

Instruction Manual

Diesel engines

DA 475

DD 575

DS 575

DF 615

DT 615

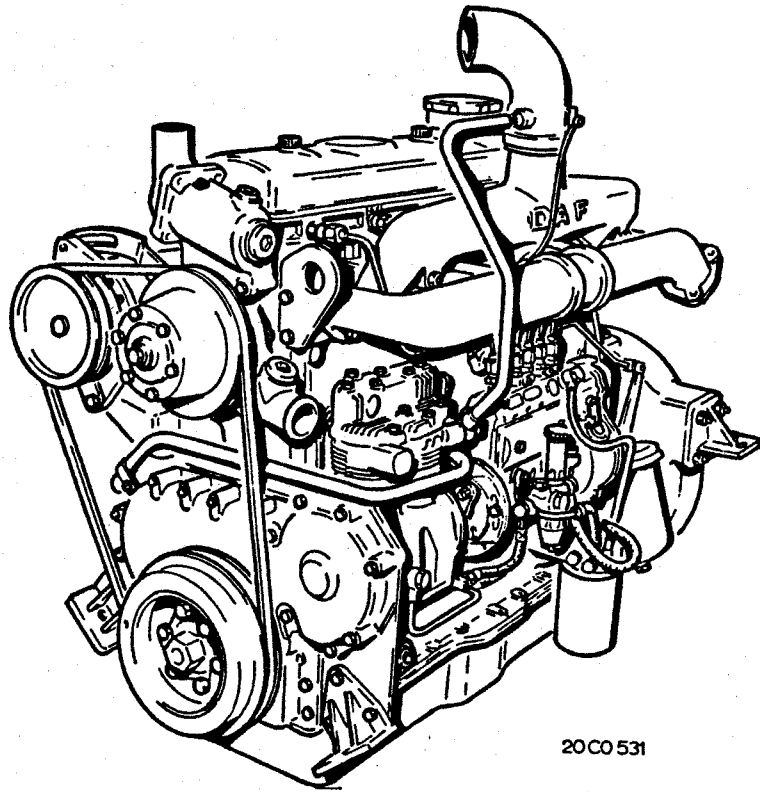
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SUBJECT TO MODIFICATIONS

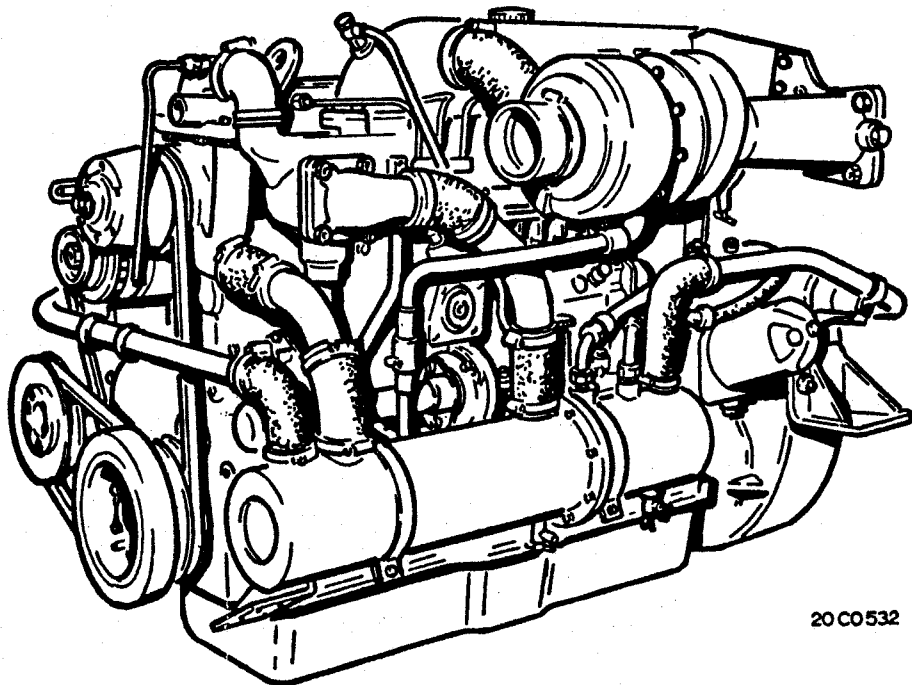
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Fig. 1
DAF DF615 diesel engine



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Fig. 2
DAF DT615-M marine diesel engine

Preface

This manual contains data concerning the operation and the maintenance of the DAF diesel-engines DA475, DD575, DS575, DF615 and DT615. These engines are produced in various versions for many different purposes and are to be recognized by the letter A, M or V following the type indication.

- A = Diesel engines for industrial applications
- M = Diesel engines for marine applications
- V = Diesel engines to be adapted to non-DAF vehicles.

The DS575 and DT615 engines are versions of DD575 and DF615 engines respectively with turbochargers.

As an introduction we point out the great importance of good and skillful repairs, but first of all the fact that regular maintenance operations are absolutely necessary.

In this connection we might draw your attention to the DAF maintenance system, which is an indispensable aid for carrying out the maintenance completely and at the prescribed intervals.

The maintenance and repair instructions of present manual are deliberately limited to work the skipper or maintenance man is able to perform.

In case of repairs and adjustments falling out of the scope of this book, you should consult a DAF dealer who is fully instructed and who should use exclusively genuine DAF parts for repairs.

Finally you should note that:

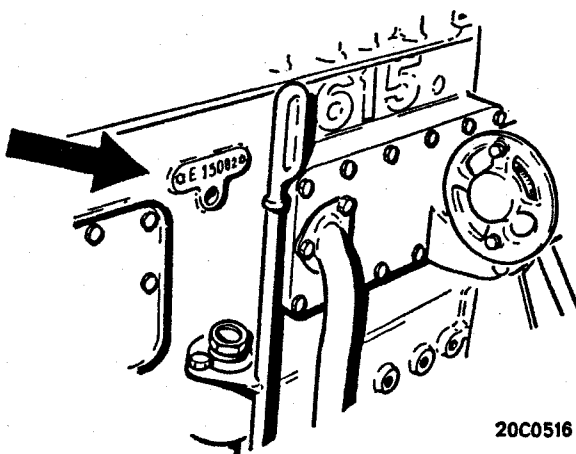
In case of unspecified stipulations, it means that they involve all engines. The terms „front“ or „rear“, „left-hand“ or „right-hand“ should be understood as seen from the flywheel side.

IMPORTANT

When ordering parts, not only the number of the engine but also the specification number as mentioned on the valve cover should be indicated.

If these data are lacking, it is not impossible that wrong spare parts are supplied.

VAN DOORNE'S AUTOMOBIELFABRIEKEN N.V.



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Fig. 3
Location of the engine number in the engine block.

TYPE	MOTORNO.
SPEC.NO.	
POMPAFSTELLING	cc
PUMPSETTING	
INSPUITMOMENT	voor
INJECTION TIMING	BDP
ONTSTEKINGSMOMENT	Before
IGNITION TIMING	t.d.c.
MAX. OMW./MIN BELAST	
GOVERNED SPEED R.P.M.	
KLEPSPELING Koud	
VALVE CLEARANCE Cold	

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Fig. 4
The engine specification plate.
When ordering parts the engine specification number should be stated, in order to ensure a correct supply of spare parts.

Controls and instruments

a. Master switch

It is advisable to provide a master switch with removable key in the cable between the battery and the starter motor. During repairs carried out on the electrical system, the key has to be taken out in order to avoid short-circuits. In this case it is not necessary to disconnect a battery cable to interrupt the current throughout the system.

b. Starter switch

The starter switch has three positions: „out“, „contact“ and „start“. By inserting the key into the lock and by turning it clockwise, the contact is made.

When subsequently the key is turned to the right, still further against spring pressure, the starter motor is actuated. The key has to be released immediately when the engine starts; it then returns automatically into the „contact“ position.

c. Oil pressure gauge

This gauge communicates with the pressure lubrication system of the engine and it indicates the pressure prevailing in the lubrication system. The measuring element is located next to the engine oil filter.

At operating temperature the oil pressure should be:

at the least 0.35 kg/cm² with engine idling;
3.5 to 4.2 kg/cm² at 2000 rev/min.

When the engine is cold, the gauge will usually indicate a higher pressure.

Attention: If the gauge indicates a too low oil pressure, the engine has to be stopped immediately.

d. Ammeter/dynamo charge warning light

The ammeter indicates at what charging-current the battery is being charged by the dynamo or to what extent current is taken from the battery without the dynamo supplying current.

In a few types the ammeter is replaced by a warning light, which ceases burning as soon as the dynamo starts recharging.

e. Water temperature gauge

The measuring element of the temperature gauge is located in front of the thermostats so that under any condition the correct temperature of the cooling water in the engine block and the cylinder heads is indicated.

The most favourable operating temperature is 75°—80° C.

f. Rev counter

The rev counter indicates the number of revolutions performed by the crankshaft of the engine in one minute. Utmost care should be taken that this rev. number NEVER exceeds the maximum to which the engine is adjusted. The rev counter is driven from the camshaft via the drive shaft of the lubrication oil pump.

g. Working hours counter

The electrical working hours counter indicates the number of running hours of the engine. The counter starts operating as soon as the dynamo voltage is more than 8 V, which is already the case at the idling speed of the engine.

h. Stop lever

The stop lever is connected through a Bowden cable with the stop lever of the fuel pump. By pulling over the lever, the fuel pump is put into the stop position. Prior to starting the stop lever has therefore to be returned to its original position.

i. Lighting switch

The illumination of the dashboard can be switched on or off by this switch. With some types the dashboard illumination is switched on by pulling the protection cap of the lamp concerned.

j. Fuel injection pump

This pump comprises the injection pump, the governor and the fuel feed pump. The latter is provided with a knob to be actuated by hand when fuel has to be delivered from the tank whilst the engine is out of operation and when the fuel system has to be bled.

k. Cold starting device

Cold starting devices equipping the engines vary according to the engine's destination.

Where DA475 and DD575 engines with pneumatic governor are concerned, the cold starting device is operated by pulling out the stop lever located on the governor.

In case of engines with a mechanical governor, a cold starting button could be located on the front-side of the fuel injection pump; this button must be pressed in case of starting with a cold engine. Furthermore there are injection pumps equipped with an automatic cold starting device; with this system an additional fuel quantity is injected whenever started, whereas no special operation is requested.

In addition, some engines could be equipped with an electric heating spiral installed in the intake manifold, which serves for heating cold intake air when starting.

Operation

Daily check prior to the first start

- a. Check the oil level in the sump by means of the oil dipstick on the right-hand side of the engine. The oil level should always be maintained between the two marks and must neither be higher nor lower.
- b. Check the cooling water level.
- c. Check the fuel contents in the tank. If the tank has been empty or if the engine has been out of operation for a longer time, the fuel system may first have to be bled. (See: „Fuel System”).

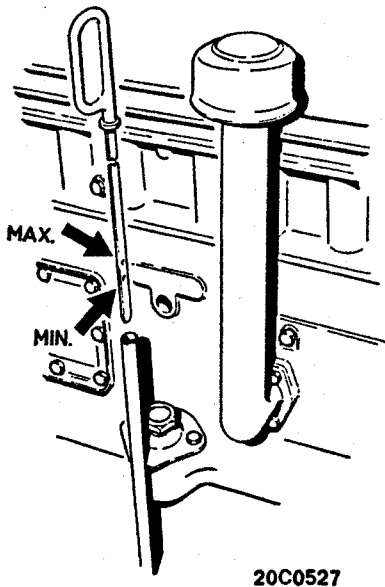


Fig. 5
The dipstick.

The lubricant level should be maintained between the two marks on the dipstick and should never be allowed to surpass the maximum level or to drop below the minimum level.

Starting the engine

Remark: In extremely cold weather it is advisable to crank the engine by hand prior to starting. In this way damage to a possibly frozen water pump is avoided.

1. Turn the main switch, if any, into the operational position.
2. Put the stop lever into the operational position.
3. Start the engine by turning the key completely to the right.

4. If, after a few seconds, the engine fails to start, the cause has to be found first.

Remark: I. Take care that after starting, the key returns from the „starting” position, since otherwise this would result in a burnt starter motor.

II. If the engine does not start immediately, a fresh start must never be attempted before the engine and the starter motor are standing still, because otherwise the starter pinion and the flywheel ring gear may be seriously damaged.

III. Avoid idling during waiting. Unnecessary running in the no-load state will have an adverse effect on the engine, since too much time is required to attain the operating temperature.

5. On cold weather, starting is made easier by using the cold starting device if provided. This is done by either pulling out the stop lever of the pneumatic governor, or - in case of a mechanical governor - by pushing in the button against the injection pump.

Cold starting device switches off automatically, after short running of the engine. If starting fails, press button again resp. pull out stop lever.

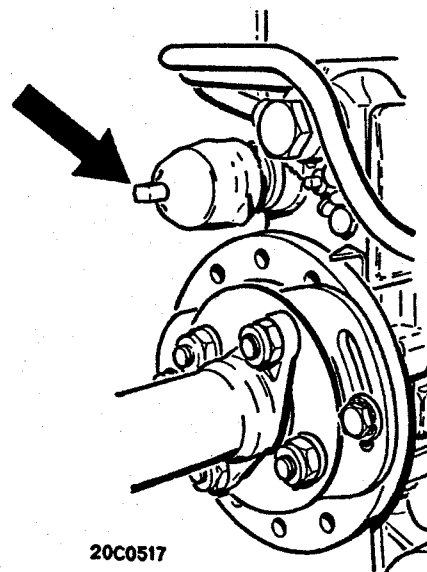


Fig. 6

Cold starting button (mechanical governor). Before operating the cold starting device, the button which is located at the frontside of the fuel pump should be depressed.

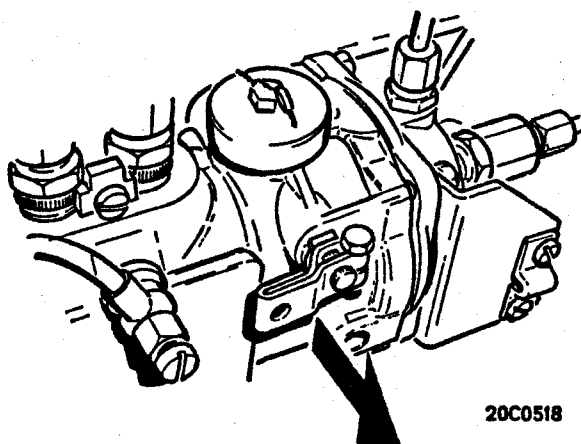


Fig. 7
Cold starting button (pneumatic governor).
For operating cold starting device, pull out cold starting lever.

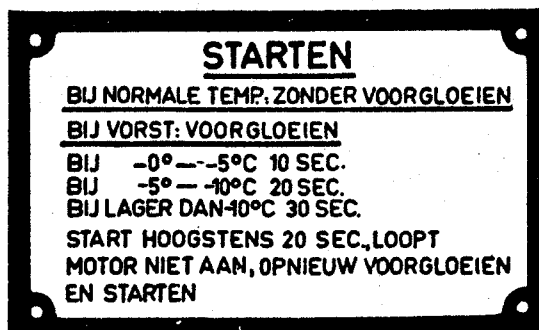
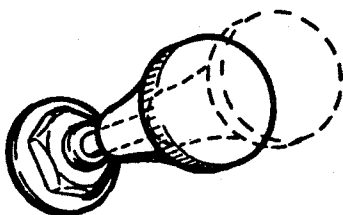
6. On very cold weather, starting is made much easier by using - if provided - the heating spiral of the intake manifold. In that case starting button can take two positions, first position actuating the heating spiral, while second position operates starter motor.

The heating times are:

for 0° C to - 5° C: 10 sec

for - 5° C to -10° C: 20 sec

for -10° C to -15° C: 30 sec



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Fig. 8
Operation button of heating spiral.
In case of a heating spiral, button is coupled to starter switch. Button pulled-out half-way: heating spiral is actuated; button further out: starter switch is operated.

Normal operation

It is very important to regularly check the working of the engine while running, by reading the instruments on the dashboard and by listening to the sound of the engine.

Cooling water temperature

The engine must not become too hot, but it should neither remain too cold. The normal operating temperature of the engine is 75° C to 80° C. It is important for the engine to reach its operating temperature as soon as possible after starting. This is best achieved by:

- a. running the engine immediately after starting at 800 to 1000 rev/min until it continues running smoothly (about half a minute);
- b. running the engine with an average speed (about 1200 rev/min) for a few minutes with some load until a cooling water temperature of about 50° C is obtained.
- c. not until then is it permissible to change over to normal load, whereas the thermostat contributes to reach operating temperature as soon as possible and to maintain it.

Oil pressure

Checking the lubrication of an operating engine is of vital importance. As soon as the oil pressure gauge indicates that the oil pressure has dropped below the required minimum of 0.35 kg/cm² at idling speed and below 3.5 to 4.2 kg/cm² at 2000 rev/min, the engine has to be stopped immediately.

