

ENGINE LUBRICATION & COOLING SYSTEMS

SECTION LC

LC

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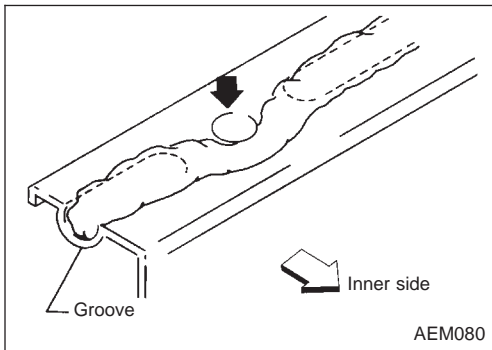
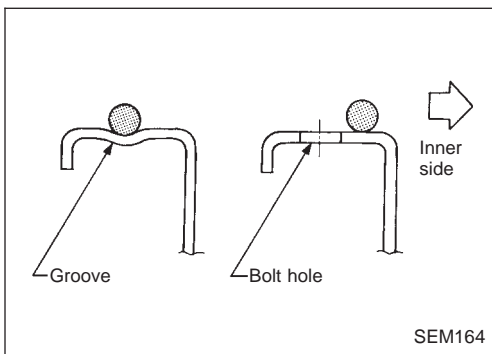
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PRECAUTION



LIQUID GASKET APPLICATION PROCEDURE

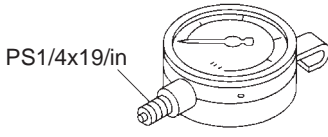
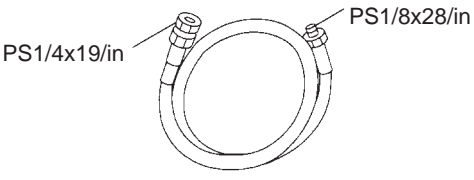
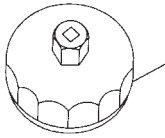
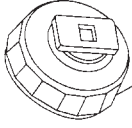
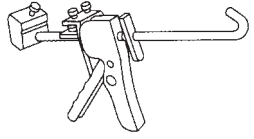
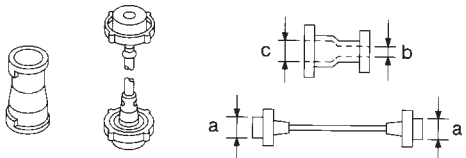
1. Use a scraper to remove all traces of old liquid gasket from mating surfaces and grooves. Also, completely clean any oil from these areas.
2. Apply a continuous bead of liquid gasket to mating surfaces. (Use Genuine Liquid Gasket or equivalent.)
 - Be sure liquid gasket is 4.0 to 5.0 mm (0.157 to 0.197 in) wide for SR engine and 3.5 to 4.5 mm (0.138 to 0.177 in) wide for QG and CD engine (for oil pan).
 - Be sure liquid gasket is 2.0 to 3.0 mm (0.079 to 0.118 in) wide (in areas except oil pan).
3. Apply liquid gasket around the inner side of bolt holes (unless otherwise specified).
4. Assembly should be done within 5 minutes after coating.
5. Wait at least 30 minutes before refilling engine oil and engine coolant.

PREPARATION

Special Service Tools

Special Service Tools

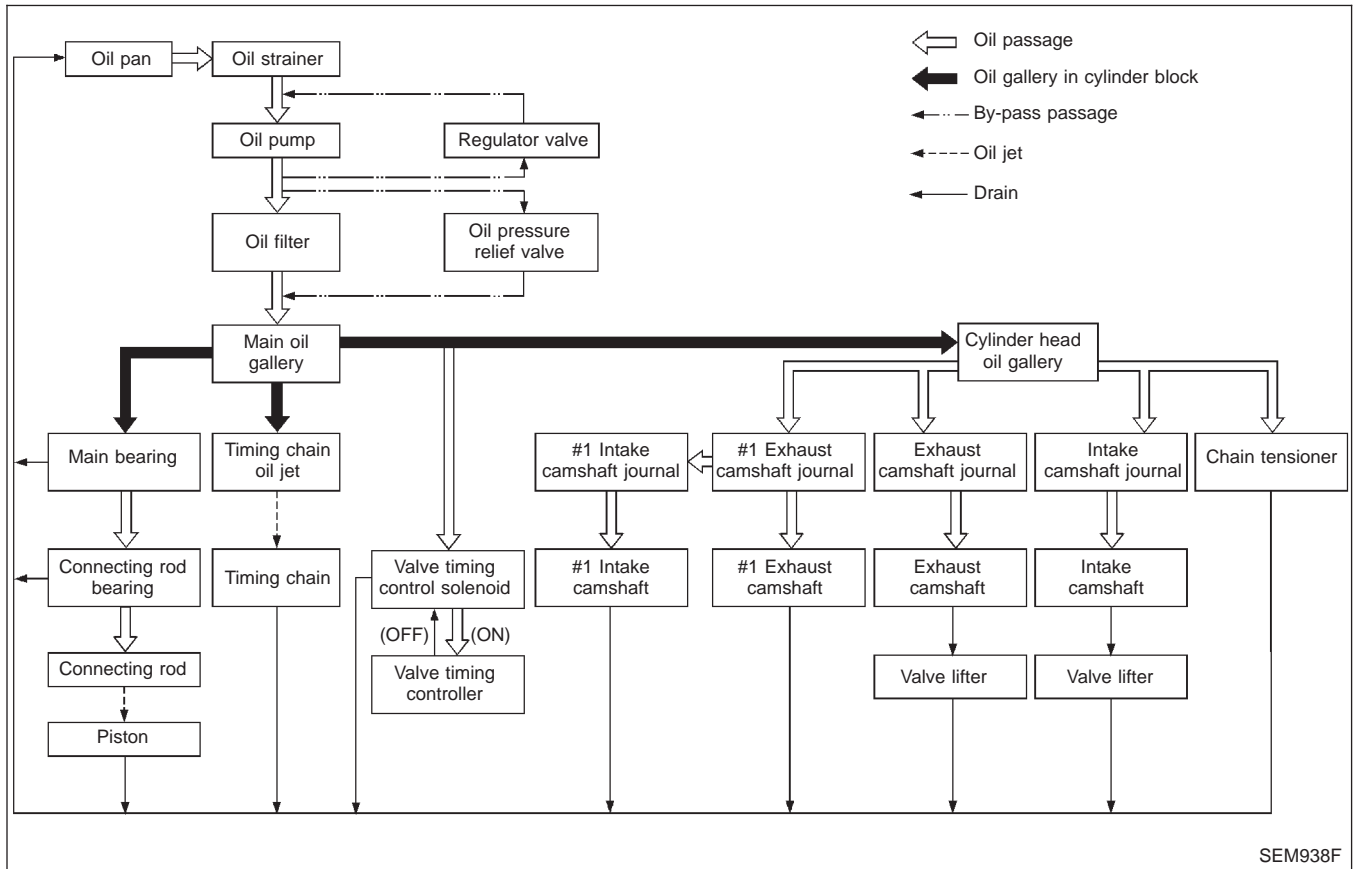
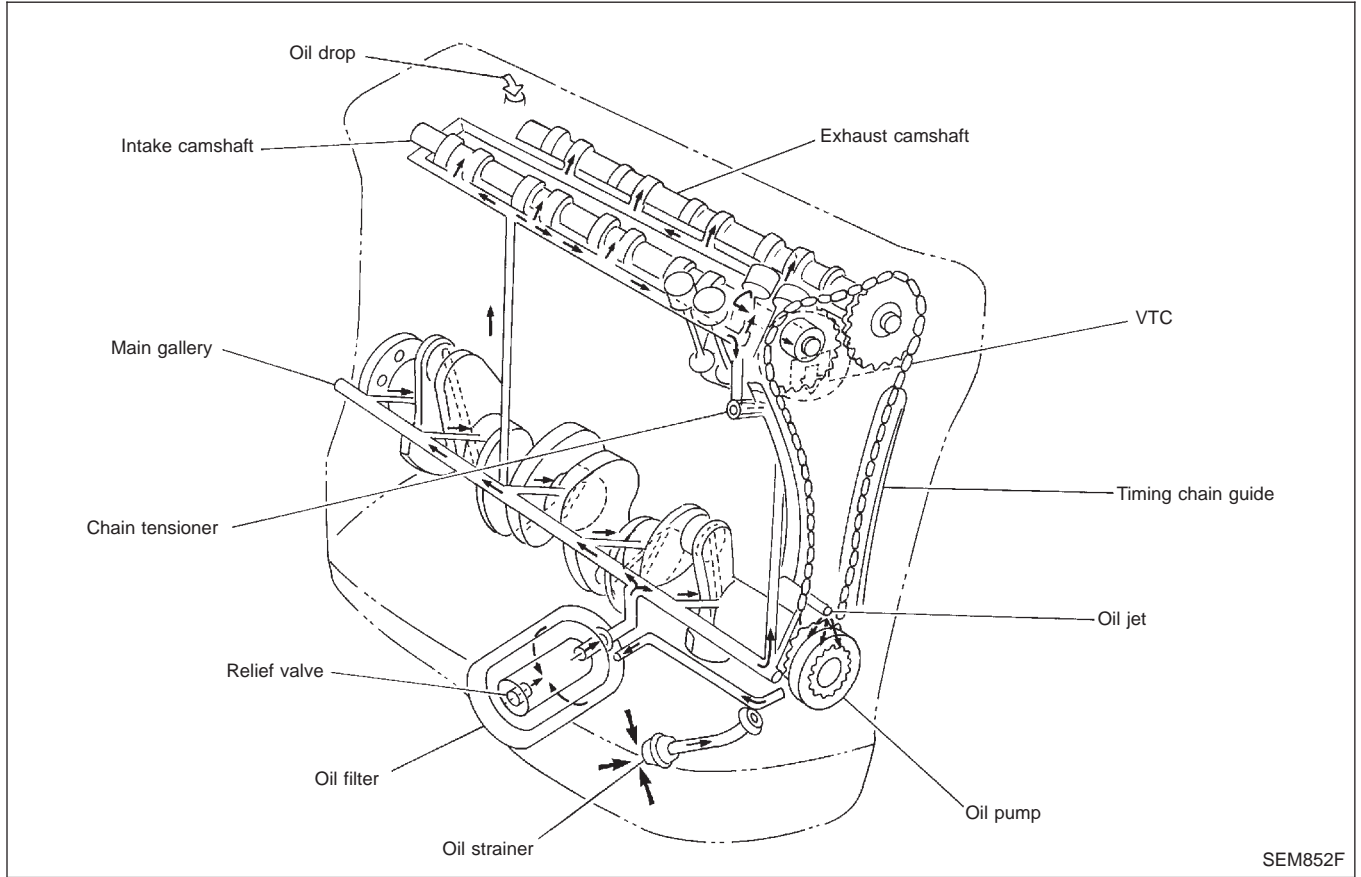
The actual shapes of Kent-Moore tools may differ from those of special service tools illustrated here.

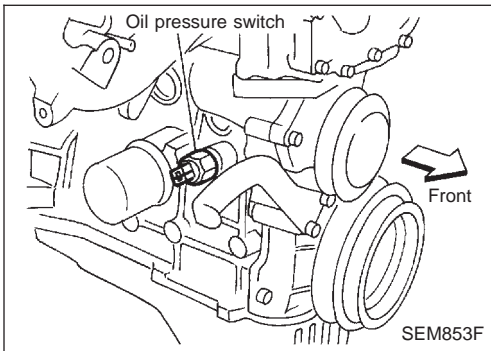
Tool number Tool name	Description	Engine application			
		SR	CD	QG	
ST25051001* Oil pressure gauge	 <p>PS1/4x19/in</p> <p>NT558</p>	Measuring oil pressure	X	X	X
ST25052000* Hose	 <p>PS1/4x19/in</p> <p>PS1/8x28/in</p> <p>NT559</p>	Adapting oil pressure gauge to cylinder block	X	X	X
KV10115801 or KV10115800 Oil filter wrench	 <p>15 faces, Inner span: 64.3 mm (2.531 in) (Face to opposite face)</p> <p>NT362</p>	Removing oil filter	X	—	X
99545R2500 (KV10106S0) Oil filter wrench	 <p>15 faces, Inner span: 92.5 mm (3.642 in) (Face to opposite corner)</p> <p>NT631</p>	Removing oil filter	—	X	—
WS39930000 Tube presser	 <p>NT052</p>	Pressing the tube of liquid gasket	X	X	X
EG17650301 Radiator cap tester adapter	 <p>NT564</p>	Adapting radiator cap tester to radiator filler neck	X	X	X

*:Special tool or commercial equivalent

Lubrication Circuit

NCLC0003





Oil Pressure Check

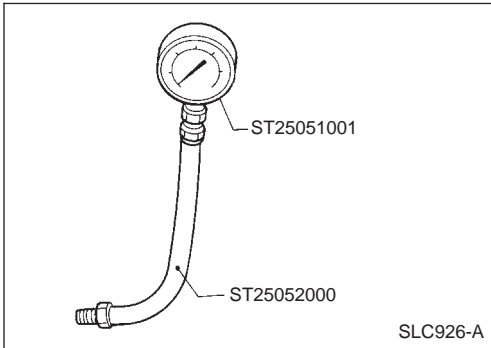
NCLC0004

WARNING:

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

- Put gearshift lever in Neutral “N” 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 (bar, kg/cm ² , psi)
600	More than 98 (0.98, 1.0, 14)
2,000	More than 294 (2.94, 3.0, 43)
6,000	More than 392 (3.92, 4.0, 57)

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

6. Install oil pressure switch with sealant.

Oil Pump

REMOVAL AND INSTALLATION

NCLC0005

- Always replace oil seal with a new one. Refer to EM section (“OIL SEAL REPLACEMENT”).

- When installing oil pump, apply engine oil to gears.

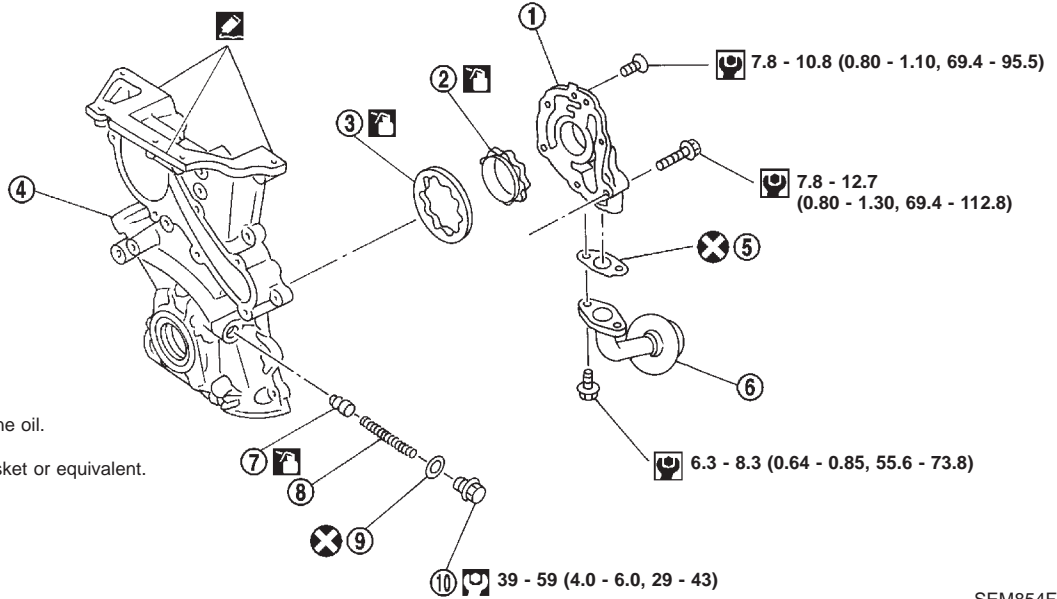
- Make sure that O-ring is fitted properly.

1. Drain engine oil.
2. Remove drive belts.
3. Remove oil pan. Refer to EM section (“OIL PAN”).
4. Remove oil strainer.
5. Remove front cover. Refer to EM section (“TIMING CHAIN”).
6. Install front cover.
7. Reinstall parts in reverse order of removal.

