

# ENGINE LUBRICATION & COOLING SYSTEMS

GI

MA

EM

LC

EC

FE

CL

MT

AT

TF

PD

FA

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ST

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BT

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EL

IDX

## SECTION LC

### MODIFICATION NOTICE:

#### Gasoline engine:

KA24DE engine has been added.

#### Diesel engine:

Oil pump inspection data have been changed.

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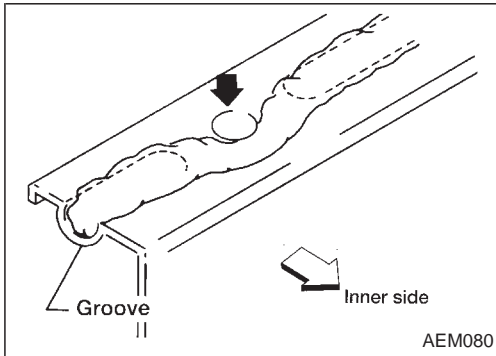
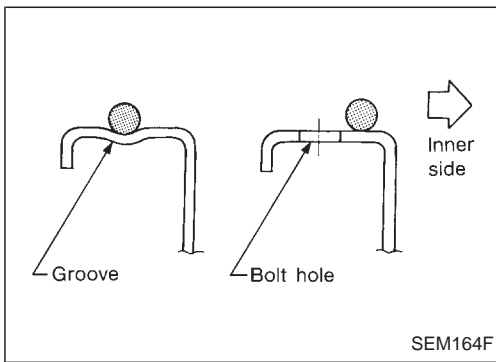
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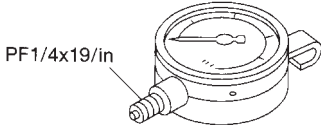
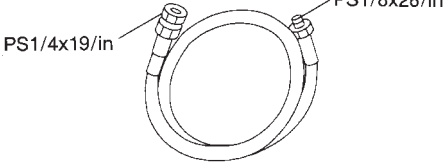
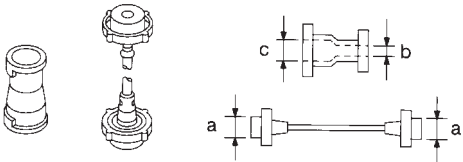
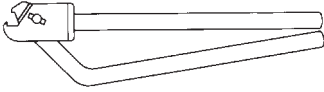

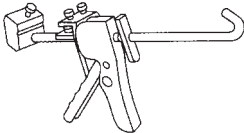


### Liquid Gasket Application Procedure

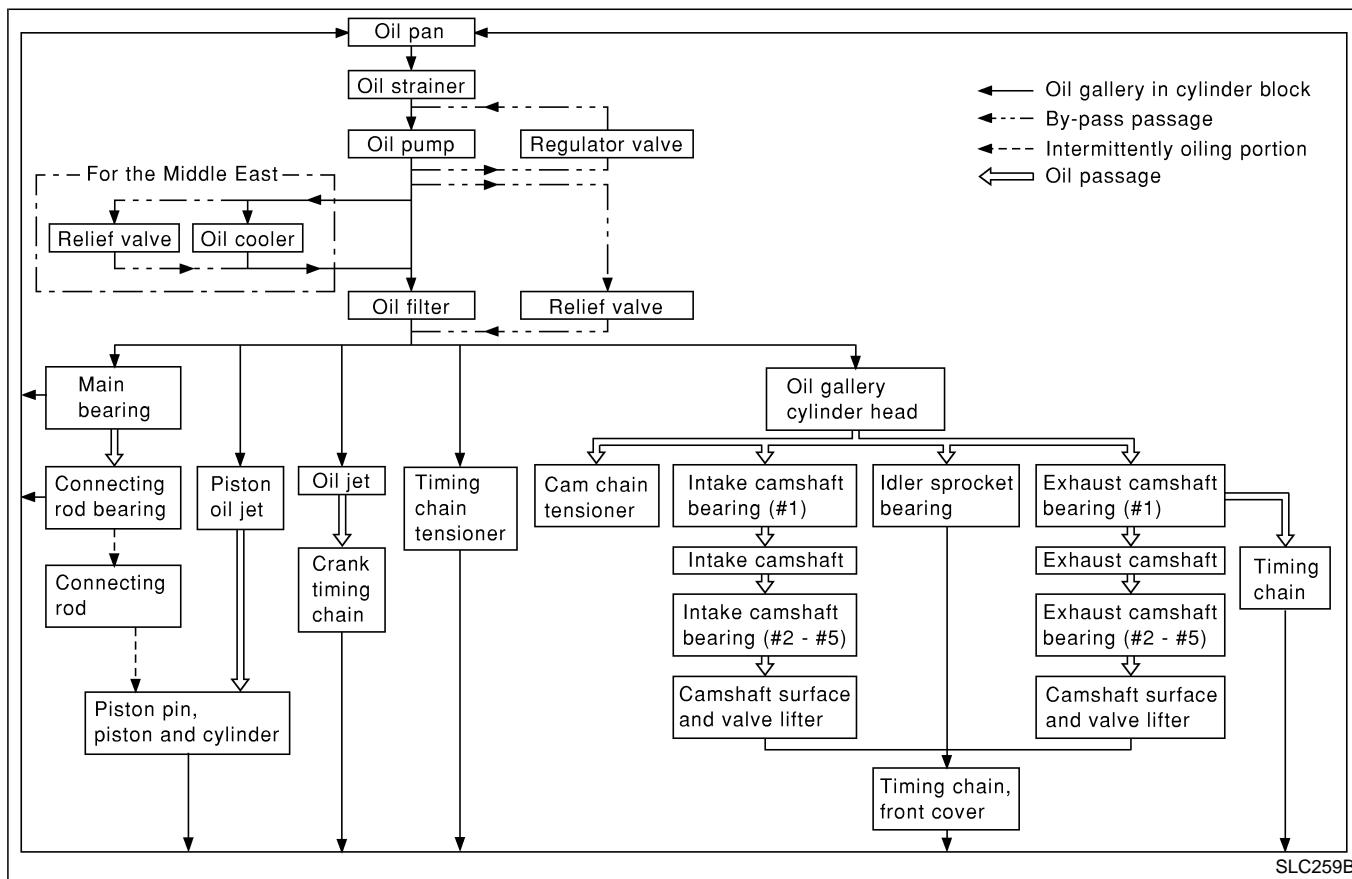
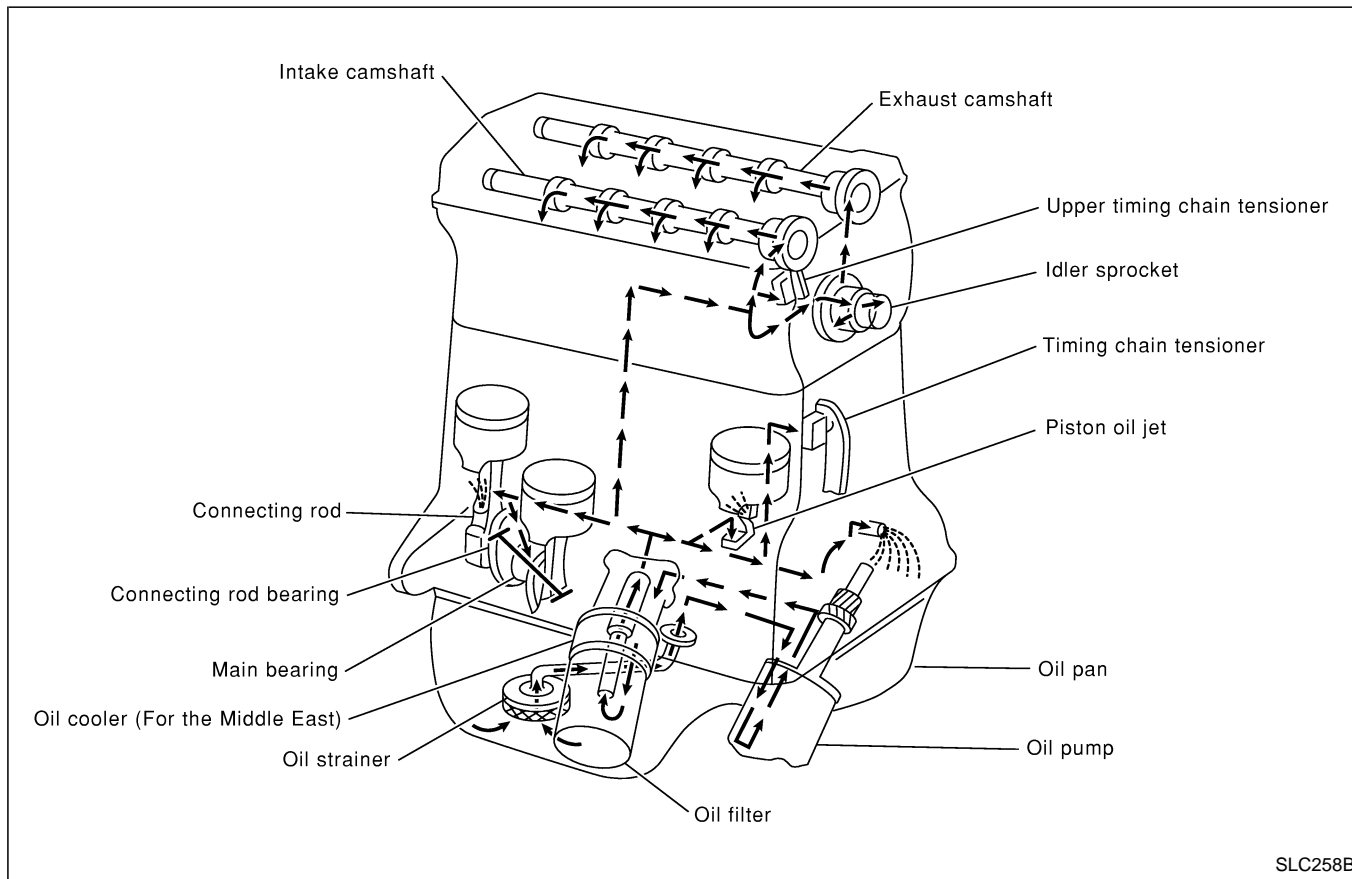
- a. Use a scraper to remove all traces of old liquid gasket from mating surfaces and grooves. Also, completely clean any oil from these areas.
- b. Apply a continuous bead of liquid gasket to mating surfaces. (Use Genuine Liquid Gasket or equivalent.)
  - For oil pan, be sure liquid gasket diameter is 3.5 to 4.5 mm (0.138 to 0.177 in) for gasoline engines.
  - 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.

