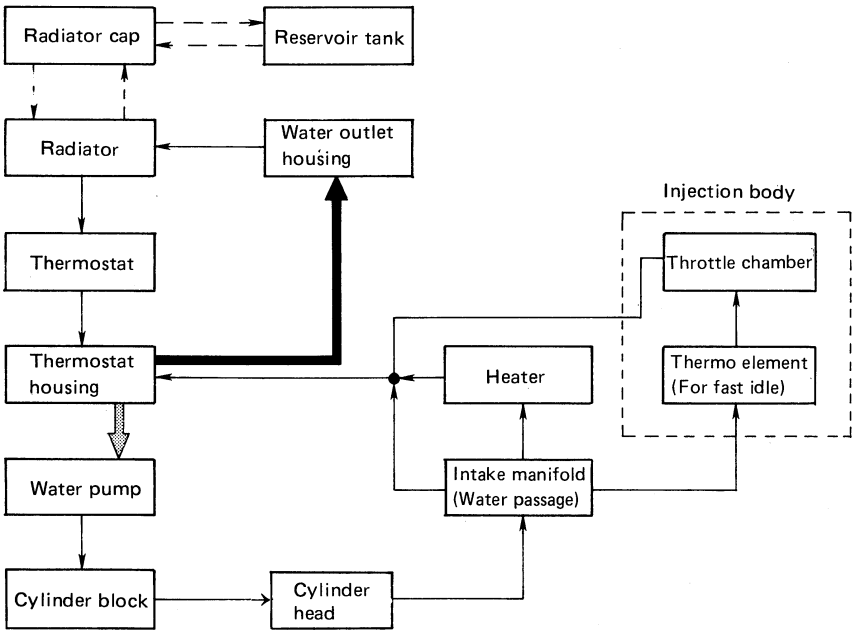


SLC550

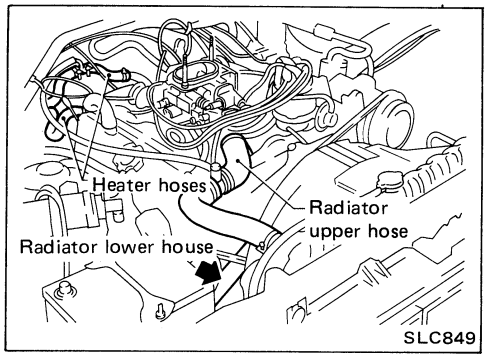
If it exceeds the limit, replace gear set or entire oil pump assembly.

Cooling Circuit





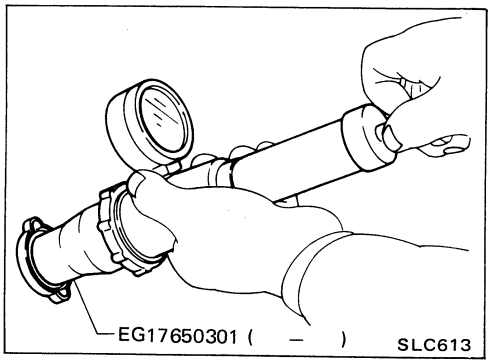
SLC819



Cooling System Inspection

CHECKING HOSES

Check hoses for proper attachment, leaks, cracks, damage, loose connections, chafing and deterioration.



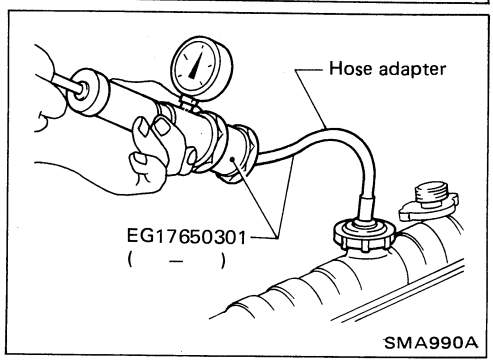
CHECKING RADIATOR CAP

Apply pressure to radiator cap by means of a cap tester to see if it is satisfactory.

Radiator cap relief pressure:

78 - 98 kPa

(0.8 - 1.0 kg/cm^2, 11 - 14 psi)



CHECKING COOLING SYSTEM FOR LEAKS

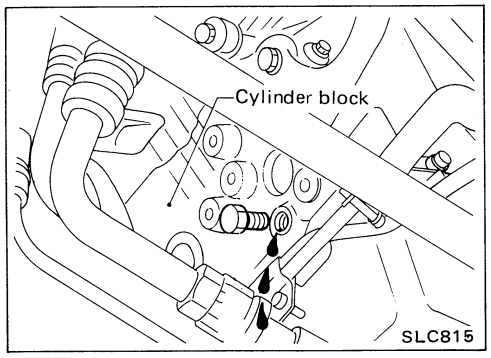
Apply pressure to the cooling system by means of a tester to check for leakage.

Testing pressure:

157 kPa (1.6 kg/cm^2, 23 psi)

CAUTION:

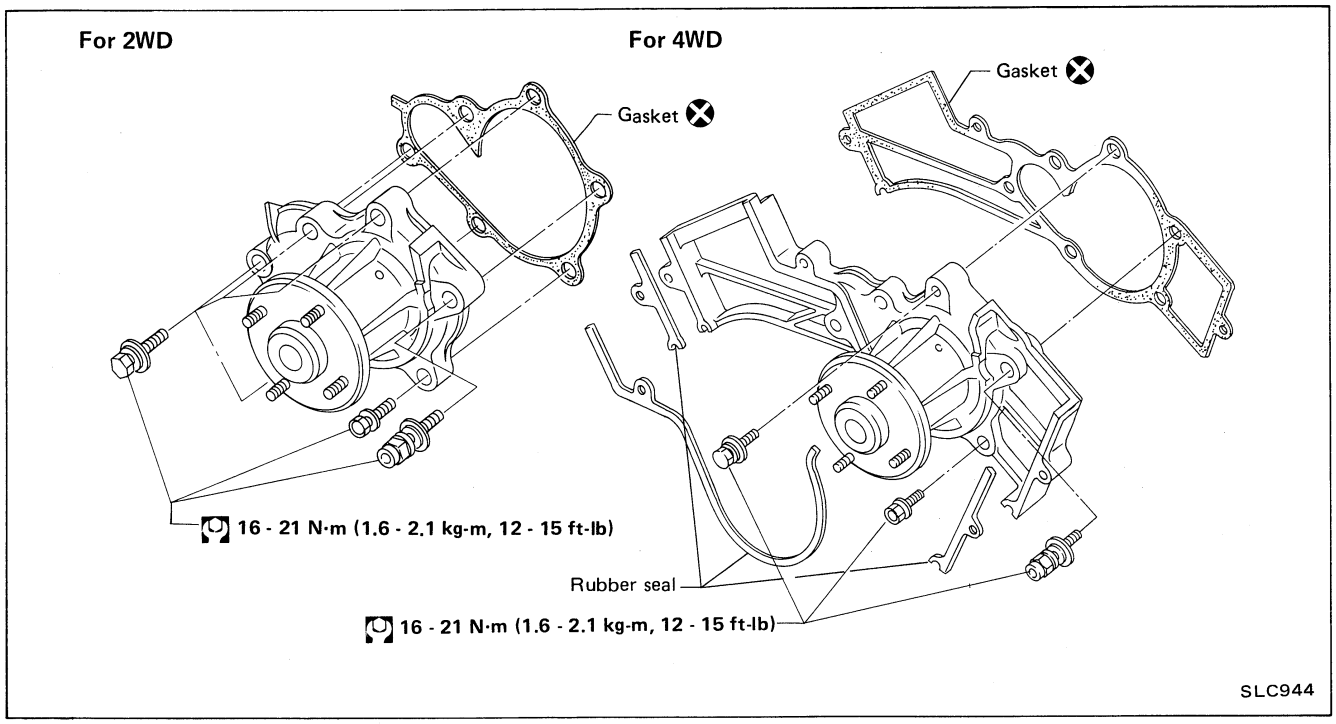
Higher than the specified pressure may cause radiator damage.



