

ENGINE LUBRICATION & COOLING SYSTEMS

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SECTION LC

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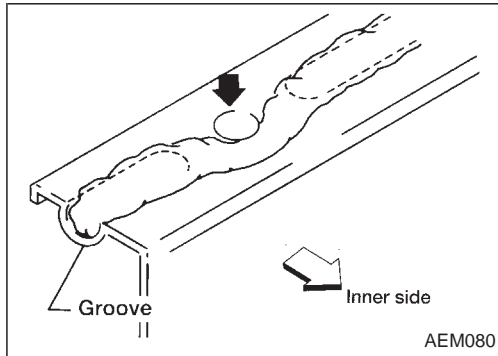
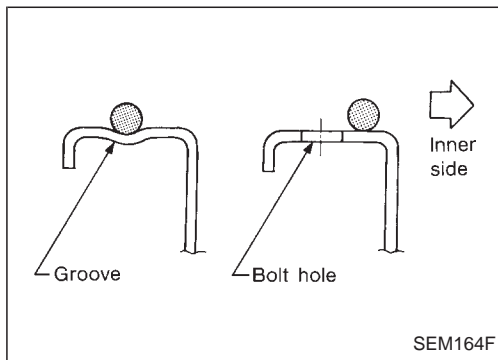
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PRECAUTIONS AND PREPARATION



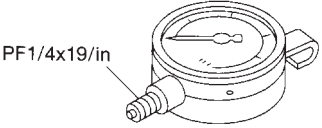
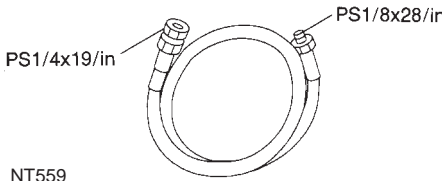
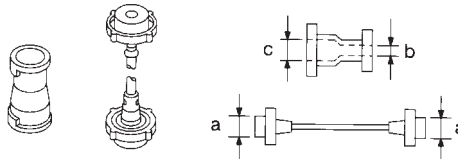
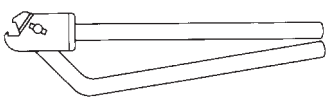

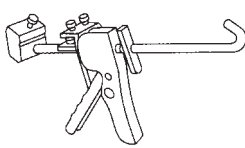
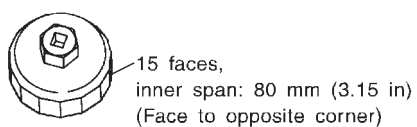
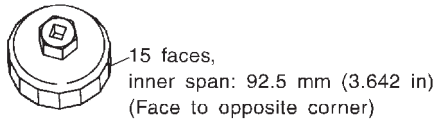
Liquid Gasket Application Procedure

- Use a scraper to remove all traces of old liquid gasket from mating surfaces and grooves. Also, completely clean any oil from these areas.
- 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 gasoline engines.
 - For areas except oil pan, be sure liquid gasket diameter is 2.0 to 3.0 mm (0.079 to 0.118 in) for gasoline engines, and 2.5 to 3.5 mm (0.098 to 0.138 in) for diesel engines.
- Apply liquid gasket around the inner side of bolt holes (unless otherwise specified).
- Assembly should be done within 5 minutes after coating.
- Wait at least 30 minutes before refilling engine oil and engine coolant.

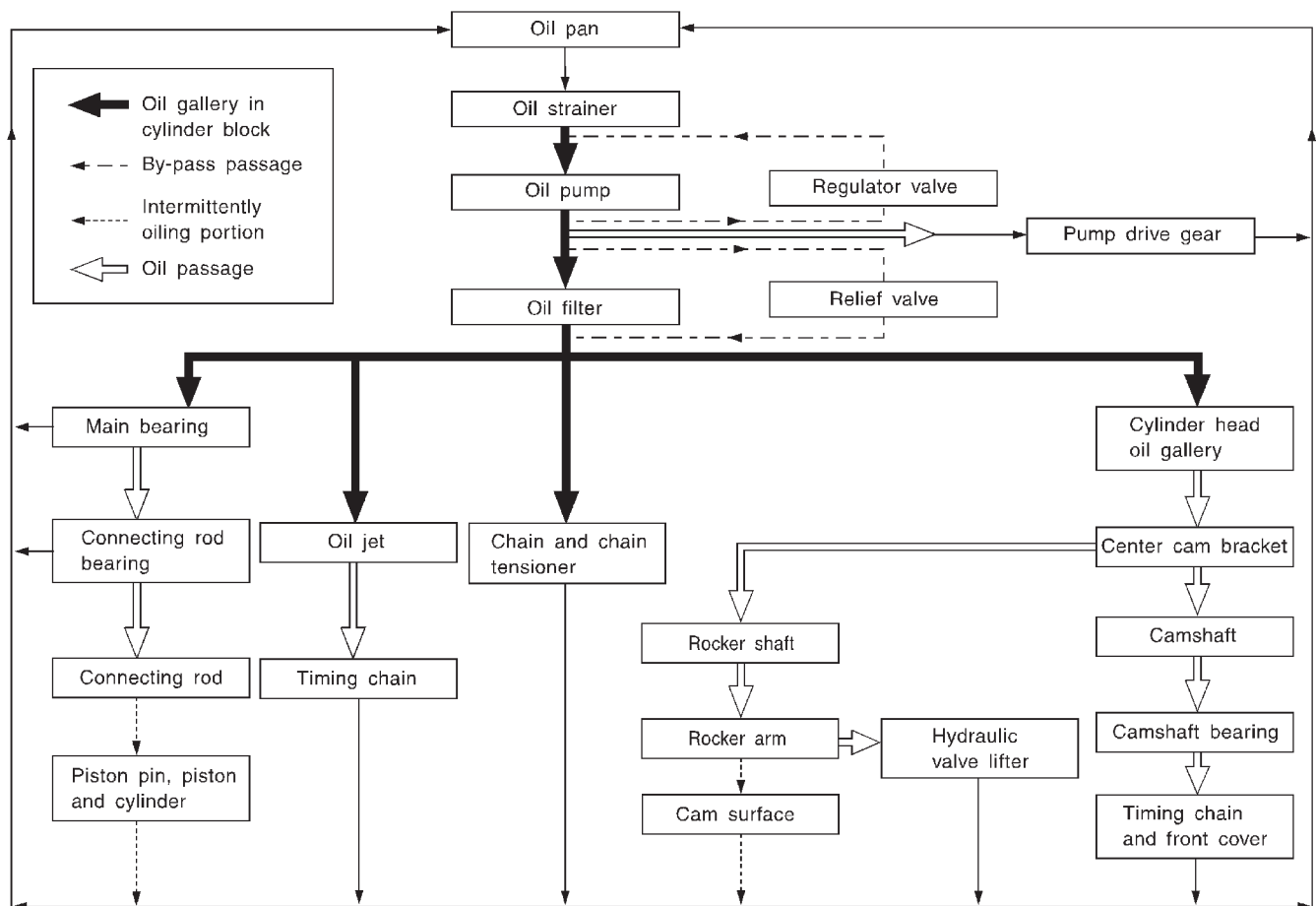
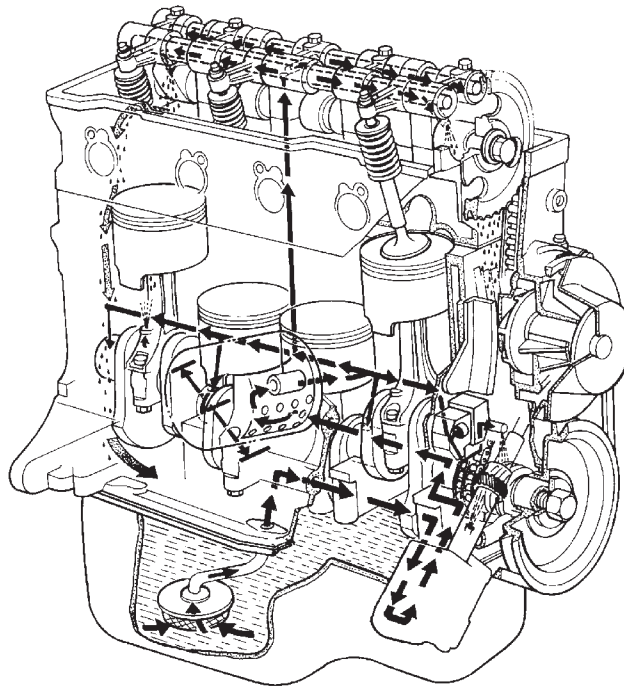
PRECAUTIONS AND PREPARATION

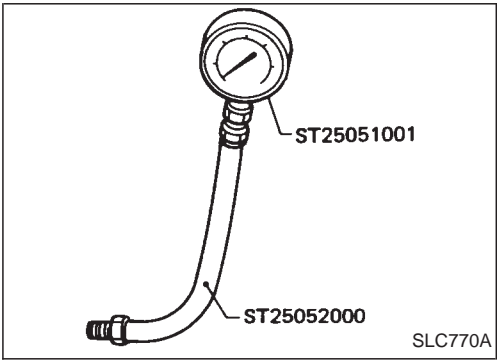
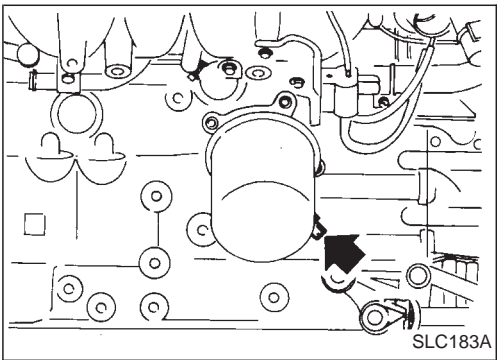
Special Service Tools

*: Special tool or commercial equivalent

| Tool number Tool name | Description | Engine application | | | | |
|---|---|--------------------|----|---|----|----|
| | | KA | NA | Z | QD | TD |
| ST25051001* Oil pressure gauge |  PF1/4x19/in NT558 Measuring oil pressure Maximum measuring range: 2,452 kPa (24.5 bar, 25 kg/cm², 356 psi) | X | X | X | X | X |
| ST25052000* Hose |  PS1/4x19/in PS1/8x28/in NT559 Adapting oil pressure gauge to cylinder block | X | X | X | X | X |
| EG17650301 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) | X | X | X | X | X |
| KV99103510 Radiator plate pliers A |  NT224 Installing radiator upper and lower tanks | X | X | X | X | X |
| KV99103520 Radiator plate pliers B |  NT225 Removing radiator upper and lower tanks | X | X | X | X | X |
| WS39930000 Tube presser |  NT052 Pressing the tube of liquid gasket | X | X | X | X | X |
| KV10105901 Oil filter cap wrench |  NT689 Removing oil filter | X | X | — | — | — |
| KV10106001 Oil filter wrench |  NT690 Replacing oil filter | — | — | X | X | X |

Lubrication Circuit





Oil Pressure Check

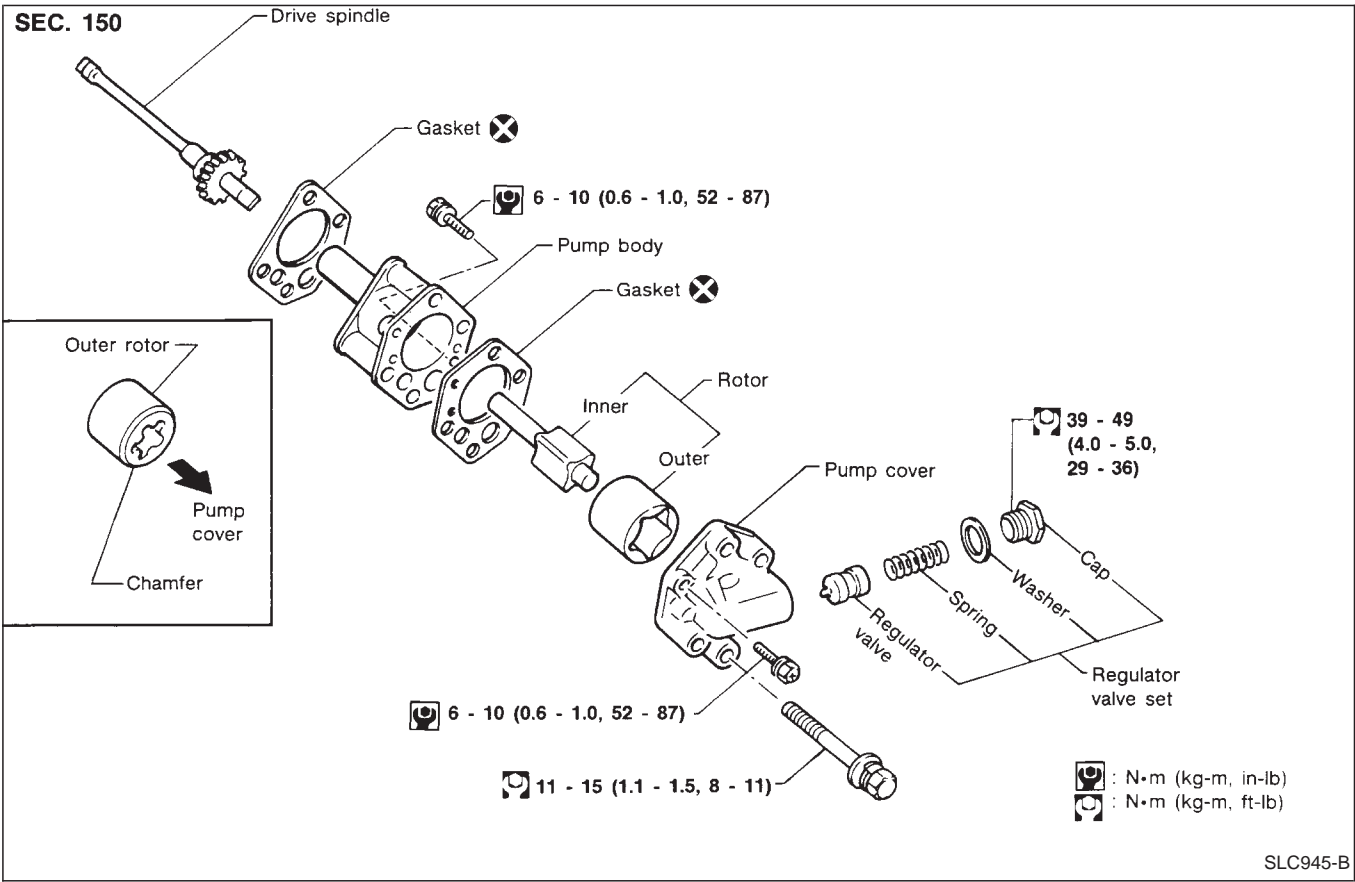
WARNING:

- 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) |
|---------------------|---|
| Idle speed | More than 78 (0.78, 0.8, 11) |
| 3,000 | 412 - 481 (4.12 - 4.81, 4.2 - 4.9, 60 - 70) |

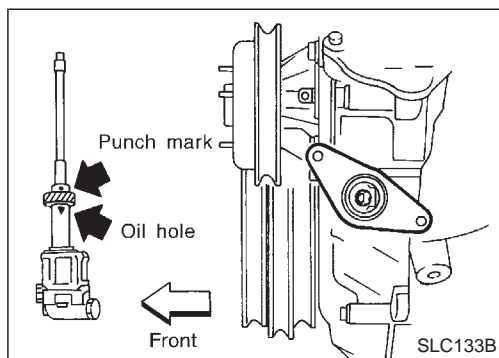
- If difference is extreme, check oil passage and oil pump for oil leaks.
- 6. Install oil pressure switch with sealant.

Oil Pump



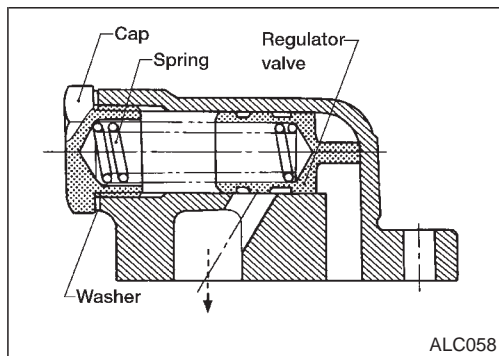
Oil Pump (Cont'd)

- Always replace with new oil seal and gasket.
- When removing oil pump, turn crankshaft so that No. 1 piston is at TDC on its compression stroke.
- When installing oil pump, apply engine oil to gears, then align punchmark on drive spindle and oil hole on oil pump.



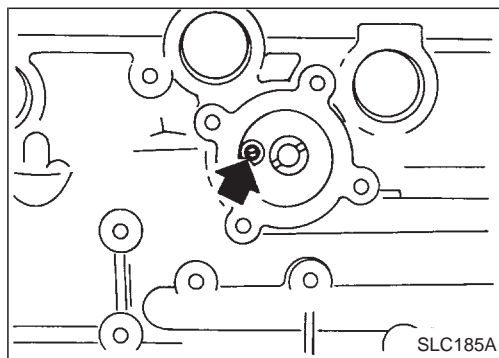
REGULATOR VALVE INSPECTION

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.
- Replace regulator valve set or oil pump assembly, if damaged.



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



OIL PUMP INSPECTION

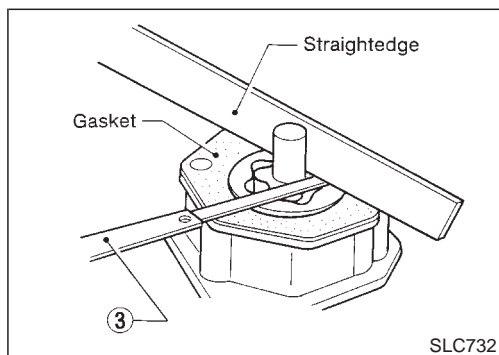
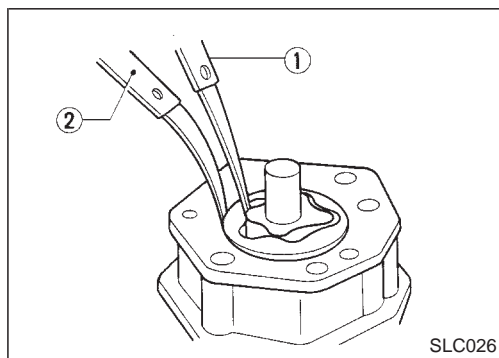
Using a feeler gauge, check the following clearance.

Standard clearance:

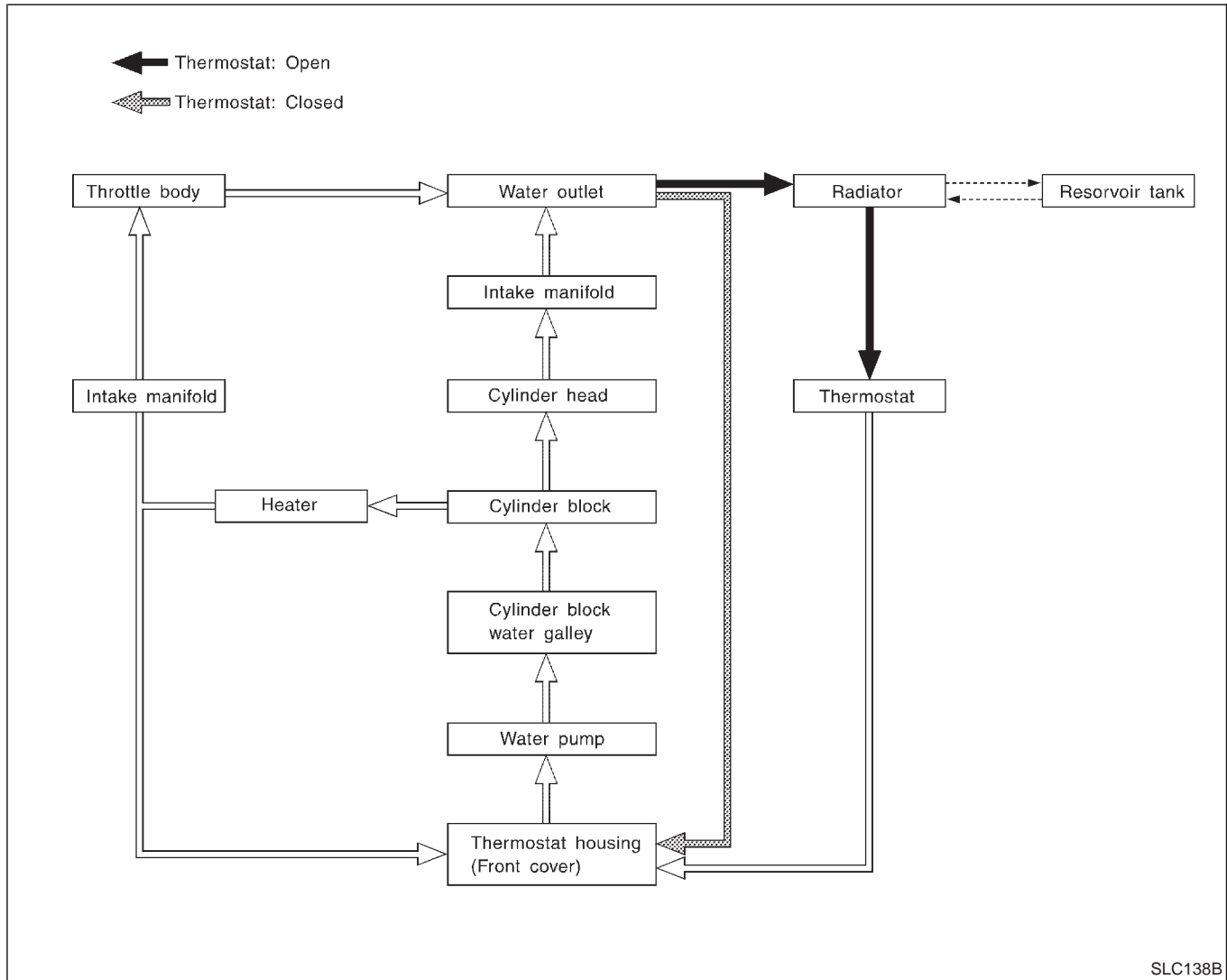
Unit: mm (in)

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

- If the tip clearance (①) exceeds the limit, replace gear set.
- If body to gear clearances (②, ③) exceed the limit, replace oil pump 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**

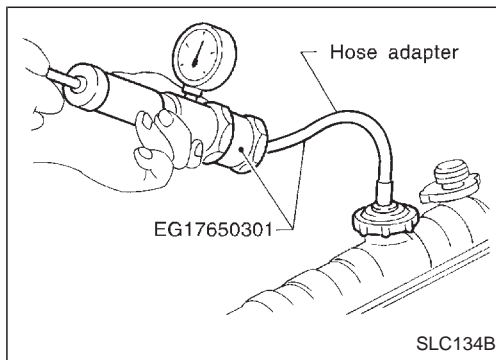
To check for leakage, apply pressure to the cooling system with a tester.