DISASSEMBLY AND ASSEMBLY

NCLC0006

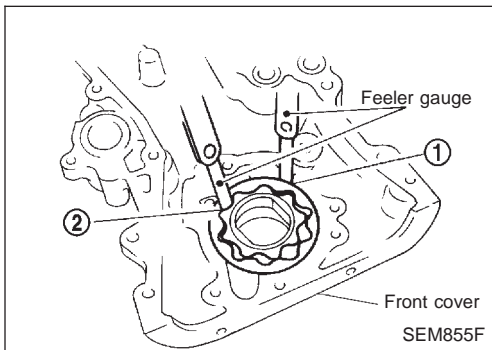
SEC. 135-150



- : Lubricate with new engine oil.
- : Use Genuine Liquid Gasket or equivalent.
- : Do not re-use.
- : N-m (kg-m; in-lb)
- : N-m (kg-m, ft-lb)

SEM854FA

- | | | |
|-------------------|--------------------|-----------|
| 1. Oil pump cover | 5. Gasket | 8. Spring |
| 2. Inner gear | 6. Oil strainer | 9. Washer |
| 3. Outer gear | 7. Regulator valve | 10. Plug |
| 4. Front cover | | |



INSPECTION

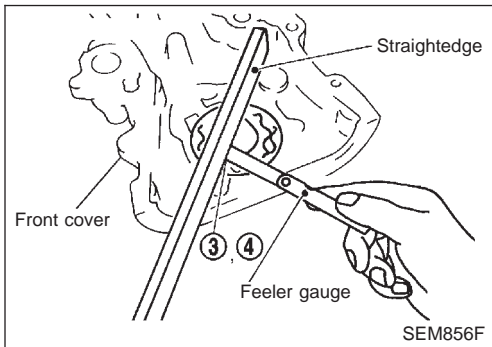
NCLC0007

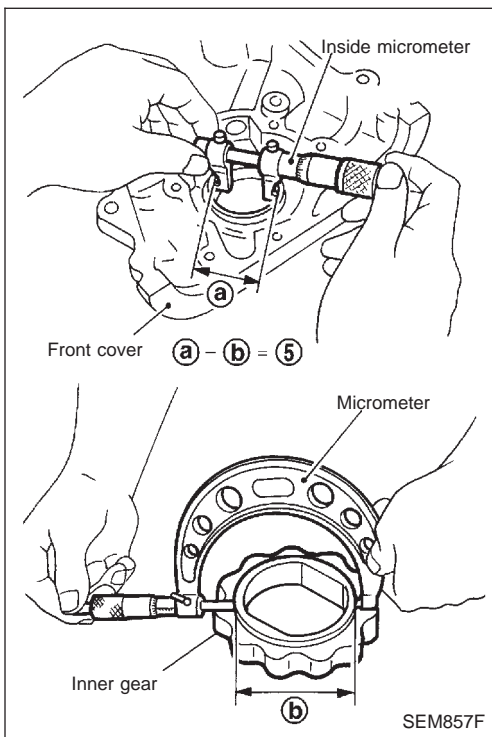
Using a feeler gauge, check the following clearances.

Standard clearance:

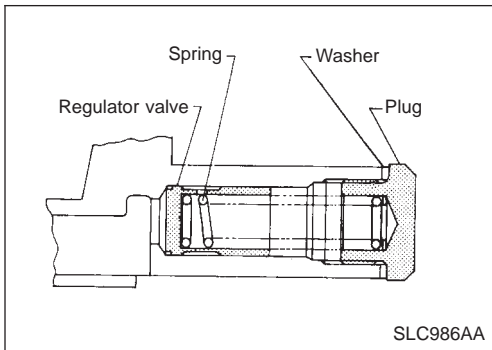
Unit: mm (in)

Body to outer gear radial clearance 1	0.250 - 0.325 (0.0098 - 0.0128)
Inner gear to outer gear tip clearance 2	Below 0.18 (0.0071)
Body to inner gear clearance 3	0.030 - 0.085 (0.0012 - 0.0033)
Body to outer gear axial clearance 4	0.030 - 0.090 (0.0012 - 0.0035)
Inner gear to brazed portion of housing 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.

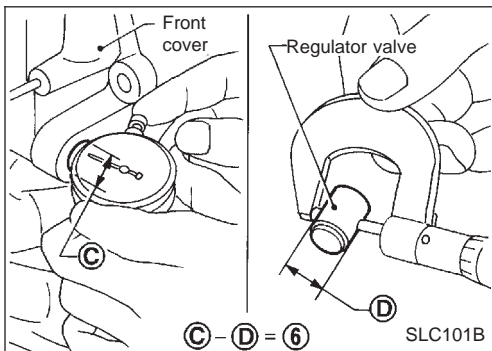


REGULATOR VALVE INSPECTION

NCLC0008

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 front cover assembly.

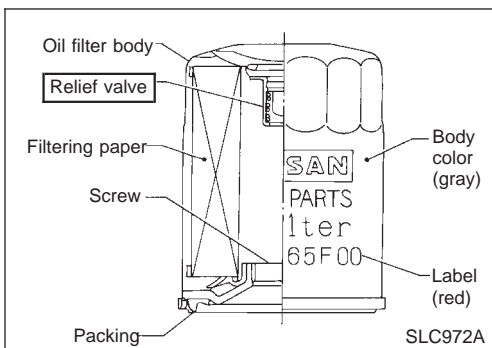


4. Check regulator valve to front cover clearance.

Clearance:

6 : 0.052 - 0.088 mm (0.0020 - 0.0035 in)

If it exceeds the limit, replace front cover assembly.



Oil Filter

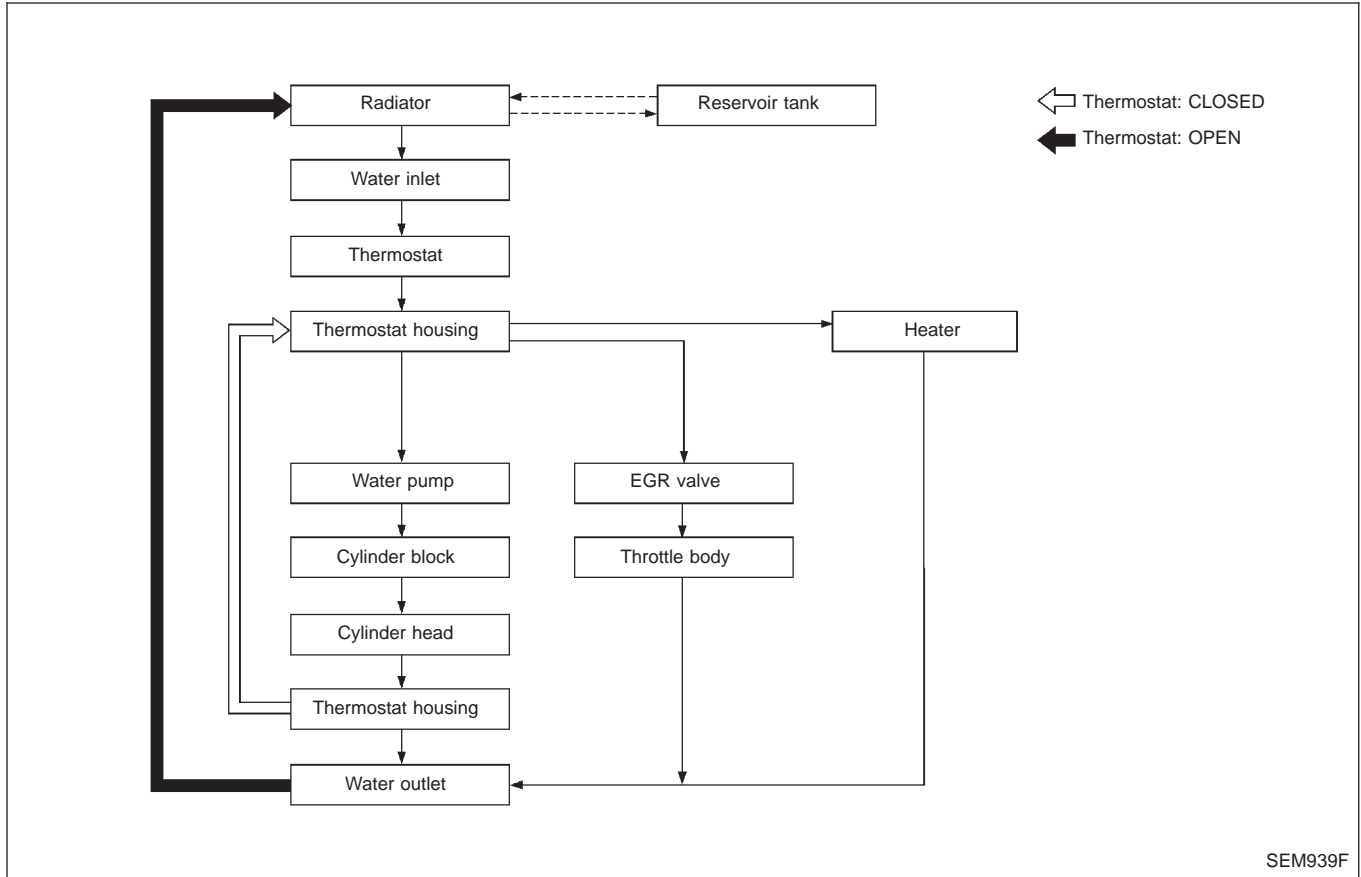
NCLC0010

The oil filter is a small, full-flow cartridge type and is provided with a relief valve.

- The new and previous oil filter designs differ from each other and are not interchangeable.
- Use Tool KV10115801 for removing oil filter.

Cooling Circuit

NCLC0016



System Check

NCLC0017

WARNING:

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

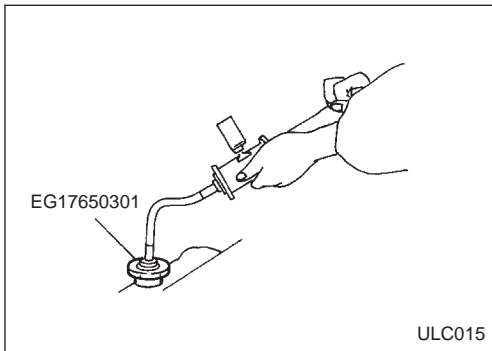
Wrap a thick cloth around the cap. Slowly turn it a quarter turn to allow built-up pressure to escape. Carefully remove the cap by turning it all the way.

CHECKING COOLING SYSTEM HOSES

NCLC0017S01

Check hoses for the following:

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



CHECKING COOLING SYSTEM FOR LEAKS

NCLC0017S02

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

Testing pressure:

157 kPa (1.57 bar, 1.6 kg/cm², 23 psi)

CAUTION:

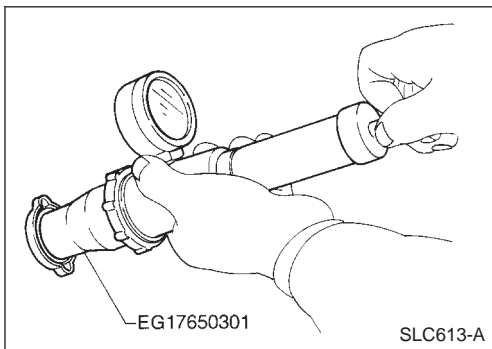
Higher pressure than specified may cause radiator damage.

CHECKING RADIATOR

NCLC0017S04

Check radiator for mud or clogging. If necessary, clean radiator as follows.

- Be careful not to bend or damage the radiator fins.
 - When radiator is cleaned without removal, remove all surrounding parts such as cooling fan, radiator shroud and horns. Then tape the harness and connectors to prevent water from entering.
1. Apply water by hose to the back side of the radiator core vertically downward.
 2. Apply water again to all radiator core surfaces once per minute.
 3. Stop washing if any stains no longer flow out from the radiator.
 4. Blow air into the back side of radiator core vertically downward.
 - Use compressed air lower than 490 kPa (4.9 bar, 5 kg/cm², 71 psi) and keep distance more than 30 cm (11.8 in).
 5. Blow air again into all the radiator core surfaces once per minute until no water sprays out.



CHECKING RADIATOR CAP

NCLC0017S03

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

Radiator cap relief pressure:

Standard

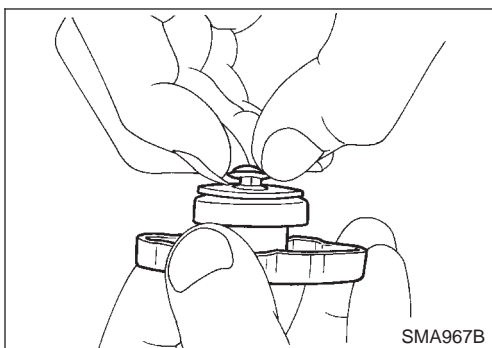
78 - 98 kPa

(0.78 - 0.98 bar, 0.8 - 1.0 kg/cm², 11 - 14 psi)

Limit

59 - 98 kPa

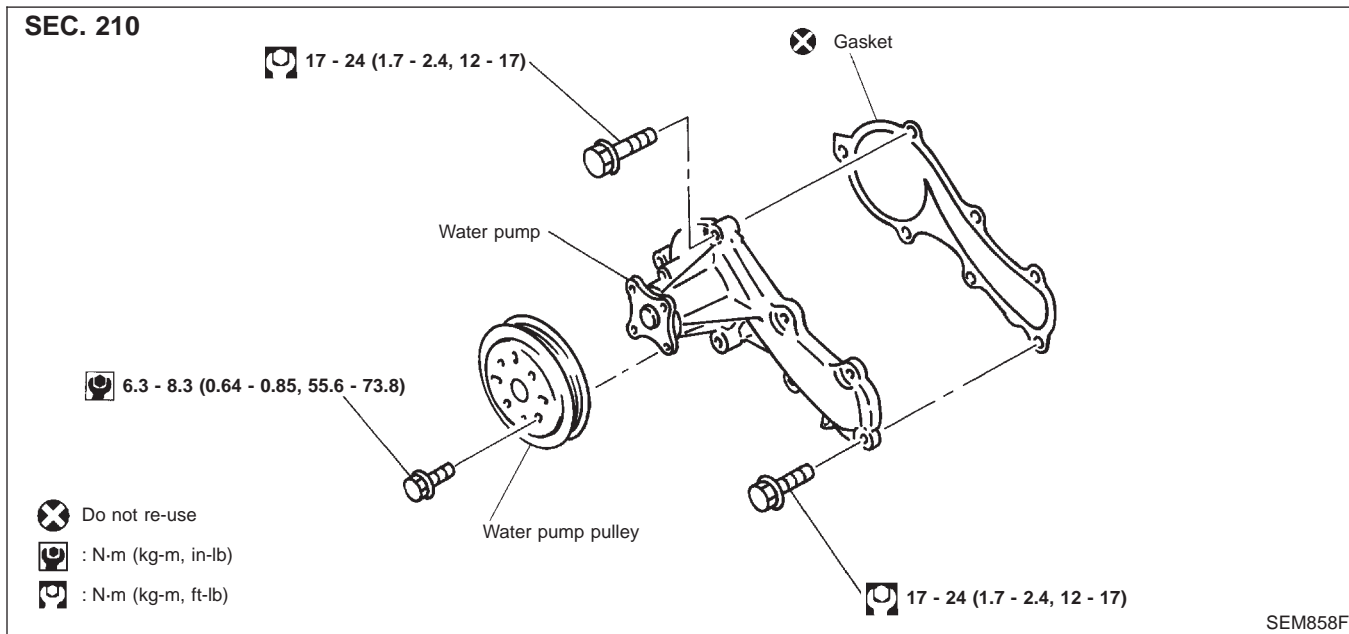
(0.59 - 0.98 bar, 0.6 - 1.0 kg/cm², 9 - 14 psi)



Pull the negative pressure valve to open it.
Check that it closes completely when released.

