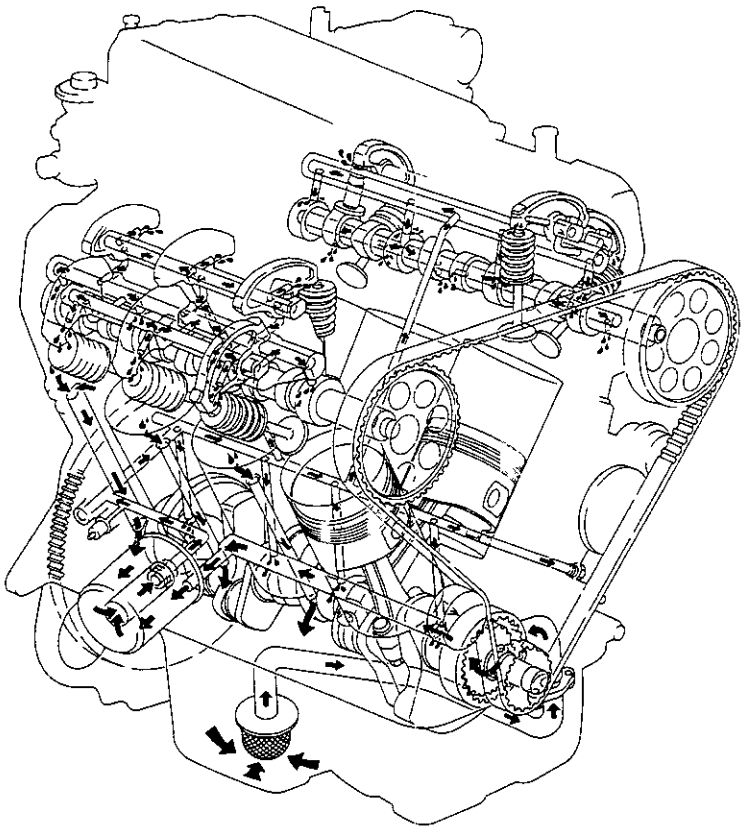
ENGINE LUBRICATION & COOLING SYSTEMS

SECTION LC

LC

CONTENTS

Lubrication Circuit



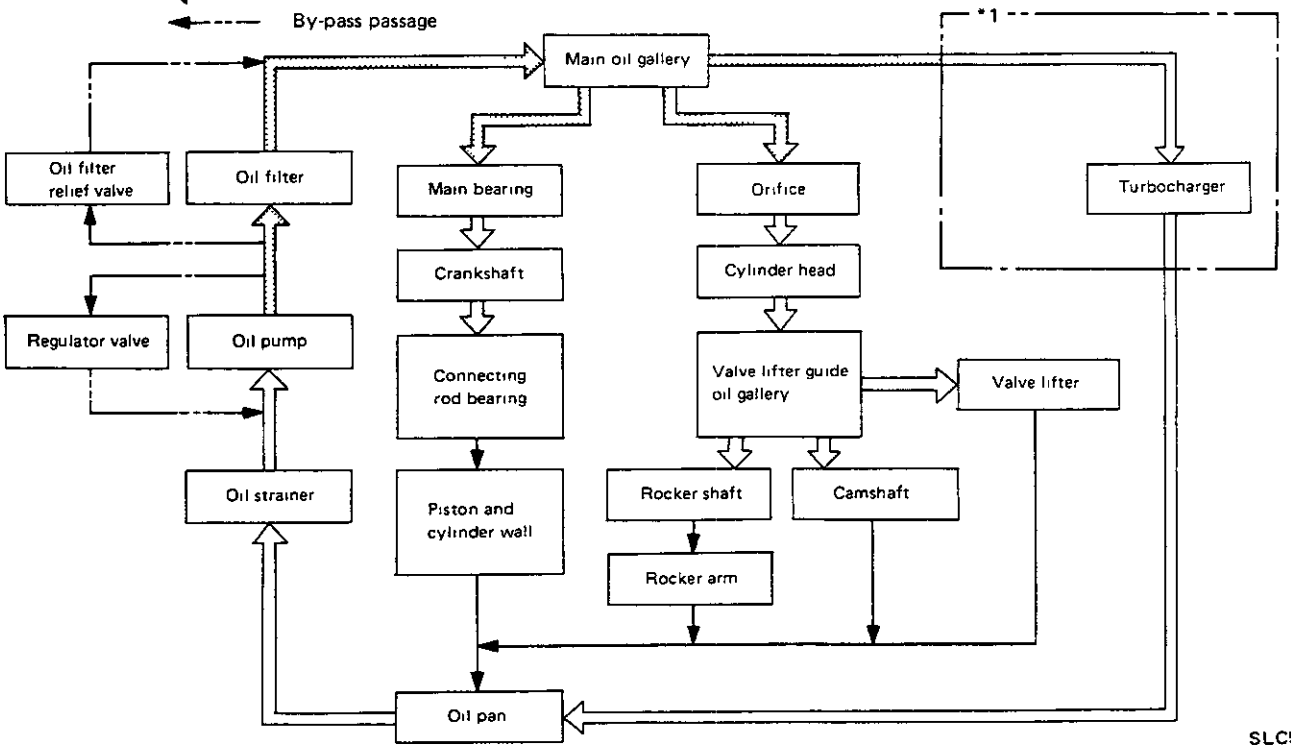
Note

Oil passage

Oil gallery in cylinder block

By-pass passage

*1 Additional lubrication circuit for turbocharged model

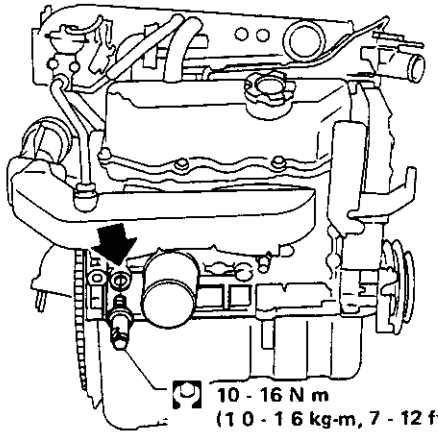


SLC544

Oil Pressure Check (On-vehicle service)