Water Pump

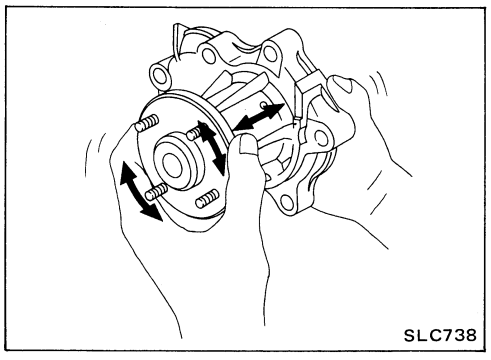
REMOVAL AND INSTALLATION

Drain coolant from drain plug behind the alternator from cylinder block and radiator.



CAUTION:

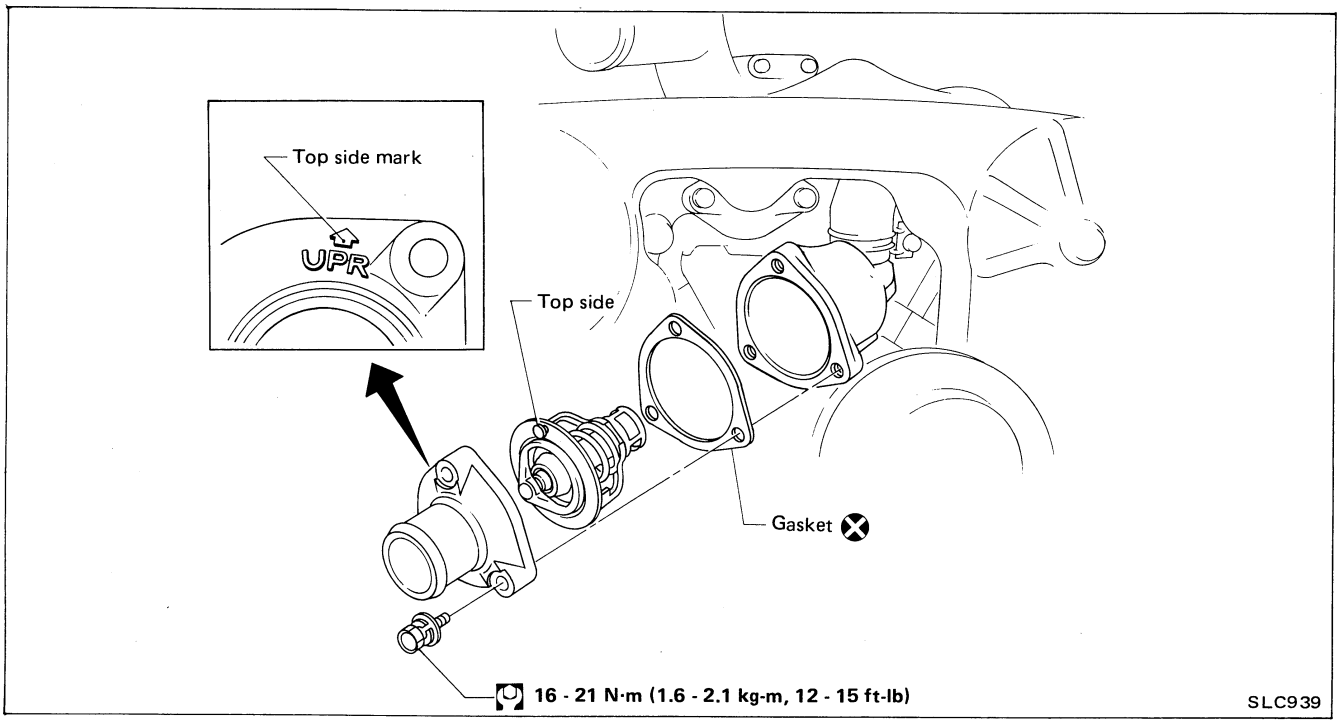
- **When removing water pump assembly, be careful not to get coolant on timing belt.**
- **Water pump cannot be disassembled and should be replaced as a unit.**
- **To avoid deforming timing cover, make sure there is adequate clearance between cover and hose clamp.**
- **After installing water pump, connect hose and clamp securely, then check for leaks using radiator cap tester.**



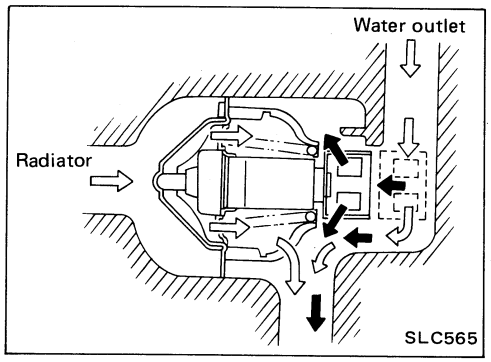
INSPECTION

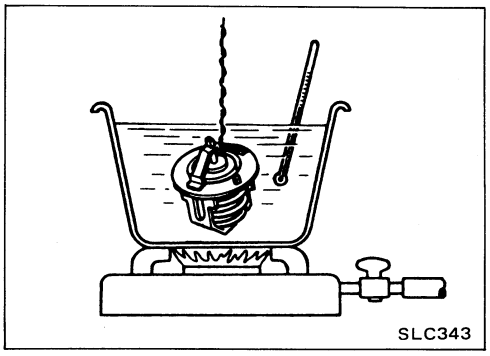
1. Check for badly rusted or corroded body assembly and vane.
2. Check for rough operation due to excessive end play.

