



**Operating Instructions for MAN Marine Diesel engines  
Bedienungsanleitung für MAN-Schiffsdieselmotoren  
Instrucciones de servicio para Motores Diesel MAN para barcos  
Instruction de service pour Moteurs Diesel marins MAN  
Norme di servizio per Motori Diesel MAN per applicazioni navali**

**D 2848 LE 401 / 403 / 405**

**D 2840 LE 401 / 402 / 407**

**D 2842 LE 401 / 402 / 403 / 406 / 408 / 411 / 412 / 413**



## Dear Customer,

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

This manual contains information on “Fuels, Lubricants and Coolants for MAN Diesel Engines”.

This manual is supplemented by the publication “Service record book”.

**Note:**

All three publications belong to the engine and must always be kept ready to hand near the engine in the engine room.

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.

**Note:**

Only use fuel, coolants and lubricants in accordance with MAN’s regulations otherwise the manufacturer’s warranty will not apply!

For basic information on the fuels see the publication “Fuels, Lubricants and Coolants for MAN Diesel Engines”.

You can find the approved products in the internet under:

–<http://www.man-mn.com/> → **Products & Solutions** → **E-Business**–

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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Important instructions which concern technical safety and protection of persons are emphasised as shown below.

**Danger:**

This refers to working and operating procedures which must be complied with in order to rule out the risk to persons.

**Caution:**

This refers to working and operating procedures which must be complied with in order to prevent damage to or destruction of material.

**Note:**

Explanations useful for understanding the working or operating procedure to be performed.

### Fitting flat seals / gaskets

Flat seals / gaskets are often inserted with sealing agents or adhesives to make fitting them easier or to achieve better sealing. Flat seals may slip in operation due to the “sewing-machine” effect, in particular if they are used between parts with different rates of linear expansion under heat (e.g. aluminium and cast iron), and leaks may then occur.

**Example:**

the cap of the front crankshaft seal. If a sealing agent or an adhesive is used here the flat seal will move inwards in the course of time as a result of the different expansion rates of the materials. Oil will be lost, for which the shaft seal may be thought to be responsible.

**Flat seals / gaskets can be fitted properly only if the following points are observed:**

- Use only genuine MAN seals / gaskets
- The sealing faces must be undamaged and clean
- Do not use any sealing agent or adhesive – as an aid to fitting the seals a little grease can be used if necessary so that the seal will stick to the part to be fitted
- Tighten bolts evenly to the specified torque

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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**

# Declaration



Technical documentation for exhaust emission approval of propulsion engines  
according to RCD 94/25/EC amended by 2003/44/EC

Manufacturer / Engine Family  
D28Main

## Declaration of Conformity for Recreational Craft Propulsion Engines with the requirements of Directive 94/25/EC as amended by 2003/44/EC (To be completed by manufacturer of inboard engines without integral exhaust)

Name of engine manufacturer: MAN Nutzfahrzeuge AG

Address: Vogelweiherstrasse 33

Town: Nuernberg Post Code: 90441 Country: Germany

Name of Authorised Representative: \_\_\_\_\_

Address: \_\_\_\_\_

Town: \_\_\_\_\_ Post Code: \_\_\_\_\_ Country: \_\_\_\_\_

Name of Notified Body for exhaust emission assessment: Germanischer Lloyd

Address: Vorsetzen 32-35

Town: Hamburg Post Code: 20459 Country: Germany ID Number: 0098

Module used for exhaust emission assessment:  B+C  B+D  B+E  B+F  G  H  
or engine type-approved according to:  stage II of Directive 97/68/EC  Directive 88/77/EC  
Other Community Directives applied: \_\_\_\_\_

### DESCRIPTION OF ENGINE(S) AND ESSENTIAL REQUIERMENTS

**Engine Type:**  z or sterndrive without integral exhaust  Inboard engine  
**Fuel Type:**  Diesel  Petrol  
**Combusion cycle:**  2 stroke  4 stroke

#### ENGINE(S) COVERED BY THIS DECLARATION

Engine model(s) or engine family name(s):	EC Type examination certificate
Engine family "D28Main"	34658-06 HH
<b>Engine types of engine family:</b>	
D2842LE 420kW	
D2842LE404 956kW	
D2842LE407 882kW	
D2840LE403 772kW	
D2848LE403 588kW	
D2876LE405 537kW	
D2876LE401 515kW	
D2876LE404 463kW	

Essential requirements	Standards Used	Other normative document used	See technical documentation
<b>Annex I.B – Exhaust Emissions</b>			
engine identification			X
exhaust emission requirements	EN ISO 8178-1:1996		
durability			X
owner's manual			X
<b>Annex I.C – Noise Emissions</b>	see craft manufacturer's Declaration of Conformity		

This declaration of conformity is issued under the sole responsibility of the manufacturer. I declare on behalf of the engine manufacturer that the engine(s) will meet the requirements of above mentioned directives when installed in a recreational craft, in accordance with the engine manufacturer's supplied instructions and that this (these) engine(s) must not be put into service until the recreational craft into which it is (they are) to be installed has been declared in conformity with the relevant provisions of the above mentioned Directives.

**Lutz Matthiesen**  
MVMV

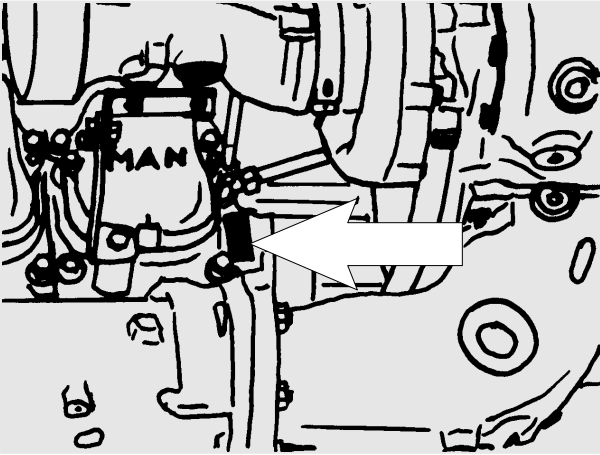
Name / function: \_\_\_\_\_ Signature and title: *Lutz Matthiesen*  
(identification of the person empowered to sign on behalf of the engine manufacturer or his authorised representative) (or an equivalent marking)

Date and place of issue: (yr/month/day) 06/02/14

**MAN Nutzfahrzeuge**  
Aktiengesellschaft  
Geschäftseinheit Motoren  
Vogelweiherstraße 33  
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 (see illustration).

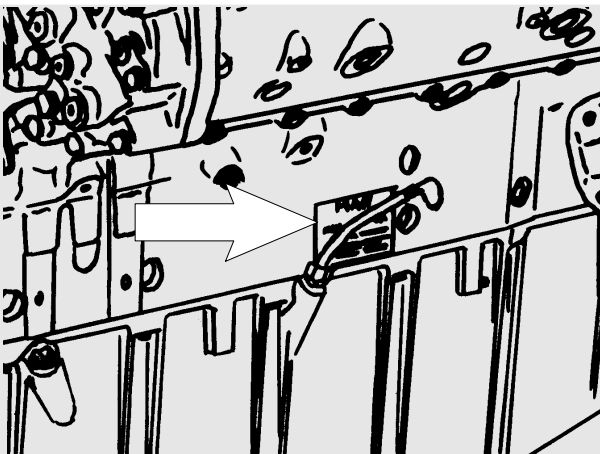
MAN Nutzfahrzeuge Aktiengesellschaft  
 Typ   
 Motor-Nr. / Engine No.  NI/II

Model

.....

delivered on

.....



installed on

.....

Engine serial number

.....

Order number

.....

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	Leistung PS Rating BHP	Aufstellhöhe m uNN	Altitude m	
<input type="text"/>	<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.
- **For safety reasons a separate, functioning red emergency-stop-button for each engine must be installed at every bridge** (the engine must stop immediately when the button is pressed once).



- 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 –

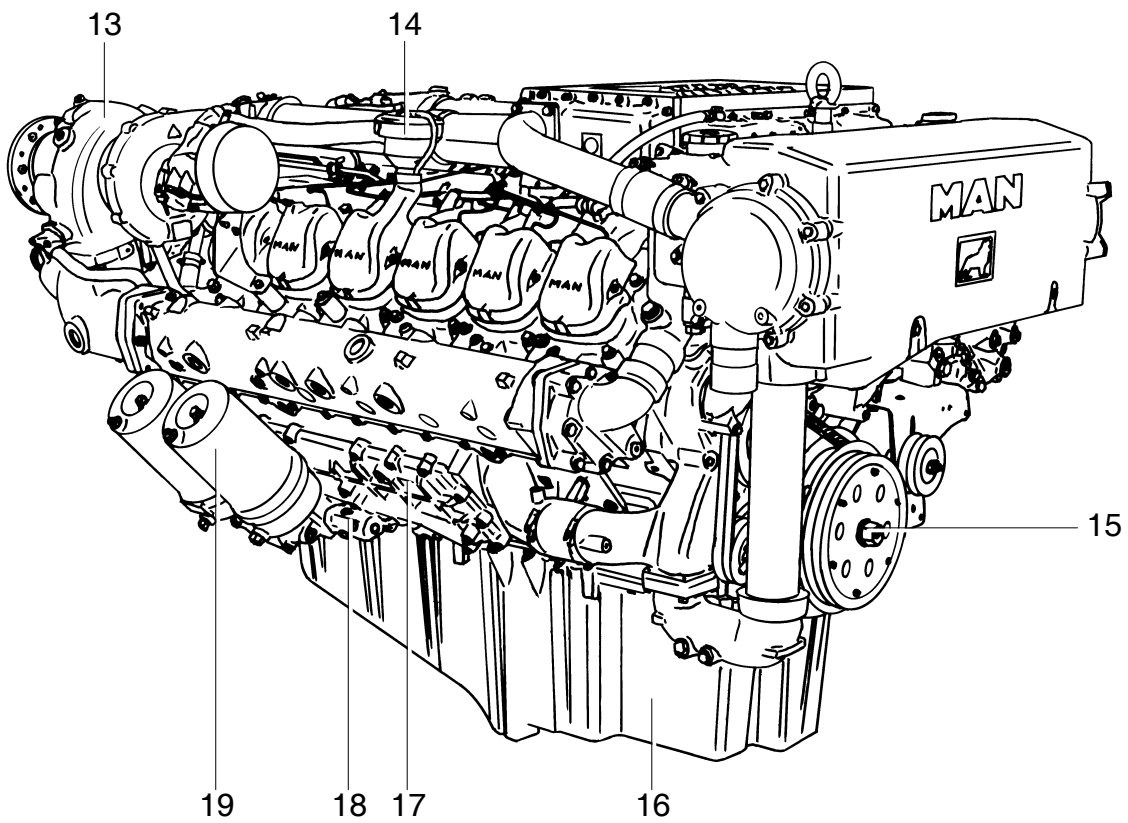
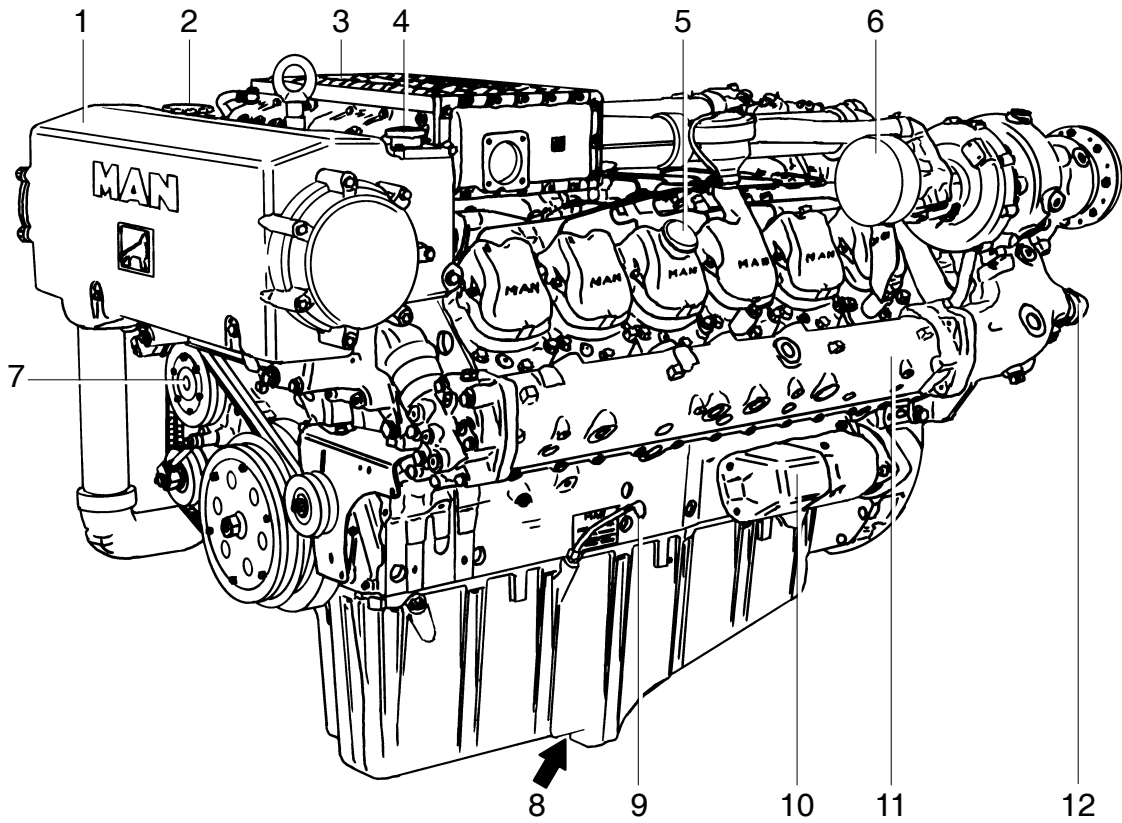
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For this reason do not let engine oil get into the ground, waterways, the drains or the sewers. Violations are punishable.

