

Operating Instructions



Diesel Engine

D 2866 LUE

D 2866 LUE 601



Dear Customer

These Operating Instructions are intended to familiarize you with your new MAN Diesel engine and how it operates.

The Publication “Fuels, Lubricants and Coolants for MAN Diesel Engines” supplements these Operating Instructions.

Note:

Both publications apply to the engine and must always be kept to hand in its vicinity in the engine room.

Please read this Manual and the “Instructions for the installation of MAN Diesel Engines” before you put the new engine into operation.

Comply in full with instructions relating to operation, prevention of accidents and environmental protection.

MAN Diesel engines are developed and manufactured in line with the latest state of the art. However, trouble-free operation and high performance can only be achieved if the specified maintenance intervals are observed and only approved fuels, lubricants and coolants are used.

It is imperative and in your own interest to entrust your MAN Local Service Centre with the removal of any disturbances and with the performance of checking, setting, and repair work.

Yours faithfully,
MAN Nutzfahrzeuge Aktiengesellschaft
Werk Nürnberg

Subject to change to keep abreast with technological progress.

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Declaration

In accordance with Article 4, paragraph 2, in conjunction with Appendix II, section B, of Directive 89/392/EEC, version 93/44/EEC

MAN Nutzfahrzeuge Aktiengesellschaft,

hereby declares that the engine described below is destined for installation in a machine as defined in the EC directive on machines.

Engine model:

Design:

For data see original declaration

Engine number:

If required this declaration is enclosed with the delivery note.

Rating / speed:

Note:

The manufacturer of the complete ready-to-use machine in which this engine is to be installed must take the further action necessary in the context of indirect safety-related engineering and provision of instructions to ensure that the ready-to-use machine complies with the requirements of the EC directive on machines.

The engine must not be put into operation until the complete machine satisfies the conditions laid down in the EC directive on machines 89/392/EEC, most recently amended by 93/44/EEC, or the latest amendment of said directive.

MAN Nutzfahrzeuge Aktiengesellschaft

Vogelweiherstraße 33

D-90441 Nürnberg



Nameplates

In all your correspondence please always quote engine model, serial number and job number (Order number).

For this reason it is advisable to read off the data from the engine type plates before putting the engine into operation and to enter them in the appropriate spaces.

The engine type plates are on the crankcase.

Model

delivered on

installed on

Engine serial number

Order number

MAN Nutzfahrzeuge Aktiengesellschaft
 Typ
 Motor-Nr. / Engine No. NI/II

MAN Nutzfahrzeuge Aktiengesellschaft
 Werk Nürnberg Germany
DIESEL ENGINE

Bauj. Year	Typ	Model	Motor-Nr.	Serial No
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Werk-Nr.	Job No	Leistung kW Rating kW	Drehz. 1/min	Speed rpm
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Temp.°C	Leistg. PS Rating BHP	Aufstellhöhe m uNN Altitude m		
<input type="text"/>	<input type="text"/>	<input type="text"/>		

-0219

General notes

Day-to-day use of power engines and the service products (fuels, lubricants, coolants) necessary for running them presents no problems if the persons occupied with their operation, maintenance and care are given suitable training and think as they work.

This summary is a compilation of the most important regulations. These are broken down into main sections which contain the information necessary for preventing injury to persons, damage to property and pollution. In addition to these regulations those dictated by the type of engine and its site are to be observed also.

Important:

If, despite all precautions, an accident occurs, in particular through contact with caustic acids, fuel penetrating the skin, scalding from hot oil, anti-freeze being splashed in the eyes etc., **consult a doctor immediately.**

1. Regulations designed to prevent accidents with injury to persons

During commissioning, starting and operation

- Before putting the engine into operation for the first time, read the operating instructions carefully and familiarize yourself with the “critical” points. If you are unsure, ask your MAN representative.
- For reasons of safety we recommend you attach a notice to the door of the engine room prohibiting the access of unauthorized persons and that you draw the attention of the operating personal to the fact that they are responsible for the safety of persons who enter the engine room.
- The engine must be started and operated only by authorized personnel. Ensure that the engine cannot be started by unauthorized persons.
- When the engine is running, do not get too close to the rotating parts. Wear close-fitting clothing.
- Do not touch the engine with bare hands when it is warm from operation – risk of burns.
- Exhaust gases are toxic. Comply with the instructions for the installation of MAN Diesel engines which are to be operated in enclosed spaces. Ensure that there is adequate ventilation and air extraction.



- Keep vicinity of engine, ladders and stairways free of oil and grease. Accidents caused by slipping can have serious consequences.

During maintenance and care

- Always carry out maintenance work when the engine is switched off. If the engine has to be maintained while it is running, e.g. changing the elements of change-over filters, remember that there is a risk of scalding. Do not get too close to rotating parts.
- Change the oil when the engines is warm from operation.
Caution:
There is a risk of burns and scalding. Do not touch oil drain plugs or oil filters with bare hands.
- Take into account the amount of oil in the sump. Use a vessel of sufficient size to ensure that the oil will not overflow.
- Open the coolant circuit only when the engine has cooled down. If opening while the engine is still warm is unavoidable, comply with the instructions in the chapter entitled "Maintenance and Care".
- Neither tighten up nor open pipes and hoses (lube oil circuit, coolant circuit and any additional hydraulic oil circuit) during the operation. The fluids which flow out can cause injury.
- Fuel is inflammable. Do not smoke or use naked lights in its vicinity. The tank must be filled only when the engine is switched off.
- When using compressed air, e.g. for cleaning the radiator, wear goggles.
- Keep service products (anti-freeze) only in containers which can not be confused with drinks containers.
- Comply with the manufacturer's instructions when handling batteries.
Caution:
Accumulator acid is toxic and caustic. Battery gases are explosive.



2. Regulations designed to prevent damage to engine and premature wear

Do not demand more from the engine than it is able to supply in its intended application. Detailed information on this can be found in the sales literature. The injection pump must not be adjusted without prior written permission of MAN Nürnberg.

If faults occur, find the cause immediately and have it eliminated in order to prevent more serious damage.

Use only genuine MAN spare parts. MAN will accept no responsibility for damage resulting from the installation of other parts which are supposedly “just as good”.

In addition to the above, note the following points:

- Never let the engine run when dry, i.e. without lube oil or coolant.
- When starting do not use any additional starting aids (e.g. injection with starting pilot).
- Use only MAN-approved service products (fuel, engine oil, anti-freeze and anti-corrosion agent). Pay attention to cleanliness. The Diesel fuel must be free of water. See “Maintenance and care”.
- Have the engine maintained at the specified intervals.
- Do not switch off the engine immediately when it is warm, but let it run without load for about 5 minutes so that temperature equalization can take place.
- Never put cold coolant into an overheated engine. See “Maintenance and care”.
- ***Do not add so much engine oil that the oil level rises above the max. marking on the dipstick. Do not exceed the maximum permissible tilt of the engine.***
Serious damage to the engine may result if these instructions are not adhered to.
- Always ensure that the testing and monitoring equipment (for battery charge, oil pressure, coolant temperature) function satisfactorily.
- Comply with instructions for operation of the alternator. See “Maintenance and care”.

3. Regulations designed to prevent pollution

Engine oil and filter elements / cartridges, fuel / fuel filter

- Take old oil only to an old oil collection point.
- Take strict precautions to ensure that no oil or Diesel fuel gets into the drains or the ground.
The drinking water supply could be contaminated.
- Filter elements are classed as dangerous waste and must be treated as such.

Coolant

- Treat undiluted anti-corrosion agent and / or anti-freeze as dangerous waste.
- When disposing of spent coolant comply with the regulations of the relevant local authorities.

4. Notes on safety in handling used engine oil *

Prolonged or repeated contact between the skin and any kind of engine oil decreases the skin. Drying, irritation or inflammation of the skin may therefore occur. Used engine oil also contains dangerous substances which have caused skin cancer in animal experiments. If the basic rules of hygiene and health and safety at work are observed, health risks are not to the expected as a result of handling used engine oil.

Health precautions:

- Avoid prolonged or repeated skin contact with used engine oil.
- Protect your skin by means of suitable agents (creams etc.) or wear protective gloves.
- Clean skin which has been in contact with engine oil.
 - Wash thoroughly with soap and water. A nailbrush is an effective aid.
 - Certain products make it easier to clean your hands.
 - Do not use petrol, Diesel fuel, gas oil, thinners or solvents as washing agents.
- After washing apply a fatty skin cream to the skin.
- Change oil-soaked clothing and shoes.
- Do not put oily rags into your pockets.

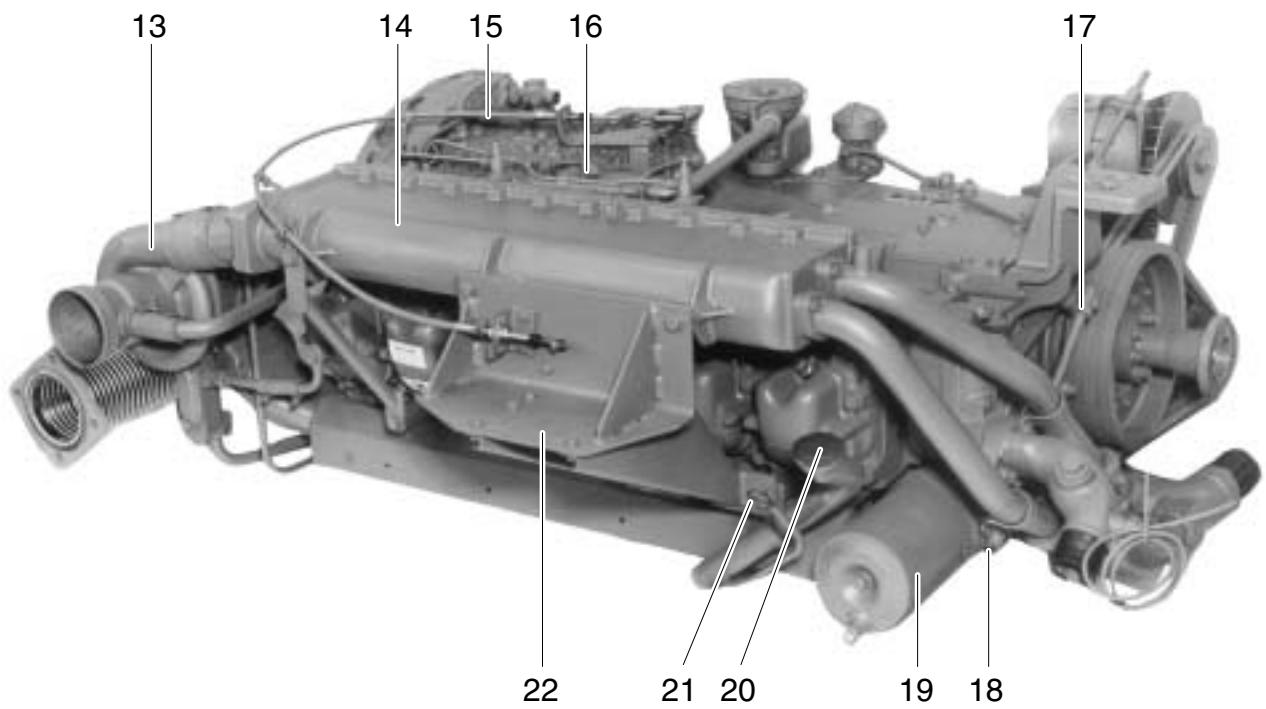
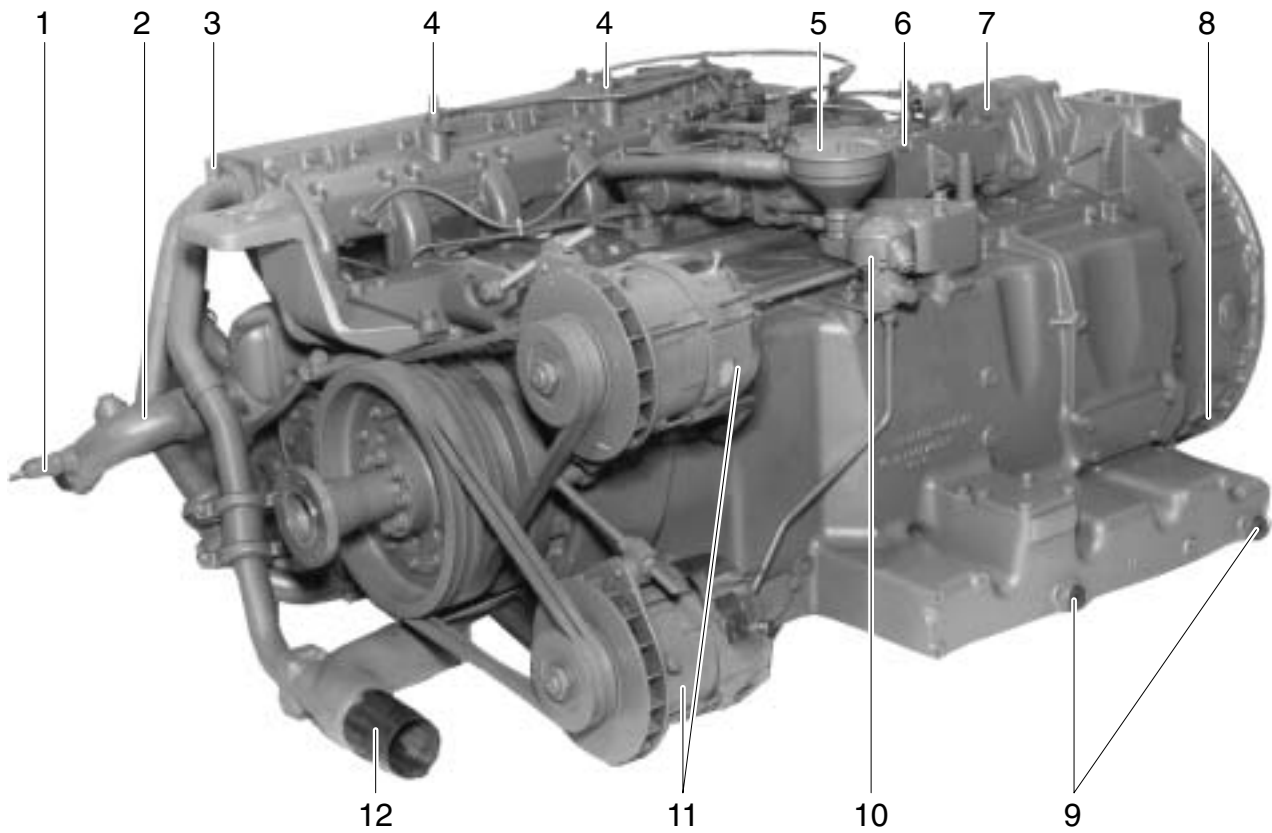
Ensure that used engine oil is disposed of properly – Engine oil can endanger the water supply –

For this reason do not let engine oil get into the ground, waterways, the drains or the sewers. Violations are punishable.

Collect and dispose of used engine oil carefully. For information on collection points please contact the seller, the supplier or the local authorities.

