2974 770 M1

WORKSHOP MANUAL

Engine D900 - series

KOMATSU

PREFACE and EXPLANATIONS

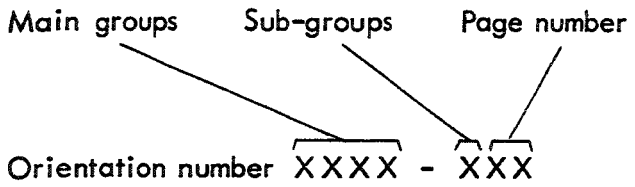
This hand book should assist the skilled construction machine mechanic when carrying out repairs and adjustments on MF construction machines. The work operations are written in such a style that the dismantling and assembling of the components can be carried out successfully and without difficulty.

To assist in the locating of specific test-repair operations, working descriptions etc. this hand book is divided into main and sub-groups. This also applies to all types of repair hand book publications.

At the top right hand corner of every page next to the section heading a series of numbers (orientation number) are to be found. These numbers follow in numerical sequence throughout the book.

The section heading applies either to the construction machine type, assembly or component for which the text and illustrations are valid.

Orientation number:



The main group numbers refer to either main assemblies, groups of main assemblies, sub-assemblies or components.

Example: Group 1700 - Steering (mechanical steering, assisted steering, hydro-steering, steering unit)

The sub-group numbers classify the descriptions and details as follows:

0 - General

1 - Functional descriptions

2 - Fault finding and possible preventive measures

3 - Test and adjustments

4 - Repairs

5 - Technical details

The instructions for dismantling and assembling of components have been coordinated with the picture tables, sectional views and parts lists so that all numbers in brackets refer to the identical part, i. e. (24).

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✱ Please note the repair value amendments on page 5000 - 500

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Machine type	Engine type
44 C	D 943 B
55 C	D 962 B
66 C	D 963 B
77 C	D 963 A 2
C 44 C	D 943 B
C 55 C	D 962 B
C 66 C	D 963 A 1
D 66 C	D 963 A 1
600 C	D 962 K
D 600 C	D 962 K
D 600 D	D 962 K
700 C	D 963 K
700 D	D 963 A 1
D 700 C	D 963 K
D 700 D	D 963 A 1

ENGINE DESCRIPTION

The crankcase is manufactured from cast iron and with the below centre crankshaft and re-inforced side walls produces a distortion free construction.

The renewable wet cylinder liners are manufactured from a centrifugally cast alloy and are sealed with a silicon sealing compound and two "O" ring seals.

Water tubes in the cylinder block guarantee an exceptional cooling of the cylinder liners.

The cylinder head is of a high quality cast iron and fitted to the crankcase with safety collar headed bolts.

The cylinder head gasket is a steel sheet coated on both sides with asbestos. The gasket bore hole rims are re-inforced with steel sheeting. When fitting the cylinder head gasket, on no account use sealing compound.

The valves operate in cast iron guides pressed into the cylinder head. In engines D 943, D 963, D 963 A 1, and D 963 A 2 the exhaust valve seat facings are stellite plated. In these engines a high heat resisting material is used for the inlet and exhaust valve seat inserts. (In the D 962 engine for the exhaust valve only).

The valve springs are of a special spring steel and are secured by spring caps and two piece split cones.

The induction hardened valve rocker shafts are mounted in light metal support brackets bolted onto the top face of the cylinder head. The inlet and exhaust valve rocker arms are manufactured from heat treated steel and are lubricated via an external oil pipe tapped into a camshaft bearing bush. They are operated by case hardened tappets and push rods.

The valve rocker gear is covered with a light metal cover.

The crankshaft is mounted in seven main bearings (the D 943 engine in five bearings) and is of cast chrome steel and hardened. The main and connecting rod journals are induction hardened, thereby guaranteeing a long life.

The precision finished bearing shells are white bearing metal lined. The bearing caps are of cast iron and secured with hexagon headed set screws.

At the front and rear of the crankshaft dust protected radial oil seals are fitted.

ENGINE DESCRIPTION (continued)

The seven journal camshaft (D 943 engine, five journals) is of cast and hardened steel. The cams and bearing surfaces are induction hardened. The camshaft is mounted in renewable precision finished bearings.

The light metal pistons have an eccentric positioned combustion chamber in the piston crowns, three compression rings and one oil control ring. The upper compression ring is chromed. In engines D 963 A 1, and D 963 A 2 the upper compression ring is fitted into a ring carrier cast in the piston.

The floating piston pins are secured with circlips.

The cast chrome alloy steel connecting rods have oblique fitting bearings caps and are located by serrations on the big end faces at right angles to the rod axis.

The piston pin bushes and connecting rod bearings are renewable. The piston complete with connecting rod can be removed from above.

The double geared oil pump guarantees all lubricating requirements of the engine even by extreme working angles of the machine.

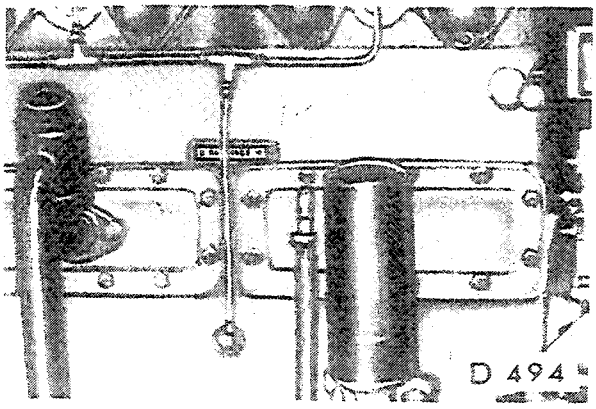
The helical timing gears are of bath nitrated cast steel. The camshaft and injection pump timing gears are interchangeable.

The oil sump and timing gear housings are of thick walled cast iron and have the effect of dampening the engine gear mechanism noise.

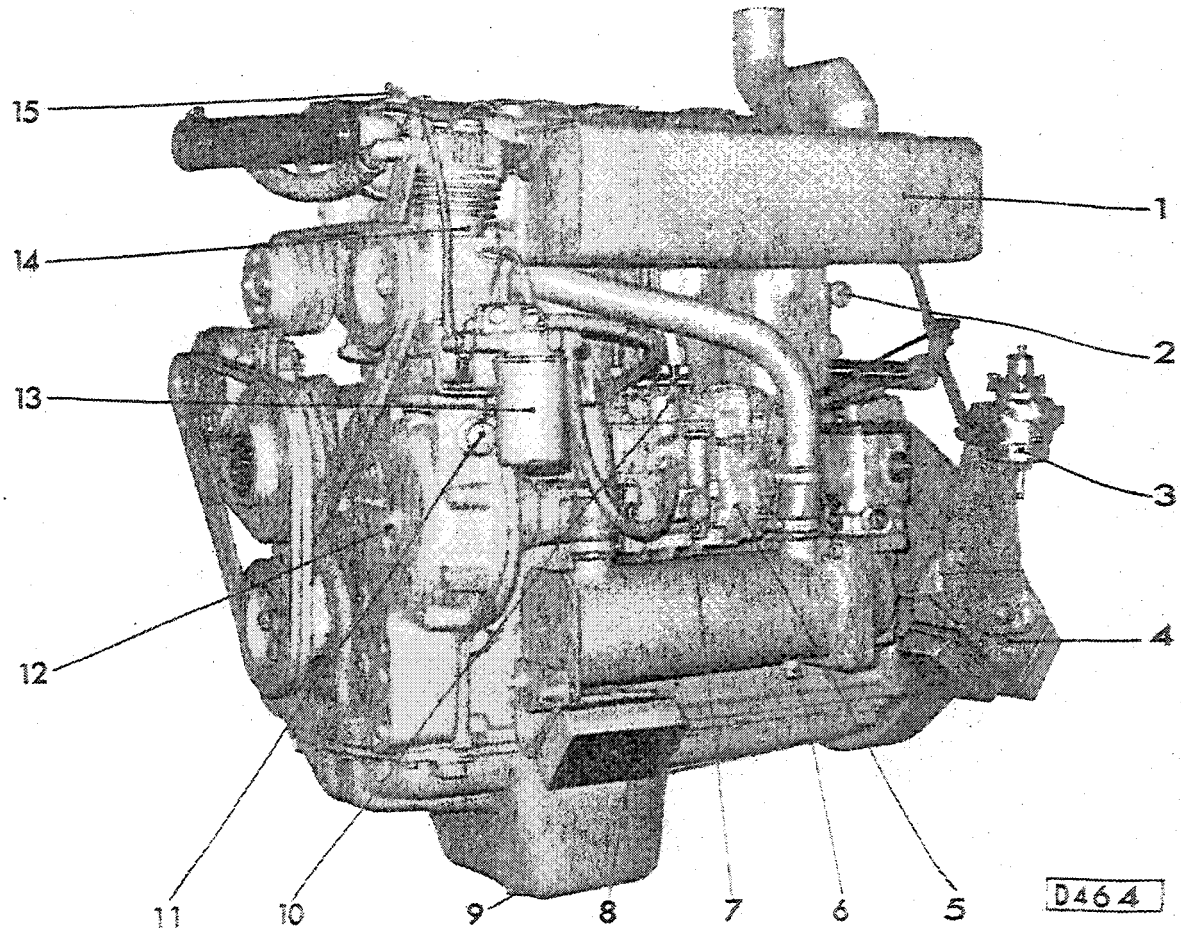
The BOSCH injection pump is mechanical and variable speed regulated. It is lubricated independent from the engine. The overflow of leak-off fuel is directed into the pump crankcase.

