

ENGINE LUBRICATION & COOLING SYSTEMS

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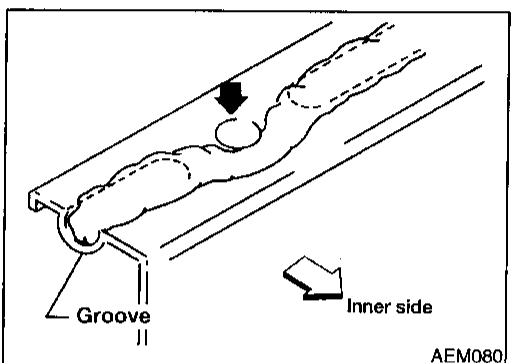
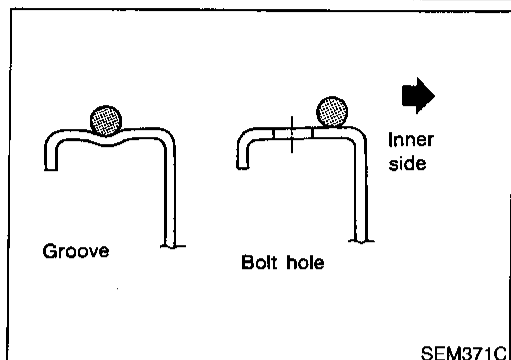
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ENGINE LUBRICATION SYSTEM

Precautions



Precautions

LIQUID GASKET APPLICATION PROCEDURE

NBLC0001

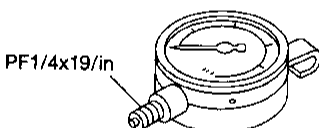
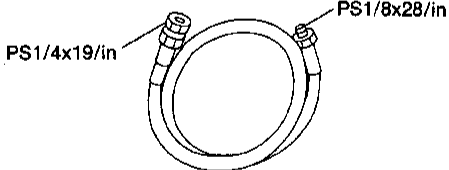
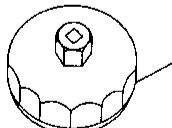
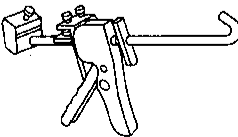
1. Use a scraper to remove all traces of old liquid gasket from mating surface and grooves. Also, completely clean any oil from these areas.
2. Apply a continuous bead of liquid gasket to mating surfaces. (Use Genuine RTV silicone sealant Part No. 999MP-A7007 or equivalent.)
 - Be sure liquid gasket is 3.5 to 4.5 mm (0.138 to 0.177 in) dia. (for oil pan).
 - Be sure liquid gasket is 2.0 to 3.0 mm (0.079 to 0.118 in) dia. (in areas except oil pan).
3. Apply liquid gasket around the inner side of bolt holes (unless otherwise specified).
4. Assembly should be done within 5 minutes after coating.
5. Wait at least 30 minutes before refilling engine oil and engine coolant.

Preparation

SPECIAL SERVICE TOOLS

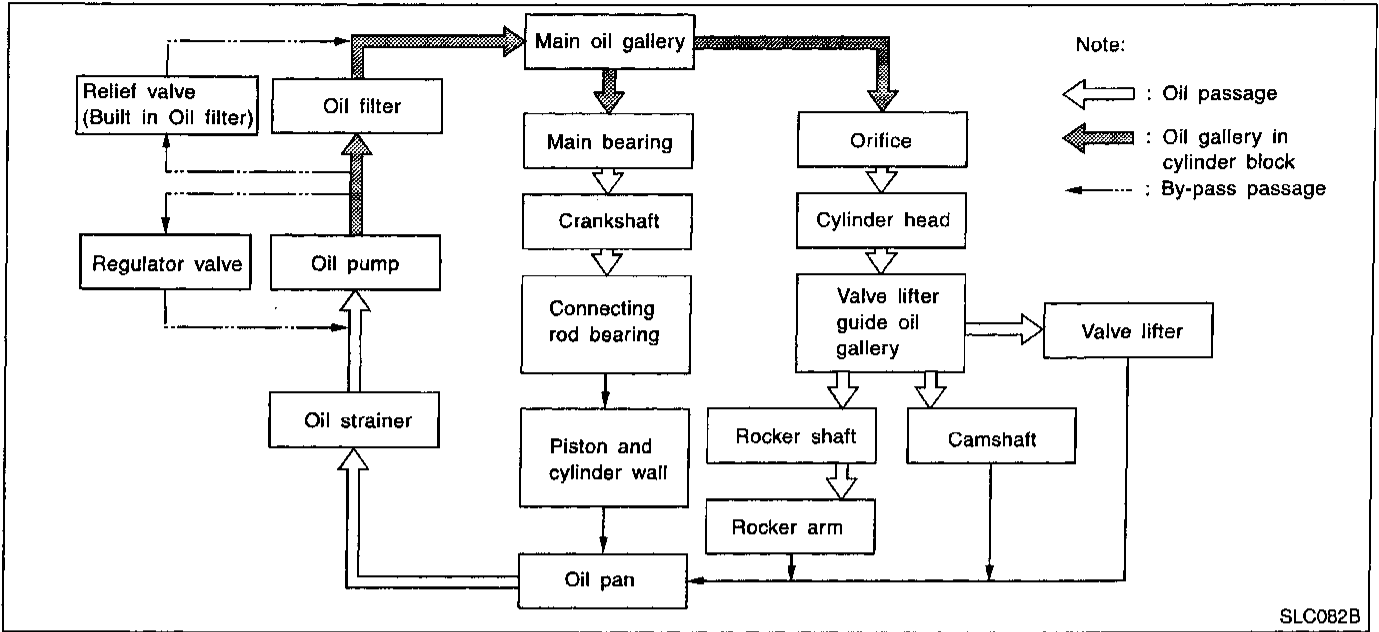
The actual shapes of Kent-Moore tools may differ from those of special service tools illustrated here.

NBLC0002

Tool number (Kent-Moore No.) Tool name	Description
ST25051001 (J25695-1) Oil pressure gauge	 Measuring oil pressure Maximum measuring range: 2,452 kPa (25 kg/cm ² , 356 psi)
NT558	
ST25052000 (J25695-2) Hose	 Adapting oil pressure gauge to cylinder block
NT559	
KV10115801 (J38956) Oil filter wrench	 14 faces, Inner span: 64.3 mm (2.531 in) (Face to opposite face)
NT362	
WS39930000 () Tube presser	 Pressing the tube of liquid gasket
NT052	

Lubrication Circuit

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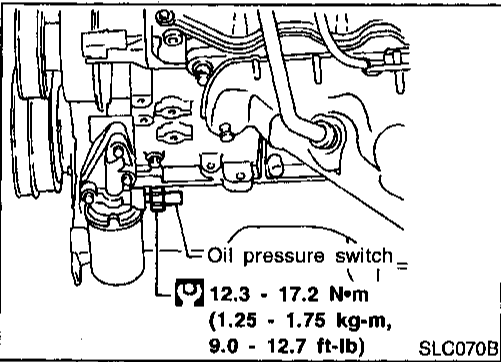
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Oil Pressure Check

NBLC0004

WARNING:

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

- Oil pressure check should be done in "Parking position".