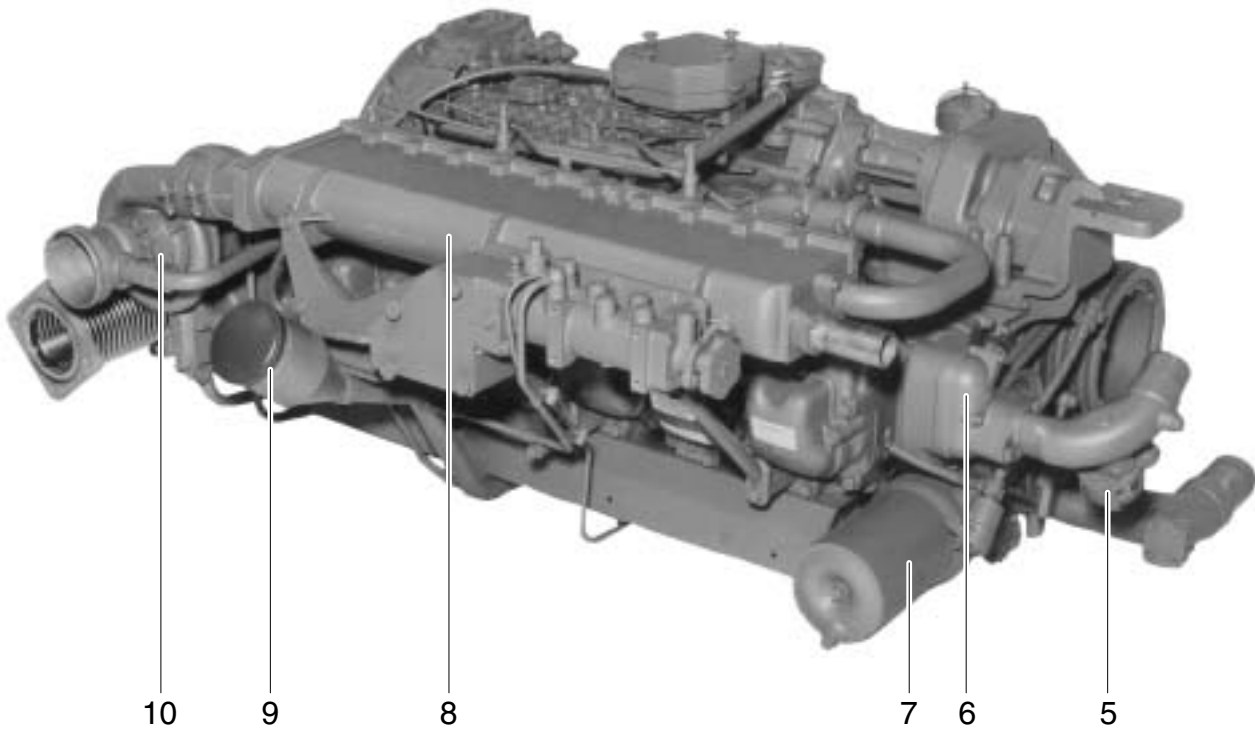
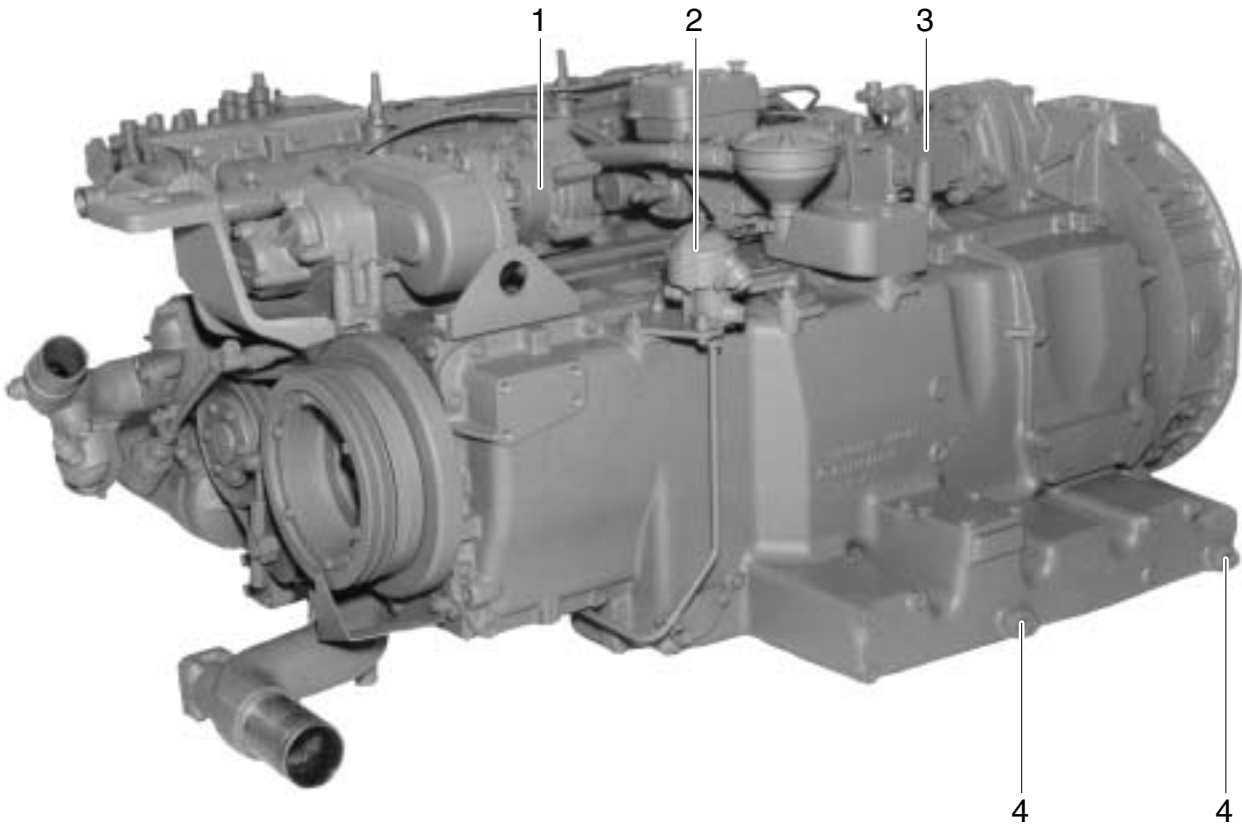
* Adapted from "Notes on handling used engine oil".

Engine views D 2866 LUE, single-circuit cooling system, injection pump at top



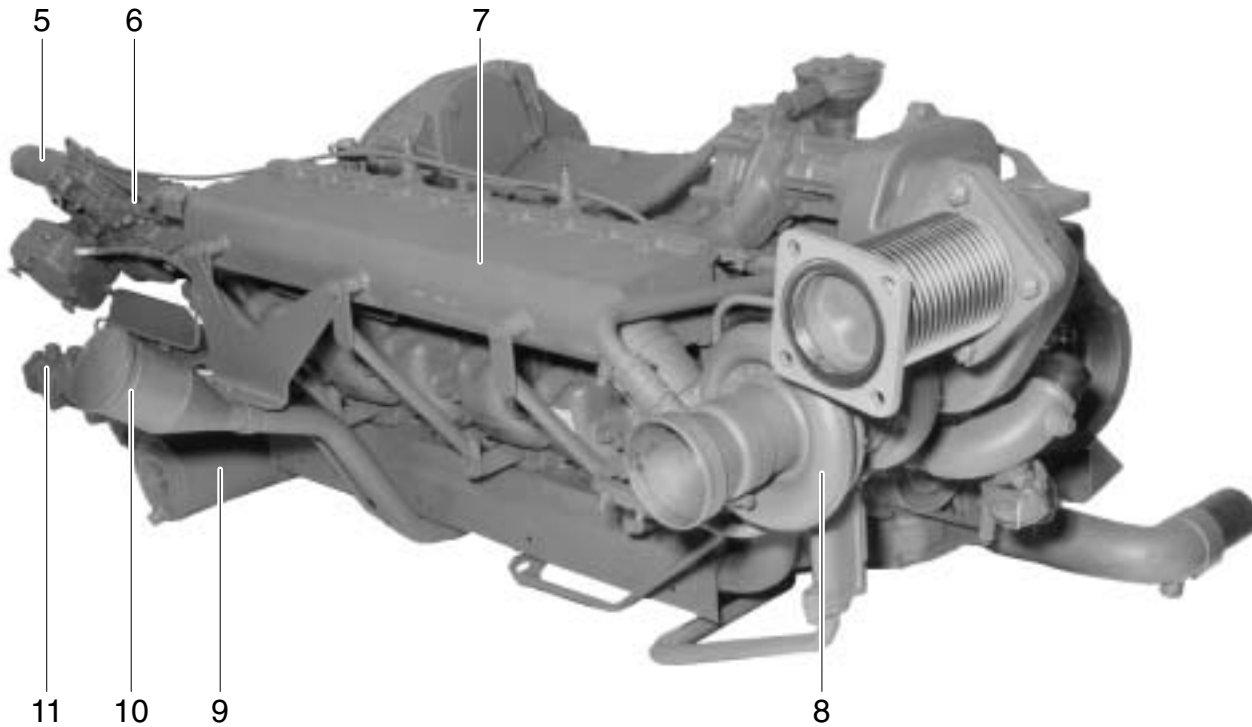
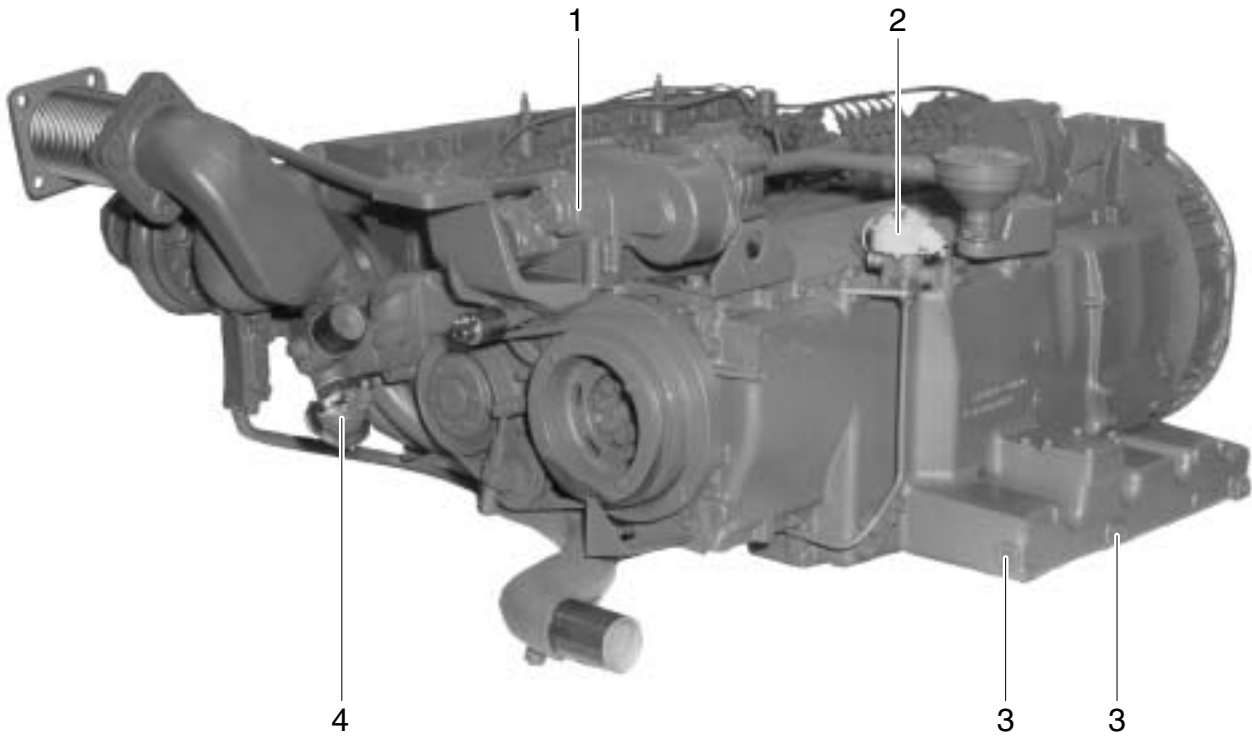
- 1 Coolant temperature gauge
- 2 Coolant outlet pipe
- 3 Bleed screw for coolant circuit
- 4 Flame start glow plugs
- 5 Oil separator valve for crankcase breather
- 6 Injection pump with shut-off solenoid
- 7 Inspection window for start of delivery setting at injection pump
- 8 Inspection window for start of delivery setting at engine (on flywheel)
- 9 Screw plugs
- 10 Lube oil pressure monitor(s)
- 11 Alternators
- 12 Coolant inlet pipe
- 13 Turbocharger
- 14 Intercooler
- 15 Pull, engine speed adjustment
- 16 Emergency lever
- 17 V-drive for engine speed measurement
- 18 Speed pick-up
- 19 Oil filter
- 20 Oil filler neck
- 21 Oil dipstick
- 22 Bracket for speed adjusting device

Engine views D 2866 LUE, dual-circuit cooling system, injection pump at top



-
- 1 Water pump for intercooler
 - 2 Oil pressure monitor(s)
 - 3 Injection pump
 - 4 Oil drain plug
 - 5 Temperature monitor(s) for coolant
 - 6 Thermostat housing
 - 7 Oil filter
 - 8 Intercooler
 - 9 Oil filler neck
 - 10 Turbocharger

Engine views D 2866 LUE, dual-circuit cooling system, injection pump at rear



-
- 1 Water pump for intercooler
 - 2 Oil pressure monitor(s)
 - 3 Oil drain plug
 - 4 Temperature monitor(s) for coolant
 - 5 Shut-off solenoid
 - 6 Injection pump
 - 7 Intercooler
 - 8 Turbocharger
 - 9 Oil filter
 - 10 Oil filler neck
 - 11 16-position regulator

First commissioning

At the time of initial commissioning of a new or overhauled engine make sure to have observed the “Technical Information for the installation of MAN Diesel engines”.

It is recommended that new or overhauled engines should not be operated at a load higher than about 75% maximum load during the first few hours of operation. Initial run-in should be at varying speeds. After this initial run-in, the engine should be brought up to full output gradually.

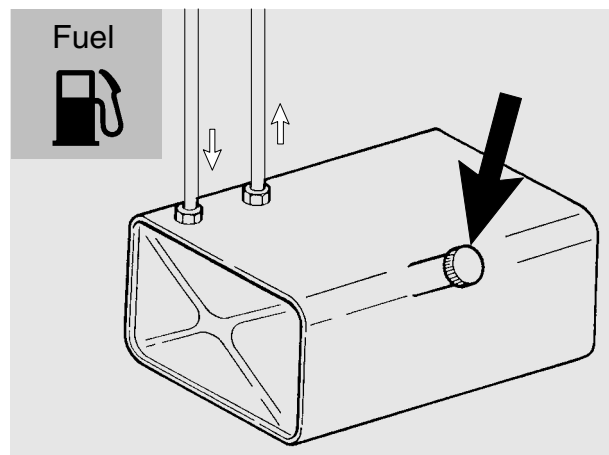
Note:

Use only approved fuels, lubricants etc. (see brochure “Fuels, lubricants etc.”). Otherwise the manufacturer’s warranty will become null and void.

Filling with fuel

Caution:

Fill the tank only when the engine is switched off. Pay attention to cleanliness. Do not spill fuel. Use only approved fuels (see “Fuels, Lubricants etc.”)

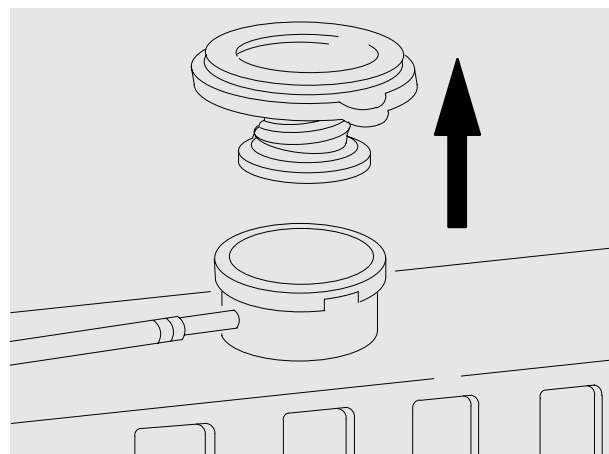


Filling-in of coolant

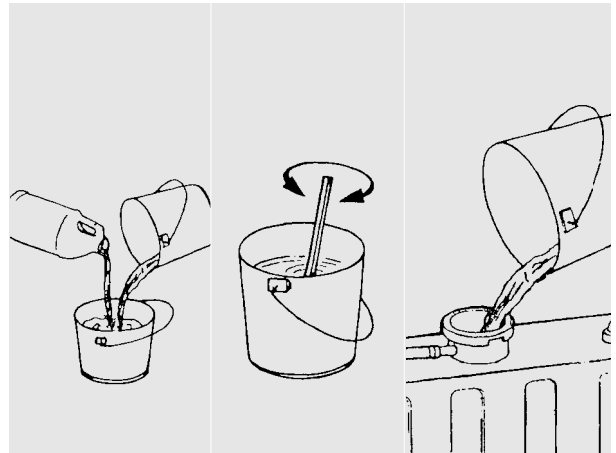
Fill the cooling system of the engine with a mixture of drinkable tap water and anti-freeze agent on ethylene glycole basis or anti-corrosion agent.

See Publication “Fuels, Lubricants and Coolants for MAN Diesel Engines”.

