

# ENGINE LUBRICATION & COOLING SYSTEMS

## SECTION **LC**

GI

MA

EM

**LC**

EC

FE

CL

MT

AT

FA

RA

BR

ST

BF

HA

EL

IDX

## CONTENTS

|   |   |  |    |
|---|---|--|----|
| <b>PRECAUTIONS AND PREPARATION</b> .....  | 2 | Cooling Circuit .....                              | 8  |
| The Supplemental Restraint System         |   | System Check.....                                  | 9  |
| "AIR BAG" .....                           | 2 | Water Pump.....                                    | 9  |
| Special Service Tools.....                | 2 | Thermostat .....                                   | 13 |
| Liquid Gasket Application Procedure ..... | 3 | Radiator.....                                      | 14 |
| <b>ENGINE LUBRICATION SYSTEM</b> .....    | 4 | Cooling Fan Control System .....                   | 14 |
| Lubrication Circuit.....                  | 4 | <b>SERVICE DATA AND SPECIFICATIONS (SDS)</b> ..... | 15 |
| Oil Pressure Check .....                  | 5 | Engine Lubrication System.....                     | 15 |
| Oil Pump.....                             | 5 | Engine Cooling System .....                        | 15 |
| <b>ENGINE COOLING SYSTEM</b> .....        | 8 |  |    |

## PRECAUTIONS AND PREPARATION

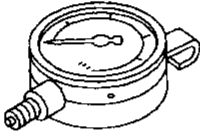
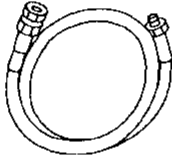
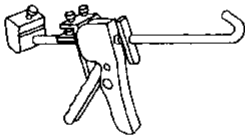
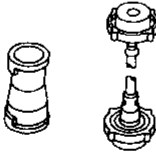
### The Supplemental Restraint System "AIR BAG"

The Supplemental Restraint System "Air Bag", used along with a seat belt, helps to reduce the risk or severity of injury to the driver and front passenger in a frontal collision. The Supplemental Restraint System consists of air bag modules (located in the center of the steering wheel and on the instrument panel on the passenger side), a diagnosis sensor unit, warning lamp, wiring harness and spiral cable. Information necessary to service the system safely is included in the **BF** section of this Service Manual.

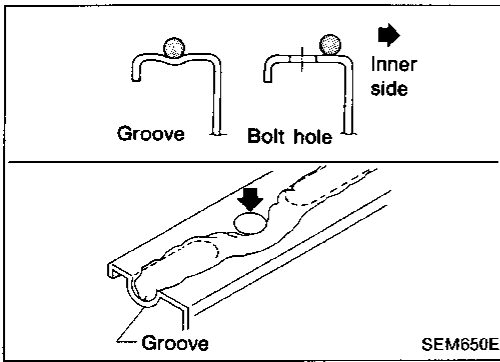
**WARNING:**

- To avoid rendering the SRS inoperative, which could lead to personal injury or death in the event of a severe frontal collision, all maintenance must be performed by an authorized NISSAN dealer.
- Improper maintenance, including incorrect removal and installation of the SRS, can lead to personal injury caused by unintentional activation of the system.
- All SRS air bag electrical wiring harnesses and connectors are covered with yellow outer insulation. Do not use electrical test equipment on any circuit related to the SRS SYSTEM.

### Special Service Tools

| Tool number<br>(Kent-Moore No.)<br>Tool name            | Description  |
|---|--|
| ST25051001<br>(J25695-1)<br>Oil pressure gauge          | <br>NT050   |
| ST25052000<br>(J25695-2)<br>Hose                        | <br>NT051<br>Adapting oil pressure gauge to upper oil pan          |
| WS39930000<br>( — )<br>Tube presser                     | <br>NT052<br>Pressing the tube of liquid gasket                   |
| EG17650301<br>(J33984-A)<br>Radiator cap tester adapter | <br>NT053<br>Adapting radiator cap tester to radiator filler neck |

## PRECAUTIONS AND PREPARATION



### Liquid Gasket Application Procedure

- Remove all traces of old liquid gasket from mating surfaces and grooves using a scraper. Then completely clean any oil stains from these portions.
- Apply a continuous bead of liquid gasket to mating surfaces. (Use Genuine Liquid Gasket or equivalent.)
  - Be sure liquid gasket is 4.5 to 5.5 mm (0.177 to 0.217 in) wide (for oil pan).
  - Be sure liquid gasket is 2.3 to 3.3 mm (0.091 to 0.130 in) wide (in areas except oil pan).
- Apply liquid gasket to inner surface around hole perimeter area.  
(Assembly should be done within 5 minutes after coating.)
- Wait at least 30 minutes before refilling engine oil and engine coolant.

