

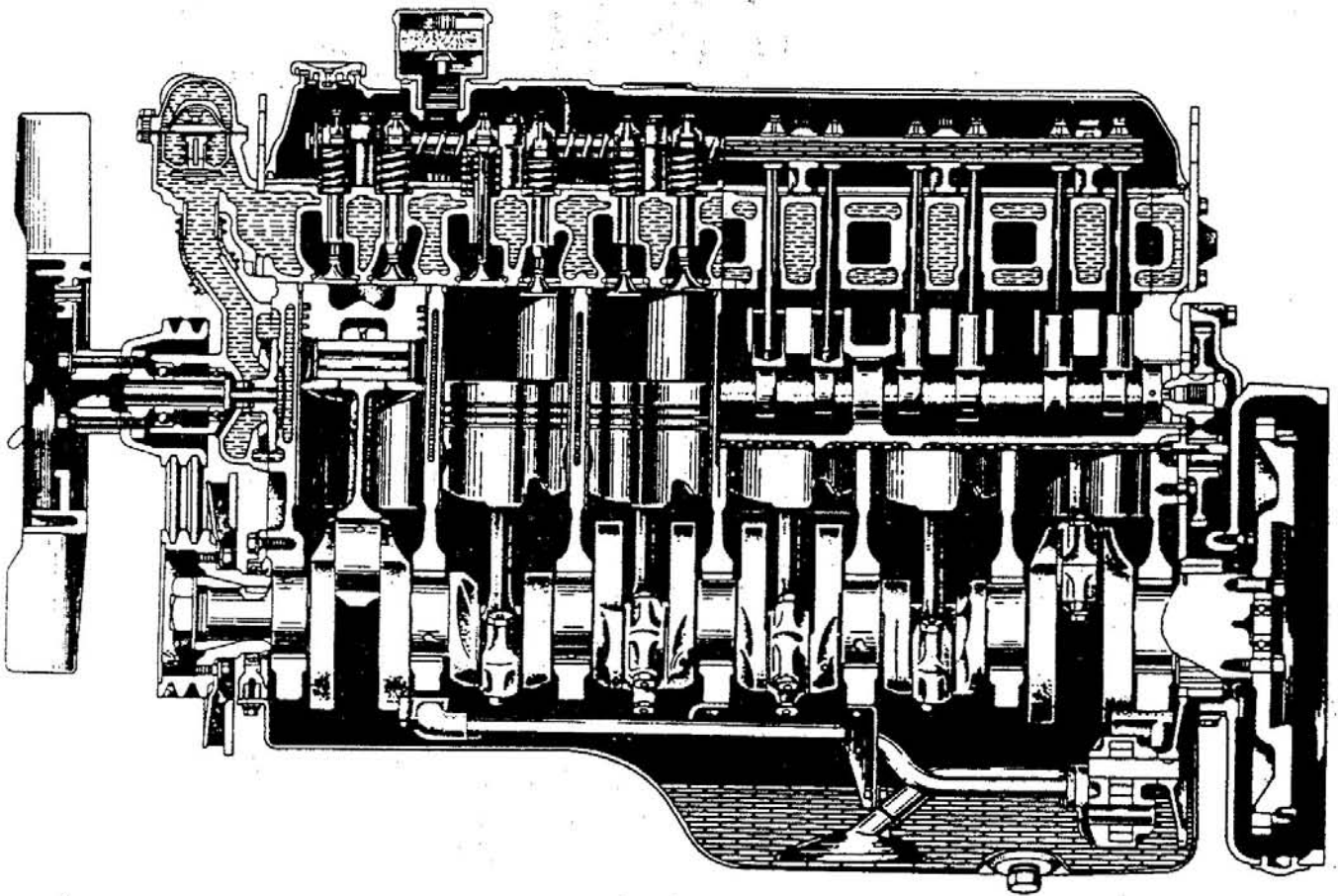
COMPILATION OF THIS MANUAL

1. The contents of this shop manual are divided as shown below when edited.

Group No.	Group Name	Contents
1	General	General description, outside view photograph and cross section view of engine, specifications, construction and operation
2	Service standards	Engine service standards, service standards table, tightening torque table, sealant and grease table
3	Special tools	Shapes and usages of special tools
4	Inspection and adjustment of engine	Decision on time to overhaul, measurement of compression pressure, troubleshooting Inspection and adjustment of valve clearance, inspection and adjustment of fuel injection start timing, engine speed adjustment
5	Removal and installation of auxiliaries	Removal and installation of auxiliaries such as injection pump, starter, alternator and compressor
6	Engine proper	Disassembly, inspection and reassembly of engine proper, including cylinder head, valve mechanism, camshaft, piston, crankshaft, timing gear, flywheel, etc.
7	Inlet and exhaust	Disassembly, inspection and reassembly of air cleaner, etc.
8	Lubrication	Disassembly inspection and reassembly of lubrication system, including oil pump, oil filter, oil cooler, etc.
9	Cooling	Disassembly, inspection and reassembly of cooling system, including water pump, thermostat, radiator, etc.

