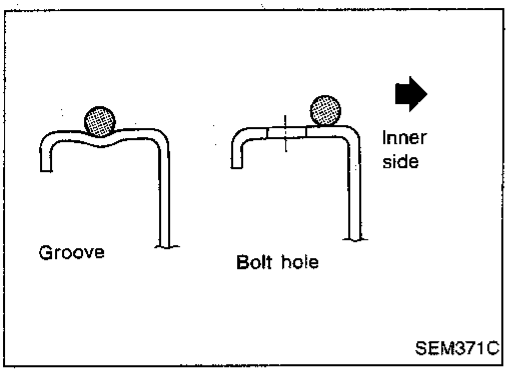
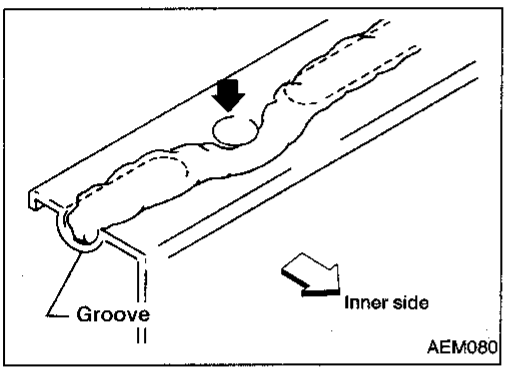
ENGINE LUBRICATION & COOLING SYSTEM

SECTION LC

CONTENTS



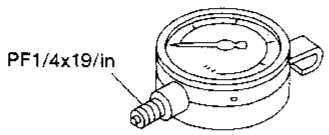
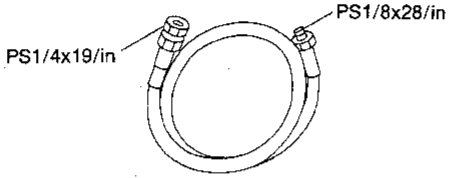
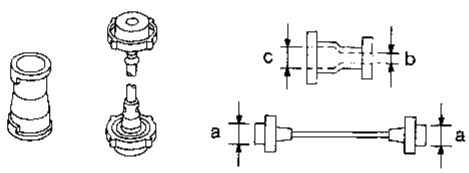
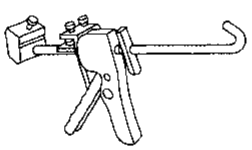


Liquid Gasket Application Procedure

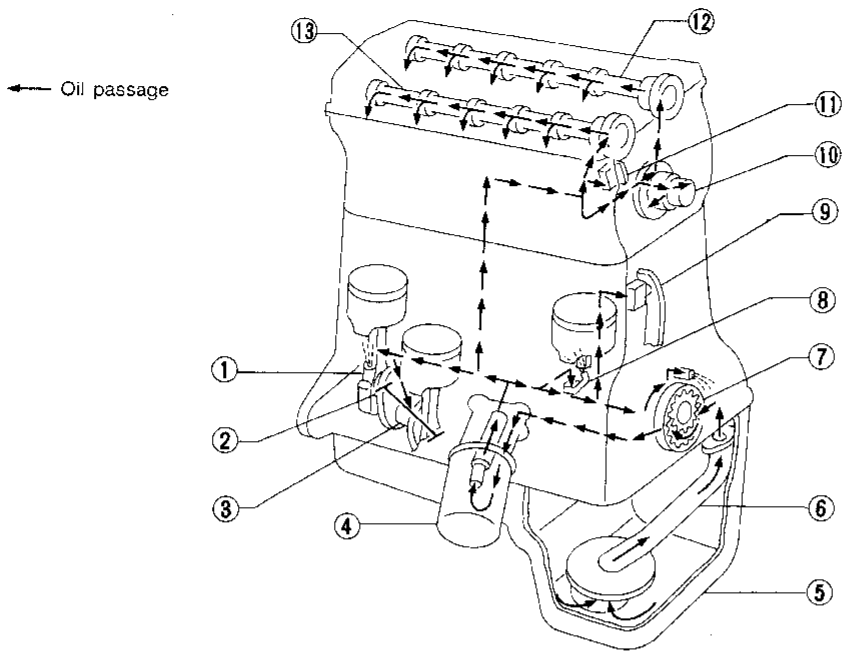
a. Use a scraper to remove all traces of old liquid gasket from mating surfaces and grooves. Also, completely clean any oil from these areas.
b. Apply a continuous bead of liquid gasket to mating surfaces. (Use Genuine Liquid Gasket or equivalent.)
   - For oil pan, be sure liquid gasket diameter is 3.5 to 4.5 mm (0.138 to 0.177 in).
   - For areas except oil pan, be sure liquid gasket diameter is 2.0 to 3.0 mm (0.079 to 0.118 in).
c. Apply liquid gasket around the inner side of bolt holes (unless otherwise specified).
d. Assembly should be done within 5 minutes after coating.
e. Wait at least 30 minutes before refilling engine oil and engine coolant.