The BOSCH injectors with multi-holed nozzles are fitted into the cylinder head with union type retaining nuts.

On the D 900 series engines the engine number is located on the camshaft side of the engine near the engine oil filter. (Fig. D 494)

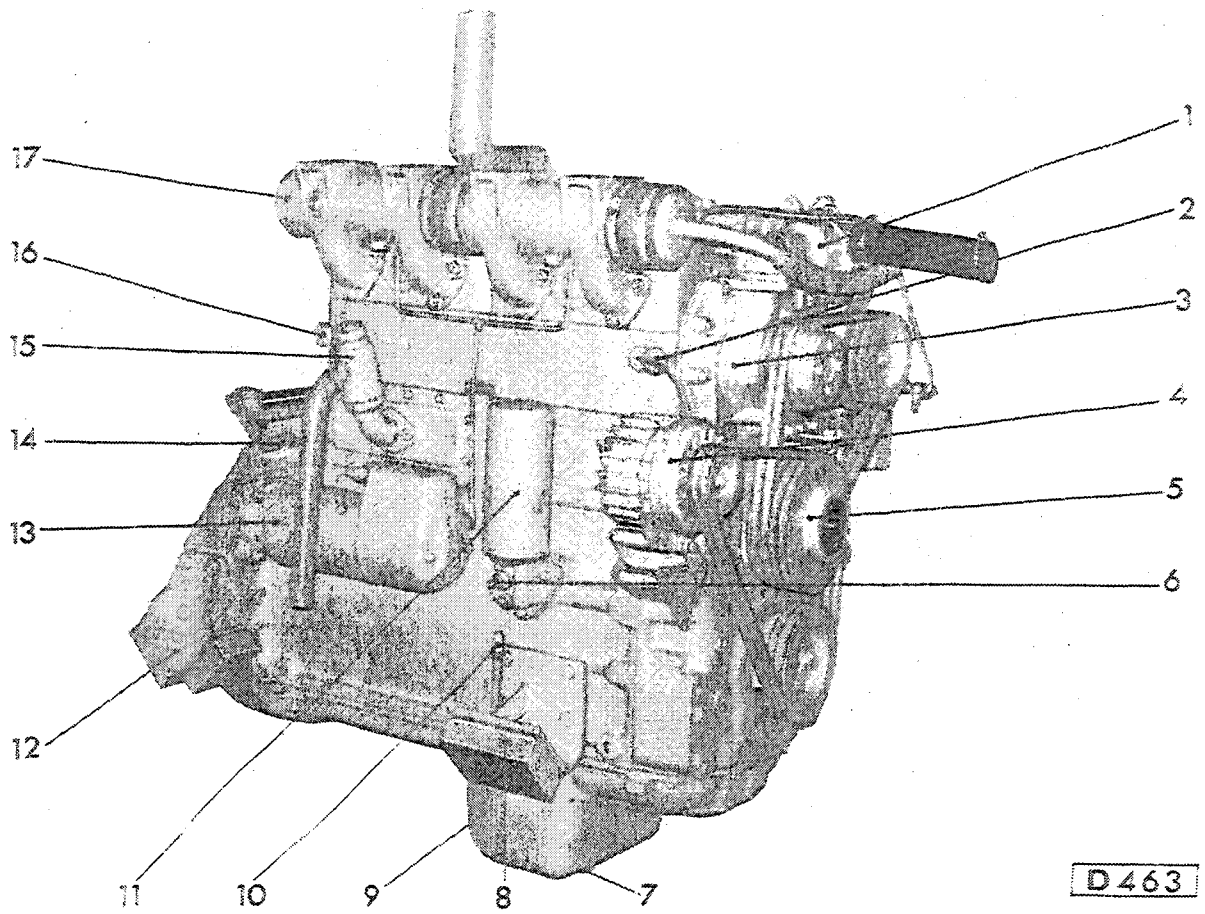


INJECTION PUMP SIDE (Fig. D 464)



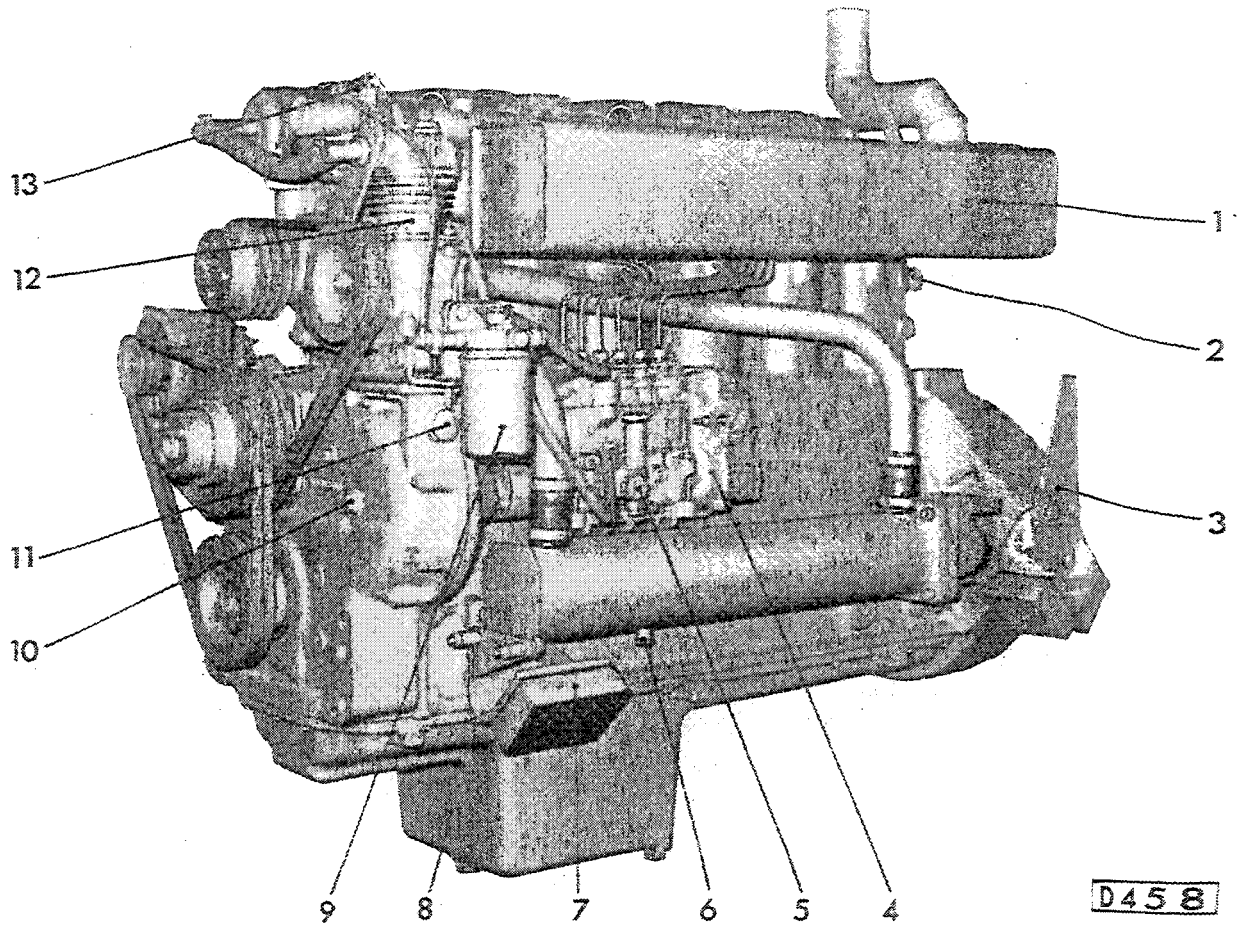
1 Silencer
2 Engine suspending point
3 Pressure regulator with tyre inflator bottle (brake system)
4 Engine bearer, rear
5 Injection pump
6 Coolant drain plug
7 Fuel feed pump
8 Engine bearer, front
9 Engine oil drain plug
10 Injection pump oil filler opening and breather filter
11 Engine suspending point
12 Attachment point for angle drive for measuring engine speed
13 Fuel filter
14 Air compressor
15 Transmitter for coolant temperature gauge

CAMSHAFT SIDE (Fig. D 463)



