<SUPPLEMENT-III>

ENGINE LUBRICATION & COOLING SYSTEMS

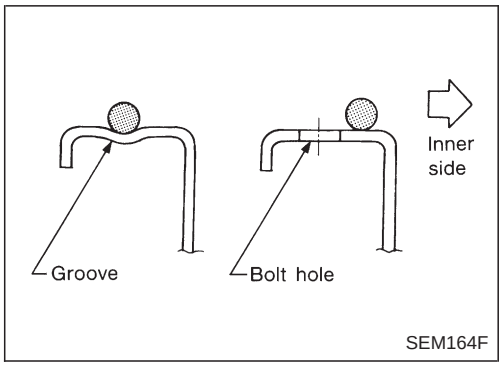
SECTION LC

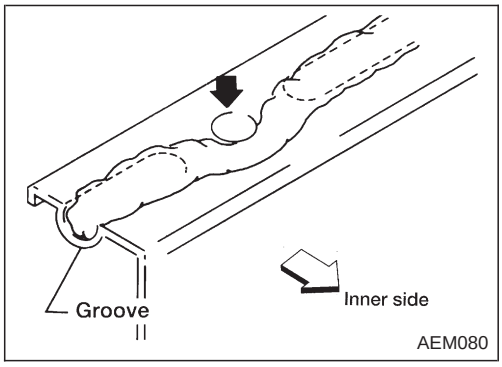
MODIFICATION NOTICE:

- TB48DE engine model has been added.

CONTENTS

TB48DE



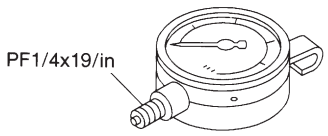
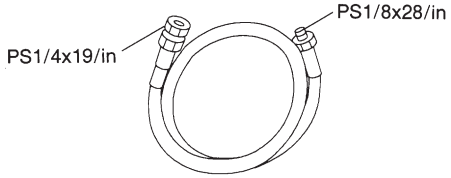
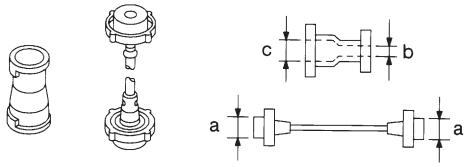


Liquid Gasket Application Procedure

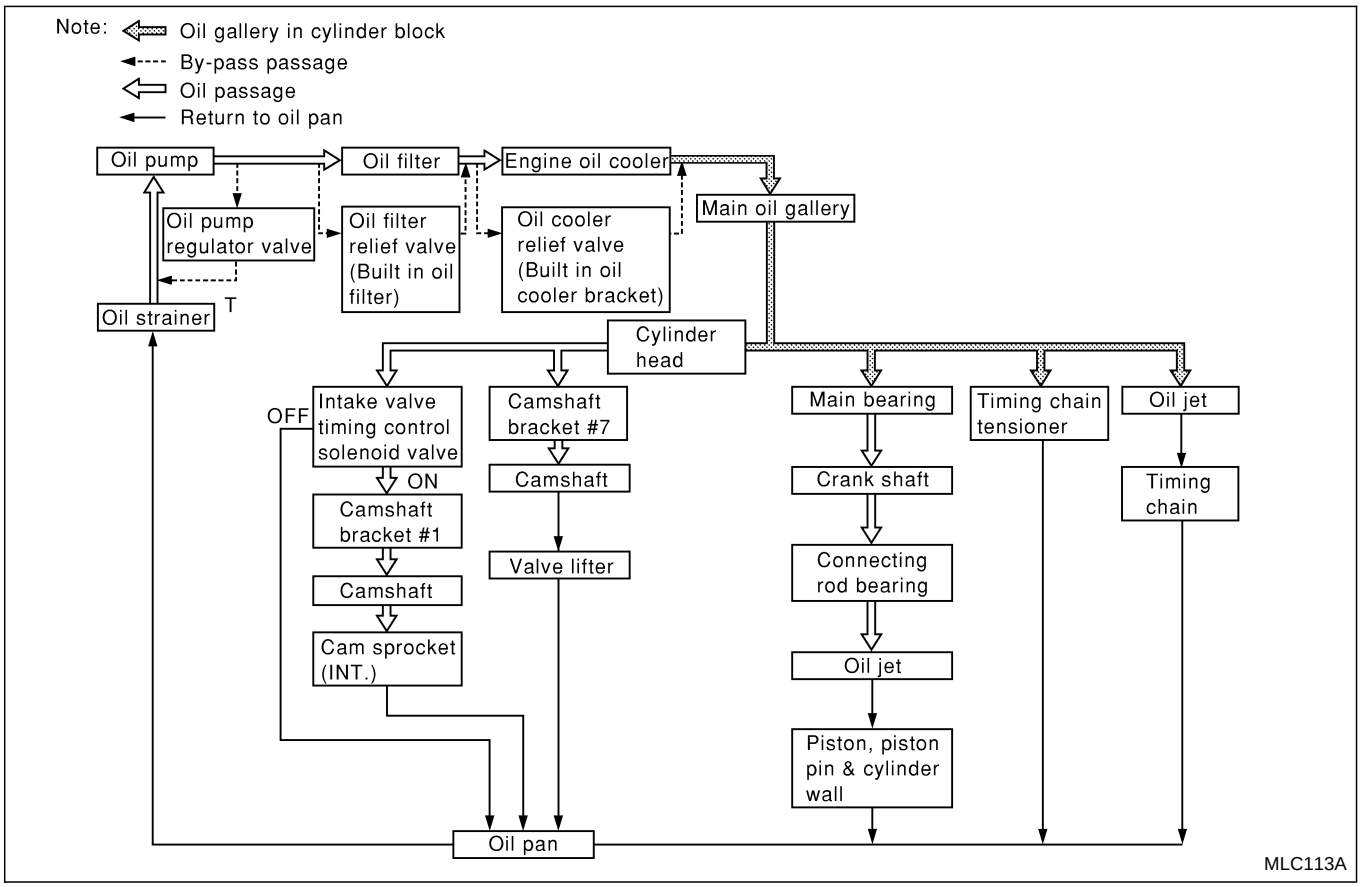
a. Use a scraper to remove all traces of old liquid gasket from mating surfaces and grooves. Also, completely clean any oil from these areas.
b. Apply a continuous bead of liquid gasket to mating surfaces. (Use Genuine Liquid Gasket or equivalent.)
   - For oil pan, be sure liquid gasket diameter is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