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

1 Warm up engine
2 Stop engine and remove oil pressure switch

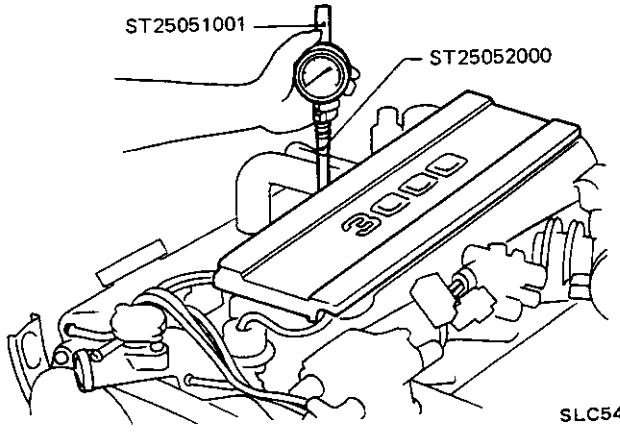


SLC545

3 Install pressure gauge
4 Start engine and check oil pressure with engine running under no-load

Engine rpm	Approximate discharge pressure kPa (kg/cm^2, psi)
1,200	196 (2, 28)
2,000	294 (3, 43)
4,000	392 (4, 57)

Oil pressure at 600 rpm (Idling) should be more than 78 kPa (0.8 kg/cm^2, 11 psi)



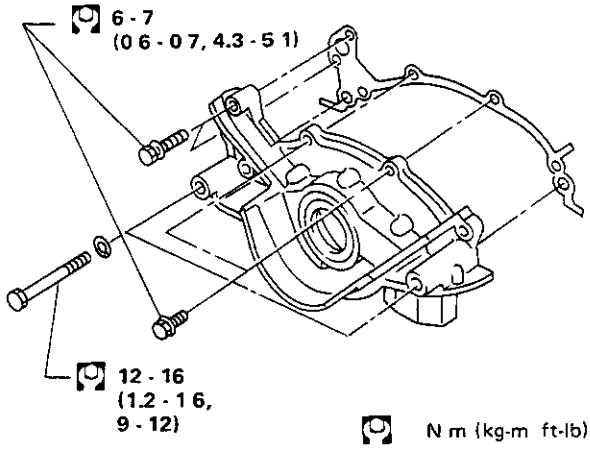
SLC546

The above table shows data tested when SAE 10W-30 oil is used and oil temperature is between 77 and 83°C (171 and 181°F). Slight difference will be found because of oil viscosity or oil temperature If difference is extreme, check oil passage and oil pump for oil leaks

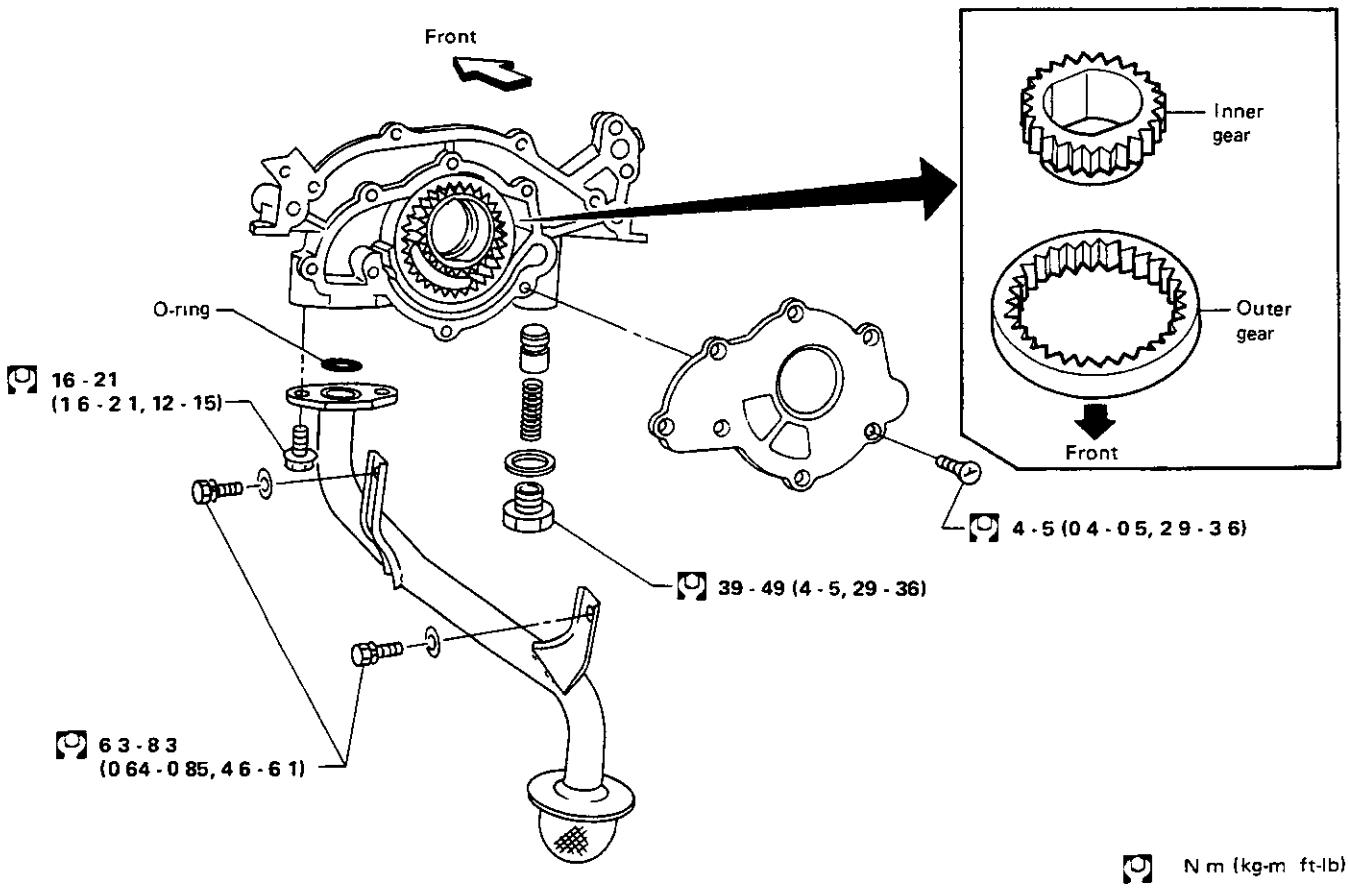
Disassembly and Assembly

1. Drain oil.
2. Remove oil pan.
   In case of on-vehicle service, refer to Oil Pan for removal in section EM
3. Remove oil pump assembly

