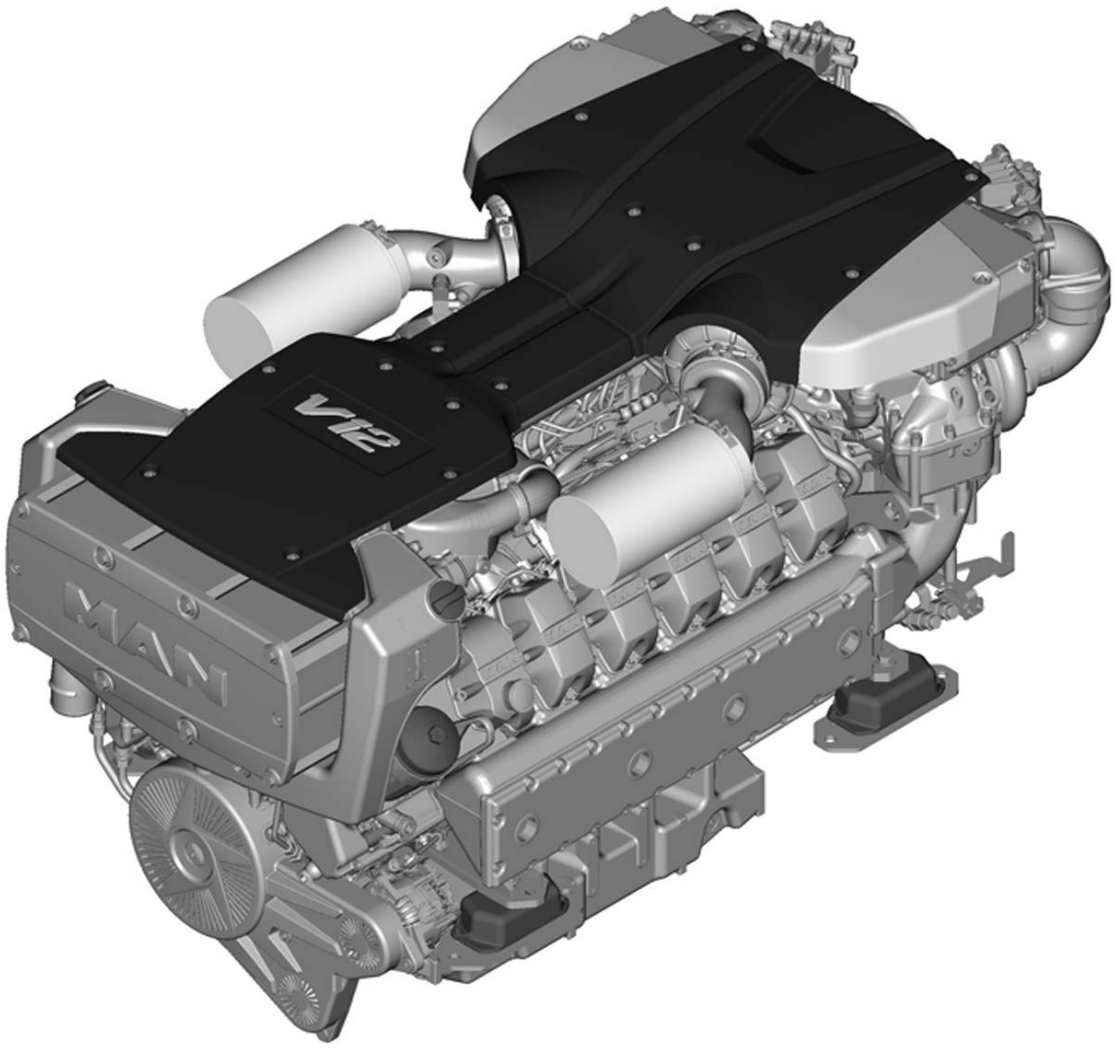
Operating Instructions

MAN Marine Diesel Engines

D2868 LE433
D2862 LE433/453
D2862 LE423/443/463



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“Translation of the original operating instructions”

Subject to technical alterations in the interests of further development.

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Contents

Dear Customer,

these Operating Instructions are intended to familiarize you with your new MAN Diesel engine and how it operates.
This manual is supplemented by the publication “Fuels, Lubricants and Coolants for MAN Diesel Engines" and the “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 fuels, lubricants etc. in accordance with MAN's regulations.
Otherwise the manufacturer's liability for defects 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:
https://mmrepro.mn.man.de/bstwebapp/BSTServlet

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 Truck & Bus AG
Werk Nürnberg

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.

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

Manufacturer / Engine Family
D28MainCR

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

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

ENGINE(S) COVERED BY THIS DECLARATION

Engine model(s) or engine family name(s):	EC Type examination certificate
Engine family "D28MainCR"	30552-05HH
Engine types of engine family:	
D2862LE433 V12-1800 1324kW	
D2842LE433 V12-1550 1140kW	
D2842LE423 V12-1360 1000kW	
D2842LE443 V12-1224 900kW	
D2842LE453 V12-1200 882kW	
D2842LE422 V12-1100 809kW	
D2840LE423 V10-1100 809kW	
D2840LE422 V10-900 662kW	
D2868LE433 V8-1200 882kW	
D2848LE423 V8-900 662kW	
D2848LE422 V8-750 551kW	
D2876LE423 R6-800 588kW	
D2876LE433 R6-730 537kW	

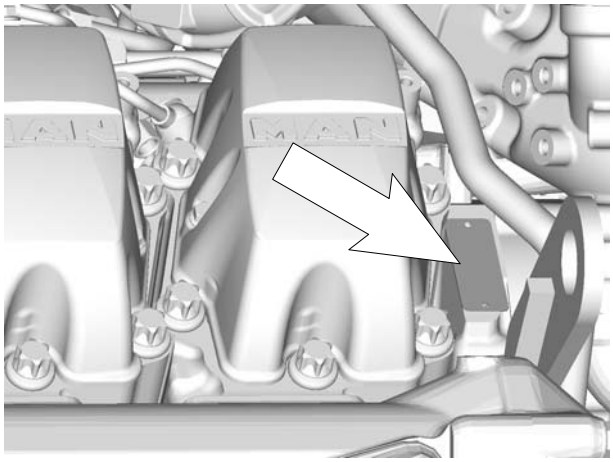
This declaration of conformity is issued under the sole responsibility of the manufacturer. I declare on behalf of the engine manufacturer that the engine(s) will meet the requirements of above mentioned directives when installed in a recreational craft, in accordance with the engine manufacturer's supplied 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.

Name / function: (identification of the person empowered to sign on behalf of the engine manufacturer or his authorised representative)

Signature and title: (or an equivalent marking)

Wolfgang Wegner
MVMT

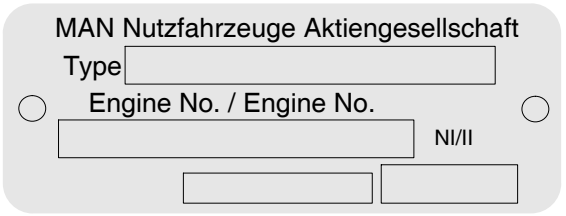
Date and place of issue: (yr/month/day) 2008 / 10 / 20



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).



Model

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delivered on

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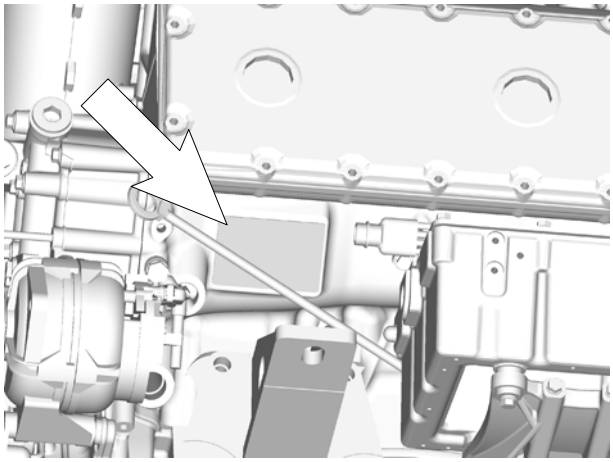

installed on

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Engine serial number

.....

Order number

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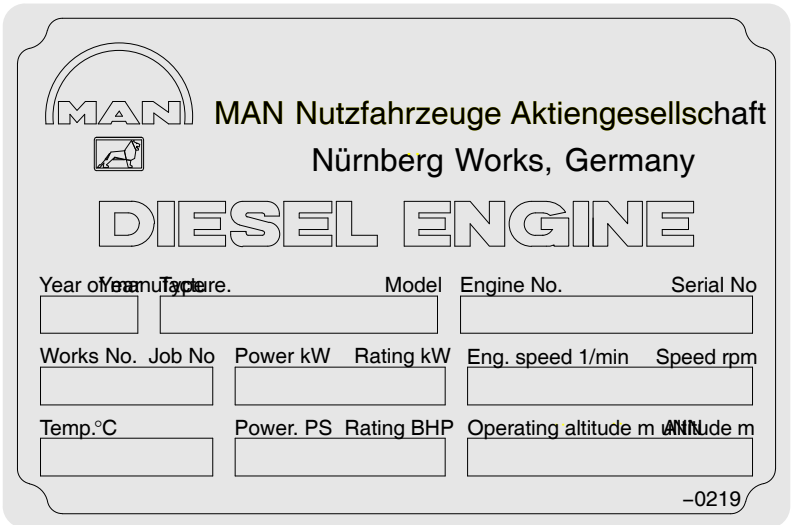


General notes

Handling diesel engines and the necessary resources is no problem when the personnel commissioned with operation and maintenance are trained accordingly and use their common sense.

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.
- **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).

- **Electrical accessories and equipment from other manufactures may only be connected without the approval of MAN to the connections provided for the customer or shipyard.**
  The control of the engine may be adversely affected and thus may lead to property damage or personal injury and is therefore not permitted.
  MAN assumes no liability for any property damage or personal injury.
  Connections to the following MAN components are prohibited:
  - EDC engine control unit (K-Line, CAN-Bus)
  - MAN internal or external throttle lever control system (CAN-Bus)
  - Emergency steering control (serial, CAN-Bus)
  - Display systems for alarms (serial, CAN-Bus)

  Approved connectors on terminal box: X4, X8 and X9.
- 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.

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.
- Today modern components of diesel injection consist of high-precision parts which are exposed to extreme stresses. The high-precision technology requires the **utmost cleanliness** during all work on the fuel system.
  Even a particle of dirt over **0,2 mm** can lead to the failure of components.
- 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.
- It is advisable to switch off the engine if an alarm of any kind is displayed in the engine monitoring and diagnostic system. If this is not possible for any reason, the engine should be run no faster than 1200 rpm until the fault is remedied, see page 24.
- Comply with instructions for operation of the alternator. See “Maintenance and care".
- Do not let the seawater 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.
  Caution:
  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".

5. Special instructions when working on the common rail system

Accident protection

- **Risk of injury!**
  Fuel jets can cut through skin.
  The atomisation of fuel creates a fire risk.

  - When the engine is running **never** loosen the screw connections on the fuel's high-pressure side of the common rail system (injection line from the high-pressure pump to the rail, on the rail and on the cylinder head to the injector)

  - Keep away from the engine when it is running

- **Risk of injury!**
  When the engine is running the lines are constantly under a fuel pressure of up to 1600 bar.

  - Wait at least a minute until the pressure in the rail has dropped before loosening a screw connection
  - If necessary check the pressure drop in the rail with MAN-Cats

- **Risk of injury!**
  - People with pacemaker must keep at least 20 cm away from the running engine.

  - Do not touch live parts on the electric connection of the injectors when the engine is running.

Cleanliness

Today modern components of diesel injection consist of high-precision parts which are exposed to extreme stresses. The high-precision technology requires the **utmost cleanliness** during all work on the fuel system.
Even a particle of dirt over **0,2 mm** can lead to the failure of components.

The measures described as follows are therefore **essential** before work begins:

Risk of damage from penetration of dirt!

- Before working on the clean side of the fuel system clean the engine and the engine compartment. During cleaning the fuel system must be closed.

- Carry out visual inspection for any leakage or damage to the fuel system
- Do not spray the high-pressure cleaner direct onto the electric components, or alternatively keep them covered
- Do not carry out any welding or sanding work in the engine compartment during maintenance / repair

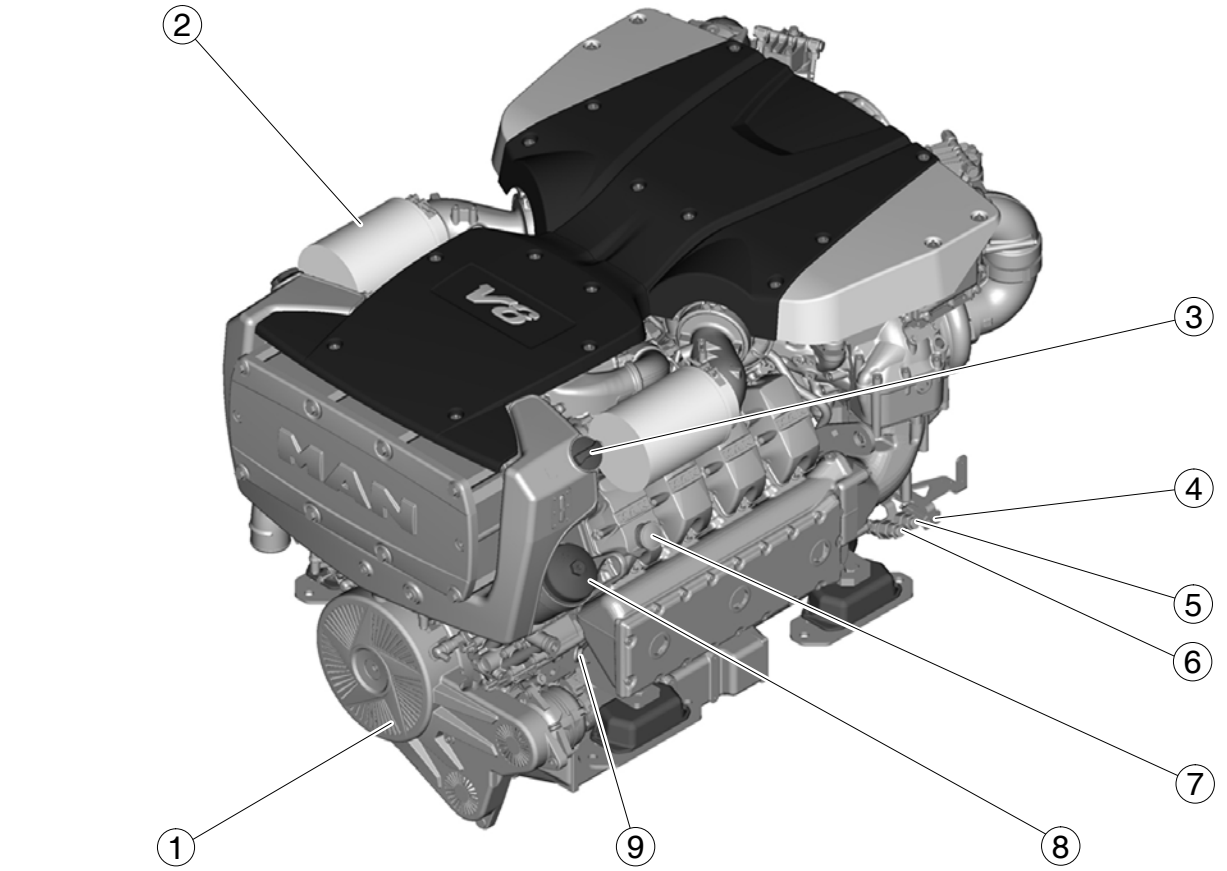
- Avoid air movements (any swirling of dust when starting engines)
- The area of the still closed fuel system must be cleaned and dried with the aid of compressed air
- Remove detached particles of dirt such as paint chippings and insulation material with a suitable extractor (industrial type vacuum cleaner)
- Cover areas of the engine compartment from which dust particles could be detached with clean foil
- Wash your hands and put on clean work clothes before starting the disassembly work

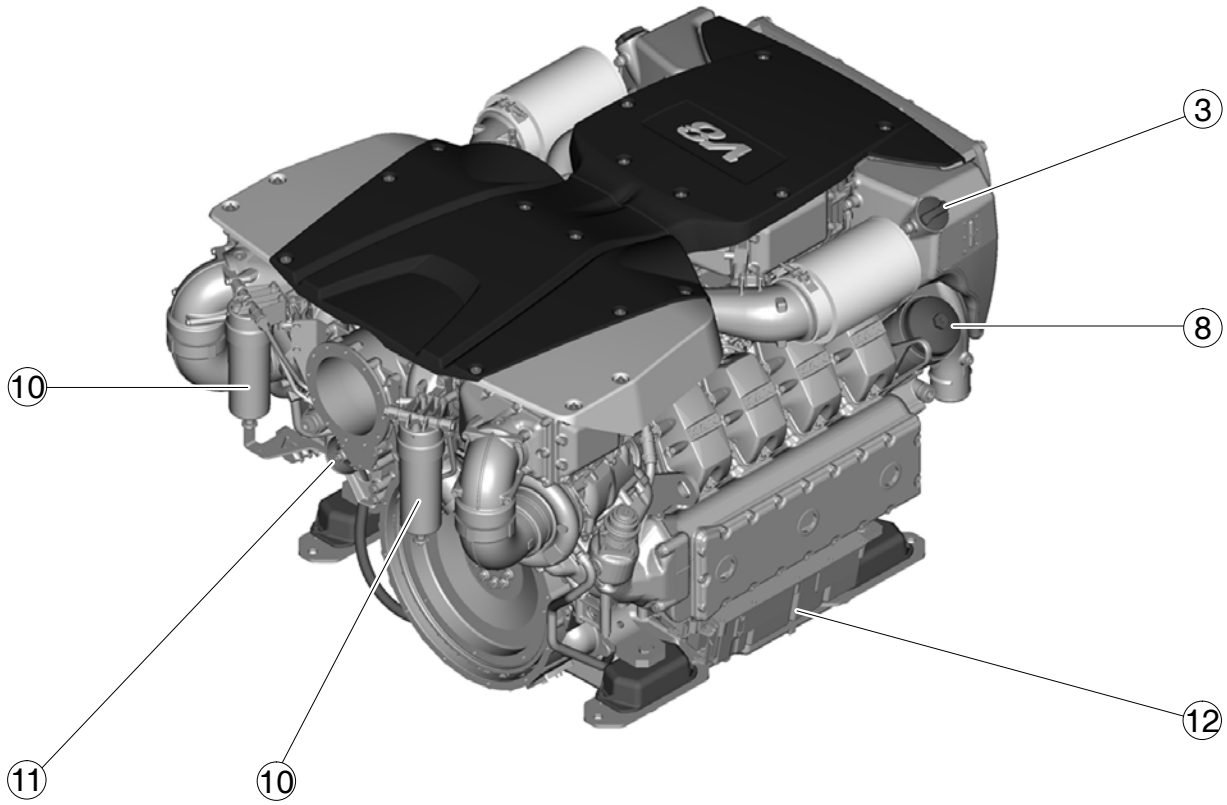
When carrying out the work it is **essential** to comply with the following measures:

Risk of damage from penetration of dirt!

- When the clean side of the fuel system has been opened it is not permissible to use compressed air for cleaning
- During assembly work loose dirt must be removed with the aid of suitable extractors (industrial type vacuum cleaners)
- Use only fluff-free cleaning cloths on the fuel system
- Clean tools and working materials before starting to work
- Only tools without any damage may be used (cracked chrome coatings)
- When removing and installing components do not use materials such as cloths, cardboard or wood since these could shed particles and fine fibres
- If any paint chips/flakes off when connections are loosened (from possible over-coating) these chippings must be carefully removed before finally loosening the screw connection
- The connection openings of all parts removed from the clean side of the fuel system must be **immediately** closed up with suitable caps/stoppers
- These caps/stoppers must be packed protected from dust prior to use and after being used once they must be disposed of
- Following this all the components must be carefully stored in a clean, closed container
- **Never** use used cleaning or testing liquids for these components
- New parts must not be removed from their original packing material until directly before use
- Work on removed components may be carried out only at a workplace specially equipped for it
- If removed parts are shipped always use the original packing material of the new part

Engine views V8-1200 (D2868 LE433)





(1) Poly-V-belt guard

(2) Air filter

(3) Coolant filler neck

(4) Main fuse for voltage supply

(5) Oil drain valve engine

(6) Oil drain valve gearbox

(7) Oil filler neck

(8) Oil filter

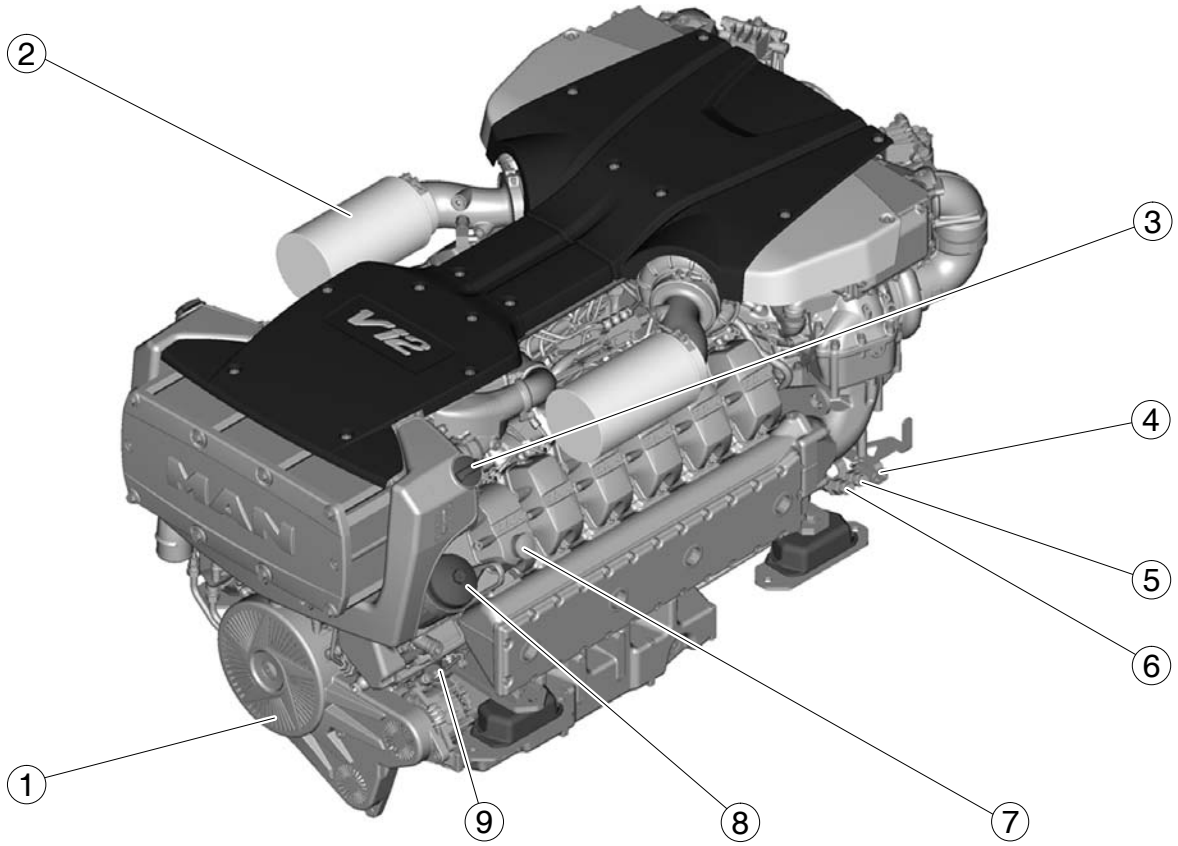
(9) Oil dipstick

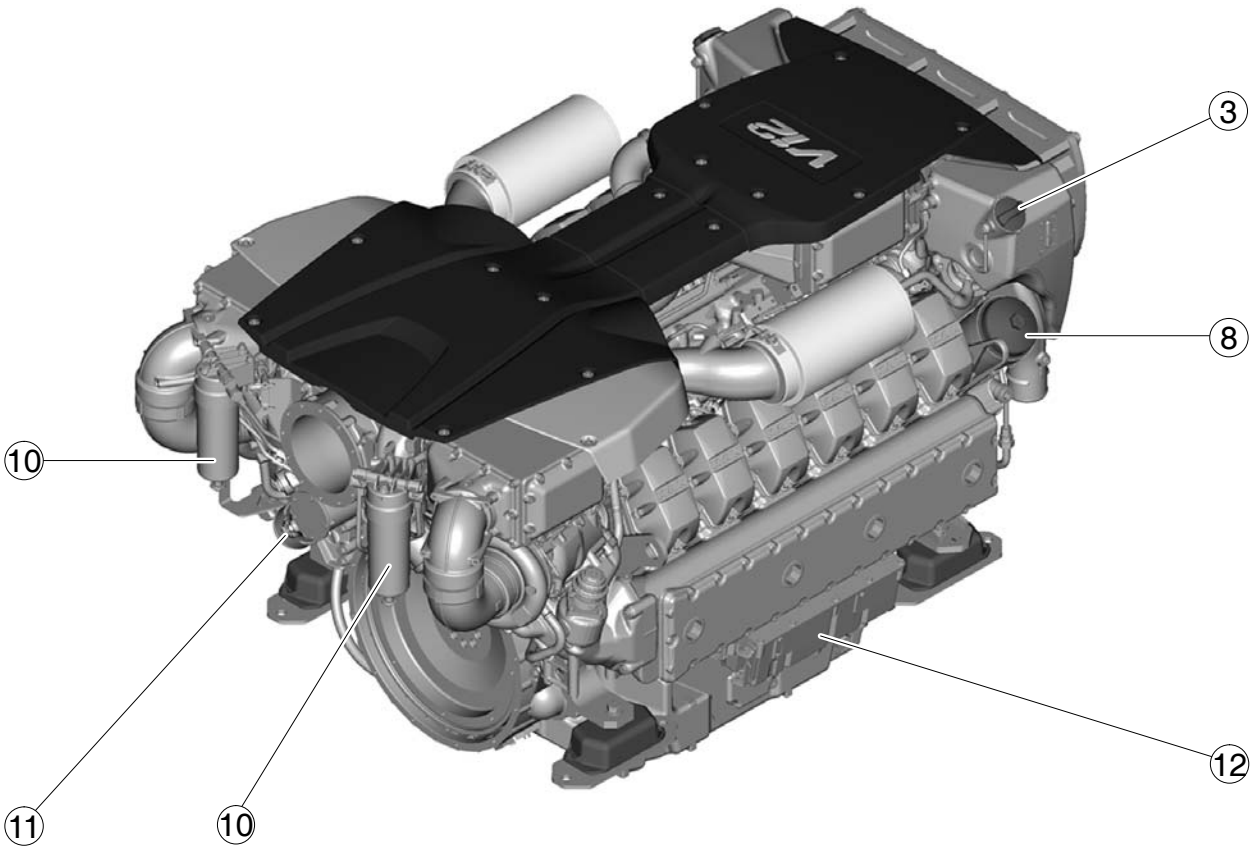
(10) Fuel filter

(11) Sea water pump

(12) Engine terminal box EDC

Engine views V12-1800 (D2862 LE433) / V12-1650 (D2862 LE453)





