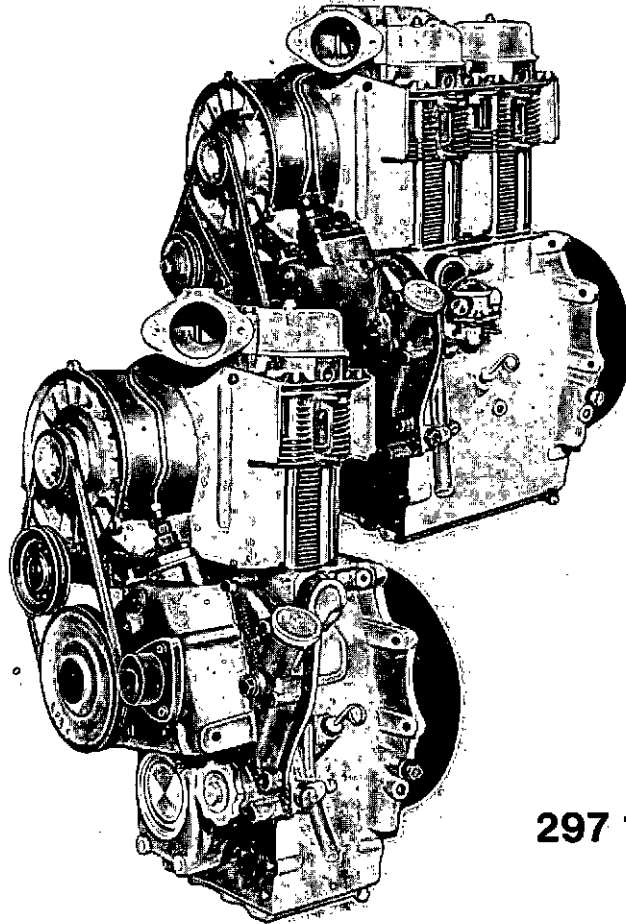


INSTRUCTION MANUAL



F1/2L411 D
F1/2L411 W



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CONTENTS

	Page
Description of Engine	2
Lube Oil Circuit	3
Fuel System-	4
Specification Data	6
Engine Operation	7
Fuel	7
Motor Oil	7
Air-venting the Fuel System	8
Starting (Electrically)	9
Starting (by Hand)	10
Starting (Electrically)	11
Stopping	12
Hints for Winter Operation	12
Maintenance Schedule	14
Notes on Maintenance Schedule	18
Workshop Maintenance	25
Trouble Chart	28
Information for the Specialist	
Tightening Screwed Joints	30
Preserving the Engine	32
Installing the Engine	32
Summary Instructions	Back Cover

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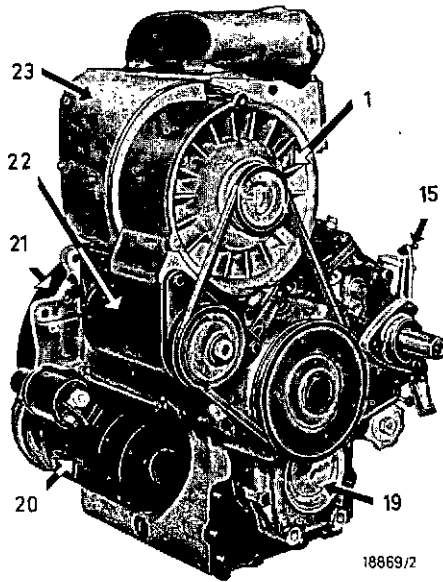


Fig. 1

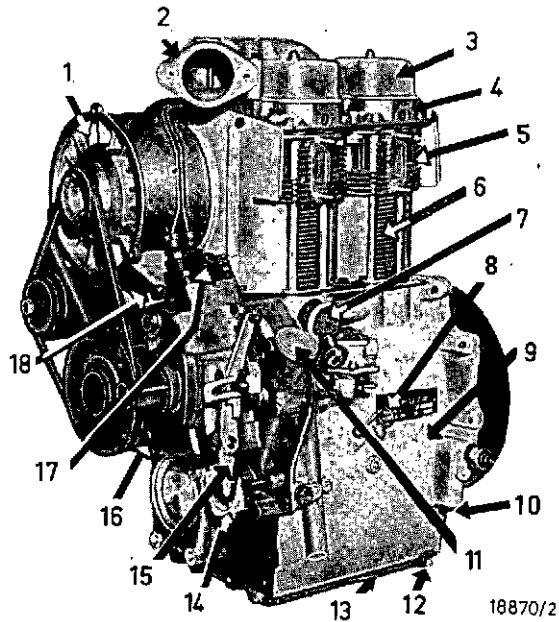


Fig. 2

Description of Engine

- | | | | |
|----|--|----|----------------------------------|
| 1 | Cooling air blower | 12 | Oil drain plug |
| 2 | Air intake manifold | 13 | Bottom cover |
| 3 | Rocker chamber cover | 14 | Full-flow lube oil filter |
| 4 | Screw-on rocker chamber | 15 | Speed control and shut-off lever |
| 5 | Cylinder head (light-alloy) | 16 | Front cover plate (light-alloy) |
| 6 | Finned cylinder liner (special-type cast iron) | 17 | Injection pump |
| 7 | Crankcase breather | 18 | Starting fuel allowance button |
| 8 | Oil dipstick | 19 | Mounting place for hydr. pump |
| 9 | Crankcase (cast iron) | 20 | Starter motor |
| 10 | Oil pressure control valve | 21 | Flywheel |
| 11 | Oil filler neck | 22 | Generator |
| | | 23 | Air cowling |

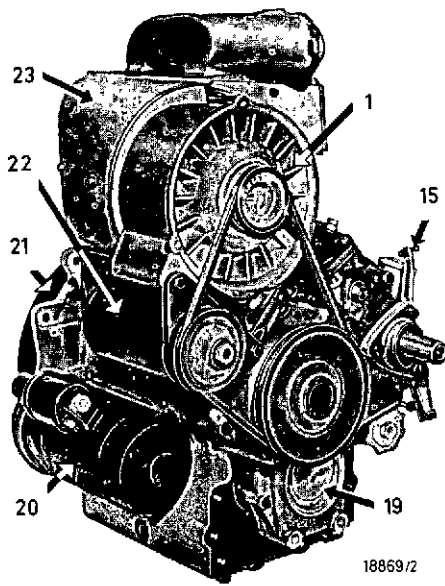


Fig. 1

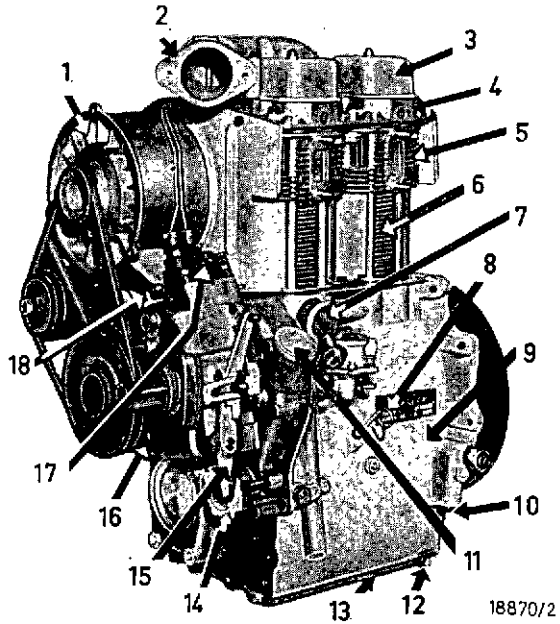


Fig. 2

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- | | | | |
|----|--|----|----------------------------------|
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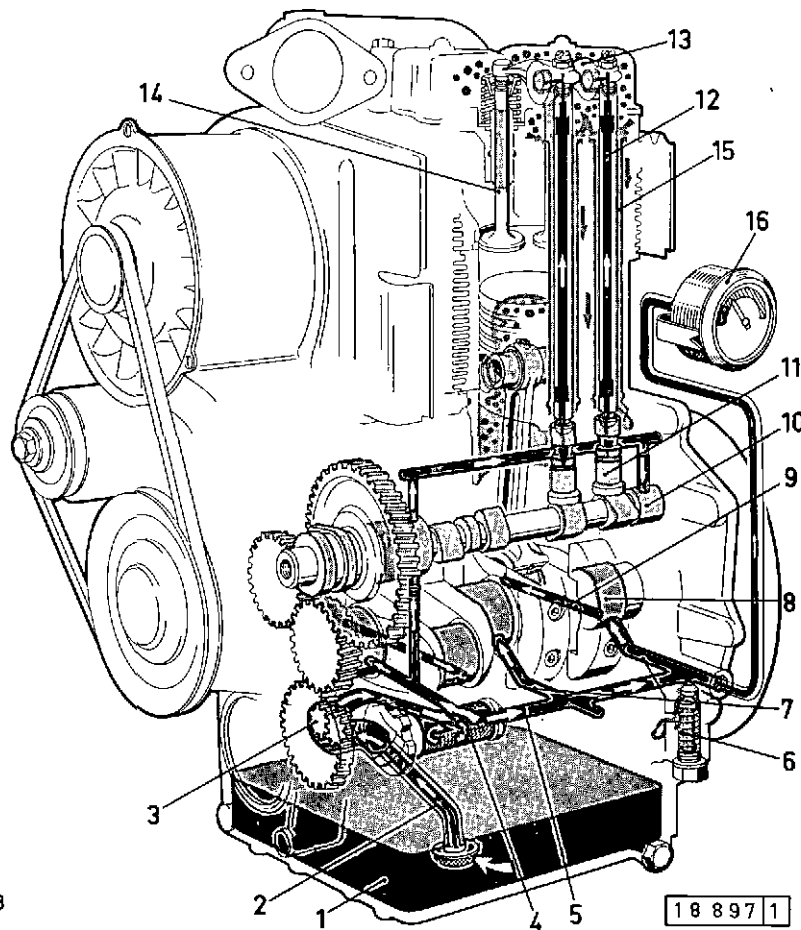


Fig. 3

Lube Oil Circuit

- | | |
|-----------------------------------|--|
| 1 Oil sump | 11 Tappet with oil groove for impulse lubrication of rocker arms |
| 2 Suction pipe | 12 Pushrod (hollow, for supplying oil to the rocker arms) |
| 3 Gear-type pump | 13 Rocker arms |
| 4 Filter fitted with safety valve | 14 Valve |
| 5 Main gallery | 15 Cover tube (returning oil from cylinder head to the sump) |
| 6 Oil pressure control valve | 16 Oil pressure gauge |
| 7 Oil passages to crankshaft | |
| 8 Main bearing | |
| 9 Oil passage to big-end bearing | |
| 10 Camshaft bearing | |

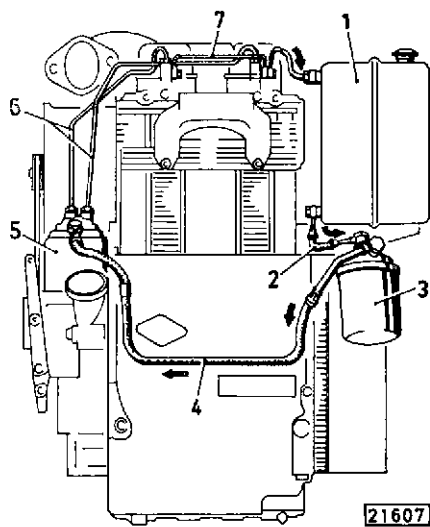


Fig. 4

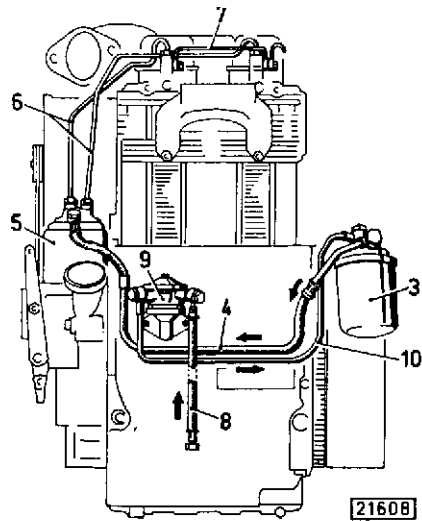


Fig. 5

Fuel System

Fig. 4 Without fuel lift pump (in case of high-level fuel tank only).