GI

MA

EM

LC

EC

FE

CL

MT

AT

FA

RA

BR

ST

BF

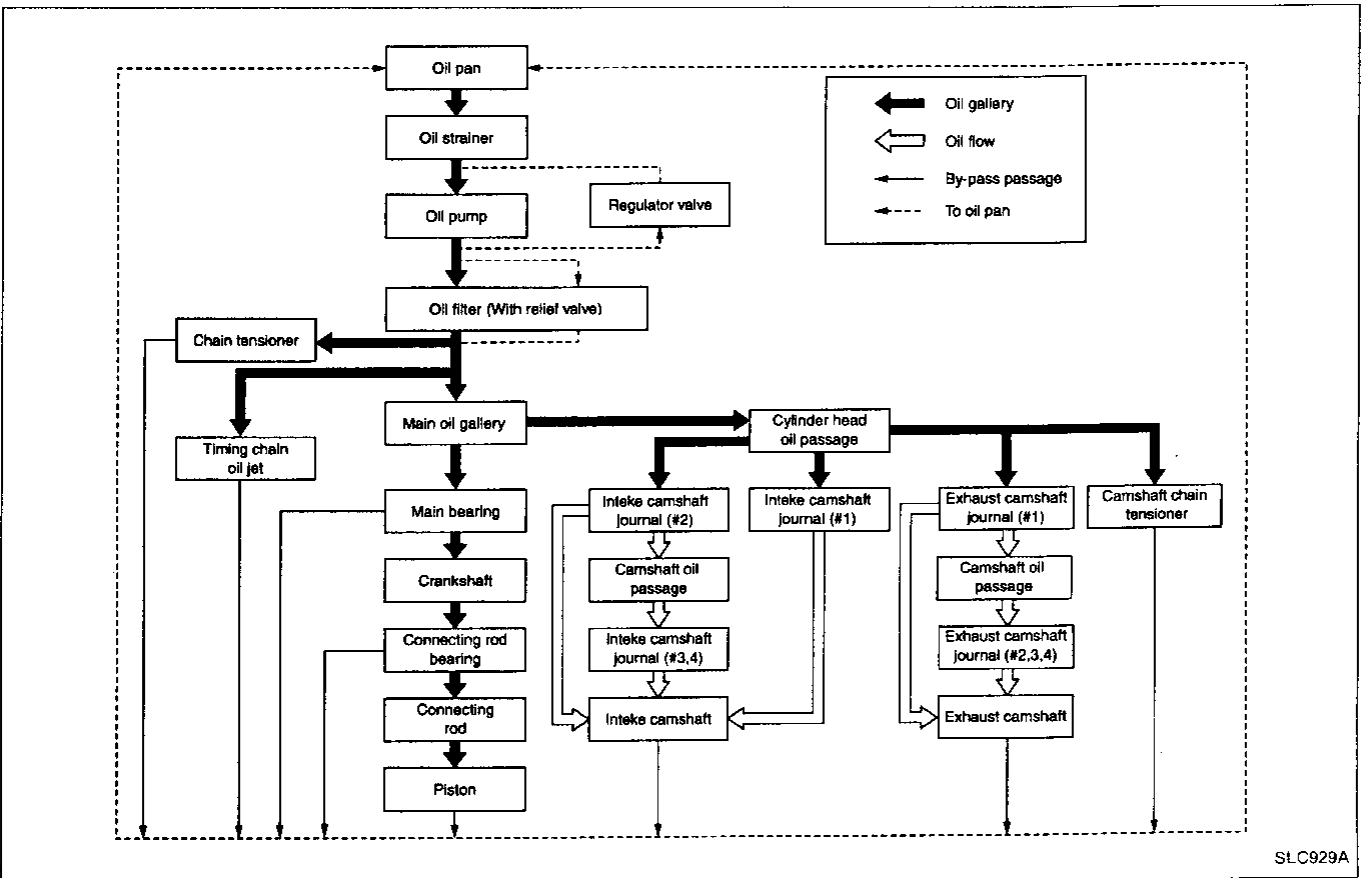
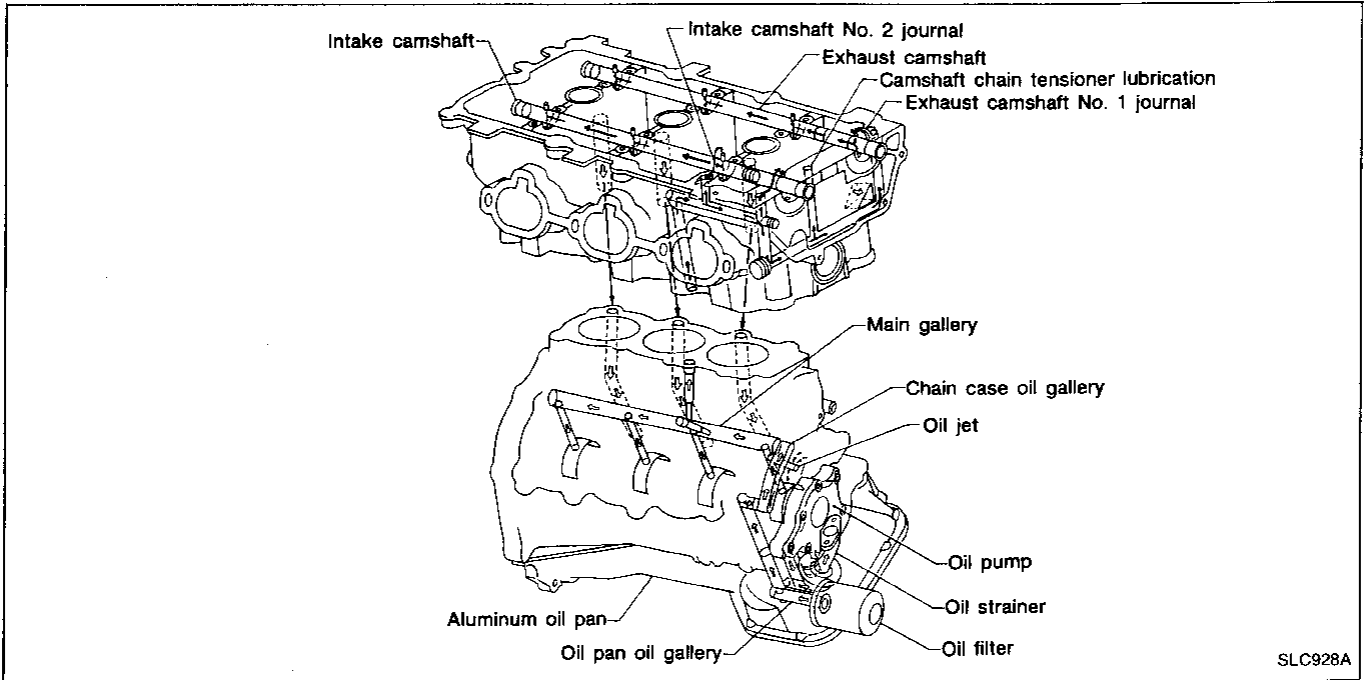
HA

EL

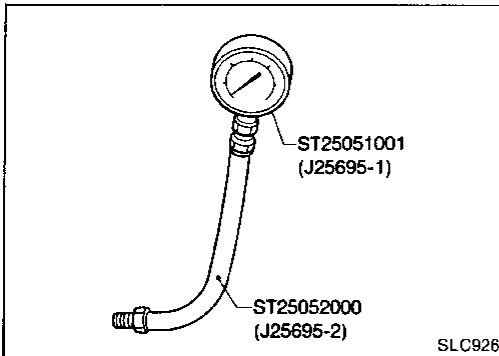
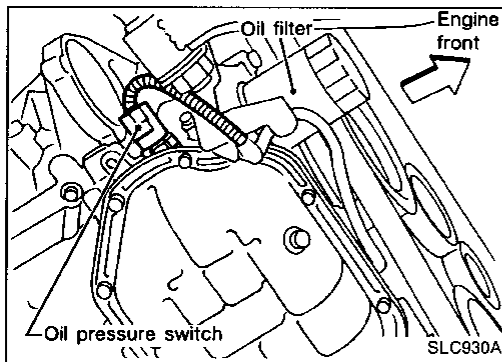
DX

# ENGINE LUBRICATION SYSTEM

## Lubrication Circuit



# ENGINE LUBRICATION SYSTEM



## 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" (M/T) or "Parking position" (A/T).
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<br>rpm | Approximate discharge pressure<br>kPa (kg/cm <sup>2</sup> , psi) |
|---------------------|--|
| Idle speed          | More than 69 (0.70, 10.0)  |
| 3,000               | 435 - 551 (4.44 - 5.62, 63.1 - 79.9)                             |

