

# Operating Instructions



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## Diesel Engine

**D 2848 LXE**

**D 2840 LXE**

**D 2842 LXE**

**D 2842 LYE**

**D 2842 LZE**





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.

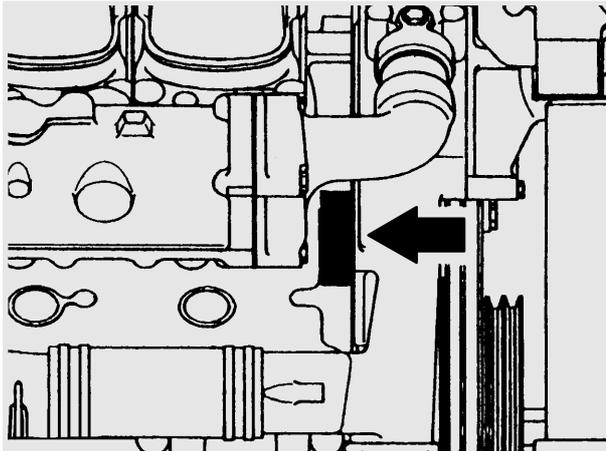
**MAN Nutzfahrzeuge Aktiengesellschaft**

**Vogelweiherstraße 33**

**D-90441 Nürnberg**



# Nameplates



Model

.....

delivered on

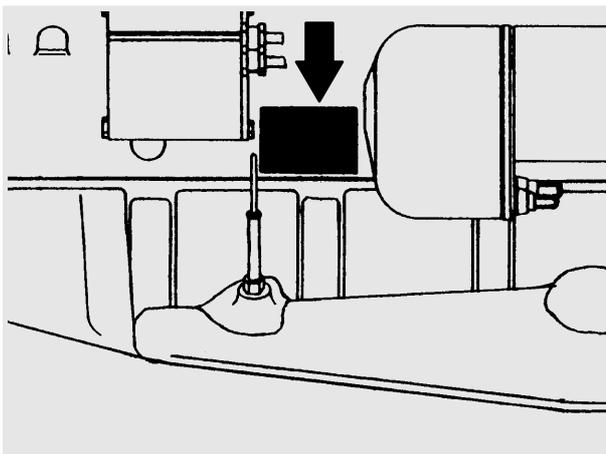
.....

installed on

.....

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

Enter 14-digit serial number (is used in the spare parts catalog to distinguish between spare parts).



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

**MAN** 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

Enter 14-digit engine serial number.

Enter 6-digit job number (Order number).

## 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”.
- Do not let the raw water pump run dry. If there is a risk of frost, drain the pump when the engine is switched off.

### 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.

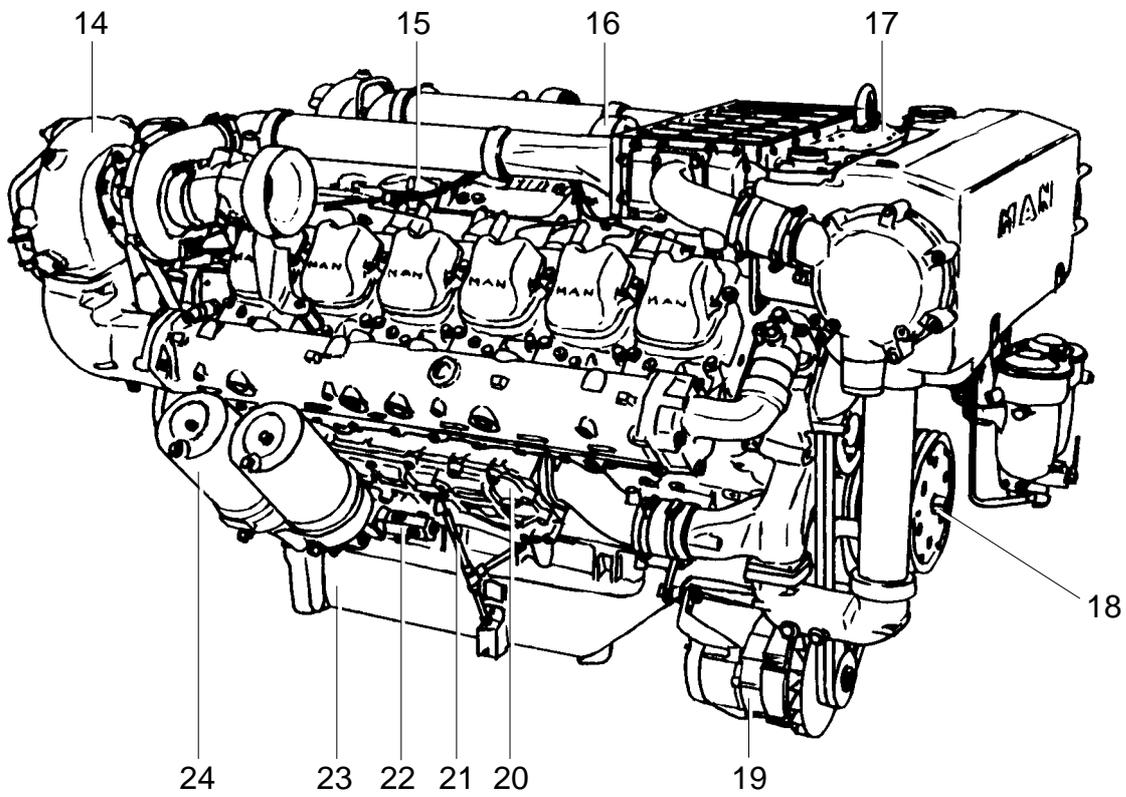
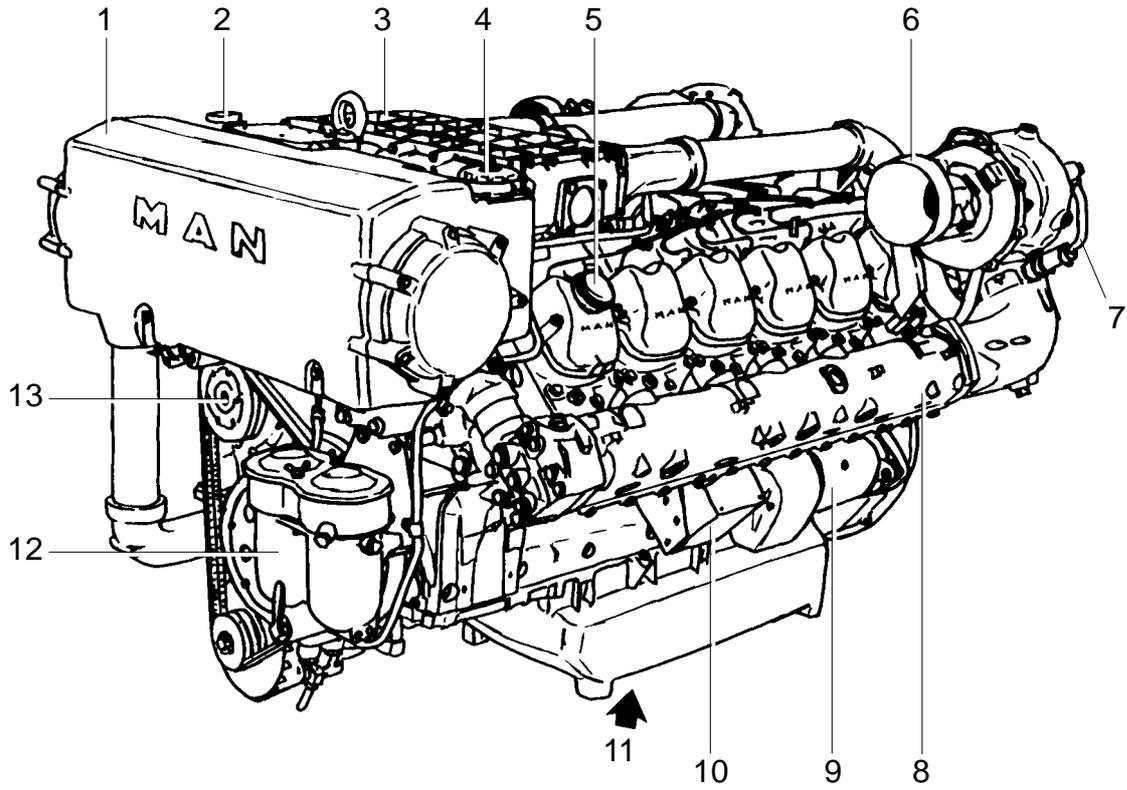
#### **Ensure that used engine oil is disposed of properly – Engine oil can endanger the water supply –**

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 2842 LXE / LYE / LZE



- 1 Heat exchanger and coolant surge tank
- 2 Relief valve on coolant surge tank
- 3 Intercooler
- 4 Coolant filler neck
- 5 Oil filler neck
- 6 Air intake
- 7 Cooling pipe to turbocharger
- 8 Exhaust pipe, liquid-cooled
- 9 Starter motor
- 10 Relay for air preheater
- 11 Oil drain plug
- 12 Fuel filter
- 13 Water pump (engine coolant circuit)
- 14 Turbocharger, liquid-cooled
- 15 Oil separator valve for crankcase breather
- 16 Diaphragm valve on intercooler
- 17 Housing for glow plugs (air preheater)
- 18 Engine cranking device
- 19 Alternator
- 20 Oil cooler
- 21 Oil dipstick
- 22 Connection for oil pressure sensor
- 23 Oil sump
- 24 Oil filter

### Engines

The engines D 2848 / 40 / LXE and D 2842 LXE / LYE / LZE are liquid-cooled 8-/ 10-/ 12-cylinder four-stroke Diesel engines with direct injection, turbocharged and intercooled. The cylinders are on a 90° V pattern.

The engines have a low compression ratio. They are therefore equipped with a cylinder bank cutout feature, and an air preheater to assist starting and reduce smoke emissions. On starting, during idling and low-load of the

D 2840 LXE, D 2842 LXE / LYE and LZE engines the left bank of cylinders is cut out (plunger cutout) and cut back in smoothly at about 1200 rpm.

In the case of the D 2848 LXE engine two cylinders of the l. h. bank and two cylinders of the r. h. bank are cut out.

The intake air is preheated by electric glow plugs on the cylinder bank on starting and during the warm-up phase. The fired glow plugs are installed in the intercooler manifold after the intercooler.

See also "Instructions for Installing Electric Intake-Air Heater", 50.99493-8219.

### Engine block

The cylinder block is a single piece of alloy cast iron. To increase its stiffness, it is extended to a level below the crankshaft centre line. The engine has replaceable wet cylinder liners and individual cylinder heads with shrunk-in valve seat rings and replaceable valve guides.

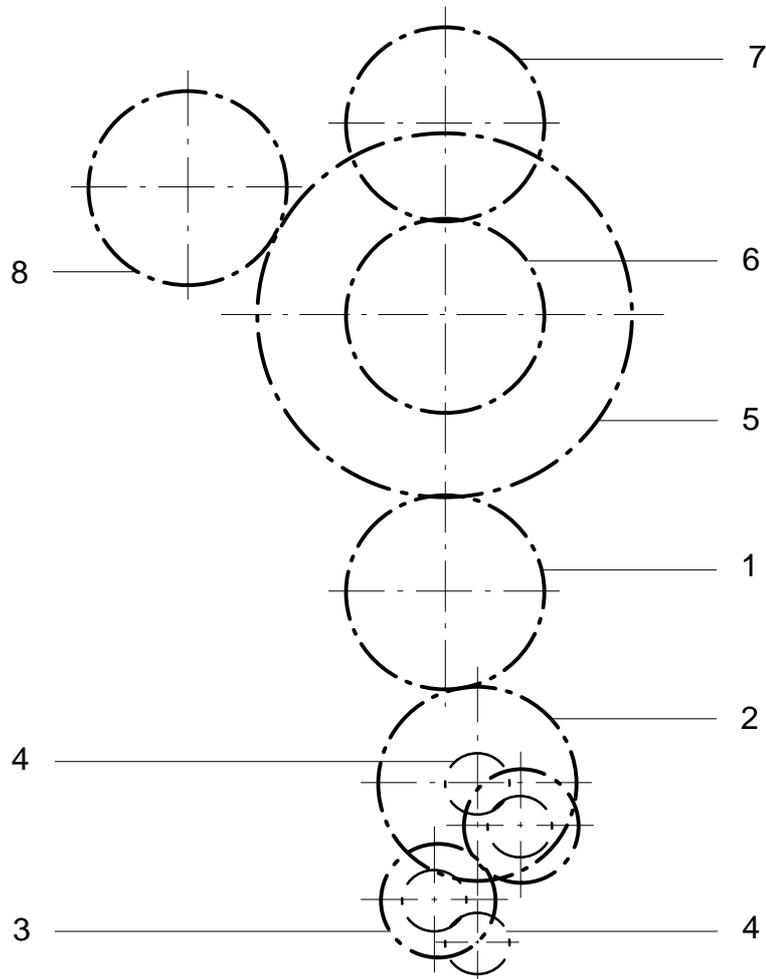
### Piston / Conrod / Crank assembly

The forged crankshaft runs on 5-/ 6-/ 7-bearings and has screwed-on counterweights. Radial seals with replaceable wearing rings on crankshaft and flywheel are provided to seal the crankcase penetrations.