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 LE 401



- 1 Heat exchanger and coolant surge tank
- 2 Coolant filler neck
- 3 Intercooler
- 4 Relief valve on coolant surge tank
- 5 Oil filler neck
- 6 Air intake
- 7 Water pump (engine coolant circuit)
- 8 Oil drain plug
- 9 Oil dipstick
- 10 Starter motor
- 11 Exhaust pipe, liquid-cooled
- 12 Waste Gate
- 13 Turbocharger, liquid-cooled
- 14 Oil separator valve for crankcase breather
- 15 Engine cranking device
- 16 Oil sump
- 17 Oil cooler
- 18 Connection for oil pressure sensor
- 19 Oil filter

### First commissioning

When putting a new or overhauled engine into operation for the first time pay attention to the “Installation instructions for MAN marine diesel engines” without fail.

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.”)

**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”.

- Pour in coolant slowly via expansion tank, see page 52
- For coolant filling quantity, see “Technical data”

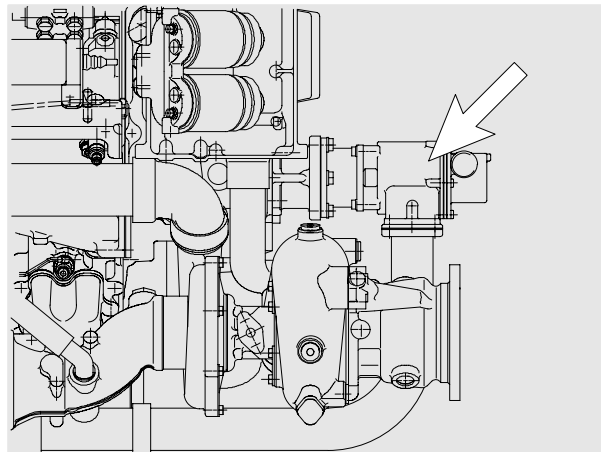


## Raw water pump

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.



## Filling with engine oil



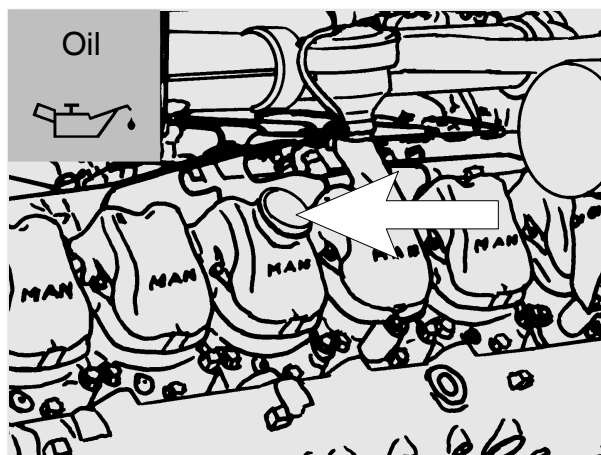
### Caution:

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 (arrow), see page 46.

For the quantity required see "Technical Data".



## Commissioning

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

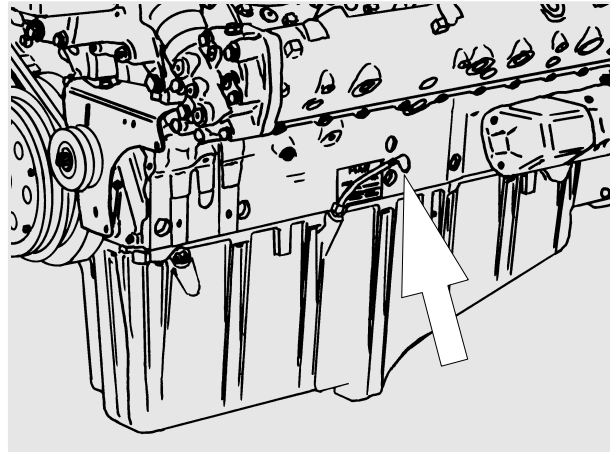
**Caution:**

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

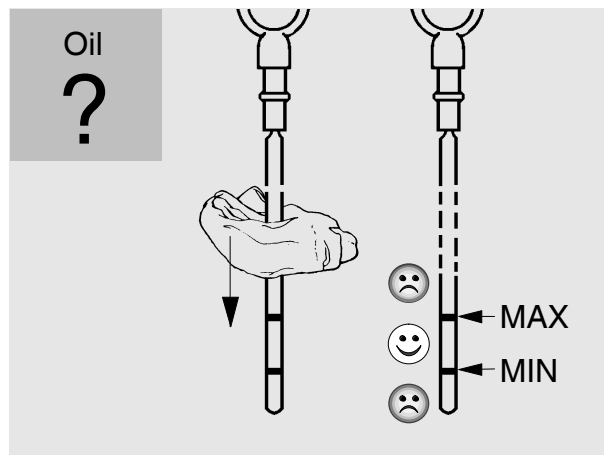
### Checking oil level

Check engine oil level only approx. 20 minutes after the unit has been switched off.

- Pull out dipstick (arrow)
- 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.

## Starting

**Danger:**

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

Ensure that the gearbox is in neutral.

**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 (<math><20^{\circ}\text{C}</math>) 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.

If the engine is kept idling for long periods it may cool down and thus start to emit white or blue smoke.

We therefore recommend that you do not let the engine idle for more than 5 minutes. It is well known that with any internal combustion engine wear is higher during idling. Idling for longer periods is also an environmental nuisance.

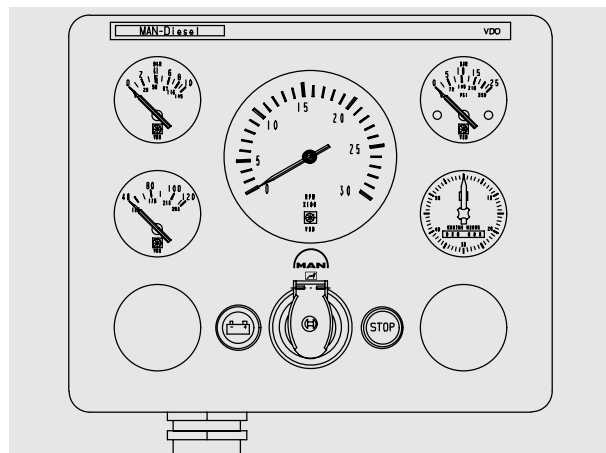


**Caution:**

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!

Display panel in the engine room. Functions independently of the BE1 operation monitor and shows analog operating values from the engine.

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.



### Operation monitoring system BE1



**Caution:**

If an engine / gear box alarm is displayed on the monitoring device, the engine is to be turned off, i.e. operated at low-pressure at a max. of 1200 rpm.

When following alarms are activated

- engine oil pressure / reduction of lubrication oil pressure
- engine coolant temperature / overheating of engine coolant
- engine charge-air temperature

the engine is to be turned off immediately and the cause of the error properly remedied, i.e. in a specialist workshop.

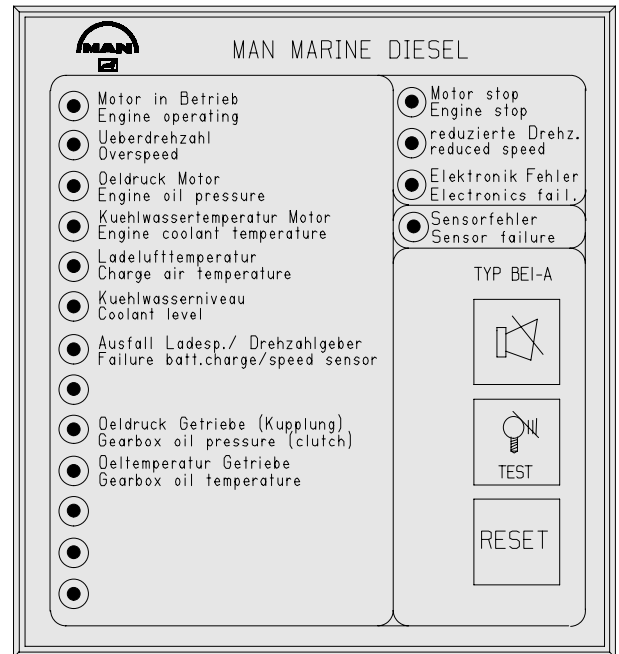
Do not put this engine into operation again until the error has been eliminated.

## Operation of the engine monitoring system BE1

The engine monitoring system BE1 warns the ship operator if important engine operating values are outside the permissible tolerance range.

The display unit of the engine monitoring system (see picture) is installed in the main navigating stand and, as an option, in the secondary navigating stand (fly-bridge) too. The alarm is raised:

- acoustically by means of a horn
- visually by the flashing of the respective red check lamp (exception: in the event of a fault in the electronic system the respective check lamp is permanently illuminated)



To protect the engine, the speed will be reduced if alarm warnings like engine oil pressure, engine coolant temperature, charge-air temperature and coolant level) is raised. The check lamp “reduced speed” is then illuminated permanently.



### Note on engines with electronically controlled diesel injection (EDC):

After the ignition has been switched on, the lamp “Fault in the electronic system” will come on momentarily (lamp check). If there is a fault in the electronically controlled diesel injection system (EDC), the lamp “Fault in the electronic system” will be illuminated permanently.

## Operation of the engine monitoring system BE1 after an alarm has been triggered

The display unit has the following operating buttons:



Switching off of the alarm horn.



Switching off of the flashing signal of the respective check lamp, ie the flashing light changes into permanent light. Before the flashing signal can be switched off, the alarm horn must be switched off.