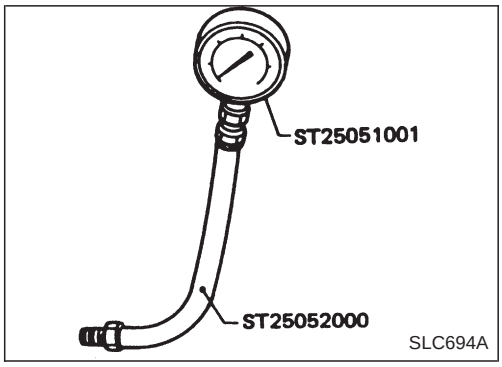
Special Service Tools

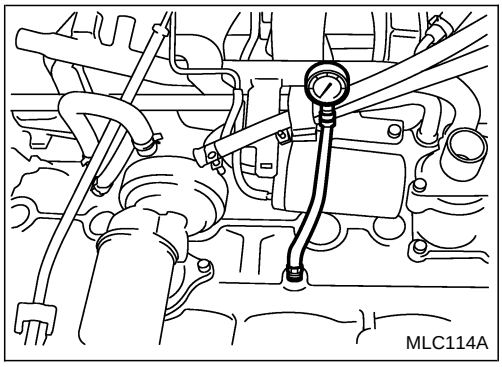
*: Special tool or commercial equivalent

Tool number Tool name	Description	
ST25051001* Oil pressure gauge	 NT558	Measuring oil pressure **Maximum measuring range: 2,452 kPa (24.5 bar, 25 kg/cm^2, 356 psi)**
ST25052000* Hose	 NT559	Adapting oil pressure gauge to cylinder block
EG17650301 Radiator cap tester adapter	 NT564	Adapting radiator cap tester to radiator filler neck and reservoir tank cap **a: 28 (1.10) dia.** **b: 31.4 (1.236) dia.** **c: 41.3 (1.626) dia.** Unit: mm (in)

Lubricating Circuit







Oil Pressure Check

WARNING:

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

1. Check oil level.
2. Remove oil pressure switch.
3. Install pressure gauge.
4. Start 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 49 (0.49, 0.5, 7)
2,800	294 - 490 (2.94 - 4.90, 3.0 - 5.0, 43 - 71)