Thermostat



- **After installation, run engine for a few minutes, and check for leaks.**
- **Be careful not to spill coolant over engine compartment. Place a rag to absorb coolant.**





DESCRIPTION

Thermostat	Coolant flows out through water outlet
Open	⇨ A little
Closed	➡ Much

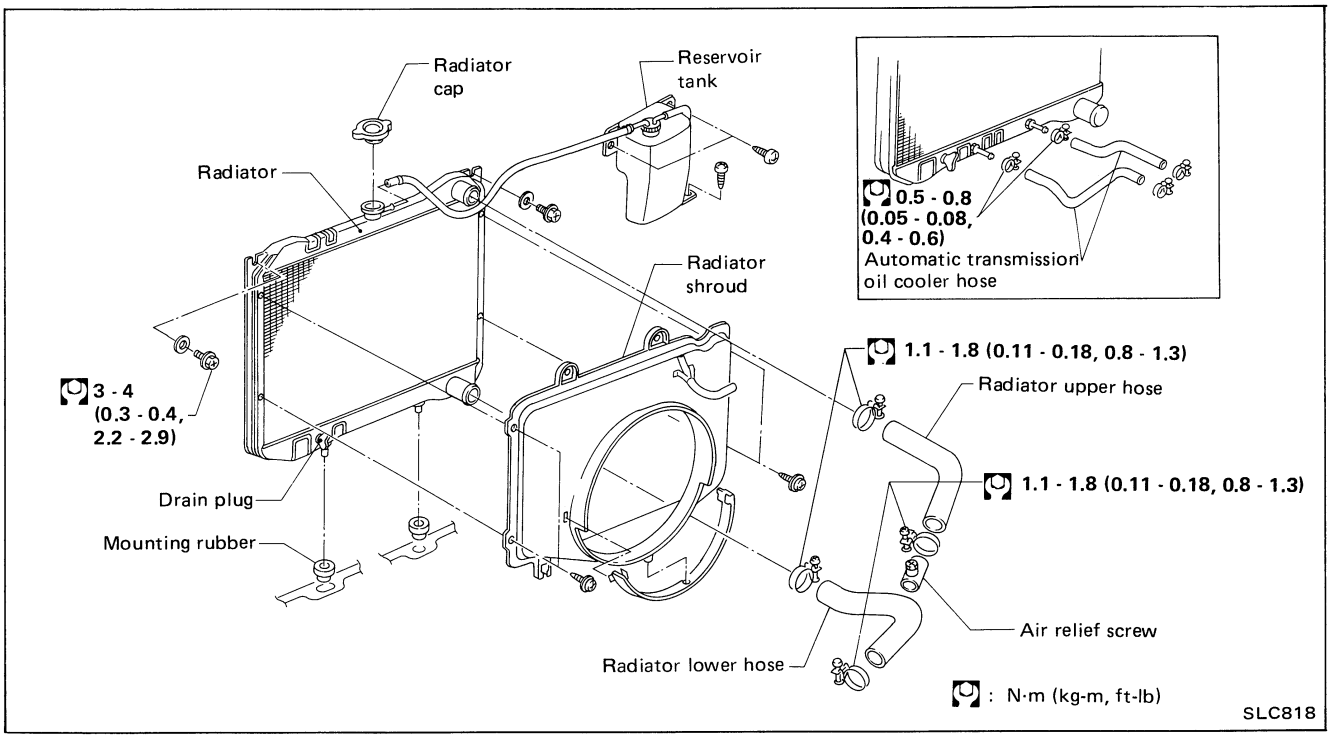
INSPECTION

1. Check 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)	68.5 (155)
Maximum valve lift	mm/°C (in/°F)	10/90 (0.39/194)

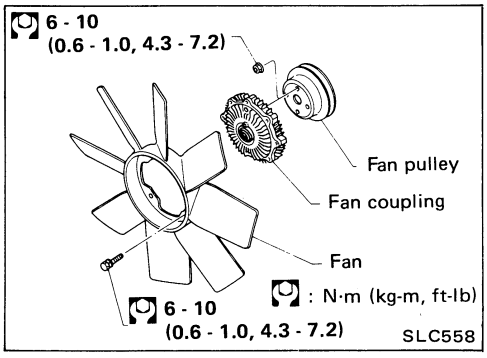
3. Then check if valve closes at 5°C (9°F) below valve opening temperature.

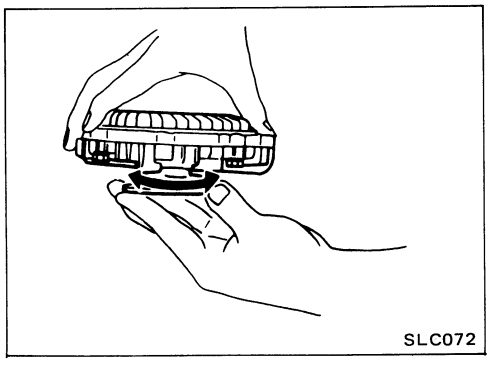
Radiator



CAUTION:
When filling radiator with coolant, refer to MA section.

Cooling Fan





INSPECTION
Check fan coupling for oil leakage or bent bimetal.

Engine Lubrication System

Oil pressure check

Engine rpm	Approximate discharge pressure kPa (kg/cm², psi)
Idle speed 3,200	More than 59 (0.6, 9) 363 - 461 (3.7 - 4.7, 53 - 67)

Oil pump

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)

Tightening torque

Unit	N·m	kg-m	ft-lb
Oil pump securing bolt			
M6	6.3 - 8.3	0.64 - 0.85	4.6 - 6.1
M8	22 - 29	2.2 - 3.0	16 - 22
Oil pump cover screw	4 - 5	0.4 - 0.5	2.9 - 3.6
Regulator valve cap bolt	39 - 69	4 - 7	29 - 51
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

Engine Cooling System

Thermostat

	Standard
Valve opening temperature °C (°F)	68.5 (155)
Maximum valve lift mm /°C (in/°F)	10/90 (0.39/194)