The connecting rods are die-forged, diagonally split and can be removed through the top of the cylinders together with the pistons. Crankshaft and connecting rods run in steel-backed lead bronze ready-to-fit type bearings.

### Engine timing

Camshaft, oil pump and injection pump are driven by a gear train arranged at the fly-wheel end. The camshaft is located centrally in the “V” and runs on 5-/ 6-/ 7-bearings.



- |                           |                             |
|---------------------------|-----------------------------|
| 1 Crankshaft gear         | 5 Camshaft drive gear       |
| 2 Oil pump drive gear     | 6 Idler gear                |
| 3 Idler gears             | 7 Injection pump drive gear |
| 4 Oil pump impeller gears | 8 Power take-off gear       |

The crankshaft gear and camshaft gear are match-marked by the digit “1” or “●”.

### Valves

The overhead valves are actuated via chilled cast iron tappets, push rods and rocker arms from the camshaft.

## Engine lubrication

The engine is equipped with force-feed lubrication.

The pressure is produced by one or two gear pumps coupled with each other. The drive gear is in direct mesh with the crankshaft gear at the fly-wheel end.

The oil pumps draw the oil from the oil sump and deliver it through the oil cooler and oil filter to the main distributor gallery and from there to the main bearings, big-end bearings and camshaft bearings as well as to the small-end bearings and the rocker arms. The injection pump and the turbochargers are also connected to the engine lubricating system.

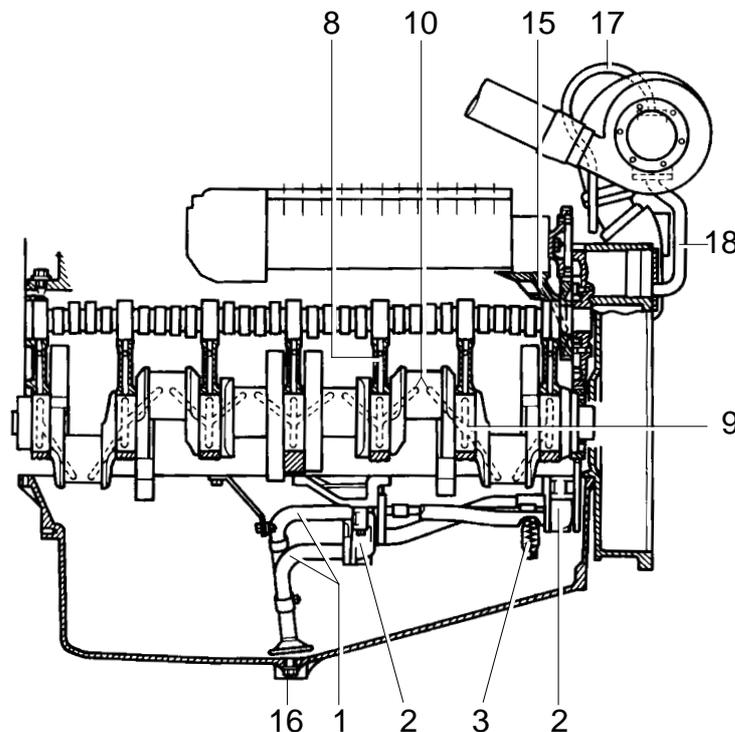
The cylinder walls and timing gears are splash-lubricated.

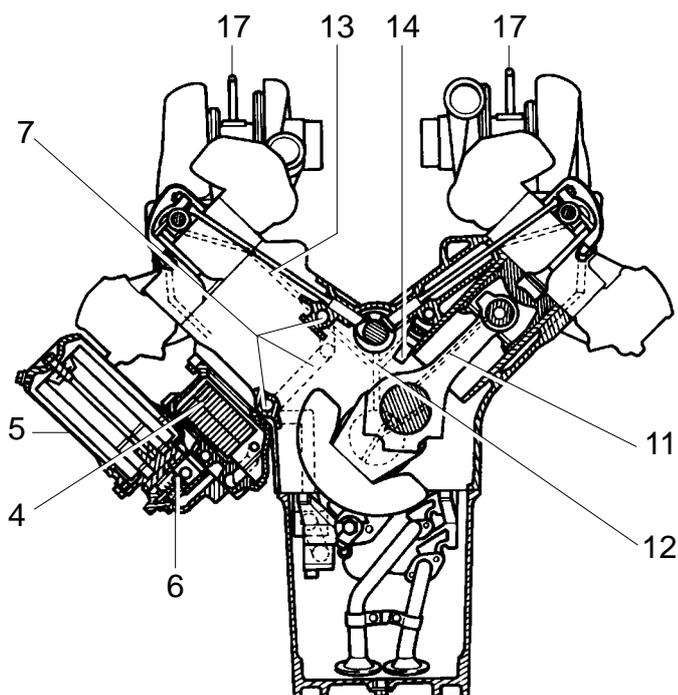
Each cylinder has an oil jet provided for cooling the underside of the pistons.

The lube oil is cleaned in a full-flow oil filter (Duplex filter, non-changeover or changeover at option).

Depending on the agreed extent of delivery and the design of the engine, the lube oil circuit can be equipped with oil pressure monitors (advance warning and cut-off function) which shut the engine down in the event of a sudden loss of pressure.

Lubricating system D 2842 LXE / LYE / LZE





- 1 Oil suction pipes
- 2 Oil pumps
- 3 Oil relief valves
- 4 Oil cooler
- 5 Oil filter
- 6 Bypass valve
- 7 Main oil galleries
- 8 Oil gallery to crankshaft
- 9 Ports for main bearing lubrication
- 10 Ports for big-end bearing lubrication
- 11 Small-end bearing lubrication
- 12 Camshaft bearing lubrication
- 13 Rocker arm lubrication
- 14 Jets for piston cooling and cam lubrication
- 15 Injection pump lubrication
- 16 Oil drain plug
- 17 Lube oil pipes to turbochargers
- 18 Oil return from turbochargers

## Oil cooler

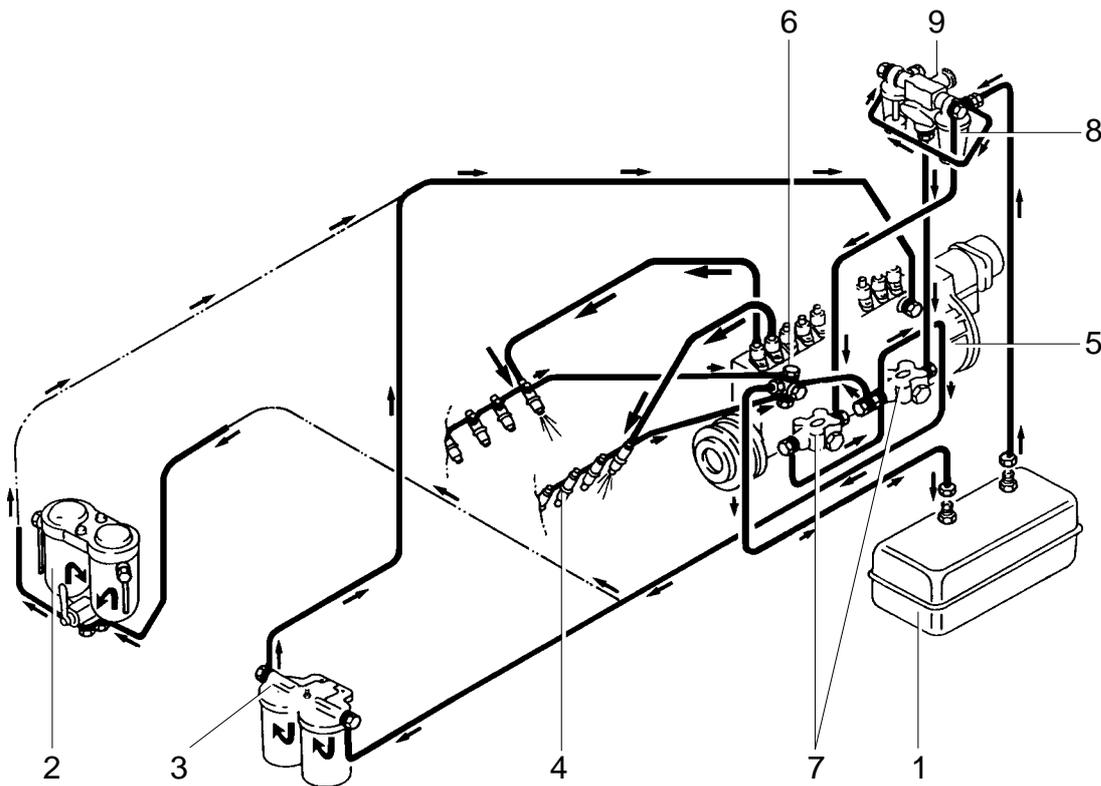
An oil cooler is provided between the oil filter and the crankcase. This cooler is of the flat tube type with turbulence inserts and operated by the engine coolant.

## Fuel system

The fuel is delivered by two fuel lift pumps via the fuel filter to the injection pump and from there to the injectors.

Excessive fuel delivered and leak fuel from the injectors flow through the return pipe back to the tank.

Two strainers and a hand pump are arranged ahead of the fuel lift pump.



- |                               |                    |
|-------------------------------|--------------------|
| 1 Fuel tank                   | 6 Relief valve     |
| 2 Changeover-type fuel filter | 7 Fuel lift pumps  |
| 3 Parallel fuel filter        | 8 Fuel strainer    |
| 4 Injector                    | 9 Manual fuel pump |
| 5 Injection pump              |                    |

## Injection pump

The injection pump is a high-pressure in-line pump driven via gears from the crankshaft. It is connected to the force-feed lubricating system of the engine and consequently maintenance-free. The centrifugal governor flange-mounted on the pump casing is a variable range governor designed to keep the speed set by the control lever constant under conditions of varying load.

The governor has a full load stop controlled by the charge-air pressure and is designed to decrease the full load fuel quantity in the low speed range from a certain (adjustable) charge-air pressure onwards.

### Fuel filters

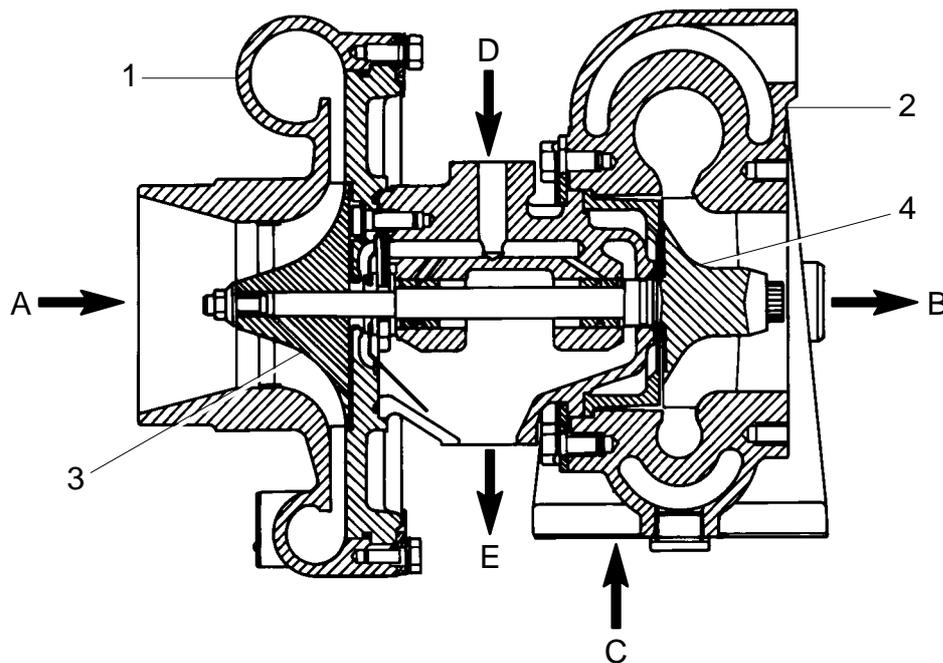
Before entering the suction chamber of the injection pump, the fuel is passed through two primary fuel filters located in the engine vee and finally cleaned in a two-stage, parallel or changeover filter.

### Turbocharger and Intercooler

The exhaust gases of the engine are passed through the turbine rotors of the two turbochargers. Air impellers mounted on the same shaft draw in fresh air and deliver it at a higher pressure to the cylinders.

The turbochargers are liquid-cooled. Lubrication of the main bearings is by oil under pressure from the engine lubricating system.

Liquid-cooled turbocharger K33 and K36



- 1 Compressor casing
- 2 Turbine casing
- 3 Compressor wheel
- 4 Turbine rotor

- A Air inlet
- B Gas outlet
- C Gas inlet
- D Oil inlet
- E Oil return

Before entering the cylinders the hot combustion air heated by compression in the turbochargers is passed through a raw-water-cooled cooler (intercooler). Cooling water is delivered through the intercooler direct from the engine raw-water pump.