Fig. 5 With fuel lift pump (in case of low-level fuel tank).

- | | |
|--------------------------------------|---|
| 1 Fuel tank | 6 Injection lines |
| 2 Pipe from fuel tank to filter | 7 Leakage pipe |
| 3 Fuel filter | 8 Pipe from fuel tank to fuel lift pump |
| 4 Pipe from filter to injection pump | 9 Fuel lift pump |
| 5 Injection pump | 10 Pipe from lift pump to filter |

Note

This Instruction Manual applies both to engines F1L and F2L 411 D (with direct injection) and engines F1L and F2L 411 W (with two-stage combustion system).

The difference of the two systems and their operation is dealt with in the sections "Specification Data", "Starting" and "Operation in Winter".

Engines provided with direct injection are destined for such applications where high power output combined with little space requirement is of more importance than best exhaust gas quality.

Two-stage combustion engines, on the other hand, are to be recommended where power output may be somewhat less but where the least possible nuisance by exhaust gases is of great importance.

Specification Data

Model	F1L 411 D	F2L 411 D	F1L 411 W	F2L 411 W
Number of cylinders	1	2	1	2
Bore	92	92	92	92
Stroke	105	105	105	105
Displacement	698	1395	698	1395
Direction of rotation (facing flywheel)	counter-clockwise			
Working principle	Four-stroke diesel with direct injection		Four-stroke diesel with two-stage combustion system	
Weight (varying with equipment), approx.	118	156	118	156
Power output	*	*	*	*
Speed	*	*	*	*
Lubrication system	Forced circulation			
Oil capacity, approx.	2.4	3.5	2.4	3.5
Valve clearance with engine cold	Inlet valve		mm 0.15	
	exhaust valve		mm 0.15	
Decompression clearance (of hand-started engine)	mm 2			
Inlet valve opens			38° bef. TDC	
Inlet valve closes	valve clearance		56.5° aft. BDC	
Exh. valve opens	being 0.15 mm		73.5° bef. BDC	
Exh. valve closes			36° aft. TDC	
	411 D		411 W	
Piston crown clearance	0.8-1.0		0.9-1.1	
Injection release pressure	175 ± 8		125	
Commencement of injection	(w/o pressing the starting allowance fuel button)			
from 1500 to 2200 rev/min	CA bef. TDC 22.5° ± 1°		21° ± 1°	
from 2201 to 3000 rev/min	CA bef. TDC 25° ± 1°		21° ± 1°	
Firing order of 2-cylinder engine	2-1			

The TDC mark on the V-belt pulley of the 2-cylinder engine refers to No. 2 cylinder.

In view of our constant improvements of engine design the above specification data and other information included in this booklet are not binding and subject to change without notice. They do not entitle to any claims.

Tachometer

If a mechanical tachometer with hourmeter is provided, it should be noted that for correct determination of operating hours, the hours indicated must be multiplied by the factor given in the table below:

Engine speed	Faktor	Engine speed	Faktor
1000	× 1.5	2300	× 0.65
1200	× 1.25	2800	× 0.55
1500	× 1.0	3000	× 0.5
1800	× 0.85	3200	× 0.45

* Depends on engine application (see rating plate)

Example:

Hours indicated	Factor at 1000 rev/min	Actual operating hours
10	× 1.5	= 15

Engine Operation

Before a new engine can be taken into operation for the first time, a number of preparatory jobs must be carried out which are described below. However, some of these jobs must again be carried out in the course of routine maintenance. In this context please refer to the Maintenance Schedule on page 14.

First fill up with fuel and oil, as follows:

1. Fuel

Always use a reputable standard grade of diesel fuel (gas oil) the sulphur content of which should be less than 0.5 per cent; pay attention to cleanliness when filling up. At low ambient temperatures use winter-grade diesel fuel only (see hints on p. 12). Replenish the fuel supply in good time so that the fuel tank never runs dry, otherwise the fuel filters and injection lines will have to be air-vented. The relevant instructions will be found on page 8. As there is no fuel in the engine when it leaves the works, air-venting is essential before the engine is started up for the first time.

2. Oil Change and Checking Oil Level (see page 18, B 1)

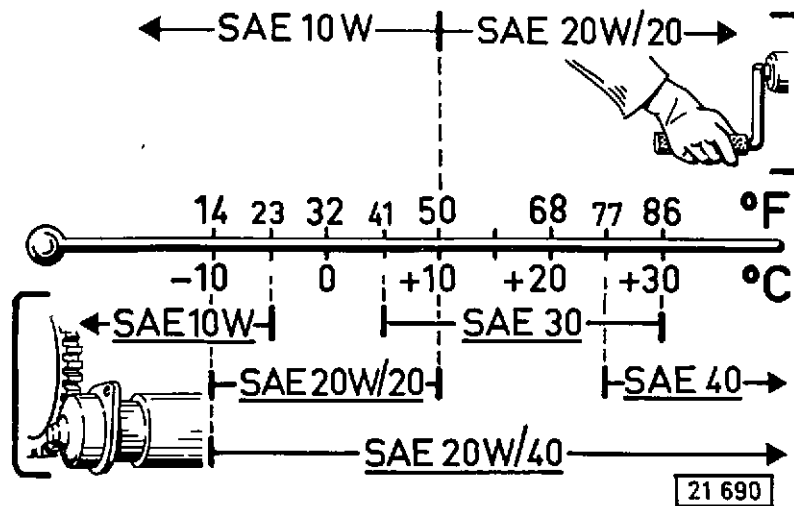
2.1 Oil Quality

During operation of the engine not only part of the oil lubricating the pistons is burnt ("consumed"), but the thermal stress and the combustion residues mixing with the oil also entail a degradation of the oil and in particular of its chemical additives. Therefore, a complete change of the oil has to be carried out at the recommended intervals.

As this "degradation" is greatly influenced by the operating conditions as well as by the quality of the fuel and that of the oil ("lubricity"), the oil change intervals differ accordingly. Therefore, the oil grades and oil change periods as specified on page 20 must strictly be observed.

2.2 Oil Viscosity

The viscosity of the oil being greatly influenced by the temperature, the choice of the viscosity grade (SAE-grade) should be governed by the ambient temperature at engine site. (See diagram).



A too viscous oil causing starting difficulties, the choice of the viscosity grade during winter operation should be governed by the ambient temperature prevailing at the time

of starting the engine. Oil changes as a function of temperatures can be avoided by using multi-grade oils which, however, should at least satisfy the requirements of high-quality HD-B oils, in conformity with MIL-L-46152 specification. Multi-grade oils, too, are subject to the oil change intervals recommended on page 20.

The required initial filling capacities are given under "Specification Data" on page 6.

3. Oil Bath Air Cleaner

The air cleaner must be filled with oil before starting up (see B 2, page 18). To do this, fill in the same grade of motor oil as that used for the engine. Be sure not to fill dust trap 7 of precleaner 6, if fitted, with oil as it is exclusively meant for collecting dust.

Air-venting the Fuel System

Never run the fuel tank dry. Any air in the fuel system, whether in the fuel filter or piping, will create a fuel vacuum. Air in the fuel system will obstruct the flow of fuel to the injection pump with the result that the engine will start with difficulty or not at all. Even after exchanging of fuel filters or disconnecting of fuel pipes, the fuel system must be air-vented.

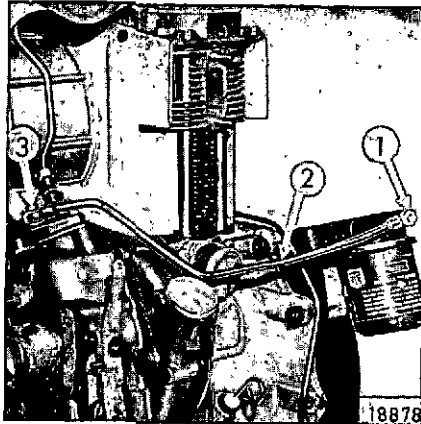


Fig. 6

On engines **not** using a fuel lift pump (Fig. 6), banjo bolt 1 at the fuel filter bracket must be slackened by two or three turns until fuel emerges free of bubbles. Venting of fuel pipe 2 leading to the injection pump is made by slightly slackening banjo bolt 3. The injection pump is vented by releasing the slotted hex. bolt 3.

On engines **using** a fuel lift pump, proceed as follows: Actuate prime lever 1 (Fig. 7) with your thumb against the spring pressure until fuel emerges free of bubbles at the released slotted hex. bolt 3.

If fuel injection line 2 (Fig. 7) had been disconnected, it must also be air-vented. To do this actuate starter or starting handle until bubble-free fuel emerges at the previously slackened union nut 1 (Fig. 8).