(1) Poly-V-belt guard

(2) Air filter

(3) Coolant filler neck

(4) Main fuse

(5) Oil drain valve gearbox

(6) Oil drain valve engine

(7) Oil filler neck

(8) Oil filter

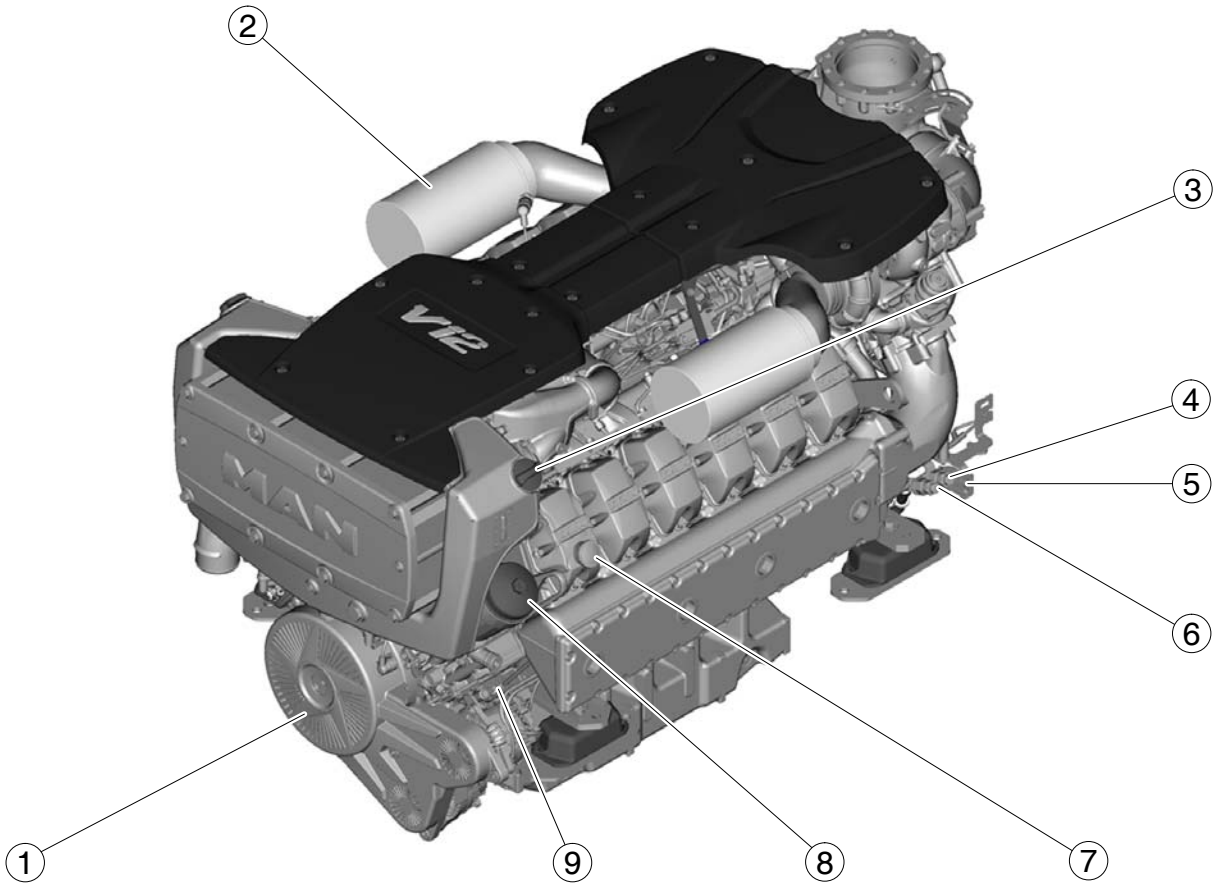
(9) Oil dipstick

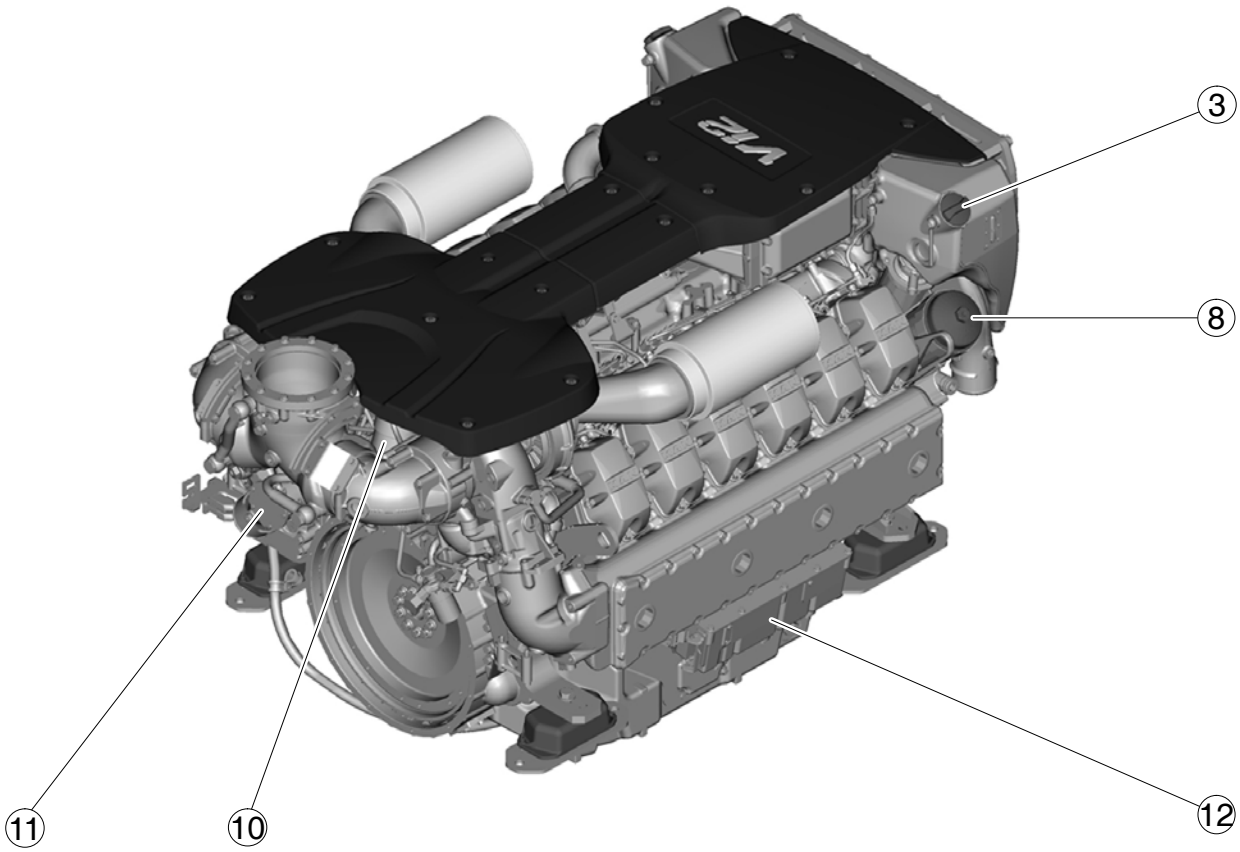
(10) Fuel filter

(11) Sea water pump

(12) IEngine terminal box EDC

Engine views V12-1550 (D2862 LE423) / V12-1400 (D2862 LE443) / D2862 LE463)





(1) Poly-V-belt guard

(2) Air filter

(3) Coolant filler neck

(4) Oil drain valve gearbox

(5) Main fuse

(6) Oil drain valve engine

(7) Oil filler neck

(8) Oil filter

(9) Oil dipstick

(10) Fuel filter

(11) Sea water pump

(12) IEngine terminal box EDC

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.

Caution:
Use only approved fuels, lubricants etc. (see brochure Fuels, lubricants etc."). Otherwise the liability for defects 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 brochure 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 the ethylene glycole basis or anti-corrosion agent.
See Publication “Fuels, Lubricants and Coolants for MAN Diesel Engines".

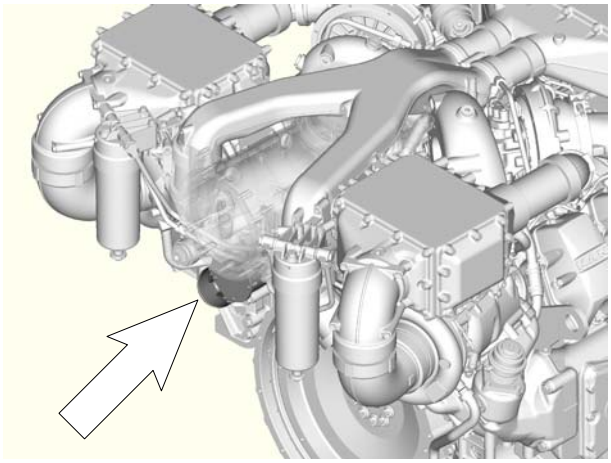
- Pour in coolant slowly via expansion tank, see page 110
- Coolant filling quantity - see “Technical data", from page 101

Seawater pump

Do not let seawater pump run dry!

Make sure that all valves / cocks in the seawater circuit are open.

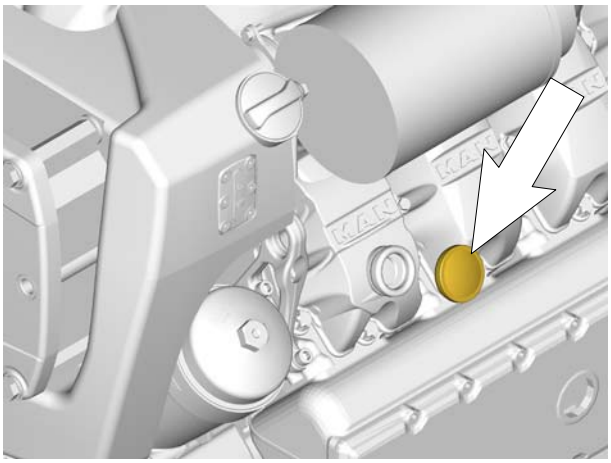
If there is a risk of frost, drain the seawater pump.



Refilling with oil

The engines are as a rule supplied without oil.
Pour oil into engine via filler neck, see page 103.

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.



Oil filling quantity - see “Technical data", from page 101.

Commissioning

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

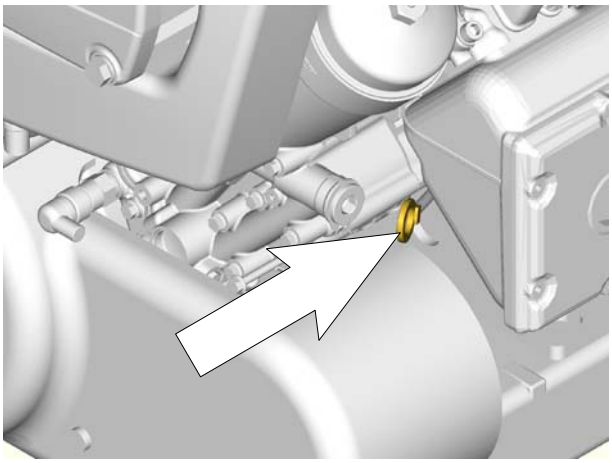
Caution:
Use only approved fuels, lubricants etc. (see brochure Fuels, lubricants etc."). Otherwise the liability for defects will become null and void!

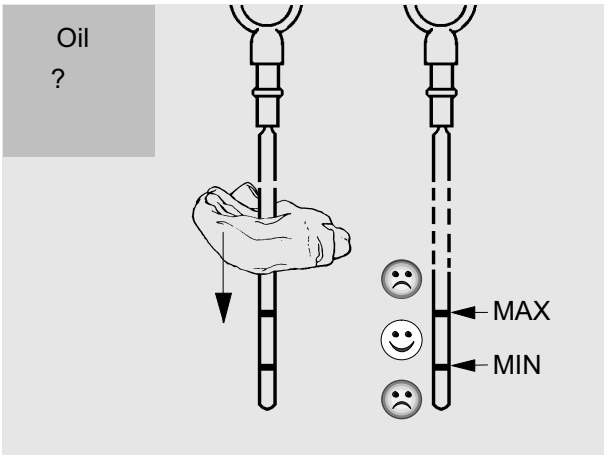
Checking oil level

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

- Pull out dipstick (arrow)
- wipe it with a clean, lint-free 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.





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.

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

There are two possibilities to start the engine: using the ignition lock or using the Start" button.

Starting via the ignition lock:

Ensure that the gearbox is in neutral.

Insert the ignition key and turn it to position I". Readiness for operation is indicated by an indicator lamp lighting up.

Turn ignition key on until stop (position “III" depending on starter lock) starter is activated.

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

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 “0".

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.
Prolonged idling is harmful to the environment.

Starting via the button:

Ensure that the gearbox is in neutral.

Press the “IGN ON/OFF“ button. Readiness for operation is indicated by an indicator lamp lighting up.

Actuate “Engine Start“ button. Starter runs up and the control light goes out.

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

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

After starting the engine, let go of the Start button and set the adjustment lever to the desired speed.

If the engine has not started, wait approx. 30 seconds before pressing the Start" button again to operate the starter motor.

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.
Prolonged idling is harmful to the environment.

Operation monitoring system

Caution:
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!

If an engine / gearbox alarm is displayed on the monitoring devices, the engine is to be turned off or, i.e. operated at low load at max. 1200 rpm.
When the following alarms are displayed

- 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 fault properly remedied, i.e. in a specialist workshop.
Do not put this engine into operation again until the fault has been eliminated.

The engine is equipped as series standard with a monitoring and diagnostic system **M**AN-**M**arine-**D**iagnose-**S**ystem (MMDS.

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

1. Engine room panel, see page 26

CAN bus-controlled display devices:

2. CAN-Bus round instruments, see page 29
3. Display device MMDS-CLC 6.5, see page 33
4. MMDS-CLC 6.5 ship's alarm display, see page 48

Display units supported by PC:

5. Display device MMDS-CMS, see page 55

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

6. Drive lever control system **M**arine **P**ower **C**ontrol (MPC), see page 75
   6.1. Mobile navigating console, see page 88
7. Optional: emergency unit Em (Emergency), see page 92
   7.1. Override button for MMDS-CR and MMDS-BE3 systems, see page 96

Differences in operating parameters of engines and gearboxes

Differences in parameters can be observed on identical engines, irrespective if they are installed in one boat or in different boats (boat series), such as

- pressures
- temperatures
- speeds
- fuel consumption
- injection quantity
- Load
- relative load
- control head signal
- oil level of engine and gearbox
- engine coolant level
- battery and charging voltage

The same applies to a single V-engine (e.g. exhaust temperatures before turbine, l.h. and r.h. side cylinder banks).

These differences may be caused by

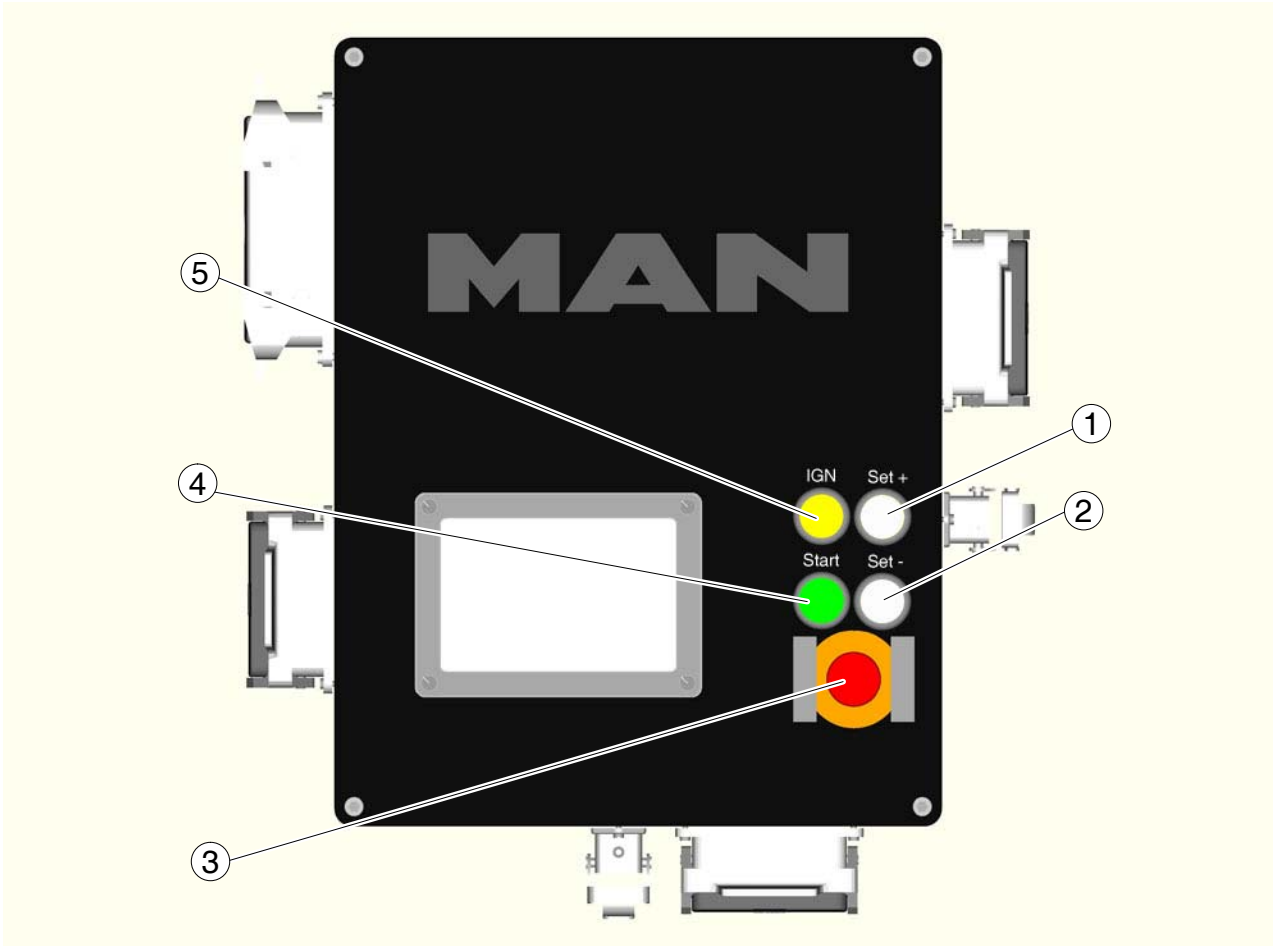
- component tolerances of the mechanical and electrical engine components
- design-related influences on engines (this applies especially to the exhaust temp.)
- external influences such as fuel supply, air supply and coolant supply
- installation conditions, hull characteristic and flow, exhaust system
- differences in the propeller and stern gear.

Under normal conditions this does not have any negative impact on the engine's operating safety. If the operating parameters are in an impermissible range, this is indicated by appropriate alarms of the diagnostic system.

The same applies to the gearbox parameters.Please note that especially differences in the oil temperature may arise on gearboxes running in clockwise or anticlockwise direction.

1. Engine room panel (integrated LC display “IGN ON/OFF"-button, Start"-button, “Set+ Set-"-button and emergency stop switch)

The engine room panel is optionally available and serves to display engine and gearbox data, as well as system information. In order to obtain the full functionality of an engine room panel, as well as the display additional function buttons are integrated for the control of the ignition. starting the engine and for engine speed adjustment.



(1) Set +

(2) Set -

(3) Emergency stop

(4) Start

(5) ING (Ignition)

Function “Ignition ON/OFF" (5) (yellow button)

After activated ignition at the control console, the ignition in the engine room is switched on and off with the **yellow buttons “IGN ON/OFF"** (5).
If the ignition is not activated at the bridge or flybridge, the button has no function.

Activation of the ignition is indicated by the internal yellow lighting of the button. Only when the ignition has been activated at the bridge is the **yellow button “IGN ON/OFF"** (5) of the engine room panel enabled.

Caution:
Ignition off ⇒ engine stop

Function “Start" (4) (green button)

With the ignition switched on, the engine can be started by pressing the **green button “Start"** (4).
The button lights up green when the ignition is switched on.

Function “Stop" (5) (yellow button)

Actuation of the **yellow button “IGN ON/OFF"** (5) stops the engine.

Function “Emergency stop“ (3)

Pressing the emergency stop switch (3) in the cover of the terminal box shuts the engine down immediately. To unlock the emergency stop switch (3), turn the cap of the switch clockwise.
Then the ignition must be switched off and on again, in order to restart the engine.

Engine speed adjustment:

Function “Set +" (1)

By actuating the button “Set +" (1) with the engine running, the engine speed is increased.

Function “Set -" (2)

By actuating the button “Set -" (2) with the engine running, the engine speed is reduced.

Activation of the intermediate speed function:

Press “Set +" and “Set -" simultaneously, until both buttons flash.
To confirm, press both buttons again. Both buttons now light continuously.

Deactivation of the intermediate speed function:
By actuating the **yellow button “IGN ON/OFF"** (5) the intermediate engine speed function is terminated.

The intermediate engine speed function is carried out in similar fashion on the emergency unit, see page 92.

Optional
External LC display of the ship-vehicle management computer (SFFR) in the cover of the engine terminal box

Alarms and their codings can be indicated via the external LC display of the ship-vehicle management computer and communicated to our customer service organisation.
If an active MMDS alarm occurs the corresponding MMDS alarm page will be indicated automatically and can be exited only after confirmation.

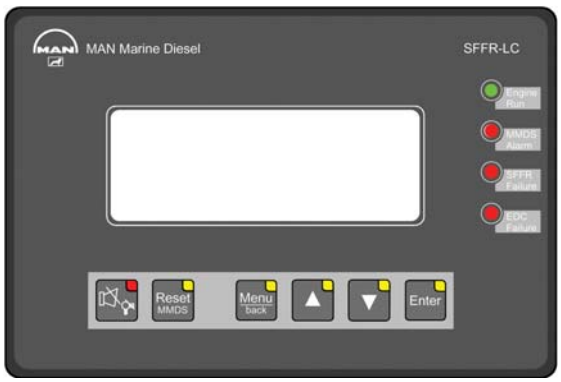
Flashing light EDC Failure , SFFR Failure Indication of EDC, SFFR fault with high priority.

Permanent light EDC Failure , SFFR Failure Indication of EDC, SFFR fault with low priority.

Flashing light MMDS Alarm Active, non-confirmed MMDS alarm

Permanent light MMDS Alarm Active, confirmed MMDS alarm

Operation of the external LC display of the ship-vehicle management computer



Menu back — Operating button for calling up menu if no active, non-confirmed MMDS alarm is indicated.

▼ ▲ — For navigating in the menu, for indicating next or previous fault.

Enter — Confirmation of selection.

Acoustic acknowledgement of all monitoring devices connected to the same CAN bus.

For visual acknowledgement of an MMDS alarm.

Reset MMDS — For sending a resetting signal to the central MMDS unit.

CAN bus-controlled display devices:

2. CAN-Bus round instruments, rev counter with information display and buttons

- Rev counter (0-3000 rpm) with integrated LCD display for the following parameters and buttons for paging:
  - Engine oil pressure
  - Gearbox oil pressure
  - Coolant temperature
  - Engine oil temperature
  - Engine exhaust temperature
  - Charge air temperature
  - Boost pressure
  - Load
  - Hours of operation
  - Fuel consumption
  - Battery voltage

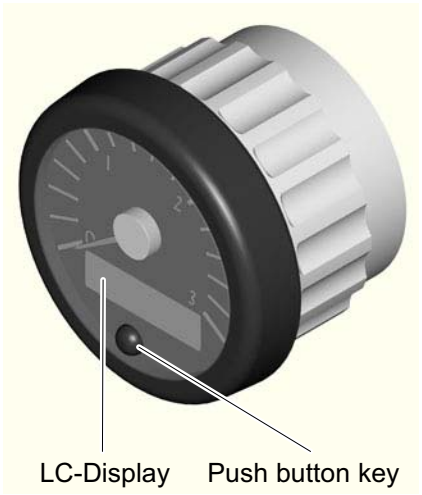
- Oil pressure engine 0-10 bar
- Gearbox oil pressure 0-25 bar
- Oil temperature engine 50--150°C
- Coolant temperature engine 40-120°C
- Exhaust temperature engine 100-900°C
- Battery voltage 18-32 V

Tachometer CAN-Master

The VDO Ocean Link Tachometer (CAN-Bus Tachometer)

The VDO Ocean Link tachometer is a multifunctional instrument for indicating engine data, and is intended for use in navigation of sports ships. The tachometer shows the actual engine speed in operation, on the analogue scale. Further values and operating aids appear in the LC display.

The instrument has a push-button on the front side, with which all the functions can be selected. Handling of the instrument is thus easy and uncomplicated.



Main Functions

The main functions of the VDO Ocean Link can be called up by pressing the push-button. Each time the button is pressed, the next measured value is displayed.


- Engine oil pressure


- Gearbox oil pressure


- Coolant temperature


- Engine oil temperature


- Exhaust gas temperature b. turbine 1


- Exhaust gas temperature b. turbine 2


- Exhaust gas temperature after turbine

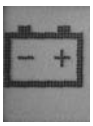

- Charge air temperature


- Charge air pressure

- % Load


- Running time


- Current fuel consumption


- Battery voltage

The exhaust temperature to be displayed must be set when the display messages (Screen on / off).

Setting possibilities

Further settings can be made by pressing the button:

- Selection of illumination intensity in 8 steps
- Selection of display unit in metric or English units
- Selection of transmitters for the analogue inputs

Selection of illumination intensity

If you keep the push-button pressed for 4 seconds, the scroll bar for the illumination setting appears. By repeatedly pressing the key, you can change the illumination of the tachometer and the connected bus display in 8 steps. The display jumps back to the normal operating mode 8 seconds after the last time the button is pressed. The illumination setting is retained even after switching the power supply off and on again. Please note that setting of the illumination is possible only if external illumination is set to “Internal" in the settings menu, see page 32.