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



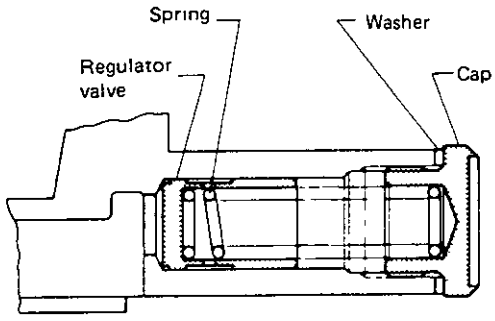
SLC547



SLC548

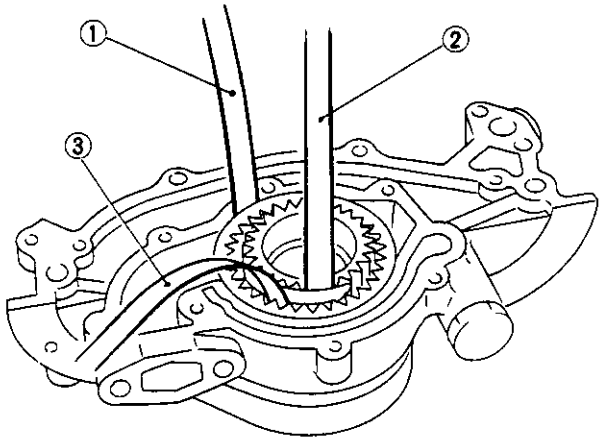
Inspection

1 Visually inspect components for wear and damage
2 Check oil pressure regulator valve sliding surface and valve spring

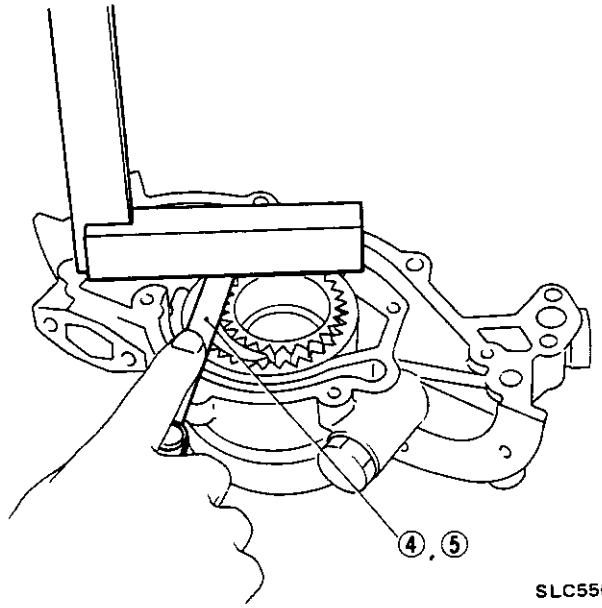


SLC295

3 Using a feeler gauge, check the following clearance



SLC549



SLC550

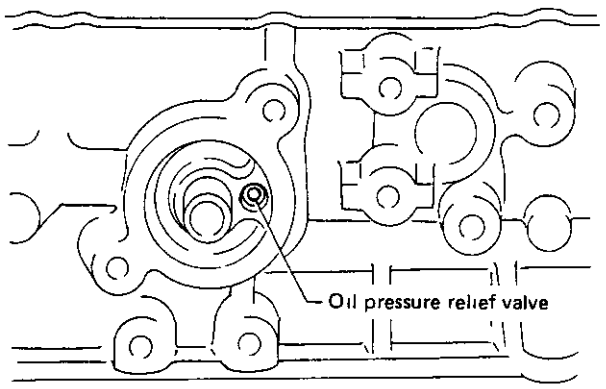
If it exceeds the limit, replace gear set or entire oil pump assembly.

Unit mm (in)

Body to outer gear clearance ①	0 11 - 0 20 (0 0043 0 0079)
Inner gear to crescent clearance ②	0 12 - 0 23 (0 0047 0 0091)
Outer gear to crescent clearance ③	0 21 - 0 32 (0 0083 0 0126)
Housing to inner gear clearance ④	0 05 - 0 09 (0 0020 - 0 0035)
Housing to outer gear clearance ⑤	0 05 - 0 11 (0 0020 - 0 0043)

Inspection

Inspect for its smooth operation by pushing ball

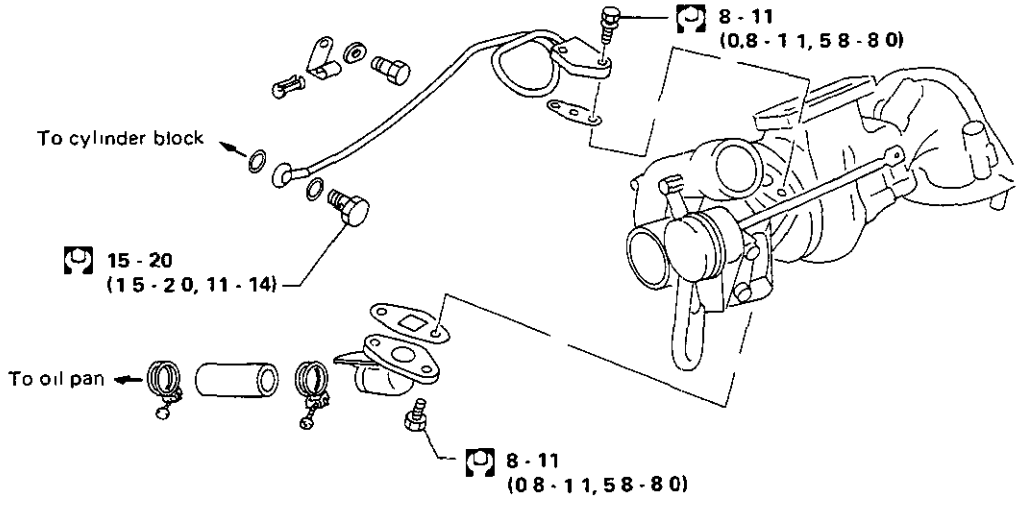


SLC551

ENGINE LUBRICATION SYSTEM
—Lubricating Oil Passage for Turbocharger—

Disassembly and Assembly

Always replace with new gasket.
After installation, run engine for a few minutes and check for leaks