Radiator

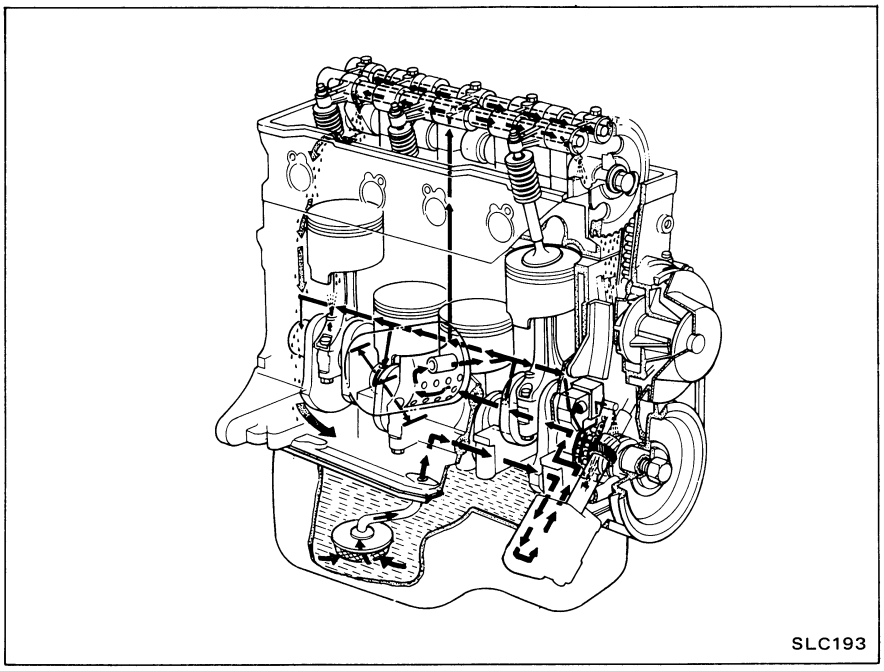
Unit: kPa (kg/cm², psi)

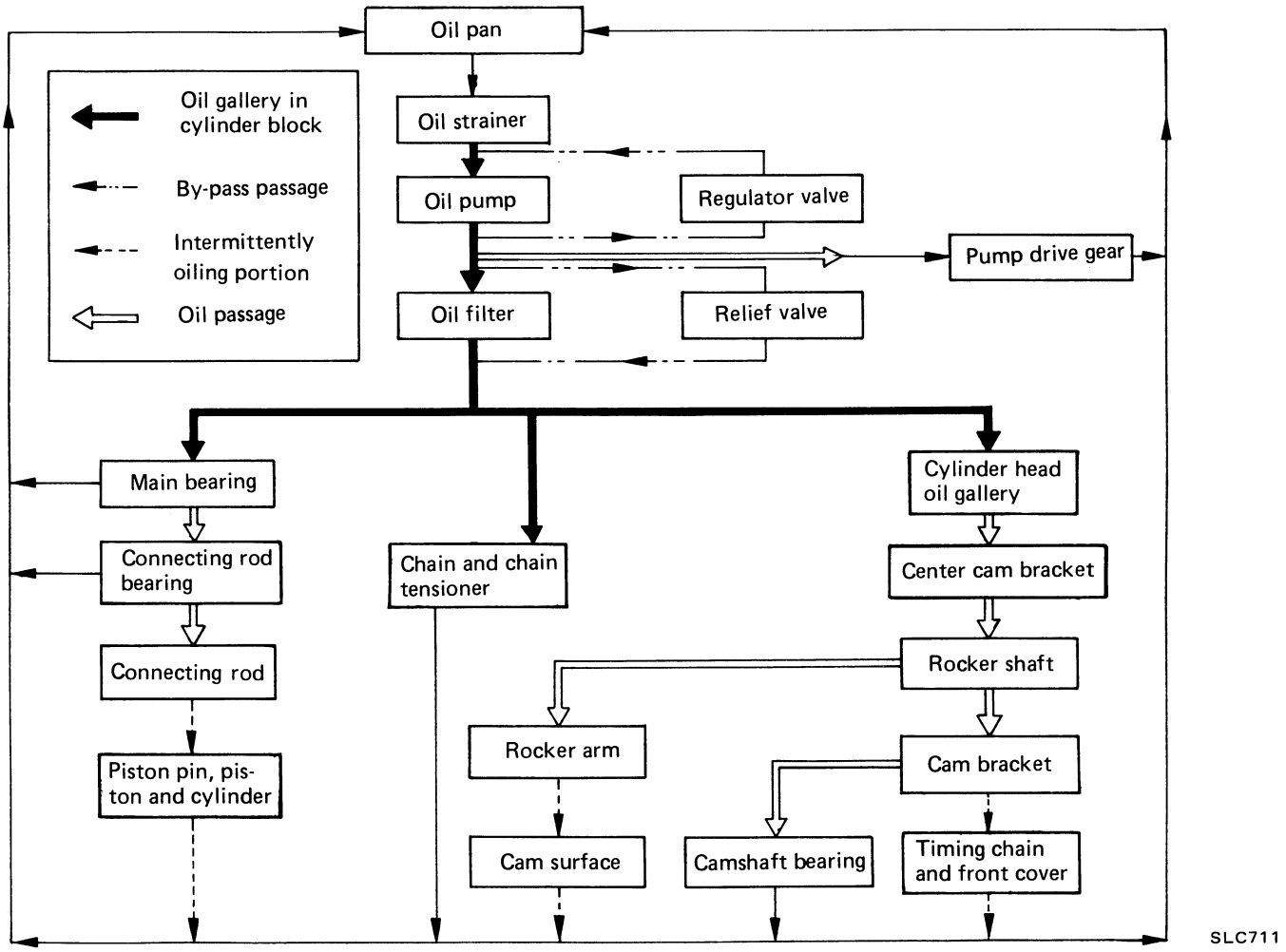
Cap relief pressure	78 - 98 (0.8 - 1.0, 11 - 14)
Leakage test pressure	157 (1.6, 23)

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
Radiator securing bolt	3 - 4	0.3 - 0.4	2.2 - 2.9
Radiator			
Upper & lower hose	1.1 - 1.8	0.11 - 0.18	0.8 - 1.3
Oil cooler hose (For A/T)	0.5 - 0.8	0.05 - 0.08	0.4 - 0.6
Fan coupling securing bolt	6 - 10	0.6 - 1.0	4.3 - 7.2
Fan securing bolt	6 - 10	0.6 - 1.0	4.3 - 7.2
Cylinder block drain plug	34 - 44	3.5 - 4.5	25 - 33

Lubricating Circuit

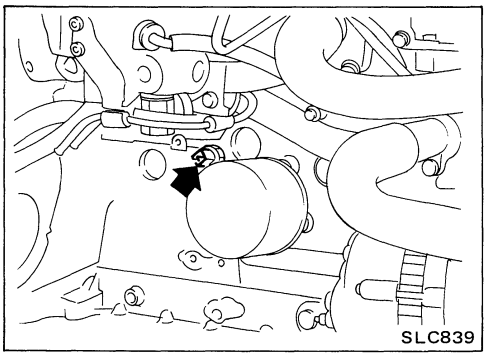




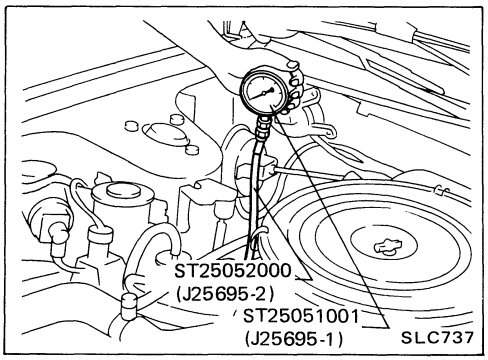
Oil Pressure Check

WARNING:

- **Be careful not to burn yourself, as the engine and oil may be hot.**
- **Oil pressure check should be done in "Neutral" gear position.**



1. Check oil level.
2. Remove oil pressure switch.



3. Install pressure gauge.
4. Start and warm up engine to normal operating temperature.
5. Check oil pressure with engine running under no-load.

