ENGINE LUBRICATION & COOLING SYSTEMS

SECTION LC

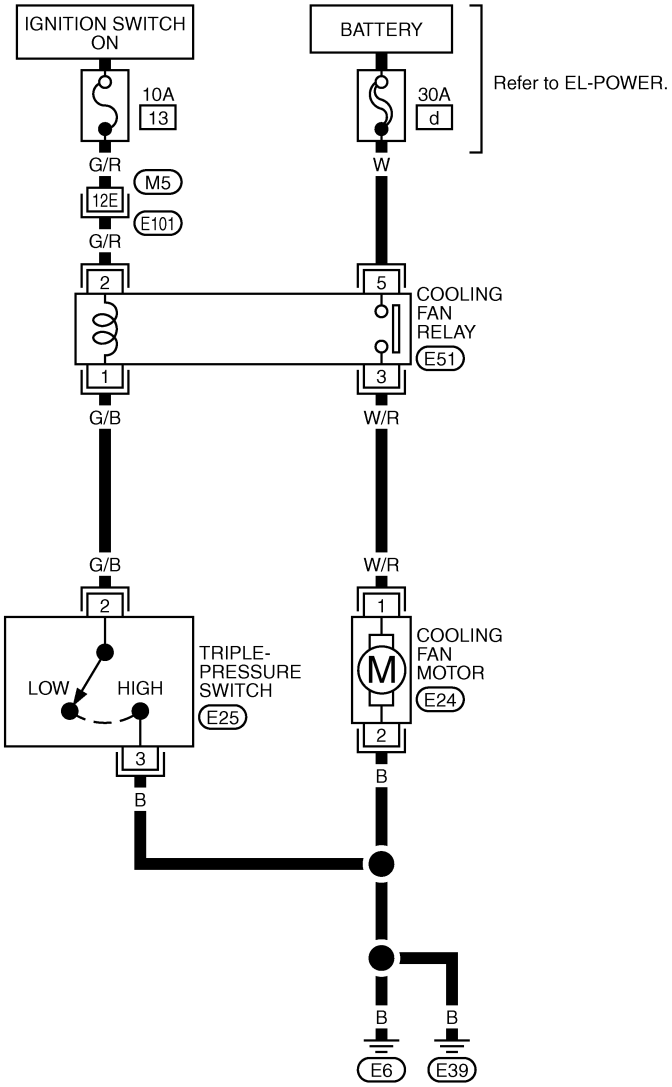
MODIFICATION NOTICE:

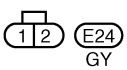
- KA24DE engine information has been added. For specifications other than those described here, refer to D22 Supplement-II Service Manual (SM9E-D22BE0E).
- YD25DDTi engine model has been added.

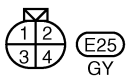
CONTENTS

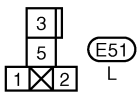
Wiring Diagram

LC-COOL/F-01









Refer to last page (Foldout page).
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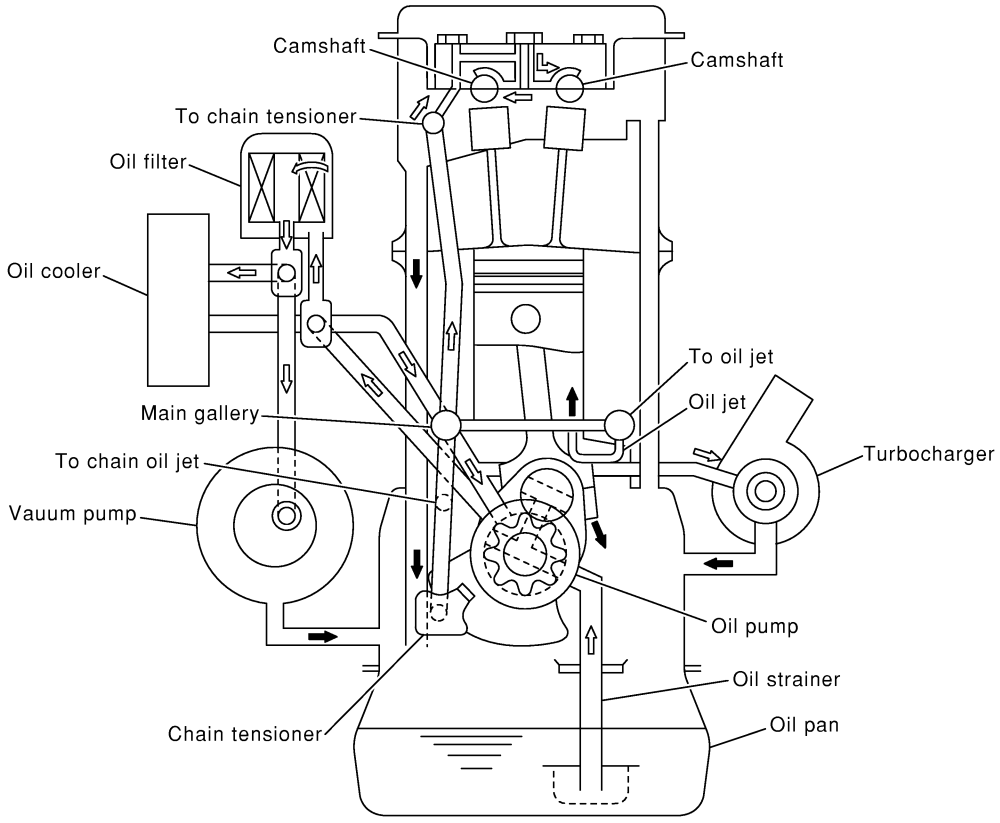
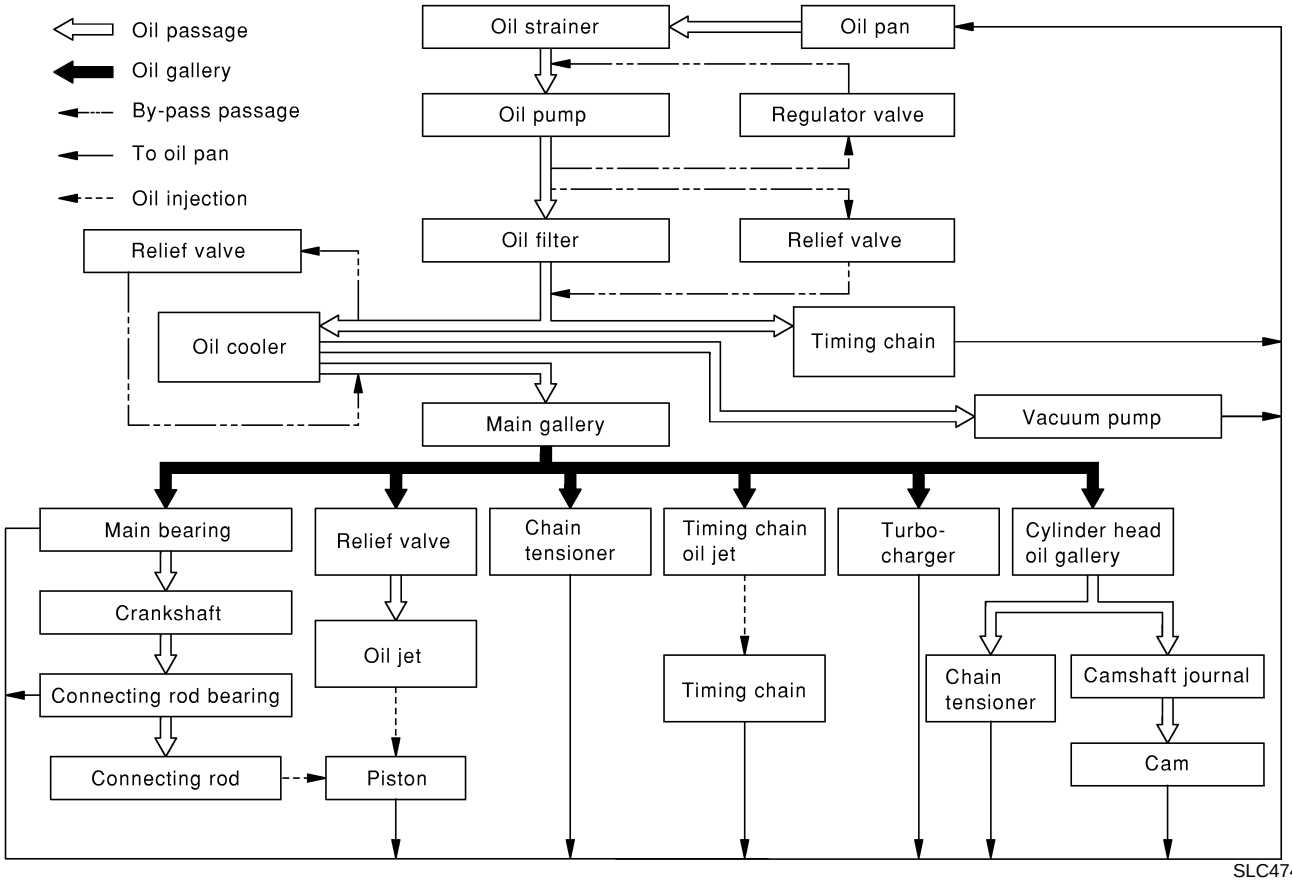
Lubricating Circuit





