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This Circular supersedes:
0199 - 99 - 2105/7

Lubricating Oil for MWM Gas Engines

The 8th replacement is made on account of:

- Conversion of company name and corporate design

The Technical Circular covers the following:

- General information
- Selection of lubricating oil
- Lubricating oil sampling
- Lubricating oil analysis
- Lubricating oil change
- Lubricating oil filter change
- Limit values
- Wear metals
- Lubricating oil consumption
- Interpretation of the parameters of the lubricating oil analysis
- Interpretation of the elements of the lubricating oil analysis
- Interpretation of the optionally analyzed elements of the lubricating oil analysis
- Released lubricating oils

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Note:
The part numbers stated in this documentation are not subject to the modification service.
For identifying spare parts, the spare part documentation has to be referred to.

Copies to:
- TR
- According to SIT 7010

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General Information

The engine may only be operated with lubricating oils approved by MWM.
The owner is solely responsible for compliance with the lubricating oil specifications described in this technical circular.
The engine manufacturer will not be liable for damage caused by non-approved lubricating oils or improper operation.

Lubricating oils for combustion engines are exposed to extreme mechanical and thermal stress. The lubricating oil should not evaporate at the high temperatures of the cylinder liners but should form a sufficiently tenacious, non-pressable, well adhesive lubricating film. It should be thin enough in the cold state to enable starting of the cold engine. The sliding surfaces should remain wet for restarting the engine when the engine is shut down.

The lubricating oils must generally have the following properties:

- stable lubricating film at all operating temperatures
- optimum viscosity at all operating temperatures
- high thermal stability
- high ageing resistance
- wear protective properties
- neutralising properties against corrosive materials
- balance ratio of ash forming ingredients
- high safety reserves for long lubricating oil change intervals

Economic operation is achieved by as long a lubricating oil change interval of the lubricating oil filling as possible. The emphasis is always on the avoidance of damage and achievement of the expected service lives of important engine and system components.

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Selection of lubricating oil

Lubricating oils (sulphate ash content up to 0.5 wt. %)

The lubricating oils listed in the section **Released lubricating oils (sulphate ash content up to 0.5 wt. %)** should be used for operating MWM gas engines.

Lubricating oils (sulphate ash content 0.5 - 1.0 wt. %)

MWM has approved other lubricating oils specially for operation with combustive gases with a higher pollution load (see also TR 0199-99-3017). These are listed in the section **Released lubricating oils (sulphate ash content 0.5 - 1.0 wt. %)**.

These lubricating oils are recognisable according to the manufacturer's data sheet by their high TBN and sulphate ash values and have a higher neutralisation reserve against acids which are produced by the burning of pollutants in the combustive gas. These acids are produced, for example, from chlorine (Cl), fluoride (F) and sulphur (S). The engine is protected against corrosion by the neutralisation of acids.

Larger amounts of lubricating oil additives are necessary to ensure neutralisation. However, this means the higher the neutralisation potential of a lubricating oil, the higher the tendency for deposits to form during combustion.

If such lubricating oils are used in combustive gases which exhibit no continuously high pollutant loads (in accordance with the values permitted in TR 0199-99-3017), the additives are not consumed because no or only small amounts of acids are produced which have to be neutralised.

Here, the advantages of these special lubricating oils become clear disadvantages.

- The unused additives form deposits in the combustion chamber and in the following system parts such as exhaust gas heat exchanger, silencer, etc.
- These deposits can bond with elements in the combustive gas, e.g. silicon (Si), in the combustion chamber. These compounds are very hard and lead to abrasive wear on pistons, piston rings, cylinder liners, valves and valve seat rings.

We therefore recommend you to operate all engines with lubricating oils according to section **Released lubricating oils (sulphate ash content up to 0.5%)** until a stable combustive gas generation has been achieved. During this time the basic conditions and effects of the used combustive gas on economical and reliable operation of the engine must be determined by lubricating oil and gas analyses.

If, at the end of the system start-up process, the concentration of pollutants in the combustive gas should remain continuously high and no economical lubricating oil change intervals reached as a result, you can change over to lubricating oils in accordance with section **Released lubricating oils (sulphate ash content 0.5 - 1.0 wt. %)** in agreement with the service partner responsible.

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Lubricating oil sampling

☞ A careful preparation and execution of the the lubricating oil sampling is a prerequisite for useful analysis v alues.