- Remove cap



- Remove bleed screw (see page 10, item 3)
- Fill in the coolant slowly
- When coolant emerges without bubbles screw the bleed screw back in
- Refit cap

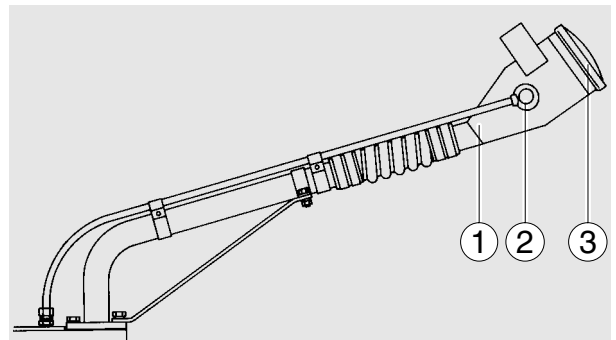


Filling with engine oil

Caution:

Do not add so much engine oil that the oil level rises above the max. marking on the dipstick. Overfilling will result in damage to the engine.

The engines are as a rule supplied without oil.
Pour oil into engine via filler neck.
For the quantity required see “Technical Data”.



- 1 Oil filler neck
- 2 Oil dipstick
- 3 Bayonet fastener

Commissioning

Before daily starting the engine, check fuel level, coolant level and engine oil level and replenish, if necessary.

Note:

Use only approved fuels, lubricants etc. (see brochure “Fuels, lubricants etc.”). Otherwise the manufacturer’s warranty will become null and void.

Checking oil level

Check the oil level when the engine is horizontal, but not until approx. 20 minutes after switching off the engine.

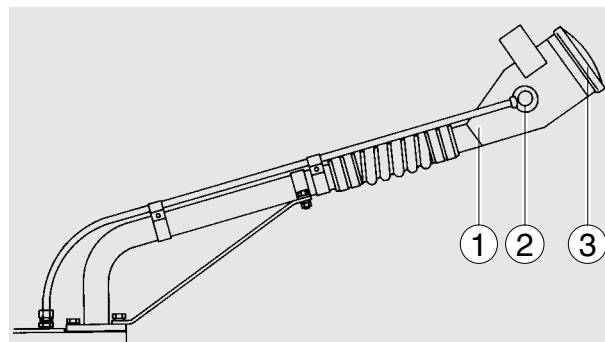
- Pull out dipstick
- wipe it with a clean, lintfree cloth
- and push it in again up to the stop
- Pull out dipstick again

The oil level should be between the two notches in the dipstick and must never fall below the lower notch. Top up oil as necessary.

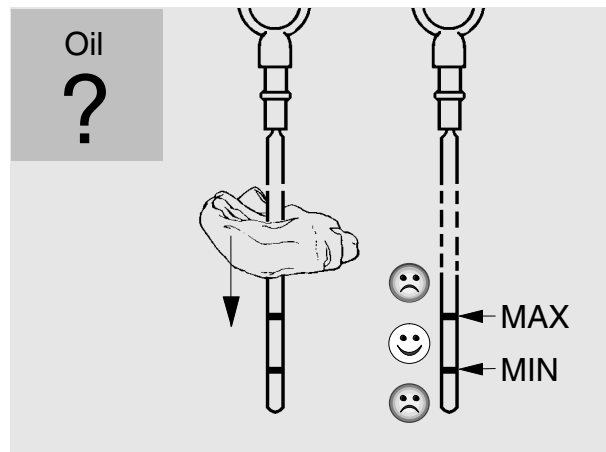
Caution:

Do not add so much engine oil that the oil level rises above the max. marking on the dipstick. Overfilling will result in damage to the engine.

Ensure utmost cleanliness when handling fuels, lubricants and coolants.



- 1 Oil filler neck
- 2 Oil dipstick
- 3 Bayonet fastener



Starting

**Danger:**

Before starting make sure that no-one is in the engine's danger area.

Caution:

When starting do not use any additional starting aids (e.g. injection with starting pilot).

Insert starter key and turn it to position "I". The check lamp comes on to show that the engine is ready for operation.

Turn starter key further to position "II" (pre-glow). The display lamp (usually in the driver's station) comes on.

After the pre-glow period the display lamp begins to flash. This signalizes that the engine is ready for starting.

Note:

If the engine is not equipped with a pre-glowing function, immediately turn the starter key through to position "III".

Turn key further up to the stop (position "III"). The display lamp goes out. The starter motor is actuated.

Lube oil pressure must build up at the oil pressure gauge. If it does not, switch off the engine immediately.

For cold engines (<20°C) move control lever into starting position (against stop for maximum engine speed).

Note:

When starting the cold engine (control lever in starting position) retract the control lever **as quickly as possible** into lower idling position after the engine has started.

The warm engine can also be started with the control lever in idling position.

Do not operate starter for longer than 10 seconds at a time.

After ignition of the engine, release the starter button and adjust control lever for desired speed.

If engine fails to start, release the key, wait about 30 seconds, then operate starter again.



Commissioning and operation

For repeated starting turn the key back to OFF.

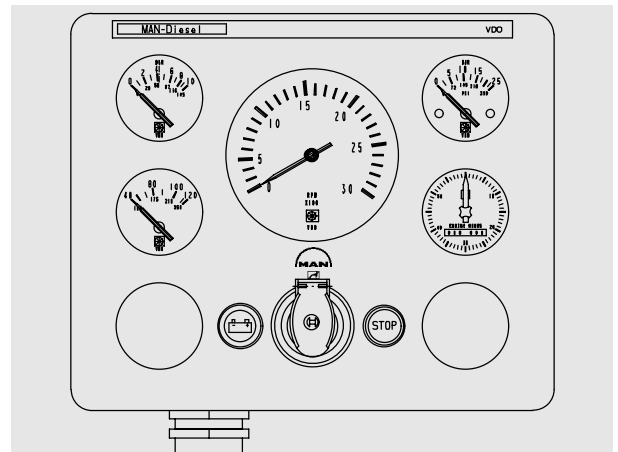
Avoid running the cold engine for any length of time since in any internal combustion engine this is liable to cause increased wear due to corrosion. Prolonged idling is harmful to the environment.

Operation monitoring system

Caution:

Do not overload the engine. Do not exceed the maximum permissible engine tilt. If faults occur, find their cause immediately and have them eliminated in order to prevent more serious damage!

During operation the oil pressure in the engine lubrication system must be monitored. If the monitoring (Fig.) devices register a drop in the lube oil pressure, switch off the engine immediately.



Shutting down

Disengage the gearbox clutch and move the shut-down lever to “stop”. After the engine has been running at a high load level, do not shut it down immediately but allow it to idle about 5 minutes so that temperatures may equalize.

Remove key from starting lock.

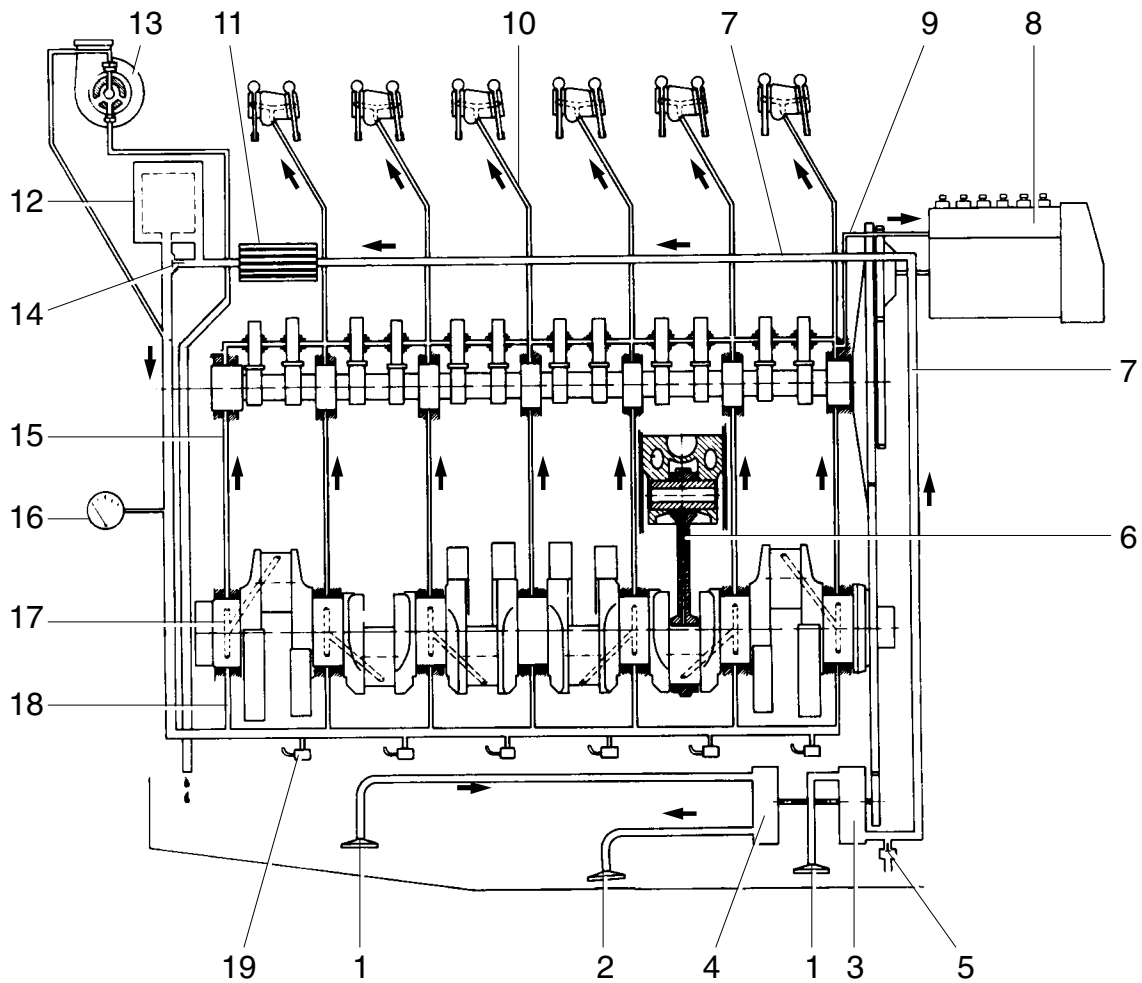


Danger:

Ensure that the engine can not be started by unauthorized persons.

Lubrication system

Lube oil diagram



- | | |
|---|---|
| 1 Oil suction basket | 11 Oil cooler |
| 2 Oil settling basket | 12 Oil filter |
| 3 Oil pressure pump | 13 Turbocharger |
| 4 Scavenge pump | 14 Bypass valve (in oil cooler housing) |
| 5 Oil relief valve | 15 Oil bore for camshaft bearing(s) |
| 6 Oil bore for gudgeon pin lubrication | 16 Oil pressure monitor(s) |
| 7 Oil bore to oil cooler | 17 Oil bore for big-end bearing(s) |
| 8 Injection pump | 18 Oil bore for crankshaft bearing(s) |
| 9 Oil bore for injection pump lubrication | 19 Oil spray jet for piston cooling |
| 10 Oil bore for rocker arm lubrication | |

Ensure utmost cleanliness when handling fuels, lubricants and coolants.

Note:

Use only approved fuels, lubricants etc. (see brochure "Fuels, lubricants etc.").
Otherwise the manufacturer's warranty will become null and void.

Engine oil change



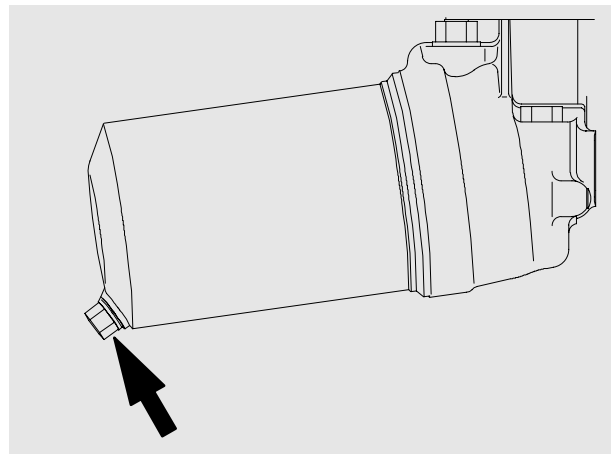
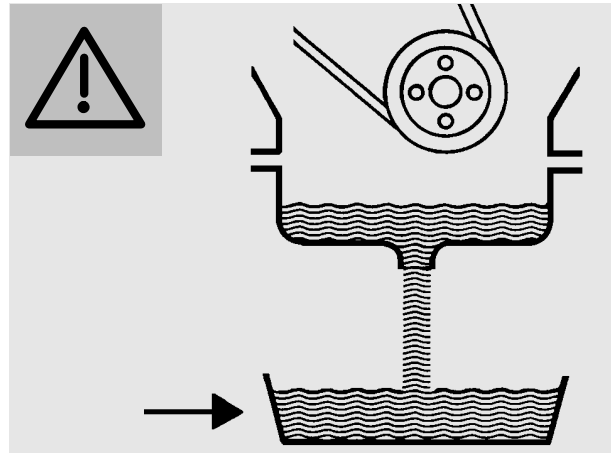
Danger:

The oil is hot- risk of scalding.
Do not touch the oil drain plug
with bare fingers.
Oil is an environmental hazard.
Handle it with care!

With the engine at operating temperature, remove the oil drain plugs on the oil sump and the oil filter bowl and allow the old oil to drain off completely.

Use a vessel of sufficient size to ensure that the oil does not overflow.

Refit the oil drain plugs with new gaskets.



Refilling with oil

Caution:

Do not add so much engine oil that the oil level rises above the max. marking on the dipstick. Overfilling will result in damage to the engine.

Refill with fresh engine oil at the oil filler neck.

After filling start the engine and let it run for a few minutes at low speed.

Caution:

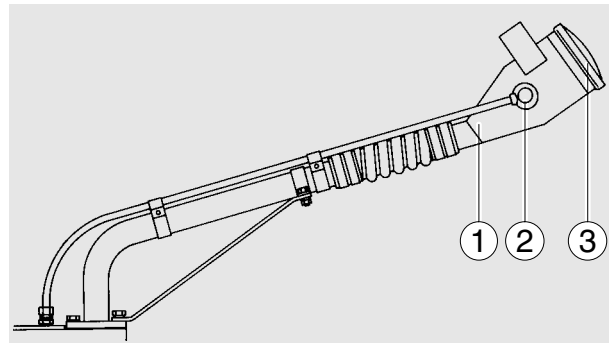
If no oil pressure builds up after approx. 10 seconds switch off the engine immediately.

Check oil pressure and check that there is no oil leakage.

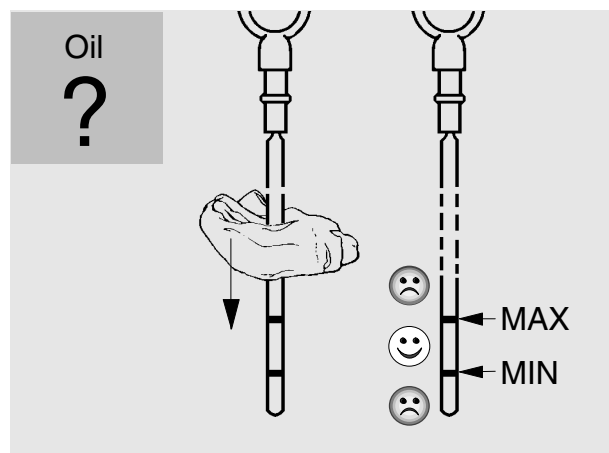
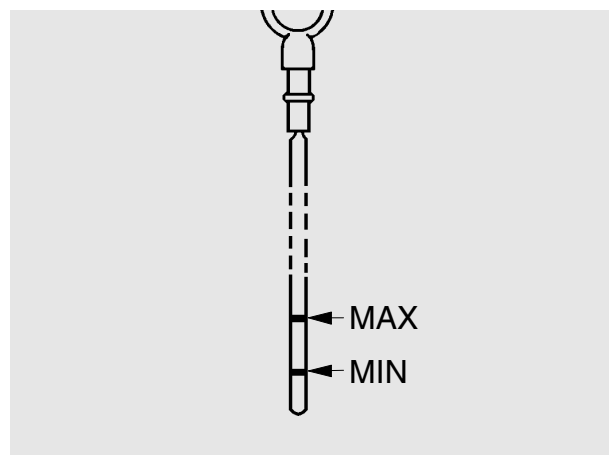
Then shut down the engine. After about 20 minutes, check the oil level.

