99719-83100

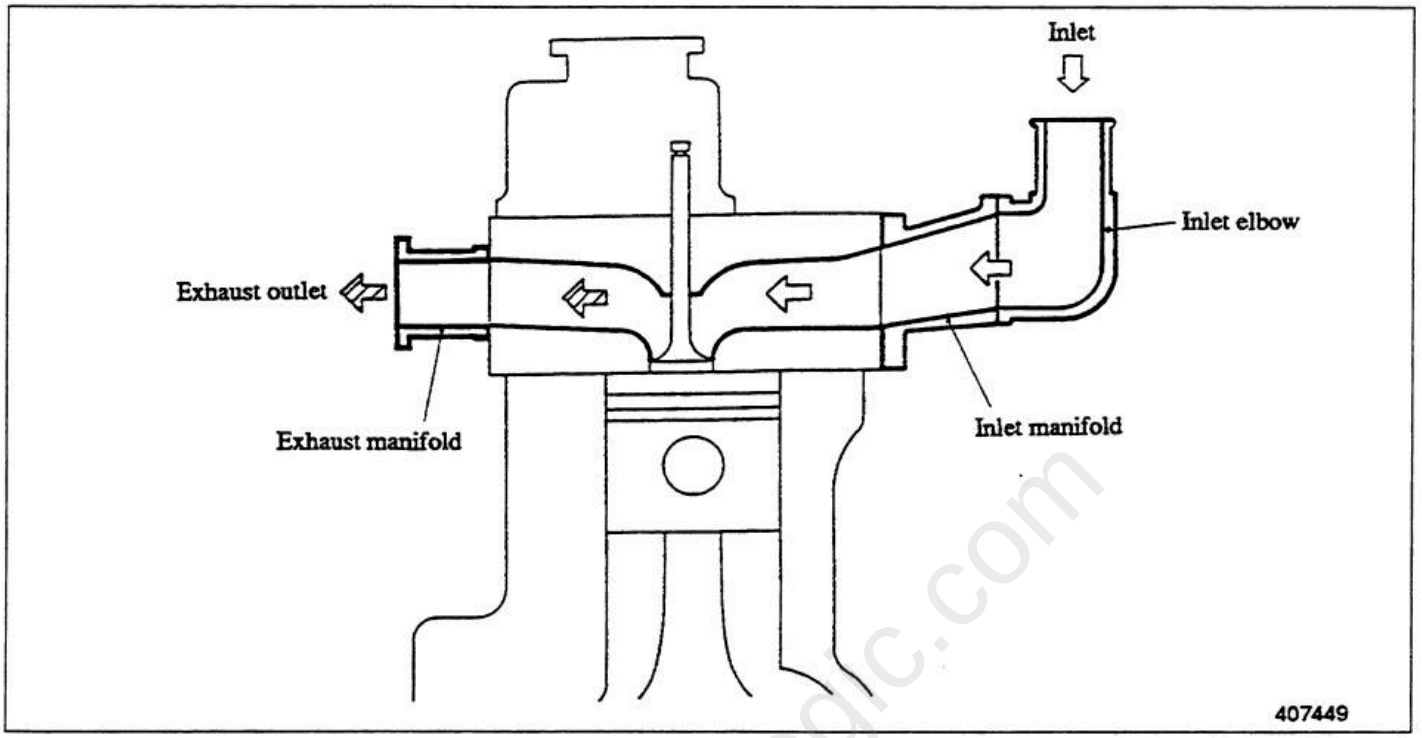
CATERPILLAR®

Service Manual

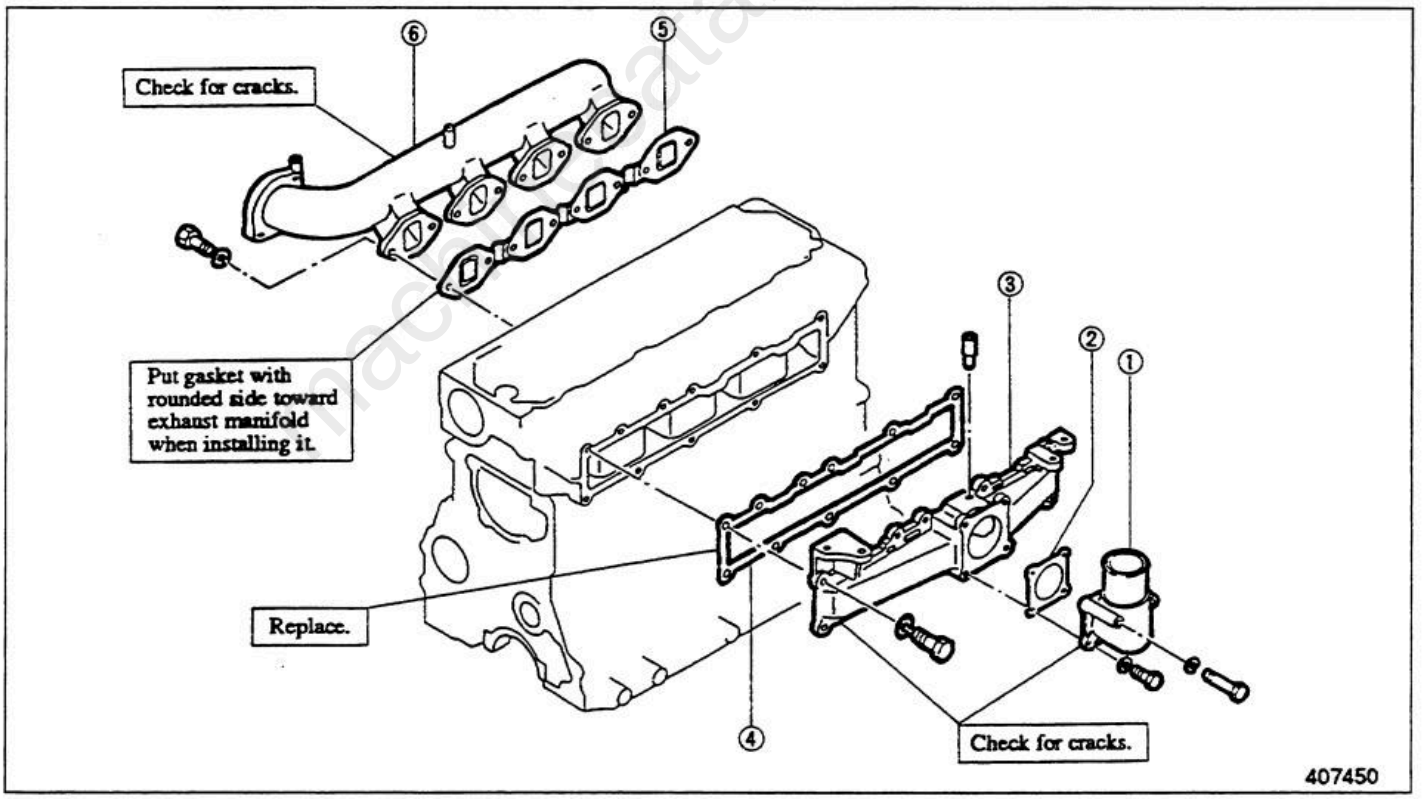
Diesel Engine S4Q2 (2976—UP)

DP10
DP14
DP15
DP18

1. GENERAL



2. DISASSEMBLY, INSPECTION AND ASSEMBLY



1 Air inlet elbow
2 Gasket
3 Inlet manifold
4 Gasket
5 Gasket
6 Exhaust manifold

72

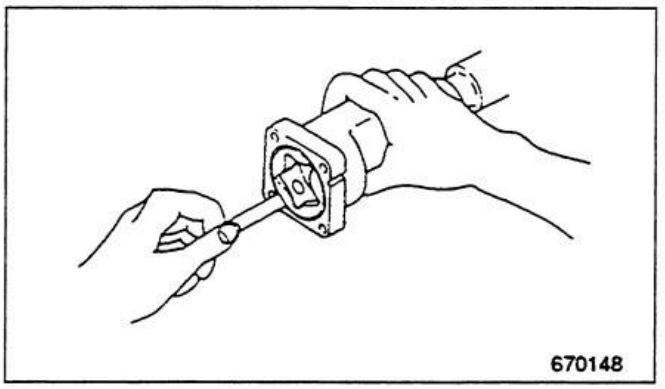
2.2 Inspection

(1) Clearance between outer rotor and inner rotor.

