NISSAN

Model LD20 & LD28 Diesel Engine

FOREWORD

This service manual has been prepared primarily for the purpose of assisting service personnel in providing effective service and maintenance of the model LD20 & LD28 diesel engine for vehicles.

This manual includes procedures for maintenance, adjustments, removal and installation, disassembly and assembly of components, and trouble-shooting.

All information, illustrations and specifications contained in this manual are based on the latest product information available at the time of publication. If your engine differs from the specifications contained in this manual, consult your NISSAN/ DATSUN dealer for information.

The right is reserved to make changes in specifications and methods at any time without notice.

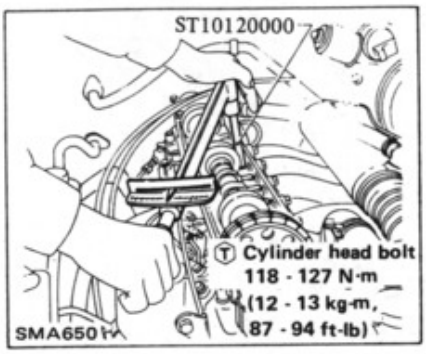
QUICK REFERENCE INDEX

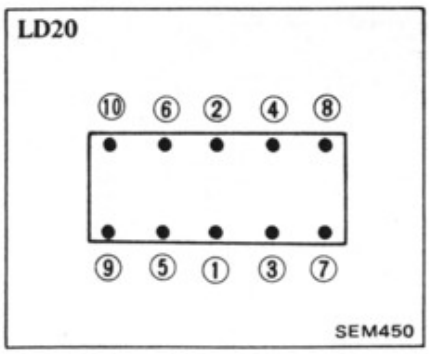
BASIC MECHANICAL SYSTEM

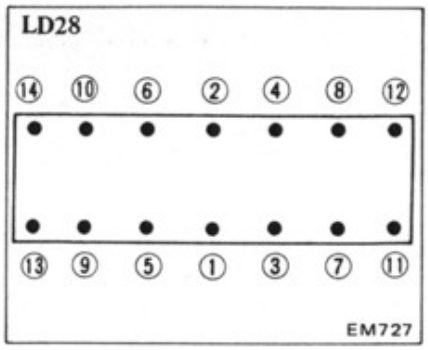
RETIGHTENING CYLINDER HEAD BOLTS, MANIFOLD NUTS

CYLINDER HEAD BOLTS

1. Run engine until coolant temperture indicator points to the middle of gauge, then stop engine.
2. Remove valve rocker cover.
3. Using Tool, tighten cylinder head bolts according to the order shown in figure, starting with the center and moving toward the ends.







4. Install valve rocker cover.

Ⓣ : **Valve rocker cover bolt**
6 - 9 N·m
(0.6 - 0.9 kg-m,
4.3 - 6.5 ft-lb)

MANIFOLD AND EXHAUST TUBE NUTS

WARNING:
Do not check the exhaust system until it has cooled off. Otherwise, you may burn yourself.

TIGHTENING TORQUE:

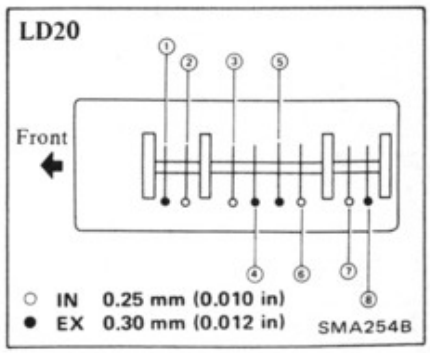
Unit		N·m	kg-m	ft-lb
Manifold	Bolt (M10)	32 - 36	3.3 - 3.7	24 - 27
	Bolt (M8)	17 - 21	1.7 - 2.1	12 - 15
	Nut	17 - 21	1.7 - 2.1	12 - 15
Exhaust tube		26 - 36	2.7 - 3.7	20 - 27

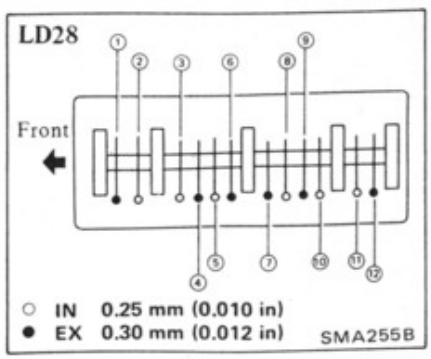
Never disassemble the intake manifold.

ADJUSTING INTAKE AND EXHAUST VALVE CLEARANCE

a. Adjustment should be made while engine is hot.
b. Adustment cannot be made while engine is in operation.
c. When rocker cover is removed to adjust intake and exhaust valve clearance, check elongation of timing chain. For details, refer to INSTALLING TIMING CHAIN in EM section.

To adjust, proceed as follows:
1. Remove valve rocker cover.
2. Set No. 1 cylinder at Top Dead Center on its compression stroke.
3. For LD20 engine, adjust clearance of half of the valves. Adjust ①, ②, ③ and ⑤ valves.
For LD28 engine, adjust ①, ②, ③, ⑥, ⑧ and ⑨ valves.
4. Set No. 4 (for LD20) or No. 6 (for LD28) cylinder at Top Dead Center on its compression stroke.
5. For LD20 engine, adjust ④, ⑥, ⑦ and ⑧ valves.





INJECTION AND FUEL SYSTEM

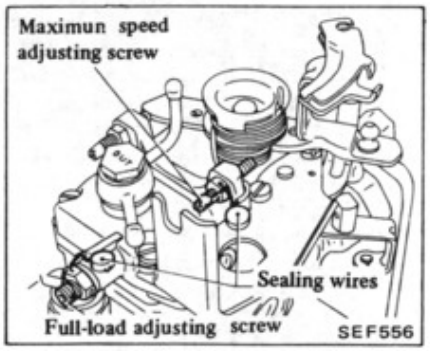
CHECKING AND ADJUSTING INJECTION TIMING

Refer to installation of injective pump in Section EF.

CHECKING AND ADJUSTING IDLE AND MAXIMUM SPEED

CAUTION:

a. Do not remove sealing wires unless absolutely necessary.

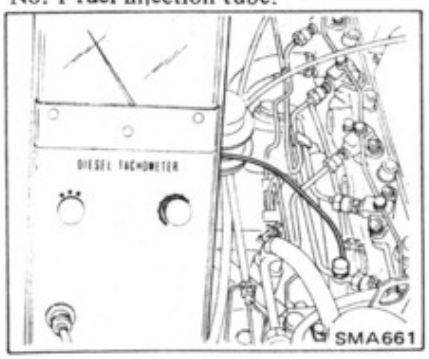


b. Disturbing full-load adjusting screw adjustment will change fuel flow characteristics, resulting in an improperly adjusted engine. Readjustment of fuel injection pump should be done using a pump tester.

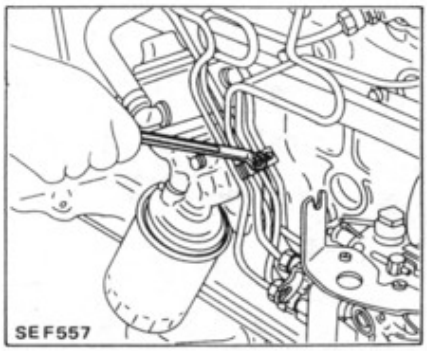
c. If maximum speed adjusting screw is turned in direction that increases control lever angle, engine damage may result.

IDLE ADJUSTMENT

1. Start engine and warm it up until coolant temperature indicator points to middle of gauge.
2. Attach tachometer's pickup to No. 1 fuel injection tube.



In order to take accurate reading of engine rpm, remove clamp that secures No. 1 fuel injection tube.

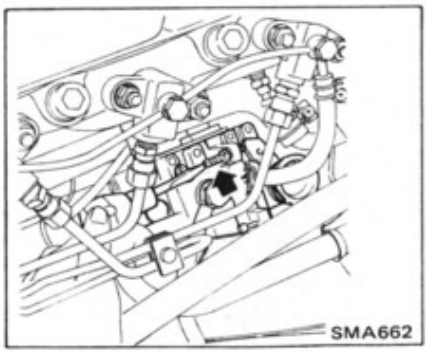


3. Start engine and check engine idle speed.

At this time, make sure the accelerator wire and throttle control wire are removed.

	Idle speed (rpm)
M/T	650
A/T	700

4. If engine idle speed is not within the specified value, proceed as follows.
(1) Loosen idle adjust screw lock nut.
(2) Turn idle adjust screw in either direction until the specified engine idle speed is obtained.