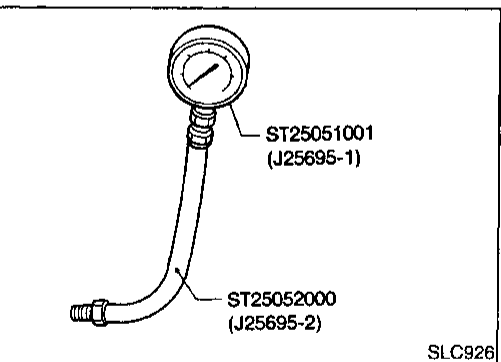
1. Check oil level.
2. Remove oil pressure switch.

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 (kg/cm ² , psi)
Idle speed	More than 59 (0.6, 9)
2,000	412 - 451 (4.2 - 4.6, 60 - 65)

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

6. Install oil pressure switch with sealant.



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ENGINE LUBRICATION SYSTEM

Oil Pump

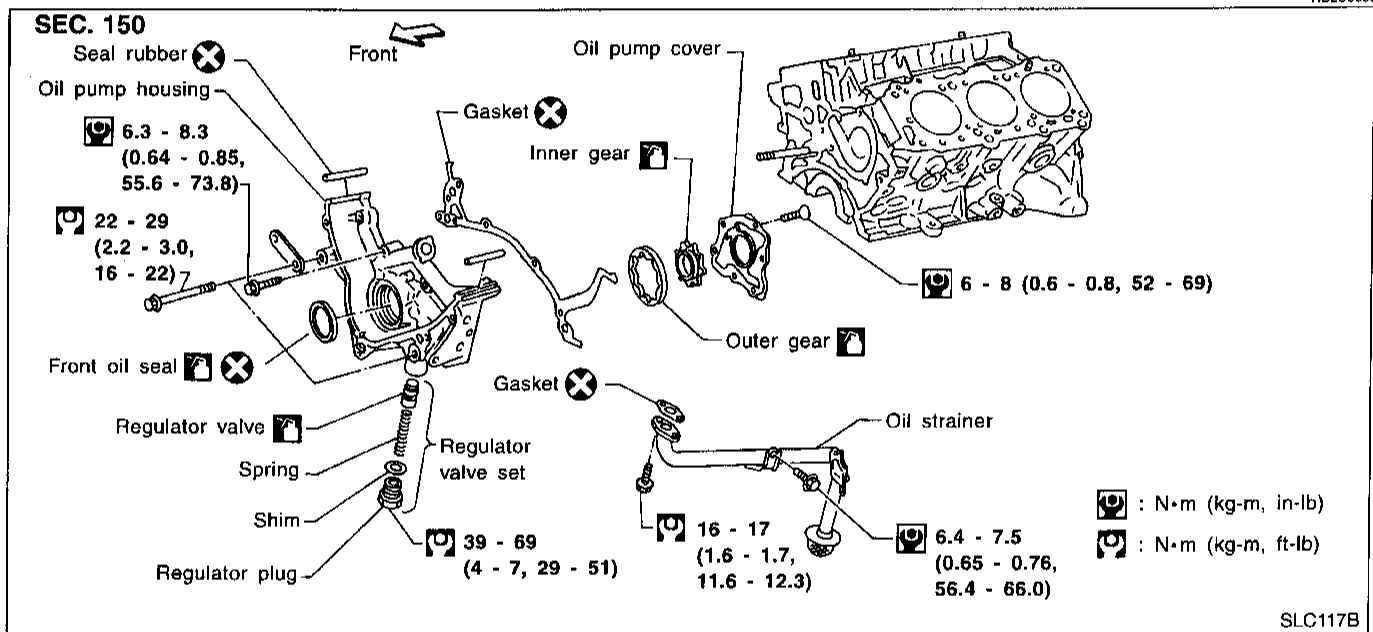
REMOVAL AND INSTALLATION

NBLC0005

1. Drain engine oil.
2. Drain engine coolant from drain plug on radiator.
3. Remove air duct (from mass air flow sensor to throttle body).
4. Remove cooling fan.
5. Remove radiator hoses (upper and lower) and fan shroud. Refer to "Radiator".
6. Remove drive belts. Refer to MA section ("Checking Drive Belts").
7. Remove crankshaft pulley and front upper and lower belt covers. Refer to EM section ("TIMING BELT").
8. Remove oil pan. Refer to EM section ("OIL PAN").
9. Remove oil strainer.
10. Remove oil pump assembly.

DISASSEMBLY AND ASSEMBLY

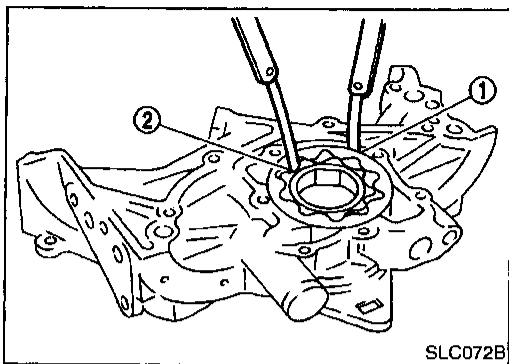
NBLC0006



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

ENGINE LUBRICATION SYSTEM

Oil Pump (Cont'd)



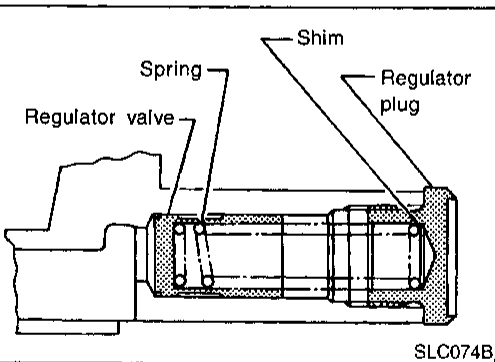
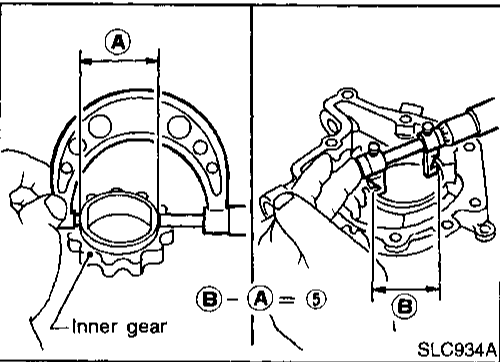
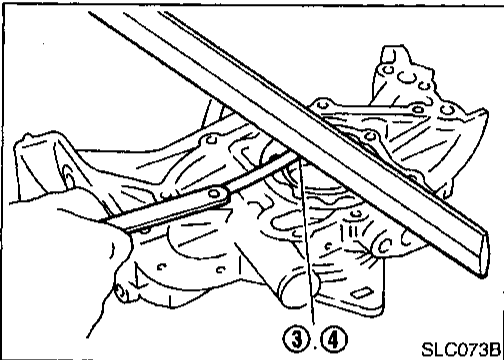
INSPECTION