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

#### CAUTION:

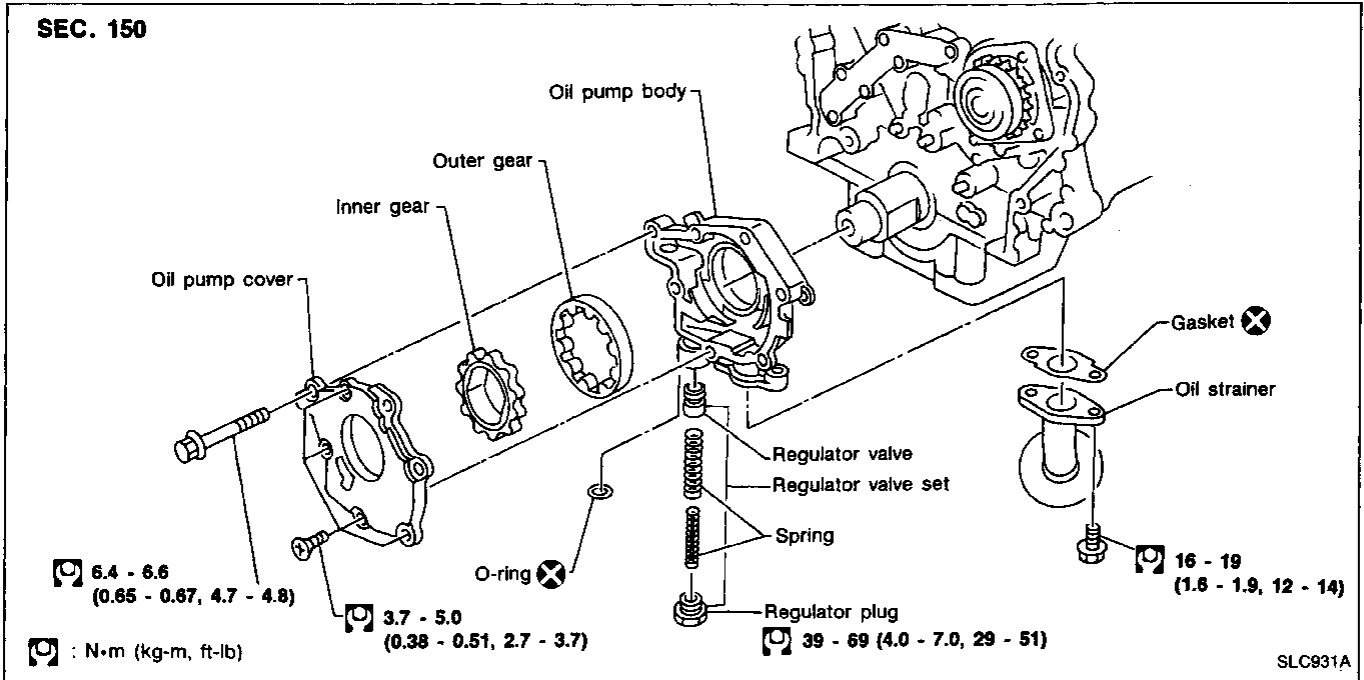
When removing the oil pans, oil pump assembly and timing chain from engine, first remove the camshaft position sensor (PHASE) and the crankshaft position sensor (REF)/(POS) from the assembly.

Be careful not to damage sensor edge.

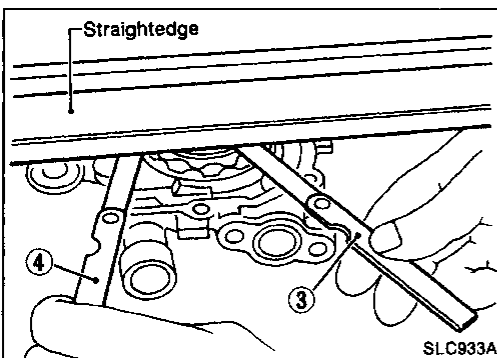
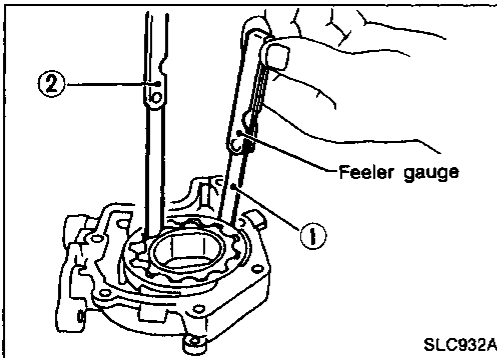
1. Drain engine oil.
2. Remove drive belts.
3. Remove camshaft position sensor (PHASE), and crankshaft position sensor (REF)/(POS).
4. Remove crank pulley.
5. Remove engine lower covers.
6. Remove front exhaust tube and its support.
7. Support engine at right and left side engine slingers with a suitable hoist.
8. Remove engine right side mounting insulator and bracket bolts and nuts.
9. Remove center member assembly.
10. Remove air compressor assembly and bracket.
11. Remove oil pans. (Refer to "Removal" of "OIL PAN" in EM section.)
12. Remove water pump cover.
13. Remove front cover assembly.
14. Remove timing chain. (Refer to "Removal" of "TIMING CHAIN" in EM section.)
15. Remove oil pump assembly.
16. Reinstall any parts removed in reverse order of removal.

# ENGINE LUBRICATION SYSTEM

## Oil Pump (Cont'd) DISASSEMBLY AND ASSEMBLY



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



### OIL PUMP INSPECTION

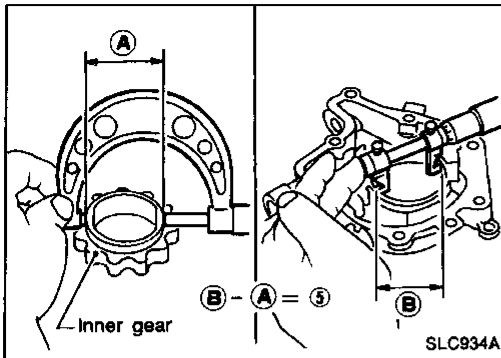
Using a feeler gauge, straightedge and micrometers, check the following clearances:

|   | Unit: mm (in)                   |
|---|---------------------------------|
| Body to outer gear clearance ①                      | 0.114 - 0.260 (0.0045 - 0.0102) |
| 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 ④                      | 0.030 - 0.190 (0.0012 - 0.0075) |
| 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 oil pump body assembly.

