



Operating Instructions for MAN Industrial Diesel Engines
Bedienungsanleitung für MAN-Industriedieselmotoren
Instrucciones de servicio para motores Diesel industriales MAN
Instruction de service pour moteurs Diesel industriels MAN
Norme di servizio per motori Diesel industriali MAN

D 0836 LE 201 / 203

Operating Instructions – MAN Industrial Diesel Engines

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

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

You can find the approved products in the internet under:

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

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

Yours faithfully,
MAN Nutzfahrzeuge Aktiengesellschaft
Werk Nürnberg

Subject to change to keep abreast with technological progress.

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

**Danger:**

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

**Caution:**

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

**Note:**

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

Fitting flat seals / gaskets

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

Example:

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

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

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

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Declaration

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

MAN Nutzfahrzeuge Aktiengesellschaft,

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

Engine model:

Design:

For data see original declaration

Engine number:

If required this declaration is enclosed with the delivery note.

Rating / speed:



Note:

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

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

MAN Nutzfahrzeuge Aktiengesellschaft

Vogelweiherstraße 33

D-90441 Nürnberg

Nameplates



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

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

The engine type plates are on the crankcase.

Model


delivered on

installed on

Engine serial number

Order number

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

 **MAN Nutzfahrzeuge Aktiengesellschaft**
Werk Nürnberg Germany
DIESEL ENGINE

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

-0219

General notes

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.***

Regulations designed to prevent accidents with injury to persons

During commissioning, starting and operation

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



During maintenance and care

- Always carry out maintenance work when the engine is switched off.
If the engine has to be maintained while it is running, e.g. changing the elements of change-over filters, remember that there is a risk of scalding. Do not get too close to rotating parts.
- Change the oil when the engine 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.



Regulations designed to prevent damage to engine and premature wear

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



Safety regulations

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

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

In addition to the above, note the following points:

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

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.

Notes on safety in handling used engine oil *
--

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

Health precautions:

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

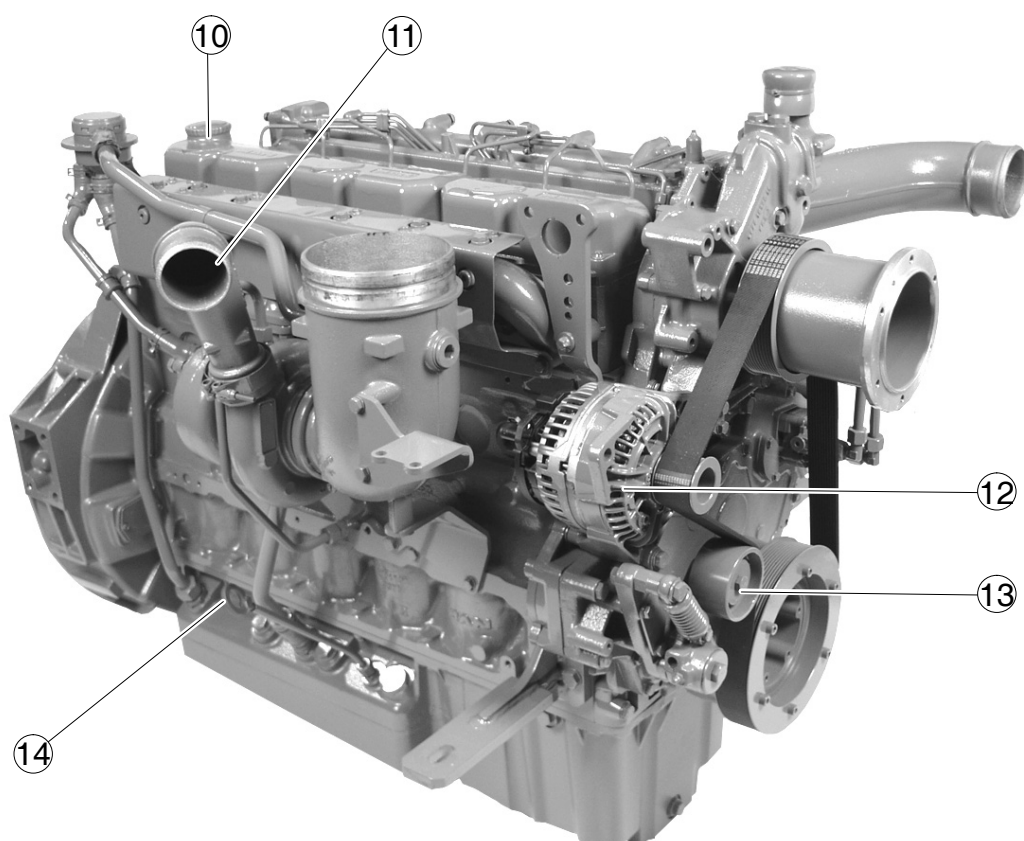
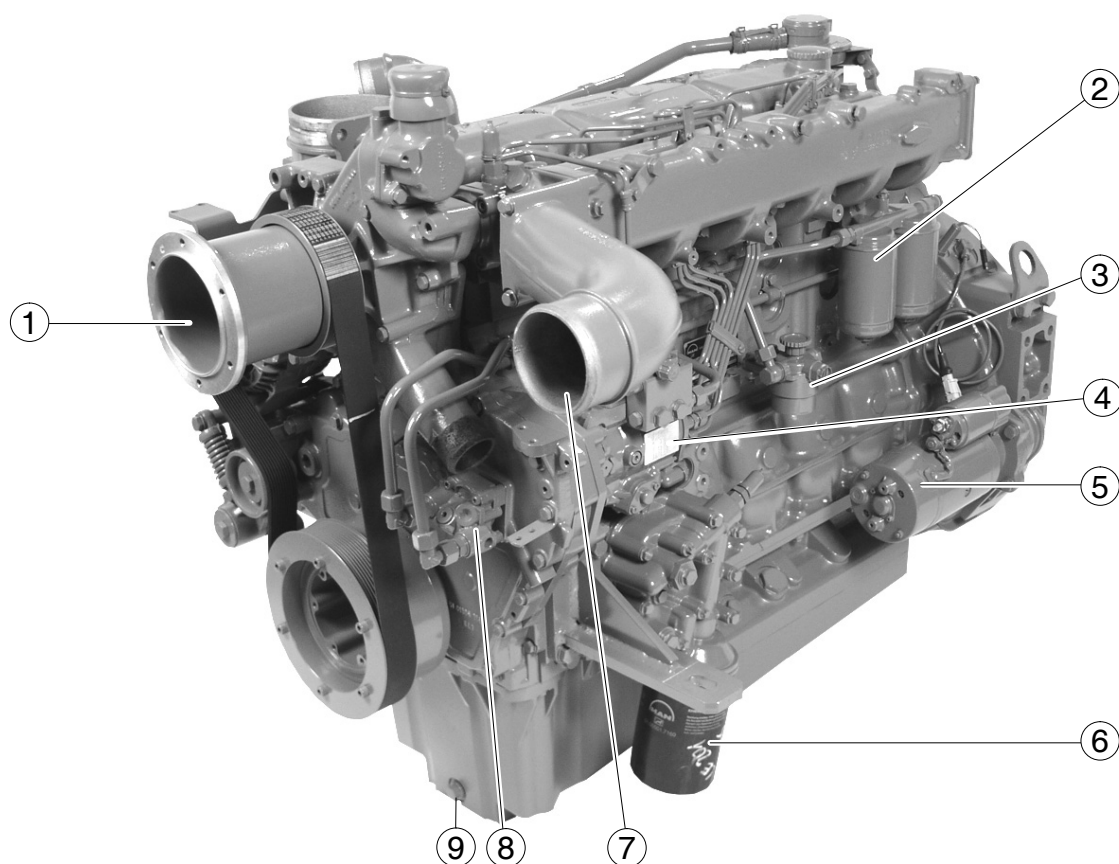
Ensure that used engine oil is disposed of properly
– Engine oil can endanger the water supply –