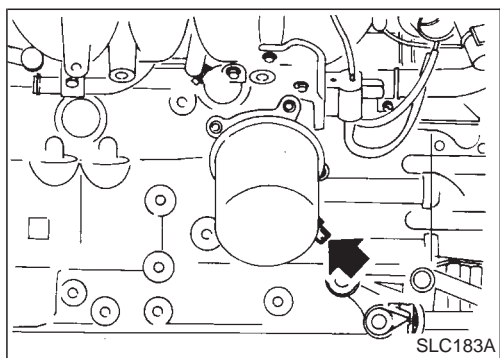
Special Service Tools

\*: Special tool or commercial equivalent

Tool number Tool name	Description	
ST25051001* Oil pressure gauge	Measuring oil pressure  <b>Maximum measuring range: 2,452 kPa (24.5 bar, 25 kg/cm<sup>2</sup>, 356 psi)</b>   PF1/4x19/in  NT558	GI  MA  EM  <b>LC</b>
ST25052000* Hose	Adapting oil pressure gauge to cylinder block   PS1/4x19/in PS1/8x28/in  NT559	EC  FE  CL
EG17650301 Radiator cap tester adapter	Adapting radiator cap tester to radiator filler neck   a b c  NT564  <b>a: 28 (1.10) dia.</b> <b>b: 31.4 (1.236) dia.</b> <b>c: 41.3 (1.626) dia.</b> Unit: mm (in)	MT  AT  TF
KV99103510 Radiator plate pliers A	Installing radiator upper and lower tanks    NT224	PD  FA
KV99103520 Radiator plate pliers B	Removing radiator upper and lower tanks    NT225	RA  BR
WS39930000 Tube presser	Pressing the tube of liquid gasket    NT052	ST  RS

Lubrication Circuit

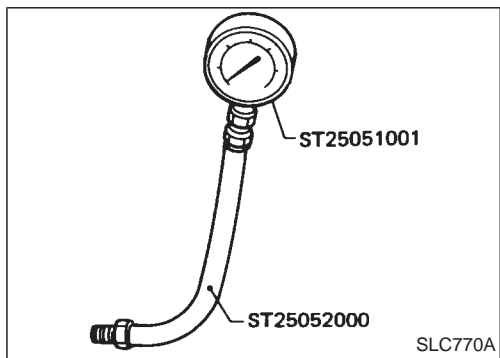




### Oil Pressure Check

**WARNING:**

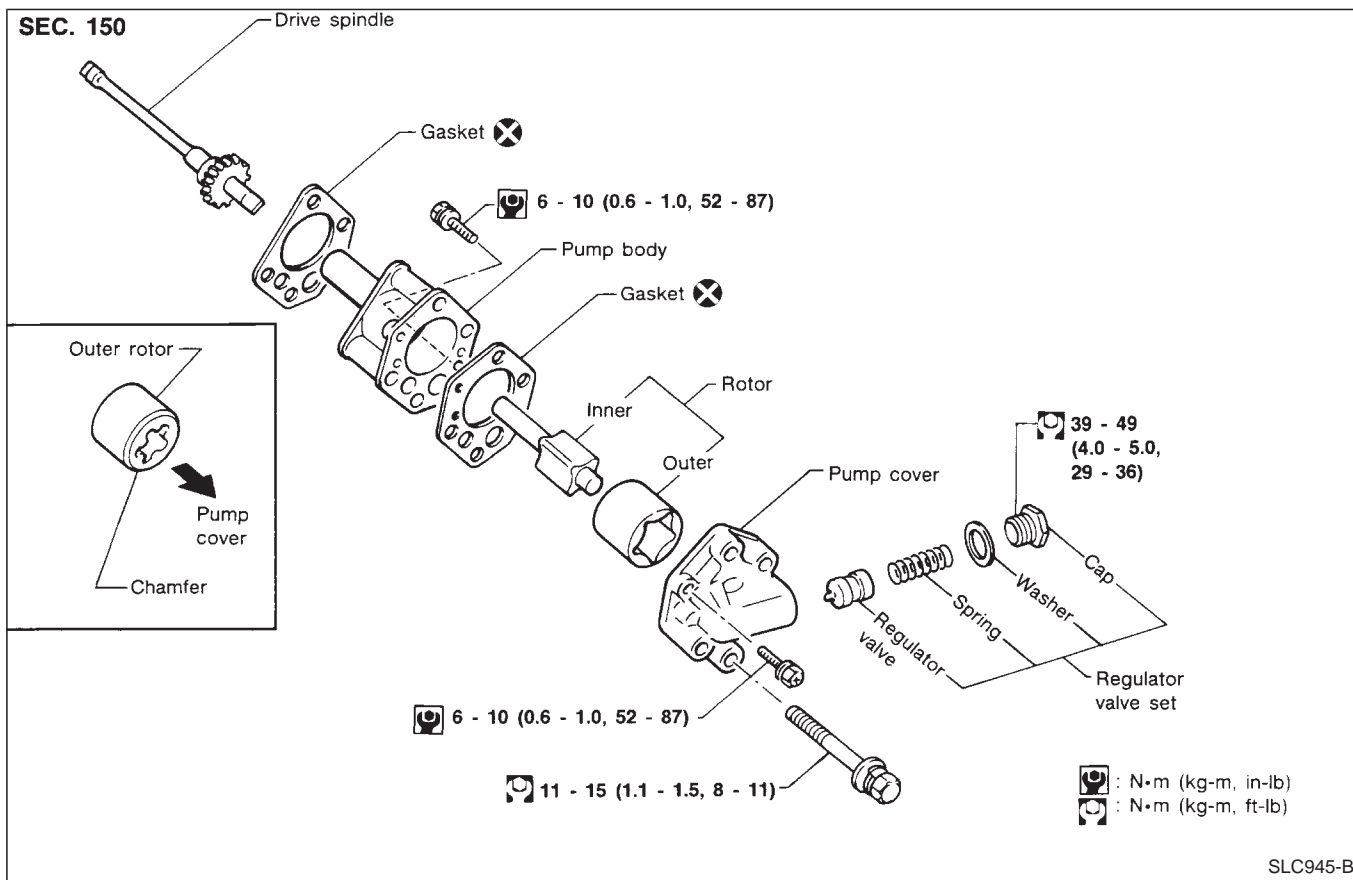
- Be careful not to burn yourself, as the engine and oil may be hot.
  - For M/T models, put gearshift lever in Neutral “N” position. For A/T models, put selector lever in Park “P” position.
1. Check oil level.
  2. Remove oil pressure switch.
  3. Install pressure gauge.
  4. Start engine and warm it 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 <sup>2</sup> , psi)
Idle speed	More than 59 (0.59, 0.6, 9)
3,000	284 - 353 (2.84 - 3.53, 2.9 - 3.6, 41 - 51)

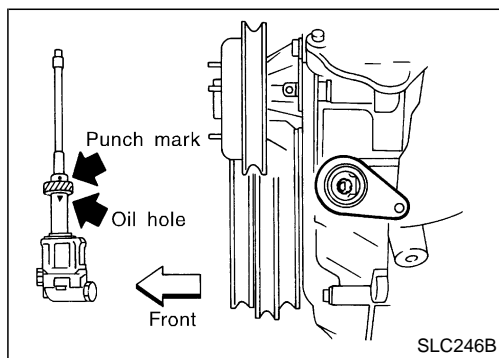
- If difference is extreme, check oil passage and oil pump for oil leaks.
6. Install oil pressure switch with sealant.