1-1 GENERAL DESCRIPTION

1-1-1 Engin Sectional Views



1-1-2 Engine Number and Nameplate

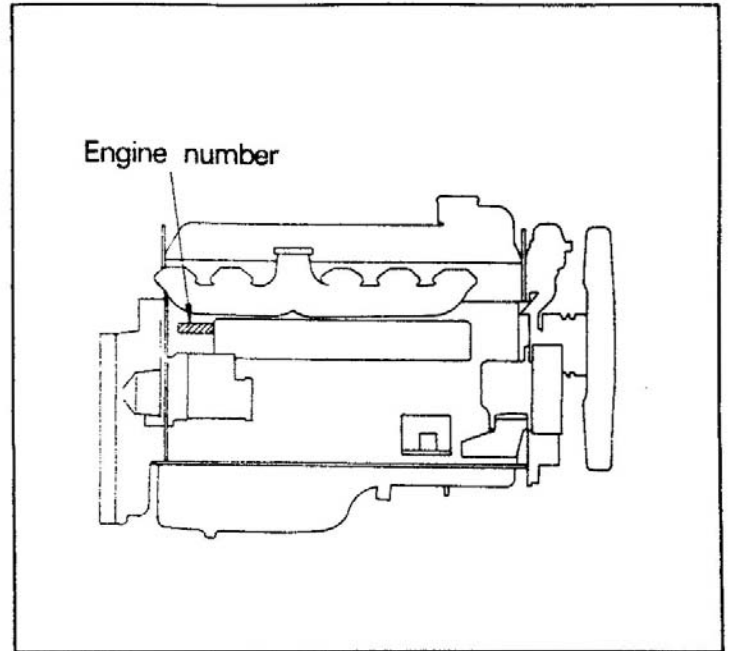
(1) Engine Number

The engine number is stamped on the right side of the crankcase (as shown below).

Example D6BR T 012345

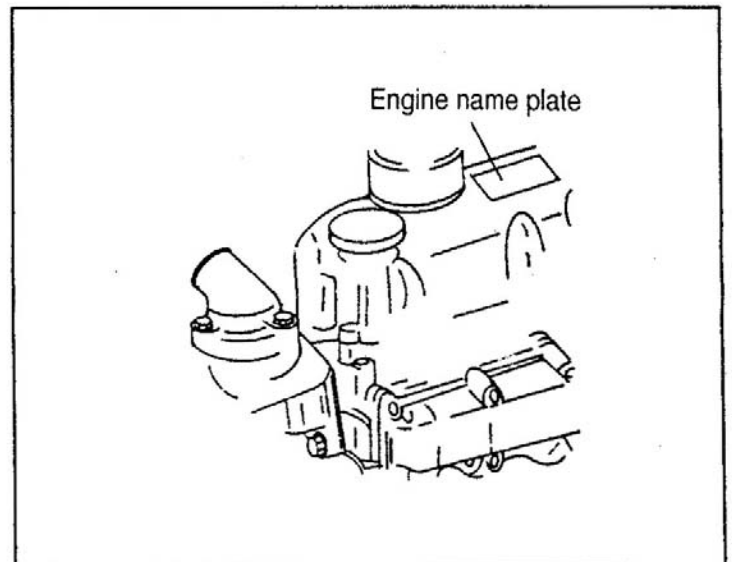
— Engine No
— Production year
— Model

The engine number is an important number in learning the history of the engine.



(2) Nameplate

The nameplate is located at the position shown in illustration at right. the nameplate shows the engine model, total displacement, rated output/ engine speed, valve clearance, firing order, and fuel injection timing.



Item	Specification
Starter Model Output Reduction mechanism	M3T56072 24V-5kW Single, external, spur gear
Starter relay Model	UIT06781
Alternator Type Output	Alternator with built-in IC regulator 24V-40A
Intake air heater Type Capacity	electric heating type 2.86kW
Heater relay Fuse Capacity	127A [for 24V]

(2) Oil Filter

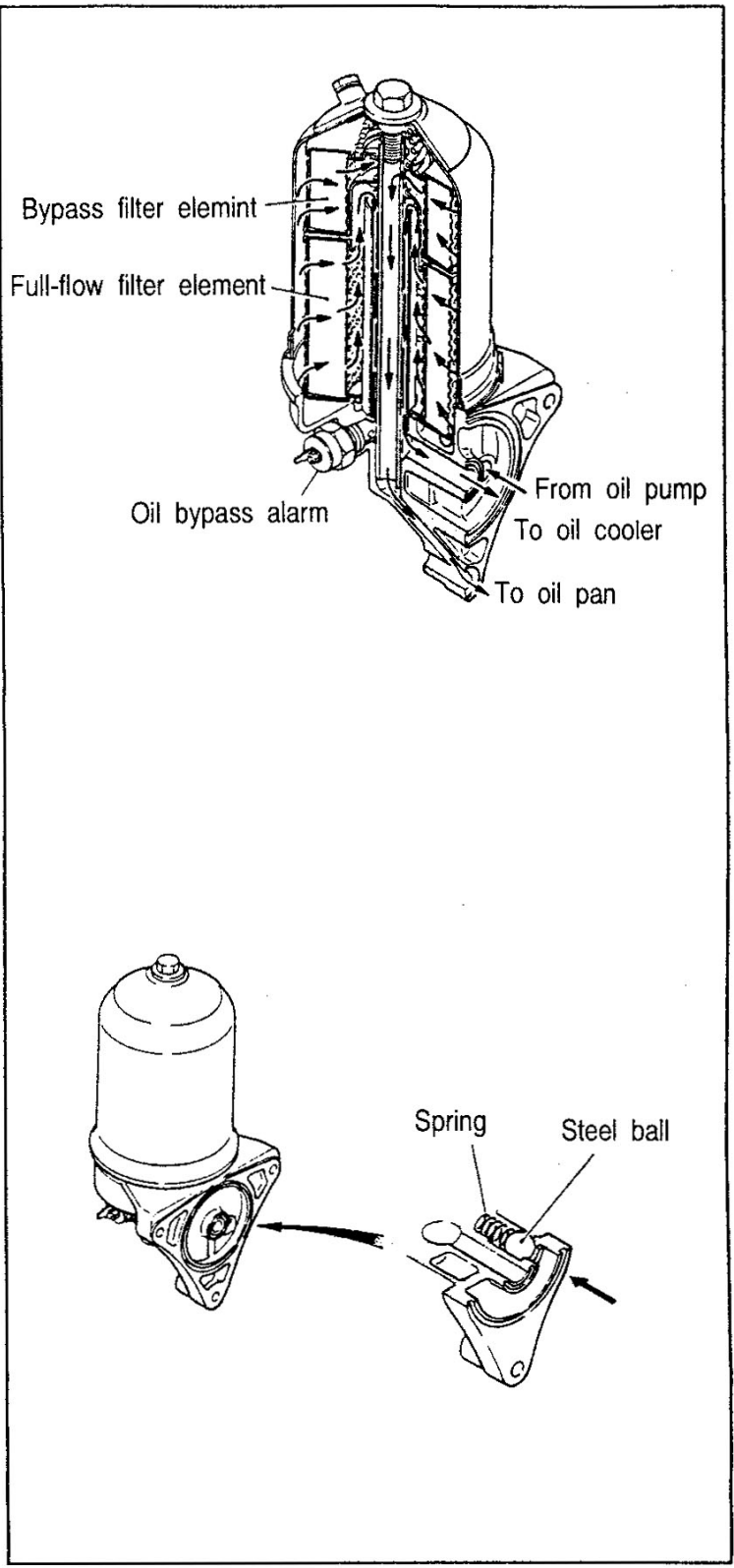
The oil filter is a combined full-flow filter and bypass filter using a one-piece filter paper element.

