

# Repair manual



MAN-Industrial Diesel Engines

D 2876 LE 201  
D 2876 LE 202  
D 2876 LE 203



Important instructions concerning technical safety and personal protection are, as shown below, especially highlighted.

**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:**

Explanatory descriptions which help in understanding the relevant work or operating procedure to be carried out.

### Fitting flat seals / gaskets

Gaskets are frequently used with sealants or adhesives as an aid to assembly or to achieve a better seal. Above all when parts with different levels of thermal expansion (e.g. aluminium and cast iron) are bonded, this can mean that the gasket is shifted during operation by the so-called stitching or sewing machine effect and leaks 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.

#### Perfect assembly of gaskets can only be achieved if the following instructions are adhered to:

- 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.

#### Assembly of round sealing rings

- Use only genuine MAN round sealing rings.
- The sealing faces must be undamaged and clean.
- Always wet round sealing rings with engine oil before fitting them.

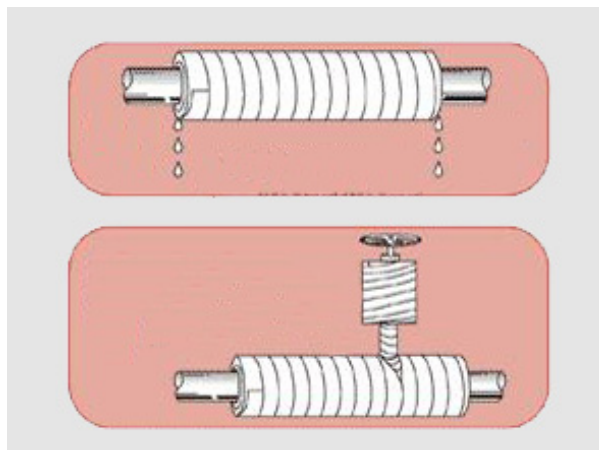
### Masking of fuel and lube oil pipe connections (for classified engines only)

The unions of pressurised oil and fuel pipes are masked with a protective tape.

If this tape is removed during a repair, the unions must be masked with protective tape again afterwards.

The following pipes are affected:

- Oil supply pipe to turbochargers
- Fuel pipes between supply pump, filter and injection pump
- Injection pipes protected against leaks



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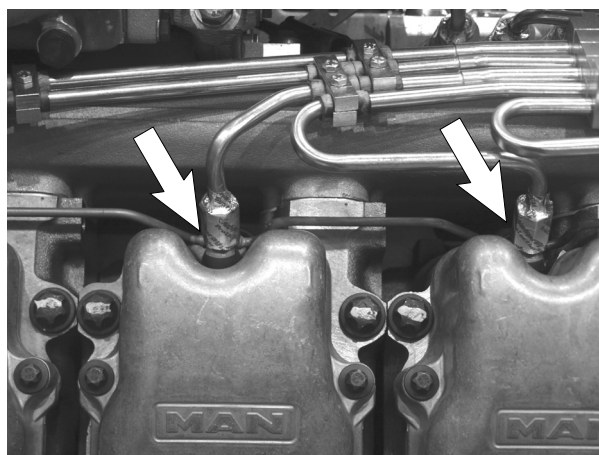
Fig. 1

A protective tape is wound around the unions. Ensure that there is 50 % overlap on every pass.

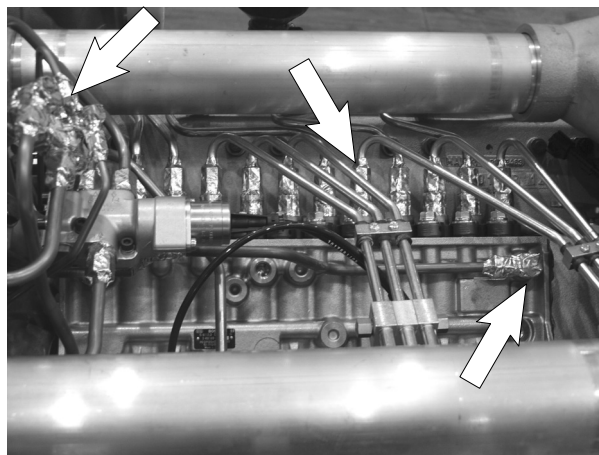
Figs. 2-4

The unions to be masked must be clean and free of oil and grease.