Lifting of the alarm message (the red check lamp will go out).  
Precondition for lifting an alarm message:

- Pressing of buttons “Horn off” and “Test” in the order indicated
- Elimination of the cause of the alarm

- Short-term reduction of the engine speed below 800 rpm, to again achieve higher engine speeds

### Functional test of the check lamps



If no alarm is raised, the check lamps may be checked. Upon pressing the button “Test”, all check lamps must come on.

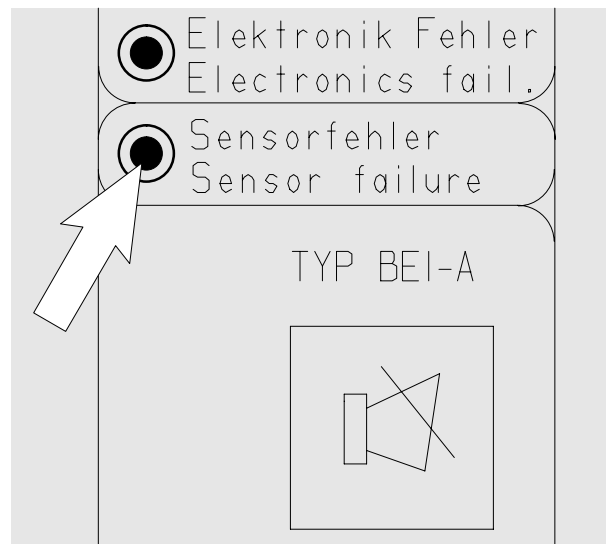
### Self-test of system BE1

To achieve optimum operational reliability, the system distinguishes between sensor fault and “real alarm”.

The following sensors are checked for sensor fault and parting of wire:

- Engine speed
- Engine oil pressure
- Coolant temperature
- Charge-air temperature
- Coolant level

If the signal sent by the sensor is a value which does not occur in practice or if the wire connection is interrupted, the check lamp “Sensor fault” and the check lamp of the associated function will start flashing.



The D 2848 LE 401 is equipped with a monitoring and diagnostic system MMDS optionally.

On the control console and alternatively on other control stands, the following display devices are available for monitoring operation:

1. Analog round instruments, see below
2. Display device MMDS-L, see page 26
3. Display device MMDS-LC, see page 28
4. Engine room panel MMDS-EP, see page 35

For operation and speed adjustment, MAN provides the following equipment:

5. Drive lever control system Mini Marex made by Mannesmann-Rexroth, see page 36

### 1. Round instruments

MAN can supply the following VDO round instruments for operation monitoring:

Revolution counter with integrated digital hours of operation counter

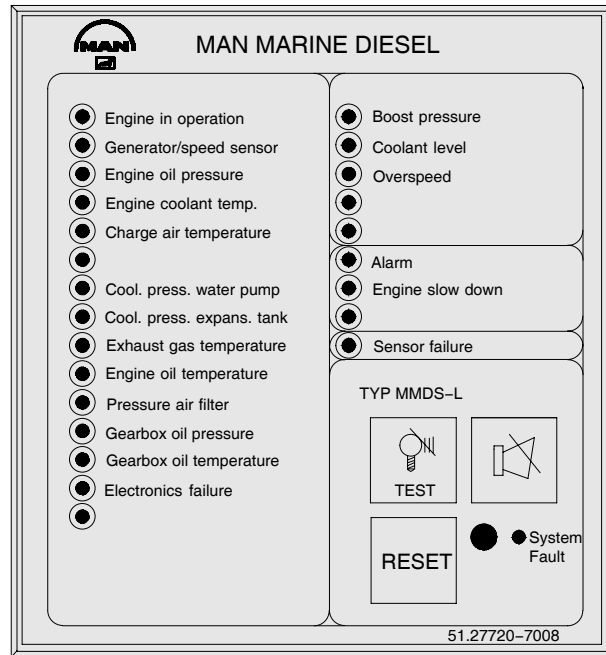
Oil pressure engine	0–6 bar
Oil pressure gearbox	0–25 bar
Oil temperature engine	50–150°C
Coolant temperature engine	40–120°C
Exhaust temperature engine	100–900°C
Voltmeter	18–32 V

## 2. Display device MMDS-L

The engine monitoring alarms the officer guiding the ship when important engine operating values are outside the permitted tolerance range.

- Acoustically by means of an integrated buzzer or horn connected at the ship-yard
- Visually in that the relevant warning lamp flashes

The engine operating parameters shown on the display device are monitored. If gearbox parameters are to be monitored, this depends whether the corresponding sensors have been fitted in the gearbox.



The device distinguishes between the following types of alarm, error messages:

- Preliminary alarm: the corresponding light-emitting diode flashes
- Main alarm: the corresponding light-emitting diode flashes  
light-emitting diode “Alarm” flashes  
In the case of an engine slow down alarm, “Engine slow down” also flashes  
In the case of a stop alarm, “Engine stop” also flashes
- Sensor fault: the corresponding light-emitting diode flashes  
light-emitting diode “Sensor fault” flashes

The alarm “Sensor fault” means that the corresponding sensor is classified by the monitoring system as defective, as it is returning an unrealistic value. The engine speed is not reduced.

In the event of a fault in the electronic system, the warning lamp lights up continuously. There is then a defect in the electronic fuel injection (EDC).

So as not to endanger the engine, the engine power is automatically reduced in the case of selected main alarms.



### Note for engines with electronically controlled diesel injection (EDC):

After the ignition has been switched on, the lamp “Electronic fault” lights up briefly (lamp test). If there is a fault in the electronically controlled diesel injection (EDC), the lamp “Electronic fault” lights up permanently.



## Operation of the display device MMDS-L

The display device has the following operating keys:



Switches off the alarm horn and the integrated buzzer



Switches off the flashing signal of the relevant warning lamp, i.e. the flashing light switches to continuous light. Before the flashing signal is cleared, the alarm horn must be switched off.



Clears the alarm message (red warning lamp goes out)

Requirement for clearing an alarm message is:

- Pressing the keys “Horn off” and “Test” in that order
- Removing the cause of the alarm
- In the event of a reduction alarm the engine speed must be brought down below 800 rpm in order to be able to reach higher speeds again
- In the case of a stop alarm, the alarm can only be deleted if the engine is at a standstill

### **Function test of the warning lamps**



If there is no alarm, the warning lamps can be tested.

When the “Test” key is pressed, all the warning lamps must light up

### **Dimming**

All alarm LEDs are dimmed automatically depending on the ambient brightness. A photo-electric element integrated in the front plate ensures this.

### **Horn test**

If the ‘Clear horn’ key is pressed for approx. 5 seconds, the fitted buzzer as well as possibly horns fitted at the shipyard go off.

### **System Failure**

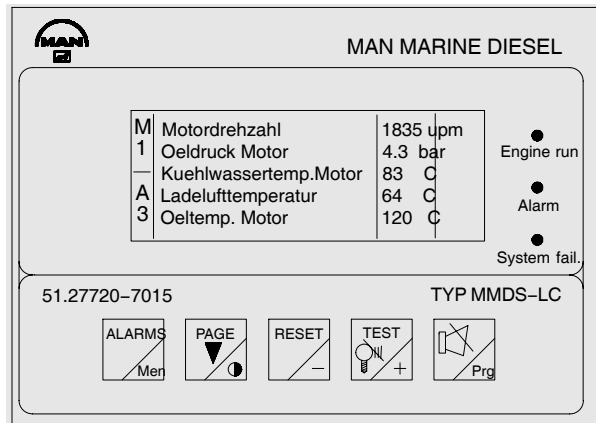
Two failure states are distinguished and indicated by the failure LED flashing or lighting up continuously:

- A flashing System Failure LED signals a communication fault, i.e. the data bus is interrupted or there is interference. In this case, the seating of plug-in connections for the MMDS-L and the serial distributor MMDS-SD are to be checked.
- Continuous lighting up of the System Failure LED indicates an internal fault. If this state remains after switching off and on again, the device is defective.

## 3. Display device MMDS-LC

The device serves to visualise analog engine data, as well as visual and acoustic notification of engine alarms. **All engine data is entered at the factory in the languages German, English, French, Italian and Spanish.**

“Scrolling” with the PAGE key enables the user to call up all the important engine data. Another key is used to show current alarms or warnings.



### Representation of monitor pages

The analog engine data provided by the MMDS is distributed on 4 monitor pages. On each page, the current engine speed is displayed in the top line. The 1st page continues with the most important engine data such as oil pressure, coolant pressure, charge-air pressure and oil pressure in the gearbox. Other engine and gearbox data, as well as exhaust temperatures and supplementary information is shown on the subsequent pages:

*Page 1 Actual value (example)*

<b>P1</b>	Engine speed	2100	rpm
	Oil pressure, engine	4,3	bar
	Coolant temperature, engine	82	°C
	Charge-air temperature	41	°C
	Oil pressure, gearbox	19	bar

*Page 2 Actual value (example)*

<b>P2</b>	Engine speed	2100	rpm
	Coolant pressure compensator reservoir	830	mbar
	Coolant pressure water pump	3,9	bar
	Oil temperature, engine	103	°C
	Battery voltage	27,1	V

<i>Page 3</i>		<i>Actual value (example)</i>	
<b>P3</b>	Engine speed	2100	rpm
	Intake air vacuum	30	mbar
	Charging pressure	1,86	bar
	Exhaust temperature T.A.	629	°C
	Exhaust temperature T.B.	613	°C

<i>Page 4</i>		<i>Actual value (example)</i>	
<b>P4</b>	Engine speed	2100	rpm
	Fuel consumption	162	l/h
	Engine load	79	%

The pages are scrolled using the “**PAGE**” key. Each time the key is pressed, the screen moves up to the next page. After page 4, page 1 appears again.

For the display of current alarms and warnings, an alarm screen has been included. This is called up using the “**ALARMS**” key. If there is no alarm, the message “**no message**” appears on the screen.

<b>A1</b>	> no message	
-----------	--------------	--

If an alarm is activated, the device switches automatically to the alarm screen. Each new entry is made in the top line. Any messages that might already be present shift one line downwards. In a column to the right of this, the code and current time are added. Although a warning (message without alarm) is entered in the alarm screen, there is no automatic switch to that screen, e.g. in the case of a programmed ship alarm or ship-specific warning, see page 34.

**The following codes are distinguished:**

- Warnings:** without code
- Warnings (preliminary alarms):** **WA**
- Main alarms:** **AL**
- Sensor error alarms:** **SE**

Example:

	<i>Message text</i>	<i>Code</i>	<i>Time</i>
<b>A1</b>	Coolant temperature	WA	14:14
	Charge-air temperature	SE	13:57
	Coolant level		11:00
	Oil pressure, engine	<b>AL</b>	08:37
	Bilge pump ON		



Programmed ship-specific warning

If there are more than 5 alarms (e.g. during commissioning in the shipyard), the alarms can be displayed in groups of five (A2 to An) by pressing the “**ALARMS**” key again.

All alarms are always displayed in reverse order of their occurrence. The alarm generated last is therefore located in the first line of the alarm screen. As long as at least one alarm is active, the red LED “**Alarm**” to the right of the display lights up.

### Alarms

If an engine alarm from the central unit MMDS or an alarm configured by the user is issued, the built-in buzzer is activated and the LED “Alarm” flashes. At the same time, the monitor switches automatically to the alarm screen. The new alarm is entered in the first line as a flashing message.

The alarms that would be issued if the engine is stopped but the engine ignition is on (e.g. lack of oil pressure) are suppressed (disabled) until the green LED “Engine run” lights up. This occurs approx. 8 seconds after ignition engine speed has been reached.

When the acoustic acknowledgement (Horn Quit key) has been pressed, the integrated buzzer switches off. With the visual acknowledgement (Visual Quit key), the flashing text and the LED “Alarm” switches to continuous display. When the fault has been remedied, the alarm text disappears from the monitor. The LED “Alarm” goes out unless another alarm has been issued.

