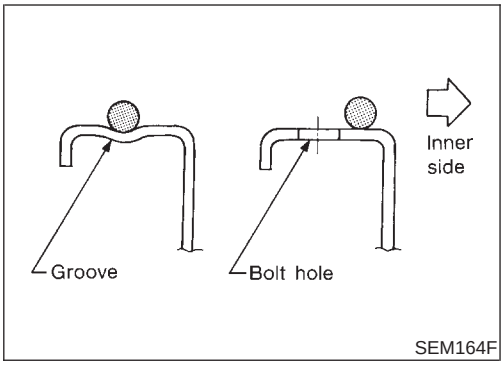
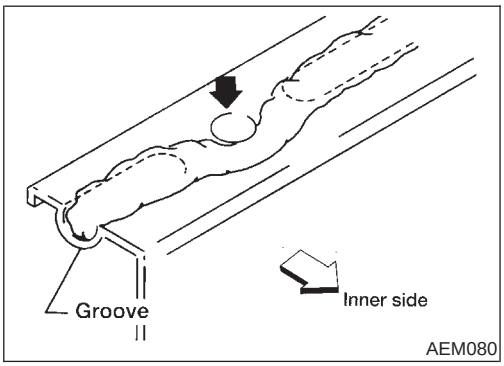
ENGINE LUBRICATION & COOLING SYSTEMS

SECTION LC

CONTENTS



SEM164F



AEM080

Precautions

LIQUID GASKET APPLICATION PROCEDURE

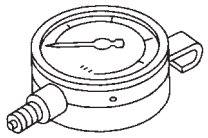
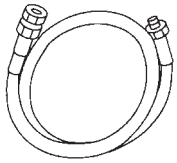
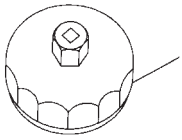
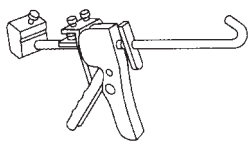
NMLC0001

1. Use a scraper to remove all traces of old liquid gasket from mating surfaces and grooves. Also, completely clean any oil from these areas.
2. 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 4.0 to 5.0 mm (0.157 to 0.197 in).
   - For areas except oil pan, be sure liquid gasket diameter is 2.0 to 3.0 mm (0.079 to 0.118 in).
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

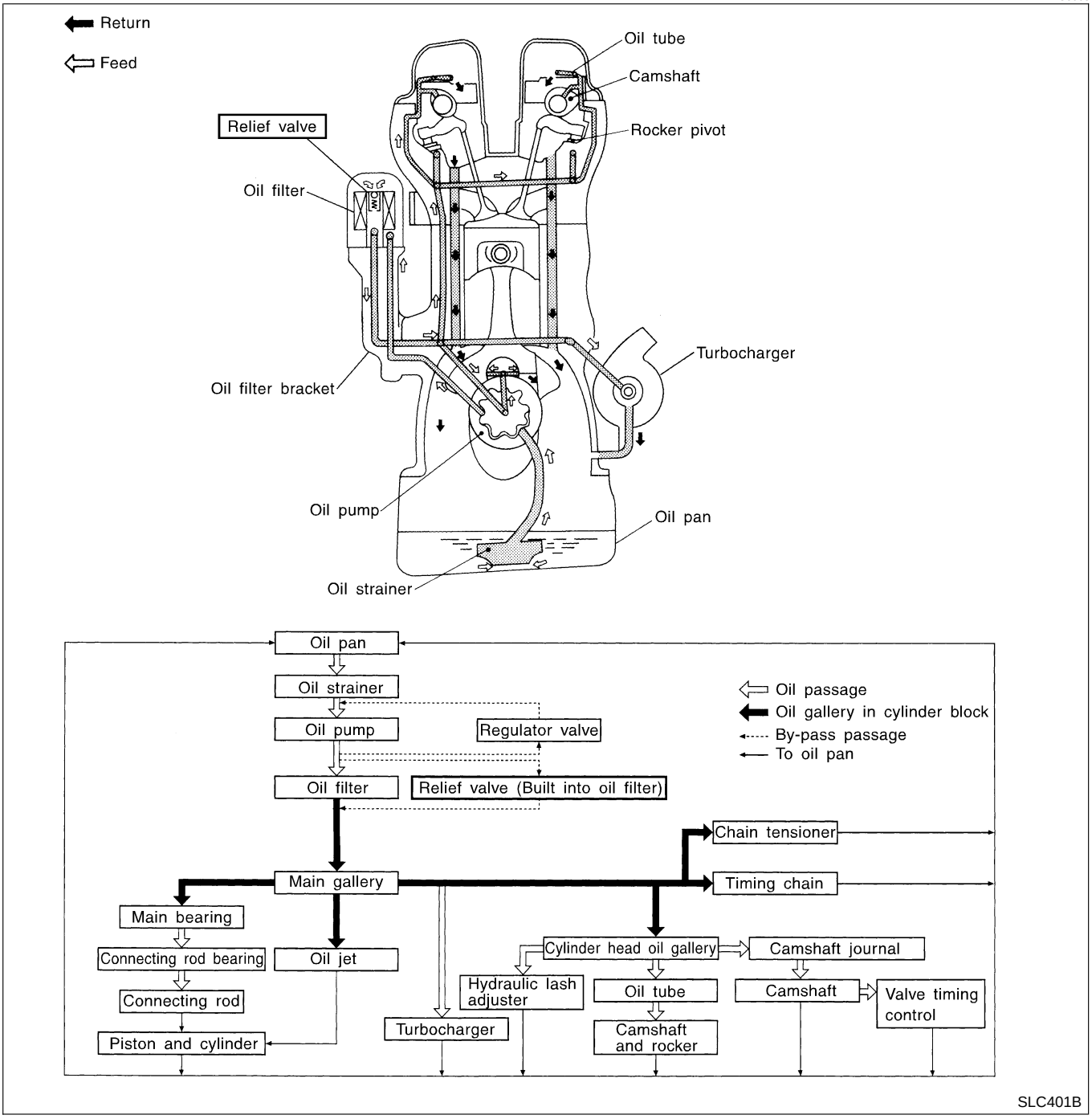
SPECIAL SERVICE TOOLS

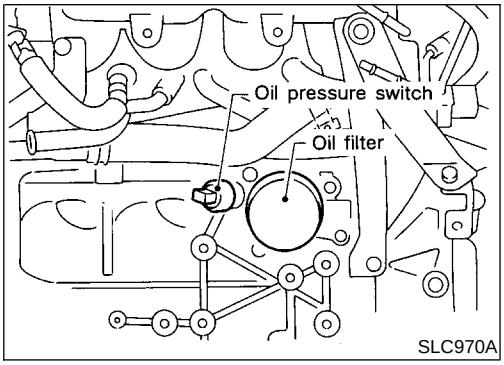
NMLC0002

Tool number Tool name	Description	
ST25051001 Oil pressure gauge	 NT050	
ST25052000 Hose	 NT051	Adapting oil pressure gauge to cylinder block
KV10115801 Oil filter wrench	 NT362	Removing oil filter
WS39930000 Tube presser	 NT052	Pressing the tube of liquid gasket

Lubrication Circuit

NMLC0003





Oil Pressure Check

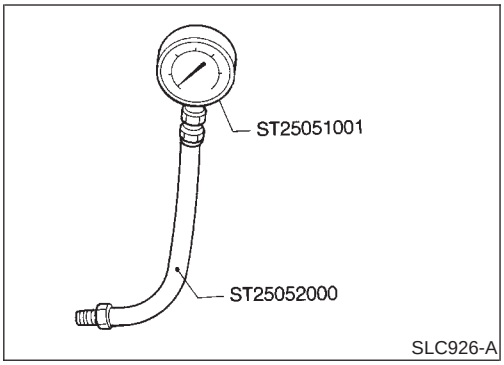
NMLC0004

WARNING:

- **Be careful not to burn yourself, as the engine and oil may be hot.**
- **For M/T models, put gearshift lever in Neutral “N” position. For A/T models, put selector lever in Park “P” position.**

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

Oil Pressure Check (Cont'd)



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)
3,200	314 - 392 (3.14 - 3.92, 3.2 - 4.0, 46 - 57)