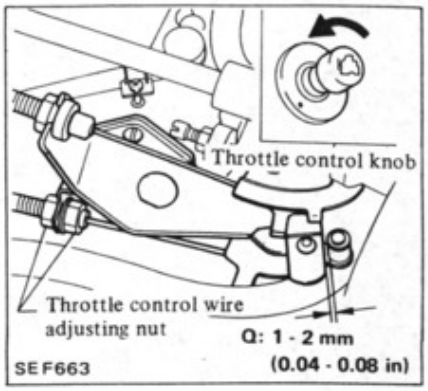
(3) Tighten idle adjust screw lock nut.
5. Fix the accelerator wire and throttle control wire.

Do not stretch wires too tightly.

THROTTLE CONTROL WIRE ADJUSTMENT

1. Turn throttle control knob fully counterclockwise.
2. Make sure that clearance between idle control lever pin and fuel injection pump control lever is within specified range.

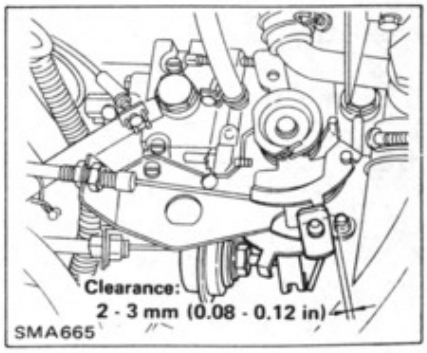
Clearance:
1 - 2 mm (0.04 - 0.08 in)



3. If not within specified range, adjust with throttle control wire adjusting nut.
4. After adjusting clearance properly, tighten lock nut.

F.I.C.D. ADJUSTMENT

1. Make certain that the clearance between the idle control lever pin and the injection pump control lever is within the specified limits.



2. Adjust idle speed to specified rpm without the air conditioner operating.
3. Then check the idle speed when the air conditioner is operating and make sure it is correct.

Unit: rpm

Idle speed (Air conditioner "ON")	800

If not, adjust it by turning F.I.C.D. actuator stroke adjusting screw.

Ⓐ

Is fuel delivered to injection pump?

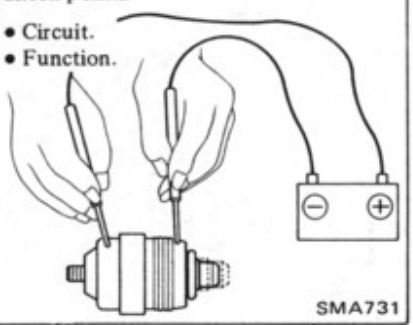
Check points.
- Fuel line twisted or clogged.
- Fuel filter clogged.

O.K. → Check fuel cut solenoid valve.

NOT O.K. → Repair or replace.

Check fuel cut solenoid valve.

Check points.
- Circuit.
- Function.



O.K. → Does delivery valve stick?

NOT O.K. → Replace.

Does delivery valve stick?

O.K. → Overhaul injection pump.

NOT O.K. → Replace.

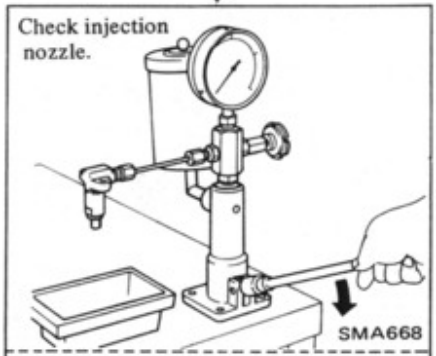
Overhaul injection pump.

Inspection points.
- Rusted or tardy movement of feed pump vane.
- Weak, broken, worn or rusted plunger spring.
- Abnormal wear on cam disc.

Ⓑ

O.K. → Check injection nozzle.

Check injection nozzle.

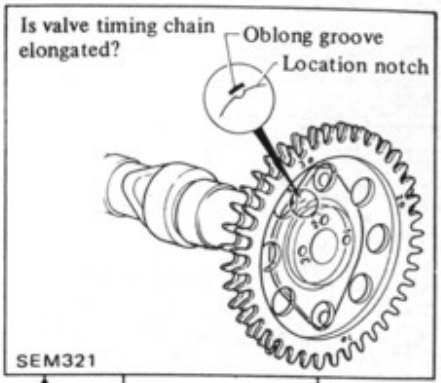


Check points.
- Fuel injection pattern.
- Clogging.
- Sticking
- Injection pressure.

NOT O.K. → Adjust, repair or replace.

O.K. → Is valve timing chain elongated?

Is valve timing chain elongated?



YES. → Adjust or replace chain.

NO. → Check valve clearance.

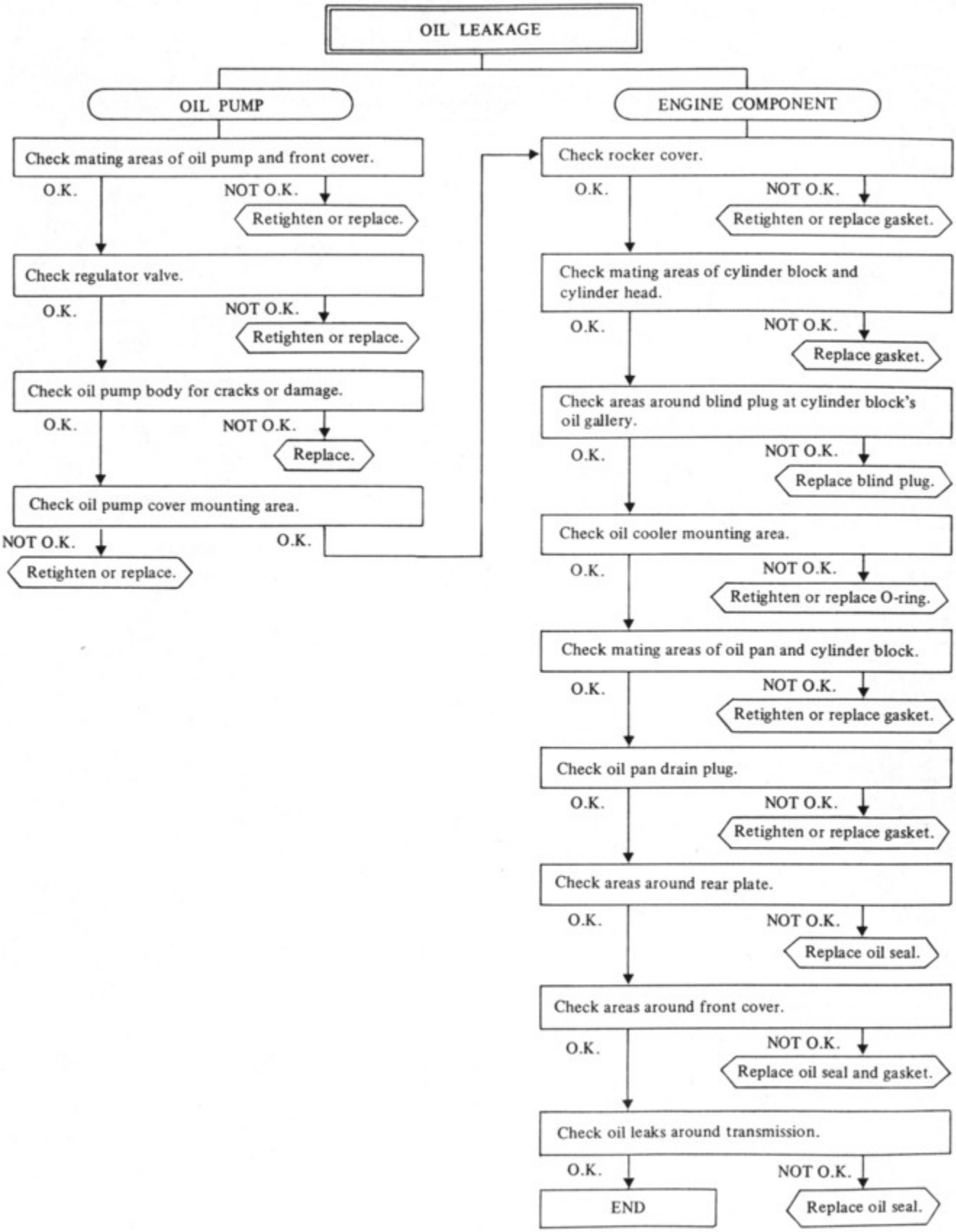
Check valve clearance.