Check the clearance with a feeler gauge, as shown in the illustration. If the clearance exceeds the service limit, replace the pump assembly.

Unit: mm (in.)

Item	Assembly standard	Service limit
Clearance between outer rotor and inner rotor	0.13 to 0.15 (0.0051 to 0.0059)	0.20 (0.0079)



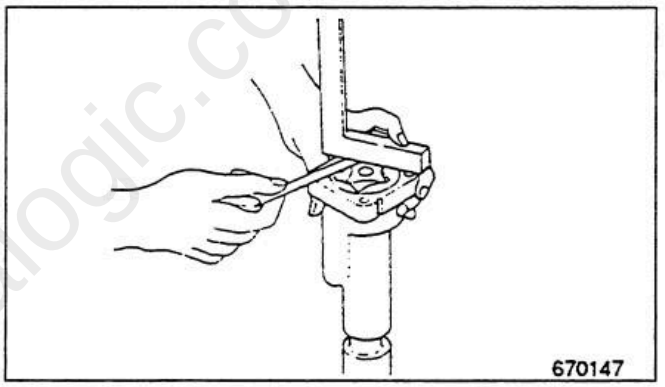
Checking clearance between outer rotor and inner rotor

(2) Clearance between rotors and cover

Check the clearance with a feeler gauge and straight edge, as shown in the illustration. If the clearance exceeds the service limit, replace the pump assembly.

Unit: mm (in.)

Item	Assembly standard	Service limit
Clearance between rotors and cover	0.04 to 0.09 (0.0016 to 0.0035)	0.15 (0.0059)



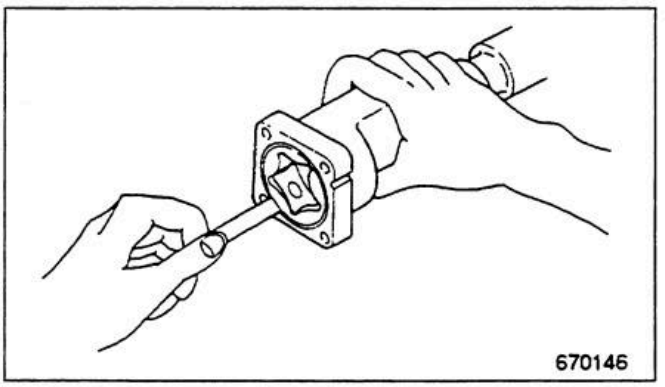
Checking clearance between rotors and cover

(3) Clearance between outer rotor and case

Check the clearance with a feeler gauge, as shown in the illustration. If the clearance exceeds the service limit, replace the pump.

Unit: mm (in.)