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

6. Install oil pressure switch with sealant.

Oil Pump

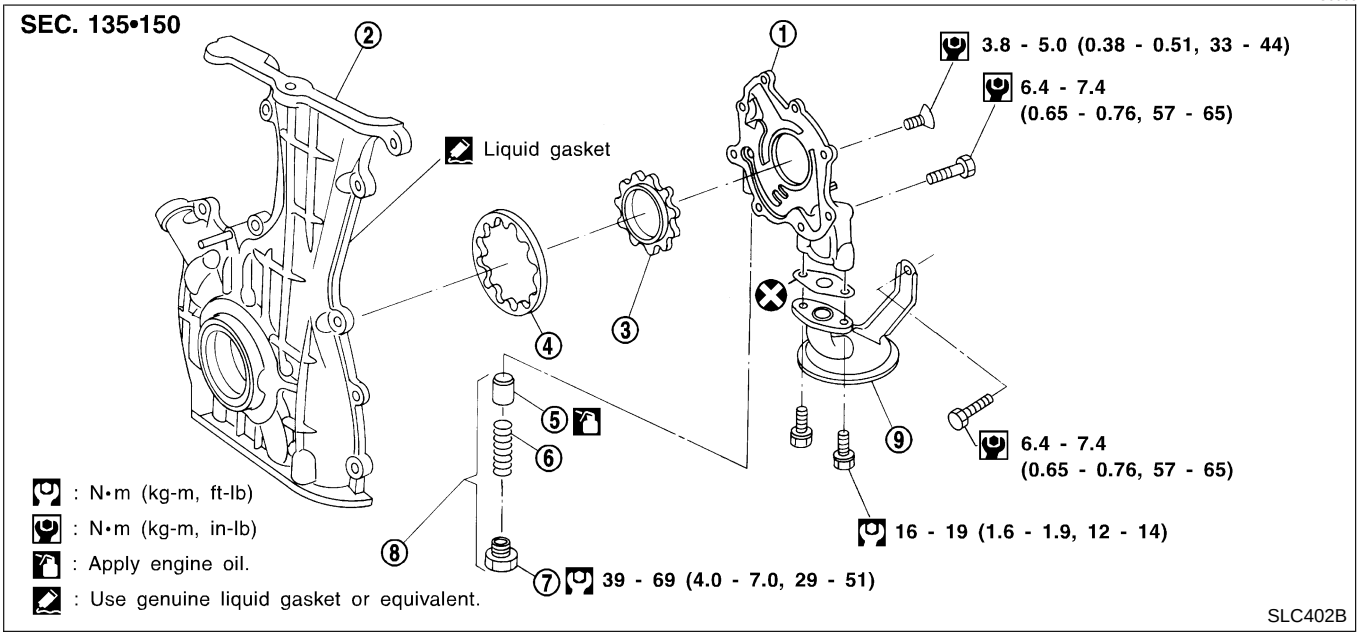
REMOVAL

NMLC0005

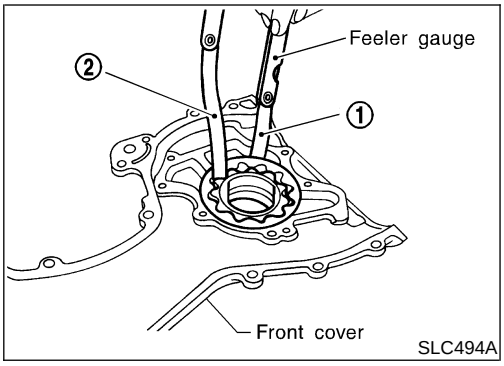
1. Remove front cover.
   Refer to EM-26, "Removal".
2. Remove oil pump cover.

DISASSEMBLY AND ASSEMBLY

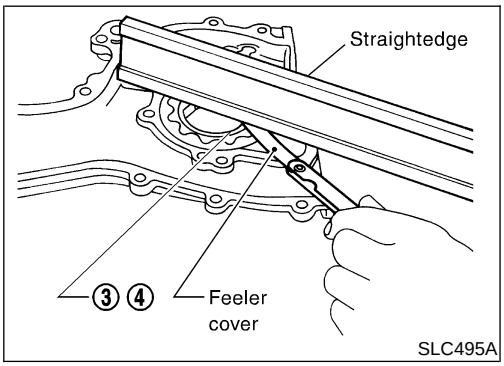
NMLC0006



1. Oil pump cover
2. Front cover
3. Inner rotor
4. Outer rotor
5. Regulator valve
6. Spring
7. Plug
8. Regulator valve assembly
9. Oil strainer



SLC494A



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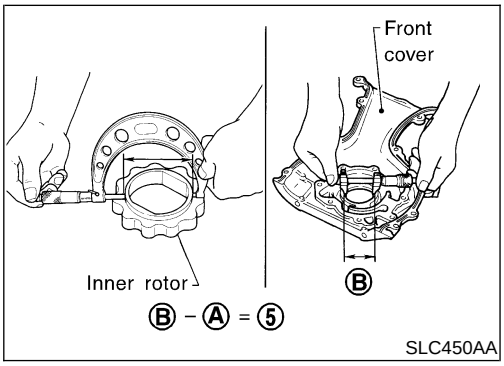


SLC450AA

INSPECTION

NMLC0007

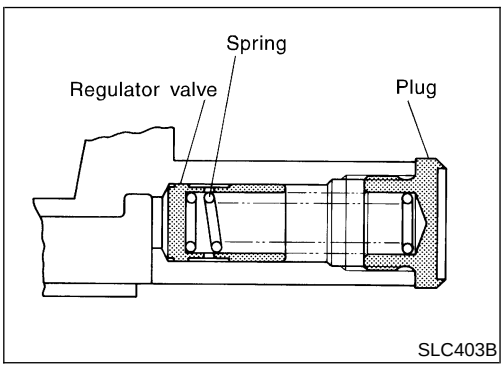
Using a feeler gauge, check the following clearances:

Standard clearance:

Unit: mm (in)

Body to outer rotor radial clearance 1	0.114 - 0.200 (0.0045 - 0.0079)
Inner rotor to outer rotor tip clearance 2	Below 0.18 (0.0071)
Body to inner rotor clearance 3	0.05 - 0.09 (0.0020 - 0.0035)
Body to outer rotor axial clearance 4	0.05 - 0.11 (0.0020 - 0.0043)
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 body to rotor clearances (1, 3, 4, 5) exceed the limit, replace front cover assembly.**



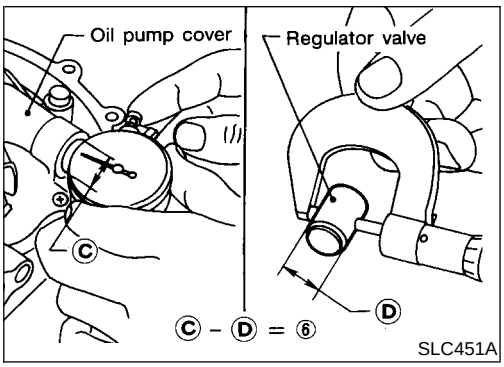
SLC403B

REGULATOR VALVE INSPECTION

NMLC0008

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 assembly.**



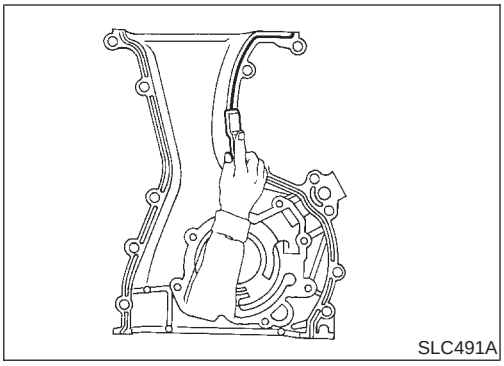
SLC451A

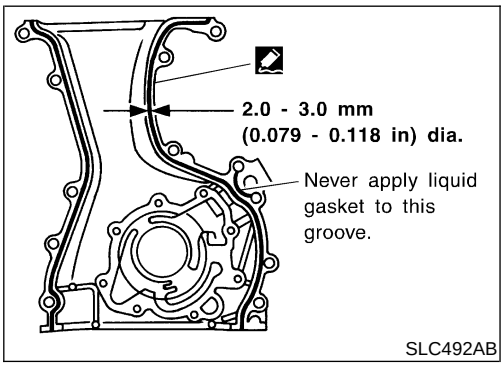
4. Check regulator valve to oil pump cover clearance.

Clearance:

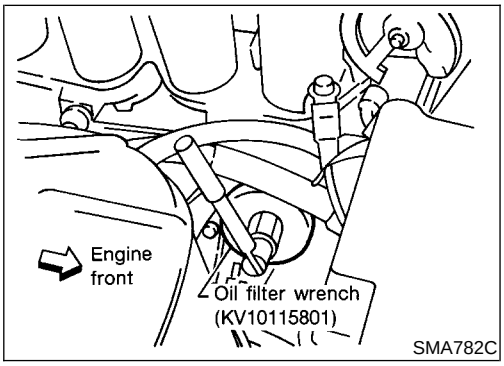
6: 0.040 - 0.097 mm (0.0016 - 0.0038 in)

- **If it exceeds the limit, replace oil pump cover.**


SLC491A



SLC492AB



SMA782C

INSTALLATION

NMLC0009

- **Always replace oil seal, O-ring and gasket with new ones. Refer to EM-34, "FRONT OIL SEAL".**
- **When installing oil pump, apply engine oil to rotor.**
- **Be sure that O-rings are properly fitted.**
- **Use a scraper to remove old liquid gasket from mating surface of front cover.**
- **Also remove traces of liquid gasket from mating surface of cylinder block.**

1. Apply a continuous bead of liquid gasket to mating surface of front cover assembly.
- **Use Genuine Liquid Gasket or equivalent.**
2. Installation is in the reverse order of removal.