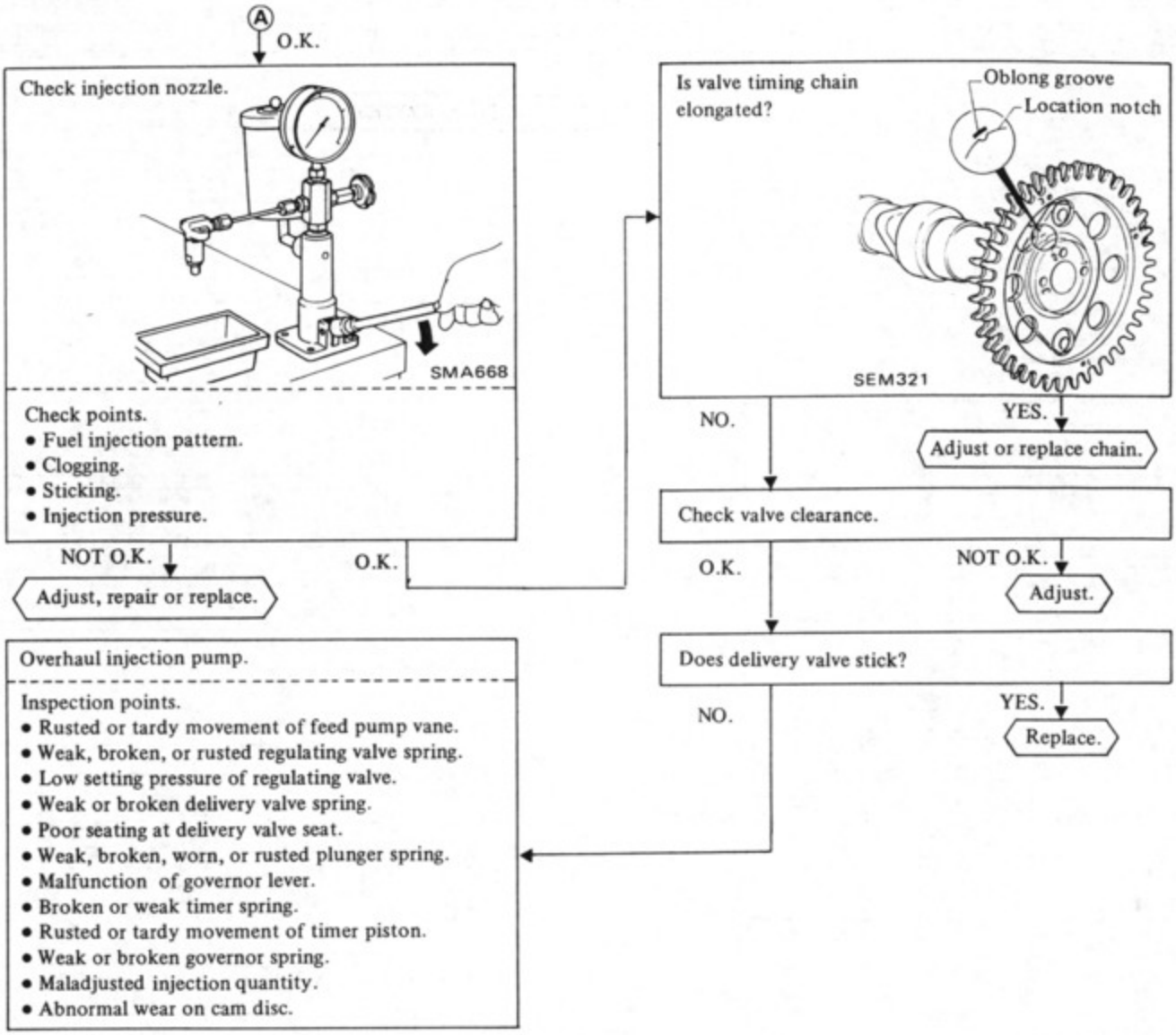
O.K. → Overhaul injection pump.

NOT O.K. → Adjust.

Overhaul injection pump.

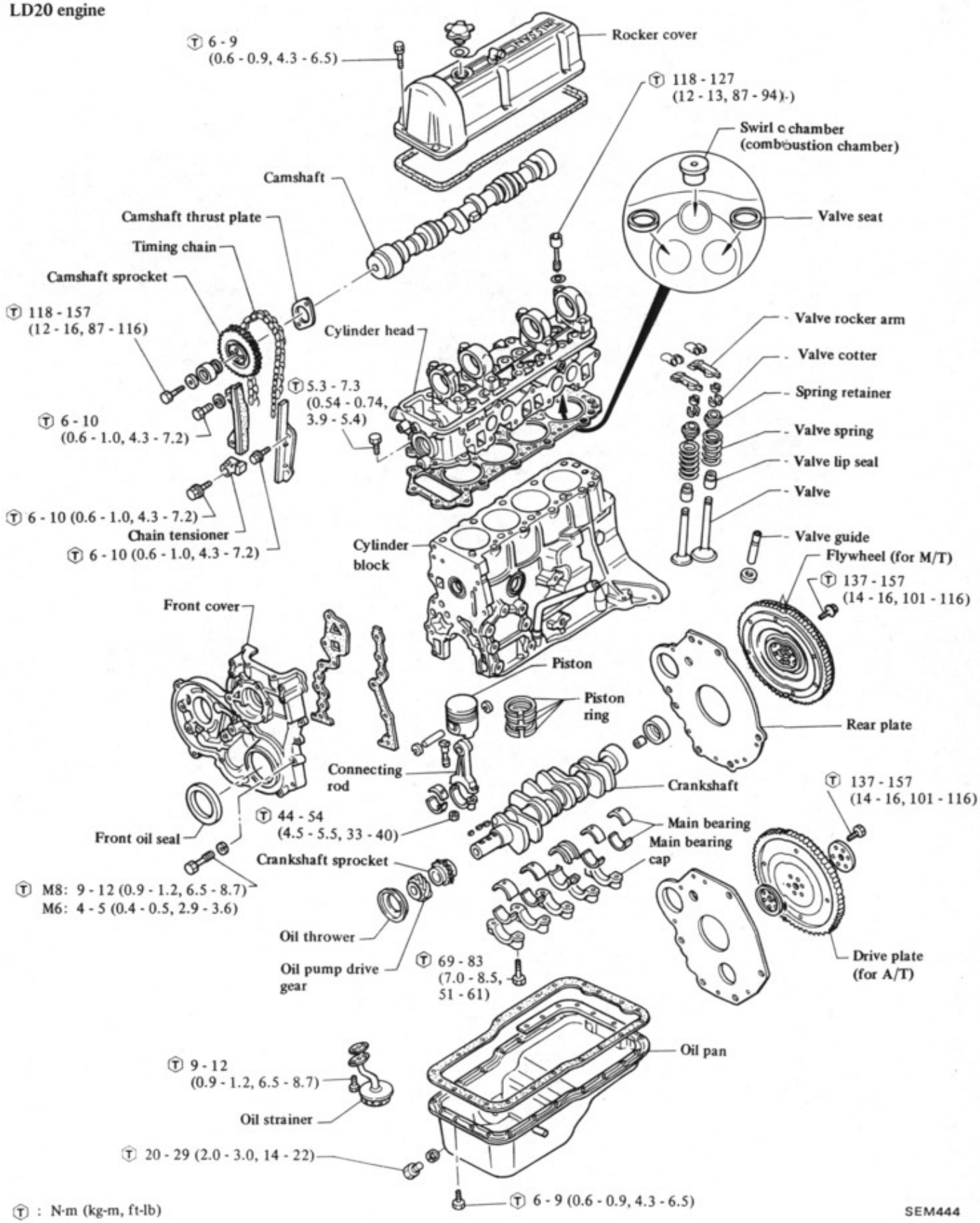
Inspection points.
- Rusted or tardy movement of feed pump vane.
- Weak, broken, or rusted regulating valve spring.
- Low setting pressure of regulating valve.
- Weak or broken delivery valve spring.
- Poor seating at delivery valve seat
- Weak, broken, worn, or rusted plunger spring.
- Malfunction of governor lever.
- Broken or weak timer spring.
- Rusted or tardy movement of timer piston.
- Weak or broken governor spring.
- Maladjusted injection quantity..
- Abnormal wear on cam disc.