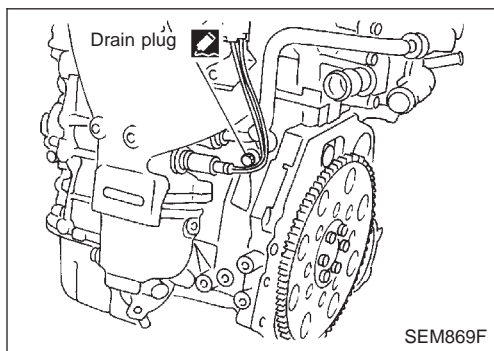
Water Pump REMOVAL AND INSTALLATION

NCLC0018

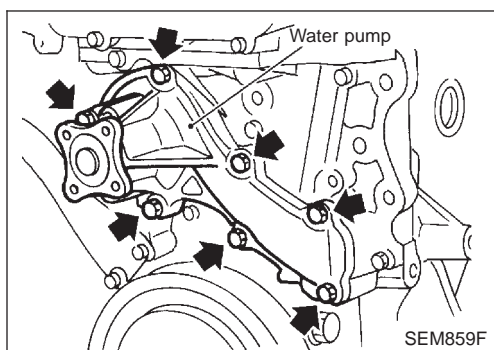


CAUTION:

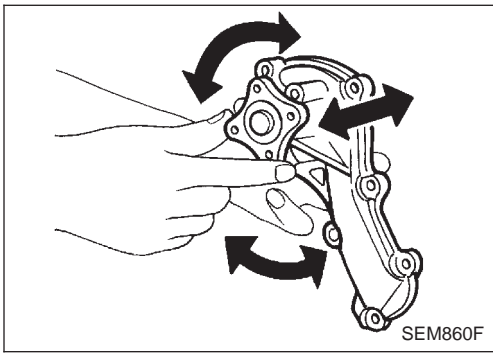
- When removing water pump assembly, be careful not to get coolant on drive belt.
- Water pump cannot be disassembled and should be replaced as a unit.
- After installing water pump, and check for leaks using radiator cap tester.



1. Drain coolant from radiator and cylinder block. Refer to MA section ("Changing Engine Coolant", "ENGINE MAINTENANCE").
2. Remove cylinder head front mounting bracket.
3. Remove drive belts and idler pulley.
4. Loosen water pump pulley bolts.
5. Remove water pump pulley.



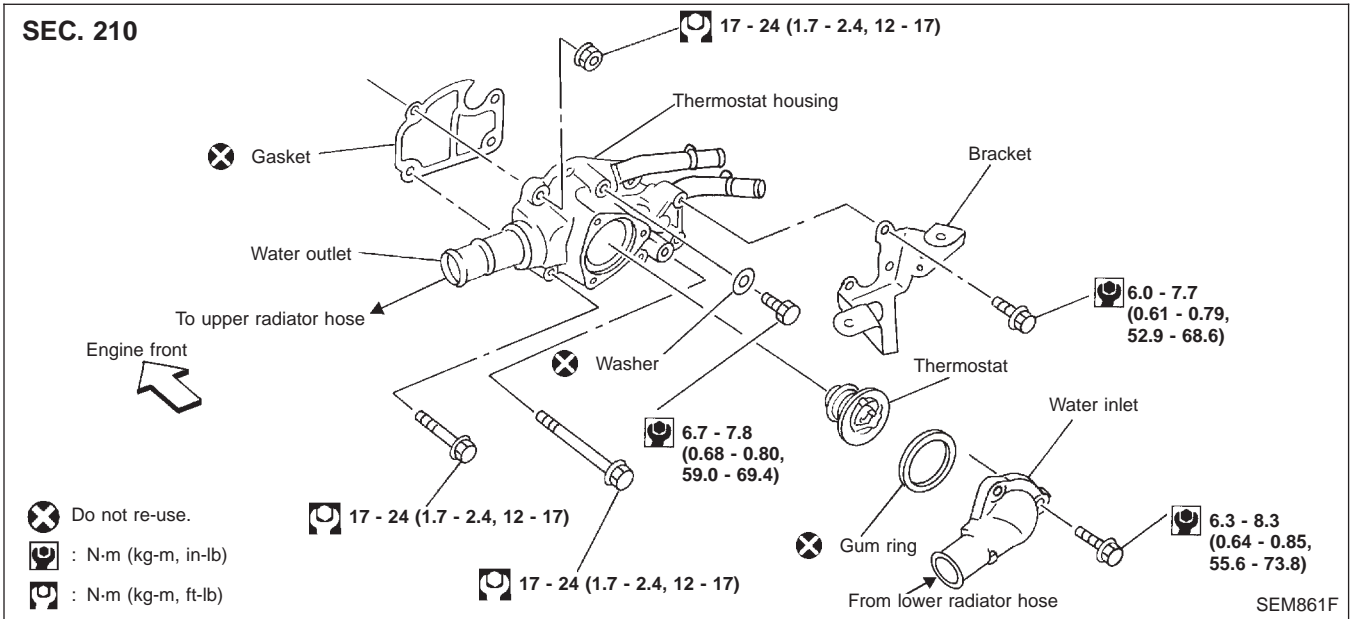
6. Remove water pump bolts.
7. Remove water pump with gasket.
8. Reinstall parts in reverse order of removal.



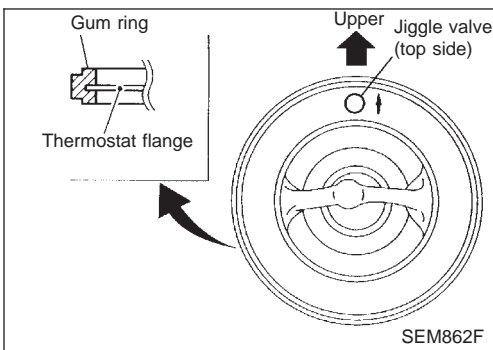
INSPECTION

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

Thermostat REMOVAL AND INSTALLATION

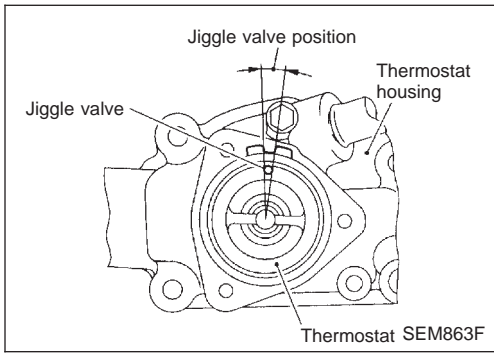


- **Be careful not to spill coolant over engine compartment. Use a rag to absorb coolant.**
 - **Use Genuine Liquid Gasket or equivalent.**
1. Drain engine coolant.
 2. Remove lower radiator hose.
 3. Remove water inlet, then take out thermostat.

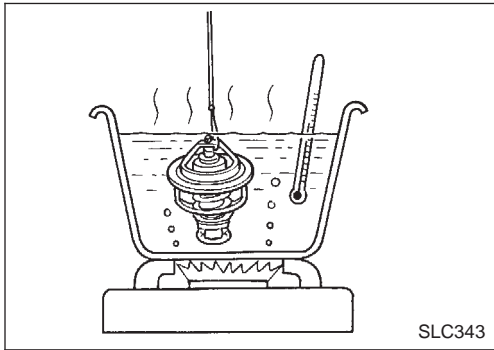


4. Install gum ring to thermostat.

Thermostat (Cont'd)



5. Install thermostat with jiggle valve or air bleeder at upper side.
 - **After installation, run engine for a few minutes, and check for leaks.**



INSPECTION

NCLC0022

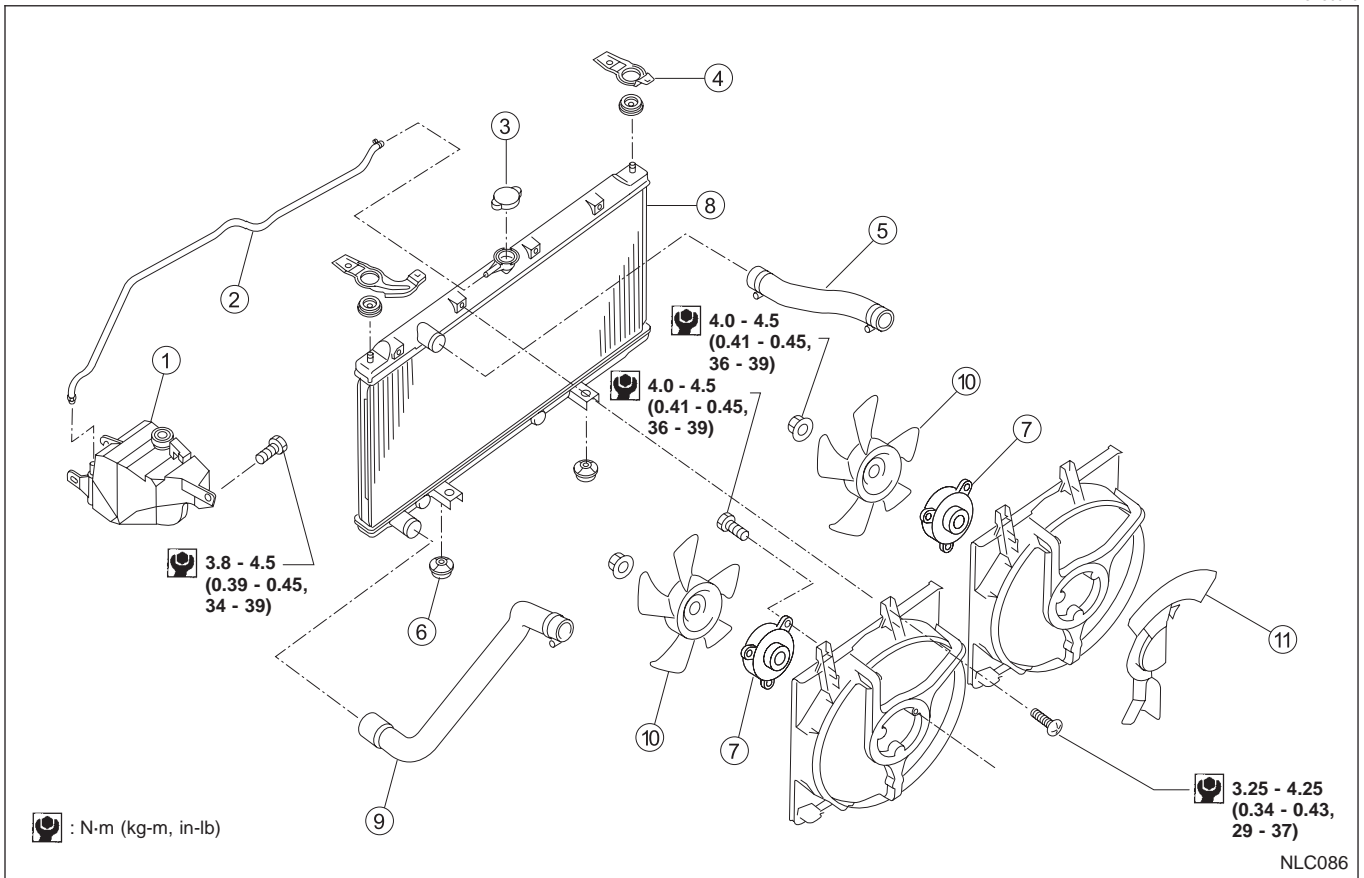
1. Check for valve seating condition at normal room temperature. It should seat tightly.
2. Check valve opening temperature and valve lift.

Valve opening temperature °C (°F)	82 (180)
Valve lift mm/°C (in/°F)	More than 9/95 (0.35/203)

3. Then check if valve closes at 5°C (41°F) below valve opening temperature.

Radiator COMPONENTS

=NCLC0025



- ① Reservoir tank
- ② Reservoir hose
- ③ Radiator cap
- ④ Mounting bracket

- ⑤ Upper radiator hose
- ⑥ Mounting rubber
- ⑦ Cooling fan motor
- ⑧ Radiator

- ⑨ Lower radiator hose
- ⑩ Cooling fan
- ⑪ Cooling fan motor shield

Cooling Fan Control System

NCLC0026

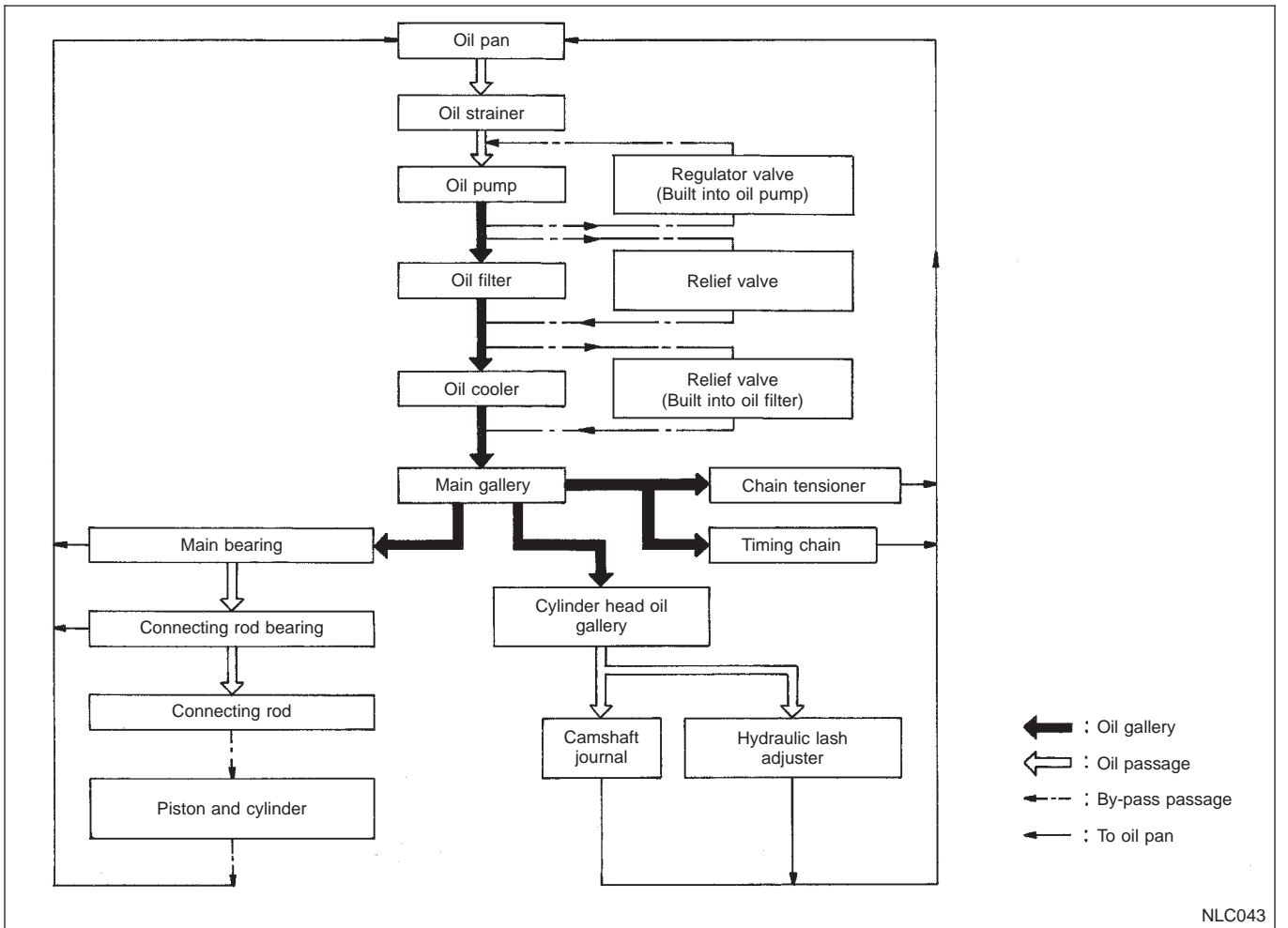
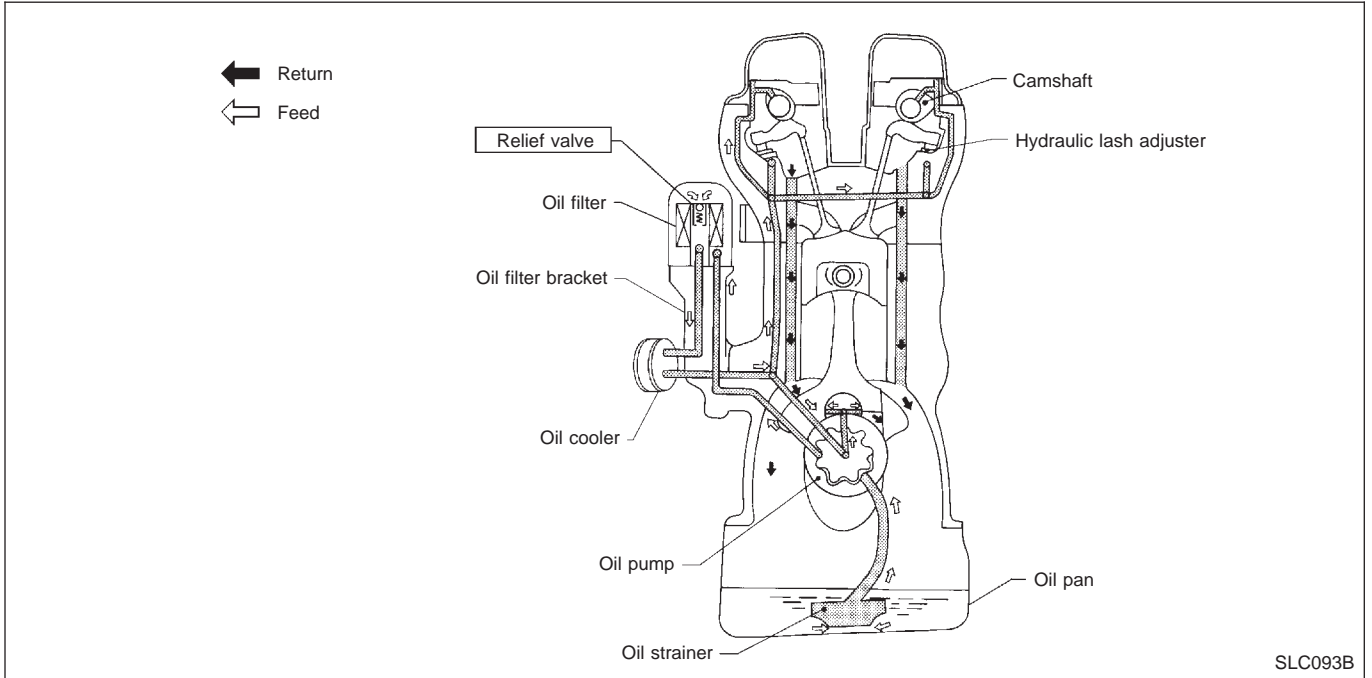
Cooling fans are controlled by the ECM. For details, refer to EC section [TROUBLE DIAGNOSIS FOR OVERHEAT (COOLING SYSTEM)].