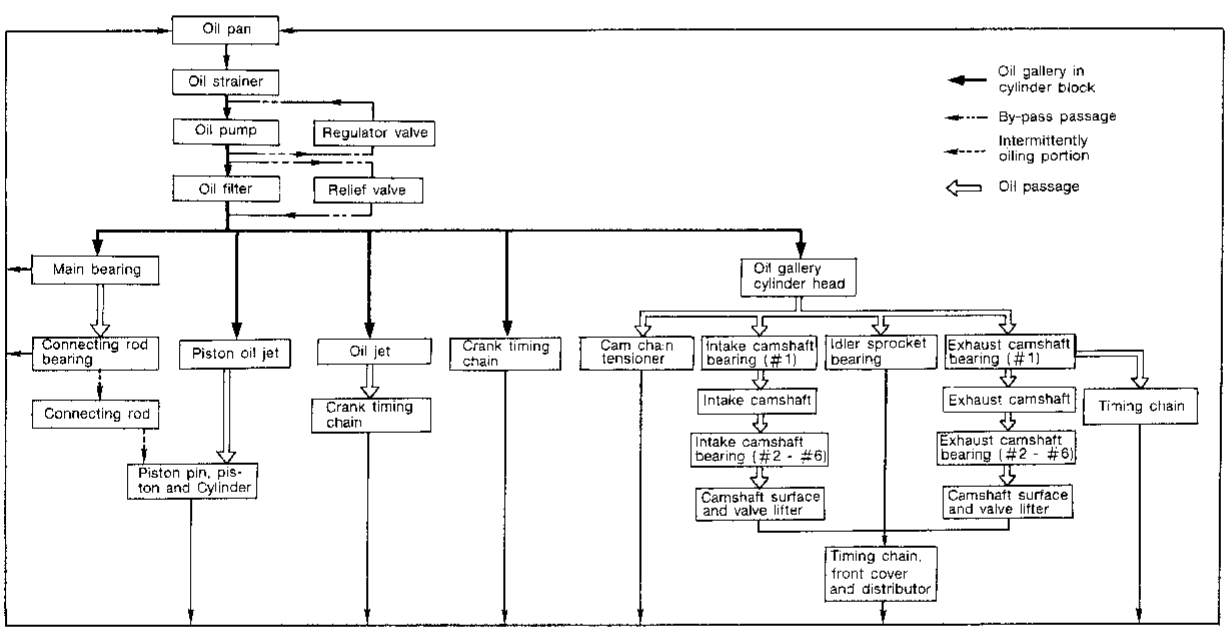
Special Service Tools

The actual shapes of Kent-Moore tools may differ from those of special service tools illustrated here.

Tool number (Kent-Moore No.) Tool name	Description	
ST25051001 (J25695-1) Oil pressure gauge	 NT558	Measuring oil pressure **Maximum measuring range: 2,452 kPa (25 kg/cm^2, 356 psi)**
ST25052000 (J25695-2) Hose	 NT559	Adapting oil pressure gauge to cylinder block
EG17650301 (J33984-A) Radiator cap tester adapter	 NT564	Adapting radiator cap tester to radiator filler neck **a: 28 (1.10) dia.** **b: 31.4 (1.236) dia.** **c: 41.3 (1.626) dia.** Unit: mm (in)
WS39930000 (—) Tube presser	 NT052	Pressing the tube of liquid gasket

Lubrication Circuit





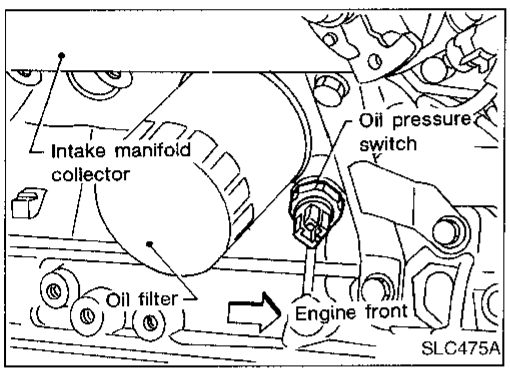
SLC749A

① Connecting rod
② Connecting rod bearing
③ Main bearing
④ Oil filter
⑤ Oil pan
⑥ Oil strainer
⑦ Oil pump
⑧ Piston oil jet
⑨ Timing chain tensioner
⑩ Idler sprocket
⑪ Upper timing chain tensioner
⑫ Exhaust camshaft
⑬ Intake camshaft

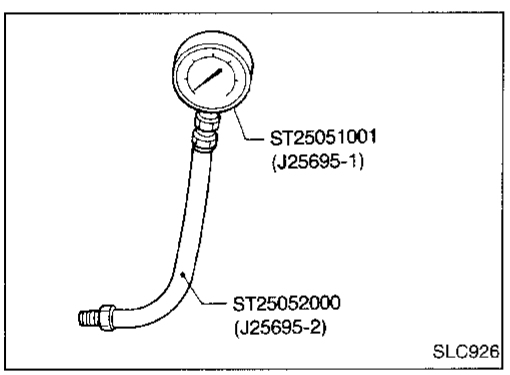
Oil Pressure Check

WARNING:

- **Be careful not to burn yourself, as the engine and oil may be hot.**
- **For M/T models, put gearshift lever in Neutral "N" position. For A/T models, put selector lever in park "P" position.**



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

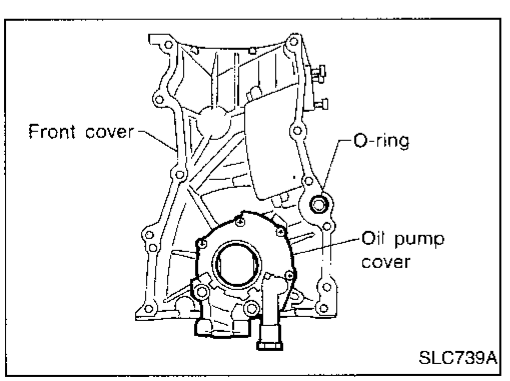


3. Install pressure gauge.
4. Start engine and warm it up to normal operating temperature.
5. Check oil pressure with engine running under no-load.

Engine speed rpm	Approximate discharge pressure kPa (kg/cm^2, psi)
Idle speed	More than 78 (0.8, 11)
3,000	412 - 481 (4.2 - 4.9, 60 - 70)