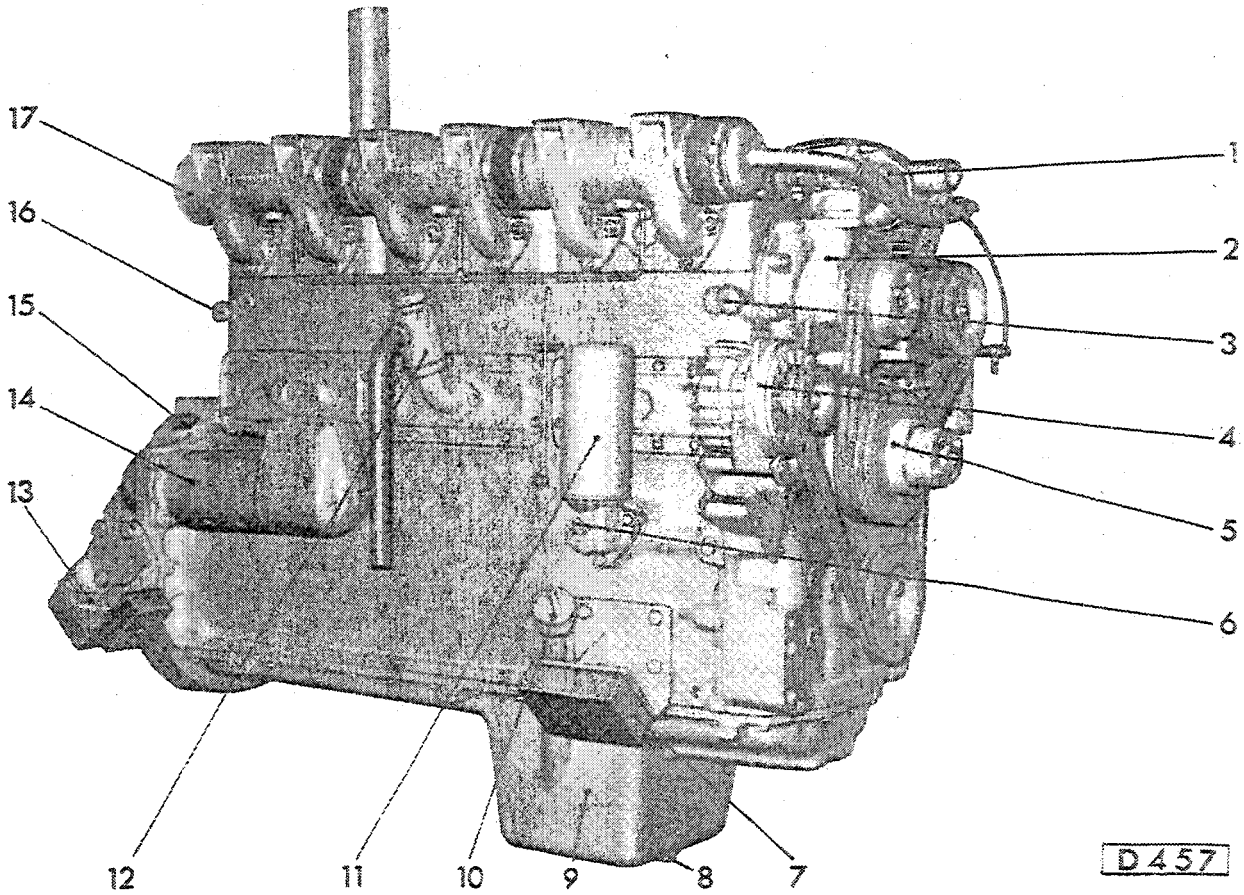
1 Thermostat
2 Engine suspending point
3 Water pump
4 Alternator
5 Fan intermediate drive
6 Oil pressure transmitter
7 Engine oil drain plug
8 Engine bearer, front
9 Oil sump
10 Oil level dip stick
11 Oil filter
12 Engine bearer, rear
13 Starter
14 Access plug for injection timing marks
15 Breather filter and oil filler neck
16 Engine suspending point
17 Inlet manifold

INJECTION PUMP SIDE (Fig. D 458)



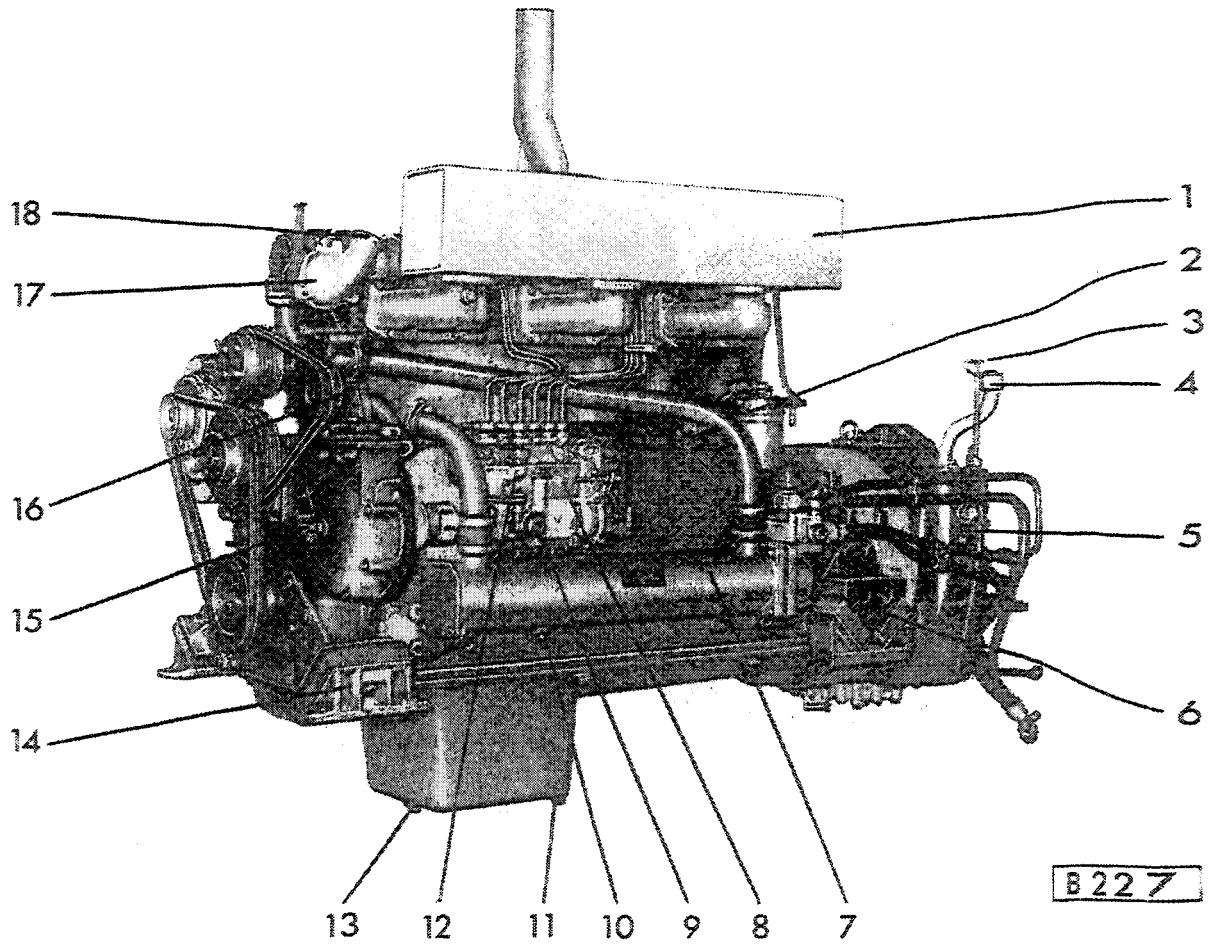
1 Silencer
2 Engine suspending point
3 Engine bearer, rear
4 Injection pump
5 Fuel feed pump
6 Coolant drain plug
7 Engine bearer, front
8 Oil sump
9 Fuel filter
10 Attachment point for angle drive for measuring engine speed
11 Engine suspending point
12 Air compressor
13 Transmitter for coolant temperature gauge

CAMSHAFT SIDE (Fig. D 457)



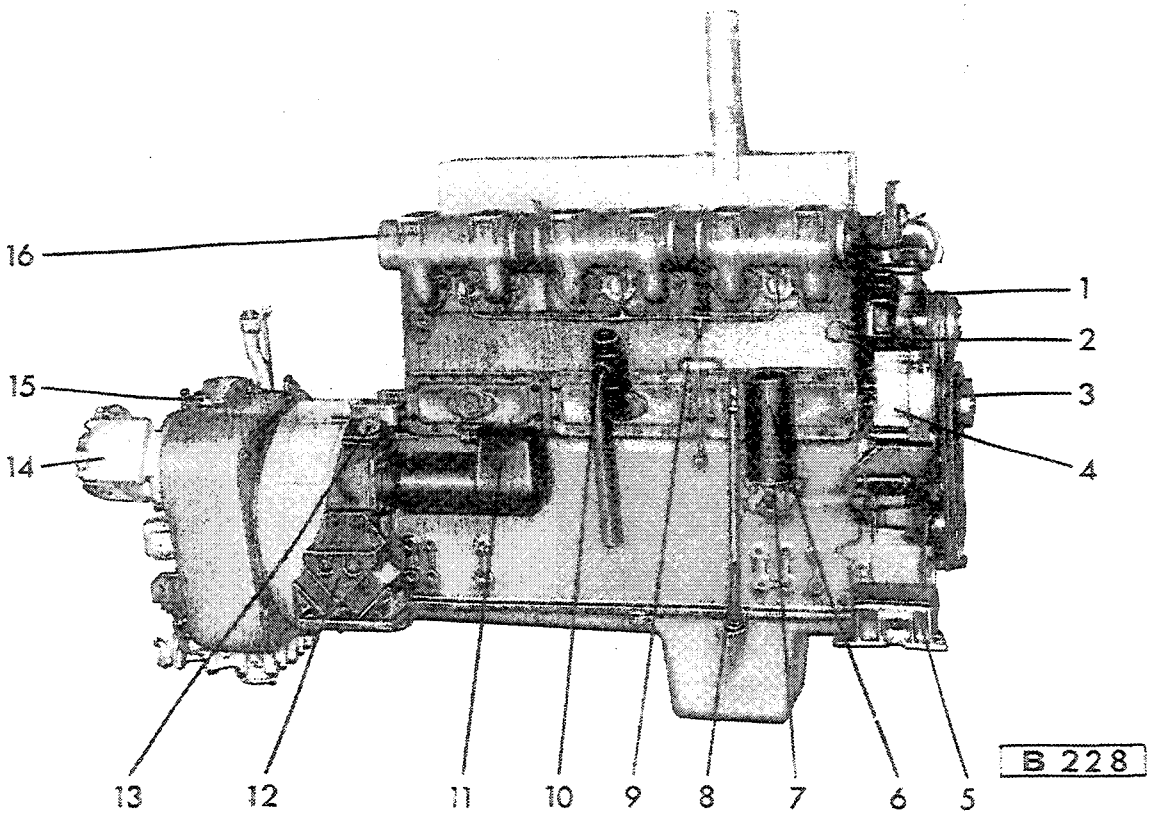
1 Thermostat
2 Water pump
3 Engine suspending point
4 Alternator
5 Fan intermediate drive
6 Oil pressure transmitter
7 Engine bearer, front
8 Engine oil drain plug
9 Oil sump
10 Oil filler neck and dip stick
11 Oil filter
12 Breather filter
13 Engine bearer, rear
14 Starter
15 Access plug for injection timing marks
16 Engine suspending point
17 Inlet manifold