OIL LEAKAGE
OIL PUMP
Check mating areas of oil pump and front cover.
O.K.
NOT O.K.
Retighten or replace.
Check regulator valve.
O.K.
NOT O.K.
Retighten or replace.
Check oil pump body for cracks or damage.
O.K.
NOT O.K.
Replace.
Check oil pump cover mounting area.
NOT O.K.
Retighten or replace.
O.K.
ENGINE COMPONENT
Check rocker cover.
O.K.
NOT O.K.
Retighten or replace gasket.
Check mating areas of cylinder block and cylinder head.
O.K.
NOT O.K.
Replace gasket.
Check areas around blind plug at cylinder block's oil gallery.
O.K.
NOT O.K.
Replace blind plug.
Check oil cooler mounting area.
O.K.
NOT O.K.
Retighten or replace O-ring.
Check mating areas of oil pan and cylinder block.
O.K.
NOT O.K.
Retighten or replace gasket.
Check oil pan drain plug.
O.K.
NOT O.K.
Retighten or replace gasket.
Check areas around rear plate.
O.K.
NOT O.K.
Replace oil seal.
Check areas around front cover.
O.K.
NOT O.K.
Replace oil seal and gasket.
Check oil leaks around transmission.
O.K.
NOT O.K.
END
Replace oil seal.


A
O.K.
Check injection nozzle.
SMA668
Check points.
• Fuel injection pattern.
• Clogging.
• Sticking.
• Injection pressure.
NOT O.K.
Adjust, repair or replace.
O.K.
Is valve timing chain elongated?
Oblong groove
Location notch
SEM321
NO.
YES.
Adjust or replace chain.
Check valve clearance.
O.K.
NOT O.K.
Adjust.
Does delivery valve stick?
NO.
YES.
Replace.
Overhaul injection pump.
Inspection points.
• Rusted or tardy movement of feed pump vane.
• Weak, broken, or rusted regulating valve spring.
• Low setting pressure of regulating valve.
• Weak or broken delivery valve spring.
• Poor seating at delivery valve seat.
• Weak, broken, worn, or rusted plunger spring.
• Malfunction of governor lever.
• Broken or weak timer spring.
• Rusted or tardy movement of timer piston.
• Weak or broken governor spring.
• Maladjusted injection quantity.
• Abnormal wear on cam disc.

ENGINE COMPONENT (Body parts)

LD20 engine



Ⓣ : N·m (kg-m, ft-lb)

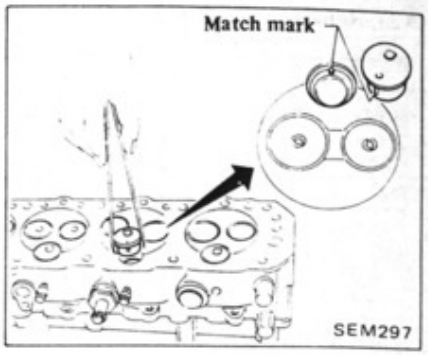
SEM444

Install combustion chamber.

1. Cool combustion chamber with dry ice for approximately 5 to 10 minutes.

WARNING:
Do not touch cooled combustion chamber with bare hand.

2. Align combustion chamber knock pin with cylinder head notch, and install it into cylinder head using a plastic-tip hammer.



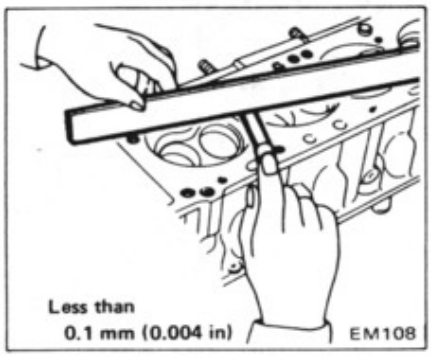
INSPECTION AND REPAIR

CYLINDER HEAD

CHECKING CYLINDER HEAD MATING FACE

1. Make a visual check for cracks or flaws. If cracks or melted areas are found in combustion chamber, replace.
2. Measure the surface of cylinder head (on cylinder block side) for warpage.

If beyond the specified limit, correct with a surface grinder.

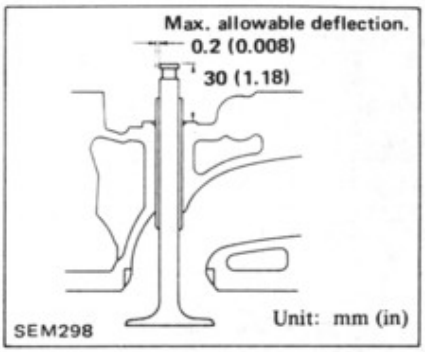


Nominal height:
89.5±0.1 mm (3.524±0.004 in)

Surface grinding limit:
The grinding limit of cylinder head is determined by the cylinder block grinding in an engine.
Depth of cylinder head grinding is "A"
Depth of cylinder block grinding is "B"
The limit is as follows:
A + B = 0.2 mm (0.008 in)

VALVE GUIDE

Measure the clearance between valve guide and valve stem. If the clearance exceeds the specified limit, replace the worn parts or both valve and valve guide. In this case, it is essential to determine if such a clearance has been caused by a worn or bend valve stem or by a worn valve guide.



Valve should be moved in parallel with rocker arm. (Generally, a large amount of wear occurs in this direction.)

Determining clearance

1. Precise method:
(1) Measure the diameter of valve stem with a micrometer in three places; top, center and bottom.
(2) Measure valve guide bore at center using telescope hole gauge.
(3) Subtract the highest reading of valve stem diameter from valve guide bore to obtain the stem to guide clearance.

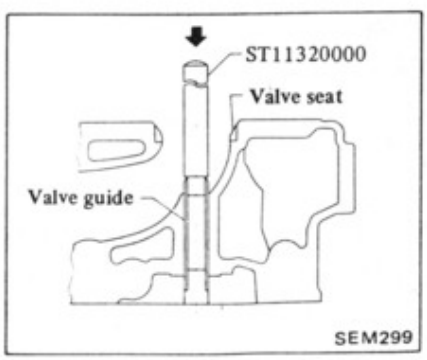
Stem to guide clearance:
Maximum Limit
0.10 mm (0.0039 in)

2. Expedient method
Pry the valve in a lateral direction, and measure the deflection at stem tip with dial gauge.

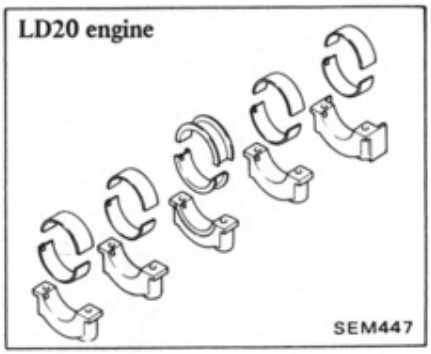
Replacement of valve guide

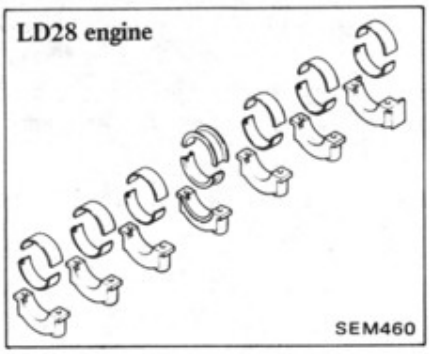
To remove old guides, use a press [under a 20 kN (2 t, 2.2 US ton, 2.0 Imp ton) pressure] or a hammer, and Tool.

1. Drive them out toward rocker cover side using Tool.



d. Other inter-bearings are the same type.

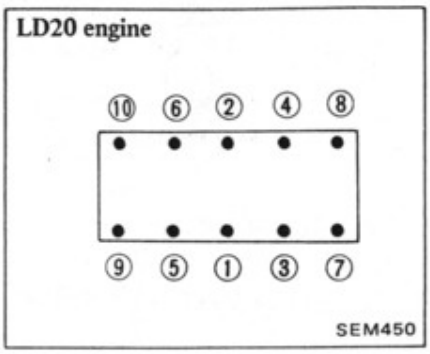


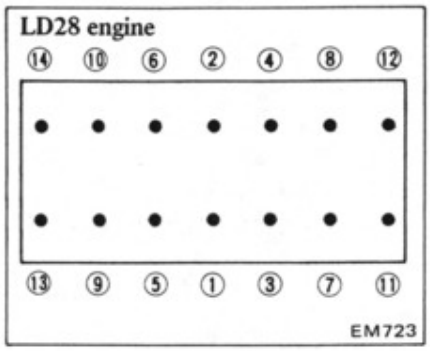


(2) Apply engine oil to main bearing surfaces on both sides of cylinder block and cap.
(3) Install crankshaft.
(4) Install main bearing cap and tighten bolts to specified torque.