Testing pressure:

157 kPa (1.57 bar, 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

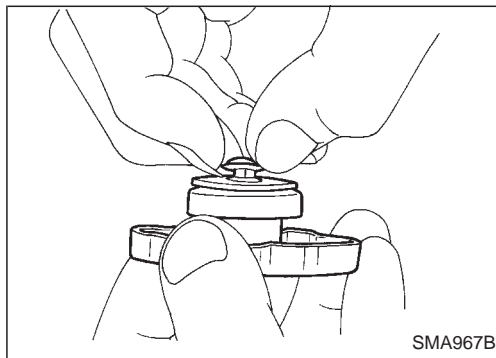
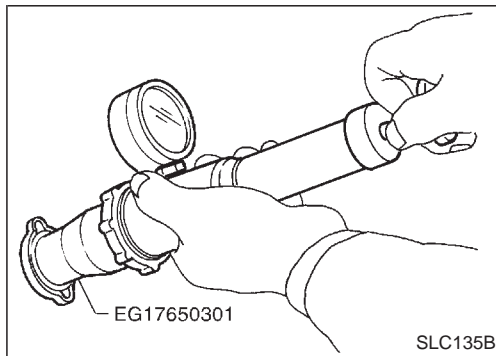
78 - 98 kPa

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

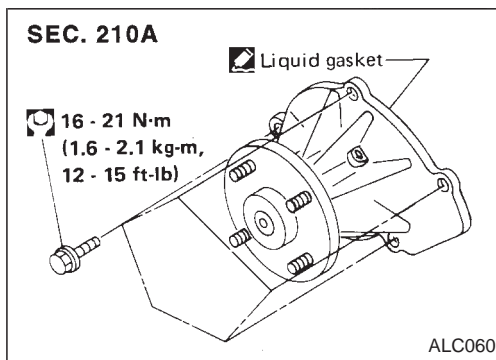
Limit

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**

CAUTION:

- When removing water pump assembly, be careful not to get coolant on drive belts.
- 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.

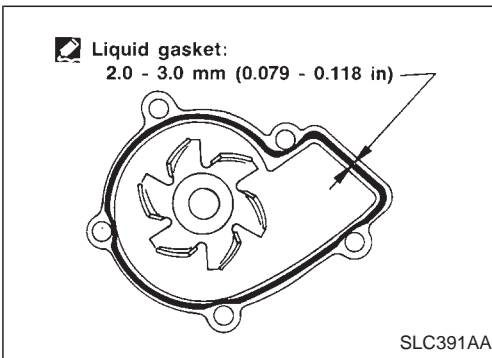
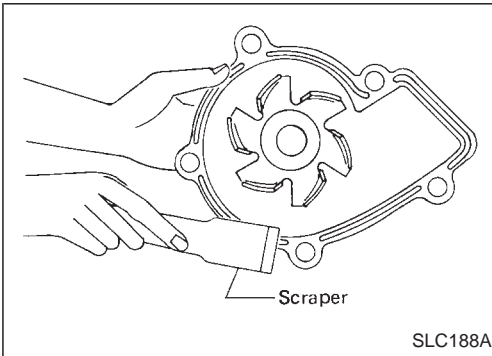
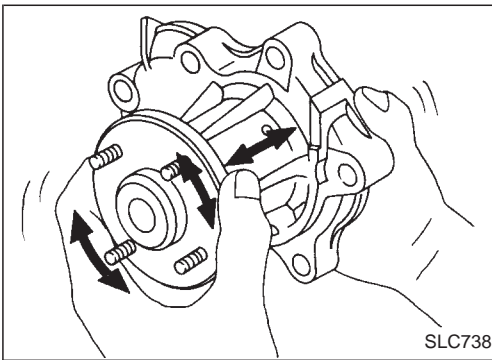
REMOVAL

1. Drain coolant from engine.
Refer to MA section ("Changing Engine Coolant", "ENGINE MAINTENANCE").
2. Remove fan coupling with fan.
3. Remove power steering pump drive belt, generator drive belt and A/C compressor drive belt.
4. Remove water pump.

Water Pump (Cont'd)

INSPECTION

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



INSTALLATION

1. Use a scraper to remove liquid gasket from water pump.
- **Also remove traces of liquid gasket from mating surface of cylinder block.**

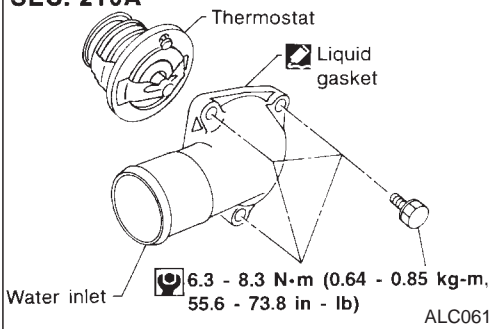
2. Apply a continuous bead of liquid gasket to mating surface of water pump.

- **Use Genuine Liquid Gasket or equivalent.**

When filling radiator with coolant, refer to MA section ("Changing Engine Coolant", "ENGINE MAINTENANCE").

When installing drive belts, refer to MA section ("Checking Drive Belts").

SEC. 210A



Thermostat

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

REMOVAL

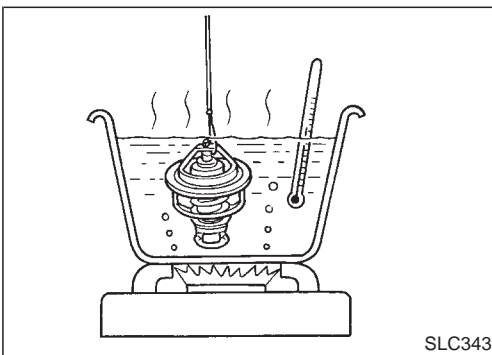
1. Drain coolant from engine. Refer to MA section ("Changing Engine Coolant", "ENGINE MAINTENANCE").
2. Remove air cleaner and air duct assembly.
3. Remove water hose from water inlet housing.
4. Remove water inlet housing, then take out thermostat.

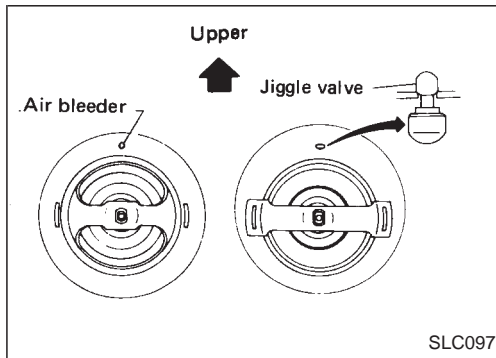
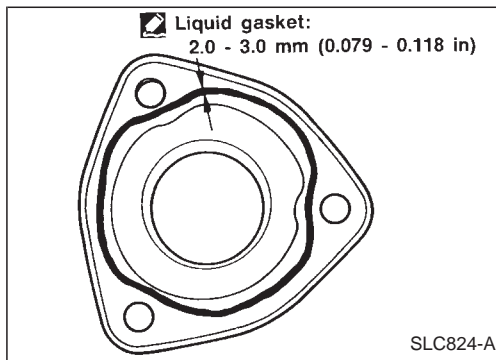
INSPECTION

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

| | | |
|---------------------------|---------------|---------------------------|
| Valve opening temperature | °C (°F) | 76.5 (170) |
| Valve lift | mm/°C (in/°F) | More than 8/90 (0.31/194) |

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





Thermostat (Cont'd)

INSTALLATION

1. Use a scraper to remove old liquid gasket from water inlet.
- **Also remove traces of liquid gasket from mating surface of front cover.**
2. Apply a continuous bead of liquid gasket to mating surface of water inlet.
- **Use Genuine Liquid Gasket or equivalent.**
3. Install thermostat with jiggle valve or air bleeder at upper side.
4. Install water inlet housing.
5. Install water hose to water inlet housing.
6. Install air cleaner and air duct assembly.
7. Refill engine coolant. Refer to MA section ("Changing Engine Coolant", "ENGINE MAINTENANCE").
- **After installation run engine for a few minutes, and check for leaks.**

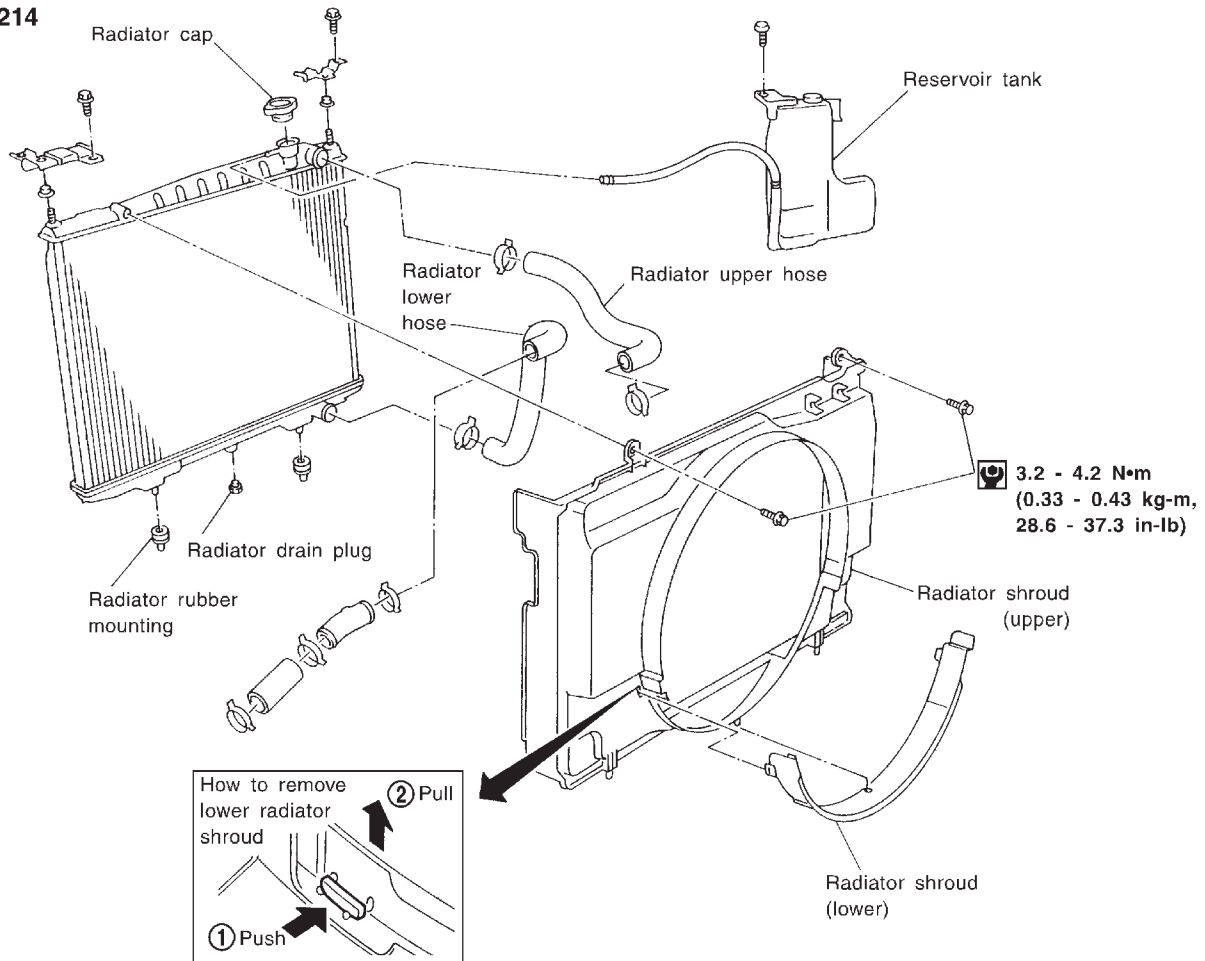
Radiator

REMOVAL AND INSTALLATION

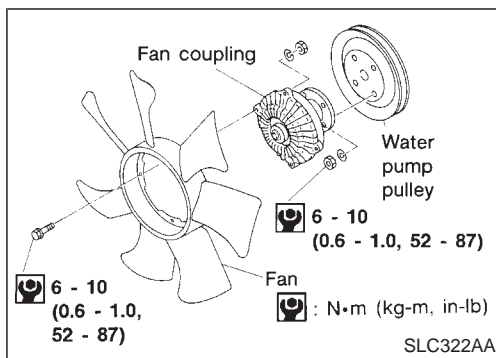
1. Drain coolant from radiator. Refer to MA section ("Changing Engine Coolant", "ENGINE MAINTENANCE").
2. Disconnect upper and lower radiator hoses.
3. Remove air cleaner and air duct assembly.
4. Remove lower radiator shroud.
5. Remove radiator shroud.
6. Disconnect coolant reservoir hose.
7. Remove radiator.
8. After replacing radiator, install all parts in reverse order of removal.
9. Refill engine coolant. Refer to MA section ("Changing Engine Coolant", "ENGINE MAINTENANCE").
- **After installation, run engine for a few minutes, and check for leaks.**

Radiator (Cont'd)

SEC. 214



SLC136B



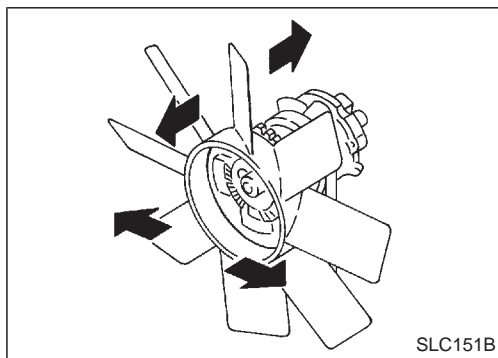
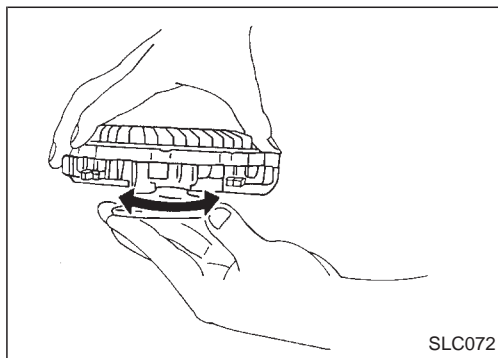
Cooling Fan (Crankshaft driven)

REMOVAL AND INSTALLATION

- Do not release the drive belt tension by removing the fan/water pump pulley.
- Fan coupling cannot be disassembled and should be replaced as a unit. If front mark (F) is present, install fan so that side marked (F) faces the front.
- Install the drive belt only after the fan and fan coupling to water pump flange bolts/nuts have been properly torqued.
- Proper alignment of these components is essential. Improper alignment will cause them to wobble and may eventually cause the fan to separate from the water pump causing extensive damage.

Cooling Fan (Crankshaft driven) (Cont'd)**INSPECTION**

Check fan coupling for rough operation, wobbling, oil leakage or bent bimetal.



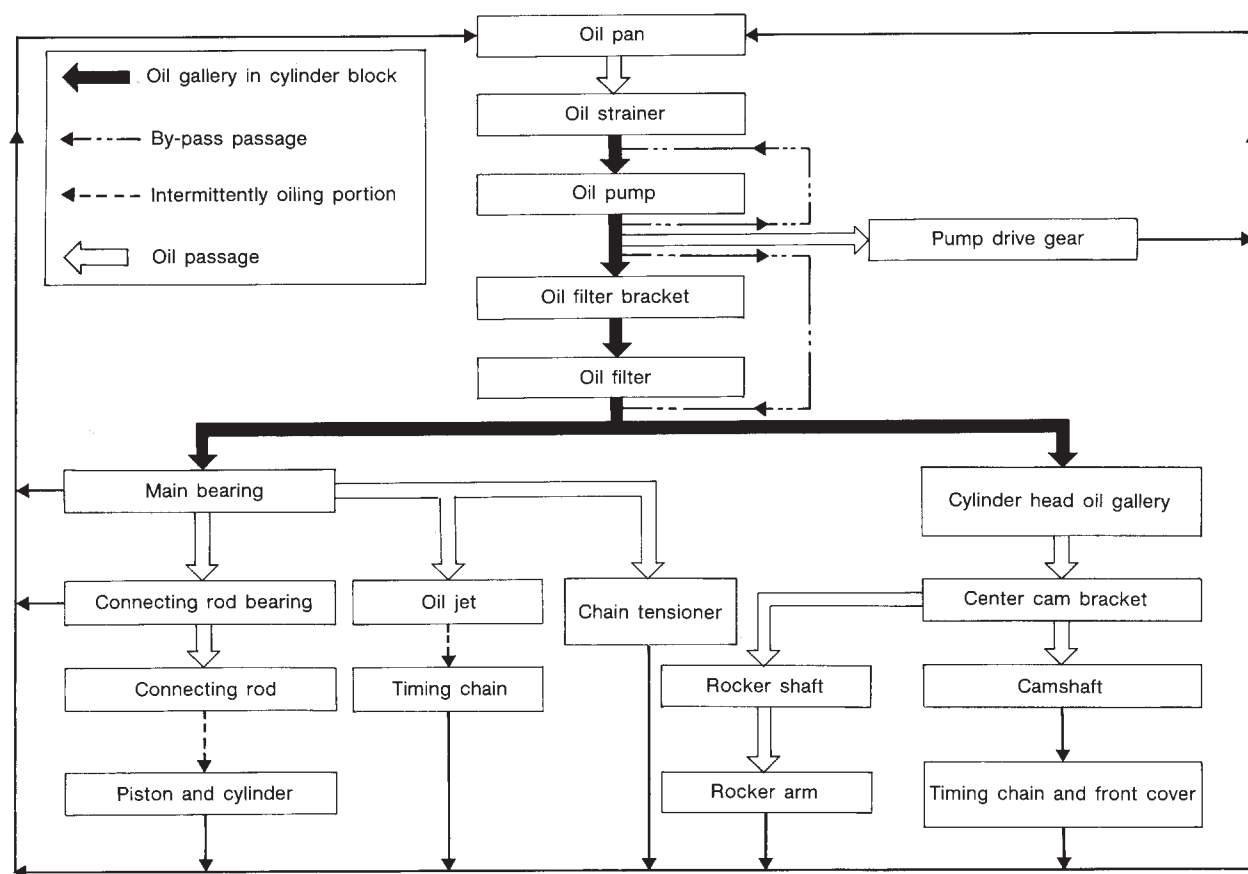
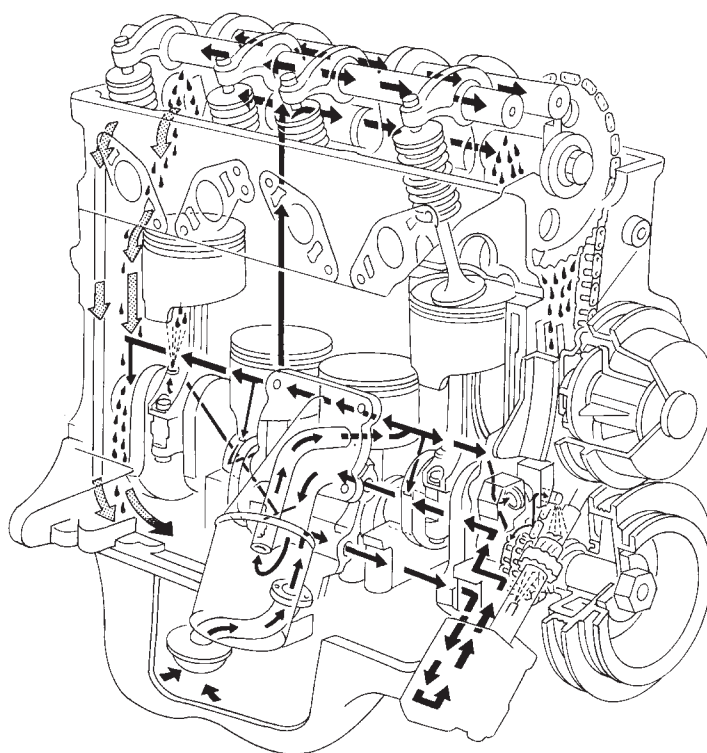
After assembly, verify the fan does not wobble or flap while the engine is running.

WARNING:

- When the engine is running, keep hands and clothing away from moving parts such as drive belts and fan.

Refilling engine coolant

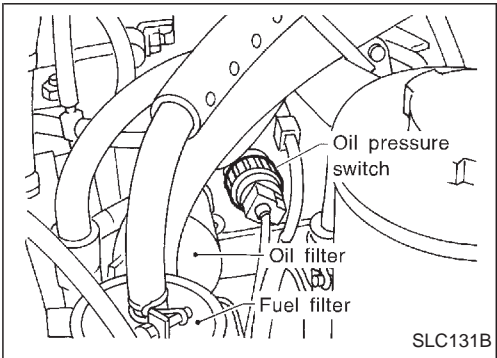
For details on refilling engine coolant, refer to MA section ("Changing Engine Coolant", "ENGINE MAINTENANCE").



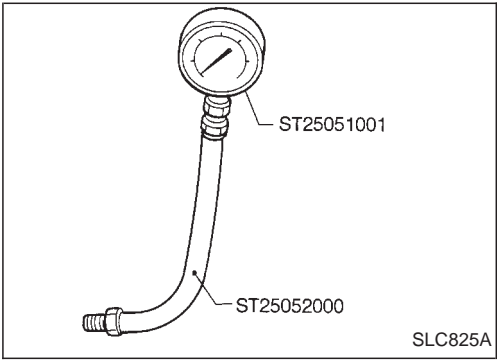
Oil Pressure Check

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.