Refilling Engine Coolant

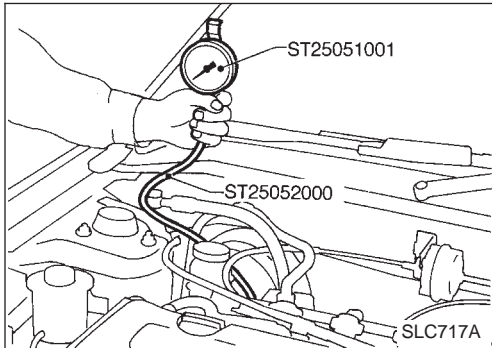
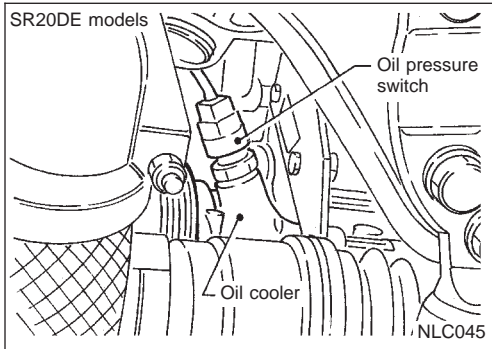
NCLC0027

For details on refilling engine coolant, refer to MA section ("ENGINE MAINTENANCE", "Changing Engine Coolant", MA-30)

Lubrication Circuit



Oil Pressure Check



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 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 (bar, kg/cm ² , psi)
Idle speed	More than 78 (0.78, 0.8, 11)
3,200	314 - 392 (3.14 - 3.92, 3.2 - 4.0, 46 - 57)

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

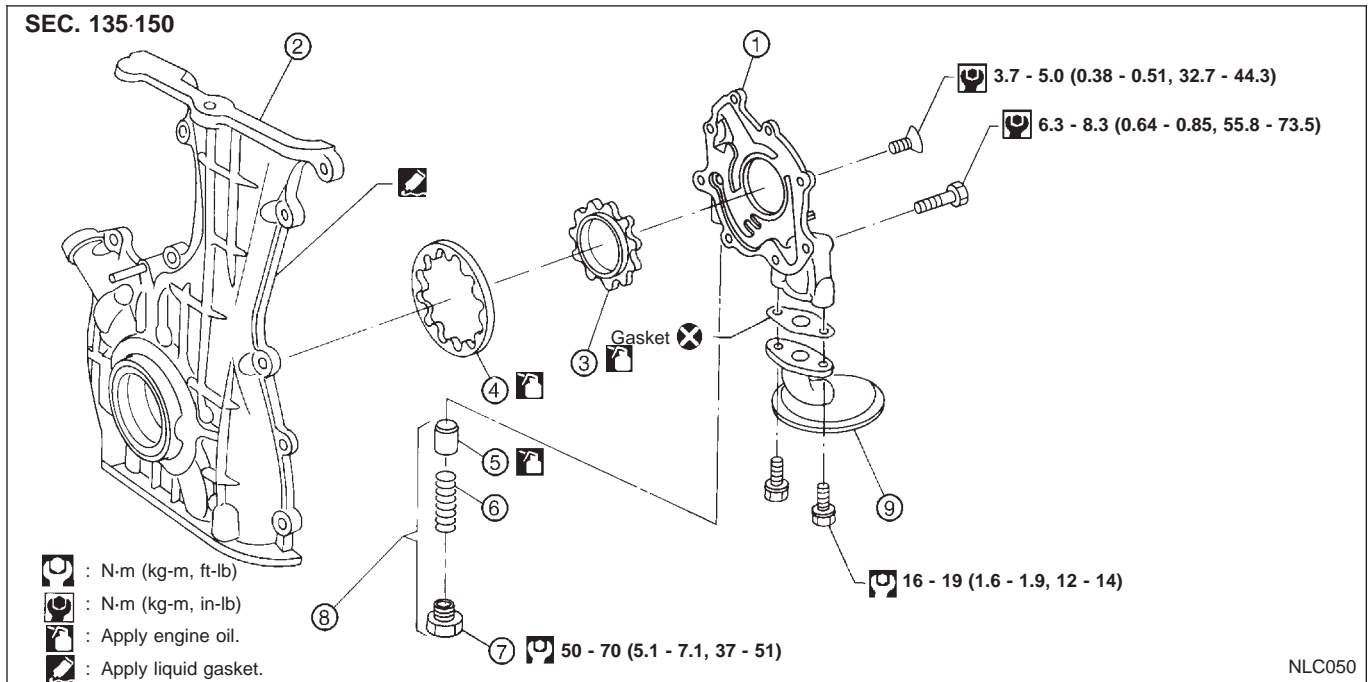
6. Install oil pressure switch with sealant.

Oil Pump

REMOVAL AND INSTALLATION

1. Drain engine oil
2. Remove drive belts.
3. Remove cylinder head. (Refer to EM section).
4. Remove oil pan. (Refer to EM section).
5. Remove oil strainer and baffle plate.
6. Remove front cover assembly.
7. Install front cover assembly.
8. Reinstall any parts removed in reverse order of removal

DISASSEMBLY AND ASSEMBLY

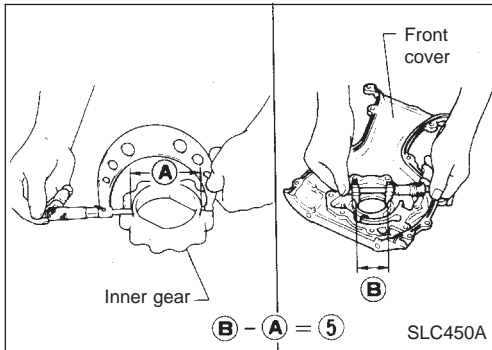
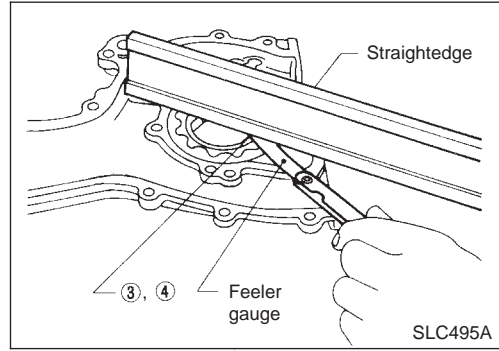
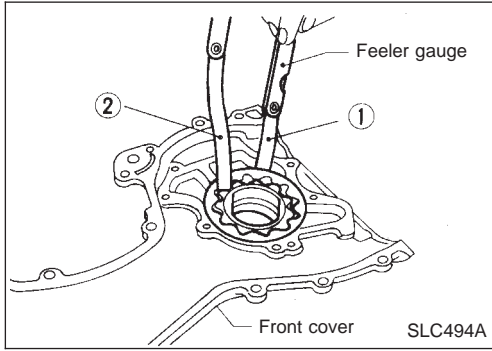


- ① Oil pump cover
- ② Front cover
- ③ Inner gear

- ④ Outer gear
- ⑤ Regulator valve
- ⑥ Spring

- ⑦ Plug
- ⑧ Regulator valve set
- ⑨ Oil strainer

- Always replace oil seal, gasket and O-ring with new ones.
- When installing oil pump, apply engine oil to inner and outer gears.
- Be sure that O-rings are properly fitted.



SLC860A

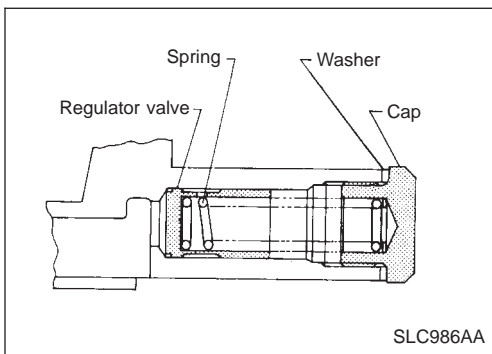
INSPECTION

Using a feeler gauge, check the following clearances:

Unit: mm (in)

Body to outer gear clearance (radial) ①	0.114 - 0.200 (0.0045 - 0.0079)
Inner gear to outer gear tip clearance ②	Below 0.18 (0.0071)
Body to inner gear clearance ③	0.05 - 0.09 (0.0020 - 0.0035)
Body to outer gear clearance (axial) ④	0.05 - 0.11 (0.0020 - 0.0043)
Inner gear to brazed portion of housing clearance ⑤	0.045 - 0.091 (0.0018 - 0.0036)

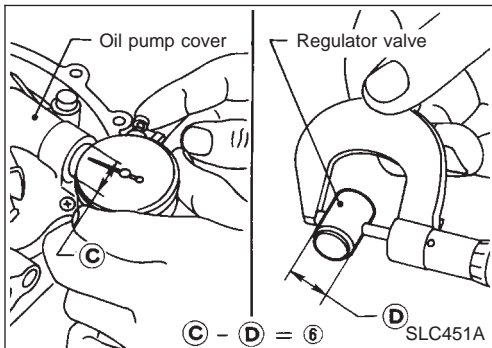
- If the tip clearance (②) exceeds the limit, replace gear set.
- If body to gear clearances (①, ③, ④, ⑤) exceed the limit, replace front cover assembly.



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 regulator valve falls smoothly into the valve hole by its own weight.

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

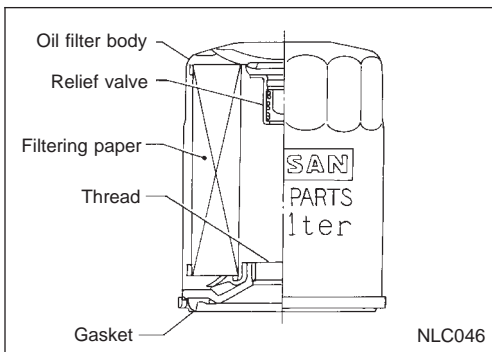


4. Check regulator valve to oil pump cover clearance.

Clearance:

⑥ : 0.040 - 0.097 mm (0.0016 - 0.0038 in)

If it exceeds the limit, replace oil pump cover.

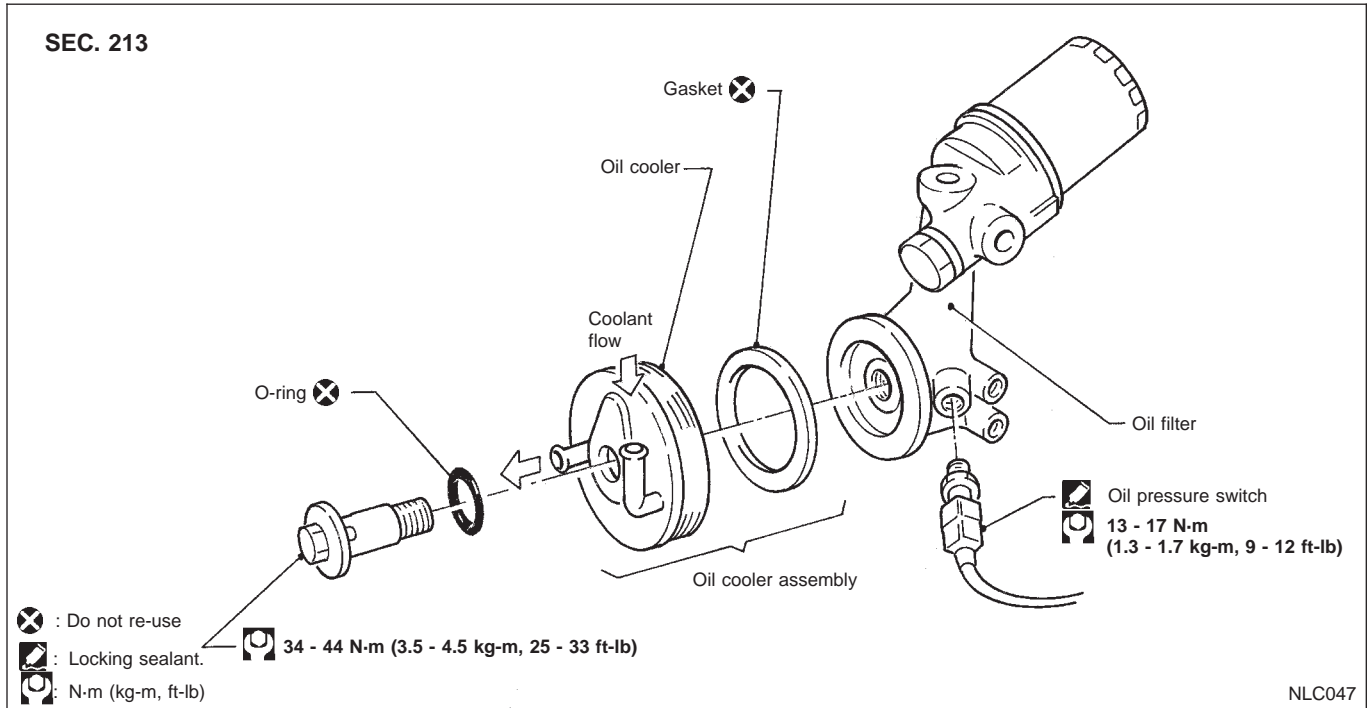


Oil Filter

The oil filter is a small, full-flow cartridge type and is provided with a relief valve.

- The new and existing oil filter designs differ from each other and are not interchangeable.
- Use Tool KV10115801 or KV10115800 for removing oil filter.