Using a feeler gauge, straightedge and micrometers, check the following clearances: NBLC0007

Unit: mm (in)

Body to outer gear radial clearance 1	0.114 - 0.200 (0.0045 - 0.0079)
Inner gear to outer gear tip clearance 2	Below 0.18 (0.0071)
Body to inner gear axial clearance 3	0.05 - 0.09 (0.0020 - 0.0035)
Body to outer gear axial clearance 4	0.050 - 0.110 (0.0020 - 0.0043)
Inner gear to brazed portion of housing clearance 5	0.045 - 0.091 (0.0018 - 0.0036)

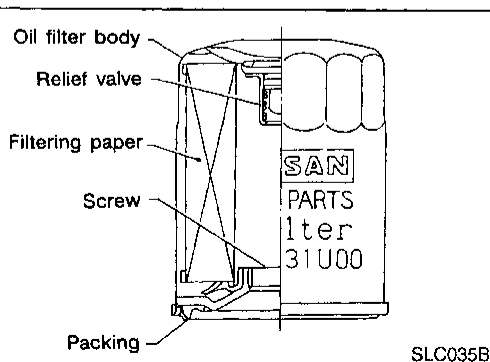
- If the tip clearance (2) exceeds the limit, replace gear set.
- If body to gear clearances (1, 3, 4, 5) exceed the limit, replace oil pump body assembly.



REGULATOR VALVE INSPECTION

1. Visually inspect components for wear and damage. NBLC0008
2. Check oil pressure regulator valve sliding surface and valve spring. ST
3. Coat regulator valve with engine oil. Check that it falls smoothly into the valve hole by its own weight. RS

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



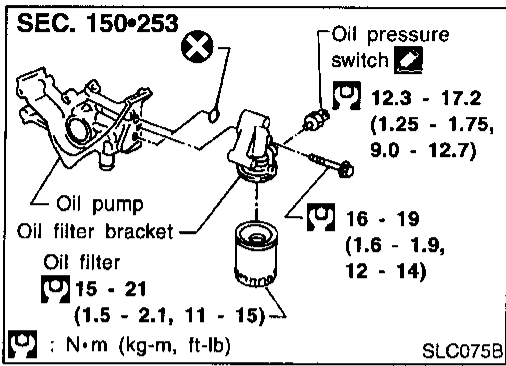
OIL FILTER

The oil filter is a small, full-flow cartridge type and is provided with a relief valve. NBLC0009

- The new and previous oil filter designs differ from each other and are not interchangeable. EL
- Use Tool KV10115801 (J38956) for removing oil filter. IDX

ENGINE LUBRICATION SYSTEM

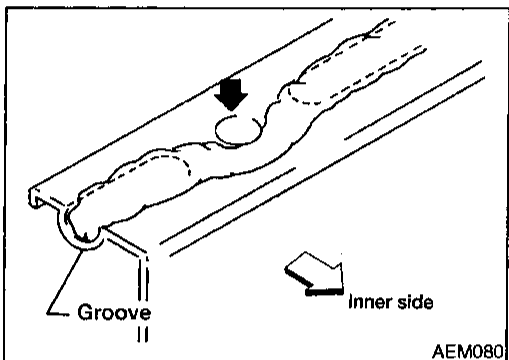
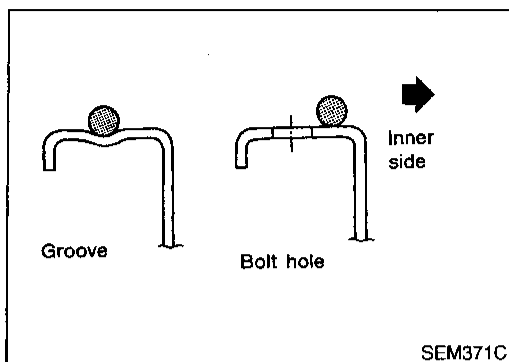
Oil Pump (Cont'd)



OIL FILTER BRACKET

NBLC0010

1. Remove oil filter.
2. Disconnect oil pressure switch and connector.
3. Remove oil filter bracket.



Precautions

LIQUID GASKET APPLICATION PROCEDURE

NBLC0014

1. Use a scraper to remove all traces of old liquid gasket from mating surface and grooves. Also, completely clean any oil from these areas.
2. Apply a continuous bead of liquid gasket to mating surfaces. (Use Genuine RTV silicone sealant Part No. 999MP-A7007 or equivalent.)
 - Be sure liquid gasket is 3.5 to 4.5 mm (0.138 to 0.177 in) dia. (for oil pan).
 - Be sure liquid gasket is 2.0 to 3.0 mm (0.079 to 0.118 in) dia. (in areas except oil pan).
3. Apply liquid gasket around the inner side of bolt holes (unless otherwise specified).
4. Assembly should be done within 5 minutes after coating.
5. Wait at least 30 minutes before refilling engine oil and engine coolant.

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Preparation

SPECIAL SERVICE TOOLS

NBLC0015

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

Tool number (Kent-Moore No.) Tool name	Description	
EG17650301 (J33984-A) Radiator cap tester adapter	<p>a: 28 (1.10) dia. b: 31.4 (1.236) dia. c: 41.3 (1.626) dia. Unit: mm (in)</p>	Adapting radiator cap tester to radiator filler neck
WS39930000 (—) Tube presser		Pressing the tube of liquid gasket
KV99103510 (—) Radiator plate pliers A		Installing radiator upper and lower tanks
KV99103520 (—) Radiator plate pliers B		Removing radiator upper and lower tanks

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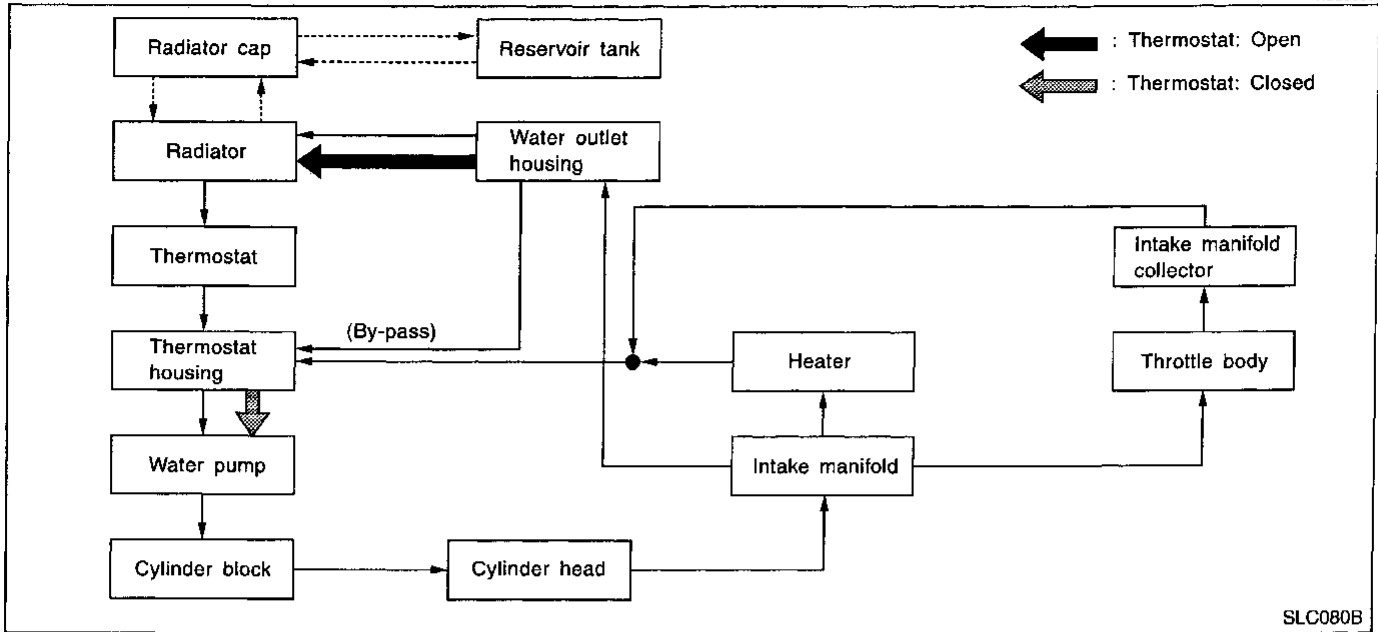
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ENGINE COOLING SYSTEM