### Oil Pump



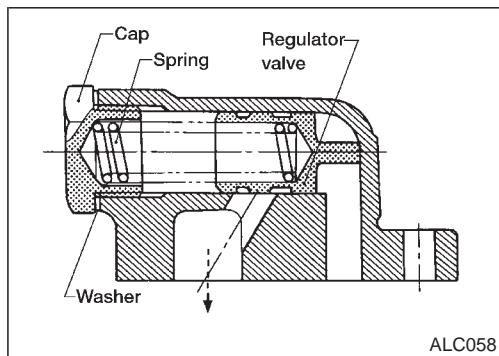
## Oil Pump (Cont'd)

- Always replace with new oil seal and gasket.
- When removing oil pump, turn crankshaft so that No. 1 piston is at TDC on its compression stroke.
- When installing oil pump, apply engine oil to gears, then align punchmark on drive spindle and oil hole on oil pump.



## REGULATOR VALVE INSPECTION

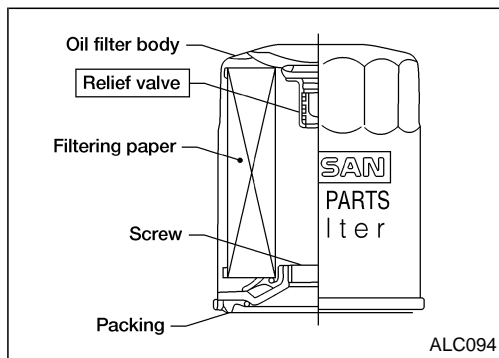
1. Visually inspect components for wear and damage.
  2. Check oil pressure regulator valve sliding surface and valve spring.
  3. Coat regulator valve with engine oil. Check that it falls smoothly into the valve hole by its own weight.
- Replace regulator valve set or oil pump assembly, if damaged.



## OIL FILTER

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

- Use Tool specified. Refer to MA section.



## OIL PUMP INSPECTION

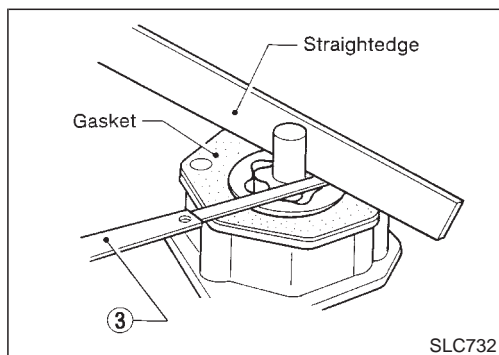
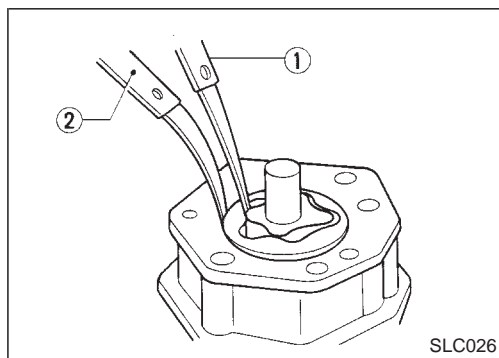
Using a feeler gauge, check the following clearance.

### Standard clearance:

Unit: mm (in)

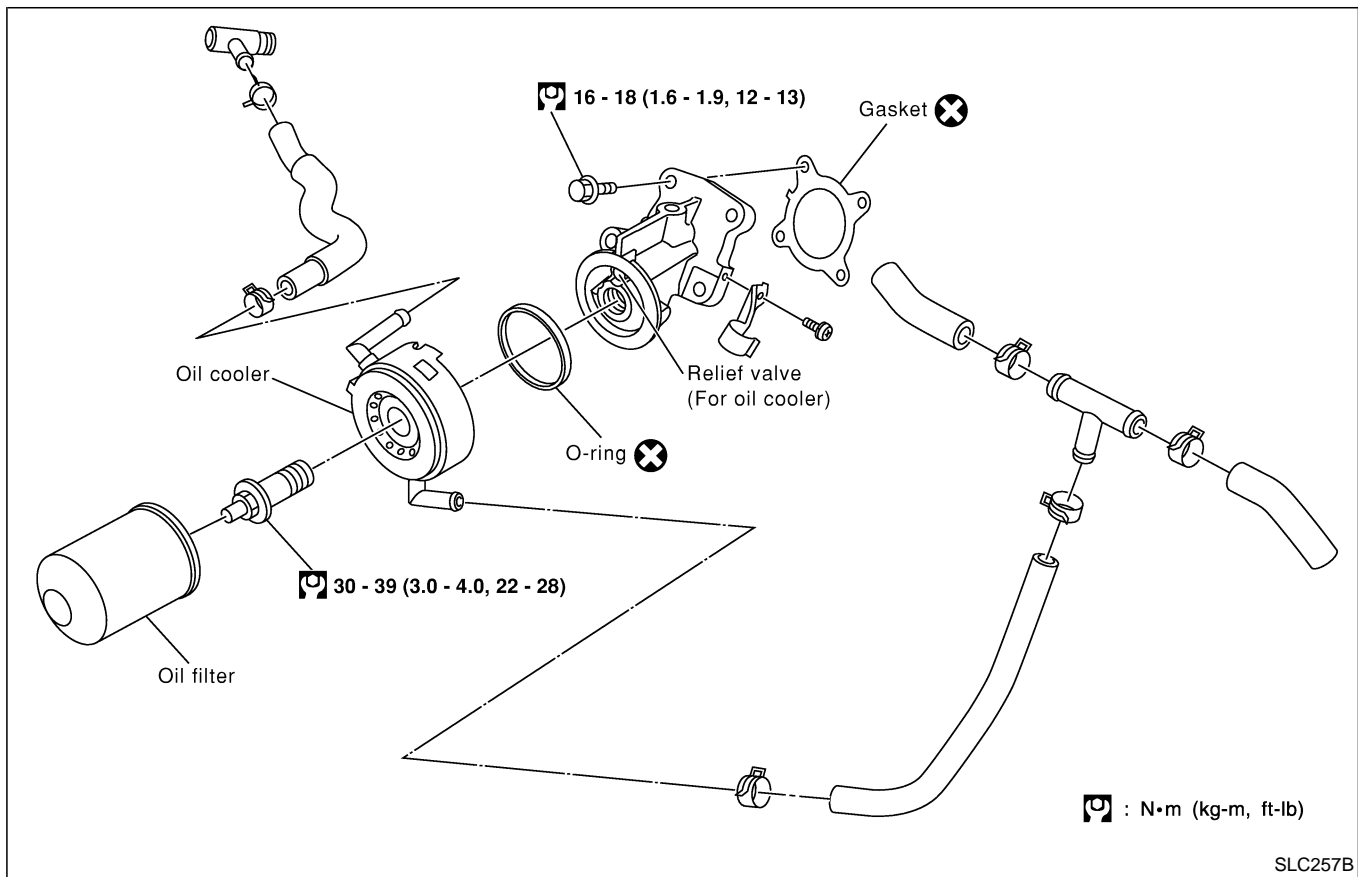
Rotor tip clearance ①	Less than 0.12 (0.0047)
Outer rotor to body radial clearance ②	0.15 - 0.21 (0.0059 - 0.0083)
Side clearance (with gasket) ③	0.04 - 0.08 (0.0016 - 0.0031)

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



## Oil Cooler (For the Middle East)

## REMOVAL AND INSTALLATION



1. Drain engine oil and coolant.
2. Remove oil cooler.
3. Installation is in reverse order of removal.
  - **Be careful not to burn yourself as engine oil is hot.**
  - **After installation, run engine for a few minutes and check for oil leaks.**
  - **Do not spill coolant on the drive belt.**