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

6. Install oil pressure switch with sealant.
   Oil pressure switch:
   : 10 - 16 N·m (1.0 - 1.6 kg-m, 87 - 139 in-lb)

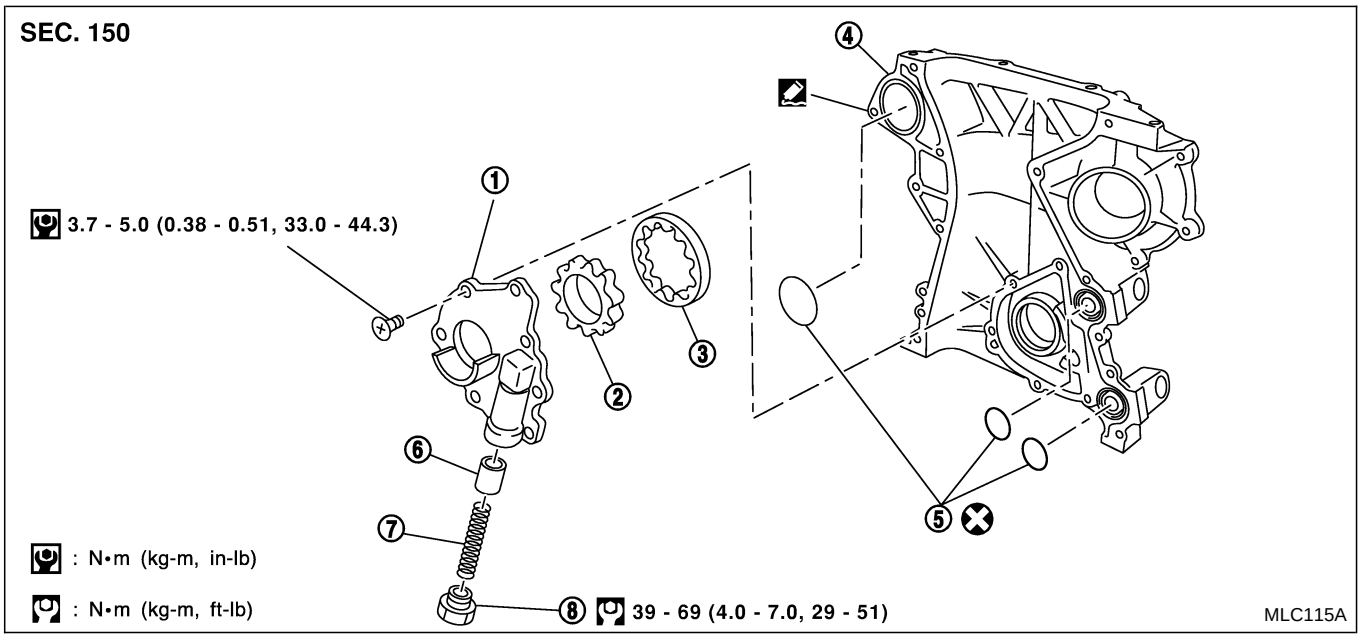
Oil Pump

REMOVAL AND INSTALLATION

1. Drain engine oil.
2. Drain coolant from radiator and cylinder block. Refer to MA section ("Changing Engine Coolant", "ENGINE MAINTENANCE").
3. Remove power steering pump drive belt, alternator drive belt and A/C compressor drive belt.
4. Remove radiator and radiator shroud.
5. Remove fan coupling with fan.
6. Remove crankshaft pulley.
7. Remove water pump.
8. Remove power steering pump and power steering pump bracket.
9. Remove alternator and alternator bracket.
10. Remove left side of the tie rod end.
11. Remove oil pans. Refer to "Removal" of "OIL PAN" in EM section.
12. Remove cylinder head front cover.
13. Remove front cover assembly.
14. Remove oil pump assembly.
15. Reinstall any part removed in reverse order of removal.

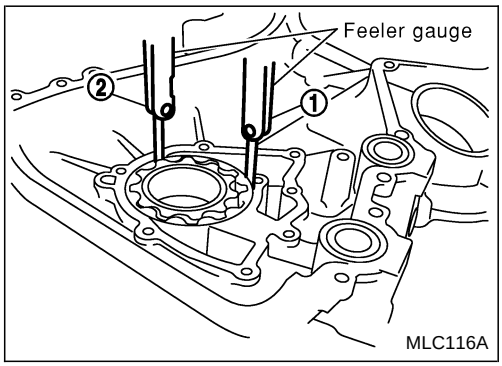
Oil Pump (Cont'd)

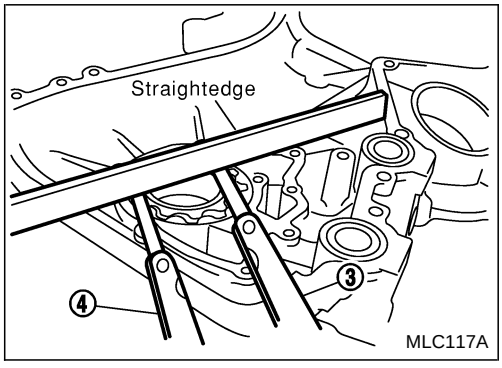
DISASSEMBLY AND ASSEMBLY



① Oil pump cover
② Inner gear
③ Outer gear
④ Front cover
⑤ O-ring
⑥ Regulator valve
⑦ Spring
⑧ Regulator plug

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





OIL PUMP INSPECTION

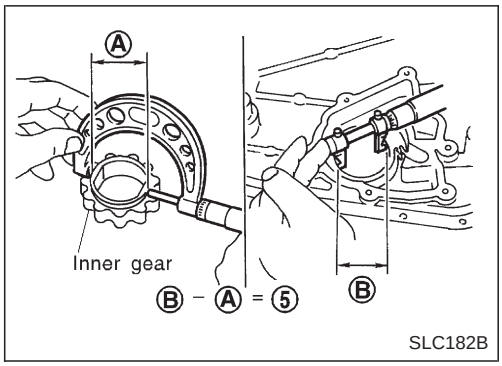
Using a feeler gauge, straightedge and micrometers, check the following clearances:

Unit: mm (in)

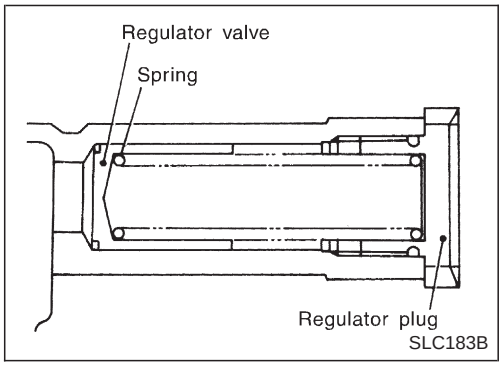
Body to outer gear clearance ①	0.114 - 0.260 (0.0045 - 0.0102)
Inner gear to outer gear tip clearance ②	Below 0.18 (0.0071)
Body to inner gear clearance ③	0.030 - 0.070 (0.0012 - 0.0028)
Body to outer gear clearance ④	0.030 - 0.190 (0.0012 - 0.0075)
Inner gear to brazed portion of housing clearance ⑤	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.**

Oil Pump (Cont'd)



SLC182B

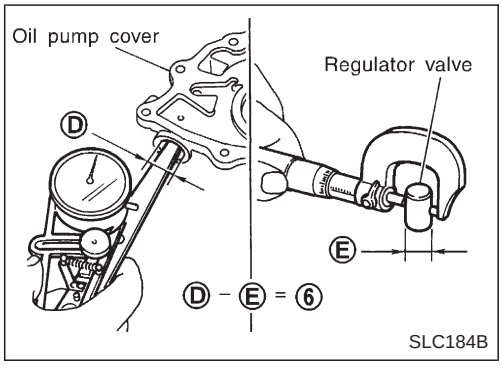


SLC183B

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 cover.