Ⓣ : Main bearing cap bolts
69 - 83 N·m
(7.0 - 8.5 kg-m,
51 - 61 ft-lb)

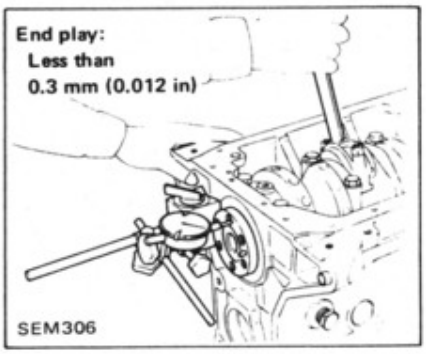
a. Apply sealant to each side of rear main bearing cap and each corner of cylinder block. Refer to Precautions.
b. Arrange the parts so that the arrow mark on bearing cap faces toward the front of engine.
c. Prior to tightening bearing cap bolts, place bearing cap in proper position by shifting crankshaft in the axial direction.
d. Tighten bearing cap bolts gradually in separating two to three stages and in sequence outwardly from center bearing.



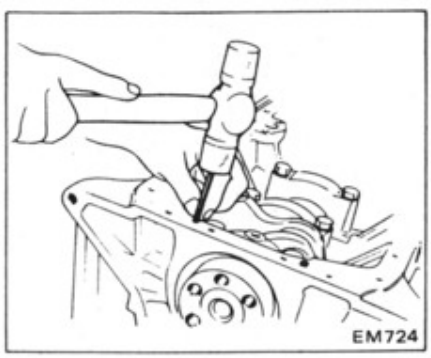


e. After securing bearing cap bolts, ascertain that crankshaft turns smoothly by hand.

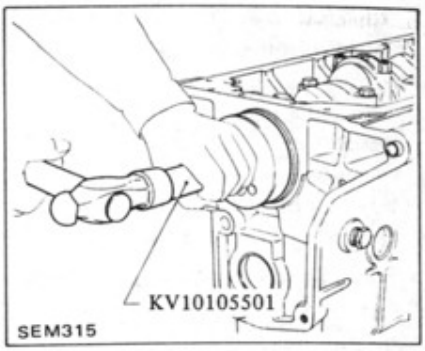
(5) Make sure that there exists proper end play at crankshaft.



2. Side oil seals. Apply sealant to these seals. Then install them into main bearing cap.

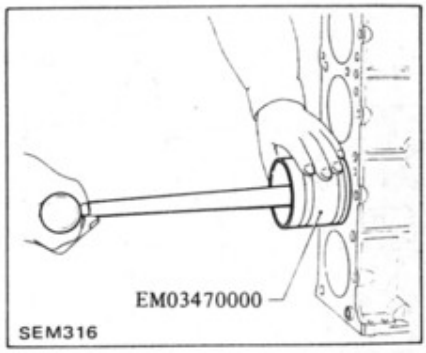


3. Rear oil seal. Install rear oil seal by using Tool.

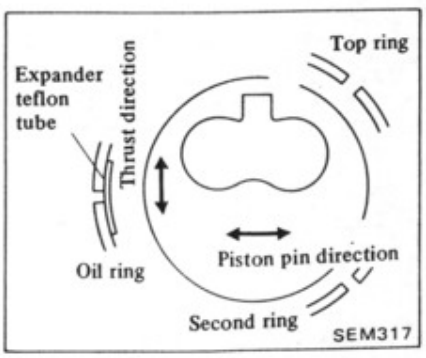


a. When installing oil seal, give coating of engine oil to mating shaft to prevent scratches and folded lip. Also apply coating of oil to periphery of oil seal.
b. Install oil seal in the direction that dust seal lip faces to the outside of crankcase.

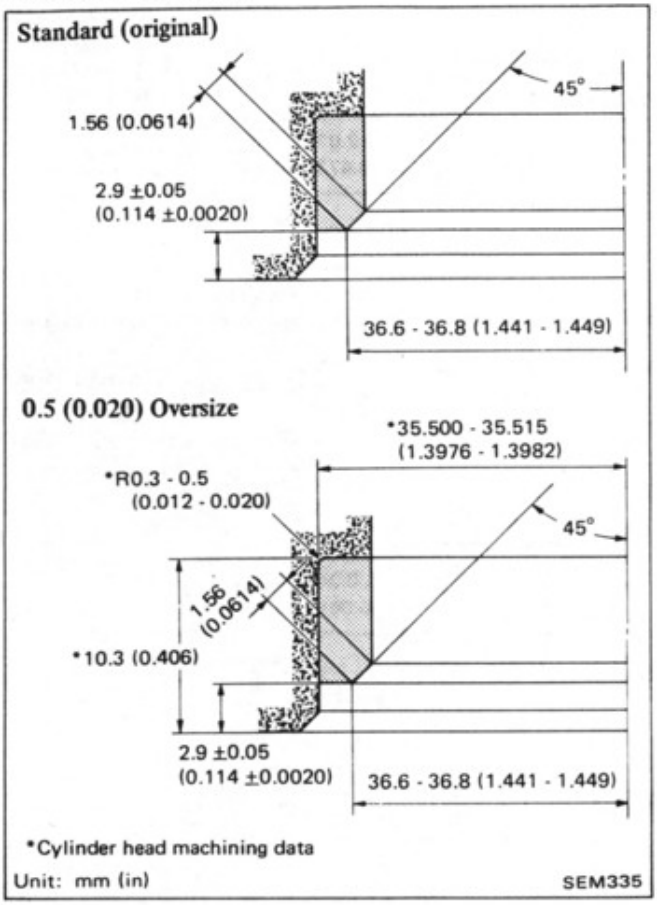
4. Piston with connecting rod
(1) Install them into corresponding cylinders using Tool.



a. Apply engine oil to sliding parts.
b. Arrange so that the grade mark on piston head faces the front of engine.
c. Set piston rings as shown below.



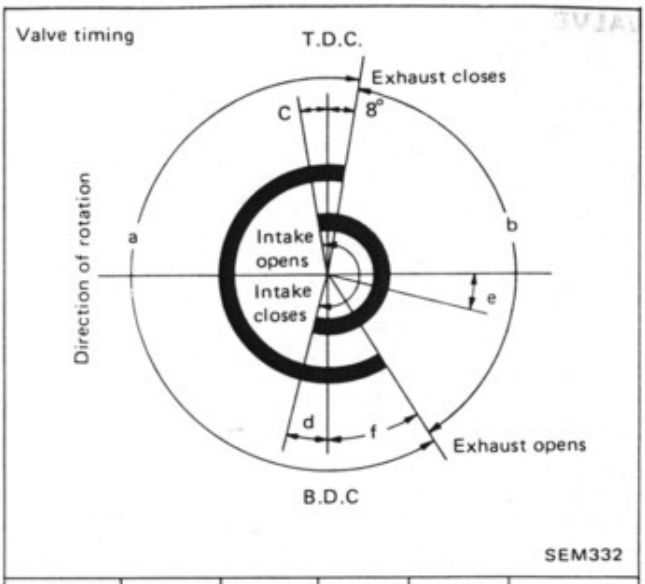
Exhaust valve seat



*Cylinder head machining data

Unit: mm (in)

SEM335



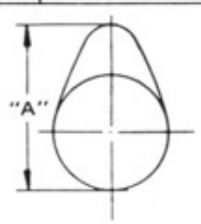
SEM332

a	b	c	d	e	f
248	232	14	38	12	60

CAMSHAFT AND CAMSHAFT BEARING

Unit: mm (in)

	Standard	Max. tolerance
Camshaft journal to bearing clearance	0.038 - 0.067 (0.0015 - 0.0026)	0.1 (0.004)
Inner diameter of camshaft bearing	48.000 - 48.016 (1.8898 - 1.8904)	–
Outer diameter of camshaft journal	47.949 - 47.962 (1.8878 - 1.8883)	–
Camshaft bend [T.I.R.]	Less than 0.02 (0.0008)	0.05 (0.0020)
Camshaft end play	0.08 - 0.38 (0.0031 - 0.0150)	

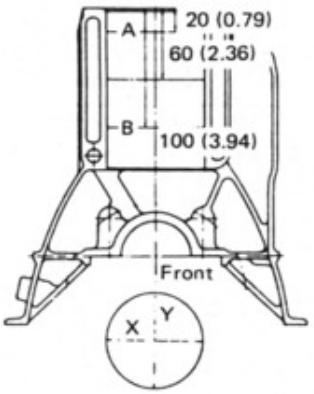


EM671

Cam height "A"	Intake	39.95 - 40.00 (1.5728 - 1.5748)
	Exhaust	40.30 - 40.35 (1.5866 - 1.5886)
Wear limit of cam height		0.15 (0.0059)

CYLINDER BLOCK

Unit: mm (in)