Changing Engine Oil

NMLC0031

WARNING:

- **Be careful not to burn yourself, as the engine oil is hot.**
- **Prolonged and repeated contact with used engine oil may cause skin cancer; try to avoid direct skin contact with used oil. If skin contact is made, wash thoroughly with soap or hand cleaner as soon as possible.**

1. Warm up engine, and check for oil leakage from engine components.
2. Stop engine.
3. Remove drain plug and oil filler cap.
4. Drain oil and refill with new engine oil.

Oil specification and viscosity

- API grade SG, SH or SJ
- ILSAC grade GF-I or GF-II
- See "RECOMMENDED FLUIDS AND LUBRICANTS", MA-8.

Oil capacity (Approximate):

Unit: ℓ (US qt, Imp qt)

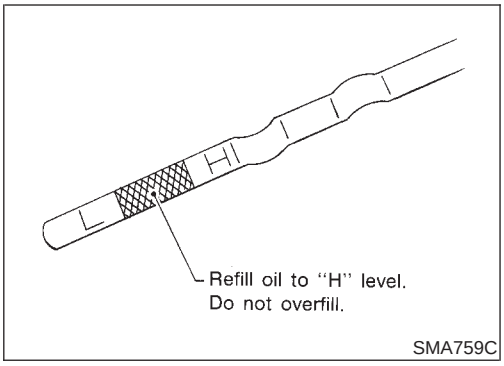
Drain and refill	With oil filter change	3.5 (3-3/4, 3-1/8)
	Without oil filter change	3.3 (3-1/2, 2-7/8)
Dry engine (engine overhaul)		3.8 (4, 3-3/8)

CAUTION:

- **Be sure to clean drain plug and install with new washer.**

  Oil pan drain plug:

  : 29 - 39 N·m (3.0 - 4.0 kg-m, 22 - 29 ft-lb)
- **The refill capacity depends on the oil temperature and drain time. Use these specifications for reference only. Always use the dipstick to determine when the proper amount of oil is in the engine.**



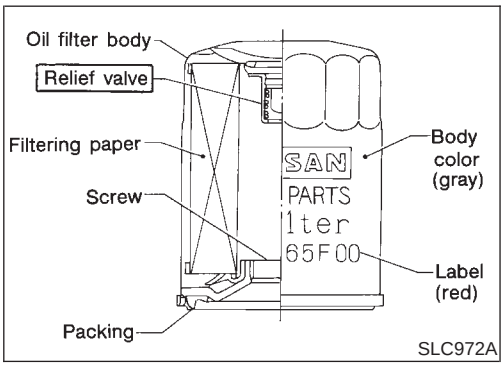
5. Warm up engine and check area around drain plug and oil filter for oil leakage.
6. Stop engine.
7. Wait about 5 minutes.
8. Check oil level.

Changing Oil Filter

NMLC0010

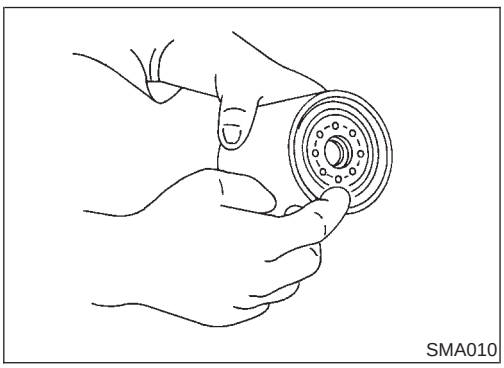
The oil filter is a small, full-flow cartridge type and is provided with a relief valve.

- **Use Tool KV10115801 for removing oil filter.**

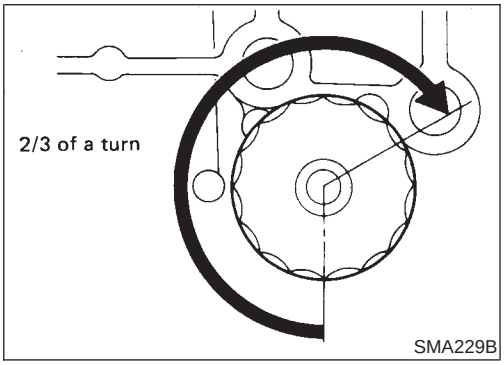


1. Remove oil filter.

WARNING:
Be careful not to burn yourself, as the engine and the engine oil are hot.



2. Before installing new oil filter, clean the oil filter mounting surface on cylinder block, and coat the rubber seal of oil filter with a little engine oil.



3. Screw in the oil filter until a slight resistance is felt, then tighten additionally more than 2/3 turn.
4. Add engine oil.

Refer to LC-6, "Changing Engine Oil".

Service Data and Specifications (SDS)

OIL PRESSURE CHECK

NMLC0011

Engine speed rpm	Approximate discharge pressure kPa (kg/cm^2, psi)
Idle speed	More than 78 (0.8, 11)
3,200	314 - 392 (3.2 - 4.0, 46 - 57)

REGULATOR VALVE INSPECTION

NMLC0012

Unit: mm (in)

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

OIL PUMP INSPECTION

NMLC0013

Unit: mm (in)

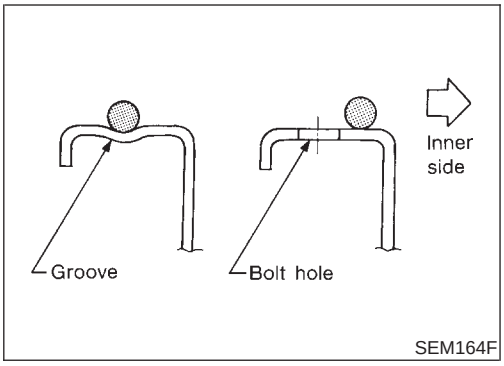
Body to outer rotor radial clearance	0.114 - 0.200 (0.0045 - 0.0079)
Inner rotor to outer rotor tip clearance	Below 0.18 (0.0071)
Body to inner rotor clearance	0.05 - 0.09 (0.0020 - 0.0035)
Body to outer rotor axial clearance	0.05 - 0.11 (0.0020 - 0.0043)
Inner rotor to brazed portion of housing clearance	0.045 - 0.091 (0.0018 - 0.0036)

ENGINE OIL CAPACITY

NMLC0032

Unit: ℓ (US qt, Imp qt)

With oil filter change	3.5 (3-3/4, 3-1/8)
Without oil filter change	3.3 (3-1/2, 2-7/8)
Dry engine (engine overhaul)	3.8 (4, 3-3/8)



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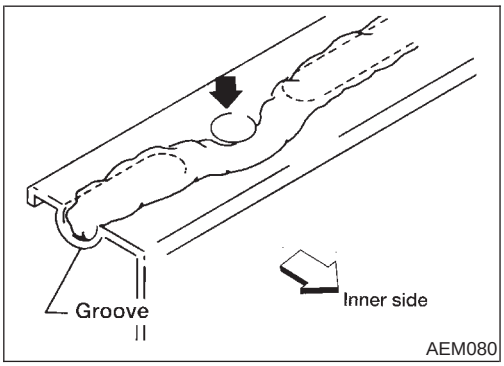


AEM080

Precautions

LIQUID GASKET APPLICATION PROCEDURE

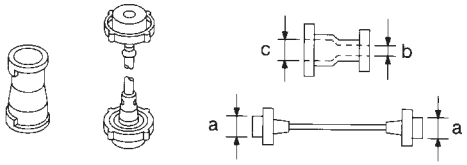
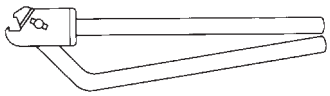
NMLC0014

1. Use a scraper to remove all traces of old liquid gasket from mating surfaces and grooves. Also, completely clean any oil from these areas.
2. 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 4.0 to 5.0 mm (0.157 to 0.197 in).
   - For areas except oil pan, be sure liquid gasket diameter is 2.0 to 3.0 mm (0.079 to 0.118 in).
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