Oil Cooler



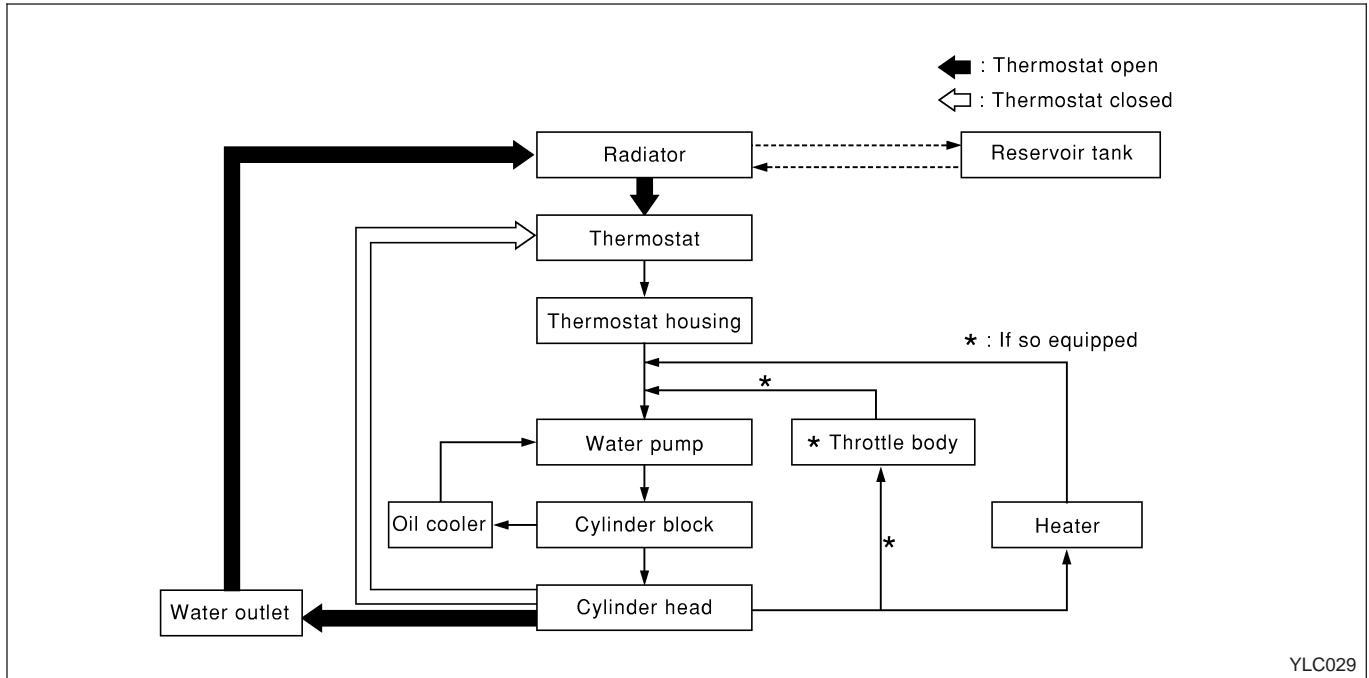
REMOVAL AND INSTALLATION

1. Drain engine oil and coolant.
2. Remove oil cooler.
3. Installation is in reverse order of removal
 - **Be careful not to burn yourself as engine oil is hot**
 - **After installation, run engine for a few minutes and check for oil leaks.**
 - **Do not spill coolant on drive belts.**

INSPECTION

1. Check oil cooler for cracks.
2. Check oil cooler for clogging by blowing through coolant inlet. If necessary, replace oil cooler assembly.

Cooling Circuit



System Check

WARNING:

Never remove the radiator cap when the engine is hot; serious burns could be caused by high pressure fluid escaping from the radiator.

Wrap a thick cloth around the cap and carefully remove it by turning it a quarter turn to allow built-up pressure to escape and then turn the cap all the way off.

Cooling System Inspection

CHECKING HOSES

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

CHECKING RADIATOR CAP

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

Radiator cap relief pressure:

Standard

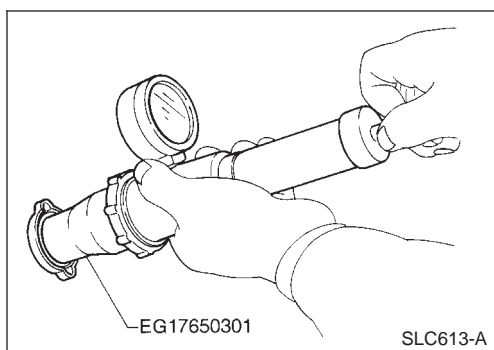
78 - 98 kPa

(0.78 - 0.98 bar, 0.8 - 1.0 kg/cm², 11 - 14 psi)

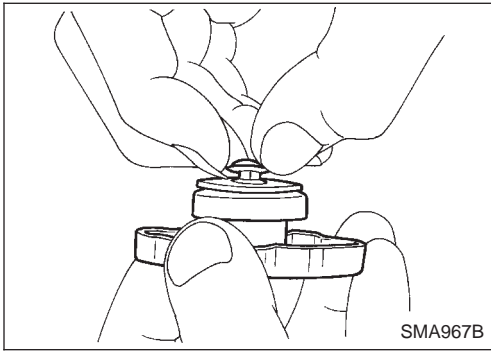
Limit

59 - 98 kPa

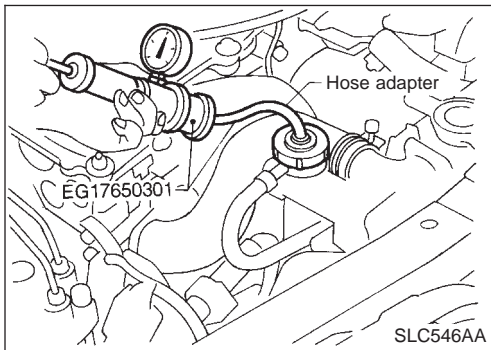
(0.59 - 0.98 bar, 0.6 - 1.0 kg/cm², 9 - 14 psi)



Cooling System Inspection (Cont'd)



Pull the negative pressure valve to open it. Check that it closes completely when released.



CHECKING COOLING SYSTEM FOR LEAKS

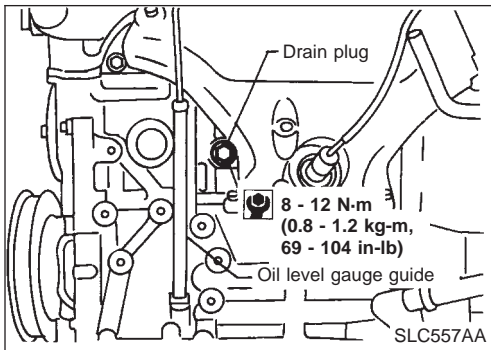
To check for leakage, apply pressure to the cooling system with a tester.

Testing pressure:

157 kPa (1.57 bar, 1.6 kg/cm², 23 psi)

CAUTION:

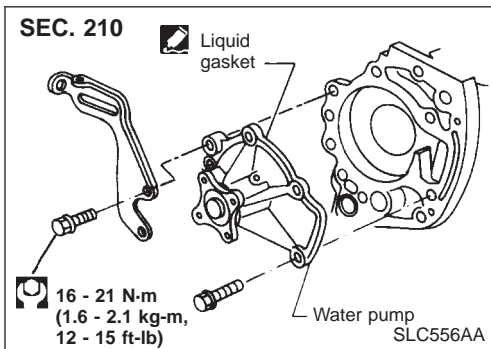
Higher than the specified pressure may cause radiator damage.



Water Pump

REMOVAL AND INSTALLATION

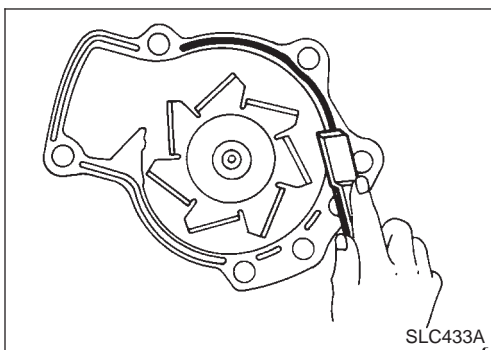
1. Drain coolant from radiator.
2. Remove cylinder block drain plug located at left front of cylinder block and drain coolant.
3. Remove front RH wheel and engine side cover.
4. Remove drive belts.
5. Remove front engine mounting.



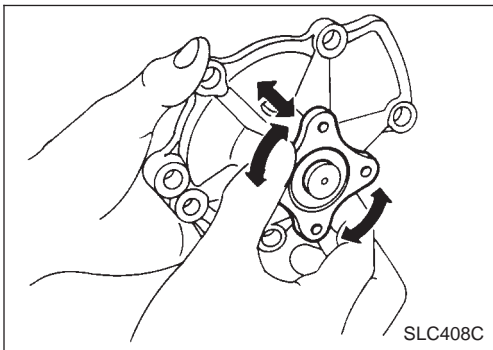
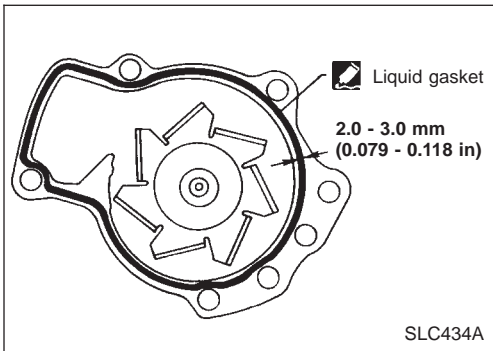
6. Remove water pump.

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 tester.



7. Before installing, remove all traces of liquid gasket from mating surface of water pump using a scraper.
 - Also remove traces of liquid gasket from mating surface of cylinder block.

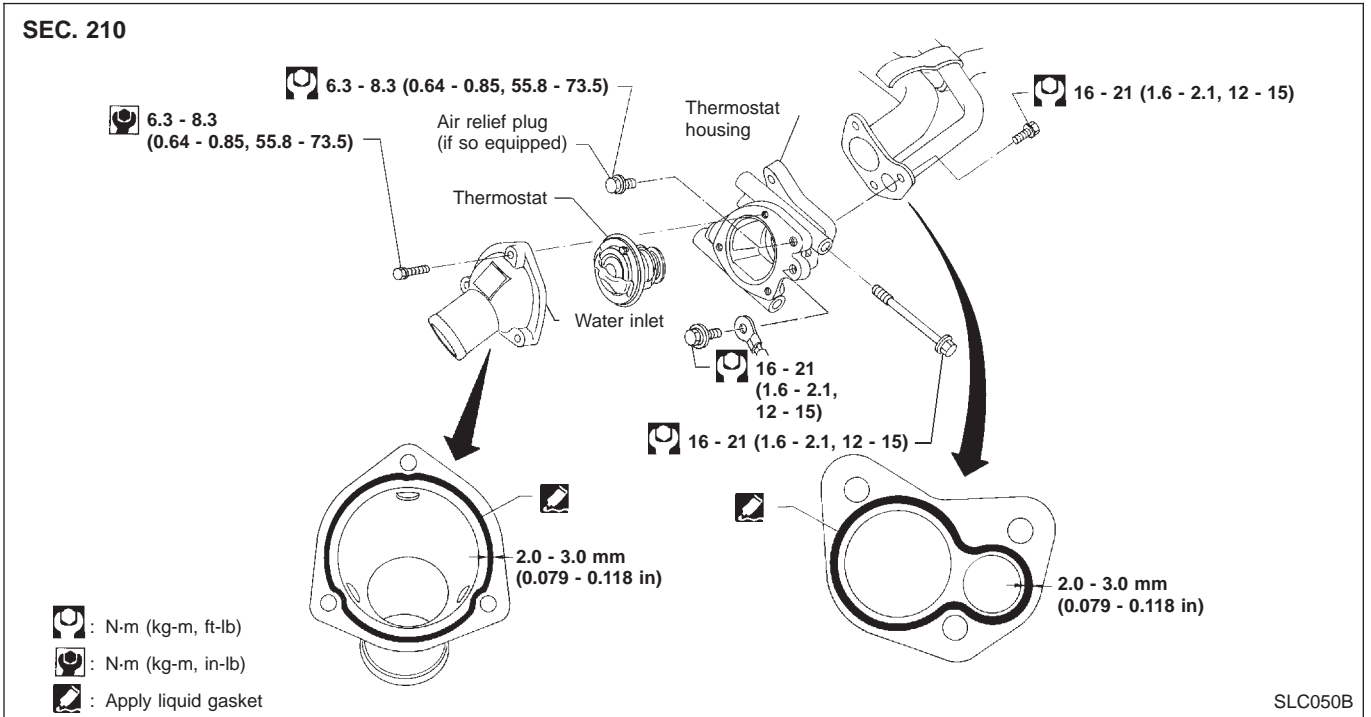


8. Apply a continuous bead of liquid gasket to mating surface of water pump.
 - **Use Genuine Liquid Gasket or equivalent.**
9. Install any parts removed in reverse order of removal

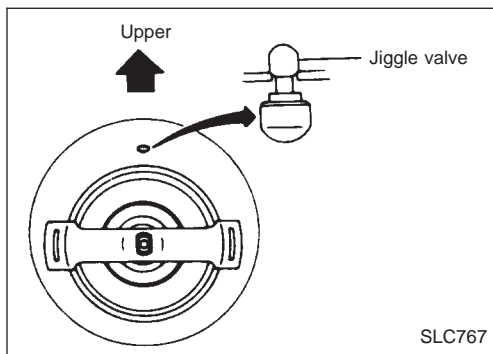
INSPECTION

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

Thermostat

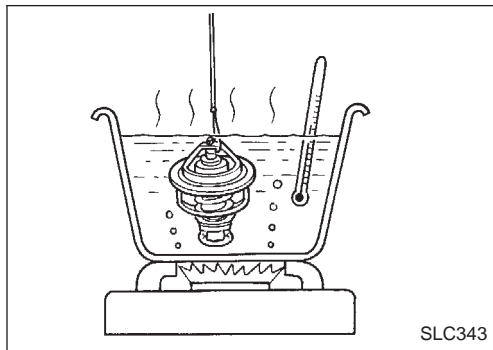


Thermostat (Cont'd)



REMOVAL AND INSTALLATION

1. Remove lower radiator hose and drain engine coolant.
2. Remove water inlet, then take out thermostat.
3. Before installing, remove all traces of liquid gasket from mating surface of each part using a scraper.
4. Apply a continuous bead of liquid gasket to mating surface of each part.
 - **Use Genuine Liquid Gasket or equivalent.**
5. Install thermostat with jiggle valve or air bleeder facing upward.
 - **After installation, run engine for a few minutes, and check for leaks.**
 - **Be careful not to spill coolant over engine compartment. Use a rag to absorb coolant.**



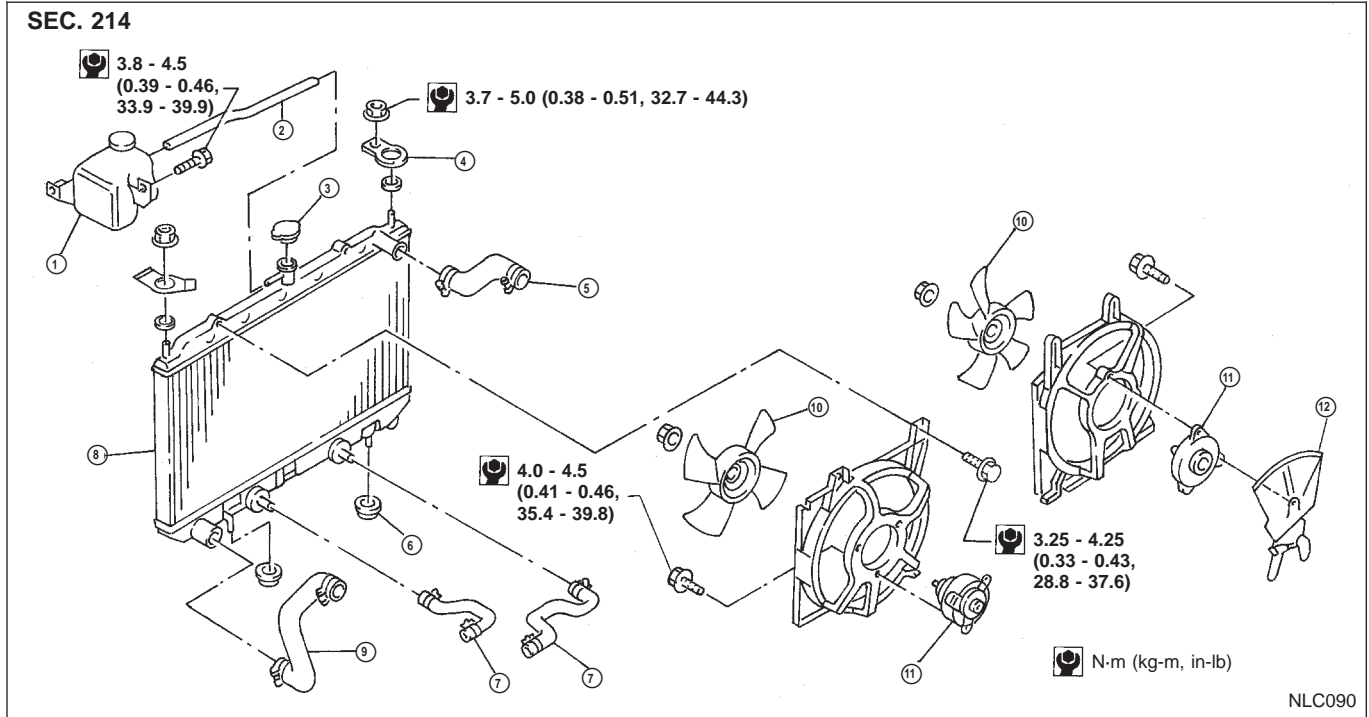
INSPECTION

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

Valve opening temperature	°C(°F)	82 (180)
Valve lift	mm/°C (in/°F)	More than 9/95 (0.35/203)