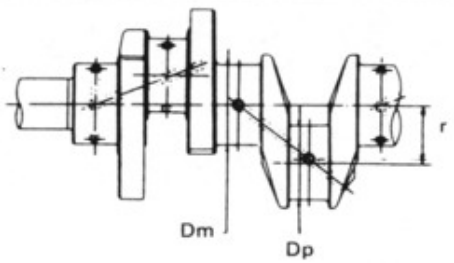
EM125

			Standard	Wear limit
Surface flatness			Less than 0.05 (0.0020)	0.10 (0.0039)
Cylinder bore	Inner diameter	LD20	85.000 - 85.050 (3.3465 - 3.3484)	–
		LD28	84.500 - 84.550 (3.3268 - 3.3287)	
	Out-of-round (X-Y)		Less than 0.02 (0.0008)	–
	Taper (A-B)		Less than 0.02 (0.0008)	–
Difference in inner diameter between cylinders			Less than 0.05 (0.0020)	–
Piston to cylinder clearance			0.05 - 0.07 (0.0020 - 0.0028)	–
Nominal height (From crankshaft center)			227.45±0.05 (8.9547±0.0020)	

CRANKSHAFT

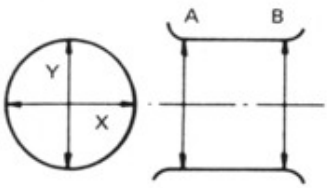
Unit: mm (in)

Main journal dia. "Dm"		LD20	59.942 - 59.955 (2.3599 - 2.3604)
		LD28	54.942 - 54.955 (2.1631 - 2.1636)
Pin journal dia. "Dp"		49.961 - 49.974 (1.9670 - 1.9675)	
Center distance "r"		LD20	43.00 (1.6929)
		LD28	41.5 (1.6339)
Out-of-round (X-Y) and taper (A-B)	Std.	Less than 0.01 (0.0004)	
	Limit	0.03 (0.0012)	
Bend [T.I.R.]	Std.	Less than 0.05 (0.0020)	
	Limit	0.10 (0.0039)	
Free end play	Std.	0.05 - 0.18 (0.0020 - 0.0071)	
	Limit	0.30 (0.0118)	
Pilot bushing insert distance		Approximately 4.0 (0.157)	



EM737

Out-of-round X-Y
Taper A-B



EM715

BEARING

Bearing clearance

Unit: mm (in)

	Standard	Limit
Main bearing clearance	0.020 - 0.062 (0.0008 - 0.0024)	0.12 (0.0047)
Connecting rod bearing clearance	0.020 - 0.062 (0.0008 - 0.0024)	0.12 (0.0047)

Main bearing undersize

Unit: mm (in)

	Crank journal diameter	
	LD20	LD28
STD	59.942 - 59.955 (2.3599 - 2.3604)	54.942 - 54.955 (2.1631 - 2.1636)
0.25 (0.0098) Undersize	59.692 - 59.705 (2.3501 - 2.3506)	54.692 - 54.705 (2.1532 - 2.1537)
0.50 (0.0197) Undersize	59.442 - 59.455 (2.3402 - 2.3407)	54.442 - 54.455 (2.1434 - 2.1439)
0.75 (0.0295) Undersize	59.192 - 59.205 (2.3304 - 2.3309)	54.192 - 54.205 (2.1335 - 2.1341)
1.00 (0.0394) Undersize	58.942 - 58.955 (2.3205 - 2.3211)	53.942 - 53.955 (2.1237 - 2.1242)

Connecting rod bearing undersize

Unit: mm (in)

	Crank pin diameter
STD	49.961 - 49.974 (1.9670 - 1.9675)
0.06 (0.0024) Undersize	49.901 - 49.914 (1.9646 - 1.9651)
0.12 (0.0047) Undersize	49.841 - 49.854 (1.9622 - 1.9628)
0.25 (0.0098) Undersize	49.711 - 49.724 (1.9571 - 1.9576)
0.50 (0.0197) Undersize	49.461 - 49.474 (1.9473 - 1.9478)
0.75 (0.0295) Undersize	49.211 - 49.224 (1.9374 - 1.9379)
1.00 (0.0394) Undersize	48.961 - 48.974 (1.9276 - 1.9281)

MISCELLANEOUS COMPONENTS

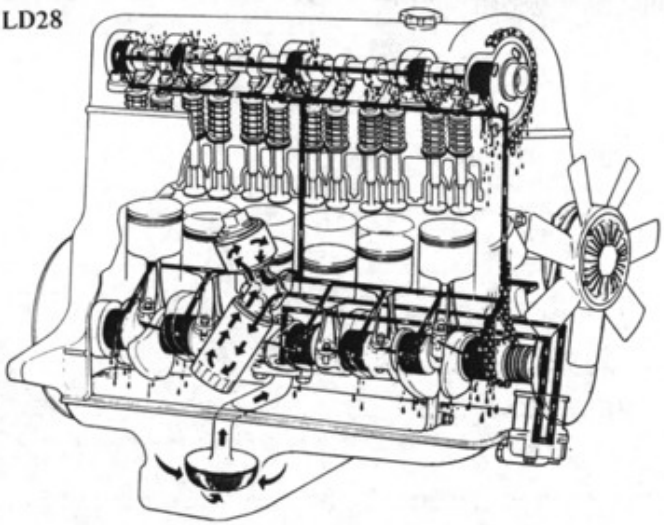
Unit: mm (in)

Camshaft sprocket Runout [T.I.R.]	Less than 0.1 (0.004)
Flywheel Runout [T.I.R.]	Less than 0.15 (0.0059)