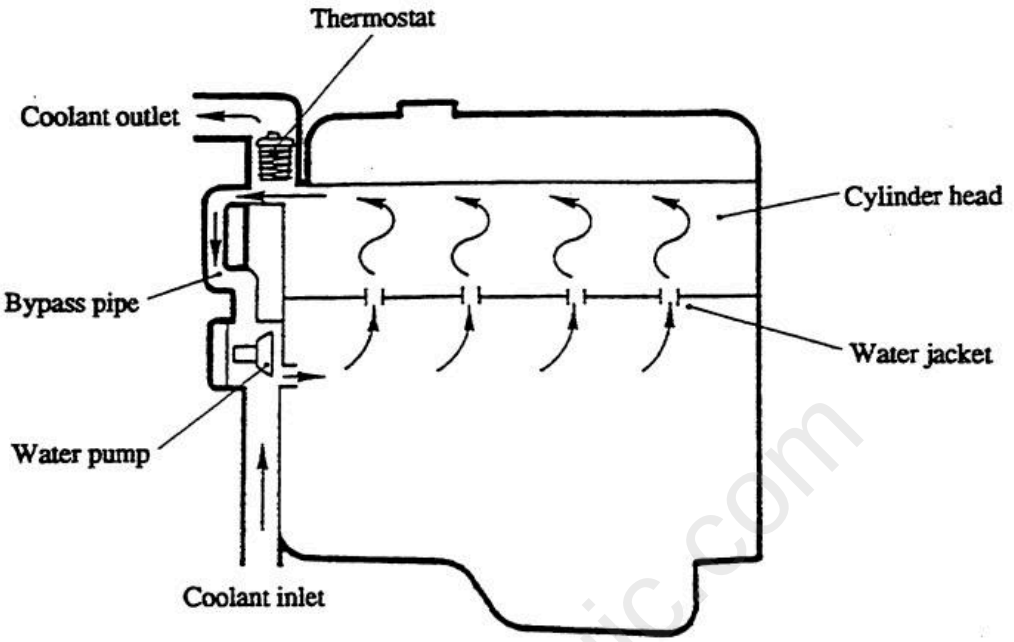
Item	Assembly standard	Service limit
Clearance between outer rotor and case	0.200 to 0.275 (0.00787 to 0.01083)	0.500 (0.01969)



Checking clearance outer rotor and case

	Complaint / Cause	Hard starting: Engine will turn: No exhaust smoke	Hard starting: Engine will turn: Little exhaust smoke	Hard starting: Engine will turn: Excessive exhaust smoke	Hard starting: Cranking speed low	Hard starting: Engine will not turn: Engine can be cranked manually	Hard starting: Engine will not turn: Engine cannot be cranked manually	Glow plug indicator does not glow red	Glow plug indicator glows red	Not enough power: Little exhaust smoke	Not enough power: Excessive white exhaust smoke	Not enough power: Excessive black exhaust smoke	Exhaust smoke abnormal: During idling	Exhaust smoke abnormal: During operation: White	Exhaust smoke abnormal: During operation: Black	Engine knocks excessively	Engine noisy	Engine runs rough	Engine hunts: During idling	Engine hunts: During operation
Cooling system	Engine not warm	–	–	○	○	–	–	–	–	–	–	–	○	–	–	○	–	–	–	–
	Radiator dissipating heat excessively	–	–	–	–	–	–	–	–	–	○	–	○	○	–	○	–	–	–	–
	Not enough coolant	–	–	–	–	–	–	–	–	–	–	○	–	–	○	–	–	–	–	–
	Radiator not dissipating heat properly	–	–	–	–	–	–	–	–	–	–	○	–	–	○	–	–	–	–	–
	Cylinder head gasket leaks	–	–	–	–	–	–	–	–	–	○	–	○	○	–	–	–	○	–	–
	Cracks in crankcase water jacket	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Electrical system	Starter switch defective	–	–	–	–	○	–	○	–	–	–	–	–	–	–	–	–	–	–	–
	Starter magnetic switch defective	–	–	–	–	○	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Starter defective	–	–	–	○	○	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Starter free wheel defective	–	–	–	○	○	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Flywheel ring gear and pinion defective	–	–	–	–	○	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Battery voltage low	–	–	○	○	○	–	○	–	–	–	–	–	–	–	–	–	–	–	–
	Glow plug(s) or indicator open circuited	–	–	○	–	–	–	○	–	–	–	–	–	–	–	–	–	–	–	–
	Glow plug(s) short circuited	–	–	○	–	–	–	–	○	–	–	–	–	–	–	–	–	–	–	–
	Alternator defective	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Relay defective	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Wiring defective	–	–	○	○	○	–	–	○	–	–	–	–	–	–	–	–	–	–	–
Mechanical problems	Running parts seized	–	–	–	○	–	○	–	–	–	–	○	–	–	○	–	○	○	–	–
	Cylinder(s), piston(s) or piston ring(s) worn	–	–	○	–	–	–	–	–	–	○	–	○	○	–	○	○	–	–	–
	Piston ring(s) worn	–	–	○	–	–	–	–	–	–	○	–	○	○	–	○	–	–	–	–
	Excessive oil clearance	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	○	–	–	–
	Connecting rod cap bolts loose	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	○	–	–	–
	Interference between valve(s) and piston(s)	–	–	–	–	–	○	–	–	–	–	–	–	–	–	–	○	–	–	–
	Valve spring(s) broken	–	–	○	–	–	–	–	–	–	○	–	○	○	–	–	○	○	○	○
	Excessive valve clearance	–	–	–	–	–	–	–	–	–	–	○	–	–	○	–	○	○	○	○
	Foreign material in cylinder(s)	–	–	–	–	–	○	–	–	–	–	–	–	–	–	–	○	–	–	–
	Excessive gear backlash	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	○	–	–	–