Engine rpm	Approximate discharge pressure kPa (kg/cm^2, psi)
Idle speed	More than 73.6 (0.75, 10.7)
3,000	324 - 461 (3.3 - 4.7, 47 - 67)

If difference is extreme, check oil passage and oil pump for oil leaks.

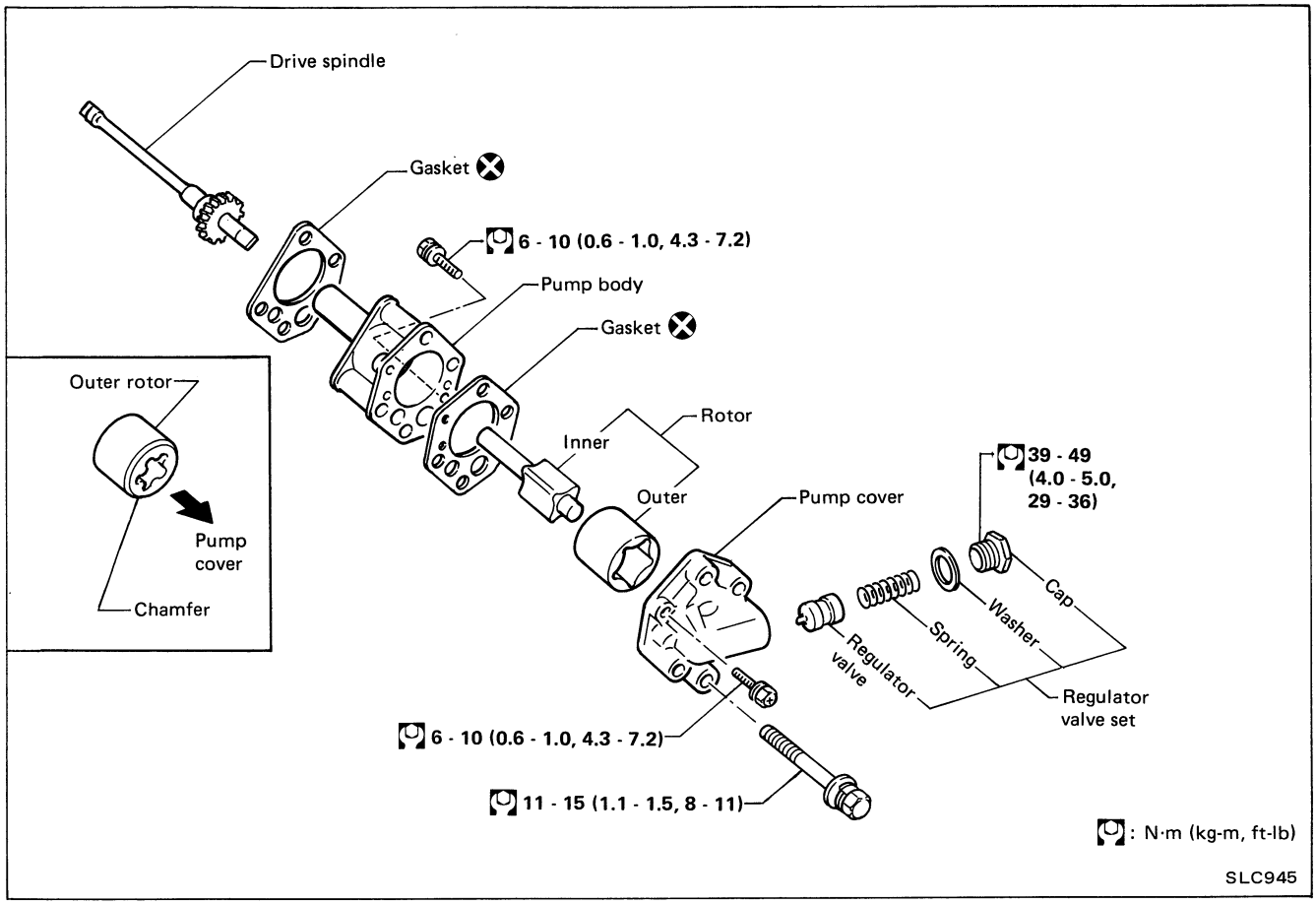
6. Install oil pressure switch.

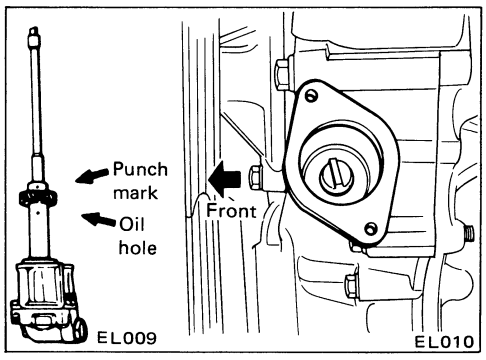
Use proper liquid sealant.

Oil pressure switch:

: 10 - 16 N·m (1.0 - 1.6 kg-m, 7 - 12 ft-lb)

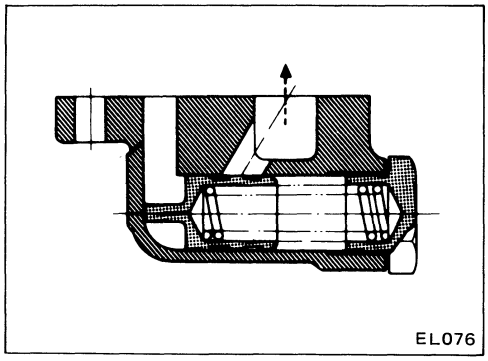
Oil Pump





- Always replace with new oil seal and gasket.
- When removing oil pump, turn crankshaft so that No. 1 piston is at T.D.C. on its compression stroke.
- When installing oil pump, align punch mark on drive spindle and oil hole on oil pump.