INJECTION PUMP SIDE (Fig. B 227)



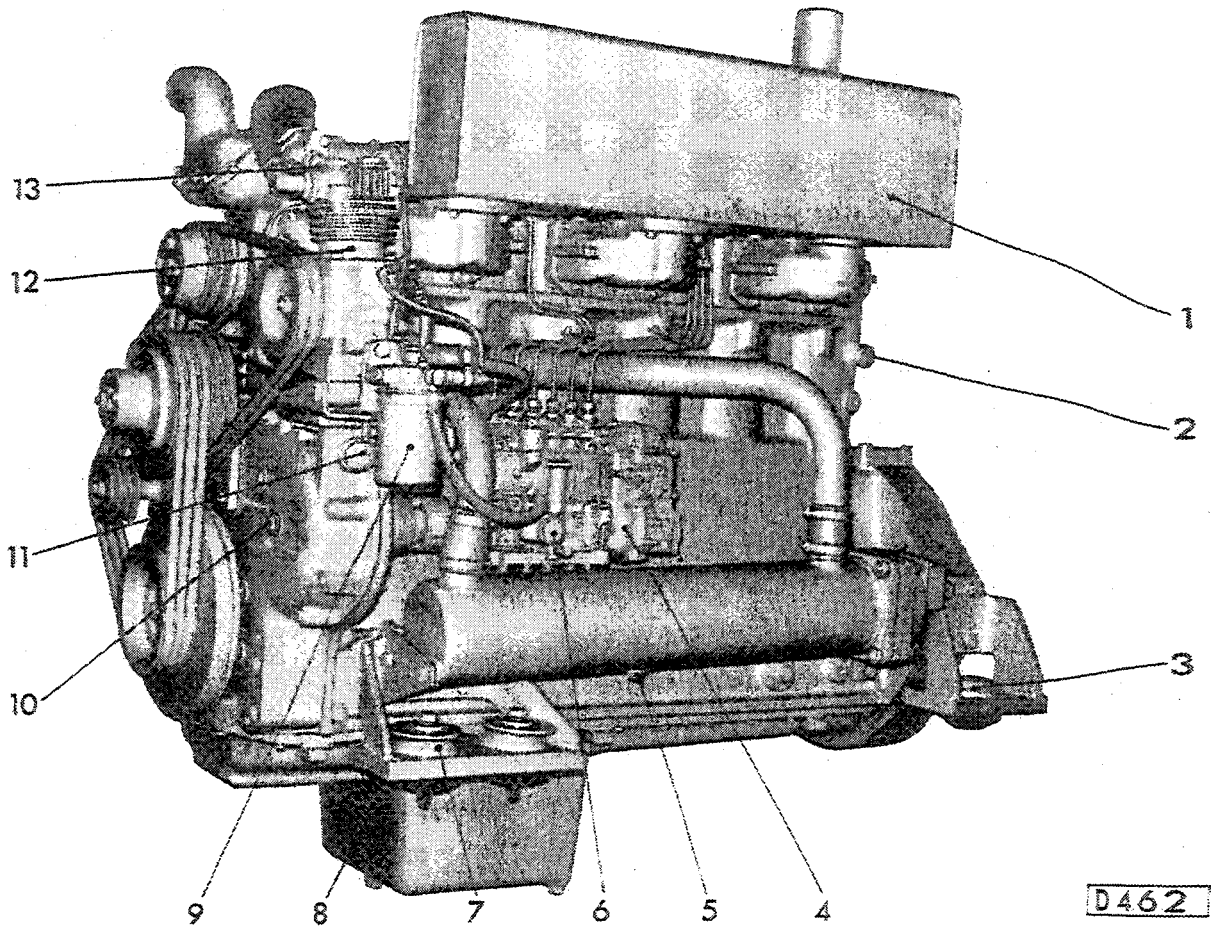
1 Silencer
2 Fuel filter
3 Dip stick for converter transmission
4 Oil filler neck
5 Converter transmission
6 Engine bearer, rear
7 Heat exchanger
8 Injection pump
9 Fuel feed pump
10 Coolant drain plug
11 Engine oil drain plug, rear
12 Injection pump oil filler neck and breather filter
13 Engine oil drain plug front
14 Engine bearer, front
15 Attachment point for angle drive for measuring engine speed
16 Tensioner pulley for water pump V-belts
17 Thermostat
18 Transmitter for coolant temperature gauge

CAMSHAFT SIDE (Fig. B 228)



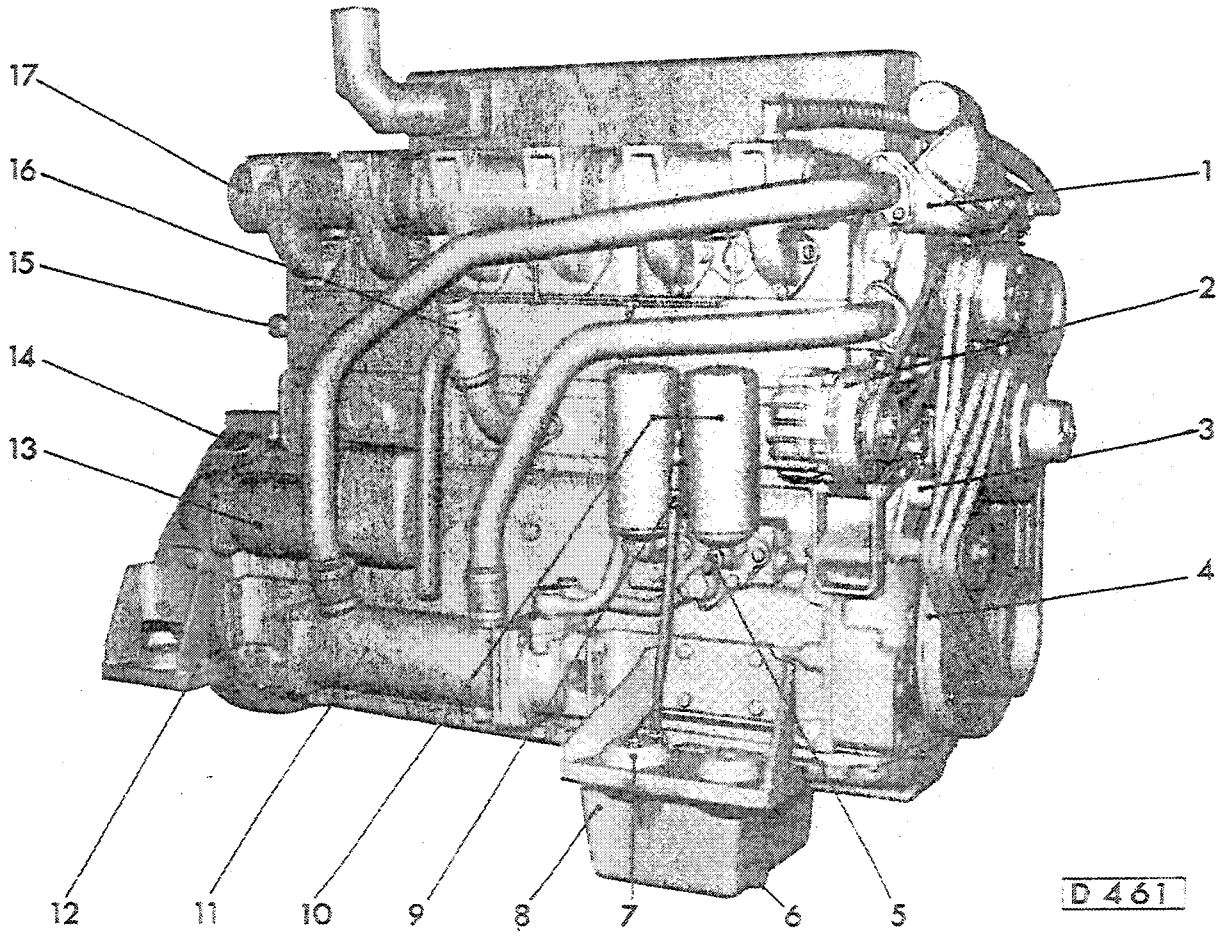
1 Water pump
2 Engine suspending point
3 Fan intermediate drive
4 Alternator
5 Engine bearer, front
6 Oil filter
7 Oil pressure transmitter
8 Oil dip stick
9 Engine number
10 Oil filler neck and breather
11 Starter
12 Engine bearer, rear
13 Access plug for injection timing marks
14 Working hydraulics pump
15 Breather valve for converter
16 Inlet manifold