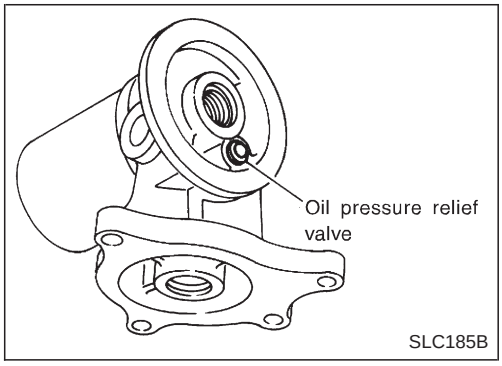
SLC184B

4. Check regulator valve to oil pump cover clearance.

Clearance:

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

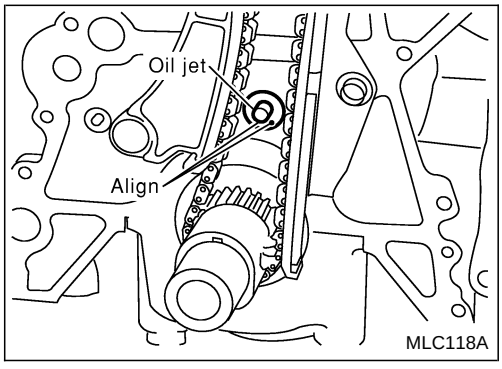
If it exceeds the limit, replace oil pump cover.



SLC185B

OIL PRESSURE RELIEF VALVE INSPECTION (For oil cooler)

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 in place by tapping it.

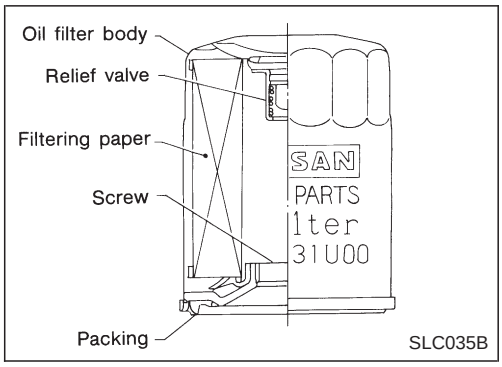


MLC118A

Oil Jet

INSPECTION (For timing chain)

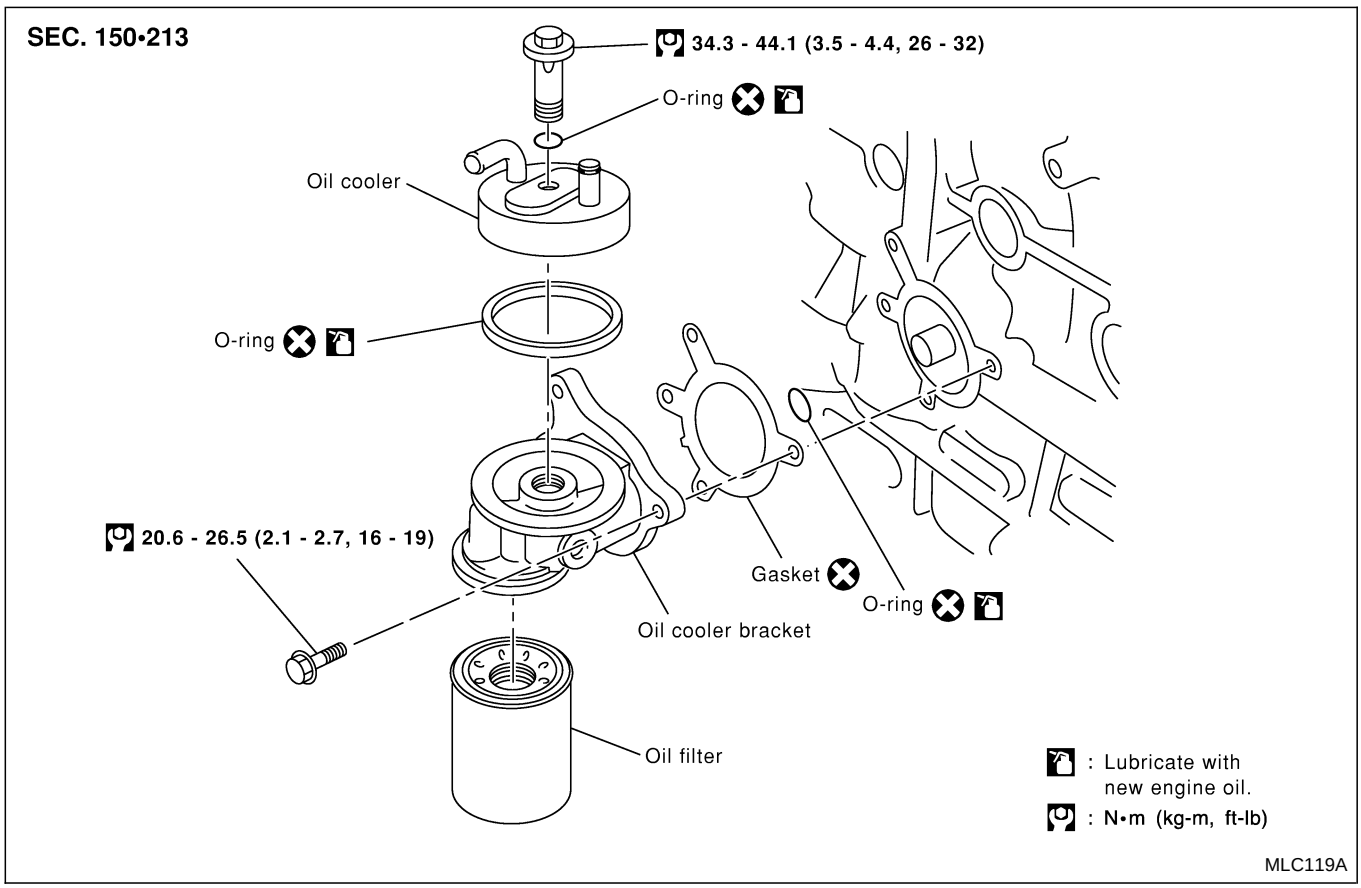
Make sure that the holes are not clogged. Clean them with a wire if necessary.
Drive oil jet into place after positioning alignment mark on cylinder block.