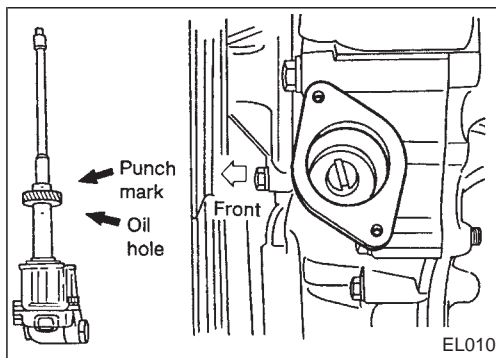
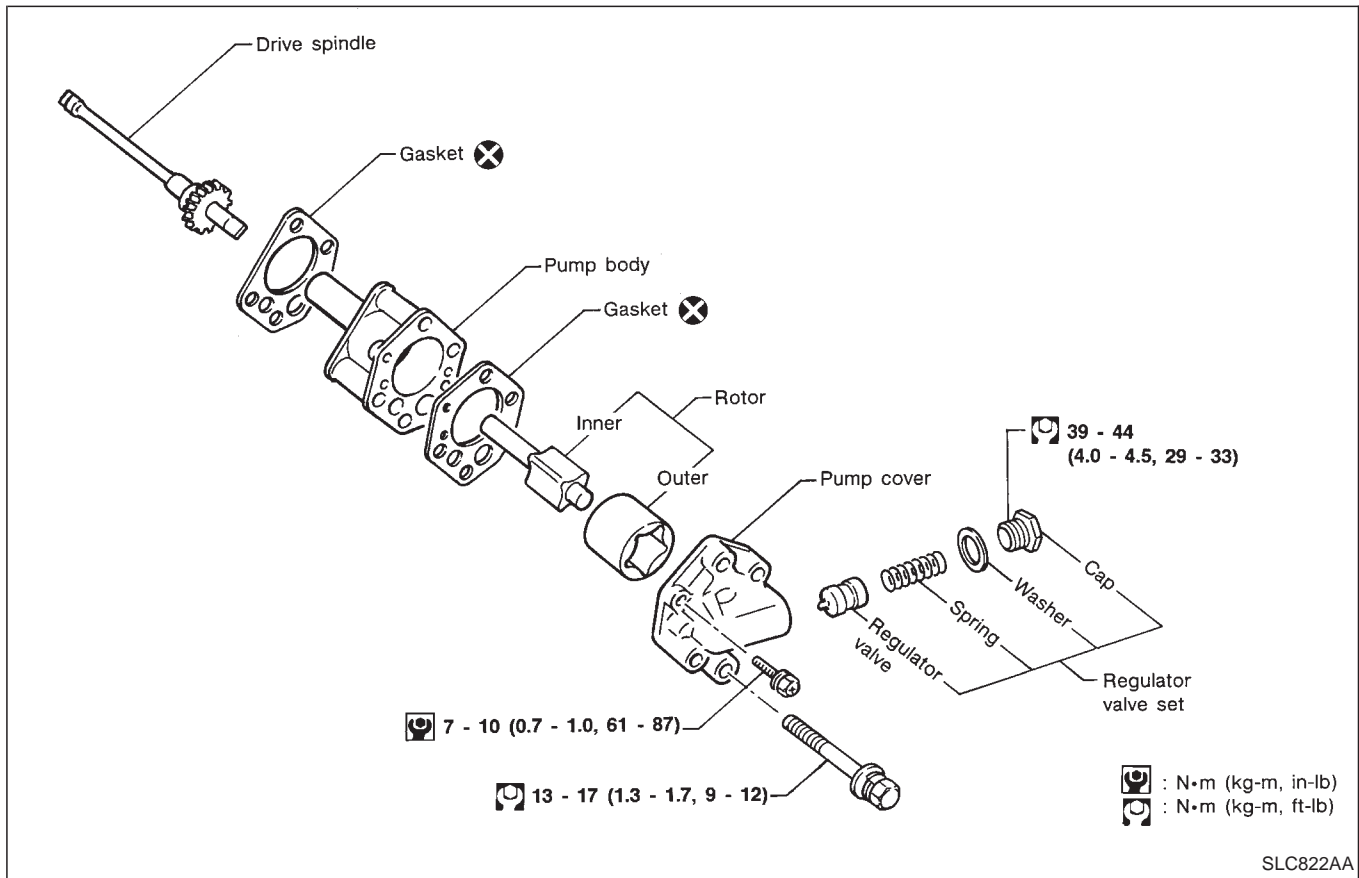
| Engine speed rpm | Approximate discharge pressure kPa (bar, kg/cm ² , psi) |
|---------------------|---|
| Idle speed | More than 98 (0.98, 1.0, 14) |
| 2,000 | 294 (2.9, 3, 43) |

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

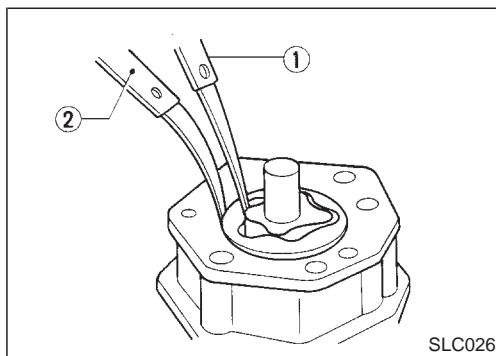
6. Install oil pressure switch with sealant.

Oil Pump

DISASSEMBLY AND ASSEMBLY

**CAUTION:**

- Always replace with new gasket.
- When removing oil pump, turn crankshaft so that No. 1 piston is at TDC on its compression stroke.
- When installing oil pump, apply engine oil to gears.
- When installing oil pump, align punch mark on drive spindle and oil hole on oil pump.

**OIL PUMP INSPECTION**

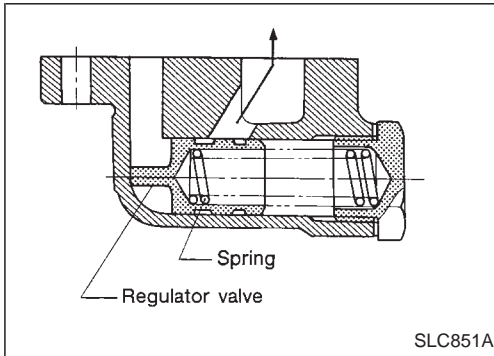
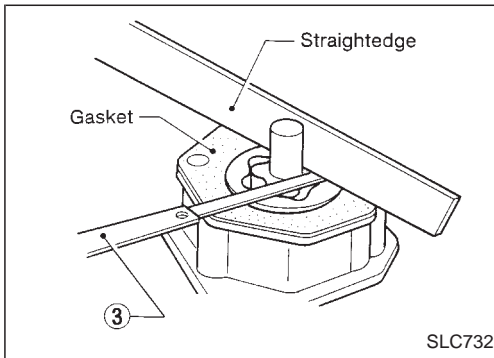
Using a feeler gauge, check the following clearances:

Unit: mm (in)

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

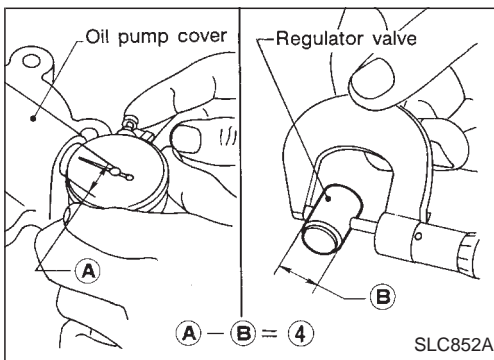
- If the tip clearance ① exceeds the limit, replace rotor set.
- If body to rotor clearances (②, ③) exceed limits, replace oil pump assembly.

Oil Pump (Cont'd)



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.

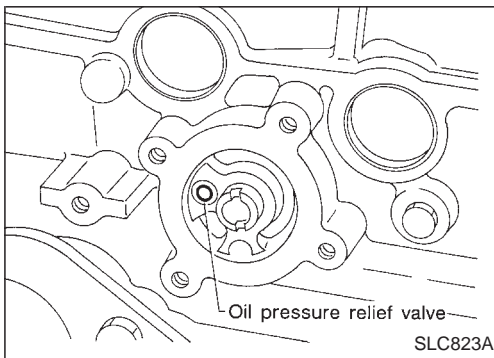


4. Check regulator valve to oil pump cover clearance.

Clearance:

④ : 0.040 - 0.100 mm (0.0016 - 0.0039 in)

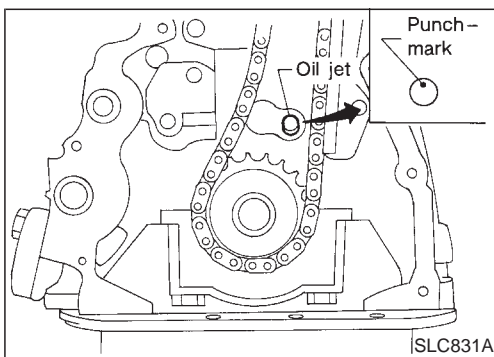
- If it exceeds the limit, replace oil pump assembly.



OIL PRESSURE RELIEF VALVE INSPECTION

Inspect oil pressure relief valve for smooth movement and damage 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 Jet (For timing chain)

REMOVAL AND INSTALLATION

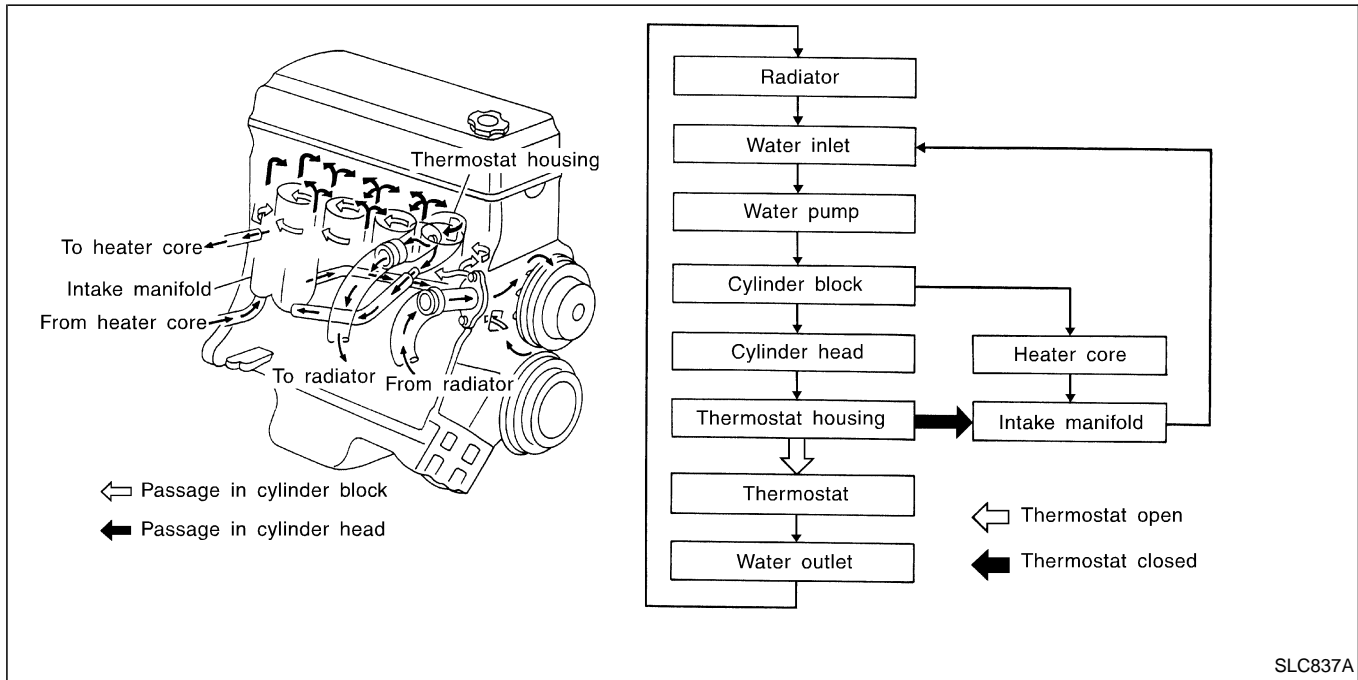
Refer to EM section ("Removal and Installation", "TIMING CHAIN").

INSPECTION

Make sure that the holes are not clogged. Clean them with a wire if necessary.

- Drive oil jet into cylinder block with punchmark facing up.

Cooling Circuit



System Check

WARNING:

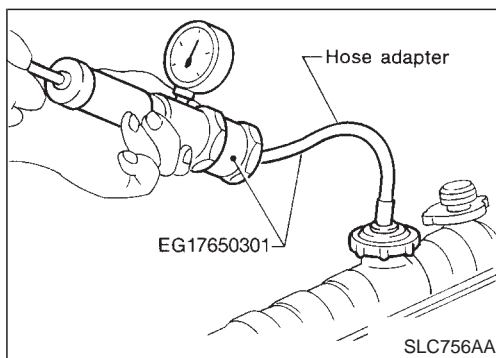
Never remove the radiator cap when the engine is hot. Serious burns could occur from high pressure coolant escaping from the radiator.

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

CHECKING COOLING SYSTEM HOSES

Check hoses for the following:

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



CHECKING COOLING SYSTEM FOR LEAKS

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

Testing pressure:

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

CAUTION:

Higher pressure than specified may cause radiator damage.

System Check (Cont'd)**CHECKING RADIATOR CAP**

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

Radiator cap relief pressure:

Standard

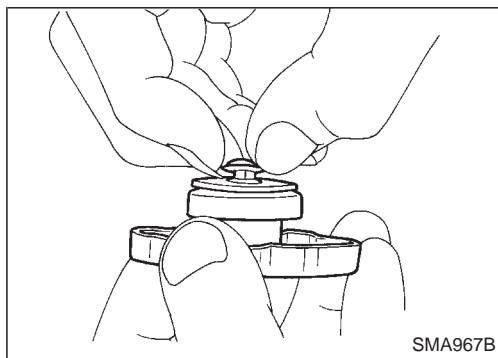
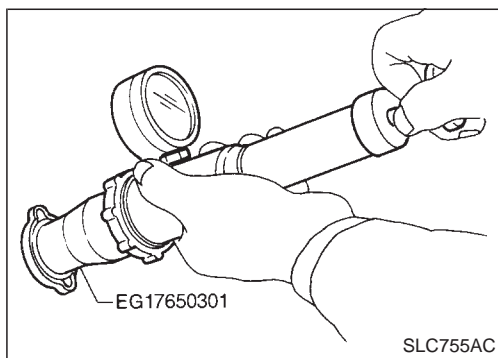
78 - 98 kPa

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

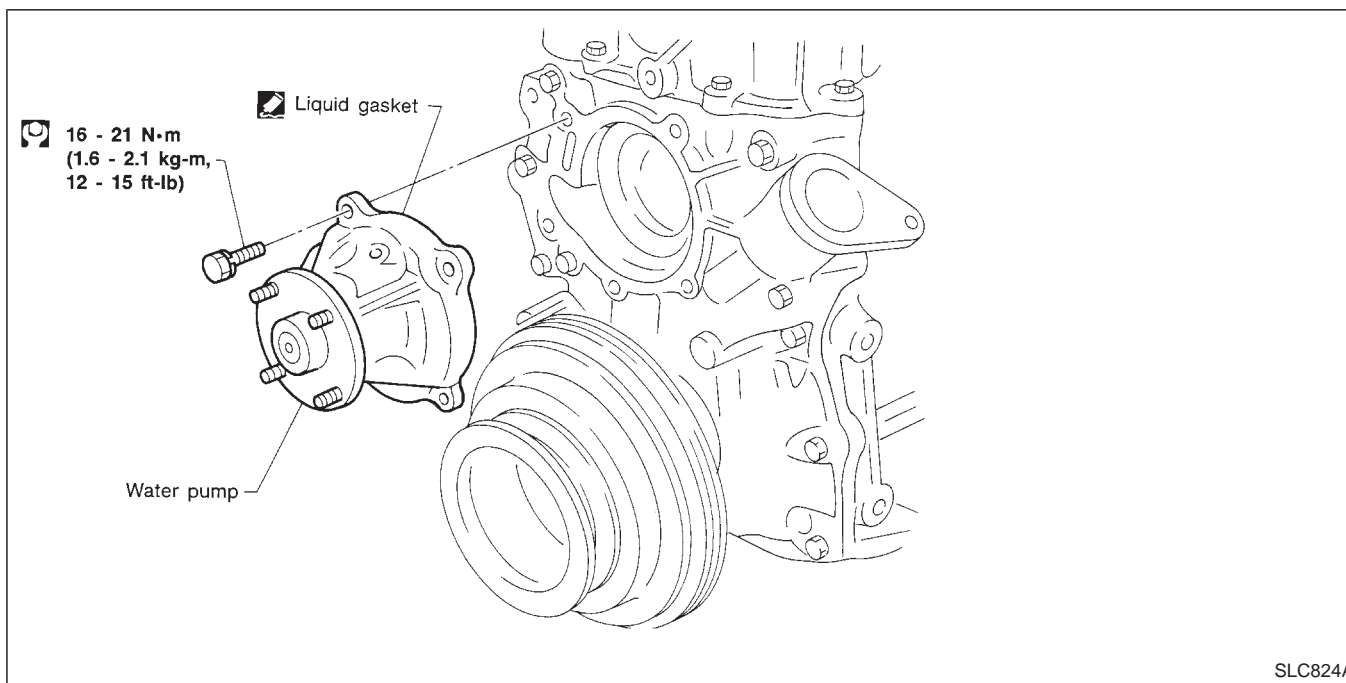
Limit

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

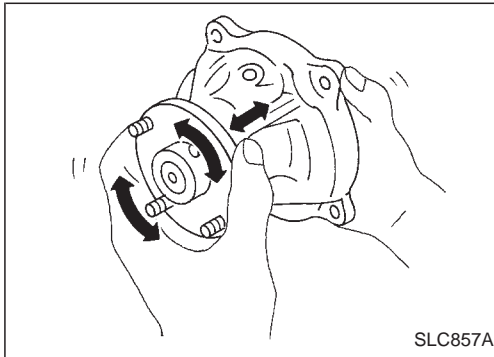
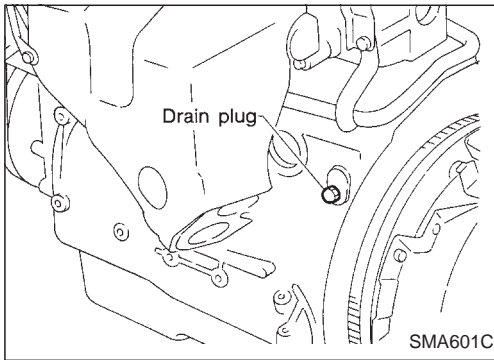
Water Pump (Cont'd)

REMOVAL

1. Drain coolant from radiator and cylinder block.
2. Remove radiator shroud and cooling fan.
3. Remove drive belts for compressor, power steering pump and alternator.
4. Remove water pump pulley.
5. Remove water pump.

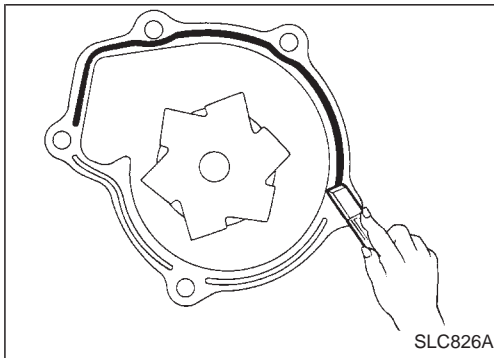
CAUTION:

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



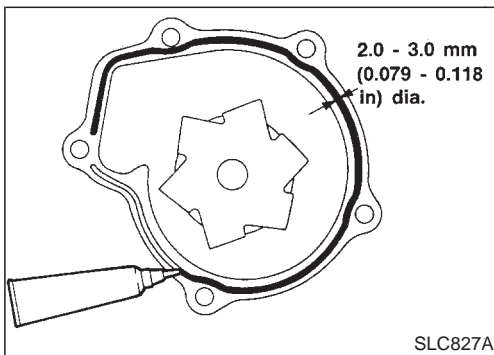
INSPECTION

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



INSTALLATION

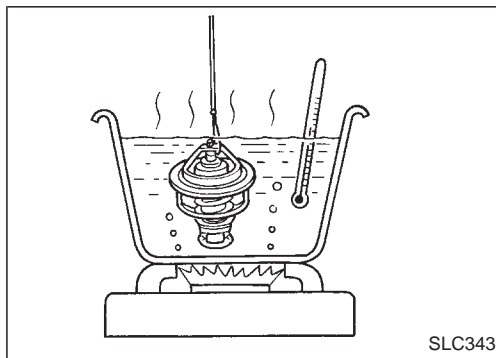
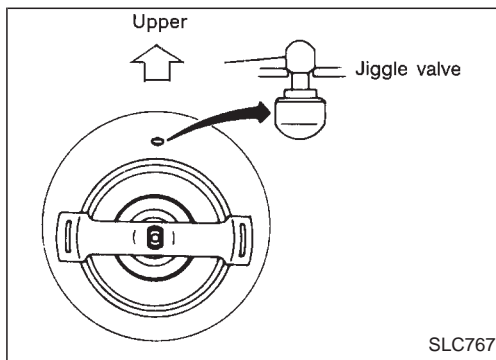
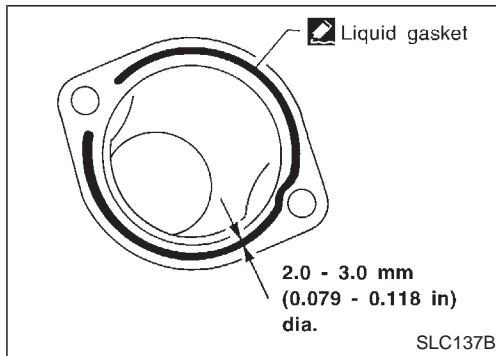
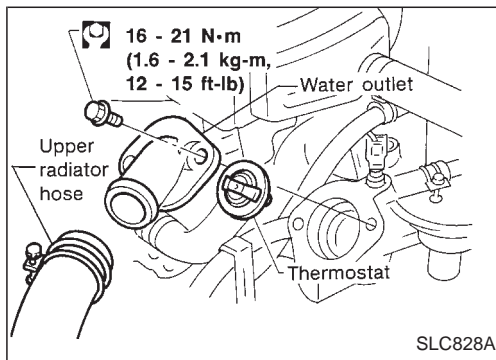
1. Use a scraper to remove liquid gasket from water pump.
 - Also remove traces of liquid gasket from mating surface of cylinder block.



2. Apply a continuous bead of liquid gasket to mating surface of water pump.
 - Use Genuine Liquid Gasket or equivalent.

When filling radiator with coolant, refer to MA section ("Changing Engine Coolant", "ENGINE MAINTENANCE").

When installing drive belts, refer to MA section ("Checking Drive Belts", "ENGINE MAINTENANCE").