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

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

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

Engine views D 0836 LE 201 / 203



-
- ① Fan hub
 - ② Fuel filter
 - ③ Fuel prestrainer
 - ④ Injection pump
 - ⑤ Starter
 - ⑥ Oil filter
 - ⑦ Combustion air pipe from intercooler
 - ⑧ Fuel pump
 - ⑨ Oil drain plug
 - ⑩ Oil filler neck
 - ⑪ Combustion air pipe to intercooler
 - ⑫ Alternator
 - ⑬ Tensioning pulley
 - ⑭ Oil dipstick

First commissioning

When putting a new or overhauled engine into operation for the first time pay attention to the "Installation instructions for MAN industrial 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.

Danach soll der Motor langsam auf volle Leistung gebracht werden.



Caution:

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

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

You can find the approved products in the internet under:

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

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 31
- For coolant filling quantity, see "Technical data"

Filling with engine oil



Caution:

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

The engines are as a rule supplied without oil.

Pour oil into engine via filler neck, see page 26.

For the quantity required see "Technical Data".

Commissioning

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



Caution:

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

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

You can find the approved products in the internet under:

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

Checking oil level

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

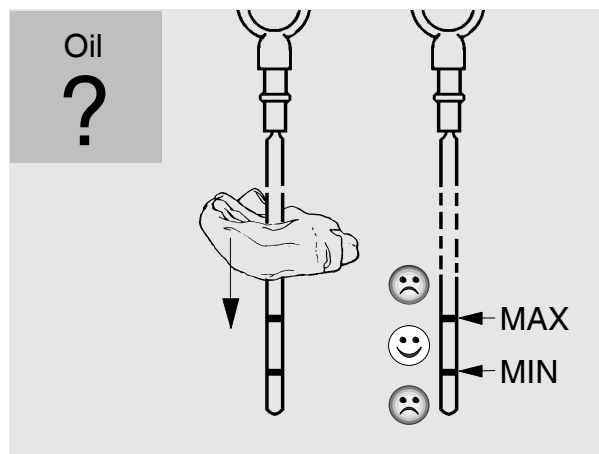
- Pull out dipstick
- wipe it with a clean, lintfree cloth
- and push it in again up to the stop
- Pull out dipstick again

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



Caution:

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



Ensure outmost 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).

- Ensure that no load is on the engine before starting it, eg switch off load, disengage clutch, put gearbox into neutral etc.

With engines without starting aid or at temperatures above 5–10°C or when engine without flame starter is already hot:

- Insert starter key in starting lock
- Press starter button until engine starts

With engines with starting aid (flame starter), at temperatures around 0°C and below:

- Insert starter key in starting lock
- Switch on flame starter; signal lamp "Preheating" is on
- Signal lamp "Preheating" is flashing; press starter button until engine starts

**Caution:**

- When engine starts, release starter button immediately
- If engine does not start, actuate starter for about 10 seconds, wait for 30 seconds and then attempt to start engine again and so on.

With engine with automatic starting (eg standby power units) it is indispensable that none of the moving parts be accessible. Warning signs "Unit starts automatically" are to be attached to the engine. Regulation on this which may apply locally are to be satisfied.

When engine is running, lube oil pressure must build up at the oil pressure gauge. If not switch off engine immediately.

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

Setting the digital speed governor



Note:

All information in this chapter is an extract from the operator's manual from the manufacturer, GAC Engine Governing Systems, or the importer, HÜGLI TECH LTD SWITZERLAND.



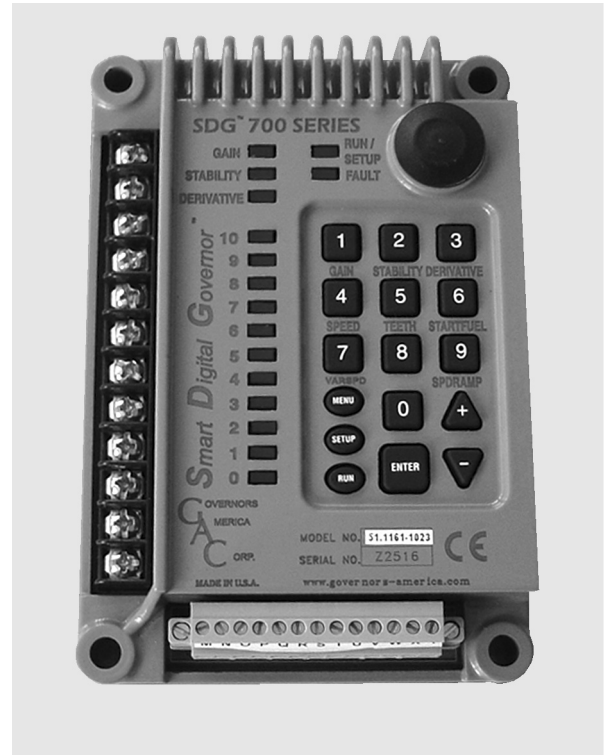
Caution:

The basic setting of the governor was made at the factory and cannot be changed.

However, the operator can adjust some functions of the governor to the engine's particular operating conditions.

The following parameters can be changed using the keyboard:

- Speed droop (P-degree) and the governor characteristics (P, I, D elements)
- Gain (sensitivity)
- Stability
- Derivative (dead time compensation)



Governor characteristics and operating behaviour

In the event of connection of load the standard conditions can be altered by changing the governor characteristics within certain limits.

Apart from this undesirable phenomena such as speed hunting can be eliminated.