# ENGINE LUBRICATION SYSTEM

## Oil Pump (Cont'd)



GI

MA

EM

LC

EC

FE

CL

MT

AT

FA

RA

BR

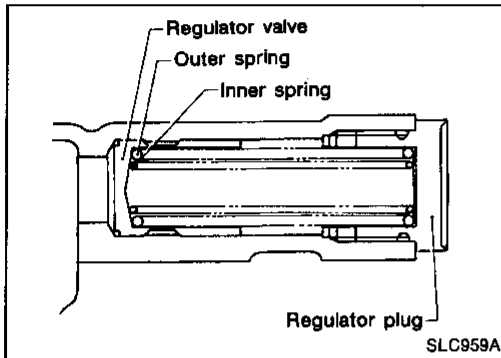
ST

BF

HA

EL

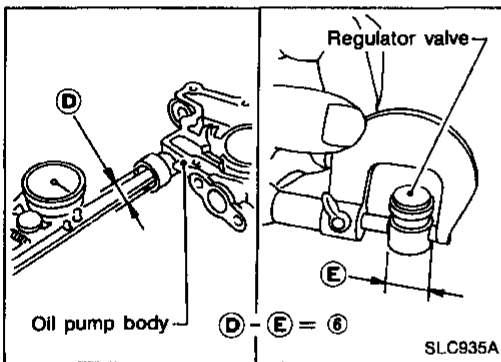
IDX



### REGULATOR VALVE INSPECTION

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

**If damaged, replace regulator valve set or oil pump body.**

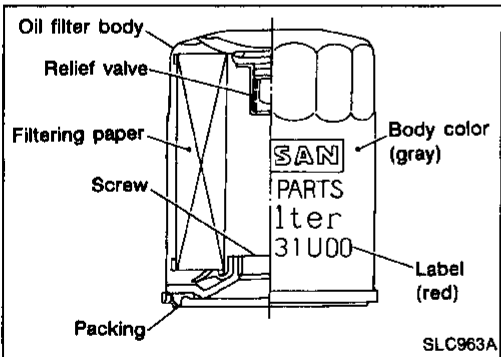


4. Check regulator valve to oil pump body clearance.

**Clearance:**

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

**If it exceeds the limit, replace oil pump body.**



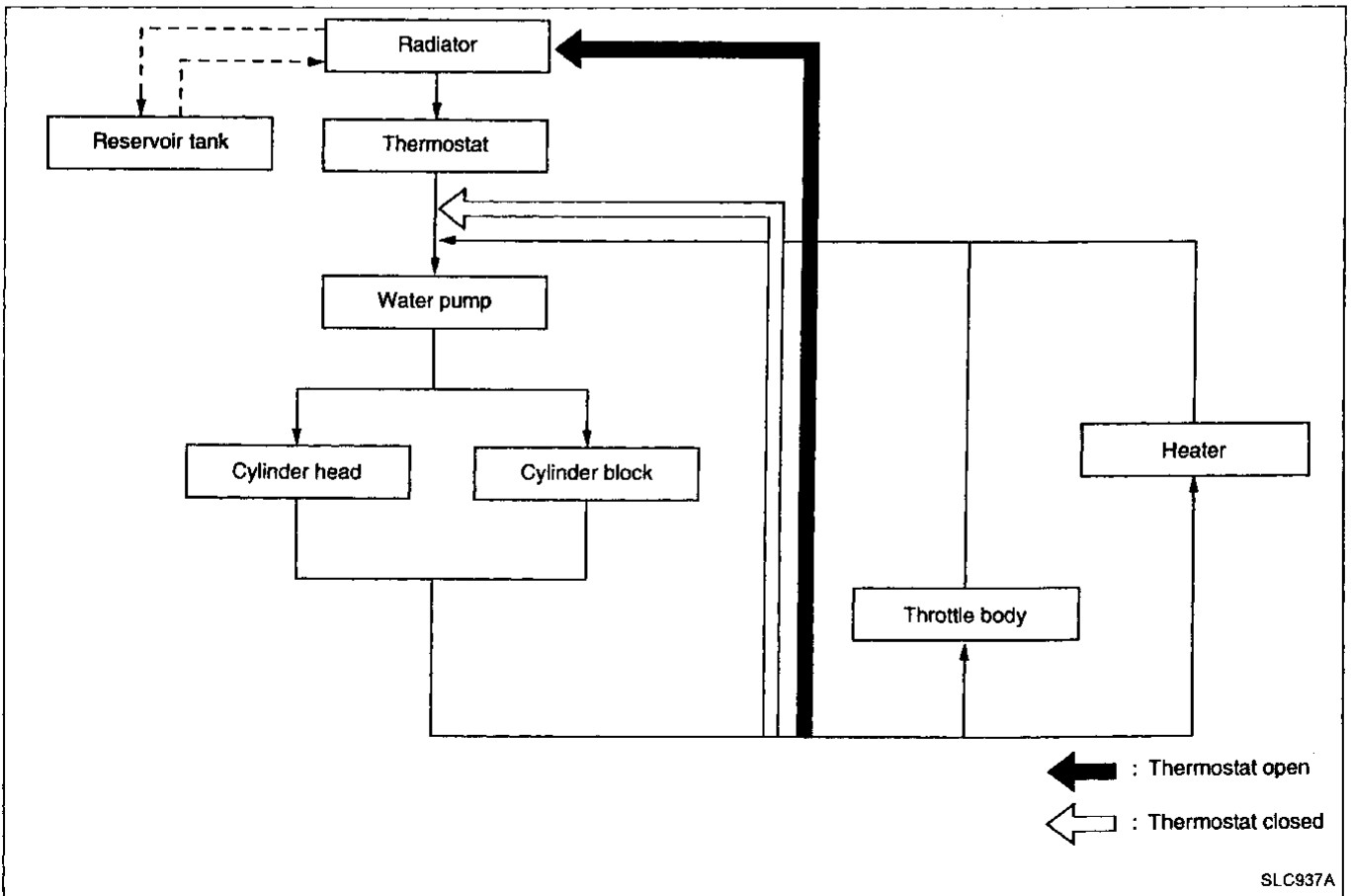
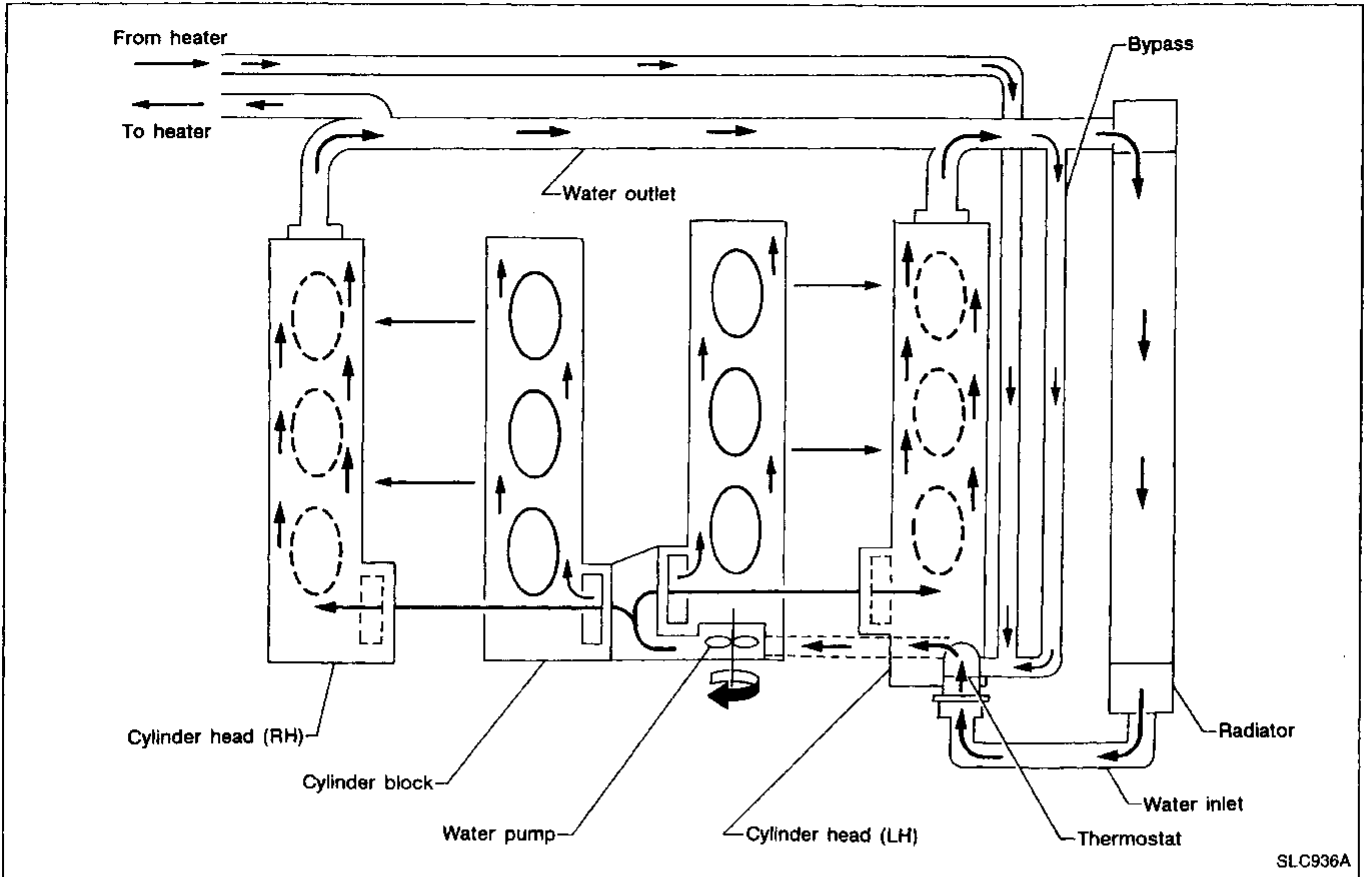
### OIL FILTER