Cooling Circuit

Cooling Circuit

NBLC0016



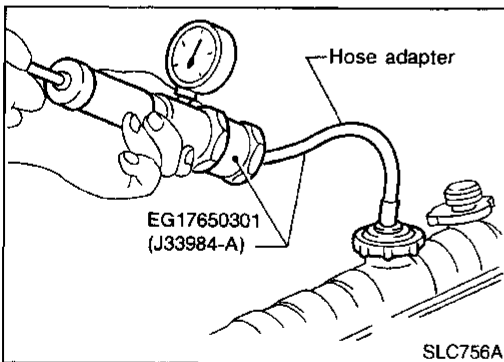
System Check

NBLC0017

WARNING:

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

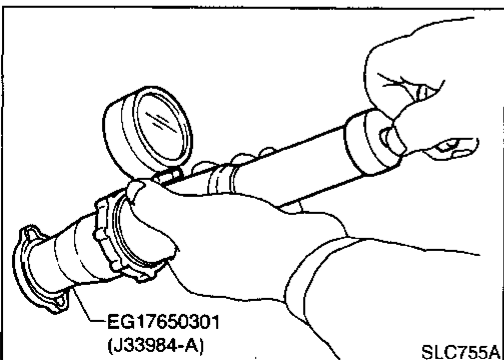
Wrap a thick cloth around the cap. Slowly turn it a quarter turn to allow built-up pressure to escape. Carefully remove the cap by turning it all the way.



CHECKING COOLING SYSTEM HOSES

NBLC0017S01

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



CHECKING RADIATOR CAP

NBLC0017S02

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

Radiator cap relief pressure:

Standard

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

Limit

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

CHECKING COOLING SYSTEM FOR LEAKS

NBLC0017S03

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

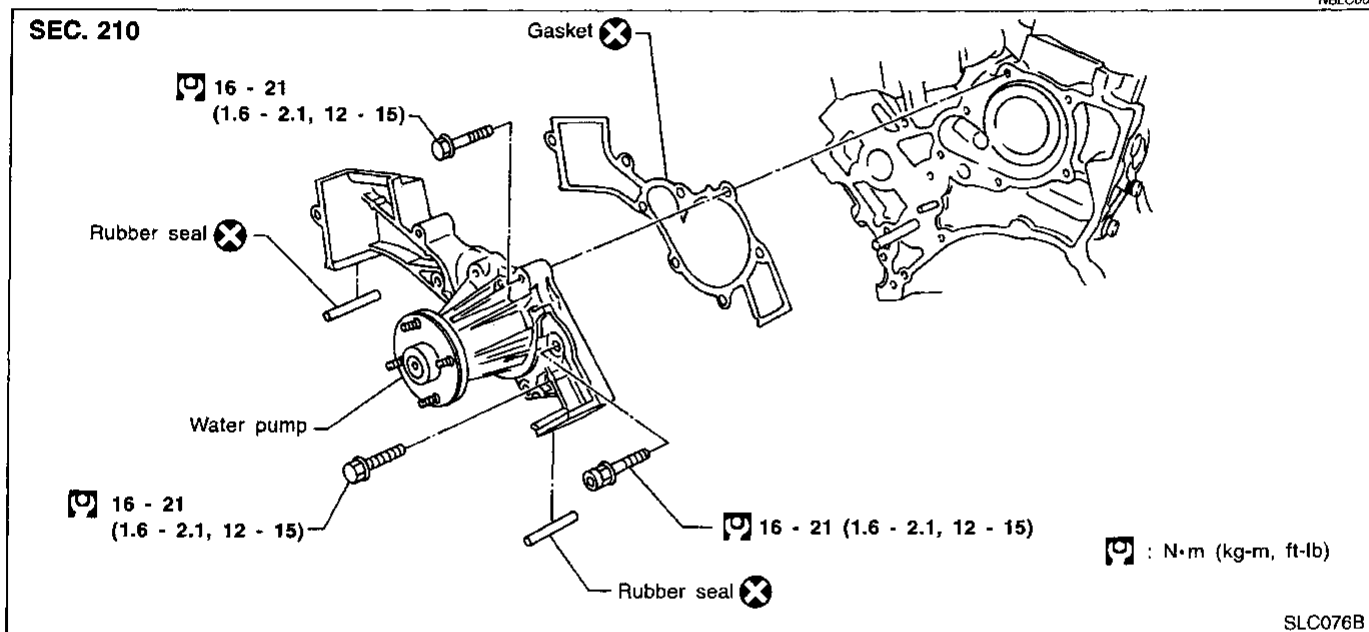
Testing pressure: 157 kPa (1.6 kg/cm², 23 psi)

CAUTION:

Higher pressure than specified may cause radiator damage.

Water Pump REMOVAL AND INSTALLATION

NBLC0018

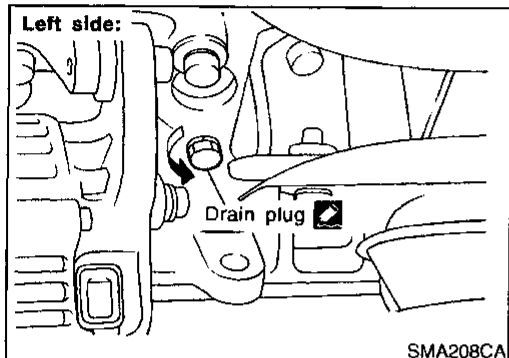
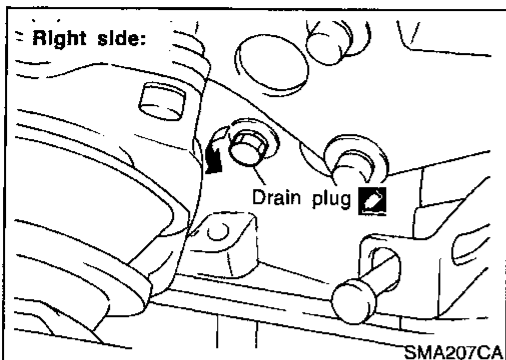


CAUTION:

- When removing water pump assembly, be careful not to get coolant on timing 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.
- To avoid deforming timing cover, make sure there is adequate clearance between it and the hose clamp.