Basic Settings

The basic settings necessary for perfect operation can be selected in the settings. These are obtained by pressing and holding the button while switching on the power supply of the display.

Display Units:	Selection of display unit
Screens on / off:	Selection of display
Simulator Mode:	activation of simulator mode
Exit Setup:	exits the setting menu

In order to change a value (e.g. from NO to YES) press the button briefly.
In order to not change a value, keep the button pressed until the set value flashes once. Then release the button immediately. This adopts the displayed setting. If the button is not pressed, the displayed setting is automatically adopted after 10 seconds.

Selection of the display units)

The values for temperatures and pressures can be displayed alternatively in the units °C/bar (METRIC) or °F/psi (ENGLISH). Selection of the units is carried out as follows:

In the example shown the unit is changed from METRIC to ENGLISH.

Setting the illumination (external illumination)

Select here whether illumination of the tachometer and the connected bus instruments are to be connected internally or externally.

EXTERNAL:	The illumination is switched on and off through an input of the 14-pin plug. Dimming of the illumination is thus not possible.
INTERNAL:	The illumination is regulated in the normal operating mode by pressing and holding the push-button key in 8 steps.

Selection of the displays (Screen on / off)

Select here which measured values are to be displayed in the normal operating mode.

YES:	Here all measured values, with their ISO symbol, are displayed. By selecting NO", the measured value can be removed from the normal operating mode. If the measured value is to be displayed again, select YES" when the ISO symbol of the measured value is displayed
NO:	No change in the setting are made.

Activation of the simulation mode (simulator mode)

Select here whether the simulation mode is to be switched on.

YES:	The simulation mode is switched on. The display now generates random values for all measuring channels and displays these. The measured values are also transmitted to the bus instruments.
NO:	The simulation mode is switched off.

Please note that the simulation mode still remains after switching off and switching on again, if it has not been switched off by selecting NO.

Setting of the number of exhaust gas temperature measured values (Charge Boost Amount)

Select here whether one or two measured values are to be displayed for the exhaust gas temperature before the turbine.

1:	One exhaust gas temperature measured value.
2:	Two exhaust gas temperature measured values. (V-engines)

Ending the settings (exit setup)

Select here whether the settings are to be exited.

YES	The settings are exited, the display restarts in the normal operating mode.
NO	The settings are restarted.

3. MMDS-CLC 6.5 display device (colour display)

Introduction

This document describes how the MMDS-CMS 6.5 colour display with MMDS-CLCB 6.5 remote control operates and is used in its application as an engine display to monitor engine operation. Fitting, mounting and installation are explained in separate instructions for the unit.

The engine and gearbox data are shown on the colour display in the form of dials and digital displays. LED symbols are used to display alarms; these are complemented by a table which lists all alarms present with more detailed information.

A logo which will be displayed on all pages may be activated when installed. The shipyard can select this logo selection itself (see page 47).

Function

The colour display is automatically activated when the supply voltage is applied. It can then be switched on and off manually using the “Power" button 

. The other alarm functions such as the alarm relay and the internal buzzer and the acknowledge button remain operative.

The engine speed display incorporates a damping algorithm to simulate mechanical instruments. This means that small variations do not lead to an unstable display, which could irritate the officer controlling the ship.

Pre-Start page

The display is activated by switching the ignition on and the following Pre-Start page is displayed.

Pre-Start page

If a button is actuated or the engine started, the display switches to the basic display.

Pre-Start page with active acknowledged alarms

Should active acknowledged alarms arise, these are indicated by a red triangle. The number corresponds to the number of alarms that have arisen.

Pre-Start page in the warning and alarm range.

If a value represented on the Pre-Start page reaches the warning or alarm range, the colour of the pictograph changes to red. In the example shown the gearbox is not in the neutral position.

Basic display

On starting the engine the start page is called up automatically, indicating engine speed, coolant temperature and oil pressure in the form of round instruments and also in digital format. The calculated fuel consumption is represented bottom, right.

Basic display

Engine and gearbox data are represented as digital display values or bar displays on three further pages.

The pages are selected with the buttons  and 

Page 2

Page 2

Page 3

The exhaust gas temperature values “Exhaust gas v. Turbo", and the operating hours counter are presented on page 3.

Page 3

Page 4

Page 4 displays the daily fuel consumption counter “Trip".

Page 4

Buttons

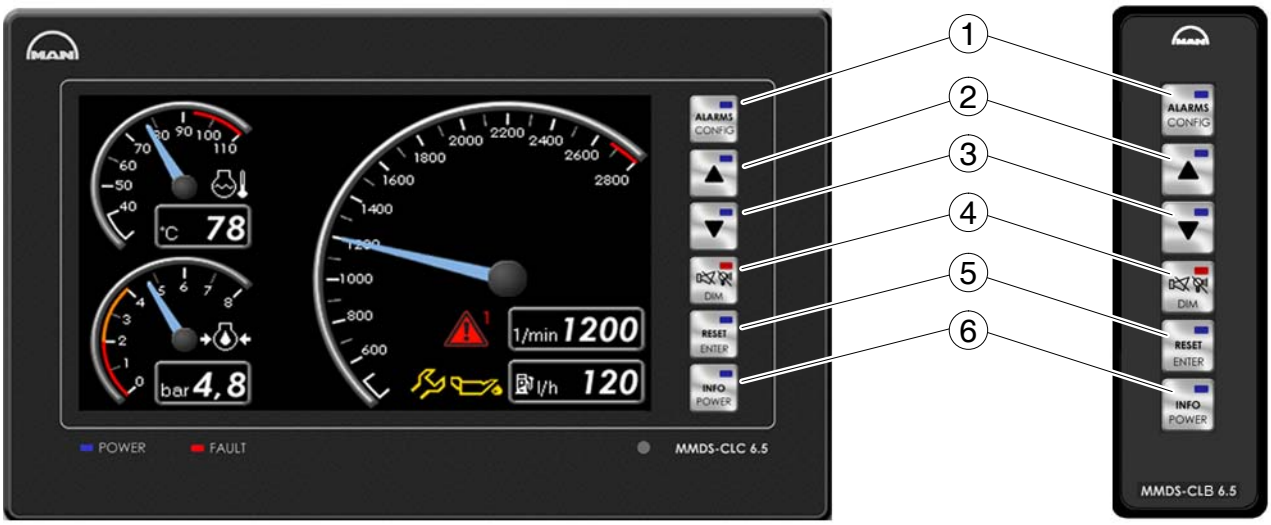


Figure: Numbering of the operating buttons

Operational functions and configuration

The operation of the system and the display adjustment is carried out with the display buttons or the remote control MMDS-CLCB 6.5.

The following functions are incorporated:

Standard function: Call the alarms table, or browse to further alarm pages.

Additional function: If pressed longer than 5 seconds ⇒ Switches configuration menu on and off.

Standard function: Page back to the previous page

Additional dimming function: On simultaneous actuation of the buttons 

(4) and  (3) the brightness is reduced.

Additional function in the menu: Change parameter / reduce value.

Standard function: page up to the next page.

Additional dimming function: On simultaneous actuation of the buttons 

(4) and  (2) the brightness is increased.

Additional function in the menu: Change parameter / increase value.

Standard function: Acoustic and optical acknowledgement of all monitoring devices connected to the same CAN-Bus.

Additional dimming function: Adjustment of the brightness on simultaneous actuation of the buttons  and  .

Test function: If currently no alarm is on, or if all alarms have previously been optically acknowledged, after an actuation for longer than 5 seconds a horn test is carried out, i.e. the internal summer and the horn relay are activated for the duration of the button press.

Standard function: A reset signal is sent via the CAN bus to the engine monitoring and diagnostic system control unit (engine terminal box) or to a data station. As long as the appropriate criteria are fulfilled, the engine slow down or shutdown alarms arising are reset.

Additional function in the menu: Accept change and pass to the next parameter.

Function (Actuation for approx. 3 seconds): Switch-on and switch-off of the display (display only, not on remote operation).
Additional display function (Brief actuation): Insertion of the info. display for approx. 5 seconds

Alarms

Definition of alarm condition

An alarm is triggered when a monitored value exceeds or fails to reach its set limit value.

Should an alarm condition occur, an alarm table is automatically displayed. This lists all advance warnings, alarms and sensor fault alarms. An internal buzzer and the horn relay are activated at the same time.
The collective alarm relay issues a repeat pulse if another alarm was already active. In this way, it is possible to activate a visual call system for each new alarm or to send a telephone message if the ship is not occupied. Acoustic acknowledgement with the 

(4) button switches the internal buzzer off and the horn relay drops out.

Alarm acknowledgements and reset signals are sent on the CAN bus to the engine monitoring and diagnostic system Diagnostics unit and to all the monitoring devices subscribing to the same CAN bus. All the equipment thus has the same alarm status.

So long as the values are displayed in white, the values are in their “normal ranges". On reaching a preliminary alarm the digital value flashes orange, with a main alarm red, and in the case of a sensor fault a yellow flashing “SE" appears. On pressing the optical acknowledgement (Button 

(4)) all the flashing displays revert to a continuously lit condition. When the fault has been eliminated and both acoustically and optically acknowledged (button 

(4)), the alarm display reverts to the “Normal condition".

Normal | Advance warning | Alarm | Sensor failure

Figure: Example of the display of the engine oil pressure with alarm indication

The engine monitoring and diagnostic system control unit monitors all important sensors for plausibility.
If a sensor fault alarm occurs, the value is cleared from the digital displays and the pointer is removed from the dials.

In the case of alarms, which have led to the automatic stopping or speed reduction of the engine via the central MMDS unit, the button 

(5) **must also be actuated. In the case of a stop alarm, this function is released on engine shutdown and with a reduce alarm below an engine speed of 800 1/min.**

Alarm acknowledgements and reset signals are sent via the CAN bus to the engine monitoring and diagnostic unit and to all the monitoring devices connected to the same CAN bus.

Alarms table

This table is automatically called when an alarm condition occurs, or can be called manually by pressing the “Alarms" button 

(1) It shows all existing alarm messages, i.e. those that have not been acknowledged or reset. Each entry contains a measuring point text, the current measured value, the time when the alarm occurred, the unit of measurement and the type of alarm. The following labels are used for the type of alarm:

Text	Meaning
Warning	Advance warning
Alarm	Alarm
Sensor	Sensor fault alarm

A new alarm always appears in the top line. This is highlighted in flashing red until it is visually acknowledged. Older messages are automatically displaced one line downwards. If there are more than 6 entries, further alarm pages are automatically presented for selection. In this event, pressing the “Alarms" button 

(1) switches on to the next available alarm page. When the first page reappears, or if the display remains the same after pushing that key, there are no further alarms. The numbering of the displayed alarm page is shown at the bottom right of the page.

A message generally remains active until it has been acoustically and visually acknowledged (button 

(4)) and the fault has been rectified. Shutdown and engine slow down alarms must also be reset using the button 

(5).

Note:
The alarm texts are presented in the selected display language.

Active alarm page

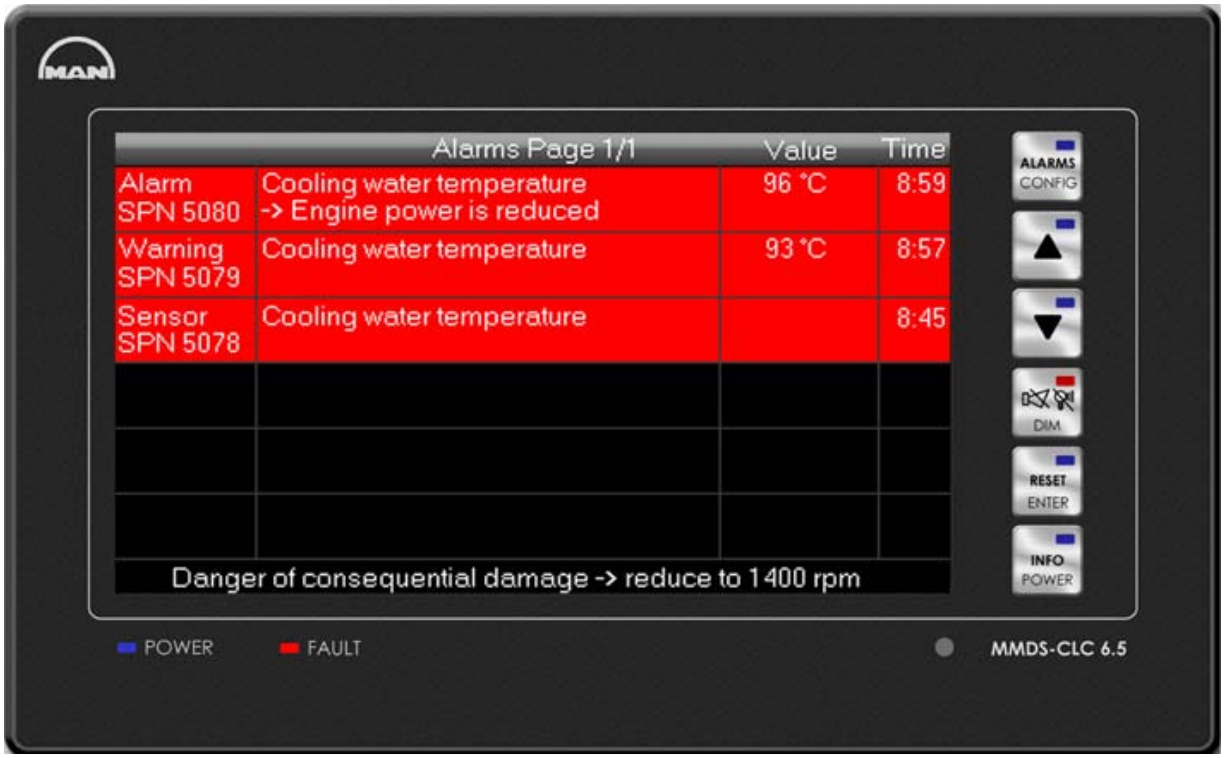
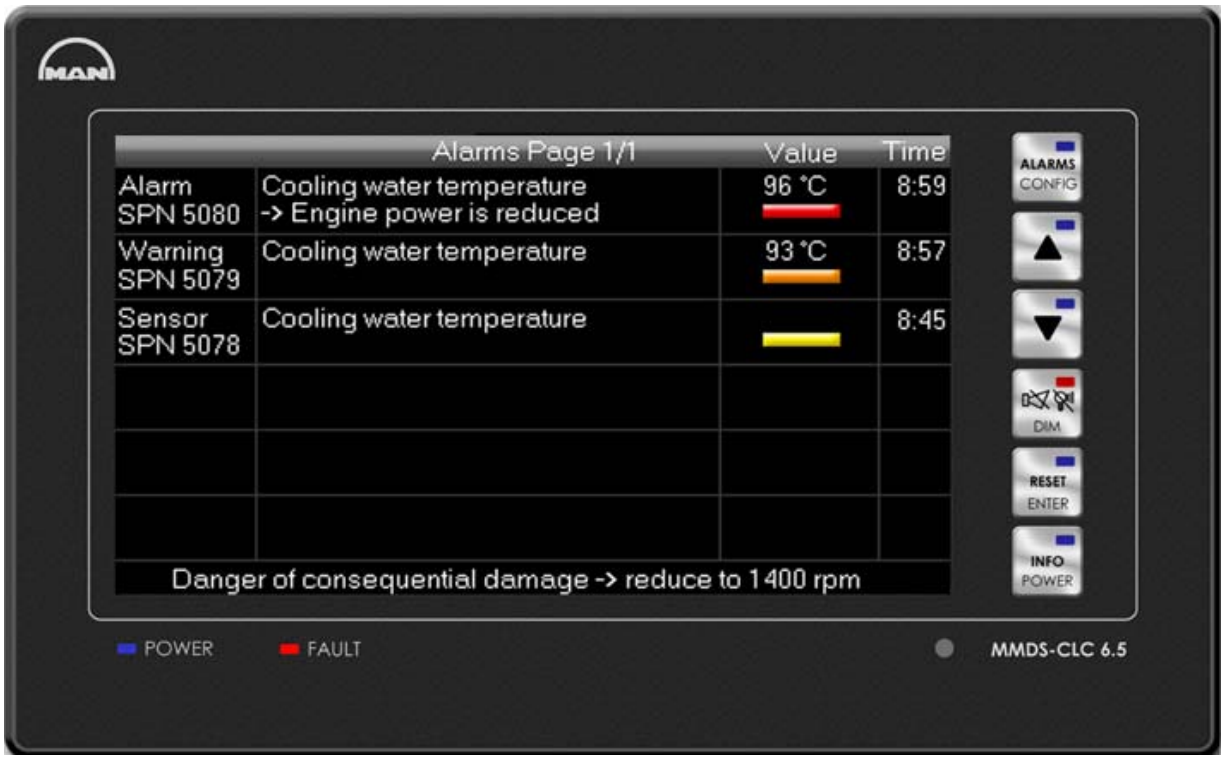


Figure: Alarms table

Acknowledged alarm page



Menu functions

The display unit provides a number of setting options. Activation of the button 

(1) for approx. 3 seconds activates the menu page. The page contains the following configuration points:

- Selection of the presentation in German, English, Italian, Spanish and French
- Setting the time
- Selection of the logo
- Selection of the display in metric/non-metric units
- Activation of display start status
- Activation of the service page

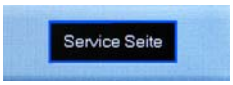
The menu point in the respective blue marked field can be changed with the buttons  (2) and  (3). Pressing the button 

(5) switches the marking to the next field. Pressing the button 

(1) again for approx. 3 seconds causes the set values to be accepted and the menu is exited. The display switches to the alarm table.

Figure: Menu for setting the display

Service page

The engine and gearbox data and the alarm conditions of all measuring stations are displayed in a table on the service page. This page is accessed and exited on selecting the menu item 

and changing the page via the buttons  (2) and  (3).

Service page

	Service page 1/2				
Engine speed	Engine speed	1200 1/min	Water pre–filter 1	0.0 mV	Water level in fuel filter 1
Throttle lever	Throttle	63 %	Water pre–filter 2	0.0 mV	Water level in fuel filter 2
Load	Load/Torque	?? m/h	Oil press. engine	4.8 bar	Engine oil pressure
Relative load	Relative load	80 %	Oil press.eng.b.filtr	?? bar	Engine oil pressure at the oil filter
Fuel consumption	Fuel consumption	120 l/h	Oil temp. engine	78 °C	Engine oil temperature
Voltage, term. 15	Pow. supply PIN15	25.2 V	Oil level engine	?? %	Engine oil level
Voltage, Gen. D+	Generator D+	24.1 V	Crankcase press.	3.8 V	Crankcase pressure
Fuel press. pump1	Fuel press. pump1	4.5 bar	Coolant temp.	?? mbar	Coolant temperature
Fuel press. pump2	Fuel press. pump2	4.4 bar	Cool. press. exp. t.	81 °C	Cool.temperature. in cool.exp. tank
Fuel press. handp.	Fuel press.handp.	250 mbar	Cool. press.wat. p.	0.5 bar	Cool.press coolant pump
Fuel press. return	Fuel press.return l.	100 mbar	Coolant level	?? bar	Coolant level in expansion tank
Fuel temperature	Fuel temperature	30 °C	Oil press. gearbox	?? bar	Gearbox oil pressure
Injection pipe leak	Inject. pipe leak	23.5 mV	Oil press.gbox.b.fil	12.5 bar	Gearbox oil pressure at the filter

	Service page 2/2				
Engine speed	Engine speed	1200 rpm	Exhaust temp. 1	510 °C	Temp. exh. b. turbine 1
Gearbox oil tempera-ture	Oil temp. gearbox	78 °C	Exhaust temp. 2	512 °C	Temp. exh. b. turbine 2
Oil level gearbox	Oil level gearbox	?? %	Exh.temp.aft.turbo	420 °C	Temp. exh. a. turbine
Bearing temp.gearb.	Bearing temp.gear	?? °C	EDC–failure	??? SPN	Failure EDC
Seawater flow	Seawater flow	?? l/min	SFFR–failure	??? SPN	Failure SFFR
Seawater press.	Seawater press.	?? bar	Remote slow down		Remote slow-down
Seawater temp.	Seawater temp.	?? °C	Override		Override
Charge air tempera-ture	Charge air temp.	58 °C	Emergency stop	?? mV	Emergency stop
	Air intake pressure	25 mbar	Alarm throttle cont		Alarm throttle control
Boost press.	Boost pressure	2.5 bar	Safety syst. fail		Safety system failure
Temp. MMDS	Temp. MMDS int.	?? °C	Alarm safety syst.		Safety system alarm
Temp. plug X1	Temp. plug X1	?? °C	Engine number	12345678	Engine number
Exh. back press.	Exh. back press.	30 mbar	Engine type	D286X LE4XX	Engine type

The table has 3 columns for each measuring point. Each entry contains an abbreviation of the designation of the measuring point, the current measured value and the unit of measurement. The alarm status is presented via LED symbols. As long as the LED is green the value is in the normal range. If the initial alarm is reached the colour changes to orange and with a main alarm to red. A flashing LED indicates that the alarm has not yet been visually acknowledged. If there is a sensor failure, the LED goes out.

Automatic dimming

A photo element is integrated in the front plate of the display unit. This registers the brightness of the environment and the background lighting is automatically adapted to the circumstances. When the light conditions get darker the brightness of the display is reduced; if there is more light it is increased.

The automatic dimming can be adjusted to one's own requirements. By simultaneously activating the buttons 

(4) and  (2) or  (3) the darkest point of the display lighting can be set.

Selection of the logo

Configuration

The logo to be blended in is selected on the logo page. This is displayed at the centre of all pages of the display. This page is opened or closed on selection of the menu item 

and changing the page via the buttons  and  .

After selection of the menu item 

by actuating the button 

an available logo can be selected via the buttons  and  . After activation of the button 

for approx. 3 seconds, the selection is accepted and the menu 

is closed.

LED displays

There are two LEDs beneath the display. A green Power" LED is activated by applying the supply voltage. The red error" LED flashes when there is no communication on the CAN data bus. The displays of the engine and gearbox data then all show the value 0".

4. MMDS-CLC 6.5 ship's alarm display, operation

Introduction

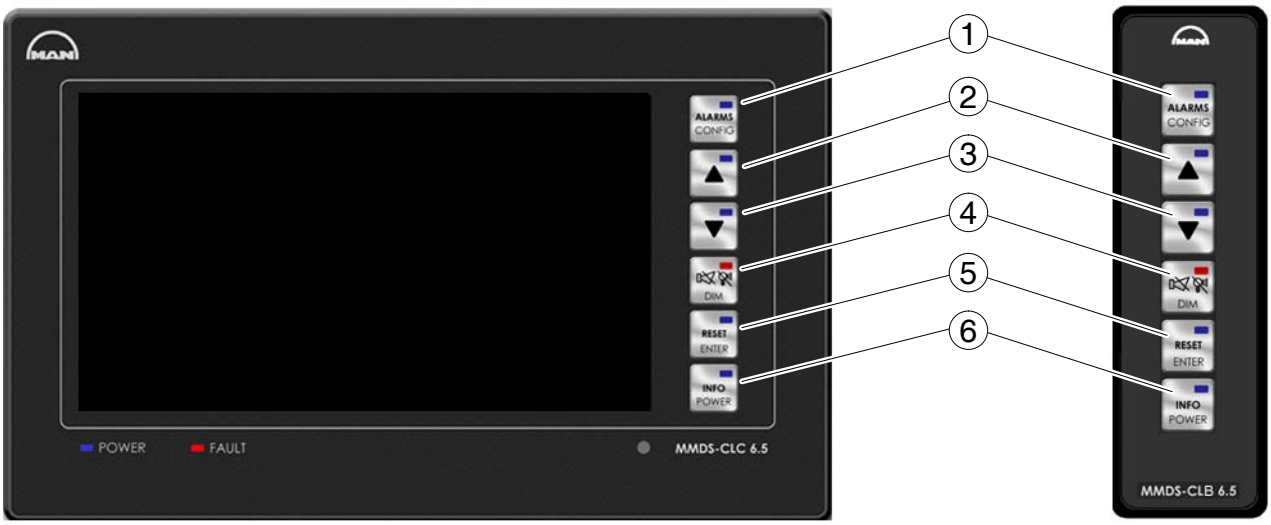
This document describes how the MMDS-CLC 6.5 colour display with MMDS-CLCB 6.5 remote control operates and is used as a ship's alarm display. Fitting, mounting and installation are explained in separate instructions for the unit.

The data monitored on the ship is visualised by the corresponding symbols and displays on the colour display. LED symbols and a table that lists all active alarms with detailed information indicate states of alarm.

For commissioning and service, there is a service page where all the measured values as well as alarm states of all sensors can be viewed at a glance.

To optimise adjustment to the user's requirements, five languages and display of the data in either metric or non-metric units can be selected.

Buttons



MMDS-CLC 6.5 ship's alarm display

Operational functions and configuration

The operation of the system and the display adjustment is carried out with the display buttons or the remote control MMDS-CLCB 6.5.

The following functions are implemented:

Standard function: Call the alarms table, or browse to further alarm pages.

Additional function: If pressed longer than 5 seconds ⇒ Switches configuration menu on and off.

Standard function: Page back to the previous page

Additional dimming function: On simultaneous actuation of the buttons 

(4) and  (3) the brightness is reduced.

Additional function in the menu: Change parameter / reduce value.

Standard function: page up to the next page.

Additional dimming function: On simultaneous actuation of the buttons DIM (4) and (2) the brightness is increased.

Additional function in the menu: Change parameter / increase value.

Standard function: Acoustic and optical acknowledgement of all monitoring devices connected to the same CAN-Bus.

Additional dimming function: Adjustment of the brightness on simultaneous actuation of the buttons and .

Test function: If currently no alarm is on, or if all alarms have previously been optically acknowledged, after an actuation for longer than 5 seconds a horn test is carried out, i.e. the internal summer and the horn relay are activated for the duration of the button press.

Standard function: A reset signal is sent via the CAN bus to the engine monitoring and diagnostic system control unit (engine terminal box) or to a data station. As long as the appropriate criteria are fulfilled, the engine slow down or shutdown alarms arising are reset.

Additional function in the menu: Accept change and pass to the next parameter.