INJECTION PUMP SIDE (Fig. D 462)



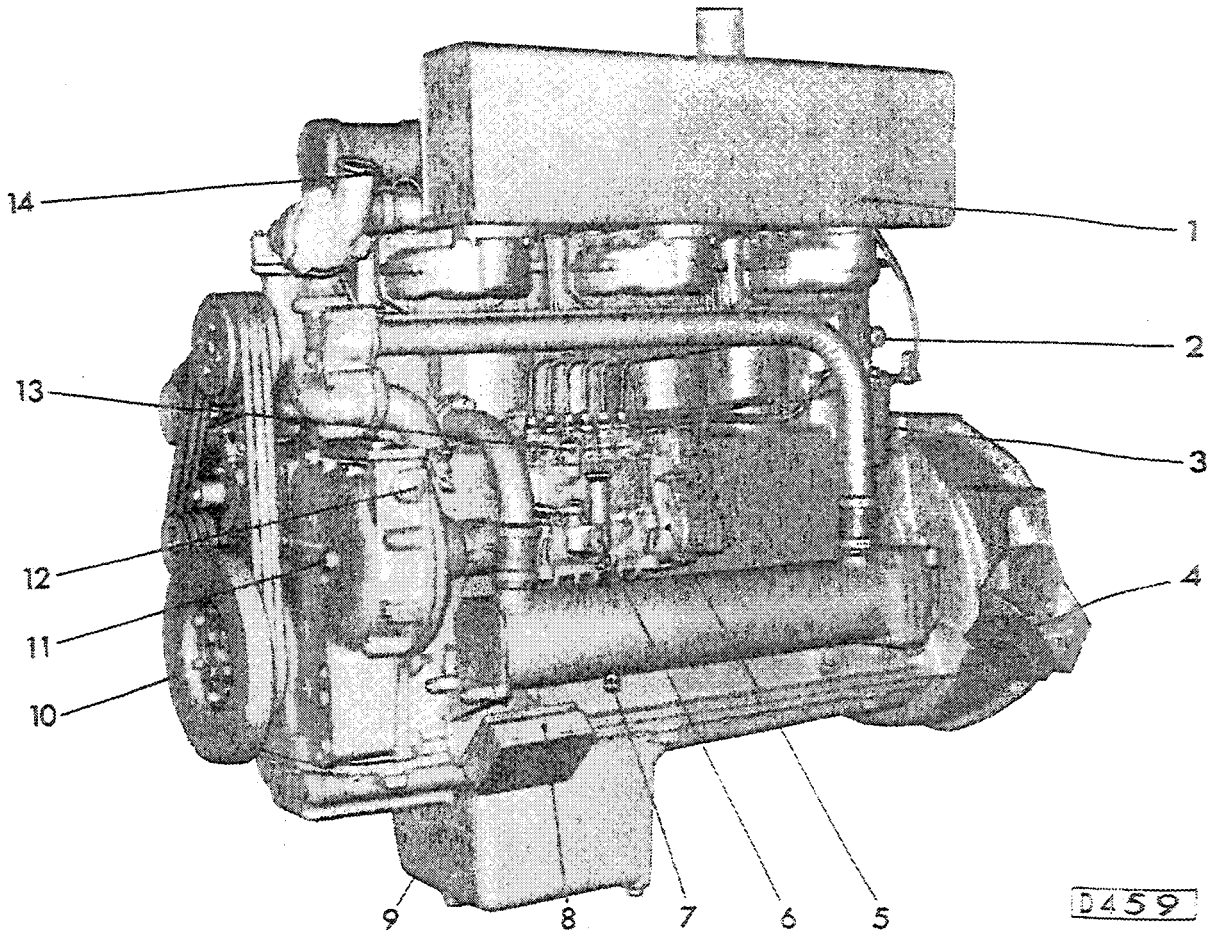
1 Silencer
2 Engine suspending point
3 Engine bearer, rear
4 Injection pump
5 Coolant drain plug
6 Fuel feed pump
7 Engine bearer, front
8 Oil sump
9 Fuel filter
10 Attachment point for angle drive for measuring engine speed
11 Engine suspending point
12 Air compressor
13 Transmitter for coolant temperature gauge

CAMSHAFT SIDE (Fig. D 461)



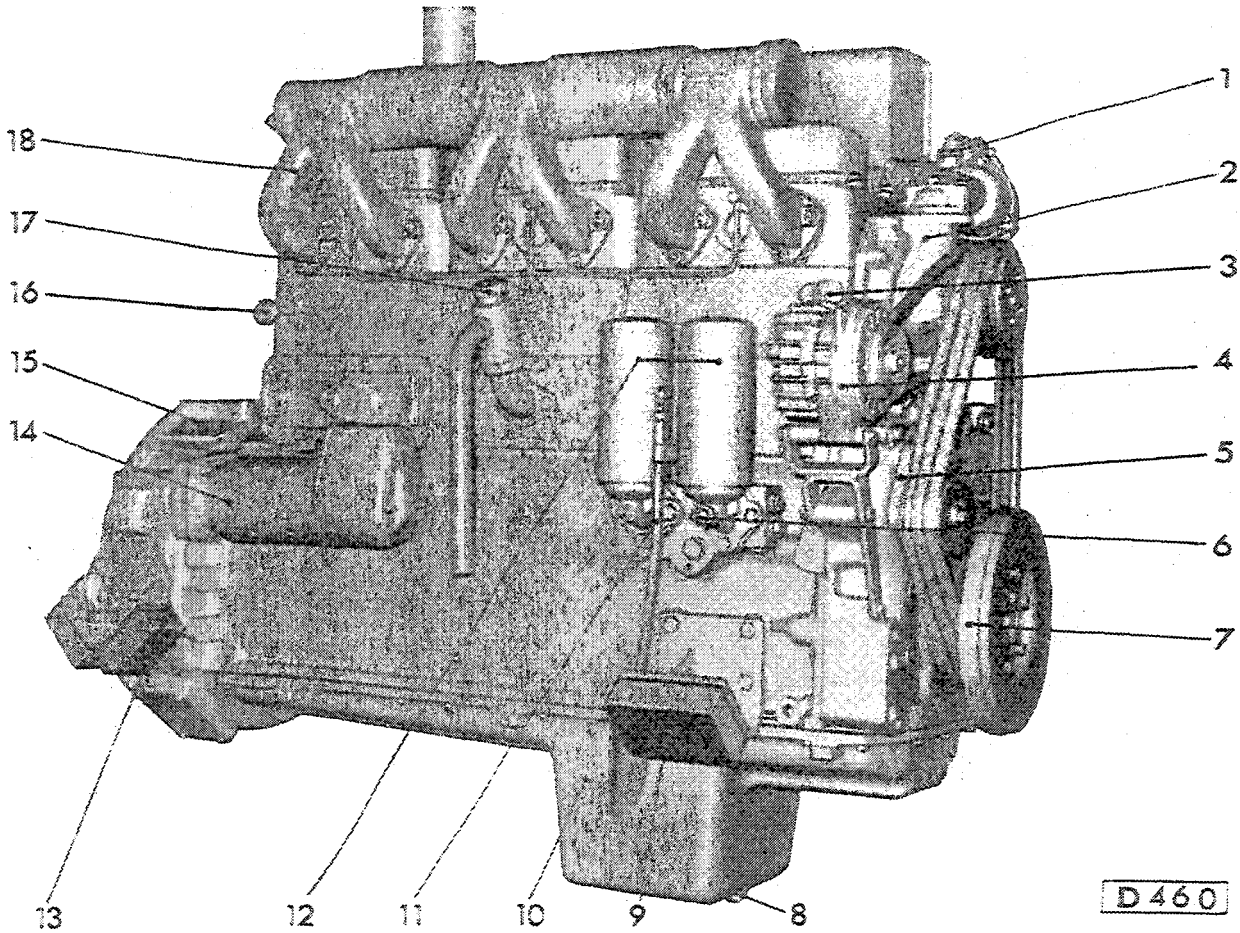
1 Water pump
2 Alternator
3 Tensioner pulley for fan belt
4 Vibration damper
5 Oil pressure transmitter
6 Engine oil drain plug
7 Engine bearer, front
8 Oil sump
9 Oil level dip stick
10 Oil filter
11 Engine oil heat exchanger
12 Engine bearer, rear
13 Starter
14 Access plug for injection timing marks
15 Engine suspending point
16 Breather filter and oil filler neck
17 Inlet manifold

