



Betriebsstoffe für MAN-Industrie-Gasmotoren
Fuels, Lubricants and Coolants for MAN Industrial Gas Engines
Ingrédients pour moteurs industrielles à gaz MAN

Fuels, Lubricants and Coolants for
MAN Gas Engines



Dear Customer,

MAN gas engines are developed to the state of the art and built using the latest production technology.

This results in significant properties such as:

- Economical operation thanks to low consumption of gas and lube oil
- Low weight
- Limited extent of maintenance and spare part requirements and a long service life
- Future-oriented environmental compatibility
- Compact design

However, trouble-free operation and high performance can be achieved only if the specified maintenance intervals are observed and the fuels, lubricants and coolants approved by MAN are used.

Please observe the guidelines for the protection of the environment when handling fuels, lubricants and coolants.

Yours faithfully
MAN Nutzfahrzeuge Aktiengesellschaft
Nuremberg Plant

We reserve the right to make technical modifications in the course of further development.

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Fuels, lubricants and coolants are poisonous, inflammable and also harmful to the environment if they are not used properly. Do not allow them to seep into the ground or into the sewerage system. Hand used oil over to old oil disposal companies or dispose of them as special waste.

Comply with safety regulations.

Follow the instruction sheet for handling used engine oil.

Engine oil

- Hand old oil over to old oil disposal companies only.
- Ensure without fail that oil does not seep into the sewerage system and / or into the ground.
Caution:
Risk of contamination of potable water.
- Dispose of used filter elements and cartridges as special waste.

Coolant

- When disposing of them treat coolant, anticorrosion agent and / or antifreeze as hazardous waste.
- The regulations of the respective local authorities must be observed when used coolant is disposed of.

Gas system

- Comply with the manufacturer's instructions when commissioning, operating, servicing and maintaining the gas system and when monitoring its operational reliability.
- Intervention in or adjustments to the gas system must be made by authorised personnel only.



Engine oils approved by MAN

Special gas engine oils complying with factory standard MAN 3271 part 2 are to be used for industrial gas engines.

The permitted engine oils can be found on the Internet:

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

Single-grade engine oils

Single-grade SAE 40 engine oils must not be used unless cold-starting can be ruled out, i.e. where ambient temperatures under +10°C do not occur.

Conditions of approval

The approval for engine oils is valid for two years and can be extended by another two years at the request of the manufacturer / supplier provided that the quality of the oil in question has not changed.

Before purchasing a product, make sure that it is still approved by having the supplier produce the MAN letter of approval.

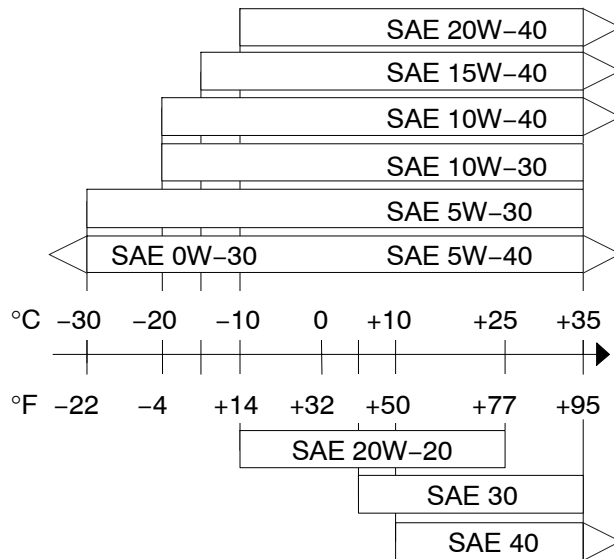
Engine oils without MAN approval

If no engine oils approved by MAN are available in particular countries, clearance for alternative products must be obtained from

MAN Nutzfahrzeuge Aktiengesellschaft
Business Unit Engines
Abt. MTVA
Vogelweiherstraße. 33
D-90441 Nürnberg

SAE viscosity classes

SAE viscosity class is dependent on ambient air temperatures (see diagram).



Engine oil additives

The engine oils approved by MAN according to factory standard M 3271 part 2 are composed in such a way that they meet the engine requirements in all cases when the specified oil change intervals are adhered to (procedure, see next page).

Any additives – no matter what kind – subsequently added to the engine oil result in changes which cannot be calculated and may cause damage to the engine.

Using such additives will render any warranty claim against MAN Nutzfahrzeuge Aktiengesellschaft null and void, if the damage results from the use of such additives.



Oil change intervals

The oil change intervals must be specified individually. After commissioning of the engine, used oil samples are to be drawn at specified intervals and these are to be analysed by the oil supplier. The intervals are to be agreed with the oil supplier and MAN Nutzfahrzeuge AG, dept. MVIT. The results of the analyses will be used to specify the permitted oil dwell time and thus the oil change interval.