The engine oil passed through the full-flow filter is forced to the oil cooler, whereas the engine oil passed through the upper bypass filter is routed through the oil filter bracket mounting bolt hole and back to the oil pan.

An oil bypass alarm is mounted to the oil filter bracket. If the oil pressure difference between before and after the oil filter exceeds specification, the valve will automatically open to bypass the unfiltered oil to the oil cooler.

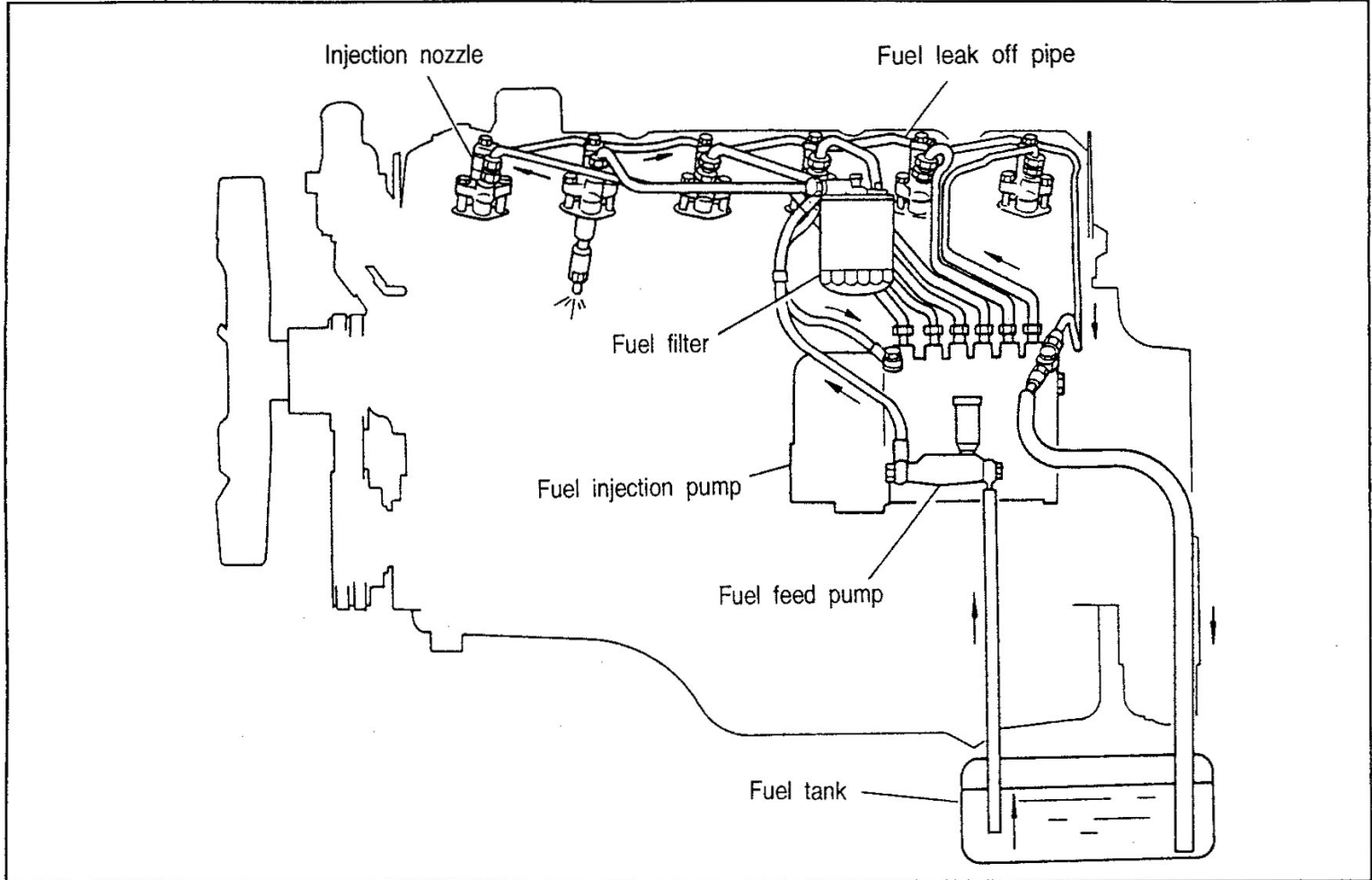
The oil bypass alarm has electric contact points which, when the valve is opened, close to light the pilot lamp and warn the driver that the element has been clogged.