Check whether the gauge indication is erroneous or whether in fact oil pressure is lacking. For checking whether lubricant pressure is available or not, the valve cover has to be removed from the engine. When the engine is started, oil has to drip from the rockers. If so, oil pressure is available but probably either the electric connection or the gauge is defective. It is possible to continue the trip, but during the first inspection to come this has to be repaired.

If the gauge is checked by means of a conventional manometer connected to the pressure side of the oil circuit, the pointer will be fluttering if oil pressure is prevailing. This is due to the structure of a conventional manometer and is therefore of no importance.

Ammeter/dynamo charge warning light

When the pointer of the ammeter is located on the left-hand part of the dial, the batteries are not being charged by the dynamo. The same applies when the warning light is burning.

Although this defect does not directly affect engine operation, its cause should be detected as soon as possible.

Sounds

The sound produced by a running engine is indicative of its smooth operating. One becomes soon familiar with the sound of a smoothly running engine so that strange noises immediately become perceptible. Detection of the cause of strange noises has to be made as soon as possible and is even required because in many cases damaging of one or more parts may thus be avoided.

Stopping

1. Reduce the speed of the engine to idling speed.
2. Keep the engine idling for a few minutes so that the engine may cool down. The cooling water is thus prevented from attaining boiling point as a result of the fairly high temperature of the engine, so that loss of anti-freeze, if any, is avoided.
3. Stop the engine by means of the stop lever.
4. Put the contact switch into the "out" position.
5. Switch off the main switch at the end of the day's task.

Running-in period

For the first 200 working hours the engine should perform only easy, light work. A comparatively high number of revolutions is by far not as detrimental as overloading of the engine at low speed.

It has to be emphasized that the engine should not perform e.g. heavy towing during the running-in period. It is, however, advisable to vary the engine speed frequently during this period.

OPERATION IN BRIEF

a. Check prior to starting

1. Lubricant level
2. Cooling water level
3. Fuel contents in the tank

b. Starting

1. Main switch "on"
2. Stop lever "open"
- 2a. If available: operate cold starting device and possibly heating spiral
3. Starting
4. Oil pressure checking
5. Running to reach operating temperature

c. Stopping

1. Slow down to idling speed
2. Idling for a few minutes
3. Stop lever to "stop"
4. Contact switch "off"
5. Main switch "off"

Maintenance

Whether an engine operates satisfactorily does not only depend upon the quality and the choice of the correct type, but also upon the method of loading and the maintenance. Nevertheless even the most careful maintenance and the best treatment cannot avoid that an engine that meets even the highest requirements will show signs of wear in the long run. This wear becomes manifest sooner with certain parts than with others and the progress is quite gradual so that, unless special attention is paid, it is hardly noticeable. However, if not checked in time, the wear may have assumed such proportions that important repairs may be unavoidable.

Such repairs may not only involve costs of labour and material, but they may also cause delay in the operator's daily business which although not to be expressed in terms of money, may be quite considerable in its consequences.

Stagnation in the operation should be prevented not only by an appropriate treatment but also by periodical checks and maintenance. The DAF organization offers you a special service in this respect, which is fully described in the booklet „Maintenance System for DAF Engines“. Ask your DAF agent.

Check and service the engine with regular intervals. It should be noted that under unfavourable operational conditions the intervals mentioned under Periodical Maintenance for the working hours may, if necessary, have to be reduced. Consult your DAF agent.

Technical data

Make	DAF
Type	Water-cooled direct injection diesel engine DS575 and DT615: with turbo-charger
Number of cylinders	6
Bore	DA475, DD575 and DS575: 100.6 mm DF615 and DT615: 104.2 mm
Stroke	DA475: 100.0 mm DD575, DS575, DF615 and DT615: 120.7 mm
Swept volume	DA475: 4.76 litres DD575 and DS575: 5.76 litres DF615 and DT615: 6.17 litres
Compression ratio	16 : 1
Maximum output
Maximum torque
Idling speed	DA475: 400-500 rev/min DF615: 400-500 rev/min DD575: 420-450 rev/min DT615: 450-500 rev/min DS575: 500-600 rev/min

Maximum speed (no load)	DA475: DF615: DD575: DT615: DS575:
Maximum speed (under load)	DA475: DF615: DD575: DT615: DS575:
Valve clearance (cold and hot)	0.5 mm
Threads	in accordance with SAE-standards
Weight: engine including accessories, without reversing gear	DA475: 470 kg DF615: 530 kg DD575: 530 kg DT615: 570 kg DS575: 570 kg
Firing order	1-5-3-6-2-4
Injection timing	28° before TDC (DA475, DD575 and DF615) 26° before TDC (DS575 and DT615) 26° before TDC (-A engines up to 1600 rev/min maximum speed under load)
Injection pressure	DA475: 170-178 kg/cm ² DD575: 145-153 kg/cm ² (CAV) DD575: 165-173 kg/cm ² (Bosch) DS575: 185-190 kg/cm ² DF615 and DT615: 165-173 kg/cm ²
Coolant operating temperature	75-80° C
Capacity cooling system litres (incl. expansion tank) litres (incl. expansion tank and heat exchanger) litres (incl. standard radiator)
Lubrication system	
Lubricant	Suppl. 1 (DA475, DD575 and DF615) Mil.-L-2104B (DS575 and DT615)
Viscosity below 0° C from 0° C to +30° C above +30° C	SAE 20 SAE 30 SAE 40
Oil pressure at: idling speed ditto 2000 rev/min	75-80° C cooling water temperature min. 1 kg/cm ² (new engine) min. 0.35 kg/cm ² (worn engine) 3.5-4.2 kg/cm ²
Capacity lubrication system	12 litres (including filter)
ditto	13 litres (including filter and heat exchanger)
Diesel fuel	at least satisfying British Standard nr. 2869-1967 Class A1.
Starter motor	bipolar, 24V - 4 HP
Dynamo	Various versions for direct current and alternating current.
Torque specifications	
Cylinder head nuts	DA, DD and DF: 25-26 mkg (180-190 ft. lbs) DS and DT : 29-30.5 mkg (210-220 ft. lbs)
Injector clamp nuts	4.75-5.5 mkg (35-40 ft. lbs)
Injection pipe union nuts	2.5 -2.9 mkg (18-21 lbs)

Lubrication

Engine oil quality

Most oils nowadays contain additives for improving the lubricating qualities.

Mixtures of various grades and brands usually do not give such favourable results as can be obtained by the constant use of a single type of high-quality oil. Therefore right at the start decide on an engine oil of a well known brand in accordance with specification and stick to it.

Oil level

The oil level in the sump is read from the dipstick and should be checked daily after the engine has been standing still for at least 20 minutes.

The level has always to lie between the two marks on the dipstick and must never drop below the lower mark. Prior to checking, the dipstick should be cleaned in order to avoid mistakes.

If oil has to be topped up, the type and brand should be the same, if anyway possible.

Oil change

Despite the use of good filters, impurities cannot be prevented from getting into the oil. They are mainly formed by dust sucked in from the atmosphere, acidic condensates and fine particles of carbon and metal which together may change the composition of the oil, cause wear and attack the metal surface by the formation of acids. The greater the contamination, the more serious the damage. Failure to change the lubricant in due time, may have quite serious consequences.

For the models DA475, DD575 and DF615 in general the lubricant should be changed every 200 working hours. Nevertheless for the DS575 and DT615 this should be done after every 100 working hours.

However these intervals should be reduced, when the engine operates under unfavourable conditions, for example, if it often runs at idling speed, is often started from cold etc. Consult your DAF agent.

Oil should be drained when warm and thus thin liquid. Then put the engine in such a position that all the oil can easily leave the sump through the drain hole. If necessary, use the sump drain pump.

In case of an inclined oil sump with double room, both rooms have a drain plug, and consequently both plugs should be taken off. If a sump drain pump is connected with both rooms, they both should be drained separately by turning the three-way cock.

Do not rinse the engine with kerosine or a similar product, because it is not possible to drain the

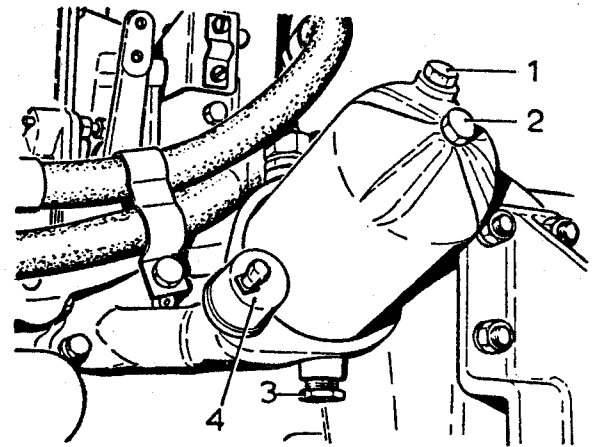
kerosine completely without removing the sump. The quantity of kerosine left will dilute the fresh oil.

Do not forget to always drain the oil filter and the oil cooler(s).

The oil filler opening should be thoroughly cleaned before fresh oil is poured in.

Running-in period

The oil of a new or reconditioned engine has to be changed after 20, 100 and 200 working hours. Subsequently a normal period of changing of 200 working hours has to be the standard. The oil filter element has to be replaced already after the first 20 working hours and afterwards every 200 working hours.



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Fig. 9
Oil filter.

- | | |
|----------------|--------------------|
| 1. Plug | 3. Oil drain plug |
| 2. Fixing bolt | 4. Oil sender unit |

Some versions have an inclined oil filter. In that case filter body should be placed so that plug 1 is located on top. Remove this plug before draining the oil.

Oil filter

The oil filter has to be provided with a new element after every 200 working hours. To this end drain the oil filter body and remove subsequently the body by unscrewing the bolt. Now the filter element is to be taken out of the body. First clean the body internally

with fuel oil, then insert the new element. After filling the engine with fresh oil, let it run for a short time, to fill up the oil filter and the oil cooler. Check the level and top up if necessary.

Note: it is advisable to examine the impurities because their nature may be indicative of some process of wear in the engine (e.g. particles of bearing material).

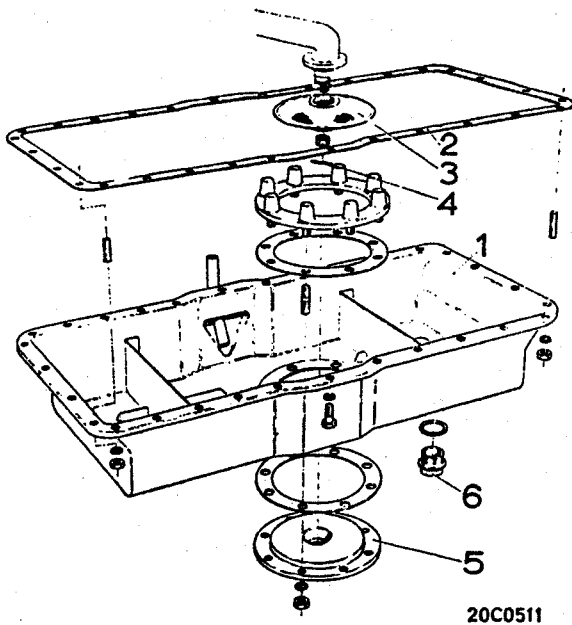


Fig. 10
Oil sump with strainer.
(standard version)

- | | |
|-------------|-------------------|
| 1. Sump | 4. Split pin |
| 2. Joint | 5. Cover |
| 3. Strainer | 6. Oil drain plug |

To drain the oil it suffices to remove plug 6 from cover 5. The strainer 3 is accessible after removal of cover 5. Do not forget to insert split pin 4 again after cleaning the strainer.

Oil pump strainer

The suction pipe of the oil pump communicates with the oil pump strainer, which is accessible through a removable cover on the bottom of sump. For this reason it is not necessary to remove the sump entirely for cleaning the strainer. Because of the particular location of the engine, in some cases it has been necessary to use an oil sump with a strainer which is accessible after removing a cover in the sidewall of the sump. In case of a double-room sump, both rooms have their own oil pump strainer.

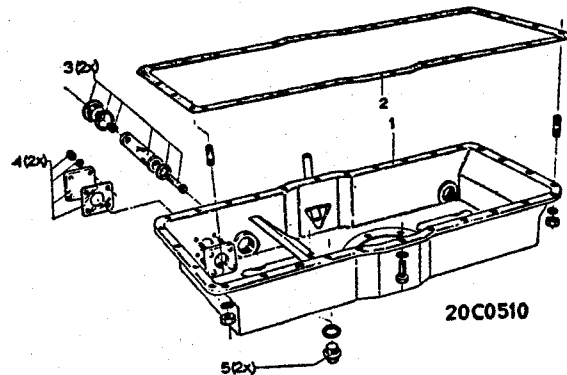


Fig. 11
Double-room oil sump.

1. Double-room oil sump
2. Joint
3. Oil strainer
4. Connection with sump drain pump
5. Oil drain plug

The double-room oil sump is divided into two separate rooms, each with its own strainer 3, oil drain plug 5 and connection possibility 4 with sump drain pump.

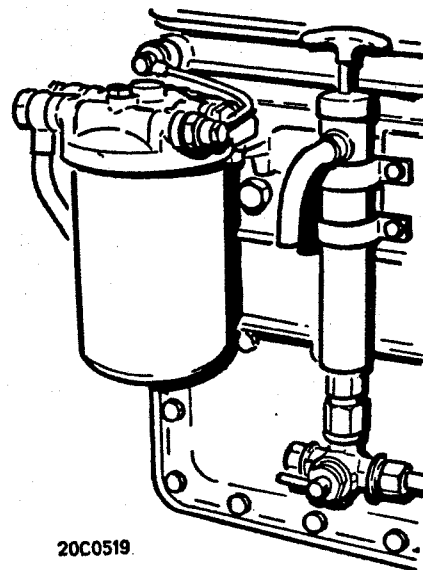


Fig. 12
Oil drain pump.

In marine diesel engines the pump is connected via a three-way cock either with the oil sumps of the engine and reverse gear, or separately with both rooms of the double-room oil sump. The sumps resp. sump-rooms are separately drained by moving the three-way cock. The cock is reset in vertical position after the pump has been used.

Dismounting and cleaning the strainer should be carried out every 2000 working hours of the engine. Cleaning has to be performed with clean petrol or fuel oil, care being taken that prior to reinstalling, the strainer is sufficiently dry to avoid dilution of the oil.

Sump drain pump

The sump drain pump permits connection of two suction pipes. In marine engines these pipes are connected with the engine oil sump and with the reversing gear. In case of a double-room oil sump the two sump rooms are connected with the sump drain pump.

Crankcase ventilation filters

The inlet filter for the crankcase ventilation is combined with the oil filler cap and is located on the valve cover. The crankcase vapour is sucked off through a filter which in some cases is connected with a pipe and is arranged on the engine's side-wall. These two filters have to be cleaned after the first 20 working hours, and subsequently every 200 hours.

The cleaning operations are as follows:

1. Flush filter thoroughly in fuel oil or flush oil
2. Sweep filter to dryness

3. Dip the filter in clean engine oil
4. Sweep again filter to dryness

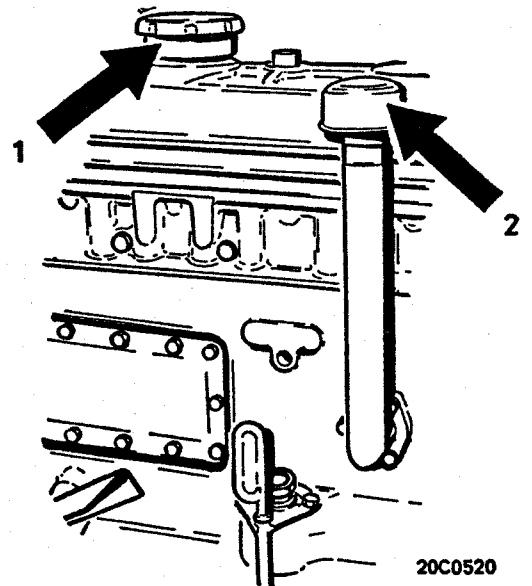


Fig. 13
Crankcase ventilation.

Air is sucked through filter 1 (also filler opening for the engine oil) and sucked off through filter 2. Often filter 2 on vehicles is replaced by a suction pipe, with its mouth in the air flow.

Fuel system

Purity of the fuel

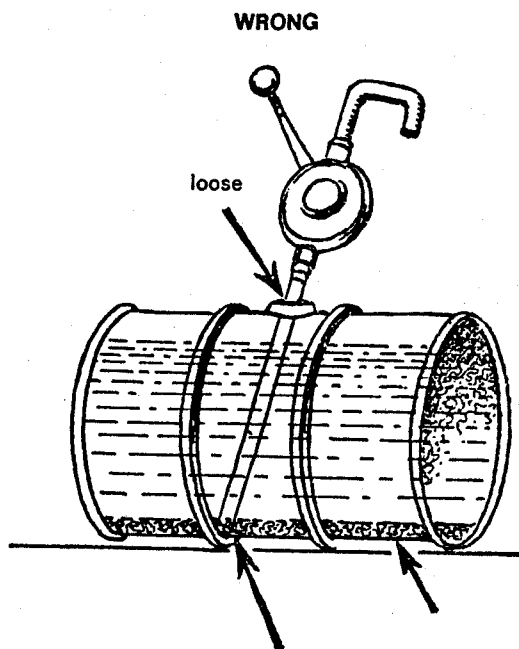
A satisfactory operation of the diesel engine requires in the first place a good quality and purity of the fuel. Regular maintenance of the filters is therefore necessary.