Actuate the function (approx. 3 seconds): Switch-on and switch-off of the display (display only, not on remote operation).
Display additional function (long actuation): Info. display appears for approx. 5 seconds

Function

The colour display is automatically activated when the supply voltage is applied. It can then be switched on and off manually using the “Power" button (6). The other alarm functions such as the alarm relay and the internal buzzer and the acknowledge button remain operative. There are two screen pages for displaying the most important engine and gearbox data. Alarms are displayed in an alarm table.

Graphical display of measured values data

When the device is switched on, page 1 is shown automatically.

Normally, the following is displayed:

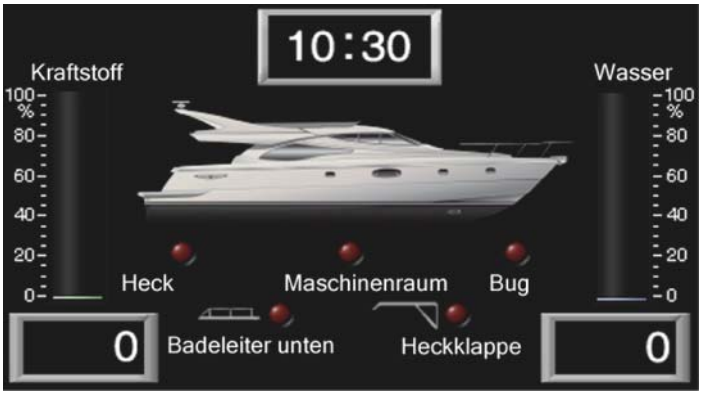


Figure: start page with fuel tank levels, bilge status and door monitoring

a) Fuel tank: (configuration depending on boat type and tank shape)
   - Fill level display and digital value
   - with approx. 10% of the tank content, an alarm is issued (dependent on customer wish)

b) Water tank: (configuration depending on boat type and tank shape)
   - Fill level display and digital value
   - with approx. 10% of the tank content, an alarm is issued (dependent on customer wish)

c) Time: can be set on menu page

d) Illustration of the boat type: adapted at the request of the customer to specification.

e) Bilge alarms: with high fill level, an alarm is triggered. (rear, engine room, front end, others are possible)

f) Miscellaneous, e.g. lower bathing ladders, rear gate open (depending on boat type and configuration)

The sensors for the tank and water level as well as the switches for the bilge fill levels and miscellaneous others are to be connected to the serial substation (e.g. IO 12). There must be harmonisation here with regard to configuration (tank curves) and possible signal inputs.

Page 2:

Normally, the following is displayed:

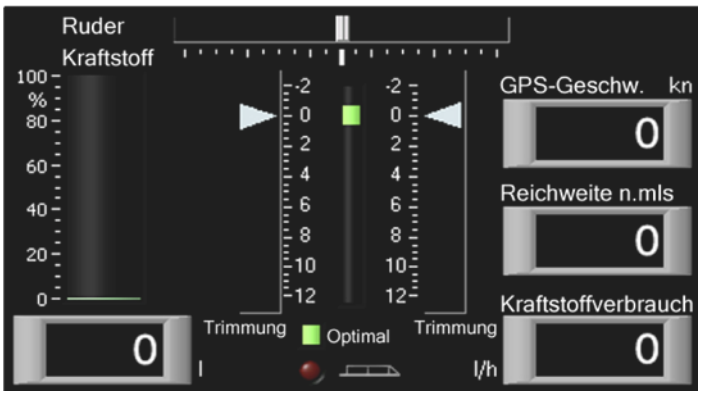


Figure: page 2 with digital display elements and bar displays

g) Trim flap position:
   here is an instrument in the middle of the display that indicates the trim flap position of the port and starboard trim flaps. For each speed, the trim flap position is suggested by means of a green rectangle. This proposal is generated from a trim curve integrated in the software that is recorded during the commissioning journey.
   The trim flap sensors are read in at the serial substation.

h) Rudder position:
   The rudder position is displayed in the upper area. The sensors for the rudder position are read in at the serial substation.

i) GPS speed:
   The speed recorded by the GPS is displayed at the right-hand edge of the screen.
   The GPS is connected to the serial interface on the back of the CLC ship display.

j) Current fuel consumption:
   The fuel consumption is shown at the bottom right.
   The value is transferred from the MMDS-CLC 6.5 engine display per data line.
   The fuel consumption can only be shown on ships with electronically controlled engines.

k) Range:
The range of the ship is displayed on the right.
This is a value calculated from the current fuel consumption, GPS speed and current fuel tank content.
The range can be displayed in nautical or standard miles, which can be selected in the menu.

Furthermore, the fuel consumption and e.g. the position of the bathing ladders are often displayed on page 2.

The 

(2) and  (3) keys can be used to switch back and forth between the two graphical pages. If the alarm table is activated, the last displayed page is opened.

All sensors and switch inputs connected to the serial substation must be provided by the shipyard and tested for proper function as well as conformity with the serial substation. Furthermore, the serial substation must have been configured. The same applies to the GPS system that is connected directly to the CLC ship.

Alarms

Should an alarm condition occur, an alarm table is automatically displayed. This lists all advance warnings, alarms and sensor fault alarms. An internal buzzer and the horn relay are activated at the same time.
The collective alarm relay issues a repeat pulse if another alarm was already active. In this way, it is possible to activate a visual call system for each new alarm or to send a telephone message if the ship is not occupied. Acoustic acknowledgement with the 

(4) Alarm acknowledgements and reset signals are sent on the CAN bus to the engine monitoring and diagnostic unit and to all the monitoring devices connected to the same CAN bus. All the equipment thus has the same alarm status.

Alarm display on the graphics pages

On reaching an alarm condition, e.g. full bilge, the associated red LED flashes. By actuating the optical acknowledgement button (button 

(4)) all the flashing displays revert to a continuously lit condition.

When the fault has been eliminated and both acoustically and optically acknowledged (Button 

(4)), the alarm display reverts to the “Normal condition".

Sensor failure

All the important sensors are monitored for plausibility. If a sensor error alarm occurs, then the measured value on the corresponding instrument disappears.

Alarms table

This table is automatically called when an alarm condition occurs, or can be called manually by pressing the button 

(1) It shows all existing alarm messages, i.e. those that have not been acknowledged or reset. Each entry contains a measuring point text, the current measured value, the time when the alarm occurred, the unit of measurement and the type of alarm. The following labels are used for the type of alarm:

Text	Meaning
Warning	Advance warning
Alarm	Alarm
Sensor	Sensor fault alarm

A new alarm always appears in the top line. This is highlighted in flashing red until it is visually acknowledged. Older messages are automatically displaced one line downwards. If there are more than 10 entries, further alarm pages are automatically presented for selection. In this event, pressing the “Alarms" button 

(1) causes paging on to the next available alarm page. If the first page appears again, or if the display remains unchanged on pressing the button, then no further alarms are present. The numbering of the alarm pages presented is displayed on the page, lower right. In general a message remains active until it has been acoustically and optically acknowledged (Button 

(4)) and the fault has been eliminated.

Figure: Alarms table

Menu functions

The display unit provides a number of setting options. Activation of the button 

(1) for approx. 3 seconds activates the menu page. The page contains the following configuration points:

- Setting the time
- Selection of the presentation in German, English, Italian, Spanish and French
- Selection of the display in metric/non-metric units
- Activation of the service page

The menu point in the respective red marked field can be changed with the buttons 

(2) and  (3). Pressing the button 

(5) switches the marking to the next field. Pressing the button 

(1) for approx. 3 seconds results in the set values being accepted and the menu is closed. The display switches to the alarm table. The selection of the language has no influence on the menu and the service page. These pages are always displayed in English.

Figure: Menu for setting the display

Selection of the logo

Configuration

The logo to be blended in is selected on the logo page. This is displayed at the centre of all pages of the display. This page is opened or closed on selection of the menu item 

and changing the page via the buttons  and  .

After selection of the menu item 

by actuating the button 

an available logo can be selected via the buttons  and  . After activation of the button 

for approx. 3 seconds, the selection is accepted and the menu 

is closed.

LED displays

There are two LEDs beneath the display. A green “Power" LED is activated by applying the supply voltage. The red “error" LED flashes when there is no communication on the CAN data bus. The displays of the ship data then all show the value “0".

5. MMDS-CMS display device

The visualisation of engine operating data, general ship's messages and alarms is an important part of modern alarm and safety systems on ships. The amount of information is steadily increasing and must be registered and evaluated quickly. Alarms and / or warnings are to be recorded and reported quickly and precisely. Clear and user-friendly displays are a precondition for safe operation of any ship.

The MAN Monitoring System represents a new component of the proven alarm, safety and diagnostic system MMDS, which offers a variety of new functions and display formats. The PC-based system is used to display operating data of several engines and general ship messages.

The 10" / 15" MMDS-CMS 10 / 15 TFT monitor is part of the system. Data that has previously been processed by the corresponding software is shown on the display. The software is controlled using integrated function keys that are located on the left of the display. The assigned functions are shown on the left edge of the display. There is a choice of various forms of display. These can be pages with digital displays, analogue instruments, visual engine graphics and tabular displays. There are also two keys at the bottom right for visual and acoustic alarm acknowledgement. The keys above these are for setting the display by means of an “on screen display" menu.

Function and operation

Display functions

The display is switched on and off using the Power button (top right). Underneath this, there are four system keys for adjustment of the display illumination and for maintenance of the display. Usually, only the arrow keys are important. The “Menu" and “Store" keys are for controlling the OSD menu.

Function: Switching the display on and off.

Functions: Activation and deactivation of the OSD menu and switching to the next higher menu level.

Standard function: Decrease display brightness.

Additional functions if the OSD menu is shown: shifting the selection field for the menu items upwards and increasing parameter values.

Standard function: Increasing display brightness

Additional functions if the OSD menu is shown: shifting selection field for the menu items downwards and decreasing parameters.

Functions: Selecting menu items and saving parameter values.

Software operation

The MMDS-CMS 10/15 monitor serves to display and control visualisation software that is installed on the PC. This software is adapted to the overall system and is explained in a system description. Ten function keys are arranged on the left of the display for operation of the software. The assigned functions are shown at the edge of the display.

Example of a function key with the assigned function to call up analogue display.

For the control of software functions, there are also two keys at the bottom right for visual and acoustic alarm acknowledgement.

Standard function: Acoustic acknowledgement of all monitoring devices contained in the system.

Additional function: If a Windows communication box appears, this key (TAB) enables selection control.

Standard function: Visual acknowledgement, which means that all flashing alarms switch to continuous light if they have previously been acknowledged acoustically. All other monitoring devices contained in the system are acknowledged as well.

Additional function: If a Windows communication box appears, this key (ENTER) enables acknowledgement.

Software description

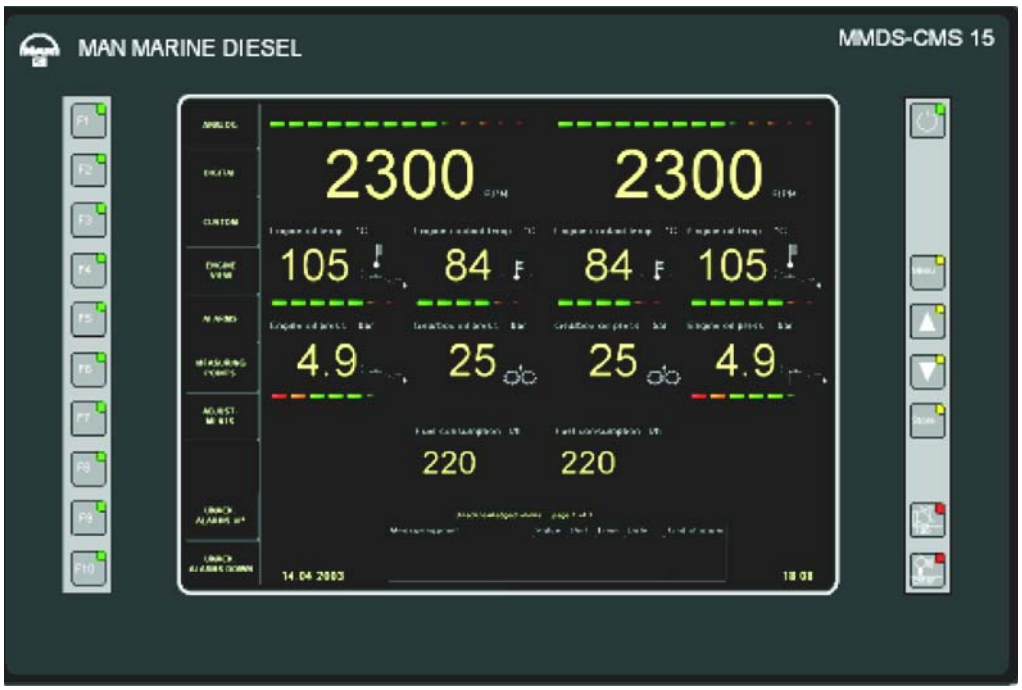
Introduction

Processing engine data, general ship data and alarms is an important part of modern alarm and safety systems on ships. The amount of information is steadily increasing and must be registered and evaluated quickly.

The MAN Monitoring System MMDS-CMS belongs to the Alarm, Safety and Diagnostic Unit MMDS.
It offers a variety of functions and types of display, which are mainly defined by the visualisation software. It is fully installed and configured on the compact PC MMDS-CMS S which is part of the system.

Measured values and alarms are displayed in different forms on the monitoring system. Alongside a preset page with displays of analogue or digital instruments, there is a page that can be freely configured by the user. In addition, the engines are represented graphically. In the event of a fault, the source of the problem can be recognised easily. A further special feature is the dynamic display of speed-dependent variables. The limit value changes directly with the speed so that the distance between an actual value and the corresponding alarm limit value is easily recognisable at any time. All alarm and measuring point lists are available in tabular form. The displays are operated using the integrated function keys or by means of an external mouse or trackball.

This documentation is intended to make the user acquainted with the operation of the software and to provide an overview of the system at a glance. Please note that this description is a minimum configuration of the monitoring system. Extension options are documented separately. The devices belonging to the system are also documented extensively in the individual device descriptions.



Scope of services

The monitoring system registers, evaluates and displays engine and gearbox data of MAN ship's diesel engines. The measured values are registered via the MMDS diagnostic units, one of which is placed each of the engine terminal boxes. Data interchange between the devices takes place via the separate CAN bus lines, CAN Engine 1 and CAN Engine 2. The compact PC, which is part of every display, processes the data and makes it available on a CMS 15" / 10" display with the help of visualisation software.

Display

The data is shown on the 10"/15" display MMDS-CMS 10" or the smaller MMDS-CMS 15". Ten function keys are integrated in each of the monitors. This enables functions such as page selection or scrolling. On connection of mouse and keyboard, one of the pages can be freely configured. On the Custom page, the selection of data and its displays can be adapted to the user's needs by means of a few mouse-clicks.

Extension options

The MMDS-CMS alarm system can be extended to form a comprehensive ship and engine alarm system. A large number of analogue and binary sensors can be integrated on connection of one or more data stations (e.g. MMDS IO12) in order to, e.g., monitor the filling levels of fuel tanks or the condition of position lanterns. Further route-specific information can be calculated by connecting a GPS receiver that uses sensor data, for example the range resulting from the current fuel consumption and speed.

Operation

The displays are activated automatically when the power supply is switched on. They can be switched on and off individually by pressing “Power" button ❶.

The computers can be switched on and off when the power supply is switched on. The startup procedure of the operating system Windows XP, as well as of the visualisation software, takes approx. one minute and is visible on the displays.

Control with the function keys

The (1) - (10) function keys to the left of the display are used to control the software. Operation is dynamic, i.e., the assigned functions change depending on the page displayed. The currently possible functions are explained in a specifically assigned section of the display located to the right of each key. Insofar as a field is empty, the assigned key does not have any function.

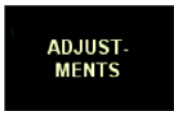
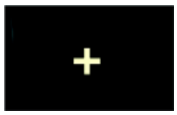
Menu functions are selected using the function keys or per mouse-click on the menu text. The following list shows all the functions available in the program. They can be used to select a specific page, to scroll within tables or perform other functions.

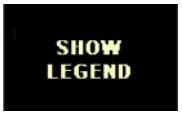
Function: opens the start page, which exclusively shows digital displays (see page 62, Main Menu).

Function: opens a page which displays data as analogue instruments (see page 64, Analogue display).

Function: opens a page which displays data digitally (see page 65, Digital display).

Function: opens a page on which the user can customise the display interface according to his / her own wishes (see page 67, User-defined display).

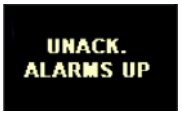
	Function: opens a page which shows visual representations of the engines with the corresponding measured values (see page 69, Visual engine display).
	Function: opens the alarm screen. Here, the acknowledged and unacknowledged alarms are displayed in tabular form (see page 73, Tabular display of alarms).
	Function: opens the measuring point lists. Here, all measuring points are shown in tabular form (see page 70, Measuring point list).
	Function: opens the settings page. Here, the clock, the unit system and other options can be set.
	Function (only available in the measuring point list, alarm table or settings page): switches over to the last visualisation mode shown.
	Function (only available on settings page): selects the next adjustable element.
	Function (only available on settings page): selects the previous adjustable element.
	Function (only available on settings page): increases value of the selected element.
	Function (only available on settings page): decreases value of the selected element.
	Function: (only available in the alarm table): scrolls up in the alarm table.
	Function: (only available in the alarm table): scrolls down in the alarm table.
	Function: (only available in the measuring point list): opens the measuring point list for the port engine.
	Function: (only available in the measuring point list): opens the measuring point list for the starboard engine.
	Function: (only available in the measuring point list): scrolls up in the measuring point list.
	Function: (only available in the measuring point list): scrolls down in the measuring point list.



Function: (only available in the measuring point list or in the alarm table): shows / hides legend with explanations for the table column “Kind of alarm".

Function: opens the instrument selection menu. An instrument selected here is deleted, if present. (only available on the “Custom" page. The button can only be selected using the mouse).

Function: opens the instrument selection menu. An instrument selected here is inserted or the form of display is changed (only available on the “Custom" page. the button can only be selected using the mouse).



Function: scrolls up in the table of unacknowledged alarms.

Function: scrolls down in the table of unacknowledged alarms.

OSD menu

The ❷ - ❺ keys to the right of the display have general functions for setting the display (on-screen menu).

Brightness adjustment

The backlighting of the display can be dimmed. On operation of the ❸ or ❹ keys, a bar display appears which indicates the current brightness in %. It is controlled by holding down the keys. The brightness is reduced using the ❸ key and increased using the ❹ key.

Acknowledgement

The ❻ + ❼ keys on the bottom right are for acknowledgement of alarms. Pressing the ❻ key acoustically acknowledges all monitoring devices contained in the system.

The ❼ keys visually acknowledges all alarms that were previously acknowledged acoustically, i.e. flashing alarms change to a permanent signal. All other monitoring devices within the system are also acknowledged in this way.

Windows communication box

The ❻ + ❼ keys also have additional functions for Windows control. Should a Windows communication box appear, the ❻ key enables selection control. The function corresponds to the “Tab" key of a PC keyboard. The ❼ key is used for confirmation and corresponds to the “Return" key.

Data display

The data is visualised on 5 different graphical pages, a page with tabular measuring point lists and an alarm table.

An engine has a total of 35 measuring points. Six measuring points per engine can be enabled on commissioning.

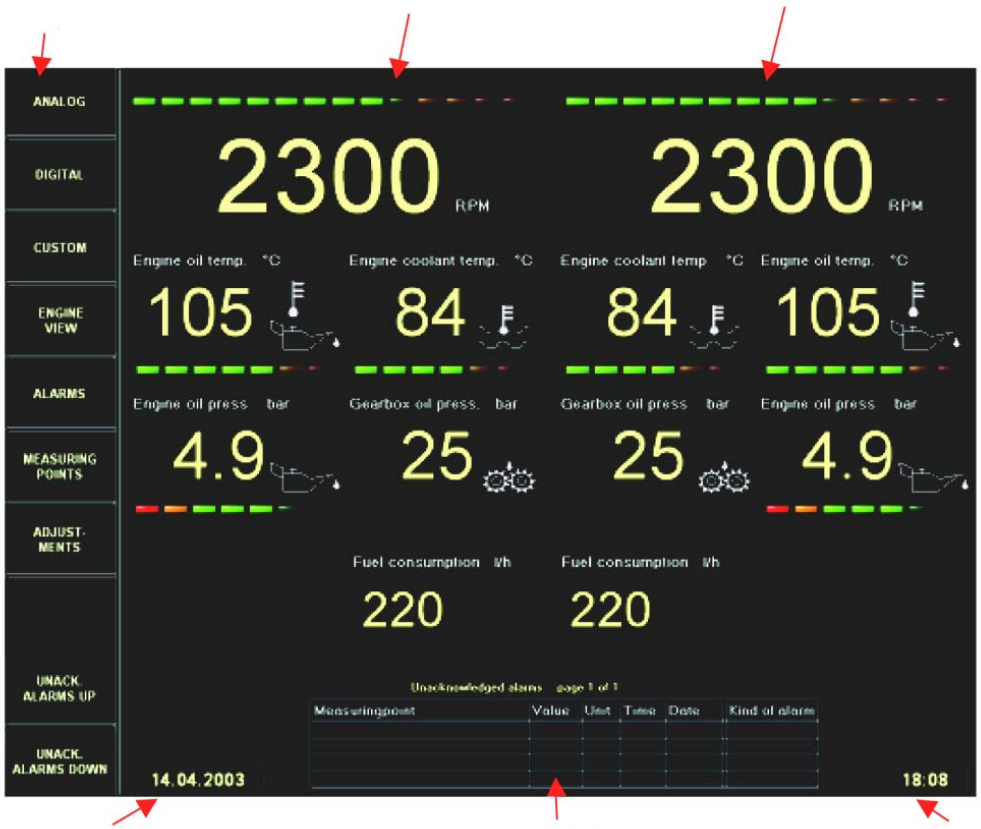
Main menu (start page)

After switching on the system, the start page is shown first of all. The start page can be called up via the “MAIN MENU" function from any other page. The most important measured values of both engines are summarised here and displayed in large digits. The unacknowledged alarms, as well as the date and time, can be found in the lower section.

Description of function keys for software operation

Area for depiction of port engine measuring points

Area for depiction of starboard engine measuring points



Date

Table of all unacknowledged alarms

Time

Figure: start menu

Settings page (Adjustments)

The time and units (metric or imperial system) are set on the settings page. The display of the mouse pointer, as well as the commissioning sensors, can be enabled and disabled here.

This page is only accessible from the “Main Menu" page. Pushing the F7 key opens the settings page.

Values are set using the F5 and F6 function keys. Pushing the F5 (+) key increases the selected value by one; pushing the F6 key (-) reduces the value accordingly. The appropriate key can also be held down to accelerate setting of the time.

The value to be set next is activated with the “NEXT ELEMENT" (F2) button. The “PREV ELEMENT" (F3) button is used to move back one value. The currently selected value is framed in red. Switching back to the main menu page is possible by means of the “BACK" button after completion of the settings. The set values are automatically adopted and stored.

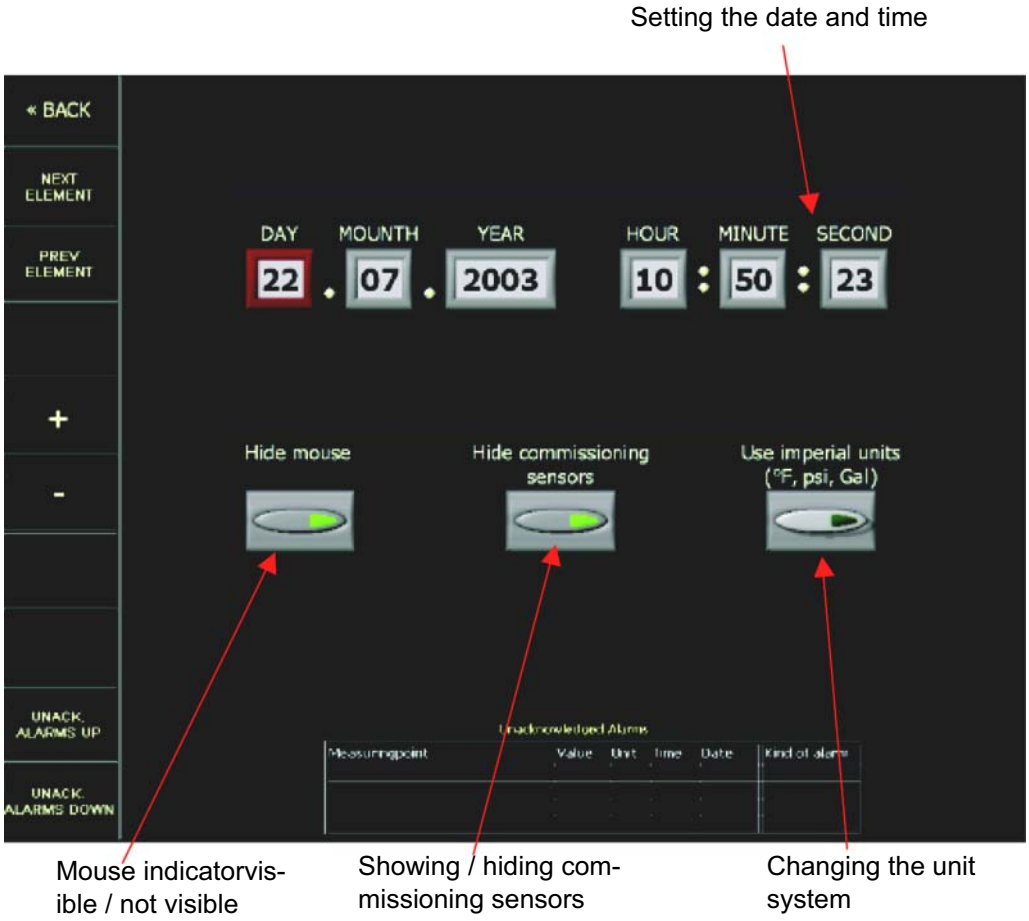


Figure: settings page

Analogue display

This page is opened using the “ANALOGUE" function. The most important engine and gearbox data is visualised as instrument dials in this display. The battery voltage and current fuel consumption are shown digitally. The unacknowledged alarms, as well as the date and time, can be found in the lower section.

Description of function keys for software operation

Area for depiction of port engine measuring points

Area for depiction of starboard engine measuring points

Table of all unacknowledged alarms

Figure: Analogue display

Digital display

This page is opened using the “DIGITAL" function. Important engine and gearbox data is shown here as bar displays. This form of representation enables easy evaluation of the registered data, including how far they are away from limit values, as well as their relationship to other values.