## Cooling

The engine has a closed liquid coolant system.

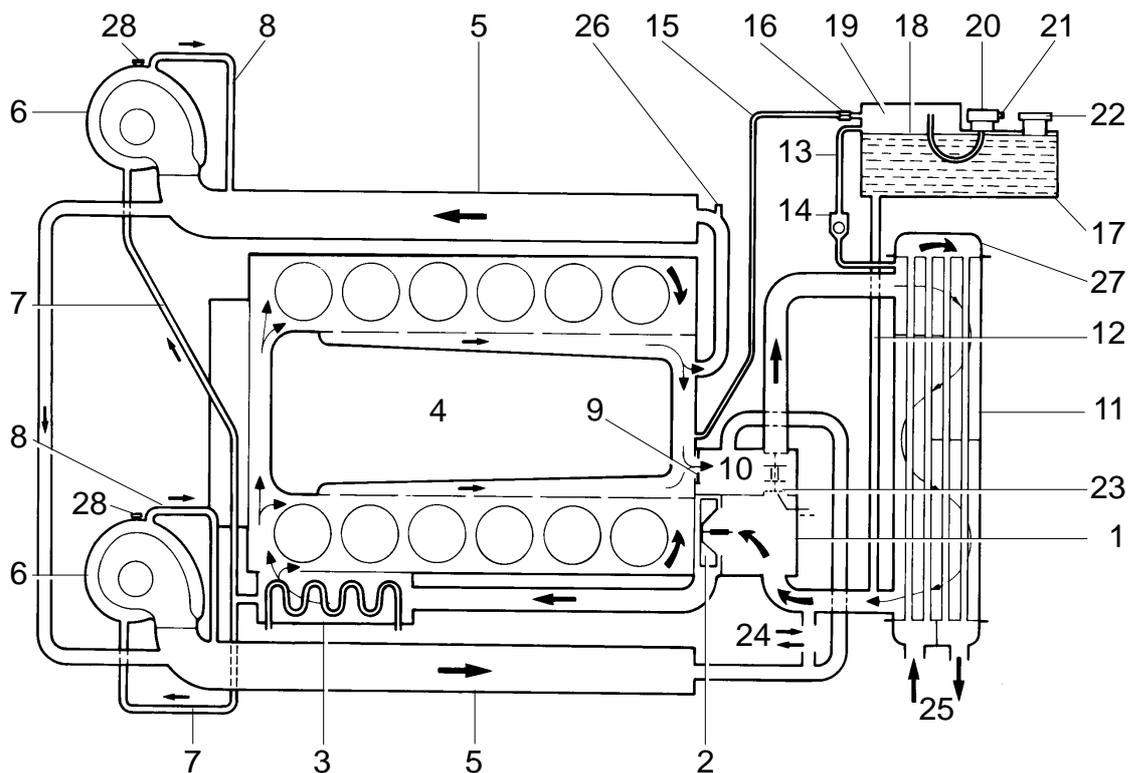
The water pump is a maintenance-free impeller pump with three integrated thermostats and is driven by V-belts from the crankshaft pulley.

Coolant surge tank and heat exchanger are integrated in one casing.

The exhaust pipes are liquid-cooled. Cooling is via the engine cooling circuit.

Depending on the agreed extent of delivery and the design of the engine, the cooling circuit can be equipped with temperature and level monitors which, in the event of overheating, will trigger an advance warning system or, in the event of loss of coolant, shut the engine down.

Cooling system diagram



- 1 Water pump housing with integrated thermostat housing
- 2 Water pump impeller
- 3 Engine oil cooler
- 4 Crankcase
- 5 Exhaust manifold, liquid-cooled
- 6 Turbocharger, liquid-cooled

- 7 Coolant pipe from oil cooler housing to turbocharger
- 8 Coolant pipe from turbocharger to exhaust
- 9 Flow orifice
- 10 Thermostat (open)
- 11 Heat exchanger, engine coolant / raw-water
- 12 Coolant filling pipe from surge tank to water pump suction chamber
- 13 Vent pipe, heat exchanger surge tank
- 14 Non-return valve
- 15 Vent pipe, engine surge tank
- 16 Throttle
- 17 Surge tank
- 18 Coolant level in surge tank
- 19 Expansion chamber in surge tank
- 20 Positive pressure / negative pressure valve
- 21 Vent pipe from surge tank to atmosphere
- 22 Coolant filler neck
- 23 Bypass in thermostat housing
- 24 Heater feed and return system
- 25 Raw-water feed (from intercooler) and discharge
- 26 Measuring point for coolant temperature and flow monitor
- 27 Deflection chamber for raw water
- 28 Bleeder screw on turbocharger (only for initial filling of coolant or refilling)

### **Air cleaner**

Air cleaners are mounted on the engine to purify the air for combustion.

The intervals at which the air cleaners require servicing depend on the specific operating conditions encountered. Clogged air filters may cause black smoke and reduce power.

A check should be made from time to time to see that the fastening elements securing the air cleaners to the intake manifolds seal the connection tightly. Any ingress of unfiltered air is liable to cause a high rate of cylinder and piston wear.

### Electrical equipment

#### Alternator

The alternator is fitted with integral silicon rectifiers.

A transistorized regulator mounted on the alternator limits the alternator voltage. The alternator should not be operated except with the regulator and battery connected in circuit to avoid damage to the rectifier and regulator.

The alternator is maintenance-free. Nevertheless, it must be protected against dust and, above all, against moisture.

Operate the alternator according to the instructions given in the chapter "Commissioning and operation".

#### Starter motor

The sliding-gear starter motor is flanged to the rear of the flywheel housing on the right-hand side.

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.

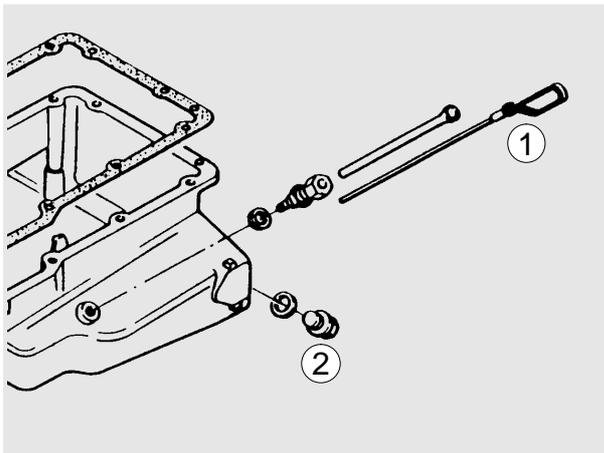
Always protect starter motor against moisture.

#### **Warning:**

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.

## Preparations

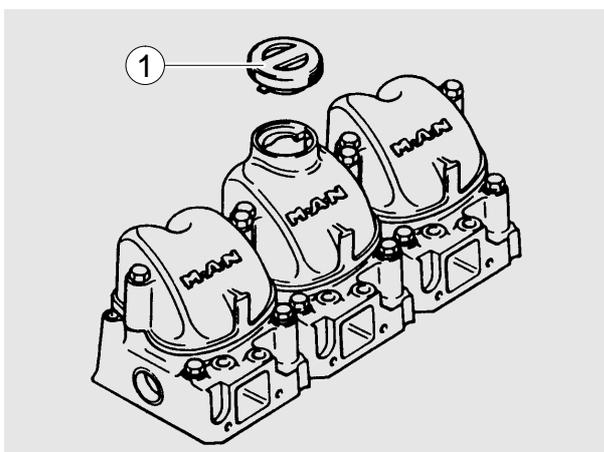
At the time of initial commissioning of a new or overhauled engine make sure to have observed the “Technical Information for the installation of MAN Diesel engines”.



- 1 Oil dipstick
- 2 Oil drain plug

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

Replenish oil through the filler neck on the valve cover.



- 1 Oil filler neck on valve cover

The notches in the dipstick indicate the highest and lowest permissible oil levels.

## Marking the dipstick

As a rule oil dipsticks of marine propulsion engines are not marked by the manufacturer since the final installed position is unknown. Therefore, they should be marked after engine installation.

### **Proceed as follows:**

- Fill with minimum oil quantity recommended for the respective engine type. After this initial filling wait about 1/2 hour until the entire oil has collected in the oil sump
- Pull out dipstick and mark minimum oil level visible on dipstick
- Thereafter fill up to maximum oil sump capacity, wait about 1/2 hour and mark maximum oil level visible on dipstick
- After refilling with oil, rotate the engine with the starter and move the shut-down lever to “stop” at the same time until the oil pressure warning light goes out and the oil pressure gauge shows a pressure. Then start the engine and allow it to run at medium speed for a few minutes. Check oil pressure and tightness of system. Then shut down the engine. After about 20 minutes, check the oil level. The oil level should now be at the upper notch of the dipstick, but not higher. Add any necessary oil to the upper dipstick mark

### **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 oil required in the sump is specified in the “Technical Data” at the end of these Instructions.

**Note:**

The oil required to fill the oil filters and pipes depends upon the engine equipment and use and must be determined individually at the time of initial commissioning (Make a note of the determined quantity).

Ensure utmost cleanliness when handling fuels, lubricants and coolants.

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

### Raw water pump

Do not let raw water pump run dry. Make sure that all valves / cocks in the raw water circuit are open. If there is a risk of frost, drain the raw water pump.

### Starting

Ensure that the gearbox is in neutral.

Insert ignition key and turn to position "I" (preliminary heating), indicator lamp lights up.

After the preliminary heating time has expired the indicator lamp flashes and signals readiness for starting.

Turn the key to the stop (position "II"), indicator lamp goes out, starter is operated.

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.

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.

**Note:**

On initial start of an overhauled engine or after long periods without use, press shut-down lever in "stop" position and operate starter motor for a few seconds (max. 10) until oil pressure is indicated. Only then the engine should be started in the normal way.

### Running in

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.

## During operation

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 devices register a drop in the lube oil pressure, switch off the engine immediately.

The coolant temperature should be approx. 80 to 85°C.

The charge warning light of the alternator should go out when the engine is running.

### Alternator

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!

## 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.

### **Caution:**

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

## 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.

## Engine lubrication

### Oil level

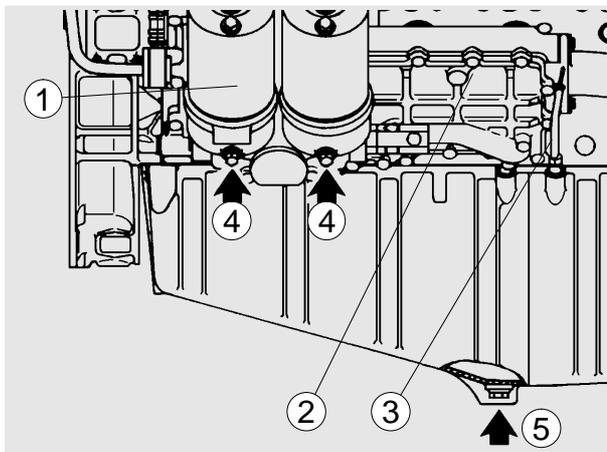
Check the oil level in the engine sump daily with a dipstick. The level should be between the two notches cut into the dipstick and should never be allowed to drop below the lower notch.

**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 oil level should be checked with the engine horizontal and only after it has been shut down for about 20 minutes.

### Oil drainage



- 1 Oil filter
- 2 Oil cooler
- 3 Oil dipstick
- 4 Oil drain plugs on oil filter
- 5 Oil drain plug on oil sump

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.

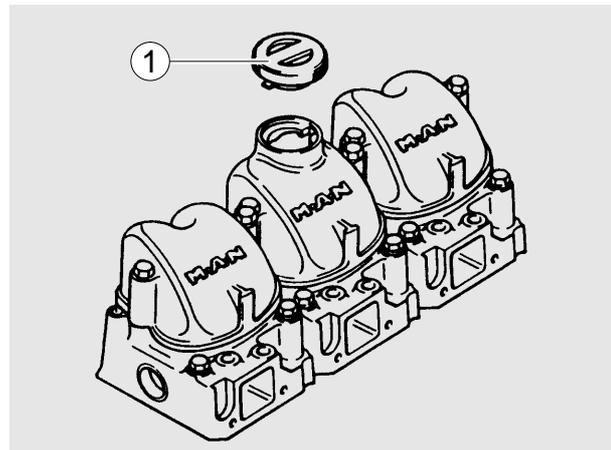
Use a vessel of sufficient size to ensure that the oil does not overflow. Refit the oil drain plugs with new gaskets.

**Caution:**

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!

### Refilling with oil

Refill with fresh engine oil at the oil filler neck.