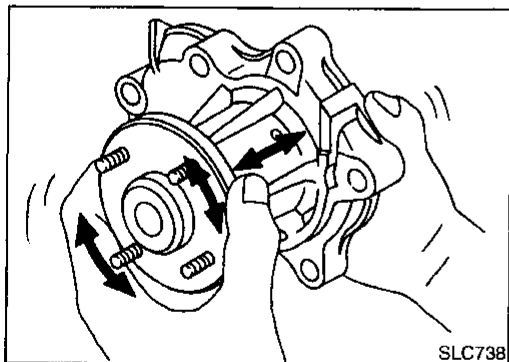
ENGINE COOLING SYSTEM

Water Pump (Cont'd)



1. Drain coolant from drain plugs on both sides of cylinder block and radiator. Refer to MA section ("Changing Engine Coolant").

2. Remove radiator hoses (upper and lower) and fan shroud. Refer to "Radiator".
3. Remove drive belts. Refer to MA section ("Checking Drive Belts").
4. Remove water pump pulley.
5. Remove crankshaft pulley and front (upper and lower) belt cover. Refer to EM section ("TIMING BELT").
6. Remove water pump.



INSPECTION

1. Check for badly rusted or corroded body assembly and vanes. NBLC0019
2. Check for rough operation due to excessive end play.

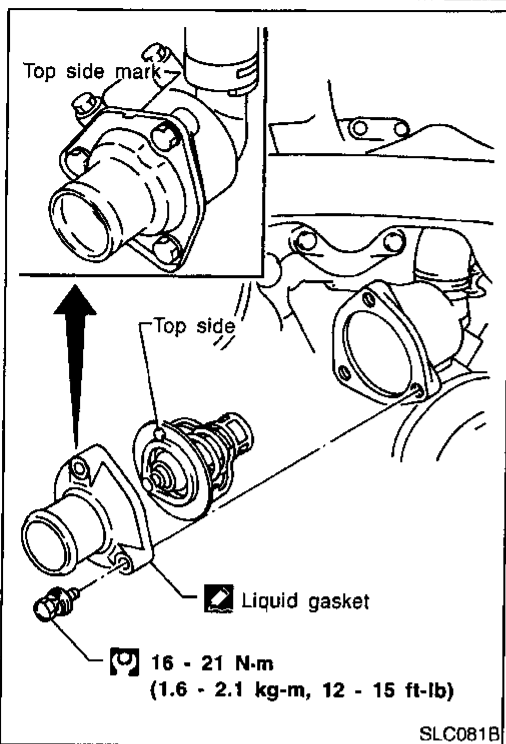
Thermostat

REMOVAL

1. Drain engine coolant from drain plugs on radiator. NBLC0020
2. Remove radiator hoses (upper and lower) and fan shroud.
3. Remove drive belts.
4. Remove pulley bracket.
5. Remove water inlet and thermostat assembly.

ENGINE COOLING SYSTEM

Thermostat (Cont'd)



INSPECTION

1. Check valve seating condition at ordinary temperatures. It should seat tightly. NBL C0021

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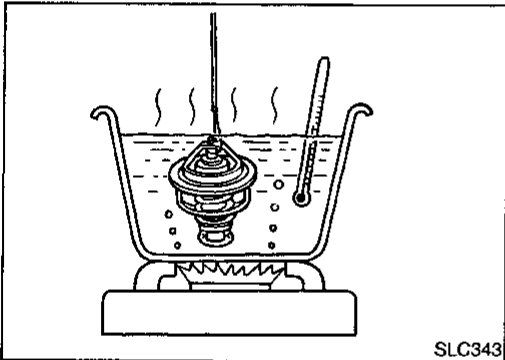
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2. Check valve opening temperature and valve lift.

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

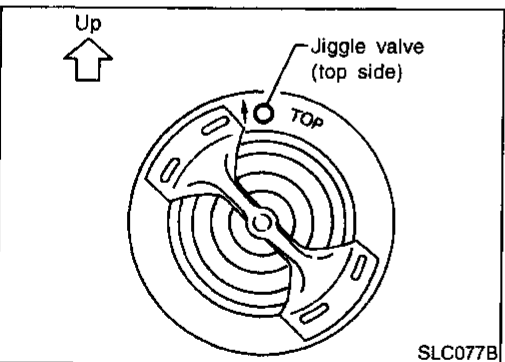
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3. Then check if valve is closed at 5°C (9°F) below valve opening temperature.

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INSTALLATION

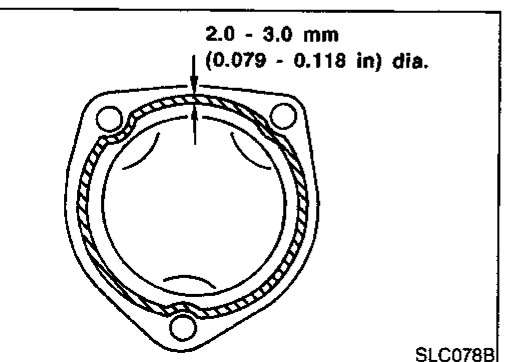
1. Install thermostat with jiggle valve or air bleeder at upper side. NBL C0022

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2. When installing water inlet apply liquid gasket as shown.
 - 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.