1. GENERAL



2. NO-LOAD MINIMUM (LOW IDLE) SPEED AND NO-LOAD MAXIMUM SPEED

⚠ CAUTION

a) The no-load minimum (low idle) speed and no-load maximum speed are set for each engine on the test bench at the factory. The set bolts are sealed. Inspection and adjustment of these speeds are to be made at the Caterpillar-authorized service shop only.

b) After adjusting the governor by breaking the seals, be sure to re-seal all stoppers, making them appear as if they were sealed at the factory.

c) Whether the stopper seals are intact or not has important bearing on the validity of claims under warranty.

d) When inspecting and adjusting these speeds, be on the standby to operate the engine stop lever manually in the event of engine overrun.

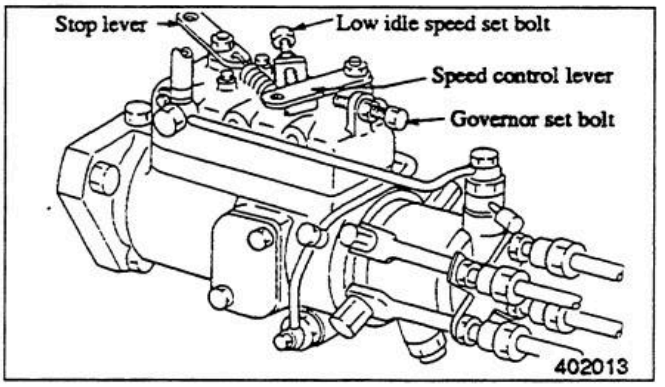
For inspection and adjustment, warm up the engine thoroughly until the coolant and oil temperatures are above 75°C (167°F).

(1) Starting engine

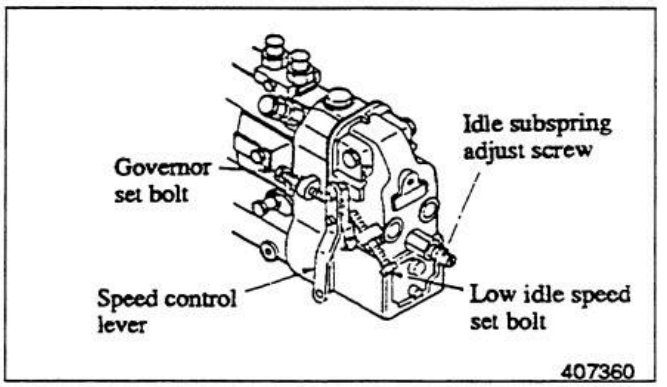
(a) Move speed control lever (1) to the high speed position and turn the starter switch to START position to crank the engine.

(b) The engine will fire up at a speed of approximately 150 rpm. When the engine fires, hold the engine speed between 800 and 1000 rpm by operating the speed control lever.

(c) When the engine runs with a steady speed, move the speed control lever back to the low idle speed position.