## INSPECTION

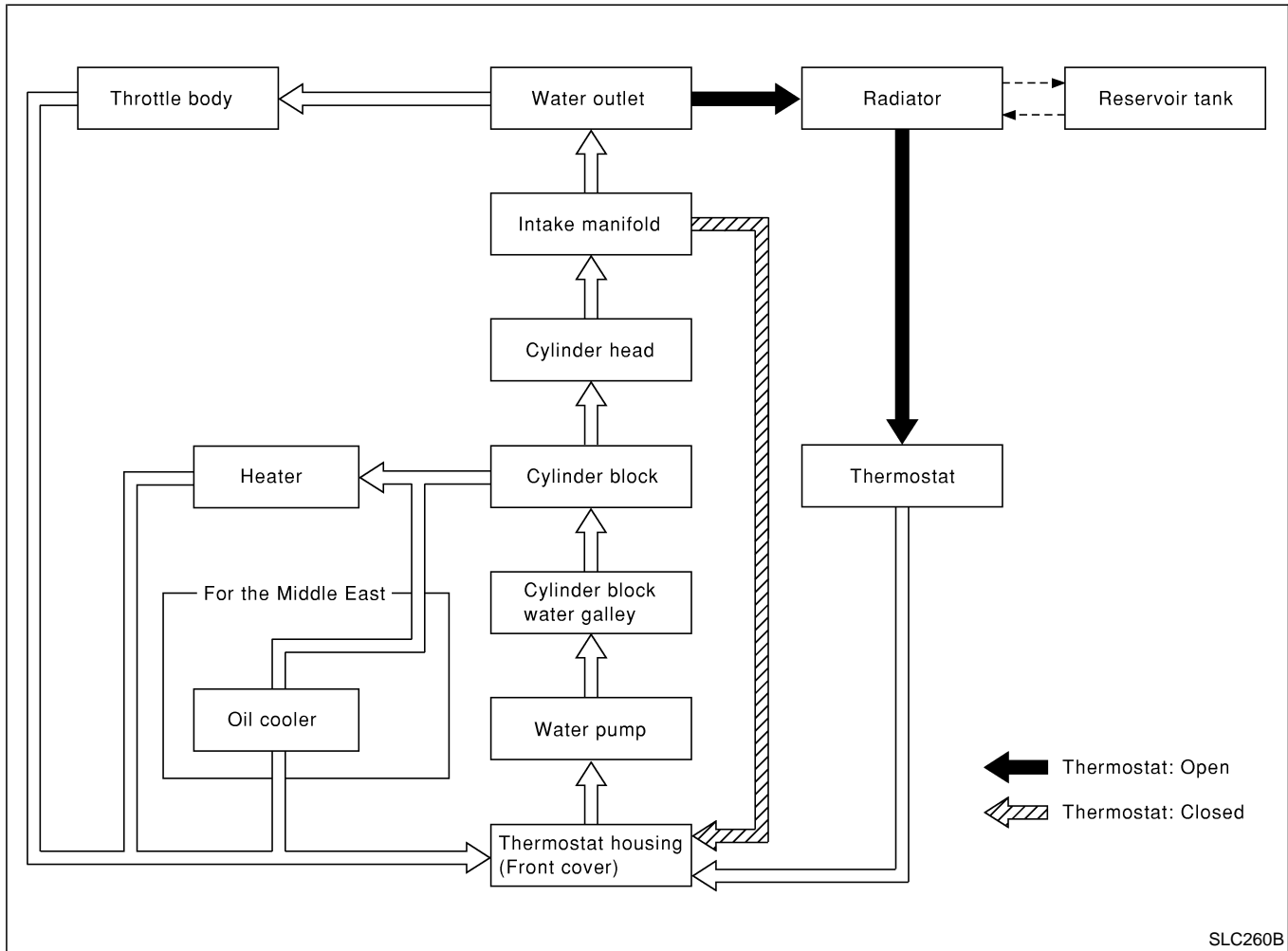
## Oil cooler

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

## Oil pressure relief valve

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 a suitable tool. Install a new valve in place by tapping it.

## 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.

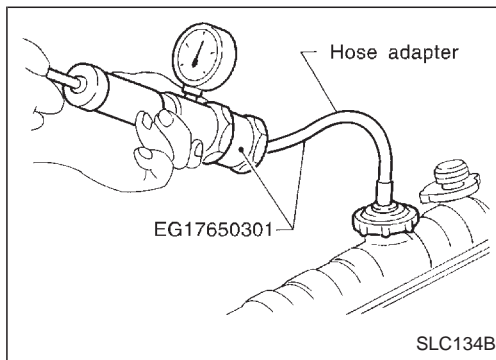
Wrap a thick cloth around the cap. Slowly turn it a quarter turn to allow built-up pressure to escape. Carefully remove the cap by turning it all the way.

**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**

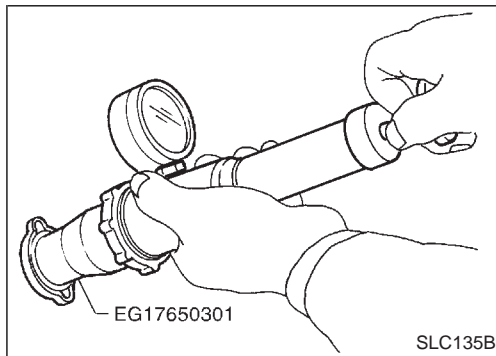
To check for leakage, apply pressure to the cooling system with a tester.

Testing pressure:

157 kPa (1.57 bar, 1.6 kg/cm<sup>2</sup>, 23 psi)

**CAUTION:**

Higher pressure than specified may cause radiator damage.

**CHECKING RADIATOR CAP**

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

Radiator cap relief pressure:

Standard

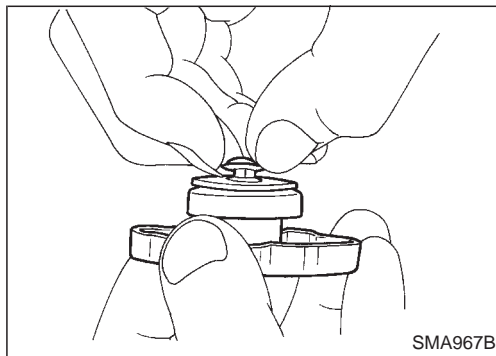
78 - 98 kPa

(0.78 - 0.98 bar, 0.8 - 1.0 kg/cm<sup>2</sup>, 11 - 14 psi)

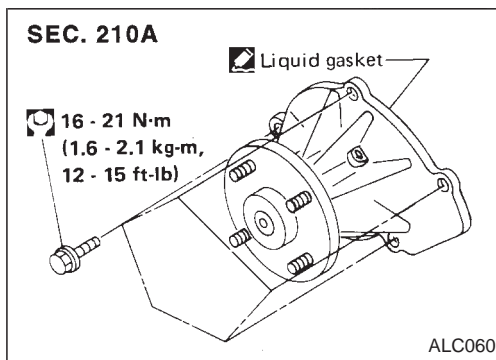
Limit

59 - 98 kPa

(0.59 - 0.98 bar, 0.6 - 1.0 kg/cm<sup>2</sup>, 9 - 14 psi)



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 belts.
- 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.

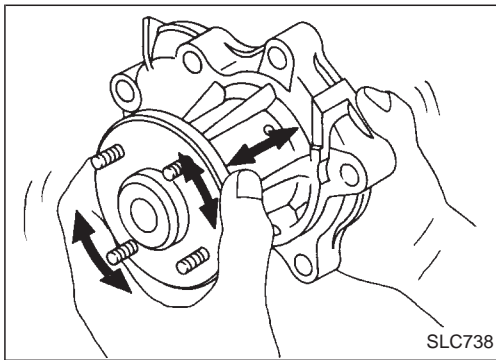
**REMOVAL**

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

## Water Pump (Cont'd)

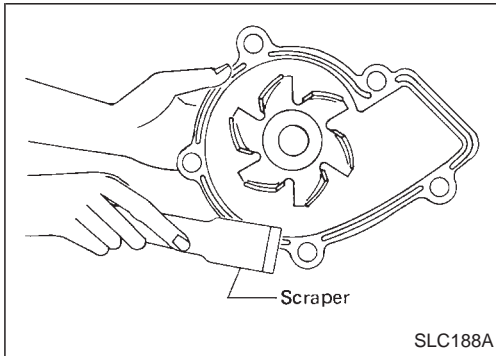
### INSPECTION

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

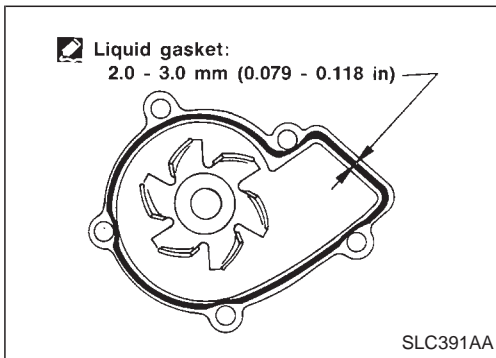


### INSTALLATION

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.



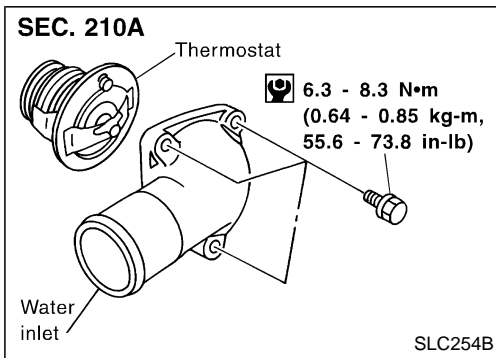
When filling radiator with coolant, refer to MA section (“Changing Engine Coolant”, “ENGINE MAINTENANCE”).  
 When installing drive belts, refer to MA section (“Checking Drive Belts”).

### Thermostat

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

### REMOVAL

1. Drain coolant from engine. Refer to MA section (“Changing Engine Coolant”, “ENGINE MAINTENANCE”).
2. Remove air duct assembly.
3. Remove water hose from water inlet housing.
4. Remove water inlet housing, then take out thermostat.