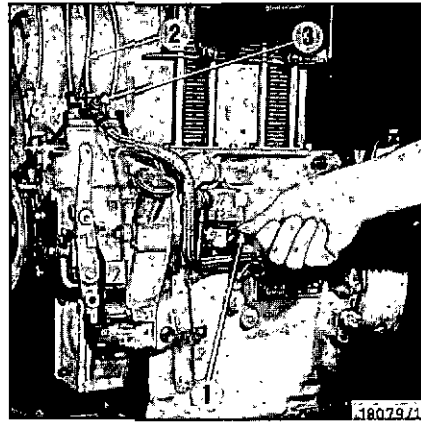


Fig. 7

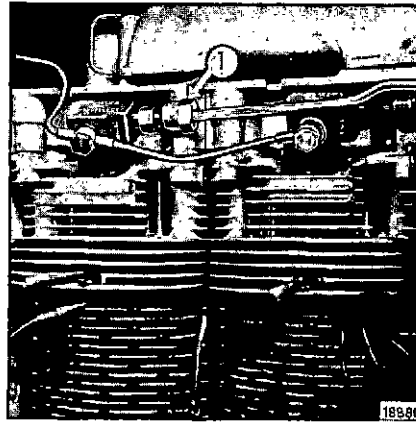


Fig. 8

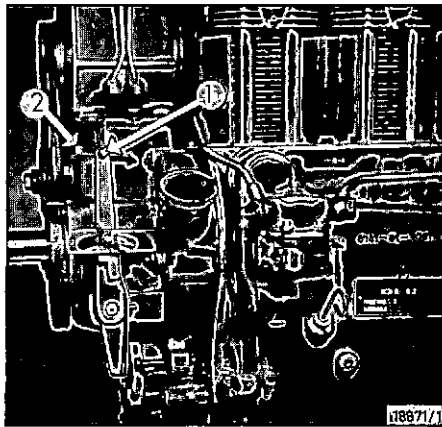


Fig. 9

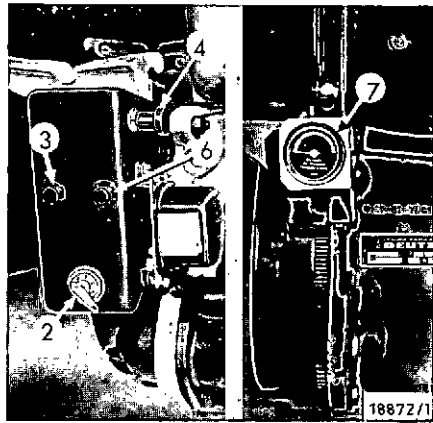


Fig. 10

Starting (electrically)

F1L and F2L 411 D (direct injection)

1. Disengage clutch to disconnect engine from driven equipment.
2. Set speed control lever 1 (Fig. 9) by hand or foot to about $\frac{1}{2}$ load in the direction of the arrow and press starting fuel allowance button 2 once.
3. Push in the switch box key 2 (Fig. 10), which should make the red charging indicator lamp 3 light up.
4. For starting, pull heater plug/starter switch 4 to the full extent. As soon as the engine starts firing, release starter switch. Starter motor should not be kept running for more than 10 seconds at a time. You will prolong the life of your battery if you wait about one minute between two starting attempts.

Do not operate the starter again as long as the crankshaft is still revolving.

For starting at low temperatures, see our instructions on page 13.

5. Cut back the speed as soon as the engine starts running smoothly. The charging indicator lamp 3 will have gone out. With moderate load and with varying speed the engine will soon be up to its normal operating temperature.

The warming up of engines driving generating sets should be done at the preset rated speed.

6. An oil pressure indicator lamp 6 (Fig. 10) or an oil pressure gauge can be supplied as an extra. During operation, the pointer of the oil pressure gauge must be in the green field. If it drops to red*, or if the green oil pressure indicator lamp lights up, the engine must be shut down immediately. Trace the cause of the low oil pressure with the aid of the Trouble Chart and remedy.

* Temporary "red" indication is permissible at low idling, provided it rises to "green" again as the speed is increased.

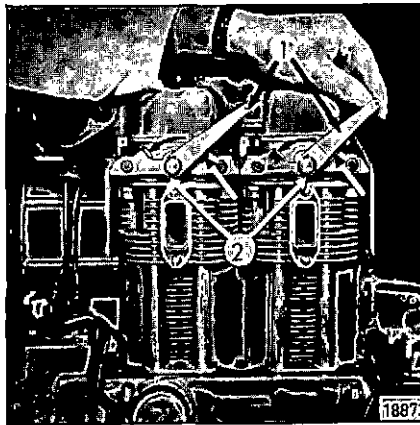


Fig. 11

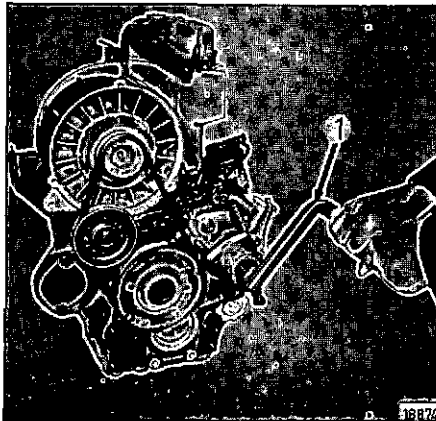


Fig. 12

Starting (by Hand)

F1L and F2L 411 D (direct injection)

Starting by hand is no more possible at temperatures below approx. -10°C as to the 1-cylinder engine and below approx. -5°C as to the 2-cylinder engine.

1. Disengage clutch to disconnect engine from driven equipment.
2. Set speed control lever 1 (Fig. 9) by hand or foot to about $\frac{1}{2}$ load in the direction of the arrow and press fuel excess button 2 once.
3. Pull decompression lever 1 (Fig. 11) from stop to stop (see arrows) and move it back to original position. Thus the exhaust valve is opened via the decompression shaft. Now the engine can be cranked easily.

By means of the decompression lever 1 you can choose after how many camshaft revolutions the decompression should be cut out.

For instance, when pulling

once from stop	}	approx. 17	} cam-	
to stop,				} shaft
twice,				
three times	approx. 7	lutions		

On the 2-cylinder engine, watch that both decompression levers are actuated simultaneously. For this purpose, the shafts are provided with strain sleeves 2 which have to point in the same direction after the decompression levers have been actuated.

4. Now turn crank handle 1 (Fig. 12) briskly until decompression shuts off automatically and the engine starts firing.
5. As soon as the engine runs smoothly, cut back the speed. When a moderate load is applied and the speed is varied, the engine will soon warm up to its normal operating temperature.
6. An oil pressure gauge 7 (fig. 10) can be supplied as an extra. During operation, the pointer of the oil pressure gauge must be in the green field. If it drops to red*, the engine must be shut down immediately! Trace the cause of the low oil pressure with the aid of the Trouble Chart and remedy.

* See footnote on page 11

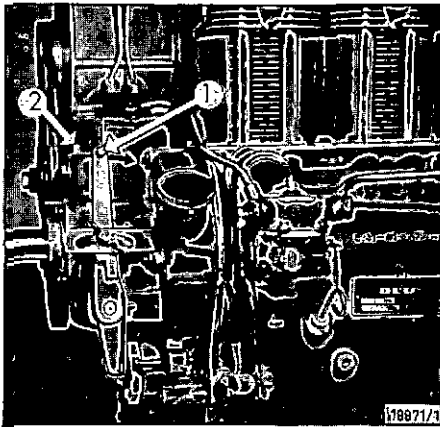


Fig. 13

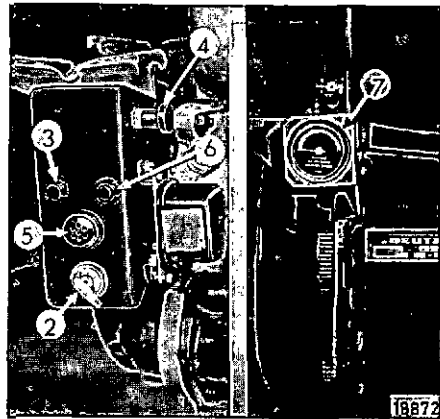


Fig. 14

Starting (electrically)

F1L and F2L 411 W (two-stage combustion)

1. Disengage clutch to disconnect engine from driven equipment.
2. Set speed control lever 1 (Fig. 13) by hand or foot to about $\frac{1}{2}$ speed in the direction of the arrow and press starting fuel allowance button 2 once.
3. As to the version with decompression device, see sect. 3 on page 10.
4. Push in switch box key 2 (Fig. 14) which should make the red charging indicator lamp light up.
5. For preheating, pull heater plug/starter button 4 to first stop and keep here for about 30 to 60 seconds and 1 to 2 minutes at low temperatures in winter. Check that heater plug indicator 5 glows up. Preheating is not required when the engine is still warm.

6. For starting, pull heater plug/starter switch 4 to the full extent. As soon as the engine starts firing, release starter switch. Starter motor should not be kept running for more than 10 seconds at a time. You will prolong the life of your battery if you wait one minute between two starting attempts.

Do not operate the starter again as long as the engine is still running.

For starting at low temperatures, see our instructions on page 13.

7. Cut back the speed as soon as the engine starts running smoothly. Charging indicator lamp 3 and heater plug indicator 5 will have gone out. With moderate load and with varying speed the engine will soon be up to its normal operating temperature.

Warming up of engines driving electric generating sets should be done at the preset rated speed.

8. An oil pressure indicator lamp 6 (fig. 14) or an oil pressure gauge 7 can be supplied as an extra. During operation, the pointer of the oil pressure gauge must be in the green field. If it drops to red* or if the green oil pressure indicator lamp lights up, the engine must be shut down immediately. Trace the cause of the low oil pressure with the aid of the Trouble Chart and remedy.

* Transient "red" indication is permissible at low idling, provided it rises to "green" again as the speed is increased.

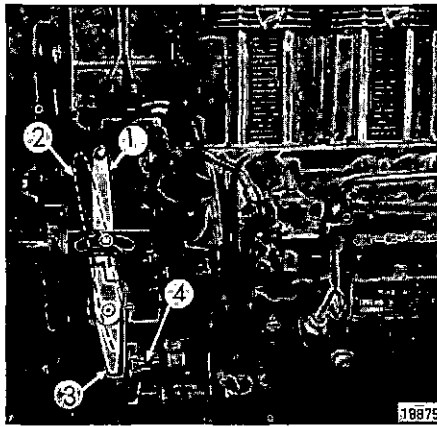


Fig. 15

Stopping

Do not shut down the engine suddenly from running under full load. Instead, let it idle for a short time so as to permit temperature balance.

1. Set speed control lever 1 (Fig. 15) to idling position 2.
2. Pull speed control lever 1 past position 2 (leaf spring 3 is pressed against lever by pin 4) until the engine stops running.
3. On the electrically started engine, the charging indicator lamp 3 (Fig. 14) lights up after the engine has stopped. Pull out switch box key 2 which causes the charging indicator lamp to go out.

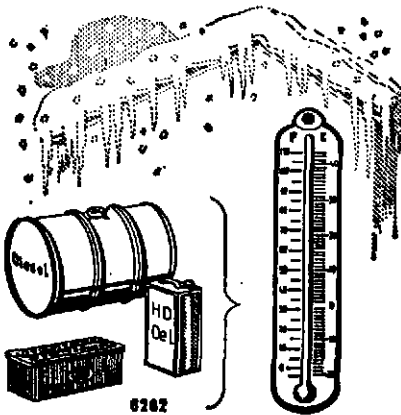


Fig. 16

Operation in Winter

1. Use winter-grade motor oil

At low ambient temperatures, the motor oil is subjected to particularly adverse conditions. Therefore, high-grade HD-B or HD-C oils should be used (oil change intervals see on page 20).