Battery voltage, current fuel consumption and total operating hours for both engines are displayed digitally. In a similar way to the other graphical pages, the table with the unacknowledged alarms is located in the lower area.

Figure: Digital display

User-defined display

The user can configure the instrument range as desired in the user-defined display. All instruments can be defined as regards their size and type of representation. Important measuring points can thereby be highlighted visually. The instruments are available in different forms of display. For example, exhaust gas temperatures can be represented as thermometers or instrument dials; the speed can be shown as an instrument dial or meter.

Binary engine alarms are not available in this display. Alarms are, however, listed in the table of unacknowledged alarms, as on all other pages.

Description of function keys
for software operation

Configurable area

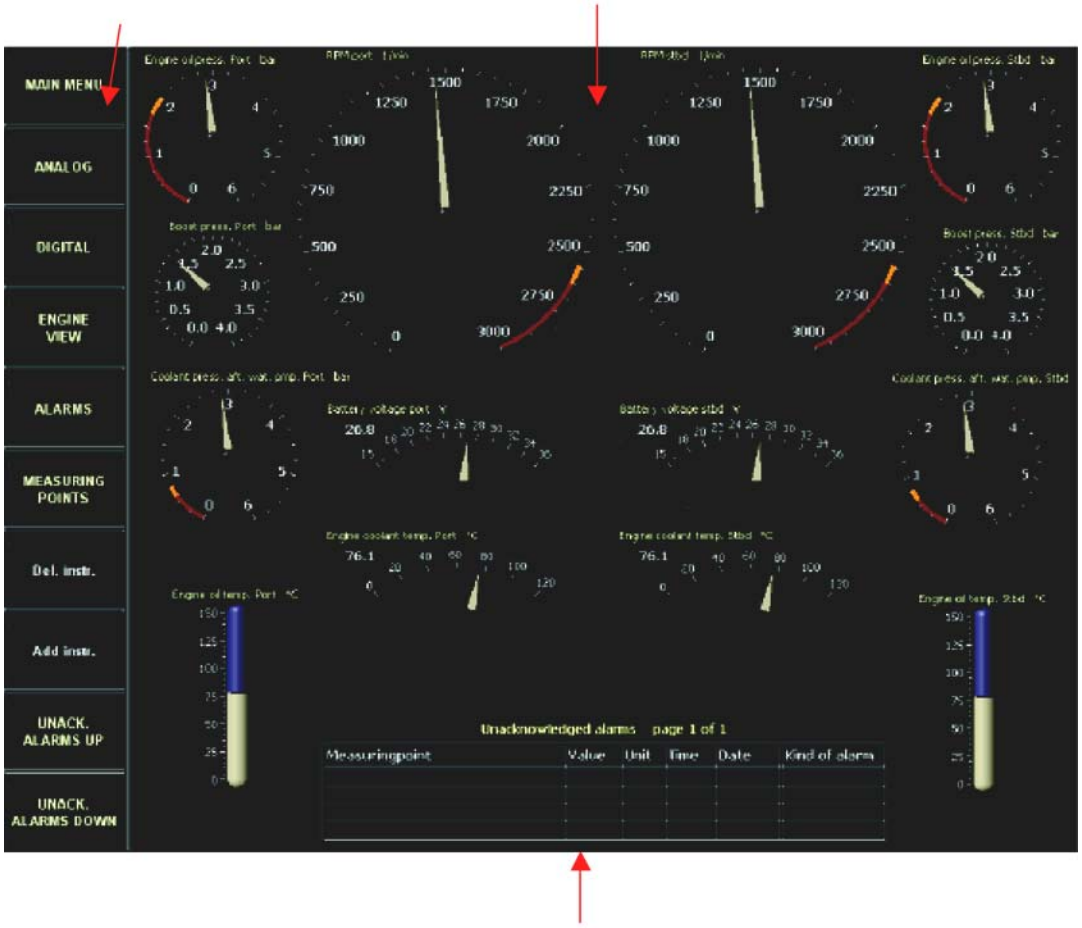


Table of all unacknowledged alarms

Figure: user-defined display (example)

Configuration of user-defined display

A mouse or trackball and a keyboard must be connected to the MMDS-CMS S compact PC in order to configure this display. To insert or delete an instrument, click on the softkeys to open the selection menu on the softkeys (the F7 and F8 keys are disabled here, as a mouse or another pointer devices is required).

Various instruments are available in this menu for the individual measuring points. Selecting an instrument adds or deletes it.

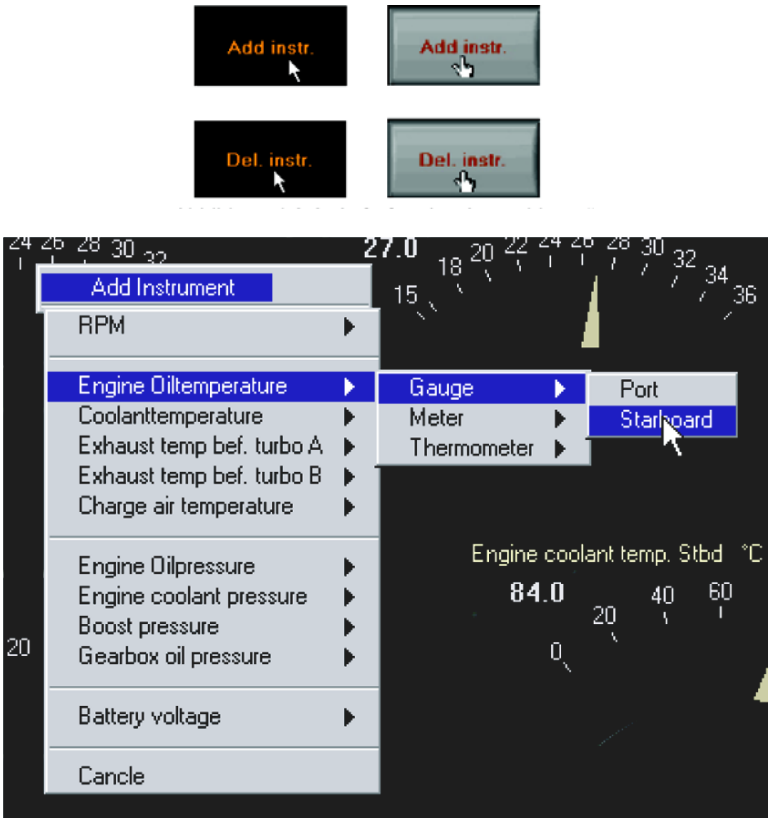


Figure: opening the selection menu

A mouse click on the point is used to configure an instrument.

Figure: click points of the individual instruments

To shift an instrument, click to select it and drag with the mouse button pressed (drag and drop).

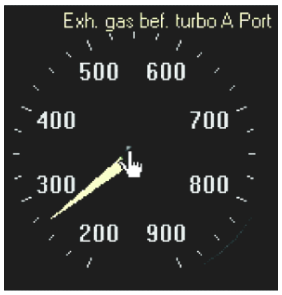


Figure: shifting an instrument

The following configuration window appears on clicking an instrument while holding down the [Shift] key. The size of an instrument can be adjusted here between 250 and 400 pixels. To do this, the orange indicator on the scale is dragged with the mouse or the value is entered directly into the adjacent field. The changes are accepted and the configuration window is closed by clicking the “DONE" button.

Figure: the configuration window

Visual engine display

In the graphical display, the exhaust gas temperatures are shown at the relevant installation positions of the sensors. Other measuring points and binary alarms are located in the lower half of the page shown. The instrument area is divided into two halves. The measuring points for the starboard are arranged in the right half; those for the port are shown in the left half.

As on all pages, the unacknowledged alarms are shown in the lower part.

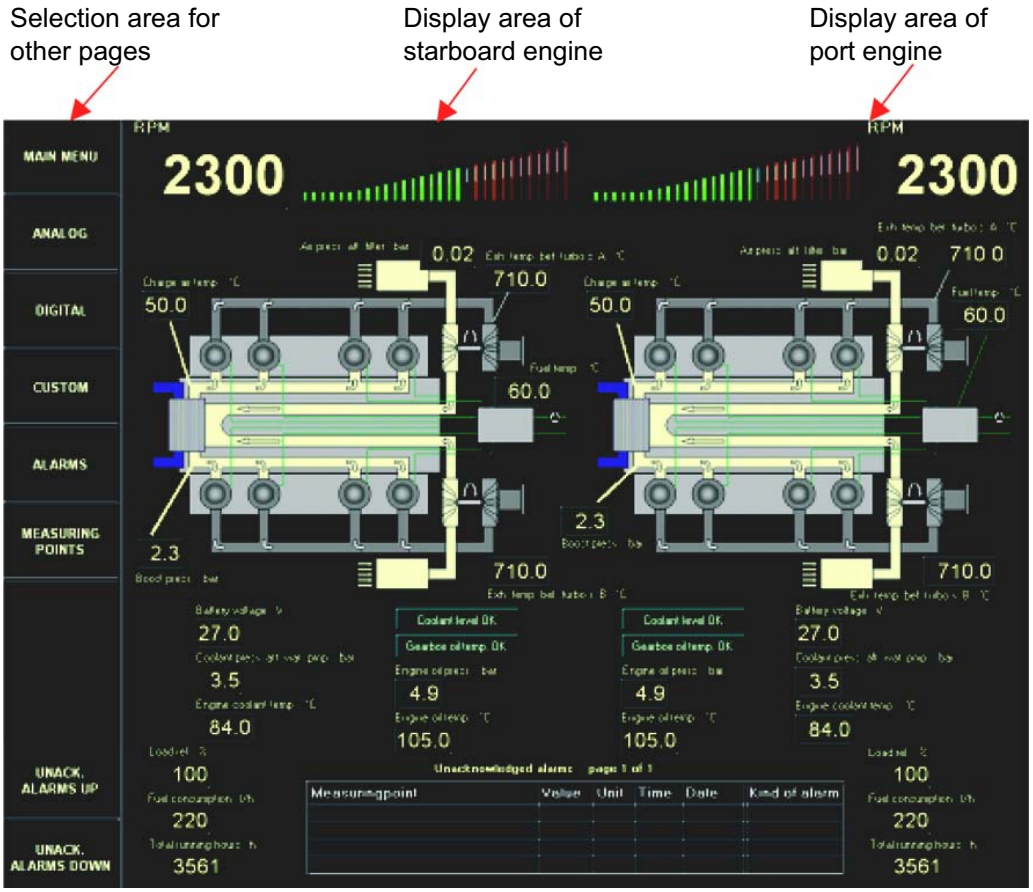


Figure: Visual engine display

Display of all measuring points

List of measuring points

This display shows tables of all the measuring points available in the system. The “ENGINE PORT" and “ENGINE STBD" keys are used to select the list for the respective engine. This view can be opened from all other pages by pressing the “MEASURING POINTS" key. The complete list can be viewed by pressing the “TABLE UP" or “TABLE DOWN" keys. Selection of the “BACK" key opens the last activated view. A legend that explains of the abbreviations can be hidden or shown using “SHOW LEGEND" button.

As on all pages, the unacknowledged alarms are shown in the lower part.

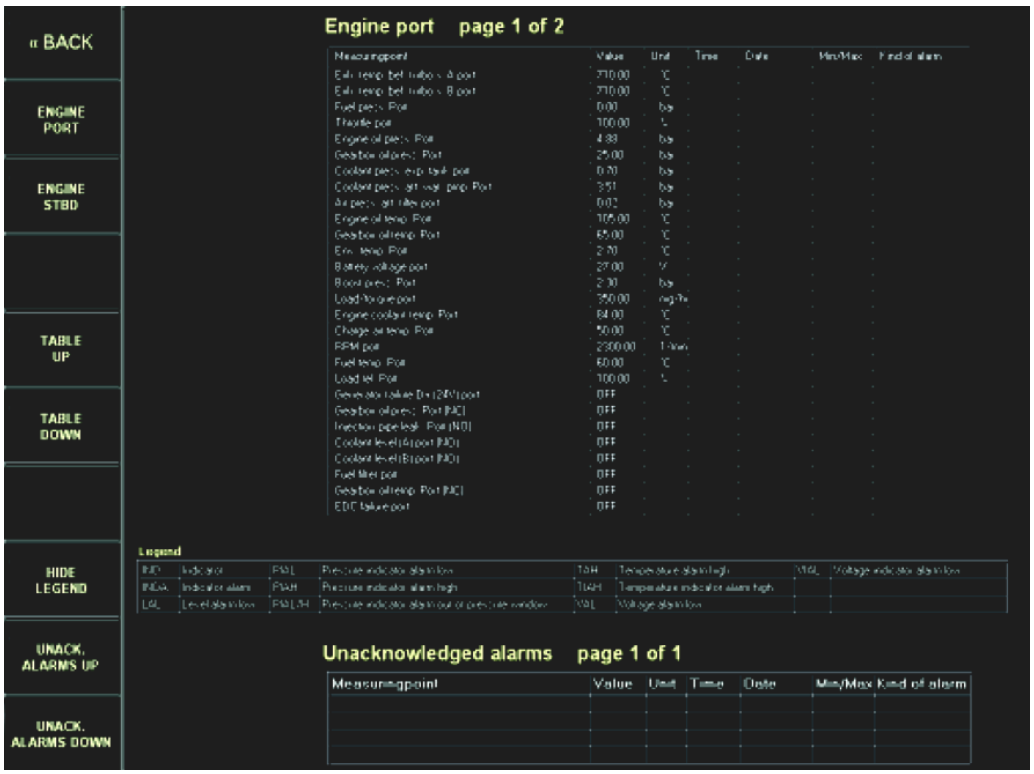


Figure: table with all measuring points and legend shown

Structure of the table

The columns “Measuring point“, “Unit", “Value" and “Kind of Alarm" in the tabular display mean:

Measuring point	Contains the designation of the measuring point
Unit	Contains the unit of the measurement variable
Value	Contains the current measured value
Min / Max	Identification of the type of monitoring of the limit value
Kind of Alarm	The three alarm stages: “Sensor failure", “Warning" or “Main alarm"

List of all measuring points

Each of the two engines has analogue and binary sensors. The measured values are monitored and evaluated by the MMDS diagnostic unit. The data is made available to the PC system via CAN BUS.

Identification of alarm monitoring

The following identifiers are distinguished at “Min / Max":

- NORM Normal state
- XA External alarm
- FAULT Failure alarm
- TIAH Temperature limit value exceeded
- TIAL Temperature limit value undershot
- DTIAH Positive temperature deviation
- DTIAL Negative temperature deviation
- TAH Temperature too high (binary alarm)
- TAL Temperature too low (binary alarm)
- PIAH Pressure limit value exceeded
- PIAL Pressure limit value undershot
- DPIAH Positive pressure deviation
- DPIAL Negative pressure deviation
- PAH Pressure too high (binary alarm)
- PAL Pressure too low (binary alarm)
- LIAH Level limit value exceeded
- LIAL Level limit value undershot
- LAH Level too high (binary alarm)
- LAL Level too low (binary alarm)
- IND Display (analogue input, no limit value control, but failure display)
- BLC Blocked alarm (measuring point blocked by another measuring point)

Alarm and limit value display

Dynamic limit value display

Limit values depending on the speed are represented dynamically by the monitoring system. In the following illustration, the speed was changed at constant oil pressure. The rise in the limit value can be recognised with increasing speed.

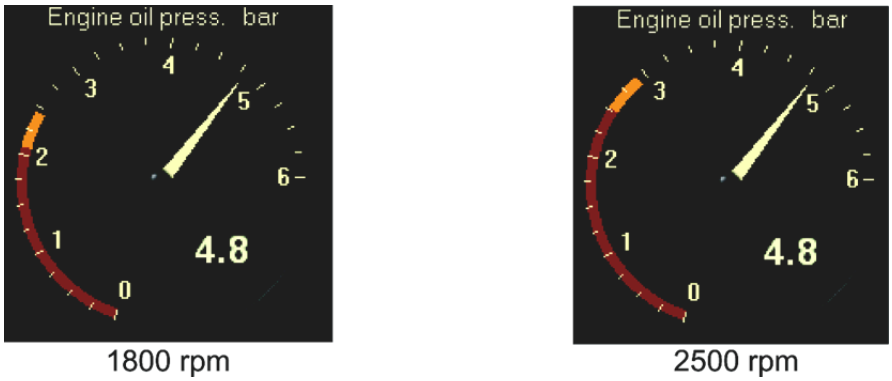


Figure: dynamic limit value display on the oil pressure gauge

Graphical alarm display and alarm acknowledgement

When a state of alarm has been reached, the corresponding instrument starts flashing. In the event of an alarm, the instrument flashes until the alarm state is acknowledged. Two keys to the right of the display are used for the acknowledgement.

Function: acoustic acknowledgement or deactivation of the internal horn. All monitoring devices within the system are acknowledged on operation.

Function: Visual acknowledgement, which means that all flashing alarms switch to continuous light if they have previously been acknowledged acoustically. All monitoring devices within the system are acknowledged on operation.

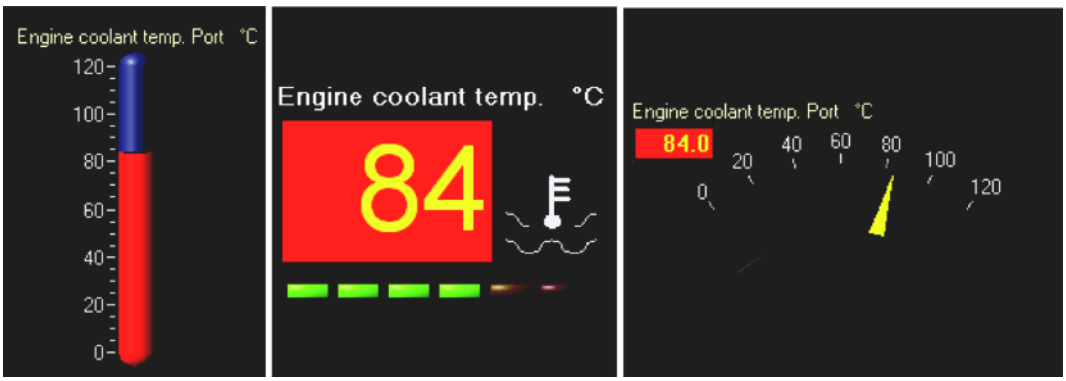


Figure: various versions of the “Coolant temperature" instrument flashing in the event of an alarm

Tabular alarm display

There is a graphical alarm display in parallel to a tabular display. There is an “Alarms" table in the display that contains all alarms and the “Unacknowledged alarms" table with all unacknowledged alarms. Both can be seen in the alarm table. This view is opened from any other page using the “ALARMS" key. An excerpt from the table with the unacknowledged alarms is also found on all other pages.

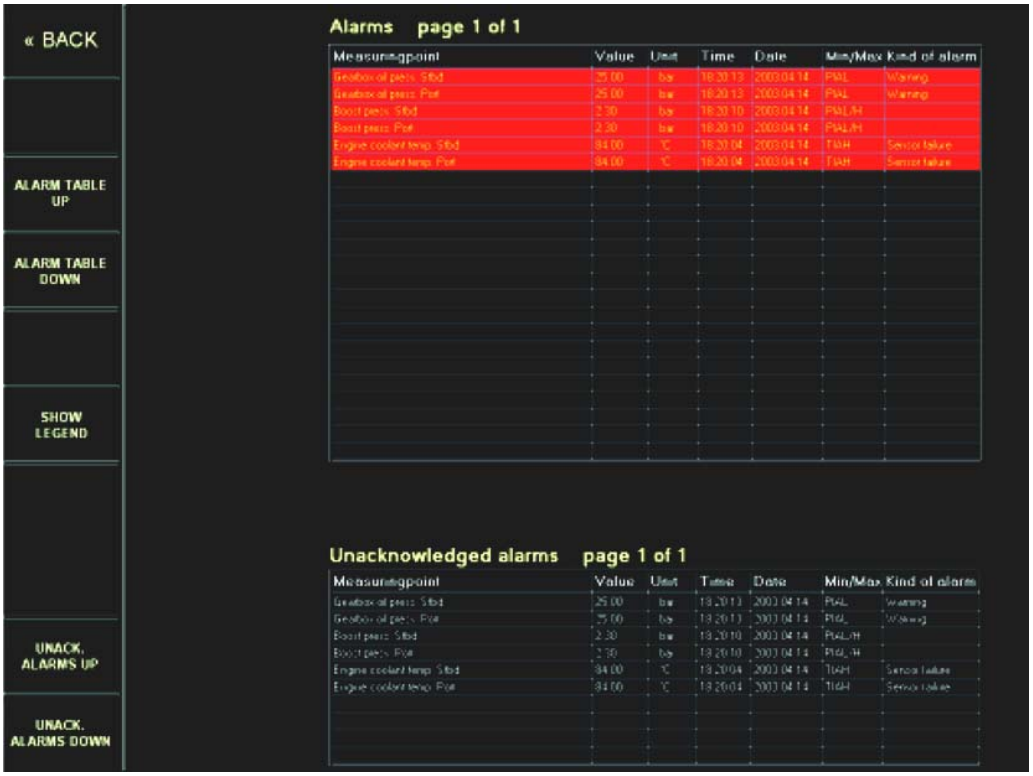


Figure: active alarm table

Structure of the table

The columns “Measuring point", “Unit", “Value", “Time", “Date" and “Kind of alarm" in the tabular display mean:

Measuring point	Contains the designation of the measuring point
Value	Contains the measured value at the time of the alarm
Unit	Contains the unit of the measurement variable
Time	Contains the time the alarm occurred
Date	Contains the date the alarm occurred
Min / Max	Identification of the type of monitoring of the limit value (see chapter “Identification of alarm monitoring" on page 71)
Kind of Alarm	The three alarm stages: “Sensor failure", “Warning" or “Main alarm"

The control options on the alarm table page are identical to those on the measuring point list.

Alarm table and alarm acknowledgement

Each new alarm flashes initially in the top line. Existing alarms move down one line. On acknowledgement, the flashing display of all alarms turns into constant light. If there are more alarms than can be represented, the user can use the “ALARM TABLE UP" and “ALARM TABLE DOWN" keys to scroll up and down. When the source of an alarm has been removed and the alarm has been acknowledged, it is deleted from the alarm table. Two keys to the right of the display are used for the acknowledgement.

Function: acoustic acknowledgement or deactivation of the internal horn. All monitoring devices within the system are acknowledged on operation.

Function: Visual acknowledgement, which means that all flashing alarms switch to continuous light if they have previously been acknowledged acoustically. All monitoring devices within the system are acknowledged on operation.

Table of unacknowledged alarms

The first alarm that occurs is shown in the top line. All following alarms initially appear in the second line and move one line down as other alarms follow. The first alarm can always be found in line 1, simplifying the evaluation of the cause of further alarms. If there are more alarms than can be displayed, the complete list of unacknowledged alarms can be called up using the F9 and F10 keys. The display remains active until the alarms have been acknowledged. All alarms in the table are deleted on acknowledgement. The “Visual ackn" and “Acoustic ackn" keys are used for acknowledgement.

6. Drive lever control Marine Power Control (MPC)

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 Bosch-Rexroth, model Marine Power Control.

This control system has plug connections specially configured for MAN.

Command master

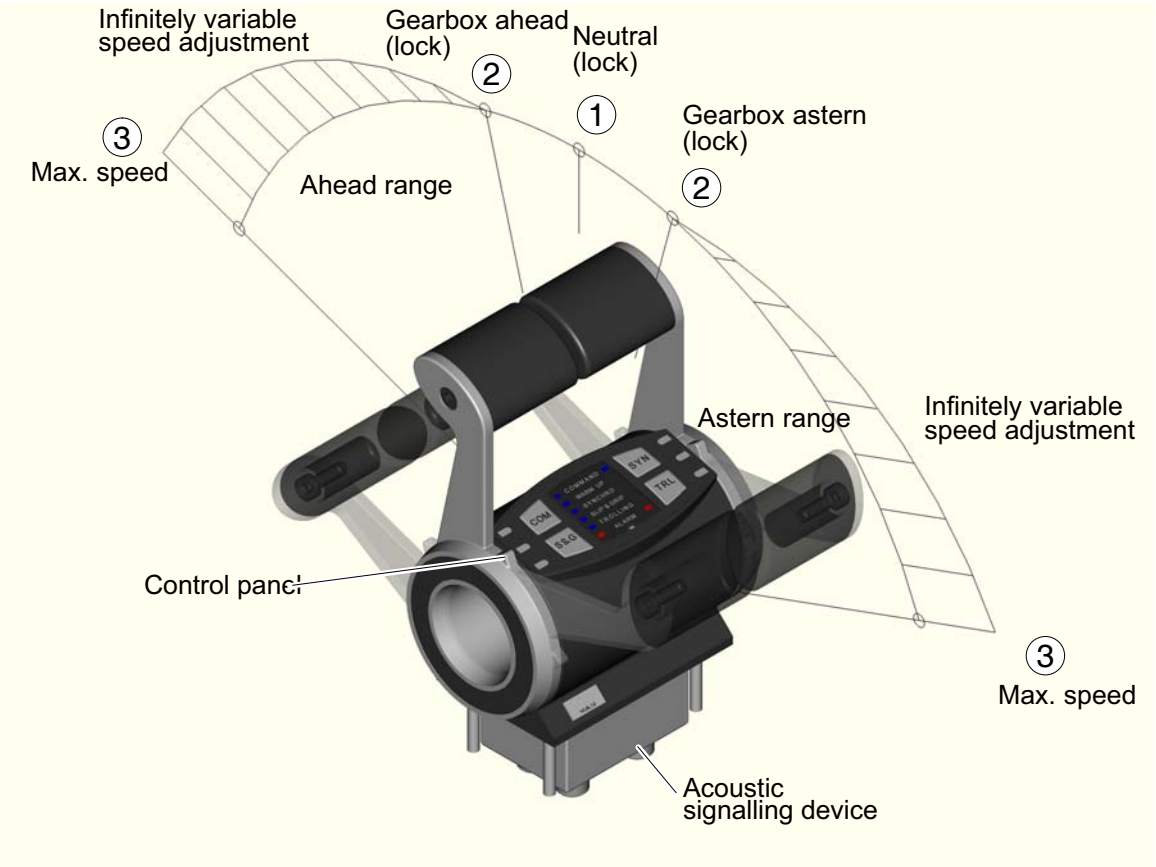
Danger:
Incorrect function due to damaged control head!
Humidity may ingress into the damaged control head. The vessel can then no longer be controlled correctly.
Inspect the control head for visible damage before every operation of the vessel.
Do not set out with a damaged control head.