INJECTION PUMP SIDE (Fig. D 459)



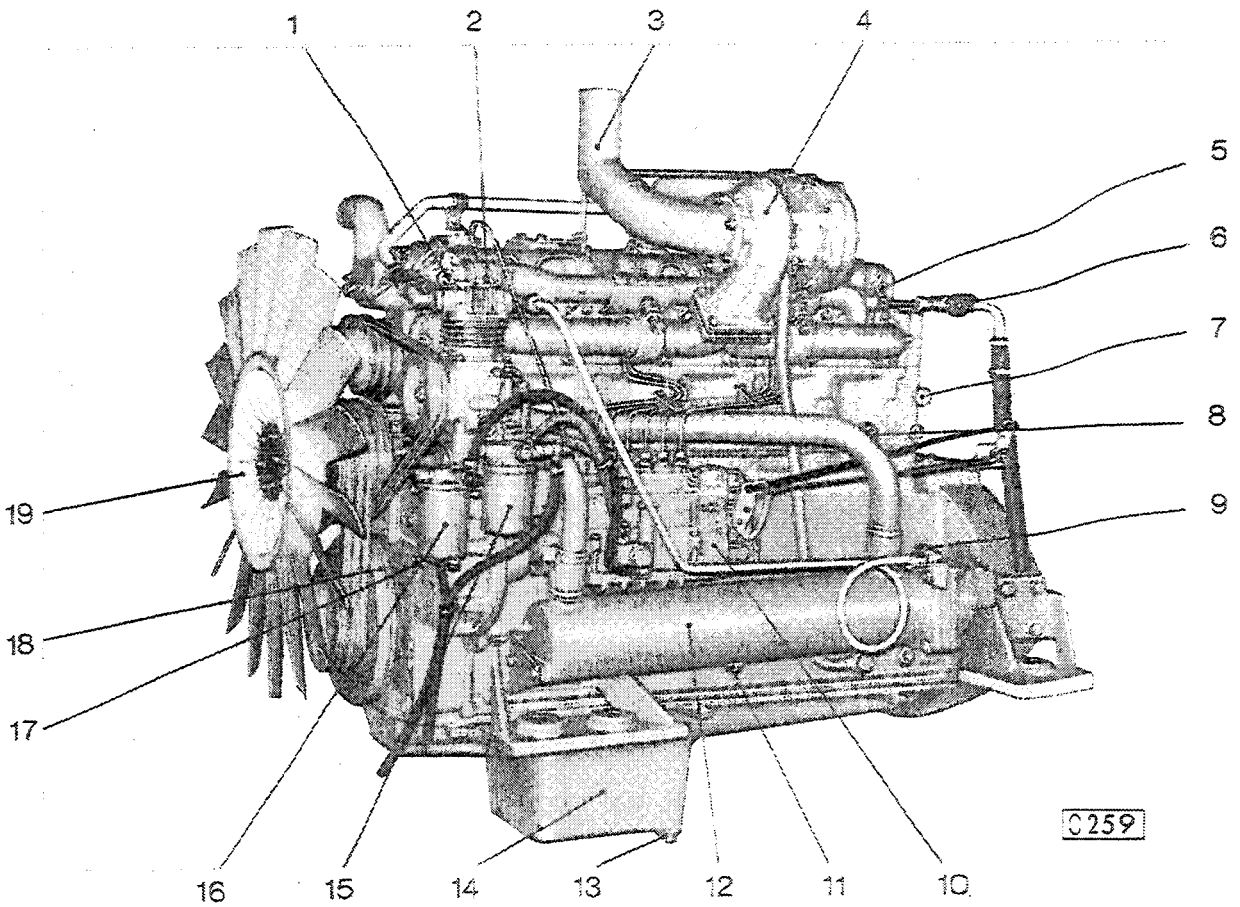
1 Silencer
2 Engine suspending point
3 Fuel filter
4 Engine bearer, rear
5 Injection pump
6 Fuel feed pump
7 Coolant drain plug
8 Engine bearer, front
9 Oil sump
10 Vibration damper
11 Attachment point for angle drive for measuring engine speed
12 Engine suspending point
13 Injection pump oil filler and breather
14 Coolant outlet to radiator

CAMSHAFT SIDE (Fig. D 460)



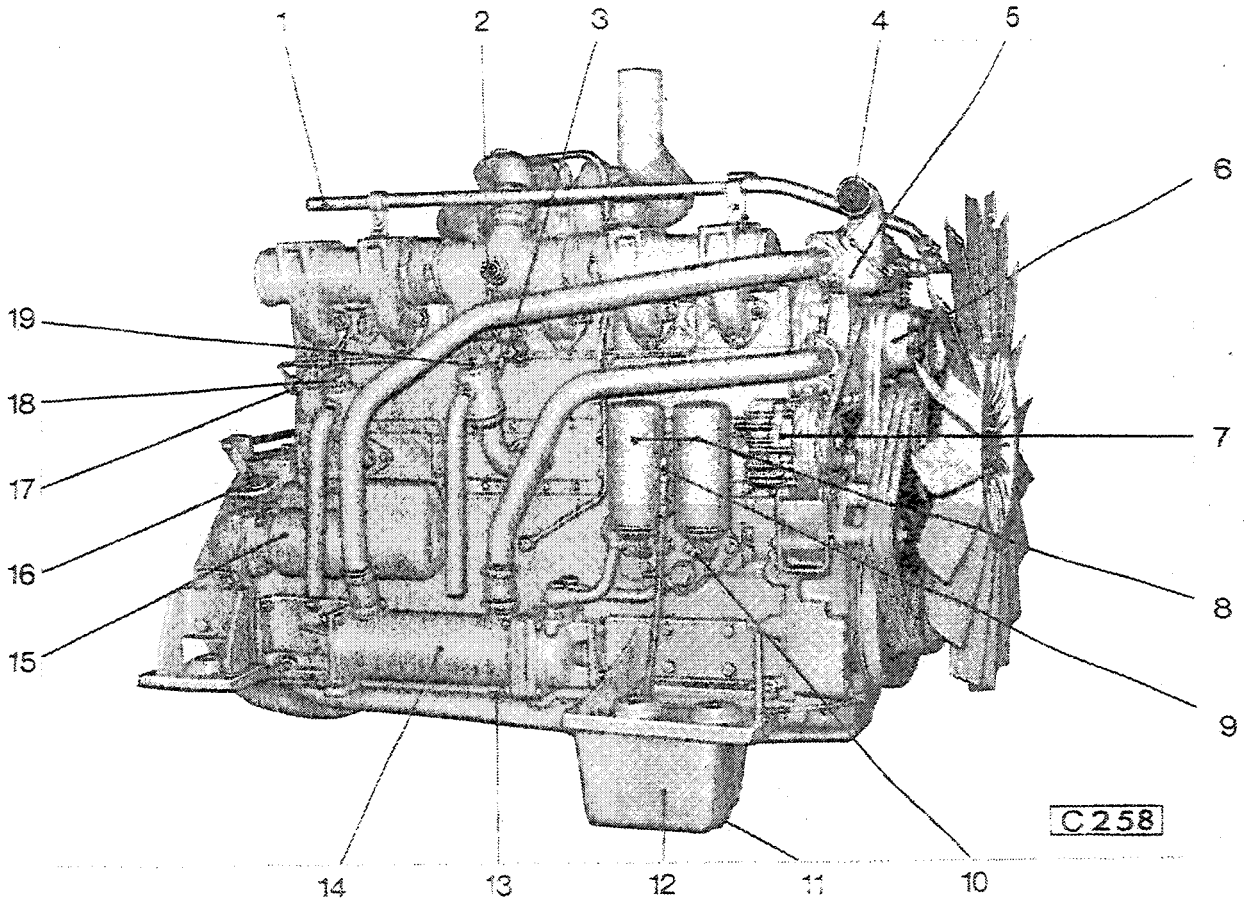
1 Transmitter for coolant temperature gauge
2 Water pump
3 Engine suspending point
4 Alternator
5 Tensioner pulley for water pump and fan belts
6 Oil pressure transmitter
7 Vibration damper
8 Engine oil drain plug
9 Engine bearer, front
10 Oil sump
11 Oil dip stick
12 Oil filter
13 Engine bearer, rear
14 Starter
15 Access plug for injection timing marks
16 Engine suspending point
17 Breather filter and oil filler neck
18 Inlet manifold

INJECTION PUMP SIDE (Fig. C 259)