Oil Filter

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

Oil Cooler



REMOVAL AND INSTALLATION

1. Disconnect water hoses from oil cooler, pinching hoses near oil cooler to prevent engine coolant from spilling.
2. Remove oil cooler. Put mating marks for easier installation.
3. Installation is in reverse order of removal.

- **Do not spill engine oil and engine coolant on the drive belt.**
- **Completely wipe off any engine oil and engine coolant that adheres to the engine and the vehicle.**

4. Check oil level and add engine oil.
5. After warming up engine, check that there is no leakage of engine oil and engine coolant.

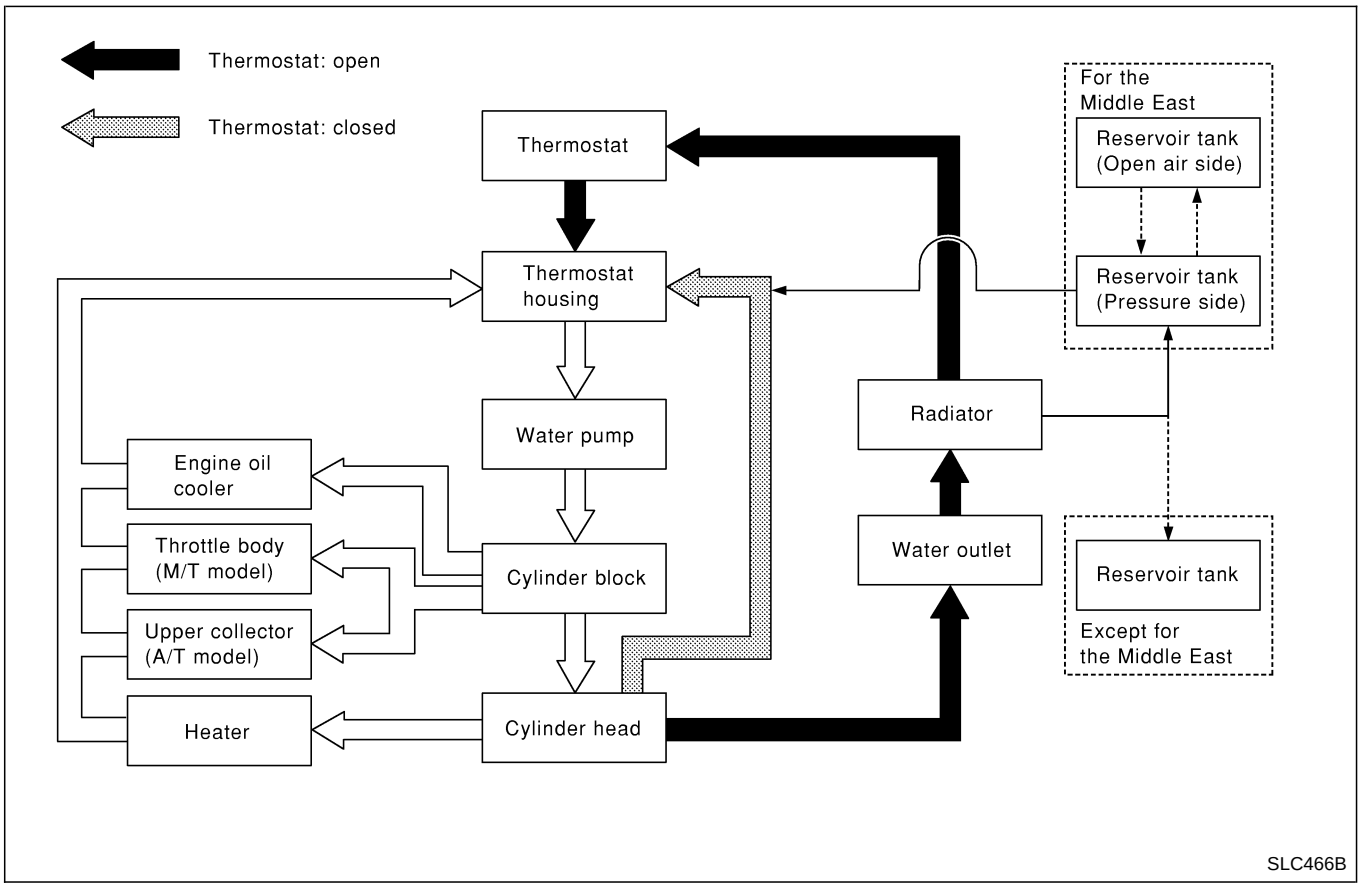
INSPECTION

1. Check oil cooler for cracks.

Oil Cooler (Cont'd)