Do not use fuel from a drum which has been open for some time and which is very likely to contain water and dirt. Better throw away a few litres of fuel rather than take the risk of disturbances in operation due to contaminations.

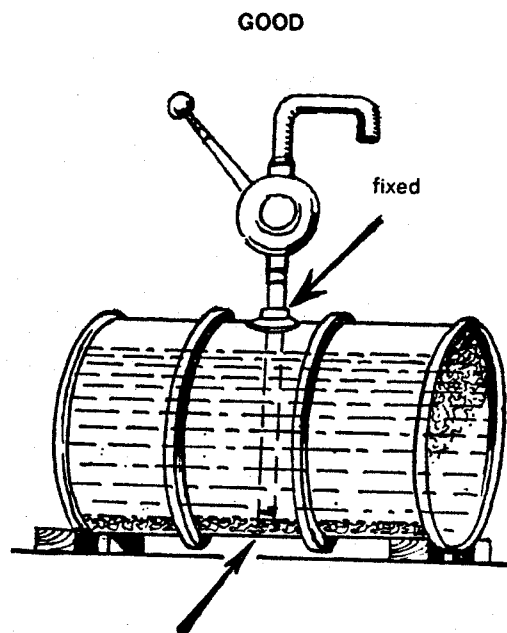
Fuel storage

As a rule the fuel for industrial and marine diesel engines is stored in the well-known 200 litre drums. In this connection some instructions for correct storing are given:

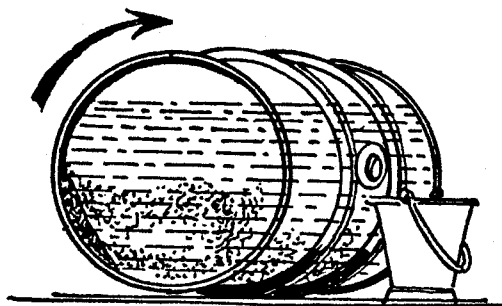
1. Always position a fuel- or oil drum in a horizontal position, especially when being stored in open air.
2. Never move the drum to facilitate pouring out.



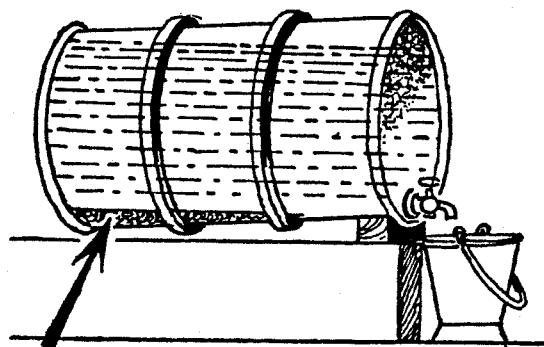
Suction opening reaches down into the sediments.



Suction opening reaches down to about 5 cm above the bottom.



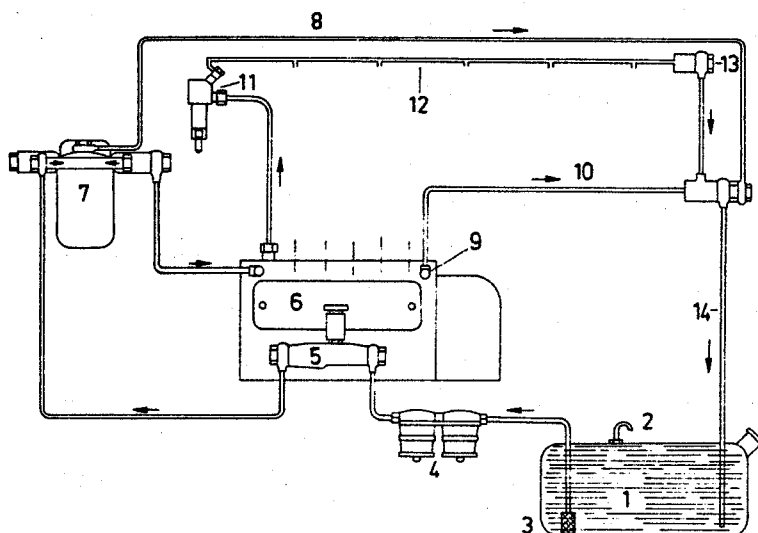
The sediments spread through the whole stock of fuel.



The sediment cannot reach the delivery tap.

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Fig. 14
FUEL STORAGE IN DRUMS



**Fig. 15
Fuel System.**

1. Fuel tank
2. Tank breather
3. Tank strainer
4. Coarse filter (moisture separator)
5. Feed pump
6. Injection pump
7. Main filter
8. Vent pipe
9. Pressure relief valve
10. Overflow pipe
11. Injectors
12. Leakage pipe
13. Non-return valve
14. Return pipe

3. Place the drum in a slightly inclined position so that the sediments cannot reach the delivery tap.
4. When an impeller blade pump is used, the suction opening should not reach down into the sediments.
5. The pump should be firmly fixed in the drum opening so that the suction opening is at a distance of about 5 cm from the bottom.
6. Leave a fresh drum in rest for a few hours to allow water and dirt to settle.

Fuel quality

Diesel fuel minimum requirement British Standard 2869-1967 Class A1.

It may be assumed that the fuel for diesel engines delivered by the well known oil companies is of good quality.

Nevertheless at very low temperatures the fuel system may get clogged due to wax deposits. This can be avoided by adding 15% of kerosene. Ice formation is prevented by adding 0.5% of methylated spirit.

Fuel tank

Since water and dirt in the fuel will settle on the

bottom of the tank, the fuel tank has to be drained after every 2000 working hours and the strainer, if any, in the tank bottom has to be cleaned.

It is not advisable to use the last litres of fuel from the tank, since this may result in dirt and air entering the fuel system.

It is therefore recommendable to fill up the fuel tank in due time and to carry out this work with utmost cleanliness.

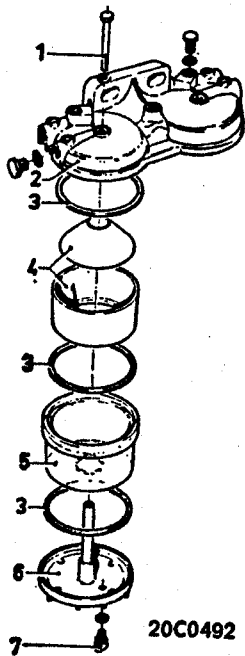
Every 2000 hours the ventilation of the tank should be checked to prevent any clogging. Venting is possible either through an orifice in the tank cap or a curved pipe on the tank.

Fuel coarse filter

The coarse filter is included in the fuel line between tank and feed pump and should be cleaned every 200 hours. For this purpose the bolt should be loosened, after which the filter body gets loose and the plate filter element can be removed. Cleaning of the element is carried out by flushing it in clean petrol or fuel oil. When the filter body is remounted, new sealing rings should be used, if required.

Some types comprise a moisture separator instead of the plate filter. The moisture separator has amongst others the function of separating the water from the fuel oil. For removing the water, the bowl has to be drained regularly by slightly opening the cock until the water has completely vanished. Drain-

ing can best be carried out after the engine has been standing still for a longer time, so that any water has been able to settle down. During the over-all inspection the deposit bowl and the small deposit bowl below the feed pump have to be cleaned.



1. Central bolt
2. Cover
3. Sealing ring
4. Guide cone
5. Deposit bowl
6. Bottom
7. Drain cock

20C0492

Fig. 16

Moisture separator (twin-type).

Do not tighten the central bolt too much to prevent breaking of the glass bowl.

Main fuel filter

The main filter is mounted in the fuel line between the feed pump and the injection pump. After every 400 working hours the element has to be renewed. Unscrew the bowl and replace it as a whole by a new one.

The old bowl must never be cleaned internally and used again.

Each time the sealing ring on the upper side of the bowl has to be replaced by a new one; the contact surfaces and the sealing ring should be clean.

All these operations should be carried out with clean hands!

Fuel lines

The lines have to be absolutely air-tight. Leaks in the fuel lines may occur on the pressure side or on the suction side of the feed pump.

Leaks on the pressure side

These are detected by cleaning the union nuts and lines on the outer side and checking them while the

engine is running. The union nuts of the fuel lines should not be forced during tightening.

Leaks on the suction side

If there are leaks between fuel tank and fuel feed pump, air may penetrate into the lines. In this case all union nuts between the fuel tank and the feed pump have to be firmly tightened.

Air may penetrate into the lines in a different way, i.e. if the stock of fuel in the tank is too small. This should be checked in the first place.

Replacement

If the fuel lines between the injection pump and the injectors have to be replaced, these lines have always to be mounted so that they exactly join the pump and the injector without stress at any point. See to it that the old line is always replaced by a genuine DAF line of the same length and the same internal diameter. It is furthermore important for the lines to be clamped tight by means of the respective clamping blocks.

Bleeding

If despite of all precautions air is found in the fuel system, bleeding is required. For this purpose the

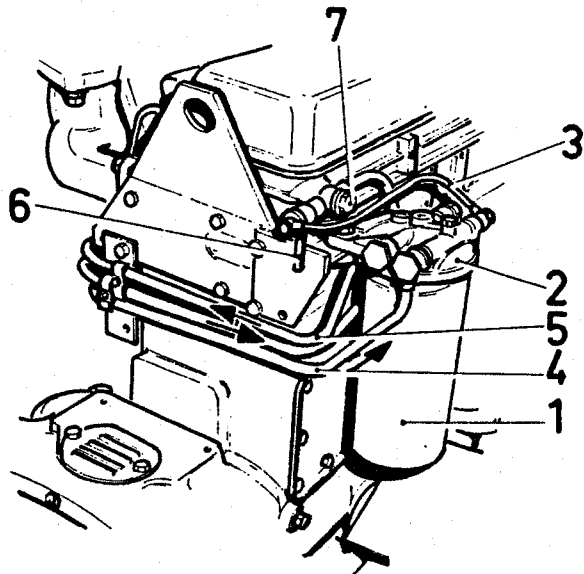


Fig. 17
Main fuel filter.

- | | |
|--------------------------|-------------------------------|
| 1. Filter element | 5. Outlet to injection pump |
| 2. Cover | 6. Fuel leak-off hose to tank |
| 3. Vent pipe | 7. Non-return valve |
| 4. Supply from feed pump | |

feed pump can be actuated by means of a milled knob by hand and on the main filter a vent screw is provided. Unscrew the knob of the feed pump and move the knob up and down until the fuel flowing from the opened vent hole onto the main filter does not contain air any longer. Tighten subsequently the vent screw while pumping. Finally the knob on the feed pump has to be pressed downwards and secured.

Fuel Injection pump

The fuel injection pump is a precision instrument to be handled only by specialists having the required tools at their disposal.

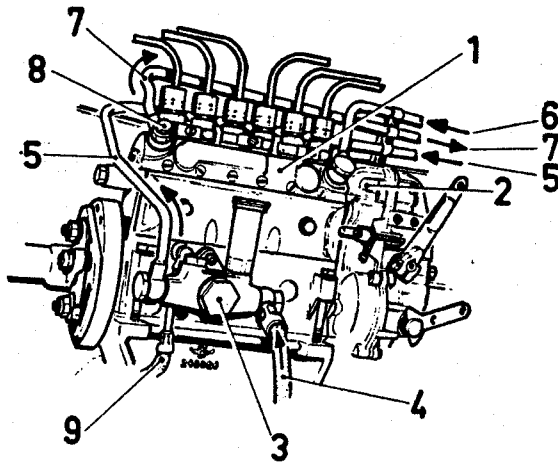


Fig. 18
Bosch fuel injection pump.

- | | |
|--------------------------|-----------------------------|
| 1. Injection pump | 6. Supply to injection pump |
| 2. Governor | 7. Overflow pipe |
| 3. Feed pump | 8. Non-return valve |
| 4. Supply from tank | 9. Oil supply |
| 5. Outlet to main filter | |

If the fuel supply to the injectors is normal - which may be inferred from the „cracking“ noise perceptible near the injectors when the engine is running - the failure to start may be due to erroneous adjustment of the pump. In such a case there may have been shifting of the coupling on the pump. This can be remedied as follows:

- Loosen the two clamping bolts of the pump coupling adjusting plate.
- Shift off the cover of the inspection hole in the flywheel housing.
- Crank the flywheel until mark no. 1 - inj. 28 (or 26) is located just under the pointer pin, with no. 1 cylinder in its compression stroke.
- Turn the flywheel on the fuel pump so that the mark is located just under the metal needle.
- Tighten the two clamping bolts firmly in this position.

If the desired result is not achieved, the DAF agent should be asked for checking and adjustment. It is advisable to have these operations performed every 2000 hours by an expert.

The Bosch fuel injection pump is connected with the lubricant circuit of the engine and therefore does not require maintenance with respect to lubrication. Do not forget to fill a newly mounted fuel pump with about 500 cc of engine oil before it is taken into operation.

The CAV fuel injection pump should be filled with about 250 cc lubricating oil separately. This oil should be changed every 100 working hours.

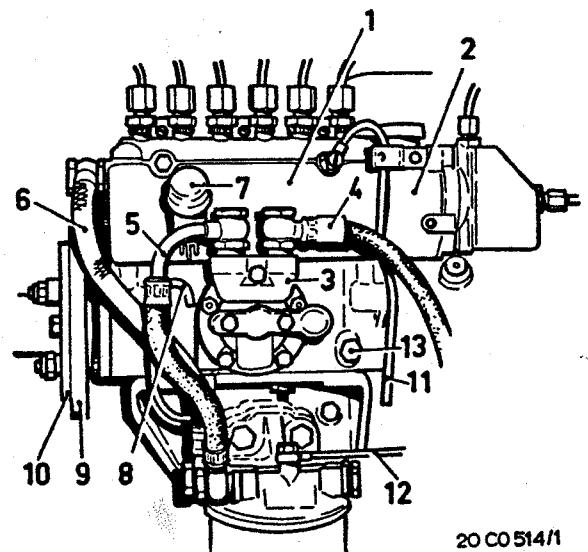


Fig. 19
CAV fuel injection pump

- Fuel injection pump
- Governor
- Feed pump
- Supply from tank
- Outlet to main filter
- Supply to injection pump
- Oil filler cap
- Overflow pipe for lubricating oil
- Flywheel
- Adjusting plate
- Bleeder
- Leakage pipe to tank
- Oil drain plug

Governor

The BOSCH governor is connected with the oil lubricating circuit of the engine via the fuel injection pump, and consequently it does not require any lubricating maintenance. Nevertheless a newly mounted governor must be filled up till level plug with lubricating oil before starting its service. The CAV mechanical governor must be filled up separately with lubricating oil till level plug. Verify oil level; and if necessary top up after 100 service hours.

Note: it is allowed to use the same type of oil for engine, injection pump and governor.

Injectors

A satisfactory operation of the diesel engine requires a correct adjustment of the injectors to the correct injection pressure. The adjustment has to be performed by an expert by means of the required tools.

It is therefore advisable to have always some correctly adjusted spare injectors at one's disposal. If it is doubtful whether an injector is operating correctly, the following process may be carried out:

With idling speed the union nut of the injection line at the injector is unscrewed until fuel oil can escape. If it is the union nut of a poorly operating injector, loosening does not perceptibly affect the operation of the engine. However, this test is not a proof of the bad operation of the injector, because an element of the fuel injection pump may be defective.

This can be detected by replacing the presumably bad injector by a good spare injector and by repeating the test.

Checking the injectors has to be carried out at any rate every 1000 hours and, moreover, immediately when the engine fumes excessively under normal load.

Cooling system

Cooling system

Summer: Tap-water with the addition of 1% of an emulsifying oil.

Winter : Water-antifreeze mixture with an emulsifying oil, if necessary.

Draining

For completely draining the cooling system the filler cap has to be removed and all drain cocks i.e. in the cylinder block, the exhaust manifold, the oil cooler and the intercooler, if any, have to be opened.

It is furthermore advisable to run the engine at idling speed for a very short time ($\frac{1}{2}$ minute at most) in order to avoid residues of water, which might cause damage when freezing.

It is furthermore recommendable to re-use the drained water to fill up the cooling system, since fresh water promotes the formation of scale.

Filling

Do not pour cold water into a hot engine, since this

Air filter

The oil wetted wire wool air filter has to be cleaned periodically, at least each time when engine oil is changed, but - in accordance with operational conditions - more frequently if required. Consult your DAF agent.