Starting engine (with distributor type injection pump)



Starting engine (with in-line type injection pump)

2. MEASURING THE COMPRESSION PRESSURE

START BY:

(a) Make sure the engine oil, air cleaner, starter and battery are normal.

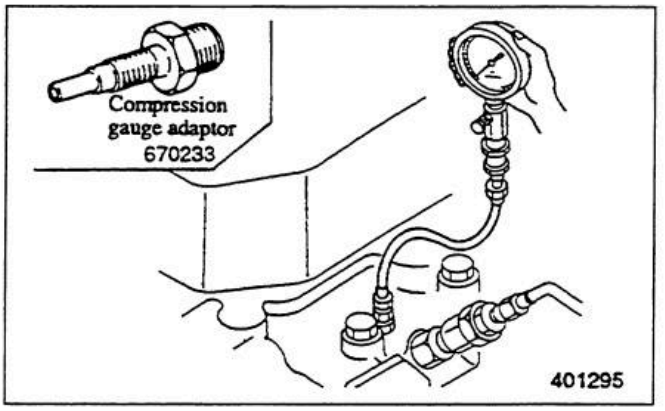
(b) Start the engine and allow it to warm up thoroughly.

(1) Move the control lever to the stop position.

(2) Remove the glow plugs from all cylinders. Connect compression gauge (33391-02100) to the cylinder on which the compression is to be measured with compression gauge adaptor (30691-21100).

(3) Crank the engine with the starter and, after the gauge pointer stops moving, take a pressure reading from the gauge.

(4) If the reading on the gauge is lower than the repair limit, overhaul the engine.



Compression gauge adaptor

⚠ CAUTION

a) Be sure to measure the compression on all cylinders.

b) The compression pressure may vary depending on engine rpm. This makes it necessary to check the engine rpm when measuring the compression.

Unit: kgf/cm² (psi) [kPa]

Item	Assembly standard	Repair limit
Compression	30 (427) [2940]	26 (370) [2550]

NOTE

Measure the compression with the engine running at 150 to 200 rpm.

⚠ CAUTION

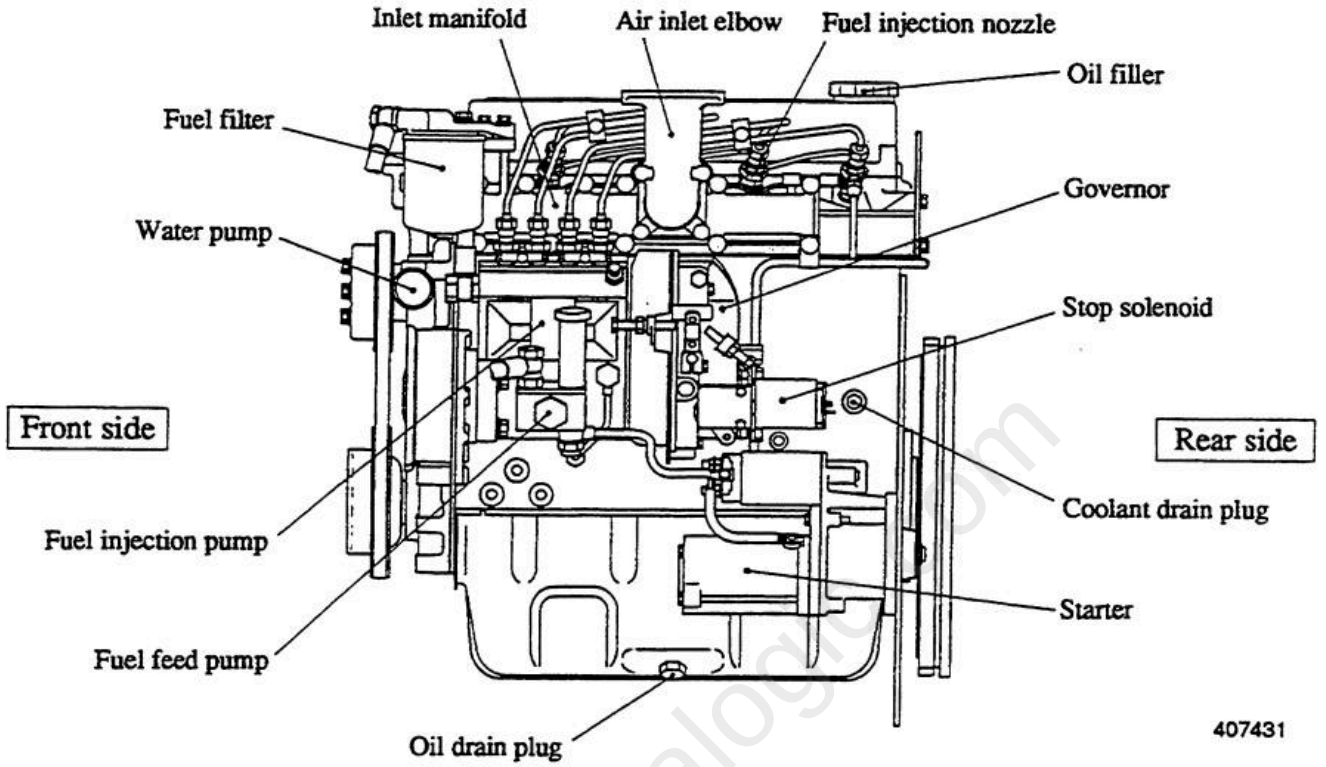
a) Measure the compression at regular intervals to obtain the data on the gradual change of compression.