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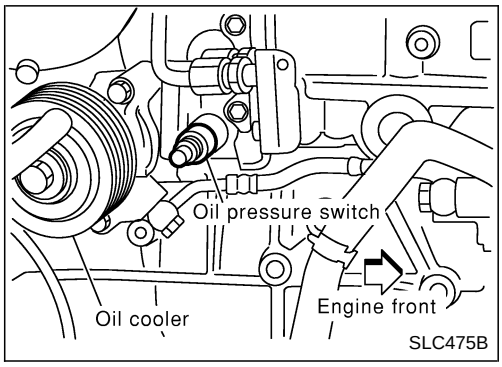
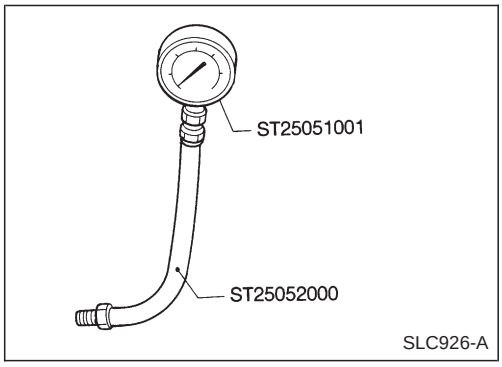




Oil Pressure Check

WARNING:

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

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

Engine speed rpm	Approximate discharge pressure kPa (bar, kg/cm^2, psi)
Idle speed	More than 140 (1.40, 1.43, 20.3)
2,000	More than 270 (2.69, 2.75, 39.1)
4,000	More than 430 (4.29, 4.38, 62.3)

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

6. After the inspections, install the oil pressure switch as follows.

a. Remove the old sealant adhering to the switch and engine.
b. Apply Genuine Liquid Gasket or equivalent to the thread and tighten.

: 13 - 17 N·m (1.25 - 1.75 kg-m, 9 - 12 ft-lb)