Make sure that the lubricating oil sample is not falsified by dirt or residue lubricating oil in the additives.

A small amount of lubricating oil is sufficient for a routine analysis.

The lube oil sample must be taken from the lube oil circuit with the engine running and at operating temperature.

At least 100 ml of lubricating oil must be drained and properly disposed of before taking the sample. Then the necessary amount of lubricating oil for the lubricating oil test must be taken.

Changes in the lubricating oil due to sampling and transport are to be avoided.

The samples must be clearly identified and the following minimum information contained:

- Owner
- Engine type
- Engine serial number
- Manufacturer of the lubricating oil
- Designation of the lubricating oil
- Date of the sampling
- Operating hours of the engine
- Operating hours of the lubricating oil
- Filling amount / lubricating oil consumption
- Total lubricating oil volume

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Lubricating oil analysis

☞ The owner must guarantee that the analysis values necessary for chooseing the lubricating oil change intervals are available on schedule.

The analysis values must be presented to the owner as quickly as possible (maximum half of the lubricating oil analysis interval)

A detailed lubricating oil anaylsis must ensure that the engine is operated with lubricating oil according to the specification in this Technical Circular. Lubricating oil analyses must be kept so that proof of the proper operation of the engine can be presented.

In case of abnormal wear values within an analysis series the analysis must be provided to the service partner responsible for engine still under guarantee.

The trend analysis is most suitable for monitoring the analysis values over a longer period. The individual analysis values are summarised in tables or graphics. An assessment can then be made by the condition of the lubricating oil or the engine (trend detection).

☞ Perform the first lubricating oil analysis independently of the gas type after 100 operating hours.

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Lubricating oil change

Lubricating oil change

The entire amount of lubricating oil must be changed in a lubricating oil change. The remaining lubricating oil volume in the engine and add-on parts should be kept as low as possible.

The lubricating oil change is necessary when one of the following criteria is satisfied:

- before exceeding the limit values in this Technical Circular
- after penetration of the lubricating oil by coolant
- after maintenance work of maintenance and service schedule E60 and E70
- after servicing of the drive assembly
- before shutting down for longer than three months
- at least once a year

lubricating oil change intervals

In addition to the lubricating oil quality the lubricating oil change intervals are dependent on:

- the gas quality
- the ambient conditions
- the operating principle of the engine

As a rule these influences lead to a change in the lubricating oil parameters.

It is therefore necessary to determine the lubricating oil change intervals by lubricating oil analyses for every system.

Perform the first lubricating oil analysis independently of the gas type after 100 operating hours.

By suitable choice of the time intervals for the lubricating oil analyses the lubricating oil can be used until reaching the limit values.

The lubricating oil change intervals must always be re-determined when:

- commissioning the system
- changing the type of operation
- after maintenance work E60 or E70
- after service work of a scope E60 or E70

Under unchanged operating conditions the further lubricating oil analysis intervals and the necessary lubricating oil change must be agreed between the owner and the responsible service partner on the basis of this technical circular.

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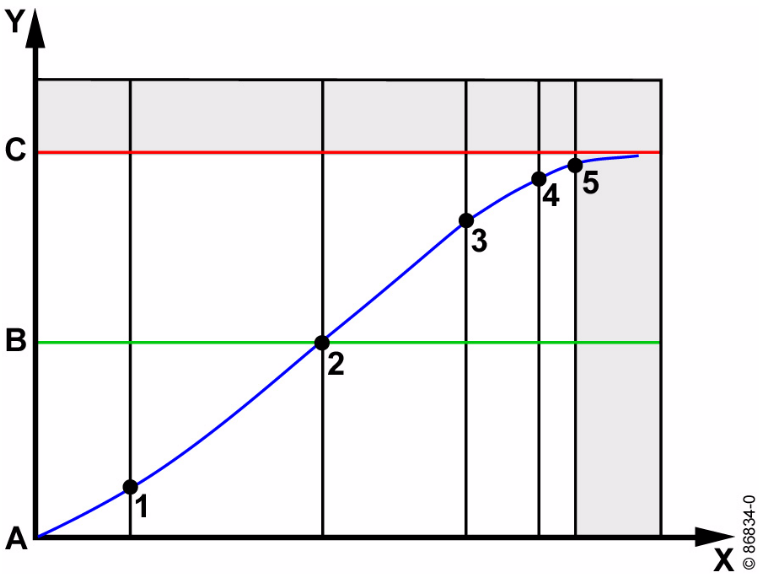
The lubricating oil change intervals must be determined as follows:

Example 1:



A 1

X axis:	Time interval
Y axis:	Numeric value of the analysis result
A:	Initial value
B:	Half of limit value
C:	Limit value
Position 1-5:	Time of the lubricating oil analysis
Position 5.	Time of the next lubricating oil change

- First lubricating oil filling
  - If the analysis values (position 1) are well below half the permissible limit values B the timer interval before the next lubricating oil analysis (position 2) can be doubled.
  - If individual analysis values reach half the permissible limit value B, the time interval before the next analysis (position 3) must be reduced.

☞ On approaching the permissible limit value C the time intervals from analysis to analysis (position 4 and 5) must be halved respectively.

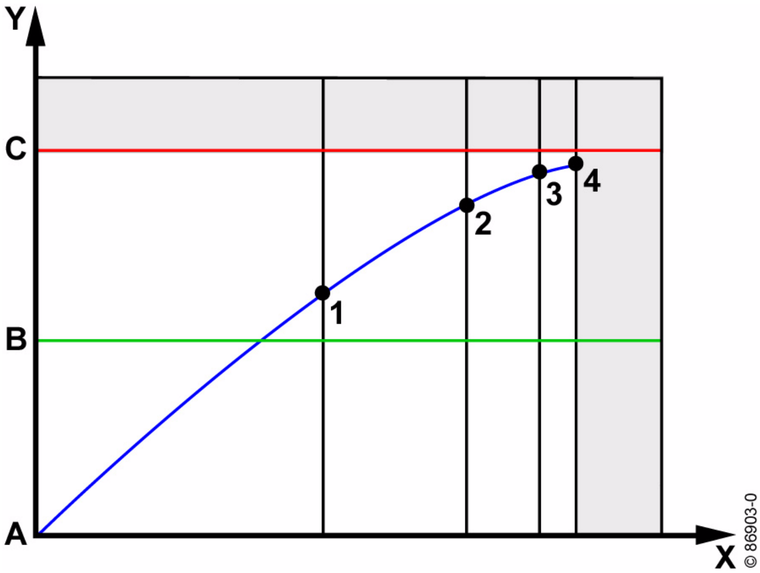
- Second and following lubricating oil fillings
  - After the first determination of the lubricating oil change interval the first lubricating oil analysis can be taken after a greater interval (position 3) for the second lubricating oil filling.
  - Another lubricating oil analysis (position 4) is taken if comparable analysis results with the first lubricating oil filling are obtained.
  - If, on the other hand, the same analysis values are reached, the same lubricating

oil change interval as in the first lubricating oil filling can be determined.

- In case of unchanged operating conditions, the lubricating oil analyses for the following lubricating oil fillings can be taken at the same interval (position 4).

If the analysis results deviate from the previous results, the lubricating oil change intervals must be re-determined until repeatable results are achieved.

Example 2:



A 2

X axis:	Time interval
Y axis:	Numeric value of the analysis result
A:	Initial value
B:	Half of limit value
C:	Limit value
Position 1-4:	Time of the lubricating oil analysis
Position 4.	Time of the next lubricating oil change

- If the analysis values of the first lubricating oil sample are already close to the permissible limit values (position 1) the operating time until the next lubricating oil analysis must be reduced (position 2).
- If the short distance from the limit values is confirmed, the last analysis period (position 3 to 4) must be halved.

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Lubricating oil filter change

All lubricating oil filters must always be changed in a lubricating oil filter change.

The lubricating oil filter change is necessary:

- with the first lubricating oil change
- with the first lubricating oil change after repairs to the drive assembly
- every second lubricating oil change or after max. 4000 oh
- if coolant in the lubricating oil has been analysed
- if a SAN has been proven in the lubricating oil
- at least once a year

☞ All the filter elements of the crankcase breather must be renewed if coolant penetrates the lubricating oil system.

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Limit values

If one of the following limit values is exceeded, the lubricating oil must be changed immediately.