**In the case of alarms that have led to automatic stopping or reduction of the engine speed by the central unit MMDS, the “RESET” key must also be pressed. This function is only enabled in the case of a stop alarm at engine standstill and in the case of a slow down alarm below an engine speed of 800 rpm.**

### Horn test

If the ‘Clear horn’ key is pressed for approx. 5 seconds, the built-in buzzer sounds.

### System Failure

The front plate of the device has a red LED with the description ‘System Failure’. This is activated in the following two cases:

- A** Failure of the serial data from the Safety, Alarm and Diagnosis system MMDS in the engine terminal box. In this case, LED “Alarm” also flashes and the message “System Failure” appears on the alarm screen.
- B** Fault in the LCD monitor itself. In this case, no other message appears.

### Key functions

The front of the device has 5 keys that enable various functions such as scrolling, contrast adjustment, alarm acknowledgement and menu control. The keys have the following functions: Standard, Test, Menu and Special functions.

Horn Quit: *Standard function:* acoustic acknowledgement or deactivation of the internal horn.



All other monitoring devices in the system are acknowledged via the serial bus.

*Test function:* Holding the key for at least 5 seconds activates the built-in buzzer.

**PRG menu function:** adopt currently selected setting (Prg=program)

## Visual Quit / Test:



*Standard function:* visual acknowledgement, i.e. all flashing alarm texts in the currently visible alarm screen switch to constant representation if the horn was acknowledged beforehand; the red alarm LED integrated in the front plate is also switched from flashing to continuous lighting. All other monitoring devices in the system are acknowledged via the serial bus.

*Test function if there is currently no alarm and / or all issued alarms have been visually acknowledged beforehand:* Lamp test, i.e. the three LEDs in the front plate are activated as long as the key is pressed.

*Special function:* see explanation of key



*+ - menu function:* Shift selection cursor to the right or increase input value.

## RESET:



*Standard function:* The reset key can be used to reset a slow down or stop alarm:

**A reduction alarm can only be reset after reduction of the speed below 800 rpm.**

If the corresponding criteria have been met, horn and optics / test button pressed / activated and the cause of the alarm eliminated, the reduction or stop alarm in the central processing unit is reset.

*Special function:* see explanation of key





*-- menu function:* Shift selection cursor to the left or decrease input value.

## PAGE:



*Standard function:* Switch to next highest display screen for analog engine data. The page number is indicated in the top left-hand side of the display with P1 to P4. Page 4 is followed again by page 1. If this key is pressed while the alarm screen is on display, the monitor switches back to the analog engine data from which the alarm screen was originally called.

*● - Special function:* Key enables setting of the LCD contrast with simultaneous pressing of the keys

TEST  or RESET .

## ALARMS:



*Standard function:* Calling up the alarm screen; the five alarms or warnings last issued and still present are displayed. At the top left of the monitor is the code A1. If there are more than 5 messages issued, the messages can be displayed in groups of five by pressing the key again. The page number is indicated in the top left with A1 to Ax. If the display jumps to the 1st alarm screen or the display remains unchanged when the key is pressed, no more messages are active.

*Special function:* Holding the key for at least 5 seconds activates the built-in configuration menu. There, the language, units, date and time can be set.


*Menu function:* Within the menu, this key has a cancel function (Esc). The program moves back by one menu level and / or from the main menu to the normal display function.

## Menu functions

By holding the “ALARMS” key (for at least 5 seconds), you enter the configuration menu. The keys are now given the significance described at “Menu function”. The new allocation is shown in the bottom line in continuous black:

<i>Escape function Cancel</i>	<i>Move function Move selection cursor</i>	<i>Enter function Accept setting</i>
<b>esc(Men)</b>	<b>move(+/-)</b>	<b>enter(Prg)</b>



Menu guidance is in English and cannot be changed. You first enter the main menu, where the language and units for measurement point designations and measured values can be selected. There are also additional sub functions for time setting (set-time), as well as service functions, incl. PC communication (service). Each current selection can


be cancelled using the Escape function (menu key ). All other previously made settings are not influenced by this.

## Selection of language and units



When the menu is opened, the current settings are shown highlighted in black. A flashing selection cursor marks the language currently set (e.g. English):


<i>English</i>	<i>German</i>	<i>French</i>	<i>Italian</i>	<i>Spanish</i>
> <b>(US/GB)</b> <	(D)	(F)	(I)	(E)

The selection cursor can be moved using the Move function (+- keys  ). The

Enter function (PRG key ) is used to accept each marked language and highlight it in black. The selection cursor then returns to the currently set unit for temperatures (e.g. °F):

<i>Display in degrees Celsius</i>	<i>Display in degrees Fahrenheit</i>
(°C)	> <b>(°F)</b> <


Selection is again using the Move function (+- keys   ) followed by accept-


ance using the Enter function (PRG key ). The selection is highlighted in black and the selection cursor jumps to the currently set unit for pressures (e.g. bar).

Display in BAR	Display in PSI
> (BAR) <	(PSI)

After selection and acceptance, all the settings for language and unit have been concluded and highlighted accordingly in black. The selection cursor jumps to the second last line to the item “**exit**”:


> <b>exit</b> <	back	set-time	service
-----------------	------	----------	---------



If this is confirmed using the Enter function (PRG key ) or you cancel at this point

using the Escape function (Menu key ) , you return with the currently marked mode to the normal display function. In the event of an input error, you can use the function “**back**” to repeat the input. The selection cursor jumps back to the initial position (language selection).


## Setting the time

First, the selection cursor must be placed in the second last line. To do so, the current

language and unit settings are confirmed each time with the key  . The selection


cursor can now be positioned using the +- keys   to “**set-time**”.




exit	back	> <b>set-time</b> <	service
------	------	---------------------	---------


The function is called up using the PRG key  .

A new page is opened and the current time (time / date) is displayed. The selection cursor jumps to “Hour”.



<i>set-time</i>		<i>hour</i>	<i>minute</i>	<i>second</i>
time	(H:M:S)	> <b>13</b> <	: 29	: 56
		<i>day</i>	<i>month</i>	<i>year</i>
date	(D:M:Y)	27	: 06	: 00


If nothing is to be changed, you can cancel using the Menu key  . Otherwise, the

setting is made using the +- keys   and the PRG key  in the order Hour,

Minute, Second, Day, Month and Year. A correctly specified time or date is confirmed using the PRG key  and the selection cursor jumps to the next value. The year is given last, and the selection cursor jumps to the second last line to the item “**exit**”; the time setting is now concluded.

>exit<	Back	get-mmnds-time
--------	------	----------------

You return to the main menu by pressing the PRG key  or the Menu key . In the event of an input error, you can use the function “**back**” to repeat the input.

An additional function makes it possible to download the system time of the MMDS central unit into the display module. To do so, the selection cursor is placed on “**get-mmnds-time**” and confirmed with PRG . If the central unit is active (engine ignition on), the date and time are overwritten and the following message appears briefly in the display.

>>> LOAD MMDS-SYSTEM-TIME <<<
-------------------------------

If the central unit is switched off (engine ignition off), nothing is changed and the following message appears:

>>> NO MMDS-TIME RECEIVED <<<
-------------------------------

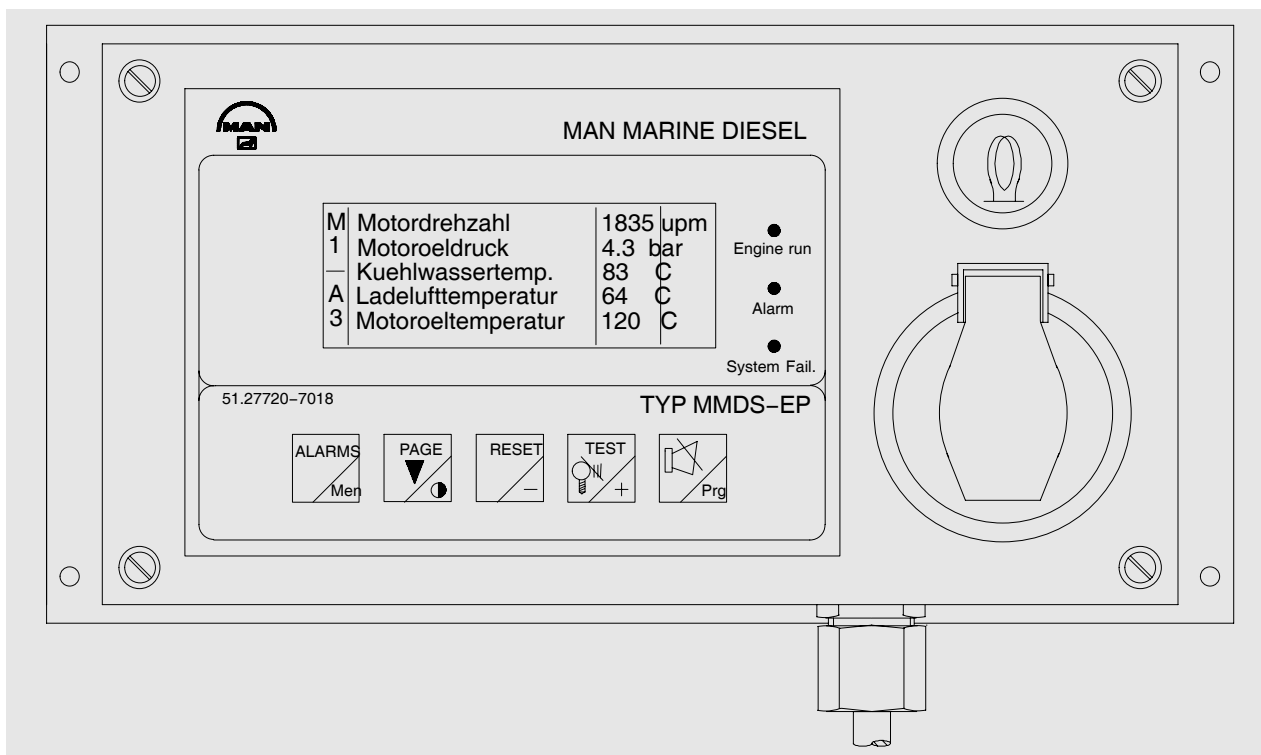
The selection cursor then jumps back to the second last line to the item “**exit**”:

### Ship-specific alarms

There is the possibility to connect 11 ship-specific alarms or warnings and to generate these using software. The text of the alarms or warnings is entered by the shipyard. In the event of an alarm, the corresponding measurement point text appears on the alarm page; the program switches automatically into the alarm menu. In the case of warnings, the program does not switch automatically into the alarm menu.



## 4. Engine room panel MMDS-EP



The functions of the keys and of the LCD displays are the same as those on the MMDS-LC (see operating instructions for MMDS-LC).

Differences to MMDS-LC:

- no ship-specific alarms can be programmed
- additional:
  - Ignition
  - Pre-glow plug



### Note on pre-glow plug:

The pre-glow plug is not active in the in-line 6-cylinder engine (D 2876 LE401/404), as this engine is not equipped with a pre-glow system.

On V-engines, pre-glow can be fitted as an option. In ignition position "I", the lamp lights up. Wait until the lamp begins to flash, then start.