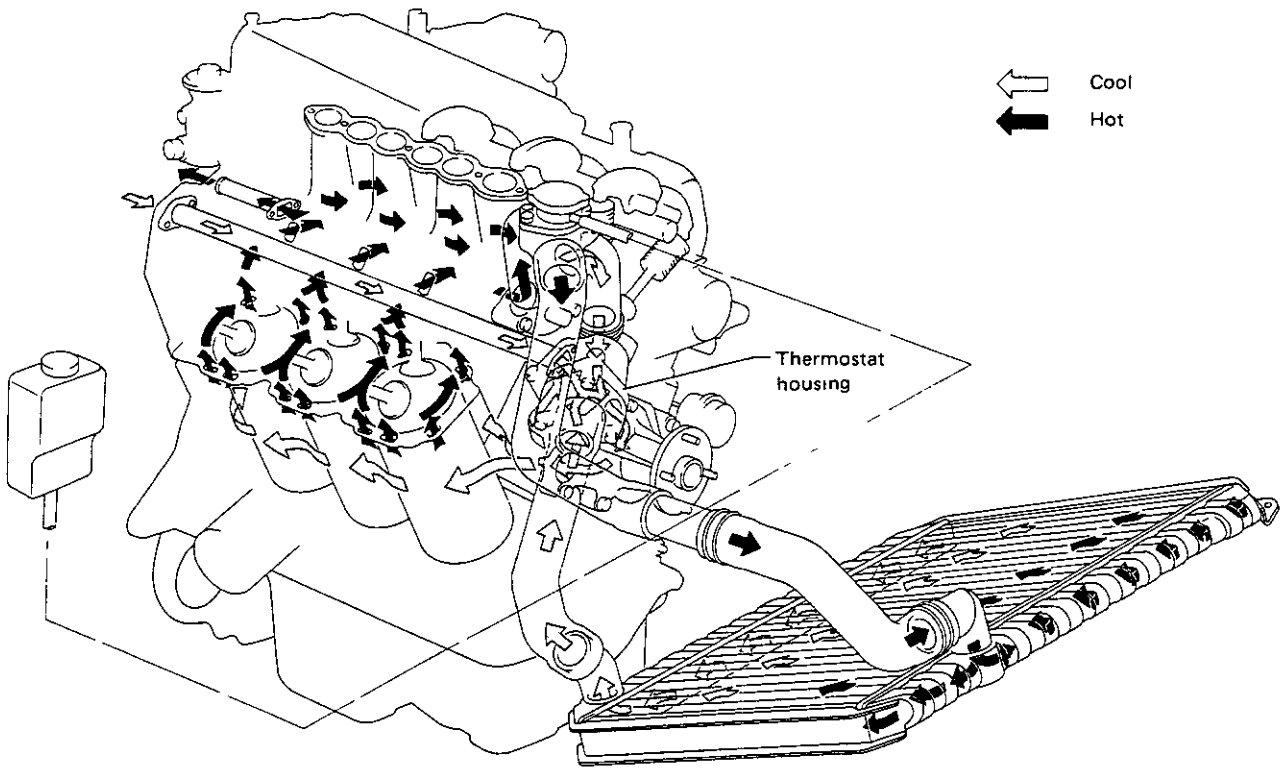


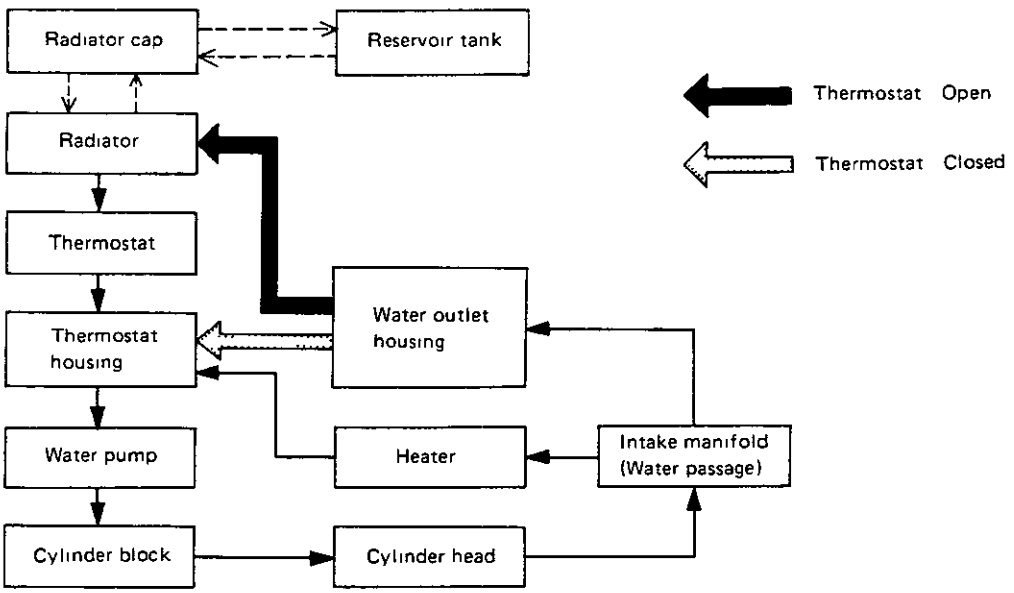
N·m (kg-m, ft-lb)

SLC552

Cooling Circuit

To avoid danger of being scalded, never attempt to drain coolant when engine is hot.
Always replace with new gasket and O-ring.



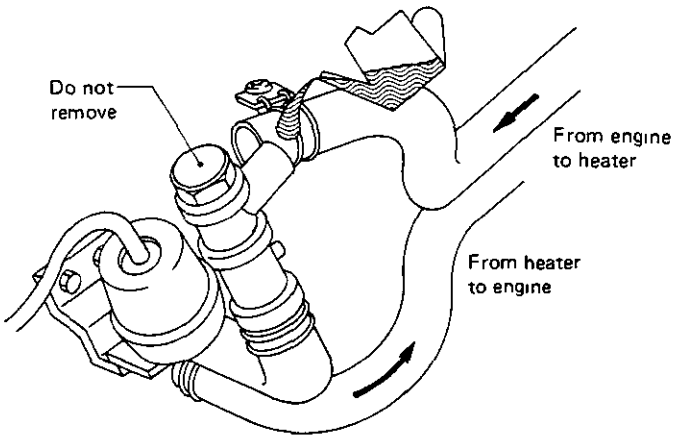


SLC553

Changing Engine Coolant

- Refer to Changing Engine Coolant in section MA
- If the hoses connecting engine and heater have been disconnected to dismount heater core unit and engine, always perform the following work before filling with engine coolant

1 Set the heater temperature lever or button to "Full Hot" position
2 Disconnect the upper hose from water cock, and fill the heater core unit with 500 mℓ (16.9 US fl oz, 17 6 Imp fl oz) or more of coolant