3. Then check if valve closes at 5°C (41°F) below valve opening temperature.

Radiator



- | | | |
|-----------------------|--------------------------------|----------------------------|
| ① Reservoir tank | ⑤ Upper hose | ⑨ Lower hose |
| ② Reservoir tank hose | ⑥ Mounting rubber | ⑩ Cooling fan |
| ③ Radiator cap | ⑦ Oil cooler hose (A/T models) | ⑪ Cooling fan motor |
| ④ Mounting bracket | ⑧ Radiator | ⑫ Cooling fan motor shield |

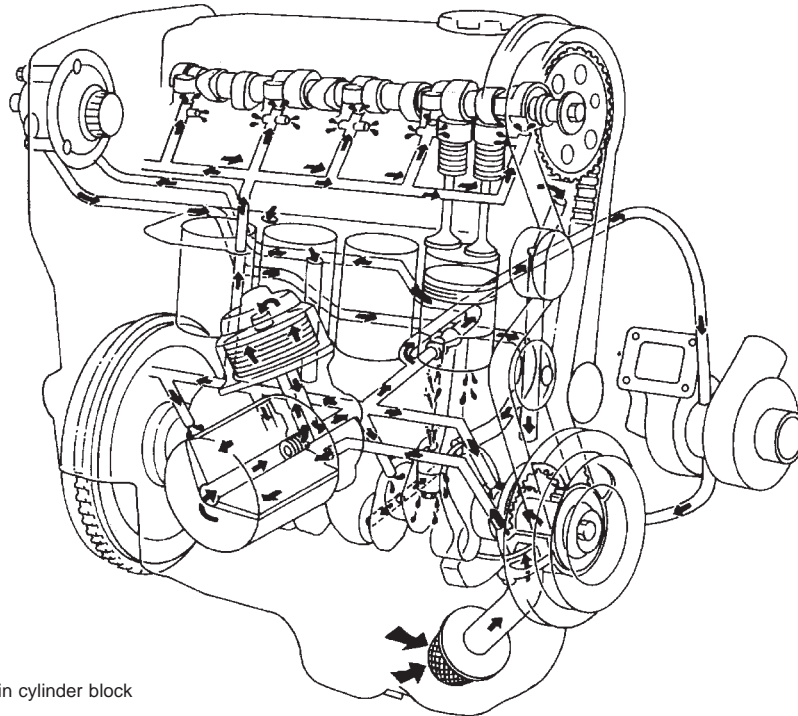
Cooling fan control system

- Cooling fans are controlled by the ECM. For details, refer to EC-section ("COOLING SYSTEM", "Diagnostic Procedure", EC-SR-284).

Refilling engine coolant

- For details on refilling engine coolant, refer to MA section ("ENGINE MAINTENANCE", "Changing Engine Coolant", MA-41).

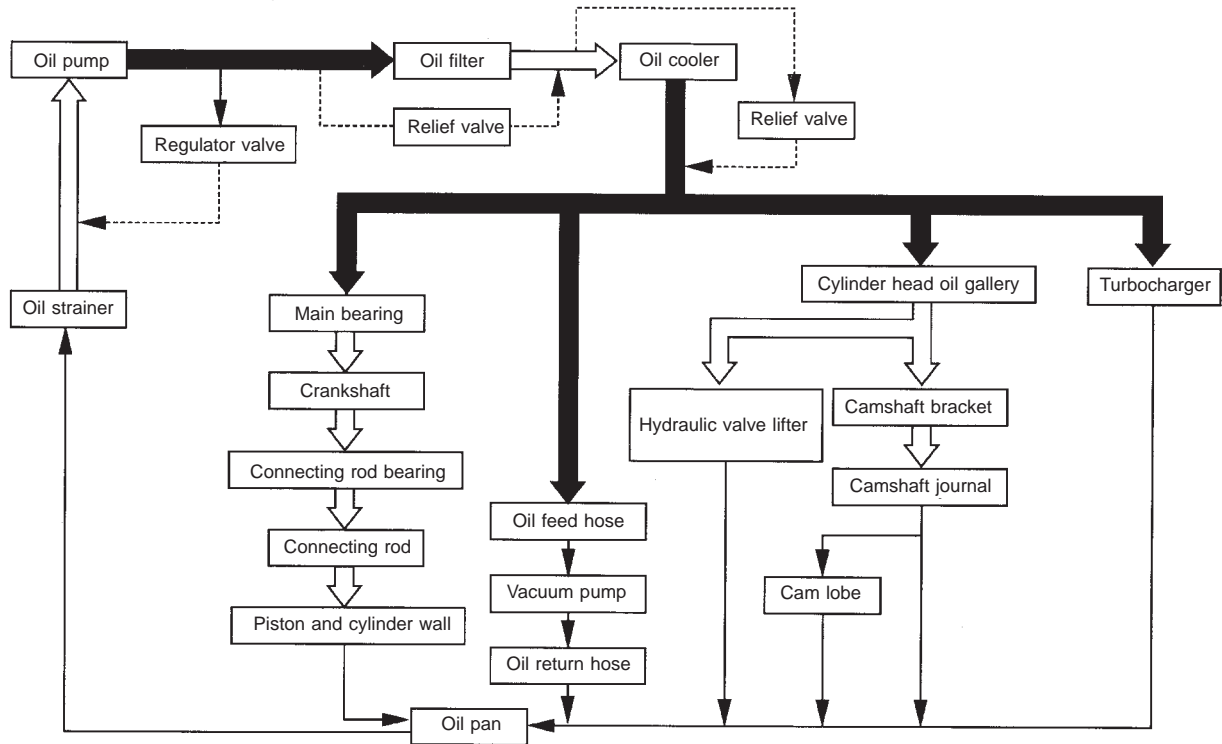
Lubrication Circuit



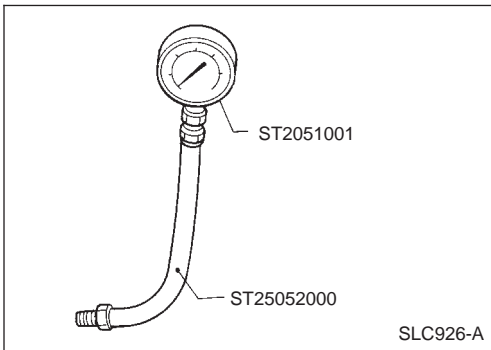
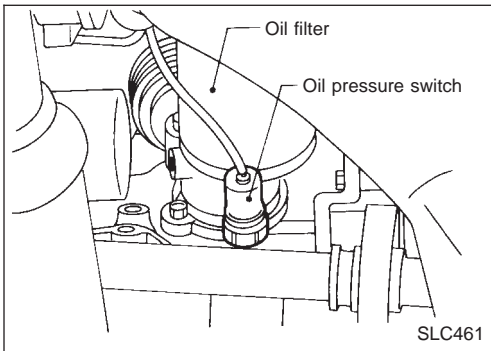
◄ : Oil gallery in cylinder block

◄ : Oil passage

◄--- : By-pass passage



SLC083B



Oil Pressure Check

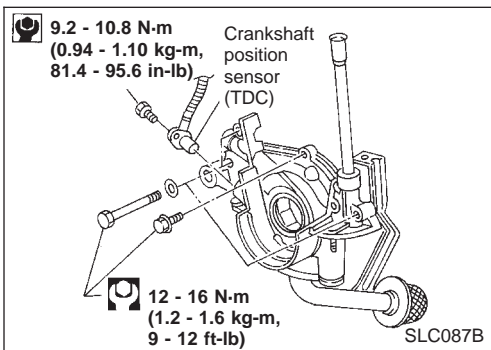
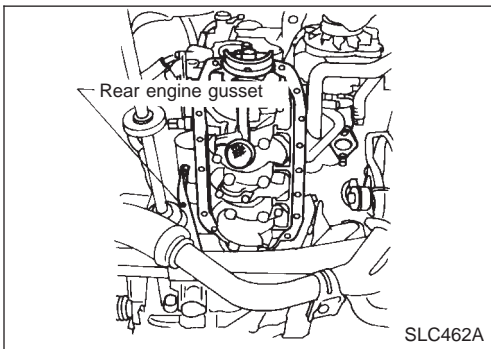
WARNING:

- 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.
 5. Check oil pressure with engine running under no-load.

Engine rpm	Approximate discharge pressure kPa (bar, kg/cm ² , psi)
Idle speed	More than 59 (0.59, 0.6, 9)
2,000	294 (2.9, 3, 43)

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

6. Install oil pressure switch with sealant.

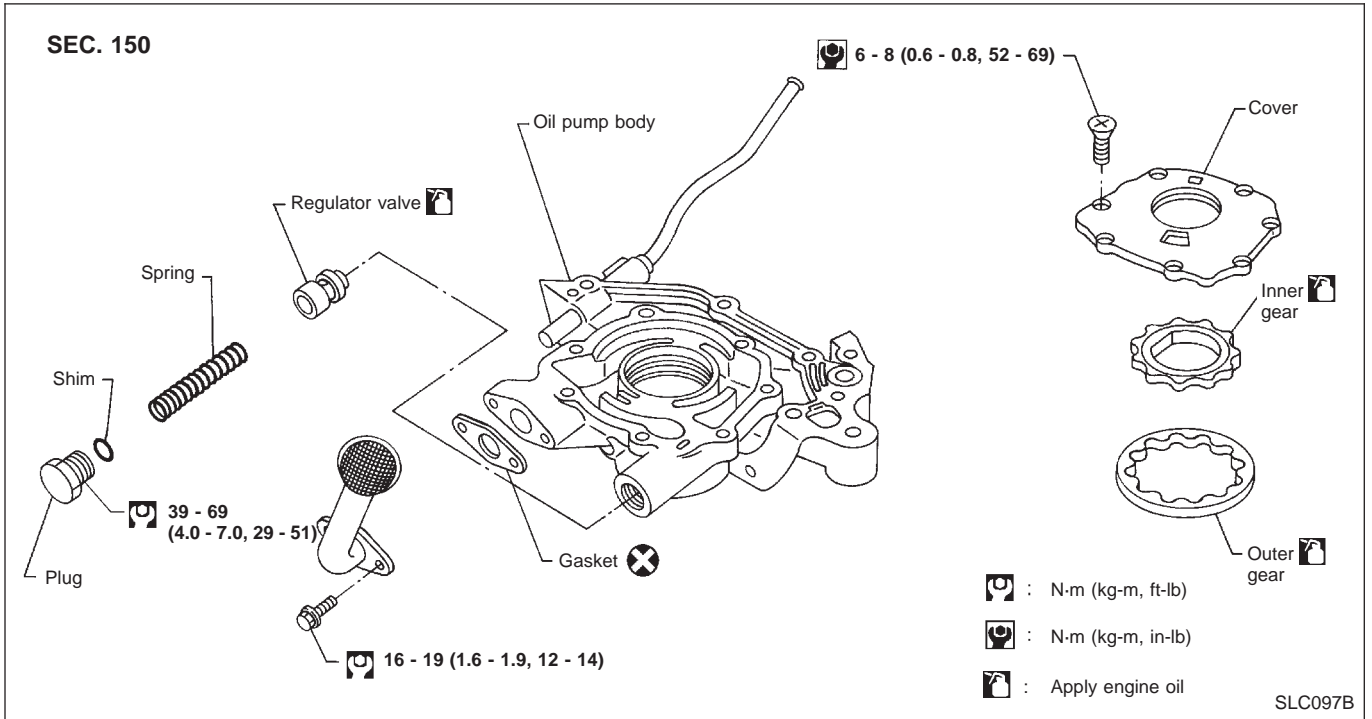


Oil Pump

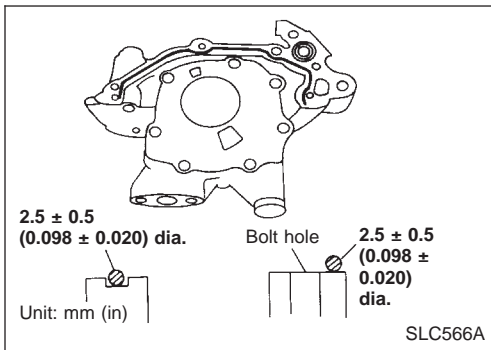
REMOVAL AND INSTALLATION

1. Drain engine coolant and engine oil.
 2. Remove upper radiator hose, drive belts, crank pulley, timing belt covers and timing belt. (Refer to EM section).
 3. Remove exhaust front tube, timing belt pulley and rear engine gusset (bar type), then remove oil pan. (Refer to EM section).
 4. Remove crankshaft position sensor (TDC).
 5. Remove oil pump assembly with oil strainer.
 6. Reinstall any part removed. Refill engine oil and engine coolant.
- Apply liquid gasket to oil pump.
 - Apply liquid gasket to oil pan.
 - Apply liquid gasket to both ends of oil pan oil seals.
 - Install oil pan, fitting oil seals in the correct position.

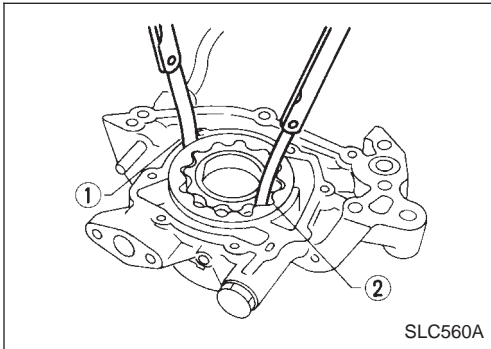
DISASSEMBLY AND ASSEMBLY



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



- Apply liquid gasket when installing oil pump onto engine.



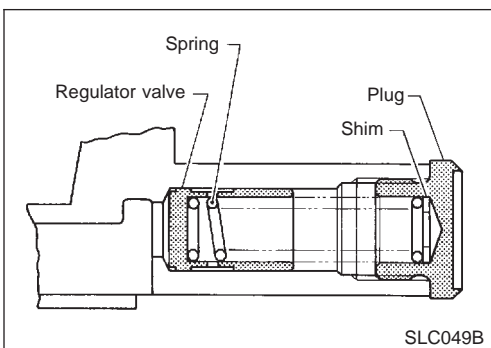
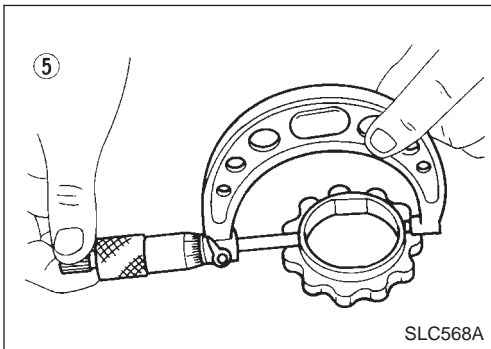
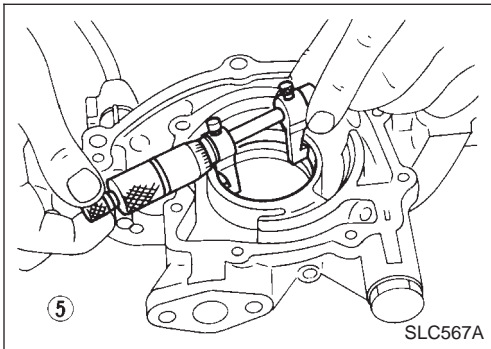
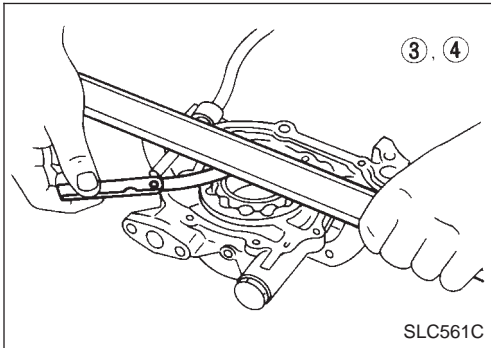
INSPECTION

Using a feeler gauge, check the following clearances.