Caution:
Danger! Do not secure or lean on the lever.
Undesired engine speed change and breakage of the lever is possible.
Never use the control head or the lever as a hand hold.
Do not lean against the control head.

Caution:
Damage can result from pointed objects!
Destruction of the covering film is possible. Dampness can then ingress and lead to control fault functions.
Do not use pointed objects to operate the control buttons.
Do not cover the control head in use with a protective hood.

The control head is used to control engine speed and the gearbox.
The operation takes place via the control lever and four buttons.
On twin engine installations the left control lever operates the port engine and gearbox and the right lever the starboard engine and gearbox.
On single engine installations the handle on the control lever is the universal control.

Function



“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)

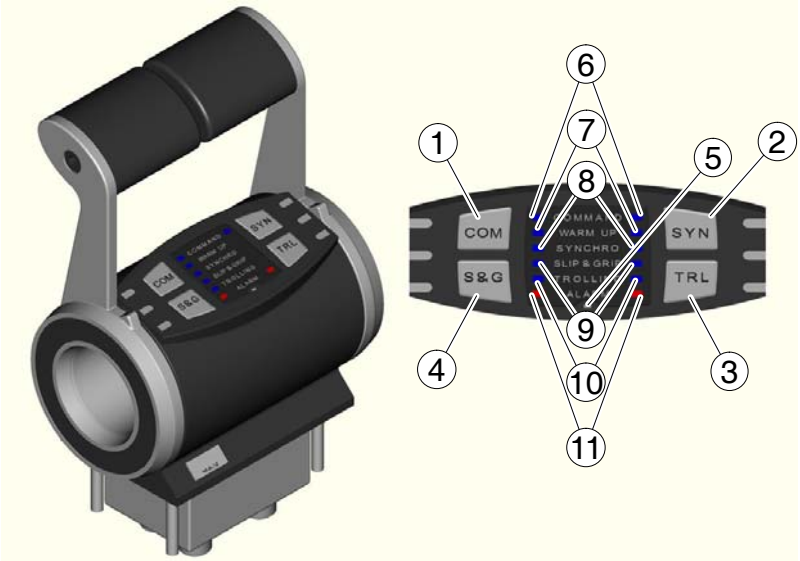
In this lever position, two different functions are possible.

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. 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 “Forward and Reverse Range". Between positions (2) and (3) the engine speed can be set variably. The gearbox clutch is engaged to “Forward" or “Reverse".

Control panel - Control head for twin engine installations



(1) Button COM
(2) Button SYN
(3) Button TRL
(4) Button S&G
(5) Brightness sensor
(6) LED COMMAND
(7) LED WARM UP
(8) LED SYNCHRO
(9) LED TROLLING
(10) LED SLIP & GRIP
(11) LED ALARM

Description of buttons

Button	Function	see
	Request command	“Activate control console", see page 79
	Accept command	“Change control console", see page 80
	Engine warm up	“Engine Warm Up", see page 81
	Acknowledge alarm	“Acknowledge alarm", see page 86
	Adjust brightness of LEDs	“Adjust brightness" see page 85
	Automatic synchronisation of the engine speeds for twin engine layouts	“Synchronise engine speed", see page 81
	Switch on and off the “Slip & Grip" operating function	Switch “Slip & Grip on and off", see page 85
	Switch on and off the “Trolling" operating function	Switch “Trolling on and off", see page 84

Description of LEDs

LED	Function	Separate display for port and starboard engine
	Flashes slowly: Command requested, Handover not possible Flashes rapidly: Command requested, Handover possible Continuously lit: Command active	yes
	Continuously lit: Engine speed adjustment possible Gearbox “Neutral"	yes
	Flashes: Speed synchronisation is in stand-by-mode Continuously lit: Speed synchronisation active	no
	Continuously lit: Trolling active	no
	Continuously lit: Slip & Grip active	no
	Continuously lit: Alarm	yes

Description of acoustic signal transmitter

Warnings and alarms can be reproduced via the acoustic signal transmitter..

Interval signal tone	Event	Meaning
fast	actuation of the button 	Handover of the control console possible
slow	Initialisation of the connected control	Handover of the control console is requested
	actuation of the button 	Handover of the control console not possible
Continuous tone	Fault alarm of the connected control	Alarm

Activate control console

If the control is switched on via the master switch, first all control consoles are initialised.
This is indicated by a slow flashing LED on each control console.

- 
- and an unbroken acoustic signal.

During the initialisation
- the control consoles are inactive and
- the vessel cannot be controlled from any control console.

Select control head

Select the control head by actuating  the button.

TheLEDs and signal tone stop on all other control consoles.

If the levers are not in the “Neutral“ position, the LEDs continue to flash  and the signal tone remains the same.

If necessary, place the lever in the “Neutral" position.

The LEDs  now flash quickly and the signal tone is faster.

Extinguish the LEDs by  pressing the button again  .
The control console is active and the engine can be started.

Change control console

Note:
The control console can only be changed, when no directional change is taking place in the gear-box.

Current control console	Control console to accept control
"Ahead range"	“Ahead" range or “Neutral"
“Neutral" range	Neutral
Astern range	“Astern" range or “Neutral"

In order to activate a passive control console, the control head must be selected and then the selection confirmed. The active command remains with the active control console, until the selection is confirmed.

Select the control head by actuating 

the button.

If the levers are not in the “Neutral position, the LEDs flash 

slowly and the signal tone is likewise slow.

Adjust the lever of the control head according to the table.

The LEDs 

flash quickly and the signal tone is likewise fast.

Confirm the control head by pressing the button again. 

The LEDs 

go out and the signal tone stops.

The requested control console now has active command, the previously active control console is passive.

If the button 

to confirm the change of command is not pressed within 15 seconds, the change of control console terminates.

Note:
If the “COM" button to confirm the change of command is not activated within 15 seconds, the change of control console terminates.

Engine Warm Up

Caution:
Do not exceed the permissible highest engine speed.

Note:
On vessels with twin engine drive the port and starboard engines can be warmed up independently.

Start the “Warm Up" function

1. Set the respective control head in the “Neutral“ detent.
2. Press 

and hold the button.
3. Set the respective control head lever in the “Ahead" or “Astern" position.
4. Release the 

button.

The “Warm Up" function is activated. The respective LED 

lights permanently. The engine speed corresponds to the lever setting, the gearbox remains disengaged.

Exit the “Warm Up" function

The “Warm Up" function is stopped by moving the lever to “Neutral".

Synchronise engine speeds

On twin engine layouts the option exists to synchronise the speeds of the propulsion engines.

The “Synchro" can be used

- to control all engines at the same engine speed,
- or to set the engine speed of all engines using one lever (Master)

In this instance the master system takes over the control of the slave system.

Note:
The engine speeds can also be synchronised in the “WARM UP“ mode. This is useful, for example, when it is required to apply identical control of the engines with reference to the tachometers.

Control engines at the same engine speed

1. Set both levers in the range between “Ahead" and “Full ahead" (max. deviation of the levers from each other 10%).
2. Press 

button.

   Both engines are regulated to the same engine speed. The LEDs 

light.

> **Note:**
> If the levers are moved out of synch. with each other by more than 10%, then the “SYNCHRO" mode reverts to Stand-by mode. As soon as the levers are again positioned less than 10% away from each other, the synchronisation becomes effective again.

Adjust engine speeds with a single lever

1. Position the lever in the “Ahead" detent.
2. Press 

button.

   The LEDs 

light. Both engines are engaged at idle.

Increase speed of all engines:

3. Push the lever of the master system forward.

   The LED 

of the master system remains lit, the LED of the slave system goes out.

> **Note:**
> If the speed of the slave system is increased, the “SYNCHRO" function reverts to the Stand-by mode. As soon as the levers are again positioned less than 10% away from each other, the synchronisation becomes effective again.

and

1. Set both levers in the range between “Ahead" and “Full ahead" (max. deviation of the levers from each other 10%).
2. Press 

button.

   The LEDs 

light. Both engines are engaged.
3. Move the lever of the slave system quickly to the “Ahead" detent.

   The LED 

of the master system remains lit, the LED of the slave system goes out.

If the slave system lever is moved too slowly, then the “SYNCHRO" function reverts to the Stand-by mode.

Both LEDs light, 

because the port and starboard sides are not synchronised.
As soon as the levers are again positioned within 10% of each other, the process is repeated.

Switch offsynchronisation

Danger:
On switching off the synchronisation, the speeds of both engines revert to the speeds set by the respective levers. The direction of travel of the vessel changes if the lever settings are not identical.

Press 

button. The synchronisation is deactivated.

Note:
The synchronisation also switches off, if at the active control console one lever is set to “Neutral" or “Astern".

Switchtrolling on and off

Control of the propellor slip of a trolling transmission can be specified with the “Trolling" function. Thus the propulsion of the vessel can be reduced when manoeuvring.

Prerequisite: The vessel must be equipped with a trolling transmission.

Danger:
On activating the trolling function a reduction in engine speed may result. On deactivating the trolling function an increase in engine speed may occur.

Switch on trolling

1. Set the levers at the active control console to the “Neutral" detent.
   The gearboxes are now disengaged.
2. Press 

button.

The LEDs 

light. The “TROLLING" transmission function is activated.

Navigate with trolling

When the lever is at the “Ahead" or “Astern" detent,

- the slip in the trolling transmission is a maximum,
- the propulsion of the vessel is almost non-existent.

When the lever is at the “Ahead" or “Astern" detent,

- the slip in the trolling transmission is minimal,
- the propulsion of the vessel is of a similar order of magnitude as in normal operation at idle.

Switch off trolling

1. Set the levers at the active control console to the “Neutral" detent.
   The gearboxes are now disengaged.
2. Press 

button.

The LEDs 

go out. The “TROLLING" transmission function is deactivated.

Switch SLIP & GRIP on and off

Prerequisite: The vessel must be equipped with a trolling transmission.

The transmission function “SLIP & GRIP“ is a combination of trolling in the lower lever range and normal operation in the upper lever range. This enables a more precise control of vessel speed at slower speeds. However, maximum speed can be selected at any time.

Danger:
On switching off the “SLIP & GRIP“ the vessel can undergo moderate accelerations.

Switch on Slip & Grip

1. Set the lever on the active control console in the “Neutral" detent.
2. Press 

button.

The LEDs 

light.

Switch off Slip & Grip

The “SLIP & GRIP" transmission function can be switched off at any lever position.

1. Press 

button.

The LEDs 

go out.

Adjust display brightness

Switch over between day and night mode

Hold button 

pressed and 

press briefly.

A repeated brief press of the button 

always switches between the day and night mode.

Continuously adjust display brightness

Hold 

button pressed and 

wait until the brightness of the display changes.

- When the display becomes brighter, you can adjust the display brightness up to maximum brightness.
- When the display becomes darker, the brightness first reaches the minimum brightness and then becomes brighter again. The display brightness can then be adjusted up to maximum brightness.

Reverse dimming direction

Hold button pressed 

and 

press in order to continuously adjust the display brightness.

Release button 

briefly and then press again.
The dimming direction reverses.

Acknowledge alarm

Alarm messages are optically displayed to all control consoles simultaneously, irrespective of whether the control console is active or passive. The acoustic signal is only output at the active control console.

Switch off acoustic signal

1. Press 

the button at the active control console.
2. Eliminate the cause of the fault message.


Danger:
Under certain circumstances the vessel is no longer manoeuvrable in the event of an alarm message!

On vessels with twin engine drive the port and starboard engine alarm messages are displayed independently of each other.

The following alarm messages can occur:

Message	Meaning
Alarm lamp without signal tone	Warning Remote control fault, which does not have a direct effect on the controllability of the drive system, e.g. control head of another control console damaged.
Alarm lamp and continuous signal tone	Alarm Control of the vessel is restricted or is even no longer possible, e.g. active control head damaged.

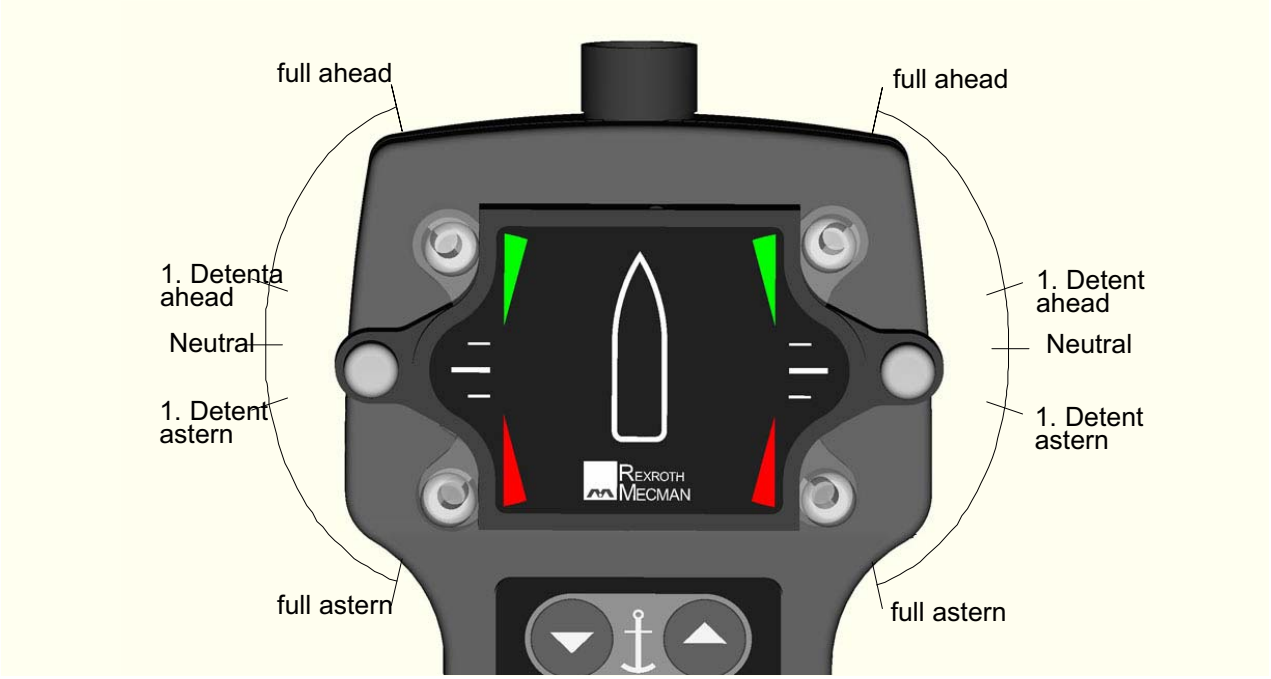
Fault table

Fault	Possible cause	Remedy
Uncontrolled behaviour of the vessel	Surface visibly damaged, water has penetrated the unit.	Replace device.
The “WARM UP" function will not start.	Lever does not remain in the “Neutral" detent.	“Warm Up" chapter, see page 81.
The “TROLLING" function will not activate.	Lever does not remain in the “Neutral" detent.	“Switch trolling on and off" chapter, see page 84.
The “SLIP & GRIP" function will not activate.	Lever does not remain in the “Neutral" detent.	“Switch SLIP & GRIP on and off" chapter, see page 85.
Control head does not react to lever movements.	Command head potentiometer is defective.	Replace device.
	Control head is not activated.	“Change control console", see page 80.
	No internal system voltage.	Check and restore Internal system voltage.

6.1. Mobile navigating console

The mobile control console serves to extend freedom of movement. The control signals are transferred to the MPC via a cable.

The two command master levers are used to set the engine speed and the gearbox position (forwards, neutral, reverse).



As an additional user interface the following operating elements are provided:

Description of the operating elements:

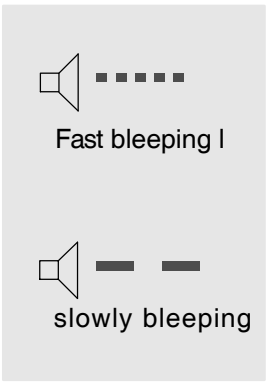
General:

After switching on the supply voltage for the Mini-Marex system and the entire system of the mobile navigating console, all correctly functioning command masters are in the state 'lamp test' (all LEDs and buzzers on). The lamp test is terminated automatically after a short time and the standard takeover procedure begins. At each navigating console, pressing the Command button once requests the command. Pressing the Command button again takes over the command.

Command push-button:

Pressing the button 

requests the command takeover for the mobile navigating console. This state is indicated by the two Command LEDs flashing and the buzzer sounding.



- The two LEDs and the buzzer will be flashing respectively bleeping fast if command transfer is possible. The command may be transferred by pressing the push-button 

once again.
- The two LEDs flash and the buzzer beeps slowly when no command takeover is possible. An error cause can be that the command master levers are not located in the same range of the active navigating console.

Steady lighting of the two command LEDs signal the transfer of command. In this mode of operation the buzzer is turned off. The hand-held remote control is now active and can give commands.

Special function “Warming Up"

The “Warming Up" function can be used to set a specified speed without shifting the gearbox. This function is required to warm up the engines.

To enable the “Warming Up" function, press the 

button and simultaneously place the lever in Forwards or Reverse. The button can then be released. To switch off, return the lever to Neutral. The 

button must not be pressed here.
If the function “Warming Up" is active, the command LED will be flashing.

☞ Warm-up function can be switched on and off independently for each side. The command LEDs are assigned to the corresponding levers.

Trolling push-button:

The  button can only be pressed in neutral position of the command master levers. The function is activated by pressing the  button and is indicated by the Trolling LED lighting up.

Pressing the  button again (the command master levers must also be in neutral position) switches off the trolling function..

Synchronising:

The command can also be adopted by the mobile navigating console when the active navigating console is in the synchronisation mode.
Here, the synchronisation mode is retained at the mobile navigating console and the LED on the Trolling button flashes. A neutral position of one of the two command master levers switches off the synchronisation.
The synchronisation cannot be switched on at the mobile navigating console; it can only be taken over from the active navigating console.

Dead man's switch:

The supporting loop of the dead man's switch at the hand-held remote control is to be looped around the user's wrist during operation of the hand-held remote control. In case of loss of the hand-held remote control the pin fixed at the supporting loop will be torn out off the hand-held remote control so that the vessel's propulsion will be turned off. In this way an uncontrolled manoeuvring of the vessel is avoided.

The dead man's switch has a function in active as well as passive mode of the hand-held remote control!

activeoperating mode	By tearing off the dead man's switch the engines are set down to idle speed and the gears are shifted into neutral position. This state will be signalled by lighting up of the two alarm LEDs and bleeping of the buzzer. In order to re-obtain command the following steps have to be carried out: 1 Acknowledge error message by means of command push-button (consequence: buzzer off). 2 Plug dead man's switch back into the designated bushing. 3 Move both control head levers to neutral position. Subsequently, the alarm LEDs will cease to be lighted and the hand-held remote control has command again.
passiveoperating mode	When requesting command without a dead man's switch being provided the following error messages will occur: 1 Both alarm LEDs will be lighted. 2. The buzzer sounds. 3 The two command LEDs will be slowly flashing. Only after plugging the dead man's switch back into the designated bushing command can be taken over.

Bow and stern thruster push-buttons:

Pressing a thruster button switches on the corresponding thruster. Releasing the button terminates the function.

☞ All relay outputs are available at the same time.If, for example, the push-buttons for starboard and portside bow thrusterare activated at the same time, accordingly both contacts will be closed.

Anchor winch push-buttons:

The anchor winch buttons are used to raise and lower the anchor. The operation is terminated when the button is released.

☞ All relay outputs are available at the same time. If, for example, the push-buttons for anchor winch upwards and downwards are operated at the same time, accordingly both contacts will be closed.

Safety stop push-button:

Caution:
The safety stop push-button is also effective in case of an inactive hand-held remote control!

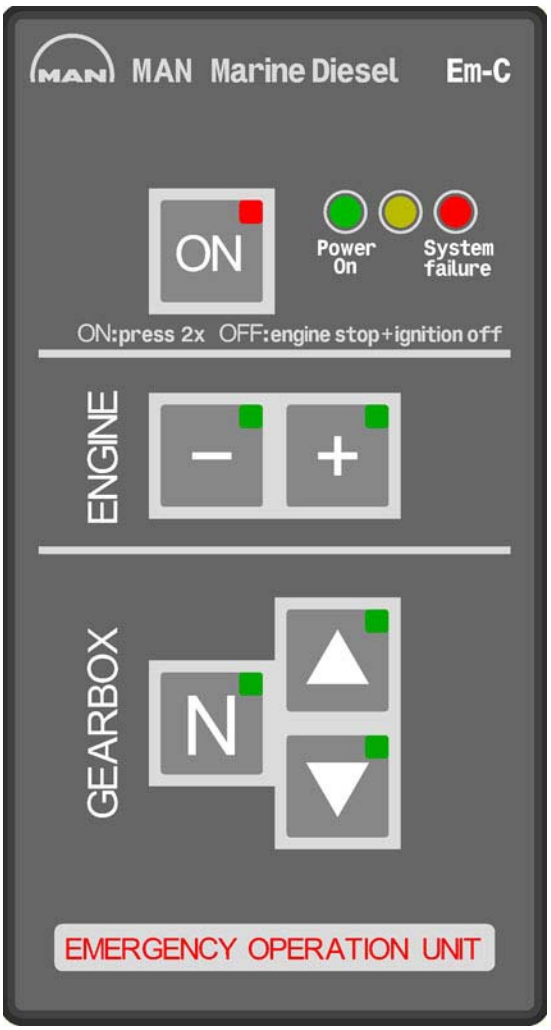
A safety stop button is available for both the port and starboard sides (see Chapter 1, page 26).
The engine is stopped immediately by actuating the safety stop button.

7. Emergency operation unit::

The emergency operation control system - Em - is conceived as a simple engine speed and gearbox control system which enables safe continuation of a trip in the event of a failure in the electrical control lever system.

The operation unit for emergency running control is preferably integrated next to the throttle lever in the bridge console. For safe marine operation, the front buttons must be easily accessible. When the ignition is on, emergency running can be activated by way of appropriate function buttons. A green LED indicates operational readiness.

Operation is effected by way of six front buttons, which light up when a requested status is achieved and thus indicate the relevant operating or actual status.



Key	ON	Activate emergency operation
Key	N	Shift gearbox to neutral position
Key	▲	Shift gearbox to forwards position
Key	▼	Shift gearbox to reverse position
Key	+	Increase engine speed
Key	−	Decrease engine speed

LED Power On indicates the presence of supply voltage when the ignition is on

LED System Failure indicates failure status by flashing or with continuous light

Operating the emergency operation unit

Requirements for operation / activation / deactivation:

- The emergency running control system should be only activated while the engine is running. Otherwise the “System Failure" LED flashes to indicate there is no engine speed signal
- The engine should be shut down via the ignition lock

When the emergency stop button is pressed, the “System Failure" LED on the Em-C operation unit lights up when the ignition is simultaneously on as the active systems EDC engine control and emergency running unit are shut down by the emergency stop.
The “System Failure" LED goes out after the emergency stop button has been released.

Operation / function of emergency operation unit in operation:

Enabling emergency operation unit

The system is ready for operation once the ignition has been turned on. This is indicated by the green “Power-On" The red LED (Failure) must not light up. The emergency running system can now be activated by pressing the 

button twice:

Pressing the button for the first time requests emergency running mode. The button flashes cyclically for approx. 6 seconds and an acoustic signal is issued. During this time, the request must be acknowledged by pressing the button for a second time. The button lights up permanently once the changeover to emergency running mode has taken place.

If there is no acknowledgement by pressing the button for a second time, the system returns to the initial setting (operational readiness).

Note:
Once the emergency running system has been activated, it is only possible to switch back to normal throttle lever mode by shutting down the engine (ignition “OFF" for at least 3 seconds)!

Gearbox control

When emergency running mode is active, the gearbox is engaged in the neutral, forwards or astern positions by means of 3 button functions:

Key		Shift gearbox to neutral position
Key		Shift gearbox to forwards position
Key		Shift gearbox to reverse position

Gearbox reversal will only take place when the engine speed is in the idle range.
It is advisable always to engage the gearbox in neutral first prior to a reversal operation.
If however the operator requests a reversal e.g. from forwards directly to astern (or vice versa) and the engine is at a higher speed, the engine is automatically set to idle speed prior to each active reversal operation.
The relevant pressed button flashes until the desired status is reached.
It goes out when another control command is given or lights up permanently to indicate that gearbox reversal has taken place (indication of actual status).

Engine speed control

Once the gearbox is engaged in the forwards or reverse position, the current engine speed can be increased or reduced by means of 2 button functions:

Key		Increase engine speed
Key		Decrease engine speed

As long as the + or - keys are pressed (“insert button symbol"), there is a continuous change in the engine speed.
The increase or alteration rate is 50 revolutions / seconds.
Each individual short pressing of a button brings about a speed change of 10 engine revolutions.
The engine speed is restricted downwards to the idling speed and upwards to the maximum permitted engine speed.

Deactivating emergency running mode

Emergency running mode is always deactivated only after the engine has been shut down, it is necessary for the ignition to have been turned off for at least 3 seconds.
When the ignition is turned on again, normal throttle lever mode is always activated first, i.e. the emergency running system must be reactivated as required.

Fault messages

Two LEDs on the Em-C operation unit (green “Power On" LED and red “Failure" LED) are used to differentiate between various failure states:

Green LED off and red LED off
Ignition off or no supply voltage (emergency running mode not possible)

Green LED on, red LED flashes without another operator button also flashing
Drop-out of internal speed signal (function with delayed reversal times nevertheless still possible)

Green LED on, red LED flashes together with forwards button
Failure after gearbox reversal into forwards direction (this propulsion direction can no longer be activated)

Green LED on, red LED flashes together with astern button
Failure after gearbox reversal into astern direction (this propulsion direction can no longer be activated)

Green LED and red LED permanently on
System failure or no communication between Em-C and Em-R. (emergency operation not possible)
Em-R is the receiver component in the terminal box.

Failure states which are indicated by flashing on the Em-C operation unit must be cancelled with the **key**  after the fault has been rectified. The failure indications continues to flash until it is cancelled.