This procedure is particularly necessary if special gases such as sewage, dump waste and fermentation gas are used, as these gases are not uniform as regards their main constituents and the content of attendant gas materials.

Attendant gas materials such as sulphur and organic halogen compounds (chlorine, fluoride) can form acids that can severely restrict the oil dwell time. This oil acidification leads to corrosive wear in the engine.

Fuel

MAN industrial gas engines can be operated with various burnable gases of different origins, such as natural gas, waste dump gas, sewage gas and fermentation gas.

Essentially, these burnable gases consist of methane, ethane, higher hydrocarbons and inert components such as carbon dioxide and nitrogen. Depending on the composition, the chemical-physical parameters of the burnable gases can differ considerably.

The attendant materials, traces of which can be in the burnable gas, have a great influence on the reliable operation of a gas engine. Organic halogen (fluoride and chlorine) and sulphur compounds as well as organic silicon compounds are particularly critical. These attendant gas materials enter the burnable gas when the gas is created and – depending on the amount and damaging effect – they have to be removed from the burnable gas before it is fed to the engine. Non-compliance can lead to premature wear or damage to the engine.

Organic halogen compounds that occur in waste dump gas can cause corrosion and wear in the engine. Sulphur compounds (hydrogen sulphide) in sewage and fermentation gas create sulphuric acid that increases the risk of corrosion and causes corrosive wear in the engine.

Dump waste gas and sewage gas can contain organic silicon compounds that contribute above all to the formation of deposits in the combustion chamber and on the exhaust valves. When these hard residues come loose, they can cause considerable abrasive wear to pistons, liners and exhaust valve seats. The content of silicon compounds in the burnable gas must always be evaluated together with the oil analyses, as the engine oil can contain silicon due to additives (antifoaming agents), but it can also come into the engine oil in the form of dust due to inadequate air filtering.

Another important parameter of the burnable gases is the methane number, MN, which characterises the knock resistance of the gas in the engine. In the case of natural gas, the methane number should be at least 80.

In order to cover consumption peaks, some local gas supply companies can temporarily add liquified gas / air mixtures to the natural gas. This reduces the methane index – possibly below the permissible limit – which may lead to damage to the engine.

**Caution:**

We urgently recommend you obtain confirmation from the gas supply company that no mixture of liquified gas and air will be added to the natural gas, even for limited periods.

The methane number of fermentation gas is significantly higher, depending on the composition, which in turn depends on the fermentation system and fermentation substrate. The methane number can be above 100, depending on how much carbon dioxide and nitrogen the gas contains. However, to maintain an adequate calorific value, the CO₂ content should not exceed 40%.

The table below lists the minimum properties of the burnable gases.

Parameters	Symbol	Limit value	Unit	Remarks
Methane number	MN	> 80	–	Lower methane number consult MAN
Calorific value	H _{u,N}	> 5	kWh / Nm ³	
Chlorine	Cl	< 100	mg / Nm ³ CH ₄	
Fluoride	F	< 50	mg / Nm ³ CH ₄	
Total – chlorine – fluoride	Σ(Cl,F)	< 100	mg / Nm ³ CH ₄	
Dust < 5 μm		< 10	mg / Nm ³ CH ₄	
Oil vapour		< 400	mg / Nm ³ CH ₄	No condensation may occur in the mixture section.
Silicon	Si	< 5	mg / Nm ³ CH ₄	If the silicon content is higher, consult MAN
Sulphur	S	< 300	mg / Nm ³	
Hydrogen sulphide	H ₂ S	< 200 / < 306	ppm / mg / Nm ³	If the hydrogen sulphide content is higher, consult MAN
Ammonia	NH ₃	< 50 / < 38	ppm / mg / Nm ³	

The burnable gas is to be fed to the engine in the following state:

Gas pressure on tapping [mbar]	20 ≤ p ≤ 50
max. gas pressure fluctuations after zero pressure controller [mbar]	± 3
max. gas temperature [°C]	30
max. relative humidity [%]	60

In general, it is recommended to run a gas analysis every six months. In the case of fluctuating gas compositions, regular gas and engine oil analyses are required for safe / reliable operation.

If the limit values are exceeded, the engine is to be shut down and switched off. Consult MAN Nutzfahrzeuge AG, Nuremberg Plant, department MVIT.

As a general principle, MAN Nutzfahrzeuge AG accepts no liability for deficiencies and / or damage (corrosion, contamination, wear etc.) caused by gases and substances that were unknown at the time of contract conclusion and were not defined in writing.

General recommendations

The cooling system functions properly only if it works at a positive pressure. It is therefore absolutely necessary that it is kept clean and tight, that the radiator closing and working valves function correctly and the required coolant level is maintained.