Cleaning should be carried out as follows:

1. The opening in the inlet manifold is covered with a clean cloth so that foreign objects and dirt cannot get into the engine.
2. Flush filter thoroughly in fuel oil or flushing oil.
3. Sweep or blow filter to dryness.
4. Dip filter in clean engine oil.
5. Have filter dripped dry and reinstall same.
6. The connection between air filter and inlet manifold of the engine should be tight in order to avoid penetration of non-filtered air.

In case of an oil bath filter the oil sump must be cleaned and filled with fresh engine oil up to the level mark, **NEVER OVER THIS MARK.**

The filter element must be cleaned with fuel oil; it is never allowed to clean it with water, steam or lye.

may cause cracks in the cylinder head or in the block.

It is necessary to add a rust inhibitor to the cooling water in order to inhibit the corrosive action in the cooling system. The anti-corrosion agent has to be an emulsifying oil up to 1% by volume of the cooling water.

The cooling water thus obtains a milky white colour. If during a regular inspection the cooling water is found to have turned more transparent, a small quantity of this oil may be added.

Anti-freeze agents usually contain by nature a rust inhibitor.

After the cooling system has been filled, the engine has to run with high idling speed for 2 to 3 minutes, after which the level in the cooling water reservoir has to be checked, coolant being added, if necessary.

Radiator and water hoses

If the air passages are obstructed, the cooling capacity of the radiator is highly reduced.

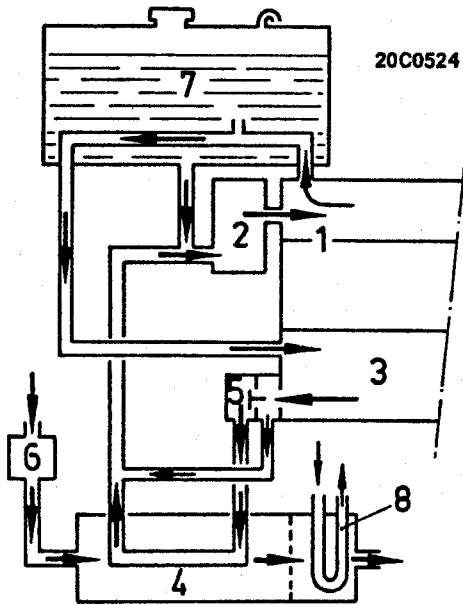


Fig. 20
Cooling water circuit. (Heat exchanger version)

1. Engine	5. Thermostat housing
2. Cooling water pump	6. Outboard water pump
3. Exhaust manifold	7. Expansion tank
4. Heat exchanger	8. Oil cooler

An easy way of cleaning is using a strong air jet or water jet directed from engine side onto the cooling block. If this remains useless, the apertures must be pierced. For this purpose it is only allowed to use a soft wooden tool, preventing damages to cooling block.

Water hoses should maintain their full passage at any time.

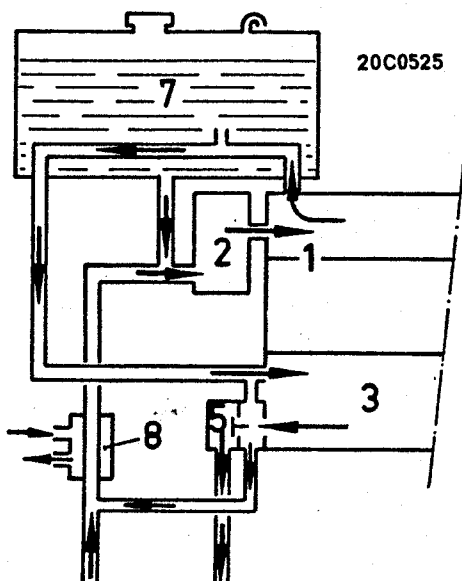


Fig. 21
Cooling water circuit. (Keel cooling version)

1. Engine	5. Thermostat housing
2. Cooling water pump	7. Expansion tank
3. Exhaust manifold	8. Oil cooler

Check every 100 hours with the engine running whether the hoses are not flattened by the suction of the engine.

It is also strongly recommended to detach a hose after 1000 working hours in order to inspect it internally.

V-belts

The tension of the V-belts should be checked every 100 hours. With the correct tension it should be possible to press down the belts between the water pump and the dynamo over 12 to 15 mm. The tension can be adjusted by means of the adjusting bolt in the dynamo support after having loosened the fixing bolt.

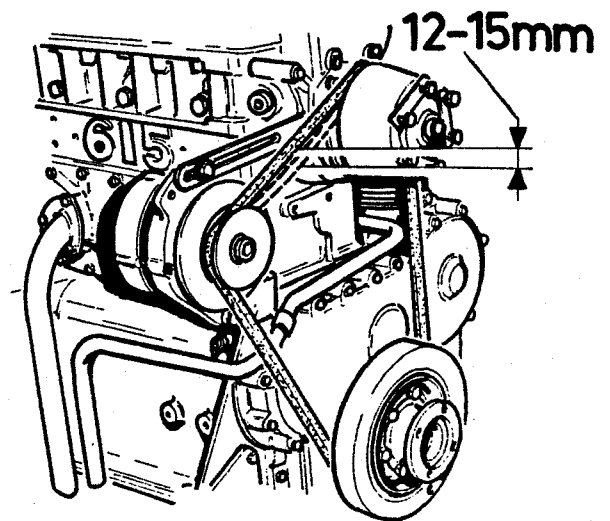


Fig. 22
V-belt tension.

The V-belt tension is correct when the belts can be pushed inwards 12 to 15 mm midway between the pulleys of the water pump and the dynamo. An excessively taut V-belt may give rise to premature wear of bearings. An excessively slack V-belt will slip.

- | | |
|----------------|-------------------|
| 1. Fixing bolt | 2. Adjusting bolt |
|----------------|-------------------|

Tension of new V-belts usually should be checked already after half an hour of operation on account of possible elongation.

Double V-belts have always to be replaced as a set.

Thermostat

The thermostat controls the coolant flow for the cold and hot engine. As long as the operating temperature is not reached, the passage of the coolant from the engine to the cooling element for the cooling water is kept closed by the thermostat.

It is obvious that a satisfactory operation of the thermostat is very important for attaining soon the operating temperature of the engine and for maintaining this temperature. A defective thermostat should be replaced immediately.

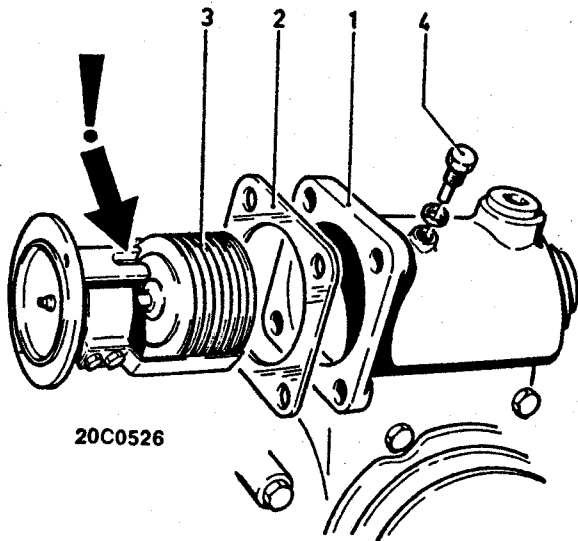


Fig. 23
Thermostat and thermostat housing.

First put sealing 2 on the housing 1, prior to fitting the thermostat 3 in such a way that locking bolt 4 is inserted in the thermostat groove.

Rinsing

It is important to maintain the maximum cooling effect of the system. For that reason the system has to be rinsed twice a year after the thermostat has been removed from the housing.

Frost precautions

When frosty weather is expected, the required precautions should be taken. The cooling water of the system must not get frozen, since this would damage the engine, the connections and the lines.

Three methods are available to avoid this:

1. Heating of the engine with the aid of a heater installed under the engine plating or under the oil pan.
2. Draining the cooling water out of the whole system.
3. Lowering the freezing point of the coolant by adding anti-freeze.

Anti-freeze agents

Various brands are being marketed under the name of anti-freeze agents, however without meeting the requirements and, although they lower the freezing point, they may cause serious damage to the cooling system.

Using fuel oil, kerosine, glycerine etc. has to be definitely avoided. The effect of said products is such that serious damages may occur.

It is strongly advised therefore to use an anti-freeze agent on the basis of ethylene-glycol of a well-known, reliable brand.

It is not possible to indicate here the desired mixing ratio of anti-freeze agents. Most good brands are sold in cans on which mixing ratios are indicated.

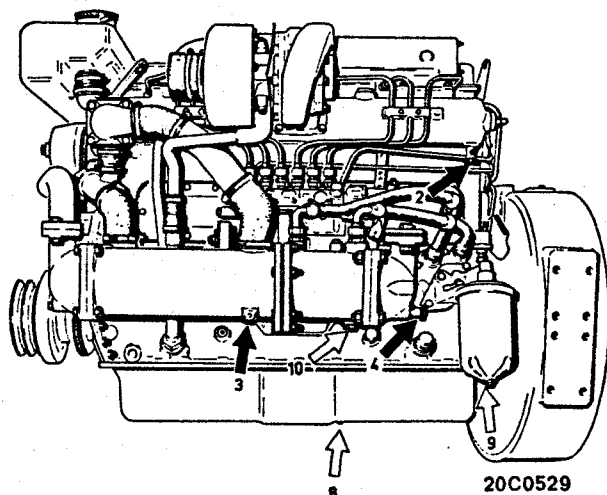
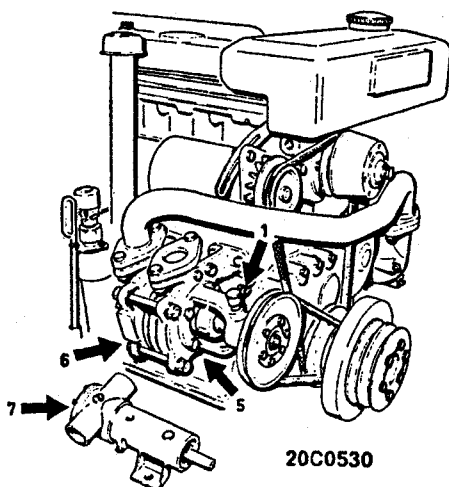


Fig. 24
Draining points of cooling water and lubrication oil

Coolant:

1. Engine
2. Exhaust manifold
3. Heat exchanger or oil cooler (engine coolant)
4. Heat exchanger (outboard water)

5. Sihi outboard waterpump
6. Sihi outboard waterpump
7. Jabsco outboard waterpump (remove cover)

Lubricating oil:

8. Oil sump
9. Oil filter
10. Heat exchanger or oil cooler

Since the specific heat of an anti-freeze mixture is lower than that of water, the temperature of the coolant will rise more rapidly at the same development of heat by the engine. This results in the temperature gauge pointer deflecting more quickly.

A few remarks:

1. Before using anti-freeze it is advisable to thoroughly clean the cooling system and to check the cylinder head gaskets for leaks (leakage of glycol in the engine results in sticking of parts). Also the water hoses should be checked and replaced, if necessary.
2. If the quantity of coolant has diminished after some time, a mixture of the same composition as the original one should be added. Water alone would raise the freezing point.
3. If the drained oil contains a sticky substance, it may be assumed that the anti-freeze has penetrat-

ed into the engine.

Thorough inspection and cleaning are required then.

Rust inhibitor

In order to protect the interior of the cooling system against corrosion, an emulsifying oil, e.g. Shell Donax C, should be added to the coolant throughout the year. The cooling system will thus be held in good condition and the risk of poor heat transfer or of clogging will be strongly reduced.

Emulsifying oil has to be added in the proportion of 1% to the coolant, which thus turns milky white. If during a regular inspection the coolant is found to have turned transparent, 100 cc may be added.

If an anti-freeze agent is used in the cooling system, it is usually not necessary to add an emulsifying oil, because most anti-freeze brands already contain a rust inhibitor.

Exhauster and air compressor

Exhauster

The exhauster is driven from the timing gear housing and is lubricated with oil vapour drawn in from the engine sump. If connection between oilsump and exhauster is broken, there is no vacuum in the exhauster, and the exhauster will run dry.

The strainer must be cleaned with fresh oil after every 400 working hours.

Air compressor

The lubrication of the air compressor is included in the engine's oil flow, and consequently it does not need a special treatment. Tighten head screws after the first 20 hours of service. Internal cleaning of the compressor head and compressed air pipes must be carried out after every 2000 working hours.

Servo steering

A hydraulic pump for steering assistance is located on the rear side of the dynamo. For this pump no particular maintenance is required. Of course main-

tenance instructions concerning the complete servo steering system must be carefully respected.

Electrical system

GENERAL MAINTENANCE

Battery maintenance

The batteries should be checked at least every 100 hours.

The liquid (electrolyte) should always be up to 5 mm above the plates. When the level has dropped below, only distilled water should be added.

The voltage, which should be at least 2 V per cell, should be measured only under load conditions. If no cell tester is available, and if only a voltmeter can be used, the illumination has to be switched on. If the cell voltage is 1.6 V or less, the cell is discharged. The differences between the cell voltages must not be more than 0.2 V. If one of the cells shows an excessive difference from the others, this may be indicative of loss of acid by leakage or internal short-circuit.

Battery terminals and clamps should be kept clean and free from oxidization. The clamps should be provided with a coating of acid-free petroleum gel. The outer side of the accumulator and especially the upper side have to be kept clean and free of grease. The vent holes in the filler caps are kept open by piercing same with piece of a wire. Ensure that the batteries are closed with the filler caps when it is necessary to work on or near the batteries, because a spark or an open fire is likely to ignite easily the explosive hydrogen gas developed in the battery.

It is advisable to check the condition of the battery from time to time by measuring the specific gravity of the electrolyte. The specific gravity will increase during the charge and decrease during the discharge.

The following data may be observed:

Fully charged 1.28 to 1.29; half charged about 1.20; discharged below 1.12. These values apply at an acid temperature of 15° C.

When the specific gravity of the electrolyte is measured, it should be checked at the same time whether the quantity sucked into the tester is clean. Dirty electrolyte may be caused by a bad condition of the plates. The battery should be replaced soon then.

The batteries should never be left unused in a discharged condition. Before storing, the batteries should be fully charged, thereafter slowly discharged (for example, by a 15 W lamp) and then again slowly charged (10 A). Once this has been done it suffices to recharge the battery every three months. The plates are thus prevented from reacting with sulphur.

Dynamo and starter motor maintenance

Dynamo and starter motor have to be checked every 2000 working hours to ensure a good working.

1. **Wiring** Check the wiring and the insulation for breakage or damage and see to it that all connections are clean and tight.

2. **Carbon brushes*** Check whether the brush moves easily in the holder after having lifted by means of a hook the spring pressing the brush against the collector.

Do not lift the spring further than required and do not move it sideways. The brushes and the brush holders have to be free of dust, oil and grease. If these parts are soiled or jammed, they should be cleaned with a clean, petrol-soaked cloth (not cotton-wool) and be dried thoroughly. The brushes should not be soaked in petrol and their blank sliding surfaces must not be worked with emery paper, a knife or a file.

Carbon brushes should be replaced when

- a. broken;
- b. the solder has got loose;
- c. worn to a length of 15 mm;
- d. the connecting wires are broken or damaged.

First the brush holder has to be cleaned, preferably by compressed air.

- Remarks:**
- a. Exclusively use the correct type of brush
 - b. Always replace all brushes at the same time.
 - c. Ensure, when inserting the brush, that the spring does not strike the brush.
 - d. It is no use mounting new carbon brushes, when the collector is not in good condition.

***Warning:** Some engines are equipped with an alternator (alternating current dynamo) which is not provided with commutator carbon brushes, but with diodes, which serve for rectifying the current. Owing to the use of diodes one should stick to the following instructions when work is carried out in the vessel.

Never disconnect the battery terminals while the alternator is rotating.

Never carry out electric welding on the vessel if the two battery terminals are not disconnected and the plug is not taken out of the regulator.

Never interchange the connections of the regulator and the generator and never connect them to earth.

Never charge the battery with the aid of a battery charger without loosening the two terminals.

Never switch on or off the master switch, when the engine is still running.

3. Commutator The commutator must have a uniform, smooth, grey surface and be free of dust, oil and grease. Dirty commutators must be cleaned by pushing a petrol wetted cloth onto them by one hand (not cotton wool) while the other hand turns the armature.

Then dry the commutator thoroughly. Grooved or non-circular commutators that are due to wear, have to be machined.

The mica has to be at a depth of 0.8 to 1.2 mm between the copper laminations. If necessary, have this carried out by an expert and never use scouring paper or emery-cloth.

The voltage control is adjusted by the factory to the correct value and sealed. Rupture of the seal cancels the right of guarantee.

Warning: Be extremely careful when using petrol. A spark may cause a small quantity of petrol vapour to explode.

It is therefore emphatically advised to switch off the current when carrying out such work.