Since the oil filter is located at a relatively high position, the oil in the oil filter could fall down to the extent that there is no more oil left in the oil filter when the engine is stationary. To prevent this, therefore, a check valve operating at a very low pressure and a center pipe are provided at the inlet so that the oil level in the filter is maintained constant at all times and the oil is quickly supplied to the lubricated parts when the engine is started.



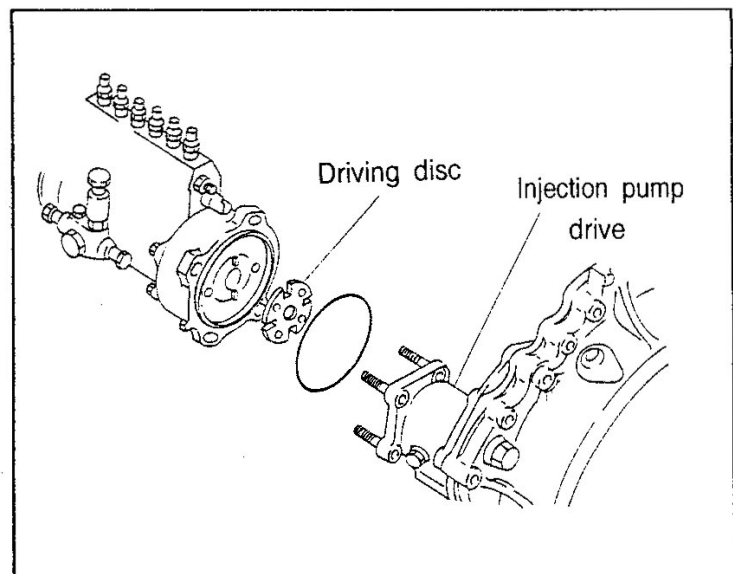
1-3-5 Fuel

The fuel system consists of a fuel filter, injection pump, general assembly, injection nozzle, fuel pipes, etc.



The injection pump drive method differs, depending on whether an air compressor is provided or not.

If air compressor is not provided, the injection pump drive gear is directly driven by the timing gear.

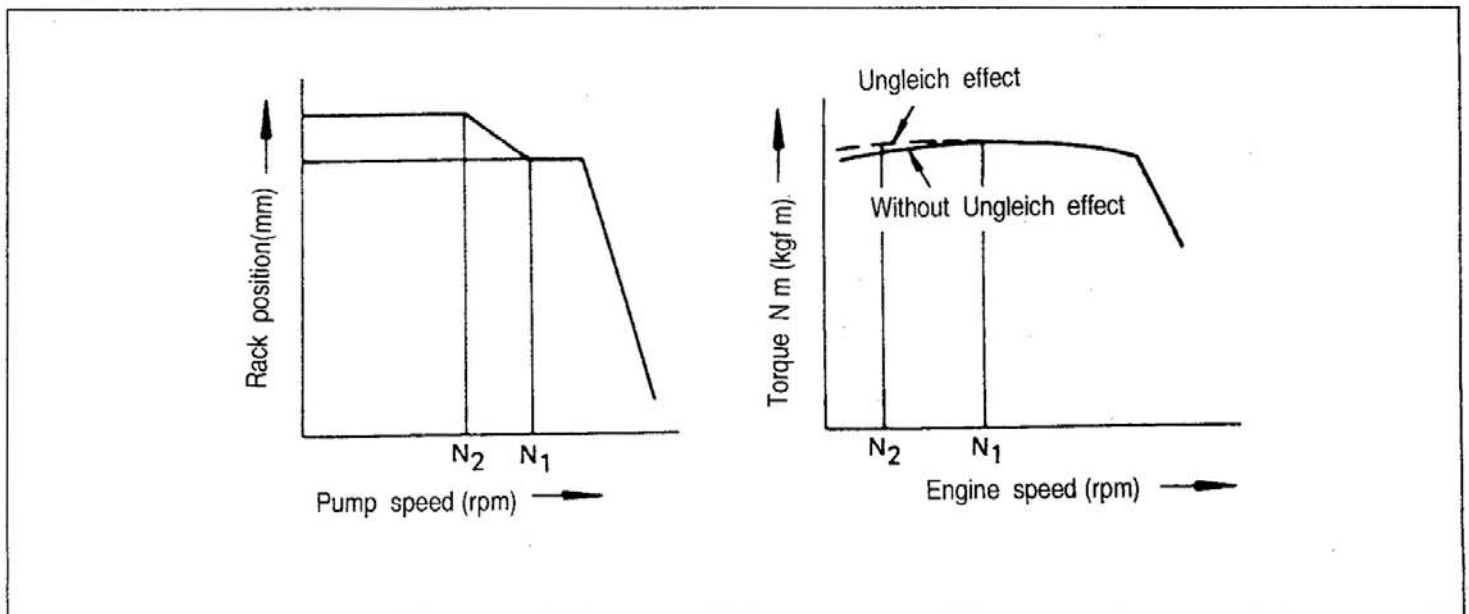


speed increases. The injection pump, on the other hand, increases the per-stroke injection as the speed increases, even with the control rack at the same position.

Therefore, if full load is set at point A to derive enough output at low speeds, the injection will reach B as the speed increases, and the engine will produce black smoke.