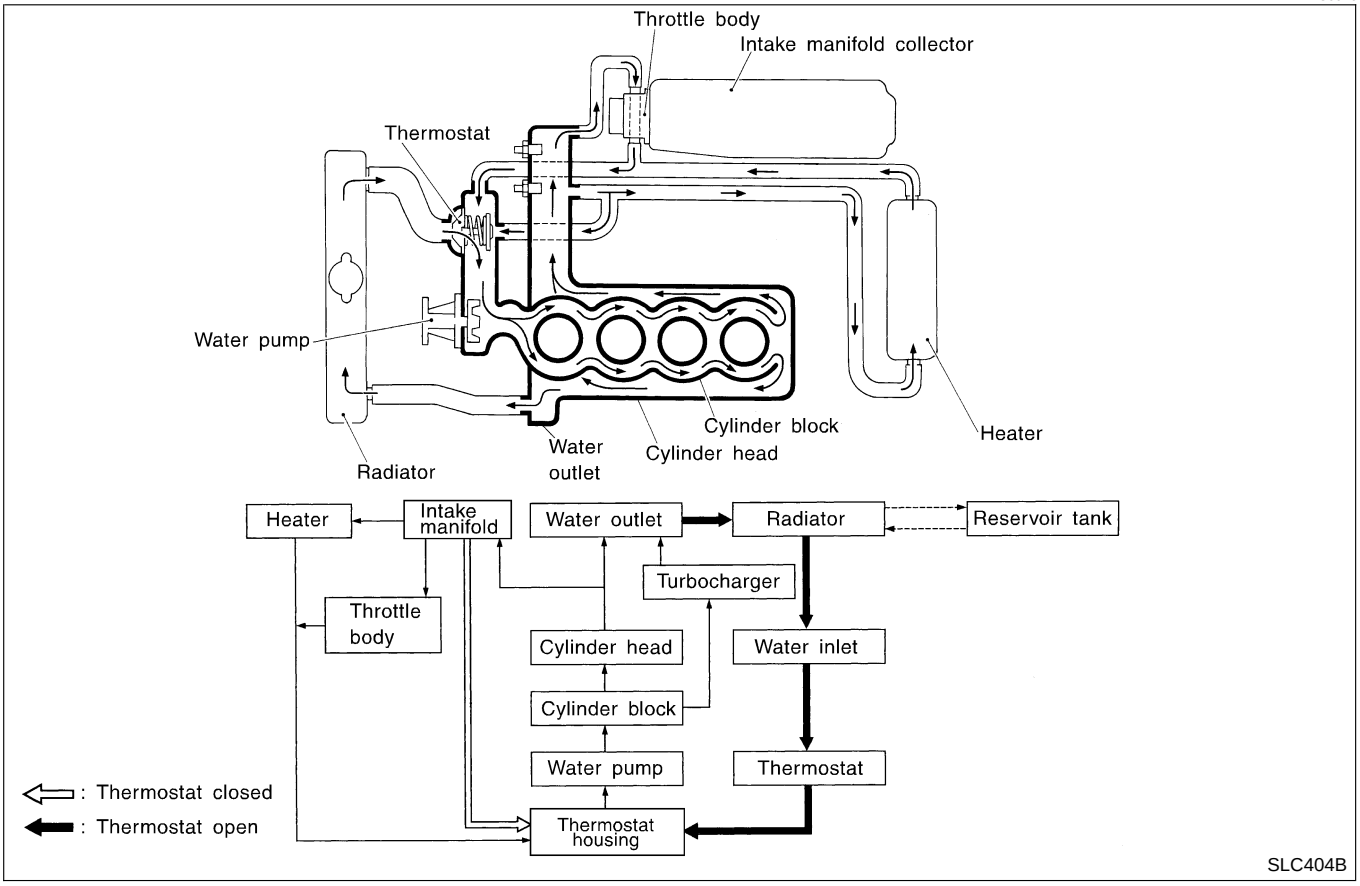
SPECIAL SERVICE TOOL

NMLC0015

Tool number Tool name	Description	
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)
KV99103510 Radiator plate pliers A	 NT224	Installing radiator upper and lower tanks
KV99103520 Radiator plate pliers B	 NT225	Removing radiator upper and lower tanks

Cooling Circuit

NMLC0016



System Check

NMLC0017

WARNING:

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

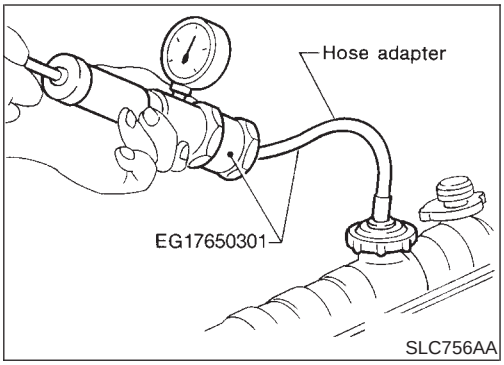
Wrap a thick cloth around the cap. Slowly turn it a quarter turn to allow built-up pressure to escape. Carefully remove the cap by turning it all the way.

CHECKING COOLING SYSTEM HOSES

NMLC0017S01

Check hoses for the following:

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



CHECKING COOLING SYSTEM FOR LEAKS

NMLC0017S02

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

Testing pressure:

157 kPa (1.6 kg/cm^2, 23 psi)

CAUTION:

Higher pressure than specified may cause radiator damage.

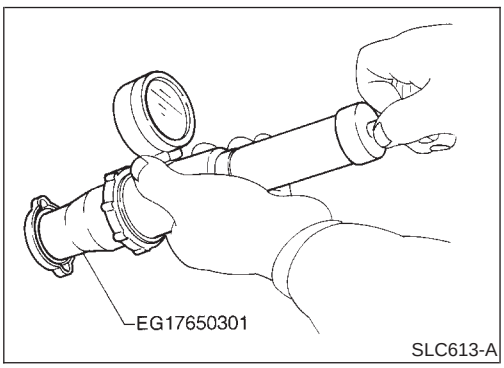
CHECKING RADIATOR

NMLC0017S04

Check radiator for mud or clogging. If necessary, clean radiator as follows.

- Be careful not to bend or damage the radiator fins.
- When radiator is cleaned without removal, remove all surrounding parts such as cooling fan, rediator shroud and horns. Then tape the harness and connectors to prevent water from entering.

1. Apply water by hose to the back side of the radiator core vertically download.
2. Apply water again to all radiator core surfaces once per minute.
3. Stop washing if any stains no longer flow out from the radiator.
4. Blow air into the back side of radiator core vertically download.
   - Use compressesd air lower than 490 kPa (5 kg/cm^2, 71 psi) and keep distance more than 30 cm (11.8 in).
5. Blow air again into all the radiator core surfaces once per minute until no water sprays out.



CHECKING RADIATOR CAP

NMLC0017S03

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

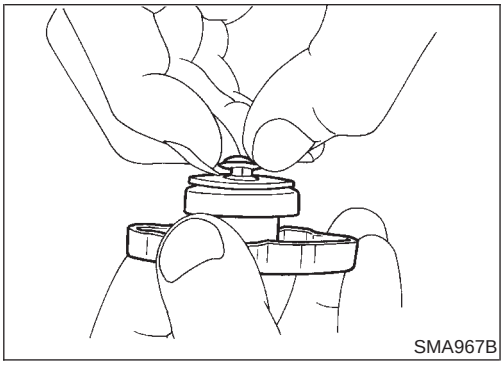
Radiator cap relief pressure:

Standard

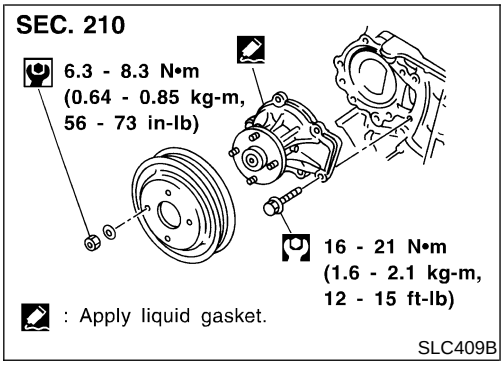
78 - 98 kPa (0.8 - 1.0 kg/cm^2, 11 - 14 psi)

Limit

59 - 98 kPa (0.6 - 1.0 kg/cm^2, 9 - 14 psi)



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



Water Pump

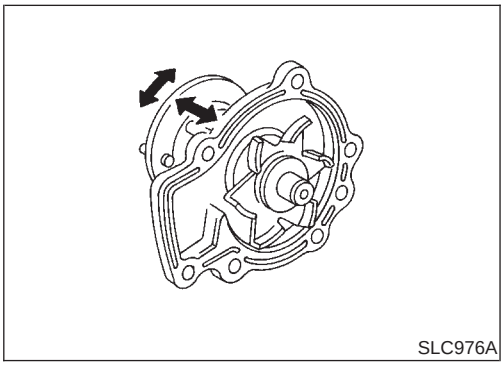
REMOVAL

NMLC0018

1. Drain coolant from cylinder block and radiator.
2. Remove fan coupling with fan.
3. Remove power steering pump drive belt, alternator drive belt and air compressor drive belt.
4. Remove water pump.