Thermostat

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

REMOVAL AND INSTALLATION

1. Drain engine coolant.
2. Remove upper radiator hose.
3. Remove water outlet, 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 a continuous bead of liquid gasket to mating surface of each part.
 - Use Genuine Liquid Gasket or equivalent.
6. Install thermostat with jiggle valve facing upward.
 - **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.**

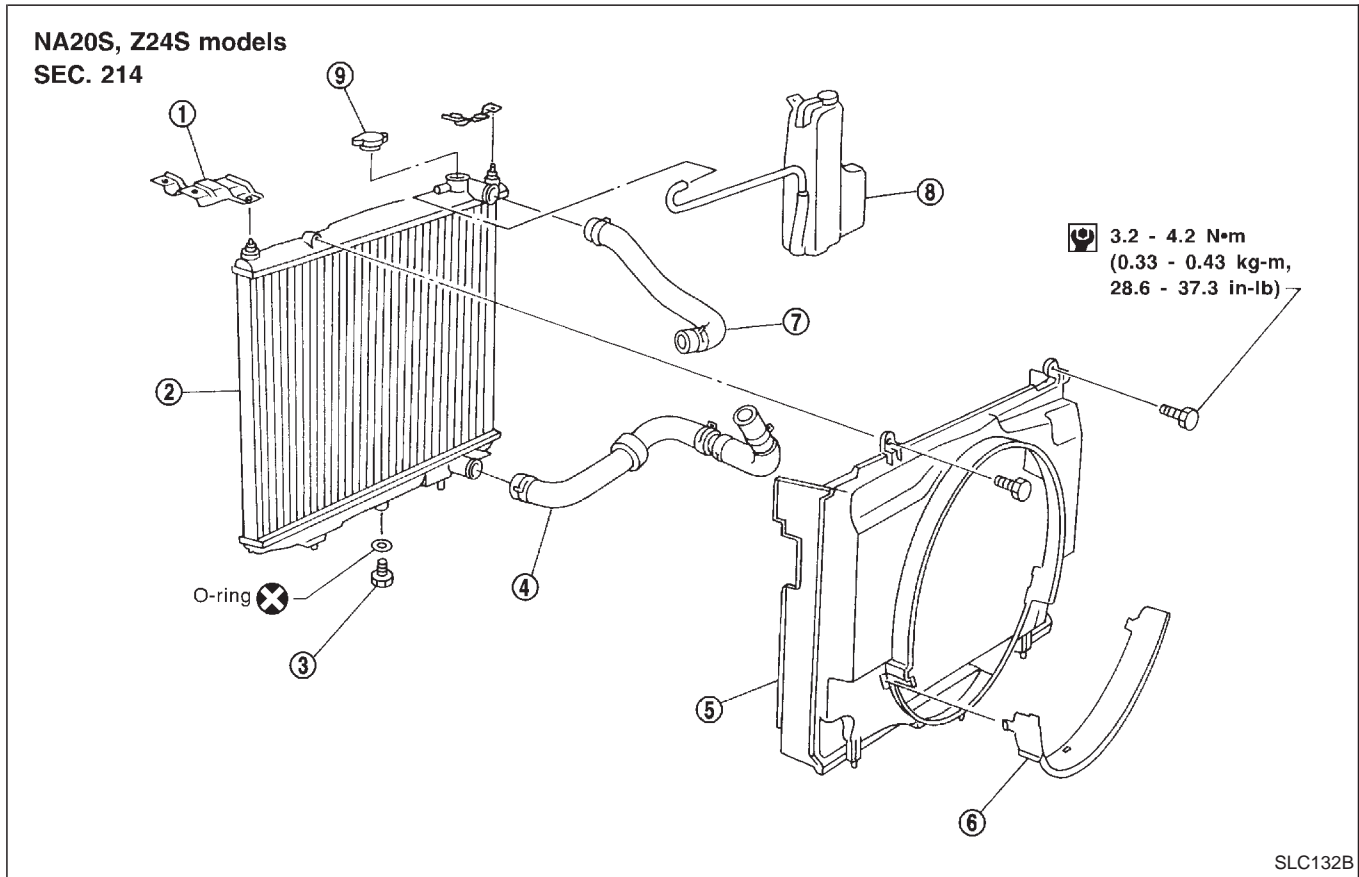
INSPECTION

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

| | Standard | Frigid type | Tropical type |
|--------------------------------------|---------------------------------|----------------------------------|---------------------------------|
| Valve opening temperature °C (°F) | 82 (180) | 88 (190) | 76.5 (170) |
| Valve lift mm/°C (in/°F) | More than 8/95 (0.31/203) | More than 8/100 (0.31/212) | More than 8/90 (0.31/194) |

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

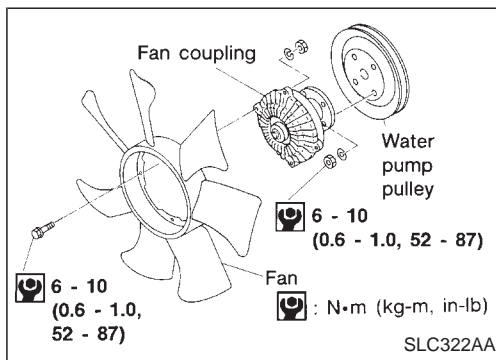
Radiator



- ① Bracket
② Radiator
③ Radiator drain plug

- ④ Lower radiator hose
⑤ Radiator shroud (Upper)
⑥ Radiator shroud (Lower)

- ⑦ Upper radiator hose
⑧ Reservoir tank
⑨ Radiator filler cap



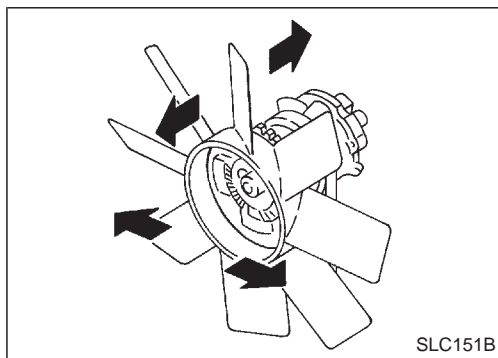
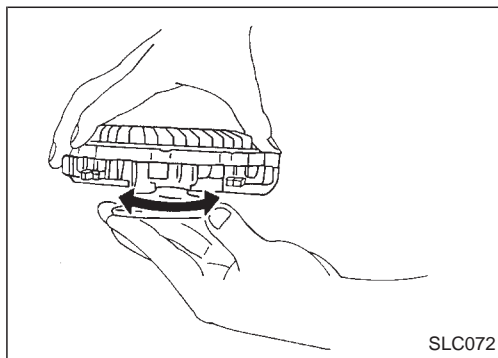
Cooling Fan (Crankshaft driven)

REMOVAL AND INSTALLATION

- Do not release the drive belt tension by removing the fan/water pump pulley.
- Fan coupling cannot be disassembled and should be replaced as a unit. If front mark F is present, install fan so that side marked F faces the front.
- Install the drive belt only after the fan and fan coupling to water pump flange bolts/nuts have been properly torqued.
- Proper alignment of these components is essential. Improper alignment will cause them to wobble and may eventually cause the fan to separate from the water pump causing extensive damage.

Cooling Fan (Crankshaft driven) (Cont'd)**INSPECTION**

Check fan coupling for rough operation, wobbling, oil leakage or bent bimetal.



After assembly, verify the fan does not wobble or flap while the engine is running.

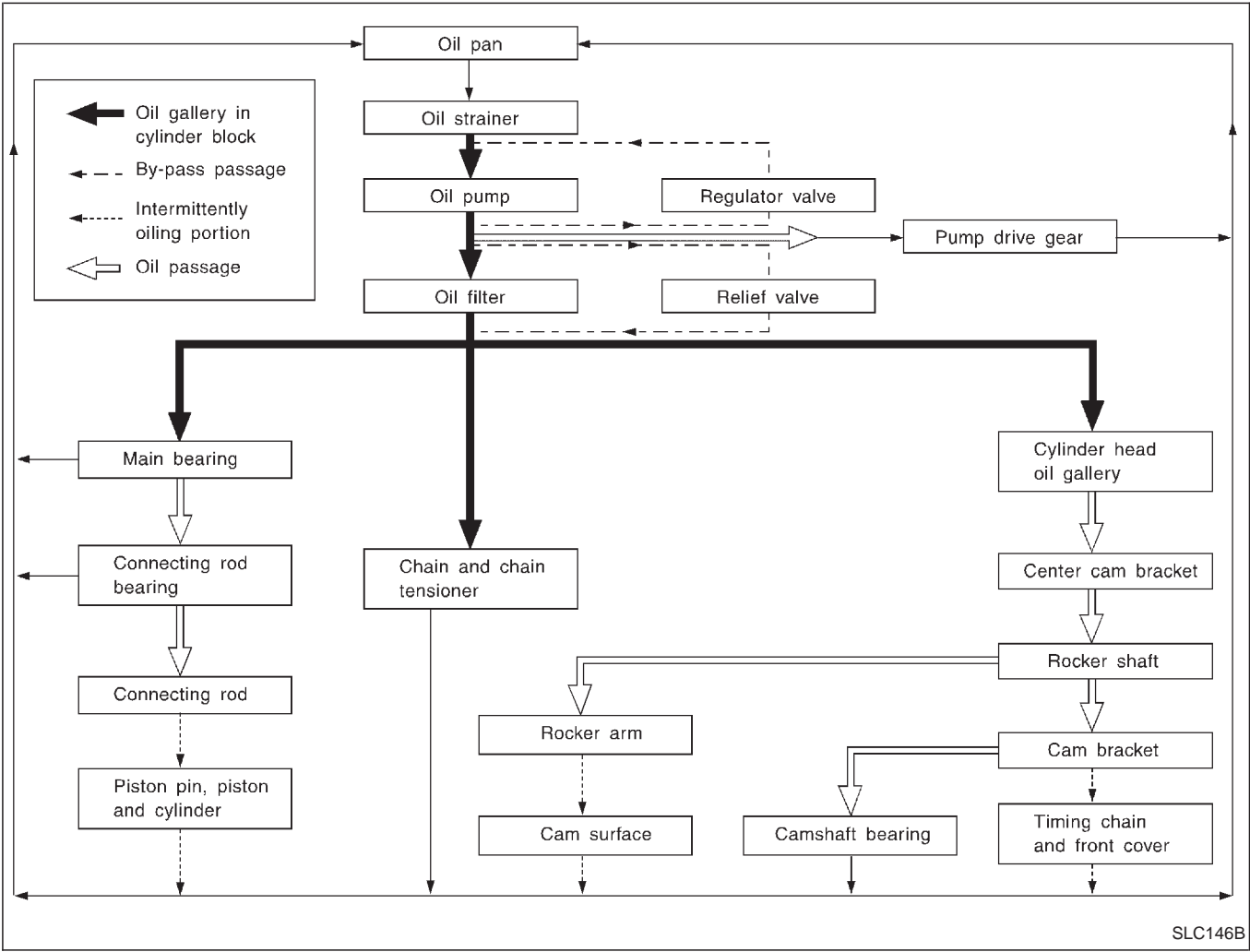
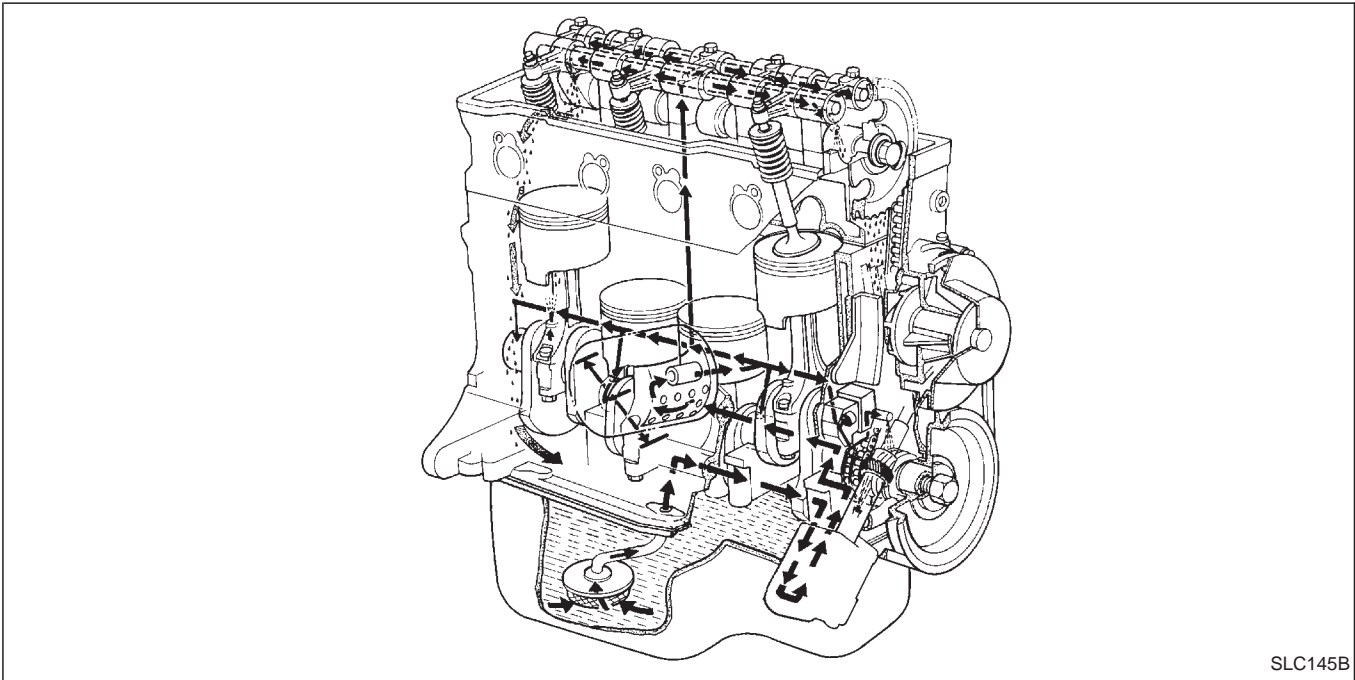
WARNING:

- When the engine is running, keep hands and clothing away from moving parts such as drive belts and fan.

Refilling engine coolant

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

Lubricating Circuit



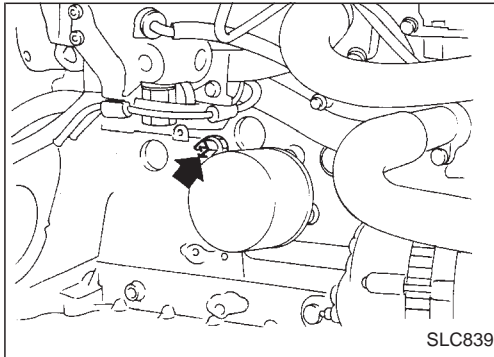
Oil Pressure Check

WARNING:

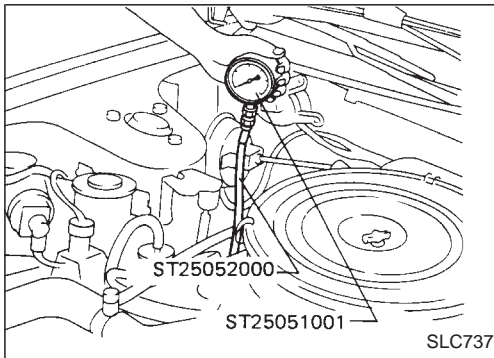
- Be careful not to burn yourself, as the engine and oil may be hot.
- Oil pressure check should be done in “Neutral” gear position.

CAUTION:

- The following data is tested using SAE 10W30 oil and oil temperature is about 80°C (176°F). Slight difference will be found because of oil viscosity or oil temperature. If difference is extreme, check oil passage and oil pump for oil leaks.



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 73.6 (0.736, 0.75, 10.7) |
| 3,000 | 363 - 461 (3.63 - 4.61, 3.7 - 4.7, 53 - 67) |

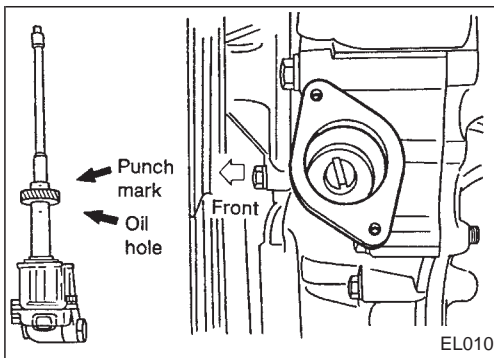
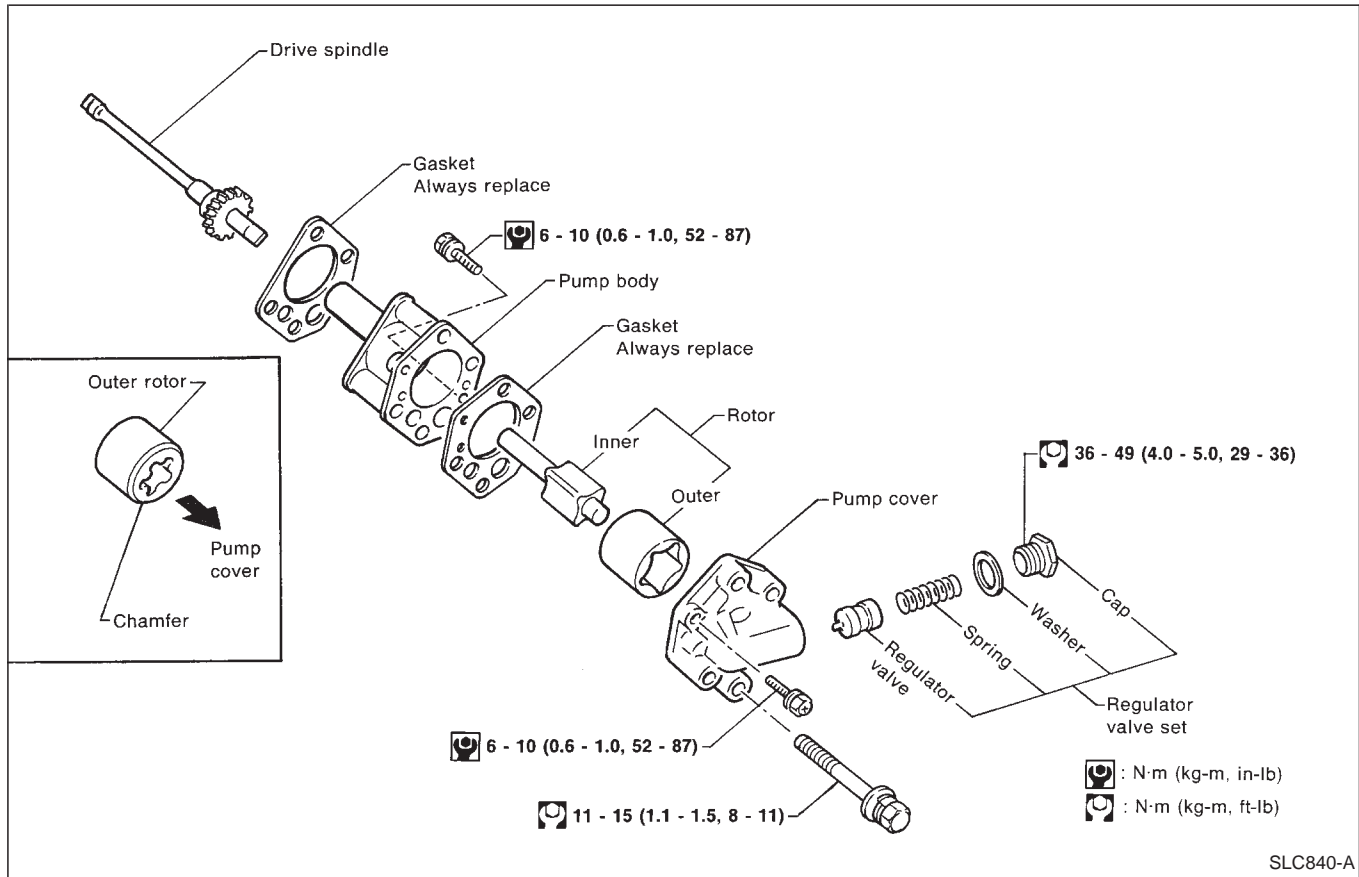
- If difference is extreme, check oil passage and oil pump for oil leaks.

6. Install oil pressure switch with sealant.

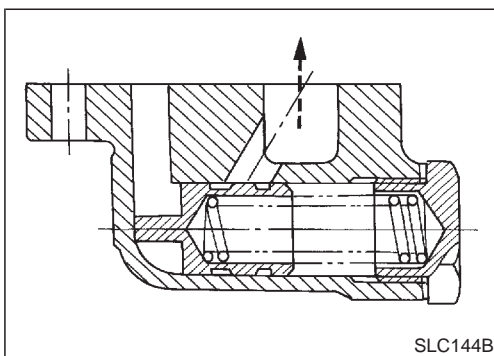
Oil pressure switch:

: 10 - 16 N·m
 (1.0 - 1.6 kg-m, 87 - 139 in-lb)

Oil Pump



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



REGULATOR VALVE INSPECTION

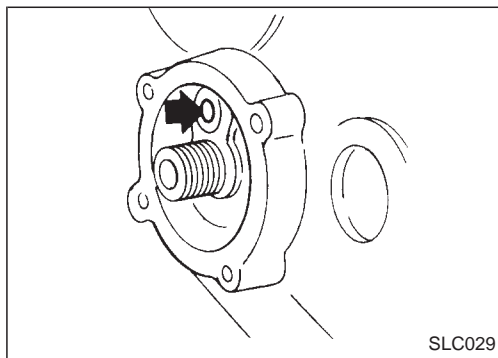
1. Visually inspect components for wear and damage.
2. Check oil pressure regulator valve sliding surface and valve spring.
3. Coat regulator valve with engine oil and check that it falls smoothly into the valve hole by its own weight.

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

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 screwdriver.

Install a new valve in place by tapping it.



SLC029

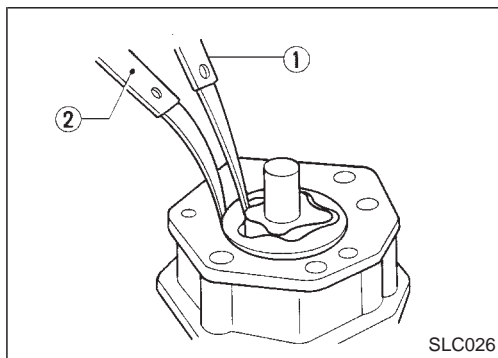
OIL PUMP INSPECTION

Using a feeler gauge, check the following clearances.

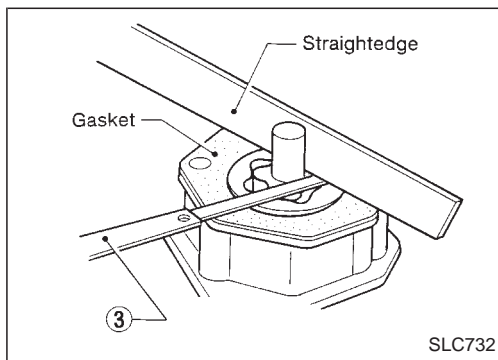
Unit: mm (in)

| | |
|--|-------------------------------|
| Rotor tip clearance ① | Less than 0.12 (0.0047) |
| Outer rotor to body radial 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.

