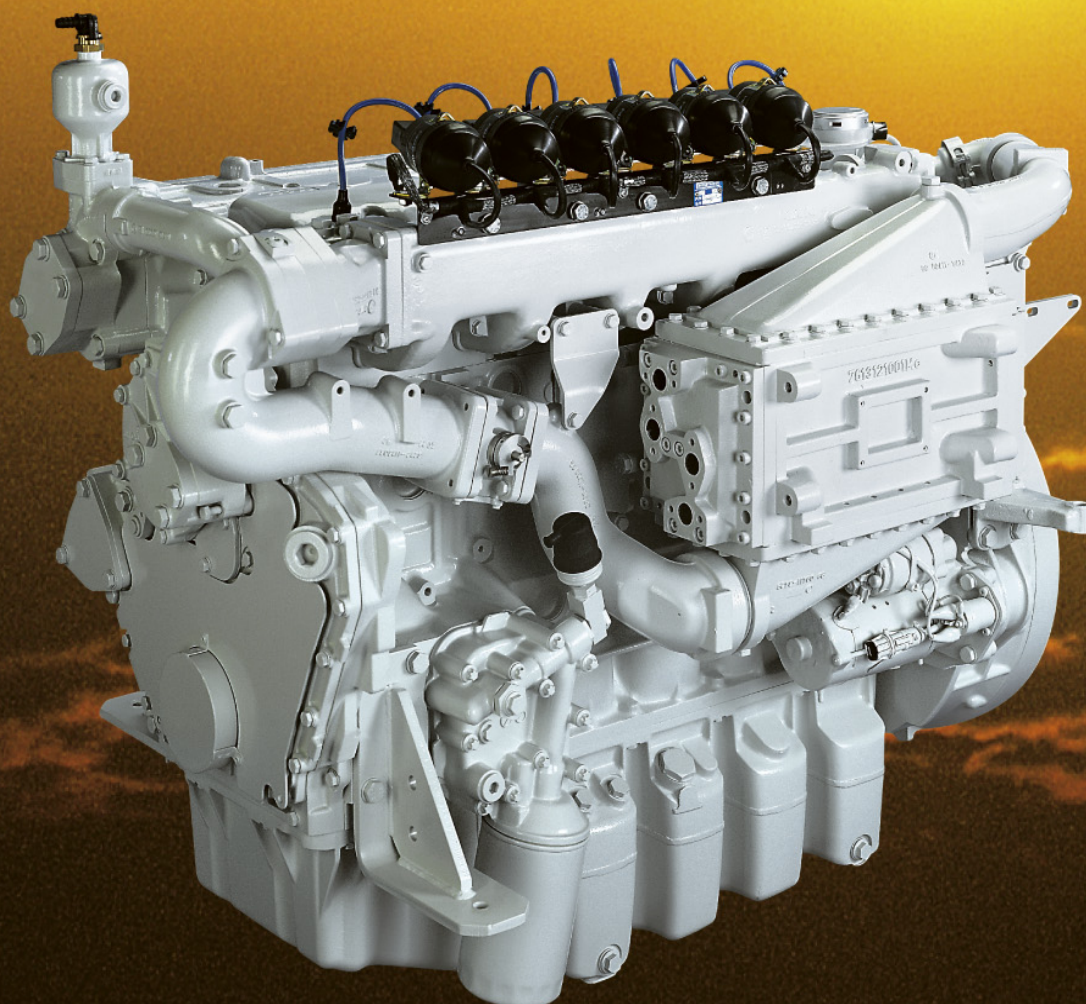


Repair Manual



MAN industrial Gas engines

E 0836 LE 202



This Repair Manual is designed to facilitate competent repair of the engines listed herein.

The pictures and relevant descriptions show typical work that may not always be applicable to the engine in hand, which nevertheless does not mean that they are not correct.

In such cases the repair work is to be planned and carried out in a similar way.

It is compulsory that the engine be removed before performing any of the work describe in this Repair Manual.

The expert knowledge necessary for handling diesel engines was taken for granted when this publication was compiled.



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 Industrial Gas Engines".

You can find the approved products in the internet under:

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

Repairs to drive units are to be performed by our customer service or the customer service of the manufacturer.

Best regards
MAN Nutzfahrzeuge Aktiengesellschaft
Nuremberg Plant

Since our products are in continuous development, we reserve the right to make technical modifications.

© 2005 MAN Nutzfahrzeuge Aktiengesellschaft

Reprinting, copying or translation, even of extracts, is not allowed without written permission from MAN. All rights under the copyright law are strictly reserved by MAN.

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:**

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

Assembly of pipes

**Danger:**

No pipes may be bent.
Risk of breakage!

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.

Fitting 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.