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

- **The new and existing oil filter designs differ from each other and are not interchangeable. A comparison of the two filters is shown in the table below.**

# ENGINE COOLING SYSTEM

## 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.

### 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:

78 - 98 kPa

(0.8 - 1.0 kg/cm<sup>2</sup>, 11 - 14 psi)

GI

MA

EM

LC

EC

FE

CL

MT

AT

FA

RA

BR

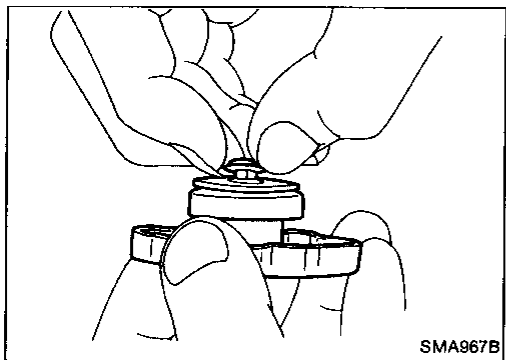
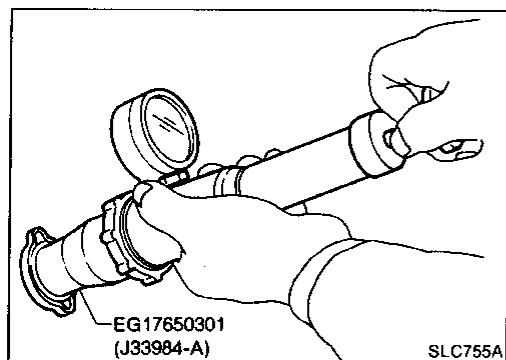
ST

BF

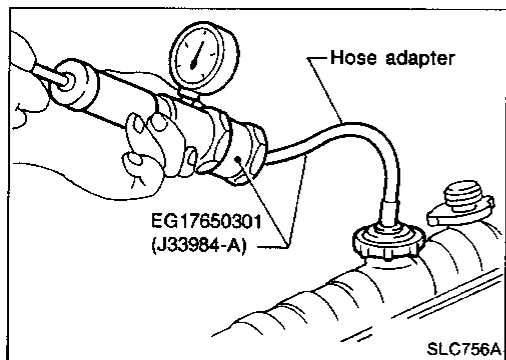
HA

EL

DX



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 (1.6 kg/cm<sup>2</sup>, 23 psi)

#### CAUTION:

Higher than the specified pressure may cause radiator damage.

## Water Pump

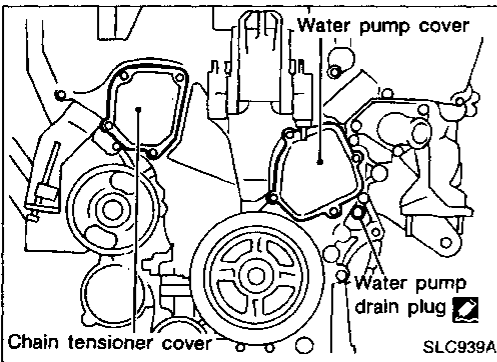
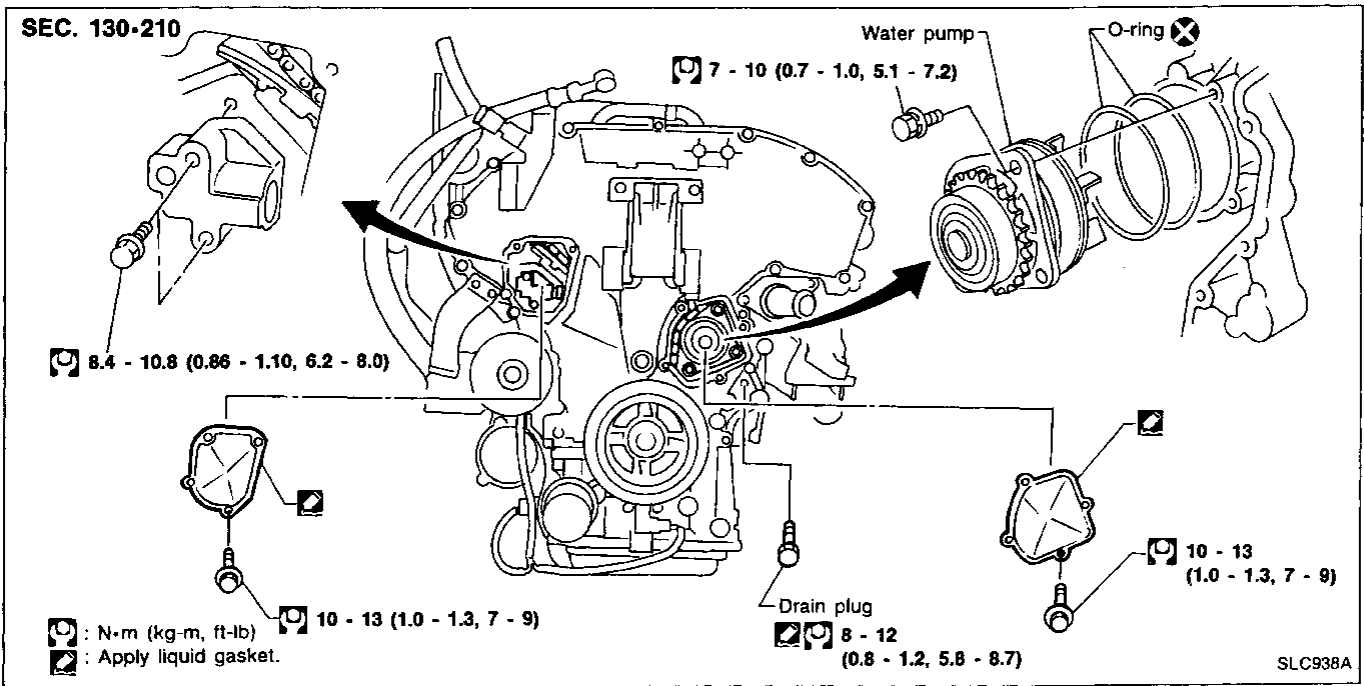
### REMOVAL AND INSTALLATION

#### CAUTION:

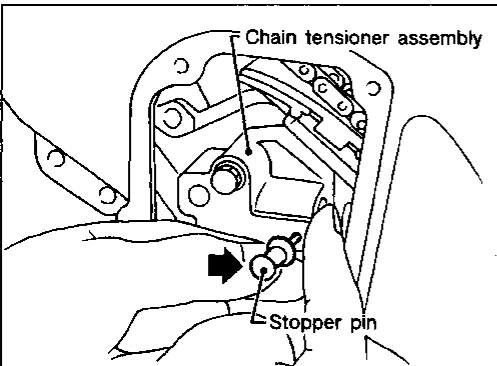
- When removing water pump assembly, be careful not to get coolant on drive belt.
- Water pump cannot be disassembled and should be replaced as a unit.
- After installing water pump, connect hose and clamp securely, then check for leaks using radiator cap tester.