SLC609

3 Connect the hoses.

Checking Cooling System

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

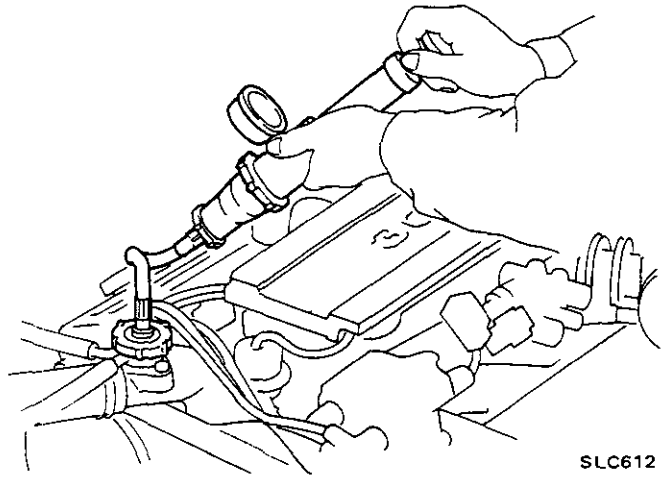
CHECKING COOLING SYSTEM HOSES

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

CHECKING COOLING SYSTEM FOR LEAKS

Apply pressure to the cooling system by means of a tester to check for leakage

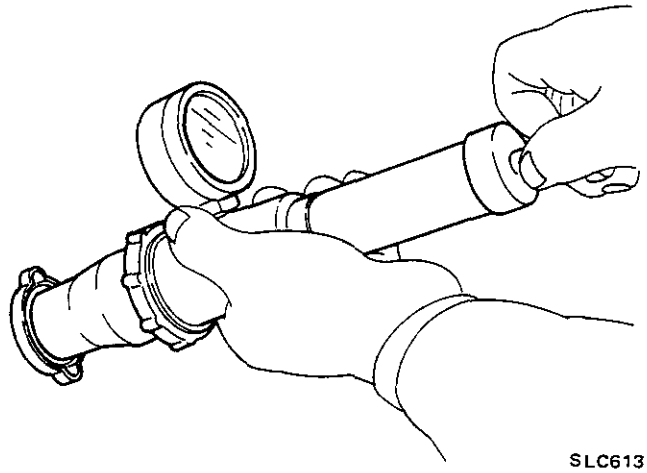
Testing pressure.
157 kPa (1 6 kg/cm^2, 23 psi)


SLC612

CHECKING RADIATOR CAP

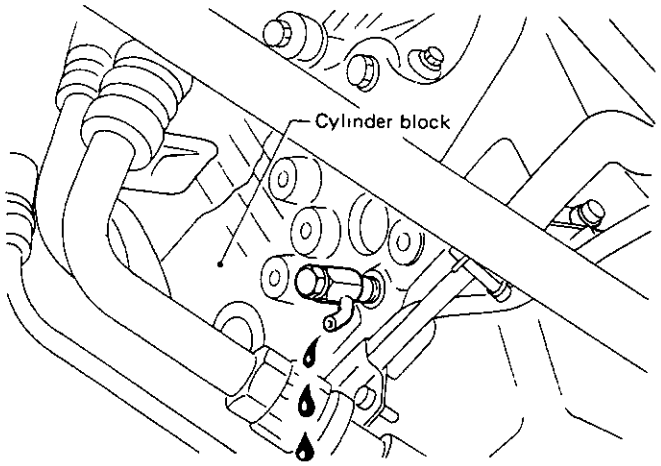
Apply pressure to radiator cap by means of a cap tester to see if it is satisfactory

Radiator cap relief pressure:
59 - 98 kPa (0.6 - 1.0 kg/cm^2, 9 - 14 psi)


SLC613

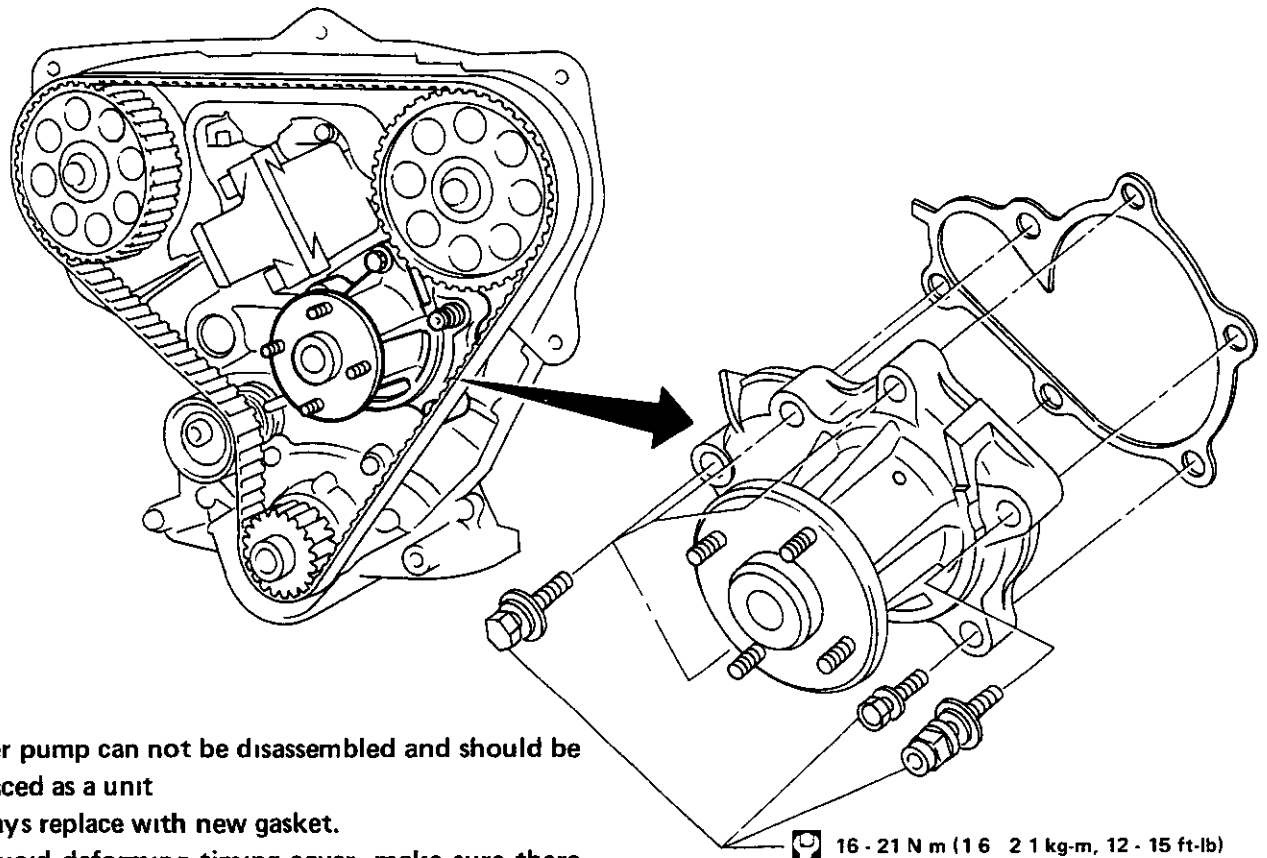
Disassembly and Assembly (On-vehicle service)

Drain coolant from right side drain cocks on cylinder block and radiator



SMA784A

CAUTION.
When removing water pump assembly, be careful not to get coolant on timing belt



16 - 21 N m (1.6 - 2.1 kg-m, 12 - 15 ft-lb)

SLC554

Water pump can not be disassembled and should be replaced as a unit

Always replace with new gasket.