Fault finding

Engine will not crank

- Too low battery voltage
- Broken or bad battery connections
- Fuses of starter switch blown
- Engine oil too thick
- Starter motor defective

Engine will not start

- Fuel tank empty
- Water in the fuel system
- Air or fuel leaks in the fuel system
- Feed pump defective
- Injection pump defective or incorrectly adjusted
- Injectors do not operate correctly
- Sticking valves
- Leaky cylinder head gasket

Engine starts but stops again

- Tank vent pipe clogged
- Vent screw on fuel filter loose
- Air in the fuel system
- Fuel line or filter clogged
- Water in the fuel system
- Feed pump defective

Engine misfires

- Air in fuel system
- Incorrectly operating injector
- Water in fuel system
- Sticking valves

Overheating

- Slipping V-belt
- Water shortage
- Clogged cooling system
- Defective water pump
- Thermostats sticking
- Injection too late

Smoky exhaust

- Incorrectly operating injector (black)
- Injection too late (black)
- Maximum fuel delivery too high (black)
- Engine oil level too high (blue)
- Low compression (blue)

Engine does not develop full power

- Air filter clogged
- Fuel filter soiled
- Too small valve clearance
- Leaky valves
- Fuel delivery too small
- Worn-out pistons or piston rings

Engine runs irregularly

- Air in fuel system
- Feed pump defective
- Injection pump defective
- Incorrectly operating injectors

Repairs

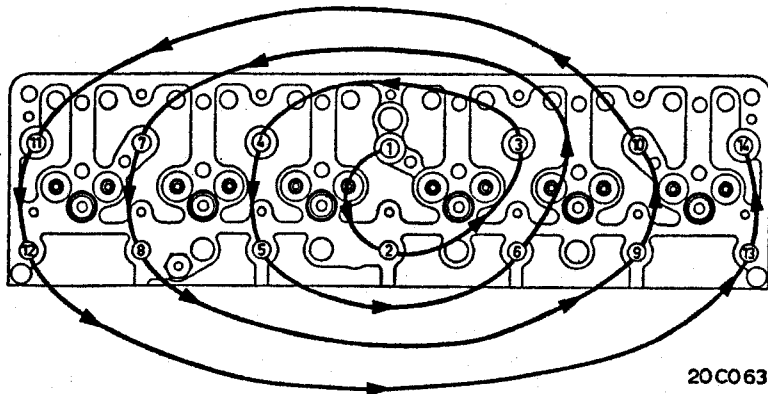


Fig. 25
Sequence of tightening cylinder head nuts and bolts.

1. Cylinder head gasket to be mounted dry, hence without oil or similar, after carefully cleaning block and head.
 2. Lightly lubricate the stud thread and the supporting face beneath the nut.
 3. Tighten nuts uniformly in the correct order.
 4. Bring the engine to the working temperature.
 5. Stop the engine and repeat 3 while it is still warm.
 6. Nuts should be retightened after 25 working hours, while the engine is still warm. Nuts have first to be slightly loosened (at the most over $\frac{1}{8}$ th turn).
- Tighten nuts in three phases:

DA475, DD575 and DF615:	13 - 20 - 26 mkg
DS575 and DT615	: 15 - 22 - 30.5 mkg

GENERAL INSTRUCTIONS

For any repair complete success depends on close observation of a few general prescriptions.

Cleanliness

A dirt particle penetrating during repair, may cause more damage than the original defect did.

- a. As far as possible carry out the works with clean hands.
- b. Clean the surroundings of a part to be dismantled before starting the operation.
- c. Cover an unprotected access by winding a cloth or paper around it.
- d. Put dismantled parts on a clean sheet of paper.

Location marks

If parts have to be dismantled which should afterwards re-occupy their original positions, marks should be made on them prior to dismantling.

Sealing

Even if it is not definitely prescribed, it is advisable to mount a new gasket or sealing ring.

Gaskets - as well as the enclosing surfaces - have

to be thoroughly clean since otherwise perfect sealing would be impossible.

Check especially whether a gasket does not, by accident, shut a passage (partly).

Observe the instructions with respect to the use of a liquid sealing compound as the case may be.

Use liquid sealing compound only sparingly. This applies especially to those places where a drop of this material might get into the oil, as this would result in run-out bearings.

Bolts and nuts

Bolts and nuts are preferably tightened always at the prescribed tightening torque. In many cases this is even compulsory.

Even if not definitely compulsory bolts and nuts should be tightened in crosswise order (never tighten two adjacent bolts in direct order of succession).

Tightening should be carried out in at least two or three phases (never tighten the bolt and the nut in one turn at the prescribed tightening torque).

Lock washers, split pins etc.

Take care to always secure bolts or nuts which were secured before. Use only reliable locking material (among others always a new split pin).

REMOVAL OF THE ENGINE

Especially if supports are used which have been adjusted in some way or other for engine alignment, it is important to provide clear marks before the engine is taken out. This will appreciably facilitate remounting afterwards.

The engine should be hoisted only by using the lifting eyes provided for this purpose.

VALVE CLEARANCE

Irrespective of whether the engine is hot or cold the clearance both of the inlet valves and the outlet valves is 0.5 mm.

The valve clearance should be measured by means of a feeler gauge between the rocker and the valve stem after the piston in the cylinder concerned has been put in T.D.C. subsequent to the compression stroke. The latter point is obtained by turning the crankshaft over almost half a stroke in the normal direction of rotation after the inlet valve of the respective cylinder is closed.

Remark: This method of determining T.D.C., which may be used for adjusting the valve clearance, is useless for an accurate determination of this point.

The correct valve clearance is obtained by loosening the lock nut of the adjusting bolt by means of a spanner and by screwing the valve adjusting bolt with a

screwdriver to such an extent, that the 0.5 mm feeler gauge can just be slipped between the rocker and the valve stem.

THERMOSTAT CHECK

For removing the thermostat it is necessary to remove the cover from the thermostat housing. Then the thermostat can be taken out of the housing. The satisfactory operation of the thermostat is tested as follows:

- Put the thermostat in a bowl of water together with a thermometer having a scale up to 100° C, and put the bowl on the fire.
- As soon as the temperature reaches about 75° C, the thermostat has to open. At 90° C the thermostat must be completely open.
- Take the bowl from the fire; as soon as the water reaches a temperature of about 75° C, the thermostat has to close.

A thermostat that does not meet the above requirements must be replaced by a new one.

REPLACEMENT OF AN INJECTOR

Tightening torque injector clamp nut:

max. 5.5 mkg (40 ft. lbs)

Clean the surroundings of the injector to be replaced to prevent dirt from falling into the injector hole. After mounting, the new injector is connected to the respective injection pipe (see also Replacement of injection pipes), after which bleeding is possible. This is done by loosening the union nut near the injector, whilst the engine is running, until the air has been able to escape. The nut is then retightened. Check the results by slightly loosening the union nut again until fuel escapes along it. When the engine then runs irregularly, the injector concerned is operating correctly. It is not at all advisable to test the operation of a loose injector, whilst the engine is running. The escaping fuel jet is sufficiently strong to cause the fuel oil to penetrate deeply into the flesh of the body, which may give rise to very dangerous infections.

REPLACEMENT OF INJECTION PIPES

A defective injection pipe has always to be replaced by a genuine spare part from the factory. During mounting it has to be ensured that the pipe exactly joins the pump and the injector without any stress and that the union nuts are not forced during tightening. It is furthermore very important to secure the pipes again with the clamping blocks.

It is always advisable to blow through new pipes with compressed air, prior to mounting.

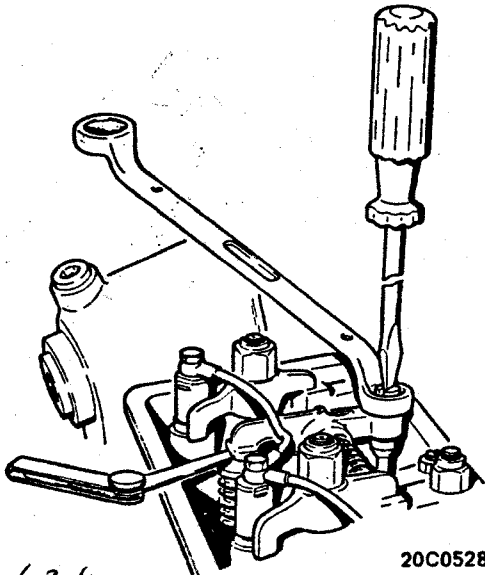


Fig. 26
Adjusting valve clearance.

In addition to the periodical inspections the valve clearance has to be checked always if one or more injectors have been replaced. After the lock nut has been tightened it is desirable to re-check the valve clearance.

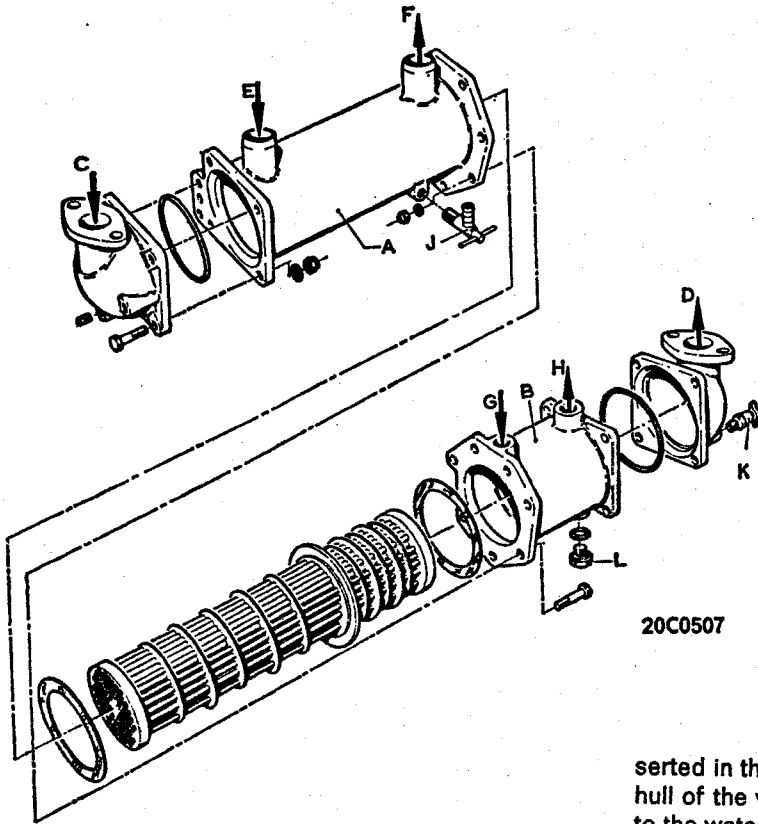
24

No 1 cylinder - rocker level - ADJUST 6.
No 5 " " " " - ADJUST 2.
No 3 " " " " - 4

No 2 level ADJUST 5
No 4 level " 3

FRANK WOOD 1-5-3-6-2-4
R. M. N. R. H. AT K. H. A. V. T.

Outboard water cooling systems



20C0507

Intercooler (mercantile type).

- A. Engine coolant compartment
- B. Engine oil compartment
- C. Outboard water inlet
- D. Outboard water outlet
- E. Engine coolant inlet
- F. Engine coolant outlet
- G. Engine oil inlet
- H. Engine oil outlet
- J. Engine coolant drain cock
- K. Outboard water drain cock
- L. Engine oil drain plug

DAF Marine Diesel Engines are usually equipped with intercooling or keel cooling and in given cases skin cooling may be used.

Intercooling

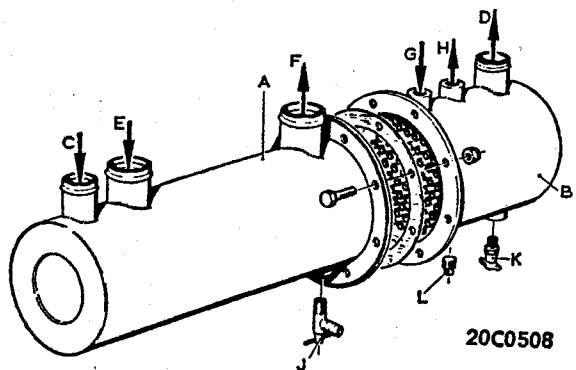
In this cooling system the cooling water of the engine is circulated in a conventional way by the water pump. The water passes through the cylinder block, the cylinder head and the cooled exhaust manifold and subsequently arrives via the oil cooler at the thermostat housing. When the thermostat is closed because the coolant is not yet at the operating temperature, the water flows directly back to the water pump.

If the thermostat is open, the coolant is first guided to the intercooler, where it can give off its heat to the outboard water, which is forced by a separate pump through the intercooler. If also the lubricating oil of the reversing gear has to be cooled, this is carried out in a separate cooler arranged between the intercooler and the water pump of the engine.

Keel cooling

In this system the water pump of the engine forces the hot cooling water through a bunch of pipes in-

serted in the water circuit and arranged on or in the hull of the vessel. At this place water gives off heat to the water flowing alongside. Therefore keel cooling dispenses with the outboard water pump and the intercooler.



20C0508

Intercooler (yacht type).

This intercooler consists of two main parts for cooling, respectively the engine coolant and the engine oil by outboard water.

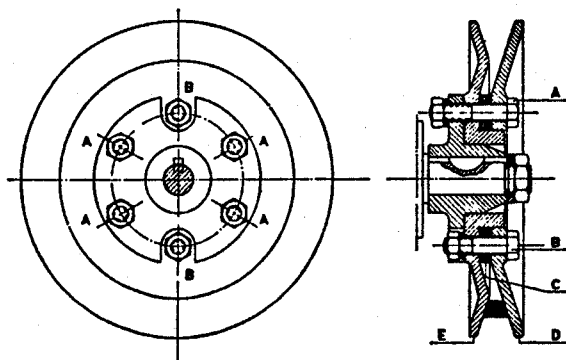
- A. Engine coolant compartment
- B. Engine oil compartment
- C. Outboard water inlet
- D. Outboard water outlet
- E. Engine coolant inlet
- F. Engine coolant outlet
- G. Engine oil inlet
- H. Engine oil outlet
- J. Engine coolant drain cock
- K. Outboard water drain cock
- L. Engine oil drain plug

Skin cooling

In principle skin cooling is for a large part identical to keel cooling. The function of the bunch of pipes is performed here, however, by a comparatively large water store, one or more surfaces of which are formed by the hull plates of the vessel so that they are in contact with the cold outboard water.

Outboard water pump

For the data and instructions relating to the outboard water pumps used by DAF, reference is made to the respective chapters of this booklet. Since the outboard water pump is not adjustably fastened to the engine block, the V-belt tension has to be adjusted by setting the pulley. The pulley comprises for this purpose two loose flanges D and E, which are clamped to each other with the interposition of the shims C by the two bolts B. The complete disc is fastened to the pump hub by the four bolts A to the pump hub.



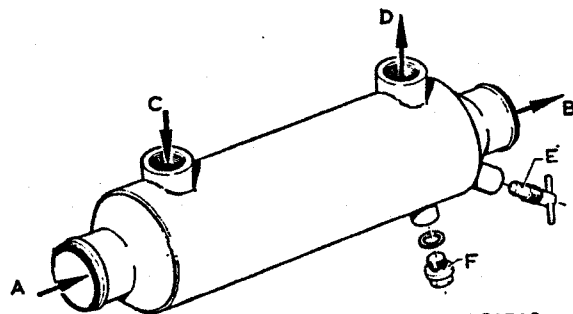
V-belt of outboard water pump.

Belt tension is adjusted as follows:

1. Loosen the four bolts A and take the disc off the pump.
2. Loosen the two bolts B.
3. Take out two (or a multiple of two) shims.
4. Refasten the outer disc halves to each other.
5. **Important:** Put one half of the number of removed shims between the inner disc half and the pump-hub and put the other shim(s) beneath the head or beneath the nut of the bolts A.

Maintenance

Since soiling of the sucked-in outboard water completely depends on the local conditions, no generally applicable intervals can be prescribed for



Engine oil cooler

- A. Water inlet
- B. Water outlet
- C. Engine oil inlet
- D. Engine oil outlet
- E. Water drain cock
- F. Oil drain plug

cleaning the filter system. The same applies to the intervals of checking whether the degree of soiling is such that the cooling effect has become insufficient. However, if these checks are made regularly, the risk of difficulties with the outboard water cooling system is extremely small.

After some time sediments will be formed in the intercooling pipes so that the outboard water cooling will no longer be effective.

This will become apparent from the coolant temperature gauge reading, exceeding the standard value. In such a case the intercooling flanges should be removed and the tubes pierced.

Use a rattan stick or copper wire of largest thickness, with a rounded off end in order to avoid the tubes being damaged.

Draining

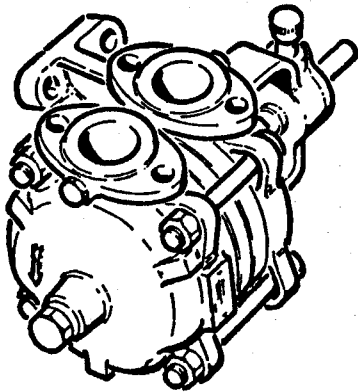
With frosty weather, water not mixed with anti-freeze should not be left anywhere in the cooling system. This applies particularly to the outboard water. For a complete removal of the outboard water, drain plugs are provided in the outboard water pump and in the intercooler.