# ENGINE COOLING SYSTEM

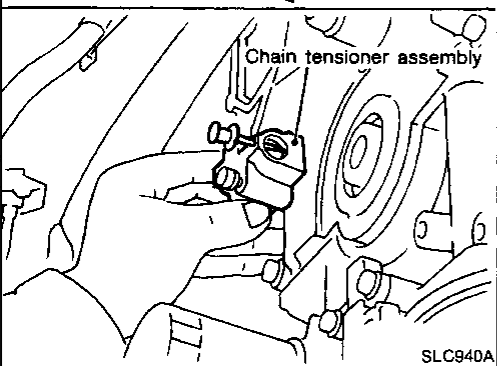
## Water Pump (Cont'd)



1. Drain coolant from drain plugs on radiator and both sides of cylinder block.  
Refer to "Changing Engine Coolant" in MA section.
2. Remove drain plug on cylinder block.
3. Remove right side engine mounting, mounting bracket and nuts.
4. Remove drive belts and idler pulley bracket.
5. Remove chain tensioner cover and water pump cover.

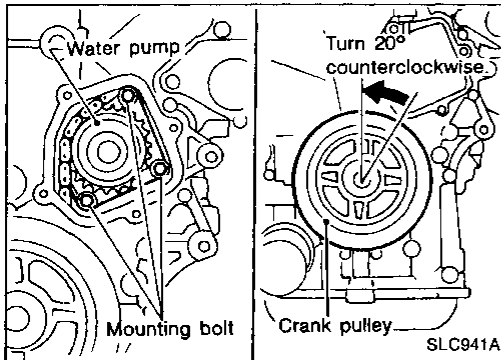


6. Pushing timing chain tensioner sleeve, apply a stopper pin so it does not return. Then remove the chain tensioner assembly.



# ENGINE COOLING SYSTEM

## Water Pump (Cont'd)



7. Remove the 3 water pump fixing bolts. Secure a gap between water pump gear and timing chain, by turning crankshaft pulley 20° backwards.

GI

MA

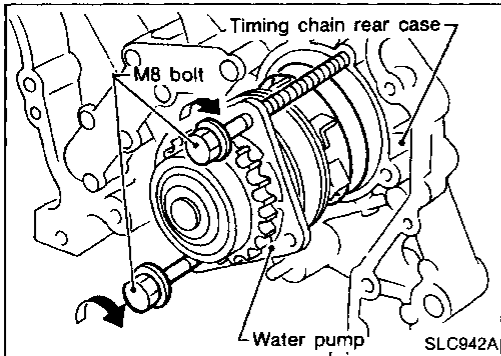
EM

LC

EC

FE

CL



8. Put M8 bolts to two M8-threaded holes out of 3 water pump fixing bolt holes.

MT

AT

FA

RA

BR

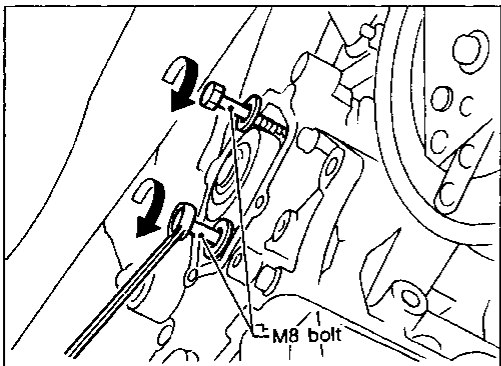
ST

BF

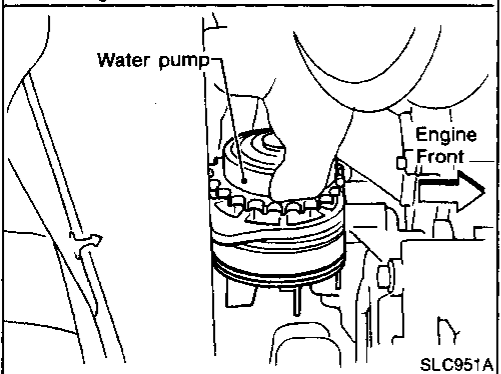
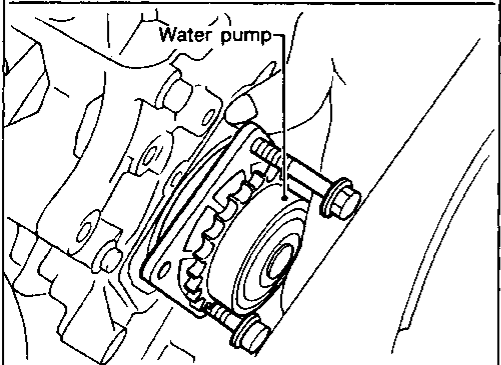
HA

EL

IDX



9. Tighten M8 bolts by turning half turn alternately until they reach timing chain rear case.
  - In order to prevent damages to water pump or timing chain rear case, do not tighten one bolt continuously. Always turn each bolt half turn each time.
10. Lift up water pump and remove it.
  - When lifting up water pump, do not allow water pump gear to hit timing chain.