Slow periodic hunting 	<ul style="list-style-type: none"> • Increase DERIVATIVE
Fast periodic hunting 	<ul style="list-style-type: none"> • Reduce GAIN • Reduce DERIVATIVE

Access to SETUP mode

Access to SETUP mode

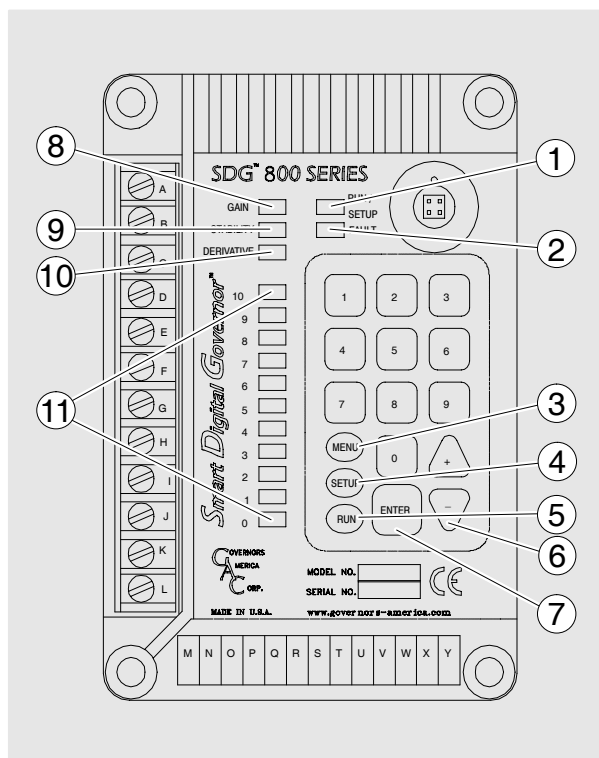
- Press SETUP button ④ until the RUN / SETUP LED ① starts to flash.
- Key in password (0000, i.e. 4x the figure zero) and press the ENTER button ⑦ to confirm.



Note:

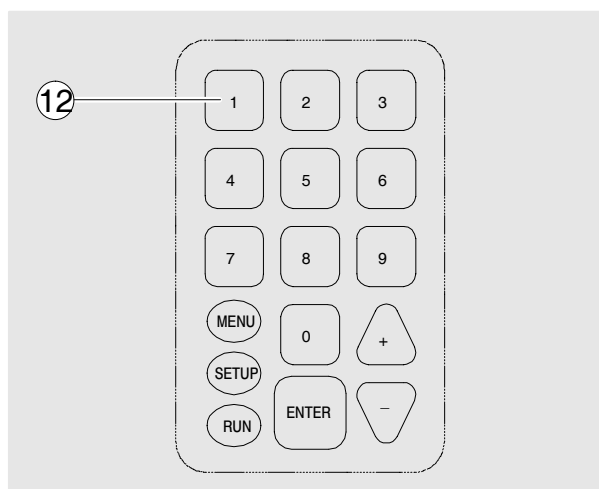
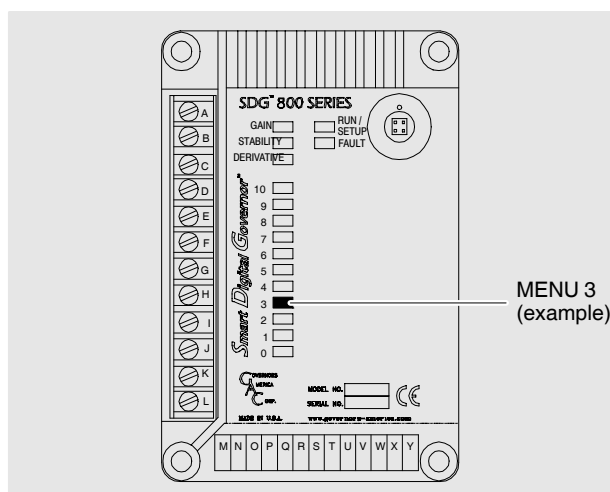
The LED bar display lights up every time a button is pressed.

- When the correct password has been keyed in the LED bar ⑪ flashes to show the software version.
- The RUN / SETUP LED ① flashes as long as the device is in SETUP mode.



Access to the parameters

- In SETUP mode the parameters can be accessed via the MENU button ③. Every time the MENU button is pressed the next MENU becomes active. The menu currently active is shown by the LED bar ⑪ (LED 0 means MENU 0, LED 1 means MENU 1 etc.) In addition to the LED bar display the FAULT LED ② comes on if a menu is active.
- If you now press the relevant numerical button ⑫ as follows you can access the desired parameter.
 Button 1: GAIN (sensitivity)
 Button 2: STABILITY
 Button 3: DERIVATIVE (dead time compensation)
 Button 4: P-degree



Setting parameters



Caution:

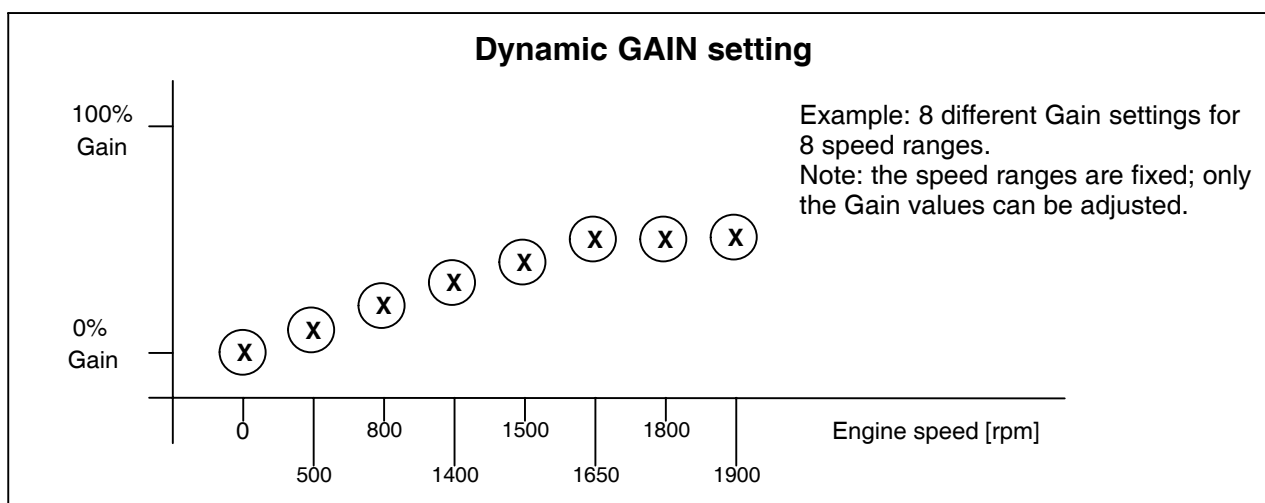
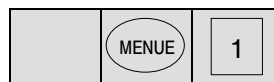
When setting the parameters:

Always leave SET-UP mode by pressing the RUN button, as the changes will otherwise be lost.