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

Cooling Circuit



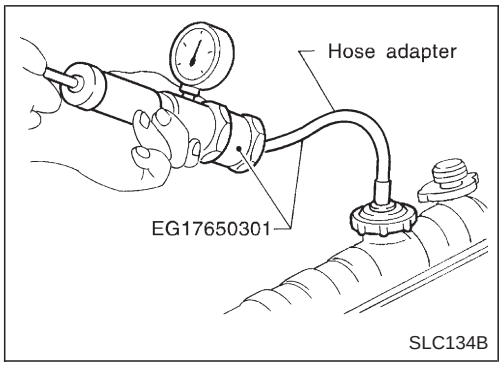
System Check

WARNING:
Never remove the radiator cap when the engine is hot. Serious burns could 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.
CAUTION:
Do not install the reservoir tank cap (pressure side), which is provided with valves, to radiator on models for the Middle East.

CHECKING COOLING SYSTEM HOSES

Check hoses for the following:
- Improper attachment
- Leaks
- Cracks
- Damage
- Chafing
- Deterioration

System Check (Cont'd)

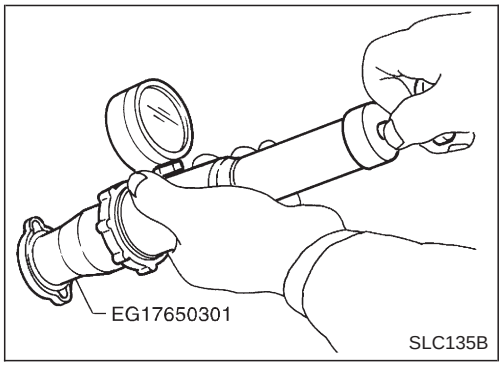


CHECKING COOLING SYSTEM FOR LEAKS

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

Testing pressure:
157 kPa (1.57 bar, 1.6 kg/cm^2, 23 psi)

CAUTION:
Higher pressure than specified may cause radiator damage.

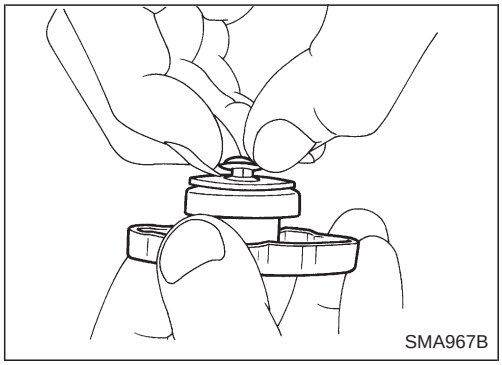


CHECKING RADIATOR CAP

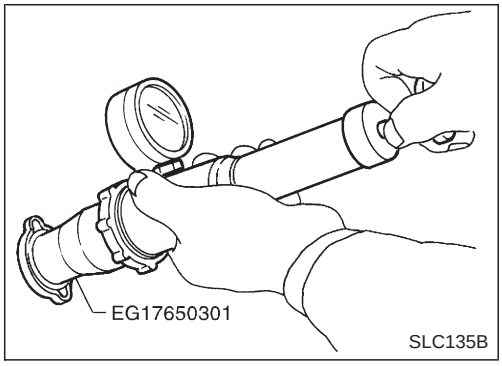
Except for the Middle East

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

Radiator cap relief pressure:
Standard
108 - 127 kPa
(1.08 - 1.27 bar, 1.1 - 1.3 kg/cm^2, 16 - 18 psi)
Limit
59 kPa (0.59 bar, 0.6 kg/cm^2, 9 psi)



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



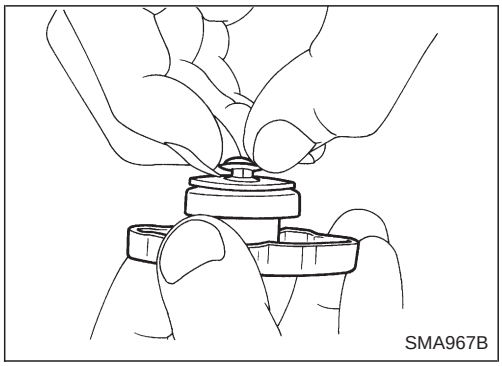
CHECKING RESERVOIR TANK CAP (PRESSURE SIDE)

For the Middle East

To check reservoir tank cap (pressure side), apply pressure to cap with a tester.