To ensure satisfactory cold starting, the choice of the viscosity grade (SAE-grade) should be governed by the ambient temperature prevailing at the time of starting (viscosity specifications on page 7).

As to the oil change intervals, it should be borne in mind that operation in winter is to be considered as "heavy operating conditions", consequently resulting in shorter oil change intervals (see section B 4, page 20).

2. **Fuel.** In winter use winter-grade diesel fuel to prevent choking by paraffin precipitation. At very low temperatures, troublesome deposits are possible even with winter-grade diesel fuel. If summer-grade diesel fuel only is available or there is the necessity of using winter-grade diesel fuel at very low temperatures, the following recommendations are given for the admixtures of engine kerosene, tractor fuel or regular gasoline considering, however, that the admixture of standard gasoline has to be understood as being a stopgap only which must not exceed one tank charge.

Ambient temperature	Summer grade diesel fuel %	Admixture %	Winter grade diesel fuel %	Admixture %
to -10° C (14° F)	90	10	100	—
to -14° C (7° F)	70	30	100	—
to -20° C (-4° F)	50	50	80	20
to -30° C (-22° F)	—	—	50	50

A simple method of testing diesel fuel for its suitability at low temperatures is as follows: Fill some diesel fuel in a small bottle and expose it to the ambient temperature.

Should there be paraffin clouding in the fuel, it will be suitable for operation in summer or in heated rooms only.

3. Cold Start for F1L and F2L 411 D (Direct Injection)

3.1 Without Starting Aid (limit temperature – 10 °C)

Provided engine and battery are properly serviced, the direct injection principle enables the engine with no need for any starting aid.

3.2 With Heater Plug (limit temperature – 15 °C)

Situated at the inlet of the air intake manifold is the heater plug that uses an electric coil to preheat the combustion air. The heater plug not only lowers the limit temperature by 5 °C, but it facilitates starting at temperatures normally not requiring a starting aid and thus reduces the wear on the battery.

Starting Procedure with Heater Plug

1. Disengage driven equipment. 2. Place speed control lever to $\frac{1}{2}$ speed. 3. Insert switch box key 2 (Fig. 10) as far as it will go. 4. Pull heater plug/starter switch button 4 to the first stop and keep here for about 30 to 60 seconds and 1 to 2 minutes at low temperatures in winter. 5. Pull button of heater plug/starter switch as far as it will go and hold it there until the engine starts firing. If the engine is not running smoothly, keep heating in position 1 for a little while before releasing the button (returns by itself to initial position). Do not operate the starter motor for more than 10 seconds at a time. Only when starting attempt is assisted by some firing, the attempt may be sustained for 20 to 25 seconds. Intervals between starting attempts should be 2 minutes or so, enabling the battery to recover.

4. Cold Start for F1L and F2L 411 W (Two-stage Combustion)

(limit temperature – 18 °C)

Starting procedure as described on page 11. If at low temperatures the engine runs untrue (misfirings) when being started, go on preheating for 1 to 2 minutes with heater plug/starter switch in position 1. Ensure that the battery is in perfect condition. See section 5.

5. Condition of Battery

The starting limit temperatures under 3.1, 3.2 and 4 require satisfactory battery condition and battery temperatures equal to the limit temperatures.

Lowering the limit temperatures by further 4–5 °C (39–41 °F) is possible by raising the battery temperature to about $+20$ °C (68 °F). This is done by removing the battery with the engine stopped and storing it in a warm room.

When installing the battery, ensure satisfactory terminal contact by keeping contact surfaces clean and bright. To avoid distortion of terminal cones, be sure to tighten screws only moderately.

6. Drain off the Thick Sludge from the Fuel Tank once a Week. Do this by taking out the sludge drain plug.





7. The Grade of Oil in the Oil Bath Air Cleaner

should suit the ambient temperature just like the engine oil.

8. The Flywheel Ring Gear

should be lubricated at temperatures below –20 °C (–4 °F) with low temperature grease, e. g. Bosch FT 1 V31, from time to time through the pinion hole to ensure full engagement of the pinion (if necessary remove starter motor).

Maintenance Schedule for **DEUTZ** Diesel Engines **F 1/2 L 411 W**
F 1/2 L 411 D

Intervals	B = Routine servicing W = Workshop maintenance	Details on page
Every  hours	B 1 Checking engine oil level	18
	B 2 Check and clean oil bath air cleaner (every 10–60 running hours, depending on dust conditions. Dry-type air cleaner only according to contamination indicator)	18
Every  hours	B 3 Clean strainer of fuel lift pump	20
	B 4 Change motor oil (see quality specification on page 7)	20
	B 5 Under dusty conditions: Clean cooling fins	21
	B 6 Clean lube oil filter at every oil change	22
	B 7 Check electrolyte level in battery	22
Every  hours	B 4 Change motor oil (see quality specification on page 7)	20
	B 6 Clean lube oil filter at every oil change	22
	B 8 Check valve clearances; for the first time after 20 running hours	22
	B 9 Check decompression clearance (on hand started engines only)	23
	B 10 Check tension of V-belt	24
Every  hours	B 11 Renew expendable fuel filter	24
Every 600 hours	W 1 Have injection nozzles tested	25
	W 2 Retighten fastening bolts of intake and exhaust manifolds	25
	W 3 Have dynamo tested	25
Every 1200 hours	W 4 Have alternator tested	25
	W 5 Have starter motor tested	25

Our guaranty is invalidated should, during the period covered by it, any adjustments or repairs be done without our approval.

The maintenance jobs duly completed can be recorded and certified in the schedule below.

Carry out

every 120 hrs. maintenance jobs B 3 to B 7

every 240 hrs. maintenance jobs B 3 to B 10

Completed Maintenance Jobs					
every 120 and 240 running hours					
Hours	Date	Signature	Hours	Date	Signature
* 20			—		
* 60/80			—		
120			240		
360			480		
600			720		
840			960		
1080			1200		
1320			1440		
1560			1680		
1800			1920		
2040			2160		
2280			2400		
2520			2640		
2760			2880		
3000			3120		
3240			3360		
3480			3600		
3720			3840		
3960			4080		
4200			4320		
4440			4560		
4680			4800		
4920			5040		
5160			5280		
5400			5520		
5640			5760		
5880			6000		

* See notes at bottom of page 17

The maintenance jobs duly completed can be recorded and certified in the schedule below.

Carry out

every 120 hrs. maintenance jobs B 3 to B 7

every 240 hrs. maintenance jobs B 3 to B 10


Completed Maintenance Jobs					
every		120	and	240	running hours
Hours	Date	Signature	Hours	Date	Signature
6 120			6 240		
6 360			6 480		
6 600			6 720		
6 840			6 960		
7 080			7 200		
7 320			7 440		
7 560			7 680		
7 800			7 920		
8 040			8 160		
8 280			8 400		
8 520			8 640		
8 760			8 880		
9 000			9 120		
9 240			9 360		
9 480			9 600		
9 720			9 840		
9 960			10 080		
10 200			10 320		
10 440			10 560		
10 680			10 800		
10 920			11 040		
11 160			11 280		
11 400			11 520		
11 640			11 760		
11 880			12 000		

The maintenance jobs duly completed can be recorded and certified in the schedule below.

Carry out

every 600 hrs. maintenance jobs W 1 to W 3

every 1200 hrs. maintenance jobs W 1 to W 5 and B 11

Completed Maintenance Jobs					
every		600	and		running hours
Hours	Date	Signature	Hours	Date	Signature
600			1 200		
1 800			2 400		
3 000			3 600		
4 200			4 800		
5 400			6 000		
6 600			7 200		
7 800			8 400		
9 000			9 600		
10 200			10 800		
11 400			12 000		

Ever-ready Availability

and a long working life will be obtained from the engine if it is given proper maintenance at the recommended intervals. During this work always use the specified lubricants and detergents. The 11 maintenance tasks (B 1) to (B 11) affecting the relatively few lubricating and maintenance points on these engines are not only clearly set out in the Maintenance Schedule but are also explained in detail on the following pages. Please read these pages carefully, too.

Oil Changes for New or Overhauled Engines

Routine Change every	1st change after	2nd change after a further	3rd change after a further	Further changes every
100-120 hours	20 hours	40 hours *	—	100-120 hours
200-240 hours	20 hours	60 hours *	120 hours	200-240 hours

* Renew lube oil filter cartridge at the same time.

When switching over to higher-grade oil, it is advisable to perform the first oil change in any case already at the end of 20 running hours. At the same time, the filter should be cleaned or replaced as required.

Note: When performing the second oil change, be sure to retighten any new V-belts.

Retighten fastening bolts of intake and exhaust manifolds at cylinder heads as well as bolts of oil sump and engine mounting.

Check that the Maintenance Schedule supplied loose with each engine is stuck at a conspicuous point!

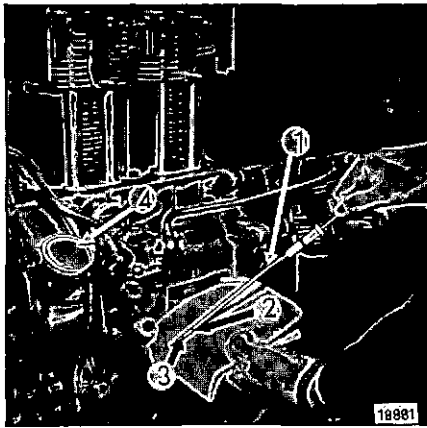


Fig. 17

B 1 Check Engine Oil Level

Normally, new engines have a higher oil consumption which necessitates the oil level being checked twice a day during the running-in period (the first 200 running hours). Thereafter, one oil level check per day will be sufficient. Check oil level with the engine stopped and standing in the horizontal. Pull out dipstick 1 (Fig. 17), wipe it with a non-fraying rag, push it in as far as it will go and then withdraw it again. The dipstick should then have a coating of oil extending to the upper mark 2. If the oil level is only up to the lower mark 3, top up with oil immediately, through filler 4, otherwise serious damage might be done to the engine (seizure of the pistons and bearings).

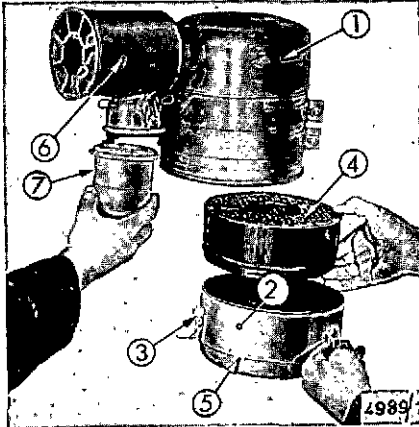


Fig. 18

B 2 Checking and Cleaning Air Cleaners

Dust in the combustion air can cause premature wear of the engine. Maintenance of the air cleaners, therefore, is essential to ensure long life. It is also necessary to check regularly the connecting points of the intake manifold.