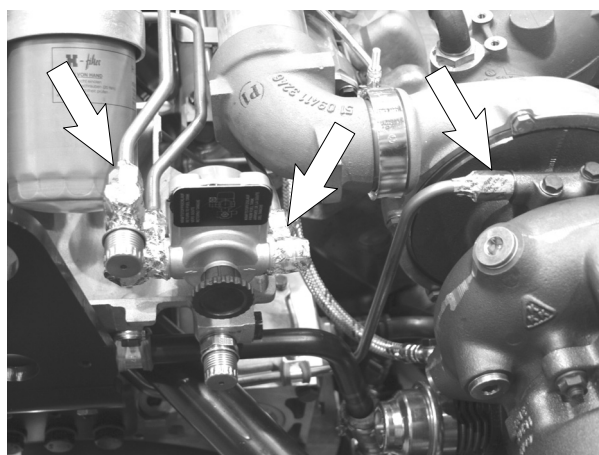
Do not apply the protective tape unless this is the case



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## General

Important safety regulations are summarized in this quick-reference overview and arranged by topic to effectively convey the knowledge necessary to avoid accidents causing injury, damage or environmental hazard. Additional information can be found in the operating instructions of the engine.

### Important:

Should an accident occur despite all precautionary measures, particularly one involving contact with corrosive acid, penetration of fuel under the skin, scalding by hot oil, antifreeze splashing into the eyes etc. **you must seek medical assistance immediately.**

### 1. Regulations designed to prevent accidents with injury to persons

Checks, setting jobs and repair work must be carried out by authorised skilled personnel only.

- When carrying out maintenance and repair work, ensure that the engine cannot be accidentally started from the bridge by unauthorised persons.
- The engine may only be started and operated by authorised personnel.
- When the engine is running, do not get too close to the rotating parts. Wear tight-fitting working clothes.
  
- Do not touch hot engine with bare hands: Risk of burns.
  
- Keep area surrounding engine, ladders and stairways free of oil and grease. Accidents caused by slipping can have serious consequences.
- Only work with tools which are in good condition. Worn spanners/wrenches slip: Danger of injury.
- Persons must not stand under an engine suspended on a crane hook. Keep lifting gear in order.
  
- Open the coolant circuit only when the engine has cooled down. If opening the coolant circuit while the engine is hot is unavoidable, observe the instructions in the chapter "Maintenance and care" in the Operator's Manual.
- Do not tighten or undo pipes and hoses under pressure (lubricating oil circuit, coolant circuit and any downstream hydraulic oil circuits). The fluids which flow out can cause injury.
  
- When checking the injection nozzles, do not hold your hands in the fuel jet. Do not inhale fuel mist.



- When working on the electrical system, first disconnect the earth cable of the battery and reconnect this last to prevent short circuits.
- Follow the manufacturer's instructions for handling batteries.  
**Caution:**  
Accumulator acid is toxic and caustic. Battery gases are explosive.
- When performing welding work, observe the "Notes for welders".



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

- ***The engine must be cleaned thoroughly prior to repair. Ensure that dirt, sand or foreign matter will not get into the engine during repair work.***
- If engine operation is disrupted, immediately determine the cause and have it remedied to prevent additional damage.
- Always use genuine MAN parts only. Installation of "equally" good parts from other suppliers may cause severe damage for which the workshop carrying out the work is responsible.
- Never allow the engine to run dry, i.e. without lubricant or coolant.  
***Appropriate notices must be attached to engines that are not ready for operation.***
- Use only MAN-approved service products (fuel, engine oil, anti-freeze and anti-corrosion agent). Pay attention to cleanliness. Diesel fuel must be free of water.
- ***Do not fill engine oil beyond the max. notch 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.
- Control and monitoring devices (charge control, oil pressure, coolant temperature) must be in perfect working order.
- Observe the instructions for operating the alternator; see chapter "Maintenance and care" in the Operator's Manual.