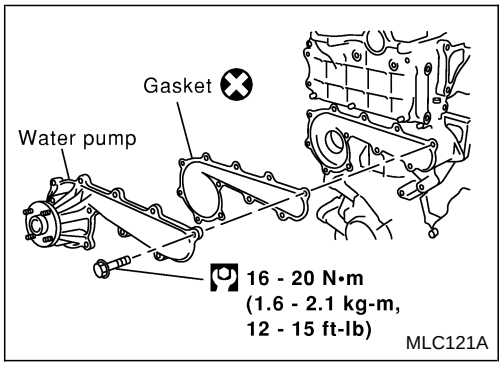
Reservoir tank cap relief pressure:
Standard
78 - 98 kPa
(0.78 - 0.98 bar, 0.8 - 1.0 kg/cm^2, 11 - 14 psi)
Limit
59 kPa (0.59 bar, 0.6 kg/cm^2, 9 psi)

System Check (Cont'd)



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

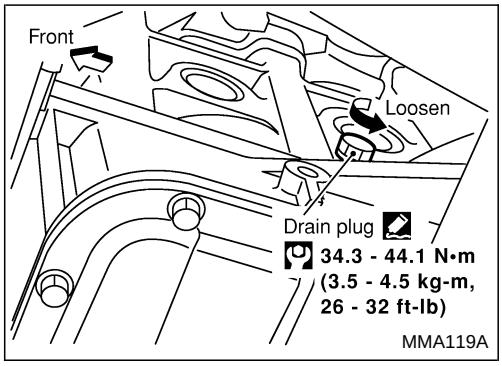
Water Pump



CAUTION:

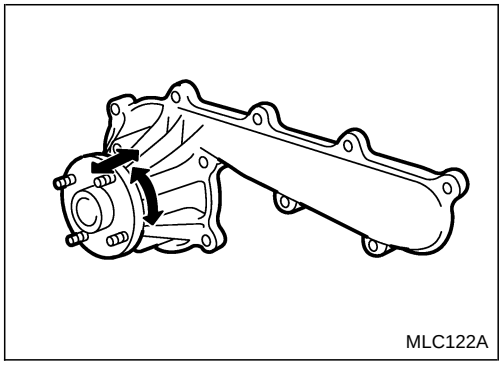
- **When removing water pump assembly, be careful not to get coolant on drive belt.**
- **Water pump cannot be disassembled and should be replaced as a unit.**
- **Always replace with new gasket.**
- **After installing water pump, connect hose and clamp securely, then check for leaks using radiator cap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

REMOVAL



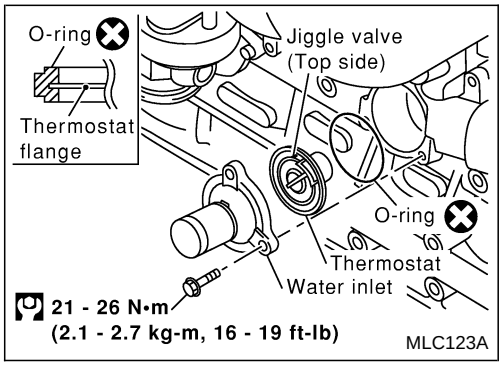
1. Drain coolant from radiator and cylinder block.
   Refer to MA section ("Changing Engine Coolant", "ENGINE MAINTENANCE").
2. Remove power steering pump drive belt, alternator drive belt and A/C compressor drive belt.
3. Remove radiator shroud.
4. Remove fan coupling with fan.
5. Remove water pump.

INSPECTION



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

Thermostat

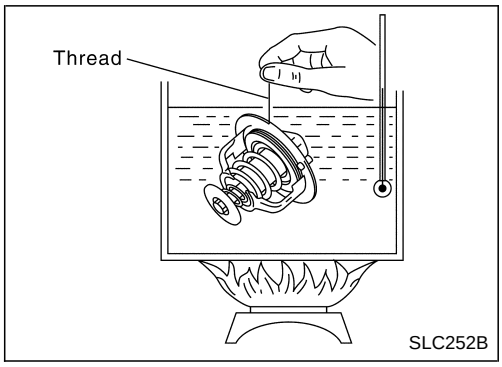


- **After installation, run engine for a few minutes and check for leaks.**
- **Be careful not to spill coolant in engine compartment. Use a rag to absorb coolant.**

REMOVAL

Drain coolant from radiator and cylinder block. Refer to MA section ("Changing Engine Coolant", "ENGINE MAINTENANCE").

Thermostat (Cont'd)

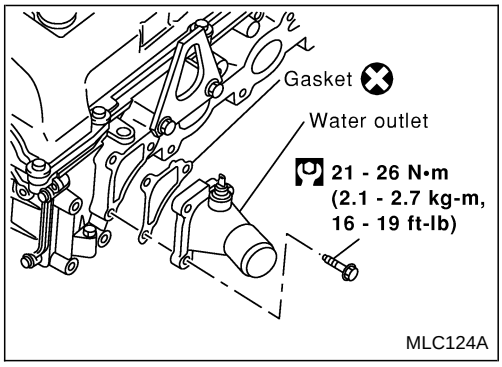


INSPECTION

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

	Gulf standard model
Valve opening temperature °C (°F)	76.5 (170)
Maximum valve lift mm/°C (in/°F)	10/90 (0.39/194)