b) The compression would be slightly higher than the assembly standard in a new or overhauled engine but it will drop after the break-in period.

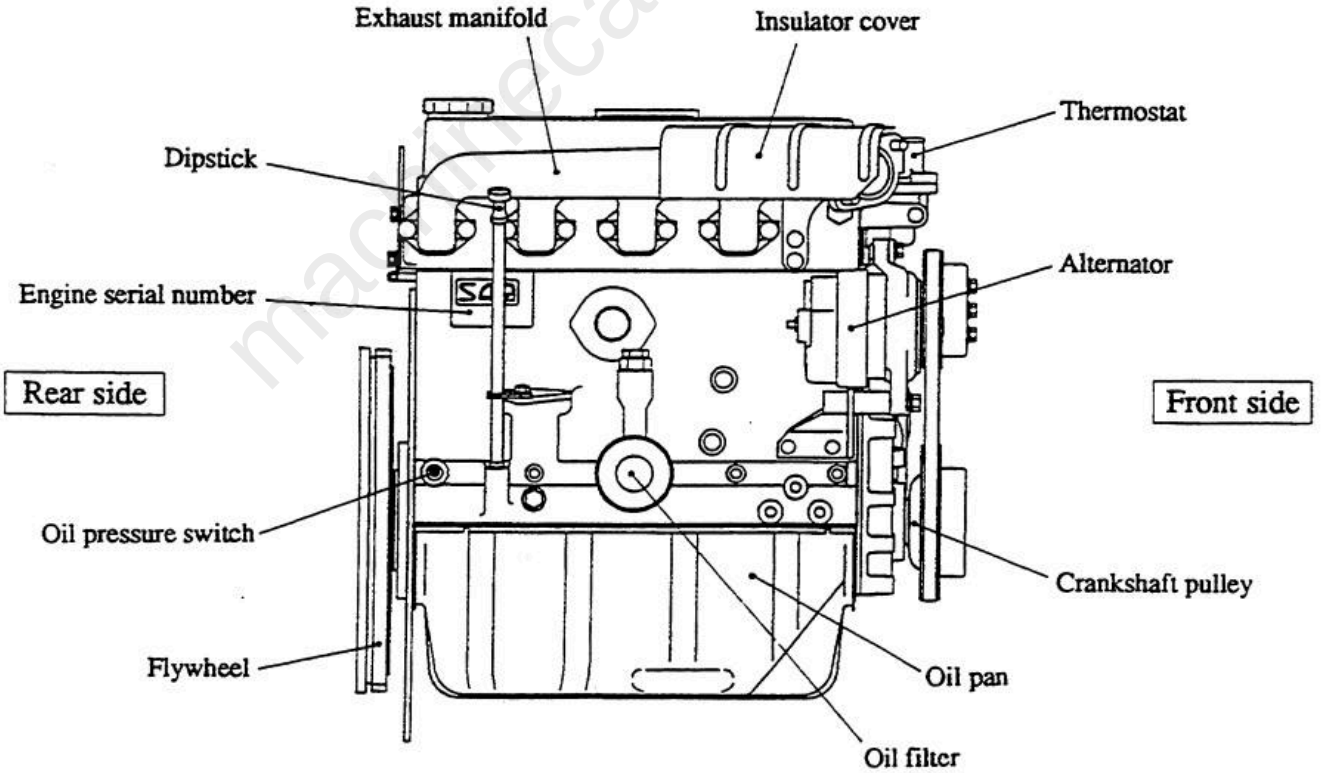
Group	Item			Nominal size	Assembly standard (standard clearance)	Repair limit (clearance)	Service limit (clearance)	Remarks
Main moving parts	Pistons	Outside diameter (at skirt)	Standard	87.970 (3.46338)	87.955 to 87.985 (3.46279 to 3.46397)		87.770 (3.45550)	
			0.25 (0.0098) oversize	88.220 (3.47322)	88.205 to 88.235 (3.47263 to 3.47381)		88.020 (3.46535)	
			0.50 (0.0197) oversize	88.470 (3.48306)	88.455 to 88.485 (3.48247 to 3.48365)		88.270 (3.47519)	
		Projection			0.13 to 0.60 (0.0051 to 0.0236)			Check metal clearance.
	Piston rings	Clearance between groove and ring	No. 1 ring		(0.060 to 0.100) ((0.00236 to 0.00394))		(0.200) ((0.00787))	Replace piston rings if service limit is not exceeded. Replace piston if service limit is exceeded.
			No. 2 ring		(0.045 to 0.080) ((0.00177 to 0.00315))		(0.150) ((0.00591))	
			Oil ring		(0.025 to 0.065) ((0.00098 to 0.00256))			
		Clearance between ends of piston ring			(0.30 to 0.50) ((0.0118 to 0.0-197))		(1.50) ((0.0591))	