- Pull out dipstick
- wipe it with a clean, lintfree cloth
- and push it in again up to the stop
- Pull out dipstick again

The oil level should be between the two notches in the dipstick and must never fall below the lower notch. Top up oil as necessary.



- 1 Oil filler neck
- 2 Oil dipstick
- 3 Bayonet fastener



Changing oil filter

Renewal of filter cartridges

- Allow the filter content to run off along drain plugs ①.
Hold a suitable vessel under hole



Danger:

The oil is hot and under pressure when the drain plug is opened.
Risk of burns and scalds.

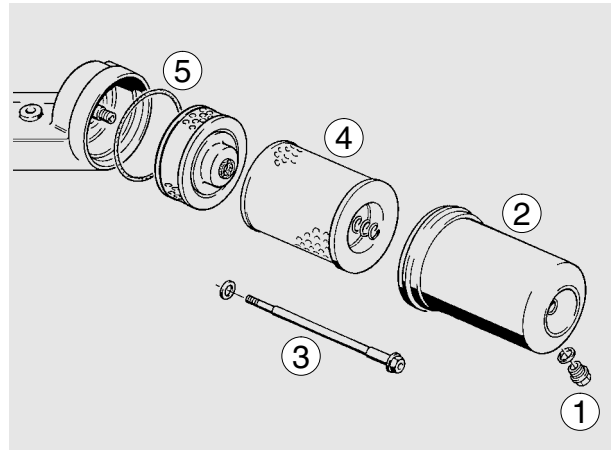
- After releasing the clamping bolts ③ remove filter bowls ②
- Renew filter cartridges ④. Thoroughly clean all other parts in cleaning fluid (do not allow cleaning fluid to enter the oil circuit)
- Use new gaskets ⑤ for reassembly of filter bowls

Note:

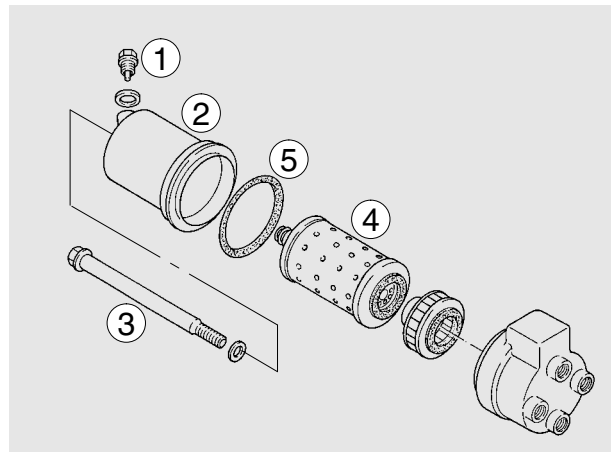
To prevent the seal ⑤ from twisting hold the filter bowl ② firmly when tightening the tensioning screw ③.

Caution:

Used oil filters are classed as dangerous waste and must be disposed of accordingly.

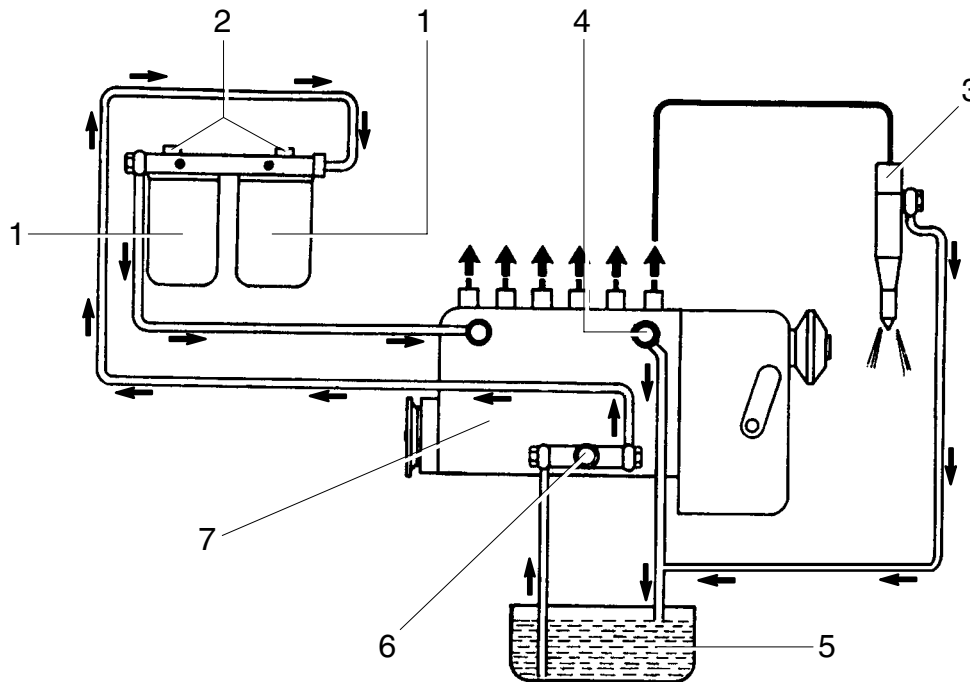


Front oil filter



Rear oil filter

Fuel system Fuel diagram



- | | |
|--------------------|------------------|
| 1 Fuel filter | 5 Fuel tank |
| 2 Bleeder screw | 6 Fuel lift pump |
| 3 Injection nozzle | 7 Injection pump |
| 4 Overflow valve | |

Fuel

If Diesel fuel which contains moisture is used the injection system and the cylinder liners / pistons will be damaged. This can be prevented to some extent by filling the tank as soon as the engine is switched off while the fuel tank is still warm (formation of condensation is prevented). Drain moisture from storage tanks regularly. Installation of a water trap upstream of the fuel filter is also advisable. Do not use any additives to improve flow properties in winter.

Injection pump

No alterations must be made to the injection pump. If the lead seal is damaged the warranty on the engine will become null and void.

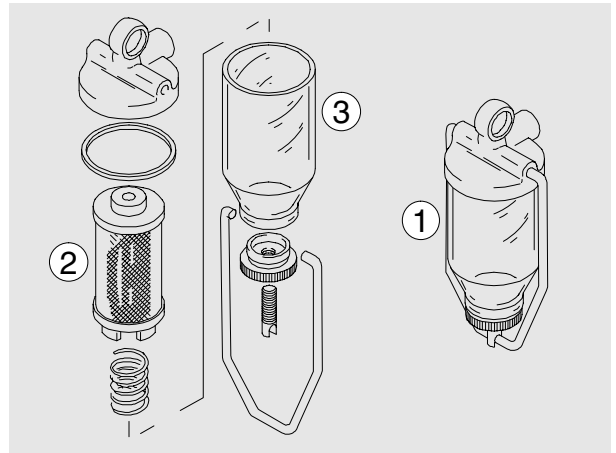
Faults

We strongly recommend that any faults developing in the injection pump should be taken care of by authorized specialist personnel.

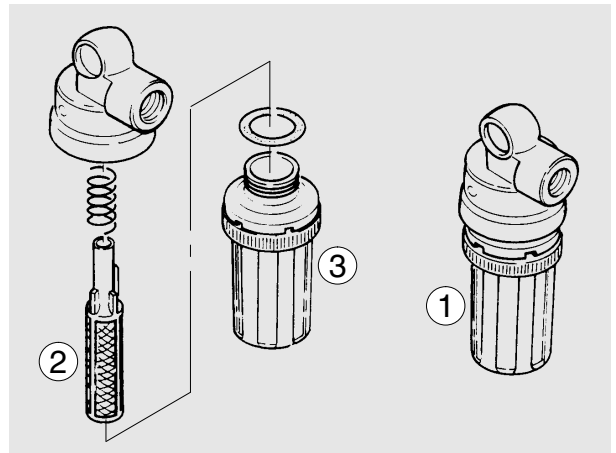
Cleaning fuel pre-cleaner

Strip the fuel pre-cleaner ①:

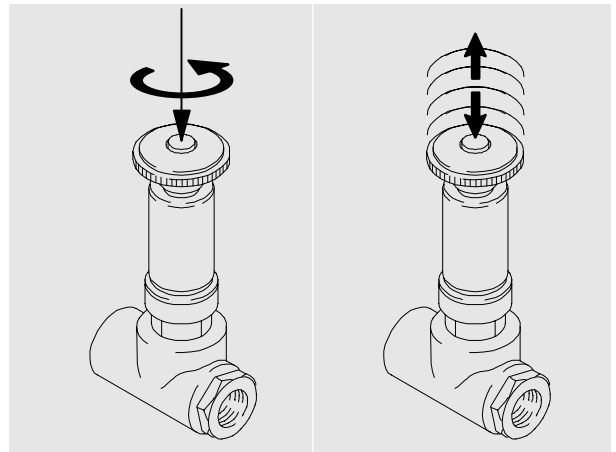
- Unscrew knurled nut of pre-cleaner
- Swing out retaining arm and take out filter housing ③ with strainer filter ②
- Wash out filter housing and strainer filter in clean Diesel fuel and blow dry with compressed air
- Re-assemble in reverse order



- Remove filter housing ③ with strainer filter ②
- Wash out filter housing and strainer filter in clean Diesel fuel and blow dry with compressed air
- Refit filter housing with strainer filter. Ensure that compression spring and seal are correctly seated



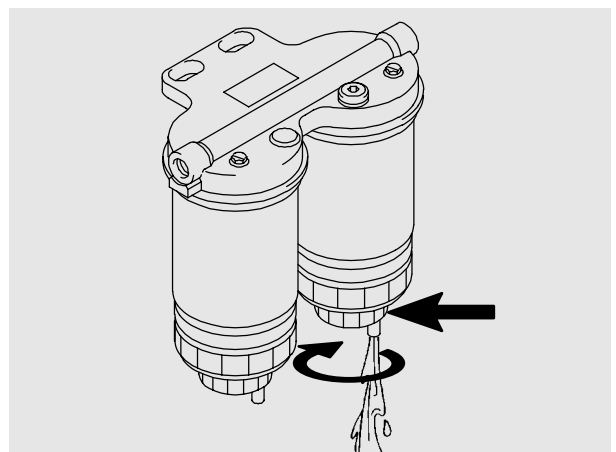
- Actuate tappet of hand primer until overflow valve of injection pump is heard to open
- Start engine
- Check fuel pre-cleaner for leaks



Parallel fuel filter

Draining moisture:

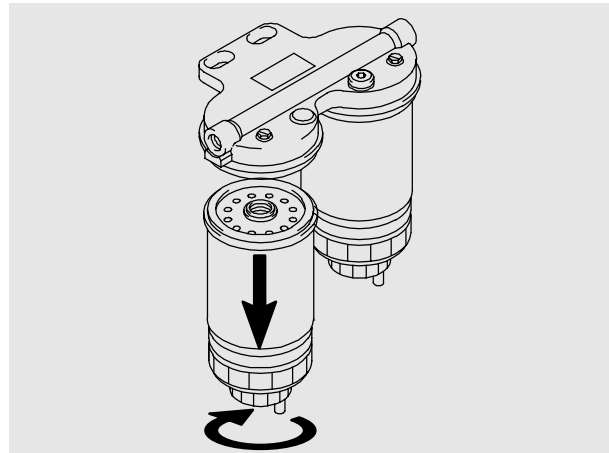
Unscrew drain plugs at every oil change until moisture has been discharged and clean fuel flows out.



Changing fuel filter

Only when engine is switched off

- Loosen filter with tape wrench and remove it
- Wet seal on new filter with fuel
- Screw on filter by hand
- After this, bleed the fuel system
- Check filter for leaks

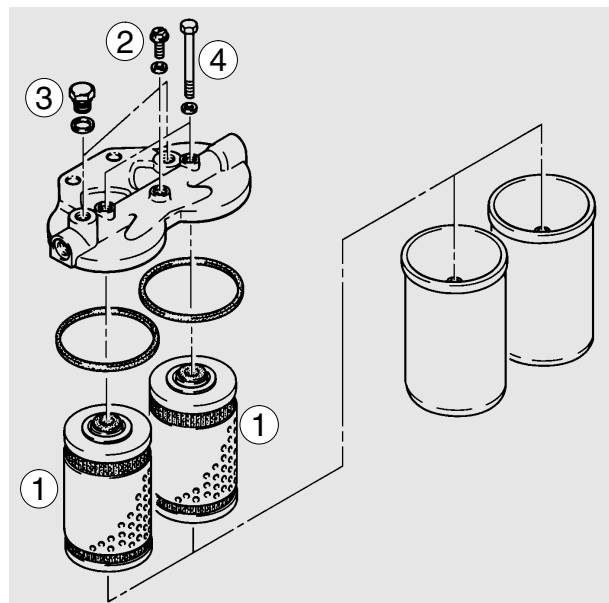


Parallel fuel filter with filter cartridges

- Remove clamping bolts
- Take off filter bowls
- Take out filter elements
- Wash out filter bowls
- Install new filter cartridges
- Refit filter bowls using new gaskets
- After this, bleed the fuel system
- Check filter for leaks

Caution:

Used fuel filters are classed as dangerous waste and must be disposed of accordingly.

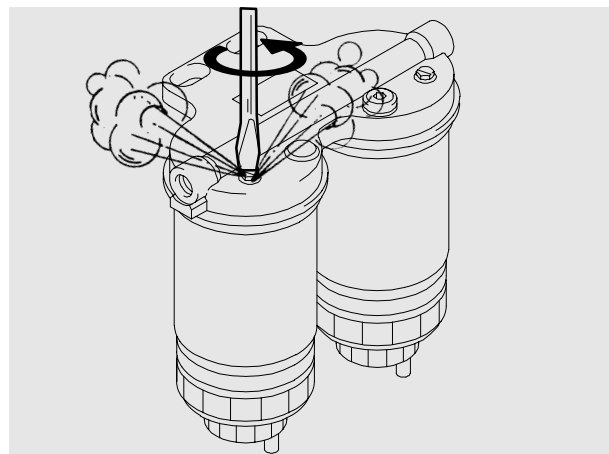


- 1 Filter elements
- 2 Vent plugs
- 3 Filler plug
- 4 Clamping screws

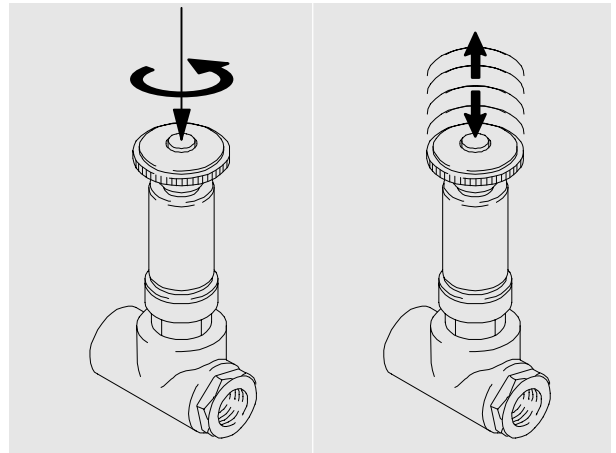
Bleeding the fuel system

An arrow on the filter head indicates the direction of fuel flow.

- Unscrew bleed screw of first filter in direction of flow by one or two turns



- Actuate tappet of hand primer until fuel emerges without bubbles
- Screw in the tappet of the hand pump again and tighten it
- Close bleed screw again
- Repeat this procedure at the second bleed screw
- Check filter for leaks

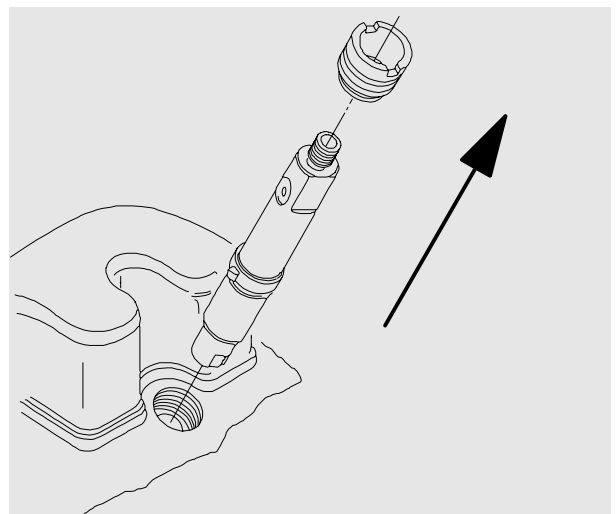


Injector maintenance

(by authorized specialist personnel)

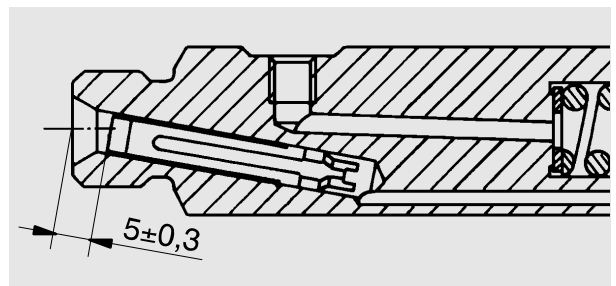
Removal, dismantling and cleaning

- Unscrew delivery pipe at nozzle holder and at the injection pump
- Remove leak-off pipe
- Release union screw of nozzle holder with special wrench
- Remove nozzle holder with gasket from the cylinder head



Clean nozzle in accordance with manufacturer's instructions.