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

6. Install oil pressure switch with sealant.



Oil Pump

REMOVAL

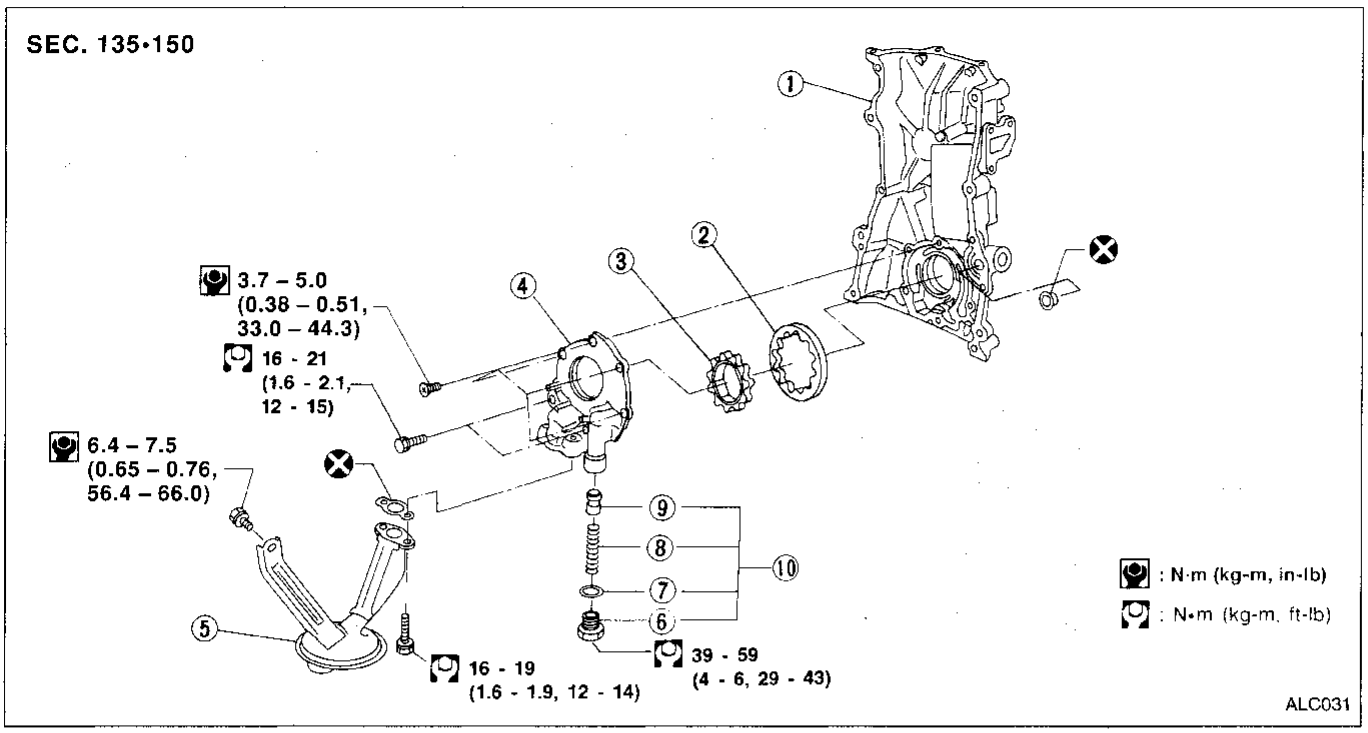
1. Remove front cover.

Refer to EM section ("Removal", "TIMING CHAIN").

2. Remove oil pump cover.

Oil Pump (Cont'd)

DISASSEMBLY AND ASSEMBLY

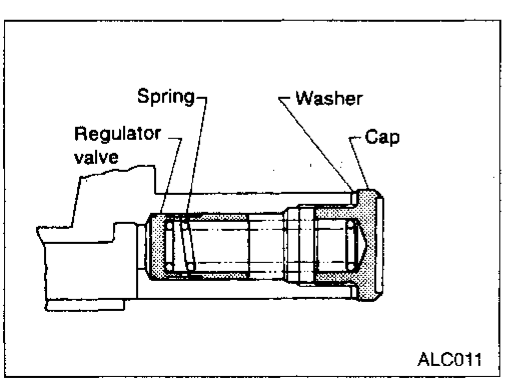


① Front cover
② Outer gear
③ Inner gear
④ Oil pump cover
⑤ Oil strainer
⑥ Cap
⑦ Washer
⑧ Spring
⑨ Regulator valve
⑩ Regulator valve assembly

INSTALLATION

Install in the reverse order of removal.

- **Always replace oil seals and gaskets with new ones. Refer to EM section ("OIL SEAL REPLACEMENT").**
- **When installing oil pump, apply engine oil to inner and outer gears.**
- **Use a scraper to remove old liquid gasket from mating surface of front cover.**
- **Also remove traces of liquid gasket from mating surface of cylinder block.**

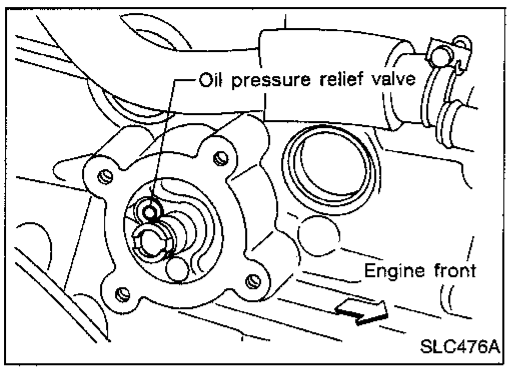


REGULATOR VALVE INSPECTION

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. Check that it falls smoothly into the valve hole by its own weight.

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

Oil Pump (Cont'd)



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 suitable tool.
Install a new valve by tapping it in place.