- 1 Oil filler neck on valve cover

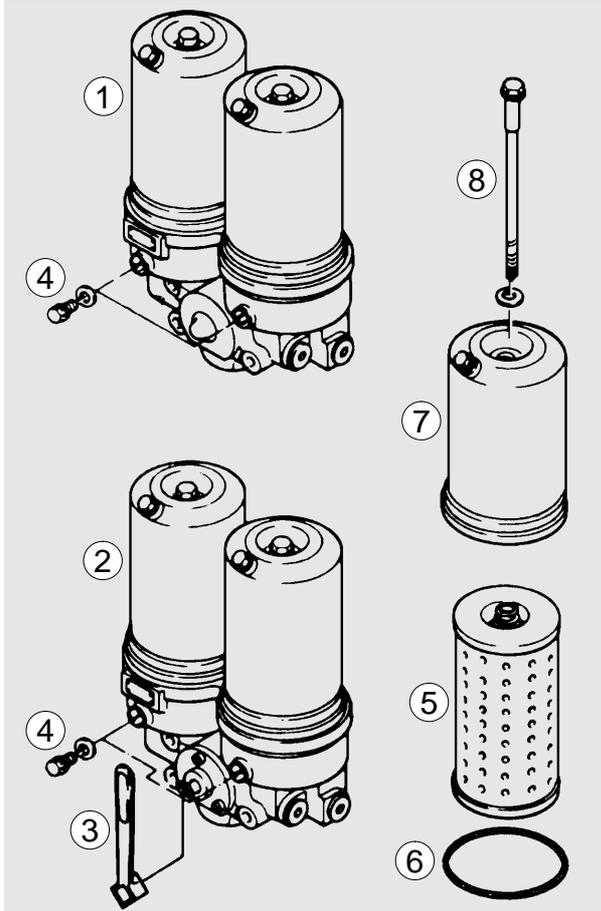
After refilling with oil, rotate the engine with the starter and move the shut-down lever to "stop" at the same time until the oil pressure warning light goes out and the oil pressure gauge shows a pressure.

Then start the engine and allow it to run at medium speed for a few minutes. Check oil pressure and tightness of system.

Then shut down the engine. After about 20 minutes, check the oil level. The oil level should now be at the upper notch of the dipstick, but not higher. Add any necessary oil to the upper dipstick mark. Do not overfill.

## Lubricating oil filter

Cleaning of the lubricating oil is effected in a full-flow oil filter with paper cartridges. A bypass valve ensures continuity of oil supply if the filter elements should be clogged.



- 1 Oil filter, standard design (non-changeover)
- 2 Oil filter, changeover-type
- 3 Selector cock
- 4 Oil drain plugs
- 5 Filter cartridge
- 6 O-ring
- 7 Filter bowl
- 8 Clamping bolt

A changeover-type oil filter, the filter elements of which can be replaced even during operation, can be fitted on request.

During continuous operation position the selector lever that both filter halves are in

operation.

Observe positions of selector lever!



Continuous operation  
(both filter halves  
in operation)



Right-hand filter  
cut out



Left-hand filter  
cut out

### Caution:

Do not leave selector lever in any intermediate position because this would be liable to interfere with oil supply.

### Renewal of filter cartridges

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

### Caution:

Oil is hot and under pressure!

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

### Note:

To prevent the seal from twisting hold the filter bowl firmly when tightening the tensioning screw

*Every time an oil change is made, the two oil filter cartridges should be renewed!*

### Caution:

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

### Fuel system

#### 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.

#### **Bleeding the fuel system**

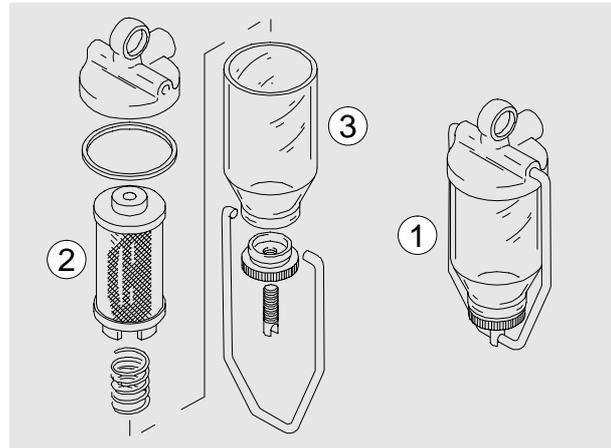
Bleeding the fuel filters is by releasing the bleed screws and operating the manual primer (fit new seals).

The suction chamber of the injection pump is continuously bled via the relief valve during operation. If the suction chamber is completely empty, e.g., when fitting a new pump, filling and bleeding it is by actuating the manual primer.

### Fuel lift pump

The fuel lift pump is operated by the injection pump camshaft via the roller tappet.

#### Strainer



- 1 Fuel strainer
- 2 Filtering screen
- 3 Filter housing

*After every 200 hours of operation the fuel strainer connected upstream of the fuel lift pump should be cleaned.*

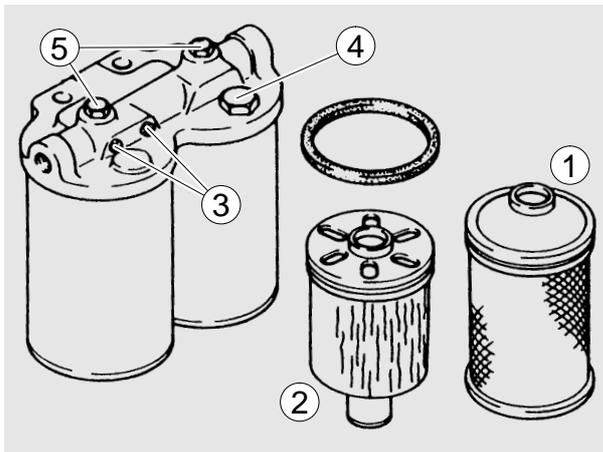
#### Fuel filter

After every 1000 hours of operation – or earlier if loss of engine power indicates clogging – the filter elements should be renewed.

## Two-stage fuel filter

(replaced by parallel fuel filter)

In two filter housings connected in series the fuel first passes through a felt tube element and then through a paper element.



- 1 Felt tube element (primary filter)
- 2 Paper element (secondary filter)
- 3 Vent plugs
- 4 Filler plug
- 5 Clamping screws

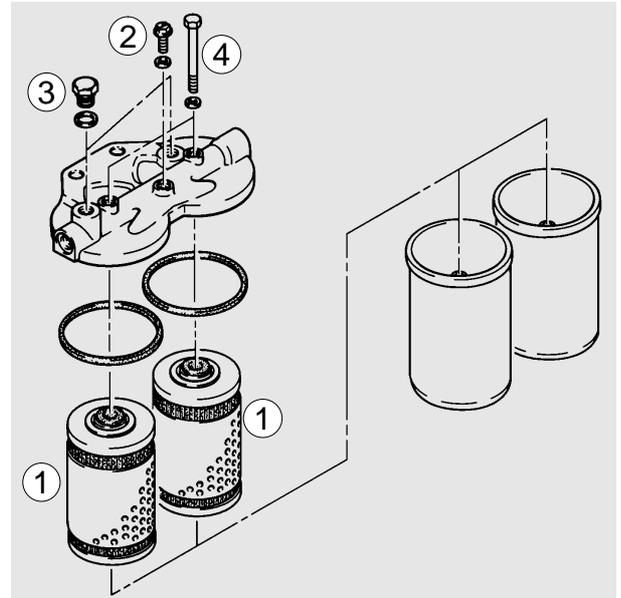
### Replacement of filter elements

- 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
- Open vent plug for primary filter (felt tube element). Fit new seals
- Operate manual fuel lift pump until fuel is emitted without any bubbles
- Close vent plug on primary filter
- Bleed secondary filter in the same manner

## Parallel fuel filter with filter cartridges

(replaced by parallel filter with interchangeable filter)

The fuel passes through two filter elements connected in parallel.



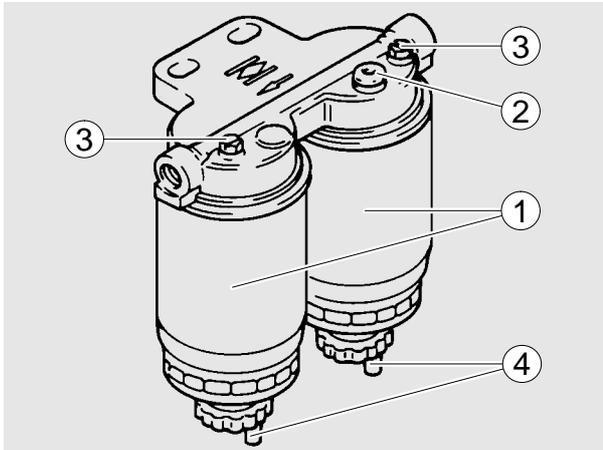
- 1 Filter elements
- 2 Vent plugs
- 3 Filler plug
- 4 Clamping screws

### Replacement of filter elements

- 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
- Open vent plug (fit new seals)
- Operate manual fuel lift pump until fuel is emitted without any bubbles
- Close vent plug

### Parallel fuel filter with interchangeable filter

The fuel flows through two parallel filters.



- 1 Filter cartridge
- 2 Screw plug
- 3 Bleed screw
- 4 Moisture drain plugs

#### **Draining moisture:**

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

#### **Replacement of filter elements:**

After every 1000 hours of operation – or earlier if loss of engine power indicates clogging – the filter elements should be renewed.

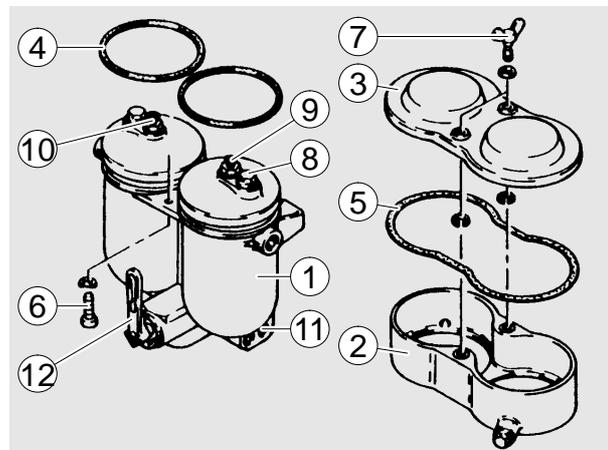
#### **Caution:**

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

### Change-over fuel filter with filter cartridges

(replaced by change-over fuel filter with interchangeable filter)

Where the changeover-type filter is installed, the servicing procedure is for the filter side requiring to be shut off with the engine running. During continuous operation, the selector lever should be placed in a position where both filter halves are in operation.



- 1 Changeover type filter
- 2 Collecting vessel
- 3 Cover for collecting vessel
- 4 O-ring
- 5 Gasket
- 6 Fixing bolts for collecting vessel
- 7 Wing nut
- 8 Filler plug
- 9 Vent plug
- 10 Fixing nut
- 11 Sludge drain plug  
(socket head width across flats 5)
- 12 Selector lever

**Caution:**

Do not leave selector lever in any intermediate position because this would be liable to interfere with fuel supply. If in doubt stop the engine to change the fuel filter.



Continuous operation  
(both filter halves  
in operation)



Right-hand filter  
cut out

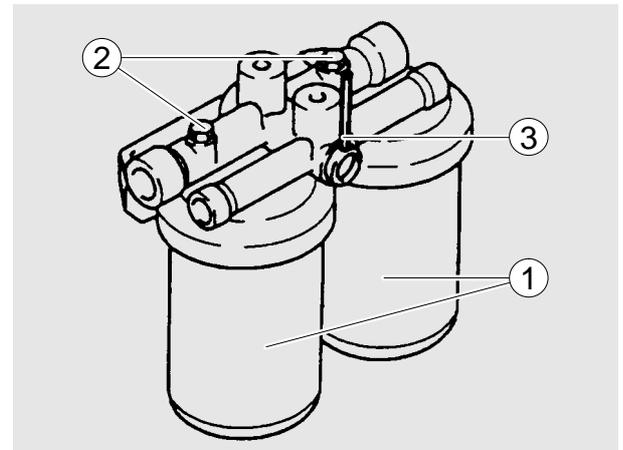


Left-hand filter  
cut out

**To replace filter element**

- Move selector lever to position where filter side to be cleaned is cut out
- Slacken vent plug 1 or 2 turns (fit new seals)
- Allow filter to drain through sludge drain plug
- Take off filter cover on slackening fixing nut
- Withdraw filter element and flush filter chamber with clean fuel
- Install new element
- Fit filter cover using new gasket
- Fill filter bowl through filler opening with fuel. Close vent plug
- Position selector lever so that both filters are in circuit

**Change-over fuel filter with interchangeable filter**



- 1 Filter cartridge
- 2 Bleed screw
- 3 Selector lever

**Replacement of filter elements:**

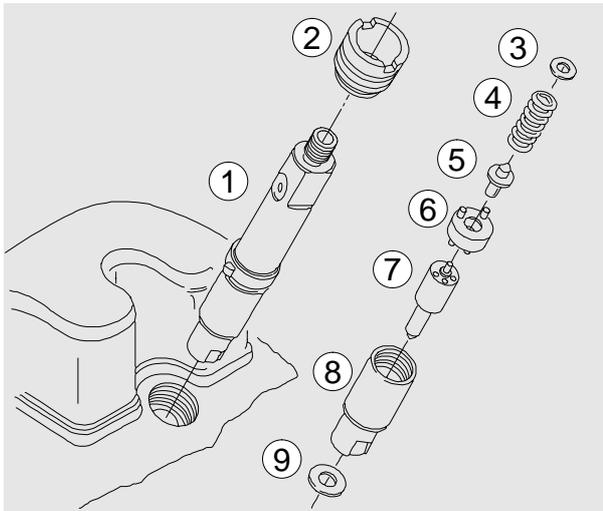
After every 1000 hours of operation – or earlier if loss of engine power indicates clogging – the filter elements should be renewed.