It is absolutely required for all drain plugs to be removed in order to ensure that no water is left.

Expansion tank

DAF marine diesel engines are equipped with a small storage tank for engine coolant, the so-called expansion tank. This small tank must not be filled up; only three quarters should be filled. A full tank would result in loss of coolant through the vent pipe.

SIHI outboard water pump



Sihi outboard water pump.

General

The Sihi outboard water pump is a self-priming suction pump consisting of five main components. The bronze impeller with rubber coated blades rotates in a chamber bounded by two bronze partitions clamped tight between two cast iron flanges. On the driven side the pump is supported in a ball bearing which requires regular lubrication by means of a grease cup. The non-driven side is supported in a water-lubricated plain bronze bearing.

The pump shaft is sealed in the usual way by means of a stuffing box. A slinger arranged on the pump-shaft prevents any water leaking along the shaft from reaching the ball bearing.

Maintenance

Priming instructions

Before the pump is operated for the first time, the following process has to be carried out:

1. Check whether the pump-shaft can be turned by hand.
2. Fill the pump completely with water via the plug holes in the two flanges. This has to be repeated each time after the pump is drained.
3. Check the temperature of bearings and stuffing box after the pump has run for some time (at the most handwarm).

Lubrication

Lubricate the ball bearing after every 300 working hours by one turn of the grease cup.

Draining

If temperatures below freezing point are anticipated the pump has to be drained completely by removing the plugs in the inlet flange and in the delivery flange. During draining turn the shaft by hand until water escapes no longer.

Running dry

The pump must never run without water!

V-belt

Check the tension of the V-belt every 100 working hours. Between the pulleys deflection over 12 to 15 mm should be possible. An excessively taut V-belt results in excessive wear of the bearings. A slack V-belt is likely to cause slipping.

Renewal of packing rings

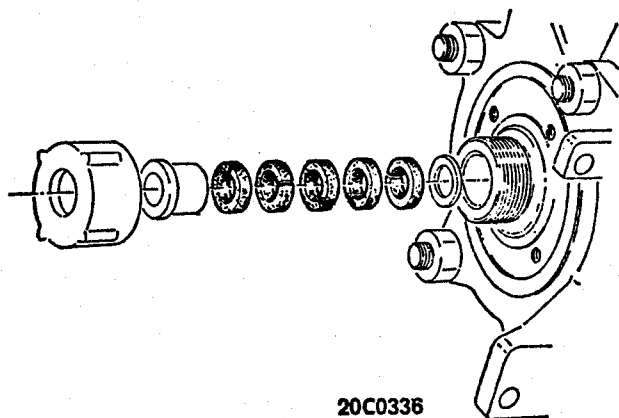
Only use the original packing rings available as a DAF part.

Remove accurately all old packing material.

Verify if the ring sections are mounted in staggered positions. Tighten firmly the gland nut so that the shaft can only just be turned by hand. Unscrew the gland nut and retighten it by hand, after which the shaft should revolve without undue binding.

It is advisable to allow the gland nut to leak slightly because it prolongs the shaft's lifetime. Excessive tightening of the gland nut may result in destruction of the pump shaft and the packing.

The gland nut has to be tightened when the engine is standing still. Only if this is not possible, it is allowed to do otherwise.



When mounting the packing rings the ring gaps have to be in staggered positions.

JABSCO marine pump

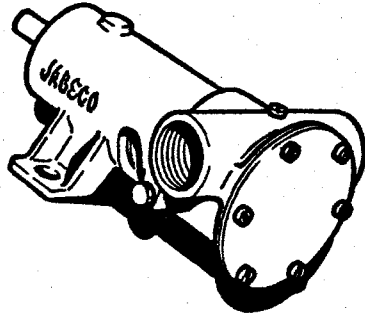


Fig. 1
View of Jabsco marine pump.

General

The Jabsco marine pump comprises two main components, viz.: a bronze pump body and a cast iron bearing housing, clamped together by means of a bolt.

The synthetic impeller rotates within the pump body. Owing to the configuration of the flexible impeller vanes water is drawn in and is forced along under pressure.

The bearing housing is sealed at either end by a grease seal. Sealing between pump body and bearing housing is effected by means of a carbon seal. Any water which might seep past this seal is deflected by the slinger mounted on the shaft and is thus prevented from entering the bearing housing.

Maintenance

V-belt

Check the tension of the V-belt after each 100 hours of operation. Belt deflection should be approx. 12 to 15 mm measured midway between the pulleys. An over-tight V-belt reduces bearing life. A loose belt on the other hand allows slipping.

Draining

If temperatures below freezing point are anticipated the pump should be drained by loosening the end-cover screws and allowing all the water in the pump to flow out.

Running dry

Do not allow the pump to run dry for more than 10 seconds.

Operating temperature

The operating temperature of the pump may not exceed approx. 45° C.

Laying up vessel

If the vessel is to be laid up for a considerable length of time, it is recommended to remove the impeller from the pump body. Store the impeller in a dry, cool and frostproof place.

Impeller replacement

Fig. 2 shows how the impeller can be prised out of the pump body by means of two rods slightly curved at the ends.

Moisten the new impeller with water and introduce it into the pump body bore with a rotary motion until its splines engage with the splines of the pump shaft. Push impeller fully into pump bore.

If the vanes of a used impeller do not regain their starting position, the impeller should be installed reversely to ensure that the full pump capacity is maintained.

Use a standard .010 in (0.25 mm) thick end-cover gasket. A thicker gasket will reduce the priming ability of the pump while a thinner one may cause the impeller to interfere with the end-cover and thus become badly damaged.

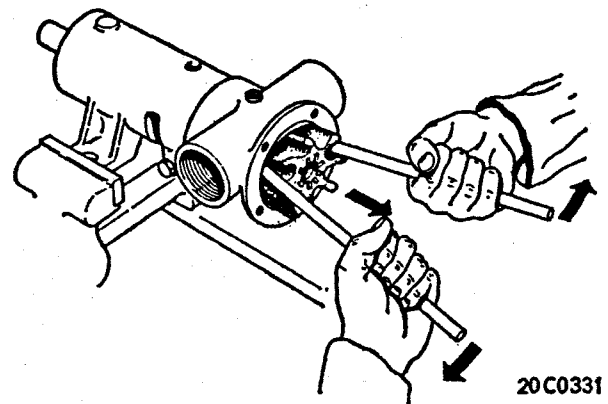
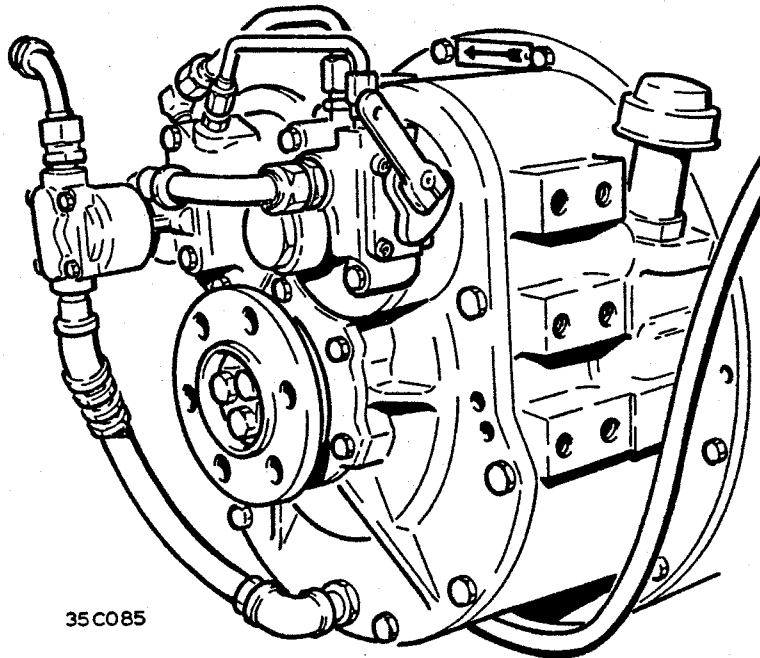


Fig. 2
Impeller removal.

TWIN DISC reversing gear



Twin Disc reversing gear MG-506

Technical data

Make	Twin-Disc
Model	MG-506
Type	hydraulically operated multiple plate reversing gear
Oil	
quantity inclusive of cooler and lines	4.5-5 litres
quality and viscosity	as prescribed for the engine lubricant
operating temperature	normal 60 to 83° C min. 60° C max. 107° C
actuation pressure (engaged)	21-22 kg/cm ² at 1800 rev/min and 83° C
ditto (neutral)	19 kg/cm ² at 1800 rev/min and 83° C
lubricating and cooling oil pressure	0.5 kg/cm ² at 1800 rev/min and 83° C
pump capacity	8.5 litres/min at 1800 rev/min

Description

In the Twin-Disc reversing gear the transmission of the engine power to the propeller shaft is achieved by means of two gear wheel sets, which are coupled in accordance with the desired direction of rotation

of the propeller shaft by means of one of the two hydraulically actuated multiple plate clutches. At the same time the engine speed is reduced. Oil pressurized by a pump is forced through a

control-valve to one of the plate clutches and provides the required pressure on the friction plates. The oil serves in addition as a lubricant and coolant. In order to keep the temperature of the oil within permissible limits, an oil cooler is included in the circuit, where the oil is cooled by means of the engine cooling water.

In the forward direction of navigation the propeller shaft rotates in the same direction as the engine crankshaft. In the reverse direction the directions of rotation of the propeller shaft and the engine crankshaft are opposite to each other.

Operation

If engine and reversing gear are not controlled simultaneously by an engine room telegraph, care should be taken that:

1. switching from neutral to forward or reverse direction should not be carried out at engine speeds higher than 1900 rpm.
2. switching directly from forward to reverse or vice versa should not be carried out with the engine running at more than 1200 rpm.

Maintenance

Oil level check. This check must be carried out with the engine idling. The oil level should be maintained between the „low“ and „full“ marks on the dipstick.

Oil filling. The oil should be poured into the oil sump through the breather pipe. After filling the engine should be started and the oil level has to be rechecked at idling speed.

Oil change. The oil should be changed after the first 20 and 200 working hours and subsequently it has to be repeated after every 1000 working hours. When the ship has been out of service for more than three months, the oil should be changed before service is resumed.

Oil of the same kind and viscosity can be used for the engine and the reversing gear.

The oil is drained by means of the pump also used for emptying the engine sump. Draining should be carried out whilst oil is still warm and is able to flow back to the oil sump (after 15 to 20 minutes). Do not forget to drain the oil from the oil cooler as well.

Oil strainer. The oil strainer in the main housing should be cleaned after the first 20 and 200 working hours and subsequently after every 1000 working hours. Cleaning should be done in pure fuel oil. The strainer is then blown to dryness and a new gasket is to be used when mounting the strainer in the main housing.

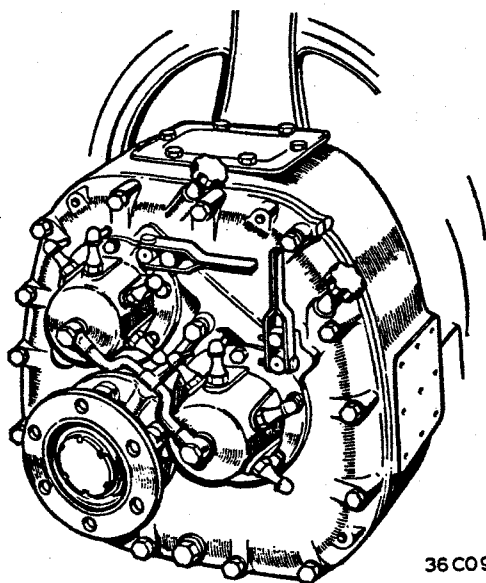
Breather filter. The breather filter should be cleaned at every oil change by flushing it thoroughly in clean fuel oil.

FAULT FINDING

Symptom	Cause
Oil pressure too low	partially clogged oil strainer
No oil pressure	no oil or insufficient quantity in sump clogged oil strainer damaged oil supply lines
Oil temperature too high	too much oil in sump wrong type of oil
Excessive noise	air leakage in suction side of oil system
Clutch not engaging smoothly	air leakage in suction side of oil system

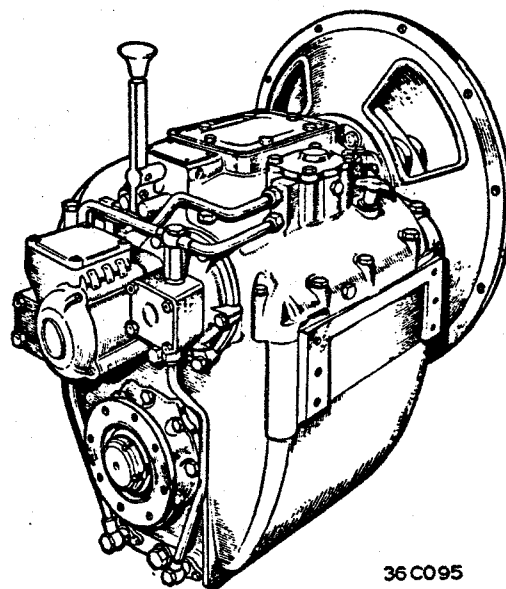
Z.F.-Reversing gear

types BW30E30 - BW30E25 - BW30ES25 - BW30E45 - BW30ES45



36 C094

Z.F.-reversing gear, type BW30E30



36 C095

Z.F.-reversing gear, type BW30V2

Technical data

Transmission ratios (optional)
 Current consumption, 24 V system
 Ditto , 12 V system
 Ampère value of fuses, 24 V system
 Ditto , 12 V system
 Oil pressure at 1500 rev/min and 75° C
 Lubricant quantity
 Lubricant type
 Material of clutch housing
 Weight

BW30E30	BW30E(S)25	BW30E(S)45
1.0 or 3.0	1.0 or 2.5	3.9 or 4.5
40 W	55 W	55 W
40 W	45 W	45 W
4 Amp.	4 Amp.	4 Amp.
6 Amp.	6 Amp.	6 Amp.
1-3 kg/cm ²	2-4 kg/cm ²	2-4 kg/cm ²
5 l approx.	5.5 l approx.	8 l approx.
the same oil as used for the engine		
cast iron	light metal	light metal
125 kg approx.	105 kg approx.	205 kg approx.

General

DAF marine diesel engines can be supplied with a Z.F. reversing gear of one of the following types: BW30E30 - BW30E25 - BW30ES25 - BW30E45 - BW30ES45.

The possibilities of use of these types appear from their technical specifications. The types E30, E25 and E45 are intended either for direct mounting on the rear side of the engine or at some distance. The S-types on the contrary are used combined with a reversely installed engine mounted in the rear of the ship, the propeller shaft extending beneath the engine to the rear.

The desired changes are obtained by two electromagnetic clutches actuated electrically. The reversing gear is for this purpose provided with three telescopic current supply brushes. For cleaning the slip rings three brushes are provided. These latter brushes are distinguished from the current supply

brushes by the absence of a cable connection.

The reversing gear comprises the possibility for switching on the forward or reverse gear by mechanical control in emergency cases. **This should be done only when the engine is stopped.**

Except for the BW30E30 type, all reversing gears are equipped with two lubricating pumps. The second one serves to provide the lubrication when the ship has to be towed with the engine stopped. For the BW30E30 type this second pump is of no use because the output shaft gears are rotating in the sump oil.

The reversing gear is actuated by means of the engine room telegraph, which has the following functions:

- The electric control of the reversing gear (telegraph and gear are interconnected to this end by means of a multi-core cable).
- Mechanical control of the engine speed.

DAF

Operation

Electrical engaging of the reversing gear is only allowed with the engine idling. When travel direction is changed, at least three seconds have to elapse, with the handle in neutral position, before the gear is switched on.

Mechanical engaging of the reversing gear is only allowed when the engine is stopped and the current source is switched off.

The BW30E30 type is provided with two engaging levers with security lock for mechanical operations.

Of course never use both levers together, one of them should always remain disengaged while the other is engaged.

To engage first loosen lock, then pull out lever, whereafter lock is to be secured again. If gear is not being engaged, the crankshaft or the propeller-shaft must be turned a little so that the gears are put in a better engaging position.

For the other ZF-reversing gears the engaging mechanism is such that inadvertently forward or reversing engaging operations are made impossible. After the gear has been engaged mechanically, the engine is started and the ship can sail away as usual.

Maintenance

Oil suction strainers. The types BW30E25 - BW30ES45 - BW30E45 - BW30ES25 have oil suction lines with a suction strainer, which has to be cleaned after every 1000 working hours and after a long period of inactivity.

For this purpose the suction lines have to be loosened, whereafter the strainers can be pulled out of the housing. Clean the strainers by rinsing them in clean fuel oil. Dry strainers thoroughly, preferably by means of compressed air.

The BW30E30 is equipped with only one oil pump and one oil suction strainer.