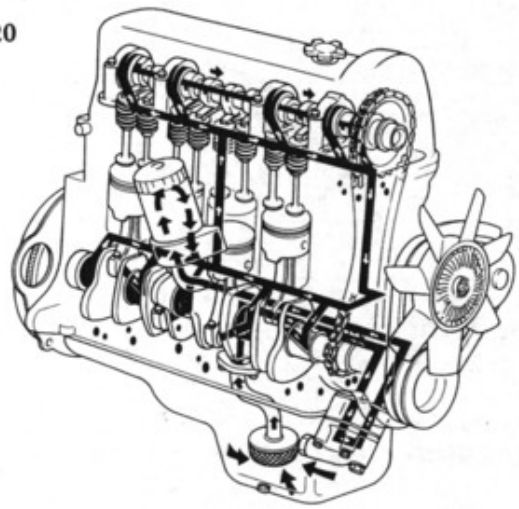
ENGINE LUBRICATION SYSTEM

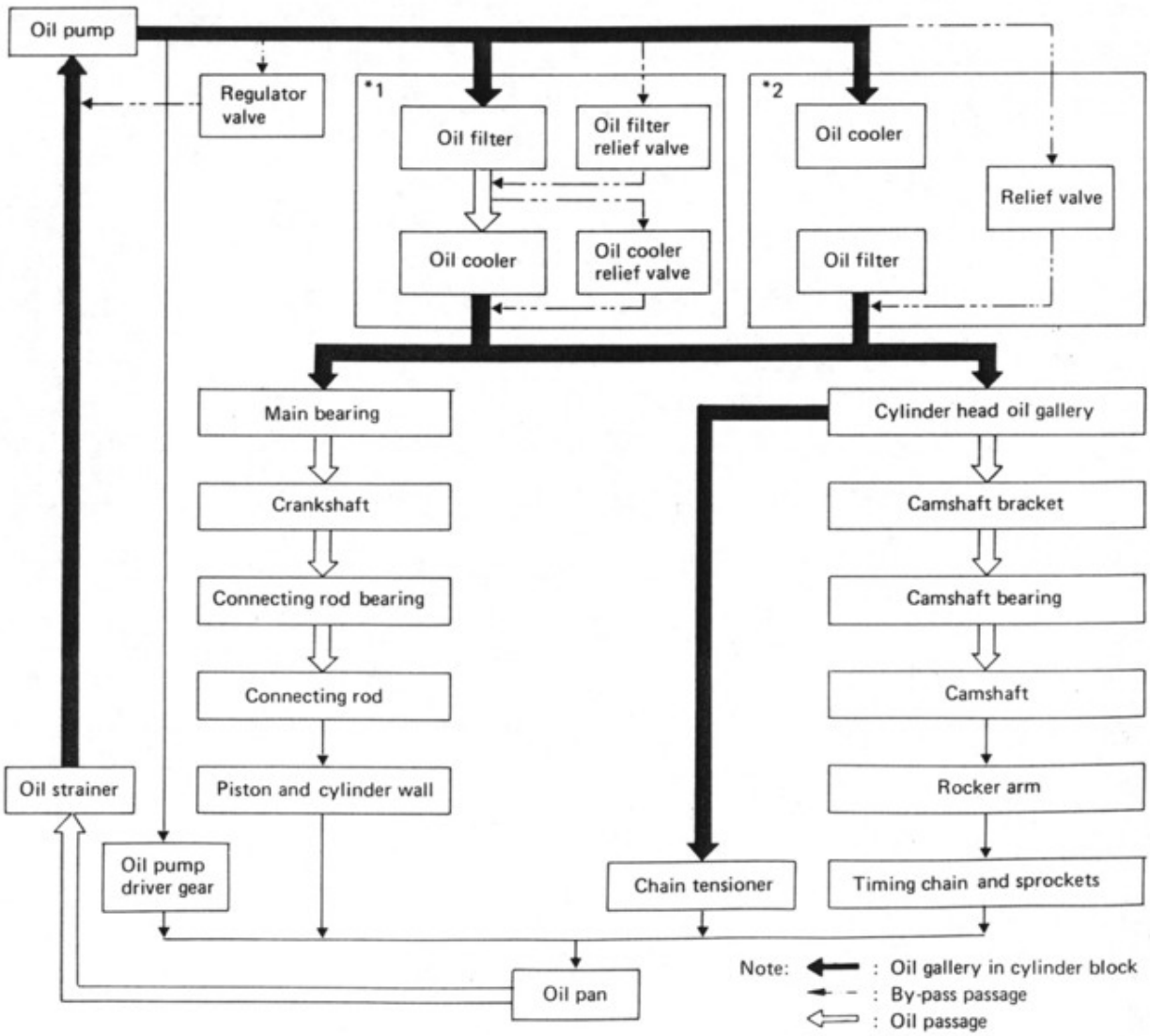
LUBRICATION CIRCUIT

LD28



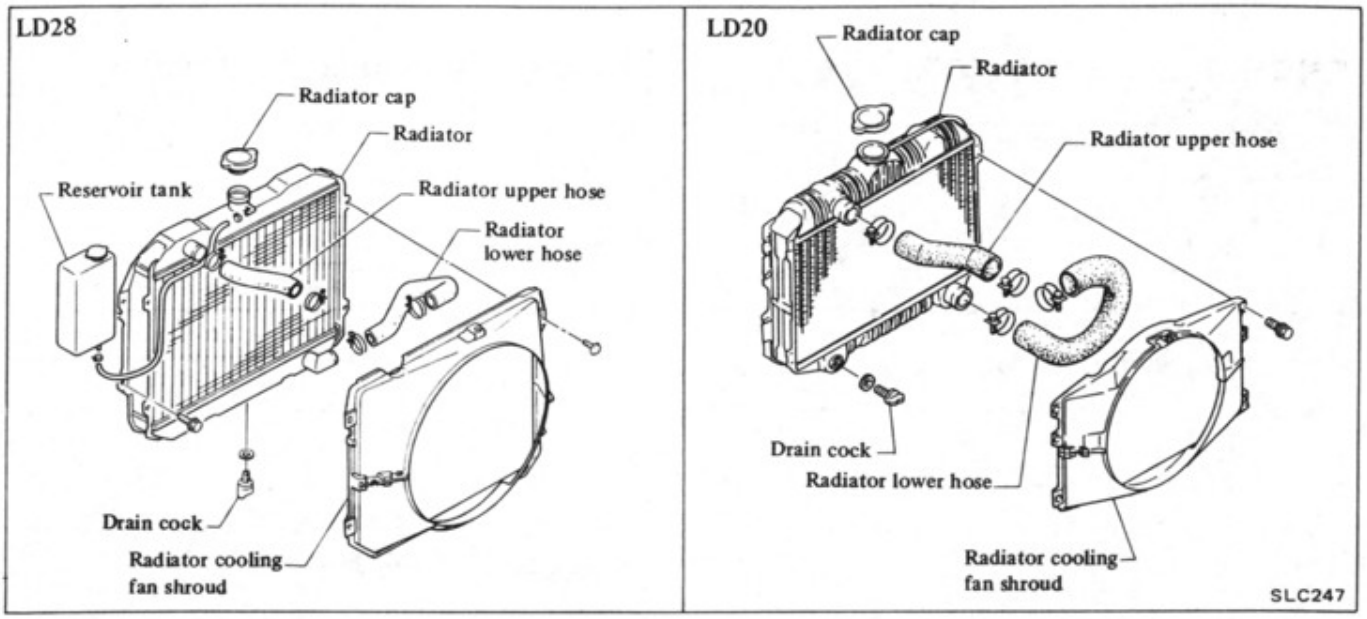
LD20





SLC235

RADIATOR



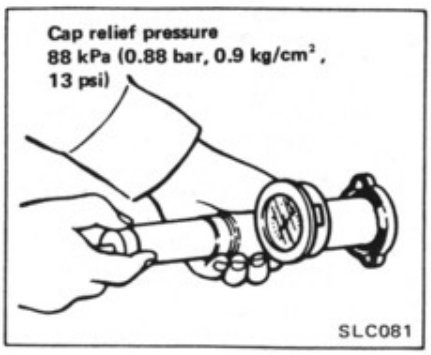
WARNING:
Never remove the radiator cap when the engine is hot; serious burns can be caused by high pressure fluid escaping from the radiator, wrap a thick cloth around cap and carefully remove the cap by turning it a quarter turn to allow built-up pressure to escape, and then turn the cap all the way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

INSPECTION

Checking radiator cap

Using cap tester, check the radiator cap relief pressure.

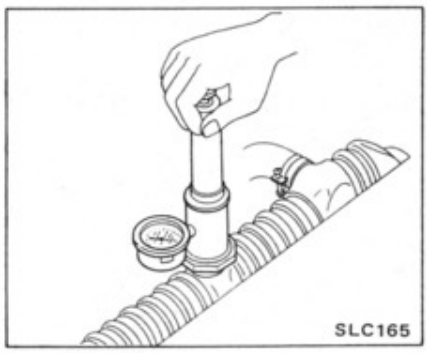
If the pressure gauge drops rapidly and excessively, replace the radiator cap.



Checking cooling system for leaks

Attach pressure tester, pump tester to the specified pressure.

Check for drop in pressure.



If the pressure drops, check for leaks from hoses, radiator, or water pump.

If no external leaks are found, check heater core, block and head.

REMOVAL AND INSTALLATION

1. Open radiator drain cock and remove radiator cap. Drain coolant into a suitable container.

WARNING:
To avoid the danger of being scalded, never attempt to drain the coolant when the engine is hot.

2. Remove radiator shroud attaching screws and place radiator shroud close to engine. (Radiator shroud can be removed after removing radiator.)
3. Disconnect radiator upper and lower hoses, and reservoir tank hose.
4. On a car with automatic transmission, disconnect cooler inlet and outlet lines from radiator.
5. Remove radiator.
6. Install radiator in the reverse order of removal.
7. Fill radiator with coolant to specified quantity.

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

INJECTION PUMP ASSEMBLY (VE-type)

DESCRIPTION

1. Disassembly and assembly of this VE-pump should be done only in service shops authorized by NISSAN/ DATSUN or by the pump manufacturer.
2. Before removing fuel injection pump from vehicle, check closely to make sure that it is apparently malfunctioning.

Refer to Trouble Diagnoses and Corrections in ET section.

INJECTION PUMP

REMOVAL

1.
- Remove battery (LD28).
- Disconnect battery ground cable (LD20).

2. Remove undercover (LD20).
3. Drain coolant.
4.
- Remove air cleaner duct and resonator (LD28).
- Remove air cleaner duct (LD20).

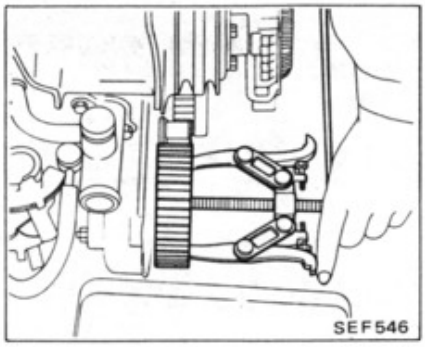
5. Remove radiator grille (LD20).
6. Remove radiator and shroud.
7. Remove cooling fan.
8. Loosen alternator bolts.
9. Remove drive belts.
- Alternator
- Power steering oil pump
- Compressor

10. Remove power steering oil pump (LD28).

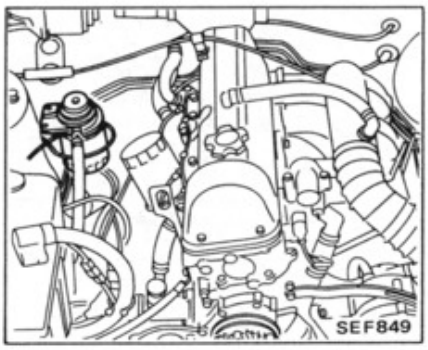
Never drain power steering oil while work is being performed.