Unit: mm (in)

Body to outer gear clearance ①	0.114 - 0.200 (0.0045 - 0.0079)
Outer gear to inner gear clearance ②	Less than 0.18 (0.0071)
Housing to inner gear clearance ③	0.05 - 0.09 (0.0020 - 0.0035)
Housing to outer gear clearance ④	0.05 - 0.11 (0.0020 - 0.0043)
Inner gear to housing clearance ⑤	0.045 - 0.091 (0.0018 - 0.0036)

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

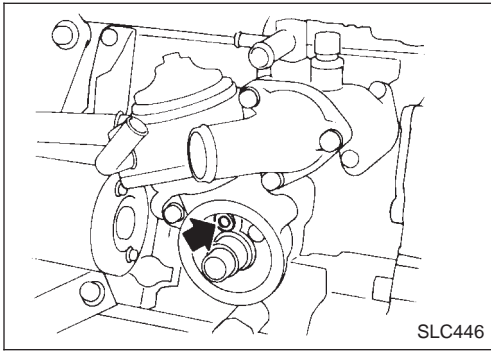


REGULATOR VALVE INSPECTION

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 freely into the valve hole by its own weight.

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

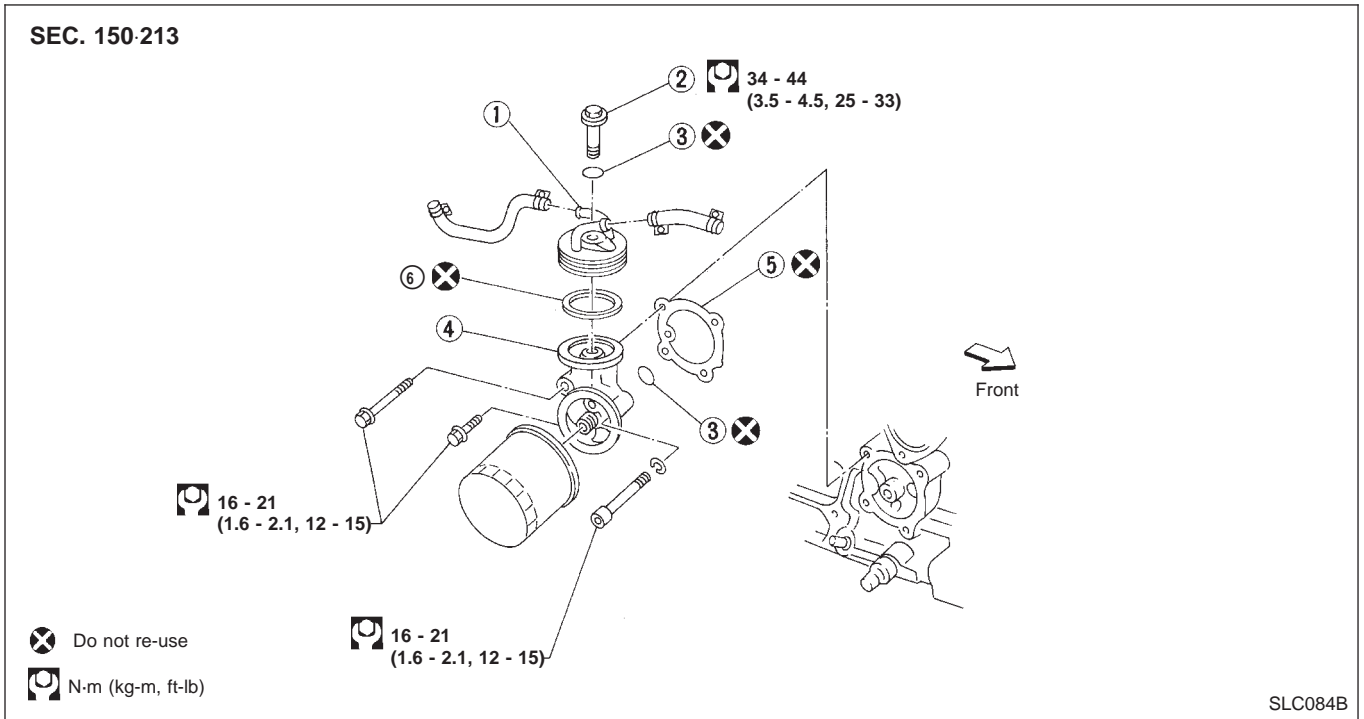
Oil Pump (Cont'd)



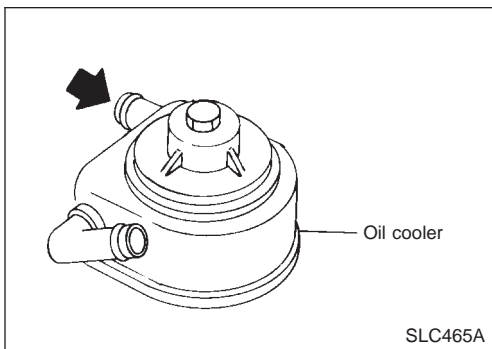
OIL PRESSURE RELIEF VALVE INSPECTION

Inspect oil pressure relief valve (indicated by arrow) 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 into place.

Oil Cooler



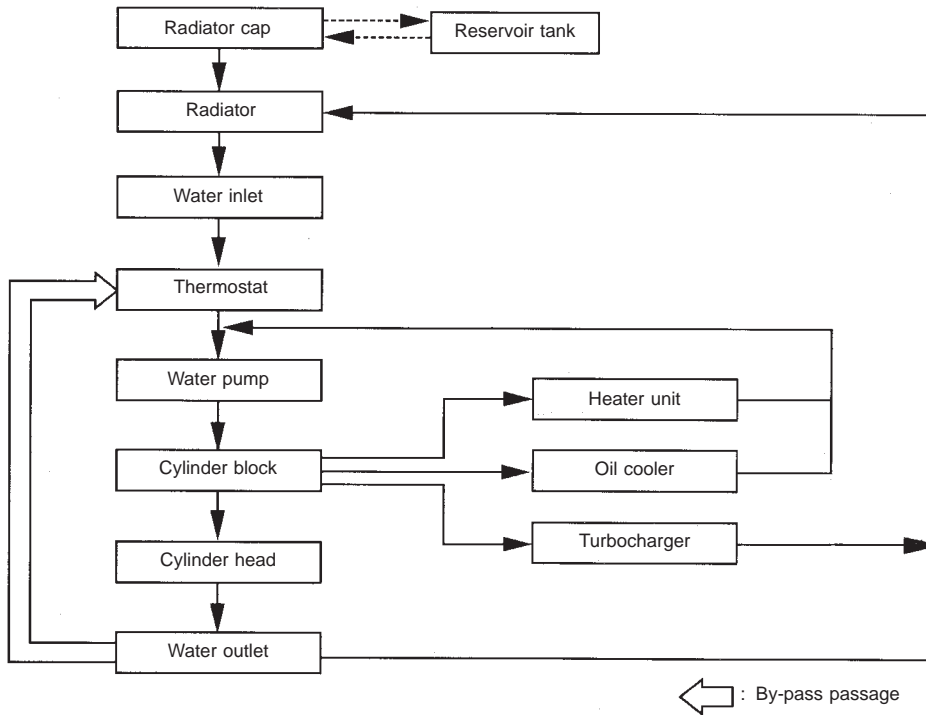
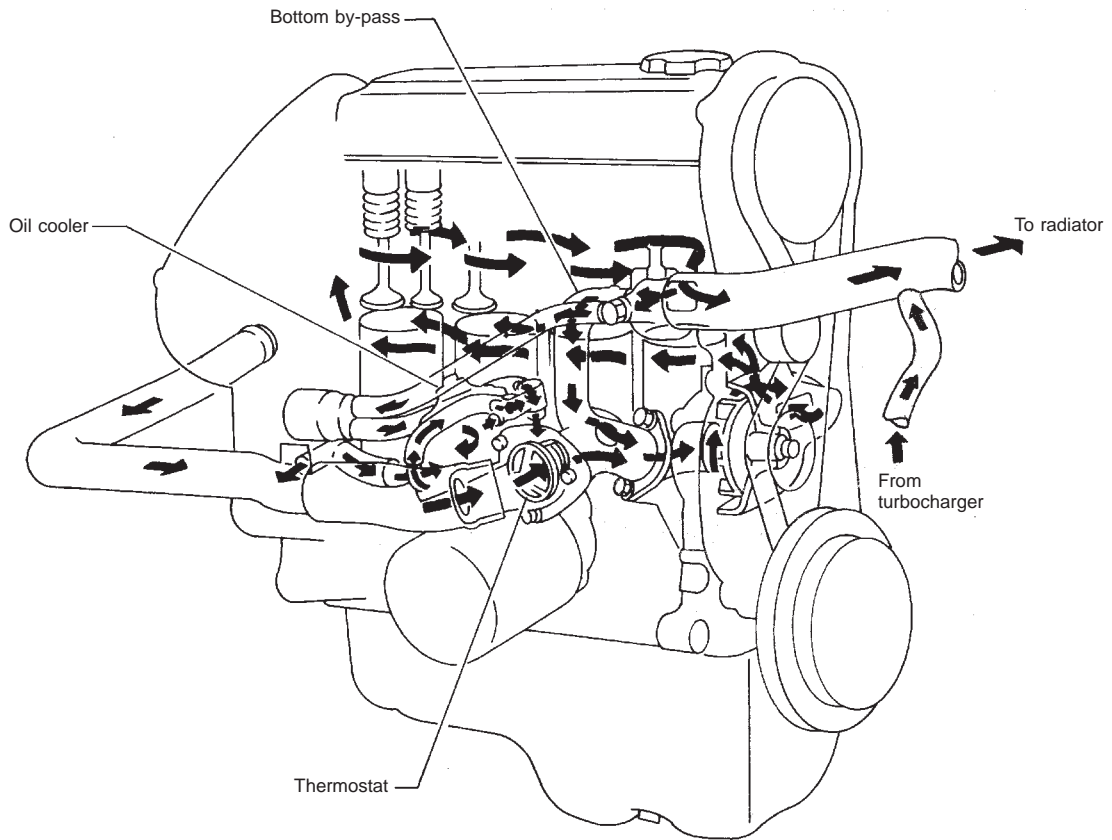
- | | | |
|--------------|----------------------|----------|
| ① Oil cooler | ③ O-ring | ⑤ Gasket |
| ② Connector | ④ Oil filter bracket | ⑥ Gasket |



INSPECTION

1. Check oil cooler element and housing for cracks.
2. Check coolant inlet of oil cooler for clogging by blowing through it.
Replace it if necessary.

Cooling Circuit



SLC085B

System Check

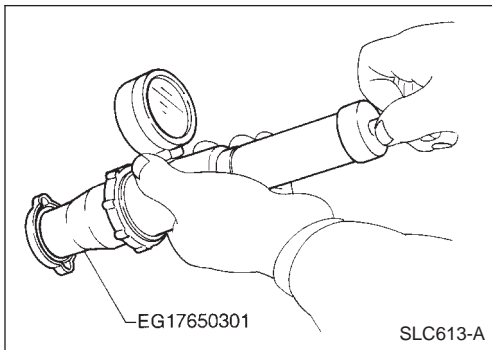
WARNING:

Never remove the radiator cap when the engine is hot; serious burns could be caused by high pressure fluid escaping from the radiator.

Wrap a thick cloth around cap and carefully loosen it a quarter turn to release built-up pressure. Then remove the cap completely.

CHECKING COOLING SYSTEM HOSES

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



CHECKING RADIATOR CAP

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

Radiator cap relief pressure:

Standard

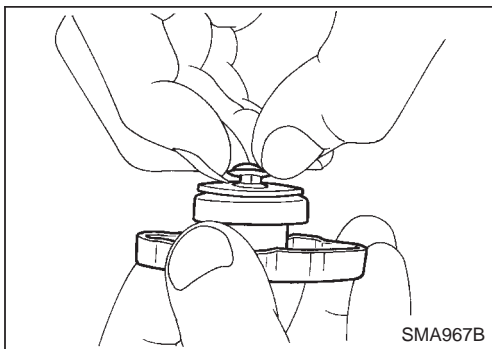
98 - 118 kPa

(0.98 - 1.18 bar, 1.0 - 1.2 kg/cm², 14 - 17 psi)

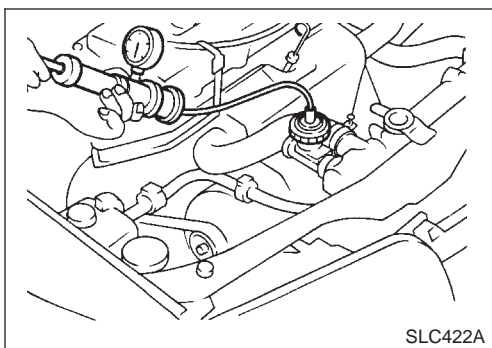
Limit

59 - 118 kPa

(0.59 - 1.18 bar, 0.6 - 1.2 kg/cm², 8.6 - 17.1 psi)



Pull the negative pressure valve to open it. Check that it closes completely when released.



CHECKING COOLING SYSTEM FOR LEAKS

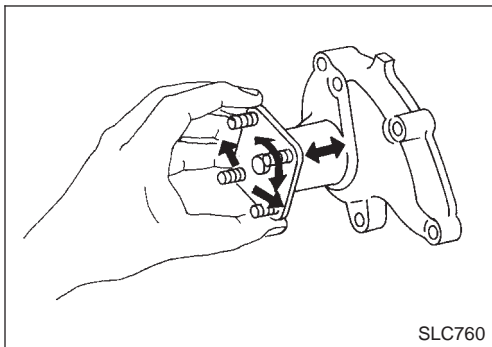
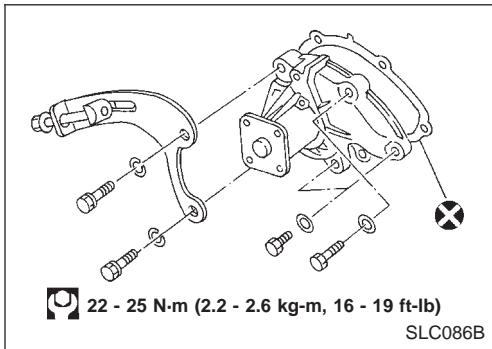
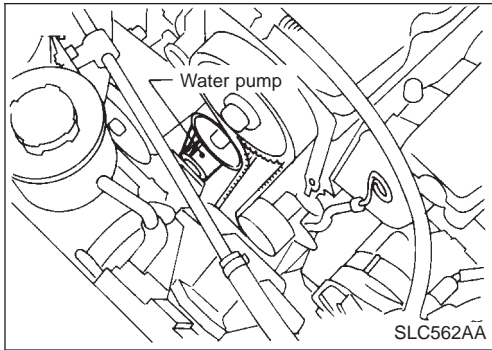
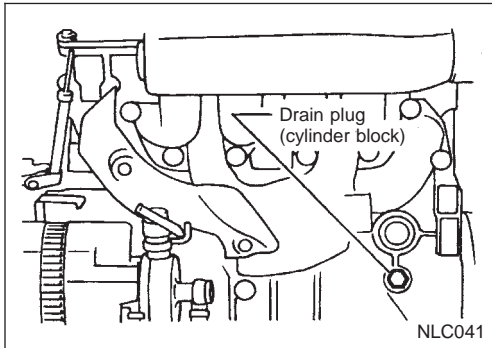
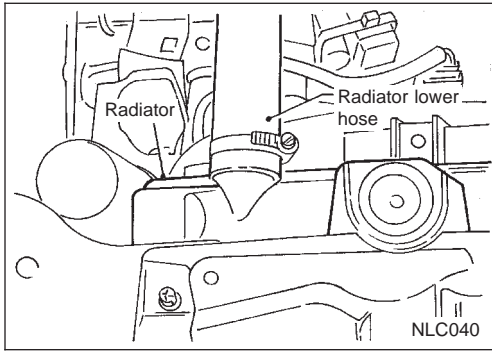
To check for leakage, apply pressure to the cooling system with a tester.