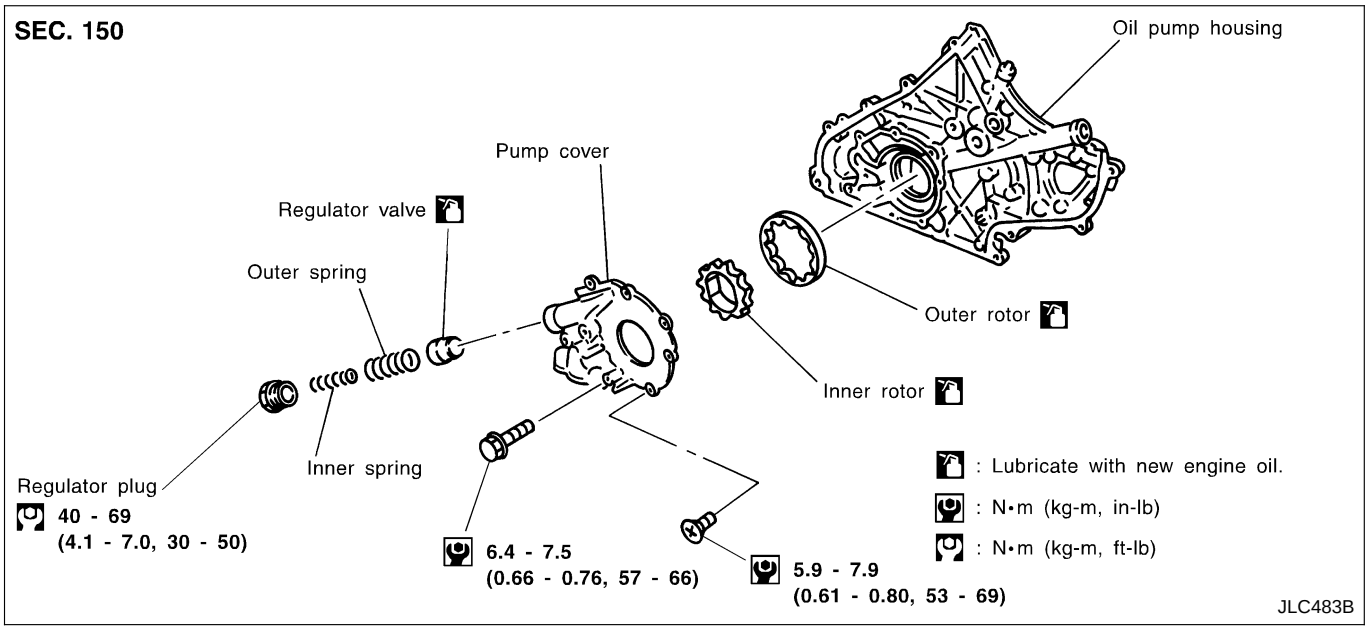
Oil Pump

REMOVAL AND INSTALLATION

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

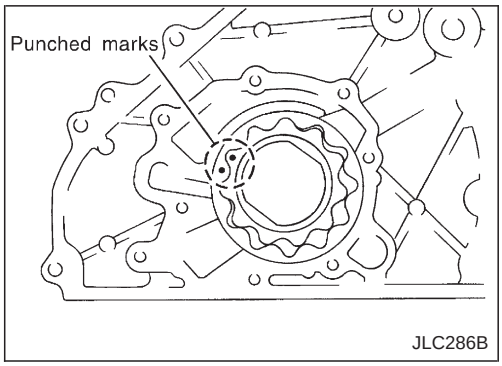
Refer to "Primary Timing Chain" in EM section.
Reinstall all parts in the reverse order of removal.

DISASSEMBLY AND ASSEMBLY



Oil Pump (Cont'd)

OIL PUMP INSPECTION

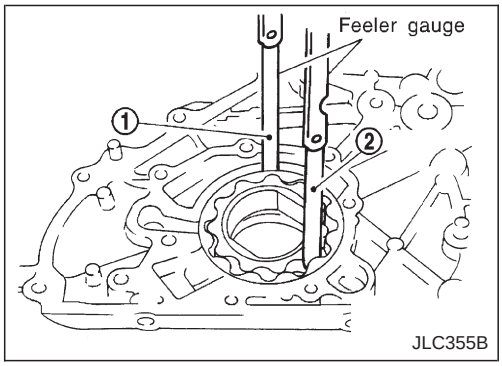


- **Install the inner rotor and outer rotor with the punched marks on the pump cover side.**

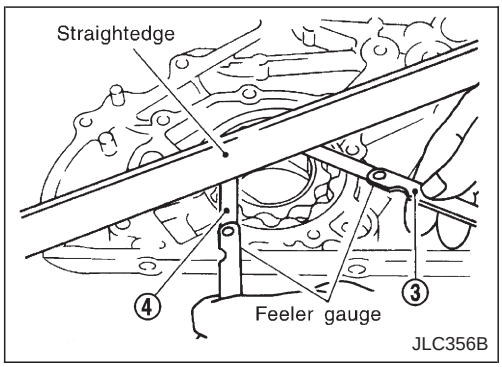
Using a feeler gauge, straightedge and micrometers, check the following clearances:

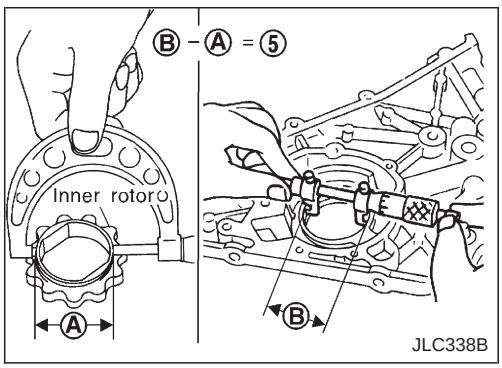
Unit: mm (in)

Housing to outer rotor radial clearance **1**	0.114 - 0.260 (0.0045 - 0.0102)
Inner rotor to outer rotor tip clearance **2**	Below 0.180 (0.0071)
Housing to inner rotor axial clearance **3**	0.050 - 0.090 (0.0020 - 0.0035)
Housing to outer rotor axial clearance **4**	0.030 - 0.190 (0.0012 - 0.0075)
Inner rotor to brazed portion of housing clearance **5**	0.045 - 0.091 (0.0018 - 0.0036)

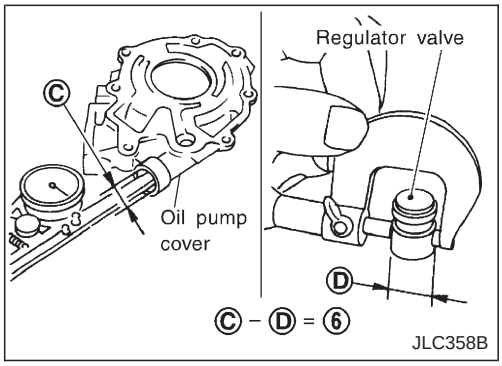


- **If the tip clearance (2) exceeds the limit, replace rotor set.**
- **If housing to rotor clearances (1, 3, 4, 5) exceed the limit, replace oil pump housing assembly.**





REGULATOR VALVE INSPECTION



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

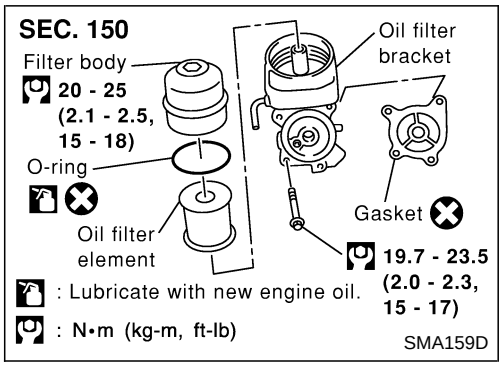
If damaged, replace regulator valve set or oil pump housing.

4. Check regulator valve to oil pump cover clearance.

Clearance 6:

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

If it exceeds the limit, replace oil pump housing.



Oil Filter Bracket

REMOVAL

1. Remove oil filter. Refer to “Changing Oil Filter” in MA section.
2. Loosen mounting bolts of oil filter bracket to drain the oil.
- Catch the oil with a pan or cloth.
3. Remove oil filter bracket.