OIL PUMP INSPECTION

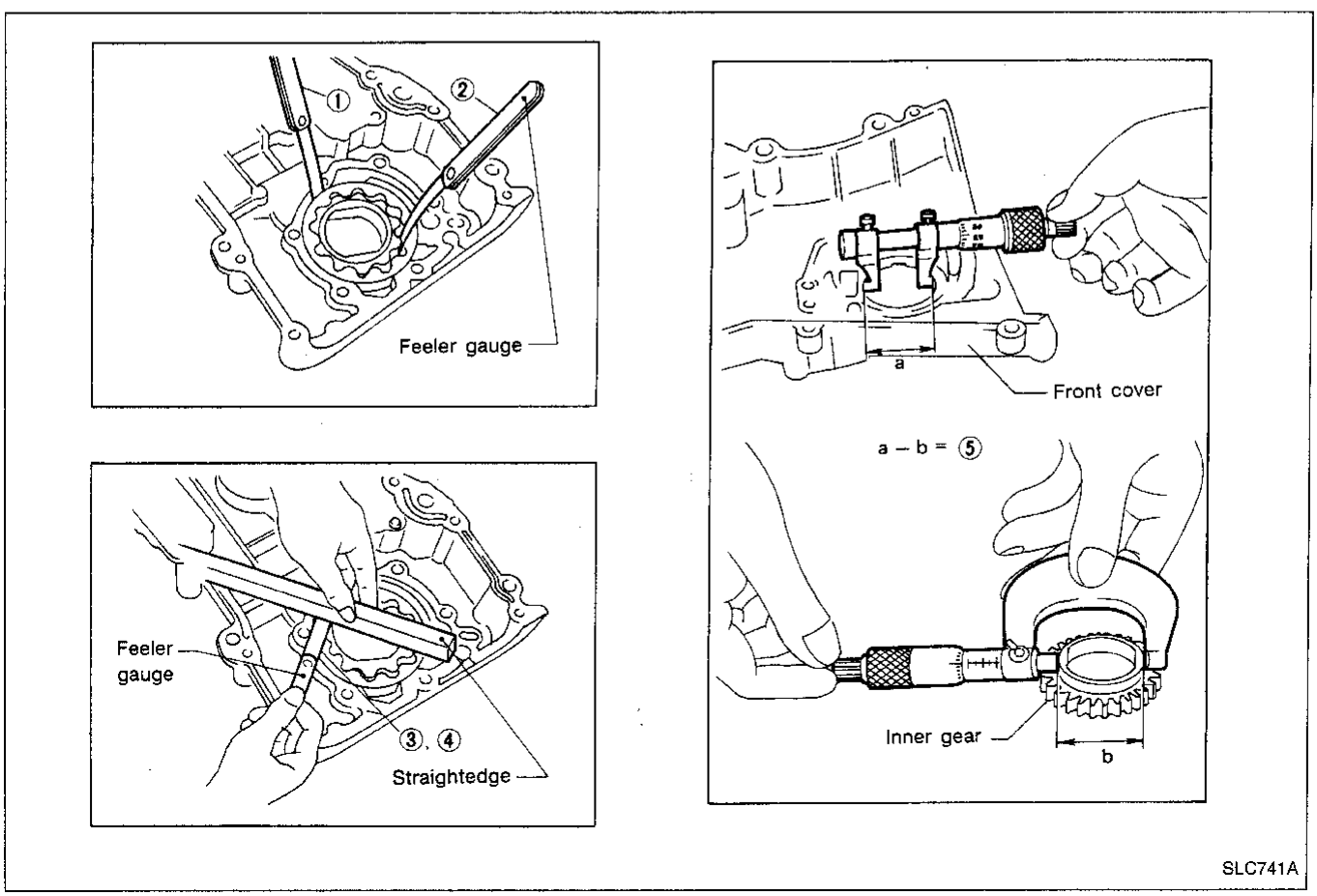
Using a feeler gauge, check the following clearances.

Standard clearance:

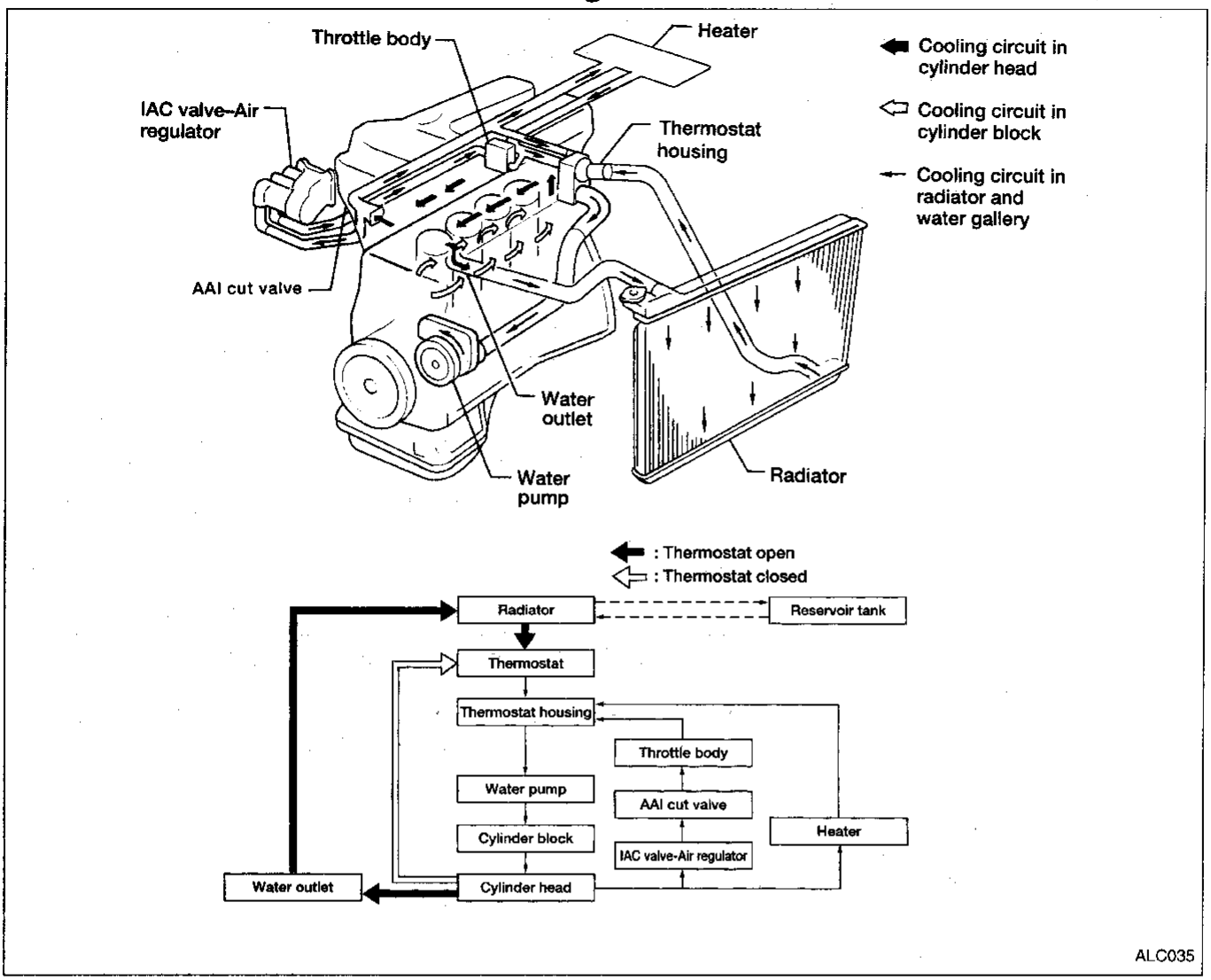
Unit: mm (in)