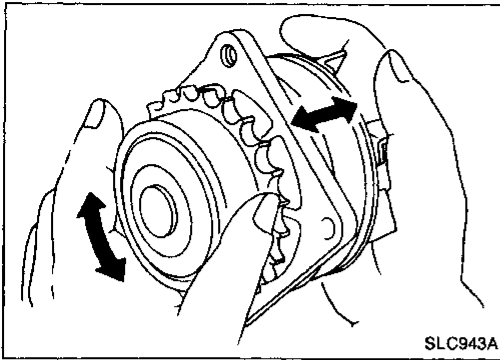


# ENGINE COOLING SYSTEM

## Water Pump (Cont'd)

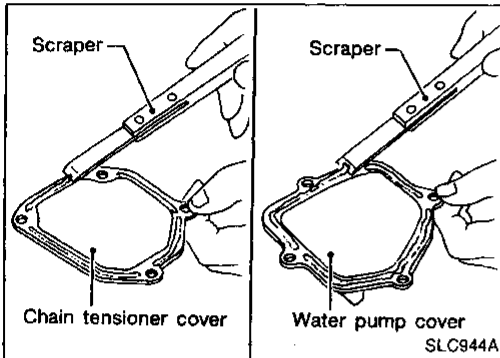
### INSPECTION

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

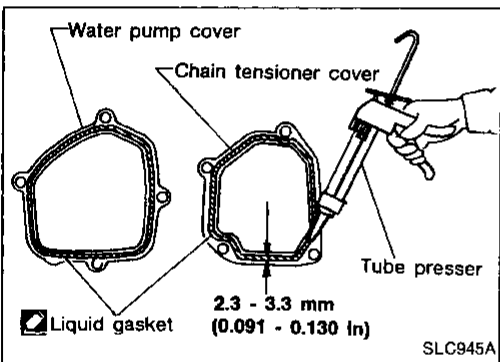


### INSTALLATION

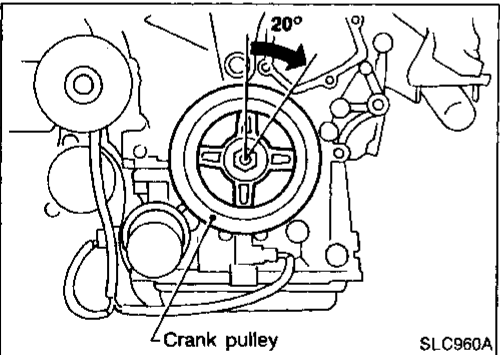
1. Before installing, remove all traces of liquid gasket from mating surface of water pump cover and chain tensioner cover using a scraper. Also remove traces of liquid gasket from mating surface of front cover.



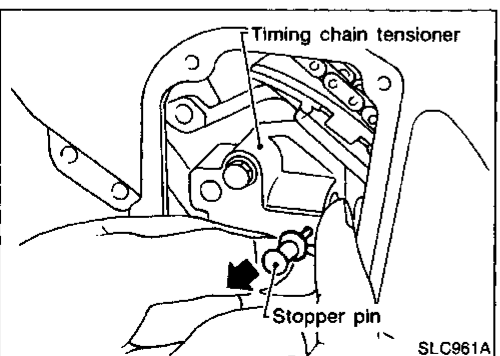
2. Apply a continuous bead of liquid gasket to mating surface of chain tensioner cover and water pump cover.



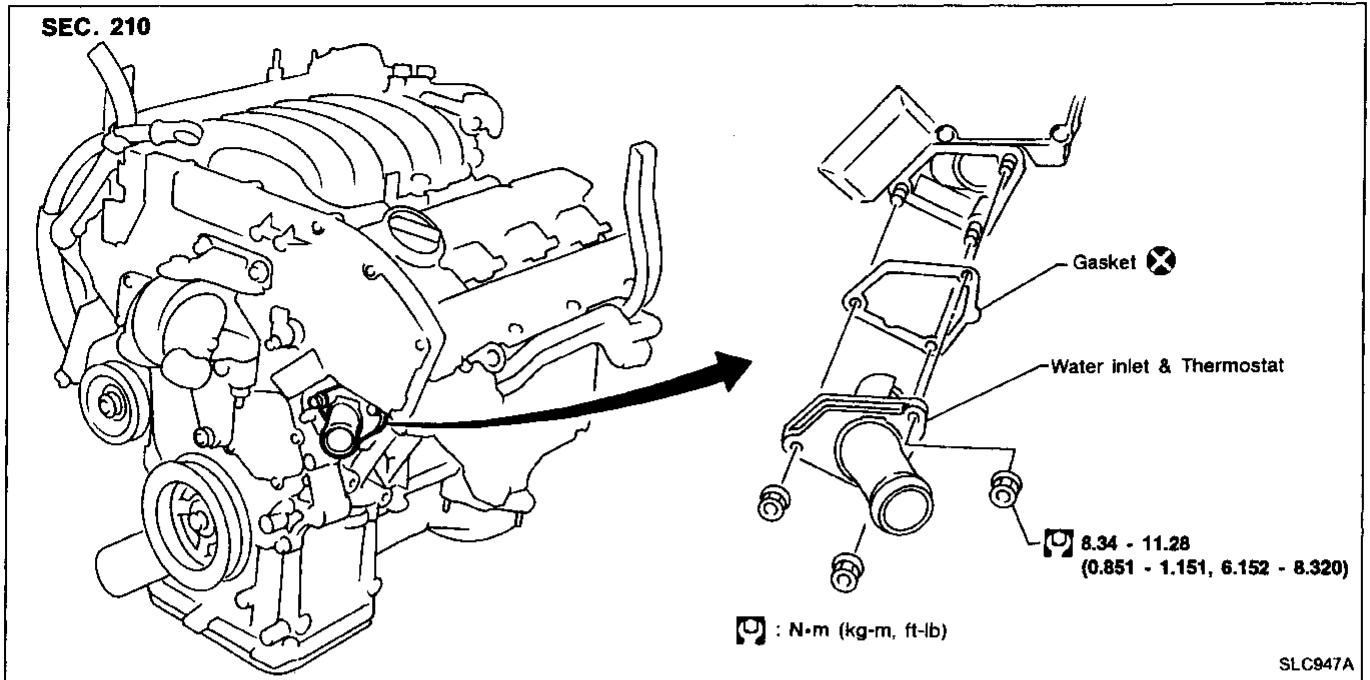
3. Return the crankshaft pulley to its original position by turning it 20° forward.



4. Install timing chain tensioner, then remove the stopper pin.
  - After installing the tensioner, race the engine at about 3,000 rpm under no load to purge air from the high-pressure chamber. The engine may produce a rattling noise. This indicates that air still remains in the chamber and is not a matter of concern.
5. Install drain plug on cylinder block.
6. Reinstall any parts removed in reverse order of removal.



## Thermostat



GI

MA

EM

LC

EC

FE

CL

MT

AT

FA

RA

BR

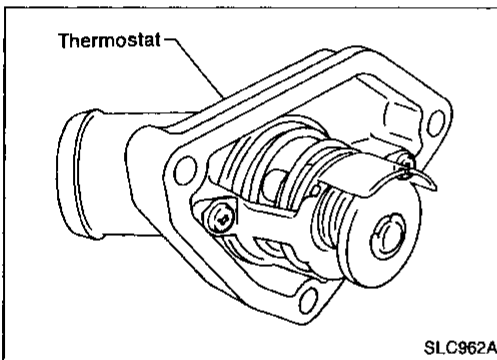
ST

BF

HA

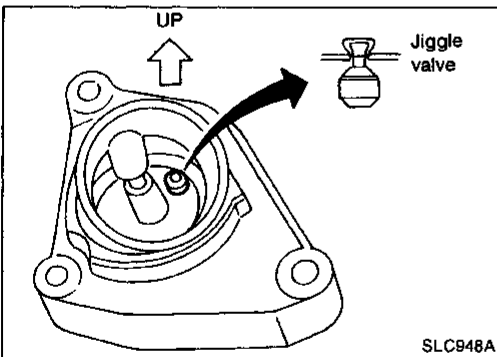
EL

IDX

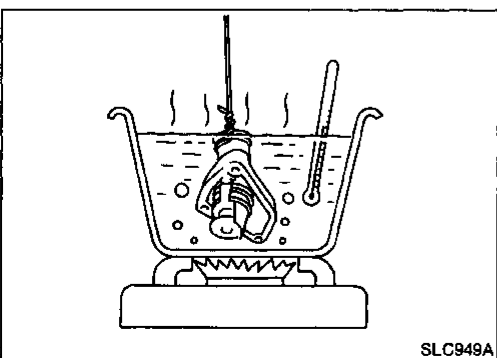


### REMOVAL AND INSTALLATION

1. Drain coolant from drain plugs on both sides of cylinder block and radiator.
2. Remove lower radiator hose.
3. Remove water inlet and thermostat assembly.
  - Do not disassemble water inlet and thermostat. Replace them as a unit, if necessary.