Oil filter, with the exception of the BW30E30 type, all types are provided with oil main filters, that should be cleaned at every oil change. Loosen four bolts and take out filter element. Cleaning is performed by flushing the element in pure fuel oil and by sweeping it to dryness or preferably by drying it with compressed air.

Oil sprayer. With the exception of the BW30E30, all types are provided with an oil sprayer directing an oil jet onto the gears.

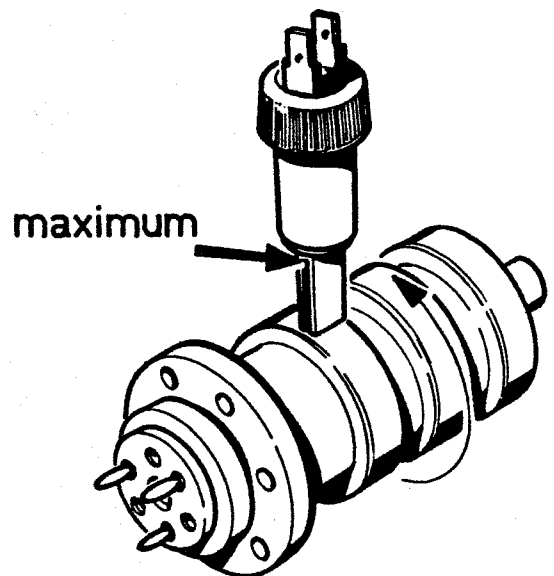
After taking out the bolts, the sprayer is to be removed. Cleaning is performed in the same way as for the oil suction strainer.

Lubricant level. The level should lie between the two marks on the dipstick and **must never be higher or lower.** Checking should preferably be prior to the first start in the morning and at least 20 minutes after the reversing gear has been stopped so that the whole quantity of oil has returned to the sump.

Oil change. The oil change has to be carried out after the first 20, 200 and 400 working hours and subsequently it has to be repeated after every 400 working hours.

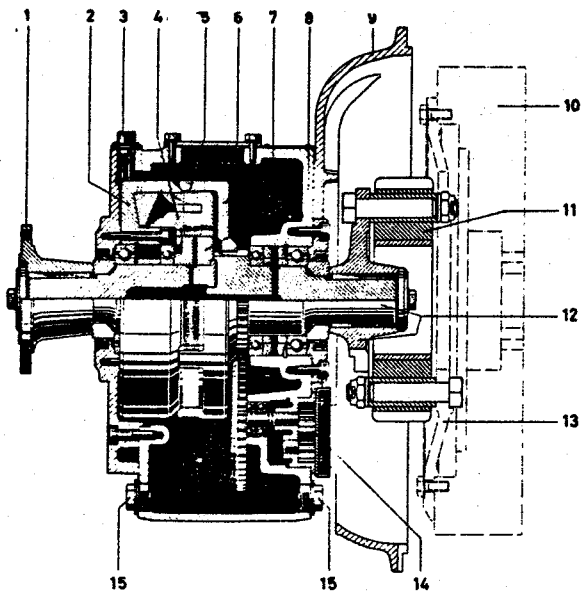
With reversing gears having a drain plug both at the front and at the rear the two plugs have to be removed for draining the oil (unless a sump drain pump is used). The drain plug is magnetic so that extremely fine metal particles - due to normal wear - will settle thereon and can be removed during the oil change.

Current brushes. At every oil change the current and cleaning brushes should be checked. Renew the brushes when worn down to the end of the groove in the brush.



The brush should be installed in such a way that the broad side runs parallel with the clutch shaft. The arrow indicates the maximum permissible wear.

Z.F.-marine engine clutch, type BMK-80



1. Output shaft with driven flange
2. Coil housing
3. Cable connection
4. Guide plates
5. Outer and inner clutch plates
6. Inspection cover
7. Outer coupler
8. Inner coupler
9. Adapter
10. Flywheel
11. Flexible coupling
12. Input shaft with coupling hub
13. Connecting disc
14. Lubricating oil pump
15. Drain plugs

Z.F.-clutch, type BMK-80.

Technical data

Transmission ratio	1 : 1
Current consumption, 24 V-system	96 W
Ampère value of fuse	8 Amp.
Lubricant type	the same as used for the engine
quantity	3.5 l approx.
Material of clutch housing	light metal
Weight	58 kg approx.

General

The BMK-80 clutch is an electro-magnetic lamination clutch transmitting the engine power to the propeller shaft. The speed of the engine is not reduced and the output shaft of the clutch can rotate only in the same direction as the crankshaft of the engine.

The clutch may either be directly secured to the rear side of the engine or may be arranged at a given distance.

The desired operation is performed by means of an electro-magnetic lamination clutch controlled electrically for this purpose.

Operation

Electric engaging of the clutch is permitted only with the engine idling.

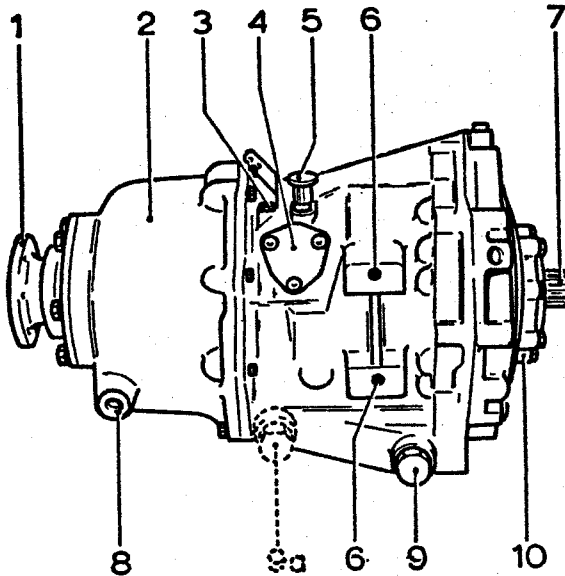
Increase the engine speed evenly, as there are passing 1 or 2 seconds before the clutch is fully engaged.

Maintenance

Oil level. The level should lie between the two marks on the dipstick and should therefore **neither be higher nor lower**. Preferably check prior to the first start in the morning and at any rate at least 20 minutes after the clutch has been stopped so that the oil has returned to the sump.

Oil change. The oil should be changed after the first 20, 200 and 400 working hours and this should be repeated subsequently after every 400 working hours.

VELVET-marine gear



35C063/1

1. Output flange
2. Reduction casing
3. Outlet port to oil cooler
4. Control valve cover
5. Breather
6. Mounting holes
7. Input shaft

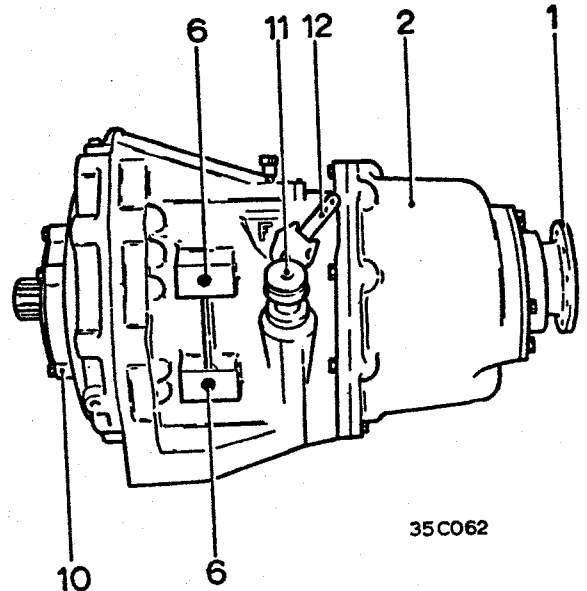
General

The Velvet hydraulic marine gear comprises two main units viz:

- a. The reverse gear, driven directly from the engine and
- b. The reduction gear attached to the rear of the reverse gear casing.

The reverse gear incorporates a planetary gear set which enables the direction of rotation of the output shaft to be reversed through application of one of the two hydraulically operated clutches. This is accomplished by means of a shift control valve which directs oil delivered under controlled pressure by the oil pump to the respective clutch.

If no reduction in output shaft speed is required the reverse gear alone is mounted and is then coupled directly to the propeller shaft.



35C062

8. Oil cooler return port (former version)
9. Oil drain plug; also opening for oil cooler return port (type 72C)
- 9a. Location of plug for type 71C
10. Oil pump
11. Oil filler cap
12. Control valve selector lever

Should a reduction be desired, however, this is achieved by attaching a reduction gear to the reverse casing, the two units then forming a single drive with the same lubrication system supplying oil to both units. The speed reduction is obtained through a planetary gear set in the reduction gear. The reverse gear and reduction gear output shafts are coaxial and rotate in the same direction*. The oil for applying the clutches and for lubrication of all moving parts of the marine gear is water cooled by means of an oil cooler connected with the reverse gear and reduction gear units. The hook-up must be such that the oil will flow to the oil cooler from the outlet port (3) and after having passed through the cooler, will flow back to the reverse gear (9) or (9a), respectively to the reduction gear (8) at former versions.

* With a 1.91 to 1 ratio reduction gear: In opposite direction.

Operation

Except for emergency cases never change gears when exceeding 1000 rev/min. of the engine.

Lubrication

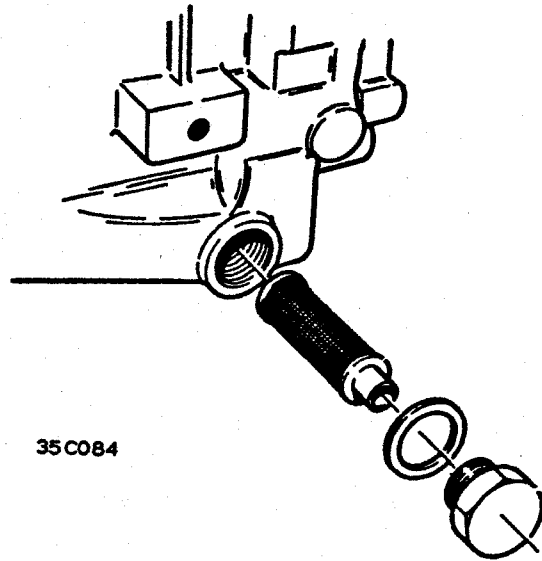
Remove the filler cap before draining the oil. The oil is drained via the drain plug opening (9).

After removing the drain plug the oil strainer becomes accessible. The strainer should be thoroughly cleaned at the same time the oil is changed. After removing the drain plug the oil strainer becomes accessible. Former versions have this filter located behind oil cooler return port (8). The unit should be filled to the full mark on the dipstick and then run idling the engine for a short while in order to fill all circuits. The oil level should be checked immediately following engine shut-off and sufficient oil should be added to bring the level to the full mark again.

For reading the oil level insert dipstick only to thread, but do not screw it down.

Where the installation is such that the oil in the cooler can flow back to the reversing gear unit when the engine is stopped, the oil level should reach above the full mark on the dipstick after the engine has been stopped for a short while. For this reason

the daily oil level check should be made immediately after engine shut-off and oil added if necessary till top mark.



Oil drain opening, strainer and drain plug.

Recommended oil type:

automatic transmission fluid, type „A“

Check oil level :

daily

Change oil :

after the first 20 working hours, then every 200 hours, but anyway twice a year at change of season

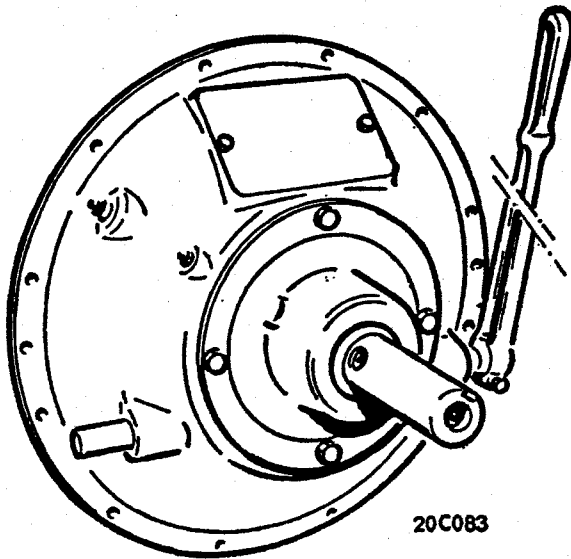
Clean oil strainer :

when oil is changed

Max. oil temperature :

approx. 185° F (85° C)

ROCKFORD-14" plate clutch



General

The main components of the Rockford clutch are formed by the clutch housing fastened to the engine flywheel housing and the clutch mechanism arranged on the driving shaft. An internally toothed ring is secured to the flywheel by bolts.

Two friction plates engage by their circumferential serrations the internally toothed ring and therefore rotate constantly with the crankshaft. In the engaged state the friction plates are clamped in between the pressure plates which are slipped with their internal toothings along the longitudinal grooves of the driving shaft.

The control lever actuates a shaft extending across the clutch housing and actuating the release fork. This fork is secured to the shaft by means of two keys and two clamping bolts and grips around the trunnions of the clutch release bearing.

The bearing housing and the clutch housing are provided with two grease nipples. One nipple serves for lubricating the conical bearings and the other communicates through a flexible hose with the clutch release bearing.

At the rear of the driving shaft a grease nipple is provided which communicates through a lubricating

channel in the shaft with the supporting bearing in the flywheel. However, if as a result of the disposition of the driving components access to this nipple is not easy, the driving shaft has midway a radial bore adapted to receive a grease nipple. The bore not used for a nipple has, of course, to be plugged. The clutch mechanism - and particularly the adjusting ring of the pressure plates - is accessible after removing the inspection cover of the clutch housing.

Adjustment

With the progressing wear of the friction plates the release fingers have to be re-adjusted, by screwing the adjusting ring further onto the clutch body. The adjustment of the clutch has to be checked regularly in order to avoid slipping. The periods of this check depend upon the working conditions. Clutches not correctly adjusted may be seriously damaged.

For adjusting the clutch first the inspection cover has to be removed whereafter the adjusting ring is turned by means of a tommy bar until the locking mechanism is accessible. Then the lock pin has to be lifted out of the clutch body by means of an angle screwdriver, whereafter the adjusting ring can be screwed further onto the clutch body until the clutch engages without need for exerting a particularly heavy force on the control lever. (A force of 25 to 30 kg may be considered to be normal.) After the adjustment of the clutch the adjusting ring should be fixed and the inspection cover remounted.

By way of final test it should be checked whether the driving shaft can easily be turned manually when the clutch is disengaged, without binding at any point.

Lubrication instructions

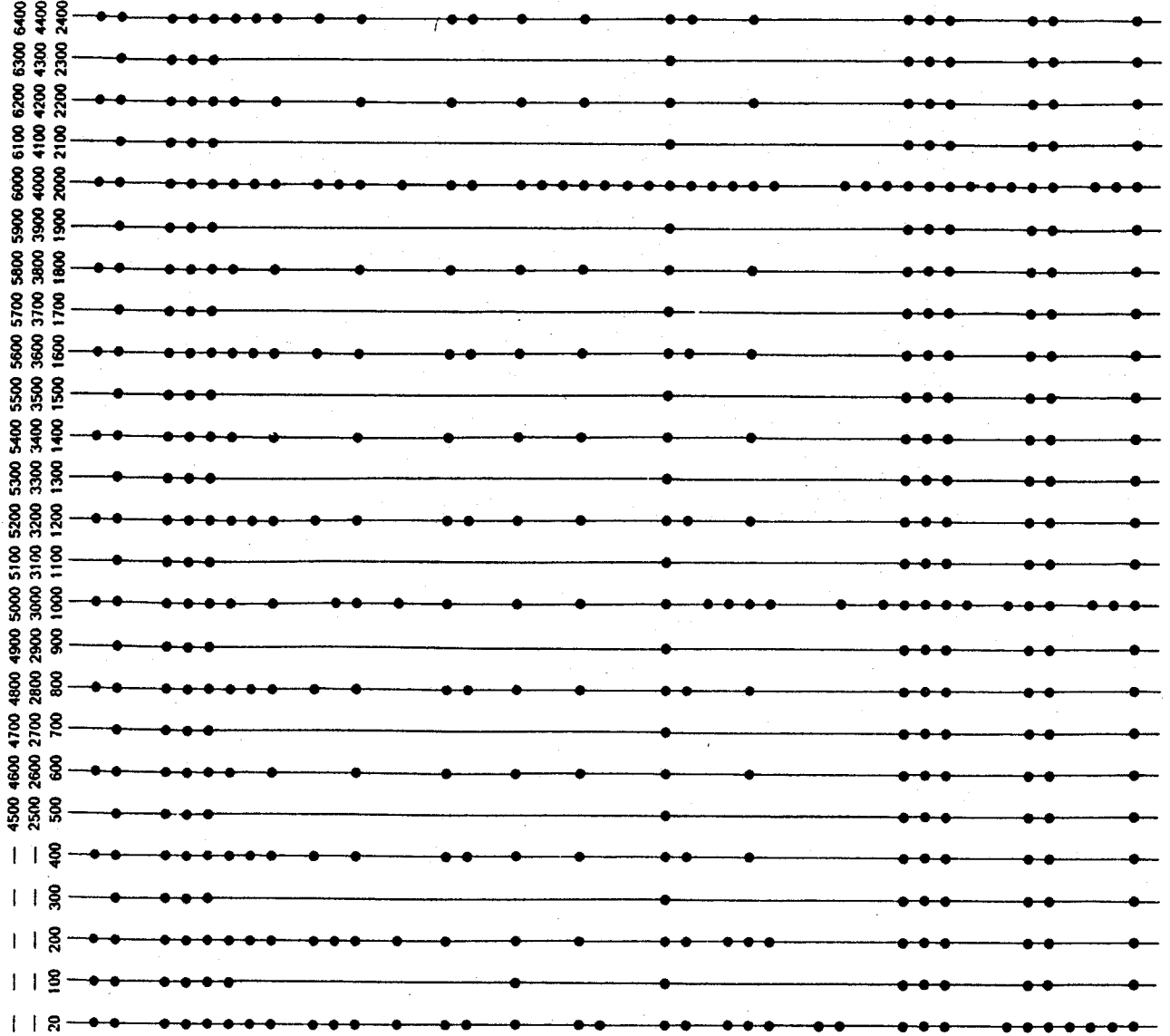
The clutch has to be lubricated with a water- and high-temperature resistant grease on the basis of lithium having a dripping point of at least 180° C. When lubricating the clutch, sufficient grease should be added to prevent overheating and seizure of the bearings. On the other hand too large a quantity of grease creates the risk of a greasy, slipping clutch. The clutch shaft bearing house should be filled with grease up to two thirds at the most. This cannot be checked, so that it is advisable to grease the bearings frequently but sparingly. Only a slight degree of leakage is allowed with a rotating clutch.