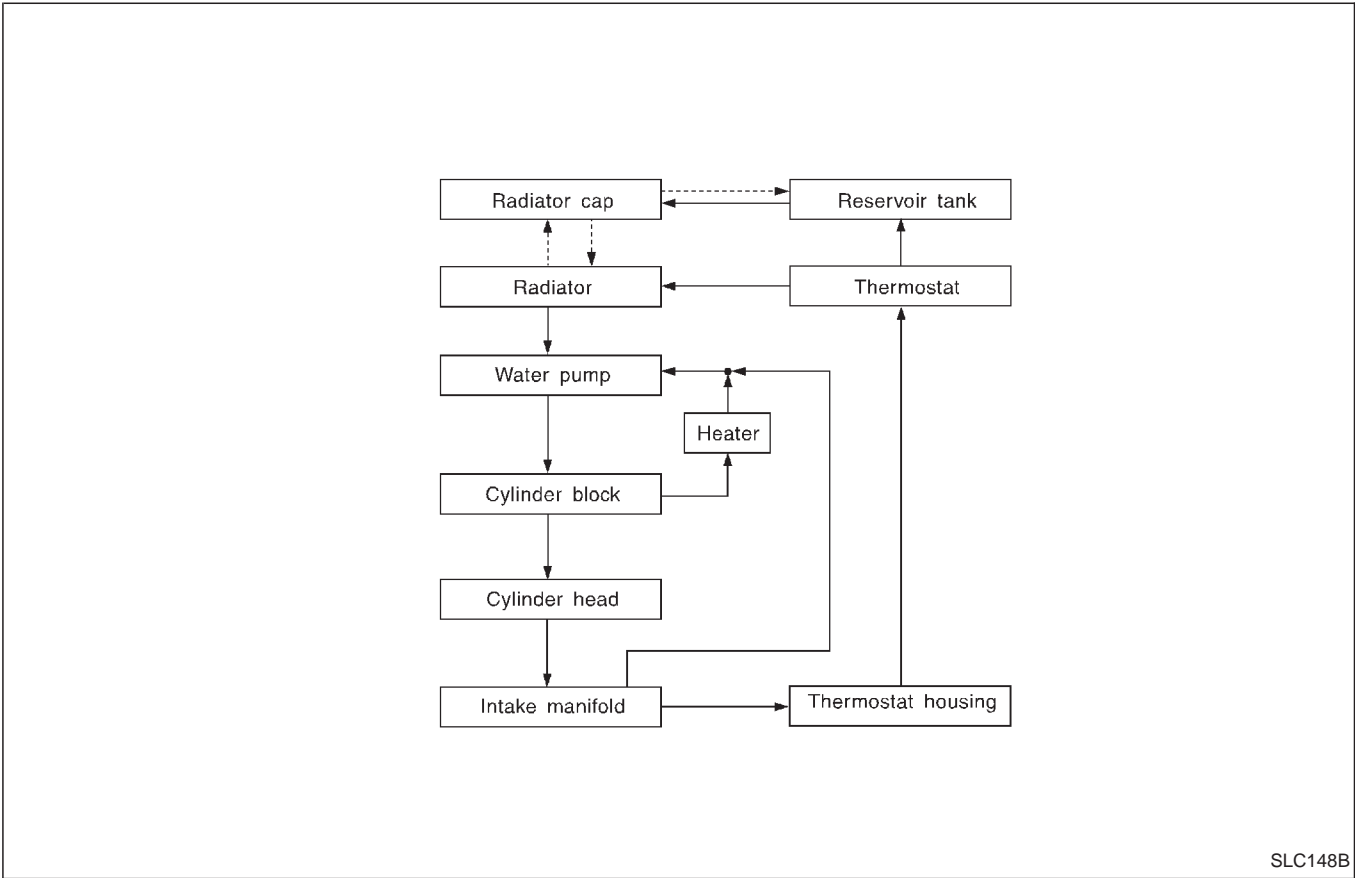
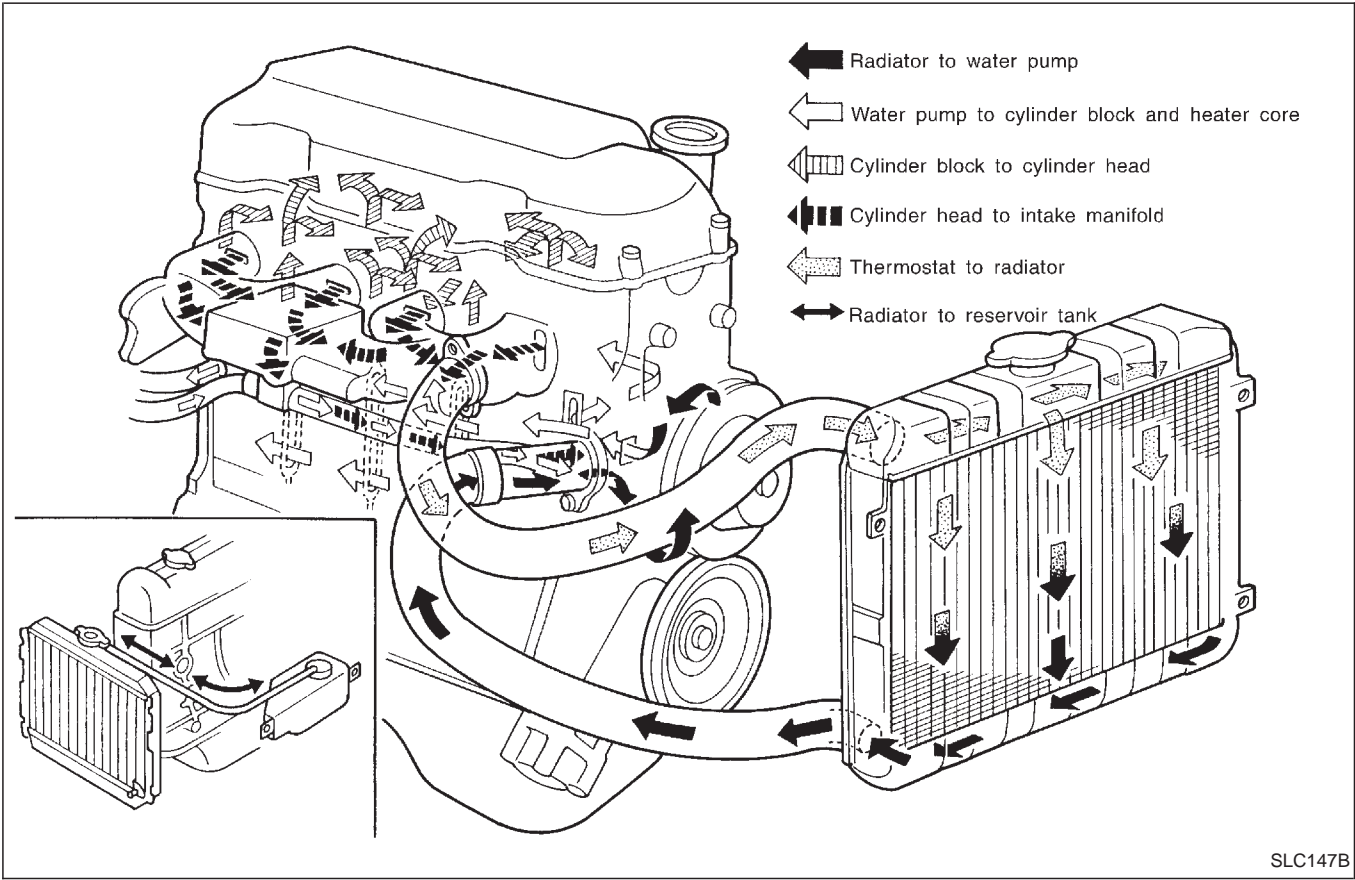


SLC026



SLC732

Cooling Circuit



System Check

WARNING:

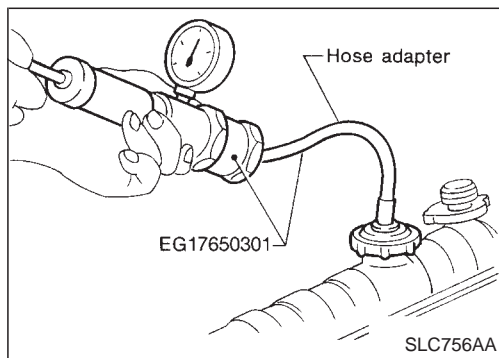
Never remove the radiator cap when the engine is hot. Serious burns could occur from high pressure coolant escaping from the radiator.

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



CHECKING COOLING SYSTEM FOR LEAKS

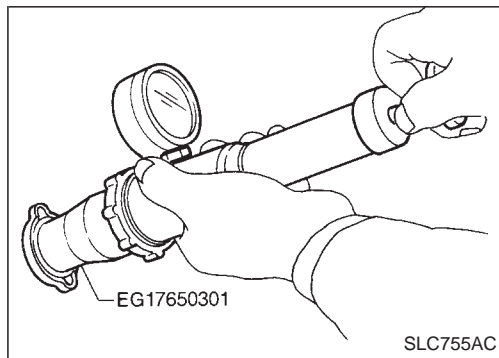
To check for leakage, apply pressure to the cooling system with a radiator cap tester.

Testing pressure:

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

CAUTION:

Higher pressure than specified may cause radiator damage.



CHECKING RADIATOR CAP

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

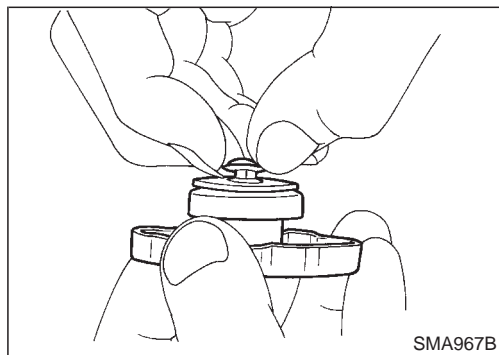
Radiator cap relief pressure:

Standard

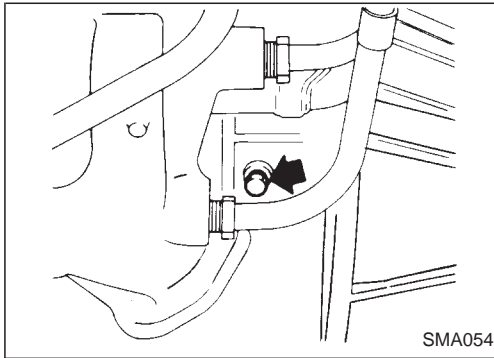
78 - 98 kPa (0.79 - 0.98 bar,
0.8 - 1.0 kg/cm², 11 - 14 psi)

Limit

59 - 98 kPa (0.59 - 0.98 bar,
0.6 - 1.0 kg/cm², 9 - 14 psi)



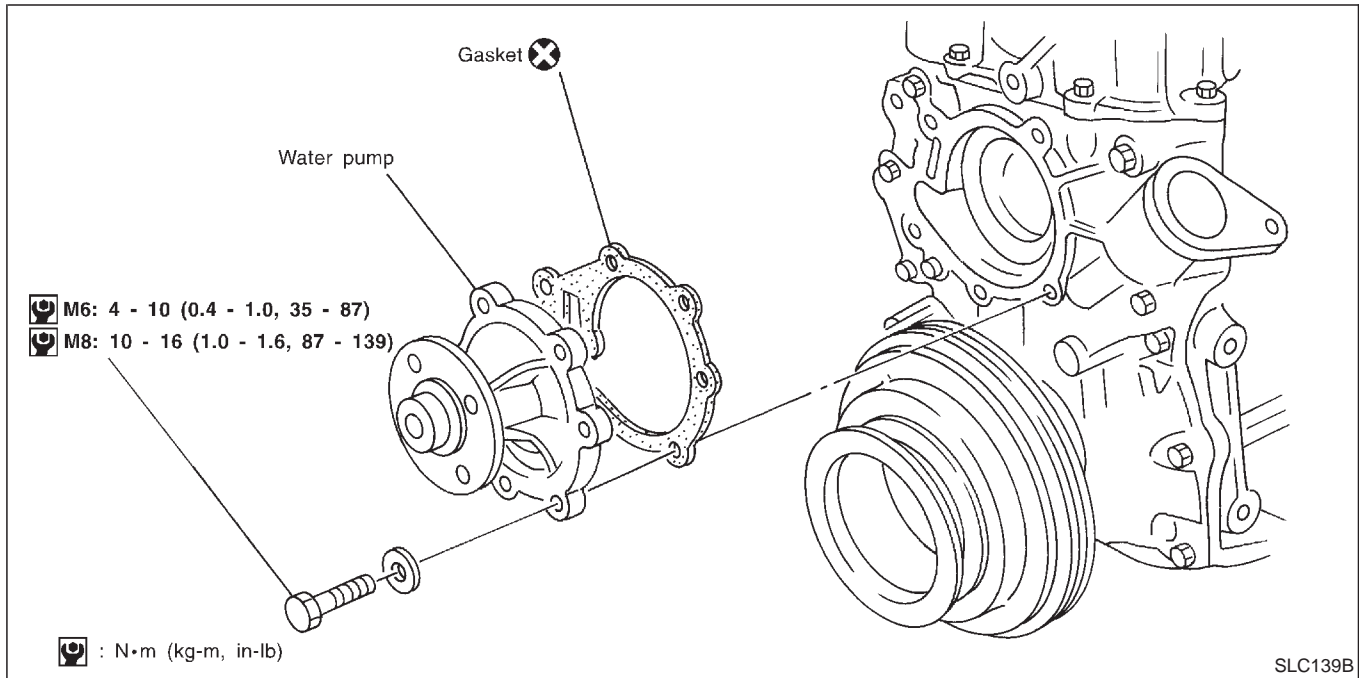
Pull the negative pressure valve to open it.
Check that it closes completely when released.



Water Pump

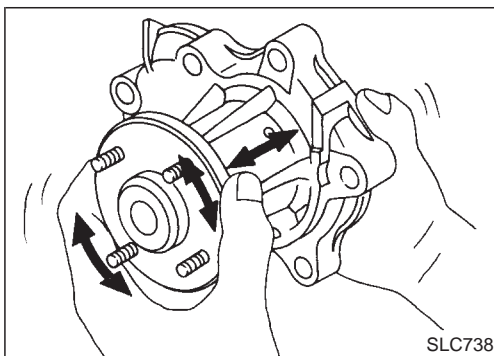
REMOVAL AND INSTALLATION

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



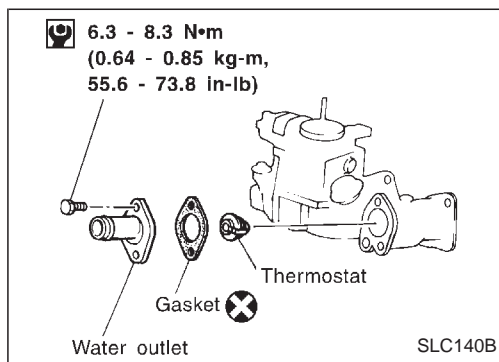
CAUTION:

- 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.
- 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. Refer to MA section.



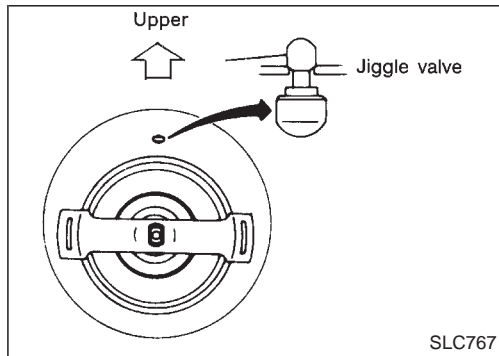
INSPECTION

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

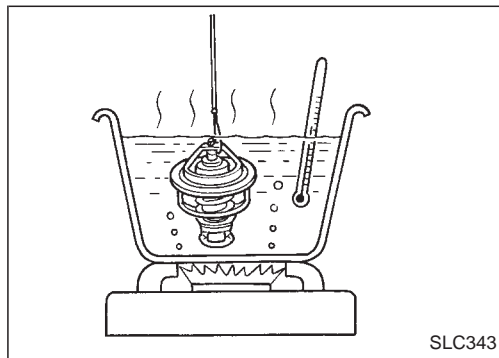


Thermostat

- 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.



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



INSPECTION

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

| | | Standard |
|---------------------------|---------------|-----------------|
| Valve opening temperature | °C (°F) | 82 (180) |
| Valve lift | mm/°C (in/°F) | 8/95 (0.31/203) |

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

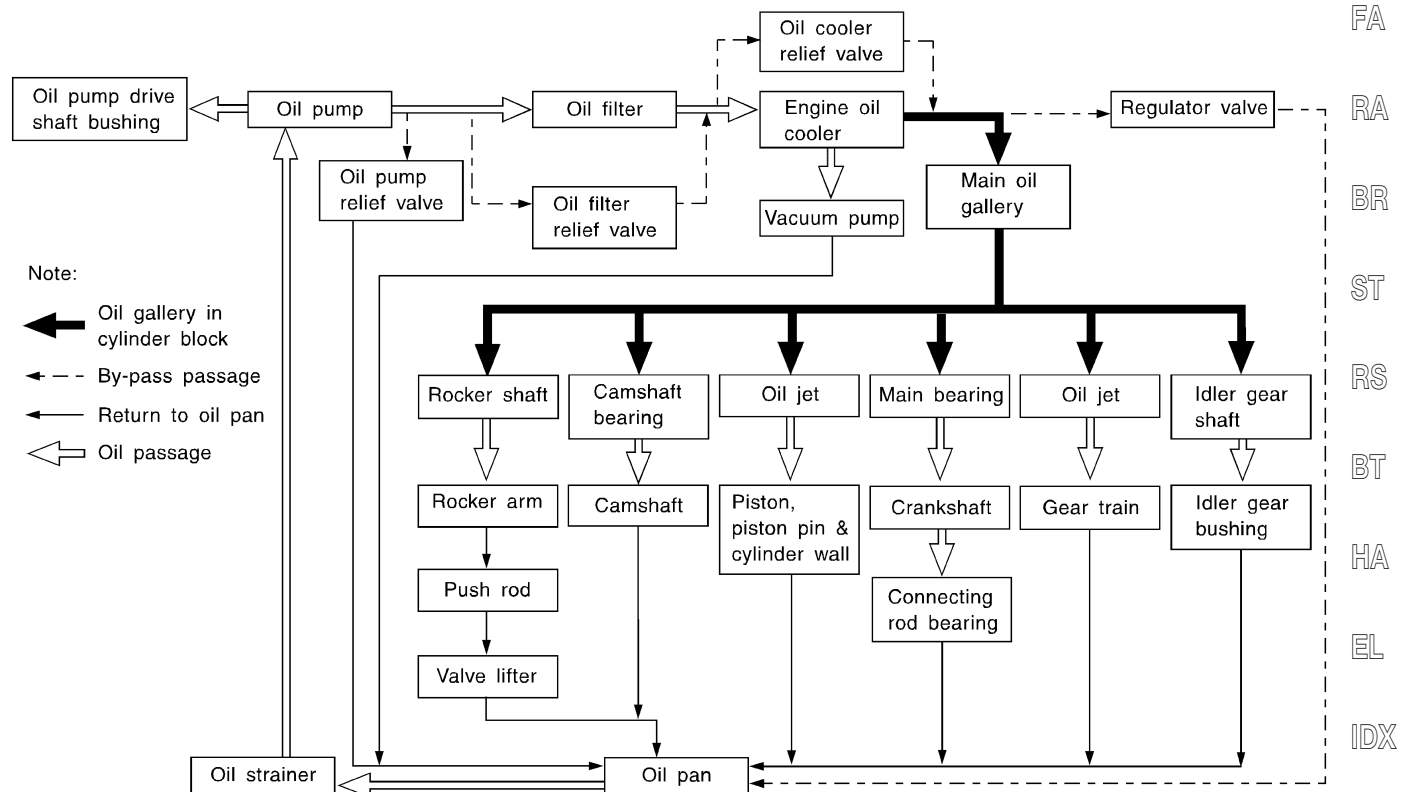
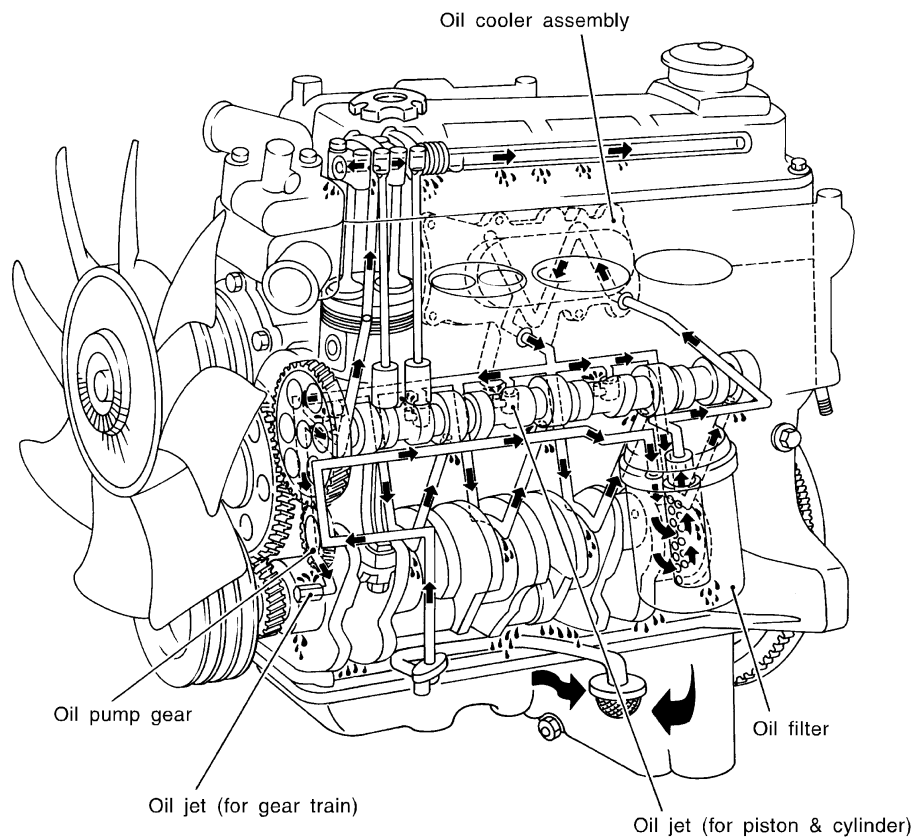
Radiator

Refer to "Radiator", "ENGINE COOLING SYSTEM", LC-21.

Cooling Fan

Refer to "Cooling Fan", "ENGINE COOLING SYSTEM", LC-21.

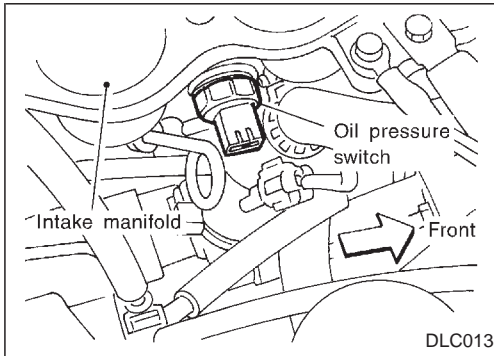
Lubrication Circuit



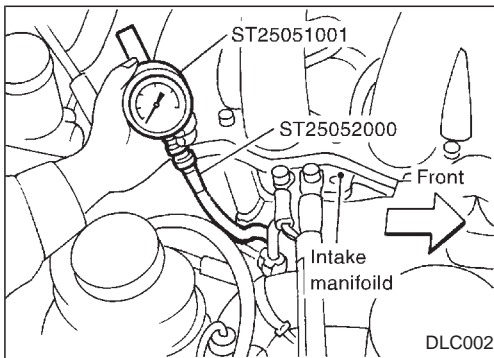
Oil Pressure Check (On-vehicle service)

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. Disconnect oil pressure switch harness connector.
3. Remove oil pressure switch.