### 3. Regulations designed to prevent pollution

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

- Old oil must be passed on for recycling.
- 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 corrosion protection agents and / or antifreeze as hazardous waste.



- When disposing of used coolant, the regulations issued by the relevant local authorities must be observed.

#### 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 hazardous substances that have caused skin cancer in tests on animals. 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 nail brush provides effective assistance here.
  - 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 clothing and shoes that are soaked in oil.
- Do not put oily cloths in your pockets.

**Ensure that used engine oil is disposed of in the appropriate manner.**  
– Engine oil is a substance that endangers the water supply –

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

Carefully collect and dispose of used engine oil. Information on collection points can be obtained from sales personnel, the supplier or the local authorities.

\* Based on "Information sheet for handling used engine oil".



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## Operating faults and possible causes

### **We recommend**

A repair is only complete when both the damage that occurred and the possible causes have been eliminated. Finding out the cause of damage is often more difficult than repairing the damage that occurred. We therefore recommend that you obtain a precise description of the operating fault before removing and dismantling components. Then use a process elimination (questions) to pinpoint the probable causes and investigate and eliminate these successively on the basis of the table **and your own experience**. This helps to reduce repairs to the required scale and to counteract claims regarding “overeager” replacement of parts and complaints about expensive work and down time.

### **Note:**

The following list is conceived as an aid to memory for experts so that to causes of damage are overlooked when dealing with faults. The precondition for this, however, is that the experts are familiar with the Repair Manual for the engine as well as the accompanying Operating Instructions and the publication “Fuels, Lubricants and Coolants for MAN Diesel Engines”.

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## Fault table



1.	Starter turns over engine only slowly or not at all			
2.	Starter motor turns engine, engine does not start			
3.	Engine does not start while cold			
4.	Engine does not run smoothly, and stops			
5.	Speed fluctuations during operation			
6.	Slow, periodic fluctuation of speed (approx. 0.5–1 Hz)			
7.	Quick periodic fluctuation of speed (approx. 8–12 Hz)			
8.	Engine cannot be switched off			
9.	Performance unsatisfactory			
10.	Coolant temperature too high, coolant loss			
11.	Lubricating oil pressure varies / too low			
12.	Lubricating oil consumption too high			
13.	Fuel consumption too high			
14.	Black smoke			
15.	Blue smoke			
16.	White smoke			
17.	Engine knocks			
				<b>Possible causes</b>
	x		x	Turbocharger contaminated or defective
		x	x	Turbocharger wear
	x			Coolant level too low
	x			Proportion of anti-freeze / anticorrosion agent too high, see "Fuels, lubricants..."
	x			Cap with working valves on expansion tank defective, leaky
	x			Thermostat in closed position blocked
	x			Radiator heavily contaminated
	x			V-belt for water pump drive not correctly tensioned (slipping)
	x			Water pump leaky, defective (bearing damage)
	x			Coolant circuit clogged by foreign matter
	x			Temperature indicator defective
x	x			Oil viscosity unsuitable (viscosity too high), see "Fuels, Lubricants..."
		x		Oil viscosity unsuitable (viscosity too low), see "Fuels, Lubricants..."
		x		Lubricating oil quality does not satisfy regulations, see "Fuels, Lubricants..."
		x		Oil level in oil pan too low
		x		Oil level in oil pan too high
		x		Automatic oil refill system incorrectly adjusted
		x		Max. inclination exceeded
		x		Oil pump gears heavily worn
		x		Safety valve in oil circuit defective (does not shut, spring fatigued or broken)
		x		Safety valve in oil circuit defective (does not open)
		x		Oil pressure gauge defective
			x x x	Engine in cold running phase
		x		Leaks in lubricating oil circuit, particularly at turbocharger and oil cooler
		x	x	Piston rings heavily worn
		x		Heavy bearing wear
		x	x	Valve guides heavily worn
			x	Crankcase breather clogged (excess pressure in the crankcase)
			x	Cylinder head gasket leaky / burned through
x				Crank gear blocked
		x		Mainly low-load operation

The service life of an engine is influenced by very different factors. It is therefore not possible to specify certain fixed numbers of operating hours for general overhauls.