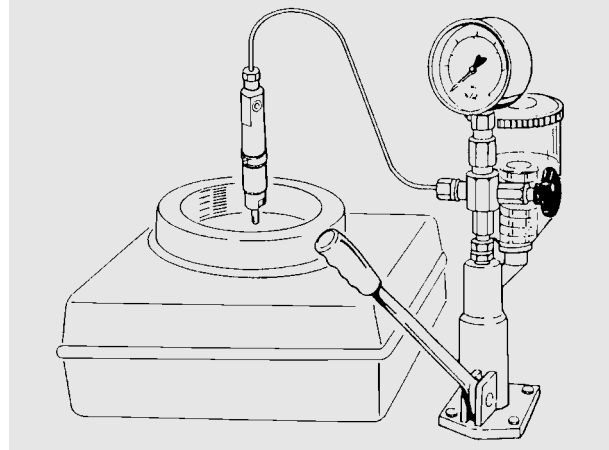
- Thoroughly clean all other parts of the nozzle holder with clean fuel
- Check nozzle discharge pressure in nozzle tester
- The edge-type filter should not be pressed into the nozzle holder by approx. 5 mm
- If this depth is exceeded the injector must be replaced



Check nozzle discharge pressure in nozzle tester. Adjust the discharge pressure by inserting shims of suitable thickness under the compression spring.

**Danger:**

Do not hold your hands under the fuel jet, as there is a risk of injury. Do not inhale the atomised fuel. If possible work under an extraction system.

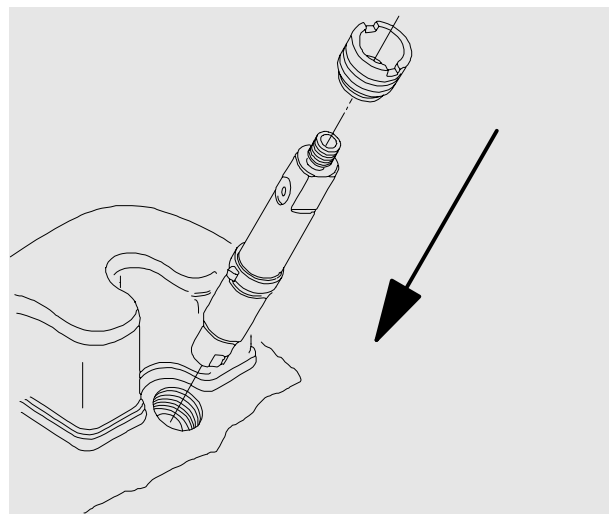


Installation

- Clean seat in cylinder head
- Insert nozzle holder with new gasket. Tighten union nut with 120 Nm
- Install injection lines **free of constraint**
- Install leak fuel lines

Caution:

The injection lines are designed for high operating pressures and should thus be handled with particular care.



- When mounting the pipes to the engine take care of good fitness
- Do not bend pipes to permanent deformation (not for replacing the nozzles either)
- Do not mount any heavily bent pipes
- Avoid bending the pipes at the ends by more than 2 to 3 degrees
- In case of faults in the injection system which might have resulted in excessive operating pressures, not only the failed part but also the injection line has to be replaced

Cooling system



Danger:

Draining hot coolant involves a risk of scalding.

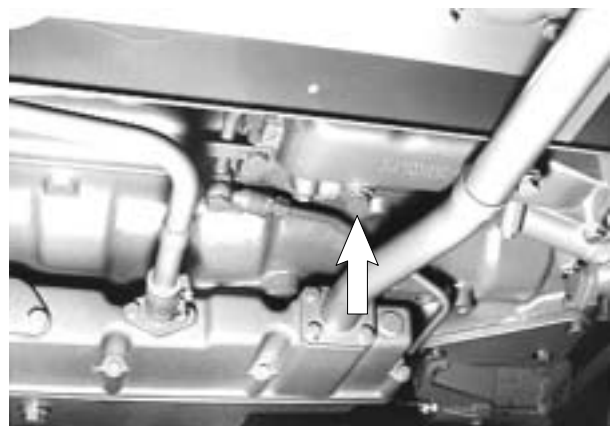
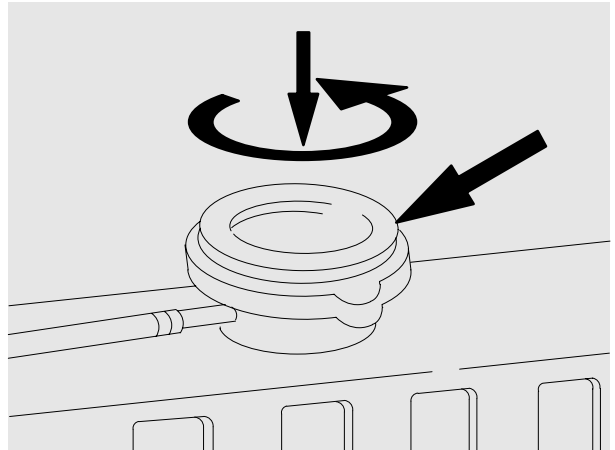
Draining the cooling system

Caution:

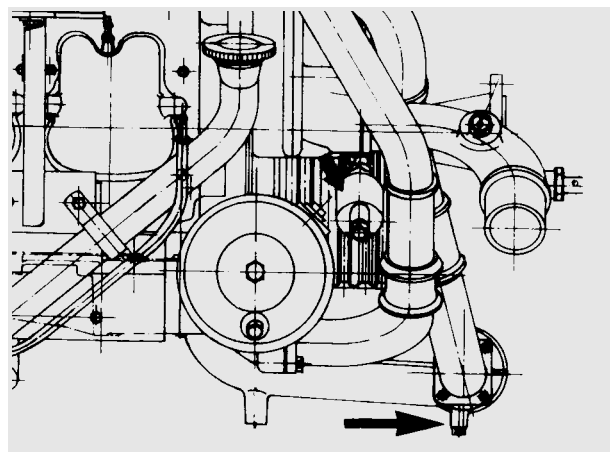
Drain coolant into a suitable container and dispose of it in accordance with regulations.

Drain coolant as follows when cooling system has cooled down:

- Briefly open cap on the filler neck of the expansion tank for pressure compensation
- Remove drain plugs from oil cooler housing and central coolant pipe
- Then remove cap
- Drain coolant into a container of adequate size
- Refit screw plugs
- Fill / bleed the cooling system



Drain plug in oil cooler housing



Drain plug on coolant pipe

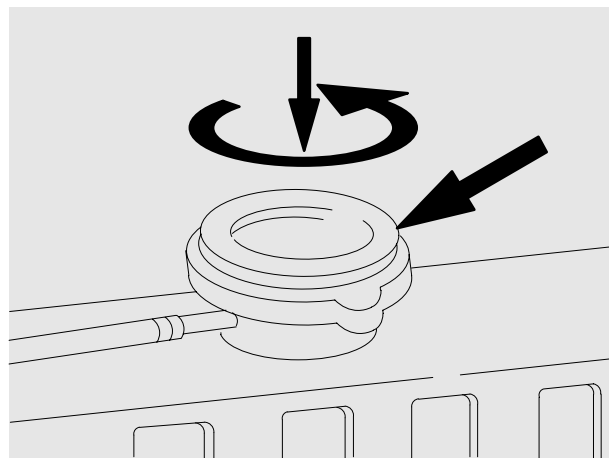
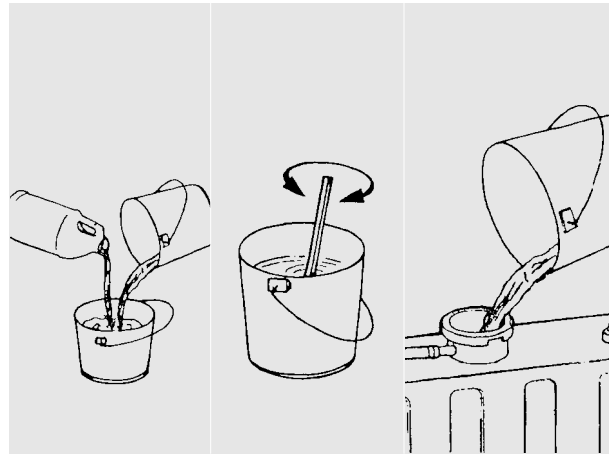
Fill / bleed the cooling system (only when engine has cooled down)

Fill the cooling system of the engine with a mixture of drinkable tap water and anti-freeze agent on ethylene glycole basis or anti-corrosion agent.

See Publication "Fuels, Lubricants and Coolants for MAN Diesel Engines".

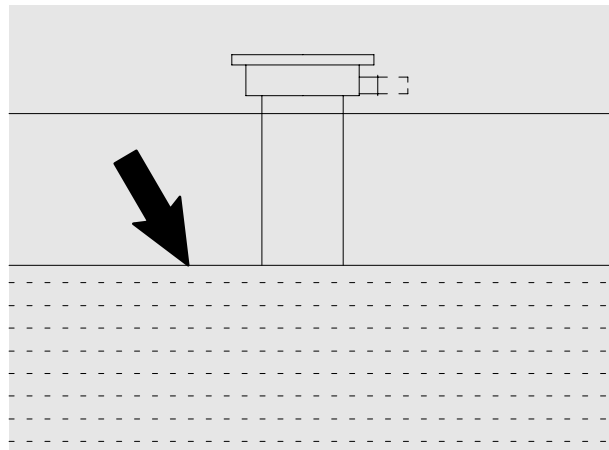
Coolant must be added at the filler neck only. Do not put cold coolant into an engine which is warm from operation. Ensure that the ratio of water to anti-freeze is correct. Find the cause of the loss of coolant and have it eliminated.

- Remove cap
- Fill in the coolant slowly.
- during the filling procedure keep bleed screw (see page 10, item 3) open until coolant emerges without bubbles
- Run the engine briefly and then check coolant level once more.



Danger:

If, in an **exceptional** case, the coolant level has to be checked in an engine that has reached operating temperature, first carefully turn the cap with safety valve to the first stop, let off pressure, then open carefully.



Caution:

If the cap with the working valves is opened, there is the risk that it will not close tightly again afterwards. The excess pressure required in the system will then no longer build up. Premature boiling occurs and coolant is lost. To prevent damage to the engine open this cap only in exceptional circumstances and fit a new one as soon as possible.

Improper mixing of anti-freeze and corrosion inhibitors may lead to lime and corrosion deposits in the engine cooling system which can jeopardize cooling efficiency. In such cases it is necessary to clean the cooling system at suitable intervals.

Cleaning the inside of the cooling system

Investigations have shown that in many cases the poor condition of the coolant and / or the cooling system accounts for damage to the water pump mechanical seal. The poor condition of the cooling system is normally due to use of unsuitable or no anti-freezing agents and corrosion inhibitor or defect, not early enough replaced covers for filler neck and working valves.

If twice in a short time the water pump of an engine develops leaks or the coolant is heavily contaminated (dull, brown, mechanically contaminated, grey or black signs of a leakage on the water pump casing, after the defect on the oil cooler) clean the cooling system **prior to** removing that water pump as follows:

- a) Drain coolant
- b) Open thermostats positively (use short-circuit inserts), so that the entire coolant circuit is flushed in the cleaning operation
- c) Fill coolant circuit with a mixture of hot water (min. 50°C) and Henkel P 3 neutrasel 5265 detergent (1.5% by volume) (-5266, -5225, Kluthe Hakopur 316), refer to Publication "Fuels, Lubricants ..."
- d) Warm up engine under load. After a temperature of 60°C is reached, run engine for a further 15 minutes
- e) Drain cleaning fluid
- f) Repeat steps c) and d)
- g) Flush cooling system. To this effect
- h) Replace drain plug by drain plug with a bore of 8 mm dia
- i) Fill cooling system with hot water
- k) Run engine at idle for 30 minutes. At the same time continuously replenish the water leaking from the bore in drain plug by adding fresh water

Repair water pump only now. Thereafter, fill the cooling system with approved cooling fluid. See Publication "Fuels, Lubricants ...".

Note:

Only sediments and suspended particles can be removed by this cleaning method. If corrosion and lime deposits are found, proceed according to the following section:

Removal of lime deposits in the cooling system

Procedure:

- Drain the coolant
- Fill the system with undiluted original pickling fluid (Lithsolventsäure or engine pickling fluid RB-06), see sources of supply
- Let the engine run (also in normal operation) for approx. 8 hours with this filling in the cooling circuit
- Drain the pickling fluid and thoroughly flush the system with tap water
- If necessary, refill the circuit again with fresh pickling fluid and pickle the engine for another 8 hours
- Drain the pickling fluid, fill the system with tap water, and run the engine at idle for 5 minutes to flush out all fluid; then drain the water
- Fill the system with a 1% soda solution. Drain the soda solution after running the engine at idle for 5 minutes, and flush with tap water until the discharging water is clear
- Fill cooling circuit with a mixture of potable tap water and anti-freeze with at least 40% by volume, refer to Publication “Fuels, Lubricants ...”

Note:

Older radiators may develop leaks when such deposits are removed. The surge tank should be filled only up to the bottom edge as otherwise foaming will cause the pickling fluid to spill over.

Filler caps and working valves of cooling system

The rubber gaskets of the filler caps and working valves (negative pressure and positive pressure valves) of the cooling system are subject to natural aging.

To preclude leakages in the cooling system and tailing pressure drop and its consequences up to severe engine damage, renew the filler caps and working valves in line with the change of coolant (every two years at the latest) see also “Filling-in of coolant” in this chapter.

Waste water treatment

Drained and spent cleaning and pickling fluid should be brought up to a pH value of 7.5 to 8.5 with the aid of caustic soda. Once the precipitation has settled to the bottom of the container the clear fluid above can be dumped into the sewer. The sludge at the bottom should be taken to a special waste dump. Anyway, it is recommended to consult the local authorities for more information about waste water rules or restrictions.

Sources of supply for pickling fluids

Lithsolventsäure
Keller & Bohacek
Liliencronstr. 54
D-40472 Düsseldorf
Tel.: (02 11) 96 53 0

Motor pickling fluid RB-06
Reincolor-Chemie GmbH
Werkstr. 21
D-90518 Altdorf
Tel.: (0 91 87) 97 03 0

Air cleaner

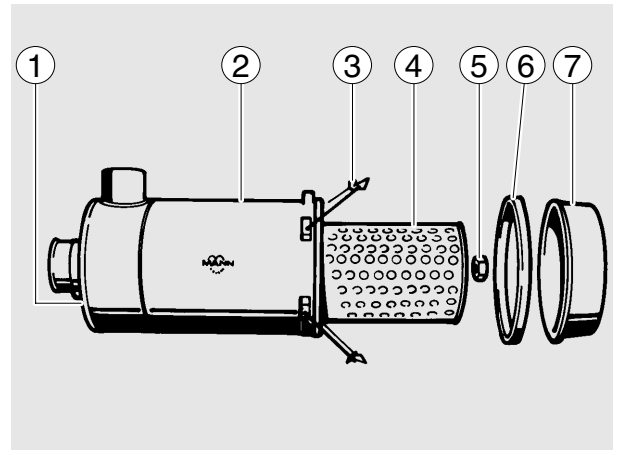
Service only when engine is switched off.

Dust collector

The dust collector must be emptied at regular intervals. The collector should never be more than half full of dust.

When the two retainers have been folded up the dust collector can be taken off. Remove the lid of the dust collector and empty the collector.

Ensure that the lid and the collector are reassembled correctly. A lug on the collector fits into a recess in the edge of the lid. If the filter is installed horizontally note the "oben" ("top") marking on the filter bowl.