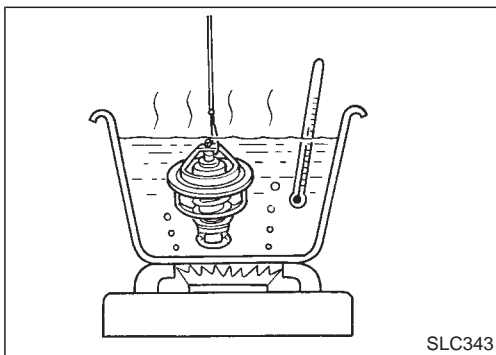


### INSPECTION

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

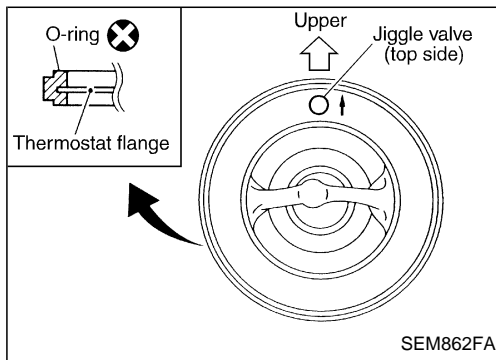
Valve opening temperature	°C (°F)	76.5 (170)
Valve lift	mm/°C (in/°F)	More than 8/90 (0.31/194)

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



## Thermostat (Cont'd)

## INSTALLATION



1. Install O-ring to thermostat.
- **Be sure to install new O-ring.**
2. Install thermostat with jiggle valve or air bleeder at upper side.
3. Install water inlet housing.
4. Install in reverse order of removal.
5. Refill engine coolant. Refer to MA section ("Changing Engine Coolant", "ENGINE MAINTENANCE").
- **After installation, run engine for a few minutes, and check for leaks.**

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## Radiator

## REMOVAL AND INSTALLATION

1. Drain coolant from radiator. Refer to MA section ("Changing Engine Coolant", "ENGINE MAINTENANCE").
2. Remove air duct assembly.
3. Disconnect upper and lower radiator hoses.
4. Remove A/T oil cooler hoses.
5. Remove lower radiator shroud.
6. Remove radiator shroud.
7. Disconnect coolant reservoir hose.
8. Remove radiator.
9. After replacing radiator, install all parts in reverse order of removal.
10. Refill engine coolant. Refer to MA section ("Changing Engine Coolant", "ENGINE MAINTENANCE").
- **After installation, run engine for a few minutes, and check for leaks.**

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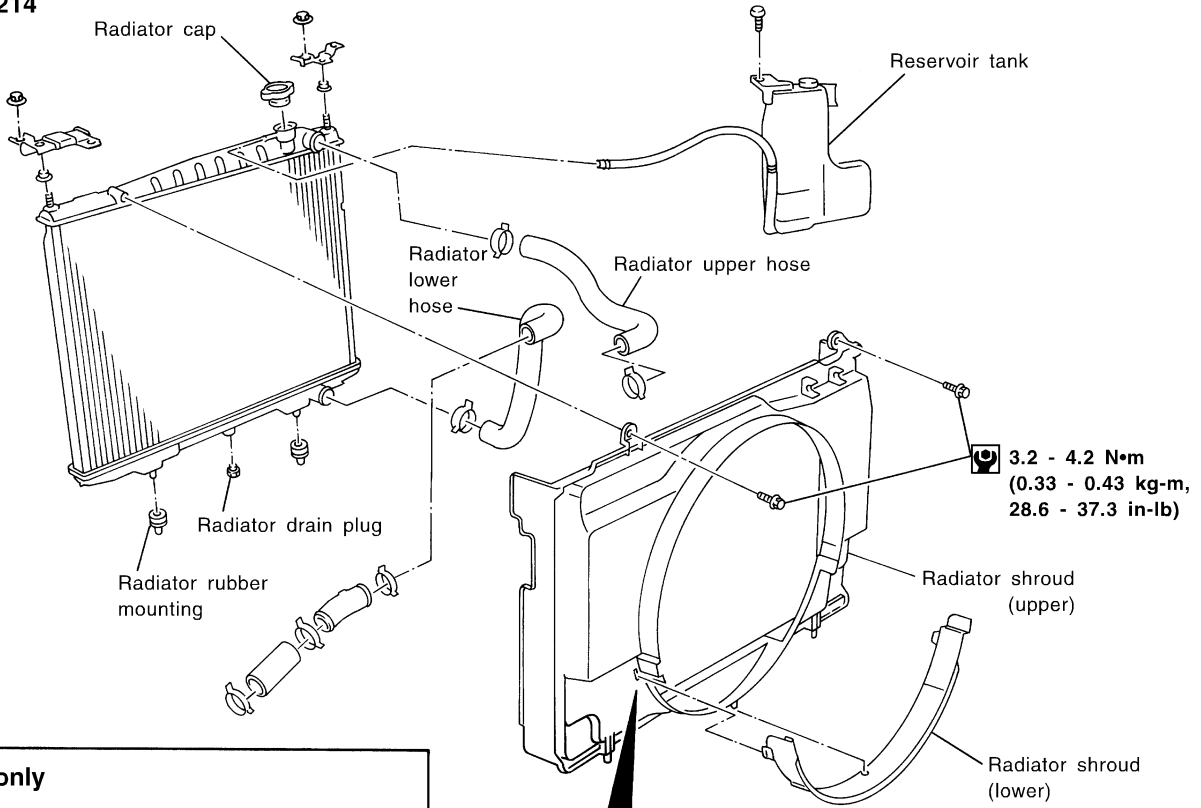
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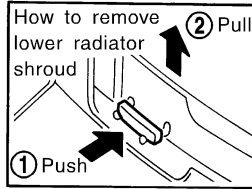
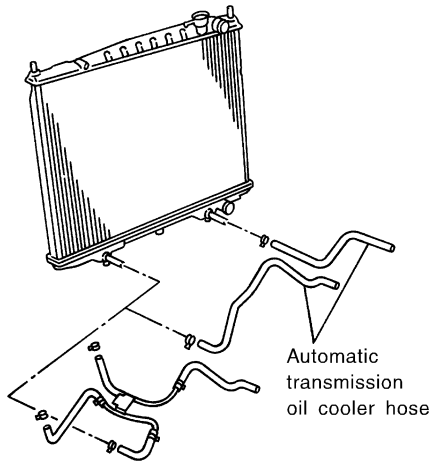
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Radiator (Cont'd)

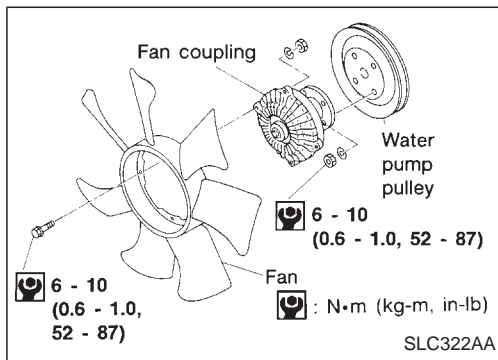
SEC. 214



A/T only



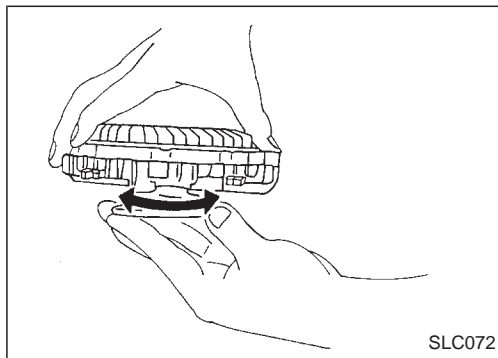
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## Cooling Fan (Crankshaft driven)

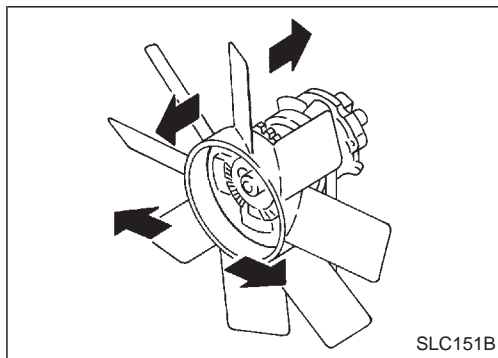
### REMOVAL AND INSTALLATION

- 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.
- 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.