In our view, it is not necessary to open up an engine or perform a general overhaul as long as the engine has good compression values and the following operating values have not changed significantly in relation to the values measured on commissioning the engine:

- Boost pressure
- Exhaust temperature
- Coolant and lubricant temperature
- Oil pressure and oil consumption
- Smoke emissions

The following criteria greatly influence the length of the engine service life:

- Correct power output setting according to the type of application
- Technically correct installation
- Inspection of installation by authorised personnel
- Regular maintenance in accordance with the maintenance schedule in the Service Booklet
- Choice and quality of lubricating oil, fuel and coolant



**Note:**

Only use coolants that comply with MAN regulations.

For basic information on the consumable materials, refer to the publication "Fuels, Lubricants and Coolants for MAN Diesel Engines". You can find the approved products on the Internet at:

–[http://www.mn.man.de/index/mn\\_eng/motor/serviceproducts.htm](http://www.mn.man.de/index/mn_eng/motor/serviceproducts.htm)–

### Pressurisation

It is extremely important for internal combustion engines (following the completion of repair work, i.e. in their dry state) to be pressurised with lubricating oil before being recommissioned. This procedure can also be used for ascertaining damage and its causes.

If engines are not pressurised, the risk of premature damage to bearing surfaces is very high because it takes a relatively long period of time for the lubricating oil drawn in from the oil pan via the oil pump to reach the individual bearings.

Such incipient damage need not necessarily lead to immediate bearing failure, but may impair the proper functioning of the bearings and reduce their service lives.

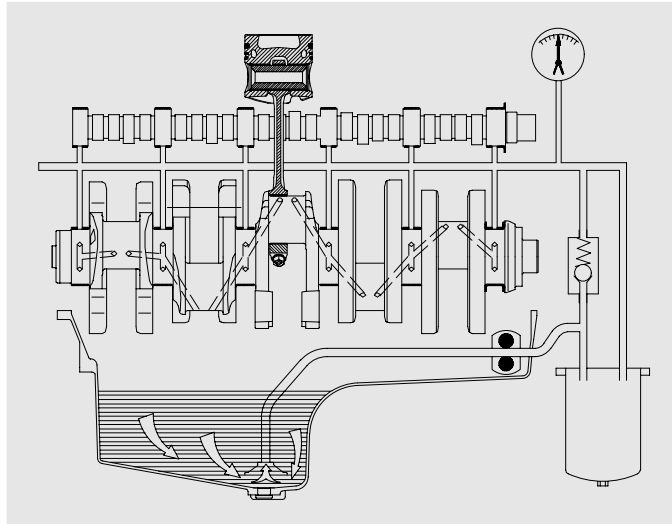
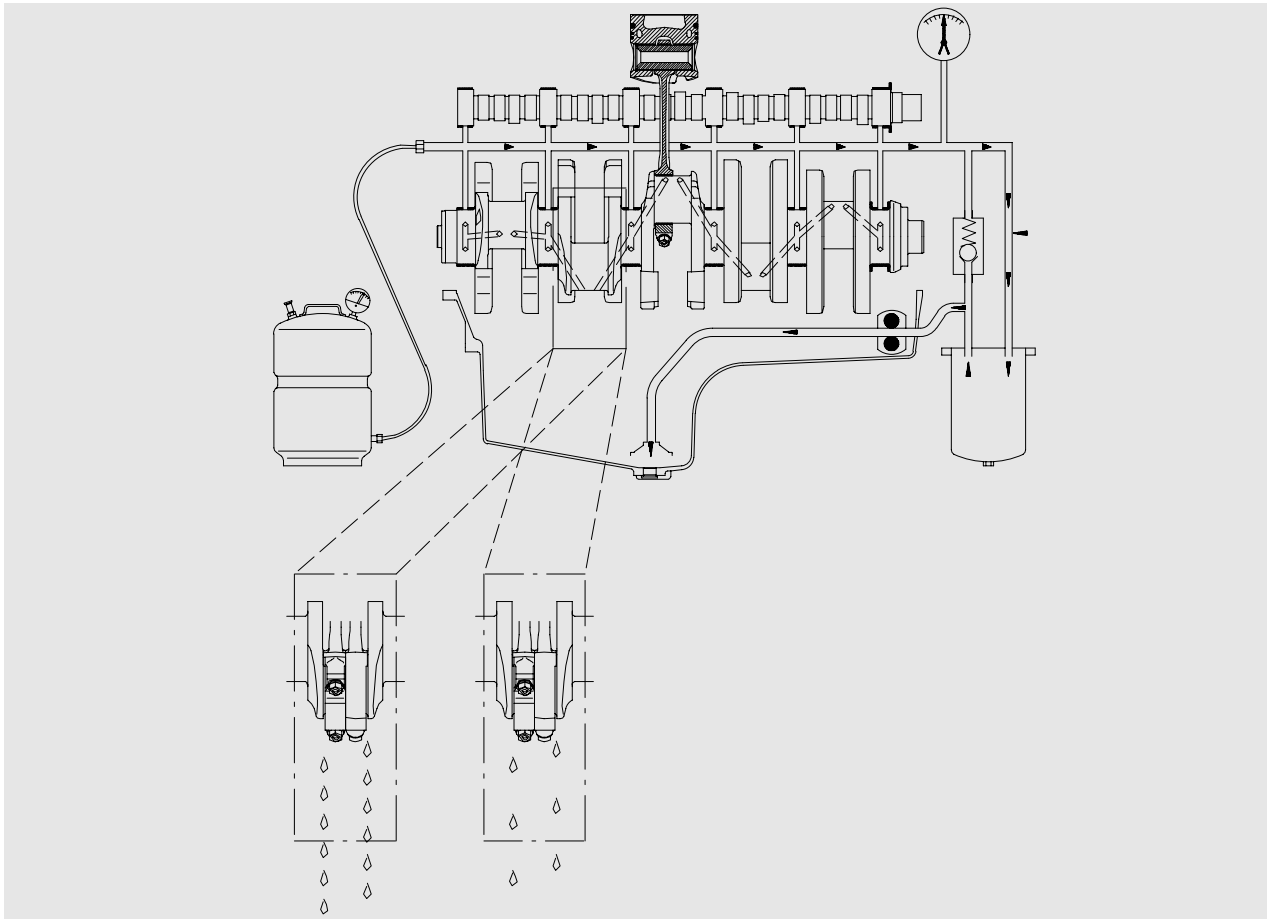