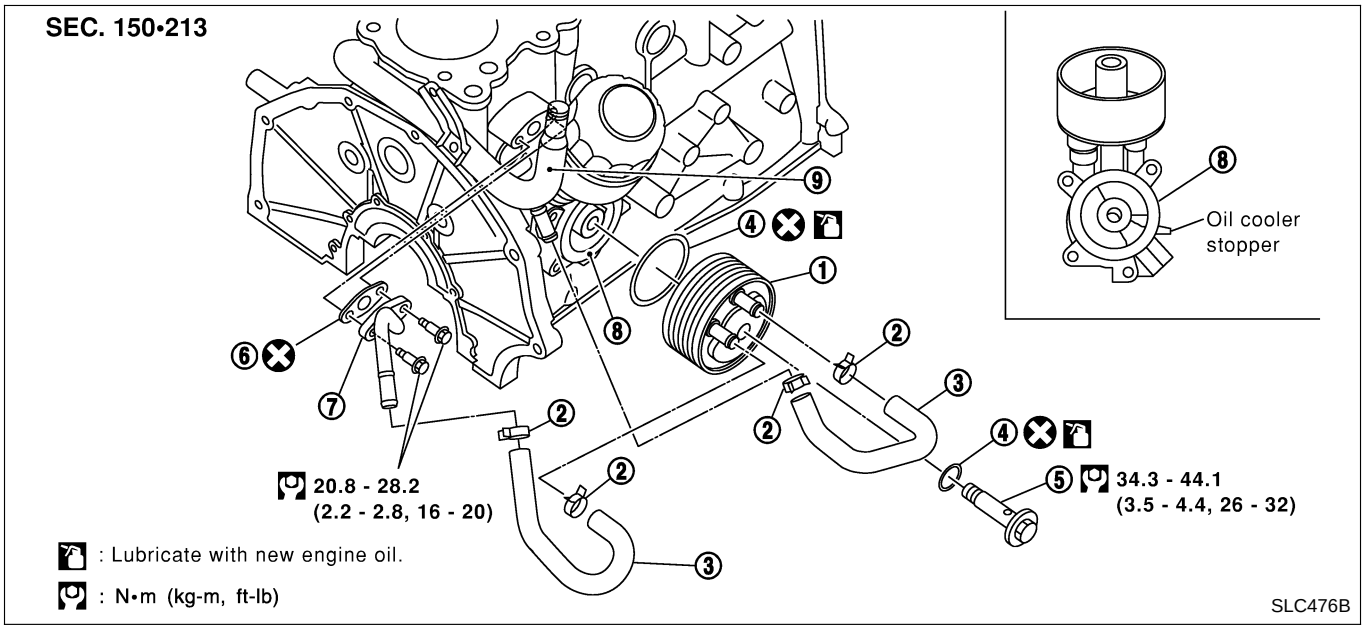
INSTALLATION

1. Completely remove all foreign objects adhering to mounting surfaces (cylinder block and bracket sides).
2. Install oil filter bracket with new gasket.
3. Install oil filter. Refer to “Changing Oil Filter” in MA section.

OIL FILTER

The oil filter is an element type. Refer to “Changing Oil Filter” in MA section.

Oil Cooler

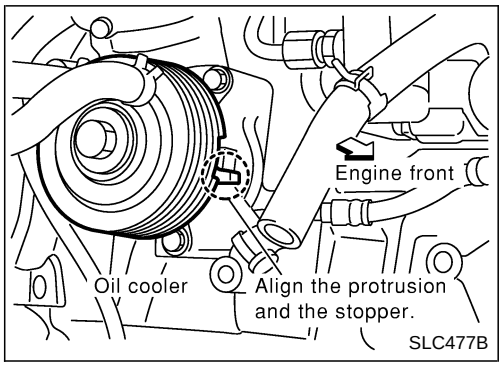


1. Oil cooler
2. Clamp
3. Water hose
4. O-ring
5. Connecting bolt
6. Gasket
7. Water hose connector
8. Oil filter bracket
9. Heater pipe

REMOVAL AND INSTALLATION

1. Draining the coolant
   Refer to “Changing Engine Coolant” in MA section.

Oil Cooler (Cont'd)



2. Reinstall all removed parts in the reverse order of removal.
- Confirm that no foreign objects are adhering to the installation planes of the oil cooler or block.
- Tighten the connecting bolt after aligning the stopper on the cylinder block side with protrusion of the oil cooler.