**Caution:**

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

### Injector maintenance

(by authorized specialist personnel)



- 1 Nozzle holder
- 2 Union screw
- 3 Washer
- 4 Compression spring
- 5 Thrust pin
- 6 Intermediate disc
- 7 Injection nozzle
- 8 Nozzle nut
- 9 Gasket

The injectors are designed to spray the fuel delivered by the injection pump directly into the spherical combustion chamber in the piston crown.

The injector consists of the nozzle and the nozzle holder.

A copper gasket fitted to the injector ensures gas-tight seating and good heat dissipation.

The opening pressure of the nozzle is adjusted by means of shims at the compression spring.

### 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.

#### **Note for cleaning nozzles with Bosch cleaning set KDEP 2900**

Clean nozzle body externally from soot and carbon. When cleaning several nozzles at the same time, make sure nozzle bodies and needles are not mixed up. Visually inspect needle and body. Cleaning is useless if the seat of the needle is indented or the pintle is damaged and the nozzle should be replaced.

Clean annular groove with scraper over full circumference. Wash out dislodged carbon deposits and dirt.

Scrape needle seat with cleaning cutter. Dip cutter in test oil before use. The cutter can also be clamped in a lathe.

Polish needle seat with wooden cleaning tool, preferably by chucking the needle in a lathe at the pintle end.

Clean the spray holes of hole nozzles using the cleaner KDEP 2900/2 by chucking a cleaning needle of suitable diameter in the collet. If the carbon deposits in the spray holes cannot be removed by rotating and pressing, have the needle project only slightly from the collet and drive out the carbon by lightly tapping on the tool.

Before reassembly thoroughly wash nozzle body and needle in clean test oil.

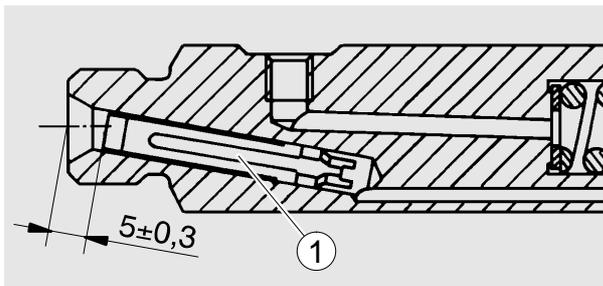
Hold the needle at the pintle end only; to avoid corrosion do not touch the lapped surfaces of the needle with your fingers.

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.



1 Edge-type filter

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

### Caution:

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.

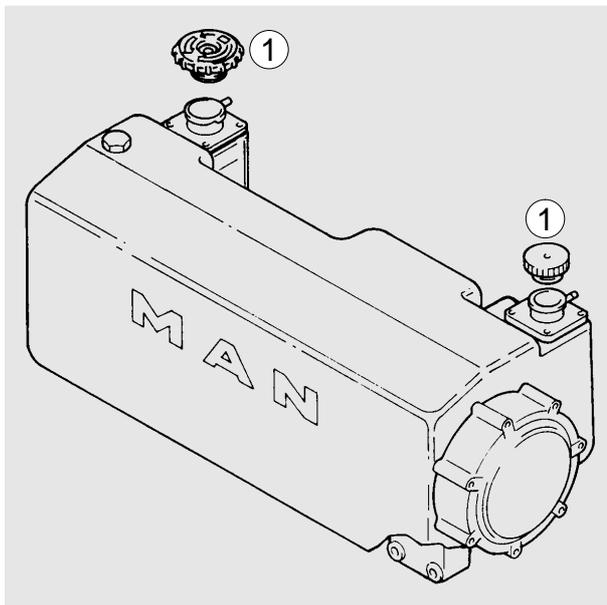
- When mounting the pipes to the engine take care of good fitness
- Do not bend pipes to permanent deformation (not for replacing the nozzles either)
- Do not mount any heavily bent pipes
- Avoid bending the pipes at the ends by more than 2 to 3 degrees
- In case of faults in the injection system which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

### Cooling

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.

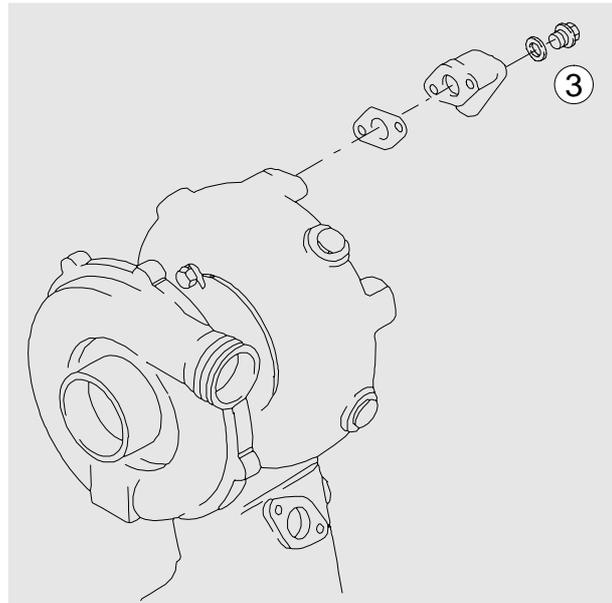
See Publication “Fuels, Lubricants and Coolants for MAN Diesel Engines”.

### Filling-in of coolant (only when engine has cooled down)



- 1 Cover for filler neck
- 2 Positive pressure valve

- Fill in the coolant slowly
- During refilling bleeding of liquid-cooled turbochargers is required. To do so, open bleeder screw ③ in oval flange on back of turbine housing until coolant flows out bubble-free
- Run the engine briefly and then check coolant level once more



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 (large cap) with safety valve to the first stop, let off pressure, then open carefully.

**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.

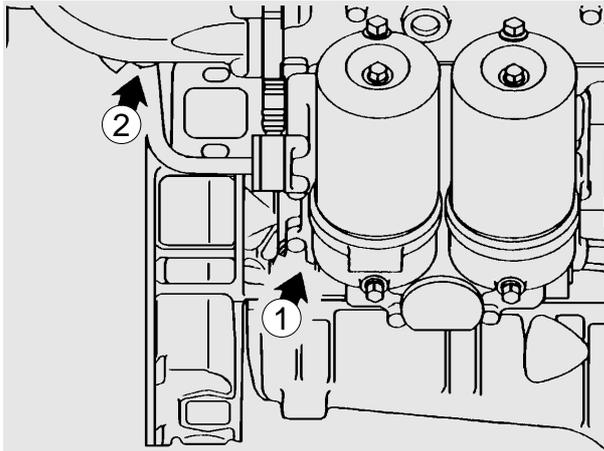
#### Warning:

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.

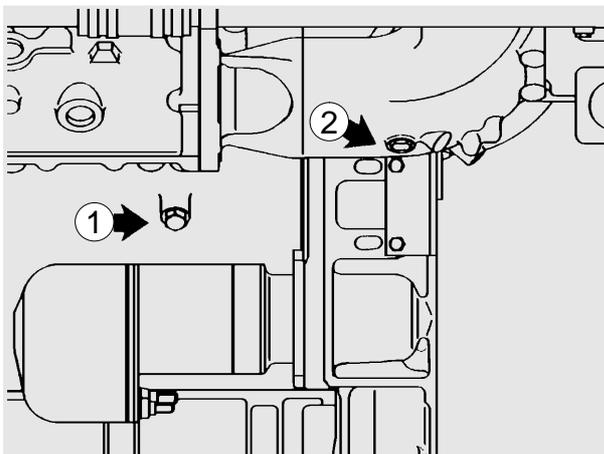
## Draining of coolant

Drain coolant as follows when cooling system has cooled down:

- Remove cover from filler neck of surge tank
- Remove drain plug in crankcase, oil cooler housing and exhaust manifold



- 1 Drain plug in oil cooler housing cover
- 2 Drain plug in exhaust manifold



- 1 Drain plug in crankcase (above the starter)
- 2 Drain plug in exhaust manifold

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

(by authorized specialist personnel)

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 neutral 5265 detergent (1.5% by volume) (-5266, -5225, Kluthe Hakopur 316)
- 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**

(by authorized specialist personnel)

**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.

**Cleaning the inside of tube bundles of raw water heat exchangers**

(by authorized specialist personnel)

Deposits building up inside the tube bundle of the water-to-water heat exchanger can reduce the flow cross-section of the individual tubes to the point where a decrease in engine cooling occurs. This condition will automatically lead to overheating of the engine with all of its accompanying effects.

For this reason, it is recommendable to clean the tube bundle of the water-to-water heat exchanger at the first sign of high engine coolant.

**Procedure:**

- Remove and dismantle the heat exchanger (integrated in the coolant surge tank)
- Place the removed tube bundle in a suitable container made of plastic, such as PE, PP, PVC, GFK
- Fill the container with undiluted original pickling fluid at room temperature (Lithsolventsäure or engine pickling fluid RB-06) until the tube bundle is completely immersed
- Allow the pickling fluid to work approx. 10 hours. If this time is not sufficient, continue the pickling process for up to 5 hours
- Pickling can be shortened by heating up the fluid (max 50°C) and by occasionally moving the tube bundle

- After pickling thoroughly flush the bundle with tap water and reinstall in the heat exchanger
- Use new gaskets (O-seals)
- Mount the heat exchanger on the engine and check for tightness

**Note:**

The variety of dirt deposits may also create problems for the method of pickling described above. In such cases, we ask you to first of all submit a specimen of the deposit for further examination.

Damaged tube bundles may develop leaks when dirt deposits are removed.

### 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  
Phone: (02 11) 96 53 0

#### Motor pickling fluid RB-06

Reincolor-Chemie GmbH  
Werkstr. 21  
D-90518 Altdorf  
Phone: (0 91 87) 97 03 0

## Turbocharger

### Maintenance

(by authorized specialist personnel)

The turbochargers do not call for any specific maintenance.

The only points to be observed are the oil pipes which should be checked at every oil change for leakage and restrictions.

The air cleaners should be carefully serviced.

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.

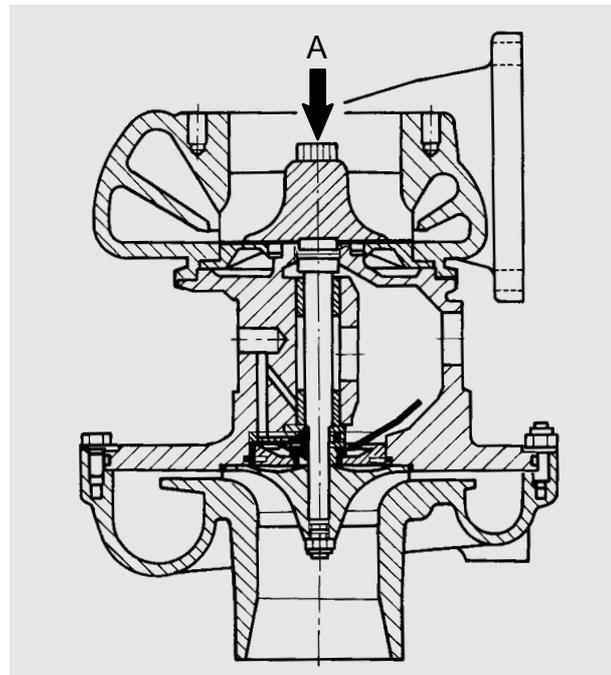
If the air compressor should be badly fouled, it is recommended that the wheel be allowed to soak in a vessel with solvent and to clean it then with a stiff brush. In doing so, take care to see that only the compressor wheel is immersed and that the turbocharger is supported on the bearing casing and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

### Special hints

It is recommended that the radial and axial clearances of the rotor be checked after every 3000 hours operation.

This precaution will enable any wear of the bearings to be detected in good time before serious damage is caused to the rotor and bearings.