- 1 Connection for contamination gauge
- 2 Filter housing
- 3 Clamp
- 4 Element
- 5 Hexagon nut
- 6 Cover
- 7 Dust bowl

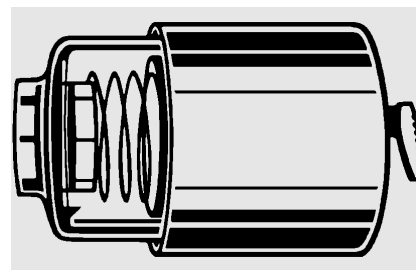
Fouling Indicator

As the degree of clogging increases the red indicator becomes more and more visible in the transparent section of the air cleaner.

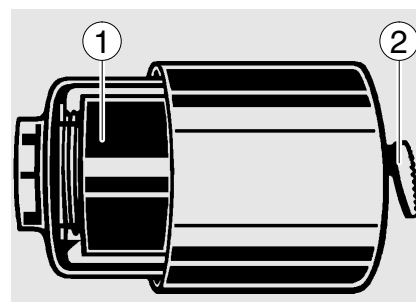
If the fouling indicator remains engaged, i.e. it still shows completely red even with the engine shut down, the filter cartridge must be cleaned or replaced.

After servicing the cartridge, press the button to reset the fouling indicator.

- 1 Red indicator
- 2 Reset button



Filter operational



Filter must be serviced

Changing the filter cartridge

Caution:

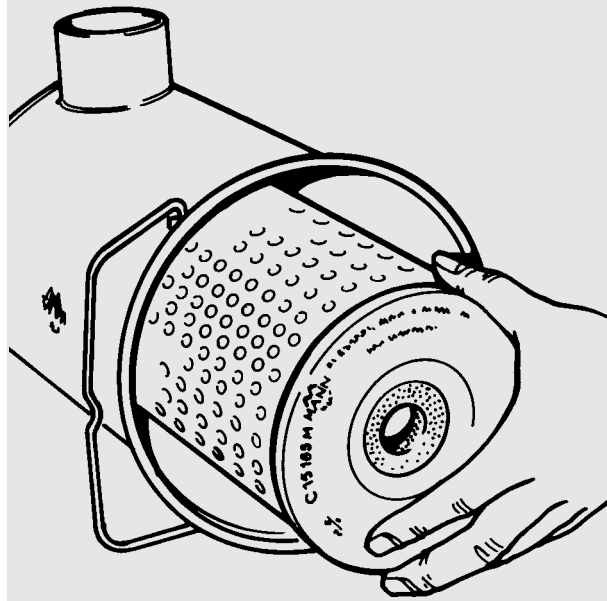
No dust must get to the clear air end.

Remove the hex nut, take out the contaminated cartridge and fit a new one.

Clean the filter housing with a damp cloth, especially at the sealing face for the cartridge.

Caution:

The engine must not be run without a main cartridge.



Cleaning the cartridge

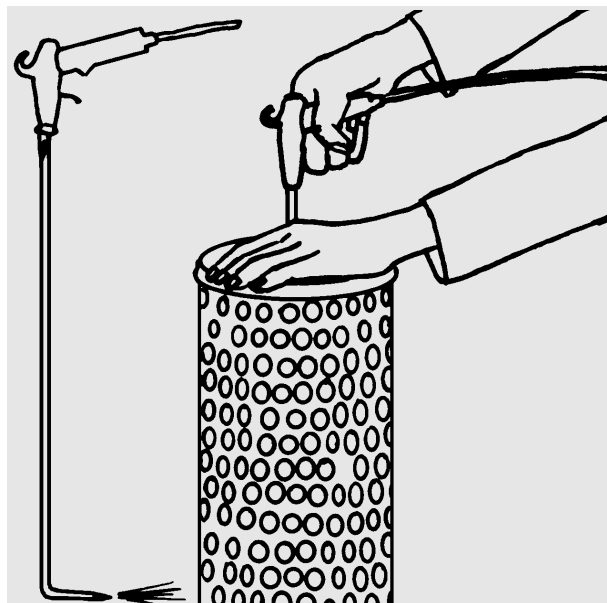
Caution:

The filter cartridge should normally be changed. Clean it only in emergencies (e.g. when no replacement is available).

Blowing out (wear goggles)

To do this fit a pipe to the compressed air gun. The end of the pipe should be bent by approx. 90°. The pipe must be long enough to reach the bottom of the cartridge.

Blow the cartridge out from the inside with dry compressed air (max. 5 bar) by moving the pipe up and down inside the cartridge until no more dust is released.

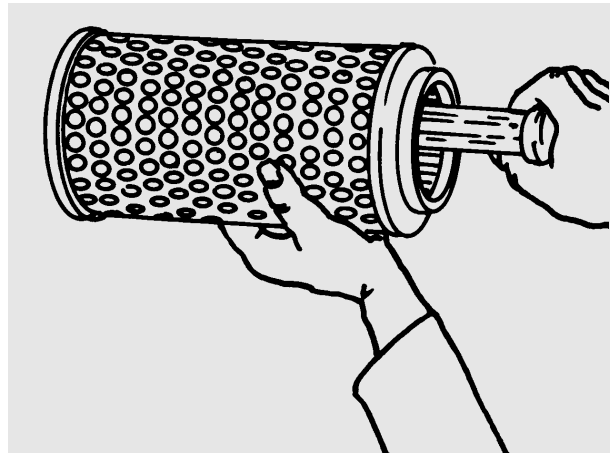


Checking the cartridge

When a cartridge has been cleaned it must be examined for damage before it is refitted, e.g. damage to the paper bag and rubber seals. Check also for compression of or dents in the metal jacket.

Tears and holes in the paper bag can be found by shining a torch into the bag.

On no account re-use damaged cartridges. If in doubt fit a new cartridge.



Safety cartridge

When the main cartridge is being serviced the safety cartridge remains in the filter housing. The engine must not be run without the main cartridge.

Safety cartridges must be neither cleaned nor re-used.

Safety cartridges must be changed:

- at the latest after being in use for two years
- if, after the main cartridge has been serviced (changed), the contamination gauge responds again immediately
- if the main cartridge is defective

When the main cartridge has been removed the safety cartridge is accessible and can be removed also.

Remove the hex nut.

Pull out the safety cartridge.

Insert a new safety cartridge. Refit and tighten the hex nut.

Turbocharger

At every engine oil change check the oil pipes for leaks and constrictions.

Furthermore, a regular check should be kept on charge air and exhaust gas pipes. Any leakages should be attended to at once because they are liable to cause overheating of the engine.

When operating in highly dust or oil-laden atmospheres, cleaning of the air impeller may be necessary from time to time. To do this, take compressor housing (**Caution: do not tilt it so that it jams**) and clean it in solvent (diesel oil, petroleum ether) using a brush.

If the air compressor should be badly fouled, it is recommended that the wheel be allowed to soak in a vessel with solvent and to clean it then with a stiff brush. In doing so, take care to see that only the compressor wheel is immersed and that the turbocharger is supported on the bearing casing and not on the wheel.

Intercooler

Maintenance

In order to maintain the heat transfer efficiency of the intercooler, it is necessary to clean it at regular intervals which depend on the quality of the coolant used.

For this purpose, dismantle the intercooler. In almost all cases, it will suffice to clean the individual parts in a hot alkaline solution, e.g. a 3 to 5% P3-FD solution.

Should hard and firmly adhering scale deposits continue to exist a second treatment should be made with a descaling agent which will not corrode the cooler core.

Use new gaskets when assembling the cooler.

Be sure to clean the sealing surfaces carefully before installing the gaskets.

Observe the specified pressure when making the hydraulic test.

Test gauge pressure	water side	4 bar
	charge air side	3 bar

Starter motor

As part of every engine overhaul, the starter pinion and ring gear should be cleaned with a brush dipped in fuel and then a coat of grease should be applied again.

Always protect starter motor against moisture.

Note:

Always disconnect the battery earth cable before starting work on the electrical system. Connect up the earth cable last, as there is otherwise a risk of short-circuits.

Alternator

The alternator is maintenance-free.

Nevertheless, it must be protected against dust and, above all, against moisture.

In order to avoid damage to the alternator, observe the following instructions:

While the engine is running

- Do not de-energize the main battery switch!
- Do not disconnect the battery or pole terminals or the cables!
- If, during operation, the battery charge lamp suddenly lights up, stop the engine immediately and remedy the fault in the electrical system!
- Do not run the engine unless the battery charge control is in satisfactory order!
- Do not short-circuit the connections of the alternator with those of the regulator or said connections with ground, not even by briefly bringing the connections into contact!
- Do not operate the alternator without battery connection!

Temporary decommissioning of engines

Temporary anti-corrosion protection according to MAN works norm M 3069 is required for engines which are to be put out of service for fairly long periods.

The works standard can be obtained from our After-Sales Service department in Nuremberg.

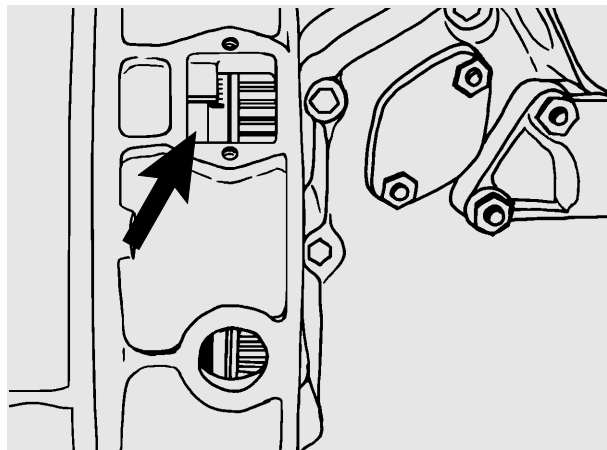
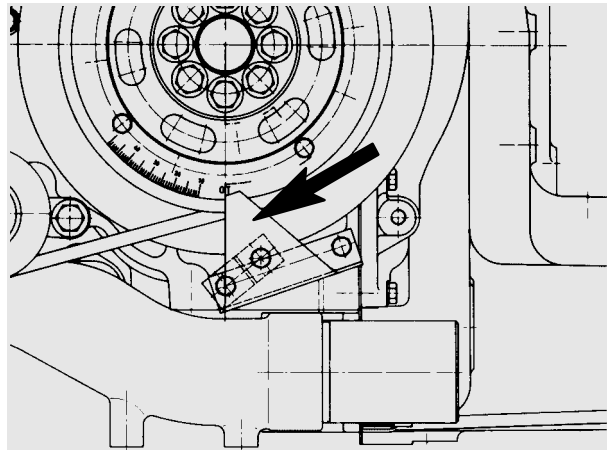
To check and set the start of delivery

For checking the start of delivery setting there is either on the belt pulley or on a disc in front of the torsional vibration damper an “OT” (TDC) marking and a scale 10 ... 50° before TDC. The counter-marking is a pointer (arrow) on the crank-case.

There is another scale engraved on the flywheel which can be read through an inspection hole in the flywheel housing but access may be difficult. The scale should be used for readjusting the pointer after the vibration damper has been removed or replaced.

In other words, before the vibration damper with the scale disc is installed, the engine should be positioned at “OT” (top dead centre) by means of the scale on the flywheel.

The pointer should then be aligned such that its measuring edge exactly coincides with the “OT” mark on the scale disc.



Checking

if "injection pump at top"

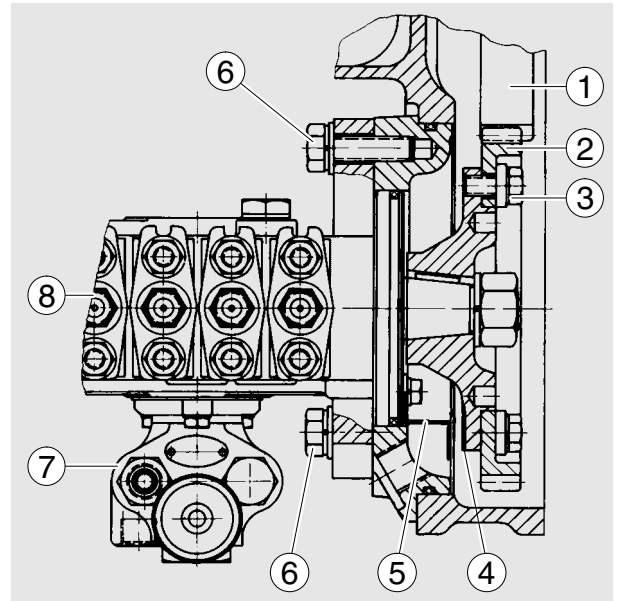
Remove screw plug for inspection hole in mounting flange of the injection pump.

Then rotate engine so that mark on pointer fitted to injection pump coincides with mark on pump hub.

Read degrees on scale engraved on disc on torsional vibration damper.

The reading should equal the specified start-of-delivery setting (see "Technical Data").

If not, correct start-of-delivery setting.



- 1 Idler gear
- 2 Injection pump drive gear
- 3 Mounting bolts
- 4 Marking on injection pump hub
- 5 Pointer
- 6 Injection pump mounting bolts
- 7 Fuel lift pump
- 8 Injection pump

Setting start of delivery

if "injection pump at top"

Correct start of delivery by turning the pump hub in the slotted holes of the drive gear.

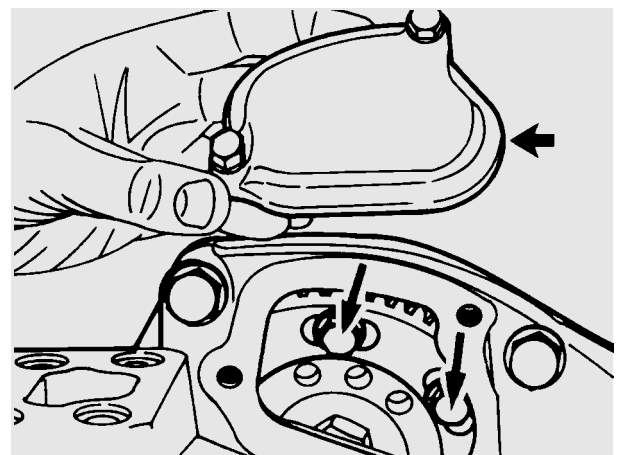
Remove cover above the injection pump drive gear

Rotate engine with barring device until the pointer is on the specified start of delivery (scale disc ahead of vibration damper).

Unscrew timing case cover. Remove fixing screws of injection pump impeller. Turn the hub of the injection pump accordingly until the line marks (pointer and injection pump hub) are in alignment. After every adjustment carefully retighten fixing screws.

Recheck start of delivery.

Use new gaskets when mounting cover and screw plug.



Checking

if “injection pump at rear”

Set piston of cylinder 1 (water-pump end) to ignition TDC.

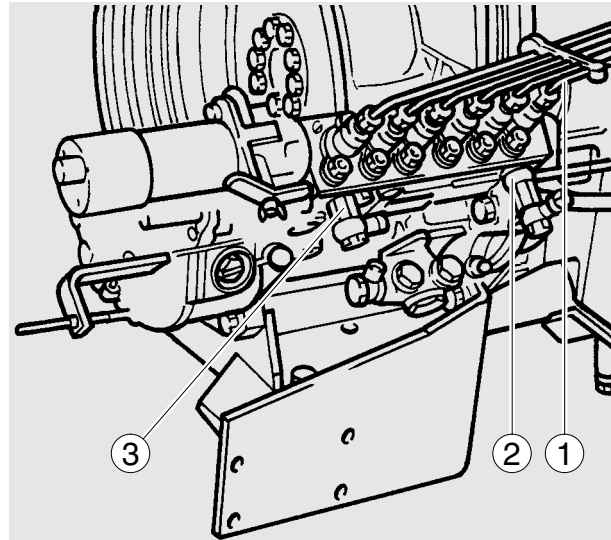
When the engine is in this position the valves of cylinder 6 are in crossover. The measuring edges of the front indicator and in the inspection hole in the flywheel housing now coincide with the TDC marking on the scale disc at the front and on the flywheel. Turn engine back past the degree mark and then, in order to eliminate backlash, once again in direction of rotation to the degree mark for the specified start of delivery value (see “Technical Data”).

Close up pump return pipe ② with a screw plug and connect hose of high-pressure pump to pump inlet pipe ③.

All injection pipes, except no. ① leading to cylinder 1, remain connected up. Fit a bent pipe in place of the injection pipe leading to cylinder 1.