Properties	Limit value	Test method
Viscosity at 100 °C	min. 12 mm^2/s (cSt) max. 18 mm^2/s (cSt)	DIN 51366, ASTM D 445, DIN EN ISO 3104
Increase in viscosity in comparison with the new condition at 100 °C	max. 3 mm^2/s (cSt)	
Water content	max. 0.2 %	DIN 51777, ASTM D 1744, DIN ISO 12937
Glycol content	max. 500 ppm	DIN 51375, ASTM D 4291
Total base number TBN	min. 2.0 mg KOH/g	ISO 3771, ASTM D 4739
AN	not greater than the TBN	DIN EN 12634, ASTM 664
SAN	0 mg KOH/g	ASTM 664
i pH (not necessary for natural gas)	greater than 4.5	
Oxidation	20 A/cm	DIN 51453
Nitration	20 A/cm	DIN 51453
Silicon	max. 300 mg/kg	DIN 51396, ASTM D 5185
	Analyse wear metals!	
	If a wear metal exceeds its permissible limit value, the limit value of silicon reduces to:	
	max. 15 mg/kg	DIN 51396, ASTM D 5185

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Wear metals

The wear metals data are an aid for engine assessment. Changes in the engine conditions can be detected at an early stage in this way.

☞ For analysis, the temporal concentration progression of every individual wear metal must be monitored in several lubricating oil analyses (trend analyses).

The rate of every individual value, and not its absolute value, is the decisive factor here.

Rate = (new concentration - old concentration) / (new operating hours - old operating hours)

If a wear metal exceeds 50 percent of the analysis value listed below, the time intervals for the sampling must be halved.

If the increased wear values are confirmed, the responsible service partner must be consulted.

All measurements must be made according to DIN 51396 (ICP OES / RFA).

Example:

Six lubricating oil samples are analysed for an engine. Lubricating oil was changed after the 3rd lubricating oil analysis $t_{3=4}$. From the penultimate lubricating oil analysis t_5 to the last t_6, wear metal concentration c_6 increases considerably faster than expected from earlier lubricating oil analyses.

Since the last rate of increase (delta $c_{5,6}$ / delta $t_{5,6}$) is above 50% of the limit value, the time interval up to the next lubricating oil analysis must be halved.

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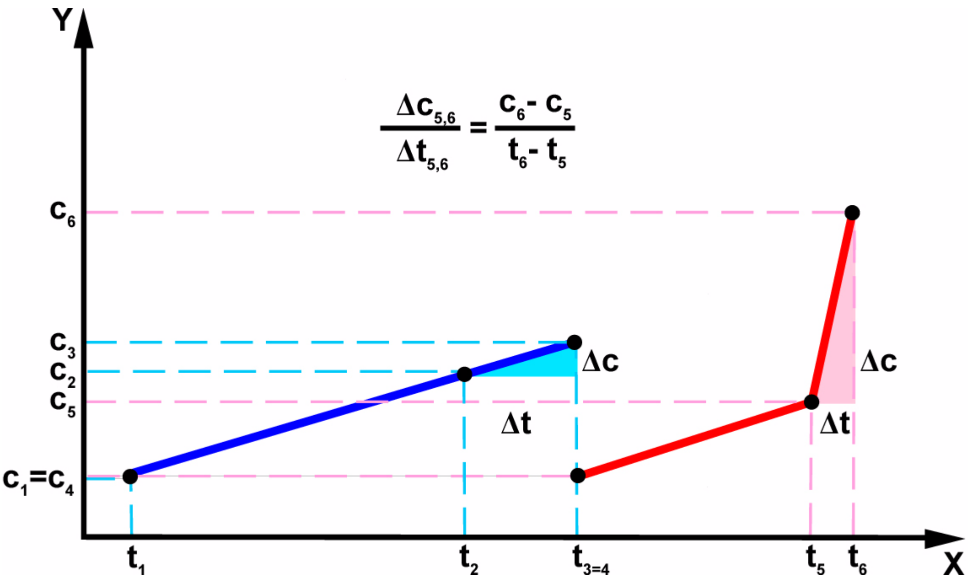

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X axis:	Time interval
Y axis:	Numeric value of the analysis result
$t_{3=4}$	Time of changing the lubricating oil
$c_1=c_4$	Concentration in the new lubricating oil

Wear metals

Series 1015 / 2015	
Aluminium	max. 2 mg/kg per 100 oh
Chrome	max. 1 mg/kg per 100 oh
Copper	max. 2 mg/kg per 100 oh
Iron	max. 3 mg/kg per 100 oh
Lead	max. 2 mg/kg per 100 oh
Tin	max. 1 mg/kg per 100 oh