Gain (sensitivity)

Input: Menue 0, button 1

Every time the MENU button is pressed the next gain point is selected and shown by the relevant LED in the LED bar. The value of the gain point is not shown until one of the arrow keys (+ or -) is pressed.

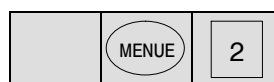


Stability

Input: Menue 0, button 2

Increase the STABILITY using the + key until the engine speed starts to hunt; Then reduce the STABILITY again by pressing the - key until the engine's running is stable again.

Then reduce by a further 2-3 pulses.



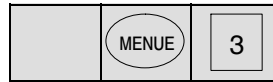
Derivative (dead time compensation)

Input: Menu 0, button 3

In certain cases it may be necessary to adjust the dead time compensation (DERIVATIVE) too.

If the engine speed is hunting quickly even though GAIN has been set low, the DERIVATIVE can be reduced by tapping the – key.

If the engine speed is hunting very slowly even though GAIN has been set low, the DERIVATIVE can be increased by tapping the + button.

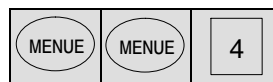


Speed droop (P-degree)

Input: Menu 1, key 4

Press the + key to increase the speed droop, press the – key to reduce the speed droop.

Each of the 3 fixed speeds and the variable speed has its individual speed droop setting. The settings must be made with the relevant connections to terminals K and/or J.



Caution:

The speed droop set at the control unit is much higher than the engine's actual speed droop.

Rule of thumb: Speed droop of engine \approx Speed droop set at control unit x 0.08.

Resetting to the works settings:

- a) Select SETUP mode, see page 60.
- b) Ensure that no menu is activated, i. e. that all LEDs are off.
- c) Key in figures 1-2-3-4 and confirm with the ENTER key.
- d) If the works settings are reactivated the LEDs 4-3-2-1 will flash.
- e) Press the RUN button and hold it down until the RUN / SETUP LED stops flashing and remains on.

Operation monitoring system

**Caution:**

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

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

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.

Then switch off engine manually via the stop lever at the injection pump or via the stop device provided (shutdown solenoid, electric speed governor etc.).

**Danger:**

Ensure that the engine cannot be started by unauthorized 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 manufacturer’s warranty will become null and void.

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

You can find the approved products in the internet under:

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

Refilling with oil

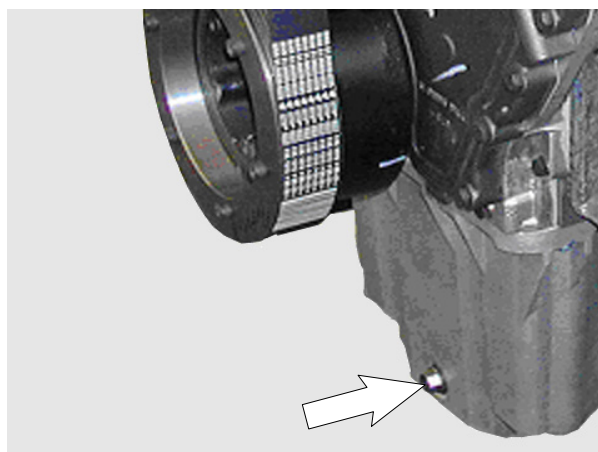
**Danger:**

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.

Refit the oil drain plugs with new gaskets.

**Note:**

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

Refilling with oil

**Caution:**

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

Refill with fresh engine oil at the oil filler neck ①.

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

**Caution:**

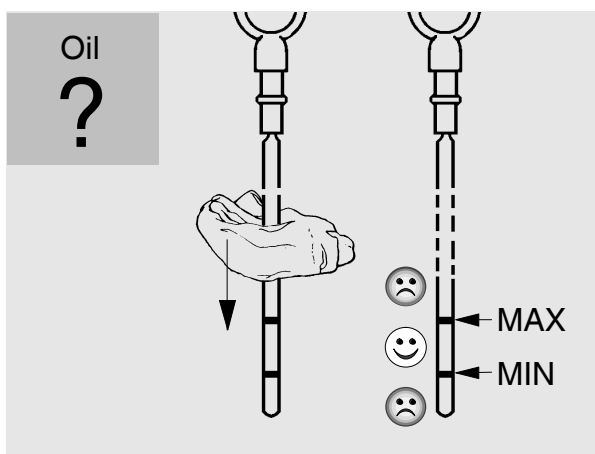
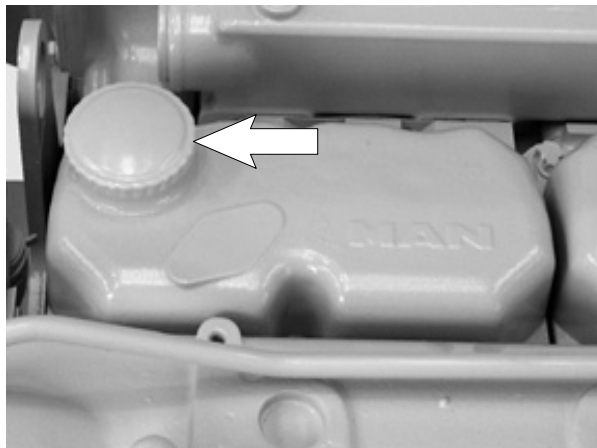
If no oil pressure builds up after approx. 10 seconds switch off the engine immediately.

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

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

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

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



Changing oil filter

**Caution:**

Used oil and oil filters are classed as dangerous waste. Observe safety regulations to prevent damage to the environment.

A tape wrench is a suitable tool for unscrewing the disposable filter box. Use a vessel of sufficient size to ensure that the oil does not overflow.

**Danger:**

Oil filter can and oil filter are filled with hot oil! Risk of burns and scalds.

Lightly oil the seal (arrow) of the new filter. Screw on filter cartridge by hand until seal is in contact. Continue to turn filter cartridge by hand for approx. a further 3/4 revolutions until it sits firmly.

Add engine oil, let engine run for a short time and check for leaks.

Tighten filter cartridge by hand if necessary.

Check oil level.