CAUTION:

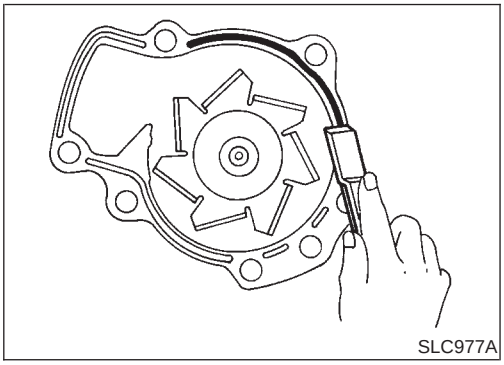
- **When removing water pump assembly, be careful not to get coolant on drive belt.**
- **Water pump cannot be disassembled and should be replaced as a unit.**
- **After installing water pump, connect hose and clamp securely, then check for leaks using radiator cap tester.**



INSPECTION

NMLC0019

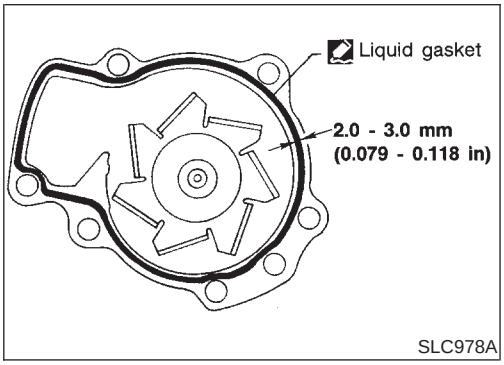
- Check body assembly for rust or corrosion.
- Check for rough operation due to excessive end play.



INSTALLATION

NMLC0020

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



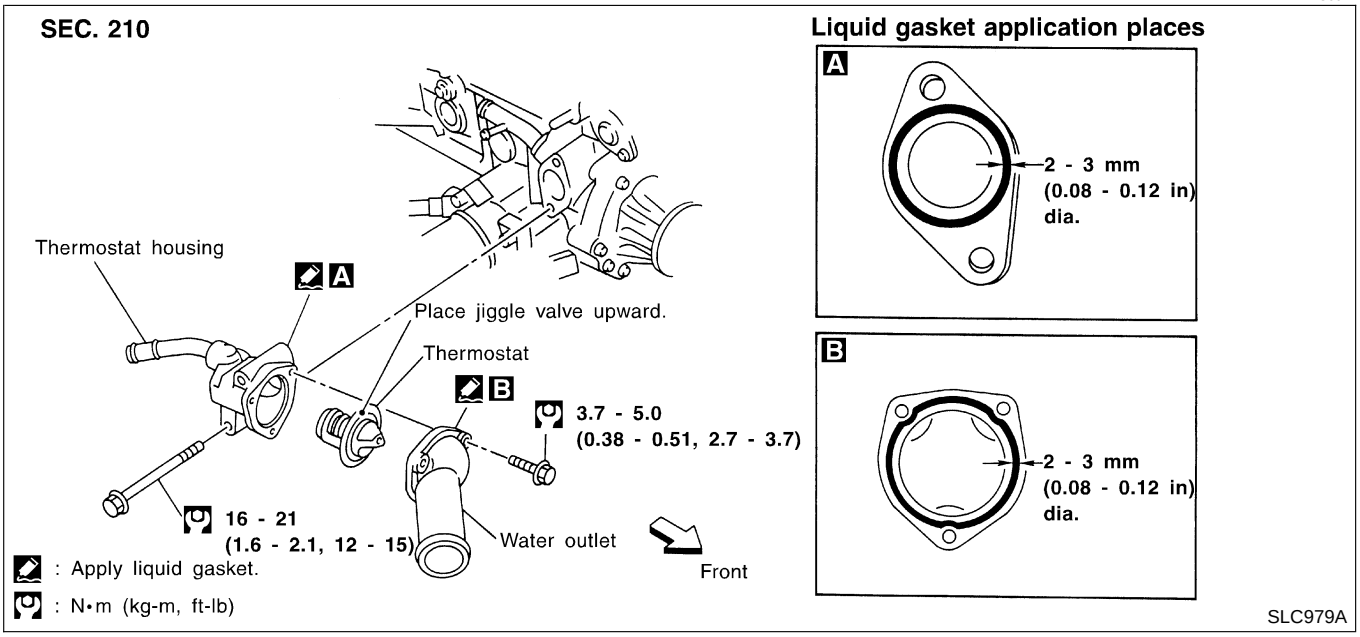
2. Apply a continuous bead of liquid gasket to mating surface of water pump.
- **Use Genuine Liquid Gasket or equivalent.**

When filling radiator with coolant, refer to LC-15, “Changing Engine Coolant”.
When installing drive belts, refer to EM-16, “Checking”.

Thermostat

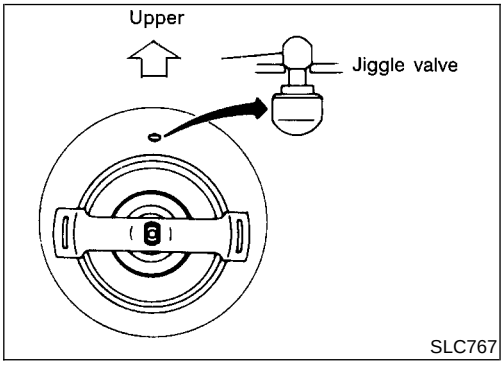
REMOVAL AND INSTALLATION

NMLC0021



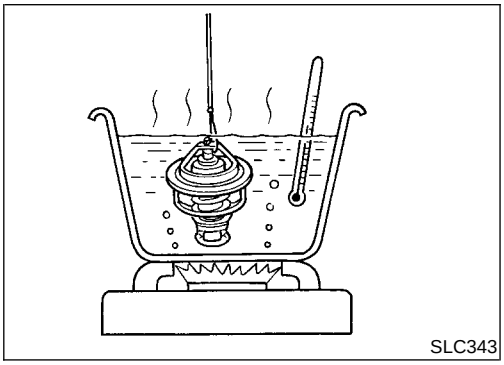
Be careful not to spill coolant over engine compartment. Use a rag to absorb coolant.

1. Drain engine coolant.
2. Remove water inlet, then take out thermostat.



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

- **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.**



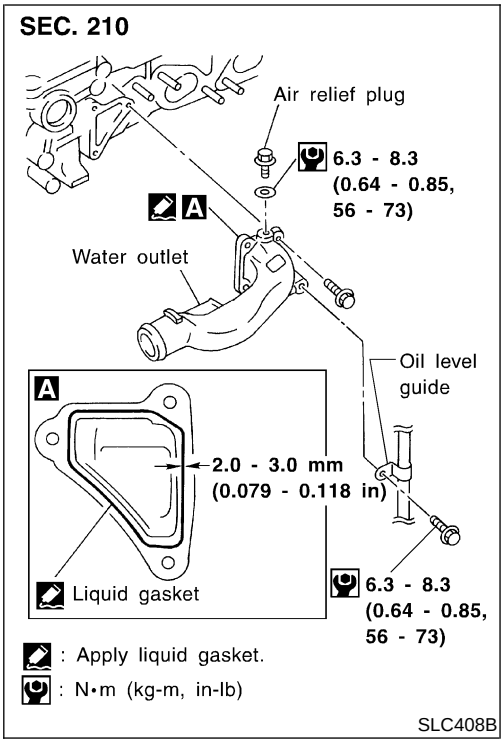
INSPECTION

NMLC0022

1. Check for valve seating condition at normal room temperature. 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 10/90 (0.39/194)

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



Water Outlet

INSPECTION

NMLC0023

Visually inspect for water leaks. If there is leakage, apply liquid gasket.