Overheating Cause Analysis

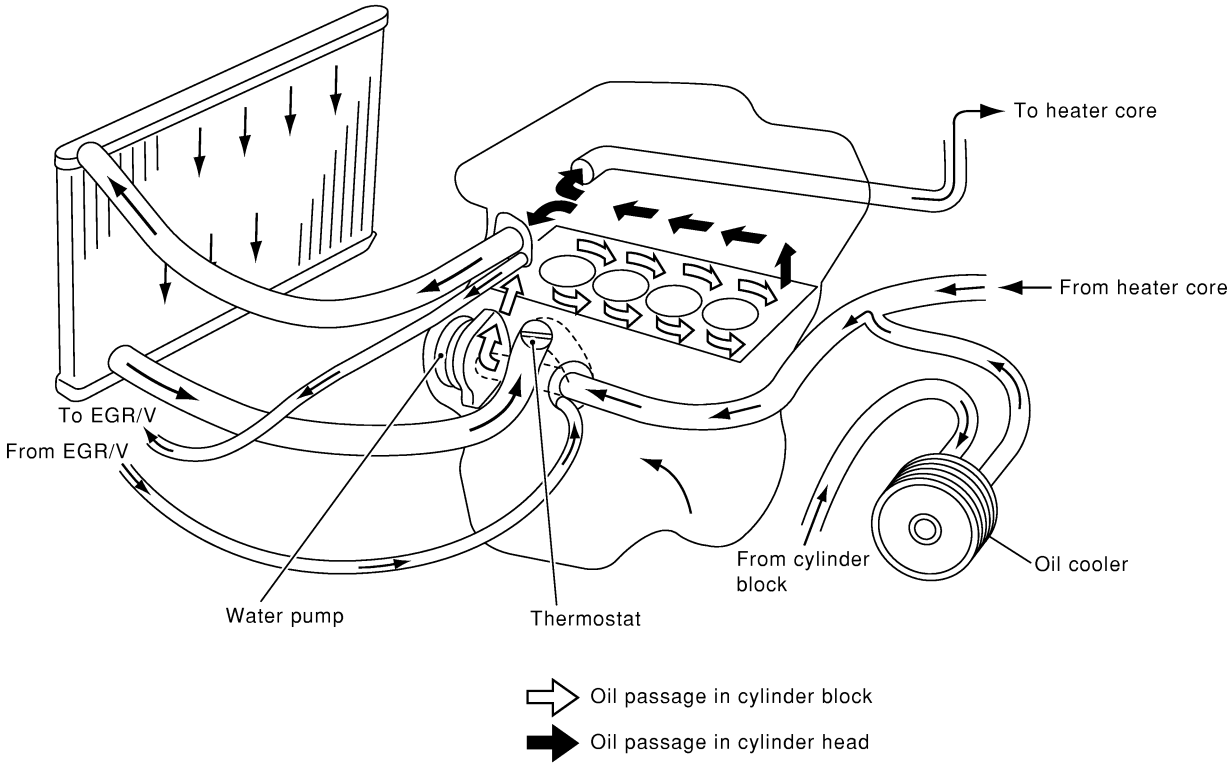
TROUBLESHOOTING CHART

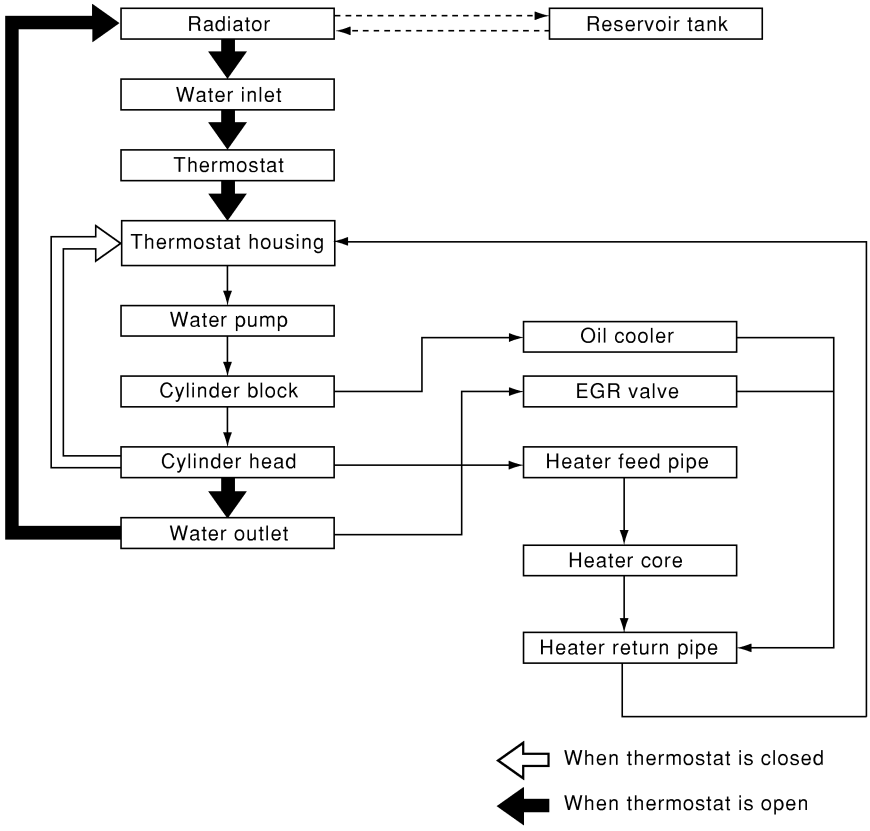
	Symptom		Check items	
Cooling system parts malfunction	Poor heat transfer	Water pump malfunction	Worn or loose drive belt	—
		Thermostat stuck closed	—	
		Damaged fins	Dust contamination or paper clogging	
			Mechanical damage	
		Clogged radiator cooling tube	Excess foreign material (rust, dirt, sand, etc.)	
	Reduced air flow	Cooling fan does not operate	—	—
		High resistance to fan rotation		
		Damaged fan blades		
	Damaged radiator shroud	—	—	—
	Improper coolant mixture ratio	—	—	—
	Poor coolant quality	—	—	—
	Insufficient coolant	Coolant leaks	Cooling hose	Loose clamp
				Cracked hose
			Water pump	Poor sealing
			Radiator cap	Loose
				Poor sealing
			Radiator	O-ring for damage, deterioration or improper fitting
				Cracked radiator tank
				Cracked radiator core
			Reservoir tank	Cracked reservoir tank
		Overflowing reservoir tank	Exhaust gas leaks into cooling system	Cylinder head deterioration
				Cylinder head gasket deterioration

Overheating Cause Analysis (Cont'd)

	Symptom		Check items	
Except cooling system parts malfunction	—	Overload on engine	Abusive driving	High engine rpm under no load
				Driving in low gear for extended time
				Driving at extremely high speed
			Power train 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		

Cooling Circuit





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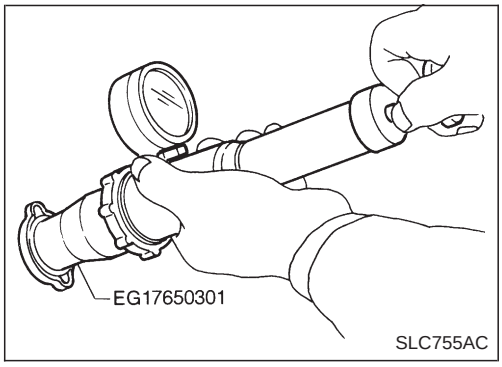
System Check

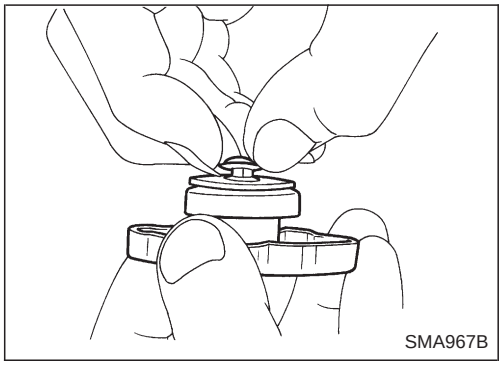
WARNING:
Never remove the radiator cap when the engine is hot; serious burns could be caused by high pressure fluid escaping from the radiator.
Wrap a thick cloth around the cap and carefully remove it by turning it a quarter turn to allow built-up pressure to escape and then turn the cap all the way off.



CHECKING 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/cm^2, 11 - 14 psi)
Limit
59 kPa (0.59 bar, 0.6 kg/cm^2, 9 psi)

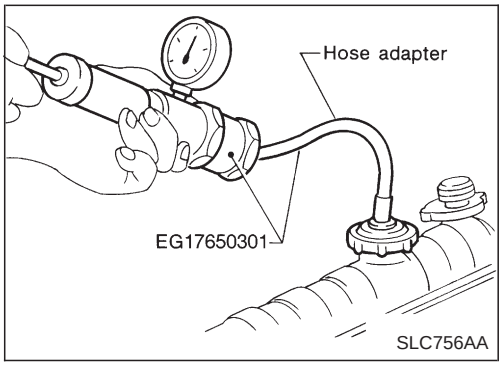


Pull the negative pressure valve to open it.
Check that it closes completely when released.

- Check the radiator cap negative pressure valve for contamination or damage to the valve seat.
- Move the negative pressure valve to check for abnormalities to the opening/shutting operation.

CAUTION:

- **Be sure to perform the inspections after cooling down the engine.**
- **Before connecting the radiator cap to the tester, apply water or LLC to the cap sealing.**
- Replace the radiator cap if abnormalities are found with the negative pressure valve, or if the valve opening pressure is out of the standard range.



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 than the specified pressure may cause radiator damage.**
- **Be sure to perform the inspections after cooling down the engine.**
- **Use a hose adapter between the cap tester and filler**

System Check (Cont'd)

neck to prevent the radiator filler neck from deforming.