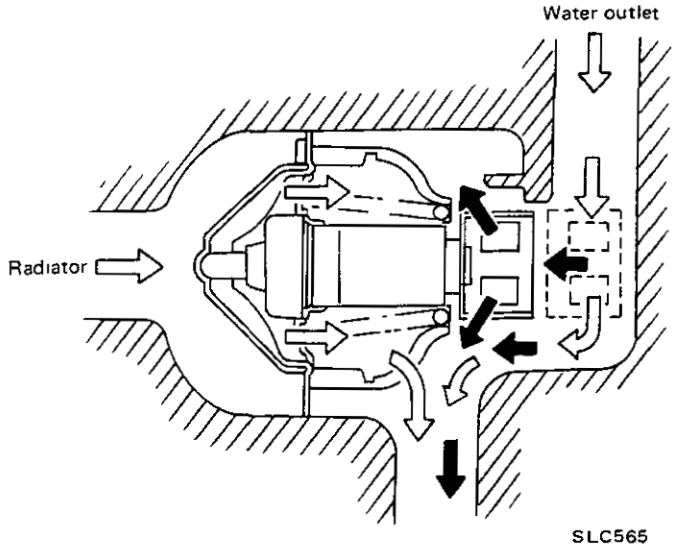
To avoid deforming timing cover, make sure there is adequate clearance between cover and hose clamp.

After installing water pump, connect hose and clamp securely, then check for leaks using cap tester.

Inspection

Check for excessive end play and rough operation

Description (Bottom by-pass coolant flow)



SLC565

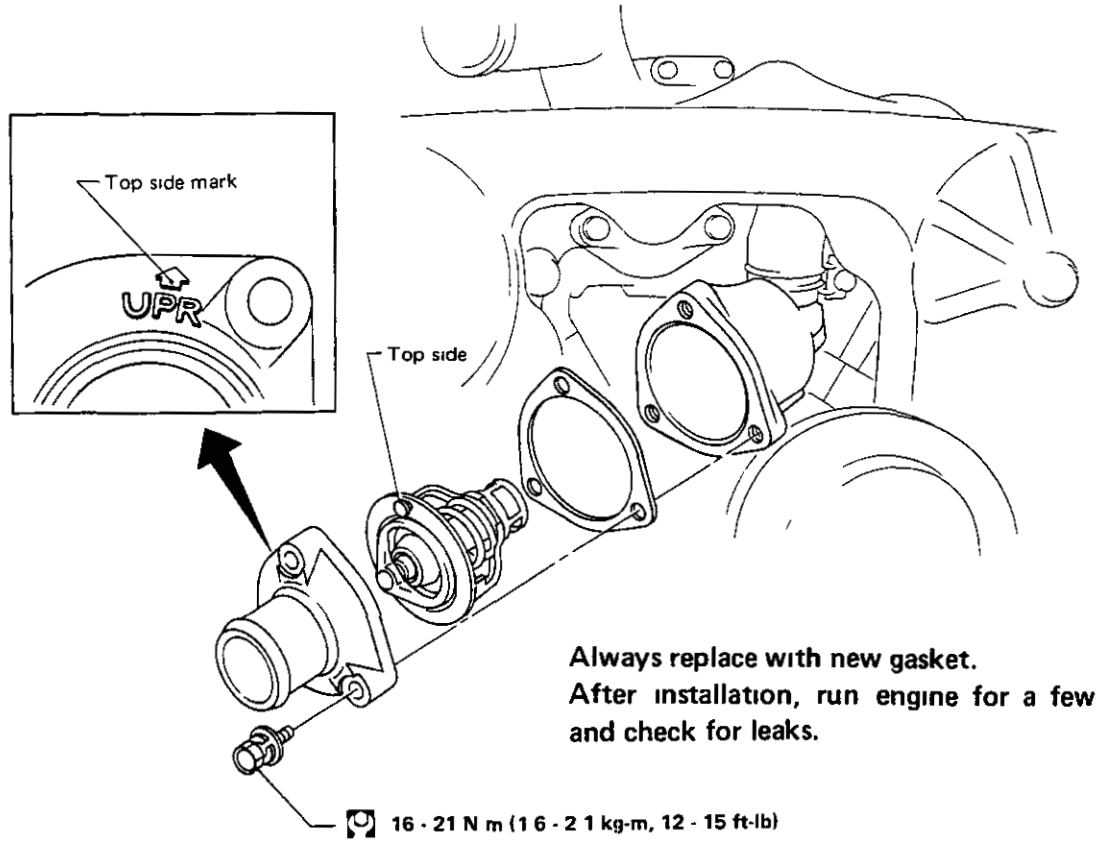
Thermostat	Coolant flow out through water outlet
Open	A few
Close	Much

Disassembly and Assembly

CAUTION:

Drain coolant from drain cocks on cylinder block side and radiator.

Remove radiator shroud, cooling fan and water suction pipe securing bolt, then remove thermostat.



Always replace with new gasket.

After installation, run engine for a few minutes, and check for leaks.

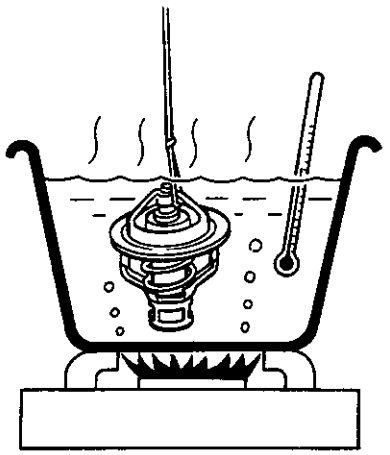
16 - 21 N m (1.6 - 2.1 kg-m, 12 - 15 ft-lb)

SLC555

Inspection

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

	Standard
Valve opening temperature °C (°F)	76 5 (170)
Maximum valve lift mm/°C (in/°F)	10/90 (0 39/194)