INSTALLATION

NMLC0024

1. Use a scraper to remove old liquid gasket from water outlet.

- **Also remove traces of liquid gasket from mating surface of cylinder head.**

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

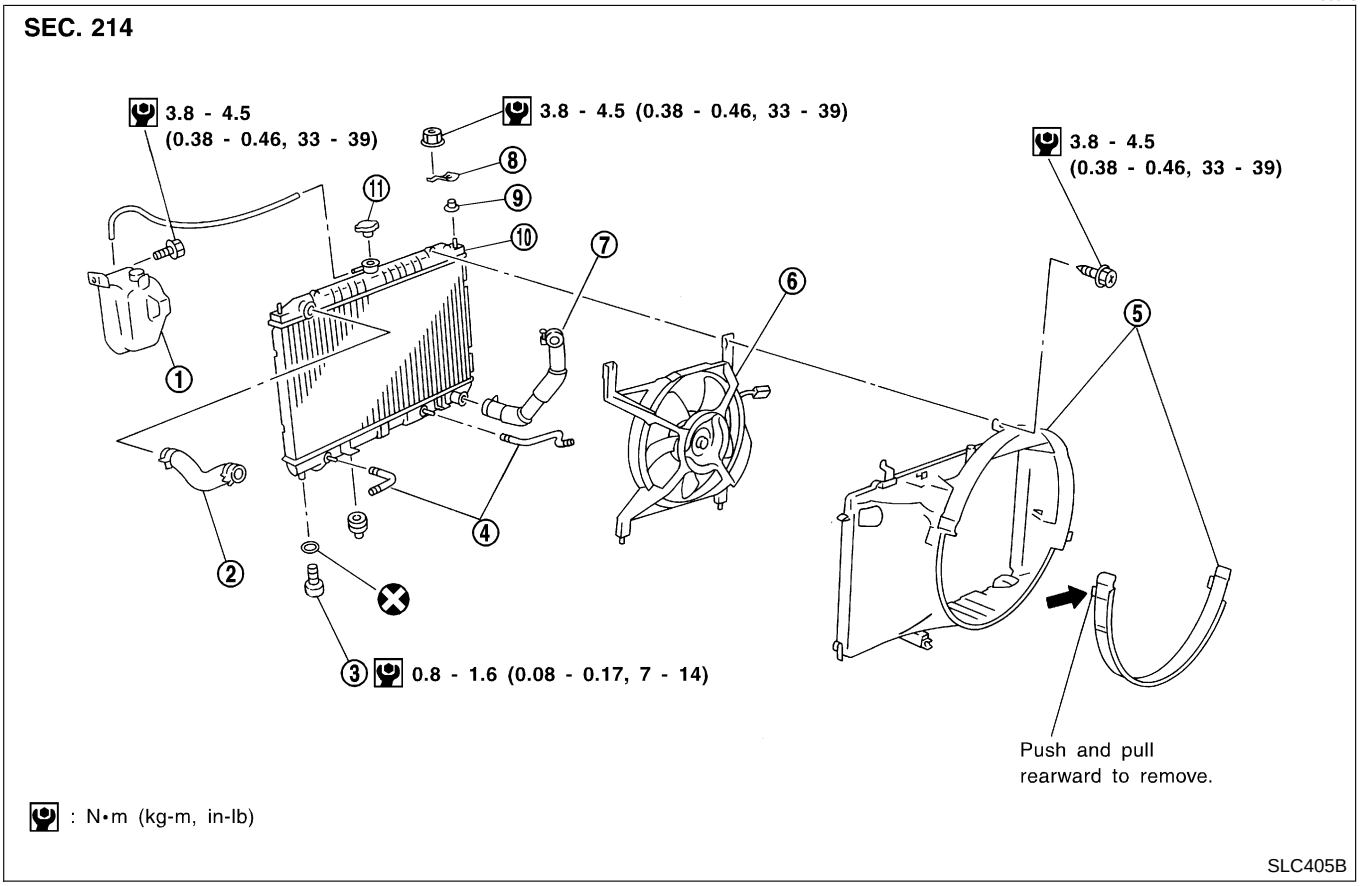
- **Use Genuine Liquid Gasket or equivalent.**
- **When installing, tighten water outlet bolts to the specified torque.**

: 6.3 - 8.3 N·m (0.64 - 0.85 kg-m, 55.6 - 73.8 in-lb)

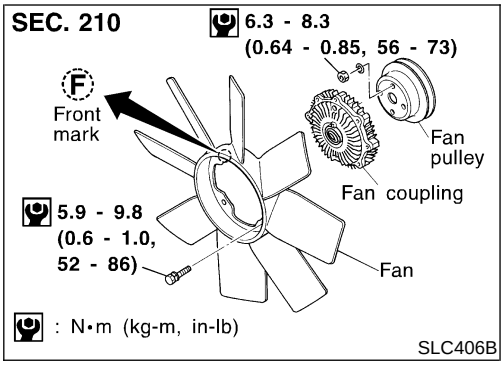
Radiator

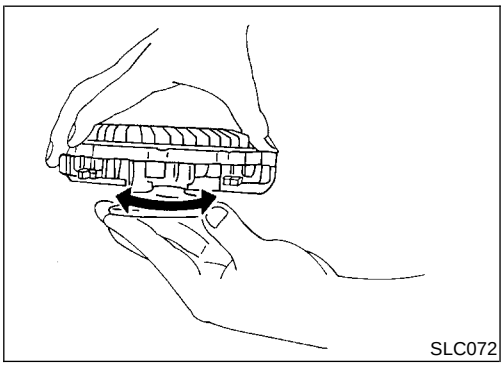
COMPONENTS

NMLC0025



1. Reservoir tank
2. Upper hose
3. Drain plug
4. Oil cooler hose (A/T models)
5. Radiator shroud
6. Cooling fan (Motor driven)
7. Lower hose
8. Mounting bracket
9. Mounting rubber
10. Radiator
11. Radiator cap





Cooling Fan (Crankshaft driven)

NMLC0033

DISASSEMBLY AND ASSEMBLY

NMLC0033S01

INSPECTION

NMLC0033S02

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

Cooling Fan Control System

NMLC0026

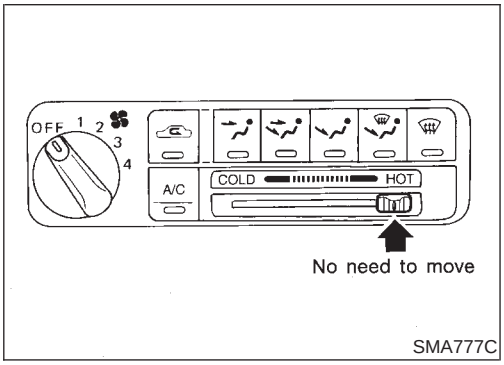
Cooling fans are controlled by the ECM. For details, refer to EC-120, “Cooling Fan Control”.

Changing Engine Coolant

NMLC0034

WARNING:

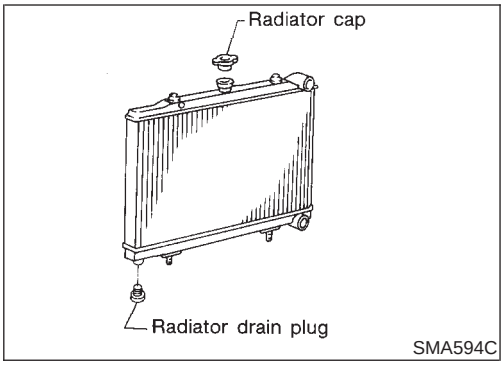
To avoid the danger of being scalded, never change the coolant when the engine is hot.



—DRAINING ENGINE COOLANT—

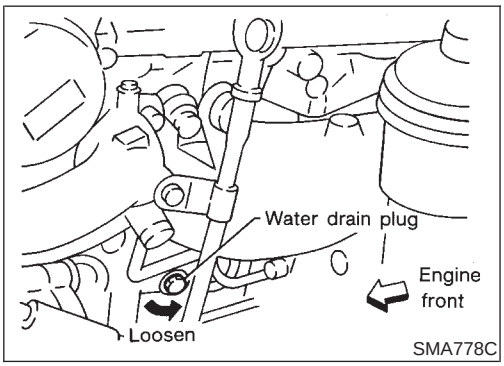
NMLC0034S01

1. Set air conditioning system to open air mix door for heater unit.

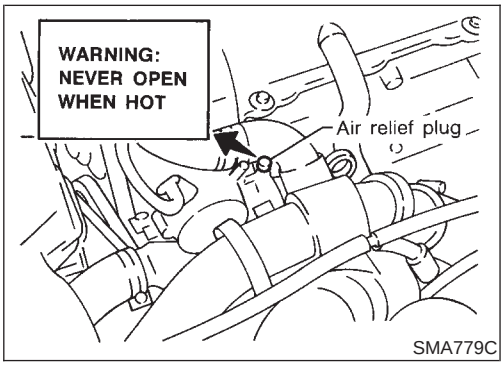


2. Open radiator drain plug at the bottom of radiator and remove radiator cap.
3. Remove reservoir tank, drain coolant, then clean reservoir tank.
   Install it temporarily.

- **Be careful not to allow coolant to contact drive belts.**



4. Remove cylinder block drain plug and air relief plug.
5. Check drained coolant for contaminants such as rust, corrosion or discoloration.
   If contaminated, flush engine cooling system.
   Refer to "—FLUSHING COOLING SYSTEM—", LC-17.