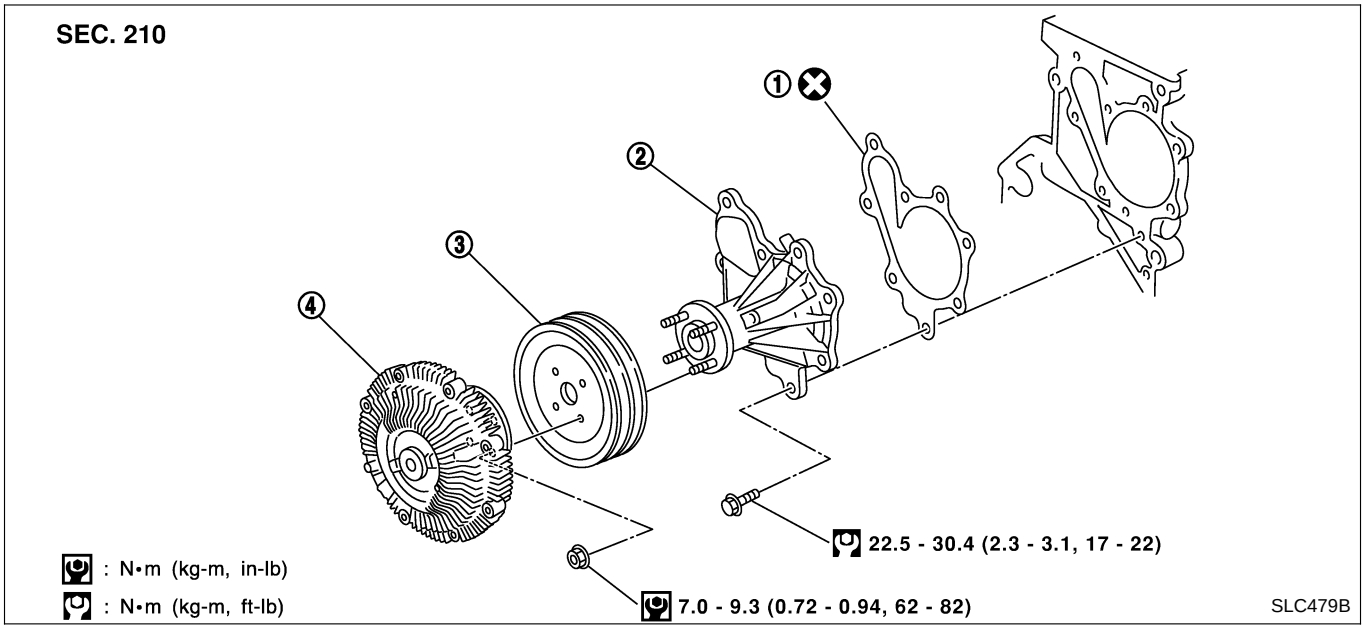
- If any abnormalities are found, repair or replace the malfunctioning parts.

Water Pump

REMOVAL AND INSTALLATION

CAUTION:

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



1. Gasket
2. Water pump
3. Water pump pulley
4. Coupling

REMOVAL

1. Drain engine coolant. Refer to "Changing Engine Coolant" in MA section.
2. Remove radiator shroud.
3. Remove cooling fan and coupling.
4. Remove drive belts. Refer to "Drive Belts" in EM section.
5. Remove the water pump pulley.
6. Remove the water pump.

INSPECTION

- Check for rust and contamination adhering to the water pump and vane.
- Turn the pump shaft by hand, and check that the pump turns smoothly without looseness.

CAUTION:

Do not disassemble cooling fan coupling.

INSTALLATION

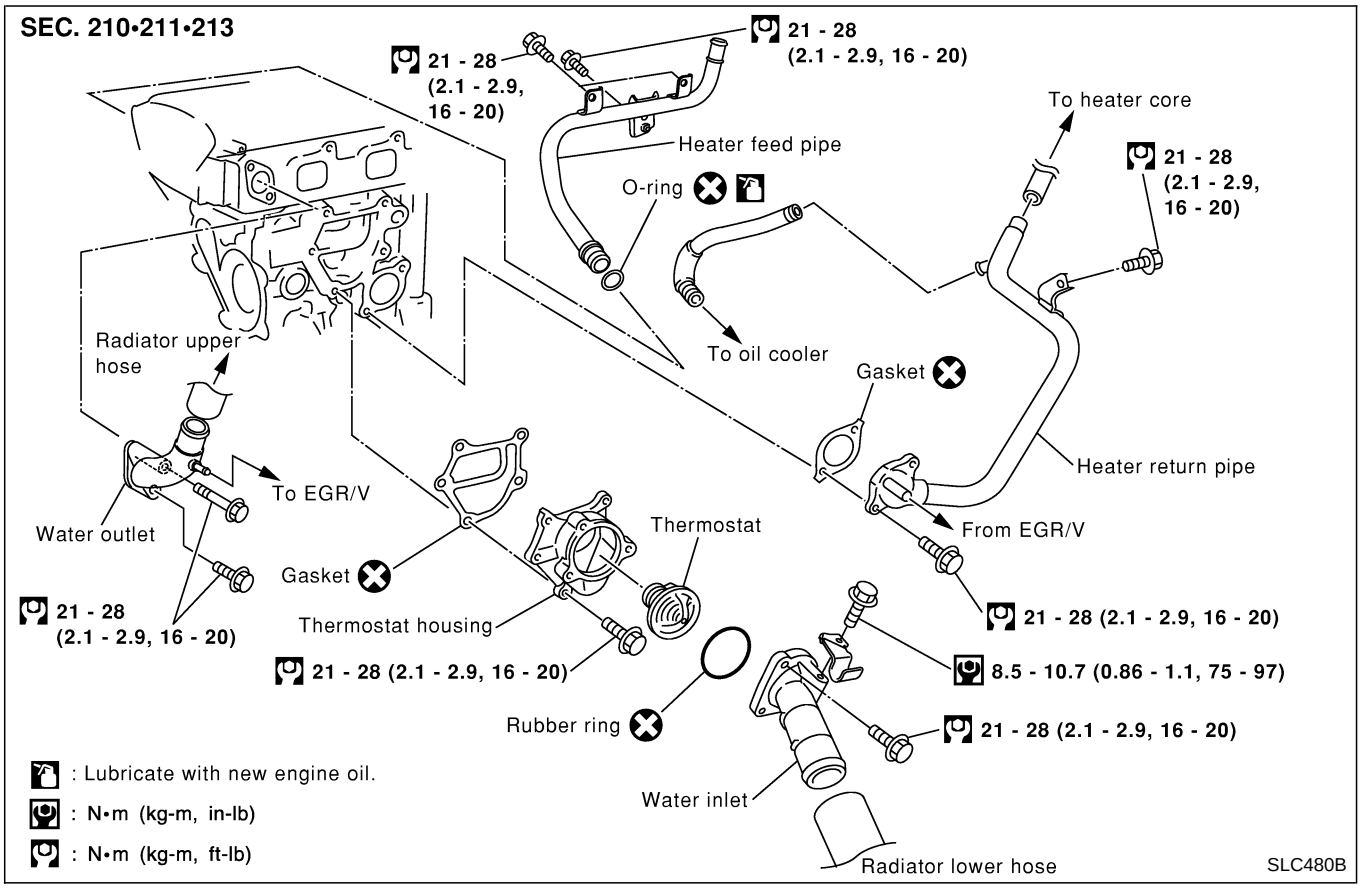
- Install the parts in the reverse order of removal.