Fuel system

Fuel

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



Caution:

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

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

You can find the approved products in the internet under:

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

Injection pump

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

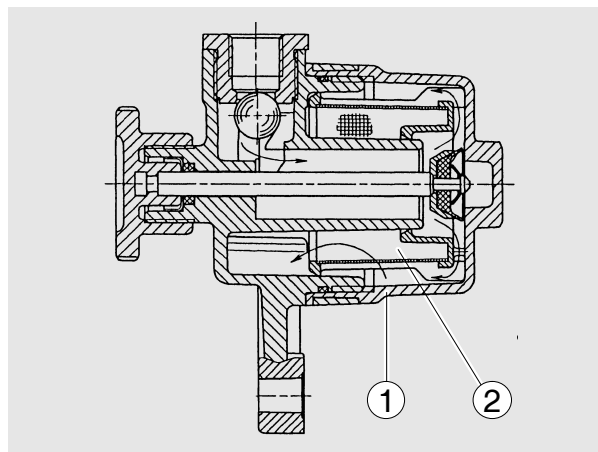
Faults

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

Cleaning fuel pre-cleaner

Strip the fuel pre-cleaner:

- Remove filter housing ①
- Wash out filter housing and gauze filter in clean Diesel fuel and blow them out with compressed air
- Reassemble using new seal
- Screw on filter housing and tighten it to 10 – 12 Nm
- Actuate tappet of hand primer until overflow valve of injection pump is heard to open
- Screw in and tighten plunger on hand pump
- Start engine
- Check fuel pre-cleaner for leaks



Fuel filter

(Single and parallel box-type filter)

Changing fuel filter

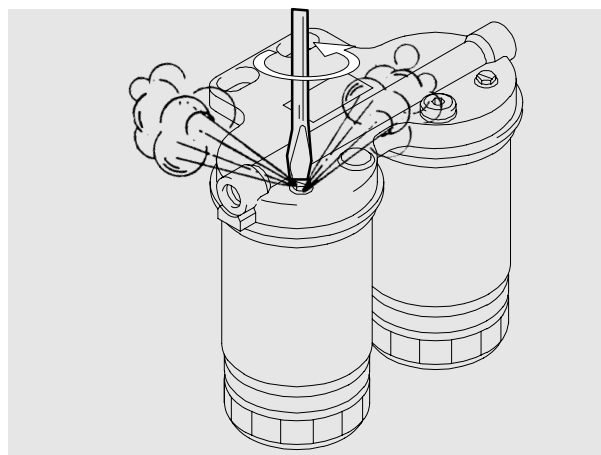
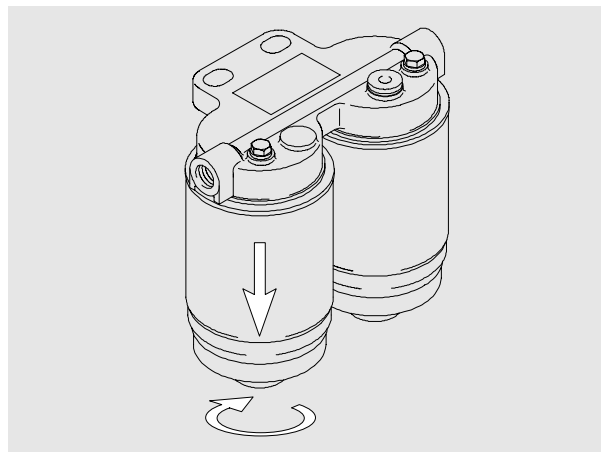
Only when the engine is switched off.

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



Caution:

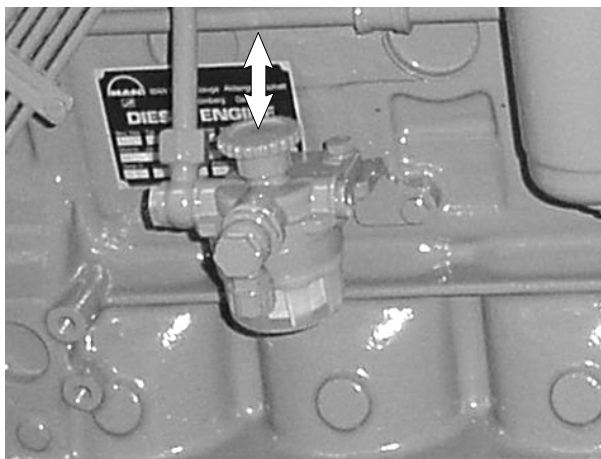
Used fuel filters are classed as dangerous waste and must be disposed of accordingly.



Bleeding the fuel system

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

- Unscrew bleed screw Δ of first filter in direction of flow by one or two turns
- Actuate tappet of hand primer until fuel emerges without bubbles
- Screw in and tighten plunger on hand pump
- Close bleed screw again
- Repeat this procedure at the second bleed screw
- Check fuel system for leaks



Cooling system



Danger:

Draining hot coolant involves a risk of scalding.

Draining the cooling system



Caution:

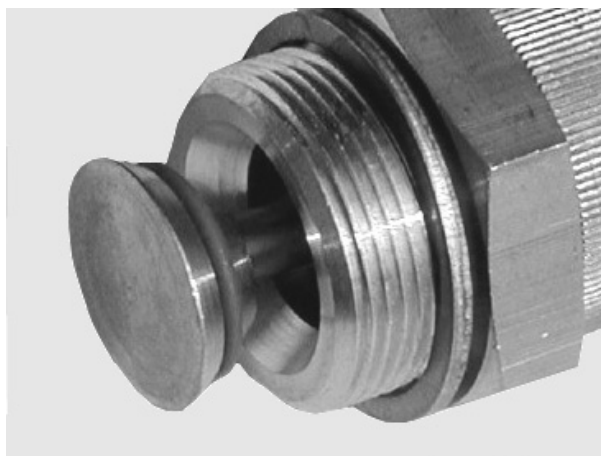
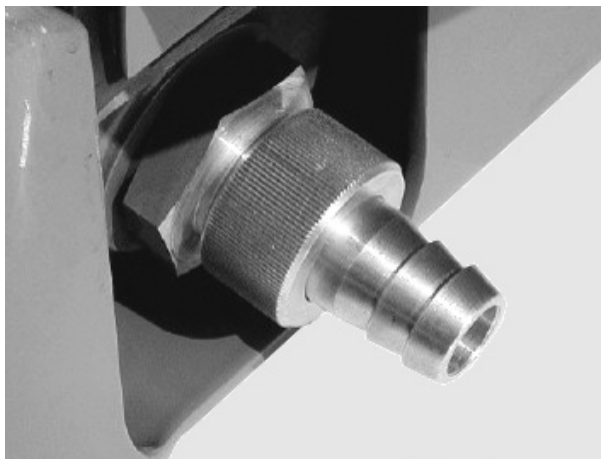
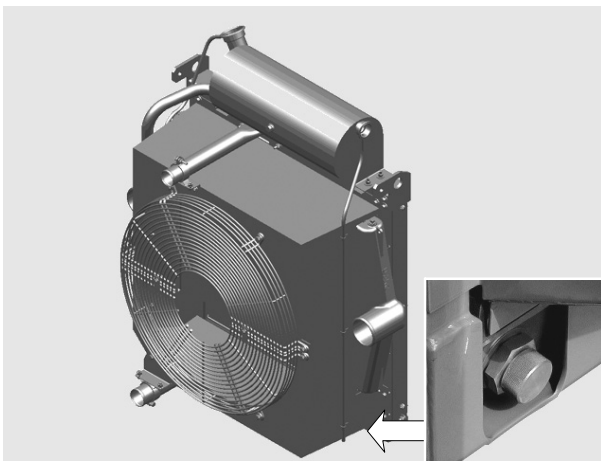
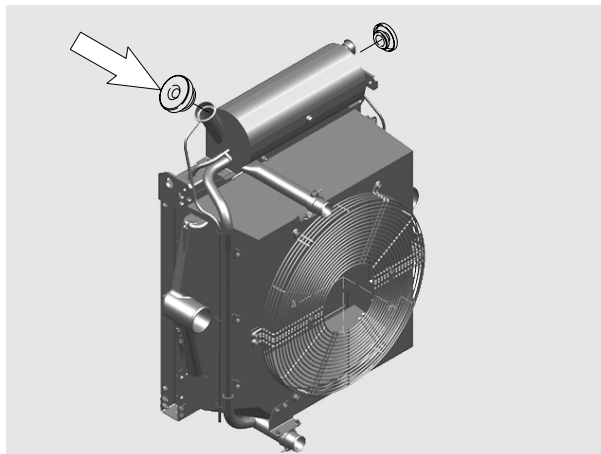
Drain coolant into a suitable container and dispose of it in accordance with regulations.