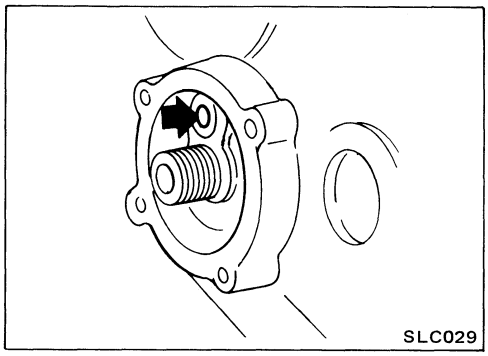
Oil Pump (Cont'd)


EL076

REGULATOR VALVE INSPECTION

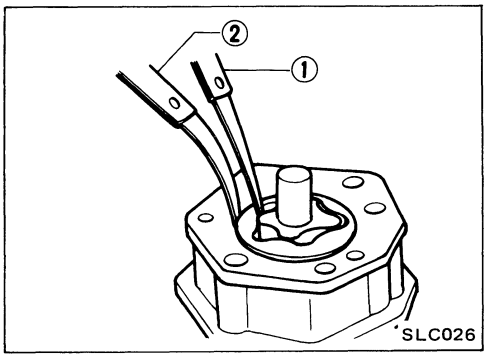
1. Visually inspect components for wear and damage.
2. Check oil pressure regulator valve sliding surface and valve spring.
3. Coat regulator valve with engine oil and check that it falls smoothly into the valve hole by its own weight.

If damaged, replace regulator valve set or oil pump assembly.


SLC029

OIL PRESSURE RELIEF VALVE INSPECTION

Inspect oil pressure relief valve for movement, cracks and breaks by pushing the ball. If replacement is necessary, remove valve by prying it out with a screwdriver.
Install a new valve in place by tapping it.



SLC026

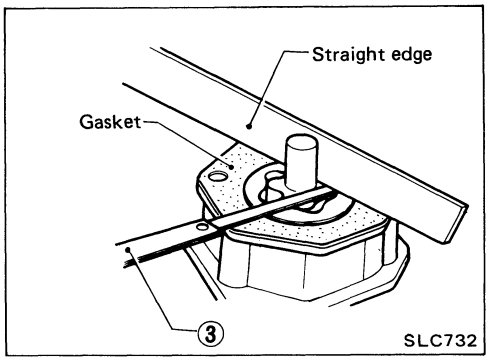
OIL PUMP INSPECTION

Using a feeler gauge, check the following clearance.

Unit: mm (in)

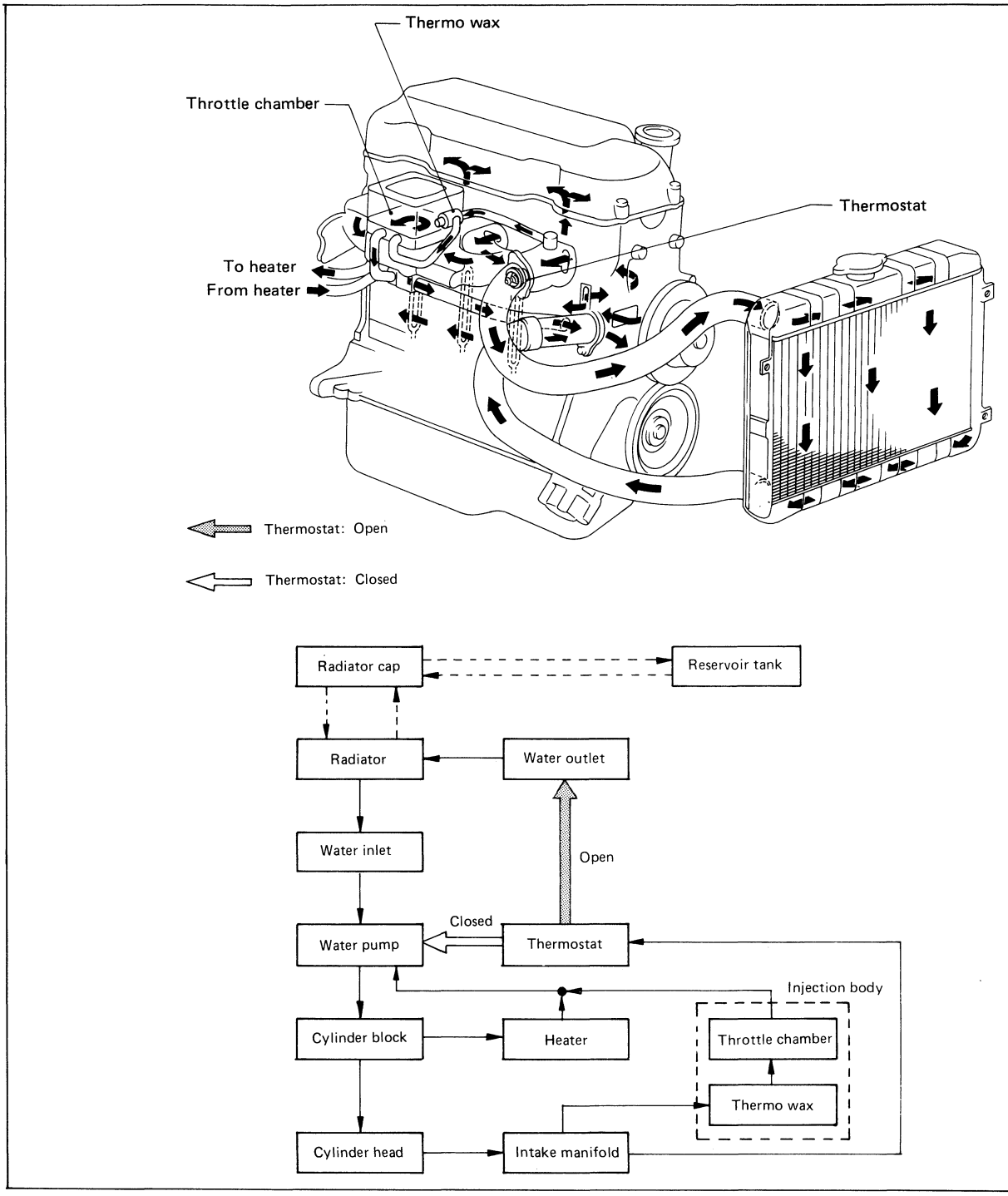
Rotor tip clearance ①	Less than 0.12 (0.0047)
Outer rotor to body clearance ②	0.15 - 0.21 (0.0059 - 0.0083)
Side clearance (with gasket) ③	0.04 - 0.08 (0.0016 - 0.0031)

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



SLC732

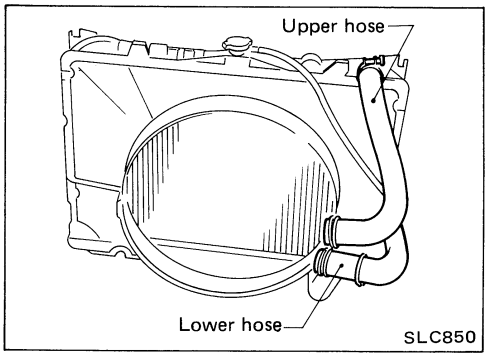
Cooling Circuit



WARNING:

To avoid serious personal injury, never remove radiator cap quickly when engine is hot. Sudden release of cooling system pressure is very dangerous.