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.**

### Refilling engine coolant

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

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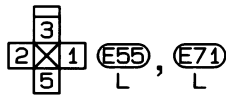
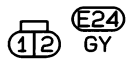
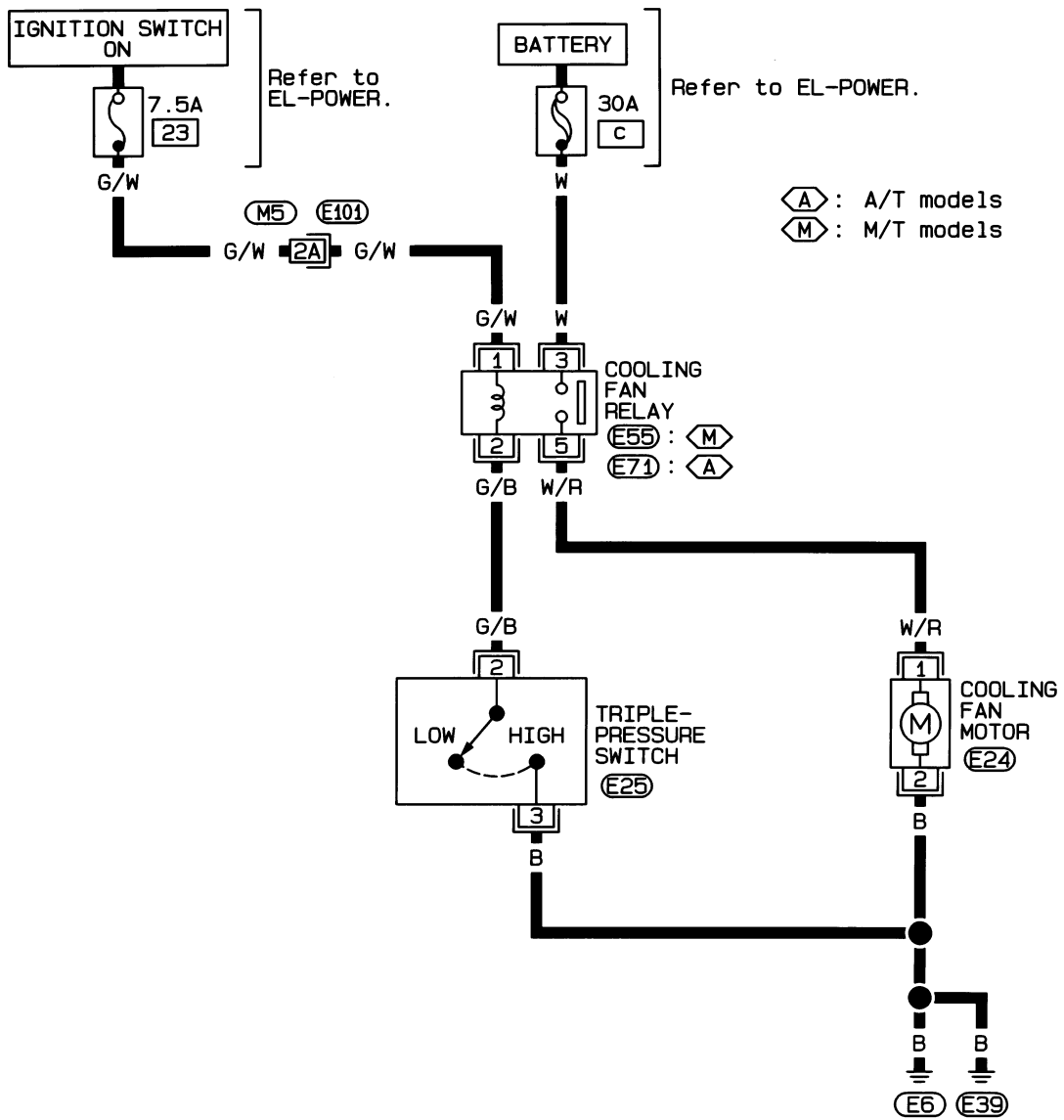
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Wiring Diagram

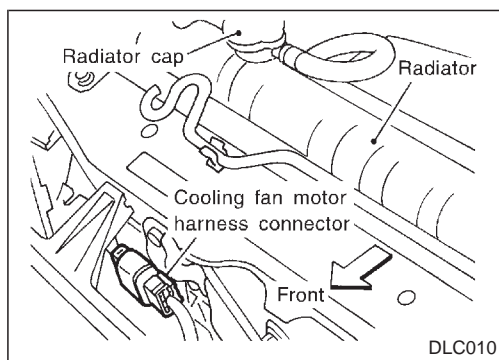
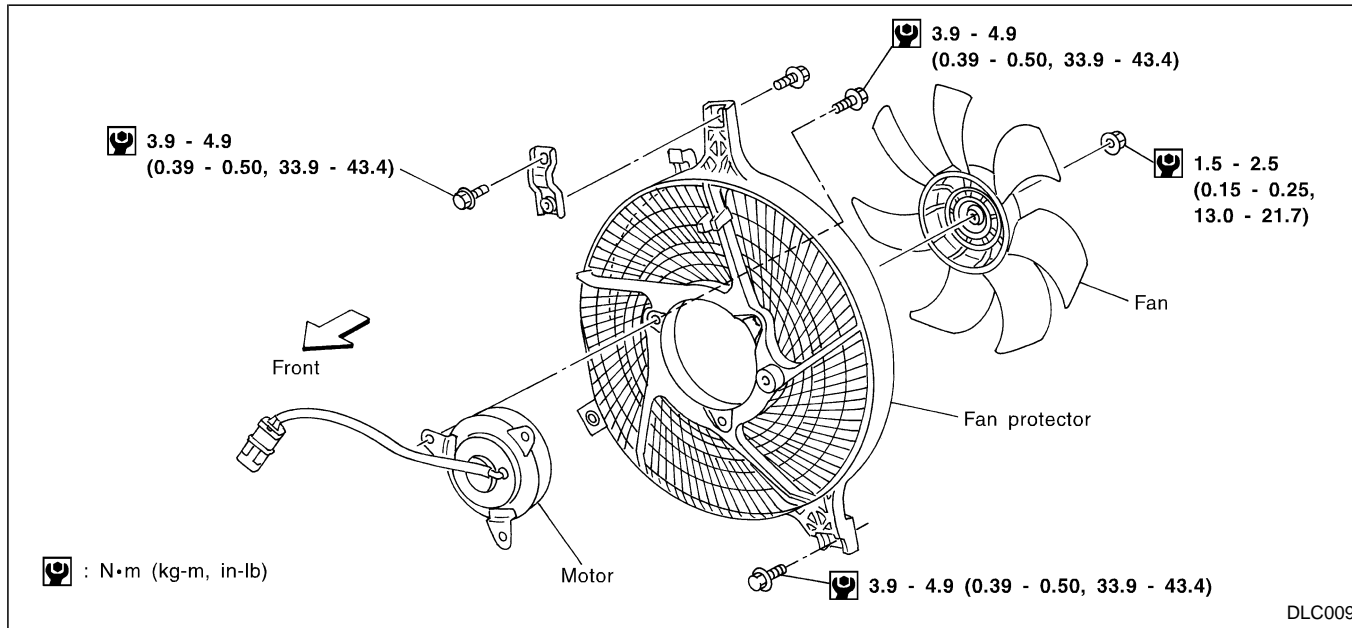
LC-COOL/F-01



Refer to last page (Foldout page).

M5, E101

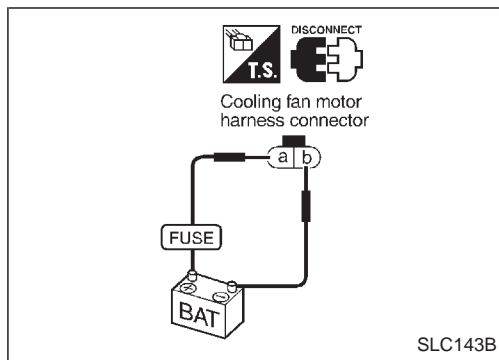
Cooling Fan (Motor driven)



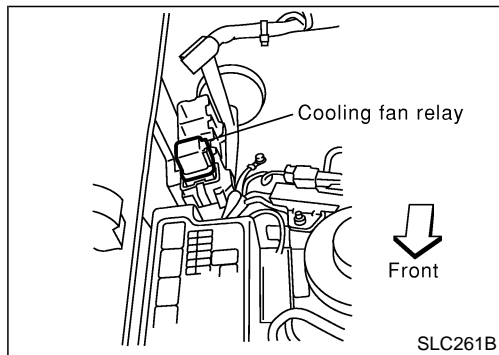
Electrical Components Inspection

COOLING FAN MOTOR

1. Disconnect cooling fan motor harness connector.



2. Supply cooling fan motor terminals with battery voltage and check operation.  
**Cooling fan motor should operate.**  
If NG, replace cooling fan motor.

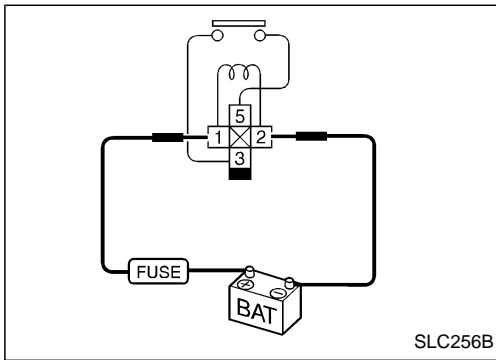


COOLING FAN RELAY

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ST  
RS  
BT  
HA  
EL  
IDX

**Electrical Components Inspection (Cont'd)**

Check continuity between terminals ③ and ⑤ .