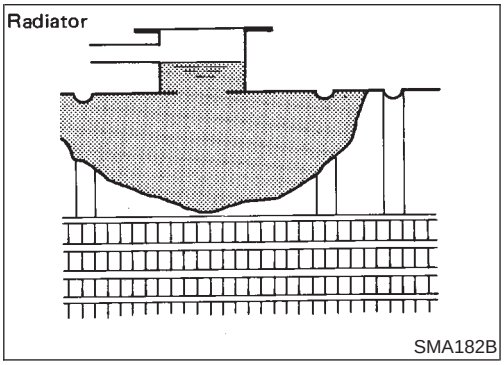


—REFILLING ENGINE COOLANT—

NMLC0034S02

1. Install reservoir tank, radiator drain plug, and cylinder block drain plug.

- **Apply sealant to the thread of cylinder block drain plug.**
  : 8 - 12 N·m (0.8 - 1.3 kg-m, 70 - 112 in-lb)



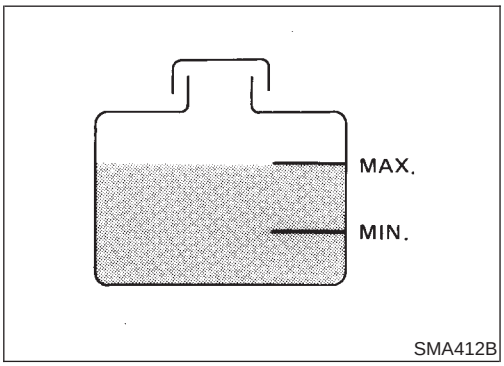
2. Fill radiator slowly with coolant until coolant spills from the air relief plug, then install air relief plug.
3. Fill radiator and reservoir tank to specified level as soon as coolant spills out without bubbles.

   Air relief plug:
   : 10 N·m (1.0 kg-m, 87 in-lb)

- **Use Nissan Genuine Engine Coolant or equivalent mixed with water (distilled or demineralized).**
- **Pour coolant through coolant filler neck slowly to allow air in system to escape.**

Refer to "RECOMMENDED FLUIDS AND LUBRICANTS", MA-8.

Coolant capacity (With reservoir tank):
7.0 ℓ (7-3/8 US qt, 6-1/8 Imp qt)



SMA412B

Reservoir tank capacity (for MAX level):
0.8 ℓ (7/8 US qt, 3/4 Imp qt)

4. Warm up engine to normal operating temperature without radiator cap installed.
- **If coolant overflows radiator filter hole, install filler cap.**
5. Run engine at 2,500 rpm for 10 seconds and return to idle speed with radiator cap installed.
- Repeat two or three times.

Watch coolant temperature gauge so as not to overheat the engine.

6. Stop engine and cool it down.
- Cool down using a fan to reduce the time.
- If necessary, refill radiator up to filler neck with coolant.
7. Refill reservoir tank to Max line with coolant.
8. Repeat step 5 through step 7 two or more times with radiator cap installed until coolant level no longer drops.
9. Check cooling system for leaks with engine running.
10. Warm up engine, and check for sound of coolant flow while running engine from idle up to 3,000 rpm with heater temperature control set at HOT position.
- Sound may be noticeable at heater core.
11. If sound is heard, bleed air from cooling system by repeating steps 5 through 7 until coolant level no longer drops.
- **Clean excess coolant from engine.**

—FLUSHING COOLING SYSTEM—

NMLC0034S03

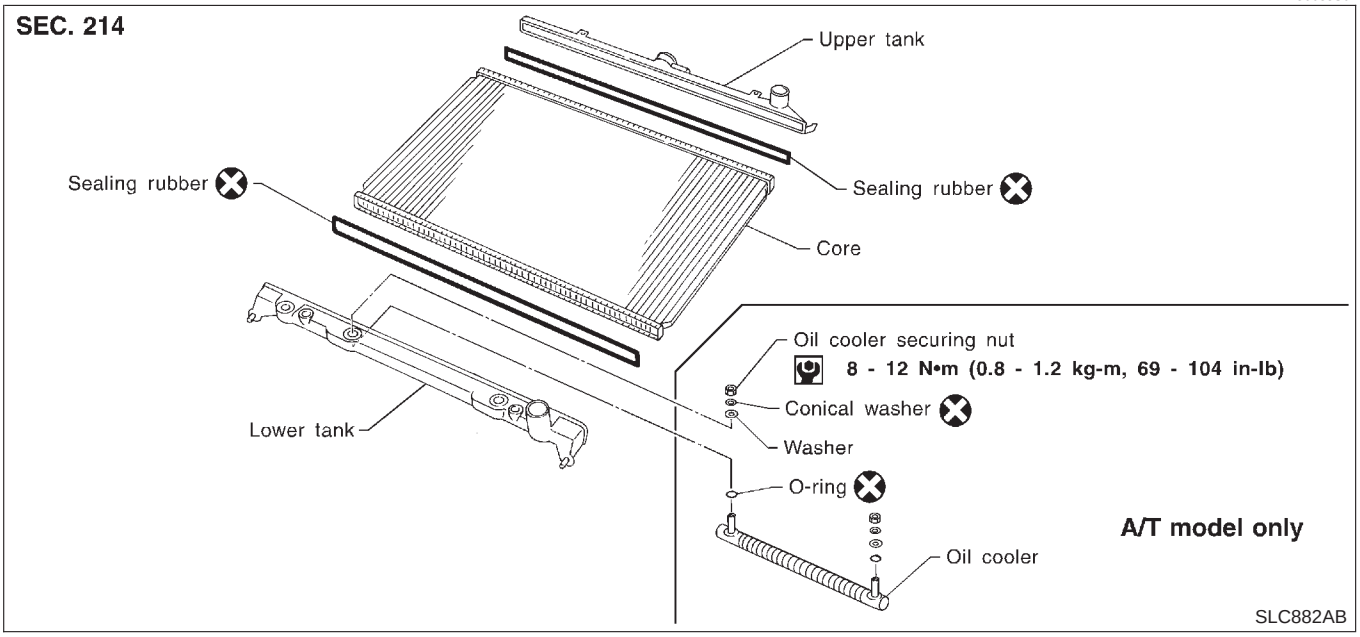
1. Open air relief plug.
2. Fill radiator with water until water spills from the air relief hole, then close air relief plug. Fill radiator and reservoir tank with water and reinstall radiator cap.
3. Run engine and warm it up to normal operating temperature.
4. Rev engine two or three times under no-load.
5. Stop engine and wait until it cools down.
6. Drain water.
7. Repeat steps 1 through 6 until clear water begins to drain from radiator.

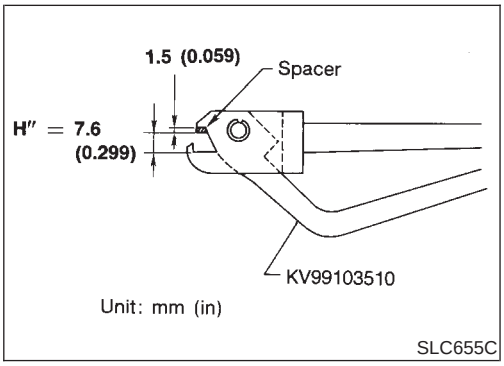
Radiator (Aluminum type)

NMLC0035

PREPARATION

NMLC0035S01



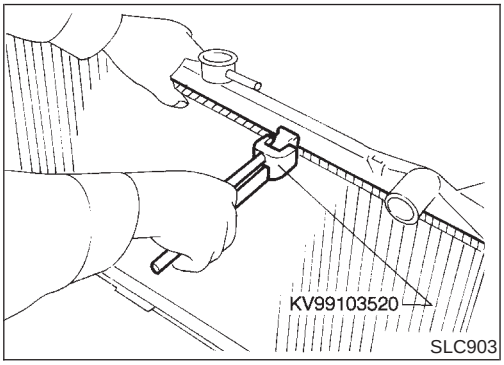


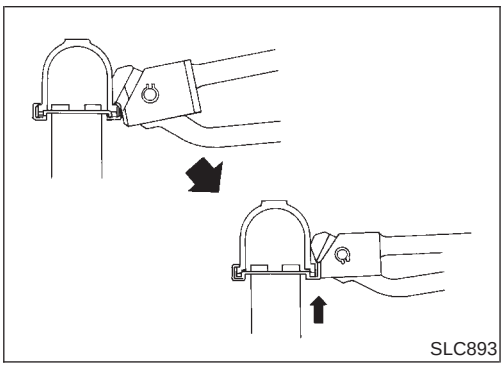
1. Attach the spacer to the tip of the radiator plate pliers A. Spacer specification: 1.5 mm (0.059 in) thick x 18 mm (0.71 in) wide x 8.5 mm (0.335 in) long.
2. Make sure that when radiator plate pliers A are closed dimension H″ is approx. 7.6 mm (0.299 in).
3. Adjust dimension H″ with the spacer, if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

DISASSEMBLY

NMLC0035S02

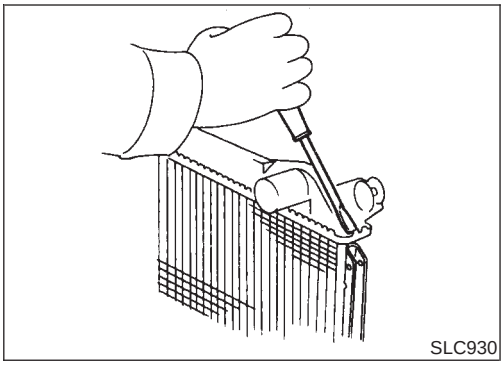
1. Remove tank with Tool.