4. Install pressure gauge and hose.
5. Start engine and warm it up to normal operating temperature.
6. 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) |
| 3,000 | 294 - 392 (2.94 - 3.92, 3.0 - 4.0, 43 - 57) |

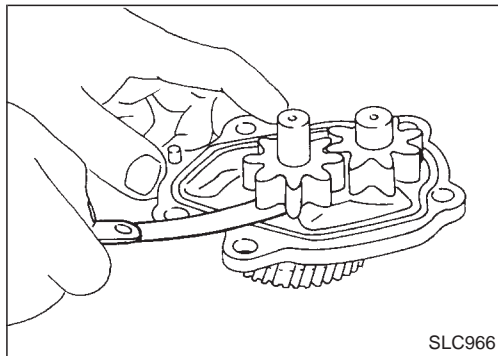
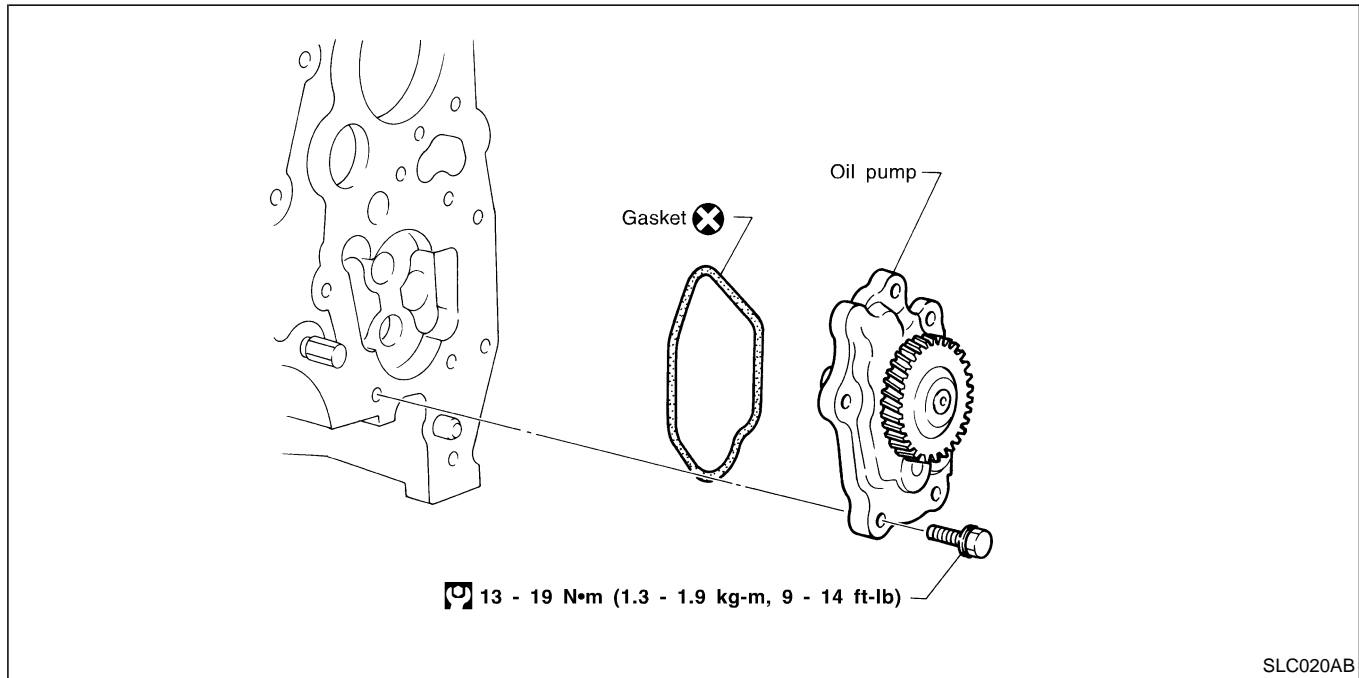
If difference is extreme, check oil passage and oil pump for oil leaks.

7. Install oil pressure switch with sealant.

Oil pressure switch:

 : 10 - 13 N·m (1.0 - 1.3 kg-m, 87 - 113 in-lb)

Oil Pump

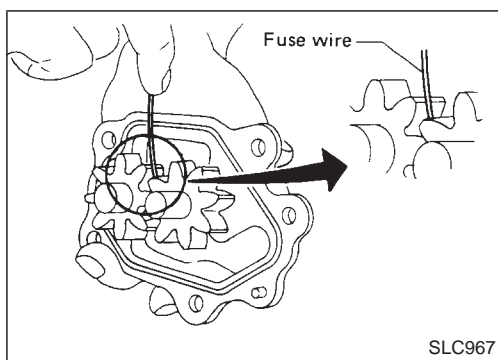


OIL PUMP INSPECTION

1. Inspect pump body, gears and drive shaft for wear and damage.
2. Using a feeler gauge and fuse wire, check the following clearances.

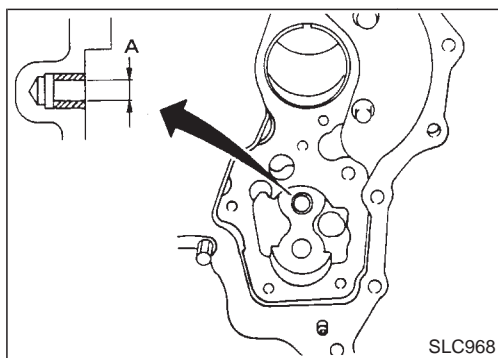
Gear side clearance:

Less than 0.13 mm (0.0051 in)



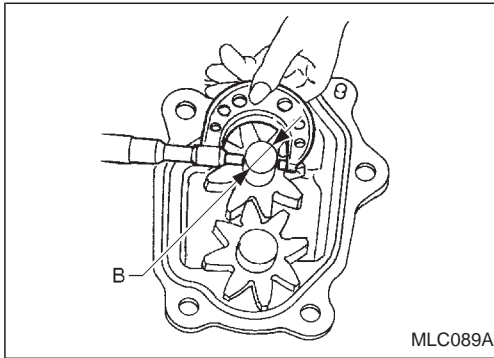
Gear backlash:

Less than 0.43 mm (0.0169 in)



3. Measure inside diameter "A" of bushing.

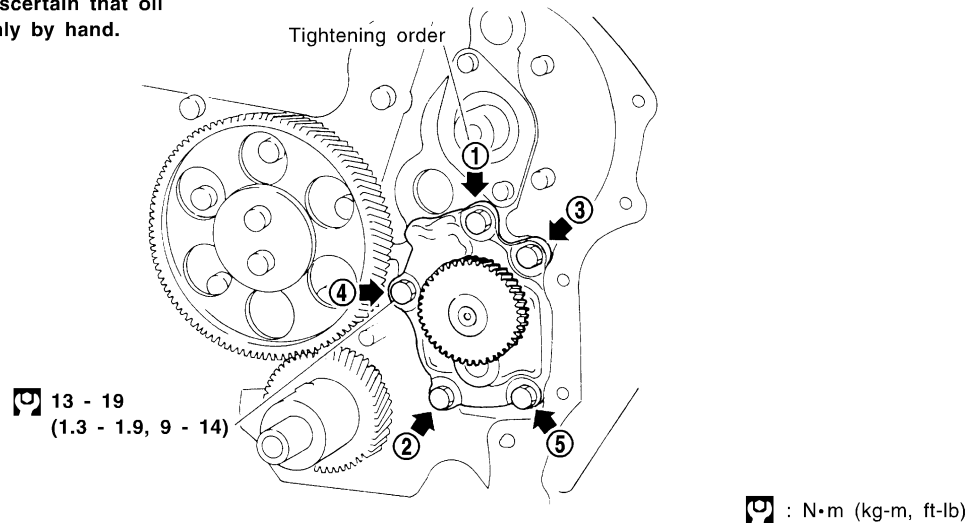
A: 13.012 - 13.106 mm (0.5123 - 0.5160 in)

Oil Pump (Cont'd)

4. Measure outside diameter "B" of drive gear shaft.
B: 12.974 - 12.992 mm (0.5108 - 0.5115 in)
5. Calculate oil pump bushing clearance.
Oil pump bushing clearance: A – B
Less than 0.15 mm (0.0059 in)

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

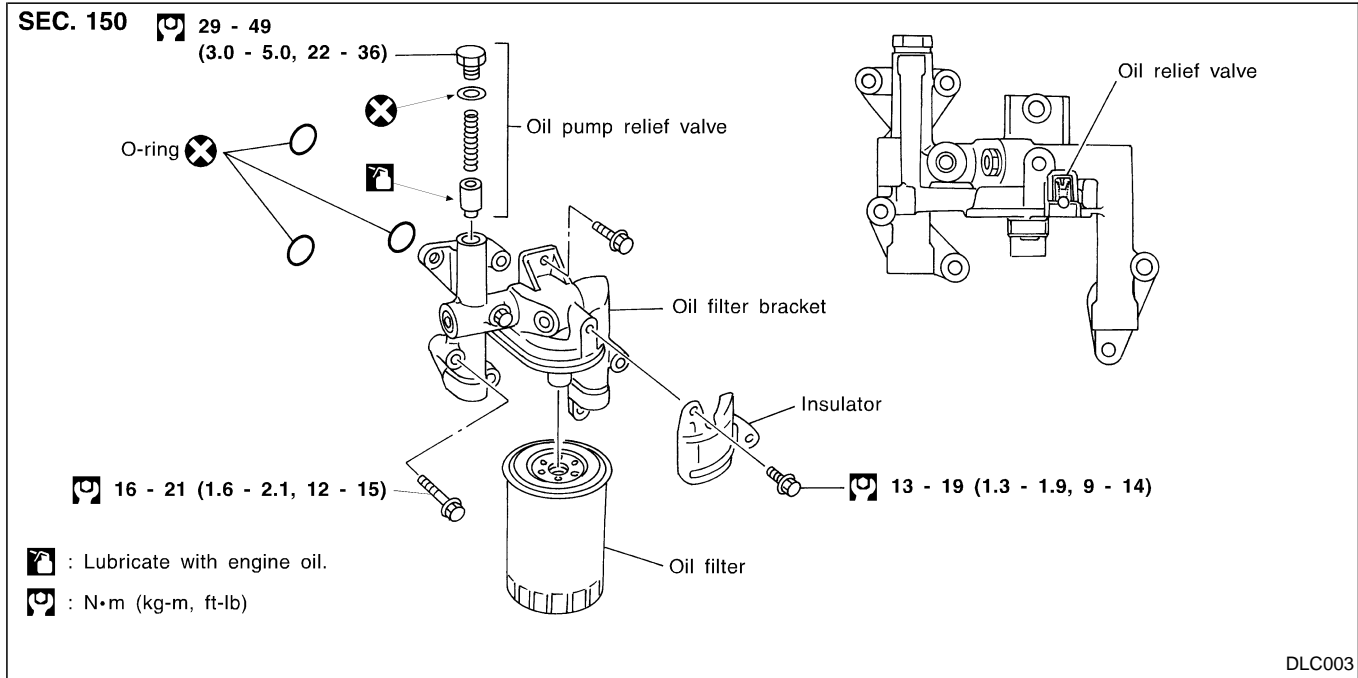
- When installing oil pump, the bolt should be tightened in two or three stages according to numerical order.
- After installation, ascertain that oil pump turns smoothly by hand.



SLC965-B

For installing timing gear case, refer to EM section ("TIMING GEAR CASE", "Assembly", "ENGINE OVERHAUL").

Oil Filter Bracket



OIL PUMP RELIEF VALVE INSPECTION

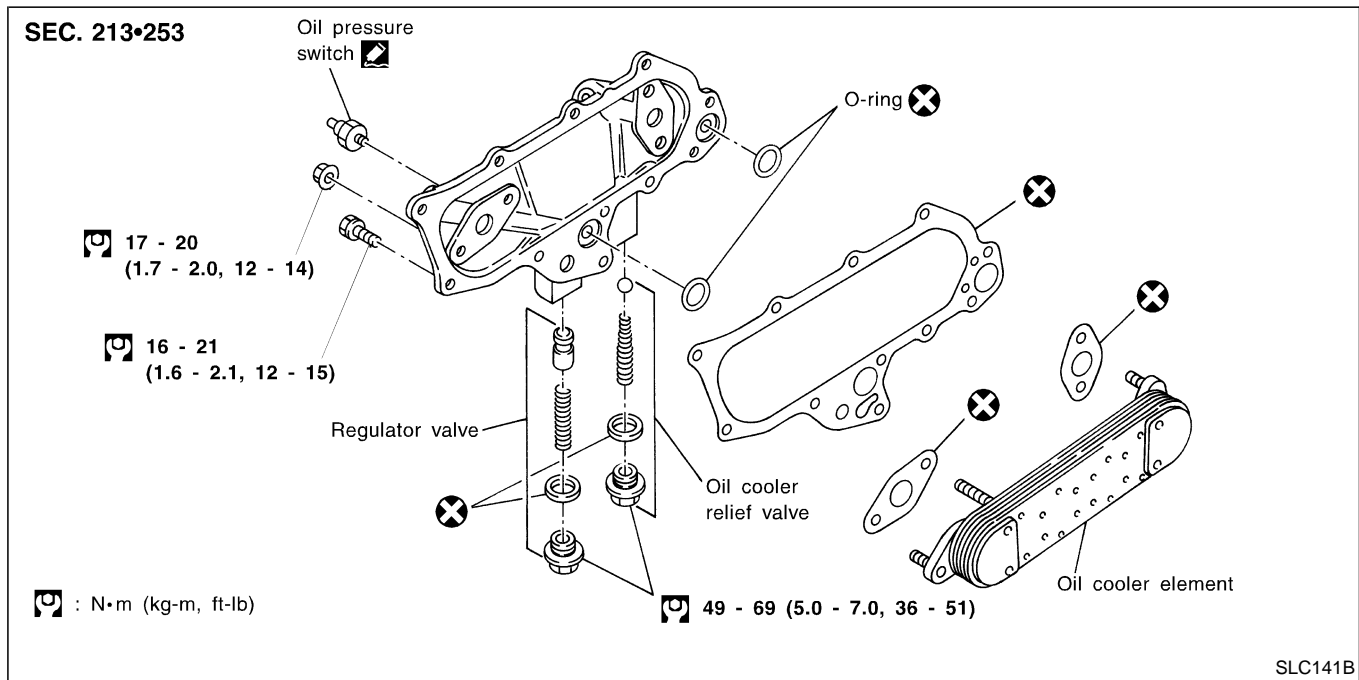
1. Visually inspect components for wear and damage.
 2. Coat relief valve with engine oil and check that it falls smoothly into the valve hole by its own weight.
- If damaged, replace oil pump relief valve set.

OIL FILTER RELIEF VALVE INSPECTION

Inspect oil filter relief valve for rough movement and damage by pushing the ball.

If damaged, replace oil filter bracket assembly.

Oil Cooler

**OIL COOLER RELIEF VALVE INSPECTION**

Inspect oil cooler relief valve for movement, cracks and breaks by pushing the ball.

If damaged, replace oil cooler relief valve set.

REGULATOR VALVE INSPECTION

1. Visually inspect components for wear and damage.
2. 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.

Oil Jet

INSPECTION (For gear train)

Make sure that the holes are not clogged. Clean them with a wire if necessary.

GI

MA

EM

LC

EC

FE

CL

MT

TF

PD

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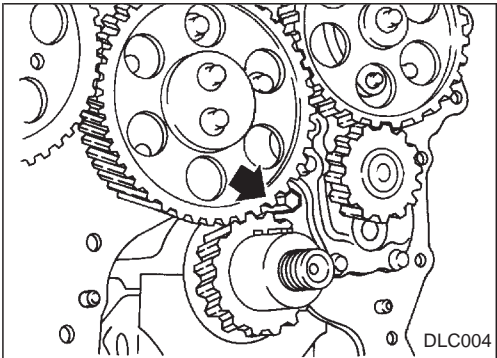
RS

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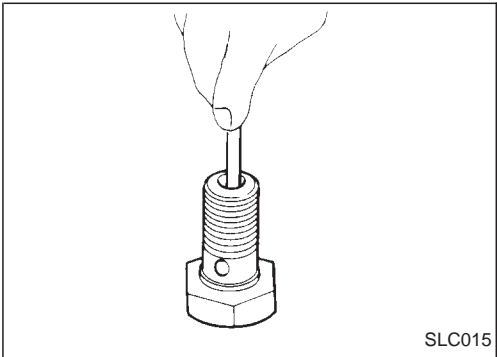
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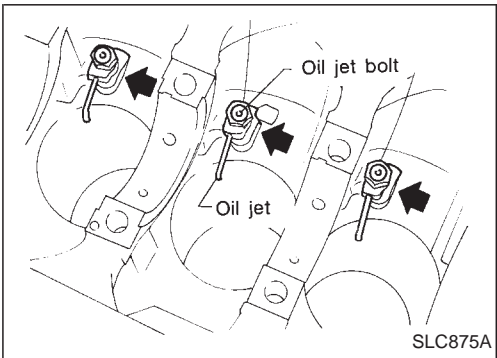


Oil jet has to be installed with oil hole facing crank gear and idler gear.



INSPECTION (For piston)

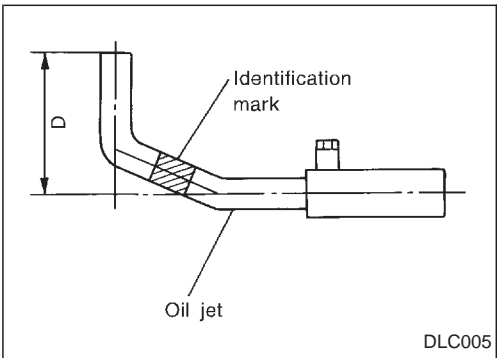
1. Push cut-off valve of oil jet bolt with a clean resin or brass rod and make sure that cut-off valve moves smoothly with proper repulsion.
2. Make sure that the oil jet passage is not clogged. Clean with a wire if necessary.



When installing oil jet, align oil jet's boss with hole on cylinder block.

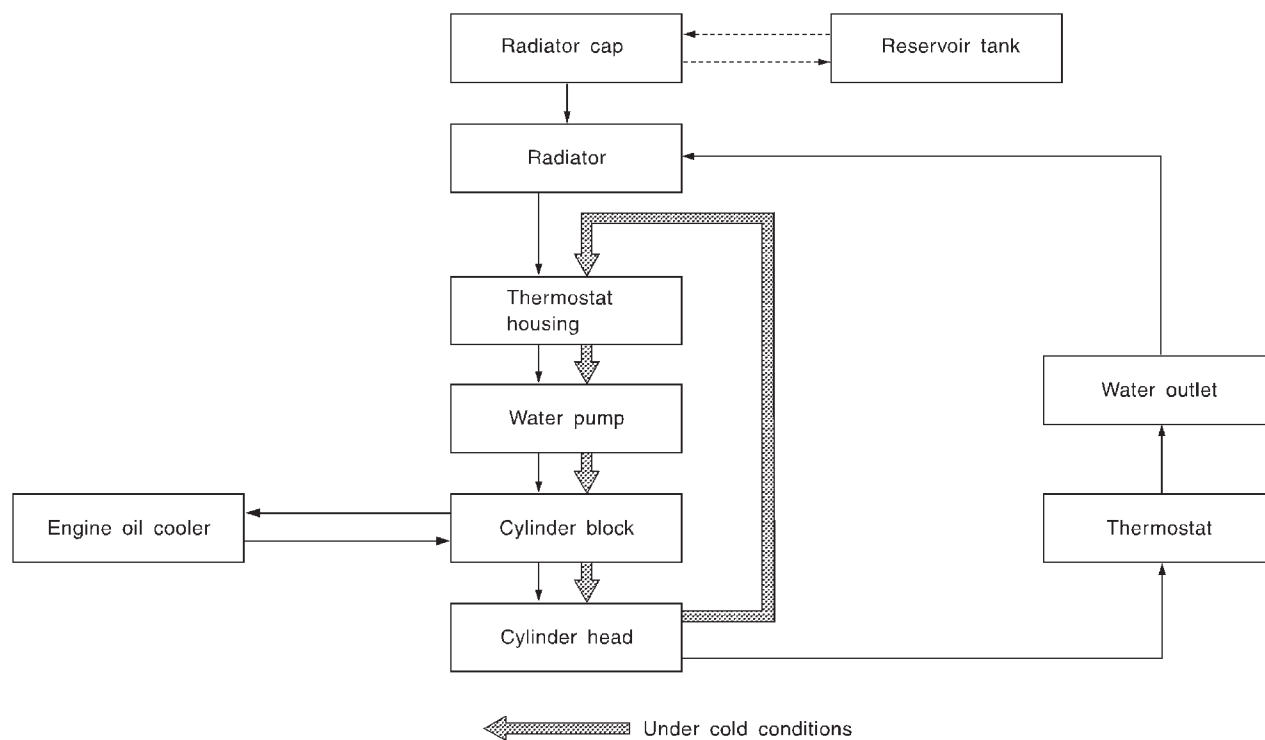
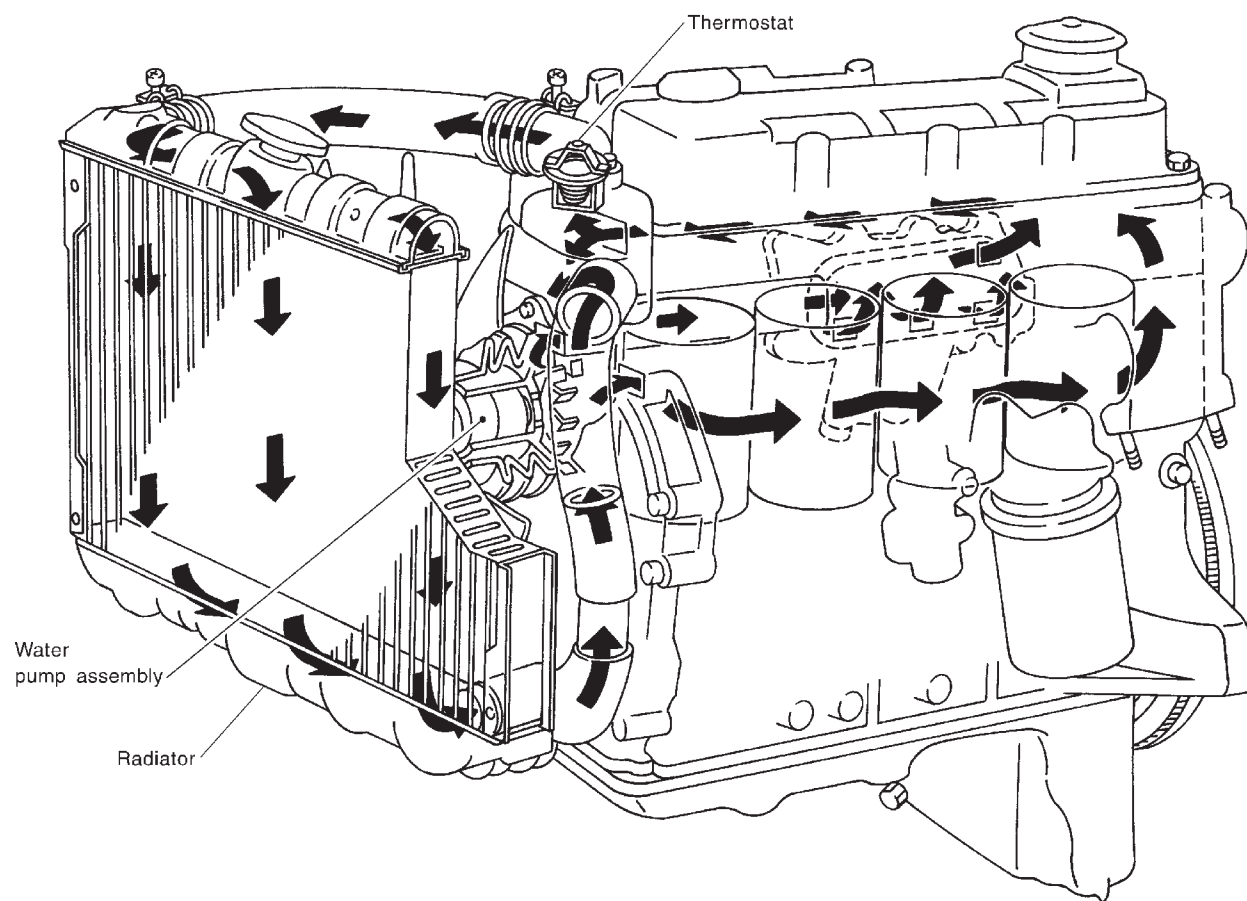
Oil jet bolt:

: 29 - 39 N·m (3.0 - 4.0 kg-m, 22 - 29 ft-lb)



| | | QD32 | TD27 |
|--------------------------|---------|-----------|-----------|
| Dimension "D" mm (in) | Type I | 17 (0.67) | — |
| | Type II | — | 12 (0.47) |
| Identification color | | Green | — |

Cooling Circuit



Cooling System Inspection

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 HOSES

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

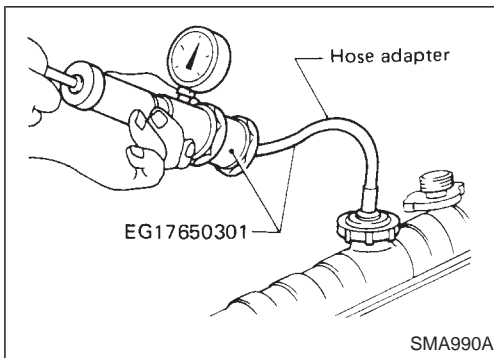
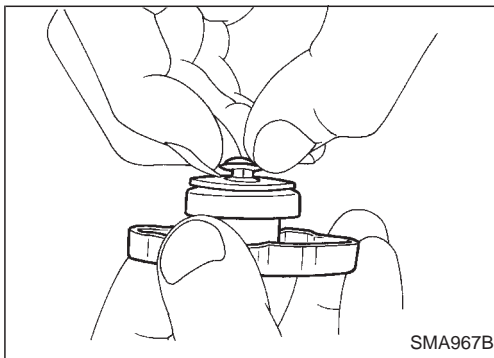
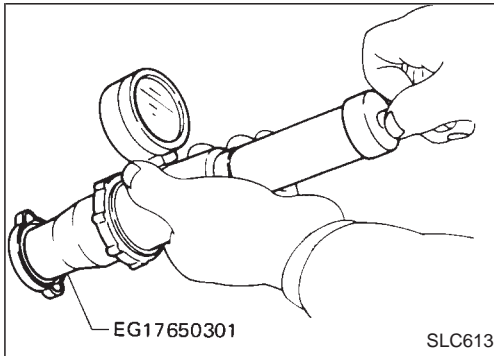
CHECKING RADIATOR CAP

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

Radiator cap relief pressure:

78 - 98 kPa

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



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

CHECKING COOLING SYSTEM FOR LEAKS

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

Testing pressure:

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

CAUTION:

Use of pressure higher than the specified value may cause damage to radiator.

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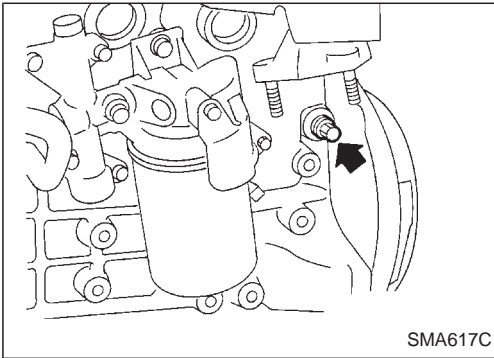
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Water Pump and Cooling Fan (Camshaft driven)

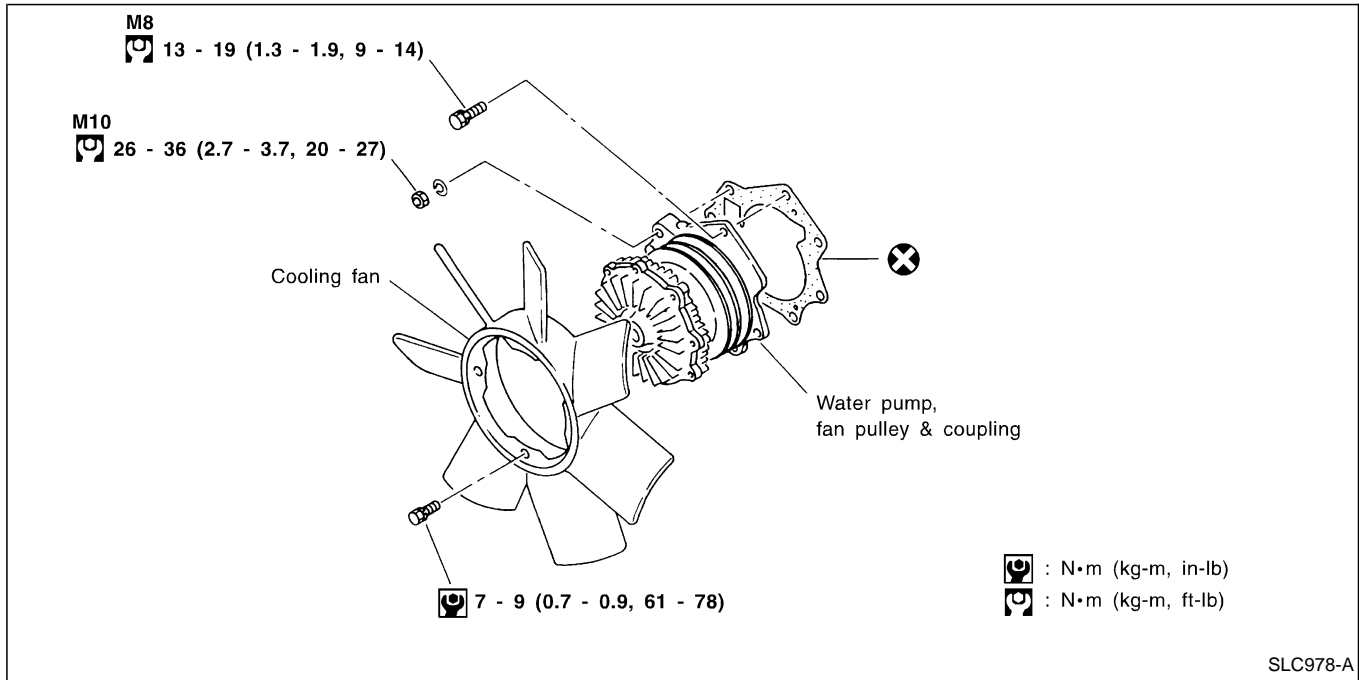
REMOVAL AND INSTALLATION

Drain coolant from drain plugs on cylinder block and radiator.

Cylinder block drain plug

(Use proper sealant):

: 20 - 29 N·m (2.0 - 3.0 kg-m, 14 - 22 ft-lb)



CAUTION:

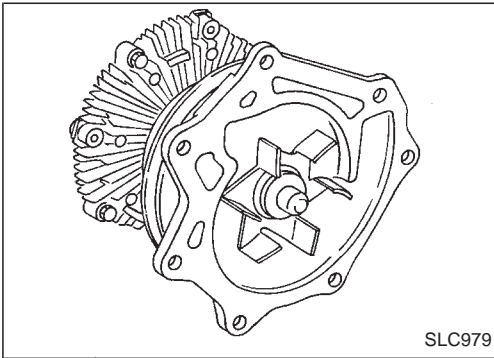
- When removing water pump assembly, be careful not to get coolant on drive belt.
- Water pump cannot be disassembled and should be replaced as a unit.
- Always replace with new gasket.
- After assembly, verify the fan does not wobble or flap while the engine is running.
- After installing water pump, connect hose and clamp securely, then check for leaks using radiator cap tester.

WARNING:

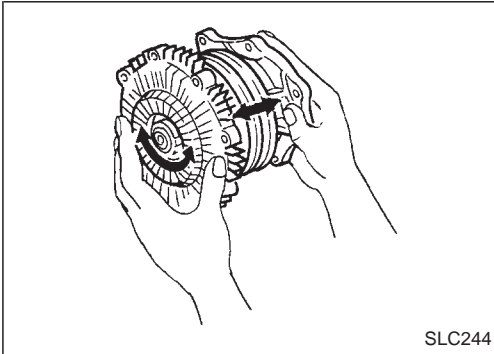
When the engine is running, keep hands and clothing away from moving parts such as drive belts and fan.

Water Pump and Cooling Fan (Camshaft driven) (Cont'd)**INSPECTION**

1. Check for badly rusted or corroded body assembly and vane.

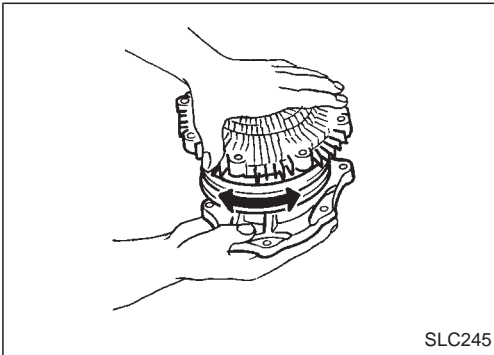


2. Check for rough operation due to excessive end play.



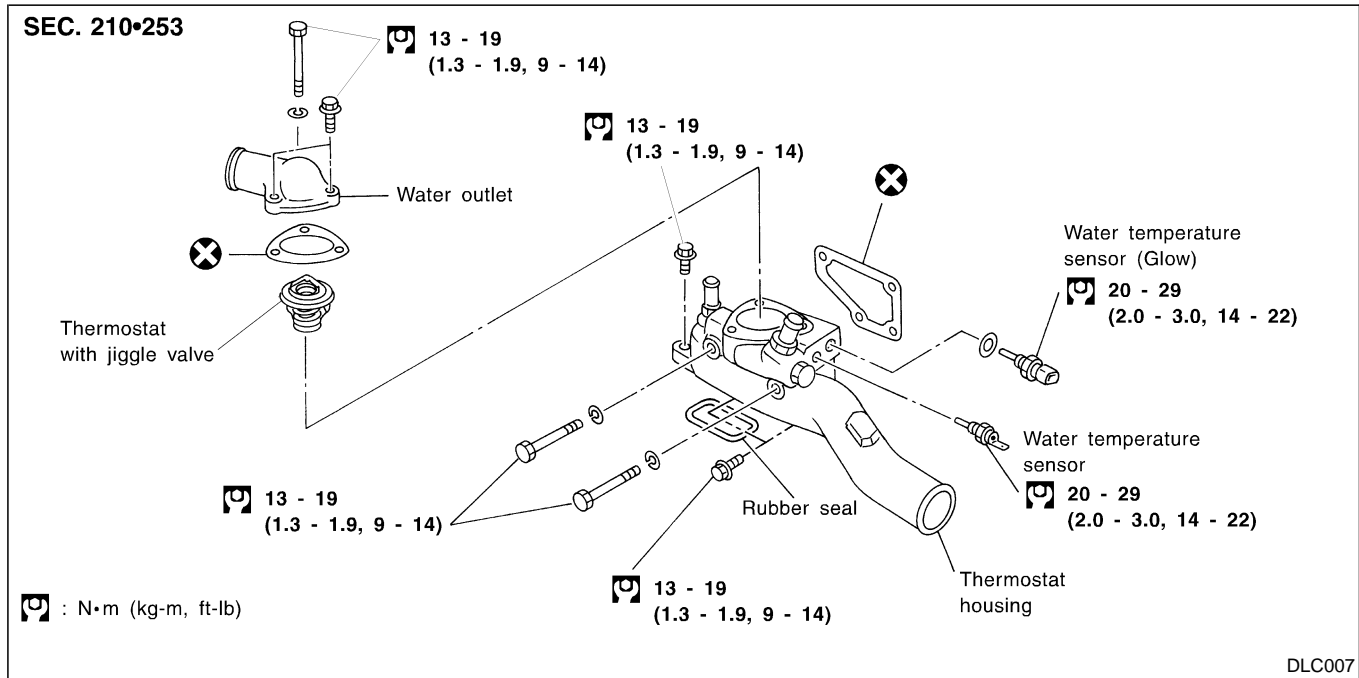
3. Check fan coupling for rough operation, wobbling, oil leakage or bent bimetal.

The water pump and fan coupling cannot be disassembled and should be replaced as a unit.

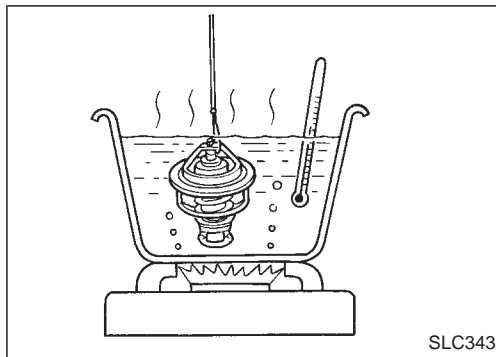


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Thermostat



- 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.



INSPECTION

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

| | Tropical type | Standard type |
|--------------------------------------|------------------------------|------------------------------|
| Valve opening temperature °C (°F) | 76.5 (170) | 82 (180) |
| Valve lift mm/°C (in/°F) | More than 8/90 (0.31/194) | More than 8/95 (0.31/203) |

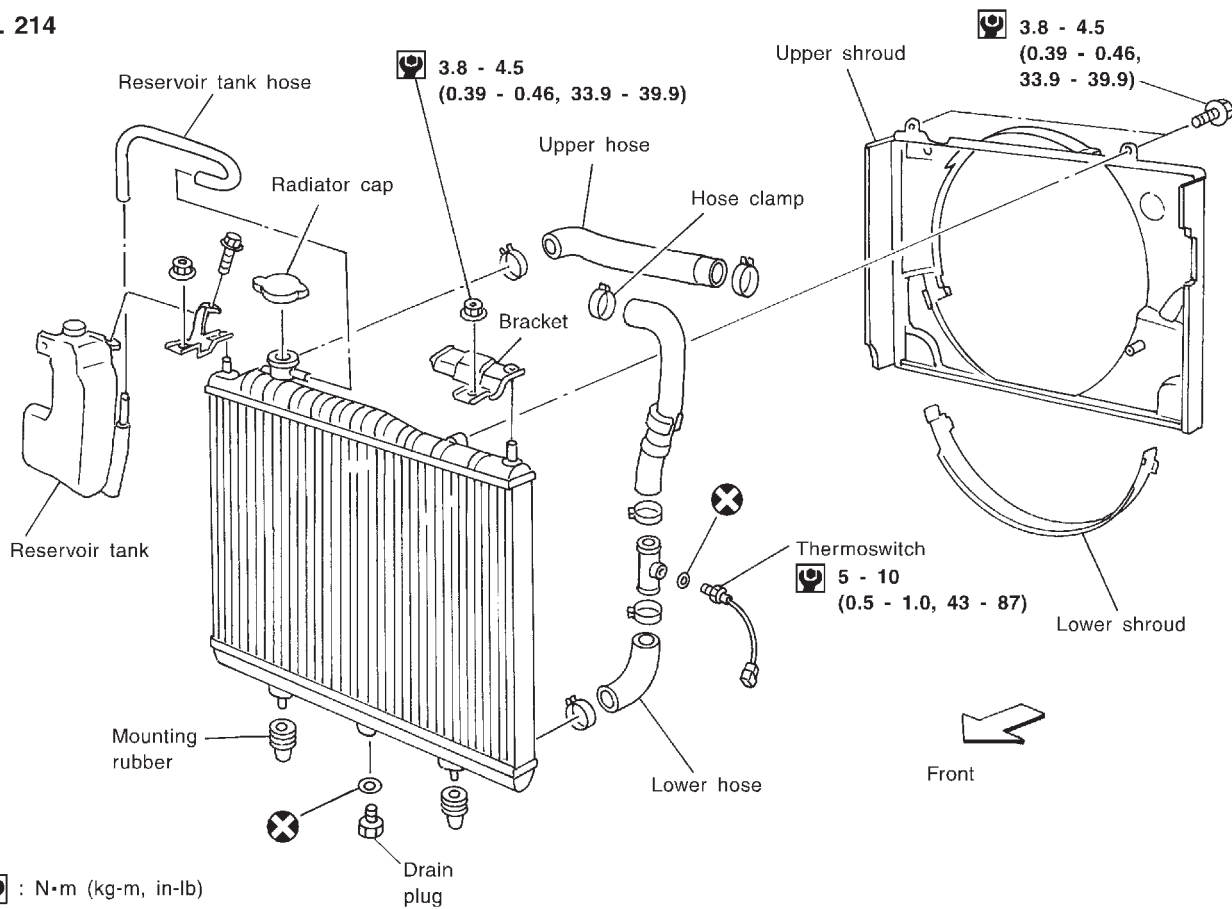
3. Then check if valve closes at 5°C (9°F) below valve opening temperature.

Radiator

REMOVAL AND INSTALLATION

1. Remove under cover.
2. Drain coolant from radiator drain plug.
3. Disconnect radiator upper and lower hoses.
4. Remove radiator lower shroud.
5. Disconnect reservoir tank hose.
6. Remove radiator.
7. After repairing or replacing radiator, install any part removed in reverse order of removal.

SEC. 214



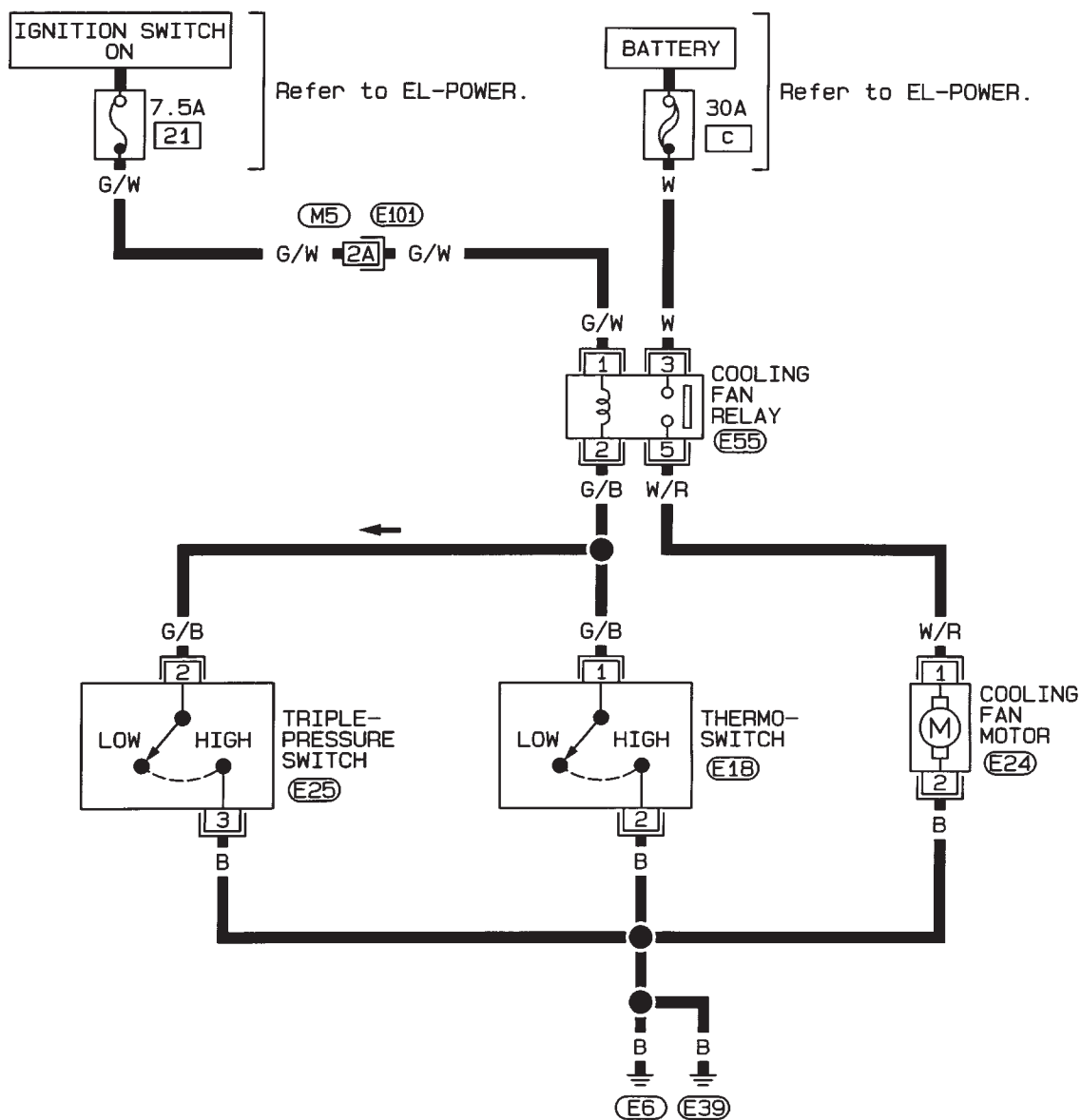
DLC008

Refilling Engine Coolant

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

Wiring Diagram

LC-COOL/F-01



(12) (E18), (E24)
GY, GY

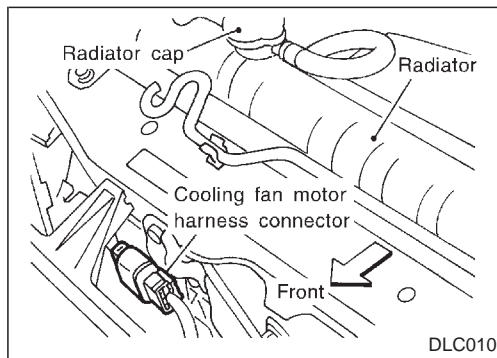
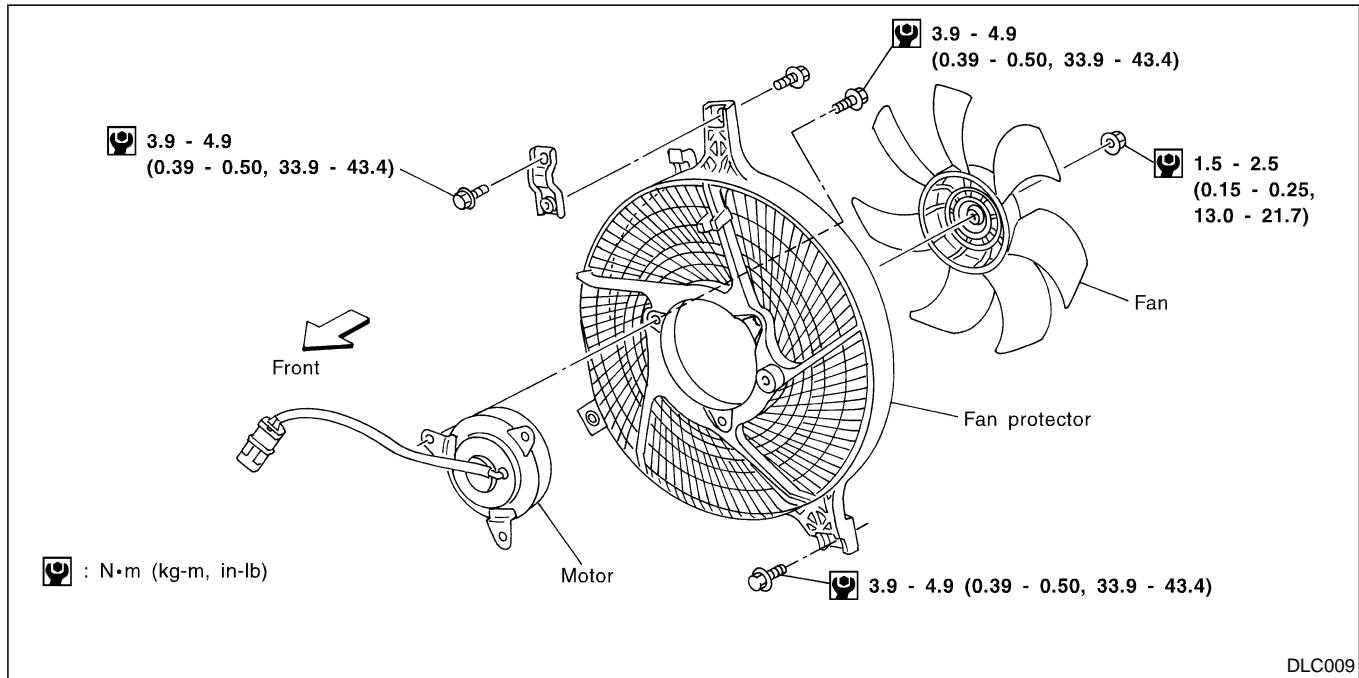
(1234) (E25)
B

(31) (E55)
L

Refer to last page
(Foldout page).