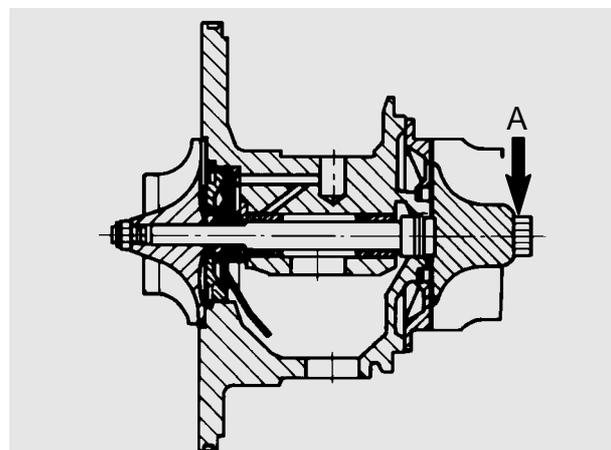
### Measuring of axial clearance



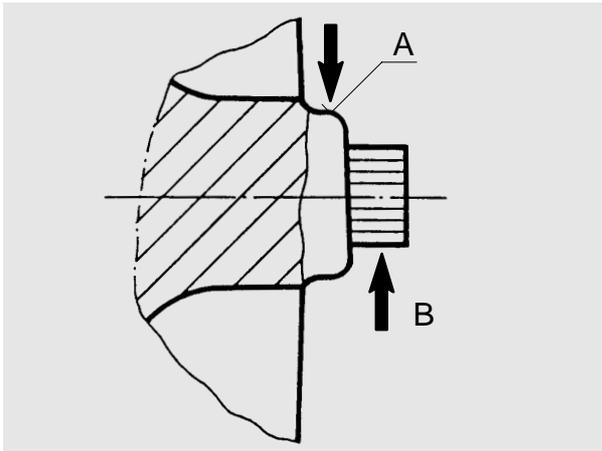
A = Measuring point for dial gauge

### Measuring of radial clearance

(The radial clearance will be determined only at turbine end)



A = Measuring point for dial gauge



**A** = Point of support for dial gauge tip  
**B** = Measuring capacity

**Axial and radial clearances**

	KKK model	axial (mm)	radial (mm)
D 2848 LXE	K 33	0,16	0,45
D 2840 LXE	K 36	0,16	0,58
D 2842 LXE D 2842 LYE D 2842 LZE	K 36	0,16	0,58

If excessive clearances are found, the turbocharger should be replaced.

**Intercooler**

**Maintenance**

(by authorized specialist personnel)

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

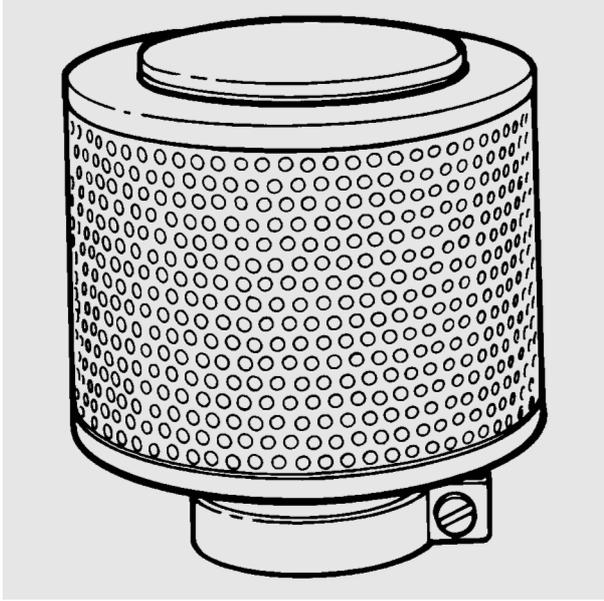
**Diaphragm valve**

(D 2840 LXE, D 2842 LXE / LYE / LZE)

The diaphragm valve located on the bifurcated distribution of the intercooler is shop-set and sealed.

The setting must not be changed.

### Air cleaner



The maintenance intervals for filters depend on the respective operating conditions.

As soon as a distinct layer of dust has accumulated on the filter element, remove air cleaner and wash in fuel or cleaning oil.

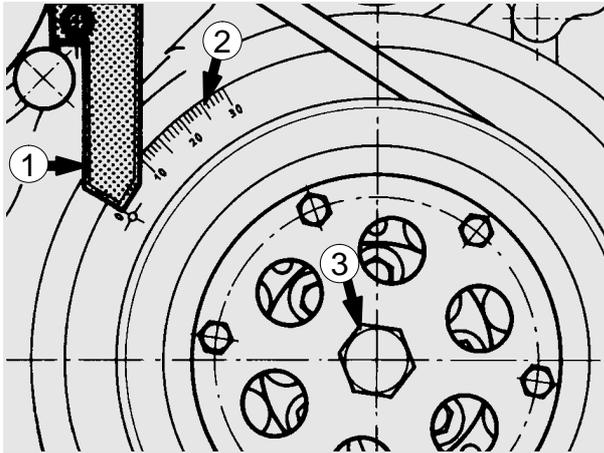
Shake element out thoroughly to dry it.

Uniformly coat filter surface with a thin film of engine oil.

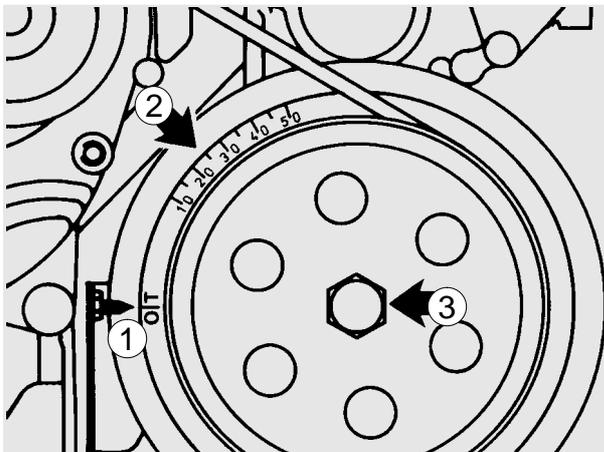
## To check and set the start of delivery with start of delivery marker on injection pump hub

(by authorized specialist personnel)

D 2840 LXE



D 2848 LXE, D 2842 LXE / LYE / LZE



- 1 Pointer
- 2 "OT" (top dead centre) mark and scale
- 3 Hexagon driver to rotate engine by hand (Width across flats 32)

For the purpose of checking the start-of-delivery setting, an "OT" (top dead centre) mark and a scale from 10 ... 40° or 50° before top dead centre are engraved on a disc fitted in front of the torsional vibration damper. The scale marks are read against a pointer fitted to the crankcase.

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.

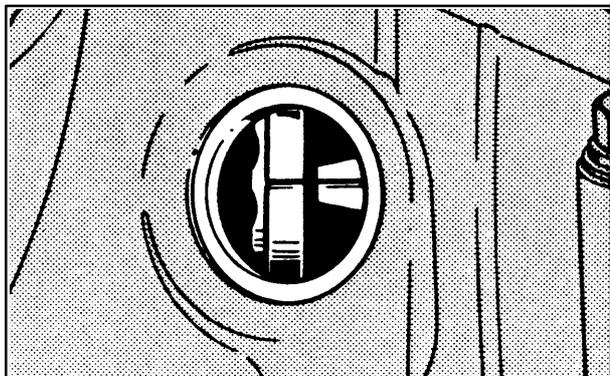
In other words, before the vibration damper with the scale disc is installed, the engine should be positioned at "OT" (top dead centre) by means of the scale on the flywheel.

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

In order to enable the engine to be rotated manually during adjustments, there is a plate with a central hexagon driver fitted to the front of the crankshaft pulley (bar-ring device).

### Checking

Remove screw plug in timing housing cover above injection pump drive gear.



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

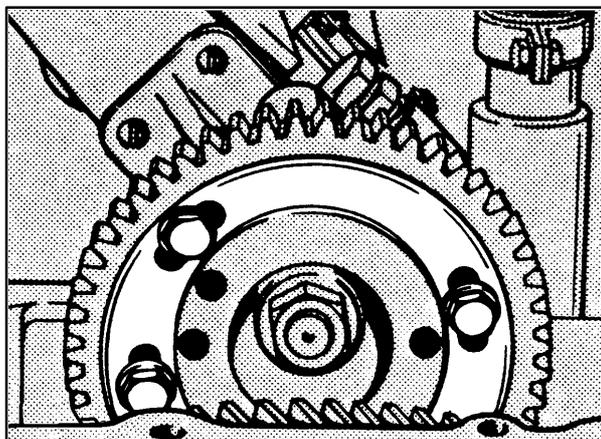
Read degrees on scale engraved on disc on torsional vibration damper.

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

If not, correct start-of-delivery setting.

### Setting start of delivery

Correct start of delivery by turning the pump drive flange 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.

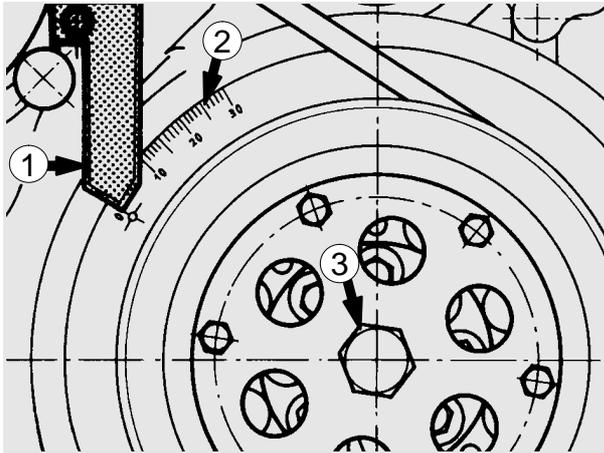
Recheck start of delivery.

Use new gaskets when mounting cover and screw plug.

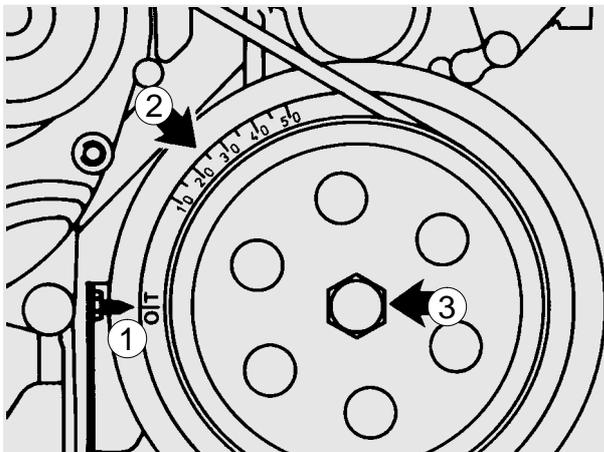
## To check and set the start of delivery with start of delivery indicator in the governor housing

(by authorized specialist personnel)

D 2840 LXE



D 2848 LXE, D 2842 LXE / LYE / LZE



- 1 Pointer
- 2 "OT" (top dead centre) mark and scale
- 3 Hexagon driver to rotate engine by hand (Width across flats 32)

For the purpose of checking the start-of-delivery setting, an "OT" (top dead centre) mark and a scale from 10 ... 40° or 50° before top dead centre are engraved on a disc fitted in front of the torsional vibration damper. The scale marks are read against a pointer fitted to the crankcase.

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.

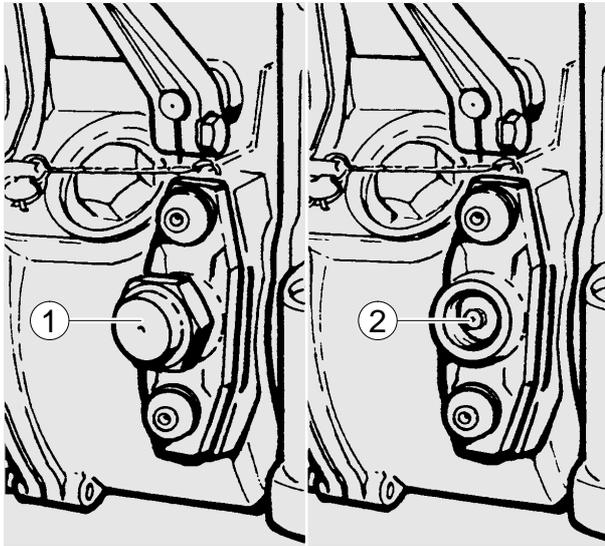
The pointer should then be aligned such that its measuring edge exactly coincides with the "OT" mark on the scale disc.

In order to enable the engine to be rotated manually during adjustments, there is a plate with a central hexagon driver fitted to the front of the crankshaft pulley (barring device).