	Piston pins	Diameter		28 (1.10)	27.994 to 28.000 (1.10212 to 1.10236)			
		Clearance between pin and bore			(0.000 to 0.016) ((0.00000 to 0.00063))		(0.050) ((0.00197))	Replace pin if service limit is not exceeded. Replace piston if service limit is exceeded.
		Clearance between pin and bushing			(0.020 to 0.051) ((0.00079 to 0.00201))		(0.080) ((0.00315))	Replace pin or bushing. Ream if necessary.
	Connecting rods	Inside diameter of bushing		28 (1.10)	28.020 to 28.045 (1.10315 to 1.10413)			
		Twist/bend			0.05/100 (0.0020/3.94), maximum	0.15/100 (0.0059/ 3.94)		
		Clearance between crankpin and connecting rod metal (oil clearance)			(0.03 to 0.09) ((0.0012 to 0.0035))	(0.20) ((0.0079))		
		End play			(0.15 to 0.35) ((0.0059 to 0.0138))		(0.50) ((0.0197))	Replace connecting rod.
	Flywheel	Flatness			0.15 (0.0059), maximum	0.50 (0.0197)		
		Face runout						

137

[S4Q2-52FL]



Left side



Right side

NOTE: Rotation of crankshaft is counterclockwise when seen from flywheel end.

Full Version Available

Caterpillar DP15 MC Forklift Engine Service Manual (99719-83100)

Caterpillar DP15 MC Forklift engine service manual, covers testing, adjustments, teardown, and rebuild procedures. Instant PDF download.