Diagram of the oil flow with unpressurised engines

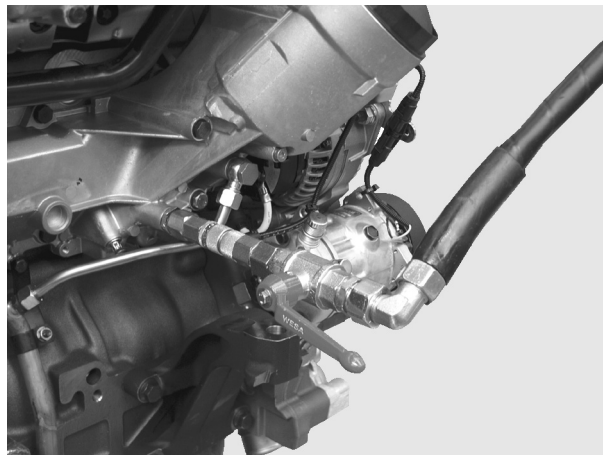
Pressurising an engine affords the following advantages:

- All engine parts are lubricated before engine startup; a lubricating film can be built up inside the bearings as early as after the first few rotations of the crankshaft, thereby preventing damage to the bearing races.
- Any loss of oil, be it the result of excessively large bearing play or leaks from the crankcase or from crankcase bores which may not be plugged, can be detected immediately. For this purpose, mount the engine on an assembly dolly, remove the oil pan and install a suitable oil collector under the crankcase in such a way that the bearings are visible



Performance of pressurisation:

At least 30% of the total oil quantity is forced from the pressurisation container into the engine oil circuit. The operating pressure serves as the yardstick for the pressure to be forced in and must not be exceeded. The pressurisation container is connected up to the engine oil circuit at the oil filter head screw plug).



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