Water Pump (Cont'd)

- Install the water pump pulley with the front mark (painted white, used to prevent errors during assembly) facing the front of the engine. Refer to the figure on the previous page.

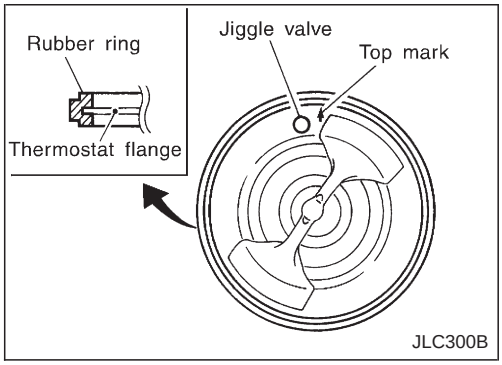
Thermostat and Water Piping

REMOVAL AND INSTALLATION



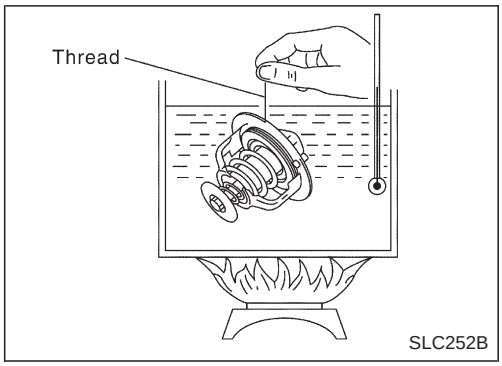
- **Be careful not to spill coolant over engine compartment. Use a rag to absorb coolant.**

1. Drain engine coolant. Refer to “Changing Engine Coolant” in MA section.
2. Remove water inlet.
3. Remove thermostat.



4. Install thermostat with jiggle valve facing upward.
- **Carefully install the rubber ring to the flange of the thermostat, making sure it does not slip out of place.**
5. After installation and refilling coolant, run engine for a few minutes, and check for leaks.

Thermostat and Water Piping (Cont'd)



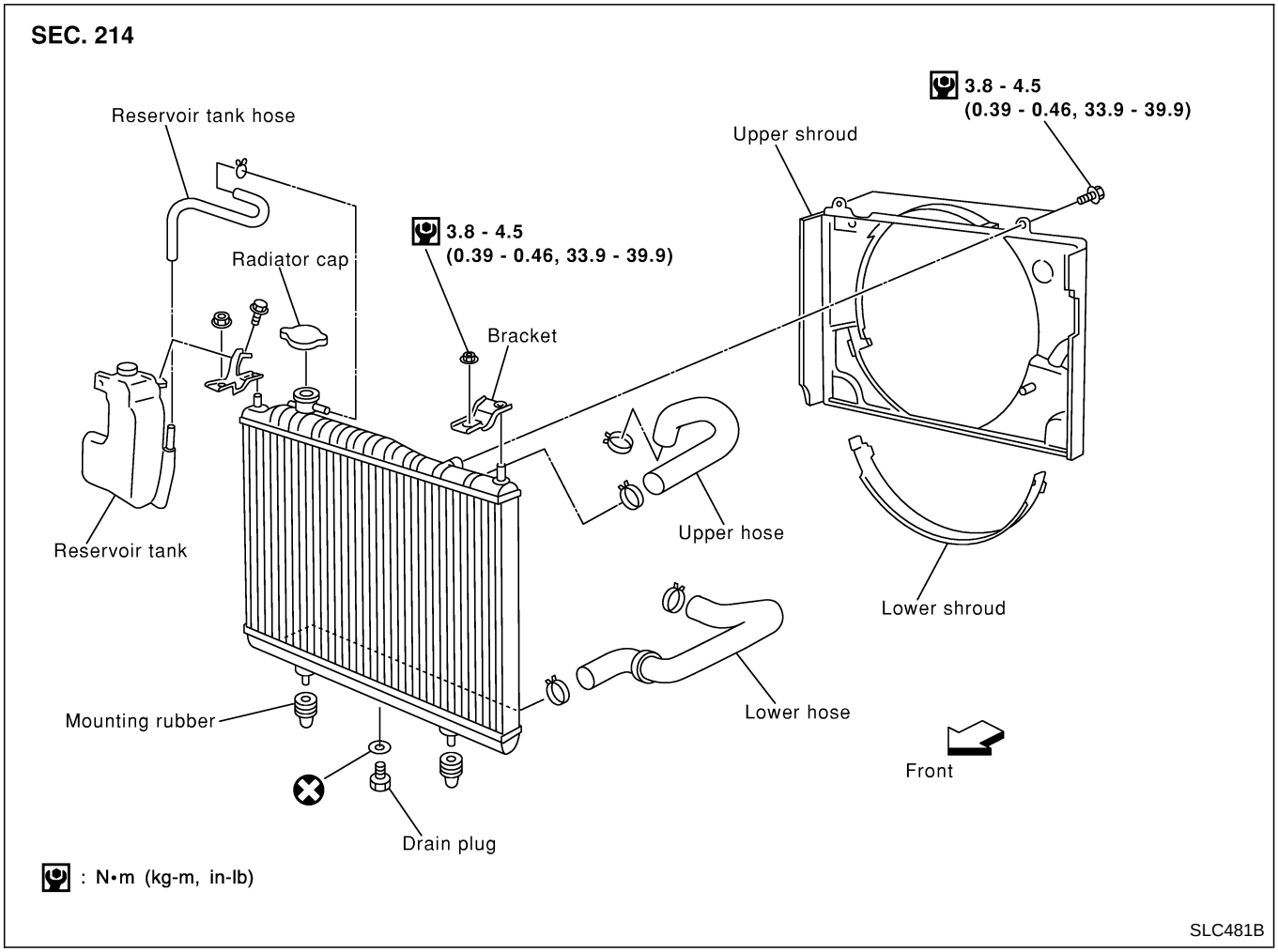
INSPECTION

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	Above 80 - 84°C (176 - 183°F)
Valve lift	More than 10 mm/95°C (0.39 in/203°F)