4. Install thermostat with jiggle valve 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 room temperatures. It should seat tightly.
2. Check valve opening temperature and maximum valve lift.

|                           |               | Standard           |
|---------------------------|---------------|--------------------|
| Valve opening temperature | °C (°F)       | 82 (180)           |
| Max. valve lift           | mm/°C (in/°F) | 8.6/95 (0.339/203) |

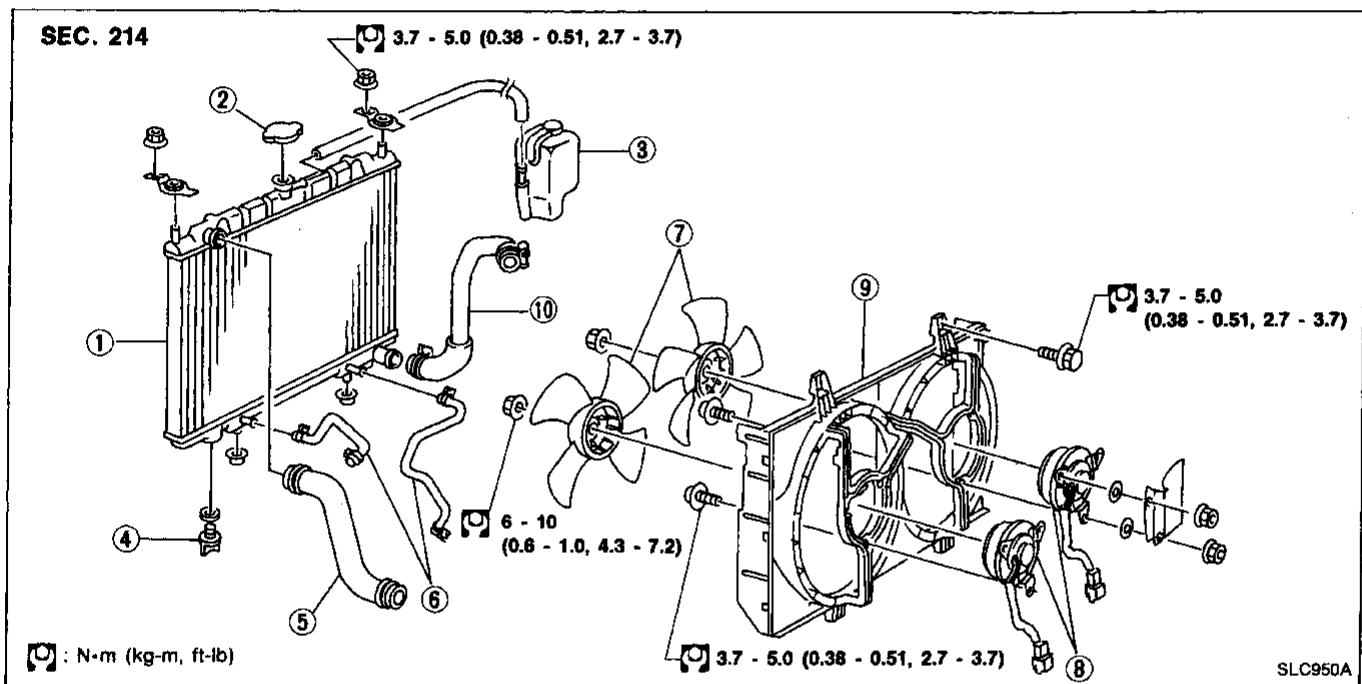
3. Then check if valve closes at 5°C (9°F) below valve opening temperature.

## Radiator

### REMOVAL AND INSTALLATION

1. Remove under cover.
2. Drain coolant from radiator.
3. Disconnect radiator upper and lower hoses.
4. Remove radiator shroud.
5. Remove A/T oil cooler hoses. (A/T models only)
6. Disconnect reservoir tank hose.
7. Remove radiator mounting bracket.
8. Remove radiator.
9. After repairing or replacing radiator, install any part removed in reverse order of removal.

When filling radiator with coolant, refer to "Changing Engine Coolant" in MA section.



- |                       |                                 |                       |
|-----------------------|---------------------------------|-----------------------|
| ① Radiator            | ⑤ Lower radiator hose           | ⑧ Cooling fan motors  |
| ② Radiator filler cap | ⑥ Oil cooler hoses (A/T models) | ⑨ Radiator shroud     |
| ③ Reservoir tank      | ⑦ Cooling fans                  | ⑩ Upper radiator hose |
| ④ Radiator drain cock |                                 |                       |

### Cooling Fan Control System

Cooling fans are controlled by ECM (ECCS control module). For details, refer to "Cooling Fan Control" of "ENGINE AND EMISSION CONTROL SYSTEM DESCRIPTION" in EC section.

# SERVICE DATA AND SPECIFICATIONS (SDS)

## Engine Lubrication System

### Oil pressure

| Engine speed<br>rpm | Approximate discharge<br>pressure kPa (kg/cm <sup>2</sup> , psi) |
|---------------------|--|
| Idle speed          | More than 69 (0.70, 10.0)  |
| 3,000               | 435 - 551 (4.44 - 5.62, 63.1 - 79.9)                             |

### Regulator valve

Unit: mm (in)

|  |                                 |
|--|---------------------------------|
| Regulator valve to oil pump<br>cover clearance | 0.040 - 0.097 (0.0016 - 0.0038) |
|--|---------------------------------|

### Oil pump

Unit: mm (in)

|  |                                 |    |
|--|---------------------------------|----|
| Body to outer gear clearance                         | 0.114 - 0.260 (0.0045 - 0.0102) | GI |
| Inner gear to outer gear tip<br>clearance            | Below 0.18 (0.0071)             | MA |
| Body to inner gear clearance                         | 0.05 - 0.09 (0.0020 - 0.0035)   | EM |
| Body to outer gear clearance                         | 0.030 - 0.190 (0.0012 - 0.0075) |    |
| Inner gear to brazed portion of<br>housing clearance | 0.045 - 0.091 (0.0018 - 0.0036) |    |

LC

EC

## Engine Cooling System

### Thermostat

|                           |               |                    |
|---------------------------|---------------|--------------------|
| Valve opening temperature | °C (°F)       | 82 (180)           |
| Max. valve lift           | mm/°C (in/°F) | 8.6/95 (0.339/203) |

### Radiator

Unit: kPa (kg/cm<sup>2</sup>, psi)

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

MT

AT

FA

RA

BR

ST

BF

HA

EL

IDX