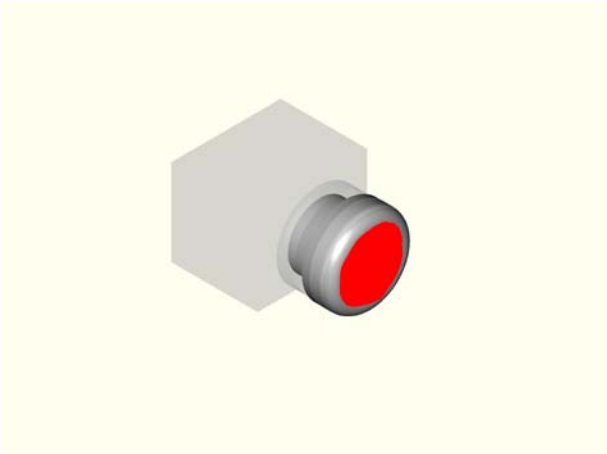
7.1. Override button

The Override button with LED is available as an option and is installed as an external button in the area of the navigating consoles. A separate Override button is required for each engine.
Pressing the Override button after an alarm has reduced the engine speed recovers the original power output of the engine.
The Override button may be used **in emergencies** exclusively to protect the health and lives of the crew.

Function:
If the engine output has been reduced due to an alarm, there is the possibility to press the Override button **once (LED on)** and recover the original power output of the engine. If there is another reason for power output reduction on the engine, this does not trigger a power output reduction of the engine.
The function remains active until the Override button is pressed **again (LED off)** or the engine is shut down via the ignition (off position).

Urgent recommendation:
Determine the cause of the drop in power output (alarm)!

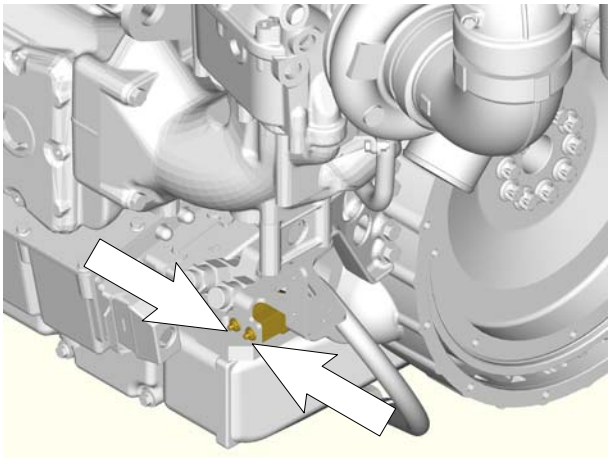
If pressing the Override button leads to engine damage, this is not covered within the framework of MAN' liability for defects.



Override button

Main fuses for voltage supply + / - to the engine

Two main fuses with 50 A are fitted at the engine; these trip in the event of overcurrent or short circuit.
If a fuse as blown, the engine can no longer be started.
The fuses can be reset by the operator using the keys fitted.

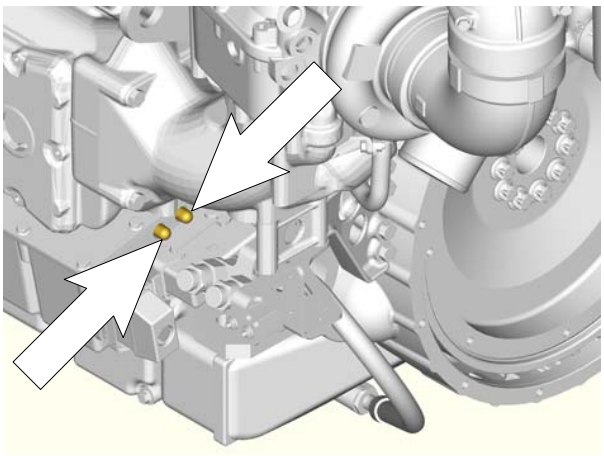


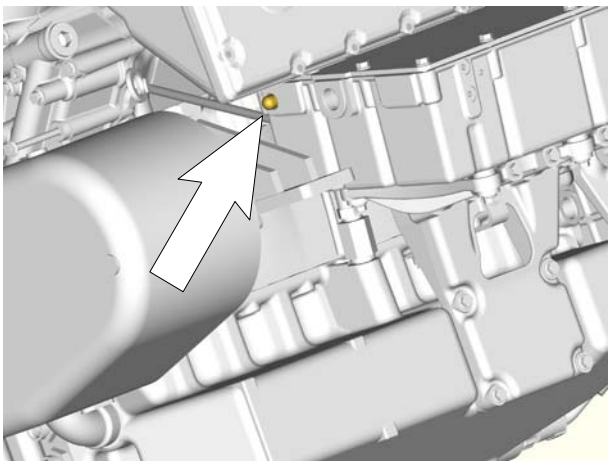
Main fuse on the control unit carrier EDC

A further 3 main fuses (arrow) are installed on the control unit carrier.

These fuses blow in the event of overcurrent or short circuit.

The fuses can be reset by the operator using the keys fitted.





Shutting down

Do not switch off engine immediately operation at high loads, but let it idle for about 5 minutes to achieve a temperature equalisation.

Set the deck switch to “Neutral" and switch off the engine by means of the ignition key or Ignition button.

Remove key from starting lock.

Danger:
Ensure that the engine cannot be started by unauthorised persons.

Lubrication system

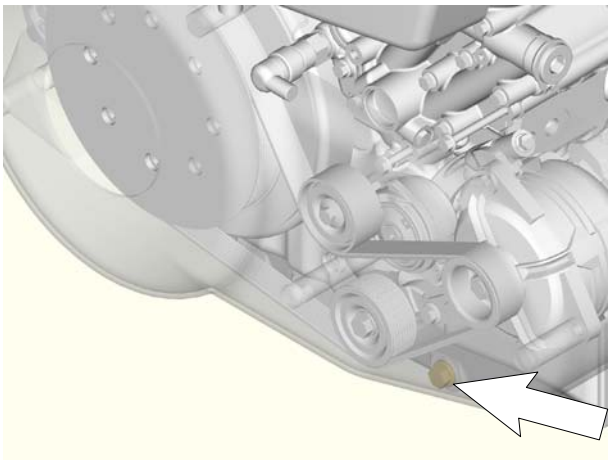
Ensure utmost cleanliness when handling fuels, lubricants and coolants.

Caution:
Use only approved fuels, lubricants etc. (see brochure Fuels, lubricants etc."). Otherwise the liability for defects will become null and void!

Refilling with oil

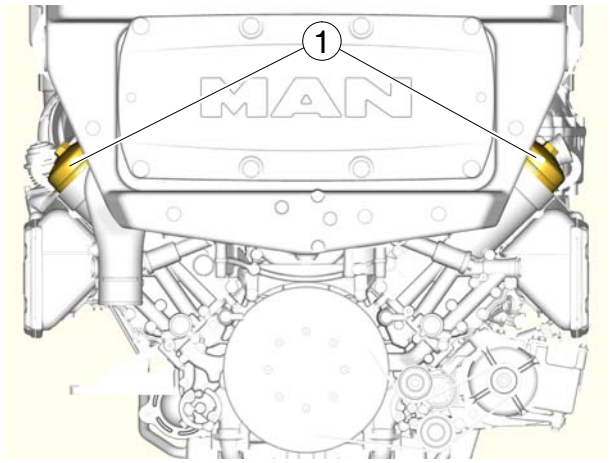
Danger:
The oil is hot-risk of scalding. Do not touch the oil drain plug with bare fingers. Oil is an environmental hazard. Handle it with care!

With the engine at operating temperature, remove the oil drain plug 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.



Note:
Change the oil filter elements every time the engine oil is changed.

Loosen oil filter cover (1) and unscrew it from the oil module by 2-3 thread turns. The engine oil now runs from the oil module into the oil pan.

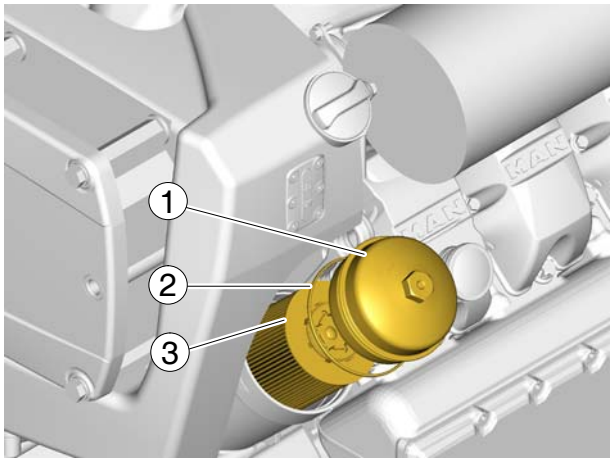


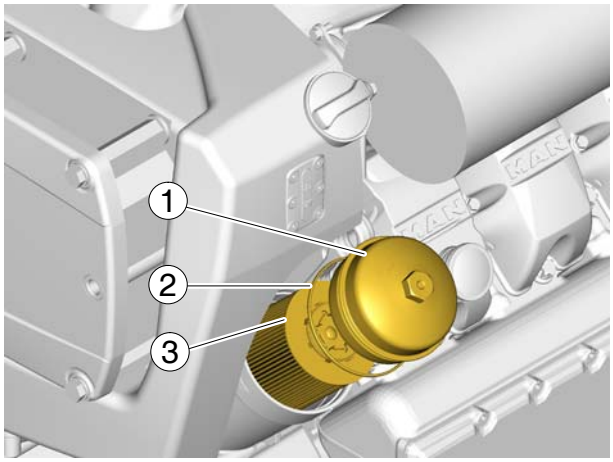
Caution:
Allow the engine oil to run out without residue, or otherwise engine oil can flow from the unfiltered area into the filtered area.

Unscrew the oil filter cover (1) and remove it, together with the oil filter insert (3).
Remove the oil filter insert (3) from the oil filter cover. Remove the sealing ring (2) from the oil filter cover.

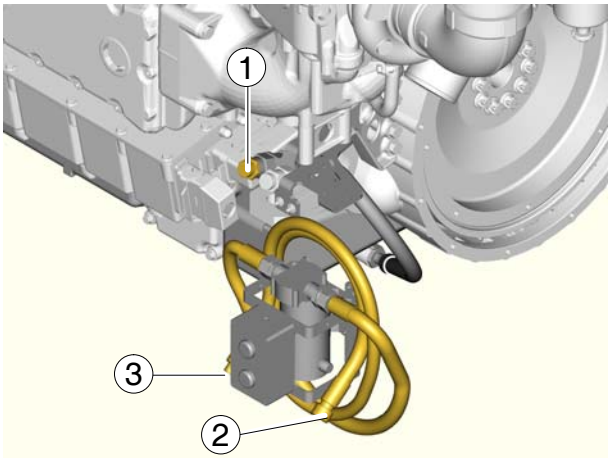
Fit new sealing ring (2) to the filter cover (1).
Insert the new oil filter insert (3) into the oil filter cover (1).
Insert the oil filter cover (1) in the oil module and tighten to a torque of 40 Nm.

Changing the second oil filter insert takes place by analogy.





Electric oil drain pump (option) for engine and gearbox oil



Pump off engine oil

Unscrew the sealing cap of the oil drainage hose (1). Connect the suction line (2) of the oil drainage pump to the engine oil drainage hose (1).

With the installation hot after running, press the “OIL OUT" button of the oil drainage pump and pump all the used oil via the oil drainage hose(1) into a container of adequate capacity.

Note:
Change the oil filter elements every time the engine oil is changed.

Fill the engine with engine oil

Fill the engine with engine oil via the discharge hose (1), by pressing the “OIL IN" button.

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.

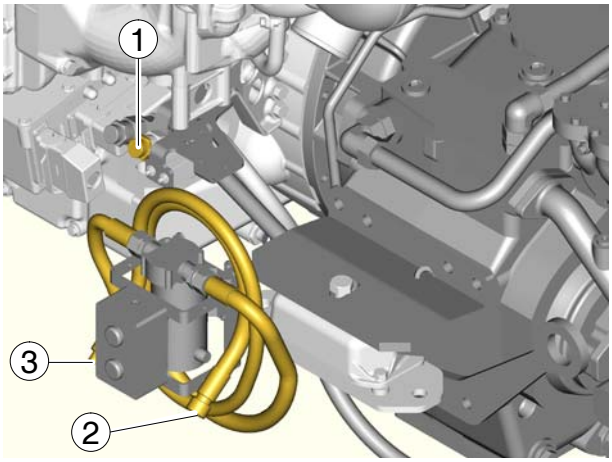
Disconnect the suction line (2) of the oil drainage pump from the engine oil drainage hose (1). Screw on the sealing cap of the oil drainage hose (1).

For oil filling quantity see “technical data", from page 116.

Pump off gearbox oil

Unscrew the sealing cap of the oil drainage hose (1). Connect the suction line (2) of the oil drainage pump to the oil drainage hose (1) of the gearbox.

With the installation hot after running, press the “OIL OUT" button of the oil drainage pump and pump all the used oil via the oil drainage hose (3) into a container of adequate capacity.



Fill the gearbox with gear oil

Fill the gearbox with gearbox oil via the discharge hose (3), by pressing the “OIL IN" button.

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

Disconnect the suction line (2) of the oil drainage pump from the oil drainage hose (1) of the gearbox. Screw on the sealing cap of the oil drainage hose (1).

For gearbox oil filling quantity see documentation of the gearbox manufacturer.

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.

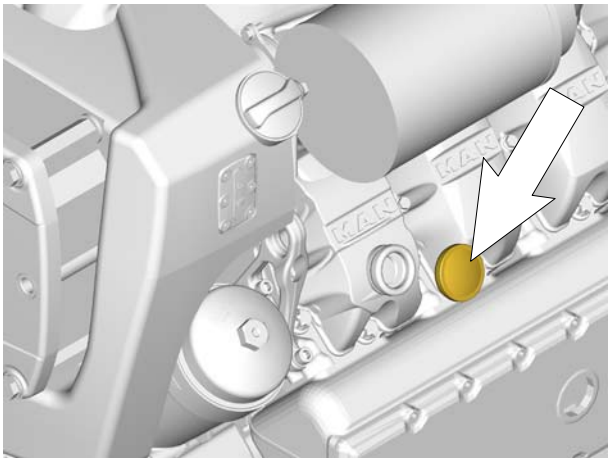
Caution:
If no oil pressure builds up after approx. 10 seconds switch off the engine immediately.

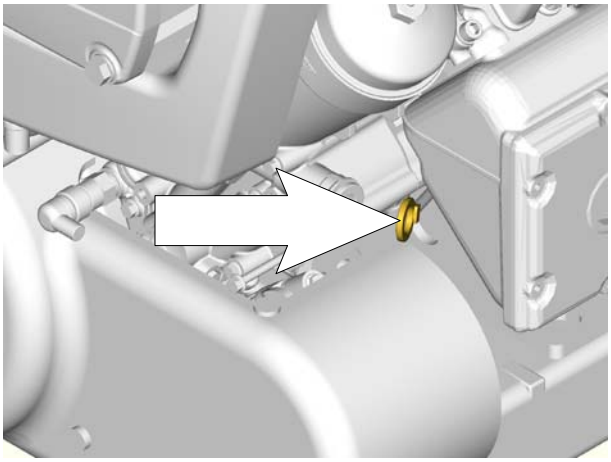
Check oil pressure and check that there is no oil leakage.
Then shut down the engine.
After about 20 minutes, check the oil level.

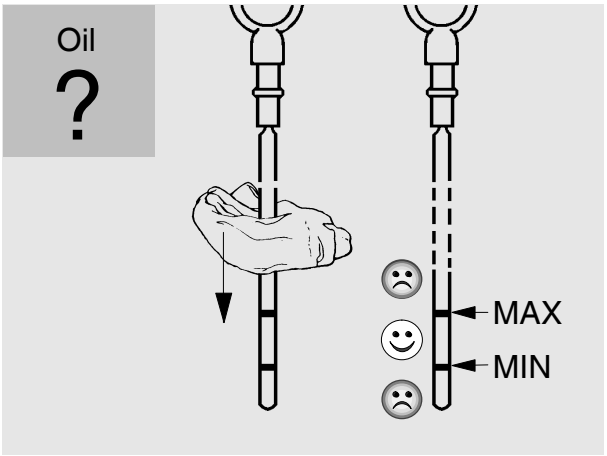
- Pull out dipstick (arrow)
- wipe it with a clean, lint-free cloth
- and push it in again up to the stop
- Pull out dipstick again

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. Do not overfill.

For oil filling quantity see “technical data", from page 116.







Fuel system

Fuel

If diesel fuel containing water is used, damage is caused to the injection system. To some extent this can be avoided by filling up with fuel after stopping the engine, while the fuel tank is still warm (prevention of condensation of water). Regularly drain off water from storage tanks.

Caution:
Use only approved fuels, lubricants etc. (see brochure Fuels, lubricants etc."). Otherwise the liability for defects will become null and void!

Faults

We urgently recommend that malfunctions of the injection system be eliminated only by a workshop authorised to perform such work.

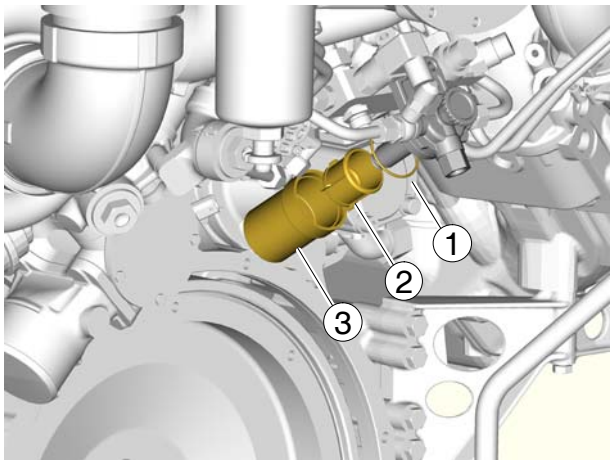
Cleaning fuel pre-cleaner

Danger:
Only service the fuel prefilter with the engine switched off.

Close shut-off valves between engine and tank.

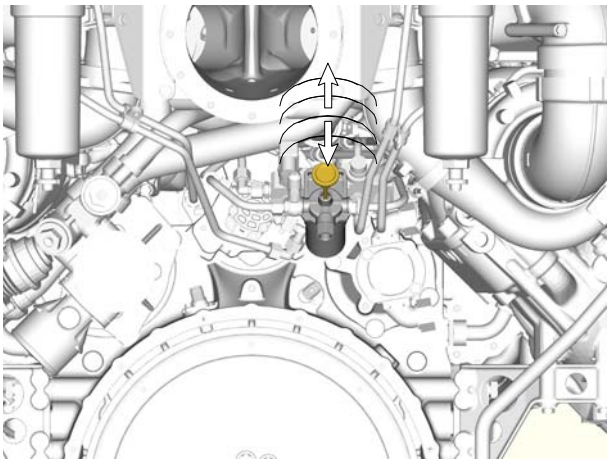
Strip the fuel pre-cleaner:

- Remove filter housing (3)
- Remove the sealing ring (1) from the filter housing (3)
- Wash out filter housing (3) and gauze filter (2) in clean diesel fuel and blow them out with compressed air
- Screw the filter housing (3) with strainer (2) and new sealing ring (1) on the fuel pre-filter housing
- Torque tighten the filter housing to 10 Nm



Open shut-off valves between engine and tank.

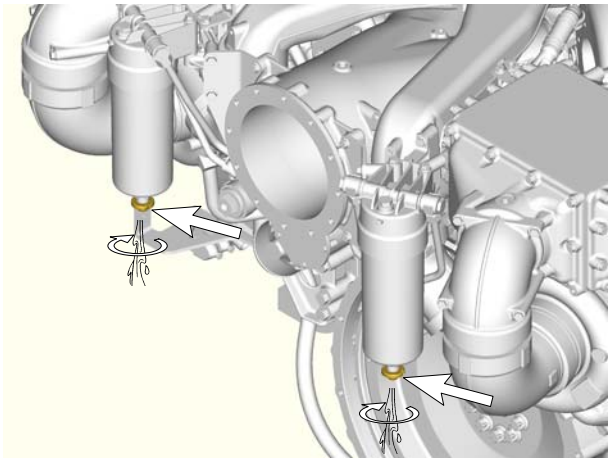
- Screw on the hand pump plunger
- Actuate plunger of hand priming pump until the overflow valve opens audibly
- Screw in and tighten plunger on hand pump
- Check fuel pre-cleaner for leaks



Fuel filter

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

Caution:
Danger of dirt ingressing the fuel system!
The fuel filter must only be replaced by an appointed MAN customer service centre.

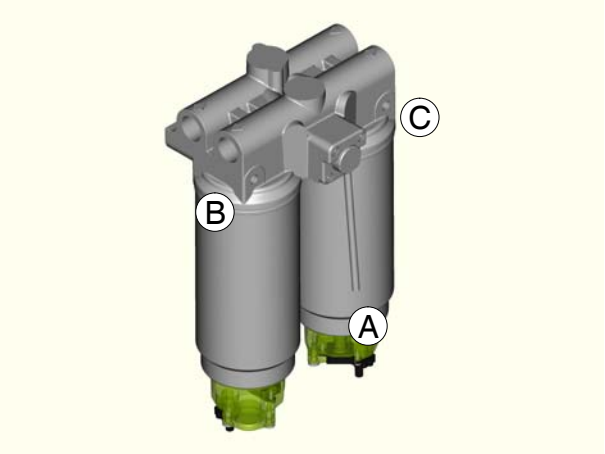


Fuel pre-filter with water separator

The fuel pre-filter with water separator is built into the fuel feed line between the tank and the engine.

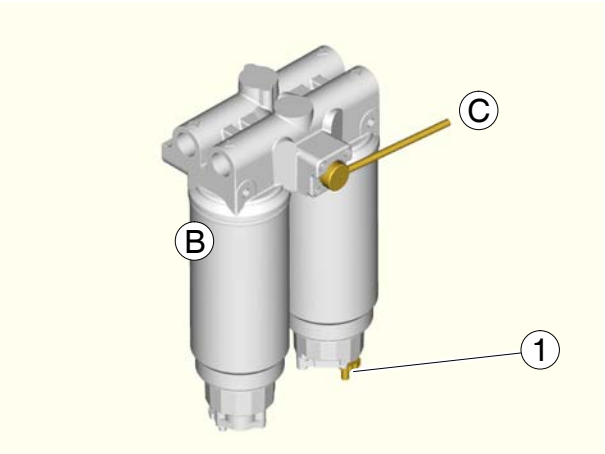
Caution:
Pay attention to the position of the 3-way cock handle. Handle in position:

A Continuous operation (both filter halves in operation)
B Left side switched off
C Right side switched off



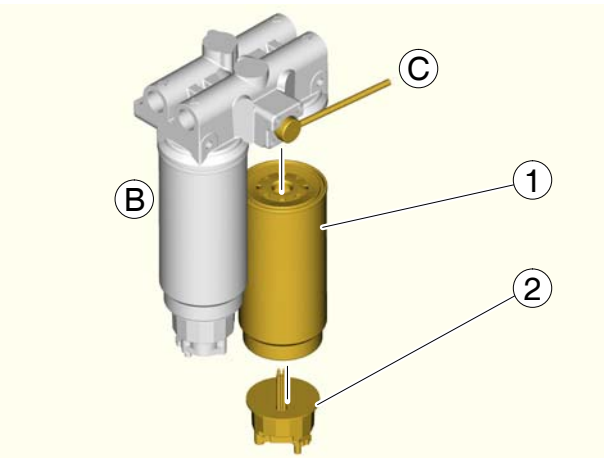
Draining water:

- Turn handle to position C (only with the engine running)
- Open the drain plug (1) and drain water off into a container of adequate capacity.
- Close drain screw (1)
- Water draining of the 2nd filter cartridge is carried out by analogy



Replace fuel filter cartridge

- Turn handle to position C (only with the engine running)
- Disconnect plug
- Unscrew filter cup (2) and fuel filter cartridge (1)
- Wet the gaskets on the new fuel filter cartridge with fuel
- Screw up the filter (10 Nm) (1) and filter bowl (20 Nm) (2) by hand
- Connect plug
- After this, bleed the fuel system
- Check filter for leaks
- Replacement of the second fuel filter cartridge is carried out by analogy



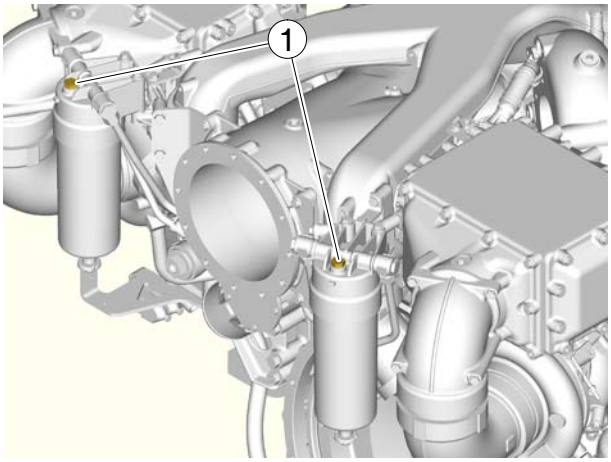
Caution:
Used fuel filters are classed as hazardous waste!

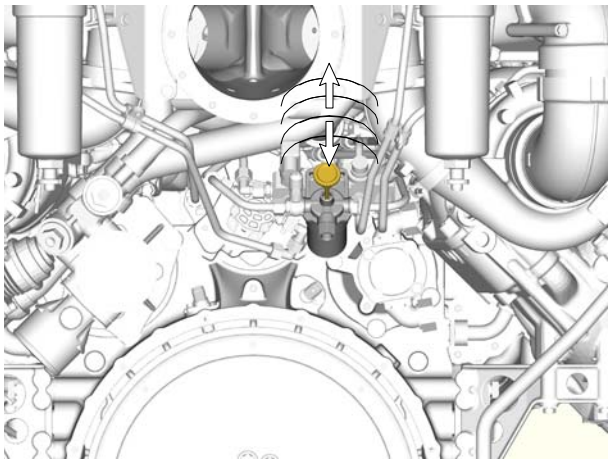
Bleeding the fuel system

Danger:
Only bleed the fuel system with the engine switched off.

Note:
To bleed the fuel system switch on the “ignition".