If full load is set at point B' to prevent black smoke, the low speed injection will come down to A', allowing combustion of more fuel.

So the Ungleich device accomplishes the function of setting full load at point A to derive the largest possible torque in the low speed range, and changing it to adjust the injection to point B' in the high speed range.

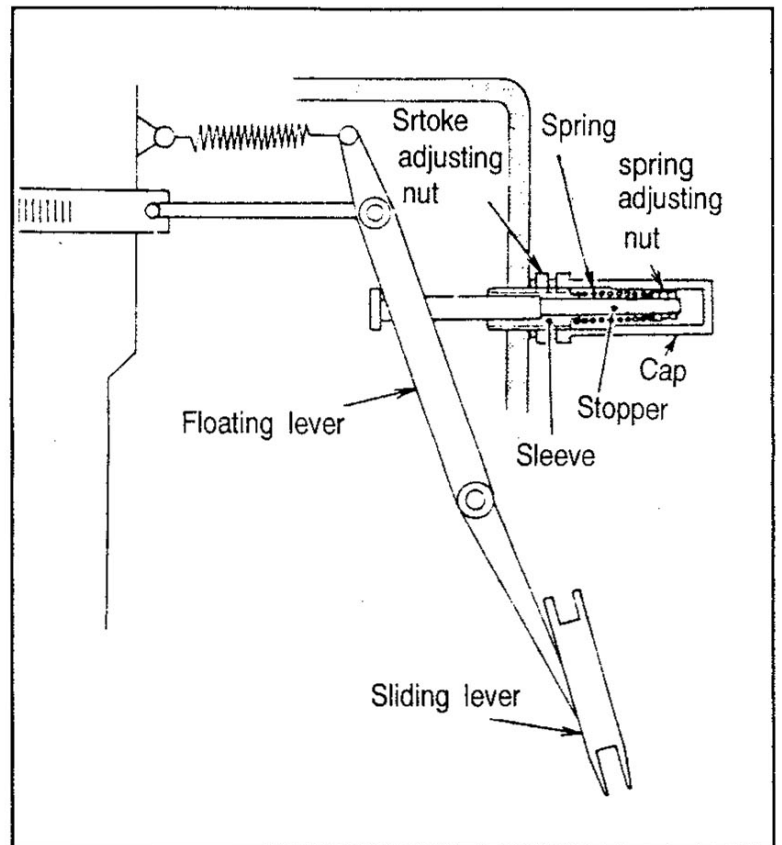


When the engine speed is low and the centrifugal force of flyweight smaller than the pressure of the Ungleich spring, the shifter is moved as much as the Ungleich stroke to the left, so the control rack moves in the direction that fuel is increased to increase the torque of the engine at low speeds.

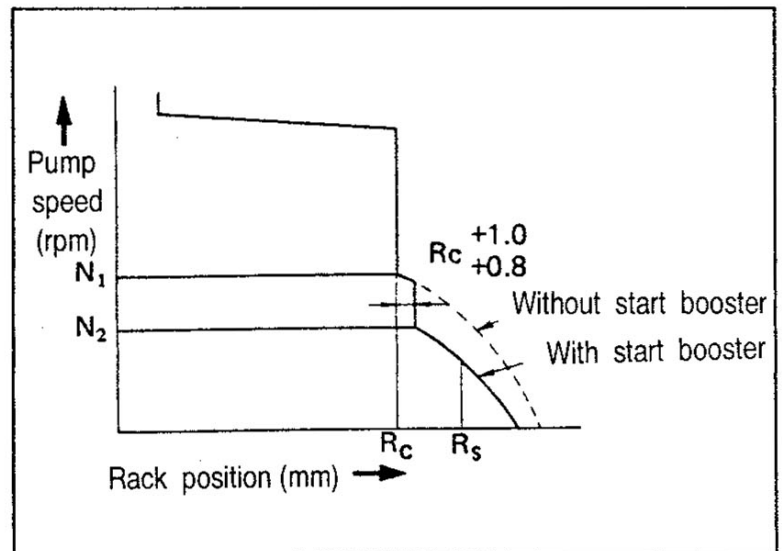
In this manner, the governor operates automatically with changes in the load, keeping a constant engine speed.

4) Start booster (smoke set assembly)

The start booster mounted to the rear of the governor consists of the functional parts (spring with setting force and stopper), a sleeve, stroke adjusting nut, spring adjusting nut and cap.



As shown in the governor characteristic curve, if the start booster is not provided, the idling spring force pushes back the shifter and floating lever when the pump speed is N_1 to move the control rack in the direction that fuel is increased. In this case, therefore, N_1 is the smoke limit.



If the start booster is provided, the spring force of the booster overcomes the idling spring force and stops movement of the floating lever unit the speed N_2 is reached.

As a result, the smoke limit goes down to N_2 from N_1 . In addition, the rack position R_s required for starting can be secured.