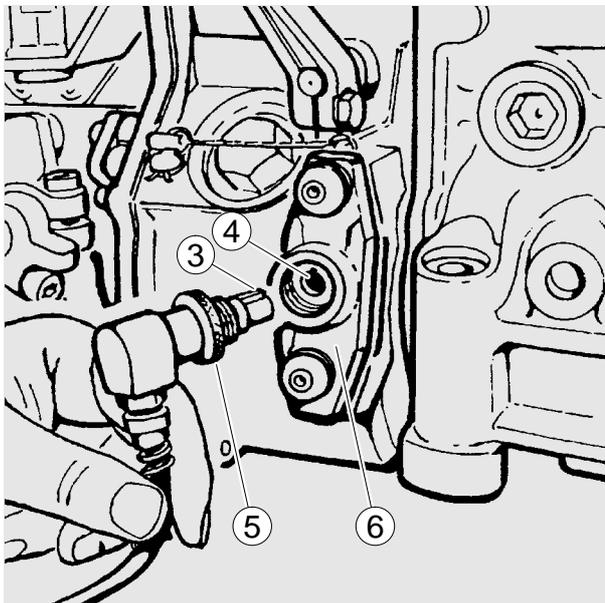
### Checking

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

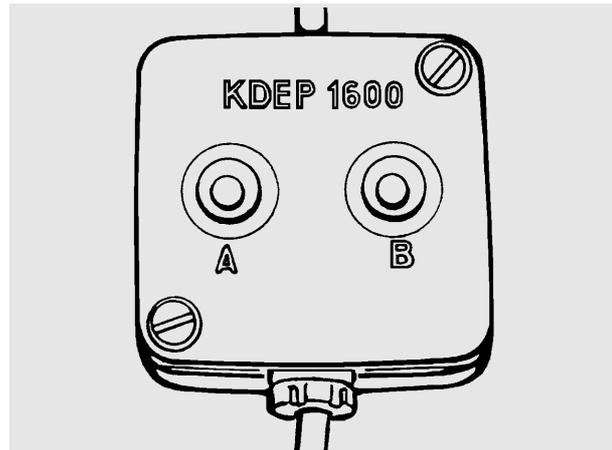


Push light signal transmitter into socket in governor housing. Ensure that the lug ③ fits in the groove ④. Tighten the knurled nut ⑤ by hand.



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.

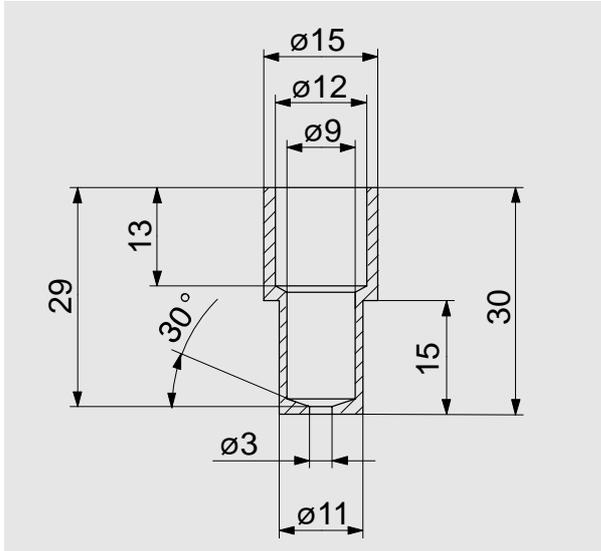
When the pump is in this position the degree scale on the flywheel housing must also indicate the specified start of delivery.

**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.



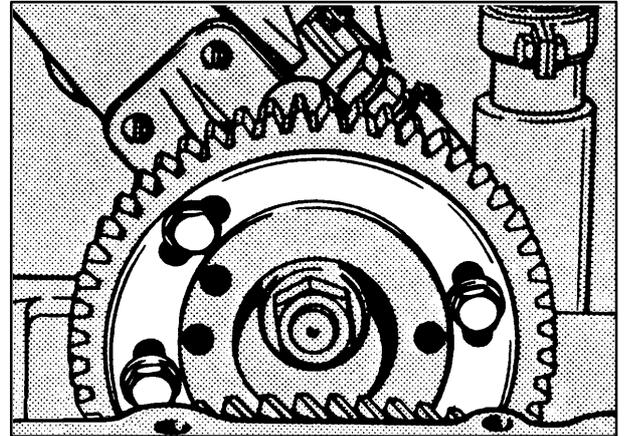
The receptacle is to be made of aluminium or steel in accordance with the drawing (figure).

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 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.

After every adjustment carefully retighten fixing bolts.

Check start of delivery again.  
Close up governor housing.

## To check and adjust valve clearance

(by authorized specialist personnel)

The valve clearance for new and overhauled engines should be checked after the first 10 to 20 hours of operation.

*Then it should be adjusted every 400 hours of operation.*

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.

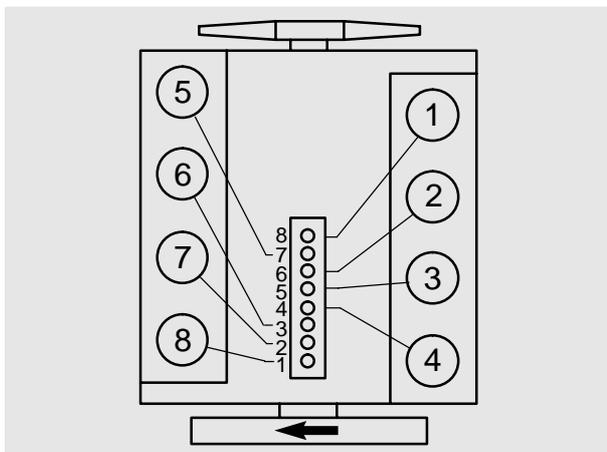
Rotate the crankshaft so that the piston of the cylinder to be adjusted is at firing TDC. This is the case when the valves of the synchronous pistons are just rocking.

### D 2848 LXE

Valve rocking on cylinder

1	5	7	2	6	3	4	8
6	3	4	8	1	5	7	2

Adjust valves on cylinder

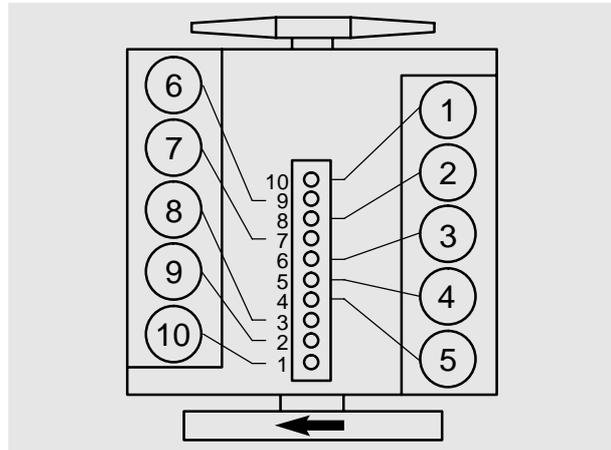


### D 2840 LXE

Valve rocking on cylinder

1	6	5	10	2	7	3	8	4	9
7	3	8	4	9	1	6	5	10	2

Adjust valves on cylinder

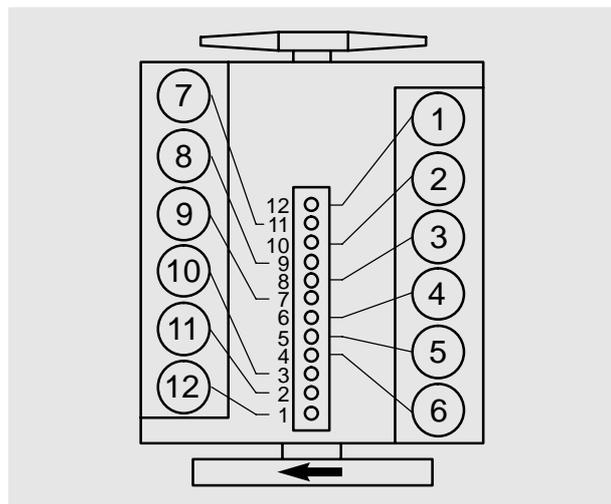


### D 2842 LXE, LYE, LZE

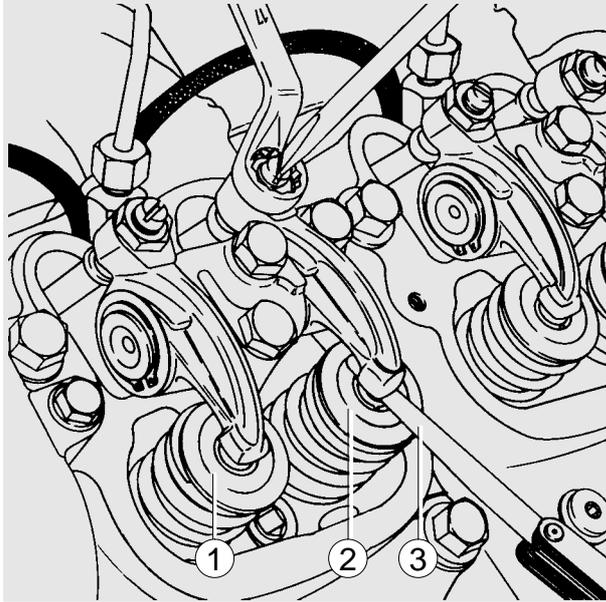
Valve rocking on cylinder

1	12	5	8	3	10	6	7	2	11	4	9
6	7	2	11	4	9	1	12	5	8	3	10

Adjust valves on cylinder



In order to enable the engine to be rotated manually during adjustments, there is a plate with a central hexagon driver fitted to the front of the crankshaft pulley (bar-ring device).



- 1 Exhaust valve
- 2 Inlet 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:

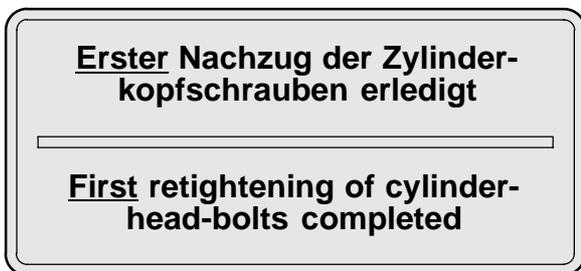
Bolts with hex head may be replaced by bolts with Torx head if all the bolts on the engine are to be changed.

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)

by authorized specialist personnel

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.



Spare part No. 51.97801-0211

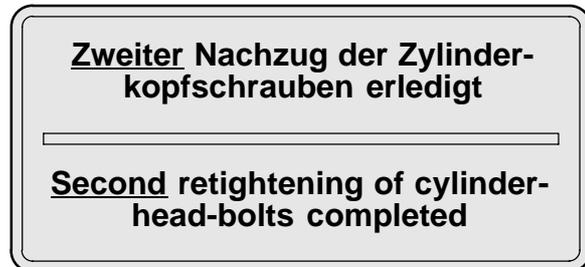
After the first 400 hours of operation retighten cylinder head bolts 1 to 4 in the order shown in Tightening diagram “1” by a further 90° (1/4 revolution).

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

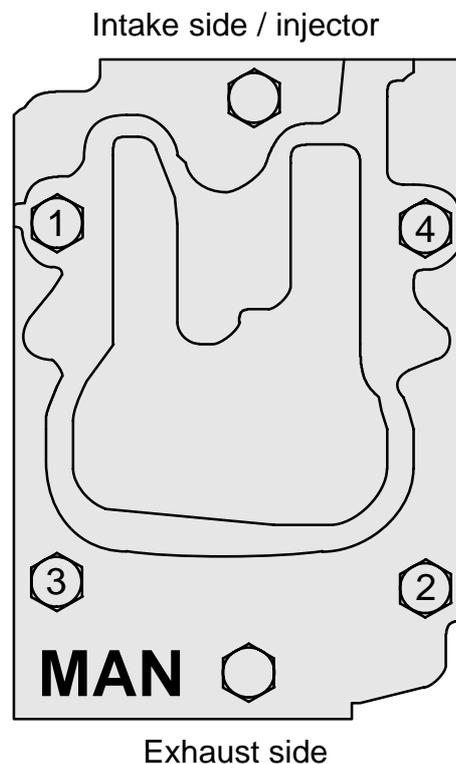
**Note:**

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. 51.97801-0212

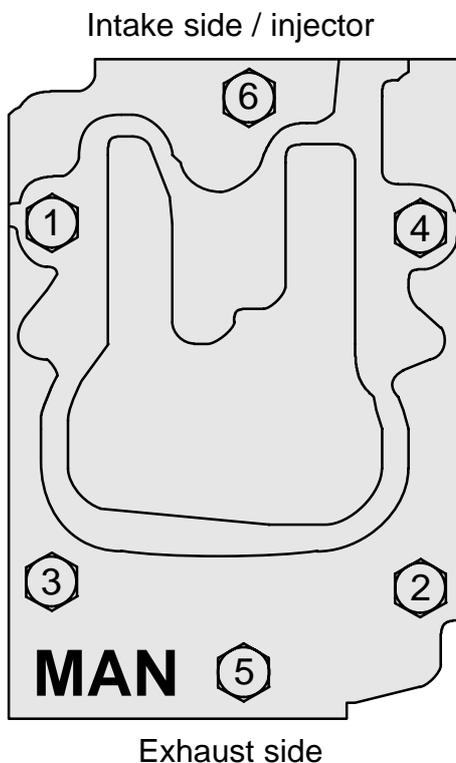


Tightening diagram “1”

## Tightening cylinder head bolts after a repair (engine cold)

by authorized specialist personnel

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 MoS<sub>2</sub>. 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

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

by authorized specialist personnel

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

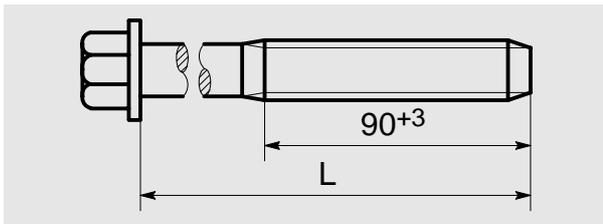
Before re-using old cylinder head bolts check them as follows:

#### Length

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

The shank lengths “L” of new bolts are 109, 144 and 168 mm.