Body to outer gear clearance ①	0.114 - 0.20 (0.0045 - 0.0079)
Inner gear to outer gear tip clearance ②	0.04 - 0.18 (0.0016 - 0.0071)
Cover to inner gear clearance ③	0.05 - 0.09 (0.0020 - 0.0035)
Cover to outer gear clearance ④	0.05 - 0.11 (0.0020 - 0.0043)
Inner gear to brazed portion clearance ⑤	0.045 - 0.091 (0.0018 - 0.0036)

- **If the tip clearance (②) exceeds the limit, replace gear set.**
- **If body to gear clearances (①, ③, ④, ⑤) exceed the limit, replace front cover assembly.**



Cooling Circuit



System Check

WARNING:

Never remove the radiator cap when the engine is hot. Serious burns could occur from high pressure coolant escaping from the radiator.

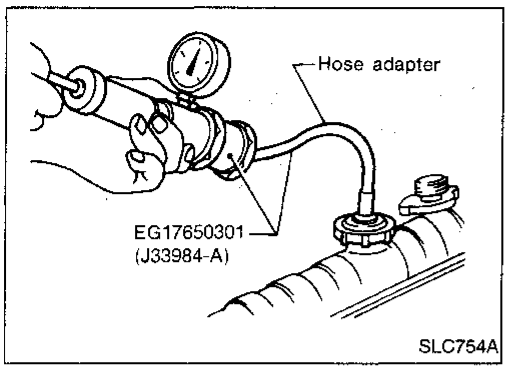
Wrap a thick cloth around the cap. Slowly turn it a quarter turn to allow built-up pressure to escape. Carefully remove the cap by turning it all the way.

CHECKING COOLING SYSTEM HOSES

Check hoses for the following:

- Improper attachment
- Leaks
- Cracks
- Damage
- Chafing
- Deterioration

System Check (Cont'd)

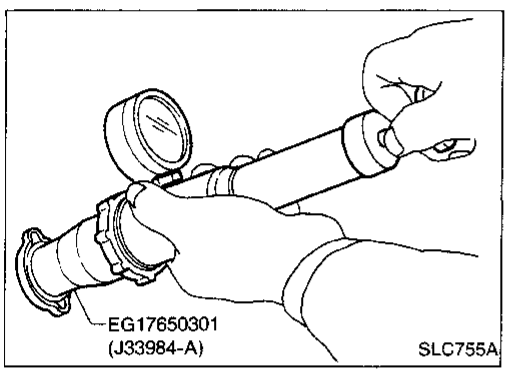


CHECKING COOLING SYSTEM FOR LEAKS

To check for leakage, apply pressure to the cooling system with a tester.

Testing pressure:
157 kPa (1.6 kg/cm², 23 psi)

CAUTION:
Higher pressure than specified may cause radiator damage.