Oil Bath Air Cleaner

every 10 to 60 running hours according to dust conditions. This check must be made after the engine has been stopped for at least one hour so that the oil has had time to drip from filter 1 into bowl 4 (Fig. 18). Release snap clips 3 and take down bowl 2. Filter element 4 is easily removed by tapping it with the hand from the side or by inserting a screwdriver. Pour out the dirty oil and wash the dismantled parts in diesel fuel. When all fuel used for washing has dripped out of element 4, fill fresh motor oil into the bowl up to oil level mark 5 and reassemble the oil bath air cleaner.

Where moderately dusty conditions exist, the oil bath air cleaner must be taken apart once a year and the upper part of the air cleaner containing a fixed filling of metal wool must be submerged in diesel fuel several times to cleanse the wool. Where the combustion air contains a higher percentage of dust, the metal wool must be washed at least twice a year.

Make sure the connection between air cleaner and intake pipe is perfectly tight.

Check that the rubber washer sealing the air cleaner element is not defective.

When in very dusty conditions a cyclone-type pre-cleaner 6 is fitted, empty the associated dust trap 7 when it is half full. However, this dust trap must under no circumstances be filled with oil as it is exclusively meant for collecting dust. Always remember that only a clean air cleaner will give clean combustion air, which is so vital for high engine performance and low wear.

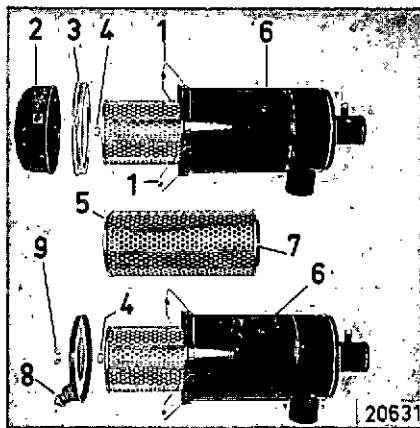


Fig. 19

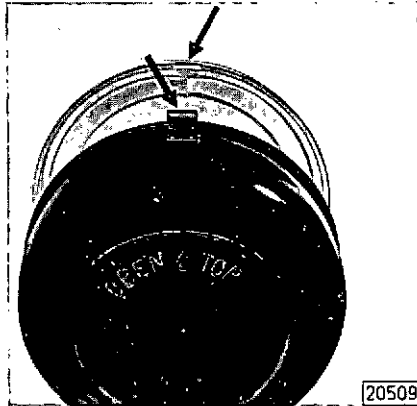


Fig. 20

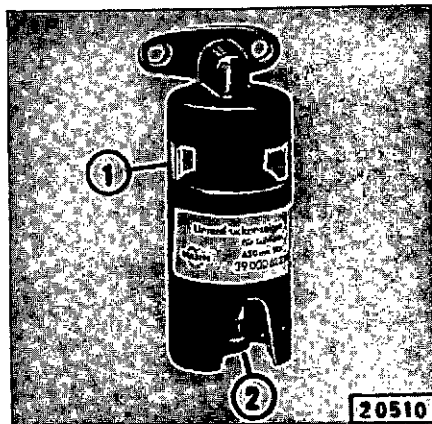


Fig. 21

Dry-type Air Cleaner

The life of the expendable paper cartridges in dry-type air cleaners depends on dust collector 2 (Fig. 19) being emptied in good time. Failing this, the cartridge will clog up fast. Be sure, therefore, to empty the collector not later than when filled half. Where the air is very dust-laden, this may require daily servicing.

If a special dust ejector 8 is provided, it is only necessary to clear the discharge slot from time to time.

1. Emptying the Dust Collector

Stop engine.

Release clips 1 (Fig. 19) and remove dust collector 2 along with cover 3. Refit assembly, seeing to it that recess on cover mates with lug on collector (see arrows in Fig. 20). When cleaner is installed in horizontal position, check that the "TOP" mark is up.

2. Servicing the Cartridge

Where a vacuum-type contamination indicator (Fig. 21) is fitted and keeps displaying the red warning signal when the engine is stopped, or where a yellow warning light goes on with the engine running, the cartridge is due for servicing. (Also indicated by smoking exhaust and decreasing engine output.) It is not advisable to service the cartridge more frequent as this may affect seal 7 (Fig. 19) between cartridge 5 and housing 6.

Proceed by taking down dust collector 2 (Fig. 19) as under 1.

Where a dust ejector 8 (Fig. 19) is provided unscrew wing nut 9 and remove cover.

Next unscrew hex. nut 4, take out cartridge and replace or clean as below. After 4 or 5 times intensive cleaning, or where the cartridge is contaminated by soot, replacement is indispensable.

Make sure that only genuine cartridges are used as supplied by the air cleaner manufacturer. Cartridges of other make usually do not fit and are a hazard to the engine.

Cleaning by dry means

- a) provisional: Tap cartridge 5 with its front end gently several times, i. g. against the palm of your hand or on a soft and plane surface to shake off the dust. Take care not to damage the front end of the cartridge.
- b) intensive: Apply air blast of max. 5 atm. diagonally inside and out until no more dust is coming forth.

Do not blow out housing 6.

Washing the cartridge:

Wash the cartridge by moving in lukewarm water containing a commercial-grade mild detergent. Rinse thoroughly in clean water, shake off water and let **dry well**. In no event use benzine or hot liquids.

3. Checking:

Prior to reassembly, introduce a lighted bulb into filter cartridge 5 to see whether it suffered damage (damaged cartridges must definitely be renewed). Also make sure that gasket 7 is not defective. If a contamination indicator with visual signal is fitted (Fig. 21), press push button 2; this causes the red signal to disappear from the window.

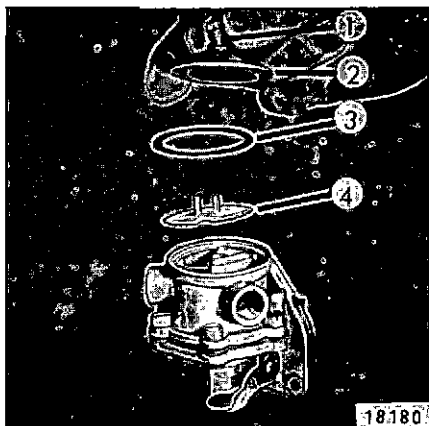


Fig. 22

B 3 Cleaning Strainer of Fuel Lift Pump

Every 120 running hours remove consecutively screw 1, cover 2, gasket 3 and strainer 4 (Fig. 22). Clean strainer in fuel. When reassembling, ensure perfect tightness.

B 4 Changing the Motor Oil

Carry out the oil changes at regular intervals and strictly adhere to the prescriptions of the table below. (As to the viscosity grades see sect. 2.2 on page 7).

Operating conditions	Sulphur content of fuel (% by weight)	Oil change intervals (hours) according to specified oil grades		
		HD-S 1	HD-B	HD-C
Normal	up to 0.5	100-120	200-240	200-240
Normal	above 0.5		100-120	200-240
Heavy*	up to 0.5			100-120
Heavy*	above 0.5			100-120

Oil Grades:

HD-S 1 **

oils are motor oils conforming to MIL-L-2104 A, Supplement 1 or DEF 2101 D.

HD-B **

oils are high-blended motor oils corresponding to specification MIL-L-2104 B as well as to specification MIL-L-2104 A, Supplement 1. Oils complying with the new specification MIL-L-46152 and with the former specification MIL-L-45199 B or with the specification S 3 are also in conformity with the required oil grades.

HD-C **

oils are motor oils corresponding to the new specification MIL-L-2104 C.

* Heavy operating conditions are understood to be: long idling periods, prolonged temperatures above 30 °C, operation in winter.

** For examples see pages 26 and 27.

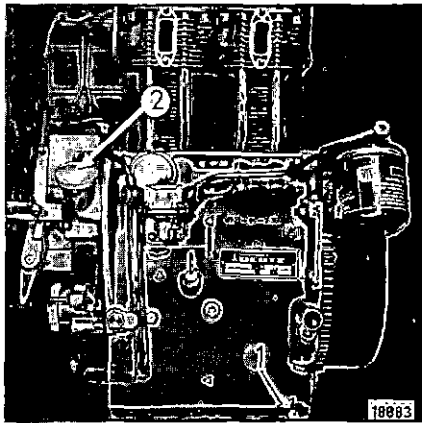


Fig. 23

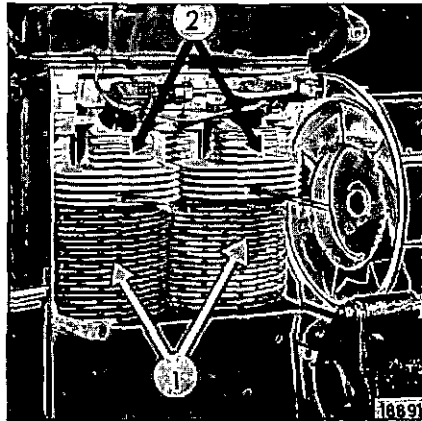


Fig. 24

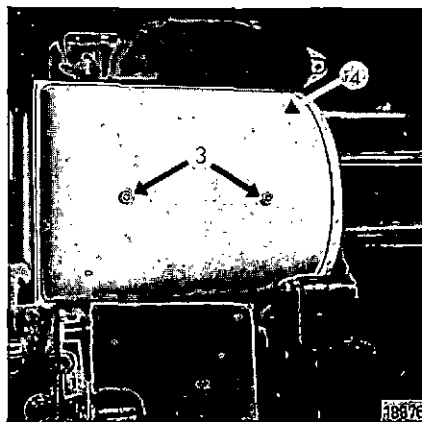


Fig. 25

In the case of engines on temporary duty only, e. g. standby power generation, carry out oil changes not later than at the end of six months.

Always change oil when the engine is warm as the oil is then thinner and runs off more easily. To do this, screw off drain plug 1 (Fig. 23) in the bottom cover plate. After the old oil has drained out, screw in plug again and fill in new oil through filler neck 2 up to the upper dipstick mark 2 (Fig. 17).

After a short trial run re-check the oil level.

Quantities of oil required for an oil change:

approx. 2.4 l for the single-cylinder engine
approx. 3.5 l for the two-cylinder engine.

B 5 External Cleaning of Engine

every 120 running hours is of particular importance where dusty operating conditions exist since the accumulation of dust on fins of cylinders 1 (Fig. 24) and cylinder heads 2 reduces cooling efficiency considerably, especially so when forming cakes in combination with fuel or oil.

After unscrewing hex. nuts 3 (Fig. 25), air cowling 4 can be removed. On the two-cylinder engine the air baffle 5 (Fig. 26) has also to be removed after releasing screw 6, to allow cleaning of the fins.