MAINTENANCE CHART

DAF

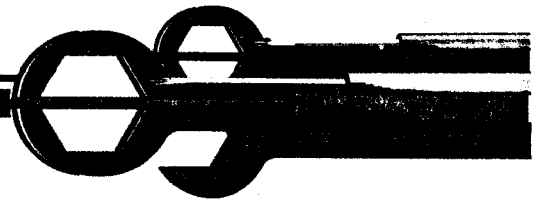
DAF DIESEL ENGINES



OPERATING HOURS *

- CHANGE
 - Engine oil DA-DD-DF-DH-DK-DP _____
 - DS-DT _____
- CHANGE OIL / LUBRICATE
 - Injection pump sump _____
 - Mechanical governor _____
 - Oil bath air cleaner _____
 - Fresh water pump, DP engine _____
 - Rev counter drive (mechanical) _____
 - Sea water pump _____
 - Reversing gear :
 - Z.F. _____
 - Masson _____
 - Velvet _____
 - Rockford clutch (see instructions on cover) _____
 - Twin Disc _____
- RENEW
 - Oil filter element _____
 - Main fuel filter element _____
- CLEAN
 - Primary fuel filter _____
 - Fuel tank strainer _____
 - Oil pump strainer _____
 - Crankcase breathing filter _____
 - Turbocharger filter _____
 - Turbocharger compressor wheel _____
 - Air compressor cover _____
 - Dry-type air cleaner _____
 - Oil filter element, Z.F. reversing gear _____
 - Oil strainer, Z.F. reversing gear _____
 - Oil strainer, Masson reversing gear _____
 - Oil strainer, Velvet reversing gear _____
 - Oil strainer, Twin Disc reversing gear _____
- CHECK / ADJUST
 - Cylinder head nuts and studs _____
 - Valve clearance _____
 - Injection pump _____
 - Injectors _____
 - V-belt tension _____
 - Lines and line connections _____
 - Battery and terminal clamps _____
 - Generator charge _____
 - Commutator / brushes, generator / starter motor _____
 - All accessible nuts and bolts (exterior) _____
 - Commutator / brushes, Z.F. reversing gear _____
 - Injection pump and venturi seals _____
 - Air compressor cylinder head nuts _____
 - Max. engine speed (no load) _____
 - Engine idling speed _____
 - Instruments _____

* The servicing intervals are based on normal operating conditions and should therefore be shortened, if necessary.



Maintenance chart

MAINTENANCE INTERVALS

Operating hours x 100	0,5	4*	8	12	16	20	24	28	32	36	40	continue with column marked with an asterisk	
A-service		■		■		■		■		■			
B-service	●		●		●		●		●		●		

MAINTENANCE SERVICE —A—

- Change oil*
- Renew oil filter(s)
- Check fluid level of cooling system
- Clean moisture separators
- Check all lines, pipe and hose connections
- Sparingly lubricate outboard waterpump
- Sparingly lubricate clutch release bearing
- Check V-belt tension, retensioning if required
- Clean oil-moistened air filter and oil with engine oil
- Clean dry-type air cleaners (to be renewed once a year)

MAINTENANCE SERVICE —B—

- A-service operations
- Clean sump breather filter — *FULLY CAP ON ROCKER COVER.*
- Renew main fuel filter
- Clean filter in suction connection of fuel feed pump
- Carry out exhaust smoke measuring**
- Retighten cylinder head bolts and nuts***
- Check valve clearance, adjusting if required
- Clean intake air cooler (water-cooled)
- Clean air-cooled cooling elements on the outside
- Clean water cooler and oil cooler
- Change gearbox oil
- Change oil of reversing gear and clean filter
- Clean outboard water system

DAILY MAINTENANCE

- Check engine oil level
- Check fluid level of cooling system
- Check functioning of instruments

MAINTENANCE UNDER SPECIAL OPERATING CONDITIONS

DAF recommends an additional oil change between the indicated intervals and a renewal of the engine oil filter for such engines which operate under special operating conditions such as:

- frequent operation of the engine under no load
- frequent stop-and-go operations
- operation in dusty and/or dirty conditions

* In the case of engines which make less than 400 operating hours per year, the engine oil must be changed once per year and simultaneously the engine oil filter(s) cleaned

** Smoke measuring to be carried out in such cases where the measuring conditions can be fulfilled

*** Only at the 50-hours inspection



FUEL AND LUBRICANT SPECIFICATIONS FOR DAF ENGINES AND COMPONENTS

It is NOT permitted to add to fuel or to lubricants any additive unless in such cases as prescribed by DAF. The specified lubricants are marketed under various brand names. Your supplier can advise you which lubricant conforms to the specifications mentioned below.

ENGINE

Lubricant

Type	A.P.I. specification	Viscosity
DA 475 DD 575 DS 575 DF 615 DT 615 DK(D)L 1160 DK 1160 DKA 1160	CC or CD	
DU 825 DHT(D) 825 DHU 825 DHR/DMS 825 DKT(D) 1160 DKS/DKX 1160 DKTL/DKCL 1160 DKFL/DKVL 1160	CD	

Temperature limits to be considered as guiding values.

* If SAE-10W oil is used and the temperature exceeds the indicated value, avoid to continuously operate the engine at high speed or under full load.

Diesel fuel

Minimum requirement British Standard no. 2869-1970 class A1. In the case of marine engines which must satisfy the requirements set by Nederlandse Scheepvaart Inspectie (Netherlands Navigation Inspectorate) and/or a classification bureau (Lloyd's, Veritas, etc.) the diesel fuel used must satisfy British Standard no. 2869-1970, class A2.

During the winter months the oil companies use additives to prevent clogging due to fuel waxing.

If such fuel is not available 25% petroleum (kerosene) may be added if permitted by law. If not, then up to 25% two-stroke petrol (a mixture of normal petrol and engine lubricant) may be added. To prevent formation of ice (and again if permitted by law) max. 0,5% methylated spirit may be added.

Coolant

Ambient temperature above 0°C:

Add an emulsifying oil (such as SHELL DONAX C) to the coolant to protect the system against corrosion.

Mixing ratio: 1%; the coolant will turn a milky white then. If an inspection reveals that the coolant has become transparent, a further 100 cm³ of emulsifying oil may be added.

Ambient temperature below 0°C:

Add ethylene-glycol based anti-freeze to the coolant thereby observing the mixing ratio as specified by the supplier. In most cases anti-freeze will contain a rust inhibitor so that there is no need to add an emulsifying oil (such as SHELL DONAX C) then.

Water pump

Lithium-based grease NLGI no. 2.

REVERSING GEARS

Twin Disc - ZF - Velvet. The same oil as specified for the engine.

In the case of reversing gears of other makes please consult the specifications of the corresponding manufacturer.

ROCKFORD PLATE CLUTCH

Water resistant grease with a melting point of at least 180° C

GEARBOX (ZF)

Lubricant

Above and below 0°C: SAE 80 (MIL-L-2105).

Remark:

For maintenance of DAF engines installed in vehicles and maintenance of other components supplied by DAF, consult the DAF commercial vehicle maintenance book.

2-086A

SERIES ALL ENGINES

DATE 8511
PAGES 1-3

TIGHTENING TORQUES OF CYLINDER HEAD NUTS AND BOLTS

This T.I. bulletin supersedes all previous publications on the tightening torque of cylinder head nuts and bolts on all engine types. By publications is understood not only T.I. bulletins but also all instructions in the workshop manual and the pocket booklets. The values stated in these publications should be changed to the values given in this bulletin. The following T.I. bulletins should be removed from the binder: 2-067, 2-082 and 2-083.

* The only difference as compared with T.I. bulletin 2-086 is that the tightening torques for the 615 engine have been changed.

Investigations have revealed that the tolerance in the pre-load of the cylinder head studs or bolts is influenced considerably by the friction of the threaded surfaces and bearing surfaces of the nut or bolt. All nuts and bolts are now given a special treatment with a bonded lubricant at the factory.

TO ENSURE PROPER PRE-LOADING WHEN REFITTING THE CYLINDER HEAD, IT IS ABSOLUTELY ESSENTIAL TO USE NEW, TREATED NUTS AND BOLTS.

COLD and WARM engines are defined as follows:

COLD ENGINE: A cold engine is an engine which, after having been at operating temperature, has been able to cool down for at least SIX HOURS.

WARM ENGINE: A warm engine is an engine which, after having been at operating temperature, has been switched off for at most THIRTY MINUTES.

If the cylinder head nuts or bolts have to be retorqued (see the instructions for the engine concerned), this should be done between 500 and 2,500 km.

Retorquing must ONLY be done with a good quality torque wrench which is calibrated at regular intervals (at least once a month).

When repairing an engine with cylinder head bolts, the threaded holes in the cylinder block must be cleaned with an M 16 x 1.5 tap before refitting the cylinder head. The holes must be degreased to obtain proper sealing.

* Modification

SERIES

DATE
PAGES

PROCEDURE FOR THE 615 ENGINE

From engine No. E 60104 onwards all 615 engines have specially treated nuts. When the cylinder head is refitted, it is essential to use new, treated nuts, recognisable from their reddish colour.

The cylinder head nuts and bolts must be retorqued between 500 and 2,500 km.

* Tightening torque for nuts

COLD engine	250 Nm
WARM engine	200 Nm

Tightening torque for short bolts 45 Nm

NOTE: THIS INSTRUCTION ONLY APPLIES TO REFITTED CYLINDER HEADS. IN THE CASE OF NEW AND CERTIFICATE ENGINES, THE CYLINDER HEAD NUTS AND BOLTS SHOULD BE RETORQUED BETWEEN 500 AND 2,500 KM.

PROCEDURE FOR THE 825 ENGINE

From engine No. D 78465 onwards all 825 engines have specially treated nuts. When the cylinder head is refitted, it is essential to use new, treated nuts, recognisable from their reddish colour.

In the foreseeable future all 825 engines will be fitted with cylinder head bolts instead of studs and nuts. These bolts will be given a special treatment, with a bonded lubricant on the bearing surfaces and a sealing and locking compound on the threaded section.

The situation is therefore as follows. When the cylinder head is refitted, treated nuts or the new, treated bolts must be used. The cylinder head nuts and bolts must be retorqued between 500 and 2,500 km.

Tightening torque for nuts,

COLD engine	200 Nm
WARM engine	160 Nm

bolts,

COLD engine	240 Nm
WARM engine	240 Nm

Tightening torque for short bolts 95 Nm

In the case of cylinder head bolts, the tightening torque is the same whether the engine is cold or warm.

NOTE: THIS INSTRUCTION ONLY APPLIES TO REFITTED CYLINDER HEADS. IN THE CASE OF NEW AND CERTIFICATE ENGINES, THE CYLINDER HEAD NUTS AND BOLTS SHOULD BE RETORQUED BETWEEN 500 AND 2,500 KM.

DAF Trucks

TIGHTENING TORQUES

CYLINDER HEAD NUTS BOLTS .

GO.

Created nuts cold engine 200 Nm.

warm engine 160 Nm .

LTS 240Nm hot or cold .

nut bolts 50Nm .

torque 500 , 2500km .

IMPORTANT!!

DO NOT RETORQUE HEADS ON NEW OR

CERTIFICATE ENGINES WITH STEEL

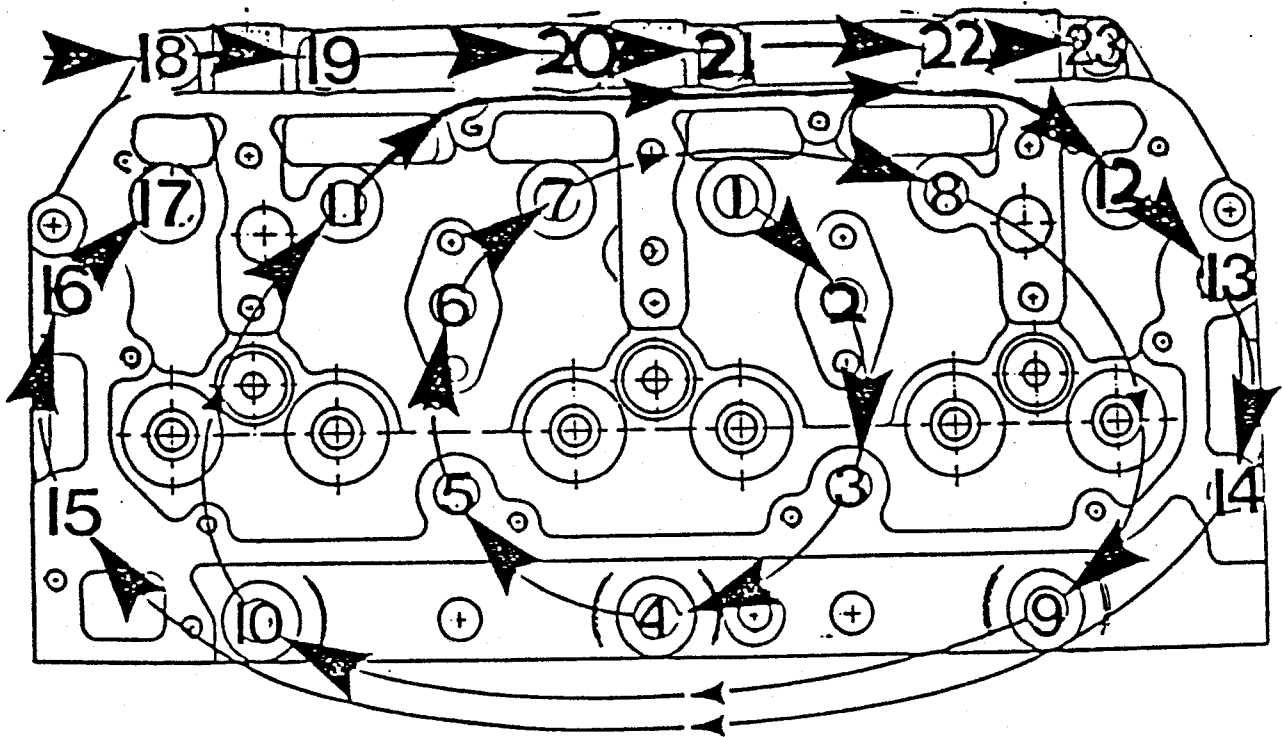
WASKETS.

REFER TO TI 2/086 .

G .

DAF Trucks

TIGHTENING SEQUENCE OF CYLINDER HEADS



REFER TO TI \longrightarrow 2 086

DAF Trucks

TIGHTENING TORQUES

CYLINDER HEAD NUTS BOLTS.

M25

Pre treated nuts cold engine 200 Nm.

warm engine 160 Nm.

BOLTS 240 Nm hot or cold..

short bolts 95Nm .

re torque 500 , 2500km .

REFER TO TI 2/086 .

HEAD SHOCK 0221601
NUTS 0278754
PRESSURE CAP 0277278

Big end torque 105-115 N.M²
Main 200 N.M² 150 ft lb.

Dynamo Belt A1380
THERMOSTAT DAF AM0301
OIL PUMP 0246247

FILAN POLICE

THAMESIDE TRUCK CENTRE

01322-384747

ENGINE SPEC. No. 401084

MAX RPM - 2400

VALVE CLEARANCES - 0.5mm

INJECTION TIMING - 28° BTDC

INJECTION PUMP SETTING - 11.6cc