Unit : mm

Description		Nominal value (Basic diameter in [])	Re- pair limit	Ser- vice limit	Remedy and remarks
Clearance between camshaft journal and bushing	No. 1	[57.75] 0.03 to 0.08	0.15		Replace bushing.
	No. 2	[58.00] 0.03 to 0.08			
	No. 3	[58.25] 0.03 to 0.08			
	No. 4	[58.50] 0.03 to 0.08			
Cam profile (Cam lobe height:)	Inlet	49.547		49.047	Replace.
	Exhaust	49.307		48.807	
Camshaft bend			0.04		Press correct or replace.
Fly- wheel	Friction surface distortion	0.05 or less	0.2		Correct or replace.
	Height up to friction surface	20		19	Replace.
	Runout of friction surface		0.2		Correct installation.
Eccentricity of flywheel			0.2		Correct installation.
Cylinder liner	Flange pr- ojction	0.03 to 0.10			replace crankcase and cylinder liner.
	I.D.	118.00 to 118. 035		118.25	Replace

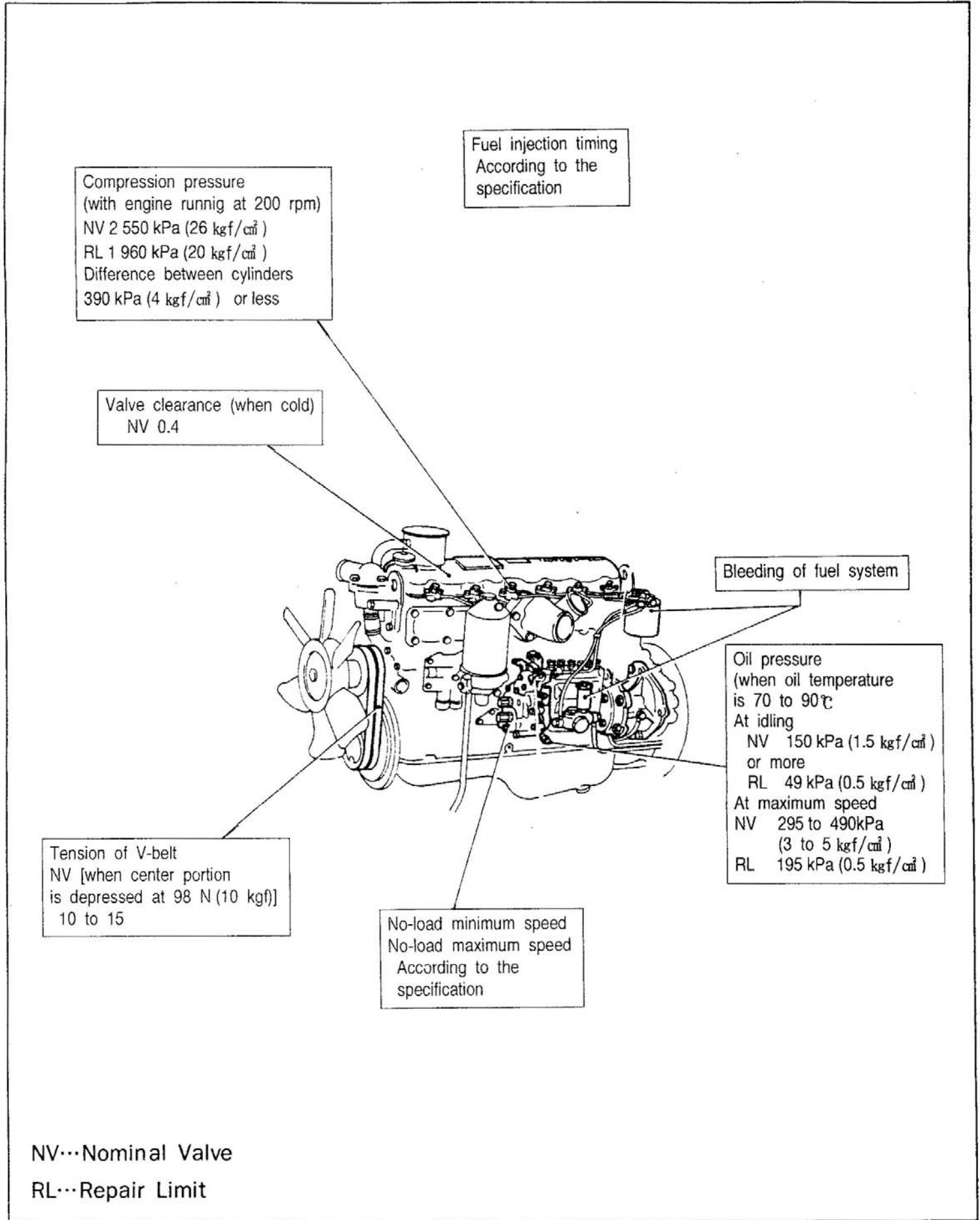
2-2-7 Other Equipment

(1) Air compressor

Unit : mm

Description		Nominal value (Basic diameter in [mm])	Re- pair limit	Service limit	Remedy and remarks
Clearance between cylinder liner and piston	Crown	[80]		0.35	Replace piston or cylinder liner.
	Skirt			0.19	
Clearance between piston ring groove and ring	Compres- sion ring	[3]		0.08	Replace piston or ring.
	Oil ring	[4]		0.08	
Piston ring end gap				1.0	Repalce piston ring.
Clearance between piston and piston pin		[16]		0.06	Repalce.
Clearance between piston pin and connecting rod small end		[16]		0.07	Replace piston pin or connec- ting rod.
Grankshaft end play				1.0	Replace.
Suction valve spring	Load N(kgf)/ installed length			3.9 (0.396)/ 6.5	Replace.
Delivery valve spring	Load N(kgf)/ installed length			2.6 (0.264)/ 9.5	Replace.
connecting rod bearing				when copper is exposed due to wear of inner plated surface.	Repalce.
Crankshaft(pin section) O.D.		[34]		33.94	Replace.
Connecting rod end play				0.5	Repalce connecting rod or crankshaft.
Clearance between crankshaft journal and bearing		[76.5]		0.12	Replace crankshaft or crankcase as- sembly.