Series 616 / 2016	
Aluminium	max. 1 mg/kg per 100 oh
Chrome	max. 0.5 mg/kg per 100 oh
Copper	max. 2.5 mg/kg per 100 oh
Iron	max. 3 mg/kg per 100 oh
Lead	max. 2 mg/kg per 100 oh
Tin	max. 1 mg/kg per 100 oh

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Series 620 / 2020	
Aluminium	max. 1 mg/kg per 100 oh
Chrome	max. 0.5 mg/kg per 100 oh
Copper	max. 1.5 mg/kg per 100 oh
Iron	max. 2 mg/kg per 100 oh
Lead	max. 2 mg/kg per 100 oh
Tin	max. 0.5 mg/kg per 100 oh

Series 632 / 2032	
Aluminium	max. 0.5 mg/kg per 100 oh
Chrome	max. 0.5 mg/kg per 100 oh
Copper	max. 1 mg/kg per 100 oh
Iron	max. 2 mg/kg per 100 oh
Lead	max. 1 mg/kg per 100 oh
Tin	max. 0.5 mg/kg per 100 oh

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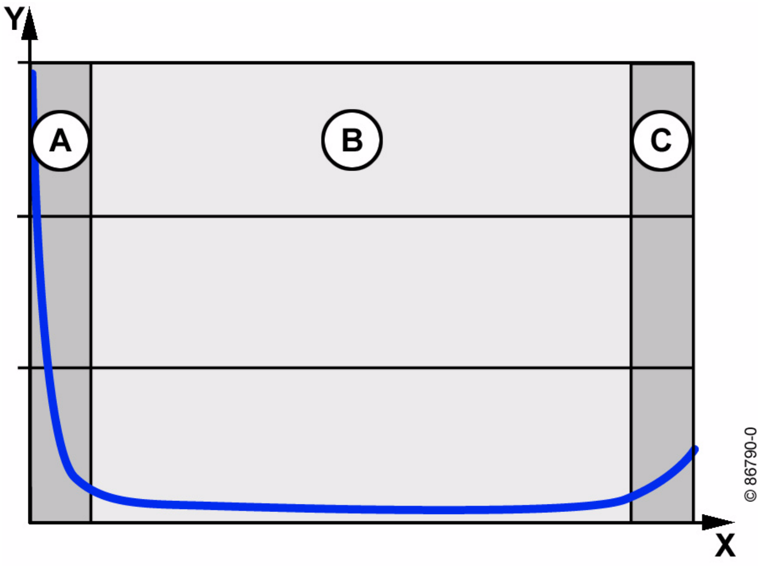
Lubricating oil consumption

The specific lubricating oil consumption is to be understood as the lubricating oil volume which is consumed per unit of time at a certain power.

The lubricating oil consumption is determined over a longer period in the same type of operation in continuous operation.

The lubricating oil consumption drops after the first few operating hours (run-in time). Then it should remain constantly low for a longer period. The wear in the engine increases with a very long running time and with it the lubricating oil consumption.



A 4

X axis:	Running time
Y axis:	Lubricating oil consumption
Range A:	Run-in time
Range B:	Operating period
Range C:	Period of rising lubricating oil consumption due to increasing material wear

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Interpretation of the parameters of the lubricating oil analysis

Viscosity

Unit: mm^2/s

The viscosity indicates the flow capacity of the lubricating oil (resistance to shift of two adjacent layers, inner friction). The viscosity is temperature-dependent.

The viscosity is increased by:

- Ageing/oxidation
- Soot/solid foreign bodies
- Evaporation of lightly boiling components

Water

Unit: wt.% water in the lubricating oil generally leads to an emulsion which leads on the whole to increased wear and corrosion risk.

Water increases the viscosity of the lubricating oil.

Possible causes:

- Leaks in the coolant system
- Condensation processes in the lubricating oil system by frequent starts and emergency stops
- Improper storage of the lubricating oil
- Insufficient ventilation of the crankcase or lubricating oil tank
- Penetration of rain water into the exhaust system

Glycol

Unit: ppm

Glycol leads to formation of sludge and filter blockage due to reaction with the lubricating oil ingredients.

Glycol is incompatible with mineral oil.