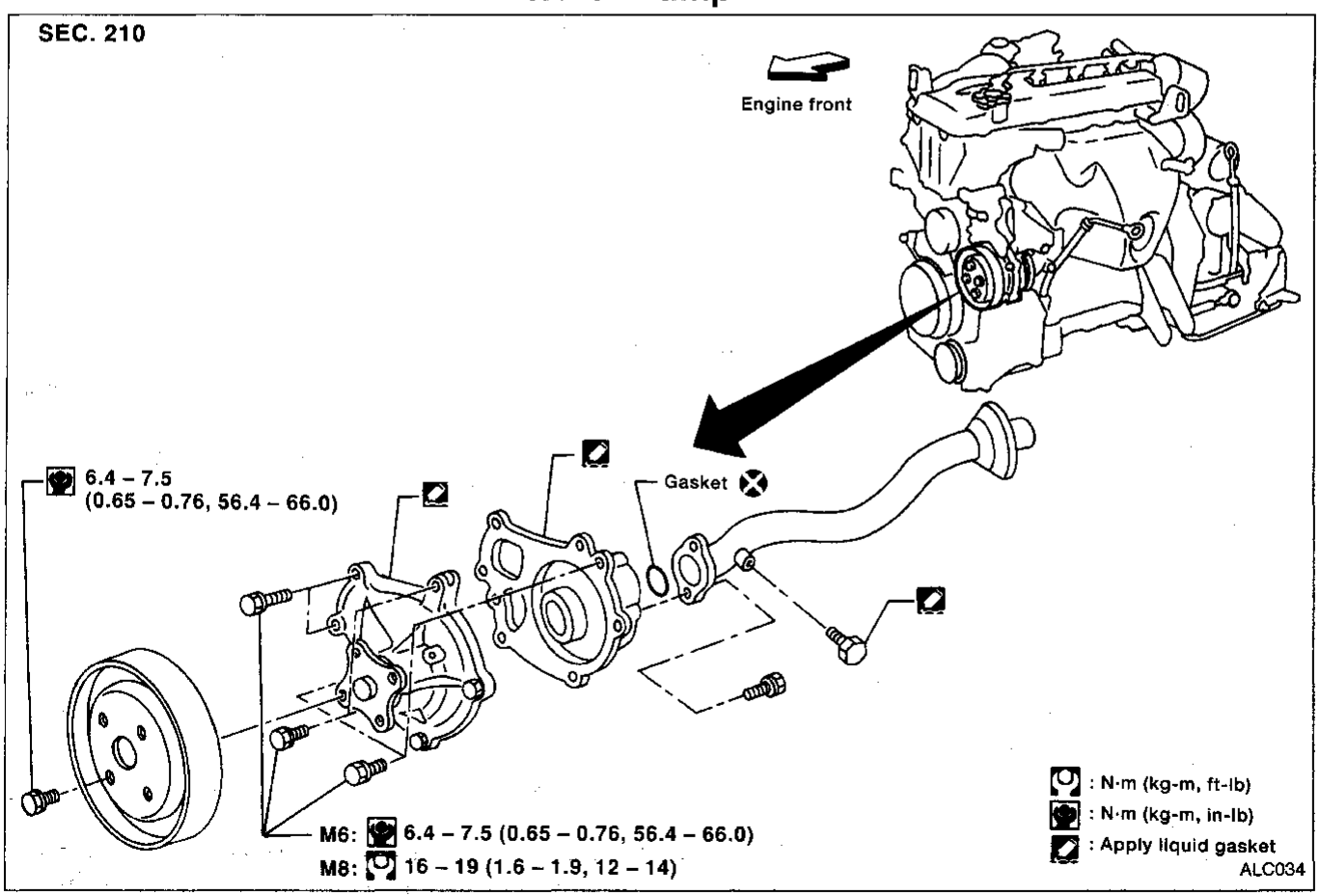


CHECKING RADIATOR CAP

To check radiator cap, apply pressure to cap with a tester.

Radiator cap relief pressure:
Standard
78 - 98 kPa (0.8 - 1.0 kg/cm², 11 - 14 psi)
Limit
59 - 98 kPa (0.6 - 1.0 kg/cm², 9 - 14 psi)

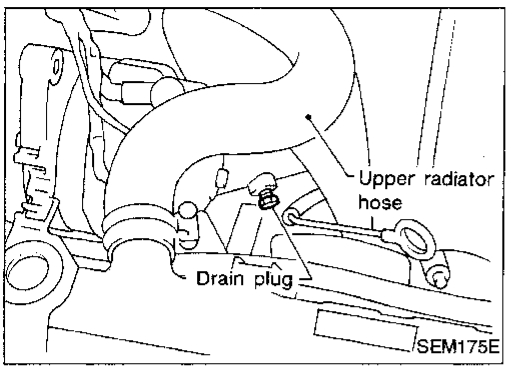
Water Pump



CAUTION:

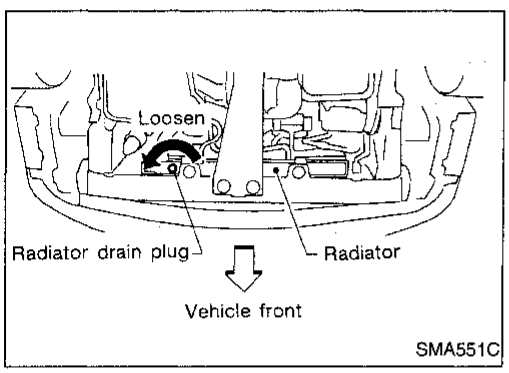
- **When removing water pump assembly, be careful not to get coolant on drive belt.**
- **Water pump cannot be disassembled and should be replaced as a unit.**
- **After installing water pump, connect hose and clamp securely, then check for leaks using radiator cap pressure tester.**

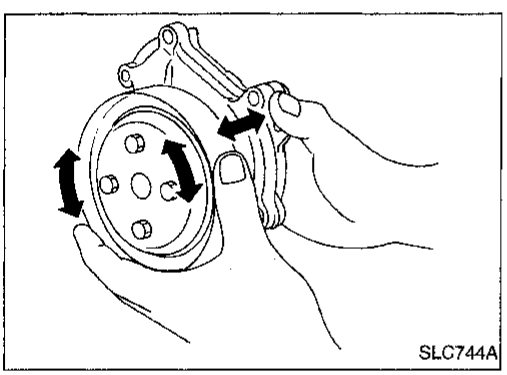
Water Pump (Cont'd)



REMOVAL

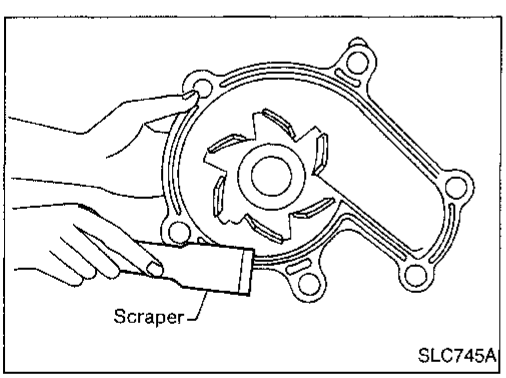
1. Drain coolant from drain plug on water pipe and radiator. Refer to MA section ("Changing Engine Coolant").
2. Remove right lower splash cover.
3. Remove generator and A/C compressor.
4. Remove two bolts from coolant tube (rear of water pump).
5. Remove water pump assembly.





INSPECTION

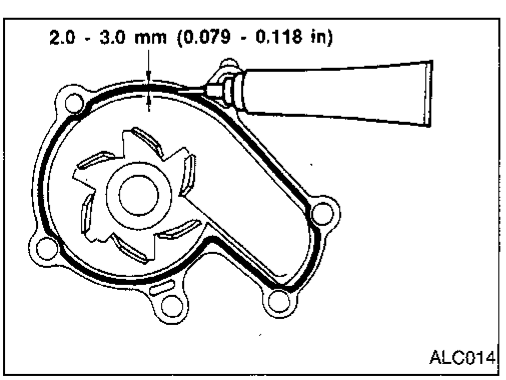
- Check body assembly for rust or corrosion.
- Check for rough operation due to excessive end play.