Inspection and Adjustment of Engine



Miscellaneous

Engine control system defective
Improper engine oil viscosity
Inferior type of fuel

Injection nozzle

Inadequate spraying
Unequal spray pressure between cylinders

Engine out of adjustment

Low idling speed
Incorrect valve clearance
Incorrect fuel injection start timing

Incorrect injection interval
Delivery valve too tight
Delivery valve malfunctioning
Damper spring out of adjustment
Idling spring out of adjustment
Unequal injection between cylinders
Loose control rack pinion

Injection pump

Cylinder head gasket defective
Valve spring deteriorated or damaged
Valve and valve seat worn and damaged
Piston ring worn and damaged
Piston and cylinder liner worn

Low compression pressure

Miscellaneous

Engine moving parts seized
Improper engine oil viscosity
Inferior type of fuel

Low compression pressure

Piston and cylinder liner worn
Piston ring worn or damaged
Valve and valve seat worn
Valve spring deteriorated and damaged
Cylinder head gasket defective

Inlet and exhaust system

Exhaust valve does not open fully
Muffler clogged
Air cleaner element clogged

Engine out of adjustment

Incorrect valve clearance
Incorrect fuel injection start timing

Plunger stuck
Incorrect timer advance angle
Incorrect injection interval
Delivery valve too tight
Delivery valve malfunctioning
Improper amount of injection
Loose control rack pinion

Injection pump

Incorrect injection pressure
Incorrect spray condition

Injection nozzle

Fuel filter element clogged
Gauze filter clogged
Feed pump delivery pressure and delivery low
Fuel pipe clogged
Improper amount of injection

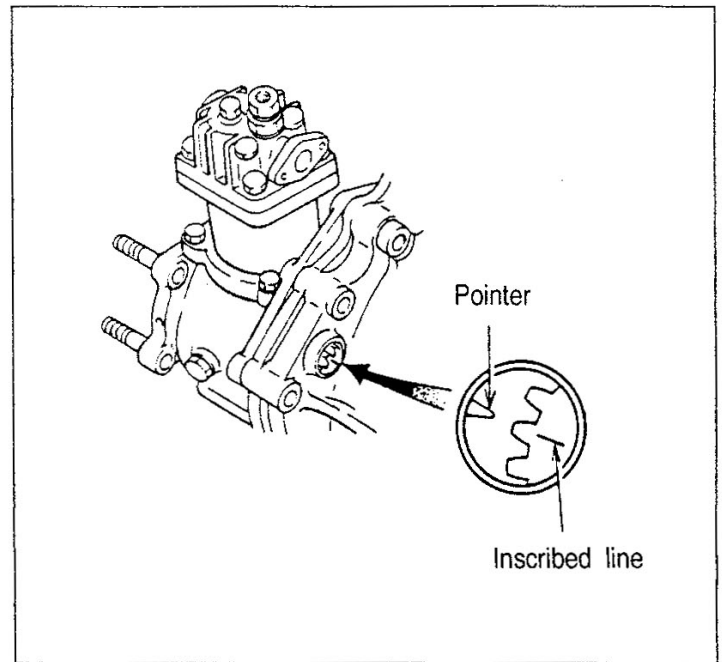
Fuel system

Low output

Unsmooth idling

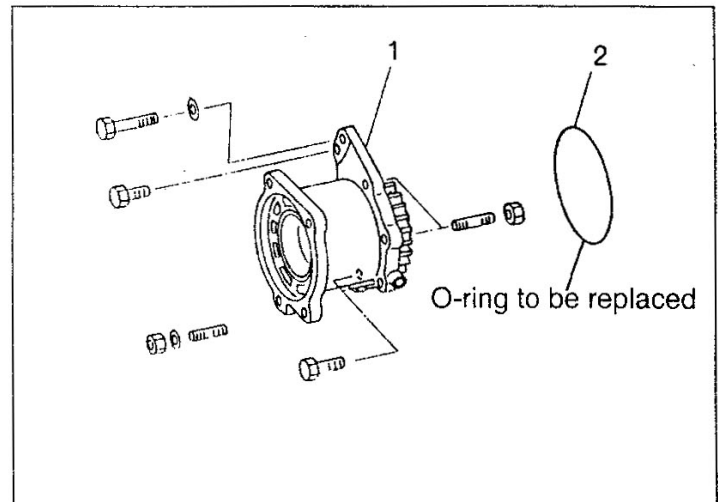
(d) After the air compressor has been mounted to the flywheel housing, remove the inspection plug of the flywheel housing and check to see that the inscribed line of the drive gear is in alignment with the pointer.

If they are out of alignment, re-install.