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

Radiator

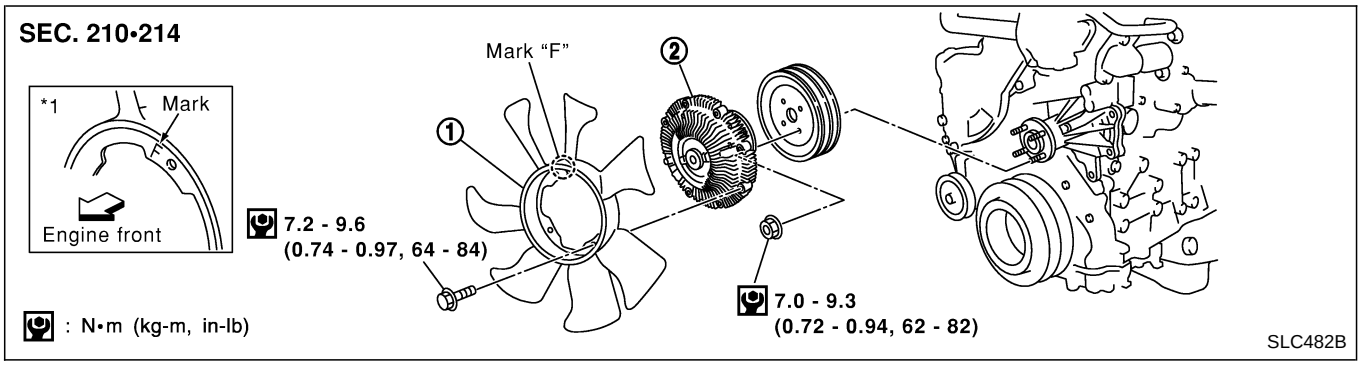


REMOVAL AND INSTALLATION

1. Remove under guard.
2. Drain engine coolant. Refer to MA section, "Changing Engine Coolant".
3. Remove radiator shroud (lower).
4. Remove radiator shroud (upper).
5. Disconnect radiator hose (upper and lower).
6. Disconnect reservoir tank hose.
7. Remove radiator.
8. After repairing or replacing radiator, install all removed parts in reverse order of removal.

Cooling Fan (Crankshaft driven)

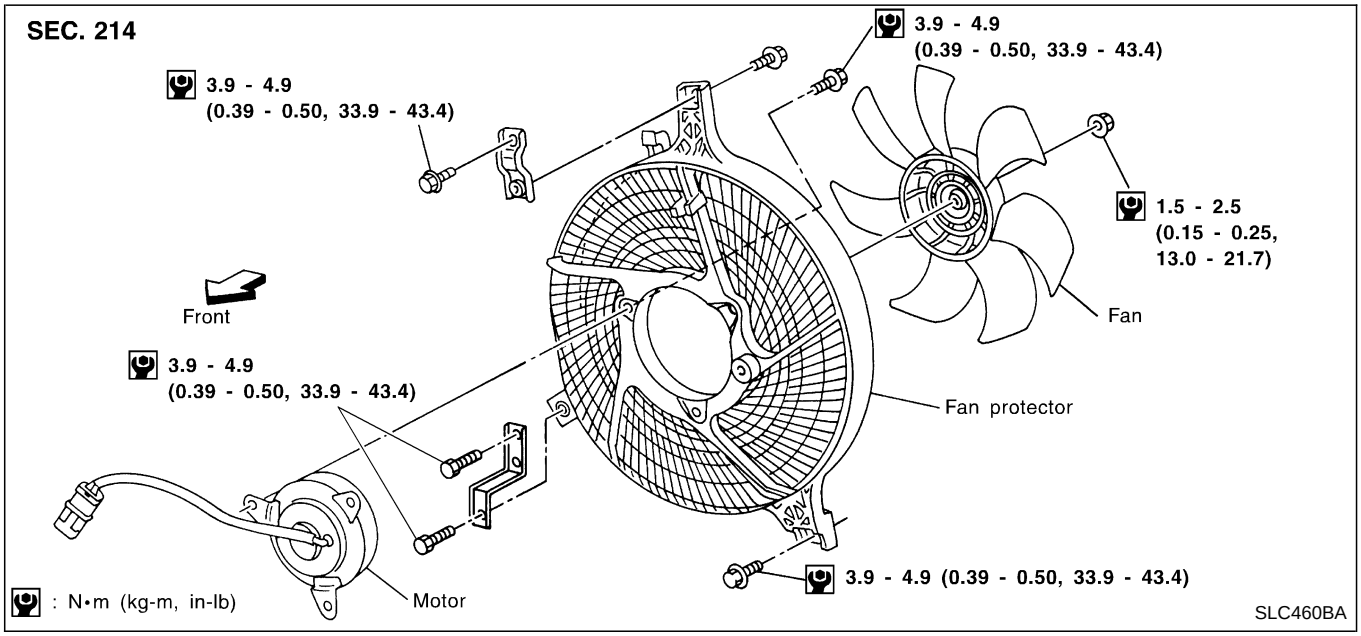
DISASSEMBLY AND INSTALLATION



1. Cooling fan
2. Coupling

- 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 Ⓕ is present, install fan so that side marked Ⓕ faces the front.
- 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 (Motor driven)



REMOVAL AND INSTALLATION

1. Remove front grille.
2. Disconnect harness connector from fan motor.
3. Remove cooling fan.

CAUTION:

Take care to avoid scratching or damaging the air conditioner condenser.

4. Install in the reverse order of removal.

Cooling Fan (Motor driven) (Cont'd)

COOLING FAN CONTROL SYSTEM

Cooling fan is controlled by ECM. For details, refer to EC section, "DTC 0208 OVERHEAT".

Engine Lubrication System

OIL PRESSURE CHECK

Engine speed rpm	Approximate discharge pressure kPa (bar, kg/cm^2, psi)
Idle speed	More than 140 (1.40, 1.43, 20.3)
2,000	More than 270 (2.69, 2.75, 39.1)
4,000	More than 430 (4.29, 4.38, 62.3)

OIL PUMP

Unit: mm (in)

Housing to outer rotor radial clearance **1**	0.114 - 0.260 (0.0045 - 0.0102)
Inner rotor to outer rotor tip clearance **2**	Below 0.180 (0.0071)
Housing to inner rotor axial clearance **3**	0.050 - 0.090 (0.0020 - 0.0035)
Housing to outer rotor axial clearance **4**	0.030 - 0.190 (0.0012 - 0.0075)
Inner rotor to brazed portion of housing clearance **5**	0.045 - 0.091 (0.0018 - 0.0036)

OIL PUMP REGULATOR VALVE

Unit: mm (in)

Regulator valve to oil pump cover clearance **6**	0.040 - 0.097 (0.0016 - 0.0038)

Engine Cooling System

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 (0.59, 0.6, 9)
Leakage test pressure		157 (1.57, 1.6, 23)

THERMOSTAT

Valve opening temperature	Above 80 - 84°C (176 - 183°F)
Valve lift	More than 10 mm/95°C (0.394 in/203°F)