Possible causes:

- Leaks in the coolant system
- Contamination with a lubricating oil based on polyglycol

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Total Base Number (TBN)

Unit: mgKOH/g

The TBN indicates the alkaline reserve of the lubricating oil and charaterises the chemical neutralisation capacity.

This is a necessary property of the lubricating oil to check the corrosive wear.

With the use of the lubricating oil the alkaline reserve is reduced by reaction with acids. The acids are ultimately reaction products of the combustion process as well as ageing/oil oxidation and nitration.

In operation with acid forming combustive gases (especially landfill, sewage and bio-gases) a fast decomposition of the TBN is to be expected.

Acid Number (AN, formerly TAN) or neutralisation number (Nz)

Unit: mgKOH/g

The method covers the strong and weak acids. The strong acids are recorded separately as Strong Acid Number (SAN). Lubricating oil ingredients influence the value of the AN which may be between 0.5 and 2 mgKOH/g in new lubricating oils.

Oxidation and nitration processes can produce weak organic acids. These are only partially neutralised by the alkaline properties of the lubricating oil. If the lubricating oil has a sufficient alkaline reserve, the AN only records the weak organic acids.

There is a rough correlation between AN rise, lubricating oil ageing and lubricating oil nitration.

Strong Acid Number (SAN)

Unit: mgKOH/g

The method only covers strong acids (e.g. sulphuric acid). If a SAN is proven, there is a risk of corrosion.

Ageing/oxidation

Unit: A/cm

Ageing/oxidation is caused by reaction of the basic oil and ingredient molecules with oxygen which leads to an increase in the viscosity and the Acid Number. Component smearing and sludge deposits can occur. The oxidation products can form organic acids which lead to corrosion even when the lubricating oil still has alkaline reserves.

The extinction at the wave number 1710 cm^{-1} in the infrared light spectrum is measured whereby the carbonyl compounds formed in the oxidation are measured.

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Nitration

Unit: A/cm

Nitration is caused by reactions of the basic oil and ingredient molecules with nitrogen oxides. The influences are comparable with those of the ageing/oxidation. They lead to changes in the lubricating oil parameters. However, the risk of corrosive reaction products is higher in comparison. In the case of strong nitration a strong decomposition of the alkaline reserve usually also occurs.

The extinction at the wave factor 1630 cm^{-1} in the infrared light spectrum is measured.

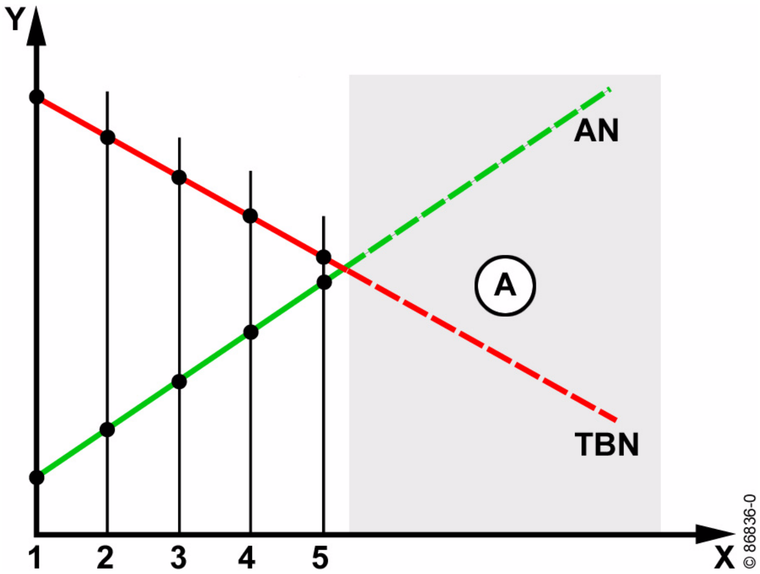
i pH

Unit: none

The method serves to determine the pH value of the lubricating oil. The measurement result is specified in dimensionless pH value units. Overacidification of the lubricating oil leads to corrosive wear.

Explanation of the relation between TBN and AN.

The TBN falls whilst the AN rises. Since according to the limit value list the AN must always be smaller than the TBN, no engine operation is permissible in range A.