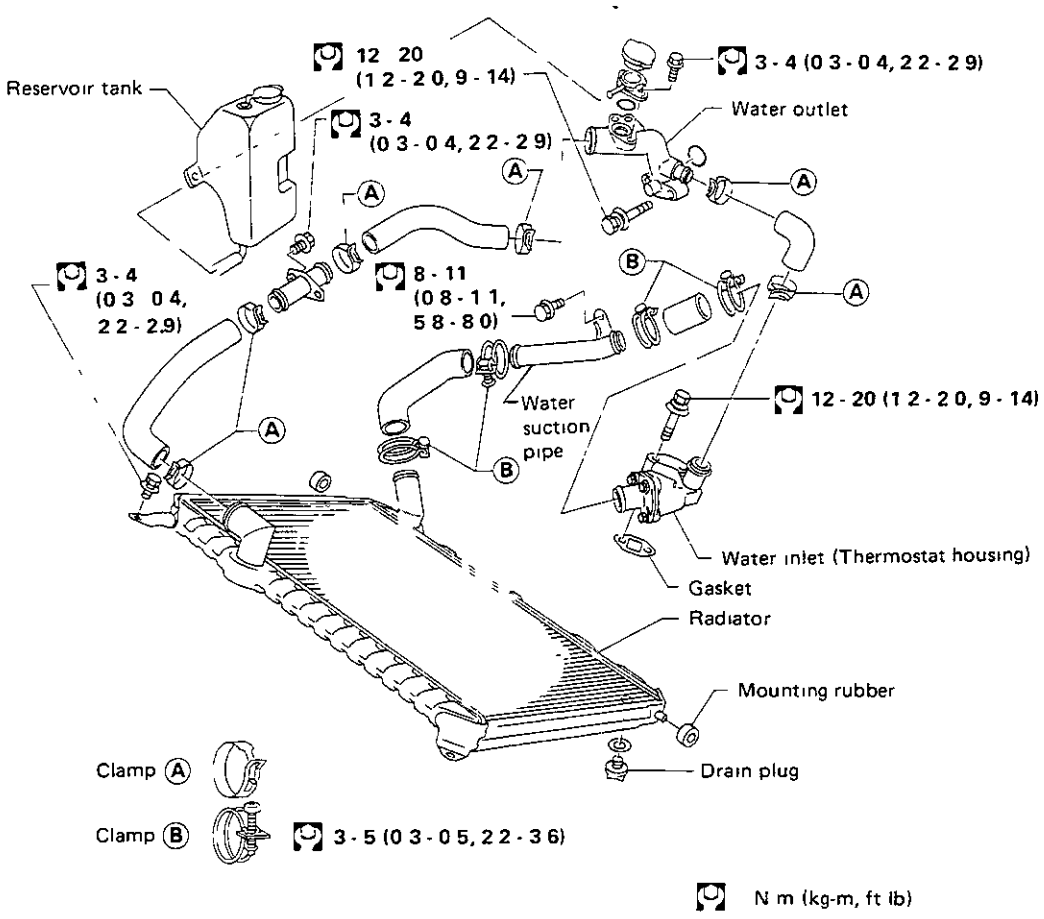


SLC556

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

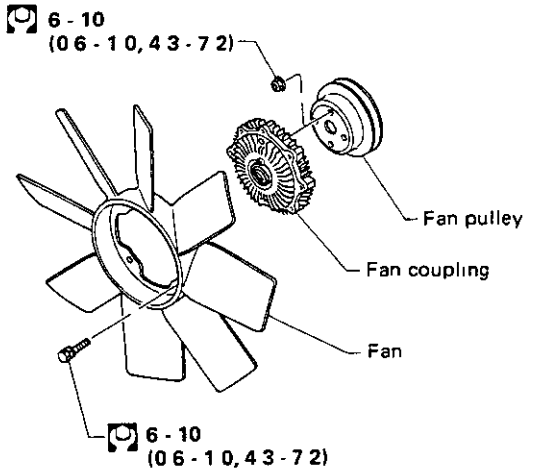
Disassembly and Assembly

Before removing radiator, remove front bumper assembly
Always replace with new gasket and O-ring
When filling radiator with coolant, refer to MA section



SLC557

Disassembly and Assembly

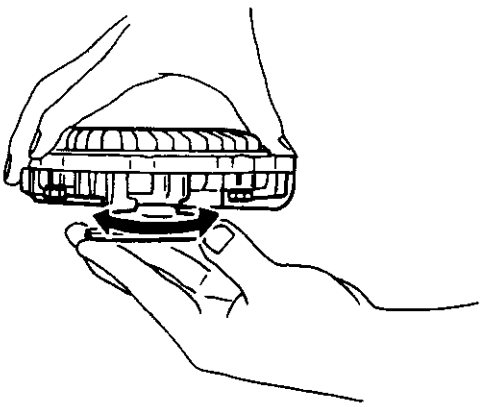


N·m (kg-m, ft-lb)