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



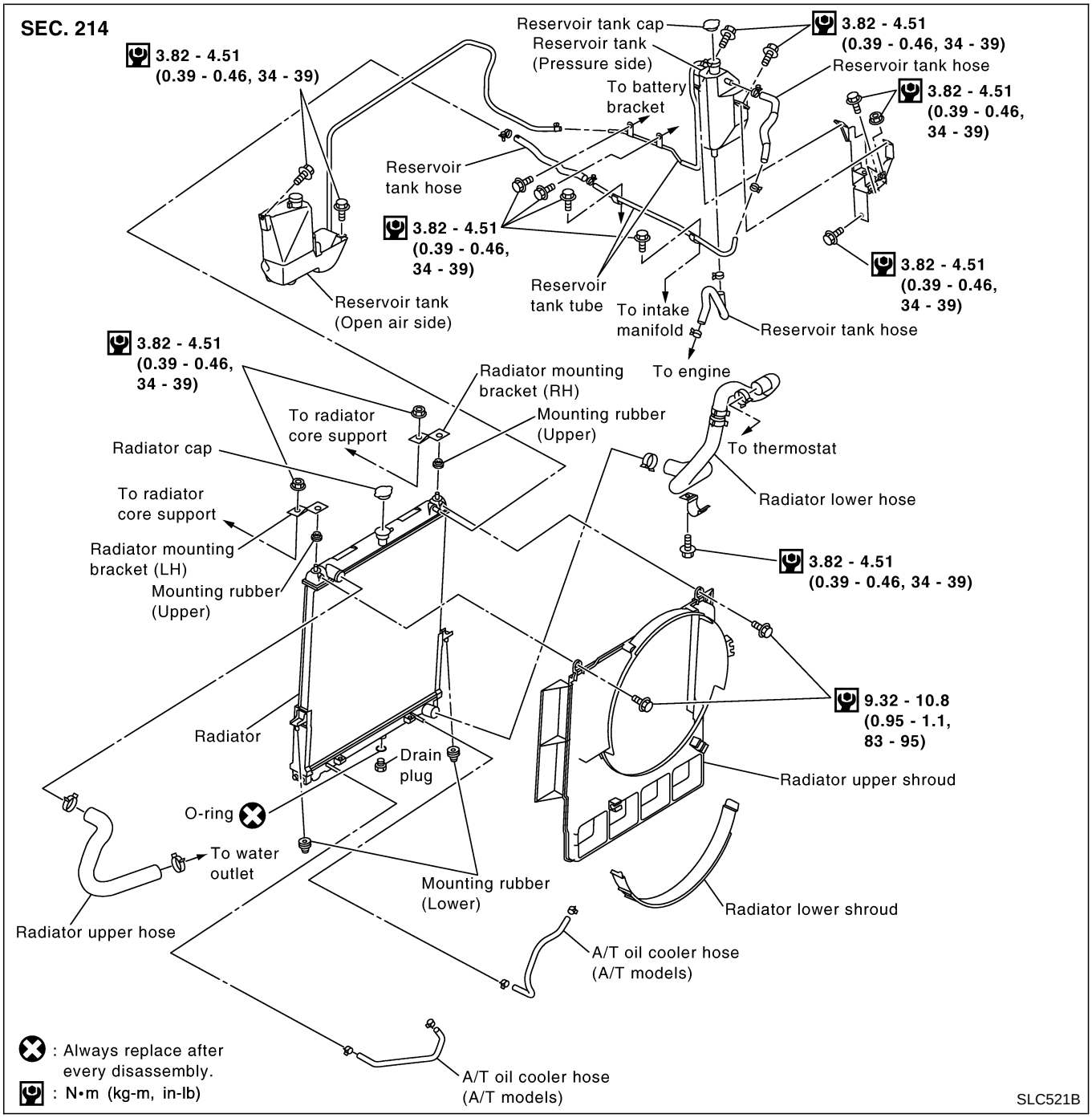
Water Outlet

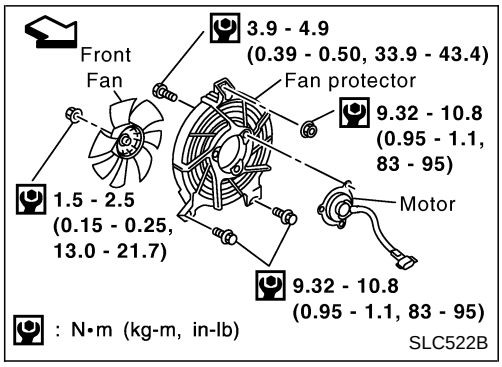
INSPECTION

Visual inspection for water leaks. If there is leakage, replace gasket.

Radiator

FOR EUROPE





Cooling Fan Control System (For Europe)

Cooling fan is controlled by ECM (Engine control module). For details, refer to EC section [“Cooling Fan”, “DTC P1217 ENGINE OVER TEMPERATURE (OVERHEAT)”].

Engine Lubrication System

OIL PRESSURE CHECK

Engine rpm	Approximate discharge pressure kPa (bar, kg/cm^2, psi)
Idle speed 2,800	More than 49 (0.49, 0.5, 7) 294 - 490 (2.94 - 4.90, 3.0 - 5.0, 43 - 71)

OIL PUMP INSPECTION

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	0.030 - 0.070 (0.0012 - 0.0028)
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)
Regulator valve to oil pump cover ⑥	0.040 - 0.097 (0.0016 - 0.0038)

Engine Cooling System

RADIATOR

Except for the Middle East

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

Radiator cap		
	Standard	108 - 127 (1.08 - 1.27, 1.1 - 1.3, 16 - 18)
	Limit	59 (0.59, 0.6, 9)
Leakage test pressure		157 (1.57, 1.6, 23)

For the Middle East

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

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

THERMOSTAT

	Standard
Valve opening temperature °C (°F)	76.5 (170)
Max. valve lift mm/°C (in/°F)	10/90 (0.39/194)