Testing pressure:

157 kPa (1.57 bar, 1.6 kg/cm², 23 psi)

CAUTION:

Higher than the specified pressure may cause radiator damage.



Water Pump

REMOVAL AND INSTALLATION

CAUTION:

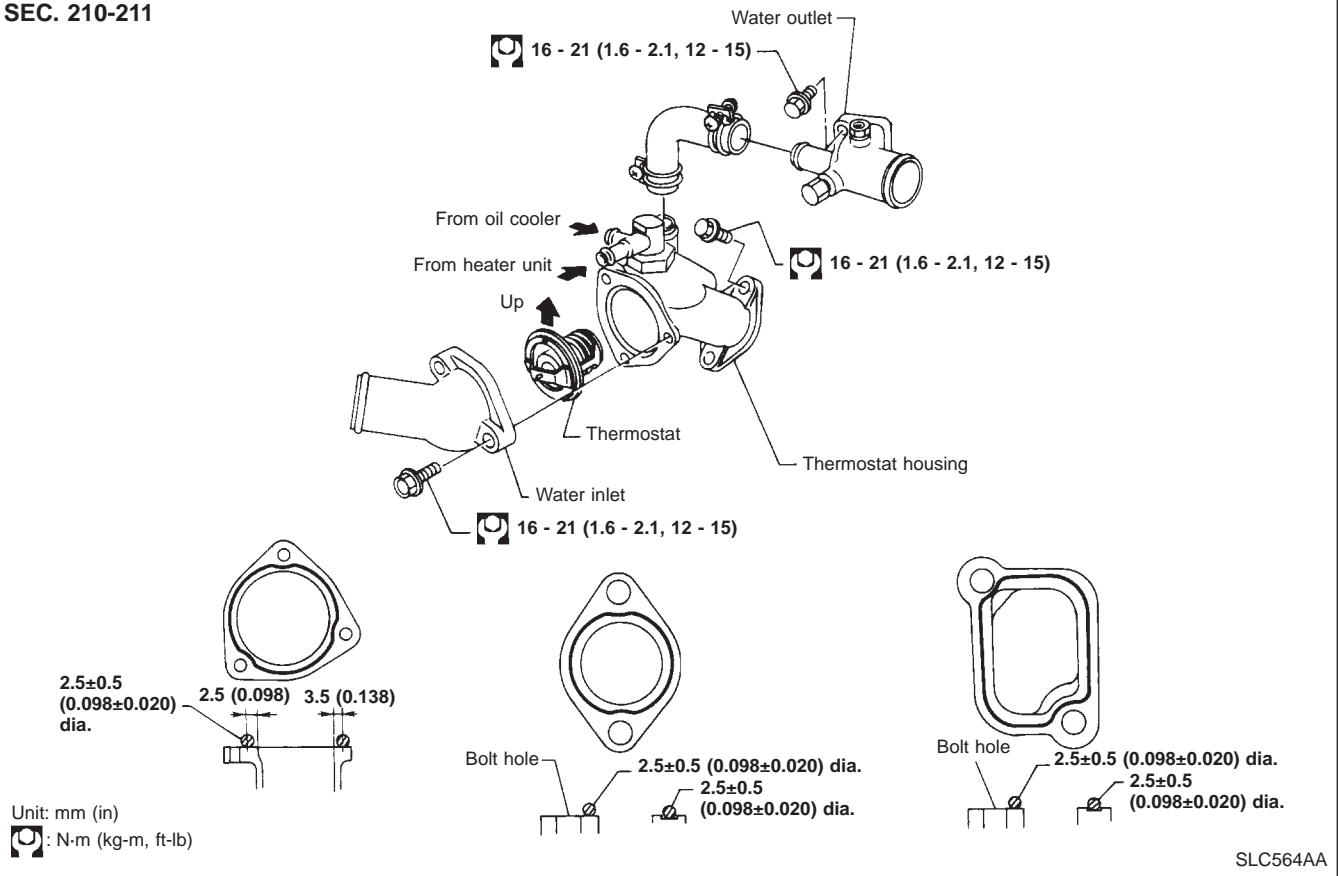
- When removing water pump assembly, be careful not to get coolant on drive belt.
 - Water pump cannot be disassembled and should be replaced as a unit.
 - After installing water pump, connect hose and clamp securely, then check for leaks using radiator cap tester.
1. Remove radiator lower hose from radiator and drain engine coolant.
 2. Drain engine coolant from cylinder block.
 3. Remove upper radiator hose, timing belt covers, front engine mounting bracket and timing belt. (Refer to EM section).
 4. Remove timing belt tensioner and idler and timing belt lower back cover.
 5. Remove water pump.

- When installing water pump, replace the gasket with a new one.

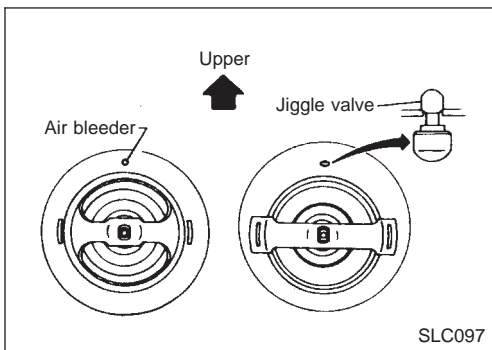
INSPECTION

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

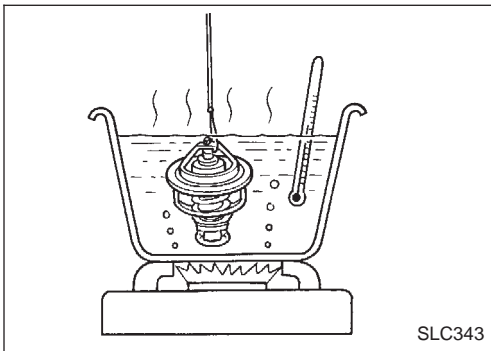
Thermostat REMOVAL AND INSTALLATION

SEC. 210-211


1. Drain engine coolant.
2. Remove lower radiator hose.
3. Remove water inlet, then take out thermostat.
4. Before installing thermostat, remove all traces of liquid gasket from mating surface of each part using a scraper.
5. Apply liquid gasket to water outlet, thermostat housing and water inlet.



6. Install thermostat with jiggle valve uppermost.
 - **After installation, run engine for a few minutes, and check for leaks.**



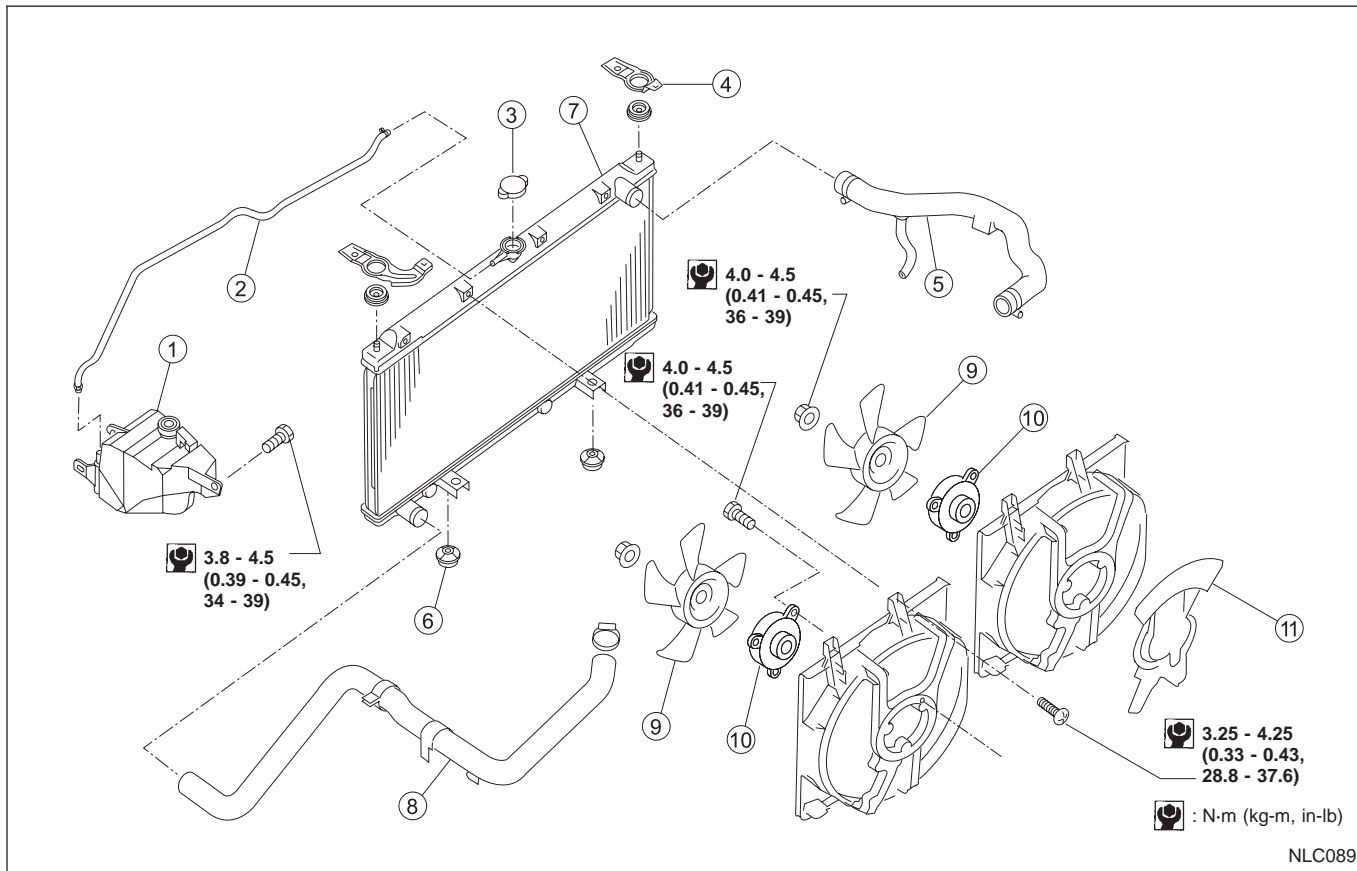
INSPECTION

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

Valve opening temperature	°C (°F)	82 (180)
Valve lift	mm/°C (in/°F)	More than 10/95 (0.39/203)

3. Then check if valve closes at 5°C (41°F) below valve opening temperature.

Radiator



NLC089

- ① Reservoir tank
- ② Reservoir tank hose
- ③ Radiator cap
- ④ Mounting bracket

- ⑤ Upper radiator hose
- ⑥ Mounting rubber
- ⑦ Radiator
- ⑧ Lower radiator hose

- ⑨ Cooling fan
- ⑩ Cooling fan motor
- ⑪ Cooling fan motor shield

Cooling fan control system

- Cooling fans are controlled by the ECM. For details, refer to EC section ("COOLING FAN", "Diagnostic Procedure", EC-CD-90).

Refilling engine coolant

- For details on refilling engine coolant, refer to MA section ("ENGINE MAINTENANCE", "Changing Engine Coolant", MA-52).

ENGINE COOLING SYSTEM

Overheating Cause Analysis

Overheating Cause Analysis

NCLC0028

		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			

ENGINE COOLING SYSTEM

Overheating Cause Analysis (Cont'd)

	Symptom		Check items	
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				

Oil Pressure Check

NCLC0011

Engine speed rpm	Approximate discharge pressure kPa (bar, kg/cm ² , psi)
600	More than 98 (0.98, 1.0, 14)
2,000	More than 294 (2.94, 3.0, 43)
6,000	More than 392 (3.92, 4.0, 57)

Oil Pump Inspection

NCLC0013
Unit: mm (in)

Body to outer gear radial clearance	0.250 - 0.325 (0.0098 - 0.0128)
Inner gear to outer gear tip clearance	Below 0.18 (0.0071)
Body to inner gear clearance	0.030 - 0.085 (0.0012 - 0.0033)
Body to outer gear axial clearance	0.030 - 0.090 (0.0012 - 0.0035)
Inner gear to brazed portion of housing clearance	0.045 - 0.091 (0.0018 - 0.0036)

Regulator Valve Inspection

NCLC0012
Unit: mm (in)

Regulator valve to oil pump cover clearance	0.052 - 0.088 (0.0020 - 0.0035)
---	---------------------------------

Thermostat

NCLC0029

Valve opening temperature °C (°F)	82 (180)
Valve lift mm/°C (in/°F)	More than 9/95 (0.35/203)

Radiator

NCLC0030
Unit: kPa (bar, kg/cm², psi)

Cap relief pressure	Standard	78 - 98 (0.78 - 0.98, 0.8 - 1.0, 11 - 14)
	Limit	59 - 98 (0.59 - 0.98, 0.6 - 1.0, 9 - 14)
Leakage test pressure		157 (1.57, 1.6, 23)

Oil Pressure Check

Engine speed rpm	Approximate discharge pressure kPa (bar, kg/cm ² , psi)
Idle speed	More than 78 (0.78, 0.8, 11)
3,200	314 - 392 (3.14 - 3.92, 3.2 - 4.0, 46 - 57)

Oil Pump Inspection

Unit: mm (in)

Body to outer gear clearance (radial)	0.114 - 0.200 (0.0045 - 0.0079)
Inner gear to outer gear tip clearance	Below 0.18 (0.0020 - 0.0071)
Body to inner gear clearance	0.05 - 0.09 (0.0020 - 0.0035)
Body to outer gear clearance (axial)	0.05 - 0.11 (0.0020 - 0.0043)
Inner gear to brazed portion of housing clearance	0.045 - 0.091 (0.0018 - 0.0036)

Regulator Valve Inspection

Unit: mm (in)

Regulator valve to oil pump cover clearance	0.040 - 0.097 (0.0016 - 0.0038)
---	---------------------------------

Thermostat

Valve opening temperature °C (°F)	82 (180)
Valve lift mm/°C (in/°F)	More than 9/95 (0.35/203)

Radiator

Unit: kPa (bar, kg/cm², psi)

Cap relief pressure	Standard	78 - 98 (0.78 - 0.98, 0.8 - 1.0, 11 - 14)
	Limit	59 - 98 (0.59 - 0.98, 0.6 - 1.0, 9 - 14)
Leakage test pressure		157 (1.57, 1.6, 23)

Oil Pressure Check

Engine speed rpm	Approximate discharge pressure kPa (bar, kg/cm ² , psi)
Idle speed	More than 59 (0.59, 0.6, 9)
2,000	294 (2.9, 3, 43)

Oil Pump Inspection

Unit: mm (in)

Body to outer gear clearance (radial)	0.114 - 0.200 (0.0045 - 0.0079)
Outer gear to inner gear clearance	Less than 0.18 (0.0071)
Housing to inner gear clearance	0.05 - 0.09 (0.0020 - 0.0035)
Housing to outer gear clearance (axial)	0.05 - 0.11 (0.0020 - 0.0043)
Inner gear to housing clearance	0.045 - 0.091 (0.0018 - 0.0036)

Thermostat

Valve opening temperature °C (°F)	82 (180)
Valve lift mm/°C (in/°F)	More than 10/95 (0.39/203)

Radiator

Unit: kPa (bar, kg/cm², psi)

Cap relief pressure	Standard	98 - 118 (0.98 - 1.18, 1.0 - 1.2, 14 - 17)
	Limit	59 - 118 (0.59 - 1.18, 0.6 - 1.2, 8.6 - 17.1)
Leakage test pressure		157 (1.57, 1.6, 23)

NOTE