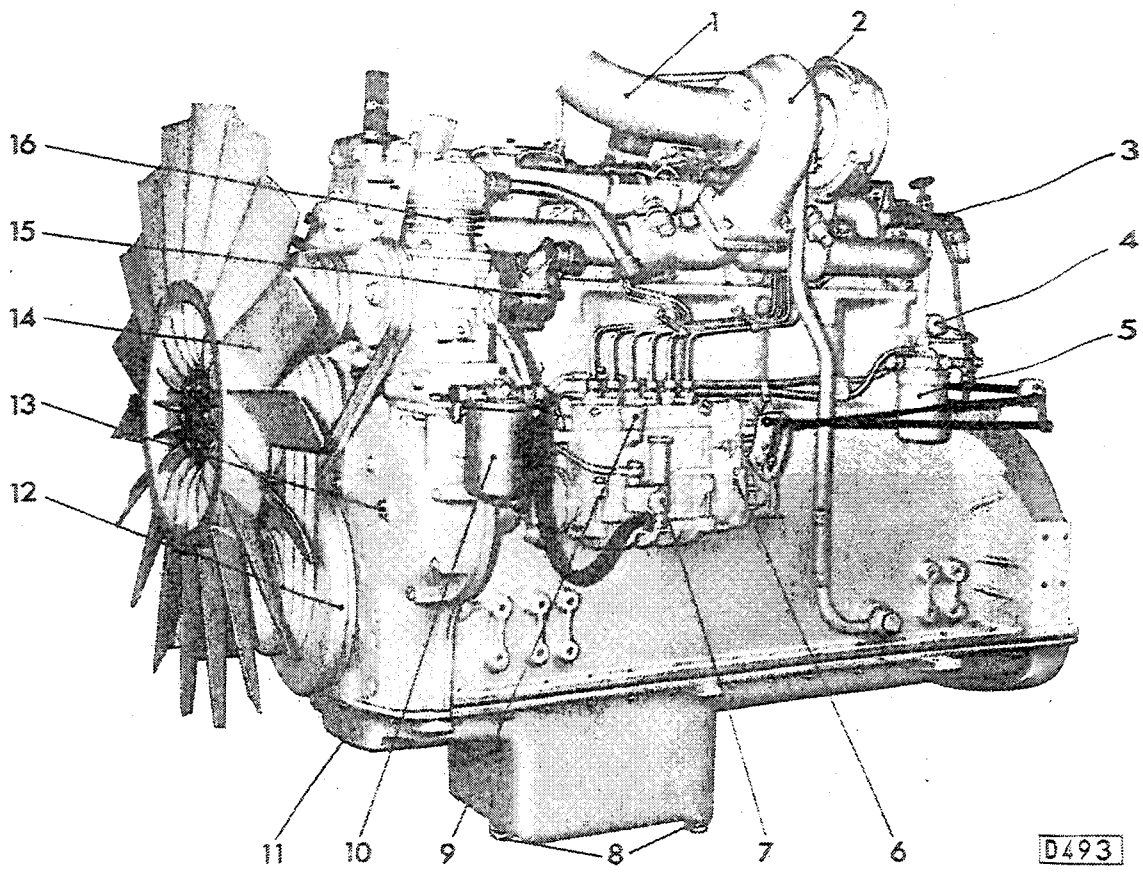
1 Transmitter for coolant temperature gauge
2 Air compressor
3 Exhaust pipe
4 Turbo charger
5 Injector
6 Shut-off valve for heating system
7 Engine suspending point
8 Coolant drain plug
9 Air pipe to pressure regulator (brakes)
10 Injection pump
11 Coolant drain plug
12 Powershift transmission heat exchanger
13 Engine oil drain plug
14 Oil sump
15 Fuel filter
16 Fuel primary filter
17 Attachment point for angle drive for measuring engine speed
18 Vibration damper
19 Fan

CAMSHAFT SIDE (Fig. C 258)



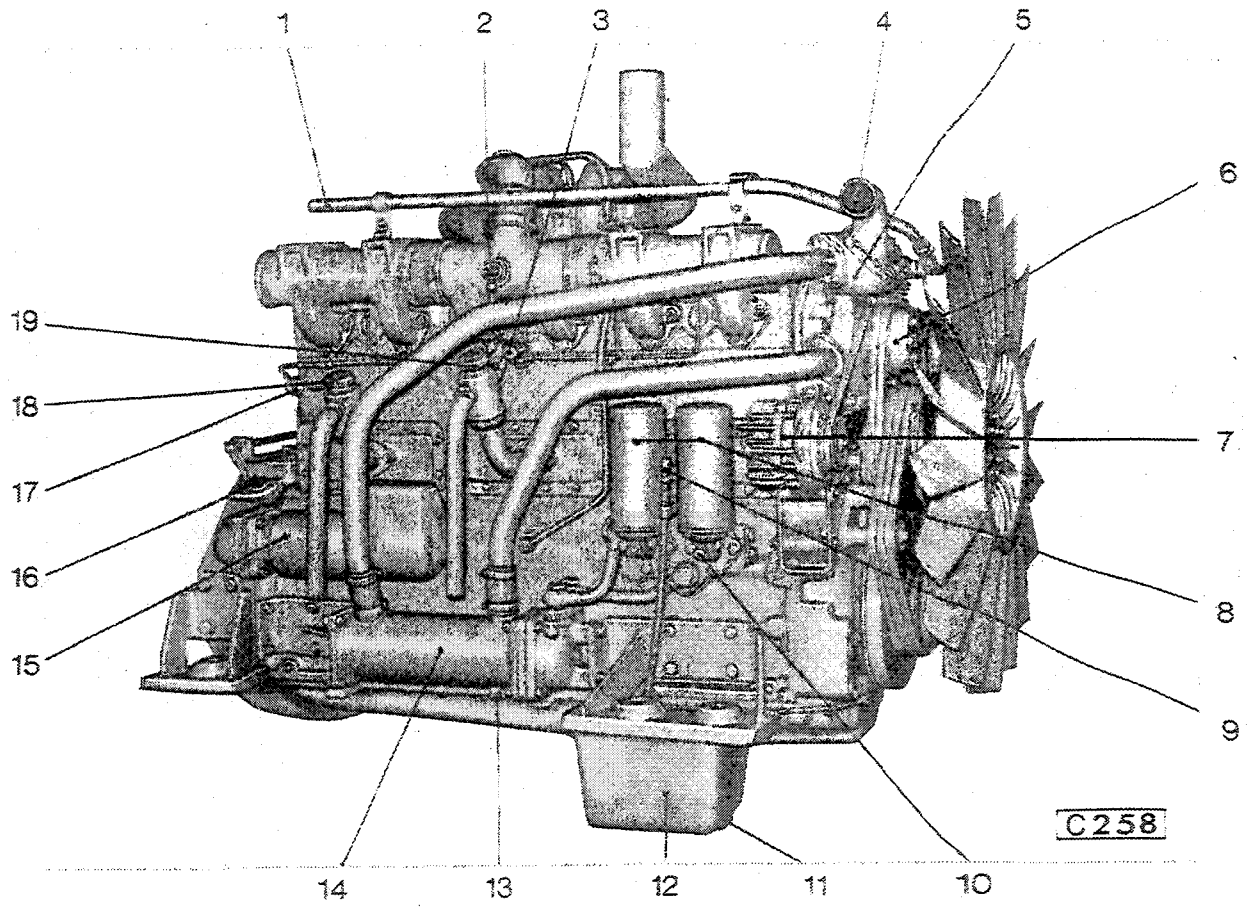
1 Air pipe to air compressor
2 Glow plug
3 Solenoid
4 Coolant outlet to radiator
5 Thermostat housing
6 Water pump
7 Alternator
8 Oil filter
9 Oil level dip stick
10 Oil pressure transmitter
11 Engine oil drain plug
12 Oil sump
13 Coolant drain plug
14 Engine oil heat exchanger
15 Starter
16 Access plug for injection timing marks
17 Engine suspending point
18 Breather filter and oil filler neck
19 Breather filter and oil filler neck

INJECTION PUMP SIDE (Fig. D 493)



1 Exhaust pipe
2 Turbo charger
3 Shut-off valve for heating system
4 Engine suspending point
5 Fuel primary filter
6 Injection pump
7 Fuel feed pump
8 Engine oil drain plug
9 Injection pump oil filler neck and breather filter
10 Fuel filter
11 Oil sump
12 Vibration damper
13 Attachment point for angle drive for measuring engine speed
14 Fan
15 Servo pump
16 Air compressor

CAMSHAFT SIDE (Fig. C 258)



1 Air pipe to air compressor
2 Glow plug
3 Solenoid
4 Coolant outlet to radiator
5 Thermostat housing
6 Water pump
7 Alternator
8 Oil filter
9 Oil level dip stick
10 Oil pressure transmitter
11 Engine oil drain plug
12 Oil sump
13 Coolant drain plug
14 Engine oil heat exchanger
15 Starter
16 Access plug for injection timing marks
17 Engine suspending point
18 Breather filter and oil filler neck
19 Breather filter and oil filler neck

ENGINE, general

Turbo-supercharger, fault diagnosis

Although troubles on the engine may at first seem to be due to a faulty turbo-supercharger, it is advisable to study the engine fault diagnosis chart, especially in respect of the fuel injection system, before referring to the fault diagnosis chart set out below.

Fault	Possible Cause	Remedy
Abnormal density of exhaust gas and power loss	As a rule caused by lack of air if charging pressure is too low.	
	Dirt in air filter system, deformations at suction piping (too high vacuum in front of compressor, possibility of oil leakages on the compressor side.	Clean air filter and/or replace filter insert. Check suction pipe.
	Silencer or exhaust gas piping behind the charger contaminated or damaged (pressure behind the charger too high).	Clean and/or repair parts.
Unusual density of exhaust gas, power loss, but accompanied by abnormal noises	Leakages at joints and flanges of air and exhaust gas pipings	Check joints and flange connections, possibly replace seals.
	Rotor contacting housing	Remove piping on turbine and compressor sides and inspect housings for scoring. If necessary, check bearing clearances as specified.
Rotor contacting housing	As a rule, too large bearing clearance, caused by temporary interruption of oil supply, too low oil pressure, foreign matter or remnants in oil pipings and channels, defective or clogged oil filter system, poor oil quality due to too long intervals between oil changes, leakages at pressure oil piping to the charger, extreme rapid-start with very cold engine (avoid fast loading after start)	Replace charger. To avoid more damage until the charger can be replaced, run engine on part load only. Observe exhaust gas density.