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ENGINE COOLING SYSTEM

Radiator

Radiator

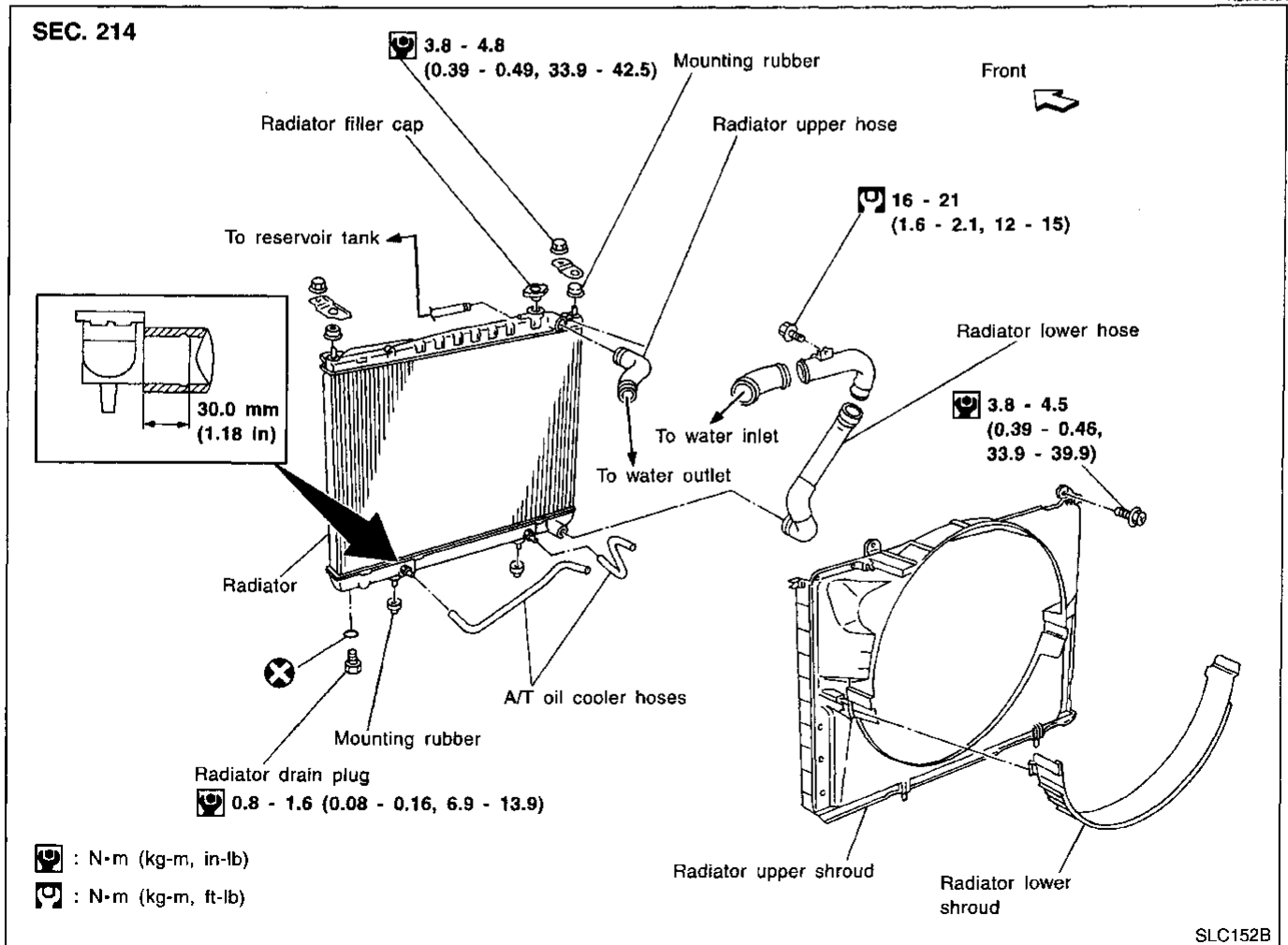
REMOVAL AND INSTALLATION

NBLC0023

1. Remove under cover.
2. Drain coolant from radiator drain plug.
3. Remove air duct. (From mass air flow sensor to throttle body)
4. Disconnect radiator upper and lower hoses.
5. Remove A/T oil cooler hoses.
6. Remove radiator lower shroud.
7. Disconnect reservoir tank hose.
8. Remove radiator.
9. After repairing or replacing radiator, install any part removed in reverse order of removal.

COMPONENTS

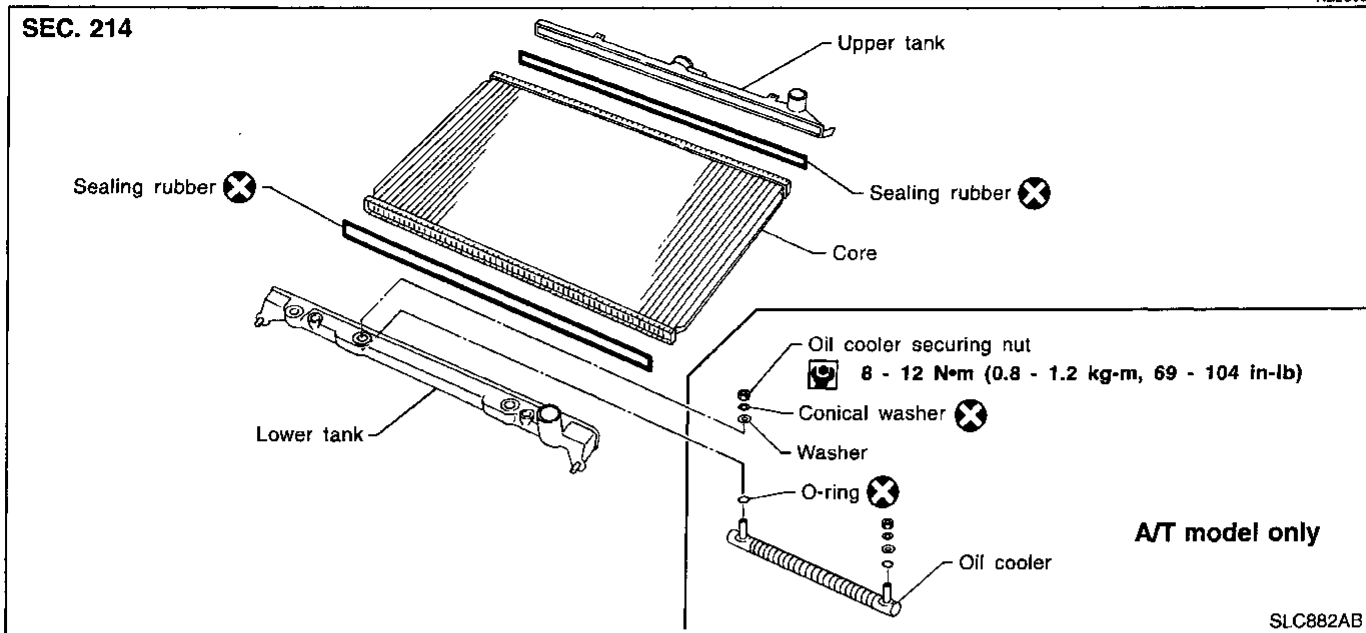
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PREPARATION

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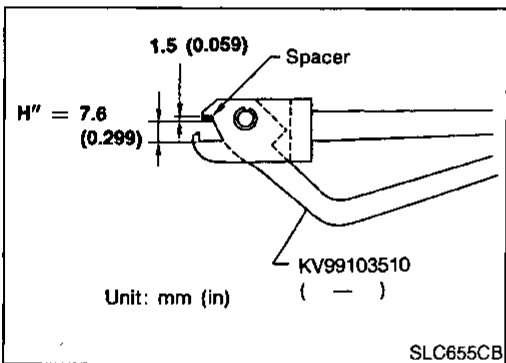
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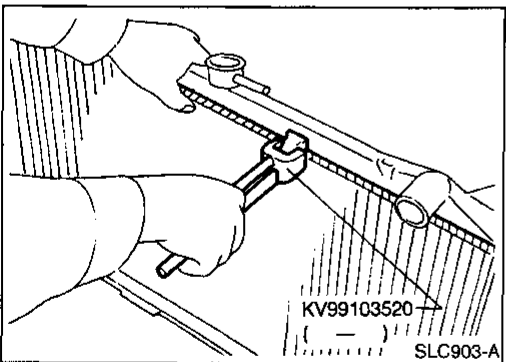
1. Attach the spacer to the tip of the radiator plate pliers A. Spacer specification: 1.5 mm (0.059 in) thick x 18 mm (0.71 in) wide x 8.5 mm (0.335 in) long.
2. Make sure that when radiator plate pliers A are closed dimension H'' is approx. 7.6 mm (0.299 in).
3. Adjust dimension H'' with the spacer, if necessary.