Drain coolant as follows when cooling system has cooled down

- Briefly open cap (large cap) on the filler neck of the expansion tank for pressure compensation

A valve for draining the coolant is located at the lower water tank of the radiator.

- Remove cap
- Screw in adapter 51.98131-6002 supplied with the radiator connecting parts
- This opens the sealing cone of the drain valve. The coolant is to be drained using a hose with 20 mm internal diameter
- Drain coolant into a container of adequate size



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 the ethylene glycole basis or anti-corrosion agent.

**Caution:**

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

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

You can find the approved products in the internet under:

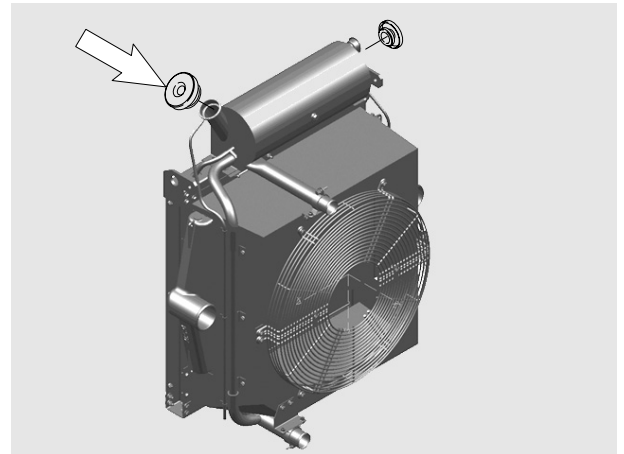
–<http://www.man-mn.com/> → **Products & Solutions** → **E-Business**–

Coolant must be added at the filler neck only (large cap).

Do not put cold coolant into an engine which is warm from operation.

Ensure that the ratio of water to anti-freeze is correct.

- Remove cap (large cap)
- Fill in the coolant slowly
- Refit end cover
- Run the engine briefly and then check coolant level once more

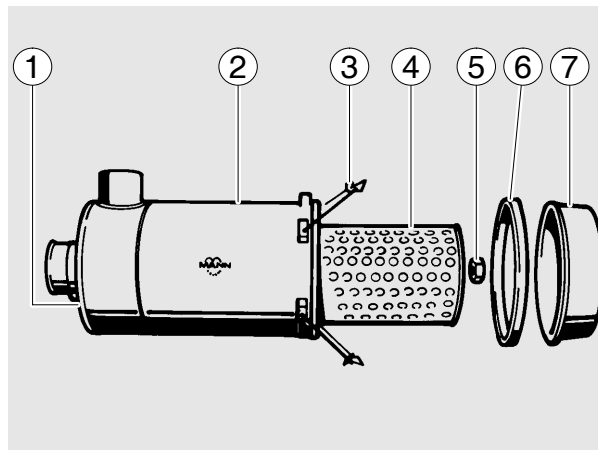
**Danger:**

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

Air filter

- ① Connection for contamination gauge
- ② Filter housing
- ③ Retainer
- ④ Filter cartridge
- ⑤ Hex nut
- ⑥ Lid
- ⑦ Dust collector

Service only when engine is switched off.



Dust collector

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

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



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

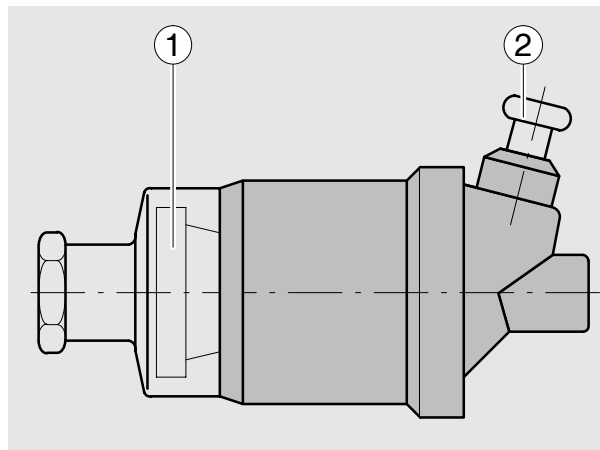
Contamination gauge

- ① Red display cylinder
- ② Return knob

In the window a red field appears which grows in size as the contamination increases.

If the red field is fully visible in the window, the air filter is contaminated and must be cleaned or changed..

When the filter has been changed pull the return knob. The red field then disappears..