## 5. Drive lever control system Mini Marex



### Danger:

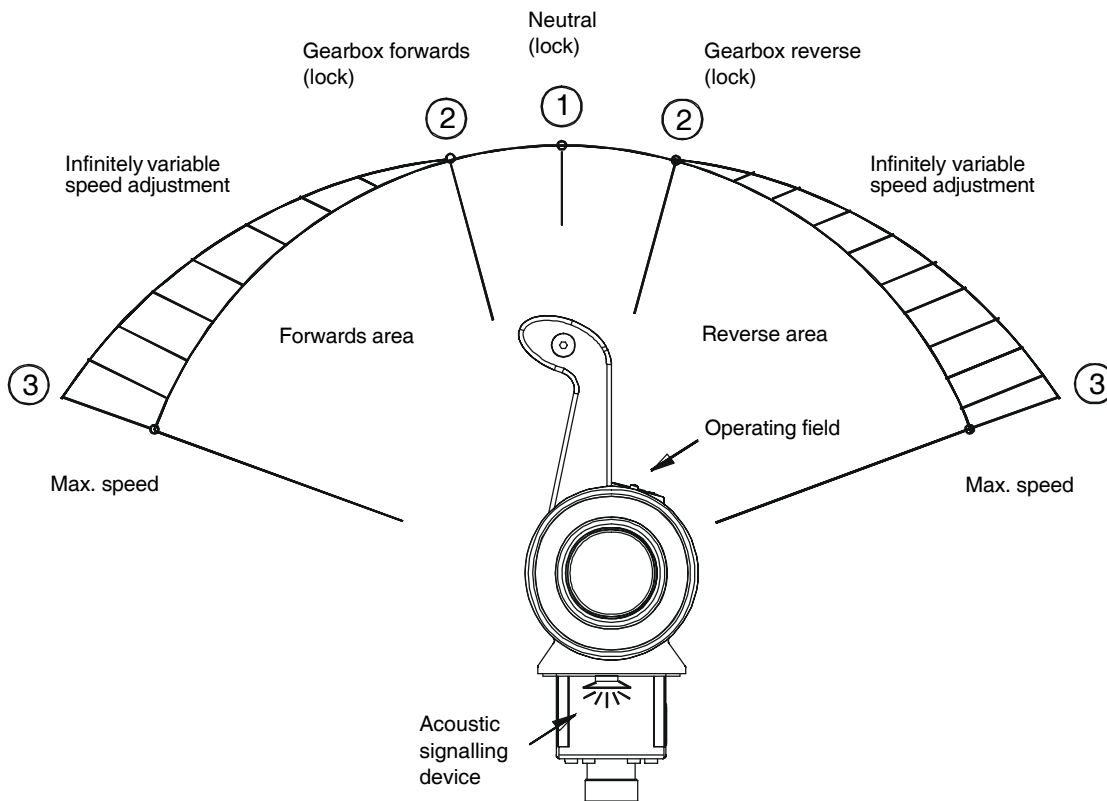
For safety reasons a separate, functioning red emergency-stop-button for each engine must be installed at every bridge (the engine must stop immediately when the button is pressed once).

At the request of the shipyard or customer, it is possible to purchase from MAN an electronic drive lever control system made by Mannesmann Rexroth, type Mini Marex.

This control system has plug connections specially configured for MAN.

Operation of the control system:

### Command master



#### “Neutral” (lock) position ①

In this position, the gearbox clutch is disengaged and the power unit is idling. Each time the “Neutral position” is reached, the control system indicates this acoustically by means of a short “beep tone”.

#### “Gearbox forwards / reverse” (lock) position ②

In this lever position, two different functions are possible.

##### 1. Standard function:

The gearbox clutch is engaged to “Forwards” or “Reverse”; the power unit is idling.

## 2. “Increase engine speed” function:

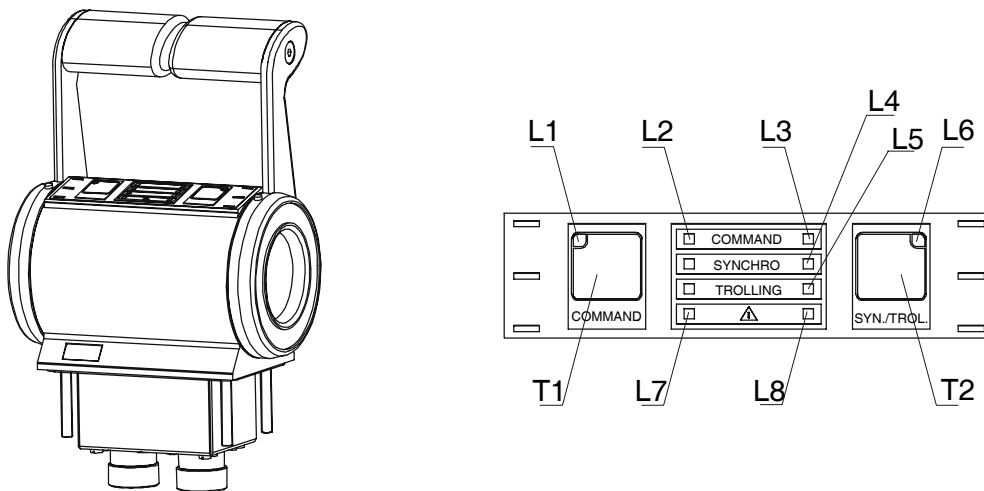
The “Increase engine speed” function is set (function switch II–8). The engine speed of the power unit is raised prior to engaging the clutch and after disengaging the clutch it is lowered again to idling speed. Between the clutch engaging operations, individual delays (waiting periods BEFORE and AFTER clutch engaging) can be set.

### “Maximum engine speed” position ③

Position ③ shows the “maximum engine speed” for the “Forwards and Backwards Range”.

Between positions ② and ③, the engine speed can be set variably. The gearbox clutch is engaged to “Forwards” or “Reverse”.

### Operating panel – command master for twin-engine systems



### Key “Command takeover” T1



The “Command takeover” key occurs only once on the command master. The key is permanently illuminated weakly via LED L1 and indicates that the control system is being supplied with voltage. The key serves to take over commands onto the relevant control stand.

The key has two other additional functions.

### Additional function “Warming Up”

The expression “Warming Up” means “engine running without shifting gear”, which enables, for example, warm-up of a cold power unit across the entire speed range. The gearbox clutch is not engaged in lever position ②.

### Starting the “Warming Up” function:

☞ The “Warming Up” function can only be started at an active command master and only from the position “① neutral”.

1. Set the control lever of the command master in position “① neutral”.

2. Press the key “Command takeover” and keep it pressed.
3. Set the control lever of the command master in position “② gearbox forwards / reverse”.  
The “Warming Up” function is indicated acoustically by a short “double beep” tone and visually by a brief, rhythmic extinguishing of the command master lighting.
4. Release the “Command takeover” key.

The engine idles and the gearbox clutch remains disengaged. The control lever can now be moved towards position “③ maximum engine speed”. The entire engine speed range between the positions ② and ③ is available.

☞ In the case of twin-engine systems, any power unit can be run separately.

### **Quitting the “Warming Up” function:**

To exit from the “Warming Up” function, the control lever of the command master must be set to position “① neutral”. The normal “beep” tone sounds for the “Neutral position”. The command master lighting returns to continuous light. The function is disabled.

If the control lever is shifted from “Forwards” to “Reverse” or vice versa during the “Warming Up” function, the “Warming Up” function stops automatically when position “① neutral” is reached. When position “② gearbox forwards / reverse” is reached again, the gearbox clutch would be engaged again.

### **Additional function: switch error message to mute**

The acoustic signal transmitter, which is activated for some alarms, can be disabled at the relevant control stand by pressing the “Command takeover” key.

☞ However, this does not delete the alarm!

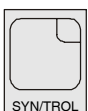
### **Display Alarm L7 and L8**



This display element is present on the command master twice (once for the port system / once for the starboard system). In the event of a fault, the “Alarm lamp” lights up continuously in red.

☞ When the control system is switched on, the “Alarm lamp” is also lit up continuously in red, but this is extinguished following command takeover.

### **Key Syn./Trol. T2**



This key can be used to ENABLE and DISABLE special functions enabled beforehand in the setting unit (key is permanently illuminated weakly via LED 6).

The following special functions are available for this setting unit:

1. Engine speed synchronisation (only twin-engine systems)
2. Trolling

**The “Syn./Trol.” key can be used to operate both functions in parallel, but not simultaneously.**

## Engine speed synchronisation (only possible with twin-engine systems)

If the special function “Engine speed synchronisation” has been enabled in the setting units, twin-engine systems provide the possibility to synchronise the engine speeds of both drive engines. For both drive engines to run synchronously, an engine speed feedback signal from a speed sensor is required for each engine.



Pressing the “Syn./Trol.” key (press once) enables the “Engine speed synchronisation” function. Pressing the key again (press once) disables the function once again.

It is only possible to enable or disable the engine speed synchronisation on the active control stand when both command master levers are in the engine speed range “Forwards” or during the “Warming Up” function. Before exiting from these areas, disable the “engine speed synchronisation”.

While the function is active, LED 4 “SYNCHRO” shows continuous light.

- ☞ As soon as one of the command masters leaves the engine speed range “Forwards” without terminating the synchronisation beforehand, it is switched off automatically. In this case, the LED “SYNCHRO” flashes rapidly (approx. 0.2 seconds on / 0.2 seconds off) and the acoustic signal transmitter issues a continuous tone at the active control stand (this is not a fault alarm but a warning). The second command master must then be set into the “Neutral” position to terminate the warnings. The engine speed of the relevant command master is kept at idling speed during this period.

While the control system is in the function “Synchronisation”, the engine speeds of both power units can **only** be changed using the control lever of the “Master system”. If there is a command change to another control stand, the active function “Engine speed synchronisation” is also taken over onto the new control stand.

## Trolling

If the special function “Trolling” has been enabled in the setting units, there is the possibility to use the “Syn./Trol.” key to enable the trolling mode to continuously adjust the clutch slip.



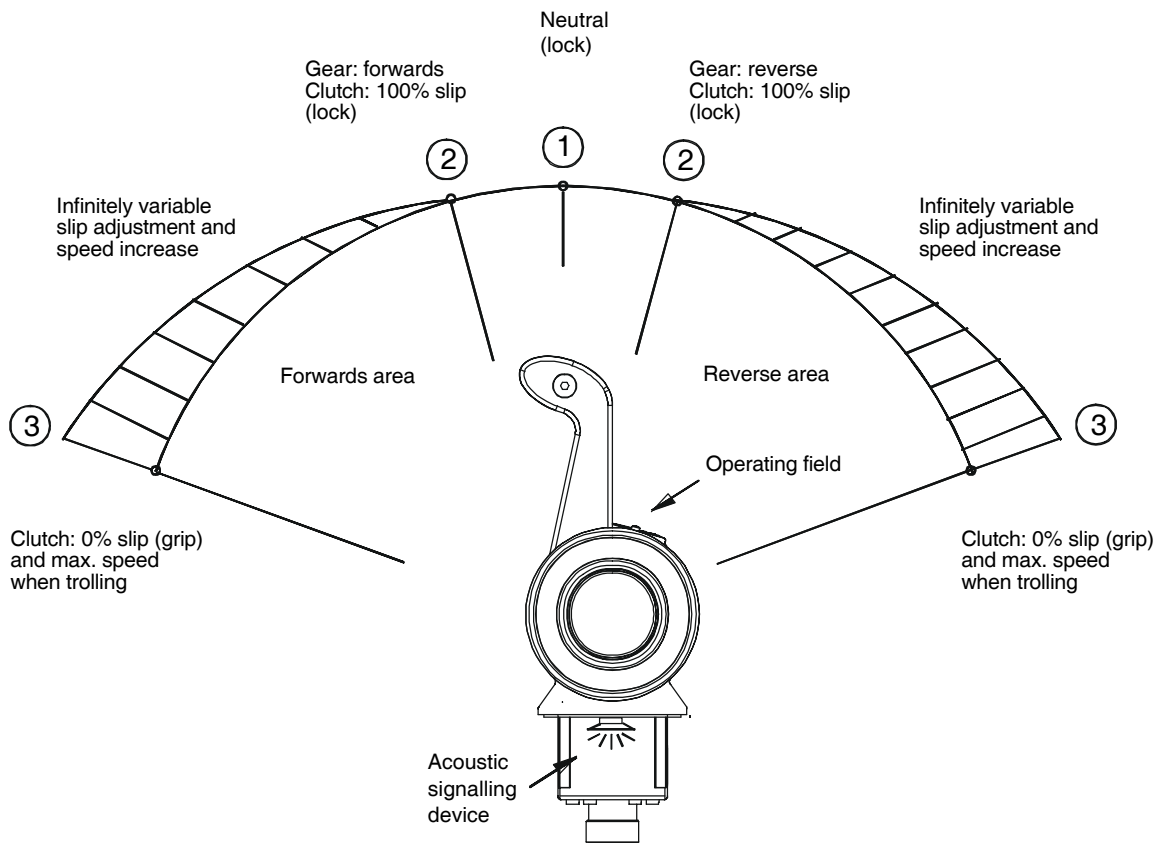
Pressing the “Syn./Trol.” key (press once) enables the “Trolling” function. Pressing again (press once) disables the function once again.