We recommend cleaning the cooling fins by dry means, e. g. a wire and, if possible, compressed air. It is advisable to start blowing through the cooling fins from the exhaust side. If diesel fuel or a cold detergent is used for cleaning, it is important, after allowing for an adequate soaking-in period, to wash the engine parts with a powerful water jet.

Following this, the engine should be run until warm so that any water left behind will be evaporated before rust can form.

If a steam jet is available, this method of cleaning is preferable to any other.

When doing a major cleaning operation of the fins in a workshop, the whole air cowling can of course be removed for better access.

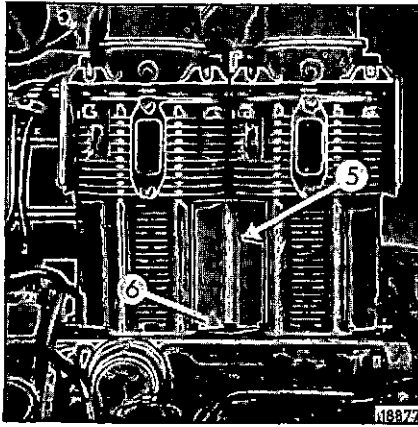


Fig. 26

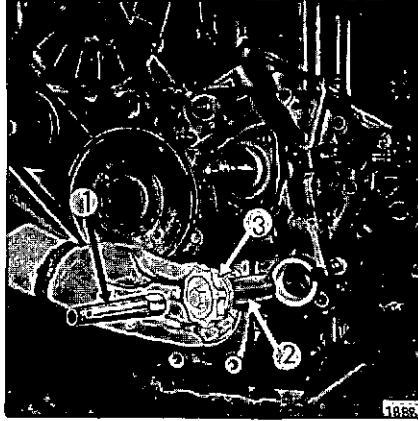


Fig. 27

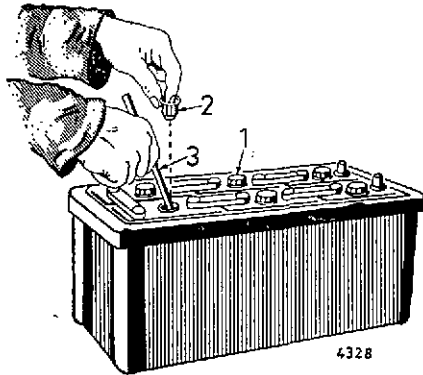


Fig. 28

B 6

B 6

Cleaning the Lube Oil Filter

every 120 or 240 running hours. At every oil change unscrew lube oil filter 2 (Fig. 27) with a 19 mm a/flats socket spanner 1 and wash the filter in clean diesel fuel. When reassembling, watch for proper position of rubber O-ring.

B 7

Checking Electrolyte in Battery

Every 120 running hours, but not later than every 4 weeks, check electrolyte level in battery by unscrewing the caps 1 (Fig. 28). In some cases electrolyte level testers 2 are provided and the level should be sufficiently high to wet the bottom of the testers. If such testers are not available, a clean wooden stick should be inserted into the cells until it touches the top of the lead plates. After it has been withdrawn, it should be wet over a distance of 10–15 mm ($\frac{3}{8}$ " to $\frac{5}{8}$ "). If the electrolyte level is low, distilled water must be used for topping up. Never place tools on the battery as they might cause a short-circuit. The battery should undergo a workshop test from time to time for checking its charge. For hints on battery care in winter see page 13.

B 8

Checking Valve Clearances *)

At 1st and 2nd oil change and subsequently, under normal operating conditions, every 240–360 running hours.

In case of unfavourable operating conditions, such as constantly changing loads, frequent daily starting or ambient dusty conditions, shorter checking intervals are required where valve clearance must be set to the maximum gap.

*) Valve clearance is the requisite gap 1 between the rockers 3 and valves 5. Good engine performance and high power output depend on its correct setting.

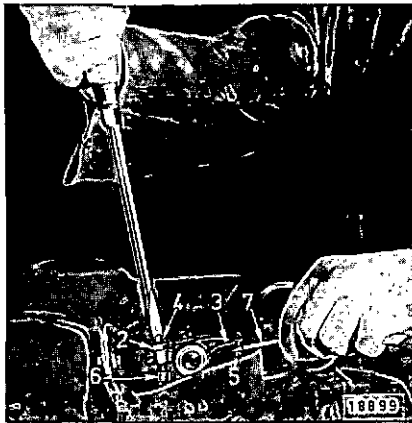


Fig. 29

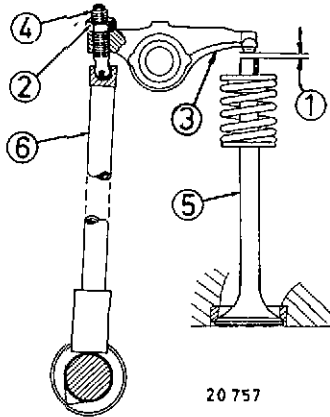


Fig. 30

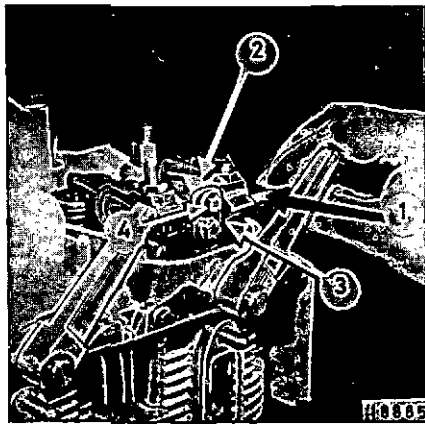


Fig. 31

Check valve clearance with engine **cold** by means of a 0.15 mm (0.006 in.) feeler gauge 7 (Fig. 29). To do this, turn crankshaft by means of the V-belt until the piston of the cylinder in question reaches the compression dead center, i.e. after overlapping of both valves (exhaust valve about to close, inlet valve about to open) go on turning the crankshaft through 360°, corresponding to a complete rotation.

The resulting gap 1 (Fig. 30) between rocker arm 3 and valve 5 should now admit with a slight drag the 0.15 mm (0.006") feeler gauge 7 (Fig. 29) at the inlet and exhaust valves. If the gap is found to be too small or too big, slacken lock nut 2 by giving it one or two turns and adjust screw 4 with a screwdriver so that, when lock nut 2 has been retightened, the feeler gauge 7 can be withdrawn easily.

B 9 Checking Decompression Clearance *)

Whenever the valve clearance has been checked or readjusted, otherwise after every **240 running hours**, the decompression clearance should be checked with the engine **cold** in a manner similar to that employed for the valve clearance, using a 2 mm (0.078") feeler gauge 1 (Fig. 31). To this end the exhaust valve must be closed. It should be possible to introduce feeler 1 with a slight drag in the gap between rocker 2 and decompression lever 3. If the gap is too small or too big, slacken hex. bolt 4 and adjust decompression lever 3 with a screwdriver so that, when bolt 4 has been retightened, feeler gauge 1 can be withdrawn with a slight drag.

*) The decompression device is fitted to hand-started engines only. It serves to facilitate starting by opening the exhaust valve. Any reasonably skilled operator should be able to adjust the decompression clearance on the lines given above. Failing this, a skilled mechanic should be called to do it.

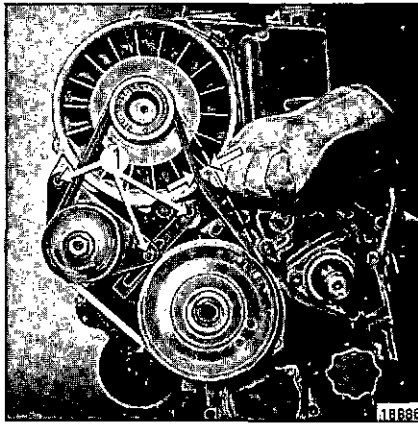


Fig. 32

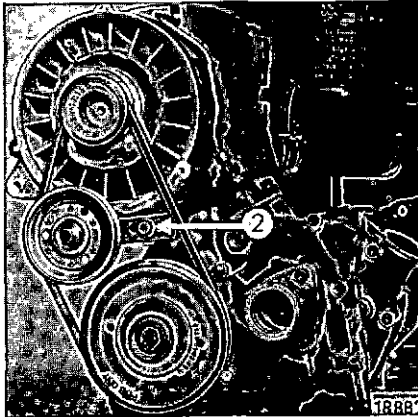


Fig. 33

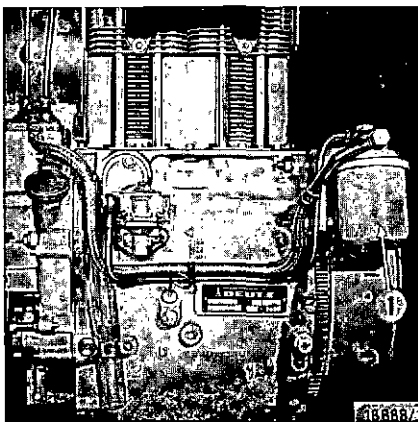


Fig. 34

B 10 Checking V-belt Tension

After every 240 running hours apply thumb pressure (Fig. 32) to check that the deflection of the belt between the pulleys is not more than 10–15 mm ($\frac{3}{8}$ "– $\frac{5}{8}$ "). If the belt has to be tightened, slacken hex. bolts 1 (Fig. 32) when a generator is fitted, or slacken hex. bolt 2 (Fig. 33) when an idler pulley is mounted.

Push generator or idler pulley outwards until correct belt tension has been attained. Then retighten hex. bolts.

New belts should be retensioned firmly a short time after having been taken into use, after 40 running hours at the latest.

To avoid damage to the V-belt, remove or refit the V-belt **without** using a screwdriver or other tools, only after slackening bolts 1 and 2 and **with the generator or idler pulley completely pushed towards the engine.**

The procedure is assisted by slowly turning the crankshaft.

With a two-belt drive, always replace **both** belts by a new set, even if only **one** belt is broken or worn. The two new V-belts must not differ in length by more than 0.15 %.

B 11 Renewing Expendable Fuel Filter *)

is recommended every 1200 running hours or when the engine output drops. On engines with mounted fuel tank, renewing of the expendable fuel filter should preferably be done before filling up the fuel tank. Unscrew filter 1 (Fig. 34) carefully, as fuel from higher levels will run out.

Before refitting the new filter, wet the rubber seal with a drop of oil. Then screw in filter by hand until the seal is squarely seated and tighten filter by a further half turn.

Venting of the fuel filter according to page 8.

After mounting, check for leaks during a short test run.

Order No. of expendable fuel filter: Q 0.5 H 4117.

*) The purpose of the fuel filter is to ensure that only absolutely clean fuel is fed to the injection pump and the injectors, as only clean fuel will allow these units to function with precision.