- Loosen threaded vent plugs (1)
- Loosen the hand pump plunger
- Actuate the hand pump plunger until the fuel is bubble-free at the threaded vent plugs (1) outlet
- Tighten the threaded vent plugs (1) to 25 Nm
- Screw in and tighten hand pump plunger
- Check fuel system for leaks





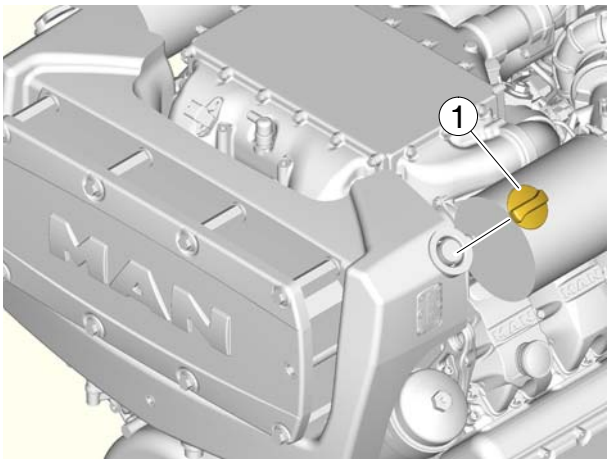
Cooling system

Danger:
Draining hot coolant involves a risk of scalding.

Draining the cooling system

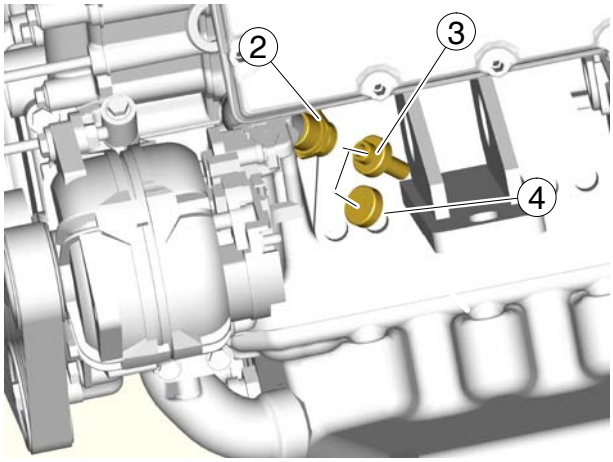
Danger:
Only empty the cooling system with the engine switched off.

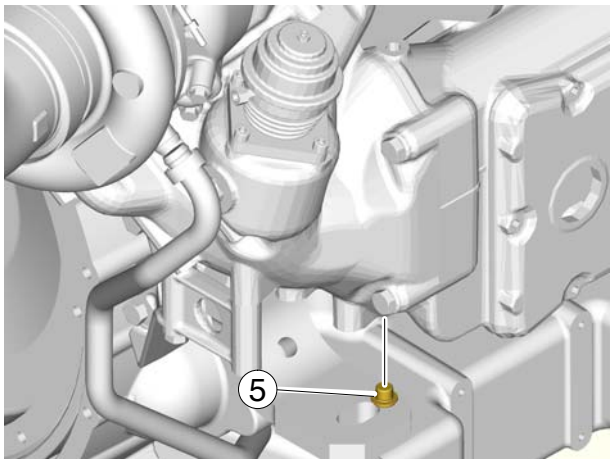
Caution:
Drain coolant into a suitable container and dispose of it in accordance with regulations.



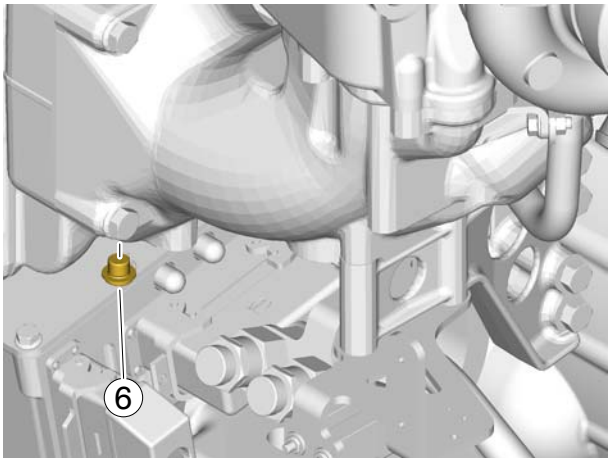
Drain coolant as follows when cooling system has cooled down:

- Briefly open the locking cap (1) on the filler neck of the expansion tank to equalise the pressure
- Unscrew the locking cap (4) of the coolant drain valve (2) and open the drain valve by screwing the hose stem (3).
- Drain coolant into a suitable container
- Then take off the cap (1)
- After the coolant has drained off unscrew the hose stem (3)
- Unscrew the plug (5) on the exhaust manifold on the right side of the engine and drain the coolant.
- Screw the plug on again (5) and tighten





- Unscrew the plug (5) on the exhaust manifold on the left side of the engine and drain the coolant.(6)
- Screw the plug on again (5) and tighten
- Filling / bleeding the cooling system



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

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

Caution:
Use only approved fuels, lubricants etc. (see brochure Fuels, lubricants etc."). Otherwise the liability for defects will become null and void!

When filling, do not fill cold coolant into an engine that is hot after operation. Make sure, that the correct mixing ratio of “Water - Antifreeze" is maintained.

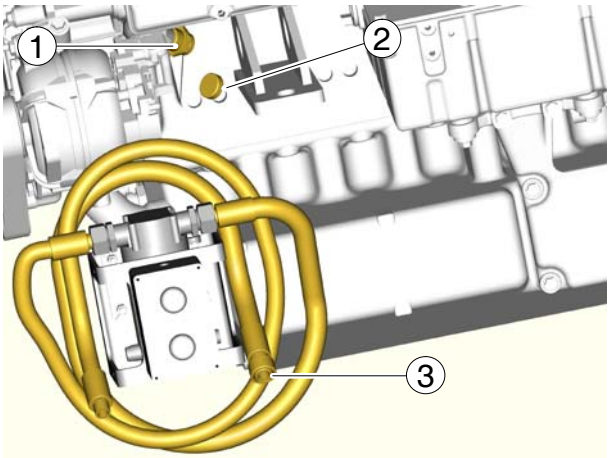
- Unscrew the locking cap (2) of the drain valve (1)
- Connect the pump via the hose stem (3) to the drain valve (1) and start the filling process by actuating the pump button

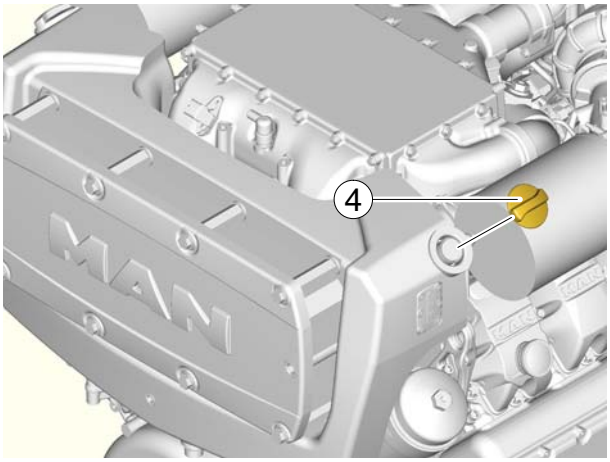
Note:
As an alternative to filling the engine with coolant using a pump, the filler necks (4) can be used for this purpose.

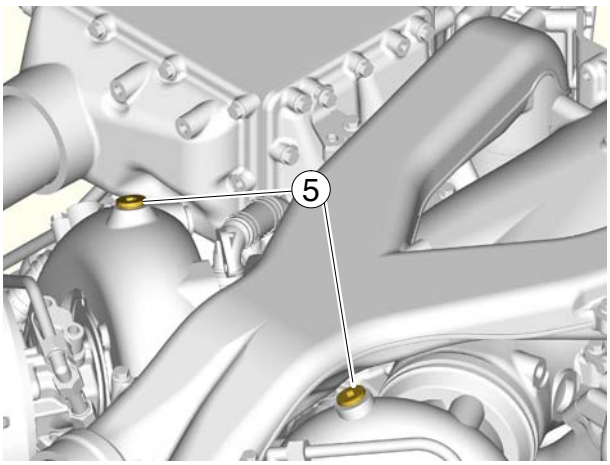
- During the filling process the liquid-cooled exhaust turbochargers have to be vented. Undo the threaded vent plugs (5). The threaded vent plugs (5) must remain open until the coolant emerges bubble-free or until the coolant reaches the filler neck (4) depending on the installed position). For the coolant filling quantity, see “Technical data", from page 107
- Tighten the threaded vent plugs (5) back in and screw on cap (4) all the way, but do not tighten yet.

Caution:
Overtightened caps can not be opened again.

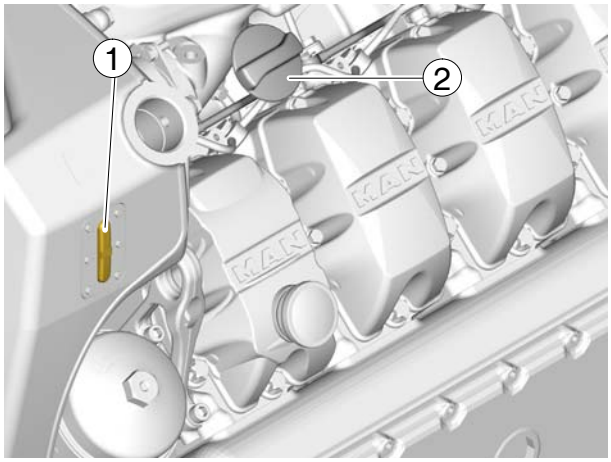
- Unscrew the hose stem (3) and screw on and tighten the locking cap (2)
- Let the engine run at a speed of 2000 1/min for approx. 15 minutes







- Stop the engine
- Check the coolant at the sight glass (1) of the expansion tank, which must be between “min" and “max"
- When topping up, carefully loosen the locking cap (2) with safety valve -release the pressure- then carefully open and fill up with coolant.



Danger:
Risk of scalding.

Note:
In the event of overfilling, excess coolant is ejected via the drainage hose during operation.

- 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

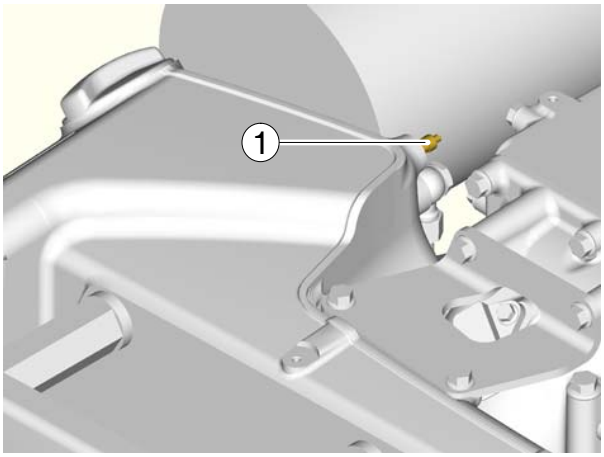
Note:
The turbochargers must not be bled while the cooling system is being topped up.

Danger:
If, in an exceptional case, it is necessary to check the coolant level with the engine hot due to running, first carefully loosen the locking cap (2) with safety valve -release the pressure- then open carefully.

Note:
Do not open the cooling system when the engine is at operating temperature. This causes a pressure loss in the cooling system.
If the cooling system has been opened when the engine is at operating temperature, this can lead to the alarm “pressure in the expansion tank" when the engine is then put into operation and to a reduction in the engine output.
Coolant pressure in the expansion tank is only built up again when the engine has cooled down.
The cooling system must therefore only be filled up when the engine is cold.

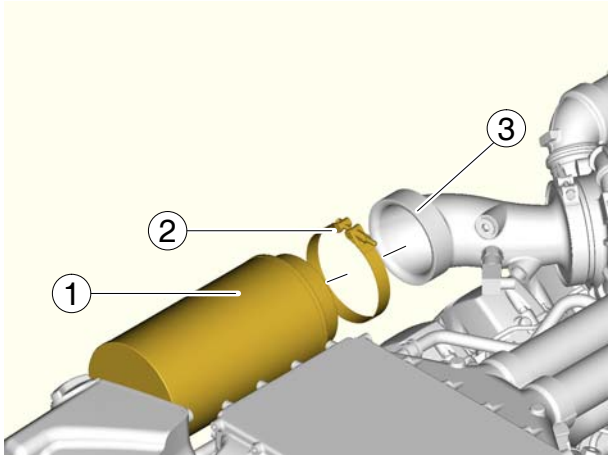
If it is necessary to fill the expansion tank when the engine is hot, the following should be noted:

- In order to be able to operate the hot engine again without an alarm, after opening the locking cap, there must be an admission pressure of 0.7 bar in the cooling system.
- In order to achieve this a pressure valve (1) is fitted on the expansion tank, to which a proprietary air pump can be connected. This can be used to pump the system pressure up to 0.7 bar



Change air filter

Danger:
Only replace the air filter with the engine switched off



Remove air filter

Loosen the hose clamp (2) and remove the air filter (1) from the intake neck (3).

Removal of the second air filter takes place by analogy.

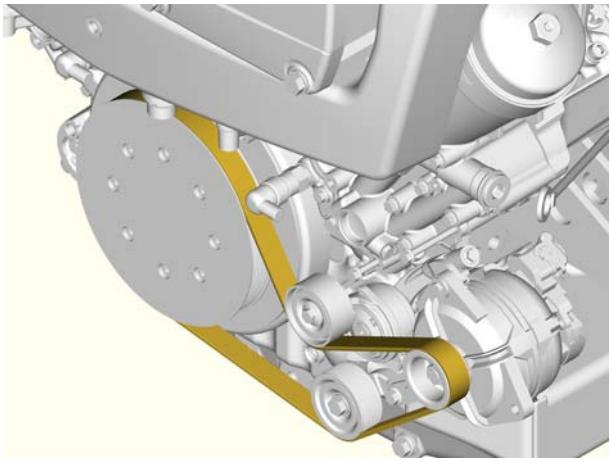
Mount air filter

Slide the new air filter (1) onto the intake neck (3). Position the hose clamp (2) and tighten to 7 Nm.

Mounting the second air filter is analogous to the first.

V-ribbed belt

Danger:
Inspect/replace the V-ribbed belt only with the engine stopped.

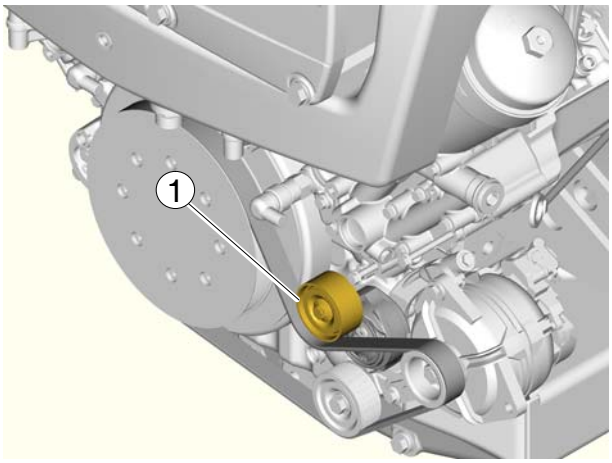


Checking condition

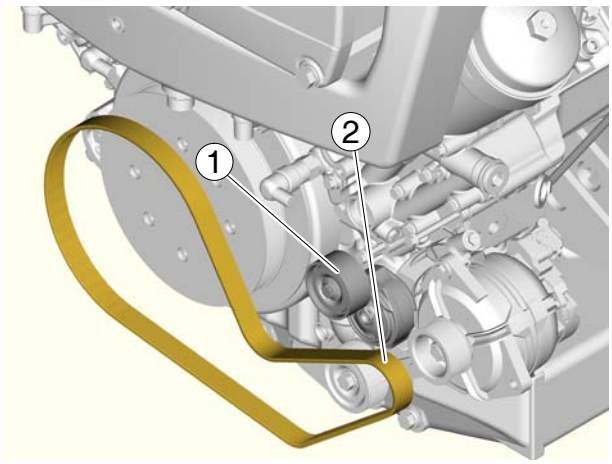
- Check V-ribbed belt for cracks, tears, oil fouling, signs of overheating and wear
- Replace damaged V-ribbed belt

Replace V-ribbed belt

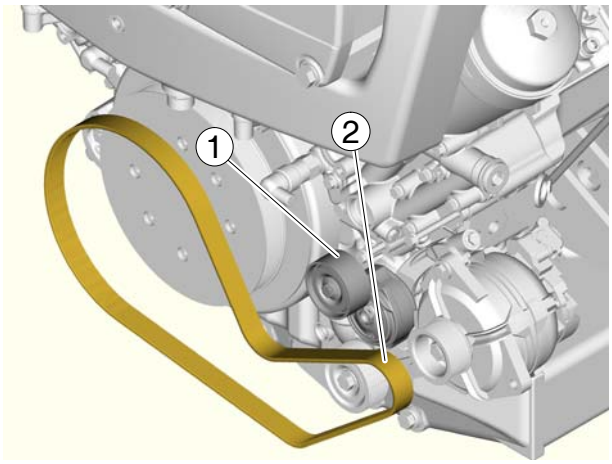
Caution:
Danger of crushing!
The V-ribbed belt tensioner is under spring pre-tension - secure against spring back!



- Rotate the tensioning pulley of the V-ribbed belt tensioner (1) clockwise up to the stop and hold



- Remove the V-ribbed belt (2)
- Carefully release the V-ribbed belt tensioning pulley (1)



- Rotate the tensioning pulley of the V-ribbed belt tensioner (1) clockwise up to the stop and hold
- Install the new V-ribbed belt (2)
- Carefully release the V-ribbed belt tensioning pulley (1)

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 to 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 standard 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 Nuremberg works.

Model	**V8-1200 (D2868 LE433)**
Design	V 90°
Cycle	4-stroke diesel
Combustion system	Direct injection
Turbocharging	2-stage exhaust turbocharger with intercooler and charge-air regulation (Waste Gate)
Number of cylinders	8
Bore	128 mm
Stroke	157 mm
Swept volume	16 160 cm^3
Compression ratio	17:1
Rating	882 KW / 1200 hp at 2300 rpm
Firing order	1-5-7-2-6-3-4-8
Valve clearance (cold engine)	
Intake	0.50 mm
Exhaust	0.80 mm
Valve timing	
Intake opens	24 ° before TDC
Intake closes	36 ° after BDC
Exhaust opens	63° before BDC
Exhaust closes	27 ° after TDC
Fuel system	
High pressure pump	2 x Bosch CP 3.4
Injection system	Common Rail
Governor	Electronic Diesel Control (EDC) - Type EDC 7 C32
Injectors	eight-hole nozzles

Engine lubrication	Force feed	
Oil capacity in oil sump (litres)	min.	max.
	50 l	60 l
Oil change quantity (with filter)	62 l	
Oil filter	2 oil modules, each with 2 oil coolers and an oil separator	
Engine cooling system	Liquid cooling	
Coolant temperature	80-90°C, temporarily 95°C allowed	
Coolant filling quantity	85 l	
Electrical equipment		
Starter	24 V; 7.0 KW	
Alternator	28 V; 120 A	

Model	**V12-1800 (D2862 LE433)**
Design	V 90°
Cycle	4-stroke diesel
Combustion system	Direct injection
Turbocharging	2-stage exhaust turbocharger with intercooler and charge-air regulation (Waste Gate)
Number of cylinders	12
Bore	128 mm
Stroke	157 mm
Swept volume	24 243 cm^3
Compression ratio	17:1
Rating	1324 KW / 1800 hp at 2300 rpm
Firing order	1-12-2-11-3-10-6-7-5-8-4-9
Valve clearance (cold engine)	
Intake	0.50 mm
Exhaust	0.80 mm
Valve timing	
Intake opens	24 ° before TDC
Intake closes	36 ° after BDC
Exhaust opens	63° before BDC
Exhaust closes	27 ° after TDC
Fuel system	
High pressure pump	2 x Bosch CP 3.4
Injection system	Common Rail
Governor	Electronic Diesel Control (EDC) - Type EDC 7 C32
Injectors	eight-hole nozzles

Engine lubrication	Force feed
Oil capacity in oil sump (litres)	min. max. 70 l 90 l
Oil change quantity (with filter)	92 l
Oil filter	2 oil modules, each with 2 oil coolers and an oil separator
Engine cooling system	Liquid cooling
Coolant temperature	80-90°C, temporarily 95°C allowed
Coolant filling quantity	113 l
Electrical equipment	
Starter	24 V; 7.0 KW
Alternator	28 V; 120 A

Model	**V12-1650 (D2862 LE453)**
Design	V 90°
Cycle	4-stroke diesel
Combustion system	Direct injection
Turbocharging	2-stage exhaust turbocharger with intercooler and charge-air regulation (Waste Gate)
Number of cylinders	12
Bore	128 mm
Stroke	157 mm
Swept volume	24 243 cm^3
Compression ratio	17:1
Rating	1213 KW / 1650 hp at 2300 rpm
Firing order	1-12-2-11-3-10-6-7-5-8-4-9
Valve clearance (cold engine)	
Intake	0.50 mm
Exhaust	0.80 mm
Valve timing	
Intake opens	24 ° before TDC
Intake closes	36 ° after BDC
Exhaust opens	63° before BDC
Exhaust closes	27 ° after TDC
Fuel system	
High pressure pump	2 x Bosch CP 3.4
Injection system	Common Rail
Governor	Electronic Diesel Control (EDC) - Type EDC 7 C32
Injectors	eight-hole nozzles

Engine lubrication	Force feed	
Oil capacity in oil sump (litres)	min.	max.
	70 l	90 l
Oil change quantity (with filter)	92 l	
Oil filter	2 oil modules, each with 2 oil coolers and an oil separator	
Engine cooling system	Liquid cooling	
Coolant temperature	80-90°C, temporarily 95°C allowed	
Coolant filling quantity	113 l	
Electrical equipment		
Starter	24 V; 7.0 KW	
Alternator	28 V; 120 A	

Model	**V12-1550 (D2862 LE423)**
Design	V 90°
Cycle	4-stroke diesel
Combustion system	Direct injection
Turbocharging	Exhaust turbocharger with intercooler and charge-air regulation (Waste Gate)
Number of cylinders	12
Bore	128 mm
Stroke	157 mm
Swept volume	24 243 cm^3
Compression ratio	17:1
Rating	1140 KW / 1550 hp at 2300 rpm
Firing order	1-12-2-11-3-10-6-7-5-8-4-9
Valve clearance (cold engine)	
Intake	0.50 mm
Exhaust	0.80 mm
Valve timing	
Intake opens	24 ° before TDC
Intake closes	36 ° after BDC
Exhaust opens	63° before BDC
Exhaust closes	27 ° after TDC
Fuel system	
High pressure pump	2 x Bosch CP 3.4
Injection system	Common Rail
Governor	Electronic Diesel Control (EDC) - Type EDC 7 C32
Injectors	eight-hole nozzles

Engine lubrication	Force feed	
Oil capacity in oil sump (litres)	min.	max.
	70 l	90 l
Oil change quantity (with filter)	92 l	
Oil filter	2 oil modules, each with 2 oil coolers and an oil separator	
Engine cooling system	Liquid cooling	
Coolant temperature	80-90°C, temporarily 95°C allowed	
Coolant filling quantity	113 l	
Electrical equipment		
Starter	24 V; 7.0 KW	
Alternator	28 V; 120 A	

Model	**V12-1400 (D2862 LE443)**
Design	V 90°
Cycle	4-stroke diesel
Combustion system	Direct injection
Turbocharging	Exhaust turbocharger with intercooler and charge-air regulation (Waste Gate)
Number of cylinders	12
Bore	128 mm
Stroke	157 mm
Swept volume	24 243 cm^3
Compression ratio	17:1
Rating	1029 KW / 1400 hp at 2300 rpm
Firing order	1-12-2-11-3-10-6-7-5-8-4-9
Valve clearance (cold engine)	
Intake	0.50 mm
Exhaust	0.80 mm
Valve timing	
Intake opens	24 ° before TDC
Intake closes	36 ° after BDC
Exhaust opens	63° before BDC
Exhaust closes	27 ° after TDC
Fuel system	
High pressure pump	2 x Bosch CP 3.4
Injection system	Common Rail
Governor	Electronic Diesel Control (EDC) - Type EDC 7 C32
Injectors	eight-hole nozzles

Engine lubrication	Force feed	
Oil capacity in oil sump (litres)	min.	max.
	70 l	90 l
Oil change quantity (with filter)	92 l	
Oil filter	2 oil modules, each with 2 oil coolers and an oil separator	
Engine cooling system	Liquid cooling	
Coolant temperature	80-90°C, temporarily 95°C allowed	
Coolant filling quantity	113 l	
Electrical equipment		
Starter	24 V; 7.0 KW	
Alternator	28 V; 120 A	

Model	**D2862 LE463**
Design	V 90°
Cycle	4-stroke diesel
Combustion system	Direct injection
Turbocharging	Exhaust turbocharger with intercooler and charge-air regulation (Waste Gate)
Number of cylinders	12
Bore	128 mm
Stroke	157 mm
Swept volume	24 243 cm^3
Compression ratio	17:1
Rating	1029 KW / 1400 hp at 2100 rpm
Firing order	1-12-2-11-3-10-6-7-5-8-4-9
Valve clearance (cold engine)	
Intake	0.50 mm
Exhaust	0.80 mm
Valve timing	
Intake opens	24 ° before TDC
Intake closes	36 ° after BDC
Exhaust opens	63° before BDC
Exhaust closes	27 ° after TDC
Fuel system	
High pressure pump	2 x Bosch CP 3.4
Injection system	Common Rail
Governor	Electronic Diesel Control (EDC) - Type EDC 7 C32
Injectors	eight-hole nozzles

Engine lubrication	Force feed	
Oil capacity in oil sump (litres)	min.	max.
	70 l	90 l
Oil change quantity (with filter)	92 l	
Oil filter	2 oil modules, each with 2 oil coolers and an oil separator	
Engine cooling system	Liquid cooling	
Coolant temperature	80-90°C, temporarily 95°C allowed	
Coolant filling quantity	113 l	
Electrical equipment		
Starter	24 V; 7.0 KW	
Alternator	28 V; 120 A	

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

Fault												
Engine does not start, or starts only with difficulty												
	Engine starts but does not reach full speed or stalls											
		Engine idles out of true when warm, misfiring										
			Engine speed fluctuates during operation									
				Power output unsatisfactory								
					Coolant temperature too high, coolant being lost							
						Lube oil pressure too low						
							Lube oil pressure too high					
								Black smoke accompanied by loss of power				
									Blue smoke			
										White smoke		
											Knocking in the engine	
												Engine “too loud"
												Reason
						●						Oil in sump too thin (mixed with condensation or fuel)
							●					Engine cold
									●	●		Engine, coolant or intake air still to 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)
				●				●			●	Intake or exhaust pipe leaking
				●				●				Charge air system leaking / fouled
				●		●		●	●			Turbocharger defective

● likely to apply

● might apply

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