Conditions	Continuity
12V direct current supply between terminals ① and ②	Yes
No current supply	No

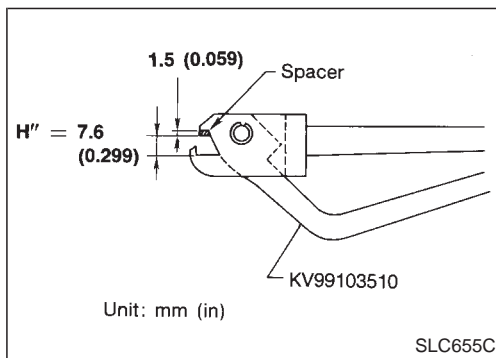
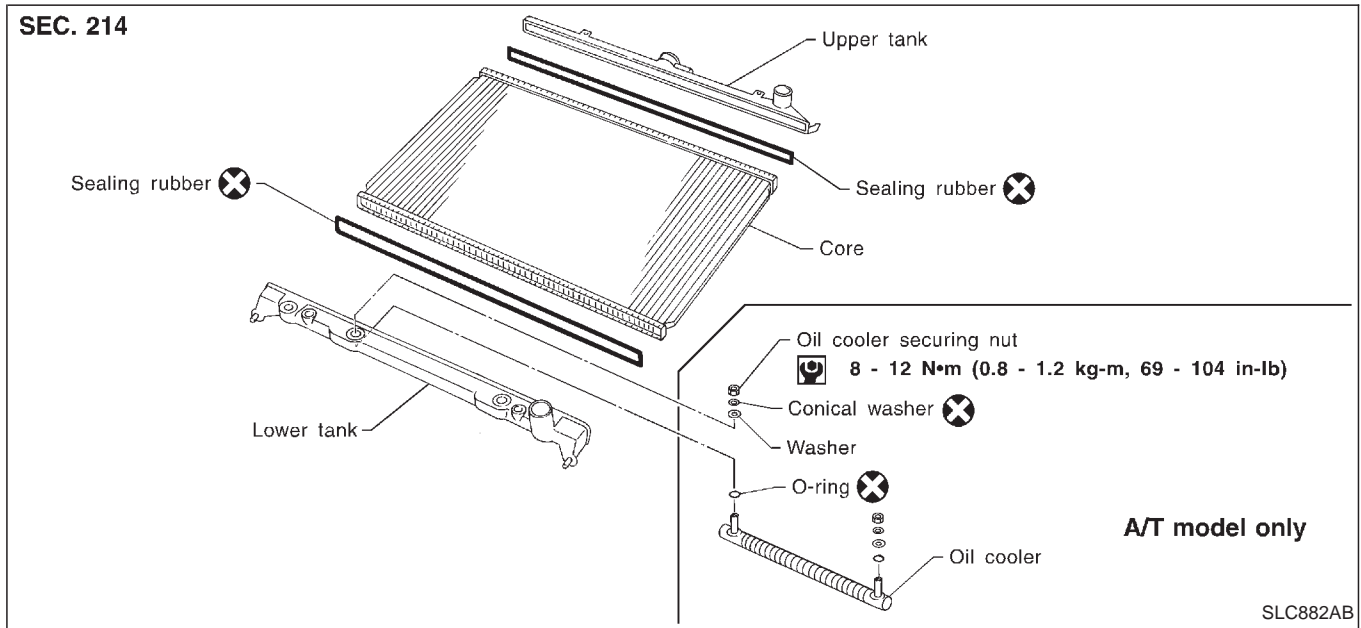
If NG, replace relay.

**TRIPLE-PRESSURE SWITCH**

For inspection of this switch, refer to HA section (“TRIPLE-PRES-SURE SWITCH”, “Electrical Components Inspection”).

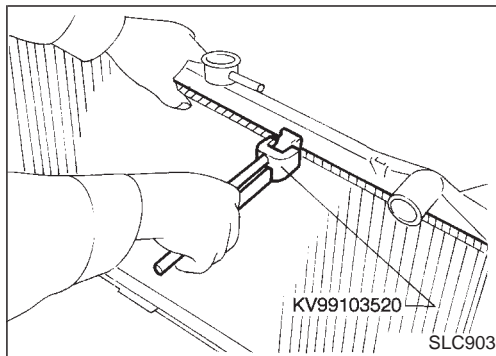


## Radiator (Aluminum type)



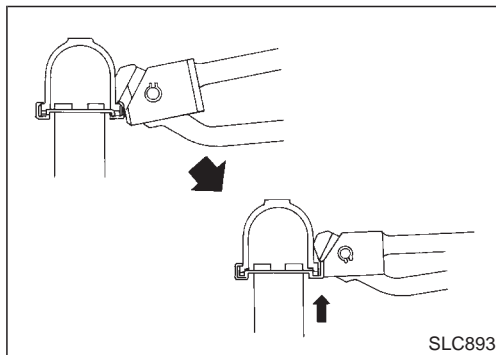
## PREPARATION

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.
  - If the radiator core rims cannot be crimped as specified, further modification of the radiator plate pliers A is required. Refer to the Technical Bulletin LC 91-001.



## DISASSEMBLY

1. Remove tank with Tool.



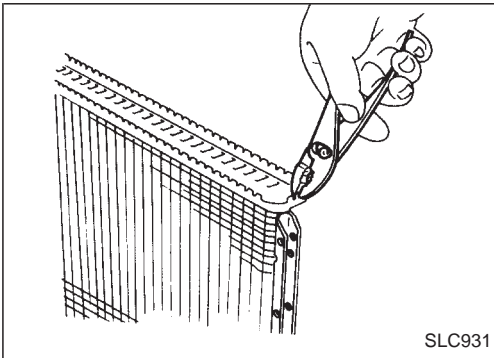
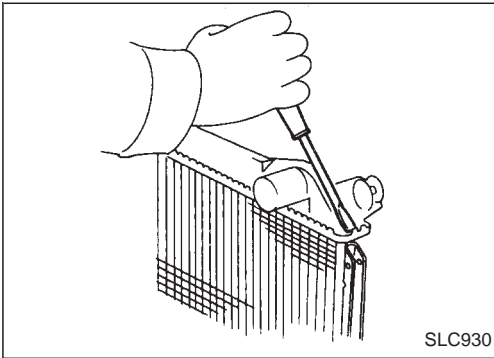
- Grip the crimped edge and bend it upwards so that Tool slips off.

**Do not bend excessively.**

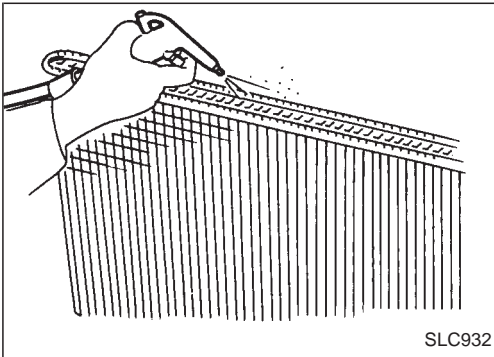
## Radiator (Aluminum type) (Cont'd)

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

**Be careful not to damage tank.**

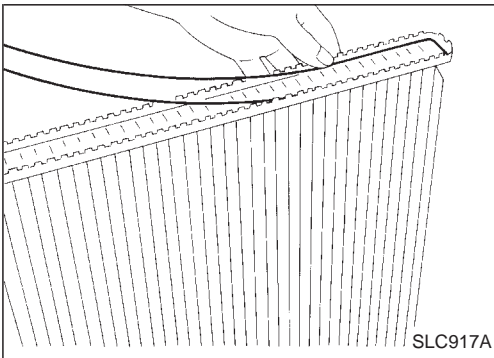


2. Make sure the edge stands straight up.

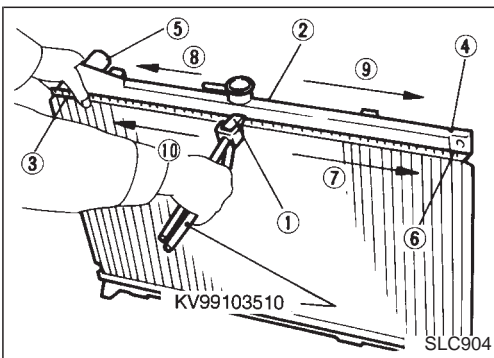


### ASSEMBLY

1. Clean contact portion of tank.

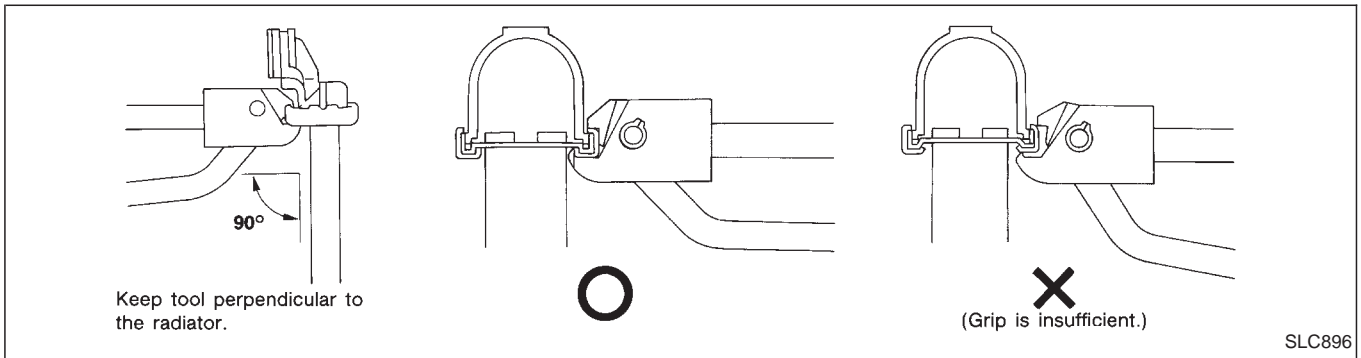


2. Install sealing rubber.  
**Push it in with fingers.**  
**Be careful not to twist sealing rubber.**

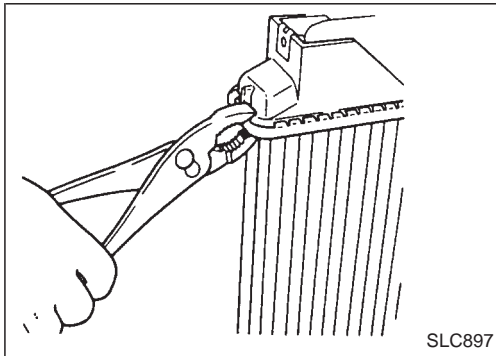


3. Caulk tank in specified sequence with Tool.

Radiator (Aluminum type) (Cont'd)