Workshop Maintenance

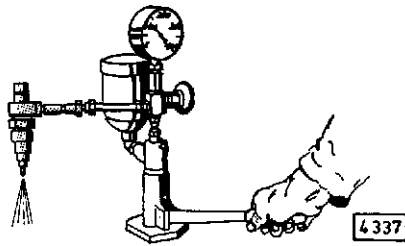


Fig. 35

W 1 Injectors

After every 600 running hours the injectors should be dismantled and cleaned in diesel fuel. They should then be carefully tested by a skilled mechanic to ascertain whether they deliver the release pressure of 125 kp/cm² (1,780 psi) specified for DEUTZ engines. This test should be made with a nozzle tester (Fig. 35).

W 2 Intake and exhaust manifolds

After every 600 running hours check the intake and exhaust manifolds for tightness at the cylinder heads, retighten fastening bolts if necessary.

W 3 Dynamo

After every 600 running hours have the dynamo 1 (Fig. 36) tested in a specialized workshop.

W 4 Alternator

After every 1,200 running hours have the alternator 1 (Fig. 36) tested in a specialized workshop.

Contrary to the dynamo, the alternator supplies power already when the engine is idling thus ensuring that the battery is always fully charged.

For the maintenance of the three-phase current system, please observe the following instructions:

1. Never disconnect the lead between battery, alternator and tension regulator when the engine is running. If, however, the engine must run without the battery, the lead between alternator and tension regulator must be disconnected prior to starting the engine.
2. Do not mix up the battery connections.
3. Defective charging current pilot lamps must be replaced immediately.
4. When washing the engine, cover up the alternator and tension regulator carefully.
5. The common practice of touching a lead against earth for checking on a DC system whether the lead is live, must under no circumstances be done on a three-phase current system.
6. In case of electric welding, connect the earth terminal of the welding apparatus direct to the piece to be welded.

W 5 Starter Motor

Every 1,200 running hours it is advisable to have starter motor 2 (Fig. 36) inspected, especially when the motor is frequently used.

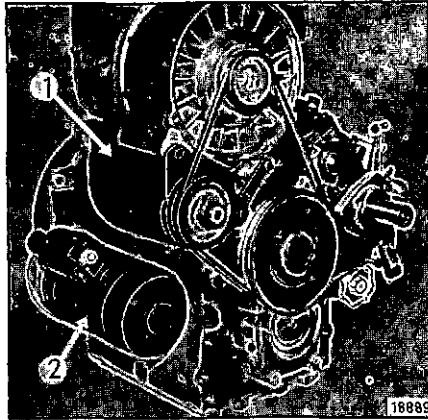


Fig. 36

List of Recommended Lube Oils

(Effective summer 1974, not exclusive *)

According to the suppliers, the brands listed below are of **HD-S 1** quality as described under section B 4 on page 20.

Oil Company	Brand of Oil
ARAL	ARAL AUTORAL
BP	BP DIESEL MOTOROIL HD, BP ENERGOL IC-D, BP ENERGOL IC-M
CASTROL	CASTROL HD, CASTROL/DEUSOL CRI
DEUTZER OEL-GES.	DEUTZ OIL SGHD
ESSO	ESSO ESTOR HD, ESSOFLEET HD
FINA	FINA SOLNA HD S 1
MOBIL	DELVAC 1130, MOBILGARD 312
RHEIN. MOTOR OEL	RMV-HD-MOTOR OIL EXTRA SPECIAL RMV High-quality Motor Oil 1318 H
TEXACO	TEXACO GARANT HD
VEEDOL	VEEDOL MOTOR OIL CADEL HD M
WENZEL & WEIDMANN	ECUBSOL-MOTOR OIL EXTRA HD

According to the suppliers, the brands listed below are of **HD-B** quality as described under section B 4 on page 20.

Oil Company	Brand of Oil
ARAL	ARAL SUPER, ARAL KOWAL, ARAL SUPER KOWAL, ARAL SPECIAL, ARAL MOTORAL
BP	BP VANELLUS-T, BP VANELLUS M, BP ENERGOL HD, BP ENERGOL DS-B, BP SUPER VISCOSTATIC
CASTROL	CASTROL/DEUSOL CRB
CHEVRON	CHEVRON DELO SPECIAL MOTOR OIL, DELO 200 MOTOR OIL, DELO 300 MOTOR OIL
DEUTZER OEL-GES.	DEUTZ OIL HD SUPER DB, SGHD-B/2 X
ESSO	ESSOLUBE SDX, ESSO ESTOR SDX, ESSOLUBE HDX, ESSO MOTOR OIL
FINA	FINA DELTA PLUS MOTOR OIL, PURFINA MOTOR OIL or FINA DELTA MOTOR OIL, FINA SOLNA S 3
FUCHS	RENOLIN HD, PENA PURA HD, PENA PURA HD SUPER, PENA PURA LD EXTRA, PENA PURA HD SUPERIOR, PENA PURA HD SUPER N
MOBIL	DELVAC 1130, DELVAC 1230, MOBILGARD 312
RHEIN. MOTOR OEL	RMV-HD EMBLEM, RMV-HD EMBLEM DB, RMV-RHEMOTOL HD S 3
SHELL	SHELL ROTELLA SX, SHELL ROTELLA TX
TEXACO	URSA OIL ED, ULTRA MOTOROIL, ULTRA ALL TEMP, URSA OIL S 3, URSA OIL LA 3
VALVOLINE	VALVOLINE SUPER ALL CLIMATE, RITZOL SUPER HDX, LOROCO HD (DBM), VALVOLINE HD SUPER, HPO D. B.
VEEDOL	VEEDOL MOTOR OIL CADEL HD 900, VEEDOL SUPER 10/40, VEEDOL SUPER 20/50, VEEDOL MOTOR OIL CADEL HD S 3
WENZEL & WEIDMANN	ECUBSOL MOTOR OIL EXTRA HD, ECUBSOL SUPER OIL HD

According to the suppliers, the brands listed below are of **HD-C** quality as described under section B 4 on page 20.

Oil Company	Brand of Oil
ARAL	ARAL TURBORAL
BP	BP VANELLUS C 3, BP ENERGOL DS 3
CASTROL	CASTROL/DEUSOL CRD, CASTROL/DEUSOL CRF
CHEVRON	DELO 400 MOTOR OIL
DEUTZER OEL-GES.	DEUTZ OIL SGHD-G
ESSO	ESSOLUBE D-3, ESSOLUBE D-3 HP, ESSO ESTOR D 3
FINA	FINA KAPPA MOTOR OIL
FUCHS	PENA PURA UNIVERSAL HD
MOBIL	DELVAC 1300
SHELL	SHELL MYRINA
TEXACO	TEXACO URSA OIL LA 3
VALVOLINE	TOPFLITE CS-3, RITZOL HD C-3
VEEDOL	VEEDOL ADELBUS HD-C
WENZEL & WEIDMANN	ECUBSOL SUPREMA C/S 3 HD

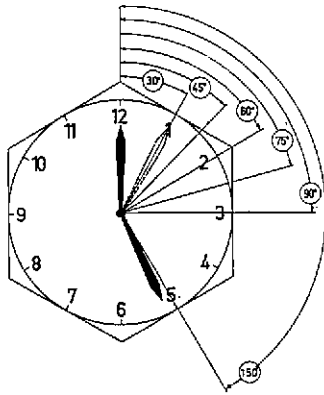
* The above oil brands are quoted as examples of oils meeting our quality requirements. Other oil brands may also be used, of course, provided they correspond in quality to these specified.

Trouble Chart

Troubles are usually attributable to incorrect operation, lubrication or maintenance of the engine. Should you therefore experience trouble, re-read carefully the few sections on pages 7 to 27 dealing with correct operation and maintenance. Then ask yourself whether you have always carried out these Instructions. If you are unable to identify the cause of the trouble or cannot remedy it yourself, then your best plan is to contact your local DEUTZ agent.

Trouble	No.	Possible Cause	Remedy	Details on page
A Engine fails to start	1	Fuel tank empty	Fill up tank and vent fuel system	8
	2	Fuel filter choked in winter by paraffin clouding	Renew tubular filter element, Use winter-grade fuel	24
	3	Fuel lines leaky	Check all fuel lines for tightness	
	4	Charging indicator lamp does not light up in spite of bulb not being defective	Push home the switch key, tighten battery terminals, check wiring connections	
	5	Heater plug indicator fails to glow in spite of battery being properly charged	Tighten battery terminals, renew filaments in heater plug indicator if necessary	
B Engine difficult to start	6	Battery output low, battery terminals loose or oxidized causing starting motor to run slowly; in winter, oil too viscous	Have battery tested, clean terminals, tighten and coat with acid-free grease; crank engine smartly by hand	23
	7	In winter especially, grade of motor oil used is too viscous	Use a grade of motor oil to suit the temperature conditions	7 12
	8	Inadequate fuel supply Blocking of fuel system by paraffin clouding in winter	Renew fuel filter, evacuate air, check fuel line connections for tightness Use winter grade fuel	24 8 12

Trouble	No.	Possible Cause	Remedy	Details on page
C Engine runs unsteadily and power output is low	9	Inadequate fuel supply	Renew fuel filter and evacuate air Tighten fuel line connections	24 8
	10	Valve clearance out of adjustment, valve spring broken	Readjust valve clearances Have valve spring renewed	23
	11	Nozzle needles stick	Have them checked by a specialist	25
D Dense exhaust	12	Level of motor oil too high	Drain to upper mark on dipstick	18
	13	Level of oil in oil bath air cleaner too high	Pour off oil to reduce level to the mark	18
	14	Inefficient compression due to seized or broken compression rings, or incorrect valve clearances	Have compression rings and pistons checked by a specialist Readjust valve clearances	23
E Engine overheats	15	Cooling fins on cylinders and cylinder heads very dirty. V-belt too loose	Clean cooling fins, on cylinder head in particular. Retighten V-belt	21 24
			16	Injectors defective
	17	Injection pump delivery out of adjustment	Have it readjusted by a specialist	
	18	Insufficient air inducted to cooling air blower	Clear air intake	32
F Engine oil pressure too low	19	Leaks in lubrication system	Stop engine immediately Check unions on lubricating pump and oil pressure gauge for tightness and retighten screws. Otherwise call in a specialist	
G Charging Indicator lamp lights up when engine is running	20	Generator speed too low	Check vee-belt tension	24
	21	Generator not charging battery because either the generator or regulator/cut-out is defective	Have it checked by a specialist	25



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Fig. 37

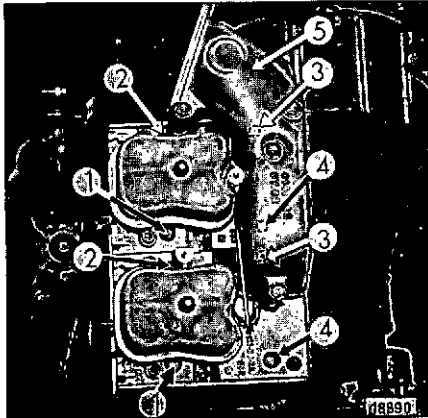


Fig. 38

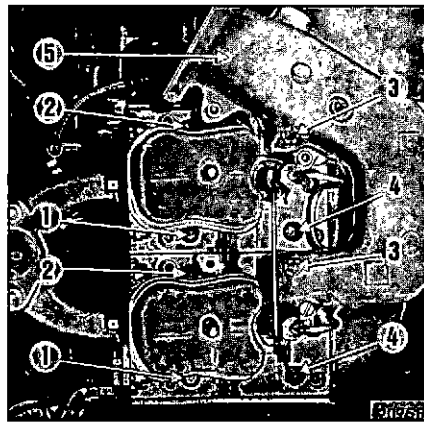


Fig. 39

Information for the Specialist

To prevent faulty assembly, the following notes include instructions on the tightening of the cylinder head bolts, because the procedure differs from that normally employed. The tightening angle is especially important, and for this reason Fig. 37 indicates how the various angles can be readily obtained by comparison with the face of a clock. To obtain the desired angle all that has to be done is for the tommy bar on the spanner to be turned by the same angle as that formed by the hour and minute hands of a clock. The 60° angles of a hex. bolt can also be a help.