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DISASSEMBLY

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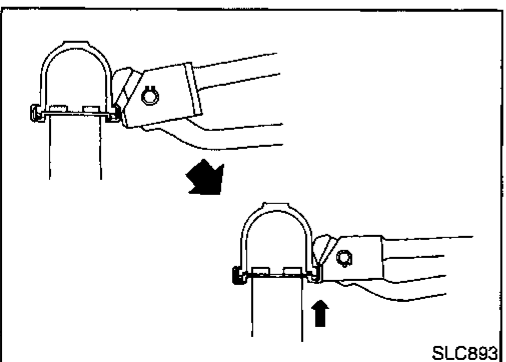
1. Remove tank with Tool.

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

Do not bend excessively.

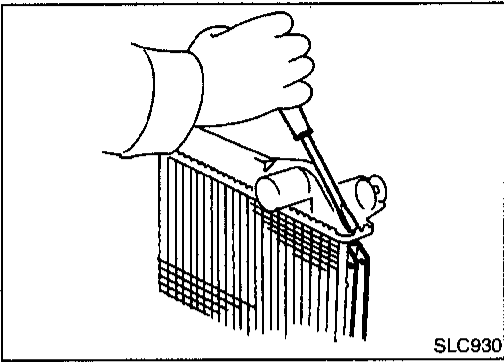
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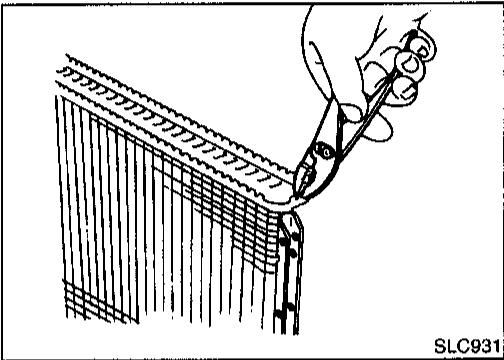
ENGINE COOLING SYSTEM

Radiator (Cont'd)

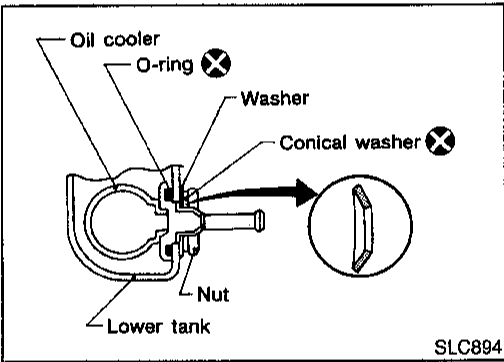


- In areas where Tool cannot be used, use a screwdriver to bend the edge up.

Be careful not to damage tank.



2. Make sure the edge stands straight up.
3. Remove oil cooler from tank.

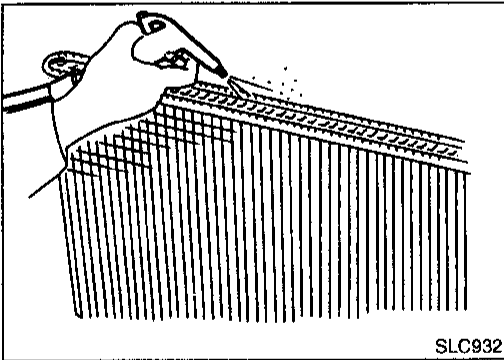


ASSEMBLY

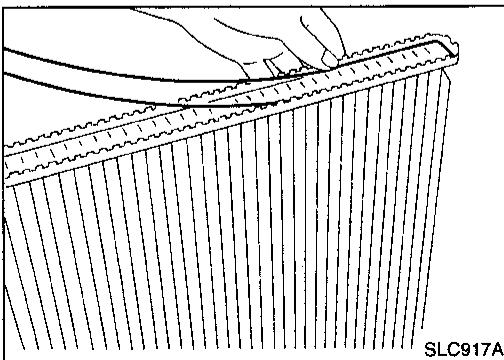
1. Install oil cooler.

Pay attention to direction of conical washer.

NBLC0027



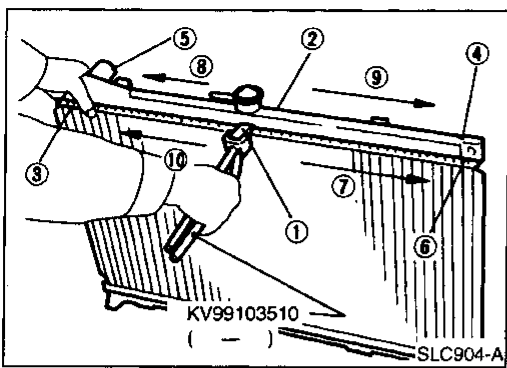
2. Clean contact portion of tank.



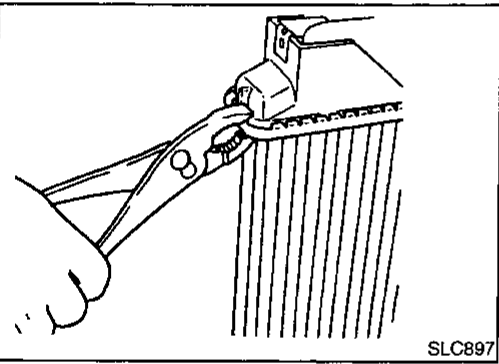
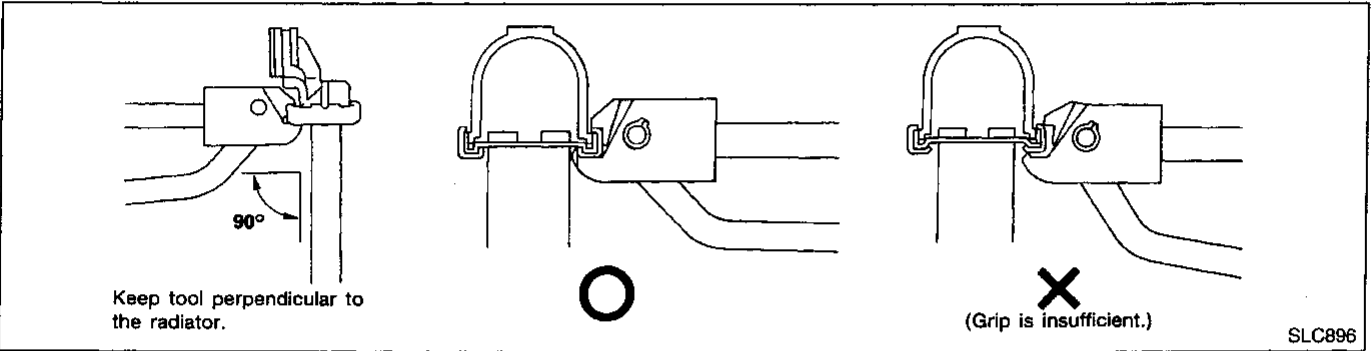
3. Install sealing rubber.
Push it in with fingers.
Be careful not to twist sealing rubber.