11. Disconnect following wires and hoses.
- Accelerator wire
- Throttle control wire
- Fuel hose
- F.I.C.D. vacuum hose.
- Fuel cut solenoid wire.

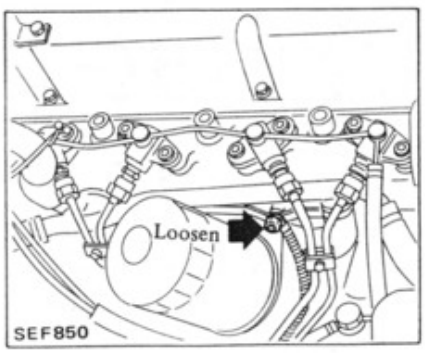
12. Remove crank damper pulley.
13. Remove dust cover.
14. Loosen spring set pin and set tensioner pulley to "free tension" position. Then tighten them.
15. Remove drive belt.



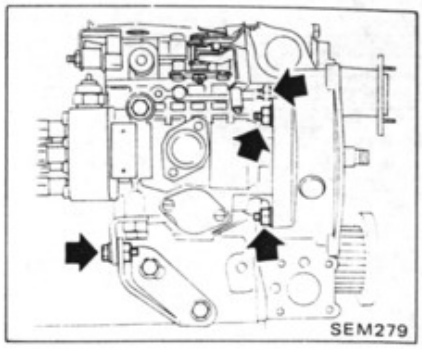
16. Remove injection pump drive pulley.
17. Disconnect wires and remove starter motor (LD20).
18. Remove water inlet (LD20).
19. Disconnect fuel filter sensor harness, then move fuel filter with bracket to work area for safety purposes (LD20).



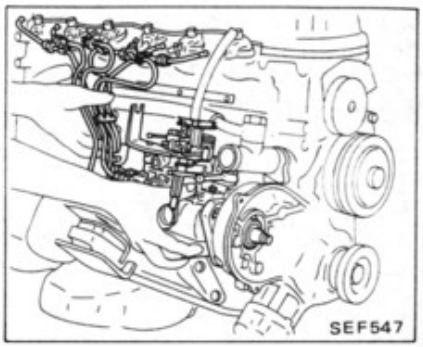
20. Remove glow plug harness (LD20).



21. Disconnect injection tube at injection nozzle side.
22. Remove injection pump fixing nuts and bracket bolt.



23. Take out injection pump assembly with injection tube.

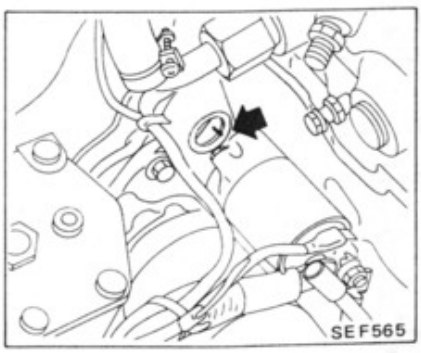


INSTALLATION

Install injection pump assembly in the reverse order of removal, observing the following.

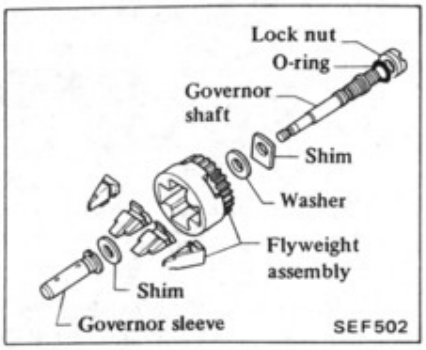
1. Set No. 1 cylinder at top dead center on compression stroke.

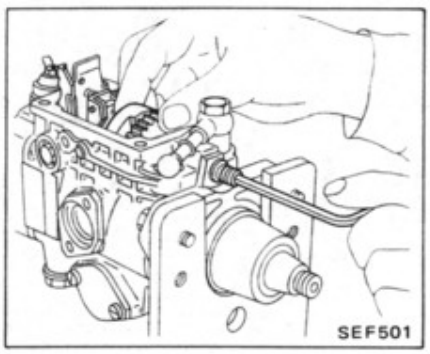
Make sure that grooves in rear plate and drive plates are aligned with each other.



22. Attach governor weight assembly.

When installing governor shaft, be careful not to scratch O-rings.





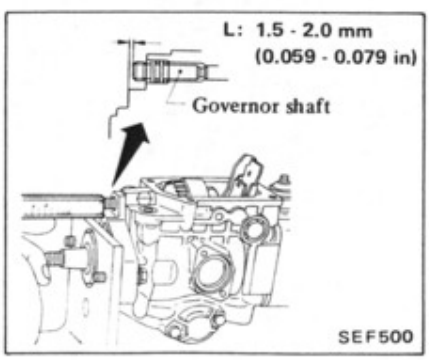
23. Adjust dimension "L", as shown.

"L":
1.5 - 2.0 mm (0.059 - 0.079 in)

a. Tighten lock nut to specified torque.

Ⓣ : 25 - 29 N·m
(2.5 - 3.0 kg-m,
18 - 22 ft-lb)

b. Governor shaft has a left hand thread for injection pumps designed to rotate in "R" direction, and a right hand thread for those rotating in "L" direction.

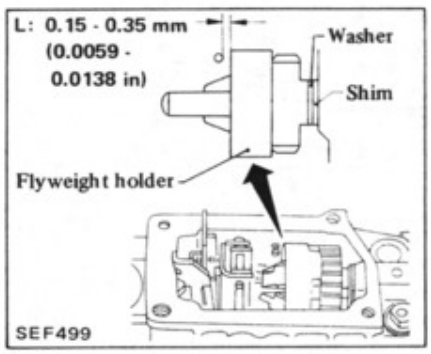


24. Measure axial play of flyweight holder. If it is not within specified range, adjust it by means of shim.

"L":
0.15 - 0.35 mm
(0.0059 - 0.0138 in)

Shims are available in five different thickness.

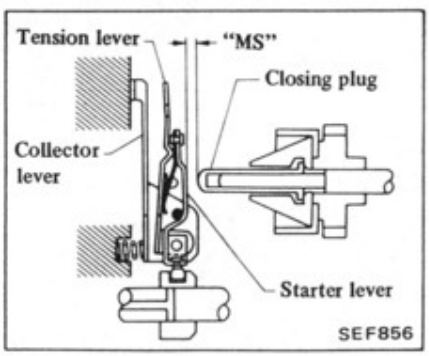
Part number	Thickness mm (in)
19208-V0700	1.05 (0.0413)
19208-V0701	1.25 (0.0492)
19208-V0702	1.45 (0.0571)
19208-V0703	1.65 (0.0650)
19208-V0704	1.85 (0.0728)



25. Measurement of dimension "MS" (for determing starting amount of fuel injection)

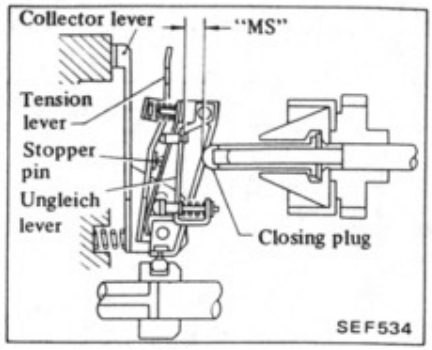
LD20 engine

Dimension "MS" is the distance from closing plug to start lever.

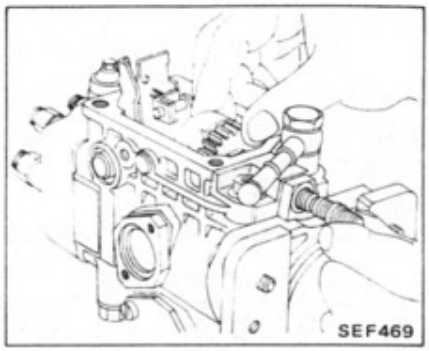


LD28 engine

Dimension "MS" is the distance from closing plug to Ungleich lever.

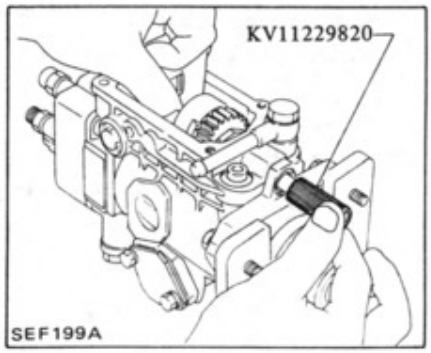


(1) Remove lock nut, governor shaft and flyweight assembly.



(2) Install Tool and flyweight assembly in place of governor shaft.

Be sure to install shim and washer when installing flyweight assembly.



(3) Set Tool, as shown.