(M5), (E101)

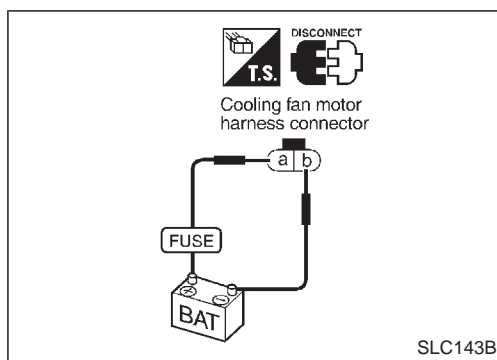
Cooling Fan (Motor driven)



Electrical Components Inspection

COOLING FAN MOTOR

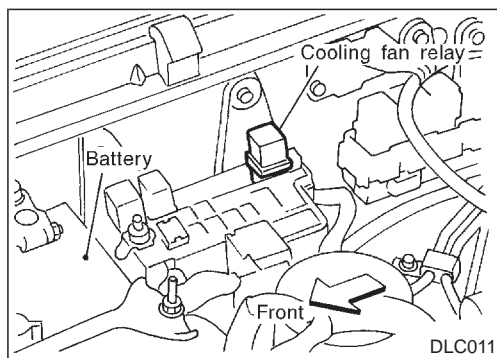
1. Disconnect cooling fan motor harness connector.



2. Supply cooling fan motor terminals with battery voltage and check operation.

Cooling fan motor should operate.

If NG, replace cooling fan motor.



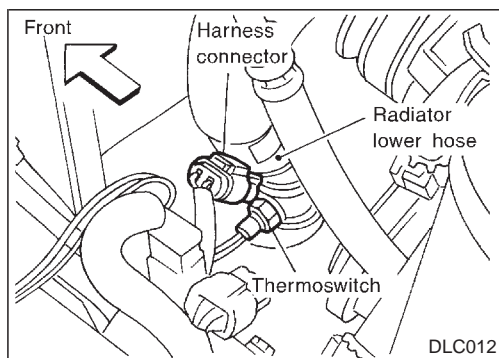
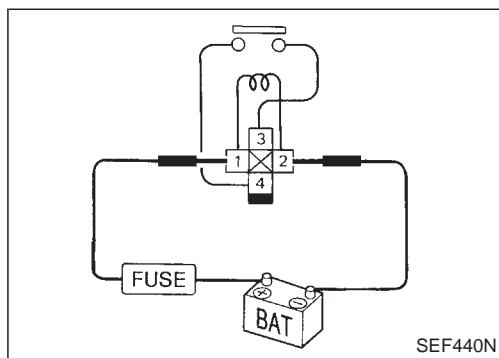
COOLING FAN RELAY

Electrical Components Inspection (Cont'd)

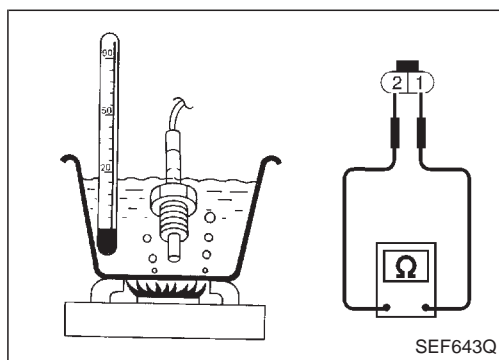
Check continuity between terminals ③ and ④ .

| Conditions | Continuity |
|---|------------|
| 12V direct current supply between terminals ① and ② | Yes |
| No current supply | No |

If NG, replace relay.

**THERMOSWITCH**

1. Disconnect thermoswitch harness connector.



2. Check operation as shown in the figure.

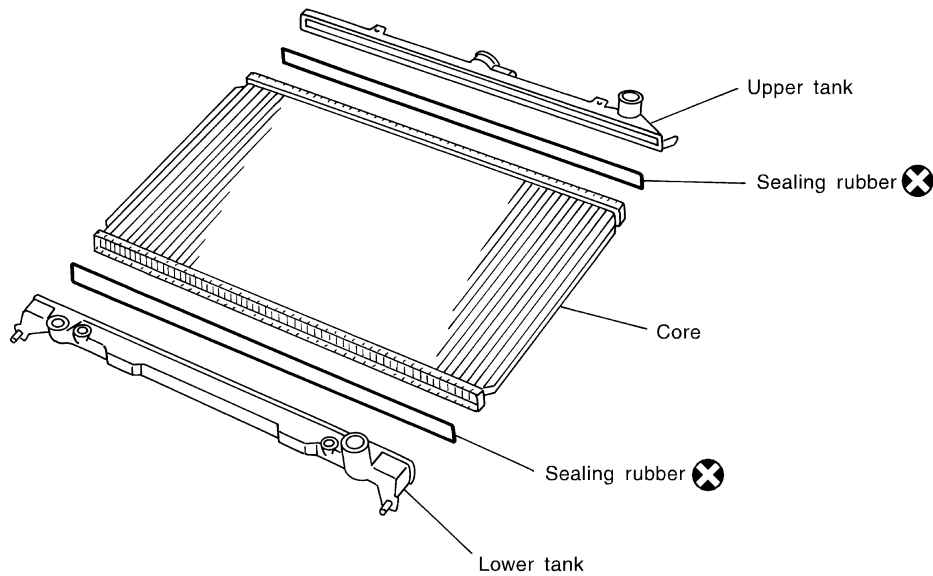
| Coolant temperature °C (°F) | Operation | Continuity |
|------------------------------------|-----------|-----------------|
| Higher than 92 - 98 (198 - 208) | ON | Exists. |
| Lower than above | OFF | Does not exist. |

TRIPLE-PRESSURE SWITCH

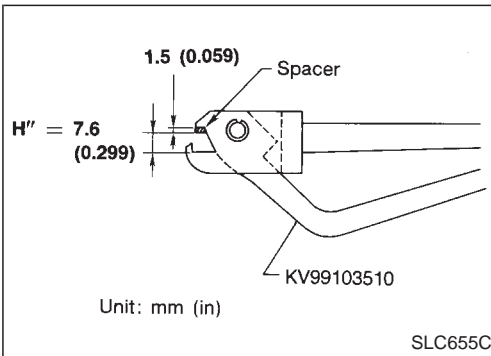
For inspection of this switch, refer to HA section ("TRIPLE-PRESSURE SWITCH", "Electrical Components Inspection").

Radiator (Aluminum type)

SEC. 214



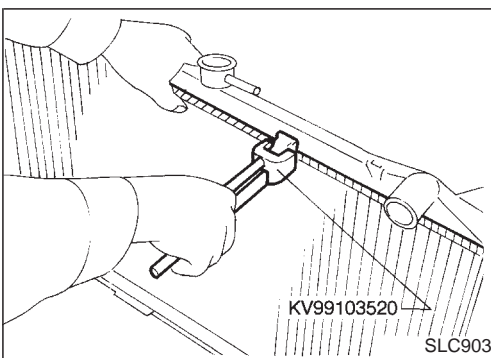
SLC142B



SLC655C

PREPARATION

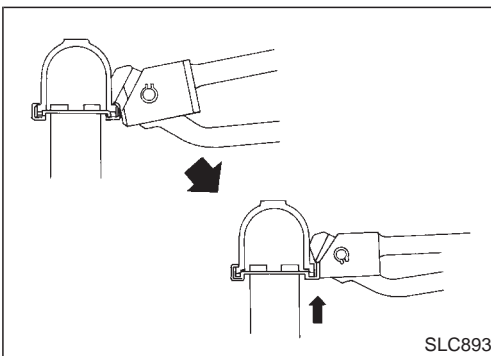
1. Attach the spacer to the tip of the radiator plate pliers A. Spacer specification: 1.5 mm (0.059 in) thick x 18 mm (0.71 in) wide x 8.5 mm (0.335 in) long.
2. Make sure that when radiator plate pliers A are closed dimension H'' is approx. 7.6 mm (0.299 in).
3. Adjust dimension H'' with the spacer, if necessary.
 - If the radiator core rims cannot be crimped as specified, further modification of the radiator plate pliers A is required. Refer to the Technical Bulletin LC 91-001.



SLC903

DISASSEMBLY

1. Remove tank with Tool.



SLC893

- Grip the crimped edge and bend it upwards so that Tool slips off.

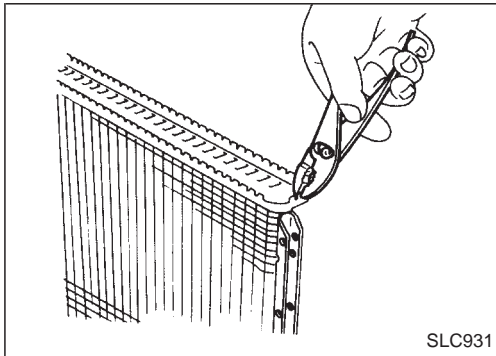
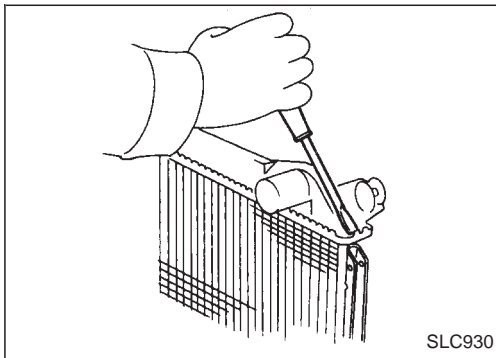
Do not bend excessively.

ENGINE COOLING SYSTEM

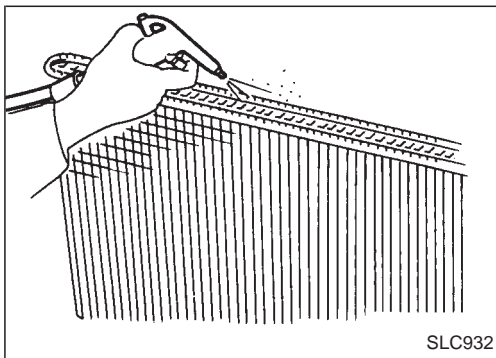
Radiator (Aluminum type) (Cont'd)

- In areas where Tool cannot be used, use a screwdriver to bend the edge up.

Be careful not to damage tank.

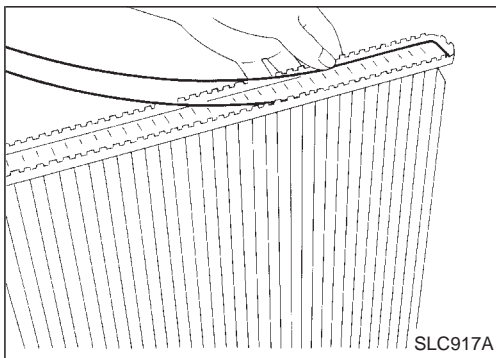


2. Make sure the edge stands straight up.

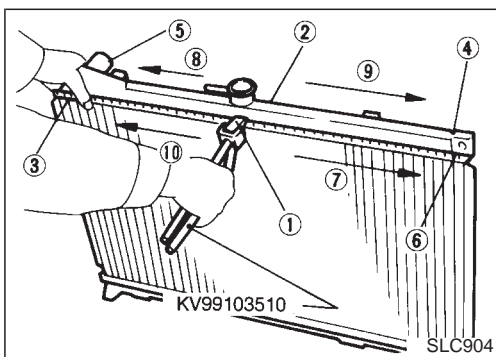


ASSEMBLY

1. Clean contact portion of tank.



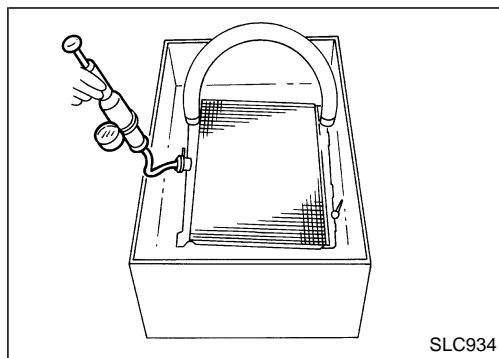
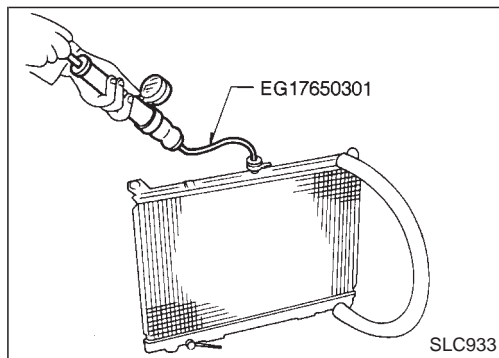
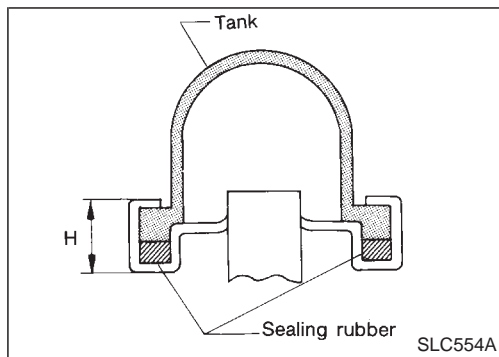
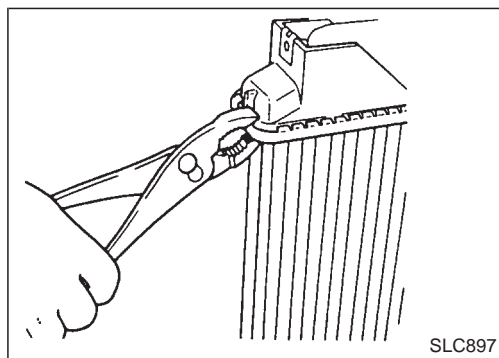
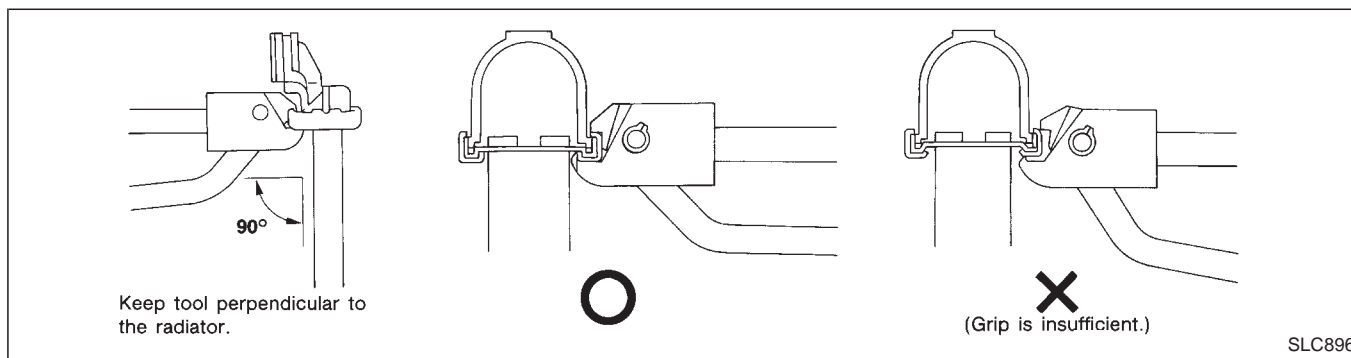
2. Install sealing rubber.
Push it in with fingers.
Be careful not to twist sealing rubber.



3. Caulk tank in specified sequence with Tool.

ENGINE COOLING SYSTEM

Radiator (Aluminum type) (Cont'd)



- Use pliers in the locations where Tool cannot be used.

4. Make sure that the rim is completely crimped down.

Standard height "H":

8.0 - 8.4 mm (0.315 - 0.331 in)

5. Confirm that there is no leakage.

Refer to Inspection.

INSPECTION

1. Apply pressure with Tool.

Specified pressure value:

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

WARNING:

To prevent the risk of the hose coming undone while under pressure, securely fasten it down with a hose clamp.

2. Check for leakage.

ENGINE COOLING SYSTEM

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 | — | — |
| | | Fan coupling 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 | | | | |

SERVICE DATA AND SPECIFICATIONS (SDS)

Engine Lubrication System (KA)

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) |
| 3,000 | 412 - 481 (4.12 - 4.81, 4.2 - 4.9, 60 - 70) |

Oil pump inspection

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

GI

MA

EM

Engine Cooling System (KA)

Thermostat

| | | |
|---------------------------|---------------|---------------------------|
| Valve opening temperature | °C (°F) | 76.5 (170) |
| Valve lift | mm/°C (in/°F) | More than 8/90 (0.31/194) |

Radiator

| Unit: kPa (bar, kg/cm ² , 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) |

LC

EC

FE

CL

Engine Lubrication System (NA)

Oil pressure check

| Engine speed rpm | Approximate discharge pressure kPa (bar, kg/cm ² , psi) |
|---------------------|---|
| Idle speed | More than 98 (0.98, 1.0, 14) |
| 2,000 | 294 (2.9, 3, 43) |

Oil pump inspection

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

MT

TF

PD

FA

Regulator valve inspection

| Unit: mm (in) | |
|---|---------------------------------|
| Regulator valve to oil pump cover clearance | 0.040 - 0.100 (0.0016 - 0.0039) |

RA

BR

Engine Cooling System (NA)

Thermostat

| | Standard | Frigid type | Tropical type |
|--------------------------------------|------------------------------|-------------------------------|------------------------------|
| Valve opening temperature °C (°F) | 82 (180) | 88 (190) | 76.5 (170) |
| Valve lift mm/°C (in/°F) | More than 8/95 (0.31/203) | More than 8/100 (0.31/212) | More than 8/90 (0.31/194) |

ST

RS

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IDX

SERVICE DATA AND SPECIFICATIONS (SDS)

Engine Lubrication System (Z)

Oil pressure check

| Engine speed rpm | Approximate discharge pressure kPa (bar, kg/cm ² , psi) |
|---------------------|---|
| Idle speed | More than 73.6 (0.736, 0.75, 10.7) |
| 3,000 | 324 - 461 (3.24 - 4.61, 3.3 - 4.7, 47 - 67) |

Regulator valve inspection

Unit: mm (in)

| | |
|--|---------------------------------|
| Regulator valve to oil pump cover clearance | 0.040 - 0.100 (0.0016 - 0.0039) |
|--|---------------------------------|

Oil pump inspection

Unit: mm (in)

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

Engine Cooling System (Z)

Thermostat

| | |
|---|-----------------|
| | Standard |
| Valve opening temperature °C (°F) | 82 (180) |
| Valve lift mm/°C (in/°F) | 8/95 (0.31/203) |

Engine Lubrication System (QD & TD)

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) |
| 3,000 | 294 - 392 (2.94 - 3.92, 3.0 - 4.0, 43 - 57) |

Oil pump inspection

Unit: mm (in)

| | |
|-----------------------------------|--------------------------------------|
| Gear side clearance | Less than 0.13 (0.0051) |
| Gear backlash | Less than 0.43 (0.0169) |
| Oil pump bushing clearance | Less than 0.15 (0.0059) |
| Oil pump bushing inside diameter | 13.012 - 13.106 (0.5123 - 0.5160) |
| Drive gear shaft outside diameter | 12.974 - 12.992 (0.5108 - 0.5115) |

Engine Cooling System (QD & TD)

Radiator

Unit: kPa (bar, kg/cm², psi)

| | |
|-----------------------|--|
| Cap relief pressure | 78 - 98 (0.78 - 0.98, 0.8 - 1.0, 11 - 14) |
| Leakage test pressure | 157 (1.57, 1.6, 23) |

Thermostat

| | | |
|--|------------------------------|------------------------------|
| | Tropical type | Standard type |
| Valve opening tem- perature °C (°F) | 76.5 (170) | 82 (180) |
| Valve lift mm/°C (in/°F) | More than 8/90 (0.31/194) | More than 8/95 (0.31/203) |