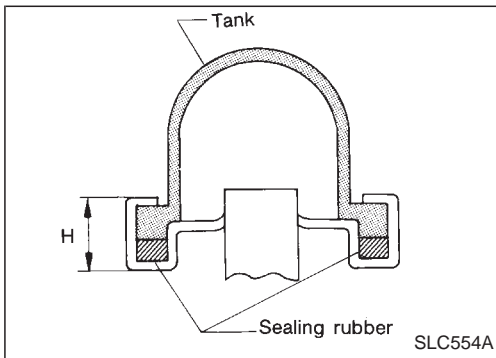


GI  
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LC



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

EC  
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MT

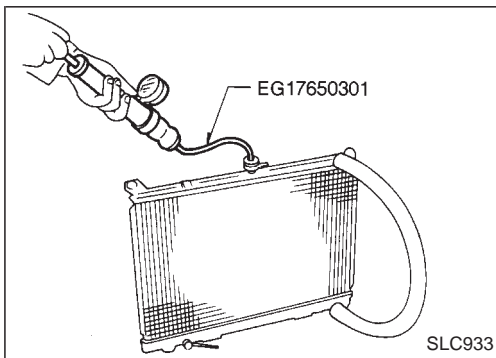


4. Make sure that the rim is completely crimped down.

**Standard height "H":**  
8.0 - 8.4 mm (0.315 - 0.331 in)

5. Confirm that there is no leakage.  
**Refer to Inspection.**

AT  
TF  
PD



**INSPECTION**

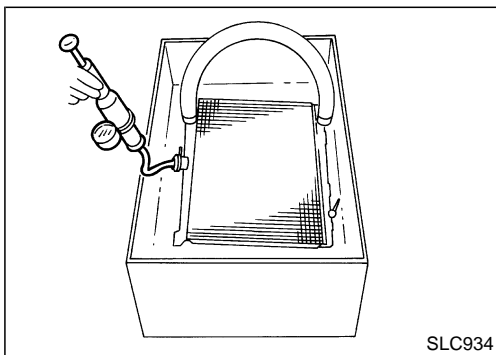
1. Apply pressure with Tool.

**Specified pressure value:**  
157 kPa (1.57 bar, 1.6 kg/cm<sup>2</sup>, 23 psi)

**WARNING:**

To prevent the risk of the hose coming undone while under pressure, securely fasten it down with a hose clamp.

FA  
RA  
BR



2. Check for leakage.

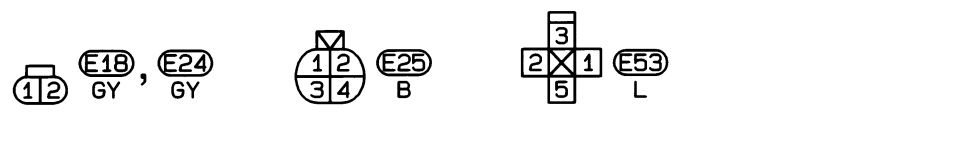
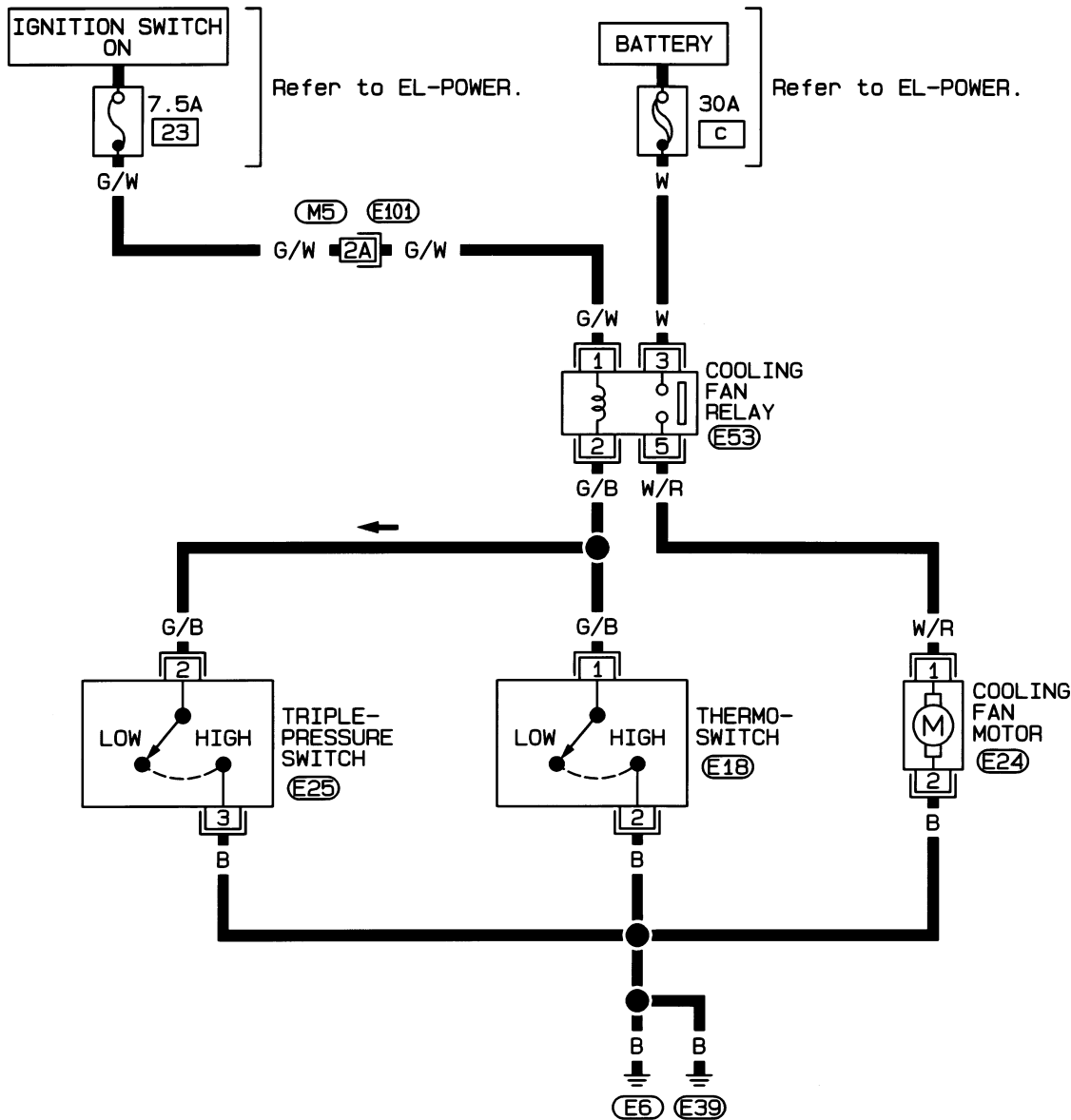
RS  
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Overheating Cause Analysis

		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	—	—
		Fan coupling 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		
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				

Wiring Diagram

LC-COOL/F-01



Refer to last page (Foldout page).

(M5), (E101)

- GI
- MA
- EM
- LC**
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**Engine Lubrication System**

**Oil pressure check**

Engine speed rpm	Approximate discharge pressure kPa (bar, kg/cm <sup>2</sup> , psi)
Idle speed	More than 59 (0.59, 0.6, 9)
3,000	284 - 353 (2.84 - 3.53, 2.9 - 3.6, 41 - 51)

**Oil pump inspection**

		Unit: mm (in)
Rotor tip clearance	Less than 0.12 (0.0047)	
Outer rotor to body radial clearance	0.15 - 0.21 (0.0059 - 0.0083)	
Side clearance (with gasket)	0.04 - 0.08 (0.0016 - 0.0031)	

**Engine Cooling System**

**Thermostat**

Valve opening temperature	°C (°F)	76.5 (170)
Valve lift	mm/°C (in/°F)	More than 8/90 (0.31/194)

**Radiator**

		Unit: kPa (bar, kg/cm <sup>2</sup> , psi)
Cap relief pressure	Standard	78 - 98 (0.78 - 0.98, 0.8 - 1.0, 11 - 14)
	Limit	59 - 98 (0.59 - 0.98, 0.6 - 1.0, 9 - 14)
Leakage test pressure		157 (1.57, 1.6, 23)

Engine Lubrication System (QD & TD)

Oil pump inspection

Unit: mm (in)

Gear side clearance	Less than 0.16 (0.0063)
Gear backlash	Less than 0.43 (0.0169)
Oil pump bushing clearance	Less than 0.15 (0.0059)
Oil pump bushing inside diameter	13.012 - 13.106 (0.5123 - 0.5160)
Drive gear shaft outside diameter	12.981 - 12.992 (0.5111 - 0.5115)

GI

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**LC**

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