INSTALLATION

1. Use a scraper to remove old liquid gasket from water pump and water pump cover.

- **Also remove traces of liquid gasket from mating surface of cylinder block.**

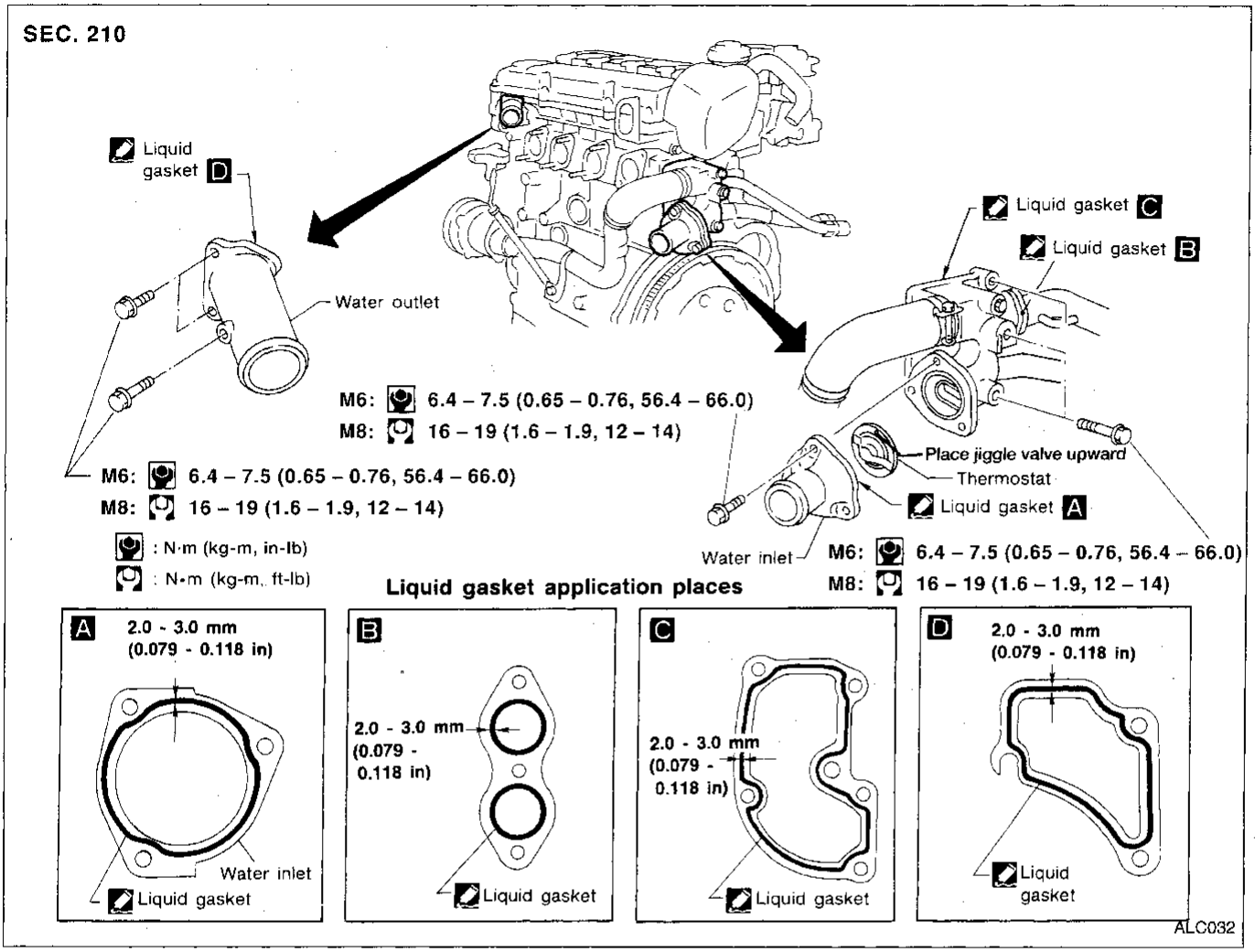


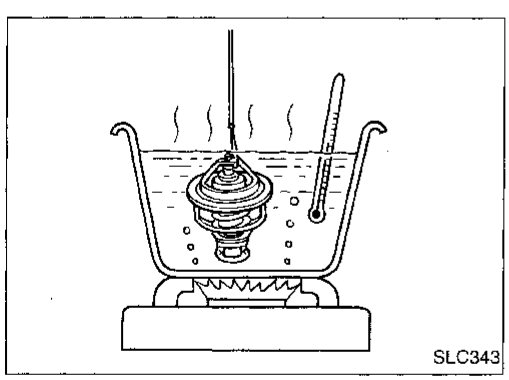
2. Apply a continuous bead of liquid gasket to mating surface of water pump and water pump cover (cylinder block side).

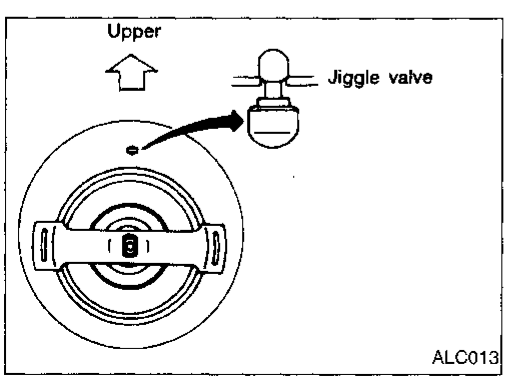
- **Use genuine liquid gasket or equivalent.**

When filling radiator with coolant, refer to MA section ("Changing Engine Coolant"). When installing drive belts, refer to MA section ("Checking Drive Belts").

Thermostat







Be careful not to spill coolant over engine compartment. Use a rag to absorb coolant.