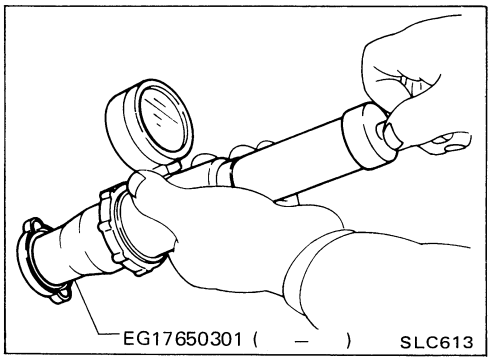
If it is necessary to remove radiator cap when radiator is hot, turn cap slowly counterclockwise to the first stop. After all pressure in the cooling system is released, turn cap passing the stop and remove it.



Cooling System Inspection

CHECKING HOSES

Check hoses for proper attachment, leaks, cracks, damage, loose connections, chafing and deterioration.

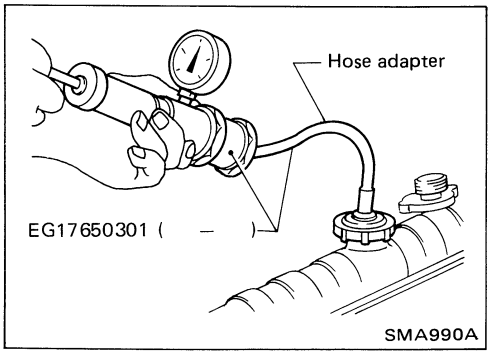


CHECKING RADIATOR CAP

Apply pressure to radiator cap by means of a cap tester to see if it is satisfactory.

Radiator cap relief pressure:

78 - 98 kPa (0.8 - 1.0 kg/cm^2, 11 - 14 psi)



CHECKING COOLING SYSTEM FOR LEAKS

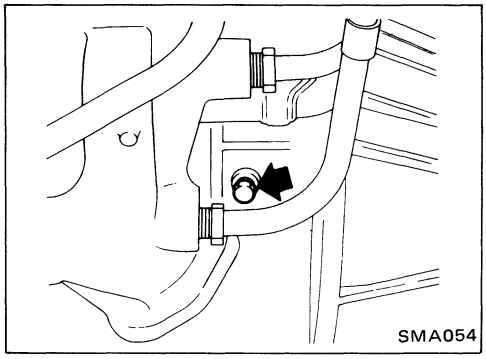
Apply pressure to the cooling system by means of a tester to check for leakage.

Testing pressure:

157 kPa (1.6 kg/cm^2, 23 psi)

CAUTION:

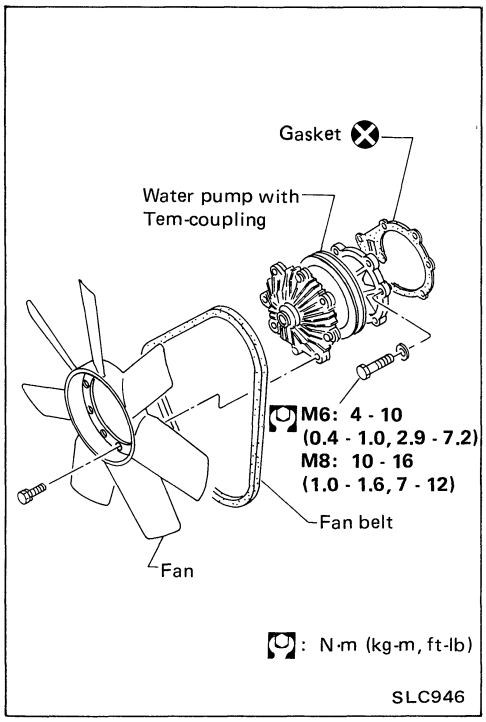
Higher than the specified pressure may cause radiator damage.


SMA054

Water Pump

REMOVAL AND INSTALLATION

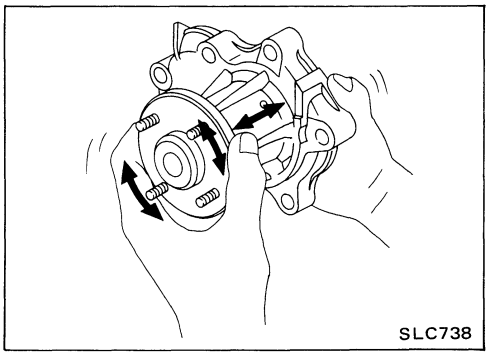
Drain coolant from drain plug on left rear of cylinder block.



SLC946

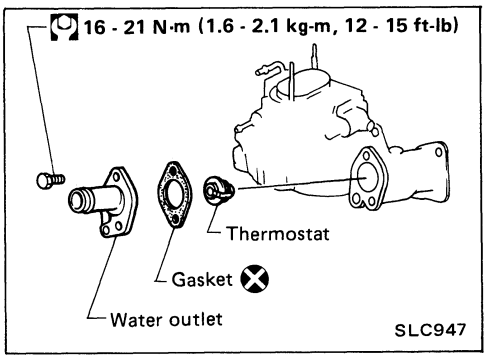
CAUTION:

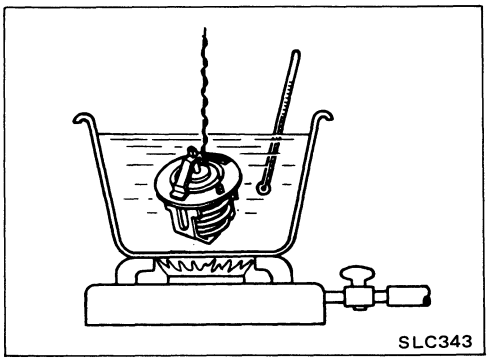
- **When removing water pump assembly, be careful not to get coolant on timing belt.**
- **Water pump cannot be disassembled and should be replaced as a unit.**
- **Always replace with new gasket.**
- **To avoid deforming timing cover, make sure there is adequate clearance between cover and hose clamp.**
- **After installing water pump, connect hose and clamp securely, then check for leaks using radiator cap tester.**


SLC738

INSPECTION

1. Check for badly rusted or corroded body assembly and vane.
2. Check for rough operation due to excessive end play.





Thermostat

- **After installation, run engine for a few minutes, and check for leaks.**
- **Be careful not to spill coolant over engine compartment. Place a rag to absorb coolant.**
- **Always replace with new gasket.**

INSPECTION

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

For U.S.A.