It is only possible to enable or disable the trolling function on the active control stand when the command master lever (both command master levers in the case twin-engine systems) is (are) in the “Neutral” position. While the function is active, LED L8 “Trolling” shows continuous light.

If there is a command change to another control stand, the active function “Trolling” is also taken over onto the new control stand.

**In the trolling mode, the command master function changes in comparison to the power shift mode.**

The command master function in the trolling mode is described below.



To enable the trolling function, the command master must be in position ① “Neutral” (lock). The engine idles and the gearbox is in neutral.

If the trolling mode is enabled, the clutch is set to its highest slip level (100% slip). The engine continues to idle and the gearbox is in neutral.

If the command master lever is set in position ② (lock), the gearbox is shifted into the “Forwards or Reverse” position. The engine idles, but due to the greatest possible clutch slip (100% slip) is not yet able to turn the propeller shaft, or can do so only very slowly.

If the command master lever is moved further towards position ③, the clutch slip drops continuously and at the same time the engine speed rises.

When position  $\hat{A}$  is reached, the clutch is in the smallest possible slip position (0% slip / frictional connection) and the engine speed has reached the set value for “Maximum engine speed for trolling”.

## Acoustic signal transmitter



The acoustic signal transmitter is located below the command master and is present once on each system (once for the port system and once for the starboard system).

The signal transmitter supports the visual displays of the command master lighting and the alarm lamp with acoustic signals. In addition, each time the “Neutral position” of the control lever is reached, it issues a short “beep tone”. The start of the “Warming Up” function is indicated by a short “double beep” tone.

## Display Command L2 and L3



Continuous light of the “Command” display indicates which command master is currently in command. The “Command” displays of the other control stands are disabled. If the command is requested on this master, the “Command” display flashes.

If the command master is in the “Warming Up” function, this is indicated by a brief, rhythmic extinguishing of the “Command” display.

The “Command” display is present on the system once (once for the port system / once for the starboard system).

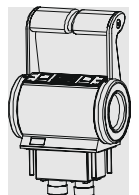
## Enabling the control system with command masters

### 1. Switch on control system

Execution: – apply supply voltage.

Consequence: –

- Display “Alarm” (red) on all control stands lights up continuously.
- “Command” and “Syn./Trol.” keys. On all control stands weakly lit up (only visible in darkness).
- Acoustic signal transmitter sounds with slow intermittent tone on all control stands.



### 2. Command request:

The command can be requested at any control stand. The control levers of the command master on the requesting control stand must be set at the “Neutral position”.

☞ “Command master calibration and enable of control stands” must have been carried out.

Otherwise, the command can only be taken over at control stand 1.

Execution: – Set the control lever of the command master to the “Neutral position”.  
– Press “Command” key once for command request.

Consequence: – Display “Alarm” (red) on all control stands remains lit up continuously.  
– Acoustic signal transmitter sounds with fast intermittent tone on all control stands.  
– The display “Command” flashes rapidly.

☞ If the control system continues to issue long lighting and tone intervals, it is usually the case that the control lever of a command master is not in the “Neutral position”.

### 3. Command takeover:

Execution: – Press “Command” key once again for confirmation of command request.

Consequence: – Display “Alarm” (red) goes out on all control stands.  
– Acoustic signal transmitter remains silent on all control stands.  
– “Command” display shows continuous light on the command master in command.  
On all other command masters, the “Command” display is off.

The command is now at this control stand. The control system is ready for operation (standby).

### Command change between control stands

For a command change to a different control stand, there are two variants which have to be set using DIP switch 1–2 in the setting unit. Command change with **lever comparison** or **free** command change.

On twin-engine systems, **both setting units** must have the same setting.

☞ “Command master calibration and enable of control stands” must have been carried out.

Otherwise, the command can not be changed between the individual control stands.

### Command change with lever comparison

The control system compares the lever positions of the command masters involved in the control stand change. A command change from one control stand to another can only take place if the **lever of the requesting command master** is either in the “Neutral position” or in the same travel direction position as the **lever of the command master that is in command**.

The command change for this variant takes place in two steps.



### ***1st step: Command request on the selected control stand.***

- Execution:
- Set the control lever of the command master in the takeover position (“Neutral” position or same travel direction as the command master that is in command).
  - Press “Command” key once to request the command on this control-stand.

- Consequence:
- The acoustic signal transmitter “beeps” in short intervals.
  - The display “Command” flashes rapidly.

The command is now requested on this control stand. The control system has enabled the command takeover and indicates this by means of short tone and lamp intervals.

☞ If the control system issues long lamp and tone intervals, the subsequent command takeover is refused. In this case, the control levers of the command master are usually not in the correct position or there is a fault in the system.

### ***2nd step: Command takeover on the selected control stand.***

- Execution:
- Press “Command” key once to take over the command on this control stand.

- Consequence:
- The acoustic signal transmitter is silent.
  - The “Command” display shows continuous light.

The command takeover is complete and the command is now at this control stand.

### **Free command change (without lever comparison)**

With this variant, a control stand change takes place without taking account of the lever position of the command master involved in the command change. The command change takes place in one step.

### ***Command takeover on the selected control stand***

- Execution:
- Press “Command” key (white) to take over the command on this control stand.

- Consequence:
- The “Command” display on the selected control stand immediately shows continuous light.

The command is immediately at this control stand and the control system **instantly** runs the lever position of the command master set here.

**In this variant, carelessness can lead to manoeuvres that are not intended.**

Example: Lever of the active command master is in position “Full forwards”.

Lever of the requesting command master is in the position “Full reverse”. If there were a command change, a full reverse manoeuvre would be performed immediately.

### Shutting down

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.

Set deck switch to “Neutral” and switch off the engine at the ignition key.

Remove key from starting lock.

**Danger:**

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

## Lubrication system

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.

As the oil drain plug is often not accessible, a manually operated vane pump may be attached to the engine for draining the oil.

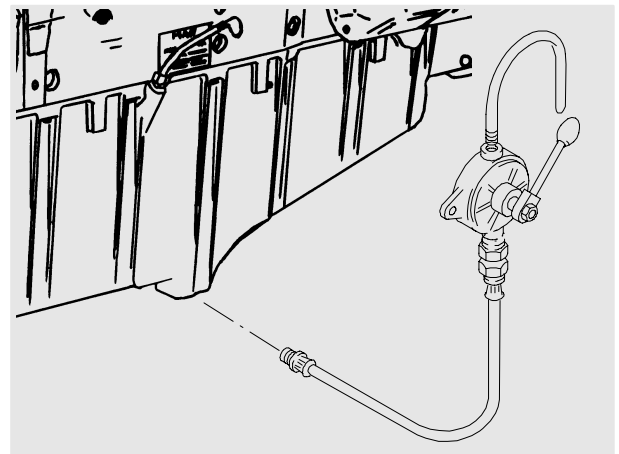
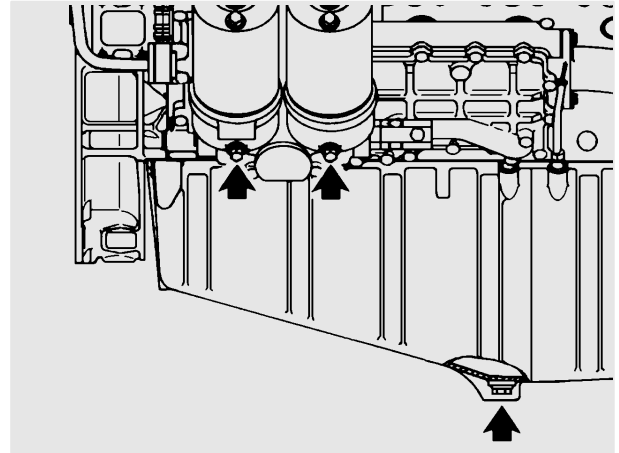
Pump the old oil out of the sump while the engine is still warm. Remove oil drain plugs in oil filter bowl and let old oil drain out of oil filters. Use a vessel of sufficient size to ensure that the oil does not overflow.

Refit the oil drain plugs with new gaskets.



**Note:**

Change the oil filter elements every time the engine oil is changed



### 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 (arrow).

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.

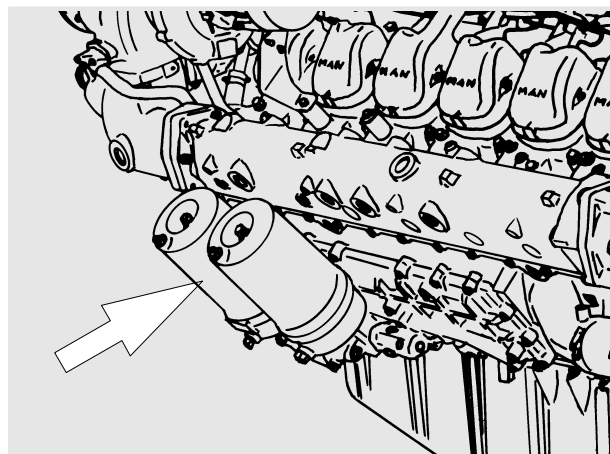
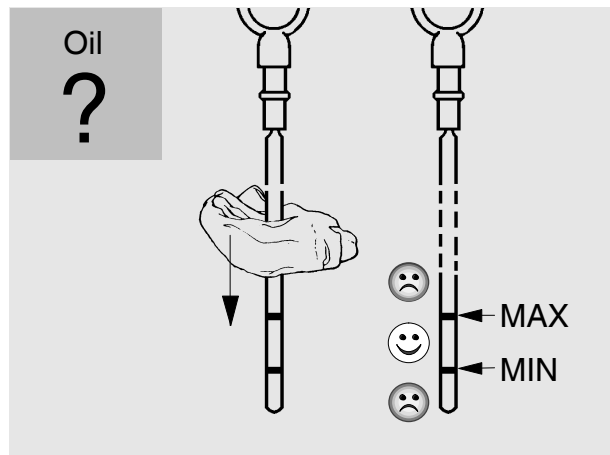
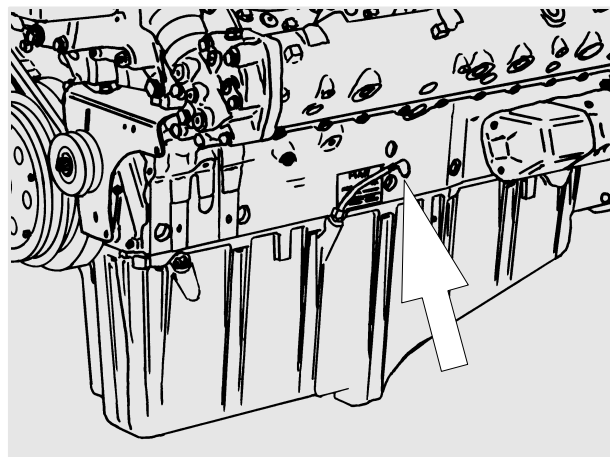
- Pull out dipstick (arrow)
- wipe it with a clean, lintfree cloth
- and push it in again up to the stop
- Pull out dipstick again

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.

### Changing oil filter

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

However, oil filter cartridges must be changed at every oil change.