	Page
Foreword	1
Instructions	2
Engine type classification	5
Safety regulations	6
Fault table	10
General notes on engine overhaul	13
Engine views	14
Schematic diagram of engine lubrication	16
Schematic diagram of cooling system	17
Schematic diagram of engine timing	19
Ignition	
Replacing the spark plugs	20
Ignition system	21
Cooling system	
Draining and filling coolant	23
Removing and refitting coolant pipe	25
Lubrication	
Changing oil filter	26
Removing and installing oil cooler	27
Removing and refitting oil pan – Removing and refitting oil intake line	28
Removing and refitting oil pump, disassembly and re-assembly	29
Removing and installing oil injection nozzle	32
Flywheel / Crankshaft seal	
Replacing front crankshaft seal	33
Removing and installing, repairing flywheel – Replacing starter ring gear	34
Removing and installing crankshaft seal, flywheel end	36
Removing and installing flywheel housing	37
Intake / exhaust system	
Removing and installing intake pipe	39
Removing and installing, cleaning charge mixture cooler	40
Removing and installing exhaust pipe	43
Turbocharger, troubleshooting	45
Removing and installing turbocharger	47
Cylinder head	
Removing and installing rocker arm mechanism, removing and installing cylinder head	49
Setting valve clearance	53
Disassembling and assembling rocker arm mechanism	54
Removing and installing valves	56
Checking compression pressure	60
Valve timing	
Removing and installing timing case	61
Removing and installing camshaft	66
Removing and installing camshaft bearing bushes	68
Checking valve timing	74



Contents

	Page
Crankgear, pistons	
Removing and installing crankshaft	75
Removing and installing piston with conrod	78
Removing piston from conrod and installing, checking – replacing conrod	81
Removing and installing, replacing piston rings	83
Replacing cylinder liners	85
Measuring excess piston retrusion	86
Attachments	
Removing and installing starter motor	87
Service Data	89
Technical data	91
Engine	91
Crankcase	92
Cylinder liner	92
Crankshaft	93
Flywheel	95
Conrod	96
Conrod bearing	96
Pistons	97
Cylinder head	98
Valve train	100
Engine lubrication	102
Ignition system	103
Ignition point	103
Starter motor	104
Turbocharger	104
Torque guide values	105
Cylinder head bolts	107
Special tools	110
Index	117

The type designation, consisting of a sequence of letters and numbers, indicates some characteristics of each engine, provided you are familiar with the basic terminology.

The system is explained here using the type E 0836 LE 202 as an example:

- E The “E” at the start of the type designation stands for natural gas (German: Erdgas)

- 08 The numbers “08” indicate that this is a power unit with **108** mm bore

- 3 The “3” means **125** mm stroke

- 6 The “6” indicates the number of cylinders **6**

- L This letter stands for the German word “Ladeluftkühlung”, meaning “**Intercooling**”

- E The “E” stands for “**fitted engine**” (German: Einbaumotor) and is intended to distinguish MAN vehicle enginesöl

- 202 This is a factory-internal development number

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 for the prevention of accidents with personal injury

Inspection, adjustment and repair work may only be performed by authorised and skilled personnel.

- 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 close-fitting clothing.
- 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 it is unavoidable that the circuit be opened with the engine at operating temperature, observe the instructions in the chapter "Maintenance and care" in the operating instructions.
- 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 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 for the prevention of engine damage and premature wear

- **The engine must be cleaned thoroughly prior to repair. Ensure that during repair work no dirt, sand or foreign bodies enter the engine.**
- If engine operation is disrupted, immediately determine the cause and have it remedied to prevent additional damage.
- In every case, use only original MAN spare parts. The installation of parts that are "just as good" but do not originate from MAN can under certain circumstances cause severe damage – for which the workshop performing the repair must bear responsibility.
- 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.
- Only use lubricants, fluids and fuel approved by MAN (gas, engine oil, antifreeze and corrosion protection agents). Pay attention to cleanliness.
- **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.

3. Safety instructions for handling the ignition system

- When the engine is in operation, the following parts of the ignition system must not be touched or disconnected under any circumstances:
 - Ignition coils and caps
 - Cables of the high-voltage circuit
 - Cables of the low-voltage circuit
 - Plugs of the output and input wiring harness
- For all work related to set-up, operation, conversion, customisation, maintenance and repairs, the power must be disconnected from the ignition system and secured against inadvertent reactivation.





4. Regulations for the prevention of environmental damage

Engine oil and filter cartridges

- Old oil must be passed on for recycling.
- Take extreme care that no oil enters the waste water system or seeps into 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.

5. Instructions for 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 principles of work safety and hygiene are observed, handling used engine oil does not represent a health hazard.

Precautionary measures to protect your health:

- 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.
 - Special hand cleaning agents make it easier to clean dirty hands.
 - Do not use petrol (gasoline), diesel fuel, gas oil 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".