Set charge regulator lever to full load. Turn engine in opposite direction past the degree mark. Build up pressure using the high-pressure pump. The fuel must flow out of the bent pipe. Now turn engine in direction of rotation until the fuel drips only. In this position the specified start of delivery value (see “Technical Data”) must be in alignment with the measuring edge on the flywheel housing and the measuring edge of the pointer on the scale disc.

If this is not the case, correct the start of delivery setting.



- 1 Injection pump line to cylinder 1
- 2 Injection pump return line
- 3 Injection pump supply line

Setting start of delivery if “injection pump at rear”

The start of delivery is corrected by turning the injection pump drive gear in relation to the hub.

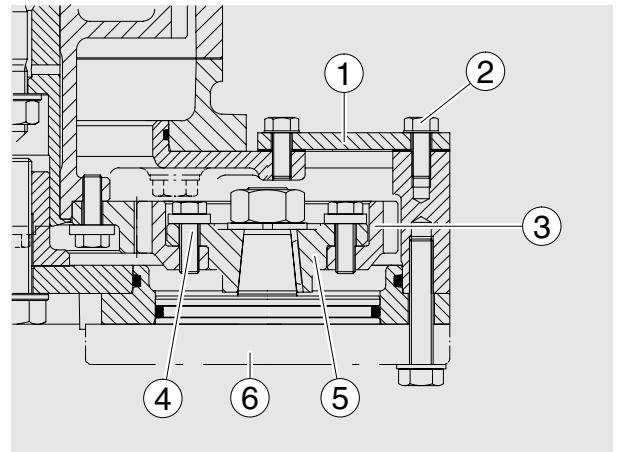
Remove end cover ①. Turn engine back by 180° and loosen the two mounting bolts ④ on the injection pump drive gear. Turn engine by a further 180° and loosen the other two bolts ④. Then turn engine back to start of delivery marking (eliminate backlash as described under “Checking start of delivery”).

Set charge regulator lever to full load. Build up pressure using the high-pressure pump. Then turn injection pump drive gear ③ slowly in relation to the hub ⑤ until the jet of fuel emerging from the bent pipe becomes a drip. In this position tighten the mounting bolts ④.

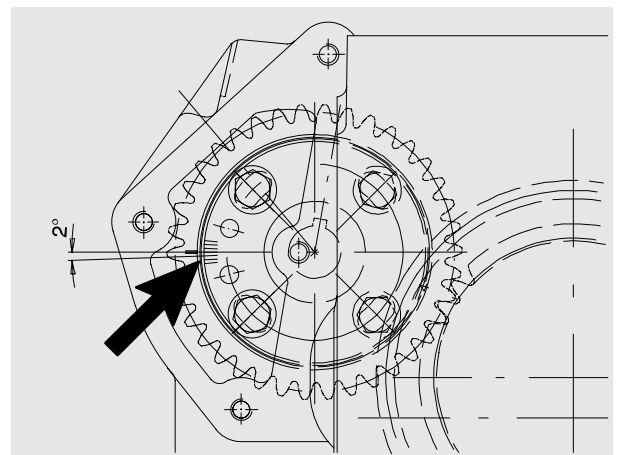
Recheck start of delivery.

Note:

Markings (arrow) have been made on the hub and the injection pump drive gear to help you in setting the start of delivery. Adjusting by one marking corresponds to an adjustment of 2°.



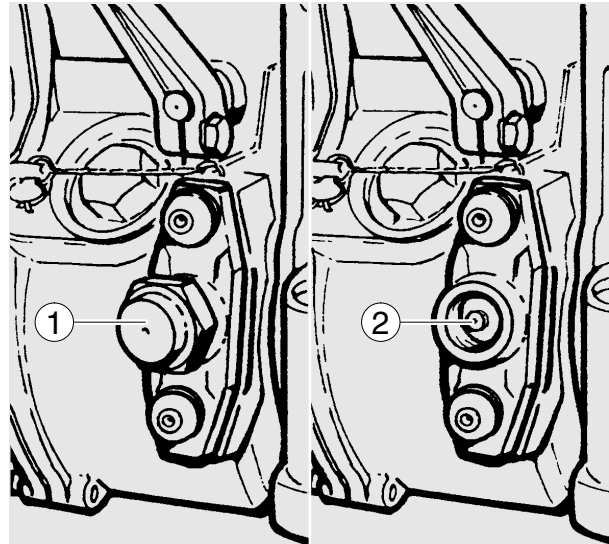
- 1 End cover
- 2 Mounting bolts
- 3 Injection pump drive gear
- 4 Mounting bolts for 3
- 5 Hub
- 6 Injection pump



Checking

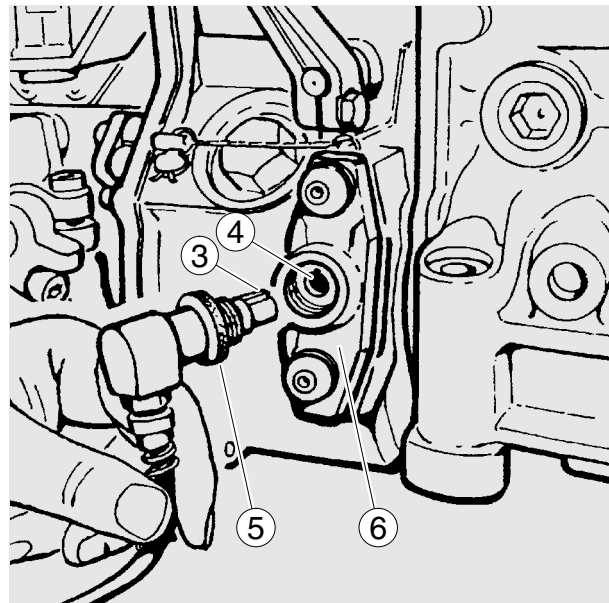
if "D 2866 LUE 601"

Remove screw plug ① on governor housing. If fitted, take out blocking pin ②. If the pointer is exactly in the centre of the inspection hole, the pump plunger for cylinder no. 1 is at start of delivery. However, it is possible to determine exactly whether or not the pump is at start of delivery only by means of the following special tools:



a) Light signal transmitter 80.99605-6002

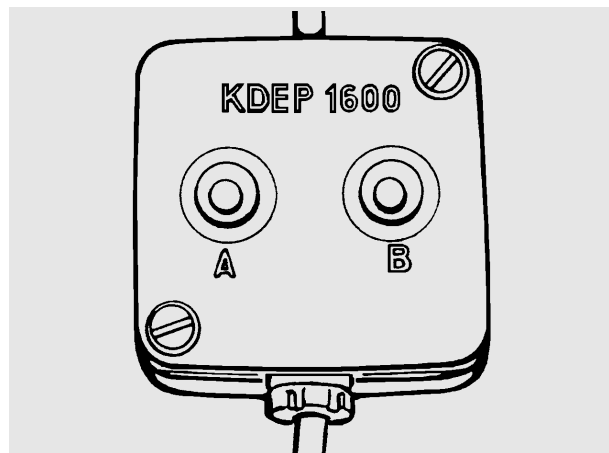
Push light signal transmitter into socket in governor housing. Ensure that the lug ③ fits in the groove ④. Tighten the knurled nut ⑤ by hand.



Connect up power supply of light signal transmitter (red terminal = +). Turn engine by hand so that piston in cylinder no. 1 in the compression stroke comes close to the start of delivery. Lamp (A) comes on shortly before start of delivery is reached.

Slowly turn the engine further until lamp (B) comes on too. The injection pump is now at start of delivery.

When the pump is in this position the degree scale on the flywheel housing must also indicate the specified start of delivery.



Note:

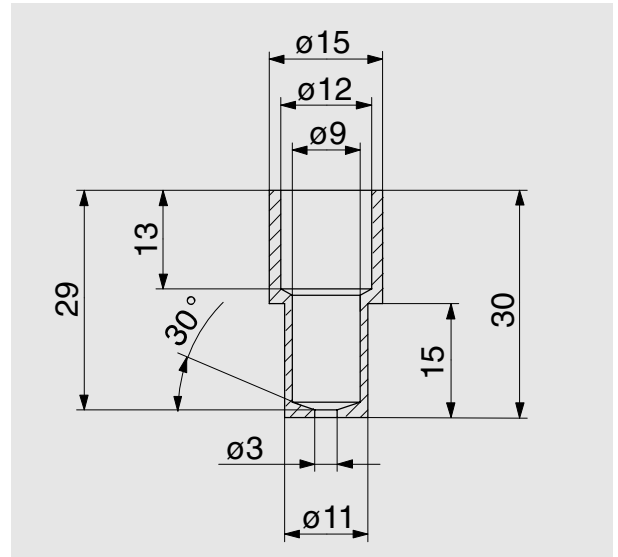
If only lamp (B) comes on during this test the engine has been turned past the start of delivery. In this case turn the engine back and repeat the procedure.

b) Sleeve

If a light signal transmitter is not available, good measurement results can also be achieved with a plug-in receptacle. The receptacle is to be made of aluminium or steel in accordance with the drawing.

Set engine to start of delivery as described above.
Insert the sleeve into the governor housing up to the stop.

The start of delivery is set exactly when the pointer for start of delivery is in the centre of the 3 mm bore in the sleeve.



Setting start of delivery

if "D 2866 LUE 601"

If the start of delivery as determined in the checks carried out in accordance with method a) or b) is not correct, proceed as follows:

Remove cover above the injection pump drive gear.

Loosen the fixing bolts joining the drive gear to the injection pump hub.

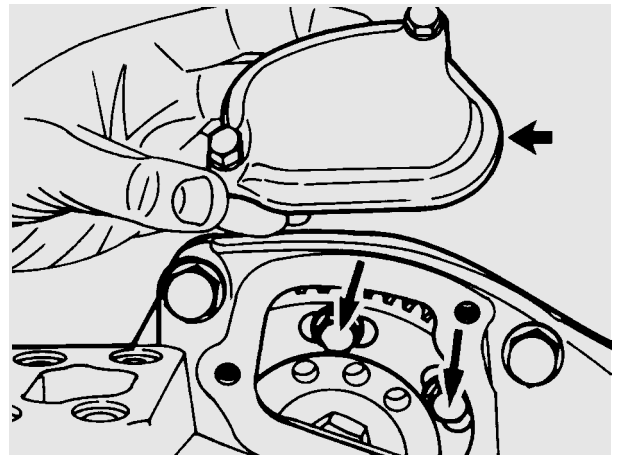
Set the engine so that the cylinder no. 1 is at the specified number of degrees before firing top dead centre (TDC).

Remove screw plug on governor housing. The pointer for start of delivery must be visible in the centre of the inspection hole. Turn the injection pump camshaft to the left or right as necessary until the conditions required for a) or b) (depending on which method is being used) are obtained.

Tighten mounting bolts on drive gear consecutively to 10 Nm initially and then finally to 30 Nm.

Check start of delivery again.

Close up governor housing.



To check and adjust valve clearance

The valve clearance (see “Technical Data”) should be adjusted so that the feeler gauge can be moved between the valves stem and the rocker arm with a slight resistance being felt.

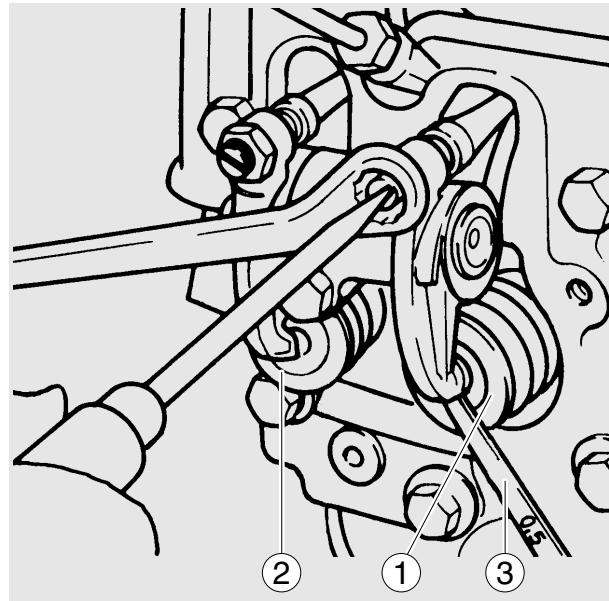
Adjustment is made with the adjusting screw after releasing the lock nut.

Rotate the crankshaft so that the piston of the cylinder to be adjusted is at firing TDC. This is the case when the valves of the synchronous pistons are just rocking.

Valve rocking on cylinder

1	5	3	6	2	4
6	2	4	1	5	3

Adjust valves on cylinder



- 1 Inlet valve
- 2 Exhaust valve
- 3 Feeler gauge

Cylinder head bolts

General notes

The engine may have either of the following two types of cylinder head bolt:

- Cylinder head bolts with hex head tightened by the angle-of-rotation method, socket size 19
- Cylinder head bolts with Torx head tightened by the angle-of-rotation method, Torx wrench size E18



Bolts to be used in event of repairs:

Bolts with hex head may be replaced by bolts with Torx head if all the bolts on the engine are to be changed.

Do not use bolts with hex head and bolts with Torx head on the same engine.

**Retightening cylinder head bolts on new engines
(engine cold or warm)**

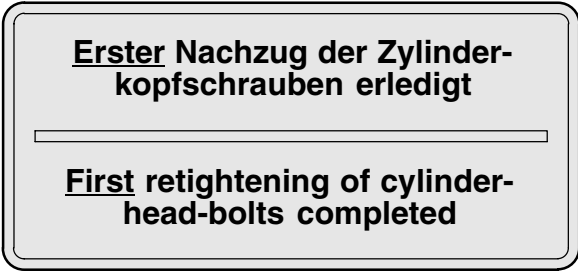
The cylinder heads are mounted with cylinder head bolts which are tightened by the angle-of-rotation method. On new engines the cylinder head bolts are tightened up for the first time at the factory after the engine has been broken in. The sticker “**First retightening of cylinder head bolts ...**” is then attached to one of the cylinder head covers.

After the first 400 hours of operation retighten cylinder head bolts 1 to 4 in the order shown in Tightening diagram “1” by a further 90° (1/4 revolution).

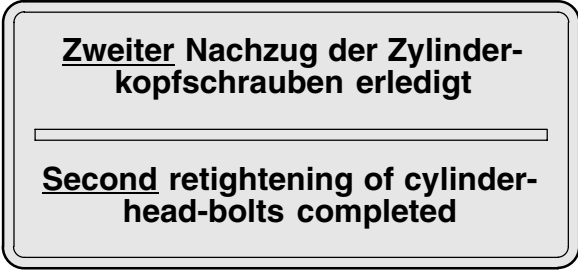
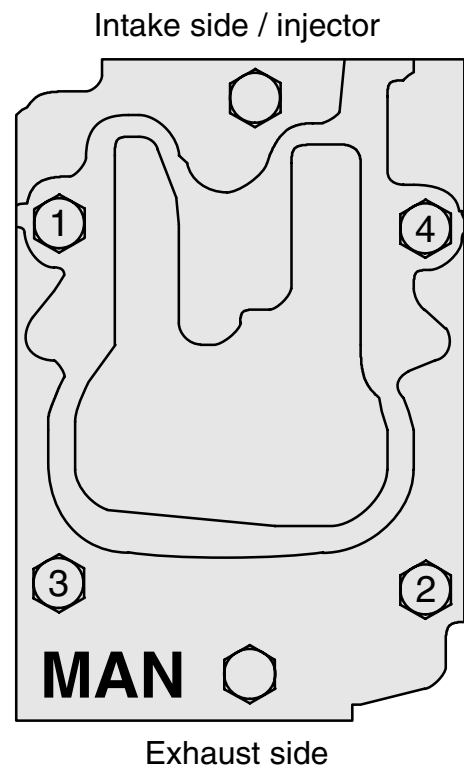
The two outer screws (intake and exhaust sides) must not be retightened.

Note:
The cylinder head bolts to be retightened must not be loosened first, but simply tightened by a further 90° (1/4 revolution) from their actual position.

Remove the sticker “**First retightening of cylinder head bolts ...**” and attach the sticker “**Second retightening of cylinder head bolts ...**” to show that the cylinder head bolts have been retightened for the second time.