Prior to mounting the turbo-charger, check the suction piping in front of the compressor, the exhaust gas piping from the engine to the turbine and the oil piping to the charger very thoroughly for foreign matter or other types of contamination, thus avoiding untimely damages to the charger. Before connecting the oil feed piping, top up the bearing housing with clean oil.

ENGINE, complete

Fault Finding Chart

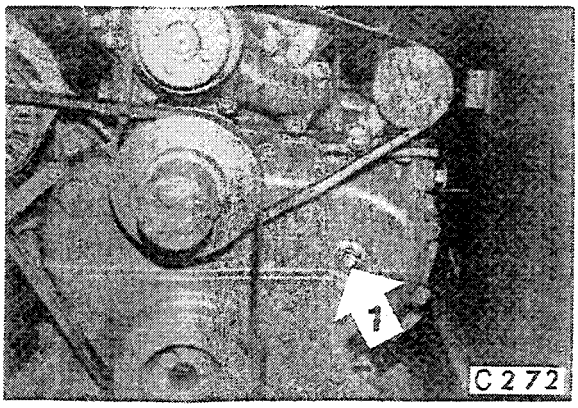
Fault	Possible Cause
Low cranking speed	1, 2, 3, 4
Will not start	5, 6, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22, 31, 32, 33, 60, 61, 62, 63, 64, 65
Difficult starting	5, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 22, 29, 31, 32, 33, 61, 62, 63, 64, 65
Lack of power	8, 9, 10, 11, 12, 13, 14, 18, 19, 20, 21, 22, 23, 25, 26, 27, 31, 32, 33, 61, 62, 63, 64, 66, 67, 68
Misfiring	8, 9, 10, 12, 13, 14, 18, 19, 20, 25, 26, 28, 29, 30, 32
Excessive fuel consumption	11, 13, 14, 18, 19, 20, 22, 23, 25, 27, 28, 29, 31, 32, 33
Black exhaust	11, 13, 14, 18, 19, 20, 22, 25, 27, 28, 29, 31, 32, 33, 66, 67, 68
Blue/white exhaust	4, 16, 18, 19, 20, 25, 27, 31, 33, 34, 45
Low oil pressure	36, 37, 38, 39, 40, 42, 43, 44, 58, 70
Knocking	9, 14, 18, 19, 22, 26, 28, 29, 31, 33, 36, 45, 46, 59
Erratic running	8, 9, 10, 11, 12, 13, 14, 20, 21, 23, 26, 28, 29, 30, 33, 45, 59
Vibration	13, 14, 20, 23, 25, 26, 29, 30, 33, 45, 47, 48, 49
High oil pressure	4, 38, 41
Overheating	11, 13, 14, 18, 19, 24, 25, 45, 50, 51, 52, 53, 54, 57, 69
Excessive crankcase pressure	25, 31, 33, 34, 45, 55
Poor compression	11, 19, 25, 28, 29, 31, 32, 33, 34, 46, 59
Starts and stops	10, 11, 12, 60

ENGINE

Fault Finding Chart

Key to fault finding chart

1 Battery capacity low
2 Bad electrical connections
3 Faulty starter motor
4 Incorrect grade of lubricating oil
5 Low cranking speed
6 Fuel tank empty
8 Blocked fuel feed pipe
9 Faulty fuel lift pump
10 Choked fuel filter
11 Restriction in air cleaner
12 Air in fuel system
13 Faulty fuel injection pump
14 Faulty injectors or incorrect type
15 Incorrect use of the cold start equipment on the D 963 A 1/A 2 engine
16 Heating element of the cold start equipment on the D 963 A 1/A 2 engine faulty
17 Broken fuel injection pump drive
18 Incorrect fuel pump timing
19 Incorrect valve timing
20 Poor compression
21 Blocked fuel tank vent
22 Incorrect type or grade of fuel
23 Sticking throttle or restricted movement
24 Exhaust pipe restriction
25 Cylinder head gasket leaking
26 Overheating
27 Cold running
28 Incorrect tappet adjustment
29 Sticking valves
30 Incorrect high pressure pipes
31 Worn cylinder bores
32 Pitted valves and seats
33 Broken, worn or sticking piston ring/s.
34 Worn valve stems and guides
36 Worn or damaged bearings
37 Insufficient oil in sump
38 Inaccurate oil pressure gauge
39 Inaccurate oil gauge transmitter
40 Pressure relief valve sticking open
41 Pressure relief valve sticking closed
42 Broken relief valve spring
43 Faulty oil suction pipe
44 Choked oil filter
45 Piston seizure/pick up
46 Incorrect piston height
47 Damaged fan
48 Faulty engine mounting
49 Incorrectly aligned flywheel housing or flywheel
50 Faulty thermostat
51 Restriction in water jacket
52 Loose fan belt
53 Choked radiator
54 Faulty water pump
55 Choked breather pipe/filter
57 Coolant level too low
58 Blocked sump strainer
59 Broken valve spring
60 Fuel shut-off cock closed
61 Primary fuel filter choked
62 Primary fuel filter leaking
63 Fuel lift pump gauze choked
64 Fuel overflow valve faulty
65 Cold start equipment solenoid on the D 963 A 1/A 2 engine faulty
66 Exhaust pipe from engine to turbocharger leaking
67 Suction pipe from turbocharger to engine leaking
68 Turbocharger faulty
69 Cooling fan reversed
70 Worn oil pumps



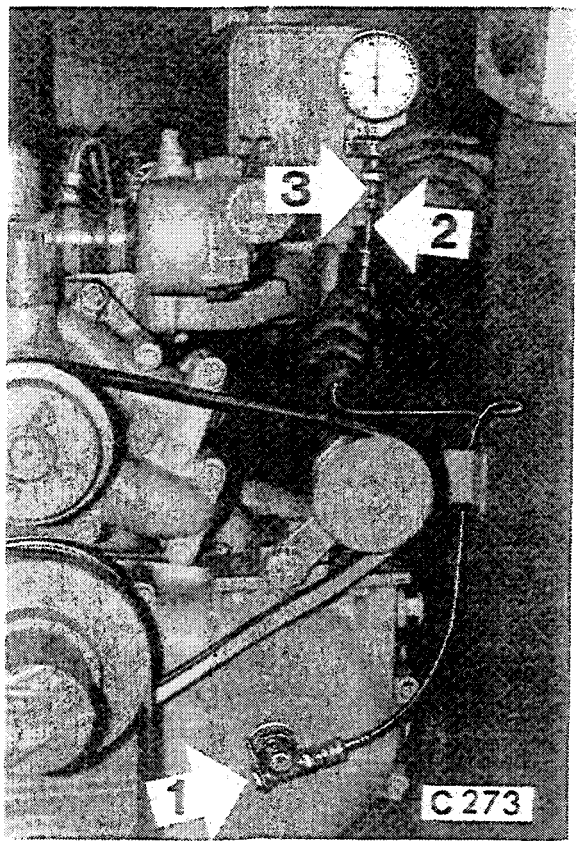
ENGINE, general

Engine speed, testing and adjusting

Tools:

Angle drive with flexible drive shaft	Wilbär 5159
Tachometer	Wilbär 2386
Sealing pliers	

Warm up engine (approx. 85° C) (185° F).



1. Using a straight ring spanner unscrew and remove the plug. (1, Fig. C 272)

2. Connect up the angle drive with flexible drive shaft. (1, Fig. C 273)

3. On the other end of the flexible drive shaft, connect the contact piece (2, Fig. C 273) with the appropriate counter part (3, Fig. C 273) in the tachometer.

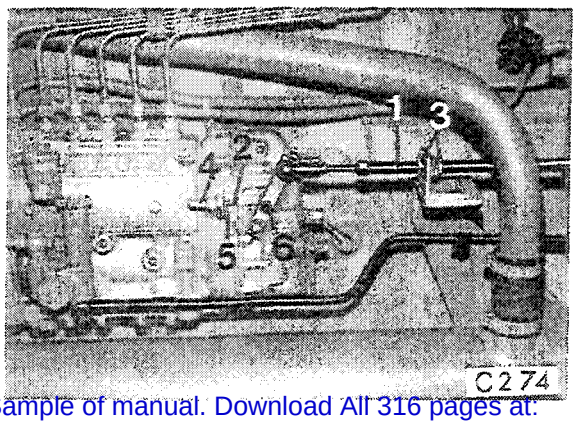
4. With the engine stopped, push the accelerator control rod towards maximum speed position and check to ensure that the governor lever (6, Fig. C 274) abuts the adjusting screw. (2, Fig. C 274)

If necessary adjust.

5. Reposition the accelerator control rod to idling position.

6. Start the engine and check engine speed.

For upper and lower speed figures see "Technical Data".



Adjusting on D 962 K and D 963 K engines (Fig. C 274):

Lower idling speed:
Loosen the lock nut (3), adjust the control rod (1) until the correct idling speed is reached. Tighten the lock nut (3).