ENGINE COOLING SYSTEM

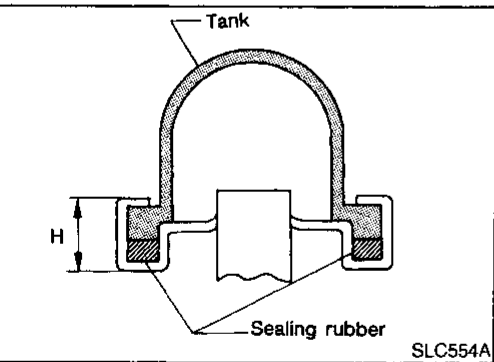
Radiator (Cont'd)



4. Caulk tank in specified sequence with Tool.



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



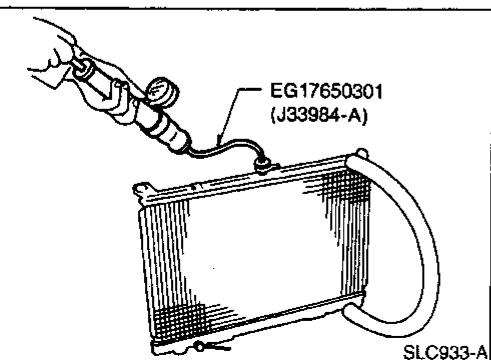
5. Make sure that the rim is completely crimped down.

Standard height "H":

8.0 - 8.4 mm (0.315 - 0.331 in)

6. Confirm that there is no leakage.

Refer to Inspection.



INSPECTION

1. Apply pressure with Tool.

Specified pressure value:

157 kPa (1.6 kg/cm², 23 psi)

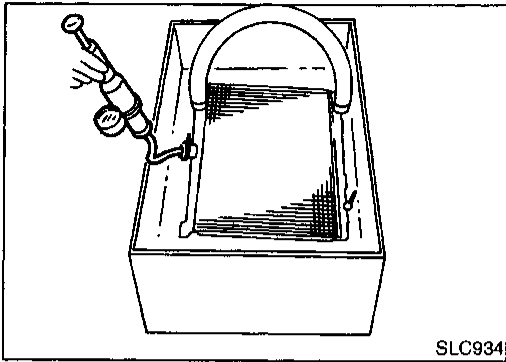
WARNING:

To prevent the risk of the hose coming undone while under pressure, securely fasten it down with a hose clamp. Attach a hose to the oil cooler as well.

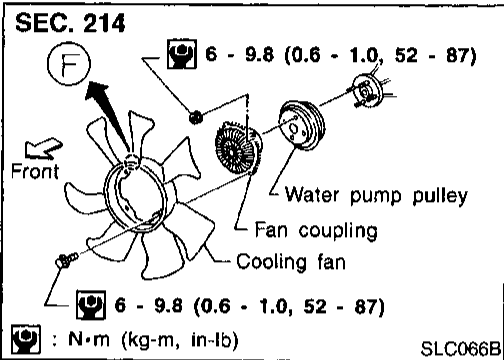
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ENGINE COOLING SYSTEM

Radiator (Cont'd)

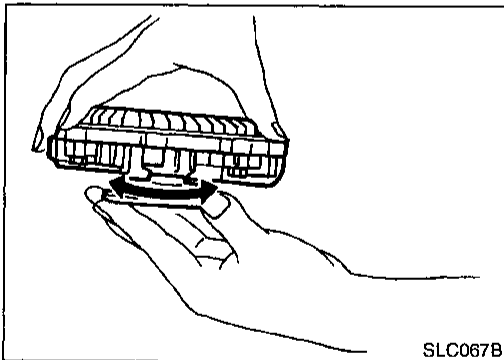


2. Check for leakage.



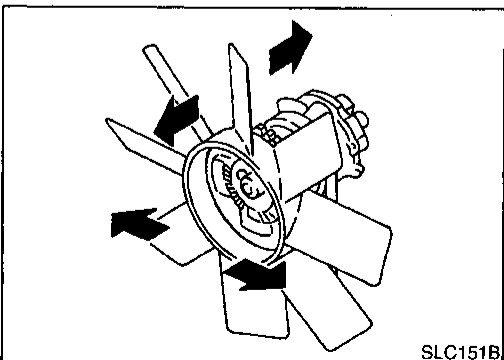
Cooling Fan (Crankshaft driven) REMOVAL AND INSTALLATION

- Do not release the drive belt tension by removing the fan/water pump pulley. NBLC0029
- 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.



INSPECTION

Check fan coupling for rough operation, wobbling, oil leakage or bent bimetal. NBLC0030



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.

ENGINE COOLING SYSTEM

Refilling Engine Coolant

Refilling Engine Coolant

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

NBLC0032

Overheating Cause Analysis

		Symptom	Check items		
Cooling system parts malfunction	Poor heat transfer	Water pump malfunction	—	—	
		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	
Radiator		Poor sealing	—		
		O-ring for damage, deterioration or improper fitting			
		Cracked radiator tank			
Cracked radiator core		—			
Reservoir tank	Cracked reservoir tank				
Overflowing reservoir tank	Exhaust gas leaks into cooling system	Cylinder head deterioration	—		
		Cylinder head gasket deterioration			

ENGINE COOLING SYSTEM

Overheating Cause Analysis (Cont'd)

		Symptom		Check items	
Except cooling system parts malfunction	—	Overload on engine	Abusive driving	High engine rpm under no load	—
				Driving in low gear for extended time	
				Driving at extremely high speed	
			Powertrain system malfunction		
			Installed improper size wheels and tires		
				Dragging brakes	
				Improper ignition timing.	
	Blocked or restricted air flow	Blocked bumper	—	—	
		Blocked radiator grille	Installed car brassiere		
			Mud contamination or paper clogging		
Blocked radiator		—			
Blocked condenser		---			
Installed large fog lamp	---				

SERVICE DATA AND SPECIFICATIONS (SDS)

Oil Pressure

Oil Pressure

NBLC0011

Engine speed rpm	Approximate discharge pressure kPa (kg/cm ² , psi)
Idle speed	More than 59 (0.6, 9)
2,000	412 - 451 (4.2 - 4.6, 60 - 65)

GI

MA

Regulator Valve

NBLC0012

Unit: mm (in)

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

LC

Oil Pump

NBLC0013

Unit: mm (in)

Body to outer gear radial clearance	0.114 - 0.200 (0.0045 - 0.0079)
Inner gear to outer gear tip clearance	Below 0.18 (0.0071)
Body to inner gear axial clearance	0.05 - 0.09 (0.0020 - 0.0035)
Body to outer gear axial clearance	0.050 - 0.110 (0.0020 - 0.0043)
Inner gear to brazed portion of housing clearance	0.045 - 0.091 (0.0018 - 0.0036)

EC

FE

AT

Thermostat

NBLC0033

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

TF

PD

Radiator

NBLC0034

Unit: kPa (kg/cm², psi)

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

AX

SU

BR

ST

RS

BT

HA

SC

EL

IDX