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

Observe positions of selector lever!



**Caution:**

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

**Renewal of filter cartridges**

- Allow the filter content to run off along drain plugs ④.  
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 ⑧ remove filter bowls ⑦
- Renew filter cartridges ⑤. Thoroughly clean all other parts in cleaning fluid (do not allow cleaning fluid to enter the oil circuit)
- Use new gaskets ⑥ for reassembly of filter bowls



**Note:**

To prevent the seal ⑥ from twisting hold the filter bowl ⑦ firmly when tightening the tensioning screw ⑧.



**Caution:**

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



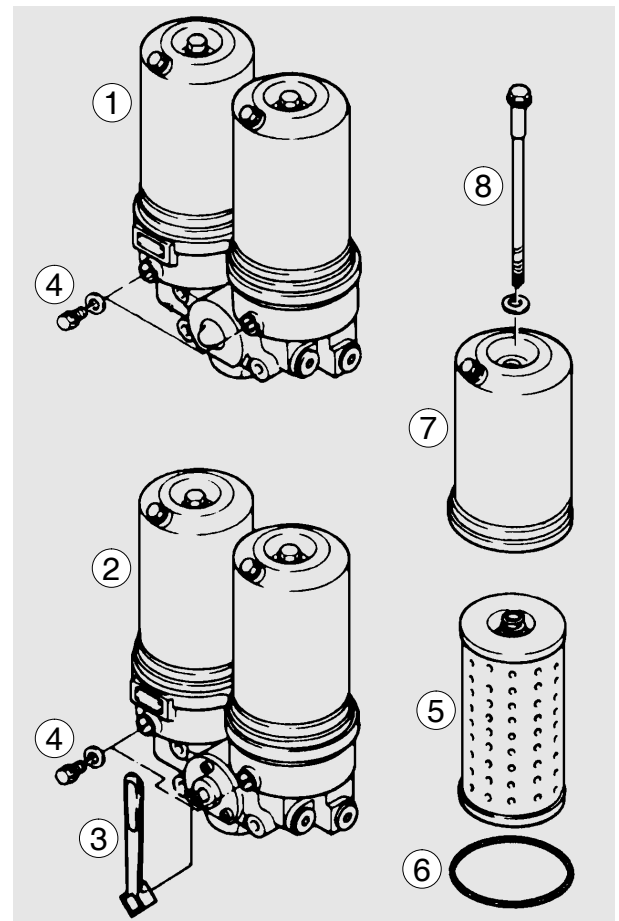
Continuous operation  
(both filter halves  
in operation)



Right-hand filter  
cut out



Left-hand filter  
cut out



- 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

## 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.



#### Note:

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

### Injection pump

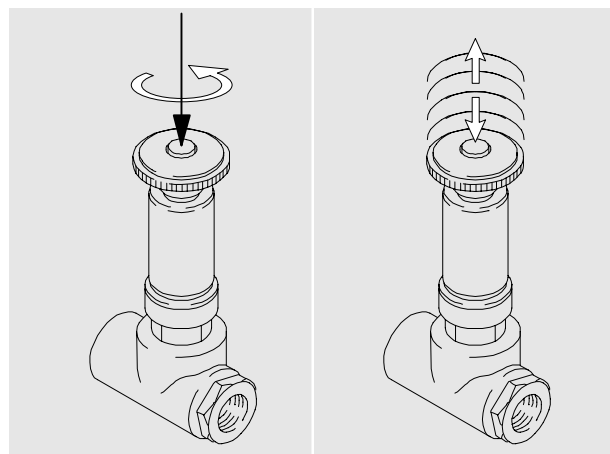
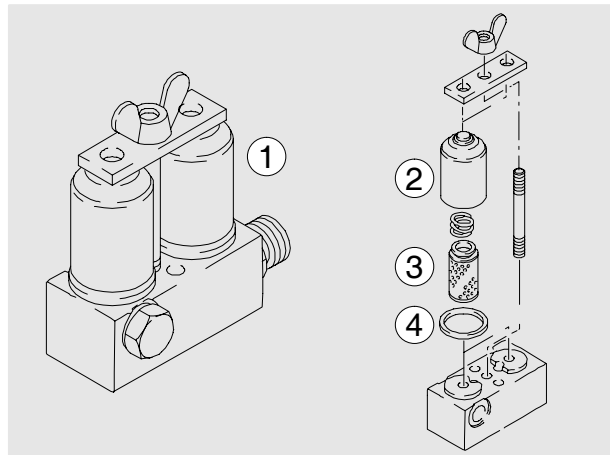
Neither the injection pump nor the control unit must be modified in any way. If the lead seal is damaged the engine warranty will become null and void.

### Faults

We urgently recommend that you have faults in the injection pump rectified only in an authorized specialist workshop.

### Cleaning fuel pre-cleaner

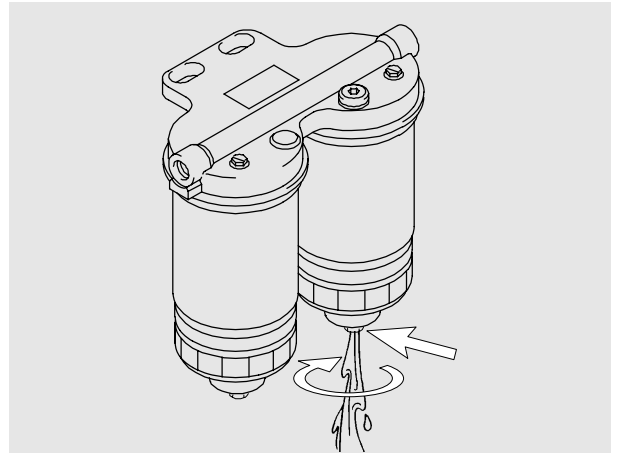
- Strip the fuel pre-cleaner ①
- Wash out filter housing ② and filter basket ③ in clean fuel
- Fit new seals ④
- Actuate tappet of hand primer until overflow valve of injection pump is heard to open
- Screw in the tappet of the hand pump again and tighten it
- Start engine
- Check fuel pre-cleaner for leaks



## Parallel fuel filter

### **Draining moisture:**

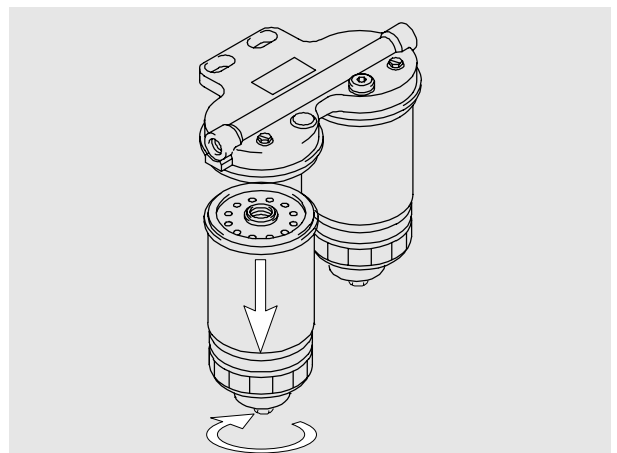
Unscrew drain plugs at every oil change until moisture has been discharged and clean fuel flows out.



## 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



### **Caution:**

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

## Change-over fuel 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.



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 fuel supply. If in doubt stop the engine to change the fuel filter.

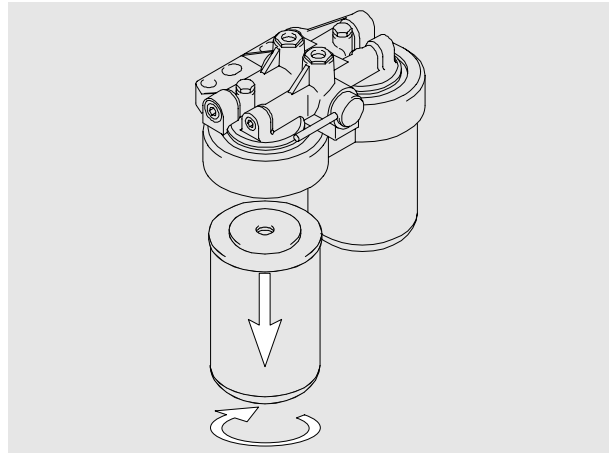
### Changing fuel filter

- 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



**Caution:**

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

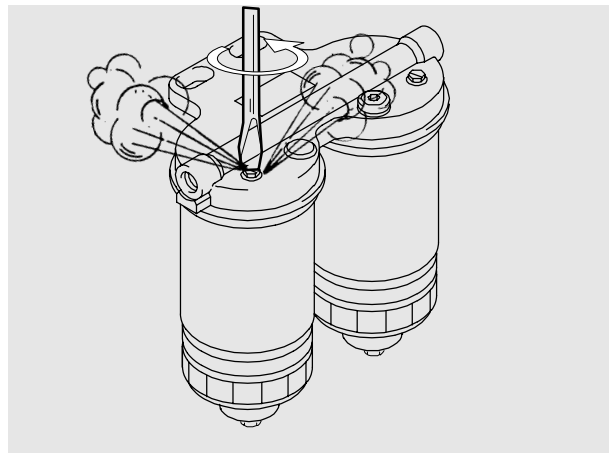


### Bleeding the fuel system



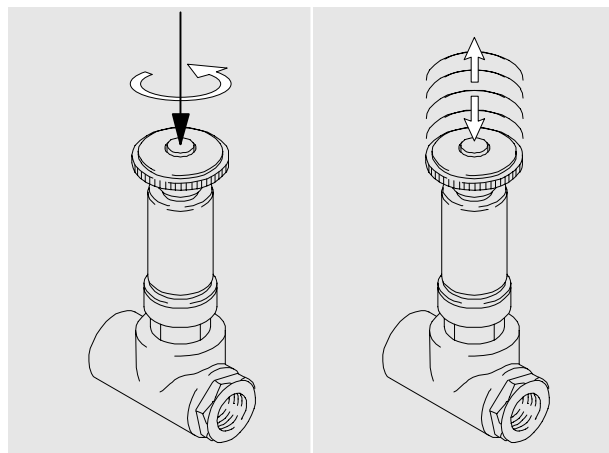
**Note:**

To bleed the fuel system switch on the "ignition" so that the EHAB will be open.



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





## Cooling system



**Danger:**  
Draining hot coolant involves a risk of scalding.

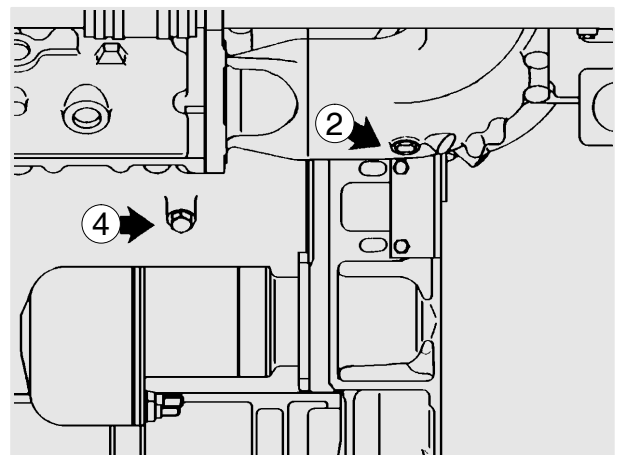
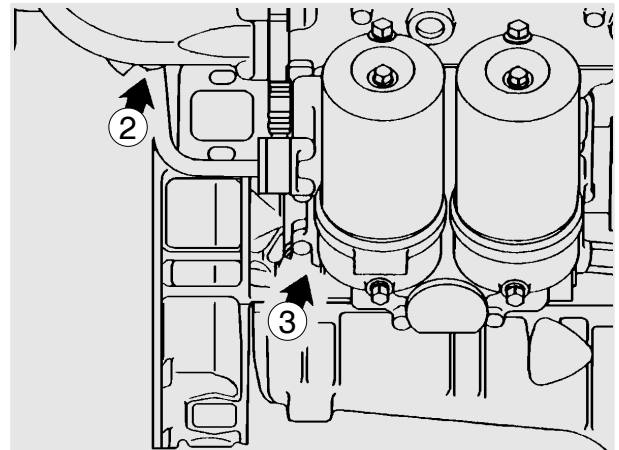
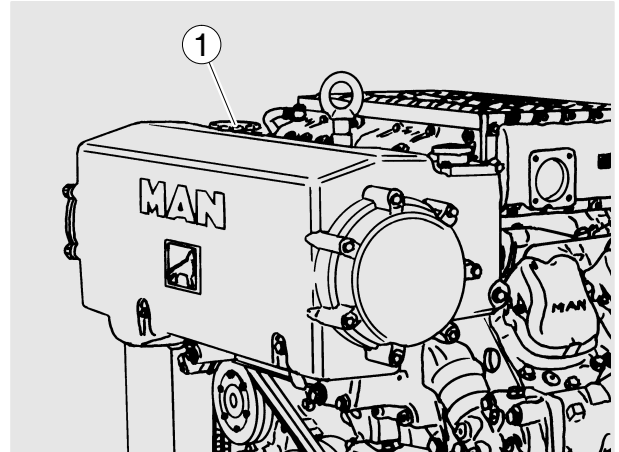
### Draining the cooling system



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

Drain coolant as follows, but only *when the engine has cooled down*.