Spare part No. 51.97801–0211



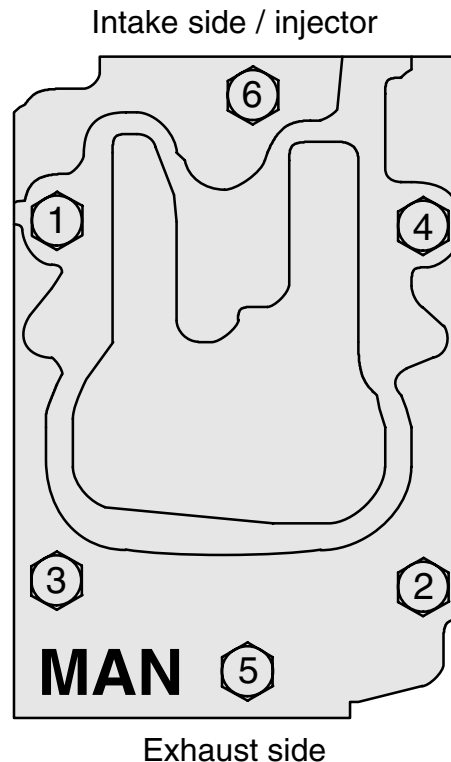
Spare part No. 51.97801–0212

Tightening cylinder head bolts after a repair (engine cold)

Before inserting the cylinder head bolts oil them with engine oil on the thread (not to the bore) and coat the contact face of the bolt head with “Optimoly White T” assembly paste. Do not use any oils or oil additives that contain MoS₂. The bolts must be tightened by the angle-of-rotation method as shown in Tightening diagram “2”.

- 1st pretightening step = to 10 Nm
- 2nd pretightening step = to 80 Nm
- 3rd pretightening step = to 150 Nm
- 4th pretightening step = turn by 90°
- Final tightening = turn by 90°

Adjust valve clearance.



Tightening diagram “2”

Retightening cylinder head bolts after repairs (engine cold or warm)

After the first 10 to 20 hours of operation after a repair turn the cylinder head bolts by a further 90° (1/4 revolution) in the order shown in Tightening diagram “2”.

The cylinder head bolts to be retightened must not be loosened first, but simply tightened by a further 90° (1/4 revolution) from their actual position.

Attach the sticker “**First retightening of cylinder head bolts ...**” (Remove any other stickers which may already be attached).

After the first 400 hours of operation after a repair tighten cylinder head bolts 1 to 4 in the order shown in Tightening diagram “1” again by a further 90° (1/4 revolution).

The two outside screws (intake and exhaust side) must not be retightened.

Attach the sticker “**Second retightening of cylinder head bolts ...**”.

Note:

When a cylinder head has been removed the cylinder head gasket must always be changed.

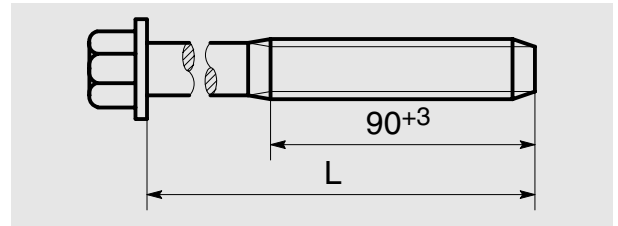
Re-using old cylinder head bolts

Checking

Before re-using old cylinder head bolts check them as follows:

Length

During tightening the bolts are intentionally stressed beyond the yield point and therefore subjected to some permanent elongation each time they are tightened.



L = Shank length

Surface

The surface of the bolts must be in satisfactory condition, i.e. the phosphate coating must be intact and there must be no rust.

Rusted or damaged bolts or bolts elongated beyond the maximum permissible length must immediately be made unusable – e.g. by destroying the threads with a hammer – and scrapped.

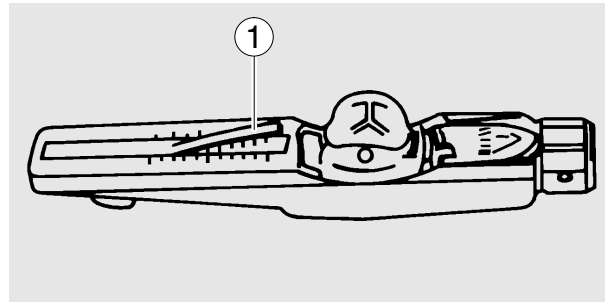
Shank lengths "L" on new bolts	Permissible maximum dimension
109 mm	111 mm
144 mm	146 mm
168 mm	170 mm

Checking V-belts

Checking condition

If, in the case of a multiple belt drive, wear or differing tensions are found, always replace the complete set of belts.

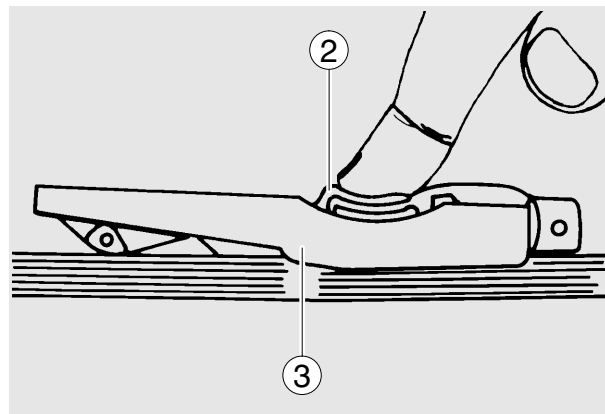
- Check V-belts for cracks, oil, overheating and wear
- Change damaged V-belts



Checking tension

Use V-belt tension tester to check V-belt tension.

- Lower indicator arm ① into the scale
- Apply tester to belt at a point midway between two pulleys so that edge of contact surface ② is flush with the V-belt
- Slowly depress pad ③ until the spring can be heard to disengage. This will cause the indicator to move upwards



If pressure is maintained after the spring has disengaged a false reading will be obtained!

Reading of tension

- Read of the tensioning force of the belt at the point where the top surface of the indicator arm ① intersects with the scale
- Before taking readings make ensure that the indicator arm remains in its position

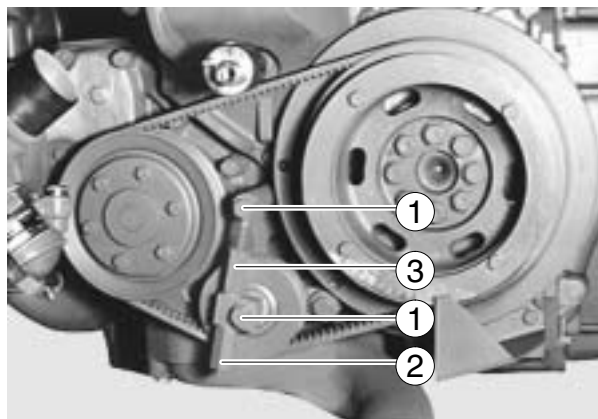
If the value measured deviates from the setting value specified, the V-belt tension must be corrected.

Drive belt width	Tensioning forces according to the kg graduation on the tester		
	New installation		When servicing after long running time
	Installation	After 10 min. running time	
9.5	45–50	40–45	30
10.0	45–50	35–40	30
12.5	50–55	45–50	35
13.0	50–55	40–45	35
20.0	75	70	60
22.0	75	70	60
2/3VX	90–100	80–90	60
3/3VX	135–150	120–135	90

Tensioning and changing V-belt

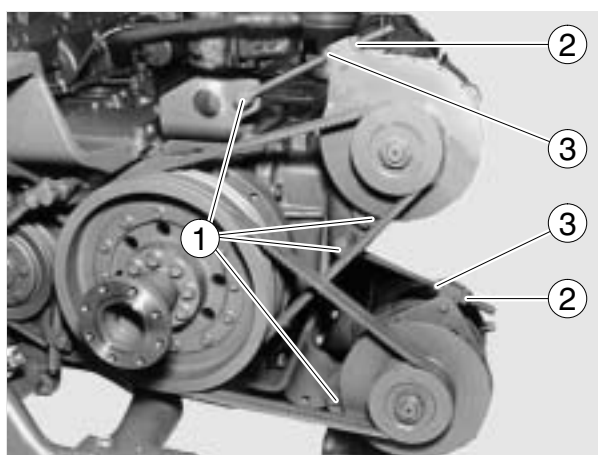
Water pump - Tensioning pulley

- Remove fixing bolts ①
- Remove lock-nut ②
- Adjust nut ③ until V-belts have correct tensions
- Retighten lock-nut and fixing bolts



Alternator

- Remove fixing bolts ①
- Remove lock-nut ②
- Adjust nut ③ until V-belts have correct tensions
- Retighten lock-nut and fixing bolts



To replace the V-belts loosen lock-nut and swing alternator inwards.



Technical data

Model	D 2866 LUE
Design	In-line, underfloor design
Cycle	4-stroke Diesel with turbocharger and intercooler
Combustion system	Direct injection
Turbocharging	Turbocharger with intercooling
Number of cylinders	6
Bore	128 mm
Stroke	155 mm
Swept volume	11 967 cm ³
Compression ratio	15.5 : 1
Rating	see engine nameplate
Firing order	1-5-3-6-2-4
Valve clearance (cold engine)	
Intake	0.50 mm
Exhaust	0.50 mm
Valve timing	
Intake opens	23° before TDC
Intake closes	37° after BDC
Exhaust opens	60° before BDC
Exhaust closes	30° after TDC
Fuel system	
Injection	In-line pump, with flange fastening
Governor	All speed type
Start of delivery	17°+1° before TDC
Injectors	4-orifice nozzles
Opening pressure of injector	
New nozzle holder:	220 + 8 bar
Used nozzle holder:	220 + 8 bar

Technical data



Engine lubrication	Force feed
Oil capacity in oil sump (litres)	min. max. 24 l 30 l
Oil change quantity (with filter)	33 l
Oil pressure during operation (depending on oil temperature, oil viscosity class and engine rpm)	must be monitored by oil pressure monitors / gauges
Oil filter	Full flow filter with paper cartridges
Engine cooling system	Liquid cooling
Coolant temperature	80–85°C, temporarily 90°C allowed
Electrical equipment	
Starter	24 V; 5.4 kW
Alternator	28 V; 85, 120 A



Technical data

Model	D 2866 LUE 601
Design	In-line, underfloor design
Cycle	4-stroke Diesel with turbocharger and intercooler
Combustion system	Direct injection
Turbocharging	Turbocharger with intercooling
Number of cylinders	6
Bore	128 mm
Stroke	155 mm
Swept volume	11 967 cm ³
Compression ratio	15.5 : 1
Rating	see engine nameplate
Firing order	1-5-3-6-2-4
Valve clearance (cold engine)	
Intake	0.50 mm
Exhaust	0.50 mm
Valve timing	
Intake opens	23° before TDC
Intake closes	12° after BDC
Exhaust opens	60° before BDC
Exhaust closes	30° after TDC
Fuel system	
Injection	In-line pump, with flange fastening
Governor	All speed type
Start of delivery	14°-1° before TDC
Injectors	4-orifice nozzles
Opening pressure of injector	
New nozzle holder:	295 + 8 bar
Used nozzle holder:	280 + 8 bar

Technical data



Engine lubrication	Force feed	
Oil capacity in oil sump (litres)	min.	max.
	24 l	30 l
Oil change quantity (with filter)	33 l	
Oil pressure during operation (depending on oil temperature, oil viscosity class and engine rpm)	must be monitored by oil pressure monitors / gauges	
Oil filter	Full flow filter with paper cartridges	
Engine cooling system	Liquid cooling	
Coolant temperature	80–85°C, temporarily 90°C allowed	
Electrical equipment		
Starter	24 V; 5.4 kW	
Alternator	28 V; 120 A	

ALWAYS COMPLY WITH SAFETY REGULATIONS !

Maintenance jobs	Maintenance cycles *								
	1	2	3	4	5	6	7	8	9
Check coolant level and oil level in engine	●								
Check air filter contamination	●								
Change engine oil in oil sump (see also page 57)		●	○	○	○				
Change oil filter cartridge (see also page 57)		●	○	○	○				
Clean fuel strainer		●	●						
Draining fuel filter / condensation (earlier if severe operating conditions demand it)			●						
Check and if necessary correct V-belt tension		●	●						
1st retightening of cylinder head bolts (with overhauled engine)		●							
Check that removable unions (bolts, hose clips, pipe fittings) are firmly in position and, if necessary, retighten		●							
Service the air cleaner (earlier if severe operating conditions demand it)			●						
2nd retightening of cylinder head bolts (with new or overhauled engine)				●					
Check and if necessary adjust valve clearance		●		●	●				
Change disposable fuel filter / filter elements						●			
Check turbocharger							●		
Change coolant								●	
Renew filler cap and working valve of cooling system								●	
Check injection nozzles									●

- * 1 – Daily
 2 – After the first 10 to 20 hours of operation (with new or overhauled engine)
 3 – Every 200 hours of operation
 4 – After the first 400 hours of operation
 5 – Every 400 hours of operation
 6 – Every 1000 hours of operation
 7 – Every 3000 hours of operation
 8 – Every 2 years
 9 – Every 5000 hours of operation for engines in permanent operation and peak load operation
 Every 48 months for engines in standby generators
- Oil change interval in hours of operation depends on oil grade used. See page 57.

Engine oil change

Engine oil change intervals in hours of operation, depending on the oil grade used.

Engine	Engine oils according to MAN Works Standard *)			
	MAN 270	MAN 271	M 3275	M 3277
D 2866 LUE / LUE 601	200 h	200 h	400 h	400 h

*) See Publication "Fuels, Lubricants and Coolants for MAN Diesel Engines".

Note:

- Use only approved engine oils
- Where Diesel fuels with a sulphur content greater than 1% are used, the oil change intervals are to be halved
- Irrespective of the periods stated, the engine oil should be changed at least once every year
- Change the oil filter elements every time the engine oil is changed



Troubleshooting table

Fault										
Engine does not start, or starts only with difficulty										
Engine starts but does not reach full speed or stalls										
Engine idles out of true when warm, misfiring										
Engine speed fluctuates during operation										
Power output unsatisfactory										
Coolant temperature too high, coolant being lost										
Lube oil pressure too low										
Lube oil pressure too high										
Black smoke accompanied by loss of power										
Blue smoke										
White smoke										
Knocking in the engine										
Engine "too loud"										
Reason										
•										Fuel tank empty
•										Fuel cock closed
•	•	•	•					•		Air in fuel system
•	•	•	•					•		Fuel pre-filter / pre-cleaner clogged
•										Condensation in fuel
•	•		•			•				Air filter clogged
•										Electric circuit interrupted
•										Batteries flat
•										Starter / solenoid switch defective
•	•					•		•	•	Start of delivery not correct / incorrectly set
•										Injection nozzles clogged
•										Internal damage to engine (piston seized, possibly caused by water in fuel)
	•		•					•		Fuel quality not in accordance with specifications or fueled severely contaminated
		•								Lower idling speed set too low
•	•							•	•	Valve clearance incorrect
		•								Injection nozzles of injection pipes leaking
		•								Too little fuel in tank
		•								Rev. counter defective
		•				•		•		Injection nozzles defective or carbonized
			•							Engine being asked to do more than it has to
			•							Fuel supply faulty, fuel too warm
							•			Oil level in sump too high
			•							Incorrect rated speed setting
				•						Coolant level too low
				•						Air in coolant circuit

Fault						
Engine does not start, or starts only with difficulty						
Engine starts but does not reach full speed or stalls						
Engine idles out of true when warm, misfiring						
Engine speed fluctuates during operation						
Power output unsatisfactory						
Coolant temperature too high, coolant being lost						
Lube oil pressure too low						
Lube oil pressure too high						
Black smoke accompanied by loss of power						
Blue smoke						
White smoke						
Knocking in the engine						
Engine "too loud"						
Reason						
						● Radiator very dirty
						● Tension of water-pump V-belts incorrect (slip)
						● Cap with working valves on expansion tank / radiator defective or leaking
						● Temperature gauge defective
						● Coolant pipes leaking, blocked or twisted
						● Oil level in sump too low
						● Engine temperature too high
						● Oil filter clogged
						● ● Oil pressure gauge defective
						● ● Selected oil viscosity not suitable for ambient temperature (oil too thin)
						● Oil in sump too thin (mixed with condensation or fuel)
						● Engine cold
						● ● Engine, coolant or intake air still too cold
						● Lube oil getting into combustion chamber (piston worn, piston rings worn or broken)
						● Overpressure in crankcase (crankcase breather clogged)
						● long operation under a low load
						● Coolant getting into combustion chamber (cylinder head / gasket leaking)
						● Engine operating temperature incorrect
						● Intake or exhaust pipe leaking



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