Display: filter service is due

Changing the filter cartridge

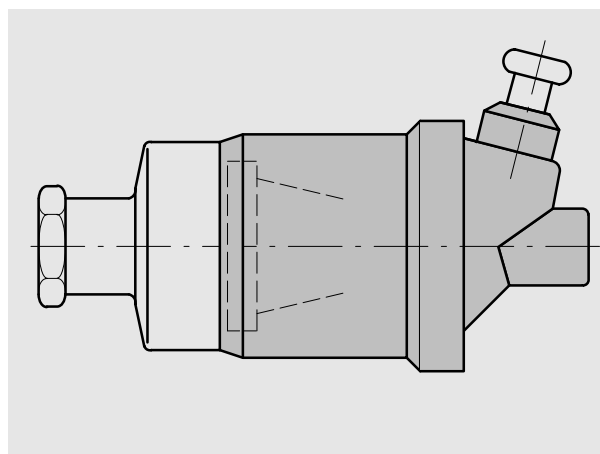


Caution:

No dust must get to the clear air end.

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

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



Display: filter is ready for operation



Caution:

The engine must not be run without a main cartridge.



Cleaning the cartridge



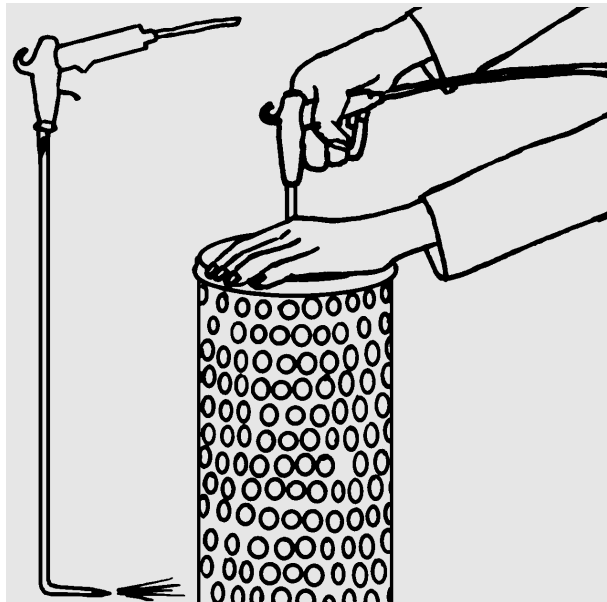
Caution:

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

Blowing out (wear goggles)

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

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

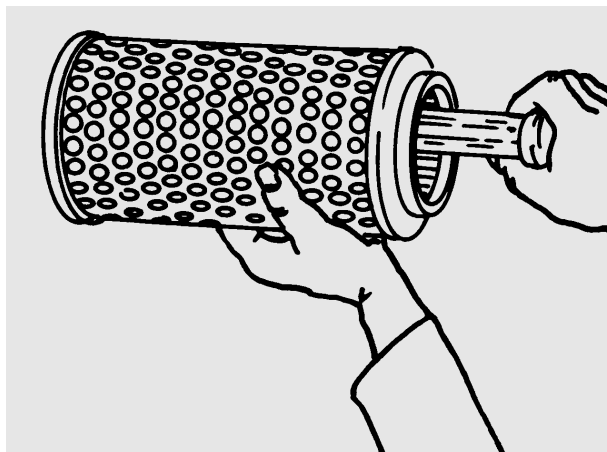


Checking the cartridge

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

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

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



Safety cartridge

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

Safety cartridges must be neither cleaned nor re-used.

Safety cartridges must be changed:

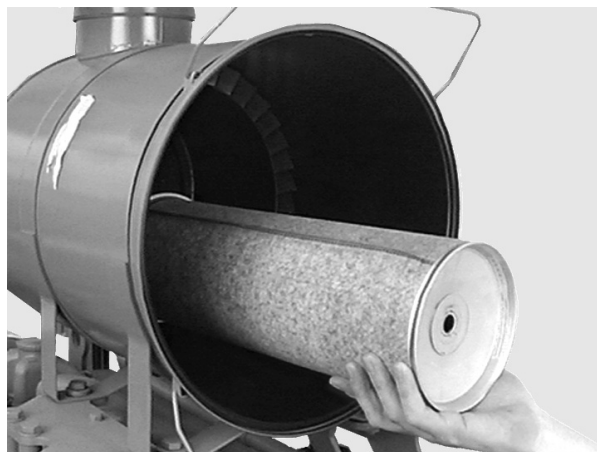
- at the latest after being in use for two years
- if, after the main cartridge has been serviced (changed), the contamination gauge responds again immediately
- if the main cartridge is defective

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

Remove the hex nut.

Pull out the safety cartridge.

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



Ribbed V-belt

Checking condition

The ribbed V-belt is maintenance free.

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

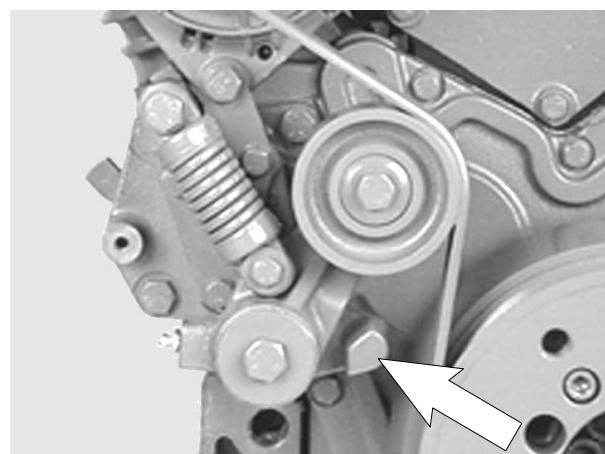
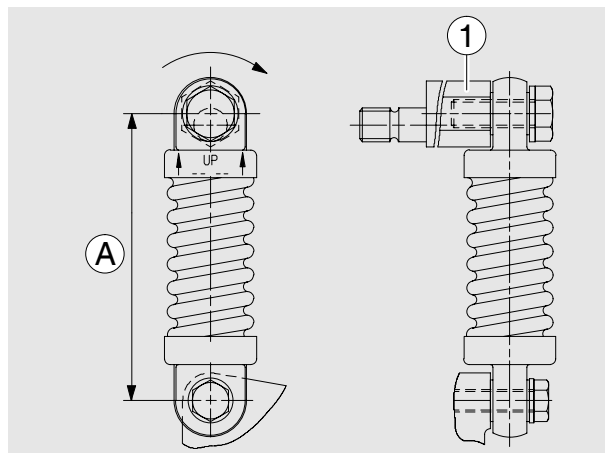
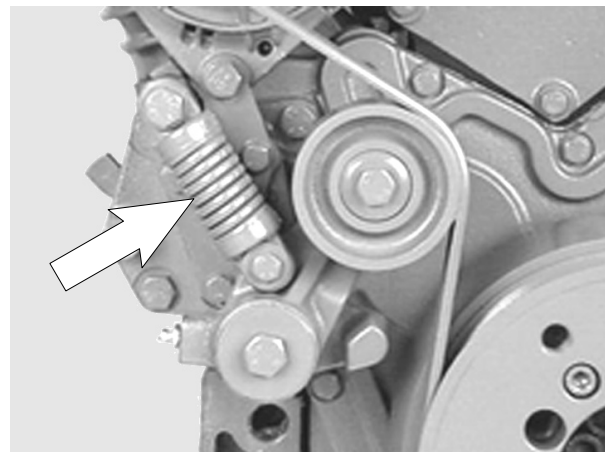
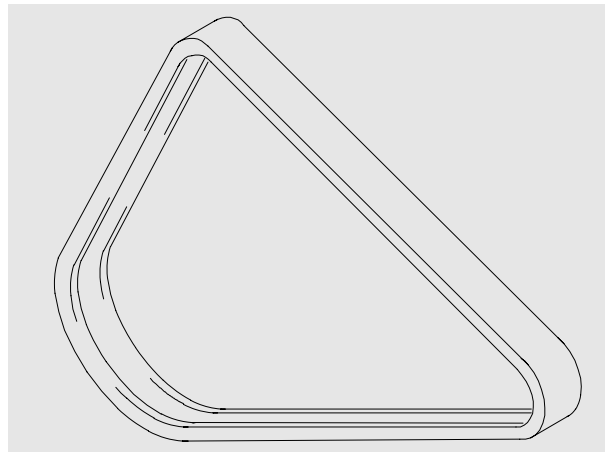
Checking tension