SLC558

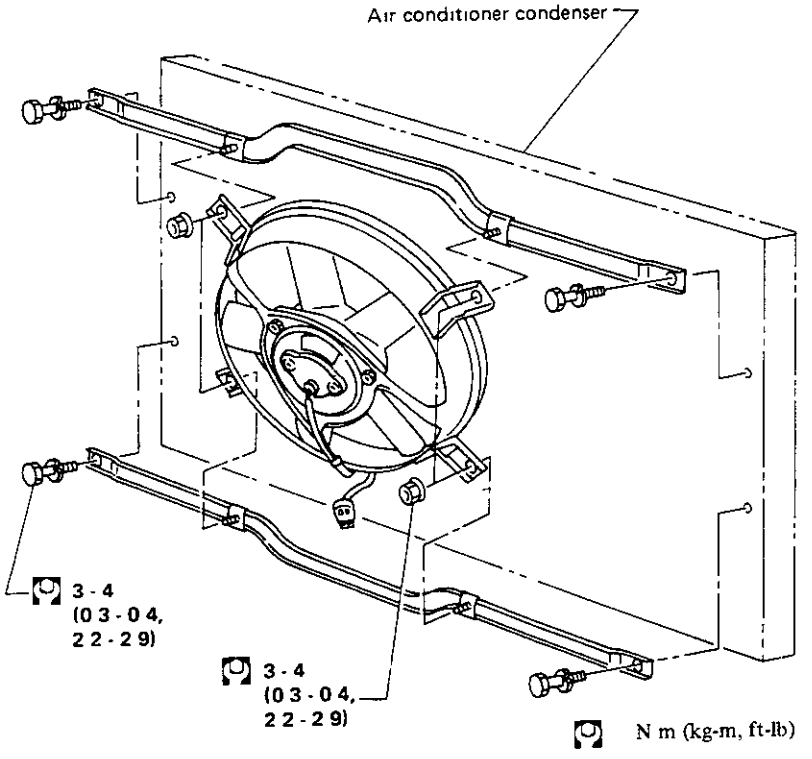
Inspection

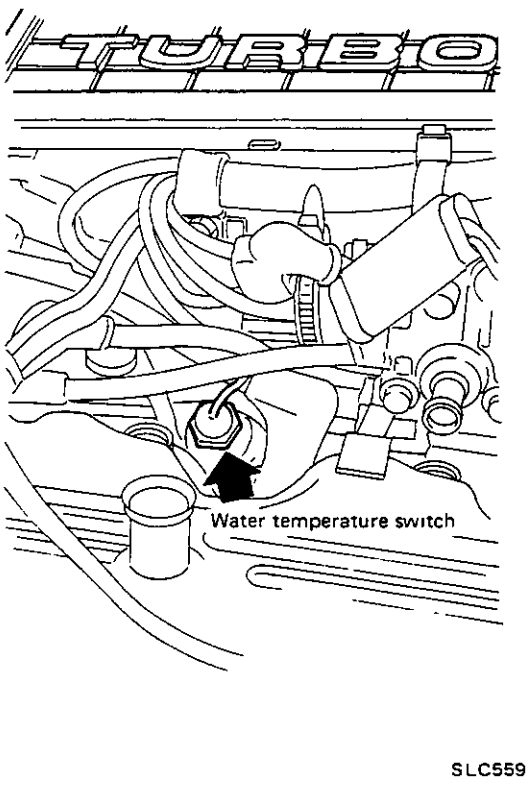
Check fan coupling for oil leakage or bent bimetal.



SLC072

Disassembly and Assembly





SLC559

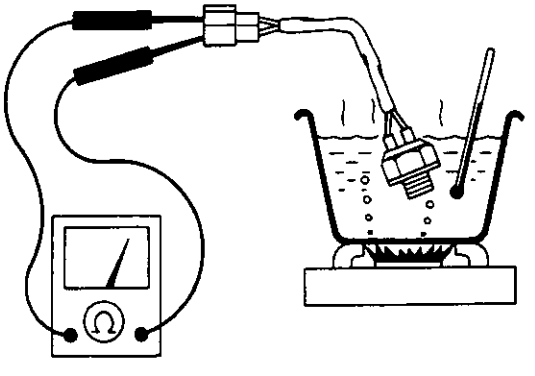
Refer to HA section for electric circuit

Inspection

Check water temperature switch for proper operation

Operating temperature

OFF → ON 100°C (212°F)



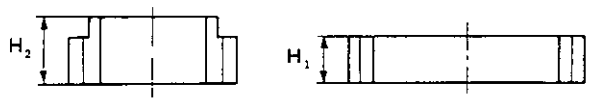
SLC463

Engine Lubrication System

Oil pressure check

Engine rpm	Approximate discharge pressure kPa (kg/cm², psi)
600	78 (0 8, 11)
1,200	196 (2, 28)
2,000	294 (3, 43)
4,000	392 (4, 57)

Oil pump



SLC573

Unit mm (in)

Height	H_1	H_2
Except turbo model	12 5 (0 492)	18 5 (0 728)
Turbo model	15 5 (0 610)	21 5 (0 846)

Unit mm (in)

Body to outer gear clearance ①	0 11 - 0 20 (0 0043 - 0 0079)
Inner gear to crescent clearance ②	0 12 - 0 23 (0 0047 - 0 0091)
Outer gear to crescent clearance ③	0 21 - 0 32 (0 0083 - 0 0126)
Housing to inner gear clearance ④	0 05 - 0 09 (0 0020 - 0 0035)
Housing to outer gear clearance ⑤	0 05 0 11 (0 0020 - 0 0043)

Oil pressure regulator valve

Valve spring free length mm (in)	xxxxx
Valve spring assembly length mm/N (mm/kg, in/lb)	xxxxx
Opening pressure kPa (kg/cm², psi)/rpm	373 - 412 (3 8 - 4 2, 54 - 60)/2,000 rpm

Tightening torque

Unit	N m	kg-m	ft-lb
Oil pump securing bolt			
M6	6 - 7	0 6 - 0 7	4 3 - 5 1
M8	12 - 16	1 2 - 1 6	9 - 12
Oil pump cover screw	4 - 5	0 4 - 0 5	2 9 - 3 6
Regulator valve cap bolt	39 - 49	4 - 5	29 - 36
Oil strainer bolt			
M6	6 3 - 8 3	0 64 - 0 85	4 6 - 6 1
M8	16 - 21	1 6 - 2 1	12 - 15
Oil pressure switch	10 - 16	1 0 - 1 6	7 - 12
Turbocharger			
Oil inlet tube to cylinder block	15 - 20	1 5 - 2 0	11 14
Oil inlet tube to turbocharger	8 11	0 8 - 1 1	5 8 8 0
Oil outlet pipe to turbocharger	8 - 11	0 8 - 1 1	5 8 - 8 0

Engine Cooling System

Radiator

	Unit kPa (kg/cm², psi)
Cap relief pressure	59 98 (0 6 1 0, 9 - 14)
Leakage test pressure	157 (1 6, 23)

Thermostat

	Standard
Valve opening temperature °C (°F)	76 5 (170)
Maximum valve lift mm/°C (in/°F)	10/90 (0 39/194)

Fan coupling

Cut off point rpm		
Low		750
High	Except turbo model	2,450
	Turbo model	2,700
Low → High temperature °C (°F)		60 - 70 (140 - 158)

Temperature switch (Turbocharged model)

Operating temperature		
OFF → ON	°C (°F)	100 (212)

Tightening torque

Unit	N m	kg-m	ft-lb
Water pump securing bolt	16 - 21	1 6 2 1	12 - 15
Thermostat housing securing bolt	16 - 21	1 6 - 2 1	12 - 15
Water inlet securing bolt	16 - 21	1 6 - 2 1	12 - 15
Water outlet securing bolt	16 - 21	1 6 - 2 1	12 - 15
Coolant filler housing bolt	3 - 4	0 3 - 0 4	2 2 - 2 9
Radiator securing bolt	3 - 4	0 3 - 0 4	2 2 - 2 9
Radiator hose clamp	3 - 5	0 3 - 0 5	2 2 - 3 6
Cooling fan securing bolt	6 - 10	0 6 - 1 0	4 3 - 7 2
Fan coupling securing bolt	6 - 10	0 6 - 1 0	4 3 - 7 2

SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No)	Tool name
EG17650300 (–)	Radiator cap tester adapter