A 5

X axis:	Running time
Y axis:	Numeric value of the analysis result
Range A:	Impermissible operating period
Position 1-5:	Time of the lubricating oil analysis
Position 5.	Time of the next lubricating oil change

Interpretation of the elements of the lubricating oil analysis

Silicon

Unit: mg/kg

Possible origin:

- Component in antifoaming ingredients
- Dust from the sucked in air
  - leads to abrasive wear even in the smallest of amounts.
- Compounds of combustive gases (e.g. landfill, sewage and bio-gases)
  - The silicon load in the lubricating oil also gives an indirect indication of the silicon load of the combustive gas.

Sodium

Unit: mg/kg

Typical element of ingredients for corrosion protection in the coolant. Strong increase in the sodium content is a sign of contaminated coolant. The engine must be checked continuously for possible coolant leaks in the course of further operation.

In many cases no water can be found in the lubricating oil despite high sodium values and the associated contamination because this evaporates due to the lubricating oil temperature in engine operation.

Aluminium

Unit: mg/kg

Typical wear element of pistons and slide bearings for example.

Aluminium may also be a part of contaminated suction intake air under certain circumstances.

Iron

Unit: mg/kg

Typical wear element of cylinder liners, cams/tappets, shaft journals, pistong rings and toothed wheels.

Chrome

Unit: mg/kg

Typical wear element of piston rings, valve stems, cams/tappets and other high alloyed engine components.

Copper

Unit: mg/kg

Typical wear element of bearings and corrosion product of lubricating oil coolers and lubricating oil lines.

Copper is also part of different mounting compounds.

Lead

Unit: mg/kg

Typical wear element of slide bearings and solder from lubricating oil coolers and lubricating oil lines.

Tin

Unit: mg/kg

Typical wear element of slide bearings.

Molybdenum

Unit: mg/kg

May be part of lubricating oil ingredients as well as different mounting compounds.

Is rarely used as a running surface coating for piston rings.

Interpretation of optionally analyzed elements of the lubricating oil analysis

Potassium and boron

Unit: mg/kg

Typical elements of ingredients for corrosion protection in the coolant. An increase in the lubricating oil is a sign of a contamination by coolant.

However, boron is a typical element of frequently used ingredients in the lubricating oil.

Calcium, zinc, phosphorus, sulphur

Unit: mg/kg

Typical elements of ingredients in the lubricating oil.

Sulphur is also a part of the lubricating oil and combustive gases.

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Released lubricating oils

Released lubricating oils with a sulphate ash content up to 0.5 wt.%

Sulphate ash content up to 0.5 wt.%

Manufacturer	Basic oils	Sulphate ash	TBN	Viscosity		
				Class	at 40 °C	at 100 °C
Product		wt.%	mgKOH/g	SAE	mm^2/s	mm^2/s
MWM GmbH						
TG LA 40 Plus	Mineral	0,45	5,9	40	141,5	14,9
ADDINOL						
MG 40 Extra LA	Mineral	0,5	6,5	40	136	14,5
ARAL AG						
Degasol LA	Mineral	0,48	4,5	40	137	13,7
BayWa						
MethaFlexx NG	Mineral	0,45	5,5	40	156	14,5
MethaFlexx NG plus	Mineral	0,45	5,9	40	141,5	14,9
BP AG						
Energol IC-DG 40S	Mineral	0,48	4,5	40	137	13,7
BP Energas NGL	Mineral	0,45	5,1	40	130	13,5
BP Energas NGS	Synthetic	0,45	4,9	20W-40	109	14
Caltex						
Geotex LA 40	Mineral	0,45	5,5	40	129,4	13,3
Geotex PX 40	MC[1]	0,5	5,4	40	88	13,2
CASTROL						
Duratec L	Mineral	0,45	5,1	40	130	13,5
Duratec XPL	Synthetic	0,45	4,9	20W-40	109	14
CEPSA						
Troncoil Gas	Mineral	0,46	5,2	40	133,8	13,8

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Sulphate ash content up to 0.5 wt.%