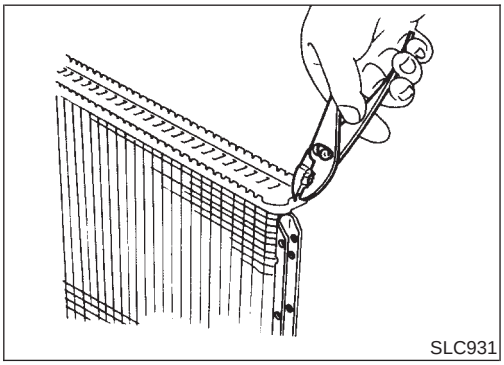
- Grip the crimped edge and bend it upwards so that Tool slips off.

Do not bend excessively.


SLC930

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

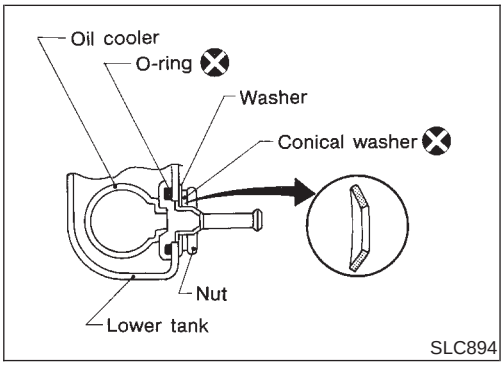
Be careful not to damage tank.


SLC931

2. Make sure the edge stands straight up.
3. Remove oil cooler from tank. (A/T model only)

ASSEMBLY

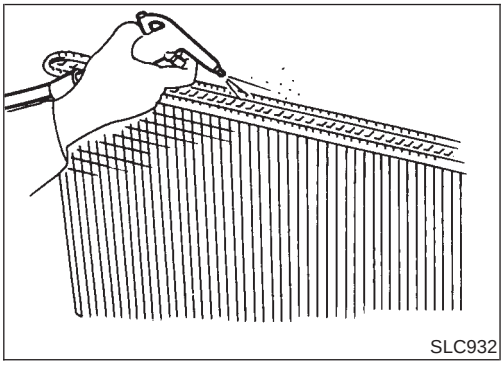
NMLC0035S03



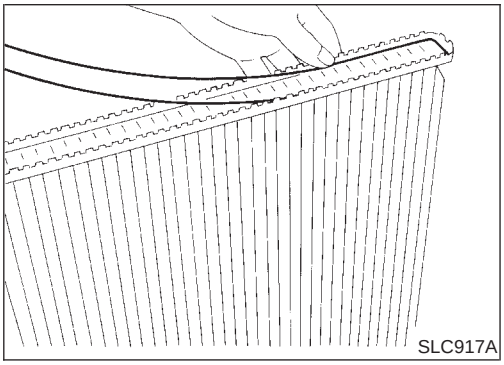
SLC894

1. Install oil cooler. (A/T model only)

Pay attention to direction of conical washer.

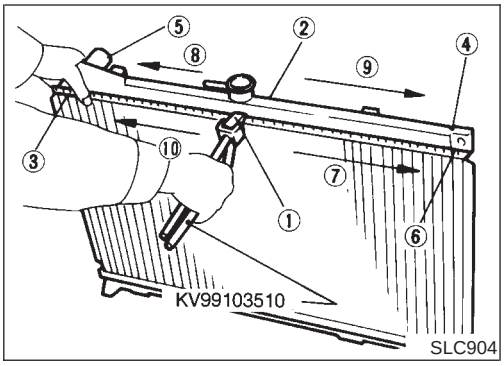

SLC932

2. Clean contact portion of tank.

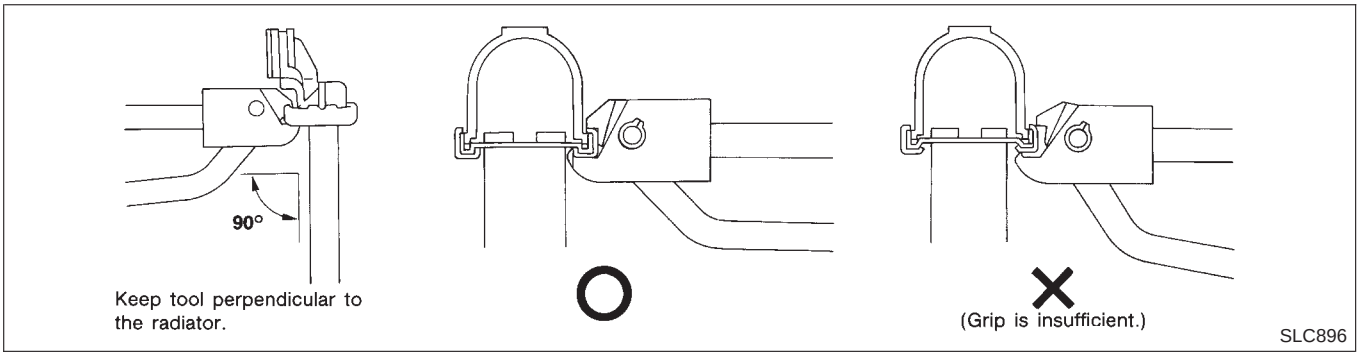

SLC917A

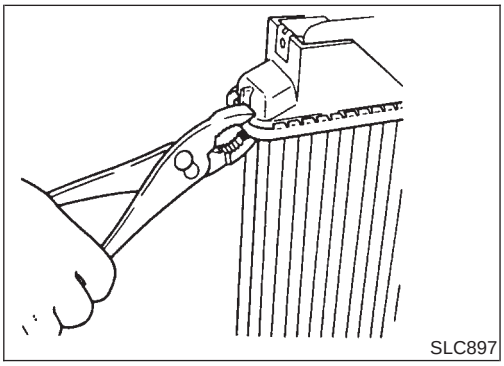
3. Install sealing rubber.

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

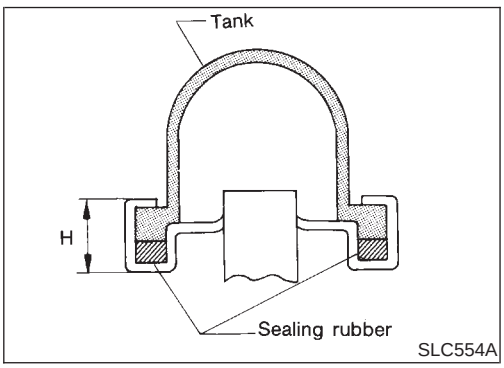


4. Caulk tank in specified sequence with Tool.



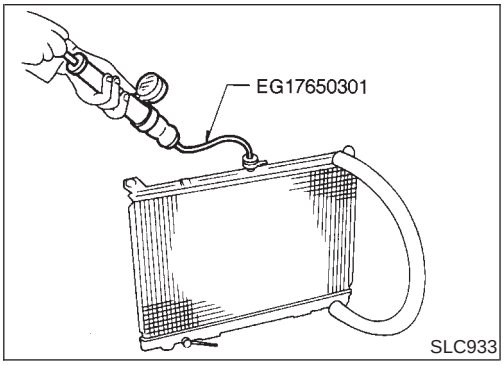


- Use pliers in the locations where Tool cannot be used.



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.

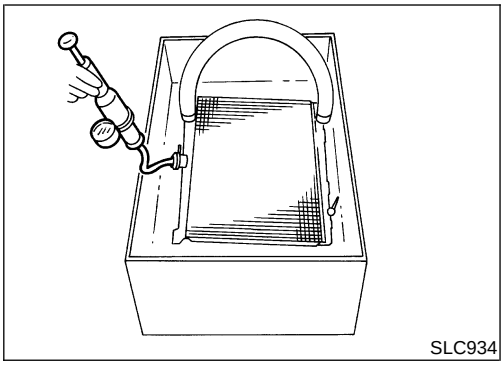


INSPECTION

NMLC0035S04

1. Apply pressure with Tool.
   Specified pressure value:
   157 kPa (1.6 kg/cm^2, 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. (A/T model only)


SLC934

2. Check for leakage.

Overheating Cause Analysis

NMLC0028

	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
			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)

THERMOSTAT

NMLC0029

Valve opening temperature °C (°F)	76.5 (170)
Valve lift mm/°C (in/°F)	More than 10/90 (0.39/194)

RADIATOR

NMLC0030

Unit: kPa (kg/cm^2, 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)

ENGINE COOLANT CAPACITY

NMLC0036

Unit: ℓ (US qt, Imp qt)

With reservoir tank	7.0 (7-3/8, 6-1/8)
Reservoir tank capacity	0.8 (7/8, 3/4)