- Briefly open cap (①, large cap) on the filler neck of the expansion tank for pressure compensation
- Remove drain plug in crankcase (④), oil cooler housing (③) and exhaust manifold (②)
- Then remove cap (①)
- Drain coolant into a container of adequate size
- Refit screw plugs
- Filling / bleeding the cooling system



### Filling / bleeding the cooling system (only when engine has cooled down)

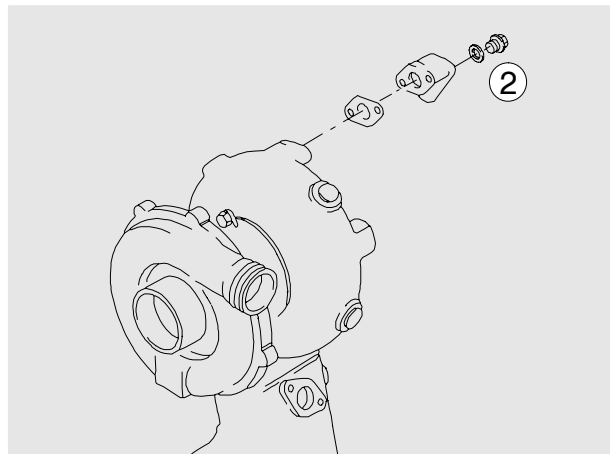
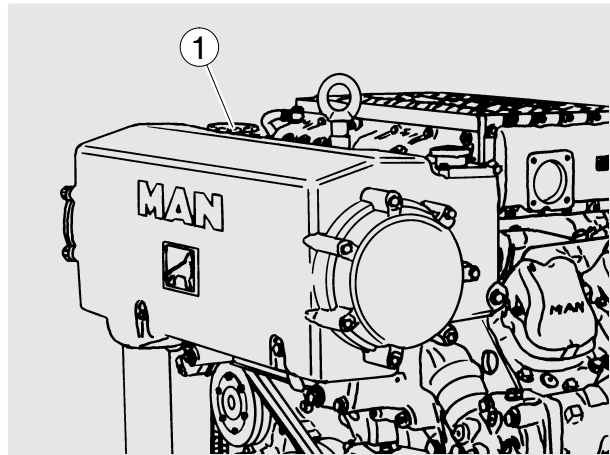
Fill the cooling system of the engine with a mixture of drinkable tap water and anti-freeze agent on ethylene glycole basis or anti-corrosion agent.

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

**Coolant must be added at the filler neck only (①, large cap).** When topping up do not add cold coolant if the engine is still 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 (①, large cap)
- Fill in the coolant slowly
- During the filling operation the liquid-cooled turbochargers are to be bled. For this purpose an oval flange with a bleeder screw ② is located on the rear side of the turbine housing. This bleeder screw must remain open until coolant emerges free of bubbles or until the coolant level has reached the filler neck (depending on the installation situation)
- Let engine run at a speed of 2,000 rpm for approx. 15 minutes
- Switch off engine, carefully turn cap ① with safety valve to the first detent to relieve pressure and then carefully remove cap and top up with coolant



**Caution:**  
Risk of scalding and burning yourself!

- Before the engine is next put into operation (with the engine cold) check the coolant level and top up if necessary
- Repeat this procedure until no more coolant can be added



**Note:**

The turbochargers must not be bled while the cooling system is being topped up.



**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 (①, large cap) with safety valve to the first stop, let off pressure, then open carefully.

## 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.

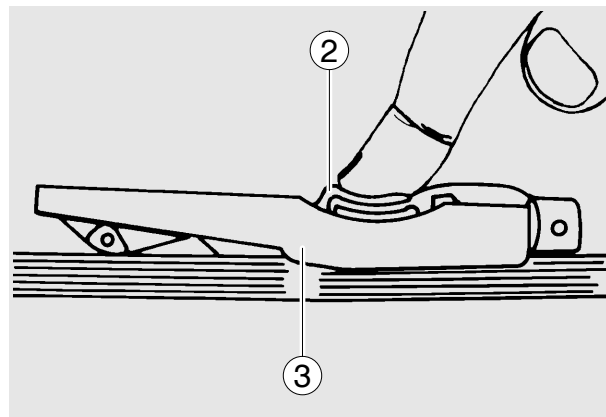
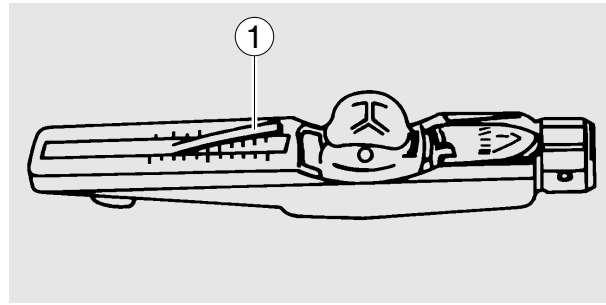
- Lower indicator arm ① into the scale
- Apply tester to belt at a point midway between two pulleys so that edge of contact surface ② is flush with the V-belt
- Slowly depress pad ③ until the spring can be heard to disengage. This will cause the indicator to move upwards

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.

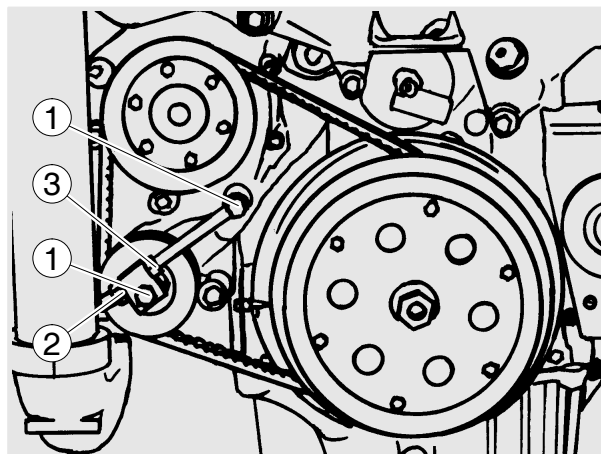


Drive belt width	Tensioning forces according to the kg graduation on the tester		
	New installation		When servicing after long running time
	Installation	After 10 min. running time	
9.5	45–50	40–45	30
10.0	45–50	35–40	30
12.5	50–55	45–50	35
13.0	50–55	40–45	35
20.0	75	70	60
22.0	75	70	60
2/3VX	90–100	70–80	60
3/3VX	135–150	105–120	90

### Tensioning and changing V-belt

- 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.



### 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.



## Technical data

Model	<b>D 2848 LE 401 / 403 / 405</b>
Design	V 90°
Cycle	4-stroke Diesel with turbocharging / intercooling and wastegate
Combustion system	Direct injection
Turbocharging	Turbocharger with intercooling and wastegate
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	from engine No. ... 7678 001 ....
Intake	0.50 mm
Exhaust	0.60 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
Start of delivery	
D 2848 LE 401	22° ± 1° before TDC
D 2848 LE 403	
up to engine No. ... 9211 019 ....	24° ± 1° before TDC
from engine No. ... 9211 020 ....	18° ± 1° before TDC
D 2848 LE 405	
up to engine No. ... 9261 016 ....	21° ± 1° before TDC
from engine No. ... 9261 017 ....	15° ± 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	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, 6.5 kW
Alternator	28 V; 55, 110, 120, 225 A



## Technical data

Model	<b>D 2840 LE 401 / 402 / 407</b>
Design	V 90°
Cycle	4-stroke Diesel with turbocharging / intercooling and wastegate
Combustion system	Direct injection
Turbocharging	Turbocharger with intercooling and wastegate
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	from engine No. ... 7661 035 ....
Intake	0.50 mm
Exhaust	0.60 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



<b>Fuel system</b>	
Injection	In-line pump, V-saddle-mounted
Governor	Centrifugal governor (variable-range speed governor) with smoke stop
Start of delivery	
D 2840 LE 401	24° ± 1° before TDC
D 2840 LE 402	
with optimised consumption	15° ± 0,5° before TDC
with optimised NO <sub>x</sub>	12° ± 0,5° before TDC
D 2840 LE 407	
with optimised consumption	24° ± 0,5° before TDC
with optimised NO <sub>x</sub>	22° ± 0,5° before TDC
<b>Injectors</b>	
D 2840 LE 401 / 407	five-hole nozzles
D 2840 LE 402	six-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
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
<b>Engine cooling system</b>	Liquid cooling
Coolant temperature	80–85°C, temporarily 90°C allowed
Coolant filling quantity	80 l
<b>Electrical equipment</b>	
Starter	24 V; 6.5 kW
Alternator	28 V; 55, 110, 120, 225 A



## Technical data

Model	<b>D 2842 LE 401 / 402 / 403 / 406 / 408</b> <b>D 2842 LE 411 / 412 / 413</b>
Design	V 90°
Cycle	4-stroke Diesel with turbocharging / intercooling and wastegate
Combustion system	Direct injection
Turbocharging	Turbocharger with intercooling and wastegate
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	from engine No. ... 7651 046 ...
Intake	0.50 mm
Exhaust	0.60 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

<b>Start of delivery</b>	
D 2842 LE 401 / 402	22° ± 0,5° before TDC
D 2842 LE 403	
with optimised consumption	15° ± 0,5° before TDC
with optimised NO <sub>x</sub>	12° ± 0,5° before TDC
D 2842 LE 406	
with optimised consumption	24° ± 0,5° before TDC
with optimised NO <sub>x</sub>	21° ± 0,5° before TDC
D 2842 LE 408	
with optimised consumption	20° ± 0,5° before TDC
with optimised NO <sub>x</sub>	18° ± 0,5° before TDC
D 2842 LE 411	18° ± 0,5° before TDC
D 2842 LE 412	13° ± 0,5° before TDC
D 2842 LE 413	16° ± 0,5° before TDC
<b>Injectors</b>	
D 2842 LE 401 / 402 / 406 / 408 / 411	five-hole nozzles
D 2842 LE 403 / 412 / 413	six-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 (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
<b>Engine cooling system</b>	Liquid cooling
Coolant temperature	80–85°C, temporarily 90°C allowed
Coolant filling quantity	96 l
<b>Electrical equipment</b>	
Starter	24 V; 6.5 kW
Alternator	28 V; 55, 120, 225 A



## 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"										
<b>Reason</b>										
•										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

<b>Fault</b>									
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"									
<b>Reason</b>									
								●	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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