Manufacturer	Basic oils	Sulphate ash	TBN	Viscosity Class	at 40 °C	at 100 °C
Product		wt.%	mgKOH/g	SAE	mm^2/s	mm^2/s
Chevron						
Geotex LA 40	Mineral	0,45	5,5	40	129,4	13,3
Geotex PX 40	MC[1]	0,5	5,4	40	88	13,2
DIVINOL						
Spezial MA	Mineral	0,5	5,5	40	141,2	13,9
FUCHS PETROLUB AG						
TITAN GANYMET LA	Mineral	0,45	5,5	40	156	14,5
TITAN GANYMET PLUS LA	Mineral	0,45	5,9	40	141,5	14,9
Kuwait Petroleum						
Q8 Mahler MA	Mineral	0,5	5,5	40	141,2	13,9
Kompressol						
LA Gas Engine Oil	Mineral	0,5	5,5	40	141,2	13,9
Mobil						
Pegasus 605*	Mineral	0,5	7,4	40	119	13
Pegasus 705	Mineral	0,49	5,3	40	122	13,1
Pegasus 805	Mineral	0,5	6,2	40	130	13,5
Pegasus 905	Mineral	0,5	6,2	40	115	12,7
Pegasus HPC	Mineral	0,48	5,5	40	138	14,1
Pegasus 1	Synthetic	0,48	7	15W-40	132	13,6

* only for sewage gas, landfill gas and other bio-gases.

Petro- Canada						
Sentron 445	HT[2]	0,45	5	40	126	13,4
Repsol						
Extra Gas 40	Mineral	0,4	6	40	130	13,5

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Sulphate ash content up to 0.5 wt.%

Manufacturer	Basic oils	Sulphate ash	TBN	Class	Viscosity at 40 °C	Viscosity at 100 °C
Product		wt.%	mgKOH/g	SAE	mm^2/s	mm^2/s
Roloil						
Mogas 40	Mineral	0,5	5,5	40	141,2	13,9
Shell						
Mysella LA	Mineral	0,45	5	40	138	13,8
Mysella XL	Mineral	0,5	4,5	40	131	14,1
Texaco						
Geotex LA 40	Mineral	0,45	5,5	40	129,4	13,3
Geotex PX 40	MC[1]	0,5	5,4	40	88	13,2
TOTAL						
Nateria MH 40	Mineral	0,43	5,5	40	142,2	14,8
WIPA Chemicals International						
Ecosyn GE 4004	Ester	0,4	6	40	155	13,7
Wunsch oils						
Wunsch gas engine oil MA	Mineral	0,5	5,5	40	141,2	13,9

[1] Molecular converted (MC)

[2] Hydro treated (HT)

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Ersatz für:
0199 - 99 - 2105/7

Released lubricating oils with a sulphate ash content of 0.5 wt.% to 1.0 wt.%

Sulphate ash content from 0.5 to 1.0 wt.%

Manufacturer	Basic oils	Sulphate ash	TBN	Viscosity		
				Class	at 40 °C	at 100 °C
Product		wt.%	mgKOH/g	SAE	mm^2/s	mm^2/s
ADDINOL						
MG 40 Extra Plus	Mineral	0,85	9,8	40	133	14,2
BayWa						
MethaFlexx MC plus	Mineral	0,8	9,2	40	132	14,5
MethaFlexx MC premium	HC[3]	0,7	8,2	40	105	13,4
Caltex						
Geostar LF 40	Mineral	0,99	8	40	138	14
Geotex LF 40	Mineral	0,99	8	40	138	14
Chevron						
Geotex LF 40	Mineral	0,99	8	40	138	14
DIVINOL						
Spezial HA	Mineral	0,9	7,9	40	141,2	14,1
FUCHS PETROLUB AG						
TITAN GANYMET PLUS	Mineral	0,8	9,2	40	132	14,5
TITAN GANYMET ULTRA	HC[3]	0,7	8,2	40	105	13,4
Kompressol						
HD gas engine oil	Mineral	0,9	7,9	40	141,2	14,1
Kuwait Petroleum						
Q8 Mahler HA	Mineral	0,9	7,9	40	141,2	14,1
Mobil						
Pegasus 605	Mineral	0,5	7,4	40	119	13

TR

0199 - 99 - 2105/8 EN

Ersatz für:
0199 - 99 - 2105/7

Sulphate ash content from 0.5 to 1.0 wt.%

Manufacturer	Basic oils	Sulphate ash	TBN	Viscosity		
				Class	at 40 °C	at 100 °C
Product		wt.%	mgKOH/g	SAE	mm²/s	mm²/s
Roloil						
Mogas 40 AC	Mineral	0,9	7,9	40	141,2	14,1
Texaco						
Geotex LF 40	Mineral	0,99	8	40	138	14
Wunsch oils						
Wunsch gas engine oil HA	Mineral	0,9	7,9	40	141,2	14,1

[3] Hydrocrack synthesis

Service Information

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