Antifreeze agents tested and approved by us guarantee sufficient protection against frost, corrosion and cavitation. They do not attack seals and hoses and do not foam.

The cooling systems of the engine must be filled for the whole year with a mixture of 60% water and 40% antifreeze providing frost protection down to -27°C .

Coolant

Coolants which contain unsuitable antifreeze agents or which are prepared insufficiently or incorrectly, are liable to cause failure of machinery and components in the cooling circuit due to cavitation or corrosion damage. Besides, heat insulating deposits may occur on heat transferring components, so that in the end the engine is overheated and fails.

To guarantee reliable operation of MAN gas engines, the coolant must generally consist of water and antifreeze over the whole year. This guarantees adequate corrosion protection. In special cases, corrosion inhibitors (chemicals) according to MAN 248 may be used.

As a matter of fundamental principle, emulsive anticorrosion protection oils are not permitted.

Specified ingredients of the coolant

Water

Potable tap water with the following restricted analytical data may be used:

Appearance: colourless, transparent, free of mechanical contaminants

Hardness: max 20° German total hardness
 $\doteq 35,6^{\circ}$ French hardness
 $\doteq 25^{\circ}$ British hardness
 $\doteq 358$ ppm USA hardness

Chlorides: max. 100 ppm

Sulphates: max. 150 ppm

pH-value at 20°C : 6,5 to 8,5

Enquires on potable water analyses are to be addressed to the competent authorities.

Where no such tap water is available, mix demineralised water or distillate or condensate until the analytic values are reached.

Antifreeze with corrosion inhibitor

Permitted antifreeze agents complying with factory standard MAN 324

MAN fuels, lubricants and coolants (approved products) can be found on the Internet at:
<http://www.man-mn.com/> → **Products & Solutions** → **E-Business**

**Caution:**

Coolants to MAN 324 Type SNF must not be used in conjunction with silicon coolant hoses to MAN 334 Type 3 (blue).

Distinguishing feature of silicon coolant hoses: blue colour, the figure 3 in the item number, e.g. 04.27405–9150, 50–~~3~~x1000.

- Use only such antifreeze agents which have been approved according to MAN 324. A minimum concentration must always be maintained at 40% b.v. as corrosion protection is inadequate below that level.
- The cooling system is designed such that in Central Europe a coolant charge with max 40% b.v. antifreeze (frost protection down to -27°C) can be left in the system during the summer months as well, providing the cooling system is in good working order.
- At the beginning of the cold weather months the antifreeze content of the coolant may have to be increased for the outside temperatures to be expected (see mixing table).

Mixing table:

Outside temperature down to $^{\circ}\text{C}$	Water %	Antifreeze %
-27	60	40
-31	55	45
-37	50	50

**Prohibited mixture:**

Coolants according to MAN 324 type SNF must not be mixed with coolants type N or type NF.

Ready-made antifreeze-water mixtures with at least 40 % b.v. of an approved antifreeze agent in deionised water are permitted.

Coolant check and replacement

- Always supplement incorrect coolant amounts with a mixture of water and a minimum of 40–50% b.v. (-37°C) antifreeze agent to that there is a reserve if only water needs to be topped up
- The concentration should be checked once every three months by means of a hydrometer or refractometer
- Never allow antifreeze concentration to drop below 40% by volume
- A concentration of more than 50% b.v. is to be avoided



Caution:

An increased proportion of antifreeze agent leads to a temperature increase in the coolant

- Renew complete coolant after 4 years at the latest
- Independent of these intervals, the coolant must be replaced if it turns brown or becomes cloudy

Corrosion inhibitor

For certain applications, where the use of antifreeze agents is not mandatory (e.g. tropical climate), corrosion inhibitors according to MAN 248 must be used.

Permitted anticorrosive agents for engine cooling systems complying with factory standard MAN 248

MAN fuels, lubricants and coolants (approved products) can be found on the Internet at: <http://www.man-mn.com/> → **Products & Solutions** → **E-Business**

The product-specific application concentration can be found in the service products database on the Internet.

Anticorrosive agent check and replacement

- Change all the coolant after one year or after 1500 operating hours, whichever period ends earlier
- Independent of these intervals, the coolant must be replaced if it turns brown or becomes cloudy
- The product-specific application concentration can be found in the service products database on the Internet



Prohibited mixture:

Anticorrosive agents according to MAN 248 must not be mixed with antifreeze agents or coolants according to MAN 324!

When antifreeze agent according to MAN 324 is to be replaced with anticorrosive agent according to MAN 248 or vice versa, the entire coolant is to be drained off. It is not necessary to flush the system.

Disposal of antifreeze and corrosion inhibitors

Undiluted antifreeze and corrosion inhibitors are to be treated as special waste. Regarding the disposal of used-up coolants (mixture of anti-freezing compound with water) the regulations of the competent local authorities have to be observed.



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