	Standard	Frigid type*
Valve opening temperature °C (°F)	82 (180)	88 (190)
Max. valve lift mm/°C (in/°F)	8/95 (0.31/203)	8/100 (0.31/212)

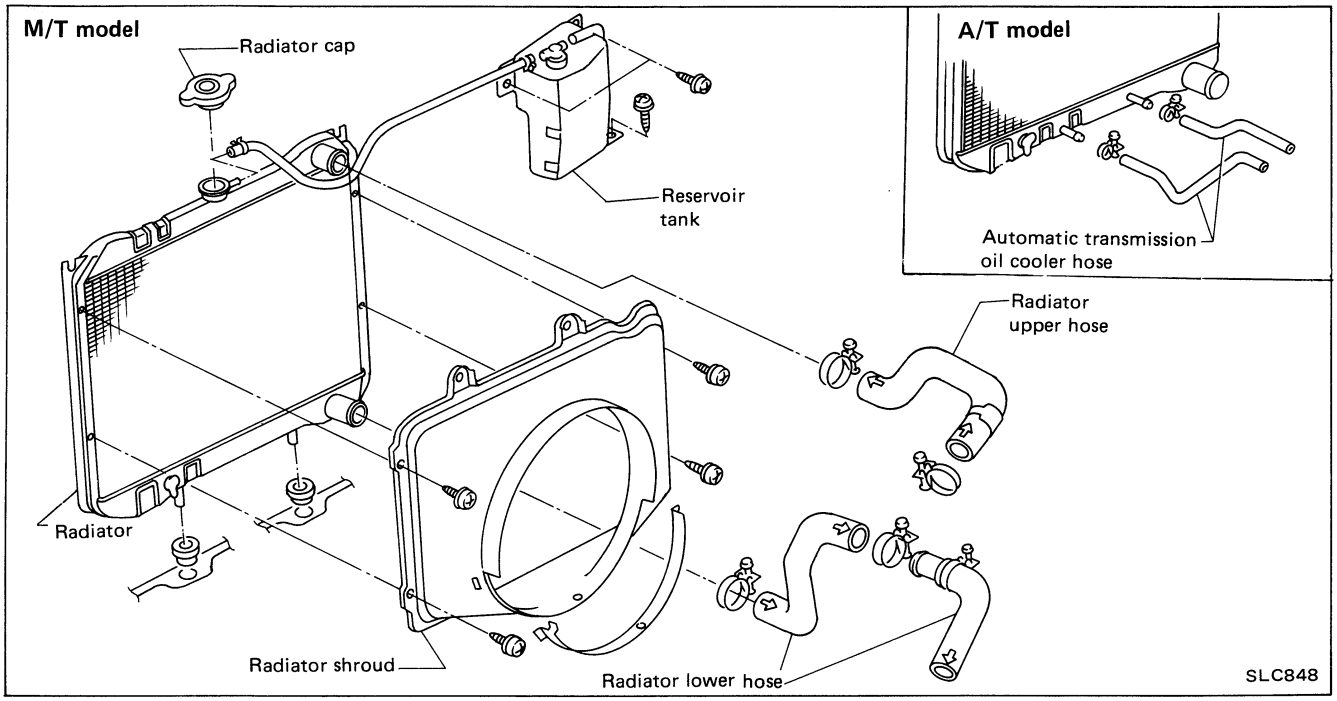
*: Option (Only Federal model)

For Canada

	Standard	Frigid type
Valve opening temperature °C (°F)	88 (190)	–
Max. valve lift mm/°C (in/°F)	8/100 (0.31/212)	–

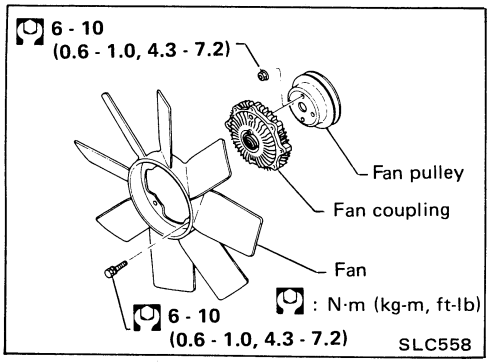
3. Then check if valve closes at 5°C (9°F) below valve opening temperature.

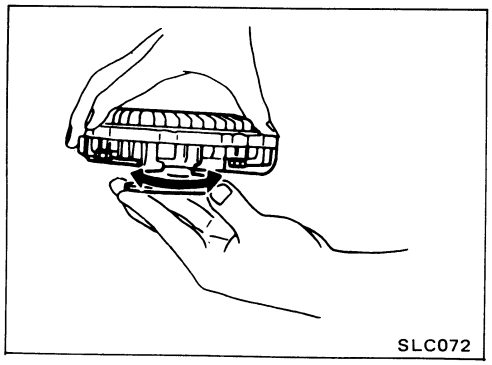
Radiator



CAUTION:
When filling radiator with coolant, refer to MA section.

Cooling Fan





INSPECTION

Check fan coupling for oil leakage or bent bimetal.

Engine Lubrication System

Oil pressure check

Engine rpm	Approximate discharge pressure kPa (kg/cm², psi)
Idle speed	More than 73.6 (0.75, 10.7)
3,000	324 - 461 (3.3 - 4.7, 47 - 67)

Oil pump

Unit: mm (in)

Rotor tip clearance	Less than 0.12 (0.0047)
Outer rotor to body clearance	0.15 - 0.21 (0.0059 - 0.0083)
Side clearance (with gasket)	0.04 - 0.08 (0.0016 - 0.0031)

Tightening torque

Unit	N·m	kg-m	ft-lb
Oil pump mounting bolt	11 - 15	1.1 - 1.5	8 - 11
Oil pump cover bolt	6 - 10	0.6 - 1.0	4.3 - 7.2
Regulator valve cap	39 - 49	4.0 - 5.0	29 - 36
Oil pressure switch	10 - 16	1.0 - 1.6	7 - 12

Engine Cooling System

Thermostat

For U.S.A.

	Standard	Frigid type*
Valve opening temperature °C (°F)	82 (180)	88 (190)
Max. valve lift mm/°C (in/°F)	8/95 (0.31/203)	8/100 (0.31/212)

*: Option (Only Federal model)

For Canada

	Standard	Frigid type
Valve opening temperature °C (°F)	88 (190)	–
Max. valve lift mm/°C (in/°F)	8/100 (0.31/212)	–

Radiator

Unit: kPa (kg/cm², psi)

Cap relief pressure	78 - 98 (0.8 - 1.0, 11 - 14)
Leakage test pressure	157 (1.6, 23)

Tightening torque

Unit	N·m	kg-m	ft-lb
Water pump securing bolt			
M6	4 - 10	0.4 - 1.0	2.9 - 7.2
M8	10 - 16	1.0 - 1.6	7 - 12
Fan installing bolt	6 - 10	0.6 - 1.0	4.3 - 7.2
Fan pulley nut	6 - 10	0.6 - 1.0	4.3 - 7.2
Water outlet housing bolt	16 - 21	1.6 - 2.1	12 - 15
Cylinder block drain plug	29 - 39	3.0 - 4.0	22 - 29