INSPECTION

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

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

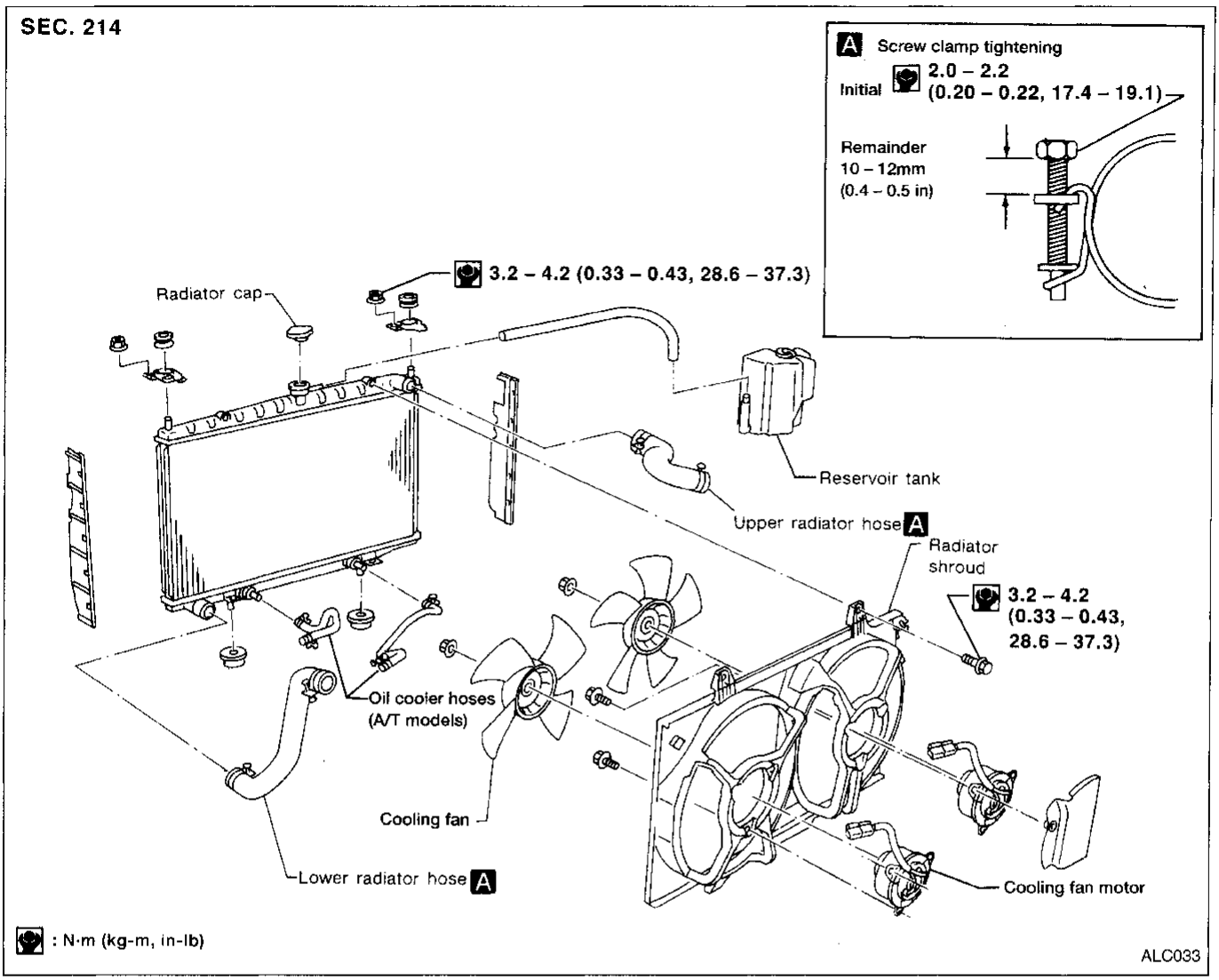
3. Then check if valve is closed at 5°C (9°F) below valve opening temperature.

INSTALLATION

Install thermostat with jiggle valve or air bleeder at upper side.

- **Apply a continuous bead of liquid gasket to mating surface of water inlet.**
- **After installation, run engine for a few minutes, and check for leaks.**

Radiator



Cooling fan control system

Cooling fans are controlled by the ECM (ECCS control module). For details, refer to EC section ("Cooling Fan", "TROUBLE DIAGNOSIS FOR DTC P1900").

Refilling engine coolant

For details on refilling engine coolant, refer to MA section ("Changing Engine Coolant").

Overheating Cause Analysis

	Symptom		Check items	
Cooling system parts malfunction	Poor heat transfer	Water pump malfunction	Worn or loose drive belt	—
		Thermostat stuck closed	—	
		Damaged fins	Dust contamination or paper clogging	
			Mechanical damage	
		Clogged radiator cooling tube	Excess foreign material (rust, dirt, sand, etc.)	
	Reduced air flow	Cooling fan does not operate	—	—
		High resistance to fan rotation		
		Damaged fan blades		
	Damaged radiator shroud	—	—	—
	Improper coolant mixture ratio	—	—	—
	Poor coolant quality	—	—	—
	Insufficient coolant	Coolant leaks	Cooling hose	Loose clamp
				Cracked hose
			Water pump	Poor sealing
			Radiator cap	Loose
				Poor sealing
			Radiator	O-ring for damage, deterioration or improper fitting
				Cracked radiator tank
				Cracked radiator core
			Reservoir tank	Cracked reservoir tank
		Overflowing reservoir tank	Exhaust gas leaks into cooling system	Cylinder head deterioration
				Cylinder head gasket deterioration
Except cooling system parts malfunction	—	Overload on engine	Abusive driving	High engine rpm under no load
				Driving in low gear for extended time
				Driving at extremely high speed
			Powertrain system malfunction	
			Installed improper size wheels and tires	
			Dragging brakes	
			Improper ignition timing	
	Blocked or restricted air flow	Blocked bumper	—	—
		Blocked radiator grille	Installed car brassiere	
			Mud contamination or paper clogging	
		Blocked radiator	—	
		Blocked condenser	—	
		Installed large fog lamp		

Engine Lubrication System

Oil pressure check

Engine speed	Approximate discharge pressure kPa (kg/cm^2, psi)
Idle speed	More than 78 (0.8, 11)
3,000 rpm	412 - 481 (4.2 - 4.9, 60 - 70)

Oil pump

Unit: mm (in)

Body to outer gear clearance	.....	0.114 - 0.20 (0.0045 - 0.0079)
Inner gear to outer gear tip clearance	.....	0.04 - 0.18 (0.0016 - 0.0071)
Cover to inner gear clearance	.....	0.05 - 0.09 (0.0020 - 0.0035)
Cover to outer gear clearance	.....	0.05 - 0.11 (0.0020 - 0.0043)
Inner gear to brazed portion clearance	.....	0.045 - 0.091 (0.0018 - 0.0036)

Engine Cooling System

Thermostat

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

Radiator

Unit: kPa (kg/cm^2, psi)

Cap relief pressure	
Standard	78 - 98 (0.8 - 1.0, 11 - 14)
Limit	59 - 98 (0.6 - 1.0, 9 - 14)
Leakage test pressure	157 (1.6, 23)