The ribbed V-belt is always kept at the correct tension by the tensioning device (arrow).

However, the following adjustment regulations for the V-belt tensioner must be observed:

1. Adjustment in the new condition at distance between pin centres
 $A = 92 \pm 1 \text{ mm}$
2. Re-adjustment of the V-belt tensioner at max. distance between the pin centres $A = 100 \text{ mm}$ by turning the eccentric to the right to distance between the pin centres $A = 92 \pm 1 \text{ mm}$ or if the eccentric ① permits a reduction of up to a minimum of 92 mm
3. If the distance between the pin centres $A = 100 \text{ mm}$ is again reached the ribbed V-belt must be changed provided that the re-adjustment range of the eccentric ① has been exhausted. New adjustment in accordance with point 1

It is also necessary to change the ribbed V-belt if the tensioning lever contacts the stopper of the console (arrow).



Caution:

A distance between the pin centres of over 100 mm can lead to the total failure of the V-belt drive since the V-belt tension is too slack!

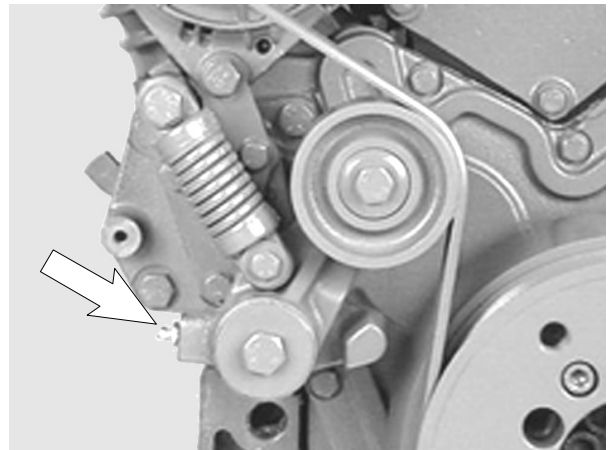
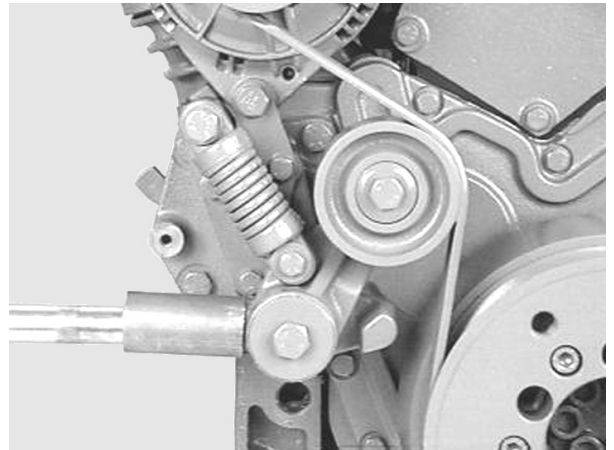
Exchanging the ribbed V-belt

- Fit suitable tool on the square head
- Press back V-belt tensioner
- and remove V-belt outwards from the tension pulley

Assembly:

- Place ribbed V-belt on the pulley of the crankshaft, the alternator and the coolant pump
- Press back V-belt tensioner
- Place V-belt on the tension pulley, release V-belt tensioner, remove tool

During the maintenance work the conical lubricating nipple (arrow) must also be lubricated.



Turbocharger

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

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

Intercooler

If the coolant output is to be retained as far as possible, the intercooler must be cleaned at certain intervals.

Starter motor

Check that the electric cables are properly fastened and that contacts and plug connections are secure.

In engines fitted with electronic speed pickups at the gear ring (electronic speed governor), the speed pickup are to be cleaned too and metal chips that may adhere are to be removed.

**Note:**

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

Alternator

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

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

While the engine is running

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

Temporary decommissioning of engines

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

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

Model	D 0836 LE 201 / 203
Design	in-line vertical
Cycle	4-stroke Diesel with turbocharger and intercooler
Combustion system	Direct injection
Turbocharging	Turbocharger with intercooler
Number of cylinders	6
Bore	108 mm
Stroke	125 mm
Swept volume	6 870 cm ³
Compression ratio	16:1
Rating	see engine nameplate
Firing order	1-5-3-6-2-4
Valve clearance (cold engine)	
Intake	0.50 mm
Exhaust	0,60 mm
Valve timing	
Intake opens	18° before TDC
Intake closes	32° after BDC
Exhaust opens	63° before BDC
Exhaust closes	29° after TDC
Fuel system	
Injection pump	Bosch-distributor-type injection pump VP 44
Governor	Electronic speed governor (GAC)
Start of delivery	0° ± 0,5° before TDC
Injectors	six-hole nozzles
Opening pressure of injector	
New nozzle holder:	300 + 10 bar
Used nozzle holder:	300 + 10 bar

Engine lubrication	Force feed	
Oil capacity in oil sump (litres)	min.	max.
	22 l	28 l
Oil change quantity (with filter)	30 l	
Oil pressure during operation (depending on oil temperature, oil viscosity class and engine rpm)	must be monitored by oil pressure monitors / / gauges	
Oil filter	Full-flow filter with paper filter elements	
Engine cooling system	Liquid cooling	
Coolant temperature	80 - -90°C, temporarily 95°C allowed	
Coolant filling quantity	16 l	
Electrical equipment		
Starter	24 V; 4 kW	
Alternator	28 V; 80 A	

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