Permissible maximum lengths are 111, 146 and 170 mm respectively.



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.

### V-belts

*The tension of the V-belts should be checked after every 200 hours of operation.*

#### Change the V-belts if necessary

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

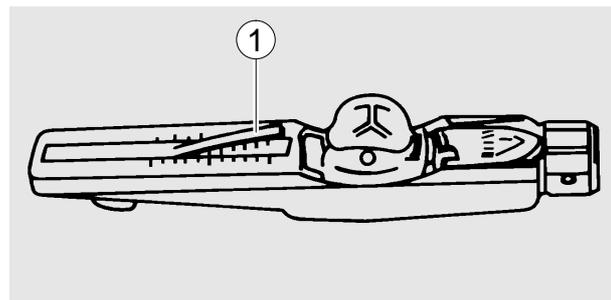
#### Checking condition

Check V-belts for cracks, oil, overheating and wear.

#### Testing by hand

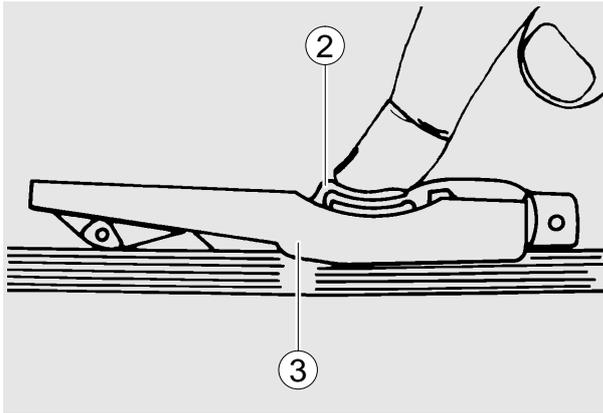
A more precise check of the V-belt tension is possible only by using a V-belt tension tester.

#### Check with V-belt tension tester



#### Measuring 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

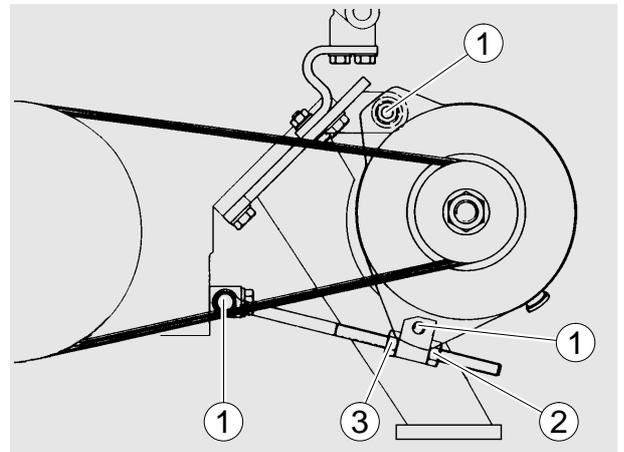
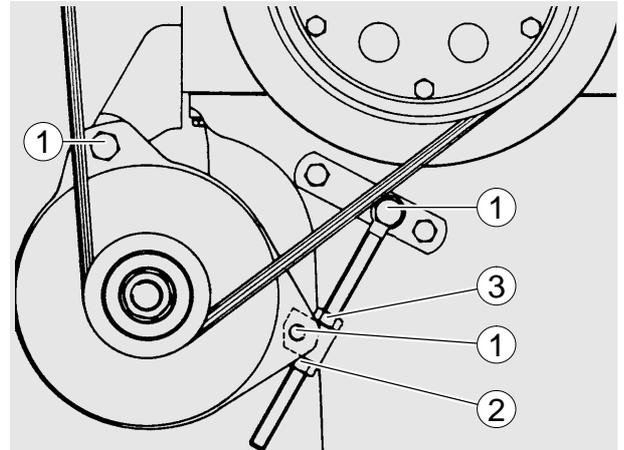
If pressure is maintained after the spring has disengaged a false reading will be obtained!

### 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

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	70–80	60
3/3VX	135–150	105–120	90

### Tension and / or replace V-belts



### Water pump - 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	<b>D 2848 LXE</b>
Design	V 90°
Cycle	4-stroke Diesel with turbocharger and intercooler
Combustion system	Direct injection
Turbocharging	Turbocharger with Intercooler
Number of cylinders	8
Bore	128 mm
Stroke	142 mm
Swept volume	14 620 cm <sup>3</sup>
Compression ratio	13.5 : 1
Rating	see engine nameplate
Firing order	1-5-7-2-6-3-4-8
Valve clearance (cold engine)	
Intake	0.25 mm
Exhaust	0.40 mm
Valve clearance changed	Starting from engine no ...7678001....
Intake	0.50 mm
Exhaust	0.50 mm
See instruction label on valve cover	
Valve timing	
Intake opens	24° before TDC
Intake closes	36° after BDC
Exhaust opens	63° before BDC
Exhaust closes	27° after TDC
Fuel system	
Injection	In-line pump, V-saddle-mounted
Governor	Centrifugal governor (variable-range speed governor) with smoke stop
Injection timer	
up to engine serial number ...6190 999....	Automatic centrifugal type in camshaft drive gear
engine serial number and up ...6191 001....	without injection timer
Start of delivery	
up to engine serial number ...6190 999....	16° ± 1° before TDC
engine serial number and up ...6191 001....	22° ± 1° before TDC

## Technical data



Injectors	five-hole nozzles
Opening pressure of injector	
New nozzle holder:	295 + 8 bar
Used nozzle holder:	280 + 8 bar
Engine lubrication	Force feed
Oil capacity in oil sump (litres)	min.    max.
deep	12 l    18 l
shallow	20 l    24 l
Oil change quantity (with filter)	
deep	21 l
shallow	27 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 two paper cartridges
Engine cooling system	Liquid cooling
Coolant temperature	80–85°C, temporarily 90°C allowed
Coolant filling quantity	63 l
Electrical equipment	
Starter	24 V; 5.4 kW or 6.5 kW
Alternator	28 V; .. A



## Technical data

Model	<b>D 2840 LXE</b>
Design	V 90°
Cycle	4-stroke Diesel with turbocharger and intercooler
Combustion system	Direct injection
Turbocharging	Turbocharger with Intercooler
Number of cylinders	10
Bore	128 mm
Stroke	142 mm
Swept volume	18 270 cm <sup>3</sup>
Compression ratio	13.5 : 1
Rating	see engine nameplate
Firing order	1-6-5-10-2-7-3-8-4-9
Valve clearance (cold engine)	
Intake	0.25 mm
Exhaust	0.40 mm
Valve clearance changed	Starting from engine no ...7661035....
Intake	0.50 mm
Exhaust	0.50 mm
See instruction label on valve cover	
Valve timing	
Intake opens	24° before TDC
Intake closes	36° after BDC
Exhaust opens	63° before BDC
Exhaust closes	27° after TDC
Fuel system	
Injection	In-line pump, V-saddle-mounted
Governor	Centrifugal governor (variable-range speed governor) with smoke stop
Injection timer	without injection timer
Start of delivery	
up to engine serial number ...6143 095....	23° ± 1° before TDC
engine serial number and up ...6143 096....	24° ± 1° before TDC
Injectors	
up to engine serial number ...6143 095....	four-hole nozzles
engine serial number and up ...6143 096....	five-hole nozzles

Opening pressure of injector	
New nozzle holder:	295 + 8 bar
Used nozzle holder:	280 + 8 bar
Engine lubrication	Force feed
Oil capacity in oil sump (litres)	min.    max.
deep (front end sump)	14 l    22 l
deep (rear end sump)	26 l    30 l
shallow	26 l    30 l
Oil change quantity (with filter)	
deep (front end sump)	25 l
deep (rear end sump)	33 l
shallow	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 two paper cartridges
Engine cooling system	Liquid cooling
Coolant temperature	80–85°C, temporarily 90°C allowed
Coolant filling quantity	80 l
Electrical equipment	
Starter	24 V; 6.5 kW
Alternator	28 V; .. A



## Technical data

Model	<b>D 2842 LXE, D 2842 LYE</b>
Design	V 90°
Cycle	4-stroke Diesel with turbocharger and intercooler
Combustion system	Direct injection
Turbocharging	Turbocharger with Intercooler
Number of cylinders	12
Bore	128 mm
Stroke	142 mm
Swept volume	21 930 cm <sup>3</sup>
Compression ratio	13.5 : 1
Rating	see engine nameplate
Firing order	1-12-5-8-3-10-6-7-2-11-4-9
Valve clearance (cold engine)	
Intake	0.25 mm
Exhaust	0.40 mm
Valve clearance changed	Starting from engine no ...7651046...
Intake	0.50 mm
Exhaust	0.50 mm
See instruction label on valve cover	
Valve timing	
Intake opens	24° before TDC
Intake closes	36° after BDC
Exhaust opens	63° before BDC
Exhaust closes	27° after TDC
Fuel system	
Injection	In-line pump, V-saddle-mounted
Governor	Centrifugal governor (variable-range speed governor) with smoke stop
Injection timer	
up to engine serial number ...6143 095....	Automatic centrifugal type in camshaft drive gear
engine serial number and up ...6143 096....	without injection timer
Start of delivery	
up to engine serial number ...6143 095....	18° ± 1° before TDC
engine serial number and up ...6143 096....	24° ± 1° before TDC

<b>Injectors</b>	
up to engine serial number ...6143 095....	four-hole nozzles
engine serial number and up ...6143 096....	five-hole nozzles
<b>Opening pressure of injector</b>	
New nozzle holder:	295 + 8 bar
Used nozzle holder:	280 + 8 bar
<b>Engine lubrication</b>	Force feed
<b>Oil capacity in oil sump (litres)</b>	min.    max.
deep	24 l    32 l
semi-shallow	22 l    30 l
for 38 / 45° tilt	37 l    45 l
<b>Oil change quantity (with filter)</b>	
deep	35 l
semi-shallow	33 l
for 38 / 45° tilt	48 l
Oil pressure during operation (depend- ing on oil temperature, oil viscosity class and engine rpm)	must be monitored by oil pressure moni- tors / gauges
<b>Oil filter</b>	Full flow filter with two paper cartridges
<b>Engine cooling system</b>	Liquid cooling
<b>Coolant temperature</b>	80–85°C, temporarily 90°C allowed
<b>Coolant filling quantity</b>	96 l
<b>Electrical equipment</b>	
<b>Starter</b>	24 V; 6.5 kW
<b>Alternator</b>	28 V; .. A



## Technical data

Model	<b>D 2842 LZE</b>
Design	V 90°
Cycle	4-stroke Diesel with turbocharger and intercooler
Combustion system	Direct injection
Turbocharging	Turbocharger with Intercooler
Number of cylinders	12
Bore	128 mm
Stroke	142 mm
Swept volume	21 930 cm <sup>3</sup>
Compression ratio	13.5 : 1
Rating	see engine nameplate
Firing order	1-12-5-8-3-10-6-7-2-11-4-9
Valve clearance (cold engine)	
Intake	0.25 mm
Exhaust	0.40 mm
Valve clearance changed	Starting from engine no ...7651046...
Intake	0.50 mm
Exhaust	0.50 mm
See instruction label on valve cover	
Valve timing	
Intake opens	24° before TDC
Intake closes	36° after BDC
Exhaust opens	63° before BDC
Exhaust closes	27° after TDC
Fuel system	
Injection	In-line pump, V-saddle-mounted
Governor	Centrifugal governor (variable-range speed governor) with smoke stop
Injection timer	
up to engine serial number ...6143 095....	Automatic centrifugal type in camshaft drive gear
engine serial number and up ...6143 096....	without injection timer
Start of delivery	
up to engine serial number ...6143 095....	23° ± 1° before TDC
engine serial number and up ...6143 096....	24° ± 1° before TDC

Injectors	five-hole nozzles
Opening pressure of injector	
New nozzle holder:	295 + 8 bar
Used nozzle holder:	280 + 8 bar
Engine lubrication	Force feed
Oil capacity in oil sump (litres)	min.    max.
deep	24 l    32 l
semi-shallow	22 l    30 l
for 38 / 45° tilt	37 l    45 l
Oil change quantity (with filter)	
deep	35 l
semi-shallow	33 l
for 38 / 45° tilt	48 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 two paper cartridges
Engine cooling system	Liquid cooling
Coolant temperature	80–85°C, temporarily 90°C allowed
Coolant filling quantity	96 l
Electrical equipment	
Starter	24 V; 6.5 kW
Alternator	28 V; .. 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 59)		●	○	○	○				
Change oil filter cartridge (see also page 59)		●	○	○	○				
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 59.

## 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 2848 LXE	400 h	400 h	600 h	600 h
D 2840 LXE	200 h	200 h	400 h	400 h
D 2842 LXE / LYE / LZE	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

<b>A</b>		<b>N</b>	
Air cleaner	19, 38	Nameplates	4
Alternator	20, 23		
<b>C</b>		<b>O</b>	
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Commissioning and operation	21–23	Oil drainage	24
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