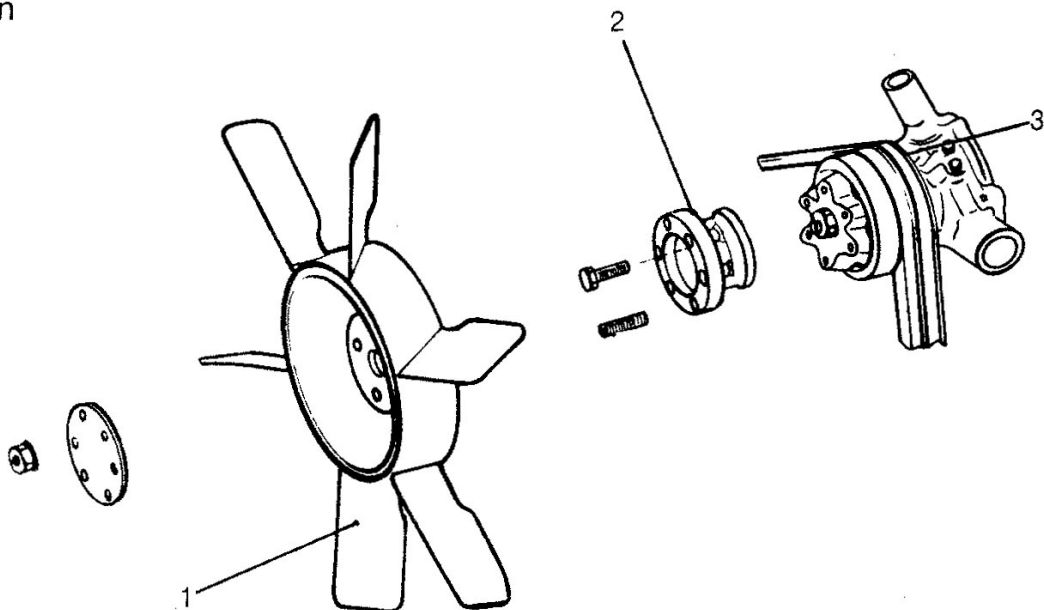
5-2-5 Injection pump drive

1. Injection pump drive
2. O-Ring

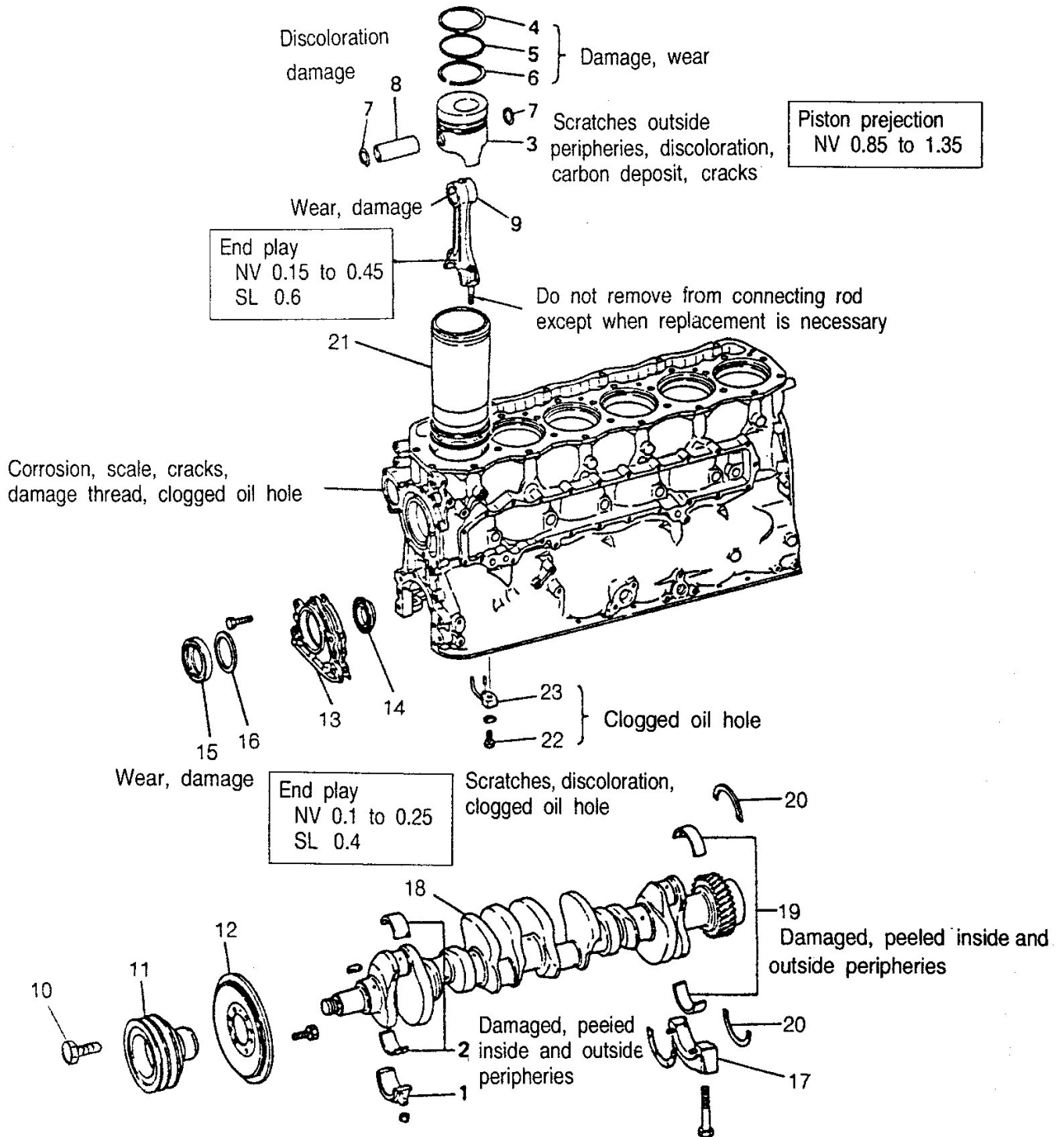


5-2-6 Cooling

1. Fan
2. Coupling-Fan
3. V-Belt



6-1-3 Crankcase and Main Moving Parts



- 1. Connecting rod cap
- 2. Connecting rod bearing
- 3. Piston
- 4. 1st compression ring
- 5. 2nd compression ring
- 6. Oil ring
- 7. Snap ring
- 8. Piston pin
- 9. Connecting rod

- 10. Crankshaft Bolt
- 11. Crankshaft pulley
- 12. Torsional damper
- 13. Front cover
- 14. Slinger
- 15. Oil seal
- 16. seal plate
- 17. Main bearing cap
- 18. Crankshaft

- 19. Main bearing
- 20. Thrust plate
- 21. Cylinder Liner
- 22. Check valve
- 23. Oil jet

NV ..Nominal Value
 SL... Service Limit
 RL... Repair Limit