FL 411 W: Position of cylinder head bolts 1, 2, 3 and 4 (Fig. 38). Cylinder head bolts 3 at No. 1 cylinder as well as cylinder head bolts 3 and 4 at No. 2 cylinder are located underneath air intake manifold 5 and are accessible only after the air intake manifold has been removed.

FL 411 D: Position of cylinder head bolts 1, 2, 3 and 4 (Fig. 39). Cylinder head bolts 3 at No. 1 and No. 2 cylinder are located underneath air intake manifold 5 and are accessible only after the air intake manifold has been removed.

Tightening Highly Stressed Bolts (Studs)

1. Wet threads and seatings with motor oil before fitting.

Do not use molybdenum disulphide products.

2. Screw the bolts in until they are squarely seated, using a socket spanner **without** tommy bar or, in the absence of a socket spanner, a box or ordinary spanner without making use of the leverage.
3. Pre-load the bolts using a socket spanner with tommy bar. Hold the tommy bar in such a manner that both hands are in contact with the spanner. When using a box or ordinary spanner for pre-loading, the tip of your straight thumb holding the spanner must touch the head of the bolt.
4. Tighten the bolts according to the Instructions on page 31, if necessary in stages in conformity with the tightening angles specified.

Bolt Tightening Table (screws and studs)

Designation	Pre-loading mkp	Tightening				Note						
		1st stage	2nd stage	3rd stage	total							
Cylinder head bolt 0141-08-15.23	3	30°	60°	60°	150°							
Injector M 10x50 DIN 912-8.8	3	60°	60°	—	120°	FL 411 D						
Connecting rod M 10x1x50 H 803-10.9	3	30°	60°	—	90°							
Bearing bracket M 10x80 DIN 912-10.9 M 12x90 DIN 931- 8.8	3 3	30° 60°	30° —	— —	60° 60°							
V-belt pulley M 14x1.5x55 H 803-10.9	3	150°	—	—	150°	With power take-off at camshaft						
V-belt pulley M 14x1.5x90 U 803-10.9	3	90°	—	—	90°	Without power take-off at camshaft						
Crankshaft gear M 10x35 DIN 912-10.9 M 10x35 DIN 933-10.9 M 10x45 DIN 912 10.9	}	3	30°	30°	—	60°						
Flywheel M 12x1.5x40 DIN 961-12 K M 12x1.5x60 DIN 961-12 K							3	60°	30°	—	90°	
Balance weight M 10x40 DIN 912-10.9							3	30°	30°	—	60°	
Rocker arm pin M 8x50 DIN 912-10.9	3	45°	—	—	45°							
Oil suction pipe 3104 W 12 (M 18x1.5)	—	—	—	—	5 mkp							
Air intake manifold M 8x 65 DIN 931-8.8 M 8x 80 DIN 931-8.8 M 8x100 DIN 931-8.8 M 8x120 DIN 931-8.8 M 8x 40 DIN 912-8.8 M 8x110 DIN 84-4.8 M 8x130 DIN 912-8.8	— — — — — — —	— — — — — — —	— — — — — — —	— — — — — — —	1.5 mkp 1.5 mkp 1.5 mkp 1.5 mkp 1.5 mkp 1.5 mkp 1.5 mkp	FL 411 W FL 411 W FL 411 W FL 411 W FL 411 D FL 411 D FL 411 D						
Cooling blower M 8x80 DIN 931-10.9	—	—	—	—	3.5 mkp							
Fastening of cooling blower M 10x80 DIN 931-8.8	3	60°	—	—	60°							
Camshaft bearing flange M 8x30 DIN 912-10.9	—	—	—	—	3.5 mkp	Power take-off at camshaft						
Hydraulic pump M 12x1.5 DIN 936-5 D M 12x1.5 DIN 936-6 G M 8x30 DIN 933-8.8 M 6x80 DIN 931-10.9	— — — —	— — — —	— — — —	— — — —	5 + 1 mkp 8 + 0.5 mkp 2.5 mkp 1.4 mkp							
Support M 14x130 DIN 931-8.8	3	90°	—	—	90°	FL 411 D						

When renewing main and big-end bearings or after piston seizures be sure to **renew** the bearing bolts as well.

Engine Preservation

If your engine is to be shut down for a major period (e. g. over the winter), we recommend the following preservative measures against rust formation.

1. Clean the outside of the engine with diesel fuel or a cold detergent.
2. Drain the engine oil in hot condition and fill in corrosion inhibitor oil *).
3. Pour the oil out of the air cleaner bowl, clean bowl and fill in inhibitor.
4. Drain fuel from tank, mix well with 10% inhibitor and fill back into tank. Instead of adding inhibitor oil to the fuel, the tank can be filled up with injection pump testing oil having corrosion inhibiting properties (e. g. Calibration Fluid B).
5. Run engine for about 10 minutes, so that pipes, filter, pump and nozzles are filled with the preservative mixture and the new motor oil is distributed to all parts.
6. After this run, detach the rocker chamber covers and the lateral cover of the injection pump and spray the rocker chambers as well as the spring chamber of the injection pump with a mixture of diesel fuel and 10% anti-corrosive. After this, refit the covers.
7. Turn engine over several times (**no firing!**) for spraying combustion chambers.
8. Take off V-belts and spray inhibitor oil on pulley grooves. Remove inhibitor when restarting operation.
9. Carefully cover up intake on oil bath air cleaner and the exhaust pipe.

These measures will give about 6 to 12 months protection, depending on weather effects.

Prior to taking the engine again into operation, drain inhibitor oil and replace by fresh motor oil.

In exceptional cases, however, the engine can be operated on corrosion-inhibitor oils, but not for more than 10 hours and only in partial load range.

Hints for Installing the Engine

Trouble-free operation of your equipment powered by our engine is ensured if you comply with the following rules:

Take all precautions that hot air discharged from the engine cannot be recirculated. In fact, if such hot air is taken in by the cooling blower, this will cause engine overheating; if taken in for combustion, the power output will fall off.

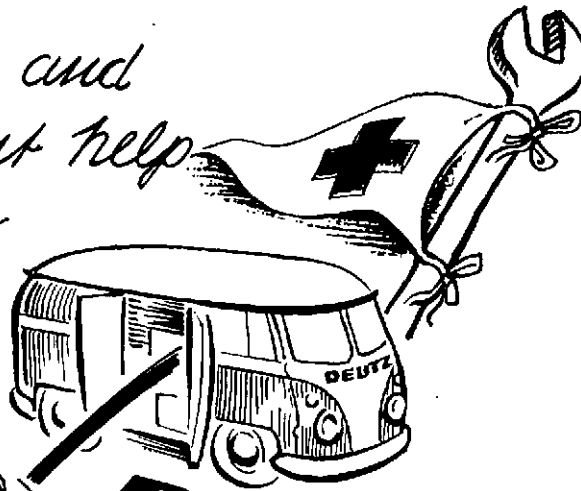
Prevent recirculation of hot air by providing suitable means for unobstructed hot air discharge. If hot air cowling is desired by you, please get in touch with us and we will be pleased to help.

The air required for cooling and combustion should be taken from a zone where there is a minimum degree of air contamination. Similarly, we shall be glad to advise you also in this respect.

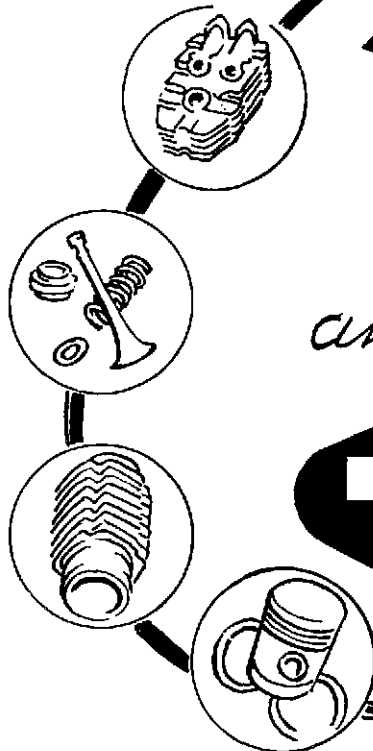
Before installing your engine, you are well advised to contact one of our DEUTZ Installation Consultants in good time, who will gladly pay you a visit to assist you in solving your particular problem.

*) Shell-Ensis 20 or equivalent

*Speedy and
efficient help
by*



**DEUTZ
SERVICE**



and



4847

Please note

The Maintenance Schedule illustrated overleaf is supplied with each engine as self-adhesive "sticker". This is to be adhered to the engine or to the equipment at a conspicuous point.

Should this Schedule be missing, ask your engine or equipment dealer to supply you with one.

SUMMARIZED INSTRUCTIONS

Checking Engine Oil Level

Starting (electrically)

1. Isolate driven equipment by **declutching**.
2. Set speed control lever to $\frac{1}{2}$ load position and press starting fuel allowance button once.
3. Insert switch box key (red charging indicator lamp lights up).
At low temperatures only:
4. Pull starting switch to first stop and **pre-heat**.
5. Pull starting switch **out** fully. **Start up**, but do not keep the starter motor running for more than 10 seconds.
6. After starting shift speed control lever back until engine runs steadily.
Under very cold conditions:
If the engine runs unsteadily, (misfires), resume pre-heating at lower speed.

Starting by hand

1. Isolate driven equipment by **declutching**.
2. Set speed control lever to $\frac{1}{2}$ load position and press starting fuel allowance button once.
3. Actuate decompression lever (see page 10).
4. Turn crank handle vigorously until decompression shuts off automatically and the engine starts to fire.

Stopping

Do not suddenly stop engine from full load running, but let it idle for a short time to permit temperature balance.

Type of engine	1-cyl.	2-cyl.
Total filling for oil changes	2.4	3.5
Designation of fuel filter cartridge: Q 0,5 H 4117.		

MAINTENANCE SCHEDULE

